

# PICO-IMX8PL

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PICO-ITX Single Board Computer

User's Manual 1<sup>st</sup> Ed

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## Packing List

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Before setting up your product, please make sure the following items have been shipped:

Item	Quantity
● PICO- IMX8PL	1
● 2-pin 3.81mm Power Terminal block w/lock	1
● 18-pin 2.54mm Phoenix plug in Connector/lock	1

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

## About this Document

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This User's Manual contains all the essential information, such as detailed descriptions and explanations on the product's hardware and software features (if any), its specifications, dimensions, jumper/connector settings/definitions, and driver installation instructions (if any), to facilitate users in setting up their product.

Users may refer to the product page on [AAEON.com](http://AAEON.com) for the latest version of this document.

## Safety Precautions

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Please read the following safety instructions carefully. It is advised that you keep this manual for future references

1. All cautions and warnings on the device should be noted.
2. Make sure the power source matches the power rating of the device.
3. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
4. Always completely disconnect the power before working on the system's hardware.
5. No connections should be made when the system is powered as a sudden rush of power may damage sensitive electronic components.
6. If the device is not to be used for a long time, disconnect it from the power supply to avoid damage by transient over-voltage.
7. Always disconnect this device from any AC supply before cleaning.
8. While cleaning, use a damp cloth instead of liquid or spray detergents.
9. Make sure the device is installed near a power outlet and is easily accessible.
10. Keep this device away from humidity.
11. Place the device on a solid surface during installation to prevent falls
12. Do not cover the openings on the device to ensure optimal heat dissipation.
13. Watch out for high temperatures when the system is running.
14. Do not touch the heat sink or heat spreader when the system is running
15. Never pour any liquid into the openings. This could cause fire or electric shock.
16. As most electronic components are sensitive to static electrical charge, be sure to ground yourself to prevent static charge when installing the internal components. Use a grounding wrist strap and contain all electronic components in any static-shielded containers.

17. If any of the following situations arises, please the contact our service personnel:
  - i. Damaged power cord or plug
  - ii. Liquid intrusion to the device
  - iii. Exposure to moisture
  - iv. Device is not working as expected or in a manner as described in this manual
  - v. The device is dropped or damaged
  - vi. Any obvious signs of damage displayed on the device
  
18. **DO NOT LEAVE THIS DEVICE IN AN UNCONTROLLED ENVIRONMENT WHERE THE STORAGE TEMPERATURE IS BELOW -40°C (-40°C) OR ABOVE 80°C (176°F) TO PREVENT DAMAGE.**

### **Warning!**



This device complies with Part 15 FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation.

### **Caution:**

*There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions and your local government's recycling or disposal directives.*

### **Attention:**

*Il y a un risque d'explosion si la batterie est remplacée de façon incorrecte. Ne la remplacer qu'avec le même modèle ou équivalent recommandé par le constructeur. Recycler les batteries usées en accord avec les instructions du fabricant et les directives gouvernementales de recyclage.*



## China RoHS Requirements (CN)

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	X	X	○	○	○	○
外部信号 连接器及线材	X	X	○	○	○	○

O: 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。

X: 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。

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。

## China RoHS Requirement (EN)

Poisonous or Hazardous Substances or Elements in Products

AAEON Main Board/ Daughter Board/ Backplane

Component	Poisonous or Hazardous Substances or Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCB & Other Components	X	X	O	O	O	O
Wires & Connectors for External Connections	X	X	O	O	O	O
<p>O: The quantity of poisonous or hazardous substances or elements found in each of the component's parts is below the SJ/T 11363-2006-stipulated requirement.</p> <p>X: The quantity of poisonous or hazardous substances or elements found in at least one of the component's parts is beyond the SJ/T 11363-2006-stipulated requirement.</p> <p>Note: The Environment Friendly Use Period as labeled on this product is applicable under normal usage only</p>						

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# Chapter 1

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Product Specifications

## 1.1 Specifications

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### System

Form Factor	PICO-ITX, 2.5" SBC
Processor	NXP i.MX8M Plus Quad-Core Arm® Cortex®-A53, up to 1.6 GHz (Default: w/ NPU, Optional: w/o NPU)
Memory Type	Onboard LPDDR4, up to 4GB
Power Requirement	9V ~36V (Optional: 12V)
Dimension	3.94" x 2.84" (100mm x 72mm)
Operating Temperature	-40°C ~ 80°C (-40°F ~ 176°F) Optional: 0°C ~ 60°C (32°F ~ 140°F)
Storage Temperature	-40°C ~ 80°C (-40°F ~ 176°F)
Operating Humidity	0% ~ 90% relative humidity, non-condensing
Certification	CE/FCC Class A

### Display

Video Output	HDMI 2.0 x 1 18/24-bit Dual-Channel LVDS x 1
Backlight Inverter Supply	12V/1A

### LED

LED	Programmable LED Control x 3
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## OS

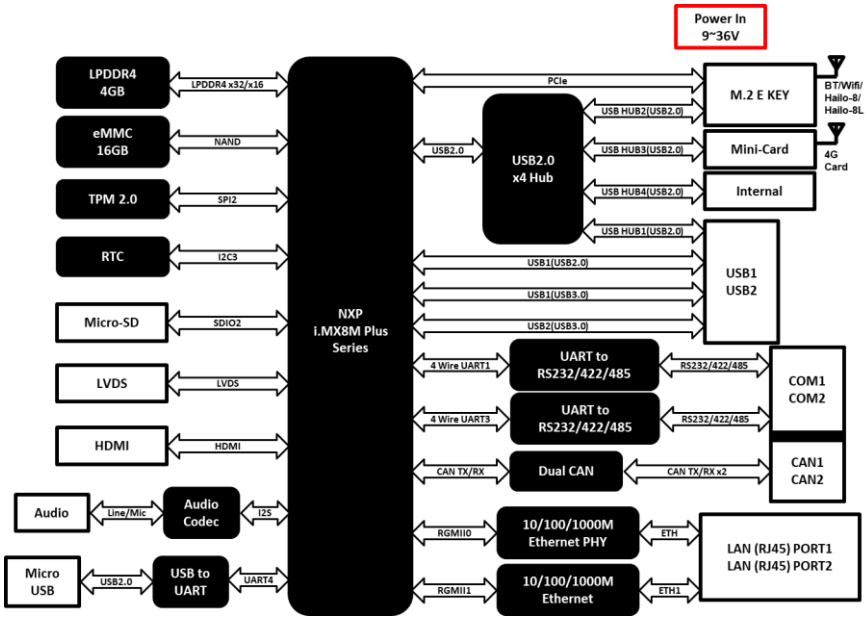
<b>Operating System</b>	Debian 11 (default) Yocto Windows® 10 IoT Android™ 13
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## I/O

<b>Ethernet</b>	RJ-45 Gigabit Ethernet x 2 (supports IEEE 1588, TSN, integrated RGMII)
<b>Audio</b>	Line in/Line Out/Mic x 1 (Optional)
<b>USB Port</b>	USB 3.0 Gen 1 x 2 (Rear I/O) USB 2.0 x 1 (Pin Header)
<b>Debug Port</b>	Micro USB x 1 (Optional)
<b>Serial Port</b>	RS-232/422/485 switchable x 2, Phoenix Connector
<b>Storage</b>	eMMC 5.1 16GB/32GB (Optional: 64GB/128GB) Micro SD Card x 1
<b>Expansion Slot</b>	M.2 2230 E-Key x 1 (Wi-Fi/BT module) Full-size Mini Card x 1 (4G module)
<b>TPM</b>	TPM 2.0 (Optional)
<b>GPIO</b>	8-bit (Optional)
<b>CANBus</b>	CAN 2.0 FD x 2 (Optional)



