

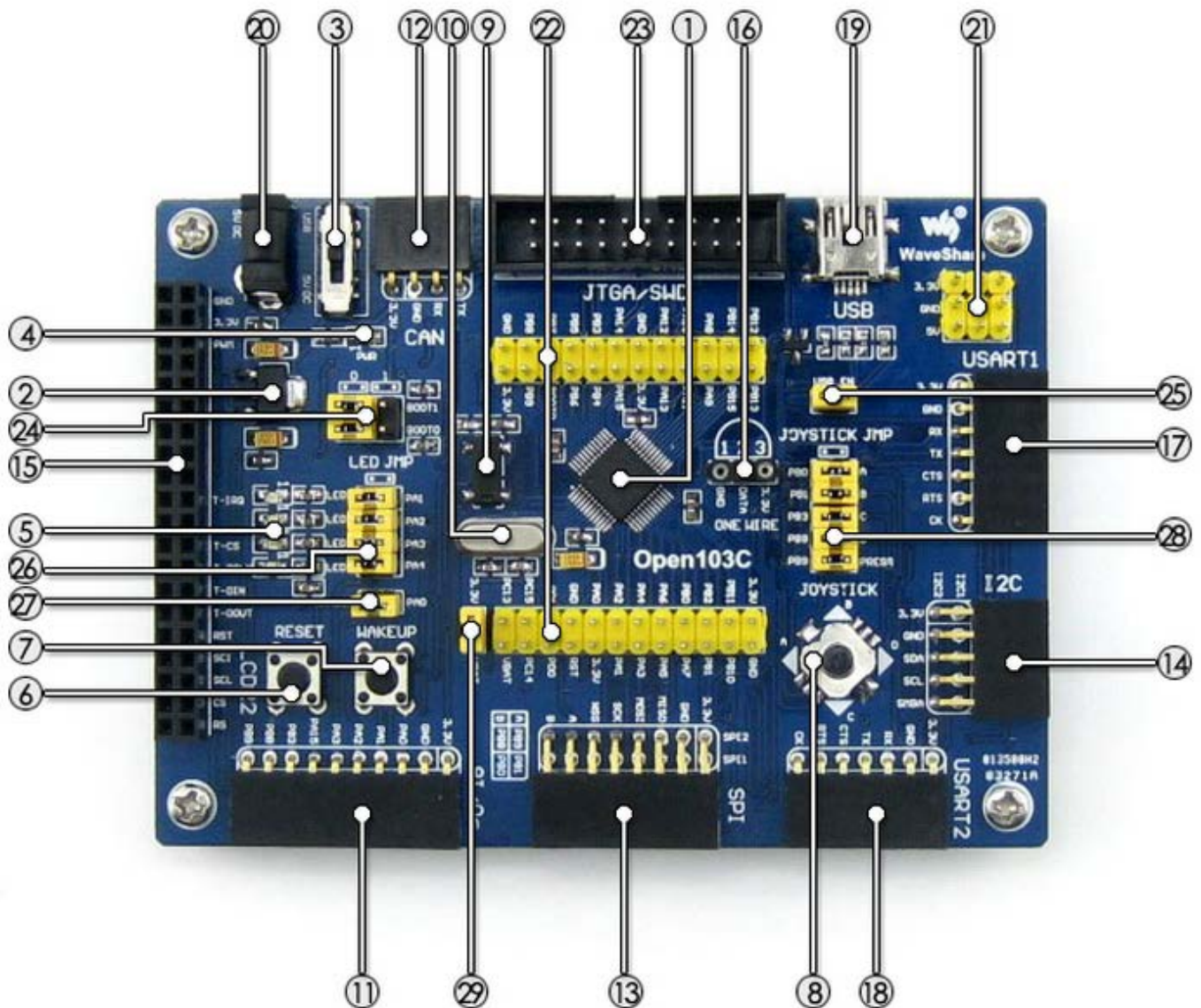
Open103C User Manual

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1. Overview

1.1. What's on board



[MCU]

1. **STM32F103CBT6**
the high performance STM32 MCU which features:
Core: Cortex-M3 32-bit RISC;
Operating Frequency: 72MHz, 1.25 DMIPS/MHz;

[Component]

3. **Power supply switch**
5V DC or USB
4. **Power indicator**
5. **LEDs**
for indicating I/O status or program debugging running state

Operating Voltage: 2-3.6V;

Package: LQFP48; **I/Os:** 37;

Memories: 128kB Flash, 20kB RAM;

Communication Interfaces: 2 x SPI, 3 x USART, 2 x I2C, 1 x USB, 1 x CAN;

AD & DA converters: 22 x AD (12-bit, 1μs, shares 10 channels);

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

2. AMS1117-3.3

3.3V voltage regulator.

