

**GigaDevice Semiconductor Inc.**

**GD32E50x 系列移植到 GD32E51x 系列**

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# 应用笔记

## AN262

## 1. 前言

本应用笔记旨在帮助您快速将应用程序从 GD32E50x 系列微控制器移植到 GD32E51x 系列微控制器。

为了更好的利用本应用笔记中的信息，您需要从官网 [www.GD32MCU.com](http://www.GD32MCU.com) 下载 GD32 各系列微控制器资料，如 Datasheet、用户手册、官方例程、插件及各种开发工具等。

## 2. 引脚兼容性

### 2.1. GD32E5 系列说明

GD32E50x 系列包含 GD32E503xx、GD32E505xx、GD32E507xx、GD32E508xx、GD32EPRTD6/VDT6;

GD32E51x 系列包含 GD32E513xx、GD32E517xx、GDE518xx、GD32EPRTD6A/VDT6A;

GD32E51x 没有 GD32E515xx 子系列，可以用 GD32E517xx 替换 GD32E505xx。

如下[表 2-1 GD32E51x 系列说明](#)所示。

表 2-1 GD32E51x 系列说明

系列	兼容子系列	兼容子系列	兼容子系列	兼容子系列	兼容子系列
GD32E50x	GD32E503C/R/V/Z	GD32E505 R/V/Z	GD32E507 R/V/Z	GD32E508 C/R/V/Z	GD32EPRTD6/VDT6
GD32E51x	GD32E513C/R/V/Z	GD32E517 R/V/Z	GD32E517 R/V/Z	GD32E518 C/R/V/Z	GD32EPRTD6A/VDT6A

### 2.2. 引脚兼容说明

GD32E50x 与 GD32E51x 在相同封装下是 Pin To Pin 兼容的，如下[表 2-2 GD32E50xZ 和 GD32E513Z 的 pin 对比](#)所示。

表 2-2 GD32E50xZ 和 GD32E513Z 的 pin 对比

Pin Name	GD32E503Z Functions description	GD32E513Z Functions description
PA1	Default: PA1 Alternate2: USART1_RTS, ADC012_IN1, TIMER4_CH1, TIMER1_CH1	Default: PA1 <b>Alternate1: TIMER14_CH0_ON</b> Alternate2: USART1_RTS, ADC012_IN1, TIMER4_CH1, TIMER1_CH1
PA2	Default: PA2 Alternate2: USART1_TX, TIMER4_CH2, ADC012_IN2, TIMER8_CH0 <sup>(4)</sup> , TIMER1_CH2, SPI0_IO2, WKUP3	Default: PA2 <b>Alternate1: CMP1_OUT, TIMER14_CH0</b> Alternate2: USART1_TX, TIMER4_CH2, ADC012_IN2, TIMER8_CH0 <sup>(4)</sup> , TIMER1_CH2, SPI0_IO2, WKUP3, <b>CMP1_IM6</b>
PA3	Default: PA3 Alternate2: USART1_RX, TIMER4_CH3, ADC012_IN3, TIMER1_CH3, TIMER8_CH1 <sup>(4)</sup> , SPI0_IO3	Default: PA3 Alternate1: TIMER14_CH1 Alternate2: USART1_RX, TIMER4_CH3, ADC012_IN3, TIMER1_CH3, TIMER8_CH1 <sup>(4)</sup> , SPI0_IO3
PA4	Default: PA4	Default: PA4

