a module solution provider

# WB2072E00A

## WB2072-00 Bluetooth® Low Energy

## Wireless MCU Module

## Evaluation Kit

## User Guide

## Draft 0.1

| Prepared By | Reviewed By | Approved By |
|---|---|---|
|  |  |  |

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# 1. INTRODUCTION

The WB2072-00 is a low power Bluetooth® wireless MCU module, compliant with the Bluetooth® specification and supports master, slave and simultaneous master-and-slave roles. The device also supports the Bluetooth Low Energy data length extension feature, 2 Mbps, Long Range and extended advertising features.

The following WB2072E00A kit is available:
• WB2072-00 LGA-42 package development platform
The WB2072E00A development platform embeds a CMSIS-DAP programming/debugging interface and features hardware resources for a wide range of application scenarios: sensor data (accelerometer, pressure and temperature sensor), human interface (buttons and LEDs), digital MEMS microphone and serial communication through USB virtual COM. Three power options are available (USB only, battery only and external power supply plus USB) for high application development and testing flexibility.
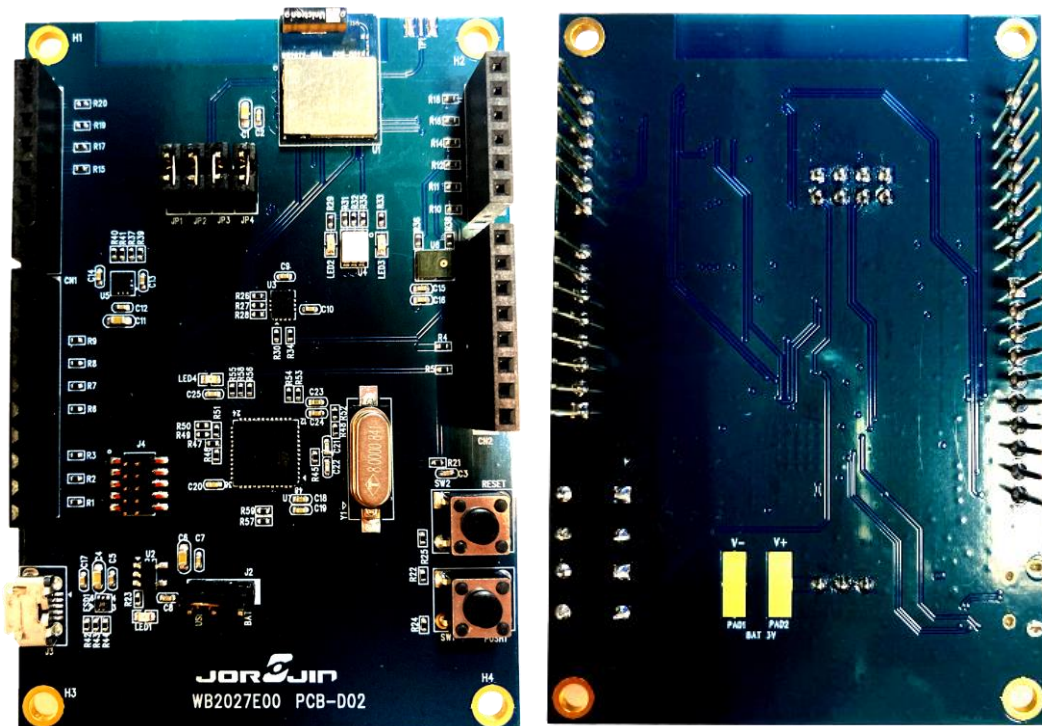


| TOP side | Bottom side |

**Figure 1-1. WB2072-00 BLE wireless MCU Module Evaluation Kit**

## 2. HARDWARE DESCRIPTION

### *2.1 WB2072E00A board overview*

The WB2072E00A development kit lets you experiment with WB2072-00 BLE wireless MCU module functions. It features:

- Bluetooth® low energy board based on the WB2072-00 BLE wireless MCU module (LGA-42 package)
- Associated development kit SW package (STSW-BNRGLP-DK) including firmware and documentation
- Bluetooth® low energy compliant, supports master, slave and simultaneous master-and-slave roles
- 3 user LEDs
- 1 user buttons
- 3D digital accelerometer and 3D digital gyroscope
- MEMS pressure sensor with embedded temperature sensor
- MEMS audio sensor omnidirectional digital microphone
- Battery pads
- CMSIS-DAP debugger/programmer via micro USB connector
- USB to serial bridge to create an I/O channel with the WB2072-00 BLE wireless MCU module
- Jumper to measure WB2072-00 BLE wireless MCU module current
- RoHS compliant

