



UG0802

EV720E00 Evaluation Board (EVB) User Guide

This document describes the evaluation board supported LM720E00&SM720E00 modules.

Rev. 1.2

Nov. 2023



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USING THIS DOCUMENT

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

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1 Overview

1.1 Introduction

The EVB supported LM720E00 and SM720E00 module is designed to provide users with flexible function demonstration and usage evaluation. It builds the minimum system including power supply and USB-to-UART log/image download interface, and provides various functions such as Wi-Fi, Bluetooth, User LED, Cap Touch, Digital-MICs, GPIO, etc. Users can configure the functions freely by using the SDK and related tools provided by REALTEK.

1.2 Features

The EVB includes the following features:

- LM720E00 module SMT supported
- LM720E00 module vertical insertion assembly supported
- SM720E00 module SMT supported
- 5V DC power supply
- Buttons for chip reset and UART download
- USB-to-UART and USB Type-C interface supported
- User LED for red/green/blue colors supported
- Cap touch functions supported through FPC interface socket
- 2 Digital-MICs supported
- Wi-Fi 2.4G and Bluetooth supported from module
- GPIO PIN Header supported for function extension

2 Quick Start

2.1 Power

The EVB can be powered by connecting a USB cable between PC and board in USB Type-C socket, refer to section 3.2.6 for details of the interface.

2.2 FLASH Download

Before the EVB leaving the factory, REALTEK has downloaded a test image into the FLASH inside the chip on the module. If the user wants to download another image, please follow the instructions in the section 4.4.

2.3 Log

LOGUART is an important way for users to interact with the chip. Users can judge the working status of the code and perform online operations through the log transferred by the serial port. Users should refer to the section 4.3.1 for detailed instructions.

NOTE

USB-to-UART circuits and interface is designed on the EVB. Users just need to connect PC and EVB by a USB Type-C cable.

2.4 Functions

The EVB based on LM720E00&SM720E00 provides many functions for users to use freely. When users want to use a specific function, please follow the following steps:

- (1) If the function supported directly on board, just use the resource on board, like User LED, Digital Mic function etc.
- (2) If the function needs external sub-board to support, confirm the available pin for the function and hardware configuration of the EVB through reference design documents.
- (3) Connect EVB and external sub-board directly or through DuPont lines.

3 PCB Layout

3.1 Component Distribution

The EVB is a four-layer PCB board, with a size of 65mm*30mm, a chamfered arc radius of 3.5mm, and a positioning hole diameter of 3.2mm.

3.1.1 Top Layer

The top layer of the EVB is illustrated in Figure 3-1.

