BOXER-8641AI Plus

AI@Edge Compact Fanless Embedded
AI System with NVIDIA® AGX Orin™

User's Manual 1st Ed

Last Updated: January 10, 2025

Copyright Notice

Acknowledgements

Packing List

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

Item	Quantity
● BOXER-8641AI Plus (BOXER-8641AI-B1)	1
● Wallmount Bracket	2
● Screw Package	1

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

About this Document

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 at AAEON.com for the latest version of this document.

Safety Precautions

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. All cables and adapters supplied by AAEON are certified and in accordance with the material safety laws and regulations of the country of sale. Do not use any cables or adapters not supplied by AAEON to prevent system malfunction or fires.
3. Make sure the power source matches the power rating of the device.
4. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
5. Always completely disconnect the power before working on the system's hardware.
6. No connections should be made when the system is powered as a sudden rush of power may damage sensitive electronic components.
7. 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.
8. Always disconnect this device from any power supply before cleaning.
9. While cleaning, use a damp cloth instead of liquid or spray detergents.
10. Make sure the device is installed near a power outlet and is easily accessible.
11. Keep this device away from humidity.
12. Place the device on a solid surface during installation to prevent falls
13. Do not cover the openings on the device to ensure optimal heat dissipation.
14. Watch out for high temperatures when the system is running.
15. Do not touch the heat sink or heat spreader when the system is running
16. Never pour any liquid into the openings. This could cause fire or electric shock.

17. 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.

18. 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

19. DO NOT LEAVE THIS DEVICE IN AN UNCONTROLLED ENVIRONMENT WITH TEMPERATURES BEYOND THE DEVICE'S PERMITTED STORAGE TEMPERATURES (SEE CHAPTER 1) TO PREVENT DAMAGE.

FCC Statement

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 System QO4-381 Rev.A0

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	×	○	○	○	○	○
外壳	○	○	○	○	○	○
中央处理器与内存	×	○	○	○	○	○
硬盘	×	○	○	○	○	○
液晶模块	×	×	○	○	○	○
光驱	×	○	○	○	○	○
触控模块	×	○	○	○	○	○
电源	×	○	○	○	○	○
电池	×	○	○	○	○	○

本表格依据 SJ/T 11364 的规定编制。

○：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GB/T 26572标准规定的限量要求以下。

×：表示该有害物质的某一均质材料超出了GB/T 26572的限量要求，然而该部件仍符合欧盟指令2011/65/EU 的规范。

备注：

一、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。

二、上述部件物质中央处理器、内存、硬盘、光驱、电源为选购品。

三、上述部件物质液晶模块、触控模块仅一体机产品适用。

China RoHS Requirement (EN)

Hazardous and Toxic Materials List

AAEON System QO4-381 Rev.A0

Component Name	Hazardous or Toxic Materials or Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBBs)	Polybrominated diphenyl ethers (PBDEs)
PCB and Components	X	O	O	O	O	O
Wires & Connectors for Ext.Connections	X	O	O	O	O	O
Chassis	O	O	O	O	O	O
CPU & RAM	X	O	O	O	O	O
HDD Drive	X	O	O	O	O	O
LCD Module	X	X	O	O	O	O
Optical Drive	X	O	O	O	O	O
Touch Control Module	X	O	O	O	O	O
PSU	X	O	O	O	O	O
Battery	X	O	O	O	O	O

This form is prepared in compliance with the provisions of SJ/T 11364.

O: The level of toxic or hazardous materials present in this component and its parts is below the limit specified by GB/T 26572.

X: The level of toxic of hazardous materials present in the component exceed the limits specified by GB/T 26572, but is still in compliance with EU Directive 2011/65/EU (RoHS 2).

Notes:

1. The Environment Friendly Use Period indicated by labelling on this product is applicable only to use under normal conditions.
2. Individual components including the CPU, RAM/memory, HDD, optical drive, and PSU are optional.
3. LCD Module and Touch Control Module only applies to certain products which feature these components.

Table of Contents

Chapter 1

Product Specifications

1.1 Specifications

System	
AI Accelerator	NVIDIA® Jetson AGX Orin™
CPU	8-core Arm® Cortex®-A78AE v8.2 64-bit CPU
	12-core Arm® Cortex®-A78AE v8.2 64-bit CPU
System Memory	32GB LPDDR5
	64GB LPDDR5
Storage Device	64GB eMMC 5.1 x 1
	M.2 2280 M-Key x 1 (NVMe)
	SATA Drive Bay x 1
Display Interface	HDMI 2.0 (Type-A) x 1
Ethernet	RJ-45 x 1 (10G LAN)
	RJ-45 x 1 (GbE LAN)
I/O	USB 3.2 Gen 2 (Type-A) x 2 (from SoM)
	USB 3.2 Gen 2 (Type-A) x 2 (from Hub)
	Micro USB x 1 for OS Flash
	DB-9 x 1 for RS-232/485 (RX/TX/RTS/CTS) (from SOM) (by Cable)
	DB-9 x 1 for RS-232/485 (RX/TX/RTS/CTS) (from SOM) (by Cable)
	DB-9 x 1 for DIO x 8 (by Cable)
	Mic-in and Line-out x 1 (by Cable)
	Reset Button x 1
	Recovery Button x 1
	Power Button x 1
	HDMI 2.0 (Type-A) x 1
	2.5" SATA Drive Bay x 1

System

I/O	SATA Power (5V) x 1
	12V Fan x 1
	OOB Connector x 1
	COM Wafer (RS-232/422/485) x 4 (2 for external COM Ports)
	Wafer x 3 for USB 2.0
	Debug UART x 1
	TPM 2.0 x 1
Expansion	M.2 2230 E-Key x 1
	M.2 3052 B-Key x 1
	M.2 2280 M-Key x 1
	2.5" SATA Port Drive x 1
	SIM Slot x 1
Indicator	Power LED x 1
OS Support	Linux (NVIDIA Jetpack™ 6.0 or above)

Power Supply

Power Requirement	2-pin Terminal Block x 1 for 12Vdc ~ 19Vdc Power Input

Mechanical

Mounting	Wall Mount
Dimensions (W x D x H)	7.09 " x 5.35 " x 3.11" (180mm x 136mm x 79.1mm)
Net Weight	5.5 lb. (2.5kg)
Gross Weight	7.8 lb. (3.55kg)

