

**GigaDevice Semiconductor Inc.**

**GD32A513R-START**

**Arm<sup>®</sup> Cortex<sup>®</sup>-M33 32-bit MCU**

## **User Guide**

Revision 1.1

(Jan. 2025)

# Table of Contents

<b>TABLE OF CONTENTS .....</b>	<b>1</b>
<b>LIST OF FIGURES .....</b>	<b>3</b>
<b>LIST OF TABLES .....</b>	<b>4</b>
<b>1. SUMMARY .....</b>	<b>5</b>
<b>2. FUNCTION PIN ASSIGN .....</b>	<b>6</b>
<b>3. GETTING STARTED .....</b>	<b>7</b>
<b>4. HARDWARE LAYOUT OVERVIEW .....</b>	<b>8</b>
4.1. Power supply .....	8
4.2. LED .....	8
4.3. KEY .....	9
4.4. USART .....	9
4.5. Extension .....	10
4.6. GD-Link .....	10
4.7. MCU .....	11
4.8. Arduino .....	11
<b>5. ROUTINE USE GUIDE .....</b>	<b>13</b>
5.1. GPIO_Running_LED .....	13
5.1.1. DEMO purpose .....	13
5.1.2. DEMO running result .....	13
5.2. GPIO_Key_Polling_mode .....	13
5.2.1. DEMO purpose .....	13
5.2.2. DEMO running result .....	13
5.3. EXTI_Key_Interrupt_mode .....	14
5.3.1. DEMO purpose .....	14
5.3.2. DEMO running result .....	14
5.4. USART_HyperTerminal_Interrupt .....	14
5.4.1. DEMO purpose .....	14
5.4.2. DEMO running result .....	14
5.5. TIMER_Key_EXTI .....	15
5.5.1. DEMO purpose .....	15
5.5.2. DEMO running result .....	15
5.6. TRIGSEL_TIMER_Trigger_EXTI .....	15
5.6.1. DEMO purpose .....	15
5.6.2. DEMO running result .....	16
<b>6. REVISION HISTORY .....</b>	<b>17</b>



## List of Figures

Figure 4-1. Schematic diagram of power supply.....	8
Figure 4-2. Schematic diagram of LED function .....	8
Figure 4-3. Schematic diagram of Key function .....	9
Figure 4-4. Schematic diagram of USART .....	9
Figure 4-5. Schematic diagram of Extension.....	10
Figure 4-6. Schematic diagram of GD-Link.....	10
Figure 4-7. Schematic diagram of MCU.....	11
Figure 4-8. Schematic diagram of Arduino .....	11

# List of Tables

Table 2-1. Function pin assignment .....	6
Table 6-1. Revision history .....	17

## 1. Summary

GD32A513R-START uses GD32A513RDT3 as the main controller. It uses GD-Link Mini USB interface to supply 5V power. Reset, User Key, LED, USART to USB, Arduino are also included. For more details, please refer to GD32A513R-START-V1.0 schematic.

## 2. Function Pin Assign

Table 2-1. Function pin assignment

Function	Pin	Description
LED	PA5	LED1
	PA6	LED2
	PA7	LED3
	PA8	LED4
RESET		K1-Reset
KEY	PA0	K2-User
USART	PB15	RS232_TX
	PD8	RS232_RX

### 3. **Getting started**

The EVAL board uses GD-Link Mini USB connector to get power DC +5V, which is the hardware system normal work voltage. A GD-Link on board is necessary in order to download and debug programs. Select the correct boot mode and then power on, the LEDPWR will turn on, which indicates the power supply is OK.

There are Keil version and IAR version of all projects. Keil version of the projects are created based on Keil MDK-ARM 5.35 uVision5. IAR version of the projects are created based on IAR Embedded Workbench for ARM 8.32.1. During use, the following points should be noted:

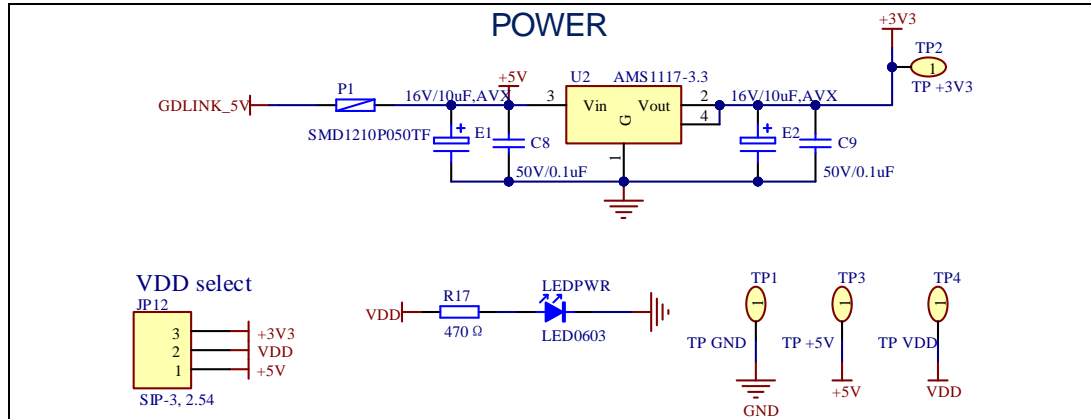
1. If you use Keil uVision5 to open the project, you need to install the latest version of GigaDevice. GD32A513\_DFP to load the related files.
2. If you use IAR to open the project, you need to install the latest version of IAR\_GD32A513\_ADDON to load the related files.