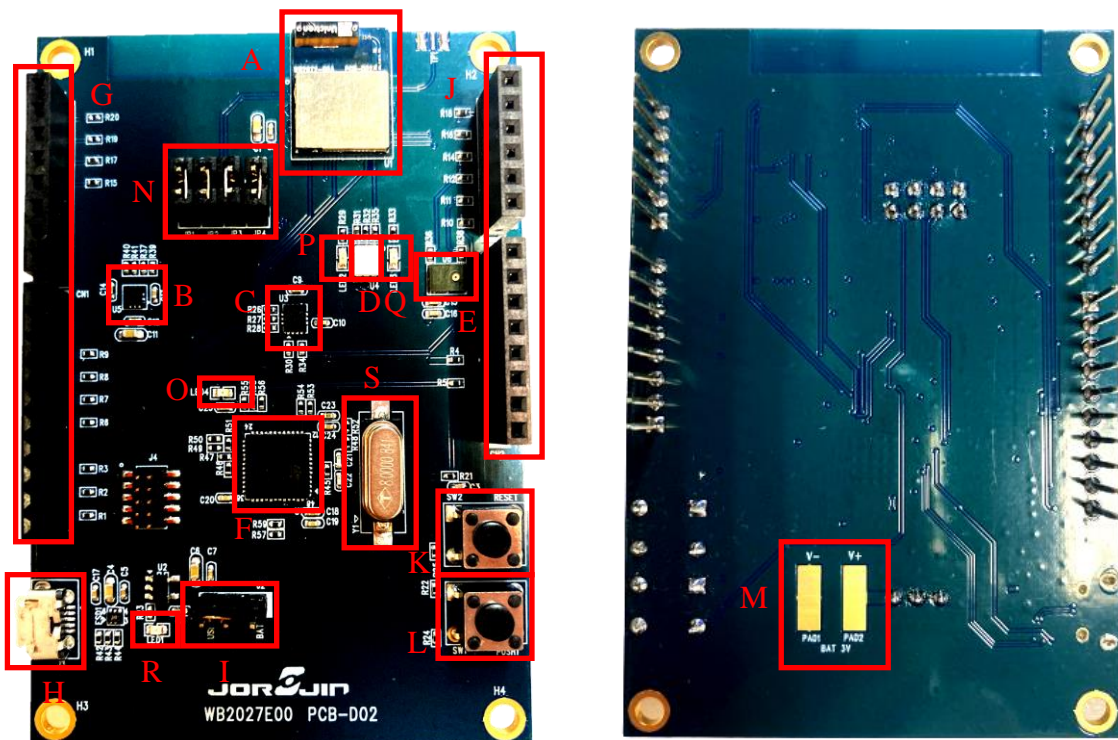The following figure and table describe physical sections of the board.



**Figure 2-1. Hardware description of Evaluation Kit**

Table 2-1. Evaluation Kit component descriptions list

| Region | Description |
|--------|-------------|
| A | WB2072-00 BLE wireless MCU module. |
| B | LPS22HB MEMS pressure sensor with embedded temperature |
| C | LSM6DSOX 3D digital accelerometer and 3D digital gyroscope |
| D | 3-color LED |
| E | MP34DT05-A digital microphone |
| F | USB CMSIS-DAP program/debug channel and serial bridge for I/O channel to PC communication (STM32F103xx 64-pin microcontroller) [1] |
| G, J | Two rows of Arduino connectors. |
| H | Micro USB connector for power supply and I/O, and CMSIS-DAP debugger/programmer |
| I | Power options (USB, battery) |
| K | Reset button |
| L | user buttons |
| M | Battery pads for two AAA batteries |
| N | Board jumpers |
| O | Programmer/debugger and communication activity (LED4) |
| P | User LED (LED2) |
| Q | User LED (LED3) |
| R | Power LED (LED1) |
| S | 8 MHz crystal |

1.    STM32 is not intended to be programmed by users.

## 2.2 WB2072-00 BLE wireless MCU module connections

Table 2-2. WB2072-00 Module pin description with board functions

| Module | | Board function | | | | | | | | | | |
|--------|--------|------|-------|---------|-------|---------|----------|------|-----|-----|-----|-----|
| Pin name | Pin no. | LEDs | Micro | Buttons | Micro phone | LPS22HB | LSM6DSOX | SWD | CN1 | CN2 | CN3 | CN4 |
| GND | 1,10,12,16,20,27,29 | | | | | | | | | 6,7 | | |
| PA3 | 2 | | SWDIO | | | | | SWCLK | | | | |
| PA2 | 3 | | SWDIO | | | | | SWDIO | | | | |

