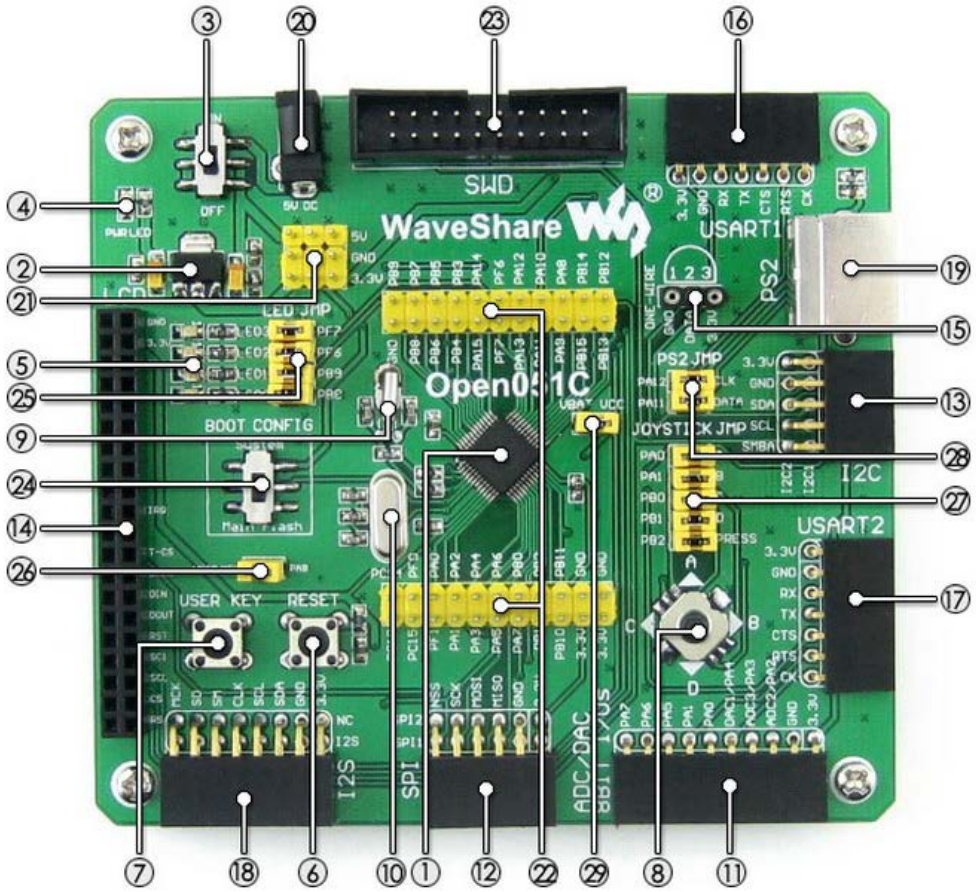
Open051C User Manual

Contents

1. Overview

1.1. What's on board



[MCU]

1. **STM32F051C8T6**
   the high performance STM32 MCU which features:
   Core: Cortex-M0 32-bit RISC;
   Operating Frequency: 48MHz;
   Operating Voltage: 2-3.6V;
   Package: LQFP48; I/Os: 39;
   Memories: 64KB Flash, 8kB RAM;
   Communication Interfaces: 2 x SPI, 2 x USART, 2 x I2C, 1 x I2S;

[Component]

3. **Power supply switch**
   5V DC or USB
4. **Power indicator**
5. **User LED**
   for indicating I/O status
6. **Reset key**
7. **User LED**
   for I/O input and/or interact with running code
8. **Joystick**
   five position

AD & DA converters： 1 x AD (12-bit, 1μs, shares 16 channels);
Debugging/Programming： supports SWD (serial wire debug) interfaces, supports IAP

2. **AMS1117-3.3**
   3.3V voltage regulator

[Interface]

11. **8I/Os + DAC + ADC Interface**
    easily connects to keypad, motor, etc.
12. **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
13. **I2C1 / I2C2 interface**
    easily connects to I2C peripherals such as I/O expander (PCF8574), EEPROM (AT24Cxx), etc.
14. **LCD interface**
    easily connects to the touch screen LCD
15. **ONE-WIRE interface**
    easily connects to ONE-WIRE devices (TO-92 package), such as temperature sensor (DS18B20), electronic registration number (DS2401), etc.
16. **USART1 interface**
    easily connects to RS232, RS485, USB TO 232
17. **USART2 interface**
    easily connects to RS232, RS485, USB TO 232
18. **I2S / I2C1 interface**
    easily connects to I2S peripherals such as audio module, etc.
19. **PS/2 interface**
    for connecting PS/2 keyboard/mouse.