## 1.2 Function Block Diagram

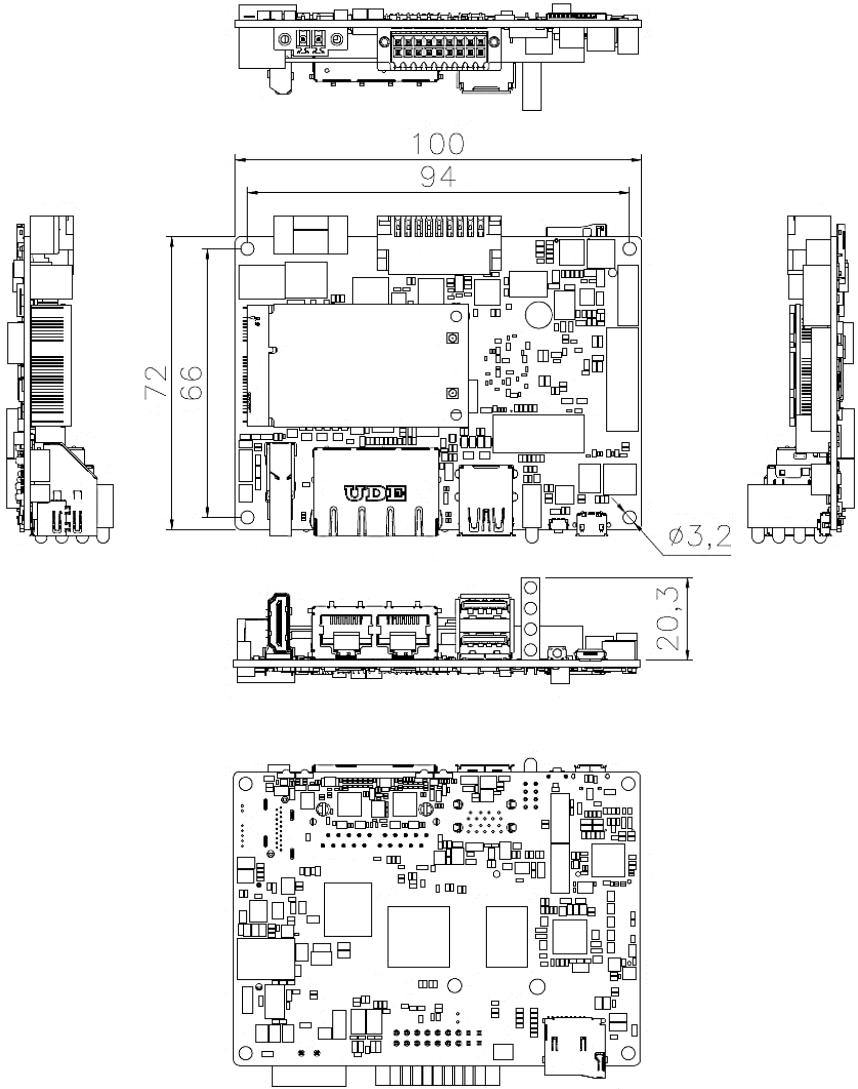


# Chapter 2

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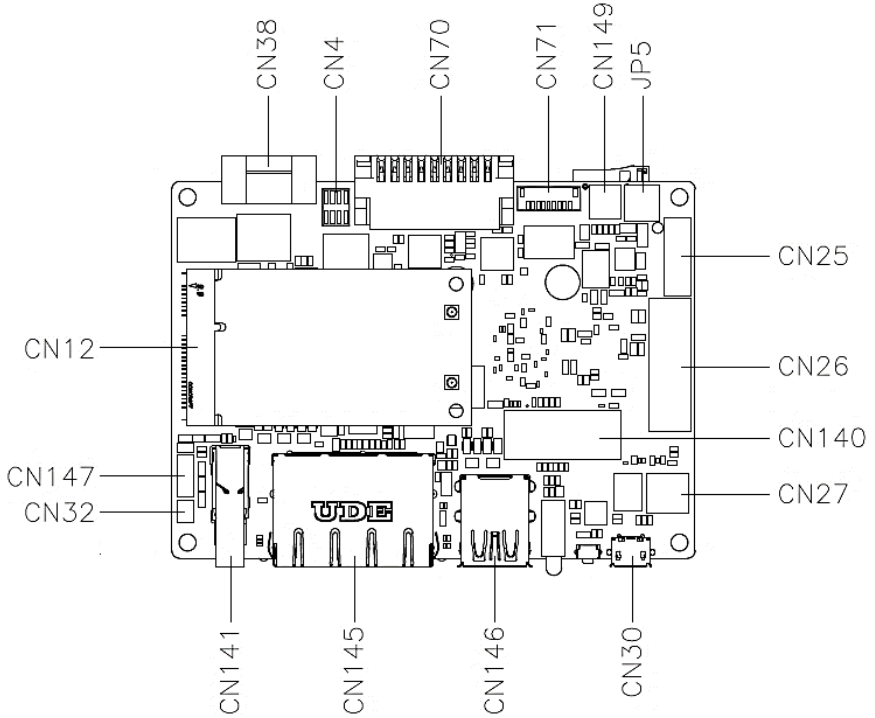
Hardware Information

## 2.1 Dimensions

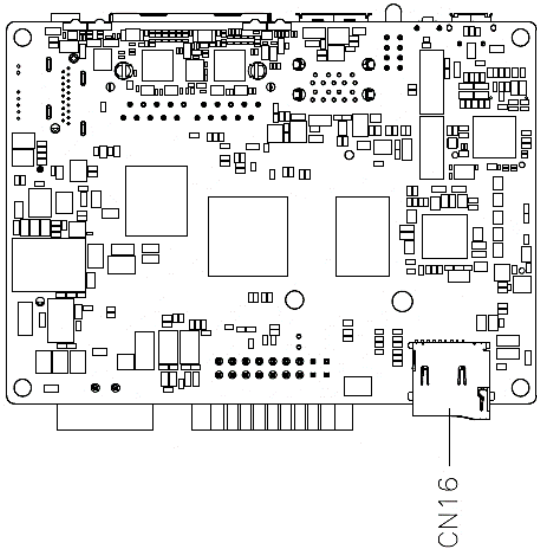


## 2.2 Jumpers and Connectors

### Component Side



Solder Side



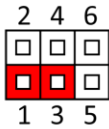
## 2.3 List of Jumpers

Jumpers allow users to manually customize system configurations to their suitable application needs.

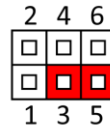
Please refer to the table below for all of the board's jumpers that you can configure for your application

Label	Function
JP5 (Pins 1, 3, 5)	LVDS VDD Power Selection
JP5 (Pins 2, 4, 6)	LVDS Backlight Power Selection

### 2.3.1 LVDS VDD Power Selection (JP5 Pins 1, 3, 5)

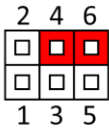


LVDS VDD = 5V

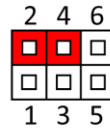


LVDS VDD = 3.3V (Default)

### 2.3.2 LVDS Backlight Power Selection (JP5 Pins 2, 4, 6)



LVDS Backlight = 5V



LVDS Backlight = 12V (Default)

**Note:** To prevent damage to the system or unwanted operation, do not use any other configuration for JP5 than what is shown in Ch2.3.1 and Ch2.3.2

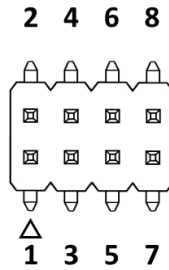
## 2.4 List of Connectors

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Please refer to the table below for all of the board's connectors that you can configure for your application

Label	Function
CN4	SPI/I2C/GPIO Connector
CN12	Full-size Mini Card Slot
CN16	Micro SD Slot
CN25	LVDS Port Inverter/Backlight Connector
CN26	LVDS Connector
CN27	Audio Connector
CN30	Debug Port
CN32	RTC Battery Connector
CN38	DC Power
CN70	COM Port 1/Port 2 (RS-232/422/485)
CN71	UART Port 1/Port 3 Connector
CN140	M.2 2230 E-Key Slot
CN141	HDMI Port
CN145	RJ-45 LAN Port 1/Port 2
CN146	USB 3.2 Port 1/Port 2
CN147	Internal USB 2.0 Connector
CN149	UART Port 2/Port 4 Connector
SW3	Boot Selection

## 2.4.1 SPI/I2C/GPIO Connector (CN4)

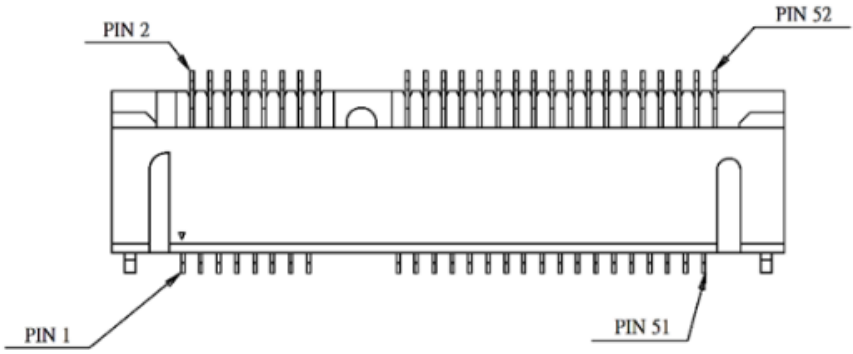


Pin	Pin Name	Signal Type	Signal Level
1	ECSPI_SS0	OUT	+3.3V
2	I2C_SCL	OUT	+3.3V
3	ECSPI_MOSI	OUT	+3.3V
4	I2C_SDA	I/O	+3.3V
5	ECSPI_MISO	IN	+3.3V
6	GPIO_3	I/O	+3.3V
7	ECSPI_SCLK	OUT	+3.3V
8	GPIO_4	I/O	+3.3V

**Note:** Pitch = 1.27mm.



## 2.4.2 Full-size Mini Card Slot (CN12)



Pin	Pin Name	Signal Type	Signal Level
1	NC		
2	+3.3VSB	PWR	+3.3V
3	NC		
4	GND	GND	
5	NC		
6	NC		
7	NC		
8	NC		
9	GND	GND	
10	NC		
11	NC		
12	NC		
13	NC		
14	NC		
15	GND	GND	
16	NC		
17	NC		
18	GND	GND	
19	NC		

Pin	Pin Name	Signal Type	Signal Level
20	W_DISABLE# (Note 1)	OUT	+3.3V
21	GND	GND	
22	PERST#	OUT	+3.3V
23	NC		
24	+3.3VSB	PWR	+3.3V
25	NC		
26	GND	GND	
27	GND	GND	
28	NC		
29	GND	GND	
30	SMB_CLK (Note 1)	I/O	+3.3V
31	NC		
32	SMB_DATA (Note 1)	I/O	+3.3V
33	NC		
34	GND	GND	
35	GND	GND	
36	USB_D-	DIFF	
37	GND	GND	
38	USB_D+	DIFF	
39	+3.3VSB	PWR	+3.3V
40	GND	GND	
41	+3.3VSB	PWR	+3.3V
42	NC		
43	NC		
44	NC		
45	NC		
46	NC		
47	NC		
48	NC		
49	NC		
50	GND	GND	
51	NC		
52	+3.3VSB	PWR	+3.3V

**Note 1:** The function is disabled by unmounted 0ohm jumper.

W\_DISABLE#: R333, SMB\_CLK: R328, SMB\_DATA: R326

**Note 2:** The driving current supports up to 2A.

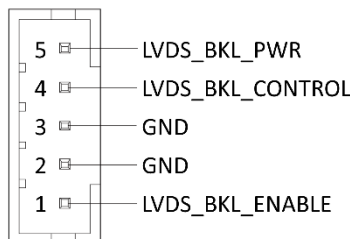
**Note 3:** For 4G full-size mini card.

