EM3288 Hardware Manual

Boardcon Technology Limited
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1. Introduction

1.1. About this Manual

This manual is intended to provide the user with an overview of the board and benefits, complete features specifications, and set up procedures. It contains important safety information as well.

1.2. Feedback and Update to this Manual

To help our customers make the most of our products, we are continually making additional and updated resources available on the Boardcon website (www.boardcon.com , www.armdesigner.com).

These include manuals, application notes, programming examples, and updated software and hardware. Check in periodically to see what's new!

When we are prioritizing work on these updated resources, feedback from customers is the number one influence, If you have questions, comments, or concerns about your product or project, please no hesitate to contact us at support@armdesigner.com.

1.3. Limited Warranty

Boardcon warrants this product to be free of defects in material and workmanship for a period of one year from date of buy. During this warranty period Boardcon will repair or replace the defective unit in accordance with the following process:

A copy of the original invoice must be included when returning the defective unit to Boardcon. This limited warranty does not cover damages resulting from lighting or other power surges, misuse, abuse, abnormal conditions of operation, or attempts to alter or modify the function of the product.

This warranty is limited to the repair or replacement of the defective unit .In no event shall Boardcon be liable or responsible for any loss or damages, including but not limited to any lost profits, incidental or consequential damages, loss of business, or anticipatory profits arising from the use or inability to use this products.

Repairs make after the expiration of the warranty period are subject to a repair charge and the cost of return shipping. Please contact Boardcon to arrange for any repair service and to obtain repair charge information.

Content

1 EM3288 Introduction

1.1 Summary

EM3288 is a single board computer based on the Rockchip RK3288, Quad Core Cortex-A17 @1.8GHz. RK3288 is powerful on multithreaded computing operation, graphics processing and video decoding ability. RK3288 supports Mali-T760 MP4 Graphics Processing, OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL, Directx11, and can 4Kx2K archieve 4kx2k H.264 and 10 bits of H.265 video decoding, 500% performance boost over Mali-400. On display aspects, RK3288 supports up to 18Gbps Data transmission rate and 4Kx2K@60Hz Video resolution.

It is implemented with a MINI3288 computer-on-module providing most of the functions and interfaces, and EM3288_C carrier board providing connectors and several additional functions. The rich feature set of EM3288 is customizable according to the price / performance needs of the target application. EM3288 contains expansion connectors which accommodate a wide range of standard peripheral devices. Wide input range switched power supply is compatible with requirements for telecom and automotive applications. EM3288 is provided with full ready-to-run Android4.4.4 and Ubuntu SW packages and comprehensive user manual and designing guide.

1.2 Rockchip RK3288 Features

- The first SoC with real 4Kx2K video decoder
- The first SoC with total solution for HDCP2.x security.

RK3288 is a high performance application processor for high-end tablet, notebook, all-in-one device, smart monitor and TV-Box. Especially it is one of most powerful solution for 4Kx2K TV-Box.

Integrate quad-core Cortex-A17 with separately Neon and FPU coprocessor, also shared 1MB L2 Cache. More than 32bits address will support up to 8GB access space.

Currently, latest generation and most powerful GPU is embedded to support smoothly high-resolution (3840x2160) display and mainstream game. Support OpenVG1.1, OpenGL ES1.1/2.0/3.0, OpenCL1.1, RenderScript and DirectX11 etc.

Full-format video decoder, including 4Kx2K multi-format decoder.

Lots of high-performance interface to get very flexible solution, such as multi-pipe display with dual-channel LVDS, dual-channel MIPI-DSI, eDP1.1, HDMI2.0 , dual-channel MIPI-CSI2 interface with 13MP ISP embedded.

Fully-integrated hardware-based security solution will provide HDCP2.x for miracast and all kinds of DRM solution based on different OS.

Dual-Channel 64bits DDR3/LPDDR2/LPDDR3 provide demanding memory bandwidths for high-performance and high-resolution application.

CPU

Quad-Core Cortex-A17

Separately Integrated Neon and FPU per CPU

32KB/32KB L1 ICache/DCache per CPU

Unified 1MB L2 Cache

LPAE (Large Physical Address Extensions) , support up to 8GB address

Space Virtualization Extensions Support

DVFS support

GPU

- 3D GPU

Quad-Core Mali-T7 series, latest powerful graphics processor

Architected for GPU computing

Support OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL1.1 and Renderscript, Directx11

DVFS support

- 2D GPU

Multi-Core architecture

Up to 8Kx8K input and 4Kx4K

Output High-quality image scale

Up/down Dither operation

Image rotation with 90/180/270 degree or x/y-

mirror BitBLT, Alpha Blending, Raster Operation

VPU

- Video Decoder

Support MPEG-2,MPEG-4,AVS,VC-1,VP8,MVC with up to 1080p@60fps

Support multi-format video decoder with up to 4Kx2K

High-quality deinterleave

- Video Encoder

Support muti-format video encoder with up to 1080p@30fps

- Video Input

Dual-channel input for front and rear camera

Dual-channel MIPI-CSI2 interface with 4-lane per channel

8/10/12 bits standard DVP interface

Maximum 5Mpixel for front camera

Maximum 13Mpixel for rear camera with high-performance ISP

- Video Display

Dual-panel display with 2 separately interface

Maximum resolution is 4Kx2K

CABC support to decrease interface power

Dual channel 8/10bits LVDS

Dual channel MIPI-DSI

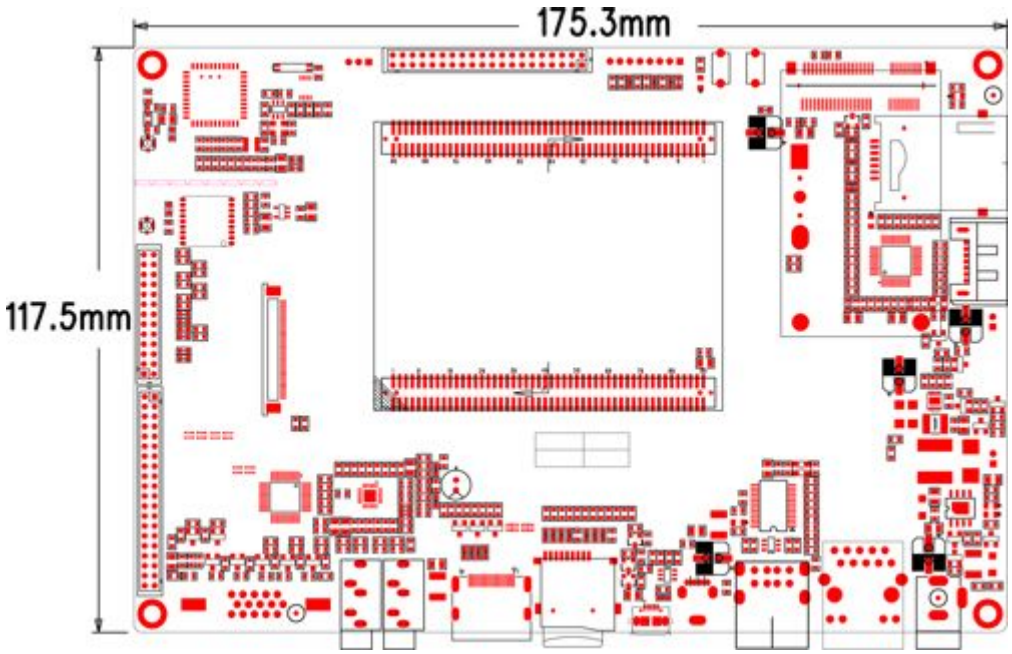
HDMI2.0 to support maximum 4Kx2K display

