Mini6410 Development Board introduction

ARM11 Samsung S3C6410, ARM1176JZF-S, up to 533MHz

256MByte DDR RAM + 1GByte NAND Flash

TV-out, GPS, GPRS, WIFI and Camera module support

Supports Linux2.6 Android 2.3 and WinCE 6.0

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Catalogue

Chapter 1 Overview

1.1 Overview

The Mini6410 Single Board Computer is a high-performance controller board introduced. It is designed based on the S3C6410 microcontroller, 256MByte DDR SDRAM, 1GByte Nand Flash, RTC, Audio and net on board. It has integrated RS232, USB, Ethernet, Audio In/Out, Keyboard, LCD, CVBS、TV out, camera in, SD card and more other functions on board. So many hardware resources provided by the expansion board, it becomes a solid reference board for customer design.

The board supports Linux 2.6.28, Android2.1 and Windows CE 6.0 operating system and is provided with complete basic drivers which enable a quick channel to evaluate the Samsung S3C6410 processor and customize application software. It would be an ideal development platform for multimedia and communication applications.

1.2 Features

The S3C6410X is a 16/32-bit RISC microprocessor, which is designed to provide a cost-effective, low-power capabilities, high performance Application Processor solution for mobile phones and general applications. To provide optimized H/W performance for the 2.5G & 3G communication services, the S3C6410X adopts 64/32-bit internal bus architecture. It also includes many powerful hardware accelerators for tasks such as motion video processing, audio processing, 2D graphics, display manipulation and scaling. An integrated Multi Format Codec (MFC) supports encoding and decoding of MPEG4/H.263/H.264 and decoding of VC1.

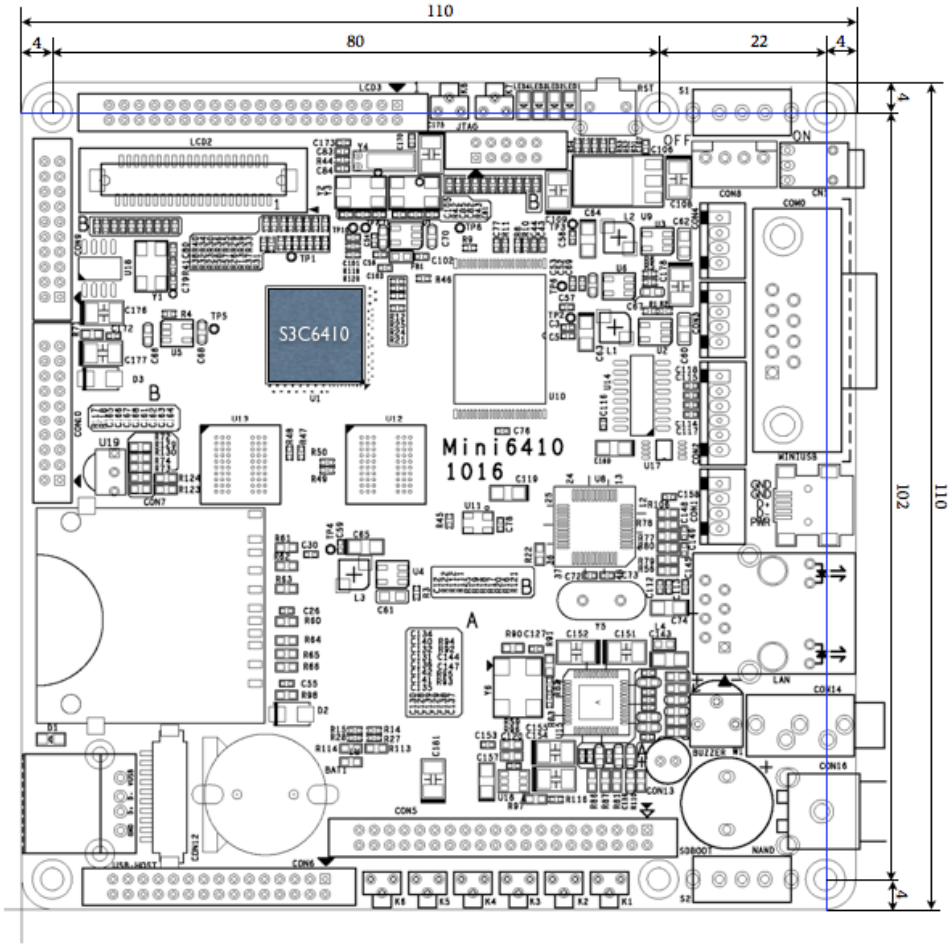
The Mini6410 Single Board Computer is based on S3C6410 processor. This board is characterized as follows:

- **Dimension**: 110 x 110 mm
- **CPU**: 533 MHz Samsung S3C6410A ARM1176JZF-S with VFP-Unit and Jazelle (max freq. 667 MHz)
- **RAM**: 256 MB DDR RAM, 32 bit Bus
- **Flash**: 1GB NAND Flash
- **EEPROM**: 1024 Byte (I2C)

