

## **AQ7-IMX6**

Freescall<sup>™</sup> i.MX6 Dual Lite/Quad  
Processor

With LCD, Gigabit Ethernet  
PCI-Express[x1] x 1, CANBus x1  
I2C x 1, SDIO x 1  
Audio, SATA 3.0 Gb/s x 1

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## Packing List

Before you begin installing your card, please make sure that the following materials have been shipped:

- 1 AQ7-IMX6 CPU Module
- 1 CD-ROM for manual (in PDF format)
- 4 M2.5 Screws

If any of these items should be missing or damaged, please contact your distributor or sales representative immediately.

# Contents

## Chapter 1 General Information

1.1 Introduction.....	1-2
1.2 Features .....	1-3
1.3 Specifications .....	1-4

## Chapter 2 Quick Installation Guide

2.1 Safety Precautions .....	2-2
2.2 Location and Mechanical Drawing of Connectors and Jumpers.....	2-3
2.3 List of Jumpers .....	2-3
2.4 Boot Mode Selection (SW1).....	2-3
2.5 Boot Selection (SW2) .....	2-4
2.6 List of Connectors .....	2-4
2.7 SPI Program Connector (CN3) .....	2-4
2.8 MCU Program Connector (CN19).....	2-5
2.9 RTC Battery Connector (BAT1) .....	2-6

## Chapter 3 Technical Note

3.1 Illustration for ECB-970 Device locations.....	3-2
3.2 Boot Up Selection.....	3-3
3.3 Button .....	3-4
3.4 UART.....	3-5
3.5 Command for Android .....	3-6
3.6 Command for Linux.....	3-8

3.7 LVDS .....	3-10
3.8 USB2.0 .....	3-11
3.9 USB OTG .....	3-12
3.10 SPI Flash Verify.....	3-13
3.11 PCI-Express[x1] .....	3-14
3.12 Audio .....	3-15
3.13 SATA .....	3-16
3.14 CAN Bus Test.....	3-17
3.15 Watchdog Test .....	3-19

Chapter

1

**General  
Information**

## **1.1 Introduction**

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AQ7-IMX6 is a Qseven module with 70mm x 70mm, Qseven Rev.2.0 specification and equips with Freescale™ i.MX6 Dual lite/Quad processor. One DDR3 1066MHz supports system memory 1 GB. Moreover, AQ7-IMX6 accommodates user-friendly expansion interfaces of one PCI-Express[x1], one CANBus, one I2C and one SDIO.

For the display specifications, AQ7-IMX6 supports up to 24-bit dual-channel LVDS LCD. In addition, AQ7-IMX6 has LVDS x 2 (24-bit x 2) or LVDS x 2 (18-bit x 2) and HDMI 1.4. For the network connection, AQ7-IMX6 equips Micrel KSZ9021RNI for Gigabit Ethernet connection.

The AQ7-IMX6 deploys five USB2.0 (shared with USB OTG client x 1) and ample storages of one SATA 3.0Gb/s and one optional eMMC. The OS supports Android 4.0 and Linux Kernel 3.0.35 (Linux File system). This model is ideal for applications of Test & Measurement, Entertainment, Industrial Automation. AAeon also provides the corresponding Qseven Rev. 2.0 carrier board: ECB-970 for evaluating this ARM solution.



## 1.2 Features

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- Freescale™ i.MX6 Quad Processor (Automotive Grade or Extended Commercial Grade)/ Dual Lite (Extended Commercial Grade)
- Onboard DDR3 Memory 1GB
- Gigabit Ethernet x 1 (KSZ9021RNI)
- 24-bit Dual-channel LVDS LCD, HDMI
- I2S Audio Interface
- SATA x 1, eMMC (Optional)
- USB2.0 x 5 (One for USB OTG), PCI-Express [x1] x 1
- Qseven Module Size, 70mm x 70mm, Qseven Rev. 2.0

### 1.3 Specifications

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#### System

- Processor  
Freescale™ i.MX6 Dual Lite 800MHz  
Processor (Extended Commercial)  
Freescale™ i.MX6 Quad 1.0GHz  
Processor (Automotive)  
Freescale™ i.MX6 Quad 1.2GHz  
Processor (Extended Commercial)
- System Memory  
Onboard DDR3 1066MHz, 1GB  
(Quad/Dual-Lite)
- Chipset  
—
- Ethernet  
Micrel® KSZ9021RNI for  
10/1000/1000Base-TX
- BIOS  
—
- Wake On LAN  
—
- Watchdog Timer  
Integrated Watch Dog and Timer
- H/W Status Monitoring  
—
- Expansion Interface  
PCI Express [x1] x1  
CAN Bus x1  
I2C x1  
SDIO x 1
- Power Requirement  
+5V DC
- Power Consumption  
(Typical)  
Typ. Application ~3 – 5 Watt @ 5V

