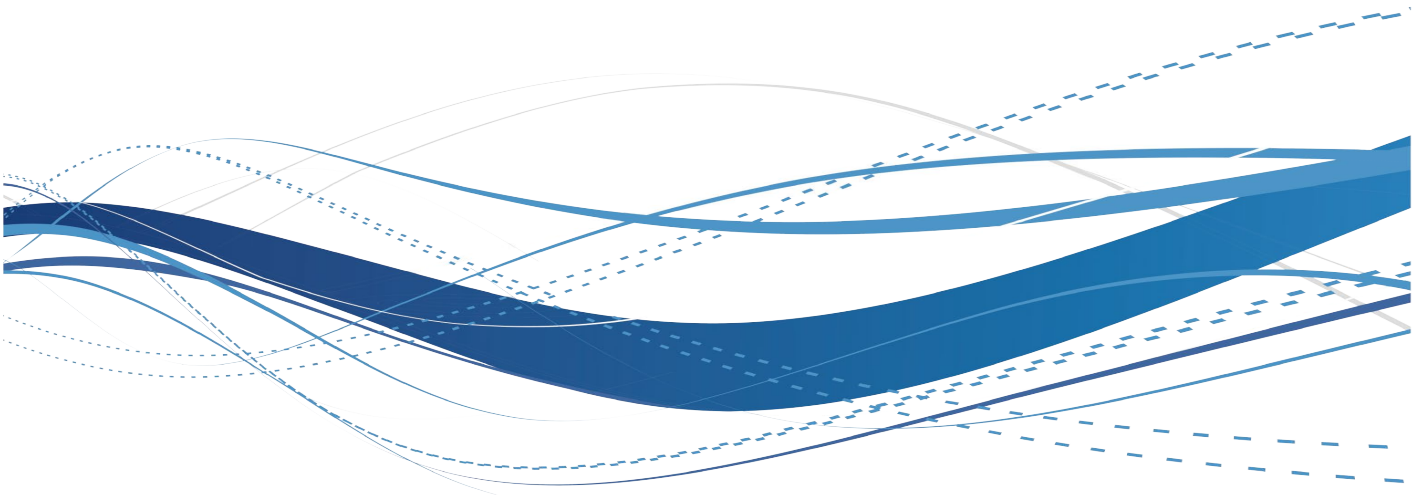**Embest Technology Co.,Ltd**

EM-TF-BB-AM5728

Hardware User Manual

V1.0

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Compliance Information:

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 or more 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.

Version History

Version	Description	Author	Date
V1.0	Initial	Jack Lei	2018.07.12

Content

Chapter1. Product Overview

1.1 Brief introduction

EM-TF-BB-AM5728 is the evaluation base board for the EM-TF-SOM-AM5728 that developed by Embest Technology company. It can be applied to medical machine, video monitor, industry control, communication and so on. It is based on TI AM572x SOC evaluation board. In the small size of EM-TF-SOM-AM5728 board but there are many resources in the EM-TF-BB-AM5728 board, the interface include Giga Ethernet, USB2.0, USB3.0, HDMI, Audio, PCIE, mini PCIE, mSATA, LCD, Camera, Micro SD card, CAN, RS485, DIDO, GPMC. Also there are SPI, I2C, UART, GPIO bus in the expansion pin header. It is flexible for customization.

1.2 Block Diagram

EM-TF-BB-AM5728_V1.0

Figure1- 1 EM-TF-BB-AM5728 Block Diagram

1.3 Packing List
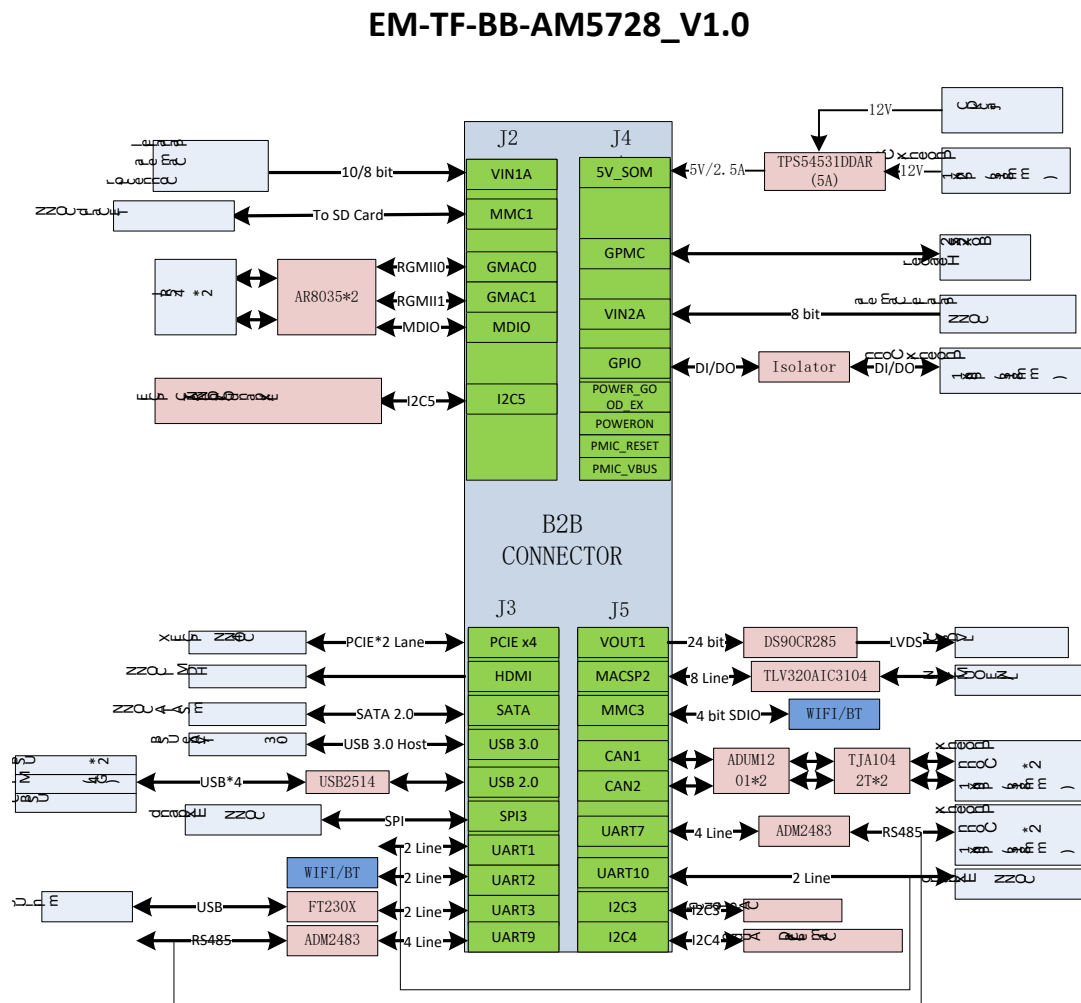
- 1X EM-TF-SOM-AM5728
- 1X EM-TF-BB-AM5728
- 1X Quick Start Guide
- 1X Power Supply(Option)

1.4 Product Features

- **Electrical Features**

  - Operating Temperature: -40~85℃（Industrial）.
  - Power Supply: 7-28V/12V@2A（Power Adapter）
  - Operating Humidity: 20%～90%（no condensation）

- **Interface**

  - 1X DC Jack + 1X2PIN 3.81mm Terminal Block
  - 2X Giga Ethernet（RJ45）
  - 2X USB2.0 Host
  - 1X USB3.0
  - 1X HDMI
  - 1X Audio
  - 1X MIC
  - 1X SIM-Card
  - 1X PCIEX4
  - 2X mini PCIE
  - 1X Mini-USB for Debug
  - 2X RS485
  - 2X CAN
  - 2X 8bit Camera
  - 1X LCD（I2C or USB2.0 Touch interface）
  - 2 XDIDO
  - 1X Micro SD-Card
  - 2X 25 Pin GPMC
  - 2X 20 Pin Expansion Pin Header(SPI、I2C、UART)
  - 2X User Button
  - 1X Reset Button
  - 2X BOOT DIP Switch
  - RTC Battery
  - 1X 2pin Fan Header

1.5 Board Component Locations
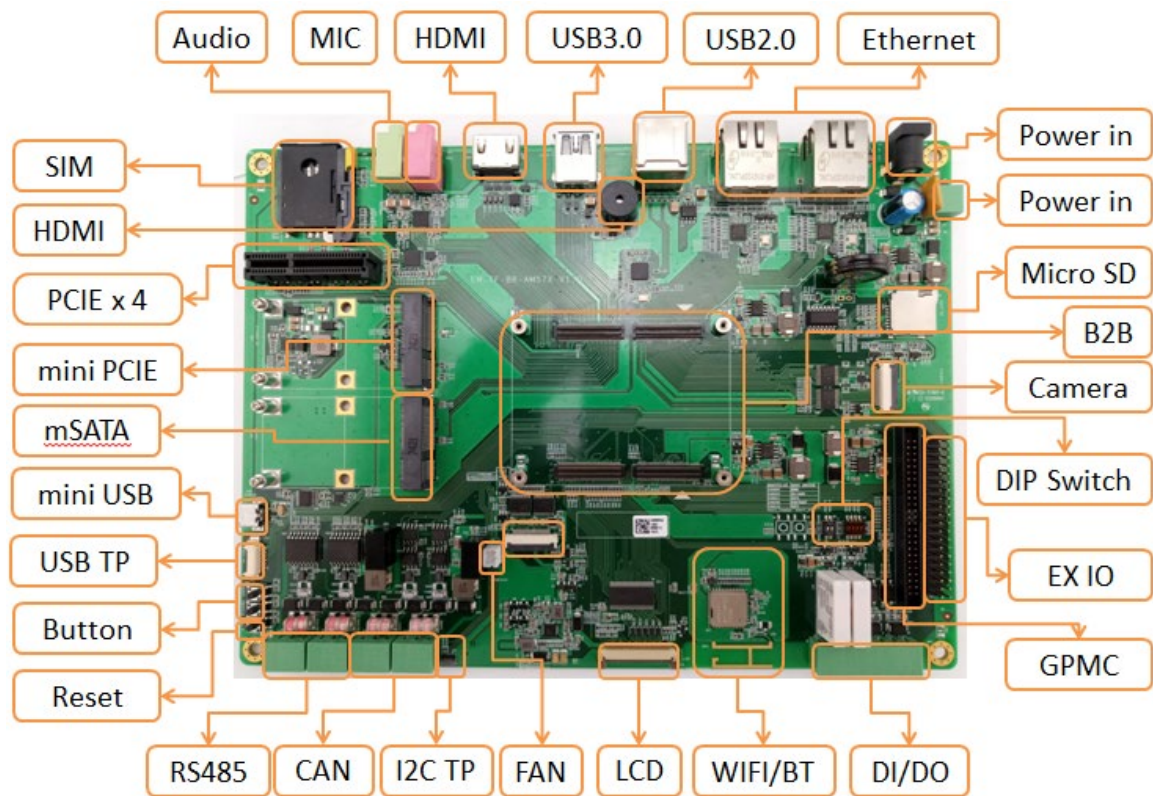
Figure1- 2 EM-TF-BB-AM5728 Top
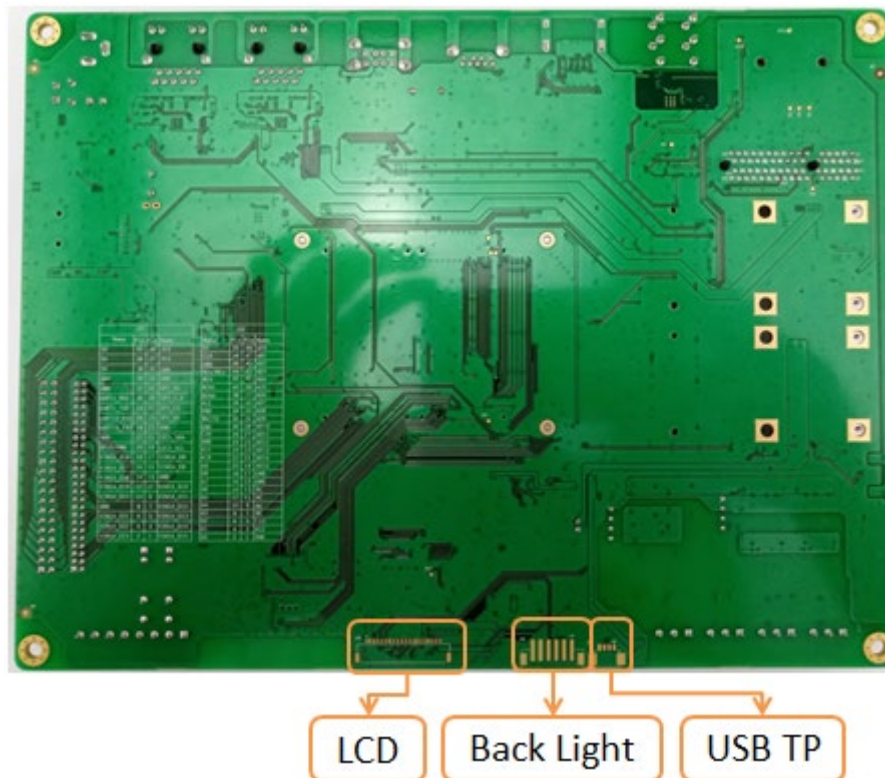
Figure1- 3 EM-TF-BB-AM5728 Bottom

