

GigaDevice Semiconductor Inc.

GD32150R-EVAL

User Guide

Rev3.3

(Dec.31.2023)

Table of Contents

Table of Contents	1
List of Figures.....	4
List of Tables	5
1. Summary.....	6
2. Function Pin Assign	6
3. Getting started.....	7
4. Hardware layout overview.....	8
4.1. Power supply.....	8
4.2. Boot option.....	8
4.3. LED	9
4.4. KEY	9
4.5. USART	10
4.6. RS485	10
4.7. ADC/DAC	10
4.8. I2S.....	11
4.9. I2C.....	11
4.10. SPI-TF CARD.....	12
4.11. SPI-TFT LCD	12
4.12. USB	13
4.13. CMP.....	13
4.14. HDMI-CEC	13
4.15. TSI.....	14
4.16. IFRP	14
4.17. RTC	15
4.18. GD-Link	15
4.19. BEEPER.....	16
4.20. Extension	16
4.21. MCU	17
5. Routine use guide.....	17

5.1. GPIO_Running_LED	17
5.1.1. DEMO purpose	17
5.1.2. DEMO running result	17
5.2. GPIO_Key_Polling_mode	18
5.2.1. DEMO purpose	18
5.2.2. DEMO running result	18
5.3. EXTI_Key_Interrupt_mode.....	18
5.3.1. DEMO purpose	18
5.3.2. DEMO running result	18
5.4. GPIO_BEEPER	19
5.4.1. DEMO purpose	19
5.4.2. DEMO running result	19
5.5. USART_Printf	19
5.5.1. DEMO purpose	19
5.5.2. DEMO running result	19
5.6. USART_HyperTerminal_Interrupt	20
5.6.1. DEMO purpose	20
5.6.2. DEMO running result	20
5.7. USART_DMA	20
5.7.1. DEMO purpose	20
5.7.2. DEMO running result	20
5.8. RS485_Test.....	21
5.8.1. DEMO purpose	21
5.8.2. DEMO running result	21
5.9. ADC_Conversion_Triggered_By_Timer	22
5.9.1. DEMO purpose	22
5.9.2. DEMO running result	23
5.10. DAC_Output_Voltage_Value	23
5.10.1. DEMO Purpose	23
5.10.2. DEMO Running Result	23
5.11. Comparator_Obtain_Brightness	23
5.11.1. DEMO purpose	23
5.11.2. DEMO running result	23
5.12. I2C_EEPROM	24
5.12.1. DEMO purpose	24
5.12.2. DEMO running result	24
5.13. SPI_TFT_LCD_Driver	25
5.13.1. DEMO purpose	25
5.13.2. DEMO running result	25

5.14.	SPI_TF_Card_Block_Operation.....	26
5.14.1.	DEMO purpose	26
5.14.2.	DEMO running result	26
5.15.	SPI_TF_Card_FATFS_Operation	27
5.15.1.	DEMO purpose	27
5.15.2.	DEMO running result	27
5.16.	HDMI-CEC_HostSlaveCommunication	28
5.16.1.	DEMO purpose	28
5.16.2.	DEMO running result	28
5.17.	I2S_Audio_Player	29
5.17.1.	DEMO purpose	29
5.17.2.	DEMO running result	29
5.18.	RCU_Clock_Out	29
5.18.1.	DEMO purpose	29
5.18.2.	DEMO running result	29
5.19.	PMU_sleep_wakeup.....	30
5.19.1.	DEMO purpose	30
5.19.2.	DEMO running result	30
5.20.	RTC_Calendar	30
5.20.1.	DEMO purpose	30
5.20.2.	DEMO running result	30
5.21.	IRInfrared_Transceiver	31
5.21.1.	DEMO purpose	31
5.21.2.	DEMO running result	31
5.22.	TIMER_Breath_LED	31
5.22.1.	DEMO purpose	31
5.22.2.	DEMO running result	31
5.23.	TSI_TouchKey_leds	31
5.23.1.	DEMO purpose	31
5.23.2.	DEMO running result	32
5.24.	USB_Device	32
5.24.1.	DEMO purpose	32
5.24.2.	DEMO running result	32
6.	Revision history	33

List of Figures

Figure 4-1 Schematic diagram of power supply.....	8
Figure 4-2 Schematic diagram of boot option.....	8
Figure 4-3 Schematic diagram of LED function.....	9
Figure 4-4 Schematic diagram of Key function	9
Figure 4-5 Schematic diagram of USART function	10
Figure 4-6 Schematic diagram of RS485 function	10
Figure 4-7 Schematic diagram of ADC/DAC function	10
Figure 4-8 Schematic diagram of I2S function.....	11
Figure 4-9 Schematic diagram of I2C function	11
Figure 4-10 Schematic diagram of SPI-TF CARD function	12
Figure 4-11 Schematic diagram of SPI-TFT LCD function	12
Figure 4-12 Schematic diagram of USB function.....	13
Figure 4-13 Schematic diagram of CMP function.....	13
Figure 4-14 Schematic diagram of HDMI-CEC function.....	13
Figure 4-15 Schematic diagram of TSI function	14
Figure 4-16 Schematic diagram of IFRP function	14
Figure 4-17 Schematic diagram of RTC function	15
Figure 4-18 Schematic diagram of GD-Link function.....	15
Figure 4-19 Schematic diagram of BEEPER function.....	16
Figure 4-20 Schematic diagram of Extension Pin.....	16
Figure 4-21 Schematic diagram of MCU Pin.....	17

List of Tables

<i>Table 2-1 Pin assignment</i>	6
<i>Table 4-1 Boot configuration</i>	8
<i>Table 6-1 Revision history</i>	33

1. Summary

GD32150R-EVAL-V1.3 evaluation board uses GD32F150RBT6 as the main controller. As a complete development platform of GD32F1x0 powered by ARM® Cortex™-M3 core, the board supports full range of peripherals. It uses mini-USB interface or AC/DC adapter to supply 3.3V power. SWD, Reset, Boot, User button key, LED, I2C, I2S, USART, RS485, TFT-LCD, HDMI-CEC, LDR, TSI, IFRP LED, IR Receiver, RTC, SPI, USB, ADC, DAC and Extension Pin are also included. This document details its hardware schematic and the relevant applications.

2. Function Pin Assign

Table 2-1 Pin assignment

Function	Pin	Description
LED	PC10	LED1
	PC11	LED2
	PC12	LED3
	PD2	LED4
RESET	-	K1-Reset
KEY	PA0	K2-Wakeup
	PF7	K3-User Key
	PC13	K4-Temper
BEEPER	PC7	BEEPER_CTL
USB	PA11	USBDM
	PA12	USBDP
	PC2	USBDP pull up pin
IR	PC6	IR_RX
	PB9	IR_TX
I2C	PB6	I2C0_SCL
	PB7	I2C0_SDA
I2S	PA4	I2S_WS
	PA5	I2S_CK
	PA7	I2S_DIN
	PA15	MSEL
	PB3	MCLK
	PB5	MDIN
	PA6	I2S_MCK
USART0	PA9	USART0_TX
	PA10	USART0_RX
RS485	PA2	RS485_TX
	PA3	RS485_RX
	PA1	RS485_DIR

Function	Pin	Description
TSI	PB11	TSI_G5_IO0
	PB12	TSI_G5_IO1
	PB13	TSI_G2_IO2
	PB14	TSI_G5_IO3
	PC5	TSI_G2_IO0
	PB0	TSI_G2_IO1
SPI	PB3	SPI0_SCK
	PB4	SPI0_MISO
	PB5	SPI0_MOSI
	PF5	TFT_CS
	PF4	TF_CARD_CS
	PC4	TFT_RESET
ADC	PC1	ADC_IN11
HDMI-CEC	PB8	CEC
COMPARATOR	PA1	COMP0_IP
DAC	PA4	DAC_OUT

3. Getting started

The EVAL Board uses mini-USB connector or AC/DC adapter to get power, the hardware system power is +3.3V. A mini-USB cable and a J-Link tool are necessary to down programs. Select the correct boot mode and then power on, the LED6 will turn on, which indicates the power supply is ready.

