Waveshare Electronics
Address: Rm 813, Dynamic World Building, Zhenhua Rd, Futian District, Shenzhen, China
TEL: +86-755-83040832 Web: http://www.wvshare.com/
FAX: 86-755-83042572 E-mail: sales@wvshare.com

E9 Mini PC
Hardware Manual

（2014-06-05 V2.0）

Waveshare Electronics

www.wvshare.com

Waveshare Electronics
Address: Rm 813, Dynamic World Building, Zhenhua Rd, Futian District, Shenzhen, China
TEL: +86-755-83040832 Web: http://www.wvshare.com/
FAX: 86-755-83042572 E-mail: sales@wvshare.com

Catalogue

Chapter One: Introduction of E9 mini PC

1.1 Brief introduction of E9

E9 is a new quad-core mini PC. Its biggest advantage is that its size is slightly bigger than common used IC card, but it owns interfaces are as rich as computer peripherals. Namely, having an E9, you will have a hand-held mini PC.

E9 is the 2nd generation mini PC using Freescale Cortex-A9 I.MX6Q platform. It is mainly used in various kinds of terminal display devices. Its size is 100 x 72 mm, and supports rich interfaces such as FPC, HDMI, VGA, LVDS, UART, USB, OTG, SATA, Micro SD CARD, Camera, 3G, CAN Bus, G-Sensor, Wifi, BlueTooth, Ir, RTC and supports other functional modules for peripheral extension.

Launched by Freescale, i.MX6Q is a new generation application processor for consumer electronics, industrial, automobile audio entertainment system and many other fields. It uses ARM Cortex-A9 kernel, 40nm process technology, the maximum operation frequency up to 1.2GHz with ARMv7TM, Neon, VFPV3 and Trustzone support. The processor is 64/32bit bus structure,32/32KB Internal Cache,1M External Cache, and can realize high performance computing capabilities of 12000DMIPS (1.2 billion instructions set per second). It is with built-in 3D graphics acceleration engine, 2D graphics acceleration, supports 4096*4096 pixels resolution maximally. Video encoding supports MPEG-4/H.263/H.264 achieving 1080p @ 30fps; video decoding MPEG2/VC1/Xvid achieves 1080p @ 30fps. And it also supports HD HDMI TV output.

I.MX6Q is a kind of high-performance, low-power processor. It's applied to making Handheld Electronic Equipment, Communication Equipment, Medical Application Equipment, Learning Machine, Notebook, Video Surveillance Equipment and a variety of Man-machine interface, etc., such as High-definition Games, Wireless GPS Navigation, Mobile Video Playback, Intelligent Control, Instrumentation, Navigation Devices, PDA Devices, Remote Monitoring, Game Development and so on.

E9 mini PC is adopted the powerful I.MX6Q chip and lead out most of I.MX6Q functional interfaces, there are various kinds of application interfaces on the board to meet the basic requirements of learning, developing. Just connect the corresponding modules to realize the function you want. With the E9 mini PC, you can create a variety of DIY products as long as having new fresh ideas.

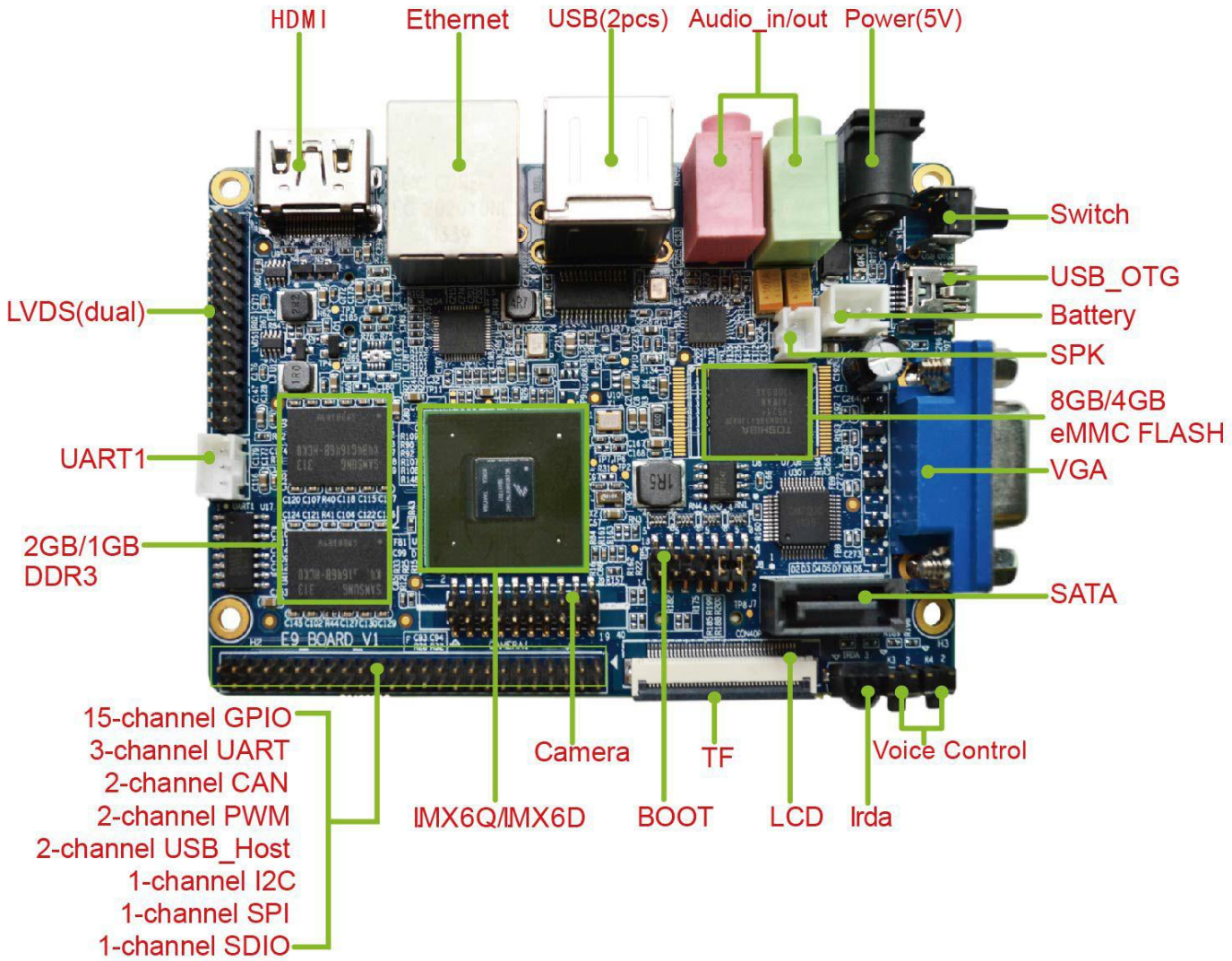
E9 mini PC's best advantages on software is that it supports multi-systems switching when start up, it's similar to PC boot that you can choose different system to boot. Currently, we provide Ubuntu12.04 and Android 4.2.