## 4. Hardware layout overview

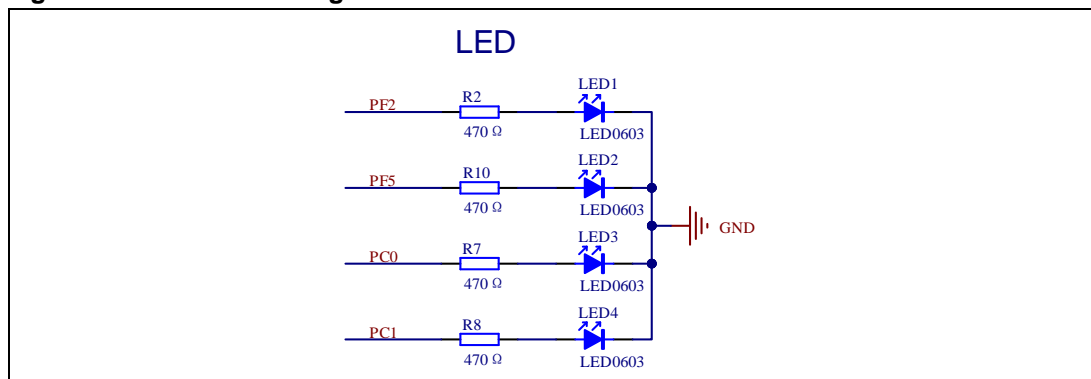
### 4.1. Power supply

Figure 4-1. Schematic diagram of power supply



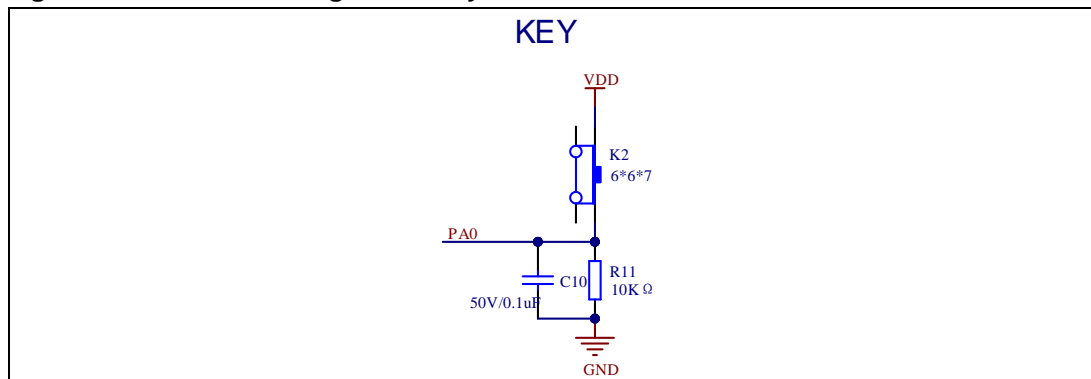
### 4.2. LED

Figure 4-2. Schematic diagram of LED function



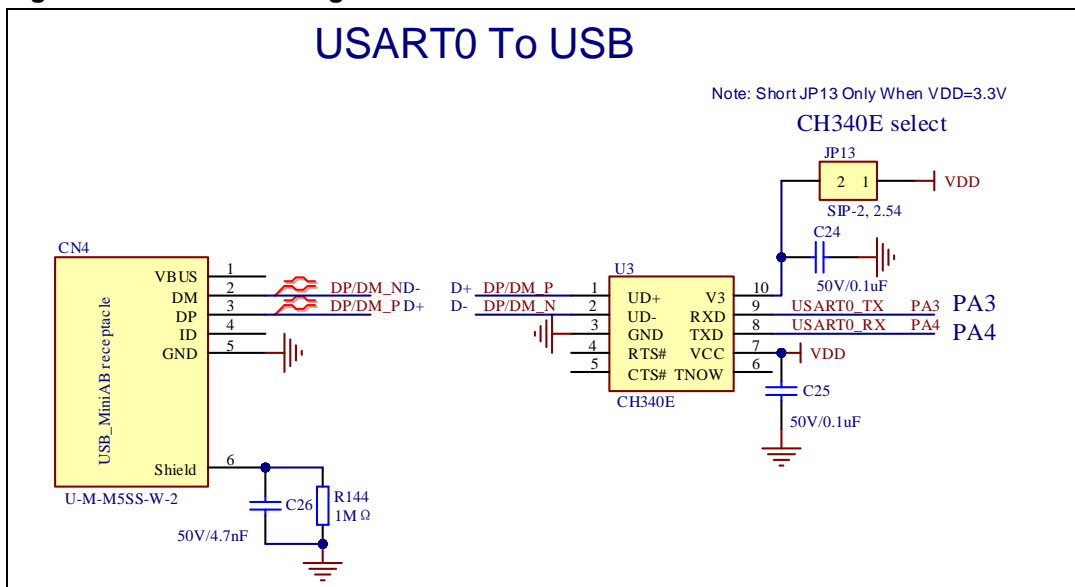
### 4.3. KEY

Figure 4-3. Schematic diagram of Key function



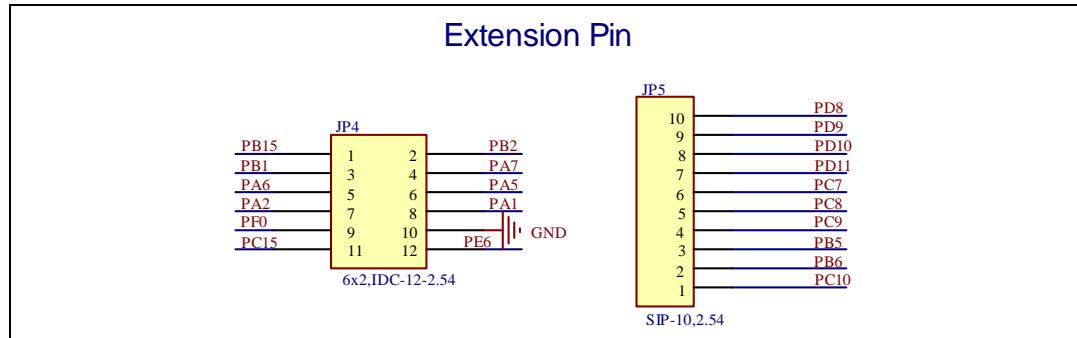
### 4.4. USART

Figure 4-4. Schematic diagram of USART



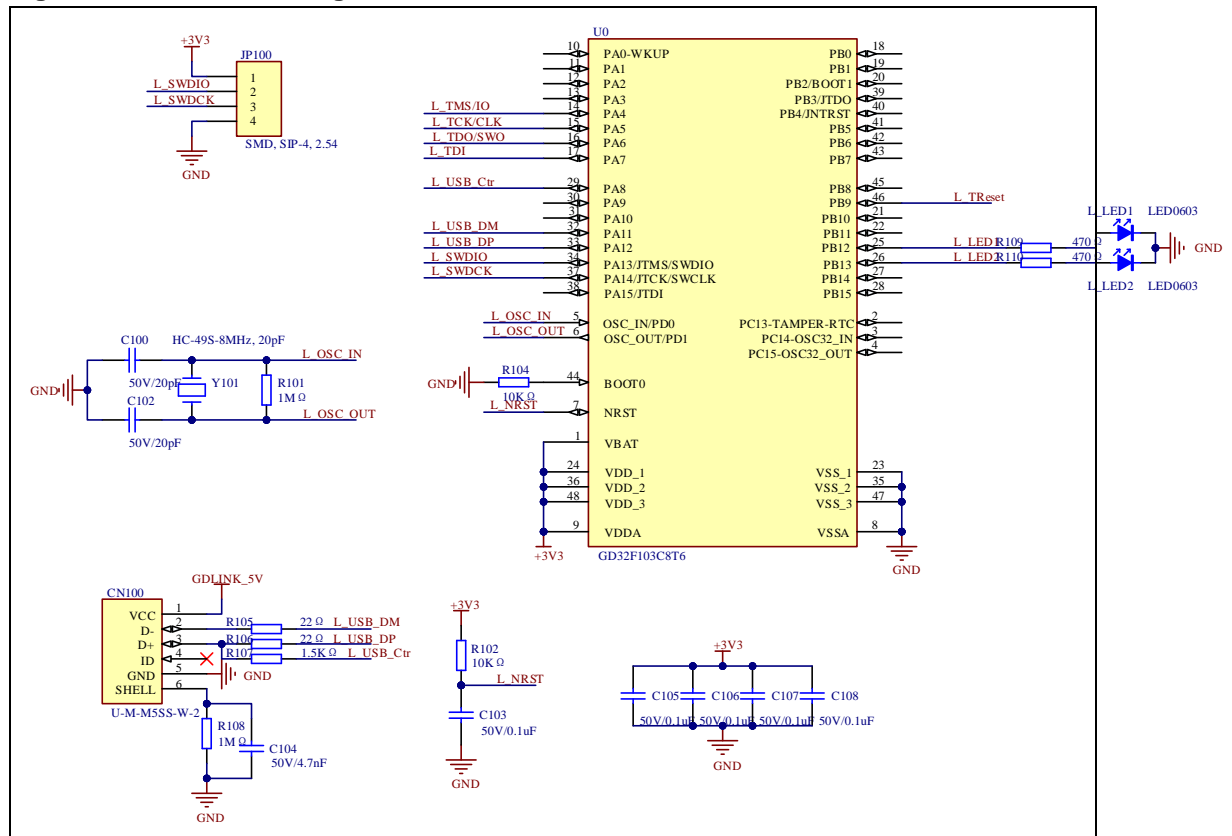
## 4.5. Extension

Figure 4-5. Schematic diagram of Extension



