點通科技股份有限公司

PT7682W-SAOPTC0&
PT7686W-SAOPTC0
HDK User Guide

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PTCOM Technology

PT7682W/PT7686W-SAOPTC0
HDK User Guide

Revision History

Date	Revision Content	Revised By	Version
2017/11/09	-Preliminary Specification	Howard.Chen	0.1
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1. Introduction

PT7682W/PT7686W-SAOPTC0 HDK 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 PT7682W/PT7686W-SAOPTC0 hardware development kit (HDK) by SAC. 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 PT7682/86 stamp module enables rich connectivity features, communication with cloud services and real-time control. The PT7682W/PT7686W-SAOPTC0 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 PT7682W/PT7686W-SAOPTC0 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 PT7682W/PT7686W-SAOPTC0 HDK.

The front view of the HDK is shown in Figure 1.

Figure 1. Front View of PT7682W/PT7686W-SAOPTC0 HDK

2. Get started with the HDK

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

2.1 Configuring the PT7682W/PT7686W-SAOPTC0 HDK

PT7682W/PT7686W-SAOPTC0 HDK includes a main board and a PT7682W/PT7686W-SAOPTC0 stamp module. The PT7682W/PT7686W-SAOPTC0 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 PT7682W/PT7686W-SAOPTC0 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.
   i. Set the jumpers J2002, J2003, 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). S2006 enables the external interrupt (Dedicate EINT input in RTC), see section 4.4, “Buttons”, for more details.
4). Press S2001 to reset the system.
5). Wi-Fi Antenna is a PCB antenna. PT7682W/PT7686W-SAOPTC0 stamp module is by default connected to the PCB antenna to transmit and receive RF signals.

The default configuration of the PT7682W/PT7686W-SAOPTC0 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 40MHz.
5). Supports RTC mode.

The hardware settings of the stamp module are shown below:

1). XTAL at 40MHz.
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 PT7682W/PT7686W-SAOPTC0 HDK drivers on Microsoft Windows

To configure the PT7682W/PT7686W-SAOPTC0 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.
• On Windows XP, click the Hardware tab and then 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 UART1 of the chipset, see section 4.5, " Extension connectors". The mbed Serial Port (UART1) is applied to flash the board and log the outputs.

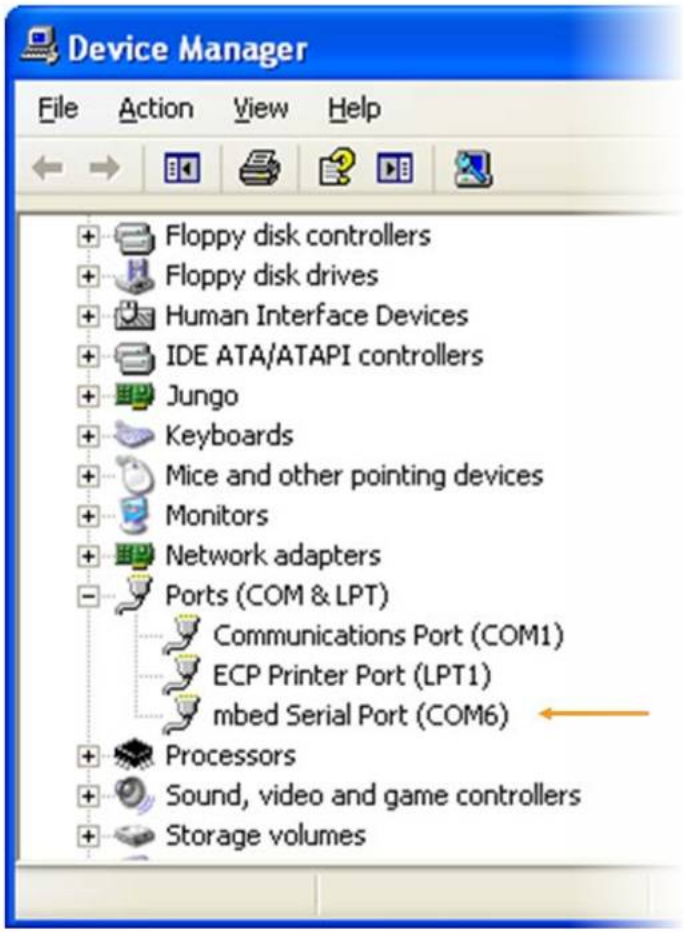

Figure 3. COM port associated with the PT7682W/PT7686W-SAOPTC0 HDK

2.3 Configuring the HDK flash mode

The PT7682W/PT7686W-SAOPTC0 HDK is embedded with 2MB flash memory. The boot options are either from the Flash memory or from the UART port.

To update the firmware on the PT7682W/PT7686W-SAOPTC0 HDK:

1). Set the jumpers J2002, J2003, J2004 and J2007 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 PT7682W/PT7686W-SAOPTC0 Flash Tool's behavior on the PC. A message "ccc" is

sent to the UART0 port of the chipset and the code is uploaded to the embedded flash memory through UART0.

2). 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 PT7682W/PT7686W-SAOPTC0 HDK:

1). Set the jumpers J2002, J2003, 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 PT7682W/PT7686W-SAOPTC0 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.

