UG0902
EV726E00 Evaluation Board (EVB) User Guide

This document describes the evaluation board supported SM726E00 modules.

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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.

Contents

1 Overview

1.1 Introduction

The EVB supported SM726E00 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, User Keys for ADC sampling, Digital-MICs, Analog-MICs, Speaker, 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:

- SM726E00 Module SMT supported
- 5V DC power supply, optional 12V power supply for Audio PA
- 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
- Extension sub-board interface supported
- User Keys for ADC sampling
- 2 Digital-MICs supported
- 3 Analog-MICs supported
- Earphone supported
- Audio PA and speaker interface socket 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 in the USB Type-C interface socket, the power source could be a PC or an adaptor. If extension sub-board connected, the EVB could be powered by the extension sub-board. 12V power supply is only optional for audio power amplifier (PA). Refer to the section 4.1 for details of the power supply.

CAUTION

If there is no special requirement, it is highly recommended that you use USB direct power supply. Be sure to read the section 4.1 carefully to configure the power source. If the user has requirement to use 12V power supply for audio PA, be sure to read the section 4.1 carefully to avoid damage to the board or PC.

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 SM726E00 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, User Key, and Audio 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*56mm, a chamfered arc radius of 3mm, and a positioning hole diameter of 2.8mm.

3.1.1 Top Layer

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

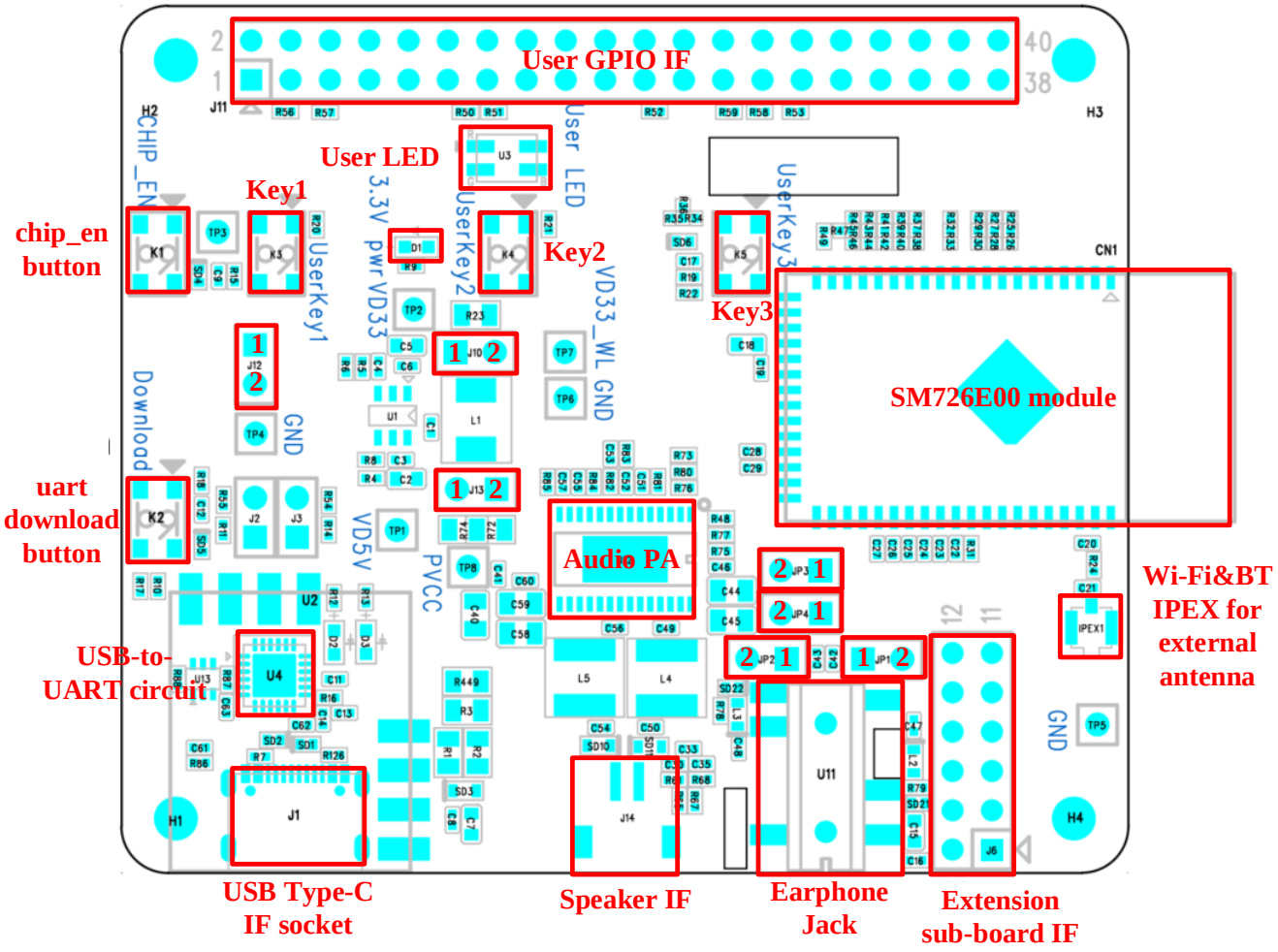

Figure 3-1 EV726E00 EVB – top layer

3.1.2 Bottom Layer

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

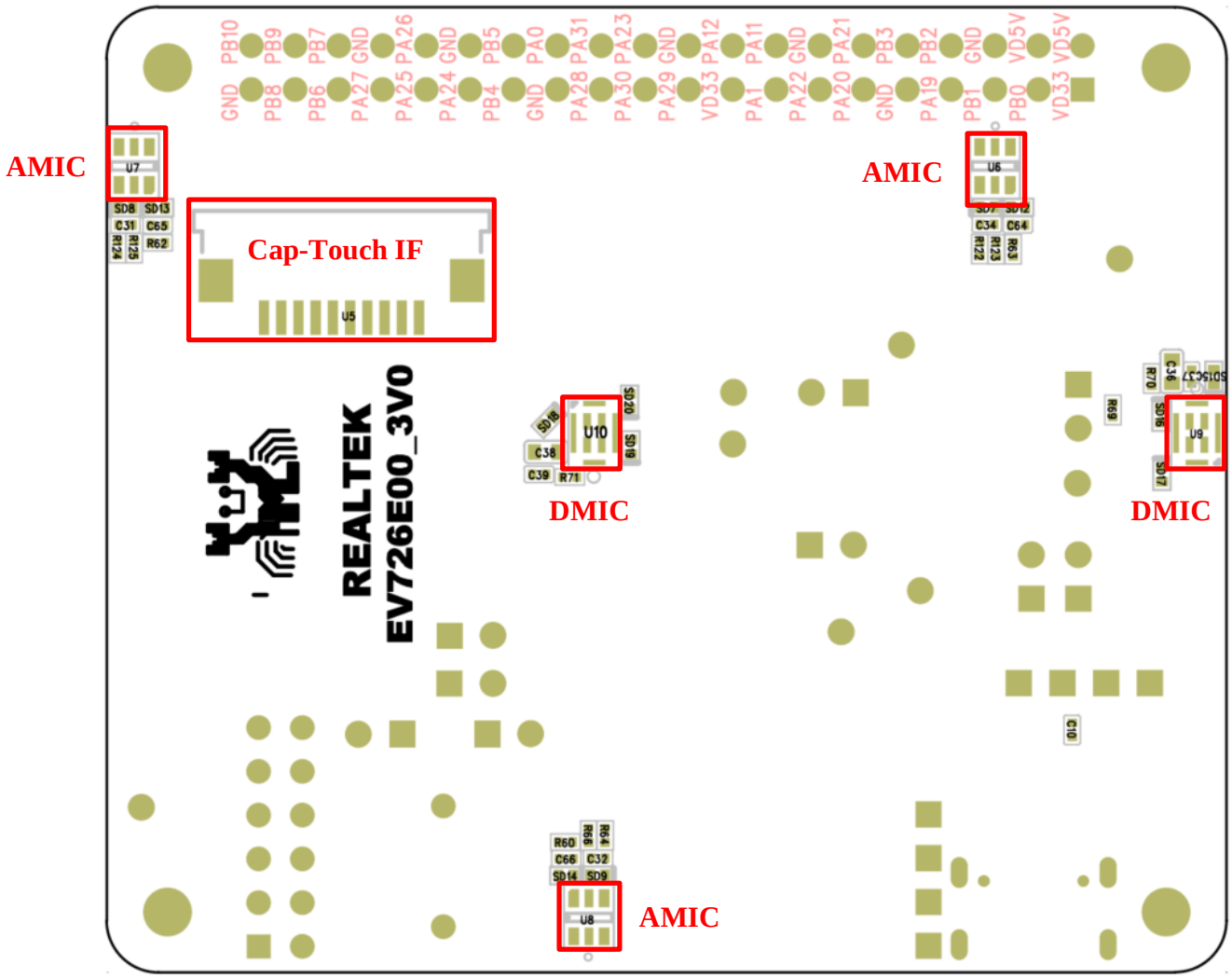

Figure 3-2 EV726E00 EVB – bottom layer

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 SM726E00 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-lay 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 and 3 Analog 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.
The SPH1642HT5H-1 is a miniature, high-performance, low power, matched sensitivity top port silicon microphone. Using Knowles' proven high performance SiSonic™ MEMS technology, the SPH1642HT5H-1 consists of an acoustic sensor, a low noise input buffer, and an output amplifier.
Please refer to the datasheet for more features and information.

