# AIROHA

# MT7686 HDK V11 User's Guide

Version:          1.3

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## Document Revision History

| Revision | Date | Description |
|---|---|---|
| 1.0 | 30 June 2017 | Initial release |
| 1.1 | 30 Oct 2017 | 1. Correct the number of LED<br>2. Add description for LED<br>3. Add jumpers setting at chapter 2.4 |
| 1.2 | 5 Jan 2018 | Add chapter 2.5 for entering IAR and GCC interface |
| 1.3 | 21 May 2018 | Updated HDK picture for jumper settings |

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# 1. Introduction

Airoha IoT SDK for RTOS is a low-cost and easy to use Internet of Things (IoT) development platform to design, prototype, evaluate and implement IoT projects. The platform supports MT7686 hardware development kit (HDK). This user manual provides required knowledge on features of the HDK, including the pins, communication interfaces, core microcontroller unit (MCU) description, the networking capabilities and how to use them through the host driver.

The HDK includes MT7686 chipset based on ARM Cortex-M4 with floating point unit in QFN48 package. It enables rich connectivity features, communication with cloud services and real-time control. The MT7686 HDK supports ARM mbed IoT Device Platform for more convenient debugging and binary code download operations.

The following features are available:

- Mass storage device (MSD) programmer.
  - o The MT7686 HDK has three binary files for bootloader, Wi-Fi connectivity and FreeRTOS. The MSD programmer enables to update the FreeRTOS binary file only.
- Coresight Debug Access Port (CMSIS-DAP) debug interface.
  - o A firmware debug interface similar to ST-link or J-link. It enables debugging a target project or downloading a binary to the flash storage of the device.
- Virtual Serial Port.
  - o Supports UART functionality, such as transferring log information from the HDK.

These features are used to download and debug a project on MT7686 HDK.

The front view of the HDK including a stamp module and main board is shown in Figure 1. MT7682 and MT7686 use the same HDK main board.
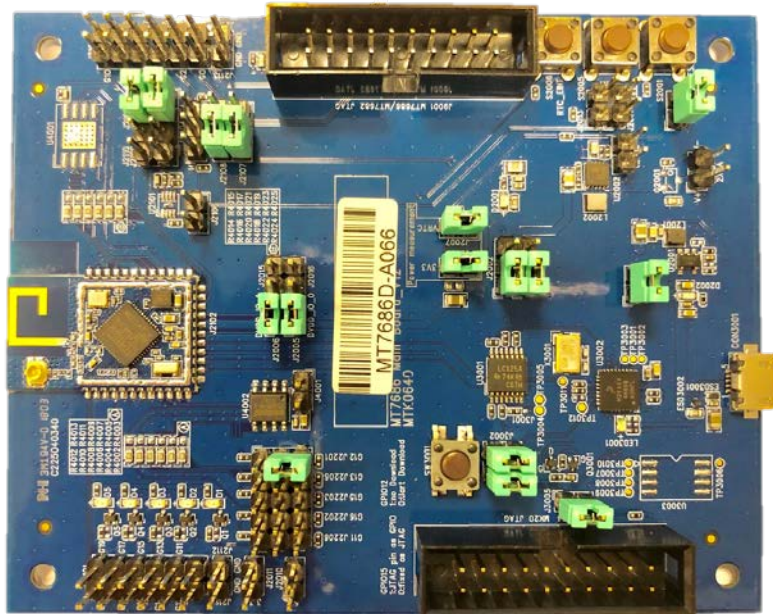


*Figure 1. Front view of MT7686 HDK*

# 2. Get started with the HDK

Before commencing the application development, you need to configure the development platform.

## 2.1. Configuring the MT7686 HDK

MT7686 HDK includes a main board (MT7686 Main Board_V11)  and a MT7686 stamp module. The MT7686 stamp module is mounted on the main board. The top view of the main board is shown in Figure 2.
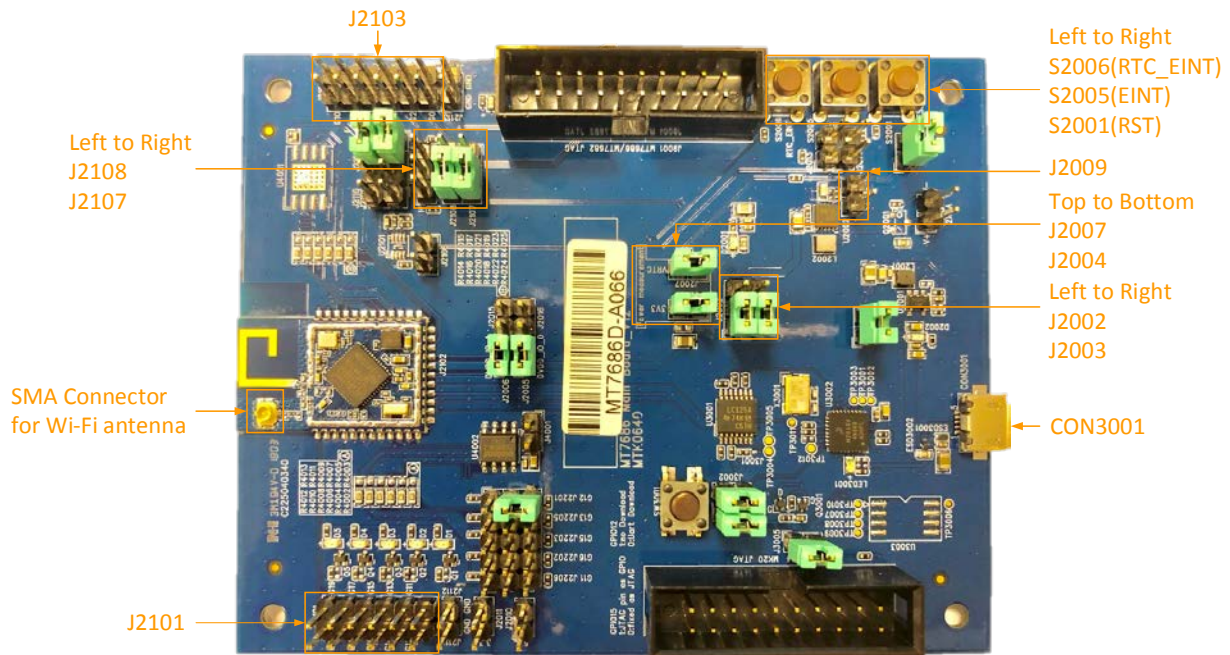


*Figure 2. Jumpers and connectors on the MT7686 HDK*

The description of pins (Figure 2) and their functionality is provided below.

1) **CON3001** is a USB connector to debug through UART, transmit and receive a signal and supply power from the PC. The USB connectivity with the PC is supported by the on-board MK20DX128VFM5.

    a) Set the jumpers **J2002** pin 1 and pin 2, **J2003** pin 1 and pin 2, **J2004** and **J2007** on, if the board is powered by a USB connector.

2) **S2005** enables the external interrupt (configured at **GPIO0**), see section 4.4, "Buttons", for more details.

3) Press **S2001** to reset the system.

4) **Wi-Fi Antenna** is a PCB antenna. MT7686 stamp module is by default connected to the PCB antenna to transmit and receive RF signals.

The default configuration of the MT7686 HDK supports the following functionality:

1) Power supply. Attach a micro-USB connector to the **CON3001.**

2) Supports RTC interrupt.