Optional eDP1.1 interface

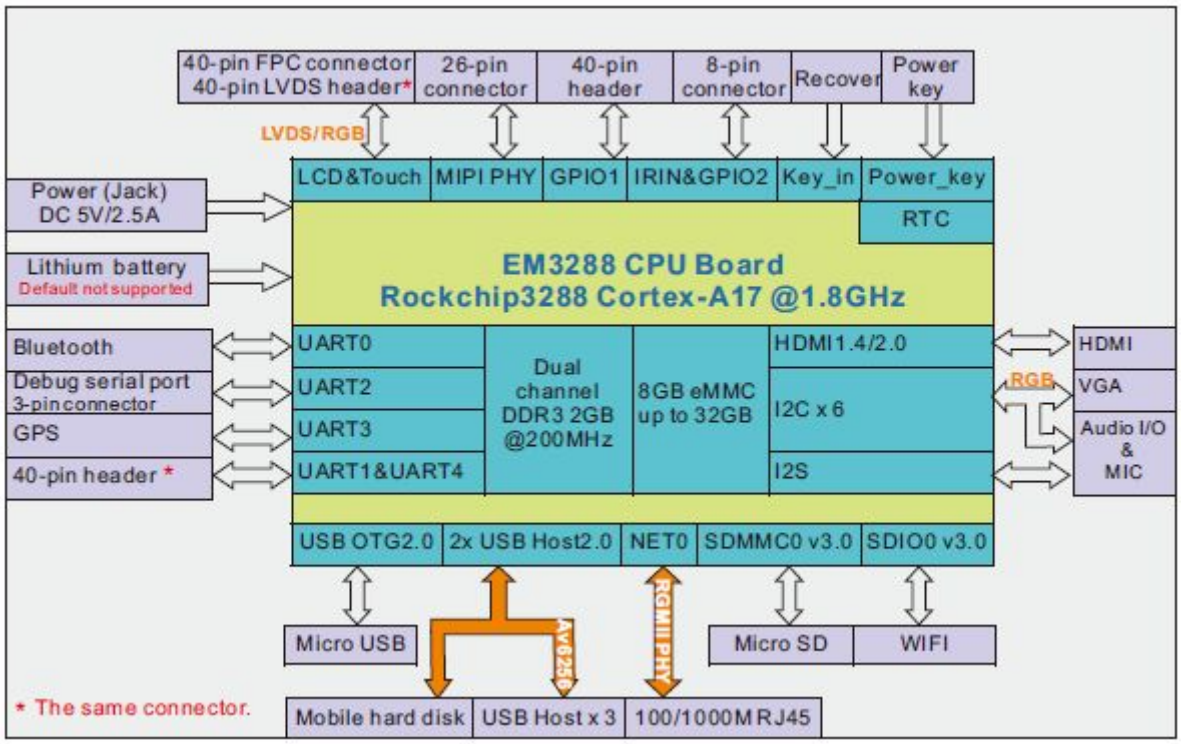
1.3 EM3288 Specifications

Feature	Specifications
CPU	· Rockchip RK3288 , Quad Core Cortex-A17 up to 1.8GHz · 28nm HKMG process
GPU	· ARM Mali-T764 GPU, with TE, ASTC, AFBC technology · Support OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL, DirectX11
Memory	2GB DDR3
Flash	8GB eMMC Flash, up to 32GB
Power	5V/3A
USB	3x USB2.0 Host, 1x USB2.0 OTG
LCD	1x 26-pin MIPI connector, 1x 40-pin LVDS(1280x800), 1x 40-pin TTL LCD connector
VGA	1x VGA connector
Ethernet	10/100/1000M, RJ45 interface
Serial port	1x 3pin connector, for debug
HDMI	HDMI V2.0, up to 4Kx2K@60fps
Audio	Microphone Header, MIC
WiFi/Bluetooth	AP6210 module. Support WiFi and Bluetooth. 2.4GHz/5GHz WiFi, support 802.11 a/b/g/n; BT4.0
SD card	1x Micro SD card slot
RTC	Real Time Clock, powered by external lithium battery
Button	Power, Recover
GPIO	1x 8-pin Control; 1x 40-pin GPIO
Other interfaces	1x SATA, 1x SATA-Power, 1x 3G Module, 1x SIM Card, 1x Lithium battery interface
Optional modules	GPS, WIFI, 3G, Bluetooth, USB camera
Dimension	117.5 x 175.3mm

1.4 PCB Dimension



1.5 Block Diagram

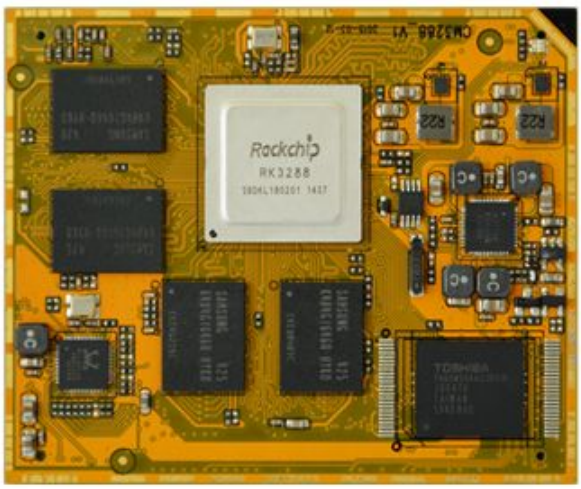


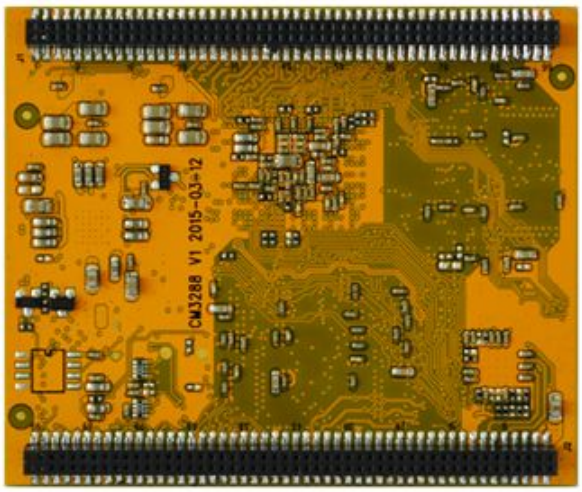
1.6 Motherboard Power meter

Support voltage	5v/2.5A				
System	Connected devices	Electric current(A)	System	Connected devices	Electric current(A)
Android 4.4.4	5v power	0.464	Android 4.4.4	Power, 10.1 inch HD capacitive screen	0.753
Android 4.4.4	Power, sd card, play 1080P video, U disk, usb Mouse, debug serial, Ethernet, 10.1 inch HD capacitive LVDS, headphone	1.13	Android4 .4.4	SLEEP+(Power, sd card, U disk, usb Mouse, debug serial, Ethernet, 10.1 inch HD capacitive LVDS, headphone)	0.35

1.7 CPU Introduction

MINI3288 is a Computer-on-module (CoM) based on Rockchip RK3288 SoC. Integrate quad-core Cortex-A17 with separately Neon and FPU coprocessor, also shared 1MB L2 Cache. Support real 4Kx2K video decoder, 3D GPU processor with OpenGL ES3.0, OpenCL1.1 and DirectX11. It is a high performance application module for high-end tablet, notebook, all-in-one device, smart monitor and TV-Box.