3.2.4 Speaker/Audio Amplifier

ESMT's high-efficiency stereo Class-D audio amplifier (AD52058) is used as the driver of external speakers. It can deliver 15W/CH output power into 4Ω loudspeaker within 10% THD+N at 12V supply voltage and without external heat sink when playing music.
Please refer to the datasheet for more features and information.

3.2.5 SM726E00 Module

SM726E00 module SMT is supported, and it is the main part of the 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 or EVB IPEX connector.
Please refer to SM726E00 design documents for more details and information.

3.2.6 Pin Headers

Several Pin Headers are designed on the EVB for extended use. Refer to section 3.1.1 for distributions of EVB. The pin multiplexing and description of each pin header is listed in Table 3-1.

Table 3-1 EV726E00 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	
J3	1	SM_LOG_RX	This Pin header NC and RSV for internal test
	2	PA_19	
J6	1	PB19	Extension sub-board signal PB19
	2	EM5V	Extension sub-board 5V power output
	3	PB18	Extension sub-board signal PB18
	4	GND	Ground
	5	PB13	Extension sub-board signal PB13
	6	PB5_CMP	Extension sub-board signal PB5_CMP
	7	PB14	Extension sub-board signal PB14
	8	GND	Ground
	9	PB12	Extension sub-board signal PB12
	10	PB6_PWM	Extension sub-board signal PB6_PWM
	11	PB11	Extension sub-board signal PB11
	12	GND	Ground
J10	1	VD33	3.3V power supply
	2	VD33_WL	3.3V power supply for SM726E00 module
J12	1	VD33	3.3V power supply
	2	VD33_D	3.3V power supply for Digital MIC
J13	1	12V	Optional 12V power supply input for audio PA
	2	GND	Ground
JP1	1	-	This Pin header RSV for internal test
	2	-	
JP2	1	-	This Pin header RSV for internal test
	2	-	
JP3	1	AU_LO_N	OPEN this Pin header when earphone function used
	2	-	
JP4	1	AU_LO_P	OPEN this Pin header when earphone function used
	2	-	
J11	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 R54 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 PA19 of chip directly through R55 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 PA22of chip directly
	14	GND	Ground
	15	PA1	Used as GPIO or other functions connected to PA1 of chip directly
	16	PA11	Used as GPIO or other functions connected to PA11of chip directly
	17	VD33	3.3V power supply
	18	PA12	Used as GPIO or other functions connected to PA12 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	PA23	Used as GPIO or other functions connected to PA23 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	PA24	Used as GPIO or other functions connected to PA24 of chip directly
	30	GND	Ground
	31	PA25	Used as GPIO or other functions connected to PA25 of chip directly
	32	PA26	Used as GPIO or other functions connected to PA26 of chip directly
	33	PA27	Used as GPIO or other functions connected to PA27 of chip directly
	34	GND	Ground
	35	PB6	Used as GPIO or other functions connected to PB6 of chip directly
	36	PB7	Used as GPIO or other functions connected to PB7 of chip directly
	37	PB8	Used as GPIO or other functions connected to PB8 of chip directly
	38	PB9	Used as GPIO or other functions connected to PB9 of chip directly
	39	GND	Ground
	40	PB10	Used as GPIO or other functions connected to PB0 of chip directly

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 J11.7 and J11.11.Other GPIOs are all connected to pin headers in Table 3-1.

3.2.7 Speaker Jack and Earphone Jack

The speaker jack is a 2-pin jack with a spacing of 1.5mm, connected with the P/N output of the power amplifier (PA).
3.5mm diameter earphone is supported to insert. Audio could output through the earphone, but input is not supported through the jack. When earphone is inserted in the jack and intended to use earphone function, JP3 and JP4 should keep OPEN.

3.2.8 IPEX

One IPEX female connector is reserved for Wi-Fi and Bluetooth RF on the EVB. The IPEX female connector should be used when there is an external antenna, and you can switch to PCB antenna or external antenna through 0ohm resistance, that could be configured on SM726E00 module. The IPEX female connector can be connected to an external antenna or connected to an instrument to measure the RF characteristics. Figure 3-3 shows the size of IPEX female connector. Pay attention to the size matching of adapter when using it.

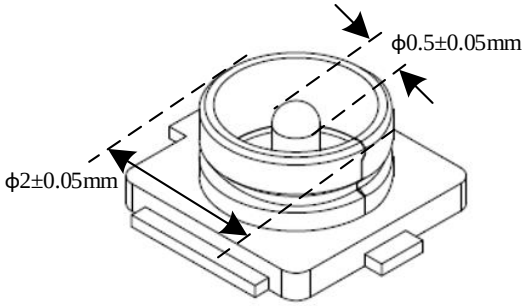

Figure 3-3 Size of IPEX female connector

3.2.9 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.