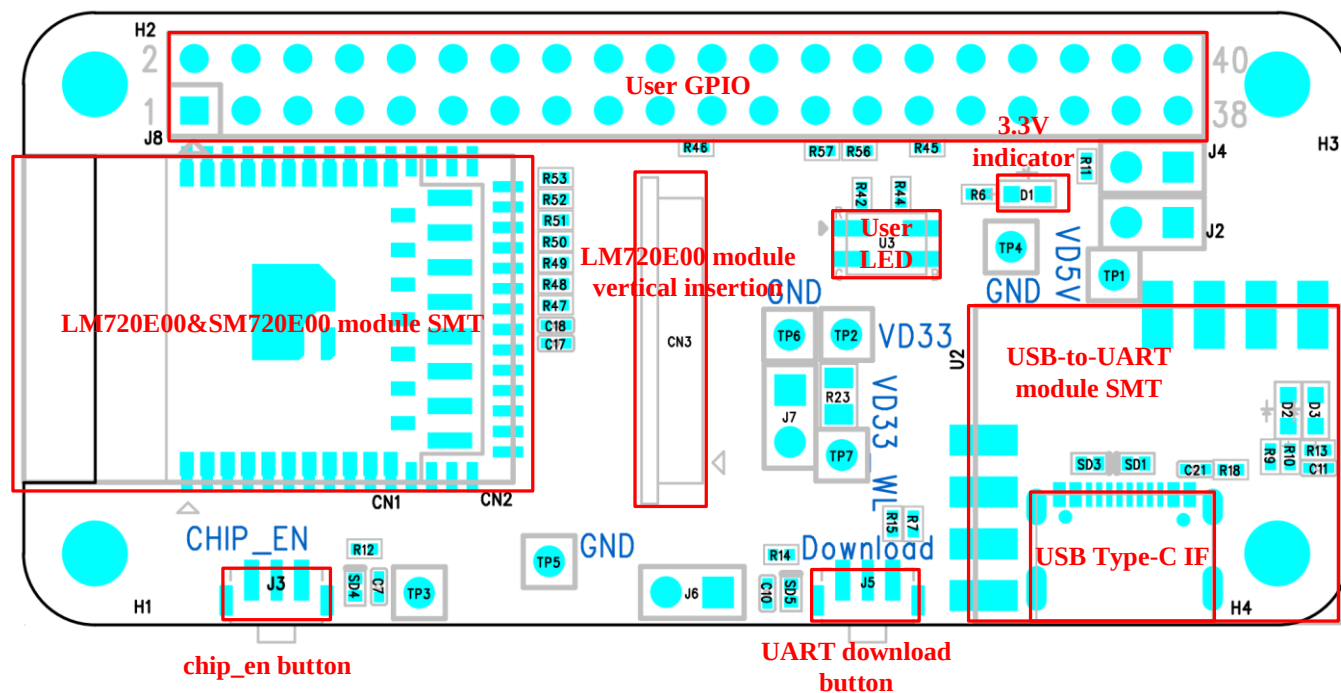


Figure 3-1 EV720E00 EVB – top layer

3.1.2 Bottom Layer

The bottom layer of the EVB is illustrated in Figure 3-2.

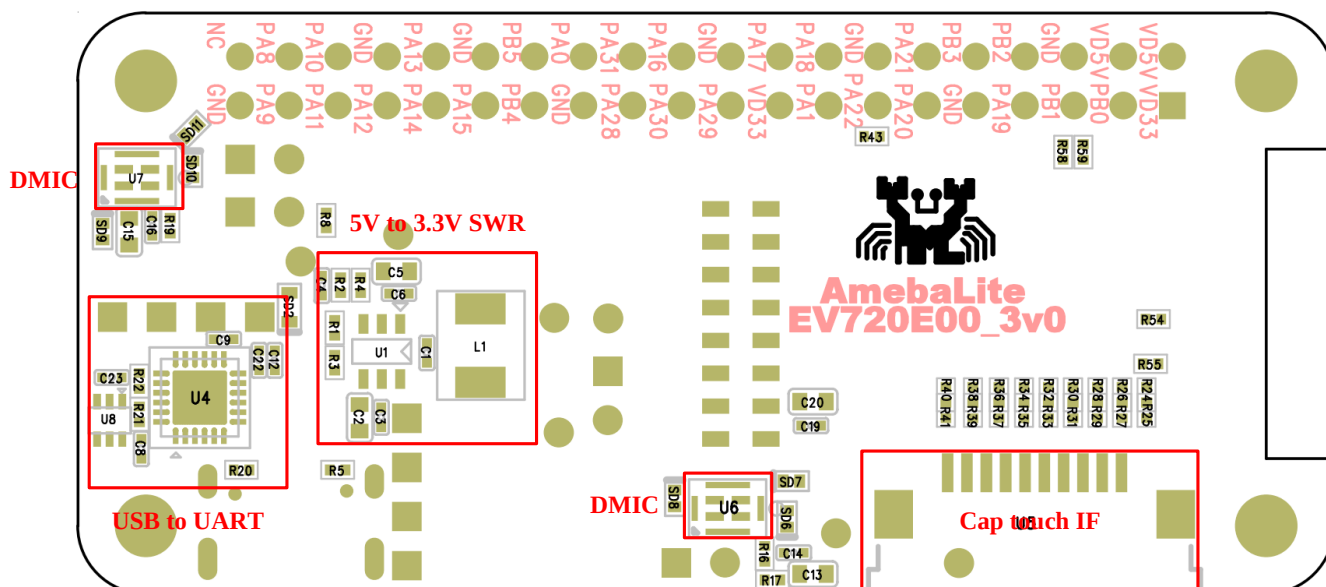


Figure 3-2 EV720E00 EVB – bottom layer

3.2 Main Parts

3.2.1 5V-to-3.3V DC-DC Converter

SILERGY's Synchronous Buck DC-DC converter chip (SY8121C1) is used as the main power source chip to supply 3.3V to the LM720E00 or SM720E00 module and other circuits on the EVB. The SY8121C1 is a high efficiency, synchronous stepdown DC/DC converter capable of delivering 2A load current. The SY8121C1 operates over a wide input voltage range from 4.2V to 18V. Please refer to the datasheet for more features and information.