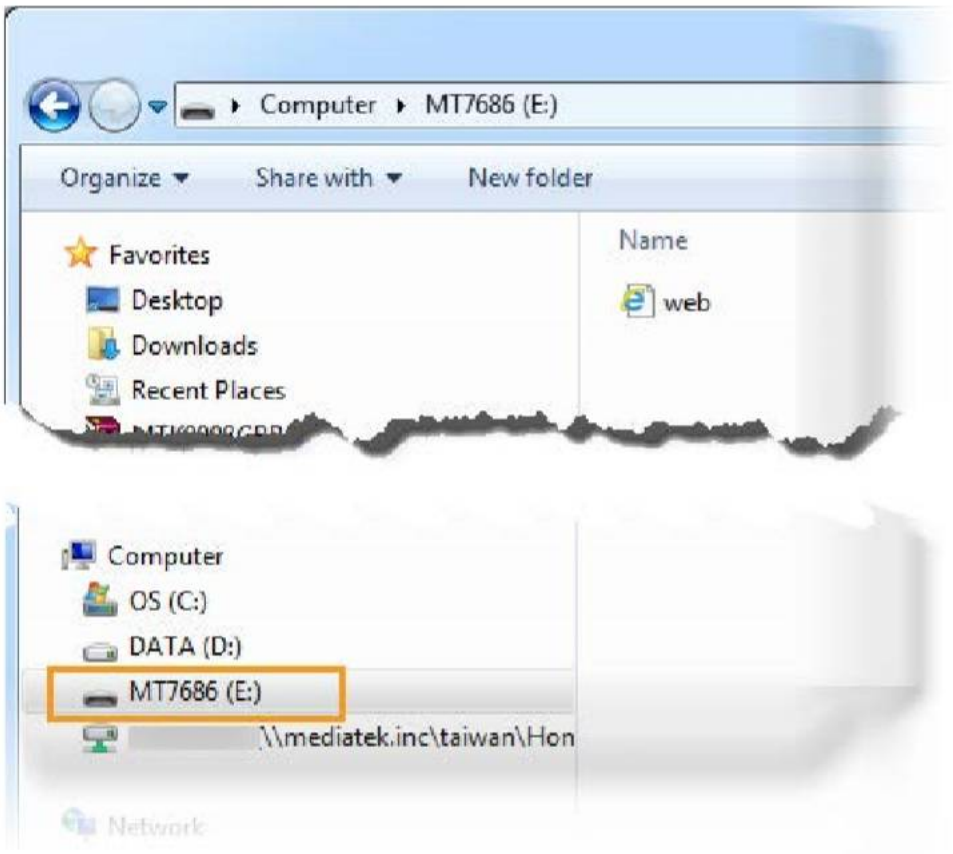

Figure 4. New removable storage detected

3. Hardware Features

This section provides the main supported features of the PT7682W/PT7686W-SAOPTC0 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 are 3.3V compatible.
- Support for FreeRTOS.
- Flexible on-board power supply
  - --USB with power (VBus, 5V).
  - --External VIN (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)
  --40MHz 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

PT7682W/PT7686W-SAOPTC0 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 PT7682W/PT7686W-SAOPTC0 HDK based on MT7682F, 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, J2003, J2004 and J2007 are required to be set on. More details on the jumpers can be found in Table 1.

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 PT7682W/PT7686W-SAOPTC0
J2003(1-2)	RTC3V3 power supply	Use micro-USB connector supporting RTC 3V3 power
J2007	Current measurement in RTC mode	Measures the current flow in RTC mode for PT7682W/PT7686W-SAOPTC0

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

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 CON5 (Figure 2). Note, that the jumpers J2003, 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)

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 PT7682W/PT7686W-SAOPTC0
J2003(2-3)	RTC3V3 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 PT7682W/PT7686W-SAOPTC0

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

4.3 LEDs

The PT7682W/PT7686W-SAOPTC0 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.

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

Table 3. GPIO pins to activate the LEDs

4.4 Buttons

The PT7682W/PT7686W-SAOPTC0 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). External interrupt button (S2006). To enter RETENTION mode is software configurable and to exit, use RTC timer or EINT.

4.5 Extension Connectors

The PT7682W/PT7686W-SAOPTC0 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.

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

Table 4. GPIO pin multi-function definition and pin-out extension connectors

Note

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 7. 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 7. Locations of I2C pull-up resistors

4.6 RTC

The PT7682W/PT7686W-SAOPTC0 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 or sleep 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 PMU_EN_RTC (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 chip antenna. An on-board U.FL, a conductive test component, (I-PEX) connector only available on PT7682W/PT7686W-SAOPTC0-SC version.

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 S2001, then plug-in the USB cable to CON3001, release the button S2001 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.

Note
Before you start to update CMSIS-DAP firmware via CON3001, please remember to confirm the Jumpers J2107 and J2108 are put on 2 and 3 pin.

5. Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA
Operation of this device is restricted to indoor use only

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the

antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna,
3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: Contains FCC ID: **"2ARUV-MWF82S01"**

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.