EM3288 Hardware Manual

V2. 0

Boardcon Embedded Design

www. boardcon. com

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 product.

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

This document (V2) is based on EM3288 V7(MINI3288 version: V4).

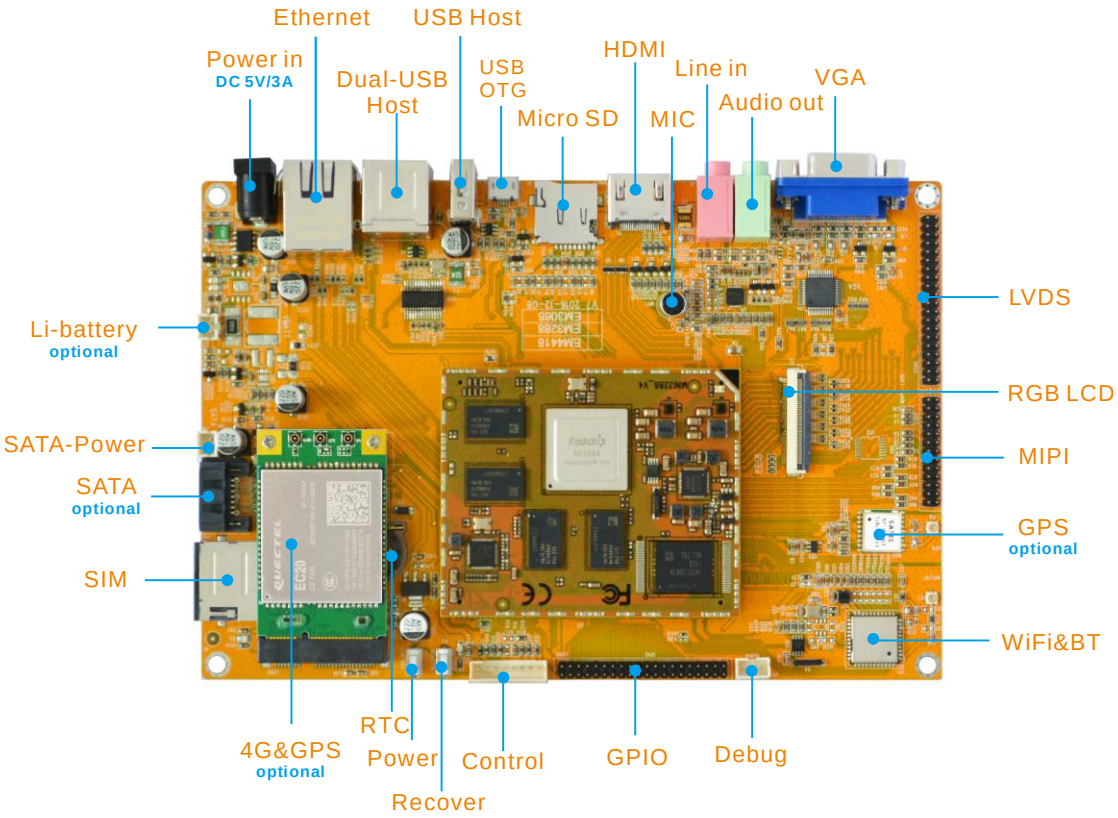
1.1 Summary

EM3288 is based on the Rockchip RK3288, Quad Core Cortex-A17 @1.8GHz. RK3288 is powerful on multithreaded computing operation, graphics processing and video decoding ability. It supports Mali-T760 MP4 Graphics Processing, OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL, Directx11, and can 4Kx2K achieve 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.
EM3288 is provided with full ready-to-run Android7.1.2 and Ubuntu SW packages and comprehensive user manual and designing guide.