Using this board with provided software library and finished product, you can realize the functions and meet your needs easily. As long as you have E9, you have a Quad hand-held mini-PC. Through it, you can realize:

- Simple All-in-one Computer
- Auto PC
- Smart Set-top Box

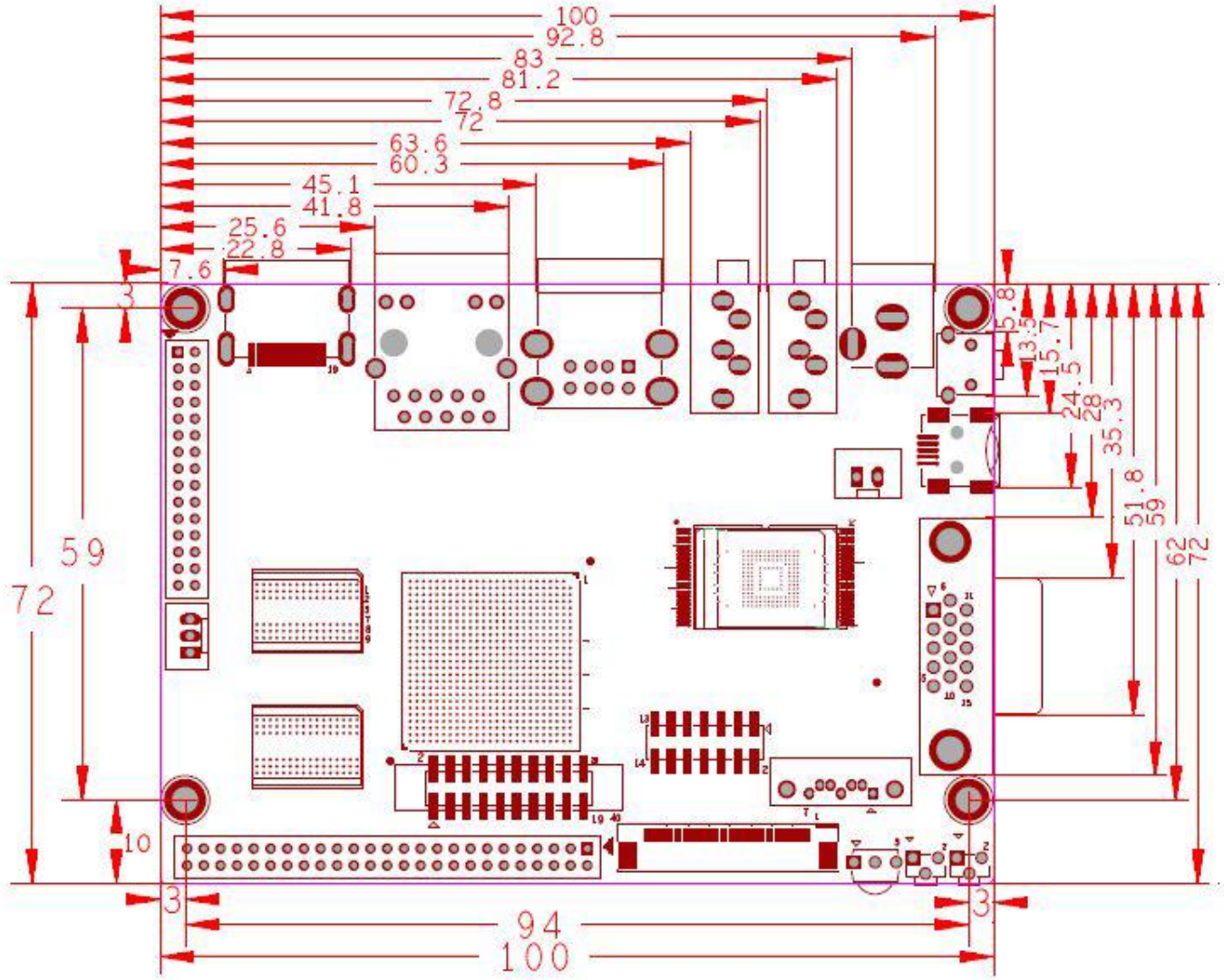
- Cloud Terminal Equipment
- Advertising Multimedia Terminal Equipment
-

1.2 What's On Board



1.3 Dimensions (100 x 72 mm)

Unit: mm; Position hole outer diameter: Φ5; inner diameter: Φ3.



1.4 The Functional Instructions E9 Mini PC

Size	100*72*20mm (excluding connection size)
PCB Layers	8 layers board craft processing, layout and wiring are full consideration of EMC and EMI
CPU	Freescale i.MX6Q (Quad) or i.MX6D (Dual) Cortex-A9
Frequency	1 GHz*4 Core or 2 Core
DDR	2GB or 1GB, DDR3,1066MHz
EMMC FLASH	8G or 4GB, can be extent to 16GB
Input Voltage	5V/2A
Power_on/off	One button to power_on or off, sleep and wake
Boot Mode	Support two boot mode: eMMC, Micro SD
Power Consumption	<4W (5V-800mA,the stand-alone boot peak)
USB OTG	1-channel USB_OTG 2.0 download interface

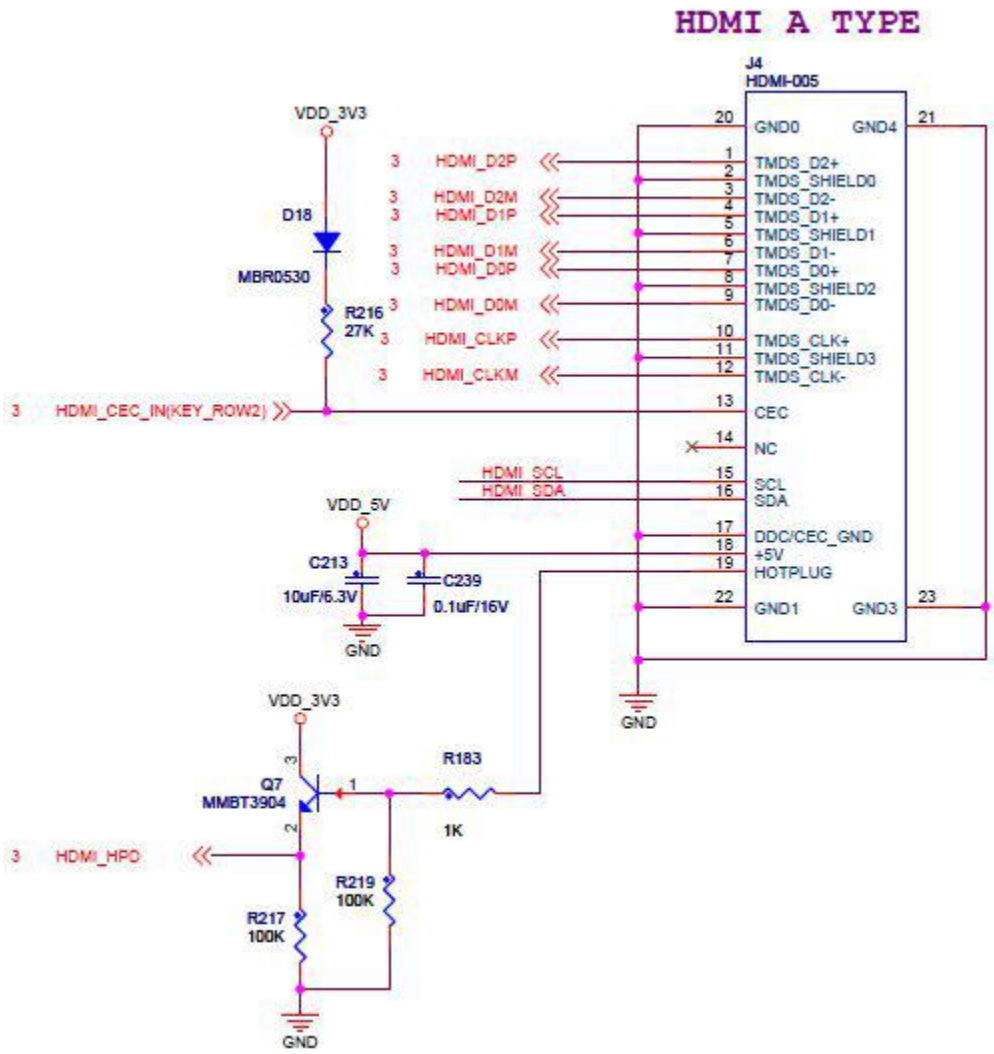
USB Host	2-channel USB_HOST 2.0 interface,2-channel scalable
SPK_output	Support 1W Output Power (8 ohms load)
HDMI	1-channel HDMI v1.4,1080p@30fps high definition digital output
VGA	1-channel,highly support resolution1920*1200
LVDS	Dual-channel LVDS
Audio	MIC, PHONE, Integrated Amplifier Interface
Ethernet	1-channel RJ45 interface, supports 10M/100M/1000M self-adaption
SATA	1-channel standard 7PIN SATA II interface
COM	1-channel 3P RS232 level debugging interface, 3-channel scalable serial port
RTC	1pcs
Micro SD	1pcs
User key	2pcs, used as the volume control buttons
Camera	1-channel,supports CMOS (Streaming media format)
IrDA	1-channel,support infrared remote control
LCD	40P FPC interface
LCD Option	support capacitive/resistance
Expansion Interface	2-channel USB, 17-channel interruptible IO, 2-channel CAN, 3-channel Serial Port,1-channel SPI,1-channel, SDIO,2-channel PWM