1.6 Product Dimensions
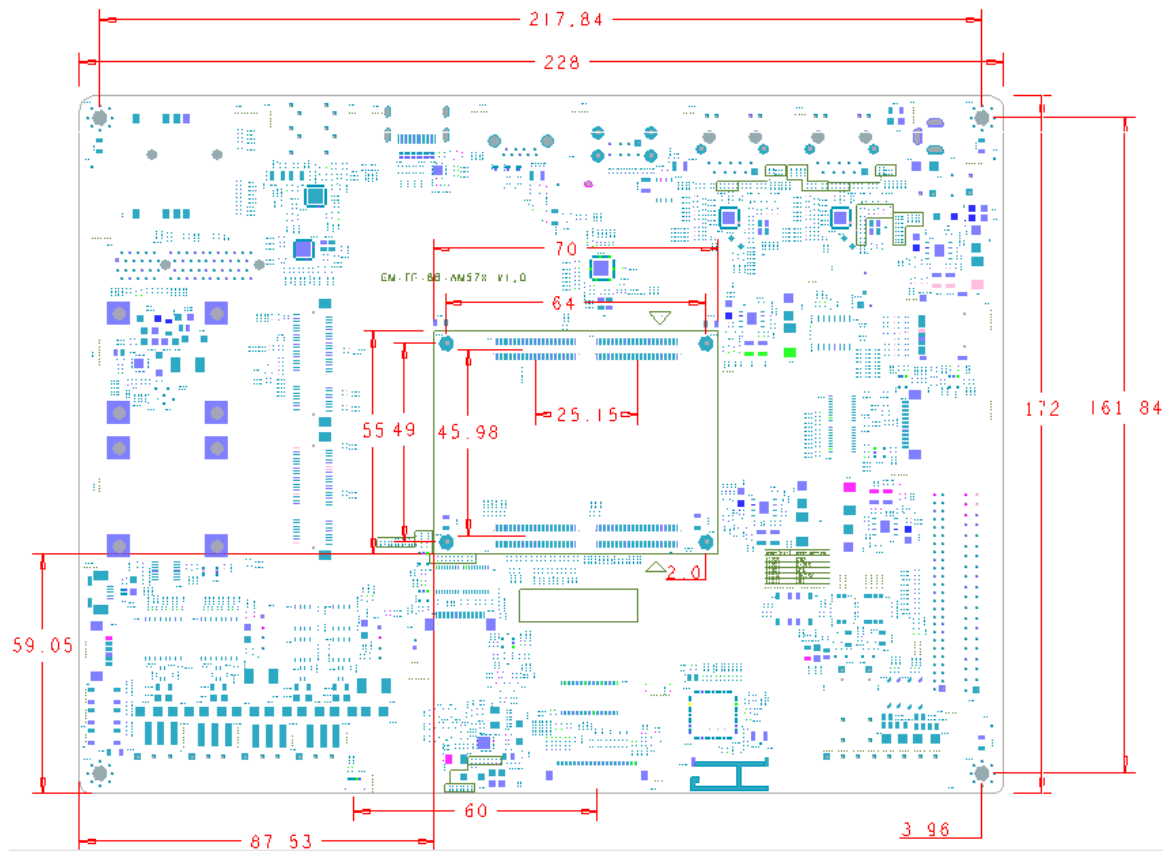
Figure1- 4   PCB Dimension (Unit: mm)

1.7 Component Height
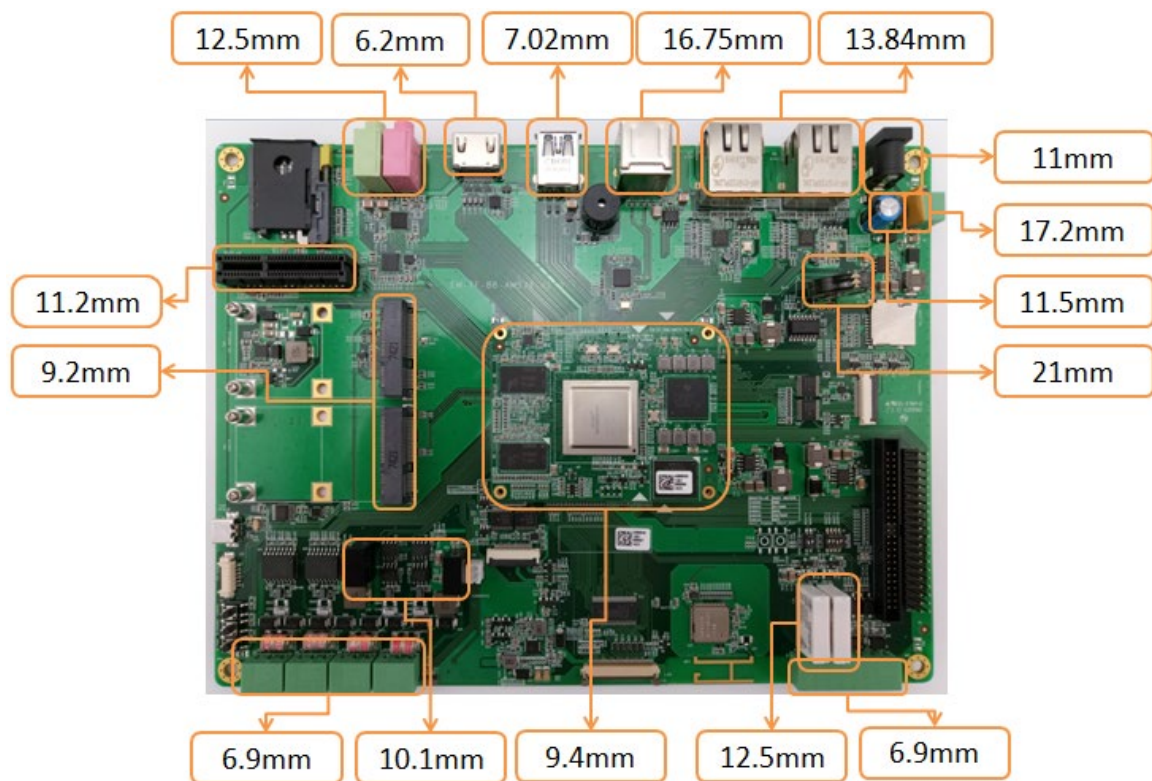
Figure1- 5 Component Height (Unit: mm)

1.8 B2B Connector Specification

The EM-TF-SOM-AM5728 is connected to EM-TF-BB-AM5728 through 4pcs board to board connectors. The connectors are 2x40 pins, the pitch is 0.5mm.

◆   EM-TF-SOM-AM5728 is used female connector MB250-G80S-B1R（MTCONN）

◆   EM-TF-BB-AM5728 is used male connector MB250-G80P-B1R（MTCONN）

Chapter2. Hardware System Description

This section mainly descripted the structure and the interface of the hardware system.

2.1 Installation and BOOT

2.1.1 Installation

Install the EM-TF-SOM-AM5728 board on the EM-TF-BB-AM5728 board correctly.   And connect the device that used.
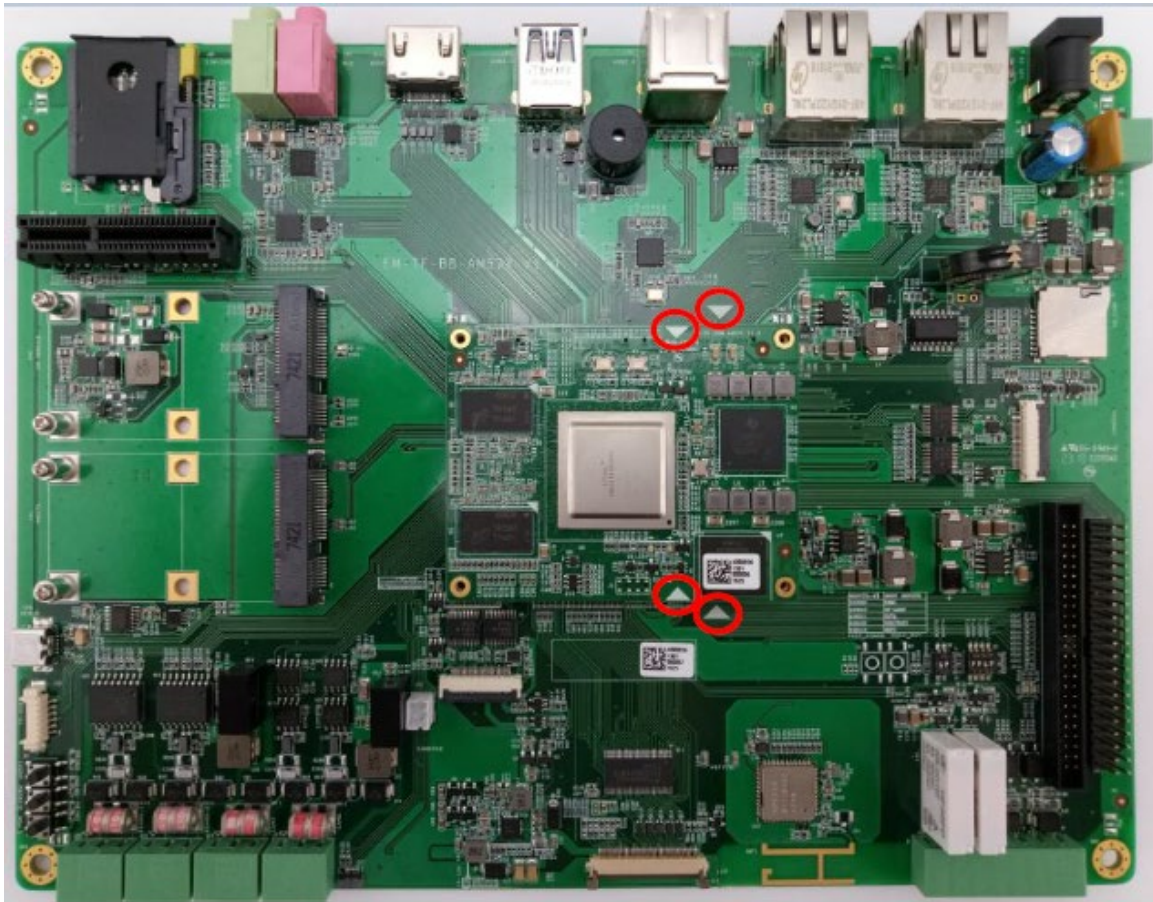
Figure2- 1 Assembly
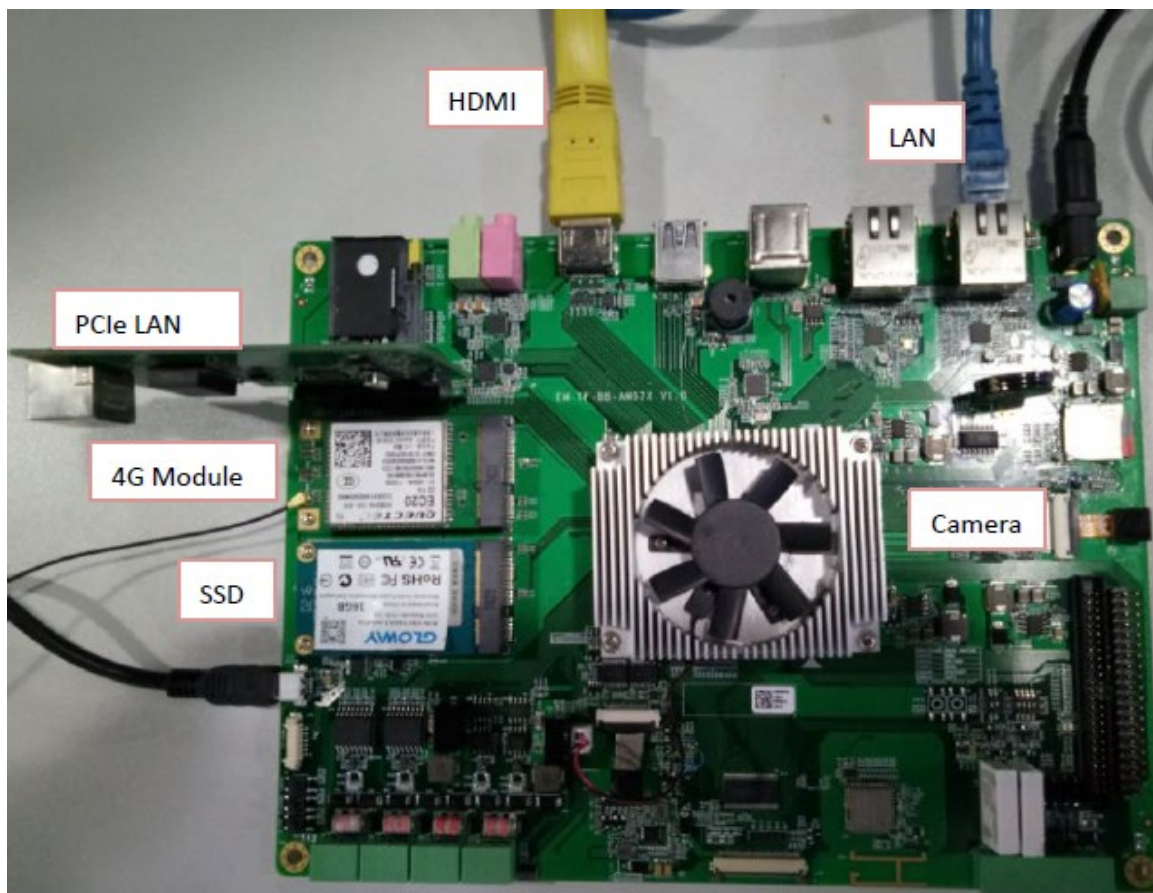
Figure2- 2 Device connection

2.1.2 BOOT Setting

EM-TF-BB-AM5728 can be set the system boot from Micro SD card or eMMC. But it boot from Micro SD card default.

2.2 2.2 Interface Description

This section descripted all function blocks and the signals definition on the connector in detail, in order to be understood the EM-TF-BB-AM5728 board.

2.2.1 B2B Connector

◆ Board to board connector

Figure2- 3 B2B Connector Location

◆ Signals definition on the B2B Connector

Table2- 1 J2 Signals Definition

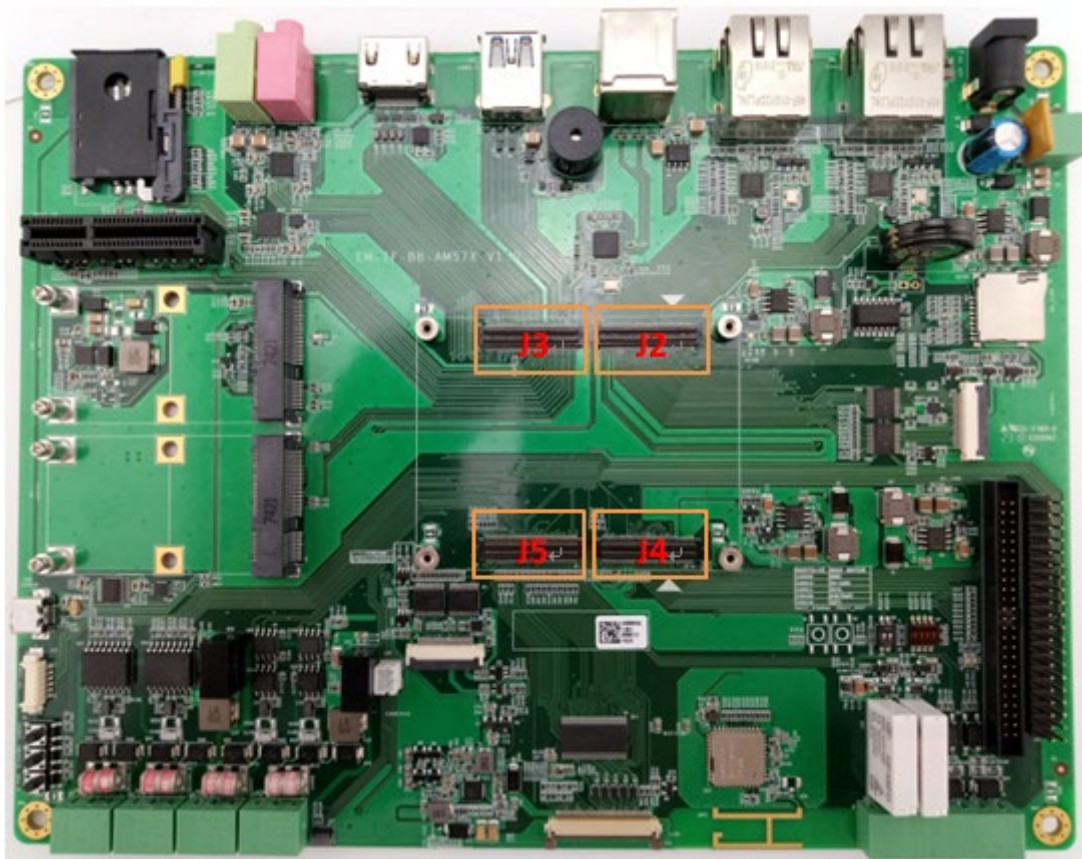| Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
						J2			
1	GND				2	GND			
3	VIN1A DE0	O	3.3	Camera 1 Power Down	4	RGMII0 TXC	O	3.3	RGMII0 Transmit Clock
5	VIN1A HSYNC0	I	3.3	Camera 1 Horizontal Sync	6	RGMII0 TXCTL	O	3.3	RGMII0 Transmit Enable
7	VIN1A VSYNC0	I	3.3	Camera 1 Vertical Sync	8	RGMII0 TXD3	O	3.3	RGMII0 Transmit Data3
9	VIN1A CLK0	I	3.3	Camera 1 Clock	10	RGMII0 TXD2	O	3.3	RGMII0 Transmit Data2
11	VIN1A FLD0	O	3.3	Camera 1 Reset	12	RGMII0 TXD1	O	3.3	RGMII0 Transmit Data1
13	GND				14	RGMII0 TXD0	O	3.3	RGMII0 Transmit Data0
15	VIN1A D0	I	3.3	Camera 1 DATA0	16	GND			
17	VIN1A D2	I	3.3	Camera 1 DATA2	18	RGMII0 RXC	I	3.3	RGMII0 Receive Clock
19	VIN1A D3	I	3.3	Camera 1 DATA3	20	RGMII0 RXCTL	I	3.3	RGMII0 Receive Control
21	VIN1A D1	I	3.3	Camera 1 DATA1	22	RGMII0 RXD3	I	3.3	RGMII0 Receive Data3
23	VIN1A D6	I	3.3	Camera 1 DATA6	24	RGMII0 RXD2	I	3.3	RGMII0 Receive Data2
25	VIN1A D5	I	3.3	Camera 1 DATA5	26	RGMII0 RXD1	I	3.3	RGMII0 Receive Data1
27	VIN1A D11	IO	3.3	GPIO	28	RGMII0 RXD0	I	3.3	RGMII0 Receive Data0
29	VIN1A D7	I	3.3	Camera 1 DATA7	30	GND			
31	VIN1A D8	IO	3.3	GPIO	32	MDIO D	IO	3.3	RGMII0/RGMII1 MDIO Data
33	VIN1A D4	I	3.3	Camera 1 DATA4	34	MDIO CLK	O	3.3	RGMII0/RGMII1 MDIO Clock
35	VIN1A D13	IO	3.3	GPIO	36	GPIO4 18	O	3.3	RGMII0 INT
37	VIN1A D10	IO	3.3	GPIO	38	GPIO6 4	O	3.3	RGMII1 INT
39	VIN1A D9	IO	3.3	GPIO	40	GPIO4 12	O	3.3	mini PCIE Wake
41	VIN1A D21	IO	3.3	GPIO	42	GPIO4 9	O	3.3	mini PCIE Reset
43	VIN1A D18	IO	3.3	GPIO	44	GPIO5 18	I	3.3	RTC INT
45	VIN1A D12	IO	3.3	GPIO	46	GPIO5 19	O	3.3	BEEP Control
47	VIN1A D15	IO	3.3	GPIO	48	I2C5 SDA	IO	3.3	PCIE/RTC/EX IO Connector I2C SDA
49	VIN1A D16	IO	3.3	GPIO	50	I2C5 SCL	O	3.3	PCIE/RTC/EX IO Connector I2C SCLK
51	VIN1A D14	IO	3.3	GPIO	52	GND			
53	VIN1A D19	IO	3.3	GPIO	54	RGMII1 RXC	I	3.3	RGMII1 Receive Clock
55	VIN1A D17	IO	3.3	GPIO	56	RGMII1 RXCTL	I	3.3	RGMII1 Receive Control
57	VIN1A D22	IO	3.3	GPIO	58	RGMII1 RXD0	I	3.3	RGMII1 Receive Data0
59	VIN1A D20	IO	3.3	GPIO	60	RGMII1 RXD1	I	3.3	RGMII1 Receive Data1
61	VIN1A D23	IO	3.3	GPIO	62	RGMII1 RXD2	I	3.3	RGMII1 Receive Data2
63	GND				64	RGMII1 RXD3	I	3.3	RGMII1 Receive Data3
65	MMC1 DATA0	IO	3.3	SD-Card Data0	66	GND			
67	MMC1 DATA1	IO	3.3	SD-Card Data1	68	RGMII1 TXCTL	O	3.3	RGMII1 Transmit Enable
69	MMC1 DATA2	IO	3.3	SD-Card Data2	70	RGMII1 TXC	O	3.3	RGMII1 Transmit Clock
71	MMC1 DATA3	IO	3.3	SD-Card Data3	72	RGMII1 TXD0	O	3.3	RGMII1 Transmit Data0
73	MMC1 CMD	O	3.3	SD-Card CMD	74	RGMII1 TXD1	O	3.3	RGMII1 Transmit Data1
75	MMC1 CLK	O	3.3	SD-Card CLK	76	RGMII1 TXD2	O	3.3	RGMII1 Transmit Data2
77	MMC1 SDCD	I	3.3	SD-Card Card Detect	78	RGMII1 TXD3	O	3.3	RGMII1 Transmit Data3
79	GND				80	SOM DET1	O		SOM Board Detect

