

GigaDevice Semiconductor Inc.

GD32L23x

Arm[®] Cortex[®]-M23 32-bit MCU

**Firmware Library
User Guide**

Revision 2.3

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Table of Contents

Table of Contents	1
List of Figures	4
List of Tables	5
1. Introduction	27
1.1. Rules of User Manual and Firmware Library	27
1.1.1. Peripherals.....	27
1.1.2. Naming rules.....	28
2. Firmware Library Overview	30
2.1. File Structure of Firmware Library	30
2.1.1. Examples Folder	31
2.1.2. Firmware Folder	31
2.1.3. Template Folder	31
2.1.4. Utilities Folder	34
2.2. File descriptions of Firmware Library	34
3. Firmware Library of Standard Peripherals	36
3.1. Overview of Firmware Library of Standard Peripherals.....	36
3.2. ADC	36
3.2.1. Descriptions of Peripheral registers.....	36
3.2.2. Descriptions of Peripheral functions	37
3.3. CAN(only for GD32L235).....	62
3.3.1. Descriptions of Peripheral registers.....	62
3.3.2. Descriptions of Peripheral functions	63
3.4. CAU	80
3.4.1. Descriptions of Peripheral registers.....	80
3.4.2. Descriptions of Peripheral functions	81
3.5. CMP	108
3.5.1. Descriptions of Peripheral registers.....	108
3.5.2. Descriptions of Peripheral functions	108
3.6. CRC	118
3.6.1. Descriptions of Peripheral registers.....	118
3.6.2. Descriptions of Peripheral functions	119
3.7. CTC.....	126
3.7.1. Descriptions of Peripheral registers.....	126

3.7.2.	Descriptions of Peripheral functions	127
3.8.	DBG	140
3.8.1.	Descriptions of Peripheral registers	140
3.8.2.	Descriptions of Peripheral functions	140
3.9.	DAC	144
3.9.1.	Peripheral register description	145
3.9.2.	Descriptions of Peripheral functions	145
3.10.	DMA/DMAMUX	160
3.10.1.	Descriptions of Peripheral registers	160
3.10.2.	Descriptions of Peripheral functions	161
3.11.	EXTI	201
3.11.1.	Descriptions of Peripheral registers	201
3.11.2.	Descriptions of Peripheral functions	201
3.12.	FMC	210
3.12.1.	Descriptions of Peripheral registers	210
3.12.2.	Descriptions of Peripheral functions	210
3.13.	FWDGT	236
3.13.1.	Descriptions of Peripheral registers	236
3.13.2.	Descriptions of Peripheral functions	236
3.14.	GPIO	241
3.14.1.	Descriptions of Peripheral registers	242
3.14.2.	Descriptions of Peripheral functions	242
3.15.	I2C	252
3.15.1.	Descriptions of Peripheral registers	253
3.15.2.	Descriptions of Peripheral functions	253
3.16.	LPTIMER	292
3.16.1.	Descriptions of Peripheral registers	292
3.16.2.	Descriptions of Peripheral functions	293
3.17.	LPUART	314
3.17.1.	Descriptions of Peripheral registers	314
3.17.2.	Descriptions of Peripheral functions	314
3.18.	MISC	343
3.18.1.	Descriptions of Peripheral registers	343
3.18.2.	Descriptions of Peripheral functions	344
3.19.	PMU	352
3.19.1.	Descriptions of Peripheral registers	352
3.19.2.	Descriptions of Peripheral functions	352
3.20.	RCU	372
3.20.1.	Descriptions of Peripheral registers	372

3.20.2.	Descriptions of Peripheral functions	373
3.21.	RTC	406
3.21.1.	Descriptions of Peripheral registers	407
3.21.2.	Descriptions of Peripheral functions	407
3.22.	SLCD	434
3.22.1.	Descriptions of Peripheral registers	435
3.22.2.	Descriptions of Peripheral functions	435
3.23.	SPI	453
3.23.1.	Descriptions of Peripheral registers	453
3.23.2.	Descriptions of Peripheral functions	453
3.24.	SYSCFG	483
3.24.1.	Descriptions of Peripheral registers	483
3.24.2.	Descriptions of Peripheral functions	484
3.25.	TIMER	492
3.25.1.	Descriptions of Peripheral registers	492
3.25.2.	Descriptions of Peripheral functions	493
3.26.	TRNG	552
3.26.1.	Descriptions of Peripheral registers	552
3.26.2.	Descriptions of Peripheral functions	553
3.27.	USART	558
3.27.1.	Descriptions of Peripheral registers	558
3.27.2.	Descriptions of Peripheral functions	558
3.28.	VREF	607
3.28.1.	Descriptions of Peripheral registers	607
3.28.2.	Descriptions of Peripheral functions	607
3.29.	WWDGT	612
3.29.1.	Descriptions of Peripheral registers	612
3.29.2.	Descriptions of Peripheral functions	612
4.	Revision history	617

List of Figures

Figure 2-1. File structure of firmware library of GD32L23x	30
Figure 2-2. Select peripheral example files	32
Figure 2-3. Copy the peripheral example files	32
Figure 2-4. Open the project file	33
Figure 2-5. Configure project files	33
Figure 2-6. Compile-debug-download	34

List of Tables

Table 1-1. Peripherals	27
Table 2-1. Function descriptions of Firmware Library	34
Table 3-1. Peripheral function format of Firmware Library	36
Table 3-2. ADC Registers	36
Table 3-3. ADC firmware function	37
Table 3-4. Function adc_deinit	38
Table 3-5. Function adc_enable	38
Table 3-6. Function adc_disable	39
Table 3-7. Function adc_calibration_number	39
Table 3-8. Function adc_calibration_enable	40
Table 3-9. Function adc_dma_mode_enable	41
Table 3-10. Function adc_dma_mode_disable	41
Table 3-11. Function adc_discontinuous_mode_config	41
Table 3-12. Function adc_special_function_config	42
Table 3-13. Function adc_channel_16_to_19	43
Table 3-14. Function adc_data_alignment_config	44
Table 3-15. Function adc_channel_length_config	44
Table 3-16. Function adc_routine_channel_config	45
Table 3-17. Function adc_inserted_channel_config	46
Table 3-18. Function adc_inserted_channel_offset_config	47
Table 3-19. Function adc_channel_differential_mode_config	48
Table 3-20. Function adc_external_trigger_config	48
Table 3-21. Function adc_external_trigger_source_config	49
Table 3-22. Function adc_software_trigger_enable	50
Table 3-23. Function adc_routine_data_read	51
Table 3-24. Function adc_inserted_data_read	51
Table 3-25. Function adc_watchdog_single_channel_enable	52
Table 3-26. Function adc_watchdog_sequence_channel_enable	53
Table 3-27. Function adc_watchdog_disable	53
Table 3-28. Function adc_watchdog_threshold_config	54
Table 3-29. Function adc_resolution_config	54
Table 3-30. Function adc_oversample_mode_config	55
Table 3-31. Function adc_oversample_mode_enable	56
Table 3-32. Function adc_oversample_mode_disable	57
Table 3-33. Function adc_charge_pulse_width_counter	57
Table 3-34. Function adc_charge_flag_get	58
Table 3-35. Function adc_flag_get	58
Table 3-36. Function adc_flag_clear	59
Table 3-37. Function adc_interrupt_enable	60
Table 3-38. Function adc_interrupt_disable	60

Table 3-39. Function <code>adc_interrupt_flag_get</code>	61
Table 3-40. Function <code>adc_interrupt_flag_clear</code>	61
Table 3-41. CAN Registers	62
Table 3-42. CAN firmware function	63
Table 3-43. Structure <code>can_parameter_struct</code>	64
Table 3-44. Structure <code>can_transmit_message_struct</code>	64
Table 3-45. Structure <code>can_receive_message_struct</code>	64
Table 3-46. Structure <code>can_filter_parameter_struct</code>	65
Table 3-47. Function <code>can_deinit</code>	65
Table 3-48. Function <code>can_struct_para_init</code>	65
Table 3-49. Function <code>can_init</code>	66
Table 3-50. Function <code>can_filter_init</code>	67
Table 3-51. Function <code>can_debug_freeze_enable</code>	67
Table 3-52. Function <code>can_debug_freeze_disable</code>	68
Table 3-53. Function <code>can_time_trigger_mode_enable</code>	68
Table 3-54. Function <code>can_time_trigger_mode_disable</code>	69
Table 3-55. Function <code>can_message_transmit</code>	69
Table 3-56. Function <code>can_transmit_states</code>	70
Table 3-57. Function <code>can_transmission_stop</code>	70
Table 3-58. Function <code>can_message_receive</code>	71
Table 3-59. Function <code>can_fifo_release</code>	71
Table 3-60. Function <code>can_receive_message_length_get</code>	72
Table 3-61. Function <code>can_working_mode_set</code>	72
Table 3-62. Function <code>can_wakeup</code>	73
Table 3-63. Function <code>can_error_get</code>	73
Table 3-64. Function <code>can_receive_error_number_get</code>	74
Table 3-65. Function <code>can_transmit_error_number_get</code>	74
Table 3-66. Function <code>can_flag_get</code>	75
Table 3-67. Function <code>can_flag_clear</code>	76
Table 3-68. Function <code>can_interrupt_enable</code>	77
Table 3-69. Function <code>can_interrupt_disable</code>	77
Table 3-70. Function <code>can_interrupt_flag_get</code>	78
Table 3-71. Function <code>can_interrupt_flag_clear</code>	79
Table 3-72. CAU Registers	80
Table 3-73. CAU firmware function	81
Table 3-74. Structure <code>cau_key_parameter_struct</code>	82
Table 3-75. Structure <code>cau_iv_parameter_struct</code>	82
Table 3-76. Structure <code>cau_context_parameter_struct</code>	82
Table 3-77. Structure <code>cau_parameter_struct</code>	83
Table 3-78. Function <code>cau_deinit</code>	83
Table 3-79. Function <code>cau_struct_para_init</code>	83
Table 3-80. Function <code>cau_key_struct_para_init</code>	84
Table 3-81. Function <code>cau_iv_struct_para_init</code>	85
Table 3-82. Function <code>cau_context_struct_para_init</code>	85

Table 3-83. Function cau_enable	86
Table 3-84. Function cau_disable	86
Table 3-85. Function cau_dma_enable	87
Table 3-86. Function cau_dma_disable	87
Table 3-87. Function cau_init	88
Table 3-88. Function cau_aes_keysize_config	89
Table 3-89. Function cau_key_init	90
Table 3-90. Function cau_iv_init	90
Table 3-91. Function cau_phase_config	91
Table 3-92. Function cau_fifo_flush	92
Table 3-93. Function cau_enable_state_get	92
Table 3-94. Function cau_data_write	93
Table 3-95. Function cau_data_read	93
Table 3-96. Function cau_context_save	94
Table 3-97. Function cau_context_restore	95
Table 3-98. Function cau_aes_ecb	95
Table 3-99. Function cau_aes_cbc	96
Table 3-100. Function cau_aes_ctr	97
Table 3-101. Function cau_aes_cfb	98
Table 3-102. Function cau_aes_ofb	99
Table 3-103. Function cau_aes_gcm	100
Table 3-104. Function cau_aes_ccm	101
Table 3-105. Function cau_tdes_ecb	102
Table 3-106. Function cau_tdes_cbc	103
Table 3-107. Function cau_des_ecb	104
Table 3-108. Function cau_des_cbc	104
Table 3-109. Function cau_flag_get	105
Table 3-110. Function cau_interrupt_enable	106
Table 3-111. Function cau_interrupt_disable	107
Table 3-112. Function cau_interrupt_flag_get	107
Table 3-113. CMP Registers	108
Table 3-114. CMP firmware function	108
Table 3-115. Enum cmp_enum	109
Table 3-116. Function cmp_deinit	109
Table 3-117. Function cmp_mode_init	109
Table 3-118. Function cmp_noninverting_input_select	111
Table 3-119. Function cmp_output_init	111
Table 3-120. Function cmp_blanking_init	112
Table 3-121. Function cmp_enable	113
Table 3-122. Function cmp_disable	114
Table 3-123. Function cmp_window_enable	114
Table 3-124. Function cmp_window_disable	115
Table 3-125. Function cmp_lock_enable	115
Table 3-126. Function cmp_voltage_scaler_enable	116

Table 3-127. Function cmp_voltage_scaler_disable	116
Table 3-128. Function cmp_scaler_bridge_enable	117
Table 3-129. Function cmp_scaler_bridge_disable	117
Table 3-130. Function cmp_output_level_get	118
Table 3-131. CRC Registers	118
Table 3-132. CRC firmware function	119
Table 3-133. Function crc_deinit	119
Table 3-134. Function crc_reverse_output_data_enable	120
Table 3-135. Function crc_reverse_output_data_disable	120
Table 3-136. Function crc_data_register_reset	121
Table 3-137. Function crc_data_register_read	121
Table 3-138. Function crc_free_data_register_read	122
Table 3-139. Function crc_free_data_register_write	122
Table 3-140. Function crc_init_data_register_write	123
Table 3-141. Function crc_input_data_reverse_config	123
Table 3-142. Function crc_polynomial_size_set	124
Table 3-143. Function crc_polynomial_set	124
Table 3-144. Function crc_single_data_calculate	125
Table 3-145. Function crc_block_data_calculate	125
Table 3-146. CTC Registers	127
Table 3-147. CTC firmware function	127
Table 3-148. Function ctc_deinit	127
Table 3-149. Function ctc_counter_enable	128
Table 3-150. Function ctc_counter_disable	128
Table 3-151. Function ctc_irc48m_trim_value_config	129
Table 3-152. Function ctc_software_refsource_pulse_generate	129
Table 3-153. Function ctc_hardware_trim_mode_config	130
Table 3-154. Function ctc_refsource_polarity_config	131
Table 3-155. Function ctc_refsource_signal_select	131
Table 3-156. Function ctc_refsource_prescaler_config	132
Table 3-157. Function ctc_clock_limit_value_config	133
Table 3-158. Function ctc_counter_reload_value_config	133
Table 3-159. Function ctc_counter_capture_value_read	134
Table 3-160. Function ctc_counter_direction_read	134
Table 3-161. Function ctc_counter_reload_value_read	135
Table 3-162. Function ctc_irc48m_trim_value_read	135
Table 3-163. Function ctc_flag_get	136
Table 3-164. Function ctc_flag_clear	136
Table 3-165. Function ctc_interrupt_enable	137
Table 3-166. Function ctc_interrupt_disable	138
Table 3-167. Function ctc_interrupt_flag_get	138
Table 3-168. Function ctc_interrupt_flag_clear	139
Table 3-169. DBG Registers	140
Table 3-170. DBG firmware function	140

Table 3-171. Enum dbg_periph_enum	140
Table 3-172. Function dbg_deinit	141
Table 3-173. Function dbg_id_get	141
Table 3-174. Function dbg_low_power_enable.....	142
Table 3-175. Function dbg_low_power_disable.....	143
Table 3-176. Function dbg_periph_enable	143
Table 3-177. Function dbg_periph_disable	144
Table 3-178. DAC Registers	145
Table 3-179. DAC firmware functions	145
Table 3-180. Function dac_deinit.....	146
Table 3-181. Function dac_enable	146
Table 3-182. Function dac_disable.....	147
Table 3-183. Function dac_dma_enable.....	147
Table 3-184. Function dac_dma_disable	148
Table 3-185. Function dac_gpio_connect_config.....	148
Table 3-186. Function dac_output_buffer_enable	149
Table 3-187. Function dac_output_buffer_disable	150
Table 3-188. Function dac_output_value_get	150
Table 3-189. Function dac_data_set	151
Table 3-190. Function dac_trigger_enable.....	152
Table 3-191. Function dac_trigger_disable.....	152
Table 3-192. Function dac_trigger_source_config.....	153
Table 3-193. Function dac_software_trigger_enable	154
Table 3-194. Function dac_wave_mode_config.....	154
Table 3-195. Function dac_lfsr_noise_config	155
Table 3-196. Function dac_triangle_noise_config.....	156
Table 3-197. Function dac_flag_get	156
Table 3-198. Function dac_flag_clear	157
Table 3-199. Function dac_interrupt_enable	158
Table 3-200. Function dac_interrupt_disable	158
Table 3-201. Function dac_interrupt_flag_get.....	159
Table 3-202. Function dac_interrupt_flag_clear	159
Table 3-203. DMA Registers.....	160
Table 3-204. DMAMUX Registers	161
Table 3-205. DMA firmware function	161
Table 3-206. DMAMUX firmware function.....	162
Table 3-207. Structure dma_parameter_struct.....	163
Table 3-208. Structure dmamux_sync_parameter_struct	163
Table 3-209. Structure dmamux_gen_parameter_struct	163
Table 3-210. Enum dmamux_interrupt_enum	163
Table 3-211. Enum dmamux_flag_enum	164
Table 3-212. Enum dmamux_interrupt_flag_enum.....	165
Table 3-213. Enum dma_channel_enum	165
Table 3-214. Enum dmamux_multiplexer_channel_enum	166

Table 3-215. Enum dmamux_generator_channel_enum	166
Table 3-216. Function dma_deinit	166
Table 3-217. Function dma_struct_para_init	167
Table 3-218. Function dma_init	167
Table 3-219. Function dma_circulation_enable	168
Table 3-220. Function dma_circulation_disable	169
Table 3-221. Function dma_memory_to_memory_enable	169
Table 3-222. Function dma_memory_to_memory_disable	170
Table 3-223. Function dma_channel_enable	170
Table 3-224. Function dma_channel_disable	171
Table 3-225. Function dma_periph_address_config	171
Table 3-226. Function dma_memory_address_config	172
Table 3-227. Function dma_transfer_number_config	172
Table 3-228. Function dma_transfer_number_get	173
Table 3-229. Function dma_priority_config	173
Table 3-230. Function dma_memory_width_config	174
Table 3-231. Function dma_periph_width_config	175
Table 3-232. Function dma_memory_increase_enable	176
Table 3-233. Function dma_memory_increase_disable	176
Table 3-234. Function dma_periph_increase_enable	177
Table 3-235. Function dma_periph_increase_disable	177
Table 3-236. Function dma_transfer_direction_config	178
Table 3-237. Function dma_flag_get	178
Table 3-238. Function dma_flag_clear	179
Table 3-239. Function dma_interrupt_enable	180
Table 3-240. Function dma_interrupt_disable	180
Table 3-241. Function dma_interrupt_flag_get	181
Table 3-242. Function dma_interrupt_flag_clear	181
Table 3-243. Function dmamux_sync_struct_para_init	182
Table 3-244. Function dmamux_synchronization_init	183
Table 3-245. Function dmamux_synchronization_enable	184
Table 3-246. Function dmamux_synchronization_disable	184
Table 3-247. Function dmamux_event_generation_enable	185
Table 3-248. Function dmamux_event_generation_disable	185
Table 3-249. Function dmamux_gen_struct_para_init	186
Table 3-250. Function dmamux_request_generator_init	186
Table 3-251. Function dmamux_request_generator_channel_enable	187
Table 3-252. Function dmamux_request_generator_channel_disable	188
Table 3-253. Function dmamux_synchronization_polarity_config	188
Table 3-254. Function dmamux_request_forward_number_config	189
Table 3-255. Function dmamux_sync_id_config	190
Table 3-256. Function dmamux_request_id_config	191
Table 3-257. Function dmamux_trigger_polarity_config	195
Table 3-258. Function dmamux_request_generate_number_config	195

Table 3-259. Function <code>dmamux_trigger_id_config</code>	196
Table 3-260. Function <code>dmamux_flag_get</code>	198
Table 3-261. Function <code>dmamux_flag_clear</code>	198
Table 3-262. Function <code>dmamux_interrupt_enable</code>	199
Table 3-263. Function <code>dmamux_interrupt_disable</code>	199
Table 3-264. Function <code>dmamux_interrupt_flag_get</code>	200
Table 3-265. Function <code>dmamux_interrupt_flag_clear</code>	200
Table 3-266. EXTI Registers.....	201
Table 3-267. EXTI firmware function	201
Table 3-268. <code>exti_line_enum</code> for GD32L233xx devices	202
Table 3-269. <code>exti_line_enum</code> for GD32L235xx devices	202
Table 3-270. <code>exti_mode_enum</code>	203
Table 3-271. <code>exti_trig_type_enum</code>	203
Table 3-272. Function <code>exti_deinit</code>	204
Table 3-273. Function <code>exti_init</code>	204
Table 3-274. Function <code>exti_interrupt_enable</code>	205
Table 3-275. Function <code>exti_interrupt_disable</code>	205
Table 3-276. Function <code>exti_event_enable</code>	206
Table 3-277. Function <code>exti_event_disable</code>	206
Table 3-278. Function <code>exti_software_interrupt_enable</code>	207
Table 3-279. Function <code>exti_software_interrupt_disable</code>	207
Table 3-280. Function <code>exti_flag_get</code>	208
Table 3-281. Function <code>exti_flag_clear</code>	208
Table 3-282. Function <code>exti_interrupt_flag_get</code>	209
Table 3-283. Function <code>exti_interrupt_flag_clear</code>	209
Table 3-284. FMC Registers	210
Table 3-285. FMC firmware function	211
Table 3-286. <code>fmc_state_enum</code>	212
Table 3-287. <code>fmc_flag_enum</code>	212
Table 3-288. <code>fmc_interrupt_flag_enum</code>	213
Table 3-289. <code>fmc_interrupt_enum</code>	214
Table 3-290. Function <code>fmc_unlock</code>	214
Table 3-291. Function <code>fmc_lock</code>	214
Table 3-292. Function <code>fmc_wscnt_set</code>	215
Table 3-293. Function <code>fmc_prefetch_enable</code>	215
Table 3-294. Function <code>fmc_prefetch_disable</code>	216
Table 3-295. Function <code>fmc_low_power_enable</code>	216
Table 3-296. Function <code>fmc_low_power_disable</code>	217
Table 3-297. Function <code>fmc_page_erase</code>	217
Table 3-298. Function <code>fmc_mass_erase</code>	218
Table 3-299. Function <code>fmc_word_program</code>	218
Table 3-300. Function <code>fmc_fast_program</code>	219
Table 3-301. Function <code>fmc_doubleword_program</code>	220
Table 3-302. Function <code>ob_unlock</code>	221

Table 3-303. Function ob_lock	221
Table 3-304. Function ob_erase	222
Table 3-305. Function ob_write_protection_enable	223
Table 3-306. Function ob_security_protection_config	223
Table 3-307. Function ob_user_write	224
Table 3-308. Function ob_data_program	225
Table 3-309. Function ob_user_get	226
Table 3-310. Function ob_data_get	226
Table 3-311. Function ob_write_protection_get	227
Table 3-312. Function ob_security_protection_flag_get	227
Table 3-313. Function fmc_ecc_address_get	228
Table 3-314. Function fmc_slp_unlock	228
Table 3-315. Function fmc_sleep_slp_enable	229
Table 3-316. Function fmc_sleep_slp_disable	229
Table 3-317. Function fmc_run_slp_enable	230
Table 3-318. Function fmc_run_slp_disable	230
Table 3-319. Function fmc_sleep_mode_enter	231
Table 3-320. Function fmc_pd_mode_enter	231
Table 3-321. Function fmc_slp_mode_exit	232
Table 3-322. Function fmc_flag_get	232
Table 3-323. Function fmc_flag_clear	233
Table 3-324. Function fmc_interrupt_enable	234
Table 3-325. Function fmc_interrupt_disable	234
Table 3-326. Function fmc_interrupt_flag_get	235
Table 3-327. Function fmc_interrupt_flag_clear	235
Table 3-328. FWDGT Registers	236
Table 3-329. FWDGT firmware function	236
Table 3-330. Function fwdgt_write_enable	237
Table 3-331. Function fwdgt_write_disable	237
Table 3-332. Function fwdgt_enable	238
Table 3-333. Function fwdgt_prescaler_value_config	238
Table 3-334. Function fwdgt_reload_value_config	239
Table 3-335. Function fwdgt_window_value_config	239
Table 3-336. Function fwdgt_counter_reload	240
Table 3-337. Function fwdgt_config	240
Table 3-338. Function fwdgt_flag_get	241
Table 3-339. GPIO Registers	242
Table 3-340. GPIO firmware function	242
Table 3-341. Function gpio_deinit	243
Table 3-342. Function gpio_mode_set	243
Table 3-343. Function gpio_output_options_set	244
Table 3-344. Function gpio_bit_set	245
Table 3-345. Function gpio_bit_reset	246
Table 3-346. Function gpio_bit_write	246

Table 3-347. Function gpio_port_write	247
Table 3-348. Function gpio_input_bit_get.....	247
Table 3-349. Function gpio_input_port_get.....	248
Table 3-350. Function gpio_output_bit_get	249
Table 3-351. Function gpio_output_port_get	249
Table 3-352. Function gpio_af_set	250
Table 3-353. Function gpio_pin_lock	251
Table 3-354. Function gpio_bit_toggle	251
Table 3-355. Function gpio_port_toggle	252
Table 3-356. I2C Registers	253
Table 3-357. I2C firmware function.....	253
Table 3-358. i2c_interrupt_flag_enum	255
Table 3-359. Function i2c_deinit	255
Table 3-360. Function i2c_timing_config	256
Table 3-361. Function i2c_digital_noise_filter_config	257
Table 3-362. Function i2c_analog_noise_filter_enable	257
Table 3-363. Function i2c_analog_noise_filter_disable	258
Table 3-364. Function i2c_master_clock_config	259
Table 3-365. Function i2c_master_addressing	259
Table 3-366. Function i2c_address10_header_enable.....	260
Table 3-367. Function i2c_address10_header_disable.....	260
Table 3-368. Function i2c_address10_enable	261
Table 3-369. Function i2c_address10_disable	261
Table 3-370. Function i2c_automatic_end_enable	262
Table 3-371. Function i2c_automatic_end_disable	262
Table 3-372. Function i2c_slave_response_to_gcall_enable	263
Table 3-373. Function i2c_slave_response_to_gcall_disable	263
Table 3-374. Function i2c_stretch_scl_low_enable	264
Table 3-375. Function i2c_stretch_scl_low_disable	264
Table 3-376. Function i2c_address_config	265
Table 3-377. Function i2c_address_bit_compare_config	266
Table 3-378. Function i2c_address_disable	267
Table 3-379. Function i2c_second_address_config.....	267
Table 3-380. Function i2c_second_address_disable	268
Table 3-381. Function i2c_receved_address_get	269
Table 3-382. Function i2c_slave_byte_control_enable.....	269
Table 3-383. Function i2c_slave_byte_control_disable.....	270
Table 3-384. Function i2c_nack_enable	270
Table 3-385. Function i2c_nack_disable	271
Table 3-386. Function i2c_wakeup_from_deepsleep_enable.....	271
Table 3-387. Function i2c_wakeup_from_deepsleep_disable.....	272
Table 3-388. Function i2c_enable	272
Table 3-389. Function i2c_disable	273
Table 3-390. Function i2c_start_on_bus	273

Table 3-391. Function i2c_stop_on_bus.....	274
Table 3-392. Function i2c_data_transmit	274
Table 3-393. Function i2c_data_receive	275
Table 3-394. Function i2c_reload_enable.....	275
Table 3-395. Function i2c_reload_disable.....	276
Table 3-396. Function i2c_transfer_byte_number_config.....	276
Table 3-397. Function i2c_dma_enable	277
Table 3-398. Function i2c_dma_disable	277
Table 3-399. Function i2c_pec_transfer	278
Table 3-400. Function i2c_pec_enable.....	279
Table 3-401. Function i2c_pec_disable.....	279
Table 3-402. Function i2c_pec_value_get	280
Table 3-403. Function i2c_smbus_alert_enable.....	280
Table 3-404. Function i2c_smbus_alert_disable.....	281
Table 3-405. Function i2c_smbus_default_addr_enable	281
Table 3-406. Function i2c_smbus_default_addr_disable	282
Table 3-407. Function i2c_smbus_host_addr_enable	282
Table 3-408. Function i2c_smbus_host_addr_disable	283
Table 3-409. Function i2c_extented_clock_timeout_enable	283
Table 3-410. Function i2c_extented_clock_timeout_disable.....	284
Table 3-411. Function i2c_clock_timeout_enable	284
Table 3-412. Function i2c_clock_timeout_disable.....	285
Table 3-413. Function i2c_bus_timeout_b_config.....	285
Table 3-414. Function i2c_bus_timeout_a_config	286
Table 3-415. Function i2c_idle_clock_timeout_config.....	286
Table 3-416. Function i2c_flag_get.....	287
Table 3-417. Function i2c_flag_clear.....	288
Table 3-418. Function i2c_interrupt_enable.....	289
Table 3-419. Function i2c_interrupt_disable	289
Table 3-420. Function i2c_interrupt_flag_get	290
Table 3-421. Function i2c_interrupt_flag_clear	291
Table 3-422. LPTIMER Registers	292
Table 3-423. LPTIMER firmware function	293
Table 3-424. Structure lptimer_parameter_struct.....	293
Table 3-425. Function lptimer_deinit.....	294
Table 3-426. Function lptimer_struct_para_init	295
Table 3-427. Function lptimer_init	295
Table 3-428. Function lptimer_inputremap	296
Table 3-429. Function lptimer_register_shadow_enable	297
Table 3-430. Function lptimer_register_shadow_disable	298
Table 3-431. Function lptimer_timeout_enable	298
Table 3-432. Function lptimer_timeout_disable.....	299
Table 3-433. Function lptimer_continue_start	299
Table 3-434. Function lptimer_single_start	300

Table 3-435. Function <code>lptimer_stop</code>	301
Table 3-436. Function <code>lptimer_counter_read</code>	301
Table 3-437. Function <code>lptimer_autoreload_read</code>	302
Table 3-438. Function <code>lptimer_compare_read</code>	302
Table 3-439. Function <code>lptimer_autoreload_value_config</code>	303
Table 3-440. Function <code>lptimer_compare_value_config</code>	304
Table 3-441. Function <code>lptimer_decodemode0_enable</code>	304
Table 3-442. Function <code>lptimer_decodemode1_enable</code>	305
Table 3-443. Function <code>lptimer_decodemode_disable</code>	305
Table 3-444. Function <code>lptimer_highlevelcounter_enable</code>	306
Table 3-445. Function <code>lptimer_highlevelcounter_disable</code>	306
Table 3-446. Function <code>lptimer_flag_get</code>	307
Table 3-447. Function <code>lptimer_flag_clear</code>	308
Table 3-448. Function <code>lptimer_interrupt_enable</code>	309
Table 3-449. Function <code>lptimer_interrupt_disable</code>	310
Table 3-450. Function <code>lptimer_interrupt_flag_get</code>	311
Table 3-451. Function <code>lptimer_interrupt_flag_clear</code>	312
Table 3-452. LPUART Registers.....	314
Table 3-453. LPUART firmware function	314
Table 3-454. Enum <code>lpuart_flag_enum</code>	315
Table 3-455. Enum <code>lpuart_interrupt_flag_enum</code>	316
Table 3-456. Enum <code>lpuart_interrupt_enum</code>	316
Table 3-457. Enum <code>lpuart_invert_enum</code>	317
Table 3-458. Function <code>lpuart_deinit</code>	317
Table 3-459. Function <code>lpuart_baudrate_set</code>	318
Table 3-460. Function <code>lpuart_parity_config</code>	318
Table 3-461. Function <code>lpuart_word_length_set</code>	319
Table 3-462. Function <code>lpuart_stop_bit_set</code>	319
Table 3-463. Function <code>lpuart_enable</code>	320
Table 3-464. Function <code>lpuart_disable</code>	320
Table 3-465. Function <code>lpuart_transmit_config</code>	321
Table 3-466. Function <code>lpuart_receive_config</code>	322
Table 3-467. Function <code>lpuart_data_first_config</code>	322
Table 3-468. Function <code>lpuart_invert_config</code>	323
Table 3-469. Function <code>lpuart_overrun_enable</code>	323
Table 3-470. Function <code>lpuart_overrun_disable</code>	324
Table 3-471. Function <code>lpuart_data_transmit</code>	324
Table 3-472. Function <code>lpuart_data_receive</code>	325
Table 3-473. Function <code>lpuart_command_enable</code>	326
Table 3-474. Function <code>lpuart_address_config</code>	326
Table 3-475. Function <code>lpuart_address_detection_mode_config</code>	327
Table 3-476. Function <code>lpuart_mute_mode_enable</code>	327
Table 3-477. Function <code>lpuart_mute_mode_disable</code>	328
Table 3-478. Function <code>lpuart_mute_mode_wakeup_config</code>	328

Table 3-479. Function lpuart_halfduplex_enable	329
Table 3-480. Function lpuart_halfduplex_disable	330
Table 3-481. Function lpuart_hardware_flow_rts_config	330
Table 3-482. Function lpuart_hardware_flow_cts_config	331
Table 3-483. Function lpuart_hardware_flow_coherence_config	331
Table 3-484. Function lpuart_rs485_driver_enable	332
Table 3-485. Function lpuart_rs485_driver_disable	332
Table 3-486. Function lpuart_driver_asserttime_config	333
Table 3-487. Function lpuart_driver_deasserttime_config	334
Table 3-488. Function lpuart_depolarity_config	334
Table 3-489. Function lpuart_dma_receive_config	335
Table 3-490. Function lpuart_dma_transmit_config	335
Table 3-491. Function lpuart_reception_error_dma_disable	336
Table 3-492. Function lpuart_reception_error_dma_enable	337
Table 3-493. Function lpuart_wakeup_enable	337
Table 3-494. Function lpuart_wakeup_disable	338
Table 3-495. Function lpuart_wakeup_mode_config	338
Table 3-496. Function lpuart_flag_get	339
Table 3-497. Function lpuart_flag_clear	339
Table 3-498. Function lpuart_interrupt_enable	340
Table 3-499. Function lpuart_interrupt_disable	341
Table 3-500. Function lpuart_interrupt_flag_get	341
Table 3-501. Function lpuart_interrupt_flag_clear	342
Table 3-502. NVIC Registers	343
Table 3-503. SysTick Registers	344
Table 3-504. MISC firmware function	344
Table 3-505. IRQn_Type for GD32L233xx devices	344
Table 3-506. IRQn_Type for GD32L235xx devices	346
Table 3-507. Function nvic_irq_enable	348
Table 3-508. Function nvic_irq_disable	348
Table 3-509. Function nvic_system_reset	349
Table 3-510. Function nvic_vector_table_set	349
Table 3-511. Function system_lowpower_set	350
Table 3-512. Function system_lowpower_reset	350
Table 3-513. Function systick_clksource_set	351
Table 3-514. PMU Registers	352
Table 3-515. PMU firmware function	352
Table 3-516. Function pmu_deinit	353
Table 3-517. Function pmu_lvd_select	354
Table 3-518. Function pmu_lvd_disable	354
Table 3-519. Function pmu_ldo_output_select	355
Table 3-520. Function pmu_vc_enable	355
Table 3-521. Function pmu_vc_disable	356
Table 3-522. Function pmu_vcr_select	356

Table 3-523. Function pmu_low_power_enable.....	357
Table 3-524. Function pmu_low_power_disable.....	357
Table 3-525. Function pmu_to_sleepmode.....	358
Table 3-526. Function pmu_to_deepsleepmode.....	359
Table 3-527. Function pmu_to_standbymode.....	359
Table 3-528. Function pmu_wakeup_pin_enable.....	360
Table 3-529. Function pmu_wakeup_pin_disable.....	361
Table 3-530. Function pmu_backup_write_enable.....	361
Table 3-531. Function pmu_backup_write_disable.....	362
Table 3-532. Function pmu_sram_power_config.....	362
Table 3-533. Function pmu_core1_power_config.....	363
Table 3-534. Function pmu_deepsleep2_retention_enable.....	363
Table 3-535. Function pmu_deepsleep2_retention_disable.....	364
Table 3-536. Function pmu_eflash_sleep_power_config.....	364
Table 3-537. Function pmu_eflash_deepsleep_power_config.....	365
Table 3-538. Function pmu_deepsleep2_sram_power_config.....	365
Table 3-539. Function pmu_deepsleep_wait_time_config.....	366
Table 3-540. Function pmu_wakeuptime_core1_software_enable.....	366
Table 3-541. Function pmu_wakeuptime_core1_software_disable.....	367
Table 3-542. Function pmu_wakeuptime_eflash_config.....	367
Table 3-543. Function pmu_wakeuptime_sram_config.....	368
Table 3-544. Function pmu_wakeuptime_sram_software_enable.....	368
Table 3-545. Function pmu_wakeuptime_sram_software_disable.....	369
Table 3-546. Function pmu_wakeuptime_deepsleep2_software_enable.....	369
Table 3-547. Function pmu_wakeuptime_deepsleep2_software_disable.....	370
Table 3-548. Function pmu_flag_get.....	370
Table 3-549. Function pmu_flag_clear.....	371
Table 3-550. RCU Registers.....	372
Table 3-551. RCU firmware function.....	373
Table 3-552. Enum rcu_periph_enum.....	374
Table 3-553. Enum rcu_periph_sleep_enum.....	375
Table 3-554. Enum rcu_periph_reset_enum.....	375
Table 3-555. Enum rcu_flag_enum.....	376
Table 3-556. Enum rcu_int_flag_enum.....	377
Table 3-557. Enum rcu_int_flag_clear_enum.....	377
Table 3-558. Enum rcu_int_enum.....	378
Table 3-559. Enum rcu_osci_type_enum.....	378
Table 3-560. Enum rcu_clock_freq_enum.....	378
Table 3-561. Enum usart_idx_enum.....	379
Table 3-562. Enum lptimer_idx_enum.....	379
Table 3-563. Enum lpuart_idx_enum.....	379
Table 3-564. Enum i2c_idx_enum.....	379
Table 3-565. Function rcu_deinit.....	380
Table 3-566. Function rcu_periph_clock_enable.....	380

Table 3-567. Function rcu_periph_clock_disable	381
Table 3-568. Function rcu_periph_clock_sleep_enable	381
Table 3-569. Function rcu_periph_clock_sleep_disable	382
Table 3-570. Function rcu_periph_reset_enable	382
Table 3-571. Function rcu_periph_reset_disable	383
Table 3-572. Function rcu_bkp_reset_enable	383
Table 3-573. Function rcu_bkp_reset_disable	384
Table 3-574. Function rcu_system_clock_source_config	384
Table 3-575. Function rcu_system_clock_source_get	385
Table 3-576. Function rcu_ahb_clock_config	385
Table 3-577. Function rcu_apb1_clock_config	386
Table 3-578. Function rcu_apb2_clock_config	386
Table 3-579. Function rcu_adc_clock_config	387
Table 3-580. Function rcu_ckout_config	388
Table 3-581. Function rcu_pll_config	389
Table 3-582. Function rcu_usart_clock_config	390
Table 3-583. Function rcu_i2c_clock_config	390
Table 3-584. Function rcu_lptimer_clock_config	391
Table 3-585. Function rcu_lptimer_clock_config	392
Table 3-586. Function rcu_lpuart_clock_config	392
Table 3-587. Function rcu_lpuart_clock_config	393
Table 3-588. Function rcu_irc16mdiv_clock_config	394
Table 3-589. Function rcu_usbd_clock_config	394
Table 3-590. Function rcu_rtc_clock_config	395
Table 3-591. Function rcu_pll_source_ck_prediv_config	396
Table 3-592. Function rcu_lxtal_drive_capability_config	396
Table 3-593. Function rcu_lp_bandgap_config	397
Table 3-594. Function rcu_osci_stab_wait	397
Table 3-595. Function rcu_osci_on	398
Table 3-596. Function rcu_osci_off	398
Table 3-597. Function rcu_osci_bypass_mode_enable	399
Table 3-598. Function rcu_osci_bypass_mode_disable	399
Table 3-599. Function rcu_irc16m_adjust_value_set	400
Table 3-600. Function rcu_hxtal_clock_monitor_enable	400
Table 3-601. Function rcu_hxtal_clock_monitor_disable	401
Table 3-602. Function rcu_lxtal_clock_monitor_enable	401
Table 3-603. Function rcu_lxtal_clock_monitor_disable	402
Table 3-604. Function rcu_voltage_key_unlock	402
Table 3-605. Function rcu_clock_freq_get	403
Table 3-606. Function rcu_flag_get	403
Table 3-607. Function rcu_all_reset_flag_clear	404
Table 3-608. Function rcu_interrupt_flag_get	404
Table 3-609. Function rcu_interrupt_flag_clear	405
Table 3-610. Function rcu_interrupt_enable	405

Table 3-611. Function rcu_interrupt_disable	406
Table 3-612. RTC Registers	407
Table 3-613. RTC firmware function.....	407
Table 3-614. Structure rtc_parameter_struct.....	408
Table 3-615. Structure rtc_alarm_struct.....	409
Table 3-616. Structure rtc_timestamp_struct.....	409
Table 3-617. Structure rtc_tamper_struct	409
Table 3-618. Function rtc_deinit	410
Table 3-619. Function rtc_init.....	410
Table 3-620. Function rtc_init_mode_enter	411
Table 3-621. Function rtc_init_mode_exit.....	412
Table 3-622. Function rtc_register_sync_wait	412
Table 3-623. Function rtc_current_time_get.....	413
Table 3-624. Function rtc_subsecond_get.....	413
Table 3-625. Function rtc_alarm_config.....	414
Table 3-626. Function rtc_alarm_subsecond_config.....	414
Table 3-627. Function rtc_alarm_enable	416
Table 3-628. Function rtc_alarm_disable	416
Table 3-629. Function rtc_alarm_get.....	417
Table 3-630. Function rtc_alarm_subsecond_get	417
Table 3-631. Function rtc_timestamp_enable	418
Table 3-632. Function rtc_timestamp_disable	418
Table 3-633. Function rtc_timestamp_internalevent_config	419
Table 3-634. Function rtc_timestamp_get.....	419
Table 3-635. Function rtc_timestamp_subsecond_get.....	420
Table 3-636. Function rtc_timestamp_enable	420
Table 3-637. Function rtc_tamper_disable.....	421
Table 3-638. Function rtc_tamper_mask	421
Table 3-639. Function rtc_tamper_without_bkp_reset	422
Table 3-640. Function rtc_output_pin_select.....	423
Table 3-641. Function rtc_alarm_output_config	423
Table 3-642. Function rtc_calibration_output_config.....	424
Table 3-643. Function rtc_hour_adjust.....	425
Table 3-644. Function rtc_second_adjust.....	425
Table 3-645. Function rtc_bypass_shadow_enable	426
Table 3-646. Function rtc_bypass_shadow_disable	426
Table 3-647. Function rtc_refclock_detection_enable.....	427
Table 3-648. Function rtc_refclock_detection_disable.....	427
Table 3-649. Function rtc_wakeup_enable	428
Table 3-650. Function rtc_wakeup_disable	428
Table 3-651. Function rtc_wakeup_clock_set	429
Table 3-652. Function rtc_wakeup_timer_set.....	430
Table 3-653. Function rtc_wakeup_timer_get	430
Table 3-654. Function rtc_smooth_calibration_config.....	431

Table 3-655. Function rtc_interrupt_enable	432
Table 3-656. Function rtc_interrupt_disable	432
Table 3-657. Function rtc_flag_get	433
Table 3-658. Function rtc_flag_clear	434
Table 3-659. SLCD Registers	435
Table 3-660. SLCD firmware function	435
Table 3-661. Enum slcd_data_register_enum	436
Table 3-662. Function slcd_deinit	436
Table 3-663. Function slcd_enable	437
Table 3-664. Function slcd_disable	437
Table 3-665. Function slcd_init	438
Table 3-666. Function slcd_enhance_mode_enable	439
Table 3-667. Function slcd_enhance_mode_disable	440
Table 3-668. Function slcd_weak_driving_resistance_select	440
Table 3-669. Function slcd_bias_voltage_select	441
Table 3-670. Function slcd_duty_select	441
Table 3-671. Function slcd_clock_config	442
Table 3-672. Function slcd_blink_mode_config	444
Table 3-673. Function slcd_contrast_ratio_config	445
Table 3-674. Function slcd_dead_time_config	446
Table 3-675. Function slcd_pulse_on_duration_config	446
Table 3-676. Function slcd_com_seg_remap	447
Table 3-677. Function slcd_voltage_source_select	448
Table 3-678. Function slcd_high_drive_config	448
Table 3-679. Function slcd_data_register_write	449
Table 3-680. Function slcd_data_update_request	449
Table 3-681. Function slcd_flag_get	450
Table 3-682. Function slcd_flag_clear	450
Table 3-683. Function slcd_interrupt_enable	451
Table 3-684. Function slcd_interrupt_disable	451
Table 3-685. Function slcd_interrupt_flag_get	452
Table 3-686. Function slcd_interrupt_flag_clear	452
Table 3-687. SPI/I2S Registers	453
Table 3-688. SPI/I2S firmware function	454
Table 3-689. spi_parameter_struct	455
Table 3-690. Function spi_i2s_deinit	455
Table 3-691. Function spi_struct_para_init	456
Table 3-692. Function spi_init	457
Table 3-693. Function spi_enable	457
Table 3-694. Function spi_disable	458
Table 3-695. Function i2s_init	458
Table 3-696. Function i2s_psc_config	459
Table 3-697. Function i2s_enable	461
Table 3-698. Function i2s_disable	461

Table 3-699. Function spi_nss_output_enable	462
Table 3-700. Function spi_nss_output_disable	462
Table 3-701. Function spi_nss_internal_high	463
Table 3-702. Function spi_nss_internal_low	463
Table 3-703. Function spi_dma_enable	464
Table 3-704. Function spi_dma_disable	465
Table 3-705. Function spi_transmit_odd_config	465
Table 3-706. Function spi_receive_odd_config	466
Table 3-707. Function spi_i2s_data_frame_format_config	466
Table 3-708. Function spi_fifo_access_size_config	467
Table 3-709. Function spi_bidirectional_transfer_config	468
Table 3-710. Function spi_i2s_data_transmit	468
Table 3-711. Function spi_i2s_data_receive	469
Table 3-712. Function spi_crc_polynomial_set	469
Table 3-713. Function spi_crc_polynomial_get	470
Table 3-714. Function spi_crc_length_set	471
Table 3-715. Function spi_crc_on	471
Table 3-716. Function spi_crc_off	472
Table 3-717. Function spi_crc_next	472
Table 3-718. Function spi_crc_get	473
Table 3-719. Function spi_crc_error_clear	473
Table 3-720. Function spi_ti_mode_enable	474
Table 3-721. Function spi_ti_mode_disable	474
Table 3-722. Function spi_nssp_mode_enable	475
Table 3-723. Function spi_nssp_mode_disable	475
Table 3-724. Function spi_quad_enable	476
Table 3-725. Function spi_quad_disable	476
Table 3-726. Function spi_quad_write_enable	477
Table 3-727. Function spi_quad_read_enable	477
Table 3-728. Function spi_quad_io23_output_enable	478
Table 3-729. Function spi_quad_io23_output_disable	478
Table 3-730. Function spi_i2s_format_error_clear	479
Table 3-731. Function spi_i2s_flag_get	480
Table 3-732. Function spi_i2s_interrupt_enable	481
Table 3-733. Function spi_i2s_interrupt_disable	482
Table 3-734. Function spi_i2s_interrupt_flag_get	482
Table 3-735. SYSCFG Registers	483
Table 3-736. SYSCFG firmware function	484
Table 3-737. Function syscfg_deinit	484
Table 3-738. Function syscfg_exti_line_config	485
Table 3-739. Function syscfg_pin_remap_enable	485
Table 3-740. Function syscfg_pin_remap_disable	486
Table 3-741. Function syscfg_high_current_enable	487
Table 3-742. Function syscfg_high_current_disable	487

Table 3-743. Function irq_latency_set	488
Table 3-744. Function syscfg_bootmode_get	488
Table 3-745. Function syscfg_sram_waitstate_insert	489
Table 3-746. Function syscfg_sram_waitstate_cancel	490
Table 3-747. Function syscfg_lock_config	490
Table 3-748. Function syscfg_flag_get	491
Table 3-749. Function syscfg_flag_clear	491
Table 3-750. TIMERx Registers	492
Table 3-751. TIMERx firmware function	493
Table 3-752. Structure timer_parameter_struct	495
Table 3-753. Structure timer_break_parameter_struct	496
Table 3-754. Structure timer_oc_parameter_struct	496
Table 3-755. Structure timer_ic_parameter_struct	497
Table 3-756. Function timer_deinit	497
Table 3-757. Function timer_struct_para_init	497
Table 3-758. Function timer_init	498
Table 3-759. Function timer_enable	499
Table 3-760. Function timer_disable	499
Table 3-761. Function timer_auto_reload_shadow_enable	500
Table 3-762. Function timer_auto_reload_shadow_disable	500
Table 3-763. Function timer_update_event_enable	501
Table 3-764. Function timer_update_event_disable	501
Table 3-765. Function timer_counter_alignment	502
Table 3-766. Function timer_counter_up_direction	503
Table 3-767. timer_counter_down_direction	503
Table 3-768. Function timer_prescaler_config	504
Table 3-769. Function timer_repetition_value_config	505
Table 3-770. Function timer_autoreload_value_config	505
Table 3-771. Function timer_counter_value_config	506
Table 3-772. Function timer_counter_read	506
Table 3-773. Function timer_prescaler_read	507
Table 3-774. Function timer_single_pulse_mode_config	508
Table 3-775. Function timer_update_source_config	508
Table 3-776. Function timer_dma_enable	509
Table 3-777. Function timer_dma_disable	510
Table 3-778. Function timer_channel_dma_request_source_select	511
Table 3-779. Function timer_dma_transfer_config	512
Table 3-780. Function timer_event_software_generate	513
Table 3-781. Function timer_break_struct_para_init	514
Table 3-782. Function timer_break_config	515
Table 3-783. Function timer_break_enable	516
Table 3-784. Function timer_break_disable	516
Table 3-785. Function timer_automatic_output_enable	517
Table 3-786. Function timer_automatic_output_disable	517

Table 3-787. Function timer_primary_output_config	518
Table 3-788. Function timer_channel_control_shadow_config	518
Table 3-789. Function timer_channel_control_shadow_update_config	519
Table 3-790. Function timer_channel_output_struct_para_init	520
Table 3-791. Function timer_channel_output_config	520
Table 3-792. Function timer_channel_output_mode_config	521
Table 3-793. Function timer_channel_output_pulse_value_config	522
Table 3-794. Function timer_channel_output_shadow_config	523
Table 3-795. Function timer_channel_output_fast_config	524
Table 3-796. Function timer_channel_output_clear_config	525
Table 3-797. Function timer_channel_output_polarity_config	526
Table 3-798. Function timer_channel_complementary_output_polarity_config	527
Table 3-799. Function timer_channel_output_state_config	528
Table 3-800. Function timer_channel_complementary_output_state_config	528
Table 3-801. Function timer_channel_input_struct_para_init	529
Table 3-802. Function timer_input_capture_config	530
Table 3-803. Function timer_channel_input_capture_prescaler_config	531
Table 3-804. Function timer_channel_capture_value_register_read	532
Table 3-805. Function timer_input_pwm_capture_config	533
Table 3-806. Function timer_hall_mode_config	533
Table 3-807. Function timer_input_trigger_source_select	534
Table 3-808. Function timer_master_output_trigger_source_select	535
Table 3-809. Function timer_slave_mode_select	536
Table 3-810. Function timer_master_slave_mode_config	537
Table 3-811. Function timer_external_trigger_config	538
Table 3-812. Function timer_quadrature_decoder_mode_config	539
Table 3-813. Function timer_internal_clock_config	540
Table 3-814. Function timer_internal_trigger_as_external_clock_config	540
Table 3-815. Function timer_external_trigger_as_external_clock_config	541
Table 3-816. Function timer_external_clock_mode0_config	542
Table 3-817. Function timer_external_clock_mode1_config	543
Table 3-818. Function timer_external_clock_mode1_disable	544
Table 3-819. Function timer_channel_remap_config	545
Table 3-820. Function timer_write_chxval_register_config	546
Table 3-821. Function timer_flag_get	546
Table 3-822. Function timer_flag_clear	547
Table 3-823. Function timer_interrupt_enable	549
Table 3-824. Function timer_interrupt_disable	549
Table 3-825. Function timer_interrupt_flag_get	550
Table 3-826. Function timer_interrupt_flag_clear	551
Table 3-827 TRNG Registers	553
Table 3-828. TRNG firmware function	553
Table 3-829. Enum trng_flag_enum	553
Table 3-830. Enum trng_int_flag_enum	553

Table 3-831. Function <code>trng_deinit</code>	553
Table 3-832. Function <code>trng_enable</code>	554
Table 3-833. Function <code>trng_disable</code>	554
Table 3-834. Function <code>trng_get_true_random_data</code>	555
Table 3-835. <code>trng_flag_get</code>	555
Table 3-836. <code>trng_interrupt_enable</code>	556
Table 3-837. <code>trng_interrupt_disable</code>	556
Table 3-838. <code>trng_interrupt_flag_get</code>	557
Table 3-839. <code>trng_interrupt_flag_clear</code>	557
Table 3-840. USART Registers.....	558
Table 3-841. USART firmware function.....	559
Table 3-842. Enum <code>usart_flag_enum</code>	561
Table 3-843. Enum <code>usart_interrupt_flag_enum</code>	561
Table 3-844. Enum <code>usart_interrupt_enum</code>	562
Table 3-845. Enum <code>usart_invert_enum</code>	562
Table 3-846. Function <code>usart_deinit</code>	563
Table 3-847. Function <code>usart_baudrate_set</code>	563
Table 3-848. Function <code>usart_parity_config</code>	564
Table 3-849. Function <code>usart_word_length_set</code>	564
Table 3-850. Function <code>usart_stop_bit_set</code>	565
Table 3-851. Function <code>usart_enable</code>	566
Table 3-852. Function <code>usart_disable</code>	566
Table 3-853. Function <code>usart_transmit_config</code>	567
Table 3-854. Function <code>usart_receive_config</code>	567
Table 3-855. Function <code>usart_data_first_config</code>	568
Table 3-856. Function <code>usart_invert_config</code>	569
Table 3-857. Function <code>usart_overrun_enable</code>	570
Table 3-858. Function <code>usart_overrun_disable</code>	570
Table 3-859. Function <code>usart_oversample_config</code>	571
Table 3-860. Function <code>usart_sample_bit_config</code>	571
Table 3-861. Function <code>usart_receiver_timeout_enable</code>	572
Table 3-862. Function <code>usart_receiver_timeout_disable</code>	572
Table 3-863. Function <code>usart_receiver_timeout_threshold_config</code>	573
Table 3-864. Function <code>usart_data_transmit</code>	574
Table 3-865. Function <code>usart_data_receive</code>	574
Table 3-866. Function <code>usart_command_enable</code>	575
Table 3-867. Function <code>usart_address_config</code>	575
Table 3-868. Function <code>usart_address_detection_mode_config</code>	576
Table 3-869. Function <code>usart_mute_mode_enable</code>	577
Table 3-870. Function <code>usart_mute_mode_disable</code>	577
Table 3-871. Function <code>usart_mute_mode_wakeup_config</code>	578
Table 3-872. Function <code>usart_lin_mode_enable</code>	578
Table 3-873. Function <code>usart_lin_mode_disable</code>	579
Table 3-874. Function <code>usart_lin_break_detection_length_config</code>	579

Table 3-875. Function usart_halfduplex_enable	580
Table 3-876. Function usart_halfduplex_disable	580
Table 3-877. Function usart_clock_enable	581
Table 3-878. Function usart_clock_disable	582
Table 3-879. Function usart_synchronous_clock_config	582
Table 3-880. Function usart_guard_time_config	583
Table 3-881. Function usart_smartcard_mode_enable	583
Table 3-882. Function usart_smartcard_mode_disable	584
Table 3-883. Function usart_smartcard_mode_nack_enable.....	584
Table 3-884. Function usart_smartcard_mode_nack_disable.....	585
Table 3-885. Function usart_smartcard_mode_early_nack_enable.....	585
Table 3-886. Function usart_smartcard_mode_early_nack_disable.....	586
Table 3-887. Function usart_smartcard_autoretry_config.....	587
Table 3-888. Function usart_block_length_config	587
Table 3-889. Function usart_irda_mode_enable.....	588
Table 3-890. Function usart_irda_mode_disable.....	588
Table 3-891. Function usart_prescaler_config.....	589
Table 3-892. Function usart_irda_lowpower_config	589
Table 3-893. Function usart_hardware_flow_rts_config	590
Table 3-894. Function usart_hardware_flow_cts_config	590
Table 3-895. Function usart_hardware_flow_coherence_config	591
Table 3-896. Function usart_rs485_driver_enable	592
Table 3-897. Function usart_rs485_driver_disable	592
Table 3-898. Function usart_driver_asserttime_config	593
Table 3-899. Function usart_driver_deasserttime_config.....	593
Table 3-900. Function usart_depolarity_config	594
Table 3-901. Function usart_dma_receive_config.....	595
Table 3-902. Function usart_dma_transmit_config.....	595
Table 3-903. Function usart_reception_error_dma_disable	596
Table 3-904. Function usart_reception_error_dma_enable	596
Table 3-905. Function usart_wakeup_enable	597
Table 3-906. Function usart_wakeup_disable	597
Table 3-907. Function usart_wakeup_mode_config	598
Table 3-908. Function usart_receive_fifo_enable.....	599
Table 3-909. Function usart_receive_fifo_disable.....	599
Table 3-910. Function usart_receive_fifo_counter_number.....	600
Table 3-911. Function usart_flag_get.....	600
Table 3-912. Function usart_flag_clear	601
Table 3-913. Function usart_interrupt_enable	602
Table 3-914. Function usart_interrupt_disable	603
Table 3-915. Function usart_interrupt_flag_get.....	604
Table 3-916. Function usart_interrupt_flag_clear.....	606
Table 3-917. WWDGT Registers	607
Table 3-918. VREF firmware function	607

Table 3-919. Function <code>vref_deinit</code>	608
Table 3-920. Function <code>vref_enable</code>	608
Table 3-921. Function <code>vref_disable</code>	609
Table 3-922. Function <code>vref_high_impedance_mode_enable</code>	609
Table 3-923. Function <code>vref_high_impedance_mode_disable</code>	610
Table 3-924. Function <code>vref_voltage_select</code>	610
Table 3-925. Function <code>vref_status_get</code>	611
Table 3-926. Function <code>vref_calib_value_set</code>	611
Table 3-927. Function <code>vref_calib_value_get</code>	612
Table 3-928. WWDGT Registers	612
Table 3-929. WWDGT firmware function	613
Table 3-930. Function <code>wwdgt_deinit</code>	613
Table 3-931. Function <code>wwdgt_enable</code>	613
Table 3-932. Function <code>wwdgt_counter_update</code>	614
Table 3-933. Function <code>wwdgt_config</code>	614
Table 3-934. Function <code>wwdgt_flag_get</code>	616
Table 3-935. Function <code>wwdgt_flag_clear</code>	616
Table 4-1. Revision history	617
Function descriptionS and Input parameter descriptionS Add SLCD in <i>Table 4-2</i> .	
<i>Function</i> <code>rcu_rtc_clock_config</code>	617

1. Introduction

This manual introduces firmware library of GD32L23x devices which are 32-bit microcontrollers based on the ARM processor.

The firmware library is a firmware function package, including program, data structure and macro definitions, all the performance features of peripherals of GD32L23x devices are involved in the package. The peripheral driving code and firmware examples on evaluation board are also included in firmware library. Users need not learn each peripherals in details and it's easy to apply a peripheral by using the firmware library. Using firmware library can greatly reduce programming time, thereby reducing development costs.

The driving code of each peripheral is concluded by a group of functions, which describes all the performance features of the peripheral. Users can drive a peripheral by a group of APIs (application programming interface), all the APIs are standardized about the code structure, function name and parameter names.

All the driving source code accord with MISRA-C:2004 standard (example files accord with extended ANSI-C standard), and will not be influenced by differences of IDEs, except the startup files which are written differently according to the IDEs.

The commonly used firmware library includes all the functions of all the peripherals, so the code size and the execution speed may not be the optimal. For most applications, users can use the library functions directly, while for the applications which are strict with the code size and execution speed, the firmware library can be used as the reference resource of how to configure a peripheral, and users adjust the code according to actual needs.

The overall structure of the firmware library user manual is shown as below:

- Rules of user manual and firmware library;
- Firmware library overview;
- Functions and registers descriptions of firmware library.

1.1. Rules of User Manual and Firmware Library

1.1.1. Peripherals

Table 1-1. Peripherals

Peripherals	Descriptions
ADC	Analog-to-digital converter
CAN	Controller area network
CAU	Cryptographic Acceleration Unit
CMP	Comparator
CRC	CRC calculation unit

Peripherals	Descriptions
CTC	Clock trim controller
DBG	Debug
DAC	Digital-to-analog converter
DMA	Direct memory access controller
DMAMUX	DMA request multiplexer
EXTI	Interrupt/event controller
FMC	Flash memory controller
FWDGT	Free watchdog timer
GPIO/AFIO	General-purpose and alternate-function I/Os
I2C	Inter-integrated circuit interface
LPTIMER	Low power timer
LPUART	Low-power universal asynchronous receiver /transmitter
MISC	Nested Vectored Interrupt Controller
PMU	Power management unit
RCU	Reset and clock unit
RTC	Real-time Clock
SLCD	Segment LCD controller
SPI/I2S	Serial peripheral interface/Inter-IC sound
SYSCFG	System configuration
TIMER	TIMER
TRNG	True random number generator
USART	Universal synchronous/asynchronous receiver /transmitter
VREF	VREF
WWDGT	Window watchdog timer

1.1.2. Naming rules

The firmware library naming rules are shown as below:

- The peripherals are shortened in XXX format, such as: ADC. More shorten information of peripherals refer to [Peripherals](#);
- The name of sourcefile and header file are started with “gd32l23x_”, such as: gd32l23x_adc.h;
- The constants used only in one file should be defined in the used file; the constants used in many files should be defined in corresponding header file. All the constants are written in uppercase of English letters;
- Registers are handled as constants. The naming of them are written in uppercase of English letters. In most cases, register names are shortened accord with the user manual;
- Variables are written in lowercase, when concluded by several words, underlines should be adapted among words;
- The naming of peripheral functions are started with the peripheral abbreviation added with an underline, when the function name is concluded by several words, underlines

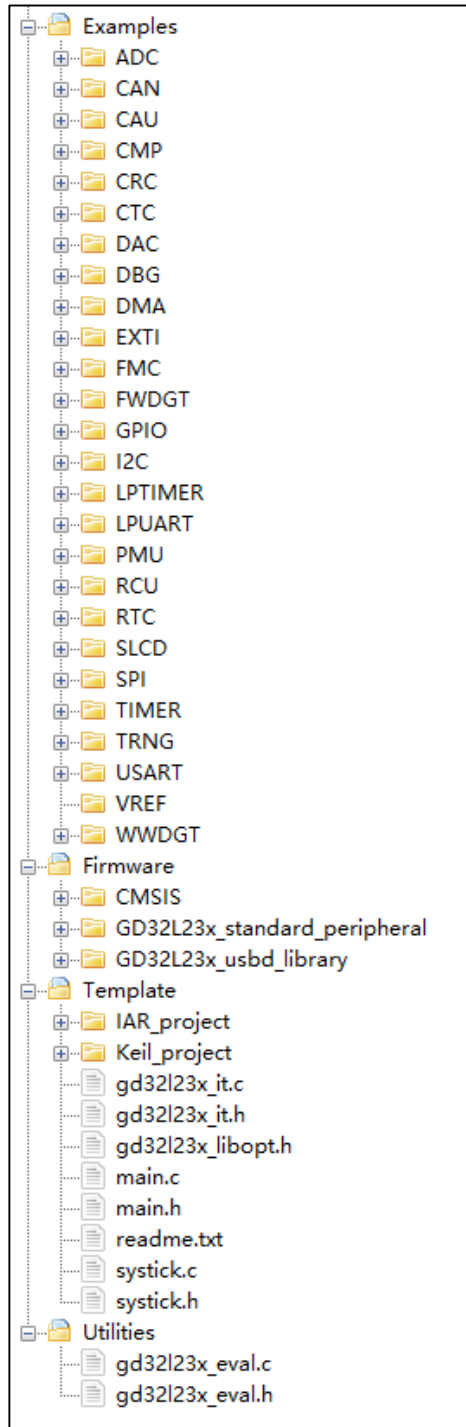
should be adapted among words, and all the peripheral functions are written in lowercase.

2. Firmware Library Overview

2.1. File Structure of Firmware Library

GD32L23x_Firmware_Library, the file structure is shown as below:

Figure 2-1. File structure of firmware library of GD32L23x



2.1.1. Examples Folder

Examples folder, each of GD32 peripheral has a subfolder. Each subfolder contains one or more examples of the peripheral, to show how to use the peripheral correctly. Each of the example subfolder includes the files shown as below:

- `readme.txt`: the description and using guide of the example;
- `gd32l23x_libopt.h`: the header file configures all the peripherals used in the example, included by different “DEFINE” sentences (all the peripherals are enabled by default);
- `gd32l23x_it.c`: the source file include all the interrupt service routines (if no interrupt is used, then all the function bodies are empty);
- `gd32l23x_it.h`: the header file include all the prototypes of the interrupt service routines;
- `systick.c`: the source file include the precise time delay functions by using `systick`;
- `systick.h`: the header file include the prototype of the precise time delay functions by using `systick`;
- `main.c`: example code. Note: all the examples are not influenced by software IDEs.

2.1.2. Firmware Folder

Firmware folder includes all the subfolder and files which are the core part of the firmware:

- CMSIS subfolder includes the Cortex M23 kernel support files, the startup file based on the Cortex M23 kernel processor, the global header file of GD32L23x and system configuration file;
- GD32L23x_standard_peripheral subfolder:
 - Include subfolder includes all the header files of firmware library, users need not modify this folder;
 - Source subfolder includes all the source files of firmware library, users need not modify this folder;

Note: All the codes accord with MISRA-C:2004 standard, and will not be influenced by different software IDEs.

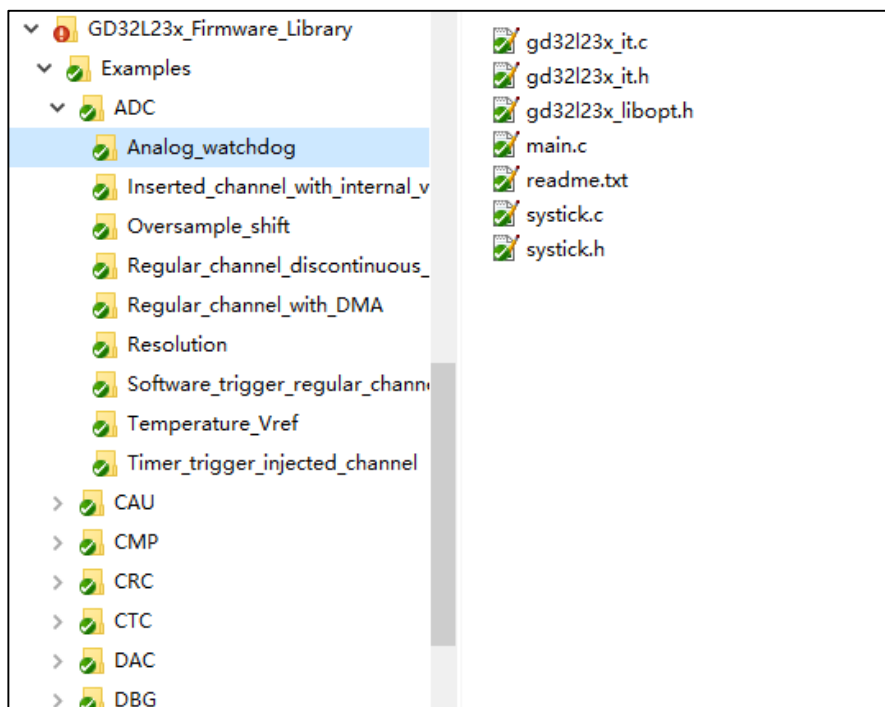
2.1.3. Template Folder

Template folder includes a simple demo of how to use LED, how to print by USART and use key to control, (IAR_project is run in IAR, and Keil_project is run in Keil5). User can use the project template to compile the formware examples, the steps are shown as below:

Select files

Open “Examples” folder, select the module to be tested, such as ADC, open “ADC” folder, select an example of ADC, such as “Analog_watchdog”, shown as below:

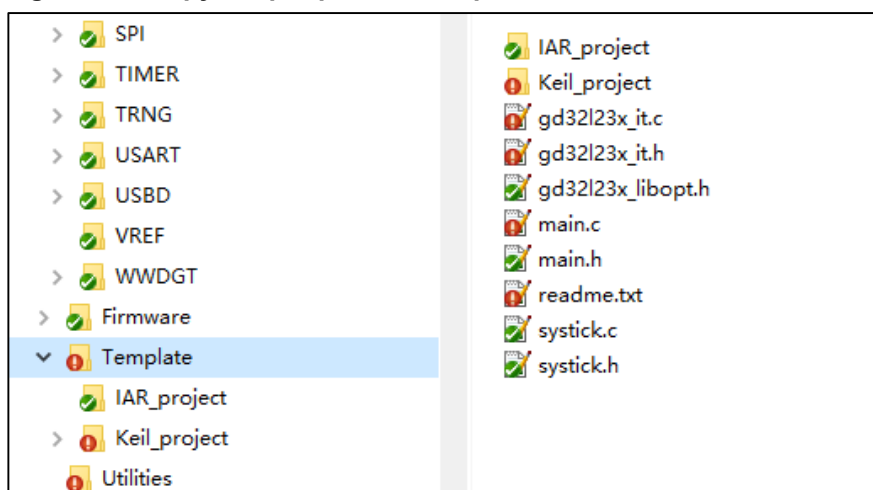
Figure 2-2. Select peripheral example files



Copy files

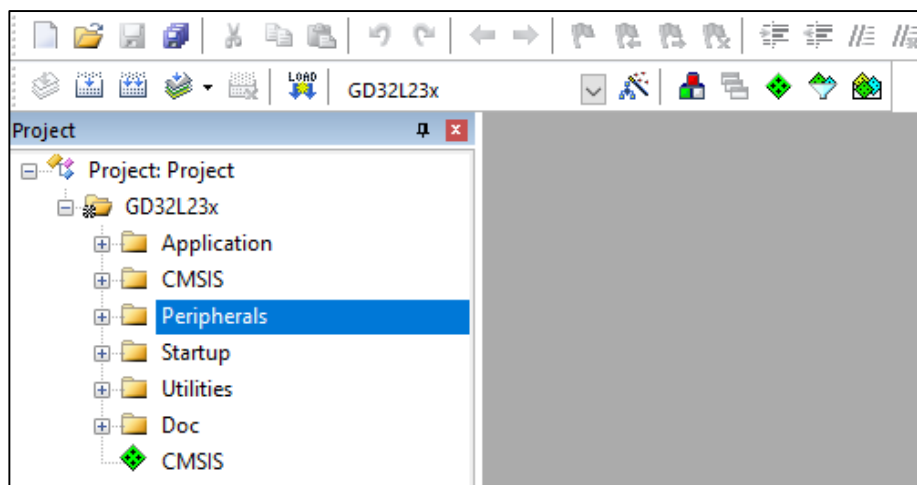
Open "Template" folder, keep the folders of " IAR_project" and " Keil_project", and delete the other files, then copy all the files in "SPI_master_transmit_slave_receive_interrupt" folder to the "Template" subfolder, shown as below:

Figure 2-3. Copy the peripheral example files

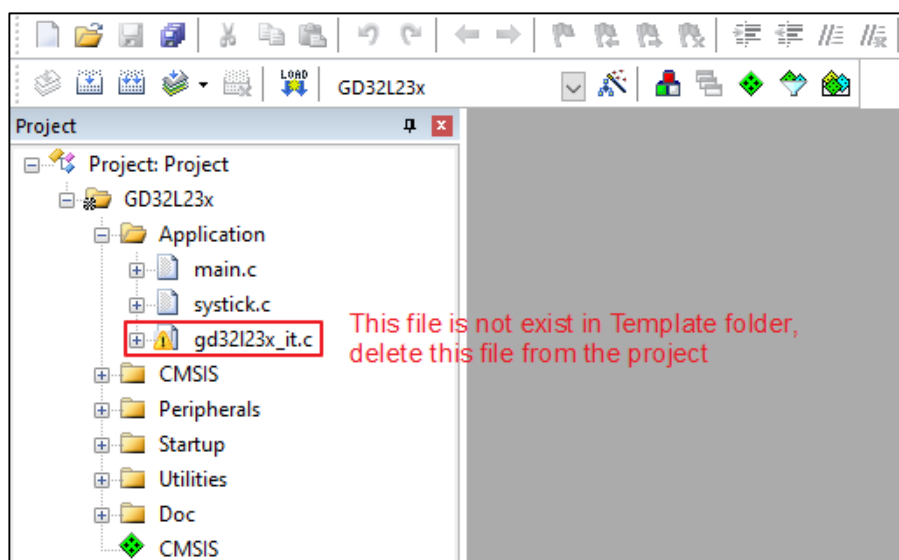


Open a project

GD provides project in Keil and IAR, users can open project in different IDEs according to their need, such as "Keil_project", open \Template\Keil_project\Project.uvprojx, shown as below:

Figure 2-4. Open the project file

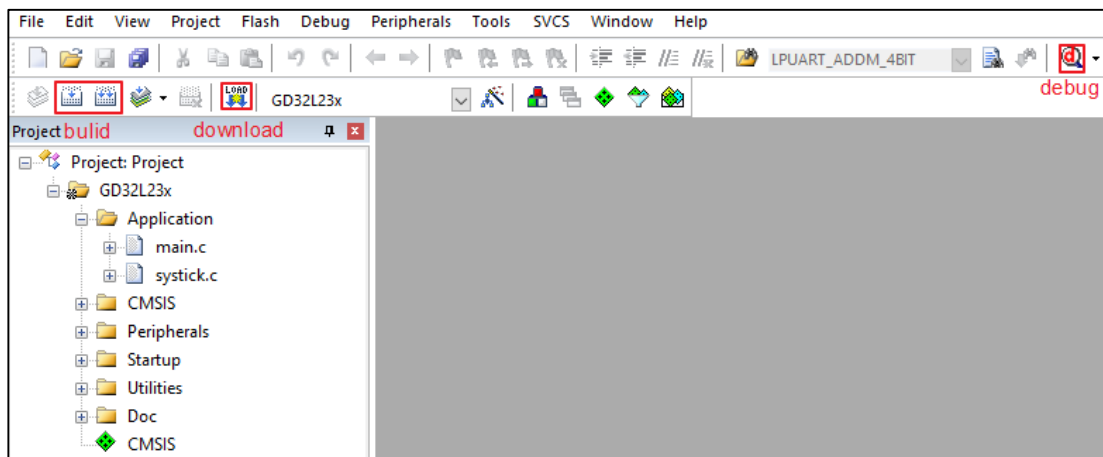
Because different module and different functions adopt different files, users should add or delete the files in project according to the copied files, shown as below:

Figure 2-5. Configure project files

Compile-Debug-Download

First compile the project, if there is no error, then select the right jumper cap according to the description of readme, download the project to the target board, and there will be the phenomenon showed accord with the description of readme. The usage of IDE can refer to corresponding software user guide. If users are using Keil, the figure is shown as below:

Figure 2-6. Compile-debug-download



2.1.4. Utilities Folder

Utilities folder includes files about the firmware examples on evaluation board:

- gd32e133r_eval.h is related header file of the evaluation board about running the firmware examples;
- gd32e233r_eval.c is related source file of the evaluation board about running the firmware examples.

Note: All the codes accord with MISRA-C:2004 standard, and will not be influenced by different software IDEs.

2.2. File descriptions of Firmware Library

The major files about the firmware library are listed and described in the table below.

Table 2-1. Function descriptions of Firmware Library

Files	Descriptions
gd32l23x_libopt.h	The header file about all the header files of peripherals. It is the only one file which is necessity to be included in the user's application, to connect the firmware library and the application.
main.c	Example of main function.
gd32l23x_it.h	Header file, including all the prototypes of interrupt service routines.
gd32l23x_it.c	Source files about interrupt service routines of peripherals. User can written his own interrupt functions in this file. For the different interrupt service requests to the same interrupt vector, users can confirm the interrupt source by functions of judging interrupt flags of peripherals. The functions are included in the firmware library.
gd32l23x_xxx.h	The header file of peripheral xxx, including functions about peripheral xxx, and the variables used for functions.

Files	Descriptions
gd32l23x_xxx.c	The C source file for driving peripheral xxx.
systick.h	The header file of systick.c, including prototypes of systick configuration function and delay function.
systick.c	The source file about systick configuration function and delay function.
readme.txt	Description document about how to configure and how to use the firmware example.

3. Firmware Library of Standard Peripherals

3.1. Overview of Firmware Library of Standard Peripherals

The description format of firmware functions are shown as below:

Table 3-1. Peripheral function format of Firmware Library

Function name	Name of peripheral function
Function prototype	Declaration prototype
Function descriptions	Explain the function how to work
Precondition	Requirements should meet before calling this function
The called functions	Other firmware functions called in this function
Input parameter{in}	
Input parameter name	Description
xxxx	Description of input parameters
Output parameter{out}	
Output parameter name	Description
xxxx	Description of output parameters
Return value	
Return value type	The range of return value

3.2. ADC

The 12-bit ADC is an analog-to-digital converter using the successive approximation method. The ADC registers are listed in chapter [3.2.1](#), the ADC firmware functions are introduced in chapter [3.2.2](#).

3.2.1. Descriptions of Peripheral registers

ADC registers are listed in the table shown as below:

Table 3-2. ADC Registers

Registers	Descriptions
ADC_STAT	Status register
ADC_CTL0	Control register 0
ADC_CTL1	Control register 1
ADC_SAMPT0	Sample time register 0
ADC_SAMPT1	Sample time register 1
ADC_IOFFx	Inserted channel data offset register x(x=0..3)
ADC_WDHT	Watchdog high threshold register

Registers	Descriptions
ADC_WDLT	Watchdog low threshold register
ADC_RSQ0	Routine sequence register 0
ADC_RSQ1	Routine sequence register 1
ADC_RSQ2	Routine sequence register 2
ADC_ISQ	Inserted sequence register
ADC_IDATAx	Inserted data register x(x=0..3)
ADC_RDATA	Routine data register
ADC_OVSAMPCTL	Oversampling control register
ADC_CCTL	Charge control register
ADC_DIFCTL	Differential mode control register

3.2.2. Descriptions of Peripheral functions

ADC firmware functions are listed in the table shown as below:

Table 3-3. ADC firmware function

Function name	Function description
adc_deinit	reset ADC
adc_enable	enable ADC
adc_disable	disable ADC
adc_calibration_number	configure ADC calibration number
adc_calibration_enable	ADC calibration and reset calibration
adc_dma_mode_enable	enable DMA request
adc_dma_mode_disable	disable DMA request
adc_discontinuous_mode_config	configure ADC discontinuous mode
adc_special_function_config	configure ADC special function
adc_channel_16_to_19	configure temperature sensor, internal reference voltage channel, VBAT channel or VSLCD channel
adc_data_alignment_config	configure ADC data alignment
adc_channel_length_config	configure the channel length of routine sequence or inserted sequence
adc_routine_channel_config	configure ADC routine channel
adc_inserted_channel_config	configure ADC inserted channel
adc_inserted_channel_offset_config	configure ADC inserted channel offset
adc_channel_differential_mode_config	configure differential mode for ADC channel
adc_external_trigger_config	configure ADC external trigger
adc_external_trigger_source_config	configure ADC external trigger source
adc_software_trigger_enable	enable ADC software trigger
adc_routine_data_read	read ADC routine sequence data register
adc_inserted_data_read	read ADC inserted sequence data register
adc_watchdog_single_channel	enable ADC analog watchdog single channel

Function name	Function description
_enable	
adc_watchdog_sequence_channel_enable	enable ADC analog watchdog sequence channel
adc_watchdog_disable	disable ADC analog watchdog
adc_watchdog_threshold_config	configure ADC analog watchdog threshold
adc_resolution_config	configure ADC resolution
adc_oversample_mode_config	configure ADC oversample mode
adc_oversample_mode_enable	enable ADC oversample mode
adc_oversample_mode_disable	disable ADC oversample mode
adc_charge_pulse_width_counter	configure ADC charge pulse width counter
adc_charge_flag_get	get ADC charge flag
adc_flag_get	get ADC flag
adc_flag_clear	clear ADC flag
adc_interrupt_enable	enable ADC interrupt
adc_interrupt_disable	disable ADC interrupt
adc_interrupt_flag_get	get the ADC interrupt flag
adc_interrupt_flag_clear	clear the ADC interrupt flag

adc_deinit

The description of adc_deinit is shown as below:

Table 3-4. Function adc_deinit

Function name	adc_deinit
Function prototype	void adc_deinit(void);
Function descriptions	reset ADC
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset ADC */
```

```
adc_deinit();
```

adc_enable

The description of adc_enable is shown as below:

Table 3-5. Function adc_enable

Function name	adc_enable
---------------	------------

Function prototype	void adc_enable(void);
Function descriptions	enable ADC
Precondition	-
The called functions	adc_charge_pulse_width_counter
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC */
adc_enable();
```

adc_disable

The description of adc_disable is shown as below:

Table 3-6. Function adc_disable

Function name	adc_disable
Function prototype	void adc_disable(void);
Function descriptions	disable ADC
Precondition	-
The called functions	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable ADC */
adc_disable();
```

adc_calibration_number (only for GD32L235)

The description of adc_calibration_number is shown as below:

Table 3-7. Function adc_calibration_number

Function name	adc_calibration_number
Function prototype	void adc_calibration_number(uint32_t clb_num);
Function descriptions	configure ADC calibration number
Precondition	-
The called functions	-
Input parameter{in}	

clb_num	calibration number
ADC_CALIBRATION_NUM1	calibrate once
ADC_CALIBRATION_NUM2	calibrate twice
ADC_CALIBRATION_NUM4	calibrate 4 times
ADC_CALIBRATION_NUM8	calibrate 8 times
ADC_CALIBRATION_NUM16	calibrate 16 times
ADC_CALIBRATION_NUM32	calibrate 32 times
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC calibration number */
```

```
adc_calibration_number(ADC_CALIBRATION_NUM1);
```

adc_calibration_enable

The description of adc_calibration_enable is shown as below:

Table 3-8. Function adc_calibration_enable

Function name	adc_calibration_enable
Function prototype	void adc_calibration_enable(void);
Function descriptions	ADC calibration and reset calibration
Precondition	-
The called functions	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* ADC calibration and reset calibration */
```

```
adc_calibration_enable();
```

adc_dma_mode_enable

The description of adc_dma_mode_enable is shown as below:

Table 3-9. Function adc_dma_mode_enable

Function name	adc_dma_mode_enable
Function prototype	void adc_dma_mode_enable(void);
Function descriptions	enable DMA request
Precondition	-
The called functions	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC DMA request */
adc_dma_mode_enable();
```

adc_dma_mode_disable

The description of adc_dma_mode_disable is shown as below:

Table 3-10. Function adc_dma_mode_disable

Function name	adc_dma_mode_disable
Function prototype	void adc_dma_mode_disable(void);
Function descriptions	disable DMA request
Precondition	-
The called functions	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable ADC DMA request */
adc_dma_mode_disable();
```

adc_discontinuous_mode_config

The description of adc_discontinuous_mode_config is shown as below:

Table 3-11. Function adc_discontinuous_mode_config

Function name	adc_discontinuous_mode_config
----------------------	-------------------------------

Function prototype	void adc_discontinuous_mode_config(uint8_t adc_sequence, uint8_t length);
Function descriptions	configure ADC discontinuous mode
Precondition	-
The called functions	-
Input parameter{in}	
adc_sequence	select the sequence
ADC_ROUTINE_CHANNEL	routine sequence
ADC_INSERTED_CHANNEL	inserted sequence
ADC_CHANNEL_DISCON_DISABLE	disable discontinuous mode of routine and inserted sequence
Input parameter{in}	
length	number of conversions in discontinuous mode,the number can be 1..16 for routine sequence, the number has no effect for inserted sequence
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC routine sequence discontinuous mode */
```

```
adc_discontinuous_mode_config(ADC_ROUTINE_CHANNEL, 6);
```

adc_special_function_config

The description of adc_special_function_config is shown as below:

Table 3-12. Function adc_special_function_config

Function name	adc_special_function_config
Function prototype	void adc_special_function_config(uint32_t function, ControlStatus newvalue);
Function descriptions	configure ADC special function
Precondition	-
The called functions	-
Input parameter{in}	
function	the function to configure
ADC_SCAN_MODE	scan mode select
ADC_INSERTED_CHANNEL_AUTO	inserted sequence convert automatically
ADC_CONTINUOUS_MODE	continuous mode select

Input parameter{in}	
newvalue	control value
<i>ENABLE</i>	enable function
<i>DISABLE</i>	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC scan mode */
```

```
adc_special_function_config(ADC_SCAN_MODE, ENABLE);
```

adc_channel_16_to_19

The description of adc_channel_16_to_19 is shown as below:

Table 3-13. Function adc_channel_16_to_19

Function name	adc_channel_16_to_19
Function prototype	void adc_channel_16_to_19(uint32_t function, ControlStatus newvalue);
Function descriptions	configure temperature sensor, internal reference voltage channel, VBAT channel or VSLCD channel
Precondition	-
The called functions	-
Input parameter{in}	
function	temperature sensor or internal reference voltage channel or VBAT channel or VSLCD channel function
<i>ADC_TEMP_CHANNEL_SWITCH</i>	channel 16 (temperature sensor) switch of ADC
<i>ADC_INTERNAL_CHANNEL_SWITCH</i>	channel 17 (internal reference voltage) switch of ADC
<i>ADC_VBAT_CHANNEL_SWITCH</i>	channel 18 (1/3 voltage of external battery) switch of ADC
<i>ADC_VSLCD_CHANNEL_SWITCH</i>	channel 19 (1/3 voltage of VSLCD) switch of ADC
Input parameter{in}	
newvalue	control value
<i>ENABLE</i>	enable function
<i>DISABLE</i>	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC temperature sensor*/

adc_channel_16_to_19(ADC_TEMP_CHANNEL_SWITCH, ENABLE);
```

adc_data_alignment_config

The description of adc_data_alignment_config is shown as below:

Table 3-14. Function adc_data_alignment_config

Function name	adc_data_alignment_config
Function prototype	void adc_data_alignment_config(uint32_t data_alignment);
Function descriptions	configure ADC data alignment
Precondition	-
The called functions	-
Input parameter{in}	
data_alignment	data alignment select
ADC_DATAALIGN_RIGHT	right alignment
ADC_DATAALIGN_LEFT	left alignment
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC data alignment */

adc_data_alignment_config(ADC_DATAALIGN_RIGHT);
```

adc_channel_length_config

The description of adc_channel_length_config is shown as below:

Table 3-15. Function adc_channel_length_config

Function name	adc_channel_length_config
Function prototype	void adc_channel_length_config(uint8_t adc_sequence, uint32_t length);
Function descriptions	configure the channel length of routine sequence or inserted sequence
Precondition	-
The called functions	-
Input parameter{in}	
adc_sequence	select the sequence
ADC_ROUTINE_CHANNEL	routine sequence

<i>ADC_INSERTED_CHANNEL</i>	inserted sequence
Input parameter{in}	
length	the channel length of the sequence, routine sequence 1-16, inserted sequence 1-4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the channel length of ADC routine sequence */
```

```
adc_channel_length_config(ADC_ROUTINE_CHANNEL, 4);
```

adc_routine_channel_config

The description of adc_routine_channel_config is shown as below:

Table 3-16. Function adc_routine_channel_config

Function name	adc_routine_channel_config
Function prototype	void adc_routine_channel_config(uint8_t rank, uint8_t adc_channel, uint32_t sample_time);
Function descriptions	configure ADC routine channel
Precondition	-
The called functions	-
Input parameter{in}	
rank	the routine sequence rank, this parameter must be between 0 to 15
Input parameter{in}	
adc_channel	the selected ADC channel
<i>ADC_CHANNEL_x</i>	ADC Channelx (x=0..19)
Input parameter{in}	
sample_time	the sample time value
<i>ADC_SAMPLETIME_2POINT5</i>	2.5 cycles
<i>ADC_SAMPLETIME_7POINT5</i>	7.5 cycles
<i>ADC_SAMPLETIME_13POINT5</i>	13.5 cycles
<i>ADC_SAMPLETIME_28POINT5</i>	28.5 cycles
<i>ADC_SAMPLETIME_41POINT5</i>	41.5 cycles
<i>ADC_SAMPLETIME_55POINT5</i>	55.5 cycles

55POINT5	
ADC_SAMPLETIME_71POINT5	71.5 cycles
ADC_SAMPLETIME_239POINT5	239.5 cycles
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC routine channel */
```

```
adc_routine_channel_config(1, ADC_CHANNEL_0, ADC_SAMPLETIME_7POINT5);
```

adc_inserted_channel_config

The description of adc_inserted_channel_config is shown as below:

Table 3-17. Function adc_inserted_channel_config

Function name	adc_inserted_channel_config
Function prototype	void adc_inserted_channel_config(uint8_t rank, uint8_t adc_channel, uint32_t sample_time);
Function descriptions	configure ADC inserted channel
Precondition	-
The called functions	-
Input parameter{in}	
rank	the inserted sequencer rank, this parameter must be between 0 to 3
Input parameter{in}	
adc_channel	the selected ADC channel
ADC_CHANNEL_x	ADC Channelx (x=0..19)
Input parameter{in}	
sample_time	the sample time value
ADC_SAMPLETIME_2POINT5	2.5 cycles
ADC_SAMPLETIME_7POINT5	7.5 cycles
ADC_SAMPLETIME_13POINT5	13.5 cycles
ADC_SAMPLETIME_28POINT5	28.5 cycles
ADC_SAMPLETIME_41POINT5	41.5 cycles
ADC_SAMPLETIME_55POINT5	55.5 cycles

55POINT5	
ADC_SAMPLETIME_71POINT5	71.5 cycles
ADC_SAMPLETIME_239POINT5	239.5 cycles
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC inserted channel */
```

```
adc_inserted_channel_config(1, ADC_CHANNEL_0, ADC_SAMPLETIME_7POINT5);
```

adc_inserted_channel_offset_config

The description of adc_inserted_channel_offset_config is shown as below:

Table 3-18. Function adc_inserted_channel_offset_config

Function name	adc_inserted_channel_offset_config
Function prototype	void adc_inserted_channel_offset_config(uint8_t inserted_channel, uint16_t offset);
Function descriptions	configure ADC inserted channel offset
Precondition	-
The called functions	-
Input parameter{in}	
inserted_channel	inserted channel select
ADC_INSERTED_CHANNEL_x	inserted channel, x=0,1,2,3
Input parameter{in}	
offset	the offset data
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC inserted channel offset */
```

```
adc_inserted_channel_offset_config(ADC_INSERTED_CHANNEL_0, 100);
```

adc_channel_differential_mode_config (only for GD32L235)

The description of adc_channel_differential_mode_config is shown as below:

Table 3-19. Function `adc_channel_differential_mode_config`

Function name	<code>adc_channel_differential_mode_config</code>
Function prototype	<code>void adc_channel_differential_mode_config(uint32_t adc_channel, ControlStatus newvalue);</code>
Function descriptions	configure differential mode for ADC channel
Precondition	-
The called functions	-
Input parameter{in}	
<code>adc_channel</code>	the channel use differential mode
<code>ADC_DIFFERENTIAL_MODE_CHANNEL_x</code>	ADC Channelx (x=0..14) for differential mode
<code>ADC_DIFFERENTIAL_MODE_CHANNEL_ALL</code>	ADC Channel0~14 for differential mode
Input parameter{in}	
<code>newvalue</code>	control value
<code>ENABLE</code>	enable function
<code>DISABLE</code>	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC channel0 differential mode */
```

```
adc_channel_differential_mode_config(ADC_DIFFERENTIAL_MODE_CHANNEL_0,
ENABLE);
```

`adc_external_trigger_config`

The description of `adc_external_trigger_config` is shown as below:

Table 3-20. Function `adc_external_trigger_config`

Function name	<code>adc_external_trigger_config</code>
Function prototype	<code>void adc_external_trigger_config(uint8_t adc_sequence, ControlStatus newvalue);</code>
Function descriptions	configure ADC external trigger
Precondition	-
The called functions	-
Input parameter{in}	
<code>adc_sequence</code>	select the sequence
<code>ADC_ROUTINE_CHANNEL</code>	routine sequence
<code>ADC_INSERTED_</code>	inserted sequence

<i>CHANNEL</i>	
Input parameter{in}	
newvalue	control value
<i>ENABLE</i>	enable function
<i>DISABLE</i>	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC inserted sequence external trigger */
```

```
adc_external_trigger_config(ADC_INSERTED_CHANNEL, ENABLE);
```

adc_external_trigger_source_config

The description of `adc_external_trigger_source_config` is shown as below:

Table 3-21. Function `adc_external_trigger_source_config`

Function name	<code>adc_external_trigger_source_config</code>
Function prototype	<code>void adc_external_trigger_source_config(uint8_t adc_sequence, uint32_t external_trigger_source);</code>
Function descriptions	configure ADC external trigger source
Precondition	-
The called functions	-
Input parameter{in}	
adc_sequence	select the sequence
<i>ADC_ROUTINE_CHANNEL</i>	routine sequence
<i>ADC_INSERTED_CHANNEL</i>	inserted sequence
Input parameter{in}	
external_trigger_source	routine or inserted sequence trigger source
<i>ADC_EXTTRIG_ROUTINE_T8_CH0</i>	external trigger TIMER8 CH0 event select for routine sequence
<i>ADC_EXTTRIG_ROUTINE_T8_CH1</i>	external trigger TIMER8 CH1 event select for routine sequence
<i>ADC_EXTTRIG_ROUTINE_T0_CH2</i>	external trigger TIMER0 CH2 event select for routine sequence (for GD32L235xx devices)
<i>ADC_EXTTRIG_ROUTINE_T1_CH1</i>	external trigger TIMER1 CH1 event select for routine sequence
<i>ADC_EXTTRIG_ROUTINE_T2_TRGO</i>	external trigger TIMER2 TRGO event select for routine sequence

NE_T2_TRGO	
ADC_EXTTRIG_ROUTING_NE_T11_CH0	external trigger TIMER11 CH0 event select for routine sequence
ADC_EXTTRIG_ROUTING_NE_EXTI_11	external trigger interrupt line 11 select for routine sequence
ADC_EXTTRIG_ROUTING_NE_NONE	external trigger software event select for routine sequence
ADC_EXTTRIG_INSERTED_TED_T0_TRGO	TIMER0 TRGO event select for inserted sequence (for GD32L235xx devices)
ADC_EXTTRIG_INSERTED_TED_T0_CH3	TIMER0 CH3 event select for inserted sequence (for GD32L235xx devices)
ADC_EXTTRIG_INSERTED_TED_T14_TRGO	TIMER14 TRGO event select for inserted sequence (for GD32L235xx devices)
ADC_EXTTRIG_INSERTED_TED_T1_TRGO	TIMER1 TRGO event select for inserted sequence
ADC_EXTTRIG_INSERTED_TED_T1_CH0	TIMER1 CH0 event select for inserted sequence
ADC_EXTTRIG_INSERTED_TED_T2_CH3	TIMER2 CH3 event select for inserted sequence
ADC_EXTTRIG_INSERTED_TED_EXTI_15	external interrupt line 15 event select for inserted sequence
ADC_EXTTRIG_INSERTED_TED_NONE	external trigger software event select for inserted sequence
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC routine sequence external trigger source */
```

```
adc_external_trigger_source_config(ADC_ROUTINE_CHANNEL,  
ADC_EXTTRIG_ROUTINE_T8_CH0);
```

adc_software_trigger_enable

The description of adc_software_trigger_enable is shown as below:

Table 3-22. Function adc_software_trigger_enable

Function name	adc_software_trigger_enable
Function prototype	void adc_software_trigger_enable(uint8_t adc_sequence);
Function descriptions	enable ADC software trigger
Precondition	-
The called functions	-

