

EM4412 Hardware Manual



Boardcon Technology Limited
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 lightning 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.

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1 EM4412 Introduction

1.1 Summary

The EM4412 is a Full Feature Quad Core ARM cortex-A9 Motherboard which provides an ideal platform to test performance and scalability prior to engaging in BOARDCON's quick turn custom design services for a feature specific product design, using Samsung's Exynos4412@ multimedia CPU which is Samsung Galaxy SII's main controller. The EM4412 has the standard I/O including a real-time clock, dual USB interface, watchdog timer, audio support, 24-bit LVDS and TFT flat panel display, HDMI, PWM outputs, RS485 and CAN. Also it provides 3G, WIFI, GPS, 5M pixels Camera, Resistive and Capacitive touch screen tailor made according to your application. The board comes with Android4.4, Android4.2 and Linux3.5 OS. The user can use EM4412 as an embedding controlling central, you can 100% concentrate on your software applications development. Also you can just order the CPU Module, we provide schematic drawing, pin definition and source code example for you reference such as LCD, GPIO, SD. You make decision for your product. The EM4412 is ideal for vision intensive applications, multi-processor applications, POS, Slot Machine, and Car Mounted systems.

Boardcon offers a full, turn-key development kit including the board and all the specified high-density breakout cables, debugging cables, and terminal breakout boards as well as sample software and additional support materials. This combined with our highly-trained Technical support Team, greatly decreases your development time and ultimately your time-to-market. To order your turn-key Development Kit today.

1.2 Exynos4412 Features

Exynos 4412 includes many hardware peripherals, such as TFT 24-bit true color LCD controller, Camera Interface, MIPI DSI, CSI-2, System Manager for power management, MIPI slimbus interface, MIPI HSI, four UARTs, 24-channel DMA, Timers, General I/O Ports, three I2S, S/PDIF, eight IIC-BUS interface, three HS-SPI, USB Host 2.0, USB 2.0 Device operating at high speed (480 Mbps), two USB HSIC, four SD Host and high-speed Multimedia Card Interface, Chip to Chip interface, and four PLLs for clock generation.

Features:

- ARM Cortex-A9 based Quad CPU Subsystem with NEON
 - 32/32/32/32 KB I/D Cache, 1 MB L2 Cache
 - Operating frequency up to 800 MHz at 0.9 V, 1 GHz at 1.0 V, and 1.4 GHz at TBD V
- 128-bit/64-bit Multi-layer bus architecture
 - Core-D domain for ARM Cortex-A9 Quad, CoreSight, and external memory interface
- Operating frequency up to 200 MHz at 1.0 V
 - Global D- domain mainly for multimedia components and external storage interfaces
- Operating frequency up to 100 MHz at 1.0 V
 - Core-P, Global-P domain mainly for other system component, such as system peripherals, peripheral

- DMA, connectivity IPs and Audio interfaces.
- Operating frequency up to 100 MHz at 1.0 V
 - Audio domain for low power audio play
 - Advanced power management for mobile applications
 - 64 KB ROM for secure booting and 256 KB RAM for security function
 - 8-bit ITU 601/656 Camera Interface supports horizontal size up to 4224 pixels for scaled and 819 pixels for un-scaled resolution
 - 2D Graphics Acceleration support
 - 1/2/4/ 8bpp Palletized or 8/16/24bpp Non-Palletized Color TFT recommend up to WXGA resolution
 - HDMI interface support for NTSC and PAL mode with image enhancer
 - MIPI-DSI and MIPI-CSI interface support
 - One AC-97 audio codec interface and 3-channel PCM serial audio interface
 - Three 24-bit I2S interface support
 - One TX only S/PDIF interface support for digital audio
 - Eight I2C interface support
 - Three SPI support
 - Four UART supports three Mbps ports for Bluetooth 2.0
 - On-chip USB 2.0 Device supports high-speed (480 Mbps, on-chip transceiver)
 - On-chip USB 2.0 Host support
 - Two on-chip USB HSIC
 - Four SD/ SDIO/HS-MMC interface support
 - 24-channel DMA controller (8 channels for Memory-to-memory DMA, 16 channels for Peripheral DMA)
 - Supports 14x8 key matrix
 - Configurable GPIOs
 - Real time clock, PLL, timer with PWM, and watch dog timer
 - Multi-core timer support for accurate tick time in power down mode (except sleep mode)
 - Memory Subsystem
 - Asynchronous SRAM/ ROM/NOR interface with x8 or x16 data bus
 - NAND interface with x8 data bus
 - LPDDR2 interface (800 Mbps/pin DDR)

1.3 EM4412 Specifications

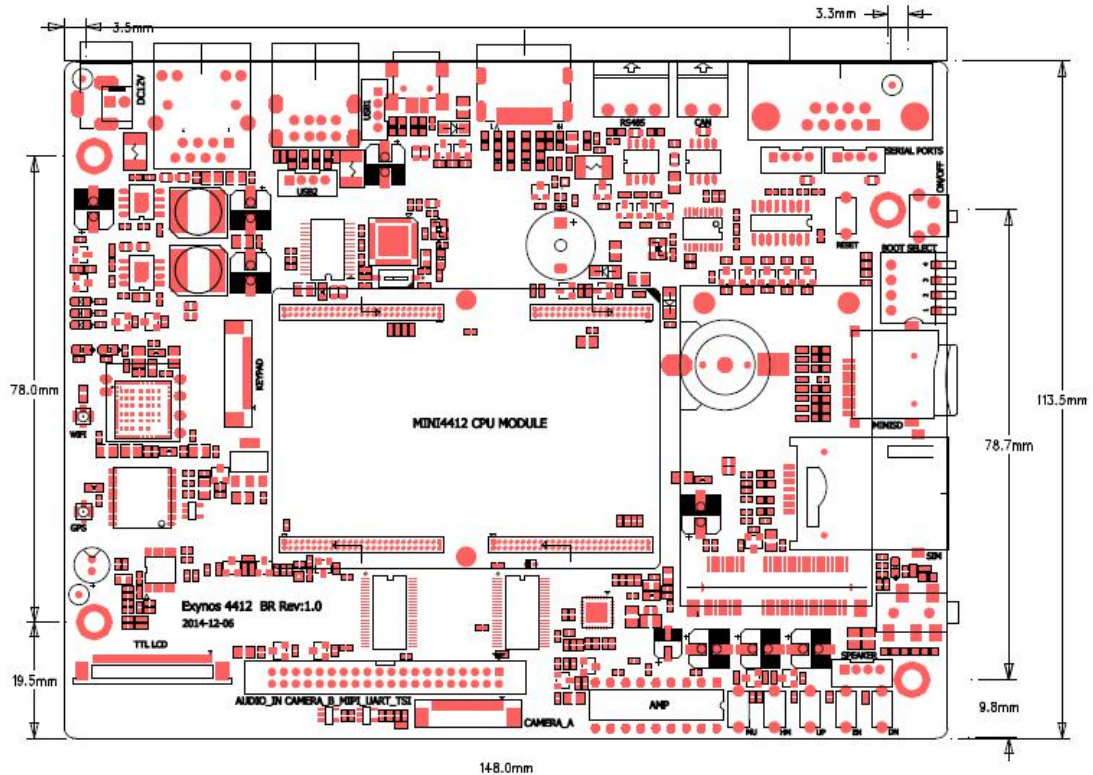
Feature	Specifications
CPU	Samsung Exynos 4412, 1.6GHz, Cortex A9 Quad Core
Memory	2GB DDR3
Flash	4GB eMMC
CPU Dimension	65mm x 47mm
LCD	4.3" / 7" / 10.1" resistive / capacitive touch screen; 24BPP RGB parallel output; PIP(OSD) function
Keypad	14*8 Matrix Keypad