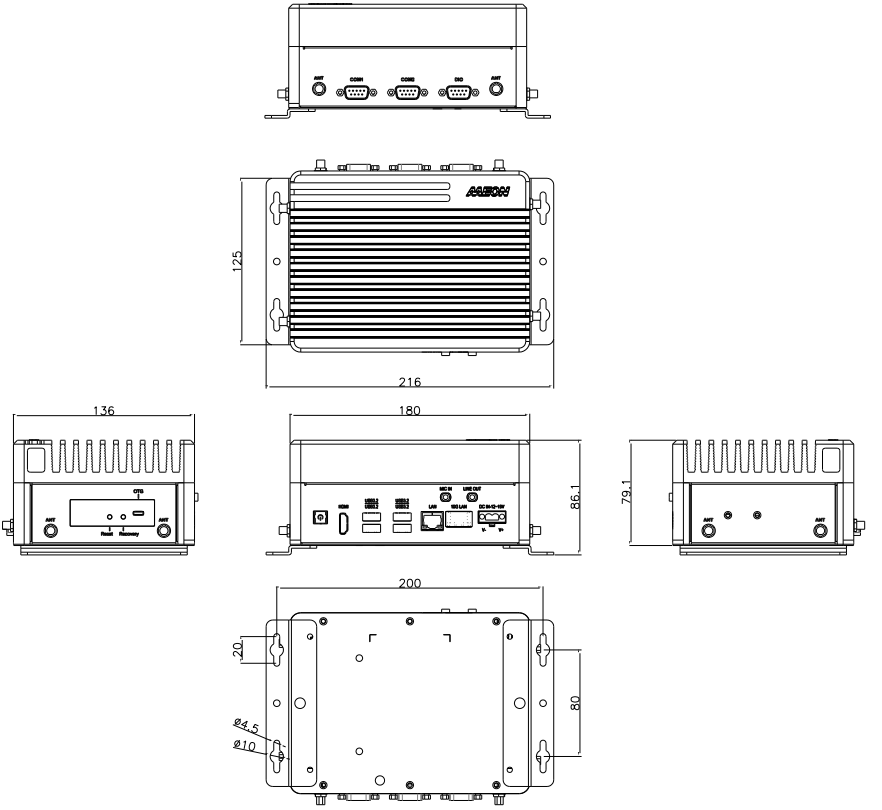
Environmental

Operating Temperature	-13°F ~ 131°F (-25°C ~ 55°C) with 0.7 m/s airflow
Storage Temperature	-40°F ~ 185°F (-40°C ~ 85°C)
Storage Humidity	5 ~ 95% @40°C, non-condensing
Anti-Vibration	Random, 3.5 Grms, 5~500Hz with SSD
Anti-Shock	50G peak acceleration
Drop	76cm (1 Corner, 3 Edge, 6 Surface)
Certification	CE/FCC Class B

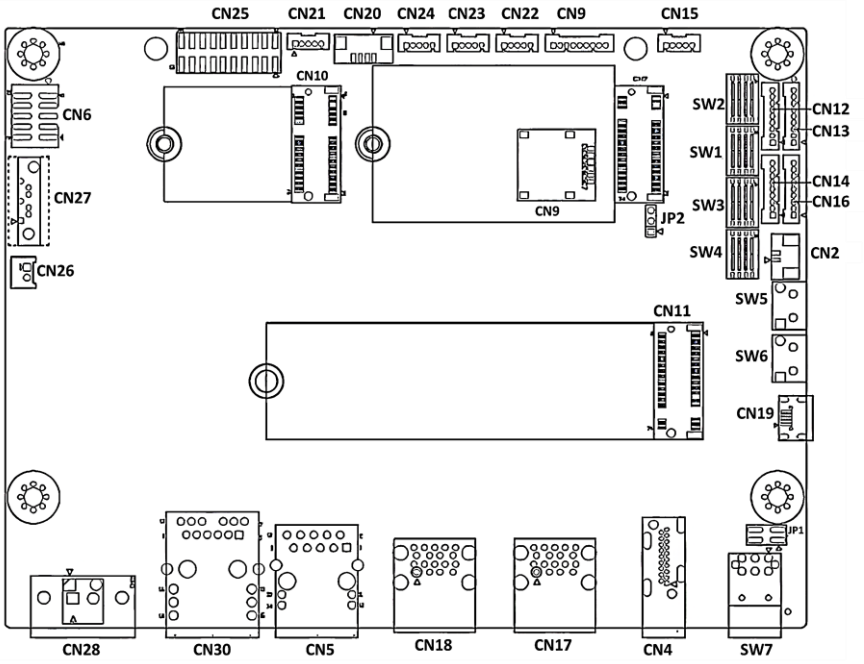
Chapter 2

Hardware Information

2.1 Dimensions



2.2 Jumpers and Connectors



2.3 List of Jumpers

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

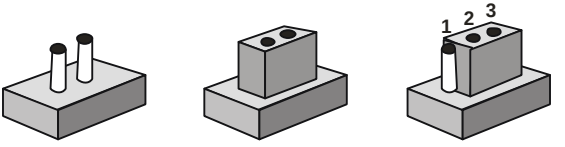
The table below shows the function of each of the board's jumpers

Label	Function
JP1	AT/ATX Selected
JP2	OOB/CN16 UART Selected

2.3.1 Setting Jumpers

You configure your card to match the needs of your application by setting jumpers. A jumper is the simplest kind of electric switch. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To "close" a jumper you connect the pins with the clip.

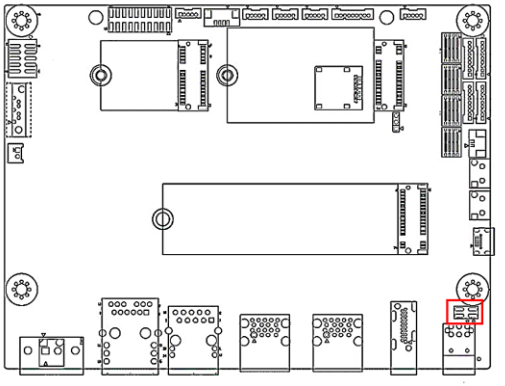
To "open" a jumper you remove the clip. Sometimes a jumper will have three pins, labeled 1, 2 and 3. In this case you would connect either pins 1 and 2 or 2 and 3.



A pair of needle-nose pliers may be helpful when working with jumpers.

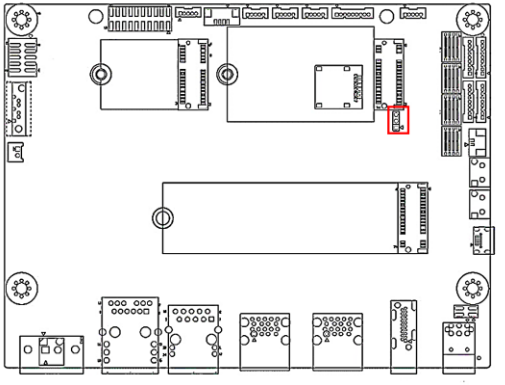
If you have any doubts about the best hardware configuration for your application, contact your local distributor or sales representative before you make any change. Generally, you simply need a standard cable to make most connections.

2.3.2 AT/ATX Mode Selection (JP1)



JP1	Function
1-2	Open ATX (Default)
1-2	Close AT

2.3.3 OOB/CN16 UART Selection (JP2)



JP2	Function
1-2	OOB
2-3	CN16 (Default)

2.4 List of Connectors

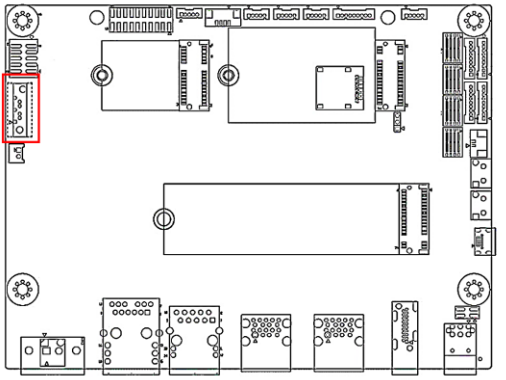
The board has a number of connectors that allow you to configure your system to suit your application.

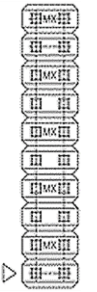
The table below shows the function of each of the board's connectors

Label	Function
CN1	NVIDIA Jetson AGX Orin Connector
CN2	RTC Battery Connector
CN4	HDMI Port
CN5	RJ-45 GbE Port
CN6	Audio Connector
CN7	M.2 3052 B-Key
CN8	Nano SIM Slot
CN9	DIO Connector
CN10	M.2 2230 E-Key
CN11	M.2 2280 M-Key
CN12	RS-232/485 Connector
CN13	RS-232/485 Connector
CN14	RS-232/485 Connector
CN15	CANBus Connector
CN16	RS-232/485 Connector
CN17	USB 3.2 Gen 2 Type-A Port
CN18	USB 3.2 Gen 2 Type-A Port
CN19	Micro USB 2.0 for Flash
CN20	Fan Connector
CN21	Debug UART Connector
CN22	USB 2.0 Connector
CN23	USB 2.0 Connector
CN24	USB 2.0 Connector
CN25	NC-SI Connector
CN26	SATA +5V Power Connector
CN27	SATA Connector
CN28	DC in Connector (5.0mm)
CN30	10G RJ45 Connector
SW1	RS-232/422/485 Select (CN12)
SW2	RS-232/422/485 Select (CN13)
SW3	RS-232/422/485 Select (CN14)