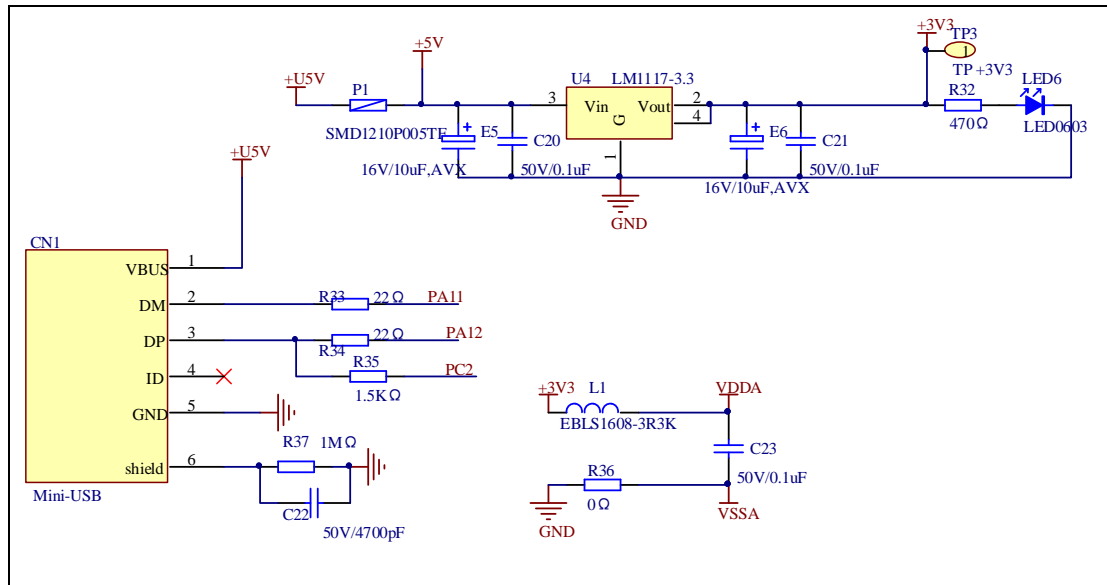
There are Keil version and IAR version of all projects. Keil version of the projects are created based on Keil MDK-ARM 4.74 uVision4. IAR version of the projects are created based on IAR Embedded Workbench for ARM 7.40.2. During use, the following points should be noted:

1. If you use Keil uVision4 to open the project, install the GD32F1x0_AddOn.3.2.0.exe to load the associated files.
2. If you use Keil uVision5 to open the project, there are two ways to solve the "Device Missing (s)" problem. One is to install GigaDevice.GD32F1x0_DFP.3.2.0.pack. In Project menu, select the Manage sub menu, click on the "Version Migrate 5 Format..." menu, the Keil uVision4 project will be converted to Keil uVision5 project. Then add "C:\Keil_v5\ARM\Pack\ARM\CMSIS\4.2.0\CMSIS\Include" to C/C++ in Option for Target. The other is to install Addon directly. Select the installation directory of Keil uVision5 software, such as C:\Keil_v5, in Destination Folder of Folder Selection. Select the corresponding device in Device of Option for Target and add "C:\Keil_v5\ARM\Pack\ARM\CMSIS\4.2.0\CMSIS\Include" to C/C++ in Option for Target.
3. If you use IAR to open the project, install IAR_GD32F1x0_ADDON.3.2..0.exe to load the associated files.

4. Hardware layout overview

4.1. Power supply

Figure 4-1 Schematic diagram of power supply



4.2. Boot option

Figure 4-2 Schematic diagram of boot option

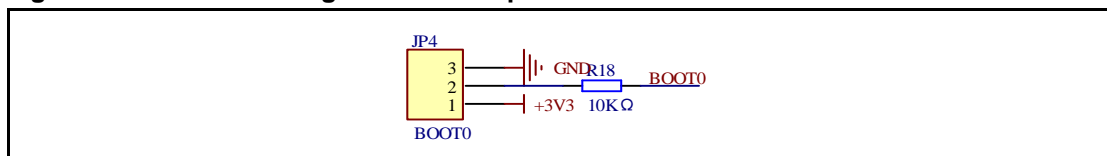
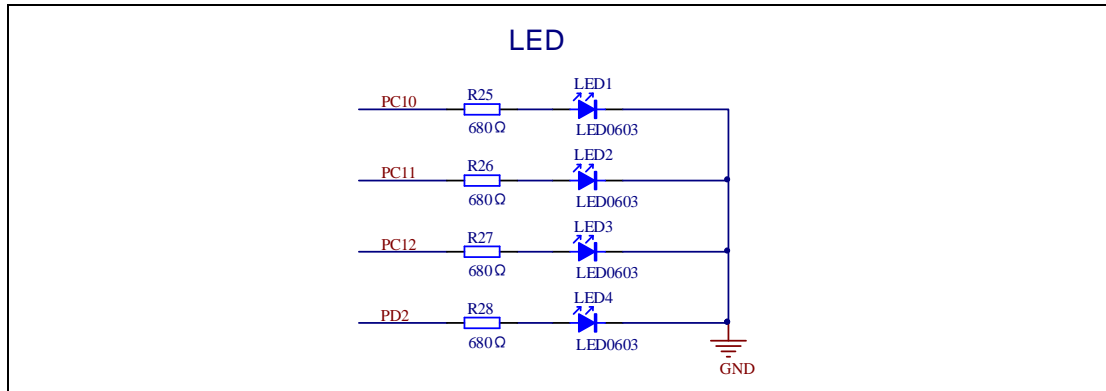


Table 4-1 Boot configuration

BOOT1	BOOT0	Boot Mode
Default	2-3	User memory
	1-2	System memory
Changed by ISP	1-2	SRAM memory