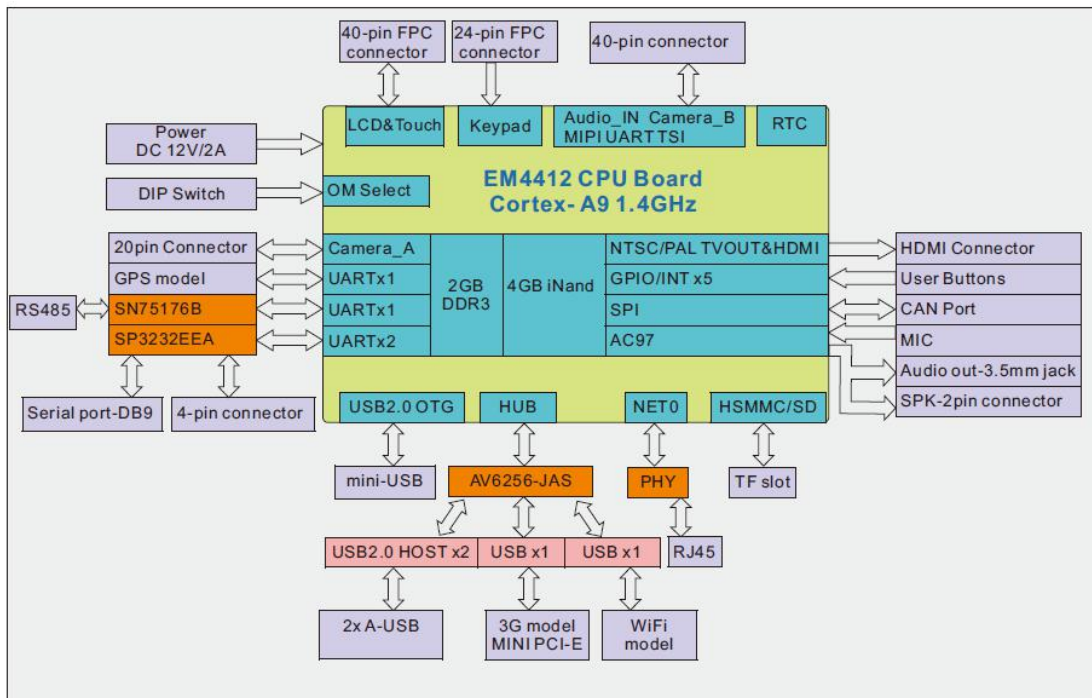
Serial port	4x UART(3 x 5-wire and 1 x 3-wire)
USB OTG	USB OTG 2.0
USB HOST	2 x USB Host 2.0
Ethernet	10/100Mbps Ethernet, RJ45 interface
HDMI	HDMI V1.4, 1080p@30fps HD output
HSIC	1x HSIC
I2C	6x I2C (option)
MIPI-CSI	1x MIPI-CSI Slave(mipi2L CH)
HS-SPI	2x HS-SPI
TSI	TSI supported (option)
RTC	Real Time Clock, powered by external lithium battery
SDIO	24bit SDIO; Boot in SDIO CH2 option; Only CH2 is 3.3V IO
SD card	mini SD card slot
SIM Card	3G SIM card slot
Camera(option)	2x camera interface; Supports ITU 601/656 I/F; Max Pixels 8192*8192
WIFI(option)	On- board WIFI Module
GPS(option)	On- board GPS module
Power input	DC 12V
Carrier board Dimension	148mm x 108.4mm



1.4 PCB Dimension



1.5 Block Diagram

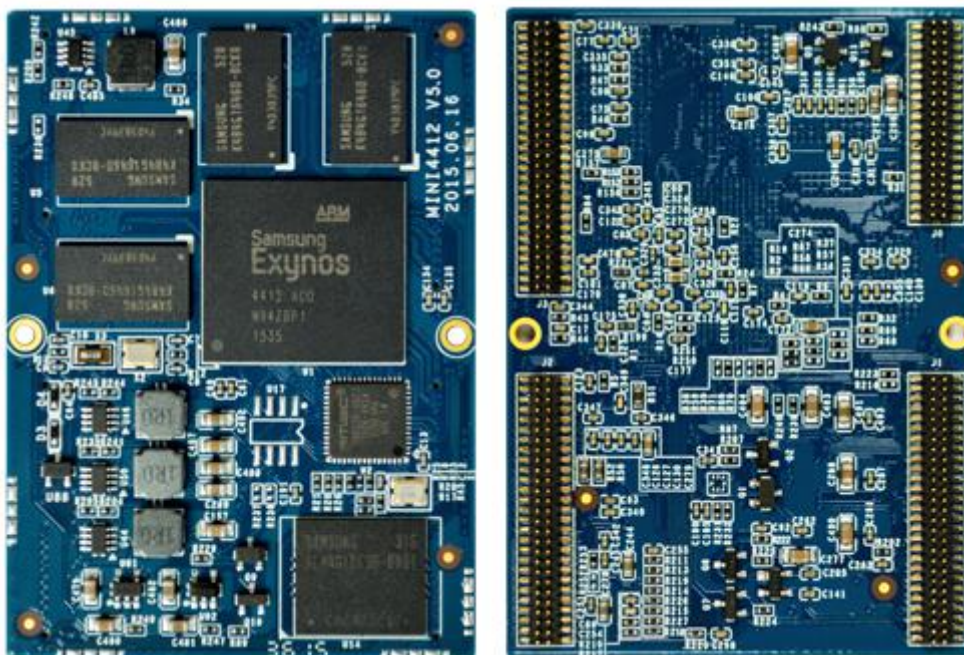


1.6 Motherboard Power meter

Support voltage	12v/2A				
System	Connected devices	Electric current(A)	System	Connected devices	Electric current(A)
Android 4.4.4	12v power	0.149	Android 4.4.4	Power, 7 inch resistive screen	0.334
Android 4.4.4	Power, sd card, play video, U disk, debug serial, Ethernet, 7inch LCD, headphone, mic, SPEAKER, HDMI	0.452	Android 4.4.4	SLEEP+7inch LCD	0.365
Linux	12v power	0.15	Linux	Power, 7 inch Resistive screen	0.326
Linux	Power , SD card, play video, U disk, debug serial, Ethernet, 7inch LCD, headphone	0.392			

1.7 CPU Module Introduction

The EM4412 CPU board -- MINI4412 is targeted to the challenging data and digital signal-processing needs of terminal equipment such as POS, Car mounted system.