3) Clock source — 32.768kHz source crystal clock for the RTC mode or external clock operating on 32.768 kHz.

4) XTAL at 26MHz.

5) Supports RTC mode.

The hardware settings of the stamp module are shown below:

1) XTAL at 26MHz.

2) Clock source — 32.768kHz source crystal clock for the RTC mode or external clock operating at 32.768kHz.

3) Supports RTC mode.

## 2.2.    Installing the MT7686 HDK drivers on Microsoft Windows

To configure the MT7686 HDK:

1) Connect the HDK to the computer using a micro-USB cable.

2) Download and install mbed Windows serial port driver from here. Open Windows **Control Panel** then click **System** and:

- On Windows 7 and 8, click **Device Manager**.

3) In **Device Manager**, navigate to **Ports (COM & LPT)** (see Figure 3).

4) A new **COM** device should appear under **Ports (COM & LPT)** in **Device Manager**, as shown in Figure 3. Note the **COMx** port number of the serial communication port, this information is needed to send command and receive logs from the COM port. Virtual COM port is connected to the board through the **UART0** of the MT7686, see section 4.5, " Extension connectors". The **mbed Serial Port** (**UART0)** is applied to flash the board and log the outputs.
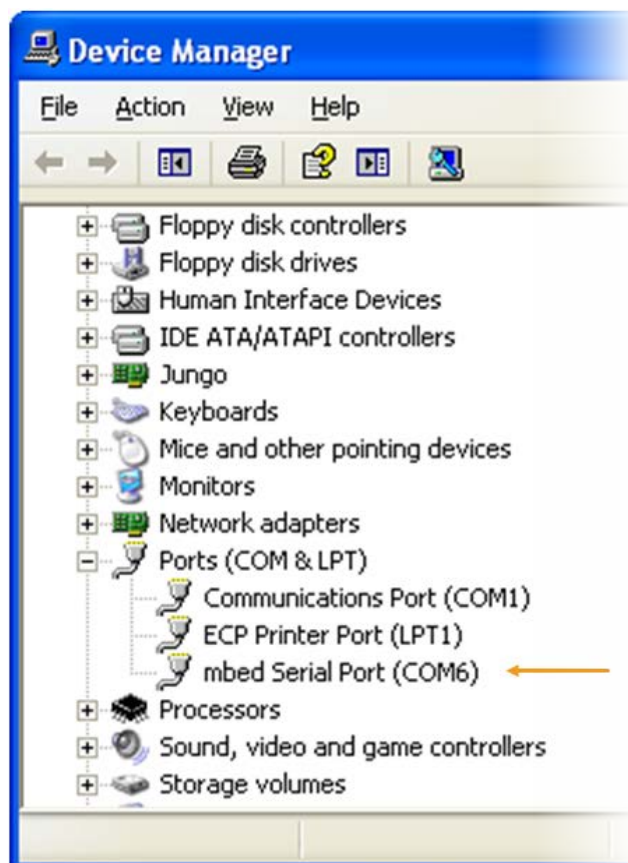
*Figure 3. COM port associated with the MT7686 HDK*

## 2.3. Configuring the HDK flash mode

The MT7686 HDK is embedded with 4MB flash memory. The boot options are either from the Flash memory or from the UART port.

To update the firmware on the MT7686 HDK:

1) Set the jumpers **J2002** pin 1 and pin 2, **J2003** pin 1 and pin 2, **J2004** and **J2007** on.

2) To enable the chipset to UART download mode, set the jumper **J2201** pin 2 and pin 3 on.

- In this mode, if the power is on, the board will load ROM code and start the **ATE Daemon** or **Firmware Upgrade Daemon** according to the MT7686 Flash Tool's behavior on the PC. A message is sent to the **UART0** port of the chipset and the code is uploaded to the embedded flash memory through **UART0**.

3) Connect the board to the computer using a micro-USB cable.

The development board should now be connected to the PC, as shown in Figure 2.

To run the project on the MT7686 HDK:

1) Set the jumpers **J2002** pin 1 and pin 2, **J2003** pin 1 and pin 2, **J2004** and **J2007** on.

2) Remove J2201 jumper, to set the board into a flash mode.

- In this mode, if the power is on, the board will load firmware from the Flash and reboot.

3) Connect the board to a computer using a micro-USB cable.

The development board should now be connected to the PC, as shown inFigure 4.

## 2.4. Downloading the image using the MT7686 HDK as a removable storage

To update the FreeRTOS binary only (example project binary: `mt7686_iot_sdk.bin`), use the HDK as a mass storage device according to the following steps:

1) Set the jumpers J2107 pin 2 and pin 3, J2108 pin2 and pin 3 on.

2) Power up the board with a micro-USB cable.

3) Navigate to **Computer** on your PC to check if a new mass storage named **MT7686** is available under **Removable Disk**, as shown in Figure 4.

4) Open the **MT7686** removable storage, then drag and drop the binary `mt7686_iot_sdk.bin` to complete downloading the image.
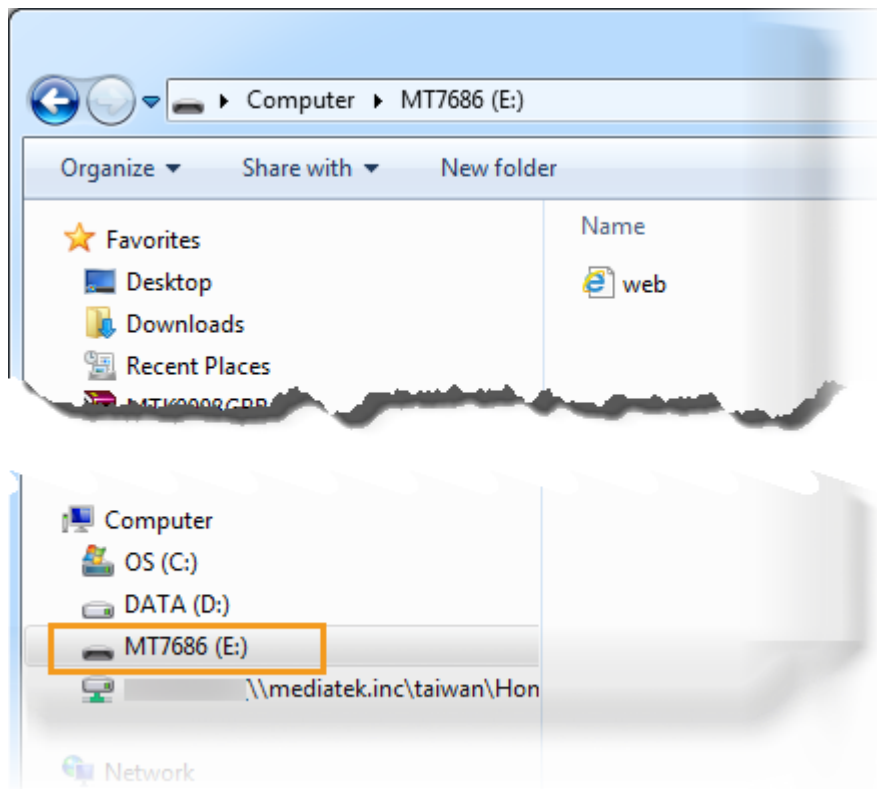


*Figure 4. New removable storage detected*

## 2.5. Enter IAR and GCC development interface

MT7686 HDK support IAR and GCC development interface to design or debug.

According to the following steps to enter these interfaces:

1) Set the jumpers J2107 pin 2 and pin 3, J2108 pin2 and pin 3 on.