- **Ext. Memory**: SD-Card socket
- **Serial Ports**: 1x DB9 connector (RS232), total: 4x serial port connectors
- **IR**: Infrared Receiver
- **USB**: 1x USB-A Host, 1x mini USB Slave-OTG 2.0
- **Audio Output**: 3.5 mm stereo jack
- **Audio Input**: Condenser microphone
- **Ethernet**: RJ-45 10/100M (DM9000)
- **RTC**: Real Time Clock with battery
- **Beeper**: PWM buzzer
- **Camera**: 20 pin Camera interface (2.0 mm)
- **TV Output**: CVBS
- **LCD Interface**
  - STN Displays:
    - Monochrome, 4 gray levels, 16 gray levels, 256 colors, 4096 colors
    - Max: 1024x768
  - TFT Displays:
    - Monochrome, 4 gray levels, 16 gray levels, 256 colors, 64k colors, true color
    - Max: 1024x768
  - 40 pin (2.0 mm) and 41 pin connector for FriendlyARM Displays (4.3" and 7")
- **Touch Panel:** 4 wire resistive
- **User Inputs:** 8x push buttons and 1x A/D pot
- **User Outputs:** 4x LEDs
- **Expansion:** 40 pin System Bus, 30 pin GPIO, 20 pin SDIO (SD, SPI, I2C), 10 pin Buttons (2.0 mm)
- **Debug:** 10 pin JTAG (2.0 mm)
- **Power:** 5V connector, power switch and LED
- **Power Supply:** regulated 5V (Mini6410: 0.25 A, Mini6410 + 4.3" LCD: 0.5 A)
- **OS Support**

- Windows CE 6
- Linux 2.6
- Android
- Ubuntu

1.3 Hardware Size



Unit:mm

1.4 Linux System Recourse

Boot loader

- verison: s3c-u-boot-1.1.6
- Function: support boot and update system by SD card and USB

Linux kernel

- verison: s3c-Linux-2.6.36

- Compile: arm-none-linux -4.5.1-v6-vfp
- Function: support MFC, Jpeg encode, 2D/3D

Device Driver

- TFT LCD/Touch screen (support 3.5"LCD, 4.3"LCD, 7.0"LCD, 8"LCD, VGA module)
- LCD backlight control
- 4 Serial port driver
- DM9000 net driver
- Audio driver(WM9714)
- RTC driver, User LED driver,
- USB HOST driver, USB camera, USB key and mouse, USB Disk.
- SD card driver,
- IIC EEPROM
- Watchdog driver
- Media play driver (JPEG, fimc, MFC, 2D/3D,TVENC, TVSCALER)
- CMOS Camera
- SPI driver
- SDIO WIFI, GPS, GPRS
- USB module (Bluetooth, WiFi, mouse, key)

File System support

- ubifs / yaffs2 / cramf / fat32 / NFS / Ext2 / Ext3

GUI support

- qtopia-2.2.0
- QtE-4.4.3
- QtE-4.7.0

Server program

- Busybox 1.13
- Telnet, FTP, Inetd

- boa(web server)
- madplay(play mp3)
- snapshot(capture program)
- ifconfig, ping, route(net command)

Test program

- ADC test, LED test, buttons test, I2C test
- LCD test, ping test, USB camera test
- recode test, web browse test
- watch dog test
- Net configure test
- LCD backlight control test
- Language test (support Chinese, English)
- QT4 test
- SMplayer test
- 3G set
- GPRS Set
- USB camera test
- TV-out test
- SD WiFi, usb WiFi test

NO.	Device	Driver position in Linux	Dev node In board	remarks
1	yaffs2	fs/yaffs2		use yaffs default
2	UBIFS	fs/ubifs		
3	EXT3	fs/ext3		
4	LCD	drivers/video/samsung/s3c_mini6410.c	/dev/fb0	The LCD driver
5	CMOS camera	drivers/media/video/samsung/fimc/ov965x.c	/dev/camera	
6	USB camera	drivers/media/video/gspca	/dev/video0	
7	USB to serial	drivers/usb/serial/pl2302.c	/dev/ttyUSB0	

8	USB mouse, key	drivers/hid/usbhid	USB mouse: /dev/input/mice USB key: /dev/input/event	
9	LED	drivers/char/mini6410_leds.c	/dev/leds	
10	Button	drivers/char/mini6410_buttons.c	/dev/buttons	
11	IIC-EEPROM	drivers/i2c	/dev/i2c/0	
12	PWM	drivers/char/mini2440_pwm.c	/dev/pwm	
13	ADC	no		
14	LCD backlight	drivers/video/mini6410_backlight.c	/dev/backlight	
15	watchdog	drivers/watchdog/s3c2410_wdt.c	/dev/watchdog	
16	Touch screen	drivers/input/touchscreen/s3c-ts.c	/dev/input/event0	
17	u-disk	drivers/USB/storage	/dev/udisk	
18	SD card	drivers/mmc/core	/dev/sdcard	up to 32G
19	NAND Flash	drivers/mtd/nand	/dev/mtdblock2	
20	WM9714 audio	sound/soc/s3c64xx	/dev/dsp	
21	RTC	drivers/rtc/rtc-s3c.c	/dev/rtc	
22	Serial	drivers/serial/s3c6400.c	/dev/ttySAC0,1,2,3	
23	USB WIFI	drivers/net/wireless/	wlan0	
24	DM9000 NET	drivers/net/dm9000.c	eth0	
25	TV-OUT	drivers/media/video/samsung/tv		
26	3D	drivers/media/video/samsung/g3d		
27	2D	drivers/media/video/samsung/g2d		
28	JPEG	drivers/media/video/samsung/jpeg		
29	rotator	drivers/media/video/samsung/rotator		
30	post	drivers/media/video/samsung/post		
31	MFC	drivers/media/video/samsung/mfc10		

1.5 Windows CE 6.0 Recourse

Boot loader

- Version: Stepldr and EBOOT (provide Source code)
- Function: support download and update system by SD and USB support update the boot logo
- Quick boot: for 15s booting

WinCE NK

- Version： Wince6.0 R3
- Function: HIVE register support, BINFS support, 256M memory manage, SLEEP

Device Drivers

- TFT LCD/Touch screen (support 3.5"LCD, 4.3"LCD, 7.0"LCD, 8"LCD, VGA)
- CMOS camera driver
- User key driver, PWM driver
- RTC driver
- DM9000 driver
- SD card support
- touch screen support
- Audio In/Out
- USB host: USB disk, USB key, USB mouse
- Serial driver
- Media support (JPEG, fimc, MFC, 2D/3D, TVENC, TVSCALER)
- WIFI, GPS, GPRS, Camera
- VGA driver (can support 1024 * 768)
- USB Bluetooth, USB WiFi, USB mouse, USB key
- IE6 explorer.