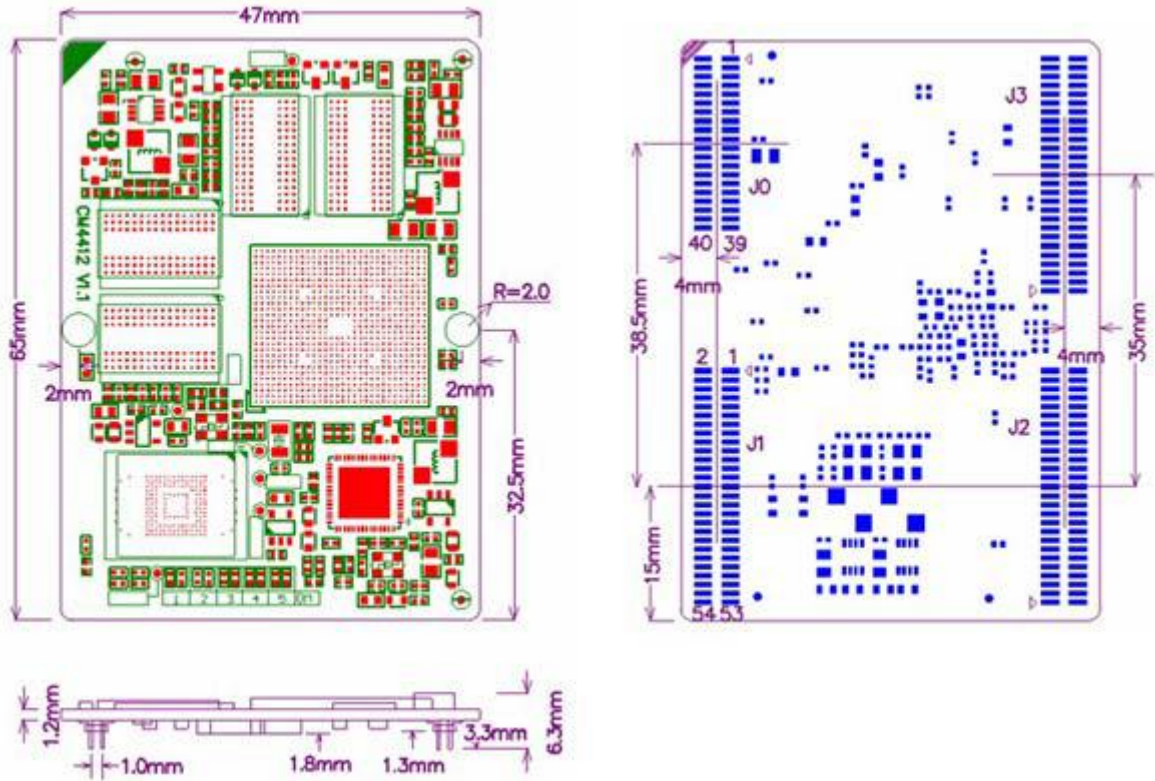




Board Dimension

- * Board size: 65mm x 47mm
- * Pin number: J0 x 40 + (J1+J2+J3) x 54 = 202 pins
- * Layer: 8 Layers, complying with EMS/EM

MINI4412 PCB Dimension



Pin Definition

J0	Signal name	Function	Description	IO Type
1	GND	Ground		P
2	GND	Ground		P
3	GND	Ground		P
4	GND	Ground		P
5	VSYS	5V Power In	3.7-5.5V Wide power input	P
6	VSYS	5V Power In	3.7-5.5V Wide power input	P
7	VSYS	5V Power In	3.7-5.5V Wide power input	P
8	VSYS	5V Power In	3.7-5.5V Wide power input	P
9	V_SAVE	RTC battery in	2.4-6V Wide power input	P
10	GND	Ground		P
11	RST_KEY	Reset Key	Low Enable, Can NC it.	I
12	nRESET	System Reset	3.3V I/O	I/O
13	OM1	OM3: 1, Others: 0 Boot in EMMC&USB OM3/5: 1, Others: 0		I



		Boot in EMMC&SD2		
14	OM3			I
15	OM4			I
16	OM5			I
17	PWRHOLD	Power On Hold		O
18	GND	Ground		P
19	VDD_IO	3.3V Power In	3.3V +/- 5%	P
20	VDD_IO	3.3V Power In	3.3V +/- 5%	P
21	XpwmTOUT2	PWM Time Out2	GPD0_2 option	I/O
22	XpwmTOUT0	PWM Time Out0	LCD_FRM/GPD0_0 option	I/O
23	XpwmTOUT1	PWM Time Out1	LCD_PWM/GPD0_1 option	I/O
24	GND	Ground		P
25	XspiMOSI0	SPI Master out/Slave in	I2C_5_SCL/GPB3 option	I/O
26	XspiMISO0	SPI Master in/Slave out	I2C_5_SDA/GPB2 option	I/O
27	XspiCLK0	SPI CH0 Clock	I2C_4_SDA/GPB0 option	I/O
28	XspiCS0	SPI Chip Select	I2C_4_SCL/GPB1 option	I/O
29	XspiMISO1	SPI Master in/Slave out	GPB6 option	I/O
30	XspiMOSI1	SPI Master out/Slave in	GPB7 option	I/O
31	XspiCLK1	SPI CH1 Clock	IEM_SCLK/GPB4	I/O
32	XspiCS1	SPI Chip Select	IEM_SPWI/GPB5	I/O
33	XuRXD0	UART0_RXD/GPA0_0	UART receives data input	I/O
34	XuTXD0	UART0_TXD/GPA0_1	UART transmits data output	I/O
35	XuCTS0	UART0_CTS/GPA0_2	UART clear to send input signal	I/O
36	XuRTS0	UART0_RTS/GPA0_3	UART request to send output signal	I/O
37	XuRXD2	UART2_RXD/GPA1_0	UART receives data input	I/O
38	XuTXD2	UART2_TXD/GPA1_1	UART transmits data output	I/O
39	XuCTS2	UART2_CTS	I2C_3_SDA/GPA1_2 option	I/O
40	XuRTS2	UART2_RTS	I2C_3_SCL/GPA1_3 option	I/O
J1	Signal name	Function	Description	IO Type
1	SPDIF/XCLK	SPDIF or XCLK Output	SPDIF and XCLK Output option	O
2	GND	Ground		P
3	XhsicSTROBE0	USB_HSIC0_Strobe		I/O
4	XhsicDATA0	USB_HSIC0_DATA		I/O
5	XotgDP	USB_OTG_DP	3.3V IO	I/O
6	XotgDM	USB_OTG_DM	3.3V IO	I/O
7	XVBUS	USB_OTG_VBUS	3.3V IO	I/O
8	USB_ID	USB_OTG_ID	3.3V IO	I/O
9	XotgDRV_VBUS	USB_OTG_DRVVBUS	3.3V IO	I/O
10	XEINT0	EINT0/GPX0_0	AUD_TCK option	I/O



11	XEINT1	EINT1/GPX0_1	AUD_TMS option	I/O
12	XEINT2	EINT2/GPX0_2	AUD_TDI option	I/O
13	XEINT3	EINT3/GPX0_3	AUD_TDO option	I/O
14	XEINT4	EINT4/GPX0_4	AUD_TRSTn option	I/O
15	XEINT5	EINT5/GPX0_5		I/O
16	XEINT6	EINT6/GPX0_6		I/O
17	XEINT7	EINT7/GPX0_7		I/O
18	XEINT9	EINT9/GPX1_1	KP_COL1 option	I/O
19	XEINT10	EINT10/GPX1_2	KP_COL2	I/O
20	XEINT11	EINT11/GPX1_3	KP_COL3	I/O
21	XEINT12	EINT12/GPX1_4	KP_COL4	I/O
22	XEINT13	EINT13/GPX1_5	KP_COL5	I/O
23	XEINT14	EINT14/GPX1_6	KP_COL6	I/O
24	XEINT15	EINT15/GPX1_7	KP_COL7	I/O
25	XEINT16	EINT16/GPX2_0	KP_ROW0 option	I/O
26	XEINT17	EINT17/GPX2_1	KP_ROW1	I
27	XEINT18	EINT18/GPX2_2	KP_ROW2	I/O
28	XEINT19	EINT19/GPX2_3	KP_ROW3	I/O
29	XEINT20	EINT20/GPX2_4	KP_ROW4	I/O
30	XEINT21	EINT21/GPX2_5	KP_ROW5	I/O
31	XEINT22	EINT22/GPX2_6	KP_ROW6	I/O
32	XEINT23	EINT23/GPX2_7	KP_ROW7	I/O
33	XEINT24	EINT24/GPX3_0	KP_ROW8	I/O
34	XEINT25	EINT25/GPX3_1	KP_ROW9	I/O
35	XEINT26	EINT26/GPX3_2	KP_ROW10	O
36	XEINT27	EINT27/GPX3_3	KP_ROW11	O
37	XEINT28	EINT28/GPX3_4	KP_ROW12	I/O
38	XEINT29	EINT29/GPX3_5	KP_ROW13	O
39	HDMI_CEC	EINT30/GPX3_6	Defined for HDMI CEC signal	I/O
40	HDMI_HPD	EINT31/GPX3_7	Defined for HDMI HPD signal	I/O
41	Xmmc2CLK	SD2_CLK/GPK2_0	3.3V IO	I/O
42	Xmmc2CMD	SD2_CMD/GPK2_1	3.3V IO	I/O
43	Xmmc2CDn	SD2_CDn/GPK2_2	3.3V IO	I/O
44	Xmmc2DATA0	SD2_DAT0/GPK2_3	3.3V IO	I/O
45	Xmmc2DATA1	SD2_DAT1/GPK2_4	3.3V IO	I/O
46	Xmmc2DATA2	SD2_DAT2/GPK2_5	3.3V IO	I/O
47	Xmmc2DATA3	SD2_DAT3/GPK2_6	3.3V IO	I/O
48	KP_COL0	KP_COL0/GPL2_0		I/O
49	SPEED	LAN_SPEED	Connect to RJ45 Orange LED	O