Table2- 2 J3 Signals Definition

Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
									J3
1	GND				2	GND			
3	UART9 TXD	O	3.3	RS485 PORT2 Transmit Data Output	4	GPIO7 8	O	3.3	Touch Panel Reset
5	UART9 RXD	I	3.3	RS485 PORT2 Receive Data Input	6	GPIO7 11	I	3.3	Touch Panel INT
7	UART9 RTSN	O	3.3	NC	8	GPIO7 10	O	3.3	Audio Codec Reset
9	UART9 CTSN	I	3.3	NC	10	GPIO7 7	I	3.3	PCIE PRSNT
11	UART3 TXD	O	3.3	Debug PORT Transmit Data Output	12	GPIO7 9	O	3.3	mini PCIE W DISABLE#
13	UART3 RXD	I	3.3	Debug PORT Receive Data Input	14	GPIO6 19	IO	3.3	NC
15	UART2 TXD	O	3.3	RS485 PORT1 Transmit Data Output	16	GPIO6 5	I	3.3	USB3.0 Power OC Detect
17	UART2 RXD	I	3.3	RS485 PORT1 Receive Data Input	18	GND			
19	UART1 TXD	O	3.3	UART1 Transmit Data Output	20	HDMI DDC HPD	I	3.3	HDMI display hot plug detect
21	UART1 RXD	I	3.3	UART1 Receive Data Input	22	HDMI DDC CEC	IO	3.3	HDMI consumer electronic control
23	GND				24	HDMI DDC SDA	IO	3.3	HDMI display data channel data
25	SPI3 D1	IO	3.3	SPI3 Data I/O. Can be configured as either MISO or MOSI.	26	HDMI DDC SCL	O	3.3	HDMI display data channel clock
27	SPI3 SCLK	O	3.3	SPI3 Clock	28	GND			
29	SPI3 CS0	O	3.3	SPI3 Chip Select	30	HDMI DATA2P	O		HDMI D2+
31	SPI3 D0	IO	3.3	SPI3 Data I/O. Can be configured as either MISO or MOSI.	32	HDMI DATA2N	O		HDMI D2-
33	GPIO5 10	O	3.3	c	34	GND			
35	TIMER4	IO	3.3	GPIO/PWM	36	HDMI DATA1P	O		HDMI D1+
37	GND				38	HDMI DATA1N	O		HDMI D1-
39	PCIE REFCLKN	I		PCIe Reference CLK- for MPU	40	GND			
41	PCIE REFCLKP	I		PCIe Reference CLK+ for MPU	42	HDMI DATA0P	O		HDMI D0+
43	GND				44	HDMI DATA0N	O		HDMI D0-
45	PCIE RXN0	I		PCIe Receive Data Lane 0-	46	GND			
47	PCIE RXP0	I		PCIe Receive Data Lane 0+	48	HDMI CLKP	O		HDMI CLK+
49	GND				50	HDMI CLKN	O		HDMI CLK-
51	PCIE TXN0	O		PCIe Transmit Data Lane 0-	52	GND			
53	PCIE TXP0	O		PCIe Transmit Data Lane 0+	54	USB1 DRVVBUS	O	3.3	USB3.0 Power Enable
55	GND				56	USB1 DM	IO		USB2.0 D-
57	PCIE RXN1	I		PCIe Receive Data Lane 1-	58	USB1 DP	IO		USB2.0 D+
59	PCIE RXP1	I		PCIe Receive Data Lane 1+	60	GND			
61	GND				62	USB RXN0	I		USB3.0 Receive D-
63	PCIE TXN1	O		PCIe Transmit Data Lane 1-	64	USB RXP0	I		USB3.0 Receive D+
65	PCIE TXP1	O		PCIe Transmit Data Lane 1+	66	GND			
67	GND				68	USB TXN0	O		USB3.0 Transmit D-
69	SATA1 TXN0	O		SATA Transmit lane 0-	70	USB TXP0	O		USB3.0 Transmit D+
71	SATA1 TXP0	O		SATA Transmit lane 0+	72	GND			
73	GND				74	USB2 DRVVBUS	O	3.3	USB2.0 Hub Reset
75	SATA1 RXN0	I		SATA Receive lane 0-	76	USB2 DM	IO		USB2.0 D-
77	SATA1 RXP0	I		SATA Receive lane 0+	78	USB2 DP	IO		USB2.0 D+
79	GND				80	GND			

Table2- 3 J4 Signals Definition

Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
						J4			
Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
1	5V VDD SOM		5	Power for SOM Board	2	GND			
3	5V VDD SOM		5	Power for SOM Board	4	GPMC CLK	IO	3.3	GPMC Clock output
5	5V VDD SOM		5	Power for SOM Board	6	GPMC BEN0	O	3.3	GPMC lower-byte enable active low
7	5V VDD SOM		5	Power for SOM Board	8	GPMC OEN REN	O	3.3	GPMC output enable active low or read enable
9	5V VDD SOM		5	Power for SOM Board	10	GPMC BEN1	O	3.3	GPMC upper-byte enable active low
11	5V VDD SOM		5	Power for SOM Board	12	GPMC ADVN ALE	O	3.3	GPMC address valid active low or address latch enable
13	GND				14	GPMC WAIT0	I	3.3	GPMC external indication of wait 0
15	GND				16	GPMC WEN	O	3.3	GPMC write enable active low
17	GND				18	GND			
19	GPMC CS3	O	3.3	GPMC Chip Select 3	20	GPMC AD1	IO	3.3	GPMC Data1
21	GPMC CS0	O	3.3	GPMC Chip Select 0	22	GPMC AD8	IO	3.3	GPMC Data8
23	GPMC A7	O	3.3	GPMC Address A7	24	GPMC AD3	IO	3.3	GPMC Data3
25	GPMC A9	O	3.3	GPMC Address A9	26	GPMC AD7	IO	3.3	GPMC Data7
27	GPMC A6	O	3.3	GPMC Address A6	28	GPMC AD9	IO	3.3	GPMC Data9
29	GPMC A2	O	3.3	GPMC Address A2	30	GPMC AD10	IO	3.3	GPMC Data10
31	GPMC A12	O	3.3	GPMC Address A12	32	GPMC AD6	IO	3.3	GPMC Data6
33	GPMC A0	O	3.3	GPMC Address A0	34	GPMC AD11	IO	3.3	GPMC Data11
35	GPMC A4	O	3.3	GPMC Address A4	36	GPMC AD5	IO	3.3	GPMC Data5
37	GPMC A8	O	3.3	GPMC Address A8	38	GPMC AD12	IO	3.3	GPMC Data12
39	GPMC A3	O	3.3	GPMC Address A3	40	GPMC AD2	IO	3.3	GPMC Data2
41	GPMC A10	O	3.3	GPMC Address A10	42	GPMC AD13	IO	3.3	GPMC Data13
43	GPMC A11	O	3.3	GPMC Address A11	44	GPMC AD14	IO	3.3	GPMC Data14
45	GPMC A5	O	3.3	GPMC Address A5	46	GPMC AD15	IO	3.3	GPMC Data15
47	GPMC A1	O	3.3	GPMC Address A1	48	GPMC AD0	IO	3.3	GPMC Data0
49	GND				50	GPMC AD4	IO	3.3	GPMC Data4
51	POWER GOOD EX	O	3.3	3V3 VDDB/5V VDD Power Enable	52	GND			
53	GPIO5 12	O	3.3	Uesr LED1	54	VIN2A HSYNC0	I	3.3	Camera 0 Horizontal Sync
55	GPIO4 17	O	3.3	Uesr LED2	56	VIN2A VSYNC0	I	3.3	Camera 0 Vertical Sync
57	GPIO5 11	I	3.3	Uesr Button1 Input	58	VIN2A CLK0	I	3.3	Camera 0 Clock
59	POWERON	I	3.3	Power On SOM Board PMIC(Reserved)	60	VIN2A DE0	O	3.3	Camera 0 Power Down
61	PMIC RESET IN	I	3.3	Reset SOM Board PMIC(Reserved)	62	VIN2A FLD0	O	3.3	Camera 0 Reset
63	GND				64	VIN2A D6	I	3.3	Camera 0 DATA6
65	EHRPWM2B	I	3.3	DI2 Input	66	VIN2A D4	I	3.3	Camera 0 DATA4
67	EHRPWM2A	I	3.3	DI1 Input	68	VIN2A D2	I	3.3	Camera 0 DATA2
69	GND				70	VIN2A D0	I	3.3	Camera 0 DATA0
71	GPIO6 6	I	3.3	Uesr Button2 Input	72	VIN2A D3	I	3.3	Camera 0 DATA3
73	GPIO5 4	O	3.3	DO2 Control	74	VIN2A D1	I	3.3	Camera 0 DATA1
75	GND				76	VIN2A D5	I	3.3	Camera 0 DATA5
77	CLKOUT3	O	3.3	Camera 0/1 Clock input(Reserved)	78	VIN2A D7	I	3.3	Camera 0 DATA7
79	GND				80	GND			

Table2- 4 J5 Signals Definition

Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
					J5				
Pin	Signal Name	IO	Voltage(V)	Description	Pin	Signal Name	IO	Voltage(V)	Description
1	GND				2	GND			
3	I2C3 SCL	O	3.3	Camera1/Touch panel I2C SCLK	4	VOUT1 D7	O	3.3	LVDS Convert Data7
5	I2C3 SDA	IO	3.3	Camera1/Touch panel I2C SDA	6	VOUT1 D10	O	3.3	LVDS Convert Data10
7	GPIO1 24	I	3.3	WIFI to wake-up HOST	8	VOUT1 D13	O	3.3	LVDS Convert Data13
9	ECAP3	O	3.3	LCD Back Light PWM	10	VOUT1 D15	O	3.3	LVDS Convert Data15
11	GPIO7 15	I	3.3	Bluetooth device to wake-up HOST	12	VOUT1 D12	O	3.3	LVDS Convert Data12
13	GPIO7 17	O	3.3	BT REG ON	14	VOUT1 D16	O	3.3	LVDS Convert Data16
15	GPIO7 16	O	3.3	HOST wake-up Bluetooth device	16	VOUT1 D6	O	3.3	LVDS Convert Data6
17	GPIO7 14	O	3.3	WIFI REG ON	18	VOUT1 D17	O	3.3	LVDS Convert Data17
19	UART7 TXD	O	3.3	BT Transmit Data Output	20	VOUT1 D18	O	3.3	LVDS Convert Data18
21	UART7 RXD	I	3.3	BT Receive Data Input	22	VOUT1 D19	O	3.3	LVDS Convert Data19
23	UART7 RTSN	O	3.3	BT Request to Send Control	24	VOUT1 D23	O	3.3	LVDS Convert Data23
25	UART7 CTSN	I	3.3	BT Clear To Send Control	26	VOUT1 D22	O	3.3	LVDS Convert Data22
27	GND				28	VOUT1 D21	O	3.3	LVDS Convert Data21
29	MMC3 DATA2	IO	3.3	WIFI SDIO DATA2	30	VOUT1 D14	O	3.3	LVDS Convert Data14
31	MMC3 DATA0	IO	3.3	WIFI SDIO DATA0	32	VOUT1 D11	O	3.3	LVDS Convert Data11
33	MMC3 DATA1	IO	3.3	WIFI SDIO DATA1	34	VOUT1 D20	O	3.3	LVDS Convert Data20
35	MMC3 CMD	O	3.3	WIFI SDIO CMD	36	VOUT1 D9	O	3.3	LVDS Convert Data9
37	MMC3 DATA3	IO	3.3	WIFI SDIO DATA3	38	VOUT1 D8	O	3.3	LVDS Convert Data8
39	MMC3 CLK	O	3.3	WIFI SDIO CLK	40	GND			
41	GND				42	VOUT1 HSYNC	O	3.3	LVDS Convert Horizontal Sync output
43	UART10 RXD	I	3.3	UART1 Receive Data Input	44	VOUT1 FLD	O	3.3	LVDS Convert Power down
45	UART10 TXD	O	3.3	UART1 Transmit Data Output	46	VOUT1 DE	O	3.3	LVDS Convert Data Enable output
47	DCAN1 RX	I	3.3	DCAN1 receive data	48	VOUT1 CLK	O	3.3	LVDS Convert Clock output
49	DCAN1 TX	O	3.3	DCAN1 transmit data	50	VOUT1 VSYNC	O	3.3	LVDS Convert Vertical Sync output
51	DCAN2 RX	I	3.3	DCAN2 receive data	52	GND			
53	DCAN2 TX	O	3.3	DCAN2 transmit data	54	VOUT1 D4	O	3.3	LVDS Convert Data4
55	GND				56	VOUT1 D0	O	3.3	LVDS Convert Data0
57	MCASP1 FSX	O	3.3	DO1 Control	58	VOUT1 D2	O	3.3	LVDS Convert Data2
59	MCASP1 AXR0	O	3.3	LCD Reset	60	VOUT1 D3	O	3.3	LVDS Convert Data3
61	MCASP1 AXR1	O	3.3	LCD StandBy Control	62	VOUT1 D1	O	3.3	LVDS Convert Data1
63	MCASP1 ACLKX	O	3.3	RS485 PORT1 Driver/Receiver Enable	64	VOUT1 D5	O	3.3	LVDS Convert Data5
65	MCASP1 AHCLKX	O	3.3	Audio Transmit High-Frequency Master Clock I/O	66	GPIO2 29	O	3.3	LCD Back Light Power Enable
67	GND				68	NMI DSP	I	3.3	NC
69	MCASP2 AXR1	IO	3.3	Audio Transmit/Receive Data1	70	SYS RESETn	O	3.3	PCIE/RGMMIO/RGMMI1 Reset
71	MCASP2 AXR0	IO	3.3	Audio Transmit/Receive Data0	72	I2C4 SDA	IO	3.3	Camera0/Audio Codec I2C SDA
73	MCASP2 FSX	O	3.3	Audio Transmit Frame Sync I/O	74	I2C4 SCL	O	3.3	Camera0/Audio Codec I2C SCLK
75	MCASP2 ACLKX	O	3.3	Audio Transmit Bit Clock I/O	76	REGEN1	O	3.3	Boot Device Power Enable
77	MCASP2 AHCLKX	O	3.3	Audio Transmit High-Frequency Master Clock I/O	78	PORZ	I	3.3	Power On Reset Button
79	GND				80	SOM DET2	O		SOM Board Detect