1.2 Rockchip RK3288 Features

- CPU
  Quad-Core Cortex-A17, up to 1.8GHz
- GPU
  Mali-T764 GPU, Supports AFBC (ARM Frame Buffer Compression)
  - Support OpenGL ES 1.1/2.0/3.1, OpenCL, DirectX9.3
  - High performance dedicated 2D processor
- Multi-Media
  4K 10bits H265/H264 video decoders
  - 1080P other video decoders (VC-1, MPEG-1/2/4, VP8)
  - 1080P video encoder for H.264 and VP8
  - Video post processor: de-interlace, de-noise, enhancement for edge/detail/color
- Display
  Support RGB/Dual LVDS/Dual MIPI-DSI/eDP interface, up to 3840*2160 resolution
  HDMI 2.0 for 4K@60Hz with HDCP 1.4/2.2
- Security
  - ARM TrustZone (TEE), Secure Video Path, Cipher Engine, Secure boot
- Memory
  - Dual-channel 64bit DDR3-1333/DDR3L-1333/LPDDR2-1066
  - Support MLC NAND, eMMC 4.51
- Connectivity
  - Embedded 13M ISP, MIPI CSI-2 and DVP interface
  - Dual SDIO 3.0 interface
  - TS in/CSA2.0, support DTV function
  - Embed HDMI, Ethernet MAC, S/PDIF, USB, I2C, I2S, UART, SPI, PS2