| PA1 | 4 | | | | I2C_SDA | | 9 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| PA0 | 5 | | | | I2C_CLK | | 10 | | | |
| PB15 | 6 | LED2 | | | | | | | | 6 |
| PB14 | 7 | LED3 | | | | | | | | 5 |
| VDD | 8,9 | | | | | | | 2,4 | | |
| PB5 | 11 | SPI_MOSI | | | SPI_MOSI | | 4 | | | |
| RSTN | 13 | RSTN | RESET | | | | | 3 | | |
| PB7 | 14 | SPI_CLK | | | SPI_CLK | | 6 | | | |
| PB6 | 15 | SPI_CS | | | | | 3 | | | |
| PB4 | 17 | SPI_MISO | | | SPI_MISO | | 5 | | | |
| PB3 | 18 | | | | SPI_CS | | | | | 4 |
| PB2 | 19 | | | DOUT | | | | | | 3 |
| PB1 | 21 | | | CLK | | | | | | 2 |
| PB0 | 22 | | | | INT1 | | | | | 1 |
| PA11 | 23 | U4 | | | | | | | 4 | |
| PA10 | 24 | BOOT | PUSH1 | | | | | | 3 | |
| PA9 | 25 | UART_TXD | | | | | | | 2 | |
| PA8 | 26 | UART_RXD | | | | | | | 1 | |
| TP1 | 28 | | | | | | | | | |

## 2.3 Power supply

LED1 green LED (Figure 2-1, region R) signals the board is being powered, either via:

• micro USB connector J3 (Figure 2-1, region H)

• two AAA batteries on BAT region at the rear of the board

• an external DC power supply

**Table 2-3. WB2072E00A kit platform power supply modes**

| Power supply mode | J2 settings | Description |
|---|---|---|
| USB | USB position | USB supply through J3 connector (Figure 2-1, region H) |
| Battery | BAT position | The supply voltage must be provided through batteries (at the rear of the board) |
| External DC power supply | Removed | The supply voltage must be provided through J2 pin 2. USB connection is not needed |

## *2.4 Jumpers*

The following jumpers are available (Figure 2-1, region N).

**Table 2-4. WB2072E00A kit platform jumpers**

| Jumper | Description |
|--------|-------------|
| J2 | It is a switch between two power domains:<br>• BAT position - to provide power from battery holder<br>• USB position - to provide power from USB connector |
| JP1 | It provides the voltage to the WB2072-00 circuit. It must be adapted and can be used for WB2072-00 current measurements. |
| JP2 | It connects the WB2072-00 BLE_SWCLK pin with the USB_CMSISDAP SWCLK pin. It must be adapted. |
| JP3 | It connects the WB2072-00 BLE_SWDIO pin with the USB_CMSISDAP SWDIO pin. It must be adapted. |
| JP4 | It connects the WB2072-00 BLE_RSTN pin a pin of the USB_CMSISDAP. It must be adapted. |

## *2.5 Sensors*

The following sensors are available on the platform:

1. An LPS22HB (Figure 2-1, region B) piezoresistive absolute pressure sensor which functions as a digital output barometer. The device comprises a sensing element and an IC interface which communicates through I²C from the sensing element to the application.
2. An LSM6DSOX (Figure 2-1, region C) 3D digital accelerometer and 3D digital gyroscope with embedded temperature sensor which communicates via SPI interface. One line for interrupt is also connected.
3. An MP34DT05-A MEMS audio sensor omnidirectional digital microphone connected to the WB2072-00 PDM port.

## *2.6 Extension connector*

WB2072-00 signal test points are shared on two Arduino connector rows: CN1, CN3 (Figure 2-1, region G) and CN2, CN4 (Figure 2-1, region J).

## *2.7 Push buttons*

The board has one user button to reset the microcontroller (Figure 2-1, region K) and one further button for application purposes (Figure 2-1, region L).

## *2.8 LEDs*

LEDs LED1 (green power LED), LED2 (red), LED3 (green), U4 (blue) and LED4 (USB_CMSISDAP activity green

LED) are available on the board (Figure 2-1, regions R, O, P, Q and D).

## 2.9 CMSIS-DAP and Virtual COM

The most important features of the STM32F103xx microcontroller (Figure 2-1, region F) are:

- CMSIS-DAP debugging/programming capability through the USB micro connector
- USB-to-serial bridge providing an I/O communication channel with the WB2072-00 Module (to interface with a USB host device as a PC)
- drag and drop capability to program the WB2072-00 Module

Note: The on-board STM32F103xx microcontroller is not intended to be programmed by users. ST provides a pre-programmed firmware image (USB_CMSISDAP.hex) to interface the WB2072-00 Module with a USB host device with the highlighted features.