- Board Size 2.75" x 2.75" (70mm x 70mm)
- Gross Weight 0.44 lb (0.2 Kg)
- Operating Temperature 32 °F ~ 140 °F (0 °C ~ 60 °C) or  
-40°F ~ 185°F (-40°C ~ 85°C)  
(Automotive)
- Storage Temperature -40°F ~ 185°F (-40°C ~ 85°C)
- Operation Humidity 0% ~ 90% relative humidity,  
non-condensing

***Display: LVDS x 2 (24 bit x 1)/ LVDS x 1 (24 bit x 2), HDMI 1.4***

- LCD Interface Up to 24-bit Dual-Channel LVDS

***I/O***

- Storage SATA 3.0 Gb/s x 1, eMMC x 1 (optional)
- USB USB 2.0 x 5 (Shared with USB OTG  
client x 1)
- Serial Port Yes, for debug only
- I2C 1
- GPIO Supported
- Audio I2S
- OS Android 4.0 , Linux Kernel 3.0.35 (Linux  
File system)

Chapter

2

**Quick  
Installation  
Guide**

## 2.1 Safety Precautions

---

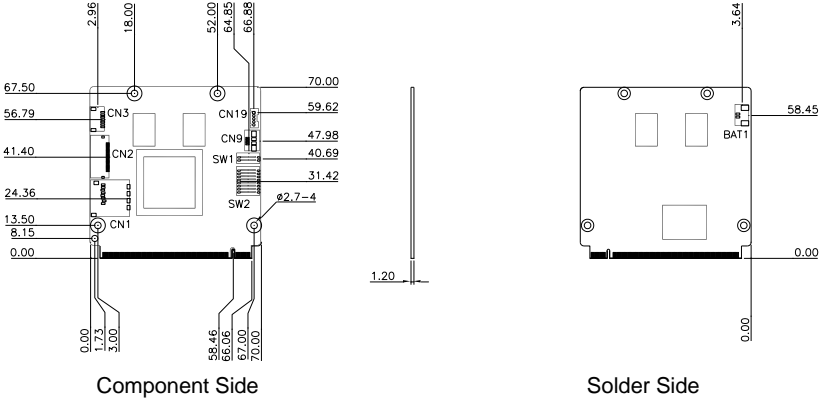
**Warning!**

*Always completely disconnect the power cord from your board whenever you are working on it. Do not make connections while the power is on, because a sudden rush of power can damage sensitive electronic components.*

**Caution!**

*Always ground yourself to remove any static charge before touching the board. Modern electronic devices are very sensitive to static electric charges. Use a grounding wrist strap at all times. Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not in the chassis*

## 2.2 Location and Mechanical Drawing of Connectors and Jumpers



## 2.3 List of Jumpers

The board has a number of jumpers/Connectors that allow you to configure your system to suit your application.

The table below shows the function of each of the board's jumpers:

Label	Function
SW1	Boot Mode Selection
SW2	Boot Selection

## 2.4 Boot Mode Selection (SW1)



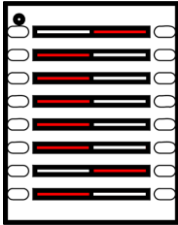
Program mode



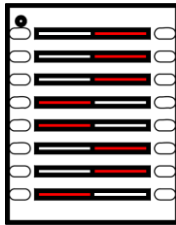
Internal Boot mode(Default)

## 2.5 Boot Selection (SW2)

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SD Boot



eMMC Boot

## 2.6 List of Connectors

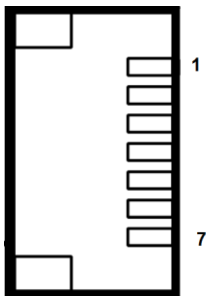
---

The board has a number of connectors that allow you to configure your system to suit your application. The table below shows the function of each board's connectors:

Label	Function
CN3	SPI Program Connector
CN19	MCU Program Connector
BAT1	RTC Battery Connector