[Interface]

11. 8 I/O Interface

easily connects to keypad, motor, etc.

12. CAN interface

communicates with accessory board which features the CAN device conveniently

13. SPI1 / SPI2 interface

easily connects to SPI peripherals such as FLASH (AT45DBxx), SD card, MP3, etc. convenient for connecting AD module, thanks to the SPI1 alternative AD function

14. I2C1 / I2C2 interface

easily connects to I2C peripherals such as I/O expander (PCF8574), EEPROM (AT24Cxx), etc.

15. LCD interface

easily connects to the touch screen LCD

16. ONE-WIRE interface

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

17. USART1 interface

easily connects to RS232, RS485, USB TO 232

18. USART2 interface

easily connects to RS232, RS485, USB TO 232

19. USB port

USB communication between board and PC

6. RESET key

7. User key

for I/O input test

8. Joystick

for I/O input test (five positions)

9. 32.768K crystal oscillator

used for internal RTC, also supports clock calibration

10. 8M crystal oscillator

enables the MCU run at 72M frequency by frequency multiplication

[Other interface]

20. 5V DC jack

21. 5V/3.3 V power input/output

usually used for power output, or common ground with other user board

22. MCU pins connector

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

23. JTAG/SWD interface

for debugging/programming

[Jumper]

20. Boot mode selection

for configuring the BOOT0 and BOOT1 pins

21. USB enable jumper

short the jumper to enable the PC auto detection while USB connecting
open the jumper to disable

22. LEDs jumper

short the jumper to connect the user key to I/Os used in example code
open the jumper to connect the user key to other custom pins via jumper wires

23. User key jumper

short the jumper to connect the user key to I/Os used in example code
open the jumper to connect the user key to other custom pins via jumper wires

24. Joystick jumper

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

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

25. **VBAT selection jumper**

short the jumper to use system power supply

open the jumper to connect the VBAT to external power, such as battery

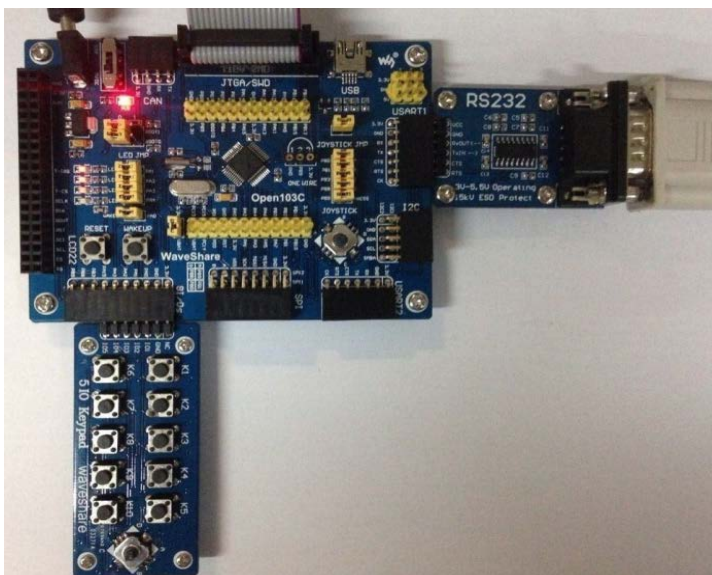
2. Demo

- 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. 5IOs

- ◆ Demo
5I/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 "5IO Keypad" to the onboard 5I/Os interface (make sure the G pin on the module connects to the GND pin on the 5I/Os)
- Connect a serial port converter(RS232) to the onboard USART1 interface