Input parameter{in}	
adc_sequence	select the sequence
<i>ADC_ROUTINE_CHAN NEL</i>	routine sequence
<i>ADC_INSERTED_CHA NNEL</i>	inserted sequence
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC routine sequence software trigger */
adc_software_trigger_enable(ADC_ROUTINE_CHANNEL);
```

adc_routine_data_read

The description of adc_routine_data_read is shown as below:

Table 3-23. Function adc_routine_data_read

Function name	adc_routine_data_read
Function prototype	uint16_t adc_routine_data_read(void);
Function descriptions	read ADC routine sequence data register
Precondition	-
The called functions	-
Output parameter{out}	
-	-
Return value	
uint16_t	the conversion value: 0~0xFFFF

Example:

```
/* read ADC routine sequence data register */
uint16_t adc_value = 0;
adc_value = adc_routine_data_read();
```

adc_inserted_data_read

The description of adc_inserted_data_read is shown as below:

Table 3-24. Function adc_inserted_data_read

Function name	adc_inserted_data_read
Function prototype	uint16_t adc_inserted_data_read(uint8_t inserted_channel);
Function descriptions	read ADC inserted sequence data register

Precondition	-
The called functions	-
Input parameter{in}	
inserted_channel	insert channel select
<i>ADC_INSERTED_CHANNEL_x</i>	inserted Channelx, x=0,1,2,3
Output parameter{out}	
-	-
Return value	
uint16_t	the conversion value: 0~0xFFFF

Example:

```

/* read ADC inserted sequence data register */

uint16_t adc_value = 0;

adc_value = adc_inserted_data_read(ADC_INSERTED_CHANNEL_0);

```

adc_watchdog_single_channel_enable

The description of adc_watchdog_single_channel_enable is shown as below:

Table 3-25. Function adc_watchdog_single_channel_enable

Function name	adc_watchdog_single_channel_enable
Function prototype	void adc_watchdog_single_channel_enable(uint8_t adc_channel);
Function descriptions	enable ADC analog watchdog single channel
Precondition	-
The called functions	-
Input parameter{in}	
adc_channel	the selected ADC channel
<i>ADC_CHANNEL_x</i>	ADC Channelx(x=0..19)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* enable ADC analog watchdog single channel */

adc_watchdog_single_channel_enable(ADC_CHANNEL_1);

```

adc_watchdog_sequence_channel_enable

The description of adc_watchdog_sequence_channel_enable is shown as below:

Table 3-26. Function `adc_watchdog_sequence_channel_enable`

Function name	<code>adc_watchdog_sequence_channel_enable</code>
Function prototype	<code>void adc_watchdog_sequence_channel_enable(uint8_t adc_sequence);</code>
Function descriptions	enable ADC analog watchdog sequence channel
Precondition	-
The called functions	-
Input parameter{in}	
adc_sequence	the sequence use analog watchdog
<code>ADC_ROUTINE_CHANNEL</code>	routine sequence
<code>ADC_INSERTED_CHANNEL</code>	inserted sequence
<code>ADC_ROUTINE_INSERTED_CHANNEL</code>	both routine and inserted sequence
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC analog watchdog sequence channel */
```

```
adc_watchdog_sequence_channel_enable(ADC_ROUTINE_CHANNEL);
```

adc_watchdog_disable

The description of `adc_watchdog_disable` is shown as below:

Table 3-27. Function `adc_watchdog_disable`

Function name	<code>adc_watchdog_disable</code>
Function prototype	<code>void adc_watchdog_disable(void);</code>
Function descriptions	disable ADC analog watchdog
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable ADC analog watchdog */
```

```
adc_watchdog_disable();
```

adc_watchdog_threshold_config

The description of adc_watchdog_threshold_config is shown as below:

Table 3-28. Function adc_watchdog_threshold_config

Function name	adc_watchdog_threshold_config
Function prototype	void adc_watchdog_threshold_config(uint16_t low_threshold, uint16_t high_threshold);
Function descriptions	configure ADC analog watchdog threshold
Precondition	-
The called functions	-
Input parameter{in}	
low_threshold	analog watchdog low threshold, 0..4095
Input parameter{in}	
high_threshold	analog watchdog high threshold, 0..4095
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC analog watchdog threshold */
```

```
adc_watchdog_threshold_config(0x0400, 0x0A00);
```

adc_resolution_config

The description of adc_resolution_config is shown as below:

Table 3-29. Function adc_resolution_config

Function name	adc_resolution_config
Function prototype	void adc_resolution_config(uint32_t resolution);
Function descriptions	configure ADC resolution
Precondition	-
The called functions	-
Input parameter{in}	
resolution	ADC resolution
ADC_RESOLUTION_12B	12-bit ADC resolution
ADC_RESOLUTION_10B	10-bit ADC resolution
ADC_RESOLUTION_8B	8-bit ADC resolution
ADC_RESOLUTION_6B	6-bit ADC resolution

6B	
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC resolution */
```

```
adc_resolution_config(ADC_RESOLUTION_12B);
```

adc_oversample_mode_config

The description of adc_oversample_mode_config is shown as below:

Table 3-30. Function adc_oversample_mode_config

Function name	adc_oversample_mode_config
Function prototype	void adc_oversample_mode_config(uint32_t mode, uint16_t shift, uint8_t ratio);
Function descriptions	configure ADC oversample mode
Precondition	-
The called functions	-
Input parameter{in}	
mode	ADC oversampling mode
ADC_OVERSAMPLING_ALL_CONVERT	all oversampled conversions for a channel are done consecutively after a trigger
ADC_OVERSAMPLING_ONE_CONVERT	each oversampled conversion for a channel needs a trigger
Input parameter{in}	
shift	ADC oversampling shift
ADC_OVERSAMPLING_SHIFT_NONE	no oversampling shift
ADC_OVERSAMPLING_SHIFT_1B	1-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_2B	2-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_3B	3-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_4B	4-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_5B	5-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_6B	6-bit oversampling shift

ADC_OVERSAMPLING_SHIFT_7B	7-bit oversampling shift
ADC_OVERSAMPLING_SHIFT_8B	8-bit oversampling shift
Input parameter{in}	
ratio	ADC oversampling ratio
ADC_OVERSAMPLING_RATIO_MUL2	oversampling ratio multiple 2
ADC_OVERSAMPLING_RATIO_MUL4	oversampling ratio multiple 4
ADC_OVERSAMPLING_RATIO_MUL8	oversampling ratio multiple 8
ADC_OVERSAMPLING_RATIO_MUL16	oversampling ratio multiple 16
ADC_OVERSAMPLING_RATIO_MUL32	oversampling ratio multiple 32
ADC_OVERSAMPLING_RATIO_MUL64	oversampling ratio multiple 64
ADC_OVERSAMPLING_RATIO_MUL128	oversampling ratio multiple 128
ADC_OVERSAMPLING_RATIO_MUL256	oversampling ratio multiple 256
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC oversample mode: 16 times sample, 4 bits shift */
```

```
adc_oversample_mode_config(ADC_OVERSAMPLING_ALL_CONVERT,
ADC_OVERSAMPLING_SHIFT_4B, ADC_OVERSAMPLING_RATIO_MUL16);
```

adc_oversample_mode_enable

The description of adc_oversample_mode_enable is shown as below:

Table 3-31. Function adc_oversample_mode_enable

Function name	adc_oversample_mode_enable
Function prototype	void adc_oversample_mode_enable(void);
Function descriptions	enable ADC oversample mode
Precondition	-
The called functions	-
Input parameter{in}	

-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC oversample mode */
adc_oversample_mode_enable();
```

adc_oversample_mode_disable

The description of adc_oversample_mode_disable is shown as below:

Table 3-32. Function adc_oversample_mode_disable

Function name	adc_oversample_mode_disable
Function prototype	void adc_oversample_mode_disable(void);
Function descriptions	disable ADC oversample mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable ADC oversample mode */
adc_oversample_mode_disable();
```

adc_charge_pulse_width_counter

The description of adc_charge_pulse_width_counter is shown as below:

Table 3-33. Function adc_charge_pulse_width_counter

Function name	adc_charge_pulse_width_counter
Function prototype	void adc_charge_pulse_width_counter(uint32_t value);
Function descriptions	configure ADC charge pulse width counter
Precondition	-
The called functions	-
Input parameter{in}	
value	ADC charge pulse width counter value

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure ADC charge pulse width counter */
adc_charge_pulse_width_counter(100);
```

adc_charge_flag_get

The description of adc_charge_flag_get is shown as below:

Table 3-34. Function adc_charge_flag_get

Function name	adc_charge_flag_get
Function prototype	FlagStatus adc_charge_flag_get(uint32_t flag);
Function descriptions	get the ADC charge flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	the ADC charge flag
ADC_FLAG_CHARGE	ADC charge flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the ADC charge flag */
FlagStatus flag_value;
flag_value = adc_charge_flag_get(ADC_FLAG_CHARGE);
```

adc_flag_get

The description of adc_flag_get is shown as below:

Table 3-35. Function adc_flag_get

Function name	adc_flag_get
Function prototype	FlagStatus adc_flag_get(uint32_t flag);
Function descriptions	get ADC flag
Precondition	-
The called functions	-
Input parameter{in}	

flag	ADC flag
<i>ADC_FLAG_WDE</i>	analog watchdog event flag
<i>ADC_FLAG_EOC</i>	end of sequence conversion flag
<i>ADC_FLAG_EOIC</i>	end of inserted sequence conversion flag
<i>ADC_FLAG_STIC</i>	start flag of inserted sequence
<i>ADC_FLAG_STRC</i>	start flag of routine sequence
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the ADC analog watchdog flag*/
FlagStatus flag_value;

flag_value = adc_flag_get(ADC_FLAG_WDE);
```

adc_flag_clear

The description of `adc_flag_clear` is shown as below:

Table 3-36. Function `adc_flag_clear`

Function name	<code>adc_flag_clear</code>
Function prototype	<code>void adc_flag_clear(uint32_t flag);</code>
Function descriptions	clear ADC flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	ADC flag
<i>ADC_FLAG_WDE</i>	analog watchdog event flag
<i>ADC_FLAG_EOC</i>	end of sequence conversion flag
<i>ADC_FLAG_EOIC</i>	end of inserted sequence conversion flag
<i>ADC_FLAG_STIC</i>	start flag of inserted sequence
<i>ADC_FLAG_STRC</i>	start flag of routine sequence
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the ADC analog watchdog flag*/
adc_flag_clear(ADC_FLAG_WDE);
```


adc_interrupt_enable

The description of adc_interrupt_enable is shown as below:

Table 3-37. Function adc_interrupt_enable

Function name	adc_interrupt_enable
Function prototype	void adc_interrupt_enable(uint32_t interrupt);
Function descriptions	enable ADC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	ADC interrupt
<i>ADC_INT_WDE</i>	analog watchdog interrupt
<i>ADC_INT_EOC</i>	end of sequence conversion interrupt
<i>ADC_INT_EOIC</i>	end of inserted sequence conversion interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable ADC analog watchdog interrupt */
adc_interrupt_enable(ADC_INT_WDE);
```

adc_interrupt_disable

The description of adc_interrupt_disable is shown as below:

Table 3-38. Function adc_interrupt_disable

Function name	adc_interrupt_disable
Function prototype	void adc_interrupt_disable(uint32_t interrupt);
Function descriptions	disable ADC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	ADC interrupt
<i>ADC_INT_WDE</i>	analog watchdog interrupt
<i>ADC_INT_EOC</i>	end of sequence conversion interrupt
<i>ADC_INT_EOIC</i>	end of inserted sequence conversion interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable ADC analog watchdog interrupt */
```

```
adc_interrupt_disable(ADC_INT_WDE);
```

adc_interrupt_flag_get

The description of adc_interrupt_flag_get is shown as below:

Table 3-39. Function adc_interrupt_flag_get

Function name	adc_interrupt_flag_get
Function prototype	FlagStatus adc_interrupt_flag_get(uint32_t int_flag);
Function descriptions	get ADC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	ADC interrupt flag
ADC_INT_FLAG_WDE	analog watchdog interrupt flag
ADC_INT_FLAG_EOC	end of sequence conversion interrupt flag
ADC_INT_FLAG_EOIC	end of inserted sequence conversion interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the ADC analog watchdog interrupt flag */
```

```
FlagStatus flag_value;
```

```
flag_value = adc_interrupt_flag_get(ADC_INT_FLAG_WDE);
```

adc_interrupt_flag_clear

The description of adc_interrupt_flag_clear is shown as below:

Table 3-40. Function adc_interrupt_flag_clear

Function name	adc_interrupt_flag_clear
Function prototype	void adc_interrupt_flag_clear(uint32_t int_flag);
Function descriptions	clear ADC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	ADC interrupt flag
ADC_INT_FLAG_WDE	analog watchdog interrupt flag

ADC_INT_FLAG_EOC	end of sequence conversion interrupt flag
ADC_INT_FLAG_EOIC	end of inserted sequence conversion interrupt flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the ADC analog watchdog interrupt flag */
```

```
adc_interrupt_flag_clear(ADC_INT_FLAG_WDE);
```

3.3. CAN(only for GD32L235)

CAN bus (for Controller Area Network) is a bus standard designed to allow microcontrollers and devices to communicate with each other without a host computer. The CAN registers are listed in chapter [3.3.1](#), the CAN firmware functions are introduced in chapter [3.3.2](#).

3.3.1. Descriptions of Peripheral registers

CAN registers are listed in the table shown as below:

Table 3-41. CAN Registers

Registers	Descriptions
CAN_CTL	Control register
CAN_STAT	Status register
CAN_TSTAT	Transmit status register
CAN_RFIFO0	Receive message FIFO0 register
CAN_RFIFO1	Receive message FIFO1 register
CAN_INTEN	Interrupt enable register
CAN_ERR	Error register
CAN_BT	Bit timing register
CAN_TMIx	Transmit mailbox identifier register
CAN_TMPx	Transmit mailbox property register
CAN_TMDATA0x	Transmit mailbox data0 register
CAN_TMDATA1x	Transmit mailbox data1 register
CAN_RFIFOMIx	Receive FIFO mailbox identifier register
CAN_RFIFOMPx	Receive FIFO mailbox property register
CAN_RFIFOMDAT A0x	Receive FIFO mailbox data0 register
CAN_RFIFOMDAT A1x	Receive FIFO mailbox data1 register
CAN_FCTL	Filter control register

Registers	Descriptions
CAN_FMCFG	Filter mode configuration register
CAN_FSCFG	Filter scale configuration register
CAN_FAFIFO	Filter associated FIFO register
CAN_FW	Filter working register
CAN_FxDATAy	Filter x data y register

3.3.2. Descriptions of Peripheral functions

CAN firmware functions are listed in the table shown as below:

Table 3-42. CAN firmware function

Function name	Function description
can_deinit	deinitialize CAN
can_struct_para_init	initialize CAN parameter struct with a default value
can_init	initialize CAN
can_filter_init	initialize CAN filter
can_debug_freeze_enable	CAN debug freeze enable
can_debug_freeze_disable	CAN debug freeze disable
can_time_trigger_mode_enable	CAN time trigger mode enable
can_time_trigger_mode_disable	CAN time trigger mode disable
can_message_transmit	transmit CAN message
can_transmit_states	get CAN transmit state
can_transmission_stop	stop CAN transmission
can_message_receive	CAN receive message
can_fifo_release	CAN release fifo
can_receive_message_length_get	CAN receive message length
can_working_mode_set	CAN working mode
can_wakeup	CAN wakeup from sleep mode
can_error_get	CAN get error
can_receive_error_number_get	get CAN receive error number
can_transmit_error_number_get	get CAN transmit error number
can_flag_get	CAN get flag state
can_flag_clear	CAN clear flag state
can_interrupt_enable	CAN interrupt enable
can_interrupt_disable	CAN interrupt disable
can_interrupt_flag_get	CAN get interrupt flag state
can_interrupt_flag_clear	CAN clear interrupt flag state

Structure can_parameter_struct

Table 3-43. Structure can_parameter_struct

Member name	Function description
working_mode	CAN working mode
resync_jump_width	CAN resynchronization jump width
time_segment_1	time segment 1
time_segment_2	time segment 2
time_triggered	time triggered communication mode
auto_bus_off_recovery	automatic bus-off recovery
auto_wake_up	automatic wake-up mode
auto_retrans	automatic retransmission mode
rec_fifo_overwrite	receive FIFO overwrite mode
trans_fifo_order	transmit FIFO order
prescaler	baudrate prescaler

Structure can_transmit_message_struct

Table 3-44. Structure can_transmit_message_struct

Member name	Function description
tx_sfid	standard format frame identifier
tx_efid	extended format frame identifier
tx_ff	format of frame: standard or extended format
tx_ft	type of frame: data or remote
tx_dlen	data length
reserved	reserved byte for alignment
tx_data[8]	transmit data

Structure can_receive_message_struct

Table 3-45. Structure can_receive_message_struct

Member name	Function description
rx_sfid	standard format frame identifier
rx_efid	extended format frame identifier
rx_ff	format of frame: standard or extended format
rx_ft	type of frame: data or remote
rx_dlen	data length
rx_fi	filtering index
rx_data[8]	receive data

Structure can_filter_parameter_struct

Table 3-46. Structure can_filter_parameter_struct

Member name	Function description
filter_list_high	filter list number high bits
filter_list_low	filter list number low bits
filter_mask_high	filter mask number high bits
filter_mask_low	filter mask number low bits
filter_fifo_number	receive FIFO associated with the filter
filter_number	filter number
filter_mode	filter mode: list or mask
filter_bits	filter scale
filter_enable	filter work or not

can_deinit

The description of can_deinit is shown as below:

Table 3-47. Function can_deinit

Function name	can_deinit
Function prototype	void can_deinit(void);
Function descriptions	deinitialize CAN
Precondition	-
The called functions	rcu_periph_reset_enable/ rcu_periph_reset_disable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* CAN deinitialize*/
can_deinit ();
```

can_struct_para_init

The description of can_struct_para_init is shown as below:

Table 3-48. Function can_struct_para_init

Function name	can_struct_para_init
Function prototype	void can_struct_para_init(can_struct_type_enum type, void* p_struct)
Function descriptions	initialize CAN parameter struct with a default value
Precondition	-

The called functions	-
Input parameter{in}	
type	Sturct type
<i>CAN_INIT_STRUCT</i>	CAN initilize parameters struct
<i>CAN_FILTER_STRUCT</i>	CAN filter parameters struct
<i>CAN_TX_MESSAGE_STRUCT</i>	CAN transmit message struct
<i>CAN_RX_MESSAGE_STRUCT</i>	CAN receive message struct
Output parameter{out}	
p_struct	the struct pointer that needs initialize
Return value	
-	-

Example:

```
can_parameter_struct can_init;
```

```
can_struct_para_init (CAN_INIT_STRUCT, &can_init);
```

can_init

The description of can_init is shown as below:

Table 3-49. Function can_init

Function name	can_init
Function prototype	ErrStatus can_init(can_parameter_struct* can_parameter_init);
Function descriptions	initialize CAN
Precondition	can_struct_para_init()
The called functions	-
Input parameter{in}	
can_parameter_init	CAN parameter initialization stuct, the structure members can refer to members of the structure Table 3-43. Structure can_parameter_struct
Output parameter{out}	
-	-
Return value	
ErrStatus	SUCCESS / ERROR

Example:

```
can_parameter_struct can_parameter;
```

```
/* CAN initialize*/
```

```
can_init (&can_parameter);
```

can_filter_init

The description of can_filter_init is shown as below:

Table 3-50. Function can_filter_init

Function name	can_filter_init
Function prototype	void can_filter_init(can_filter_parameter_struct* can_filter_parameter_init);
Function descriptions	initialize CAN filter
Precondition	can_struct_para_init()
The called functions	-
Input parameter{in}	
can_filter_parameter_i nit	CAN filter initialization struct, the structure members can refer to members of the structure Table 3-46. Structure can_filter_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize CAN filter */
can_filter_init(&can_filter);
```

can_debug_freeze_enable

The description of can_debug_freeze_enable is shown as below:

Table 3-51. Function can_debug_freeze_enable

Function name	can_debug_freeze_enable
Function prototype	void can_debug_freeze_enable(void);
Function descriptions	enable CAN debug freeze
Precondition	-
The called functions	dbg_periph_enable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CAN debug freeze */
can_debug_freeze_enable ();
```


can_debug_freeze_disable

The description of can_debug_freeze_disable is shown as below:

Table 3-52. Function can_debug_freeze_disable

Function name	can_debug_freeze_disable
Function prototype	void can_debug_freeze_disable(void);
Function descriptions	disable CAN debug freeze
Precondition	-
The called functions	dbg_periph_disable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CAN debug freeze */
can_debug_freeze_disable ();
```

can_time_trigger_mode_enable

The description of can_time_trigger_mode_enable is shown as below:

Table 3-53. Function can_time_trigger_mode_enable

Function name	can_time_trigger_mode_enable
Function prototype	void can_time_trigger_mode_enable(void);
Function descriptions	enable CAN time trigger mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CAN time trigger mode */
can_time_trigger_mode_enable ();
```

can_time_trigger_mode_disable

The description of can_time_trigger_mode_disable is shown as below:

Table 3-54. Function can_time_trigger_mode_disable

Function name	can_time_trigger_mode_disable
Function prototype	void can_time_trigger_mode_disable(void);
Function descriptions	disable CAN time trigger mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CAN time trigger mode */
can_time_trigger_mode_disable ();
```

can_message_transmit

The description of can_message_transmit is shown as below:

Table 3-55. Function can_message_transmit

Function name	can_message_transmit
Function prototype	uint8_t can_message_transmit(can_transmit_message_struct* transmit_message);
Function descriptions	transmit CAN message
Precondition	can_struct_para_init()
The called functions	-
Input parameter{in}	
transmit_message	CAN transmit message struct, the structure members can refer to members of the structure Table 3-44. Structure can transmit message struct
Output parameter{out}	
-	-
Return value	
uint8_t	0x00-0x03

Example:

```
/* CAN transmit message and return the mailbox number*/
```

```
uint8_t transmit_mailbox = 0;
```

```
transmit_mailbox = can_message_transmit(&transmit_message);
```

can_transmit_states

The description of can_transmit_states is shown as below:

Table 3-56. Function can_transmit_states

Function name	can_transmit_states
Function prototype	can_transmit_state_enum can_transmit_states(uint8_t mailbox_number);
Function descriptions	get CAN transmit state
Precondition	-
The called functions	-
Input parameter{in}	
mailbox_number	Mailbox number
<i>CAN_MAILBOXx</i>	CAN_MAILBOXx(x=0,1,2)
Output parameter{out}	
-	-
Return value	
can_transmit_state_enum	0..4

Example:

```
/* CAN mailbox0 transmit state */
```

```
uint8_t transmit_state = 0;
```

```
transmit_state = can_transmit_states (CAN_MAILBOX0);
```

can_transmission_stop

The description of can_transmission_stop is shown as below:

Table 3-57. Function can_transmission_stop

Function name	can_transmission_stop
Function prototype	void can_transmission_stop(uint8_t mailbox_number);
Function descriptions	stop CAN transmission
Precondition	-
The called functions	-
Input parameter{in}	
mailbox_number	Mailbox number
<i>CAN_MAILBOXx</i>	CAN_MAILBOXx(x=0,1,2)
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* stop CAN mailbox0 transmission */

can_transmission_stop (CAN_MAILBOX0);
```

can_message_receive

The description of can_message_receive is shown as below:

Table 3-58. Function can_message_receive

Function name	can_message_receive
Function prototype	void can_message_receive(uint8_t fifo_number, can_receive_message_struct* receive_message);
Function descriptions	CAN receive message
Precondition	can_struct_para_init()
The called functions	-
Input parameter{in}	
fifo_number	Fifo number
<i>CAN_FIFOx</i>	CAN_FIFOx(x=0,1)
Input parameter{in}	
receive_message	CAN message receive struct, the structure members can refer to members of the structure Table 3-45. Structure can_receive_message_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* CAN FIFO0 receive message */

can_message_receive(CAN_FIFO0, &receive_message);
```

can_fifo_release

The description of can_fifo_release is shown as below:

Table 3-59. Function can_fifo_release

Function name	can_fifo_release
Function prototype	void can_fifo_release(uint8_t fifo_number);
Function descriptions	release FIFO0
Precondition	-
The called functions	-
Input parameter{in}	

fifo_number	Fifo number
<i>CAN_FIFOx</i>	CAN_FIFOx(x=0,1)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* CAN release FIFO0*/
```

```
can_fifo_release (CAN_FIFO0);
```

can_receive_message_length_get

The description of can_receive_message_length_get is shown as below:

Table 3-60. Function can_receive_message_length_get

Function name	can_receive_message_length_get
Function prototype	uint8_t can_receive_message_length_get(uint8_t fifo_number);
Function descriptions	CAN receive message length
Precondition	-
The called functions	-
Input parameter{in}	
fifo_number	Fifo number
<i>CAN_FIFOx</i>	CAN_FIFOx(x=0,1)
Output parameter{out}	
-	-
Return value	
uint8_t	0..3

Example:

```
/* CAN FIFO0 receive message length */
```

```
uint8_t frame_number = 0;
```

```
frame_number = can_receive_message_length_get (CAN_FIFO0);
```

can_working_mode_set

The description of can_working_mode_set is shown as below:

Table 3-61. Function can_working_mode_set

Function name	can_working_mode_set
Function prototype	ErrStatus can_working_mode_set(uint8_t working_mode);
Function descriptions	set CAN working mode
Precondition	-

The called functions	-
Input parameter{in}	
can_working_mode	Mode select
CAN_MODE_INITIALIZE	Initialize mode
CAN_MODE_NORMAL	Normal mode
CAN_MODE_SLEEP	Sleep mode
Output parameter{out}	
-	-
Return value	
ErrStatus	SUCCESS / ERROR

Example:

```
/* set CAN working at initialize mode */
can_working_mode_set (CAN_MODE_INITIALIZE);
```

can_wakeup

The description of can_wakeup is shown as below:

Table 3-62. Function can_wakeup

Function name	can_wakeup
Function prototype	ErrStatus can_wakeup(void);
Function descriptions	wake up CAN
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	SUCCESS / ERROR

Example:

```
/* wake up CAN */
can_wakeup ();
```

can_error_get

The description of can_error_get is shown as below:

Table 3-63. Function can_error_get

Function name	can_error_get
----------------------	---------------

Function prototype	can_error_enum can_error_get(void);
Function descriptions	get CAN error type
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
can_error_enum	0..7

Example:

```
/* get CAN error type */
```

```
can_error_get ();
```

can_receive_error_number_get

The description of can_receive_error_number_get is shown as below:

Table 3-64. Function can_receive_error_number_get

Function name	can_receive_error_number_get
Function prototype	uint8_t can_receive_error_number_get(void);
Function descriptions	get CAN receive error number
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	0..255

Example:

```
/* get CAN receive error number */
```

```
uint8_t error_num;
```

```
error_num = can_receive_error_number_get ();
```

can_transmit_error_number_get

The description of can_transmit_error_number_get is shown as below:

Table 3-65. Function can_transmit_error_number_get

Function name	can_transmit_error_number_get
----------------------	-------------------------------

Function prototype	uint8_t can_transmit_error_number_get(void);
Function descriptions	get CAN transmit error number
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	0..255

Example:

```
/* get CAN transmit error number */
```

```
uint8_t error_num;
```

```
error_num = can_transmit_error_number_get ();
```

can_flag_get

The description of can_flag_get is shown as below:

Table 3-66. Function can_flag_get

Function name	can_flag_get
Function prototype	FlagStatus can_flag_get(an_flag_enum flag);
Function descriptions	get CAN flag state
Precondition	-
The called functions	-
Input parameter{in}	
flag	CAN flags
CAN_FLAG_MTE2	mailbox 2 transmit error
CAN_FLAG_MTE1	mailbox 1 transmit error
CAN_FLAG_MTE0	mailbox 0 transmit error
CAN_FLAG_MTF2	mailbox 2 transmit finished
CAN_FLAG_MTF1	mailbox 1 transmit finished
CAN_FLAG_MTF0	mailbox 0 transmit finished
CAN_FLAG_RFO0	receive FIFO0 overfull
CAN_FLAG_RFF0	receive FIFO0 full
CAN_FLAG_RFO1	receive FIFO1 overfull
CAN_FLAG_RFF1	receive FIFO1 full
CAN_FLAG_BOERR	bus-off error
CAN_FLAG_PERR	passive error
CAN_FLAG_WERR	warning error
Output parameter{out}	

-	-
Return value	
FlagStatus	SET / RESET

Example:

```
/* get CAN mailbox 0 transmit finished flag */
```

```
can_flag_get (CAN_FLAG_MTF0);
```

can_flag_clear

The description of can_flag_clear is shown as below:

Table 3-67. Function can_flag_clear

Function name	can_flag_clear
Function prototype	void can_flag_clear(can_flag_enum flag);
Function descriptions	clear CAN flag state
Precondition	-
The called functions	-
Input parameter{in}	
flag	CAN flags
CAN_FLAG_MTE2	mailbox 2 transmit error
CAN_FLAG_MTE1	mailbox 1 transmit error
CAN_FLAG_MTE0	mailbox 0 transmit error
CAN_FLAG_MTF2	mailbox 2 transmit finished
CAN_FLAG_MTF1	mailbox 1 transmit finished
CAN_FLAG_MTF0	mailbox 0 transmit finished
CAN_FLAG_RFO0	receive FIFO0 overfull
CAN_FLAG_RFF0	receive FIFO0 full
CAN_FLAG_RFO1	receive FIFO1 overfull
CAN_FLAG_RFF1	receive FIFO1 full
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear CAN mailbox 0 transmit error flag*/
```

```
can_flag_clear (CAN_FLAG_MTE0);
```

can_interrupt_enable

The description of can_interrupt_enable is shown as below:

Table 3-68. Function can_interrupt_enable

Function name	can_interrupt_enable
Function prototype	void can_interrupt_enable(uint32_t interrupt);
Function descriptions	enable CAN interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	Interrupt type
CAN_INT_TME	transmit mailbox empty interrupt enable
CAN_INT_RFNE0	receive FIFO0 not empty interrupt enable
CAN_INT_RFF0	receive FIFO0 full interrupt enable
CAN_INT_RFO0	receive FIFO0 overfull interrupt enable
CAN_INT_RFNE1	receive FIFO1 not empty interrupt enable
CAN_INT_RFF1	receive FIFO1 full interrupt enable
CAN_INT_RFO1	receive FIFO1 overfull interrupt enable
CAN_INT_WERR	warning error interrupt enable
CAN_INT_PERR	passive error interrupt enable
CAN_INT_BO	bus-off interrupt enable
CAN_INT_ERRN	error number interrupt enable
CAN_INT_ERR	error interrupt enable
CAN_INT_WU	wakeup interrupt enable
CAN_INT_SLPW	sleep working interrupt enable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* CAN transmit mailbox empty interrupt enable */
```

```
can_interrupt_enable (CAN_INT_TME);
```

can_interrupt_disable

The description of can_interrupt_disable is shown as below:

Table 3-69. Function can_interrupt_disable

Function name	can_interrupt_disable
Function prototype	void can_interrupt_disable(uint32_t interrupt);
Function descriptions	disable CAN interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	Interrupt type

<i>CAN_INT_TME</i>	transmit mailbox empty interrupt enable
<i>CAN_INT_RFNE0</i>	receive FIFO0 not empty interrupt enable
<i>CAN_INT_RFF0</i>	receive FIFO0 full interrupt enable
<i>CAN_INT_RFO0</i>	receive FIFO0 overfull interrupt enable
<i>CAN_INT_RFNE1</i>	receive FIFO1 not empty interrupt enable
<i>CAN_INT_RFF1</i>	receive FIFO1 full interrupt enable
<i>CAN_INT_RFO1</i>	receive FIFO1 overfull interrupt enable
<i>CAN_INT_WERR</i>	warning error interrupt enable
<i>CAN_INT_PERR</i>	passive error interrupt enable
<i>CAN_INT_BO</i>	bus-off interrupt enable
<i>CAN_INT_ERRN</i>	error number interrupt enable
<i>CAN_INT_ERR</i>	error interrupt enable
<i>CAN_INT_WU</i>	wakeup interrupt enable
<i>CAN_INT_SLPW</i>	sleep working interrupt enable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* CAN transmit mailbox empty interrupt disable */
```

```
can_interrupt_disable (CAN_INT_TME);
```

can_interrupt_flag_get

The description of can_interrupt_flag_get is shown as below:

Table 3-70. Function can_interrupt_flag_get

Function name	can_interrupt_flag_get
Function prototype	FlagStatus can_interrupt_flag_get(can_interrupt_flag_enum flag);
Function descriptions	get CAN interrupt flag state
Precondition	-
The called functions	-
Input parameter{in}	
flag	CAN interrupt flags
<i>CAN_INT_FLAG_SLPIF</i>	status change interrupt flag of sleep working mode entering
<i>CAN_INT_FLAG_WUIF</i>	status change interrupt flag of wakeup from sleep working mode
<i>CAN_INT_FLAG_ERRIF</i>	error interrupt flag
<i>CAN_INT_FLAG_MTF2</i>	mailbox 2 transmit finished interrupt flag
<i>CAN_INT_FLAG_MTF1</i>	mailbox 1 transmit finished interrupt flag
<i>CAN_INT_FLAG_MTF0</i>	mailbox 0 transmit finished interrupt flag

CAN_INT_FLAG_RFO0	receive FIFO0 overfull interrupt flag
CAN_INT_FLAG_RFF0	receive FIFO0 full interrupt flag
CAN_INT_FLAG_RFO1	receive FIFO1 overfull interrupt flag
CAN_INT_FLAG_RFF1	receive FIFO1 full interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET / RESET

Example:

```
/* get CAN mailbox 0 transmit finished interrupt flag */
```

```
can_interrupt_flag_get (CAN_INT_FLAG_MTF0);
```

can_interrupt_flag_clear

The description of can_interrupt_flag_clear is shown as below:

Table 3-71. Function can_interrupt_flag_clear

Function name	can_interrupt_flag_clear
Function prototype	void can_interrupt_flag_clear(can_interrupt_flag_enum flag);
Function descriptions	clear CAN interrupt flag state
Precondition	-
The called functions	-
Input parameter{in}	
can_periph	CAN peripheral
CANx(x=0,1)	CAN peripheral selection, the CAN1 only for GD32F30X_CL
Input parameter{in}	
flag	CAN interrupt flags
CAN_INT_FLAG_SLPIF	status change interrupt flag of sleep working mode entering
CAN_INT_FLAG_WUIF	status change interrupt flag of wakeup from sleep working mode
CAN_INT_FLAG_ERRIF	error interrupt flag
CAN_INT_FLAG_MTF2	mailbox 2 transmit finished interrupt flag
CAN_INT_FLAG_MTF1	mailbox 1 transmit finished interrupt flag
CAN_INT_FLAG_MTF0	mailbox 0 transmit finished interrupt flag
CAN_INT_FLAG_RFO0	receive FIFO0 overfull interrupt flag
CAN_INT_FLAG_RFF0	receive FIFO0 full interrupt flag
CAN_INT_FLAG_RFO1	receive FIFO1 overfull interrupt flag
CAN_INT_FLAG_RFF1	receive FIFO1 full interrupt flag
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* clear CAN mailbox 0 transmit finished interrupt flag */
```

```
can_interrupt_flag_clear (CAN_INT_FLAG_MTF0);
```

3.4. CAU

The Cryptographic Acceleration Unit supports acceleration of DES, Triple-DES or AES (128,192, or 256) algorithms. The CAU registers are listed in chapter [3.4.1](#) the CAU firmware functions are introduced in chapter [3.4.2](#).

3.4.1. Descriptions of Peripheral registers

CAU registers are listed in the table shown as below:

Table 3-72. CAU Registers

Registers	Descriptions
CAU_CTL	control register
CAU_STAT0	status register 0
CAU_DI	data input register
CAU_DO	data output register
CAU_DMAEN	DMA enable register
CAU_INTEN	interrupt enable register
CAU_STAT1	status register 1
CAU_INTF	interrupt flag register
CAU_KEY0H	key 0 high register
CAU_KEY0L	key 0 low register
CAU_KEY1H	key 1 high register
CAU_KEY1L	key 1 low register
CAU_KEY2H	key 2 high register
CAU_KEY2L	key 2 low register
CAU_KEY3H	key 3 high register
CAU_KEY3L	key 3 low register
CAU_IV0H	initial vector 0 high register
CAU_IV0L	initial vector 0 low register
CAU_IV1H	initial vector 1 high register
CAU_IV1L	initial vector 1 low register
CAU_GCMCCMCT XSx (x = 0..7)	GCM or CCM mode context switch register x
CAU_GCMCTXSx (x = 0..7)	GCM mode context switch register x

3.4.2. Descriptions of Peripheral functions

CAU firmware functions are listed in the table shown as below:

Table 3-73. CAU firmware function

Function name	Function description
cau_deinit	reset the CAU peripheral
cau_struct_para_init	initialize the CAU encrypt and decrypt parameter struct with the default values
cau_key_struct_para_init	initialize the key parameter struct with the default values
cau_iv_struct_para_init	initialize the vectors parameter struct with the default values
cau_context_struct_para_init	initialize the context parameter struct with the default values
cau_enable	enable the CAU peripheral
cau_disable	disable the CAU peripheral
cau_dma_enable	enable the CAU DMA interface
cau_dma_disable	disable the CAU DMA interface
cau_init	initialize the CAU peripheral
cau_aes_keysize_config	configure key size if use AES algorithm
cau_key_init	initialize the key parameters
cau_iv_init	initialize the vectors parameters
cau_phase_config	configure phase
cau_fifo_flush	flush the IN and OUT FIFOs
cau_enable_state_get	return whether CAU peripheral is enabled or disabled
cau_data_write	write data to the IN FIFO
cau_data_read	return the last data entered into the output FIFO
cau_context_save	save context before context switching
cau_context_restore	restore context after context switching
cau_aes_ecb	encrypt and decrypt using AES in ECB mode
cau_aes_cbc	encrypt and decrypt using AES in CBC mode
cau_aes_ctr	encrypt and decrypt using AES in CTR mode
cau_aes_cfb	encrypt and decrypt using AES in CFB mode
cau_aes_ofb	encrypt and decrypt using AES in OFB mode
cau_aes_gcm	encrypt and decrypt using AES in GCM mode
cau_aes_ccm	encrypt and decrypt using AES in CCM mode
cau_tdes_ecb	encrypt and decrypt using TDES in ECB mode
cau_tdes_cbc	encrypt and decrypt using TDES in CBC mode
cau_des_ecb	encrypt and decrypt using DES in ECB mode
cau_des_cbc	encrypt and decrypt using DES in CBC mode
cau_flag_get	get the CAU flag status
cau_interrupt_enable	enable the CAU interrupts
cau_interrupt_disable	disable the CAU interrupts
cau_interrupt_flag_get	get the interrupt flag

Structure cau_key_parameter_struct

Table 3-74. Structure cau_key_parameter_struct

Member name	Function description
key_0_high	key 0 high
key_0_low	key 0 low
key_1_high	key 1 high
key_1_low	key 1 low
key_2_high	key 2 high
key_2_low	key 2 low
key_3_high	key 3 high
key_3_low	key 3 low

Structure cau_iv_parameter_struct

Table 3-75. Structure cau_iv_parameter_struct

Member name	Function description
iv_0_high	init vector 0 high
iv_0_low	init vector 0 low
iv_1_high	init vector 1 high
iv_1_low	init vector 1 low

Structure cau_context_parameter_struct

Table 3-76. Structure cau_context_parameter_struct

Member name	Function description
ctl_config	current configuration
iv_0_high	init vector 0 high
iv_0_low	init vector 0 low
iv_1_high	init vector 1 high
iv_1_low	init vector 1 low
key_0_high	key 0 high
key_0_low	key 0 low
key_1_high	key 1 high
key_1_low	key 1 low
key_2_high	key 2 high
key_2_low	key 2 low
key_3_high	key 3 high
key_3_low	key 3 low
gcmccmctxs[8]	GCM or CCM mode context switch
gcmctxs[8]	GCM mode context switch

Structure cau_parameter_struct

Table 3-77. Structure cau_parameter_struct

Member name	Function description
alg_dir	algorithm directory
*key	key
key_size	key size in bytes
*iv	initialization vector
iv_size	iv size in bytes
*input	input data
in_length	input data length in bytes
*aad	additional authentication data
aad_size	aad size

cau_deinit

The description of cau_deinit is shown as below:

Table 3-78. Function cau_deinit

Function name	cau_deinit
Function prototype	void cau_deinit(void);
Function descriptions	reset the CAU peripheral
Precondition	-
The called functions	rcu_periph_reset_enable/ rcu_periph_reset_disable/ rcu_periph_clock_enable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset the CAU peripheral */
```

```
cau_deinit();
```

cau_struct_para_init

The description of cau_struct_para_init is shown as below:

Table 3-79. Function cau_struct_para_init

Function name	cau_struct_para_init
Function prototype	void cau_struct_para_init(cau_parameter_struct *cau_parameter);
Function descriptions	initialize the CAU encrypt and decrypt parameter struct with the default

	values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Return value	
-	-

Example:

```
cau_parameter_struct text;
```

```
/* initialize CAU encrypt and decrypt parameter struct */
```

```
cau_struct_para_init(&text);
```

cau_key_struct_para_init

The description of cau_key_struct_para_init is shown as below:

Table 3-80. Function cau_key_struct_para_init

Function name	cau_key_struct_para_init
Function prototype	void cau_key_struct_para_init(cau_key_parameter_struct *key_initpara);
Function descriptions	initialize the key parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
key_initpara	structure for keys initialization of the cau, refer to structure Table 3-74. Structure cau_key_parameter_struct
Return value	
-	-

Example:

```
/* initialize the key parameter struct */
```

```
cau_key_parameter_struct key_initpara;
```

```
cau_key_struct_para_init(&key_initpara);
```

cau_iv_struct_para_init

The description of cau_iv_struct_para_init is shown as below:

Table 3-81. Function cau_iv_struct_para_init

Function name	cau_iv_struct_para_init
Function prototype	void cau_iv_struct_para_init(cau_iv_parameter_struct *iv_initpara);
Function descriptions	initialize the vectors parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
iv_initpara	structure for vectors initialization of the cau, refer to structure Table 3-75. Structure cau iv parameter struct
Return value	
-	-

Example:

```
/* initialize the vectors parameter struct */
cau_iv_parameter_struct iv_initpara;
cau_iv_struct_para_init(&iv_initpara);
```

cau_context_struct_para_init

The description of cau_context_struct_para_init is shown as below:

Table 3-82. Function cau_context_struct_para_init

Function name	cau_context_struct_para_init
Function prototype	void cau_context_struct_para_init(cau_context_parameter_struct *cau_context);
Function descriptions	initialize the context parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
cau_context	structure for cau context swapping, refer to structure Table 3-76. Structure cau context parameter struct
Return value	
-	-

Example:

```
/* initialize the context parameter struct */
cau_context_parameter_struct context_initpara;
cau_context_struct_para_init(&context_initpara);
```

cau_enable

The description of cau_enable is shown as below:

Table 3-83. Function cau_enable

Function name	cau_enable
Function prototype	void cau_enable(void);
Function descriptions	enable the CAU peripheral
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the CAU peripheral */
cau_enable();
```

cau_disable

The description of cau_disable is shown as below:

Table 3-84. Function cau_disable

Function name	cau_disable
Function prototype	void cau_disable(void);
Function descriptions	disable the CAU peripheral
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the CAU peripheral */
cau_disable();
```

cau_dma_enable

The description of cau_dma_enable is shown as below:

Table 3-85. Function cau_dma_enable

Function name	cau_dma_enable
Function prototype	void cau_dma_enable(uint32_t dma_req);
Function descriptions	enable the CAU DMA interface
Precondition	-
The called functions	-
Input parameter{in}	
dma_req	specify the CAU DMA transfer request to be enabled
CAU_DMA_INFIFO	DMA for incoming(Rx) data transfer
CAU_DMA_OUTFIFO	DMA for outgoing(Tx) data transfer
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the CAU DMA interface */
cau_dma_enable(CAU_DMA_INFIFO);
```

cau_dma_disable

The description of cau_dma_disable is shown as below:

Table 3-86. Function cau_dma_disable

Function name	cau_dma_disable
Function prototype	void cau_dma_disable(uint32_t dma_req);
Function descriptions	disable the CAU DMA interface
Precondition	-
The called functions	-
Input parameter{in}	
dma_req	specify the CAU DMA transfer request to be disabled
CAU_DMA_INFIFO	DMA for incoming(Rx) data transfer
CAU_DMA_OUTFIFO	DMA for outgoing(Tx) data transfer
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the CAU DMA interface */
```

```
cau_dma_disable(CAU_DMA_INFIFO);
```

cau_init

The description of cau_init is shown as below:

Table 3-87. Function cau_init

Function name	cau_init
Function prototype	void cau_init(uint32_t algo_dir, uint32_t algo_mode, uint32_t swapping);
Function descriptions	initialize the CAU peripheral
Precondition	-
The called functions	-
Input parameter{in}	
algo_dir	algorithm direction
CAU_ENCRYPT	encrypt
CAU_DECRYPT	decrypt
Input parameter{in}	
algo_mode	algorithm mode selection
CAU_MODE_TDES_ECB	TDES-ECB (3DES Electronic codebook)
CAU_MODE_TDES_CBC	TDES-CBC (3DES Cipher block chaining)
CAU_MODE_DES_ECB	DES-ECB (simple DES Electronic codebook)
CAU_MODE_DES_CBC	DES-CBC (simple DES Cipher block chaining)
CAU_MODE_AES_ECB	AES-ECB (AES Electronic codebook)
CAU_MODE_AES_CBC	AES-CBC (AES Cipher block chaining)
CAU_MODE_AES_CTR	AES-CTR (AES counter mode)
CAU_MODE_AES_KEY	AES decryption key preparation mode
CAU_MODE_AES_GCM	AES-GCM (AES Galois/counter mode)
CAU_MODE_AES_CCM	AES-CCM (AES combined cipher machine mode)
CAU_MODE_AES_CFB	AES-CFB (cipher feedback mode)
CAU_MODE_AES_OFB	AES-OFB (output feedback mode)
Input parameter{in}	
swapping	data swapping selection

<i>CAU_SWAPPING_32BIT</i>	no swapping
<i>CAU_SWAPPING_16BIT</i>	half-word swapping
<i>CAU_SWAPPING_8BIT</i>	bytes swapping
<i>CAU_SWAPPING_1BIT</i>	bit swapping
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize the CAU peripheral */
```

```
cau_init(CAU_ENCRYPT, CAU_MODE_TDES_ECB, CAU_SWAPPING_32BIT);
```

cau_aes_keysize_config

The description of cau_aes_keysize_config is shown as below:

Table 3-88. Function cau_aes_keysize_config

Function name	cau_aes_keysize_config
Function prototype	void cau_aes_keysize_config(uint32_t key_size);
Function descriptions	configure key size if used AES algorithm
Precondition	-
The called functions	-
Input parameter{in}	
key_size	key length selection when aes mode
<i>CAU_KEYSIZE_128BIT</i>	128 bit key length
<i>CAU_KEYSIZE_192BIT</i>	192 bit key length
<i>CAU_KEYSIZE_256BIT</i>	256 bit key length
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure key size if used AES algorithm */
```

```
cau_aes_keysize_config(CAU_KEYSIZE_128BIT);
```

cau_key_init

The description of cau_key_init is shown as below:

Table 3-89. Function cau_key_init

Function name	cau_key_init
Function prototype	void cau_key_init(cau_key_parameter_struct* key_initpara);
Function descriptions	initialize the key parameters
Precondition	-
The called functions	-
Input parameter{in}	
key_initpara	structure for keys initialization of the cau, refer to structure Table 3-74. Structure cau_key_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* initialize the key parameters */

cau_key_parameter_struct key_initpara;

key_initpara->key_0_high = 0x12345678;
key_initpara->key_0_low = 0x12345678;
key_initpara->key_1_high = 0x12345678;
key_initpara->key_1_low = 0x12345678;
key_initpara->key_2_high = 0x12345678;
key_initpara->key_2_low = 0x12345678;
key_initpara->key_3_high = 0x12345678;
key_initpara->key_4_low = 0x12345678;

cau_key_init(&key_initpara);

```

cau_iv_init

The description of cau_iv_init is shown as below:

Table 3-90. Function cau_iv_init

Function name	cau_iv_init
Function prototype	void cau_iv_init(cau_iv_parameter_struct* iv_initpara);
Function descriptions	initialize the vectors parameters
Precondition	-
The called functions	-
Input parameter{in}	
iv_initpara	structure for vectors initialization of the cau, refer to structure Table 3-75.

	<u>Structure cau_iv_parameter_struct</u>
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize the vectors parameters */

cau_iv_parameter_struct iv_initpara;

iv_initpara->iv_0_high = 0x12345678;

iv_initpara->iv_0_low = 0x12345678;

iv_initpara->iv_1_high = 0x12345678;

iv_initpara->iv_1_low = 0x12345678;

cau_iv_init(&iv_initpara);
```

cau_phase_config

The description of cau_phase_config is shown as below:

Table 3-91. Function cau_phase_config

Function name	cau_phase_config
Function prototype	void cau_phase_config(uint32_t phase);
Function descriptions	configure phase
Precondition	-
The called functions	-
Input parameter{in}	
phase	gcm or ccm phase
CAU_PREPARE_PHASE	prepare phase
CAU_AAD_PHASE	AAD phase
CAU_ENCRYPT_DECRYPT_PHASE	encryption/decryption phase
CAU_TAG_PHASE	tag phase
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select prepare phase */
```



```
cau_phase_config(CAU_PREPARE_PHASE);
```

cau_fifo_flush

The description of cau_fifo_flush is shown as below:

Table 3-92. Function cau_fifo_flush

Function name	cau_fifo_flush
Function prototype	void cau_fifo_flush(void);
Function descriptions	flush the IN and OUT FIFOs
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* flush the IN and OUT FIFOs */
```

```
cau_fifo_flush();
```

cau_enable_state_get

The description of cau_enable_state_get is shown as below:

Table 3-93. Function cau_enable_state_get

Function name	cau_enable_state_get
Function prototype	ControlStatus cau_enable_state_get(void);
Function descriptions	return whether CAU peripheral is enabled or disabled
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ControlStatus	ENABLE or DISABLE

Example:

```
/* return whether CAU peripheral is enabled or disabled */
```

```
ControlStatus state = DISABLE;
```

```
state = cau_enable_state_get();
```

cau_data_write

The description of cau_data_write is shown as below:

Table 3-94. Function cau_data_write

Function name	cau_data_write
Function prototype	void cau_data_write(uint32_t data);
Function descriptions	write data to the IN FIFO
Precondition	-
The called functions	-
Input parameter{in}	
data	data to write: 0 - 0xFFFFFFFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* write data to the IN FIFO */
```

```
cau_data_write(0x10);
```

cau_data_read

The description of cau_data_read is shown as below:

Table 3-95. Function cau_data_read

Function name	cau_data_read
Function prototype	uint32_t cau_data_read(void);
Function descriptions	return the last data entered into the output FIFO
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint32_t	0x0 – 0xFFFFFFFF

Example:

```
/* return the last data entered into the output FIFO */
```

```
uint32_t data;
```

```
data = cau_data_read();
```

cau_context_save

The description of cau_context_save is shown as below:

Table 3-96. Function cau_context_save

Function name	cau_context_save
Function prototype	void cau_context_save(cau_context_parameter_struct *cau_context, cau_key_parameter_struct* key_initpara);
Function descriptions	save context before context switching
Precondition	-
The called functions	-
Input parameter{in}	
key_initpara	structure for keys initialization of the cau, refer to structure Table 3-74. Structure cau_key_parameter_struct
Output parameter{out}	
cau_context	structure for cau context swapping, refer to structure Table 3-76. Structure cau_context_parameter_struct
Return value	
-	-

Example:

```
cau_context_parameter_struct context;

cau_key_parameter_struct key;

cau_parameter_struct cau_parameter;

uint32_t keyaddr;

.....

keyaddr = (uint32_t)(cau_parameter->key);

cau_key_struct_para_init(&key);

key.key_1_high = __REV(*(uint32_t*)(keyaddr));

keyaddr += 4U;

key.key_1_low = __REV(*(uint32_t*)(keyaddr));

/* save context before context switching */

cau_context_save(&context, &key);
```

cau_context_restore

The description of cau_context_restore is shown as below:

Table 3-97. Function cau_context_restore

Function name	cau_context_restore
Function prototype	void cau_context_restore(cau_context_parameter_struct *cau_context);
Function descriptions	restore context after context switching
Precondition	-
The called functions	-
Input parameter{in}	
cau_context	structure for cau context swapping, refer to structure Table 3-76. Structure cau_context_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
cau_context_parameter_struct context;
```

```
.....
```

```
cau_context_save(&context, &key);
```

```
.....
```

```
/* restore context after context switching */
```

```
cau_context_restore(&context);
```

cau_aes_ecb

The description of cau_aes_ecb is shown as below:

Table 3-98. Function cau_aes_ecb

Function name	cau_aes_ecb
Function prototype	ErrStatus cau_aes_ecb(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using AES in ECB mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct text;

uint8_t encrypt_result[TEXT_SIZE];

ErrStatus status;

.....

key_addr = key_select[i];

key_size = keysize[i];

text.alg_dir = CAU_ENCRYPT;

text.key = key_addr;

text.key_size = key_size;

text.input = plaintext;

text.in_length = TEXT_SIZE;

/* encryption in ECB mode */

status = cau_aes_ecb(&text, encrypt_result);

```

cau_aes_cbc

The description of cau_aes_cbc is shown as below:

Table 3-99. Function cau_aes_cbc

Function name	cau_aes_cbc
Function prototype	ErrStatus cau_aes_cbc(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using AES in CBC mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct text;

uint8_t encrypt_result[TEXT_SIZE];

ErrStatus status;

```

```

.....

key_addr = key_select[i];

key_size = keysize[i];

text.alg_dir = CAU_ENCRYPT;

text.key = key_addr;

text.key_size = key_size;

text.iv = vectors;

text.input = plaintext;

text.in_length = TEXT_SIZE;

/* encryption in CBC mode */

status = cau_aes_cbc(&text, encrypt_result);

```

cau_aes_ctr

The description of cau_aes_ctr is shown as below:

Table 3-100. Function cau_aes_ctr

Function name	cau_aes_ctr
Function prototype	ErrStatus cau_aes_ctr(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using AES in CTR mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct text;

uint8_t encrypt_result[TEXT_SIZE];

ErrStatus status;

.....

key_addr = key_select[i];

```

```

key_size = keysize[i];

text.alg_dir = CAU_ENCRYPT;

text.key = key_addr;

text.key_size = key_size;

text.iv = vectors;

text.input = plaintext;

text.in_length = TEXT_SIZE;

/* encryption in CTR mode */

status = cau_aes_ctr(&text, encrypt_result);

```

cau_aes_cfb

The description of cau_aes_cfb is shown as below:

Table 3-101. Function cau_aes_cfb

Function name	cau_aes_cfb
Function prototype	ErrStatus cau_aes_cfb(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using AES in CFB mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct cau_cfb_parameter;

uint8_t encrypt_result[TEXT_SIZE];

ErrStatus status;

.....

/* encryption in CFB mode */

cau_cfb_parameter.alg_dir = CAU_ENCRYPT;

cau_cfb_parameter.key = (uint8_t *)key_128;

```

```

cau_cfb_parameter.key_size = KEY_SIZE;

cau_cfb_parameter.iv = (uint8_t *)vectors;

cau_cfb_parameter.iv_size = IV_SIZE;

cau_cfb_parameter.input = (uint8_t *)plaintext;

cau_cfb_parameter.in_length = PLAINTEXT_SIZE;

status = cau_aes_cfb(&cau_cfb_parameter, encrypt_result);

```

cau_aes_ofb

The description of cau_aes_ofb is shown as below:

Table 3-102. Function cau_aes_ofb

Function name	cau_aes_ofb
Function prototype	ErrStatus cau_aes_ofb(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using AES in OFB mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct cau_ofb_parameter;

uint8_t encrypt_result[TEXT_SIZE];

ErrStatus status;

.....

/* encryption in OFB mode */

cau_ofb_parameter.alg_dir = CAU_ENCRYPT;

cau_ofb_parameter.key = (uint8_t *)key_128;

cau_ofb_parameter.key_size = KEY_SIZE;

cau_ofb_parameter.iv = (uint8_t *)vectors;

cau_ofb_parameter.iv_size = IV_SIZE;

```



```
cau_ofb_parameter.input = (uint8_t *)plaintext;

cau_ofb_parameter.in_length = PLAINTEXT_SIZE;

status = cau_aes_ofb(&cau_ofb_parameter, encrypt_result);
```

cau_aes_gcm

The description of cau_aes_gcm is shown as below:

Table 3-103. Function cau_aes_gcm

Function name	cau_aes_gcm
Function prototype	ErrStatus cau_aes_gcm(cau_parameter_struct *cau_parameter, uint8_t *output, uint8_t *tag);
Function descriptions	encrypt and decrypt using AES in GCM mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Output parameter{out}	
tag	pointer to the returned tag buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```
cau_parameter_struct cau_gcm_parameter;

uint8_t encrypt_result[TEXT_SIZE];

uint8_t gcm_tag[GCM_TAG_SIZE];

ErrStatus status;

.....

/* encryption in GCM mode */

cau_gcm_parameter.alg_dir = CAU_ENCRYPT;

cau_gcm_parameter.key = (uint8_t *)key_128;

cau_gcm_parameter.key_size = KEY_SIZE;

cau_gcm_parameter.iv = (uint8_t *)vectors;

cau_gcm_parameter.iv_size = IV_SIZE;

cau_gcm_parameter.input = (uint8_t *)plaintext;
```

```

cau_gcm_parameter.in_length = PLAINTEXT_SIZE;

cau_gcm_parameter.aad = (uint8_t *)aadmessage;

cau_gcm_parameter.aad_size = AAD_SIZE;

status = cau_aes_gcm(&cau_gcm_parameter, encrypt_result, gcm_tag);

```

cau_aes_ccm

The description of cau_aes_ccm is shown as below:

Table 3-104. Function cau_aes_ccm

Function name	cau_aes_ccm
Function prototype	ErrStatus cau_aes_ccm(cau_parameter_struct *cau_parameter, uint8_t *output, uint8_t tag[], uint32_t tag_size, uint8_t aad_buf[]);
Function descriptions	encrypt and decrypt using AES in CCM mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Input parameter{in}	
tag_size	tag size (in bytes)
Output parameter{out}	
output	pointer to the returned buffer
Output parameter{out}	
tag	pointer to the returned tag buffer
Output parameter{out}	
aad_buf	pointer to the user buffer used when formatting aad block
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct cau_ccm_parameter;

uint8_t encrypt_result[TEXT_SIZE];

uint8_t ccm_tag[CCM_TAG_SIZE];

uint8_t aad_buf[AAD_SIZE + 21];

ErrStatus status;

.....

/* encryption in CCM mode */

cau_ccm_parameter.alg_dir = CAU_ENCRYPT;

```

```

cau_ccm_parameter.key = (uint8_t *)ccm_key_128;

cau_ccm_parameter.key_size = KEY_SIZE;

cau_ccm_parameter.iv = (uint8_t *)ccm_vectors;

cau_ccm_parameter.iv_size = CCM_IV_SIZE;

cau_ccm_parameter.input = (uint8_t *)plaintext;

cau_ccm_parameter.in_length = PLAINTEXT_SIZE;

cau_ccm_parameter.aad = (uint8_t *)aadmessage;

cau_ccm_parameter.aad_size = AAD_SIZE;

status = cau_aes_ccm(&cau_ccm_parameter, encrypt_result, ccm_tag, CCM_TAG_SIZE,
(uint8_t *)aad_buf);

```

cau_tdes_ecb

The description of cau_tdes_ecb is shown as below:

Table 3-105. Function cau_tdes_ecb

Function name	cau_tdes_ecb
Function prototype	ErrStatus cau_tdes_ecb(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using TDES in ECB mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct text;

uint8_t encrypt_result[DATA_SIZE];

ErrStatus status;

.....

text.alg_dir = CAU_ENCRYPT;

text.key = tdes_key;

```

```

text.input = plaintext;

text.in_length = DATA_SIZE;

/* encryption in ECB mode */

status = cau_tdes_ecb(&text, encrypt_result);

```

cau_tdes_cbc

The description of cau_tdes_cbc is shown as below:

Table 3-106. Function cau_tdes_cbc

Function name	cau_tdes_cbc
Function prototype	ErrStatus cau_tdes_cbc(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using TDES in CBC mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```

cau_parameter_struct text;

uint8_t encrypt_result[DATA_SIZE];

ErrStatus status;

.....

text.alg_dir = CAU_ENCRYPT;

text.key = tdes_key;

text.iv = vectors;

text.input = plaintext;

text.in_length = DATA_SIZE;

/* encryption in CBC mode */

status = cau_tdes_cbc(&text, encrypt_result);

```

cau_des_ecb

The description of cau_des_ecb is shown as below:

Table 3-107. Function cau_des_ecb

Function name	cau_des_ecb
Function prototype	ErrStatus cau_des_ecb(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using DES in ECB mode
Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```
cau_parameter_struct text;

uint8_t encrypt_result[DATA_SIZE];

ErrStatus status;

.....

text.alg_dir = CAU_ENCRYPT;

text.key = des_key;

text.input = plaintext;

text.in_length = DATA_SIZE;

/* encryption in ECB mode */

status = cau_des_ecb(&text, encrypt_result);
```

cau_des_cbc

The description of cau_des_cbc is shown as below:

Table 3-108. Function cau_des_cbc

Function name	cau_des_cbc
Function prototype	ErrStatus cau_des_cbc(cau_parameter_struct *cau_parameter, uint8_t *output);
Function descriptions	encrypt and decrypt using DES in CBC mode

Precondition	-
The called functions	-
Input parameter{in}	
cau_parameter	structure for encrypt and decrypt parameters, refer to structure Table 3-77. Structure cau_parameter_struct
Output parameter{out}	
output	pointer to the returned buffer
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```
cau_parameter_struct text;

uint8_t encrypt_result[DATA_SIZE];

ErrStatus status;

.....

text.alg_dir = CAU_ENCRYPT;

text.key = des_key;

text.iv = vectors;

text.input = plaintext;

text.in_length = DATA_SIZE;

/* encryption in CBC mode */

status = cau_des_cbc(&text, encrypt_result);
```

cau_flag_get

The description of cau_flag_get is shown as below:

Table 3-109. Function cau_flag_get

Function name	cau_flag_get
Function prototype	FlagStatus cau_flag_get(uint32_t flag);
Function descriptions	get the CAU flag status
Precondition	-
The called functions	-
Input parameter{in}	
flag	CAU flag status
CAU_FLAG_INFIFO_EMPTY	input FIFO empty
CAU_FLAG_INFIFO_NOT_FULL	input FIFO is not full

CAU_FLAG_OUTFIFO_NO_EMPTY	output FIFO not empty
CAU_FLAG_OUTFIFO_FULL	output FIFO is full
CAU_FLAG_BUSY	the CAU core is busy
CAU_FLAG_INFIFO	input FIFO flag status
CAU_FLAG_OUTFIFO	output FIFO flag status
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the CAU flag status */
```

```
FlagStatus status = RESET;
```

```
status = cau_flag_get(CAU_FLAG_INFIFO_EMPTY);
```

cau_interrupt_enable

The description of cau_interrupt_enable is shown as below:

Table 3-110. Function cau_interrupt_enable

Function name	cau_interrupt_enable
Function prototype	void cau_interrupt_enable(uint32_t interrupt);
Function descriptions	enable the CAU interrupts
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify the CAU interrupt source to be enabled
CAU_INT_INFIFO	input FIFO interrupt
CAU_INT_OUTFIFO	output FIFO interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable cau interrupt */
```

```
cau_interrupt_enable(CAU_INT_INFIFO);
```

cau_interrupt_disable

The description of cau_interrupt_disable is shown as below:

Table 3-111. Function cau_interrupt_disable

Function name	cau_interrupt_disable
Function prototype	void cau_interrupt_disable(uint32_t interrupt);
Function descriptions	disable the CAU interrupts
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify the CAU interrupt source to be disabled
CAU_INT_INFIFO	input FIFO interrupt
CAU_INT_OUTFIFO	output FIFO interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable cau interrupt */
cau_interrupt_disable(CAU_INT_INFIFO);
```

cau_interrupt_flag_get

The description of cau_interrupt_flag_get is shown as below:

Table 3-112. Function cau_interrupt_flag_get

Function name	cau_interrupt_flag_get
Function prototype	FlagStatus cau_interrupt_flag_get(uint32_t int_flag);
Function descriptions	get the interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	CAU interrupt flag
CAU_INT_FLAG_INFIFO	input FIFO interrupt
CAU_INT_FLAG_OUTFIFO	output FIFO interrupt
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the CAU interrupt flag status */
FlagStatus status = RESET;
```



```
status = cau_interrupt_flag_get(CAU_INT_FLAG_INFIFO);
```

3.5. CMP

The general purpose CMP can work either standalone (all terminal are available on I / Os) or together with the timers. It can be used to wake up the MCU from low-power mode by an analog signal, provide a trigger source when an analog signal is in a certain condition. The CMP registers are listed in chapter [3.5.1](#), the CMP firmware functions are introduced in chapter [3.5.2](#).

3.5.1. Descriptions of Peripheral registers

CMP registers are listed in the table shown as below:

Table 3-113. CMP Registers

Registers	Descriptions
CMP0_CS	CMP0 control and status register
CMP1_CS	CMP1 control and status register

3.5.2. Descriptions of Peripheral functions

CMP firmware functions are listed in the table shown as below:

Table 3-114. CMP firmware function

Function name	Function description
cmp_deinit	CMP deinit
cmp_mode_init	CMP mode init
cmp_noninverting_input_select	CMP noninverting input select
cmp_output_init	CMP output init
cmp_blanking_init	CMP output blanking function init
cmp_enable	enable CMP
cmp_disable	disable CMP
cmp_window_enable	enable the window mode
cmp_window_disable	disable the window mode
cmp_lock_enable	lock the CMP
cmp_voltage_scaler_enable	enable the voltage scaler
cmp_voltage_scaler_disable	disable the voltage scaler
cmp_scaler_bridge_enable	enable the scaler bridge
cmp_scaler_bridge_disable	disable the scaler bridge
cmp_output_level_get	get output level

Enum cmp_enum

Table 3-115. Enum cmp_enum

Member name	Function description
CMP0	cmoparator 0
CMP1	cmoparator 1

cmp_deinit

The description of cmp_deinit is shown as below:

Table 3-116. Function cmp_deinit

Function name	cmp_deinit
Function prototype	void cmp_deinit(cmp_enum cmp_periph);
Function descriptions	CMP deinit
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* deinitialize CMP0 */
cmp_deinit(CMP0);
```

cmp_mode_init

The description of cmp_mode_init is shown as below:

Table 3-117. Function cmp_mode_init

Function name	cmp_mode_init
Function prototype	void cmp_mode_init(cmp_enum cmp_periph, uint32_t operating_mode, uint32_t inverting_input, uint32_t output_hysteresis);
Function descriptions	CMP mode init
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Input parameter{in}	
operating_mode	operating mode
CMP_MODE_HIGHSP	high speed mode

<i>EED</i>	
<i>CMP_MODE_MIDDLE SPEED</i>	medium speed mode
<i>CMP_MODE_LOWSPE ED</i>	low speed mode
Input parameter{in}	
inverting_input	inverting input select
<i>CMP_INVERTING_INP UT_1_4VREFINT</i>	VREFINT *1/4 input
<i>CMP_INVERTING_INP UT_1_2VREFINT</i>	VREFINT *1/2 input
<i>CMP_INVERTING_INP UT_3_4VREFINT</i>	VREFINT *3/4 input
<i>CMP_INVERTING_INP UT_VREFINT</i>	VREFINT input
<i>CMP_INVERTING_INP UT_PA0_PA2</i>	PA0 for CMP0 or PA2 for CMP1 as inverting input
<i>CMP_INVERTING_INP UT_DAC0_OUT0</i>	PA4(DAC) input
<i>CMP_INVERTING_INP UT_PB3</i>	PB3 input only for CMP1
Input parameter{in}	
output_hysteresis	hysteresis level
<i>CMP_HYSTERESIS_N O</i>	output no hysteresis
<i>CMP_HYSTERESIS_L OW</i>	output low hysteresis
<i>CMP_HYSTERESIS_M IDDLE</i>	output middle hysteresis
<i>CMP_HYSTERESIS_HI GH</i>	output high hysteresis
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize CMP0 mode */
```

```
cmp_mode_init(CMP0, CMP_MODE_HIGHSPEED, CMP_INVERTING_INPUT_1_4VREFINT, CMP_HYSTERESIS_NO);
```

cmp_noninverting_input_select

The description of cmp_noninverting_input_select is shown as below:

Table 3-118. Function cmp_noninverting_input_select

Function name	cmp_noninverting_input_select
Function prototype	void cmp_noninverting_input_select(cmp_enum cmp_periph, uint32_t noninverting_input)
Function descriptions	CMP noninverting input select
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Input parameter{in}	
noninverting_input	noninverting input select
CMP_NONINVERTING_INPUT_PA3	CMP noninverting input PA3 for CMP1
CMP_NONINVERTING_INPUT_PB4	CMP noninverting input PB4 for CMP1
CMP_NONINVERTING_INPUT_PB5	CMP noninverting input PB5 for CMP1
CMP_NONINVERTING_INPUT_PB6	CMP noninverting input PB6 for CMP1
CMP_NONINVERTING_INPUT_PB7	CMP noninverting input PB7 for CMP1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* selecte the noninverting input for CMP1*/
```

```
cmp_noninverting_input_select (CMP1, CMP_NONINVERTING_INPUT_PA3);
```

cmp_output_init

The description of cmp_output_init is shown as below:

Table 3-119. Function cmp_output_init

Function name	cmp_output_init
Function prototype	void cmp_output_init(cmp_enum cmp_periph, uint32_t output_selection, uint32_t output_polarity)
Function descriptions	CMP output init
Precondition	-

The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Input parameter{in}	
output_selction	CMP output select
CMP_OUTPUT_NONE	output no selection
CMP_OUTPUT_TIMER1_IC3	CMP output TIMER1_CH3 input capture
CMP_OUTPUT_TIMER2_IC0	CMP output TIMER2_CH0 input capture
Input parameter{in}	
output_polarity	CMP output polarity
CMP_OUTPUT_POLARITY_INVERTED	output is inverted
CMP_OUTPUT_POLARITY_NONINVERTED	output is not inverted
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize CMP0 output */
```

```
cmp_output_init (CMP0, CMP_OUTPUT_NONE, CMP_OUTPUT_POLARITY_NONINVERTED);
```

cmp_blanking_init

The description of cmp_blanking_init is shown as below:

Table 3-120. Function cmp_blanking_init

Function name	cmp_blanking_init
Function prototype	void cmp_blanking_init(cmp_enum cmp_periph, uint32_t blanking_source_selection);
Function descriptions	CMP output blanking function init
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Input parameter{in}	
blanking_source_selection	blanking source selection
CMP_BLANKING_NON	CMP no blanking source

<i>E</i>	
<i>CMP_BLANKING_TIM</i> <i>ER1_OC1</i>	CMP TIMER1_CH1 output compare signal selected as blanking source
<i>CMP_BLANKING_TIM</i> <i>ER2_OC1</i>	CMP TIMER2_CH1 output compare signal selected as blanking source
<i>CMP_BLANKING_TIM</i> <i>ER8_OC1</i>	CMP TIMER8_CH1 output compare signal selected as blanking source
<i>CMP_BLANKING_TIM</i> <i>ER11_OC1</i>	CMP TIMER11_CH1 output compare signal selected as blanking source
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize CMP0 blanking function */
cmp_blanking_init(CMP0, CMP_BLANKING_NONE);
```

cmp_enable

The description of cmp_enable is shown as below:

Table 3-121. Function cmp_enable

Function name	cmp_enable
Function prototype	void cmp_enable(cmp_enum cmp_periph);
Function descriptions	enable CMP
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CMP0*/
cmp_enable(CMP0);
```

cmp_disable

The description of cmp_disable is shown as below:

Table 3-122. Function cmp_disable

Function name	cmp_disable
Function prototype	void cmp_disable(cmp_enum cmp_periph);
Function descriptions	disable CMP
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CMP0 */
cmp_disable(CMP0);
```

cmp_window_enable

The description of cmp_window_enable is shown as below:

Table 3-123. Function cmp_window_enable

Function name	cmp_window_enable
Function prototype	void cmp_window_enable(void);
Function descriptions	enable the window mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the window mode */
cmp_window_enable();
```

cmp_window_disable

The description of cmp_window_disable is shown as below:

Table 3-124. Function cmp_window_disable

Function name	cmp_window_disable
Function prototype	void cmp_window_disable(void);
Function descriptions	disable the window mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the window mode */
cmp_window_disable();
```

cmp_lock_enable

The description of cmp_lock_enable is shown as below:

Table 3-125. Function cmp_lock_enable

Function name	cmp_lock_enable
Function prototype	void cmp_lock_enable(cmp_enum cmp_periph);
Function descriptions	lock the CMP
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* lock CMP0 register */
cmp_lock_enable(CMP0);
```

cmp_voltage_scaler_enable

The description of cmp_voltage_scaler_enable is shown as below:

Table 3-126. Function cmp_voltage_scaler_enable

Function name	cmp_voltage_scaler_enable
Function prototype	void cmp_voltage_scaler_enable(cmp_enum cmp_periph);
Function descriptions	enable the voltage scaler
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CMP0 the voltage scaler */
cmp_voltage_scaler_enable(CMP0);
```

cmp_voltage_scaler_disable

The description of cmp_voltage_scaler_disable is shown as below:

Table 3-127. Function cmp_voltage_scaler_disable

Function name	cmp_voltage_scaler_disable
Function prototype	void cmp_voltage_scaler_disable(cmp_enum cmp_periph);
Function descriptions	disable the voltage scaler
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CMP0 the voltage scaler */
cmp_voltage_scaler_disable(CMP0);
```

cmp_scaler_bridge_enable

The description of cmp_scaler_bridge_enable is shown as below:

Table 3-128. Function cmp_scaler_bridge_enable

Function name	cmp_scaler_bridge_enable
Function prototype	void cmp_scaler_bridge_enable(cmp_enum cmp_periph);
Function descriptions	enable the scaler bridge
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CMP0 the scaler bridge */
cmp_scaler_bridge_enable(CMP0);
```

cmp_scaler_bridge_disable

The description of cmp_scaler_bridge_disable is shown as below:

Table 3-129. Function cmp_scaler_bridge_disable

Function name	cmp_scaler_bridge_disable
Function prototype	void cmp_scaler_bridge_disable(cmp_enum cmp_periph);
Function descriptions	disable the scaler bridge
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CMP0 the scaler bridge */
cmp_scaler_bridge_disable(CMP0);
```

cmp_output_level_get

The description of cmp_output_level_get is shown as below:

Table 3-130. Function cmp_output_level_get

Function name	cmp_output_level_get
Function prototype	uint32_t cmp_output_level_get(cmp_enum cmp_periph);
Function descriptions	get output level
Precondition	-
The called functions	-
Input parameter{in}	
cmp_periph	refer to enum Table 3-115. Enum cmp_enum
Output parameter{out}	
-	-
Return value	
uint32_t	the output level
CMP_OUTPUTLEVEL_HIGH	comparator output high
CMP_OUTPUTLEVEL_LOW	comparator output low

Example:

```
uint32_t level;

/* get CMP0 output level */

level = cmp_output_level_get(CMP0);
```

3.6. CRC

A cyclic redundancy check (CRC) is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data. The CRC registers are listed in chapter [3.6.1](#), the CRC firmware functions are introduced in chapter [3.6.2](#).

3.6.1. Descriptions of Peripheral registers

CRC registers are listed in the table shown as below:

Table 3-131. CRC Registers

Registers	Descriptions
CRC_DATA	CRC data register
CRC_FDATA	CRC free data register
CRC_CTL	CRC control register
CRC_IDATA	CRC initialization data register
CRC_POLY	CRC polynomial register

3.6.2. Descriptions of Peripheral functions

CRC firmware functions are listed in the table shown as below:

Table 3-132. CRC firmware function

Function name	Function description
crc_deinit	deinit CRC calculation unit
crc_reverse_output_data_enable	enable the reverse operation of output data
crc_reverse_output_data_disable	disable the reverse operation of output data
crc_data_register_reset	reset data register to the value of initializaiton data register
crc_data_register_read	read the data register
crc_free_data_register_read	read the free data register
crc_free_data_register_write	write the free data register
crc_init_data_register_write	write the initialization value register
crc_input_data_reverse_config	configure the CRC input data function
crc_polynomial_size_set	configure the CRC size of polynomial function
crc_polynomial_set	configure the CRC polynomial value function
crc_single_data_calculate	CRC calculate single data
crc_block_data_calculate	CRC calculate a data array

crc_deinit

The description of crc_deinit is shown as below:

Table 3-133. Function crc_deinit

Function name	crc_deinit
Function prototype	void crc_deinit(void);
Function descriptions	deinit CRC calculation unit
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset crc */
crc_deinit();
```

crc_reverse_output_data_enable

The description of crc_reverse_output_data_enable is shown as below:

Table 3-134. Function `crc_reverse_output_data_enable`

Function name	<code>crc_reverse_output_data_enable</code>
Function prototype	<code>void crc_reverse_output_data_enable(void);</code>
Function descriptions	enable the reverse operation of output data
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CRC reverse operation of output data */
crc_reverse_output_data_enable();
```

`crc_reverse_output_data_disable`

The description of `crc_reverse_output_data_disable` is shown as below:

Table 3-135. Function `crc_reverse_output_data_disable`

Function name	<code>crc_reverse_output_data_disable</code>
Function prototype	<code>void crc_reverse_output_data_disable(void);</code>
Function descriptions	disable the reverse operation of output data
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable crc reverse operation of output data */
crc_reverse_output_data_disable();
```

`crc_data_register_reset`

The description of `crc_data_register_reset` is shown as below:

Table 3-136. Function `crc_data_register_reset`

Function name	<code>crc_data_register_reset</code>
Function prototype	<code>void crc_data_register_reset(void);</code>
Function descriptions	reset data register to the value of initializaiton data register
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset crc data register */
crc_data_register_reset();
```

`crc_data_register_read`

The description of `crc_data_register_read` is shown as below:

Table 3-137. Function `crc_data_register_read`

Function name	<code>crc_data_register_read</code>
Function prototype	<code>uint32_t crc_data_register_read(void);</code>
Function descriptions	read the data register
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
<code>uint32_t</code>	32-bit value of the data register (0-0xFFFFFFFF)

Example:

```
/* read crc data register */
uint32_t crc_value = 0;
crc_value = crc_data_register_read();
```

`crc_free_data_register_read`

The description of `crc_free_data_register_read` is shown as below:

Table 3-138. Function `crc_free_data_register_read`

Function name	<code>crc_free_data_register_read</code>
Function prototype	<code>uint8_t crc_free_data_register_read(void);</code>
Function descriptions	read the free data register
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
<code>uint8_t</code>	8-bit value of the free data register (0-0xFF)

Example:

```
/* read crc free data register */
uint8_t crc_value = 0;
crc_value = crc_free_data_register_read();
```

`crc_free_data_register_write`

The description of `crc_free_data_register_write` is shown as below:

Table 3-139. Function `crc_free_data_register_write`

Function name	<code>crc_free_data_register_write</code>
Function prototype	<code>void crc_free_data_register_write(uint8_t free_data);</code>
Function descriptions	write the free data register
Precondition	-
The called functions	-
Input parameter{in}	
<code>free_data</code>	specify 8-bit data
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* write the free data register */
crc_free_data_register_write(0x11);
```

`crc_init_data_register_write`

The description of `crc_init_data_register_write` is shown as below:

Table 3-140. Function `crc_init_data_register_write`

Function name	<code>crc_init_data_register_write</code>
Function prototype	<code>void crc_init_data_register_write(uint32_t init_data)</code>
Function descriptions	write the initializaiton data register
Precondition	-
The called functions	-
Input parameter{in}	
<code>init_data</code>	specify 32-bit data
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* write crc initializaiton data register */
crc_init_data_register_write(0x11223344);
```

`crc_input_data_reverse_config`

The description of `crc_input_data_reverse_config` is shown as below:

Table 3-141. Function `crc_input_data_reverse_config`

Function name	<code>crc_input_data_reverse_config</code>
Function prototype	<code>void crc_input_data_reverse_config(uint32_t data_reverse)</code>
Function descriptions	configure the crc input data function
Precondition	-
The called functions	-
Input parameter{in}	
<code>data_reverse</code>	specify input data reverse function
<code>CRC_INPUT_DATA_NOT</code>	input data is not reversed
<code>CRC_INPUT_DATA_BYTE</code>	input data is reversed on 8 bits
<code>CRC_INPUT_DATA_HALFWORD</code>	input data is reversed on 16 bits
<code>CRC_INPUT_DATA_WORD</code>	input data is reversed on 32 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:


```
/* configure the crc input data */
```

```
crc_input_data_reverse_config(CRC_INPUT_DATA_WORD);
```

crc_polynomial_size_set

The description of crc_polynomial_size_set is shown as below:

Table 3-142. Function crc_polynomial_size_set

Function name	crc_polynomial_size_set
Function prototype	void crc_polynomial_size_set(uint32_t poly_size)
Function descriptions	configure the CRC size of polynomial function
Precondition	-
The called functions	-
Input parameter{in}	
poly_size	size of polynomial
CRC_CTL_PS_32	32-bit polynomial for CRC calculation
CRC_CTL_PS_16	16-bit polynomial for CRC calculation
CRC_CTL_PS_8	8-bit polynomial for CRC calculation
CRC_CTL_PS_7	7-bit polynomial for CRC calculation
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the CRC polynomial size */
```

```
crc_polynomial_size_set(CRC_CTL_PS_7);
```

crc_polynomial_set

The description of crc_polynomial_set is shown as below:

Table 3-143. Function crc_polynomial_set

Function name	crc_polynomial_set
Function prototype	void crc_polynomial_set(uint32_t poly)
Function descriptions	configure the CRC polynomial value function
Precondition	-
The called functions	-
Input parameter{in}	
poly	configurable polynomial value
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* configure the CRC polynomial value */
```

```
crc_polynomial_set(0x11223344);
```

crc_single_data_calculate

The description of crc_single_data_calculate is shown as below:

Table 3-144. Function crc_single_data_calculate

Function name	crc_single_data_calculate
Function prototype	uint32_t crc_single_data_calculate(uint32_t sdata, uint8_t data_format);
Function descriptions	CRC calculate single data
Precondition	-
The called functions	-
Input parameter{in}	
sdata	specify input data
Input parameter{in}	
data_format	input data format
INPUT_FORMAT_WORD	input data in word format
INPUT_FORMAT_HALFWORD	input data in half-word format
INPUT_FORMAT_BYTE	input data in byte format
Output parameter{out}	
-	-
Return value	
uint32_t	CRC calculate value (0-0xFFFFFFFF)

Example:

```
/* CRC calculate a 32-bit data */
```

```
uint32_t val = 0, valcrc = 0;
```

```
val = (uint32_t)0xabcd1234;
```

```
valcrc = crc_single_data_calculate(val, INPUT_FORMAT_WORD);
```

crc_block_data_calculate

The description of crc_block_data_calculate is shown as below:

Table 3-145. Function crc_block_data_calculate

Function name	crc_block_data_calculate
----------------------	--------------------------

Function prototype	uint32_t crc_block_data_calculate(void *array, uint32_t size, uint8_t data_format);
Function descriptions	CRC calculate a data array
Precondition	-
The called functions	-
Input parameter{in}	
array	pointer to the input data array
Input parameter{in}	
size	size of the array
Input parameter{in}	
data_format	input data format
<i>INPUT_FORMAT_WORD</i>	input data in word format
<i>INPUT_FORMAT_HALFWORD</i>	input data in half-word format
<i>INPUT_FORMAT_BYTE</i>	input data in byte format
Output parameter{out}	
-	-
Return value	
uint32_t	CRC calculate value (0-0xFFFFFFFF)

Example:

```

/* CRC calculate a 32-bit data array */

#define BUFFER_SIZE    6

uint32_t valcrc = 0;

static const uint32_t data_buffer[BUFFER_SIZE] = {

0x00001111, 0x00002222, 0x00003333, 0x00004444, 0x00005555, 0x00006666};

valcrc = crc_block_data_calculate(data_buffer, BUFFER_SIZE, INPUT_FORMAT_WORD);

```

3.7. CTC

The CTC unit trims the frequency of the IRC48M which is based on an external accurate reference signal source. It can adjust the calibration value to provide a precise IRC48M clock automatically or manually. The CTC registers are listed in chapter [3.7.1](#), the CTC firmware functions are introduced in chapter [3.7.2](#).

3.7.1. Descriptions of Peripheral registers

CTC registers are listed in the table shown as below:

Table 3-146. CTC Registers

Registers	Descriptions
CTC_CTL0	CTC control register 0
CTC_CTL1	CTC control register 1
CTC_STAT	CTC status register
CTC_INTC	CTC interrupt clear register

3.7.2. Descriptions of Peripheral functions

CTC registers are listed in the table shown as below:

Table 3-147. CTC firmware function

Function name	Function description
ctc_deinit	reset CTC clock trim controller
ctc_counter_enable	enable CTC trim counter
ctc_counter_disable	disable CTC trim counter
ctc_irc48m_trim_value_config	configure the IRC48M trim value
ctc_software_refsource_pulse_generate	generate software reference source sync pulse
ctc_hardware_trim_mode_config	configure hardware automatically trim mode
ctc_refsource_polarity_config	configure reference signal source polarity
ctc_refsource_signal_select	select reference signal source
ctc_refsource_prescaler_config	configure reference signal source prescaler
ctc_clock_limit_value_config	configure clock trim base limit value
ctc_counter_reload_value_config	configure CTC counter reload value
ctc_counter_capture_value_read	read CTC counter capture value when reference sync pulse occurred
ctc_counter_direction_read	read CTC trim counter direction when reference sync pulse occurred
ctc_counter_reload_value_read	read CTC counter reload value
ctc_irc48m_trim_value_read	read the IRC48M trim value
ctc_interrupt_enable	enable the CTC interrupt
ctc_interrupt_disable	disable the CTC interrupt
ctc_interrupt_flag_get	get CTC interrupt flag
ctc_interrupt_flag_clear	clear CTC interrupt flag
ctc_flag_get	get CTC flag
ctc_flag_clear	clear CTC flag

ctc_deinit

The description of ctc_deinit is shown as below:

Table 3-148. Function ctc_deinit

Function name	ctc_deinit
---------------	------------

Function prototype	void ctc_deinit(void)
Function descriptions	reset CTC clock trim controller
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset CTC */
```

```
ctc_deinit();
```

ctc_counter_enable

The description of ctc_counter_enable is shown as below:

Table 3-149. Function ctc_counter_enable

Function name	ctc_counter_enable
Function prototype	void ctc_counter_enable(void);
Function descriptions	enable CTC counter
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CTC trim counter*/
```

```
ctc_counter_enable();
```

ctc_counter_disable

The description of ctc_counter_disable is shown as below:

Table 3-150. Function ctc_counter_disable

Function name	ctc_counter_disable
Function prototype	void ctc_counter_disable(void);

Function descriptions	disable CTC counter
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CTC trim counter */
ctc_counter_disable();
```

ctc_irc48m_trim_value_config

The description of ctc_irc48m_trim_value_config is shown as below:

Table 3-151. Function ctc_irc48m_trim_value_config

Function name	ctc_irc48m_trim_value_config
Function prototype	void ctc_irc48m_trim_value_config(uint8_t trim_value);
Function descriptions	configure the IRC48M trim value
Precondition	-
The called functions	-
Input parameter{in}	
trim_value	0~127
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* IRC48M trim value configuration */
ctc_irc48m_trim_value_config(0x01);
```

ctc_software_refsource_pulse_generate

The description of ctc_software_refsource_pulse_generate is shown as below:

Table 3-152. Function ctc_software_refsource_pulse_generate

Function name	ctc_software_refsource_pulse_generate
Function prototype	void ctc_software_refsource_pulse_generate(void);
Function descriptions	generate software reference source sync pulse

Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* generate reference source sync pulse */
ctc_software_refsource_pulse_generate();
```

ctc_hardware_trim_mode_config

The description of ctc_hardware_trim_mode_config is shown as below:

Table 3-153. Function ctc_hardware_trim_mode_config

Function name	ctc_hardware_trim_mode_config
Function prototype	void ctc_hardware_trim_mode_config(uint32_t hardmode);
Function descriptions	configure hardware automatically trim mode
Precondition	-
The called functions	-
Input parameter{in}	
hardmode	hardware automatically trim mode enable or disable
CTC_HARDWARE_TRIM_MODE_ENABLE	hardware automatically trim mode enable
CTC_HARDWARE_TRIM_MODE_DISABLE	hardware automatically trim mode disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CTC hardware trim */
ctc_hardware_trim_mode_config(CTC_HARDWARE_TRIM_MODE_ENABLE);
```

ctc_refsource_polarity_config

The description of ctc_refsource_polarity_config is shown as below:

Table 3-154. Function `ctc_refsource_polarity_config`

Function name	<code>ctc_refsource_polarity_config</code>
Function prototype	<code>void ctc_refsource_polarity_config(uint32_t polarity);</code>
Function descriptions	configure reference signal source polarity
Precondition	-
The called functions	-
Input parameter{in}	
polarity	reference signal source polarity
<code>CTC_REFSOURCE_POLARITY_FALLING</code>	reference signal source polarity is falling edge
<code>CTC_REFSOURCE_POLARITY_RISING</code>	reference signal source polarity is rising edge
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set reference source polarity */
ctc_refsource_polarity_config(CTC_REFSOURCE_POLARITY_RISING);
```

`ctc_refsource_signal_select`

The description of `ctc_refsource_signal_select` is shown as below:

Table 3-155. Function `ctc_refsource_signal_select`

Function name	<code>ctc_refsource_signal_select</code>
Function prototype	<code>void ctc_refsource_signal_select(uint32_t refs);</code>
Function descriptions	select reference signal source
Precondition	-
The called functions	-
Input parameter{in}	
refs	reference signal source
<code>CTC_REFSOURCE_GPIO</code>	GPIO is selected
<code>CTC_REFSOURCE_LXTAL</code>	LXTAL is selected
Output parameter{out}	
-	-
Return value	
-	-

Example:


```
/* reference signal selection */
```

```
ctc_refsource_signal_select(CTC_REFSOURCE_LXTAL);
```

ctc_refsource_prescaler_config

The description of ctc_refsource_prescaler_config is shown as below:

Table 3-156. Function ctc_refsource_prescaler_config

Function name	ctc_refsource_prescaler_config
Function prototype	void ctc_refsource_prescaler_config(uint32_t prescaler);
Function descriptions	configure reference signal source prescaler
Precondition	-
The called functions	-
Input parameter{in}	
prescaler	Prescaler factor
CTC_REFSOURCE_P SC_OFF	reference signal not divided
CTC_REFSOURCE_P SC_DIV2	reference signal divided by 2
CTC_REFSOURCE_P SC_DIV4	reference signal divided by 4
CTC_REFSOURCE_P SC_DIV8	reference signal divided by 8
CTC_REFSOURCE_P SC_DIV16	reference signal divided by 16
CTC_REFSOURCE_P SC_DIV32	reference signal divided by 32
CTC_REFSOURCE_P SC_DIV64	reference signal divided by 64
CTC_REFSOURCE_P SC_DIV128	reference signal divided by 128
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure reference signal source prescaler */
```

```
ctc_refsource_prescaler_config(CTC_REFSOURCE_PSC_DIV2);
```

ctc_clock_limit_value_config

The description of ctc_clock_limit_value_config is shown as below:

Table 3-157. Function `ctc_clock_limit_value_config`

Function name	<code>ctc_clock_limit_value_config</code>
Function prototype	<code>void ctc_clock_limit_value_config(uint8_t limit_value);</code>
Function descriptions	configure clock trim base limit value
Precondition	-
The called functions	-
Input parameter{in}	
limit_value	0x00 - 0xFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure clock trim base limit value */
ctc_clock_limit_value_config(0x1F);
```

`ctc_counter_reload_value_config`

The description of `ctc_counter_reload_value_config` is shown as below:

Table 3-158. Function `ctc_counter_reload_value_config`

Function name	<code>ctc_counter_reload_value_config</code>
Function prototype	<code>void ctc_counter_reload_value_config(uint16_t reload_value);</code>
Function descriptions	configure CTC counter reload value
Precondition	-
The called functions	-
Input parameter{in}	
reload_value	0x0000 - 0xFFFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure CTC counter reload value */
ctc_counter_reload_value_config(0x00FF);
```

`ctc_counter_capture_value_read`

The description of `ctc_counter_capture_value_read` is shown as below:

Table 3-159. Function `ctc_counter_capture_value_read`

Function name	<code>ctc_counter_capture_value_read</code>
Function prototype	<code>uint16_t ctc_counter_capture_value_read(void);</code>
Function descriptions	read CTC counter capture value when reference sync pulse occurred
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint16_t	the 16-bit CTC counter capture value (0x0000 - 0xFFFF)

Example:

```
/* read CTC counter capture value */

uint16_t ctc_value = 0;

ctc_value = ctc_counter_capture_value_read();
```

`ctc_counter_direction_read`

The description of `ctc_counter_direction_read` is shown as below:

Table 3-160. Function `ctc_counter_direction_read`

Function name	<code>ctc_counter_direction_read</code>
Function prototype	<code>FlagStatus ctc_counter_direction_read(void);</code>
Function descriptions	read CTC trim counter direction when reference sync pulse occurred
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
FlagStatus	SET(count-down) / RESET(count-up)

Example:

```
/* read ctc counter direction */

FlagStatus ctc_direction = SET;

ctc_direction = ctc_counter_direction_read();
```

ctc_counter_reload_value_read

The description of ctc_counter_reload_value_read is shown as below:

Table 3-161. Function ctc_counter_reload_value_read

Function name	ctc_counter_reload_value_read
Function prototype	uint16_t ctc_counter_reload_value_read(void);
Function descriptions	read CTC counter reload value
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint16_t	Read 16-bit data of counter reload value (0x0000 - 0xFFFF)

Example:

```
/* read CTC counter reload value */
uint16_t ctc_reload_value = 0;
ctc_reload_value = ctc_counter_reload_value_read();
```

ctc_irc48m_trim_value_read

The description of ctc_irc48m_trim_value_read is shown as below:

Table 3-162. Function ctc_irc48m_trim_value_read

Function name	ctc_irc48m_trim_value_read
Function prototype	uint8_t ctc_irc48m_trim_value_read(void);
Function descriptions	read the IRC48M trim value
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	the 7-bit IRC48M trim value (0-127)

Example:

```
/* read the IRC48M trim value */
uint8_t ctc_trim_value = 0;
```

```
ctc_trim_value = ctc_irc48m_trim_value_read();
```

ctc_flag_get

The description of ctc_flag_get is shown as below:

Table 3-163. Function ctc_flag_get

Function name	ctc_flag_get
Function prototype	FlagStatus ctc_flag_get(uint32_t flag);
Function descriptions	get CTC flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	CTC status flag
CTC_FLAG_CKOK	clock trim OK interrupt flag
CTC_FLAG_CKWARN	clock trim warning interrupt flag
CTC_FLAG_ERR	error interrupt flag
CTC_FLAG_EREf	expect reference interrupt flag
CTC_FLAG_CKERR	clock trim error bit
CTC_FLAG_REFMISS	reference sync pulse miss flag
CTC_FLAG_TRIMERR	trim value error flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get CTC flag status */
```

```
FlagStatus state = ctc_flag_get(CTC_FLAG_CKOK);
```

ctc_flag_clear

The description of ctc_flag_clear is shown as below:

Table 3-164. Function ctc_flag_clear

Function name	ctc_flag_clear
Function prototype	void ctc_flag_clear(uint32_t flag);
Function descriptions	clear CTC flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	CTC status flag
CTC_FLAG_CKOK	clock trim OK interrupt flag
CTC_FLAG_CKWARN	clock trim warning interrupt flag

<i>CTC_FLAG_ERR</i>	error interrupt flag
<i>CTC_FLAG_EREFP</i>	expect reference interrupt flag
<i>CTC_FLAG_CKERR</i>	clock trim error bit
<i>CTC_FLAG_REFMIS</i>	reference sync pulse miss flag
<i>CTC_FLAG_TRIMERR</i>	trim value error flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear CTC flag status */
ctc_flag_clear(CTC_FLAG_CKOK);
```

ctc_interrupt_enable

The description of ctc_interrupt_enable is shown as below:

Table 3-165. Function ctc_interrupt_enable

Function name	ctc_interrupt_enable
Function prototype	void ctc_interrupt_enable(uint32_t interrupt);
Function descriptions	enable the CTC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	CTC interrupt
<i>CTC_INT_CKOK</i>	clock trim OK interrupt
<i>CTC_INT_CKWARN</i>	clock trim warning interrupt
<i>CTC_INT_ERR</i>	error interrupt
<i>CTC_INT_EREFP</i>	expect reference interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable CTC clock trim OK interrupt */
ctc_interrupt_enable(CTC_INT_CKOK);
```

ctc_interrupt_disable

The description of ctc_interrupt_disable is shown as below:

Table 3-166. Function `ctc_interrupt_disable`

Function name	<code>ctc_interrupt_disable</code>
Function prototype	<code>void ctc_interrupt_disable(uint32_t interrupt);</code>
Function descriptions	disable the CTC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	CTC interrupt
<code>CTC_INT_CKOK</code>	clock trim OK interrupt
<code>CTC_INT_CKWARN</code>	clock trim warning interrupt
<code>CTC_INT_ERR</code>	error interrupt
<code>CTC_INT_EREFS</code>	expect reference interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable CTC clock trim OK interrupt */
```

```
ctc_interrupt_disable(CTC_INT_CKOK);
```

ctc_interrupt_flag_get

The description of `ctc_interrupt_flag_get` is shown as below:

Table 3-167. Function `ctc_interrupt_flag_get`

Function name	<code>ctc_interrupt_flag_get</code>
Function prototype	<code>FlagStatus ctc_interrupt_flag_get(uint32_t int_flag);</code>
Function descriptions	get CTC interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	CTC interrupt flag
<code>CTC_INT_FLAG_CKOK</code>	clock trim OK interrupt
<code>CTC_INT_FLAG_CKWARN</code>	clock trim warning interrupt
<code>CTC_INT_FLAG_ERR</code>	error interrupt
<code>CTC_INT_FLAG_EREFS</code>	expect reference interrupt
<code>CTC_INT_FLAG_CKEERR</code>	clock trim error bit interrupt
<code>CTC_INT_FLAG_REFMISS</code>	reference sync pulse miss interrupt

<i>CTC_INT_FLAG_TRIM ERR</i>	trim value error interrupt
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get CTC interrupt flag status */
```

```
FlagStatus state = ctc_interrupt_flag_get(CTC_INT_FLAG_CKOK);
```

ctc_interrupt_flag_clear

The description of ctc_interrupt_flag_clear is shown as below:

Table 3-168. Function ctc_interrupt_flag_clear

Function name	ctc_interrupt_flag_clear
Function prototype	void ctc_interrupt_flag_clear(uint32_t int_flag);
Function descriptions	clear CTC interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	CTC interrupt flag
<i>CTC_INT_FLAG_CKOK</i>	clock trim OK interrupt
<i>CTC_INT_FLAG_CKWARN</i>	clock trim warning interrupt
<i>CTC_INT_FLAG_ERR</i>	error interrupt
<i>CTC_INT_FLAG_EREFP</i>	expect reference interrupt
<i>CTC_INT_FLAG_CKE RR</i>	clock trim error bit interrupt
<i>CTC_INT_FLAG_REF MISS</i>	reference sync pulse miss interrupt
<i>CTC_INT_FLAG_TRIM ERR</i>	trim value error interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear CTC interrupt flag status */
```

```
ctc_interrupt_flag_clear(CTC_INT_FLAG_CKOK);
```


3.8. DBG

The DBG hold unit helps debugger to debug power saving mode. The DBG registers are listed in chapter [3.8.1](#). the DBG firmware functions are introduced in chapter [3.8.2](#).

