# MT7682 HDK V11 User's Guide

Version: 1.1

Release date: 30 June 2017

# Document Revision History

| Revision | Date | Description |
|---|---|---|
| 1.0 | 5 May 2017 | Initial release |
| 1.1 | 30 June 2017 | • Updated the HDK board version to V11.<br>• Corrected XTAL frequency to 26MHz.<br>• Add power jumper setting configuration description.<br>• Corrected extension connector pin definitions. |

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# 1. Introduction

MediaTek LinkIt™ for real-time operating system (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 MT7682 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 MediaTek MT7682 chipset which is based on ARM Cortex-M4 with floating point unit in QFN40 package. It enables rich connectivity features, communication with cloud services and real-time control. The MT7682 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.
  - The MT7682 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.
  - 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.
  - Supports UART functionality, such as transferring log information from the HDK.

These features are used to download and debug a project on MT7682 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.

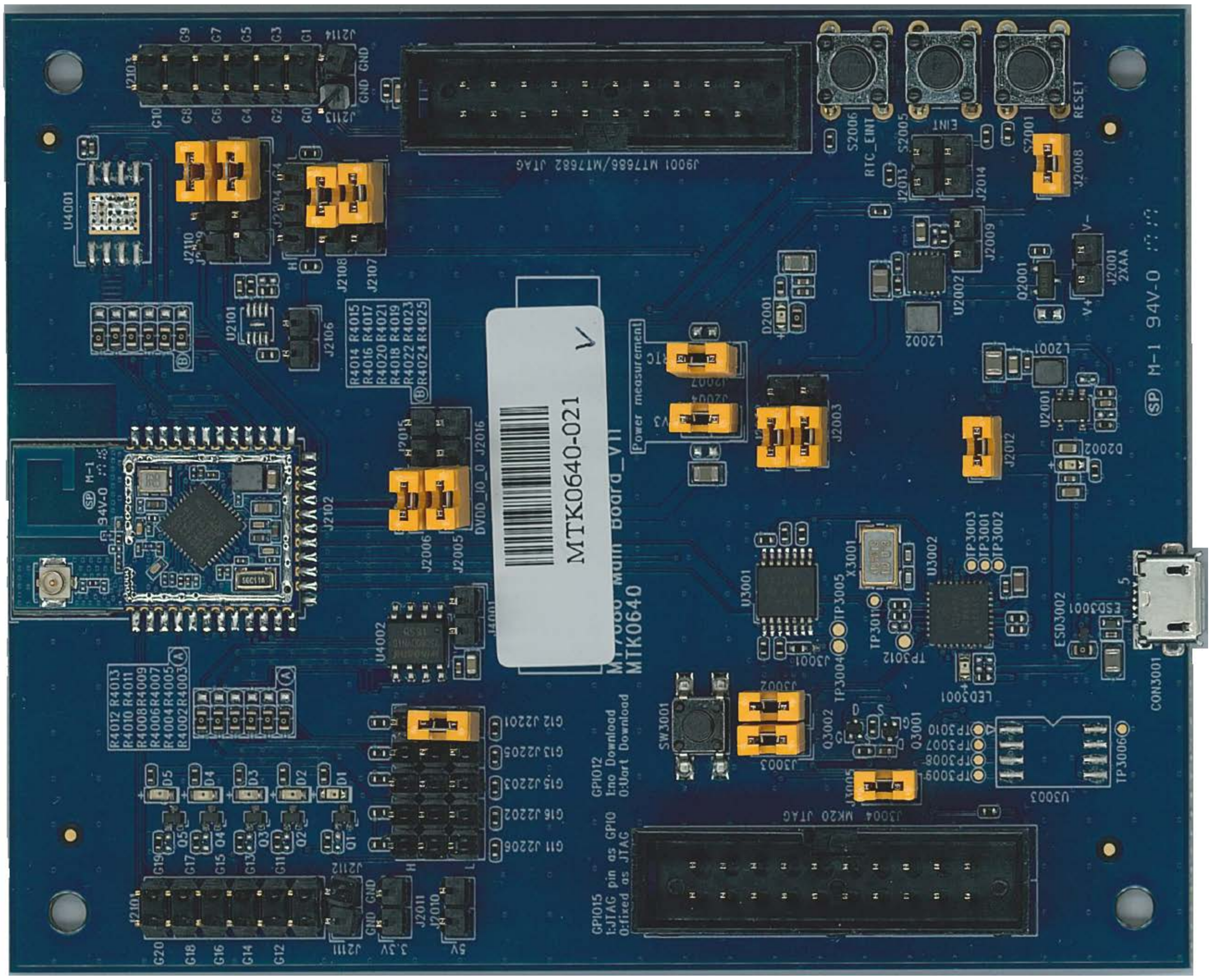



*Figure 1. Front view of MT7682 HDK*

# 2. Get started with the HDK

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

## 2.1. Configuring the MT7682 HDK

MT7682 HDK includes a main board (MT7686 Main Board_V11) and a MT7682 stamp module. The MT7682 stamp module is mounted on the main board. The top view of the main board is shown in Figure 2.

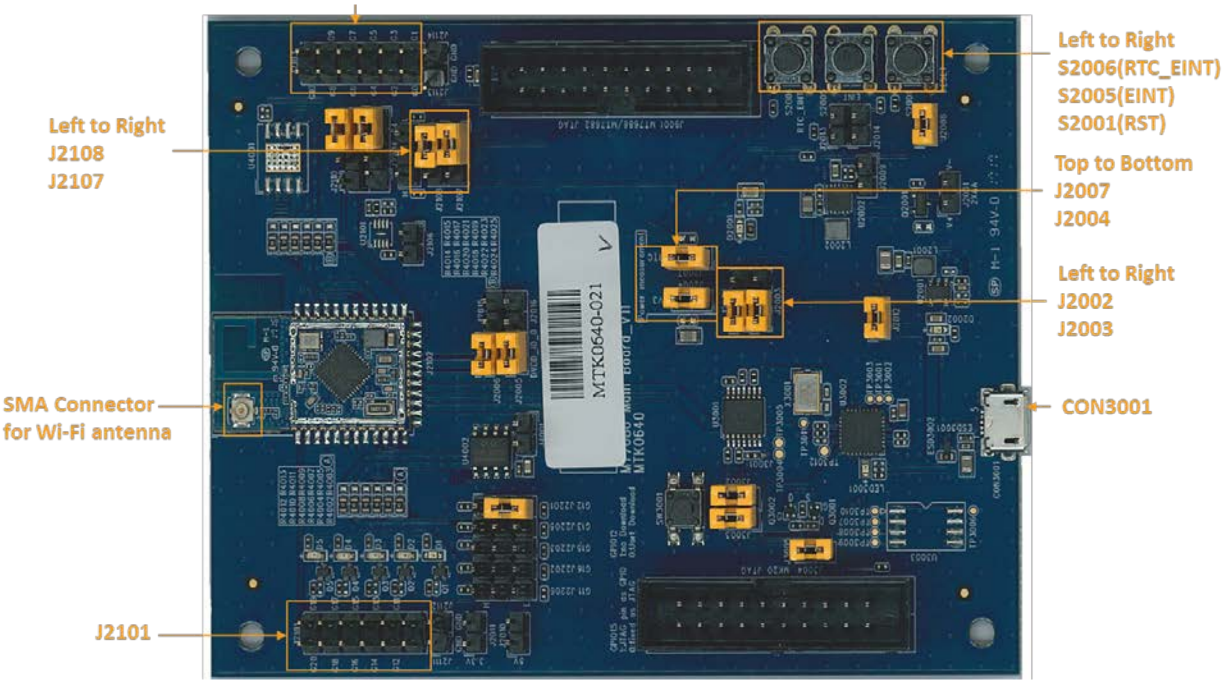



***Figure 2. Jumpers and connectors on the MT7682 HDK***

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** pin1 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”.
3) Press **S2001** to reset the system.
4) **Wi-Fi Antenna** is a PCB antenna. MT7682 stamp module is by default connected to the PCB antenna to transmit and receive RF signals.