Test program

- LED test, button test, serial debug tools, PWM test, TV test, OpenGL test
- COMS camera test, SD WiFi test, USB WiFi test, backlight control test, USB Bluetooth test, NET test.

1.6 Android System Recourse

Boot loader

- Version: s3c-u-boot-1.1.6
- Function: support boot and update system by SD card and USB

Linux kernel

- Version: s3c-Linux-2.6.28.6
- Compile: jdk5

Device Driver

- TFT LCD/Touch screen, Audio OUT, MMC/SD card, NET, Serial port
- watchdog, RTC, keyboard
- WIFI, GPS, Camera, USB Bluetooth, Net DHCP, USB disk, 3G

File System support

- Ubi filesystem, yaffs, ext2/3,

Function use example

- Ethernet, Support DHCP.
- SD WiFi support
- GPS support
- COMS Camera support
- 3G support(WCDMA, CDMA2000, TD-CDMA)
- USB Disk support
- USB Bluetooth support
- Switch horizontal and vertical screen
- Dynamic Wallpapers

1.7 Ubuntu System Recourse

Boot loader

- verison: s3c-u-boot-1.1.6
- Function: support boot and update system by SD card and USB

Linux kernel

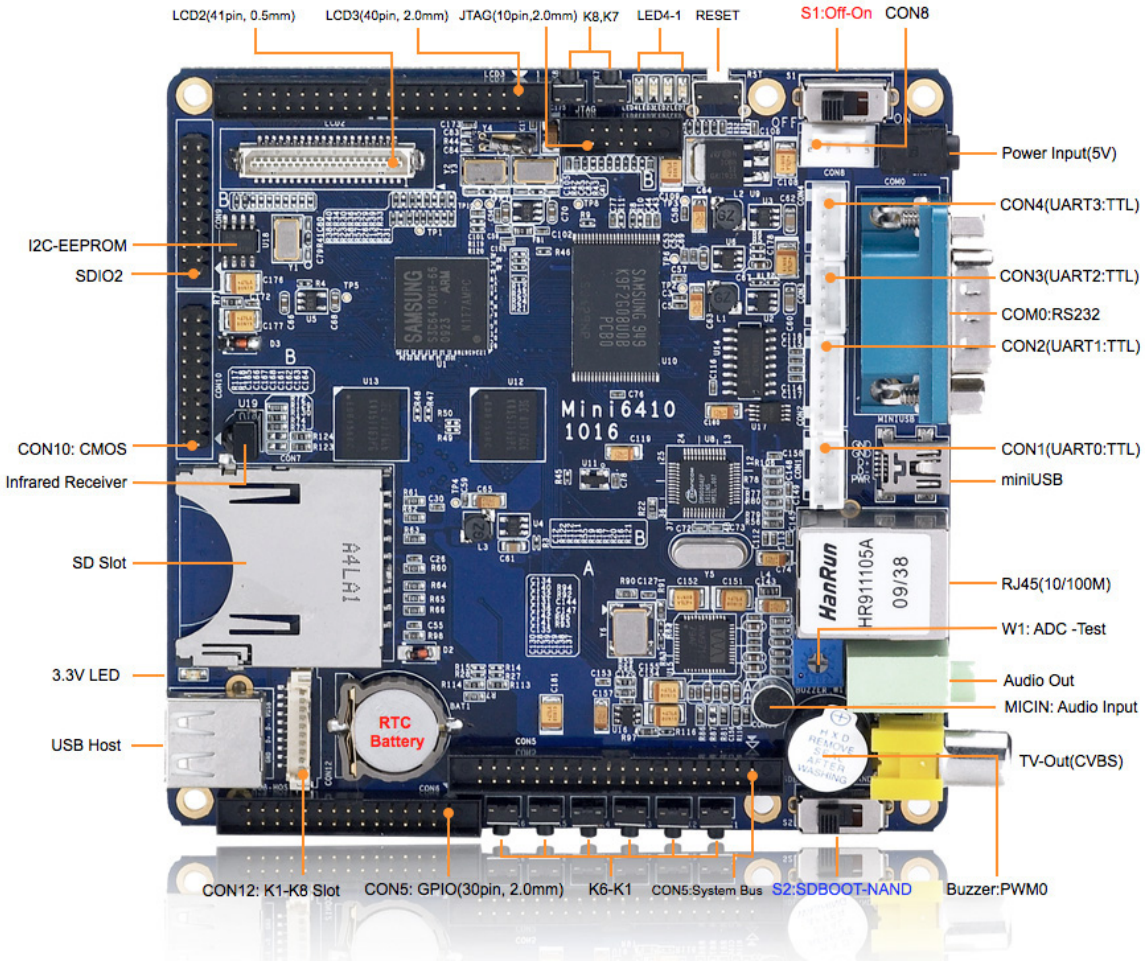
• verison: s3c-Linux-2.6.28.6

Ubuntu rootfs

• Ubuntu 0910, EXT2/3, UBIFS

Chapter 2 Hardware Specification

This section provides a definition of the pin-outs and cables to be used with all of the connectors and headers on the board.