Label	Function
SW4	RS-232/422/485 Select (CN16)
SW5	Reset Button
SW6	Recovery Button
SW7	Power Button
JP1	AT/ATX Select
JP2	OOB/CN16 UART Select

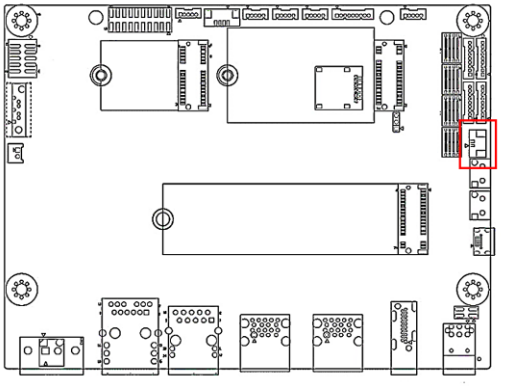
2.4.1 NC-SI Connector (CN27)

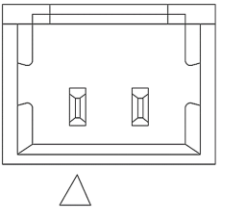




Pin	Signal	Pin	Signal
1	+3.3V	2	3.3V_AO
3	Debug UART TX	4	NC_SI_TXD0
5	Debug UART RX	6	NC_SI_TXD1
7	I2C1 SCL	8	NC_SI_RXD0
9	I2C1 SDA	10	NC_SI_RXD1
11	System Reset	12	NC_SI_CLK_IN
13	GND	14	NC_SI_CRB
15	Button power	16	NC_SI_TX_EN
17	GND	18	OOB_UART_TXD
19	5V_AO	20	OOB_UART_RXD

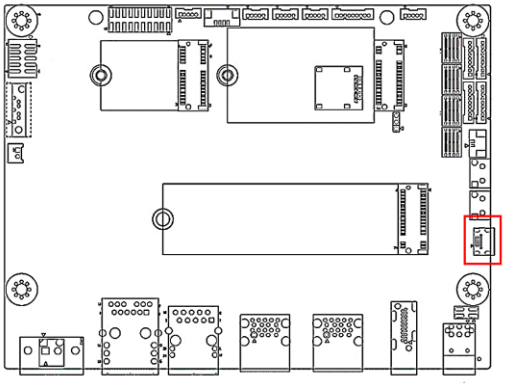
2.4.2 RTC Battery Connector (CN2)

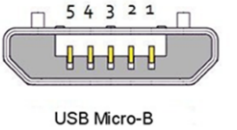




Pin	Signal	Pin	Signal
1	Positive	2	Negative

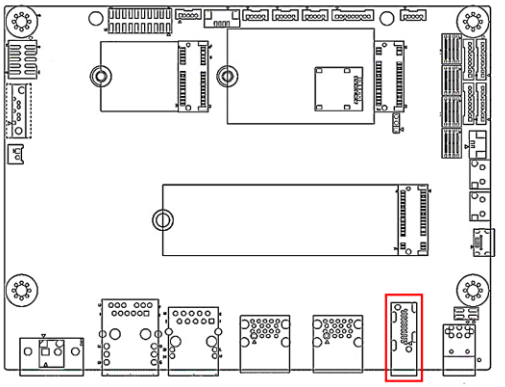
2.4.3 Micro USB (Flash OS) (CN19)

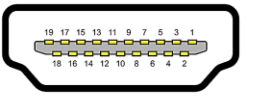




Pin	Signal	Pin	Signal
1	+5V	2	USB1-
3	USB1+	4	
5	GND		

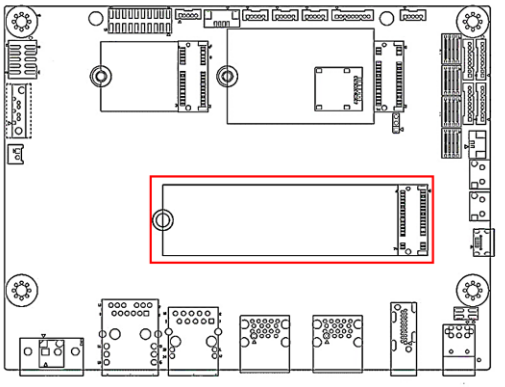
2.4.4 HDMI Connector (CN4)





Pin	Signal	Pin	Signal
1	HDMI_DATA2_P	2	GND
3	HDMI_DATA2_N	4	HDMI_DATA1_P
5	GND	6	HDMI_DATA1_N
7	HDMI_DATA0_P	8	GND
9	HDMI_DATA0_N	10	HDMI_CLK_P
11	GND	12	HDMI_CLK_N
13	NC	14	NC
15	HDMI_SCL	16	HDMI_SDA
17	GND	18	HDMI_PWR
19	HDMI_HDP		

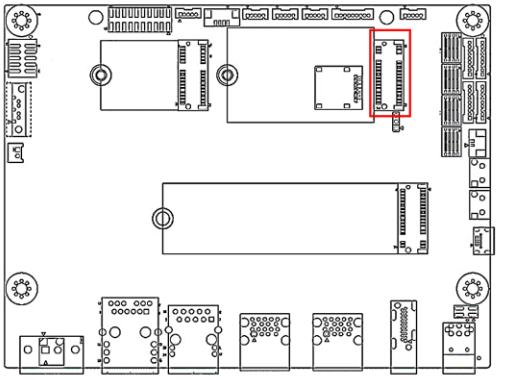
2.4.5 M.2 2280 M-Key (CN11)



Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	GND	73
70	3.3V	GND	71
68	SUSCLK (O)(0/3.3V)	PEDET	69
	Key M	NC	67
	Key M	Key M	
	Key M	Key M	
	Key M	Key M	
	Key M	Key M	
58	NC	GND	57
56	NC	REFCLKp	55
54	PEWAKE# (I/O)(0/3.3V) or NC	REFCLKn	53
52	CLKREQ# (I/O)(0/3.3V) or NC	GND	51
50	PERST# (O)(0/3.3V) or NC	PETpO/SATA-A+	49
48	NC	PETnO/SATA-A-	47
46	NC	GND	45
44	ALERT# 00 (0/1.8V)	PERpO/SATA-B-	43
42	SMB_DATA (VO) (0/1.8V)	PERnO/SATA-B+	41
40	SMB_CLK (I/O)(0/1.8V)	GND	39
38	DEVSLP (O)	PETp1	37
36	NC	PETn1	35
34	NC	GND	33
32	NC	PERp1	31
30	NC	PERn1	29
28	NC	GND	27

Pin	Signal	Signal	Pin
26	NC	PETp2	25
24	NC	PETn2	23
22	NC	GND	21
20	NC	PERp2	19
18	3.3V	PERn2	17
16	3.3V	GND	15
14	3.3V	PETn3	13
12	3.3V	PETn3	11
10	DAS/DSS (I/O)/LED_I# (I)(0/3.3V)	GND	9
8	NC	PERp3	7
6	NC	PERn3	5
4	3.3V	GND	3
2	3.3V	GND	1

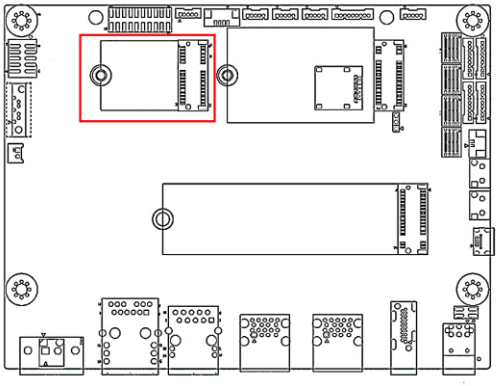
2.4.6 M.2 3052 B-Key (CN7)



Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	RESERVED / REFCLKN1	73
70	UIM_Power_In/GPIO1/PEWake1#	RESERVED / REFCLKP1	71
68	UIM_Power_Out/CLKREQ1#	GND	69
66	UIM_SWP / PERST1#	RESERVED / PERn1	67
64	RESERVED	RESERVED / PERp1	65
62	ALERT# (1)(0/3.3V)	GND	63
60	I2C CLK (O)(0/3.3V)	RESERVED / PETn1	61
58	I2C DATA (IO)(0/3.3V)	RESERVED / PETp1	59

Pin	Signal	Signal	Pin
56	W_DISABLE#1 (O)(0/3.3V)	GND	57
54	RESERVED/W_DISABLE#2 (O)(0/3.3V)	PEWake0# (IO)(0/3.3V)	55
52	PERST0# (O)(0/3.3V)	CLKREQ0 (IO)(0/3.3V)	53
50	SUSCLK (32kHz)(O)(0/3.3V)	GND	51
48	COEX1 (I/O)(0/1.8V)	REFCLKN0	49
46	COEX2 (I/O)(0/1.8V)	REFCLKP0	47
44	COEX3 (I/O)(0/1.8V)	GND	45
42	VENDOR DEFINED	PERn0	43
40	VENDOR DEFINED	PERp0	41
38	VENDOR DEFINED	GND	39
36	UART RTS (O)(0/1.8V)	PETn0	37
34	UART CTS (O)(0/1.8V)	PETp0	35
32	UART Tx (O)(0/1.8V)	GND	33
	Connector Key	Connector Key	
	Connector Key	Connector Key	
	Connector Key	Connector Key	
	Connector Key	Connector Key	
22	UART Rx (I)(0/1.8V)	SDIO Reset (I)(0/1.8V)	23
20	UART Wake (I)(0/3.3V)	SDIO Wake (I)(0/1.8V)	21
18	GND	SDIO DAT3 (IO)(0/1.8V)	19
16	LED#2 (I)(OD)	SDIO DAT2 (IO)(0/1.8V)	17
14	PCM_OUT/I2S SD_OUT (O)(0/1.8V)	SDIO DAT1 (IO)(0/1.8V)	15
12	PCM_IN / I2S SD_IN (I)(0/1.8V)	SDIO DAT0 (IO)(0/1.8V)	13
10	PCM_SYNC / I2S WS O/I)(0/1.8V)	SDIO CMD (IO)(0/1.8V)	11
8	PCM_CLK / I2S SCK (O/I)(0/1.8V)	SDIO CLK (O)(0/1.8V)	9
6	LED#1 (I)(OD)	GND	7
4	3.3V	USB_D-	5
2	3.3V	USB_D+	3
		GND	1

2.4.7 M.2 2230 E-Key (CN10)

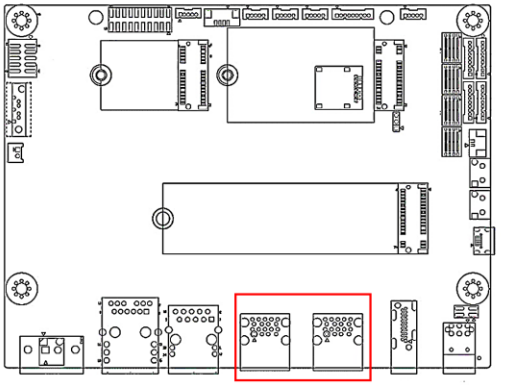


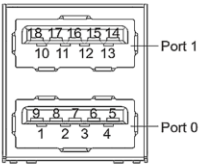
Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	RESERVED/REFCLKn1	73
70	UIM_POWER_SRC/GPIO1/PEWAKE1#	RESERVED/REFCLKp1	71
68	UIM_POWER_SNK/CLKREQ1#	GND	69
66	UIM_SWP/PERST1#	RESERVED/PETn1	67
64	RESERVED	RESERVED/PETp1	65
62	ALERT# (O)(0/3.3V)	GND	63
60	I2C_CLK (I)(0/3.3V)	RESERVED/PERn1	61
58	I2C_DATA (I/O)(0/3.3V)	RESERVED/PERp1	59
56	W_DISABLE1# (I)(0/3.3V)	GND	57
54	W_DISABLE2# (I)(0/3.3V)	PEWAKE# (I/O)(0/3.3V)	55
52	PERST0# (I)(0/3.3V)	CLKREQ0# (I/O)(0/3.3V)	53
50	SUSCLK(32kHz) (I/O)(0/3.3V)	GND	51
48	COEX1 (I/O)(0/1.8V)	REFCLKn0	49
46	COEX2 (I/O)(0/1.8V)	REFCLKp0	47
44	COEX3 (I/O)(0/1.8V)	GND	45
42	VENDOR DEFINED	PETn0	43
40	VENDOR DEFINED	PETp0	41
38	VENDOR DEFINED	GND	39
36	UART CTS (I)(0/1.8V)	PERn0	37
34	UART RTS (O)(0/1.8V)	PERp0	35
32	UART RXD (I)(0/1.8V)	GND	33
	Module Key	Module Key	
	Module Key	Module Key	
	Module Key	Module Key	

Pin	Signal	Signal	Pin
	Module Key	Module Key	
22	UART TXD (O)(0/1.8V)	SDIO RESET# (I)(0/1.8V)	23
20	UART WAKE# (O)(0/3.3V)	SDIO WAKE# (O)(0/1.8V)	21
18	GND	SDIO DATA3 (I/O)(0/1.8V)	19
16	LED2# (O)(OD)	SDIO DATA2 (I/O)(0/1.8V)	17
14	PCM_IN/I2S SD_IN (I)(0/1.8V)	SDIO DATA1 (I/O)(0/1.8V)	15
12	PCM_OUT/I2S SD_OUT (O)(0/1.8V)	SDIO DATA0 (I/O)(0/1.8V)	13
10	PCM_SYNC/I2S WS (I/O)(0/1.8V)	SDIO CMD (I/O)(0/1.8V)	11
8	PCM_CLK/I2S SCK (I/O)(0/1.8V)	SDIO CLK (I/O)(0/1.8V)	9
6	LED1# (O)(OD)	GND	7
4	3.3V	USB_D-	5
2	3.3V	USB_D+	3
1	GND		-

2.4.8 USB 3.2 Gen 2 Type-A Ports (CN17/CN18)

Note: Please ensure that USB devices (e.g., keyboard, mouse, etc.) are connected to CN17 during boot.

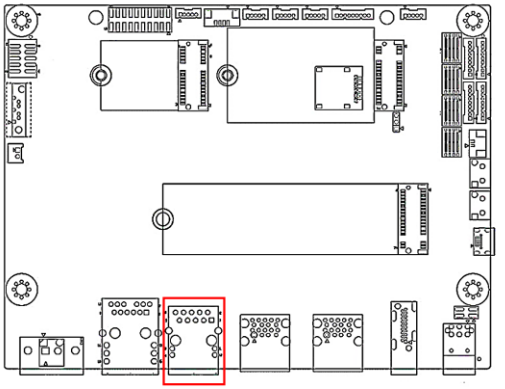


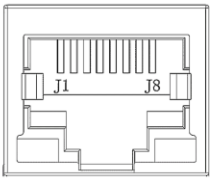


Pin	Signal	Pin	Signal
U1	VBUS_1	U10	VBUS_2
U2	(A)D-	U11	(B)D-
U3	(A)D+	U12	(B)D+
U4	GND	U13	GND
U5	(A)SSRX-	U14	(B)SSRX-

Pin	Signal	Pin	Signal
U6	(A)SSRX+	U15	(B)SSRX+
U7	GND	U16	GND
U8	(A)SSTX-	U17	(B)SSTX-
U9	(A)SSTX+	U18	(B)SSTX+