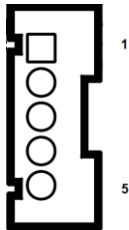
## 2.7 SPI Program Connector (CN3)

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Pin	Pin Name	Signal type	Signal Level
1	MISO	I/O	+3.3V
2	GND	PWR	GND
3	CLK	I/O	+3.3V
4	VCC	PWR	+3.3V
5	MOSI	I/O	+3.3V
6	CS1	I/O	+3.3V
7	N/C	N/C	N/C

## 2.8 MCU Program Connector (CN19)

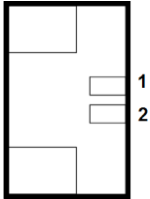


Pin	Pin Name	Signal Type	Signal Level
1	MCLR#	I/O	+3.3V
2	+3.3VSB	PWR	+3.3V
3	GND	PWR	GND
4	ICSPDAT	I/O	+3.3V
5	ICSPCLK	I/O	+3.3V



## 2.9 RTC Battery Connector (BAT1)

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Pin	Pin Name	Signal Type	Signal Level
1	GND	PWR	GND
2	+3V	PWR	+3V

## Below Table for China RoHS Requirements

产品中有毒有害物质或元素名称及含量

## AAEON Main Board/ Daughter Board/ Backplane

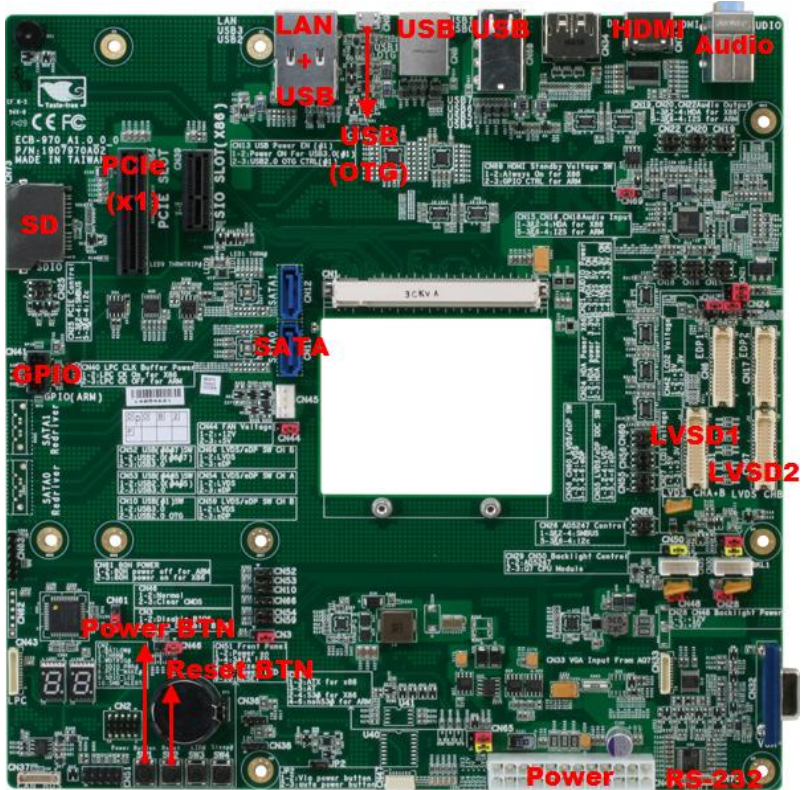
部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板 及其电子组件	×	○	○	○	○	○
外部信号 连接器及线材	×	○	○	○	○	○
<p><b>O:</b> 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T 11363-2006 标准规定的限量要求以下。</p> <p><b>X:</b> 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 标准规定的限量要求。</p> <p>备注：此产品所标示之环保使用期限，系指在一般正常使用状况下。</p>						

Chapter

3

# Technical Note

### 3.1 Illustration for ECB-970 Device locations



### 3.2 Boot Up Selection

AQ7-IMX6 boot-up could be adjusted jumper setting via SW2 Switch for two types, including eMMC/SD device to boot up.