50	LINK	LAN_LINK	Connect to RJ45 Green LED	O
51	ETX+	TPO	Transmit Positive Output	O/I
52	ETX-	TNO	Transmit Negative Output	O/I
53	ERX+	RPI	Receive Positive Input	I/O
54	ERX-	RNI	Receive Negative Input	I/O
J2	Signal name	Function	Description	IO Type
1	Xmmc3CLK	SD3_CLK/GPK3_0		I/O
2	Xmmc3CMD	SD3_CMD/GPK3_1		I/O
3	Xmmc3CDn	SD3_CDn/GPK3_2		I/O
4	Xmmc3DATA0	SD3_DAT0/GPK3_3	SD2_DAT4 option	I/O
5	Xmmc3DATA1	SD3_DAT1/GPK3_4	SD2_DAT5 option	I/O
6	Xmmc3DATA2	SD3_DAT2/GPK3_5	SD2_DAT6 option	I/O
7	Xmmc3DATA3	SD3_DAT3/GPK3_6	SD2_DAT7 option	I/O
8	GND	Ground		P
9	KP_COL1	KP_COL1/GPL2_1		I/O
10	KP_COL2	KP_COL2/GPL2_2		I/O
11	KP_COL3	KP_COL3/GPL2_3		I/O
12	KP_COL4	KP_COL4/GPL2_4		I/O
13	KP_COL5	KP_COL5/GPL2_5		I/O
14	KP_COL6	KP_COL6/GPL2_6		I/O
15	KP_COL7	KP_COL7/GPL2_7		I/O
16	Xi2sSCLK0	I2S0_SCLK/GPZ0	I2S CH0 bus serial clock	I/O
17	Xi2sCDCLK0	I2S0_CDCLK/GPZ1	I2S CH0 Code system clock	I/O
18	Xi2sLRCK0	I2S0_LRCLK/GPZ2	I2S CH0 bus channel select clock	I/O
19	Xi2sSDI0	I2S0_SDI/GPZ3	I2S CH0 bus serial data input	I/O
20	Xi2sSDO0	I2S0_SD0/GPZ4	I2S CH0 bus serial data0 output	I/O
21	Xi2sSDO1	I2S0_SD1/GPZ5	I2S CH0 bus serial data1 output	I/O
22	Xi2sSDO2	I2S0_SD2/GPZ6	I2S CH0 bus serial data2 output	I/O
23	XciBPCLK	CAMB_PCLK/GPM0_0	TS_CLK option	I/O
24	XciBVSNC	CAMB_VSNC/GPM2_0		I/O
25	XciBHREF	CAMB_HREF/GPM2_1		I/O
26	XciBFIELD	CAMB_FIELD/GPM1_1		I/O
27	XciBMCLK	CAMB_MCLK/GPM2_2		I/O
28	XciBDATA0	CAMB_DATA0/GPM0_1	TS_SYNC option	I/O
29	XciBDATA1	CAMB_DATA1/GPM0_2	TS_VAL option	I/O
30	XciBDATA2	CAMB_DATA2/GPM0_3	TS_DATA option	I/O
31	XciBDATA3	CAMB_DATA3/GPM0_4	TS_ERROR option	I/O
32	XciBDATA4	CAMB_DATA4/GPM0_5		I/O
33	XciBDATA5	CAMB_DATA5/GPM0_6		I/O