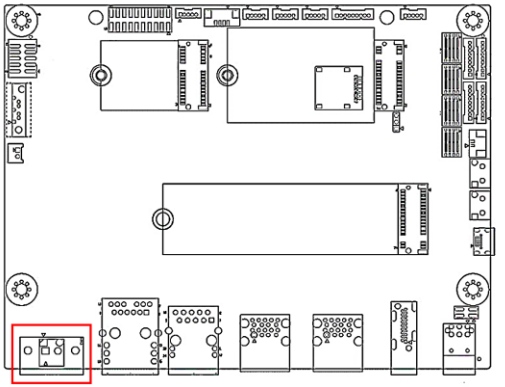
2.4.9 RJ-45 GbE Port (CN5)

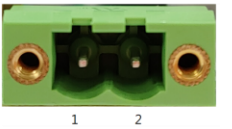




Pin	Signal	Pin	Signal
1	MDI0+	2	MDI0-
3	MDI1+	4	MDI1-
5	MDI2+	6	MDI2-
7	MDI3+	8	MDI3-

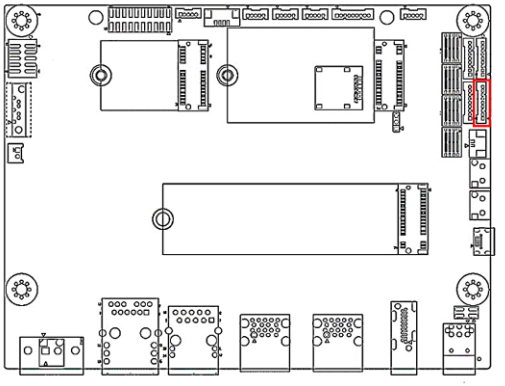
2.4.10 DC in Connector (5.0mm) (CN28)





Pin	Signal	Pin	Signal
1	DC Positive	2	DC Negative

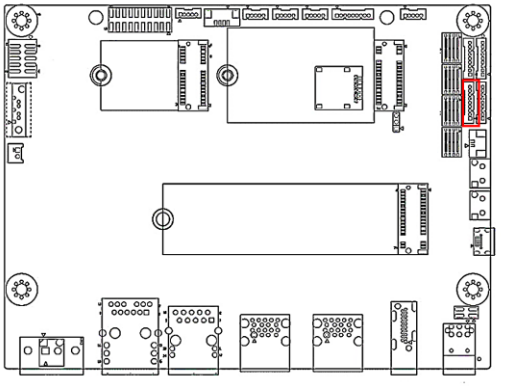
2.4.11 COM Port Connector (CN16/SW4)



Pin	RS-232	RS-485
1		D-
2		
3	RXD	D+
4	RTS	
5	TXD	
6	CTS	
7		

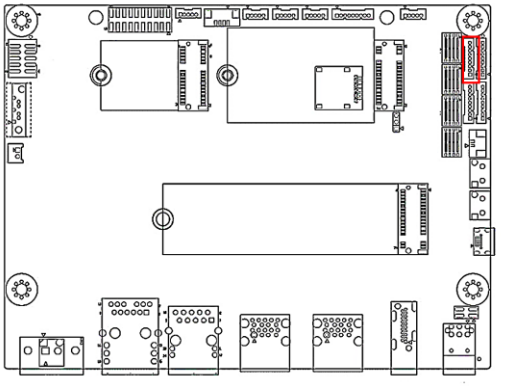
Pin	RS-232	RS-485
8		
9	GND	GND

2.4.12 COM Port Connector (CN14/SW3)



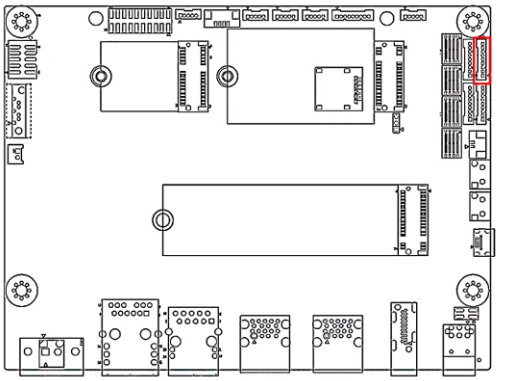
Pin	RS-232	RS-485
1		D-
2		
3	RXD	D+
4	RTS	
5	TXD	
6	CTS	
7		
8		
9	GND	GND

2.4.13 COM Port Connector (CN12/SW1)



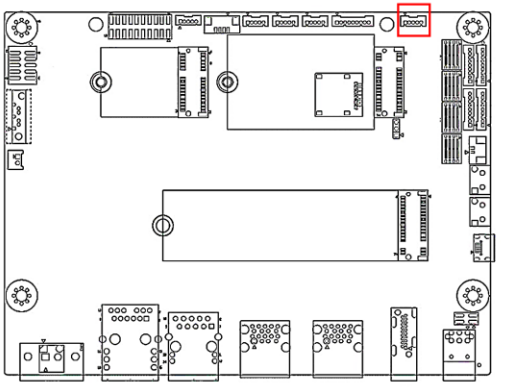
Pin	RS-232	RS-485
1		D-
2		
3	RXD	D+
4	RTS	
5	TXD	
6	CTS	
7		
8		
9	GND	GND

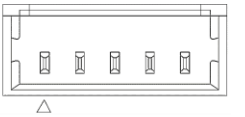
2.4.14 COM Port Connector (CN13/SW2)



Pin	RS-232	RS-485
1		D-
2		
3	RXD	D+
4	RTS	
5	TXD	
6	CTS	
7		
8		
9	GND	GND

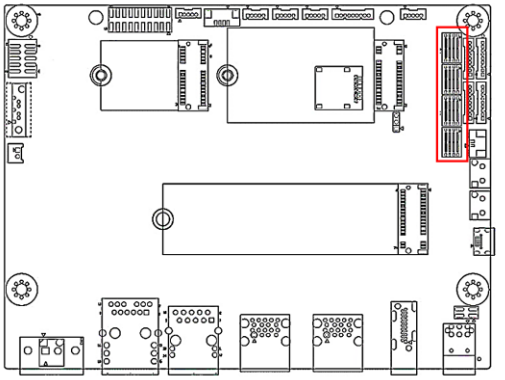
2.4.15 CANBus Connector (CN15)

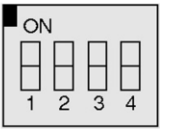




Pin	Signal
1	CAN0_H
2	CAN0_L
3	CAN1_H
4	CAN1_L
5	GND

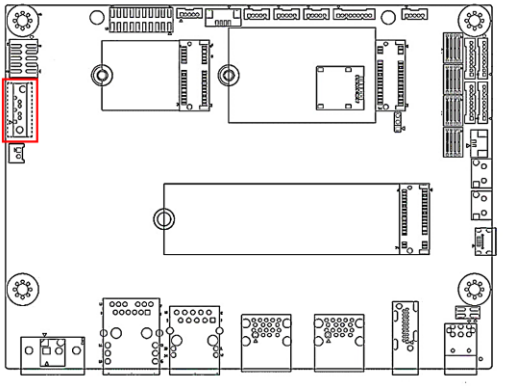
2.4.16 RS-232/422/485 Select (SW1/SW2/SW3/SW4)

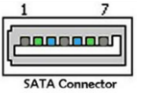




Mode	S-1	S-2	S-3	S-4
1T/1R RS-232	On	On	Off	
1T/1R RS-485	On	Off	Off	
Low power shutdown	Off	Off	Off	
250kbps for RS-232 and RS-485				On
RS-232 to 1.5Mbps and RS-485 to 10Mbps				Off

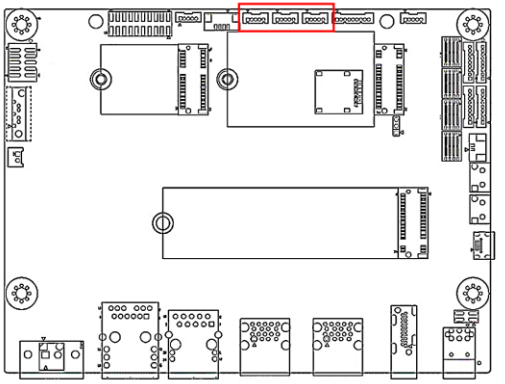
2.4.17 SATA Connector (CN27)