2.2.2 Power Input

EM-TF-BB-AM5728 used a DC-Jack or a 3.81mm pitch 2pins terminal block for the power input interface. The

voltage can be 7-28V.
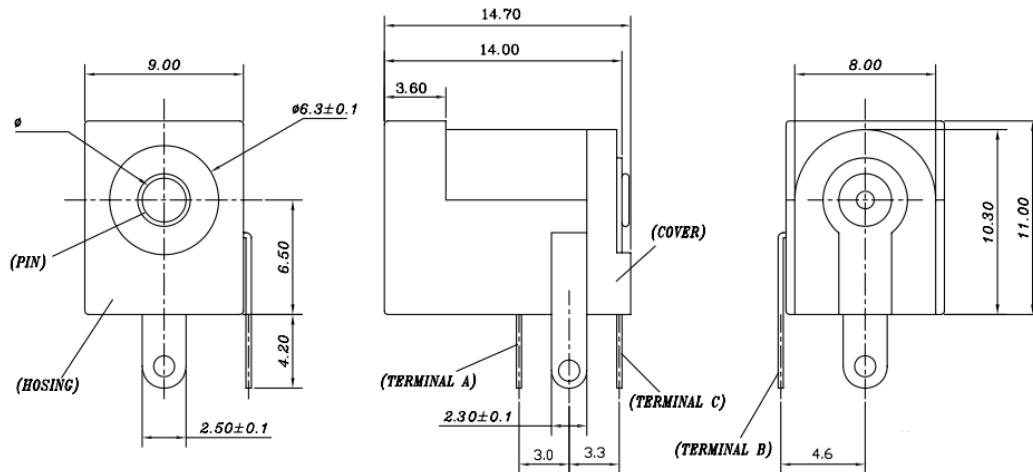
Figure2- 4 DC-Jack

TP381H-00V

L=P×Poles
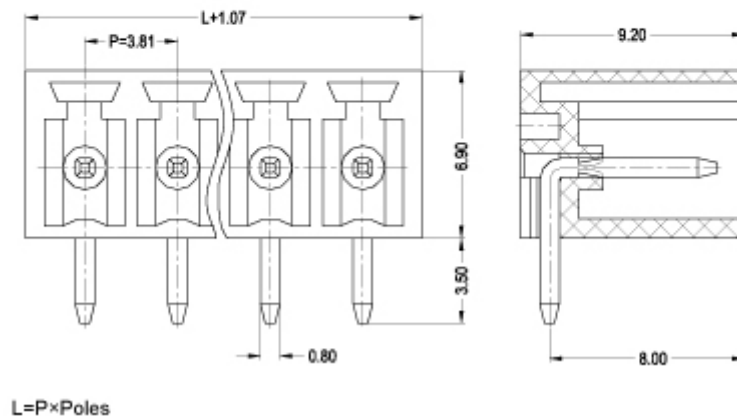
Figure2- 5 2Pins Terminal Block

2.2.3 LCD/HDMI

There are LCD and HDMI connector in EM-TF-BB-AM5728. It is important for video application.

◆ **LCD**

EM-TF-BB-AM5728 select a high performance transmitter convert DS90CR285MTDX/NOPB (U11). The DS90CR285 transmitter converts 28 bits of LVCMOS/LVTTL data into four LVDS (Low Voltage Differential Signaling) data streams. The LVDS signals connect to LCD module through a 40 pins FPC connector (J10). The LCD module power solution designed in the EM-TF-BB-AM5728, so it is not need the power solution on LCD module. It support 7 inch LCD module SPF-PH102600T009-IBC03_001[1](I2C interface touch panel) and

SPF-PH102600T009-IBC04_001[1](USB interface touch panel). Also it reserved connector that definition by Embest to compatible others LCD module.

■0.5mm Pitch Top Contact Type
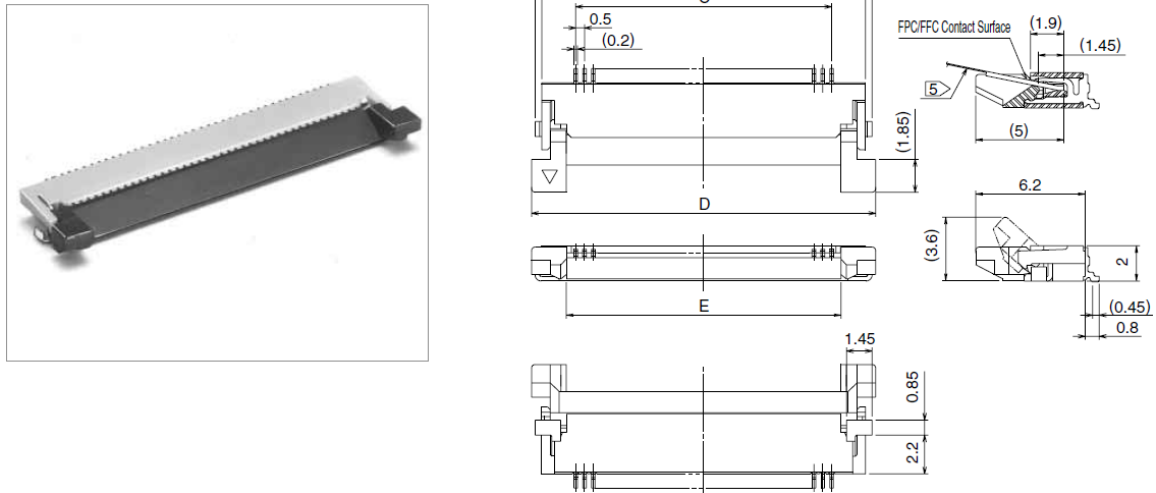
Figure2- 6 LCD FPC Connector

■Connector Dimensions
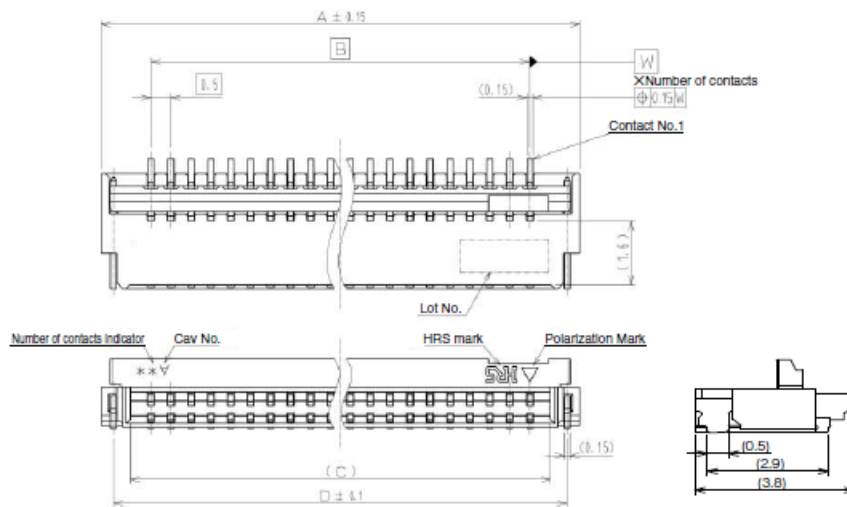
Note 1 : The coplanarity of each terminal lead within specified dimension is 0.1mm Max.
Note 2 : Packaged on tape and reel only. Check packaging specification.
Note 3 : Slight variations in color of the plastic compounds do not affect form, fit or function of the connector.
Note 4 : After reflow, the terminal plating may change color, however this does not represent a quality issue.

Unit : mm

Part No.	HRS No.	No. of Contacts	A	B	C	D
FH34SRJ-4S-0.5SH(50)	580-1238-7 50	4	4	1.5	2.53	3.38
FH34SRJ-5S-0.5SH(50)	580-1264-7 50	5	4.5	2	3.03	3.88
FH34SRJ-6S-0.5SH(50)	580-1236-1 50	6	5	2.5	3.53	4.38

Figure2- 7 LCD I2C Interface TP Connector

Figure2- 8 LCD USB Interface TP Connector

Table2- 5 LCD Signals

Pin	Signal Name	Description	Pin	Signal Name	Description
			J10		
1	VCOM_LVDS	Common Power	21	TXOUT3+	LVDS differential data3+
2	3V3_VDDB	Digital Power	22	GND	
3	3V3_VDDB	Digital Power	23	NC	No connection
4	NC	No connection	24	NC	No connection
5	MCASP1_AXR0	Reset	25	GND	
6	MCASP1_AXR1	StandBy	26	NC	No connection
7	GND		27	DIM_LVDS	Pull up.Turn on external backlight controller
8	TXOUT0-	LVDS differential data0-	28	SELB_LVDS	Pull down.8 bits data input
9	TXOUT0+	LVDS differential data0+	29	VAVDD_LVDS	Analog Power
10	GND		30	GND	
11	TXOUT1-	LVDS differential data1-	31	VLED-	LED Cathode
12	TXOUT1+	LVDS differential data1+	32	VLED-	LED Cathode
13	GND		33	L/R_SCAN	Pull up.Left to right scan
14	TXOUT2-	LVDS differential data2-	34	U/D_SCAN	Pull down.Top to bottom scan
15	TXOUT2+	LVDS differential data2+	35	VGL	Gate OFF Voltage
16	GND		36	CABC_EN1	Pull down.User interface Image
17	TXCLK-	LVDS differential clk-	37	CABC_EN0	Pull up.User interface Image
18	TXCLK+	LVDS differential clk+	38	VGH	Gate ON Voltage
19	GND		39	VLED+	LED Anode
20	TXOUT3-	LVDS differential data3-	40	VLED+	LED Anode

Table2- 6 LCD TP Signals

J11		
Pin	Signal Name	Description
1	GND	
2	3V3_VDDB	POWER
3	I2C3_SCL	I2C Clock
4	I2C3_SDA	I2C Data
5	GPIO7_11	Interrupt to the Host
6	GPIO7_8	RESET
J12		
Pin	Signal Name	Description
1	NC	
2	NC	
3	GND	
4	DP4	USB differential+
5	DN4	USB differential-
6	5V_VDD	POWER

◆ **HDMI**

J13 is the standard 19 pins HDMI connector in EM-TF-BB-AM5728 board.
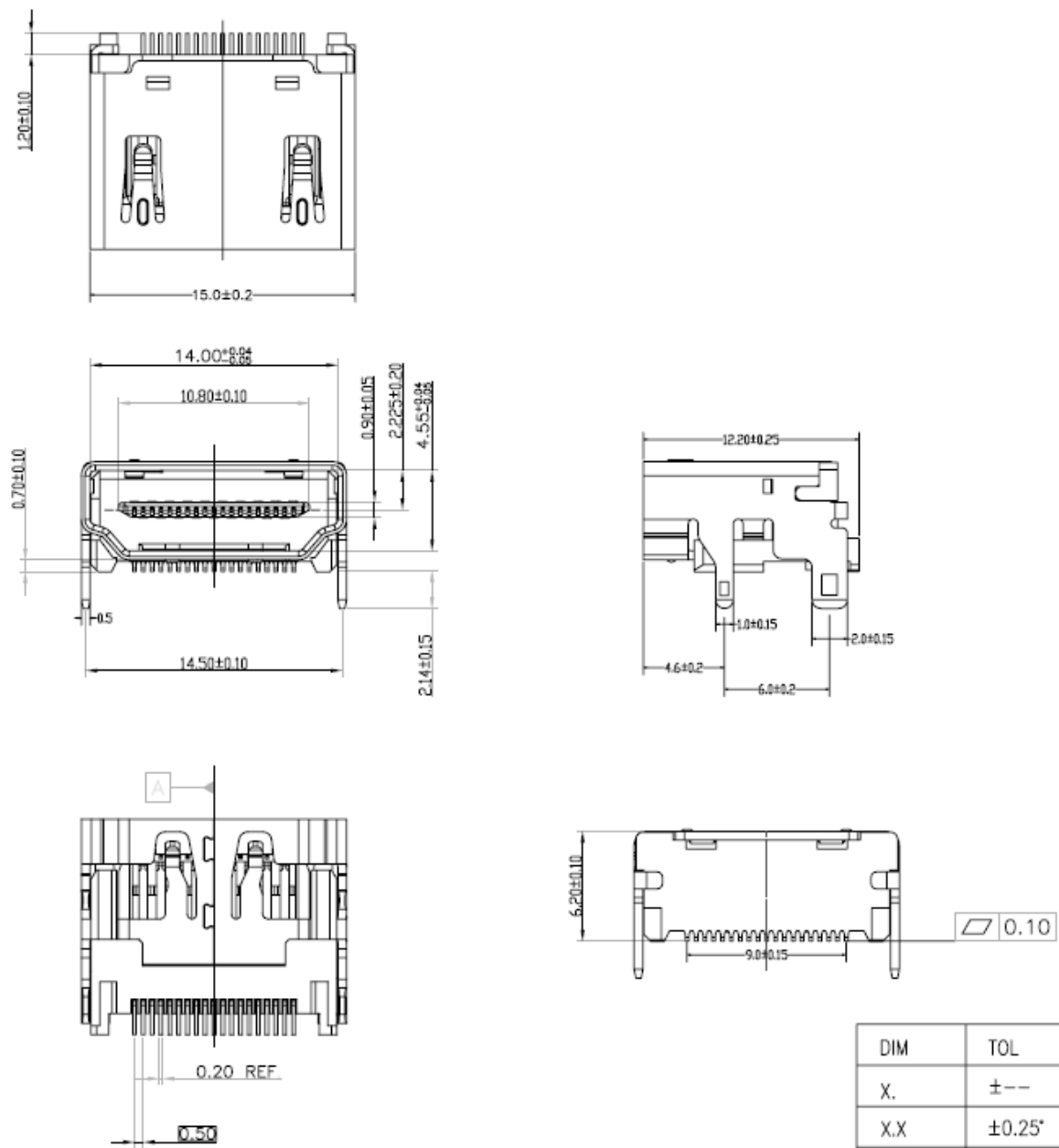
Figure2- 9 HDMI Connector

Table2- 7 HDMI Signals

J13		
Pin	Signal Name	Description
1	HDMI D2P C	
2	GND	
3	HDMI D2N C	
4	HDMI D1P C	
5	GND	
6	HDMI D1N C	
7	HDMI D0P C	
8	GND	
9	HDMI D0N C	Differential
10	HDMI CLKP C	Data & Clock, GND as
11	GND	reference for signal
12	HDMI CLKN C	
13	HDMI CEC C	Other
14	NC	
15	HDMI SCL C	
16	HDMI SDA C	I2C
17	GND	
18	5V HDMI	Power 5V
19	HDMI HPD C	Hot Plug Detect

2.2.4 Camera

EM-TF-BB-AM5728 supports two cameras at the same time. The two cameras are identical. J7/J29 is the 26 pins FPC connector for cameras.