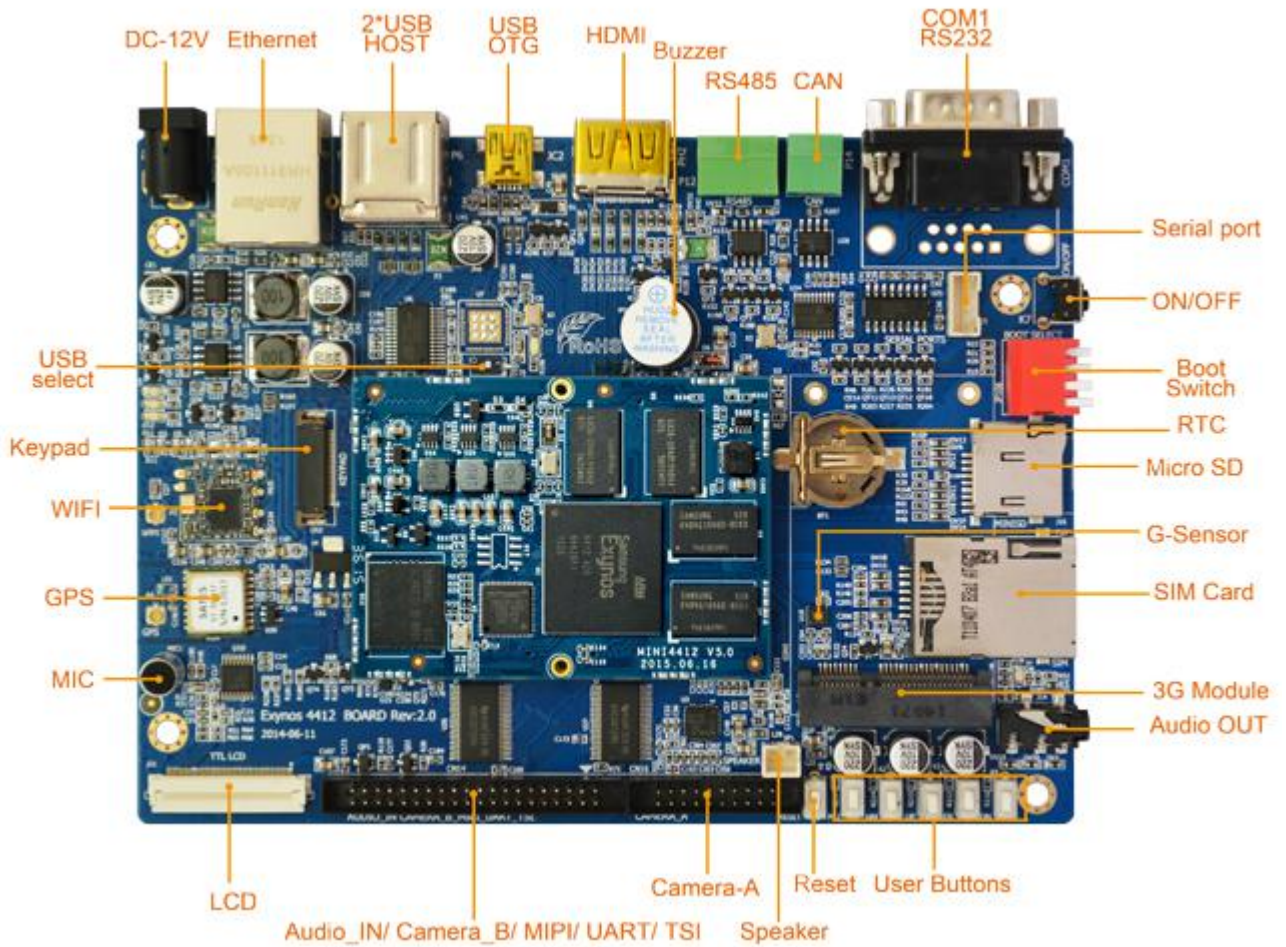


34	XciBDATA6	CAMB_DATA6/GPM0_7		I/O
35	XciBDATA7	CAMB_DATA7/GPM1_0		I/O
36	XciAPCLK	CAMA_PCLK/GPJ0_0	Camera A clock in	I/O
37	XciAVSYNC	CAMA_VSYNC/GPJ0_1	Camera A VSYNC in	I/O
38	XciAHREF	CAMA_HREF/GPJ0_2	Camera A HSYNC in	I/O
39	XciADATA0	CAMA_DATA0/GPJ0_3	Camera A data 0 in	I/O
40	XciADATA1	CAMA_DATA1/GPJ0_4	Camera A data 1 in	IO
41	XciADATA2	CAMA_DATA2/GPJ0_5	Camera A data 2 in	I/O
42	XciADATA3	CAMA_DATA3/GPJ0_6	Camera A data 3 in	I/O
43	XciADATA4	CAMA_DATA4/GPJ0_7	Camera A data 4 in	I/O
44	XciADATA5	CAMA_DATA5/GPJ1_0	Camera A data 5 in	I/O
45	XciADATA6	CAMA_DATA6/GPJ1_1	Camera A data 6 in	I/O
46	XciADATA7	CAMA_DATA7/GPJ1_2	Camera A data 7 in	I/O
47	XciAMCLK	CAMA_MCLK/GPJ1_3	Master clock to driver Camera	I/O
48	XciAFIELD	CAMA_FIELD/GPJ1_4	Reset or Power down Camera	I/O
49	Xmipi2LSDP1	MIPI2L_SDP1		I
50	Xmipi2LSDN1	MIPI2L_SDN1		I
51	Xmipi2LSDPCLK	MIPI2L_SDPCLK		I
52	Xmipi2LSDNCLK	MIPI2L_SDNCLK		I
53	Xmipi2LSDP0	MIPI2L_SDP0		I
54	Xmipi2LSDN0	MIPI2L_SDN0		I
J3	Signal name	Function	Description	IO Type
1	XadcAIN0	ADC_IN0		I
2	XadcAIN1	ADC_IN1		I
3	TXCP	HDMI_TXCP		O
4	TXCN	HDMI_TXCN		O
5	TX0P	HDMI_TX0P		O
6	TX0N	HDMI_TX0N		O
7	TX1P	HDMI_TX1P		O
8	TX1N	HDMI_TX1N		O
9	TX2P	HDMI_TX2P		O
10	TX2N	HDMI_TX2N		O
11	GND	Ground		P
12	XvHSYNC	LCD_HSYNC/GPF0_0		I/O
13	XvVSYNC	LCD_VSYNC/GPF0_1		I/O
14	XvVDEN	LCD_VDEN/GPF0_2		I/O
15	XvVCLK	LCD_VCLK/GPF0_3		I/O



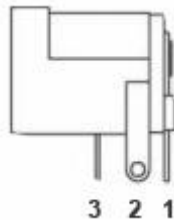
16	XvVD0	LCD_VD0/GPF0_4		I/O
17	XvVD1	LCD_VD1/GPF0_5		I/O
18	XvVD2	LCD_VD2/GPF0_6		I/O
19	XvVD3	LCD_VD3/GPF0_7		I/O
20	XvVD4	LCD_VD4/GPF1_0		I/O
21	XvVD5	LCD_VD5/GPF1_1		I/O
22	XvVD6	LCD_VD6/GPF1_2		I/O
23	XvVD7	LCD_VD7/GPF1_3		I/O
24	XvVD8	LCD_VD8/GPF1_4		I/O
25	XvVD9	LCD_VD9/GPF1_5		I/O
26	XvVD10	LCD_VD10/GPF1_6		I/O
27	XvVD11	LCD_VD11/GPF1_7		I/O
28	XvVD12	LCD_VD12/GPF2_0		I/O
29	XvVD13	LCD_VD13/GPF2_1		I/O
30	XvVD14	LCD_VD14/GPF2_2		I/O
31	XvVD15	LCD_VD15/GPF2_3		I/O
32	XvVD16	LCD_VD16/GPF2_4		I/O
33	XvVD17	LCD_VD17/GPF2_5		I/O
34	XvVD18	LCD_VD18/GPF2_6		I/O
35	XvVD19	LCD_VD19/GPF2_7		I/O
36	XvVD20	LCD_VD20/GPF3_0		I/O
37	XvVD21	LCD_VD21/GPF3_1		I/O
38	XvVD22	LCD_VD22/GPF3_2		I/O
39	XvVD23	LCD_VD23/GPF3_3		I/O
40	AC97_BCLK	I2S1_SCLK/GPC0_0	PCM1_SCLK set for Bluetooth	I/O
41	AC97_RST	I2S1_CDCLK/GPC0_1	PCM1_EXTCLK set for Bluetooth	I/O
42	AC97_SYNC	I2S1_LRCLK/GPC0_2	PCM1_FSYNC set for Bluetooth	I/O
43	AC97_SDI	I2S1_SDI/GPC0_3	PCM1_SIN set for Bluetooth	I/O
44	AC97_SDO	I2S1_SDO/GPC0_4	PCM1_SOUT set for Bluetooth	I/O
45	XuRXD1	RXD1/GPA0_4		I/O
46	XuTXD1	TXD1/GPA0_5		I/O
47	XuCTSn1	CTSn1/GPA0_6	I2C_2_SDA option	I/O
48	XuRTSn1	RTSn1/GPA0_7	I2C_2_SCL option	I/O
49	Xi2cSDA0	I2C_0_SDA/GPD1_0		I/O
50	Xi2cSCL0	I2C_0_SCL/GPD1_1		I/O
51	Xi2cSDA1	I2C_1_SDA/GPD1_2		I/O
52	Xi2cSCL1	I2C_1_SCL/GPD1_3		I/O
53	XuRXD3	RXD3/GPA1_4	UART_AUDIO_RXD option	I/O
54	XuTXD3	TXD3/GPA1_5	UART_AUDIO_TXD option	I/O

2 Peripherals Introduction



2.1 Power (P1)

Power supply: DC 12V/2A.



Pin	Signal	Description	Pin	Signal	Description
1	VDD12V	Main power supply. DC 12V power in	2	GND	Ground
3	GND	Ground			

2.2 Power switch (K7)

K7 is use to control power on /off (controlled by EINT0).



