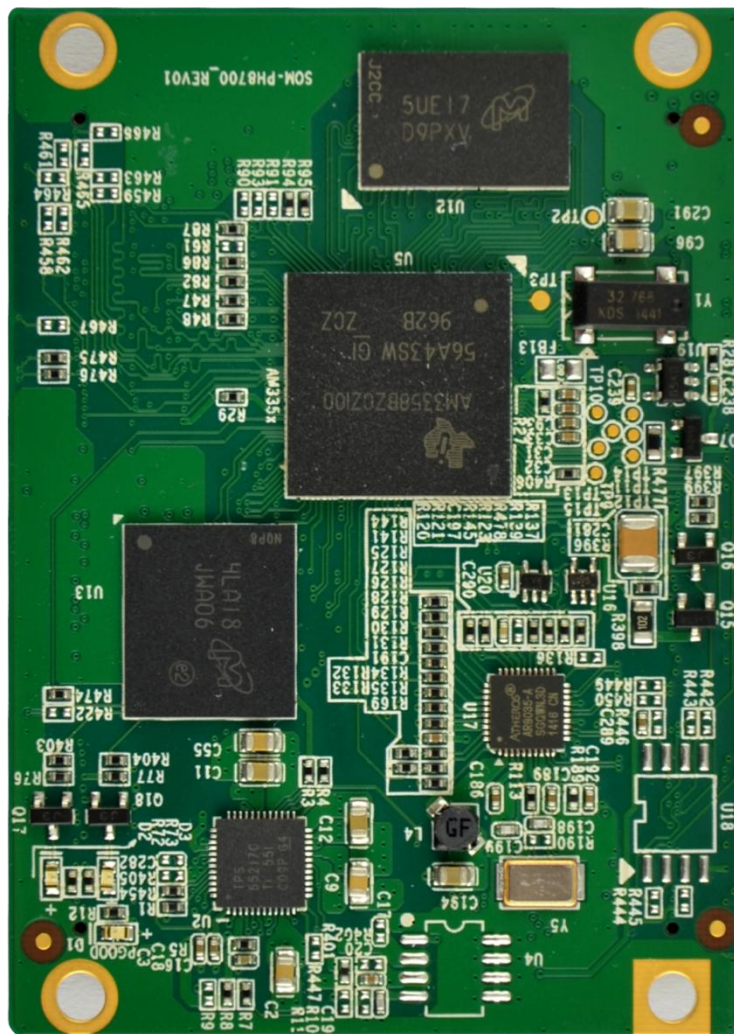


# SOM-PH8700 Core Board

## User Manual

Version– March 2016



---

---

## Copyright Statement:

- SOM-PH8700 and its related intellectual property are owned by Shenzhen Embest Technology Co., Ltd.
- Shenzhen Embest Technology has the copyright of this document and reserves all rights. Any part of the document should not be modified, distributed or duplicated in any approach and form with the written permission issued by Embest Technology Co., Ltd.

## Disclaimer:

- Shenzhen Embest Technology does not take warranty of any kind, either expressed or implied, as to the program source code, software and documents in the CD/DVD-ROMs provided along with the products, and including, but not limited to, warranties of fitness for a particular purpose; The entire risk as to the quality or performance of the program is with the user of products.
- Revision History:

Version	Date	Description
1.0	2016-3-3	Original Version

---

---

---

# Table of Contents

<b>Chapter 1 Product Overview .....</b>	<b>1</b>
1 Brief Introduction .....	1
1.1.1 Packing List.....	1
1.1.2 Product Features.....	1
2 System Block Diagram .....	2
3 Product Dimensions .....	3
<b>Chapter 2 Introduction to Hardware System .....</b>	<b>4</b>
1 Overview of CPU .....	4
2 Introduction of Peripheral Chips .....	5
1 DDR3.....	5
2 EMMC Flash.....	5
3 EEPROM.....	5
4 AR8035 .....	6
5 TPS65217 .....	6
6 LED .....	6
3 Power Distribution .....	6
4 Details of Interfaces.....	6