3.2.2 USB-to-UART

The EVB co-layer designed the USB-to-UART circuit and USB-to-UART module. For customer use, the components of USB-to-UART circuit are on board by default. USB-to-UART module is mainly REALTEK internal used. FT232RQ of FTDI is a USB to serial UART interface, supports signal chip USB to asynchronous serial data transfer. Please refer to the datasheet for more features and information.

3.2.3 MIC

The EVB designs with 2 Digital MICs. The 3SM222FMT1KA microphone IC is integrated with specialized pre-amplification & analog-to-digital converter ASIC to provide high SNR output from a capacitive audio sensor. Please refer to the datasheet for more features and information.

3.2.4 LM720E00&SM720E00 Module

LM720E00 module or SM720E00 module as shown in Figure 3-3 could be placed on the EVB. Figure 3-4 shows the module assembly on the EVB, CN1 for LM720E00 SMT position, CN2 for SM720E00 SMT position, and LM720E00 is supported the vertical insertion assembly on the EVB through CN3.

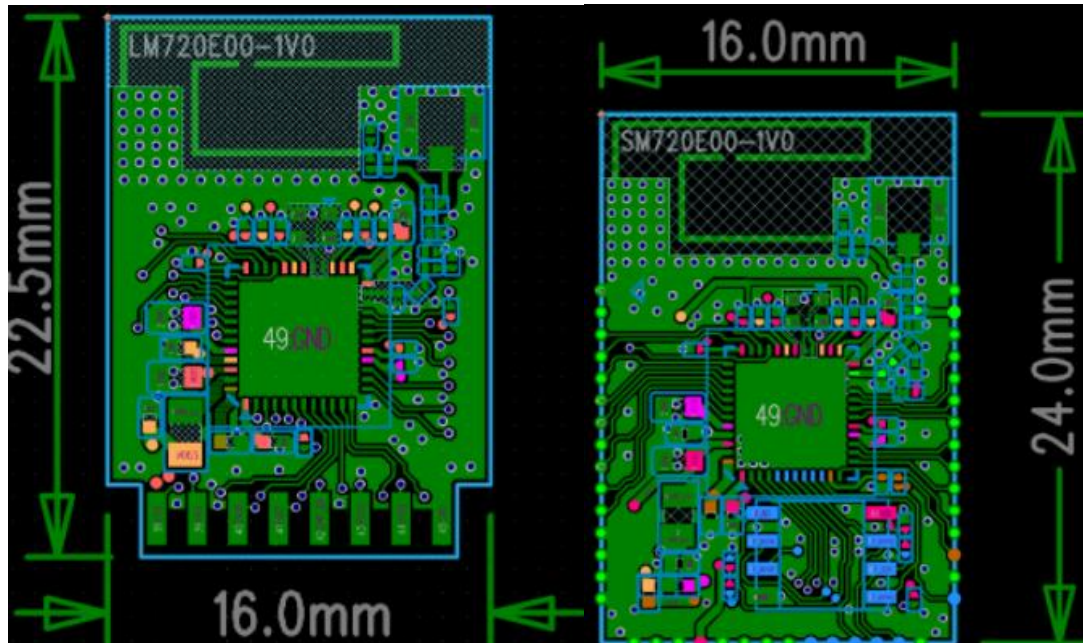


Figure 3-3 LM720E00 module and SM720E00 module

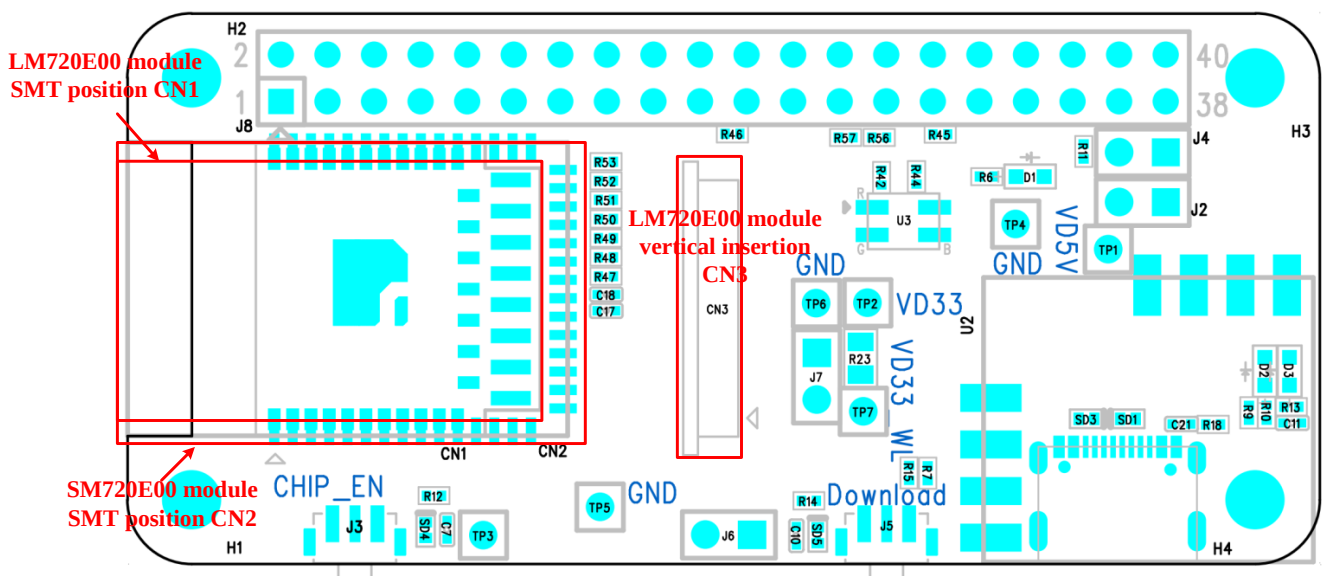


Figure 3-4 module assembly on EVB

For RF function, users could use Wi-Fi 2.4G and Bluetooth (BT) function. PCB antenna is designed on the module board. Users could use on-board antenna also could connect external antenna to module IPEX connector. Please refer to the design documents of LM720E00 and SM720E00 for more details and information.

3.2.5 Pin Headers

Several Pin Headers are designed on the EVB for extended use. Refer to section 3.1 for component distributions of EVB. The pin multiplexing and description of each pin header is listed in Table 3-1.

Table 3-1 EV720E00 EVB - pin headers

Designator	Pin number	Symbol	Description
J2	1	SM_LOG_TX	This Pin header NC and RSV for internal test
	2	PA_20	
J4	1	SM_LOG_RX	This Pin header NC and RSV for internal test
	2	PA_19	

J6	1	VD33	3.3V power supply
	2	VD33_D	3.3V power supply for Digital MIC
J7	1	VD33	3.3V power supply
	2	VD33_WL	3.3V power supply for module
J8	1	VD33	3.3V power supply
	2	VD5V	5V power supply
	3	PB0	Used as GPIO or other functions connected to PB0 of chip directly