### 2.4.3 Micro SD Slot (CN16)



Pin	Pin Name	Signal Type	Signal Level
1	SD_DAT2	I/O	+3.3V
2	SD_DAT3	I/O	+3.3V
3	SD_CMD	OUT	+3.3V
4	SD_VDD	PWR	+3.3V
5	SD_CLK	OUT	+3.3V
6	SD_VSS	GND	
7	SD_DAT0	I/O	+3.3V
8	SD_DAT1	I/O	+3.3V

### 2.4.4 LVDS Port Inverter/Backlight Connector (CN25)



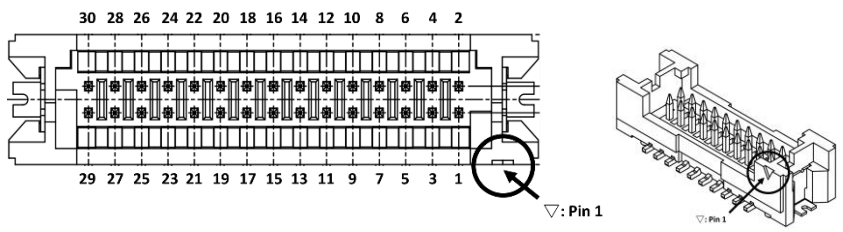
Pin	Pin Name	Signal Type	Signal Level
1	LVDS_BKL_ENABLE	OUT	+3.3V
2	GND	GND	

Pin	Pin Name	Signal Type	Signal Level
3	GND	GND	
4	LVDS_BKL_CONTROL	OUT	
5	LVDS_BLK_PWR	PWR	+5V / +12V

**Note 1:** LVDS/ LVDS\_BLK\_PWR can be set to +5V or +12V by JP5.

**Note 2:** The driving current supports up to 2A.

### 2.4.5 LVDS Port (CN26)



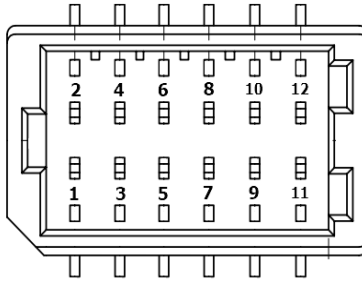
Pin	Pin Name	Signal Type	Signal Level
1	LVDS_BLK_ENABLE	OUT	
2	LVDS_BKL_CONTROL	OUT	
3	LVDS_VDD	PWR	+3.3V / +5V
4	GND	GND	
5	LVDS_A_CLK-	DIFF	
6	LVDS_A_CLK+	DIFF	
7	LVDS_VDD	PWR	+3.3V / +5V
8	GND	GND	
9	LVDS_DA0-	DIFF	
10	LVDS_DA0+	DIFF	
11	LVDS_DA1-	DIFF	
12	LVDS_DA1+	DIFF	
13	LVDS_DA2-	DIFF	
14	LVDS_DA2+	DIFF	
15	LVDS_DA3-	DIFF	
16	LVDS_DA3+	DIFF	

Pin	Pin Name	Signal Type	Signal Level
17	DDC_DATA	I/O	+3.3V
18	DDC_CLK	I/O	+3.3V
19	LVDS_DB0-	DIFF	
20	LVDS_DB0+	DIFF	
21	LVDS_DB1-	DIFF	
22	LVDS_DB1+	DIFF	
23	LVDS_DB2-	DIFF	
24	LVDS_DB2+	DIFF	
25	LVDS_DB3-	DIFF	
26	LVDS_DB3+	DIFF	
27	LVDS_VDD	PWR	+3.3V / +5V
28	GND	GND	
29	LVDS_B_CLK-	DIFF	
30	LVDS_B_CLK+	DIFF	

**Note 1:** LVDS/ LVDS\_VDD can be set to +3.3V or +5V by JP5.

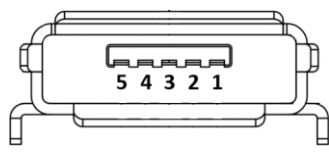
**Note 2:** The driving current supports up to 2A.

## 2.4.6 Audio Port (CN27)



Pin	Pin Name	Signal Type	Signal Level
1	LINE_R_OUT	OUT	+3.3V
2	MIC_R	IN	+3.3V
3	LINE_L_OUT	OUT	+3.3V
4	MIC_L	IN	+3.3V
5	NC		
6	NC		
7	GND_AUDIO	GND	
8	GND_AUDIO	GND	
9	NC		
10	LINE_R_IN	IN	+3.3V
11	+VDD_AUDIO	PWR	+3.3V
12	LINE_L_IN	IN	+3.3V

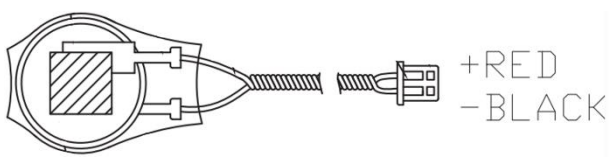
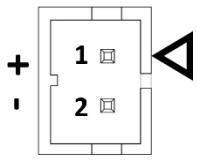
### 2.4.7 Debug Port (CN30)



Pin	Pin Name	Signal Type	Signal Level
1	+5VSB	PWR	5V
2	USB0_DN	DIFF	
3	USB0_DP	DIFF	
4	USB0_ID	IN	3.3V
5	GND	GND	

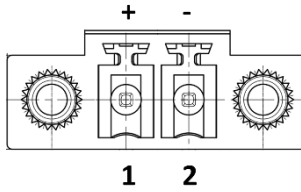
**Note 1:** USB to UART (XR21V1410) debug port.

### 2.4.8 RTC Battery Connector (CN32)



Pin	Pin Name	Signal Type	Signal Level
1	+3.3V	PWR	+3.3V
2	GND	GND	

## 2.4.9 DC Power (CN38)

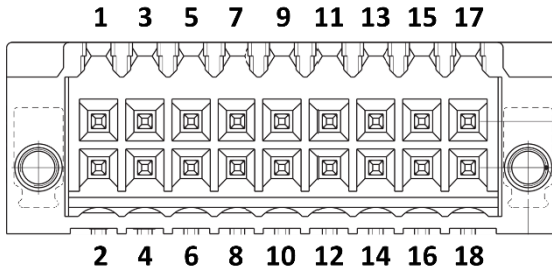


Pin	Pin Name	Signal Type	Signal Level
1	DC_IN	PWR	+9~36V / +12V
2	GND	GND	

**Note 1:** Wide range input voltage from +9V to +36V or +12V for specified version.

**Note 2:** Please check the input voltage description on product label before inserting power.

## 2.4.10 COM Port 1/Port 2 (RS-232/422/485)



Pin	Pin Name	Signal Type	Signal Level
1	DCD1	IN	±9V / ±5V
2	RX1	IN	±9V / ±5V
3	TX1	OUT	±9V / ±5V
4	DTR1	OUT	±9V / ±5V
5	GND	GND	
6	CAN1_H	DIFF	



Pin	Pin Name	Signal Type	Signal Level
7	CAN1_L	DIFF	
8	RTS1	OUT	±9V / ±5V
9	CTS1	IN	±9V / ±5V
10	DCD2	IN	±9V / ±5V
11	RX2	IN	±9V / ±5V
12	TX2	OUT	±9V / ±5V
13	DTR2	OUT	±9V / ±5V
14	GND	GND	
15	CAN2_H	DIFF	
16	CAN2_L	DIFF	
17	RTS2	OUT	±9V / ±5V
18	CTS2	IN	±9V / ±5V

## COM Port 1 RS-422

Pin	Pin Name	Signal Type	Signal Level
7	GND	GND	
3	RS422_TX-	OUT	±9V / ±5V
2	RS422_TX+	OUT	±9V / ±5V
1	RS422_RX+	IN	±9V / ±5V
4	RS422_RX-	IN	±9V / ±5V

## COM Port 1 RS-485

Pin	Pin Name	Signal Type	Signal Level
7	GND	GND	
3	RS485_D-	I/O	±9V / ±5V
2	RS485_D+	I/O	±9V / ±5V

## COM Port 2 RS-422

Pin	Pin Name	Signal Type	Signal Level
16	GND	GND	
12	RS422_TX-	OUT	±9V / ±5V
11	RS422_TX+	OUT	±9V / ±5V
10	RS422_RX+	IN	±9V / ±5V

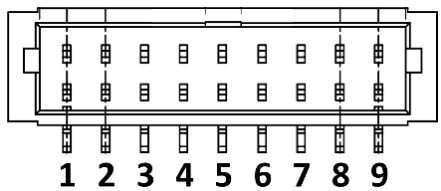
COM Port 2 RS-422			
Pin	Pin Name	Signal Type	Signal Level
13	RS422_RX-	IN	±9V / ±5V

COM Port 2 RS-485			
Pin	Pin Name	Signal Type	Signal Level
16	GND	GND	
12	RS485_D-	I/O	±9V / ±5V
11	RS485_D+	I/O	±9V / ±5V

**Note 1:** COM1/2 RS-232/422/485 can be set by setting and the default is RS-232.

**Note 2:** Set signal level ±9V / ±5V by PSP5/PSP6 short.

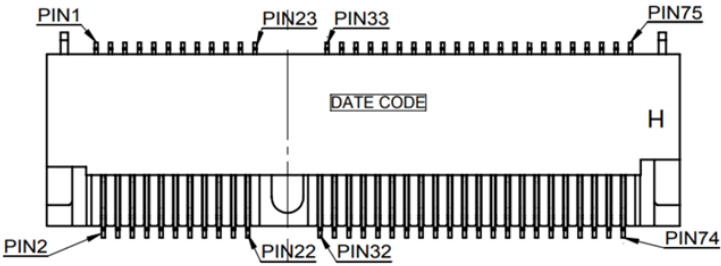
### 2.4.11 UART Port 1/Port 3 Connector (CN71)



Pin	Pin Name	Signal Type	Signal Level
1	UART1_TXD	OUT	+3.3V
2	UART1_RTS	OUT	+3.3V
3	UART1_RXD	IN	+3.3V
4	UART1_CTS	IN	+3.3V
5	GND	GND	
6	UART3_TXD	OUT	+3.3V
7	UART3_RTS	OUT	+3.3V
8	UART3_RXD	IN	+3.3V
9	UART3_CTS	IN	+3.3V

**Note:** UART port and COM port cannot be used simultaneously.

## 2.4.12 M.2 2230 E-Key Slot (CN140)



Pin	Pin Name	Signal Type	Signal Level
1	GND		
2	+3.3VSB	PWR	+3.3V
3	USB_D+	DIFF	
4	+3.3VSB	PWR	+3.3V
5	USB_D-	DIFF	
6	NC		
7	GND	GND	
8	NC		
9	NC		
10	NC		
11	NC		
12	NC		
13	NC		
14	NC		
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	NC		

Pin	Pin Name	Signal Type	Signal Level
23	NC		
32	NC		
33	GND	GND	
34	NC		
35	PCIE_TX+	DIFF	
36	NC		
37	PCIE_TX-	DIFF	
38	NC		
39	GND	GND	+3.3V
40	NC		
41	PCIE_RX+	DIFF	+3.3V
42	NC		
43	PCIE_RX-	DIFF	
44	NC		
45	GND	GND	
46	NC		
47	PCIE_CLK+	DIFF	
48	NC		
49	PCIE_CLK-	DIFF	
50	NC		
51	GND		
52	PERST#	OUT	+3.3V
53	PCIE_CLK_REQ#	IN	
54	W_DISABLE2# (Note 1)	OUT	+3.3V
55	PCIE_WAKE#	IN	
56	W_DISABLE1# (Note 1)	OUT	+3.3V
57	GND	GND	
58	SMB_SDA (Note 1)	I/O	+3.3V
59	NC		
60	SMB_SCL (Note 1)	OUT	+3.3V
61	NC		
62	NC		
63	GND	GND	

Pin	Pin Name	Signal Type	Signal Level
64	TP		
65	NC		
66	NC		
67	NC		
68	NC		
69	GND	GND	
70	NC		
71	NC		
72	+V3P3A	PWR	+3.3V
73	NC		
74	+V3P3A	PWR	+3.3V
75	GND	GND	

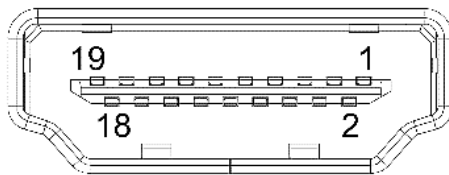
**Note 1:** The function is disabled by unmounted 0ohm jumper.