# Chapter 1 Product Overview

## 1 Brief Introduction

SOM-PH8700 is developed by EMBEST Technology Co., Ltd . The module can be used for medical instruments, industrial control, communications and other fields. The SOM-PH8700 is build using a core board based on Ti Am335x .This processor comes with a 1GHz ARM Cortex –A8 core and provides rich peripheral interfaces. Extensions on SOM-PH8700 can provide a series of expansion interfaces including network, audio input and output, USB, media card interface, serial interface, SPI, IIC interface, CAN interface, RS485 interface, ADC, TFT screen output and touch screen.

SOM - PH8700 has a very wide range of application scenarios, including gaming peripherals, home and industrial automation, consumer medical devices, printers, intelligent charging system, intelligent vending machines, weighing system, terminal education, toys, and so on, in other areas with different needs.

### 1.1.1 Packing List

### 1.1.2 Product Features

#### Electrical Features

- Operating temperature: 0~70°C (commercial)、-40~85°C (Industrial )
- Input voltage: 5V
- Operating humidity: 20% ~ 90% (no condensation)
- Mainboard size: 70 mm×50 mm
- PCB specifications: 8 layer design

#### Processor Features

- 720-MHz ARM Cortex™-A8 32-Bit RISC Microprocessor
    - NEON™ SIMD Coprocessor
    - 32KB/32KB of L1 Instruction/Data Cache with Single-Error Detection (parity)
    - 256KB of L2 Cache with Error Correcting Code (ECC)
  - SGX530 Graphics Engine
- Programmable Real-Time Unit Subsystem

#### Onboard Memory:

- 512MB DDR3 SDRAM
- 4GB eMMC Flash
- 32K EEPROM

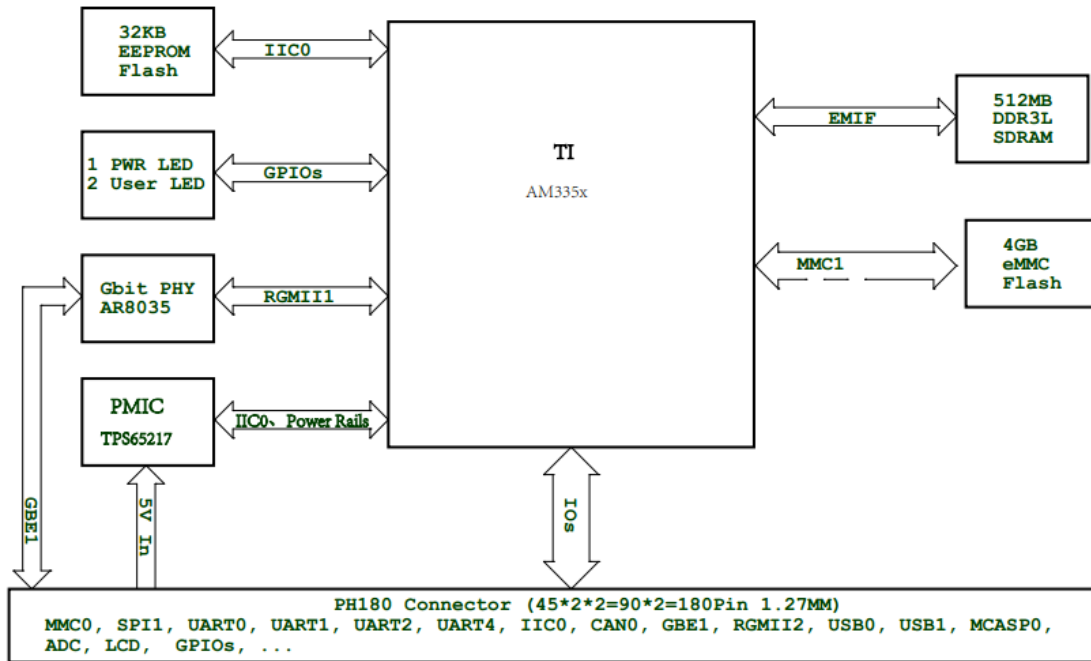
**Communication Interfaces:**

- Two 90Pins 1.27mm pitch connectors (including I<sup>2</sup>C、SPI、CAN、UART、MMC、I<sup>2</sup>S、LCD、RGMII、GPIO、Gigabit Ethernet、Power and so on)