The default configuration of the MT7682 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 MT7682 HDK drivers on Microsoft Windows

To configure the MT7682 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 chipset, see section 4.5, " Extension connectors". The **mbed Serial Port** (**UART0)** is applied to flash the board and log the outputs.

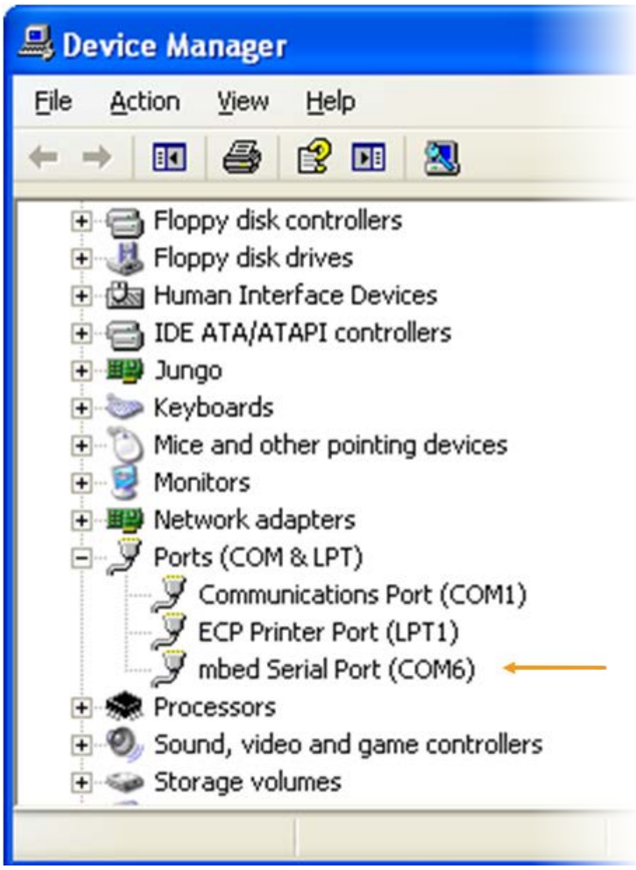



*Figure 3. COM port associated with the MT7682 HDK*

## 2.3. Configuring the HDK flash mode

The MT7682 HDK is embedded with 1MB flash memory. The boot options are either from the Flash memory or from the UART port.

To update the firmware on the MT7682 HDK:

1) Set the jumpers **J2002** pin 1 and pin2, **J2003** pin 1 and pin2, **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 MT7682 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 MT7682 HDK:

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

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

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

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

## 2.4. Downloading the image using the MT7682 HDK as a removable storage

To update the FreeRTOS binary only (example project binary: `mt7682_iot_sdk.bin`), use the HDK as a mass storage device according to the following steps:

1) Power up the board with a micro-USB cable.
2) Navigate to **Computer** on your PC to check if a new mass storage named **MT7682** is available under **Removable Disk**, as shown in Figure 4.
3) Open the **MT7682** removable storage, then drag and drop the binary `mt7682_iot_sdk.bin` to complete downloading the image.

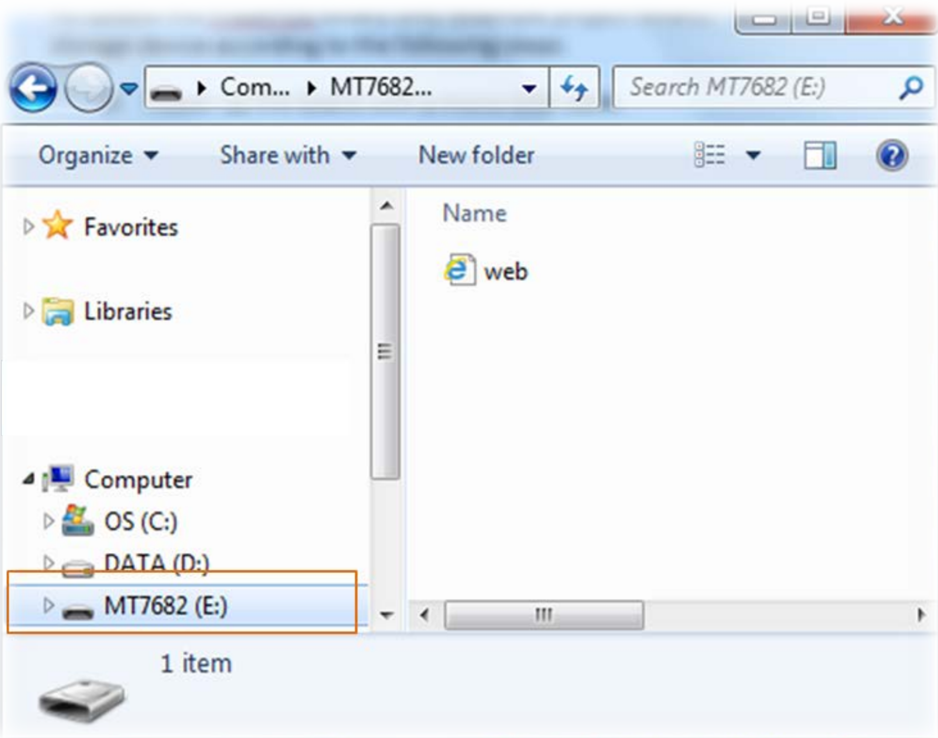



*Figure 4. New removable storage detected*

# 3. Hardware Features

This section provides the main supported features of the MT7682 HDK. The detailed description of the features is provided in the upcoming sections.

- IEEE 802.11bgn Wireless Connectivity Single Chip with QFN40 package.
- The IOs on MT7682 HDK are 3.3V compatible. MT7682 chip IO can support 3.3V, 2.8V and 1.8V.
- Support for FreeRTOS.
- Flexible on-board power supply
  - USB with power ($V_{Bus}$, 5V).
  - External $V_{IN}$ (1.8~3.2V).
- Ten LEDs
  - Power LEDs (**D2001, D2002**) and user LEDs (**D1, D2, D3**, **D4**, **D5**).
- Three push buttons
  - System Reset.
  - Real Time Clock (RTC) Interrupt.
  - External Interrupt.
- XTAL (Crystal Oscillator)
  - 26MHz source clock support with low power consumption in idle mode.
  - 32.768kHz clock for the RTC mode or external 32.768kHz mode.
- USB re-enumeration capability: two different interfaces supported on the same USB.
  - CMSIS-DAP USB.
  - 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

MT7682 features an ARM Cortex-M4 with floating point processor, which is the most energy efficient ARM processor available.

