

**GigaDevice Semiconductor Inc.**

**GD32L233K-START**

**Arm<sup>®</sup> Cortex<sup>®</sup>-M23 32-bit MCU**

## **User Guide**

Revision 1.0

(Nov. 2021)

# Table of Contents

<b>Table of Contents.....</b>	<b>1</b>
<b>List of Figures .....</b>	<b>2</b>
<b>List of Tables .....</b>	<b>3</b>
<b>1. Summary.....</b>	<b>4</b>
<b>2. Function Pin Assign.....</b>	<b>5</b>
<b>3. Getting started.....</b>	<b>6</b>
<b>4. Hardware layout overview .....</b>	<b>7</b>
4.1. Power supply.....	7
4.2. Boot option.....	7
4.3. LED .....	7
4.4. KEY.....	7
4.5. USART .....	8
4.6. USB.....	8
4.7. GD-Link.....	8
4.8. Arduino.....	9
4.9. MCU.....	10
<b>5. Routine use guide .....</b>	<b>11</b>
<b>5.1. GPIO_Running_LED.....</b>	<b>11</b>
5.1.1. DEMO purpose.....	11
5.1.2. DEMO running result.....	11
<b>5.2. GPIO_Key_Polling_mode.....</b>	<b>11</b>
5.2.1. DEMO purpose.....	11
5.2.2. DEMO running result.....	11
<b>5.3. EXTI_Key_Interrupt_mode.....</b>	<b>12</b>
5.3.1. DEMO purpose.....	12
5.3.2. DEMO running result.....	12
<b>5.4. USART_HyperTerminal_Interrupt.....</b>	<b>12</b>
5.4.1. DEMO purpose.....	12
5.4.2. DEMO running result.....	12
<b>5.5. TIMER_Key_EXTI .....</b>	<b>13</b>
5.5.1. DEMO purpose.....	13
5.5.2. DEMO running result.....	13
<b>5.6. USB_D_CDC_ACM .....</b>	<b>13</b>
5.6.1. DEMO Purpose .....	13
5.6.2. DEMO Running Result.....	14
<b>6. Revision history .....</b>	<b>15</b>

## List of Figures

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

# List of Tables

Table 2-1. Function pin assignment.....	5
Table 6-1. Revision history.....	15

## 1. Summary

GD32L233K-START uses GD32L233KBT6 as the main controller. It uses GD-Link Mini USB interface to supply 5V power. Reset, Boot, Button key, LED, USB and USART to USB interface are also included. For more details, please refer to GD32L233K-START\_Rev1.0 schematic.

## 2. Function Pin Assign

Table 2-1. Function pin assignment

Function	Pin	Description
LED	PA8	LED1
RESET		Reset
KEY	PA0	K2(Wakeup key)
USART	PA9	USART0_TX
	PA10	USART0_RX
USB	PA11	USB_DM
	PA12	USB_DP

### 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.

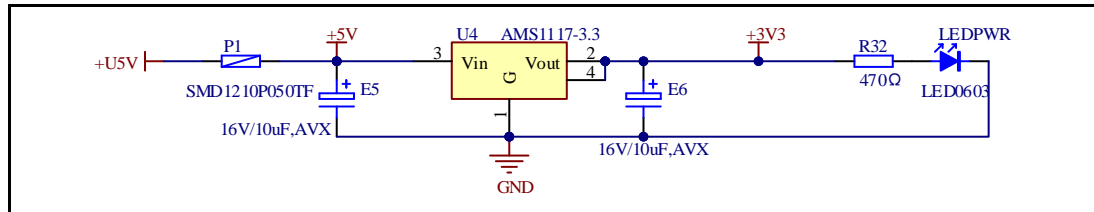
There are Keil version and IAR version of all projects. Keil version of the projects are created based on Keil MDK-ARM 5.26 uVision5. IAR version of the projects are created based on IAR Embedded Workbench for ARM 8.32.1. During use, the following points should be noted:

1. If you use Keil uVision5 to open the project. In order to solve the "Device Missing (s)" problem, you can install GigaDevice.GD32L23x\_DFP\_1.0.0.
2. If you use IAR to open the project, install IAR\_GD32L23x\_ADDON\_1.0.0.exe to load the associated files.

