

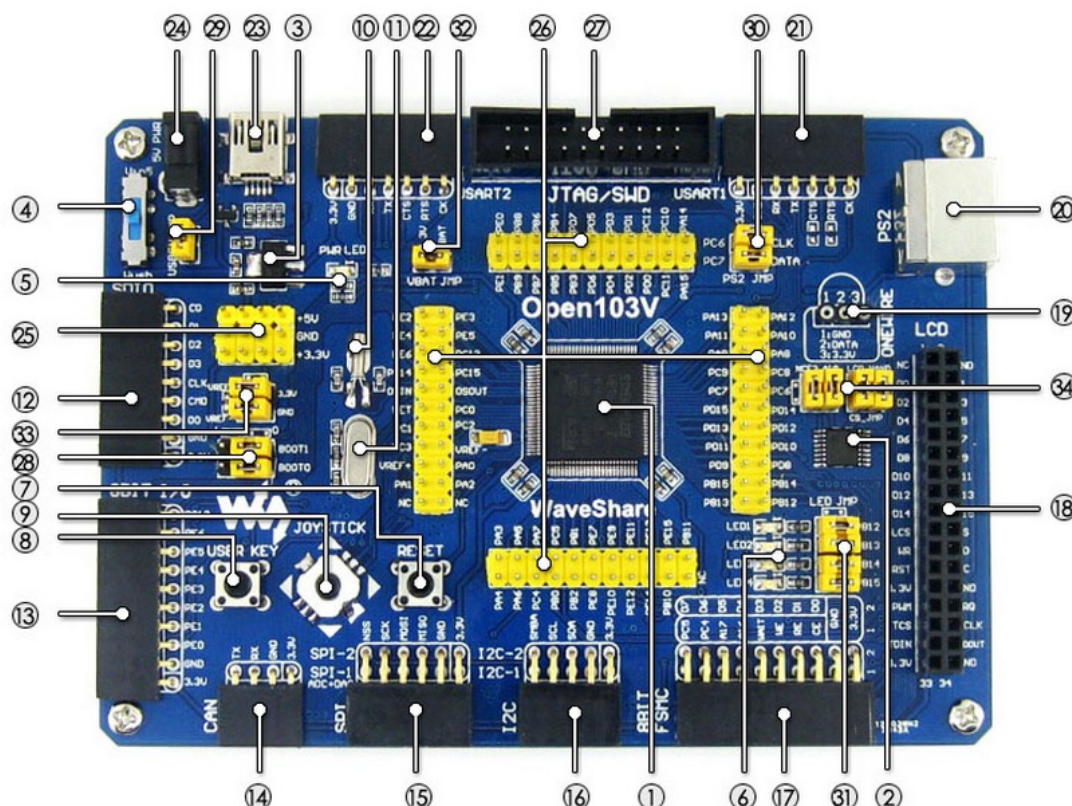
# Open103V User Manual

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# 1. Overview

## 1.1. What's on board



### [ MCU ]

#### 1. STM32F103VET6

the high performance STM32 MCU in LQFP100 package which features:

**Core:** Cortex-M3 32-bit RISC;

**Operating Frequency:** 72MHz, 1.25 DMIPS/MHz;

**Operating Voltage:** 2-3.6V;

**Package:** LQFP100; **I/Os:** 80;

**Memories:** 512kB Flash, 64kB RAM (the highest specification in STM32F103V series);

**Communication Interfaces:** 3 x SPI, 5 x USART, 2 x I2S, 2 x I2C; 1 x FSMC, 1 x LCD, 1 x SDIO, 1 x USB, 1 x CAN;

**AD & DA converters:** 3xAD(12bit, 1μs, shares

### [ Other components ]

#### 4. Power supply switch

5V DC or USB;

#### 5. Power indicator

#### 6. LEDs

Convenient for indicating I/O status or program debugging running state;

#### 7. Reset button

#### 8. User key

Convenient for indicating I/O status or program debugging running state;