- ◆ Operation and result

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

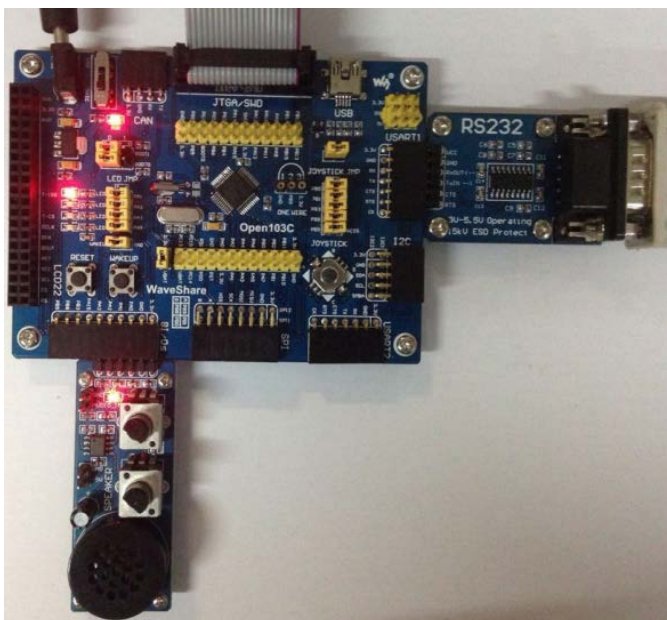
```
KeyValue is : -K1.  
KeyValue is : -K2.  
KeyValue is : -K3.  
KeyValue is : -K4.  
KeyValue is : -K5.  
KeyValue is : -K6.  
KeyValue is : -K7.  
KeyValue is : -K8.  
KeyValue is : -K9.  
KeyValue is : -K10.  
KeyValue is : -Right.  
KeyValue is : -Left.  
KeyValue is : -Up.  
KeyValue is : -Down.
```

2.2. ADC

◆ Overview

ADC analog voltage acquisition 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 8I/Os interface

◆ Operation and result

- Rotate the potentiometer on the Analog Test Board, the below information will be printed on the serial debugging assistant (the KEY value is larger indicates that the current voltage is larger):

2.3. CAN-LoopBack

◆ Overview

CAN demo in LoopBack 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 USART2 interface

◆ Operation and result

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

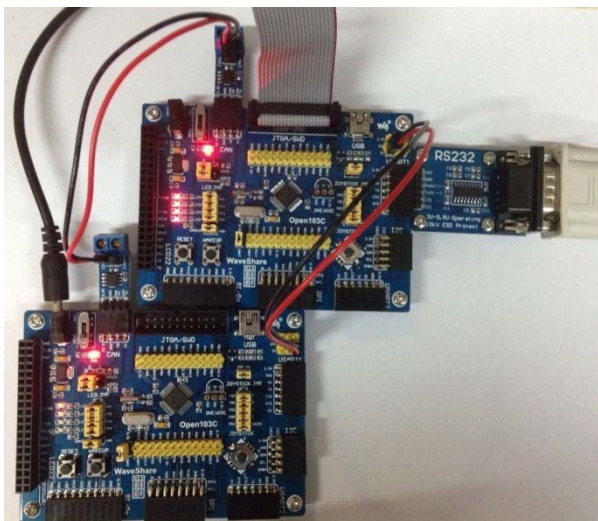
```
*****
CAN-Bus Test
CAN-Bus by polling in loopback mode is OK
CAN-Bus by interrupt in loopback mode is OK
```