## 4. Hardware layout overview

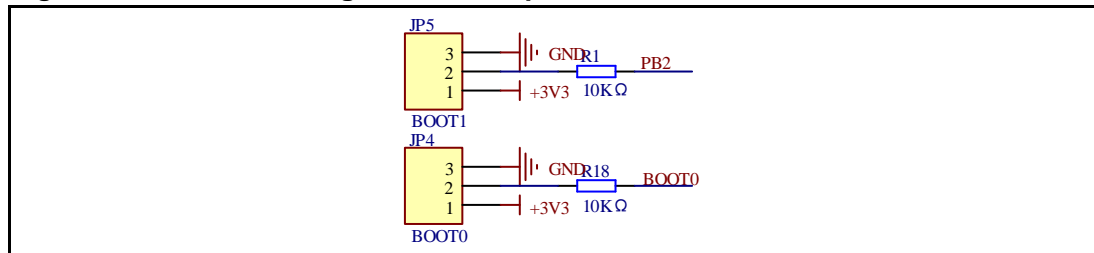
### 4.1. Power supply

Figure 4-1. Schematic diagram of power supply



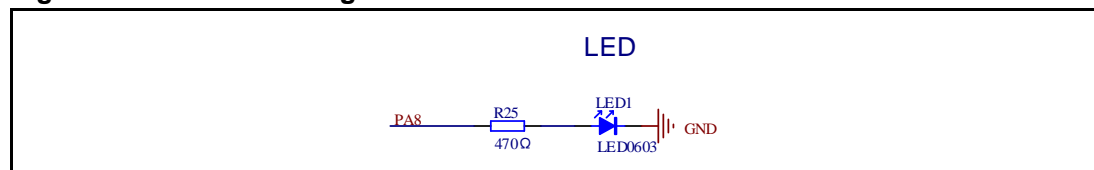
### 4.2. Boot option

Figure 4-2. Schematic diagram of boot option



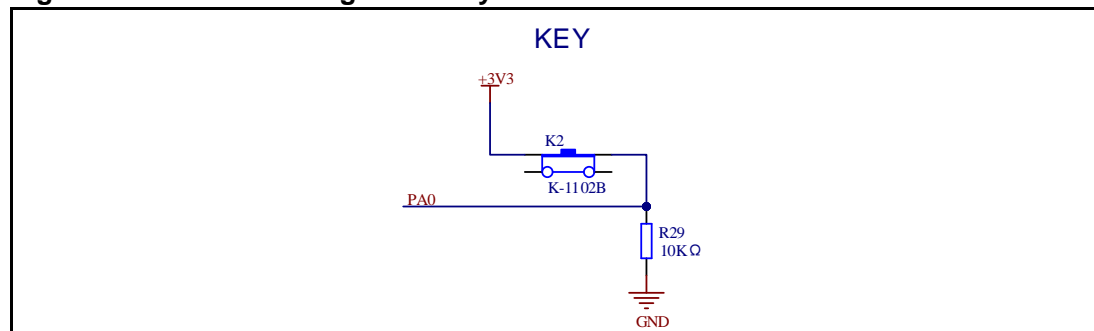
### 4.3. LED

Figure 4-3. Schematic diagram of LED function



### 4.4. KEY

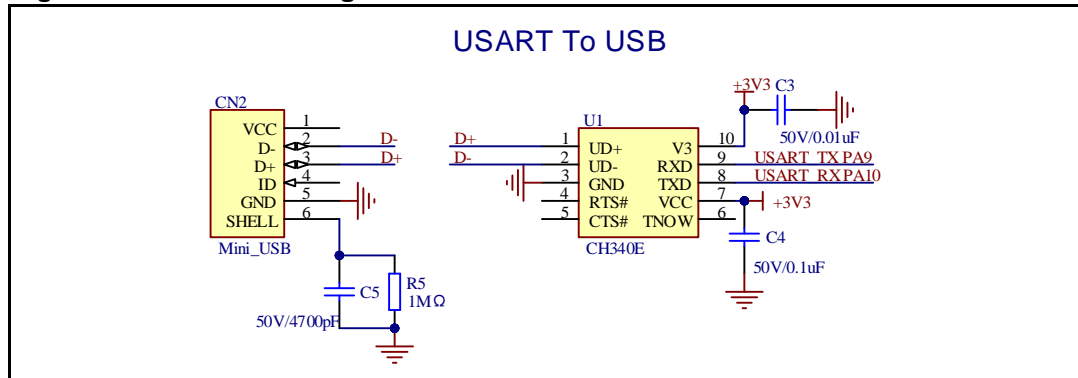
Figure 4-4. Schematic diagram of Key function