#### 9. Joystick

Convenient for I/O input (five positions);

#### 10. 32.768K crystal oscillator

used for internal RTC;

16 channels); 2xDA(12bit);

**Debugging/Programming:** supports JTAG/SWD (serial wire debug) interfaces, supports IAP;

## 2. 74LVC139

NAND FLASH for FSMC expansion, makes it possible to connect more peripherals through FSMC at the same time, such as connecting a LCD and a NAND FLASH;

## 3. AMS1117-3.3

3.3V voltage regulator;

### [ Interface ]

## 12. SDIO Interface

connects to the Micro SD Board easily, It is much faster to read/write the Micro SD card via SDIO than via SPI;

## 13. 8 I/O Interface

easily connects to keypad, motor, etc.;

## 14. CAN Interface

communicates with accessory board which features the CAN device conveniently;

## 15. SPI1 / SPI2 interface

easily connects to SPI peripherals such as FLASH (AT45DBxx), SD card, MP3, etc.; SPI1 features AD/DA alternative function, supports connecting AD/DA module as well

## 16. I2C1/I2C2 interface

easily connects to I2C peripherals such as I/O expander (PCF8574), FRAM (FM24CLxx), etc.

## 17. FSMC interface (8-bit FSMC)

easily connects to peripherals such as NandFlash, Ethernet, etc.

## 18. FSMC + SPI interface (16-bit FSMC + SPI)

for connecting touch screen LCD

## 19. ONE-WIRE interface

easily connects to ONE-WIRE devices (TO-92 package), such as temperature sensor (DS18B20), electronic registration number (DS2401), etc.

## 20. PS/2 Interface

easily connects to PS/2 keyboard or mouse;

## 21. USART1 Interface

## 11. 8M crystal oscillator

enables the MCU run at 72M frequency by frequency multiplication setting;

### [ Other interfaces ]

## 24. 5V DC jack

## 25. 5V/3.3 V power input/output;

usually used as power output, also common-grounding with other user board

## 26. MCU pins connector

all the MCU pins are accessible on expansion connectors for further expansion;

## 27. JTAG/SWD interface

for debugging/programming;

### [ Jumper ]

## 24. Boot Mode Selection

for configuring the BOOT0 and BOOT1 pins;

## 25. USB Enable Jumper

Short the jumper to enable the PC auto detection while USB connecting;  
Open the jumper to disable;

## 26. PS/2 Interface Jumper

Short the jumper to connect the PS/2 device to default I/Os;  
Open the jumper to connect the PS/2 device to custom I/Os via DuPont wires;

## 27. LEDs Jumper

Short the jumper to connect the LEDs to default I/Os;  
Open the jumper to connect the LEDs to custom I/Os via DuPont wires;

## 28. VBAT Selection Jumper

Short the jumper to use system power supply;  
Open the jumper to connect the VBAT to external power, such as battery;

## 29. VREF Selection Jumper

short the jumper to connect VREF+/VREF- to VCC/GND  
open the jumper to connect VREF+/VREF- to other custom pin via jumper wire

## 30. 74LVC139 selection jumper (for FSMC chip select)

easily connects to RS232, RS485, USB TO 232;

## 22. USART2 Interface

easily connects to RS232, RS485, USB TO 232;

## 23. USB Port

USB communication between board and PC;

short the jumper to connect to I/Os used in example code

open the jumper to connect to other custom pins via jumper wires

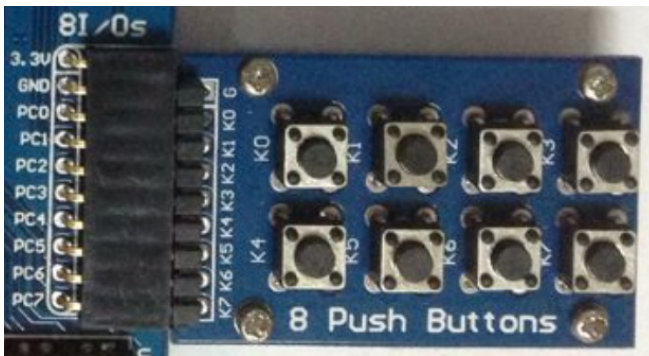
# 2. Demo

- KEIL MDK Version: 4.54
- Programmer/Debugger: ULINK/V2
- Programming/Debugging interface: SWD
- Serial port settings:

Select a proper COM port	
Baud rate	115200
Data bits	8
Stop bits	1
Parity bits	None
Flow control	None

## 2.1. 8I/Os

- ◆ Overview
  - 8I/Os demo
- ◆ Hardware connection

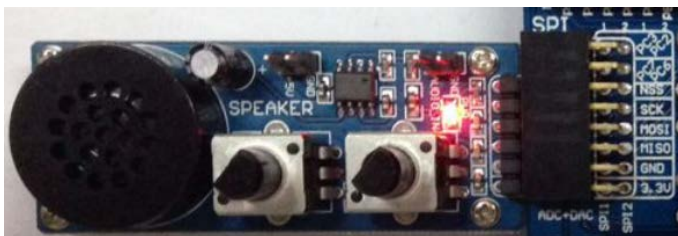


- Connect the board to 5V power via 5VDC interface
- Connect the ULINK board to the board via SWD interface
- Connect the "8 Push Button " to the onboard 8I/Os interface (make sure the G pin on the module connects to the GND pin on the 8I/Os)

- ◆ Operation and result  
Push the button, the LED will keep blinking accordingly.

## 2.2. ADC+DMA

- ◆ Overview  
ADC+DMA demo
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK board to the board via SWD interface
- Connect a serial port converter(RS232) to the onboard USART1 interface
- Connect the Analog Test Board to the board via SPI1 (ADC+DAC) interface

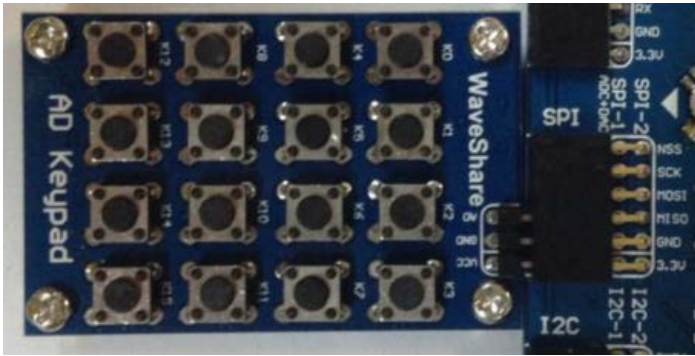
- ◆ Operation and result
  - Rotate the potentiometer on the Analog Test Board, the below information will be printed on the serial debugging assistant:

```
*****
The current AD value = 2.36V
The current AD value = 2.36V
The current AD value = 3.30V
The current AD value = 2.83V
The current AD value = 0.72V
The current AD value = 0.01V |
The current AD value = 0.01V
```

## 2.3. ADC+DMA+KEYPAD

- ◆ Overview  
ADC+DMA+KEYPAD demo
- ◆ Hardware connection





- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter(RS232) to the onboard USART1 interface
- Connect the AD Keypad board to the board via SPI1 (ADC+DAC) interface

#### ◆ Operation and result

- Rotate the potentiometer on the Analog Test Board, the below information will be printed on the serial debugging assistant:

```
The current AD value = 1.0264V  
The current AD value = 1.2319V  
The current AD value = 2.6837V  
The current AD value = 2.4750V
```

## 2.4. CAN-LoopBack

#### ◆ Overview

CAN demo in LoopBack mode

#### ◆ Hardware connection

- Connect the board to 5V power via 5VDC interface
- Connect the ULINK board to the board via SWD interface
- Connect a serial port converter(RS232) to the onboard USART2 interface