2.1 System memory

Address start	Address end	Size(MB)	Description
0x0000_0000	0x07FF_FFFF	128MB	Boot image
0x0800_0000	0x0BFF_FFFF	64MB	In-ROM
0x0C00_0000	0x0FFF_FFFF	128MB	Stepping Stone(8KB)
0x1000_0000	0x17FF_FFFF	128MB	
0x1800_0000	0x1FFF_FFFF	128MB	DM9000AEP
0x2000_0000	0x27FF_FFFF	128MB	
0x2800_0000	0x2FFF_FFFF	128MB	
0x3000_0000	0x37FF_FFFF	128MB	
0x3800_0000	0x3FFF_FFFF	128MB	
0x4000_0000	0x47FF_FFFF	128MB	
0x4800_0000	0x4FFF_FFFF	128MB	
0x5000_0000	0x5FFF_FFFF	256MB	128MB
0x6000_0000	0x6FFF_FFFF	256MB	128M

2.2 Power In

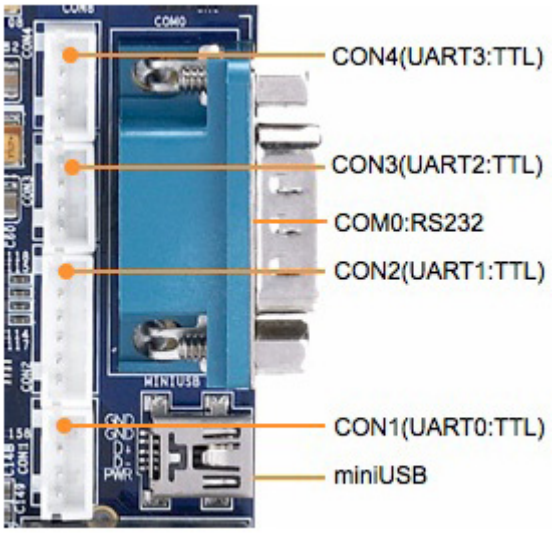
The board use 5V power supply, it have two method to power the board. One is the D-jack (CN1)power in, the others is 4Pin header(CON8).

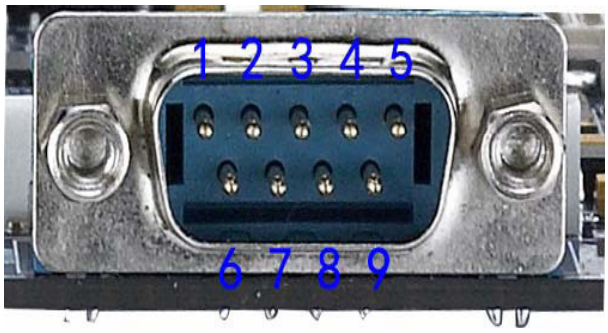
CON8	Pins defines
1	VDD5V
2	GND
3	GND
4	VDDIN

2.3 Serial port

S3C6410 have four serial port, it is UART0,1,2,3, UART0 and UART1 is 5-wired serial, the others is 3-wired serial.

In mini6410 board, COM0 was linked from UART0, RS232,you can link it to PC to debug the board. And the all serial was linked from the board by CON1, CON2, CON3, and CON4.



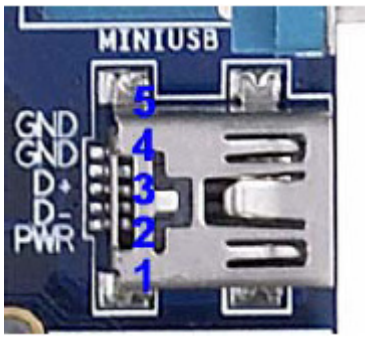


CON1, 2,3	Pins signal(TTL)	CON2	Pins signal(TTI)	COM0	Pins signal(RS232)
1	TXD	1	RTSn	1	NC
2	RXD	2	CTSn	2	RSRXD
3	5V	3	TXD	3	RSTXD
4	GND	4	RXD	4	NC
		5	5V	5	GND
			GND	6	NC
				7	RSCTSn
				8	RSRTSn
				9	NC

2.4 USB interface

In min6410 board, it have two usb interface, one is usb host, and the other is usb otg interface.

miniUSB interface(USB otg)