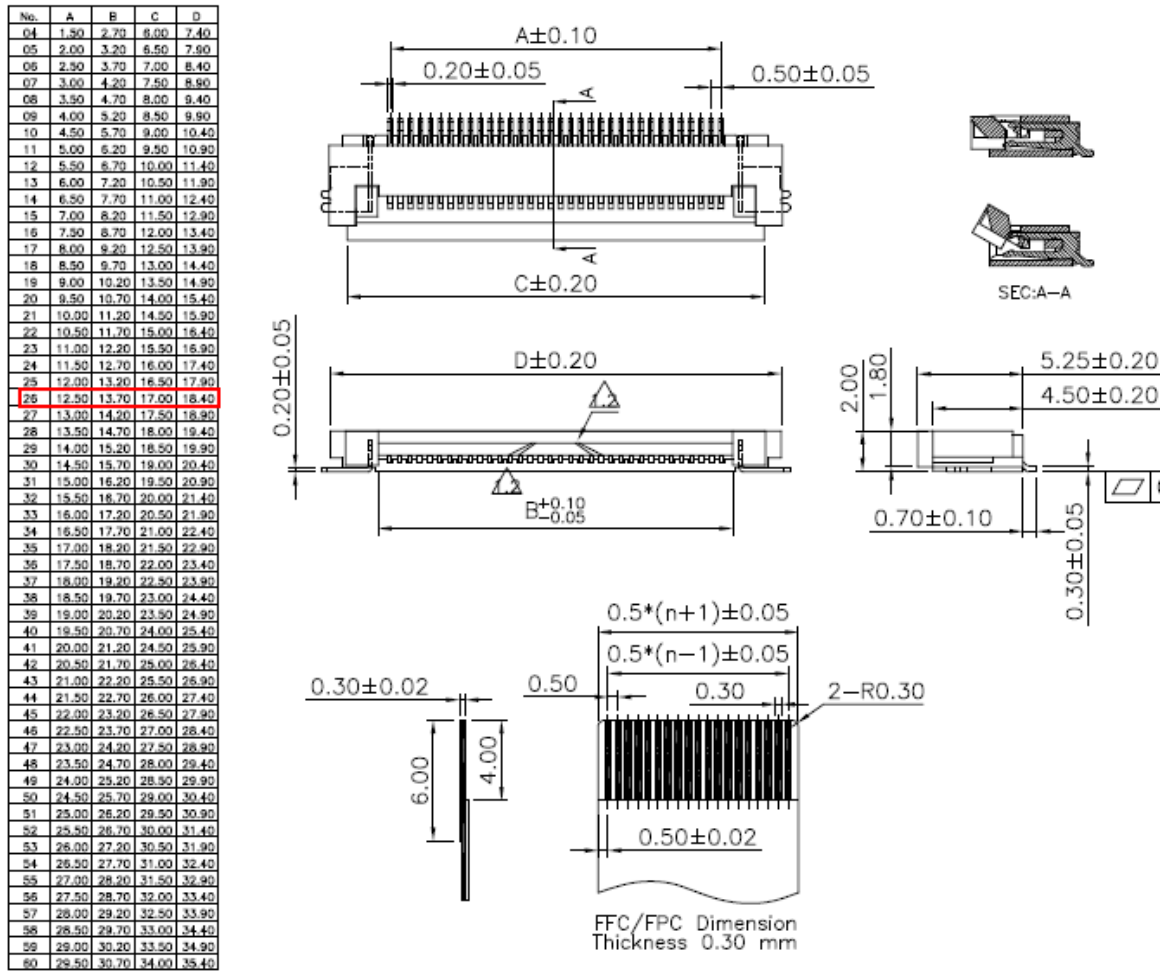| No.	A	B	C	D
04	1.50	2.70	6.00	7.40
05	2.00	3.20	6.50	7.90
06	2.50	3.70	7.00	8.40
07	3.00	4.20	7.50	8.90
08	3.50	4.70	8.00	9.40
09	4.00	5.20	8.50	9.90
10	4.50	5.70	9.00	10.40
11	5.00	6.20	9.50	10.90
12	5.50	6.70	10.00	11.40
13	6.00	7.20	10.50	11.90
14	6.50	7.70	11.00	12.40
15	7.00	8.20	11.50	12.90
16	7.50	8.70	12.00	13.40
17	8.00	9.20	12.50	13.90
18	8.50	9.70	13.00	14.40
19	9.00	10.20	13.50	14.90
20	9.50	10.70	14.00	15.40
21	10.00	11.20	14.50	15.90
22	10.50	11.70	15.00	16.40
23	11.00	12.20	15.50	16.90
24	11.50	12.70	16.00	17.40
25	12.00	13.20	16.50	17.90
26	12.50	13.70	17.00	18.40
27	13.00	14.20	17.50	18.90
28	13.50	14.70	18.00	19.40
29	14.00	15.20	18.50	19.90
30	14.50	15.70	19.00	20.40
31	15.00	16.20	19.50	20.90
32	15.50	16.70	20.00	21.40
33	16.00	17.20	20.50	21.90
34	16.50	17.70	21.00	22.40
35	17.00	18.20	21.50	22.90
36	17.50	18.70	22.00	23.40
37	18.00	19.20	22.50	23.90
38	18.50	19.70	23.00	24.40
39	19.00	20.20	23.50	24.90
40	19.50	20.70	24.00	25.40
41	20.00	21.20	24.50	25.90
42	20.50	21.70	25.00	26.40
43	21.00	22.20	25.50	26.90
44	21.50	22.70	26.00	27.40
45	22.00	23.20	26.50	27.90
46	22.50	23.70	27.00	28.40
47	23.00	24.20	27.50	28.90
48	23.50	24.70	28.00	29.40
49	24.00	25.20	28.50	29.90
50	24.50	25.70	29.00	30.40
51	25.00	26.20	29.50	30.90
52	25.50	26.70	30.00	31.40
53	26.00	27.20	30.50	31.90
54	26.50	27.70	31.00	32.40
55	27.00	28.20	31.50	32.90
56	27.50	28.70	32.00	33.40
57	28.00	29.20	32.50	33.90
58	28.50	29.70	33.00	34.40
59	29.00	30.20	33.50	34.90
60	29.50	30.70	34.00	35.40

Figure2- 10 Camera Connector

Table2- 8 Camera Signals on FPC

Pin	Signal Name	Description	Pin	Signal Name	Description
		J7			
Pin	Signal Name	Description	Pin	Signal Name	Description
1	NC		14	OV_Y6	Parallel data6
2	OV_AGND	GND	15	GND	
3	OV_SIO_D	SCCB data	16	OV_Y5	Parallel data5
4	2V8_VDD	Analog power	17	OV_PCLK	Pixel clock
5	OV_SIO_C	SCCB input clock	18	OV_Y4	Parallel data4
6	OV_RESET_L	Reset	19	OV_Y0	Parallel data0
7	OV_VSYNC	Vertical sync	20	OV_Y3	Parallel data3
8	OV_PWDN_H	Power down	21	OV_Y1	Parallel data1
9	OV_HSYNC	Horizontal sync	22	OV_Y2	Parallel data2
10	1V5_VDD	Core power	23	NC	
11	VDD_IO	I/O power	24	AF_VDD	VCM power
12	OV_Y7	Parallel data7	25	GND	
13	OV_XCLK	Clock input	26	GND	
		J29			
Pin	Signal Name	Description	Pin	Signal Name	Description
1	NC		14	OV1_Y6	Parallel data6
2	OV1_AGND	GND	15	GND	
3	OV1_SIO_D	SCCB data	16	OV1_Y5	Parallel data5
4	2V8_VDD1	Analog power	17	OV1_PCLK	Pixel clock
5	OV1_SIO_C	SCCB input clock	18	OV1_Y4	Parallel data4
6	OV1_RESET_L	Reset	19	OV1_Y0	Parallel data0
7	OV1_VSYNC	Vertical sync	20	OV1_Y3	Parallel data3
8	OV1_PWDN_H	Power down	21	OV1_Y1	Parallel data1
9	OV1_HSYNC	Horizontal sync	22	OV1_Y2	Parallel data2
10	1V5_VDD1	Core power	23	NC	
11	VDD_IO1	I/O power	24	AF_VDD1	VCM power
12	OV1_Y7	Parallel data7	25	GND	
13	OV1_XCLK	Clock input	26	GND	

2.2.5 Gig Ethernet

The EM-TF-BB-AM5728 has two Giga Ethernet PYH AR8035-AL1B solutions. It is powerful for Ethernet interface.

1. RJ-45

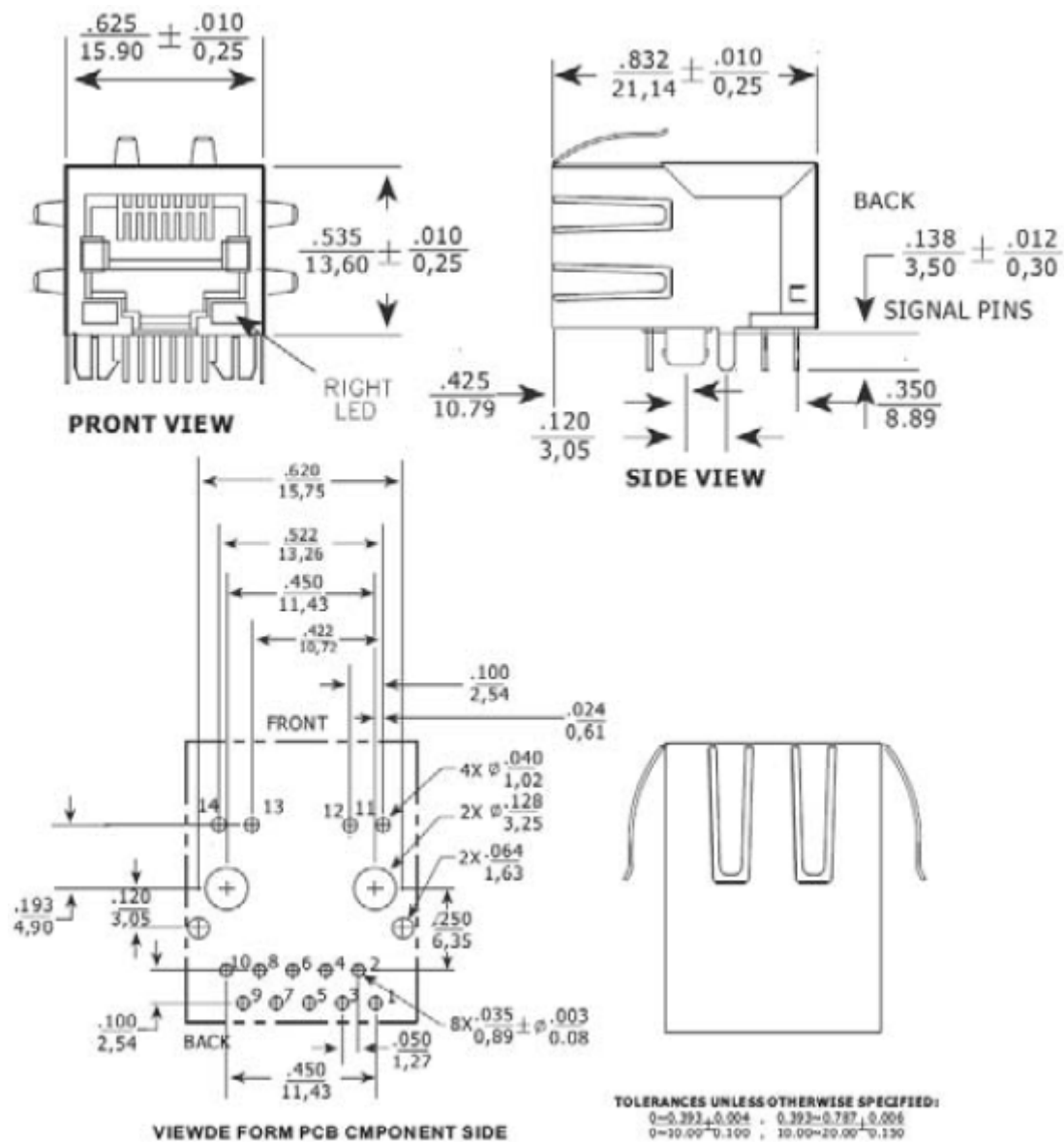J27/J28 is RJ45 connector of Giga Ethernet. The signals definition as below:

Figure2- 11 RJ45 Connector

Table2- 9 RJ45 Signals

Pin	Signal Name	Description	Pin	Signal Name	Description
J27					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	MII0_TRP0	Differential DATA0+	10	MII0_TRN3	Differential DATA3-
2	MII0_TRN0	Differential DATA0-	11	MII0_LED_LINK	LED Link+
3	MII0_TRP1	Differential DATA1+	12	GND	LED Link-
4	MII0_TRN1	Differential DATA1-	13	MII0_LED_ACT	LED_ACT-
5	MII0_CT	TCT(NC)	14	MII0_LED_YEL	LED_ACT+,Pull up
6	MII0_CT	RCT(NC)	15	GND	
7	MII0_TRP2	Differential DATA2+	16	GND	
8	MII0_TRN2	Differential DATA2-	17	NC	
9	MII0_TRP3	Differential DATA3+	18	NC	
J28					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	MII1_TRP0	Differential DATA0+	10	MII1_TRN3	Differential DATA3-
2	MII1_TRN0	Differential DATA0-	11	MII1_LED_LINK	LED Link+
3	MII1_TRP1	Differential DATA1+	12	GND	LED Link-
4	MII1_TRN1	Differential DATA1-	13	MII1_LED_ACT	LED_ACT-
5	MII1_CT	TCT(NC)	14	MII1_LED_YEL	LED_ACT+,Pull up
6	MII1_CT	RCT(NC)	15	GND	
7	MII1_TRP2	Differential DATA2+	16	GND	
8	MII1_TRN2	Differential DATA2-	17	NC	
9	MII1_TRP3	Differential DATA3+	18	NC	

2.2.6 Micro SD-Card

Micro SD-Card used for boot system code.
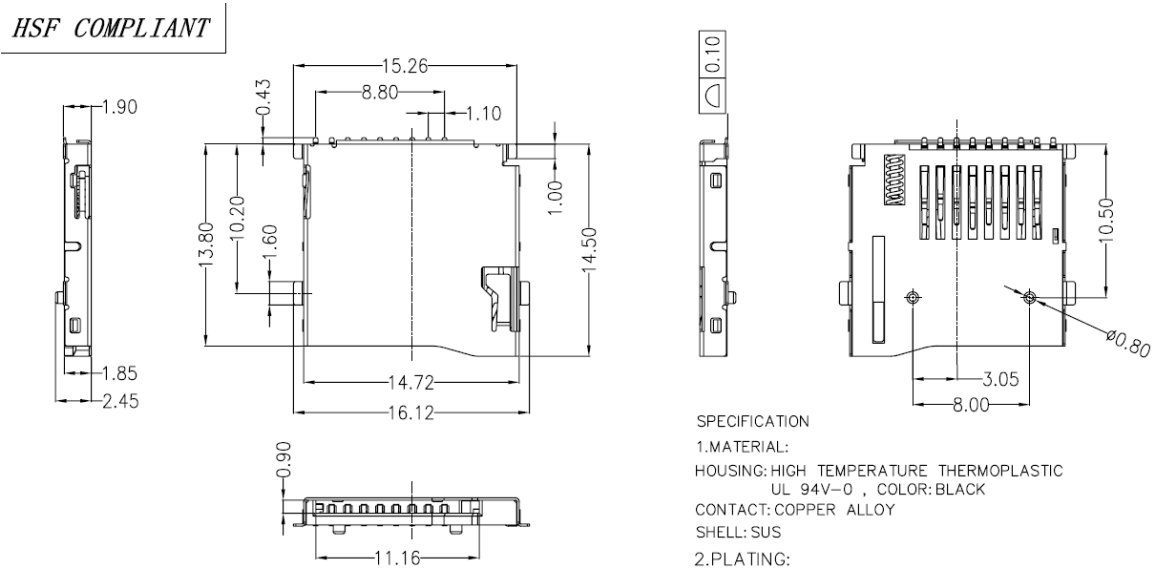
Figure2- 12 Micro SD-Card connector

Micro SD-Card signals definition:

Table2- 10 Micro SD-Card signal definition

J8		
Pin	Signal Name	Description
1	MMC1 DATA2	SD Card DATA2
2	MMC1 DATA3	SD Card DATA3
3	MMC1 CMD	SD Card Command
4	MMC1 CLK	SD Card Clock
5	3V3 VDDA	SD Card Power
6	GND	
7	MMC1 DATA0	SD Card DATA0
8	MMC1 DATA1	SD Card DATA1
9	MMC1 SDCD	SD Card Detect
10	GND	
11	GND	
12	GND	
13	GND	

2.2.7 USB

There are two USB2.0 interface, one USB3.0 interface and one mini USB interface for debug in the EM-TF-BB-AM5728 board. The USB2.0 connector is dual stack.