9. **32.768K crystal oscillator**
   used for internal RTC, also supports clock calibration
10. **8M crystal oscillator**
    enables the MCU run at 48M frequency by frequency multiplication

[Other interfaces]

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. **SWD interface**
    for debugging/programming

[Jumper/switch]

20. **Boot mode selection**
    for configuring the BOOT0 pins
21. **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
22. **Joystick jumper**
    short the jumper to connect the joystick to I/Os used in example code
    open the jumper to connect the joystick to other custom pins via jumper wires
23. **PS/2 interface jumper**
    I/O；short the jumper to connect the PS/2 interface to I/Os used in example code
    open the jumper to connect the PS/2 interface to other custom pins via jumper wires
24. **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

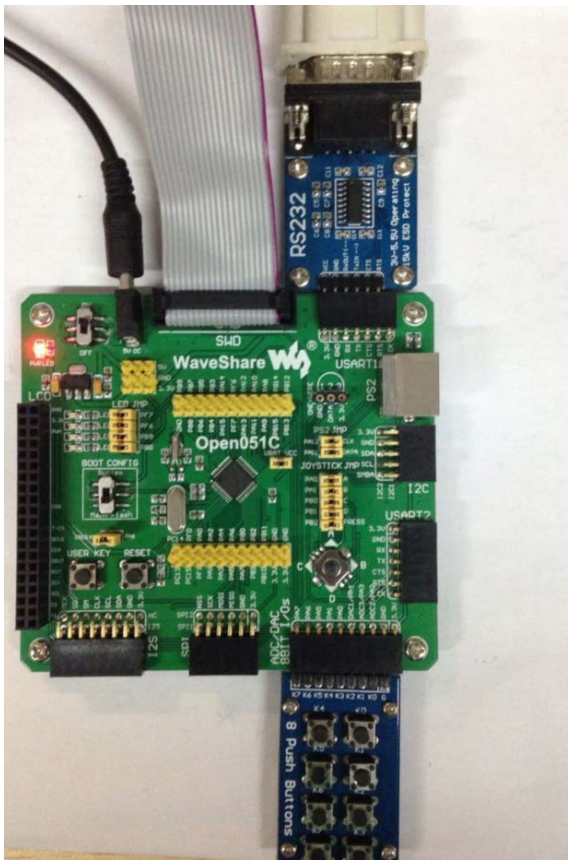
- KEIL MDK Version：4.54
- Programmer/Debugger: ULINK/V2
- Programming/Debugging interface: SWD
- Serial port settings:

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

2.1. 8Ios

- Overview

  8bit I/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 board via 8I/Os+DAC+DAC interface (The G pin on the module connect to the GND pin on the board)
- USART1 Connect a serial port converter(RS232) to the board via UART1 interface

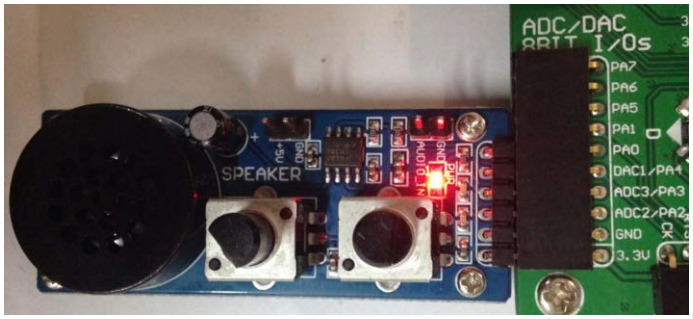
- Operation and result
  - The below information will be printed on the serial debugging assistant:

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

2.2. ADC+DMA

- Overview

  ADC analog voltage acquisition 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 board via UART1 interface
- Connect the Analog Test Board to the board via 8I/Os+DAC+DAC interface

◆ Operation and result

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

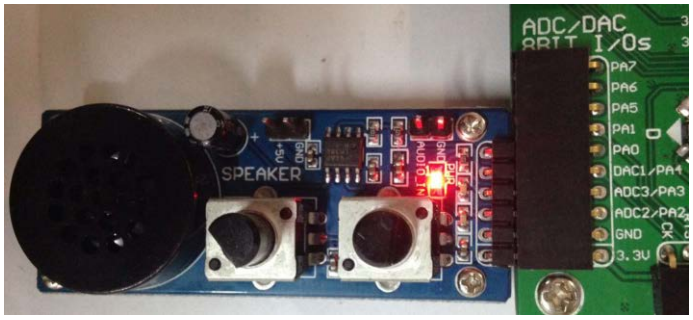
```
RegularConvData_Tab0=41,
RegularConvData_Tab1=7fd,
RegularConvData_Tab2=5fe,
RegularConvData_Tab3=6d9,
RegularConvData_Tab4=0,
waveshare
AD1=0.000000,
AD2=0.000000,
RegularConvData_Tab0=5bf,
RegularConvData_Tab1=7f9,
RegularConvData_Tab2=5fc,
RegularConvData_Tab3=6d2,
RegularConvData_Tab4=0,
waveshare
AD1=1.095971,
AD2=0.001465,
```