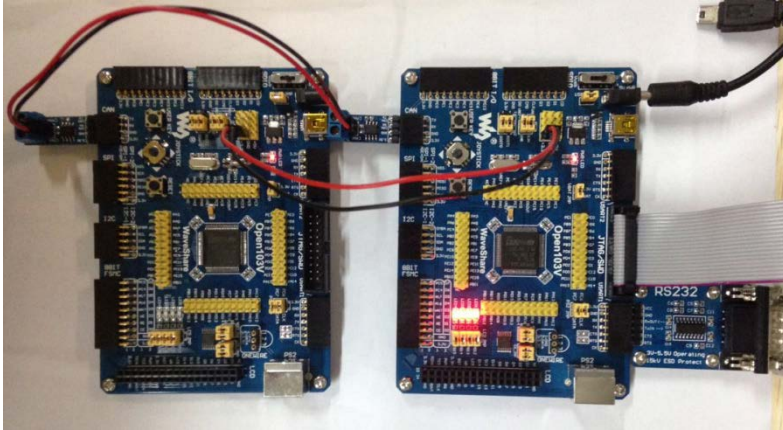
#### ◆ Operation and result

- LED keep blinking;
- The below information will be printed on the serial debugging assistant:

```
*****  
CAN-Bus Test  
CAN-Bus by polling in loopback mode is OK  
CAN-Bus by interrupt in loopback mode is OK
```

## 2.5. CAN-Normal

- ◆ Overview  
CAN demo in Normal mode
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter (RS232) to the onboard USART1 interface
- Two "SN65HVD230 CAN Board" are required, connect them to two Open103C board respectively

- ◆ Operation and result

- The below information will be printed on the serial debugging assistant:

```
*****  
CAN-Bus Test  
CAN-Bus Speed 100kHz  
CAN Receive Data  
CAN ID 5a5  
CAN_DATA0 ee  
CAN_DATA1 de  
CAN_DATA2 b8  
CAN_DATA3 5f  
CAN_DATA4 e3  
CAN_DATA5 65  
CAN_DATA6 3c  
CAN_DATA7 c  
CAN Receive Data  
CAN ID 5a5  
CAN_DATA0 84  
CAN_DATA1 b8  
CAN_DATA2 d5
```

## 2.6. DAC

- ◆ Overview  
DAC demo
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the Analog Test Board to the board

via SPI1 (ADC+DAC) interface

- Connect the 5V pin headers on both the main board and the Analog Test Board via jumper wire

◆ Operation and result

- You should hear sound from the Analog Test Board

## 2.4. ENC28J60

◆ Overview

"ENC28J60 Ethernet Board" demos

◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the ENC28J60 Ethernet Board to the board via SPI1 (ADC+DAC) interface

◆ The IP of the PC configuring as 192.168.0.xxx; for example:

Configuring IP of both the PC and the module on the same network:

Right click the **【Internet】** -» **【Attribute】** -» Click **【Local connection】** -» Click **【Attribute】** -» Find Internet Protocol Version4 (TCP/IP V4, the following dialog box will pop up, set the appropriate IP address, subnet mask, and default gateway:

IP addresses : 192.168.0.11  
Subnet Mask: 255.255.255.0  
Default Gateway: 192.168.0.1

◆ Operation and result

Open the browser; enter 192.168.0.100/888; press the Enter key:

```
Sent data to ENC28J60 : 0x0
```

```
[refresh]
```

```
+1
```

```
Open103V WEB test
```

## 2.7. GPIO LED JOYSTICK

◆ Overview



LED, joystick demo

◆ Hardware connection

Short the LED JMP, JOYSTICK JMP, KEY JMP

◆ Operation and result

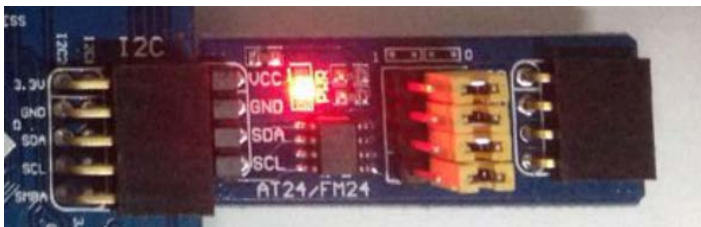
Push the button or joystick, the LED status should keep changing accordingly