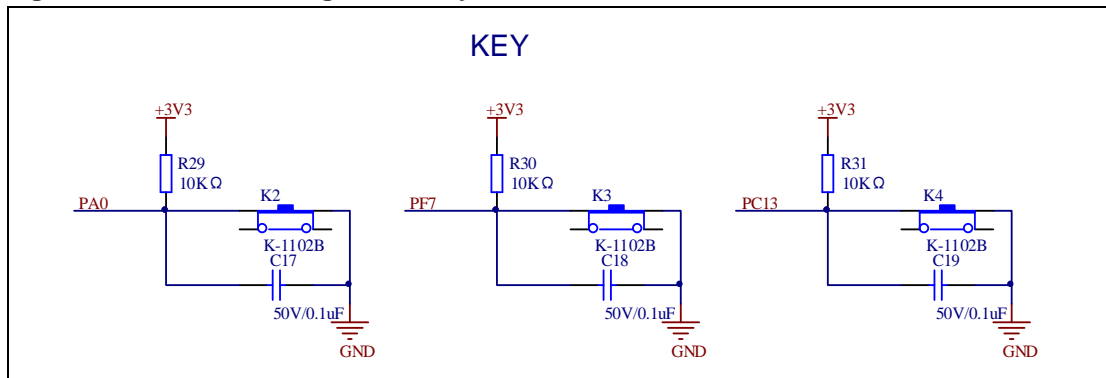
4.3. LED

Figure 4-3 Schematic diagram of LED function



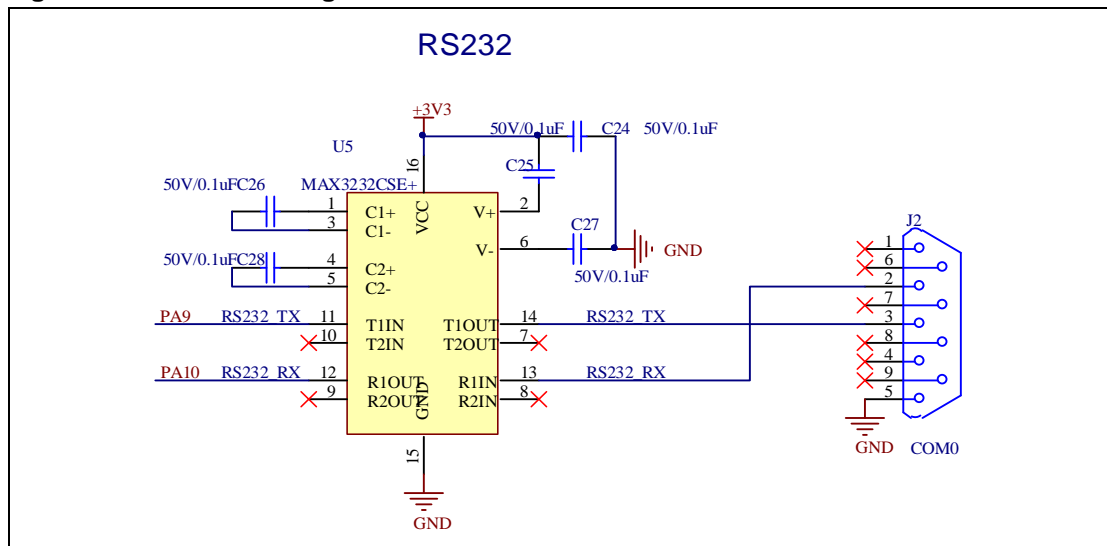
4.4. KEY

Figure 4-4 Schematic diagram of Key function



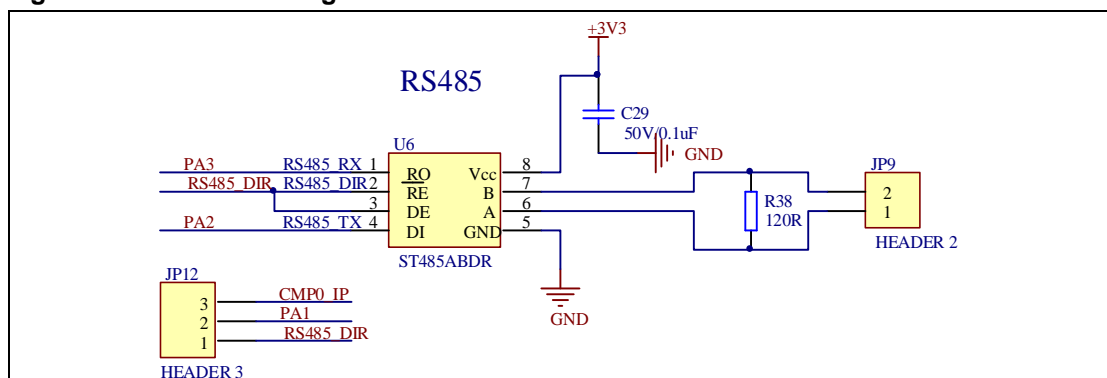
4.5. USART

Figure 4-5 Schematic diagram of USART function



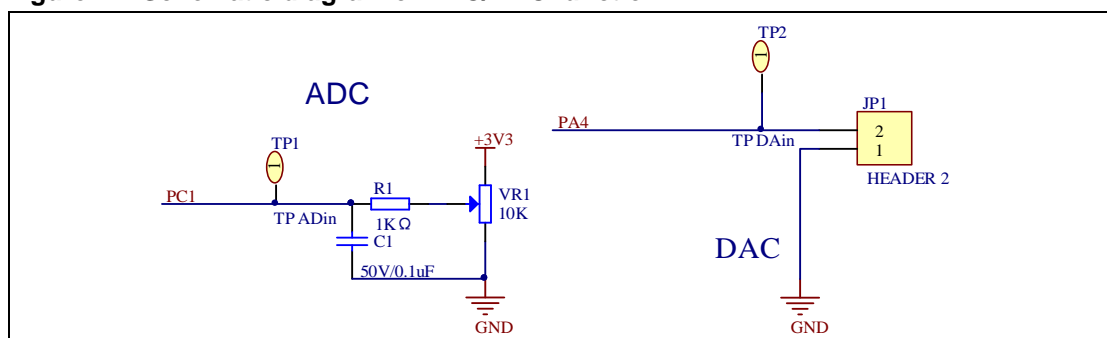
4.6. RS485

Figure 4-6 Schematic diagram of RS485 function



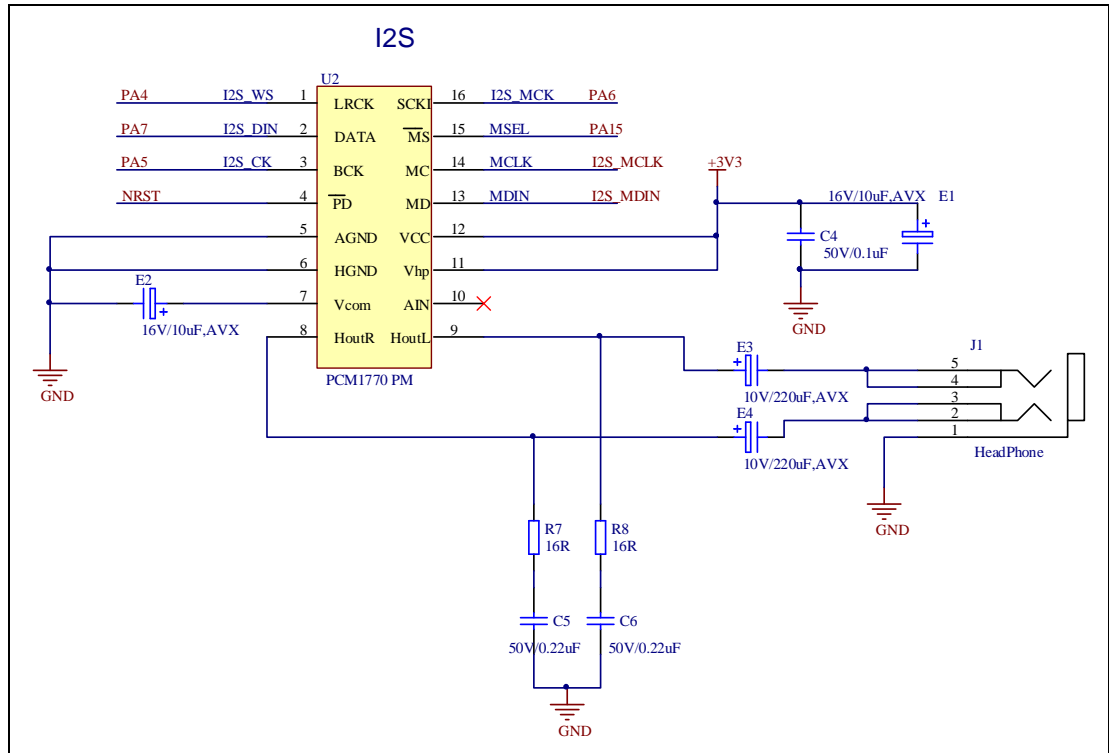
4.7. ADC/DAC

Figure 4-7 Schematic diagram of ADC/DAC function



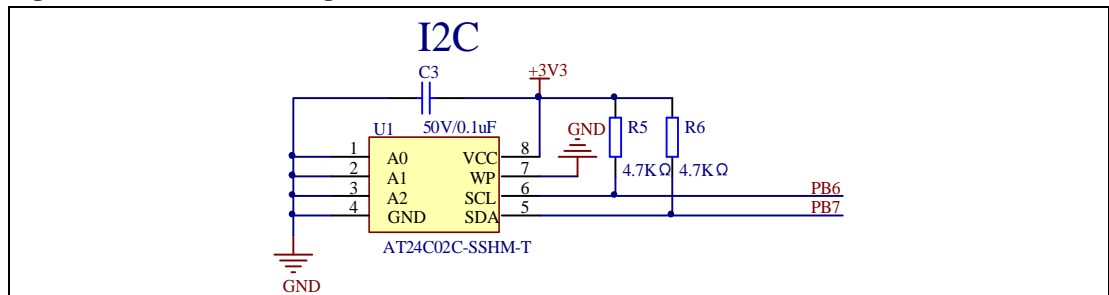
4.8. I2S

Figure 4-8 Schematic diagram of I2S function



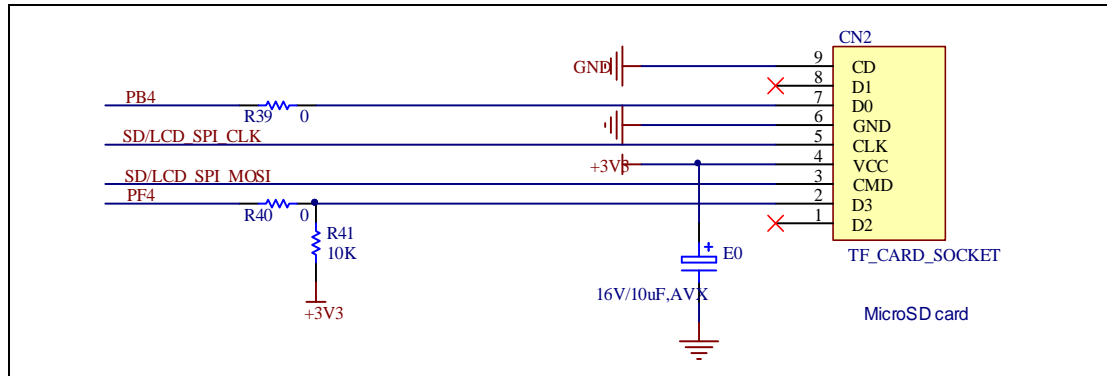
4.9. I2C

Figure 4-9 Schematic diagram of I2C function



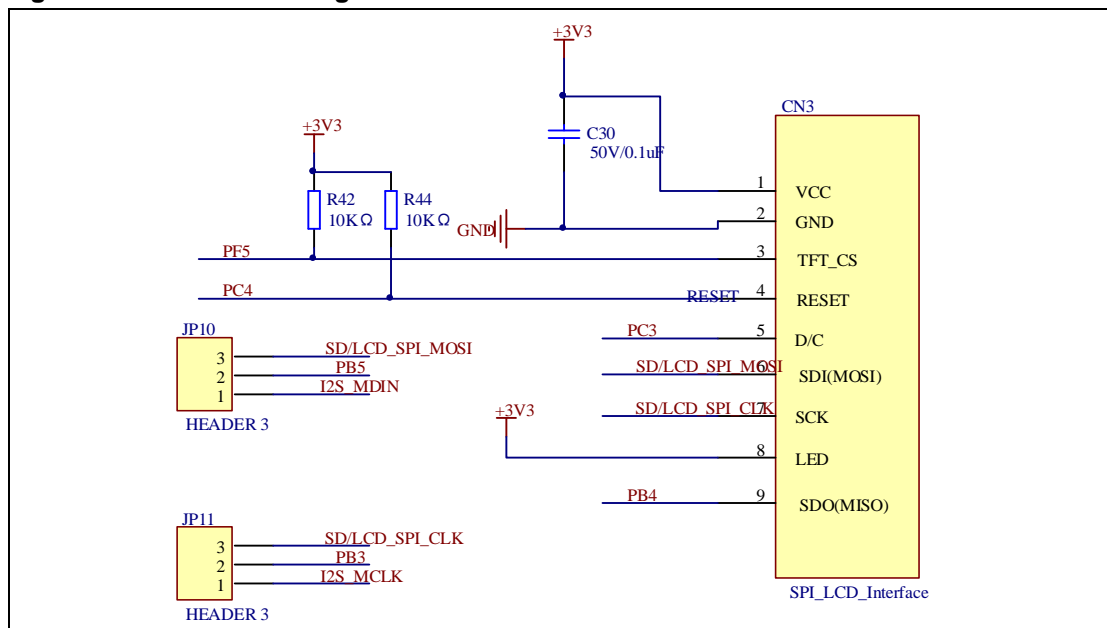
4.10. SPI-TF CARD