**Debugging Interfaces**

- Support UART serial debugging

## 2 System Block Diagram



**Figure 1-1 SOM-PH8700 System Block**

### 3 Product Dimensions

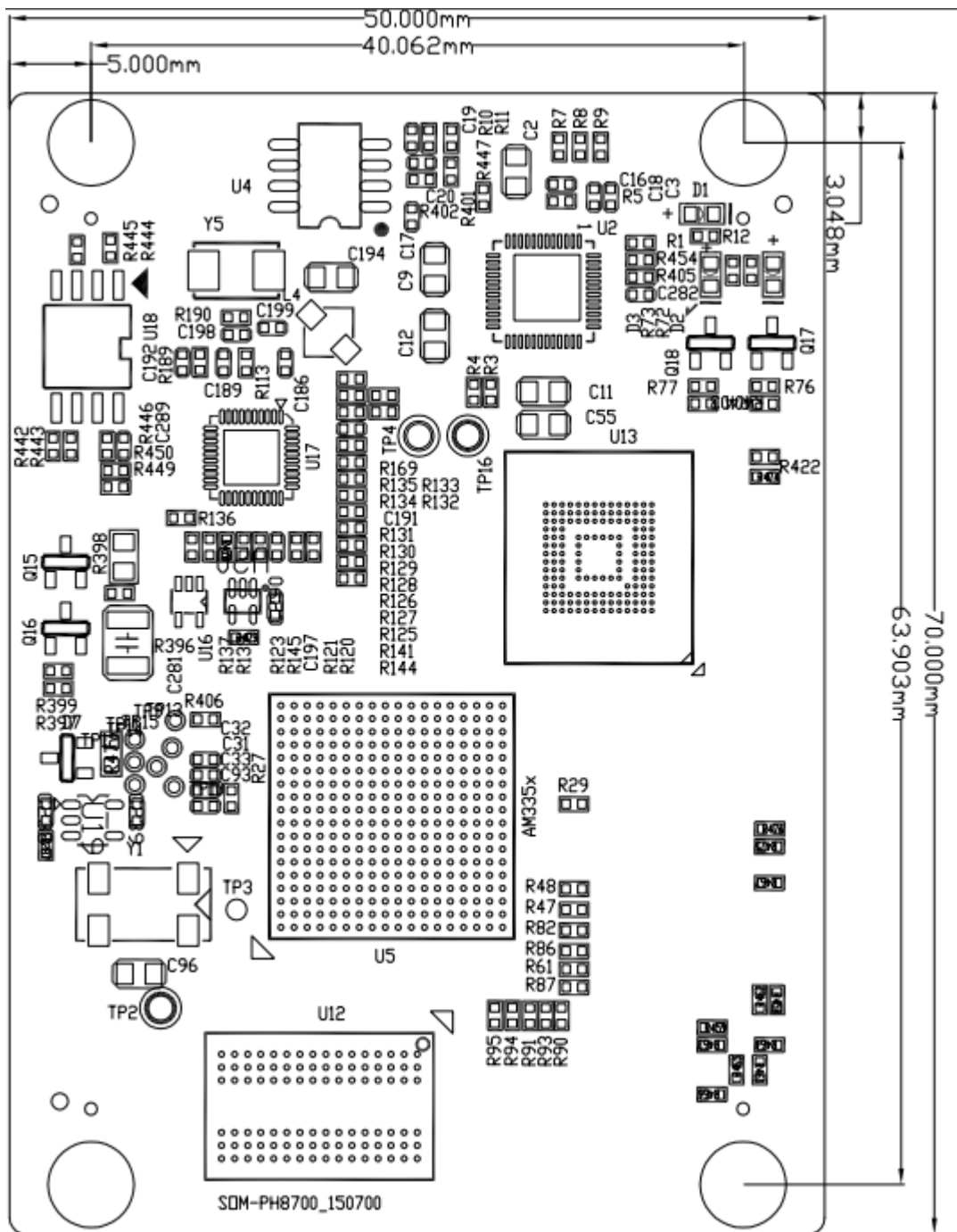


Figure 1-2 Product Dimensions

1

# Chapter 2 Introduction to Hardware

## System

This chapter will introduce in detail the structure, expansion and peripheral interfaces of SOM-PH8700 hardware system .

### 1 Overview of CPU

The AM335x microprocessors, based on the ARM Cortex-A8 processor, is enhanced for image, graphics processing, peripherals and industrial interface options such as **EtherCAT** and **PROFIBUS**. The devices support high-level operating systems (HLOS). Open Sources BSPs like Linux<sup>®</sup> and Android<sup>™</sup> are available free of charge from TI.

#### **A brief description of AM335x microprocessor:**

The microprocessor unit (MPU) subsystem is based on the ARM Cortex-A8 processor and the PowerVR SGX<sup>™</sup> Graphics Accelerator subsystem. The Graphics provides 3D graphics acceleration to support display and gaming effects.