2) Set the jumpers J2201 pin1 and pin2 on.

3) Power up the board with a micro-USB cable.

4) Use computer to enter the IAR and GCC software.
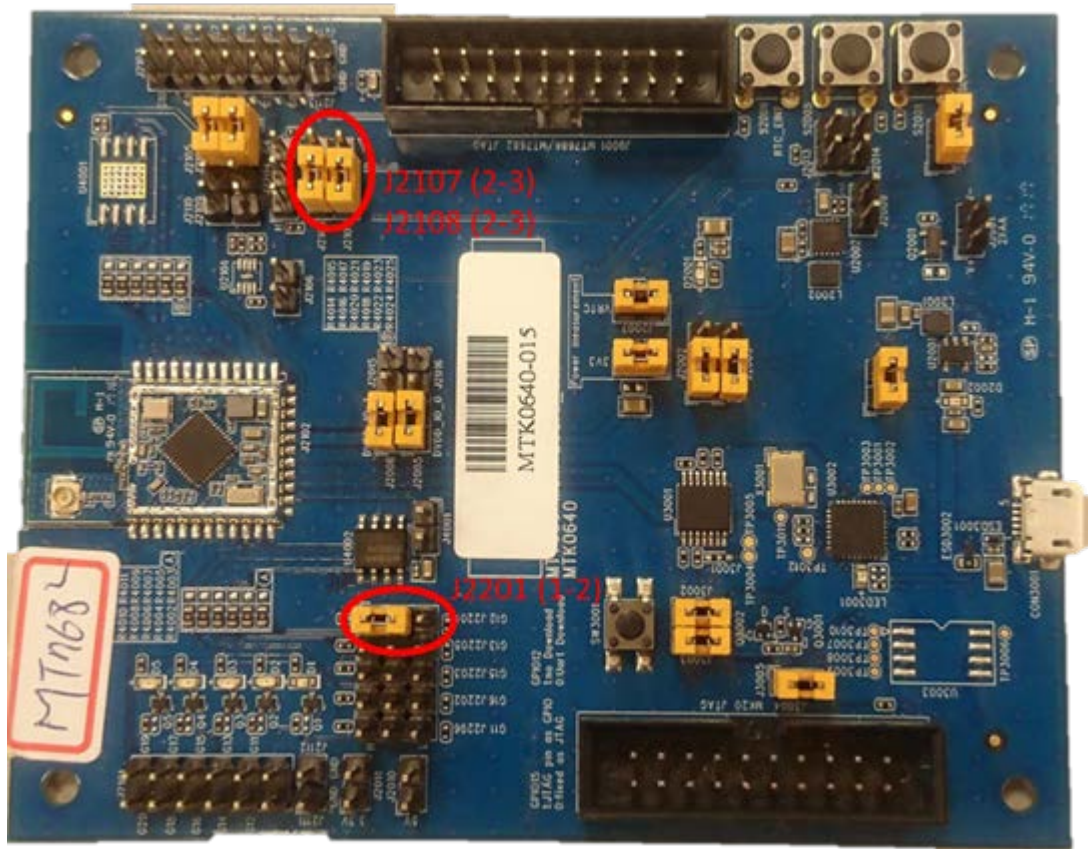


*Figure 5. Switch j2107, j2108 and j2201 to enter IAR and GCC interface.*

# 3.　Hardware Features

This section provides the main supported features of the MT7686 HDK. The detailed description of the features is provided in the upcoming sections.

- IEEE 802.11bgn Wireless Connectivity Single Chip with QFN68 package.

- The IOs on MT7686 HDK are 3.3V compatible. MT7686 chip IO can support 3.3V, 2.8V and 1.8V.

- Support for FreeRTOS.

- Flexible on-board power supply
  - o USB with power ($V_{Bus}$, 5V).
  - o External $V_{IN}$ (1.8~3.63V).

- Eight LEDs
  - o Power LEDs (**D2001, D2002**)
  - o User LEDs (**D1, D2, D3**, **D4**, **D5**).
  - o UART communication LEDs(**LED3001**)

- Three push buttons
  - o System Reset.
  - o Real Time Clock (RTC) Interrupt.
  - o External Interrupt.

- XTAL (Crystal Oscillator)
  - o 26MHz source clock support with low power consumption in idle mode.
  - o 32.768kHz clock for the RTC mode or external 32.768kHz mode.

- USB re-enumeration capability: two different interfaces supported on the same USB.
  - o CMSIS-DAP USB.
  - o Virtual COM port UART through USB on PC.

- On-board chip antenna with `U.FL` for conducted testing.

- Micro USB connector for power and debug connections.

- Headers for current measurement.

# 4. Hardware Feature Configuration

## 4.1. Microcontroller

MT7686 features an ARM Cortex-M4 with floating point processor, which is the most energy efficient ARM processor available.

MT7686 provides low power consumption embedded architecture and it's optimized for various types of applications in home automation, smart grid, handheld devices, personal medical devices and industrial control that have lower data rates, and transmit or receive data on an infrequent basis.

## 4.2. Power supply

MT7686 HDK supports two types of power supply.

1) Power up with a micro-USB connector.

An on-board switching regulator provides voltage of 3.3V for the MT7686 HDK based on MT7686F, if the power is supplied from an on-board micro-USB connector **CON3001** (Figure 2). This supply can be isolated from the switching regulator using the jumpers. Note, that the jumpers **J2002** pin 1 and pin 2, **J2003** pin 1 and pin 2, **J2004** and **J2007** are required to be set on. More details on the jumpers can be found in Table 1.

*Table 1. Jumper settings for system power input through USB connection*

| Jumper | Usage | Comments |
|---|---|---|
| **J2002(1-2)** | 3.3V power supply | Use micro-USB connector supporting 3.3V power source. |
| **J2004** | Current measurement | Measures the current flow in MT7686F. |
| **J2003(1-2)** | AVDD33_VRTC power supply | Use micro-USB connector supporting RTC 3V3 power. |
| **J2007** | Current measurement in RTC mode | Measures the current flow in RTC mode for MT7686. |

2) Power up using an AA or AAA battery.

- Connect an external AA battery to battery pin header (**J2001**) to supply power to the system, as shown in Figure 6. When using an AA battery, plug the USB to micro-USB connector **CON3001** (Figure 2). Note, that the jumpers **J2002** pin 2 and pin 3**, J2003** pin 2 and pin 3, **J2004**, **J2007**, and **J2009** are required to be set on. More details on the jumpers can be found in Table 2.
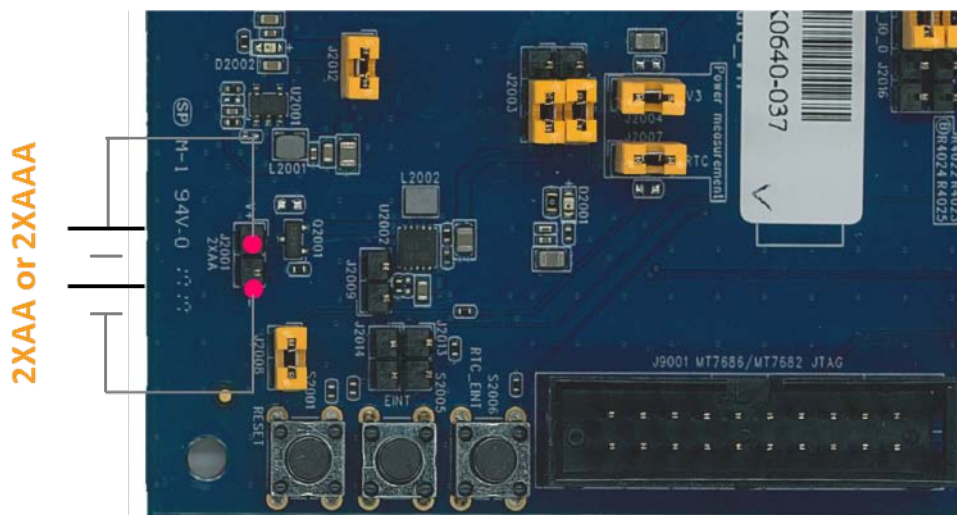
*Figure 6. Power up the HDK using an AA or AAA Battery (J2001)*