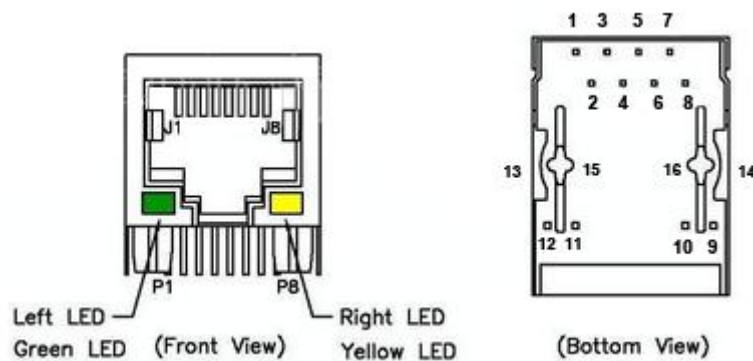
Pin	Signal	Description	Pin	Signal	Description
1	PWIN	Power in	2	PWRSW	Controlled by XEINT0. To control power on/off
3	NC		4	NC	

2.3 Ethernet (P7)

EM4412 incorporates a full-featured 10/100M Ethernet interface. The platform adopts AN9220 as the Ethernet chip.

Features:

- 10/100 BASE-T IEEE 802.3 compliant
- IEEE 802.3u compliant Auto-Negotiation
- Integrated IEEE 1588 time stamping module (inside the MAC).
- Automatic channel swap (ACS)
- Full- and Half-duplex
- Automatic MDI/MDIX crossover
- Automatic polarity correction
- Activity and speed indicator LED controls
- You can set a fixed IP or automatically obtain IP



Pin	Signal	Description	Pin	Signal	Description
1	ETX+	Net data send +	2	ETX-	Net data send -

3	ERX+	Net data receive +	4	DV3V3	3.3V voltage
5	DV3V3	3.3V voltage	6	ERX-	Net data receive +
7	NC	NC	8	GND	Ground
9	DV3V3	3.3V voltage	10	SPEED	Detect speed
11	LINK	Detect link	12	DV3V3	3.3V voltage
13	GND	Ground	14	GND	Ground
15	GND	Ground	16	GND	Ground

2.4 USB HOST (P6)

The EM4412 supports USB 2.0 High Speed (480Mbps), Full Speed (12Mbps) and Low Speed (1.5Mbps) modes. It enables up to 2x USB Host ports by utilizing an optional on-board USB2.0 hub. It is used to connect USB mouse, U disk and other USB devices, supports hot-plug.

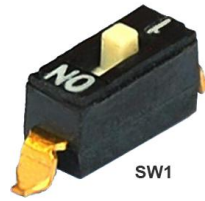


Pin	Signal	Description	Pin	Signal	Description
1	VCC_USB	USB Power. DC 5V	2	USB_DM2	USB host port 2 negative data
3	USB_DP2	USB host port 2 positive data	4	GND	Ground
5	VCC_USB	USB Power. DC 5V	6	USB_DM3	USB host port 3 negative data
7	USB_DP3	USB host port 3 positive data	8	GND	Ground
9	GND	Ground	10	GND	Ground
11	GND	Ground	12	GND	Ground

The switch SW1 is used to select OTG/HUB.

OTG: SW1 = ON

HUB: SW1= OFF



ON - OTG; OFF - HOST

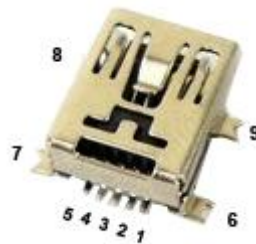
Pin	Signal	Description	Pin	Signal	Description
ON	HBRST	HUB reset(HUB ON/OFF)	1	GND	Ground

2.5 USB OTG (JC2)

Features:

- 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 device mode.
- Hardware support: OTG signaling, session request protocol, and host negotiation protocol

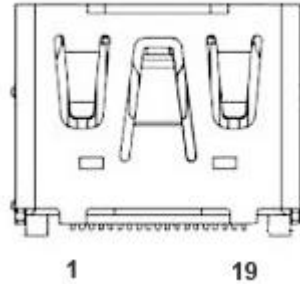
The OTG is only used to download image, ADB transfer is not supported.



Pin	Signal	Description	Pin	Signal	Description
1	USBVDD	EM4412 does not supply VBUS power. This pin must be connected to the 5V VBUS rail. VBUS can either be supplied by an external system or generated on-board the carrier board. EM4412 can draw up to 50mA from this pin	2	XotgDM	USB OTG negative data
3	XotgDP	USB OTG positive data	4	USB_ID	USB OTG ID signal
5	GND	Ground	6	GND	Ground
7	GND	Ground	8	GND	Ground
9	GND	Ground			

2.6 HDMI (PH2)

EM4412 supports HDMI v1.4, 1080p@30fps at 60Hz high-definition digital output, and it also enables audio 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	TX2P	hdmi data 2 pair	2	GND	Ground
3	TX2N		4	TX1P	hdmi data 1 pair
5	GND	Ground	6	TX1N	
7	TX0P	hdmi data 0 pair	8	GND	Ground
9	TX0N		10	TXCP	hdmi clock pair
11	GND	Ground	12	TXCN	
13	CEC	Consumer Electronics Control signal	14	NC	NC
15	HDMI_SCL	VESA Data Display Channel clock signal	16	HDMI_SDA	VESA Data Display Channel data signal
17	GND	Ground	18	HDMI_VCC	VDD 5V/GND
19	HPD	Hot Plug Detect signal, 5V tolerant.			

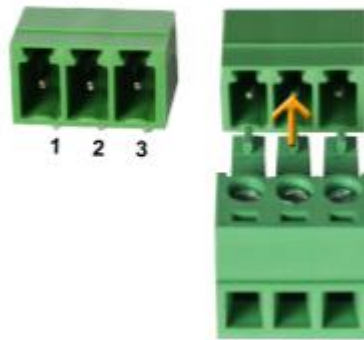
2.7 Serial Ports (P12, COM1, J5)

RS485 uses differential mode to transmit signals, without checking the signal just check potential difference to send / receiver data.

Features:

- 9-bit or Multidrop mode (RS-485) support (automatic slave address detection).
- RXD input and TXD output can be inverted respectively in RS-485 mode
- RS-485 driver direction control via CTS signal

RS485 (P12)



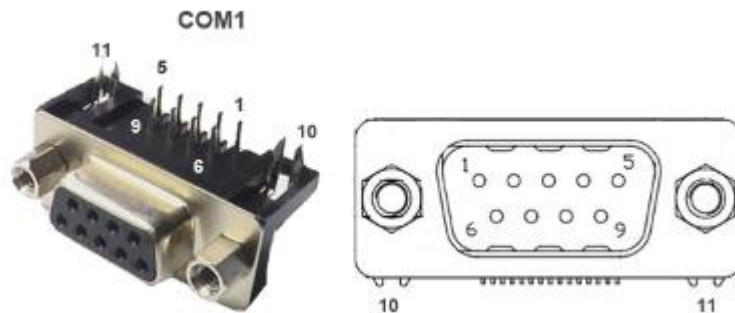
Pin	Signal	Description	Pin	Signal	Description
1	RS1_A	Connect to SN75176B	2	RS1_B	Connect to SN75176B
3	GND	Ground			

The EM4412 incorporates two RS232 ports: COM1 and J5.

COM1 is debug-port. It is used to input and display interactive command, view system boot information and transfer files.

COM1 features:

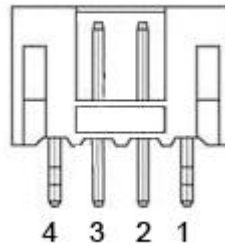
- 32-entry FIFO for receiver and 32-entry FIFO for transmitter
- Programmable baud rate of up to 250K bit/s
- The serial port operates at RS232 voltage levels.