Chapter Two: The Introduction of Each Part's Circuit

Note: This chapter starts from the HDMI interface then one by one according to clockwise. Please find the specific circuit diagram in the related DVD.

2.1 HDMI High-definition Interface

It supports HDMI v1.4,1080p@30fps high-definition digital output and it can also realize audio video synchronization output. Here, the HDMI interface is the regular 19pins HDMI type A, with width 13.9mm and thickness 4.45mm.



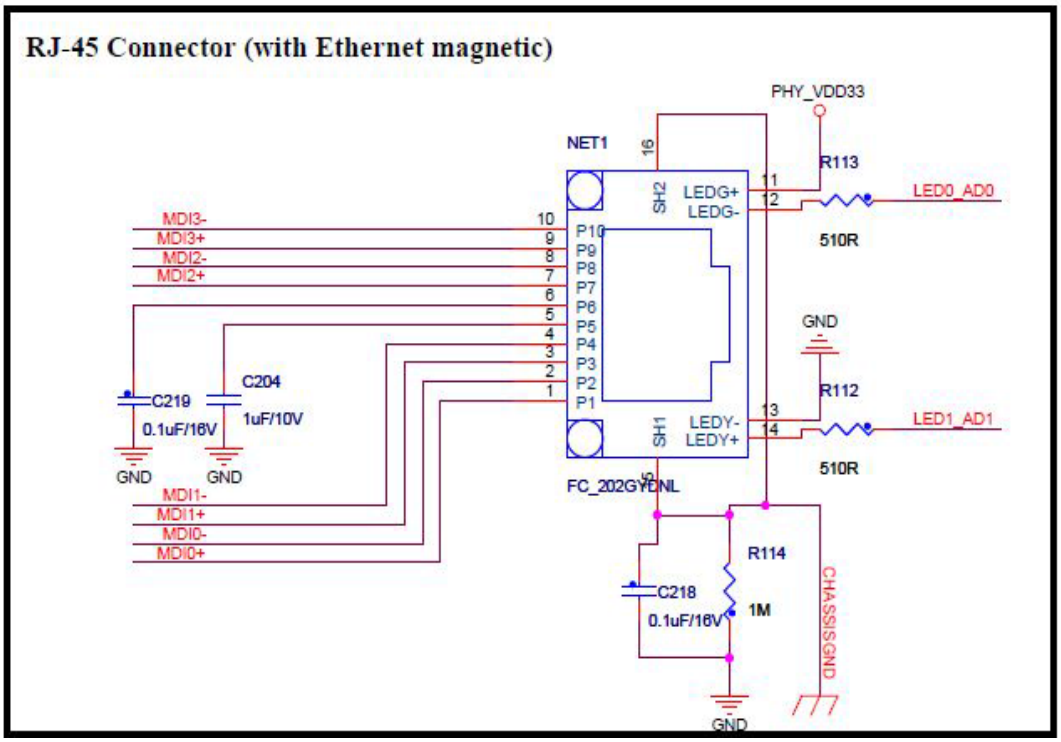
2.2 1000M Ethernet Interface

As Freescale i.MX6Q has integrated Gigabit Ethernet MAC internally, you just need to connect the PHY chip externally when using. This platform's Ethernet transceiver uses RTL8211E as Ethernet chip. Currently, it works in Gigabit mode, the card crystal is 25M. Mode can be configured through the resistor R87~R95 (please refer to the Base Board Diagram and RTL8211 Chip Manual for detailed configuration). The development board is configured as Gigabit full-duplex mode by default.

The RTL8211E/RTL8211EG is Realtek's newest network PHY chip, supporting 10Base-T/100Base-TX/1000Base-T, IEEE 802.3 standards. The interface of the main chip MAC is RGMII, which supports Crossover, Detection, Auto-Correction, polarity correction, adaptive equalization, cross-talk, cancellation, echo cancellation and other functions. The platform uses RTL8211E as the network card, it is because RTL8211EG's package is QFN64, RTL8211E's package is QFN48, but the price is so different between the two, RTL8211E is cheaper, while RTL8211EG is a little expensive, the main difference is RTL8211EG supports GMII/MII interface, RTL8211E doesn't. So if you are consider more about the cost control, it is suggested to chose