miniUSB	Pin signal
1	GND
2	OTGID
3	D+
4	D-
5	Vbus

USB Host interface

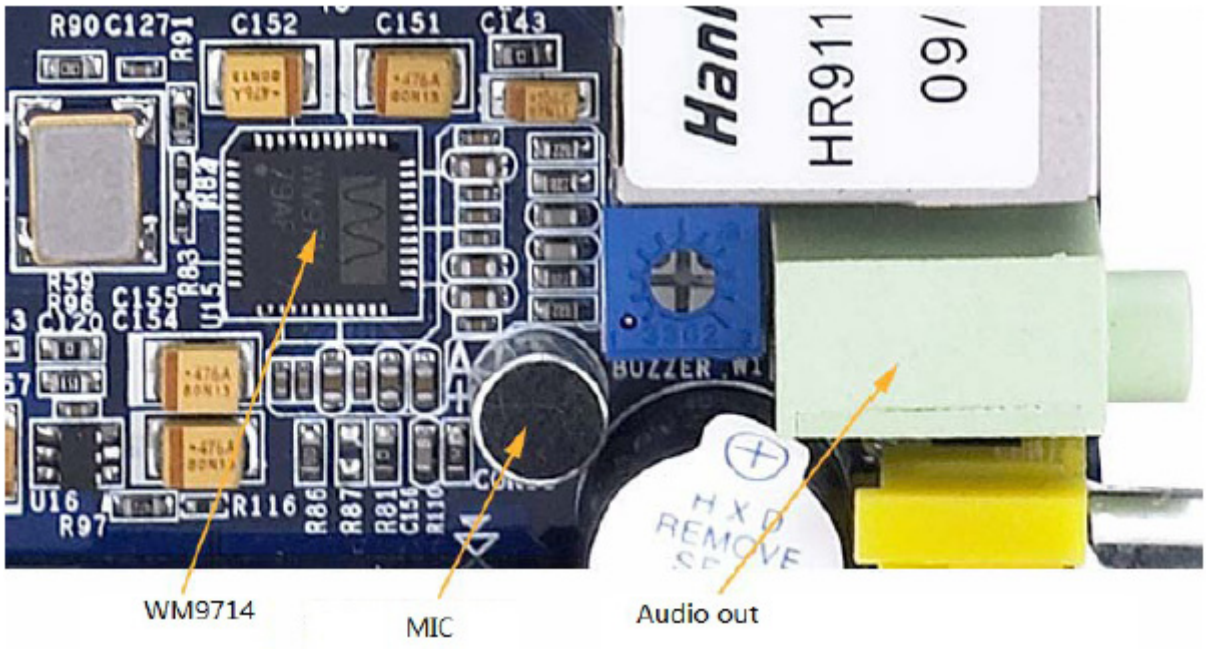
Pin signal	Pin signal
1	5V
2	D-
3	D+
4	GND

2.5 Network interface

the board carries a 100M network card interface, use the DM9000 chips.

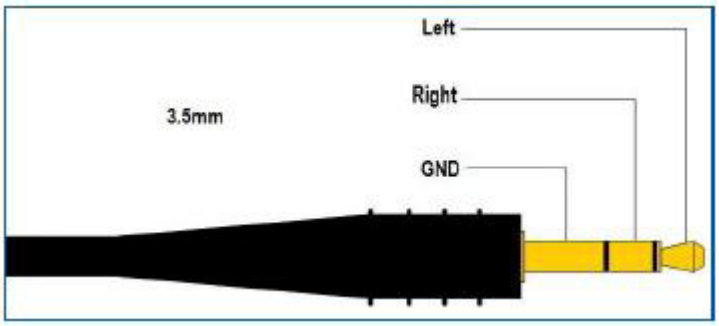
2.6 Audio intreface

The S3C6410 can support I2C/PCM/AC97 audio interface, Mini6410 use the AC97 interface and use the WM9714 as the codec function.



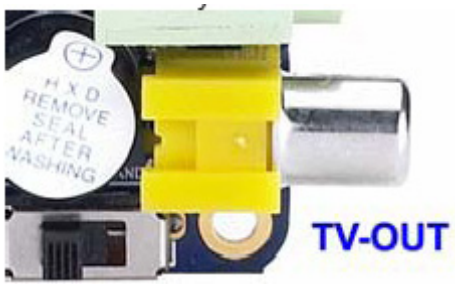
The board provides standard audio out interfaces.

Figure is the audio-out jack required to connect to the board.

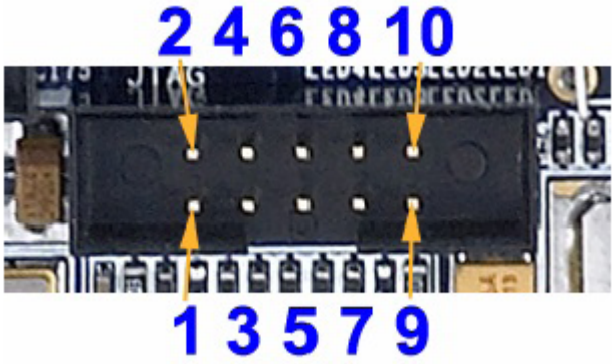


2.7 TV-out interface

The board provide two TV-out interface, One is from DACOUT0, and you can link to the TV directly the other is at the pin30 of the CON6. When you use DACOUT0, you should set the TV mode for CVBS mode.



2.8 JTAG



JTAG interface

Pin	1	3	5	7	8
Signal	3.3V	nTRST	TDI	TMS	TCK
Pin	2	4	6	8	10
Signal	3.3V	nRESET	TDO	GND	GND

2.9 LED

The board has 4 LED; you can control it, when output GPIO for 0, the LED will be light.

LED	LED4	LED3	LED2	LED1
GPIO	GPK7	GPK6	GPK5	GPK4

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2.10 Key

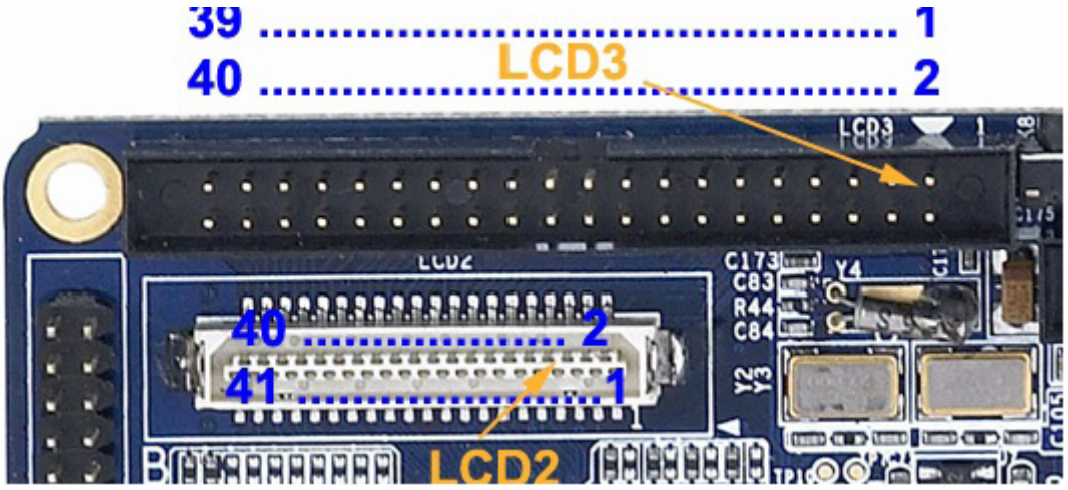
The board have 8 user key, and it can be linked for GPIO(CON12).

