

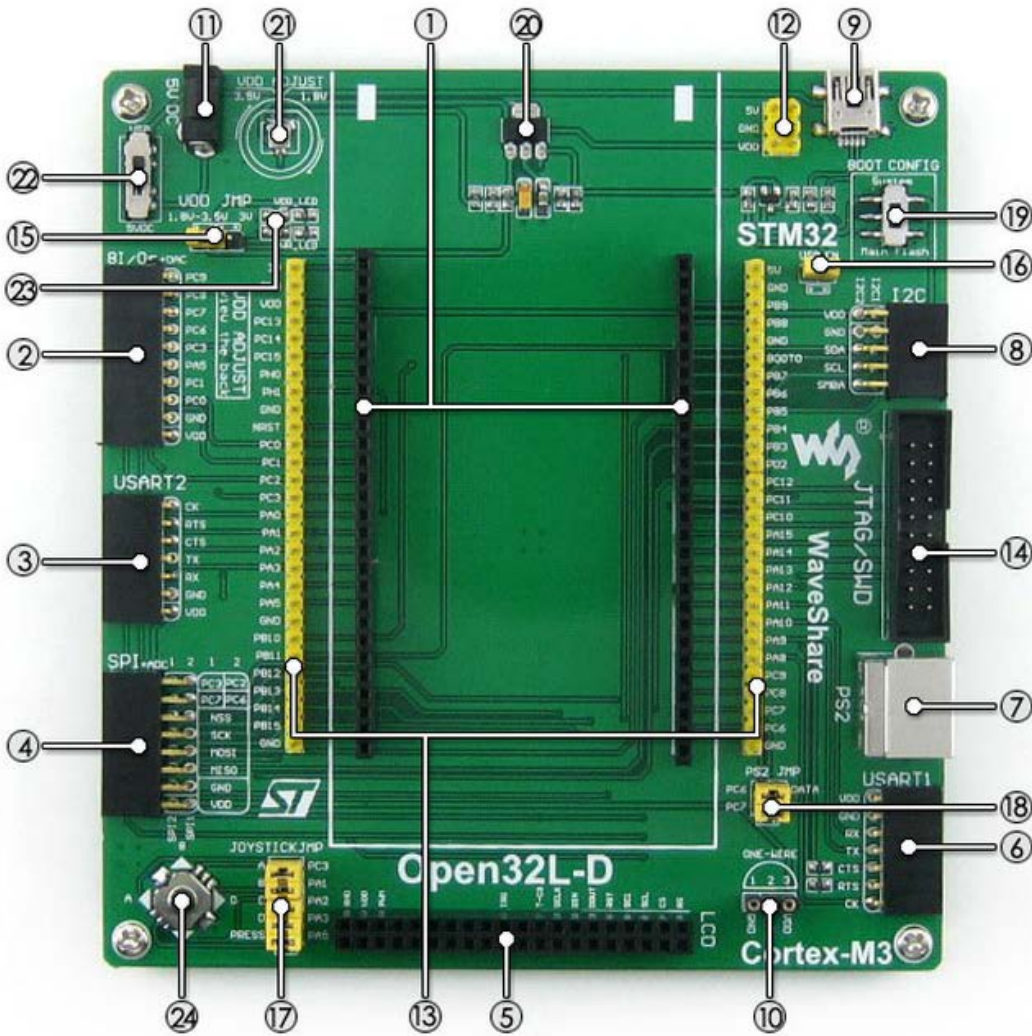
Open32L-D User Manual

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1. Overview

1.1. What's on board



[Core interface]