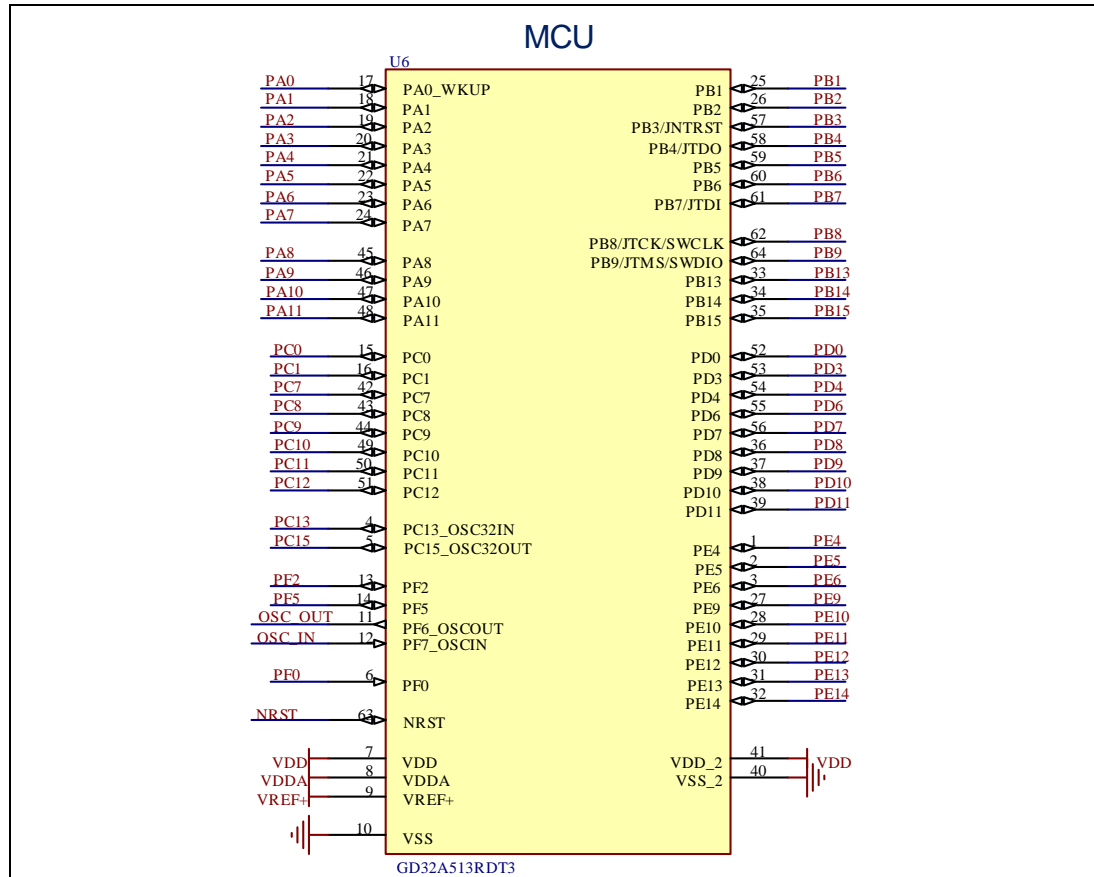
## 4.6. GD-Link

Figure 4-6. Schematic diagram of GD-Link



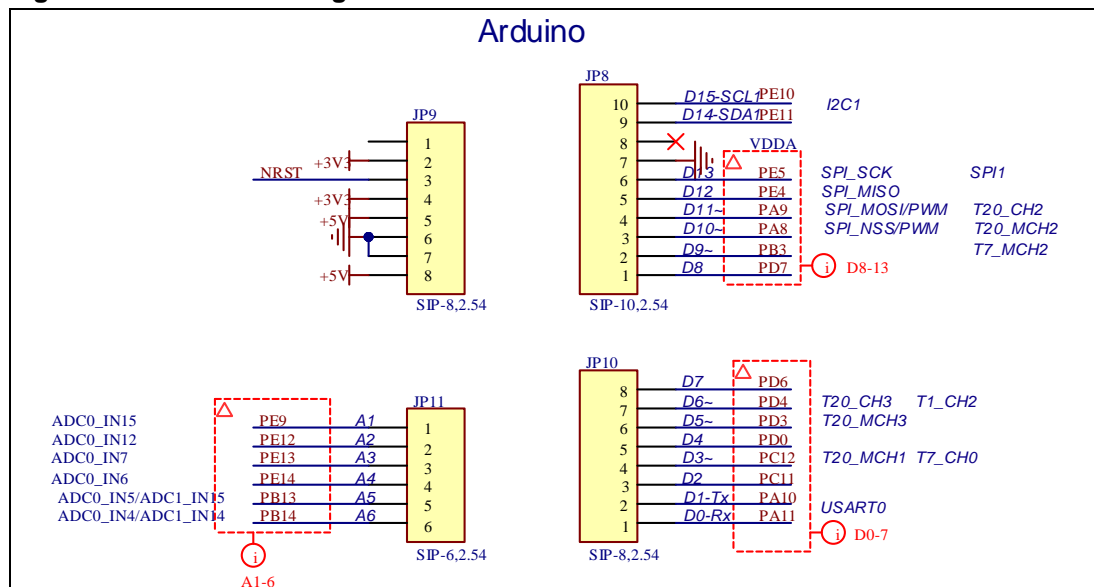
## 4.7. MCU

Figure 4-7. Schematic diagram of MCU



## 4.8. Arduino

Figure 4-8. Schematic diagram of Arduino





## 5. Routine use guide

### 5.1. GPIO\_Running\_LED

#### 5.1.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use GPIO control the LED
- Learn to use SysTick to generate 1ms delay

GD32A513R-START board has 2 keys and 4 LEDs. The 2 keys are Reset key and Wakeup key. The LEDs are controlled by GPIO.

This demo will show how to light the LEDs.

#### 5.1.2. DEMO running result

Download the program < 01\_GPIO\_Running\_LED > to the EVAL board, The LEDs can light cycles.

### 5.2. GPIO\_Key\_Polling\_mode

#### 5.2.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use GPIO control the LED and the KEY
- Learn to use SysTick to generate 1ms delay

GD32A513R-START board has 2 keys and 4 LEDs. The 2 keys are Reset key and Wakeup key. The LEDs are controlled by GPIO.