*Table 2. System power input from AA or AAA battery jumpers*

| Jumper | Usage | Comments |
|---|---|---|
| **J2002(2-3)** | 3.3V power supply | Use AA or AAA battery source supporting 3.3V power. |
| **J2004** | Current measurement | Measures the current flow in MT7686. |
| **J2003(2-3)** | AVDD33_VRTC power supply | Use AA or AAA battery source supporting RTC 3V3 power. |
| **J2007** | Current measurement in RTC mode | Measures the current flow in RTC mode for MT7686. |
| **J2009** | Enables booster | Connects MT7686 EXT_PWR_EN (pin 21) to booster enabling pin |

## 4.3.    LEDs

The MT7686 HDK has onboard LEDs associated with different functionalities of the board (Figure 7).

1)    **D2002** indicates the power rail 5V is on.

2)    **D2001** indicates the power rail 3.3V is on.

3)    Blinking **LED3001** indicates communication between MK20 UART and MT7682 UART0.

4)    **D1**, **D2**, **D3**, **D4**, and **D5** are LEDs assigned for user interaction. All LEDs are high active (Figure 7).
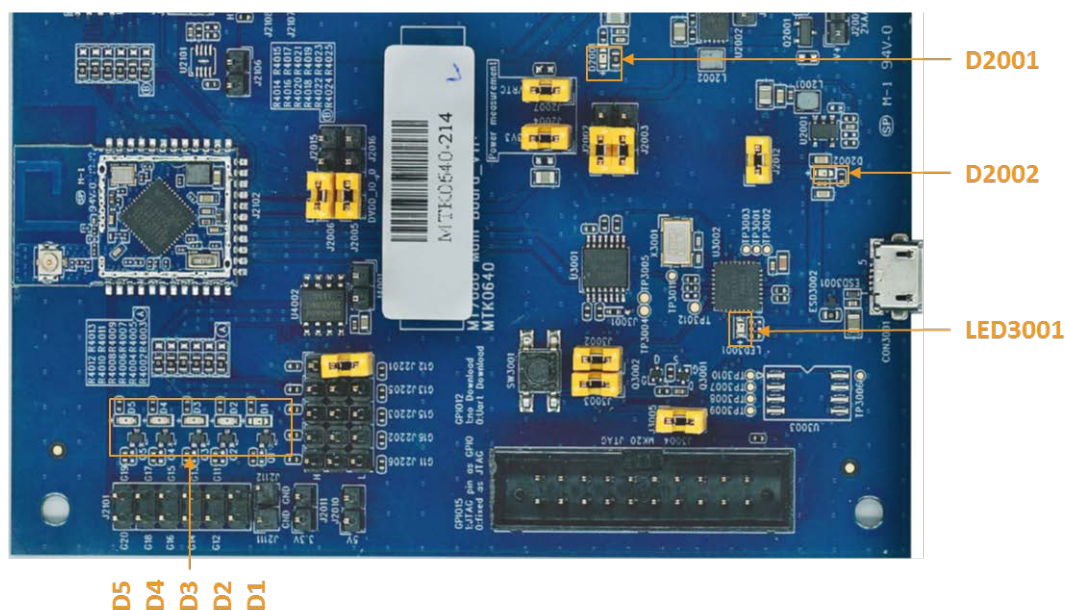
*Figure 7. On-board LEDs*

GPIO pins to activate the LEDs are shown in Table 3.

*Table 3. GPIO pins to activate the LEDS*

| LED | GPIO |
|-----|------|
| D1  | GPIO11 |
| D2  | GPIO12 |
| D3  | GPIO13 |
| D4  | GPIO14 |
| D5  | GPIO15 |

## 4.4.    Buttons

The MT7686 HDK is equipped with buttons with the following functionality. The push buttons are shown in Figure 2.

1) System reset button (**S2001**) resets the MT7686 HDK.

2) External interrupt button (**S2005**). Users can configure GPIO0 as an external interrupt pin. Press the button to wake up the system from the sleep mode.

3) RTC interrupt button (S2006). When the system is in RTC mode, push the button to wake up the system.

4) CMSIS-DAP Firmware update button (**SW3001**). Press the button to enter upload mode and upload the latest CMSIS-DAP Firmware to MK20.

## 4.5. Extension connectors

The MT7686 HDK provides similar pin-out extension connectors (**J2101** and **J2103**) for various sensor and device connectivity, as shown in Figure 2 and described in Table 4.

The board has 21 GPIOs multiplexed with other interfaces. Depending on the use case, user can configure each I/O functionality.

*Table 4. GPIO  pin-out extension connectors*

| Connector Pin Number | Signal Name | Connector Pin Number | Signal Name |
|---|---|---|---|
| **J2101.1** | GPIO20 | **J2103.1** | GPIO1 |
| **J2101.2** | GPIO19 | **J2103.2** | GPIO0 |
| **J2101.3** | GPIO18 | **J2103.3** | GPIO3 |
| **J2101.4** | GPIO17 | **J2103.4** | GPIO2 |
| **J2101.5** | GPIO16 | **J2103.5** | GPIO5 |
| **J2101.6** | GPIO15 | **J2103.6** | GPIO4 |
| **J2101.7** | GPIO14 | **J2103.7** | GPIO7 |
| **J2101.8** | GPIO13 | **J2103.8** | GPIO6 |
| **J2101.9** | GPIO12 | **J2103.9** | GPIO9 |
| **J2101.10** | GPIO11 | **J2103.10** | GPIO8 |
| J2101.11 | X ** | **J2103.11** | x |
| J2101.12 | RTC_EINT | **J2103.12** | GPIO10 |