Figure 4-10 Schematic diagram of SPI-TF CARD function



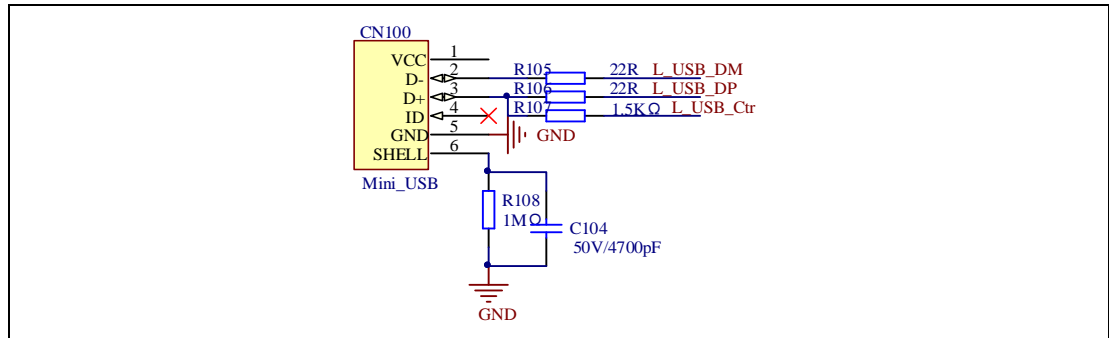
4.11. SPI-TFT LCD

Figure 4-11 Schematic diagram of SPI-TFT LCD function



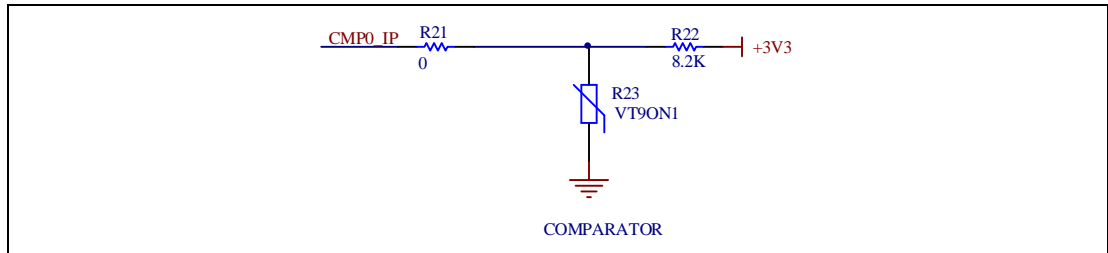
4.12. USB

Figure 4-12 Schematic diagram of USB function



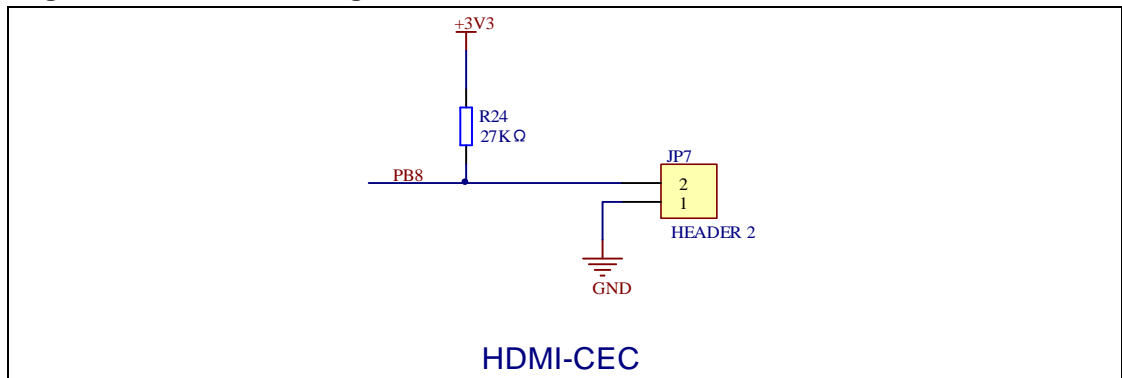
4.13. CMP

Figure 4-13 Schematic diagram of CMP function



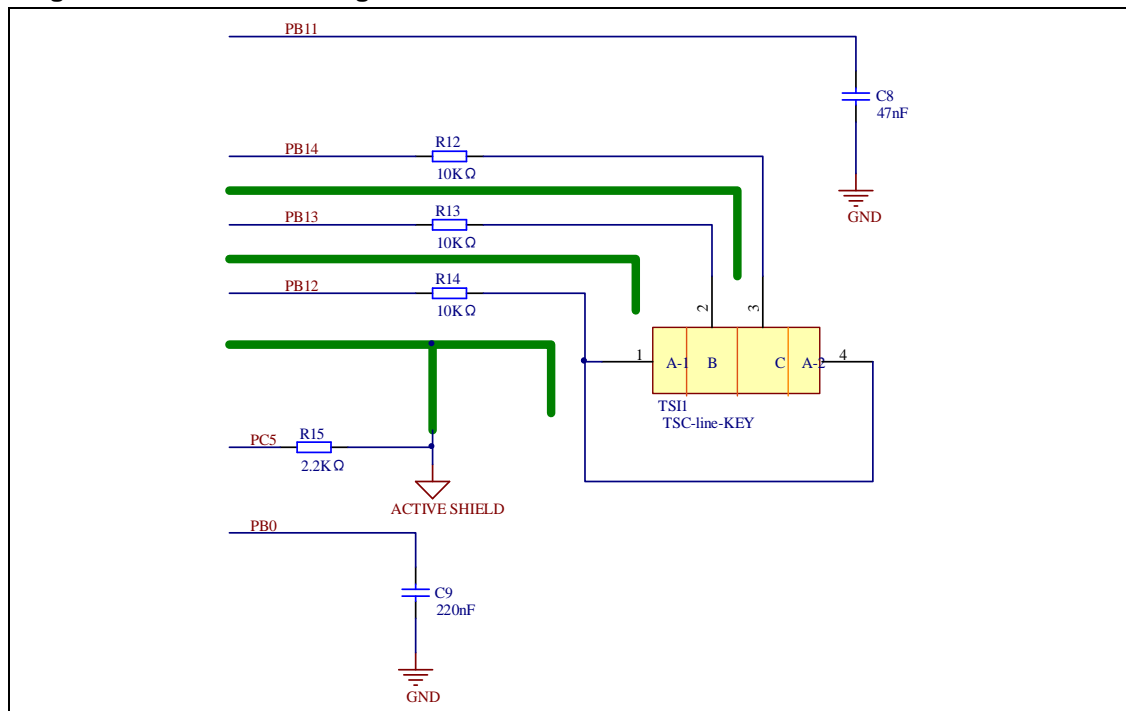
4.14. HDMI-CEC

Figure 4-14 Schematic diagram of HDMI-CEC function



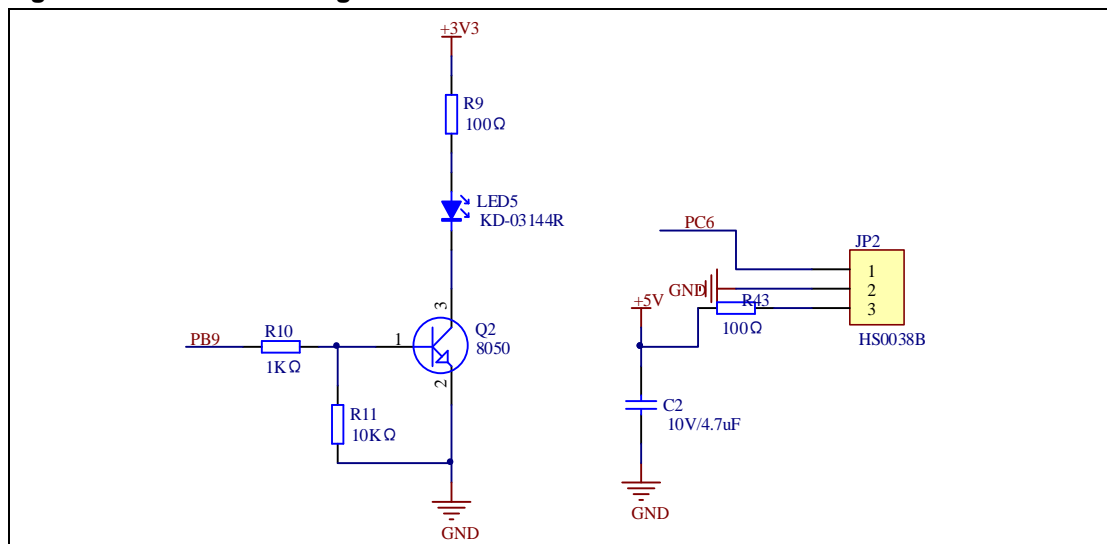
4.15. TSI

Figure 4-15 Schematic diagram of TSI function



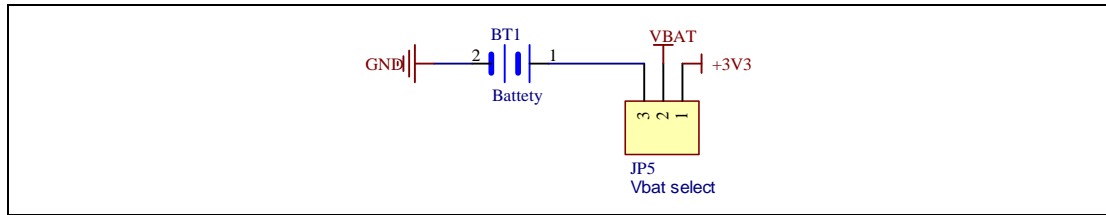
4.16. IFRP

Figure 4-16 Schematic diagram of IFRP function



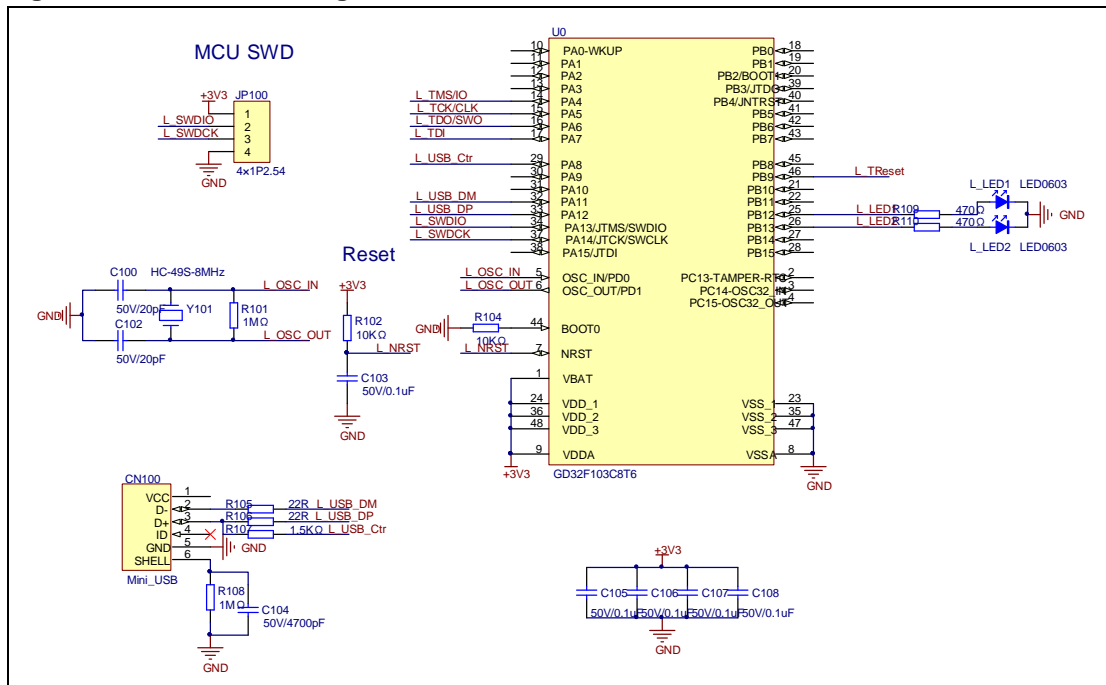
4.17. RTC

Figure 4-17 Schematic diagram of RTC function