1. **USB2.0**
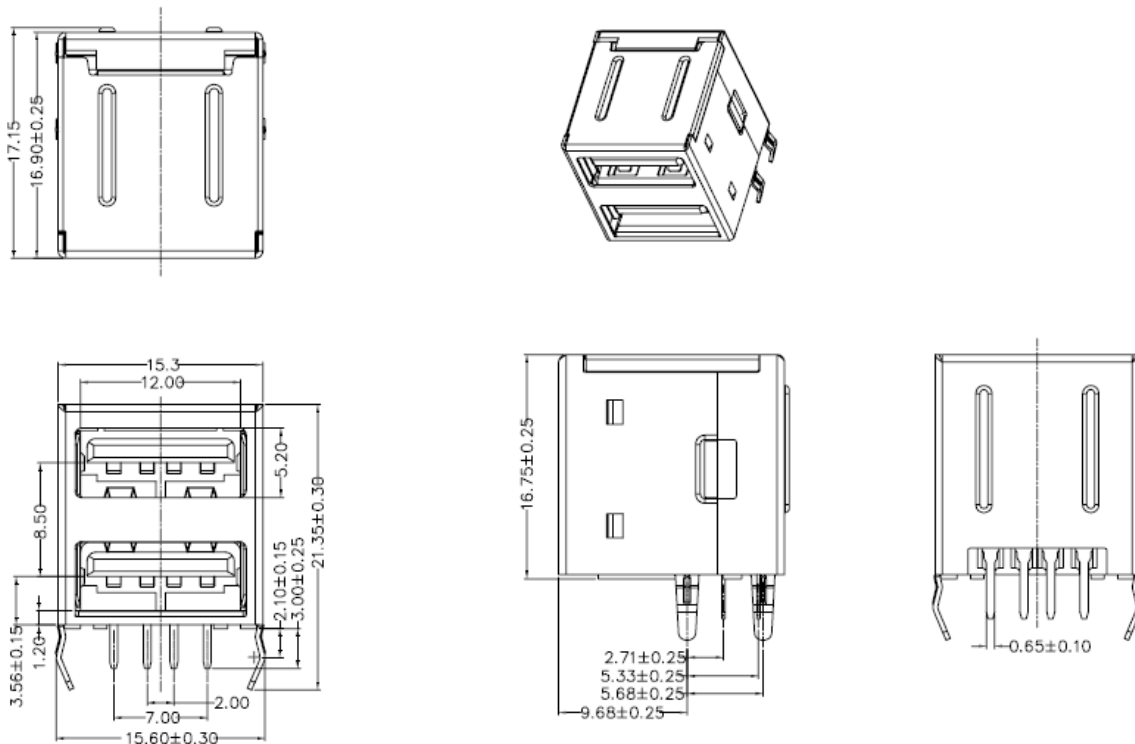
Figure2- 13 Dual Stack USB2.0 Connector

Table2- 11 USB2.0 Interface

J15		
Pin	Signal Name	Description
1	VBUS1	USB2.0 Power
2	DN1	USB2.0 DA-
3	DP1	USB2.0 DA+
4	GND	
5	VBUS2	USB Power
6	DN2	USB2.0 DB-
7	DP2	USB2.0 DB+
8	GND	
9	GND	Shield
10	GND	Shield
11	GND	Shield
12	GND	Shield

2. USB3.0
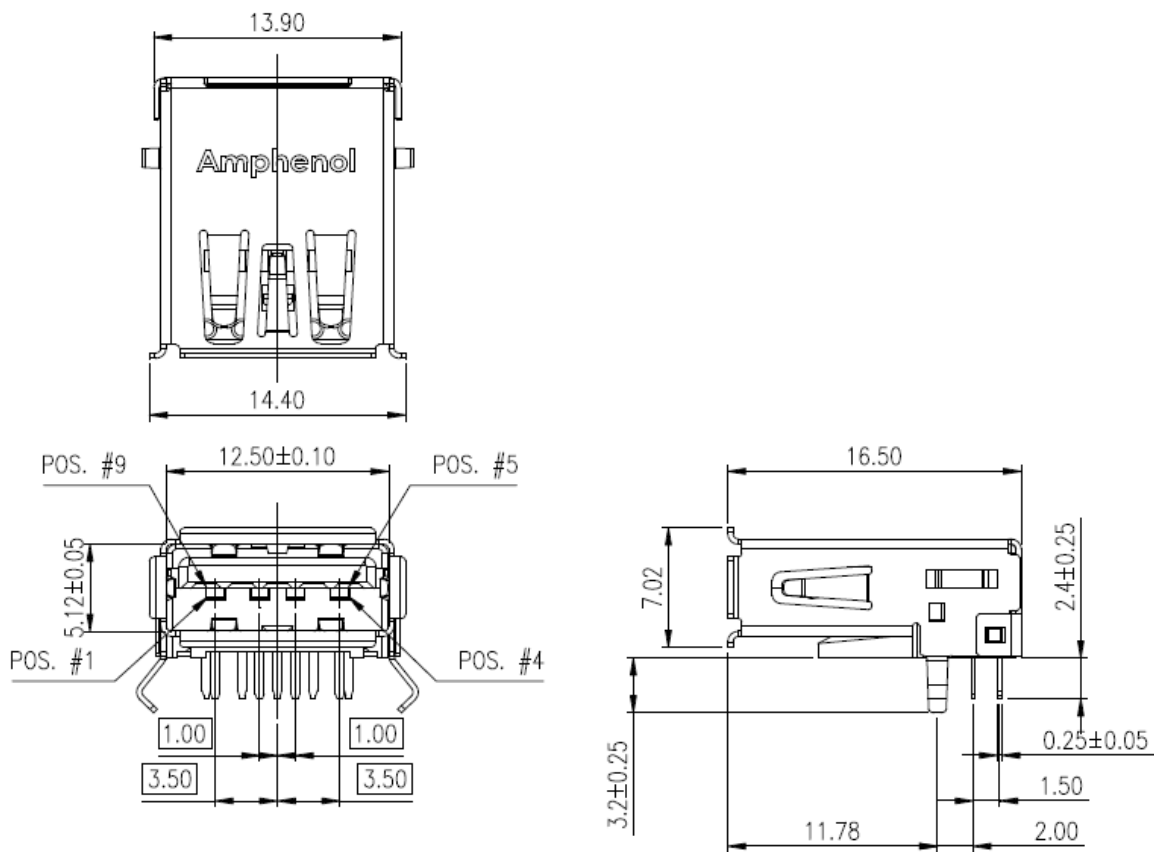
Figure2- 14 USB3.0 Connector

Table2- 12 USB3.0 interface

J16		
Pin	Signal Name	Description
1	USB1VBUS	USB3.0 Power
2	DN1	USB2.0 USB1 DM
3	DP1	USB2.0 USB1 DP
4	GND	
5	USB_RXN0	USB3.0 RX-
6	USB_RXP0	USB3.0 RX+
7	GND	
8	USB_TXN0	USB3.0 TX-
9	USB_TXP0	USB3.0 TX+
10	GND	Shield
11	GND	Shield

3. Mini-USB Debug port
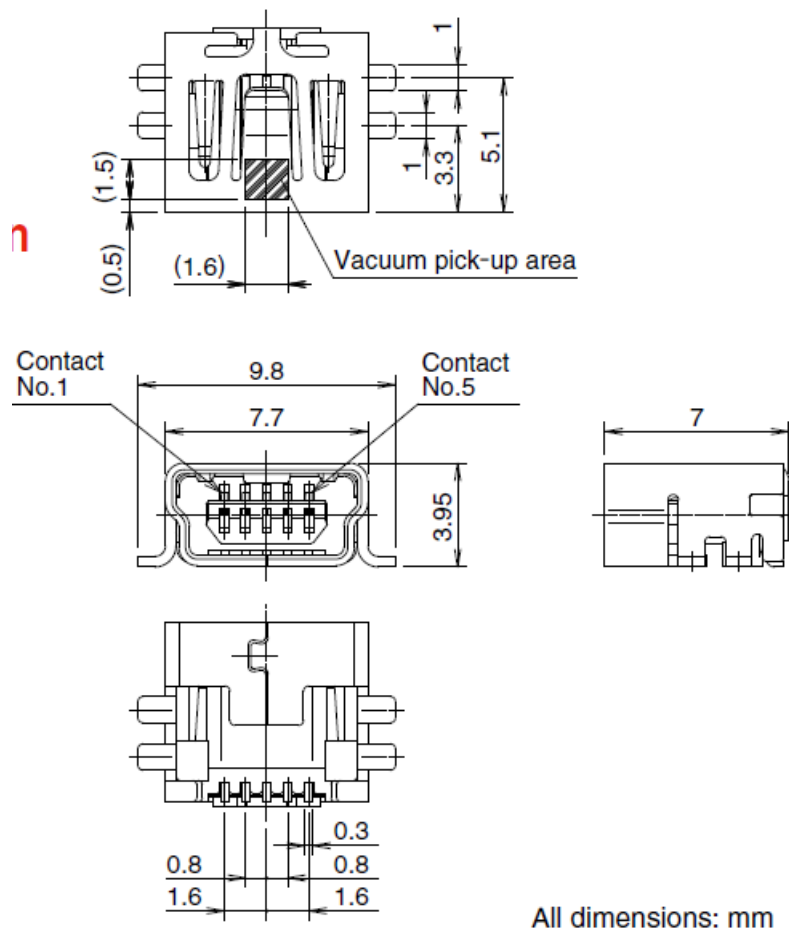
Figure2- 15 mini USB Connector

Table2- 13 Mini-USB interface

CON1		
Pin	Signal Name	Description
1	5V_USB_UART	USB2.0 Power
2	USB-UART_DM	USB2.0 DA-
3	USB-UART_DP	USB2.0 DA+
4	USB-UART_ID	NC
5	GND	
6	GND	Shield
7	GND	Shield
8	GND	Shield
9	GND	Shield

2.2.8 RS485&CAN

There are two RS485s and two CANs in EM-TF-BB-AM5728. The four terminal blocks are the same as 3pin

3.81mm.
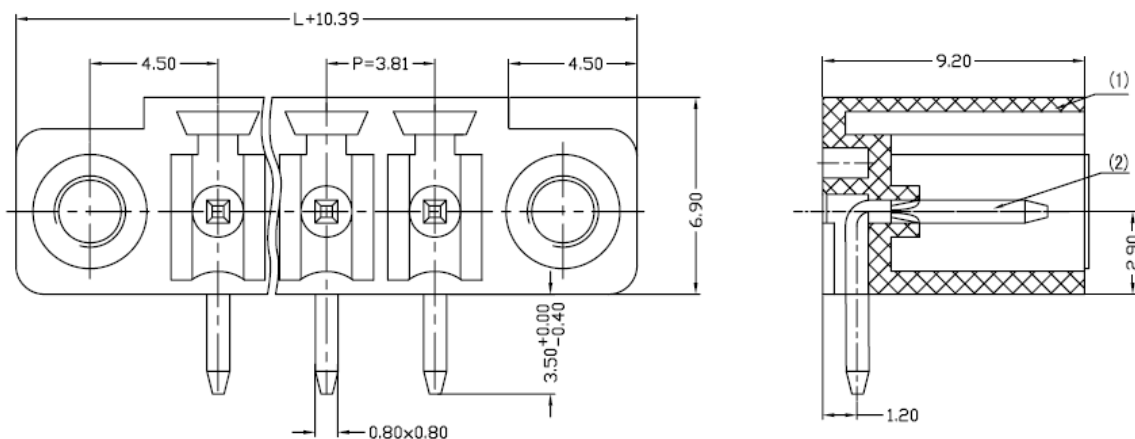
Figure2- 16 3Pin Terminal Block

Table2- 14 RS485&CAN interface

J20		
Pin	Signal Name	Description
1	GND_ISO	GND
2	CANL1	
3	CANH1	CAN
J21		
Pin	Signal Name	Description
1	GND_ISO	GND
2	CANL2	
3	CANH2	CAN
J22		
Pin	Signal Name	Description
1	GND_485	GND
2	RS485_A1	
3	RS485_B1	RS485
J23		
Pin	Signal Name	Description
1	GND_485	GND
2	RS485_A2	
3	RS485_B2	RS485

2.2.9 GPMC

EM-TF-BB-AM5728 supports 12 bit address and 16 bit data GPMC bus through a 2x25pin, 2.0mm pitch Box Header.
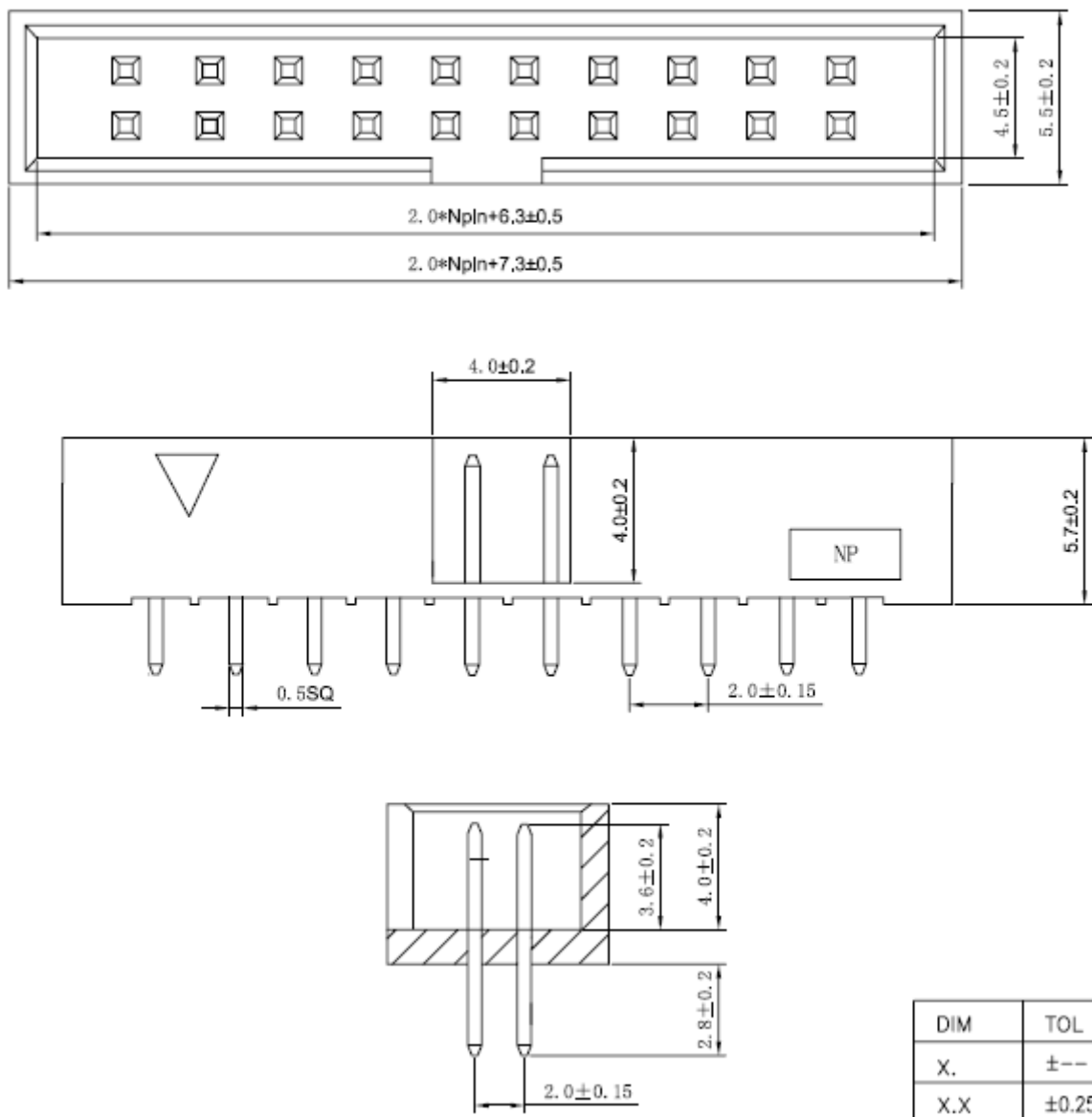
Figure2- 17 2x25 Box Header

Table2- 15 GPMC interface

Pin	Signal Name	Description	Pin	Signal Name	Description
J30					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	GND		2	GPMC A0	
3	GPMC A12	GPMC Address	4	GPMC A1	
5	GPMC CS3	GPMC Chip Select	6	GPMC A2	
7	NC		8	GPMC A3	
9	NC		10	GPMC A4	
11	NC		12	GPMC A5	
13	NC		14	GPMC A6	
15	GND		16	GPMC_A7	
17	GND		18	GPMC_A8	
19	GPMC_AD15		20	GPMC_A9	
21	GPMC_AD14		22	GPMC_A10	
23	GPMC_AD13		24	GPMC_A11	GPMC Address
25	GPMC_AD12		26	GND	
27	GPMC_AD11		28	GPMC_CS0	GPMC Chip Select
29	GPMC_AD10		30	GND	
31	GPMC_AD9		32	GPMC_WAIT0	GPMC Wait 0
33	GPMC_AD8		34	GND	
35	GPMC_AD7		36	GPMC_ADVN_ALE	GPMC Address Valid / Address Latch Enable
37	GPMC_AD6		38	GPMC_BEN0	GPMC Byte Enable 0 / Command Latch Enable
39	GPMC_AD5		40	GPMC_BEN1	GPMC Byte Enable 1
41	GPMC_AD4		42	GPMC_WEN	GPMC Write Enable
43	GPMC_AD3		44	GPMC_OEN_REN	GPMC Output / Read Enable
45	GPMC_AD2	GPMC Address and Data	46	GND	
47	GPMC_AD1		48	GPMC_CLK	GPMC Clock
49	GPMC_AD0		50	5V_VDD	Power