*Table 5. GPIO pin multi-function definition*

| Pin alias | Name | Description |
|---|---|---|
| **GPIO0** | GPIO0 | General purpose input, output |
| | EINT0 | External interrupt |
| | U1RTS | UART RTS |
| | SCL1 | I2C CLK |
| | I2S_RX | I2S RX |
| | JTDI | JTAG Debug port |
| | WIFI_ANT_SEL0 | External frontend control |
| | BT_PRI1 | Wi-Fi and Bluetooth coexistence control signal |
| | PWM0 | Pulse-width-modulated output |
| **GPIO1** | GPIO1 | General purpose input, output |
| | EINT1 | External interrupt |
| | U1CTS | UART CTS |
| | SDA1 | I2C Data |
| | I2S_TX | I2S TX |

|  | JTMS | JTAG Debug port |
|---|---|---|
|  | WIFI_ANT_SEL1 | External frontend control |
|  | BT_PRI3 | Wi-Fi and Bluetooth coexistence control signal |
|  | PWM1 | Pulse-width-modulated output |
| **GPIO2** | GPIO2 | General purpose input, output |
|  | EINT2 | External interrupt |
|  | URXD1 | UART RX |
|  | PWM0 | Pulse-width-modulated output |
|  | I2S_WS | I2S WS |
|  | JTCK | JTAG Debug port |
|  | CLKO0 | Clock out port |
|  | BT_PRI0 | Wi-Fi and Bluetooth coexistence control signal |
|  | WIFI_ANT_SEL4 | External frontend control |
| **GPIO3** | GPIO3 | General purpose input, output |
|  | EINT3 | External interrupt |
|  | UTXD1 | UART TX |
|  | PWM1 | Pulse-width-modulated output |
|  | I2S_CK | I2S bit clock |
|  | JTRST_B | JTAG Debug port |
|  | WIFI_ANT_SEL2 | External frontend control |
|  | I2S_CK | I2S bit clock |
| **GPIO4** | GPIO4 | General purpose input, output |
|  | SPISLV_A_SIO2 | SPI slave SIO2 |
|  | SPIMST_A_SIO2 | SPI master SIO2 |
|  | EINT4 | External interrupt |
|  | I2S_MCK | I2S MCLK |
|  | JTDO | JTAG Debug port |
|  | WIFI_ANT_SEL3 | External frontend control |
|  | I2S_MCK | I2S MCLK |
| **GPIO5** | GPIO5 | General purpose input, output |
|  | SPISLV_A_SIO3 | SPI slave SIO3 |
|  | SPIMST_A_SIO3 | SPI master SIO3 |
|  | EINT5 | External interrupt |
|  | URXD0 | UART RX |
|  | WIFI_ANT_SEL0 | External frontend control |
|  | TDM_RX | TDM RX |
|  | SCL0 | I2C CLK |
|  | PMU_RGU_RSTB | PMU Control Signal |

| GPIO6 | GPIO6 | General purpose input, output |
|---|---|---|
| | SPISLV_A_CS | SPI slave CS |
| | SPIMST_A_CS | SPI master CS |
| | EINT6 | External interrupt |
| | UTXD0 | UART TX |
| | WIFI_ANT_SEL1 | External frontend control |
| | TDM_TX | TDM TX |
| | SDA0 | I2C DATA |
| GPIO7 | GPIO7 | General purpose input, output |
| | SPISLV_A_SCK | SPI slave CLOCK |
| | SPIMST_A_SCK | SPI master CLOCK |
| | EINT7 | External interrupt |
| | CLKO1 | Clock out port |
| | WIFI_ANT_SEL2 | External frontend control |
| | TDM_WS | TDM WS |
| | BT_PRI3 | Wi-Fi and Bluetooth coexistence control signal |
| GPIO8 | GPIO8 | General purpose input, output |
| | SPISLV_A_SIO0 | SPI slave SIO0 |
| | SPIMST_A_SIO0 | SPI master SIO0 |
| | EINT8 | External interrupt |
| | SCL0 | I2C CLK |
| | U0RTS | UART RTS |
| | TDM_CK | TDM CK |
| | BT_PRI0 | Wi-Fi and Bluetooth coexistence control signal |
| GPIO9 | GPIO9 | General purpose input, output |
| | SPISLV_A_SIO1 | SPI slave SIO1 |
| | SPIMST_A_SIO1 | SPI master SIO1 |
| | EINT9 | External interrupt |
| | SDA0 | I2C DATA |
| | U0CTS | UART CTS |
| | TDM_MCLK | TDM MCLK |
| | WIFI_ANT_SEL3 | External frontend control |
| | BT_PRI1 | Wi-Fi and Bluetooth coexistence control signal |
| GPIO10 | GPIO10 | General purpose input, output |
| | EINT10 | External interrupt |
| | U2CTS | UART CTS |
| | PWM2 | Pulse-width-modulated output |

| | PMU_RGU_RSTB | PMU Control Signal |
|---|---|---|
| | PMU_GOTO_SLEEP | PMU Control Signal |
| | WIFI_ANT_SEL4 | External frontend control |
| | SDA0 | I2C DATA |
| **GPIO11** | GPIO11 | General purpose input, output |
| | EINT11 | External interrupt |
| | PWM3 | Pulse-width-modulated output |
| | URXD2 | UART RX |
| | MA_MC0_CK | SDIO master clock |
| | SLV_MC0_CK | SDIO slave clock |
| | CLKO2 | Clock out port |
| | WIFI_ANT_SEL0 | External frontend control |
| | I2S_RX | I2S RX |
| **GPIO12** | GPIO12 | General purpose input, output |
| | SPISLV_B_SIO3 | SPI slave  SIO3 |
| | SPIMST_B_SIO3 | SPI master SIO3 |
| | UTXD2 | UART TX |
| | MA_MC0_CM0 | SDIO master command |
| | SLV_MC0_CM0 | SDIO slave command |
| | EINT12 | External interrupt |
| | WIFI_ANT_SEL1 | External frontend control |
| | I2S_TX | I2S TX |
| **GPIO13** | GPIO13 | General purpose input, output |
| | SPISLV_B_SIO2 | SPI slave SIO2 |
| | SPIMST_B_SIO2 | SPI master SIO2 |
| | U2RTS | UART RTS |
| | MA_MC0_DA0 | SDIO mater Data0 |
| | SLV_MC0_DA0 | SDIO slave Data0 |
| | CLKO4 | Clock out port |
| | EINT13 | External interrupt |
| | I2S_WS | I2S WS |
| **GPIO14** | GPIO14 | General purpose input, output |
| | SPISLV_B_SIO1 | SPI slave SIO1 |
| | SPIMST_B_SIO1 | SPI master SIO1 |
| | TDM_RX | TDM RX |
| | MA_MC0_DA1 | SDIO master Data1 |
| | SLV_MC0_DA1 | SDIO slave Data1 |
| | PWM4 | Pulse-width-modulated output |
| | EINT14 | External interrupt |
| | CLKO4 | Clock out port |

| GPIO15 | GPIO15 | General purpose input, output |
|---|---|---|
| | SPISLV_B_SIO0 | SPI slave SIO0 |
| | SPIMST_B_SIO0 | SPI master SIO0 |
| | TDM_TX | TDM TX |
| | MA_MC0_DA2 | SDIO mater Data2 |
| | SLV_MC0_DA2 | SDIO slave Data2 |
| | SCL1 | I2C Clock |
| | EINT15 | External interrupt |
| | PWM3 | Pulse-width-modulated output |
| GPIO16 | GPIO16 | General purpose input, output |
| | SPISLV_B_SCK | SPI slave clock |
| | SPIMST_B_SCK | SPI master clock |
| | TDM_WS | TDM  WS |
| | MA_MC0_DA3 | SDIO master Data3 |
| | SLV_MC0_DA3 | SDIO slave Data3 |
| | SDA1 | I2C data |
| | EINT16 | External interrupt |
| GPIO17 | GPIO17 | General purpose input, output |
| | SPISLV_B_CS | SPI slave CS |
| | SPIMST_B_CS | SPI master CS |
| | TDM_CK | TDM  CK |
| | CLKO3 | Clock out port |
| | AUXADC0 | AUX ADC |
| | EINT17 | External interrupt |
| | BT_PRI0 | Wi-Fi and Bluetooth coexistence control signal |
| GPIO18 | GPIO18 | General purpose input, output |
| | PMU_GOTO_SLEEP | PMU Control Signal |
| | TDM_MCLK | TDM MCLK |
| | CLKO4 | Clock out port |
| | SDA1 | I2C data |
| | ZCV (SW set AUXADC1) | AUX ADC |
| | EINT18 | External interrupt |
| | CLKO3 | Clock out port |
| | PMU_RGU_RSTB | PMU Control Signal |
| GPIO19 | GPIO19 | General purpose input, output |
| | URXD0 | UART RX |
| | EINT19 | External interrupt |
| | SCL1 | I2C Clock |
| | PWM5 | Pulse-width-modulated output |

| | AUXADC2 | AUX ADC |
|---|---|---|
| **GPIO20** | GPIO19 | General purpose input, output |
| | UTXD0 | UART TX |
| | EINT20 | External interrupt |
| | AUXADC3 | AUX ADC |

Note, to use the GPIO8 and GPIO9 pins as I2C0, add pull-up resistors on the HDK or on the I2C0 daughterboard.