	4	VD5V	5V power supply
	5	PB1	Used as GPIO or other functions connected to PB1 of chip directly
	6	GND	Ground
	7	PA19	Used as GPIO or other functions connected to PA19 of chip directly through R58 0 ohm resistor(default NC)
	8	PB2	Used as GPIO or other functions connected to PB2 of chip directly
	9	GND	Ground
	10	PB3	Used as GPIO or other functions connected to PB3 of chip directly
	11	PA20	Used as GPIO or other functions connected to PA20 of chip directly through R59 0 ohm resistor(default NC)
	12	PA21	Used as GPIO or other functions connected to PA21 of chip directly
	13	PA22	Used as GPIO or other functions connected to PA22 of chip directly
	14	GND	Ground
	15	PA1	Used as GPIO or other functions connected to PA1 of chip directly
	16	PA18	Used as GPIO or other functions connected to PA18 of chip directly
	17	VD33	3.3V power supply
	18	PA17	Used as GPIO or other functions connected to PA17 of chip directly
	19	PA29	Used as GPIO or other functions connected to PA29 of chip directly
	20	GND	Ground
	21	PA30	Used as GPIO or other functions connected to PA30 of chip directly
	22	PA16	Used as GPIO or other functions connected to PA16 of chip directly
	23	PA28	Used as GPIO or other functions connected to PA28 of chip directly
	24	PA31	Used as GPIO or other functions connected to PA31 of chip directly
	25	GND	Ground
	26	PA0	Used as GPIO or other functions connected to PA0 of chip directly
	27	PB4	Used as GPIO or other functions connected to PB4 of chip directly
	28	PB5	Used as GPIO or other functions connected to PB5 of chip directly
	29	PA15	Used as GPIO or other functions connected to PA15 of chip directly
	30	GND	Ground
	31	PA14	Used as GPIO or other functions connected to PA14 of chip directly
	32	PA13	Used as GPIO or other functions connected to PA13 of chip directly
	33	PA12	Used as GPIO or other functions connected to PA12 of chip directly
	34	GND	Ground
	35	PA11	Used as GPIO or other functions connected to PA11 of chip directly
	36	PA10	Used as GPIO or other functions connected to PA10 of chip directly
	37	PA9	Used as GPIO or other functions connected to PA9 of chip directly
	38	PA8	Used as GPIO or other functions connected to PA8 of chip directly
	39	GND	Ground
	40	NC	NC