Jumper Setting, SW2 Left-hand side: "OFF", Right-hand side: "ON"

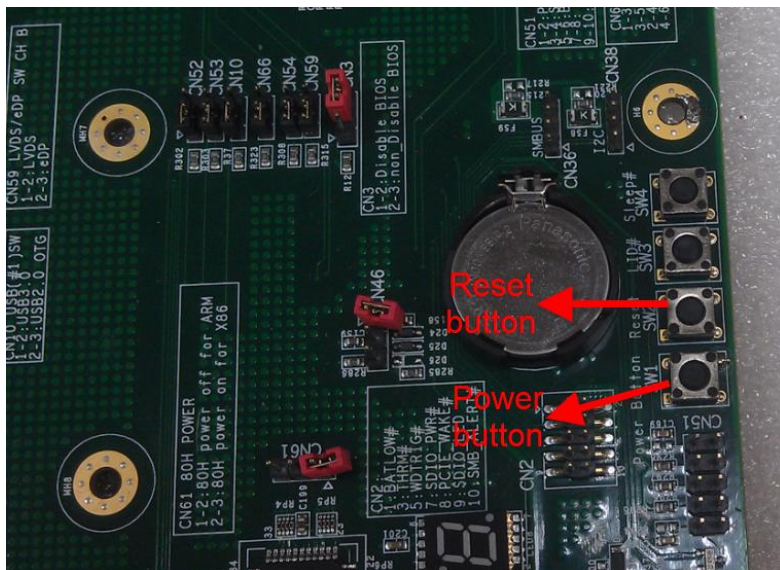
Boot Device	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8
SD	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
eMMC	ON	ON	ON	OFF	OFF	ON	ON	OFF



### 3.3 Button

Power Button : Power on/ Hibernate (S4)/ Wake up/ Power off

Reset Button: Reset



## 3.4 UART

PC terminal setting default is 115200bps. After boot-up, you could command to AQ7-IMX6 via Tera Term then show the current status of system.

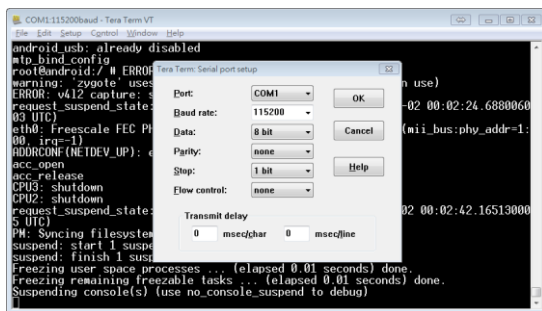
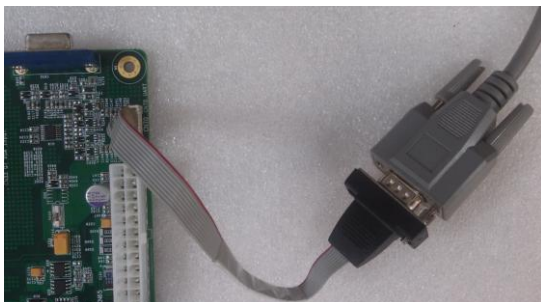
### Tera Term Terminal setting

Baud rate: 115200bps

Data: 8 bit

Parity: none

Stop: 1 bit



### Tera Term Utility

Download path:

<http://sourceforge.jp/projects/tssh2/downloads/59442/teraterm-4.79.exe/>

### 3.5 Command for Android

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Each kind of boot-up device and display should adjust both SW2 switch and entering different command in order to boot up smoothly.

**【1】 Android OS (eMMC boot up):**

**HDMI display:**

```
command 1: setenv bootargs console=ttymxc0,115200
androidboot.console=ttymxc0 vmalloc=400M init=/init
video=mxcfb0:dev=hdmi,1920x1080M@60 fbmem=28M
```

```
command 2: setenv bootcmd booti mmc3
```

```
command 3: saveenv
```

```
command 4: boot
```

**LVDS display:**

```
command 1(24-bit): setenv bootargs 'console=ttymxc0,115200
androidboot.console=ttymxc0 vmalloc=400M init=/init
video=mxcfb0:dev=ldb,LDB-XGA,if=RGB24
video=mxcfb1:dev=ldb,LDB-XGA,if=RGB24 ldb=dul1'
```

```
command 1(18-bit): setenv bootargs 'console=ttymxc0,115200
androidboot.console=ttymxc0 vmalloc=400M init=/init
video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666
video=mxcfb1:dev=ldb,LDB-XGA,if=RGB666 ldb=dul1'
```

```
command 2: setenv bootcmd booti mmc3
```

```
command 3: saveenv
```