4 Basic Usage

4.1 Power Supply

The EVB is 5V DC power supported, and can be powered by USB or Extension sub-board, of which USB is used to supply power by default. 12V is only optional for audio PA power supply when users require larger power output for the speaker. But must be careful to check the power configuration before connecting the external 12V power supply to the EVB, otherwise damage may happen to the EVB, PC or adaptor.

4.1.1 USB Power

The EVB can be powered by plugging the USB cable into the USB Type-C socket, power supply from PC or power adaptor of rated power no less than 15W.
Figure 4-1 shows the power supply of the EVB is from USB by default (see Figure 3-1 and Figure 3-2 for locations of each components).

- R3 and R449 removed;
- R1 and R2 of 0Ω resistors placed on the board.

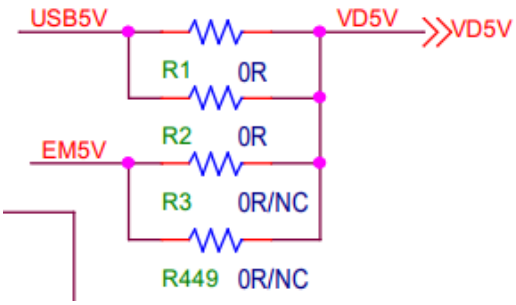

Figure 4-1 5V power supply configuration

4.1.2 Extension sub-board Power

The EVB can be powered by extension sub-board from pin header J6. If users want to use extension sub-board to power the EVB, please change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R1 and R2 removed;
- R3 and R449 of 0Ω resistors placed on the board.

4.1.3 12V Power Optional for Audio PA

Audio PA is powered by VD5V by default. Figure 4-2 shows the default hardware configuration of the power supply to audio PA.

- R72 removed;
- R74 of 0Ω resistor placed on the board.

If users require larger power output for the speaker, 12V power is optional and supported. Please be carefully to change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R74 must be removed;
- R72 of 0Ω resistor placed on the board;
- connect external 12V power supply on the PIN1 of J13 and ground of power supply on the PIN2 of J13.

NOTE

When 12V power is used for Audio PA, must be careful to connect external power supply on J13 PIN Header, PIN1 for 12V power input and PIN2 for ground. Besides, R72 is placed, R74 must be removed. Otherwise damage may happen to the EVB, PC or adaptor. (See Figure 3-1 and Figure 3-2 for locations of each components)

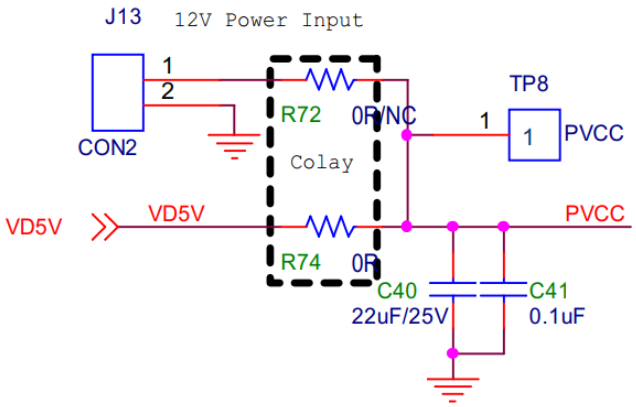

Figure 4-2 Power supply configuration for audio PA

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 K1. Press the K1 button that pulls low CHIP_EN signal. Release the K1 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 cable, USB Type-C on EVB.
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 4-3, 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.

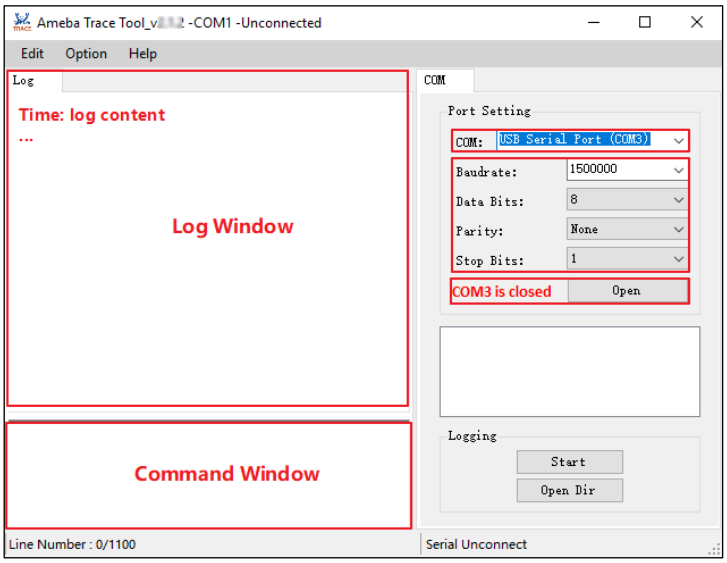

Figure 4-3 Trace Tool UI

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 J11.