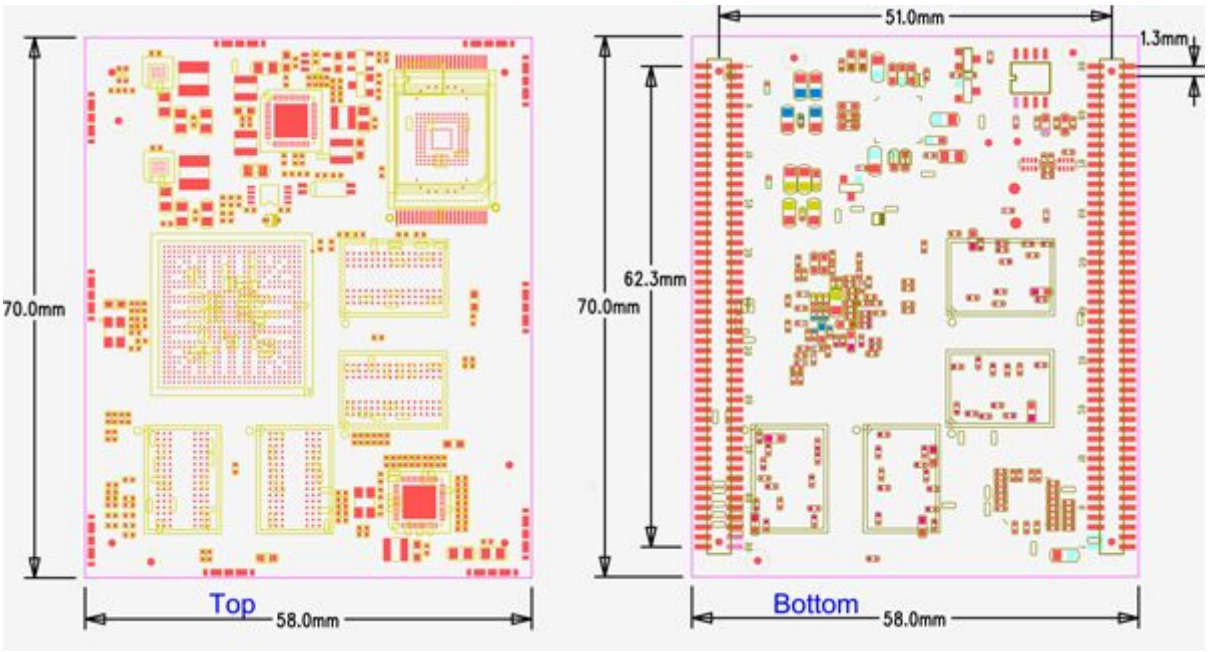
Board Dimension

* Board size: 70mm x 58mm
* Pin to Pin space: 1.3mm
* Pin number: (J11+J12) x 100 = 200 pins
* Layer: 8 Layers, complying with EMS/EMI

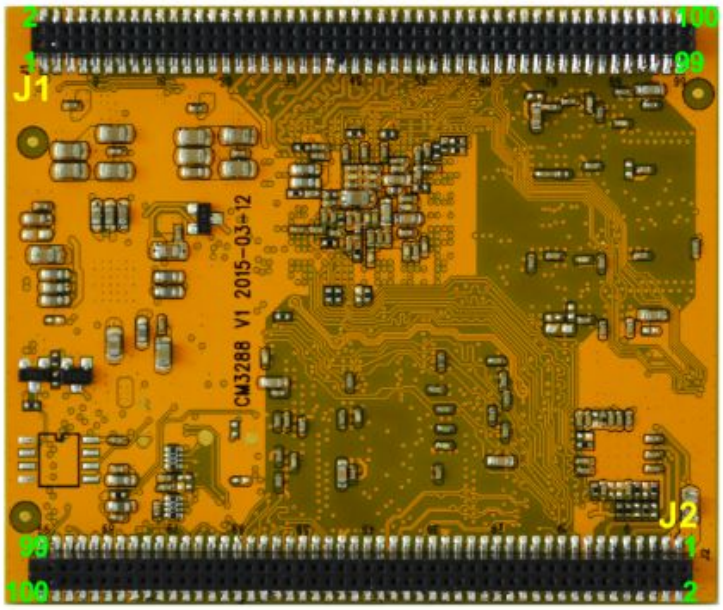
Feature

* MINI3288 Development Board: EM3288
* Processor: Rockchip RK3288, Quad Core Cortex-A17 @ 1.8GHz
* DDR: 2GB DDR3
* NAND Flash: 8GB eMMC
* Preinstalled Android4.4.4
* Power supply: 5V/2.5A
* The modular is led out most signals of RK3288, such as USB Host, USB OTG, LCD, VGA, UART, Gigabit Ethernet, HDMI, Audio, SD/MMC/SDIO, SPI, I2C, I2S, ADC, MIPI-CSI/DSI, LVDS and so on.
* Application: MID, POS, PND, and Terminal controller
* Compatible module: MINI3066, MINI4418