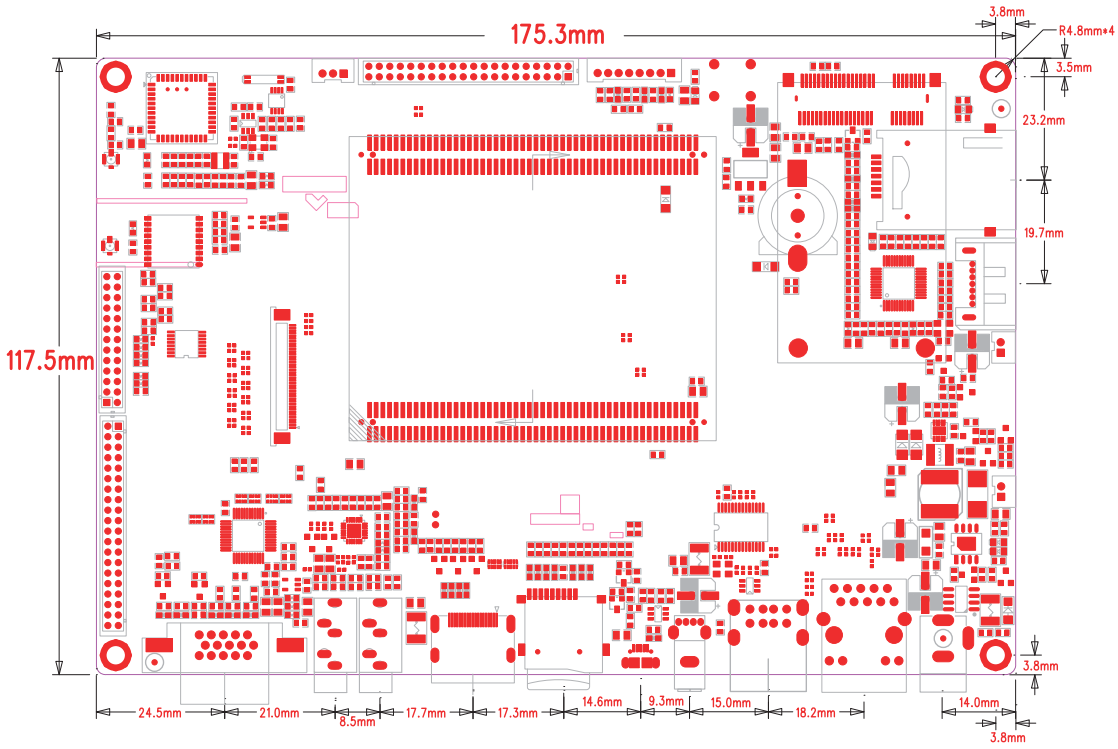
1.3 EM3288 Specifications



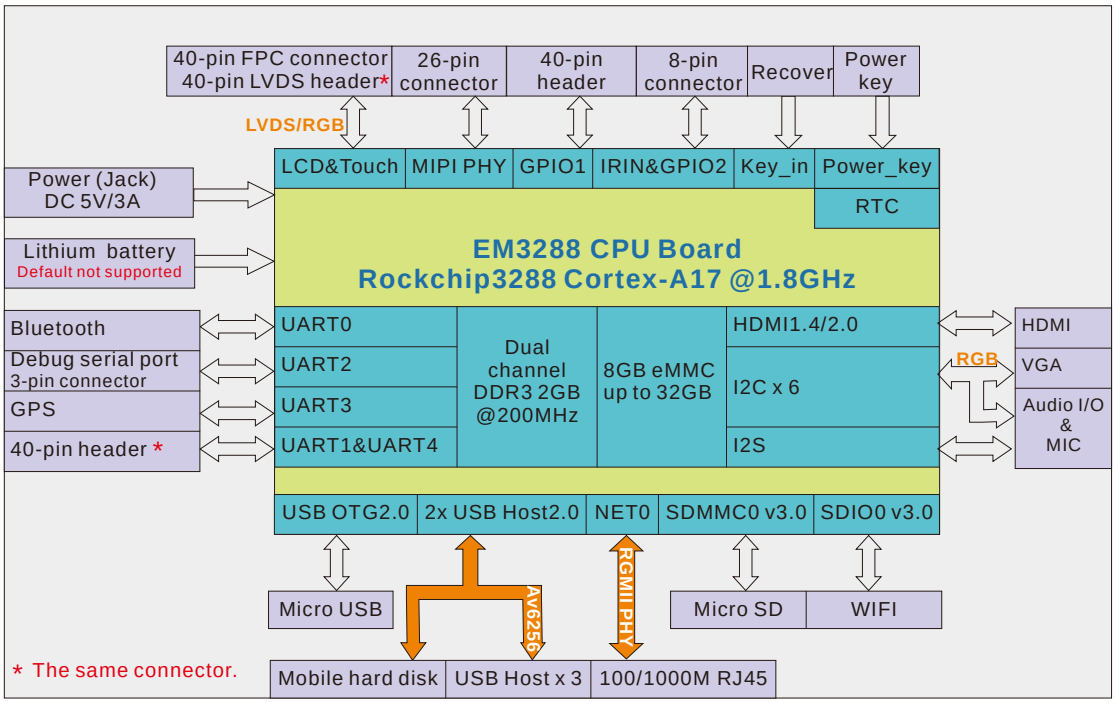
Feature	Specifications
CPU	· Rockchip RK3288, Quad Core Cortex-A17 @ 1.8GHz · 28nm HKMG process
GPU	· ARM Mali-T764 GPU, with TE, ASTC, AFBC technology · Support OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL, DirectX11
Memory	2GB DDR3
Flash	4G/8GB eMMC Flash
Power	5V/3A
USB	3x USB2.0 Host, 1x USB2.0 OTG
LCD	1x 40-pin LVDS: - 10.1-inch 1280 x 800 LCD with multi-dot capacitive touchscreen; - 7-inch 1024 x6 00 LCD with multi-dot capacitive touchscreen; 1x 40-pin TTL LCD connector
VGA	1x VGA connector. Automatically adjust according to display size
Ethernet	100/1000M, RJ45 interface. RTL8211E-VB-CG controller
Serial port	1x 3pin connector, for debug
HDMI	HDMI V2.0, up to 4Kx2K@60fps. Audio sync-output
Audio	3.5mm jacks, MIC. ES8388 audio codec

SD card	1x Micro SD card slot
WiFi & Bluetooth	AP6236 module. WiFi - 2.4GHz, 802.11b/g/n. Bluetooth4.0.
4G	Quectel EC20, PCIe connector
GPS	SATES ST-91-U7
Camera	Supporting MIPI camera, and most of USB CMOS camera on the market,
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 SIM Card, 1x Lithium battery interface
Dimension	117.5 x 175.3mm