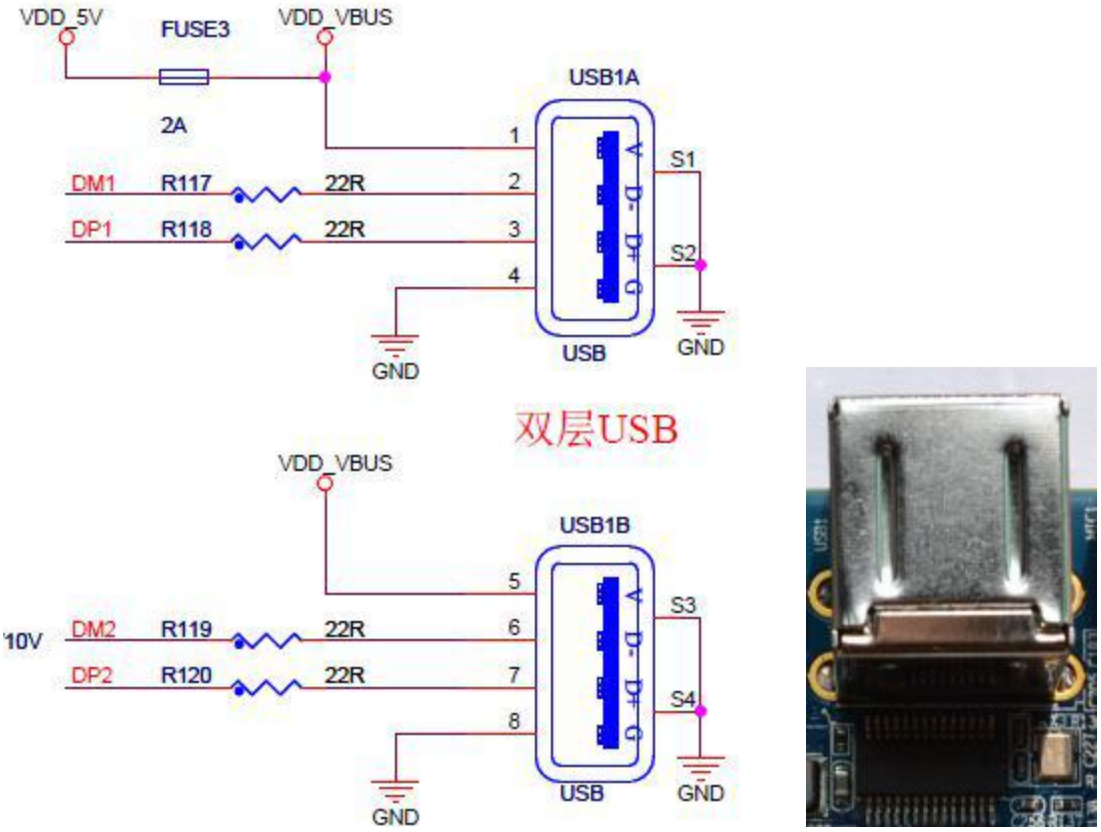
RTL8211E, RTL8211EG's price is more expensive than RTL8211E by 60~70%.Specially,need to use GMII/MII interface, please use RTL8211EG.

This platform Ethernet interface integrates transformer, after connecting the network cable and configuring correctly, you can surf the Internet. The interface is as below:



2.3 Double-deck USB Interface

The 4-channel USB HOST interface is extended by USB-HUB chip FE1.1S. It is the USB2.0 HUB chip with high performance, low power and cost-effective, it can extend 4-channel HOST output and support hot plug. Through one USB double-deck interface--USB1 and the extended interface—J6, it can extend to 2-channel HOST. It supports external connection of USB-WIFI module, USB Bluetooth module, USB mouse & keyboard, U disk and other USB equipment.



2.4 I2S Audio Input/output Interface

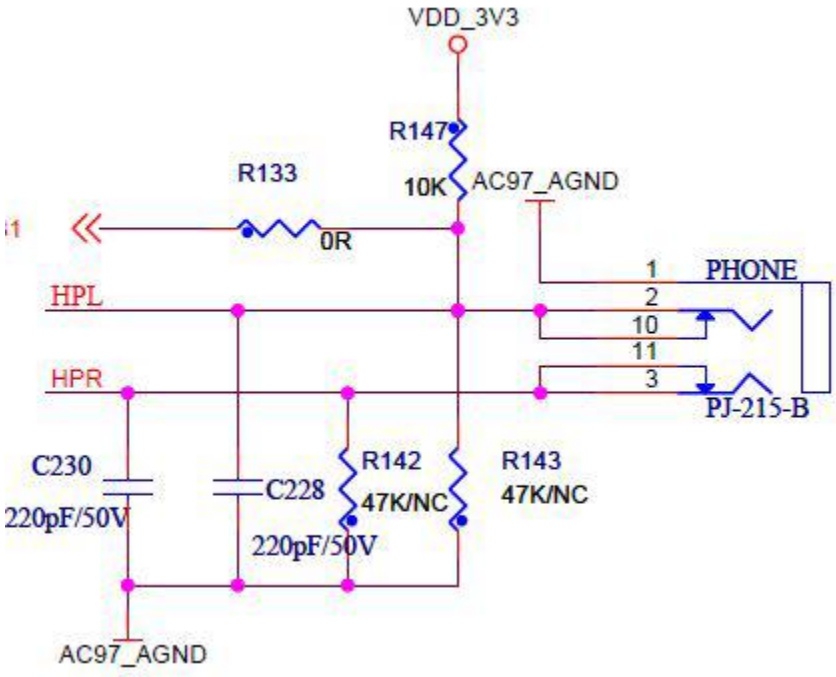
I2S Audio Circuit adopts Wolfson Microelectronics audio converter chip--WM8960, which is a low power, high quality stereo coder-decoder, especially designed for portable digital audio applications.

WM8960 integrates a complete microphone interface and a stereo headphone driver, as there is no need separate microphone, speaker or headphone amplifiers, which greatly reduces the external component requirements. The advanced digital signal processing realizes the automatic level control of microphone or circuit input.

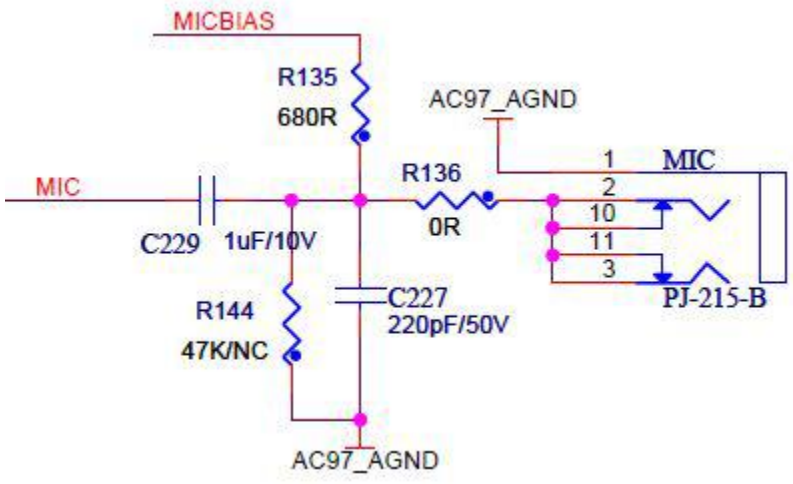
The stereo uses 24-bit sigma-delta analog digital converter (ADC) and digital analog converter (DAC), while using a low power oversampling digital interpolation and decimation filters, as well as a flexible digital audio interface. Master clock can be input directly or generated by the built-in internal phase-locked loop, which supports the most common clock mode.

WM8960 operates at analogue supply voltages as low as 2.7V. To save power, the digital core can operate at voltages down to 1.7V. The speaker supplies voltage 5.5V superlatively, and each channel's output can be 1W8Ω load, other power voltage is up to 3.6V. Different parts of the chip can be turned off by software control. Using 5*5mm 32pins QFN package, it's ideal for making handheld and portable devices.