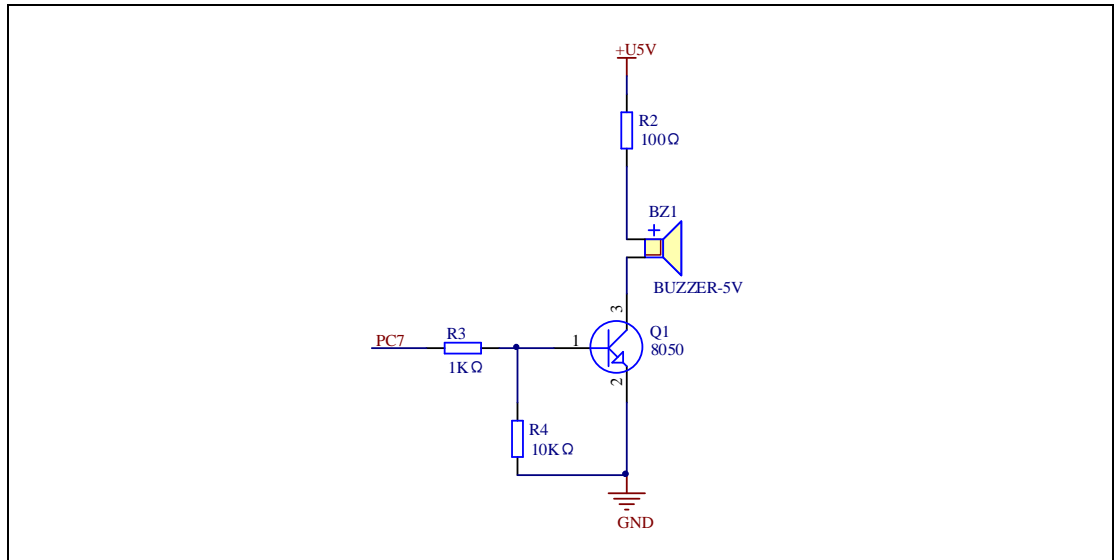
4.18. GD-Link

Figure 4-18 Schematic diagram of GD-Link function



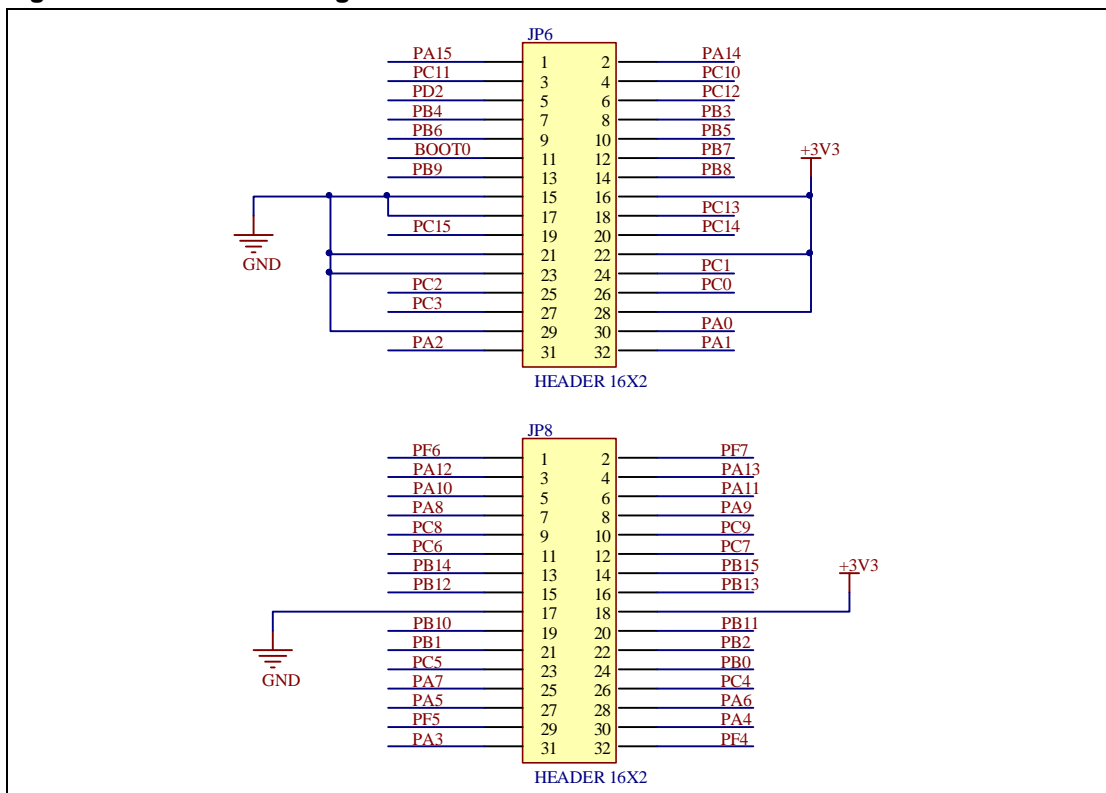
4.19. BEEPER

Figure 4-19 Schematic diagram of BEEPER function



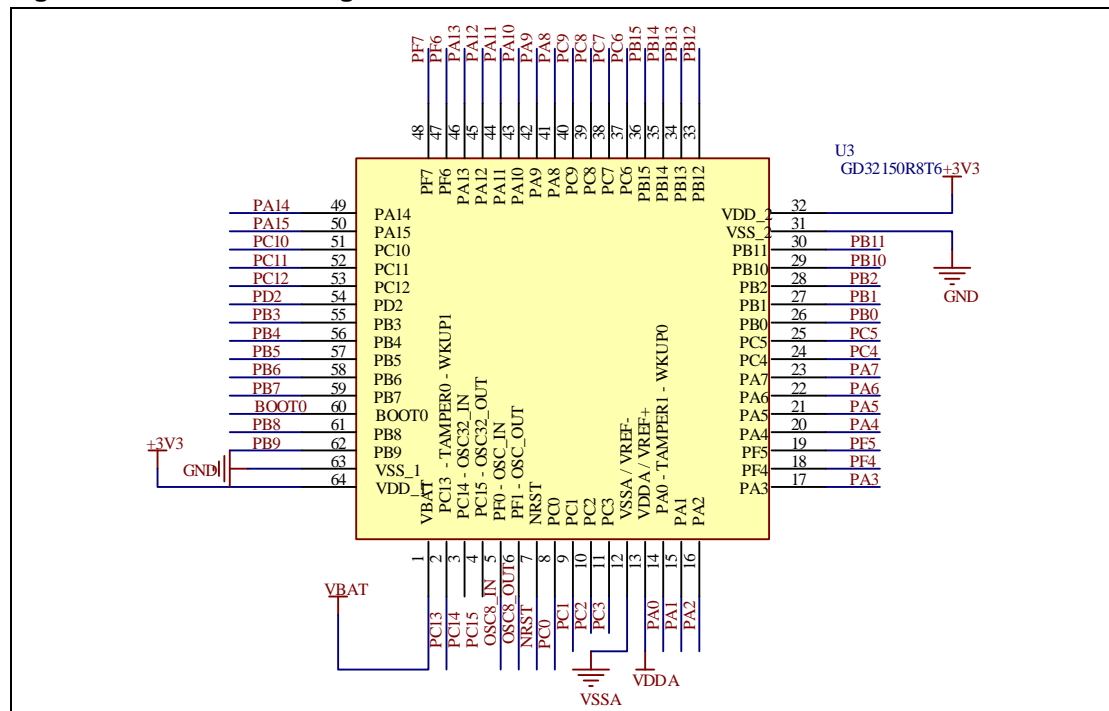
4.20. Extension

Figure 4-20 Schematic diagram of Extension Pin



4.21. MCU

Figure 4-21 Schematic diagram of MCU Pin



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 for controlling the LED
- Learn to use SysTick to generate 1ms delay

GD32150R-EVAL-V1.3 board has four LEDs. The LED1, LED2, LED3 and LED4 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, four LEDs will turn on one by one from LED1 to LED4 every 200ms, and then turn off together. 200ms later, the four LEDs work like previous again.