command 4: boot

**【2】 Android OS (SD boot-up):**

**HDMI display:**

command 1: setenv bootargs console=ttymxc0,115200

androidboot.console=ttymxc0 vmalloc=400M init=/init

video=mxcfb0:dev=hdmi,1920x1080M@60 fbmem=28M

command 2: setenv bootcmd booti mmc1

command 3: saveenv

command 4: boot

**LVDS display:**

command 1(24-bit): setenv bootargs 'console=ttymxc0,115200

androidboot.console=ttymxc0 vmalloc=400M init=/init

video=mxcfb0:dev=ldb,LDB-XGA,if=RGB24

video=mxcfb1:dev=ldb,LDB-XGA,if=RGB24 ldb=dul1'

command 1(18-bit): setenv bootargs 'console=ttymxc0,115200

androidboot.console=ttymxc0 vmalloc=400M init=/init

video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666

video=mxcfb1:dev=ldb,LDB-XGA,if=RGB666 ldb=dul1'

command 2: setenv bootcmd booti mmc1

command 3: saveenv

command 4: boot

### 3.6 Command for Linux

---

#### 【1】 Linux OS (eMMC boot-up):

##### HDMI display:

command 1: `setenv bootargs_mmc 'setenv bootargs ${bootargs}`

`root=/dev/mmcblk0p1 rootwait rw`

`video=mxcfb1:dev=ldb,LDB-XGA,if=RGB666`

`video=mxcfb0:dev=hdmi,1920x1080M@60,if=RGB24'`

command 2: `saveenv`

command 3: `boot`

##### LVDS display:

command 1(18-bit): `setenv bootargs_mmc 'setenv bootargs ${bootargs}`

`root=/dev/mmcblk0p1 rootwait rw`

`video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666 ldb=sin0'`

command 1(24-bit): `setenv bootargs_mmc 'setenv bootargs ${bootargs}`

`root=/dev/mmcblk0p1 rootwait rw`

`video=mxcfb0:dev=ldb,LDB-XGA,if=RGB24 ldb=sin0'`

command 2: `saveenv`

command 3: `boot`

#### 【2】 Linux OS (SD boot-up):

##### HDMI display:

command 1: `setenv bootargs_mmc 'setenv bootargs ${bootargs}`

---

```
root=/dev/mmcblk1p1 rootwait rw
```

```
video=mxcfb1:dev=ldb,LDB-XGA,if=RGB666
```

```
video=mxcfb0:dev=hdmj,1920x1080M@60,if=RGB24'
```

```
command 2: setenv bootcmd_mmc 'run bootargs_base
```

```
bootargs_mmc;mmc dev 1;mmc read ${loadaddr} 0x800 0x2000;bootm'
```

```
command 6: saveenv
```

```
command 7: boot
```

### **LVDS display:**

```
command 1(18-bit): setenv bootargs_mmc 'setenv bootargs ${bootargs}
```

```
root=/dev/mmcblk1p1 rootwait rw
```

```
video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666 ldb=sin0'
```

```
command 1(24-bit): setenv bootargs_mmc 'setenv bootargs ${bootargs}
```

```
root=/dev/mmcblk1p1 rootwait rw
```

```
video=mxcfb0:dev=ldb,LDB-XGA,if=RGB24 ldb=sin0'
```

```
command 2: setenv bootcmd_mmc 'run bootargs_base
```

```
bootargs_mmc;mmc dev 1;mmc read ${loadaddr} 0x800 0x2000;bootm'
```

```
command 3: saveenv
```