	Alternate2: SPI0_NSS, USART1_CK, DAC_OUT0, ADC01_IN4 Remap: SPI2_NSS, I2S2_WS	Alternate2: SPI0_NSS, USART1_CK, DAC_OUT0, <b>ADC01_IN4, CMP1_IM4,  CMP3_IM4, CMP5_IM4</b> Remap: SPI2_NSS, I2S2_WS
PA5	Default: PA5 Alternate2: SPI0_SCK, ADC01_IN5, DAC_OUT1	Default: PA5 Alternate2: SPI0_SCK, ADC01_IN5, DAC_OUT1, <b>CMP1_IM5, CMP3_IM5,  CMP5_IM5</b>
PA6	Default: PA6 Alternate2: SPI0_MISO, TIMER7_BRKIN, ADC01_IN6, TIMER2_CH0, TIMER12_CH0 <sup>(4)</sup> Remap: TIMER0_BRKIN	Default: PA6 <b>Alternate1: TIMER15_CH0</b> Alternate2: SPI0_MISO, TIMER7_BRKIN, ADC01_IN6, TIMER2_CH0, TIMER12_CH0 <sup>(4)</sup> , <b>DAC1_OUT0</b> Remap: TIMER0_BRKIN
PA7	Default: PA7 Alternate2: SPI0_MOSI, TIMER7_CH0_ON, ADC01_IN7, TIMER2_CH1, TIMER13_CH0 <sup>(4)</sup> Remap: TIMER0_CH0_ON	Default: PA7 <b>Alternate1: TIMER16_CH0</b> Alternate2: SPI0_MOSI, TIMER7_CH0_ON, ADC01_IN7, TIMER2_CH1, TIMER13_CH0 <sup>(4)</sup> , <b>CMP1_IP</b> Remap: TIMER0_CH0_ON
PB1	Default: PB1 Alternate1: SHRTIMER_SCOUT Alternate2: ADC01_IN9, TIMER2_CH3, TIMER7_CH2_ON Remap: TIMER0_CH2_ON	Default: PB1 Alternate1: <b>CMP3_OUT</b> , SHRTIMER_SCOUT Alternate2: ADC01_IN9, TIMER2_CH3, TIMER7_CH2_ON Remap: TIMER0_CH2_ON
PB2	Default: PB2, BOOT1 Alternate1: SHRTIMER_SCIN	Default: PB2, BOOT1 Alternate1: SHRTIMER_SCIN <b>Alternate2: CMP3_IM7</b>
PE8	Default: PE8 Alternate2: EXMC_D5 Remap: TIMER0_CH0_ON	Default: PE8 <b>Alternate1: CMP1_OUT</b> Alternate2: EXMC_D5 Remap: TIMER0_CH0_ON
PE9	Default: PE9 Alternate2: EXMC_D6 Remap: TIMER0_CH0	Default: PE9 <b>Alternate1: CMP3_OUT</b> Alternate2: EXMC_D6 Remap: TIMER0_CH0
PE10	Default: PE10 Alternate2: EXMC_D7 Remap: TIMER0_CH1_ON	Default: PE10 <b>Alternate1: CMP5_OUT</b> Alternate2: EXMC_D7 Remap: TIMER0_CH1_ON
PE11	Default: PE11	Default: PE11

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	Alternate2: EXMC_D8 Remap: TIMER0_CH1	Alternate1: <b>CMP5_OUT</b> Alternate2: EXMC_D8 Remap: TIMER0_CH1
PE12	Default: PE12 Alternate2: EXMC_D9 Remap: TIMER0_CH2_ON	Default: PE12 Alternate1: <b>CMP3_OUT</b> Alternate2: EXMC_D9 Remap: TIMER0_CH2_ON
PE13	Default: PE13 Alternate2: EXMC_D10 Remap: TIMER0_CH2	Default: PE13 Alternate1: <b>CMP1_OUT</b> Alternate2: EXMC_D10 Remap: TIMER0_CH2
PB10	Default: PB10 Alternate1: SHRTIMER_FLT2 Alternate2: I2C1_SCL, USART2_TX Remap: TIMER1_CH2	Default: PB10 Alternate1: <b>CAN2_RX</b> , SHRTIMER_FLT2 Alternate2: I2C1_SCL, USART2_TX Remap: TIMER1_CH2
PB11	Default: PB11 Alternate1: SHRTIMER_FLT3 Alternate2: I2C1_SDA, USART2_RX Remap: TIMER1_CH3	Default: PB11 Alternate1: <b>CAN2_TX</b> , SHRTIMER_FLT3 Alternate2: I2C1_SDA, USART2_RX, <b>CMP5_IP</b> Remap: TIMER1_CH3
PB15	Default: PB15 Alternate1: SHRTIMER_ST3CH1 Alternate2: SPI1_MOSI, TIMER0_CH2_ON, I2S1_SD, TIMER11_CH1 <sup>(4)</sup> , WKUP6	Default: PB15 Alternate1: SHRTIMER_ST3CH1, <b>TIMER14_CH1, TIMER14_CH0_ON</b> Alternate2: SPI1_MOSI, TIMER0_CH2_ON, I2S1_SD, TIMER11_CH1 <sup>(4)</sup> , WKUP6, <b>CMP5_IM7</b>
PA9	Default: PA9 Alternate1: SHRTIMER_ST0CH1, I2C2_SMBA Alternate2: USART0_TX, TIMER0_CH1	Default: PA9 Alternate1: <b>CAN2_RX</b> , SHRTIMER_ST0CH1, I2C2_SMBA, <b>TIMER14_BRKIN</b> Alternate2: USART0_TX, TIMER0_CH1
PA10	Default: PA10 Alternate1: SHRTIMER_ST1CH0 Alternate2: USART0_RX, TIMER0_CH2	Default: PA10 Alternate1: <b>CAN2_TX, CMP5_OUT</b> , SHRTIMER_ST1CH0, <b>TIMER16_BRKIN</b> Alternate2: USART0_RX, TIMER0_CH2
PA12	Default: PA12 Alternate1: SHRTIMER_FLT0, USART5_RX Alternate2: USART0_RTS, CAN0_TX, USBDP, TIMER0_ETI	Default: PA12 Alternate1: <b>CMP1_OUT</b> , SHRTIMER_FLT0, USART5_RX, <b>TIMER15_CH0</b> Alternate2: USART0_RTS, CAN0_TX, TIMER0_ETI, USBDP
PA13	Default: JTMS, SWDIO Remap: PA13	Default: JTMS, SWDIO Alternate1: <b>TIMER15_CH0_ON</b> ,