To add pull-up resistors on the HDK, refer to the resistor locations in Figure 8. The location of R2101 is for adding the pull-up resistor for I2C0_SDA (GPIO9). The location of R2102 is for adding the pull-up resistor for I2C0_CLK (GPIO8).
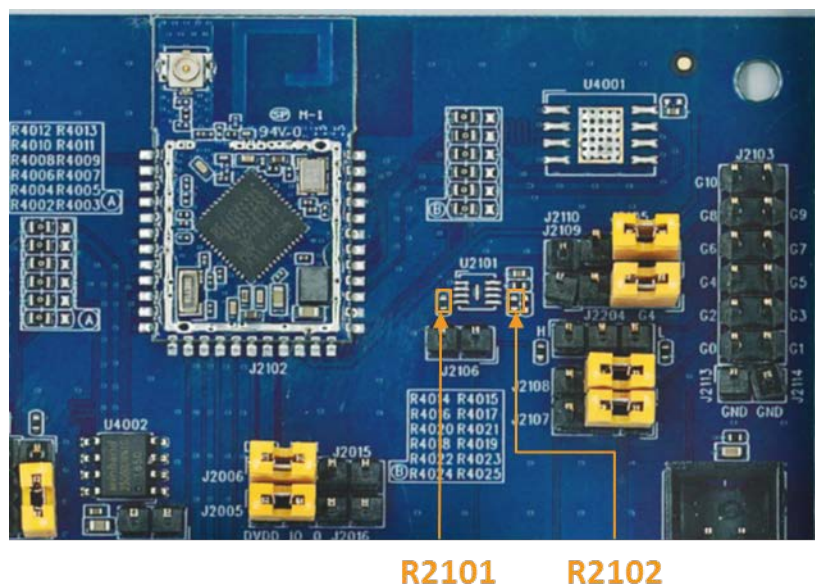


*Figure 8. Locations of I2C pull-up resistors*

## 4.6. RTC

The MT7686 HDK features an RTC module. The clock source operates at 32.768kHz crystal oscillator or an external clock source. The RTC has built-in accurate timer to wake up the system when the user-defined timer expires. The RTC uses a different power source from the Power Management Unit (PMU). In retention mode, the PMU is turned off while the RTC module remains powered on. The RTC module only consumes 3μA in retention mode. The RTC has a dedicated PMU control pin EXT_PWR_EN (pin 21) used to turn the power on when the RTC timer expires and turn the power off when it intends to enter the hibernate mode.

## 4.7. RF connections

By default, the board ships with RF signals routed to the on-board circuit antenna. An on-board U.FL, a conductive test component, (I-PEX) connector enables to test the signals using a compatible cable. If a user wants to perform the testing, the user needs to solder the capacitor from the location **C17** to **C18**.
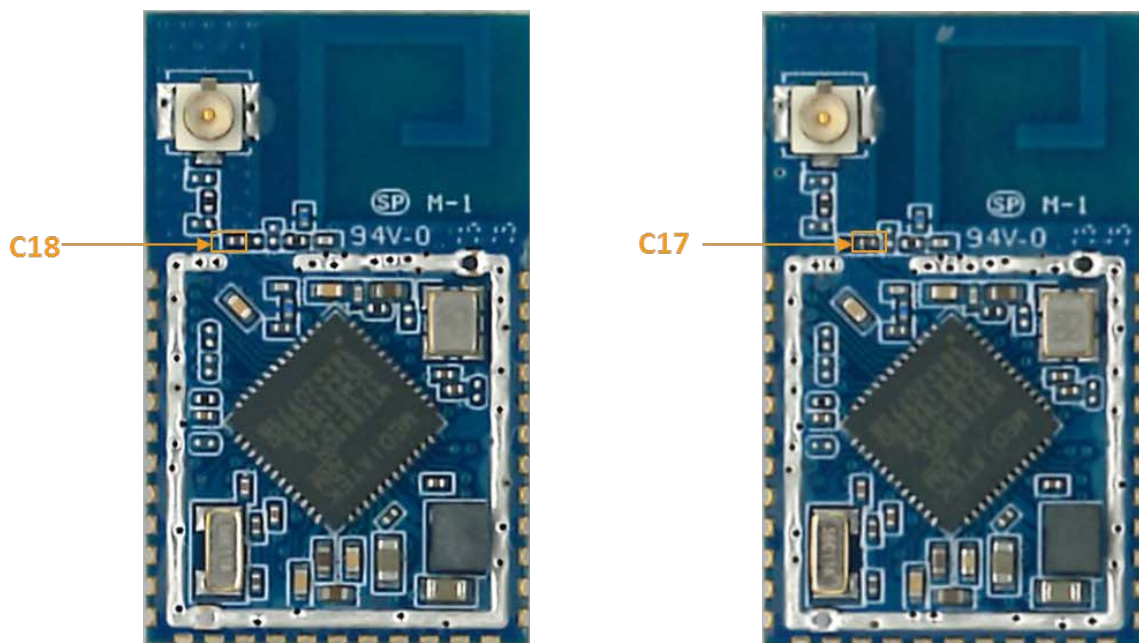
*Figure 9. Location of the components C17 and C18*

## 4.8. CMSIS-DAP firmware update procedure

The latest firmware from OpenSDA platform can be downloaded from the mbed official website. To update the binary firmware of CMSIS-DAP, press and hold the **SW3001**, then plug-in the USB cable to **CON3001**, release the button **SW3001** once the mass storage is shown, and then drag and drop in the binary code. After the mass storage disappears, keep the power connected for 10 seconds, and then reboot the system again to finish the firmware update.