3.8.1. Descriptions of Peripheral registers

DBG registers are listed in the table shown as below:

Table 3-169. DBG Registers

Registers	Descriptions
DBG_ID	DBG ID code register
DBG_CTL0	DBG control register0
DBG_CTL1	DBG control register1

3.8.2. Descriptions of Peripheral functions

DBG firmware functions are listed in the table shown as below:

Table 3-170. DBG firmware function

Function name	Function description
dbg_deinit	reset DBG register
dbg_id_get	read DBG_ID code register
dbg_low_power_enable	enable low power behavior when the MCU is in debug mode
dbg_low_power_disable	disable low power behavior when the MCU is in debug mode
dbg_periph_enable	enable peripheral behavior when the MCU is in debug mode
dbg_periph_disable	disable peripheral behavior when the MCU is in debug mode

Enum dbg_periph_enum

Table 3-171. Enum dbg_periph_enum

Member name	Function description
DBG_FWDGT_HOLD	debug FWDGT kept when core is halted
DBG_WWDGT_HOLD	debug WWDGT kept when core is halted
DBG_TIMER0_HOLD	hold TIMER0 counter when core is halted (only available in GD32L235xx)
DBG_TIMER1_HOLD	hold TIMER1 counter when core is halted
DBG_TIMER2_HOLD	hold TIMER2 counter when core is halted
DBG_CAN_HOLD	hold CAN kept when core is halted (only available in GD32L235xx)
DBG_I2C0_HOLD	hold I2C0 smbus when core is halted
DBG_I2C1_HOLD	hold I2C1 smbus when core is halted
DBG_TIMER5_HOLD	hold TIMER5 counter when core is halted

Member name	Function description
DBG_TIMER6_HOLD	hold TIMER6 counter when core is halted
DBG_TIMER8_HOLD	hold TIMER8 counter when core is halted
DBG_TIMER11_HOLD	hold TIMER11 counter when core is halted
DBG_TIMER14_HOLD	hold TIMER14 counter when core is halted (only available in GD32L235xx)
DBG_TIMER40_HOLD	hold TIMER40 counter when core is halted (only available in GD32L235xx)
DBG_RTC_HOLD	hold RTC counter when core is halted
DBG_LPTIMER_HOLD	hold LPTIMER counter when core is halted(only available in GD32L233xx)
DBG_LPTIMER0_HOLD	hold LPTIMER0 counter when core is halted(only available in GD32L235xx)
DBG_I2C2_HOLD	hold I2C2 smbus when core is halted
DBG_LPTIMER1_HOLD	hold LPTIMER1 counter when core is halted (only available in GD32L235xx)

dbg_deinit

The description of dbg_deinit is shown as below:

Table 3-172. Function dbg_deinit

Function name	dbg_deinit
Function prototype	void dbg_deinit(void);
Function descriptions	deinitialize the DBG
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* deinitialize the DBG*/
```

```
dbg_deinit();
```

dbg_id_get

The description of dbg_id_get is shown as below:

Table 3-173. Function dbg_id_get

Function name	dbg_id_get
---------------	------------

Function prototype	uint32_t dbg_id_get(void);
Function descriptions	Read DBG_ID code register
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint32_t	DBG_ID code (0-0xFFFFFFFF)

Example:

```
/* read DBG_ID code register */
```

```
uint32_t id_value = 0;
```

```
id_value = dbg_id_get();
```

dbg_low_power_enable

The description of dbg_low_power_enable is shown as below:

Table 3-174. Function dbg_low_power_enable

Function name	dbg_low_power_enable
Function prototype	void dbg_low_power_enable(uint32_t dbg_low_power);
Function descriptions	Enable low power behavior when the mcu is in debug mode
Precondition	-
The called functions	-
Input parameter{in}	
dbg_low_power	low power mode
<i>DBG_LOW_POWER_SLEEP</i>	keep debugger connection during sleep mode
<i>DBG_LOW_POWER_DEEPSLEEP</i>	keep debugger connection during deepsleep mode
<i>DBG_LOW_POWER_STANDBY</i>	keep debugger connection during standby mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable low power behavior when the mcu is in debug mode */
```

```
dbg_low_power_enable(DBG_LOW_POWER_SLEEP);
```

dbg_low_power_disable

The description of dbg_low_power_disable is shown as below:

Table 3-175. Function dbg_low_power_disable

Function name	dbg_low_power_disable
Function prototype	void dbg_low_power_disable(uint32_t dbg_low_power);
Function descriptions	Disable low power behavior when the mcu is in debug mode
Precondition	-
The called functions	-
Input parameter{in}	
dbg_low_power	low power mode
<i>DBG_LOW_POWER_SLEEP</i>	keep debugger connection during sleep mode
<i>DBG_LOW_POWER_DEEPSLEEP</i>	keep debugger connection during deepsleep mode
<i>DBG_LOW_POWER_STANDBY</i>	keep debugger connection during standby mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable low power behavior when the mcu is in debug mode */
dbg_low_power_disable(DBG_LOW_POWER_SLEEP);
```

dbg_periph_enable

The description of dbg_periph_enable is shown as below:

Table 3-176. Function dbg_periph_enable

Function name	dbg_periph_enable
Function prototype	void dbg_periph_enable(dbg_periph_enum dbg_periph);
Function descriptions	Enable peripheral behavior when the mcu is in debug mode
Precondition	-
The called functions	-
Input parameter{in}	
dbg_periph	Peripheral refer to Table 3-171. Enum dbg_periph_enum
<i>DBG_FWDGT_HOLD</i>	debug FWDGT kept when core is halted
<i>DBG_WWDGT_HOLD</i>	debug WWDGT kept when core is halted
<i>DBG_TIMERx_HOLD</i>	x=1,2,5,6,8,11, hold TIMERx counter when core is halted
<i>DBG_I2Cx_HOLD</i>	x=0,1,2, hold I2Cx smbus when core is halted
<i>DBG_RTC_HOLD</i>	hold RTC counter when core is halted

<i>DBG_LPTIMER_HOLD</i>	hold LPTIMER counter when core is halted
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable peripheral behavior when the mcu is in debug mode */
dbg_periph_enable(DBG_TIMER1_HOLD);
```

dbg_periph_disable

The description of dbg_periph_disable is shown as below:

Table 3-177. Function dbg_periph_disable

Function name	dbg_periph_disable
Function prototype	void dbg_periph_disable(dbg_periph_enum dbg_periph);
Function descriptions	Disable peripheral behavior when the mcu is in debug mode
Precondition	-
The called functions	-
Input parameter{in}	
dbg_periph	peripheral refer to Table 3-171. Enum dbg_periph_enum
<i>DBG_FWDGT_HOLD</i>	debug FWDGT kept when core is halted
<i>DBG_WWDGT_HOLD</i>	debug WWDGT kept when core is halted
<i>DBG_TIMERx_HOLD</i>	x=1,2,5,6,8,11, hold TIMERx counter when core is halted
<i>DBG_I2Cx_HOLD</i>	x=0,1,2, hold I2Cx smbus when core is halted
<i>DBG_RTC_HOLD</i>	hold RTC counter when core is halted
<i>DBG_LPTIMER_HOLD</i>	hold LPTIMER counter when core is halted
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable peripheral behavior when the mcu is in debug mode */
dbg_periph_disable(DBG_TIMER1_HOLD);
```

3.9. DAC

The Digital-to-analog converter converts 12-bit digital data to a voltage on the external pins. The DAC registers are listed in chapter [3.9.1](#) the DAC firmware functions are introduced in chapter [3.9.2](#).

3.9.1. Peripheral register description

DAC registers are listed in the table shown as below:

Table 3-178. DAC Registers

Register	Descriptions
DAC_CTL0	DACx control register 0
DAC_SWT	DACx software trigger register
DAC_OUT0_R12DH	DACx_OUT0 12-bit right-aligned data holding register
DAC_OUT0_L12DH	DACx_OUT0 12-bit left-aligned data holding register
DAC_OUT0_R8DH	DACx_OUT0 8-bit right-aligned data holding register
DAC_OUT0_DO	DACx_OUT0 data output register
DAC_STAT0	DACx status register 0

3.9.2. Descriptions of Peripheral functions

DAC firmware functions are listed in the table shown as below:

Table 3-179. DAC firmware functions

Function name	Function description
dac_deinit	deinitialize DAC
dac_enable	enable DAC
dac_disable	disable DAC
dac_dma_enable	enable DAC DMA function
dac_dma_disable	disable DAC DMA function
dac_gpio_connect_config	configure gpio connection
dac_output_buffer_enable	enable DAC output buffer
dac_output_buffer_disable	disable DAC output buffer
dac_output_value_get	get DAC output value
dac_data_set	set DAC data holding register value
dac_trigger_enable	enable DAC trigger
dac_trigger_disable	disable DAC trigger
dac_trigger_source_config	configure DAC trigger source
dac_software_trigger_enable	enable DAC software trigger
dac_wave_mode_config	configure DAC wave mode
dac_lfsr_noise_config	configure DAC LFSR noise mode
dac_triangle_noise_config	configure DAC triangle noise mode
dac_flag_get	get DAC flag
dac_flag_clear	clear DAC flag
dac_interrupt_enable	enable DAC interrupt
dac_interrupt_disable	disable DAC interrupt
dac_interrupt_flag_get	get DAC interrupt flag
dac_interrupt_flag_clear	clear DAC interrupt flag

dac_deinit

The description of dac_deinit is shown as below:

Table 3-180. Function dac_deinit

Function name	dac_deinit
Function prototype	void dac_deinit(uint32_t dac_periph);
Function descriptions	deinitialize DAC
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* deinitialize DAC0 */
dac_deinit(DAC0);
```

dac_enable

The description of dac_enable is shown as below:

Table 3-181. Function dac_enable

Function name	dac_enable
Function prototype	void dac_enable(uint32_t dac_periph, uint8_t dac_out);
Function descriptions	enable DAC
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0_OUT0 */
```

```
dac_enable(DAC0, DAC_OUT0);
```

dac_disable

The description of `dac_disable` is shown as below:

Table 3-182. Function `dac_disable`

Function name	<code>dac_disable</code>
Function prototype	<code>void dac_disable(uint32_t dac_periph, uint8_t dac_out);</code>
Function descriptions	disable DAC
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DAC0_OUT0 */
```

```
dac_disable(DAC0, DAC_OUT0);
```

dac_dma_enable

The description of `dac_dma_enable` is shown as below:

Table 3-183. Function `dac_dma_enable`

Function name	<code>dac_dma_enable</code>
Function prototype	<code>void dac_dma_enable(uint32_t dac_periph, uint8_t dac_out);</code>
Function descriptions	enable DAC DMA function
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output

<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0_OUT0 DMA function */
dac_dma_enable(DAC0, DAC_OUT0);
```

dac_dma_disable

The description of `dac_dma_disable` is shown as below:

Table 3-184. Function `dac_dma_disable`

Function name	<code>dac_dma_disable</code>
Function prototype	<code>void dac_dma_disable(uint32_t dac_periph, uint8_t dac_out);</code>
Function descriptions	disable DAC DMA function
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DAC0_OUT0 DMA function */
dac_dma_disable(DAC0, DAC_OUT0);
```

dac_gpio_connect_config

The description of `dac_gpio_connect_config` is shown as below:

Table 3-185. Function `dac_gpio_connect_config`

Function name	<code>dac_gpio_connect_config</code>
Function prototype	<code>void dac_gpio_connect_config(uint32_t dac_periph, uint8_t dac_out, uint32_t gpio_connect);</code>

Function descriptions	configure GPIO connection
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Input parameter{in}	
gpio_connect	DAC_OUTx connect GPIO mode
<i>PIN_PERIPHERAL</i>	DAC_OUTx connected to the external pin and on chip peripherals(CMP)
<i>PIN_PERIPHERAL_BUFFER</i>	Whether DAC_OUTx is connected to external pin and on chip peripherals(CMP) depends on the output buffer
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DAC0_OUT0 GPIO connection working in PIN_PERIPHERAL*/
```

```
dac_gpio_connect_config (DAC0, DAC_OUT0, PIN_PERIPHERAL);
```

dac_output_buffer_enable

The description of dac_output_buffer_enable is shown as below:

Table 3-186. Function dac_output_buffer_enable

Function name	dac_output_buffer_enable
Function prototype	void dac_output_buffer_enable(uint32_t dac_periph, uint8_t dac_out);
Function descriptions	enable DAC output buffer
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0_OUT0 output buffer */
dac_output_buffer_enable(DAC0, DAC_OUT0);
```

dac_output_buffer_disable

The description of dac_output_buffer_disable is shown as below:

Table 3-187. Function dac_output_buffer_disable

Function name	dac_output_buffer_disable
Function prototype	void dac_output_buffer_disable(uint32_t dac_periph, uint8_t dac_out);
Function descriptions	disable DAC output buffer
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DAC0_OUT0 output buffer */
dac_output_buffer_disable(DAC0, DAC_OUT0);
```

dac_output_value_get

The description of dac_output_value_get is shown as below:

Table 3-188. Function dac_output_value_get

Function name	dac_output_value_get
Function prototype	uint16_t dac_output_value_get(uint32_t dac_periph);
Function descriptions	get DAC output value
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	

dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
uint16_t	DAC output data (0~4095)

Example:

```
/* get the DAC0_OUT0 last data output value */
```

```
uint16_t data = 0;
```

```
data = dac_output_value_get(DAC0, DAC_OUT0);
```

dac_data_set

The description of `dac_data_set` is shown as below:

Table 3-189. Function `dac_data_set`

Function name	<code>dac_data_set</code>
Function prototype	<code>void dac_data_set(uint32_t dac_periph, uint8_t dac_out, uint32_t dac_align, uint16_t data);</code>
Function descriptions	set DAC data holding register value
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Input parameter{in}	
dac_align	DAC data alignment mode
<i>DAC_ALIGN_12B_R</i>	12-bit right-aligned data
<i>DAC_ALIGN_12B_L</i>	12-bit left-aligned data
<i>DAC_ALIGN_8B_R</i>	8-bit right-aligned data
Input parameter{in}	
data	data to be loaded (0~4095)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set DAC0_OUT0 data holding register value */
```

```
dac_data_set(DAC0, DAC_OUT0, DAC_ALIGN_8B_R, 0xFF);
```

dac_trigger_enable

The description of dac_trigger_enable is shown as below:

Table 3-190. Function dac_trigger_enable

Function name	dac_trigger_enable
Function prototype	void dac_trigger_enable(uint32_t dac_periph, uint8_t dac_out);
Function descriptions	enable DAC trigger
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0_OUT0 trigger */
```

```
dac_trigger_enable(DAC0, DAC_OUT0);
```

dac_trigger_disable

The description of dac_trigger_disable is shown as below:

Table 3-191. Function dac_trigger_disable

Function name	dac_trigger_disable
Function prototype	void dac_trigger_disable(uint32_t dac_periph, uint8_t dac_out);
Function descriptions	disable DAC trigger
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* disable DAC0_OUT0 trigger */
```

```
dac_trigger_disable(DAC0, DAC_OUT0);
```

dac_trigger_source_config

The description of dac_trigger_source_config is shown as below:

Table 3-192. Function dac_trigger_source_config

Function name	dac_trigger_source_config
Function prototype	void dac_trigger_source_config(uint32_t dac_periph, uint8_t dac_out, uint32_t triggersource);
Function descriptions	configure DAC trigger source
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Input parameter{in}	
triggersource	external trigger of DAC
<i>DAC_TRIGGER_T1_TRGO</i>	TIMER1 TRGO
<i>DAC_TRIGGER_T2_TRGO</i>	TIMER2 TRGO
<i>DAC_TRIGGER_T6_TRGO</i>	TIMER6 TRGO
<i>DAC_TRIGGER_T5_TRGO</i>	TIMER5 TRGO
<i>DAC_TRIGGER_EXTI_9</i>	EXTI interrupt line9 event
<i>DAC_TRIGGER_SOFTWARE</i>	software trigger
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DAC0_OUT0 trigger source */
```

```
dac_trigger_source_config(DAC0, DAC_OUT0, DAC_TRIGGER_T1_TRGO);
```

dac_software_trigger_enable

The description of `dac_software_trigger_enable` is shown as below:

Table 3-193. Function `dac_software_trigger_enable`

Function name	<code>dac_software_trigger_enable</code>
Function prototype	<code>void dac_software_trigger_enable(uint32_t dac_periph, uint8_t dac_out);</code>
Function descriptions	enable DAC software trigger
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection(x = 0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0_OUT0 software trigger */
```

```
dac_software_trigger_enable(DAC0, DAC_OUT0);
```

dac_wave_mode_config

The description of `dac_wave_mode_config` is shown as below:

Table 3-194. Function `dac_wave_mode_config`

Function name	<code>dac_wave_mode_config</code>
Function prototype	<code>void dac_wave_mode_config(uint32_t dac_periph, uint8_t dac_out, uint32_t wave_mode);</code>
Function descriptions	configure DAC wave mode
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)

Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Input parameter{in}	
wave_mode	DAC wave mode
<i>DAC_WAVE_DISABLE</i>	wave mode disable
<i>DAC_WAVE_MODE_LFSR</i>	LFSR noise mode
<i>DAC_WAVE_MODE_TRIANGLE</i>	triangle noise mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DAC0_OUT0 wave mode */
```

```
dac_wave_mode_config(DAC0, DAC_OUT0, DAC_WAVE_DISABLE);
```

dac_lfsr_noise_config

The description of `dac_lfsr_noise_config` is shown as below:

Table 3-195. Function `dac_lfsr_noise_config`

Function name	<code>dac_lfsr_noise_config</code>
Function prototype	<code>void dac_lfsr_noise_config(uint32_t dac_periph, uint8_t dac_out, uint32_t unmask_bits);</code>
Function descriptions	configure DAC LFSR noise mode
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
<i>DAC_OUTx</i>	DAC output channel selection (x = 0)
Input parameter{in}	
unmask_bits	LFSR noise unmask bits
<i>DAC_LFSR_BIT0</i>	unmask the LFSR bit0
<i>DAC_LFSR_BITSx_0</i>	unmask the LFSR bits [x:0] (x = 1,2,3..11)
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* configure DAC0_OUT0 LFSR noise mode */
```

```
dac_lfsr_noise_config(DAC0, DAC_OUT0, DAC_LFSR_BIT0);
```

dac_triangle_noise_config

The description of dac_triangle_noise_config is shown as below:

Table 3-196. Function dac_triangle_noise_config

Function name	dac_triangle_noise_config
Function prototype	void dac_triangle_noise_config(uint32_t dac_periph, uint8_t dac_out, uint32_t amplitude);
Function descriptions	configure DAC triangle noise mode
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
DACx	DAC peripheral selection (x = 0)
Input parameter{in}	
dac_out	DAC output
DAC_OUTx	DAC output channel selection (x = 0)
Input parameter{in}	
amplitude	the amplitude of the triangle
DAC_TRIANGLE_AMPLIT UDE_x	$x = 2^n - 1$ (n = 1..12)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DAC0_OUT0 triangle noise mode */
```

```
dac_triangle_noise_config(DAC0, DAC_OUT0, DAC_TRIANGLE_AMPLITUDE_1);
```

dac_flag_get

The description of dac_flag_get is shown as below:

Table 3-197. Function dac_flag_get

Function name	dac_flag_get
Function prototype	FlagStatus dac_flag_get(uint32_t dac_periph, uint32_t flag);

Function descriptions	get DAC flag
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
flag	the DAC status flags
<i>DAC_FLAG_DDUDR0</i>	DACx_OUT0 DMA underrun flag
Output parameter{out}	
-	-
Return value	
FlagStatus	the state of DAC bit (SET or RESET)

Example:

```
/* get DAC0 flag */
```

```
FlagStatus flag;
```

```
flag = dac_flag_get(DAC0, DAC_FLAG_DDUDR0);
```

dac_flag_clear

The description of dac_flag_clear is shown as below:

Table 3-198. Function dac_flag_clear

Function name	dac_flag_clear
Function prototype	void dac_flag_clear(uint32_t dac_periph, uint32_t flag);
Function descriptions	clear DAC flag
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
flag	DAC flag
<i>DAC_FLAG_DDUDR0</i>	DACx_OUT0 DMA underrun flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear DAC0 flag */
```

```
dac_flag_clear(DAC0, DAC_FLAG_DDUDR0);
```

dac_interrupt_enable

The description of `dac_interrupt_enable` is shown as below:

Table 3-199. Function `dac_interrupt_enable`

Function name	<code>dac_interrupt_enable</code>
Function prototype	<code>void dac_interrupt_enable(uint32_t dac_periph, uint32_t interrupt);</code>
Function descriptions	enable DAC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
interrupt	the DAC interrupt
<i>DAC_INT_DDUDR0</i>	DACx_OUT0 DMA underrun interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DAC0 interrupt */
```

```
dac_interrupt_enable (DAC0, DAC_INT_DDUDR0);
```

dac_interrupt_disable

The description of `dac_interrupt_disable` is shown as below:

Table 3-200. Function `dac_interrupt_disable`

Function name	<code>dac_interrupt_disable</code>
Function prototype	<code>void dac_interrupt_disable(uint32_t dac_periph, uint32_t interrupt);</code>
Function descriptions	disable DAC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
interrupt	the DAC interrupt
<i>DAC_INT_DDUDR0</i>	DACx_OUT0 DMA underrun interrupt
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* disable DAC0 interrupt */
```

```
dac_interrupt_disable (DAC0, DAC_INT_DDUDR0);
```

dac_interrupt_flag_get

The description of `dac_interrupt_flag_get` is shown as below:

Table 3-201. Function `dac_interrupt_flag_get`

Function name	<code>dac_interrupt_flag_get</code>
Function prototype	<code>FlagStatus dac_interrupt_flag_get(uint32_t dac_periph, uint32_t int_flag);</code>
Function descriptions	get DAC interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
int_flag	DAC interrupt flag
<i>DAC_INT_FLAG_DDUDR0</i>	DACx_OUT0 DMA underrun interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	the state of DAC interrupt flag(SET or RESET)

Example:

```
/* get DAC0 interrupt flag */
```

```
FlagStatus flag;
```

```
flag = dac_interrupt_flag_get(DAC0, DAC_INT_FLAG_DDUDR0);
```

dac_interrupt_flag_clear

The description of `dac_interrupt_flag_clear` is shown as below:

Table 3-202. Function `dac_interrupt_flag_clear`

Function name	<code>dac_interrupt_flag_clear</code>
Function prototype	<code>void dac_interrupt_flag_clear(uint32_t dac_periph, uint32_t int_flag);</code>
Function descriptions	clear DAC interrupt flag

Precondition	-
The called functions	-
Input parameter{in}	
dac_periph	DAC peripheral
<i>DACx</i>	DAC peripheral selection(x = 0)
Input parameter{in}	
int_flag	DAC interrupt flag
<i>DAC_INT_FLAG_DDUDR0</i>	DACx_OUT0 DMA underrun interrupt flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear DAC0 interrupt flag */
```

```
dac_interrupt_flag_clear(DAC0, DAC_INT_FLAG_DDUDR0);
```

3.10. DMA/DMAMUX

The direct memory access (DMA) controller provides a hardware method of transferring data between peripherals and/or memory without intervention from the CPU, thereby freeing up bandwidth for other system functions. The DMA registers are listed in chapter [3.10.1](#), the DMA firmware functions are introduced in chapter [3.10.2](#).

DMAMUX is a transmission scheduler for DMA requests. The DMAMUX request multiplexer is used for routing a DMA request line between the peripherals / generated DMA request (from the DMAMUX request generator) and the DMA controller. The DMAMUX registers are listed in chapter [3.10.1](#), the DMAMUX firmware functions are introduced in chapter [3.10.2](#).

3.10.1. Descriptions of Peripheral registers

DMA registers are listed in the table shown as below:

Table 3-203. DMA Registers

Registers	Descriptions
DMA_INTF	Interrupt flag register
DMA_INTC	Interrupt flag clear register
DMA_CHxCTL (x=0..6)	Channel x control register
DMA_CHxCNT (x=0..6)	Channel x counter register
DMA_CHxPADDR (x=0..6)	Channel x peripheral base address register

Registers	Descriptions
DMA_CHxMADDR (x=0..6)	Channel x memory base address register

DMAMUX registers are listed in the table shown as below:

Table 3-204. DMAMUX Registers

Registers	Descriptions
DMAMUX_RM_CHx CFG (x=0..6)	Request multiplexer channel x configuration register
DMAMUX_RM_INT F	Request multiplexer channel interrupt flag register
DMAMUX_RM_INT C	Request multiplexer channel interrupt flag clear register
DMAMUX_RG_CHx CFG (x=0..6)	Request generator channel x configuration register
DMAMUX_RG_INT F	Request generator channel interrupt flag register
DMAMUX_RG_INT C	Rquest generator channel interrupt flag clear register

3.10.2. Descriptions of Peripheral functions

DMA firmware functions are listed in the table shown as below:

Table 3-205. DMA firmware function

Function name	Function description
dma_deinit	deinitialize DMA a channel registers
dma_struct_para_init	initialize the parameters of DMA struct with the default values
dma_init	initialize DMA channel
dma_circulation_enable	enable DMA circulation mode
dma_circulation_disable	disable DMA circulation mode
dma_memory_to_memory_enable	enable memory to memory mode
dma_memory_to_memory_disable	disable memory to memory mode
dma_channel_enable	enable DMA channel
dma_channel_disable	disable DMA channel
dma_periph_address_config	set DMA peripheral base address
dma_memory_address_config	set DMA memory base address
dma_transfer_number_config	set the number of remaining data to be transferred by the DMA
dma_transfer_number_get	get the number of remaining data to be transferred by the DMA
dma_priority_config	configure priority level of DMA channel
dma_memory_width_config	configure transfer data size of memory

Function name	Function description
dma_periph_width_config	configure transfer data size of peripheral
dma_memory_increase_enable	enable next address increasement algorithm of memory
dma_memory_increase_disable	disable next address increasement algorithm of memory
dma_periph_increase_enable	enable next address increasement algorithm of peripheral
dma_periph_increase_disable	disable next address increasement algorithm of peripheral
dma_transfer_direction_config	configure the direction of data transfer on the channel
dma_flag_get	check DMA flag is set or not
dma_flag_clear	clear DMA a channel flag
dma_interrupt_enable	enable DMA interrupt
dma_interrupt_disable	disable DMA interrupt
dma_interrupt_flag_get	check DMA flag and interrupt enable bit is set or not
dma_interrupt_flag_clear	clear DMA a channel flag

DMAMUX firmware functions are listed in the table shown as below:

Table 3-206. DMAMUX firmware function

Function name	Function description
dmamux_sync_struct_para_init	initialize the parameters of DMAMUX synchronization mode structure with the default values
dmamux_synchronization_init	initialize DMAMUX request multiplexer channel synchronization mode
dmamux_synchronization_enable	enable synchronization mode
dmamux_synchronization_disable	disable synchronization mode
dmamux_event_generation_enable	enable event generation
dmamux_event_generation_disable	disable event generation
dmamux_gen_struct_para_init	initialize the parameters of DMAMUX request generator structure with the default values
dmamux_request_generator_init	initialize DMAMUX request generator channel
dmamux_request_generator_channel_enable	enable DMAMUX request generator channel
dmamux_request_generator_channel_disable	disable DMAMUX request generator channel
dmamux_synchronization_polarity_config	configure synchronization input polarity
dmamux_request_forward_number_config	configure number of DMA requests to forward
dmamux_sync_id_config	configure synchronization input identification
dmamux_request_id_config	configure multiplexer input identification
dmamux_trigger_polarity_config	configure trigger input polarity
dmamux_request_generate_number_config	configure number of DMA requests to be generated
dmamux_trigger_id_config	configure trigger input identification

Function name	Function description
dmamux_flag_get	get DMAMUX flag
dmamux_flag_clear	clear DMAMUX flag
dmamux_interrupt_enable	enable DMAMUX interrupt
dmamux_interrupt_disable	disable DMAMUX interrupt
dmamux_interrupt_flag_get	get DMAMUX interrupt flag
dmamux_interrupt_flag_clear	clear DMAMUX interrupt flag

Structure dma_parameter_struct

Table 3-207. Structure dma_parameter_struct

Member name	Function description
periph_addr	peripheral base address
periph_width	transfer data size of peripheral
memory_addr	memory base address
memory_width	transfer data size of memory
number	channel transfer number
priority	channel priority level
periph_inc	peripheral increasing mode
memory_inc	memory increasing mode
direction	channel data transfer direction
request	channel input identification

Structure dmamux_sync_parameter_struct

Table 3-208. Structure dmamux_sync_parameter_struct

Member name	Function description
sync_id	synchronization input identification
sync_polarity	synchronization input polarity
request_number	number of DMA requests to forward

Structure dmamux_gen_parameter_struct

Table 3-209. Structure dmamux_gen_parameter_struct

Member name	Function description
trigger_id	trigger input identification
trigger_polarity	DMAMUX request generator trigger polarity
request_number	number of DMA requests to be generated

Enum dmamux_interrupt_enum

Table 3-210. Enum dmamux_interrupt_enum

Member name	Function description
DMAMUX_INT_MU	DMAMUX request multiplexer channel 0 synchronization overrun interrupt

XCH0_SO	
DMAMUX_INT_MU XCH1_SO	DMAMUX request multiplexer channel 1 synchronization overrun interrupt
DMAMUX_INT_MU XCH2_SO	DMAMUX request multiplexer channel 2 synchronization overrun interrupt
DMAMUX_INT_MU XCH3_SO	DMAMUX request multiplexer channel 3 synchronization overrun interrupt
DMAMUX_INT_MU XCH4_SO	DMAMUX request multiplexer channel 4 synchronization overrun interrupt
DMAMUX_INT_MU XCH5_SO	DMAMUX request multiplexer channel 5 synchronization overrun interrupt
DMAMUX_INT_MU XCH6_SO	DMAMUX request multiplexer channel 6 synchronization overrun interrupt
DMAMUX_INT_GE NCH0_TO	DMAMUX request generator channel 0 trigger overrun interrupt
DMAMUX_INT_GE NCH1_TO	DMAMUX request generator channel 1 trigger overrun interrupt
DMAMUX_INT_GE NCH2_TO	DMAMUX request generator channel 2 trigger overrun interrupt
DMAMUX_INT_GE NCH3_TO	DMAMUX request generator channel 3 trigger overrun interrupt

Enum dmamux_flag_enum

Table 3-211. Enum dmamux_flag_enum

Member name	Function description
DMAMUX_FLAG_M UXCH0_SO	DMAMUX request multiplexer channel 0 synchronization overrun flag
DMAMUX_FLAG_M UXCH1_SO	DMAMUX request multiplexer channel 1 synchronization overrun flag
DMAMUX_FLAG_M UXCH2_SO	DMAMUX request multiplexer channel 2 synchronization overrun flag
DMAMUX_FLAG_M UXCH3_SO	DMAMUX request multiplexer channel 3 synchronization overrun flag
DMAMUX_FLAG_M UXCH4_SO	DMAMUX request multiplexer channel 4 synchronization overrun flag
DMAMUX_FLAG_M UXCH5_SO	DMAMUX request multiplexer channel 5 synchronization overrun flag
DMAMUX_FLAG_M UXCH6_SO	DMAMUX request multiplexer channel 6 synchronization overrun flag
DMAMUX_FLAG_G ENCH0_TO	DMAMUX request generator channel 0 trigger overrun flag
DMAMUX_FLAG_G	DMAMUX request generator channel 1 trigger overrun flag

ENCH1_TO	
DMAMUX_FLAG_G ENCH2_TO	DMAMUX request generator channel 2 trigger overrun flag
DMAMUX_FLAG_G ENCH3_TO	DMAMUX request generator channel 3 trigger overrun flag

Enum dmamux_interrupt_flag_enum

Table 3-212. Enum dmamux_interrupt_flag_enum

Member name	Function description
DMAMUX_INT_FLAG_MUXCH0_SO	DMAMUX request multiplexer channel 0 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH1_SO	DMAMUX request multiplexer channel 1 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH2_SO	DMAMUX request multiplexer channel 2 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH3_SO	DMAMUX request multiplexer channel 3 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH4_SO	DMAMUX request multiplexer channel 4 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH5_SO	DMAMUX request multiplexer channel 5 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_MUXCH6_SO	DMAMUX request multiplexer channel 6 synchronization overrun interrupt flag
DMAMUX_INT_FLAG_GENCH0_TO	DMAMUX request generator channel 0 trigger overrun interrupt flag
DMAMUX_INT_FLAG_GENCH1_TO	DMAMUX request generator channel 1 trigger overrun interrupt flag
DMAMUX_INT_FLAG_GENCH2_TO	DMAMUX request generator channel 2 trigger overrun interrupt flag
DMAMUX_INT_FLAG_GENCH3_TO	DMAMUX request generator channel 3 trigger overrun interrupt flag

Enum dma_channel_enum

Table 3-213. Enum dma_channel_enum

Member name	Function description
DMA_CH0	DMA Channel 0
DMA_CH1	DMA Channel 1
DMA_CH2	DMA Channel 2
DMA_CH3	DMA Channel 3
DMA_CH4	DMA Channel 4
DMA_CH5	DMA Channel 5

DMA_CH6	DMA Channel 6
---------	---------------

Enum dmamux_multiplexer_channel_enum

Table 3-214. Enum dmamux_multiplexer_channel_enum

Member name	Function description
DMAMUX_MUXCH 0	DMAMUX request multiplexer Channel0
DMAMUX_MUXCH 1	DMAMUX request multiplexer Channel1
DMAMUX_MUXCH 2	DMAMUX request multiplexer Channel2
DMAMUX_MUXCH 3	DMAMUX request multiplexer Channel3
DMAMUX_MUXCH 4	DMAMUX request multiplexer Channel4
DMAMUX_MUXCH 5	DMAMUX request multiplexer Channel5
DMAMUX_MUXCH 6	DMAMUX request multiplexer Channel6

Enum dmamux_generator_channel_enum

Table 3-215. Enum dmamux_generator_channel_enum

Member name	Function description
DMAMUX_GENCH0	DMAMUX request generator Channel0
DMAMUX_GENCH1	DMAMUX request generator Channel1
DMAMUX_GENCH2	DMAMUX request generator Channel2
DMAMUX_GENCH3	DMAMUX request generator Channel3

dma_deinit

The description of dma_deinit is shown as below:

Table 3-216. Function dma_deinit

Function name	dma_deinit
Function prototype	void dma_deinit(dma_channel_enum channelx);
Function descriptions	deinitialize DMA a channel registers
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* deinitialize DMA channel0 registers*/
dma_deinit(DMA_CH0);
```

dma_struct_para_init

The description of dma_struct_para_init is shown as below:

Table 3-217. Function dma_struct_para_init

Function name	dma_struct_para_init
Function prototype	void dma_struct_para_init(dma_parameter_struct* init_struct);
Function descriptions	initialize the parameters of DMA struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
init_struct	the initialization data needed to initialize DMA channel, refer to Table 3-207. Structure dma_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize the parameters of DMA */
dma_parameter_struct dma_init_struct;
dma_struct_para_init(&dma_init_struct);
```

dma_init

The description of dma_init is shown as below:

Table 3-218. Function dma_init

Function name	dma_init
Function prototype	void dma_init(dma_channel_enum channelx, dma_parameter_struct init_struct);
Function descriptions	initialize DMA channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel

<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
init_struct	Structure for initialization, the structure members can refer to Table 3-207. Structure dma_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* DMA channel0 initialize */
dma_parameter_struct dma_init_struct;

dma_struct_para_init(&dma_init_struct);
dma_init_struct.direction = DMA_PERIPHERAL_TO_MEMORY;
dma_init_struct.memory_addr = (uint32_t)g_destbuf;
dma_init_struct.memory_inc = DMA_MEMORY_INCREASE_ENABLE;
dma_init_struct.memory_width = DMA_MEMORY_WIDTH_8BIT;
dma_init_struct.number = TRANSFER_NUM;
dma_init_struct.periph_addr = (uint32_t)BANK0_WRITE_START_ADDR;
dma_init_struct.periph_inc = DMA_PERIPH_INCREASE_ENABLE;
dma_init_struct.periph_width = DMA_PERIPHERAL_WIDTH_8BIT;
dma_init_struct.priority = DMA_PRIORITY_ULTRA_HIGH;
dma_init(DMA_CH0, dma_init_struct);

```

dma_circulation_enable

The description of dma_circulation_enable is shown as below:

Table 3-219. Function dma_circulation_enable

Function name	dma_circulation_enable
Function prototype	void dma_circulation_enable(dma_channel_enum channelx);
Function descriptions	enable DMA circulation mode
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA channel0 circulation mode */
```

```
dma_circulation_enable(DMA_CH0);
```

dma_circulation_disable

The description of dma_circulation_disable is shown as below:

Table 3-220. Function dma_circulation_disable

Function name	dma_circulation_disable
Function prototype	void dma_circulation_disable(dma_channel_enum channelx);
Function descriptions	disable DMA circulation mode
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMA channel0 circulation mode */
```

```
dma_circulation_disable(DMA_CH0);
```

dma_memory_to_memory_enable

The description of dma_memory_to_memory_enable is shown as below:

Table 3-221. Function dma_memory_to_memory_enable

Function name	dma_memory_to_memory_enable
Function prototype	void dma_memory_to_memory_enable(dma_channel_enum channelx);
Function descriptions	enable memory to memory mode
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA channel0 memory to memory mode */
```

```
dma_memory_to_memory_enable(DMA_CH0);
```

dma_memory_to_memory_disable

The description of dma_memory_to_memory_disable is shown as below:

Table 3-222. Function dma_memory_to_memory_disable

Function name	dma_memory_to_memory_disable
Function prototype	void dma_memory_to_memory_disable(dma_channel_enum channelx);
Function descriptions	disable memory to memory mode
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*disable DMA channel0 memory to memory mode */
dma_memory_to_memory_disable(DMA_CH0);
```

dma_channel_enable

The description of dma_channel_enable is shown as below:

Table 3-223. Function dma_channel_enable

Function name	dma_channel_enable
Function prototype	void dma_channel_enable(dma_channel_enum channelx);
Function descriptions	enable DMA channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA channel0 */
dma_channel_enable(DMA_CH0);
```

dma_channel_disable

The description of dma_channel_disable is shown as below:

Table 3-224. Function dma_channel_disable

Function name	dma_channel_disable
Function prototype	void dma_channel_disable(dma_channel_enum channelx);
Function descriptions	disable DMA channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMA channel0 */
dma_channel_disable(DMA_CH0);
```

dma_periph_address_config

The description of dma_periph_address_config is shown as below:

Table 3-225. Function dma_periph_address_config

Function name	dma_periph_address_config
Function prototype	void dma_periph_address_config(dma_channel_enum channelx, uint32_t address);
Function descriptions	set DMA peripheral base address
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
address	peripheral base address, 0 – 0xFFFFFFFF
Output parameter{out}	
-	-
Return value	
-	-

Example:


```

/* configure DMA channel0 periph address */
#define BANK0_WRITE_START_ADDR          ((uint32_t)0x08004000)
dma_periph_address_config(DMA_CH0, BANK0_WRITE_START_ADDR);

```

dma_memory_address_config

The description of dma_memory_address_config is shown as below:

Table 3-226. Function dma_memory_address_config

Function name	dma_memory_address_config
Function prototype	void dma_memory_address_config(dma_channel_enum channelx, uint32_t address);
Function descriptions	set DMA memory base address
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
address	memory base address, 0 – 0xFFFFFFFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* configure DMA channel0 memory address */
uint8_t g_destbuf[TRANSFER_NUM];
dma_memory_address_config(DMA_CH0, (uint32_t) g_destbuf);

```

dma_transfer_number_config

The description of dma_transfer_number_config is shown as below:

Table 3-227. Function dma_transfer_number_config

Function name	dma_transfer_number_config
Function prototype	void dma_transfer_number_config(dma_channel_enum channelx, uint32_t number);
Function descriptions	set the number of remaining data to be transferred by the DMA
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum

Input parameter{in}	
number	data transfer number(0x0-0xFFFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DMA channel0 transfer number */
#define TRANSFER_NUM                0x400
dma_transfer_number_config(DMA_CH0, TRANSFER_NUM);
```

dma_transfer_number_get

The description of dma_transfer_number_get is shown as below:

Table 3-228. Function dma_transfer_number_get

Function name	dma_transfer_number_get
Function prototype	uint32_t dma_transfer_number_get(dma_channel_enum channelx);
Function descriptions	get the number of remaining data to be transferred by the DMA
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
uint32_t	DMA data transmission remaining quantity (0x0-0xFFFF)

Example:

```
/* get DMA channel0 transfer number */
uint32_t number = 0;
number = dma_transfer_number_get(DMA0, DMA_CH0);
```

dma_priority_config

The description of dma_priority_config is shown as below:

Table 3-229. Function dma_priority_config

Function name	dma_priority_config
Function prototype	void dma_priority_config(dma_channel_enum channelx, uint32_t priority);
Function descriptions	configure priority level of DMA channel
Precondition	corresponding channel enable bit CHEN should be 0

The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
priority	priority Level of this channel
<i>DMA_PRIORITY_LOW</i>	low priority
<i>DMA_PRIORITY_MEDIUM</i>	medium priority
<i>DMA_PRIORITY_HIGH</i>	high priority
<i>DMA_PRIORITY_ULTRA_HIGH</i>	ultra high priority
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DMA channel0 priority */
dma_priority_config(DMA_CH0, DMA_PRIORITY_ULTRA_HIGH);
```

dma_memory_width_config

The description of dma_memory_width_config is shown as below:

Table 3-230. Function dma_memory_width_config

Function name	dma_memory_width_config
Function prototype	void dma_memory_width_config(dma_channel_enum channelx, uint32_t mwidth);
Function descriptions	configure transfer data size of memory
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
mwidth	transfer data width of memory
<i>DMA_MEMORY_WIDTH_8BIT</i>	transfer data width of memory is 8-bit
<i>DMA_MEMORY_WIDTH_16BIT</i>	transfer data width of memory is 16-bit
<i>DMA_MEMORY_WIDTH_32BIT</i>	transfer data width of memory is 32-bit

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DMA channel0 memory width */
dma_memory_width_config(DMA_CH0, DMA_MEMORY_WIDTH_8BIT);
```

dma_periph_width_config

The description of dma_periph_width_config is shown as below:

Table 3-231. Function dma_periph_width_config

Function name	dma_periph_width_config
Function prototype	void dma_periph_width_config(dma_channel_enum channelx, uint32_t pwidth);
Function descriptions	configure transfer data width of peripheral
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
pwidth	transfer data width of peripheral
DMA_PERIPHERAL_WIDTH_8BIT	transfer data width of peripheral is 8-bit
DMA_PERIPHERAL_WIDTH_16BIT	transfer data width of peripheral is 16-bit
DMA_PERIPHERAL_WIDTH_32BIT	transfer data width of peripheral is 32-bit
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DMA channel0 periph width */
dma_periph_width_config(DMA_CH0, DMA_PERIPHERAL_WIDTH_8BIT);
```

dma_memory_increase_enable

The description of dma_memory_increase_enable is shown as below:

Table 3-232. Function dma_memory_increase_enable

Function name	dma_memory_increase_enable
Function prototype	void dma_memory_increase_enable(dma_channel_enum channelx);
Function descriptions	enable next address increasement algorithm of memory
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA channel0 memory increase */
dma_memory_increase_enable(DMA_CH0);
```

dma_memory_increase_disable

The description of dma_memory_increase_disable is shown as below:

Table 3-233. Function dma_memory_increase_disable

Function name	dma_memory_increase_disable
Function prototype	void dma_memory_increase_disable(dma_channel_enum channelx);
Function descriptions	disable next address increasement algorithm of memory
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMA channel0 memory increase */
dma_memory_increase_disable(DMA_CH0);
```

dma_periph_increase_enable

The description of dma_periph_increase_enable is shown as below:

Table 3-234. Function dma_periph_increase_enable

Function name	dma_periph_increase_enable
Function prototype	void dma_periph_increase_enable(dma_channel_enum channelx);
Function descriptions	enable next address increasement algorithm of peripheral
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable next address increasement algorithm of DMA channel0 */
dma_periph_increase_enable(DMA_CH0);
```

dma_periph_increase_disable

The description of dma_periph_increase_disable is shown as below:

Table 3-235. Function dma_periph_increase_disable

Function name	dma_periph_increase_disable
Function prototype	void dma_periph_increase_disable(dma_channel_enum channelx);
Function descriptions	disable next address increasement algorithm of peripheral
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable next address increasement algorithm of DMA channel0 */
dma_periph_increase_disable(DMA_CH0);
```

dma_transfer_direction_config

The description of dma_transfer_direction_config is shown as below:

Table 3-236. Function dma_transfer_direction_config

Function name	dma_transfer_direction_config
Function prototype	void dma_transfer_direction_config(dma_channel_enum channelx, uint32_t direction);
Function descriptions	configure the direction of data transfer on the channel
Precondition	corresponding channel enable bit CHEN should be 0
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
direction	specify the direction of data transfer
DMA_PERIPHERAL_TO_MEMORY	read from peripheral and write to memory
DMA_MEMORY_TO_PERIPHERAL	read from memory and write to peripheral
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure DMA channel0 transfer direction */
dma_transfer_direction_config(DMA_CH0, DMA_PERIPHERAL_TO_MEMORY);
```

dma_flag_get

The description of dma_flag_get is shown as below:

Table 3-237. Function dma_flag_get

Function name	dma_flag_get
Function prototype	FlagStatus dma_flag_get(dma_channel_enum channelx, uint32_t flag);
Function descriptions	check DMA flag is set or not
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
flag	specify get which flag
DMA_FLAG_G	global interrupt flag of channel
DMA_FLAG_FTF	full transfer finish flag of channel
DMA_FLAG_HTF	half transfer finish flag of channel

<i>DMA_FLAG_ERR</i>	error flag of channel
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get DMA channel0 flag */
FlagStatus flag = RESET;
flag = dma_flag_get(DMA_CH0, DMA_FLAG_FTF);
```

dma_flag_clear

The description of dma_flag_clear is shown as below:

Table 3-238. Function dma_flag_clear

Function name	dma_flag_clear
Function prototype	void dma_flag_clear(dma_channel_enum channelx, uint32_t flag);
Function descriptions	clear DMA a channel flag
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
flag	specify get which flag
<i>DMA_FLAG_G</i>	global interrupt flag of channel
<i>DMA_FLAG_FTF</i>	full transfer finish flag of channel
<i>DMA_FLAG_HTF</i>	half transfer finish flag of channel
<i>DMA_FLAG_ERR</i>	error flag of channel
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear DMA channel0 flag */
dma_flag_clear(DMA_CH0, DMA_FLAG_FTF);
```

dma_interrupt_enable

The description of dma_interrupt_enable is shown as below:

Table 3-239. Function dma_interrupt_enable

Function name	dma_interrupt_enable
Function prototype	void dma_interrupt_enable(dma_channel_enum channelx, uint32_t source);
Function descriptions	enable DMA interrupt
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
source	DMA interrupt source
<i>DMA_INT_FTF</i>	full transfer finish interrupt of channel
<i>DMA_INT_HTF</i>	half transfer finish interrupt of channel
<i>DMA_INT_ERR</i>	error interrupt of channel
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA channel0 interrupt */
dma_interrupt_enable(DMA_CH0, DMA_INT_FTF);
```

dma_interrupt_disable

The description of dma_interrupt_disable is shown as below:

Table 3-240. Function dma_interrupt_disable

Function name	dma_interrupt_disable
Function prototype	void dma_interrupt_disable(dma_channel_enum channelx, uint32_t source);
Function descriptions	disable DMA interrupt
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
source	DMA interrupt source
<i>DMA_INT_FTF</i>	full transfer finish interrupt of channel
<i>DMA_INT_HTF</i>	half transfer finish interrupt of channel
<i>DMA_INT_ERR</i>	error interrupt of channel
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* disable DMA channel0 interrupt */
dma_interrupt_disable(DMA_CH0, DMA_INT_FTF);
```

dma_interrupt_flag_get

The description of dma_interrupt_flag_get is shown as below:

Table 3-241. Function dma_interrupt_flag_get

Function name	dma_interrupt_flag_get
Function prototype	FlagStatus dma_interrupt_flag_get(dma_channel_enum channelx, uint32_t flag);
Function descriptions	check DMA flag and interrupt enable bit is set or not
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
DMA_CHx(x=0..6)	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
flag	specify get which flag
DMA_INT_FLAG_FTF	full transfer finish interrupt flag of channel
DMA_INT_FLAG_HTF	half transfer finish interrupt flag of channel
DMA_INT_FLAG_ERR	error interrupt flag of channel
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get DMA interrupt_flag */
if(dma_interrupt_flag_get(DMA_CH3, DMA_INT_FLAG_FTF)){
    dma_interrupt_flag_clear(DMA_CH3, DMA_INT_FLAG_FTF);
}
```

dma_interrupt_flag_clear

The description of dma_interrupt_flag_clear is shown as below:

Table 3-242. Function dma_interrupt_flag_clear

Function name	dma_interrupt_flag_clear
Function prototype	void dma_interrupt_flag_clear(dma_channel_enum channelx, uint32_t flag);

Function descriptions	clear DMA a channel flag
Precondition	-
The called functions	-
Input parameter{in}	
channelx	DMA channel
<i>DMA_CHx(x=0..6)</i>	DMA channel selection, refer to Table 3-213. Enum dma_channel_enum
Input parameter{in}	
flag	specify get which flag
<i>DMA_INT_FLAG_G</i>	global interrupt flag of channel
<i>DMA_INT_FLAG_FTF</i>	full transfer finish interrupt flag of channel
<i>DMA_INT_FLAG_HTF</i>	half transfer finish interrupt flag of channel
<i>DMA_INT_FLAG_ERR</i>	error interrupt flag of channel
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* get DMA interrupt_flag */
if(dma_interrupt_flag_get(DMA_CH3, DMA_INT_FLAG_FTF)){
    dma_interrupt_flag_clear(DMA_CH3, DMA_INT_FLAG_FTF);
}

```

dmamux_sync_struct_para_init

The description of dmamux_sync_struct_para_init is shown as below:

Table 3-243. Function dmamux_sync_struct_para_init

Function name	dmamux_sync_struct_para_init
Function prototype	void dmamux_sync_struct_para_init(dmamux_sync_parameter_struct *init_struct);
Function descriptions	initialize the parameters of DMAMUX synchronization mode structure with the default values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
init_struct	the initialization data needed to initialize DMAMUX request multiplexer channel synchronization mode, refer to Table 3-208. Structure dmamux_sync_parameter_struct
Return value	
-	-

Example:

```
/* initialize DMAMUX synchronization mode structure */
dmamux_sync_parameter_struct dmamux_sync_init_struct;
dmamux_sync_struct_para_init(&dmamux_sync_init_struct);
```

dmamux_synchronization_init

The description of dmamux_synchronization_init is shown as below:

Table 3-244. Function dmamux_synchronization_init

Function name	dmamux_synchronization_init
Function prototype	void dmamux_synchronization_init(dmamux_multiplexer_channel_enum channelx, dmamux_sync_parameter_struct *init_struct);
Function descriptions	initialize DMAMUX request multiplexer channel synchronization mode
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Input parameter{in}	
init_struct	the initialization data needed to initialize DMAMUX request multiplexer channel synchronization mode, refer to Table 3-208. Structure dmamux_sync_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize DMAMUX synchronization mode structure */
dmamux_sync_parameter_struct dmamux_sync_init_struct;
dmamux_sync_struct_para_init(&dmamux_sync_init_struct);
/* initialize DMA request multiplexer channel 0 with synchronization mode */
dmamux_sync_init_struct.sync_id      = DMAMUX_SYNC_EXTI0;
dmamux_sync_init_struct.sync_polarity = DMAMUX_SYNC_RISING;
dmamux_sync_init_struct.request_number = 4;
dmamux_synchronization_init(DMAMUX_MUXCH0, &dmamux_sync_init_struct);
```

dmamux_synchronization_enable

The description of dmamux_synchronization_enable is shown as below:

Table 3-245. Function dmamux_synchronization_enable

Function name	dmamux_synchronization_enable
Function prototype	void dmamux_synchronization_enable(dmamux_multiplexer_channel_enum channelx);
Function descriptions	enable synchronization mode
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable synchronization mode */
dmamux_synchronization_enable(DMAMUX_MUXCH0);
```

dmamux_synchronization_disable

The description of dmamux_synchronization_disable is shown as below:

Table 3-246. Function dmamux_synchronization_disable

Function name	dmamux_synchronization_disable
Function prototype	void dmamux_synchronization_disable(dmamux_multiplexer_channel_enum channelx);
Function descriptions	disable synchronization mode
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable synchronization mode */
dmamux_synchronization_disable(DMAMUX_MUXCH0);
```

dmamux_event_generation_enable

The description of dmamux_event_generation_enable is shown as below:

Table 3-247. Function dmamux_event_generation_enable

Function name	dmamux_event_generation_enable
Function prototype	void dmamux_event_generation_enable(dmamux_mux_channel_enum channelx);
Function descriptions	enable event generation
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_mux_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable event generation */
dmamux_event_generation_enable(DMAMUX_MUXCH0);
```

dmamux_event_generation_disable

The description of dmamux_event_generation_disable is shown as below:

Table 3-248. Function dmamux_event_generation_disable

Function name	dmamux_event_generation_disable
Function prototype	void dmamux_event_generation_disable(dmamux_mux_channel_enum channelx);
Function descriptions	disable event generation
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_mux_channel_enum
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* disable event generation */
dmamux_event_generation_disable(DMAMUX_MUXCH0);
```

dmamux_gen_struct_para_init

The description of dmamux_gen_struct_para_init is shown as below:

Table 3-249. Function dmamux_gen_struct_para_init

Function name	dmamux_gen_struct_para_init
Function prototype	void dmamux_gen_struct_para_init(dmamux_gen_parameter_struct *init_struct);
Function descriptions	initialize the parameters of DMAMUX request generator structure with the default values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
init_struct	the initialization data needed to initialize DMAMUX request generator channel, refer to Table 3-209. Structure dmamux_gen_parameter_struct
Return value	
-	-

Example:

```
/* initialize DMA request generator structure */
dmamux_gen_parameter_struct dmamux_gen_init_struct;
dmamux_gen_struct_para_init(&dmamux_gen_init_struct);
```

dmamux_request_generator_init

The description of dmamux_request_generator_init is shown as below:

Table 3-250. Function dmamux_request_generator_init

Function name	dmamux_request_generator_init
Function prototype	void dmamux_request_generator_init(dmamux_generator_channel_enum channelx, dmamux_gen_parameter_struct *init_struct);
Function descriptions	initialize DMAMUX request generator channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=	DMAMUX generation channel selection, refer to Table 3-215. Enum

0..3)	dmamux_generator_channel_enum
Input parameter{in}	
init_struct	the initialization data needed to initialize DMAMUX request generator channel, refer to Table 3-209. Structure dmamux_gen_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* initialize DMA request generator channel 0 */
dmamux_gen_parameter_struct  dmamux_gen_init_struct;
dmamux_gen_struct_para_init(&dmamux_gen_init_struct);
dmamux_gen_init_struct.trigger_id      = DMAMUX_TRIGGER_EXTI13;
dmamux_gen_init_struct.trigger_polarity = DMAMUX_GEN_RISING;
dmamux_gen_init_struct.request_number = 1;
dmamux_request_generator_init(DMAMUX_GENCH0, &dmamux_gen_init_struct);

```

dmamux_request_generator_channel_enable

The description of dmamux_request_generator_channel_enable is shown as below:

Table 3-251. Function dmamux_request_generator_channel_enable

Function name	dmamux_request_generator_channel_enable
Function prototype	void dmamux_request_generator_channel_enable(dmamux_generator_channel_enum channelx);
Function descriptions	enable DMAMUX request generator channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=0..3)	DMAMUX generation channel selection, refer to Table 3-215. Enum dmamux_generator_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* enable DMAMUX request generator channel */
dmamux_request_generator_channel_enable(DMAMUX_GENCH0);

```


dmamux_request_generator_channel_disable

The description of dmamux_request_generator_channel_disable is shown as below:

Table 3-252. Function dmamux_request_generator_channel_disable

Function name	dmamux_request_generator_channel_disable
Function prototype	void dmamux_request_generator_channel_disable(dmamux_generator_channel_enum channelx);
Function descriptions	disable DMAMUX request generator channel
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=0..3)	DMAMUX generation channel selection, refer to Table 3-215. Enum dmamux_generator_channel_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMAMUX request generator channel */
dmamux_request_generator_channel_disable(DMAMUX_GENCH0);
```

dmamux_synchronization_polarity_config

The description of dmamux_synchronization_polarity_config is shown as below:

Table 3-253. Function dmamux_synchronization_polarity_config

Function name	dmamux_synchronization_polarity_config
Function prototype	void dmamux_synchronization_polarity_config(dmamux_multiplexer_channel_enum channelx, uint32_t polarity);
Function descriptions	configure synchronization input polarity
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Input parameter{in}	
polarity	synchronization input polarity
DMAMUX_SYNC_NO_	no event detection

<i>EVENT</i>	
<i>DMAMUX_SYNC_RISING</i>	rising edge
<i>DMAMUX_SYNC_FALLING</i>	falling edge
<i>DMAMUX_SYNC_RISING_FALLING</i>	rising and falling edges
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure synchronization input polarity */
dmamux_synchronization_polarity_config(DMAMUX_MUXCH0, DMAMUX_SYNC_RISING);
```

dmamux_request_forward_number_config

The description of dmamux_request_forward_number_config is shown as below:

Table 3-254. Function dmamux_request_forward_number_config

Function name	dmamux_request_forward_number_config
Function prototype	void dmamux_request_forward_number_config(dmamux_multiplexer_channel_enum channelx, uint32_t number);
Function descriptions	configure number of DMA requests to forward
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
<i>DMAMUX_MUXCHx</i> (x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Input parameter{in}	
number	DMA requests number to forward (1 - 32)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure number of DMA requests to forward */
dmamux_request_forward_number_config(DMAMUX_MUXCH0, 4);
```

dmamux_sync_id_config

The description of dmamux_sync_id_config is shown as below:

Table 3-255. Function dmamux_sync_id_config

Function name	dmamux_sync_id_config
Function prototype	void dmamux_sync_id_config(dmamux_multiplexer_channel_enum channelx, uint32_t id);
Function descriptions	configure synchronization input identification
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
DMAMUX_MUXCHx(x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum
Input parameter{in}	
id	synchronization input identification
DMAMUX_SYNC_EXTI0	synchronization input is EXTI0
DMAMUX_SYNC_EXTI1	synchronization input is EXTI1
DMAMUX_SYNC_EXTI2	synchronization input is EXTI2
DMAMUX_SYNC_EXTI3	synchronization input is EXTI3
DMAMUX_SYNC_EXTI4	synchronization input is EXTI4
DMAMUX_SYNC_EXTI5	synchronization input is EXTI5
DMAMUX_SYNC_EXTI6	synchronization input is EXTI6
DMAMUX_SYNC_EXTI7	synchronization input is EXTI7
DMAMUX_SYNC_EXTI8	synchronization input is EXTI8
DMAMUX_SYNC_EXTI9	synchronization input is EXTI9
DMAMUX_SYNC_EXTI10	synchronization input is EXTI10
DMAMUX_SYNC_EXTI11	synchronization input is EXTI11
DMAMUX_SYNC_EXTI12	synchronization input is EXTI12

<i>DMAMUX_SYNC_EXTI</i> 13	synchronization input is EXTI13
<i>DMAMUX_SYNC_EXTI</i> 14	synchronization input is EXTI14
<i>DMAMUX_SYNC_EXTI</i> 15	synchronization input is EXTI15
<i>DMAMUX_SYNC_EVT</i> 0_OUT	synchronization input is Evt0_out
<i>DMAMUX_SYNC_EVT</i> 1_OUT	synchronization input is Evt1_out
<i>DMAMUX_SYNC_EVT</i> 2_OUT	synchronization input is Evt2_out
<i>DMAMUX_SYNC_EVT</i> 3_OUT	synchronization input is Evt3_out
<i>DMAMUX_SYNC_TIMER</i> 11_CH0_O	synchronization input is TIMER11_CH0_O
<i>DMAMUX_SYNC_EXTI</i> 0	synchronization input is EXTI0
<i>DMAMUX_SYNC_EXTI</i> 1	synchronization input is EXTI1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure synchronization input identification */
dmamux_sync_id_config(DMAMUX_MUXCH0, DMAMUX_SYNC_EXTI0);
```

dmamux_request_id_config

The description of dmamux_request_id_config is shown as below:

Table 3-256. Function dmamux_request_id_config

Function name	dmamux_request_id_config
Function prototype	void dmamux_request_id_config(dmamux_multiplexer_channel_enum channelx, uint32_t id);
Function descriptions	configure multiplexer input identification
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request multiplexer channel is initialized
<i>DMAMUX_MUXCHx</i> (x=0..6)	DMAMUX channel selection, refer to Table 3-214. Enum dmamux_multiplexer_channel_enum

Input parameter{in}	
id	input DMA request identification
<i>DMA_REQUEST_M2M</i>	memory to memory transfer
<i>DMA_REQUEST_GENERATOR0</i>	DMAMUX request generator 0
<i>DMA_REQUEST_GENERATOR1</i>	DMAMUX request generator 1
<i>DMA_REQUEST_GENERATOR2</i>	DMAMUX request generator 2
<i>DMA_REQUEST_GENERATOR3</i>	DMAMUX request generator 3
<i>DMA_REQUEST_ADC</i>	DMAMUX ADC request
<i>DMA_REQUEST_DAC</i>	DMAMUX DAC request
<i>DMA_REQUEST_I2C0_RX</i>	DMAMUX I2C0 RX request
<i>DMA_REQUEST_I2C0_TX</i>	DMAMUX I2C0 TX request
<i>DMA_REQUEST_I2C1_RX</i>	DMAMUX I2C1 RX request
<i>DMA_REQUEST_I2C1_TX</i>	DMAMUX I2C1 TX request
<i>DMA_REQUEST_I2C2_RX</i>	DMAMUX I2C2 RX request
<i>DMA_REQUEST_I2C2_TX</i>	DMAMUX I2C2 TX request
<i>DMA_REQUEST_SPI0_RX</i>	DMAMUX SPI0 RX request
<i>DMA_REQUEST_SPI0_TX</i>	DMAMUX SPI0 TX request
<i>DMA_REQUEST_SPI1_RX</i>	DMAMUX SPI1 RX request
<i>DMA_REQUEST_SPI1_TX</i>	DMAMUX SPI1 TX request
<i>DMA_REQUEST_TIMER1_CH0</i>	DMAMUX TIMER1 CH0 request
<i>DMA_REQUEST_TIMER1_CH1</i>	DMAMUX TIMER1 CH1 request
<i>DMA_REQUEST_TIMER1_CH2</i>	DMAMUX TIMER1 CH2 request
<i>DMA_REQUEST_TIMER1_CH3</i>	DMAMUX TIMER1 CH3 request
<i>DMA_REQUEST_TIMER1_UP</i>	DMAMUX TIMER1 UP request

<i>DMA_REQUEST_TIME</i> <i>R2_CH0</i>	DMAMUX TIMER2 CH0 request
<i>DMA_REQUEST_TIME</i> <i>R2_CH1</i>	DMAMUX TIMER2 CH1 request
<i>DMA_REQUEST_TIME</i> <i>R2_CH2</i>	DMAMUX TIMER2 CH2 request
<i>DMA_REQUEST_TIME</i> <i>R2_CH3</i>	DMAMUX TIMER2 CH3 request
<i>DMA_REQUEST_TIME</i> <i>R2_TRIG</i>	DMAMUX TIMER2 TRIG request
<i>DMA_REQUEST_TIME</i> <i>R2_UP</i>	DMAMUX TIMER2 UP request
<i>DMA_REQUEST_TIME</i> <i>R5_UP</i>	DMAMUX TIMER5 UP request
<i>DMA_REQUEST_TIME</i> <i>R6_UP</i>	DMAMUX TIMER6 UP request
<i>DMA_REQUEST_CAU</i> <i>_IN</i>	DMAMUX CAU IN request
<i>DMA_REQUEST_CAU</i> <i>_OUT</i>	DMAMUX CAU OUT request
<i>DMA_REQUEST_USA</i> <i>RT0_RX</i>	DMAMUX USART0 RX request
<i>DMA_REQUEST_USA</i> <i>RT0_TX</i>	DMAMUX USART0 TX request
<i>DMA_REQUEST_USA</i> <i>RT1_RX</i>	DMAMUX USART1 RX request
<i>DMA_REQUEST_USA</i> <i>RT1_TX</i>	DMAMUX USART1 TX request
<i>DMA_REQUEST_UAR</i> <i>T3_RX</i>	DMAMUX UART3 RX request
<i>DMA_REQUEST_UAR</i> <i>T3_TX</i>	DMAMUX UART3 TX request
<i>DMA_REQUEST_UAR</i> <i>T4_RX</i>	DMAMUX UART4 RX request
<i>DMA_REQUEST_UAR</i> <i>T4_TX</i>	DMAMUX UART4 TX request
<i>DMA_REQUEST_LPU</i> <i>ART_RX</i>	DMAMUX LPUART RX request, only for GD32L233
<i>DMA_REQUEST_LPU</i> <i>ART_TX</i>	DMAMUX LPUART TX request, only for GD32L233
<i>DMA_REQUEST_LPU</i> <i>ART0_RX</i>	DMAMUX LPUART0 RX request, only for GD32L235
<i>DMA_REQUEST_LPU</i>	DMAMUX LPUART0 TX request, only for GD32L235

ART0_TX	
DMA_REQUEST_LPU ART1_RX	DMAMUX LPUART1 RX request, only for GD32L235
DMA_REQUEST_LPU ART1_TX	DMAMUX LPUART1 TX request, only for GD32L235
DMA_REQUEST_TIME R0_CH0	DMAMUX TIMER0 CH0 request, only for GD32L235
DMA_REQUEST_TIME R0_CH1	DMAMUX TIMER0 CH1 request, only for GD32L235
DMA_REQUEST_TIME R0_CH2	DMAMUX TIMER0 CH2 request, only for GD32L235
DMA_REQUEST_TIME R0_CH3	DMAMUX TIMER0 CH3 request, only for GD32L235
DMA_REQUEST_TIME R0_UP	DMAMUX TIMER0 UP request, only for GD32L235
DMA_REQUEST_TIME R0_COM	DMAMUX TIMER0 COM request, only for GD32L235
DMA_REQUEST_TIME R14_CH0	DMAMUX TIMER14 CH0 request, only for GD32L235
DMA_REQUEST_TIME R14_CH1	DMAMUX TIMER14 CH1 request, only for GD32L235
DMA_REQUEST_TIME R14_TRIG	DMAMUX TIMER14 TRIG request, only for GD32L235
DMA_REQUEST_TIME R14_UP	DMAMUX TIMER14 UP request, only for GD32L235
DMA_REQUEST_TIME R14_COM	DMAMUX TIMER14 COM request, only for GD32L235
DMA_REQUEST_TIME R40_CH0	DMAMUX TIMER40 CH0 request, only for GD32L235
DMA_REQUEST_TIME R40_CH1	DMAMUX TIMER40 CH1 request, only for GD32L235
DMA_REQUEST_TIME R40_TRIG	DMAMUX TIMER40 TRIG request, only for GD32L235
DMA_REQUEST_TIME R40_UP	DMAMUX TIMER40 UP request, only for GD32L235
DMA_REQUEST_TIME R40_COM	DMAMUX TIMER40 COM request, only for GD32L235
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure multiplexer input identification */
```

```
dmamux_request_id_config(DMAMUX_MUXCH0, DMA_REQUEST_GENERATOR0);
```

dmamux_trigger_polarity_config

The description of dmamux_trigger_polarity_config is shown as below:

Table 3-257. Function dmamux_trigger_polarity_config

Function name	dmamux_trigger_polarity_config
Function prototype	void dmamux_trigger_polarity_config(dmamux_generator_channel_enum channelx, uint32_t polarity);
Function descriptions	configure trigger input polarity
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=0..3)	DMAMUX generation channel selection, refer to Table 3-215. Enum dmamux_generator_channel_enum
Input parameter{in}	
polarity	trigger input polarity
DMAMUX_GEN_NO_EVENT	no event detection
DMAMUX_GEN_RISING	rising edge
DMAMUX_GEN_FALLING	falling edge
DMAMUX_GEN_RISING_FALLING	rising and falling edges
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure trigger input polarity */
```

```
dmamux_trigger_polarity_config(DMAMUX_GENCH0, DMAMUX_GEN_RISING);
```

dmamux_request_generate_number_config

The description of dmamux_request_generate_number_config is shown as below:

Table 3-258. Function dmamux_request_generate_number_config

Function name	dmamux_request_generate_number_config
Function prototype	void dmamux_request_generate_number_config(dmamux_generator_channel_e

	num channelx, uint32_t number);
Function descriptions	configure number of DMA requests to be generated
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=0..3)	DMAMUX generation channel selection, refer to Table 3-215. Enum dmamux_generator_channel_enum
Input parameter{in}	
number	DMA requests number to be generated (1 - 32)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure number of DMA requests to be generated */
dmamux_request_generate_number_config(DMAMUX_GENCH0, 1);
```

dmamux_trigger_id_config

The description of dmamux_trigger_id_config is shown as below:

Table 3-259. Function dmamux_trigger_id_config

Function name	dmamux_trigger_id_config
Function prototype	void dmamux_trigger_id_config(dmamux_generator_channel_enum channelx, uint32_t id);
Function descriptions	configure trigger input identification
Precondition	-
The called functions	-
Input parameter{in}	
channelx	specify which DMAMUX request generator channel is initialized
DMAMUX_GENCHx(x=0..3)	DMAMUX generation channel selection, refer to Table 3-215. Enum dmamux_generator_channel_enum
Input parameter{in}	
id	trigger input identification
DMAMUX_TRIGGER_EXTI0	trigger input is EXTI0
DMAMUX_TRIGGER_EXTI1	trigger input is EXTI1
DMAMUX_TRIGGER_EXTI2	trigger input is EXTI2
DMAMUX_TRIGGER_EXTI3	trigger input is EXTI3

<i>EXTI3</i>	
<i>DMAMUX_TRIGGER_</i> <i>EXTI4</i>	trigger input is EXTI4
<i>DMAMUX_TRIGGER_</i> <i>EXTI5</i>	trigger input is EXTI5
<i>DMAMUX_TRIGGER_</i> <i>EXTI6</i>	trigger input is EXTI6
<i>DMAMUX_TRIGGER_</i> <i>EXTI7</i>	trigger input is EXTI7
<i>DMAMUX_TRIGGER_</i> <i>EXTI8</i>	trigger input is EXTI8
<i>DMAMUX_TRIGGER_</i> <i>EXTI9</i>	trigger input is EXTI9
<i>DMAMUX_TRIGGER_</i> <i>EXTI10</i>	trigger input is EXTI10
<i>DMAMUX_TRIGGER_</i> <i>EXTI11</i>	trigger input is EXTI11
<i>DMAMUX_TRIGGER_</i> <i>EXTI12</i>	trigger input is EXTI12
<i>DMAMUX_TRIGGER_</i> <i>EXTI13</i>	trigger input is EXTI13
<i>DMAMUX_TRIGGER_</i> <i>EXTI14</i>	trigger input is EXTI14
<i>DMAMUX_TRIGGER_</i> <i>EXTI15</i>	trigger input is EXTI15
<i>DMAMUX_TRIGGER_</i> <i>EVT0_OUT</i>	trigger input is Evt0_out
<i>DMAMUX_TRIGGER_</i> <i>EVT1_OUT</i>	trigger input is Evt1_out
<i>DMAMUX_TRIGGER_</i> <i>EVT2_OUT</i>	trigger input is Evt2_out
<i>DMAMUX_TRIGGER_</i> <i>EVT3_OUT</i>	trigger input is Evt3_out
<i>DMAMUX_TRIGGER_</i> <i>TIMER11_CH0_O</i>	trigger input is TIMER11_CH0_O
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure trigger input identification */
dmamux_trigger_id_config(DMAMUX_GENCH0, DMAMUX_TRIGGER_EXTI13);
```

dmamux_flag_get

The description of dmamux_flag_get is shown as below:

Table 3-260. Function dmamux_flag_get

Function name	dmamux_flag_get
Function prototype	FlagStatus dmamux_flag_get(dmamux_flag_enum flag);
Function descriptions	get DMAMUX flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	flag type, refer to Table 3-211. Enum dmamux_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
FlagStatus flag = RESET;
/* get DMAMUX flag */
flag = dmamux_flag_get(DMAMUX_FLAG_GENCH0_TO);
```

dmamux_flag_clear

The description of dmamux_flag_clear is shown as below:

Table 3-261. Function dmamux_flag_clear

Function name	dmamux_flag_clear
Function prototype	void dmamux_flag_clear(dmamux_flag_enum flag);
Function descriptions	clear DMAMUX flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	flag type, refer to Table 3-211. Enum dmamux_flag_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear DMAMUX flag */
dmamux_flag_clear(DMAMUX_FLAG_GENCH0_TO);
```

dmamux_interrupt_enable

The description of dmamux_interrupt_enable is shown as below:

Table 3-262. Function dmamux_interrupt_enable

Function name	dmamux_interrupt_enable
Function prototype	void dmamux_interrupt_enable(dmamux_interrupt_enum interrupt);
Function descriptions	enable DMAMUX interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify which interrupt to enable, refer to Table 3-210. Enum dmamux_interrupt_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMAMUX interrupt */
dmamux_interrupt_enable(DMAMUX_INT_MUXCH0_SO);
```

dmamux_interrupt_disable

The description of dmamux_interrupt_disable is shown as below:

Table 3-263. Function dmamux_interrupt_disable

Function name	dmamux_interrupt_disable
Function prototype	void dmamux_interrupt_disable(dmamux_interrupt_enum interrupt);
Function descriptions	disable DMAMUX interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify which interrupt to disable, refer to Table 3-210. Enum dmamux_interrupt_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMAMUX interrupt */
dmamux_interrupt_disable(DMAMUX_INT_MUXCH0_SO);
```

dmamux_interrupt_flag_get

The description of dmamux_interrupt_flag_get is shown as below:

Table 3-264. Function dmamux_interrupt_flag_get

Function name	dmamux_interrupt_flag_get
Function prototype	FlagStatus dmamux_interrupt_flag_get(dmamux_interrupt_flag_enum int_flag);
Function descriptions	get DMAMUX interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	flag type, refer to Table 3-212. Enum dmamux_interrupt_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* check DMAMUX interrupt flag */
if(dmamux_interrupt_flag_get(DMAMUX_INT_FLAG_GENCH0_TO)) {
    dmamux_interrupt_flag_clear(DMAMUX_INT_FLAG_GENCH0_TO);
}
```

dmamux_interrupt_flag_clear

The description of dmamux_interrupt_flag_clear is shown as below:

Table 3-265. Function dmamux_interrupt_flag_clear

Function name	dmamux_interrupt_flag_clear
Function prototype	FlagStatus dmamux_interrupt_flag_clear(dmamux_interrupt_flag_enum int_flag);
Function descriptions	clear DMAMUX interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	flag type, refer to Table 3-212. Enum dmamux_interrupt_flag_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* check DMAMUX interrupt flag */
```

```

if(dmamux_interrupt_flag_get(DMAMUX_INT_FLAG_GENCH0_TO)) {
    dmamux_interrupt_flag_clear(DMAMUX_INT_FLAG_GENCH0_TO);
}

```

3.11. EXTI

EXTI is the interrupt/event controller in the MCU. It contains up to 30 independent edge detectors (for GD32L233xx devices) or 32 independent edge detectors (for GD32L235xx devices) and generates interrupt requests or events to the processor. The EXTI registers are listed in chapter [3.11.1](#), the EXTI firmware functions are introduced in chapter [3.11.2](#).

3.11.1. Descriptions of Peripheral registers

EXTI registers are listed in the table shown as below:

Table 3-266. EXTI Registers

Registers	Descriptions
EXTI_INTEN	interrupt enable register
EXTI_EVEN	event enable register
EXTI_RTEN	rising edge trigger enable register
EXTI_FTEN	falling edge trigger enable register
EXTI_SWIEV	software interrupt event register
EXTI_PD	pending register

3.11.2. Descriptions of Peripheral functions

EXTI firmware functions are listed in the table shown as below:

Table 3-267. EXTI firmware function

Function name	Function description
exti_deinit	deinitialize the EXTI
exti_init	initialize the EXTI line x
exti_interrupt_enable	enable the interrupts from EXTI line x
exti_interrupt_disable	disable the interrupts from EXTI line x
exti_event_enable	enable the events from EXTI line x
exti_event_disable	disable the events from EXTI line x
exti_software_interrupt_enable	enable EXTI software interrupt event
exti_software_interrupt_disable	disable EXTI software interrupt event
exti_flag_get	get EXTI line x interrupt pending flag
exti_flag_clear	clear EXTI line x interrupt pending flag
exti_interrupt_flag_get	get EXTI line x interrupt pending flag
exti_interrupt_flag_clear	clear EXTI line x interrupt pending flag

Enum exti_line_enum

Table 3-268. exti_line_enum for GD32L233xx devices

enum name	Function description
EXTI_0	EXTI line 0
EXTI_1	EXTI line 1
EXTI_2	EXTI line 2
EXTI_3	EXTI line 3
EXTI_4	EXTI line 4
EXTI_5	EXTI line 5
EXTI_6	EXTI line 6
EXTI_7	EXTI line 7
EXTI_8	EXTI line 8
EXTI_9	EXTI line 9
EXTI_10	EXTI line 10
EXTI_11	EXTI line 11
EXTI_12	EXTI line 12
EXTI_13	EXTI line 13
EXTI_14	EXTI line 14
EXTI_15	EXTI line 15
EXTI_16	EXTI line 16
EXTI_17	EXTI line 17
EXTI_18	EXTI line 18
EXTI_19	EXTI line 19
EXTI_20	EXTI line 20
EXTI_21	EXTI line 21
EXTI_22	EXTI line 22
EXTI_23	EXTI line 23
EXTI_24	EXTI line 24
EXTI_25	EXTI line 25
EXTI_26	EXTI line 26
EXTI_27	EXTI line 27
EXTI_28	EXTI line 28
EXTI_29	EXTI line 29

Table 3-269. exti_line_enum for GD32L235xx devices

enum name	Function description
EXTI_0	EXTI line 0
EXTI_1	EXTI line 1
EXTI_2	EXTI line 2
EXTI_3	EXTI line 3
EXTI_4	EXTI line 4
EXTI_5	EXTI line 5

enum name	Function description
EXTI_6	EXTI line 6
EXTI_7	EXTI line 7
EXTI_8	EXTI line 8
EXTI_9	EXTI line 9
EXTI_10	EXTI line 10
EXTI_11	EXTI line 11
EXTI_12	EXTI line 12
EXTI_13	EXTI line 13
EXTI_14	EXTI line 14
EXTI_15	EXTI line 15
EXTI_16	EXTI line 16
EXTI_17	EXTI line 17
EXTI_18	EXTI line 18
EXTI_19	EXTI line 19
EXTI_20	EXTI line 20
EXTI_21	EXTI line 21
EXTI_22	EXTI line 22
EXTI_23	EXTI line 23
EXTI_24	EXTI line 24
EXTI_25	EXTI line 25
EXTI_26	EXTI line 26
EXTI_27	EXTI line 27
EXTI_28	EXTI line 28
EXTI_29	EXTI line 29
EXTI_30	EXTI line 30
EXTI_31	EXTI line 31

Enum exti_mode_enum

Table 3-270. exti_mode_enum

enum name	Function description
EXTI_INTERRUPT	EXTI interrupt mode
EXTI_EVENT	EXTI event mode

Enum exti_trig_type_enum

Table 3-271. exti_trig_type_enum

enum name	Function description
EXTI_TRIG_RISING	EXTI rising edge trigger
EXTI_TRIG_FALLING	EXTI falling edge trigger
EXTI_TRIG_BOTH	EXTI rising and falling edge trigger
EXTI_TRIG_NONE	EXTI without rising edge or falling edge trigger

exti_deinit

The description of exti_deinit is shown as below:

Table 3-272. Function exti_deinit

Function name	exti_deinit
Function prototype	void exti_deinit(void);
Function descriptions	deinitialize the EXTI
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* deinitialize the EXTI */
```

```
exti_deinit();
```

exti_init

The description of exti_init is shown as below:

Table 3-273. Function exti_init

Function name	exti_init
Function prototype	void exti_init(exti_line_enum linex, exti_mode_enum mode, exti_trig_type_enum trig_type);
Function descriptions	initialize the EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Input parameter{in}	
mode	EXTI mode, refer to Table 3-270. exti_mode_enum
Input parameter{in}	
trig_type	trigger type, refer to Table 3-271. exti_trig_type_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure EXTI_0 */

exti_init(EXTI_0, EXTI_INTERRUPT, EXTI_TRIG_BOTH);
```

exti_interrupt_enable

The description of exti_interrupt_enable is shown as below:

Table 3-274. Function exti_interrupt_enable

Function name	exti_interrupt_enable
Function prototype	void exti_interrupt_enable(exti_line_enum linex);
Function descriptions	enable the interrupts from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the interrupts from EXTI line 0 */

exti_interrupt_enable(EXTI_0);
```

exti_interrupt_disable

The description of exti_interrupt_disable is shown as below:

Table 3-275. Function exti_interrupt_disable

Function name	exti_interrupt_disable
Function prototype	void exti_interrupt_disable(exti_line_enum linex);
Function descriptions	disable the interrupts from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* disable the interrupts from EXTI line 0 */
```

```
exti_interrupt_disable(EXTI_0);
```

exti_event_enable

The description of exti_event_enable is shown as below:

Table 3-276. Function exti_event_enable

Function name	exti_event_enable
Function prototype	void exti_event_enable(exti_line_enum linex);
Function descriptions	enable the events from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the events from EXTI line 0 */
```

```
exti_event_enable(EXTI_0);
```

exti_event_disable

The description of exti_event_disable is shown as below:

Table 3-277. Function exti_event_disable

Function name	exti_event_disable
Function prototype	void exti_event_disable(exti_line_enum linex);
Function descriptions	disable the events from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the events from EXTI line 0 */
exti_event_disable(EXTI_0);
```

exti_software_interrupt_enable

The description of exti_software_interrupt_enable is shown as below:

Table 3-278. Function exti_software_interrupt_enable

Function name	exti_software_interrupt_enable
Function prototype	void exti_software_interrupt_enable(exti_line_enum linex);
Function descriptions	enable software interrupt event from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable EXTI line 0 software interrupt */
exti_software_interrupt_enable(EXTI_0);
```

exti_software_interrupt_disable

The description of exti_software_interrupt_disable is shown as below:

Table 3-279. Function exti_software_interrupt_disable

Function name	exti_software_interrupt_disable
Function prototype	void exti_software_interrupt_disable(exti_line_enum linex);
Function descriptions	disable software interrupt event from EXTI line x
Precondition	-
The called functions	-
Input parameter{in}	

linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable EXTI line 0 software interrupt */
exti_software_interrupt_disable(EXTI_0);
```

exti_flag_get

The description of exti_flag_get is shown as below:

Table 3-280. Function exti_flag_get

Function name	exti_flag_get
Function prototype	FlagStatus exti_flag_get(exti_line_enum linex);
Function descriptions	get EXTI line x interrupt pending flag
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get EXTI line 0 flag status */
FlagStatus state = exti_flag_get(EXTI_0);
```

exti_flag_clear

The description of exti_flag_clear is shown as below:

Table 3-281. Function exti_flag_clear

Function name	exti_flag_clear
Function prototype	void exti_flag_clear(exti_line_enum linex);
Function descriptions	clear EXTI line x interrupt pending flag
Precondition	-

The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear EXTI line 0 flag status */
```

```
exti_flag_clear(EXTI_0);
```

exti_interrupt_flag_get

The description of exti_interrupt_flag_get is shown as below:

Table 3-282. Function exti_interrupt_flag_get

Function name	exti_interrupt_flag_get
Function prototype	FlagStatus exti_interrupt_flag_get(exti_line_enum linex);
Function descriptions	get EXTI line x interrupt pending flag
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get EXTI line 0 interrupt flag status */
```

```
FlagStatus state = exti_interrupt_flag_get(EXTI_0);
```

exti_interrupt_flag_clear

The description of exti_interrupt_flag_clear is shown as below:

Table 3-283. Function exti_interrupt_flag_clear

Function name	exti_interrupt_flag_clear
Function prototype	void exti_interrupt_flag_clear(exti_line_enum linex);

Function descriptions	clear EXTI line x interrupt pending flag
Precondition	-
The called functions	-
Input parameter{in}	
linex	EXTI line x, for GD32L233xx devices which refer to Table 3-268. exti_line_enum for GD32L233xx devices , for for GD32L235xx devices which refer to Table 3-269. exti_line_enum for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear EXTI line 0 interrupt flag status */
```

```
exti_interrupt_flag_clear(EXTI_0);
```

3.12. FMC

There is flash controller and option byte for GD32L23x series. The FMC registers are listed in chapter [3.12.1](#) the FMC firmware functions are introduced in chapter [3.12.2](#).

3.12.1. Descriptions of Peripheral registers

FMC registers are listed in the table shown as below:

Table 3-284. FMC Registers

Registers	Descriptions
FMC_WS	FMC wait state register
FMC_KEY	FMC unlock key register
FMC_OBKEY	FMC option bytes unlock key register
FMC_STAT	FMC status register
FMC_CTL	FMC control register
FMC_ADDR	FMC address register
FMC_ECCCS	FMC ECC control and status register (only available in GD32L235xx)
FMC_OBSTAT	FMC option bytes status register
FMC_WP	FMC erase/write protection register
FMC_SLPKEY	FMC flash sleep or power-down mode unlock key register
FMC_PID	FMC product ID register

3.12.2. Descriptions of Peripheral functions

FMC firmware functions are listed in the table shown as below:

Table 3-285. FMC firmware function

Function name	Function description
fmc_unlock	unlock the main FMC operation
fmc_lock	lock the main FMC operation
fmc_wsnt_set	set the wait state
fmc_prefetch_enable	enable pre-fetch
fmc_prefetch_disable	disable pre-fetch
fmc_low_power_enable	enable low power (only available in GD32L233xx)
fmc_low_power_disable	disable low power (only available in GD32L233xx)
fmc_page_erase	erase FMC page
fmc_mass_erase	erase FMC whole chip
fmc_word_program	FMC program a word at the corresponding address (only available in GD32L233xx)
fmc_fast_program	FMC fast program a row words (32 double words) at the corresponding address (only available in GD32L233xx)
fmc_doubleword_program	FMC program a doubleword at the corresponding address (only available in GD32L235xx)
ob_unlock	unlock the option byte operation
ob_lock	lock the option byte operation
ob_erase	erase the option byte
ob_write_protection_enable	enable write protection
ob_security_protection_config	configure the option bytes security protection
ob_user_write	program option bytes USER
ob_data_program	program option bytes DATA
ob_user_get	get the value of option bytes USER
ob_data_get	get the value of option bytes DATA
ob_write_protection_get	get the value of option bytes write protection
ob_security_protection_flag_get	get option bytes security protection state
fmc_ecc_address_get	get the address where ECC error occur on
fmc_slp_unlock	unlock operation of RUN_SLP bit in FMC_WS register
fmc_sleep_slp_enable	flash enter sleep mode when MCU enter deep-sleep mode or RUN_SLP bit is set
fmc_sleep_slp_disable	flash enter power-down mode(GD32L233) / idle mode(GD32L235) when MCU enter deep-sleep mode or RUN_SLP bit is set
fmc_run_slp_enable	flash enter idle mode when MCU run mode (GD32L235, together with the SLEEP_SLP bit) / flash enter idle mode when MCU run mode or enter low-power run mode (GD32L233, together with the SLEEP_SLP bit)
fmc_run_slp_disable	flash enter sleep mode when MCU run mode (GD32L235, together with the SLEEP_SLP bit) / flash enter sleep or power-down mode when MCU run mode

Function name	Function description
	or enter low-power run mode (GD32L233, together with the SLEEP_SLP bit)
fmc_sleep_mode_enter	flash enter sleep mode when MCU run mode. Please note that this function needs to run in SRAM.
fmc_pd_mode_enter	flash enter power down mode when MCU run mode/low-power run mode (only available in GD32L233xx). Please note that this function needs to run in SRAM.
fmc_slp_mode_exit	flash exit sleep or power-down mode when MCU run mode/low-power run mode(GD32L233) flash exit sleep mode when MCU run mode mode(GD32L235). Please note that this function needs to run in SRAM.
fmc_flag_get	get FMC flag status
fmc_flag_clear	clear the FMC flag
fmc_interrupt_enable	enable FMC interrupt
fmc_interrupt_disable	disable FMC interrupt
fmc_interrupt_flag_get	get FMC interrupt flag
fmc_interrupt_flag_clear	clear FMC interrupt flag

fmc_state_enum

Table 3-286. fmc_state_enum

enum name	enum description
FMC_READY	the operation has been completed
FMC_BUSY	the operation is in progress
FMC_PGERR	program error
FMC_PGAERR	program alignment error
FMC_WPERR	erase/program protection error
FMC_TOERR	timeout error
FMC_OB_HSPC	high security protection
FMC_SLP	sleep or power-down status

fmc_flag_enum

Table 3-287. fmc_flag_enum

enum name	enum description
FMC_FLAG_BUSY	flash busy flag
FMC_FLAG_PGER R	flash program error flag
FMC_FLAG_PGAE RR	flash program alignment error flag
FMC_FLAG_WPER	flash erase/program protection error flag

enum name	enum description
R	
FMC_FLAG_SLP	flash sleep or power-down flag (only available in GD32L233xx)
FMC_FLAG_POWERDOWN	flash power-down flag (only available in GD32L235xx)
FMC_FLAG_SLEEP	flash sleep flag (only available in GD32L235xx)
FMC_FLAG_ECCCOR	one bit error detected and correct flag (only available in GD32L235xx)
FMC_FLAG_ECCDET	two bit error detect flag (only available in GD32L235xx)
FMC_FLAG_SYSECC	an ECC error is detected in system memory flag (only available in GD32L235xx)
FMC_FLAG_MFEC	an ECC error is detected in main Flash flag (only available in GD32L235xx)
FMC_FLAG_OTPECC	an ECC error is detected in OTP flag (only available in GD32L235xx)
FMC_FLAG_OBEC	an ECC error is detected in reading option bytes flag (only available in GD32L235xx)
FMC_FLAG_OBECDET	option bytes two bit error detect in loading option bytes to register flag (only available in GD32L235xx)
FMC_FLAG_OBER	option bytes error flag

fmc_interrupt_flag_enum

Table 3-288. fmc_interrupt_flag_enum

enum name	enum description
FMC_INT_FLAG_PGERR	flash program error interrupt flag
FMC_INT_FLAG_PGGAERR	flash program alignment error interrupt flag
FMC_INT_FLAG_WPERR	flash erase/program protection error interrupt flag
FMC_INT_FLAG_END	flash end of operation interrupt flag
FMC_INT_FLAG_ECCCOR	one bit error detected and correct interrupt flag (only available in GD32L235xx)
FMC_INT_FLAG_ECCDET	two bits error detect interrupt flag (only available in GD32L235xx)
FMC_INT_FLAG_OBECDET	option bytes two bit error detect in loading option bytes to register interrupt flag (only available in GD32L235xx)

fmc_interrupt_enum

Table 3-289. fmc_interrupt_enum

enum name	enum description
FMC_INT_ERR	FMC error interrupt
FMC_INT_END	FMC end of operation interrupt
FMC_INT_ECCCOR	FMC one bit error correct interrupt (only available in GD32L235xx)
FMC_INT_ECCDET	FMC two bits error interrupt (only available in GD32L235xx)

fmc_unlock

The description of fmc_unlock is shown as below:

Table 3-290. Function fmc_unlock

Function name	fmc_unlock
Function prototype	void fmc_unlock(void);
Function descriptions	unlock the main FMC operation
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* unlock the main FMC operation */
```

```
fmc_unlock();
```

fmc_lock

The description of fmc_lock is shown as below:

Table 3-291. Function fmc_lock

Function name	fmc_lock
Function prototype	void fmc_lock(void);
Function descriptions	lock the main FMC operation
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* lock the main FMC operation */
```