NOTE

1. Please refer to REALTEK PIN MUX specification for details and more information of the pin multiplex function.
2. PA19 and PA20 are used as LOGUART function default and are not connected to pin header J8.7 and J8.11. Other GPIOs are all connected to pin headers in Table 3-1.

3.2.6 USB Type-C

There is a standard USB Type-C socket on the EVB, which can be used as a power supply to power the EVB or as a communication interface when using the USB-to-UART function.

NOTE

EV720E00 3V0 version can only support PC USB Type-A to EVB USB Type-C connection. Later version will improve the design to support both A-to-C and C-to-C connection.

4 Basic Usage

4.1 Power Supply

The EVB is 5V DC power supported, can be powered from USB Type-C interface socket by PC or power adaptor of rated power no less than 2W.

4.2 Reset

When the power supply is stable, the EVB can be reset by pressing and releasing the CHIP_EN button on the board, or powering the board off and then powering on. The CHIP_EN button on the EVB is J3. Press the J3 button that pulls low CHIP_EN signal. Release the J3 button that pulls high CHIP_EN signal. CHIP_EN is on HIGH state during normal operation.

4.3 Communication

4.3.1 LOGUART

The EVB can interact with PC through the USB-to-UART circuits on board. Users need to connect the EVB and PC through an USB Type-C cable. The default LOGUART function is distributed on PA19 (LOG_RX) and PA20 (LOG_TX).

In the Trace Tool provided by REALTEK, select the serial port according to the steps in Figure 4-1, configure the transmission baud rate and frame format, and open the serial port to interact with the EVB on the PC.

NOTE

The default transmission baud rate of LOGUART is 1.5Mbps.

After that, the log window of the Trace Tool will display the data received/transmitted by PC and parse it into ASCII characters. Each line of log will display the time of receiving/transmitting this log.

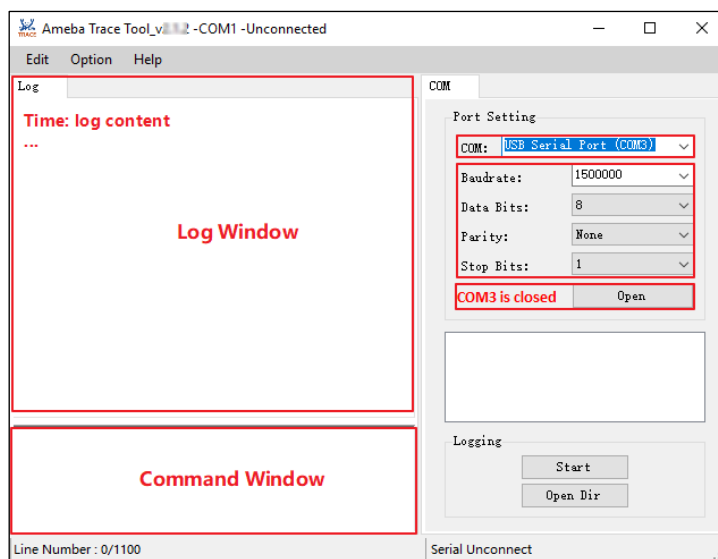


Figure 4-1 Trace Tool UI

4.3.2 SWD

The EVB supports 2-pin serial-wire debug (SWD) interface for users to access core integrated in the chip. Users can access KR4 core through KR_SWD interface, and can access both KR4 core and KM4 core through Share_SWD interface.