The Programmable Real-Time Unit Subsystem and Industrial Communication Subsystem (PRU-ICSS) is separated from the ARM core, allowing independent operation and clocking for greater efficiency and flexibility. The PRU-ICSS enables additional peripheral interfaces and real-time protocols such as EtherCAT, PROFINET, EtherNet/IP, PROFIBUS, Ethernet Powerlink, Sercos, and others. Additionally, the programmable nature of the PRU-ICSS, along with its access to pins, events and all system-on-chip (SoC) resources, provides flexibility in implementing fast, real-time responses, specialized data handling operations, custom peripheral interfaces, and offloading tasks from the processor cores of the SoC.

#### **Features of AM335x**

- Up to 1-GHz Sitara<sup>™</sup> ARM<sup>®</sup> Cortex<sup>®</sup>-A8 32-Bit RISC Processor
- Programmable Real-Time Unit Subsystem and Industrial Communication Subsystem (PRU-ICSS), supports protocols such as EtherCAT<sup>®</sup>, PROFIBUS, PROFINET, EtherNet/IP<sup>™</sup>, and more
- Power, Reset, and Clock Management (PRCM) Module

- Real-TimeClock(RTC), Up to Two USB2.0 High-Speed OTG Ports With Integrated PHY, Two Industrial Gigabit Ethernet MACs, Two CANs, Two McASPs, six UARTs, two McSPI, three MMC/SD/SDIO Ports, three I<sup>2</sup>Cs, four blanks of GPIO, LCD controller, PWMs, eCAPs.