```
fmc_lock();
```

fmc_wscnt_set

The description of fmc_wscnt_set is shown as below:

Table 3-292. Function fmc_wscnt_set

Function name	fmc_wscnt_set
Function prototype	void fmc_wscnt_set(uint32_t wscnt);
Function descriptions	set the wait state
Precondition	-
The called functions	-
Input parameter{in}	
wscnt	wait state counter value
<i>FMC_WAIT_STATE_0</i>	0 wait state added
<i>FMC_WAIT_STATE_1</i>	1 wait state added
<i>FMC_WAIT_STATE_2</i>	2 wait state added
<i>FMC_WAIT_STATE_3</i>	3 wait state added (only available in GD32L233xx)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the wait state */
```

```
fmc_wscnt_set(FMC_WAIT_STATE_1);
```

fmc_prefetch_enable

The description of fmc_prefetch_enable is shown as below:

Table 3-293. Function fmc_prefetch_enable

Function name	fmc_prefetch_enable
Function prototype	void fmc_prefetch_enable(void);
Function descriptions	enable pre-fetch
Precondition	-
The called functions	-

Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable pre-fetch */
```

```
fmc_prefetch_enable();
```

fmc_prefetch_disable

The description of fmc_prefetch_disable is shown as below:

Table 3-294. Function fmc_prefetch_disable

Function name	fmc_prefetch_disable
Function prototype	void fmc_prefetch_disable(void);
Function descriptions	disable pre-fetch
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable pre-fetch */
```

```
fmc_prefetch_disable();
```

fmc_low_power_enable

The description of fmc_low_power_enable is shown as below:

Table 3-295. Function fmc_low_power_enable

Function name	fmc_low_power_enable
Function prototype	void fmc_low_power_enable(void);
Function descriptions	enable low power
Precondition	-
The called functions	-
Input parameter{in}	

-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable low power */
```

```
fmc_low_power_enable();
```

fmc_low_power_disable

The description of fmc_low_power_disable is shown as below:

Table 3-296. Function fmc_low_power_disable

Function name	fmc_low_power_disable
Function prototype	void fmc_low_power_disable(void);
Function descriptions	disable low power
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable low power */
```

```
fmc_low_power_disable();
```

fmc_page_erase

The description of fmc_page_erase is shown as below:

Table 3-297. Function fmc_page_erase

Function name	fmc_page_erase
Function prototype	fmc_state_enum fmc_page_erase(uint32_t page_address);
Function descriptions	erase page
Precondition	fmc_unlock
The called functions	-
Input parameter{in}	
page_address	the page address to be erased

Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();

/* erase page */

fmc_state_enum state = fmc_page_erase(0x08004000);
```

fmc_mass_erase

The description of fmc_mass_erase is shown as below:

Table 3-298. Function fmc_mass_erase

Function name	fmc_mass_erase
Function prototype	fmc_state_enum fmc_mass_erase(void);
Function descriptions	erase whole chip
Precondition	fmc_unlock
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();

/* erase whole chip */

fmc_state_enum state = fmc_mass_erase();
```

fmc_word_program

The description of fmc_word_program is shown as below:

Table 3-299. Function fmc_word_program

Function name	fmc_word_program
Function prototype	fmc_state_enum fmc_word_program(uint32_t address, uint32_t data);
Function descriptions	program a word at the corresponding address
Precondition	fmc_unlock

The called functions	-
Input parameter{in}	
address	the address to be programmed
Input parameter{in}	
data	the data to be programmed
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();
```

```
fmc_page_erase(0x08004000);
```

```
/* program a word at the corresponding address */
```

```
fmc_state_enum fmc_state = fmc_word_program(0x08004000, 0xaabbccdd);
```

fmc_fast_program

The description of fmc_fast_program is shown as below:

Table 3-300. Function fmc_fast_program

Function name	fmc_fast_program
Function prototype	fmc_state_enum fmc_fast_program(uint32_t address, uint64_t data[]);
Function descriptions	FMC fast program one row data (32 double-word) starting at the corresponding address
Precondition	fmc_unlock
The called functions	-
Input parameter{in}	
address	the address to be programmed
Input parameter{in}	
data	the data to be programmed
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
/* data buffer for fast programming */
```

```
static uint64_t data_buffer[32] = {
```



```

0x0000000000000000U,    0x1111111111111111U,    0x2222222222222222U,
0x3333333333333333U,

    0x4444444444444444U,    0x5555555555555555U,    0x6666666666666666U,
0x7777777777777777U,

    0x8888888888888888U,    0x9999999999999999U,    0xAAAAAAAAAAAAAAAAAU,
0BBBBBBBBBBBBBBBBBBU,

    0xCCCCCCCCCCCCCCCCCU,                                0xDDDDDDDDDDDDDDDDDDDU,
0EEEEEEEEEEEEEEEEEU, 0xFFFFFFFFFFFFFFFFFU,

    0x0011001100110011U,    0x2233223322332233U,    0x4455445544554455U,
0x6677667766776677U,

    0x8899889988998899U, 0xAABBAABBAABBAABBU, 0xCCDDCCDDCCDDCCDDU,
0xEEFFEEFFEEFFEEFFU,

    0x2200220022002200U,    0x3311331133113311U,    0x6644664466446644U,
0x7755775577557755U,

    0xAA88AA88AA88AA88U, 0xBB99BB99BB99BB99U, 0xEECCEECCEECCECCU,
0xFFDDFFDDFFDDFFDDU

};

fmc_unlock();

fmc_page_erase(0x08004000);

/* program flash */

fmc_state_enum fmc_state = fmc_fast_program(0x08004000, data_buffer);

```

fmc_doubleword_program

The description of fmc_doubleword_program is shown as below:

Table 3-301. Function fmc_doubleword_program

Function name	fmc_doubleword_program
Function prototype	fmc_state_enum fmc_doubleword_program(uint32_t address, uint64_t data);
Function descriptions	program a double-word at the corresponding address
Precondition	fmc_unlock
The called functions	-
Input parameter{in}	
address	the address to be programmed
Input parameter{in}	
data	the data to be programmed
Output parameter{out}	

-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();
```

```
fmc_page_erase(0x08004000);
```

```
/* program a double-word at the corresponding address */
```

```
fmc_state_enum          fmc_state          =          fmc_
doubleword_program(0x08004000,0xaabbccddaabbccdd);
```

ob_unlock

The description of ob_unlock is shown as below:

Table 3-302. Function ob_unlock

Function name	ob_unlock
Function prototype	void ob_unlock(void);
Function descriptions	unlock the option byte operation
Precondition	fmc_unlock
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
fmc_unlock();
```

```
/* unlock the option byte operation */
```

```
ob_unlock();
```

ob_lock

The description of ob_lock is shown as below:

Table 3-303. Function ob_lock

Function name	ob_lock
Function prototype	void ob_lock(void);
Function descriptions	lock the option byte operation

Precondition	fmc_lock
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
fmc_lock();
```

```
/* lock the option byte operation */
```

```
ob_lock();
```

ob_erase

The description of ob_erase is shown as below:

Table 3-304. Function ob_erase

Function name	ob_erase
Function prototype	void ob_erase(void);
Function descriptions	erase the option byte
Precondition	ob_unlock
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();
```

```
ob_unlock();
```

```
/* erase the option byte */
```

```
fmc_state_enum fmc_state = ob_erase();
```

ob_write_protection_enable

The description of ob_write_protection_enable is shown as below:

Table 3-305. Function ob_write_protection_enable

Function name	ob_write_protection_enable
Function prototype	fmc_state_enum ob_write_protection_enable(uint32_t ob_wp);
Function descriptions	enable erase/write protection
Precondition	ob_unlock
The called functions	-
Input parameter{in}	
ob_wp	specify sector to be write protected
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();

ob_unlock();

/* enable write protection */

fmc_state_enum fmc_state = ob_write_protection_enable(OB_WP_1);
```

ob_security_protection_config

The description of ob_security_protection_config is shown as below:

Table 3-306. Function ob_security_protection_config

Function name	ob_security_protection_config
Function prototype	fmc_state_enum ob_security_protection_config(uint8_t ob_spc);
Function descriptions	configure security protection
Precondition	ob_unlock
The called functions	-
Input parameter{in}	
ob_spc	specify security protection
FMC_NSPC	no security protection
FMC_LSPC	low security protection
FMC_HSPC	high security protection
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_state_enum fmc_state;

fmc_unlock();

ob_unlock();

/* enable security protection */

fmc_state = ob_security_protection_config(FMC_USPC);
```

ob_user_write

The description of ob_user_write is shown as below:

Table 3-307. Function ob_user_write

Function name	ob_user_write
Function prototype	fmc_state_enum ob_user_write(uint8_t ob_fwdgt, uint8_t ob_deepsleep, uint8_t ob_stdby, uint8_t ob_bor_th); (only available in GD32L233xx)/ fmc_state_enum ob_user_write(uint8_t ob_fwdgt, uint8_t ob_deepsleep, uint8_t ob_stdby, uint8_t ob_bor_th, uint8_t ob_sram_parity_check); (only available in GD32L235xx)
Function descriptions	program option bytes USER
Precondition	ob_unlock
The called functions	-
Input parameter{in}	
ob_fwdgt	option bytes free watchdog value
<i>OB_FWDGT_SW</i>	software free watchdog
<i>OB_FWDGT_HW</i>	hardware free watchdog
Input parameter{in}	
ob_deepsleep	option bytes deepsleep reset value
<i>OB_DEEPSLEEP_NRS</i> <i>T</i>	no reset when entering deepsleep mode
<i>OB_DEEPSLEEP_RST</i>	generate a reset instead of entering deepsleep mode
Input parameter{in}	
ob_stdby	option bytes standby reset value
<i>OB_STDBY_NRST</i>	no reset when entering standby mode
<i>OB_STDBY_RST</i>	generate a reset instead of entering standby mode
Input parameter{in}	
ob_bor_th	option bytes BOR threshold value
<i>OB_BOR_TH_VALUE0</i>	BOR threshold value 0
<i>OB_BOR_TH_VALUE1</i>	BOR threshold value 1
<i>OB_BOR_TH_VALUE2</i>	BOR threshold value 2
<i>OB_BOR_TH_VALUE3</i>	BOR threshold value 3
<i>OB_BOR_TH_VALUE4</i>	BOR threshold value 4
Input parameter{in}	
ob_sram_parity_chec	option bytes sram parity check value (only available in GD32L235xx)

k	
<i>OB_SRAM_PARITY_CHECK_ENABLE</i>	enable SRAM parity check
<i>OB_SRAM_PARITY_CHECK_DISABLE</i>	disable SRAM parity check
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();
```

```
ob_unlock();
```

```
/* program the FMC user option byte */
```

```
fmc_state_enum fmc_state = ob_user_write(OB_FWDGT_HW, OB_DEEPSLEEP_Nrst,
OB_STDBY_Nrst, OB_BOR_TH_VALUE0);
```

ob_data_program

The description of ob_data_program is shown as below:

Table 3-308. Function ob_data_program

Function name	ob_data_program
Function prototype	fmc_state_enum ob_data_program(uint16_t data);
Function descriptions	program option bytes DATA
Precondition	ob_unlock
The called functions	-
Input parameter{in}	
data	the data to be programmed
Output parameter{out}	
-	-
Return value	
fmc_state_enum	state of FMC, the enum members can refer to members of the enum Table 3-286. fmc_state_enum .

Example:

```
fmc_unlock();
```

```
ob_unlock();
```

```
/* program option bytes data */
```

```
fmc_state_enum fmc_state = ob_data_program(0xddd22);
```

ob_user_get

The description of ob_user_get is shown as below:

Table 3-309. Function ob_user_get

Function name	ob_user_get
Function prototype	uint8_t ob_user_get(void);
Function descriptions	get the value of option bytes USER
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	the FMC user option byte values(0x00 – 0xFF)

Example:

```
/* get the FMC user option byte */
```

```
uint8_t user = ob_user_get();
```

ob_data_get

The description of ob_data_get is shown as below:

Table 3-310. Function ob_data_get

Function name	ob_data_get
Function prototype	uint16_t ob_data_get(void);
Function descriptions	get the value of option bytes DATA
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint16_t	the FMC data option byte values(0x0 – 0xFFFF)

Example:

```
/* get the FMC data option byte */
```

```
uint16_t data = ob_data_get();
```

ob_write_protection_get

The description of ob_write_protection_get is shown as below:

Table 3-311. Function ob_write_protection_get

Function name	ob_write_protection_get
Function prototype	uint32_t ob_write_protection_get(void);
Function descriptions	get the value of option bytes write protection
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint32_t	the FMC write protection option byte value(0x0 – 0xFFFF FFFF)

Example:

```
/* get the FMC option byte write protection */
```

```
uint32_t wp = ob_write_protection_get();
```

ob_security_protection_flag_get

The description of ob_security_protection_flag_get is shown as below:

Table 3-312. Function ob_security_protection_flag_get

Function name	ob_security_protection_flag_get
Function prototype	FlagStatus ob_security_protection_flag_get(void);
Function descriptions	get the FMC option bytes security protection state
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the FMC option byte security protection level */
```

```
FlagStatus spc_flag = ob_security_protection_flag_get();
```


fmc_ecc_address_get

The description of fmc_ecc_address_get is shown as below:

Table 3-313. Function fmc_ecc_address_get

Function name	fmc_ecc_address_get
Function prototype	uint16_t fmc_ecc_address_get(void);
Function descriptions	get the address where ECC error occur on
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint16_t	0 ~ 0x3FFF

Example:

```
/* get the address where ECC error occur on */
```

```
uint16_t ecc_addr = fmc_ecc_address_get();
```

fmc_slp_unlock

The description of fmc_slp_unlock is shown as below:

Table 3-314. Function fmc_slp_unlock

Function name	fmc_slp_unlock
Function prototype	void fmc_slp_unlock(void);
Function descriptions	unlock operation of RUN_SLP bit in FMC_WS register
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* unlock RUN_SLP bit in FMC_WS register */
```

```
fmc_slp_unlock();
```

fmc_sleep_slp_enable

The description of fmc_sleep_slp_enable is shown as below:

Table 3-315. Function fmc_sleep_slp_enable

Function name	fmc_sleep_slp_enable
Function prototype	void fmc_sleep_slp_enable(void);
Function descriptions	flash enter sleep/power-down mode during MCU run/low-power run mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* flash enter sleep/power-down mode during MCU run/low-power run mode */
```

```
fmc_sleep_slp_enable();
```

fmc_sleep_slp_disable

The description of fmc_sleep_slp_disable is shown as below:

Table 3-316. Function fmc_sleep_slp_disable

Function name	fmc_sleep_slp_disable
Function prototype	void fmc_sleep_slp_disable(void);
Function descriptions	For GD32L233, flash enter power-down mode when MCU enter deep-sleep mode or RUN_SLP bit is set. For GD32L235, flash enter idle mode when MCU enter deep-sleep mode or RUN_SLP bit is set
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* for GD32L233, flash enter power-down mode when MCU enter deep-sleep mode or RUN_SLP bit is set */
```

```
fmc_sleep_slp_disable();
```

fmc_run_slp_enable

The description of fmc_run_slp_enable is shown as below:

Table 3-317. Function fmc_run_slp_enable

Function name	fmc_run_slp_enable
Function prototype	void fmc_run_slp_enable(void);
Function descriptions	For GD32L233, flash enter idle mode when MCU run mode or enter low-power run mode (together with the SLEEP_SLP bit). For GD32L235, flash enter idle mode when MCU run mode (together with the SLEEP_SLP bit).
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
fmc_slp_unlock();
```

```
/* for GD32L235, flash enter idle mode when MCU run mode (together with the SLEEP_SLP bit) */
```

```
fmc_run_slp_enable();
```

fmc_run_slp_disable

The description of fmc_run_slp_disable is shown as below:

Table 3-318. Function fmc_run_slp_disable

Function name	fmc_run_slp_disable
Function prototype	void fmc_run_slp_disable(void);
Function descriptions	For GD32L233, flash enter sleep or power-down mode when MCU run mode or enter low-power run mode (together with the SLEEP_SLP bit). For GD32L235, flash enter sleep mode when MCU run mode (together with the SLEEP_SLP bit).
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
fmc_slp_unlock();
```

```
/* for GD32L235, flash enter sleep mode when MCU run mode (together with the SLEEP_SLP bit) */
```

```
fmc_run_slp_disable();
```

fmc_sleep_mode_enter

The description of fmc_sleep_mode_enter is shown as below:

Table 3-319. Function fmc_sleep_mode_enter

Function name	fmc_sleep_mode_enter
Function prototype	void fmc_sleep_mode_enter(void);
Function descriptions	flash enter sleep mode when MCU run mode. Please note that this function needs to run in SRAM.
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* flash enter sleep mode when MCU run mode */
```

```
fmc_sleep_mode_enter ();
```

fmc_pd_mode_enter

The description of fmc_pd_mode_enter is shown as below:

Table 3-320. Function fmc_pd_mode_enter

Function name	fmc_pd_mode_enter
Function prototype	void fmc_pd_mode_enter(void);
Function descriptions	flash enter power down mode when MCU run mode/low-power run mode. Please note that this function needs to run in SRAM.
Precondition	-
The called functions	-
Input parameter{in}	

-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* for GD32L235, flash enter sleep mode when MCU run mode (together with the SLEEP_SLP
bit) */
```

```
fmc_pd_mode_enter ();
```

fmc_slp_mode_exit

The description of fmc_slp_mode_exit is shown as below:

Table 3-321. Function fmc_slp_mode_exit

Function name	fmc_slp_mode_exit
Function prototype	void fmc_slp_mode_exit(void);
Function descriptions	For GD32L233, flash exit sleep or power-down mode when MCU run mode/low-power run mode. For GD32L235, flash exit sleep mode when MCU run mode mode. Please note that this function needs to run in SRAM.
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* for GD32L235, flash exit sleep mode when MCU run mode mode */
```

```
fmc_slp_mode_exit ();
```

fmc_flag_get

The description of fmc_flag_get is shown as below:

Table 3-322. Function fmc_flag_get

Function name	fmc_flag_get
Function prototype	FlagStatus fmc_flag_get(fmc_flag_enum flag);
Function descriptions	get FMC flag status
Precondition	-
The called functions	-

Input parameter{in}	
flag	FMC flag, the enum members can refer to members of the enum Table 3-287. fmc_flag_enum .
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get FMC end flag */
```

```
FlagStatus flag = fmc_flag_get(FMC_FLAG_END);
```

fmc_flag_clear

The description of fmc_flag_clear is shown as below:

Table 3-323. Function fmc_flag_clear

Function name	fmc_flag_clear
Function prototype	void fmc_flag_clear(fmc_flag_enum flag);
Function descriptions	clear the FMC flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	FMC flag
<i>FMC_FLAG_PGERR</i>	flash program error flag
<i>FMC_FLAG_PGAERR</i>	flash program alignment error flag
<i>FMC_FLAG_WPERR</i>	flash erase/program protection error flag
<i>FMC_FLAG_ECCCOR</i>	one bit error detected and correct flag (only available in GD32L235xx)
<i>FMC_FLAG_ECCDET</i>	two bit error detect flag (only available in GD32L235xx)
<i>FMC_FLAG_SYSECC</i>	an ECC error is detected in system memory flag (only available in GD32L235xx)
<i>FMC_FLAG_MFECC</i>	an ECC error is detected in main Flash flag (only available in GD32L235xx)
<i>FMC_FLAG_OTPECC</i>	an ECC error is detected in OTP flag (only available in GD32L235xx)
<i>FMC_FLAG_OBECC</i>	an ECC error is detected in reading option bytes flag (only available in GD32L235xx)
<i>FMC_FLAG_OBECCDET</i>	option bytes two bit error detect in loading option bytes to register flag (only available in GD32L235xx)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear FMC end flag */
```

```
fmc_flag_clear(FMC_FLAG_END);
```

fmc_interrupt_enable

The description of fmc_interrupt_enable is shown as below:

Table 3-324. Function fmc_interrupt_enable

Function name	fmc_interrupt_enable
Function prototype	void fmc_interrupt_enable(fmc_interrupt_enum interrupt);
Function descriptions	enable FMC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	FMC interrupt, the enum members can refer to members of the enum Table 3-289. fmc_interrupt_enum .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable FMC end interrupt */
```

```
fmc_interrupt_enable(FMC_INT_END);
```

fmc_interrupt_disable

The description of fmc_interrupt_disable is shown as below:

Table 3-325. Function fmc_interrupt_disable

Function name	fmc_interrupt_disable
Function prototype	void fmc_interrupt_disable(fmc_interrupt_enum interrupt);
Function descriptions	disable FMC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	FMC interrupt, the enum members can refer to members of the enum Table 3-289. fmc_interrupt_enum .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable FMC end interrupt */
```

```
fmc_interrupt_disable(FMC_INT_END);
```

fmc_interrupt_flag_get

The description of fmc_interrupt_flag_get is shown as below:

Table 3-326. Function fmc_interrupt_flag_get

Function name	fmc_interrupt_flag_get
Function prototype	FlagStatus fmc_interrupt_flag_get(fmc_interrupt_flag_enum int_flag);
Function descriptions	get FMC interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	FMC interrupt flag, the enum members can refer to members of the enum Table 3-288. fmc_interrupt_flag_enum .
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* check FMC program operation error flag is set or not */
```

```
FlagStatus flag = fmc_interrupt_flag_get(FMC_INT_FLAG_PGERR);
```

fmc_interrupt_flag_clear

The description of fmc_interrupt_flag_get is shown as below:

Table 3-327. Function fmc_interrupt_flag_clear

Function name	fmc_interrupt_flag_clear
Function prototype	void fmc_interrupt_flag_clear(fmc_interrupt_flag_enum int_flag);
Function descriptions	clear the FMC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	FMC interrupt flag, the enum members can refer to members of the enum Table 3-288. fmc_interrupt_flag_enum .
Output parameter{out}	
-	-
Return value	
-	-

Example:


```
/* clear FMC program operation error flag */
```

```
fmc_interrupt_flag_get(FMC_INT_FLAG_PGERR);
```

3.13. FWDGT

The free watchdog timer (FWDGT) is a hardware timing circuitry that can be used to detect system failures due to software malfunctions. It's suitable for the situation that requires an independent environment and lower timing accuracy. The FWDGT registers are listed in chapter [3.13.1](#) the FWDGT firmware functions are introduced in chapter [3.13.2](#).

3.13.1. Descriptions of Peripheral registers

FWDGT registers are listed in the table shown as below:

Table 3-328. FWDGT Registers

Registers	Descriptions
FWDGT_CTL	Control register
FWDGT_PSC	Prescaler register
FWDGT_RLD	Reload register
FWDGT_STAT	Status register
FWDGT_WND	window register

3.13.2. Descriptions of Peripheral functions

FWDGT firmware functions are listed in the table shown as below:

Table 3-329. FWDGT firmware function

Function name	Function description
fwdgt_write_enable	enable write access to FWDGT_PSC and FWDGT_RLD and FWDGT_WND
fwdgt_write_disable	disable write access to FWDGT_PSC and FWDGT_RLD and FWDGT_WND
fwdgt_enable	start the FWDGT counter
fwdgt_prescaler_value_config	configure the FWDGT counter prescaler value
fwdgt_reload_value_config	configure the FWDGT counter reload value
fwdgt_window_value_config	configure the FWDGT counter window value
fwdgt_counter_reload	reload the counter of FWDGT
fwdgt_config	configure counter reload value, and prescaler divider value
fwdgt_flag_get	get flag state of FWDGT

fwdgt_write_enable

The description of fwdgt_write_enable is shown as below:

Table 3-330. Function fwdgt_write_enable

Function name	fwdgt_write_enable
Function prototype	void fwdgt_write_enable(void);
Function descriptions	enable write access to FWDGT_PSC and FWDGT_RLD and FWDGT_WND
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable write access to FWDGT_PSC and FWDGT_RLD and FWDGT_WND */
fwdgt_write_enable();
```

fwdgt_write_disable

The description of fwdgt_write_disable is shown as below:

Table 3-331. Function fwdgt_write_disable

Function name	fwdgt_write_disable
Function prototype	void fwdgt_write_disable(void);
Function descriptions	disable write access to FWDGT_PSC,FWDGT_RLD and FWDGT_WND
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable write access to FWDGT_PSC,FWDGT_RLD and FWDGT_WND */
fwdgt_write_disable();
```

fwdgt_enable

The description of fwdgt_enable is shown as below:

Table 3-332. Function fwdgt_enable

Function name	fwdgt_enable
Function prototype	void fwdgt_enable(void);
Function descriptions	start the FWDGT counter
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* start the free watchdog timer counter */
```

```
fwdgt_enable();
```

fwdgt_prescaler_value_config

The description of fwdgt_prescaler_value_config is shown as below:

Table 3-333. Function fwdgt_prescaler_value_config

Function name	fwdgt_prescaler_value_config
Function prototype	ErrStatus fwdgt_prescaler_value_config(uint16_t prescaler_value);
Function descriptions	configure the FWDGT counter clock prescaler value
Precondition	-
The called functions	-
Input parameter{in}	
prescaler_value	specify prescaler value
FWDGT_PSC_DIV4	FWDGT prescaler set to 4
FWDGT_PSC_DIV8	FWDGT prescaler set to 8
FWDGT_PSC_DIV16	FWDGT prescaler set to 16
FWDGT_PSC_DIV32	FWDGT prescaler set to 32
FWDGT_PSC_DIV64	FWDGT prescaler set to 64
FWDGT_PSC_DIV128	FWDGT prescaler set to 128
FWDGT_PSC_DIV256	FWDGT prescaler set to 256
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR / SUCCESS

Example:

```
/* set FWDGT prescaler to 4 */
```

ErrStatus flag;

```
flag = fwdgt_prescaler_value_config(FWDGT_PSC_DIV4);
```

fwdgt_reload_value_config

The description of fwdgt_reload_value_config is shown as below:

Table 3-334. Function fwdgt_reload_value_config

Function name	fwdgt_reload_value_config
Function prototype	ErrStatus fwdgt_reload_value_config(uint16_t reload_value);
Function descriptions	configure the FWDGT counter reload value
Precondition	-
The called functions	-
Input parameter{in}	
reload_value	reload_value, specify reload value(0x0000 - 0x0FFF)
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR / SUCCESS

Example:

```
/* set FWDGT reload value to 0xFFF */
```

ErrStatus flag;

```
flag = fwdgt_reload_value_config(0xFFF);
```

fwdgt_window_value_config

The description of fwdgt_window_value_config is shown as below:

Table 3-335. Function fwdgt_window_value_config

Function name	fwdgt_window_value_config
Function prototype	ErrStatus fwdgt_window_value_config(uint16_t window_value);
Function descriptions	configure the FWDGT counter window value
Precondition	-
The called functions	-
Input parameter{in}	
window_value	window_value, specify window value(0x0000 - 0x0FFF)
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR / SUCCESS

Example:

```
/* set FWDGT window value to 0xFFFF */
```

```
ErrStatus flag;
```

```
flag = fwdgt_window_value_config(0xFFFF);
```

fwdgt_counter_reload

The description of fwdgt_counter_reload is shown as below:

Table 3-336. Function fwdgt_counter_reload

Function name	fwdgt_counter_reload
Function prototype	void fwdgt_counter_reload(void);
Function descriptions	reload the counter of FWDGT
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reload FWDGT counter */
```

```
fwdgt_counter_reload();
```

fwdgt_config

The description of fwdgt_config is shown as below:

Table 3-337. Function fwdgt_config

Function name	fwdgt_config
Function prototype	ErrStatus fwdgt_config(uint16_t reload_value, uint8_t prescaler_div);
Function descriptions	configure counter reload value, and prescaler divider value
Precondition	-
The called functions	-
Input parameter{in}	
reload_value	specify reload value(0x0000 - 0x0FFF)
Input parameter{in}	
prescaler_div	FWDGT prescaler value
<i>FWDGT_PSC_DIV4</i>	FWDGT prescaler set to 4
<i>FWDGT_PSC_DIV8</i>	FWDGT prescaler set to 8
<i>FWDGT_PSC_DIV16</i>	FWDGT prescaler set to 16
<i>FWDGT_PSC_DIV32</i>	FWDGT prescaler set to 32

<i>FWDGT_PSC_DIV64</i>	FWDGT prescaler set to 64
<i>FWDGT_PSC_DIV128</i>	FWDGT prescaler set to 128
<i>FWDGT_PSC_DIV256</i>	FWDGT prescaler set to 256
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* confiure FWDGT counter clock: 40KHz(IRC40K) / 64 = 0.625 KHz */
```

```
fwdgt_config(2*500, FWDGT_PSC_DIV64);
```

fwdgt_flag_get

The description of fwdgt_flag_get is shown as below:

Table 3-338. Function fwdgt_flag_get

Function name	fwdgt_flag_get
Function prototype	FlagStatus fwdgt_flag_get(uint16_t flag);
Function descriptions	get flag state of FWDGT
Precondition	-
The called functions	-
Input parameter{in}	
flag	flag to get
<i>FWDGT_FLAG_PUD</i>	a write operation to FWDGT_PSC register is on going
<i>FWDGT_FLAG_RUD</i>	a write operation to FWDGT_RLD register is on going
<i>FWDGT_FLAG_WUD</i>	a write operation to FWDGT_WND register is on going
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* test if a prescaler value update is on going */
```

```
FlagStatus status;
```

```
status = fwdgt_flag_get(FWDGT_FLAG_PUD);
```

3.14. GPIO

GPIO is used to implement logic input/output functions for the devices. The GPIO registers are listed in chapter [3.14.1](#), the GPIO firmware functions are introduced in chapter [3.14.2](#).

3.14.1. Descriptions of Peripheral registers

GPIO registers are listed in the table shown as below:

Table 3-339. GPIO Registers

Registers	Descriptions
GPIOx_CTL	GPIO port control register
GPIOx_OMODE	GPIO port output mode register
GPIOx_OSPD	GPIO port output speed register
GPIOx_PUD	GPIO port pull-up/pull-down register
GPIOx_ISTAT	GPIO port input status register
GPIOx_OCTL	GPIO port output control register
GPIOx_BOP	GPIO port bit operation register
GPIOx_LOCK	GPIO port configuration lock register
GPIOx_AFSEL0	GPIO alternate function selected register 0
GPIOx_AFSEL1	GPIO alternate function selected register 1
GPIOx_BC	GPIO bit clear register
GPIOx_TG	GPIO port bit toggle register

3.14.2. Descriptions of Peripheral functions

GPIO firmware functions are listed in the table shown as below:

Table 3-340. GPIO firmware function

Function name	Function description
gpio_deinit	reset GPIO port
gpio_mode_set	set GPIO mode
gpio_output_options_set	set GPIO output type and speed
gpio_bit_set	set GPIO pin bit
gpio_bit_reset	reset GPIO pin bit
gpio_bit_write	write data to the specified GPIO pin
gpio_port_write	write data to the specified GPIO port
gpio_input_bit_get	get GPIO pin input status
gpio_input_port_get	get GPIO port input status
gpio_output_bit_get	get GPIO pin output status
gpio_output_port_get	get GPIO port output status
gpio_af_set	set GPIO alternate function
gpio_pin_lock	lock GPIO pin bit
gpio_bit_toggle	toggle GPIO pin status
gpio_port_toggle	toggle GPIO port status

gpio_deinit

The description of gpio_deinit is shown as below:

Table 3-341. Function gpio_deinit

Function name	gpio_deinit
Function prototype	void gpio_deinit(uint32_t gpio_periph);
Function descriptions	reset GPIO port
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset GPIOA */
gpio_deinit(GPIOA);
```

gpio_mode_set

The description of gpio_mode_set is shown as below:

Table 3-342. Function gpio_mode_set

Function name	gpio_mode_set
Function prototype	void gpio_mode_set(uint32_t gpio_periph, uint32_t mode, uint32_t pull_up_down, uint32_t pin);
Function descriptions	set GPIO mode
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
mode	gpio pin mode
GPIO_MODE_INPUT	input mode
GPIO_MODE_OUTPUT	output mode
GPIO_MODE_AF	alternate function mode
GPIO_MODE_ANALOG	analog mode
Input parameter{in}	
pull_up_down	gpio pin with pull-up or pull-down resistor
GPIO_PUPD_NONE	floating mode, no pull-up and pull-down resistors

<i>GPIO_PUPD_PULLUP</i>	with pull-up resistor
<i>GPIO_PUPD_PULLDOWN</i>	with pull-down resistor
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* config PA0 as input mode with pullup */
```

```
gpio_mode_set(GPIOA, GPIO_MODE_INPUT, GPIO_PUPD_PULLUP, GPIO_PIN_0);
```

gpio_output_options_set

The description of gpio_output_options_set is shown as below:

Table 3-343. Function gpio_output_options_set

Function name	gpio_output_options_set
Function prototype	void gpio_output_options_set(uint32_t gpio_periph, uint8_t otype, uint32_t speed, uint32_t pin);
Function descriptions	set GPIO output type and speed
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
otype	gpio pin output mode
<i>GPIO_OTYPE_PP</i>	push pull mode
<i>GPIO_OTYPE_OD</i>	open drain mode
Input parameter{in}	
speed	gpio pin output max speed
<i>GPIO_OSPEED_2MHZ</i>	output max speed 2MHz
<i>GPIO_OSPEED_10MHZ</i>	output max speed 10MHz
<i>GPIO_OSPEED_50MHZ</i>	output max speed 50MHz
Input parameter{in}	
pin	GPIO pin

<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* config PA0 as push pull mode */
```

```
gpio_output_options_set(GPIOA, GPIO_OTYPE_PP, GPIO_OSPEED_2MHZ,
GPIO_PIN_0);
```

gpio_bit_set

The description of gpio_bit_set is shown as below:

Table 3-344. Function gpio_bit_set

Function name	gpio_bit_set
Function prototype	void gpio_bit_set(uint32_t gpio_periph,uint32_t pin);
Function descriptions	set GPIO pin bit
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set PA0 */
```

```
gpio_bit_set(GPIOA, GPIO_PIN_0);
```

gpio_bit_reset

The description of gpio_bit_reset is shown as below:

Table 3-345. Function gpio_bit_reset

Function name	gpio_bit_reset
Function prototype	void gpio_bit_reset(uint32_t gpio_periph,uint32_t pin);
Function descriptions	reset GPIO pin
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
GPIO_PIN_x	GPIO_PIN_x(x=0..15)
GPIO_PIN_ALL	All pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset PA0 */
```

```
gpio_bit_set(GPIOA, GPIO_PIN_0);
```

gpio_bit_write

The description of gpio_bit_write is shown as below:

Table 3-346. Function gpio_bit_write

Function name	gpio_bit_write
Function prototype	void gpio_bit_write(uint32_t gpio_periph,uint32_t pin,bit_status bit_value);
Function descriptions	write data to the specified GPIO pin
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
GPIO_PIN_x	GPIO_PIN_x(x=0..15)
GPIO_PIN_ALL	All pins
Input parameter{in}	
bit_value	SET or RESET
RESET	clear the port pin
SET	set the port pin

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* write 1 to PA0 */
```

```
gpio_bit_write(GPIOA, GPIO_PIN_0, SET);
```

gpio_port_write

The description of gpio_port_write is shown as below:

Table 3-347. Function gpio_port_write

Function name	gpio_port_write
Function prototype	void gpio_port_write(uint32_t gpio_periph,uint16_t data);
Function descriptions	write data to the specified GPIO port
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
data	specify the value to be written to the port output data register
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*write 1010 0101 1010 0101 to Port A */
```

```
gpio_port_write(GPIOA, 0xA5A5);
```

gpio_input_bit_get

The description of gpio_input_bit_get is shown as below:

Table 3-348. Function gpio_input_bit_get

Function name	gpio_input_bit_get
Function prototype	FlagStatus gpio_input_bit_get(uint32_t gpio_periph,uint32_t pin);
Function descriptions	get GPIO pin input status
Precondition	-
The called functions	-

Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-
Return value	
FlagStatus	SET / RESET

Example:

```
/* get status of PA0 */
```

```
FlagStatus bit_state;
```

```
bit_state = gpio_input_bit_get(GPIOA, GPIO_PIN_0);
```

gpio_input_port_get

The description of gpio_input_port_get is shown as below:

Table 3-349. Function gpio_input_port_get

Function name	gpio_input_port_get
Function prototype	uint16_t gpio_input_port_get(uint32_t gpio_periph);
Function descriptions	get GPIO all pins input status
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Output parameter{out}	
-	-
Return value	
uint16_t	0x0000-0xFFFF

Example:

```
/* get input value of Port A */
```

```
uint16_t port_state;
```

```
port_state = gpio_input_port_get(GPIOA);
```

gpio_output_bit_get

The description of gpio_output_bit_get is shown as below:

Table 3-350. Function gpio_output_bit_get

Function name	gpio_output_bit_get
Function prototype	FlagStatus gpio_output_bit_get(uint32_t gpio_periph,uint32_t pin);
Function descriptions	get GPIO pin output status
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-
Return value	
FlagStatus	SET / RESET

Example:

```
/* get output status of PA0 */
```

```
FlagStatus bit_state;
```

```
bit_state = gpio_output_bit_get(GPIOA, GPIO_PIN_0);
```

gpio_output_port_get

The description of gpio_output_port_get is shown as below:

Table 3-351. Function gpio_output_port_get

Function name	gpio_output_port_get
Function prototype	uint16_t gpio_output_port_get(uint32_t gpio_periph);
Function descriptions	get GPIO all pins output status
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Output parameter{out}	
-	-
Return value	

Uint16_t	0x0000-0xFFFF
----------	---------------

Example:

```
/* get output value of Port A */
```

```
uint16_t port_state;
```

```
port_state = gpio_output_port_get(GPIOA);
```

gpio_af_set

The description of gpio_af_set is shown as below:

Table 3-352. Function gpio_af_set

Function name	gpio_af_set
Function prototype	void gpio_af_set(uint32_t gpio_periph, uint32_t alt_func_num, uint32_t pin);
Function descriptions	set GPIO alternate function
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x =A,B,C,D,F)
Input parameter{in}	
alt_func_num	GPIO pin af function, please refer to specific device datasheet
<i>GPIO_AF_0</i>	SPI0, SPI1, TIMER0, RTC_OUT, CK_OUT, SWDIO, SWCLK, LPTIMER1, TIMER14
<i>GPIO_AF_1</i>	TIMER1, TIMER40, TIMER2, TIMER0, LPTIMER0, TIMER11, TIMER8, LPTIMER1, TIMER14
<i>GPIO_AF_2</i>	LPTIMER0, TIMER8, LPUART0, TIMER14, TIMER11, TIMER0
<i>GPIO_AF_3</i>	SLCD
<i>GPIO_AF_4</i>	I2C0, I2C1, I2C2, UART4, CAN
<i>GPIO_AF_5</i>	SPI0, SPI1, I2S1, I2C2
<i>GPIO_AF_6</i>	SPI1, CMP0, CMP1, I2S1, LPTIMER1, TIMER14
<i>GPIO_AF_7</i>	USART1, TIMER11, USART0, LPUART1, CAN, UART3, UART4, LPUART0
<i>GPIO_AF_8</i>	CTC, LPUART0, UART4, I2C1, CMP1, UART3, TIMER11, CAN, USART1
<i>GPIO_AF_9</i>	EVENTOUT
<i>GPIO_AF_10</i>	TIMER1, TIMER8, TIMER11, TIMER14, TIMER40, I2C1, LPUART1
<i>GPIO_AF_11</i>	TIMER0, TIMER40, I2C1, I2C2, CAN, TIMER11
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
<i>GPIO_PIN_ALL</i>	All pins
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/*set PA0 alternate function 0 */
```

```
gpio_af_set(GPIOA, GPIO_AF_0, GPIO_PIN_0);
```

gpio_pin_lock

The description of gpio_pin_lock is shown as below:

Table 3-353. Function gpio_pin_lock

Function name	gpio_pin_lock
Function prototype	void gpio_pin_lock(uint32_t gpio_periph, uint32_t pin);
Function descriptions	lock GPIO pin bit
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
GPIOx	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
GPIO_PIN_x	GPIO_PIN_x(x=0..15)
GPIO_PIN_ALL	All pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* lock PA0 */
```

```
gpio_pin_lock(GPIOA, GPIO_PIN_0);
```

gpio_bit_toggle

The description of gpio_bit_toggle is shown as below:

Table 3-354. Function gpio_bit_toggle

Function name	gpio_bit_toggle
Function prototype	void gpio_bit_toggle(uint32_t gpio_periph, uint32_t pin);
Function descriptions	toggle GPIO pin status
Precondition	-
The called functions	-

Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Input parameter{in}	
pin	GPIO pin
<i>GPIO_PIN_x</i>	GPIO_PIN_x(x=0..15)
GPIO_PIN_ALL	GPIO_PIN_ALL
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* toggle PA0 */
gpio_bit_toggle(GPIOA, GPIO_PIN_0);
```

gpio_port_toggle

The description of gpio_port_toggle is shown as below:

Table 3-355. Function gpio_port_toggle

Function name	gpio_port_toggle
Function prototype	void gpio_port_toggle(uint32_t gpio_periph);
Function descriptions	toggle GPIO port status
Precondition	-
The called functions	-
Input parameter{in}	
gpio_periph	GPIO port
<i>GPIOx</i>	GPIOx(x = A,B,C,D,F)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* toggle GPIOA */
gpio_port_toggle(GPIOA);
```

3.15. I2C

The I2C (inter-integrated circuit) module provides an I2C interface which is an industry standard two-line serial interface for MCU to communicate with external I2C interface. The

I2C registers are listed in chapter [3.15.1](#), the I2C firmware functions are introduced in chapter [3.15.2](#).

3.15.1. Descriptions of Peripheral registers

I2C registers are listed in the table shown as below:

Table 3-356. I2C Registers

Registers	Descriptions
I2C_CTL0	Control register 0
I2C_CTL1	Control register 1
I2C_SADDR0	Slave address register 0
I2C_SADDR1	Slave address register 1
I2C_TIMING	Timing register
I2C_TIMEOUT	Timeout register
I2C_STAT	Status register
I2C_STATC	Status clear register
I2C_PEC	PEC register
I2C_RDATA	Receive data register
I2C_TDATA	Transmit data register
I2C_CTL2	Control register 2

3.15.2. Descriptions of Peripheral functions

I2C firmware functions are listed in the table shown as below:

Table 3-357. I2C firmware function

Function name	Function description
i2c_deinit	reset I2C
i2c_timing_config	configure the timing parameters
i2c_digital_noise_filter_config	configure digital noise filter
i2c_analog_noise_filter_enable	enable analog noise filter
i2c_analog_noise_filter_disable	disable analog noise filter
i2c_master_clock_config	configure the SCL high and low period of clock in master mode
i2c_master_addressing	configure i2c slave addresss and transfer direction in master mode
i2c_address10_header_enable	10-bit address header executes read direction only in master receive mode
i2c_address10_header_disable	10-bit address header executes complete sequence in master receive mode
i2c_address10_enable	enable 10-bit addressing mode in master mode
i2c_address10_disable	disable 10-bit addressing mode in master mode
i2c_automatic_end_enable	enable I2C automatic end mode in master mode

Function name	Function description
i2c_automatic_end_disable	disable I2C automatic end mode in master mode
i2c_slave_response_to_gcall_enable	enable the response to a general call
i2c_slave_response_to_gcall_disable	disable the response to a general call
i2c_stretch_scl_low_enable	enable to stretch SCL low when data is not ready in slave mode
i2c_stretch_scl_low_disable	disable to stretch SCL low when data is not ready in slave mode
i2c_address_config	configure i2c slave address
i2c_address_bit_compare_config	define which bits of ADDRESS[7:1] need to compare with the incoming address byte
i2c_address_disable	disable i2c address in slave mode
i2c_second_address_config	configure i2c second slave address
i2c_second_address_disable	disable i2c second address in slave mode
i2c_receved_address_get	get received match address in slave mode
i2c_slave_byte_control_enable	enable slave byte control
i2c_slave_byte_control_disable	disable slave byte control
i2c_nack_enable	generate a NACK in slave mode
i2c_nack_disable	generate an ACK in slave mode
i2c_wakeup_from_deepsleep_enable	enable wakeup from Deep-sleep mode
i2c_wakeup_from_deepsleep_disable	disable wakeup from Deep-sleep mode
i2c_enable	enable I2C
i2c_disable	disable I2C
i2c_start_on_bus	generate a START condition on I2C bus
i2c_stop_on_bus	generate a STOP condition on I2C bus
i2c_data_transmit	I2C transmit data
i2c_data_receive	I2C receive data
i2c_reload_enable	enable I2C reload mode
i2c_reload_disable	disable I2C reload mode
i2c_transfer_byte_number_config	configure number of bytes to be transferred
i2c_dma_enable	enable I2C DMA for transmission or reception
i2c_dma_disable	disable I2C DMA for transmission or reception
i2c_pec_transfer	I2C transfers PEC value
i2c_pec_enable	enable I2C PEC calculation
i2c_pec_disable	disable I2C PEC calculation
i2c_pec_value_get	get packet error checking value
i2c_smbus_alert_enable	enable SMBus Alert
i2c_smbus_alert_disable	disable SMBus Alert
i2c_smbus_default_addr_enable	enable SMBus device default address
i2c_smbus_default_addr_disable	disable SMBus device default address
i2c_smbus_host_addr_enable	enable SMBus Host address
i2c_smbus_host_addr_disable	disable SMBus Host address

Function name	Function description
i2c_extented_clock_timeout_enable	enable extended clock timeout detection
i2c_extented_clock_timeout_disable	disable extended clock timeout detection
i2c_clock_timeout_enable	enable clock timeout detection
i2c_clock_timeout_disable	disable clock timeout detection
i2c_bus_timeout_b_config	configure bus timeout B
i2c_bus_timeout_a_config	configure bus timeout A
i2c_idle_clock_timeout_config	configure idle clock timeout detection
i2c_flag_get	get I2C flag status
i2c_flag_clear	clear I2C flag status
i2c_interrupt_enable	enable I2C interrupt
i2c_interrupt_disable	disable I2C interrupt
i2c_interrupt_flag_get	get I2C interrupt flag status
i2c_interrupt_flag_clear	clear I2C interrupt flag status

Enum i2c_interrupt_flag_enum

Table 3-358. i2c_interrupt_flag_enum

Member name	Function description
I2C_INT_FLAG_TI	transmit interrupt flag
I2C_INT_FLAG_RBNE	I2C_RDATA is not empty during receiving interrupt flag
I2C_INT_FLAG_ADDSEND	address received matches in slave mode interrupt flag
I2C_INT_FLAG_NACK	not acknowledge interrupt flag
I2C_INT_FLAG_STPDET	stop condition detected in slave mode interrupt flag
I2C_INT_FLAG_TC	transfer complete in master mode interrupt flag
I2C_INT_FLAG_TCR	transfer complete reload interrupt flag
I2C_INT_FLAG_BERR	bus error interrupt flag
I2C_INT_FLAG_LOSTARB	arbitration lost interrupt flag
I2C_INT_FLAG_OUERR	overflow/underrun error in slave mode interrupt flag
I2C_INT_FLAG_PECERR	PEC error interrupt flag
I2C_INT_FLAG_TIMEOUT	timeout interrupt flag
I2C_INT_FLAG_SMBALT	SMBus Alert interrupt flag

i2c_deinit

The description of i2c_deinit is shown as below:

Table 3-359. Function i2c_deinit

Function name	i2c_deinit
Function prototype	void i2c_deinit(uint32_t i2c_periph);
Function descriptions	reset I2C
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	

i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset I2C0 */
```

```
i2c_deinit(I2C0);
```

i2c_timing_config

The description of i2c_timing_config is shown as below:

Table 3-360. Function i2c_timing_config

Function name	i2c_timing_config
Function prototype	void i2c_timing_config(uint32_t i2c_periph, uint32_t psc, uint32_t scl_dely, uint32_t sda_dely);
Function descriptions	configure the timing parameters
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
psc	0-0xf, timing prescaler
Input parameter{in}	
scl_dely	0-0xf, data setup time
Input parameter{in}	
sda_dely	0-0xf, data hold time
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the timing parameters */
```

```
i2c_timing_config(I2C0, 0x1, 0x2, 0x1);
```

i2c_digital_noise_filter_config

The description of i2c_digital_noise_filter_config is shown as below:

Table 3-361. Function `i2c_digital_noise_filter_config`

Function name	<code>i2c_digital_noise_filter_config</code>
Function prototype	<code>void i2c_digital_noise_filter_config(uint32_t i2c_periph, uint32_t filter_length);</code>
Function descriptions	configure digital noise filter
Precondition	-
The called functions	-
Input parameter{in}	
<code>i2c_periph</code>	I2C peripheral
<code>I2Cx</code>	(x=0,1,2)
Input parameter{in}	
<code>filter_length</code>	<code>filter_length</code>
<code>FILTER_DISABLE</code>	digital filter is disabled
<code>FILTER_LENGTH_1</code>	digital filter is enabled and filter spikes with a length of up to 1 t_{I2CCLK}
<code>FILTER_LENGTH_2</code>	digital filter is enabled and filter spikes with a length of up to 2 t_{I2CCLK}
<code>FILTER_LENGTH_3</code>	digital filter is enabled and filter spikes with a length of up to 3 t_{I2CCLK}
<code>FILTER_LENGTH_4</code>	digital filter is enabled and filter spikes with a length of up to 4 t_{I2CCLK}
<code>FILTER_LENGTH_5</code>	digital filter is enabled and filter spikes with a length of up to 5 t_{I2CCLK}
<code>FILTER_LENGTH_6</code>	digital filter is enabled and filter spikes with a length of up to 6 t_{I2CCLK}
<code>FILTER_LENGTH_7</code>	digital filter is enabled and filter spikes with a length of up to 7 t_{I2CCLK}
<code>FILTER_LENGTH_8</code>	digital filter is enabled and filter spikes with a length of up to 8 t_{I2CCLK}
<code>FILTER_LENGTH_9</code>	digital filter is enabled and filter spikes with a length of up to 9 t_{I2CCLK}
<code>FILTER_LENGTH_10</code>	digital filter is enabled and filter spikes with a length of up to 10 t_{I2CCLK}
<code>FILTER_LENGTH_11</code>	digital filter is enabled and filter spikes with a length of up to 11 t_{I2CCLK}
<code>FILTER_LENGTH_12</code>	digital filter is enabled and filter spikes with a length of up to 12 t_{I2CCLK}
<code>FILTER_LENGTH_13</code>	digital filter is enabled and filter spikes with a length of up to 13 t_{I2CCLK}
<code>FILTER_LENGTH_14</code>	digital filter is enabled and filter spikes with a length of up to 14 t_{I2CCLK}
<code>FILTER_LENGTH_15</code>	digital filter is enabled and filter spikes with a length of up to 15 t_{I2CCLK}
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* I2C0 digital filter filters spikes with a length of up to 1 tI2CCLK */
```

```
i2c_digital_noise_filter_config(I2C0, FILTER_LENGTH_1);
```

`i2c_analog_noise_filter_enable`

The description of `i2c_analog_noise_filter_enable` is shown as below:

Table 3-362. Function `i2c_analog_noise_filter_enable`

Function name	<code>i2c_analog_noise_filter_enable</code>
---------------	---

Function prototype	void i2c_analog_noise_filter_enable(uint32_t i2c_periph);
Function descriptions	enable analog noise filter
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable analog noise filter */

i2c_analog_noise_filter_enable(I2C0);
```

i2c_analog_noise_filter_disable

The description of i2c_analog_noise_filter_disable is shown as below:

Table 3-363. Function i2c_analog_noise_filter_disable

Function name	i2c_analog_noise_filter_disable
Function prototype	void i2c_analog_noise_filter_disable(uint32_t i2c_periph);
Function descriptions	disable analog noise filter
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable analog noise filter */

i2c_analog_noise_filter_disable(I2C0);
```

i2c_master_clock_config

The description of i2c_master_clock_config is shown as below:

Table 3-364. Function i2c_master_clock_config

Function name	i2c_master_clock_config
Function prototype	void i2c_master_clock_config(uint32_t i2c_periph, uint32_t sclh, uint32_t scll);
Function descriptions	configure the SCL high and low period of clock in master mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Input parameter{in}	
sclh	0-0xff, SCL high period
Input parameter{in}	
scll	0-0xff, SCL low period
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the SCL and SDA period of clock in master mode */
```

```
i2c_master_clock_config(I2C0, 0x0f, 0x0f);
```

i2c_master_addressing

The description of i2c_master_addressing is shown as below:

Table 3-365. Function i2c_master_addressing

Function name	i2c_master_addressing
Function prototype	void i2c_master_addressing(uint32_t i2c_periph, uint32_t address, uint32_t trans_direction);
Function descriptions	configure i2c slave addresss and transfer direction in master mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Input parameter{in}	
address	0-0x3FF except reserved address, I2C slave address to be sent
Input parameter{in}	
trans_direction	I2C transfer direction in master mode
I2C_MASTER_TRANS MIT	master transmit

<i>I2C_MASTER_RECEIVE</i> <i>E</i>	master receive
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* send slave address to I2C bus */
```

```
i2c_master_addressing(I2C0, 0x82, I2C_MASTER_TRANSMIT);
```

i2c_address10_header_enable

The description of i2c_address10_header_enable is shown as below:

Table 3-366. Function i2c_address10_header_enable

Function name	i2c_address10_header_enable
Function prototype	void i2c_address10_header_enable(uint32_t i2c_periph);
Function descriptions	10-bit address header executes read direction only in master receive mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* 10-bit address header executes read direction only in master receive mode */
```

```
i2c_address10_header_enable(I2C0);
```

i2c_address10_header_disable

The description of i2c_address10_header_disable is shown as below:

Table 3-367. Function i2c_address10_header_disable

Function name	i2c_address10_header_disable
Function prototype	void i2c_address10_header_disable(uint32_t i2c_periph);
Function descriptions	10-bit address header executes complete sequence in master receive mode
Precondition	-
The called functions	-

Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* 10-bit address header executes complete sequence in master receive mode */
```

```
i2c_address10_header_disable(I2C0);
```

i2c_address10_enable

The description of i2c_address10_enable is shown as below:

Table 3-368. Function i2c_address10_enable

Function name	i2c_address10_enable
Function prototype	void i2c_address10_enable(uint32_t i2c_periph);
Function descriptions	enable 10-bit addressing mode in master mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable 10-bit addressing mode in master mode */
```

```
i2c_address10_enable(I2C0);
```

i2c_address10_disable

The description of i2c_address10_disable is shown as below:

Table 3-369. Function i2c_address10_disable

Function name	i2c_address10_disable
Function prototype	void i2c_address10_disable(uint32_t i2c_periph);
Function descriptions	disable 10-bit addressing mode in master mode
Precondition	-

The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable 10-bit addressing mode in master mode */
```

```
i2c_address10_disable(I2C0);
```

i2c_automatic_end_enable

The description of i2c_automatic_end_enable is shown as below:

Table 3-370. Function i2c_automatic_end_enable

Function name	i2c_automatic_end_enable
Function prototype	void i2c_automatic_end_enable(uint32_t i2c_periph);
Function descriptions	enable I2C automatic end mode in master mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C automatic end mode in master mode */
```

```
i2c_automatic_end_enable(I2C0);
```

i2c_automatic_end_disable

The description of i2c_automatic_end_disable is shown as below:

Table 3-371. Function i2c_automatic_end_disable

Function name	i2c_automatic_end_disable
Function prototype	void i2c_automatic_end_disable(uint32_t i2c_periph);
Function descriptions	disable I2C automatic end mode in master mode

Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C automatic end mode in master mode */
```

```
i2c_automatic_end_disable(I2C0);
```

i2c_slave_response_to_gcall_enable

The description of i2c_slave_response_to_gcall_enable is shown as below:

Table 3-372. Function i2c_slave_response_to_gcall_enable

Function name	i2c_slave_response_to_gcall_enable
Function prototype	void i2c_slave_response_to_gcall_enable(uint32_t i2c_periph);
Function descriptions	enable the response to a general call
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the response to a general call */
```

```
i2c_slave_response_to_gcall_enable(I2C0);
```

i2c_slave_response_to_gcall_disable

The description of i2c_slave_response_to_gcall_disable is shown as below:

Table 3-373. Function i2c_slave_response_to_gcall_disable

Function name	i2c_slave_response_to_gcall_disable
Function prototype	void i2c_slave_response_to_gcall_disable(uint32_t i2c_periph);

Function descriptions	disable the response to a general call
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the response to a general call */
i2c_slave_response_to_gcall_disable(I2C0);
```

i2c_stretch_scl_low_enable

The description of i2c_stretch_scl_low_enable is shown as below:

Table 3-374. Function i2c_stretch_scl_low_enable

Function name	i2c_stretch_scl_low_enable
Function prototype	void i2c_stretch_scl_low_enable(uint32_t i2c_periph);
Function descriptions	enable to stretch SCL low when data is not ready in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable to stretch SCL low when data is not ready in slave mode */
i2c_stretch_scl_low_enable(I2C0);
```

i2c_stretch_scl_low_disable

The description of i2c_stretch_scl_low_disable is shown as below:

Table 3-375. Function i2c_stretch_scl_low_disable

Function name	i2c_stretch_scl_low_disable
----------------------	-----------------------------

Function prototype	void i2c_stretch_scl_low_disable(uint32_t i2c_periph);
Function descriptions	disable to stretch SCL low when data is not ready in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable to stretch SCL low when data is not ready in slave mode */
```

```
i2c_stretch_scl_low_disable(I2C0);
```

i2c_address_config

The description of i2c_address_config is shown as below:

Table 3-376. Function i2c_address_config

Function name	i2c_address_config
Function prototype	void i2c_address_config(uint32_t i2c_periph, uint32_t address, uint32_t addr_format);
Function descriptions	configure i2c slave address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
address	I2C address
Input parameter{in}	
addr_format	7bits or 10bits
<i>I2C_ADDFORMAT_7BITS</i>	7bits
<i>I2C_ADDFORMAT_10BITS</i>	10bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure i2c slave address */
```

```
i2c_address_config(I2C0, 0x82, I2C_ADDFORMAT_7BITS);
```

i2c_address_bit_compare_config

The description of i2c_address_bit_compare_config is shown as below:

Table 3-377. Function i2c_address_bit_compare_config

Function name	i2c_address_bit_compare_config
Function prototype	void i2c_address_bit_compare_config(uint32_t i2c_periph, uint32_t compare_bits);
Function descriptions	define which bits of ADDRESS[7:1] need to compare with the incoming address byte
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
compare_bits	the bits need to compare
<i>ADDRESS_BIT1_COMPARE</i>	address bit1 needs compare
<i>ADDRESS_BIT2_COMPARE</i>	address bit2 needs compare
<i>ADDRESS_BIT3_COMPARE</i>	address bit3 needs compare
<i>ADDRESS_BIT4_COMPARE</i>	address bit4 needs compare
<i>ADDRESS_BIT5_COMPARE</i>	address bit5 needs compare
<i>ADDRESS_BIT6_COMPARE</i>	address bit6 needs compare
<i>ADDRESS_BIT7_COMPARE</i>	address bit7 needs compare
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* bit 1 of ADDRESS[7:1] need to compare with the incoming address byte */
```

```
i2c_address_bit_compare_config(I2C0, ADDRESS_BIT1_COMPARE);
```

i2c_address_disable

The description of i2c_address_disable is shown as below:

Table 3-378. Function i2c_address_disable

Function name	i2c_address_disable
Function prototype	void i2c_address_disable(uint32_t i2c_periph);
Function descriptions	disable i2c address in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable i2c address in slave mode */
```

```
i2c_address_disable(I2C0);
```

i2c_second_address_config

The description of i2c_second_address_config is shown as below:

Table 3-379. Function i2c_second_address_config

Function name	i2c_second_address_config
Function prototype	void i2c_second_address_config(uint32_t i2c_periph, uint32_t address, uint32_t addr_mask);
Function descriptions	configure i2c second slave address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
address	I2C address
Input parameter{in}	
addr_mask	the bits not need to compare
<i>ADDRESS2_NO_MASK</i> <i>K</i>	no mask, all the bits must be compared
<i>ADDRESS2_MASK_BIT1</i> <i>T1</i>	ADDRESS2[1] is masked, only ADDRESS2[7:2] are compared

ADDRESS2_MASK_BIT1_2	ADDRESS2[2:1] is masked, only ADDRESS2[7:3] are compared
ADDRESS2_MASK_BIT1_3	ADDRESS2[3:1] is masked, only ADDRESS2[7:4] are compared
ADDRESS2_MASK_BIT1_4	ADDRESS2[4:1] is masked, only ADDRESS2[7:5] are compared
ADDRESS2_MASK_BIT1_5	ADDRESS2[5:1] is masked, only ADDRESS2[7:6] are compared
ADDRESS2_MASK_BIT1_6	ADDRESS2[6:1] is masked, only ADDRESS2[7] are compared
ADDRESS2_MASK_ALL	all the ADDRESS2[7:1] bits are masked
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure i2c second slave address */
```

```
i2c_second_address_config(I2C0, 0x82, ADDRESS2_MASK_BIT1_2);
```

i2c_second_address_disable

The description of i2c_second_address_disable is shown as below:

Table 3-380. Function i2c_second_address_disable

Function name	i2c_second_address_disable
Function prototype	void i2c_second_address_disable(uint32_t i2c_periph);
Function descriptions	disable i2c second address in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable i2c second address in slave mode */
```

```
i2c_second_address_disable(I2C0);
```

i2c_receved_address_get

The description of i2c_receved_address_get is shown as below:

Table 3-381. Function i2c_receved_address_get

Function name	i2c_receved_address_get
Function prototype	uint32_t i2c_receved_address_get(uint32_t i2c_periph);
Function descriptions	get received match address in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
uint32_t	0x00..0x7F

Example:

```
/* get received match address in slave mode */
```

```
uint32_t address;
```

```
address = i2c_receved_address_get(I2C0);
```

i2c_slave_byte_control_enable

The description of i2c_slave_byte_control_enable is shown as below:

Table 3-382. Function i2c_slave_byte_control_enable

Function name	i2c_slave_byte_control_enable
Function prototype	void i2c_slave_byte_control_enable(uint32_t i2c_periph);
Function descriptions	enable slave byte control
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable slave byte control */
```

```
i2c_slave_byte_control_enable(I2C0);
```

i2c_slave_byte_control_disable

The description of i2c_slave_byte_control_disable is shown as below:

Table 3-383. Function i2c_slave_byte_control_disable

Function name	i2c_slave_byte_control_disable
Function prototype	void i2c_slave_byte_control_disable(uint32_t i2c_periph);
Function descriptions	disable slave byte control
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable slave byte control */
```

```
i2c_slave_byte_control_disable(I2C0);
```

i2c_nack_enable

The description of i2c_nack_enable is shown as below:

Table 3-384. Function i2c_nack_enable

Function name	i2c_nack_enable
Function prototype	void i2c_nack_enable(uint32_t i2c_periph);
Function descriptions	generate a NACK in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* generate a NACK in slave mode */
```

```
i2c_nack_enable(I2C0);
```

i2c_nack_disable

The description of i2c_nack_disable is shown as below:

Table 3-385. Function i2c_nack_disable

Function name	i2c_nack_disable
Function prototype	void i2c_nack_disable(uint32_t i2c_periph);
Function descriptions	generate a ACK in slave mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* generate a ACK in slave mode */
```

```
i2c_nack_disable(I2C0);
```

i2c_wakeup_from_deepsleep_enable

The description of i2c_wakeup_from_deepsleep_enable is shown as below:

Table 3-386. Function i2c_wakeup_from_deepsleep_enable

Function name	i2c_wakeup_from_deepsleep_enable
Function prototype	void i2c_wakeup_from_deepsleep_enable(uint32_t i2c_periph);
Function descriptions	enable wakeup from Deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable wakeup from Deep-sleep mode */
```

```
i2c_wakeup_from_deepsleep_enable(I2C0);
```

i2c_wakeup_from_deepsleep_disable

The description of i2c_wakeup_from_deepsleep_disable is shown as below:

Table 3-387. Function i2c_wakeup_from_deepsleep_disable

Function name	i2c_wakeup_from_deepsleep_disable
Function prototype	void i2c_wakeup_from_deepsleep_disable(uint32_t i2c_periph);
Function descriptions	disable wakeup from Deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable wakeup from Deep-sleep mode */
```

```
i2c_wakeup_from_deepsleep_disable(I2C0);
```

i2c_enable

The description of i2c_enable is shown as below:

Table 3-388. Function i2c_enable

Function name	i2c_enable
Function prototype	void i2c_enable(uint32_t i2c_periph);
Function descriptions	enable I2C
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C0 */
```

```
i2c_enable(I2C0);
```

i2c_disable

The description of i2c_disable is shown as below:

Table 3-389. Function i2c_disable

Function name	i2c_disable
Function prototype	void i2c_disable(uint32_t i2c_periph);
Function descriptions	disable I2C
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C0 */
```

```
i2c_disable(I2C0);
```

i2c_start_on_bus

The description of i2c_start_on_bus is shown as below:

Table 3-390. Function i2c_start_on_bus

Function name	i2c_start_on_bus
Function prototype	void i2c_start_on_bus(uint32_t i2c_periph);
Function descriptions	generate a START condition on I2C bus
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* I2C0 send a start condition to I2C bus */
```

```
i2c_start_on_bus(I2C0);
```

i2c_stop_on_bus

The description of i2c_stop_on_bus is shown as below:

Table 3-391. Function i2c_stop_on_bus

Function name	i2c_stop_on_bus
Function prototype	void i2c_stop_on_bus(uint32_t i2c_periph);
Function descriptions	generate a STOP condition on I2C bus
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* I2C0 generate a STOP condition to I2C bus */
```

```
i2c_stop_on_bus(I2C0);
```

i2c_data_transmit

The description of i2c_data_transmit is shown as below:

Table 3-392. Function i2c_data_transmit

Function name	i2c_data_transmit
Function prototype	void i2c_data_transmit(uint32_t i2c_periph, uint32_t data);
Function descriptions	I2C transmit data
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
data	transmit data
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* I2C0 transmit data */
```

```
i2c_data_transmit(I2C0, 0x80);
```

i2c_data_receive

The description of i2c_data_receive is shown as below:

Table 3-393. Function i2c_data_receive

Function name	i2c_data_receive
Function prototype	uint32_t i2c_data_receive(uint32_t i2c_periph);
Function descriptions	I2C receive data
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
uint32_t	0x0000..0x00FF

Example:

```
/* I2C0 receive data */
```

```
uint32_t i2c_receiver;
```

```
i2c_receiver = i2c_data_receive(I2C0);
```

i2c_reload_enable

The description of i2c_reload_enable is shown as below:

Table 3-394. Function i2c_reload_enable

Function name	i2c_reload_enable
Function prototype	void i2c_reload_enable(uint32_t i2c_periph);
Function descriptions	enable I2C reload mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C reload mode */
```

```
i2c_reload_enable(I2C0);
```

i2c_reload_disable

The description of i2c_reload_disable is shown as below:

Table 3-395. Function i2c_reload_disable

Function name	i2c_reload_disable
Function prototype	void i2c_reload_disable(uint32_t i2c_periph);
Function descriptions	disable I2C reload mode
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C reload mode */
```

```
i2c_reload_disable(I2C0);
```

i2c_transfer_byte_number_config

The description of i2c_transfer_byte_number_config is shown as below:

Table 3-396. Function i2c_transfer_byte_number_config

Function name	i2c_transfer_byte_number_config
Function prototype	void i2c_transfer_byte_number_config(uint32_t i2c_periph, uint32_t byte_number);
Function descriptions	configure number of bytes to be transferred
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
byte_number	0x0-0xFF, number of bytes to be transferred
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* configure number of bytes to be transferred */
```

```
i2c_transfer_byte_number_config(I2C0, 0xFF);
```

i2c_dma_enable

The description of i2c_dma_enable is shown as below:

Table 3-397. Function i2c_dma_enable

Function name	i2c_dma_enable
Function prototype	void i2c_dma_enable(uint32_t i2c_periph, uint8_t dma);
Function descriptions	enable I2C DMA for transmission or reception
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
dma	I2C DMA
<i>I2C_DMA_TRANSMIT</i>	transmit data using DMA
<i>I2C_DMA_RECEIVE</i>	receive data using DMA
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C DMA for transmission or reception */
```

```
i2c_dma_enable(I2C0, I2C_DMA_RECEIVE);
```

i2c_dma_disable

The description of i2c_dma_disable is shown as below:

Table 3-398. Function i2c_dma_disable

Function name	i2c_dma_disable
Function prototype	void i2c_dma_disable(uint32_t i2c_periph, uint8_t dma);
Function descriptions	disable I2C DMA for transmission or reception
Precondition	-

The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
dma	I2C DMA
<i>I2C_DMA_TRANSMIT</i>	transmit data using DMA
<i>I2C_DMA_RECEIVE</i>	receive data using DMA
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C DMA for transmission or reception */
```

```
i2c_dma_disable(I2C0, I2C_DMA_RECEIVE);
```

i2c_pec_transfer

The description of i2c_pec_transfer is shown as below:

Table 3-399. Function i2c_pec_transfer

Function name	i2c_pec_transfer
Function prototype	void i2c_pec_transfer(uint32_t i2c_periph);
Function descriptions	I2C transfers PEC value
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* I2C transfers PEC value */
```

```
i2c_pec_transfer(I2C0);
```

i2c_pec_enable

The description of i2c_pec_enable is shown as below:

Table 3-400. Function i2c_pec_enable

Function name	i2c_pec_enable
Function prototype	void i2c_pec_enable(uint32_t i2c_periph);
Function descriptions	enable I2C PEC calculation
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C PEC calculation */
i2c_pec_enable(I2C0);
```

i2c_pec_disable

The description of i2c_pec_disable is shown as below:

Table 3-401. Function i2c_pec_disable

Function name	i2c_pec_disable
Function prototype	void i2c_pec_disable(uint32_t i2c_periph);
Function descriptions	disable I2C PEC calculation
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C PEC calculation */
i2c_pec_disable(I2C0);
```

i2c_pec_value_get

The description of i2c_pec_value_get is shown as below:

Table 3-402. Function i2c_pec_value_get

Function name	i2c_pec_value_get
Function prototype	uint32_t i2c_pec_value_get(uint32_t i2c_periph);
Function descriptions	get packet error checking value
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
uint32_t	PEC value

Example:

```
/* I2C0 get packet error checking value */
uint32_t pec_value;
pec_value = i2c_pec_value_get(I2C0);
```

i2c_smbus_alert_enable

The description of i2c_smbus_alert_enable is shown as below:

Table 3-403. Function i2c_smbus_alert_enable

Function name	i2c_smbus_alert_enable
Function prototype	void i2c_smbus_alert_enable(uint32_t i2c_periph);
Function descriptions	enable SMBus Alert
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SMBus Alert */
i2c_smbus_alert_enable(I2C0);
```

i2c_smbus_alert_disable

The description of i2c_smbus_alert_disable is shown as below:

Table 3-404. Function i2c_smbus_alert_disable

Function name	i2c_smbus_alert_disable
Function prototype	void i2c_smbus_alert_disable(uint32_t i2c_periph);
Function descriptions	disable SMBus Alert
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SMBus Alert */
i2c_smbus_alert_disable(I2C0);
```

i2c_smbus_default_addr_enable

The description of i2c_smbus_default_addr_enable is shown as below:

Table 3-405. Function i2c_smbus_default_addr_enable

Function name	i2c_smbus_default_addr_enable
Function prototype	void i2c_smbus_default_addr_enable(uint32_t i2c_periph);
Function descriptions	enable SMBus device default address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SMBus device default address */
i2c_smbus_default_addr_enable(I2C0);
```

i2c_smbus_default_addr_disable

The description of i2c_smbus_default_addr_disable is shown as below:

Table 3-406. Function i2c_smbus_default_addr_disable

Function name	i2c_smbus_default_addr_disable
Function prototype	void i2c_smbus_default_addr_disable(uint32_t i2c_periph);
Function descriptions	disable SMBus device default address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SMBus device default address */
```

```
i2c_smbus_default_addr_disable(I2C0);
```

i2c_smbus_host_addr_enable

The description of i2c_smbus_host_addr_enable is shown as below:

Table 3-407. Function i2c_smbus_host_addr_enable

Function name	i2c_smbus_host_addr_enable
Function prototype	void i2c_smbus_host_addr_enable(uint32_t i2c_periph);
Function descriptions	enable SMBus Host address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SMBus Host address */
```

```
i2c_smbus_host_addr_enable(I2C0);
```

i2c_smbus_host_addr_disable

The description of i2c_smbus_host_addr_disable is shown as below:

Table 3-408. Function i2c_smbus_host_addr_disable

Function name	i2c_smbus_host_addr_disable
Function prototype	void i2c_smbus_host_addr_disable(uint32_t i2c_periph);
Function descriptions	disable SMBus Host address
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SMBus Host address */
```

```
i2c_smbus_host_addr_disable(I2C0);
```

i2c_extented_clock_timeout_enable

The description of i2c_extented_clock_timeout_enable is shown as below:

Table 3-409. Function i2c_extented_clock_timeout_enable

Function name	i2c_extented_clock_timeout_enable
Function prototype	void i2c_extented_clock_timeout_enable(uint32_t i2c_periph);
Function descriptions	enable extended clock timeout detection
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable extended clock timeout detection */
```

```
i2c_extented_clock_timeout_enable(I2C0);
```


i2c_extented_clock_timeout_disable

The description of i2c_extented_clock_timeout_disable is shown as below:

Table 3-410. Function i2c_extented_clock_timeout_disable

Function name	i2c_extented_clock_timeout_disable
Function prototype	void i2c_extented_clock_timeout_disable(uint32_t i2c_periph);
Function descriptions	disable extended clock timeout detection
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable extended clock timeout detection */
```

```
i2c_extented_clock_timeout_disable(I2C0);
```

i2c_clock_timeout_enable

The description of i2c_clock_timeout_enable is shown as below:

Table 3-411. Function i2c_clock_timeout_enable

Function name	i2c_clock_timeout_enable
Function prototype	void i2c_clock_timeout_enable(uint32_t i2c_periph);
Function descriptions	enable clock timeout detection
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable clock timeout detection */
```

```
i2c_clock_timeout_enable(I2C0);
```

i2c_clock_timeout_disable

The description of i2c_clock_timeout_disable is shown as below:

Table 3-412. Function i2c_clock_timeout_disable

Function name	i2c_clock_timeout_disable
Function prototype	void i2c_clock_timeout_disable(uint32_t i2c_periph);
Function descriptions	disable clock timeout detection
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable clock timeout detection */
```

```
i2c_clock_timeout_disable(I2C0);
```

i2c_bus_timeout_b_config

The description of i2c_bus_timeout_b_config is shown as below:

Table 3-413. Function i2c_bus_timeout_b_config

Function name	i2c_bus_timeout_b_config
Function prototype	void i2c_bus_timeout_b_config(uint32_t i2c_periph, uint32_t timeout);
Function descriptions	configure bus timeout B
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
timeout	0-0xffff, bus timeout B
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure bus timeout B */
```

```
i2c_bus_timeout_b_config(I2C0, 0xff);
```

i2c_bus_timeout_a_config

The description of i2c_bus_timeout_a_config is shown as below:

Table 3-414. Function i2c_bus_timeout_a_config

Function name	i2c_bus_timeout_a_config
Function prototype	void i2c_bus_timeout_a_config(uint32_t i2c_periph, uint32_t timeout);
Function descriptions	configure bus timeout A
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
timeout	0-0xffff, bus timeout A
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure bus timeout A */
```

```
i2c_bus_timeout_a_config(I2C0, 0xff);
```

i2c_idle_clock_timeout_config

The description of i2c_idle_clock_timeout_config is shown as below:

Table 3-415. Function i2c_idle_clock_timeout_config

Function name	i2c_idle_clock_timeout_config
Function prototype	void i2c_idle_clock_timeout_config(uint32_t i2c_periph, uint32_t timeout);
Function descriptions	configure idle clock timeout detection
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
timeout	bus timeout A
<i>BUSTOA_DETECT_SCL_LOW</i>	BUSTOA is used to detect SCL low timeout
<i>BUSTOA_DETECT_ID</i>	BUSTOA is used to detect both SCL and SDA high timeout when the bus is

<i>LE</i>	idle
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure idle clock timeout detection */
```

```
i2c_idle_clock_timeout_config(I2C0, BUSTOA_DETECT_SCL_LOW);
```

i2c_flag_get

The description of i2c_flag_get is shown as below:

Table 3-416. Function i2c_flag_get

Function name	i2c_flag_get
Function prototype	FlagStatus i2c_flag_get(uint32_t i2c_periph, uint32_t flag);
Function descriptions	get I2C flag status
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
flag	I2C flags
<i>I2C_FLAG_TBE</i>	I2C_TDATA is empty during transmitting
<i>I2C_FLAG_TI</i>	transmit interrupt
<i>I2C_FLAG_RBNE</i>	I2C_RDATA is not empty during receiving
<i>I2C_FLAG_ADDSEND</i>	address received matches in slave mode
<i>I2C_FLAG_NACK</i>	not acknowledge flag
<i>I2C_FLAG_STPDET</i>	STOP condition detected in slave mode
<i>I2C_FLAG_TC</i>	transfer complete in master mode
<i>I2C_FLAG_TCR</i>	transfer complete reload
<i>I2C_FLAG_BERR</i>	bus error
<i>I2C_FLAG_LOSTARB</i>	arbitration Lost
<i>I2C_FLAG_OUERR</i>	overrun/underrun error in slave mode
<i>I2C_FLAG_PECERR</i>	PEC error
<i>I2C_FLAG_TIMEOUT</i>	timeout flag
<i>I2C_FLAG_SMBALT</i>	SMBus Alert
<i>I2C_FLAG_I2CBSY</i>	busy flag
<i>I2C_FLAG_TR</i>	whether the I2C is a transmitter or a receiver in slave mode
Output parameter{out}	
-	-

Return value	
FlagStatus	SET / RESET

Example:

```
/* get I2C flag status */
```

```
FlagStatus flag_state = RESET;
```

```
flag_state = i2c_flag_get(I2C0, I2C_FLAG_TBE);
```

i2c_flag_clear

The description of i2c_flag_clear is shown as below:

Table 3-417. Function i2c_flag_clear

Function name	i2c_flag_clear
Function prototype	void i2c_flag_clear(uint32_t i2c_periph, uint32_t flag);
Function descriptions	clear I2C flag status
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
I2Cx	(x=0,1,2)
Input parameter{in}	
flag	I2C flags
I2C_FLAG_ADDSEND	address received matches in slave mode
I2C_FLAG_NACK	not acknowledge flag
I2C_FLAG_STPDET	STOP condition detected in slave mode
I2C_FLAG_BERR	bus error
I2C_FLAG_LOSTARB	arbitration Lost
I2C_FLAG_OUERR	overflow/underrun error in slave mode
I2C_FLAG_PECERR	PEC error
I2C_FLAG_TIMEOUT	timeout flag
I2C_FLAG_SMBALT	SMBus Alert
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear a bus error flag*/
```

```
i2c_flag_clear(I2C0, I2C_FLAG_BERR);
```

i2c_interrupt_enable

The description of i2c_interrupt_enable is shown as below:

Table 3-418. Function i2c_interrupt_enable

Function name	i2c_interrupt_enable
Function prototype	void i2c_interrupt_enable(uint32_t i2c_periph, uint32_t interrupt);
Function descriptions	enable I2C interrupt
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
interrupt	I2C interrupts
<i>I2C_INT_ERR</i>	error interrupt
<i>I2C_INT_TC</i>	transfer complete interrupt
<i>I2C_INT_STPDET</i>	stop detection interrupt
<i>I2C_INT_NACK</i>	not acknowledge received interrupt
<i>I2C_INT_ADDM</i>	address match interrupt
<i>I2C_INT_RBNE</i>	receive interrupt
<i>I2C_INT_TI</i>	transmit interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2C0 transmit interrupt */
```

```
i2c_interrupt_enable(I2C0, I2C_INT_TI);
```

i2c_interrupt_disable

The description of i2c_interrupt_disable is shown as below:

Table 3-419. Function i2c_interrupt_disable

Function name	i2c_interrupt_disable
Function prototype	void i2c_interrupt_disable(uint32_t i2c_periph, uint32_t interrupt);
Function descriptions	disable I2C interrupt
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)

Input parameter{in}	
interrupt	I2C interrupts
<i>I2C_INT_ERR</i>	error interrupt
<i>I2C_INT_TC</i>	transfer complete interrupt
<i>I2C_INT_STPDET</i>	stop detection interrupt
<i>I2C_INT_NACK</i>	not acknowledge received interrupt
<i>I2C_INT_ADDM</i>	address match interrupt
<i>I2C_INT_RBNE</i>	receive interrupt
<i>I2C_INT_TI</i>	transmit interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2C0 transmit interrupt */
```

```
i2c_interrupt_disable(I2C0, I2C_INT_TI);
```

i2c_interrupt_flag_get

The description of i2c_interrupt_flag_get is shown as below:

Table 3-420. Function i2c_interrupt_flag_get

Function name	i2c_interrupt_flag_get
Function prototype	FlagStatus i2c_interrupt_flag_get(uint32_t i2c_periph, i2c_interrupt_flag_enum int_flag);
Function descriptions	get I2C interrupt flag status
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
int_flag	I2C interrupt flags, refer to Table 3-358. i2c_interrupt_flag_enum .
<i>I2C_INT_FLAG_TI</i>	transmit interrupt flag
<i>I2C_INT_FLAG_RBNE</i>	I2C_RDATA is not empty during receiving interrupt flag
<i>I2C_INT_FLAG_ADDS END</i>	address received matches in slave mode interrupt flag
<i>I2C_INT_FLAG_NACK</i>	not acknowledge interrupt flag
<i>I2C_INT_FLAG_STPD ET</i>	stop condition detected in slave mode interrupt flag
<i>I2C_INT_FLAG_TC</i>	transfer complete in master mode interrupt flag
<i>I2C_INT_FLAG_TCR</i>	transfer complete reload interrupt flag

<i>I2C_INT_FLAG_BERR</i>	bus error interrupt flag
<i>I2C_INT_FLAG_LOSTARB</i>	arbitration lost interrupt flag
<i>I2C_INT_FLAG_OUER</i> <i>R</i>	overflow/underrun error in slave mode interrupt flag
<i>I2C_INT_FLAG_PECERR</i> <i>RR</i>	PEC error interrupt flag
<i>I2C_INT_FLAG_TIMEOUT</i> <i>UT</i>	timeout interrupt flag
<i>I2C_INT_FLAG_SMBAL</i> <i>LT</i>	SMBus Alert interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET / RESET

Example:

```
/* get I2C interrupt flag status */
```

```
FlagStatus flag_state = RESET;
```

```
flag_state = i2c_interrupt_flag_get(I2C0, I2C_INT_FLAG_TI);
```

i2c_interrupt_flag_clear

The description of i2c_interrupt_flag_clear is shown as below:

Table 3-421. Function i2c_interrupt_flag_clear

Function name	i2c_interrupt_flag_clear
Function prototype	void i2c_interrupt_flag_clear(uint32_t i2c_periph, i2c_interrupt_flag_enum int_flag);
Function descriptions	clear I2C interrupt flag status
Precondition	-
The called functions	-
Input parameter{in}	
i2c_periph	I2C peripheral
<i>I2Cx</i>	(x=0,1,2)
Input parameter{in}	
int_flag	I2C interrupt flags, refer to Table 3-358. i2c_interrupt_flag_enum .
<i>I2C_INT_FLAG_ADDS</i> <i>END</i>	address received matches in slave mode interrupt flag
<i>I2C_INT_FLAG_NACK</i>	not acknowledge interrupt flag
<i>I2C_INT_FLAG_STPD</i> <i>ET</i>	stop condition detected in slave mode interrupt flag
<i>I2C_INT_FLAG_BERR</i>	bus error interrupt flag

<i>I2C_INT_FLAG_LOSTA</i> <i>RB</i>	arbitration lost interrupt flag
<i>I2C_INT_FLAG_OUER</i> <i>R</i>	overflow/underrun error in slave mode interrupt flag
<i>I2C_INT_FLAG_PEC</i> <i>RR</i>	PEC error interrupt flag
<i>I2C_INT_FLAG_TIMEOUT</i> <i>UT</i>	timeout interrupt flag
<i>I2C_INT_FLAG_SMBAL</i> <i>LT</i>	SMBus Alert interrupt flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear a bus error flag */
```

```
i2c_interrupt_flag_clear(I2C0, I2C_INT_FLAG_BERR);
```

3.16. LPTIMER

The LPTIMER is a 16-bit / 32-bit timer and it is able to keep running in all power modes except for Standby mode with its diversity of clock sources. The LPTIMER registers are listed in chapter [3.16.1](#), the LPTIMER firmware functions are introduced in chapter [3.16.2](#).