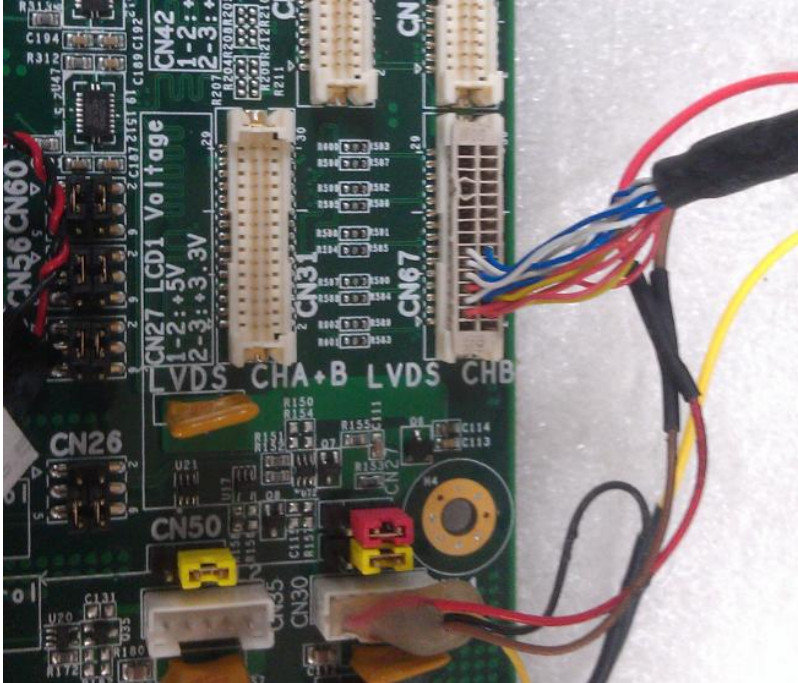
```
command 4: boot
```

### 3.7 LVDS

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Two LVDS channels are in the same LVDS connector on ECB-970.

Please use different LVDS cables to test different LVDS channels.



LVDS Connector: **CN31**

LVDS backlight connector: **CN30**

LVDS Operating voltage selection: **CN27**

**CN27(1-2) : +5V**

**CN27(2-3) : +3.3V**

LVDS Inverter voltage selection : **CN28**

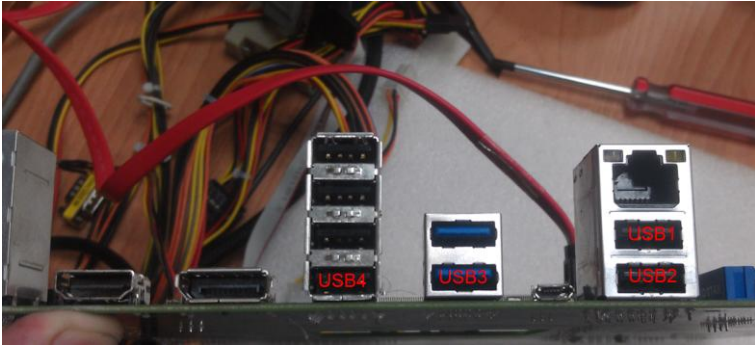
**CN28(1-2) : +12V**

**CN28(2-3) : +5V**

### 3.8 USB2.0

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Four USB 2.0 ports on ECB-970 as illustration. Please set up the CN13 Jumper into CN13(1-2) shunted.



### 3.9 USB OTG

Please prepare an **USB OTG cable** (ID pin short to GND) for testing. Set CN10 Jumper to (2-3) shunted then plug USB Pendrive to provide external power for device.

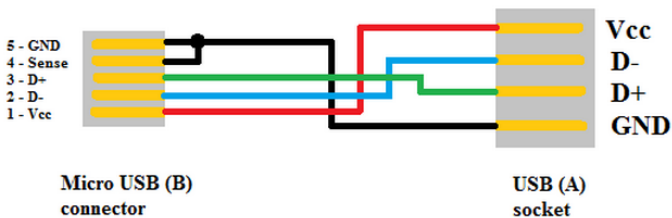
**Note:** **Never use normal** micro USB-to-USB cable. Otherwise, there is no function in USB OTG function.



USB 2.0 Switch

**CN10(2-3): USB OTG**

**CN13(1-2): USB OTG Control**



### 3.10 SPI Flash Verify

In U-boot mode, write a value into flash then read back from Flash and check whether the value are match.

```

COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help
MX6Q SABRES0 U-Boot > sf probe 0
JEDEC ID: 0xc2 0x20 0x16
4096 KB M25P32 - 4MB at 0:0 is now current device
MX6Q SABRES0 U-Boot > sf erase 0 0x10000
MX6Q SABRES0 U-Boot > mw.l 0x12000000 0x54612354 0x100000
MX6Q SABRES0 U-Boot > sf write 0x12000000 0x0 0x1000
..... SUCCESS
MX6Q SABRES0 U-Boot > sf read 0x13000000 0x0 0x1000
MX6Q SABRES0 U-Boot > md 0x13000000
13000000: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000010: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000020: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000030: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000040: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000050: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000060: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000070: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000080: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
13000090: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000a0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000b0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000c0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000d0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000e0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
130000f0: 54612354 54612354 54612354 54612354 T#at#at#at#at#at
MX6Q SABRES0 U-Boot >