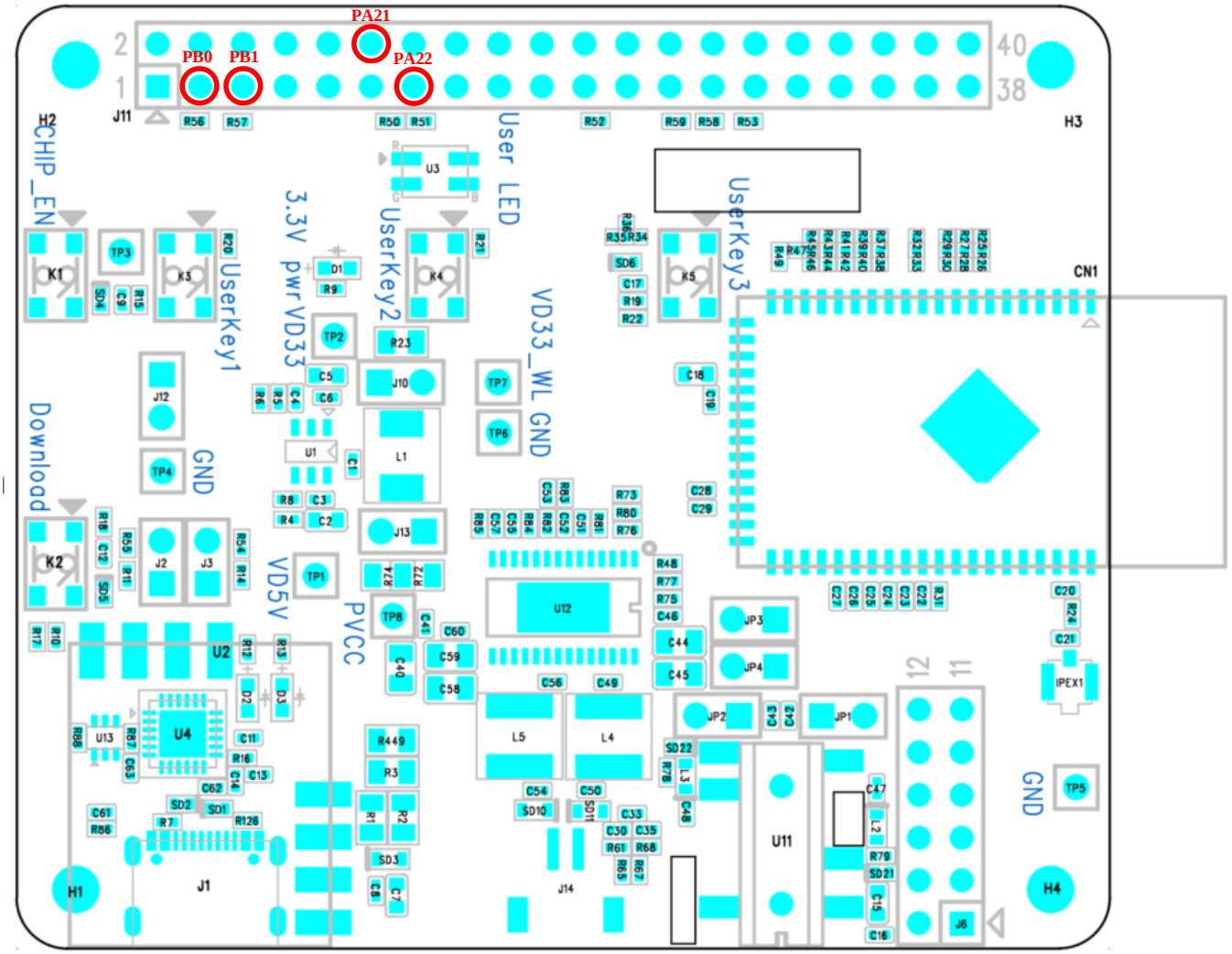

Figure 4-4 Location of SWD function on EVB

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 4-5.
(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.