PCB Dimension



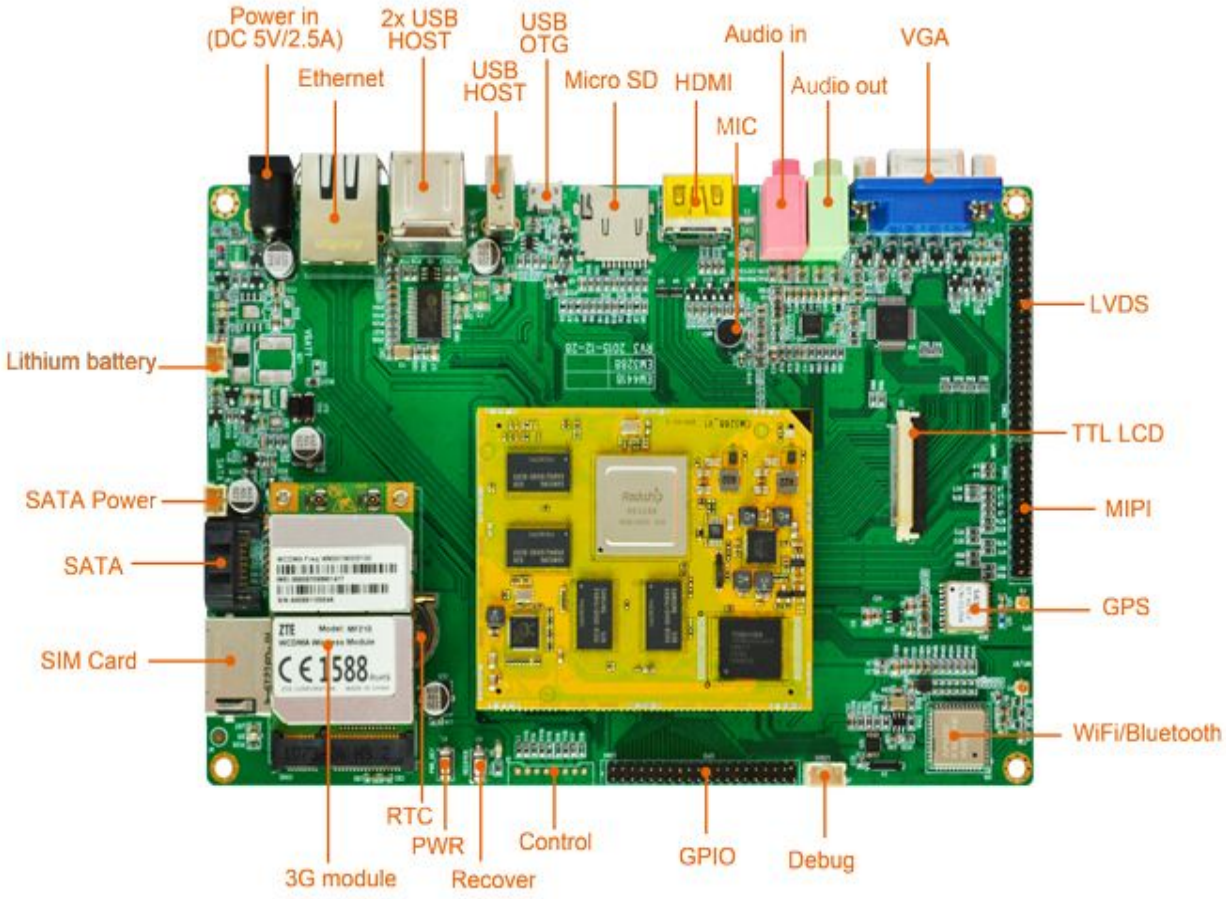
Pin Definition



Pin (J1)	Signal	Pin (J1)	Signal	Pin (J2)	Signal	Pin (J2)	Signal
1	TX_C	51	MIPI_TX/RX_D2P	1	VDD5V	51	TS0_D7
2	TX_0-	52	MIPI_TX/RX_D1P	2	GND	52	TS0_D6
3	TX_C+	53	MIPI_TX/RX_D3P	3	VDD5V	53	GND
4	TX_0+	54	GND	4	GND	54	TS0_SYNC
5	GND	55	MIPI_TX/RX_D3N	5	nRESET	55	TS0_D2
6	GND	56	VDD3V3_EN	6	MDI0+	56	TS0_D3
7	TX_1-	57	HSIC_STROBE	7	MDI1+	57	TS0_D0
8	TX_2-	58	HSIC_DATA	8	MDI0-	58	TS0_D1
9	TX_1+	59	GND	9	MDI1-	59	TS0_CLK
10	TX_2+	60	CIF_D1	10	LCD1_BL	60	TS0_VALID
11	HDMI_HPD	61	CIF_D0	11	MDI2+	61	TS0_ERR
12	HDMI_CEC	62	CIF_D3	12	MDI3+	62	DEMO_RST
13	I2C5_SDA_HDMI	63	CIF_D2	13	MDI2-	63	SDMMC_CLK
14	I2C5_SCL_HDMI	64	CIF_D5	14	MDI3-	64	GND
15	GND	65	CIF_D4	15	GND	65	SDMMC_D0
16	LCD_VSYNC	66	CIF_D7	16	RST_KEY	66	SDMMC_CMD
17	LCD_HSYNC	67	CIF_D6	17	SDIO0_CMD	67	SDMMC_D2
18	LCD_CLK	68	CIF_D9	18	SDIO0_D0	68	SDMMC_D1
19	LCD_DEN	69	CIF_D8	19	SDIO0_D1	69	SDMMC_DET
20	LCD_D0_LD0P	70	VIN_INT	20	SDIO0_D2	70	SDMMC_D3
21	LCD_D1_LD0N	71	VIN_EN	21	SDIO0_D3	71	SDMMC_PWR
22	LCD_D2_LD1P	72	CIF_HREF	22	SDIO0_CLK	72	PWR_LED
23	LCD_D3_LD1N	73	CIF_VSYNC	23	BT_WAKE	73	GND
24	LCD_D4_LD2P	74	CIF_CLKOUT	24	NFC_WAKE	74	SATA_EN

25	LCD_D5_LD2N	75	CIF_CLKIN	25	WIFI_REG_ON	75	I2S_SDI
26	LCD_D6_LD3P	76	I2C3_SCL	26	BT_HOST_WAKE	76	I2S_MCLK
27	LCD_D7_LD3N	77	I2C3_SDA	27	WIFI_HOST_WAKE	77	I2S_SCLK
28	LCD_D8_LD4P	78	GND	28	BT_RST	78	I2S_LRCK_RX
29	LCD_D9_LD4N	79	NFC_HOST_WAKE	29	WORK_LED	79	I2S_LRCK_TX
30	LCD_D10_LCK0P	80	3G_PWEN	30	SATA_RST	80	I2S_SDO0
31	LCD_D11_LCK0N	81	TOUCH_RST	31	LCD1_BL_EN	81	2S_SDO1
32	LCD_D12_LD5P	82	IR_IN	32	TOUCH_INT	82	I2S_SDO2
33	LCD_D13_LD5N	83	LED0_AD0	33	OTG_VBUS_DRV	83	I2S_SDO3
34	LCD_D14_LD6P	84	LED1_AD1	34	NFC_REG_ON	84	SPDIF_TX
35	LCD_D15_LD6N	85	VCC_LAN	35	UART0_RX	85	I2C2_SDA
36	LCD_D16_LD7P	86	PS2_DATA	36	UART0_TX	86	GND
37	LCD_D17_LD7N	87	PS2_CLK	37	GND	87	I2C1_SDA
38	LCD_D18_LD8P	88	ADC0_IN	38	UART0_CTS	88	I2C2_SCL
39	LCD_D19_LD8N	89	HUB_RST	39	OTG_DM	89	I2C4_SDA
40	LCD_D20_LD9P	90	KEY_IN	40	UART0_RTS	90	I2C1_SCL
41	LCD_D21_LD9N	91	VCCIO_SD	41	OTG_DP	91	UART2_RX
42	LCD_D22_LCK1P	92	ADC2_IN	42	OTG_ID	92	I2C4_SCL
43	LCD_D23_LCK1N	93	VCCA_18	43	HOST1_DM	93	UART3_RX
44	GND	94	VCCA_33	44	OTG_DET	94	UART2_TX
45	MIPI_TX/RX_CLKN	95	VCC_18	45	HOST1_DP	95	UART3_RTSn
46	MIPI_TX/RX_D0P	96	VCC_RTC	46	HOST2_DM	96	UART3_TX
47	MIPI_TX/RX_CLKP	97	VCC_IO	47	TS0_D5	97	LCD2_BL
48	MIPI_TX/RX_D0N	98	GND	48	HOST2_DP	98	UART3_CTSn
49	MIPI_TX/RX_D2N	99	VCC_IO	49	TS0_D4	99	PWR_KEY
50	MIPI_TX/RX_D1N	100	GND	50	GND	100	DEMO_INT