CON12

CON12	1	2	3	4	5	6	7	8	9	10
KEY	K1	K2	K3	K4	K5	K6	K7	K8		
EINT	EINT0	EINT1	EINT2	EINT3	EINT4	EINT5	EINT19	EINT20		
GPIO	GPN0	GPN1	GPN2	GPN3	GPN4	GPN5	GPL11	GPL12	3.3V	GND

2.11 LCD interface

We Link two LCD interface, it have the same signal.



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LCD2&LCD3 Pins signal details:

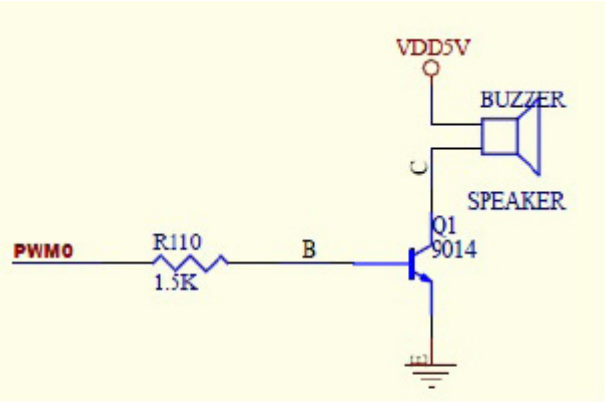
LCD2&LCD3	signal	LCD2&LCD3	Signal
1	5V	2	5V
3	VD0	4	VD1
5	VD2	6	VD3
7	VD4	8	VD5
9	VD6	10	VD7
11	GND	12	VD8
13	VD9	14	VD10
15	VD11	16	VD12
17	VD13	18	VD14
19	VD15	20	GND
21	VD16	22	VD17
23	VD18	24	VD19
25	VD20	26	VD21
27	VD22	28	VD23
29	GND	30	GPE0/LCD_PWR
31	PWM1/GPF15	32	nRESET
33	VDEN/VM	34	VSYNC
35	HSYNC	36	VCLK
37	TSXM	38	TSXP
39	TSYM	40	TSYP
41	GND		

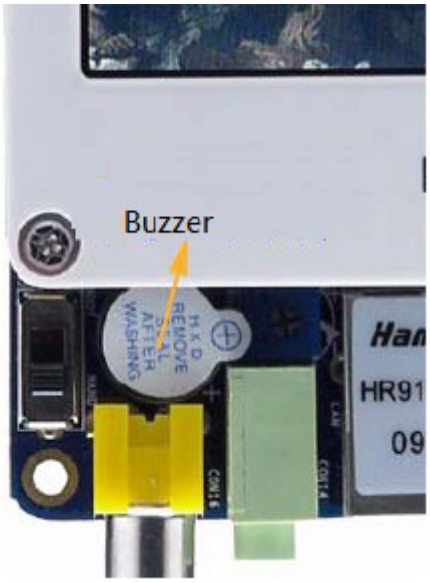
2.12 ADC input

The board have 4 Chanel A/D, AIN0 was linked to W1, AIN1, AIN2, AIN3 was linked to Pin27, PIN28, Pin29 of the CON6(refer to chapter 2.19), it can be configure 10/12 bit

2.13 PWM(buzzer)

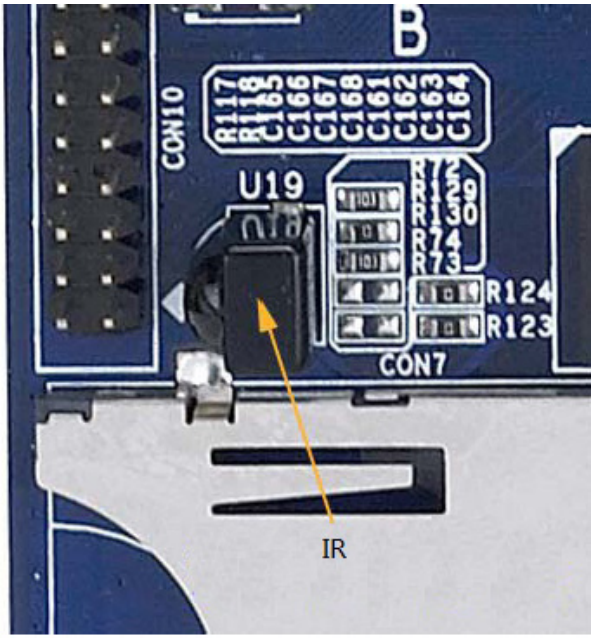
The Buzzer in the board was controlled by PWM, it is PWM0(GPF14)