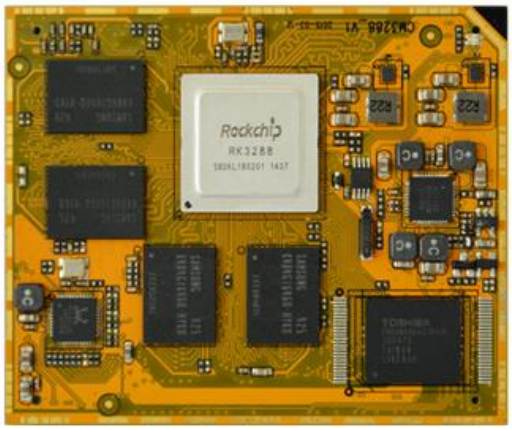
1.4 PCB Dimension

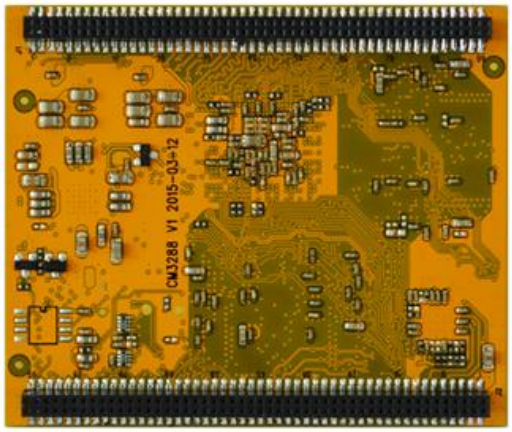


1.5 Block Diagram



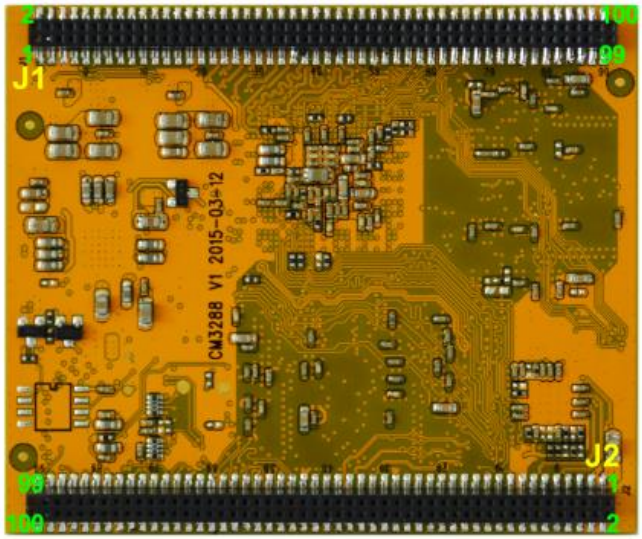
1.6 CPU Introduction





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



Pin Definition

Pin (J1)	Signal	Pin (J1)	Signal	Pin (J2)	Signal	Pin (J2)	Signal
1	TX_C	51	MIPI_TX/RX_D2P	1	VCC_SYS	51	SPI0_UART4_RXD
2	TX_0-	52	MIPI_TX/RX_D1P	2	GND	52	SPI0_UART4_TXD
3	TX_C+	53	MIPI_TX/RX_D3P	3	VCC_SYS	53	GND
4	TX_0+	54	GND	4	GND	54	TS0_SYNC
5	GND	55	MIPI_TX/RX_D3N	5	nRESET	55	UART1_CTSn
6	GND	56	DVP_PWR	6	MDI0+	56	UART1_RTSn
7	TX_1-	57	HSIC_STROBE	7	MDI1+	57	UART1_RX_TS0_D0
8	TX_2-	58	HSIC_DATA	8	MDI0-	58	UART1_TX
9	TX_1+	59	GND	9	MDI1-	59	TS0_CLK
10	TX_2+	60	CIF_D1	10	IR_INT	60	TS0_VALID
11	HDMI_HPD	61	CIF_D0	11	MDI2+	61	TS0_ERR
12	HDMI_CEC	62	CIF_D3	12	MDI3+	62	GPIO7_B4_U
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	CIF_PDN0	20	SDIO0_D2	70	SDMMC_D3
21	LCD_D1_LD0N	71	CIF_D10	21	SDIO0_D3	71	SDMMC_PWR
22	LCD_D2_LD1P	72	CIF_HREF	22	SDIO0_CLK	72	GPIO0_B5_D
23	LCD_D3_LD1N	73	CIF_VSYNC	23	BT_WAKE	73	GND
24	LCD_D4_LD2P	74	CIF_CLKOUT	24	SDIO0_WP	74	GPIO7_B7_D
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	GPIO0_B2_D	29	SPI2_CLK	79	I2S_LRCK_TX
30	LCD_D10_LCK0P	80	GPIO7_A3_D	30	SP2I_CSn0	80	I2S_SDO0
31	LCD_D11_LCK0N	81	GPIO7_A6_U	31	SPI2_RXD	81	2S_SDO1
32	LCD_D12_LD5P	82	GPIO0_A6_U	32	SPI2_TXD	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	HOST_VBUS_DRV	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