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

GD32150R-EVAL-V1.3 board has four keys and four LEDs. The four keys are Reset key, Tamper key, User key and Wakeup key. The LED1, LED2, LED3 and LED4 are controlled by GPIO.

This demo will show how to use the Tamper key to control the LED2. When press down the User Key, it will check the input value of the IO port. If the value is 0, wait for 50ms. Then check the input value of the IO port again. If the value is still 0, indicates that the button is pressed down successfully, and light the LED2.

5.2.2. DEMO running result

Download the program <02_GPIO_Key_Polling_mode> to the EVAL board, first of all, all the LEDs will be flashed once for test. Then press down the Tamper Key, LED2 will be turned on. Press down the Tamper 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 to control the LED and the KEY
- Learn to use EXTI to generate external interrupt

GD32150R-EVAL-V1.3 board has four keys and four LEDs. The four keys are Reset key, Wakeup key, User key and Tamper key. The LED1, LED2, LED3 and LED4 are controlled by GPIO.

This demo will show how to use EXTI interrupt line to control the LED2. When press down the Tamper 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, first of all, all the LEDs will be flashed once for test. Then press down the Tamper Key, LED2 will be turned

on. Press down the Tamper Key again, LED2 will be turned off.

5.4. GPIO_BEEPER

5.4.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

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

GD32150R-EVAL-V1.3 board has one beeper and connected by PC7. This demo will show how to use GPIO to control the beeper.

5.4.2. DEMO running result

Download the program <04_GPIO_BEEPER> to the EVAL board, when the program running, the status of the beeper will change every 200ms.

5.5. USART_Printf

5.5.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use GPIO: the Tamper key control the LED
- Learn to retarget the C library printf function to the USART

5.5.2. DEMO running result

Download the program <05_USART_Printf> to the EVAL board and connect serial cable to COM. This implementation outputs “please press the Tamper Key” on the hyperterminal. Press the Tamper key, serial port will output “USART Printf Example”. The information via a serial port output as following.

```
please press the Wakeup Key
```

```
USART printf example
```

5.6. USART_HyperTerminal_Interrupt

5.6.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use the EVAL_COM transmit and receive interrupts to communicate with the hyperterminal

5.6.2. DEMO running result

Download the program <06_USART_HyperTerminal_Interrupt> to the EVAL board and run. Firstly, all the LEDs are turned on and off for test. Then, the COM sends the tx_buffer array (from 0x00 to 0xFF) to the hyperterminal and waits for receiving data from the hyperterminal that you must send. The string that you have sent is stored in the rx_buffer array. The receive buffer have a BUFFER_SIZE bytes as maximum. After that, compare tx_buffer with rx_buffer. If tx_buffer is same with rx_buffer, LED1 and LED2 are turned on, LED3 and LED4 are turned off. Otherwise, LED1 and LED2 are turned off, LED3 and LED4 are turned on.

The information via a serial port output 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
```

5.7. USART_DMA

5.7.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use the COM transmit and receive using DMA

5.7.2. DEMO running result

Download the program <07_USART_DMA> to the EVAL board and run. Firstly, all the LEDs are turned on and off for test. Then, the COM sends the tx_buffer array to the hyperterminal and waits for receiving data from the hyperterminal that you must send. The string that you

have sent is stored in the rx_buffer array. The receive buffer have a BUFFER_SIZE bytes as maximum. After that, compare tx_buffer with rx_buffer. If tx_buffer is same with rx_buffer, f tx_buffer is same with rx_buffer, LED1, LED2, LED3 and LED4 are turned on. Otherwise, LED1, LED2, LED3 and LED4 are turned off.

The information via a serial port output 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
```

5.8. RS485_Test

5.8.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use the USART RS485

5.8.2. DEMO running result

Jump the JP12 to RS485 with the jumper cap. This routines need to prepare two GD32F150R_EVAL boards, one board as a sender, the other as a receiver. First connect two GD32150R-EVAL-V1.3 boards through RS485 line A and B, and then download the program <08_RS485_Test> to the board for running. When press the Wakeup key on one board, the board is set as RS485 transmitter and LED2 is on and when press the Tamper key on one board, the board is set as RS485 receiver and LED3 is on.

Download the program <08_RS485_Test> to the EVAL board and run, the information via a serial port output as following:

```
-----  
-----  
  
GD32F150R_EVAL RS485_Test  
  
--> Press down KEY_WAKEUP to set GD32F150R_EVAL as RS485  
transmitter  
  
--> Press down KEY_TAMPER to set GD32F150R_EVAL as RS485  
receiver  
  
-----  
-----
```

According to the tips, press down Tamper key to set one board as a receiver first and then press down Wakeup key to the other as a transmitter. The transmitter output as following.

```
RS485 transmitter is enabled  
Data is being transmitted: GD32MCU  
Data is being transmitted: GD32MCU  
Data is being transmitted: GD32MCU  
Data is being transmitted: GD32MCU
```

The receiver output as following.

```
RS485 receiver is enabled  
Waiting for received data  
The received data: [GD32MCU]  
The received data: [GD32MCU]  
The received data: [GD32MCU]  
The received data: [GD32MCU]
```

5.9. ADC_Conversion_Triggered_By_Timer

5.9.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use ADC to convert analog to digital
- Learn to use TIMER to generate a compare event
- Learn to use LCD to show the ADC converted result

TIMER1 CH1 event triggers ADC conversion, the value displayed on the LCD corresponds to the ADC analog input, and changes with it. The converted data moved to SRAM through

DMA continuously.

5.9.2. DEMO running result

Download the program <09_ADC_Conversion_Triggered_By_Timer> to the GD32150R-EVAL-V1.3 board, adjust the adjustable potentiometer knob to change the analog input. The ADC, which is triggered by TIMER1 CH1 event, will convert the analog input, and the result, a voltage curve, is displayed on the LCD. The curve coincides with the analog input.

5.10. DAC_Output_Voltage_Value

5.10.1. DEMO Purpose

This demo includes the following functions of GD32 MCU:

- Learn to use DAC to output voltage on DAC0_OUT0 output

5.10.2. DEMO Running Result

Download the program <10_DAC_Output_Voltage_Value> to the EVAL board and run.

Firstly, all the LEDs will turn on and turn off for test. And then the digital value 0x7FF0, which should be 1.65V ($V_{REF}/2$), would be output on PA4.

The voltage on PA4 can be observed through the oscilloscope.

5.11. Comparator_Obtain_Brightness

5.11.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use comparator output compare result

The comparator has two inputs, in this demo, one input is PA1, and the other one is the reference voltage. Compare the two input voltages, the output is a high or low level, and the LED2 will performs the corresponding action.

5.11.2. DEMO running result

Download the program <11_Comparator_obtain_brightness> to the EVAL board, comparing two input voltage, if output level is high, LED2 is off, otherwise LED2 is on.

5.12. I2C_EEPROM

5.12.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn how to use the master transmitting mode of the I2C module
- Learn how to use the master receiving mode of the I2C module
- Learn to read and write the EEPROM with the I2C interface

5.12.2. DEMO running result

Download the program <12_I2C_EEPROM> to the EVAL board and run. Connect serial cable to COM0, and open the HyperTerminal to show the print message.

Firstly, the data of 256 bytes will be written to the EEPROM from the address 0x00 and printed by the serial port. Then, reading the EEPROM from address 0x00 for 256 bytes and the result will be printed. Finally, compare the data that were written to the EEPROM and the data that were read from the EEPROM. If they are the same, the serial port will output "I2C-AT24C02 test passed!" and the four LEDs lights flashing, otherwise the serial port will output "Err: data read and write aren't matching." and all the four LEDs light.