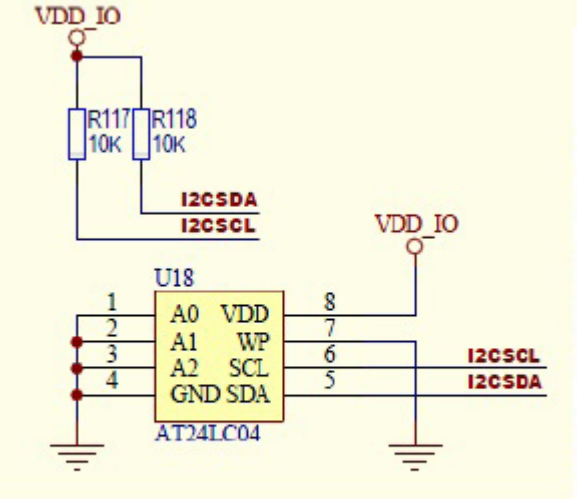
2.14 IR

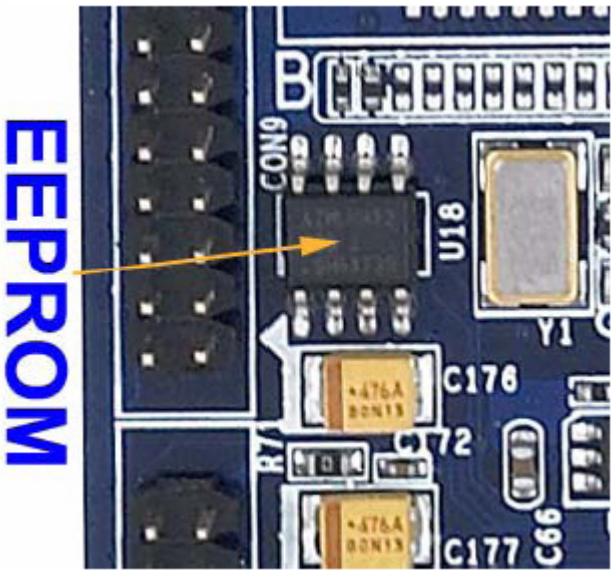
In the board, it have IR, the name is IRM3638, It link to the pin EINT12 as received pins.



2.15 I2C-EEPROM

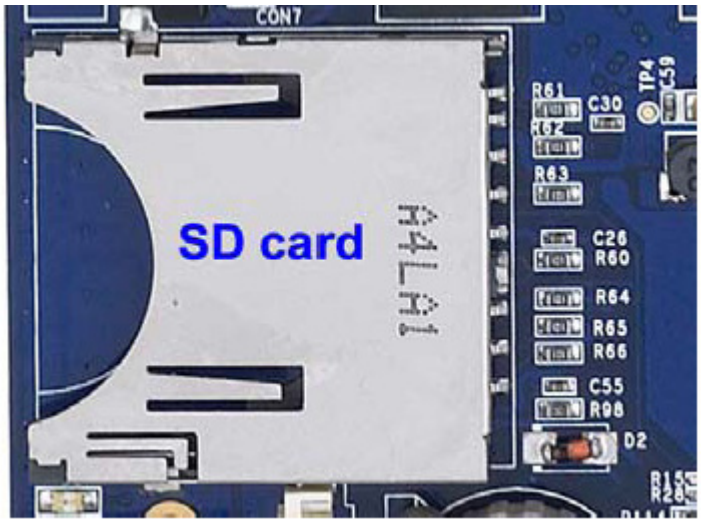
The I2C was linked to EEPROM, AT24C08, it was 256byte. only for test the I2C.





2.16 SD card slot

The SD card slot is as follow:



2.17 SDIO-II/SD-WiFi interface

The SDIO was linked to CON9, it also contain 1 SPI, 1 I2C, 4 GPIO.

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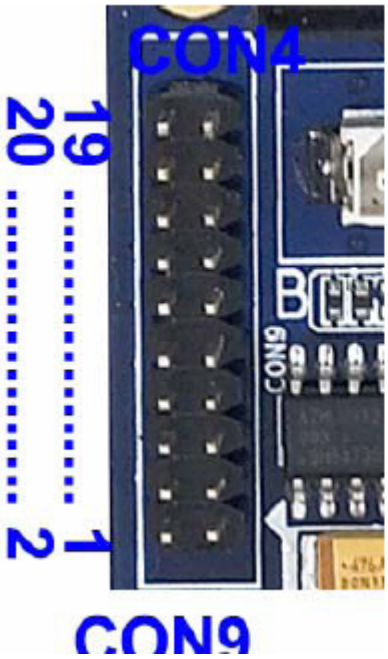
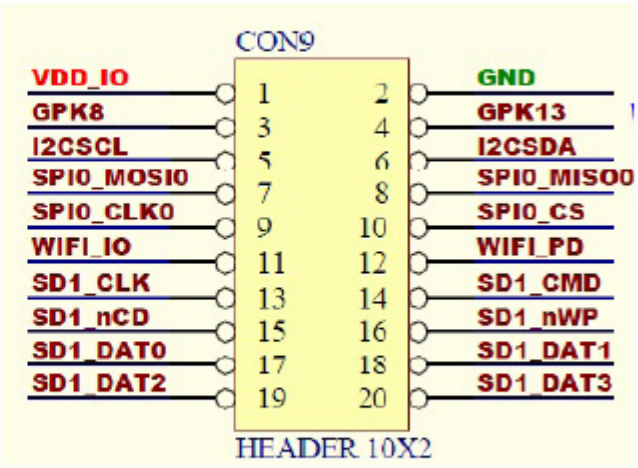
The SDIO was linked to CON9, it also contain 1 SPI, 1 I2C, 4 GPIO.