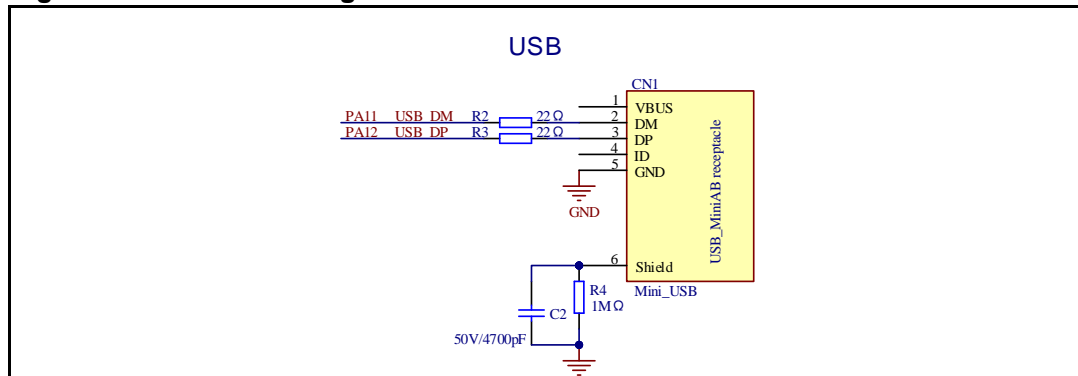
## 4.5. USART

Figure 4-5. Schematic diagram of USART



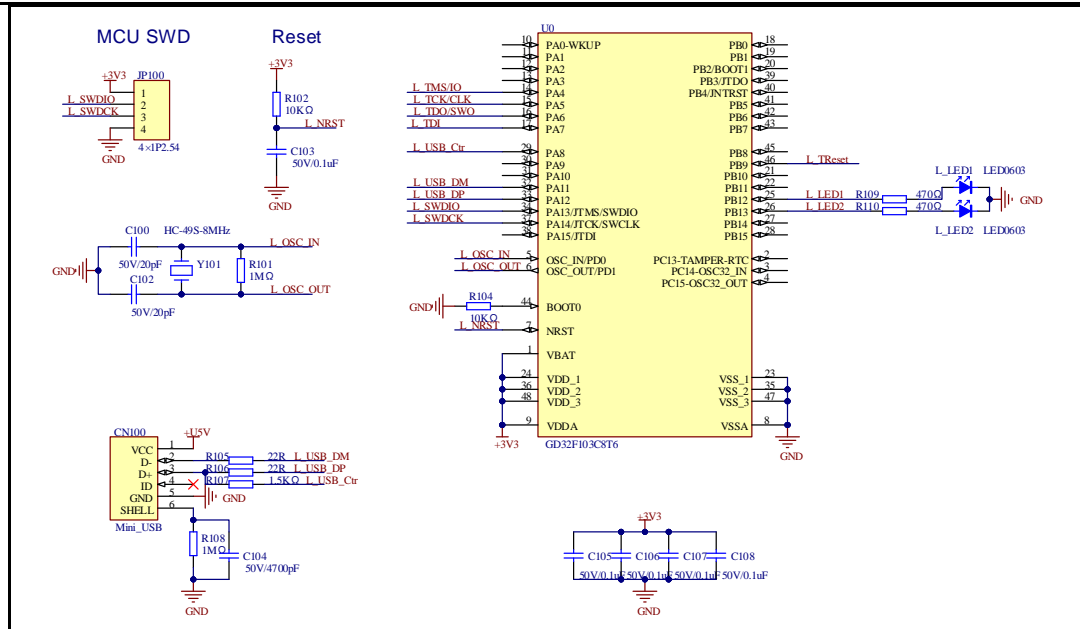
## 4.6. USB

Figure 4-6. Schematic diagram of USB



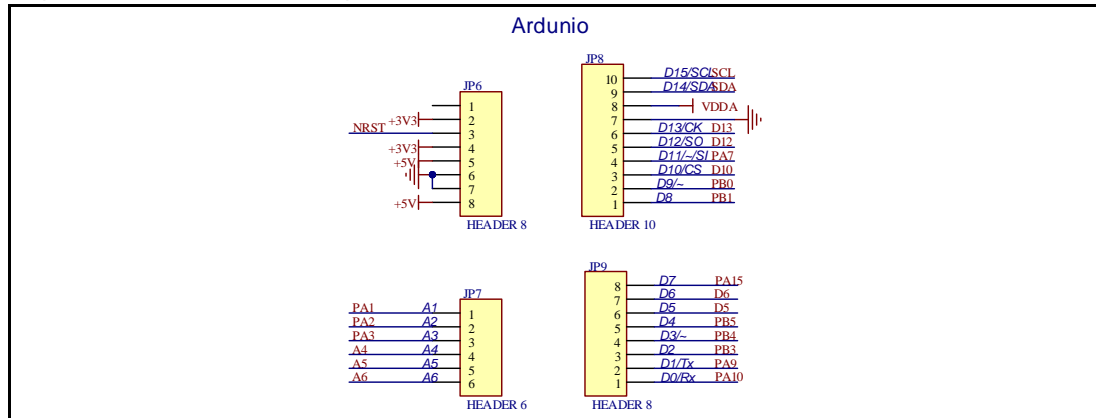
## 4.7. GD-Link

Figure 4-7. Schematic diagram of GD-Link



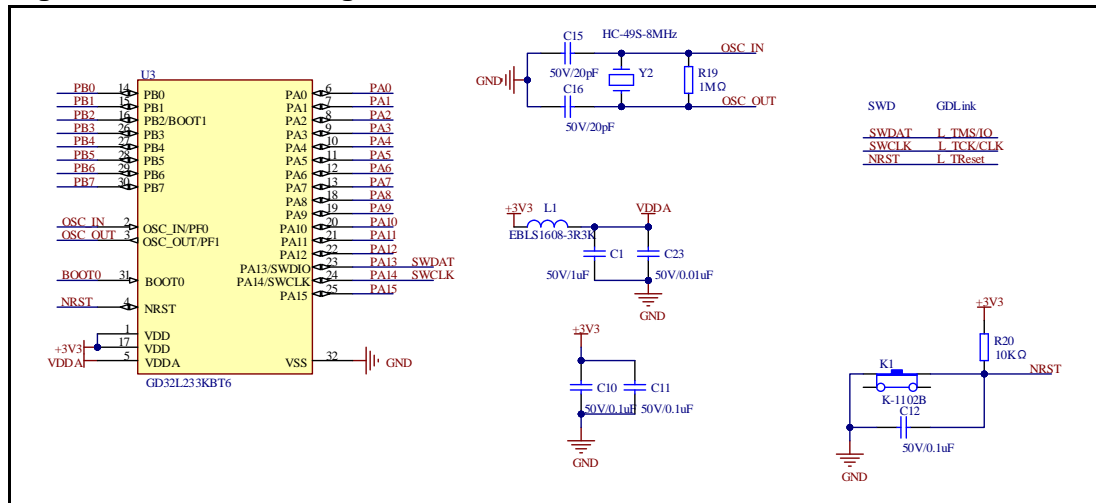
## 4.8. Arduino

Figure 4-8. Schematic diagram of Arduino



## 4.9. MCU

Figure 4-9. Schematic diagram of MCU



## 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

GD32L233K-START board has two keys and one LED. The two keys are Reset key and Wakeup key. The LED1 is 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 START board, LED1 can flash.

### 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

GD32L233K-START board has two keys and one LED. The two keys are Reset key and Wakeup key. The LED1 is controlled by GPIO.

This demo will show how to use the Wakeup key to control the LED1. When press down the Wakeup key, it will check the input value of the IO port. If the value is 0 and will wait for 100ms. Check the input value of the IO port again. If the value still is 0, it indicates that the button is pressed successfully and toggle LED1.