MT7682 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

MT7682 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 MT7682 HDK based on MT7682, 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 2, **J2003** pin 1 and 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 MT7682. |
| **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 MT7682. |

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 5. When using an AA battery, plug the USB to micro-USB connector **CON3001** (Figure 2). Note, that the jumpers J2002 pin 2 and 3, **J2003** pin2 and 3, **J2004**, and **J2007** are required to be set on. More details on the jumpers can be found in Table 2.

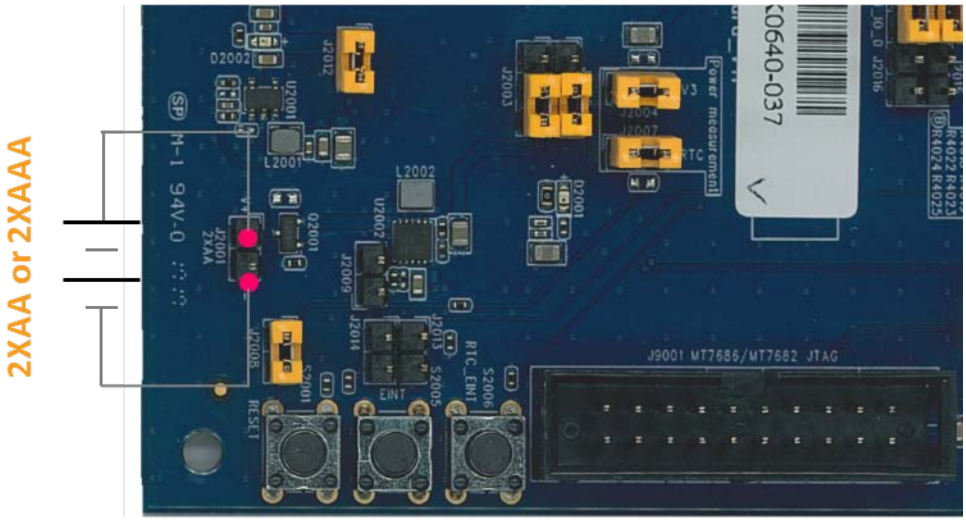



*Figure 5. Power up the HDK using an AA or AAA Battery (J2001)*

*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 MT7682. |
| **J2003(2-3)** | AVD33_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 MT7682. |

## 4.3. LEDs

The MT7682 HDK has onboard LEDs associated with different functionalities of the board (Figure 6).

1) **D2002** indicates the power rail 5V is on.
2) **D2001** indicates the power rail 3.3V is on.

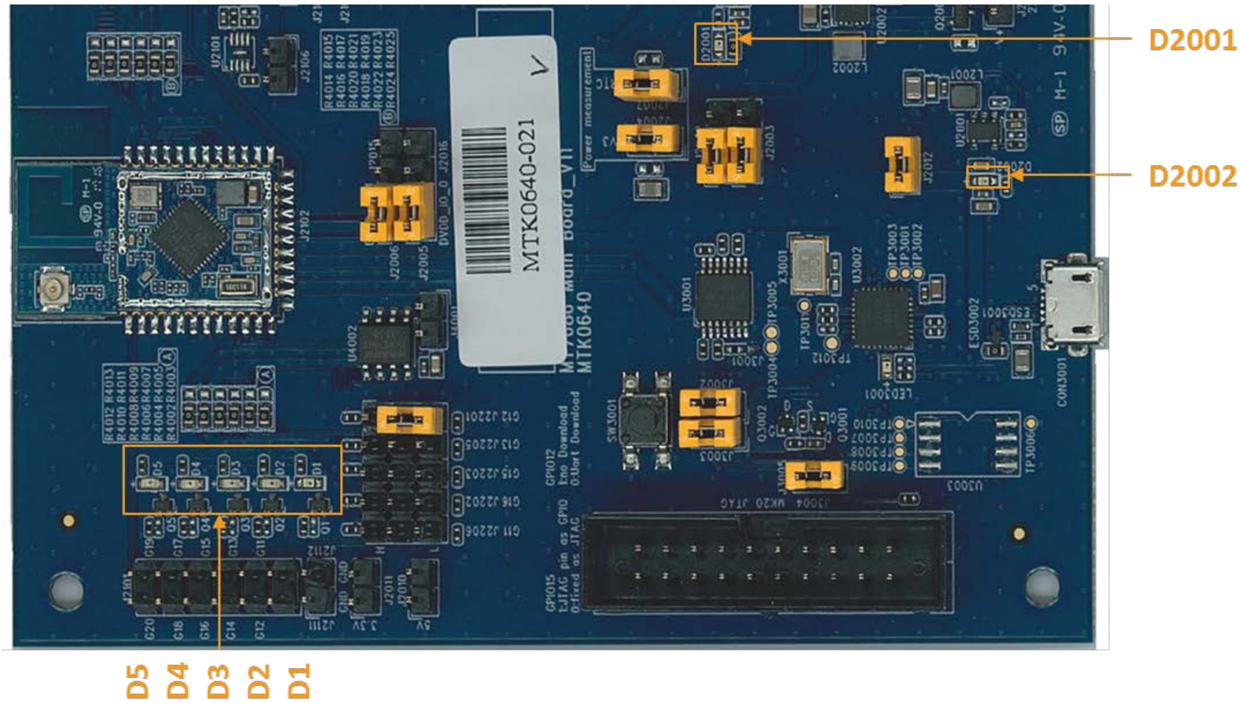



*Figure 6. On-board LEDs*

3) **D1**, **D2**, **D3**, **D4**, and **D5** are LEDs assigned for user interaction. All LEDs are high active (Figure 6).

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 MT7682 HDK is equipped with buttons with the following functionality. The push buttons are shown in Figure 2.

1) System reset button (**S2001**) resets the MT7682 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.

## 4.5. Extension connectors

The MT7682 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 14 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** | GPIO22 | **J2103.1** | GPIO1 |
| **J2101.2** | GPIO21 | **J2103.2** | GPIO0 |
| **J2101.3** | x | **J2103.3** | GPIO3 |
| **J2101.4** | GPIO17 | **J2103.4** | GPIO2 |
| **J2101.5** | GPIO16 | **J2103.5** | x |
| **J2101.6** | GPIO15 | **J2103.6** | GPIO4 |
| **J2101.7** | GPIO14 | **J2103.7** | x |
| **J2101.8** | GPIO13 | **J2103.8** | x |
| **J2101.9** | GPIO12 | **J2103.9** | x |
| **J2101.10** | GPIO11 | **J2103.10** | x |
| | | **J2103.11** | x |