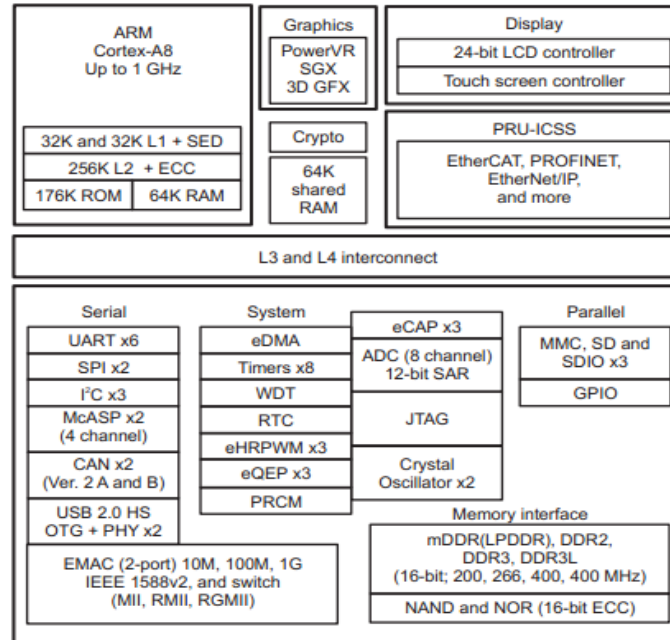


Figure 2-1 Functional Block Diagram

## 2 Introduction of Peripheral Chips

### 1 DDR3

AM335x provides a memory controller for expanding external dynamic storage space. SOM-PH8700 board extends 1 Micron DDR3 (MT41K256M16HA-125), it can provide 512B RAM access to external space. 1GB RAM access in the larger space can be supported by SOM-PH8700.

### 2 EMMC Flash

AM335x provides three routes MMC interfaces, supporting memory card and eMMC memory, and SOM-PH8700 board a size of 4GB eMMC Flash.

### 3 EEPROM

SOM-PH8700 has a 32KB EEPROM (24LC32AT). As a non-volatile memory, the memory can be used to store some important information, such as board's core configuration information.



## **4 AR8035**

AR8035 is a low-power and low-cost Ethernet PHY and integrated with a 10/100/1000Mb transceiver. It is a single-port tri-speed Ethernet PHY and supports MAC, RGMII interfaces.

AR8035 is compliant with the IEEE 802.3az Energy Efficiency Ethernet Standard and the Atheros's proprietary SmartEEE standard, which allows traditional MAC/SoC devices incompatible with 802.3az to function as a compatible 802.3az system.

The Board can be connected to a hub with a straight-through network cable, or connected to a computer with a crossover cable.

## **5 TPS65217**

The TPS65217 is a single-chip power management IC specifically designed to support applications in portable and 5V non-portable applications. It provides a linear battery charger for single-cell Li-ion and Li-Polymer batteries, dual-input power path, three step-down converters, four LDOs, and a high-efficiency boost converter to power two strings of up to 10 LEDs each. The system can be supplied by any combination of USB port, 5-V AC adaptor, or Li-Ion battery. The device is characterized across a  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$  temperature range which makes it suitable for industrial applications. Three high-efficiency 2.25-MHz step-down converters can providing the core voltage, memory, and I/O voltage for a system.

## **6 LED**

SOM-PH8700 built three green LEDs, One of them is used to indicate power good, others is used as user LED.

## **3 Power Distribution**

SOM-PH8700 needs a 5V power supply and a Li-on battery(3V) for RTC power supply. ADC reference power supply input (option), all others power supply is powered by the PMIC.

## **4 Details of Interfaces**

SOM-PH8800 has two 1.27mm 90Pin connectors to extend, including take power from the outside, and allocate the CPU pin resource.

The definition of two 1.27mm double 90Pin pins as follows:

Table 1 P1 Singular Pin Definition

Pin No.	Pin Name	Description	voltage	Pin Out
1	WAKE_UP	Wake Up Signal for PMIC	1.8V	C5
3	MCASPO_AHCLKX	McASP Transmit Master Clock	3.3V	A14
5	MCASPO_FSX	McASP Transmit Frame Sync	3.3V	B13
7	MCASPO_AHCLKR	McASP Receive Master Clock	3.3V	C12
9	MCASPO_FSR	McASP Receive Frame Sync	3.3V	C13
11	VDDA_ADC	Supply Voltage For ADC	1.8V	D8
13	ADC0	Analog Input/Output	1.8V	B6
15	ADC2	Analog Input/Output	1.8V	B7
17	GND4_ADC	Ground For ADC	0	--
19	HDMI_HPD/ADC5	Analog Input/Output	1.8V	B8
21	HDMI_DSCL/IO1	SPI0 interrupt input	3.3V	R7
23	HDMI_DSDA/IO2	RTC interrupt input	3.3V	C5(option By carrier board)
25	HDMI_TX1-/IO3	HDMI hot plug input	3.3V	T7
27	HDMI_TX1+/IO4	No Connection	--	--
29	HDMI_TX0-/IO5	User LED Output	3.3V	T17(option By carrier board)
31	HDMI_TX0+/IO6	Beep Output	3.3V	U17(option By carrier board)
33	GND4	Ground	0	--
35	LCD_D0	LCD Data Bus	3.3V	U10
37	LCD_D1	LCD Data Bus	3.3V	U12
39	LCD_D2	LCD Data Bus	3.3V	V13
41	LCD_D3	LCD Data Bus	3.3V	U4
43	LCD_D4	LCD Data Bus	3.3V	V2
45	LCD_D5	LCD Data Bus	3.3V	V3
47	LCD_D6	LCD Data Bus	3.3V	V4
49	LCD_D7	LCD Data Bus	3.3V	T5
51	LCD_D8	LCD Data Bus	3.3V	T10
53	LCD_D9	LCD Data Bus	3.3V	T12
55	LCD_D10	LCD Data Bus	3.3V	T2
57	LCD_HSYNC	LCD Horizontal Sync	3.3V	R5
59	LCD_VSYNC	LCD Vertical Sync	3.3V	U5
61	GND5	Ground	0	--
63	LCD_PCLK	LCD Clock	3.3V	V5
65	GND7	Ground	0	--
67	IO1/ETH_TXEN	RMII Transmit Enable	3.3V	R13
69	IO2/ETH_RXDV	MII Receive Data Valid	3.3V	V14
71	IO4/ETH_TXD2	RGMIITransmit Data Bit2	3.3V	T14
73	IO6/ETH_TXD0	RGMIITransmit Data Bit0	3.3V	V15
75	IO8/ETH_RXCK	RGMIIReceive Clock	3.3V	T15

77	IO10/ETH_RXD2	RGMII Receive Data Bit2	3.3V	U16
79	IO12/ETH_RXD0	RGMII Receive Data Bit0	3.3V	V17
81	RVD2/MMC2_CMD	No Connection	--	--
83	RVD4/MMC2_D1	No Connection	--	--
85	RVD6/MMC2_D3	No Connection	--	--
87	RVD5/MMC2_D5	No Connection	--	--
89	GND8	Ground	0	--

Table 2 P1 Dual Pin Definition

Pin No.	Pin Name	Description	voltage	Pin Out
2	PWR_GOOD	Power Good Output	3.3V	PMIC
4	RESET_OUTn	Reset Signal Output	3.3V	--
6	MCASP0_ACLKX	McASP Transmit Bit Clock	3.3V	A13
8	MCASP0_ACLKR	McASP Receive Bit Clock	3.3V	B12
10	MCASP0_AXR0	McASP Serial Data	3.3V	D12
12	MCASP0_AXR1	McASP Serial Data	3.3V	D13
14	ADC1	Analog Input/Output	1.8V	C7
16	ADC3	Analog Input/Output	1.8V	A7
18	HDMI_CEC/ADC4	Analog Input/Output	1.8V	C8
20	HDMI_TX2-/ADC6	Analog Input/Output	1.8V	A8
22	HDMI_TX2+/ADC7	Analog Input/Output	1.8V	C9
24	GND2	Ground	0	--
26	HDMI_TXC-/IO7	No Connection	--	--
28	HDMI_TXC+/IO8	No Connection	--	--
30	GND3	Ground	0	
32	LCD_D11	LCD Data Bus	3.3V	T3
34	LCD_D12	LCD Data Bus	3.3V	T4
36	LCD_D13	LCD Data Bus	3.3V	U1
38	LCD_D14	LCD Data Bus	3.3V	U2
40	LCD_D15	LCD Data Bus	3.3V	U3
42	GND6	Ground	0	--
44	LCD_DE	LCD AC Bias Enable Chip Select	3.3V	R6
46	LCD_D16	LCD Data Bus	3.3V	T11
48	LCD_D17	LCD Data Bus	3.3V	R12
50	LCD_D18	LCD Data Bus	3.3V	U13
52	LCD_D19	LCD Data Bus	3.3V	R1
54	LCD_D20	LCD Data Bus	3.3V	R2
56	LCD_D21	LCD Data Bus	3.3V	R3
58	LCD_D22	LCD Data Bus	3.3V	R4
60	LCD_D23	LCD Data Bus	3.3V	T1
62	CAN1_RX	GPIO	3.3V	T13