### 2.9.1 Virtual COM port driver setup for Windows

In Windows 7, the driver installation for the Virtual COM port requires the installation of the driver files available at https://os.mbed.com/docs/mbed-os/v5.7/tutorials/windows-serial-driver.html In Windows 10, no installation is required.

### 2.9.2 System functionality checks

To check if the system is ready to use, follow the steps below.

**Step 1.** Check whether the CMSIS-DAP device is present in the Windows Device Manager.



**Figure 2-2. Windows Device Manager - CMSIS-DAP**

Note: The composite device (WebUSB: CMSIS-DAP) installation is not required, as this functionality is not used.

**Step 2.** Check under [Devices and drives] whether the ST IDB011VX mass storage device is present (if the board is powered by USB cable and connected to a PC).

**Figure 2-3. ST IDB011VX mass storage device**

**Step 3.** Check whether LED1 LED is on (if the board is powered by USB).

## 2.9.3 USB_CMSISDAP programming/debugging feature

The WB2072E00A enables the on-board programming/debugging feature (USB_CMSISDAP). To use it, you have to choose CMSIS DAP as debugger/programmer in IAR EWARM or KEIL µVision development environments.
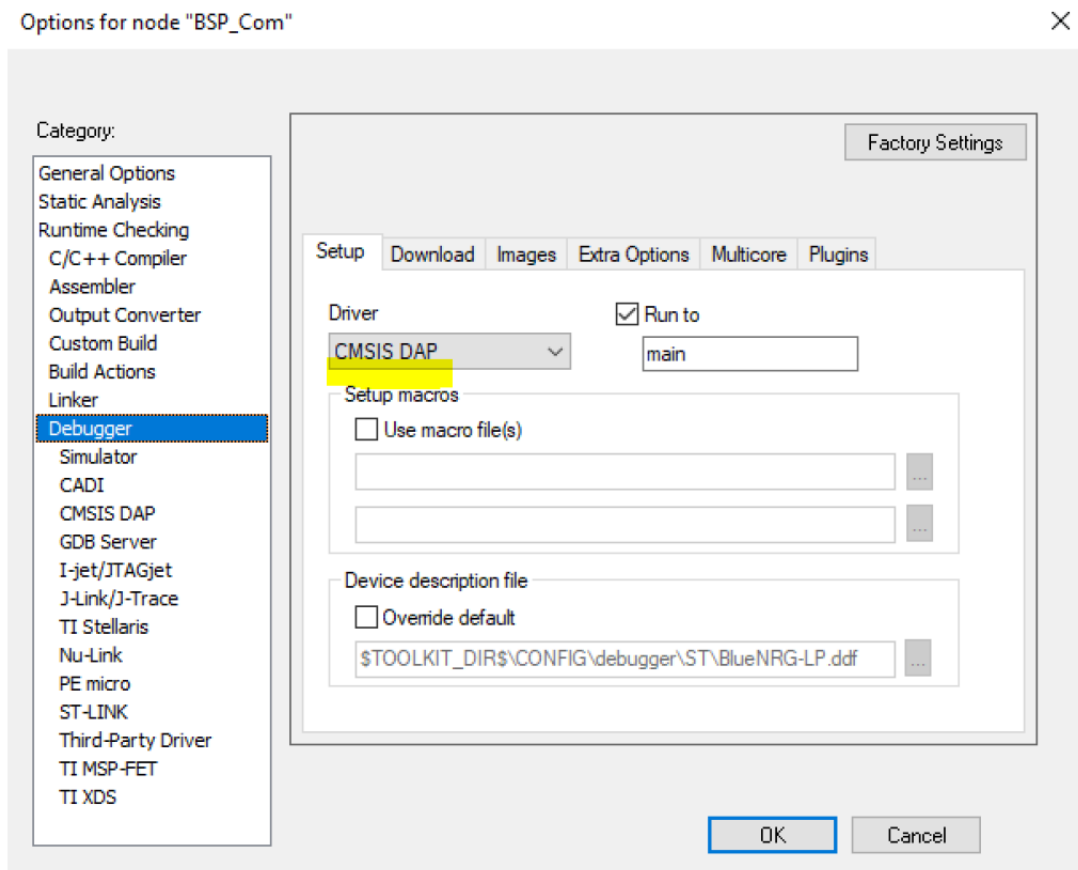