***Table 5. GPIO pin multi-function definition***

| Pin alias | Name | Direction | Description |
|---|---|---|---|
| **GPIO0** | GPIO[0] | I/O | General purpose input, output |
| | UART1_RTS | O | UART1 RTS |
| | PWM[0] | I/O | Pulse-width-modulated output |
| | EINT[0] | I | External interrupt |
| | I2C1_CLK | I/O | I2C1 CLK |
| | I2S_RX | I | I2S slave RX |
| **GPIO1** | GPIO[1] | I/O | General purpose input, output |
| | UART1_CTS | O | UART1 CTS |
| | PWM[1] | O | Pulse-width-modulated output |
| | EINT[1] | I | External interrupt |
| | I2C1_CLK | I/O | I2C1 CLK |
| | I2S_TX | O | I2S slave TX |
| **GPIO2** | GPIO[2] | I/O | General purpose input, output |
| | UART1_RX | I | UART1_RX |
| | PWM[0] | O | Pulse-width-modulated output |
| | EINT[2] | I | External interrupt |
| | I2S_WS | O | I2S slave TX |
| **GPIO3** | GPIO[3] | I/O | General purpose input, output |
| | UART1_TX | O | UART1_TX |

| | | | |
|---|---|---|---|
| | PWM[1] | O | Pulse-width-modulated output |
| | EINT[3] | I | External interrupt |
| | I2S_CK | O | I2S slave TX |
| **GPIO4** | GPIO[4] | I/O | General purpose input, output |
| | SPI_A_SIO2_M | I/O | SPI_ A master SIO2 |
| | PWM[1] | O | Pulse-width-modulated output |
| | EINT[4] | I | External interrupt |
| | SPI_A _SIO2_S | I/O | SP_ A I slave SIO2 |
| | I2S_MCK | O | I2S master MCK |
| **GPIO11** | GPIO[11] | I/O | General purpose input, output |
| | MC0_ CK_M | O | SDIO master CK |
| | PWM[3] | O | Pulse-width-modulated output |
| | EINT[11] | I | External interrupt |
| | MC0_ CK_S | O | SDIO slave CK |
| | CLKO2 | O | Clock output source_2 |
| | I2S_RX | I | I2S RX |
| **GPIO12** | GPIO[12] | I/O | General purpose input, output |
| | SPI_B_ SIO3_M | I/O | SPI_ B master SIO3 |
| | UART0_RTS | I | UART0 RTS |
| | EINT[12] | I | External interrupt |
| | SPI_A _SIO3_S | I/O | SPI_ B slave SIO3 |
| | UART2_TX | O | UART2 TX |
| | I2S_TX | O | I2S TX |
| | MC0_ CMD_M | O | SDIO master CMD |
| | MC0_ CMD_S | O | SDIO slave CMD |
| **GPIO13** | GPIO[13] | I/O | General purpose input, output |
| | SPI_B_ SIO2_M | I/O | SPI_ B master SIO2 |
| | UART0_RTS | I | UART0 RTS |
| | EINT[13] | I | External interrupt |
| | SPI_A _SIO2_S | I/O | SPI_ B slave SIO2 |
| | UART2_RTS | I | UART2 RTS |
| | I2S_WS | O | I2S WS |
| | MC0_ DA0_M | I/O | SDIO master DA0 |
| | MC0_ DA0_S | I/O | SDIO slave DA0 |
| | CLKO4 | O | Clock output source_4 |
| **GPIO14** | GPIO[14] | I/O | General purpose input, output |
| | SPI_B_ SIO1_M | I/O | SPI_ B master SIO1 |
| | UART0_RTS | I | UART0 RTS |
| | EINT[14] | I | External interrupt |
| | SPI_A _SIO1_S | I/O | SPI_ B slave SIO1 |

| | | | |
|---|---|---|---|
| | UART2_RTS | I | UART2 RTS |
| | TDM_RX | I | TDM RX |
| | MC0_ DA1_M | I/O | SDIO master DA1 |
| | MC0_ DA1_S | I/O | SDIO slave DA1 |
| | CLKO4 | O | Clock output source_4 |
| | PWM[4] | O | Pulse-width-modulated output |
| **GPIO15** | GPIO[15] | I/O | General purpose input, output |
| | SPI_B_ SIO0_M | I/O | SPI_ B master SIO0 |
| | UART0_RTS | I | UART0 RTS |
| | EINT[15] | I | External interrupt |
| | SPI_A _SIO0_S | I/O | SPI_ B slave SIO0 |
| | UART2_RTS | I | UART2 RTS |
| | TDM_TX | I | TDM TX |
| | MC0_ DA2_M | I/O | SDIO master DA2 |
| | MC0_ DA2_S | I/O | SDIO slave DA2 |
| | I2C1_SCL | O | I2C1 SCL |
| | PWM[3] | O | Pulse-width-modulated output |
| **GPIO16** | GPIO[16] | I/O | General purpose input, output |
| | SPI_B_ SCK_M | O | SPI_ B master SCK |
| | UART0_RTS | I | UART0 RTS |
| | EINT[16] | I | External interrupt |
| | SPI_A _ SCK _S | I/O | SPI_ B slave SCK |
| | UART2_RTS | I | UART2 RTS |
| | TDM_WS | I | TDM WS |
| | MC0_ DA3_M | I/O | SDIO master DA3 |
| | MC0_ DA3_S | I/O | SDIO slave DA3 |
| | I2C1_SDA | I/O | I2C1 SDA |
| | UART3_TX_N9 | I | N9_UART3 TX |
| **GPIO17** | GPIO[17] | I/O | General purpose input, output |
| | SPI_B_ CS_M | O | SPI_ B master CS |
| | EINT[16] | I | External interrupt |
| | SPI_B _ CS _S | I/O | SPI_ B slave CS |
| | UART2_RTS | I | UART2 RTS |
| | TDM_CK | I | TDM CK |
| | PWM[5] | O | Pulse-width-modulated output |
| | CLKO3 | O | Clock output source_3 |
| | ADC_IN0 | I | Auxiliary ADC input |
| **GPIO21** | GPIO[21] | I/O | General purpose input, output |
| | EINT[19] | I | External interrupt |
| | UART0_RX | I | UART0 RX |

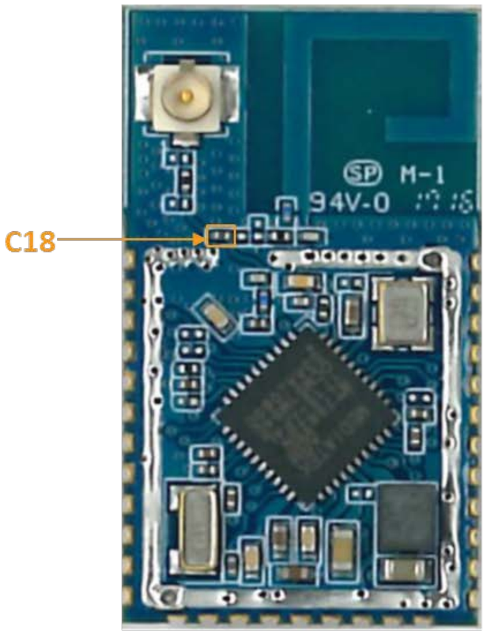
| | | | |
|---|---|---|---|
| | ADC_IN3 | I | Auxiliary ADC input |
| | I2C1_SCL | O | I2C1 SCL |
| | PWM[5] | O | Pulse-width-modulated output |
| **GPIO22** | GPIO[22] | I/O | General purpose input, output |
| | EINT[20] | I | External interrupt |
| | UART0_TX | O | UART0 TX |

## 4.6. RTC

The MT7682 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 hibernate mode, the PMU is turned off while the RTC module remains powered on. The RTC module only consumes 3μA in hibernate mode. The RTC has a dedicated PMU control pin EXT_PWR_EN (pin 14) 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**.