2 Peripherals Introduction



2.1 Power (P6, J17)

EM3288 Power Supply – 5V DC power supply or external Li+ battery

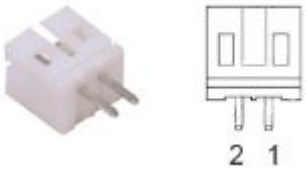
- **5V/2.5A DC power supply (P6)**

Pin	Signal	Description	Pin	Signal	Description
1	VDD5V	Main power supply. DC 5V power in	2	GND	Ground
3	GND	Ground			

- **Lithium battery (J17)**

EM3288 gains a Li+ battery management unit and provides an external Li+ battery interface.

(Reserved interface, the function is not supported currently.)



Pin	Signal	Description	Pin	Signal	Description
1	VBAT	Li+ Battery	2	GND	Ground

2.2 Ethernet (JP1)

RK3288 has integrated Gigabit Ethernet MAC. EM3288 adopts RTL8211E as the Ethernet chip. RJ45 connector

Feature

* Supports 10/100/1000-Mbps data transfer rates with the RGMII interfaces
* Supports both full-duplex and half-duplex operation
* Supports IEEE 802.1Q VLAN tag detection for reception frames

Pin	Signal	Description	Pin	Signal	Description
1	COM	Common	2	MDI0+	Bi-directional transmit/receive pair 0
3	MDI0-	Bi-directional transmit/receive pair 0	4	MDI1+	Bi-directional transmit/receive pair 1
5	MDI2+	Bi-directional transmit/receive pair2	6	MDI2-	Bi-directional transmit/receive pair2
7	MDI1-	Bi-directional transmit/receive pair 1	8	MDI3+	Bi-directional transmit/receive pair 3
9	MDI3-	Bi-directional transmit/receive pair 3	10	GND	Ground
11	VDD_LAN	3.3.V	12	LINK	Detect link
13	GND	Ground	14	SPEED	Detect speed
15	GND	Ground	16	GND	Ground

2.3 USB HOST (P2, P3)

EM3288 provides 3x USB2.0 Host. One is a single USB (P2), and the other is a double-USB (P3). The 3-ch USB HOST interfaces are extended by AU6256 which is a fully compliant with the USB 2.0 hub specification and is designed to work with USB host as a high-speed hub. It is used to connect USB mouse, U disk, USB camera, and other USB devices, supports hot-plug.

Feature

* Compatible with USB Host2.0 specification
* Supports high-speed (480Mbps), full-speed (12Mbps) and low-speed (1.5Mbps) mode
* Supports automatic switching between bus- and self-powered modes
* Provides 16 host mode channels
* Support periodic out channel in host mode

Single-Host (P2)					
Pin	Signal	Description	Pin	Signal	Description
1	VCC_USB	USB Power. DC 5V	2	USB_DM2	USB data-
3	USB_DP2	USB Data+	4	GND	Ground
5	GND	Ground	6	GND	Ground
7	GND	Ground			

Double- Host (P3)					
Pin	Signal	Description	Pin	Signal	Description
1	VCC_USB	USB Power. DC 5V	2	USB_DM4	USB data-
3	USB_DP4	USB Data+	4	GND	Ground
5	VCC_USB	USB Power. DC 5V	6	USB_DM3	USB data-

7	USB_DP3	USB Data+	8	GND	Ground
9	GND	Ground	10	GND	Ground
11	GND	Ground	12	GND	Ground

2.4 USB OTG (J8)

EM3288 OTG is a Micro USB2.0 port, it is used to download image and ADB transfer file.

Feature

* Compatible with USB OTG2.0 specification

*Supports USB 2.0 High Speed (480Mbps), Full Speed (12Mbps) and Low Speed (1.5Mbps) operation in host mode

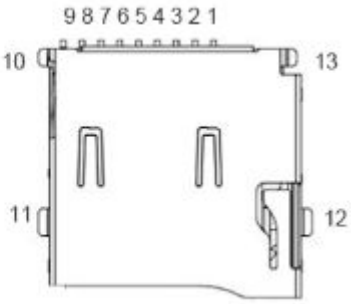
*Supports USB 2.0 High Speed (480 Mbps) and Full Speed (12 Mbps) operation in peripheral mode.

*Hardware support for OTG signaling, session request protocol, and host negotiation protocol.

Micro USB					
Pin	Signal	Description	Pin	Signal	Description
1	OTG_DET	OTG detection. OTG 5V power supply	2	OTG_DM	OTG data -
3	OTG_DP	OTG data+	4	OTG_ID	OTG ID indicator
5	GND	Ground	6	GND	Ground
7	GND	Ground			

2.5 Micro SD (J1)

The Micro SD card is used as an external storage device. The MMC controller interface supports up to 4-bit transfer modes. MMC is always accessible through the carrier board interface. It does not support hot-plug.

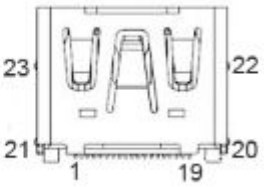


Pin	Signal	Description	Pin	Signal	Description
1	SDMMC_D2	SD/MMC data2	2	SDMMC_D3	SD/MMC data3
3	SDMMC_CMD	SD/MMC command signal	4	VCCIO_SD	3.3V
5	SDMMC_CLK	SD/MMC clock	6	GND	Ground
7	SDMMC_D0	SD/MMC data0	8	SDMMC_D1	SD/MMC data1
9	SDMMC_DET	SD/MMC detect signal	10	GND	Ground
11	GND	Ground	12	GND	Ground

2.6 HDMI (PH1)

The HDMI interface available is based on the “HDMI transmitter” & “HDMI 3D Tx PHY” integrated into the EM3288 SoC. The “HDMI transmitter” combines video/display data from the IPU, Audio data from EM3288 memory & control/status data from the ARM complex, into Xhdmi data & clock channels. The “HDMI 3D Tx PHY” transmits the combined data by means of 3 Xhdmi data pairs and an Xhdmi clock pair to the EM3288 carrier board interface.