The output information via the serial port is as following.

```
I2C-24C02 configured...
The I2C0 is hardware interface
The speed is 400000
AT24C02 writing...
0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A 0x0B 0x0C 0x0D 0x0E 0x0F
0x10 0x11 0x12 0x13 0x14 0x15 0x16 0x17 0x18 0x19 0x1A 0x1B 0x1C 0x1D 0x1E 0x1F
0x20 0x21 0x22 0x23 0x24 0x25 0x26 0x27 0x28 0x29 0x2A 0x2B 0x2C 0x2D 0x2E 0x2F
0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x3A 0x3B 0x3C 0x3D 0x3E 0x3F
0x40 0x41 0x42 0x43 0x44 0x45 0x46 0x47 0x48 0x49 0x4A 0x4B 0x4C 0x4D 0x4E 0x4F
0x50 0x51 0x52 0x53 0x54 0x55 0x56 0x57 0x58 0x59 0x5A 0x5B 0x5C 0x5D 0x5E 0x5F
0x60 0x61 0x62 0x63 0x64 0x65 0x66 0x67 0x68 0x69 0x6A 0x6B 0x6C 0x6D 0x6E 0x6F
0x70 0x71 0x72 0x73 0x74 0x75 0x76 0x77 0x78 0x79 0x7A 0x7B 0x7C 0x7D 0x7E 0x7F
0x80 0x81 0x82 0x83 0x84 0x85 0x86 0x87 0x88 0x89 0x8A 0x8B 0x8C 0x8D 0x8E 0x8F
0x90 0x91 0x92 0x93 0x94 0x95 0x96 0x97 0x98 0x99 0x9A 0x9B 0x9C 0x9D 0x9E 0x9F
0xA0 0xA1 0xA2 0xA3 0xA4 0xA5 0xA6 0xA7 0xA8 0xA9 0xAA 0xAB 0xAC 0xAD 0xAE 0xAF
0xB0 0xB1 0xB2 0xB3 0xB4 0xB5 0xB6 0xB7 0xB8 0xB9 0xBA 0xBB 0xBC 0xBD 0xBE 0xBF
0xC0 0xC1 0xC2 0xC3 0xC4 0xC5 0xC6 0xC7 0xC8 0xC9 0xCA 0xCB 0xCC 0xCD 0xCE 0xCF
0xD0 0xD1 0xD2 0xD3 0xD4 0xD5 0xD6 0xD7 0xD8 0xD9 0xDA 0xDB 0xDC 0xDD 0xDE 0xDF
0xE0 0xE1 0xE2 0xE3 0xE4 0xE5 0xE6 0xE7 0xE8 0xE9 0xEA 0xEB 0xEC 0xED 0xEE 0xEF
0xF0 0xF1 0xF2 0xF3 0xF4 0xF5 0xF6 0xF7 0xF8 0xF9 0xFA 0xFB 0xFC 0xFD 0xFE 0xFF
AT24C02 reading...
0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A 0x0B 0x0C 0x0D 0x0E 0x0F
0x10 0x11 0x12 0x13 0x14 0x15 0x16 0x17 0x18 0x19 0x1A 0x1B 0x1C 0x1D 0x1E 0x1F
0x20 0x21 0x22 0x23 0x24 0x25 0x26 0x27 0x28 0x29 0x2A 0x2B 0x2C 0x2D 0x2E 0x2F
0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x3A 0x3B 0x3C 0x3D 0x3E 0x3F
0x40 0x41 0x42 0x43 0x44 0x45 0x46 0x47 0x48 0x49 0x4A 0x4B 0x4C 0x4D 0x4E 0x4F
0x50 0x51 0x52 0x53 0x54 0x55 0x56 0x57 0x58 0x59 0x5A 0x5B 0x5C 0x5D 0x5E 0x5F
0x60 0x61 0x62 0x63 0x64 0x65 0x66 0x67 0x68 0x69 0x6A 0x6B 0x6C 0x6D 0x6E 0x6F
0x70 0x71 0x72 0x73 0x74 0x75 0x76 0x77 0x78 0x79 0x7A 0x7B 0x7C 0x7D 0x7E 0x7F
0x80 0x81 0x82 0x83 0x84 0x85 0x86 0x87 0x88 0x89 0x8A 0x8B 0x8C 0x8D 0x8E 0x8F
0x90 0x91 0x92 0x93 0x94 0x95 0x96 0x97 0x98 0x99 0x9A 0x9B 0x9C 0x9D 0x9E 0x9F
0xA0 0xA1 0xA2 0xA3 0xA4 0xA5 0xA6 0xA7 0xA8 0xA9 0xAA 0xAB 0xAC 0xAD 0xAE 0xAF
0xB0 0xB1 0xB2 0xB3 0xB4 0xB5 0xB6 0xB7 0xB8 0xB9 0xBA 0xBB 0xBC 0xBD 0xBE 0xBF
0xC0 0xC1 0xC2 0xC3 0xC4 0xC5 0xC6 0xC7 0xC8 0xC9 0xCA 0xCB 0xCC 0xCD 0xCE 0xCF
0xD0 0xD1 0xD2 0xD3 0xD4 0xD5 0xD6 0xD7 0xD8 0xD9 0xDA 0xDB 0xDC 0xDD 0xDE 0xDF
0xE0 0xE1 0xE2 0xE3 0xE4 0xE5 0xE6 0xE7 0xE8 0xE9 0xEA 0xEB 0xEC 0xED 0xEE 0xEF
0xF0 0xF1 0xF2 0xF3 0xF4 0xF5 0xF6 0xF7 0xF8 0xF9 0xFA 0xFB 0xFC 0xFD 0xFE 0xFF
I2C-AT24C02 test passed!
```

5.13. SPI_TFT_LCD_Driver

5.13.1. DEMO purpose

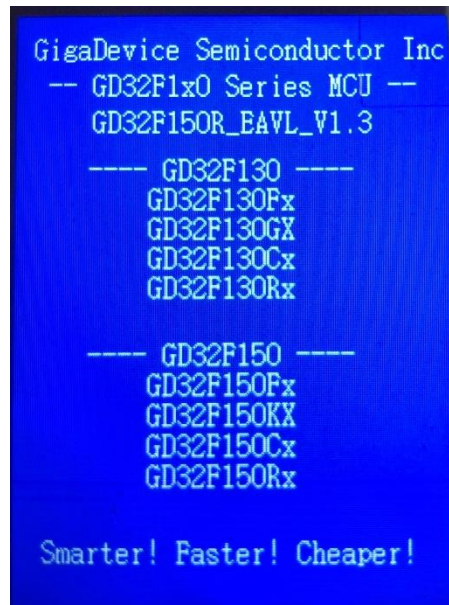
This Demo includes the following function of GD32 MCU:

- Learn how to use SPI to drive TFT LCD screen and display

GD32150R-EVAL-V1.3 board has a TFT LCD screen which supports SPI interface. In this demo, tests of font, number, draw and color are displayed on the LCD screen respectively.

5.13.2. DEMO running result

Firstly, JP10 and JP11 must be fitted to SPI port and then download the program <13_SPI_TFT_LCD_Driver> to the EVAL board. All the LEDs are turned on and then turned off for test. After that, the LCD screen on the board will display the GUI tests in infinite loop.



5.14. SPI_TF_Card_Block_Operation

5.14.1. DEMO purpose

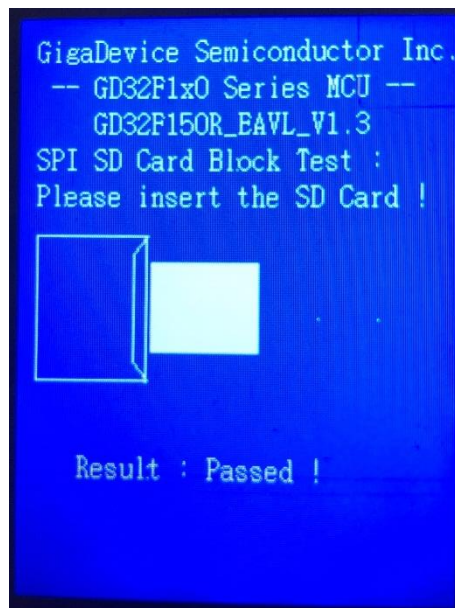
This Demo includes the following function of GD32 MCU:

- Learn how to use SPI to block read and write from TF card

In this demo, the SPI interface is used for reading from and writing to TF card. Write to TF card with 0 to 255, a total of 2048 bytes directly. Then read data from the original address, check the correctness of the written and read data. Note that, the FATFS is not used in this demo and in the absence of FATFS, read and write to the TF card will destroy the file system, please make a backup before testing.

5.14.2. DEMO running result

Firstly, JP10 and JP11 must be fitted to SPI and then download the program <14_SPI_TF_Card_Block_Operation> to the EVAL board. All the LEDs are turned on and then turned off for test. Insert the TF card to the board, the test results will be displayed on the LCD screen.



5.15. SPI_TF_Card_FATFS_Operation

5.15.1. DEMO purpose

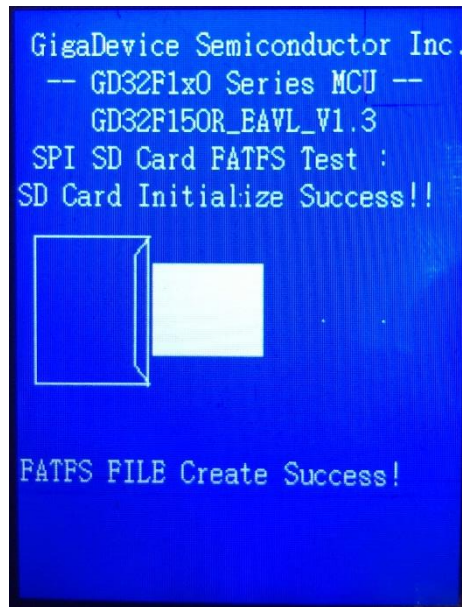
This Demo includes the following function of GD32 MCU:

- Learn how to use SPI to read and write from TF card with FATFS

In this demo, the SPI interface is used for reading from and writing to TF card. Make sure the TF card has FAT file system. If not, some information will be displayed on the LCD screen.