The KR_SWD function is distributed on PA21 (Data) and PA22 (CLK), Share_SWD function is distributed on PB0 (Data) and PB1 (CLK). The KR_SWD and Share_SWD interface are available on the Pin Header J8.

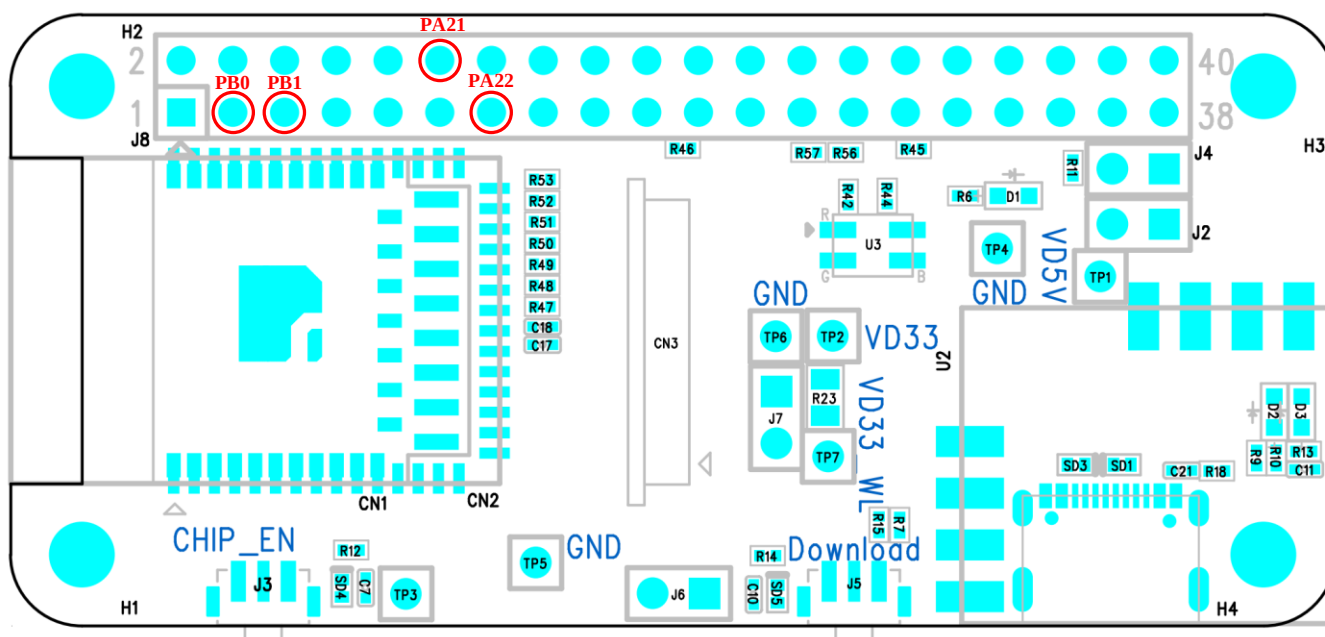


Figure 4-2 Location of SWD function on EVB

4.4 Flash Download

Users can download the image into FLASH through USB-to-UART function on the EVB.

The steps of downloading the image are below:

- (1) Connect the EVB to PC through the USB cable, power on the chip.
- (2) Keep pressing the UART download button, press and release the CHIP_EN button to enter into Flash download mode.
- (3) Select the corresponding serial port in the Image Tool provided by REALTEK.
- (4) Click Chip Select (in red) menu of Image Tool and select RTL8720E_FreeRTOS_NOR.rdev configuration file.
- (5) Set the transmission baud rate, and 1.5Mbps is recommended.
- (6) Select the storage directory of the compiled program and set the address of each image according to Figure 4-3.
- (7) Click the download button to start downloading the image.

After the download, the Image Tool will show whether the transmission of each image is successful. If the transmission is successful, reset the chip according to the method in section 4.2.