2.4. 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

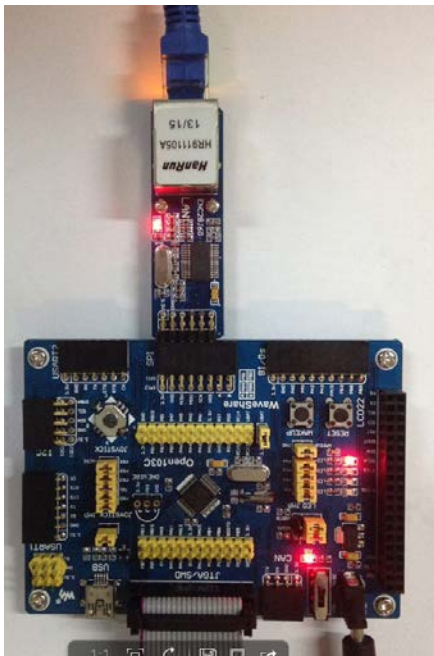
◆ Operation and result

- 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 f3
CAN_DATA5 65
CAN_DATA6 3c
CAN_DATA7 c
CAN Receive Data
CAN ID 5a5
CAN_DATA0 84
CAN_DATA1 b8
```

2.5. 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 onboard SPI interface, then connect it to PC through an Ethernet cable

- ◆ 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 : 0x6

[\[refresh\]](#)

[+1](#)

Open103C WEB test

2.6. GPIO_LED_JOYSTICK

- ◆ Overview
LED, push button, joystick demo
- ◆ Hardware connection

Short the LED JMP, JOYSTICK JMP, KEY JMP

◆ Operation and result

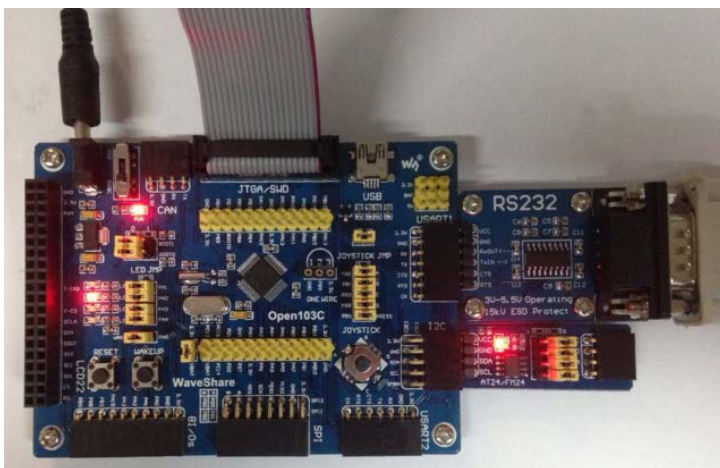
Push the button or joystick, the LED status should keep changing accordingly

2.7. 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
```

2.8. LCD22

◆ Overview

LCD demo

◆ Hardware connection



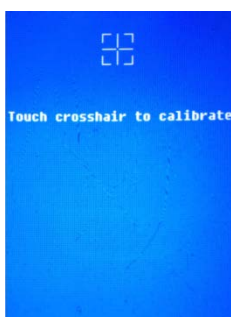
- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect the "2.2inch 320x240 Touch LCD (A)" to the board

- ◆ Operation and result
Display image on the LCD

2.9. LCD22_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 "2.2inch 320x240 Touch LCD (A)" to the board

- ◆ Operation and result
Display image on the LCD

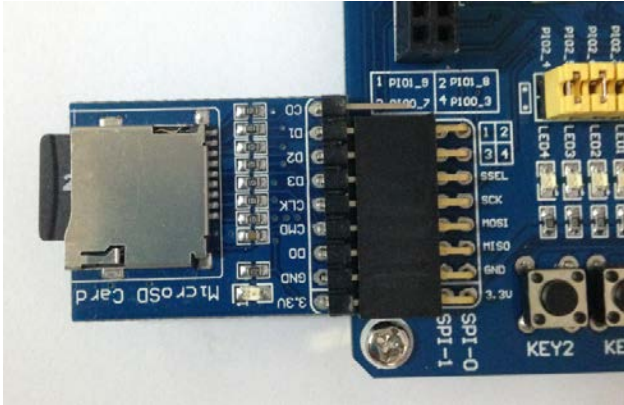


Display image on
the LCD

- ◆ Application
Handheld device display

2.10. Micro SD

- ◆ 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

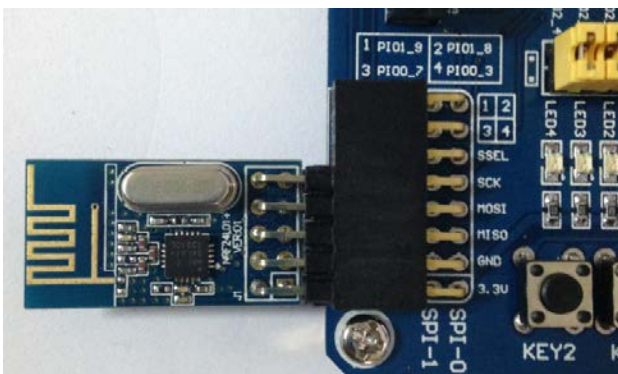
- ◆ Software configuration
- ◆ Operation and result