		Remap: PA13
PB4	Default: NJTRST Alternate1: SHRTIMER_EXEV6, I2C2_SDA, I2S2_ADD_SD Alternate2: SPI2_MISO, I2C0_TXFRAME Remap: TIMER2_CH0, PB4, SPI0_MISO	Default: NJTRST Alternate1: SHRTIMER_EXEV6, I2C2_SDA, I2S2_ADD_SD, <b>TIMER15_CH0, TIMER16_BRKIN</b> Alternate2: SPI2_MISO, I2C0_TXFRAME Remap: TIMER2_CH0, PB4, SPI0_MISO
PB5	Default: PB5 Alternate1: SHRTIMER_EXEV5, I2C2_SCL Alternate2: I2C0_SMBA, SPI2_MOSI, I2S2_SD, WKUP5 Remap: TIMER2_CH1, SPI0_MOSI, CAN1_RX	Default: PB5 Alternate1: SHRTIMER_EXEV5, I2C2_SCL, <b>TIMER15_BRKIN,</b> <b>TIMER16_CH0</b> Alternate2: I2C0_SMBA, SPI2_MOSI, I2S2_SD, WKUP5, Remap: TIMER2_CH1, SPI0_MOSI, CAN1_RX
PB7	Default: PB7 Alternate1: SHRTIMER_EXEV2 Alternate2: I2C0_SDA, TIMER3_CH1, EXMC_NADV Remap: USART0_RX, SPI0_IO3	Default: PB7 Alternate1: SHRTIMER_EXEV2, <b>TIMER16_CH0_ON</b> Alternate2: I2C0_SDA, TIMER3_CH1, EXMC_NADV Remap: USART0_RX, SPI0_IO3
PB8	Default: PB8 Alternate1: SHRTIMER_EXEV7, I2C2_SDA Alternate2: TIMER3_CH2, SDIO_D4, TIMER9_CH0 <sup>(4)</sup> Remap: I2C0_SCL, CAN0_RX	Default: PB8 Alternate1: SHRTIMER_EXEV7, I2C2_SDA, <b>TIMER15_CH0</b> Alternate2: TIMER3_CH2, SDIO_D4, TIMER9_CH0 <sup>(4)</sup> Remap: I2C0_SCL, CAN0_RX
PB9	Default: PB9 Alternate1: SHRTIMER_EXEV4 Alternate2: TIMER3_CH3, SDIO_D5, TIMER10_CH0 <sup>(4)</sup> Remap: I2C0_SDA, CAN0_TX	Default: PB9 Alternate1: <b>CMP1_OUT,</b> SHRTIMER_EXEV4, <b>TIMER16_CH0</b> Alternate2: TIMER3_CH3, SDIO_D5, TIMER10_CH0 <sup>(4)</sup> Remap: I2C0_SDA, CAN0_TX

### 3. 内部资源兼容性

GD32E51x 在 GD32E50x 的基础上增加了部分外设资源，增加外设如下。详细参数可以参考 GD32E51x 用户手册。

TIMER: 增加了 TIMER14、TIMER15、TIMER16;

DAC: 增加 DAC0 的单元，共三路 DAC 通道输出;

ADC: 最大可以支持 21 个通道;