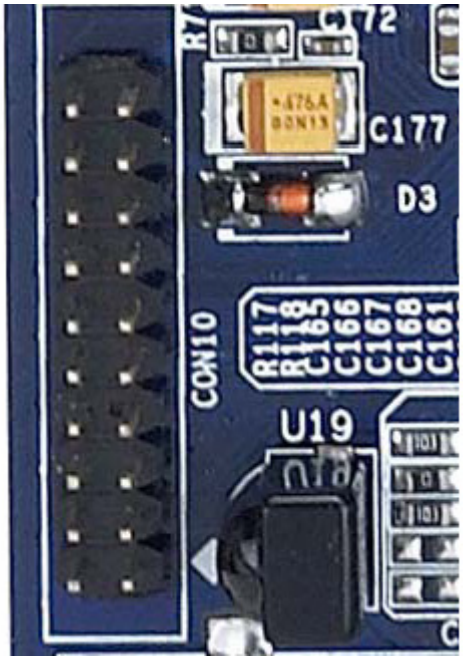


CON9	Signal	CON9	Signal
1	VDD/3.3V	2	GND
3	GPK8	4	GPK13
5	I2CSCL	6	I2CSDA
7	SPI0_MOSI0	8	SPI0_MISO0
9	SPI0_CLK0	10	SPI0_CS
11	GPP10/WiFi_IO	12	GPP11/WiFi_PD
13	SD1_CLK	14	SD1_CMD
15	SD1_nCD	16	SD1_nWP
17	SD1_DAT0	18	SD1_DAT1
19	SD1_DAT2	20	SD1_DAT3

2.18 CMOS Camera interface

The camera interface was linked with CON10, it can be insert the camera module.

CON10:CMOS

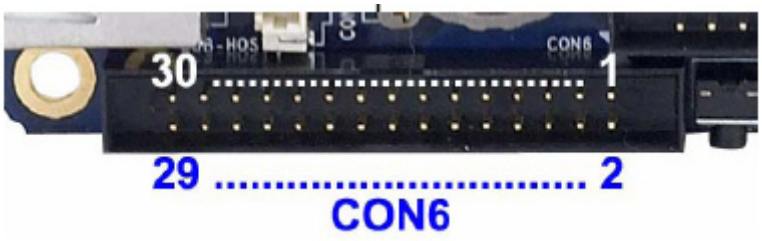


CON10	Signal	CON10	Signal
1	CAMSDA	2	CAMSCL
3	GPK2	4	CAMRSTn
5	CAMCLK	6	CAMHREF
7	CAMVSYNC	8	CAMPCLK
9	CAMDATA7	10	CAMDATA6
11	CAMDATA5	12	CAMDATA4
13	CAMDATA3	14	CAMDATA2
15	CAMDATA1	16	CAMDATA0
17	3.3V	18	2.45-2.8V
19	1.8V	20	GND

2.19 GPIO interface

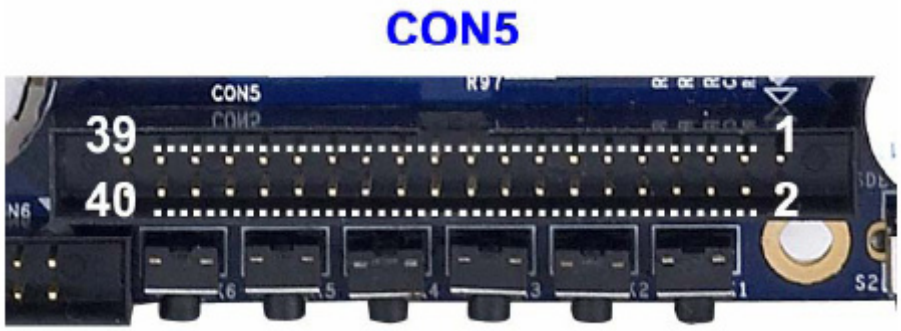
The board have a 30pin 2.0mm GPIO interface, it was connect to CON6

CON6	Signal	remarks	CON6	Signal	remarks
1	3.3V	Power out	2	GND	
3	GPE1		4	GPE2	
5	GPE3		6	GPE4	
7	GPM0		8	GPM1	
9	GPM2		10	GPM3	
11	GPM4		12	GPM5	
13	GPQ1		14	GPQ2	
15	GPQ3		16	GPQ4	
17	GPQ5		18	GPQ6	
19	SPI1_CLK		20	SPI1_MISO	
21	SPI1_CS		22	SPI1_MOSI	
23	EINT6		24	EINT9	
25	EINT11		26	EINT16	
27	AIN1	AD1(0-3.3V)	28	AIN2	AD2(0-3.3V)
29	AIN3	AD3(0-3.3V)	30	DACOUT1	



2.20 system bus

The CON5 is the system bus, it have 16bit data bus(D0-D15), 8 address bus(A0-A6, A24)



CON5	Signal	CON5	Signal
1	5V	2	GND
3	EINT17	4	EINT18
5	NC	6	NC
7	nCS4	8	nCS5
9	GND	10	GND
11	LnOE	12	LnWE
13	nWAIT	14	nRESET
15	GND	16	GND
17	ADDR0	18	ADDR1
19	ADDR2	20	ADDR3
21	ADDR4	22	ADDR5
23	ADDR6	24	ADDR19
25	DATA0	26	DATA1
27	DATA2	28	DATA3
29	DATA4	30	DATA5
31	DATA6	32	DATA7
33	DATA8	34	DATA9
35	DATA10	36	DATA11
37	DATA12	38	DATA13
39	DATA14	40	DATA15

Chapter 3 Boot mode set

You can choose the boot mode for S2 switch,

S2: in SDBOOT, the board will boot from SD card.

S2: in NAND, the board will boot from NAND.