1. **STM32L-DISCOVERY socket**
for easily connecting the STM32L-DISCOVERY
2. **8I/Os + DAC interface**
for connecting accessory boards such buttons, motors, etc.
3. **USART2 interface**
easily connects to RS232, RS485, USB TO 232, etc.
4. **SPI1 / SPI2 + ADC interface**
easily connects to SPI peripherals such as DataFlash (AT45DBxx), SD card, MP3 module, etc..
SPI1 features AD/DA alternative function, supports connecting AD/DA module as well.
5. **LCD connector**
for connecting touch screen LCD
6. **USART1 interface**
easily connects to RS232, RS485, USB TO 232, etc.
7. **PS/2 interface**
for connecting PS/2 keyboard and/or mouse
8. **I2C1 / I2C2 interface**
easily connects to I2C peripherals such as I/O expander (PCF8574), FRAM (FM24CLxx), etc.
9. **USB interface**
for connecting the STM32 development board to PC through USB connection
10. **ONE-WIRE interface**
easily connects to ONE-WIRE devices (TO-92 package), such as temperature sensor (DS18B20), electronic registration number (DS2401), etc.

[Other interface]

11. **5V DC jack**
12. **5V and VDD power input/output**
usually used as power output, also common-grounding with other user board
13. **MCU pins connector**
all the MCU I/O ports are accessible on expansion connectors for further expansion
14. **JTAG/SWD interface**
for debugging/programming

[Jumper/switch]

15. **VDD jumper**
16. **USB enable jumper**
short the jumper to enable PC auto-detection while USB connecting
open the jumper to disable
17. **Joystick jumper**
short the jumper to connect the joystick to default I/Os used in example code
open the jumper to connect the joystick to custom I/Os via jumper wires
18. **PS/2 interface jumper**
short the jumper to connect the PS/2 interface to default I/Os used in example code
open the jumper to connect the PS/2 interface to custom I/Os via jumper wires
19. **Boot mode switch**
for configuring BOOT0 pin

[Component]

20. **AMS1117-ADJ**
21. **Adjustable resistor**
for adjusting VDD (1.8V-3.5V, $\pm 2\%$)
22. **Power supply switch**
5V DC or USB
23. **Power indicator**
24. **Joystick**
5 position

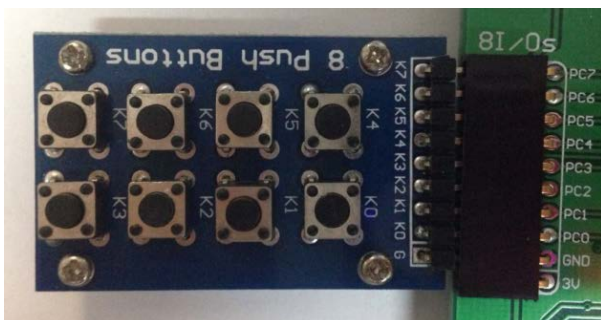
2. Demo

- KEIL MDK Version: 4.54
- Programmer/Debugger: STM32L-DISCOVERY onboard SWD
- Programming/Debugging interface: SWD
- Connect the serial port module to the board via USART1
- 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. 8BitIO-Pushbutton

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



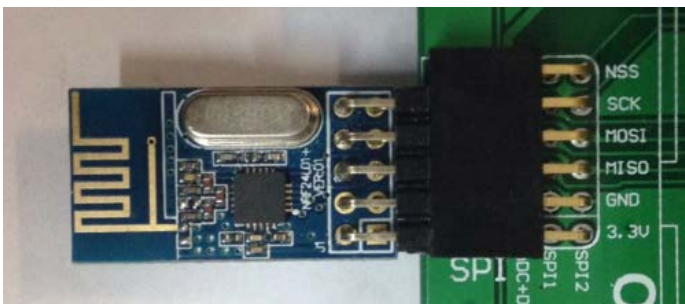
- Connect the 8 Push Button to the onboard 8 I/Os connector (Make sure the G pinheader is connect to the board GND pinheader)

- ◆ Operation and result
 - The below information will be displayed on the serial debugging assistant:

```
key4 key0 key1 key5 key2 key6 key7 key3 |
```

2.2. 24L01

- ◆ Overview
NRF24L01 demo
- ◆ Hardware connection



- Connect the NRF24L01 Board to the board via SPI interface

- ◆ Software connection
Two NRF24L01 is needed for this demo, 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.