This demo will show how to use the User key to control the LED2. When press down the Wakeup key, it will check the input value of the IO port. If the value is 1 and will wait for 100ms. Check the input value of the IO port again. If the value still is 1, it indicates that the button is pressed successfully and toggle LED2

#### 5.2.2. DEMO running result

Download the program < 02\_GPIO\_Key\_Polling\_mode > to the EVAL board, press down the Wakeup key, LED2 will be turned on. Press down the Wakeup key again, LED2 will be turned off.

## 5.3. EXTI\_Key\_Interrupt\_mode

### 5.3.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use GPIO control the LED and the KEY.
- Learn to use EXTI to generate external interrupt.

GD32A513R-START board has 2 keys and 4 LEDs. The 2 keys are Reset key and Wakeup key. The LEDs are controlled by GPIO.

This demo will show how to use the EXTI interrupt line to control the LED2. When press down the Wakeup key, it will produce an interrupt. In the interrupt service function, the demo will toggle LED2.

### 5.3.2. DEMO running result

Download the program < 03\_EXTI\_Key\_Interrupt\_mode > to the EVAL board, LED2 is turned on and off for test. When press down the Wakeup key, LED2 will be turned on. Press down the Wakeup key again, LED2 will be turned off.

## 5.4. USART\_HyperTerminal\_Interrupt

### 5.4.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use the USART transmit and receive interrupts to communicate with the serial terminal tool.

### 5.4.2. DEMO running result

Download the program < 04\_USART\_HyperTerminal\_Interrupt > to the board, connect serial cable to UART. Firstly, all the LEDs are turned on and off for test. Then, the UART sends the tx\_buffer array (from 0x00 to 0xFF) to the serial terminal tool supporting hex format communication and waits for receiving data of BUFFER\_SIZE bytes from the serial terminal. The data MCU has received is stored in the rx\_buffer array. After that, compare tx\_buffer with rx\_buffer. If tx\_buffer is same with rx\_buffer, LED1, LED2, LED3 and LED4 flash by turns. Otherwise, LED1, LED2, LED3 and LED4 toggle together.

The output information via the serial port is as following:

```

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17
18 19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 40 41 42 43 44 45 46 47
48 49 4A 4B 4C 4D 4E 4F 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74 75 76 77
78 79 7A 7B 7C 7D 7E 7F 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F A0 A1 A2 A3 A4 A5 A6 A7
A8 A9 AA AB AC AD AE AF B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF D0 D1 D2 D3 D4 D5 D6 D7
D8 D9 DA DB DC DD DE DF E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF

```

## 5.5. TIMER\_Key\_EXTI

### 5.5.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use GPIO control the LED and the KEY
- Learn to use EXTI to generate external interrupt
- Learn to use TIMER to generate PWM

GD32A513R-START board has 2 keys and 4 LEDs. The 2 keys are Reset key and Wakeup key. The LEDs are controlled by GPIO.

This demo will show how to use the TIMER PWM to trigger EXTI interrupt to toggle the state of LED1 and EXTI interrupt line to control the LED1. When press down the Wakeup key, it will produce an interrupt. In the interrupt service function, the demo will toggle LED1.

### 5.5.2. DEMO running result

Download the program <05\_TIMER\_Key\_EXTI> to the START board, the LED1 is flashed once for test, press down the Wakeup key, LED1 will be turned on. Press down the Wakeup key again, LED1 will be turned off. Connect PE6 (TIMER1\_CH0) and PA2(JP4) with DuPont line. The LED1 will be toggled every 500ms.

## 5.6. TRIGSEL\_TIMER\_Trigger\_EXTI

### 5.6.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn to use TIMER output PWM wave.
- Learn to use EXTI generate interrupt.
- Learn to use TRIGSEL select trigger source and trigger peripheral.



### 5.6.2. DEMO running result

Download the program < 06\_TRIGSEL\_TIMER\_Trigger\_EXTI > to the EVAL board, LED2 is turned on and off for test.

When the program is running, the EXTI10 interrupt is triggered by TRIGSEL output every 200ms, and LED2 state is toggled by the interrupt.

## 6. Revision history

Table 6-1. Revision history

Revision No.	Description	Date
1.0	Initial Release	Nov.17, 2023
1.1	Update chapter 3	Jan.25, 2025

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