W\_DISABLE2#: R95, W\_DISABLE1#: R94, SMB\_SDA: R96, SMB\_SCL: R97

**Note 2:** The driving current supports up to 2A.

**Note 3:** For Wi-Fi/BT/Hailo-8/Hailo-8L card.

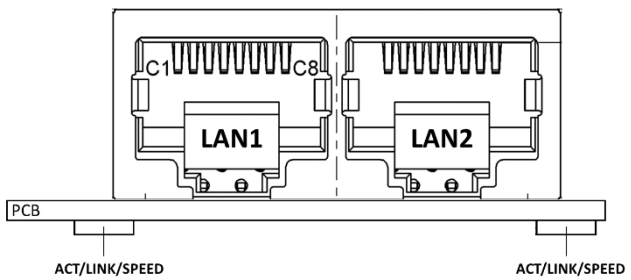
### 2.4.13 HDMI Port (CN141)



Pin	Pin Name	Signal Type	Signal Level
1	HDMI_TX2+	DIFF	
2	GND	GND	
3	HDMI_TX2-	DIFF	
4	HDMI_TX1+	DIFF	
5	GND	GND	

Pin	Pin Name	Signal Type	Signal Level
6	HDMI_TX1-	DIFF	
7	HDMI_TX0+	DIFF	
8	GND	GND	
9	HDMI_TX0-	DIFF	
10	HDMI_CLK+	DIFF	
11	GND	GND	
12	HDMI_CLK-	DIFF	
13	HDMI_CEC	OUT	+3.3V
14	HDMI_Utility	OUT	+1.8V
15	DDC_CLK	I/O	+5V
16	DDC_DATA	I/O	+5V
17	GND	GND	
18	+V5S	PWR	+5V
19	HDMI_HPD	OUT	+1.8V

### 2.4.14 RJ-45 LAN Port 1/Port 2 (CN145)

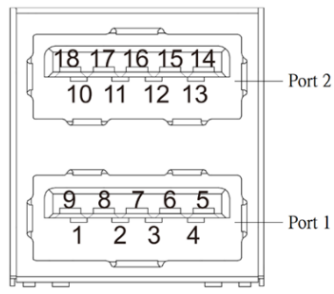


Pin	Pin Name	Signal Type	Signal Level
L_1	LAN1_MDI0_P	DIFF	
L_2	LAN1_MDI0_N	DIFF	
L_3	LAN1_MDI1_P	DIFF	
L_4	LAN1_MDI1_N	DIFF	
L_5	GND	GND	
L_6	GND	GND	

Pin	Pin Name	Signal Type	Signal Level
L_7	LAN1_MDI2_P	DIFF	
L_8	LAN1_MDI2_N	DIFF	
L_9	LAN1_MDI3_P	DIFF	
L_10	LAN1_MDI3_N	DIFF	
R_1	LAN2_MDI0_P	DIFF	
R_2	LAN2_MDI0_N	DIFF	
R_3	LAN2_MDI1_P	DIFF	
R_4	LAN2_MDI1_N	DIFF	
R_5	GND	GND	
R_6	GND	GND	
R_7	LAN2_MDI2_P	DIFF	
R_8	LAN2_MDI2_N	DIFF	
R_9	LAN2_MDI3_P	DIFF	
R_10	LAN2_MDI3_N	DIFF	

**Note 1:** External ACTIVE/LINK/SPEED LEDs.

### 2.4.15 USB 3.2 Port 1/Port 2 (CN146)

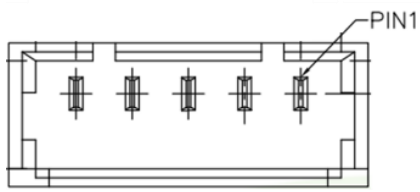


Pin	Pin Name	Signal Type	Signal Level
1	+5VSB	PWR	+5V
2	USB1_DN	DIFF	
3	USB1_DP	DIFF	
4	GND	GND	

Pin	Pin Name	Signal Type	Signal Level
5	USB1_RXN	DIFF	
6	USB1_RXP	DIFF	
7	GND	GND	
8	USB1_TXN	DIFF	
9	USB1_TXP	DIFF	
10	+5VSB	PWR	+5V
11	USB2_DN	DIFF	
12	USB2_DP	DIFF	
13	GND	GND	
14	USB2_RXN	DIFF	
15	USB2_RXP	DIFF	
16	GND	GND	
17	USB2_TXN	DIFF	
18	USB2_TXP	DIFF	

**Note:** The driving current supports up to 2A.

### 2.4.16 Internal USB 2.0 Connector (CN147)

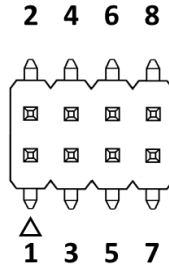


Pin	Pin Name	Signal Type	Signal Level
1	+5VSB	PWR	+5V
2	USB3_DN	DIFF	
3	USB3_DP	DIFF	
4	GND	GND	
5	GND	GND	

**Note 1:** The driving current supports up to 2A.



## 2.4.17 UART Port 2/Port 4 Connector (CN149)

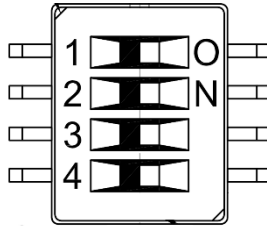


Pin	Pin Name	Signal Type	Signal Level
1	UART2_TXD	OUT	+3.3V
2	UART4_TXD	OUT	+3.3V
3	UART2_RXD	IN	+3.3V
4	UART4_RXD	IN	+3.3V
5	UART2_RTS	OUT	+3.3V
6	GND	GND	
7	UART2_CTS	IN	+3.3V
8	NC		

**Note 1:** Pitch = 1.27mm.

**Note 2:** UART port and COM port cannot be used simultaneously.

## 2.4.18 Boot Selection (SW3)



Pin	Pin Name	Signal Type	Signal Level
1	BOOT_MODE3	IN	+1.8V
2	BOOT_MODE2	IN	+1.8V
3	BOOT_MODE1	IN	+1.8V
4	BOOT_MODE0	IN	+1.8V

Boot Mode Table

BOOT_MODE 3	BOOT_MODE 2	BOOT_MODE 1	BOOT_MODE 0	Boot Modes
0	0	0	0	Boot from internal fuses
0	0	0	1	USB serial download
0	0	1	0	USDHC3 (eMMC boot only, SD3 8-bit)
0	0	1	1	USDHC2 (SD boot only, SD2)

**Note 1:** Number side is 1 (HIGH) and ON side is 0 (LOW).

# Chapter 3

---

Product Setup and Configuration

## 3.1 System Account Management

---

### 3.1.1 Debug Console

---

When connecting a PC or laptop to the PICO-IMX8PL, using PuTTY with Windows 10 is recommended. Users can download the software from the PuTTY website:

**Step 1:** Download the PuTTY tools: <https://www.putty.org/>.

**Step 2:** Switch jumper (SW3) to 0010. (Factory default settings).



Switch Pin:



**PIN 1, 2, 4:** Switch is OFF.

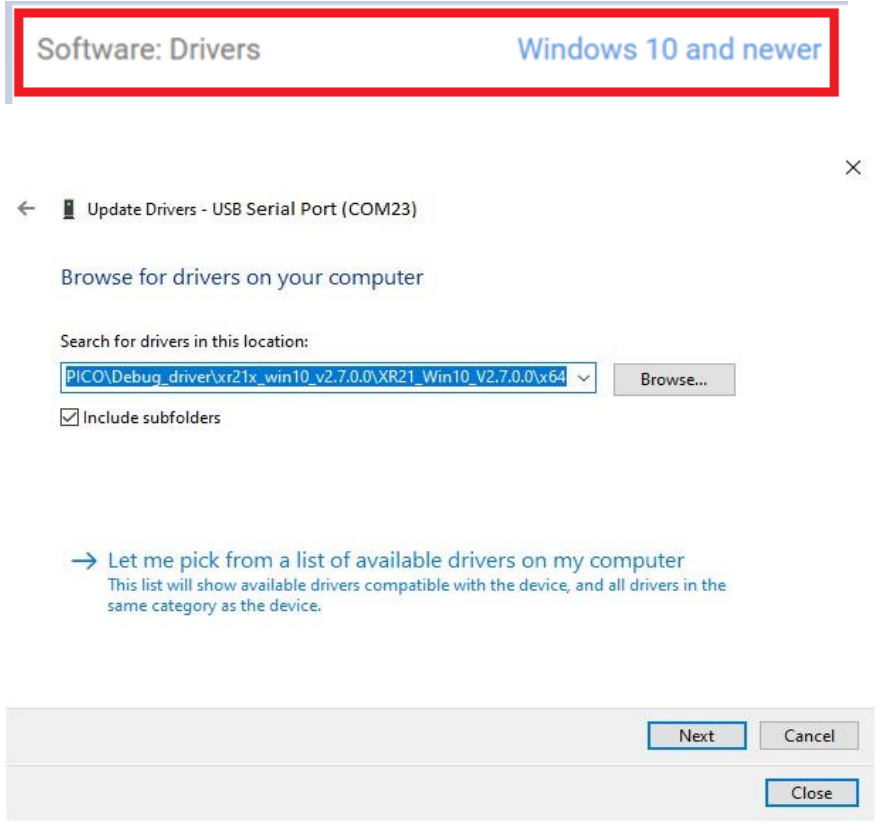
**PIN 3:** Switch is ON.