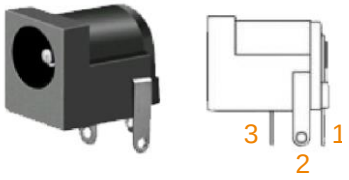
39	LCD_D19_LD8N	89	GPIO0_A7_U	39	OTG_DM	89	I2C4_SDA
40	LCD_D20_LD9P	90	ADC1_IN	40	UART0_RTS	90	I2C1_SCL
41	LCD_D21_LD9N	91	VCCIO_SD	41	OTG_DP	91	UART2_RX
42	LCD_D22_LCK1P	92	ADC2_IN	42	OTG_ID	92	I2C4_SCL
43	LCD_D23_LCK1N	93	VCC_CAM	43	HOST1_DM	93	UART3_RX
44	GND	94	VCCA_33	44	OTG_DET	94	UART2_TX
45	MIPI_TX/RX_CLKN	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	SPI0_CSn0	97	PWM1
48	MIPI_TX/RX_D0N	98	GND	48	HOST2_DP	98	UART3_CTSn
49	MIPI_TX/RX_D2N	99	VCC_IO	49	SPI0_CLK	99	PWR_KEY
50	MIPI_TX/RX_D1N	100	GND	50	GND	100	GPIO7_C5_D

2 Peripherals Introduction

2.1 Power (P6, J17)

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

- **5V/3A DC power supply (P6)**

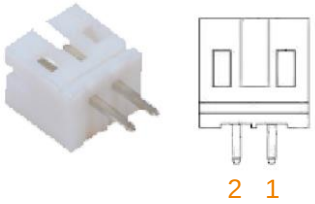


Pin	Signal	Description	Pin	Signal	Description
1	VDD5V	Main power supply. DC 5V power in	2	GND	Ground
3	GND	Ground			

- **Lithium battery (J17)**

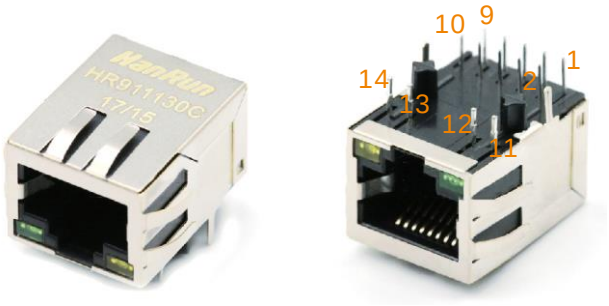
EM3288 provides an external Li-battery interface. **It is a Reserved interface that function not**

supported currently.



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

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

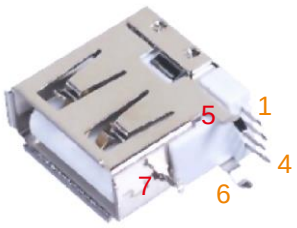
Pin	Signal	Description	Pin	Signal	Description
1	COM	Common	2	MDI0P	Bi-directional transmit/receive pair 0
3	MDI0N	Bi-directional transmit/receive pair 0	4	MDI1P	Bi-directional transmit/receive pair 1
5	MDI2P	Bi-directional transmit/receive pair2	6	MDI2N	Bi-directional transmit/receive pair2
7	MDI1N	Bi-directional transmit/receive pair 1	8	MDI3P	Bi-directional transmit/receive pair 3
9	MDI3N	Bi-directional transmit/receive pair 3	10	GND	Ground
11	VCC_LAN	3.3V	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.

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_5V	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_DM3	USB data-
3	USB_DP3	USB Data+	4	GND	Ground
5	VCC_USB	USB Power. DC 5V	6	USB_DM4	USB data-
7	USB_DP4	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.

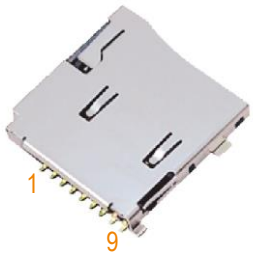
Feature

- 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.

Pin	Signal	Description	Pin	Signal	Description
1	OTG_DET	OTG detection	2	OTG_DM	OTG data -
3	OTG_DP	OTG data+	4	OTG_ID	OTG ID indicator
5	GND	Ground			

2.5 Micro SD (J1)

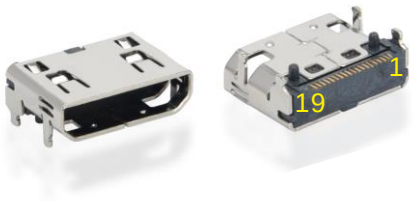
The Micro SD card is used as an external storage device. The MMC controller interface supports up to 4-bit transfer modes. MMC is always accessible through the carrier board interface. It does not support hot-plug.