2.3. ADC+DMA

- ◆ Overview
ADC analog voltage acquisition
- ◆ Hardware connection



- Connect a serial port converter(RS232) to the board via UART1 interface
- Connect the Analog Test Board to the board via SPI1 interface

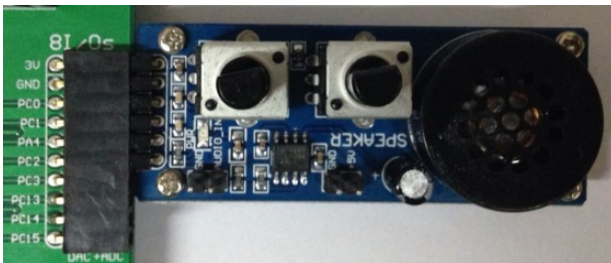
- ◆ Operation and result

- Rotate the potentiometer on the Analog Test Board. Message will be displayed on the serial debugging assistant.

```
*****  
The current AD value = 0.00V  
The current AD value = 0.00V  
The current AD value = 0.00V  
The current AD value = 1.10V  
The current AD value = 2.46V  
The current AD value = 3.30V  
The current AD value = 2.51V  
The current AD value = 1.79V
```

2.4. DAC

- ◆ Overview
DAC demo
- ◆ Hardware connection



- Connect the Analog Test Board to the board via 8 I/Os (ADC+DAC)
- Connect the 5V pin headers on both the main board and the Analog Test Board via jumper wire.

- ◆ Operation and result
 - You will hear sound from Analog Test Board while press the reset key.

2.5. GPIO LED

- ◆ Overview
LED demo
- ◆ Hardware connection
- ◆ Operation and result
Two LEDs on the Discovery board will blinking.

2.6. GPIO LED KEY

- ◆ Overview
LED, push button demo
- ◆ Hardware connection
- ◆ Operation and result

Push the button, the LED status should keep changing accordingly.