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

```
SD card experiment!  
Please plug in 1 GB SD card!  
SD card is OK  
SD card size capacity:1886 Mb  
Written to the success!  
Read success!  
Testing is complete! All the data are correct!
```

2.11. NRF24L01

- ◆ Overview
NRF24L01 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 NRF24L01 Board to the board via SPI interface

- ◆ Software connection

Two NRF24L01 are needed for this demo, the software configuring as below:

When configuring as mode of transmitting, enabled: `#define T_O_R 1`, comment out: `//#define T_O_R 0`;

When configuring as mode of receiving, enable: `#define T_O_R 0`, comment out: `//#define T_O_R 0`

◆ Operation and result

Message will be printed on the serial debugging assistant.

2.12. 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 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
```

2.13. RTC

◆ Overview

RTC demo

◆ Hardware connection

Connect the board to 5V power via 5VDC interface

Connect the ULINK2 board to the board via SWD interface

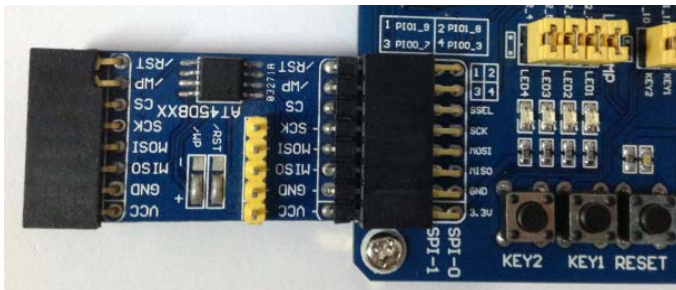
◆ Operation and result

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

```
*****
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. 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 onboard SPIX interface (connect to SPI1 or SPI2 depends on the program)
- Connect a serial port converter to the onboard USART2 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
|
```

2.15. Ucos II

- ◆ Overview
Ucos ii demo
- ◆ Hardware connection

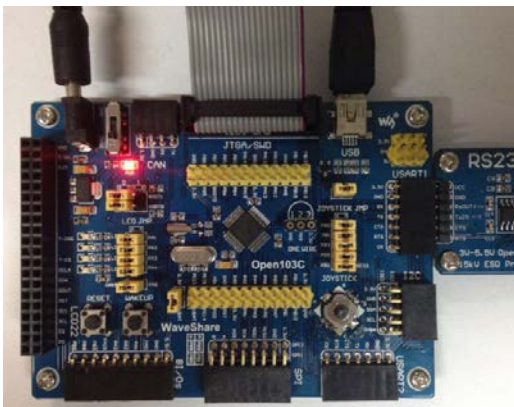


- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Short the LED jumper
- Connect the "2.2inch 320x240 Touch LCD (A)" to the board

- ◆ Operation and result
LCD displays message, LEDs keep blinking at the same time

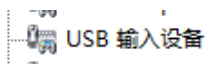
2.16. USB-JoyStick Mouse

- ◆ 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:



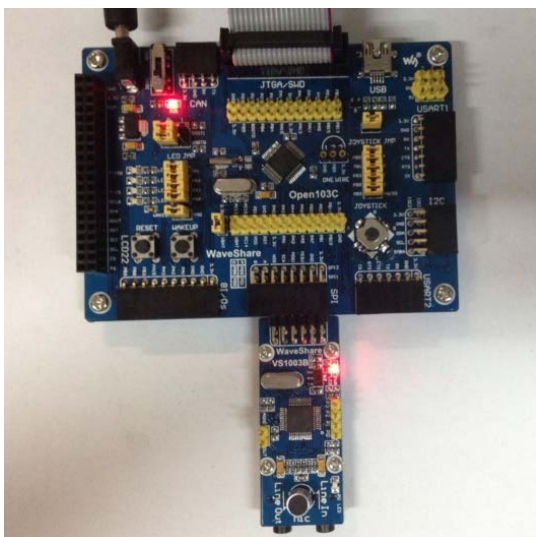
Control the computer cursor by joystick

2.17. 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 SPI1 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