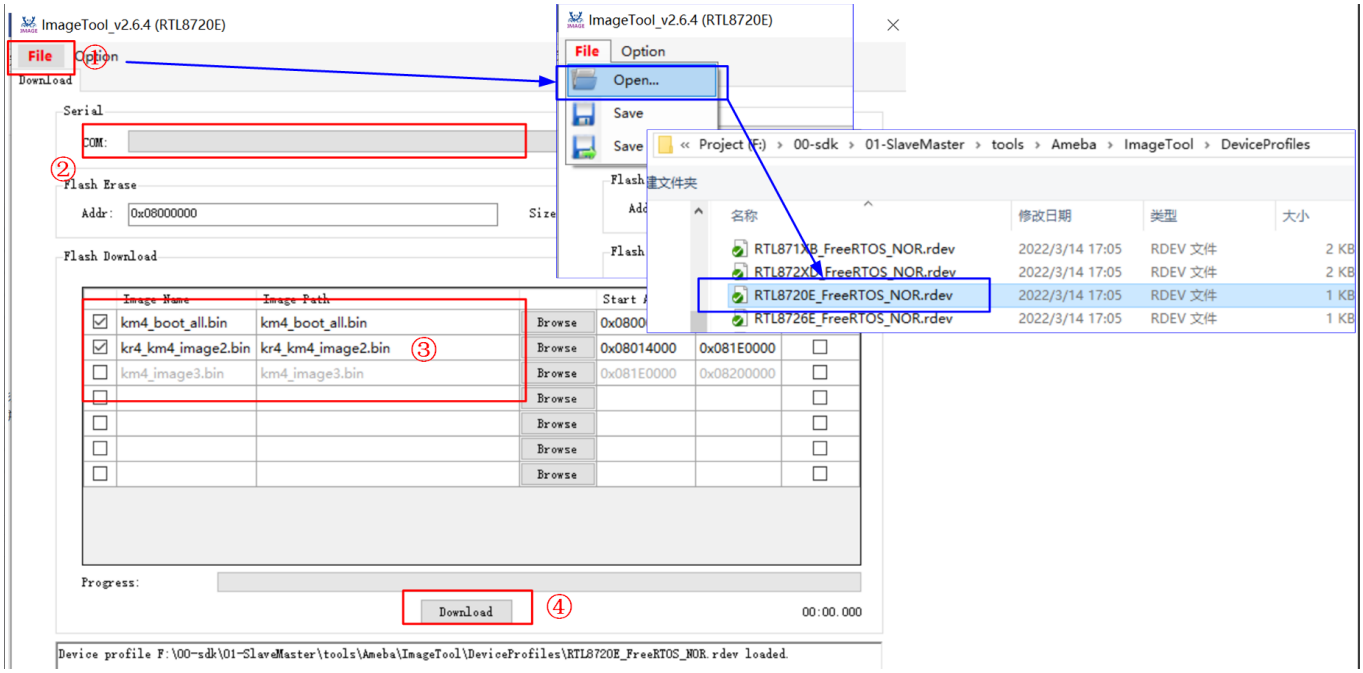

Figure 4-5 ImageTool UI

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 SM726E00 for more detailed information. When users want to measure Wi-Fi RF characteristics through the IPEX connector on the EVB, please place the IPEX connector (IPEX1) and suitable components on the reserved pi-type matching circuits (R24/C20/C21) according to the impedance of external antenna.

5.2 Bluetooth

The EVB supports Bluetooth protocol 5.2. Please refer to the design documents of SM726E00 for more detailed information.
When users want to measure Bluetooth RF characteristics through the IPEX connector on the EVB, please place the IPEX connector (IPEX1) and suitable components on the reserved pi-type matching circuits (R24/C20/C21) according to the impedance of external antenna.

5.3 Cap Touch

The EVB supports 9 channels of cap touch application. Users can connect the cap touch sub-board to the EVB through a FPC 10pin connector (U5). 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 by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R25, R27, R29, R32, R37, R39, R41, R43, R45, R47 removed;
- R26, R28, R30, R33, R38, R40, R42, R44, R46 of 560Ω resistors placed on the board.

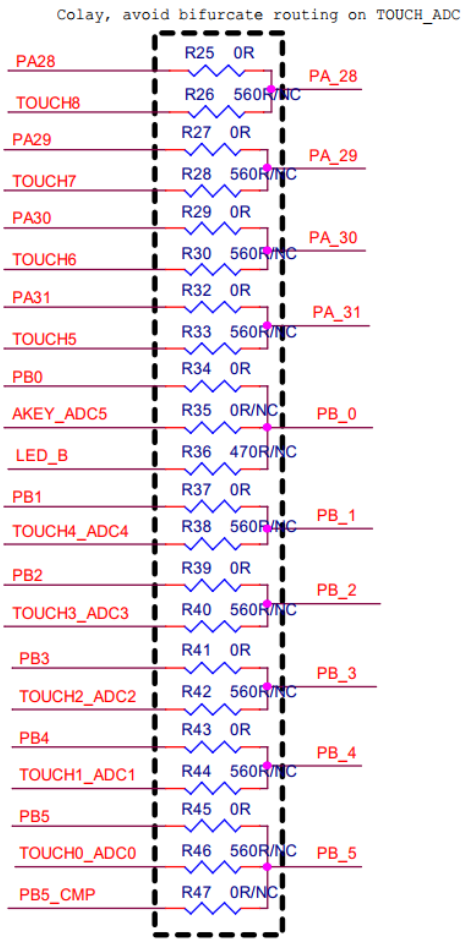

Figure 5-1 Hardware configuration of the cap touch

5.4 Extension

The EVB supports the Extension sub-board application, by connecting the sub-board to the EVB through the pin header J6. The PINs shown in the Figure 5-2Figure 5-1 are used as audio function or GPIO by default. If users want to apply extension function, please change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- C22-C27 and R45, R46 removed;
- R47, R49 of 0Ω resistors placed on the board.