EM3288 HDMI2.0 supports maximum 4Kx2K display, and it also enables HDMI/LCD audio and video synchronization output. The HDMI interface is the regular 19pins HDMI type A, with width 13.9mm and thickness 4.45mm. The resolution up to 1920x1080p@60HZ.



Pin	Signal	Description	Pin	Signal	Description
1	TX_2+	HDMI data 2 pair	2	GND	Ground
3	TX_2-		4	TX_1+	HDMI data 1 pair
5	GND	Ground	6	TX_1-	
7	TX_0+	HDMI data 0 pair	8	GND	Ground
9	TX_0-		10	TX_C+	HDMI clock pair
11	GND	Ground	12	TX_C-	
13	HDMI_CEC	Consumer electronics control	14	NC	Not connect

15	HDMI_SCL	HDMI serial clock	16	HDMI_SDA	HDMI serial data
17	GND	Ground	18	HDMI_VCC	5V
19	HDMI_HPD	Hot Plug Detect	20	GND	Ground
21	GND	Ground	22	GND	Ground
23	GND	Ground			

2.7 Audio I/O (J6, J7, MIC1)

The EM3288 adopts audio codec ES8323, provides stereo audio output (Green, 3.5mm audio jack) and line in (Pink, 3.5mm audio jack).

Features

- Low power
- Integrated ADC and DAC
- IIS transfer audio data
- Stereo output, support recording

Line in (J6)					
Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	RIN2	Right Channel input
3	RIN2	Right Channel input	4	LIN2	Left Channel input
5	LIN2	Left Channel input			
Headphone (J7)					
Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	HP_RO	Right Channel Headphone Output
3	AROUT	Right Channel Headphone Output	4	ALOUT	Left Channel Headphone Output
5	HP_LO	Left Channel Headphone Output			

The MIC1 model is WM_64BC MIC/F6/DIP. It is used for recording.

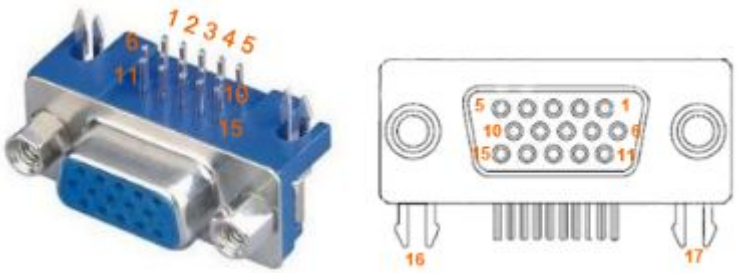
MIC1					
Pin	Signal	Description	Pin	Signal	Description
1	MIC1P	Command signal	2	MIC1N	Ground

Note: 1. If insert HDMI, The audio default output from HDMI, the headphone not voice. Plug out the HDMI cable the headphone output audio.

2. If insert line in cable, the line in port default record. Plug out the line in cable the MIC1 record.

2.8 VGA (J20)

EM3288 adopts standard 15-pin female VGA connector, and SDA7123 3-Channel 10 Digit Video D/A converter. The VGA function default is not supported.



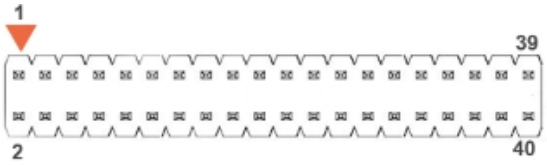
Pin	Signal	Description	Pin	Signal	Description
1	NC	Not connect	2	TXD3	Transmit Data
3	RXD3	Receive Data	4	NC	Not connect
5	GND	Ground	6	NC	Not connect
7	RTSn3	Request To Send	8	CTSn3	Clear To Send
9	NC	Not connect	10	GND	Ground
11	GND	Ground	12	VGA_OUT_SDA	Serial Data
13	LCD_HSYNC	LCD Horizontal Sync	14	LCD_VSYNC	LCD Vertical Sync
15	VGA_OUT_SCL	VGA_OUT Data Clock	16	GND	Ground
17	GND	Ground			

2.9 LVDS (CON3)

The LVDS is a 40-pin header connector. EM3288 supports 10.1-inch HD capacitive LCD. The resolution up to 1280 x 800.

Features

* Comply with the TIA/EIA-644-A LVDS standard
* Combine LVTTL IO, support LVDS/LVTTL data output
* Support reference clock frequency range from 10MHz to 148.5MHz
* Support LVDS RGB 30/24/18bits color data transfer
* Support VESA/JEIDA LVDS data format transfer
* Support LVDS single channel and double channel data transfer, every channel include 4 data lanes and 1 clock lane
* Support MSB mode and LSB mode data transfer
* Support APB slave bus interface
* Support low power mode



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	VCC5V	2	VCC5V	3	GND	4	GND
5	VCC_IO	6	VCC_IO	7	GND	8	GND
9	I2C4_SCL	10	I2C4_SDA	11	TOUCH_RST	12	TOUCH_INT
13	LVDS_EN	14	LVDS_PWM	15	GND	16	GND
17	LCK1P	18	LCK1N	19	GND	20	GND
21	LD8P	22	LD8N	23	LD7P	24	LD7N
25	LD6P	26	LD6N	27	LD5P	28	LD5N
29	LCK0P	30	LCK0N	31	GND	32	GND
33	LD3P	34	LD3N	35	LD2P	36	LD2N
37	LD1P	38	LD1N	39	LD0P	40	LD0N

2.10 TTL LCD (J21)

J21 is a 40-pin FPC connector for TTL LCD. Currently the TTL LCD function is not supported.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	VDD5V	2	VDD5V	3	VDD5V	4	GND
5	GND	6	GND	7	GND	8	LCD1_BL
9	LCD1_BL_EN	10	LCD1_RST	11	VCC_IO	12	VCC_IO
13	VCCA_18	14	VCCA_18	15	GND	16	GND
17	CLKN	18	CLKP	19	GND	20	GND

21	D0N	22	D0P	23	GND	24	GND
25	D1N	26	D1P	27	GND	28	GND
29	D2N	30	D2P	31	GND	32	GND
33	D3N	34	D3P	35	GND	36	GND
37	I2C4_SCL	38	I2C4_SDA	39	TOUCH_RST	40	TOUCH_INT

2.11 MIPI (CON5)

EM3288 supports a 26-pin MIPI connector. Currently the MIPI function is not supported.

Features

* Embedded 3 MIPI PHY, MIPI 0 only for TX, MIPI 1 for TX and RX, MIPI 2 only for RX
* Support 4 data lane, providing up to 6Gbps data rate
* Support 1080p@60fps output
* Lane operation ranging from 80 Mbps to 1.5Gbps in forward direction.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	VCC5V	2	VCC5V	3	GND	4	GND
5	VCC_IO	6	VCC_IO	7	VCCA_18	8	GND
9	LCD1_BL	10	LCD1_BL_EN	11	LCD1_RST	12	I2C4_SCL
13	I2C4_SDA	14	TOUCH_RST	15	TOUCH_INT	16	GND
17	CLKN	18	CLKP	19	D0N	20	D0P
21	D1N	22	D1P	23	D2N	24	D2P
25	D3N	26	D3P				

2.12 GPS (MU4)

The GPS module (Model: ST-91-U7) uses ublox 7 chipset which is high performance u-blox 7 multi-GNSS(GPS, GLONASS, QZSS, SBAS – Galileo and Compass ready) position engine delivers exceptional sensitivity and acquisition times.