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			

2.6 HDMI (PH1)

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.



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 ES8388, 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			
Audio out (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 Microphone 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. The audio default output from HDMI. No sound in headphone if not remove HDMI.
2. Default recording via MIC1 if the Line_in jack is not plugged in.

2.8 VGA (J20)

EM3288 adopts standard 15-pin female VGA connector, and SDA7123 3-Channel 10 Digit Video D/A converter.

Pin	Signal	Description	Pin	Signal	Description
1	IOR	Video red	2	IOG	Video green
3	IOB	Video blue	4	NC	Not connect
5	GND	Ground	6	GND	Ground
7	GND	GND	8	GND	GND
9	VCC5V	DC 5V	10	GND	Ground

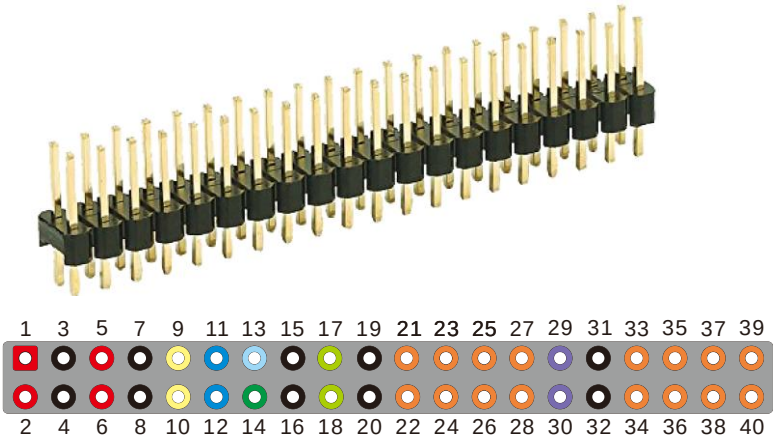
11	NC	Not connect	12	VGA_OUT_SDA	Serial Data
13	LCD_HSYNC	LCD Horizontal Sync	14	LCD_VSYNC	LCD Vertical Sync
15	GND	GND			

2.9 LVDS (CON3)

EM3288 supports 10.1-inch HD capacitive LCD, up to 1280 x 800 resolution.

Feature

- 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 MSB mode and LSB mode data transfer



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.

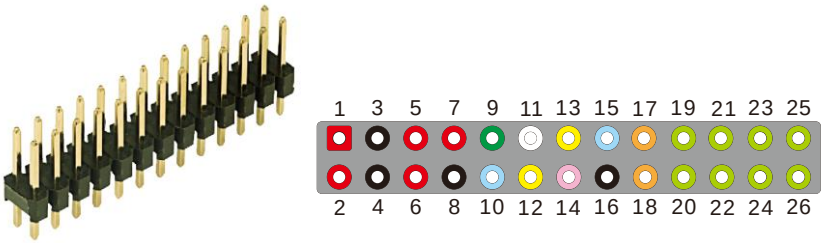
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	VCC5V	2	VCC5V	3	LCD_D0_LD0P	4	LCD_D1_LD0N
5	LCD_D2_LD1P	6	CD_D3_LD1N	7	LCD_D4_LD2P	8	LCD_D5_LD2N
9	LCD_D6_LD3P	10	LCD_D7_LD3N	11	GND	12	LCD_D8_LD4P
13	LCD_D9_LD4N	14	LCD_D10_LCK0P	15	LCD_D11_LCK0N	16	LCD_D12_LD5P
17	LCD_D13_LD5N	18	LCD_D14_LD6P	19	LCD_D15_LD6N	20	GND
21	LCD_D16_LD7P	22	LCD_D17_LD7N	23	LCD_D18_LD8P	24	LCD_D19_LD8N
25	LCD_D20_LD9P	26	LCD_D21_LD9N	27	LCD_D22_LCK1P	28	LCD_D23_LCK1N
29	GND	30	LVDS_PWM	31	GND	32	GND
33	LCD_DEN	34	LCD_VSYNC	35	LCD_HSYNC	36	LCD_CLK
37	TSXM	38	TSXP	39	TSYM	40	TSYP

2.11 MIPI (CON5)

EM3288 supports MIPI Camera.