# 5. Schematics (V11)

Main board schematic-1



20_Power Tree

Main board schematic-2

Module



J2102

**MediaTek Inc.**

MT76x7 Main Board

C | 2_Test Interface | 3.0

Thursday, April 13, 2017 | 21 | 99

Main board schematic-3

**Host Interface Enable**

GPIO4
J2204
GPIO4_STRAP_H
R2201    R / 10 / K / 0402
GPIO4_STRAP_L
R2206    R / 10 / K / 0402
DVDD_IO_1
DIP3/P2.54
JUMPER3

{GPIO4}
0:Disable Host Interface at boot(default)
1:Enable Host Interface

**Host Interface Select(active if HIF_EN=1)**

GPIO13
J2205
GPIO13_STRAP_H
R2207    R / 10 / K / 0402
GPIO13_STRAP_L
R2205    R / 10 / K / 0402
DVDD_IO_0
DIP3/P2.54
JUMPER3

{GPIO13}
1: host interface via SDIO slave (default)
0: host interface via SPI slave

**SLT_MODE**

DIP3/P2.54
JUMPER3
GPIO11
GPIO11_STRAP_H
R2113    R / 10 / K / 0402
GPIO11_STRAP_L
R2114    R / 10 / K / 0402
DVDD_IO_0
J2206

{GPIO11}
0: normal (default,internal pull)
1: SLT

**DL_MODE_B**

J2201
GPIO12
GPIO12_STRAP_H
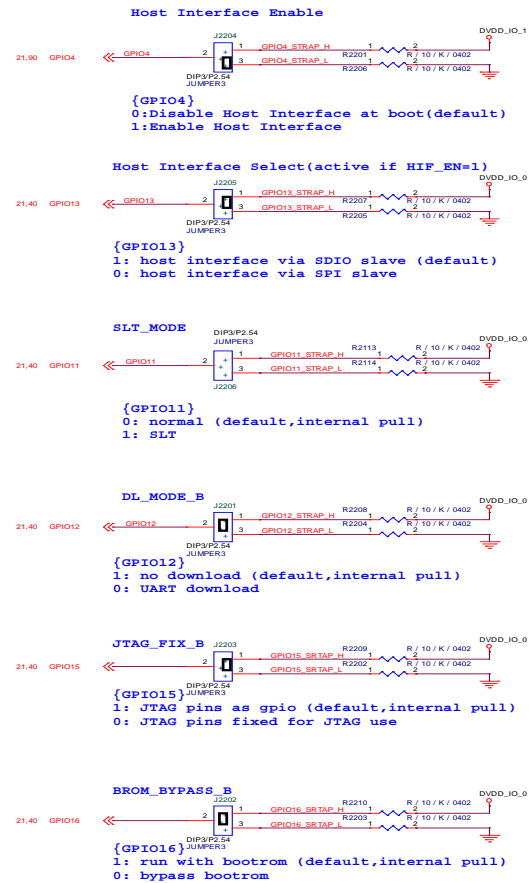R2208    R / 10 / K / 0402
GPIO12_STRAP_L
R2204    R / 10 / K / 0402
DVDD_IO_0
DIP3/P2.54
JUMPER3
{GPIO12}
1: no download (default,internal pull)
0: UART download

**JTAG_FIX_B**

J2203
GPIO15
GPIO15_SRTAP_H
R2209    R / 10 / K / 0402
GPIO15_SRTAP_L
R2202    R / 10 / K / 0402
DVDD_IO_0
DIP3/P2.54
{GPIO15}  JUMPER3
1: JTAG pins as gpio (default,internal pull)
0: JTAG pins fixed for JTAG use

**BROM_BYPASS_B**

J2202
GPIO16
GPIO16_SRTAP_H
R2210    R / 10 / K / 0402
GPIO16_SRTAP_L
R2203    R / 10 / K / 0402
DVDD_IO_0
DIP3/P2.54
{GPIO16}  JUMPER3
1: run with bootrom (default,internal pull)
0: bypass bootrom

| Title | 22_Straping Option |
|---|---|
| Size C | MTK Confidential |
| Date: Tuesday , February 07, 2017 | Sheet 22 of 99 |

Main board schematic-4

Main board schematic-5



Note: 40-1

DVDD18   R4001 R / 0 / Ohm / 0402 / NC
DVDD18_EXT
C4001
C / 0.1 / uF / 0402

GPIO5: SFSWP
GPIO6: SFSOUT
GPIO7: SFSCK
GPIO8: SFSIN
GPIO9: SFSHOLD
GPIO10: SFSCS0

U4001
GPIO6_F   5   DI(DQ0)   VCC   8
GPIO8_F   2   DO(DQ1)   CS#   1
GPIO5_F   3   WP#(DQ2)  CLK   6   GPIO10_F
GPIO9_F   7   NC(DQ3)         GPIO7_F
              VSS   4

MX2SU12835FZNI_10G / NC
WSON8/SMD/P1.27/2-IN-1

MXIC MX25U12835FZNI-10G,
1.8V,128Mb,WSON 6*5:

SHOLD : SIO3
SWP : SIO2
SOUT : SQI_SI : DQ0
SIN : SQI_SO : DQ1

DVDD_IO_00   J4001
                1  □ □  2

C4002           C4003
C / 10 / uF / 0603   C / 100 / nF / 0402

U4002 SPI Flash/ SOB
SPIMST_B_CS    1   /CS       VCC        8
SPIMST_B_SIO1  2   DO(IQ1)   /HOLD(IQ3) 7   SPIMST_B_SIO3
SPIMST_B_SIO2  3   /WP(IQ2)  CLK        6   SPIMST_B_SCK
               4   GND       DI(IQ0)    5   SPIMST_B_SIO0
SPI Flash/W25Q80DVSNIG

Co-pad

21  GPIO5    R4014 R / 0 / ohm / 060    GPIO5_R   21
             R4015 R / 0 / ohm / 060 / NC   GPIO5_F
21  GPIO6    R4016 R / 0 / ohm / 060    GPIO6_R   21
             R4017 R / 0 / ohm / 060 / NC   GPIO6_F
21  GPIO7    R4018 R / 0 / ohm / 060    GPIO7_R   21
             R4019 R / 0 / ohm / 060 / NC   GPIO7_F
21  GPIO8    R4020 R / 0 / ohm / 060    GPIO8_R   21
             R4021 R / 0 / ohm / 060 / NC   GPIO8_F
21  GPIO9    R4022 R / 0 / ohm / 060    GPIO9_R   21
             R4023 R / 0 / ohm / 060 / NC   GPIO9_F
21  GPIO10   R4024 R / 0 / ohm / 060    GPIO10_R  21
             R4025 R / 0 / ohm / 060 / NC   GPIO10_F

Co-pad

21,22  GPIO12   R4002 R / 0 / ohm / 060    GPIO12_R  21,41
                R4003 R / 0 / ohm / 060 / NC   SPIMST_B_SIO3
21,22  GPIO13   R4004 R / 0 / ohm / 060    GPIO13_R  21,41
                R4005 R / 0 / ohm / 060 / NC   SPIMST_B_SIO2
21     GPIO14   R4006 R / 0 / ohm / 060    GPIO14_R  21,41
                R4007 R / 0 / ohm / 060 / NC   SPIMST_B_SIO1
21,22  GPIO15   R4008 R / 0 / ohm / 060    GPIO15_R  21,41
                R4009 R / 0 / ohm / 060 / NC   SPIMST_B_SIO0
21,22  GPIO16   R4010 R / 0 / ohm / 060    GPIO16_R  21
                R4011 R / 0 / ohm / 060 / NC   SPIMST_B_SCK
21     GPIO17   R4012 R / 0 / ohm / 060    GPIO17_R  21
                R4013 R / 0 / ohm / 060 / NC   SPIMST_B_CS

Title: 40_MEMORY_ Serial Flash
Size: C
MTK Confidential
Date: Tuesday, February 07, 2017   Sheet   40   of   99