2.2.10 Audio

TLV320AIC3104IRHB is the audio Codec for line out and microphone input in the EM-TF-BB-AM5728. The two connectors are the same except the color. The green one is for line out and the pink one is for microphone input.
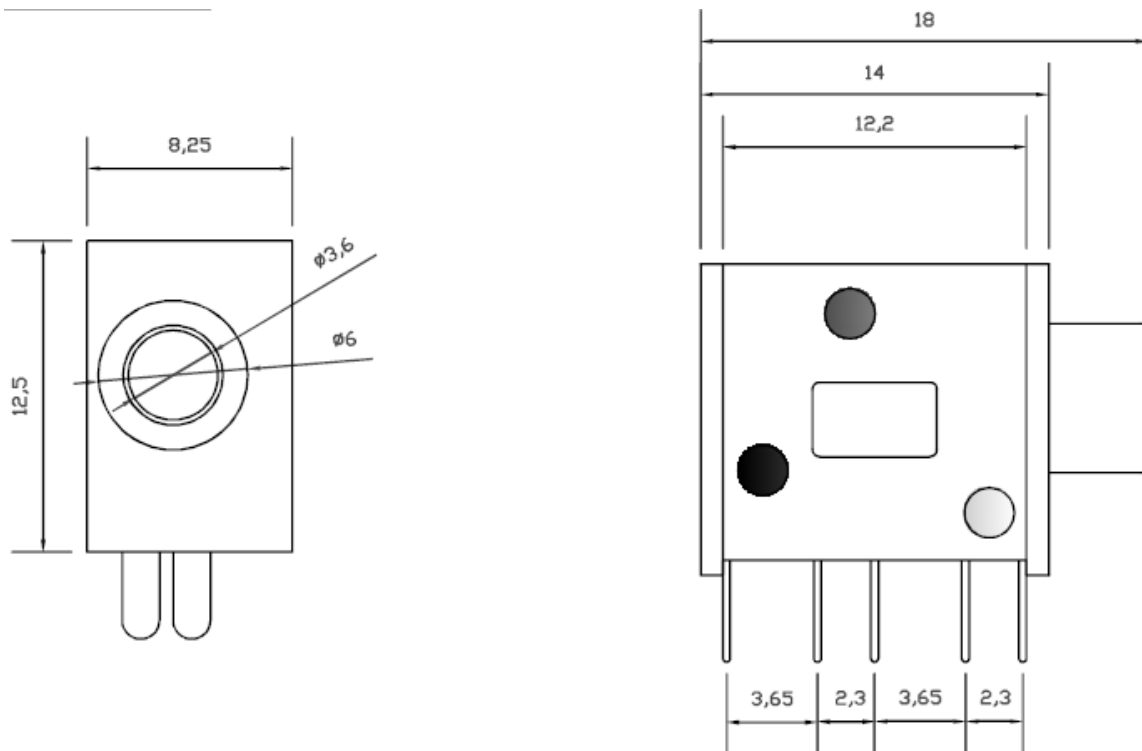
Figure2- 18 3.5mm Audio Connector

Table2- 16 Audio/MIC interface

J17		
Pin	Signal Name	Description
1	GND	Audio GND
2	LEFTOUT	Line out left channel
3	RIGHTOUT	
4	RIGHTOUT	Line out right channel
5	LEFTOUT	Line out left channel
J18		
Pin	Signal Name	Description
1	GND	Audio GND
2	LEFTIN	MIC IN left channel
3	RIGHTIN	
4	RIGHTIN	MIC IN right channel
5	LEFTIN	MIC IN left channel

2.2.11 mini PCIE

The mini PCIE slot is used for 4G module in EM-TF-BB-AM572. And the J25/J26 are used for populating the SIM card.
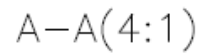
Figure2- 19 mini PCIE Connector

Table2- 17 mini PCIE interface

CN2					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	GPIO4_12	Wake up	2	MPCIE_3P3V	Power
3	NC		4	GND	
5	NC		6	NC	
7	NC		8	UIM_PWR	SIM Card Power
9	GND		10	UIM_DATA	SIM Card Data
11	REFCLK-	NC.Pull up	12	UIM_CLK	SIM Card Clock
13	REFCLK+	NC.Pull up	14	UIM_RESET	SIM Card Reset
15	GND		16	NC	
17	NC		18	GND	
19	NC		20	GPIO7_9	W_DISABLE
21	GND		22	PERST	Reset
23	NC		24	MPCIE_3P3V	Power
25	NC		26	GND	
27	GND		28	NC	
29	GND		30	SMB_CLK	NC.Pull up/down
31	NC		32	SMB_DATA	NC.Pull up/down
33	NC		34	GND	
35	GND		36	DN3	USB2.0 DA-
37	GND		38	DP3	USB2.0 DA+
39	MPCIE_3P3V		40	GND	
41	MPCIE_3P3V	Power	42	LED_WWAN#	Connect to LED
43	GND		44	NC	
45	NC		46	NC	
47	NC		48	NC	
49	NC		50	GND	
51	NC		52	MPCIE_3P3V	Power
53	GND	Shield	54	GND	Shield
55	GND	Shield	56	GND	Shield
J25					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	UIM_PWR	SIM Card Power	2	UIM_RESET	SIM Card Reset
3	UIM_CLK	SIM Card Clock	4	GND	
5	UIM_PWR	SIM Card Power	6	UIM_DATA	SIM Card Data
7	NC		8	NC	

2.2.12 mSATA

mSATA Slot(CN1) is used for connect external SSD.

NO.	Part Name	Material	SATATUS
③	Terminal	Copper Alloy	Au—Plating
②	Housing	LCP	Black
①	Grounding Pad	Copper Alloy	Sn—Plating

A—A(4:1)
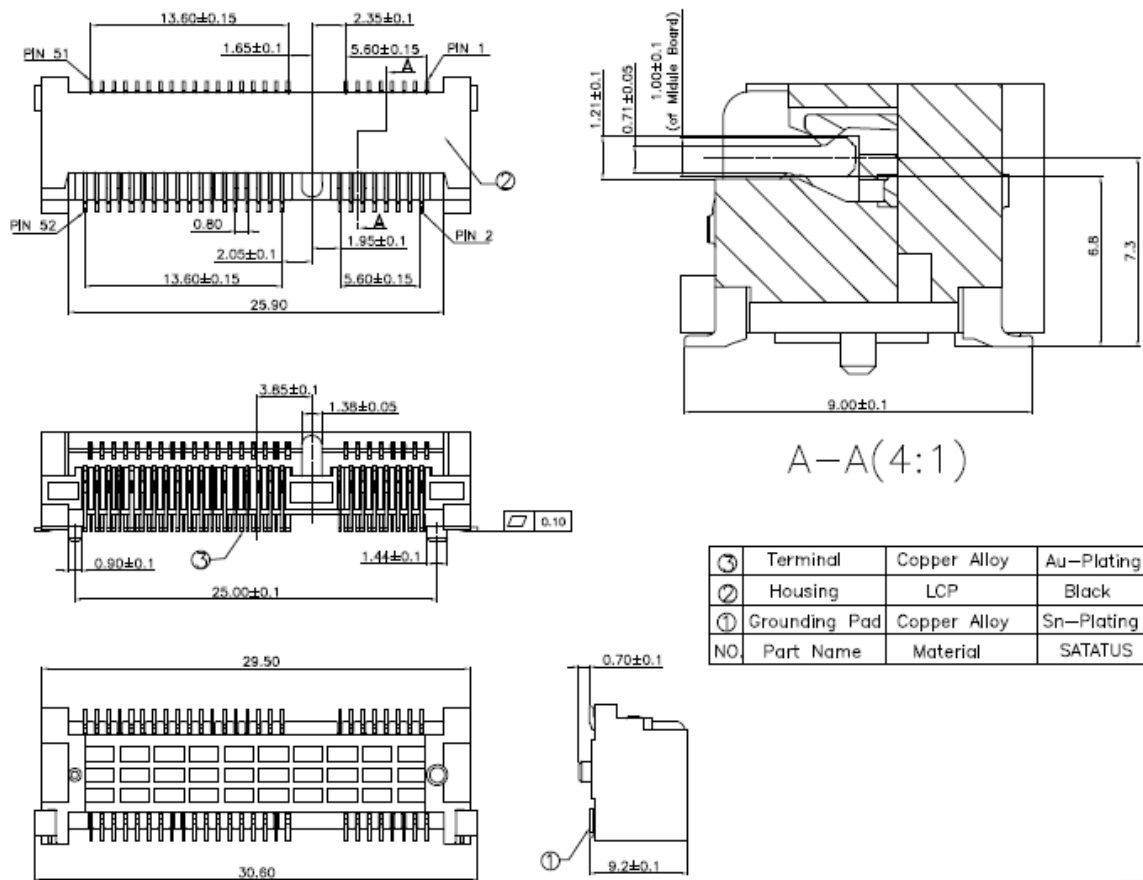
Figure2- 20 mSATA Connector

Table2- 18 mSATA interface

CN1					
Pin	Signal Name	Description	Pin	Signal Name	Description
1	NC		2	3V3_VDDA	Power
3	NC		4	GND	
5	NC		6	NC	
7	NC		8	NC	
9	GND		10	NC	
11	NC		12	NC	
13	NC		14	NC	
15	GND		16	NC	
17	NC		18	GND	
19	NC		20	NC	
21	GND		22	NC	
23	SATA1_RXP0	mSATA Receive Differential	24	3V3_VDDA	Power
25	SATA1_RXN0		26	GND	
27	GND		28	NC	
29	GND		30	NC	
31	SATA1_TXP0	mSATA Transmit Differential	32	NC	
33	SATA1_TXN0		34	GND	
35	GND		36	NC	
37	GND		38	NC	
39	3V3_VDDA		40	GND	
41	3V3_VDDA	Power	42	NC	
43	GND		44	NC	
45	NC		46	NC	
47	NC		48	NC	
49	NC		50	GND	
51	NC		52	3V3_VDDA	Power
53	GND	Shield	54	GND	Shield
55	GND	Shield	56	GND	Shield

2.2.13 PCIE

There is a standard PCIE x 4 connector(J14), but it only supports two channels in EM-TF-BB-AM5728.
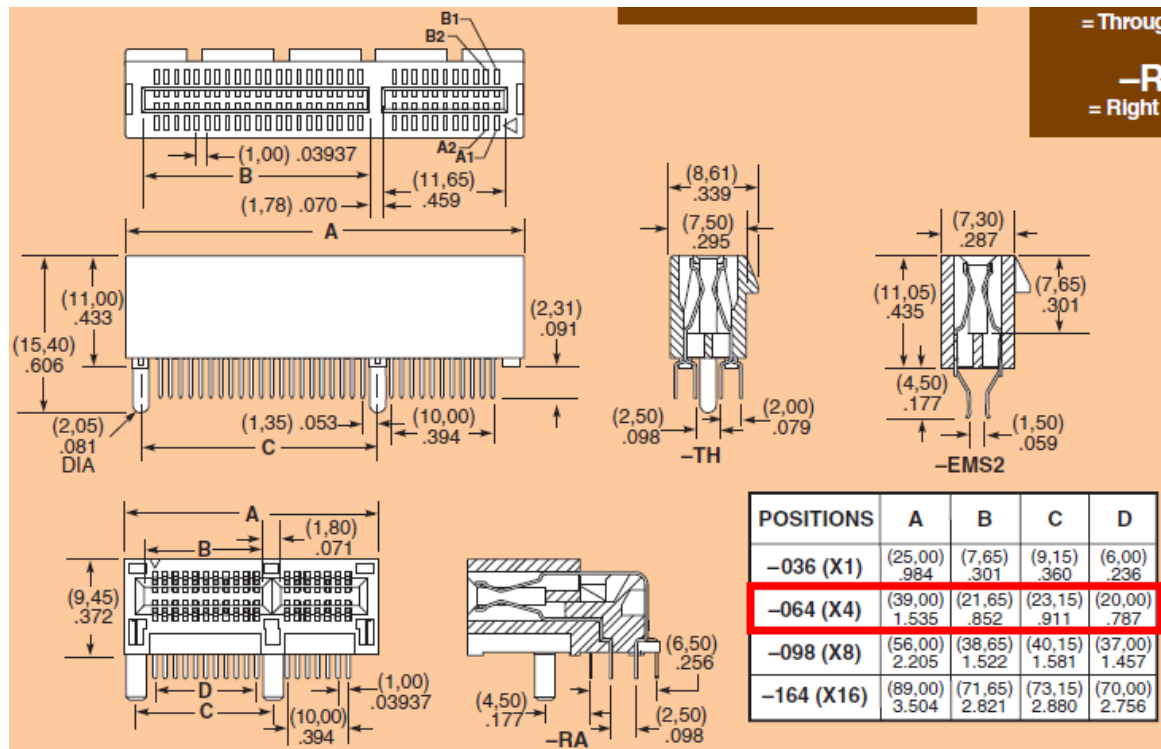
Figure2- 21 PCIE x 4 Connector

Table2- 19 PCIE x 4 interface

Pin	Signal Name	Description	Pin	Signal Name	Description
J14					
A1	GND		B1	12V_PCIE	
A2	12V_PCIE		B2	12V_PCIE	Power
A3	12V_PCIE	Power	B3	NC	
A4	GND		B4	GND	
A5	NC		B5	I2C5_SCL	SMBUS Clock
A6	NC		B6	I2C5_SDA	SMBUS Data
A7	NC		B7	GND	
A8	NC		B8	3V3_PCIE	Power
A9	3V3_PCIE		B9	NC	
A10	3V3_PCIE	Power	B10	3V3_PCIE	Power
A11	SYS_RESETn	Reset	B11	NC	
A12	GND		B12	NC	
A13	PCIE_CONNCLKP	100MHz Reference	B13	GND	
A14	PCIE_CONNCLKN	Differential Clock	B14	PCIE_TXP0	PCIE Transmit
A15	GND		B15	PCIE_TXN0	Differential Channel 0
A16	PCIE_RXP0	PCIE Receive	B16	GND	
A17	PCIE_RXN0	Differential Channel 0	B17	GPIO7_7	PCIE Present Detect
A18	GND		B18	GND	
A19	NC		B19	PCIE_TXP1	PCIE Transmit
A20	GND		B20	PCIE_TXN1	Differential Channel 1
A21	PCIE_RXP1	PCIE Receive	B21	GND	
A22	PCIE_RXN1	Differential Channel 1	B22	GND	
A23	GND		B23	NC	
A24	GND		B24	NC	
A25	NC		B25	GND	
A26	NC		B26	GND	
A27	GND		B27	NC	
A28	GND		B28	NC	
A29	NC		B29	GND	
A30	NC		B30	NC	
A31	GND		B31	GPIO7_7	PCIE Present Detect
A32	NC		B32	GND	

2.2.14 DIDO

There are two channels DI and DO interface in EM-TF-BB-AM5728. All the signals are placed on 8pins 3.81 pitch terminal blocks.
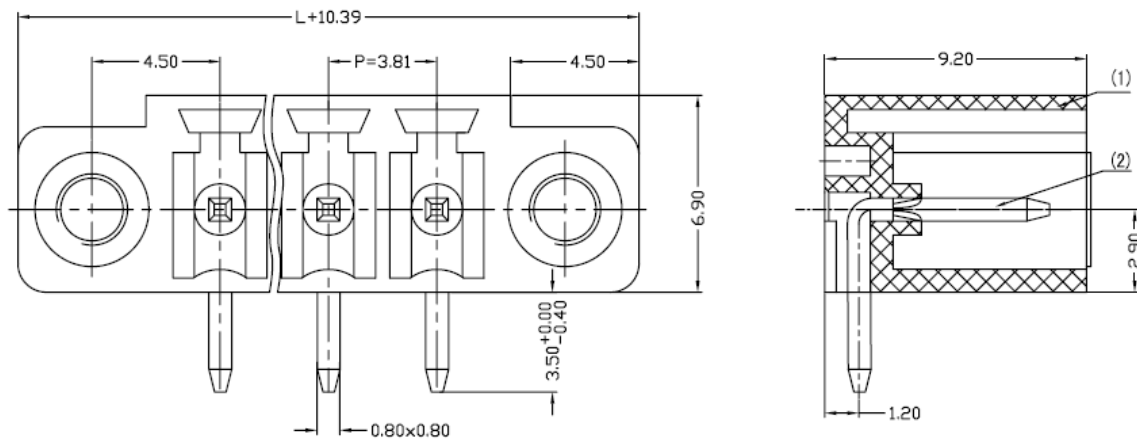
Figure2- 22 8Pins Terminal Block

Table2- 20 DI/DO interface

J19		
Pin	Signal Name	Description
1	NO1-	DO 1-
2	NO1+	DO 1+
3	NO2-	DO 2-
4	NO2+	DO 2+
5	DI 1+	DI 1+
6	DI 1-	DI 1-
7	DI 2+	DI 2+
8	DI 2-	DI 2-

2.2.15 Button

There are three buttons in the EM-TF-BB-AM572. The S3 is used for reset the system, the S4 and S5 are used for customization.
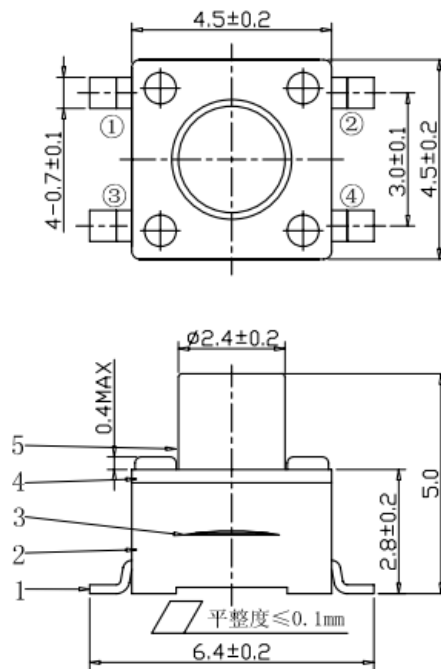
Figure2- 23 Button

2.2.16 DIP Switch

The two DIP Switch are used for system boot setting. The system boots from Micro SD-Card default.