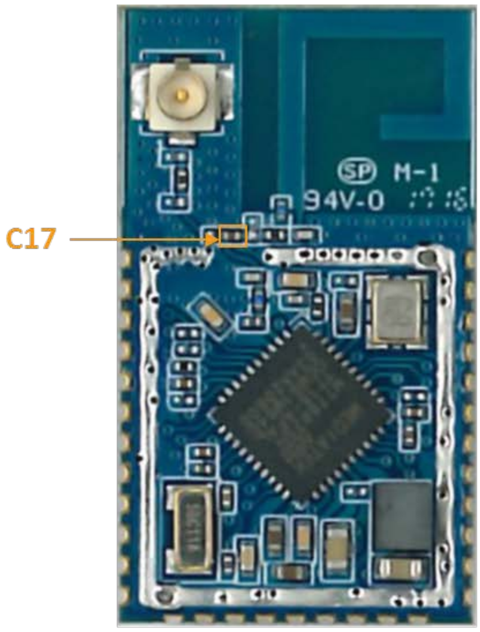



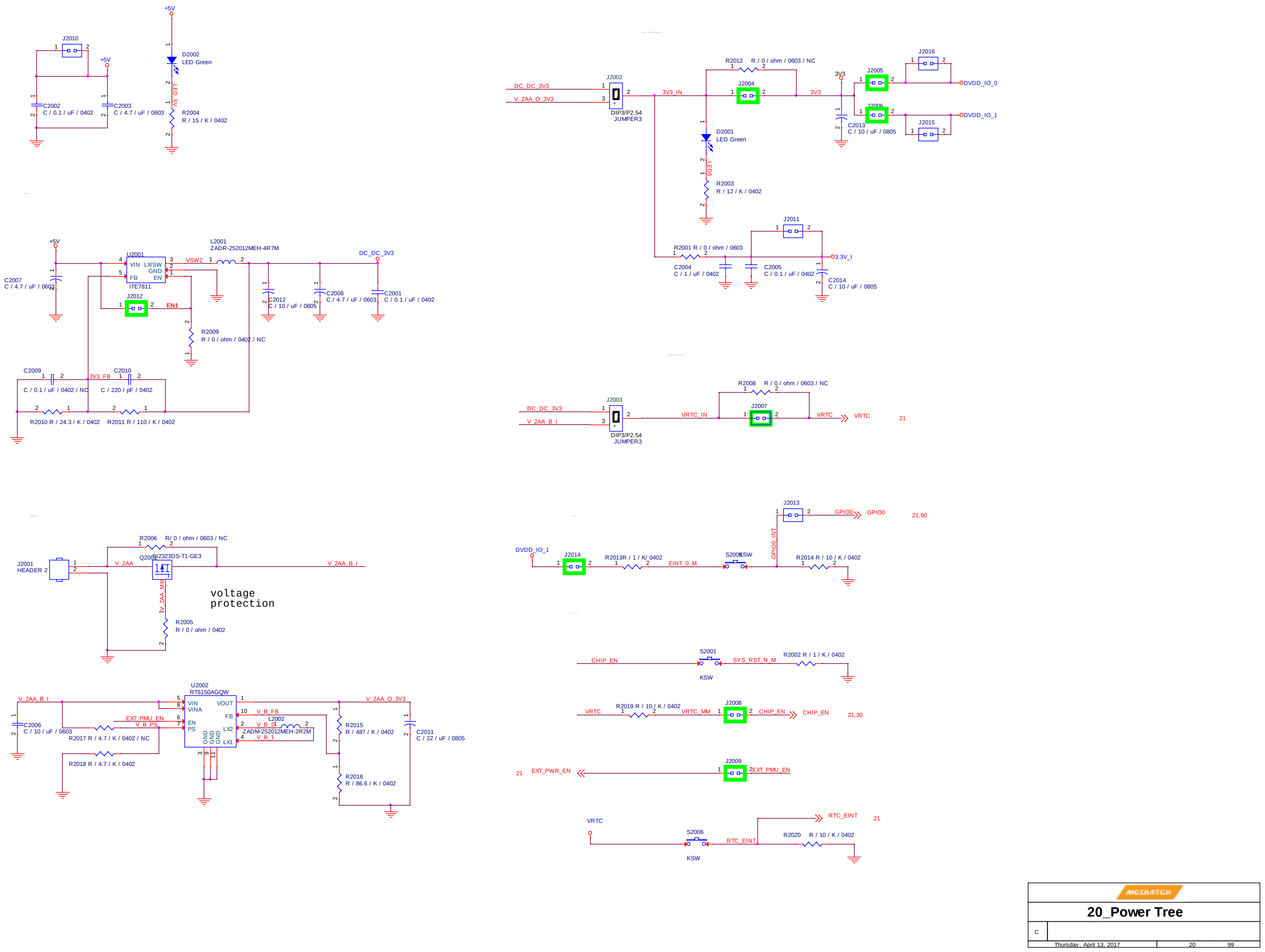

*Figure 7. Location of the components C17 and C18*

## 4.8. CMSIS-DAP Firmware update procedure

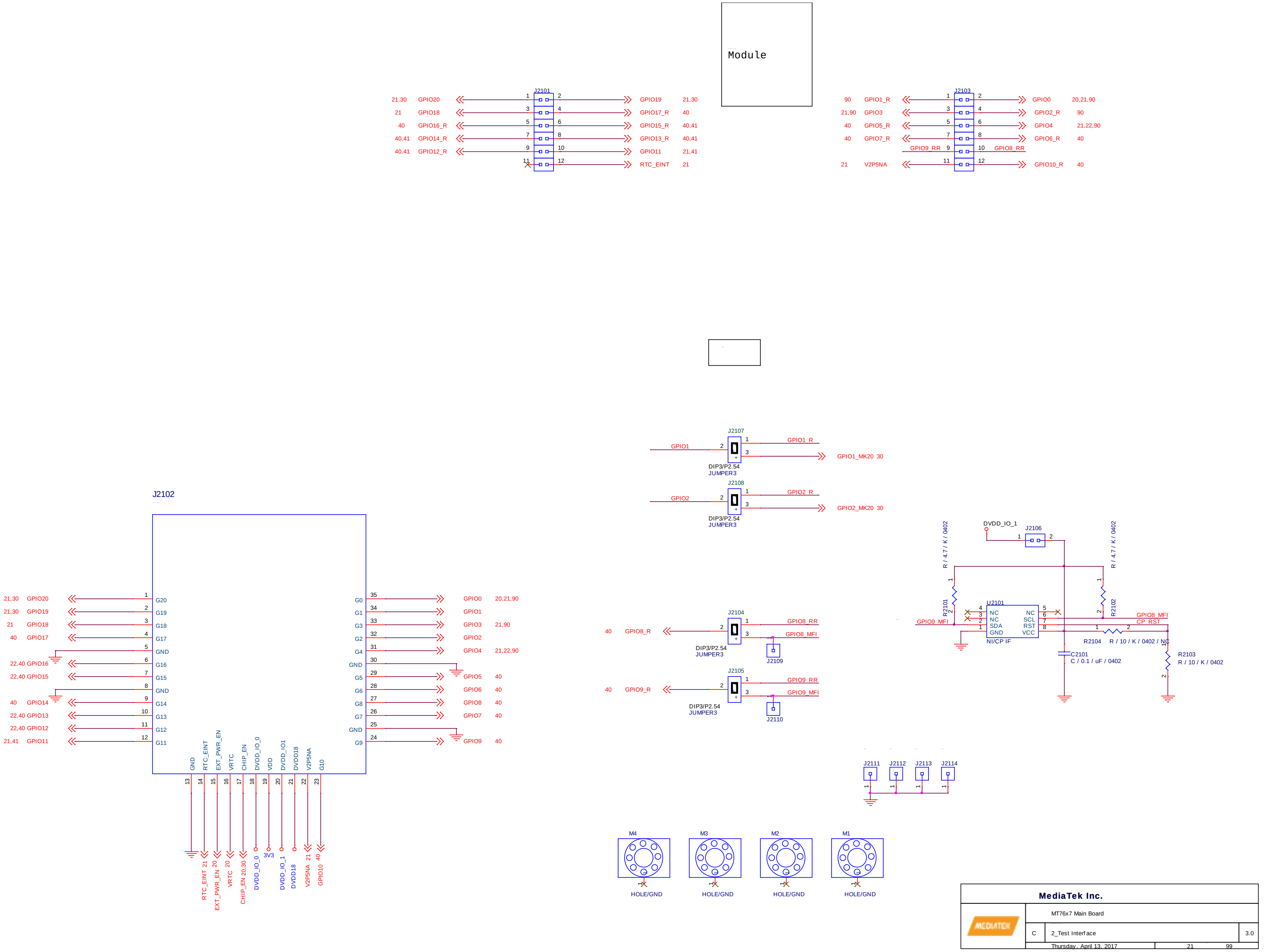
The latest firmware from OpenSDA platform can be downloaded from the mbed official website. To update the binary firmware of CMSIS-DAP, press and hold the **SW3001**, then plug-in the USB cable to **CON3001**, release the button **SW3001** once the mass storage is shown, and then drag and drop in the 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)