```

#### SPI Flash Read/Write command:

command 1: sf probe 0

command 2: sf erase 0 0x10000

command 3: mw.l 0x12000000 0x54612354 0x100000

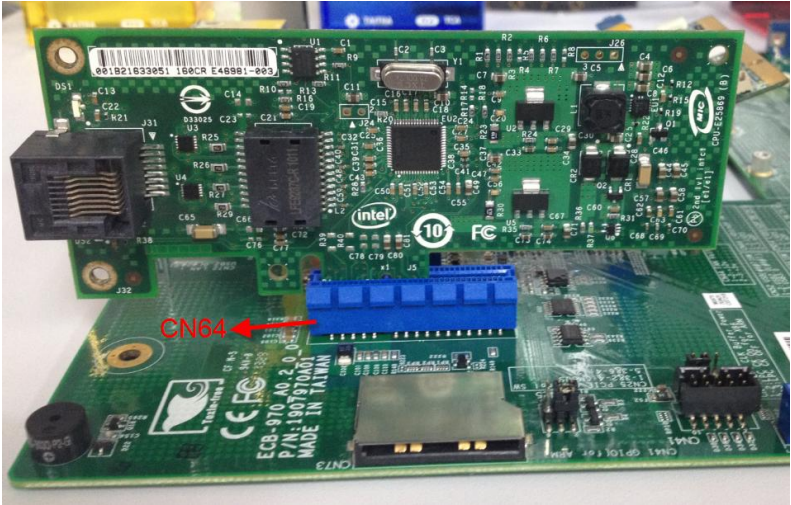
command 4: sf write 0x12000000 0x0 0x1000

command 5: sf read 0x13000000 0x0 0x1000

command 6: md 0x13000000

### 3.11 PCI-Express[x1]

Please insert Intel EXPI9301CTBLK PCI-Express[x1] Network Adapter in to CN64 to verify PCI-E[x1] function.





### 3.12 Audio

Please set the following jumper to verify I2S audio function.

**Audio Input selection:**

CN15(3-5, 4-6): I2S input

CN16(3-5, 4-6): I2S input

CN18(3-5): I2S input

**Audio Output selection:**

CN19(3-5, 4-6): I2S output

CN20(3-5, 4-6): I2S output

CN22(3-5, 4-6): I2S output

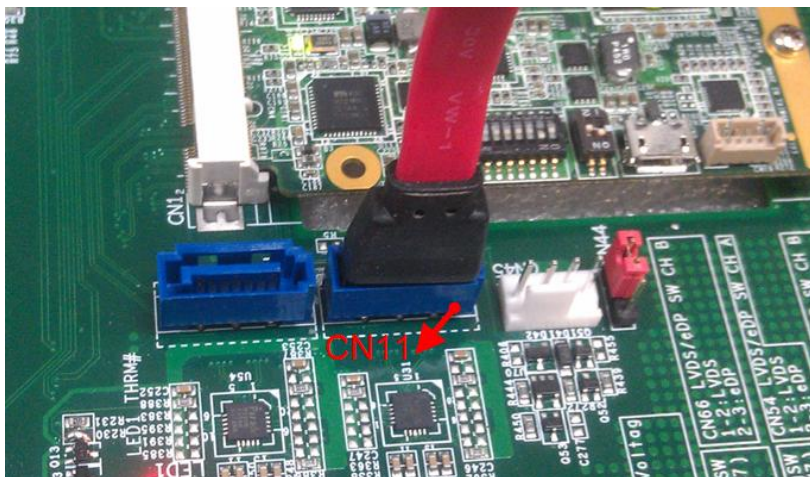
**Audio Power selection:**

CN21(3-5, 4-6): WM8962 power on

### 3.13 SATA

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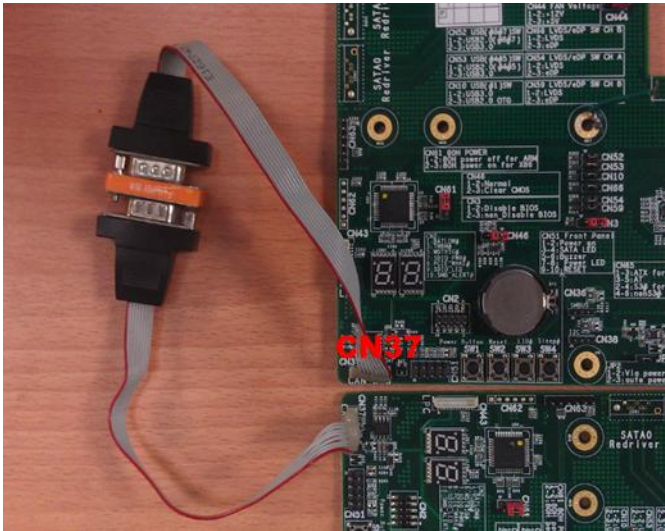
Please insert HDD SATA cable into CN11 to verify SATA function.