Pin	Signal	Description	Pin	Signal	Description
1	NC	NULL	2	TOUT2	RS232 serial data out
3	RIN2	RS232 serial data in	4	NC	NULL
5	GND	Ground	6	GND	Ground
7	NC	NULL	8	NC	NULL
9	NC	NULL	10	GND	Ground
11	GND	Ground			

J5 is a 5-pin connector. It is used as a communication port.

J5



Pin	Signal	Description	Pin	Signal	Description
1	GND	Ground	2	RX2	RS232 serial data in
3	TX2	RS232 serial data out	4	DV3V3	3.3V voltage

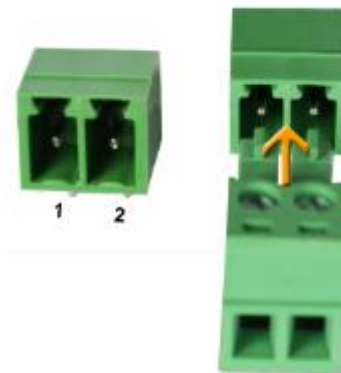
2.8 CAN (P14)

The CAN is used to change data.

Features:

- Compliant with the CAN 2.0B protocol specification
- Programmable bit rate up to 1 Mb/sec

CAN signal is the SPI signal conversion.



Pin	Signal	Description	Pin	Signal	Description
1	CANL	CAN low	2	CANH	CAN high

2.9 Boot Select (JP106)

EM4412 supports booting from SD and iNAND. The CPU will boot in corresponding way automatically after getting the OM signal set by DIP switch JP106.



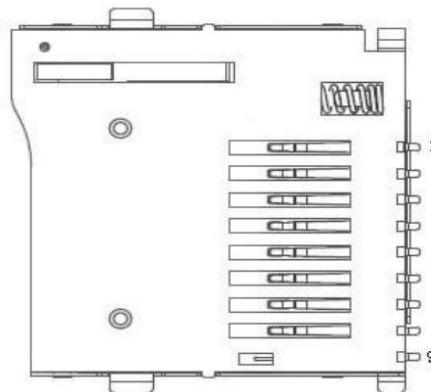
Pin	Signal	Description	Pin	Signal	Description
1	OM5	Mode selection 5	2	OM3	Mode selection 3
3	OM2	Mode selection 2	4	OM1	Mode selection 1
5	GND	Ground	6	GND	Ground
7	GND	Ground	8	GND	Ground

Boot mode

Pin Boot mode	J1	J2	J3	J4
iNAND	ON	OFF	ON	ON
SD card	ON	ON	OFF	ON

2.10 MINI SD (J16)

The MINI SD card is used as an external storage device generally, and it also can be used to boot system and download image. The MMC controller interface supports up to 4-bit transfer modes. MMC is always accessible via the carrier board interface.

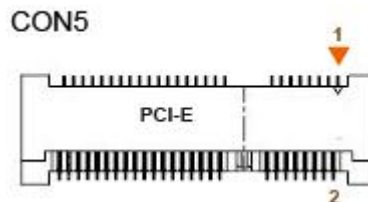


Pin	Signal	Description	Pin	Signal	Description
1	Xmmc2DATA2	Card send/receiver data bit 2	2	Xmmc2DATA3	Card send/receiver data bit 3
3	Xmmc2CMD	Command signal	4	DV3V3	3.3V voltage

5	Xmmc2CLK	Interface clock	6	GND	Ground
7	Xmmc2DATA0	Card send/receiver data bit 0	8	Xmmc2DATA1	Card send/receiver data bit 1
9	Xmmc2CDn	Card Detection	10	GND	Ground
11	GND	Ground	12	GND	Ground

2.11 3G Connector (CON5)

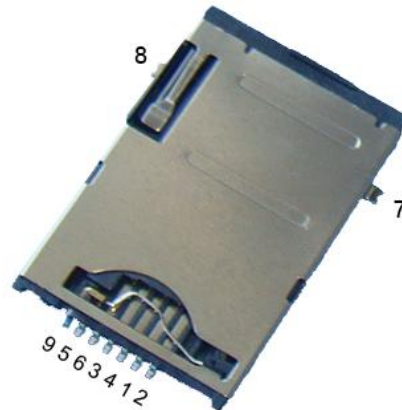
MINI PCI-E is an on-board 3G module connector, we use MF210 3G module in EM4412. The EM4412 is also equipped with a SIM card slot.



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GSM_MIC+	2	3GVCC	3	GSM_MIC-	4	GND
5	GSM_SPK+	6	NC	7	GSM_SPK-	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	PERST	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	3GVCC
53	GND	54	GND	55	GND	56	GND

2.12 SIM (P13)

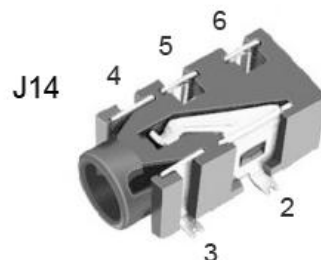
P13 is an auto pop-up SIM card slot which is compatible to the standard SIM Card and can be used for wireless transmission with a 3G module. It supports WCDMA, CDMA2000, TD-SCDMA and WiMax SIM card.



Pin	Signal	Description	Pin	Signal	Description
1	SIM_CLK	Interface 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			

2.13 Audio I/O (J14, SP1, MIC1)

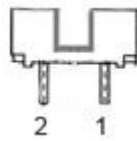
Audio Circuit adopts Wolfson Microelectronics audio converter chip -- WM8976G, which is a low power, high quality stereo coder-decoder, especially designed for portable digital audio applications. The 3.5mm Headphone supports two-channel audio output.



J14

Pin	Signal	Description	Pin	Signal	Description
2	MIC2/XEINT9/AU_GND	Command signal	3	GND	Ground
4	XEINT6/VDDIO_18	Command signal	5	HP_LO	Left output
6	HP_RO	Right output			

SP1 is a 2.00mm pitch 2-Pin interface (white). It can directly connect to the speaker (8Ω/1W). EM4412 supports SPK and headphone, HDMI sync output.



SP1

Pin	Signal	Description	Pin	Signal	Description
1	ROUT2	Right output	2	LOUT2	Left output

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

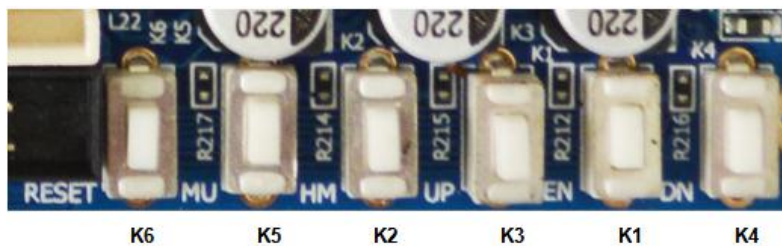


MC1

Pin	Signal	Description	Pin	Signal	Description
1	MIC1	Command signal	2	GND	Ground

2.14 Buttons (K1/K2/K3/K4/K5/K6)

On-board 5 user buttons and 1 reset key. Long press the reset key can shut down (not reset) the system.



Button functions

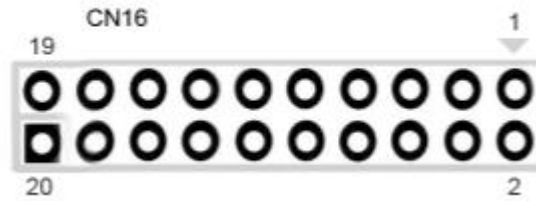
button	function	button	function	button	function
K1	ENTHER	K2	HOME	K3	Volume UP
K4	Volume DOWN	K5	MENU	K6	RESET

2.15 Camera (CN16, CN14)

EM4412 adopts two camera connectors: Camera_A and Camera_B.