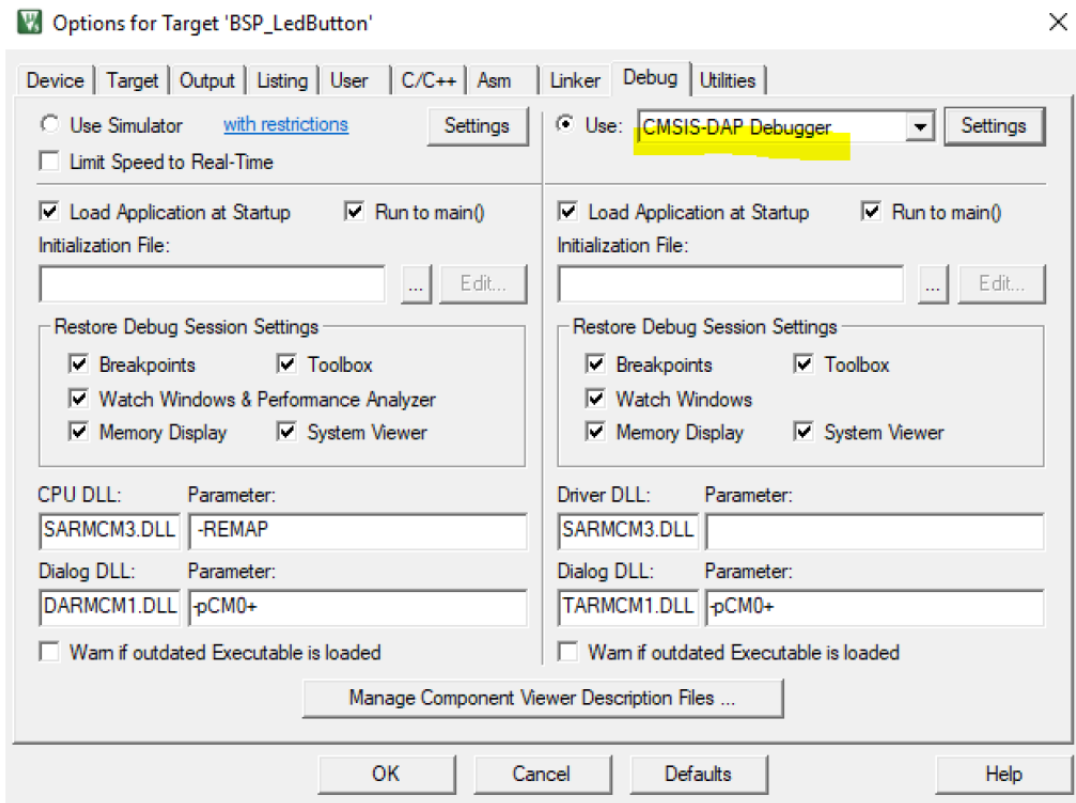
**Figure 2-4. IAR EWARM project - Debugger option**

**Figure 2-5. KEIL μVision project - Debugger option**

You can load a binary image (.bin or .hex) to the WB2072-00 Module by copying and pasting (or dragging and dropping) the binary file into the ST IDB011VX mass storage device.

## 2.9.4 USB_CMSISDAP firmware update

If an updated version of the USB_CMSISDAP firmware is released, you should follow the procedure below for firmware update.

**Step 1.** Unplug the USB cable (if plugged).

**Step 2.** Press and hold the [RESET] button.

**Step 3.** Plug the USB cable.

**Step 4.** Release the [RESET] button.

A new mass storage device ([MAINTENANCE]) appears.
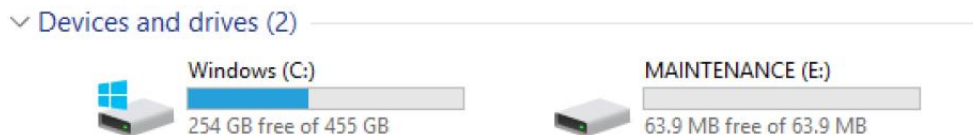


**Figure 2-6. USB_CMSISDAP firmware - MAINTENANCE mass storage device**

**Step 5.** Copy and paste the new binary image into the [MAINTENANCE] mass storage device.

**Step 6.** At the end of the operation, unplug and then plug the USB cable again to start the board up.

## 2.10 WB2072-00 module programming and debugging

To program and debug the WB2072-00 module embedded in the WB2072E00A board, you can use an external SWD programmer/debugger tool after removing JP3, JP4 and JP5 jumpers from the WB2072E00A kit platform and connecting the SWD tool to the board as listed in the table below.