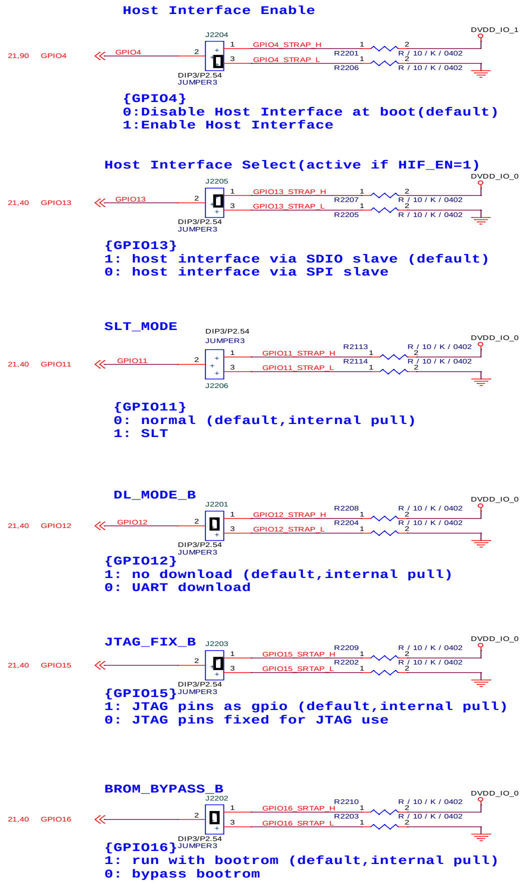
Main board schematic-1



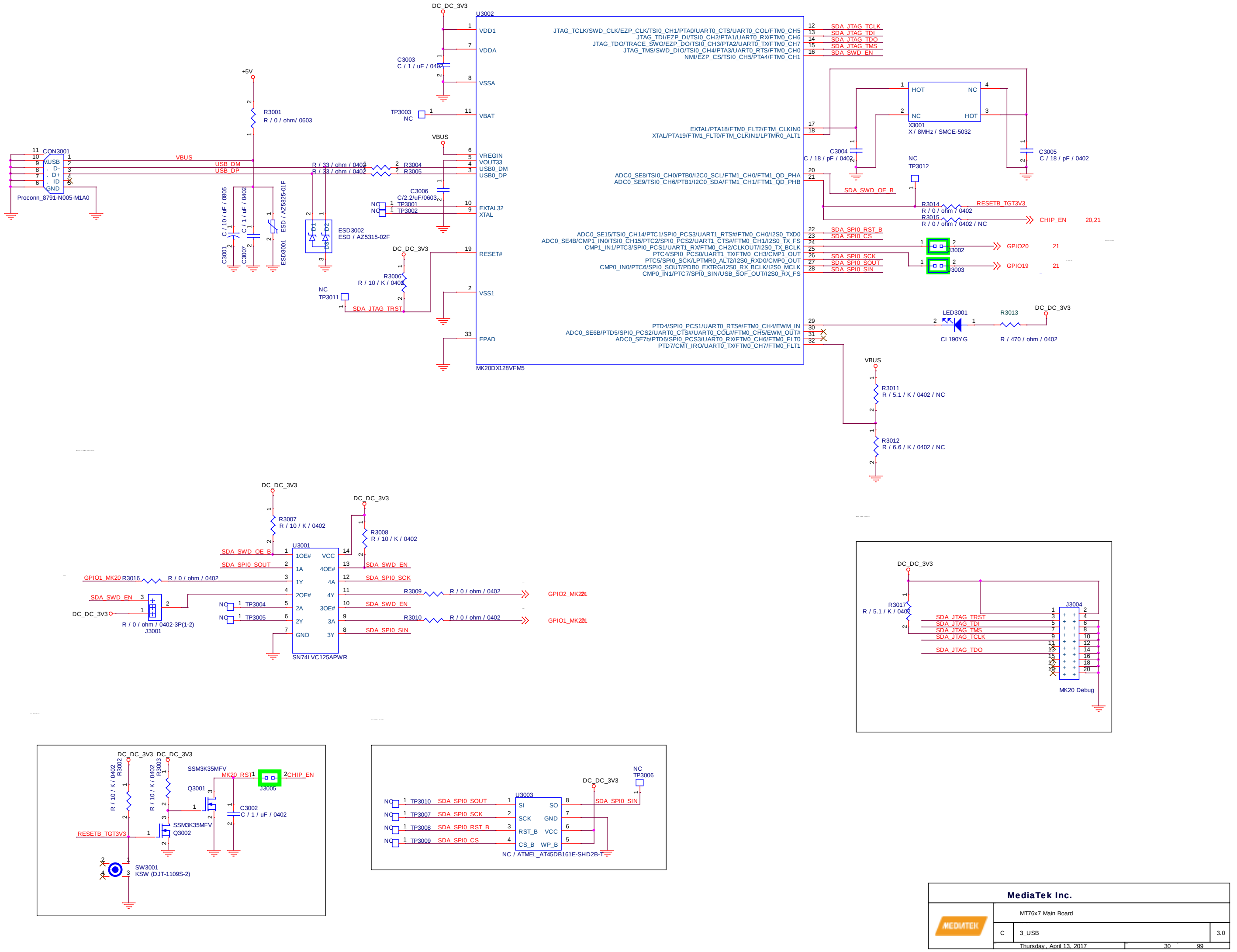
Main board schematic-2



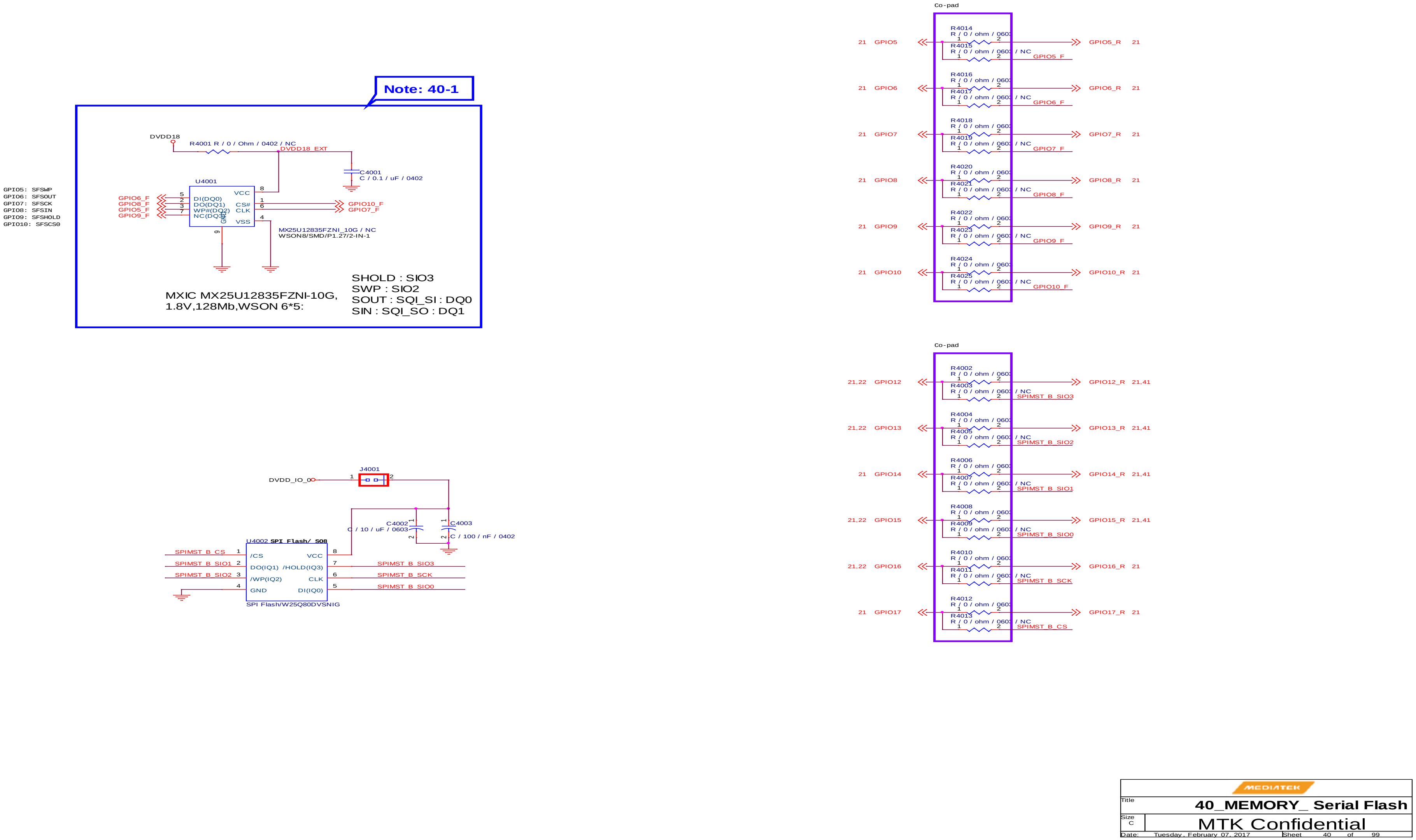
Main board schematic-3



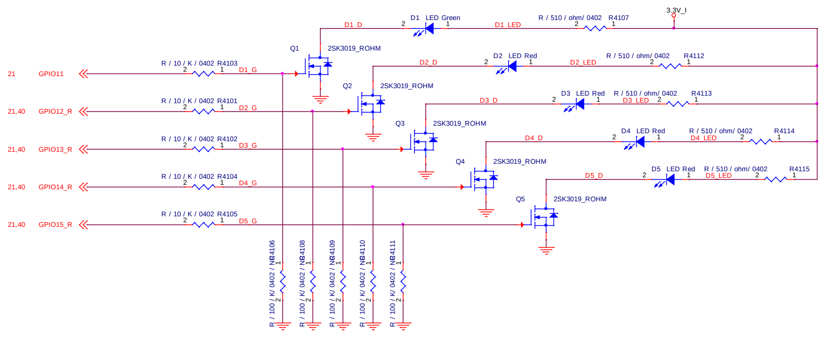

Main board schematic-4