3.16.1. Descriptions of Peripheral registers

LPTIMER registers are listed in the table shown as below:

Table 3-422. LPTIMER Registers

Registers	Descriptions
LPTIMER_INTF	interrupt flag register
LPTIMER_INTC	interrupt flag clear register
LPTIMER_INTEN	interrupt enable register
LPTIMER_CTL0	control register 0
LPTIMER_CTL1	control register 1
LPTIMER_CMPV	compare value register
LPTIMER_CAR	counter auto reload register
LPTIMER_CNT	counter register
LPTIMER_EIRMP	external input remap register
LPTIMER_INHLCMV	input high level counter max value register

3.16.2. Descriptions of Peripheral functions

The description format of firmware functions are shown as below:

Table 3-423. LPTIMER firmware function

Function name	Function description
lptimer_deinit	deinit the LPTIMER
lptimer_struct_para_init	initialize LPTIMER init parameter struct with a default value
lptimer_init	initialize LPTIMER counter
lptimer_inputremap	configure external input remap
lptimer_register_shadow_enable	enable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function
lptimer_register_shadow_disable	disable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function
lptimer_timeout_enable	enable the LPTIMER TIMEOUT function
lptimer_timeout_disable	disable the LPTIMER TIMEOUT function
lptimer_continue_start	LPTIMER start with continue mode
lptimer_single_start	LPTIMER start with single mode
lptimer_stop	stop LPTIMER
lptimer_counter_read	read LPTIMER current counter value
lptimer_autoreload_read	read LPTIMER auto reload value
lptimer_compare_read	read LPTIMER compare value
lptimer_autoreload_value_config	configure LPTIMER autoreload register value
lptimer_compare_value_config	configure LPTIMER compare value
lptimer_decodemode0_enable	enable decode mode 0
lptimer_decodemode1_enable	enable decode mode 1
lptimer_decodemode_disable	disable decode mode 0/1
lptimer_highlevelcounter_enable	enable external input high level counter
lptimer_highlevelcounter_disable	disable external input high level counter
lptimer_flag_get	get LPTIMER flags
lptimer_flag_clear	clear LPTIMER flags
lptimer_interrupt_enable	enable the LPTIMER interrupt
lptimer_interrupt_disable	disable the LPTIMER interrupt
lptimer_interrupt_flag_get	get LPTIMER interrupt flag
lptimer_interrupt_flag_clear	clear LPTIMER interrupt flag

Structure lptimer_parameter_struct

Table 3-424. Structure lptimer_parameter_struct

Member name	Function description
clocksource	clock source (LPTIMER_INTERNALCLK, LPTIMER_EXTERNALCLK)
prescaler	counter clock prescaler (LPTIMER_PSC_x, x=1,2,4,8..128)
extclockpolarity	external clock polarity of the active edge for the counter

Member name	Function description
	(LPTIMER_EXTERNALCLK_RISING, LPTIMER_EXTERNALCLK_FALLING, LPTIMER_EXTERNALCLK_BOTH)
extclockfilter	external clock sampling time to configure the clock glitch filter (LPTIMER_EXTERNALCLK_FILTEROFF, LPTIMER_EXTERNALCLK_FILTER_2, LPTIMER_EXTERNALCLK_FILTER_4, LPTIMER_EXTERNALCLK_FILTER_8)
triggermode	trigger mode (LPTIMER_TRIGGER_SOFTWARE, LPTIMER_TRIGGER_EXTERNALRISING, LPTIMER_TRIGGER_EXTERNALFALLING, LPTIMER_TRIGGER_EXTERNALBOTH)
extriggersource	external trigger source (LPTIMER_EXTRIGGER_GPIO, LPTIMER_EXTRIGGER_RTCALARM0, LPTIMER_EXTRIGGER_RTCALARM1, LPTIMER_EXTRIGGER_RTCTAMP0, LPTIMER_EXTRIGGER_RTCTAMP1, LPTIMER_EXTRIGGER_RTCTAMP2, LPTIMER_EXTRIGGER_CMP0_OUT, LPTIMER_EXTRIGGER_CMP1_OUT)
extriggerfilter	external trigger filter (LPTIMER_TRIGGER_FILTEROFF, LPTIMER_TRIGGER_FILTER_2, LPTIMER_TRIGGER_FILTER_4, LPTIMER_TRIGGER_FILTER_8)
outputpolarity	output polarity (LPTIMER_OUTPUT_NOTINVERTED, LPTIMER_OUTPUT_INVERTED)
outputmode	output mode (LPTIMER_OUTPUT_PWMORSINGLE, LPTIMER_OUTPUT_SET)
countersource	counter source (LPTIMER_COUNTER_INTERNAL, LPTIMER_COUNTER_EXTERNAL)

lptimer_deinit

The description of lptimer_deinit is shown as below:

Table 3-425. Function lptimer_deinit

Function name	lptimer_deinit
Function prototype	void lptimer_deinit(uint32_t lptimer_periph);
Function descriptions	deinit LPTIMER
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* deinit LPTIMER */
```

```
lptimer_deinit(LPTIMER);
```

lptimer_struct_para_init

The description of lptimer_struct_para_init is shown as below:

Table 3-426. Function lptimer_struct_para_init

Function name	lptimer_struct_para_init
Function prototype	void lptimer_struct_para_init(lptimer_parameter_struct *initpara);
Function descriptions	initialize LPTIMER init parameter struct with a default value
Precondition	-
The called functions	-
Input parameter{in}	
initpara	LPTIMER init parameter struct, the structure members can refer to Table 3-424. Structure lptimer_parameter_struct.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize LPTIMER init parameter struct with a default value */
```

```
lptimer_parameter_struct lptimer_initpara;
```

```
lptimer_struct_para_init(&lptimer_initpara);
```

lptimer_init

The description of lptimer_init is shown as below:

Table 3-427. Function lptimer_init

Function name	lptimer_init
Function prototype	void lptimer_init(uint32_t lptimer_periph, lptimer_parameter_struct *initpara);
Function descriptions	initialize LPTIMER counter
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral

<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
initpara	TIMER init parameter struct, the structure members can refer to Table 3-424. Structure lptimer_parameter_struct.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize LPTIMER */
```

```
lptimer_parameter_struct lptimer_structure;
```

```
lptimer_structure.clocksource      = LPTIMER_INTERNALCLK;
```

```
lptimer_structure.prescaler       = LPTIMER_PSC_16;
```

```
lptimer_structure.extclockpolarity = LPTIMER_EXTERNALCLK_RISING;
```

```
lptimer_structure.extclockfilter  = LPTIMER_EXTERNALCLK_FILTEROFF;
```

```
lptimer_structure.triggermode     = LPTIMER_TRIGGER_SOFTWARE;
```

```
lptimer_structure.extriggersource = LPTIMER_EXTRIGGER_GPIO;
```

```
lptimer_structure.extriggerfilter = LPTIMER_TRIGGER_FILTEROFF;
```

```
lptimer_structure.outputpolarity = LPTIMER_OUTPUT_NOTINVERTED;
```

```
lptimer_structure.outputmode     = LPTIMER_OUTPUT_PWMORSINGLE;
```

```
lptimer_structure.countersource  = LPTIMER_COUNTER_INTERNAL;
```

```
lptimer_init(LPTIMER, lptimer_structure);
```

lptimer_inputremap

The description of lptimer_inputremap is shown as below:

Table 3-428. Function lptimer_inputremap

Function name	lptimer_inputremap
Function prototype	void lptimer_inputremap(uint32_t lptimer_periph, uint32_t input0remap, uint32_t input1remap);
Function descriptions	configure external input remap
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral

<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
input0remap	external input0 remap
<i>LPTIMER_INPUT0_GPIO</i> <i>O</i>	external input is remaped to GPIO
<i>LPTIMER_INPUT0_CM</i> <i>P0_OUT</i>	external input is remaped to CMP0_OUT
Input parameter{in}	
input1remap	external input1 remap
<i>LPTIMER_INPUT1_GPIO</i> <i>O</i>	external input is remaped to GPIO
<i>LPTIMER_INPUT1_CM</i> <i>P1_OUT</i>	external input is remaped to CMP1_OUT
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPTIMER inputs is connected to GPIO */
```

```
lptimer_inputremap(LPTIMER, LPTIMER_INPUT0_GPIO, LPTIMER_INPUT1_GPIO);
```

lptimer_register_shadow_enable

The description of `lptimer_register_shadow_enable` is shown as below:

Table 3-429. Function `lptimer_register_shadow_enable`

Function name	<code>lptimer_register_shadow_enable</code>
Function prototype	<code>void lptimer_register_shadow_enable(uint32_t lptimer_periph);</code>
Function descriptions	enable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function */
```

```
lptimer_register_shadow_enable(LPTIMER);
```

lptimer_register_shadow_disable

The description of lptimer_register_shadow_disable is shown as below:

Table 3-430. Function lptimer_register_shadow_disable

Function name	lptimer_register_shadow_disable
Function prototype	void lptimer_register_shadow_disable(uint32_t lptimer_periph);
Function descriptions	disable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the LPTIMER_CAR and LPTIMER_CMPV registers shadow function */
```

```
lptimer_register_shadow_disable(LPTIMER);
```

lptimer_timeout_enable

The description of lptimer_timeout_enable is shown as below:

Table 3-431. Function lptimer_timeout_enable

Function name	lptimer_timeout_enable
Function prototype	void lptimer_timeout_enable(uint32_t lptimer_periph);
Function descriptions	enable the LPTIMER TIMEOUT function
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the LPTIMER TIMEOUT function */
```

```
lptimer_timeout_enable(LPTIMER);
```

lptimer_timeout_disable

The description of lptimer_timeout_disable is shown as below:

Table 3-432. Function lptimer_timeout_disable

Function name	lptimer_timeout_disable
Function prototype	void lptimer_timeout_disable(uint32_t lptimer_periph);
Function descriptions	disable the LPTIMER TIMEOUT function
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the LPTIMER TIMEOUT function */
```

```
lptimer_timeout_disable(LPTIMER);
```

lptimer_countinue_start

The description of lptimer_countinue_start is shown as below:

Table 3-433. Function lptimer_countinue_start

Function name	lptimer_countinue_start
Function prototype	void lptimer_countinue_start(uint32_t lptimer_periph, uint32_t autoreload, uint32_t compare);
Function descriptions	LPTIMER countinue start
Precondition	-

The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Input parameter{in}	
autoreload	auto reload value, 0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx
Input parameter{in}	
compare	0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPTIMER countinue start */
```

```
lptimer_countinue_start(LPTIMER, 0x0000FFFF, 0x00007FFF);
```

lptimer_single_start

The description of lptimer_single_start is shown as below:

Table 3-434. Function lptimer_single_start

Function name	lptimer_single_start
Function prototype	void lptimer_single_start(uint32_t lptimer_periph, uint32_t autoreload, uint32_t compare);
Function descriptions	LPTIMER single start
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Input parameter{in}	
autoreload	auto reload value, 0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx
Input parameter{in}	
compare	0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPTIMER single start */

lptimer_single_start(LPTIMER, 0x0000FFFF, 0x00007FFF);
```

lptimer_stop

The description of lptimer_stop is shown as below:

Table 3-435. Function lptimer_stop

Function name	lptimer_stop
Function prototype	void lptimer_stop(uint32_t lptimer_periph);
Function descriptions	stop LPTIMER
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* stop LPTIMER */

lptimer_stop(LPTIMER);
```

lptimer_counter_read

The description of lptimer_counter_read is shown as below:

Table 3-436. Function lptimer_counter_read

Function name	lptimer_counter_read
Function prototype	uint32_t lptimer_counter_read(uint32_t lptimer_periph);
Function descriptions	read LPTIMER current counter value
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	

-	-
Return value	
uint32_t	counter value (0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx)

Example:

```
/* read LPTIMER current counter value */
uint32_t i = 0;
i = lptimer_counter_read(LPTIMER);
```

lptimer_autoreload_read

The description of lptimer_autoreload_read is shown as below:

Table 3-437. Function lptimer_autoreload_read

Function name	lptimer_autoreload_read
Function prototype	uint32_t lptimer_autoreload_read(uint32_t lptimer_periph);
Function descriptions	read LPTIMER auto reload value
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
uint32_t	auto reload value (0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx)

Example:

```
/* read LPTIMER auto reload value */
uint32_t i = 0;
i = lptimer_autoreload_read(LPTIMER);
```

lptimer_compare_read

The description of lptimer_compare_read is shown as below:

Table 3-438. Function lptimer_compare_read

Function name	lptimer_compare_read
Function prototype	uint32_t lptimer_compare_read(uint32_t lptimer_periph);
Function descriptions	read LPTIMER compare value

Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
uint32_t	compare value (0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx)

Example:

```
/* read LPTIMER compare value */
```

```
uint32_t i = 0;
```

```
i = lptimer_compare_read(LPTIMER);
```

lptimer_autoreload_value_config

The description of lptimer_autoreload_value_config is shown as below:

Table 3-439. Function lptimer_autoreload_value_config

Function name	lptimer_autoreload_value_config
Function prototype	void lptimer_autoreload_value_config(uint32_t lptimer_periph, uint32_t autoreload);
Function descriptions	configure LPTIMER autoreload register value
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
autoreload	autoreload value (0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPTIMER autoreload register value */
```

```
lptimer_autoreload_value_config(LPTIMER, 0x000000FF);
```

lptimer_compare_value_config

The description of lptimer_compare_value_config is shown as below:

Table 3-440. Function lptimer_compare_value_config

Function name	lptimer_compare_value_config
Function prototype	void lptimer_compare_value_config(uint32_t lptimer_periph, uint32_t compare);
Function descriptions	configure LPTIMER compare value
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Input parameter{in}	
counter	compare value (0x0~0xFFFF for GD32L235xx, 0x0~0xFFFFFFFF for GD32L233xx)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPTIMER compare value */
```

```
lptimer_compare_value_config(LPTIMER, 0x000000FF);
```

lptimer_decodemode0_enable

The description of lptimer_decodemode0_enable is shown as below:

Table 3-441. Function lptimer_decodemode0_enable

Function name	lptimer_decodemode0_enable
Function prototype	void lptimer_decodemode0_enable(uint32_t lptimer_periph);
Function descriptions	enable decode mode 0
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* enable decode mode 0 */
```

```
lptimer_decodemode0_enable(LPTIMER);
```

lptimer_decodemode1_enable

The description of lptimer_decodemode1_enable is shown as below:

Table 3-442. Function lptimer_decodemode1_enable

Function name	lptimer_decodemode1_enable
Function prototype	void lptimer_decodemode1_enable(uint32_t lptimer_periph);
Function descriptions	enable decode mode 1
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable decode mode 1 */
```

```
lptimer_decodemode1_enable(LPTIMER);
```

lptimer_decodemode_disable

The description of lptimer_decodemode_disable is shown as below:

Table 3-443. Function lptimer_decodemode_disable

Function name	lptimer_decodemode_disable
Function prototype	void lptimer_decodemode_disable(uint32_t lptimer_periph);
Function descriptions	disable decode mode 0/1
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral

<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable decode mode 0/1 */
```

```
lptimer_decodemode_disable(LPTIMER);
```

lptimer_highlevelcounter_enable

The description of lptimer_highlevelcounter_enable is shown as below:

Table 3-444. Function lptimer_highlevelcounter_enable

Function name	lptimer_highlevelcounter_enable
Function prototype	void lptimer_highlevelcounter_enable(uint32_t lptimer_periph, uint32_t maxvalue);
Function descriptions	enable external input high level counter
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
maxvalue	input high level counter max value, 0x0~0x03FFFFFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable external input high level counter */
```

```
lptimer_highlevelcounter_enable(LPTIMER, 0x00007FFF);
```

lptimer_highlevelcounter_disable

The description of lptimer_highlevelcounter_disable is shown as below:

Table 3-445. Function lptimer_highlevelcounter_disable

Function name	lptimer_highlevelcounter_disable
----------------------	----------------------------------

Function prototype	void lptimer_highlevelcounter_disable(uint32_t lptimer_periph);
Function descriptions	disable external input high level counter
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable external input high level counter */
lptimer_highlevelcounter_disable(LPTIMER);
```

lptimer_flag_get

The description of lptimer_flag_get is shown as below:

Table 3-446. Function lptimer_flag_get

Function name	lptimer_flag_get
Function prototype	FlagStatus lptimer_flag_get(uint32_t lptimer_periph, uint32_t flag);
Function descriptions	get LPTIMER flags
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
LPTIMER	for GD32L233xx series
LPTIMER0 / 1	for GD32L235xx series
Input parameter{in}	
flag	the LPTIMER flag
LPTIMER_FLAG_CMPVM	compare value register match flag
LPTIMER_FLAG_CARM	counter auto reload register match flag
LPTIMER_FLAG_ETEDV	external trigger edge event flag
LPTIMER_FLAG_CMPVUP	compare value register update flag
LPTIMER_FLAG_CARUP	counter auto reload register update flag
LPTIMER_FLAG_UP	LPTIMER counter direction change down to up flag

<i>LPTIMER_FLAG_DOW N</i>	LPTIMER counter direction change up to down flag
<i>LPTIMER_FLAG_HLCM VUP</i>	input high level counter max value register update flag
<i>LPTIMER_FLAG_INHLC O</i>	LPTIMER_INx(x=0,1) high level counter overflow flag
<i>LPTIMER_FLAG_INHLO E</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error flag
<i>LPTIMER_FLAG_INRF OE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error flag
<i>LPTIMER_FLAG_IN0E</i>	LPTIMER_IN0 error flag
<i>LPTIMER_FLAG_IN1E</i>	LPTIMER_IN1 error flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get LPTIMER flag */
```

```
FlagStatus Flag_status = RESET;
```

```
Flag_status = lptimer_flag_get(LPTIMER, LPTIMER_FLAG_CMPVM);
```

lptimer_flag_clear

The description of lptimer_flag_clear is shown as below:

Table 3-447. Function lptimer_flag_clear

Function name	lptimer_flag_clear
Function prototype	void lptimer_flag_clear(uint32_t lptimer_periph, uint32_t flag);
Function descriptions	clear LPTIMER flags
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
flag	the LPTIMER flag
<i>LPTIMER_FLAG_CMPV M</i>	compare value register match flag
<i>LPTIMER_FLAG_CARM</i>	counter auto reload register match flag
<i>LPTIMER_FLAG_ETED EV</i>	external trigger edge event flag

<i>LPTIMER_FLAG_CMPV UP</i>	compare value register update flag
<i>LPTIMER_FLAG_CARU P</i>	counter auto reload register update flag
<i>LPTIMER_FLAG_UP</i>	LPTIMER counter direction change down to up flag
<i>LPTIMER_FLAG_DOW N</i>	LPTIMER counter direction change up to down flag
<i>LPTIMER_FLAG_HLCM VUP</i>	input high level counter max value register update flag
<i>LPTIMER_FLAG_INHLC O</i>	LPTIMER_INx(x=0,1) high level counter overflow flag
<i>LPTIMER_FLAG_INHLO E</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error flag
<i>LPTIMER_FLAG_INRF OE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error flag
<i>LPTIMER_FLAG_IN0E</i>	LPTIMER_IN0 error flag
<i>LPTIMER_FLAG_IN1E</i>	LPTIMER_IN1 error flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear LPTIMER flag */
```

```
lptimer_flag_clear(LPTIMER, LPTIMER_FLAG_CMPVM);
```

lptimer_interrupt_enable

The description of lptimer_interrupt_enable is shown as below:

Table 3-448. Function lptimer_interrupt_enable

Function name	lptimer_interrupt_enable
Function prototype	void lptimer_interrupt_enable(uint32_t lptimer_periph, uint32_t interrupt);
Function descriptions	enable the LPTIMER interrupt
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
interrupt	LPTIMER interrupt source
<i>LPTIMER_INT_CMPVM</i>	compare value register match interrupt

<i>LPTIMER_INT_CARM</i>	counter auto reload register match interrupt
<i>LPTIMER_INT_ETEDEV</i>	external trigger edge event interrupt
<i>LPTIMER_INT_CMPVUP</i>	compare value register update interrupt
<i>LPTIMER_INT_CARUP</i>	counter auto reload register update interrupt
<i>LPTIMER_INT_UP</i>	LPTIMER counter direction change down to up interrupt
<i>LPTIMER_INT_DOWN</i>	LPTIMER counter direction change up to down interrupt
<i>LPTIMER_INT_HLCMVUP</i>	input high level counter max value register update interrupt
<i>LPTIMER_INT_INHLCO</i>	LPTIMER_INx(x=0,1) high level counter overflow interrupt
<i>LPTIMER_INT_INHLOE</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt
<i>LPTIMER_INT_INRFOE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt
<i>LPTIMER_INT_IN0E</i>	LPTIMER_IN0 error interrupt
<i>LPTIMER_INT_IN1E</i>	LPTIMER_IN1 error interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the LPTIMER interrupt */
```

```
lptimer_interrupt_enable(LPTIMER, LPTIMER_INT_CMPVM);
```

lptimer_interrupt_disable

The description of lptimer_interrupt_disable is shown as below:

Table 3-449. Function lptimer_interrupt_disable

Function name	lptimer_interrupt_disable
Function prototype	void lptimer_interrupt_disable(uint32_t lptimer_periph, uint32_t interrupt);
Function descriptions	disable the LPTIMER interrupt
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
interrupt	LPTIMER interrupt source
<i>LPTIMER_INT_CMPVM</i>	compare value register match interrupt
<i>LPTIMER_INT_CARM</i>	counter auto reload register match interrupt
<i>LPTIMER_INT_ETEDEV</i>	external trigger edge event interrupt

<i>LPTIMER_INT_CMPVUP</i>	compare value register update interrupt
<i>LPTIMER_INT_CARUP</i>	counter auto reload register update interrupt
<i>LPTIMER_INT_UP</i>	LPTIMER counter direction change down to up interrupt
<i>LPTIMER_INT_DOWN</i>	LPTIMER counter direction change up to down interrupt
<i>LPTIMER_INT_HLCMVUP</i>	input high level counter max value register update interrupt
<i>LPTIMER_INT_INHLCO</i>	LPTIMER_INx(x=0,1) high level counter overflow interrupt
<i>LPTIMER_INT_INHLOE</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt
<i>LPTIMER_INT_INRFOE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt
<i>LPTIMER_INT_IN0E</i>	LPTIMER_IN0 error interrupt
<i>LPTIMER_INT_IN1E</i>	LPTIMER_IN1 error interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the LPTIMER interrupt */
```

```
lptimer_interrupt_disable(LPTIMER, LPTIMER_INT_CMPVM);
```

lptimer_interrupt_flag_get

The description of lptimer_interrupt_flag_get is shown as below:

Table 3-450. Function lptimer_interrupt_flag_get

Function name	lptimer_interrupt_flag_get
Function prototype	FlagStatus lptimer_interrupt_flag_get(uint32_t lptimer_periph, uint32_t int_flag);
Function descriptions	get LPTIMER interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
int_flag	the LPTIMER interrupt flag
<i>LPTIMER_INT_FLAG_CMPVM</i>	compare value register match interrupt flag
<i>LPTIMER_INT_FLAG_CARM</i>	counter auto reload register match interrupt flag

<i>LPTIMER_INT_FLAG_ETEDEV</i>	external trigger edge event interrupt flag
<i>LPTIMER_INT_FLAG_CMPVUP</i>	compare value register update interrupt flag
<i>LPTIMER_INT_FLAG_CARUP</i>	counter auto reload register update interrupt flag
<i>LPTIMER_INT_FLAG_UP</i>	LPTIMER counter direction change down to up interrupt flag
<i>LPTIMER_INT_FLAG_DOWN</i>	LPTIMER counter direction change up to down interrupt flag
<i>LPTIMER_INT_FLAG_HLCMVUP</i>	input high level counter max value register update interrupt flag
<i>LPTIMER_INT_FLAG_I_NHLCO</i>	LPTIMER_INx(x=0,1) high level counter overflow interrupt flag
<i>LPTIMER_INT_FLAG_I_NHLOE</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt flag
<i>LPTIMER_INT_FLAG_I_NRFOE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt flag
<i>LPTIMER_INT_FLAG_I_N0E</i>	LPTIMER_IN0 error interrupt flag
<i>LPTIMER_INT_FLAG_I_N1E</i>	LPTIMER_IN1 error interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get LPTIMER interrupt flag */
```

```
FlagStatus Flag_interrupt = RESET;
```

```
Flag_interrupt = lptimer_interrupt_flag_get(LPTIMER, LPTIMER_INT_FLAG_CMPVM);
```

lptimer_interrupt_flag_clear

The description of lptimer_interrupt_flag_clear is shown as below:

Table 3-451. Function lptimer_interrupt_flag_clear

Function name	lptimer_interrupt_flag_clear
Function prototype	void lptimer_interrupt_flag_clear(uint32_t lptimer_periph, uint32_t int_flag);
Function descriptions	clear LPTIMER interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	

uint32_t lptimer_periph	LPTIMER peripheral
<i>LPTIMER</i>	for GD32L233xx series
<i>LPTIMER0 / 1</i>	for GD32L235xx series
Input parameter{in}	
int_flag	the LPTIMER interrupt flag
<i>LPTIMER_INT_FLAG_CMPVM</i>	compare value register match interrupt flag
<i>LPTIMER_INT_FLAG_CARM</i>	counter auto reload register match interrupt flag
<i>LPTIMER_INT_FLAG_ETEDEV</i>	external trigger edge event interrupt flag
<i>LPTIMER_INT_FLAG_CMPVUP</i>	compare value register update interrupt flag
<i>LPTIMER_INT_FLAG_CARUP</i>	counter auto reload register update interrupt flag
<i>LPTIMER_INT_FLAG_UP</i>	LPTIMER counter direction change down to up interrupt flag
<i>LPTIMER_INT_FLAG_DOWN</i>	LPTIMER counter direction change up to down interrupt flag
<i>LPTIMER_INT_FLAG_HLCMVUP</i>	input high level counter max value register update interrupt flag
<i>LPTIMER_INT_FLAG_I_NHLCO</i>	LPTIMER_INx(x=0,1) high level counter overflow interrupt flag
<i>LPTIMER_INT_FLAG_I_NHLOE</i>	the high level of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt flag
<i>LPTIMER_INT_FLAG_I_NRFOE</i>	the falling and rising edges of LPTIMER_IN0 and LPTIMER_IN1 overlap error interrupt flag
<i>LPTIMER_INT_FLAG_I_N0E</i>	LPTIMER_IN0 error interrupt flag
<i>LPTIMER_INT_FLAG_I_N1E</i>	LPTIMER_IN1 error interrupt flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear LPTIMER interrupt flag */
```

```
lptimer_interrupt_flag_clear(LPTIMER, LPTIMER_INT_FLAG_CMPVM);
```

3.17. LPUART

The Low power Universal Asynchronous Receiver/Transmitter (LPUART) provides a flexible serial data exchange interface. The LPUART registers are listed in chapter [3.17.1](#), the LPUART firmware functions are introduced in chapter [3.17.2](#).

3.17.1. Descriptions of Peripheral registers

LPUART registers are listed in the table shown as below:

Table 3-452. LPUART Registers

Registers	Descriptions
LPUART_CTL0	Control register 0
LPUART_CTL1	Control register 1
LPUART_CTL2	Control register 2
LPUART_BAUD	Baud rate register
LPUART_CMD	Command register
LPUART_STAT	Status register
LPUART_INTC	Status clear register
LPUART_RDATA	Receive data register
LPUART_TDATA	Transmit data register
LPUART_CHC	Coherence control register

3.17.2. Descriptions of Peripheral functions

LPUART firmware functions are listed in the table shown as below:

Table 3-453. LPUART firmware function

Function name	Function description
lpuart_deinit	reset LPUART
lpuart_baudrate_set	configure LPUART baud rate value
lpuart_parity_config	configure LPUART parity
lpuart_word_length_set	configure LPUART word length
lpuart_stop_bit_set	configure LPUART stop bit length
lpuart_enable	enable LPUART
lpuart_disable	disable LPUART
lpuart_transmit_config	configure LPUART transmitter
lpuart_receive_config	configure LPUART receiver
lpuart_data_first_config	data is transmitted/received with the LSB/MSB first
lpuart_invert_config	configure LPUART inverted
lpuart_overrun_enable	enable the LPUART overrun function
lpuart_overrun_disable	disable the LPUART overrun function
lpuart_data_transmit	LPUART transmit data function

Function name	Function description
lpuart_data_receive	LPUART receive data function
lpuart_command_enable	enable LPUART command
lpuart_address_config	configure address of the LPUART
lpuart_address_detection_mode_config	configure address detection mode
lpuart_mute_mode_enable	enable mute mode
lpuart_mute_mode_disable	disable mute mode
lpuart_mute_mode_wakeup_config	configure wakeup method in mute mode
lpuart_halfduplex_enable	enable half-duplex mode
lpuart_halfduplex_disable	disable half-duplex mode
lpuart_hardware_flow_rts_config	configure hardware flow control RTS
lpuart_hardware_flow_cts_config	configure hardware flow control CTS
lpuart_hardware_flow_coherence_config	configure hardware flow control coherence mode
lpuart_rs485_driver_enable	enable RS485 driver
lpuart_rs485_driver_disable	disable RS485 driver
lpuart_driver_asserttime_config	configure driver enable assertion time
lpuart_driver_deasserttime_config	configure driver enable de-assertion time
lpuart_depolarity_config	configure driver enable polarity mode
lpuart_dma_receive_config	configure LPUART DMA for reception
lpuart_dma_transmit_config	configure LPUART DMA for transmission
lpuart_reception_error_dma_disable	disable DMA on reception error
lpuart_reception_error_dma_enable	enable DMA on reception error
lpuart_wakeup_enable	enable LPUART to wakeup the mcu from deep-sleep mode
lpuart_wakeup_disable	disable LPUART to wakeup the mcu from deep-sleep mode
lpuart_wakeup_mode_config	configure the LPUART wakeup mode from deep-sleep mode
lpuart_flag_get	get flag in STAT/CHC register
lpuart_flag_clear	clear LPUART status
lpuart_interrupt_enable	enable LPUART interrupt
lpuart_interrupt_disable	disable LPUART interrupt
lpuart_interrupt_flag_get	get LPUART interrupt and flag status
lpuart_interrupt_flag_clear	clear LPUART interrupt flag

Enum lpuart_flag_enum

Table 3-454. Enum lpuart_flag_enum

Member name	Function description
LPUART_FLAG_REA	receive enable acknowledge flag
LPUART_FLAG_TEA	transmit enable acknowledge flag
LPUART_FLAG_WU	wakeup from Deep-sleep mode flag
LPUART_FLAG_RWU	receiver wakeup from mute mode
LPUART_FLAG_AM	ADDR match flag

Member name	Function description
LPUART_FLAG_BSY	busy flag
LPUART_FLAG_CTS	CTS level
LPUART_FLAG_CTSF	CTS change flag
LPUART_FLAG_TBE	transmit data buffer empty
LPUART_FLAG_TC	transmission complete
LPUART_FLAG_RBNE	read data buffer not empty
LPUART_FLAG_IDLE	IDLE line detected flag
LPUART_FLAG_ORERR	overrun error
LPUART_FLAG_NERR	noise error flag
LPUART_FLAG_FERR	frame error flag
LPUART_FLAG_PERR	parity error flag
LPUART_FLAG_EPERR	early parity error flag

Enum lpuart_interrupt_flag_enum

Table 3-455. Enum lpuart_interrupt_flag_enum

Member name	Function description
LPUART_INT_FLAG_AM	address match interrupt and flag
LPUART_INT_FLAG_PERR	parity error interrupt and flag
LPUART_INT_FLAG_TBE	transmitter buffer empty interrupt and flag
LPUART_INT_FLAG_TC	transmission complete interrupt and flag
LPUART_INT_FLAG_RBNE	read data buffer not empty interrupt and flag
LPUART_INT_FLAG_RBNE_ORERR	read data buffer not empty interrupt and overrun error flag
LPUART_INT_FLAG_IDLE	IDLE line detected interrupt and flag
LPUART_INT_FLAG_WU	wakeup from deep-sleep mode interrupt and flag
LPUART_INT_FLAG_CTS	CTS interrupt and flag
LPUART_INT_FLAG_ERR_NERR	error interrupt and noise error flag
LPUART_INT_FLAG_ERR_ORERR	error interrupt and overrun error
LPUART_INT_FLAG_ERR_FERR	error interrupt and frame error flag

Enum lpuart_interrupt_enum

Table 3-456. Enum lpuart_interrupt_enum

Member name	Function description
LPUART_INT_AM	address match interrupt
LPUART_INT_PERR	parity error interrupt
LPUART_INT_TBE	transmitter buffer empty interrupt
LPUART_INT_TC	transmission complete interrupt
LPUART_INT_RBNE	read data buffer not empty interrupt and overrun error interrupt
LPUART_INT_IDLE	IDLE line detected interrupt

Member name	Function description
LPUART_INT_WU	wakeup from deep-sleep mode interrupt
LPUART_INT_CTS	CTS interrupt
LPUART_INT_ERR	error interrupt

Enum lpuart_invert_enum

Table 3-457. Enum lpuart_invert_enum

Member name	Function description
LPUART_DINV_ENABLE	data bit level inversion
LPUART_DINV_DISABLE	data bit level not inversion
LPUART_TXPIN_ENABLE	TX pin level inversion
LPUART_TXPIN_DISABLE	TX pin level not inversion
LPUART_RXPIN_ENABLE	RX pin level inversion
LPUART_RXPIN_DISABLE	RX pin level not inversion
LPUART_SWAP_ENABLE	swap TX/RX pins
LPUART_SWAP_DISABLE	not swap TX/RX pins

lpuart_deinit

The description of lpuart_deinit is shown as below:

Table 3-458. Function lpuart_deinit

Function name	lpuart_deinit
Function prototype	void lpuart_deinit(uint32_t lpuart_periph);
Function descriptions	reset LPUART
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset LPUART0 */
lpuart_deinit(LPUART0);
```

lpuart_baudrate_set

The description of lpuart_baudrate_set is shown as below:

Table 3-459. Function lpuart_baudrate_set

Function name	lpuart_baudrate_set
Function prototype	void lpuart_baudrate_set(uint32_t lpuart_periph, uint32_t baudval);
Function descriptions	configure LPUART baud rate value
Precondition	-
The called functions	rcu_clock_freq_get
Input parameter{in}	
lpuart_periph	LPUART peripheral
LPUARTx	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
baudval	baud rate value
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 baud rate value */
```

```
lpuart_baudrate_set(LPUART0, 115200);
```

lpuart_parity_config

The description of lpuart_parity_config is shown as below:

Table 3-460. Function lpuart_parity_config

Function name	lpuart_parity_config
Function prototype	void lpuart_parity_config(uint32_t lpuart_periph, uint32_t paritycfg);
Function descriptions	configure LPUART parity
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
LPUARTx	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
paritycfg	configure LPUART parity
LPUART_PM_NONE	no parity
LPUART_PM_ODD	odd parity
LPUART_PM_EVEN	even parity
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 parity */

lpuart_parity_config(LPUART0, LPUART_PM_EVEN);
```

lpuart_word_length_set

The description of lpuart_word_length_set is shown as below:

Table 3-461. Function lpuart_word_length_set

Function name	lpuart_word_length_set
Function prototype	void lpuart_word_length_set(uint32_t lpuart_periph, uint32_t wlen);
Function descriptions	configure LPUART word length
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
wlen	LPUART word length configure
<i>LPUART_WL_7BIT</i>	7 bits
<i>LPUART_WL_8BIT</i>	8 bits
<i>LPUART_WL_9BIT</i>	9 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 word length */

lpuart_word_length_set(LPUART0, LPUART_WL_9BIT);
```

lpuart_stop_bit_set

The description of lpuart_stop_bit_set is shown as below:

Table 3-462. Function lpuart_stop_bit_set

Function name	lpuart_stop_bit_set
Function prototype	void lpuart_stop_bit_set(uint32_t lpuart_periph, uint32_t stblen);
Function descriptions	configure LPUART stop bit length
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral

<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
stblen	LPUART stop bit configure
<i>USART_STB_1BIT</i>	1 bit
<i>USART_STB_2BIT</i>	2 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 stop bit length */
lpuart_stop_bit_set(LPUART0, LPUART_STB_2BIT);
```

lpuart_enable

The description of lpuart_enable is shown as below:

Table 3-463. Function lpuart_enable

Function name	lpuart_enable
Function prototype	void lpuart_enable(uint32_t lpuart_periph);
Function descriptions	enable LPUART
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 */
lpuart_enable(LPUART0);
```

lpuart_disable

The description of lpuart_disable is shown as below:

Table 3-464. Function lpuart_disable

Function name	lpuart_disable
Function prototype	void lpuart_disable(uint32_t lpuart_periph);

Function descriptions	disable LPUART
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 */
```

```
lpuart_disable(LPUART0);
```

lpuart_transmit_config

The description of lpuart_transmit_config is shown as below:

Table 3-465. Function lpuart_transmit_config

Function name	lpuart_transmit_config
Function prototype	void lpuart_transmit_config(uint32_t lpuart_periph, uint32_t txconfig);
Function descriptions	configure LPUART transmitter
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
txconfig	enable or disable LPUART transmitter
<i>LPUART_TRANSMIT_ENABLE</i>	enable LPUART transmission
<i>LPUART_TRANSMIT_DISABLE</i>	disable LPUART transmission
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 transmitter */
```

```
lpuart_transmit_config(LPUART0, LPUART_TRANSMIT_ENABLE);
```

lpuart_receive_config

The description of lpuart_receive_config is shown as below:

Table 3-466. Function lpuart_receive_config

Function name	lpuart_receive_config
Function prototype	void lpuart_receive_config(uint32_t lpuart_periph, uint32_t rxconfig);
Function descriptions	configure LPUART receiver
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
rxconfig	enable or disable LPUART receiver
<i>LPUART_RECEIVE_ENABLE</i>	enable LPUART reception
<i>LPUART_RECEIVE_DISABLE</i>	disable LPUART reception
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 receiver */
```

```
lpuart_receive_config(LPUART0, LPUART_RECEIVE_ENABLE);
```

lpuart_data_first_config

The description of lpuart_data_first_config is shown as below:

Table 3-467. Function lpuart_data_first_config

Function name	lpuart_data_first_config
Function prototype	void lpuart_data_first_config(uint32_t lpuart_periph, uint32_t msbf);
Function descriptions	data is transmitted/received with the LSB/MSB first
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
msbf	LSB/MSB
<i>LPUART_MSBF_LSB</i>	LSB first

<i>LPUART_MSBF_MSB</i>	MSB first
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LSB of data first */
```

```
lpuart_data_first_config(LPUART0, LPUART_MSBF_LSB);
```

lpuart_invert_config

The description of lpuart_invert_config is shown as below:

Table 3-468. Function lpuart_invert_config

Function name	lpuart_invert_config
Function prototype	void lpuart_invert_config(uint32_t lpuart_periph, lpuart_invert_enum invertpara);
Function descriptions	configure LPUART inverted
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
invertpara	refer to Table 3-457. Enum lpuart_invert_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 inversion */
```

```
lpuart_invert_config(LPUART0, LPUART_DINV_ENABLE);
```

lpuart_overrun_enable

The description of lpuart_overrun_enable is shown as below:

Table 3-469. Function lpuart_overrun_enable

Function name	lpuart_overrun_enable
Function prototype	void lpuart_overrun_enable(uint32_t lpuart_periph);
Function descriptions	enable the LPUART overrun

Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 overrun */
```

```
lpuart_overrun_enable(LPUART0);
```

lpuart_overrun_disable

The description of lpuart_overrun_disable is shown as below:

Table 3-470. Function lpuart_overrun_disable

Function name	lpuart_overrun_disable
Function prototype	void lpuart_overrun_disable(uint32_t lpuart_periph);
Function descriptions	disable the LPUART overrun function
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 overrun */
```

```
lpuart_overrun_disable(LPUART0);
```

lpuart_data_transmit

The description of lpuart_data_transmit is shown as below:

Table 3-471. Function lpuart_data_transmit

Function name	lpuart_data_transmit
Function prototype	void lpuart_data_transmit(uint32_t lpuart_periph, uint32_t data);

Function descriptions	LPUART transmit data function
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
data	data of transmission (0x00-0xFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPUART0 transmit data */
```

```
lpuart_data_transmit(LPUART0, 0xAA);
```

lpuart_data_receive

The description of lpuart_data_receive is shown as below:

Table 3-472. Function lpuart_data_receive

Function name	lpuart_data_receive
Function prototype	uint16_t lpuart_data_receive(uint32_t lpuart_periph);
Function descriptions	LPUART receive data function
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
uint16_t	data of received (0x0000-0x01FF)

Example:

```
/* LPUART0 receive data */
```

```
uint16_t temp;
```

```
temp = lpuart_data_receive(LPUART0);
```

lpuart_command_enable

The description of lpuart_command_enable is shown as below:

Table 3-473. Function `lpuart_command_enable`

Function name	<code>lpuart_command_enable</code>
Function prototype	<code>void lpuart_command_enable(uint32_t lpuart_periph, uint32_t cmdtype);</code>
Function descriptions	enable LPUART command
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
cmdtype	command type
<i>LPUART_CMD_MMCM</i> <i>D</i>	mute mode command
<i>LPUART_CMD_RXFC</i> <i>MD</i>	receive data flush command
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 command */
```

```
lpuart_command_enable(LPUART0, LPUART_CMD_MMCM);
```

lpuart_address_config

The description of `lpuart_address_config` is shown as below:

Table 3-474. Function `lpuart_address_config`

Function name	<code>lpuart_address_config</code>
Function prototype	<code>void lpuart_address_config(uint32_t lpuart_periph, uint8_t addr);</code>
Function descriptions	configure address of the LPUART
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
addr	address of LPUART (0-0xFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure address of the LPUART0 */

lpuart_address_config(LPUART0, 0x00);
```

lpuart_address_detection_mode_config

The description of lpuart_address_detection_mode_config is shown as below:

Table 3-475. Function lpuart_address_detection_mode_config

Function name	lpuart_address_detection_mode_config
Function prototype	void lpuart_address_detection_mode_config(uint32_t lpuart_periph, uint32_t addmod);
Function descriptions	configure address detection mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
addmod	address detection mode
<i>LPUART_ADDM_4BIT</i>	4-bit address detection
<i>LPUART_ADDM_FULL BIT</i>	full-bit address detection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*configure address detection mode */

lpuart_address_config(LPUART0, LPUART_ADDM_4BIT);
```

lpuart_mute_mode_enable

The description of lpuart_mute_mode_enable is shown as below:

Table 3-476. Function lpuart_mute_mode_enable

Function name	lpuart_mute_mode_enable
Function prototype	void lpuart_mute_mode_enable(uint32_t lpuart_periph);
Function descriptions	enable mute mode
Precondition	-
The called functions	-
Input parameter{in}	

lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 receiver in mute mode */
```

```
lpuart_mute_mode_enable(LPUART0);
```

lpuart_mute_mode_disable

The description of lpuart_mute_mode_disable is shown as below:

Table 3-477. Function lpuart_mute_mode_disable

Function name	lpuart_mute_mode_disable
Function prototype	void lpuart_mute_mode_disable(uint32_t lpuart_periph);
Function descriptions	disable mute mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 receiver in mute mode */
```

```
lpuart_mute_mode_disable(LPUART0);
```

lpuart_mute_mode_wakeup_config

The description of lpuart_mute_mode_wakeup_config is shown as below:

Table 3-478. Function lpuart_mute_mode_wakeup_config

Function name	lpuart_mute_mode_wakeup_config
Function prototype	void lpuart_mute_mode_wakeup_config(uint32_t lpuart_periph, uint32_t wmethod);
Function descriptions	configure wakeup method in mute mode
Precondition	-

The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
wmethod	two methods be used to enter or exit the mute mode
<i>LPUART_WM_IDLE</i>	idle line
<i>LPUART_WM_ADDR</i>	address mask
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 wakeup method in mute mode */
```

```
lpuart_mute_mode_wakeup_config(LPUART0, LPUART_WM_IDLE);
```

lpuart_halfduplex_enable

The description of lpuart_halfduplex_enable is shown as below:

Table 3-479. Function lpuart_halfduplex_enable

Function name	lpuart_halfduplex_enable
Function prototype	void lpuart_halfduplex_enable(uint32_t lpuart_periph);
Function descriptions	enable half-duplex mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 half duplex mode*/
```

```
lpuart_halfduplex_enable(LPUART0);
```

lpuart_halfduplex_disable

The description of lpuart_halfduplex_disable is shown as below:

Table 3-480. Function lpuart_halfduplex_disable

Function name	lpuart_halfduplex_disable
Function prototype	void lpuart_halfduplex_disable(uint32_t lpuart_periph);
Function descriptions	disable half-duplex mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 half duplex mode*/
lpuart_halfduplex_disable(LPUART0);
```

lpuart_hardware_flow_rts_config

The description of lpuart_hardware_flow_rts_config is shown as below:

Table 3-481. Function lpuart_hardware_flow_rts_config

Function name	lpuart_hardware_flow_rts_config
Function prototype	void lpuart_hardware_flow_rts_config(uint32_t lpuart_periph, uint32_t rtsconfig);
Function descriptions	configure hardware flow control RTS
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
rtsconfig	enable or disable RTS
<i>LPUART_RTS_ENABLER</i>	enable RTS
<i>LPUART_RTS_DISABLE</i>	disable RTS
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 hardware flow control RTS */
```

```
lpuart_hardware_flow_rts_config(LPUART0, LPUART_RTS_ENABLE);
```

lpuart_hardware_flow_cts_config

The description of lpuart_hardware_flow_cts_config is shown as below:

Table 3-482. Function lpuart_hardware_flow_cts_config

Function name	lpuart_hardware_flow_cts_config
Function prototype	void lpuart_hardware_flow_cts_config(uint32_t lpuart_periph, uint32_t ctsconfig);
Function descriptions	configure hardware flow control CTS
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
ctsconfig	enable or disable CTS
<i>LPUART_CTS_ENABLE</i>	enable CTS
<i>LPUART_CTS_DISABLE</i>	disable CTS
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LPUART0 hardware flow control CTS */
```

```
lpuart_hardware_flow_cts_config(LPUART0, LPUART_CTS_ENABLE);
```

lpuart_hardware_flow_coherence_config

The description of lpuart_hardware_flow_coherence_config is shown as below:

Table 3-483. Function lpuart_hardware_flow_coherence_config

Function name	lpuart_hardware_flow_coherence_config
Function prototype	void lpuart_hardware_flow_coherence_config(uint32_t lpuart_periph, uint32_t hcm);
Function descriptions	configure hardware flow control coherence mode
Precondition	-
The called functions	-
Input parameter{in}	

lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
hcm	Hardware flow control coherence mode
<i>LPUART_HCM_NONE</i>	nRTS signal equals to the RBNE status register
<i>LPUART_HCM_EN</i>	nRTS signal is set when the last data bit has been sampled
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure hardware flow control coherence mode */
```

```
lpuart_hardware_flow_coherence_config(LPUART0, LPUART_HCM_NONE);
```

lpuart_rs485_driver_enable

The description of lpuart_rs485_driver_enable is shown as below:

Table 3-484. Function lpuart_rs485_driver_enable

Function name	lpuart_rs485_driver_enable
Function prototype	void lpuart_rs485_driver_enable(uint32_t lpuart_periph);
Function descriptions	enable RS485 driver
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 RS485 driver */
```

```
lpuart_rs485_driver_enable(LPUART0);
```

lpuart_rs485_driver_disable

The description of lpuart_rs485_driver_disable is shown as below:

Table 3-485. Function lpuart_rs485_driver_disable

Function name	lpuart_rs485_driver_disable
----------------------	-----------------------------

Function prototype	void lpuart_rs485_driver_disable(uint32_t lpuart_periph);
Function descriptions	disable RS485 driver
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 RS485 driver */
```

```
lpuart_rs485_driver_disable(LPUART0);
```

lpuart_driver_assertime_config

The description of lpuart_driver_assertime_config is shown as below:

Table 3-486. Function lpuart_driver_assertime_config

Function name	lpuart_driver_assertime_config
Function prototype	void lpuart_driver_assertime_config(uint32_t lpuart_periph, uint32_t deatime);
Function descriptions	configure driver enable assertion time
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
deatime	driver enable assertion time (0x00-0x0000001F)
Return value	
-	-

Example:

```
/* set LPUART0 driver assertime */
```

```
lpuart_driver_assertime_config(LPUART0, 0x0000001F);
```

lpuart_driver_deasserttime_config

The description of lpuart_driver_deasserttime_config is shown as below:

Table 3-487. Function lpuart_driver_deasserttime_config

Function name	lpuart_driver_deasserttime_config
Function prototype	void lpuart_driver_deasserttime_config(uint32_t lpuart_periph, uint32_t lpuart_periph, uint32_t dedtime);
Function descriptions	configure driver enable de-assertion time
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
dedtime	driver enable de-assertion time (0x00-0x0000001F)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set LPUART0 driver deasserttime */
```

```
lpuart_driver_deasserttime_config(LPUART0, 0x0000001F);
```

lpuart_depolarity_config

The description of lpuart_depolarity_config is shown as below:

Table 3-488. Function lpuart_depolarity_config

Function name	lpuart_depolarity_config
Function prototype	void lpuart_depolarity_config(uint32_t lpuart_periph, uint32_t dep);
Function descriptions	configure driver enable polarity mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
dep	DE signal
<i>LPUART_DEP_HIGH</i>	DE signal is active high
<i>LPUART_DEP_LOW</i>	DE signal is active low
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* configure driver enable polarity mode */
```

```
lpuart_driver_depolarity_config(LPUART0, LPUART_DEP_HIGH);
```

lpuart_dma_receive_config

The description of lpuart_dma_receive_config is shown as below:

Table 3-489. Function lpuart_dma_receive_config

Function name	lpuart_dma_receive_config
Function prototype	void lpuart_dma_receive_config(uint32_t lpuart_periph, uint32_t dmacmd);
Function descriptions	configure LPUART DMA for reception
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
LPUARTx	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
dmacmd	enable or disable DMA for reception
LPUART_DENR_ENABLE	DMA enable for reception
LPUART_DENR_DISABLE	DMA disable for reception
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPUART0 DMA enable for reception */
```

```
lpuart_dma_receive_config(LPUART0, LPUART_DENR_ENABLE);
```

lpuart_dma_transmit_config

The description of lpuart_dma_transmit_config is shown as below:

Table 3-490. Function lpuart_dma_transmit_config

Function name	lpuart_dma_transmit_config
Function prototype	void lpuart_dma_transmit_config(uint32_t lpuart_periph, uint32_t dmacmd);
Function descriptions	configure LPUART DMA for transmission

Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
dmacmd	enable or disable DMA for transmission
<i>LPUART_DENT_ENABLE</i>	DMA enable for transmission
<i>LPUART_DENT_DISABLE</i>	DMA disable for transmission
Return value	
-	-

Example:

```
/* LPUART0 DMA enable for transmission */
```

```
lpuart_dma_transmit_config(LPUART0, LPUART_DENT_ENABLE);
```

lpuart_reception_error_dma_disable

The description of lpuart_reception_error_dma_disable is shown as below:

Table 3-491. Function lpuart_reception_error_dma_disable

Function name	lpuart_reception_error_dma_disable
Function prototype	void lpuart_reception_error_dma_disable(uint32_t lpuart_periph);
Function descriptions	disable DMA on reception error
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMA on reception error */
```

```
lpuart_reception_error_dma_disable(LPUART0);
```

lpuart_reception_error_dma_enable

The description of lpuart_reception_error_dma_enable is shown as below:

Table 3-492. Function lpuart_reception_error_dma_enable

Function name	lpuart_reception_error_dma_enable
Function prototype	void lpuart_reception_error_dma_enable(uint32_t lpuart_periph);
Function descriptions	enable DMA on reception error
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA on reception error */
lpuart_reception_error_dma_enable(LPUART0);
```

lpuart_wakeup_enable

The description of lpuart_wakeup_enable is shown as below:

Table 3-493. Function lpuart_wakeup_enable

Function name	lpuart_wakeup_enable
Function prototype	void lpuart_wakeup_enable(uint32_t lpuart_periph);
Function descriptions	enable LPUART to wakeup the mcu from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPUART0 wake up enable */
lpuart_wakeup_enable(LPUART0);
```

lpuart_wakeup_disable

The description of lpuart_wakeup_disable is shown as below:

Table 3-494. Function lpuart_wakeup_disable

Function name	lpuart_wakeup_disable
Function prototype	void lpuart_wakeup_disable(uint32_t lpuart_periph);
Function descriptions	disable LPUART to wakeup the mcu from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* LPUART0 wake up disable */
```

```
lpuart_wakeup_disable(LPUART0);
```

lpuart_wakeup_mode_config

The description of lpuart_wakeup_mode_config is shown as below:

Table 3-495. Function lpuart_wakeup_mode_config

Function name	lpuart_wakeup_mode_config
Function prototype	void lpuart_wakeup_mode_config(uint32_t lpuart_periph, uint32_t wum);
Function descriptions	configure the LPUART wakeup mode from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
wum	wakeup mode
<i>LPUART_WUM_ADDR</i>	WUF active on address match
<i>LPUART_WUM_STAR</i> <i>TB</i>	WUF active on start bit
<i>LPUART_WUM_RBNE</i>	WUF active on RBNE
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* configure LPUART0 wake up mode */
```

```
lpuart_wakeup_mode_config(LPUART0, LPUART_WUM_ADDR);
```

lpuart_flag_get

The description of lpuart_flag_get is shown as below:

Table 3-496. Function lpuart_flag_get

Function name	lpuart_flag_get
Function prototype	FlagStatus lpuart_flag_get(uint32_t lpuart_periph, lpuart_flag_enum flag);
Function descriptions	get flag in STAT/CHC register
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
flag	LPUART flags, refer to Table 3-454. Enum lpuart_flag_enum only one among these parameters can be selected
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get flag LPUART0 state */
```

```
FlagStatus status;
```

```
status = lpuart_flag_get(LPUART0, LPUART_FLAG_TBE);
```

lpuart_flag_clear

The description of lpuart_flag_clear is shown as below:

Table 3-497. Function lpuart_flag_clear

Function name	lpuart_flag_clear
Function prototype	void lpuart_flag_clear(uint32_t lpuart_periph, lpuart_flag_enum flag);
Function descriptions	clear LPUART status
Precondition	-
The called functions	-
Input parameter{in}	

lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
flag	LPUART flags, refer to Table 3-454. Enum lpuart_flag_enum only one among these parameters can be selected
<i>LPUART_FLAG_PERR</i>	parity error flag
<i>LPUART_FLAG_FERR</i>	frame error flag
<i>LPUART_FLAG_NERR</i>	noise detected flag
<i>LPUART_FLAG_ORER</i> <i>R</i>	overrun error flag
<i>LPUART_FLAG_IDLE</i>	idle line detected flag
<i>LPUART_FLAG_TC</i>	transmission complete flag
<i>LPUART_FLAG_CTSF</i>	CTS change flag
<i>LPUART_FLAG_AM</i>	address match flag
<i>LPUART_FLAG_WU</i>	wakeup from deep-sleep mode flag
<i>LPUART_FLAG_EPER</i> <i>R</i>	early parity error flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear LPUART0 flag */
```

```
lpuart_flag_clear(LPUART0, LPUART_FLAG_TC);
```

lpuart_interrupt_enable

The description of lpuart_interrupt_enable is shown as below:

Table 3-498. Function lpuart_interrupt_enable

Function name	lpuart_interrupt_enable
Function prototype	void lpuart_interrupt_enable(uint32_t lpuart_periph, lpuart_interrupt_enum interrupt);
Function descriptions	enable LPUART interrupt
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
interrupt	interrupt type, refer to Table 3-456. Enum lpuart_interrupt_enum only one among these parameters can be selected

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable LPUART0 TBE interrupt */
```

```
lpuart_interrupt_enable(LPUART0, LPUART_INT_TBE);
```

lpuart_interrupt_disable

The description of lpuart_interrupt_disable is shown as below:

Table 3-499. Function lpuart_interrupt_disable

Function name	lpuart_interrupt_disable
Function prototype	void lpuart_interrupt_disable(uint32_t lpuart_periph, lpuart_interrupt_enum interrupt);
Function descriptions	disable LPUART interrupt
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
LPUARTx	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
interrupt	interrupt type, refer to Table 3-456. Enum lpuart_interrupt_enum only one among these parameters can be selected
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable LPUART0 TBE interrupt */
```

```
lpuart_interrupt_disable(LPUART0, LPUART_INT_TBE);
```

lpuart_interrupt_flag_get

The description of lpuart_interrupt_flag_get is shown as below:

Table 3-500. Function lpuart_interrupt_flag_get

Function name	lpuart_interrupt_flag_get
Function prototype	FlagStatus lpuart_interrupt_flag_get(uint32_t lpuart_periph, lpuart_interrupt_flag_enum int_flag);
Function descriptions	get LPUART interrupt and flag status

Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
int_flag	LPUART interrupt flag, refer to Table 3-455. Enum lpuart_interrupt_flag_enum , only one among these parameters can be selected
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the LPUART0 interrupt flag status */
```

```
FlagStatus status;
```

```
status = lpuart_interrupt_flag_get(LPUART0, LPUART_INT_FLAG_RBNE);
```

lpuart_interrupt_flag_clear

The description of lpuart_interrupt_flag_clear is shown as below:

Table 3-501. Function lpuart_interrupt_flag_clear

Function name	lpuart_interrupt_flag_clear
Function prototype	void lpuart_interrupt_flag_clear(uint32_t lpuart_periph, lpuart_interrupt_flag_enum int_flag);
Function descriptions	clear LPUART interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_periph	LPUART peripheral
<i>LPUARTx</i>	(x=0,1) (LPUART1 only for GD32L235xx series)
Input parameter{in}	
int_flag	LPUART interrupt flag, refer to Table 3-455. Enum lpuart_interrupt_flag_enum , only one among these parameters can be selected
<i>LPUART_INT_FLAG_PERR</i>	parity error flag
<i>LPUART_INT_FLAG_ERR_FERR</i>	frame error flag
<i>LPUART_INT_FLAG_ENOISE</i>	noise detected flag

<i>RR_NERR</i>	
<i>LPUART_INT_FLAG_R BNE_ORERR</i>	read data buffer not empty interrupt and overrun error flag
<i>LPUART_INT_FLAG_E RR_ORERR</i>	error interrupt and overrun error
<i>LPUART_INT_FLAG_I DLE</i>	idle line detected flag
<i>LPUART_INT_FLAG_T C</i>	transmission complete flag
<i>LPUART_INT_FLAG_C TS</i>	CTS change flag
<i>LPUART_INT_FLAG_A M</i>	address match flag
<i>LPUART_INT_FLAG_ WU</i>	wakeup from deep-sleep mode flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the LPUART0 interrupt flag */
```

```
lpuart_interrupt_flag_clear(LPUART0, LPUART_INT_FLAG_TC);
```

3.18. MISC

MISC is a software package that provide the interfaces for NVIC and SysTick. The NVIC and SysTick registers are listed in chapter [3.18.1](#), the MISC firmware functions are introduced in chapter [3.18.2](#).

3.18.1. Descriptions of Peripheral registers

Table 3-502. NVIC Registers

Registers	Descriptions
ISER ⁽¹⁾	Interrupt Set Enable Register
ICER ⁽¹⁾	Interrupt Clear Enable Register
ISPR ⁽¹⁾	Interrupt Set Pending Register
ICPR ⁽¹⁾	Interrupt Clear Pending Register
IABR ⁽¹⁾	Interrupt Active bit Register
ITNS ⁽¹⁾	Interrupt Non-Secure State Register
IPR ⁽¹⁾	Interrupt Priority Register
CPUID ⁽²⁾	CPUID Base Register

Registers	Descriptions
ICSR ⁽²⁾	Interrupt Control and State Register
VTOR ⁽²⁾	Vector Table Offset Register
AIRCR ⁽²⁾	Application Interrupt and Reset Control Register
SCR ⁽²⁾	System Control Register
CCR ⁽²⁾	Configuration Control Register
SHPR ⁽²⁾	System Handlers Priority Registers
SHCSR ⁽²⁾	System Handler Control and State Register

1. refer to the structure NVIC_Type, is defined in the core_cm23.h file

2. refer to the structure SCB_Type, is defined in the core_cm23.h file

Table 3-503. SysTick Registers

Registers	Descriptions
CTRL ⁽¹⁾	SysTick Control and Status Register
LOAD ⁽¹⁾	SysTick Reload Value Register
VAL ⁽¹⁾	SysTick Current Value Register
CALIB ⁽¹⁾	SysTick Calibration Register

1. refer to the structure SysTick_Type, is defined in the core_cm23.h file

3.18.2. Descriptions of Peripheral functions

MISC firmware functions are listed in the table shown as below:

Table 3-504. MISC firmware function

Function name	Function description
nvic_irq_enable	enable NVIC interrupt request
nvic_irq_disable	disable NVIC interrupt request
nvic_system_reset	initiates a system reset request to reset the MCU
nvic_vector_table_set	set the NVIC vector table base address
system_lowpower_set	set the state of the low power mode
system_lowpower_reset	reset the state of the low power mode
systick_clksource_set	set the systick clock source

Enum IRQn_Type

Table 3-505. IRQn_Type for GD32L233xx devices

Member name	Function description
WWDGT_IRQn	window watchDog timer interrupt
LVD_IRQn	LVD through EXTI line detect interrupt
TAMPER_STAMP_IRQn	RTC Tamper and Timestamp from EXTI interrupt
RTC_WKUP_IRQn	RTC Wakeup interrupt
FMC_IRQn	FMC interrupt
RCU_CTC_IRQn	RCU and CTC interrupt
EXTI0_IRQn	EXTI line 0 interrupts

Member name	Function description
EXTI1_IRQn	EXTI line 1 interrupts
EXTI2_IRQn	EXTI line 2 interrupts
EXTI3_IRQn	EXTI line 3 interrupts
EXTI4_IRQn	EXTI line 4 interrupts
DMA_Channel0_IRQn	DMA channel 0 interrupt
DMA_Channel1_IRQn	DMA channel 1 interrupts
DMA_Channel2_IRQn	DMA channel 2 interrupts
DMA_Channel3_IRQn	DMA channel 3 interrupts
DMA_Channel4_IRQn	DMA channel 4 interrupts
DMA_Channel5_IRQn	DMA channel 5 interrupts
DMA_Channel6_IRQn	DMA channel 6 interrupts
ADC_IRQn	ADC interrupts
USB_D_HP_IRQn	USB_D High Priority
USB_D_LP_IRQn	USB_D Low Priority
TIMER1_IRQn	TIMER1 interrupt
TIMER2_IRQn	TIMER2 interrupt
TIMER8_IRQn	TIMER8 interrupt
TIMER11_IRQn	TIMER11 interrupt
TIMER5_IRQn	TIMER5 interrupt
TIMER6_IRQn	TIMER6 interrupt
USART0_IRQn	USART0 interrupt
USART1_IRQn	USART1 interrupt
UART3_IRQn	UART3 interrupt
UART4_IRQn	UART4 interrupt
I2C0_EV_IRQn	I2C0 event interrupt
I2C0_ER_IRQn	I2C0 error interrupt
I2C1_EV_IRQn	I2C1 event interrupt
I2C1_ER_IRQn	I2C1 error interrupt
SPI0_IRQn	SPI0 interrupt
SPI1_IRQn	SPI1 interrupt
DAC_IRQn	DAC interrupt
I2C2_EV_IRQn	I2C2 event interrupt
I2C2_ER_IRQn	I2C2 error interrupt
RTC_Alarm_IRQn	RTC Alarm interrupt
USB_D_WKUP_IRQn	USB_D Wakeup interrupt
EXTI5_9_IRQn	EXTI line 5 to 9 interrupts
EXTI10_15_IRQn	EXTI line 10 to 15 interrupts
DMAMUX_IRQn	DMAMUX interrupt
CMP0_IRQn	Comparator 0 interrupt
CMP1_IRQn	Comparator 1 interrupt
I2C0_WKUP_IRQn	I2C0 Wakeup interrupt

Member name	Function description
I2C2_WKUP_IRQn	I2C2 Wakeup interrupt
USART0_WKUP_IRQn	USART0 Wakeup interrupt
LPUART_IRQn	LPUART global interrupt
CAU_IRQn	CAU interrupt
TRNG_IRQn	TRNG interrupt
SLCD_IRQn	SLCD interrupt
USART1_WKUP_IRQn	USART1 Wakeup interrupt
I2C1_WKUP_IRQn	I2C1 Wakeup interrupt
LPUART_WKUP_IRQn	LPUART Wakeup interrupt
LPTIMER_IRQn	LPTIMER interrupt

Table 3-506. IRQn_Type for GD32L235xx devices

Member name	Function description
WWDGT_IRQn	window watchDog timer interrupt
LVD_IRQn	LVD through EXTI line detect interrupt
TAMPER_STAMP_IRQn	RTC Tamper and Timestamp from EXTI interrupt
RTC_WKUP_IRQn	RTC Wakeup interrupt
FMC_IRQn	FMC interrupt
RCU_CTC_IRQn	RCU and CTC interrupt
EXTI0_IRQn	EXTI line 0 interrupts
EXTI1_IRQn	EXTI line 1 interrupts
EXTI2_IRQn	EXTI line 2 interrupts
EXTI3_IRQn	EXTI line 3 interrupts
EXTI4_IRQn	EXTI line 4 interrupts
DMA_Channel0_IRQn	DMA channel 0 interrupt
DMA_Channel1_IRQn	DMA channel 1 interrupts
DMA_Channel2_IRQn	DMA channel 2 interrupts
DMA_Channel3_IRQn	DMA channel 3 interrupts
DMA_Channel4_IRQn	DMA channel 4 interrupts
DMA_Channel5_IRQn	DMA channel 5 interrupts
DMA_Channel6_IRQn	DMA channel 6 interrupts
ADC_IRQn	ADC interrupts
USBD_HP_CAN_TX_IRQn	USBD High Priority or CAN TX
USBD_LP_CAN_RX0_IRQn	USBD Low Priority or CAN RX0
TIMER1_IRQn	TIMER1 interrupt
TIMER2_IRQn	TIMER2 interrupt
TIMER8_IRQn	TIMER8 interrupt
TIMER11_IRQn	TIMER11 interrupt
TIMER5_IRQn	TIMER5 interrupt
TIMER6_IRQn	TIMER6 interrupt
USART0_IRQn	USART0 interrupt
USART1_IRQn	USART1 interrupt

Member name	Function description
UART3_IRQn	UART3 interrupt
UART4_IRQn	UART4 interrupt
I2C0_EV_IRQn	I2C0 event interrupt
I2C0_ER_IRQn	I2C0 error interrupt
I2C1_EV_IRQn	I2C1 event interrupt
I2C1_ER_IRQn	I2C1 error interrupt
SPI0_IRQn	SPI0 interrupt
SPI1_IRQn	SPI1 interrupt
DAC_IRQn	DAC interrupt
I2C2_EV_IRQn	I2C2 event interrupt
I2C2_ER_IRQn	I2C2 error interrupt
RTC_Alarm_IRQn	RTC Alarm interrupt
USBD_WKUP_IRQn	USBD Wakeup interrupt
EXTI5_9_IRQn	EXTI line 5 to 9 interrupts
TIMER0_TRG_CMT_UP_BRK_IRQn	TIMER0 trigger and Channel commutation or update or break interrupt
TIMER0_Channel_IRQn	TIMER0 capture compare interrupt
TIMER14_IRQn	TIMER14 interrupt
EXTI10_15_IRQn	EXTI line 10 to 15 interrupts
TIMER40_IRQn	TIMER40 interrupt
CAN_RX1_IRQn	CAN RX1 interrupt
CAN_EWMC_IRQn	CAN EWMC interrupt
DMAMUX_IRQn	DMAMUX interrupt
CMP0_IRQn	Comparator 0 interrupt
CMP1_IRQn	Comparator 1 interrupt
I2C0_WKUP_IRQn	I2C0 Wakeup interrupt
I2C2_WKUP_IRQn	I2C2 Wakeup interrupt
USART0_WKUP_IRQn	USART0 Wakeup interrupt
LPUART0_IRQn	LPUART0 global interrupt
CAU_IRQn	CAU interrupt
TRNG_IRQn	TRNG interrupt
SLCD_IRQn	SLCD interrupt
USART1_WKUP_IRQn	USART1 Wakeup interrupt
I2C1_WKUP_IRQn	I2C1 Wakeup interrupt
LPUART0_WKUP_IRQn	LPUART0 Wakeup interrupt
LPTIMER0_IRQn	LPTIMER0 interrupt
LPUART1_WKUP_IRQn	LPUART1 Wakeup interrupt
LPTIMER1_IRQn	LPTIMER1 interrupt
LPUART1_IRQn	LPUART1 global interrupt

nvic_irq_enable

The description of nvic_irq_enable is shown as below:

Table 3-507. Function nvic_irq_enable

Function name	nvic_irq_enable
Function prototype	void nvic_irq_enable(uint8_t nvic_irq, uint8_t nvic_irq_pre_priority);
Function descriptions	enable NVIC interrupt request
Precondition	-
The called functions	NVIC_SetPriority、NVIC_EnableIRQ
Input parameter{in}	
nvic_irq	NVIC interrupt, for GD32L233xx devices which refer to enum Table 3-505. IRQn_Type for GD32L233xx devices or for GD32L235xx devices Table 3-506. IRQn_Type for GD32L235xx devices
Input parameter{in}	
nvic_irq_pre_priority	the pre-emption priority needed to set
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable window watchDog timer interrupt, priority is 1 */
nvic_irq_enable(WWDGT_IRQn, 1);
```

nvic_irq_disable

The description of nvic_irq_disable is shown as below:

Table 3-508. Function nvic_irq_disable

Function name	nvic_irq_disable
Function prototype	void nvic_irq_disable(uint8_t nvic_irq);
Function descriptions	disable NVIC interrupt request
Precondition	-
The called functions	-
Input parameter{in}	
nvic_irq	NVIC interrupt, for GD32L233xx devices which refer to enum Table 3-505. IRQn_Type for GD32L233xx devices or for GD32L235xx devices Table 3-506. IRQn_Type for GD32L235xx devices
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable window watchDog timer interrupt */
```

```
nvic_irq_disable(WWDGT_IRQn);
```

nvic_system_reset

The description of nvic_system_reset is shown as below:

Table 3-509. Function nvic_system_reset

Function name	nvic_system_reset
Function prototype	void nvic_system_reset(void);
Function descriptions	initiates a system reset request to reset the MCU
Precondition	-
The called functions	NVIC_SystemReset
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset the MCU */
```

```
nvic_system_reset();
```

nvic_vector_table_set

The description of nvic_vector_table_set is shown as below:

Table 3-510. Function nvic_vector_table_set

Function name	nvic_vector_table_set
Function prototype	void nvic_vector_table_set(uint32_t nvic_vect_tab, uint32_t offset);
Function descriptions	set the NVIC vector table base address
Precondition	-
The called functions	-
Input parameter{in}	
nvic_vect_tab	the RAM or FLASH base address
<i>NVIC_VECTTAB_RAM</i>	RAM base address
<i>NVIC_VECTTAB_FLASH</i>	Flash base address
Input parameter{in}	
offset	vector table offset (vector table start address= base address+offset)
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* set vector table address = NVIC_VECTTAB_FLASH + 0x200 */
nvic_vector_table_set(NVIC_VECTTAB_FLASH, 0x200);
```

system_lowpower_set

The description of system_lowpower_set is shown as below:

Table 3-511. Function system_lowpower_set

Function name	system_lowpower_set
Function prototype	void system_lowpower_set(uint8_t lowpower_mode);
Function descriptions	set the state of the low power mode
Precondition	-
The called functions	-
Input parameter{in}	
lowpower_mode	the low power mode state
SCB_LPM_SLEEP_EXIT_ISR	if chose this para, the system always enter low power mode by exiting from ISR
SCB_LPM_DEEPSLEEP	if chose this para, the system will enter the DEEPSLEEP mode
SCB_LPM_WAKE_BY_ALL_INT	if chose this para, the lowpower mode can be woke up by all the enable and disable interrupts
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* the system always enter low power mode by exiting from ISR */
system_lowpower_set(SCB_LPM_SLEEP_EXIT_ISR);
```

system_lowpower_reset

The description of system_lowpower_reset is shown as below:

Table 3-512. Function system_lowpower_reset

Function name	system_lowpower_reset
Function prototype	void system_lowpower_reset(uint8_t lowpower_mode);
Function descriptions	reset the state of the low power mode
Precondition	-
The called functions	-
Input parameter{in}	

lowpower_mode	the low power mode state
<i>SCB_LPM_SLEEP_EXIT_ISR</i>	if chose this para, the system will exit low power mode by exiting from ISR
<i>SCB_LPM_DEEPSLEEP</i>	if chose this para, the system will enter the SLEEP mode
<i>SCB_LPM_WAKE_BY_ALL_INT</i>	if chose this para, the lowpower mode only can be woke up by the enable interrupts
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* the system will exit low power mode by exiting from ISR */
system_lowpower_reset(SCB_LPM_SLEEP_EXIT_ISR);
```

systick_clksource_set

The description of systick_clksource_set is shown as below:

Table 3-513. Function systick_clksource_set

Function name	systick_clksource_set
Function prototype	void systick_clksource_set(uint32_t systick_clksource);
Function descriptions	set the systick clock source
Precondition	-
The called functions	-
Input parameter{in}	
systick_clksource	the systick clock source needed to choose
<i>SYSTICK_CLKSOURC_E_HCLK</i>	systick clock source is from HCLK
<i>SYSTICK_CLKSOURC_E_HCLK_DIV8</i>	systick clock source is from HCLK/8
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* systick clock source is HCLK/8 */
systick_clksource_set(SYSTICK_CLKSOURCE_HCLK_DIV8);
```

3.19. PMU

According to the Power management unit (PMU), provides ten types of power saving modes, including Run, Run1, Run2, Sleep, Sleep1, Sleep2, Deep-sleep, Deep-sleep 1, Deep-sleep 2 and Standby mode. The PMU registers are listed in chapter [3.19.1](#), the PMU firmware functions are introduced in chapter [3.19.2](#).

3.19.1. Descriptions of Peripheral registers

PMU registers are listed in the table shown as below:

Table 3-514. PMU Registers

Registers	Descriptions
PMU_CTL0	PMU control 0 register
PMU_CS	PMU control and status register
PMU_CTL1	PMU control 1 register
PMU_STAT	PMU status register
PMU_PAR	PMU parameter register

3.19.2. Descriptions of Peripheral functions

PMU firmware functions are listed in the table shown as below:

Table 3-515. PMU firmware function

Function name	Function description
pmu_deinit	reset PMU
pmu_lvd_select	select low voltage detector threshold
pmu_lvd_disable	disable PMU lvd
pmu_ldo_output_select	select LDO output voltage
pmu_vc_enable	enable VBAT battery charging
pmu_vc_disable	disable VBAT battery charging
pmu_vcr_select	select PMU VBAT battery charging resistor
pmu_low_power_enable	enable low power in Run/Sleep mode
pmu_low_power_disable	disable low power in Run/Sleep mode
pmu_to_sleepmode	PMU work in sleep mode
pmu_to_deepsleepmode	PMU work at Deep-sleep/Deep-sleep 1/Deep-sleep 2 mode
pmu_to_standbymode	pmu work at standby mode
pmu_wakeup_pin_enable	enable PMU wakeup pin
pmu_wakeup_pin_disable	disable PMU wakeup pin
pmu_backup_write_enable	enable backup domain write
pmu_backup_write_disable	disable backup domain write
pmu_sram_power_config	configure power state of SRAM1
pmu_core1_power_config	configure power state of COREOFF1 domain (only for

Function name	Function description
	GD32L233xx series)
pmu_eflash_sleep_power_config	configure power state of eflash domain when in Run / Run1 / Run2 / Run3 mode (only for GD32L235xx series)
pmu_eflash_deepsleep_power_config	configure power state of eflash domain when in Deep-sleep / Deep-sleep 1 / Deep-sleep 2 mode (only for GD32L235xx series)
pmu_deepsleep2_retention_enable	have retention register in Deep-sleep 2
pmu_deepsleep2_retention_disable	no retention register in Deep-sleep 2
pmu_deepsleep2_sram_power_config	configure SRAM1 power state when enter Deep-sleep 2
pmu_deepsleep_wait_time_config	configure IRC16M counter before enter Deep-sleep mode
pmu_wakeuptime_core1_software_enable	use software value signal when wake up COREOFF1 domain (only for GD32L233xx series)
pmu_wakeuptime_core1_software_disable	use hardware ack signal when wake up COREOFF1 domain (only for GD32L233xx series)
pmu_wakeuptime_eflash_config	configure eflash wake up counter (only for GD32L235xx series)
pmu_wakeuptime_sram_config	configure SRAM1 wakeup time
pmu_wakeuptime_sram_software_enable	use software value signal when wake up SRAM1 (only for GD32L233xx series)
pmu_wakeuptime_sram_software_disable	use hardware ack signal when wake up SRAM1 (only for GD32L233xx series)
pmu_wakeuptime_deepsleep2_software_enable	use software value signal when wake up Deep-sleep 2
pmu_wakeuptime_deepsleep2_software_disable	use hardware ack signal when wake up Deep-sleep 2
pmu_flag_get	get PMU flag status
pmu_flag_clear	clear PMU flag status

pmu_deinit

The description of pmu_deinit is shown as below:

Table 3-516. Function pmu_deinit

Function name	pmu_deinit
Function prototype	void pmu_deinit(void);
Function descriptions	reset PMU
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
-	-
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* reset PMU */
```

```
pmu_deinit();
```

pmu_lvd_select

The description of pmu_lvd_select is shown as below:

Table 3-517. Function pmu_lvd_select

Function name	pmu_lvd_select
Function prototype	void pmu_lvd_select(uint32_t lvd_t_n);
Function descriptions	select low voltage detector threshold
Precondition	-
The called functions	-
Input parameter{in}	
lvd_t_n	voltage threshold value
PMU_LVDT_0	voltage threshold is 2.1V
PMU_LVDT_1	voltage threshold is 2.3V
PMU_LVDT_2	voltage threshold is 2.4V
PMU_LVDT_3	voltage threshold is 2.6V
PMU_LVDT_4	voltage threshold is 2.7V
PMU_LVDT_5	voltage threshold is 2.9V
PMU_LVDT_6	voltage threshold is 3.0V
PMU_LVDT_7	input analog voltage on PB7 (compared with 0.8V)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select low voltage detector threshold as 3.0V */
```

```
pmu_lvd_select(PMU_LVDT_6);
```

pmu_lvd_disable

The description of pmu_lvd_disable is shown as below:

Table 3-518. Function pmu_lvd_disable

Function name	pmu_lvd_disable
Function prototype	void pmu_lvd_disable(void);

Function descriptions	disable PMU lvd
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable PMU lvd */
pmu_lvd_disable();
```

pmu_ldo_output_select

The description of pmu_ldo_output_select is shown as below:

Table 3-519. Function pmu_ldo_output_select

Function name	pmu_ldo_output_select
Function prototype	void pmu_ldo_output_select(uint32_t ldo_output);
Function descriptions	select LDO output voltage
Precondition	-
The called functions	-
Input parameter{in}	
ldo_output	output voltage mode
<i>PMU_LDOVS_LOW</i>	LDO output voltage low mode, only for GD32L233xx series
<i>PMU_LDOVS_HIGH</i>	LDO output voltage high mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select output low voltage mode */
pmu_ldo_output_select(PMU_LDOVS_LOW);
```

pmu_vc_enable

The description of pmu_vc_enable is shown as below:

Table 3-520. Function pmu_vc_enable

Function name	pmu_vc_enable
----------------------	---------------

Function prototype	void pmu_vc_enable(void);
Function descriptions	enable VBAT battery charging
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable VBAT battery charging */
pmu_vc_enable();
```

pmu_vc_disable

The description of pmu_vc_disable is shown as below:

Table 3-521. Function pmu_vc_disable

Function name	pmu_vc_disable
Function prototype	void pmu_vc_disable(void);
Function descriptions	disable VBAT battery charging
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable VBAT battery charging */
pmu_vc_disable();
```

pmu_vcr_select

The description of pmu_vcr_select is shown as below:

Table 3-522. Function pmu_vcr_select

Function name	pmu_vcr_select
Function prototype	void pmu_vcr_select(uint32_t resistor);

Function descriptions	select PMU VBAT battery charging resistor
Precondition	-
The called functions	-
Input parameter{in}	
resistor	VBAT battery charging resistor
<i>PMU_VCRSEL_5K</i>	5 kOhms resistor is selected for charging VBAT battery
<i>PMU_VCRSEL_1P5K</i>	1.5 kOhms resistor is selected for charging VBAT battery
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select PMU VBAT battery charging resistor */
```

```
pmu_vcr_select(PMU_VCRSEL_5K);
```

pmu_low_power_enable

The description of pmu_low_power_enable is shown as below:

Table 3-523. Function pmu_low_power_enable

Function name	pmu_low_power_enable
Function prototype	void pmu_low_power_enable(void);
Function descriptions	enable low power in Run/Sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable low power in Run/Sleep mode */
```

```
pmu_low_power_enable();
```

pmu_low_power_disable

The description of pmu_low_power_disable is shown as below:

Table 3-524. Function pmu_low_power_disable

Function name	pmu_low_power_disable
----------------------	-----------------------

Function prototype	void pmu_low_power_disable(void);
Function descriptions	disable low power in Run/Sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable low power in Run/Sleep mode */
```

```
pmu_low_power_disable();
```

pmu_to_sleepmode

The description of pmu_to_sleepmode is shown as below:

Table 3-525. Function pmu_to_sleepmode

Function name	pmu_to_sleepmode
Function prototype	void pmu_to_sleepmode(uint32_t lowdrive, uint8_t sleepmodecmd);
Function descriptions	PMU work at sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
lowdrive	NPLDO work mode
<i>PMU_LDNPDSP_NOR MALDRIVE</i>	low-driver mode disable
<i>PMU_LDNPDSP_LOW DRIVE</i>	low-driver mode enable
Input parameter{in}	
sleepmodecmd	command to enter sleep mode
<i>WFI_CMD</i>	use WFI command
<i>WFE_CMD</i>	use WFE command
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* PMU work at sleep mode */
```

```
pmu_to_sleepmode(PMU_LDNP_LOWDRIVE, WFI_CMD);
```

pmu_to_deepsleepmode

The description of pmu_to_deepsleepmode is shown as below:

Table 3-526. Function pmu_to_deepsleepmode

Function name	pmu_to_deepsleepmode
Function prototype	void pmu_to_deepsleepmode(uint32_t lowdrive, uint8_t deepsleepmodecmd, uint8_t deepsleepmode);
Function descriptions	PMU work at Deep-sleep/Deep-sleep 1/Deep-sleep 2 mode
Precondition	-
The called functions	-
Input parameter{in}	
lowdrive	NPLDO work mode
PMU_LDNPDSP_NOR MALDRIVE	low-driver mode disable
PMU_LDNPDSP_LOW DRIVE	low-driver mode enable
Input parameter{in}	
deepsleepmodecmd	command to enter Deep-sleep/Deep-sleep 1/Deep-sleep 2 mode
WFI_CMD	use WFI command
WFE_CMD	use WFE command
Input parameter{in}	
deepsleepmode	Deep-sleep mode
PMU_DEEPSLEEP	Deep-sleep mode
PMU_DEEPSLEEP1	Deep-sleep mode 1
PMU_DEEPSLEEP2	Deep-sleep mode 2
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* PMU work at Deep-sleep mode */
```

```
pmu_to_deepsleepmode(PMU_LDNPDSP_NORMALDRIVE, WFI_CMD, PMU_DEEPSLEEP);
```

pmu_to_standbymode

The description of pmu_to_standbymode is shown as below:

Table 3-527. Function pmu_to_standbymode

Function name	pmu_to_standbymode
Function prototype	void pmu_to_standbymode();
Function descriptions	pmu work at standby mode

Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* PMU work at standby mode */
pmu_to_standby(WFI_CMD);
```

pmu_wakeup_pin_enable

The description of pmu_wakeup_pin_enable is shown as below:

Table 3-528. Function pmu_wakeup_pin_enable

Function name	pmu_wakeup_pin_enable
Function prototype	void pmu_wakeup_pin_enable(uint32_t wakeup_pin);
Function descriptions	enable wakeup pin
Precondition	-
The called functions	-
Input parameter{in}	
wakeup_pin	Wakeup pin
<i>PMU_WAKEUP_PIN0</i>	WKUP Pin 0 (PA0)
<i>PMU_WAKEUP_PIN1</i>	WKUP Pin 1 (PC13)
<i>PMU_WAKEUP_PIN2</i>	WKUP Pin 2 (PA2)
<i>PMU_WAKEUP_PIN3</i>	WKUP Pin 3 (PB2)
<i>PMU_WAKEUP_PIN4</i>	WKUP Pin 4 (PC6)
<i>PMU_WAKEUP_PIN5</i>	WKUP Pin 5 (PB5) (only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable wakeup pin0 */
pmu_wakeup_pin_enable(PMU_WAKEUP_PIN0);
```

pmu_wakeup_pin_disable

The description of pmu_wakeup_pin_disable is shown as below:

Table 3-529. Function pmu_wakeup_pin_disable

Function name	pmu_wakeup_pin_disable
Function prototype	void pmu_wakeup_pin_disable(uint32_t wakeup_pin);
Function descriptions	disable wakeup pin
Precondition	-
The called functions	-
Input parameter{in}	
wakeup_pin	Wakeup pin
PMU_WAKEUP_PIN0	WKUP Pin 0 (PA0)
PMU_WAKEUP_PIN1	WKUP Pin 1 (PC13)
PMU_WAKEUP_PIN2	WKUP Pin 2 (PA2)
PMU_WAKEUP_PIN3	WKUP Pin 3 (PB2)
PMU_WAKEUP_PIN4	WKUP Pin 4 (PC6)
PMU_WAKEUP_PIN5	WKUP Pin 5 (PB5) (only for GD32L235xx series)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable wakeup pin0 */
pmu_wakeup_pin_disable(PMU_WAKEUP_PIN0);
```

pmu_backup_write_enable

The description of pmu_backup_write_enable is shown as below:

Table 3-530. Function pmu_backup_write_enable

Function name	pmu_backup_write_enable
Function prototype	void pmu_backup_write_enable(void);
Function descriptions	enable backup domain write
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable backup domain write */
pmu_backup_write_enable();
```

pmu_backup_write_disable

The description of pmu_backup_write_disable is shown as below:

Table 3-531. Function pmu_backup_write_disable

Function name	pmu_backup_write_disable
Function prototype	void pmu_backup_write_disable(void);
Function descriptions	disable backup domain write
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable backup domain write */
pmu_backup_write_disable();
```

pmu_sram_power_config

The description of pmu_sram_power_config is shown as below:

Table 3-532. Function pmu_sram_power_config

Function name	pmu_sram_power_config
Function prototype	void pmu_sram_power_config(uint32_t state);
Function descriptions	configure power state of SRAM1
Precondition	-
The called functions	-
Input parameter{in}	
state	power state of SRAM1
<i>PMU_SRAM1_SLEEP</i>	SRAM1 go to power-off
<i>PMU_SRAM1_WAKE</i>	SRAM1 wakeup
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure power state of SRAM1 */
pmu_sram_power_config(PMU_SRAM1_WAKE);
```

pmu_core1_power_config (only for GD32L233xx series)

The description of pmu_core1_power_config is shown as below:

Table 3-533. Function pmu_core1_power_config

Function name	pmu_core1_power_config
Function prototype	void pmu_core1_power_config(uint32_t state);
Function descriptions	configure power state of COREOFF1 domain
Precondition	-
The called functions	-
Input parameter{in}	
state	power state of COREOFF1 domain
<i>PMU_CORE1_SLEEP</i>	COREOFF1 domain go to power-off
<i>PMU_CORE1_WAKE</i>	COREOFF1 domain wakeup
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure power state of COREOFF1 domain */
pmu_core1_power_config(PMU_SRAM1_WAKE);
```

pmu_deepsleep2_retention_enable (only for GD32L233xx series)

The description of pmu_deepsleep2_retention_enable is shown as below:

Table 3-534. Function pmu_deepsleep2_retention_enable

Function name	pmu_deepsleep2_retention_enable
Function prototype	void pmu_deepsleep2_retention_enable(void);
Function descriptions	have retention register in Deep-sleep 2
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* have retention register in Deep-sleep 2 */
pmu_deepsleep2_retention_enable();
```


pmu_deepsleep2_retention_disable (only for GD32L233xx series)

The description of pmu_deepsleep2_retention_disable is shown as below:

Table 3-535. Function pmu_deepsleep2_retention_disable

Function name	pmu_deepsleep2_retention_disable
Function prototype	void pmu_deepsleep2_retention_disable(void);
Function descriptions	no retention register in Deep-sleep 2
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* no retention register in Deep-sleep 2 */
pmu_deepsleep2_retention_disable();
```

pmu_eflash_sleep_power_config (only for GD32L235xx series)

The description of pmu_eflash_sleep_power_config is shown as below:

Table 3-536. Function pmu_eflash_sleep_power_config

Function name	pmu_eflash_sleep_power_config
Function prototype	void pmu_eflash_sleep_power_config(uint32_t state);
Function descriptions	configure power state of eflash domain when in Run mode
Precondition	-
The called functions	-
Input parameter{in}	
state	power state of eflash domain
<i>PMU_EFLASH_SLEEP_ON</i>	eflash domain power on in Run mode
<i>PMU_EFLASH_SLEEP_OFF</i>	eflash domain power off in Run mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure power state of eflash domain when in Run mode */
```

```
pmu_eflash_sleep_power_config(PMU_EFLASH_SLEEP_ON);
```

pmu_eflash_deepsleep_power_config (only for GD32L235xx series)

The description of pmu_eflash_deepsleep_power_config is shown as below:

Table 3-537. Function pmu_eflash_deepsleep_power_config

Function name	pmu_eflash_deepsleep_power_config
Function prototype	void pmu_eflash_deepsleep_power_config(uint32_t state);
Function descriptions	configure power state of eflash domain when in Deep-sleep / Deep-sleep 1 / Deep-sleep 2 mode
Precondition	-
The called functions	-
Input parameter{in}	
state	power state of eflash domain
<i>PMU_EFLASH_DSPSL EEP_ON</i>	eflash power on when in Deep-sleep / Deep-sleep 1 / Deep-sleep 2 mode
<i>PMU_EFLASH_DSPSL EEP_OFF</i>	eflash power off when in Deep-sleep / Deep-sleep 1 / Deep-sleep 2 mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure power state of eflash domain when in Deep-sleep / Deep-sleep 1 / Deep-sleep 2 mode */
```

```
pmu_eflash_deepsleep_power_config(PMU_EFLASH_DSPSLEEP_ON);
```

pmu_deepsleep2_sram_power_config

The description of pmu_deepsleep2_sram_power_config is shown as below:

Table 3-538. Function pmu_deepsleep2_sram_power_config

Function name	pmu_deepsleep2_sram_power_config
Function prototype	void pmu_deepsleep2_sram_power_config(uint32_t state);
Function descriptions	configure SRAM1 power state when enter Deep-sleep 2
Precondition	-
The called functions	-
Input parameter{in}	
state	power state of SRAM1
<i>PMU_SRAM1_POWER _OFF</i>	SRAM1 power-off
<i>PMU_SRAM1_POWER</i>	SRAM1 power same as Run / Run1 / Run2 mode for GD32L233xx series

<code>_REMAIN</code>	and Run mode for GD32L235xx series
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SRAM1 power state when enter Deep-sleep 2 */
```

```
pmu_deepsleep2_sram_power_config(PMU_SRAM1_POWER_OFF);
```

pmu_deepsleep_wait_time_config

The description of `pmu_deepsleep_wait_time_config` is shown as below:

Table 3-539. Function `pmu_deepsleep_wait_time_config`

Function name	<code>pmu_deepsleep_wait_time_config</code>
Function prototype	<code>void pmu_deepsleep_wait_time_config(uint32_t wait_time);</code>
Function descriptions	configure IRC16M counter before enter Deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
wait_time	IRC16M counter before enter Deep-sleep mode
<i>uint32_t</i>	0x0~0x1F
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure IRC16M counter before enter Deep-sleep mode */
```

```
pmu_deepsleep_wait_time_config(1);
```

pmu_wakeuptime_core1_software_enable (only for GD32L233xx series)

The description of `pmu_wakeuptime_core1_software_enable` is shown as below:

Table 3-540. Function `pmu_wakeuptime_core1_software_enable`

Function name	<code>pmu_wakeuptime_core1_software_enable</code>
Function prototype	<code>void pmu_wakeuptime_core1_software_enable(uint32_t wakeup_time);</code>
Function descriptions	use software value signal when wake up COREOFF1 domain
Precondition	-
The called functions	-
Input parameter{in}	

wakeup_time	wakeup time of power switch of COREOFF1 domain
<i>uint32_t</i>	0x0~0xFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use software value signal when wake up COREOFF1 domain */
```

```
pmu_wakeuptime_core1_software_enable(1);
```

pmu_wakeuptime_core1_software_disable (only for GD32L233xx series)

The description of pmu_wakeuptime_core1_software_disable is shown as below:

Table 3-541. Function pmu_wakeuptime_core1_software_disable

Function name	pmu_wakeuptime_core1_software_disable
Function prototype	void pmu_wakeuptime_core1_software_disable(void);
Function descriptions	use hardware ack signal when wake up COREOFF1 domain
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use hardware ack signal when wake up COREOFF1 domain */
```

```
pmu_wakeuptime_core1_software_disable();
```

pmu_wakeuptime_eflash_config (only for GD32L235xx series)

The description of pmu_wakeuptime_eflash_config is shown as below:

Table 3-542. Function pmu_wakeuptime_eflash_config

Function name	pmu_wakeuptime_eflash_config
Function prototype	void pmu_wakeuptime_eflash_config(uint32_t wait_time);
Function descriptions	configure eflash wake up counter
Precondition	-
The called functions	-
Input parameter{in}	

wait_time	IRC16M counter, 0x0~0xFF
<i>uint32_t</i>	0x0~0xFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure eflash wake up counter */
pmu_wakeuptime_eflash_config(2);
```

pmu_wakeuptime_sram_config

The description of pmu_wakeuptime_sram_config is shown as below:

Table 3-543. Function pmu_wakeuptime_sram_config

Function name	pmu_wakeuptime_sram_config
Function prototype	void pmu_wakeuptime_sram_config(uint32_t wakeup_time);
Function descriptions	configure SRAM1 wakeup time
Precondition	-
The called functions	-
Input parameter{in}	
wakeup_time	wakeup time of power switch of SRAM1
<i>uint32_t</i>	0x0~0xFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SRAM1 wakeup time */
pmu_wakeuptime_sram_config(2);
```

pmu_wakeuptime_sram_software_enable (only for GD32L233xx series)

The description of pmu_wakeuptime_sram_software_enable is shown as below:

Table 3-544. Function pmu_wakeuptime_sram_software_enable

Function name	pmu_wakeuptime_sram_software_enable
Function prototype	void pmu_wakeuptime_sram_software_enable(void);
Function descriptions	use software value signal when wake up SRAM1
Precondition	-
The called functions	-

Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use software value signal when wake up SRAM1 */
```

```
pmu_wakeuptime_sram_software_enable();
```

pmu_wakeuptime_sram_software_disable (only for GD32L233xx series)

The description of pmu_wakeuptime_sram_software_disable is shown as below:

Table 3-545. Function pmu_wakeuptime_sram_software_disable

Function name	pmu_wakeuptime_sram_software_disable
Function prototype	void pmu_wakeuptime_sram_software_disable(void);
Function descriptions	use hardware ack signal when wake up SRAM1
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use hardware ack signal when wake up SRAM1 */
```

```
pmu_wakeuptime_sram_software_disable();
```

pmu_wakeuptime_deepsleep2_software_enable

The description of pmu_wakeuptime_deepsleep2_software_enable is shown as below:

Table 3-546. Function pmu_wakeuptime_deepsleep2_software_enable

Function name	pmu_wakeuptime_deepsleep2_software_enable
Function prototype	void pmu_wakeuptime_deepsleep2_software_enable(uint32_t wakeup_time);
Function descriptions	use software value signal when wake up Deep-sleep 2
Precondition	-
The called functions	-

Input parameter{in}	
wakeup_time	wakeup time of power switch of COREOFF0 domain
<i>uint32_t</i>	0x0~0xFF
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use software value signal when wake up Deep-sleep 2 */
pmu_wakeuptime_deepsleep2_software_enable(1);
```

pmu_wakeuptime_deepsleep2_software_disable

The description of pmu_wakeuptime_deepsleep2_software_disable is shown as below:

Table 3-547. Function pmu_wakeuptime_deepsleep2_software_disable

Function name	pmu_wakeuptime_deepsleep2_software_disable
Function prototype	void pmu_wakeuptime_deepsleep2_software_disable(void);
Function descriptions	use hardware ack signal when wake up Deep-sleep 2
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* use hardware ack signal when wake up Deep-sleep 2 */
pmu_wakeuptime_deepsleep2_software_disable();
```

pmu_flag_get

The description of pmu_flag_get is shown as below:

Table 3-548. Function pmu_flag_get

Function name	pmu_flag_get
Function prototype	FlagStatus pmu_flag_get(uint32_t flag);
Function descriptions	get PMU flag status
Precondition	-
The called functions	-

Input parameter{in}	
flag	flag
<i>PMU_FLAG_WAKEUP</i>	wakeup flag
<i>PMU_FLAG_STANDBY</i>	standby flag
<i>PMU_FLAG_LVD</i>	lvd flag
<i>PMU_FLAG_LDOVSRF</i>	LDO voltage select ready flag
<i>PMU_FLAG_NPRDY</i>	normal-power LDO ready flag
<i>PMU_FLAG_LPRDY</i>	low-power LDO ready flag
<i>PMU_FLAG_SRAM1_SLEEP</i>	SRAM1 is in sleep state flag
<i>PMU_FLAG_SRAM1_ACTIVE</i>	SRAM1 is in active state flag
<i>PMU_FLAG_EFLASH_SLEEP</i>	eflash domain is in sleep state flag (only for GD32L235xx series)
<i>PMU_FLAG_EFLASH_ACTIVE</i>	eflash domain is in active state flag (only for GD32L235xx series)
<i>PMU_FLAG_CORE1_SLEEP</i>	COREOFF1 domain is in sleep state flag (only for GD32L233xx series)
<i>PMU_FLAG_CORE1_ACTIVE</i>	COREOFF1 domain is in active state flag (only for GD32L233xx series)
<i>PMU_FLAG_DEEPSLEEP_2</i>	Deep-sleep 2 mode status flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get flag state */
```

```
FlagStatus status;
```

```
status = pmu_flag_get(PMU_FLAG_WAKEUP);
```

pmu_flag_clear

The description of pmu_flag_clear is shown as below:

Table 3-549. Function pmu_flag_clear

Function name	pmu_flag_clear
Function prototype	void pmu_flag_clear(uint32_t flag);
Function descriptions	clear PMU flag status
Precondition	-
The called functions	-
Input parameter{in}	

flag	flag
<i>PMU_FLAG_WAKEUP</i>	wakeup flag
<i>PMU_FLAG_STANDBY</i>	standby flag
<i>PMU_FLAG_DEEPSLEEP_2</i>	Deep-sleep 2 mode status flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear flag bit */
```

```
pmu_flag_clear(PMU_FLAG_STANDBY);
```

3.20. RCU

RCU is the reset and clock unit. Reset Control includes the control of three kinds of reset: power reset, system reset and backup domain reset. The Clock Control unit provides a range of frequencies and clock functions. The RCU registers are listed in chapter [3.20.1](#), the RCU firmware functions are introduced in chapter [3.20.2](#).