**Step 3:** Connect the gateway via a USB cable. Connect your computer to the PICO-IMX8PL using the Micro USB port.

**Step 4:** Open Device Manager and locate Multifunction Composite Gadget. Double click on the device. A pop-up should appear, with a notice that the CDC Serial is unrecognized.

Download debug port driver: (usb->uart) :

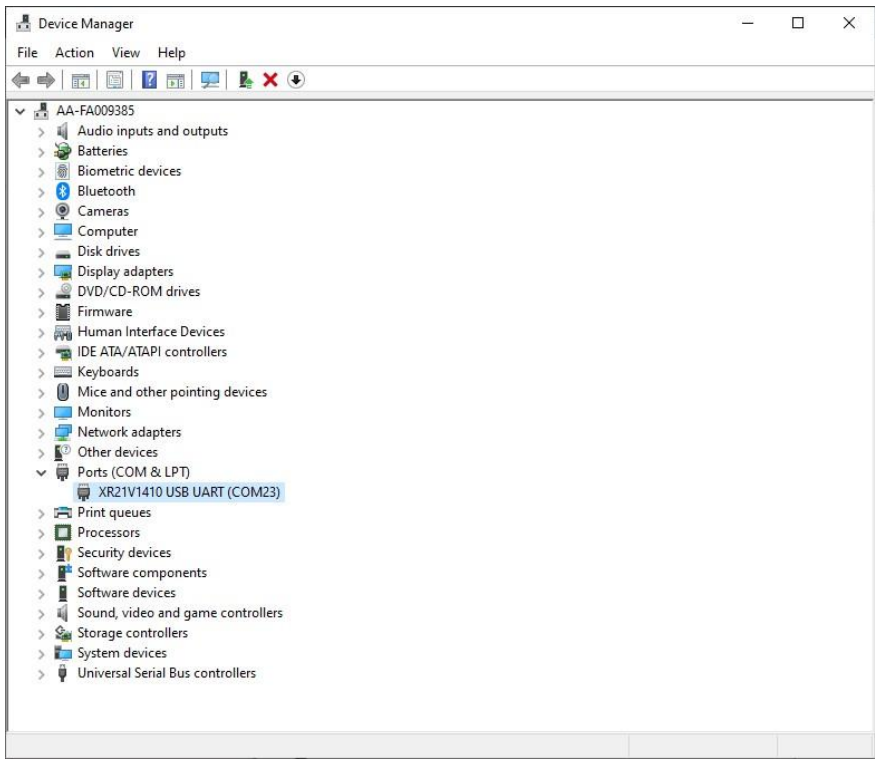
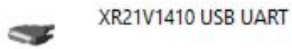
<https://www.maxlinear.com/product/interface/uarts/usb-uarts/xr21v1410>



← Update Drivers - XR21V1410 USB UART (COM23)

Windows has successfully updated your drivers

Windows has finished installing the drivers for this device:



**Step 5:** Setting the putty configuration.

Open the putty and use the settings to log into the system.

The screenshot shows the PuTTY Configuration dialog box. On the left, a tree view lists various categories: Session, Logging, Terminal (Keyboard, Bell, Features), Window (Appearance, Behaviour, Translation), Selection, Colours, Connection (Data, Proxy), SSH, and Serial. The 'Serial' category is highlighted with a red rectangle. On the right, the 'Options controlling local serial lines' section is active, showing the following settings:

- Serial line to connect to: COM23
- Speed (baud): 115200
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: XON/XOFF

Buttons for 'About', 'Open', and 'Cancel' are visible at the bottom.

## 3.1.2 Log In

---

Log into the system using the below credentials.

Login Settings	
<b>Username</b>	root
<b>Password</b>	Pw#12345





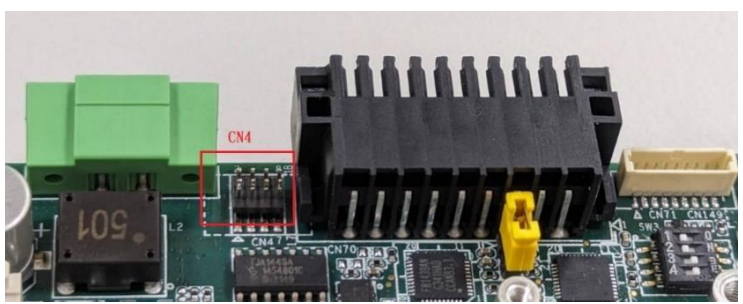
Step 3: candump CAN1

```
candump can1&
```

```
cansend can1 111#8877665544332211
```

```
can0 111 [8] 88 77 66 55 44 33 22 11
```

### 3.2.2 DIO



SPI/I2C/GPIO Connector (CN4) pin define: Please refer to table 2.4.1

CN4\_pin\_6: GPIO1\_IO01

CN4\_pin\_8: EXT\_GPIO\_4 (GPIO4\_IO23)

Command:

```
gpiowrite 0 1=0
```

```
gpiowrite 0 1=1
```



```
gpiowrite 3 23=0
```

```
gpiowrite 3 23=1
```

### 3.2.3 Ethernet

This section will show you how to check and setup the network settings.

*NETWORKPROFILE ->It should be:*

Profile	Support Hardware
eth1	LAN 1 
eth0	LAN 2 
Modem	4G LTE Module

**Step 1:** Connect the cable, and check the Ethernet device

```
$ sudo ifconfig
```

```

eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.209 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::bba8:9997:2486:4a25 prefixlen 64 scopeid 0x20<link>
    ether 00:07:32:a5:a5:88 txqueuelen 1000 (Ethernet)
    RX packets 29 bytes 4058 (3.9 KiB)
    RX errors 0 dropped 8 overruns 0 frame 0
    TX packets 23 bytes 3017 (2.9 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 00:07:32:a5:a5:89 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 222

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 10 bytes 1612 (1.5 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 10 bytes 1612 (1.5 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    
```

Step 2: Ping test:

Ping 8.8.8.8

```

PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=55 time=3.71 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=55 time=2.88 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=55 time=3.55 ms

```

### 3.2.4 PCIe (M.2 E-Key)

---

Host pin define:

```
SAI1_TXD6 -> Mini1_Reset_EN -> GPIO4_IO18
```

```
SAI1_TXD7 -> Mini2_Reset_EN -> GPIO4_IO19
```

Reset CN12 mini card (USB interface) and CN140 M.2 E-Key (PCIe interface)

```
Set GPIO4_IO18 high.
```

```
Set GPIO4_IO19 high.
```

Command:

```
gpioset 3 18=1 // Reset CN12 mini card
```

```
gpioset 3 19=1 // Reset CN140 M.2 key E
```

You can run command to check when you insert an external card into the M.2 slot (CN140).

Command:

It can use the PCIe protocol to get some information.

```
root@pico-imx8mp:~# lspci
00:00.0 PCI bridge: Synopsys, Inc. DWC usb3 / PCIe bridge (rev 01)
01:00.0 Network controller: Realtek Semiconductor Co., Ltd. RTL8822CE 802.11ac PCIe Wireless Network Adapter
```

### 3.2.5 RTC

---

Step 1: Read rtc0 name.

```
cat /sys/class/rtc/rtc0/name
```

```
rtc-pcf85063 2-0051
```

PCF85063 is our default RTC.

Step 2: Read rtc1 name.

```
cat /sys/class/rtc/rtc1/name
```

```
snvs_rtc 30370000.snvs:snvs-rtc-lp
```

SNVS\_RTC is the built-in RTC of the CPU

### 3.2.6 SD Card

---

Step 1: Select the switch: 0x10 (emmc boot)..

Step 2: lsblk.

```
NAME                                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
mmcblk2                             179:0    0 29.1G 0 disk
├──mmcblk2p1                         179:1    0  128M 0 part
└──mmcblk2p2                         179:2    0   29G 0 part /
mmcblk2boot0                        179:32   0    4M 1 disk
mmcblk2boot1                        179:64   0    4M 1 disk
mmcblk1                              179:96   0   7.5G 0 disk
├──mmcblk1p1                         179:97   0  208M 0 part
└──mmcblk1p2                         179:98   0   7.1G 0 part
```

mmcblk1: SD card

mmcblk2: emmc

Run command to mount SD card:

```
sudo mkdir -p /sd_boot
```

```
sudo mkdir -p /sd_rootfs
```

```
sudo mount /dev/mmcblk1p1 /sd_boot // Link sd_boot folder → sd card
```

partition 1

`sudo mount /dev/mmcbk1p2 /sd_rootfs // Link sd_rootfs folder → sd card`

partition 2

`lsblk`

```
NAME                MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
mmcbk2              179:0   0 29.1G  0 disk
├─mmcbk2p1          179:1   0  128M  0 part
└─mmcbk2p2          179:2   0   29G   0 part /
mmcbk2boot0        179:32  0    4M   1 disk
mmcbk2boot1        179:64  0    4M   1 disk
mmcbk1              179:96  0   7.5G  0 disk
├─mmcbk1p1          179:97  0  208M  0 part /sd boot
└─mmcbk1p2          179:98  0   7.1G  0 part /sd rootfs
```

### 3.2.7 Serial

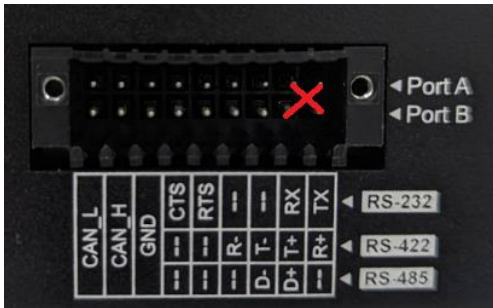
COM PortA			
/dev/ttyxc0	RS232	RS422	RS485
GPIO1_IO07	0	0	0
GPIO1_IO08	0	0	1
GPIO1_IO012	1	0	1

COM PortB			
/dev/ttyxc2	RS232	RS422	RS485
GPIO1_IO14	0	0	0
GPIO3_IO22	0	0	1
GPIO3_IO021	1	0	1

UART2	/dev/ttyxc1
-------	-------------

### 3.2.7.1 RS-232

Please refer to the red lines in the picture. Please connect the pin as follows.