CN16

Camera_A (CN16) is a 2mm pitch 26-pin connector. It can be connected to the OV3640 module combined with an adapter plate. OV3640 is a 3.1Mega pixels CMOS camera module.

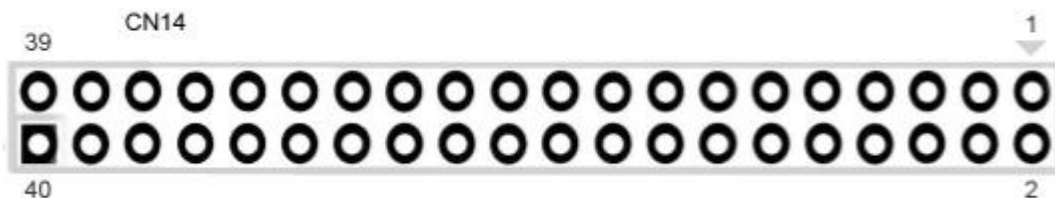


CN16

Pin	Signal	Description	Pin	Signal	Description
1	Xi2cSDA0	I2C bus data line	2	Xi2cSCL0	I2C bus clock line
3	XEINT12	Interrupt 12	4	XciAFIELD	Reset or Power down Camera
5	XciAPCLK	Camera pixel clock	6	XciAHREF	camera (output) of the Horizontal synchronization
7	XciAVSYNC	camera (output) of the vertical synchronizing signal	8	XciAMCLK	The camera's Master Clock
9	XciADATA7	Camera A data 7 in	10	XciADATA6	Camera A data 6 in
11	XciADATA5	Camera A data 5 in	12	XciADATA4	Camera A data 4 in
13	XciADATA3	Camera A data 3 in	14	XciADATA2	Camera A data 2 in
15	XciADATA1	Camera A data 1 in	16	XciADATA0	Camera A data 0 in
17	VDD5V	5v power	18	DV3V3	3.3V voltage
19	GND	Ground	20	GND	Ground

CN14

CN14 can be multiplexed as AUDIO_IN, CAMERA_B, MIPI, UART and TSI.



CN14

Pin	Signal	Description	Pin	Signal	Description
1	XuCTS2	I2C_3_SDA/GPA1_2 option	2	XuRTS2	I2C_3_SCL/GPA1_3 option
3	XEINT15	Interrupt 15	4	XciBFIELD	Reset or Power down Camera
5	XciBPCLK_TS	Camera B pixel clock	6	XciBHREF	Camera B (output) of the

CLK			Horizontal synchronization		
7	XciBVSYNC	camera B (output) of the vertical synchronizing signal	8	XciBMCLK	The camera's Master Clock
9	XciBDATA7	Camera B data 7 in	10	XciBDATA6	Camera B data 6 in
11	XciBDATA5	Camera B data 5 in	12	XciBDATA4	Camera B data 4 in
13	XciBDATA3_T SERROR	TS_ERROR option	14	XciBDATA2_T SDATA	TS_DATA option
15	XciBDATA1_T SVAL	TS_VAL option	16	XciBDATA0_T SSYNC	TS_SYNC option
17	VDD5V	5v power	18	DV3V3	3.3V voltage
19	GND	Ground	20	GND	Ground
21	Xmipi2LSDN0	MIPI2L_SDN0	22	Xmipi2LSDP0	Xmipi2LSDP0
23	Xmipi2LSDNC LK	MIPI2L_SDNCLK	24	Xmipi2LSDPC LK	MIPI2L_SDPCLK
25	Xmipi2LSDN1	MIPI2L_SDN1	26	Xmipi2LSDP1	MIPI2L_SDP1
27	GND	Ground	28	GND	Ground
29	XadcAIN0	ADC_IN0	30	XEINT28	Interrupt 28
31	XadcAIN1	ADC_IN1	32	XEINT29	Interrupt 29
33	GND	Ground	34	NC	NC
35	AUXRIN-	AUDIO_IN-	36	XpwmTOUT2	PWM_OUT2
37	AUXRIN+	AUDIO_IN+	38	GND	Ground
39	GND	Ground	40	SPDIF_OUT0	SPDIF Output 0

2.16 LCD (J21)

On-board 40pin LCD interface. The board comes with driver for 4.3", 7" and 10.1" resistive /capacitive LCD. User can choose other size of LCD and touch screen.

There are some differences on the baseboard between the resistive /capacitive screen selections:

Resistive screen:

Soldering: resistive (0R 0402) -- R31, R33, R51, R65;

resistive (2KR 0402)--R236, R237:

IC -- U10, U15

NC: R32, R35, R64, R66, R72, R70.

Capacitive screen:

Soldering: resistive (0R 0402) -- R32, R35, R64, R66, R72, R70

NC: R31, R33, R51, R65, R236, R237, U10, U15.



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PVCC	2	PVCC	3	LCD_D0	4	LCD_D1
5	LCD_D2	6	LCD_D3	7	LCD_D4	8	LCD_D5
9	LCD_D6	10	LCD_D7	11	GND	12	LCD_D8
13	LCD_D9	14	LCD_D10	15	LCD_D11	16	LCD_D12
17	LCD_D13	18	LCD_D14	19	LCD_D15	20	GND
21	LCD_D16	22	LCD_D17	23	LCD_D18	24	LCD_D19
25	LCD_D20	26	LCD_D21	27	LCD_D22	28	LCD_D23
29	GND	30	XPWMTOUTO	31	MP02_1	32	MP02_0
33	LCD_DEN	34	LCD_SYNC	35	XVHSYNC	36	LCD_CLK
37	TSXM	38	N16760323	39	TSYM	40	TSYP

2.17 Keypad (CN2)

The Keypad is a 24-Pin 0.5mm connector.

Features:

- Open drain design
- Glitch suppression circuit design
- Multiple-key detection
- Long key-press detection
- Support 2-point and 3-point contact key matrix



Pin	Signal	Description	Pin	Signal	Description
1	DV3V3	3.3V voltage	2	DV3V3	3.3V voltage
3	GND	Ground	4	GND	Ground
5	KP_COL0	KP_COL0 option	6	KP_COL1	KP_COL1 option
7	KP_COL2	KP_COL2 option	8	KP_COL3	KP_COL3 option
9	KP_COL4	KP_COL4 option	10	KP_COL5	KP_COL5 option
11	KP_COL6	KP_COL6 option	12	KP_COL7	KP_COL7 option
13	KP_ROW0	KP_ROW0 option	14	KP_ROW1	KP_ROW1 option
15	KP_ROW2	KP_ROW2 option	16	KP_ROW3	KP_ROW3 option

17	KP_ROW4	KP_ROW4 option	18	KP_ROW5	KP_ROW5 option
19	KP_ROW6	KP_ROW6 option	20	KP_ROW7	KP_ROW7 option
21	KP_ROW8	KP_ROW8 option	22	KP_ROW9	KP_ROW9 option
23	KP_ROW10	KP_ROW10 option	24	KP_ROW11	KP_ROW11 option

2.18 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

- EM4412 Single board computer x1
- CD-ROM (Linux BSP, Android BSP, Documents, tools, Schematic Drawing, datasheets) x1
- Ethernet cable x1
- Serial Cable x1
- USB Cable x1
- 12V/2A DC power adaptor x1

3.2 Optional Parts

- WiFi Module x1
- GPS Module x1
- 3G Module x1
- Camera Module x1
- LCD Module x1
- Bluetooth x1