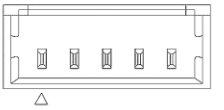




Pin	Signal
1	GND
2	TX+
3	TX-
4	GND
5	RX+
6	RX-
7	GND

2.4.18 USB 2.0 Connector (CN22/CN23/CN24)

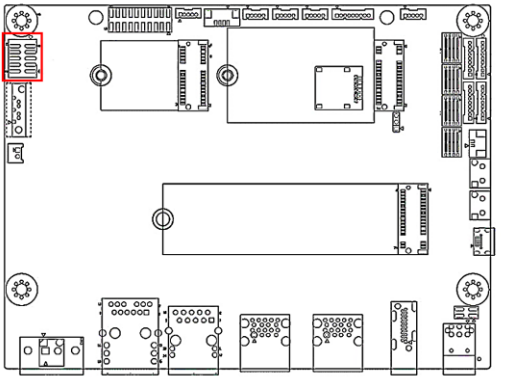


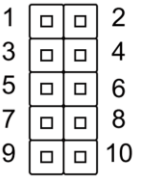


Pin	Signal
1	+5V

Pin	Signal
2	D-
3	D+
4	GND
5	GND

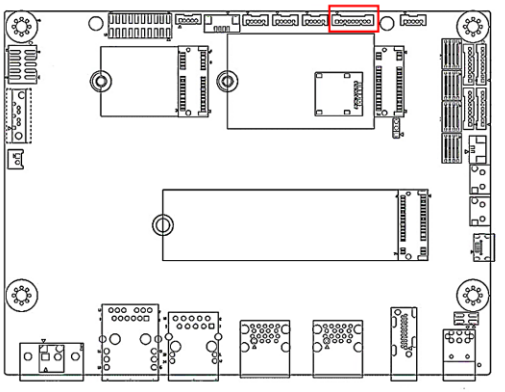
2.4.19 Audio Connector (CN6)

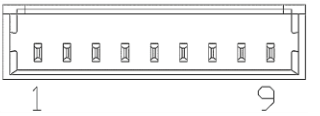




Pin	Signal	Pin	Signal
1	MIC1	2	GND
3	MIC2	4	
5	HPO_R	6	MIC_IN_DET
7	GND	8	
9	HPO_L	10	PHONE_DET

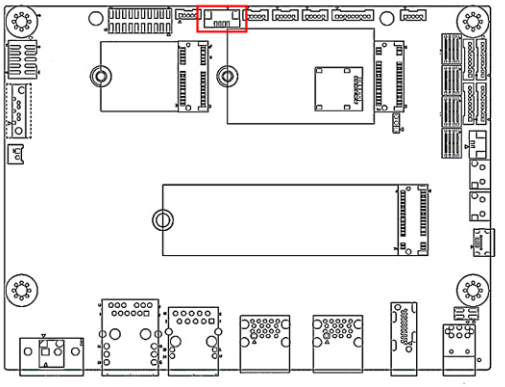
2.4.20 DIO Connector (CN9)

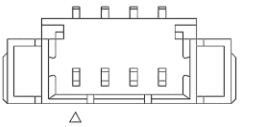




Pin	Signal
1	PA.02
2	PA.01
3	PAA.04
4	PAA.07
5	PBB.00
6	PBB.01
7	PA.03
8	PA.00
9	GND

2.4.21 Fan Connector (CN20)





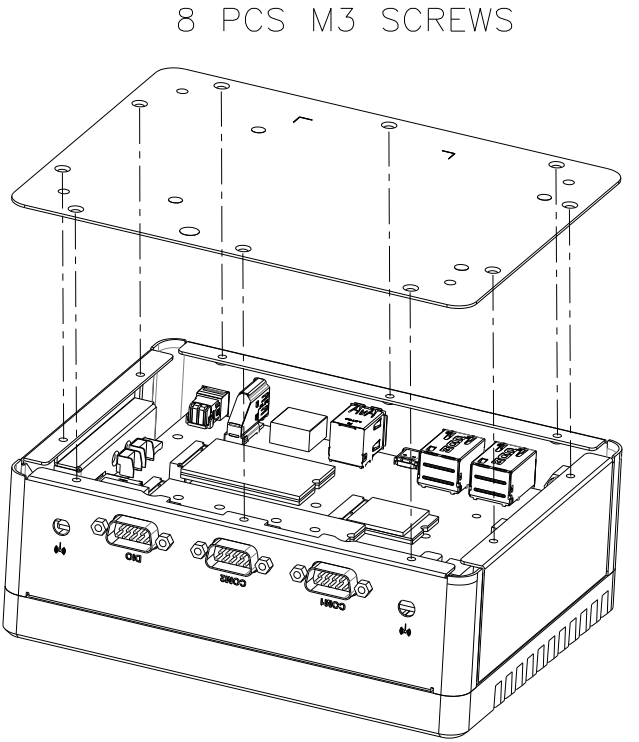
Pin	Signal	Pin	Signal
1	GND	2	Power(+12V)
3	FAN_TACH	4	FAN_PWM

2.5 Hardware Assembly

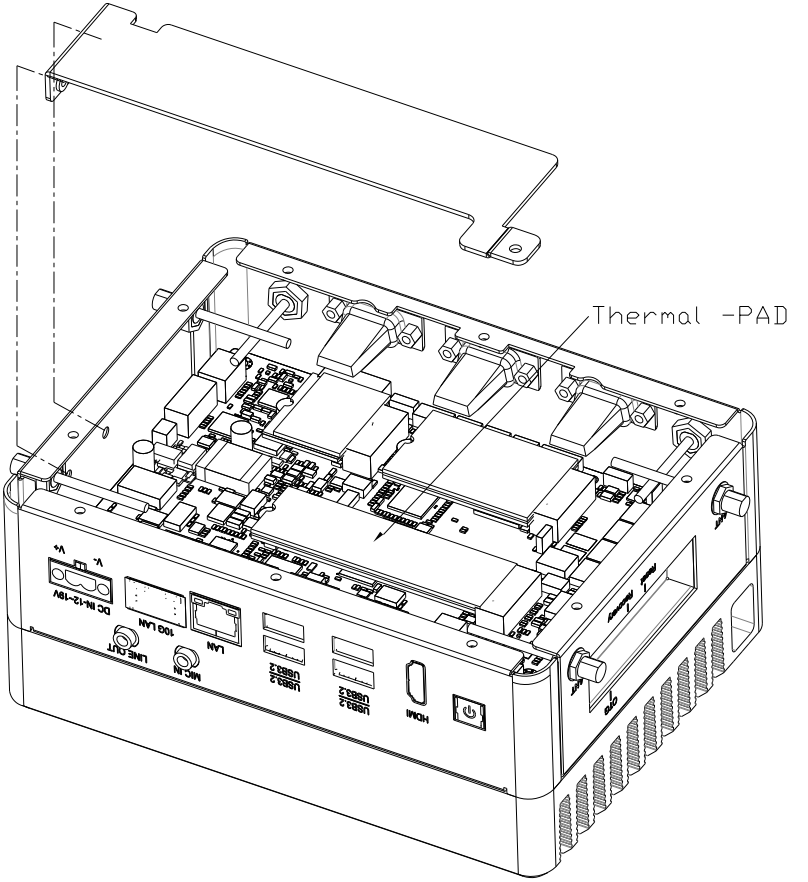
This section details the steps needed to install various hardware components for the BOXER-8641AI Plus.

2.5.1 M.2 Expansion Module Installation

The M.2 2280 M-Key, M.2 2230 E-Key, and M.2 3052 B-Key slots can be accessed via removable covers on the bottom panel of the BOXER 8641AI Plus system as shown in the following diagram.