Diameter 3.5mm Headphone output interface (green):



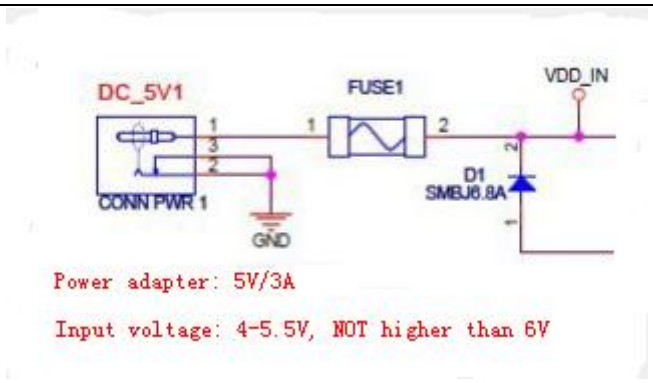
Diameter 3.5mm Microphone input interface (pink):



1W8Ω SPK interface: 2Pin white interface, 2.00mm pitch

2.5 Power_in Interface

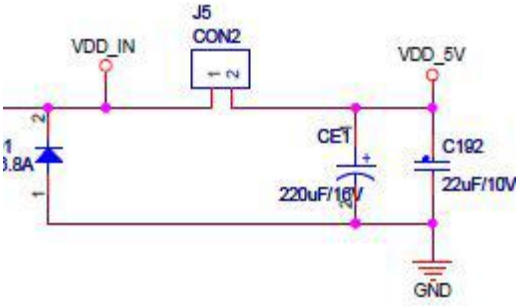
Standard 5V-2A power adapter input, using 6.8V transient pipe and 2.6V recoverable fuse to protect the overcurrent of the power. In order to ensure the normal use, please use the mating power adapter.



2.6 Switch Interface

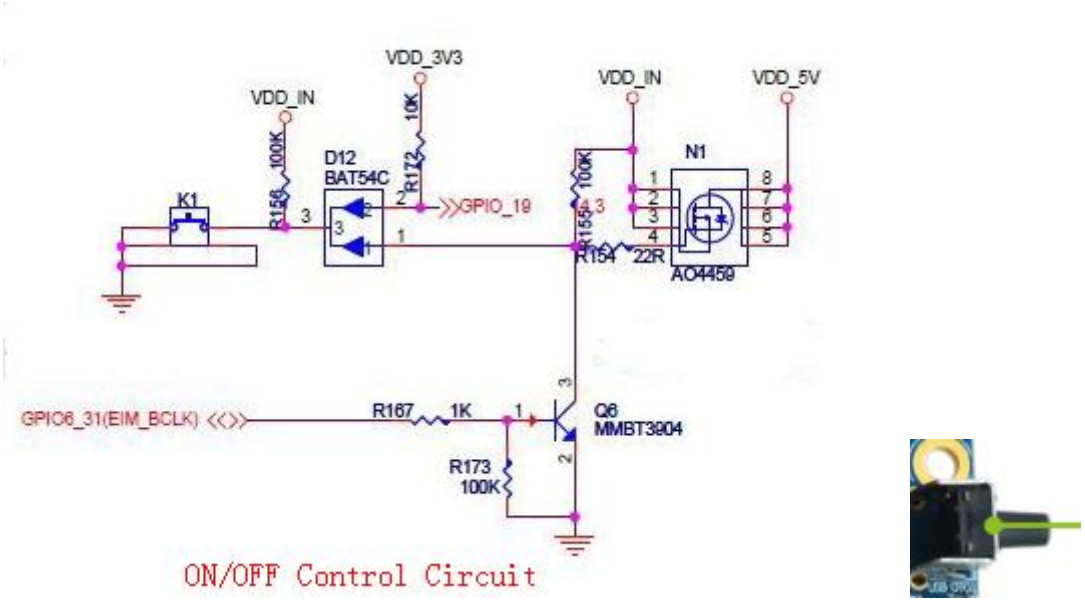
J5 is the reserved power switch interface, using 2.54mm pitch white interface, and you need to let the external switch leads docking when using. Its function is to skip the power management circuit and control the board's power on or off directly.

If you use the J5 as the power switch, it may cause the situation that it can't be switch off after power on. This is because the application has the software power off. In this case, you need to modify the application to cancel the software control or remove the MOS N1 on the circuit.



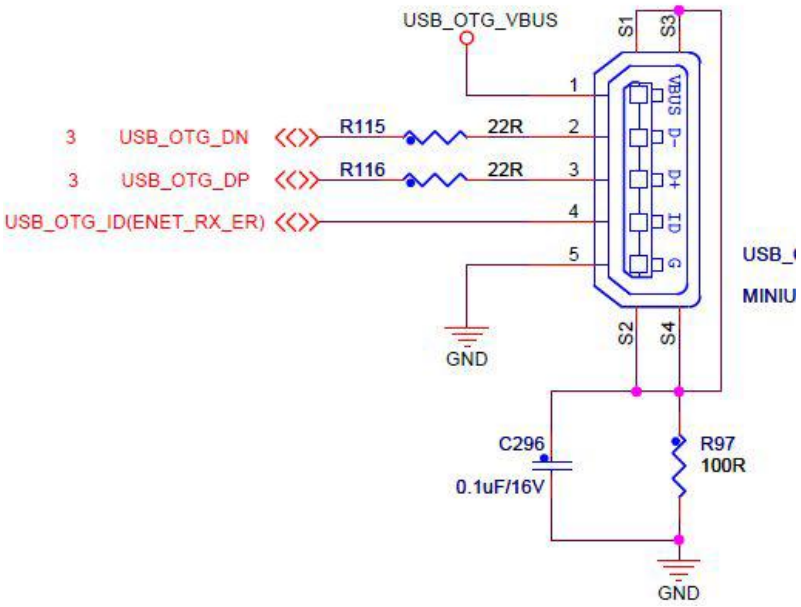
2.7 ON/OFF KEY

K1 is the power switch for the board. It is able to power on or off when pressing in long time (3-5 seconds), and wake-up when pressing in short time (1 second).



2.8 MINI-USB Interface

Mini-USB interface will be used as the ordinary USB slave.

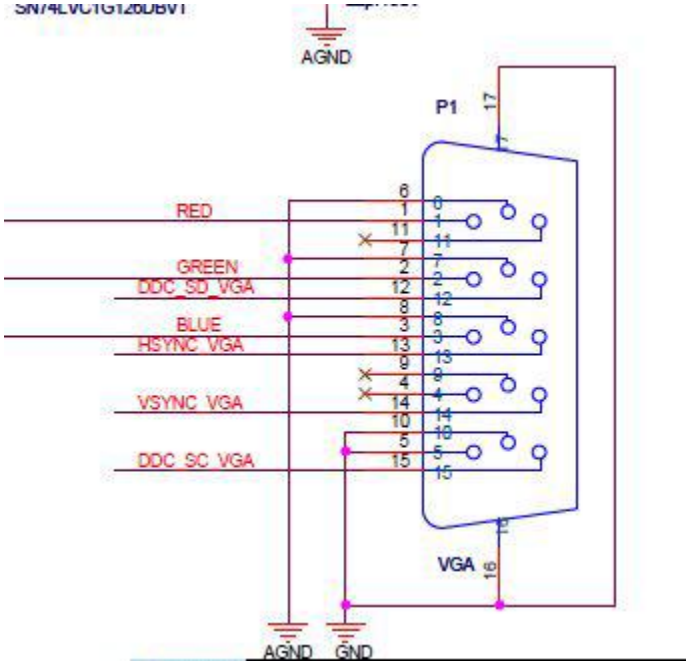


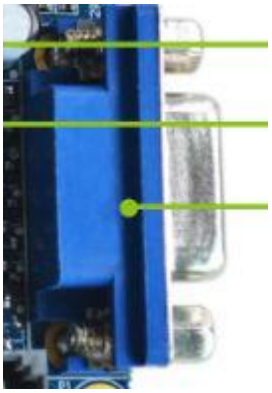
2.9 VGA Interface

VGA has the advantages of high resolution, quick display, rich color, etc. And it has already been widely used in color

display filed. i.MX6Q doesn't support VGA interface in display. Here, it uses LCD to VGA chip-- GM7123C so as to realize the VGA output.