3.20.1. Descriptions of Peripheral registers

Table 3-550. RCU Registers

Registers	Descriptions
RCU_CTL	control register
RCU_CFG0	clock configuration register 0
RCU_INT	clock interrupt register
RCU_APB2RST	APB2 reset register
RCU_APB1RST	APB1 reset register
RCU_AHBEN	AHB enable register
RCU_APB2EN	APB2 enable register
RCU_APB1EN	APB1 enable register
RCU_BDCTL	backup domain control register
RCU_RSTSCK	reset source/clock register
RCU_AHBRST	AHB reset register
RCU_CFG1	clock configuration register 1
RCU_CFG2	clock configuration register 2
RCU_ANB2EN	AHB2 enable register
RCU_AHB2RST	AHB2 reset register
RCU_VKEY	voltage key register

Registers	Descriptions
RCU_LPB	low-power bandgap mode register

3.20.2. Descriptions of Peripheral functions

Table 3-551. RCU firmware function

Function name	Function description
rcu_deinit	deinitialize the RCU
rcu_periph_clock_enable	enable the peripherals clock
rcu_periph_clock_disable	disable the peripherals clock
rcu_periph_clock_sleep_enable	enable the peripherals clock when in sleep mode
rcu_periph_clock_sleep_disable	disable the peripherals clock when in sleep mode
rcu_periph_reset_enable	enable the peripherals reset
rcu_periph_reset_disable	disable the peripheral reset
rcu_bkp_reset_enable	enable the BKP domain reset
rcu_bkp_reset_disable	disable the BKP domain reset
rcu_system_clock_source_config	configure the system clock source
rcu_system_clock_source_get	get the system clock source
rcu_ahb_clock_config	configure the AHB clock prescaler selection
rcu_apb1_clock_config	configure the APB1 clock prescaler selection
rcu_apb2_clock_config	configure the APB2 clock prescaler selection
rcu_adc_clock_config	configure the ADC clock source and prescaler selection
rcu_ckout_config	configure the CK_OUT clock source and divider
rcu_pll_config	configure the main PLL clock
rcu_usart_clock_config	configure the usart clock
rcu_i2c_clock_config	configure the I2Cx(x=0,1,2) clock source selection
rcu_lptimer_clock_config	configure the LPTIMER clock source selection
rcu_lpuart_clock_config	configure the LPUART clock source selection
rcu_irc16mdiv_clock_config	configure the IRC16MDIV clock selection
rcu_usbd_clock_config	configure the USBD clock source selection
rcu_rtc_clock_config	configure the RTC/SLCD clock source selection
rcu_pll_source_ck_prediv_config	configure PLL source clocks pre-divider
rcu_lxtal_drive_capability_config	configure the LXTAL drive capability
rcu_lp_bandgap_config	configure low power bandgap mode selection
rcu_osci_stab_wait	wait for oscillator stabilization flags is SET or oscillator startup is timeout
rcu_osci_on	turn on the oscillator
rcu_osci_off	turn off the oscillator
rcu_osci_bypass_mode_enable	enable the oscillator bypass mode
rcu_osci_bypass_mode_disable	disable the oscillator bypass mode
rcu_irc16m_adjust_value_set	set the IRC16M adjust value
rcu_hxtal_clock_monitor_enable	enable the HXTAL clock monitor

Function name	Function description
rcu_hxtal_clock_monitor_disable	disable the HXTAL clock monitor
rcu_lxtal_clock_monitor_enable	enable the LXTAL clock monitor
rcu_lxtal_clock_monitor_disable	disable the LXTAL clock monitor
rcu_voltage_key_unlock	unlock the voltage key
rcu_clock_freq_get	get the system clock, bus and peripheral clock frequency
rcu_flag_get	get the clock stabilization and peripheral reset flags
rcu_all_reset_flag_clear	clear all the reset flag
rcu_interrupt_enable	enable the stabilization interrupt
rcu_interrupt_disable	disable the stabilization interrupt
rcu_interrupt_flag_get	get the clock stabilization interrupt and ckm flags
rcu_interrupt_flag_clear	clear the interrupt flags

Enum rcu_periph_enum

Table 3-552. Enum rcu_periph_enum

enum name	Function description
RCU_DMA	DMA clock
RCU_CAU	CAU clock
RCU_TRNG	TRNG clock
RCU_CRC	CRC clock
RCU_GPIOA	GPIOA clock
RCU_GPIOB	GPIOB clock
RCU_GPIOC	GPIOC clock
RCU_GPIOD	GPIOD clock
RCU_GPIOF	GPIOF clock
RCU_SYSCFG	SYSCFG clock
RCU_CMP	CMP clock
RCU_ADC	ADC clock
RCU_TIMER8	TIMER8 clock
RCU_SPI0	SPI0 clock
RCU_USART0	USART0 clock
RCU_DBGMCU	DBGMCU clock
RCU_TIMER1	TIMER1 clock
RCU_TIMER2	TIMER2 clock
RCU_TIMER5	TIMER5 clock
RCU_TIMER6	TIMER6 clock
RCU_TIMER11	TIMER11 clock
RCU_LPTIMER	LPTIMER clock (only for GD32L233xx series)
RCU_LPTIMER0	LPTIMER0 clock (only for GD32L235xx series)
RCU_LPTIMER1	LPTIMER1 clock (only for GD32L235xx series)
RCU_SLCD	SLCD clock
RCU_WWDGT	WWDGT clock

enum name	Function description
RCU_SPI1	SPI1 clock
RCU_USART1	USART1 clock
RCU_LPUART	LPUART clock (only for GD32L233xx series)
RCU_LPUART0	LPUART0 clock (only for GD32L235xx series)
RCU_LPUART1	LPUART1 clock (only for GD32L235xx series)
RCU_CAN	CAN clock (only for GD32L235xx series)
RCU_UART3	UART3 clock
RCU_UART4	UART4 clock
RCU_I2C0	I2C0 clock
RCU_I2C1	I2C1 clock
RCU_USBD	USB clock
RCU_I2C2	I2C2 clock
RCU_PMU	PMU clock
RCU_DAC	DAC clock
RCU_CTC	CTC clock
RCU_BKP	BKP clock
RCU_RTC	RTC clock

Enum rcu_periph_sleep_enum

Table 3-553. Enum rcu_periph_sleep_enum

enum name	Function description
RCU_SRAM0_SLP	SRAM0 clock
RCU_FMC_SLP	FMC clock
RCU_SRAM1_SLP	SRAM1 clock

Enum rcu_periph_reset_enum

Table 3-554. Enum rcu_periph_reset_enum

enum name	Function description
RCU_CAURST	SRAM0 clock
RCU_TRNGRST	TRNG reset
RCU_CRCRST	CRC reset
RCU_GPIOARST	GPIOA reset
RCU_GPIOBRST	GPIOB reset
RCU_GPIOCRST	GPIOC reset
RCU_GPIODRST	GPIOD reset
RCU_GPIOFRST	GPIOF reset
RCU_SYSCFGRST	SYSCFG reset
RCU_CMPRST	CMP reset
RCU_ADCRST	ADC reset
RCU_TIMER8RST	TIMER8 reset

enum name	Function description
RCU_SPI0RST	SPI0 reset
RCU_USART0RST	USART0 reset
RCU_TIMER1RST	TIMER1 reset
RCU_TIMER2RST	TIMER2 reset
RCU_TIMER5RST	TIMER5 reset
RCU_TIMER6RST	TIMER6 reset
RCU_TIMER11RST	TIMER11 reset
RCU_LPTIMERRST	LPTIMER reset (only for GD32L233xx series)
RCU_LPTIMER0RST	LPTIMER0 reset (only for GD32L235xx series)
RCU_LPTIMER1RST	LPTIMER1 reset (only for GD32L235xx series)
RCU_SLCDRST	SLCD reset
RCU_WWDGTRST	WWDGT reset
RCU_SPI1RST	SPI1 reset
RCU_USART1RST	USART1 reset
RCU_LPUARTRST	LPUART reset (only for GD32L233xx series)
RCU_LPUART0RST	LPUART0 reset (only for GD32L235xx series)
RCU_LPUART1RST	LPUART1 reset (only for GD32L235xx series)
RCU_CANRST	CAN reset (only for GD32L235xx series)
RCU_UART3RST	UART3 reset
RCU_UART4RST	UART4 reset
RCU_I2C0RST	I2C0 reset
RCU_I2C1RST	I2C1 reset
RCU_USBDRST	USB reset
RCU_I2C2RST	I2C2 reset
RCU_PMURST	PMU reset
RCU_DACRST	DAC reset
RCU_CTCRST	CTC reset

Enum rcu_flag_enum

Table 3-555. Enum rcu_flag_enum

enum name	Function description
RCU_FLAG_IRC32KST B	IRC32K stabilization flags
RCU_FLAG_LXTALST B	LXTAL stabilization flags
RCU_FLAG_IRC16MS TB	IRC16M stabilization flags
RCU_FLAG_HXTALST B	HXTAL stabilization flags
RCU_FLAG_IRC48MS TB	IRC48M stabilization flags

enum name	Function description
RCU_FLAG_PLLSTB	PLL stabilization flags
RCU_FLAG_V11RST	V11 reset flags
RCU_FLAG_EPRST	EPR reset flags
RCU_FLAG_PORRST	power reset flags
RCU_FLAG_SWRST	SW reset flags
RCU_FLAG_FWDGTR ST	FWDGT reset flags
RCU_FLAG_WWDGTR ST	WWDGT reset flags
RCU_FLAG_LPRST	LP reset flags

Enum rcu_int_flag_enum

Table 3-556. Enum rcu_int_flag_enum

enum name	Function description
RCU_INT_FLAG_IRC3 2KSTB	IRC32K stabilization interrupt flag
RCU_INT_FLAG_LXTA LSTB	LXTAL stabilization interrupt flag
RCU_INT_FLAG_IRC1 6MSTB	IRC16M stabilization interrupt flag
RCU_INT_FLAG_HXTA LSTB	HXTAL stabilization interrupt flag
RCU_INT_FLAG_PLLS TB	PLL stabilization interrupt flag
RCU_INT_FLAG_IRC4 8MSTB	IRC48M stabilization interrupt flag
RCU_INT_FLAG_LXTA LCKM	LXTAL clock stuck interrupt flag
RCU_INT_FLAG_CKM	CKM interrupt flag
RCU_INT_FLAG_IRC3 2KSTB	IRC32K stabilization interrupt flag

Enum rcu_int_flag_clear_enum

Table 3-557. Enum rcu_int_flag_clear_enum

enum name	Function description
RCU_INT_FLAG_IRC3 2KSTB_CLR	IRC32K stabilization interrupt flags clear
RCU_INT_FLAG_LXTA LSTB_CLR	LXTAL stabilization interrupt flags clear
RCU_INT_FLAG_IRC1	IRC16M stabilization interrupt flags clear

enum name	Function description
6MSTB_CLR	
RCU_INT_FLAG_HXTA LSTB_CLR	HXTAL stabilization interrupt flags clear
RCU_INT_FLAG_PLLS TB_CLR	PLL stabilization interrupt flags clear
RCU_INT_FLAG_IRC4 8MSTB_CLR	IRC48M stabilization interrupt flags clear
RCU_INT_FLAG_LXTA LCKM_CLR	LXTAL clock stuck interrupt flag clear
RCU_INT_FLAG_CKM _CLR	CKM interrupt flags clear
RCU_INT_FLAG_IRC3 2KSTB_CLR	IRC32K stabilization interrupt flags clear

Enum rcu_int_enum

Table 3-558. Enum rcu_int_enum

enum name	Function description
RCU_INT_IRC32KSTB	IRC32K stabilization interrupt
RCU_INT_LXTALSTB	LXTAL stabilization interrupt
RCU_INT_IRC16MSTB	IRC16M stabilization interrupt
RCU_INT_HXTALSTB	HXTAL stabilization interrupt
RCU_INT_PLLSTB	PLL stabilization interrupt
RCU_INT_IRC48MSTB	IRC48M stabilization interrupt
RCU_INT_LCKM	LXTAL clock stuck interrupt

Enum rcu_osci_type_enum

Table 3-559. Enum rcu_osci_type_enum

enum name	Function description
RCU_HXTAL	HXTAL
RCU_LXTAL	LXTAL
RCU_IRC16M	IRC16M
RCU_IRC48M	IRC48M
RCU_IRC32K	IRC32K
RCU_PLL_CK	PLL

Enum rcu_clock_freq_enum

Table 3-560. Enum rcu_clock_freq_enum

enum name	Function description
CK_SYS	system clock
CK_AHB	AHB clock

enum name	Function description
CK_APB1	APB1 clock
CK_APB2	APB2 clock
CK_ADC	ADC clock
CK_USART0	USART0 clock
CK_I2C0	I2C0 clock
CK_I2C1	I2C1 clock
CK_I2C2	I2C2 clock
CK_LPUART	LPUART clock (only for GD32L233xx series)
CK_LPUART0	LPUART0 clock (only for GD32L235xx series)
CK_LPUART1	LPUART1 clock (only for GD32L235xx series)
CK_USART1	USART1 clock
CK_LPTIMER	LPTIMER clock (only for GD32L233xx series)
CK_LPTIMER0	LPTIMER clock (only for GD32L235xx series)
CK_LPTIMER1	LPTIMER clock (only for GD32L235xx series)

Enum usart_idx_enum

Table 3-561. Enum usart_idx_enum

enum name	Function description
IDX_USART0	idnex of USART0
IDX_USART1	idnex of USART1

Enum lptimer_idx_enum (only for GD32L235xx series)

Table 3-562. Enum lptimer_idx_enum

enum name	Function description
IDX_LPTIMER0	idnex of LPTIMER0
IDX_LPTIMER1	idnex of LPTIMER1

Enum lpuart_idx_enum (only for GD32L235xx series)

Table 3-563. Enum lpuart_idx_enum

enum name	Function description
IDX_LPUART0	idnex of LPUART0
IDX_LPUART1	idnex of LPUART1

Enum i2c_idx_enum

Table 3-564. Enum i2c_idx_enum

enum name	Function description
IDX_I2C0	idnex of I2C0
IDX_I2C1	idnex of I2C1
IDX_I2C2	idnex of I2C2

rcu_deinit

The description of rcu_deinit is shown as below:

Table 3-565. Function rcu_deinit

Function name	rcu_deinit
Function prototype	void rcu_deinit(void);
Function descriptions	deinitialize the RCU, reset the value of all RCU registers into initial values
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset RCU */
rcu_deinit();
```

rcu_periph_clock_enable

The description of rcu_periph_clock_enable is shown as below:

Table 3-566. Function rcu_periph_clock_enable

Function name	rcu_periph_clock_enable
Function prototype	void rcu_periph_clock_enable(rcu_periph_enum periph);
Function descriptions	enable the peripherals clock
Precondition	-
The called functions	-
Input parameter{in}	
periph	RCU peripherals, refer to Table 3-552. Enum rcu_periph_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the USART0 clock */
rcu_periph_clock_enable(RCU_USART0);
```

rcu_periph_clock_disable

The description of rcu_periph_clock_disable is shown as below:

Table 3-567. Function rcu_periph_clock_disable

Function name	rcu_periph_clock_disable
Function prototype	void rcu_periph_clock_disable(rcu_periph_enum periph);
Function descriptions	disable the peripherals clock
Precondition	-
The called functions	-
Input parameter{in}	
periph	RCU peripherals, refer to Table 3-552. Enum rcu_periph_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the USART0 clock */
rcu_periph_clock_disable(RCU_USART0);
```

rcu_periph_clock_sleep_enable

The description of rcu_periph_clock_sleep_enable is shown as below:

Table 3-568. Function rcu_periph_clock_sleep_enable

Function name	rcu_periph_clock_sleep_enable
Function prototype	void rcu_periph_clock_sleep_enable(rcu_periph_sleep_enum periph);
Function descriptions	enable the peripherals clock when in sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
periph	RCU peripherals, refer to Table 3-553. Enum rcu_periph_sleep_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the FMC clock when in sleep mode */
rcu_periph_clock_sleep_enable(RCU_FMC_SLP);
```

rcu_periph_clock_sleep_disable

The description of rcu_periph_clock_sleep_disable is shown as below:

Table 3-569. Function rcu_periph_clock_sleep_disable

Function name	rcu_periph_clock_sleep_disable
Function prototype	void rcu_periph_clock_sleep_disable(rcu_periph_sleep_enum periph);
Function descriptions	disable the peripherals clock when in sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
periph	RCU peripherals, refer to Table 3-553. Enum rcu_periph_sleep_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the FMC clock when in sleep mode */
rcu_periph_clock_sleep_disable(RCU_FMC_SLP);
```

rcu_periph_reset_enable

The description of rcu_periph_reset_enable is shown as below:

Table 3-570. Function rcu_periph_reset_enable

Function name	rcu_periph_reset_enable
Function prototype	void rcu_periph_reset_enable(rcu_periph_reset_enum periph_reset);
Function descriptions	enable the peripherals reset
Precondition	-
The called functions	-
Input parameter{in}	
periph_reset	RCU peripherals reset, refer to Table 3-554. Enum rcu_periph_reset_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI0 reset */
rcu_periph_reset_enable(RCU_SPI0RST);
```

rcu_periph_reset_disable

The description of rcu_periph_reset_disable is shown as below:

Table 3-571. Function rcu_periph_reset_disable

Function name	rcu_periph_reset_disable
Function prototype	void rcu_periph_reset_disable(rcu_periph_reset_enum periph_reset);
Function descriptions	disable the peripheral reset
Precondition	-
The called functions	-
Input parameter{in}	
periph_reset	RCU peripherals reset, refer to Table 3-554. Enum rcu_periph_reset_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI0 reset */
rcu_periph_reset_disable(RCU_SPI0RST);
```

rcu_bkp_reset_enable

The description of rcu_bkp_reset_enable is shown as below:

Table 3-572. Function rcu_bkp_reset_enable

Function name	rcu_bkp_reset_enable
Function prototype	void rcu_bkp_reset_enable(void);
Function descriptions	enable the BKP domain reset
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset the BKP domain */
rcu_bkp_reset_enable();
```

rcu_bkp_reset_disable

The description of rcu_bkp_reset_disable is shown as below:

Table 3-573. Function rcu_bkp_reset_disable

Function name	rcu_bkp_reset_disable
Function prototype	void rcu_bkp_reset_disable(void);
Function descriptions	disable the BKP domain reset
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the BKP domain reset */
```

```
rcu_bkp_reset_disable();
```

rcu_system_clock_source_config

The description of rcu_system_clock_source_config is shown as below:

Table 3-574. Function rcu_system_clock_source_config

Function name	rcu_system_clock_source_config
Function prototype	void rcu_system_clock_source_config(uint32_t ck_sys);
Function descriptions	configure the system clock source
Precondition	-
The called functions	-
Input parameter{in}	
ck_sys	system clock source select
<i>RCU_CKSYSSRC_IRC16M</i>	select CK_IRC16M as the CK_SYS source
<i>RCU_CKSYSSRC_HXTAL</i>	select CK_HXTAL as the CK_SYS source
<i>RCU_CKSYSSRC_PLL</i>	select CK_PLL as the CK_SYS source
<i>RCU_CKSYSSRC_IRC48M</i>	select CK_IRC48M as the CK_SYS source
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the CK_HXTAL as the CK_SYS source */
rcu_system_clock_source_config(RCU_CKSYSSRC_HXTAL);
```

rcu_system_clock_source_get

The description of rcu_system_clock_source_get is shown as below:

Table 3-575. Function rcu_system_clock_source_get

Function name	rcu_system_clock_source_get
Function prototype	uint32_t rcu_system_clock_source_get(void);
Function descriptions	get the system clock source
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint32_t	RCU_SCSS_IRC16M/RCU_SCSS_HXTAL/RCU_SCSS_PLL/RCU_SCSS_IRC48M

Example:

```
uint32_t temp_cksys_status;

/* get the CK_SYS source */
temp_cksys_status = rcu_system_clock_source_get();
```

rcu_ahb_clock_config

The description of rcu_ahb_clock_config is shown as below:

Table 3-576. Function rcu_ahb_clock_config

Function name	rcu_ahb_clock_config
Function prototype	void rcu_ahb_clock_config(uint32_t ck_ahb);
Function descriptions	configure the AHB clock prescaler selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_ahb	AHB clock prescaler selection
RCU_AHB_CKSYS_DIVx	select CK_SYS / x, (x=1, 2, 4, 8, 16, 64, 128, 256, 512)
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* configure CK_SYS/128 */
```

```
rcu_ahb_clock_config(RCU_AHB_CKSYS_DIV128);
```

rcu_apb1_clock_config

The description of rcu_apb1_clock_config is shown as below:

Table 3-577. Function rcu_apb1_clock_config

Function name	rcu_apb1_clock_config
Function prototype	void rcu_apb1_clock_config(uint32_t ck_apb1);
Function descriptions	configure the APB1 clock prescaler selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_apb1	APB1 clock prescaler selection
<i>RCU_APB1_CKAHB_D</i> <i>IVx</i>	select (CK_AHB / x) as CK_APB1 (x=1,2,4,8,16)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure CK_AHB/16 as CK_APB1 */
```

```
rcu_apb1_clock_config(RCU_APB1_CKAHB_DIV16);
```

rcu_apb2_clock_config

The description of rcu_apb2_clock_config is shown as below:

Table 3-578. Function rcu_apb2_clock_config

Function name	rcu_apb2_clock_config
Function prototype	void rcu_apb2_clock_config(uint32_t ck_apb2);
Function descriptions	configure the APB2 clock prescaler selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_apb2	APB2 clock prescaler selection
<i>RCU_APB2_CKAHB_D</i>	select (CK_AHB / x) as CK_APB2 clock (x=1,2,4,8,16)

IVx	
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure CK_AHB/8 as CK_APB2 */
```

```
rcu_apb2_clock_config(RCU_APB2_CKAHB_DIV8);
```

rcu_adc_clock_config

The description of rcu_adc_clock_config is shown as below:

Table 3-579. Function rcu_adc_clock_config

Function name	rcu_adc_clock_config
Function prototype	void rcu_adc_clock_config(rcu_adc_clock_enum ck_adc);
Function descriptions	configure the ADC clock prescaler selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_adc	ADC clock prescaler selection
RCU_ADCCCK_IRC16M	select CK_IRC16M as CK_ADC
RCU_ADCCCK_APB2_D IV2	select CK_APB2/2 as CK_ADC
RCU_ADCCCK_APB2_D IV4	select CK_APB2/4 as CK_ADC
RCU_ADCCCK_APB2_D IV6	select CK_APB2/6 as CK_ADC
RCU_ADCCCK_APB2_D IV8	select CK_APB2/8 as CK_ADC
RCU_ADCCCK_APB2_D IV10	select CK_APB2/10 as CK_ADC
RCU_ADCCCK_APB2_D IV12	select CK_APB2/12 as CK_ADC
RCU_ADCCCK_APB2_D IV14	select CK_APB2/14 as CK_ADC
RCU_ADCCCK_APB2_D IV16	select CK_APB2/16 as CK_ADC
RCU_ADCCCK_AHB_DI V3	select CK_AHB/3 as CK_ADC
RCU_ADCCCK_AHB_DI V5	select CK_AHB/5 as CK_ADC

<i>RCU_ADCCCK_AHB_DI</i> V7	select CK_AHB/7 as CK_ADC
<i>RCU_ADCCCK_AHB_DI</i> V9	select CK_AHB/9 as CK_ADC
<i>RCU_ADCCCK_AHB_DI</i> V11	select CK_AHB/11 as CK_ADC
<i>RCU_ADCCCK_AHB_DI</i> V13	select CK_AHB/13 as CK_ADC
<i>RCU_ADCCCK_AHB_DI</i> V15	select CK_AHB/15 as CK_ADC
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the ADC prescaler factor */
```

```
rcu_adc_clock_config(RCU_ADCCCK_APB2_DIV2);
```

rcu_ckout_config

The description of rcu_ckout_config is shown as below:

Table 3-580. Function rcu_ckout_config

Function name	rcu_ckout_config
Function prototype	void rcu_ckout_config(uint32_t ckout_src, uint32_t ckout_div);
Function descriptions	configure the CK_OUT clock source and divoision factor
Precondition	-
The called functions	-
Input parameter{in}	
ckout_src	CK_OUT clock source selection
<i>RCU_CKOUTSRC_NO</i> <i>NE</i>	no clock selected
<i>RCU_CKOUTSRC_IRC</i> <i>48M</i>	select high speed 48M internal oscillator clock
<i>RCU_CKOUTSRC_IRC</i> <i>32K</i>	select high speed 32K internal oscillator clock
<i>RCU_CKOUTSRC_LX</i> <i>TAL</i>	select LXTAL clock
<i>RCU_CKOUTSRC_CK</i> <i>SYS</i>	select system clock CK_SYS
<i>RCU_CKOUTSRC_IRC</i> <i>16M</i>	select high speed 16M internal oscillator clock

<i>RCU_CKOUTSRC_HXTAL</i>	select HXTAL clock
<i>RCU_CKOUTSRC_CKPLL_DIV1</i>	select CK_PLL clock
<i>RCU_CKOUTSRC_CKPLL_DIV2</i>	Select (CK_PLL / 2) clock
Input parameter{in}	
ckout_div	CK_OUT divider
<i>RCU_CKOUT_DIVx</i>	CK_OUT is divided by x(x=1,2,4,8,16,32,64,128)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the HXTAL as CK_OUT clock source */
```

```
rcu_ckout_config(RCU_CKOUTSRC_HXTAL, RCU_CKOUT_DIV1);
```

rcu_pll_config

The description of rcu_pll_config is shown as below:

Table 3-581. Function rcu_pll_config

Function name	rcu_pll_config
Function prototype	void rcu_pll_config(uint32_t pll_src, uint32_t pll_mul);
Function descriptions	configure the main PLL clock
Precondition	-
The called functions	-
Input parameter{in}	
pll_src	PLL clock source selection
<i>RCU_PLLSRC_IRC16M</i>	IRC16M clock is selected as source clock of PLL
<i>RCU_PLLSRC_HXTAL</i>	HXTAL is selected as source clock of PLL
<i>RCU_PLLSRC_IRC48M</i>	select CK_IRC48M as PLL source clock
Input parameter{in}	
pll_mul	PLL clock multiplication factor
<i>RCU_PLL_MULx</i>	PLL source clock * x (x = 4..127)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the PLL */
```

```
rcu_pll_config(RCU_PLLSRC_HXTAL, RCU_PLL_MUL10);
```

rcu_usart_clock_config

The description of rcu_usart_clock_config is shown as below:

Table 3-582. Function rcu_usart_clock_config

Function name	rcu_usart_clock_config
Function prototype	void rcu_usart_clock_config(usart_idx_enum usart_idx, uint32_t ck_usart);
Function descriptions	configure the USARTx(x=0,1) clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
usart_idx	idnex of USART, refer to Table 3-561. Enum usart_idx_enum
IDX_USARTx	idnex of USARTx(x=0,1)
ck_usart	USART clock source selection
RCU_USARTSRC_CK_APB	CK_USART select CK_APB1/ CK_APB2
RCU_USARTSRC_CK_SYS	CK_USART select CK_SYS
RCU_USARTSRC_LXTAL	CK_USART select CK_LXTAL
RCU_USARTSRC_IRC_16M_DIV	CK_USART select CK_IRC16MDIV
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the LXTAL as USART0 clock */
```

```
rcu_usart_clock_config(IDX_USART0, RCU_USART0SRC_LXTAL);
```

rcu_i2c_clock_config

The description of rcu_i2c_clock_config is shown as below:

Table 3-583. Function rcu_i2c_clock_config

Function name	rcu_i2c_clock_config
Function prototype	void rcu_i2c_clock_config(i2c_idx_enum i2c_idx, uint32_t ck_i2c);
Function descriptions	configure the I2Cx(x=0,1,2) clock source selection
Precondition	-
The called functions	-

Input parameter{in}	
i2c_idx	idnex of I2C, refer to Table 3-564. Enum i2c_idx_enum
<i>IDX_I2Cx</i>	idnex of I2Cx(x=0,1,2)
ck_i2c	I2C clock source selection
<i>RCU_I2CSRC_CKAPB1</i>	CK_I2C select CK_APB1
<i>RCU_I2CSRC_CKSYS</i>	CK_I2C select CK_SYS
<i>RCU_I2CSRC_IRC16MDIV</i>	CK_I2C select IRC16MDIV
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the CKAPB1 as I2C0 clock */
```

```
rcu_usart_clock_config(IDX_I2C0, RCU_I2CSRC_CKAPB1);
```

rcu_lptimer_clock_config (only for GD32L233xx series)

The description of rcu_lptimer_clock_config is shown as below:

Table 3-584. Function rcu_lptimer_clock_config

Function name	rcu_lptimer_clock_config
Function prototype	void rcu_lptimer_clock_config(uint32_t ck_lptimer);
Function descriptions	configure the LPTIMER clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_lptimer	LPTIMER clock source selection
<i>RCU_LPTIMERSRC_CKAPB1</i>	CK_LPTIMER select CK_APB1
<i>RCU_LPTIMERSRC_CKIRC32K</i>	CK_LPTIMER select CK_IRC32K
<i>RCU_LPTIMERSRC_CKLXTAL</i>	CK_LPTIMER select CK_LXTAL
<i>RCU_LPTIMERSRC_CKIRC16MDIV</i>	CK_LPTIMER select CK_IRC16MDIV
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the LPTIMER clock source selection */
```

```
rcu_lptimer_clock_config(RCU_LPTIMERSRC_CKAPB1);
```

rcu_lptimer_clock_config (only for GD32L235xx series)

The description of rcu_lptimer_clock_config is shown as below:

Table 3-585. Function rcu_lptimer_clock_config

Function name	rcu_lptimer_clock_config
Function prototype	void rcu_lptimer_clock_config(lptimer_idx_enum lptimer_idx, uint32_t ck_lptimer);
Function descriptions	configure the LPTIMER clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
lptimer_idx	idnex of LPTIMER, refer to Table 3-562. Enum lptimer_idx_enum
<i>IDX_LPTIMERx</i>	idnex of LPTIMERx(x=0,1)
ck_lptimer	LPTIMER clock source selection
<i>RCU_LPTIMERSRC_CKAPB1</i>	CK_LPTIMER select CK_APB1
<i>RCU_LPTIMERSRC_CKIRC32K</i>	CK_LPTIMER select CK_IRC32K
<i>RCU_LPTIMERSRC_CKLXTAL</i>	CK_LPTIMER select CK_LXTAL
<i>RCU_LPTIMERSRC_CKIRC16MDIV</i>	CK_LPTIMER select CK_IRC16MDIV
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the LPTIMER clock source selection */
```

```
rcu_lptimer_clock_config(IDX_LPTIMER0, RCU_LPTIMERSRC_CKAPB1);
```

rcu_lpuart_clock_config (only for GD32L233xx series)

The description of rcu_lpuart_clock_config is shown as below:

Table 3-586. Function rcu_lpuart_clock_config

Function name	rcu_lpuart_clock_config
Function prototype	void rcu_lpuart_clock_config(uint32_t ck_lpuart);
Function descriptions	configure the LPUART clock source selection
Precondition	-

The called functions	-
Input parameter{in}	
ck_lpuart	LPUART clock source selection
RCU_LPUARTSRC_C KAPB1	LPUART select CK_APB1
RCU_LPUARTSRC_C KSYS	LPUART select CK_SYS
RCU_LPUARTSRC_LX TAL	LPUART select CK_LXTAL
RCU_LPUARTSRC_IR C16MDIV	LPUART select CK_IRC16MDIV
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the lpuart clock source selection */
```

```
rcu_lpuart_clock_config(RCU_LPUARTSRC_CKAPB1);
```

rcu_lpuart_clock_config (only for GD32L235xx series)

The description of rcu_lpuart_clock_config is shown as below:

Table 3-587. Function rcu_lpuart_clock_config

Function name	rcu_lpuart_clock_config
Function prototype	void rcu_lpuart_clock_config(lpuart_idx_enum lpuart_idx, uint32_t ck_lpuart);
Function descriptions	configure the LPUART clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
lpuart_idx	idnex of LPUART, refer to Table 3-563. Enum lpuart_idx_enum
IDX_LPUARTx	idnex of LPUARTx(x=0,1)
ck_lpuart	LPUART clock source selection
RCU_LPUARTSRC_C KAPB1	LPUART select CK_APB1
RCU_LPUARTSRC_C KSYS	LPUART select CK_SYS
RCU_LPUARTSRC_LX TAL	LPUART select CK_LXTAL
RCU_LPUARTSRC_IR C16MDIV	LPUART select CK_IRC16MDIV

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the lpuart clock source selection */
```

```
rcu_lpuart_clock_config(IDX_LPUART0, RCU_LPUARTSRC_CKAPB1);
```

rcu_irc16mdiv_clock_config

The description of rcu_irc16mdiv_clock_config is shown as below:

Table 3-588. Function rcu_irc16mdiv_clock_config

Function name	rcu_irc16mdiv_clock_config
Function prototype	void rcu_irc16mdiv_clock_config(uint32_t ck_irc16mdiv);
Function descriptions	configure the IRC16MDIV clock selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_irc16mdiv	IRC16MDIV clock selection
RCU_IRC16MDIV_NONE	CK_IRC16MDIV select CK_IRC16M
RCU_IRC16MDIV_2	CK_IRC16MDIV select CK_IRC16M divided by 2
RCU_IRC16MDIV_4	CK_IRC16MDIV select CK_IRC16M divided by 4
RCU_IRC16MDIV_8	CK_IRC16MDIV select CK_IRC16M divided by 8
RCU_IRC16MDIV_16	CK_IRC16MDIV select CK_IRC16M divided by 16
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the IRC16MDIV clock selection */
```

```
rcu_irc16mdiv_clock_config(RCU_IRC16MDIV_2);
```

rcu_usbd_clock_config

The description of rcu_usbd_clock_config is shown as below:

Table 3-589. Function rcu_usbd_clock_config

Function name	rcu_usbd_clock_config
Function prototype	void rcu_usbd_clock_config(uint32_t ck_usbd);

Function descriptions	configure the USB D clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
ck_usbd	USB D clock source selection
<i>RCU_USBDSRC_IRC48M</i>	select CK_IRC48M as USB D source clock
<i>RCU_USBDSRC_PLL</i>	select CK_PLL as USB D source clock
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the USB D clock source selection */
```

```
rcu_usbd_clock_config(RCU_USBDSRC_IRC48M);
```

rcu_rtc_clock_config

The description of rcu_rtc_clock_config is shown as below:

Table 3-590. Function rcu_rtc_clock_config

Function name	rcu_rtc_clock_config
Function prototype	void rcu_rtc_clock_config(uint32_t rtc_clock_source);
Function descriptions	configure the RTC/SLCD clock source selection
Precondition	-
The called functions	-
Input parameter{in}	
rtc_clock_source	RTC/SLCD clock source selection
<i>RCU_RTCSRC_NONE</i>	no clock selected
<i>RCU_RTCSRC_LXTAL</i>	select CK_LXTAL as RTC/SLCD source clock
<i>RCU_RTCSRC_IRC40K</i>	select CK_IRC40K as RTC/SLCD source clock
<i>RCU_RTCSRC_HXTAL_DIV_32</i>	select (CK_HXTAL / 32) as RTC/SLCD source clock
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the RTC clock source selection */
```

```
rcu_rtc_clock_config(RCU_RTCSRC_IRC32K);
```


rcu_pll_source_ck_prediv_config

The description of rcu_pll_source_ck_prediv_config is shown as below:

Table 3-591. Function rcu_pll_source_ck_prediv_config

Function name	rcu_pll_source_ck_prediv_config
Function prototype	void rcu_pll_source_ck_prediv_config(uint32_t pllsource_ck_prediv);
Function descriptions	configure PLL source clocks pre-divider
Precondition	-
The called functions	-
Input parameter{in}	
pllsource_ck_prediv	PLL source clocks divider used as input of PLL
<i>RCU_PLL_PREDVx</i>	PLL source clocks divided x used as input of PLL (x=1..16)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure PLL source clocks pre-divider */
```

```
rcu_pll_source_ck_prediv_config(RCU_PLL_PREDV2);
```

rcu_lxtal_drive_capability_config

The description of rcu_lxtal_drive_capability_config is shown as below:

Table 3-592. Function rcu_lxtal_drive_capability_config

Function name	rcu_lxtal_drive_capability_config
Function prototype	void rcu_lxtal_drive_capability_config(uint32_t lxtal_dricap);
Function descriptions	configure the LXTAL drive capability
Precondition	-
The called functions	-
Input parameter{in}	
lxtal_dricap	drive capability of LXTAL
<i>RCU_LXTAL_LOWDRI</i>	lower driving capability
<i>RCU_LXTAL_MED_LOWDRI</i>	medium low driving capability
<i>RCU_LXTAL_MED_HI_GHDRI</i>	medium high driving capability
<i>RCU_LXTAL_HIGHDRI</i>	higher driving capability
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the LXTAL lower driving capability */
```

```
rcu_lxtal_drive_capability_config(RCU_LXTAL_LOWDRI);
```

rcu_lp_bandgap_config

The description of rcu_lp_bandgap_config is shown as below:

Table 3-593. Function rcu_lp_bandgap_config

Function name	rcu_lp_bandgap_config
Function prototype	void rcu_lp_bandgap_config(uint32_t lp_bandgap_clock);
Function descriptions	configure low power bandgap mode selection
Precondition	-
The called functions	-
Input parameter{in}	
lp_bandgap_clock	low power bandgap clock
RCU_LPBM_32CLK	The length of holding phase is 3.2ms, 32 clock cycles
RCU_LPBM_64CLK	The length of holding phase is 6.4ms, 64 clock cycles
RCU_LPBM_128CLK	The length of holding phase is 12.8ms, 128 clock cycles
RCU_LPBM_256CLK	The length of holding phase is 25.6ms, 256 clock cycles
RCU_LPBM_512CLK	The length of holding phase is 51.2ms, 512 clock cycles
RCU_LPBM_1024CLK	The length of holding phase is 102.4ms, 1024 clock cycles
RCU_LPBM_2048CLK	The length of holding phase is 204.8ms, 2048 clock cycles
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure low power bandgap mode selection */
```

```
rcu_lp_bandgap_config(RCU_LPBM_64CLK);
```

rcu_osci_stab_wait

The description of rcu_osci_stab_wait is shown as below:

Table 3-594. Function rcu_osci_stab_wait

Function name	rcu_osci_stab_wait
Function prototype	ErrStatus rcu_osci_stab_wait(rcu_osci_type_enum osci);
Function descriptions	wait for oscillator stabilization flags is SET or oscillator startup is timeout
Precondition	-
The called functions	-
Input parameter{in}	

osci	oscillator types, refer to Table 3-559. Enum rcu_osci_type_enum
Output parameter{out}	
-	-
Return value	
ErrStatus	SUCCESS or ERROR

Example:

```
/* wait for oscillator stabilization flag */
if(SUCCESS == rcu_osci_stab_wait(RCU_HXTAL)){
}
```

rcu_osci_on

The description of rcu_osci_on is shown as below:

Table 3-595. Function rcu_osci_on

Function name	rcu_osci_on
Function prototype	void rcu_osci_on(rcu_osci_type_enum osci);
Function descriptions	turn on the oscillator
Precondition	-
The called functions	-
Input parameter{in}	
osci	oscillator types, refer to Table 3-559. Enum rcu_osci_type_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* turn on the high speed crystal oscillator */
rcu_osci_on(RCU_HXTAL);
```

rcu_osci_off

The description of rcu_osci_off is shown as below:

Table 3-596. Function rcu_osci_off

Function name	rcu_osci_off
Function prototype	void rcu_osci_off(rcu_osci_type_enum osci);
Function descriptions	turn off the oscillator
Precondition	-
The called functions	-
Input parameter{in}	

osci	oscillator types, refer to Table 3-559. Enum rcu_osci_type_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* turn off the high speed crystal oscillator */
rcu_osci_off(RCU_HXTAL);
```

rcu_osci_bypass_mode_enable

The description of rcu_osci_bypass_mode_enable is shown as below:

Table 3-597. Function rcu_osci_bypass_mode_enable

Function name	rcu_osci_bypass_mode_enable
Function prototype	void rcu_osci_bypass_mode_enable(rcu_osci_type_enum osci);
Function descriptions	enable the oscillator bypass mode
Precondition	HXTALEN or LXTALEN must be reset before it
The called functions	-
Input parameter{in}	
osci	oscillator types, refer to Table 3-559. Enum rcu_osci_type_enum
RCU_HXTAL	high speed crystal oscillator(HXTAL)
RCU_LXTAL	low speed crystal oscillator(LXTAL)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the high speed crystal oscillator bypass mode */
rcu_osci_bypass_mode_enable(RCU_HXTAL);
```

rcu_osci_bypass_mode_disable

The description of rcu_osci_bypass_mode_disable is shown as below:

Table 3-598. Function rcu_osci_bypass_mode_disable

Function name	rcu_osci_bypass_mode_disable
Function prototype	void rcu_osci_bypass_mode_disable(rcu_osci_type_enum osci);
Function descriptions	disable the oscillator bypass mode
Precondition	HXTALEN or LXTALEN must be reset before it
The called functions	-

Input parameter{in}	
osci	oscillator types, refer to Table 3-559. Enum rcu_osci_type_enum
<i>RCU_HXTAL</i>	high speed crystal oscillator(HXTAL)
<i>RCU_LXTAL</i>	low speed crystal oscillator(LXTAL)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the high speed crystal oscillator bypass mode */
```

```
rcu_osci_bypass_mode_disable(RCU_HXTAL);
```

rcu_irc16m_adjust_value_set

The description of rcu_irc16m_adjust_value_set is shown as below:

Table 3-599. Function rcu_irc16m_adjust_value_set

Function name	rcu_irc16m_adjust_value_set
Function prototype	void rcu_irc16m_adjust_value_set(uint32_t irc16m_adjval);
Function descriptions	set the IRC16M adjust value
Precondition	-
The called functions	-
Input parameter{in}	
irc16m_adjval	IRC8M adjust value, must be between 0 and 0x1F
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the IRC16M adjust value */
```

```
rcu_irc16m_adjust_value_set(0x10);
```

rcu_hxtal_clock_monitor_enable

The description of rcu_hxtal_clock_monitor_enable is shown as below:

Table 3-600. Function rcu_hxtal_clock_monitor_enable

Function name	rcu_hxtal_clock_monitor_enable
Function prototype	void rcu_hxtal_clock_monitor_enable(void);
Function descriptions	enable the HXTAL clock monitor
Precondition	-

The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the HXTAL clock monitor */
```

```
rcu_hxtal_clock_monitor_enable();
```

rcu_hxtal_clock_monitor_disable

The description of rcu_hxtal_clock_monitor_disable is shown as below:

Table 3-601. Function rcu_hxtal_clock_monitor_disable

Function name	rcu_hxtal_clock_monitor_disable
Function prototype	void rcu_hxtal_clock_monitor_disable(void);
Function descriptions	disable the HXTAL clock monitor
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the HXTAL clock monitor */
```

```
rcu_hxtal_clock_monitor_disable();
```

rcu_lxtal_clock_monitor_enable

The description of rcu_lxtal_clock_monitor_enable is shown as below:

Table 3-602. Function rcu_lxtal_clock_monitor_enable

Function name	rcu_lxtal_clock_monitor_enable
Function prototype	void rcu_lxtal_clock_monitor_enable(void);
Function descriptions	enable the LXTAL clock monitor
Precondition	-
The called functions	-

Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the LXTAL clock monitor */
```

```
rcu_lxtal_clock_monitor_enable();
```

rcu_lxtal_clock_monitor_disable

The description of rcu_lxtal_clock_monitor_disable is shown as below:

Table 3-603. Function rcu_lxtal_clock_monitor_disable

Function name	rcu_lxtal_clock_monitor_disable
Function prototype	void rcu_lxtal_clock_monitor_disable(void);
Function descriptions	disable the LXTAL clock monitor
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the LXTAL clock monitor */
```

```
rcu_lxtal_clock_monitor_disable();
```

rcu_voltage_key_unlock

The description of rcu_voltage_key_unlock is shown as below:

Table 3-604. Function rcu_voltage_key_unlock

Function name	rcu_voltage_key_unlock
Function prototype	void rcu_voltage_key_unlock(void);
Function descriptions	unlock the voltage key
Precondition	-
The called functions	-
Input parameter{in}	

-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* unlock the voltage key */
rcu_voltage_key_unlock();
```

rcu_clock_freq_get

The description of rcu_clock_freq_get is shown as below:

Table 3-605. Function rcu_clock_freq_get

Function name	rcu_clock_freq_get
Function prototype	uint32_t rcu_clock_freq_get(rcu_clock_freq_enum clock);
Function descriptions	get the system clock, bus clock and peripheral clock frequency
Precondition	-
The called functions	-
Input parameter{in}	
clock	the clock frequency which to get, refer to Table 3-560. Enum rcu_clock_freq_enum
Output parameter{out}	
-	
Return value	
uint32_t	clock frequency of system, AHB, APB1, APB2, ADC or USRAT0/1, LPUART, LPTIMER, LPTIMERx (x=0,1) (GD32L235xx series), CK_LPUARTx (x=0,1) (GD32L235xx series)

Example:

```
uint32_t temp_freq;
/* get the system clock frequency */
temp_freq = rcu_clock_freq_get(CK_SYS);
```

rcu_flag_get

The description of rcu_flag_get is shown as below:

Table 3-606. Function rcu_flag_get

Function name	rcu_flag_get
Function prototype	FlagStatus rcu_flag_get(rcu_flag_enum flag);
Function descriptions	get the clock stabilization and peripheral reset flags

Precondition	-
The called functions	-
Input parameter{in}	
flag	the clock stabilization and peripheral reset flags, refer to Table 3-555. Enum rcu_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the clock stabilization flag */
if(RESET != rcu_flag_get(RCU_FLAG_LXTALSTB)){
}
```

rcu_all_reset_flag_clear

The description of rcu_all_reset_flag_clear is shown as below:

Table 3-607. Function rcu_all_reset_flag_clear

Function name	rcu_all_reset_flag_clear
Function prototype	void rcu_all_reset_flag_clear(void);
Function descriptions	clear all the reset flag
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear all the reset flag */
rcu_all_reset_flag_clear();
```

rcu_interrupt_flag_get

The description of rcu_interrupt_flag_get is shown as below:

Table 3-608. Function rcu_interrupt_flag_get

Function name	rcu_interrupt_flag_get
Function prototype	FlagStatus rcu_interrupt_flag_get(rcu_int_flag_enum int_flag);

Function descriptions	get the clock stabilization interrupt and ckm flags
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	interrupt and ckm flags, refer to Table 3-556. Enum rcu_int_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the clock stabilization interrupt flag */
if(SET == rcu_interrupt_flag_get(RCU_INT_FLAG_HXTALSTB)){
}

```

rcu_interrupt_flag_clear

The description of rcu_interrupt_flag_clear is shown as below:

Table 3-609. Function rcu_interrupt_flag_clear

Function name	rcu_interrupt_flag_clear
Function prototype	void rcu_interrupt_flag_clear(rcu_int_flag_clear_enum int_flag_clear)
Function descriptions	clear the interrupt flags
Precondition	-
The called functions	-
Input parameter{in}	
int_flag_clear	clock stabilization and stuck interrupt flags clear, refer to Table 3-557. Enum rcu_int_flag_clear_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the interrupt HXTAL stabilization interrupt flag */
rcu_interrupt_flag_clear(RCU_INT_FLAG_HXTALSTB_CLR);

```

rcu_interrupt_enable

The description of rcu_interrupt_enable is shown as below:

Table 3-610. Function rcu_interrupt_enable

Function name	rcu_interrupt_enable
----------------------	----------------------

Function prototype	void rcu_interrupt_enable(rcu_int_enum stab_int);
Function descriptions	enable the stabilization interrupt
Precondition	-
The called functions	-
Input parameter{in}	
stab_int	clock stabilization interrupt, refer to Table 3-558. Enum rcu_int_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the HXTAL stabilization interrupt */
rcu_interrupt_enable(RCU_INT_HXTALSTB);
```

rcu_interrupt_disable

The description of rcu_interrupt_disable is shown as below:

Table 3-611. Function rcu_interrupt_disable

Function name	rcu_interrupt_disable
Function prototype	void rcu_interrupt_disable(rcu_int_enum stab_int);
Function descriptions	disable the stabilization interrupt
Precondition	-
The called functions	-
Input parameter{in}	
stab_int	clock stabilization interrupt, refer to Table 3-558. Enum rcu_int_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the HXTAL stabilization interrupt */
rcu_interrupt_disable(RCU_INT_HXTALSTB);
```

3.21. RTC

The Real-time Clock (RTC) is usually used as a clock-calendar. The ones in the Backup Domain consist of a 32-bit up-counter, an alarm, a prescaler, a divider and the RTC clock configuration register. The RTC registers are listed in chapter [3.21.1](#), the FWDGT firmware functions are introduced in chapter [3.21.2](#).

3.21.1. Descriptions of Peripheral registers

RTC registers are listed in the table shown as below:

Table 3-612. RTC Registers

Registers	Descriptions
RTC_TIME	RTC time of day register
RTC_DATE	RTC date register
RTC_CTL	RTC control register
RTC_STAT	RTC status register
RTC_PSC	RTC time prescaler register
RTC_WUT	RTC wakeup timer register
RTC_ALRM0TD	RTC alarm 0 time and date register
RTC_ALRM1TD	RTC alarm 1 time and date register
RTC_WPK	RTC write protection key register
RTC_SS	RTC sub second register
RTC_SHIFTCTL	RTC shift function control register
RTC_TTS	RTC time of timestamp register
RTC_DTS	RTC date of timestamp register
RTC_SSTS	RTC sub second of timestamp register
RTC_HRFC	RTC high resolution frequency compensation register
RTC_TAMP	RTC tamper register
RTC_ALRM0SS	RTC alarm 0 sub second register
RTC_ALRM1SS	RTC alarm 1 sub second register
RTC_BKP0	RTC backup 0 register
RTC_BKP1	RTC backup 1 register
RTC_BKP2	RTC backup 2 register
RTC_BKP3	RTC backup 3 register
RTC_BKP4	RTC backup 4 register

3.21.2. Descriptions of Peripheral functions

RTC firmware functions are listed in the table shown as below:

Table 3-613. RTC firmware function

Function name	Function description
rtc_deinit	reset most of the RTC registers
rtc_init	initialize RTC registers
rtc_init_mode_enter	enter RTC init mode
rtc_init_mode_exit	exit RTC init mode
rtc_register_sync_wait	wait until RTC_TIME and RTC_DATE registers are synchronized with APB clock, and the shadow registers are updated

Function name	Function description
rtc_current_time_get	get current time and date
rtc_subsecond_get	get current subsecond value
rtc_alarm_config	configure RTC alarm
rtc_alarm_subsecond_config	configure subsecond of RTC alarm
rtc_alarm_get	get RTC alarm
rtc_alarm_subsecond_get	get RTC alarm subsecond
rtc_alarm_enable	enable RTC alarm
rtc_alarm_disable	disable RTC alarm
rtc_timestamp_enable	enable RTC time-stamp
rtc_timestamp_disable	disable RTC time-stamp
rtc_timestamp_get	get RTC timestamp time and date
rtc_timestamp_internalevent_config	configure RTC time-stamp internal event
rtc_timestamp_subsecond_get	get RTC time-stamp subsecond
rtc_tamper_enable	enable RTC tamper
rtc_tamper_disable	disable RTC tamper
rtc_tamper_mask	set specified RTC tamper mask function
rtc_tamper_without_bkp_reset	tamperx event does not erase the RTC_BKP registers
rtc_output_pin_select	select the RTC output pin
rtc_alarm_output_config	configure RTC alarm output source
rtc_calibration_output_config	configure RTC calibration output source
rtc_hour_adjust	ajust the daylight saving time by adding or subtracting one hour from the current time
rtc_second_adjust	ajust RTC second or subsecond value of current time
rtc_bypass_shadow_enable	enable RTC bypass shadow registers function
rtc_bypass_shadow_disable	disable RTC bypass shadow registers function
rtc_refclock_detection_enable	enable RTC reference clock detection function
rtc_refclock_detection_disable	disable RTC reference clock detection function
rtc_wakeup_enable	enable RTC wakeup timer
rtc_wakeup_disable	disable RTC wakeup timer
rtc_wakeup_clock_set	set auto wakeup timer clock
rtc_wakeup_timer_set	set auto wakeup timer value
rtc_wakeup_timer_get	get auto wakeup timer value
rtc_smooth_calibration_config	configure RTC smooth calibration
rtc_interrupt_enable	enable specified RTC interrupt
rtc_interrupt_disable	disble specified RTC interrupt
rtc_flag_get	check specified flag
rtc_flag_clear	clear specified flag

Structure rtc_parameter_struct

Table 3-614. Structure rtc_parameter_struct

Member name	Function description
-------------	----------------------

year	RTC year value: 0x0 - 0x99(BCD format)
month	RTC month value (BCD format)
date	RTC date value: 0x1 - 0x31(BCD format)
day_of_week	RTC weekday value(BCD format)
hour	RTC hour value: 0x1 - 0x12(BCD format) or 0x0 - 0x23(BCD format)
minute	RTC minute value: 0x0 - 0x59(BCD format)
second	RTC second value: 0x0 - 0x59(BCD format)
factor_asyn	RTC asynchronous prescaler value: 0x0 - 0x7F
factor_syn	RTC synchronous prescaler value: 0x0 - 0x7FFF
am_pm	RTC AM/PM value
display_format	RTC time notation

Structure rtc_alarm_struct

Table 3-615. Structure rtc_alarm_struct

Member name	Function description
alarm_mask	RTC alarm mask
weekday_or_date	specify RTC alarm is on date or weekday
alarm_day	RTC alarm date or weekday value(BCD format)
alarm_hour	RTC alarm hour value: 0x1 - 0x12(BCD format) or 0x0 - 0x23(BCD format)
alarm_minute	RTC alarm minute value: 0x0 - 0x59(BCD format)
alarm_second	RTC alarm second value: 0x0 - 0x59(BCD format)
am_pm	RTC alarm AM/PM value

Structure rtc_timestamp_struct

Table 3-616. Structure rtc_timestamp_struct

Member name	Function description
timestamp_month	RTC time-stamp month value(BCD format)
timestamp_date	RTC time-stamp date value: 0x1 - 0x31(BCD format)
timestamp_day	RTC time-stamp weekday value(BCD format)
timestamp_hour	RTC time-stamp hour value(BCD format): 0x1 - 0x12(BCD format) or 0x0 - 0x23(BCD format)
timestamp_minute	RTC time-stamp minute value: 0x0 - 0x59(BCD format)
timestamp_second	RTC time-stamp second value: 0x0 - 0x59(BCD format)
am_pm	RTC time-stamp AM/PM value

Structure rtc_tamper_struct

Table 3-617. Structure rtc_tamper_struct

Member name	Function description
tamper_source	RTC tamper source
tamper_trigger	RTC tamper trigger
tamper_filter	RTC tamper consecutive samples needed during a voltage level detection

tamper_sample_frequency	RTC tamper sampling frequency during a voltage level detection
tamper_precharge_enable	RTC tamper precharge feature during a voltage level detection
tamper_precharge_time	RTC tamper precharge duration if precharge feature is enabled
tamper_with_timestamp	RTC tamper time-stamp feature

rtc_deinit

The description of rtc_deinit is shown as below:

Table 3-618. Function rtc_deinit

Function name	rtc_deinit
Function prototype	ErrStatus rtc_deinit(void);
Function descriptions	reset most of the RTC registers
Precondition	-
The called functions	rcu_periph_reset_enable/ rcu_periph_reset_disable -
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* reset most of the RTC registers*/
```

```
ErrStatus error_status = rtc_deinit();
```

rtc_init

The description of rtc_init is shown as below:

Table 3-619. Function rtc_init

Function name	rtc_init
Function prototype	ErrStatus rtc_init(rtc_parameter_struct* rtc_initpara_struct);
Function descriptions	initialize RTC registers
Precondition	-
The called functions	-
Input parameter{in}	
rtc_initpara_struct	pointer to a rtc_parameter_struct structure which contains parameters for initialization of the rtc peripheral, the structure members can refer to members of the structure Table 3-614. Structure

	<u>rtc_parameter_struct</u>
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```

/* initialize RTC registers */

rtc_parameter_struct rtc_initpara;

rtc_interrupt_disable(RTC_INT_SECOND);

rtc_initpara.factor_asyn = prescaler_a;

rtc_initpara.factor_syn = prescaler_s;

rtc_initpara.year = 0x16;

rtc_initpara.day_of_week = RTC_SATURDAY;

rtc_initpara.month = RTC_APR;

rtc_initpara.date = 0x30;

rtc_initpara.display_format = RTC_24HOUR;

rtc_initpara.am_pm = RTC_AM;

rtc_init(&rtc_initpara);

```

rtc_init_mode_enter

The description of rtc_init_mode_enter is shown as below:

Table 3-620. Function rtc_init_mode_enter

Function name	rtc_init_mode_enter
Function prototype	ErrStatus rtc_init_mode_enter(void);
Function descriptions	enter RTC init mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:


```
/*enter RTC init mode*/
```

```
ErrStatus error_status = rtc_init_mode_enter();
```

rtc_init_mode_exit

The description of rtc_init_mode_exit is shown as below:

Table 3-621. Function rtc_init_mode_exit

Function name	rtc_init_mode_exit
Function prototype	void rtc_init_mode_exit(void);
Function descriptions	exit RTC init mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*exit RTC init mode*/
```

```
rtc_init_mode_exit();
```

rtc_register_sync_wait

The description of rtc_register_sync_wait is shown as below:

Table 3-622. Function rtc_register_sync_wait

Function name	rtc_register_sync_wait
Function prototype	ErrStatus rtc_register_sync_wait(void);
Function descriptions	wait until RTC_TIME and RTC_DATE registers are synchronized with APB clock, and the shadow registers are updated
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/*wait until RTC_TIME and RTC_DATE registers are synchronized with APB clock, and the
```

shadow registers are updated*/

```
ErrStatus error_status = rtc_register_sync_wait();
```

rtc_current_time_get

The description of rtc_current_time_get is shown as below:

Table 3-623. Function rtc_current_time_get

Function name	rtc_current_time_get
Function prototype	void rtc_current_time_get(rtc_parameter_struct* rtc_initpara_struct);
Function descriptions	get current time and date
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
rtc_initpara_struct	pointer to a rtc_parameter_struct structure which contains parameters for initialization of the rtc peripheral, the structure members can refer to members of the structure Table 3-614. Structure rtc_parameter_struct
Return value	
-	-

Example:

```
/*get current time and date*/
rtc_parameter_struct rtc_initpara_struct;
rtc_current_time_get(&rtc_initpara_struct);
```

rtc_subsecond_get

The description of rtc_subsecond_get is shown as below:

Table 3-624. Function rtc_subsecond_get

Function name	rtc_subsecond_get
Function prototype	uint32_t rtc_subsecond_get(void);
Function descriptions	get current subsecond value
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	

uint32_t	current subsecond value(0x00-0xFFFF)
----------	--------------------------------------

Example:

```
/*get current subsecond value*/
```

```
uint32_t sub_second = rtc_subsecond_get();
```

rtc_alarm_config

The description of rtc_alarm_config is shown as below:

Table 3-625. Function rtc_alarm_config

Function name	rtc_alarm_config
Function prototype	void rtc_alarm_config(uint8_t rtc_alarm, rtc_alarm_struct *rtc_alarm_time);
Function descriptions	configure RTC alarm
Precondition	-
The called functions	-
Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Input parameter{in}	
rtc_alarm_time	pointer to a rtc_alarm_struct structure which contains parameters for RTC alarm configuration, the structure members can refer to members of the structure Table 3-615. Structure rtc_alarm_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*rtc_alarm_config*/
```

```
rtc_alarm_struct rtc_alarm_time;
```

```
rtc_alarm_config(RTC_ALARM0,&rtc_alarm_time);
```

rtc_alarm_subsecond_config

The description of rtc_alarm_subsecond_config is shown as below:

Table 3-626. Function rtc_alarm_subsecond_config

Function name	rtc_alarm_subsecond_config
Function prototype	void rtc_alarm_subsecond_config(uint8_t rtc_alarm, uint32_t mask_subsecond, uint32_t subsecond)
Function descriptions	configure subsecond of RTC alarm
Precondition	-
The called functions	-

Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Input parameter{in}	
mask_subsecond	alarm subsecond mask
<i>RTC_MASKSSC_0_14</i>	mask alarm subsecond configuration
<i>RTC_MASKSSC_1_14</i>	mask RTC_ALARM0SS_SSC[14:1], and RTC_ALARM0SS_SSC[0] is to be compared
<i>RTC_MASKSSC_2_14</i>	mask RTC_ALARM0SS_SSC[14:2], and RTC_ALARM0SS_SSC[1:0] is to be compared
<i>RTC_MASKSSC_3_14</i>	mask RTC_ALARM0SS_SSC[14:3], and RTC_ALARM0SS_SSC[2:0] is to be compared
<i>RTC_MASKSSC_4_14</i>	mask RTC_ALARM0SS_SSC[14:4], and RTC_ALARM0SS_SSC[3:0] is to be compared
<i>RTC_MASKSSC_5_14</i>	mask RTC_ALARM0SS_SSC[14:5], and RTC_ALARM0SS_SSC[4:0] is to be compared
<i>RTC_MASKSSC_6_14</i>	mask RTC_ALARM0SS_SSC[14:6], and RTC_ALARM0SS_SSC[5:0] is to be compared
<i>RTC_MASKSSC_7_14</i>	mask RTC_ALARM0SS_SSC[14:7], and RTC_ALARM0SS_SSC[6:0] is to be compared
<i>RTC_MASKSSC_8_14</i>	mask RTC_ALARM0SS_SSC[14:8], and RTC_ALARM0SS_SSC[7:0] is to be compared
<i>RTC_MASKSSC_9_14</i>	mask RTC_ALARM0SS_SSC[14:9], and RTC_ALARM0SS_SSC[8:0] is to be compared
<i>RTC_MASKSSC_10_14</i> 4	mask RTC_ALARM0SS_SSC[14:10], and RTC_ALARM0SS_SSC[9:0] is to be compared
<i>RTC_MASKSSC_11_14</i> 4	mask RTC_ALARM0SS_SSC[14:11], and RTC_ALARM0SS_SSC[10:0] is to be compared
<i>RTC_MASKSSC_12_14</i> 4	mask RTC_ALARM0SS_SSC[14:12], and RTC_ALARM0SS_SSC[11:0] is to be compared
<i>RTC_MASKSSC_13_14</i> 4	mask RTC_ALARM0SS_SSC[14:13], and RTC_ALARM0SS_SSC[12:0] is to be compared
<i>RTC_MASKSSC_14</i>	mask RTC_ALARM0SS_SSC[14], and RTC_ALARM0SS_SSC[13:0] is to be compared
<i>RTC_MASKSSC_NONE</i>	mask none, and RTC_ALARM0SS_SSC[14:0] is to be compared
Input parameter{in}	
subsecond	alarm subsecond value(0x000 - 0x7FFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*configure subsecond of RTC alarm*/
```

```
rtc_subsecond_config(RTC_ALARM0,RTC_MASKSSC_9_14, 0x7FFF);
```

rtc_alarm_enable

The description of rtc_alarm_enable is shown as below:

Table 3-627. Function rtc_alarm_enable

Function name	rtc_alarm_enable
Function prototype	void rtc_alarm_enable(uint8_t rtc_alarm);
Function descriptions	enable RTC alarm
Precondition	-
The called functions	-
Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*enable RTC alarm*/
```

```
rtc_alarm_enable(RTC_ALARM0);
```

rtc_alarm_disable

The description of rtc_alarm_disable is shown as below:

Table 3-628. Function rtc_alarm_disable

Function name	rtc_alarm_disable
Function prototype	ErrStatus rtc_alarm_disable(uint8_t rtc_alarm);
Function descriptions	disable RTC alarm
Precondition	-
The called functions	-
Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/*disable RTC alarm*/
```

```
ErrStatus error_status = rtc_alarm_disable(RTC_ALARM0);
```

rtc_alarm_get

The description of rtc_alarm_get is shown as below:

Table 3-629. Function rtc_alarm_get

Function name	rtc_alarm_get
Function prototype	void rtc_alarm_get(uint8_t rtc_alarm, rtc_alarm_struct *rtc_alarm_time);
Function descriptions	get RTC alarm
Precondition	-
The called functions	-
Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Output parameter{out}	
rtc_alarm_time	pointer to a rtc_alarm_struct structure which contains parameters for RTC alarm configuration, the structure members can refer to members of the structure Table 3-615. Structure rtc_alarm_struct
Return value	
-	-

Example:

```
/*disable RTC alarm*/
```

```
rtc_alarm_struct rtc_alarm_time;
```

```
rtc_alarm_get(RTC_ALARM0,&rtc_alarm_time);
```

rtc_alarm_subsecond_get

The description of rtc_alarm_subsecond_get is shown as below:

Table 3-630. Function rtc_alarm_subsecond_get

Function name	rtc_alarm_subsecond_get
Function prototype	uint32_t rtc_alarm_subsecond_get(uint8_t rtc_alarm);
Function descriptions	get RTC alarm subsecond
Precondition	-
The called functions	-
Input parameter{in}	
rtc_alarm	RTC_ALARM0 or RTC_ALARM1
Output parameter{out}	
-	-
Return value	
uint32_t	RTC alarm subsecond value(0x0-0x3FFF)

Example:

```
/*get RTC alarm subsecond*/
```

```
uint32_t subsecond = rtc_alarm_subsecond_get(RTC_ALARM0);
```

rtc_timestamp_enable

The description of rtc_timestamp_enable is shown as below:

Table 3-631. Function rtc_timestamp_enable

Function name	rtc_timestamp_enable
Function prototype	void rtc_timestamp_enable(uint32_t edge);
Function descriptions	enable RTC time-stamp
Precondition	-
The called functions	-
Input parameter{in}	
edge	specify which edge to detect of time-stamp
<i>RTC_TIMESTAMP_RISING_EDGE</i>	rising edge is valid event edge for timestamp event
<i>RTC_TIMESTAMP_FALLING_EDGE</i>	falling edge is valid event edge for timestamp event
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*enable RTC time-stamp*/
```

```
rtc_timestamp_enable(RTC_TIMESTAMP_RISING_EDGE);
```

rtc_timestamp_disable

The description of rtc_timestamp_disable is shown as below:

Table 3-632. Function rtc_timestamp_disable

Function name	rtc_timestamp_disable
Function prototype	void rtc_timestamp_disable(void);
Function descriptions	disable RTC time-stamp
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/*disable RTC time-stamp*/
```

```
rtc_timestamp_disable();
```

rtc_timestamp_internalevent_config

The description of rtc_timestamp_internalevent_config is shown as below:

Table 3-633. Function rtc_timestamp_internalevent_config

Function name	rtc_timestamp_internalevent_config
Function prototype	void rtc_timestamp_internalevent_config(uint32_t mode)
Function descriptions	configure RTC time-stamp internal event
Precondition	-
The called functions	-
Input parameter{in}	
mode	specify which internal or external event to be detected
<i>RTC_ITSEN_DISABLE</i>	disable RTC time-stamp internal event
<i>RTC_ITSEN_ENABLE</i>	enable RTC time-stamp internal event
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable RTC time-stamp internal event */
```

```
rtc_timestamp_internalevent_config(RTC_ITSEN_DISABLE);
```

rtc_timestamp_get

The description of rtc_timestamp_get is shown as below:

Table 3-634. Function rtc_timestamp_get

Function name	rtc_timestamp_get
Function prototype	void rtc_timestamp_get(rtc_timestamp_struct* rtc_timestamp);
Function descriptions	get RTC timestamp time and date
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
rtc_timestamp	Pointer to a rtc_timestamp_struct structure which contains

	parameters for RTC time-stamp configuration, the structure members can refer to members of the structure Table 3-617. Structure <i>rtc_tamper</i> struct
Return value	
-	-

Example:

```
/* get RTC timestamp time and date */
rtc_timestamp_struct rtc_timestamp;
rtc_timestamp_get(& rtc_timestamp);
```

rtc_timestamp_subsecond_get

The description of `rtc_timestamp_subsecond_get` is shown as below:

Table 3-635. Function `rtc_timestamp_subsecond_get`

Function name	<code>rtc_timestamp_subsecond_get</code>
Function prototype	<code>uint32_t rtc_timestamp_subsecond_get(void);</code>
Function descriptions	get RTC time-stamp subsecond
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
<code>uint32_t</code>	RTC time-stamp subsecond value

Example:

```
/* get RTC time-stamp subsecond */
uint32_t subsecond = rtc_timestamp_subsecond_get();
```

rtc_tamper_enable

The description of `rtc_tamper_enable` is shown as below:

Table 3-636. Function `rtc_tamper_enable`

Function name	<code>rtc_tamper_enable</code>
Function prototype	<code>void rtc_tamper_enable(rtc_tamper_struct* rtc_tamper);</code>
Function descriptions	enable RTC tamper
Precondition	-
The called functions	-
Input parameter{in}	

rtc_tamper	pointer to a <code>rtc_tamper_struct</code> structure which contains parameters for RTC tamper configuration, the structure members can refer to members of the structure Table 3-617. Structure <code>rtc_tamper</code> struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable RTC tamper */

rtc_tamper_struct rtc_tamper

rtc_tamper_enable(& rtc_tamper);
```

rtc_tamper_disable

The description of `rtc_tamper_disable` is shown as below:

Table 3-637. Function `rtc_tamper_disable`

Function name	<code>rtc_tamper_disable</code>
Function prototype	<code>void rtc_tamper_disable(uint32_t source);</code>
Function descriptions	disable RTC tamper
Precondition	-
The called functions	-
Input parameter{in}	
source	specify which tamper source to be disabled
<code>RTC_TAMPER0</code>	RTC tamper0
<code>RTC_TAMPER1</code>	RTC tamper1
<code>RTC_TAMPER2</code>	RTC tamper2
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable RTC tamper0 */

rtc_tamper_disable(RTC_TAMPER0);
```

rtc_tamper_mask

The description of `rtc_tamper_mask` is shown as below:

Table 3-638. Function `rtc_tamper_mask`

Function name	<code>rtc_tamper_mask</code>
----------------------	------------------------------

Function prototype	void rtc_tamper_mask(uint32_t source);
Function descriptions	set specified RTC tamper mask
Precondition	-
The called functions	-
Input parameter{in}	
source	specify which tamper will be masked
<i>RTC_TAMPMASK_NONE</i>	both tamper 0~2 would not be masked
<i>RTC_TAMPMASK_TP0</i>	tamper0 will be masked, both TPIE and TP0IE would be fouced to reset
<i>RTC_TAMPMASK_TP1</i>	Tamper1 will be masked, both TPIE and TP1IE would be fouced to reset
<i>RTC_TAMPMASK_TP2</i>	Tamper2 will be masked, both TPIE and TP2IE would be fouced to reset
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* both tamper 0~3 would not be masked */
```

```
rtc_tamper_mask(RTC_TAMPMASK_NONE);
```

rtc_tamper_without_bkp_reset

The description of rtc_tamper_without_bkp_reset is shown as below:

Table 3-639. Function rtc_tamper_without_bkp_reset

Function name	rtc_tamper_without_bkp_reset
Function prototype	void rtc_tamper_without_bkp_reset(uint32_t ne_source);
Function descriptions	tamperx event does not erase the RTC_BKP registers
Precondition	-
The called functions	-
Input parameter{in}	
ne_source	specify which tamper source will not trigger the RTC_BKP registers reset
<i>RTC_TAMPXNOERAS_E_NONE</i>	both tamper0 and tamper1 event will trigger RTC_BKP registers reset
<i>RTC_TAMPXNOERAS_E_TP0</i>	tamper0 event will not trigger RTC_BKP registers reset
<i>RTC_TAMPXNOERAS_E_TP1</i>	tamper1 event will not trigger RTC_BKP registers reset
<i>RTC_TAMPXNOERAS_E_TP2</i>	tamper2 event will not trigger RTC_BKP registers reset
<i>RTC_TAMPXNOERAS_E_TP0_TP1</i>	Neither tamper0 nor tamepr1 event will trigger RTC_BKP registers reset
<i>RTC_TAMPXNOERAS</i>	tamper 0~3 event all will not trigger RTC_BKP registers reset

<i>E_TP_ALL</i>	
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* tamper 0~3 event all will not trigger RTC_BKP registers reset */
```

```
rtc_tamper_without_bkp_reset(RTC_TAMPXNOERASE_TP_ALL);
```

rtc_output_pin_select

The description of rtc_output_pin_select is shown as below:

Table 3-640. Function rtc_output_pin_select

Function name	rtc_output_pin_select
Function prototype	void rtc_output_pin_select(uint32_t outputpin);
Function descriptions	select the RTC output pin
Precondition	-
The called functions	-
Input parameter{in}	
outputpin	specify the rtc output pin is PC13 or not
<i>RTC_OUT_PC13</i>	the rtc output pin is PC13
<i>RTC_OUT_PB2_PB14</i>	the rtc output pin is PB2 or PB14
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* specify the rtc output pin is PC13 */
```

```
rtc_output_pin_select(RTC_OUT_PC13);
```

rtc_alarm_output_config

The description of rtc_alarm_output_config is shown as below:

Table 3-641. Function rtc_alarm_output_config

Function name	rtc_alarm_output_config
Function prototype	void rtc_alarm_output_config(uint32_t source, uint32_t mode);
Function descriptions	configure rtc alarm output source
Precondition	-
The called functions	-

Input parameter{in}	
source	specify signal to output
<i>RTC_ALARM0_HIGH</i>	when the alarm0 flag is set, the output pin is high
<i>RTC_ALARM0_LOW</i>	when the alarm0 flag is set, the output pin is low
<i>RTC_ALARM1_HIGH</i>	when the alarm1 flag is set, the output pin is high
<i>RTC_ALARM1_LOW</i>	when the alarm1 flag is set, the output pin is low
<i>RTC_WAKEUP_HIGH</i>	when the wakeup flag is set, the output pin is high
<i>RTC_WAKEUP_LOW</i>	when the wakeup flag is set, the output pin is low
Input parameter{in}	
mode	specify the output pin mode when output alarm signal or auto wakeup signal
<i>RTC_ALARM_OUTPUTPU</i> <i>T_OD</i>	open drain mode
<i>RTC_ALARM_OUTPUTPU</i> <i>T_PP</i>	push pull mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure rtc alarm0 output source */
```

```
rtc_alarm_output_config(RTC_ALARM0_LOW, RTC_ALARM_OUTPUT_PP);
```

rtc_calibration_output_config

The description of `rtc_calibration_output_config` is shown as below:

Table 3-642. Function `rtc_calibration_output_config`

Function name	<code>rtc_calibration_output_config</code>
Function prototype	<code>void rtc_calibration_output_config(uint32_t source);</code>
Function descriptions	configure rtc calibration output source
Precondition	-
The called functions	-
Input parameter{in}	
source	specify signal to output
<i>RTC_CALIBRATION_5</i> <i>12HZ</i>	when the LSE frequency is 32768Hz and the RTC_PSC is the default value, output 512Hz signal
<i>RTC_CALIBRATION_1</i> <i>HZ</i>	when the LSE frequency is 32768Hz and the RTC_PSC is the default value, output 1Hz signal
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* when the LSE frequency is 32768Hz and the RTC_PSC
is the default value, output 1Hz signal */

rtc_calibration_output_config(RTC_CALIBRATION_1HZ);
```

rtc_hour_adjust

The description of rtc_hour_adjust is shown as below:

Table 3-643. Function rtc_hour_adjust

Function name	rtc_hour_adjust
Function prototype	void rtc_hour_adjust(uint32_t operation);
Function descriptions	adjust the daylight saving time by adding or subtracting one hour from the current time
Precondition	-
The called functions	-
Input parameter{in}	
operation	hour adjustment operation
<i>RTC_CTL_A1H</i>	add one hour
<i>RTC_CTL_S1H</i>	subtract one hour
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* adjust the daylight saving time by adding one hour from the current time */

rtc_hour_adjust(RTC_CTL_A1H);
```

rtc_second_adjust

The description of rtc_second_adjust is shown as below:

Table 3-644. Function rtc_second_adjust

Function name	rtc_second_adjust
Function prototype	ErrStatus rtc_second_adjust(uint32_t add, uint32_t minus);
Function descriptions	adjust RTC second or subsecond value of current time
Precondition	-
The called functions	-
Input parameter{in}	
add	add 1s to current time or not
<i>RTC_SHIFT_ADD1S_R</i> <i>ESET</i>	no effect

<i>RTC_SHIFT_ADD1S_SET</i>	add 1s to current time
Input parameter{in}	
minus	number of subsecond to minus from current time(0x0 - 0x7FFF)
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* adjust RTC second or subsecond value of current time */
```

```
ErrStatus error_status = rtc_second_adjust(RTC_SHIFT_ADD1S_SET, 0);
```

rtc_bypass_shadow_enable

The description of `rtc_bypass_shadow_enable` is shown as below:

Table 3-645. Function `rtc_bypass_shadow_enable`

Function name	<code>rtc_bypass_shadow_enable</code>
Function prototype	<code>void rtc_bypass_shadow_enable(void);</code>
Function descriptions	enable RTC bypass shadow registers function
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable RTC bypass shadow registers function*/
```

```
rtc_bypass_shadow_enable();
```

rtc_bypass_shadow_disable

The description of `rtc_bypass_shadow_disable` is shown as below:

Table 3-646. Function `rtc_bypass_shadow_disable`

Function name	<code>rtc_bypass_shadow_disable</code>
Function prototype	<code>void rtc_bypass_shadow_disable(void);</code>
Function descriptions	disable RTC bypass shadow registers function
Precondition	-

The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable RTC bypass shadow registers function*/
```

```
rtc_bypass_shadow_disable();
```

rtc_refclock_detection_enable

The description of rtc_refclock_detection_enable shown as below:

Table 3-647. Function rtc_refclock_detection_enable

Function name	rtc_refclock_detection_enable
Function prototype	ErrStatus rtc_refclock_detection_enable(void);
Function descriptions	enable RTC reference clock detection function
Precondition	-
The called functions	rtc_init_mode_enter/rtc_init_mode_exit
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* enable RTC reference clock detection function*/
```

```
ErrStatus error_status = rtc_refclock_detection_enable();
```

rtc_refclock_detection_disable

The description of rtc_refclock_detection_disable shown as below:

Table 3-648. Function rtc_refclock_detection_disable

Function name	rtc_refclock_detection_disable
Function prototype	ErrStatus rtc_refclock_detection_disable(void);
Function descriptions	disable RTC reference clock detection function
Precondition	-
The called functions	rtc_init_mode_enter/rtc_init_mode_exit

Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* disableRTC reference clock detection function*/
```

```
ErrStatus error_status = rtc_refclock_detection_disable();
```

rtc_wakeup_enable

The description of rtc_refclock_detection_disable is shown as below:

Table 3-649. Function rtc_wakeup_enable

Function name	rtc_wakeup_enable
Function prototype	void rtc_wakeup_enable(void);
Function descriptions	enable RTC auto wakeup function
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable RTC auto wakeup function */
```

```
rtc_wakeup_enable();
```

rtc_wakeup_disable

The description of rtc_wakeup_disable is shown as below:

Table 3-650. Function rtc_wakeup_disable

Function name	rtc_wakeup_disable
Function prototype	ErrStatus rtc_wakeup_disable(void);
Function descriptions	disable RTC auto wakeup function
Precondition	-
The called functions	-
Input parameter{in}	

-	-
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* disable RTC auto wakeup function */
```

```
ErrStatus error_status = rtc_wakeup_disable();
```

rtc_wakeup_clock_set

The description of rtc_wakeup_clock_set is shown as below:

Table 3-651. Function rtc_wakeup_clock_set

Function name	rtc_wakeup_clock_set
Function prototype	ErrStatus rtc_wakeup_clock_set(uint8_t wakeup_clock);
Function descriptions	set RTC auto wakeup timer clock
Precondition	-
The called functions	-
Input parameter{in}	
wakeup_clock	wakeup timer clock is RTC clock divided factor
WAKEUP_RTCK_DIV 16	RTC auto wakeup timer clock is RTC clock divided by 16
WAKEUP_RTCK_DIV 8	RTC auto wakeup timer clock is RTC clock divided by 8
WAKEUP_RTCK_DIV 4	RTC auto wakeup timer clock is RTC clock divided by 4
WAKEUP_RTCK_DIV 2	RTC auto wakeup timer clock is RTC clock divided by 2
WAKEUP_CKSPRE	RTC auto wakeup timer clock is ckspre
WAKEUP_CKSPRE_2 EXP16	RTC auto wakeup timer clock is ckspre and wakeup timer add 2exp16
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* RTC auto wakeup timer clock is ckspre */
```

```
ErrStatus error_status = rtc_wakeup_clock_set(WAKEUP_RTCK_DIV8);
```

rtc_wakeup_timer_set

The description of rtc_wakeup_timer_set is shown as below:

Table 3-652. Function rtc_wakeup_timer_set

Function name	rtc_wakeup_timer_set
Function prototype	ErrStatus rtc_wakeup_timer_set(uint16_t wakeup_timer);
Function descriptions	set wakeup timer value
Precondition	-
The called functions	-
Input parameter{in}	
wakeup_timer	wakeup timer value
<i>uint16_t</i>	0x0000-0xffff
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* set wakeup timer value */
```

```
ErrStatus error_status = rtc_wakeup_timer_set(0XFFEE);
```

rtc_wakeup_timer_get

The description of rtc_wakeup_timer_set is shown as below:

Table 3-653. Function rtc_wakeup_timer_get

Function name	rtc_wakeup_timer_get
Function prototype	uint16_t rtc_wakeup_timer_get(void);
Function descriptions	set wakeup timer value
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint16_t	0-0xFFFF

Example:

```
/* get wakeup timer value */
```

```
uint32_t wakeup_time = rtc_wakeup_timer_get();
```

rtc_smooth_calibration_config

The description of rtc_smooth_calibration_config is shown as below:

Table 3-654. Function rtc_smooth_calibration_config

Function name	rtc_smooth_calibration_config
Function prototype	ErrStatus rtc_smooth_calibration_config(uint32_t window, uint32_t plus, uint32_t minus);
Function descriptions	configure RTC smooth calibration
Precondition	-
The called functions	-
Input parameter{in}	
window	select calibration window
RTC_CALIBRATION_WINDOW_32S	2exp20 RTCCLK cycles, 32s if RTCCLK = 32768 Hz
RTC_CALIBRATION_WINDOW_16S	2exp19 RTCCLK cycles, 16s if RTCCLK = 32768 Hz
RTC_CALIBRATION_WINDOW_8S	2exp18 RTCCLK cycles, 8s if RTCCLK = 32768 Hz
Input parameter{in}	
plus	add RTC clock or not
RTC_CALIBRATION_PLUS_SET	add one RTC clock every 2048 rtc clock
RTC_CALIBRATION_PLUS_RESET	no effect
Input parameter{in}	
minus	the RTC clock to minus during the calibration window(0x0 - 0x1FF)
Output parameter{out}	
-	-
Return value	
ErrStatus	ERROR or SUCCESS

Example:

```
/* configure RTC smooth calibration */
```

```
ErrStatus error_status;
```

```
error_status = rtc_smooth_calibration_config(RTC_CALIBRATION_WINDOW_32S,
RTC_CALIBRATION_PLUS_SET, 0x10);
```

rtc_interrupt_enable

The description of rtc_interrupt_enable is shown as below:

Table 3-655. Function rtc_interrupt_enable

Function name	rtc_interrupt_enable
Function prototype	void rtc_interrupt_enable(uint32_t interrupt);
Function descriptions	enable specified RTC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify which interrupt source to be enabled
<i>RTC_INT_TIMESTAMP</i>	timestamp interrupt
<i>RTC_INT_ALARM0</i>	Alarm0 interrupt
<i>RTC_INT_ALARM1</i>	Alarm1 interrupt
<i>RTC_INT_TAMP_ALL</i>	tamp interrupt
<i>RTC_INT_TAMP0</i>	Tamper0 detection interrupt
<i>RTC_INT_TAMP1</i>	Tamper1 detection interrupt
<i>RTC_INT_TAMP2</i>	Tamper2 detection interrupt
<i>RTC_INT_WAKEUP</i>	wakeup timer interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable specified RTC interrupt*/
rtc_interrupt_enable(RTC_INT_TAMP0);
```

rtc_interrupt_disable

The description of rtc_interrupt_disable is shown as below:

Table 3-656. Function rtc_interrupt_disable

Function name	rtc_interrupt_disable
Function prototype	void rtc_interrupt_disable(uint32_t interrupt);
Function descriptions	disble specified RTC interrupt
Precondition	-
The called functions	-
Input parameter{in}	
interrupt	specify which RTC interrupt to disable
<i>RTC_INT_TIMESTAMP</i>	timestamp interrupt
<i>RTC_INT_ALARM0</i>	Alarm0 interrupt
<i>RTC_INT_ALARM1</i>	Alarm1 interrupt
<i>RTC_INT_TAMP_ALL</i>	All tamp interrupt
<i>RTC_INT_TAMP0</i>	Tamper0 detection interrupt
<i>RTC_INT_TAMP1</i>	Tamper1 detection interrupt

<i>RTC_INT_TAMP2</i>	Tamper2 detection interrupt
<i>RTC_INT_WAKEUP</i>	wakeup timer interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable specified RTC interrupt */
```

```
rtc_interrupt_disable(RTC_INT_TAMP0);
```

rtc_flag_get

The description of `rtc_flag_get` is shown as below:

Table 3-657. Function `rtc_flag_get`

Function name	<code>rtc_flag_get</code>
Function prototype	<code>FlagStatus rtc_flag_get(uint32_t flag);</code>
Function descriptions	check specified flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	specify which flag to check
<i>RTC_FLAG_SCP</i>	smooth calibration pending flag
<i>RTC_FLAG_TP2</i>	RTC tamper 2 detected flag
<i>RTC_FLAG_TP1</i>	RTC tamper 1 detected flag
<i>RTC_FLAG_TP0</i>	RTC tamper 0 detected flag
<i>RTC_FLAG_TSOVR</i>	time-stamp overflow event flag
<i>RTC_FLAG_TS</i>	time-stamp event flag
<i>RTC_FLAG_ALARM0</i>	Alarm0 event flag
<i>RTC_FLAG_ALARM1</i>	Alarm1 event flag
<i>RTC_FLAG_WT</i>	wakeup timer occurs flag
<i>RTC_FLAG_INIT</i>	init mode event flag
<i>RTC_FLAG_RSYN</i>	time and date registers synchronized event flag
<i>RTC_FLAG_YCM</i>	year parameter configured event flag
<i>RTC_FLAG_SOP</i>	shift function operation pending flag
<i>RTC_FLAG_ALARM0</i> <i>W</i>	Alarm0 written available flag
<i>RTC_FLAG_ALARM1</i> <i>W</i>	Alarm1 written available flag
<i>RTC_FLAG_WTW</i>	wakeup timer can be written flag
Output parameter{out}	
-	-

Return value	
FlagStatus	SET or RESET

Example:

```
/* check time-stamp event flag */
```

```
FlagStatus = rtc_flag_get(RTC_FLAG_TS);
```

rtc_flag_clear

The description of rtc_flag_clear is shown as below:

Table 3-658. Function rtc_flag_clear

Function name	rtc_flag_clear
Function prototype	void rtc_flag_clear(uint32_t flag);
Function descriptions	clear specified flag
Precondition	-
The called functions	-
Input parameter{in}	
flag	specify which flag to clear
<i>RTC_FLAG_TP2</i>	RTC tamper 2 detected flag
<i>RTC_FLAG_TP1</i>	RTC tamper 1 detected flag
<i>RTC_FLAG_TP0</i>	RTC tamper 0 detected flag
<i>RTC_FLAG_TSOVR</i>	time-stamp overflow event flag
<i>RTC_FLAG_TS</i>	time-stamp event flag
<i>RTC_FLAG_WT</i>	wakeup timer occurs flag
<i>RTC_FLAG_ALARM0</i>	Alarm0 event flag
<i>RTC_FLAG_ALARM1</i>	Alarm1 event flag
<i>RTC_FLAG_RSYN</i>	time and date registers synchronized event flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* cleartime-stamp event flag */
```

```
rtc_flag_clear(RTC_FLAG_TS);
```

3.22. SLCD

The SLCD controller directly drives LCD displays by creating the AC segment and commonvoltage signals automatically. The SLCD registers are listed in chapter [3.22.1](#), the SLCD firmware functions are introduced in chapter [3.22.2](#).

3.22.1. Descriptions of Peripheral registers

SLCD registers are listed in the table shown as below:

Table 3-659. SLCD Registers

Registers	Descriptions
SLCD_CTL	SLCD control register
SLCD_CFG	SLCD configuration register
SLCD_STAT	SLCD status register
SLCD_STATC	SLCD status flag clear register
SLCD_DATA0	SLCD display data register 0
SLCD_DATA1	SLCD display data register 1
SLCD_DATA2	SLCD display data register 2
SLCD_DATA3	SLCD display data register 3
SLCD_DATA4	SLCD display data register 4
SLCD_DATA5	SLCD display data register 5
SLCD_DATA6	SLCD display data register 6
SLCD_DATA7	SLCD display data register 7

3.22.2. Descriptions of Peripheral functions

SLCD firmware functions are listed in the table shown as below:

Table 3-660. SLCD firmware function

Function name	Function description
slcd_deinit	reset SLCD interface
slcd_enable	enable SLCD interface
slcd_disable	disable SLCD interface
slcd_init	initialize SLCD interface
slcd_enhance_mode_enable	enable SLCD enhance mode (only for GD32L233xx series)
slcd_enhance_mode_disable	disable SLCD enhance mode (only for GD32L233xx series)
slcd_weak_driving_resistance_select	select SLCD weak driving resistance (only for GD32L235xx series)
slcd_bias_voltage_select	select SLCD bias voltage
slcd_duty_select	select SLCD duty
slcd_clock_config	configure SLCD input clock
slcd_blink_mode_config	configure SLCD blink mode
slcd_contrast_ratio_config	configure SLCD contrast ratio
slcd_dead_time_config	configure SLCD dead time duration
slcd_pulse_on_duration_config	configure SLCD pulse on duration (only for GD32L233xx series)
slcd_com_seg_remap	select SLCD common/segment pad
slcd_voltage_source_select	select SLCD voltage source

Function name	Function description
slcd_high_drive_config	enable or disable permanent high drive
slcd_data_register_write	write SLCD display data registers
slcd_data_update_request	update SLCD data request
slcd_flag_get	get SLCD status flag
slcd_flag_clear	clear SLCD flag
slcd_interrupt_enable	enable SLCD interrupt
slcd_interrupt_disable	disable SLCD interrupt
slcd_interrupt_flag_get	get SLCD interrupt flag
slcd_interrupt_flag_clear	clear SLCD interrupt flag

Enum slcd_data_register_enum

Table 3-661. Enum slcd_data_register_enum

Member name	Function description
SLCD_DATA_REG0	SLCD display data register 0
SLCD_DATA_REG1	SLCD display data register 1
SLCD_DATA_REG2	SLCD display data register 2
SLCD_DATA_REG3	SLCD display data register 3
SLCD_DATA_REG4	SLCD display data register 4
SLCD_DATA_REG5	SLCD display data register 5
SLCD_DATA_REG6	SLCD display data register 6
SLCD_DATA_REG7	SLCD display data register 7

slcd_deinit

The description of slcd_deinit is shown as below:

Table 3-662. Function slcd_deinit

Function name	slcd_deinit
Function prototype	void slcd_deinit(void);
Function descriptions	SLCD reset interface
Precondition	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset the SLCD */
```

```
slcd_deinit();
```

slcd_enable

The description of slcd_enable is shown as below:

Table 3-663. Function slcd_enable

Function name	slcd_enable
Function prototype	void slcd_enable(void);
Function descriptions	enable SLCD interface
Precondition	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SLCD */
slcd_enable();
```

slcd_disable

The description of slcd_disable is shown as below:

Table 3-664. Function slcd_disable

Function name	slcd_disable
Function prototype	void slcd_disable(void);
Function descriptions	disable SLCD interface
Precondition	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SLCD */
slcd_disable();
```

slcd_init

The description of slcd_init is shown as below:

Table 3-665. Function slcd_init

Function name	slcd_init
Function prototype	void slcd_init(uint32_t prescaler, uint32_t divider, uint32_t duty, uint32_t bias);
Function descriptions	initialize SLCD interface
Precondition	-
Input parameter{in}	
prescaler	the SLCD prescaler
SLCD_PRESCALER_1	$f_{PSC} = f_{in_clk}$
SLCD_PRESCALER_2	$f_{PSC} = f_{in_clk}/2$
SLCD_PRESCALER_4	$f_{PSC} = f_{in_clk}/4$
SLCD_PRESCALER_8	$f_{PSC} = f_{in_clk}/8$
SLCD_PRESCALER_16	$f_{PSC} = f_{in_clk}/4$
SLCD_PRESCALER_32	$f_{PSC} = f_{in_clk}/32$
SLCD_PRESCALER_64	$f_{PSC} = f_{in_clk}/64$
SLCD_PRESCALER_128	$f_{PSC} = f_{in_clk}/128$
SLCD_PRESCALER_256	$f_{PSC} = f_{in_clk}/256$
SLCD_PRESCALER_512	$f_{PSC} = f_{in_clk}/512$
SLCD_PRESCALER_1024	$f_{PSC} = f_{in_clk}/1024$
SLCD_PRESCALER_2048	$f_{PSC} = f_{in_clk}/2048$
SLCD_PRESCALER_4096	$f_{PSC} = f_{in_clk}/4096$
SLCD_PRESCALER_8192	$f_{PSC} = f_{in_clk}/8192$
SLCD_PRESCALER_16384	$f_{PSC} = f_{in_clk}/16384$
SLCD_PRESCALER_32768	$f_{PSC} = f_{in_clk}/32768$
Input parameter{in}	
divider	the SLCD divider
SLCD_DIVIDER_16	$f_{SLCD} = f_{PSC}/16$
SLCD_DIVIDER_17	$f_{SLCD} = f_{PSC}/17$
SLCD_DIVIDER_18	$f_{SLCD} = f_{PSC}/18$
SLCD_DIVIDER_19	$f_{SLCD} = f_{PSC}/19$
SLCD_DIVIDER_20	$f_{SLCD} = f_{PSC}/20$

SLCD_DIVIDER_21	fSLCD = fPSC/21
SLCD_DIVIDER_22	fSLCD = fPSC/22
SLCD_DIVIDER_23	fSLCD = fPSC/23
SLCD_DIVIDER_24	fSLCD = fPSC/24
SLCD_DIVIDER_25	fSLCD = fPSC/25
SLCD_DIVIDER_26	fSLCD = fPSC/26
SLCD_DIVIDER_27	fSLCD = fPSC/27
SLCD_DIVIDER_28	fSLCD = fPSC/28
SLCD_DIVIDER_29	fSLCD = fPSC/29
SLCD_DIVIDER_30	fSLCD = fPSC/30
SLCD_DIVIDER_31	fSLCD = fPSC/31
Input parameter{in}	
duty	the SLCD duty
SLCD_DUTY_STATIC	static duty
SLCD_DUTY_1_2	1/2 duty
SLCD_DUTY_1_3	1/3 duty
SLCD_DUTY_1_4	1/4 duty
SLCD_DUTY_1_6	1/6 duty
SLCD_DUTY_1_8	1/8 duty
Input parameter{in}	
bias	the SLCD voltage bias
SLCD_BIAS_1_4	1/4 voltage bias
SLCD_BIAS_1_2	1/2 voltage bias
SLCD_BIAS_1_3	1/3 voltage bias
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize SLCD interface */
```

```
slcd_init(SLCD_PRESCALER_16,          SLCD_DIVIDER_20,          SLCD_DUTY_1_4,
SLCD_BIAS_1_4);
```

slcd_enhance_mode_enable (only for GD32L233xx series)

The description of slcd_enhance_mode_enable is shown as below:

Table 3-666. Function slcd_enhance_mode_enable

Function name	slcd_enhance_mode_enable
Function prototype	void slcd_enhance_mode_enable(void);
Function descriptions	enable SLCD enhance mode
Precondition	-

Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SLCD enhance mode */
```

```
slcd_enhance_mode_enable();
```

slcd_enhance_mode_disable (only for GD32L233xx series)

The description of slcd_enhance_mode_disable is shown as below:

Table 3-667. Function slcd_enhance_mode_disable

Function name	slcd_enhance_mode_disable
Function prototype	void slcd_enhance_mode_disable(void);
Function descriptions	disable SLCD enhance mode
Precondition	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SLCD enhance mode */
```

```
slcd_enhance_mode_disable();
```

slcd_weak_driving_resistance_select (only for GD32L235xx series)

The description of slcd_weak_driving_resistance_select is shown as below:

Table 3-668. Function slcd_weak_driving_resistance_select

Function name	slcd_weak_driving_resistance_select
Function prototype	void slcd_weak_driving_resistance_select(uint32_t resistance);
Function descriptions	select SLCD weak driving resistance
Precondition	-
Input parameter{in}	
resistance	weak driving resistance
<i>SLCD_RSEL_6M</i>	weak driving resistance 6M

<i>SLCD_RSEL_4M</i>	weak driving resistance 4M
<i>SLCD_RSEL_2M</i>	weak driving resistance 2M
<i>SLCD_RSEL_1M</i>	weak driving resistance 1M
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select weak driving resistance */
slcd_weak_driving_resistance_select(SLCD_RSEL_1M);
```

slcd_bias_voltage_select

The description of slcd_bias_voltage_select is shown as below:

Table 3-669. Function slcd_bias_voltage_select

Function name	slcd_bias_voltage_select
Function prototype	void slcd_bias_voltage_select(uint32_t bias_voltage);
Function descriptions	select SLCD bias voltage
Precondition	-
Input parameter{in}	
bias_voltage	the SLCD voltage bias
<i>SLCD_BIAS_1_4</i>	1/4 voltage bias
<i>SLCD_BIAS_1_2</i>	1/2 voltage bias
<i>SLCD_BIAS_1_3</i>	1/3 voltage bias
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the SLCD 1/4 bias voltage */
slcd_bias_voltage_select(SLCD_BIAS_1_4);
```

slcd_duty_select

The description of slcd_duty_select is shown as below:

Table 3-670. Function slcd_duty_select

Function name	slcd_duty_select
Function prototype	void slcd_duty_select(uint32_t duty);
Function descriptions	select SLCD duty

Precondition	-
Input parameter{in}	
duty	duty select
<i>SLCD_DUTY_STATIC</i>	static duty
<i>SLCD_DUTY_1_2</i>	1/2 duty
<i>SLCD_DUTY_1_3</i>	1/3 duty
<i>SLCD_DUTY_1_4</i>	1/4 duty
<i>SLCD_DUTY_1_6</i>	1/6 duty
<i>SLCD_DUTY_1_8</i>	1/8 duty
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select SLCD duty */
```

```
slcd_duty_select(SLCD_DUTY_1_2);
```

slcd_clock_config

The description of slcd_clock_config is shown as below:

Table 3-671. Function slcd_clock_config

Function name	slcd_clock_config
Function prototype	void slcd_clock_config(uint32_t prescaler,uint32_t divider);
Function descriptions	configure SLCD input clock
Precondition	-
Input parameter{in}	
prescaler	the prescaler factor
<i>SLCD_PRESCALER_1</i>	$f_{PSC} = f_{in_clk}$
<i>SLCD_PRESCALER_2</i>	$f_{PSC} = f_{in_clk}/2$
<i>SLCD_PRESCALER_4</i>	$f_{PSC} = f_{in_clk}/4$
<i>SLCD_PRESCALER_8</i>	$f_{PSC} = f_{in_clk}/8$
<i>SLCD_PRESCALER_16</i>	$f_{PSC} = f_{in_clk}/16$
<i>SLCD_PRESCALER_32</i>	$f_{PSC} = f_{in_clk}/32$
<i>SLCD_PRESCALER_64</i>	$f_{PSC} = f_{in_clk}/64$
<i>SLCD_PRESCALER_128</i>	$f_{PSC} = f_{in_clk}/128$
<i>SLCD_PRESCALER_256</i>	$f_{PSC} = f_{in_clk}/256$

SLCD_PRESCALER_5 12	$f_{PSC} = f_{in_clk}/512$
SLCD_PRESCALER_1 024	$f_{PSC} = f_{in_clk}/1024$
SLCD_PRESCALER_2 048	$f_{PSC} = f_{in_clk}/2048$
SLCD_PRESCALER_4 096	$f_{PSC} = f_{in_clk}/4096$
SLCD_PRESCALER_8 192	$f_{PSC} = f_{in_clk}/8192$
SLCD_PRESCALER_1 6384	$f_{PSC} = f_{in_clk}/16384$
SLCD_PRESCALER_3 2768	$f_{PSC} = f_{in_clk}/32768$
Input parameter{in}	
divider	the divider factor
SLCD_DIVIDER_16	$f_{SLCD} = f_{PSC}/16$
SLCD_DIVIDER_17	$f_{SLCD} = f_{PSC}/17$
SLCD_DIVIDER_18	$f_{SLCD} = f_{PSC}/18$
SLCD_DIVIDER_19	$f_{SLCD} = f_{PSC}/19$
SLCD_DIVIDER_20	$f_{SLCD} = f_{PSC}/20$
SLCD_DIVIDER_21	$f_{SLCD} = f_{PSC}/21$
SLCD_DIVIDER_22	$f_{SLCD} = f_{PSC}/22$
SLCD_DIVIDER_23	$f_{SLCD} = f_{PSC}/23$
SLCD_DIVIDER_24	$f_{SLCD} = f_{PSC}/24$
SLCD_DIVIDER_25	$f_{SLCD} = f_{PSC}/25$
SLCD_DIVIDER_26	$f_{SLCD} = f_{PSC}/26$
SLCD_DIVIDER_27	$f_{SLCD} = f_{PSC}/27$
SLCD_DIVIDER_28	$f_{SLCD} = f_{PSC}/28$
SLCD_DIVIDER_29	$f_{SLCD} = f_{PSC}/29$
SLCD_DIVIDER_30	$f_{SLCD} = f_{PSC}/30$
SLCD_DIVIDER_31	$f_{SLCD} = f_{PSC}/31$
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the prescaler and the divider of SLCD clock */
```

```
slcd_clock_config(SLCD_PRESCALER_4, SLCD_DIVIDER_19);
```


slcd_blink_mode_config

The description of slcd_blink_mode_config is shown as below:

Table 3-672. Function slcd_blink_mode_config

Function name	slcd_blink_mode_config
Function prototype	void slcd_blink_mode_config(uint32_t mode,uint32_t blink_divider);
Function descriptions	configure SLCD blink mode
Precondition	-
Input parameter{in}	
mode	blink mode
SLCD_BLINKMODE_O FF	blink disabled
SLCD_BLINKMODE_S EG0_COM0	blink enabled on SEG[0], COM[0]
SLCD_BLINKMODE_S EG0_ALLCOM	blink enabled on SEG[0], all COM
SLCD_BLINKMODE_A LLSEG_ALLCOM	blink enabled on all SEG and all COM
Input parameter{in}	
divider	the divider factor
SLCD_BLINK_FREQU ENCY_DIV8	blink frequency = $f_{SLCD}/8$
SLCD_BLINK_FREQU ENCY_DIV16	blink frequency = $f_{SLCD}/16$
SLCD_BLINK_FREQU ENCY_DIV32	blink frequency = $f_{SLCD}/32$
SLCD_BLINK_FREQU ENCY_DIV64	blink frequency = $f_{SLCD}/64$
SLCD_BLINK_FREQU ENCY_DIV128	blink frequency = $f_{SLCD}/128$
SLCD_BLINK_FREQU ENCY_DIV256	blink frequency = $f_{SLCD}/256$
SLCD_BLINK_FREQU ENCY_DIV512	blink frequency = $f_{SLCD}/512$
SLCD_BLINK_FREQU ENCY_DIV1024	blink frequency = $f_{SLCD}/1024$
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SLCD blink mode */
```

```
slcd_blink_mode_config(SLCD_BLINKMODE_SEG0_COM0,  
SLCD_BLINK_FREQUENCY_DIV8);
```

slcd_contrast_ratio_config

The description of slcd_contrast_ratio_config is shown as below:

Table 3-673. Function slcd_contrast_ratio_config

Function name	slcd_contrast_ratio_config
Function prototype	void slcd_contrast_ratio_config(uint32_t contrast_ratio);
Function descriptions	configure SLCD contrast ratio
Precondition	-
Input parameter{in}	
contrast_ratio	specify the VSLCD voltage
SLCD_CONTRAST_LE VEL_0	maximum SLCD Voltage = 2.65V
SLCD_CONTRAST_LE VEL_1	maximum SLCD Voltage = 2.80V
SLCD_CONTRAST_LE VEL_2	maximum SLCD Voltage = 2.92V
SLCD_CONTRAST_LE VEL_3	maximum SLCD Voltage = 3.08V
SLCD_CONTRAST_LE VEL_4	maximum SLCD Voltage = 3.23V
SLCD_CONTRAST_LE VEL_5	maximum SLCD Voltage = 3.37V
SLCD_CONTRAST_LE VEL_6	maximum SLCD Voltage = 3.52V
SLCD_CONTRAST_LE VEL_7	maximum SLCD Voltage = 3.67V
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SLCD contrast ratio */
```

```
slcd_contrast_ratio_config(SLCD_CONTRAST_LEVEL_0);
```

slcd_dead_time_config

The description of slcd_dead_time_config is shown as below:

Table 3-674. Function `slcd_dead_time_config`

Function name	<code>slcd_dead_time_config</code>
Function prototype	<code>void slcd_dead_time_config(uint32_t dead_time);</code>
Function descriptions	configure SLCD dead time duration
Precondition	-
Input parameter{in}	
dead_time	the length of the dead time between frames
<code>SLCD_DEADTIME_PE</code> <code>RIOD_0</code>	no dead time
<code>SLCD_DEADTIME_PE</code> <code>RIOD_1</code>	1 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_2</code>	2 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_3</code>	3 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_4</code>	4 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_5</code>	5 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_6</code>	6 phase inserted between couple of frame
<code>SLCD_DEADTIME_PE</code> <code>RIOD_7</code>	7 phase inserted between couple of frame
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SLCD dead time duration */
slcd_dead_time_config(SLCD_DEADTIME_PERIOD_1);
```

`slcd_pulse_on_duration_config` (only for GD32L233xx series)

The description of `slcd_pulse_on_duration_config` is shown as below:

Table 3-675. Function `slcd_pulse_on_duration_config`

Function name	<code>slcd_pulse_on_duration_config</code>
Function prototype	<code>void slcd_pulse_on_duration_config(uint32_t duration);</code>
Function descriptions	configure SLCD pulse on duration
Precondition	-
Input parameter{in}	
duration	the pulse duration in terms of PSC pulses

<i>SLCD_PULSEON_DURATION_0</i>	pulse on duration = 0
<i>SLCD_PULSEON_DURATION_1</i>	pulse on duration = $1/f_{psc}$
<i>SLCD_PULSEON_DURATION_2</i>	pulse on duration = $2/f_{psc}$
<i>SLCD_PULSEON_DURATION_3</i>	pulse on duration = $3/f_{psc}$
<i>SLCD_PULSEON_DURATION_4</i>	pulse on duration = $4/f_{psc}$
<i>SLCD_PULSEON_DURATION_5</i>	pulse on duration = $5/f_{psc}$
<i>SLCD_PULSEON_DURATION_6</i>	pulse on duration = $6/f_{psc}$
<i>SLCD_PULSEON_DURATION_7</i>	pulse on duration = $7/f_{psc}$
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SLCD pulse on duration */
```

```
slcd_pulse_on_duration_config(SLCD_PULSEON_DURATION_7);
```

slcd_com_seg_remap

The description of slcd_com_seg_remap is shown as below:

Table 3-676. Function slcd_com_seg_remap

Function name	slcd_com_seg_remap
Function prototype	void slcd_com_seg_remap(ControlStatus newvalue);
Function descriptions	select SLCD common/segment pad
Precondition	-
Input parameter{in}	
NewValue	ENABLE or DISABLE
<i>ENABLE</i>	LCD_COM[7:4] pad select LCD_SEG[31:28]
<i>DISABLE</i>	LCD_COM[7:4] pad select LCD_COM[7:4]
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select SLCD common/segment pad */
```

```
slcd_com_seg_remap(ENABLE);
```

slcd_voltage_source_select

The description of slcd_voltage_source_select is shown as below:

Table 3-677. Function slcd_voltage_source_select

Function name	slcd_voltage_source_select
Function prototype	void slcd_voltage_source_select(uint8_t voltage_source);
Function descriptions	select SLCD voltage source
Precondition	-
Input parameter{in}	
voltage_source	the SLCD voltage source
SLCD_VOLTAGE_INTERNAL	internal source
SLCD_VOLTAGE_EXTERNAL	external source (VSLCD pin)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select SLCD voltage source */
```

```
slcd_voltage_source_select(SLCD_VOLTAGE_EXTERNAL);
```

slcd_high_drive_config

The description of slcd_high_drive_config is shown as below:

Table 3-678. Function slcd_high_drive_config

Function name	slcd_high_drive_config
Function prototype	void slcd_high_drive_config(ControlStatus newvalue);
Function descriptions	enable or disable permanent high drive
Precondition	-
Input parameter{in}	
NewValue	ENABLE or DISABLE
ENABLE	Permanent high drive enabled
DISABLE	Permanent high drive disabled
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* enable permanent high drive */
slcd_high_drive_config(ENABLE);
```

slcd_data_register_write

The description of slcd_data_register_write is shown as below:

Table 3-679. Function slcd_data_register_write

Function name	slcd_data_register_write
Function prototype	void slcd_data_register_write(slcd_data_register_enum register_number, uint32_t data);
Function descriptions	write SLCD data register
Precondition	-
Input parameter{in}	
register_number	refer to Table 3-661. Enum slcd_data_register_enum.
SLCD_DATA_REGx(x=0, 1, ..., 7)	SLCD_DATAx register
Input parameter{in}	
data	the data write to the register
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* write SLCD data register */
slcd_data_register_write(SLCD_DATA_REG0, 0x0000FFFF);
```

slcd_data_update_request

The description of slcd_data_update_request is shown as below:

Table 3-680. Function slcd_data_update_request

Function name	slcd_data_update_request
Function prototype	void slcd_data_update_request(void);
Function descriptions	update SLCD data request
Precondition	-
Input parameter{in}	
-	-
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* update SLCD data request */
```

```
slcd_data_update_request();
```

slcd_flag_get

The description of slcd_flag_get is shown as below:

Table 3-681. Function slcd_flag_get

Function name	slcd_flag_get
Function prototype	FlagStatus slcd_flag_get(uint8_t flag);
Function descriptions	get the SLCD flag
Precondition	-
Input parameter{in}	
flag	status flag
SLCD_FLAG_ON	SLCD controller on flag
SLCD_FLAG_SOF	start of frame flag
SLCD_FLAG_UPR	SLCD data update request flag
SLCD_FLAG_UPD	update SLCD data done flag
SLCD_FLAG_VRDY	SLCD voltage ready flag (only for GD32L233xx series)
SLCD_FLAG_SYN	SLCD CFG register synchronization flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the SLCD status flag */
```

```
slcd_flag_get(SLCD_FLAG_ON);
```

slcd_flag_clear

The description of slcd_flag_clear is shown as below:

Table 3-682. Function slcd_flag_clear

Function name	slcd_flag_clear
Function prototype	void slcd_flag_clear(uint8_t flag);
Function descriptions	Clear the SLCD status flag
Precondition	-

Input parameter{in}	
flag	status flag
<i>SLCD_FLAG_SOF</i>	start of frame flag
<i>SLCD_FLAG_UPD</i>	update SLCD data done flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the SLCD status flag */
slcd_flag_clear(SLCD_FLAG_SOF);
```

slcd_interrupt_enable

The description of slcd_interrupt_enable is shown as below:

Table 3-683. Function slcd_interrupt_enable

Function name	slcd_interrupt_enable
Function prototype	void slcd_interrupt_enable(uint32_t interrupt);
Function descriptions	enable the SLCD interrupt
Precondition	-
Input parameter{in}	
interrupt	interrupt source
<i>SLCD_INT_SOF</i>	start of frame interrupt
<i>SLCD_INT_UPD</i>	SLCD update done interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the start of frame interrupt */
slcd_interrupt_enable(SLCD_INT_SOF);
```

slcd_interrupt_disable

The description of slcd_interrupt_disable is shown as below:

Table 3-684. Function slcd_interrupt_disable

Function name	slcd_interrupt_disable
Function prototype	void slcd_interrupt_disable(uint32_t interrupt);
Function descriptions	disable the SLCD interrupt

Precondition	-
Input parameter{in}	
interrupt	interrupt source
<i>SLCD_INT_SOF</i>	start of frame interrupt
<i>SLCD_INT_UPD</i>	SLCD update done interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the start of frame interrupt */
slcd_interrupt_disable(SLCD_INT_SOF);
```

slcd_interrupt_flag_get

The description of slcd_interrupt_flag_get is shown as below:

Table 3-685. Function slcd_interrupt_flag_get

Function name	slcd_interrupt_flag_get
Function prototype	FlagStatus slcd_interrupt_flag_get(uint8_t interrupt);
Function descriptions	get the SLCD interrupt flag
Precondition	-
Input parameter{in}	
interrupt	interrupt source
<i>SLCD_INT_FLAG_SOF</i>	start of frame interrupt
<i>SLCD_INT_FLAG_UPD</i>	SLCD update done interrupt
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the SLCD interrupt flag */
slcd_interrupt_flag_get(SLCD_INT_FLAG_SOF);
```

slcd_interrupt_flag_clear

The description of slcd_interrupt_flag_clear is shown as below:

Table 3-686. Function slcd_interrupt_flag_clear

Function name	slcd_interrupt_flag_clear
Function prototype	FlagStatus slcd_interrupt_flag_clear(uint8_t interrupt);

Function descriptions	clear the SLCD interrupt flag
Precondition	-
Input parameter{in}	
interrupt	interrupt source
SLCD_INT_FLAG_SOF	start of frame interrupt
SLCD_INT_FLAG_UPD	SLCD update done interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the SLCD interrupt flag */
slcd_interrupt_flag_clear(SLCD_INT_FLAG_SOF);
```

3.23. SPI

The SPI/I2S module can communicate with external devices using the SPI protocol or the I2S audio protocol. The SPI/I2S registers are listed in chapter [3.23.1](#), the SPI/I2S firmware functions are introduced in chapter [3.23.2](#).