### 3.14 CAN Bus Test

---

Please verify CAN Bus in Linux OS environment



**【 Step1 】** Setup two AQ7-IMX6 with ECB-970; one for transmitter and one for receiver

**【 Step2 】** Please connect CN37 to each other, as the figure shows,  
(CANH to CANH; CANL to CANL; GND to GND)

**【 Step3 】** In Linux OS, enter command in receiver side:

command 1: `canconfig can0 bitrate 500000`

command 2: `ifconfig can0 up`

command 3: `canecho can0 -v`

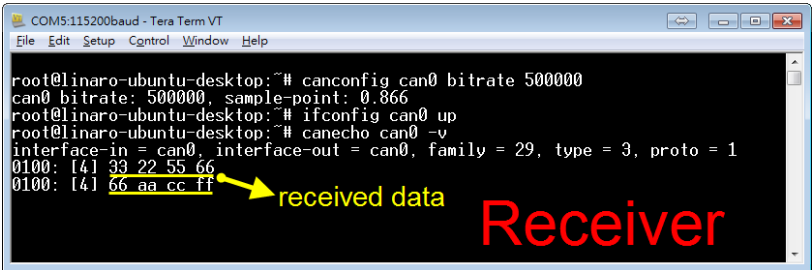
**【 Step4 】** In Linux OS, enter command in transmitter side:

command 1: `canconfig can0 bitrate 500000`

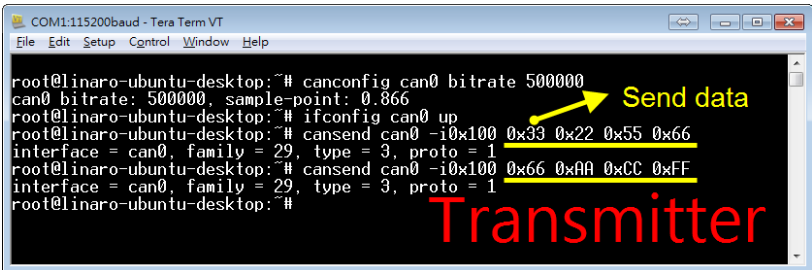
command 2: `ifconfig can0 up`

command 3: cansend can0 -i0x100 0x33 0x22 0x55 0x66

Receiver side:



Transmitter side:



### 3.15 Watchdog Test

In Linux OS serial console, enter command:

command 1: `cd /unit_tests/`

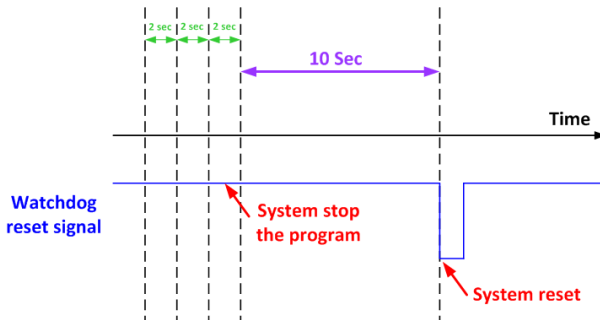
command 2: `./wdt_driver_test.out 10 2 0`

```

COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help
saned disabled; edit /etc/default/saned
1 Jan 00:06:10 ntpdate[5718]: no servers can be used, exiting
root@linaro-ubuntu-desktop:~#
root@linaro-ubuntu-desktop:~# cd /unit_tests/
root@linaro-ubuntu-desktop:/unit_tests# ./wdt_driver_test.out 10 2 0
Starting wdt_driver (timeout: 10, sleep: 2, test: ioctl)
Trying to set timeout value=10 seconds
The actual timeout was set to 10 seconds
Now reading back -- The timeout is 10 seconds

```

- Program will kick watchdog every 2 sec
- Will enable watchdog with 10 sec timeout
- When we stop the program with **Ctrl+C** board will reset after approximately 12 seconds



**Usage:** `wdt_driver_test <timeout> <sleep> <test>`

**timeout:** value in seconds to cause wdt timeout/reset

**sleep:** value in seconds to service the wdt

**test:** 0 - Service wdt with `ioctl()`, 1 - with `write()`