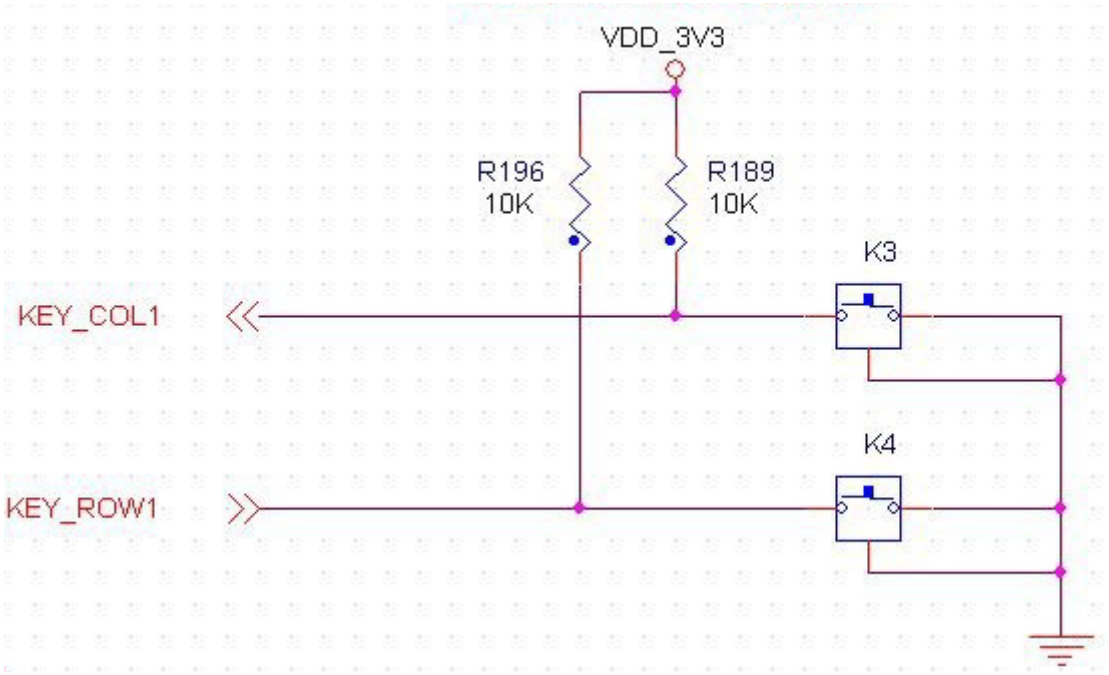
The VGA interface on the board is the standard 15pins female connector.





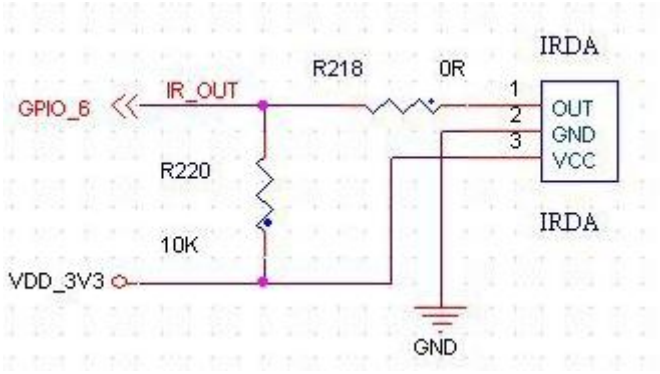
2.10 User Keys

Two user keys K3 and K4 are used for increasing or decreasing the volume.



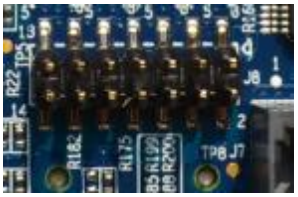
2.11 IRDA

The IrDA is using HS0038B miniature infrared receiver. It's easy to use, low output level, and compatible with TTL and CMOS level, low power consumption, and strong anti-interference capability. Large-screen display with the IrDA remote controller can realize remote control easily.



2.12 Boot Switch

J8 is the system boot mode selection interface, shorting different jumper cap can realize different boot mode. The interface is 2.0mm pitch 10pins, the matching jumper cap in 2.00mm pitch.



E9 keeps all the boot modes. Please refer to the "Chapter Three: Development Platform BOOT Guide" for boot mode selection. Here we list three kinds of boot switch: **(in the above picture, the right side is the first foot)**

Boot Select Table							
Boot	1	2	3	4	5	6	7
Device	BT_CFG1_6	BT_CFG1_5	BT_CFG1_4	BT_CFG2_6	BT_CFG2_5	BT_CFG2_4	BT_CFG2_3
eMMC	1	1	X	X	1	1	1
SD	1	0	X	X	0	0	1
DownLoad	0	1	1	0	0	0	0

Note: Make the Ethernet interface UP; J8 interface from left to right is 7, 6, 5, 4, 3, 2, 1 corresponding to the above table, **short the jumper cap is "1"**. X means connect or not connected.

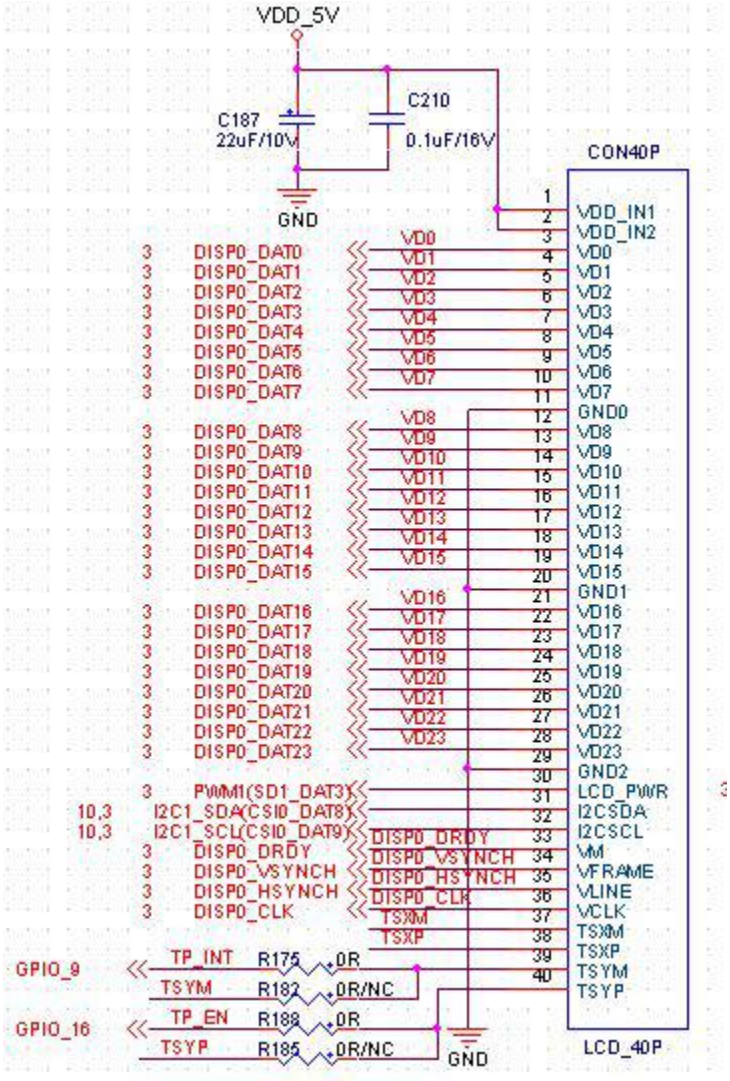
2.13 LCD Interface

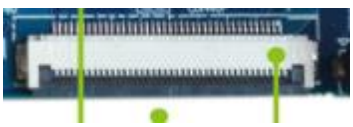
The FPC interface is 40Pin 0.5mm pitch down renovate interface. Its interface definition matches with all LCD display from Embedsky. And it supports to select resistive or capacitive screen (capacitive screen by default), the touch signal is in the 37pin to 39pin interface.