Package: 部分型号支持 QFN48 封装。

如下[表 3-1 GD32E51x 系列和 GD32E50x 系列内部资源差异对比总览](#)所示。

**表 3-1 GD32E51x 系列和 GD32E50x 系列内部资源差异对比总览**

片内资源	TMU	CMP	TIMER (14 15 16)	SDIO	ADC Units(CHs)	DAC Units(CHs)	Package
GD32E503xx	×	0	×	√	3(21)	1(2)	√
GD32E513xx	√	3	√	√	3(21)	2(3)	√
GD32E505/7xx	√	3	×	×	2(16)	1(2)	√
GD32E517xx	√	3	√	√	3(21)	2(3)	√
GD32E508xx	√	3	×	×	2(16)	1(2)	×
GD32E518xx	√	3	√	√	3(21)	2(3)	LQFP48

### 4. 程序移植

假如使用 GD32E50x 没有使用到 FMC 来擦写 flash, 代码基本可以 GD32E50x 的代码运行在 GD32E51x 上运行;

假如使用了 FMC, 由于 GD32E51x flash 编程仅支持 64bit 宽度, GD32E50x 支持 32bit 编程, 所以在移植过程中需要改为 64bit 编程, 可以通过升级固件库或者将 FMC.C 和 FMC.H 文件替换的方式来解决这个差异。具体差异详见如下 5.1 的 FMC 章节。

### 5. 外设差异

GD32E50x 与 GD32E51x 在外设上寄存器基本兼容的, 如下为各外设差异, 未列出的外设则表明基本一致。

#### 5.1. 闪存控制器 (FMC)

GD32E51x 较 GD32E50x 在 FMC 上增加了 ECC 校验;

GD32E50x 支持 32bit 宽度编程, GD32E51x 仅支持 64bit 的宽度编程。具体功能及寄存器可以参考 GD32E51x 用户手册。

FMC 功能差异体现在编程宽度及 ECC 检查功能, 具体参考。如下[表 5-1 FMC 功能差异](#)所示。

表 5-1 FMC 功能差异

产品系列	编程宽度	FLASH ECC 功能
GD32E50x	32 位	不支持
GD32E51x	64 位	支持

## 5.2. 数模转换器 (DAC)

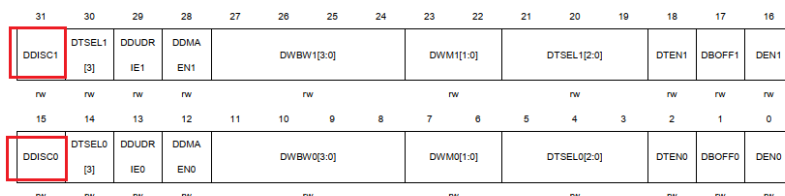
GD32E51x 较 GD32E50x 增加了 DAC 与外部引脚断开的功能，即当 DAC 给内部 CMP 使用时，GPIO 可以作为其他功能来使用。如下图所示为新增的寄存器 bit。

### 14.4.1. DACx control register 0 (DAC\_CTL0)

Address offset: 0x00  
Reset value: 0x0000 0000

The bits-field [31:16] of this register is only available in DAC0, and must be kept at reset value in DAC1.

This register has to be accessed by word (32-bit).



Bits	Fields	Descriptions
31	DDISC1	<b>DACx_OUT1 connect GPIO selection</b> 0: DACx_OUT1 is connected to the external pin and on chip peripherals (CMP). 1: DACx_OUT1 is connected to on chip peripherals (CMP) independently only if DACx_OUT1 output buffer turns off (DBOFF1=1). Otherwise DACx_OUT1 is connected to the external pin and on chip peripherals (CMP).

## 5.3. 定时器 (TIMER)

GD32E51x 较 GD32E50x 多了 TIMER14 TIMER15 TIMER16,如下表 5-2 新增 TIMER 及功能所示。若没有用到相关 TIMER，则可以忽略，若想软件用到相关 TIMER，可以更新最新的 GD32E51x 固件库即可。详细说明可以参考 GD32E51x 用户手册 TIMER 章节。

表 5-2 新增 TIMER 及功能

定时器	定时器 14	定时器 15/16
类型	通用 L3	通用 L4
预分频器	16 位	16 位
计数器	16 位	16 位
计数模式	只有向上	只有向上
可重复性	●	●
捕获/比较通道数	2	1
互补和死区时间	●	●

中止输入	•	•
单脉冲	•	•
正交译码器	×	×
主-从管理	•	×
内部连接	•	×
<b>DMA</b>	•	•
<b>Debug 模式</b>	•	•

## 6. 版本历史

表 6-1 版本历史

版本号	说明	日期
1.0	首次发布	2024 年 5 月 15 日

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