#### 5.2.2. DEMO running result

Download the program < 02\_GPIO\_Key\_Polling\_mode > to the START board, press down the Wakeup key, LED2 will be turned on. Press down the Wakeup key again, LED1 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

GD32L233K-START board has two keys and one LED. The two keys are Reset key and Wakeup key. The LED1 is controlled by GPIO.

This demo will show how to use the 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.

### 5.3.2. DEMO running result

Download the program < 03\_EXTI\_Key\_Interrupt\_mode > to the START board, LED1 is turned on and off for test. When press down the Wakeup key, LED1 will be turned on. Press down the Wakeup key again, LED1 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 HyperTerminal.

### 5.4.2. DEMO running result

Download the program <04\_USART\_HyperTerminal\_Interrupt> to the EVAL board and connect serial cable to USART. Firstly, the LED1 is turned on and off for test. Then, the USART 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 turn on. Otherwise, LED1 flash.

The output information via the HyperTerminal 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

GD32L233K-START board has two keys and one LED. The two keys are Reset key and Wakeup key. The LED1 is 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 generate 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, LED1 will flash once for test, press down the Wakeup Key, LED1 will be turned on. Press down the Wakeup Key again, LED1 will be turned off. Jump JP3 to Dx and connect PA6(TIMER2\_CH0) and PB1 with DuPont line. The LED1 will be toggled every 500ms.

## 5.6. USBD\_CDC\_ACM

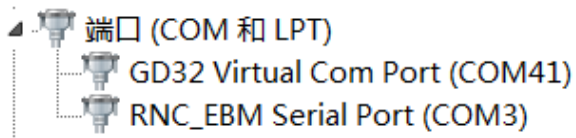
### 5.6.1. DEMO Purpose

This demo includes the following functions of GD32 MCU:

- Learn how to use the USBD peripheral
- Learn how to implement USB CDC device

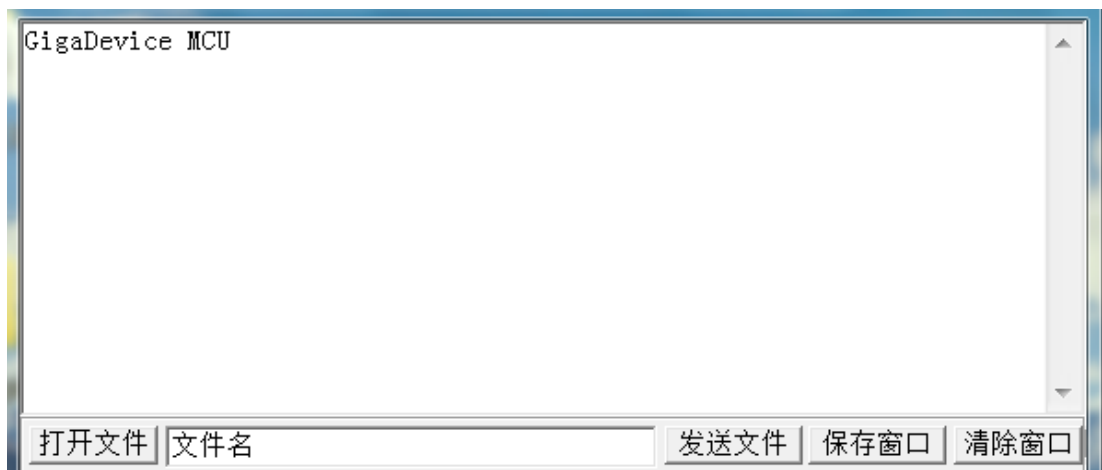
GD32L233K-START board has one USBD interface. In this demo, the GD32L233K-START board is enumerated as an USB virtual COM port, which was shown in device manager of

PC as below. This demo makes the USB device look like a serial port, and loops back the contents of a text file over USB port. To run the demo, input a message using the PC's keyboard. Any data that shows in HyperTerminal is received from the device.



### 5.6.2. DEMO Running Result

Download the program <06\_USBD\_CDC\_ACM> to the START board and run. When user input message through computer keyboard, the HyperTerminal will receive and shown the message. For example, when you input "GigaDevice MCU", the HyperTerminal will get and show it as below.



## 6. Revision history

**Table 6-1. Revision history**

Revision No.	Description	Date
1.0	Initial Release	Nov.15, 2021



## 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.