When soldering U20, R182 and R185, not soldering R175 and R188, it's for resistive screen;

When not soldering U20, R182 and R185, soldering R175 and R188, it's for capacitive screen;

R175, R182, R185 and R188 are all 0 ohm resistor, 0402 package, they are on the top left of the LCD interface.



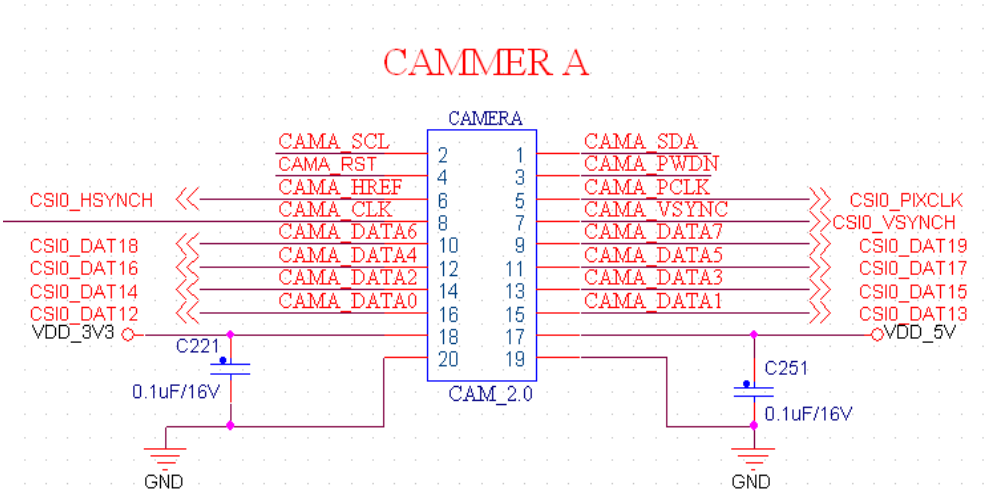


2.14 Camera Interface

Camera interfaces--CAMERA is 2.00mm pitch 20 pins interface, can connect 3Megapixel OV3640 module.

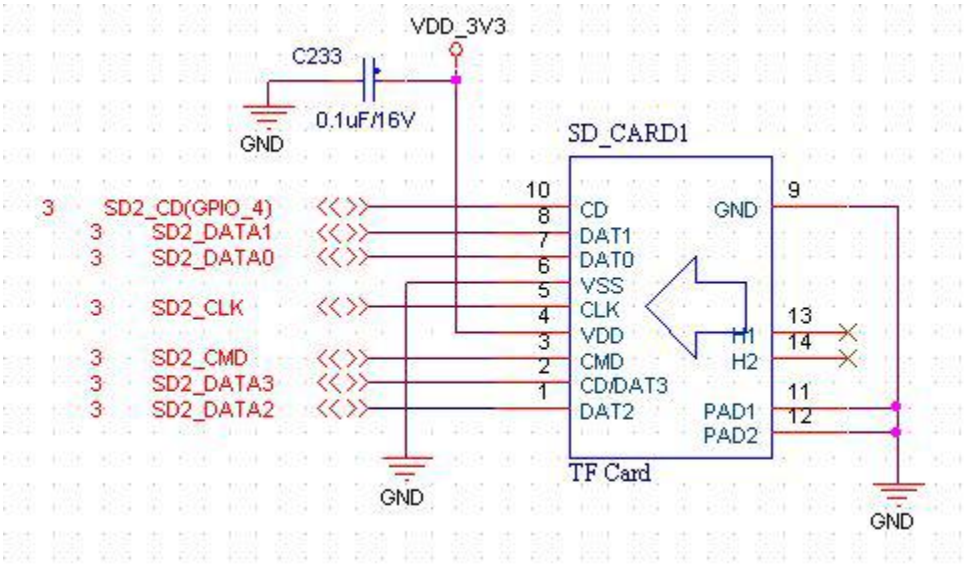
Note: When connecting the camera module, it must pay attention to the interface's direction; the triangle symbol on the module must be inserted to the corresponding triangle symbol on the board. If connect incorrectly, it is easy to burn the

camera module directly. After connect the OV3640 camera module, the camera should be in the direction of the PCB.



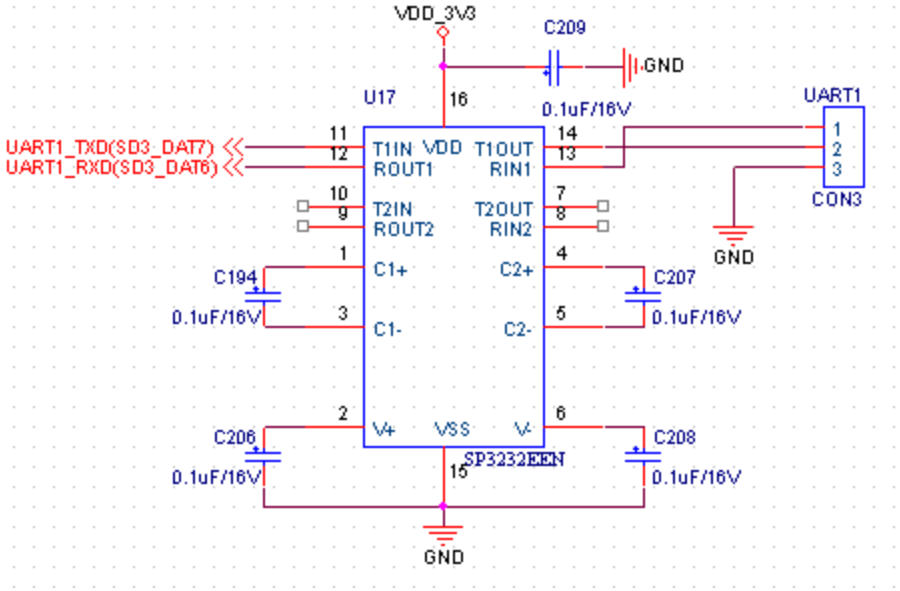
2.15 Micro SD Card Interface

Micro SD Card Interface is on the back side of Camera interface. When inserting please do not be so hard, in case of making the SD card bend and damage. When there is no program, set the boot mode as SD card boot, then you can burn program to the board. The SD card can be set as automatic burning, manual burning or UBoot boot card. After the system booted, the Micro SD card can be used as an external storage device.