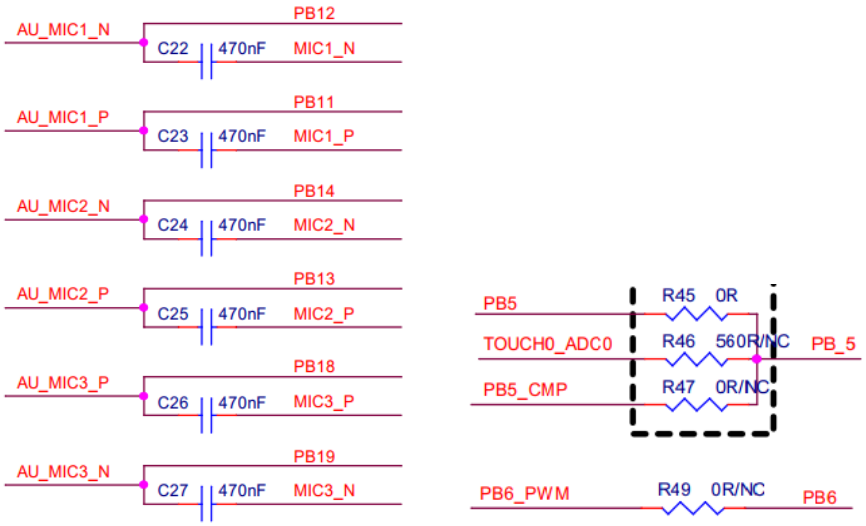

Figure 5-2 Hardware configuration of the Extension function

5.5 User Key

The EVB supports 3 user keys for ADC sampling. Press any of the user key or two or three keys, the circuit could generate different voltage, and results in different sampling data. The PIN shown in the Figure 5-3Figure 5-1 is used as GPIO by default. If users want to apply user key function, please change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R34, R36 removed;
- R35 of 0Ω resistor placed on the board.

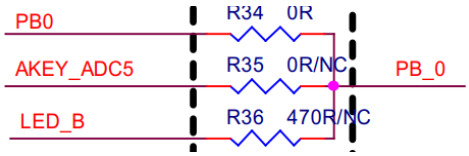

Figure 5-3 Hardware configuration of the User Key ADC

5.6 User LED

The EVB supports a 3-color LED (R/G/B) for users to use. The PINs shown in the Figure 5-4Figure 5-1 are used as GPIO by default. If users want to apply user LED function, please change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R34, R35 removed;
- R36, R50, R51 of 470Ω resistors placed on the board.

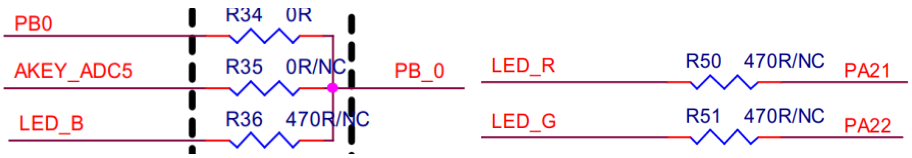

Figure 5-4 Hardware configuration of the User LED

5.7 Speaker/Earphone

The EVB supports on-board line-out power amplifier (PA) and external speaker through a 2-PIN jack (J14), also supports the line-out signal directly output to earphone jack (U11).
When using the function of PA and external speaker, the EVB can directly drive 4/8Ω impedance speaker with maximum power of 15W through AD52058. Please check and confirm the configuration of the EVB. Refer to section 4.1 for power supply selection. And JP3, JP4 should be shorted with mini jumper on the board.
When using the function of earphone, open JP3 and JP4 by removing the mini jumper from the board.

5.8 MIC

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

- R52 and R53 of 22Ω resistors placed on the board.

Figure 5-5 Hardware configuration of the Digital MIC

The EVB supports 3 analog MICs. The PINs shown in the Figure 5-6Figure 5-1 are used as MIC function by default. Users could directly apply the analog MIC function. If the hardware configuration changed by other function application, please check and change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R31 of 0Ω resistor and C22-C27 of 470nF capacitors placed on the board;
- If using the function of MIC3, R60, R64, R66 of 0Ω resistors placed on the board;
- Remove all the components of Acoustic Echo Cancellation (AEC) circuit, including C30, C33, C35, R61, R65, R67, R68.
- If using the function of AEC, C30, C35 of 22nF capacitors and R61, R68 of 1kΩ resistors and R65, R67 of 20kΩ resistors placed on the board;
- R64, R66 removed.