3.23.1. Descriptions of Peripheral registers

SPI/I2S registers are listed in the table shown as below:

Table 3-687. SPI/I2S Registers

Registers	Descriptions
SPI_CTL0	SPI control register 0
SPI_CTL1	SPI control register 1
SPI_STAT	SPI status register
SPI_DATA	SPI data register
SPI_CRCPOLY	SPI CRC polynomial register
SPI_RCRC	SPI receive CRC register
SPI_TCRC	SPI transmit CRC register
SPI_I2SCTL	SPI/I2S control register
SPI_I2SPSC	SPI/I2S clock prescaler register
SPI_QCTL	Quad-SPI mode control register

3.23.2. Descriptions of Peripheral functions

SPI/I2S firmware functions are listed in the table shown as below:

Table 3-688. SPI/I2S firmware function

Function name	Function description
spi_i2s_deinit	reset SPI and I2S peripheral
spi_struct_para_init	initialize the parameters of SPI struct
spi_init	initialize SPI parameter
spi_enable	enable SPI
spi_disable	disable SPI
i2s_init	initialize I2S parameter
i2s_psc_config	configure I2S prescaler
i2s_enable	enable I2S
i2s_disable	disable I2S
spi_nss_output_enable	enable SPI NSS output function
spi_nss_output_disable	disable SPI NSS output function
spi_nss_internal_high	SPI NSS pin high level in software mode
spi_nss_internal_low	SPI NSS pin low level in software mode
spi_dma_enable	enable SPI DMA function
spi_dma_disable	disable SPI DMA function
spi_transmit_odd_config	configure SPI total number of data transmitting by DMA is odd or not
spi_receive_odd_config	configure SPI total number of data receiving by DMA is odd or not
spi_i2s_data_frame_format_config	configure SPI data frame format
spi_fifo_access_size_config	configure SPI access size to FIFO(8-bit or 16-bit)
spi_bidirectional_transfer_config	configure SPI bidirectional transfer direction
spi_i2s_data_transmit	SPI transmit data
spi_i2s_data_receive	SPI receive data
spi_crc_polynomial_set	set SPI CRC polynomial
spi_crc_polynomial_get	get SPI CRC polynomial
spi_crc_length_set	set CRC length
spi_crc_on	turn on SPI CRC function
spi_crc_off	turn off SPI CRC function
spi_crc_next	SPI next data is CRC value
spi_crc_get	get SPI CRC send value or receive value
spi_crc_error_clear	clear SPI CRC error flag status
spi_ti_mode_enable	enable SPI TI mode
spi_ti_mode_disable	disable SPI TI mode
spi_nssp_mode_enable	enable SPI NSS pulse mode
spi_nssp_mode_disable	disable SPI NSS pulse mode
spi_quad_enable	enable quad wire SPI
spi_quad_disable	disable quad wire SPI
spi_quad_write_enable	enable quad wire SPI write
spi_quad_read_enable	enable quad wire SPI read

Function name	Function description
spi_quad_io23_output_enable	enable quad wire SPI_IO2 and SPI_IO3 pin output
spi_quad_io23_output_disable	disable quad wire SPI_IO2 and SPI_IO3 pin output
spi_i2s_format_error_clear	clear SPI/I2S format error flag status
spi_i2s_flag_get	get SPI and I2S flag status
spi_i2s_interrupt_enable	enable SPI and I2S interrupt
spi_i2s_interrupt_disable	disable SPI and I2S interrupt
spi_i2s_interrupt_flag_get	get SPI and I2S interrupt status

Structure spi_parameter_struct

Table 3-689. spi_parameter_struct

Member name	Function description
device_mode	SPI master or slave (SPI_MASTER, SPI_SLAVE)
trans_mode	SPI transtype (SPI_TRANSMODE_FULLDUPLEX, SPI_TRANSMODE_RECEIVEONLY, SPI_TRANSMODE_BDRECEIVE, SPI_TRANSMODE_BDTRANSMIT)
frame_size	SPI frame size (SPI_FRAME_SIZE_16BIT, SPI_FRAME_SIZE_8BIT)
nss	SPI NSS control by hardware or software (SPI_NSS_SOFT, SPI_NSS_HARD)
endian	SPI big endian or little endian (SPI_ENDIAN_MSB, SPI_ENDIAN_LSB)
clock_polarity_phase	SPI clock phase and polarity (SPI_CK_PL_LOW_PH_1EDGE, SPI_CK_PL_HIGH_PH_1EDGE, SPI_CK_PL_LOW_PH_2EDGE, SPI_CK_PL_HIGH_PH_2EDGE)
prescale	SPI prescale factor (SPI_PSC_n (n=2,4,8,16,32,64,128,256))

spi_i2s_deinit

The description of spi_i2s_deinit is shown as below:

Table 3-690. Function spi_i2s_deinit

Function name	spi_i2s_deinit
Function prototype	void spi_i2s_deinit(uint32_t spi_periph);
Function descriptions	reset SPI and I2S peripheral
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
spi_periph	SPI/I2S peripheral
SPIx(x=0,1)	SPI/I2S peripheral selection

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset SPI0 */
spi_i2s_deinit(SPI0);
```

spi_struct_para_init

The description of spi_struct_para_init is shown as below:

Table 3-691. Function spi_struct_para_init

Function name	spi_struct_para_init
Function prototype	void spi_struct_para_init(spi_parameter_struct* spi_struct);
Function descriptions	initialize the parameters of SPI struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
spi_struct	SPI parameter struct, the structure members can refer to members of the structure Table 3-689. spi_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize the parameters of SPI struct */
spi_parameter_struct spi_struct;
spi_struct->device_mode = SPI_SLAVE;
spi_struct->trans_mode = SPI_TRANSMODE_FULLDUPLEX;
spi_struct->frame_size = SPI_FRAMESIZE_8BIT;
spi_struct->nss = SPI_NSS_HARD;
spi_struct->clock_polarity_phase = SPI_CK_PL_LOW_PH_1EDGE;
spi_struct->prescale = SPI_PSC_2;
spi_struct_para_init(&spi_struct);
```

spi_init

The description of spi_init is shown as below:

Table 3-692. Function spi_init

Function name	spi_init
Function prototype	void spi_init(uint32_t spi_periph, spi_parameter_struct* spi_struct);
Function descriptions	initialize SPI peripheral parameter
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
spi_struct	SPI parameter initialization struct, the structure members can refer to members of the structure Table 3-689. spi_parameter_struct
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* initialize SPI0 */

spi_parameter_struct spi_init_struct;

spi_init_struct.trans_mode = SPI_TRANSMODE_BDTRANSMIT;

spi_init_struct.device_mode = SPI_MASTER;

spi_init_struct.frame_size = SPI_FRAME_SIZE_8BIT;

spi_init_struct.clock_polarity_phase = SPI_CK_PL_HIGH_PH_2EDGE;

spi_init_struct.nss = SPI_NSS_SOFT;

spi_init_struct.prescale = SPI_PSC_8;

spi_init_struct.endian = SPI_ENDIAN_MSB;

spi_init(SPI0, &spi_init_struct);

```

spi_enable

The description of spi_enable is shown as below:

Table 3-693. Function spi_enable

Function name	spi_enable
Function prototype	void spi_enable(uint32_t spi_periph);

Function descriptions	enable SPI
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0, 1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI0 */
spi_enable(SPI0);
```

spi_disable

The description of spi_disable is shown as below:

Table 3-694. Function spi_disable

Function name	spi_disable
Function prototype	void spi_disable(uint32_t spi_periph);
Function descriptions	disable SPIx
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0, 1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI0 */
spi_disable(SPI0);
```

i2s_init

The description of i2s_init is shown as below:

Table 3-695. Function i2s_init

Function name	i2s_init
----------------------	----------

Function prototype	void i2s_init(uint32_t spi_periph, uint32_t mode, uint32_t standard, uint32_t ckpl);
Function descriptions	initialize I2S peripheral parameter
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	I2S peripheral
<i>SPIx(x=1)</i>	I2S peripheral selection
Input parameter{in}	
mode	I2S operation mode
<i>I2S_MODE_SLAVETX</i>	I2S slave transmit mode
<i>I2S_MODE_SLAVRX</i>	I2S slave receive mode
<i>I2S_MODE_MASTERTX</i>	I2S master transmit mode
<i>I2S_MODE_MASTERRX</i>	I2S master receive mode
Input parameter{in}	
standard	I2S standard
<i>I2S_STD_PHILLIPS</i>	I2S phillips standard
<i>I2S_STD_MSB</i>	I2S MSB standard
<i>I2S_STD_LSB</i>	I2S LSB standard
<i>I2S_STD_PCMSHORT</i>	I2S PCM short standard
<i>I2S_STD_PCMLONG</i>	I2S PCM long standard
Input parameter{in}	
ckpl	I2S idle state clock polarity
<i>I2S_CKPL_LOW</i>	I2S clock polarity low level
<i>I2S_CKPL_HIGH</i>	I2S clock polarity high level
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize I2S1 */
```

```
i2s_init(SPI1, I2S_MODE_MASTERTX, I2S_STD_PHILLIPS, I2S_CKPL_LOW);
```

i2s_psc_config

The description of i2s_psc_config is shown as below:

Table 3-696. Function i2s_psc_config

Function name	i2s_psc_config
Function prototype	void i2s_psc_config(uint32_t spi_periph, uint32_t audiosample, uint32_t

	frameformat, uint32_t mckout);
Function descriptions	configure I2S prescaler
Precondition	-
The called functions	rcu_clock_freq_get
Input parameter{in}	
spi_periph	I2S peripheral
SPIx(x=1)	I2S peripheral selection
Input parameter{in}	
audiosample	I2S audio sample rate
I2S_AUDIOSAMPLE_8K	audio sample rate is 8KHz
I2S_AUDIOSAMPLE_11K	audio sample rate is 11KHz
I2S_AUDIOSAMPLE_16K	audio sample rate is 16KHz
I2S_AUDIOSAMPLE_22K	audio sample rate is 22KHz
I2S_AUDIOSAMPLE_32K	audio sample rate is 32KHz
I2S_AUDIOSAMPLE_44K	audio sample rate is 44KHz
I2S_AUDIOSAMPLE_48K	audio sample rate is 48KHz
I2S_AUDIOSAMPLE_96K	audio sample rate is 96KHz
I2S_AUDIOSAMPLE_192K	audio sample rate is 192KHz
Input parameter{in}	
frameformat	I2S data length and channel length
I2S_FRAMEFORMAT_DT16B_CH16B	I2S data length is 16 bit and channel length is 16 bit
I2S_FRAMEFORMAT_DT16B_CH32B	I2S data length is 16 bit and channel length is 32 bit
I2S_FRAMEFORMAT_DT24B_CH32B	I2S data length is 24 bit and channel length is 32 bit
I2S_FRAMEFORMAT_DT32B_CH32B	I2S data length is 32 bit and channel length is 32 bit
Input parameter{in}	
mckout	I2S master clock output
I2S_MCKOUT_ENABLER	I2S master clock output enable
I2S_MCKOUT_DISABLE	I2S master clock output disable

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure I2S1 prescaler */
```

```
i2s_psc_config(SPI1, I2S_AUDIOSAMPLE_44K, I2S_FRAMEFORMAT_DT16B_CH16B,
I2S_MCKOUT_DISABLE);
```

i2s_enable

The description of i2s_enable is shown as below:

Table 3-697. Function i2s_enable

Function name	i2s_enable
Function prototype	void i2s_enable(uint32_t spi_periph);
Function descriptions	enable I2S
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	I2S peripheral
SPIx(x=1)	I2S peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable I2S1*/
```

```
i2s_enable(SPI1);
```

i2s_disable

The description of i2s_disable is shown as below:

Table 3-698. Function i2s_disable

Function name	i2s_disable
Function prototype	void i2s_disable(uint32_t spi_periph);
Function descriptions	disable I2S
Precondition	-
The called functions	-
Input parameter{in}	

spi_periph	I2S peripheral
<i>SPIx</i> (<i>x</i> =1)	I2S peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable I2S1*/
```

```
i2s_disable(SPI1);
```

spi_nss_output_enable

The description of spi_nss_output_enable is shown as below:

Table 3-699. Function spi_nss_output_enable

Function name	spi_nss_output_enable
Function prototype	void spi_nss_output_enable(uint32_t spi_periph);
Function descriptions	enable SPI NSS output function
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx</i> (<i>x</i> =0, 1)	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI0 NSS output */
```

```
spi_nss_output_enable(SPI0);
```

spi_nss_output_disable

The description of spi_nss_output_disable is shown as below:

Table 3-700. Function spi_nss_output_disable

Function name	spi_nss_output_disable
Function prototype	void spi_nss_output_disable(uint32_t spi_periph);
Function descriptions	disable SPI NSS output function
Precondition	-
The called functions	-

Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI0 NSS output */
spi_nss_output_disable(SPI0);
```

spi_nss_internal_high

The description of spi_nss_internal_high is shown as below:

Table 3-701. Function spi_nss_internal_high

Function name	spi_nss_internal_high
Function prototype	void spi_nss_internal_high(uint32_t spi_periph);
Function descriptions	SPI NSS pin high level in software mode
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* SPI0 NSS pin is pulled high level in software mode */
spi_nss_internal_high(SPI0);
```

spi_nss_internal_low

The description of spi_nss_internal_low is shown as below:

Table 3-702. Function spi_nss_internal_low

Function name	spi_nss_internal_low
Function prototype	void spi_nss_internal_low(uint32_t spi_periph);
Function descriptions	SPI NSS pin low level in software mode
Precondition	-

The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* SPI0 NSS pin is pulled low level in software mode */
```

```
spi_nss_internal_low(SPI0);
```

spi_dma_enable

The description of spi_dma_enable is shown as below:

Table 3-703. Function spi_dma_enable

Function name	spi_dma_enable
Function prototype	void spi_dma_enable(uint32_t spi_periph, uint8_t dma);
Function descriptions	enable SPI DMA function
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
dma	SPI DMA mode
<i>SPI_DMA_TRANSMIT</i>	SPI transmit data use DMA
<i>SPI_DMA_RECEIVE</i>	SPI receive data use DMA
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI0 transmit data DMA function */
```

```
spi_dma_enable(SPI0, SPI_DMA_TRANSMIT);
```

spi_dma_disable

The description of spi_dma_disable is shown as below:

Table 3-704. Function spi_dma_disable

Function name	spi_dma_disable
Function prototype	void spi_dma_disable(uint32_t spi_periph, uint8_t dma);
Function descriptions	disable SPI DMA function
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
SPIx(x=0, 1)	SPI peripheral selection
Input parameter{in}	
dma	SPI DMA mode
SPI_DMA_TRANSMIT	SPI transmit data use DMA
SPI_DMA_RECEIVE	SPI receive data use DMA
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI0 transmit data DMA function */
```

```
spi_dma_disable(SPI0, SPI_DMA_TRANSMIT);
```

spi_transmit_odd_config

The description of spi_transmit_odd_config is shown as below:

Table 3-705. Function spi_transmit_odd_config

Function name	spi_transmit_odd_config
Function prototype	void spi_transmit_odd_config(uint32_t spi_periph, uint16_t odd);
Function descriptions	configure SPI0 total number of data to transmit by DMA is odd or not
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
SPIx(x=0)	SPI peripheral selection
Input parameter{in}	
dma	SPI DMA mode
SPI_TXDMA_EVEN	number of byte in TX DMA channel is even
SPI_TXDMA_ODD	number of byte in TX DMA channel is odd
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SPI0 total number of data to transmit by DMA is odd */
```

```
spi_transmit_odd_config (SPI0, SPI_TXDMA_ODD);
```

spi_receive_odd_config

The description of spi_receive_odd_config is shown as below:

Table 3-706. Function spi_receive_odd_config

Function name	spi_receive_odd_config
Function prototype	void spi_receive_odd_config(uint32_t spi_periph, uint16_t odd);
Function descriptions	configure SPI0 total number of data to receive by DMA is odd or not
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Input parameter{in}	
dma	SPI DMA mode
<i>SPI_RXDMA_EVEN</i>	number of byte in RX DMA channel is even
<i>SPI_RXDMA_ODD</i>	number of byte in RX DMA channel is odd
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SPI0 total number of data to receive by DMA is odd */
```

```
spi_receive_odd_config (SPI0, SPI_RXDMA_ODD);
```

spi_i2s_data_frame_format_config

The description of spi_i2s_data_frame_format_config is shown as below:

Table 3-707. Function spi_i2s_data_frame_format_config

Function name	spi_i2s_data_frame_format_config
Function prototype	void spi_i2s_data_frame_format_config(uint32_t spi_periph, uint16_t frame_format);
Function descriptions	configure SPI/I2S data frame format
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral

<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
frame_format	SPI frame size
<i>SPI_FRAME_SIZE_xBIT</i>	SPI frame size is x bits, x=4,5,..16
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SPI1/I2S1 data frame format size is 16 bits */
```

```
spi_i2s_data_frame_format_config(SPI1, SPI_FRAME_SIZE_16BIT);
```

spi_fifo_access_size_config

The description of spi_fifo_access_size_config is shown as below:

Table 3-708. Function spi_fifo_access_size_config

Function name	spi_fifo_access_size_config
Function prototype	void spi_fifo_access_size_config(uint32_t spi_periph, uint16_t fifo_access_size);
Function descriptions	configure SPI0 access size to FIFO(8bit or 16bit)
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Input parameter{in}	
frame_format	SPI frame size
<i>SPI_HALFWORD_ACCESS</i>	half-word access to FIFO
<i>SPI_BYTE_ACCESS</i>	byte access to FIFO
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure SPI0 access size half word */
```

```
spi_fifo_access_size_config (SPI0, SPI_HALFWORD_ACCESS);
```


spi_bidirectional_transfer_config

The description of spi_bidirectional_transfer_config is shown as below:

Table 3-709. Function spi_bidirectional_transfer_config

Function name	spi_bidirectional_transfer_config
Function prototype	void spi_bidirectional_transfer_config(uint32_t spi_periph, uint32_t transfer_direction);
Function descriptions	configure SPI bidirectional transfer direction
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
transfer_direction	SPI transfer direction
<i>SPI_BIDIRECTIONAL_TRANSMIT</i>	SPI work in transmit-only mode
<i>SPI_BIDIRECTIONAL_RECEIVE</i>	SPI work in receive-only mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* SPI0 works in transmit-only mode */
```

```
spi_bidirectional_transfer_config(SPI0, SPI_BIDIRECTIONAL_TRANSMIT);
```

spi_i2s_data_transmit

The description of spi_i2s_data_transmit is shown as below:

Table 3-710. Function spi_i2s_data_transmit

Function name	spi_i2s_data_transmit
Function prototype	void spi_i2s_data_transmit(uint32_t spi_periph, uint16_t data);
Function descriptions	SPI transmit data
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
data	16-bit data

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* SPI0 transmit data */
uint16_t spi0_send_array[10];
uint8_t send_n = 1;
spi_i2s_data_transmit(SPI0, spi0_send_array[send_n]);
```

spi_i2s_data_receive

The description of spi_i2s_data_receive is shown as below:

Table 3-711. Function spi_i2s_data_receive

Function name	spi_i2s_data_receive
Function prototype	uint16_t spi_i2s_data_receive(uint32_t spi_periph);
Function descriptions	SPI receive data
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
SPIx(x=0,1)	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
uint16_t	16-bit data

Example:

```
/* SPI0 receive data */
uint16_t spi0_receive_array[10];
uint8_t receive_n = 1;
spi0_receive_array[receive_n] = spi_i2s_data_receive(SPI0);
```

spi_crc_polynomial_set

The description of spi_crc_polynomial_set is shown as below:

Table 3-712. Function spi_crc_polynomial_set

Function name	spi_crc_polynomial_set
Function prototype	void spi_crc_polynomial_set(uint32_t spi_periph, uint16_t crc_poly);

Function descriptions	set SPI CRC polynomial
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0, 1)</i>	SPI peripheral selection
Input parameter{in}	
crc_poly	CRC polynomial value
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set SPI0 CRC polynomial */
uint16_t CRC_VALUE = 0x8;
spi_crc_polynomial_set(SPI0,CRC_VALUE);
```

spi_crc_polynomial_get

The description of spi_crc_polynomial_get is shown as below:

Table 3-713. Function spi_crc_polynomial_get

Function name	spi_crc_polynomial_get
Function prototype	uint16_t spi_crc_polynomial_get(uint32_t spi_periph);
Function descriptions	get SPI CRC polynomial
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0, 1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
uint16_t	16-bit CRC polynomial (0-0xFFFF)

Example:

```
/* get SPI0 CRC polynomial */
uint16_t CRC_VALUE;
CRC_VALUE = spi_crc_polynomial_get(SPI0);
```

spi_crc_length_set

The description of spi_crc_length_set is shown as below:

Table 3-714. Function spi_crc_length_set

Function name	spi_crc_length_set
Function prototype	void spi_crc_length_set(uint32_t spi_periph, uint16_t crc_length);
Function descriptions	set CRC length
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Input parameter{in}	
crc_length	CRC length
<i>SPI_CRC_8BIT</i>	CRC length is 8 bits
<i>SPI_CRC_16BIT</i>	CRC length is 16 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set CRC length is 8 bits*/
spi_crc_length_set(SPI0, SPI_CRC_8BIT);
```

spi_crc_on

The description of spi_crc_on is shown as below:

Table 3-715. Function spi_crc_on

Function name	spi_crc_on
Function prototype	void spi_crc_on(uint32_t spi_periph);
Function descriptions	turn on SPI CRC function
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* turn on SPI0 CRC function */
```

```
spi_crc_on(SPI0);
```

spi_crc_off

The description of spi_crc_off is shown as below:

Table 3-716. Function spi_crc_off

Function name	spi_crc_off
Function prototype	void spi_crc_off(uint32_t spi_periph);
Function descriptions	turn off SPI CRC function
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* turn off SPI0 CRC function */
```

```
spi_crc_off(SPI0);
```

spi_crc_next

The description of spi_crc_next is shown as below:

Table 3-717. Function spi_crc_next

Function name	spi_crc_next
Function prototype	void spi_crc_next(uint32_t spi_periph);
Function descriptions	SPI next data is CRC value
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* SPI0 next data is CRC value */

spi_crc_next(SPI0);
```

spi_crc_get

The description of spi_crc_get is shown as below:

Table 3-718. Function spi_crc_get

Function name	spi_crc_get
Function prototype	uint16_t spi_crc_get(uint32_t spi_periph, uint8_t crc);
Function descriptions	get SPI CRC send value or receive value
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
crc	SPI crc value
<i>SPI_CRC_TX</i>	get transmit crc value
<i>SPI_CRC_RX</i>	get receive crc value
Output parameter{out}	
-	-
Return value	
uint16_t	16-bit CRC value (0-0xFFFF)

Example:

```
/* get SPI0 CRC send value */

uint16_t value;

value = spi_crc_get(SPI0, SPI_CRC_TX);
```

spi_crc_error_clear

The description of spi_crc_error_clear is shown as below:

Table 3-719. Function spi_crc_error_clear

Function name	spi_crc_error_clear
Function prototype	void spi_crc_error_clear(uint32_t spi_periph);
Function descriptions	clear SPI CRC error flag status
Precondition	-
The called functions	-
Input parameter{in}	

spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear SPI CRC error flag status */
```

```
spi_crc_error_clear(SPI0);
```

spi_ti_mode_enable

The description of spi_ti_mode_enable is shown as below:

Table 3-720. Function spi_ti_mode_enable

Function name	spi_ti_mode_enable
Function prototype	void spi_ti_mode_enable (uint32_t spi_periph);
Function descriptions	enable SPI TI mode
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI TI mode */
```

```
spi_ti_mode_enable(SPI0);
```

spi_ti_mode_disable

The description of spi_ti_mode_disable is shown as below:

Table 3-721. Function spi_ti_mode_disable

Function name	spi_ti_mode_disable
Function prototype	void spi_ti_mode_disable (uint32_t spi_periph);
Function descriptions	disable SPI TI mode
Precondition	-
The called functions	-

Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI TI mode */
spi_ti_mode_disable(SPI0);
```

spi_nssp_mode_enable

The description of spi_nssp_mode_enable is shown as below:

Table 3-722. Function spi_nssp_mode_enable

Function name	spi_nssp_mode_enable
Function prototype	void spi_nssp_mode_enable(uint32_t spi_periph);
Function descriptions	enable SPI NSS pulse mode
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI NSS pulse mode */
spi_nssp_mode_enable(SPI0);
```

spi_nssp_mode_disable

The description of spi_nssp_mode_disable is shown as below:

Table 3-723. Function spi_nssp_mode_disable

Function name	spi_nssp_mode_disable
Function prototype	void spi_nssp_mode_disable(uint32_t spi_periph);
Function descriptions	disable SPI NSS pulse mode
Precondition	-

The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
SPIx(x=0,1)	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI NSS pulse mode */
spi_nssp_mode_disable(SPI0);
```

spi_quad_enable

The description of spi_quad_enable is shown as below:

Table 3-724. Function spi_quad_enable

Function name	spi_quad_enable
Function prototype	void spi_quad_enable(uint32_t spi_periph);
Function descriptions	enable quad wire SPI
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
SPIx(x=0)	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable quad wire SPI */
spi_quad_enable(SPI0);
```

spi_quad_disable

The description of spi_quad_disable is shown as below:

Table 3-725. Function spi_quad_disable

Function name	spi_quad_disable
Function prototype	void spi_quad_disable(uint32_t spi_periph);
Function descriptions	disable quad wire SPI

Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable quad wire SPI */
spi_quad_disable(SPI0);
```

spi_quad_write_enable

The description of spi_quad_write_enable is shown as below:

Table 3-726. Function spi_quad_write_enable

Function name	spi_quad_write_enable
Function prototype	void spi_quad_write_enable(uint32_t spi_periph);
Function descriptions	enable quad wire SPI write
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable quad wire SPI write */
spi_quad_write_enable(SPI0);
```

spi_quad_read_enable

The description of spi_quad_read_enable is shown as below:

Table 3-727. Function spi_quad_read_enable

Function name	spi_quad_read_enable
Function prototype	void spi_quad_read_enable(uint32_t spi_periph);

Function descriptions	enable quad wire SPI read
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable quad wire SPI read */
spi_quad_read_enable(SPI0);
```

spi_quad_io23_output_enable

The description of spi_quad_io23_output_enable is shown as below:

Table 3-728. Function spi_quad_io23_output_enable

Function name	spi_quad_io23_output_enable
Function prototype	void spi_quad_io23_output_enable(uint32_t spi_periph);
Function descriptions	enable SPI_IO2 and SPI_IO3 pin output
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI_IO2 and SPI_IO3 pin output */
spi_quad_io23_output_enable(SPI0);
```

spi_quad_io23_output_disable

The description of spi_quad_io23_output_disable is shown as below:

Table 3-729. Function spi_quad_io23_output_disable

Function name	spi_quad_io23_output_disable
----------------------	------------------------------

Function prototype	void spi_quad_io23_output_disable(uint32_t spi_periph);
Function descriptions	disable SPI_IO2 and SPI_IO3 pin output
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0)</i>	SPI peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI_IO2 and SPI_IO3 pin output */
```

```
spi_quad_io23_output_disable(SPI0);
```

spi_i2s_format_error_clear

The description of spi_i2s_format_error_clear is shown as below:

Table 3-730. Function spi_i2s_format_error_clear

Function name	spi_i2s_format_error_clear
Function prototype	void spi_i2s_format_error_clear(uint32_t spi_periph, uint32_t flag);
Function descriptions	clear SPI/I2S format error flag status
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
flag	SPI/I2S frame format error flag
<i>SPI_FLAG_FERR</i>	SPI format error flag
<i>I2S_FLAG_FERR</i>	I2S format error flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear SPI format error flag status */
```

```
spi_i2s_format_error_clear(SPI0, SPI_FLAG_FERR);
```

spi_i2s_flag_get

The description of spi_i2s_flag_get is shown as below:

Table 3-731. Function spi_i2s_flag_get

Function name	spi_i2s_flag_get
Function prototype	FlagStatus spi_i2s_flag_get(uint32_t spi_periph, uint32_t flag);
Function descriptions	get SPI and I2S flag status
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
flag	SPI/I2S flag status
<i>SPI_FLAG_TBE</i>	transmit buffer empty flag
<i>SPI_FLAG_RBNE</i>	receive buffer not empty flag
<i>SPI_FLAG_TRANS</i>	transmit on-going flag
<i>SPI_FLAG_RXORERR</i>	receive overrun error flag
<i>SPI_FLAG_CONFERR</i>	mode config error flag
<i>SPI_FLAG_CRCERR</i>	CRC error flag
<i>SPI_FLAG_FERR</i>	SPI format error interrupt flag
<i>I2S_FLAG_TBE</i>	transmit buffer empty flag
<i>I2S_FLAG_RBNE</i>	receive buffer not empty flag
<i>I2S_FLAG_CH</i>	channel side flag
<i>I2S_FLAG_TXURERR</i>	underrun error flag
<i>I2S_FLAG_TRANS</i>	transmit on-going flag
<i>I2S_FLAG_RXORERR</i>	overrun error flag
<i>I2S_FLAG_FERR</i>	I2S format error interrupt flag
only for SPI0	
<i>SPI_FLAG_TXLVL_EMPTY</i>	SPI TXFIFO is empty
<i>SPI_FLAG_TXLVL_QUARTER_FULL</i>	SPI TXFIFO is a quarter of full
<i>SPI_FLAG_TXLVL_HALF_FULL</i>	SPI TXFIFO is a half of full
<i>SPI_FLAG_TXLVL_FULL</i>	SPI TXFIFO is full
<i>SPI_FLAG_RXLVL_EMPTY</i>	SPI RXFIFO is empty
<i>SPI_FLAG_RXLVL_QUARTER_FULL</i>	SPI RXFIFO is a quarter of full
<i>SPI_FLAG_RXLVL_HALF_FULL</i>	SPI RXFIFO is a half of full

<i>F_FULL</i>	
<i>SPI_FLAG_RXLVL_FULL</i>	SPI RXFIFO is full
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get SPI0 transmit buffer empty flag status */
```

```
FlagStatus Flag = RESET;
```

```
Flag = spi_i2s_flag_get(SPI0, SPI_FLAG_TBE);
```

spi_i2s_interrupt_enable

The description of spi_i2s_interrupt_enable is shown as below:

Table 3-732. Function spi_i2s_interrupt_enable

Function name	spi_i2s_interrupt_enable
Function prototype	void spi_i2s_interrupt_enable(uint32_t spi_periph, uint8_t interrupt);
Function descriptions	enable SPI and I2S interrupt
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
interrupt	SPI/I2S interrupt
<i>SPI_I2S_INT_TBE</i>	transmit buffer empty interrupt
<i>SPI_I2S_INT_RBNE</i>	receive buffer not empty interrupt
<i>SPI_I2S_INT_ERR</i>	CRC error,configuration error,reception overrun error, transmission underrun error and format error interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable SPI0 transmit buffer empty interrupt */
```

```
spi_i2s_interrupt_enable(SPI0, SPI_I2S_INT_TBE);
```

spi_i2s_interrupt_disable

The description of spi_i2s_interrupt_disable is shown as below:

Table 3-733. Function spi_i2s_interrupt_disable

Function name	spi_i2s_interrupt_disable
Function prototype	void spi_i2s_interrupt_disable(uint32_t spi_periph, uint8_t interrupt);
Function descriptions	disable SPI and I2S interrupt
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
interrupt	SPI/I2S interrupt
<i>SPI_I2S_INT_TBE</i>	transmit buffer empty interrupt
<i>SPI_I2S_INT_RBNE</i>	receive buffer not empty interrupt
<i>SPI_I2S_INT_ERR</i>	CRC error,configuration error,reception overrun error, transmission underrun error and format error interrupt
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable SPI0 transmit buffer empty interrupt */
```

```
spi_i2s_interrupt_disable(SPI0, SPI_I2S_INT_TBE);
```

spi_i2s_interrupt_flag_get

The description of spi_i2s_interrupt_flag_get is shown as below:

Table 3-734. Function spi_i2s_interrupt_flag_get

Function name	spi_i2s_interrupt_flag_get
Function prototype	FlagStatus spi_i2s_interrupt_flag_get(uint32_t spi_periph, uint8_t interrupt);
Function descriptions	get SPI and I2S interrupt status
Precondition	-
The called functions	-
Input parameter{in}	
spi_periph	SPI peripheral
<i>SPIx(x=0,1)</i>	SPI peripheral selection
Input parameter{in}	
interrupt	SPI/I2S interrupt flag status
<i>SPI_I2S_INT_FLAG_T</i>	transmit buffer empty interrupt

<i>BE</i>	
<i>SPI_I2S_INT_FLAG_R</i> <i>BNE</i>	receive buffer not empty interrupt
<i>SPI_I2S_INT_FLAG_R</i> <i>XORERR</i>	overrun interrupt
<i>SPI_INT_FLAG_CONF</i> <i>ERR</i>	config error interrupt
<i>SPI_INT_FLAG_CRCE</i> <i>RR</i>	CRC error interrupt
<i>I2S_INT_FLAG_TXUR</i> <i>ERR</i>	underrun error interrupt
<i>SPI_I2S_INT_FLAG_F</i> <i>ERR</i>	format error interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get SPI0 transmit buffer empty interrupt status */
```

```
FlagStatus Flag_interrupt = RESET;
```

```
Flag_interrupt = spi_i2s_interrupt_flag_get(SPI0, SPI_I2S_INT_FLAG_TBE);
```

3.24. SYSCFG

The SYSCFG registers are listed in chapter [3.24.1](#), the SYSCFG firmware functions are introduced in chapter [3.24.2](#).

3.24.1. Descriptions of Peripheral registers

SYSCFG registers are listed in the table shown as below:

Table 3-735. SYSCFG Registers

Registers	Descriptions
SYSCFG_CFG0	system configuration register 0
SYSCFG_EXTISS0	EXTI sources selection register 0
SYSCFG_EXTISS1	EXTI sources selection register 1
SYSCFG_EXTISS2	EXTI sources selection register 2
SYSCFG_EXTISS3	EXTI sources selection register 3
SYSCFG_CFG1	system configuration register 1 (only for GD32L235)
SYSCFG_CPU_IRQ_LAT	IRQ Latency register
SYSCFG_TIMERxCFG	TIMERx configuration register, x = 0,1,2,8,11,14,40 (only for GD32L235)

3.24.2. Descriptions of Peripheral functions

SYSCFG firmware functions are listed in the table shown as below:

Table 3-736. SYSCFG firmware function

Function name	Function description
syscfg_deinit	deinit syscfg module
syscfg_exti_line_config	configure the GPIO pin as EXTI Line
syscfg_pin_remap_enable	enable remap pin function for small packages
syscfg_pin_remap_disable	disable remap pin function for small packages
syscfg_high_current_enable	enable PBx(x=6,7,8,9) high current capability
syscfg_high_current_disable	disable PBx(x=6,7,8,9) high current capability
irq_latency_set	set the IRQ_LATENCY value
syscfg_bootmode_get	get the boot mode
syscfg_sram_waitstate_insert	insert wait state in read accesses of SRAM0/SRAM1 when LDO is 1.1V (only for GD32L235)
syscfg_sram_waitstate_cancel	cancel insertion of wait state in read accesses of SRAM0/SRAM1 when LDO is 1.1V (only for GD32L235)
syscfg_lock_config	connect TIMER0/14/40 break input to the selected parameter (only for GD32L235)
syscfg_flag_get	check if the specified flag in SYSCFG_CFG1 is set or not (only for GD32L235)
syscfg_flag_clear	clear the flag in SYSCFG_CFG1 by writing 1 (only for GD32L235)

syscfg_deinit

The description of syscfg_deinit is shown as below:

Table 3-737. Function syscfg_deinit

Function name	syscfg_deinit
Function prototype	void syscfg_deinit(void);
Function descriptions	reset the SYSCFG registers
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset SYSCFG registers */
```

```
syscfg_deinit();
```

syscfg_exti_line_config

The description of syscfg_exti_line_config is shown as below:

Table 3-738. Function syscfg_exti_line_config

Function name	syscfg_exti_line_config
Function prototype	void syscfg_exti_line_config(uint8_t exti_port, uint8_t exti_pin);
Function descriptions	configure the GPIO pin as EXTI Line
Precondition	-
The called functions	-
Input parameter{in}	
exti_port	specify the GPIO port used in EXTI
<i>EXTI_SOURCE_GPIOx</i>	x = A,B,C,D,F
exti_pin	specify the EXTI line
<i>EXTI_SOURCE_PINx</i>	GPIOAx = 0..15, GPIOBx = 0..15, GPIOCx = 0..15, GPIODx = 0..6,8,9, GPIOFx = 0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the GPIO pin as EXTI Line */
```

```
syscfg_exti_line_config(EXTI_SOURCE_GPIOA, EXTI_SOURCE_PIN0);
```

syscfg_pin_remap_enable

The description of syscfg_pin_remap_enable is shown as below:

Table 3-739. Function syscfg_pin_remap_enable

Function name	syscfg_pin_remap_enable
Function prototype	void syscfg_pin_remap_enable(uint32_t remap_pin);
Function descriptions	enable remap pin function for small packages
Precondition	-
The called functions	-
Input parameter{in}	
remap_pin	remap pin
<i>SYSCFG_PA11_PA12_REMAP</i>	PA11 PA12 remap
<i>SYSCFG_BOOT0_PD3_REMAP</i>	BOOT0 PD3 remap
<i>SYSCFG_PA8_REMAP</i>	PA8 remap (only for GD32L235)

<i>SYSCFG_PD0_PD1_PD2_REMAP</i>	PD0 PD1 PD2 remap (only for GD32L235)
<i>SYSCFG_PA11_PA12_PB6_PB8_REMAP</i>	PA11 PA12 PB6 PB8 remap (only for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable BOOT0 remap to PD3 function */
```

```
syscfg_pin_remap_enable(SYSCFG_BOOT0_PD3_REMAP);
```

syscfg_pin_remap_disable

The description of syscfg_pin_remap_disable is shown as below:

Table 3-740. Function syscfg_pin_remap_disable

Function name	syscfg_pin_remap_disable
Function prototype	void syscfg_pin_remap_disable(void);
Function descriptions	disable remap pin function for small packages
Precondition	-
The called functions	-
Input parameter{in}	
remap_pin	remap pin
<i>SYSCFG_PA11_PA12_REMAP</i>	PA11 PA12 remap
<i>SYSCFG_BOOT0_PD3_REMAP</i>	BOOT0 PD3 remap
<i>SYSCFG_PA8_REMAP</i>	PA8 remap (only for GD32L235)
<i>SYSCFG_PD0_PD1_PD2_REMAP</i>	PD0 PD1 PD2 remap (only for GD32L235)
<i>SYSCFG_PA11_PA12_PB6_PB8_REMAP</i>	PA11 PA12 PB6 PB8 remap (only for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable BOOT0 remap to PD3 function */
```

```
syscfg_pin_remap_disable(SYSCFG_BOOT0_PD3_REMAP);
```

syscfg_high_current_enable

The description of syscfg_high_current_enable is shown as below:

Table 3-741. Function syscfg_high_current_enable

Function name	syscfg_high_current_enable
Function prototype	void syscfg_high_current_enable(uint32_t syscfg_gpio);
Function descriptions	enable PBx(x=6,7,8,9) high current capability
Precondition	-
The called functions	-
Input parameter{in}	
syscfg_gpio	SYSCFG GPIO
SYSCFG_PB6_HIGH_CURRENT	PB6 pin high current capability
SYSCFG_PB7_HIGH_CURRENT	PB7 pin high current capability
SYSCFG_PB8_HIGH_CURRENT	PB8 pin high current capability
SYSCFG_PB9_HIGH_CURRENT	PB9 pin high current capability
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable PB9 high current capability */
```

```
syscfg_high_current_enable(SYSCFG_PB9_HIGH_CURRENT);
```

syscfg_high_current_disable

The description of syscfg_high_current_disable is shown as below:

Table 3-742. Function syscfg_high_current_disable

Function name	syscfg_high_current_disable
Function prototype	void syscfg_high_current_disable(uint32_t syscfg_gpio);
Function descriptions	disable PB9 high current capability
Precondition	-
The called functions	-
Input parameter{in}	
syscfg_gpio	SYSCFG GPIO
SYSCFG_PB6_HIGH_CURRENT	PB6 pin high current capability
SYSCFG_PB7_HIGH_CURRENT	PB7 pin high current capability

<i>CURRENT</i>	
<i>SYSCFG_PB8_HIGH_CURRENT</i>	PB8 pin high current capability
<i>SYSCFG_PB9_HIGH_CURRENT</i>	PB9 pin high current capability
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable PB9 high current capability */
syscfg_high_current_disable(SYSCFG_PB9_HIGH_CURRENT);
```

irq_latency_set

The description of irq_latency_set is shown as below:

Table 3-743. Function irq_latency_set

Function name	irq_latency_set
Function prototype	void irq_latency_set(uint8_t irq_latency);
Function descriptions	set the IRQ_LATENCY value
Precondition	-
The called functions	-
Input parameter{in}	
irq_latency	IRQ_LATENCY value
<i>0x00 - 0xFF</i>	IRQ_LATENCY value
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the wait state counter value */
irq_latency_set(0xFF);
```

syscfg_bootmode_get

The description of syscfg_bootmode_get is shown as below:

Table 3-744. Function syscfg_bootmode_get

Function name	syscfg_bootmode_get
Function prototype	uint8_t syscfg_bootmode_get(void);

Function descriptions	get the current boot mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	boot mode
<i>SYSCFG_BOOTMODE_FLASH</i>	boot from the main flash
<i>SYSCFG_BOOTMODE_SYSTEM</i>	boot from the system flash memory
<i>SYSCFG_BOOTMODE_SRAM</i>	boot from the embedded SRAM

Example:

```

/* get the current boot mode */

uint8_t boot_mode;

boot_mode = syscfg_bootmode_get();

```

syscfg_sram_waitstate_insert

The description of syscfg_sram_waitstate_insert is shown as below:

Table 3-745. Function syscfg_sram_waitstate_insert

Function name	syscfg_sram_waitstate_insert
Function prototype	void syscfg_sram_waitstate_insert(void);
Function descriptions	insert wait state in read accesses of SRAM0/SRAM1 when LDO is 1.1V (only for GD32L235)
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* insert wait state in read accesses of SRAM0/SRAM1 */

syscfg_sram_waitstate_insert();

```

syscfg_sram_waitstate_cancel

The description of syscfg_sram_waitstate_cancel is shown as below:

Table 3-746. Function syscfg_sram_waitstate_cancel

Function name	syscfg_sram_waitstate_cancel
Function prototype	void syscfg_sram_waitstate_cancel(void);
Function descriptions	cancel insertion of wait state in read accesses of SRAM0/SRAM1 when LDO is 1.1V (only for GD32L235)
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* cancel insertion of wait state in read accesses of SRAM0/SRAM1 */
```

```
syscfg_sram_waitstate_cancel();
```

syscfg_lock_config

The description of syscfg_lock_config is shown as below:

Table 3-747. Function syscfg_lock_config

Function name	syscfg_lock_config
Function prototype	void syscfg_lock_config(uint32_t syscfg_lock);
Function descriptions	connect TIMER0/14/40 break input to the selected parameter (only for GD32L235)
Precondition	-
The called functions	-
Input parameter{in}	
syscfg_lock	specify the parameter to be connected
<i>SYSCFG_LOCK_LOCKUP</i>	Cortex-M23 lockup output connected to the break input
<i>SYSCFG_LOCK_SRAM_PARITY_ERROR</i>	SRAM_PARITY check error connected to the break input
<i>SYSCFG_LOCK_LVD</i>	LVD interrupt connected to the break input
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* connect TIMER0/14/40 break input to the SYSCFG_LOCK_LOCKUP */
syscfg_lock_config(SYSCFG_LOCK_LOCKUP);
```

syscfg_flag_get

The description of syscfg_flag_get is shown as below:

Table 3-748. Function syscfg_flag_get

Function name	syscfg_flag_get
Function prototype	FlagStatus syscfg_flag_get(uint32_t syscfg_flag);
Function descriptions	check if the specified flag in SYSCFG_CFG1 is set or not (only for GD32L235)
Precondition	-
The called functions	-
Input parameter{in}	
syscfg_flag	specify the flag in SYSCFG_CFG1 to check
SYSCFG_FLAG_SRAM_PCEF	SRAM parity check error flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
FlagStatus tempflag;

/* get the SYSCFG flag */
tempflag = syscfg_flag_get(SYSCFG_FLAG_SRAM_PCEF);
```

syscfg_flag_clear

The description of syscfg_flag_clear is shown as below:

Table 3-749. Function syscfg_flag_clear

Function name	syscfg_flag_clear
Function prototype	void syscfg_flag_clear(uint32_t syscfg_flag);
Function descriptions	clear the flag in SYSCFG_CFG1 by writing 1 (only for GD32L235)
Precondition	-
The called functions	-
Input parameter{in}	
syscfg_flag	specify the flag in SYSCFG_CFG1 to clear
SYSCFG_FLAG_SRAM_PCEF	SRAM parity check error flag

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the SYSCFG flag */
```

```
syscfg_flag_clear(SYSCFG_FLAG_SRAM_PCEF);
```

3.25. TIMER

The timers have a 16-bit counter that can be used as an unsigned counter and supports both input capture and output compare. Timers (TIMERx) are divided into five sorts: advanced timer (TIMER0), general level0 timer (TIMER1, TIMER2), general level1 timer (TIMER8, TIMER11), general level3 timer (TIMER14, TIMER40), Basic timer (TIMER5, TIMER6). The specific functions of different types of timer are different. The TIMER registers are listed in chapter [3.25.1](#), the TIMER firmware functions are introduced in chapter [3.25.2](#).

3.25.1. Descriptions of Peripheral registers

TIMERx registers are listed in the table shown as below:

Table 3-750. TIMERx Registers

Registers	Descriptions
TIMER_CTL0(timerx, x=0,1, 2, 5, 6, 8, 11, 14, 40)	Control register 0
TIMERx_CTL1(timerx, x=0,1, 2, 5, 6, 14, 40)	Control register 1
TIMERx_SMCFG(timerx, x=0, 1, 2, 8, 11, 14, 40)	Slave mode configuration register
TIMERx_DMAINTEN(timerx, x=0,1, 2, 5, 6, 8, 11, 14, 40)	DMA and interrupt enable register
TIMERx_INTF(timerx, x=0,1, 2, 5, 6, 8, 11, 14, 40)	Interrupt flag register
TIMERx_SWEVG(timerx, x=0,1, 2, 5, 6, 8, 11, 14, 40)	Software event generation register
TIMERx_CHCTL0(timerx, x=0, 1, 2, 8, 11 14, 40)	Channel control register 0
TIMERx_CHCTL1(timerx, x=0, 1, 2)	Channel control register 1
TIMERx_CHCTL2(timerx, x=0, 1, 2, 8, 11. 14, 40)	Channel control register 2
TIMERx_CNT(timerx, x=0, 1, 2, 5, 6, 8, 11 14, 40)	Counter register

Registers	Descriptions
TIMERx_PSC(timerx, x=0, 1, 2, 5, 6, 8, 11 14, 40)	Prescaler register
TIMERx_CAR(timerx, x=0, 1, 2, 5, 6, 8, 11 14, 40)	Counter auto reload register
TIMERx_CREP(timerx, x=0, 14, 40)	Counter repetition register
TIMERx_CH0CV(timerx, x=0, 1, 2, 8, 11 14, 40)	Channel 0 capture/compare value register
TIMERx_CH1CV(timerx, x=0, 1, 2, 8, 11 14, 40)	Channel 1 capture/compare value register
TIMERx_CH2CV(timerx, x=0, 1, 2)	Channel 2 capture/compare value register
TIMERx_CH3CV(timerx, x=0, 1, 2)	Channel 3 capture/compare value register
TIMERx_IRMP(timerx, x= 8, 11)	Channel complementary protection register
TIMERx_CCHP(timerx, x=0, 14, 40)	TIMER complementary channel protection register
TIMERx_DMCFG(timerx, x=0, 1, 2, 14 ,40)	DMA configuration register
TIMERx_DMATB(timerx, x=0, 1, 2, 14, 40)	DMA transfer buffer register
TIMERx_CFG(timerx, x=0, 1, 2, 8, 11, 14, 40)	Configuration register

3.25.2. Descriptions of Peripheral functions

The description format of firmware functions are shown as below:

Table 3-751. TIMERx firmware function

Function name	Function description
timer_deinit	deinit a timer
timer_struct_para_init	initialize the parameters of TIMER init parameter struct with the default values
timer_init	initialize TIMER counter
timer_enable	enable a timer
timer_disable	disable a timer
timer_auto_reload_shadow_enable	enable the auto reload shadow function
timer_auto_reload_shadow_disable	disable the auto reload shadow function
timer_update_event_enable	enable the update event
timer_update_event_disable	disable the update event
timer_counter_alignment	set TIMER counter alignment mode
timer_counter_up_direction	set TIMER counter up direction
timer_counter_down_direction	set TIMER counter down direction
timer_prescaler_config	configure TIMER prescaler
timer_repetition_value_config	configure TIMER repetition register value
timer_autoreload_value_config	configure TIMER autoreload register value
timer_counter_value_config	configure TIMER counter register value
timer_counter_read	read TIMER counter value
timer_prescaler_read	read TIMER prescaler value

Function name	Function description
timer_single_pulse_mode_config	configure TIMER single pulse mode
timer_update_source_config	configure TIMER update source
timer_dma_enable	enable the TIMER DMA
timer_dma_disable	disable the TIMER DMA
timer_channel_dma_request_source_select	channel DMA request source selection
timer_dma_transfer_config	configure the TIMER DMA transfer
timer_event_software_generate	software generate events
timer_break_struct_para_init	initialize the parameters of TIMER break parameter struct with the default values
timer_break_config	configure TIMER break function
timer_break_enable	enable TIMER break function
timer_break_disable	disable TIMER break function
timer_automatic_output_enable	enable TIMER output automatic function
timer_automatic_output_disable	disable TIMER output automatic function
timer_primary_output_config	configure TIMER primary output function
timer_channel_control_shadow_config	channel capture/compare control shadow register enable
timer_channel_control_shadow_update_config	configure TIMER channel control shadow register update control
timer_channel_output_struct_para_init	initialize the parameters of TIMER channel output parameter struct with the default values
timer_channel_output_config	configure TIMER channel output function
timer_channel_output_mode_config	configure TIMER channel output compare mode
timer_channel_output_pulse_value_config	configure TIMER channel output pulse value
timer_channel_output_shadow_config	configure TIMER channel output shadow function
timer_channel_output_fast_config	configure TIMER channel output fast function
timer_channel_output_clear_config	configure TIMER channel output clear function
timer_channel_output_polarity_config	configure TIMER channel output polarity
timer_channel_complementary_output_polarity_config	configure TIMER channel complementary output polarity
timer_channel_output_state_config	configure TIMER channel enable state
timer_channel_complementary_output_state_config	configure TIMER channel complementary output enable state
timer_channel_input_struct_para_init	initialize the parameters of TIMER channel input parameter struct with the default values
timer_input_capture_config	configure TIMER input capture parameter
timer_channel_input_capture_	configure TIMER channel input capture prescaler value

Function name	Function description
prescaler_config	
timer_channel_capture_value_register_read	read TIMER channel capture compare register value
timer_input_pwm_capture_config	configure TIMER input pwm capture function
timer_hall_mode_config	configure TIMER hall sensor mode
timer_input_trigger_source_select	select TIMER input trigger source
timer_master_output_trigger_source_select	select TIMER master mode output trigger source
timer_slave_mode_select	select TIMER slave mode
timer_master_slave_mode_config	configure TIMER master slave mode
timer_external_trigger_config	configure TIMER external trigger input
timer_quadrature_decoder_mode_config	configure TIMER quadrature decoder mode
timer_internal_trigger_as_external_clock_config	configure TIMER the internal trigger as external clock input
timer_external_trigger_as_external_clock_config	configure TIMER the external trigger as external clock input
timer_external_clock_mode0_config	configure TIMER the external clock mode 0
timer_external_clock_mode1_config	configure TIMER the external clock mode 1
timer_external_clock_mode1_disable	disable TIMER the external clock mode 1
timer_channel_remap_config	configure TIMER channel remap function
timer_write_chxval_register_config	configure TIMER write CHxVAL register selection
timer_flag_get	get TIMER flags
timer_flag_clear	clear TIMER flags
timer_interrupt_enable	enable the TIMER interrupt
timer_interrupt_disable	disable the TIMER interrupt
timer_interrupt_flag_get	get timer interrupt flag
timer_interrupt_flag_clear	clear TIMER interrupt flag

Structure timer_parameter_struct

Table 3-752. Structure timer_parameter_struct

Member name	Function description
prescaler	prescaler value (0~65535)
alignedmode	aligned mode (TIMER_COUNTER_EDGE, TIMER_COUNTER_CENTER_DOWN, TIMER_COUNTER_CENTER_UP, TIMER_COUNTER_CENTER_BOTH)
counterdirection	counter direction (TIMER_COUNTER_UP, TIMER_COUNTER_DOWN)
clockdivision	clock division value (TIMER_CKDIV_DIV1, TIMER_CKDIV_DIV2, TIMER_CKDIV_DIV4)
period	period value (0~65535)

Member name	Function description
repetitioncounter	the counter repetition value(0~255) only for GD32L235

Structure timer_break_parameter_struct (only for GD32L235)

Table 3-753. Structure timer_break_parameter_struct

Member name	Function description
runoffstate	run mode off-state(TIMER_ROS_STATE_ENABLE, TIMER_ROS_STATE_DISABLE)
ideloffstate	idle mode off-state(TIMER_IOS_STATE_ENABLE, TIMER_IOS_STATE_DISABLE)
deadtime	dead time(0~255)
breakpolarity	break polarity(TIMER_BREAK_POLARITY_LOW, TIMER_BREAK_POLARITY_HIGH)
outputautostate	output automatic enable (TIMER_OUTAUTO_ENABLE, TIMER_OUTAUTO_DISABLE)
protectmode	complementary register protect control(TIMER_CCHP_PROT_OFF, TIMER_CCHP_PROT_0, TIMER_CCHP_PROT_1, TIMER_CCHP_PROT_2)
breakstate	break enable(TIMER_BREAK_ENABLE, TIMER_BREAK_DISABLE)

Structure timer_oc_parameter_struct

Table 3-754. Structure timer_oc_parameter_struct

Member name	Function description
outputstate	channel output state(TIMER_CCX_ENABLE, TIMER_CCX_DISABLE)
outputnstate	channel complementary output state(TIMER_CCXN_ENABLE, TIMER_CCXN_DISABLE) only for GD32L235
ocpolarity	channel output polarity(TIMER_OC_POLARITY_HIGH, TIMER_OC_POLARITY_LOW)
ocnpolarity	channel complementary output polarity(TIMER_OCN_POLARITY_HIGH, TIMER_OCN_POLARITY_LOW) only for GD32L235
ocidlestate	idle state of channel output(TIMER_OC_IDLE_STATE_LOW, TIMER_OC_IDLE_STATE_HIGH) only for GD32L235
ocnidlestate	idle state of channel complementary output(TIMER_OCN_IDLE_STATE_LOW, TIMER_OCN_IDLE_STATE_HIGH) only for GD32L235

Structure timer_ic_parameter_struct

Table 3-755. Structure timer_ic_parameter_struct

Member name	Function description
icpolarity	channel input polarity (TIMER_IC_POLARITY_RISING, TIMER_IC_POLARITY_FALLING, TIMER_IC_POLARITY_BOTH_EDGE)
icselection	channel input mode selection (TIMER_IC_SELECTION_DIRECTTI, TIMER_IC_SELECTION_INDIRECTTI, TIMER_IC_SELECTION_ITS)
icprescaler	channel input capture prescaler (TIMER_IC_PSC_DIV1, TIMER_IC_PSC_DIV2, TIMER_IC_PSC_DIV4, TIMER_IC_PSC_DIV8)
icfilter	channel input capture filter control (0~15)

timer_deinit

The description of timer_deinit is shown as below:

Table 3-756. Function timer_deinit

Function name	timer_deinit
Function prototype	void timer_deinit(uint32_t timer_periph);
Function descriptions	deinit a TIMER
Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset TIMER1 */
timer_deinit(TIMER1);
```

timer_struct_para_init

The description of timer_struct_para_init is shown as below:

Table 3-757. Function timer_struct_para_init

Function name	timer_struct_para_init
Function prototype	void timer_struct_para_init(timer_parameter_struct* initpara);
Function descriptions	initialize the parameters of TIMER init parameter struct with the default values

Precondition	-
The called functions	-
Input parameter{in}	
initpara	TIMER init parameter struct, the structure members can refer to Table 3-752. Structure timer parameter struct.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize TIMER init parameter struct with a default value */
```

```
timer_parameter_struct timer_initpara;
```

```
timer_struct_para_init(timer_initpara);
```

timer_init

The description of timer_init is shown as below:

Table 3-758. Function timer_init

Function name	timer_init
Function prototype	void timer_init(uint32_t timer_periph, timer_parameter_struct* initpara);
Function descriptions	initialize TIMER counter
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Input parameter{in}	
initpara	TIMER init parameter struct, the structure members can refer to Table 3-752. Structure timer parameter struct.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize TIMER1 */
```

```
timer_parameter_struct timer_initpara;
```

```
timer_initpara.prescaler = 63;
```

```

timer_initpara.alignedmode    = TIMER_COUNTER_EDGE;

timer_initpara.counterdirection = TIMER_COUNTER_UP;

timer_initpara.period        = 999;

timer_initpara.clockdivision   = TIMER_CKDIV_DIV1;

timer_init(TIMER1,&timer_initpara);

```

timer_enable

The description of timer_enable is shown as below:

Table 3-759. Function timer_enable

Function name	timer_enable
Function prototype	void timer_enable(uint32_t timer_periph);
Function descriptions	enable a timer
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* enable TIMER1 */

timer_enable(TIMER1);

```

timer_disable

The description of timer_disable is shown as below:

Table 3-760. Function timer_disable

Function name	timer_disable
Function prototype	void timer_disable(uint32_t timer_periph);
Function descriptions	disable a timer
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection

	(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TIMER1 */
```

```
timer_disable(TIMER1);
```

timer_auto_reload_shadow_enable

The description of timer_auto_reload_shadow_enable is shown as below:

Table 3-761. Function timer_auto_reload_shadow_enable

Function name	timer_auto_reload_shadow_enable
Function prototype	void timer_auto_reload_shadow_enable(uint32_t timer_periph);
Function descriptions	enable the auto reload shadow function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the TIMER1 auto reload shadow function */
```

```
timer_auto_reload_shadow_enable(TIMER1);
```

timer_auto_reload_shadow_disable

The description of timer_auto_reload_shadow_disable is shown as below:

Table 3-762. Function timer_auto_reload_shadow_disable

Function name	timer_auto_reload_shadow_disable
Function prototype	void timer_auto_reload_shadow_disable(uint32_t timer_periph);
Function descriptions	disable the auto reload shadow function
Precondition	-
The called functions	-

Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the TIMER1 auto reload shadow function */
```

```
timer_auto_reload_shadow_disable(TIMER1);
```

timer_update_event_enable

The description of timer_update_event_enable is shown as below:

Table 3-763. Function timer_update_event_enable

Function name	timer_update_event_enable
Function prototype	void timer_update_event_enable(uint32_t timer_periph);
Function descriptions	enable the update event
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TIMER1 the update event */
```

```
timer_update_event_enable(TIMER1);
```

timer_update_event_disable

The description of timer_update_event_disable is shown as below:

Table 3-764. Function timer_update_event_disable

Function name	timer_update_event_disable
Function prototype	void timer_update_event_disable(uint32_t timer_periph);

Function descriptions	disable the update event
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TIMER1 the update event */
```

```
timer_update_event_disable(TIMER1);
```

timer_counter_alignment

The description of timer_counter_alignment is shown as below:

Table 3-765. Function timer_counter_alignment

Function name	timer_counter_alignment
Function prototype	void timer_counter_alignment(uint32_t timer_periph, uint16_t aligned);
Function descriptions	set TIMER counter alignment mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
aligned	alignment mode
<i>TIMER_COUNTER_EDGE</i>	No center-aligned mode (edge-aligned mode). The direction of the counter is specified by the DIR bit.
<i>TIMER_COUNTER_COUNTER_DOWN</i>	Center-aligned and counting down assert mode. The counter counts under center aligned and channel is configured in output mode (CHxMS=00 in <i>TIMERx_CHCTL0</i> register). Only when the counter is counting down, compare interrupt flag of channels can be set.
<i>TIMER_COUNTER_COUNTER_UP</i>	Center-aligned and counting up assert mode. The counter counts under center aligned and channel is configured in output mode (CHxMS=00 in <i>TIMERx_CHCTL0</i> register). Only when the counter is counting up, compare interrupt flag of channels can be set.
<i>TIMER_COUNTER_COUNTER</i>	Center-aligned and counting up/down assert mode. The counter counts

<i>NTER_BOTH</i>	under center-aligned and channel is configured in output mode (CHxMS=00 in TIMERx_CHCTL0 register). Both when the counter is counting up and counting down, compare interrupt flag of channels can be set.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set TIMER1 counter center-aligned and counting up assert mode */
timer_counter_alignment(TIMER1, TIMER_COUNTER_CENTER_UP);
```

timer_counter_up_direction

The description of timer_counter_up_direction is shown as below:

Table 3-766. Function timer_counter_up_direction

Function name	timer_counter_up_direction
Function prototype	void timer_counter_up_direction(uint32_t timer_periph);
Function descriptions	set TIMER counter up direction
Precondition	set TIMER counter no center-aligned mode (edge-aligned mode)
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set TIMER1 counter up direction */
timer_counter_up_direction(TIMER1);
```

timer_counter_down_direction

The description of timer_counter_down_direction is shown as below:

Table 3-767. timer_counter_down_direction

Function name	timer_counter_down_direction
Function prototype	void timer_counter_down_direction(uint32_t timer_periph);
Function descriptions	set TIMER counter down direction
Precondition	set TIMER counter no center-aligned mode (edge-aligned mode)

The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection (x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set TIMER1 counter down direction */
```

```
timer_counter_down_direction(TIMER1);
```

timer_prescaler_config

The description of timer_prescaler_config is shown as below:

Table 3-768. Function timer_prescaler_config

Function name	timer_prescaler_config
Function prototype	void timer_prescaler_config(uint32_t timer_periph, uint16_t prescaler, uint8_t pscreload);
Function descriptions	configure TIMER prescaler
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Input parameter{in}	
prescaler	prescaler value (0~65535)
Input parameter{in}	
pscreload	prescaler reload mode
TIMER_PSC_RELOAD_NOW	the prescaler is loaded right now
TIMER_PSC_RELOAD_UPDATE	the prescaler is loaded at the next update event
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 prescaler */
```

```
timer_prescaler_config(TIMER1, 3000, TIMER_PSC_RELOAD_NOW);
```

timer_repetition_value_config

The description of timer_repetition_value_config is shown as below:

Table 3-769. Function timer_repetition_value_config

Function name	timer_repetition_value_config
Function prototype	void timer_repetition_value_config(uint32_t timer_periph, uint16_t repetition);
Function descriptions	configure TIMER repetition register value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=0,14,40 for GD32L235)
Input parameter{in}	
repetition	the counter repetition value (0~255)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 repetition register value */
```

```
timer_repetition_value_config (TIMER0, 98);
```

timer_autoreload_value_config

The description of timer_autoreload_value_config is shown as below:

Table 3-770. Function timer_autoreload_value_config

Function name	timer_autoreload_value_config
Function prototype	void timer_autoreload_value_config(uint32_t timer_periph, uint16_t autoreload);
Function descriptions	configure TIMER autoreload register value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)

Input parameter{in}	
autoreload	the counter auto-reload value (0-65535)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 autoreload register value */
```

```
timer_autoreload_value_config(TIMER1, 3000);
```

timer_counter_value_config

The description of timer_counter_value_config is shown as below:

Table 3-771. Function timer_counter_value_config

Function name	timer_counter_value_config
Function prototype	void timer_counter_value_config(uint32_t timer_periph, uint16_t counter);
Function descriptions	configure TIMER counter register value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Input parameter{in}	
counter	the counter value(0-65535)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 counter register value */
```

```
timer_counter_value_config(TIMER1, 3000);
```

timer_counter_read

The description of timer_counter_read is shown as below:

Table 3-772. Function timer_counter_read

Function name	timer_counter_read
Function prototype	uint32_t timer_counter_read(uint32_t timer_periph);

Function descriptions	read TIMER counter value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
uint32_t	counter value(0~65535)

Example:

```
/* read TIMER1 counter value */

uint32_t i = 0;

i = timer_counter_read(TIMER1);
```

timer_prescaler_read

The description of timer_prescaler_read is shown as below:

Table 3-773. Function timer_prescaler_read

Function name	timer_prescaler_read
Function prototype	uint16_t timer_prescaler_read(uint32_t timer_periph);
Function descriptions	read TIMER prescaler value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
uint16_t	prescaler register value (0~65535)

Example:

```
/* read TIMER1 prescaler value */

uint16_t i = 0;

i = timer_prescaler_read(TIMER1);
```


timer_single_pulse_mode_config

The description of timer_single_pulse_mode_config is shown as below:

Table 3-774. Function timer_single_pulse_mode_config

Function name	timer_single_pulse_mode_config
Function prototype	void timer_single_pulse_mode_config(uint32_t timer_periph, uint8_t spmode);
Function descriptions	configure TIMER single pulse mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
Input parameter{in}	
spmode	pulse mode
<i>TIMER_SP_MODE_SINGLE</i>	single pulse mode
<i>TIMER_SP_MODE_REPETITIVE</i>	repetitive pulse mode
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 single pulse mode */
timer_single_pulse_mode_config(TIMER1, TIMER_SP_MODE_SINGLE);
```

timer_update_source_config

The description of timer_update_source_config is shown as below:

Table 3-775. Function timer_update_source_config

Function name	timer_update_source_config
Function prototype	void timer_update_source_config(uint32_t timer_periph, uint32_t update);
Function descriptions	configure TIMER update source
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)

Input parameter{in}	
update	update source
<i>TIMER_UPDATE_SRC_GLOBAL</i>	Any of the following events generate an update interrupt or DMA request: <ul style="list-style-type: none"> - The UPG bit is set - The counter generates an overflow or underflow event - The slave mode controller generates an update event
<i>TIMER_UPDATE_SRC_REGULAR</i>	Only counter overflow/underflow generates an update interrupt or DMA request.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 update only by counter overflow/underflow */
```

```
timer_update_source_config(TIMER1, TIMER_UPDATE_SRC_REGULAR);
```

timer_dma_enable

The description of timer_dma_enable is shown as below:

Table 3-776. Function timer_dma_enable

Function name	timer_dma_enable
Function prototype	void timer_dma_enable(uint32_t timer_periph, uint16_t dma);
Function descriptions	enable the TIMER DMA
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
dma	timer DMA source enable
<i>TIMER_DMA_UPD</i>	update DMA enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH0D</i>	channel 0 DMA enable TIMERx (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH1D</i>	channel 1 DMA enable TIMERx (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH2D</i>	channel 2 DMA enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_DMA_CH3D</i>	channel 3 DMA enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)

<i>TIMER_DMA_CMTD</i>	commutation DMA request enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_DMA_TRGD</i>	trigger DMA enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the TIMER1 update DMA */
```

```
timer_dma_enable(TIMER1, TIMER_DMA_UPD);
```

timer_dma_disable

The description of timer_dma_disable is shown as below:

Table 3-777. Function timer_dma_disable

Function name	timer_dma_disable
Function prototype	void timer_dma_disable(uint32_t timer_periph, uint16_t dma);
Function descriptions	disable the TIMER DMA
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
dma	timer DMA source disable
<i>TIMER_DMA_UPD</i>	update DMA enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH0D</i>	channel 0 DMA enable TIMERx (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH1D</i>	channel 1 DMA enable TIMERx (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_DMA_CH2D</i>	channel 2 DMA enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_DMA_CH3D</i>	channel 3 DMA enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_DMA_CMTD</i>	commutation DMA request enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_DMA_TRGD</i>	trigger DMA enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the TIMER1 update DMA */
timer_dma_disable(TIMER1, TIMER_DMA_UPD);
```

timer_channel_dma_request_source_select

The description of timer_channel_dma_request_source_select is shown as below:

Table 3-778. Function timer_channel_dma_request_source_select

Function name	timer_channel_dma_request_source_select
Function prototype	void timer_channel_dma_request_source_select(uint32_t timer_periph, uint32_t dma_request);
Function descriptions	channel DMA request source selection
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2 for GD32L233, x=0,1,2,14,40 for GD32L235)
Input parameter{in}	
dma_request	channel DMA request source selection
<i>TIMER_DMAREQUEST_CHANNELEVENT</i>	DMA request of channel n is sent when channel y event occurs
<i>TIMER_DMAREQUEST_UPDATEEVENT</i>	DMA request of channel n is sent when update event occurs
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* TIMER1 channel DMA request of channel n is sent when channel y event occurs */
timer_channel_dma_request_source_select(TIMER1,
TIMER_DMAREQUEST_CHANNELEVENT);
```

timer_dma_transfer_config

The description of timer_dma_transfer_config is shown as below:

Table 3-779. Function timer_dma_transfer_config

Function name	timer_dma_transfer_config
Function prototype	void timer_dma_transfer_config(uint32_t timer_periph, uint32_t dma_baseaddr, uint32_t dma_lenth);
Function descriptions	configure the TIMER DMA transfer
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection (x=1,2 for GD32L233, x=0,1,2,14,40 for GD32L235)
Input parameter{in}	
dma_baseaddr	DMA transfer access start address
<i>TIMER_DMACFG_DMA TA_CTL0</i>	DMA transfer address is TIMER_CTL0
<i>TIMER_DMACFG_DMA TA_CTL1</i>	DMA transfer address is TIMER_CTL1
<i>TIMER_DMACFG_DMA TA_SMCFG</i>	DMA transfer address is TIMER_SMCFG
<i>TIMER_DMACFG_DMA TA_DMAINTEN</i>	DMA transfer address is TIMER_DMAINTEN
<i>TIMER_DMACFG_DMA TA_INTF</i>	DMA transfer address is TIMER_INTF
<i>TIMER_DMACFG_DMA TA_SWEVG</i>	DMA transfer address is TIMER_SWEVG
<i>TIMER_DMACFG_DMA TA_CHCTL0</i>	DMA transfer address is TIMER_CHCTL0
<i>TIMER_DMACFG_DMA TA_CHCTL1</i>	DMA transfer address is TIMER_CHCTL1
<i>TIMER_DMACFG_DMA TA_CHCTL2</i>	DMA transfer address is TIMER_CHCTL2
<i>TIMER_DMACFG_DMA TA_CNT</i>	DMA transfer address is TIMER_CNT
<i>TIMER_DMACFG_DMA TA_PSC</i>	DMA transfer address is TIMER_PSC
<i>TIMER_DMACFG_DMA TA_CAR</i>	MA transfer address is TIMER_CAR
<i>TIMER_DMACFG_DMA TA_CH0CV</i>	DMA transfer address is TIMER_CH0CV
<i>TIMER_DMACFG_DMA TA_CH1CV</i>	DMA transfer address is TIMER_CH1CV
<i>TIMER_DMACFG_DMA TA_CH2CV</i>	DMA transfer address is TIMER_CH2CV

<i>TIMER_DMACFG_DMA</i> <i>TA_CH3CV</i>	DMA transfer address is <i>TIMER_CH3CV</i>
<i>TIMER_DMACFG_DMA</i> <i>TA_CCHP</i>	DMA transfer address is <i>TIMER_CCHP</i>
<i>TIMER_DMACFG_DMA</i> <i>TA_DMACFG</i>	DMA transfer address is <i>TIMER_DMACFG</i>
Input parameter{in}	
dma_lenth	DMA transfer count
<i>TIMER_DMACFG_DMA</i> <i>TC_xTRANSFER</i>	x=1..18, DMA transfer x time
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the TIMER1 DMA transfer */
```

```
timer_dma_transfer_config(TIMER1, TIMER_DMACFG_DMATA_CTL0,  
TIMER_DMACFG_DMATC_5TRANSFER);
```

timer_event_software_generate

The description of `timer_event_software_generate` is shown as below:

Table 3-780. Function `timer_event_software_generate`

Function name	<code>timer_event_software_generate</code>
Function prototype	<code>void timer_event_software_generate(uint32_t timer_periph, uint16_t event);</code>
Function descriptions	software generate events
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
event	the timer software event generation sources
<i>TIMER_EVENT_SRC_UPG</i>	update event TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_EVENT_SRC_CH0G</i>	channel 0 capture or compare event generation TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_EVENT_SRC_CH1G</i>	channel 1 capture or compare event generation TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)

<i>TIMER_EVENT_SRC_C</i> <i>H2G</i>	channel 2 capture or compare event generation TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_EVENT_SRC_C</i> <i>H3G</i>	channel 3 capture or compare event generation TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_EVENT_SRC_C</i> <i>MTG</i>	channel commutation event generation TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_EVENT_SRC_T</i> <i>RGG</i>	trigger event generation TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_EVENT_SRC_B</i> <i>RKG</i>	break event generation TIMERx(x=0,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* software generate update event*/
```

```
timer_event_software_generate(TIMER1, TIMER_EVENT_SRC_UPG);
```

timer_break_struct_para_init (only for GD32L235)

The description of timer_break_struct_para_init is shown as below:

Table 3-781. Function timer_break_struct_para_init

Function name	timer_break_struct_para_init
Function prototype	void timer_break_struct_para_init(timer_break_parameter_struct* breakpara);
Function descriptions	initialize the parameters of TIMER break parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
breakpara	TIMER break parameter struct, the structure members can refer to <u>Structure timer break parameter struct.</u>
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize TIMER break parameter struct with a default value */
```

```
timer_break_parameter_struct timer_breakpara;
```

```
timer_break_struct_para_init(timer_breakpara);
```

timer_break_config (only for GD32L235)

The description of timer_break_config is shown as below:

Table 3-782. Function timer_break_config

Function name	timer_break_config
Function prototype	void timer_break_config(uint32_t timer_periph, timer_break_parameter_struct* breakpara);
Function descriptions	configure TIMER break function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Input parameter{in}	
breakpara	TIMER break parameter struct, the structure members can refer to Structure timer break parameter struct.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 break function */
timer_break_parameter_struct timer_breakpara;

timer_breakpara.runoffstate      = TIMER_ROS_STATE_DISABLE;
timer_breakpara.ideloffstate     = TIMER_IOS_STATE_DISABLE ;
timer_breakpara.deadtime        = 255;
timer_breakpara.breakpolarity   = TIMER_BREAK_POLARITY_LOW;
timer_breakpara.outputautostate  = TIMER_OUTAUTO_ENABLE;
timer_breakpara.protectmode      = TIMER_CCHP_PROT_0;
timer_breakpara.breakstate       = TIMER_BREAK_ENABLE;

timer_break_config(TIMER0, &timer_breakpara);
```

timer_break_enable (only for GD32L235)

The description of timer_break_enable is shown as below:

Table 3-783. Function timer_break_enable

Function name	timer_break_enable
Function prototype	void timer_break_enable(uint32_t timer_periph);
Function descriptions	enable TIMER break function
Precondition	This function can be called only when PROT [1:0] bit-filed in TIMERx_CCHP register is 00.
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TIMER0 break function*/
```

```
timer_break_enable (TIMER0);
```

timer_break_disable (only for GD32L235)

The description of timer_break_disable is shown as below:

Table 3-784. Function timer_break_disable

Function name	timer_break_disable
Function prototype	void timer_break_disable(uint32_t timer_periph);
Function descriptions	disable TIMER break function
Precondition	This function can be called only when PROT [1:0] bit-filed in TIMERx_CCHP register is 00.
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TIMER0 break function*/
```

```
timer_break_disable (TIMER0);
```

timer_automatic_output_enable (only for GD32L235)

The description of timer_automatic_output_enable is shown as below:

Table 3-785. Function timer_automatic_output_enable

Function name	timer_automatic_output_enable
Function prototype	void timer_automatic_output_enable(uint32_t timer_periph);
Function descriptions	enable TIMER output automatic function
Precondition	This function can be called only when PROT [1:0] bit-filed in TIMERx_CCHP register is 00.
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TIMER0 output automatic function */
```

```
timer_automatic_output_enable (TIMER0);
```

timer_automatic_output_disable (only for GD32L235)

The description of timer_automatic_output_disable is shown as below:

Table 3-786. Function timer_automatic_output_disable

Function name	timer_automatic_output_disable
Function prototype	void timer_automatic_output_disable (uint32_t timer_periph);
Function descriptions	disable TIMER output automatic function
Precondition	This function can be called only when PROT [1:0] bit-filed in TIMERx_CCHP register is 00.
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TIMER0 output automatic function */
```

timer_automatic_output_disable (TIMER0);

timer_primary_output_config (only for GD32L235)

The description of timer_primary_output_config is shown as below:

Table 3-787. Function timer_primary_output_config

Function name	timer_primary_output_config
Function prototype	void timer_primary_output_config(uint32_t timer_periph, ControlStatus newvalue);
Function descriptions	configure TIMER primary output function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx(x=0, 14, 40)	TIMER peripheral selection
Input parameter{in}	
newvalue	control value
ENABLE	enable function
DISABLE	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TIMER0 primary output function */
```

```
timer_primary_output_config (TIMER0, ENABLE);
```

timer_channel_control_shadow_config (only for GD32L235)

The description of timer_channel_control_shadow_config is shown as below:

Table 3-788. Function timer_channel_control_shadow_config

Function name	timer_channel_control_shadow_config
Function prototype	void timer_channel_control_shadow_config(uint32_t timer_periph, ControlStatus newvalue);
Function descriptions	channel commutation control shadow register enable
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx(x=0, 14, 40)	TIMER peripheral selection
Input parameter{in}	

newvalue	control value
<i>ENABLE</i>	enable function
<i>DISABLE</i>	disable function
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* channel capture/compare control shadow register enable */
```

```
timer_channel_control_shadow_config (TIMER0, ENABLE);
```

timer_channel_control_shadow_update_config (only for GD32L235)

The description of timer_channel_control_shadow_update_config is shown as below:

Table 3-789. Function timer_channel_control_shadow_update_config

Function name	timer_channel_control_shadow_update_config
Function prototype	void timer_channel_control_shadow_update_config(uint32_t timer_periph, uint8_t ccctl);
Function descriptions	configure commutation control shadow register update control
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14, 40)</i>	TIMER peripheral selection
Input parameter{in}	
ccctl	channel control shadow register update control
<i>TIMER_UPDATECTL_CCU</i>	the shadow registers update by when CMTG bit is set
<i>TIMER_UPDATECTL_CUTRI</i>	the shadow registers update by when CMTG bit is set or an rising edge of TRGI occurs
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 channel control shadow register update when CMTG bit is set */
```

```
timer_channel_control_shadow_update_config (TIMER0, TIMER_UPDATECTL_CCU);
```

timer_channel_output_struct_para_init

The description of timer_channel_output_struct_para_init is shown as below:

Table 3-790. Function timer_channel_output_struct_para_init

Function name	timer_channel_output_struct_para_init
Function prototype	void timer_channel_output_struct_para_init(timer_oc_parameter_struct* ocpa);
Function descriptions	initialize the parameters of TIMER channel output parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
ocpara	TIMER channel output parameter struct, the structure members can refer to Table 3-754. Structure timer oc parameter struct .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* initialize TIMER channel output parameter struct with a default value */
timer_oc_parameter_struct timer_ocinitpara;
timer_channel_output_struct_para_init(timer_ocinitpara);
```

timer_channel_output_config

The description of timer_channel_output_config is shown as below:

Table 3-791. Function timer_channel_output_config

Function name	timer_channel_output_config
Function prototype	void timer_channel_output_config(uint32_t timer_periph, uint16_t channel, timer_oc_parameter_struct* ocpa);
Function descriptions	configure TIMER channel output function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)

<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
ocpara	TIMER channel output parameter struct, the structure members can refer to Table 3-754. Structure timer_oc_parameter_struct .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* configure TIMER1 channel 0 output function */

timer_oc_parameter_struct timer_ocinitpara;

timer_ocinitpara.outputstate = TIMER_CCX_ENABLE;

timer_ocinitpara.ocpolarity = TIMER_OC_POLARITY_HIGH;

timer_channel_output_config(TIMER1, TIMER_CH_0, &timer_ocinitpara);

```

timer_channel_output_mode_config

The description of timer_channel_output_mode_config is shown as below:

Table 3-792. Function timer_channel_output_mode_config

Function name	timer_channel_output_mode_config
Function prototype	void timer_channel_output_mode_config(uint32_t timer_periph, uint16_t channel, uint16_t ocmode);
Function descriptions	configure TIMER channel output compare mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2

	TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	IMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
ocmode	channel output compare mode
<i>TIMER_OC_MODE_TIMING</i>	timing mode
<i>TIMER_OC_MODE_ACTIVE</i>	set the channel output
<i>TIMER_OC_MODE_INACTIVE</i>	clear the channel output
<i>TIMER_OC_MODE_TOGGLE</i>	toggle on match
<i>TIMER_OC_MODE_LOW</i>	force low mode
<i>TIMER_OC_MODE_HIGH</i>	force high mode
<i>TIMER_OC_MODE_PWM0</i>	PWM mode 0
<i>TIMER_OC_MODE_PWM1</i>	PWM mode 1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel PWM 0 mode */
```

```
timer_channel_output_mode_config(TIMER1, TIMER_CH_0, TIMER_OC_MODE_PWM0);
```

timer_channel_output_pulse_value_config

The description of timer_channel_output_pulse_value_config is shown as below:

Table 3-793. Function timer_channel_output_pulse_value_config

Function name	timer_channel_output_pulse_value_config
Function prototype	void timer_channel_output_pulse_value_config(uint32_t timer_periph, uint16_t channel, uint32_t pulse);
Function descriptions	configure TIMER channel output pulse value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral

<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
pulse	channel output pulse value(0~65535)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 output pulse value */
```

```
timer_channel_output_pulse_value_config(TIMER1, TIMER_CH_0, 399);
```

timer_channel_output_shadow_config

The description of timer_channel_output_shadow_config is shown as below:

Table 3-794. Function timer_channel_output_shadow_config

Function name	timer_channel_output_shadow_config
Function prototype	void timer_channel_output_shadow_config(uint32_t timer_periph, uint16_t channel, uint16_t ocshadow);
Function descriptions	configure TIMER channel output shadow function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2

	TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
ocshadow	channel output shadow state
<i>TIMER_OC_SHADOW_ENABLE</i>	channel output shadow state enable
<i>TIMER_OC_SHADOW_DISABLE</i>	channel output shadow state disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*configure TIMER1 channel 0 output shadow function */
```

```
timer_channel_output_shadow_config(TIMER1, TIMER_CH_0,  
TIMER_OC_SHADOW_ENABLE);
```

timer_channel_output_fast_config

The description of timer_channel_output_fast_config is shown as below:

Table 3-795. Function timer_channel_output_fast_config

Function name	timer_channel_output_fast_config
Function prototype	void timer_channel_output_fast_config(uint32_t timer_periph, uint16_t channel, uint16_t ocfast);
Function descriptions	configure TIMER channel output fast function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)

Input parameter{in}	
ocfast	channel output fast function
<i>TIMER_OC_FAST_ENABLE</i>	channel output fast function enable
<i>TIMER_OC_FAST_DISABLE</i>	channel output fast function disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 output fast function */
timer_channel_output_fast_config(TIMER1, TIMER_CH_0, TIMER_OC_FAST_ENABLE);
```

timer_channel_output_clear_config

The description of timer_channel_output_clear_config is shown as below:

Table 3-796. Function timer_channel_output_clear_config

Function name	timer_channel_output_clear_config
Function prototype	void timer_channel_output_clear_config(uint32_t timer_periph, uint16_t channel, uint16_t occlear);
Function descriptions	configure TIMER channel output clear function
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER periphera
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
occlear	channel output clear function
<i>TIMER_OC_CLEAR_ENABLE</i>	channel output clear function enable

<i>TIMER_OC_CLEAR_DISABLE</i>	channel output clear function disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 output clear function */
```

```
timer_channel_output_clear_config(TIMER1, TIMER_CH_0,
TIMER_OC_CLEAR_ENABLE);
```

timer_channel_output_polarity_config

The description of timer_channel_output_polarity_config is shown as below:

Table 3-797. Function timer_channel_output_polarity_config

Function name	timer_channel_output_polarity_config
Function prototype	void timer_channel_output_polarity_config(uint32_t timer_periph, uint16_t channel, uint16_t ocpolarity);
Function descriptions	configure TIMER channel output polarity
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
ocpolarity	channel output polarity
<i>TIMER_OC_POLARITY_HIGH</i>	channel output polarity is high
<i>TIMER_OC_POLARITY_LOW</i>	channel output polarity is low
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 output polarity */
```

```
timer_channel_output_polarity_config(TIMER1, TIMER_CH_0,
TIMER_OC_POLARITY_HIGH);
```

timer_channel_complementary_output_polarity_config (only for GD32L235)

The description of timer_channel_complementary_output_polarity_config is shown as below:

Table 3-798. Function timer_channel_complementary_output_polarity_config

Function name	timer_channel_complementary_output_polarity_config
Function prototype	void timer_channel_complementary_output_polarity_config(uint32_t timer_periph, uint16_t channel, uint16_t ocnpolarity);
Function descriptions	configure TIMER channel complementary output polarity
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 <i>TIMERx</i> (<i>x</i> =0, 14, 40)
<i>TIMER_CH_1</i>	TIMER channel 1 <i>TIMERx</i> (<i>x</i> =0)
<i>TIMER_CH_2</i>	TIMER channel 2 <i>TIMERx</i> (<i>x</i> =0)
Input parameter{in}	
ocnpolarity	channel complementary output polarity
<i>TIMER_OCN_POLARITY_HIGH</i>	channel complementary output polarity is high
<i>TIMER_OCN_POLARITY_LOW</i>	channel complementary output polarity is low
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 channel 0 complementary output polarity */
```