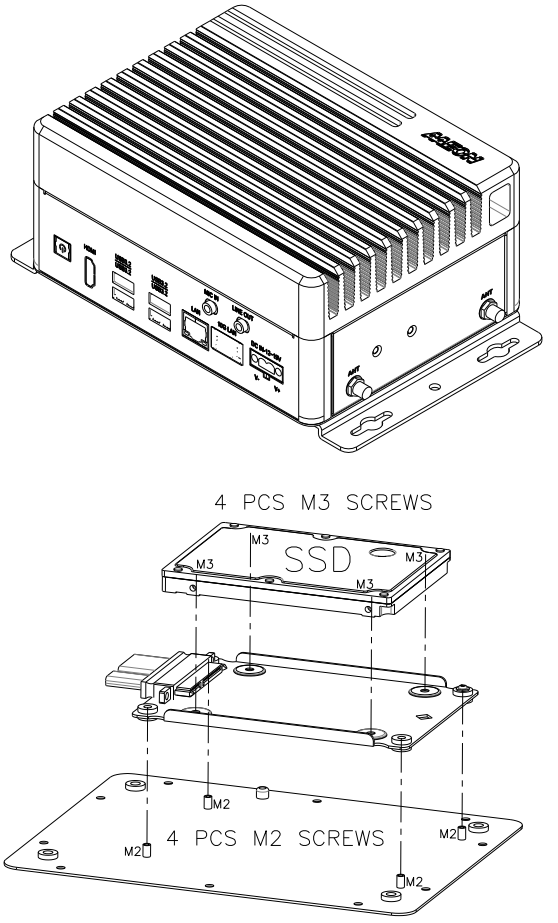


When installing the M.2 2280 M-Key, please ensure a thermal pad is used, as illustrated below.



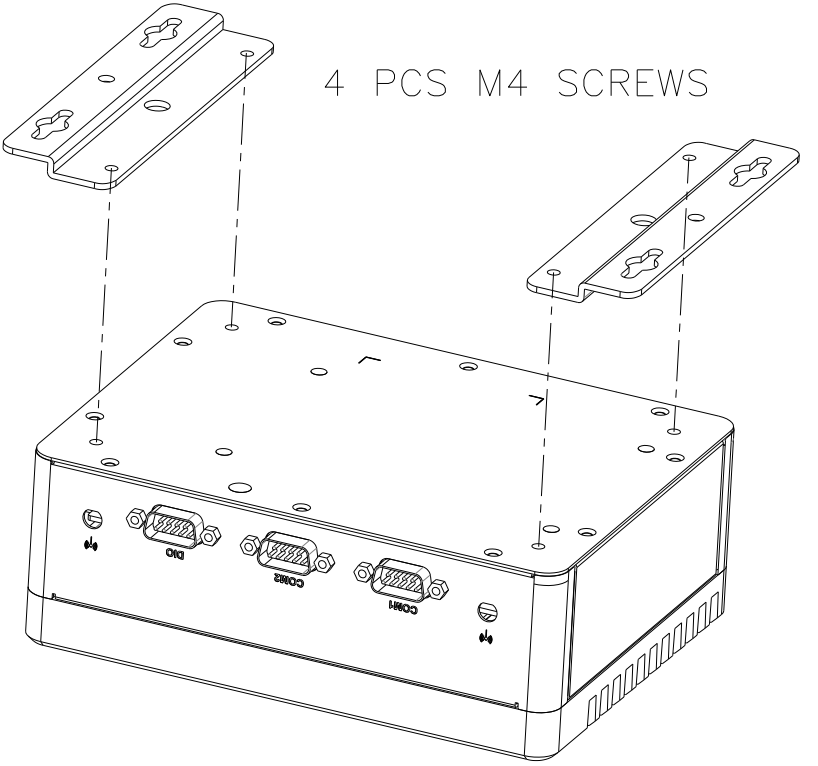
2.5.2 2.5″ HDD or SSD Installation

The 2.5″ HDD or SSD drive bay can accessed for drive installation via removable covers on the bottom panel of the BOXER 8641AI Plus system as shown in the following diagram.



2.5.3 Wall Mount Installation

The BOXER 8641AI Plus can be secured via a wall mount as shown in the following diagram.



Chapter 3

BSP Flash Guide

3.1 Before Installation

Before starting the process, make sure your BOXER-8641AI Plus system is turned off and the power in is disconnected. You will need a Host PC running Ubuntu 20.04/22.04, and make sure the NVIDIA Jetson Orin AGX module is installed on the BOXER-8641AI Plus carrier board system.

Note: Do not use a virtual machine as a host PC, since some virtual machine may have un-stable USB connection which may cause flash procedure fail.

Download the compressed BSP image file "**BOXER_8641AI-B1_J6.0_A00_1.0.3_20241225.tar.gz"** into Host Ubuntu 20.04/22.04 PC directory

Note: No spaces, special characters, or non-English characters can be used for the name of the folder where the file is stored, or its parent folder.

Ensure the language settings of Ubuntu 20.04/22.04 are set to English, and the format setting is the United States, to prevent flash failure.

3.2 Connecting to PC/ Force Recovery Mode

Step 1:

On Host Computer, open Linux terminal and enter the following command to extract compressed BSP image files (BSP file name may vary):

```
$ sudo tar -zxvf BOXER_8641AI-B1_J6.0_A00_1.0.3_20241225.tar.gz
```

Note: Do not decompress the file (Internal.tar.gz) using a Windows OS, BSP should only be decompressed in a Linux EXT3/4 file system.

Step 2:

Perform the following actions to force the system to start in USB Recovery Mode:

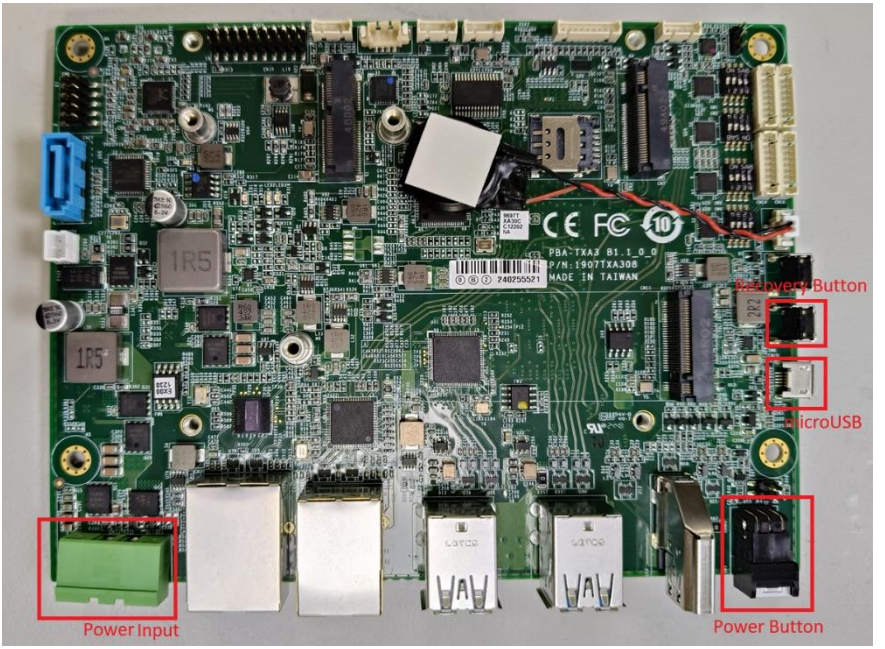
1. Connect the Micro-USB plug on the USB cable to the Recovery Port on the BOXER-8641AI Plus, and the other end to an available USB port on the Host PC.
2. Connect the BOXER-8641AI Plus to a power supply.
3. Press and hold the recovery key button. While holding the recovery key button, power on the system, and continue to hold the recovery key button for two seconds, then release. The BOXER-8641AI should then enter recovery mode.
4. To check if device is in recovery mode, enter the command lsusb in terminal on Host.

```
$ lsusb | grep "0955:7523"
```

If successful, the command will return "0955:7523 Nvidia Corp"

```
Bus 001 Device 018: ID 0955:7523 NVidia Corp.
```

Note: Recovery mode cannot be initiated if the NVIDIA Jetson Orin AGX module is disassembled. Ensure the NVIDIA Jetson Orin AGX module is installed and refer to the image below to perform the steps:



3.3 Flash Image to Board

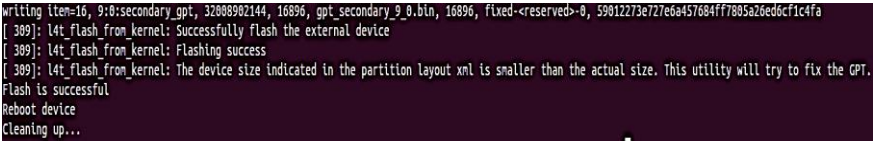
Use the following steps to flash the OS to the BOXER-8641AI Plus.