2.16 Debug serial port

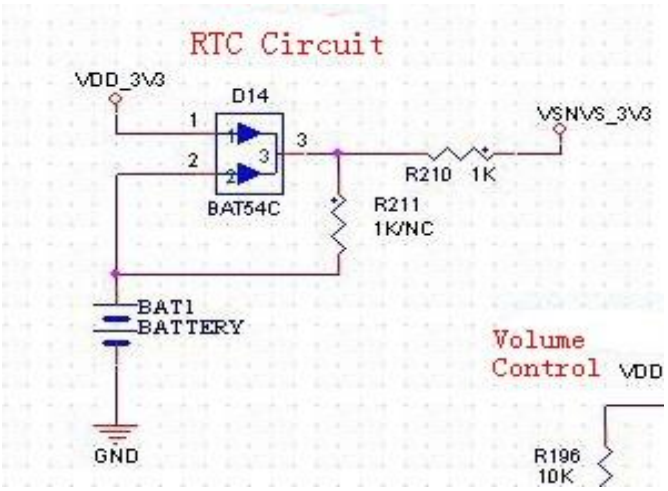
UART1 white interface is the 3-line RS232 level debug serial port, 3pin 2.00mm pitch. The real pin's position is on the bottom of the interface. The interface definition is RXD0, TXD0, and GND from the bottom to top.

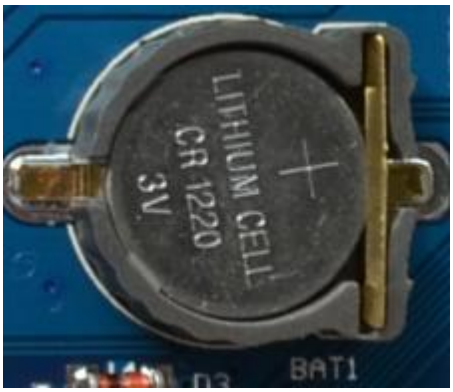


2.17 RTC Circuit

In order to ensure the RTC is right and effective, the 3V button battery will continue to supply power to the system RTC after the external power interrupted.

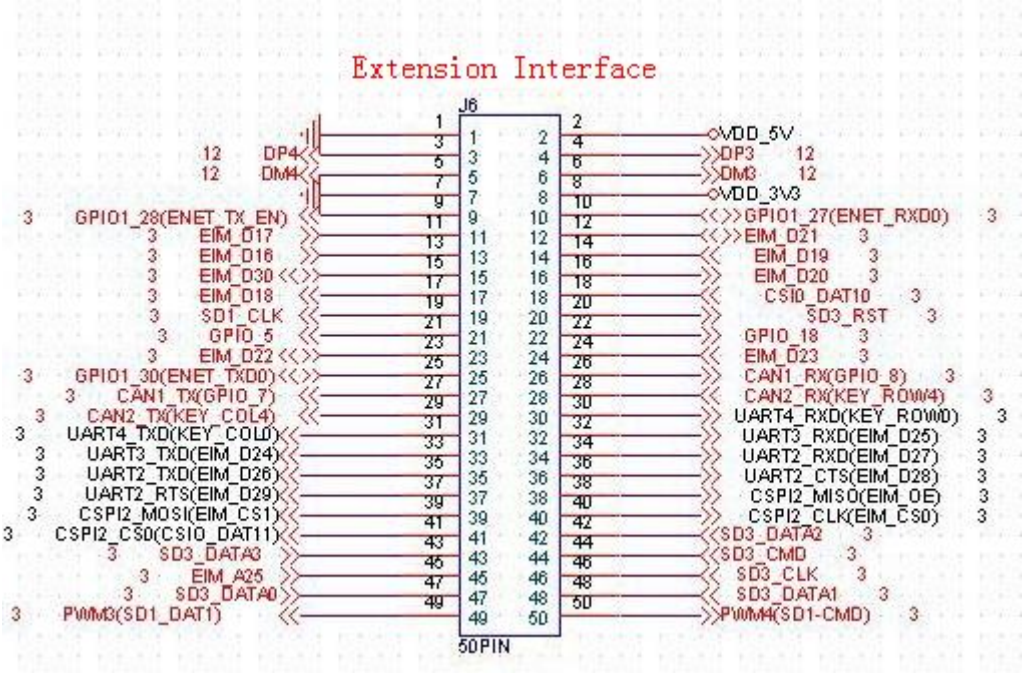
The battery model is CR1220; it is on the back of the board.





2.18 Extension Interface

E9 Mini PC provides 2.00mm pitch 2*25 double pins extension interfaces. The extension interfaces: 5V and 3.3V power supply, 2-channel USB Host, 17-channel GPIO with interrupt function, 2-channel CAN, 3-channel UART, 1-channel SPI, 1-channel SDIO, 2-channel PWM.



On the front left of E9, the triangle part (in the right corner) is the 1 foot. Detailed features below:

NO.	CPU	Descriptions
1	GND	Ground
2	5V	5V Power
3	DP4	3 works with 5,can be used as USB Host
4	DP3	4 works with 6,can be used as USB Host
5	DM4	3 works with 5,can be used as USB Host
6	DM3	4 works with 6,can be used as USB Host
7	GND	Ground
8	3.3V	3.3V Power
9	GPIO1_28	GPIO interface
10	GPIO1_27	GPIO interface
11	EIM_D17	external interrupt 4, can be used as IO
12	EIM_D21	external interrupt 5, can be used as IO
13	EIM_D16	external interrupt 6(work with IrDA), can be used as IO
14	EIM_D19	external interrupt 8, can be used as IO
15	EIM_D30	external interrupt 16, can be used as IO or matrix keyboard
16	EIM_D20	external interrupt 17, can be used as IO or matrix keyboard
17	EIM_D18	external interrupt 18, can be used as IO or matrix keyboard
18	CSI0_DATA10	external interrupt 19, can be used as IO or matrix keyboard
19	SD1_CLK	external interrupt 20, can be used as IO or matrix keyboard
20	SD3_RST	external interrupt 21, can be used as IO or matrix keyboard
21	GPIO_5	external interrupt 22, can be used as IO or matrix keyboard
22	GPIO_18	external interrupt 23, can be used as IO or matrix keyboard

23	EIM_D22	external interrupt 24, can be used as IO or matrix keyboard
24	EIM_D23	external interrupt 25, can be used as IO or matrix keyboard
25	GPIO1_30	external interrupt 26, can be used as IO or matrix keyboard
26	CAN1_RX	2-channel CAN Bus
27	CAN1_TX	
28	CAN2_RX	
29	CAN2_TX	
30	UART4_RXD	3.3V level serial port 3
31	UART4_TXD	
32	UART3_RXD	3.3V level serial port 2
33	UART3_TXD	
34	UART2_RXD	3.3V level serial port 1,works with cts and rts,can realize 5-line serial port
35	UART2_TXD	
36	UART2_CTS	
37	UART2_RTS	
38	CSPI2_MISO	SPI0 interface, can connect gravity sensor and other SPI devices
39	CSPI2_CS0	
40	CSPI2_CLK	
41	CSPI2_CS0	
42	SD3_DATA2	SD 3,can connect SDIO wifi and so on
43	SD3_DATA3	
44	SD3_CMD	
45	EIM_A25	
46	SD3_CLK	
47	SD3_DATA0	
48	SD3_DATA1	
49	PWM3	PWM
50	PWM4	PWM