64	CAN1_TX	GPIO	3.3V	U18
66	I2C_SCL	No Connection	--	--
68	I2C_SDA	No Connection	--	--
70	IO3/ETH_TXD3	RGMII Transmit Data Bit3	3.3V	U14
72	IO5/ETH_TXD1	RGMII Transmit Data Bit1	3.3V	R14
74	IO7/ETH_TXCK	RGMII Transmit Clock	3.3V	U15
76	IO9/ETH_RXD3	RGMII Receive Data Bit3	3.3V	V16
78	IO11/ETH_RXD1	RGMII Receive Data Bit1	3.3V	T16
80	RVD1/MMC2_CLK	No Connection	--	--
82	RVD3/MMC2_D0	No Connection	--	--
84	RVD5/MMC2_D2	No Connection	--	--
86	RVD7/MMC2_D4	No Connection	--	--
88	RVD9/MMC2_D6	No Connection	--	--
90	GND9	Ground	0	--

Table 3 P2 Singular Pin Definition

Pin No.	Pin Name	Description	voltage	Pin Out
1	VRTC	3V Power for RTC	3V	--
3	MMC0_DAT0	MMC/SD/SDIO Data Bus Bit0	3.3V	G16
5	MMC0_DAT1	MMC/SD/SDIO Data Bus Bit1	3.3V	G15
7	MMC0_DAT2	MMC/SD/SDIO Data Bus Bit2	3.3V	F18
9	MMC0_DAT3	MMC/SD/SDIO Data Bus Bit3	3.3V	F17
11	GND1	Ground	0	--
13	SPIO_SCLK	SPI Clock	3.3V	A17
15	SPIO_D0	SPI Data	3.3V	B17
17	UART0_RXD	UART Receive Data	3.3V	E15
19	UART0_TXD	UART Transmit Data	3.3V	E16
21	UART3_RXD	UART Receive Data	3.3V	E18
23	UART3_TXD	UART Transmit Data	3.3V	E17
25	CAN0_RX	DCAN0 Receive Data	3.3V	D17
27	CAN0_TX	DCAN0 Transmit Data	3.3V	D18
29	I2C0_SDA	I2C0 Data	3.3V	C17
31	I2C0_SCL	I2C0 Clock	3.3V	C16
33	GND2	Ground	0	--
35	CAM_D0	Battery +	--	PMIC
37	CAM_D2	Battery +	--	PMIC
39	CAM_D4	Battery Sense	--	PMIC
41	CAM_D6	Battery Test	--	PMIC
43	CAM_D8	No Connection	--	--
45	GND4	Ground	0	--

47	CAM_FIELD	No Connection	--	--
49	CAM_WEN	No Connection	--	--
51	GBE_GREEN	GBE Link	3.3V	AR8035
53	GBE_YELLOW	GBE ACT	3.3V	AR8035
55	GND8	Ground	0	--
57	GBE_TRP2	GBE Data Plus	--	AR8035
59	GBE_TRN2	GBE Data Minus	--	AR8035
61	GBE_TRP3	GBE Data Plus	--	AR8035
63	GBE_TRN3	GBE Data Minus	--	AR8035
65	GND9	Ground	0	--
67	USB0_DM	USB0 Data Minus	--	N18
69	USB0_DP	USB0 Data Plus	--	N17
71	GND11	Ground	0	--
73	USB1_DM	USB1 Data Minus	--	R18
75	USB1_DP	USB0 Data Plus	--	R17
77	GND12	Ground	0	--
79	SPI1_SCLK	No Connection	--	--
81	SPI1_D0	No Connection	--	--
83	SPI1_D1	No Connection	--	--
85	SPI1_CS0	No Connection	--	--
87	GND13	Ground	0	--
89	5V_VDD1	5V Power Supply	5V	--