Features

* Ublox 7 high performance and low power consumption GPS Chipset
* Very high sensitivity (Tracking Sensitivity: -162dBm)
* Extremely fast TTFF (Time To First Fix) at low signal level
* Two serial port: UART, I2C
* Built-in LNA
* A-GPS Support
* Exceptional jamming immunity
* Support NMEA 0183 and ublox binary protocol
* Channels: 56
* Available Baud: 9,600 bps
* The antenna band is 1575.42MHZ; Voltage: 3.0-5.0V

Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	GPS_UART3_RX	UART3 receive
3	GPS_UART3_TX	UART3 transmit	4	NC	Not connect
5	NC	Not connect	6	VCC_RTC	Backup voltage supply
7	GPSVDDIO	IO Supply Voltage	8	VDD_GPS	Supply voltage
9	GPSRST	Reset	10	GND	Ground
11	GPS_RFIN	GPS signal input	12	GND	Ground
13	NC	Not connect	14	RFVCC	Output Voltage RF section
15	NC	Not connect	16	NC	Not connect
17	NC	Not connect	18	NC	Not connect

2.13 WiFi&Bluetooth (U11)

AP6210 is a low-power consumption module which has incorporated Wi-Fi and Bluetooth into one chip. The module complies with IEEE 802.11 b/g/n standard and it could achieve up to a speed of 72.2Mbps with single stream in 802.11n draft, 54Mbps as specified in 802.11g, or 11Mbps for 802.11b to connect to the wireless LAN. The integrated module provides SDIO interface for WiFi, UART / PCM for Bluetooth.

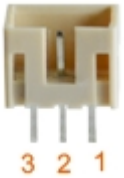
Features

* 802.11b/g/n single-band radio
* Bluetooth V4.0 + EDR with integrated Class 1.5 PA Concurrent Bluetooth and WLAN operation
* Simultaneous BT / WLAN receive with single antenna
* WLAN host interface options:
  - SDIO v2.0 — up to 50 MHz clock rate
* BT host digital interface:
  - UART (up to 4 Mbps)
* IEEE Co-existence technologies are integrated die solution

Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	WL_BL_ANT	RF I/O port
3	GND	Ground	4	NC	Not connect
5	NC	Not connect	6	BT_WAKE	HOST wake-up Bluetooth device
7	BT_HOST_WAKE	Bluetooth device to wake-up HOST	8	NC	Not connect
9	VBAT_WL	Main power voltage source input	10	NC	Not connect
11	NC	Not connect	12	WIFI_REG_ON	Regulators power enable/disable
13	WIFI_HOST_WAKE	WIFI to wake-up HOST	14	WIFI_D2	WIFI data line2
15	WIFI_D3	WIFI data line3	16	WIFI_CMD	WIFI command line
17	WIFI_CLK	WIFI CLK line	18	WIFI_D0	WIFI data line0
19	WIFI_D1	WIFI data line1	20	GND	Ground
21	VIN_LDO_OUT	Internal Buck voltage generation pin	22	VCCIO_WL	I/O Voltage supply input
23	VIN_LDO	Internal Buck voltage generation pin	24	LPO	External Low Power Clock input (32.768KHz)
25	NC	Not connect	26	NC	Not connect
27	NC	Not connect	28	NC	Not connect
29	VCCIO_WL	1.7V to 3.3V supply for the TCXO driver	30	MCLK_IN	Reference clock input
31	GND	Ground	32	NC	Not connect
33	GND	Ground	34	BT_RST	Low asserting reset for Bluetooth core
35	NC	Not connect	36	GND	Ground
37	NC	Not connect	38	NC	Not connect
39	NC	Not connect	40	NC	Not connect
41	UART0_CTS	Bluetooth UART interface	42	UART0_RX	Bluetooth UART interface

43	UART0_TX	Bluetooth UART interface	44	UART0_RTS	Bluetooth UART interface

2.14 Debug serial port (J10)

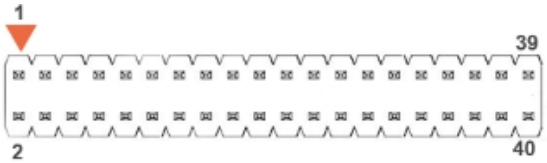


EM3288 provides an online debug serial port (UART2). It is used to connect PC and board with the USB-to-serial TTL232 serial cable.

Pin	Signal	Description	Pin	Signal	Description
1	UART2_RX	UART2 receive	2	UART2_TX	UART2 transmit
3	GND	Ground			

2.15 GPIO (CON4)

The GPIO is a 40-pin header connector. The pins can be defined as data input / output.

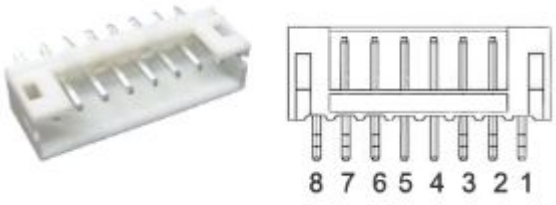


GPIO (CON4)					
Pin	Signal	Description	Pin	Signal	Description
1	ADC2_IN	ADC2 input	2	ADC0_IN	ADC0 input
3	SPI0_CLK/TS0_D4	SPI0 clock/ TSI data4	4	SPI0_CSn0/TS0_D5	SPI0 Chip Select/ TSI data5
5	SPI0_UART4_RXD/TS0_D7	UART4 receive data/ TSI data7	6	SPI0_UART4_TXD/ TS0_D6	UART4 transmit data/ TSI data6
7	UART1_CTSn/TS0_D2	UART1 clear to send/ TSI data2	8	TS0_SYNC	TSI synchronizer signal
9	UART1_RX/TS0_D0	UART1 receive/ TSI data0	10	UART1_RTSn/TS0_D3	UART1 ready-to-send output/ TSI data3
11	TS0_CLK	TSI reference clock	12	UART1_TX/TS0_D1	UART1 transmit/ TSI data1
13	TS0_ERR	TSI fail signal	14	TS0_VALID	TSI valid signal

15	I2C3_SCL	I2C3 serial clock	16	I2C3_SDA	I2C3 serial data
17	CIF_CLKOUT	Camera0 interface output work clock	18	CIF_CLKIN	Camera0 interface input pixel clock
19	CIF_HREF	Camera0 interface horizontal sync signal	20	CIF_VSYNC	Camera0 interface vertical sync signal
21	VIN_INT	VIN interrupt	22	VIN_EN	VIN enable
23	CIF_D9	Camera0 interface input pixel data9	24	CIF_D8	Camera0 interface input pixel data8
25	CIF_D7	Camera0 interface input pixel data7	26	CIF_D6	Camera0 interface input pixel data6
27	CIF_D5	Camera0 interface input pixel data5	28	CIF_D4	Camera0 interface input pixel data4
29	CIF_D3	Camera0 interface input pixel data3	30	CIF_D2	Camera0 interface input pixel data2
31	CIF_D1	Camera0 interface input pixel data1	32	CIF_D0	Camera0 interface input pixel data0
33	GND	Ground	34	GND	Ground
35	VCC_IO	3.3V	36	VCC_IO	3.3V
37	GND	Ground	38	GND	Ground
39	VCC5V	5V	40	VCC5V	5V

2.15 Control (J2)

The Pin6 of J2 is IR_IN. The EM3288 supports IR data receiver. The signals are transmitted directly to the CPU.