PART NO.	NO.OF POS	DIM A
DHN-02	2	3.77
DHN-04	4	6.31
DHN-06	6	8.85
DHN-08	8	11.39
DHN-10	10	13.93
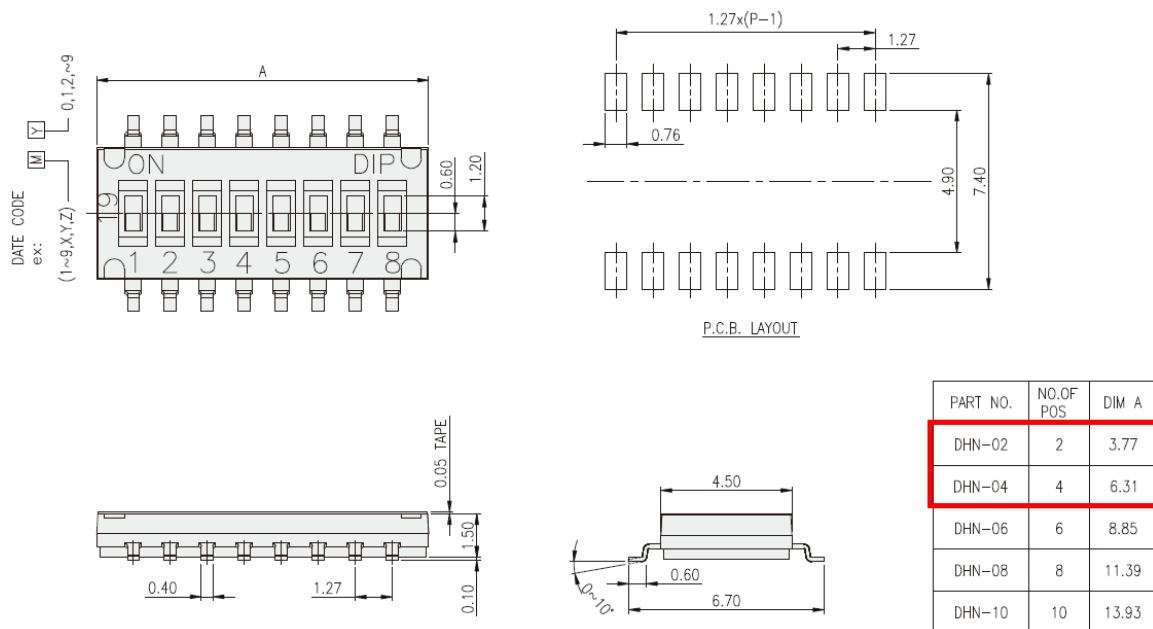
Figure2- 24 DIP Switch

Table2- 21 Boot configure

BOOT[5:0]	BOOT DEVICE
100000	EMMC

100010	SD-CARD
100011	SATA
100100	USB/UART
100110	QSPI

2.2.17 LED

There are 3 LEDs for power indication, and 2 LEDs for user defining.

Table2- 22 LED Indication Status

LED Ref	Signal Name	LED Function
D7		Bright indicate 5V_VDD good
D10		Bright indicate 3V3_VDDA power good
D13		Bright indicate 3V3_VDDB power good
D55	GPIO5_12	User defined
D56	GPIO4_17	User defined

2.2.18 RTC

The super capacitor is used for RTC circuit. Also it reserved a connector for external battery.
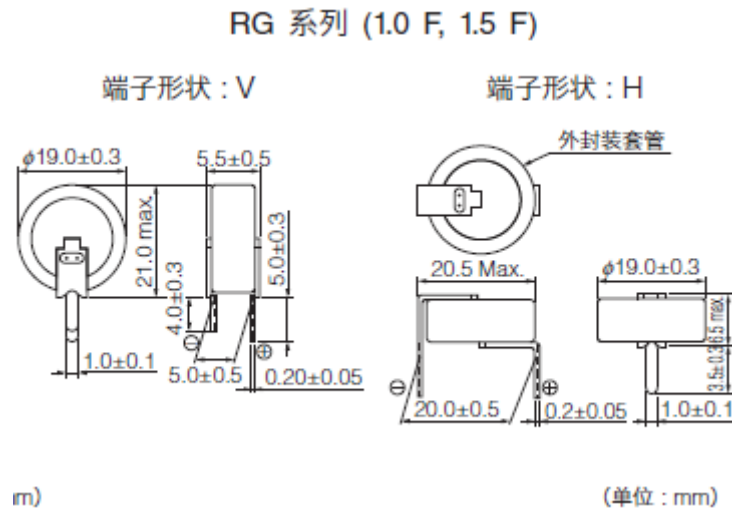
Figure2- 25 Super Capacitor

2.2.19 BEEP

There is a beep in the EM-TF-BB-AM5728. The beep is controlled by GPIO5_19.
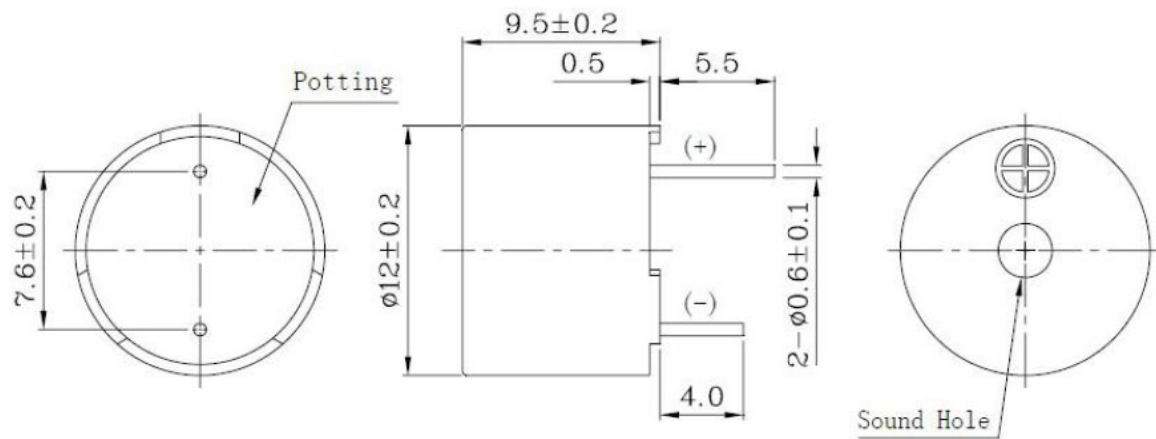
Figure2- 26 BEEP

2.2.20 Expansion Interface

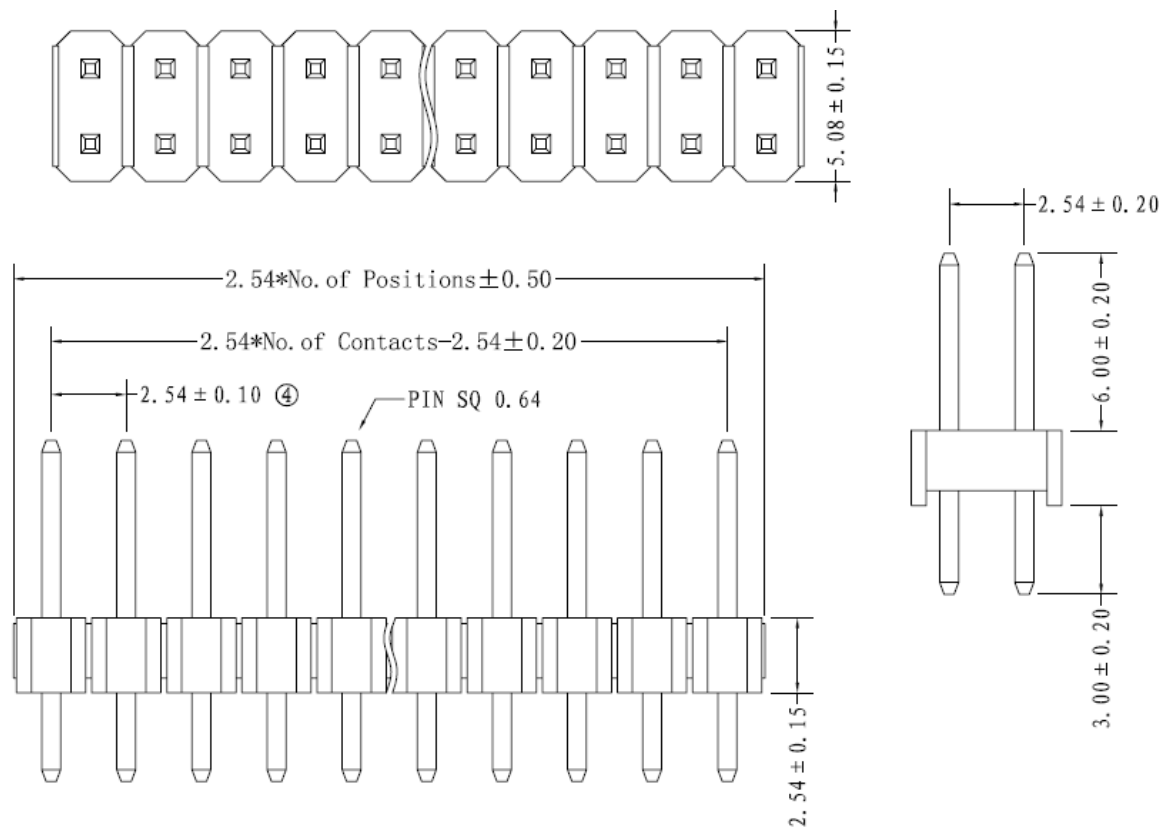The expansion interface is connected to 2 x 20 pins 2.54mm pitch pin header.

Figure2- 27 2x20Pin Header

Table2- 23 Expansion interface

Pin	Signal Name	Description	Pin	Signal Name	Description
J31					
1	VIN1A_D15		2	VIN1A_D23	
3	VIN1A_D14		4	VIN1A_D22	
5	VIN1A_D13		6	VIN1A_D21	GPIO
7	VIN1A_D12		8	GND	
9	VIN1A_D11		10	VIN1A_D20	
11	VIN1A_D10	GPIO	12	VIN1A_D19	
13	GND		14	VIN1A_D18	
15	VIN1A_D9		16	VIN1A_D17	
17	VIN1A_D8	GPIO	18	VIN1A_D16	GPIO
19	I2C5_SCL		20	TIMER4	PWM Output
21	I2C5_SDA	I2C	22	GND	
23	GND		24	UART10_TXD	
25	SPI3_D0		26	UART10_RXD	UART
27	SPI3_CS0		28	UART1_TXD	
29	SPI3_SCLK		30	UART1_RXD	UART
31	SPI3_D1	SPI	32	GND	
33	GND		34	GND	
35	GND		36	5V_VDD	
37	3V3_VDDA		38	5V_VDD	
39	3V3_VDDA	Power	40	5V_VDD	Power

2.3 Other Device Description

2.3.1 DS90CR285MTDX

The DS90CR285 transmitter converts 28 bits of LVCMOS/LVTTL data into four LVDS (Low Voltage Differential Signaling) data streams. A phase-locked transmit clock is transmitted in parallel with the data streams over a fifth LVDS link. At a transmit clock frequency of 66 MHz, 28 bits of TTL data are transmitted at a rate of 462 Mbps per LVDS data channel.

2.3.2 AR8035

The AR8035 is Atheros' 4th generation, single port 10/100/1000 Mbps Tri-speed Ethernet PHY. It supports RGMII interface to the MAC.™ The AR8035 provides a low power, low BOM (Bill of Materials) cost solution for comprehensive applications including consumer, enterprise, carrier and home networks such as PC, HDTV, Gaming machines, Blue-ray players, IPTV STB, Media Players, IP Cameras, NAS, Printers, Digital Photo Frames, MoCA/Homeplug (Powerline)/EoC/ adapters and Home Router & Gateways, etc. The AR8035 supports IEEE 802.3az Energy Efficient Ethernet (EEE) standard and Atheros proprietary SmartEEE, which allows legacy MAC/SoC devices without 802.3az support to function as the complete 802.3az system.

2.3.3 AP6255

AMPAK Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi, Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP,

Bluetooth headsets applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n/ac Access Points in the wireless LAN.

The wireless module complies with IEEE 802.11 a/b/g/n/ac standard and it can achieve up to a speed of 433.3Mbps with single stream in 802.11ac draft to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi, UART / PCM interface for Bluetooth.

This compact module is a total solution for a combination of Wi-Fi + BT technologies. The module is specifically developed for Smart phones and Portable devices.

2.3.4 USB2514BI

The Microchip USB251xB/xBi hub is a family of low power, configurable, MTT (multi transaction translator) hub controller IC products for embedded USB solutions. The Microchip hub supports low-speed, full-speed, and hi-speed (if operating as a hi-speed hub) downstream devices on all of the enabled downstream ports.

2.3.5 TLV320AIC3014I

The TLV320AIC3104 is a low-power stereo audio codec with stereo headphone amplifier, as well as multiple inputs and outputs that are programmable in single-ended or fully differential configurations. The device includes extensive register-based power control is included, thus enabling stereo 48-kHz DAC playback as low as 14 mW from a 3.3-V analog supply, making the device ideal for portable battery powered audio and telephony applications.

Chapter3. Appendix

This section described the software of EM-TF-BB-AM5728.

3.1 Software

EM-TF-BB-AM5728 support Linux only.

◈ **Linux**

    ◆ 《EM-TF-EVK-AM5728 Linux Software Released Description》
    ◆ 《EM-TF-EVK-AM5728 Software User Manual》
    ◆ 《EM-TF-EVK-AM5728 Software Development Instruction》

Chapter4. Technical Support and Warranty

4.1 Technical Support

Embest Technology provides its product with one-year free technical support including:

- Providing software and hardware resources related to the embedded products of Embest Technology;
- Helping customers properly compile and run the source code provided by Embest Technology;
- Providing technical support service if the embedded hardware products do not function properly under the circumstances that customers operate according to the instructions in the documents provided by Embest Technology;
- Helping customers troubleshoot the products.

🚫 The following conditions will not be covered by our technical support service. We will take appropriate measures accordingly:

- Customers encounter issues related to software or hardware during their development process;
- Customers encounter issues caused by any unauthorized alter to the embedded operating system;
- Customers encounter issues related to their own applications
- Customers encounter issues caused by any unauthorized alter to the source code provided by Embest Technology.

4.2 Warranty

1） 12-month free warranty on the PCB under normal conditions of use since the sales of the product;

2） The following conditions are not covered by free services; Embest Technology will charge accordingly:

- Customers fail to provide valid purchase vouchers or the product identification tag is damaged, unreadable, altered or inconsistent with the products;
- Not according to the user's manual operation causes damage to the product;
- Products are damaged in appearance or function caused by natural disasters (flood, fire, earthquake, lightning strike or typhoon) or natural aging of components or other force majeure;
- Products are damaged in appearance or function caused by power failure, external forces, water, animals or foreign materials;
- Products malfunction caused by disassembly or alter of components by customers or, products disassembled or repaired by persons or organizations unauthorized by Embest Technology, or altered in

factory specifications, or configured or expanded with the components that are not provided or recognized by Embest Technology and the resulted damage in appearance or function;

- Product failures caused by the software or system installed by customers or inappropriate settings of software or computer viruses;;

- Products purchased from unauthorized sales;

- Warranty (including verbal and written) that is not made by Embest Technology and not included in the scope of our warranty should be fulfilled by the party who committed. Embest Technology has no any responsibility;

3）Within the period of warranty, the freight for sending products from customers to Embest Technology should be paid by customers; the freight from Embest to customers should be paid by us. The freight in any direction occurs after warranty period should be paid by customers;

4）Please contact technical support if there is any repair request.

◇ **Note**:

📖 Embest Technology will not take any responsibility on the products sent back without the permission of the company.

Chapter5. Contact Information

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