```
timer_channel_complementary_output_polarity_config (TIMER0, TIMER_CH_0,
TIMER_OCN_POLARITY_HIGH);
```

timer_channel_output_state_config

The description of timer_channel_output_state_config is shown as below:

Table 3-799. Function timer_channel_output_state_config

Function name	timer_channel_output_state_config
Function prototype	void timer_channel_output_state_config(uint32_t timer_periph, uint16_t channel, uint32_t state);
Function descriptions	configure TIMER channel enable state
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
state	TIMER channel enable state
<i>TIMER_CCX_ENABLE</i>	channel enable
<i>TIMER_CCX_DISABLE</i>	channel disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 enable state */
```

```
timer_channel_output_state_config(TIMER1, TIMER_CH_0, TIMER_CCX_ENABLE);
```

timer_channel_complementary_output_state_config (only for GD32L235)

The description of timer_channel_complementary_output_state_config is shown as below:

Table 3-800. Function timer_channel_complementary_output_state_config

Function name	timer_channel_complementary_output_state_config
Function prototype	void timer_channel_complementary_output_state_config(uint32_t

	timer_periph, uint16_t channel, uint16_t ocnstate);
Function descriptions	configure TIMER channel complementary output enable state
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=0, 14,.. 16)</i>	TIMER peripheral selection
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=0, 14, 40)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=0)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=0)
Input parameter{in}	
state	TIMER channel complementary output enable state
<i>TIMER_CCXN_ENABLE</i>	channel complementary enable
<i>TIMER_CCXN_DISABLE</i>	channel complementary disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 channel 0 complementary output enable state */
```

```
timer_channel_complementary_output_state_config (TIMER0, TIMER_CH_0,  
TIMER_CCXN_ENABLE);
```

timer_channel_input_struct_para_init

The description of timer_channel_input_struct_para_init is shown as below:

Table 3-801. Function timer_channel_input_struct_para_init

Function name	timer_channel_input_struct_para_init
Function prototype	void timer_channel_input_struct_para_init(timer_ic_parameter_struct* icpara);
Function descriptions	initialize the parameters of TIMER channel input parameter struct with the default values
Precondition	-
The called functions	-
Input parameter{in}	
icpara	TIMER channel input parameter struct, the structure members can refer to Table 3-755. Structure timer_ic_parameter_struct .
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* initialize TIMER channel input parameter struct with a default value */
```

```
timer_ic_parameter_struct timer_icinitpara;
```

```
timer_channel_input_struct_para_init(&timer_icinitpara);
```

timer_input_capture_config

The description of timer_input_capture_config is shown as below:

Table 3-802. Function timer_input_capture_config

Function name	timer_input_capture_config
Function prototype	void timer_input_capture_config(uint32_t timer_periph, uint16_t channel, timer_ic_parameter_struct* icpara);
Function descriptions	configure TIMER input capture parameter
Precondition	-
The called functions	timer_channel_input_capture_prescaler_config
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
<i>TIMER_CH_0</i>	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_1</i>	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_CH_2</i>	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_CH_3</i>	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
icpara	TIMER channel input parameter struct, the structure members can refer to Table 3-755. Structure timer_ic_parameter_struct .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 input capture parameter */
```

```

timer_ic_parameter_struct timer_icinitpara;

timer_icinitpara.icpolarity = TIMER_IC_POLARITY_RISING;

timer_icinitpara.icselection = TIMER_IC_SELECTION_DIRECTTTI;

timer_icinitpara.icprescaler = TIMER_IC_PSC_DIV1;

timer_icinitpara.icfilter = 0x0;

timer_input_capture_config(TIMER1, TIMER_CH_0, &timer_icinitpara);

```

timer_channel_input_capture_prescaler_config

The description of timer_channel_input_capture_prescaler_config is shown as below:

Table 3-803. Function timer_channel_input_capture_prescaler_config

Function name	timer_channel_input_capture_prescaler_config
Function prototype	void timer_channel_input_capture_prescaler_config(uint32_t timer_periph, uint16_t channel, uint16_t prescaler);
Function descriptions	configure TIMER channel input capture prescaler value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
TIMER_CH_0	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
TIMER_CH_1	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
TIMER_CH_2	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
TIMER_CH_3	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Input parameter{in}	
prescaler	channel input capture prescaler value
TIMER_IC_PSC_DIV1	no prescaler
TIMER_IC_PSC_DIV2	divided by 2
TIMER_IC_PSC_DIV4	divided by 4
TIMER_IC_PSC_DIV8	divided by 8
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 channel 0 input capture prescaler value */

timer_channel_input_capture_prescaler_config(TIMER1, TIMER_CH_0,
TIMER_IC_PSC_DIV2);
```

timer_channel_capture_value_register_read

The description of timer_channel_capture_value_register_read is shown as below:

Table 3-804. Function timer_channel_capture_value_register_read

Function name	timer_channel_capture_value_register_read
Function prototype	uint32_t timer_channel_capture_value_register_read(uint32_t timer_periph, uint16_t channel);
Function descriptions	read TIMER channel capture compare register value
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	please refer to the following parameters
Input parameter{in}	
channel	channel to be configured
TIMER_CH_0	TIMER channel 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
TIMER_CH_1	TIMER channel 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
TIMER_CH_2	TIMER channel 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
TIMER_CH_3	TIMER channel 3 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Output parameter{out}	
-	-
Return value	
uint32_t	channel capture compare register value (0~65535)

Example:

```
/* read TIMER1 channel 0 capture compare register value */

uint32_t ch0_value = 0;

ch0_value = timer_channel_capture_value_register_read (TIMER1, TIMER_CH_0);
```

timer_input_pwm_capture_config

The description of timer_input_pwm_capture_config is shown as below:

Table 3-805. Function timer_input_pwm_capture_config

Function name	timer_input_pwm_capture_config
Function prototype	void timer_input_pwm_capture_config(uint32_t timer_periph, uint16_t channel, timer_ic_parameter_struct* icpwm);
Function descriptions	configure TIMER input pwm capture function
Precondition	-
The called functions	timer_channel_input_capture_prescaler_config
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Input parameter{in}	
channel	channel to be configured
TIMER_CH_0	TIMER channel 0
TIMER_CH_1	TIMER channel 1
Input parameter{in}	
icpwm	TIMER channel input pwm parameter struct, the structure members can refer to Table 3-755. Structure timer_ic_parameter_struct .
Output parameter{out}	
-	-
Return value	
-	-

Example:

```

/* configure TIMER1 input pwm capture parameter */

timer_ic_parameter_struct timer_icinitpara;

timer_icinitpara.icpolarity = TIMER_IC_POLARITY_RISING;

timer_icinitpara.icselection = TIMER_IC_SELECTION_DIRECTTTI;

timer_icinitpara.icprescaler = TIMER_IC_PSC_DIV1;

timer_icinitpara.icfilter = 0x0;

timer_input_pwm_capture_config(TIMER1, TIMER_CH_0, &timer_icinitpara);

```

timer_hall_mode_config

The description of timer_hall_mode_config is shown as below:

Table 3-806. Function timer_hall_mode_config

Function name	timer_hall_mode_config
Function prototype	void timer_hall_mode_config(uint32_t timer_periph, uint8_t hallmode);
Function descriptions	configure TIMER hall sensor mode
Precondition	-

The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2 for GD32L233, x=0,1,2 for GD32L235
Input parameter{in}	
hallmode	TIMER hall sensor mode state
<i>TIMER_HALLINTERFA CE_ENABLE</i>	TIMER hall sensor mode enable
<i>TIMER_HALLINTERFA CE_DISABLE</i>	TIMER hall sensor mode disable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 hall sensor mode */
```

```
timer_hall_mode_config(TIMER1, TIMER_HALLINTERFACE_ENABLE);
```

timer_input_trigger_source_select

The description of timer_input_trigger_source_select is shown as below:

Table 3-807. Function timer_input_trigger_source_select

Function name	timer_input_trigger_source_select
Function prototype	void timer_input_trigger_source_select(uint32_t timer_periph, uint32_t intrigger);
Function descriptions	select TIMER input trigger source
Precondition	SMC[2:0] = 000
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
intrigger	trigger selection
<i>TIMER_SMCFG_TRGS EL_ITI0</i>	Internal trigger input 0 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS EL_ITI1</i>	Internal trigger input 1 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS EL_ITI2</i>	Internal trigger input 2 TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i>	Internal trigger input 3

<i>EL_ITI3</i>	TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_CIOF_ED</i>	CIO edge flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_CIOFE0</i>	channel 0 input Filtered output TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_CI1FE1</i>	channel 1 input Filtered output TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_ETIFP</i>	External trigger input filter output TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select TIMER1 input trigger source */
```

```
timer_input_trigger_source_select(TIMER1, TIMER_SMCFG_TRGSEL_ITI0);
```

timer_master_output_trigger_source_select

The description of timer_master_output_trigger_source_select is shown as below:

Table 3-808. Function timer_master_output_trigger_source_select

Function name	timer_master_output_trigger_source_select
Function prototype	void timer_master_output_trigger_source_select(uint32_t timer_periph, uint32_t outrigger);
Function descriptions	select TIMER master mode output trigger source
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection
Input parameter{in}	
outrigger	master mode control
<i>TIMER_TRI_OUT_SRC_RESET</i>	Reset. When the UPG bit in the TIMERx_SWEVG register is set or a reset is generated by the slave mode controller, a TRGO pulse occurs. And in the latter case, the signal on TRGO is delayed compared to the actual reset
<i>TIMER_TRI_OUT_SRC_ENABLE</i>	Enable. This mode is useful to start several timers at the same time or to control a window in which a slave timer is enabled. In this mode the master mode controller selects the counter enable signal as TRGO. The counter enable signal is set when CEN control bit is set or the trigger input in pause mode is high. There is a delay between the trigger input in pause mode

	and the TRGO output, except if the master-slave mode is selected.
<i>TIMER_TRI_OUT_SRC_UPDATE</i>	Update. In this mode the master mode controller selects the update event as TRGO.
<i>TIMER_TRI_OUT_SRC_CH0</i>	Capture/compare pulse. In this mode the master mode controller generates a TRGO pulse when a capture or a compare match occurred in channel 0.
<i>TIMER_TRI_OUT_SRC_O0CPRE</i>	Compare. In this mode the master mode controller selects the O0CPRE signal is used as TRGO.
<i>TIMER_TRI_OUT_SRC_O1CPRE</i>	Compare. In this mode the master mode controller selects the O1CPRE signal is used as TRGO.
<i>TIMER_TRI_OUT_SRC_O2CPRE</i>	Compare. In this mode the master mode controller selects the O2CPRE signal is used as TRGO.
<i>TIMER_TRI_OUT_SRC_O3CPRE</i>	Compare. In this mode the master mode controller selects the O3CPRE signal is used as TRGO.
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select TIMER1 master mode output trigger source */
```

```
timer_master_output_trigger_source_select(TIMER1, TIMER_TRI_OUT_SRC_RESET);
```

timer_slave_mode_select

The description of timer_slave_mode_select is shown as below:

Table 3-809. Function timer_slave_mode_select

Function name	timer_slave_mode_select
Function prototype	void timer_slave_mode_select(uint32_t timer_periph, uint32_t slavemode);
Function descriptions	select TIMER slave mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection
Input parameter{in}	
slavemode	slave mode
<i>TIMER_SLAVE_MODE_DISABLE</i>	slave mode disable
<i>TIMER_QUAD_DECODER_MODE0</i>	quadrature decoder mode 0 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_QUAD_DECODER_MODE1</i>	quadrature decoder mode 1 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)

<i>TIMER_QUAD_DECODER_MODE2</i>	quadrature decoder mode 2 TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_SLAVE_MODE_RESTART</i>	restart mode TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SLAVE_MODE_PAUSE</i>	pause mode TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SLAVE_MODE_EVENT</i>	event mode TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SLAVE_MODE_EXTERNAL0</i>	external clock mode 0 (x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* select TIMER1 slave mode */
```

```
timer_slave_mode_select(TIMER1, TIMER_QUAD_DECODER_MODE0);
```

timer_master_slave_mode_config

The description of timer_master_slave_mode_config is shown as below:

Table 3-810. Function timer_master_slave_mode_config

Function name	timer_master_slave_mode_config
Function prototype	void timer_master_slave_mode_config(uint32_t timer_periph, uint8_t masterslave);
Function descriptions	configure TIMER master slave mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Input parameter{in}	
masterslave	master slave mode state
<i>TIMER_MASTER_SLAVE_MODE_ENABLE</i>	master slave mode enable
<i>TIMER_MASTER_SLAVE_MODE_DISABLE</i>	master slave mode disable
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* configure TIMER1 master slave mode */
```

```
timer_master_slave_mode_config(TIMER1, TIMER_MASTER_SLAVE_MODE_ENABLE);
```

timer_external_trigger_config

The description of timer_external_trigger_config is shown as below:

Table 3-811. Function timer_external_trigger_config

Function name	timer_external_trigger_config
Function prototype	void timer_external_trigger_config(uint32_t timer_periph, uint32_t extprescaler, uint32_t expolarity, uint32_t extfilter);
Function descriptions	configure TIMER external trigger input
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection x=1,2 for GD32L233, x=0,1,2 for GD32L235
Input parameter{in}	
extprescaler	external trigger prescaler
TIMER_EXT_TRI_PSC_OFF	no divided
TIMER_EXT_TRI_PSC_DIV2	divided by 2
TIMER_EXT_TRI_PSC_DIV4	divided by 4
TIMER_EXT_TRI_PSC_DIV8	divided by 8
Input parameter{in}	
expolarity	external trigger polarity
TIMER_ETP_FALLING	active low or falling edge active
TIMER_ETP_RISING	active high or rising edge active
Input parameter{in}	
extfilter	external trigger filter control(0~15)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 external trigger input */
```

```
timer_external_trigger_config(TIMER1,                                TIMER_EXT_TRI_PSC_DIV2,
TIMER_ETP_FALLING, 10);
```

timer_quadrature_decoder_mode_config

The description of timer_quadrature_decoder_mode_config is shown as below:

Table 3-812. Function timer_quadrature_decoder_mode_config

Function name	timer_quadrature_decoder_mode_config
Function prototype	void timer_quadrature_decoder_mode_config(uint32_t timer_periph, uint32_t decomode, uint16_t ic0polarity, uint16_t ic1polarity);
Function descriptions	configure TIMER quadrature decoder mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMEx	TIMER peripheral selection x=1,2 for GD32L233, x=0,1,2 for GD32L235
Input parameter{in}	
decomode	quadrature decoder mode
TIMER_QUAD_DECODER_MODE0	counter counts on CI0FE0 edge depending on CI1FE1 level
TIMER_QUAD_DECODER_MODE1	counter counts on CI1FE1 edge depending on CI0FE0 level
TIMER_QUAD_DECODER_MODE2	counter counts on both CI0FE0 and CI1FE1 edges depending on the level of the other input
Input parameter{in}	
ic0polarity	IC0 polarity
TIMER_IC_POLARITY_RISING	capture rising edge
TIMER_IC_POLARITY_FALLING	capture falling edge
TIMER_IC_POLARITY_BOTH_EDGE	capture both edge
Input parameter{in}	
ic1polarity	IC1 polarity
TIMER_IC_POLARITY_RISING	capture rising edge
TIMER_IC_POLARITY_FALLING	capture falling edge
TIMER_IC_POLARITY_BOTH_EDGE	capture both edge

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 quadrature decoder mode */
```

```
timer_quadrature_decoder_mode_config(TIMER1, TIMER_QUAD_DECODER_MODE0,
TIMER_IC_POLARITY_RISING, TIMER_IC_POLARITY_RISING);
```

timer_internal_clock_config

The description of timer_internal_clock_config is shown as below:

Table 3-813. Function timer_internal_clock_config

Function name	timer_internal_clock_config
Function prototype	void timer_internal_clock_config(uint32_t timer_periph);
Function descriptions	configure TIMER internal clock mode
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER0 internal clock mode */
```

```
timer_internal_clock_config (TIMER0);
```

timer_internal_trigger_as_external_clock_config

The description of timer_internal_trigger_as_external_clock_config is shown as below:

Table 3-814. Function timer_internal_trigger_as_external_clock_config

Function name	timer_internal_trigger_as_external_clock_config
Function prototype	void timer_internal_trigger_as_external_clock_config(uint32_t timer_periph, uint32_t intrigger);
Function descriptions	configure TIMER the internal trigger as external clock input
Precondition	-
The called functions	timer_input_trigger_source_select

Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection
Input parameter{in}	
intrigger	trigger selection
<i>TIMER_SMCFG_TRGS</i> <i>EL_ITI0</i>	Internal trigger input 0 (ITI0) TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_ITI1</i>	Internal trigger input 1 (ITI1) TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_ITI2</i>	Internal trigger input 2 (ITI2) TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_SMCFG_TRGS</i> <i>EL_ITI3</i>	Internal trigger input 3 (ITI3) TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 the internal trigger ITI0 as external clock input */
```

```
timer_internal_trigger_as_external_clock_config(TIMER1, TIMER_SMCFG_TRGSEL_ITI0);
```

timer_external_trigger_as_external_clock_config

The description of timer_external_trigger_as_external_clock_config is shown as below:

Table 3-815. Function timer_external_trigger_as_external_clock_config

Function name	timer_external_trigger_as_external_clock_config
Function prototype	void timer_external_trigger_as_external_clock_config(uint32_t timer_periph, uint32_t extrigger, uint16_t expolarity, uint32_t extfilter);
Function descriptions	configure TIMER the external trigger as external clock input
Precondition	-
The called functions	timer_input_trigger_source_select
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Input parameter{in}	
extrigger	external trigger selection
<i>TIMER_SMCFG_TRGS</i> <i>EL_CIOF_ED</i>	CIO edge flag (CIOF_ED)
<i>TIMER_SMCFG_TRGS</i> <i>EL_CIOFE0</i>	channel 0 input Filtered output (CIOFE0)

<i>TIMER_SMCFG_TRGS</i> <i>EL_CI1FE1</i>	channel 1 input Filtered output (CI1FE1)
Input parameter{in}	
expolarity	external trigger polarity
<i>TIMER_IC_POLARITY_</i> <i>RISING</i>	active high or rising edge active
<i>TIMER_IC_POLARITY_</i> <i>FALLING</i>	active low or falling edge active
<i>TIMER_IC_POLARITY_</i> <i>BOTH_EDGE</i>	falling edge or rising edge active
Input parameter{in}	
extfilter	external trigger filter control(0~15)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 the external trigger CI0FE0 as external clock input */
```

```
timer_external_trigger_as_external_clock_config(TIMER1,  
TIMER_SMCFG_TRGSEL_CI0FE0, TIMER_IC_POLARITY_RISING, 0);
```

timer_external_clock_mode0_config

The description of timer_external_clock_mode0_config is shown as below:

Table 3-816. Function timer_external_clock_mode0_config

Function name	timer_external_clock_mode0_config
Function prototype	void timer_external_clock_mode0_config(uint32_t timer_periph, uint32_t extprescaler, uint32_t expolarity, uint32_t extfilter);
Function descriptions	configure TIMER the external clock mode0
Precondition	-
The called functions	timer_external_trigger_config
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Input parameter{in}	
extprescaler	ETI external trigger prescaler
<i>TIMER_EXT_TRI_PSC_</i> <i>OFF</i>	no divided
<i>TIMER_EXT_TRI_PSC_</i> <i>DIV2</i>	divided by 2

<i>TIMER_EXT_TRI_PSC_DIV4</i>	divided by 4
<i>TIMER_EXT_TRI_PSC_DIV8</i>	divided by 8
Input parameter{in}	
expolarity	ETI external trigger polarity
<i>TIMER_ETP_FALLING</i>	active low or falling edge active
<i>TIMER_ETP_RISING</i>	active high or rising edge active
Input parameter{in}	
extfilter	ETI external trigger filter control(0~15)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 the external clock mode0 */
```

```
timer_external_clock_mode0_config(TIMER1,          TIMER_EXT_TRI_PSC_DIV2,
timer_ETP_FALLING, 0);
```

timer_external_clock_mode1_config

The description of timer_external_clock_mode1_config is shown as below:

Table 3-817. Function timer_external_clock_mode1_config

Function name	timer_external_clock_mode1_config
Function prototype	void timer_external_clock_mode1_config(uint32_t timer_periph, uint32_t extprescaler, uint32_t expolarity, uint32_t extfilter);
Function descriptions	configure TIMER the external clock mode1
Precondition	-
The called functions	timer_external_trigger_config
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2 for GD32L233, x=0,1,2 for GD32L235
Input parameter{in}	
extprescaler	ETI external trigger prescaler
<i>TIMER_EXT_TRI_PSC_OFF</i>	no divided
<i>TIMER_EXT_TRI_PSC_DIV2</i>	divided by 2
<i>TIMER_EXT_TRI_PSC_DIV4</i>	divided by 4

<i>TIMER_EXT_TRI_PSC_DIV8</i>	divided by 8
Input parameter{in}	
expolarity	ETI external trigger polarity
<i>TIMER_ETP_FALLING</i>	active low or falling edge active
<i>TIMER_ETP_RISING</i>	active high or rising edge active
Input parameter{in}	
extfilter	ETI external trigger filter control(0~15)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 the external clock mode1 */
```

```
timer_external_clock_mode1_config(TIMER1,          TIMER_EXT_TRI_PSC_DIV2,
timer_ETP_FALLING, 0);
```

timer_external_clock_mode1_disable

The description of timer_external_clock_mode1_disable is shown as below:

Table 3-818. Function timer_external_clock_mode1_disable

Function name	timer_external_clock_mode1_disable
Function prototype	void timer_external_clock_mode1_disable(uint32_t timer_periph);
Function descriptions	disable TIMER the external clock mode1
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	TIMER peripheral selection x=1,2 for GD32L233, x=0,1,2 for GD32L235
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TIMER1 the external clock mode1 */
```

```
timer_external_clock_mode1_disable(TIMER1);
```

timer_channel_remap_config

The description of timer_channel_remap_config is shown as below:

Table 3-819. Function timer_channel_remap_config

Function name	timer_channel_remap_config
Function prototype	void timer_channel_remap_config(uint32_t timer_periph, uint32_t remap);
Function descriptions	configure TIMER channel remap function
Precondition	-
The called functions	timer_external_trigger_config
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx(x=8, 11)</i>	TIMER peripheral selection
Input parameter{in}	
remap	remap function selection
<i>TIMER8_CIO_RMP_GPIO</i>	Timer8 channel 0 input is connected to GPIO(TIMER8_CH0) TIMERx(x=8)
<i>TIMER8_CIO_RMP_LXTAL</i>	Timer8 channel 0 input is connected to the LXTAL TIMERx(x=8)
<i>TIMER8_CIO_RMP_HXTAL_DIV32</i>	Timer8 channel 0 input is connected to HXTAL_DIV32 clock TIMERx(x=8)
<i>TIMER8_CIO_RMP_CKOUTSEL</i>	Timer8 channel 0 input is connected to CKOUTSEL TIMERx(x=8)
<i>TIMER11_CIO_RMP_GPIO</i>	Timer11 channel 0 input is connected to GPIO(TIMER11_CH0) TIMERx(x=11)
<i>TIMER11_CIO_RMP_IRC32K</i>	Timer11 channel 0 input is connected to the IRC32K TIMERx(x=11)
<i>TIMER11_CIO_RMP_LXTAL</i>	Timer11 channel 0 input is connected to LXTAL clock TIMERx(x=11)
<i>TIMER11_CIO_RMP_RTC_OUT</i>	Timer11 channel 0 input is connected to RTC_OUT TIMERx(x=11)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER8 channel 0 input is connected to GPIO */
timer_channel_remap_config(TIMER8, TIMER8_CIO_RMP_GPIO);
```

timer_write_chxval_register_config

The description of timer_write_chxval_register_config is shown as below:

Table 3-820. Function timer_write_chxval_register_config

Function name	timer_write_chxval_register_config
Function prototype	void timer_write_chxval_register_config(uint32_t timer_periph, uint16_t ccsel);
Function descriptions	configure TIMER write CHxVAL register selection
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	TIMER peripheral selection x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235
Input parameter{in}	
ccsel	write CHxVAL register selection
TIMER_CHVSEL_DISABLE	no effect
TIMER_CHVSEL_ENABLE	when write the CHxVAL register, if the write value is same as the CHxVAL value, the write access is ignored
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure TIMER1 write CHxVAL register selection */
```

```
timer_write_chxval_register_config(TIMER1, TIMER_CHVSEL_ENABLE);
```

timer_flag_get

The description of timer_flag_get is shown as below:

Table 3-821. Function timer_flag_get

Function name	timer_flag_get
Function prototype	FlagStatus timer_flag_get(uint32_t timer_periph, uint32_t flag);
Function descriptions	get TIMER flags
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
TIMERx	please refer to the following parameters
Input parameter{in}	
flag	the timer interrupt flags
TIMER_FLAG_UP	update flag TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for

	GD32L235)
<i>TIMER_FLAG_CH0</i>	channel 0 flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH1</i>	channel 1 flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH2</i>	channel 2 flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CH3</i>	channel 3 flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CMT</i>	channel commutation flag TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_FLAG_TRG</i>	trigger flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_BRK</i>	break flag TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_FLAG_CH0O</i>	channel 0 overcapture flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH1O</i>	channel 1 overcapture flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH2O</i>	channel 2 overcapture flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CH3O</i>	channel 3 overcapture flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get TIMER1 update flags */
```

```
FlagStatus Flag_status = RESET;
```

```
Flag_status = timer_flag_get(TIMER1, TIMER_FLAG_UP);
```

timer_flag_clear

The description of timer_flag_clear is shown as below:

Table 3-822. Function timer_flag_clear

Function name	timer_flag_clear
Function prototype	void timer_flag_clear(uint32_t timer_periph, uint32_t flag);
Function descriptions	clear TIMER flags
Precondition	-
The called functions	-

Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
flag	the timer interrupt flags
<i>TIMER_FLAG_UP</i>	update flag TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH0</i>	channel 0 flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH1</i>	channel 1 flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH2</i>	channel 2 flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CH3</i>	channel 3 flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CMT</i>	channel commutation flag TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_FLAG_TRG</i>	trigger flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_BRK</i>	break flag TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_FLAG_CH0O</i>	channel 0 overcapture flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH1O</i>	channel 1 overcapture flag TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_FLAG_CH2O</i>	channel 2 overcapture flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_FLAG_CH3O</i>	channel 3 overcapture flag TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear TIMER1 update flags */
```

```
timer_flag_clear(TIMER1, TIMER_FLAG_UP);
```

timer_interrupt_enable

The description of timer_interrupt_enable is shown as below:

Table 3-823. Function timer_interrupt_enable

Function name	timer_interrupt_enable
Function prototype	void timer_interrupt_enable(uint32_t timer_periph, uint32_t interrupt);
Function descriptions	enable the TIMER interrupt
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
interrupt	timer interrupt enable source
<i>TIMER_INT_UP</i>	update interrupt enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH0</i>	channel 0 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH1</i>	channel 1 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH2</i>	channel 2 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_CH3</i>	channel 3 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_CMT</i>	commutation interrupt enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_INT_TRG</i>	trigger interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_BRK</i>	break interrupt enable TIMERx(x=0,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable the TIMER1 update interrupt */
timer_interrupt_enable(TIMER1, TIMER_INT_UP);
```

timer_interrupt_disable

The description of timer_interrupt_disable is shown as below:

Table 3-824. Function timer_interrupt_disable

Function name	timer_interrupt_disable
----------------------	-------------------------

Function prototype	void timer_interrupt_disable(uint32_t timer_periph, uint32_t interrupt);
Function descriptions	disable the TIMER interrupt
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
interrupt	timer interrupt disable source
<i>TIMER_INT_UP</i>	update interrupt enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH0</i>	channel 0 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH1</i>	channel 1 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_CH2</i>	channel 2 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_CH3</i>	channel 3 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_CMT</i>	commutation interrupt enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_INT_TRG</i>	trigger interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_BRK</i>	break interrupt enable TIMERx(x=0,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable the TIMER1 update interrupt */
```

```
timer_interrupt_disable(TIMER1, TIMER_INT_UP);
```

timer_interrupt_flag_get

The description of timer_interrupt_flag_get is shown as below:

Table 3-825. Function timer_interrupt_flag_get

Function name	timer_interrupt_flag_get
Function prototype	FlagStatus timer_interrupt_flag_get(uint32_t timer_periph, uint32_t interrupt);

Function descriptions	get timer interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
interrupt	the timer interrupt bits
<i>TIMER_INT_FLAG_UP</i>	update interrupt enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH0</i>	channel 0 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH1</i>	channel 1 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH2</i>	channel 2 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_FLAG_CH3</i>	channel 3 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_FLAG_CMT</i>	commutation interrupt enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_INT_FLAG_TRG</i>	trigger interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_BRK</i>	break interrupt enable TIMERx(x=0,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get TIMER1 update interrupt flag */
```

```
FlagStatus Flag_interrupt = RESET;
```

```
Flag_interrupt = timer_interrupt_flag_get(TIMER1, TIMER_INT_FLAG_UP);
```

timer_interrupt_flag_clear

The description of timer_interrupt_flag_clear is shown as below:

Table 3-826. Function timer_interrupt_flag_clear

Function name	timer_interrupt_flag_clear
Function prototype	void timer_interrupt_flag_clear(uint32_t timer_periph, uint32_t interrupt);
Function descriptions	clear TIMER interrupt flag

Precondition	-
The called functions	-
Input parameter{in}	
timer_periph	TIMER peripheral
<i>TIMERx</i>	please refer to the following parameters
Input parameter{in}	
interrupt	the timer interrupt bits
<i>TIMER_INT_FLAG_UP</i>	update interrupt enable TIMERx(x=1,2,5,6,8,11 for GD32L233, x=0,1,2,5,6,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH0</i>	channel 0 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH1</i>	channel 1 interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_CH2</i>	channel 2 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_FLAG_CH3</i>	channel 3 interrupt enable TIMERx(x=1,2 for GD32L233, x=0,1,2 for GD32L235)
<i>TIMER_INT_FLAG_CMT</i>	commutation interrupt enable TIMERx(x=0,14,40 for GD32L235)
<i>TIMER_INT_FLAG_TRG</i>	trigger interrupt enable TIMERx(x=1,2,8,11 for GD32L233, x=0,1,2,8,11,14,40 for GD32L235)
<i>TIMER_INT_FLAG_BRK</i>	break interrupt enable TIMERx(x=0,14,40 for GD32L235)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear TIMER1 update interrupt flag */
```

```
timer_interrupt_flag_clear(TIMER1, TIMER_INT_FLAG_UP);
```

3.26. TRNG

The true random number generator (TRNG) module can generate a 32-bit value using continuous analog noise. The TRNG registers are listed in chapter [3.26.1](#). the TRNG firmware functions are introduced in chapter [3.26.2](#).

3.26.1. Descriptions of Peripheral registers

TRNG registers are listed in the table shown as below:

Table 3-827 TRNG Registers

Registers	Descriptions
TRNG_CTL	TRNG control register
TRNG_STAT	TRNG status register
TRNG_DATA	TRNG data register

3.26.2. Descriptions of Peripheral functions

TRNG firmware functions are listed in the table shown as below:

Table 3-828. TRNG firmware function

Function name	Function description
trng_deinit	deinitialize the TRNG
trng_enable	enable the TRNG
trng_disable	disable the TRNG
trng_get_true_random_data	get the true random data
trng_flag_get	get the TRNG status flags
trng_interrupt_enable	enable the TRNG interrupt
trng_interrupt_disable	disable the TRNG interrupt
trng_interrupt_flag_get	get the TRNG interrupt flags
trng_interrupt_flag_clear	clear the TRNG interrupt flags

Enum trng_flag_enum

Table 3-829. Enum trng_flag_enum

Member name	Function description
TRNG_FLAG_DRDY	random data ready status
TRNG_FLAG_CECS	clock error current status
TRNG_FLAG_SECS	seed error current status

Enum trng_int_flag_enum

Table 3-830. Enum trng_int_flag_enum

Member name	Function description
TRNG_INT_FLAG_CEIF	clock error interrupt flag
TRNG_INT_FLAG_SEIF	seed error interrupt flag

trng_deinit

The description of trng_deinit is shown as below:

Table 3-831. Function trng_deinit

Function name	trng_deinit
Function prototype	void trng_deinit(void);
Function descriptions	reset TRNG

Precondition	-
The called functions	rcu_periph_reset_enable / rcu_periph_reset_disable
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset TRNG */
```

```
trng_deinit();
```

trng_enable

The description of trng_enable is shown as below:

Table 3-832. Function trng_enable

Function name	trng_enable
Function prototype	void trng_enable(void);
Function descriptions	enable the TRNG
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TRNG */
```

```
trng_enable();
```

trng_disable

The description of trng_disable is shown as below:

Table 3-833 Function trng_disable

Function name	trng_disable
Function prototype	void trng_disable(void);
Function descriptions	disable the TRNG
Precondition	-

The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TRNG */
trng_disable();
```

trng_get_true_random_data

The description of trng_get_true_random_data is shown as below:

Table 3-834 Function trng_get_true_random_data

Function name	trng_get_true_random_data
Function prototype	uint32_t trng_get_true_random_data(void);
Function descriptions	get the true random data
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint32_t	0x0 – 0xFFFFFFFF

Example:

```
/* get true random data */
uint32_t data;
data = trng_get_true_random_data();
```

trng_flag_get

The description of trng_flag_get is shown as below:

Table 3-835 trng_flag_get

Function name	trng_flag_get
Function prototype	FlagStatus trng_flag_get(trng_flag_enum flag);
Function descriptions	get the trng status flags
Precondition	-

The called functions	-
Input parameter{in}	
flag	TRNG status flag, refer to Table 3-829. Enum trng_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get TRNG clock error current flag status */
FlagStatus flag_status = RESET;
flag_status == trng_flag_get(TRNG_FLAG_CECS);
```

trng_interrupt_enable

The description of trng_interrupt_enable is shown as below:

Table 3-836 trng_interrupt_enable

Function name	trng_interrupt_enable
Function prototype	void trng_interrupt_enable(void);
Function descriptions	enable the TRNG interrupt
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable TRNG interrupt */
trng_interrupt_enable();
```

trng_interrupt_disable

The description of trng_interrupt_disable is shown as below:

Table 3-837 trng_interrupt_disable

Function name	trng_interrupt_disable
Function prototype	void trng_interrupt_disable(void);
Function descriptions	disable the TRNG interrupt
Precondition	-

The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable TRNG interrupt */
```

```
trng_interrupt_disable();
```

trng_interrupt_flag_get

The description of trng_interrupt_flag_get is shown as below:

Table 3-838 trng_interrupt_flag_get

Function name	trng_interrupt_flag_get
Function prototype	FlagStatus trng_interrupt_flag_get(trng_int_flag_enum int_flag);
Function descriptions	get the trng interrupt flags
Precondition	-
The called functions	-
Input parameter{in}	
int_flag	TRNG interrupt flag, refer to Table 3-830. Enum trng_int_flag_enum
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get TRNG clock error interrupt flag */
```

```
FlagStatus interrupt_flag = RESET;
```

```
interrupt_flag = trng_interrupt_flag_get(TRNG_INT_FLAG_CEIF);
```

trng_interrupt_flag_clear

The description of trng_interrupt_flag_clear is shown as below:

Table 3-839 trng_interrupt_flag_clear

Function name	trng_interrupt_flag_clear
Function prototype	void trng_interrupt_flag_get(trng_int_flag_enum int_flag);
Function descriptions	clear the trng interrupt flags
Precondition	-

The called functions	-
Input parameter{in}	
int_flag	TRNG interrupt flag, refer to Table 3-830. Enum trng_int_flag_enum
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear TRNG clock error interrupt flag */
trng_interrupt_flag_clear(TRNG_INT_FLAG_CEIF);
```

3.27. USART

The Universal Synchronous/Asynchronous Receiver/Transmitter (USART) provides a flexible serial data exchange interface. The USART registers are listed in chapter [3.27.1](#), the USART firmware functions are introduced in chapter [3.27.2](#).

3.27.1. Descriptions of Peripheral registers

USART registers are listed in the table shown as below:

Table 3-840. USART Registers

Registers	Descriptions
USART_CTL0	Control register 0
USART_CTL1	Control register 1
USART_CTL2	Control register 2
USART_BAUD	Baud rate register
USART_GP	Guard time and prescaler register
USART_RT	Receiver timeout register
USART_CMD	Command register
USART_STAT	Status register
USART_INTC	Status clear register
USART_RDATA	Receive data register
USART_TDATA	Transmit data register
USART_CHC	Coherence control register
USART_RFCS	Receive FIFO control and status register

3.27.2. Descriptions of Peripheral functions

USART firmware functions are listed in the table shown as below:

Table 3-841. USART firmware function

Function name	Function description
usart_deinit	reset USART
usart_baudrate_set	configure USART baud rate value
usart_parity_config	configure USART parity function
usart_word_length_set	configure USART word length
usart_stop_bit_set	configure USART stop bit length
usart_enable	enable USART
usart_disable	disable USART
usart_transmit_config	configure USART transmitter
usart_receive_config	configure USART receiver
usart_data_first_config	data is transmitted/received with the LSB/MSB first
usart_invert_config	configure USART inverted
usart_overrun_enable	enable the USART overrun function
usart_overrun_disable	disable the USART overrun function
usart_oversample_config	configure the USART oversample mode
usart_sample_bit_config	configure sample bit method
usart_receiver_timeout_enable	enable receiver timeout
usart_receiver_timeout_disable	disable receiver timeout
usart_receiver_timeout_threshold_config	configure receiver timeout threshold
usart_data_transmit	USART transmit data function
usart_data_receive	USART receive data function
usart_command_enable	enable USART command
usart_address_config	configure address of the USART
usart_address_detection_mode_config	configure address detection mode
usart_mute_mode_enable	enable mute mode
usart_mute_mode_disable	disable mute mode
usart_mute_mode_wakeup_config	configure wakeup method in mute mode
usart_lin_mode_enable	enable LIN mode
usart_lin_mode_disable	disable LIN mode
usart_lin_break_detection_length_config	LIN break detection length
usart_halfduplex_enable	enable half-duplex mode
usart_halfduplex_disable	disable half-duplex mode
usart_clock_enable	enable clock
usart_clock_disable	disable clock
usart_synchronous_clock_config	configure USART synchronous mode parameters
usart_guard_time_config	configure guard time value in smartcard mode
usart_smartcard_mode_enable	enable smartcard mode
usart_smartcard_mode_disable	disable smartcard mode

Function name	Function description
usart_smartcard_mode_nack_enable	enable NACK in smartcard mode
usart_smartcard_mode_nack_disable	disable NACK in smartcard mode
usart_smartcard_mode_early_nack_enable	enable early NACK in smartcard mode
usart_smartcard_mode_early_nack_disable	disable early NACK in smartcard mode
usart_smartcard_autoretry_config	configure smartcard auto-retry number
usart_block_length_config	configure block length
usart_irda_mode_enable	enable IrDA mode
usart_irda_mode_disable	disable IrDA mode
usart_prescaler_config	configure the peripheral clock prescaler
usart_irda_lowpower_config	configure IrDA low-power
usart_hardware_flow_rts_config	configure hardware flow control RTS
usart_hardware_flow_cts_config	configure hardware flow control CTS
usart_hardware_flow_coherence_config	configure hardware flow control coherence mode
usart_rs485_driver_enable	enable RS485 driver
usart_rs485_driver_disable	disable RS485 driver
usart_driver_asserttime_config	configure driver enable assertion time
usart_driver_deasserttime_config	configure driver enable de-assertion time
usart_depolarity_config	configure driver enable polarity mode
usart_dma_receive_config	configure USART DMA for reception
usart_dma_transmit_config	configure USART DMA for transmission
usart_reception_error_dma_disable	disable DMA on reception error
usart_reception_error_dma_enable	enable DMA on reception error
usart_wakeup_enable	enable USART to wakeup the mcu from deep-sleep mode
usart_wakeup_disable	disable USART to wakeup the mcu from deep-sleep mode
usart_wakeup_mode_config	configure the USART wakeup mode from deep-sleep mode
usart_receive_fifo_enable	enable receive FIFO
usart_receive_fifo_disable	disable receive FIFO
usart_receive_fifo_counter_number	read receive FIFO counter number
usart_flag_get	get flag in STAT/RFCs register
usart_flag_clear	clear USART status
usart_interrupt_enable	enable USART interrupt
usart_interrupt_disable	disable USART interrupt
usart_interrupt_flag_get	get USART interrupt and flag status
usart_interrupt_flag_clear	clear USART interrupt flag

Enum usart_flag_enum

Table 3-842. Enum usart_flag_enum

Member name	Function description
USART_FLAG_REA	receive enable acknowledge flag
USART_FLAG_TEA	transmit enable acknowledge flag
USART_FLAG_WU	wakeup from Deep-sleep mode flag
USART_FLAG_RWU	receiver wakeup from mute mode
USART_FLAG_SB	send break flag
USART_FLAG_AM	ADDR match flag
USART_FLAG_BSY	busy flag
USART_FLAG_EB	end of block flag
USART_FLAG_RT	receiver timeout flag
USART_FLAG_CTS	CTS level
USART_FLAG_CTSF	CTS change flag
USART_FLAG_LBD	LIN break detected flag
USART_FLAG_TBE	transmit data buffer empty
USART_FLAG_TC	transmission complete
USART_FLAG_RBNE	read data buffer not empty
USART_FLAG_IDLE	IDLE line detected flag
USART_FLAG_ORERR	overrun error
USART_FLAG_NERR	noise error flag
USART_FLAG_FERR	frame error flag
USART_FLAG_PERR	parity error flag
USART_FLAG_EPERR	early parity error flag
USART_FLAG_RFFINT	receive FIFO full interrupt flag
USART_FLAG_RFF	receive FIFO full flag
USART_FLAG_RFE	receive FIFO empty flag

Enum usart_interrupt_flag_enum

Table 3-843. Enum usart_interrupt_flag_enum

Member name	Function description
USART_INT_FLAG_EB	end of block interrupt and flag
USART_INT_FLAG_RT	receiver timeout interrupt and flag
USART_INT_FLAG_AM	address match interrupt and flag
USART_INT_FLAG_PERR	parity error interrupt and flag
USART_INT_FLAG_TBE	transmitter buffer empty interrupt and flag
USART_INT_FLAG_TC	transmission complete interrupt and flag
USART_INT_FLAG_RBNE	read data buffer not empty interrupt and flag
USART_INT_FLAG_RBNE_ORERR	read data buffer not empty interrupt and overrun error flag
USART_INT_FLAG_IDLE	IDLE line detected interrupt and flag

Member name	Function description
USART_INT_FLAG_LBD	LIN break detected interrupt and flag
USART_INT_FLAG_WU	wakeup from deep-sleep mode interrupt and flag
USART_INT_FLAG_CTS	CTS interrupt and flag
USART_INT_FLAG_ERR_NERR	error interrupt and noise error flag
USART_INT_FLAG_ERR_ORERR	error interrupt and overrun error
USART_INT_FLAG_ERR_FERR	error interrupt and frame error flag
USART_INT_FLAG_RFF	receive FIFO full interrupt and flag

Enum usart_interrupt_enum

Table 3-844. Enum usart_interrupt_enum

Member name	Function description
USART_INT_EB	end of block interrupt
USART_INT_RT	receiver timeout interrupt
USART_INT_AM	address match interrupt
USART_INT_PERR	parity error interrupt
USART_INT_TBE	transmitter buffer empty interrupt
USART_INT_TC	transmission complete interrupt
USART_INT_RBNE	read data buffer not empty interrupt and overrun error interrupt
USART_INT_IDLE	IDLE line detected interrupt
USART_INT_LBD	LIN break detected interrupt
USART_INT_WU	wakeup from deep-sleep mode interrupt
USART_INT_CTS	CTS interrupt
USART_INT_ERR	error interrupt
USART_INT_RFF	receive FIFO full interrupt

Enum usart_invert_enum

Table 3-845. Enum usart_invert_enum

Member name	Function description
USART_DINV_ENABLE	data bit level inversion
USART_DINV_DISABLE	data bit level not inversion
USART_TXPIN_ENABLE	TX pin level inversion
USART_TXPIN_DISABLE	TX pin level not inversion
USART_RXPIN_ENABLE	RX pin level inversion
USART_RXPIN_DISABLE	RX pin level not inversion
USART_SWAP_ENABLE	swap TX/RX pins
USART_SWAP_DISABLE	not swap TX/RX pins

usart_deinit

The description of usart_deinit is shown as below:

Table 3-846. Function `usart_deinit`

Function name	<code>usart_deinit</code>
Function prototype	<code>void usart_deinit(uint32_t usart_periph);</code>
Function descriptions	reset USART
Precondition	-
The called functions	<code>rcu_periph_reset_enable</code> / <code>rcu_periph_reset_disable</code>
Input parameter{in}	
<code>usart_periph</code>	外设USARTx/UARTx
<code>USARTx</code>	x=0,1
<code>UARTx</code>	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset USART0 */
usart_deinit(USART0);
```

`usart_baudrate_set`

The description of `usart_baudrate_set` is shown as below:

Table 3-847. Function `usart_baudrate_set`

Function name	<code>usart_baudrate_set</code>
Function prototype	<code>void usart_baudrate_set(uint32_t usart_periph, uint32_t baudval);</code>
Function descriptions	configure USART baud rate value
Precondition	-
The called functions	<code>rcu_clock_freq_get</code>
Input parameter{in}	
<code>usart_periph</code>	外设USARTx/UARTx
<code>USARTx</code>	x=0,1
<code>UARTx</code>	x=3,4
Input parameter{in}	
<code>baudval</code>	baud rate value
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 baud rate value */
usart_baudrate_set(USART0, 115200);
```


usart_parity_config

The description of usart_parity_config is shown as below:

Table 3-848. Function usart_parity_config

Function name	usart_parity_config
Function prototype	void usart_parity_config(uint32_t usart_periph, uint32_t paritycfg);
Function descriptions	configure USART parity function
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
paritycfg	configure USART parity
USART_PM_NONE	no parity
USART_PM_ODD	odd parity
USART_PM_EVEN	even parity
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 parity */
usart_parity_config(USART0, USART_PM_EVEN);
```

usart_word_length_set

The description of usart_word_length_set is shown as below:

Table 3-849. Function usart_word_length_set

Function name	usart_word_length_set
Function prototype	void usart_word_length_set(uint32_t usart_periph, uint32_t wlen);
Function descriptions	configure USART word length
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
wlen	USART word length configure

<i>USART_WL_8BIT</i>	8 bits
<i>USART_WL_9BIT</i>	9 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 word length */
```

```
usart_word_length_set(USART0, USART_WL_9BIT);
```

usart_stop_bit_set

The description of usart_stop_bit_set is shown as below:

Table 3-850. Function usart_stop_bit_set

Function name	usart_stop_bit_set
Function prototype	void usart_stop_bit_set(uint32_t usart_periph, uint32_t stblen);
Function descriptions	configure USART stop bit length
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
stblen	USART stop bit configure
<i>USART_STB_1BIT</i>	1 bit
<i>USART_STB_0_5BIT</i>	0.5 bit
<i>USART_STB_2BIT</i>	2 bits
<i>USART_STB_1_5BIT</i>	1.5 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 stop bit length */
```

```
usart_stop_bit_set(USART0, USART_STB_1_5BIT);
```

usart_enable

The description of usart_enable is shown as below:

Table 3-851. Function `usart_enable`

Function name	<code>usart_enable</code>
Function prototype	<code>void usart_enable(uint32_t usart_periph);</code>
Function descriptions	enable USART
Precondition	-
The called functions	-
Input parameter{in}	
<code>usart_periph</code>	外设USARTx/UARTx
<code>USARTx</code>	x=0,1
<code>UARTx</code>	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 */
usart_enable(USART0);
```

`usart_disable`

The description of `usart_disable` is shown as below:

Table 3-852. Function `usart_disable`

Function name	<code>usart_disable</code>
Function prototype	<code>void usart_disable(uint32_t usart_periph);</code>
Function descriptions	disable USART
Precondition	-
The called functions	-
Input parameter{in}	
<code>usart_periph</code>	外设USARTx/UARTx
<code>USARTx</code>	x=0,1
<code>UARTx</code>	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 */
usart_disable(USART0);
```

usart_transmit_config

The description of usart_transmit_config is shown as below:

Table 3-853. Function usart_transmit_config

Function name	usart_transmit_config
Function prototype	void usart_transmit_config(uint32_t usart_periph, uint32_t txconfig);
Function descriptions	configure USART transmitter
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
txconfig	enable or disable USART transmitter
USART_TRANSMIT_ENABLE	enable USART transmission
USART_TRANSMIT_DISABLE	disable USART transmission
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 transmitter */
```

```
usart_transmit_config(USART0,USART_TRANSMIT_ENABLE);
```

usart_receive_config

The description of usart_receive_config is shown as below:

Table 3-854. Function usart_receive_config

Function name	usart_receive_config
Function prototype	void usart_receive_config(uint32_t usart_periph, uint32_t rxconfig);
Function descriptions	configure USART receiver
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	

rxconfig	enable or disable USART receiver
<i>USART_RECEIVE_ENABLE</i>	enable USART reception
<i>USART_RECEIVE_DISABLE</i>	disable USART reception
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 receiver */
```

```
usart_receive_config(USART0, USART_RECEIVE_ENABLE);
```

usart_data_first_config

The description of usart_data_first_config is shown as below:

Table 3-855. Function usart_data_first_config

Function name	usart_data_first_config
Function prototype	void usart_data_first_config(uint32_t usart_periph, uint32_t msbf);
Function descriptions	data is transmitted/received with the LSB/MSB first
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
msbf	LSB/MSB
<i>USART_MSBF_LSB</i>	LSB first
<i>USART_MSBF_MSB</i>	MSB first
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LSB of data first */
```

```
usart_data_first_config(USART0, USART_MSBF_LSB);
```

usart_invert_config

The description of usart_invert_config is shown as below:

Table 3-856. Function usart_invert_config

Function name	usart_invert_config
Function prototype	void usart_invert_config(uint32_t usart_periph, usart_invert_enum invertpara);
Function descriptions	configure USART inverted
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
invertpara	refer to Table 3-845. Enum usart_invert_enum
USART_DINV_ENAB LE	data bit level inversion
USART_DINV_DISAB LE	data bit level not inversion
USART_TXPIN_ENAB LE	TX pin level inversion
USART_TXPIN_DISAB LE	TX pin level not inversion
USART_RXPIN_ENAB LE	RX pin level inversion
USART_RXPIN_DISAB LE	RX pin level not inversion
USART_SWAP_ENAB LE	swap TX/RX pins
USART_SWAP_DISAB LE	not swap TX/RX pins
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 inversion */
```

```
usart_invert_config(USART0, USART_DINV_ENABLE);
```

usart_overrun_enable

The description of usart_overrun_enable is shown as below:

Table 3-857. Function usart_overrun_enable

Function name	usart_overrun_enable
Function prototype	void usart_overrun_enable(uint32_t usart_periph);
Function descriptions	enable the USART overrun function
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 overrun */
usart_overrun_enable(USART0);
```

usart_overrun_disable

The description of usart_overrun_disable is shown as below:

Table 3-858. Function usart_overrun_disable

Function name	usart_overrun_disable
Function prototype	void usart_overrun_disable(uint32_t usart_periph);
Function descriptions	disable the USART overrun function
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 overrun */
```

```
usart_overrun_disable(USART0);
```

usart_oversample_config

The description of usart_oversample_config is shown as below:

Table 3-859. Function usart_oversample_config

Function name	usart_oversample_config
Function prototype	void usart_oversample_config(uint32_t usart_periph, uint32_t oversamp);
Function descriptions	configure the USART oversample mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
oversamp	oversample value
USART_OVSMOD_8	oversampling by 8
USART_OVSMOD_16	oversampling by 16
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* config USART0 oversampling by 8 */
```

```
usart_oversample_config(USART0, USART_OVSMOD_8);
```

usart_sample_bit_config

The description of usart_sample_bit_config is shown as below:

Table 3-860. Function usart_sample_bit_config

Function name	usart_sample_bit_config
Function prototype	void usart_sample_bit_config(uint32_t usart_periph, uint32_t osb);
Function descriptions	configure the sample bit method
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	

osb	sample bit
<i>USART_OSB_1BIT</i>	1 bit
<i>USART_OSB_3BIT</i>	3 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* config USART0 1 bit sample mode */
usart_sample_bit_config(USART0, USART_OSB_1BIT);
```

usart_receiver_timeout_enable

The description of usart_receiver_timeout_enable is shown as below:

Table 3-861. Function usart_receiver_timeout_enable

Function name	usart_receiver_timeout_enable
Function prototype	void usart_receiver_timeout_enable(uint32_t usart_periph);
Function descriptions	enable receiver timeout
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 receiver timeout */
usart_receiver_timeout_enable(USART0);
```

usart_receiver_timeout_disable

The description of usart_receiver_timeout_disable is shown as below:

Table 3-862. Function usart_receiver_timeout_disable

Function name	usart_receiver_timeout_disable
Function prototype	void usart_receiver_timeout_disable(uint32_t usart_periph);
Function descriptions	disable receiver timeout
Precondition	-

The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 receiver timeout */
usart_receiver_timeout_disable(USART0);
```

usart_receiver_timeout_threshold_config

The description of usart_receiver_timeout_threshold_config is shown as below:

Table 3-863. Function usart_receiver_timeout_threshold_config

Function name	usart_receiver_timeout_threshold_config
Function prototype	void usart_receiver_timeout_threshold_config(uint32_t usart_periph, uint32_t rtimeout);
Function descriptions	configure receiver timeout threshold
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
rtimeout	receiver timeout (0x00000000-0x00FFFFFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set the receiver timeout threshold of USART0*/
usart_receiver_timeout_threshold_config(USART0, 115200*3);
```

usart_data_transmit

The description of usart_data_transmit is shown as below:

Table 3-864. Function usart_data_transmit

Function name	usart_data_transmit
Function prototype	void usart_data_transmit(uint32_t usart_periph, uint16_t data);
Function descriptions	USART transmit data function
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
data	data of transmission (0x00-0xFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 transmit data */
usart_data_transmit(USART0, 0xAA);
```

usart_data_receive

The description of usart_data_receive is shown as below:

Table 3-865. Function usart_data_receive

Function name	usart_data_receive
Function prototype	uint16_t usart_data_receive(uint32_t usart_periph);
Function descriptions	USART receive data function
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
uint16_t	data of received (0x00-0xFF)

Example:

```
/* USART0 receive data */
uint16_t temp;
```

```
temp = usart_data_receive(USART0);
```

usart_command_enable

The description of usart_command_enable is shown as below:

Table 3-866. Function usart_command_enable

Function name	usart_command_enable
Function prototype	void usart_command_enable(uint32_t usart_periph, uint32_t cmdtype);
Function descriptions	enable USART command
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
cmdtype	command type
USART_CMD_SBKCM D	send break command
USART_CMD_MMCM	mute mode command
USART_CMD_RXFCM D	receive data flush command
USART_CMD_TXFCM D	transmit data flush request
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 command */
```

```
usart_command_enable(USART0, USART_CMD_SBKCM);
```

usart_address_config

The description of usart_address_config is shown as below:

Table 3-867. Function usart_address_config

Function name	usart_address_config
Function prototype	void usart_address_config(uint32_t usart_periph, uint8_t addr);
Function descriptions	configure the address of the USART
Precondition	-
The called functions	-

Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
addr	address of USART (0x00-0xFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure address of the USART0 */
usart_address_config(USART0, 0x00);
```

usart_address_detection_mode_config

The description of usart_address_detection_mode_config is shown as below:

Table 3-868. Function usart_address_detection_mode_config

Function name	usart_address_detection_mode_config
Function prototype	void usart_address_detection_mode_config(uint32_t usart_periph, uint32_t addmod);
Function descriptions	configure address detection mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
addmod	address detection mode
<i>USART_ADDDM_4BIT</i>	4 bits
<i>USART_ADDDM_FULLBIT</i>	full bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/*configure address detection mode */
usart_address_config(USART0, USART_ADDDM_4BIT);
```

usart_mute_mode_enable

The description of usart_mute_mode_enable is shown as below:

Table 3-869. Function usart_mute_mode_enable

Function name	usart_mute_mode_enable
Function prototype	void usart_mute_mode_enable(uint32_t usart_periph);
Function descriptions	enable mute mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 receiver in mute mode */
```

```
usart_mute_mode_enable(USART0);
```

usart_mute_mode_disable

The description of usart_mute_mode_disable is shown as below:

Table 3-870. Function usart_mute_mode_disable

Function name	usart_mute_mode_disable
Function prototype	void usart_mute_mode_disable(uint32_t usart_periph);
Function descriptions	disable mute mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 receiver in mute mode */
```

```
usart_mute_mode_disable(USART0);
```

usart_mute_mode_wakeup_config

The description of usart_mute_mode_wakeup_config is shown as below:

Table 3-871. Function usart_mute_mode_wakeup_config

Function name	usart_mute_mode_wakeup_config
Function prototype	void usart_mute_mode_wakeup_config(uint32_t usart_periph, uint32_t wmethod);
Function descriptions	configure wakeup method in mute mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
wmethod	two methods be used to enter or exit the mute mode
USART_WM_IDLE	idle line
USART_WM_ADDR	address mask
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 wakeup method in mute mode */
```

```
usart_mute_mode_wakeup_config(USART0, USART_WM_IDLE);
```

usart_lin_mode_enable

The description of usart_lin_mode_enable is shown as below:

Table 3-872. Function usart_lin_mode_enable

Function name	usart_lin_mode_enable
Function prototype	void usart_lin_mode_enable(uint32_t usart_periph);
Function descriptions	enable LIN mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Output parameter{out}	

-	-
Return value	
-	-

Example:

```
/* USART0 LIN mode enable */
```

```
usart_lin_mode_enable(USART0);
```

usart_lin_mode_disable

The description of usart_lin_mode_disable is shown as below:

Table 3-873. Function usart_lin_mode_disable

Function name	usart_lin_mode_disable
Function prototype	void usart_lin_mode_disable(uint32_t usart_periph);
Function descriptions	disable LIN mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 LIN mode disable */
```

```
usart_lin_mode_disable(USART0);
```

usart_lin_break_dection_length_config

The description of usart_lin_break_dection_length_config is shown as below:

Table 3-874. Function usart_lin_break_dection_length_config

Function name	usart_lin_break_dection_length_config
Function prototype	void usart_lin_break_dection_length_config(uint32_t usart_periph, uint32_t lflen);
Function descriptions	LIN break detection length
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral

USARTx	x=0,1
Input parameter{in}	
lblen	two methods be used to enter or exit the mute mode
USART_LBLEN_10B	10 bits
USART_LBLEN_11B	11 bits
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure LIN break frame length */
```

```
usart_lin_break_dection_length_config(USART0, USART_LBLEN_10B);
```

usart_halfduplex_enable

The description of usart_halfduplex_enable is shown as below:

Table 3-875. Function usart_halfduplex_enable

Function name	usart_halfduplex_enable
Function prototype	void usart_halfduplex_enable(uint32_t usart_periph);
Function descriptions	enable half-duplex mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 half duplex mode*/
```

```
usart_halfduplex_enable(USART0);
```

usart_halfduplex_disable

The description of usart_halfduplex_disable is shown as below:

Table 3-876. Function usart_halfduplex_disable

Function name	usart_halfduplex_disable
----------------------	--------------------------

Function prototype	void usart_halfduplex_disable(uint32_t usart_periph);
Function descriptions	disable half-duplex mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 half duplex mode*/
```

```
usart_halfduplex_disable(USART0);
```

usart_clock_enable

The description of usart_clock_enable is shown as below:

Table 3-877. Function usart_clock_enable

Function name	usart_clock_enable
Function prototype	void usart_clock_enable(uint32_t usart_periph);
Function descriptions	enable clock
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0, 1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable clock */
```

```
usart_clock_enable(USART0);
```

usart_clock_disable

The description of usart_clock_disable is shown as below:

Table 3-878. Function usart_clock_disable

Function name	usart_clock_disable
Function prototype	void usart_clock_disable(uint32_t usart_periph);
Function descriptions	disable clock
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0, 1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable clock */
```

```
usart_clock_disable(USART0);
```

usart_synchronous_clock_config

The description of usart_synchronous_clock_config is shown as below:

Table 3-879. Function usart_synchronous_clock_config

Function name	usart_synchronous_clock_config
Function prototype	void usart_synchronous_clock_config(uint32_t usart_periph, uint32_t clen, uint32_t cph, uint32_t cpl);
Function descriptions	configure USART synchronous mode parameters
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
clen	last bit clock pulse
<i>USART_CLEN_NONE</i>	clock pulse of the last data bit (MSB) is not output to the CK pin
<i>USART_CLEN_EN</i>	clock pulse of the last data bit (MSB) is output to the CK pin
Input parameter{in}	
cph	clock phase
<i>USART_CPH_1CK</i>	first clock transition is the first data capture edge
<i>USART_CPH_2CK</i>	second clock transition is the first data capture edge
Input parameter{in}	
cpl	clock polarity
<i>USART_CPL_LOW</i>	steady low value on CK pin

<i>USART_CPL_HIGH</i>	steady high value on CK pin
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 synchronous mode parameters */
```

```
usart_synchronous_clock_config(USART0,          USART_CLEN_EN,USART_CPH_2CK,
USART_CPL_HIGH);
```

usart_guard_time_config

The description of usart_guard_time_config is shown as below:

Table 3-880. Function usart_guard_time_config

Function name	usart_guard_time_config
Function prototype	void usart_guard_time_config(uint32_t usart_periph,uint32_t guat);
Function descriptions	configure guard time value in smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
guat	guard time value (0x00-0x000000FF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 guard time value in smartcard mode */
```

```
usart_guard_time_config(USART0, 0x0000 0055);
```

usart_smartcard_mode_enable

The description of usart_smartcard_mode_enable is shown as below:

Table 3-881. Function usart_smartcard_mode_enable

Function name	usart_smartcard_mode_enable
Function prototype	void usart_smartcard_mode_enable(uint32_t usart_periph);
Function descriptions	enable smartcard mode

Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 smartcard mode enable */
usart_smartcard_mode_enable(USART0);
```

usart_smartcard_mode_disable

The description of usart_smartcard_mode_disable is shown as below:

Table 3-882. Function usart_smartcard_mode_disable

Function name	usart_smartcard_mode_disable
Function prototype	void usart_smartcard_mode_disable(uint32_t usart_periph);
Function descriptions	disable smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 smartcard mode disable */
usart_smartcard_mode_disable(USART0);
```

usart_smartcard_mode_nack_enable

The description of usart_smartcard_mode_nack_enable is shown as below:

Table 3-883. Function usart_smartcard_mode_nack_enable

Function name	usart_smartcard_mode_nack_enable
Function prototype	void usart_smartcard_mode_nack_enable(uint32_t usart_periph);

Function descriptions	enable NACK in smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 NACK in smartcard mode */
usart_smartcard_mode_nack_enable(USART0);
```

usart_smartcard_mode_nack_disable

The description of usart_smartcard_mode_nack_disable is shown as below:

Table 3-884. Function usart_smartcard_mode_nack_disable

Function name	usart_smartcard_mode_nack_disable
Function prototype	void usart_smartcard_mode_nack_disable(uint32_t usart_periph);
Function descriptions	disable NACK in smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 NACK in smartcard mode */
usart_smartcard_mode_nack_disable(USART0);
```

usart_smartcard_mode_early_nack_enable

The description of usart_smartcard_mode_early_nack_enable is shown as below:

Table 3-885. Function usart_smartcard_mode_early_nack_enable

Function name	usart_smartcard_mode_early_nack_enable
----------------------	--

Function prototype	void usart_smartcard_mode_early_nack_enable(uint32_t usart_periph);
Function descriptions	enable early NACK in smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 early NACK in smartcard mode */
usart_smartcard_mode_early_nack_enable(USART0);
```

usart_smartcard_mode_early_nack_disable

The description of usart_smartcard_mode_early_nack_disable is shown as below:

Table 3-886. Function usart_smartcard_mode_early_nack_disable

Function name	usart_smartcard_mode_early_nack_disable
Function prototype	void usart_smartcard_mode_early_nack_disable(uint32_t usart_periph);
Function descriptions	disable early NACK in smartcard mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 early NACK in smartcard mode */
usart_smartcard_mode_early_nack_disable(USART0);
```

usart_smartcard_autoretry_config

The description of usart_smartcard_autoretry_config is shown as below:

Table 3-887. Function `usart_smartcard_autoretry_config`

Function name	<code>usart_smartcard_autoretry_config</code>
Function prototype	<code>void usart_smartcard_autoretry_config(uint32_t usart_periph, uint32_t scrtnum);</code>
Function descriptions	configure smartcard auto-retry number
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
scrtnum	smartcard auto-retry number (0x00-0x00000007)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure smartcard auto-retry number */
usart_smartcard_autoretry_config(USART0, 0x00000007);
```

`usart_block_length_config`

The description of `usart_block_length_config` is shown as below:

Table 3-888. Function `usart_block_length_config`

Function name	<code>usart_block_length_config</code>
Function prototype	<code>void usart_block_length_config(uint32_t usart_periph, uint32_t bl);</code>
Function descriptions	configure block length
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
bl	block length(0x00-0x000000FF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure block length in Smartcard T=1 reception */
```



```
usart_block_length_config(USART0, 0x000000FF);
```

usart_irda_mode_enable

The description of usart_irda_mode_enable is shown as below:

Table 3-889. Function usart_irda_mode_enable

Function name	usart_irda_mode_enable
Function prototype	void usart_irda_mode_enable(uint32_t usart_periph);
Function descriptions	enable IrDA mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 IrDA mode */
```

```
usart_irda_mode_enable(USART0);
```

usart_irda_mode_disable

The description of usart_irda_mode_disable is shown as below:

Table 3-890. Function usart_irda_mode_disable

Function name	usart_irda_mode_disable
Function prototype	void usart_irda_mode_disable(uint32_t usart_periph);
Function descriptions	disable IrDA mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 IrDA mode */
```

```
usart_irda_mode_disable(USART0);
```

usart_prescaler_config

The description of usart_prescaler_config is shown as below:

Table 3-891. Function usart_prescaler_config

Function name	usart_prescaler_config
Function prototype	void usart_prescaler_config(uint32_t usart_periph, uint8_t psc);
Function descriptions	configure the peripheral clock prescaler
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
psc	clock prescaler (0x00-0xFF)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure the USART0 peripheral clock prescaler in USART IrDA low-power mode */
```

```
usart_prescaler_config(USART0, 0x00);
```

usart_irda_lowpower_config

The description of usart_irda_lowpower_config is shown as below:

Table 3-892. Function usart_irda_lowpower_config

Function name	usart_irda_lowpower_config
Function prototype	void usart_irda_lowpower_config(uint32_t usart_periph, uint32_t irlp);
Function descriptions	configure IrDA low-power
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
irlp	IrDA low-power or normal
USART_IRLP_LOW	low-power
USART_IRLP_NORMAL	normal

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 IrDA low-power */
```

```
usart_irda_lowpower_config(USART0, USART_IRLP_LOW);
```

usart_hardware_flow_rts_config

The description of usart_hardware_flow_rts_config is shown as below:

Table 3-893. Function usart_hardware_flow_rts_config

Function name	usart_hardware_flow_rts_config
Function prototype	void usart_hardware_flow_rts_config(uint32_t usart_periph, uint32_t rtsconfig);
Function descriptions	configure hardware flow control RTS
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
rtsconfig	enable or disable RTS
USART_RTS_ENABLE	enable RTS
USART_RTS_DISABLE	disable RTS
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 hardware flow control RTS */
```

```
usart_hardware_flow_rts_config(USART0, USART_RTS_ENABLE);
```

usart_hardware_flow_cts_config

The description of usart_hardware_flow_cts_config is shown as below:

Table 3-894. Function usart_hardware_flow_cts_config

Function name	usart_hardware_flow_cts_config
---------------	--------------------------------

Function prototype	void usart_hardware_flow_cts_config(uint32_t usart_periph, uint32_t ctsconfig);
Function descriptions	configure hardware flow control CTS
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
ctsconfig	enable or disable CTS
USART_CTS_ENABLE	enable CTS
USART_CTS_DISABLE	disable CTS
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 hardware flow control CTS */
```

```
usart_hardware_flow_cts_config(USART0, USART_CTS_ENABLE);
```

usart_hardware_flow_coherence_config

The description of usart_hardware_flow_coherence_config is shown as below:

Table 3-895. Function usart_hardware_flow_coherence_config

Function name	usart_hardware_flow_coherence_config
Function prototype	void usart_hardware_flow_coherence_config(uint32_t usart_periph, uint32_t hcm);
Function descriptions	configure hardware flow control coherence mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
hcm	Hardware flow control coherence mode
USART_HCM_NONE	nRTS signal equals to the rxne status register
USART_HCM_EN	nRTS signal is set when the last data bit has been sampled
Output parameter{out}	
-	-
Return value	

-	-
---	---

Example:

```
/* configure hardware flow control coherence mode */
```

```
usart_hardware_flow_coherence_config(USART0, USART_HCM_NONE);
```

usart_rs485_driver_enable

The description of usart_rs485_driver_enable is shown as below:

Table 3-896. Function usart_rs485_driver_enable

Function name	usart_rs485_driver_enable
Function prototype	void usart_rs485_driver_enable(uint32_t usart_periph);
Function descriptions	enable USART RS485 driver
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 RS485 driver */
```

```
usart_rs485_driver_enable(USART0);
```

usart_rs485_driver_disable

The description of usart_rs485_driver_disable is shown as below:

Table 3-897. Function usart_rs485_driver_disable

Function name	usart_rs485_driver_disable
Function prototype	void usart_rs485_driver_disable(uint32_t usart_periph);
Function descriptions	disable USART RS485 driver
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Output parameter{out}	
-	-

Return value	
-	-

Example:

```
/* disable USART0 RS485 driver */

usart_rs485_driver_disable(USART0);
```

usart_driver_assertime_config

The description of usart_driver_assertime_config is shown as below:

Table 3-898. Function usart_driver_assertime_config

Function name	usart_driver_assertime_config
Function prototype	void usart_driver_assertime_config(uint32_t usart_periph, uint32_t deatime);
Function descriptions	configure driver enable assertion time
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Input parameter{in}	
deatime	driver enable assertion time (0x00-0x0000001F)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set USART0 driver assertime */

usart_driver_assertime_config(USART0, 0x0000001F);
```

usart_driver_deassertime_config

The description of usart_driver_deassertime_config is shown as below:

Table 3-899. Function usart_driver_deassertime_config

Function name	usart_driver_deassertime_config
Function prototype	void usart_driver_deassertime_config(uint32_t usart_periph, uint32_t dedtime);
Function descriptions	configure driver enable de-assertion time
Precondition	-
The called functions	-

Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
dedtime	driver enable de-assertion time (0x00-0x0000001F)
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* set USART0 driver deasserttime */
```

```
usart_driver_deasserttime_config(USART0, 0x0000001F);
```

usart_depolarity_config

The description of usart_depolarity_config is shown as below:

Table 3-900. Function usart_depolarity_config

Function name	usart_depolarity_config
Function prototype	void usart_depolarity_config(uint32_t usart_periph, uint32_t dep);
Function descriptions	configure driver enable polarity mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
dep	DE signal
<i>USART_DEP_HIGH</i>	DE signal is active high
<i>USART_DEP_LOW</i>	DE signal is active low
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure driver enable polarity mode */
```

```
usart_depolarity_config(USART0, USART_DEP_HIGH);
```

usart_dma_receive_config

The description of usart_dma_receive_config is shown as below:

Table 3-901. Function `usart_dma_receive_config`

Function name	<code>usart_dma_receive_config</code>
Function prototype	<code>void usart_dma_receive_config(uint32_t usart_periph, uint32_t dmacmd);</code>
Function descriptions	configure USART DMA for reception
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
dmacmd	enable or disable DMA for reception
<i>USART_RECEIVE_DMA_ENABLE</i>	DMA enable for reception
<i>USART_RECEIVE_DMA_DISABLE</i>	DMA disable for reception
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 DMA enable for reception */
```

```
usart_dma_receive_config(USART0, USART_RECEIVE_DMA_ENABLE);
```

usart_dma_transmit_config

The description of `usart_dma_transmit_config` is shown as below:

Table 3-902. Function `usart_dma_transmit_config`

Function name	<code>usart_dma_transmit_config</code>
Function prototype	<code>void usart_dma_transmit_config(uint32_t usart_periph, uint32_t dmacmd);</code>
Function descriptions	configure USART DMA for transmission
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
<i>USARTx</i>	x=0,1
<i>UARTx</i>	x=3,4
Input parameter{in}	
dmacmd	enable or disable DMA for transmission
<i>USART_TRANSMIT_DMA_ENABLE</i>	DMA enable for transmission

USART_TRANSMIT_DMA_DISABLE	DMA disable for transmission
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 DMA enable for transmission */
```

```
usart_dma_transmit_config(USART0, USART_TRANSMIT_DMA_ENABLE);
```

usart_reception_error_dma_disable

The description of usart_reception_error_dma_disable is shown as below:

Table 3-903. Function usart_reception_error_dma_disable

Function name	usart_reception_error_dma_disable
Function prototype	void usart_reception_error_dma_disable(uint32_t usart_periph);
Function descriptions	disable DMA on reception error
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable DMA on reception error */
```

```
usart_reception_error_dma_disable(USART0);
```

usart_reception_error_dma_enable

The description of usart_reception_error_dma_enable is shown as below:

Table 3-904. Function usart_reception_error_dma_enable

Function name	usart_reception_error_dma_enable
Function prototype	void usart_reception_error_dma_enable(uint32_t usart_periph);
Function descriptions	enable DMA on reception error
Precondition	-

The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable DMA on reception error */
```

```
usart_reception_error_dma_enable(USART0);
```

usart_wakeup_enable

The description of usart_wakeup_enable is shown as below:

Table 3-905. Function usart_wakeup_enable

Function name	usart_wakeup_enable
Function prototype	void usart_wakeup_enable(uint32_t usart_periph);
Function descriptions	enable USART to wakeup the mcu from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
USARTx	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 wake up enable */
```

```
usart_wakeup_enable(USART0);
```

usart_wakeup_disable

The description of usart_wakeup_disable is shown as below:

Table 3-906. Function usart_wakeup_disable

Function name	usart_wakeup_disable
Function prototype	void usart_wakeup_disable(uint32_t usart_periph);

Function descriptions	disable USART to wakeup the mcu from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* USART0 wake up disable */
usart_wakeup_disable(USART0);
```

usart_wakeup_mode_config

The description of usart_wakeup_mode_config is shown as below:

Table 3-907. Function usart_wakeup_mode_config

Function name	usart_wakeup_mode_config
Function prototype	void usart_wakeup_mode_config(uint32_t usart_periph, uint32_t wum);
Function descriptions	configure the USART wakeup mode from deep-sleep mode
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	usart peripheral
<i>USARTx</i>	x=0,1
Input parameter{in}	
wum	wakeup mode
<i>USART_WUM_ADDR</i>	WUF active on address match
<i>USART_WUM_START B</i>	WUF active on start bit
<i>USART_WUM_RBNE</i>	WUF active on RBNE
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure USART0 wake up mode */
usart_wakeup_mode_config(USART0, USART_WUM_ADDR);
```

usart_receive_fifo_enable

The description of usart_receive_fifo_enable is shown as below:

Table 3-908. Function usart_receive_fifo_enable

Function name	usart_receive_fifo_enable
Function prototype	void usart_receive_fifo_enable(uint32_t usart_periph);
Function descriptions	enable receive FIFO
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable receive FIFO */
usart_receive_fifo_enable(USART0);
```

usart_receive_fifo_disable

The description of usart_receive_fifo_disable is shown as below:

Table 3-909. Function usart_receive_fifo_disable

Function name	usart_receive_fifo_disable
Function prototype	void usart_receive_fifo_disable(uint32_t usart_periph);
Function descriptions	disable receive FIFO
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable receive FIFO */
```

```
usart_receive_fifo_disable(USART0);
```

usart_receive_fifo_counter_number

The description of usart_receive_fifo_counter_number is shown as below:

Table 3-910. Function usart_receive_fifo_counter_number

Function name	usart_receive_fifo_counter_number
Function prototype	uint8_t usart_receive_fifo_counter_number(uint32_t usart_periph);
Function descriptions	read receive FIFO counter number
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Output parameter{out}	
-	-
Return value	
uint8_t	receive FIFO counter number

Example:

```
/* read receive FIFO counter number */
uint8_t temp;
temp = usart_receive_fifo_counter_number(USART0);
```

usart_flag_get

The description of usart_flag_get is shown as below:

Table 3-911. Function usart_flag_get

Function name	usart_flag_get
Function prototype	FlagStatus usart_flag_get(uint32_t usart_periph, usart_flag_enum flag);
Function descriptions	get flag in STAT/RFCs register
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
flag	USART flags, refer to Table 3-842. Enum usart_flag_enum only one among these parameters can be selected

USART_FLAG_PERR	parity error flag
USART_FLAG_FERR	frame error flag
USART_FLAG_NERR	noise error flag
USART_FLAG_ORER R	overrun error
USART_FLAG_IDLE	idle line detected flag
USART_FLAG_RBNE	read data buffer not empty
USART_FLAG_TC	transmission completed
USART_FLAG_TBE	transmit data register empty
USART_FLAG_LBD	LIN break detected flag
USART_FLAG_CTSF	CTS change flag
USART_FLAG_CTS	CTS level
USART_FLAG_RT	receiver timeout flag
USART_FLAG_EB	end of block flag
USART_FLAG_BSY	busy flag
USART_FLAG_AM	address match flag
USART_FLAG_SB	send break flag
USART_FLAG_RWU	receiver wakeup from mute mode
USART_FLAG_WU	wakeup from deep-sleep mode flag
USART_FLAG_TEA	transmit enable acknowledge flag
USART_FLAG_REA	receive enable acknowledge flag
USART_FLAG_EPERR	early parity error flag
USART_FLAG_RFE	receive FIFO empty flag
USART_FLAG_RFF	receive FIFO full flag
USART_FLAG_RFFINT	receive FIFO full interrupt flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get flag USART0 state */
```

```
FlagStatus status;
```

```
status = usart_flag_get(USART0, USART_FLAG_TBE);
```

usart_flag_clear

The description of usart_flag_clear is shown as below:

Table 3-912. Function usart_flag_clear

Function name	usart_flag_clear
Function prototype	void usart_flag_clear(uint32_t usart_periph, usart_flag_enum flag);

Function descriptions	clear flag in STAT register
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
flag	USART flags, refer to Table 3-842. Enum usart_flag_enum only one among these parameters can be selected
USART_FLAG_PERR	parity error flag
USART_FLAG_FERR	frame error flag
USART_FLAG_NERR	noise detected flag
USART_FLAG_ORER R	overrun error flag
USART_FLAG_IDLE	idle line detected flag
USART_FLAG_TC	transmission complete flag
USART_FLAG_LBD	LIN break detected flag
USART_FLAG_CTSF	CTS change flag
USART_FLAG_RT	receiver timeout flag
USART_FLAG_EB	end of block flag
USART_FLAG_AM	address match flag
USART_FLAG_WU	wakeup from deep-sleep mode flag
USART_FLAG_EPERR	early parity error flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear USART0 flag */
```

```
usart_flag_clear(USART0, USART_FLAG_TC);
```

usart_interrupt_enable

The description of usart_interrupt_enable is shown as below:

Table 3-913. Function usart_interrupt_enable

Function name	usart_interrupt_enable
Function prototype	void usart_interrupt_enable(uint32_t usart_periph, usart_interrupt_enum interrupt);
Function descriptions	enable USART interrupt
Precondition	-

The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
interrupt	interrupt type, refer to Table 3-844. Enum usart_interrupt_enum only one among these parameters can be selected
USART_INT_IDLE	idle interrupt
USART_INT_RBNE	read data buffer not empty interrupt and overrun error interrupt enable interrupt
USART_INT_TC	transmission complete interrupt
USART_INT_TBE	transmit data register empty interrupt
USART_INT_PERR	parity error interrupt
USART_INT_AM	address match interrupt
USART_INT_RT	receiver timeout interrupt
USART_INT_EB	end of block interrupt
USART_INT_LBD	LIN break detection interrupt
USART_INT_ERR	error interrupt enable in multibuffer communication
USART_INT_CTS	CTS interrupt
USART_INT_WU	wakeup from deep-sleep mode interrupt
USART_INT_RFF	receive FIFO full interrupt enable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* enable USART0 TBE interrupt */
```

```
usart_interrupt_enable(USART0, USART_INT_TBE);
```

usart_interrupt_disable

The description of usart_interrupt_disable is shown as below:

Table 3-914. Function usart_interrupt_disable

Function name	usart_interrupt_disable
Function prototype	void usart_interrupt_disable(uint32_t usart_periph, usart_interrupt_enum interrupt);
Function descriptions	disable USART interrupt
Precondition	-
The called functions	-
Input parameter{in}	

usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
interrupt	interrupt type, refer to Table 3-844. Enum usart_interrupt_enum only one among these parameters can be selected
USART_INT_IDLE	idle interrupt
USART_INT_RBNE	read data buffer not empty interrupt and overrun error interrupt enable interrupt
USART_INT_TC	transmission complete interrupt
USART_INT_TBE	transmit data register empty interrupt
USART_INT_PERR	parity error interrupt
USART_INT_AM	address match interrupt
USART_INT_RT	receiver timeout interrupt
USART_INT_EB	end of block interrupt
USART_INT_LBD	LIN break detection interrupt
USART_INT_ERR	error interrupt enable in multibuffer communication
USART_INT_CTS	CTS interrupt
USART_INT_WU	wakeup from deep-sleep mode interrupt
USART_INT_RFF	receive FIFO full interrupt enable
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* disable USART0 TBE interrupt */
```

```
usart_interrupt_disable(USART0, USART_INT_TBE);
```

usart_interrupt_flag_get

The description of usart_interrupt_flag_get is shown as below:

Table 3-915. Function usart_interrupt_flag_get

Function name	usart_interrupt_flag_get
Function prototype	FlagStatus usart_interrupt_flag_get(uint32_t usart_periph, usart_interrupt_flag_enum int_flag);
Function descriptions	get USART interrupt and flag status
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1

UARTx	x=3,4
Input parameter{in}	
int_flag	USART interrupt flag, refer to Table 3-843. Enum usart_interrupt_flag_enum , only one among these parameters can be selected
USART_INT_FLAG_EB	end of block interrupt and flag
USART_INT_FLAG_RT	receiver timeout interrupt and flag
USART_INT_FLAG_A M	address match interrupt and flag
USART_INT_FLAG_PE RR	parity error interrupt and flag
USART_INT_FLAG_TB E	transmitter buffer empty interrupt and flag
USART_INT_FLAG_TC	transmission complete interrupt and flag
USART_INT_FLAG_RB NE	read data buffer not empty interrupt and flag
USART_INT_FLAG_RB NE_ORERR	read data buffer not empty interrupt and overrun error flag
USART_INT_FLAG_ID LE	IDLE line detected interrupt and flag
USART_INT_FLAG_LB D	LIN break detected interrupt and flag
USART_INT_FLAG_W U	wakeup from deep-sleep mode interrupt and flag
USART_INT_FLAG_CT S	CTS interrupt and flag
USART_INT_FLAG_ER R_NERR	error interrupt and noise error flag
USART_INT_FLAG_ER R_ORERR	error interrupt and overrun error
USART_INT_FLAG_ER R_FERR	error interrupt and frame error flag
USART_INT_FLAG_RF F	receive FIFO full interrupt and flag
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* get the USART0 interrupt flag status */
```

```
FlagStatus status;
```

```
status = usart_interrupt_flag_get(USART0, USART_INT_FLAG_RBNE);
```

usart_interrupt_flag_clear

The description of usart_interrupt_flag_clear is shown as below:

Table 3-916. Function usart_interrupt_flag_clear

Function name	usart_interrupt_flag_clear
Function prototype	void usart_interrupt_flag_clear(uint32_t usart_periph, usart_interrupt_flag_enum int_flag);
Function descriptions	clear USART interrupt flag
Precondition	-
The called functions	-
Input parameter{in}	
usart_periph	外设USARTx/UARTx
USARTx	x=0,1
UARTx	x=3,4
Input parameter{in}	
int_flag	USART interrupt flag, refer to Table 3-843. Enum usart_interrupt_flag_enum , only one among these parameters can be selected
USART_INT_FLAG_PERRR	parity error flag
USART_INT_FLAG_ERFR	frame error flag
USART_INT_FLAG_ERNR	noise detected flag
USART_INT_FLAG_RBNE_ORERR	read data buffer not empty interrupt and overrun error flag
USART_INT_FLAG_ERORERR	error interrupt and overrun error
USART_INT_FLAG_IDLE	idle line detected flag
USART_INT_FLAG_TC	transmission complete flag
USART_INT_FLAG_LBD	LIN break detected flag
USART_INT_FLAG_CTS	CTS change flag
USART_INT_FLAG_RTS	receiver timeout flag
USART_INT_FLAG_EB	end of block flag
USART_INT_FLAG_AM	address match flag
USART_INT_FLAG_WU	wakeup from deep-sleep mode flag

USART_INT_FLAG_RF F	receive FIFO full interrupt and flag
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear the USART0 interrupt flag */
```

```
usart_interrupt_flag_clear(USART0, USART_INT_FLAG_TC);
```

3.28. VREF

The precision internal reference is used to provide reference voltage for ADC/DAC, or used by off-chip circuit connecting to V_{REF} pin. The VREF registers are listed in chapter [3.28.1](#), the VREF firmware functions are introduced in chapter [3.28.2](#).

3.28.1. Descriptions of Peripheral registers

VREF registers are listed in the table shown as below:

Table 3-917. WWDGT Registers

Registers	Descriptions
VREF_CS	VREF Control and status register
VREF_CALIB	VREF Calibration register

3.28.2. Descriptions of Peripheral functions

VREF firmware functions are listed in the table shown as below:

Table 3-918. VREF firmware function

Function name	Function description
vref_deinit	deinitialize the VREF
vref_enable	enable VREF
vref_disable	disable VREF
vref_high_impedance_mode_enable	enable VREF high impedance mode
vref_high_impedance_mode_disable	disable VREF high impedance mode
vref_voltage_select	select VREF voltage reference (only for L235xx series)
vref_status_get	get the status of VREF
vref_calib_value_set	set the calibration value of VREF
vref_calib_value_get	get the calibration value of VREF

vref_deinit

The description of vref_deinit is shown as below:

Table 3-919. Function vref_deinit

Function name	vref_deinit
Function prototype	void vref_deinit(void);
Function descriptions	deinitialize the VREF
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* deinitialize the VREF */
```

```
vref_deinit();
```

vref_enable

The description of vref_enable is shown as below:

Table 3-920. Function vref_enable

Function name	vref_enable
Function prototype	void vref_enable(void);
Function descriptions	enable VREF
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* enable VREF */
```

```
vref_enablet();
```

vref_disable

The description of vref_disable is shown as below:

Table 3-921. Function vref_disable

Function name	vref_disable
Function prototype	void vref_disable(void);
Function descriptions	disable VREF
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* disable VREF */
vref_disable();
```

vref_high_impedance_mode_enable

The description of vref_high_impedance_mode_enable is shown as below:

Table 3-922. Function vref_high_impedance_mode_enable

Function name	vref_high_impedance_mode_enable
Function prototype	void vref_high_impedance_mode_enable(void);
Function descriptions	enable VREF high impedance mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* enable VREF high impedance mode */
vref_high_impedance_mode_enable();
```

vref_high_impedance_mode_disable

The description of vref_high_impedance_mode_disable is shown as below:

Table 3-923. Function vref_high_impedance_mode_disable

Function name	vref_high_impedance_mode_disable
Function prototype	void vref_high_impedance_mode_disable(void);
Function descriptions	disable VREF high impedance mode
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* disable VREF high impedance mode */
vref_high_impedance_mode_disable();
```

vref_voltage_select (only for L235xx series)

The description of vref_voltage_select is shown as below:

Table 3-924. Function vref_voltage_select

Function name	vref_voltage_select
Function prototype	void vref_voltage_select(uint32_t vref_voltage);
Function descriptions	select VREF voltage reference
Precondition	-
The called functions	-
Input parameter{in}	
vref_voltage	reference voltage
VREF_VOLTAGE_SEL_LEVEL_0	2.048 V
VREF_VOLTAGE_SEL_LEVEL_1	2.5 V
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* VREF voltage reference select 2.5V */
```

```
vref_voltage_select(VREF_VOLTAGE_SEL_LEVEL_1);
```

vref_status_get

The description of vref_status_get is shown as below:

Table 3-925. Function vref_status_get

Function name	vref_status_get
Function prototype	FlagStatus vref_status_get(void);
Function descriptions	get the status of VREF
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

example:

```
/* get the status of VREF */
```

```
FlagStatus status;
```

```
status = vref_status_get();
```

vref_calib_value_set

The description of vref_calib_value_set is shown as below:

Table 3-926. Function vref_calib_value_set

Function name	vref_calib_value_set
Function prototype	void vref_calib_value_set(uint8_t value);
Function descriptions	set the calibration value of VREF
Precondition	-
The called functions	-
Input parameter{in}	
value	calibration value (0x00 - 0x3F)
Output parameter{out}	
-	-
Return value	
-	-

example:

```
/* set the calibration value of VREF */
```



```
vref_calib_value_set(0x0A);
```

vref_calib_value_get

The description of vref_calib_value_get is shown as below:

Table 3-927. Function vref_calib_value_get

Function name	vref_calib_value_get
Function prototype	uint8_t vref_calib_value_get(void);
Function descriptions	get the calibration value of VREF
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
uint8_t	calibration value (0x00 - 0x3F)

example:

```
/* get the calibration value of VREF */
```

```
uint8_t cal_val;
```

```
cal_val = vref_calib_value_get();
```

3.29. WWDGT

The window watchdog timer (WWDGT) is used to detect system failures due to software malfunctions. The WWDGT registers are listed in chapter [3.29.1](#), the WWDGT firmware functions are introduced in chapter [3.29.2](#).

3.29.1. Descriptions of Peripheral registers

WWDGT registers are listed in the table shown as below:

Table 3-928. WWDGT Registers

Registers	Descriptions
WWDGT_CTL	WWDGT control register
WWDGT_CFG	WWDGT configuration register
WWDGT_STAT	WWDGT status register

3.29.2. Descriptions of Peripheral functions

WWDGT firmware functions are listed in the table shown as below:

Table 3-929. WWDGT firmware function

Function name	Function description
wwdgt_deinit	reset the window watchdog timer configuration
wwdgt_enable	start the window watchdog timer counter
wwdgt_counter_update	configure the window watchdog timer counter value
wwdgt_config	configure counter value, window value, and prescaler divider value
wwdgt_interrupt_enable	enable early wakeup interrupt of WWDGT
wwdgt_flag_get	check early wakeup interrupt state of WWDGT
wwdgt_flag_clear	clear early wakeup interrupt state of WWDGT

wwdgt_deinit

The description of wwdgt_deinit is shown as below:

Table 3-930. Function wwdgt_deinit

Function name	wwdgt_deinit
Function prototype	void wwdgt_deinit(void);
Function descriptions	reset the window watchdog timer configuration
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* reset the window watchdog timer configuration */
```

```
wwdgt_deinit();
```

wwdgt_enable

The description of wwdgt_enable is shown as below:

Table 3-931. Function wwdgt_enable

Function name	wwdgt_enable
Function prototype	void wwdgt_enable(void);
Function descriptions	start the window watchdog timer counter
Precondition	-
The called functions	-
Input parameter{in}	
-	-

Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* start the WWDGT counter */
wwdgt_enable();
```

wwdgt_counter_update

The description of wwdgt_counter_update is shown as below:

Table 3-932. Function wwdgt_counter_update

Function name	wwdgt_counter_update
Function prototype	void wwdgt_counter_update(uint16_t counter_value);
Function descriptions	configure the window watchdog timer counter value
Precondition	-
The called functions	-
Input parameter{in}	
counter_value	counter_value: 0x00000000 - 0x0000007F
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* update WWDGT counter to 0x7F */
wwdgt_counter_update(127);
```

wwdgt_config

The description of wwdgt_config is shown as below:

Table 3-933. Function wwdgt_config

Function name	wwdgt_config
Function prototype	void wwdgt_config(uint16_t counter, uint16_t window, uint32_t prescaler);
Function descriptions	configure counter value, window value, and prescaler divider value
Precondition	-
The called functions	-
Input parameter{in}	
counter	counter: 0x00000000 - 0x0000007F
Input parameter{in}	

window	window: 0x00000000 - 0x0000007F
Input parameter{in}	
prescaler	wwdgt prescaler value
WWDGT_CFG_PSC_D IV1	the time base of WWDGT counter = (PCLK1 / 4096) / 1
WWDGT_CFG_PSC_D IV2	the time base of WWDGT counter = (PCLK1 / 4096) / 2
WWDGT_CFG_PSC_D IV4	the time base of WWDGT counter = (PCLK1 / 4096) / 4
WWDGT_CFG_PSC_D IV8	the time base of WWDGT counter = (PCLK1 / 4096) / 8
WWDGT_CFG_PSC_D IV16	the time base of WWDGT counter = (PCLK1 / 4096) / 16
WWDGT_CFG_PSC_D IV32	the time base of WWDGT counter = (PCLK1 / 4096) / 32
WWDGT_CFG_PSC_D IV64	the time base of WWDGT counter = (PCLK1 / 4096) / 64
WWDGT_CFG_PSC_D IV128	the time base of WWDGT counter = (PCLK1 / 4096) / 128
WWDGT_CFG_PSC_D IV256	the time base of WWDGT counter = (PCLK1 / 4096) / 256
WWDGT_CFG_PSC_D IV512	the time base of WWDGT counter = (PCLK1 / 4096) / 512
WWDGT_CFG_PSC_D IV1024	the time base of WWDGT counter = (PCLK1 / 4096) / 1024
WWDGT_CFG_PSC_D IV2048	the time base of WWDGT counter = (PCLK1 / 4096) / 2048
WWDGT_CFG_PSC_D IV4096	the time base of WWDGT counter = (PCLK1 / 4096) / 4096
WWDGT_CFG_PSC_D IV8192	the time base of WWDGT counter = (PCLK1 / 4096) / 8192
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* configure WWDGT counter value to 0x7F, window value to 0x50, prescaler divider value to 8 */
```

```
wwdgt_config(127, 80, WWDGT_CFG_PSC_DIV8);
```

wwdgt_flag_get

The description of wwdgt_flag_get is shown as below:

Table 3-934. Function wwdgt_flag_get

Function name	wwdgt_flag_get
Function prototype	FlagStatus wwdgt_flag_get(void);
Function descriptions	check early wakeup interrupt state of WWDGT
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
FlagStatus	SET or RESET

Example:

```
/* test if the counter value update has reached the 0x40 */
```

```
FlagStatus status;
```

```
status = wwdgt_flag_get();
```

wwdgt_flag_clear

The description of wwdgt_flag_clear is shown as below:

Table 3-935. Function wwdgt_flag_clear

Function name	wwdgt_flag_clear
Function prototype	void wwdgt_flag_clear(void);
Function descriptions	clear early wakeup interrupt state of WWDGT
Precondition	-
The called functions	-
Input parameter{in}	
-	-
Output parameter{out}	
-	-
Return value	
-	-

Example:

```
/* clear early wakeup interrupt state of WWDGT */
```

```
wwdgt_flag_clear();
```

4. Revision history

Table 4-1. Revision history

Revision No.	Description	Date
1.0	Initial Release	Aug.25, 2021
1.1	Adjust the formatting of the document	Jul.8, 2022
1.2	Modify some function entries to be consistent with the firmware library code	Dec.21, 2022
1.3	Function descriptionS and Input parameter descriptionS Add SLCD in <u>Table 4-2.</u> <u>Functionrcu rtc clock config</u>	Jun.21, 2023
2.0	Add support GD32L235xx series	Jul.17, 2023
2.1	Modify some function descriptions	Nov.2, 2023
2.2	Delete pmu_lowepower_ldo_enable and pmu_lowepower_ldo_disable function for GD32L235	Jan.29, 2024
2.3	Update EXTI Line enum table in 3.11 EXTI chapter	Jul.30, 2024

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