**Table 2-5. External SWD and STEVAL-IDB011V1 pin connections**

| SWD pins | WB2072-00 kit platform pins |
|---|---|
| SWDIO | JP3 pin 1 |
| SWCLK | JP2 pin 1 |
| NRST | JP4 pin 1 |
| GND | GND |
| Target VCC | VBAT |

Remember:

Before using the supported IDE toolchains, select the related SWD programmer/debugger tool from the IAR EWARM project (Option/Debugger) and from the KEIL µVision project (Option/Debug).

The CMSIS-DAP debugging/programming capability via the USB micro-connector can also be used to program/ debug a WB2072-00 module on a different board. Remove JP2, JP3 and JP4 jumpers and connect the WB2072E00A kit platform to the board SWD pins, GND and Target VCC as follows:

**Table 2-6. WB2072E00A kit platform and user board pin connection**

| WB2072E00A kit platform pins | User board SWD pins |
|---|---|
| JP3 pin 2 | SWDIO |
| JP2 pin 2 | SWCLK |
| JP4 pin 2 | NRST |
| GND | GND |
| VBAT | Target VCC |

Then connect the WB2072E00A kit platform USB to a PC USB port to start programming and debugging the WB2072-00 module on your board.

## 2.11 Current measurements

To monitor the WB2072-00 module power consumption, you must remove the jumper from JP1 and insert an ammeter between the connector pins 1 and 2.

Since WB2072-00 module power consumption is usually very low, an accurate instrument in the range of few micro amps is recommended.

## *2.12 Hardware setup*

Step 1. Configure the WB2072E00A board to USB power supply mode as per Table 2-3

Step 2. Connect the WB2072E00A board to a PC via USB cable (J3 connector)

Step 3. Check whether the LED1 power indication LED is on.

## 3. SOFTWARE DESCRIPTION

### *3.1 WB2072E00A GPIO configuration*

WB2072E00A GPIO configuration in attached file.

WB2072EVB_IO_
Config.zip

Update four files as below



### *3.2 ST STSW-BNRGLP-DK*

References ST DK1.0.0. link as below

https://www.st.com/content/st_com/en/products/embedded-software/evaluation-tool-software/stsw-bnrglp-dk.html
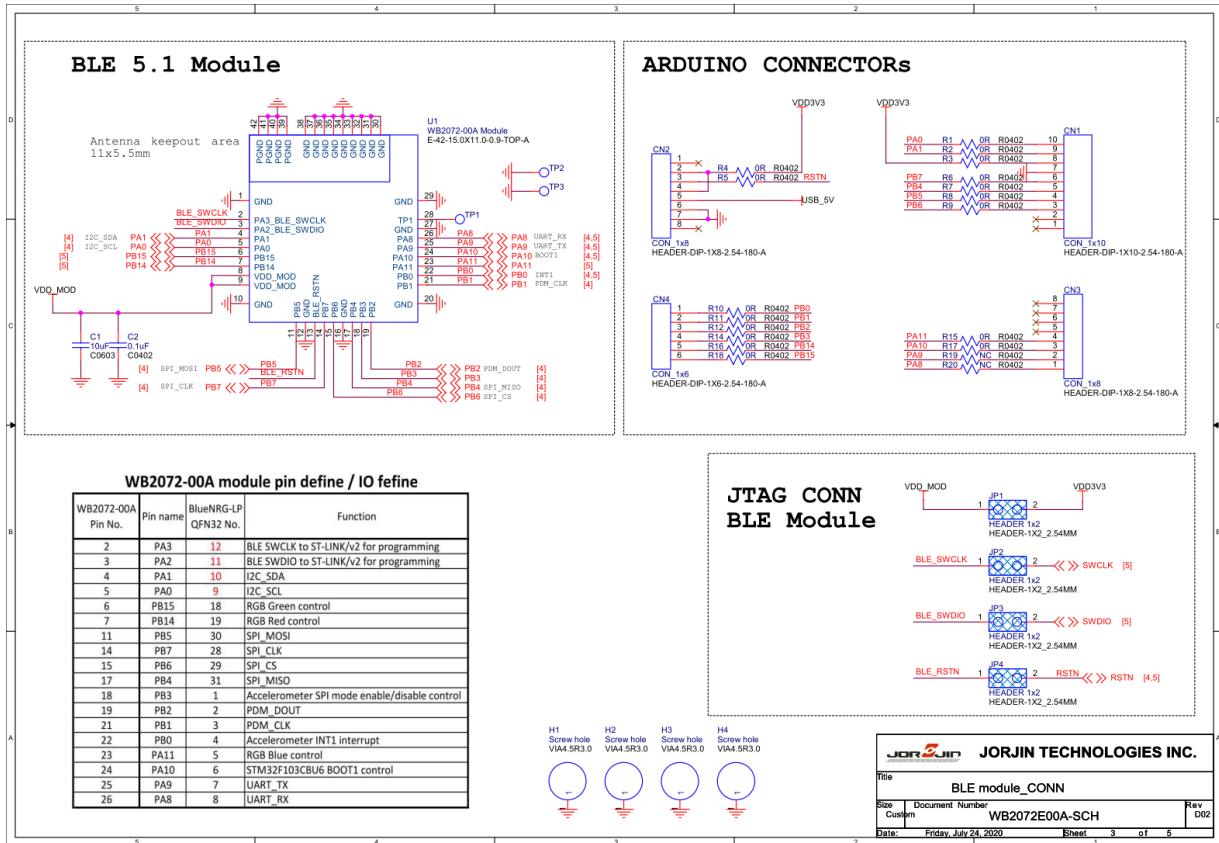
# 4. SCHEMATIC DIAGRAMS