Pin	Signal	Description	Pin	Signal	Description
1	VCC_IO	3.3V	2	GND	Ground
3	KEY_IN	Recover key in	4	PWR_KEY	Power key
5	GND	Ground	6	IR_IN	IR in
7	WORK_LED	Work LED	8	PWR_LED	Power LED

2.16 Buttons (K1, K2)

On-board 2x buttons, K1 is Power key, and K2 is Recover.

The K1&K2 share the same signal port with PIN3&4 of J2.

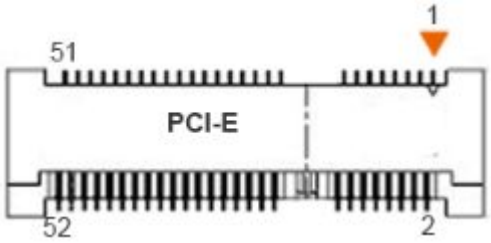
The K2 is used for download. If download system, connect PC and EM3288 with USB cable, then keep-press K2 and power up until the PC pop up “found one download device”.

Short press K1 is sleep, and press again is wake up. Long press is power off and reboot.

2.17 3G connector & SIM slot (CON2, P4)

MINI PCI-E is an on-board 3G module connector. The EM3288 is also equipped with a SIM card slot. The EM3288 3G module (Model: ZTE MF210) can be used directly in any country without modifying the APN and dial number.

The 3G module is optional.



3G connector (CON2)							
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	NC	2	3GVCC	3	NC	4	GND
5	NC	6	NC	7	NC	8	SIM_VCC
9	GND	10	SIM_DATA	11	NC	12	SIM_CLK
13	13	NC	14	15	GND	16	NC
17	NC	18	GND	19	NC	20	3GVCC
21	GND	22	3G_PWEN	23	NC	24	3GVCC
25	NC	26	GND	27	GND	28	NC
29	GND	30	NC	31	NC	32	NC
33	NC	34	GND	35	GND	36	USB_DM1
37	GND	38	USB_DP1	39	3GVCC	40	GND
41	3GVCC	42	LED_RED	43	GND	44	NC
45	NC	46	NC	47	NC	48	NC
49	NC	50	GND	51	NC	52	3GVCC

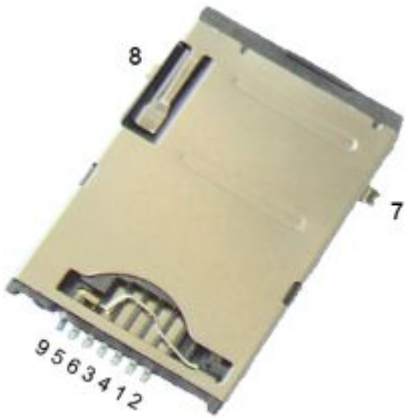
ZTE MF210 Technical Specifications

* Form Factor: PCI Express Mini Card
* Size: 51*30*4.7mm
* Weight: About 10g
* Chipset: MSM6290+ RTR6285 + PM6653
* Memory: (SDRAM/NAND)32MByte/64MByte
* Air Interface: HSUPA/HSDPA/WCDMAEDGE/GPRS/GSM
* Frequency Bands:
- WCDMA/HSPA 2100/1900/850(900) MHz
- GSM/GPRS/EDGE 1900/1800/900/850MHz
* RxDiv Band: 2100/1900/850(900) MHz
* Control Options: AT Commands

Data Speed

* HSDPA DL: 7.2Mbps
* HSUPA UL: 5.76Mbps
* WCDMA PSDL: 384 Kbps UL: 384 Kbps
* WCDMA CSDL: 64 Kbps UL: 64 Kbps
* EDGE CLASS12
* GPRS CLASS10
* GSM CSDL: 9.6kbps UL: 9.6kbps

P4 is an auto pop-up SIM card slot which is compatible to the standard SIM Card and can be used for wireless transmission with a 3G module. It supports WCDMA, CDMA2000, TD-SDCDMA and WiMax SIM card.



SIM Card slot (P4)					
Pin	Signal	Description	Pin	Signal	Description
1	SIM_CLK	Clock	2	SIM_DATA	send/receiver data I/O control
3	SIM_RST	Reset	4	SIM_VCC	Connect to CON5
5	SIM_VCC	Connect to CON5	6	GND	Ground
7	GND	Ground	8	GND	Ground
9	GND	Ground			

2.18 SATA & SATA_Power (J14, J18)

On-board 7-pin SATA Interface, equipped with a HS USB to SATA bridge JM20329. The SATA requires 5V power supply.

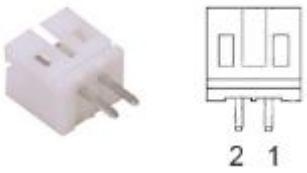
The SATA only supports mobile hard disk, and desktop hard disk is not supported.

Features

* Compliance with Gen1i/Gen1m of Serial ATA II Electrical Specification 2.5

* Support SATA II Asynchronous Signal Recovery (Hot Plug) feature

SATA connector (J14)					
Pin	Signal	Description	Pin	Signal	Description
1	SATA_TXP	SATA transmit data(positive)	2	GND	Ground
3	SATA_TXN	SATA transmit data(negative)	4	GND	Ground
5	SATA_RXN	SATA receive data(negative)	6	SATA_RXP	SATA receive data(positive)
7	GND	Ground			



SATA_Power (J18)					
Pin	Signal	Description	Pin	Signal	Description
1	SATA_5V	SATA power. DC 5V	2	GND	Ground

2.19 RTC (BT1)

The backup battery (3V) is used to ensure the RTC (frequency 32.768KHz) is still able to work after power off. Lithium cell model: CR1220.

3 Product Configurations

3.1 Standard Contents

- EM3288 board x1
- CD-ROM (Android BSP, Ubuntu BSP, Documents, tools, Schematic Drawing, datasheets) x1
- Ethernet cable x1
- Serial Cable x1
- USB Cable x1
- 5V/2.5A DC power adaptor x1

3.2 Optional Parts

- USB camera Module
- WiFi & Bluetooth Module
- GPS Module
- LCD Module (10.1-inch HD capacitive screen)
- 3G Module (MF210)