5.15.2. DEMO running result

Firstly, JP10 and JP11 must be fitted to SPI and then download the program <15_SPI_TF_Card_FATFS_Operation> to the EVAL board. All the LEDs are turned on and then turned off for test. Insert a formatted TF card, a text file will be created in this TF card. When the screen appears "FATFS FILE Create Success", you can remove the TF card and check whether the file is successfully created in the TF card with a card reader. When the exception occurs, operate follow the screen prompts.



5.16. HDMI-CEC_HostSlaveCommunication

5.16.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

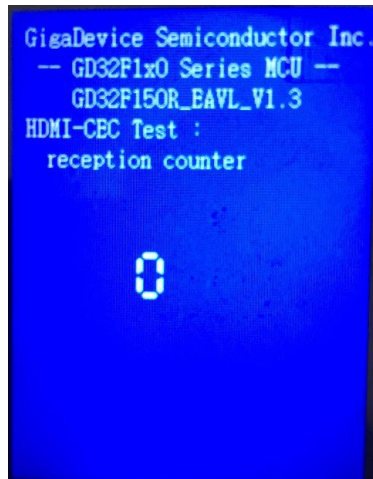
- Learn the communication function of HDMI-CEC

In the process of communication, the sender sends data to receiver through the key interrupt, the receiver for receiving data in the CEC interrupt. The entire communication process does not make the error processing.

5.16.2. DEMO running result

This routines need to prepare two EVAL board, one board as a sender, the other as a receiver. First use the DuPont to connect CEC bus (PB8) and ground wire (GND) pins in the two board, and then download the program <16_HDMI-CEC_HostSlaveCommunication> to the board for running. When the program runs, the first development board of the LCD display is data 0, press one of the development board USER key, the other piece of the development board LCD number will increase, which shows the end of a data transmission. Each it increases to 9, it will clear to 0 to re-increase; press the TAMPER key, the number will decrease, which also shows the end of a data transmission. Every time it decreases to 0, it will return to the number 9 to re-decrease.

The LCD display as following:



5.17. I2S_Audio_Player

5.17.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use I2S module to output audio file

GD32150R-EVAL-V1.3 board integrates the I2S (Inter-IC Sound) module, and the module can communicate with external devices using the I2S audio protocol. This Demo mainly shows how to use the I2S interface of the board for audio output.

5.17.2. DEMO running result

Download the program <17_I2S_Audio_Player> to the EVAL board. After downloading the program, insert the earphone into the audio port J1, then listen to the audio file.

5.18. RCU_Clock_Out

5.18.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use GPIO control the LED
- Learn to use the clock output function of RCU
- Learn to communicate with PC by USART

5.18.2. DEMO running result

Download the program <18_RCU_Clock_Out> to the EVAL board and run. Connect serial cable to EVAL_COM0, open the HyperTerminal. When the program is running, HyperTerminal will display the initial information. Then user can choose the type of the output

clock by pressing the USER button. After pressing, the corresponding LED will be turned on and HyperTerminal will display which mode be selected. The frequency of the output clock can be observed through the oscilloscope by PA8 pin.

Information via a serial port output as following:

```
/===== Gigadevice clock output Demo =====/  
press user key to select clock output source  
CK_OUT: IRC14M, DIV:1  
CK_OUT: IRC40K, DIV:1  
CK_OUT: LXTAL, DIV:1  
CK_OUT: CKSYS, DIV:4  
CK_OUT: IRC8M, DIV:1
```

5.19. PMU_sleep_wakeup

5.19.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use the USART receive interrupt to wake up the PMU from sleep mode

5.19.2. DEMO running result

Download the program < 19_PMU_sleep_wakeup > to the EVAL board, connect serial cable to EVAL_COM0. After power-on, all the LEDs are off. The MCU will enter sleep mode and the software stop running. When the USART0 receives a byte of data from the HyperTerminal, the MCU will wake up from a receive interrupt. And all the LEDs will flash together.

5.20. RTC_Calendar

5.20.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use RTC module to implement calendar function
- Learn to use LCD module to display the time of calendar

5.20.2. DEMO running result

Download the program <20_RTC_Calendar> to the EVAL board and run. When the program is running, the four LEDs, LED1 to LED4 turn on, then turn off. And then the LCD prints out the information of the board, and the calendar. When you press the Wakeup key, the time will be configured to 2016-05-13, 12:00:00.

If place a battery on GD32150R-EVAL-V1.3 board, it can realize no losing of time when power down. In this case, notice that JP5 jump to the VBAT.

5.21. IRInfrared_Transceiver

5.21.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use general timer output PWM wave
- Learn to use general timer generated update interrupt
- Learn to use general timer capture interrupt
- Learn to use general timer TIMER15 and TIMER16 implement Infrared function

5.21.2. DEMO running result

Download the program <21_IRInfrared_Transceiver> to the EVAL board and run. When the program is running, if the infrared receiver received data is correct, LED1~LED4 light in turn, otherwise LED1~LED4 toggle together.

5.22. TIMER_Breath_LED

5.22.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use Timer output PWM wave
- Learn to update channel value

5.22.2. DEMO running result

Use the DuPont line to connect the TIMER0_CH0 (PA8) and LED1 (PC10), and then download the program <22_TIMER_Breath_LED> to the GD32150R-EVAL-V1.3 board and run. PA8 should not be reused by other peripherals.

When the program is running, you can see LED1 lighting from dark to bright gradually and then gradually darken, ad infinitum, just like breathing as rhythm.

5.23. TSI_TouchKey_leds

5.23.1. DEMO purpose

This Demo includes the following functions of GD32 MCU:

- Learn to use TSI module implement Touch Key function

5.23.2. DEMO running result

Download the program <23_TSI_TouchKey_Leds> to the EVAL board and run. When the program is running, you can use a finger slide the Touch Sensor (A-1, B, C or A-2) on the EVAL board, and then the associated LED is light.

5.24. USB_Device

5.24.1. DEMO purpose

This demo includes the following functions of GD32 MCU:

- Learn how to use the USBFS peripheral mode
- Learn how to implement USB HID(human interface) device

EVAL board has four keys and one USB interface. The five keys are Reset key, Wakeup key, Tamper key and User key. In this demo, the EVAL board is enumerated as an USB Keyboard, which uses the native PC Host HID driver, as shown below. The USB Keyboard uses three keys(wakeup key, tamper key and user key) to output three characters ('b', 'a' and 'c'). In addition, the demo also supports remote wakeup which is the ability of a USB device to bring a suspended bus back to the active condition, and the wakeup key is used as the remote wakeup source.



5.24.2. DEMO running result

Download the program <24_USB_keyboard> to the EVAL board and run. If you press the Wakeup key, will output 'b'. If you press the User key, will output 'c'. If you press the Tamper key, will output 'a'.

If you want to test USB remote wakeup function, you can do as follows:

- Manually switch PC to standby mode
- Wait for PC to fully enter the standby mode

- Push the Wakeup key
- If PC is ON, remote wakeup is OK, else failed.

6. Revision history

Table 6-1 Revision history

Revision No.	Description	Date
1.0	Initial Release	Jun.28, 2017
2.0	Updated format across the whole document	Jun.1, 2019
3.0	Updated format across the whole document	Nov.1, 2019
3.1	Updated format across the whole document	Dec.31, 2021
3.2	1. Modified the description of chap <u>5.19.</u> <u>PMU sleep wakeup.</u>	Jun.30, 2022
3.3	1. Modified the description of chap <u>5.10.</u> <u>DAC Output Voltage Value.</u> 2. Modified the description of chap <u>5.11.</u> <u>Comparator Obtain Brightness.</u>	Dec.31, 2023

Important Notice

This document is the property of GigaDevice Semiconductor Inc. and its subsidiaries (the "Company"). This document, including any product of the Company described in this document (the "Product"), is owned by the Company under the intellectual property laws and treaties of the People's Republic of China and other jurisdictions worldwide. The Company reserves all rights under such laws and treaties and does not grant any license under its patents, copyrights, trademarks, or other intellectual property rights. The names and brands of third party referred thereto (if any) are the property of their respective owner and referred to for identification purposes only.

The Company makes no warranty of any kind, express or implied, with regard to this document or any Product, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Company does not assume any liability arising out of the application or use of any Product described in this document. Any information provided in this document is provided only for reference purposes. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. Except for customized products which has been expressly identified in the applicable agreement, the Products are designed, developed, and/or manufactured for ordinary business, industrial, personal, and/or household applications only. The Products are not designed, intended, or authorized for use as components in systems designed or intended for the operation of weapons, weapons systems, nuclear installations, atomic energy control instruments, combustion control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, life-support devices or systems, other medical devices or systems (including resuscitation equipment and surgical implants), pollution control or hazardous substances management, or other uses where the failure of the device or Product could cause personal injury, death, property or environmental damage ("Unintended Uses"). Customers shall take any and all actions to ensure using and selling the Products in accordance with the applicable laws and regulations. The Company is not liable, in whole or in part, and customers shall and hereby do release the Company as well as its suppliers and/or distributors from any claim, damage, or other liability arising from or related to all Unintended Uses of the Products. Customers shall indemnify and hold the Company as well as its suppliers and/or distributors harmless from and against all claims, costs, damages, and other liabilities, including claims for personal injury or death, arising from or related to any Unintended Uses of the Products.

Information in this document is provided solely in connection with the Products. The Company reserves the right to make changes, corrections, modifications or improvements to this document and Products and services described herein at any time, without notice.