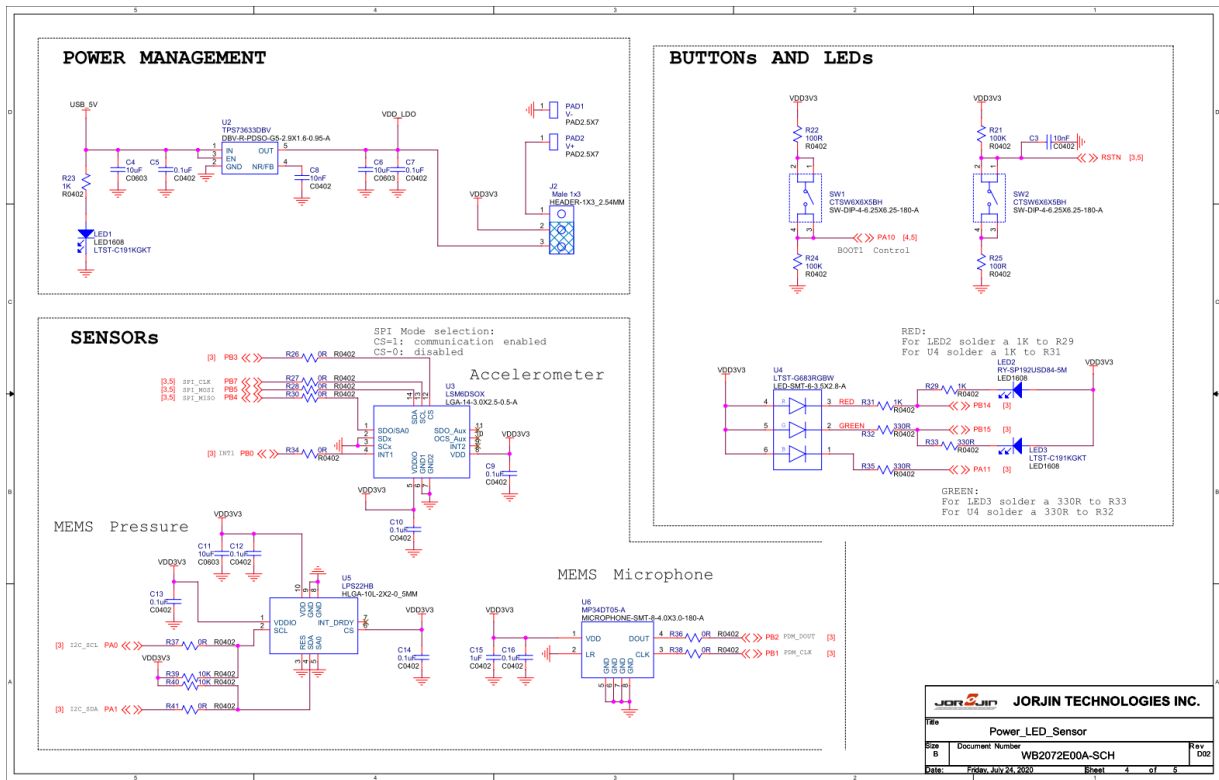**Figure 3-1. WB2072E00A circuit schematic (1 of 3)**