2.7. I2C

- ◆ Overview
I2C EEPROM demo
- ◆ Hardware connection



- Connect a serial port converter to the board via UART1 interface
- Connect the AT24CXX EEPROM 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 24C?  
EEPROM 24C02 Write Test  
EEPROM 24C02 Write Test OK  
EEPROM 24C02 Read Test  
EEPROM 24C02 Read Test OK  
EEPROM 24C02 Read Test OK
```

2.8. JOYSTICK

- ◆ Overview
JOYSTICK demo
- ◆ Hardware connection
Short the JOYSTICK JMP
- ◆ Operation and result
Push the joystick, the LED status should keep changing accordingly

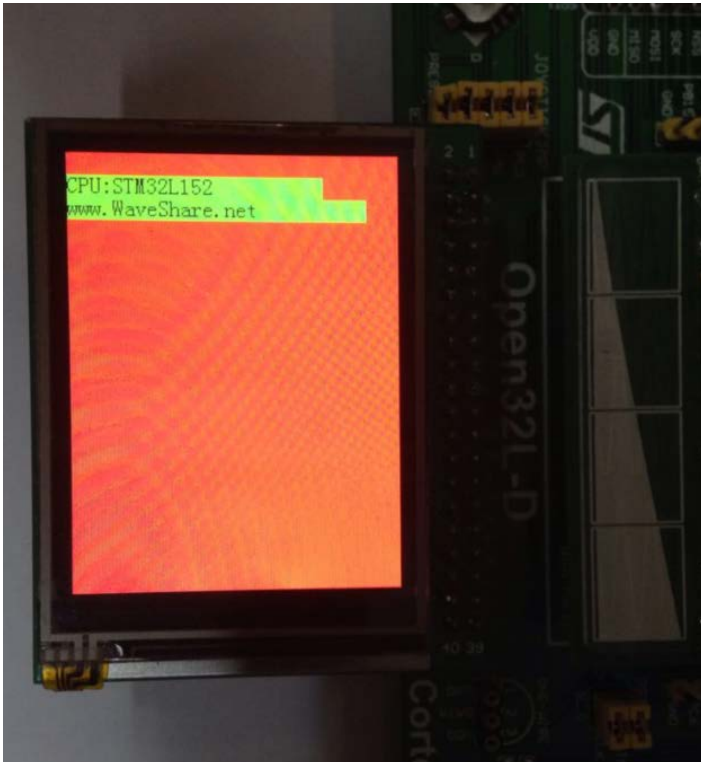
2.9. LCD_glass

- ◆ Overview
LCD_glasss demo
- ◆ Hardware connection
- ◆ Operation and result

LCD glass screen shows message/info

2.10. LCD22-Picture


- ◆ Overview
LCD demo
- ◆ Hardware connection

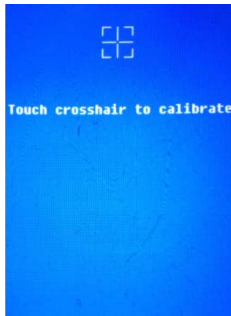


- Connect the "2.2inch 320x240 Touch LCD (A)" to the board

- ◆ Operation and result
Display image on the LCD

2.11. LCD22_TouchPanel

- ◆ Overview
LCD demo
 1. Calibrate the touch screen by click  three times, and then enter into drawing board in the touch screen interface.
 2. You can draw lines freely on the drawing board.
- ◆ Hardware connection
Connect the "2.2inch 320x240 Touch LCD (A)" to the board
- ◆ Operation and result
Message will be displayed on the LCD

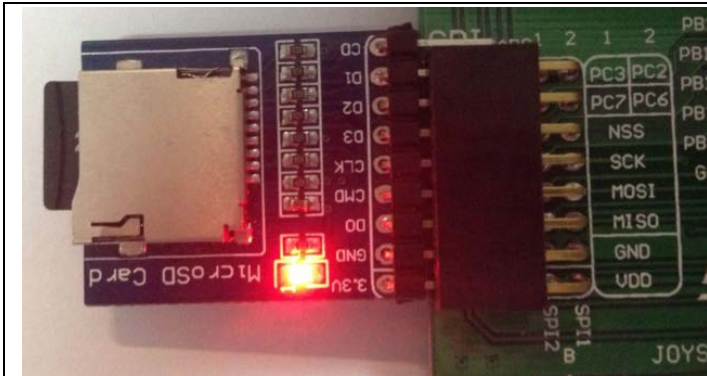


Message will be displayed on the LCD

- ◆ Application
Handheld device display

2.12. Micro SD

- ◆ Overview
SPI SD card demo
- ◆ Hardware connection



- Connect the DS18B20 to the board via One-Wire connector
- Connect the "Micro SD Storage Board" to the board via SPI1 interface
- Insert the SD card to the Micro SD Storage Board socket.

- ◆ Operation and result
The below information will be printed on the serial debugging assistant:

```
how The MCU USEING CLK:
SYSCLK:16M
HCLK:16M
PCLK1:16M
PCLK2:16M
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!
```

2.13. One-Wire

- ◆ Overview

One-Wire demo

◆ Hardware connection

Connect a serial port converter to the board via UART1 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
```

2.14. PS2

◆ Overview

PS2 keyboard demo

◆ Hardware connection

Connect the PS2 keyboard to the board via PS2 interface

◆ Operation and result

Connect the PS2 keyboard to the board via PS2 interface

```
Welcome to WaveShare STM32F2 series MCU Board Open20TV
*****Now the PS2 experiments*****

Press the button on the PS2:
Keyboard Input : j
Keyboard Input : 4
Keyboard Input : 8
Keyboard Input : g
Keyboard Input : b
Keyboard Input : ]
```

2.15. SPI

◆ Overview

SPI demo

◆ Hardware connection



➤ Connect the AT45DBXX DataFlash Board to the board via SPIX interface (connect to SPI1 or SPI2 depends on the program)

◆ 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:

```
T45DBXX had been Init!
AT45DBXX ID is 0xff 0xff 0xff 0xff
```

2.16. USART

◆ Overview

USART demo

◆ Hardware connection

◆ Operation and result

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

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

3. Revision history

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