2.3. DAC+DMA

◆ 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 8I/Os+DAC+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. GPIO_LED

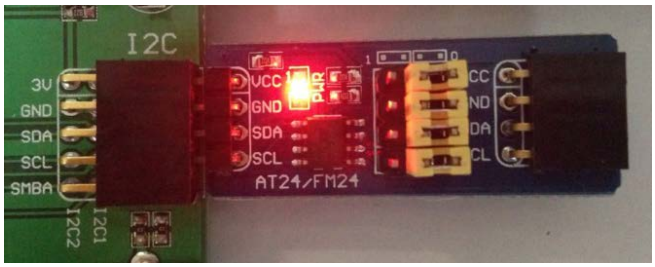
- Overview
  GPIO_LED demo
- Operation and result
  Short the LED JMP
- Operation and result
  The LED blinking

2.5. GPIO_LED _KEY

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

2.6. 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 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:

```
Transfer 1 FAILED  transmitted data: 0x0
transmitted data: 0x1
transmitted data: 0x2
transmitted data: 0x3
transmitted data: 0x4
transmitted data: 0x5
transmitted data: 0x6
transmitted data: 0x7
transmitted data: 0x8
transmitted data: 0x9
```

2.7. I2S UDA1380 & SD_FATFS

- Overview
  Audio file placed on SD Card (with FATFS)
- Hardware connection

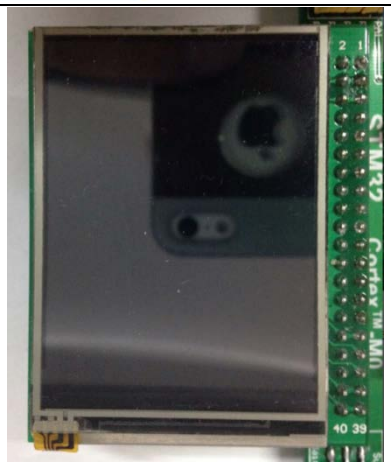
  - Connect the board to 5V power via 5VDC interface
  - Connect the ULINK2 board to the board via SWD interface
  - Connect the UDA1380 Board to the onboard I2S interface
  - Connect an earphone to theUDA1380 Board LINEOUT interface
  - Connect the Micro SD Storage Board (with SD card) to the onboard SPI2 interface
  - Connect the CD pin on the Micro SD Storage Board to the onboard PB0 pin using a jumper wire.
- Operation and result
  - The below information will be printed on the serial debugging assistant:

2.8. JOYSTICK

- Overview
  Joystick demo
- Hardware connection
  Short the LED JMP，JOYSTICK JMP，KEY JMP.
- Operation and result
  Push the joystick or the keys, the LED status should keep changing accordingly.

2.9. 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

2.10. LCD22-Touch

◆ Overview

LCD demo

◆ Hardware connection

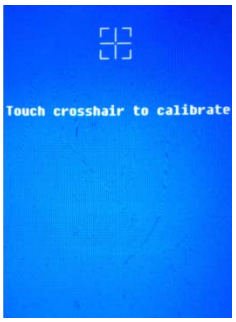
Connect the board to 5V power via 5VDC interface