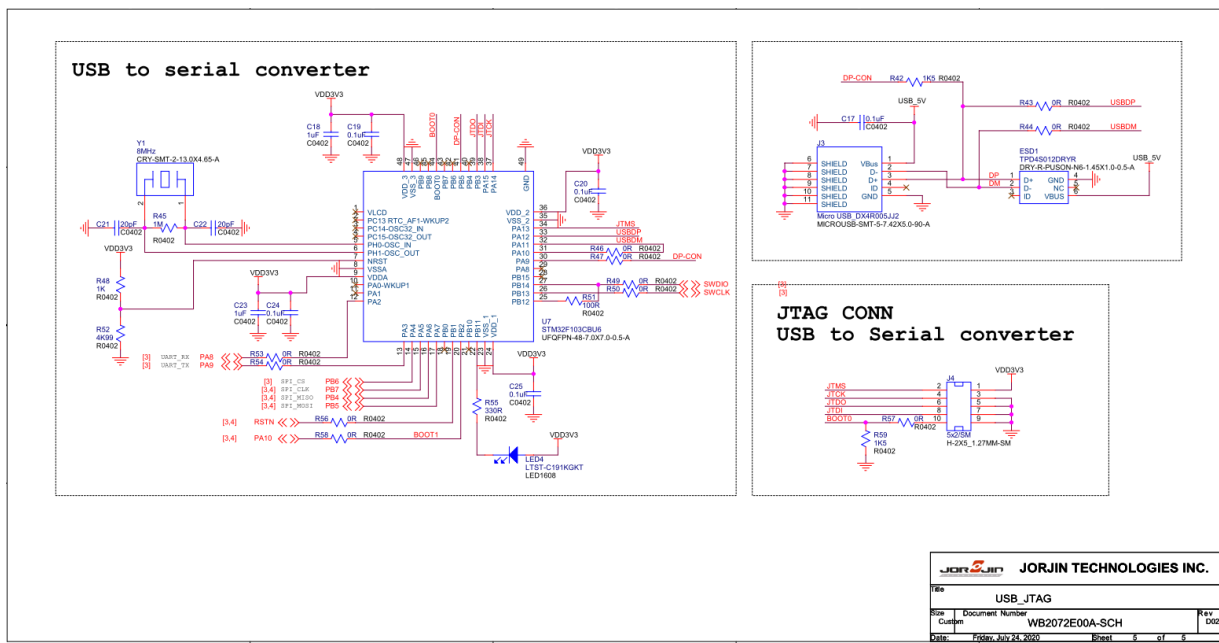**Figure 3-1. WB2072E00A circuit schematic (2 of 3)**



**Figure 3-1. WB2072E00A circuit schematic (3 of 3)**
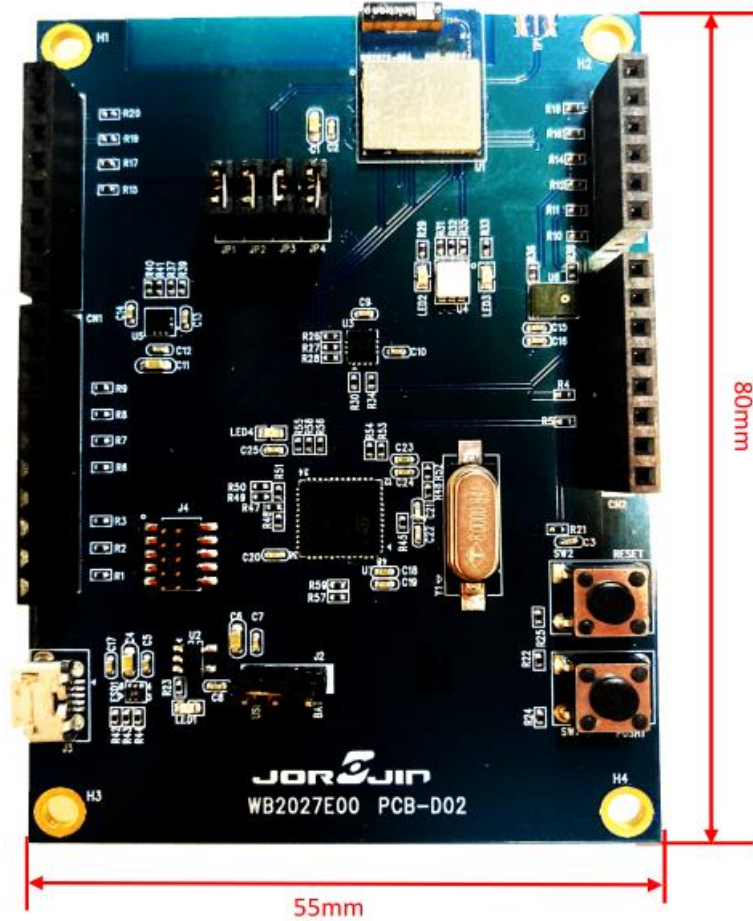
## 5. DIMENSION



**Figure 4-1. Board Dimension**

## 6. HISTORY CHANGE

| Revision | Date | Description |
|----------|------|-------------|
| Draft 0.1 | 2020-11-03 | Draft version. |
| | | |
| | | |