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	Description	Pin	Signal	Description
1	VCC5V	DC 5V	2	VCC5V	DC 5V
3	GND	Ground	4	GND	Ground
5	VCC_IO	DC 3.3V	6	VCC_IO	DC 3.3V

7	VCCA_18	DC 1.8V	8	GND	Ground
9	LCD1_BL	Backlight	10	LCD1_BL_EN	Backlight enable
11	CIF_CLKOUT	Camera clock	12	I2C3_SCL	I2C clock line
13	I2C3_SDA	I2c date line	14	TOUCH_RST	Touch screen reset
15	TOUCH_INT	Touch screen int	16	GND	Ground
17	CLKN	MIPI clock -	18	CLKP	MIPI clock +
19	D0N	Negative Transmission Data of Pixel0	20	D0P	Positive Transmission Data of Pixel0
21	D1N	Negative Transmission Data of Pixel1	22	D1P	Positive Transmission Data of Pixel1
23	D2N	Negative Transmission Data of Pixel2	24	D2P	Positive Transmission Data of Pixel2
25	D3N	Negative Transmission Data of Pixel3	26	D3P	Positive Transmission Data of Pixel3

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.

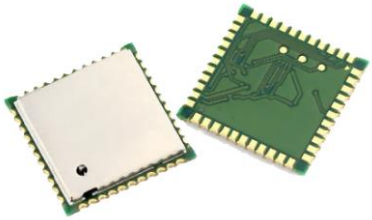
Features

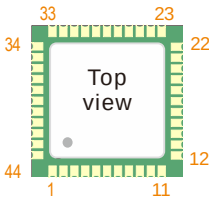
- Ublox 7 high performance and low power consumption GPS Chipset
- Very high sensitivity (Tracking Sensitivity: -162dBm)
- Extremely fast TTFF (Time to First Fix) at low signal level
- Two serial port: UART, I2C
- Built-in LNA
- A-GPS Support
- Exceptional jamming immunity
- Support NMEA 0183 and ublox 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)





AP6236 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.

Features

- 802.11b/g/n single-band radio
- Bluetooth V4.0(HS) with integrated Class 1.5 PA and Low Energy (BLE) support
- Concurrent Bluetooth, 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
- ECI — enhanced coexistence support, ability to coordinate BT SCO transmissions around WLAN receives

Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	WL_BT_ANT	RF I/O
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	XTAL_IN	Crystal input

11	XTAL_OUT	Crystal output	12	WIFI_REG_ON	Internal regulators power enable / disable
13	WIFI_HOST_WAKE	External Interrupt Input / Keypad input	14	WIFI_D2	WiFi data
15	WIFI_D3	WiFi data	16	WIFI_CMD	WiFi command
17	WIFI_CLK	WiFi clock	18	WIFI_D0	WiFi data
19	WIFI_D1	WiFi data	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	NC	Not connect	30	NC	Not connect
31	GND	Ground	32	NC	Not connect
33	GND	Ground	34	BT_RST	Bluetooth reset
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

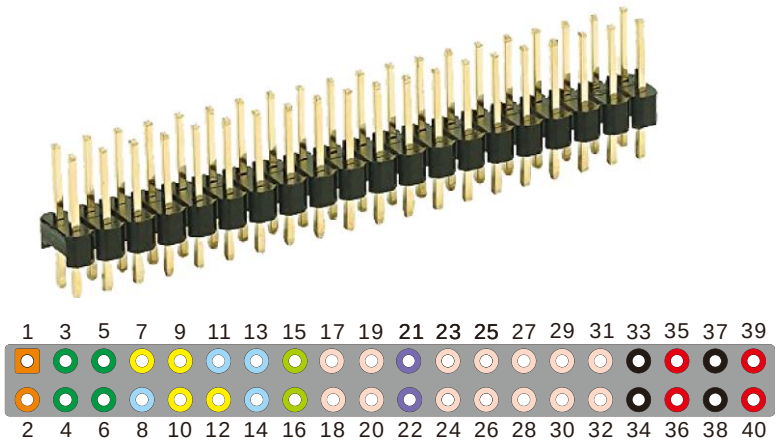
2.14 Debug UART (J10)

The debug serial port (UART2) is used to connect PC and board with the USB-to-serial cable (CP2102).

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.