Command:

```
gpio set 0 7=0
```

```
gpio set 0 8=0
```

```
gpio set 0 12=1
```

```
gpio set 0 14=0
```

```
gpio set 2 22=0
```

```
gpio set 2 21=1
```

```
stty -F /dev/ttymx0 -echo -onlcr 115200
```

```
stty -F /dev/ttymx2 -echo -onlcr 115200
```

```
cat /dev/ttymx0 &
```

```
cat /dev/ttymx2 &
```

```
echo hello > /dev/ttymx2
```

```
// You can see the hello string
```



```
root@pico-imx8mp:~# echo hello > /dev/ttymx2  
root@pico-imx8mp:~# hello
```

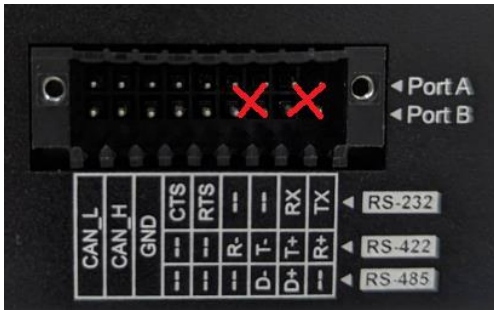
```
echo hello > /dev/ttymx0
```

// You can see the hello string

```
root@pico-imx8mp:~# echo hello > /dev/ttymx0  
root@pico-imx8mp:~# hello
```

### 3.2.7.2 RS-422

Please refer to the red lines in the picture. Please connect the pin as follows.



Command:

```
gpioset 0 7=0
```

```
gpioset 0 8=0
```

```
gpioset 0 12=0
```

```
gpioset 0 14=0
```

```
gpioset 2 22=0
```

```
gpioset 2 21=0
```

```
stty -F /dev/ttymx0 -echo -onlcr 115200
```

```
stty -F /dev/ttymx2 -echo -onlcr 115200
```

```
cat /dev/ttymx0 &
```

```
cat /dev/ttymx2 &
```

```
echo hello > /dev/ttymx2
```

```
// You can see the hello string
```

```
root@pico-imx8mp:~# echo hello > /dev/ttymx2  
root@pico-imx8mp:~# hello
```

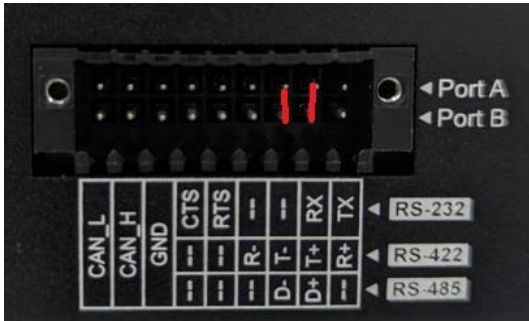
```
echo hello > /dev/ttymx0
```

```
// You can see the hello string
```

```
root@pico-imx8mp:~# echo hello > /dev/ttymx0  
root@pico-imx8mp:~# hello
```

### 3.2.7.3 RS-485

Please refer to the red lines in the picture. Please connect the pin as follows.



	RS485
RTS pin	Low : receiver High : sender
CTS pin	X

RS485 (Mode : 011)	It does'nt include termination resistor.
--------------------	--

Command:

Install python3 package: `apt -get install python3`

Set GPIO to RS485 mode:

```
gpioset 0 7=0
```

```
gpioset 0 8=1
```

```
gpioset 0 12=1
```

```
gpioset 0 14=0
```

```
gpioset 2 22=1
```

```
gpioset 2 21=1
```

Run RS485\_test.py (com port A send data to com port B).

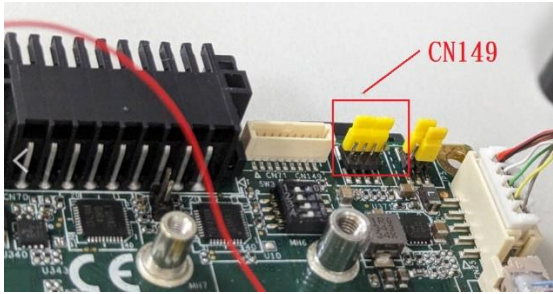
python3 RS485\_test.py:

```
import serial
comA = serial.Serial("/dev/ttymx0", 115200, timeout=1)
comB = serial.Serial("/dev/ttymx2", 115200, timeout=1)
comA.setRTS(0) #sender
comB.setRTS(1) #receiver
data_len = comA.write(b'test string')
data = comB.read(data_len)
print(data)
comA.close()
comB.close()
```

Result:

```
b'test string'
```

### 3.2.7.4 UART2



UART Port 2/Port 4 pin define: Please refer to the table in section 2.4.17.

Pin 1 and pin 3 are connected.

Pin 5 and pin 7 are connected.

Command:

```
stty -F /dev/ttymxcl crtscts  
stty -F /dev/ttymxcl -echo -onlcr 115200  
cat /dev/ttymxcl &
```

```
echo hello > /dev/ttymxcl
```

```
root@pico-imx8mp:/test# echo hello > /dev/ttymxcl  
root@pico-imx8mp:/test# hello
```

### 3.2.8 TPM

---

Command: `tpm2_selftest`

// Do TPM self test:

```
tpm2_getcap properties-fixed
```

// Get TPM chip information:

Result:

```
TPM2_PT_FAMILY_INDICATOR
```

```
raw: 0x322E3000
```

```
value: "2.0" TPM2_PT_LEVEL:
```

```
raw: 0 TPM2_PT_REVISION:
```

```
raw: 0x8A
```

```
value: 1.38 TPM2_PT_DAY_OF_YEAR:
```

```
raw: 0x12F TPM2_PT_YEAR:
```

```
raw: 0x7E3 TPM2_PT_MANUFACTURER:
```

```
raw: 0x4E544300
```

```
value: "NTC" TPM2_PT_VENDOR_STRING_1:
```

```
raw: 0x4E504354
```

```
value: "NPCT" TPM2_PT_VENDOR_STRING_2:
```

```
raw: 0x37357800
```

```
value: "75x" TPM2_PT_VENDOR_STRING_3:
```

```
raw: 0x22212134
```

```
value: ""!4"
```

## 3.2.9 USB

Step 1: Run command: lsblk.

```
NAME                MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
mmcblk2             179:0    0 29.1G  0 disk
├─mmcblk2p1         179:1    0  128M  0 part
└─mmcblk2p2         179:2    0   29G  0 part /
mmcblk2boot0        179:32   0    4M   1 disk
mmcblk2boot1        179:64   0    4M   1 disk
mmcblk1             179:96   0   7.5G  0 disk
├─mmcblk1p1         179:97   0  208M  0 part /sd_boot
└─mmcblk1p2         179:98   0   7.1G  0 part /sd_rootfs
```

Step 2: Plug the USB storage into the PICO-IMX8PL board.

Step 3: Run command: lsblk.

```
NAME                MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda                  8:0      1 232.9G  0 disk
├─sda1                8:1      1 232.9G  0 part /media/KING
mmcblk2             179:0    0 29.1G  0 disk
├─mmcblk2p1         179:1    0  128M  0 part
└─mmcblk2p2         179:2    0   29G  0 part /
mmcblk2boot0        179:32   0    4M   1 disk
mmcblk2boot1        179:64   0    4M   1 disk
mmcblk1             179:96   0   7.5G  0 disk
├─mmcblk1p1         179:97   0  208M  0 part /sd_boot
└─mmcblk1p2         179:98   0   7.1G  0 part /sd_rootfs
```

USB device name : /dev/sda1

USB mount point: /media/xxxxxx

Ex: /media/KING is my USB storage.

You can run command as follows if you don't see the mountpoint (/media/KING) .

Ex:

```
sudo mkdir -p /media/KING
```

```
sudo mount /dev/sda1 /media/KING
```

You can run umount command if you want to remove the USB storage.

Ex:

```
sudo umount /media/KING/
```



### 3.2.10 Watchdog Timer

---

(1) CPU built-in watchdog:

Run command as follows:

```
sw_wdt <timeout (second)> <sleep (scond)> < 0 (ioctrl) >
```

Ex: `sudo /usr/sbin/sw_wdt 180 60 0`

Every 60 seconds, the watchdog count will restart counting, otherwise watchdog will reset the CPU after 180 seconds.

sw\_wdt source code:

wdt\_driver\_test.c:

```
#include "test_utils.h"
void help_info(void);
int main(int argc, char * const argv[])
{
    int fd, timeout, sleep_sec, test;
    print_name(argv);
    if (argc < 2) {
        help_info();
        return 1;
    }
    timeout = atoi(argv[1]);
    sleep_sec = atoi(argv[2]);
    if (sleep_sec <= 0) {
        sleep_sec = 1;
        printf("correct 0 or negative sleep time to %d seconds\n",
            sleep_sec);
    }
}
```

```
test = atoi(argv[3]);
printf("Starting wdt_driver (timeout: %d, sleep: %d, test: %s)\n",
timeout, sleep_sec, (test == 0) ? "ioctl" : "write");
fd = open("/dev/watchdog", O_WRONLY);
if (fd == -1) {
perror("watchdog");
exit(1);
}
printf("Trying to set timeout value=%d seconds\n", timeout);
ioctl(fd, WDIOC_SETTIMEOUT, &timeout);
printf("The actual timeout was set to %d seconds\n", timeout);
ioctl(fd, WDIOC_GETTIMEOUT, &timeout);
printf("Now reading back -- The timeout is %d seconds\n", timeout);
while (1) {
if (test == 0) {
ioctl(fd, WDIOC_KEEPAIVE, 0);
} else {
write(fd, "\0", 1);
}
sleep(sleep_sec);
}
print_result(argv);
return 0;
}
void help_info(void)
{
printf("Usage: wdt_driver_test <timeout> <sleep> <test>\n");
printf("  timeout: value in seconds to cause wdt timeout/reset\n");
```

```
printf("  sleep: value in seconds to service the wdt\n");
printf("  test: 0 - Service wdt with ioctl(), 1 - with write()\n");
}
```

test\_utils.h:

```
inline void print_name(char * const argv[])
{
printf("\n---- Running < %s > test ----\n\n", argv[0]);
}

inline void print_result(char * const argv[])
{
printf("\n---- Test < %s > ended ----\n\n", argv[0]);
}
```

## (2) External watchdog

It uses an external watchdog device on the PICO-IMX8PL board. The CPU will be reset every 70 seconds if the watchdog times out.