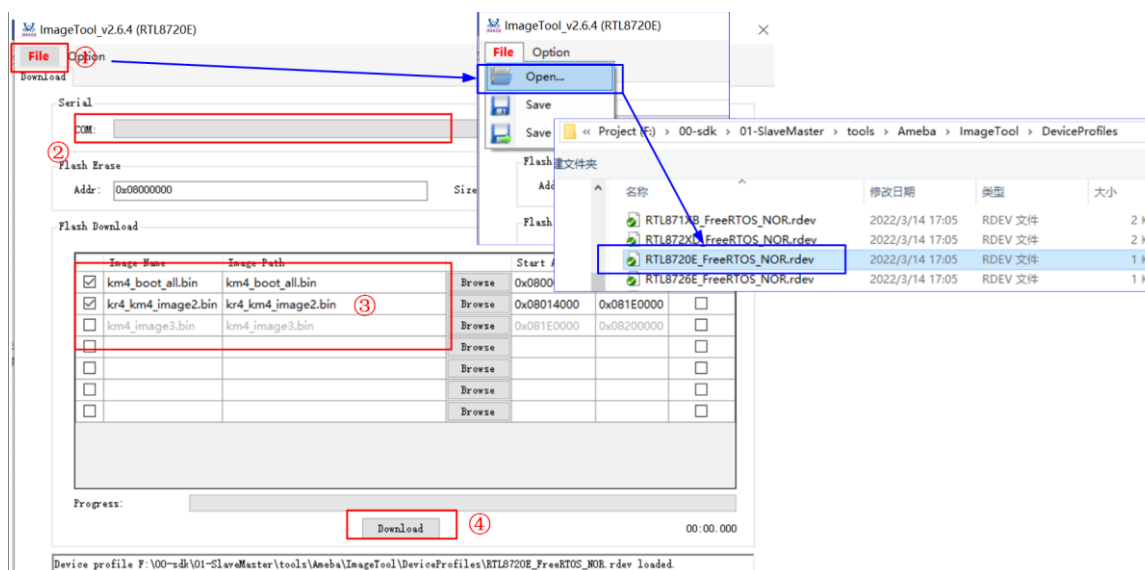


Figure 4-3 ImageTool UI

5 Other Functions and Instructions

5.1 Wi-Fi

The EVB supports 2.4G RF of Wi-Fi 802.11ax protocol. Please refer to the design documents of LM720E00 and SM720E00 for more detailed information.

5.2 Bluetooth

The EVB supports Bluetooth protocol 5.2. Please refer to the design documents of LM720E00 and SM720E00 for more detailed information.

5.3 Cap Touch

The EVB supports 9 channels of cap touch application. Users can connect cap touch sub-board through the FPC 10pin connector (U5) on the EVB. Please be noted that the FPC cable should be carefully inserted into the connector to avoid damage to the golden finger.

The PINs shown in the Figure 5-1 are used as GPIO by default. If users want to apply cap-touch function, please change the hardware configurations following below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R24, R26, R28, R30, R32, R34, R36, R38, R40 removed;
- R25, R27, R29, R31, R33, R35, R37, R39, R41 of 560Ω resistors placed on the board.

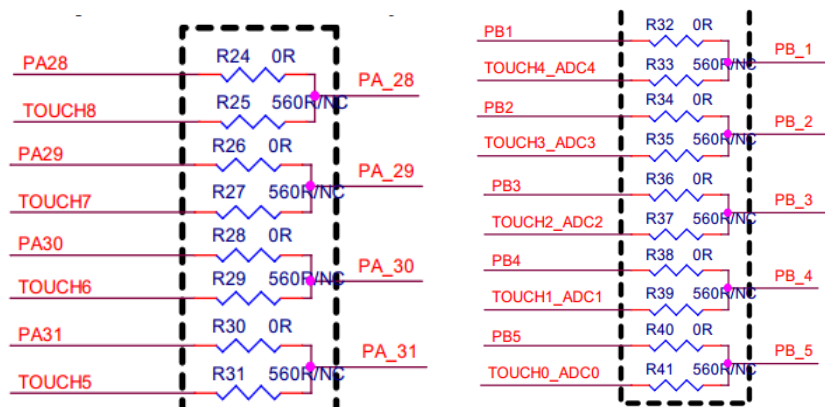


Figure 5-1 Hardware configuration of the cap touch

5.4 User LED

The EVB supports a 3-color LED (R/G/B) for users to use. The PINs shown in the Figure 5-2 are used as GPIO by default. If users want to apply user LED function, please change the hardware configurations following below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R42, R43, R44 of 470Ω resistors placed on the board.