Main board schematic-6

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Main board schematic-7
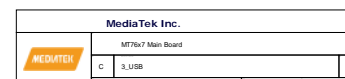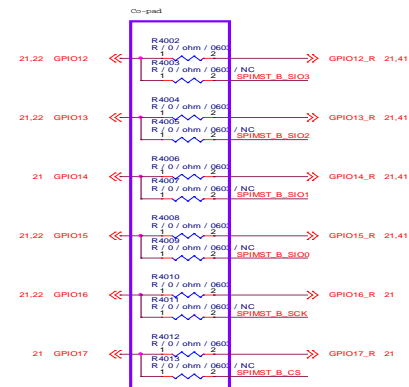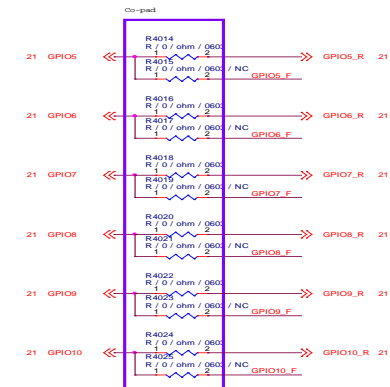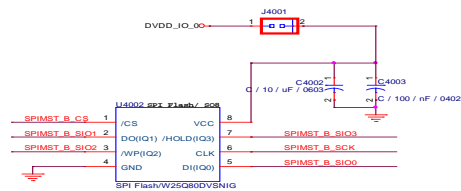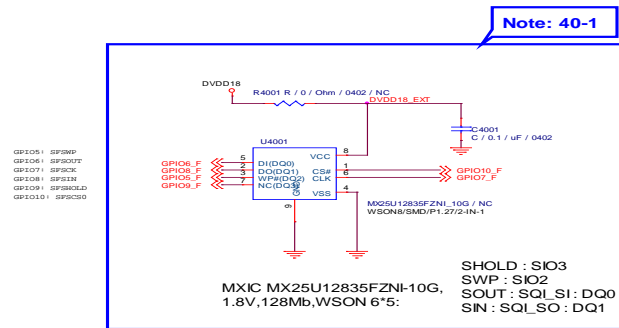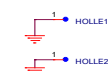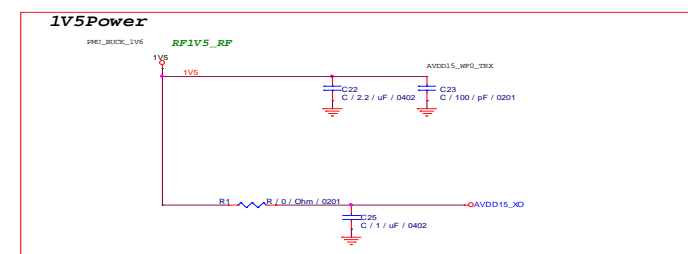
MT7686_STAMP_MODULE_V10 schematic-1



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MT7686_STAMP_MODULE_V10 schematic-2

**PCB Antenna**
ANT-WIFI-24G E1

ANTE1E_2_M  C14  R / 0 / Ohm / 0201  ANT_ANTENNA

C15  C / 10 / pF / 0201 / NC   C16  C / 10 / pF / 0201 / NC

L3 / 2.6 / nH / 0201

C17  C / 10 / pF / 0201 / NC

1WF0_RF_2G_TRX   WF0_RF_2G_TRX

C18  C / 10 / pF / 0201   ANTE1E_2   C19  R / 0 / ohm / 0201   ANTE1E_1

SMA/UFLR/RF
CON1

C20  C / 0.4 / pF / 0201 / NC   C21  C / 10 / pF / 0201 / NC

**1V5Power**

PMI_BUCK_1V6   *RF1V5_RF*

1V5

1V5   AVDD15_WF0_TRX

C22  C / 2.2 / uF / 0402   C23  C / 100 / pF / 0201

*RF3V3_WF*

3V3   AVDD33_WF0_G_PA

R1  R / 0 / Ohm / 0201   AVDD15_XO

C24  C / 2.2 / uF / 0402

C25  C / 1 / uF / 0402

1  HOLLE1

1  HOLLE2

| MediaTek Inc. | | |
|---|---|---|
| Title | MT7686 Stamp Module | |
| Size C | Document Number 20_RF Antenna and Connector | Rev 0.1 |
| Date: Friday, January 13, 2017 | Sheet 2 of 4 | |

MT7686_STAMP_MODULE_V10 schematic-3

## Strap Pin

**XTAL Select**

DVDD_IO_0

GPIO17  R4  R / 10K / Ohm / 0201 / NC
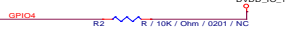
{GPIO17}
0:26MHz (default)
1:40MHz

**SLOW_SRC_B**

R5  R / 10K / Ohm / 0201
GPIO14
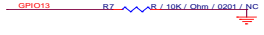
{GPIO14}
0:External
1:Internal (from 26/40MHz clock) (default)

**Host Interface Enable**

DVDD_IO_1

GPIO4
R2  R / 10K / Ohm / 0201 / NC

{GPIO4}
0:Disable Host Interface at boot(default)
1:Enable Host Interface

**Host Interface Select(active if HIF_EN=1)**

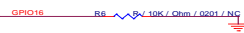GPIO13  R7  R / 10K / Ohm / 0201 / NC

{GPIO13}
1: host interface via SDIO slave (default)
0: host interface via SPI slave

**JTAG_FIX_B**

{GPIO15}
1: JTAG pins as gpio (default)
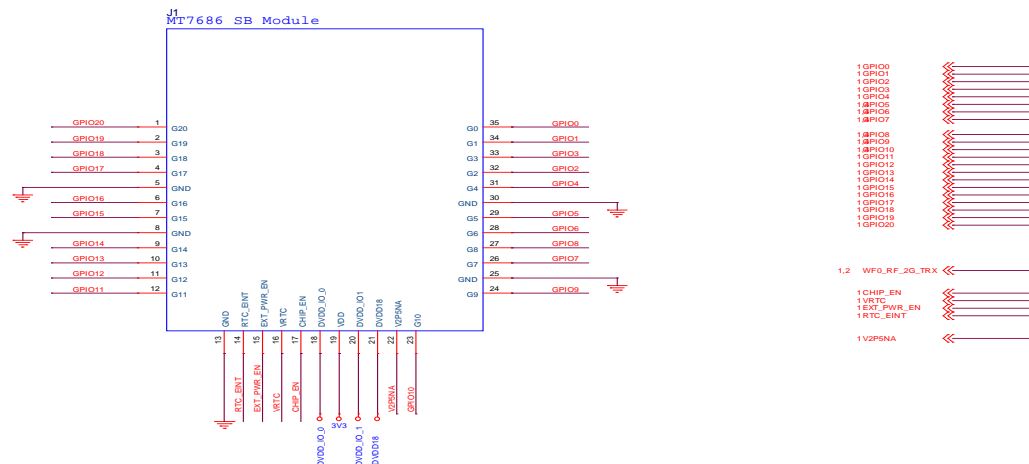0: JTAG pins fixed for JTAG use

**BROM_BYPASS_B**

GPIO16  R6  R / 10K / Ohm / 0201 / NC

{GPIO16}
1: run with bootrom (default)
0: bypass bootrom

**SLT_MODE**

{GPIO11}
0: normal (default)
1: SLT

**DL_MODE_B**

{GPIO12}
1: no download (default)
0: UART download

J1
MT7686 SB Module

**MediaTek Inc.**

| | Title | MT7686 Stamp Module | | | |
|---|---|---|---|---|---|
| COMPRESSED IMAGE | Size C | Document Number 21_Strap and Module | | | Rev 0.1 |
| | Date: Friday, January 13, 2017 | | Sheet 3 | of | 4 |