WDI pin (GPIO2\_IO08): Watchdog input. A falling edge must occur at WDI before the timeout (tWD) expires. You must toggle the WDT pin high and low for the watchdog to restart counting.

Please refer to `/usr/sbin/watchdog.sh`.

```
#!/bin/bash
gpioset 1 8=0
while true
do
gpioset 1 8=1
sleep 0.1
```

```
gpioset 1 8=0
```

```
sleep 4.9
```

```
done
```

You have to call watchdog.sh when booting.

Please refer to watchdog.service . It calls /usr/sbin/watchdog.sh when booting.

watchdog.service :

```
[Unit]
```

```
Description=WatchDog supervise
```

```
[Service]
```

```
Type=simple
```

```
ExecStart=/usr/sbin/watchdog.sh
```

```
Restart=always
```

```
[Install]
```

```
WantedBy=multi-user.target
```

## 3.3 Wireless Control Command and Example

### 3.3.1 4G

Insert the EG25G card (4G module) into the PICO-IMX8PL board (CN12).

GPIO02\_IO00: The GPIO control 4G module power (CN12).

Command:

```
gpioset 1 0=1 // It will turn off the 4G module power if the GPIO02_IO00 is high.
```

```
gpioset 1 0=0 //It will turn on the 4G module power if the GPIO02_IO00 is low.
```

4G wireless network connection.

Command:

```
systemctl enable ModemManager
```

```
systemctl start ModemManager mmcli --list-modems
```

```
root@pico-imx8mp:~# mmcli --list-modems
/org/freedesktop/ModemManager1/Modem/0 [Quectel] EG25
```

```
mmcli -m 0
```

```
-----
General |          dbus path: /org/freedesktop/ModemManager1/Modem/0
          device id: 3d7e973c1d5e95f87075d2ddd20e959ff3fb92f7
-----
Hardware | manufacturer: Quectel
          model: EG25
          firmware revision: EG25GCBR07A07M2G
          supported: gsm-umts, lte
          current: gsm-umts, lte
          equipment id: 867698040211339
-----
System |          device: /sys/devices/platform/soc@0/32f10108.usb/38200000.usb/xhci-hcd.2.auto/usb3/3-1/3-1.3
          drivers: option, qmi_wwan_q
          plugin: quectel
          primary port: ttyUSB2
          ports: ttyUSB0 (qcdm), ttyUSB1 (gps), ttyUSB2 (at), ttyUSB3 (at)
-----
Status |          unlock retries: sim-pin (3), sim-puk (10), sim-pin2 (3), sim-puk2 (10)
          state: registered
          power state: on
          access tech: lte
          signal quality: 100% (recent)
-----
Modes |          supported: allowed: 2g, 3g, 4g; preferred: none
          current: allowed: 2g, 3g, 4g; preferred: none
-----
IP |          supported: ipv4, ipv6, ipv4v6
-----
3GPP |          imei: 867698040211339
          operator id: 46692
          operator name: Chunghwa Telecom
          registration: home
-----
3GPP EPS | ue mode of operation: cspc-2
-----
SIM |          dbus path: /org/freedesktop/ModemManager1/SIM/0
-----
```

```
mmcli -m 0 -e
```

```
root@pico-imx8mp:~# mmcli -m 0 -e  
successfully enabled the modem
```

```
nmcli -a
```

```
root@pico-imx8mp:~# nmcli -a  
ttyUSB2: disconnected  
"Quectel EG25-G"  
gsm (option1, qmi_wwan_q), hw
```

```
nmcli c add con-name test type gsm ifname ttyUSB2 apn internet
```

```
Connection 'test' (2e0e655f-fdd3-42ba-bbca-24c15bedf59f) successfully added.
```

Command: **ifconfig**

```
root@Essential-BX1:~# ifconfig  
eth0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether 00:07:32:a5:a5:88 txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
eth1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether 00:07:32:a5:a5:89 txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
device interrupt 222  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 10 bytes 1612 (1.5 KiB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 10 bytes 1612 (1.5 KiB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
ppp0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST> mtu 1500  
inet 10.40.215.21 netmask 255.255.255.255 destination 10.64.64.64  
inet6 fe80::fd8f:214d:8ee0:65a7 prefixlen 64 scopeid 0x20<link>  
inet6 fe80::e68d:d31a:48c9:b931 prefixlen 64 scopeid 0x20<link>  
inet6 2001:b400:e251:3309:5aal:6eed:db39:13fd prefixlen 64 scopeid 0x<global>  
ppp txqueuelen 3 (Point-to-Point Protocol)  
RX packets 26 bytes 1790 (1.7 KiB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 29 bytes 1600 (1.5 KiB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
ping 8.8.8.8
```

```
root@pico-imx8mp:~# ping 8.8.8.8  
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.  
64 bytes from 8.8.8.8: icmp_seq=1 ttl=253 time=118 ms  
64 bytes from 8.8.8.8: icmp_seq=2 ttl=253 time=34.6 ms  
64 bytes from 8.8.8.8: icmp_seq=3 ttl=253 time=110 ms
```

### 3.3.2 Bluetooth

Command:

```
$ bluetoothctl
# power on
# agent off
# agent NoInputNoOutput
# default-agent
# scan on // Find the K380 mac address
```

```
root@pico-imx8mp:~# bluetoothctl
Agent registered
[CHG] Controller 74:4C:A1:90:E8:F8 Pairable: yes
[bluetooth]# power on
Changing power on succeeded
[bluetooth]# agent off
Agent unregistered
[CHG] Controller 74:4C:A1:90:E8:F8 Pairable: no
[bluetooth]# agent NoInputNoOutput
Agent registered
[CHG] Controller 74:4C:A1:90:E8:F8 Pairable: yes
[bluetooth]# default-agent
Default agent request successful
[bluetooth]# scan on
```

Trust K380 mac address

```
# trust XX:XX:XX:XX:XX:XX
Pair K380 mac address
# pair XX:XX:XX:XX:XX:XX
# connect XX:XX:XX:XX:XX:XX
# info XX:XX:XX:XX:XX:XX
# scan off
```

```
[Keyboard K380]# info F4:73:35:75:CF:7B
Device F4:73:35:75:CF:7B (public)
  Name: Keyboard K380
  Alias: Keyboard K380
  Class: 0x00002540
  Icon: input-keyboard
  Paired: yes
  Trusted: yes
  Blocked: no
  Connected: yes
  WakeAllowed: yes
  LegacyPairing: yes
  UUID: Service Discovery Serve.. (00001000-0000-1000-8000-00805f9b34fb)
  UUID: Human Interface Device.. (00001124-0000-1000-8000-00805f9b34fb)
  UUID: PnP Information          (00001200-0000-1000-8000-00805f9b34fb)
  Modalias: usb:v046DpB342d4201
```

The Bluetooth device is connected successfully.

### 3.3.3 Wi-Fi

#### 3.3.3.1 Wi-Fi Connect

Insert an M.2 WIFI module into the PICO-IMX8PL.



Set up your phone to use as a Wi-Fi hotspot.

```
nmcli dev wifi connect 'SSID' password 'XXXXXXXX'
```

```
ifconfig
```

```
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.123.208 netmask 255.255.255.0 broadcast 192.168.123.255
inet6 2001:b400:e2df:7ed3:1899:3369:a373:6fef prefixlen 64 scopeid 0x0<global>
inet6 fe80::1efe:8f38:33ba:fc47 prefixlen 64 scopeid 0x20<link>
ether 74:4c:a1:90:e8:f7 txqueuelen 1000 (Ethernet)
RX packets 52 bytes 6372 (6.2 KiB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 69 bytes 9975 (9.7 KiB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
ping 8.8.8.8
```

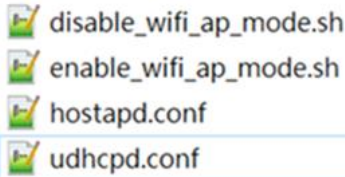
```
root@pico-imx8mp:/test# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=155 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=41.0 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=54 time=39.2 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=54 time=47.1 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=54 time=105 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=54 time=91.7 ms
```



### 3.3.3.2 Wi-Fi AP Mode

---

Please put these files in the same directory.



Please install hostapd package: `apt-get install hostapd`

Enable WIFI AP mode: `./enable_wifi_ap_mode.sh`

Disable wifi ap mode: `./disable_wifi_ap_mode.sh`

`enable_wifi_ap_mode.sh`:

```
#!/bin/sh
hostapd ./hostapd.conf -B
ifconfig wlan0 192.168.175.1
udhcpd ./udhcpd.conf
echo 1 > /proc/sys/net/ipv4/ip_forward
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
iptables -A FORWARD -i eth0 -o wlan0 -m conntrack --ctstate
RELATED,ESTABLISHED -j ACCEPT
iptables -A FORWARD -i wlan0 -o eth0 -j ACCEPT
```

`disable_wifi_ap_mode.sh`:

```
#!/bin/sh
killall5 -9 hostapd
killall5 -9 udhcpd
```

hostapd.conf:

```
interface=wlan0
driver=nl80211
ssid=aaeon_srg_wifi
channel=6
hw_mode=g
ignore_broadcast_ssid=0
auth_algs=1
wpa=3
wpa_passphrase=11111111
wpa_key_mgmt=WPA-PSK
wpa_pairwise=TKIP
rsn_pairwise=CCMP
```

udhcpd.conf:

```
start 192.168.175.2
end 192.168.175.254
interface wlan0
max_leases 234
opt router 192.168.175.1
```

Test wifi ap mode on Windows NB:

```
ping 8.8.8.8 -S 192.168.175.xxx -t
```

## 3.4 HDMI

---

### Precautions:

The graphics must be initialized at boot time if you want to use the GUI interface software. If you connect the PICO-IMX8PL screen with an HDMI cable after booting, you will miss this initialization opportunity, and you won't see any GUI patterns on the screen.

If using GUI software, please follow these steps:

1. Connect the PICO-IMX8PL screen using an HDMI cable.
2. Turn on the power.
3. After waiting for some time, you will see the GUI pattern on the screen.