Table 4 P2 Dual Pin Definition

Pin No.	Pin Name	UART Transmit Data	voltage	Pin Out
2	PWRON_RESETh	Reset Signal Input	3.3V	--
4	WARM_RESETh	CPU Reset Signal Input and output	3.3V	--
6	MMC0_CMD	MMC/SD/SDIO Command	3.3V	G18
8	MMC0_CD	SD Card Detect	3.3V	C15
10	MMC0_CLK	MMC/SD/SDIO Clock	3.3V	G17
12	SPIO_CS0	SPI Chip Select	3.3V	A16
14	SPIO_D1	SPI Data	3.3V	B16
16	UART2_RXD	UART Receive Data	3.3V	H17
18	UART2_TXD	UART Transmit Data	3.3V	J15
20	UART2_RTS	No Connection	3.3V	--
22	UART2_CTS	No Connection	3.3V	--
24	UART1_RXD	UART Receive Data	3.3V	D16
26	UART1_TXD	UART Transmit Data	3.3V	D15
28	UART1_RTS	No Connection	3.3V	--
30	UART1_CTS	No Connection	3.3V	--
32	GND3	Ground	0	--

34	CAM_D1	No Connection	--	--
36	CAM_D3	No Connection	--	--
38	CAM_D5	No Connection	--	--
40	CAM_D7	No Connection	--	--
42	CAM_D9	No Connection	--	--
44	CAM_D10	No Connection	--	--
46	CAM_D11	No Connection	--	--
48	GND5	Ground	3.3V	--
50	CAM_PCLK	No Connection	--	--
52	GND6	Ground	3.3V	--
54	CAM_HD	Interrupt Input	3.3V	A15
56	CAM_VD	Interrupt Input	3.3V	D14
58	GND7	Ground	0	--
60	GBE_TRP0	GBE Data Plus	--	AR8035
62	GBE_TRN0	GBE Data Minus	--	AR8035
64	GBE_TRP1	GBE Data Plus	--	AR8035
66	GBE_TRN1	GBE Data Minus	--	AR8035
68	GND10	Ground	0	--
70	GBE_MDC	MDIO Clk	3.3V	M18
72	GBE_MDIO	MDIO Data	3.3V	M17
74	USB0_ID	USB0 OTG ID	--	P16
76	USB0_VBUS	USB0 VBUS	5V	P15
78	USB1_VBUS	USB1 VBUS	5V	T18
80	LCD_PWM	LCD Backlight PWM Output	3.3V	C18
82	BOOT0_SEL	Boot Select Input	3.3V	--
84	BOOT1_SEL	PMIC Power Button Input	3.3V	PMIC
86	BOOT2_SEL	No Connection	--	--
88	GND14	Ground	3.3V	--
90	5V_VDD2	5V Power Supply	5V	--

# Technical Support and Warranty

## 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 troubleshooting 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;

## Warranty Conditions

- 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 under 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.
  - Products are damaged caused by operations inconsistent with the user manual;
  - 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;
- 1) 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.
  - 2) 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.

## Contact Information

**Technical Support**

Tel: +86-755-25635626-872/875/897

Email: [support@embest-tech.com](mailto:support@embest-tech.com)

Maillist: <http://lists.rocketboards.org/cgi-bin/mailman/listinfo/rfi>

**Sales Information**

Tel: +86-755-25635626-863/865/866/867/868

Fax: +86-755-25616057

Email: [globalsales@embest-tech.com](mailto:globalsales@embest-tech.com)



**Company Information**

Website: <http://www.embest-tech.com>

Address: Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park,  
Liuxian Ave. No. 1183, Nanshan District, Shenzhen, Guangdong, China (518055)