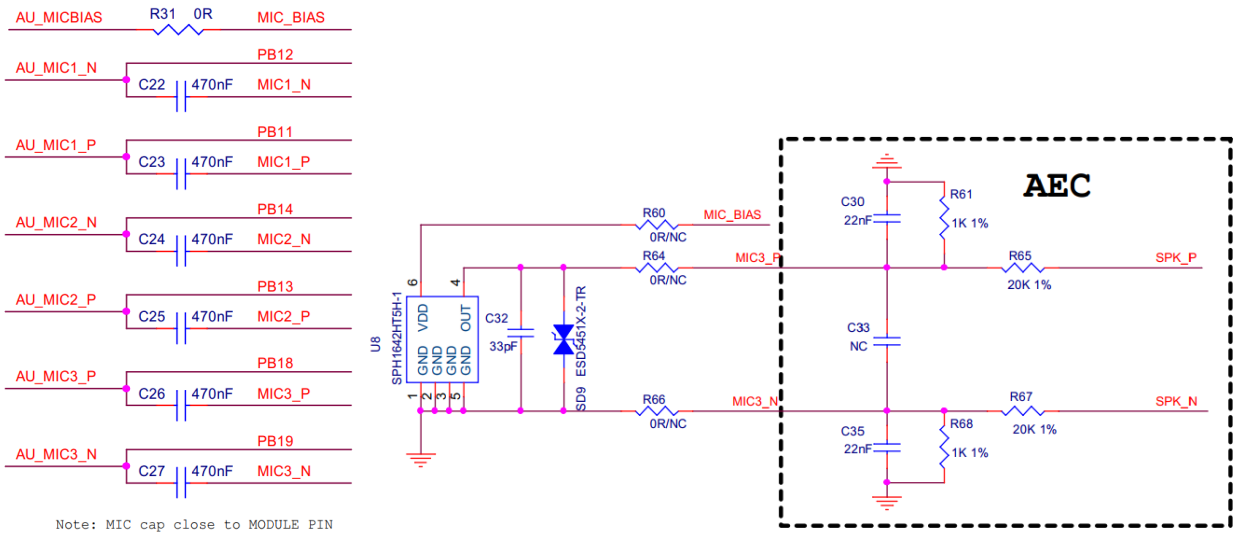

Figure 5-6 Hardware configuration of the analog MIC

5.9 GPIO

There are multiple GPIOs on the EVB. Refer to section 3.2.6 Pin Headers for the function and description of each I/O. If users want to apply GPIO function, please check and change the hardware configurations following by the below instructions (see Figure 3-1 and Figure 3-2 for locations of each components):

- R26, R28, R30, R33, R35, R36, R38, R40, R42, R44, R46, R47, R49-R53 removed;
- R25, R27, R29, R32, R34, R37, R39, R41, R43, R45, R54, R55 of 0Ω resistors placed on the board.

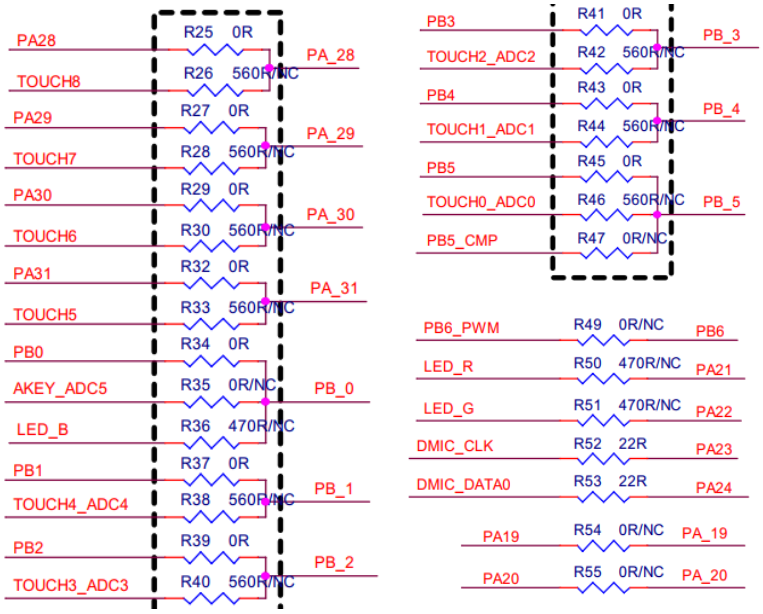

Figure 5-7 Hardware configuration of the GPIO

5.10 Test Points

Several test points are reserved on the EVB for debugging.

Table 5-1 EV726E00 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 SM726E00 module test point
TP8	1	PVCC	5V/12V power for audio PA 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 3.2.6