### 3.5 LVDS Display

---

**Step 1:** Use LVDS cable to connect LVDS panel and PICO-IMX8PL board.

**Step 2:** Insert jumper into the corresponding position

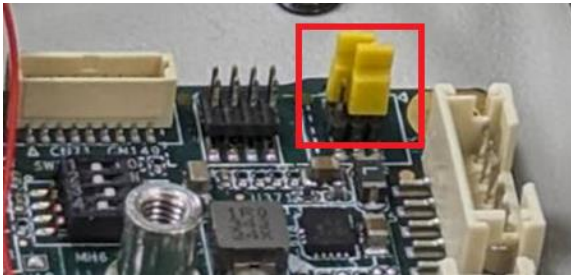
**Step 3:** After booting, check whether the screen displays normally.

**Step 4:** Run command to set backlight brightness

```
cd /sys/class/backlight/lvds_backlight/
```

```
echo 200 > brightness //Backlight brightness is high
```

```
echo 20 > brightness // Backlight brightness is low
```



## 3.6 Audio

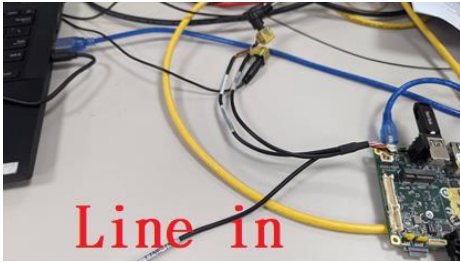
---

Use audio cable to connect as follows:

PICO-IMX8PL Line in ==> Computer headphone jack.

PICO-IMX8PL Line out ==> Headphones or speakers.s

PICO-IMX8PL mic ==> microphone



### 3.6.1 Line Out Test

---

Command:

```
cd /rootfs/root/Music
```

```
aplay -l
```

```
card 0: tlv320audio [tlv320-audio], device 0: 30c30000.sai-tlv320aic3x-hifi
```

```
tlv320aic3x-hifi-0 [30c30000.sai-tlv320aic3x-hifi tlv320aic3x-hifi-0]
```

```
card 1: audiohdmi [audio-hdmi], device 0: i.MX HDMI i2s-hifi-0 [i.MX HDMI
```

```
i2s-hifi-0]
```

```
Subdevices: 1/1
```

```
Subdevice #0: subdevice #0
```

```
tlv320audio is card0 .
```

Command:

```
aplay -D plughw:0,0 Beijing_Bass.wav
```

If tlv320audio is card1, run command as follows:

Command:

```
aplay -D plughw:1,0 Beijing_Bass.wav
```

### 3.6.2 Line In Test

---

Command:

```
aplay -l  
card 0: tlv320audio [tlv320-audio], device 0: 30c30000.sai-tlv320aic3x-hifi  
tlv320aic3x-hifi-0 [30c30000.sai-tlv320aic3x-hifi tlv320aic3x-hifi-0]  
card 1: audiohdmi [audio-hdmi], device 0: i.MX HDMI i2s-hifi-0 [i.MX HDMI  
i2s-hifi-0]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
tlv320audio is card0.
```

Command:

```
arecord -Dhw:0,0 -r 48000 -c 2 --period-size=64 -f S16_LE | aplay -Dhw:0,0
```

If tlv320audio is card1, run command as follows:

Command:

```
arecord -Dhw:1,0 -r 48000 -c 2 --period-size=64 -f S16_LE | aplay -Dhw:1,0
```

### 3.6.3 Microphone Test

---

Command:

```
aplay -l  
card 0: tlv320audio [tlv320-audio], device 0: 30c30000.sai-tlv320aic3x-hifi  
tlv320aic3x-hifi-0 [30c30000.sai-tlv320aic3x-hifi tlv320aic3x-hifi-0]  
card 1: audiohdm1 [audio-hdm1], device 0: i.MX HDMI i2s-hifi-0 [i.MX HDMI  
i2s-hifi-0]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
tlv320audio is card0
```

Command:

```
arecord -Dhw:0,0 -r 48000 -c 2 --period-size=64 -f S16_LE | aplay -Dhw:0,0
```

If tlv320audio is card1, run command as follows

Command:

```
arecord -Dhw:1,0 -r 48000 -c 2 --period-size=64 -f S16_LE | aplay -Dhw:1,0
```

Speak into the microphone to ensure you can hear your voice from the headphones.



## 3.7 OS Installation

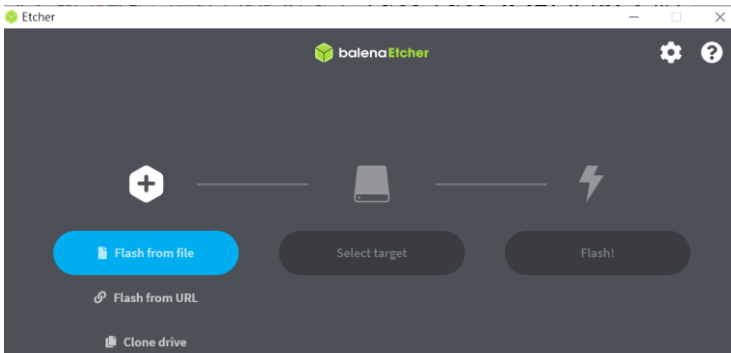
### 3.7.1 Flash SD Card

Step 1: Download balenaEtcher tool: <https://www.balena.io/etcher/>

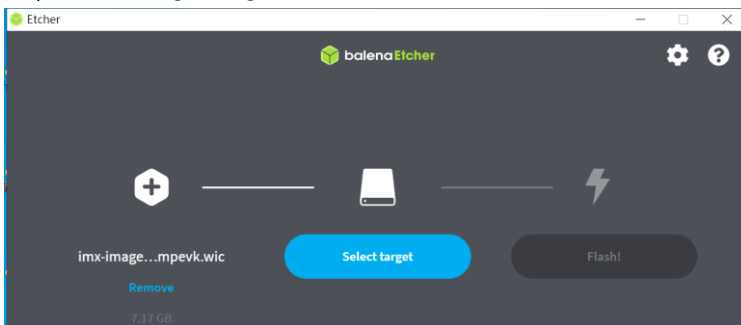
ASSET	OS	ARCH	
ETCHER FOR WINDOWS (X86 X64) (INSTALLER)	WINDOWS	X86 X64	<a href="#">Download</a>
<b>ETCHER FOR WINDOWS (X86 X64) (PORTABLE)</b>	WINDOWS	X86 X64	<a href="#">Download</a>

Step 2: Insert SD card to computer.

Step 3: Flash from file: Select the image you want to flash.



Step 4: Select target: Target is SD card.



Generic STORAGE...VICE USB Device 8.07 GB E:\

Step 5: Press the Flash button. It will flash image to SD card.

### 3.7.2 Flash eMMC

**Step 1:** Insert a bootable SD card to the board.

**Step 2:** Set the switch to 0x11. It will boot from SD card.

Switch: 0011



**Step 3:** login: root

Password: Pw#12345

**Step 4:** Run command as follows, and it will flash image from SD card to eMMC.

Command:

```
/usr/sbin/imx8_plus_emmc_flasher.sh
```

**Step 5:** Turn off power.

**Step 6:** You can set the switch to 0x10. Turn on power.

It will then boot from eMMC.

Switch: 0010



### 3.7.3 Check Version

---

Check SW version on board (2G RAM).

Command:

```
cat /etc/os-release
```

```
root@pico-imx8mp:~# cat /etc/os-release
PRETTY_NAME="Debian GNU/Linux 11 (bullseye)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/support"
BUG_REPORT_URL="https://bugs.debian.org/"
PROJECT="pico-imx8mplus"
IMAGE_VERSION="VB10"
HW_INFO="2G RAM MT53E512M32D1"
CREATE_DATE="2024/5/7"
```

Check SW version on board (4G RAM).

Command:

```
cat /etc/os-release
```

```
root@pico-imx8mp:~# cat /etc/os-release
PRETTY_NAME="Debian GNU/Linux 11 (bullseye)"
NAME="Debian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=debian
HOME_URL="https://www.debian.org/"
SUPPORT_URL="https://www.debian.org/support"
BUG_REPORT_URL="https://bugs.debian.org/"
PROJECT="pico-imx8mplus"
IMAGE_VERSION="VB10"
HW_INFO="4G RAM MT53E1G32D2"
CREATE_DATE="2024/5/7"
```

# Appendix A

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Mating Connectors

## A.1 List of Mating Connectors and Cables

The following table lists mating connectors and available cables.

Conn Label	Function	Mating Connector		Available Cable	Cable P/N
		Vendor	Model No.		
CN4	SPI/I2C/GPIO Connector	PINREX	232-92-04GBEM	N/A	N/A
CN12	4G Full-Size Mini Card Slot	Quectel	Quectel.EG-25G	4G Module Card	9686EG25G0
CN16	Micro SD Slot	Transcend	TS16GUSD300S-A	N/A	N/A
CN25	LVDS Port Inverter/Backlight Connector	JST	PHR-5	N/A	N/A
CN26	LVDS Port	ACES	50247-030H0H0-001	LVDS Cable	1704300030 (LVDS panel: AUO G185XW01)
CN27	Audio Port	ACES	50247-012H0 H0-001	Audio Port Cable	170X000156
CN30	Debug Port	UGREEN	US289	USB 2.0 Micro B Cable	N/A
CN32	RTC Battery Connector	Molex	51021-0200	RTC Battery Cable	175011301K
CN38	DC Power	DINKLE	EC381RM-02P	N/A	N/A
CN70	RS-232/422/485 COM Port 1/Port 2	DINKLE	0156-1718-BK	N/A	N/A
CN71	UART Port 1/Port 3 Connector	PINREX	710-73-09TW01	N/A	N/A
CN140	WIFI/BT/Hailo-8/Hailo-8L M.2 Key E Slot	SparkLAN	WPET-239ACN(BT)	N/A	N/A
CN141	HDMI Port	Molex	88768-9900	HDMI Cable	N/A
CN145	LAN (RJ-45) Port 1, Port 2	Molex	44915-0001	N/A	N/A
CN146	USB 3.2 Port1, Port 2	UGREEN	US128	USB 3.2 Cable	N/A
CN147	Internal USB 2.0 Port	PINREX	712-91-055W60	N/A	N/A
CN149	UART Port 2, Port 4 Connector	PINREX	232-92-04GBEM	N/A	N/A