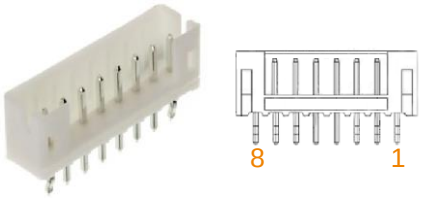


GPIO (CON4)					
Pin	Signal	Description	Pin	Signal	Description
1	ADC2_IN	ADC2 input	2	ADC0_IN	ADC0 input
3	SPI0_CLK/TS0_D4	SPI0 clock/ TSI data4	4	SPI0_CSn0/TS0_D5	SPI0 Chip Select/ TSI data5
5	SPI0_UART4_RXD/TS0_D7	UART4 receive data/ TSI data7	6	SPI0_UART4_TXD/TS0_D6	UART4 transmit data/ TSI data6
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	GPIO1_B7	GPIO	22	GPIO1_B6	GPIO
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

2.16 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

2.17 Buttons (K1, K2)

Short press K1 is sleep/wake up and long press is reboot.
The K2 is used for download combined with OTG

Key	Signal	Description	Key	Signal	Description
K1	PWR-KEY	Short: Sleep/Wake up Long: Reboot	K2	RECOVER	Download mode

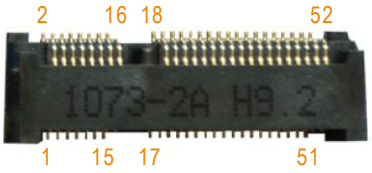
2.18 4G (CON2)

EM3288 adopts the standard PCI Express MiniCard form factor (MiniPCIe) and provides global network coverage on the connectivity of LTE. It delivers 50Mbps-up and100Mbps-down data rates on LTE FDD networks and can also be fully backward compatible with existing UMTS and GSM/GPRS networks.

4G (EC20) Technical Specifications

- Form Factor: PCI Express Mini Card

- Size: 51 x 30 x 4.9mm
- Weight: 9.8g
- Bandwidth: 1.4/3/5/10/15/20MHz
- Temperature Range: -40°C ~ +80°C
- Supply Voltage: 3.0V~3.6V, 3.3V Typical
- 3GPP TS27.007 and Enhanced AT Commands



4G 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	NC	14	SIM_RST	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_WWAN	43	GND	44	NC
45	NC	46	NC	47	NC	48	NC
49	NC	50	GND	51	NC	52	LED_RED. 3.3V

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/4G module.

SIM Card slot (P4)					
Pin	Signal	Description	Pin	Signal	Description
1	SIM_CLK	Clock	2	SIM_DATA	send/receive data
3	SIM_RST	Reset	4	SIM_VCC	SIM power supply
5	SIM_VCC	SIM power supply	6	GND	Ground

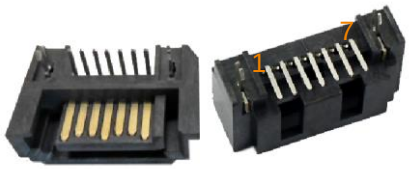
7	GND	Ground	8	GND	Ground
9	GND	Ground			

2.19 SATA & SATA_Power (J14, J18)

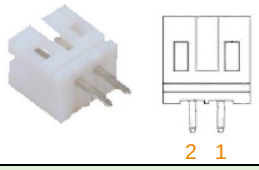
On-board 7-pin SATA Interface, equipped with a HS USB to SATA bridge JM20329. It requires 5V power supply. The SATA only supports mobile hard disk, not desktop hard disk.

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	GND	Ground	2	SATA_TXP	Transmit +
3	SATA_TXN	Transmit -	4	GND	Ground
5	SATA_RXN	Receive -	6	SATA_RXP	Receive +
7	GND	Ground			



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

2.20 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

NO.	Item	Qty. (PCS)	Description
1	EM3288 board	1	Standard Content (2GB RAM, 4GB eMMC, WiFi&BT)
2	TF Card / CD-ROM	1	Android BSP, Ubuntu BSP, Documents, tools, Schematic Drawing, Datasheets
3	Ethernet cable	1	
4	Serial Cable	1	CP2102
5	USB Cable	1	Micro USB
6	Power adaptor	1	5V/3A DC

3.2 Optional Parts

NO.	Item	Description
1	Camera	1.3 Mega Pixel MIPI camera module
2	4G Module	LTE/UMTS/ GSM/GPRS networks. PCIe connect.
3	GPS	Ublox 7 low power consumption GPS Chipset
4	SATA	
5	LCD	10.1-inch LVDS, 1280 x 800