## 2.8. AT24CXX-I2C

◆ Overview

I2C EEPROM demo

◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the AT24/FM24 Board to the board via I2CX interface( connect to I2C1 or I2C2 depends on the program)

◆ Operation and result

- The below information will be printed on the serial debugging assistant:

```
*****
EEPROM 24C02 Write Test
EEPROM 24C02 Write Test OK
EEPROM 24C02 Read Test
EEPROM 24C02 Read Test OK
```

## 2.9. LCD

◆ Overview

LCD demo

◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the 3.2inch 320x240 Touch LCD (A) to the board

◆ Operation and result

- Display image on the LCD:

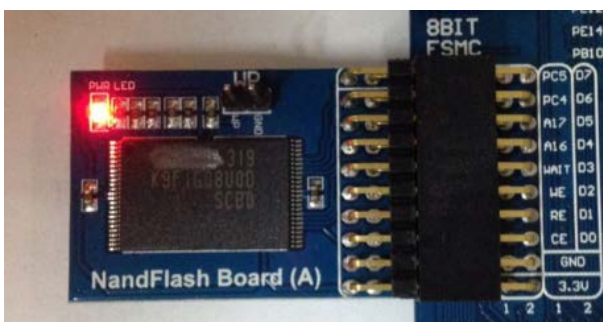


## 2.10. NandFlash

◆ Overview

NandFlash demo

◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the NandFlash Board to the board via I2C2 interface.

◆ Operation and result

- The below information will be printed on the serial debugging assistant:

```
Nand Flash ID = EC,F1,00,95  Type = K9F1G08U0B  
Nand Flash is OK
```

## 2.11. One-Wire

### ◆ Overview

One-Wire demo

### ◆ Hardware connection

Connect the board to 5V power via 5VDC interface

Connect the ULINK2 board to the board via SWD interface

Connect a serial port converter to the onboard USART1 interface

Connect the DS18B20 to the onboard One-wire socket.

### ◆ Operation and result

The below information will be printed on the serial debugging assistant:

```
*****  
DS18B20's ID :0x28 0x76 0xfe 0x49 0x5 0x2 0x0 0x20 Temperature:8 'C  
Temperature:30 'C  
Temperature:29 'C  
Temperature:30 'C  
Temperature:29 'C  
Temperature:30 'C  
Temperature:29 'C  
Temperature:30 'C
```

## 2.12. PS2

### ◆ Overview

PS2 keyboard demo

### ◆ Hardware connection



Connect the board to 5V power via 5VDC interface

- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the PS2 keyboard to the board via PS2 interface
- Short the PS2 JMP.

### ◆ Operation and result

The below key value will be printed on the serial debugging assistant while connect the PS2 keyboard:

```
Please Input Keyboard!  
Keyboard Input : u  
Keyboard Input : y  
Keyboard Input : h  
Keyboard Input : g  
Keyboard Input : f
```

## 2.13. RTC

- ◆ Overview

RTC demo

- ◆ Hardware connection

Connect the board to 5V power via 5VDC interface

Connect a serial port converter to the onboard USART2 interface

Connect the ULINK2 board to the board via SWD interface

- ◆ Operation and result

The below information will be printed on the serial debugging assistant:

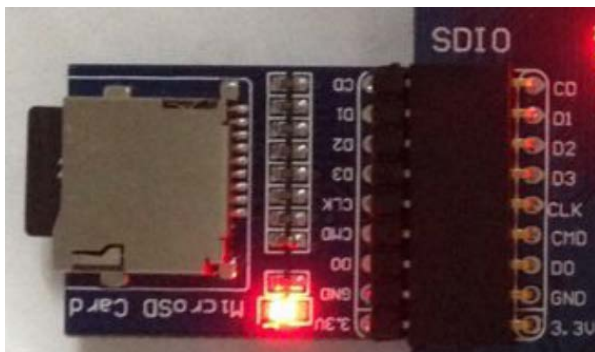
```
*****
External Reset occurred...
No need to configure RTC...
Time: 2012-1-1 00:00:08
Time: 2012-1-1 00:00:09
Time: 2012-1-1 00:00:10
Time: 2012-1-1 00:00:11
```

## 2.14. SD\_FatFS

- ◆ Overview

SD\_FatFS demo

- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the Micro SD Storage Board (with SD card) to the board via SPI1 interface

- ◆ Operation and result

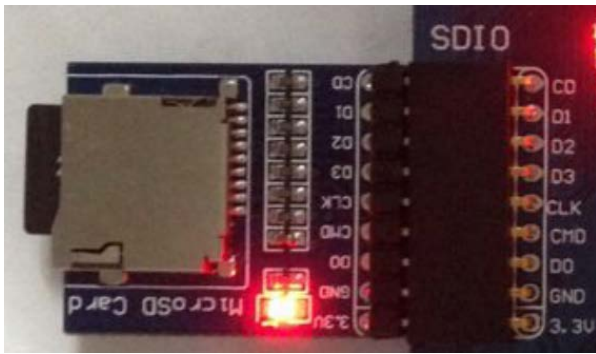
Message will be printed on the serial debugging assistant.

## 2.15. SDIO

- ◆ Overview

SDIO demo

- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the Micro SD Storage Board (with SD card) to the board via SPI1 interface

#### ◆ Operation and result

The below information will be printed on the serial debugging assistant:

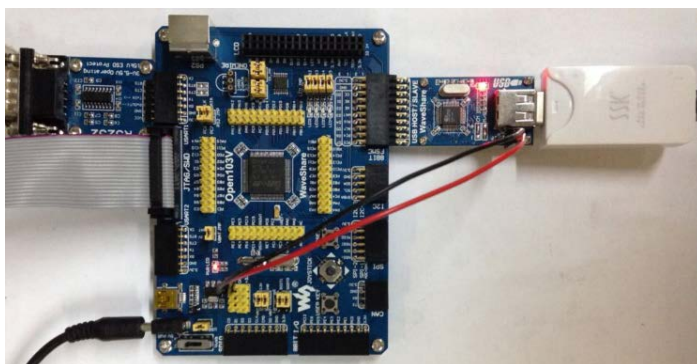
```
WARNING: THIS PROCESS WILL ERASE THE SD CARD!
Press 'y' to continue.y
01. ----- SD_Init Status:42
      Initialize SD card successfully!
02. ----- SD_GetCardInfo Status:42
      Get SD card infomation successfully!
      Block size:400, Card type:1
03. ----- SD_SelectDeselect Status:42
      Select SD card successfully!
04. ----- SD_EnableWideBusOperation Status:42
      Enable wide bus operation successfully!
```

## 2.16. SL811 USB

#### ◆ Overview

“SL811 USB Board” demo

#### ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the onboard USART1 interface
- Connect the SL811 USB Board to the board via 8BIT+FSMC interface

#### ◆ Operation and result

- The serial debugging assistant read information in the USB flash disk
- The below information will be printed on the serial debugging assistant:



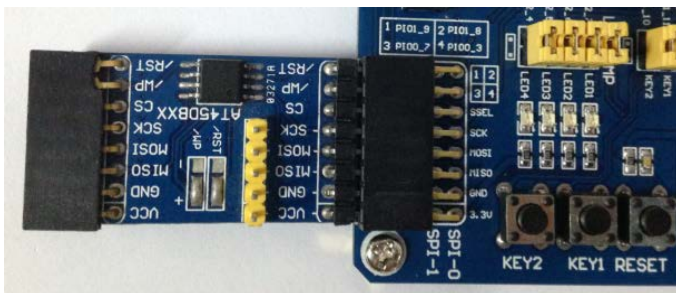
```

hip revision: OE
Please connect USB device...
USB Low speed device !!!
hip revision: AE
Please connect USB device...
USB Full speed device detected
Device descriptor :
10 C3 C3 C4 C4 C5 C5 C6 10 CE CE CF CF D0 D1 20 D8
Configuration descriptor :
10 F3 F3 F4 F4 F5 F5 F6 10 FE FE 10 11 12 13 14
10 24 25 26 27 28 29 2A 10 3A 3B 3C 3D 3E 3F 40

```

## 2.17. AT45DB-SPI

- ◆ Overview
  - SPI demo
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the AT45DBXX DataFlash Board to the board via SPIX interface(connect to SIP1 or SPI2 depends on the program)
- Connect a serial port converter to the onboard USART1 interface

- ◆ Software connection
  - Serial assistant configuration:

Launch the serial debugging assistant SSCOM32, choose related COM port, set baud rate as 115200, click to open it.

- ◆ Operation and result

The below information will be printed on the serial debugging assistant:

```

*****
SPI is ready!
AT45DBXX had been Init!
AT45DBXX ID is 0x1f 0x24 0x0 0x0

```

## 2.18. TouchPanel

- ◆ Overview
  - LCD demo
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the 3.2inch 320x240 Touch LCD (A) to the board

◆ Operation and result

Calibrate the LCD first, then touch it, draw any line on it.

## 2.19. uCOSII2.91+UCGUI3.90A

◆ Overview

UcosII+GUI demo

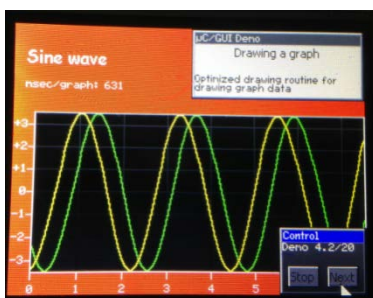
◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the 3.2inch 320x240 Touch LCD (A) to the board

◆ Operation and result

- Display image on the LCD:



## 2.20. USART

- ◆ Overview  
USART demo
- ◆ Hardware connection  
Connect the board to 5V power via 5VDC interface  
Connect the ULINK2 board to the board via SWD interface
- ◆ Operation and result  
The below information will be printed on the serial debugging assistant:

```
Waveshare!  
Waveshare!  
Waveshare!
```

## 2.21. USB-JoyStickMouse

- ◆ Overview  
USB mouse demo
- ◆ Hardware connection
  - Connect the board to 5V power via 5VDC interface
  - Connect the ULINK2 board to the board via SWD interface
  - Connect the board to the PC through USB cable
- ◆ Software configuration
- ◆ Operation and result  
An USB device will appear on the PC device manager:  
Control the computer cursor by joystick

## 2.22. USB-Mass\_Storage-MCU Flash

- ◆ Overview  
USB-Mass\_Storage-MCU Flash demo
- ◆ Hardware connection
  - Connect the board to 5V power via 5VDC interface
  - Connect the ULINK2 board to the board via SWD interface
  - Connect the board to the PC through USB cable
- ◆ Software configuration
- ◆ Operation and result

An USB device and a removable disk will appear on the PC device manager:

## 2.23. VS1003B

- ◆ Overview
  - MP3 record/play demo
- ◆ Hardware connection



- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the "VS1003B MP3 Board" to the onboard SPI interface

- ◆ Operation and result
  - VS1003 (GPIO): P0 LED keep blinking
  - VS1003 (line in): can hear music from the PC
  - VS1003 (line out): can hear music from the MCU FLASH
  - VS1003 (record): can hear sound from the microphone

## 3. Revision history

Version	Description	Date	Author
V1.0	Initial revision	2014/05/17	Waveshare team