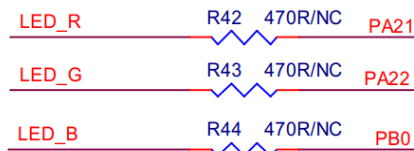


Figure 5-2 Hardware configuration of the User LED

5.5 MIC

The EVB supports 2 digital MICs. The PINs shown in the Figure 5-3 are used as GPIO by default. If users want to apply digital MIC function, please change the hardware configurations following below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R45 and R46 of 22Ω resistors placed on the board.

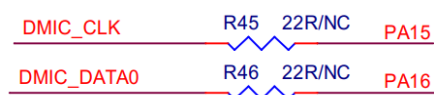


Figure 5-3 Hardware configuration of the Digital MIC

5.6 GPIO

There are multiple GPIOs on the EVB. Refer to section 3.2.5 Pin Headers for the function and description of each I/O. The PINs shown in the Figure 5-4 are used as GPIO by default. So users could apply GPIO function directly. If hardware configuration changed by other function application, please change the hardware configurations following below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R25, R27, R29, R31, R33, R35, R37, R39, R41, R42-R46 removed;
- R24, R26, R28, R30, R32, R34, R36, R38, R40, R47-R53 of 0Ω resistors placed on the board.

NOTE

When module with RTL8720EAM/RTL8710ECM is placed on the EVB, signal name PA8-PA14 corresponding to the actual connected pins are PA2-PA7 which are connected to an external flash. These GPIOs are not available on the pin header (J8) and the resistors of R47-R53 will be removed.

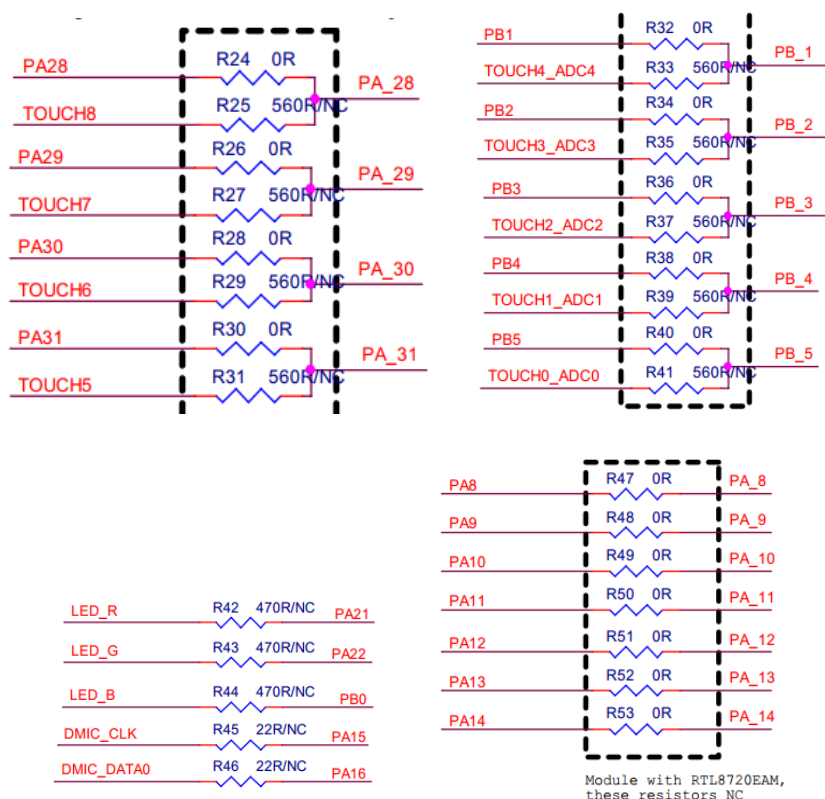


Figure 5-4 Hardware configurations of the GPIO

5.7 Test Points

Several test points are reserved on the EVB for debugging.

Table 5-1 EV720E00 EVB – test points

Designator	Pin number	Symbol	Description
TP1	1	VD5V	5V power test point
TP2	1	VD33	3.3V power test point
TP3	1	CHIP_EN	CHIP_EN signal test point
TP4	1	GND	Ground test point
TP5	1	GND	Ground test point

TP6	1	GND	Ground test point
TP7	1	VD33_WL	3.3V power for module test point

Revision History

Date	Version	Description
2022-05-10	v1.0	Initial release
2022-11-30	V1.1	Correct some mistakes
2023-11-22	V1.2	1. Correct some mistakes 2. Add contents in 3.2.5