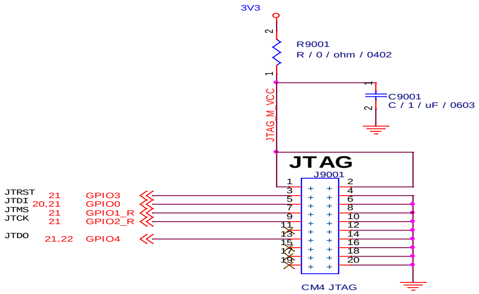
Main board schematic-5



Main board schematic-6



Main board schematic-7

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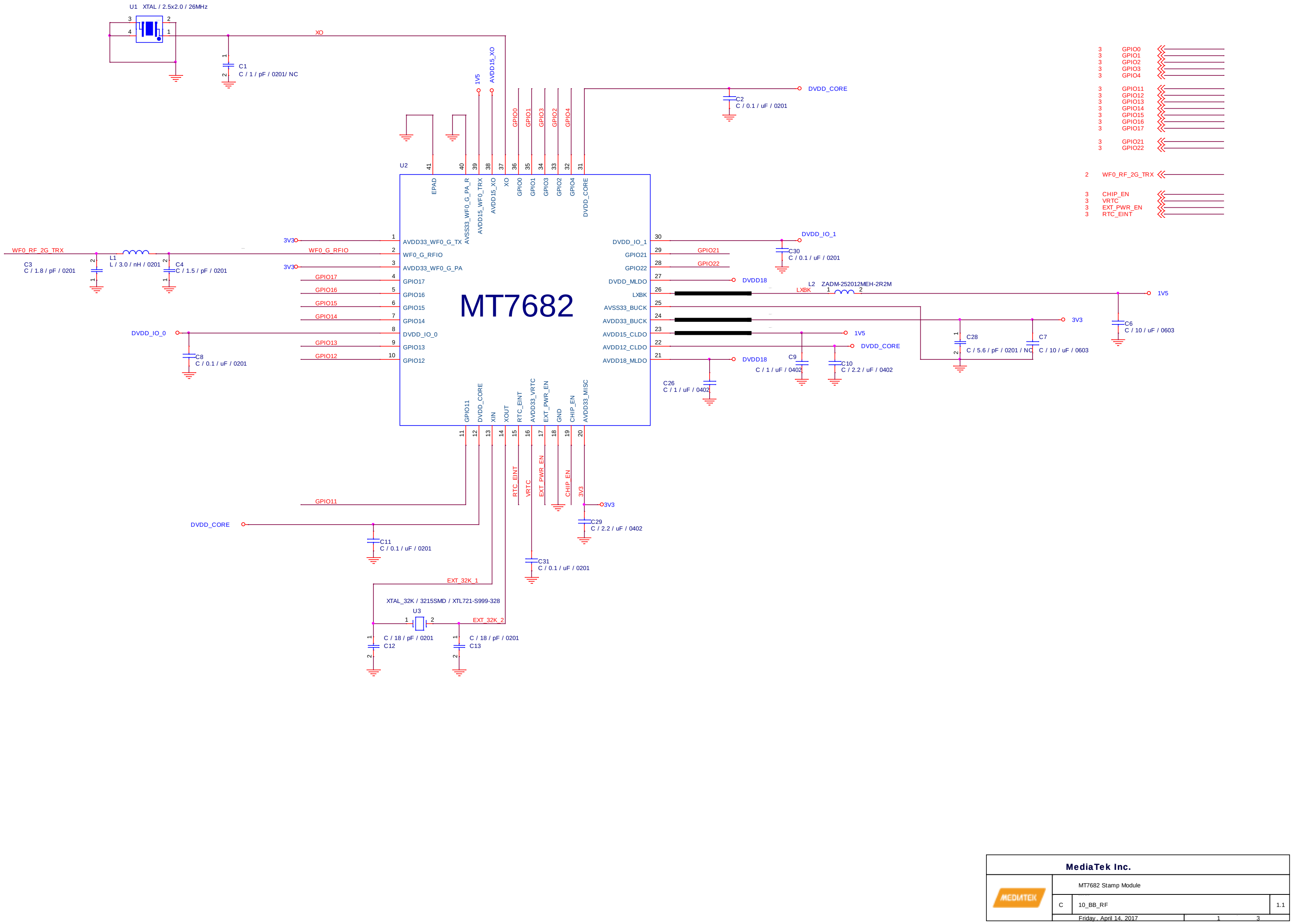
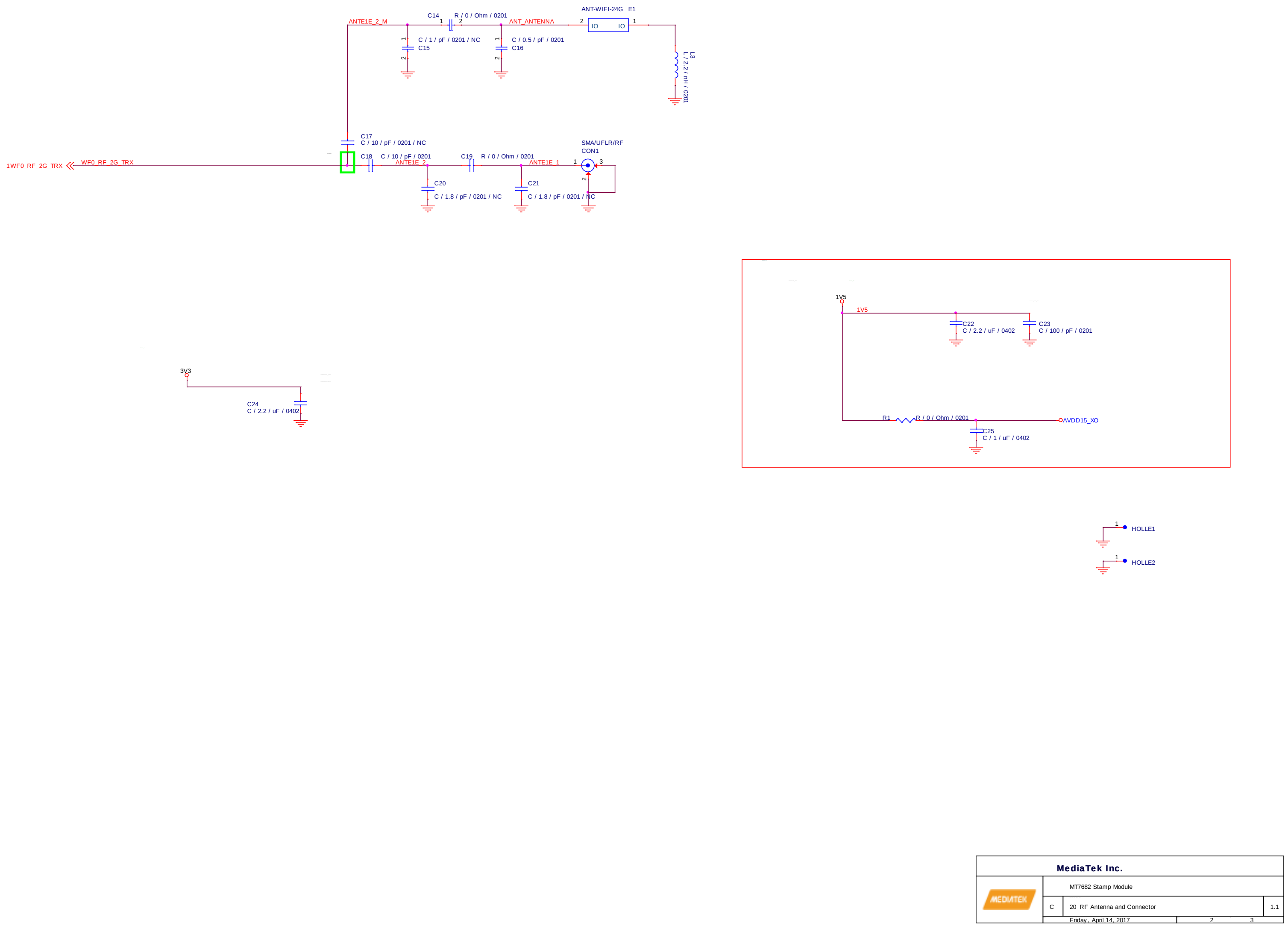
|---|---|---|---|---|
| Title | 90_Debug Interface | | | |
| Size C | MTK Confidential | | | |
| Date: | Tuesday , February 07, 2017 | Sheet 90 | of | 99 |

MT7682_STAMP_MODULE_V10 schematic-1



MT7682_STAMP_MODULE_V10 schematic-2



MT7682_STAMP_MODULE_V10 schematic-3