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



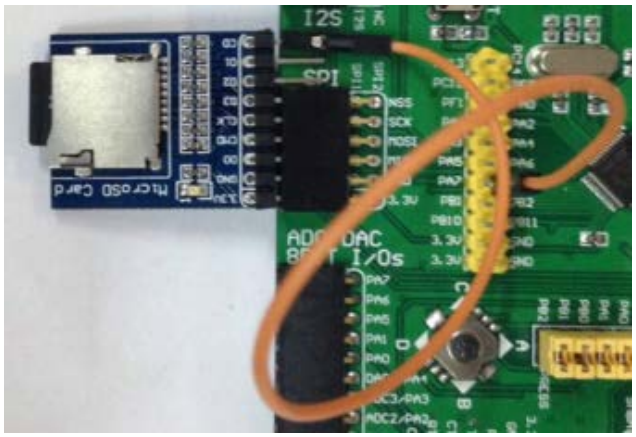
Message will be displayed on the LCD

◆ Application

Handheld device display

2.11. FATFS V0.08A-SD Card

- Overview
  SD_FatFS demo
- Hardware connection



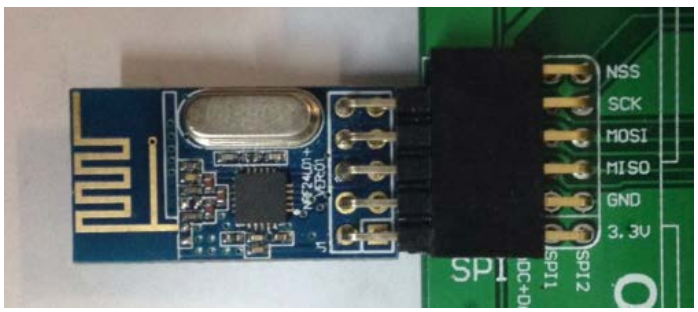
- Connect the board to 5V power via 5VDC interface
- Connect the ULINK2 board to the board via SWD interface
- Connect a serial port converter to the board via UART1
- Connect the Micro SD Storage Board (with SD card) to the board via SPI2 interface
- Connect the CD pin on the Micro SD Storage Board to the onboard PB0 pin using a jumper wire.

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

```
-- SD card detected OK
Card Type                    : SD V2
Card Type                    : SD V2
Card Type                    : SD V2
```

2.12. 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 the ULINK2 board to the board via SWD interface
- Connect the NRF24L01 Board to the board via SPI interface

- Software configuration
  Download the transmitting and receiving program to the two NRF24L01 board respectively.
- Operation and result
  Message will be printed on the serial debugging assistant.

2.13. 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 Temperture:8 'C
 Temperture:30 'C
 Temperture:29 'C
 Temperture:30 'C
 Temperture:29 'C
 Temperture:30 'C
 Temperture:29 'C
 Temperture:30 'C
```

2.14. 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 the ULINK2 board to the board via SWD interface
- Connect the PS2 keyboard to the board via PS2 interface.

- Short the PS2 JMP.

◆ Operation and result

Press keys on the PS2 keyboard, the related key value will display on the serial debugging assistant:

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

2.15. 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:

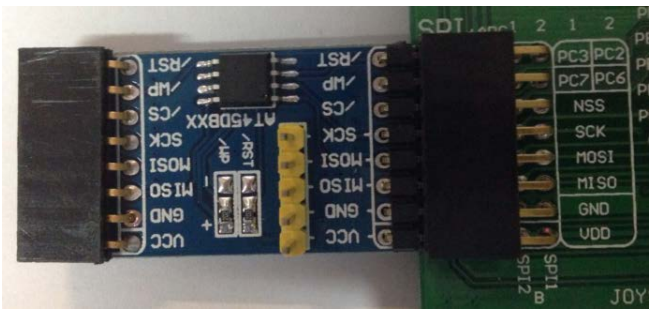
```
*****************************************************************
External Reset occurred....
No need to configure RTC....
Time: 2012-1-1   00:00:08
Time: 2012-1-1   00:00:09
Time: 2012-1-1   00:00:10
Time: 2012-1-1   00:00:11
```

2.16. 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 USART1 interface

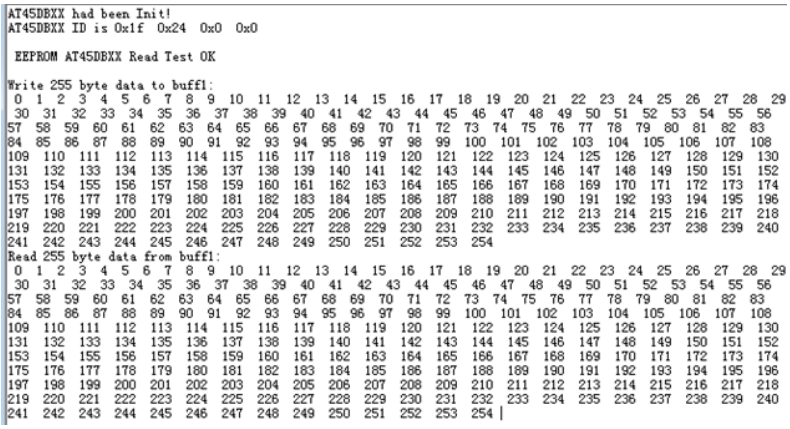
◆ Software connection

Software 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:



2.17. Ucos II

- Overview

  Ucos ii demo

- Hardware connection

  Connect the board to 5V power via 5VDC interface

  Connect the board to 5V power via 5VDC interface

  Short the LED jumper

- Operation and result

The two LED blinking in different frequency.

2.18. USART

- Overview

  USART demo

- Hardware connection

  Connect the board to 5V power via 5VDC interface

  Connect the board to 5V power via 5VDC interface

  Connect a serial port converter to the onboard USARTX interface (connect to USART1 or USART2 depends on the program)

- Operation and result

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

3. Revision history

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