1) Open terminal on the Ubuntu Host PC, then access the folder you extracted in the previous section.

2) Enter the following command in terminal to flash the image:

```
$ ./flashboxer.sh    emmc
```

3) Wait as the image is installed. Once complete you should see the following:



3.4 Check BSP Version

Once the flash image is successfully installed, the BOXER-8641AI Plus will reboot automatically, then check the BSP version to see if the system is flashing the correct version of BSP.

Open a Terminal, and type command "**cat /proc/product**"

```
aaeon@localhost:~$ cat /proc/product
BOXER-8641AI_J5.0.2_E00_1.0.0_20220817
BOXER-8641AI.Ubuntu20.04_AGXORINJP5.0.2_V1.0.0_17/08/2022
```

The version name will follow the format of:

{PJ_IF}. {OS_IF}_{PLF_IF}{JPV_IF}_{IMGV_IF}_{BD_IF}

For example:

BOXER-8641AI-B1_J6.0_A00_1.0.3_20241225

Note: Filename may differ from this example.

{PJ_IF} is Project Information; e.g. BOXER-8641AI-B1

{IMGV_IF} is Build Version; e.g. 1.0.3

{JPV_IF} is Jetpack Version; e.g. J6.0

{BD_IF} is Build Date; e.g. 20241225

Chapter 4

OS User Guide

4.1 Introduction

The BOXER-8641AI Plus OS, Ubuntu/Linux version, and preinstalled SDK components are as follows:

For Jetpack 6.0 (l4t 36.3)

1. Jetpack 6.0, L4T 36.3.0
    a. Ubuntu version: 22.04.4
    b. Kernel version: 5.15.136-tegra
    c. UEFI version: 36.3.0-gcid-36191598
2. Pre-installed NV components, deepstream
    a. CUDA 12.2.1
    b. cuDNN 8.9.4
    c. TensorRT 8.6.2
    d. OpenCV 4.8
    e. Vulkan 1.3
    f. VPI 3.1
    g. NVIDIA Container Runtime 2.1
    h. Multimedia API 36.3.0
    i. Nsight Systems 2024.2
    j. Nsight Graphics 2023.4
    k. Nsight Perf SDK 2023.5
3. Deepstream 7.0

Built-in Allxon DMS:

    a. Please refer to vendor website at https://www.allxon.com/solutions

Default login user/password is:

Account: aaeon

Password: aaeon.

4.2 Update Note

Running **$ sudo apt upgrade** command in terminal will overwrite the **Aaeon kernel device tree(.dtb)/kernel image(Image)/bootloader** in the OS, which can lead to unexpected results, including the loss of I/O ports.

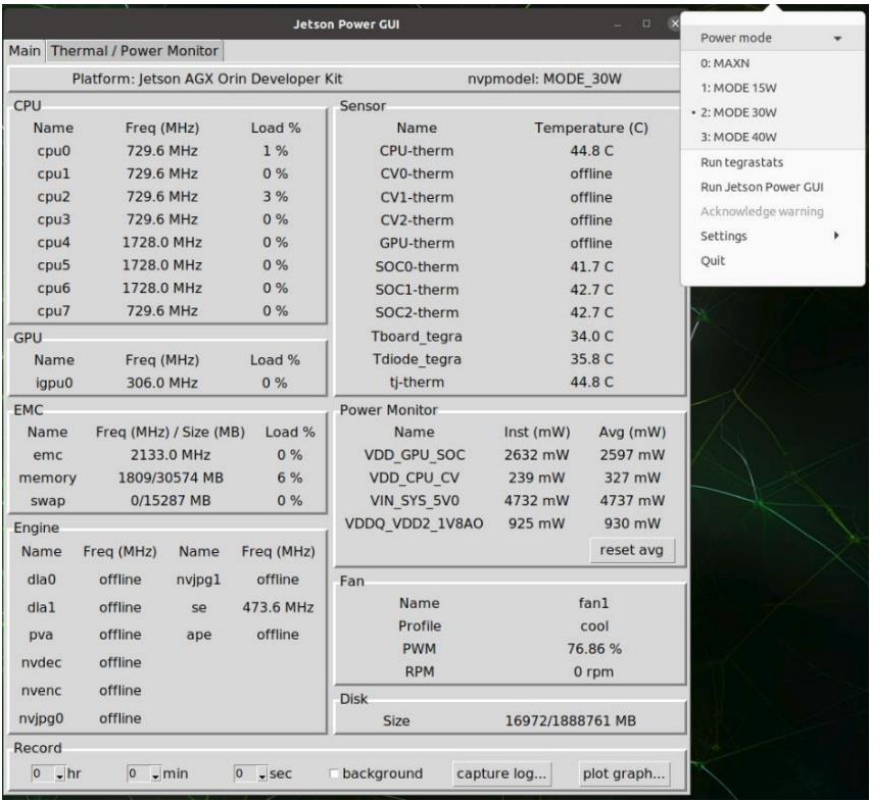
So Aaeon default disable Nvidia apt Repo for updating Nvidia apt package.

AAEON maintains updated versions of BSP on the product page, which follow updates to the NVIDIA Jetpack software. Contact your AAEON representative or visit the product page to download the latest version of Aaeon BSP for your system:

https://www.aaeon.com/en/product/detail/ai-edge-solutions-boxer-8641ai-plus/download

4.3 BOXER-8641AI Plus Power Mode

NVIDIA Jetson Orin AGX power mode can be selected and monitored by GUI, please refer to the following picture:



Note: Power mode is dependent on DRAM size. For more detailed information please visit: https://developer.nvidia.com/embedded/jetson-modules

4.4 BOXER-8641AI Plus GPIO Test Command

Please refer to the **Hardware DIO/GPIO section** for pin numbers and GPIO ID mappings.

For example, on **JP6**, "PIN 1" maps to "GPIO ID: PA.02."

GPIO Test Command:

1. Set GPIO to 0

- Run the following command to set GPIO PA.02 to 0:

```
$ sudo gpioset -m time -u 300000 -b $(sudo gpiofind "PA.02")=0
```

2. Read the input value of GPIO

- Run the following command to read the input value of GPIO PA.02:

```
$ sudo gpioget $(sudo gpiofind "PA.02")
```

Note: For JP6, there is no need to manually export and set the direction of the GPIO. When using gpioget, the direction will automatically change to input, and similarly, when using gpioset, the direction will change to output.

FAN PWM Test Command

If the customer wants to use FAN PWM for normal PWM control, follow the steps below:

1. Stop the NV Fan Control Daemon

- Stop the NV fan control service with the following command:

```
$ sudo systemctl stop nvfancontrol
```

2. Set PWM value

To set the PWM duty cycle, run the following command:

```
$ echo [PWM_duty_cycle] > sys/devices/platform/pwm-fan/hwmon/hwmon<x>/pwm1
```

Where: [PWM_duty_cycle] is a value in the range [0, 255]. <x> is the kernel-enumerated number for the fan hwmon.