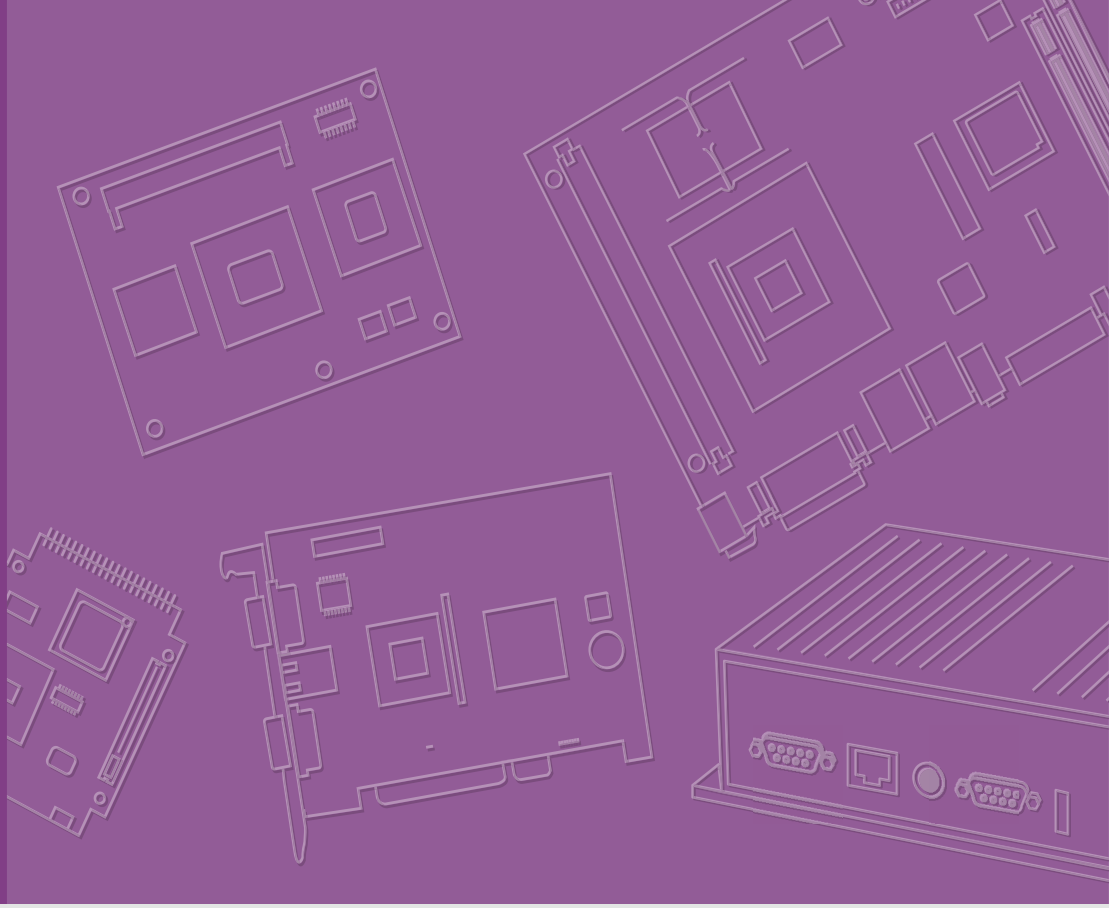


User Manual

ASR-D501

Qualcomm® Dragonwing™ QCS6490 SBC

ADVANTECH

Enabling an Intelligent Planet

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This manual is for the ASR-D501.

Part No. 2006D50100 Edition 1
Printed in China September 2026

Product Warranty (2 years)

Advantech warrants the original purchaser that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers will be billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product to be defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandize authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This type of cable is available from Advantech. Please contact your local supplier for ordering information.

Test conditions for passing also include the equipment being operated within an industrial enclosure. In order to protect the product from damage caused by electrostatic discharge (ESD) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for assistance.

Caution! *There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manflatterer. Discard used batteries according to the manufacturer's instructions.*



Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before calling:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Packing List

Before system installation, check that the items listed below are included and in good condition. If any item does not accord with the list, contact your dealer immediately.

- 1 x ASR-D501 SBC
- 1 x Passive Heatsink P/N: 1970006381T001
- 1 x 2P Plug-in Block P/N: 1652002024

Optional Accessories

Part number	Description
TBD	Heatspreader
1970006379T001	Active Cooler
170P000036-01	COM Cable D-SUB 9P(M)/1*6P-1.25 20cm
170P000037-01	CANBus Cable D-SUB 9P(M)/1*4P-1.25 20cm
170P000038-01	GPIO Cable D-SUB 9P(F)/1*10P-1.25 20cm
1700025149-11	LAN cable RJ45-8P8C(F)/1x14P-1.25 22cm
1700036505-01	Mini DP to DP cable 0P(M)/DP 20P(M) CB803E-4000-10F
AIW-356	5G (Sub-6G)/LTE/WCDMA module, with GNSS
AIW-170BQ-001	Wi-Fi 6E + BT 5.3, WCN6856/QCA2066, 2T2R, M.2 2230 E key

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Chapter 1

General Introduction

This chapter gives background information on the ASR-D501

Sections include:

- Introduction
- Specifications
- Block diagram

1.1 Introduction

The ASR-D501 is a compact companion/mission computer designed for drone applications. Based on Advantech's compact form factor, the board measures 100 × 60 mm and features the Qualcomm® Dragonwing™ QCS6490 platform, supporting an extended operating temperature range of -20°C to 70°C.

The ASR-D501 delivers powerful yet low-power performance with an 8-core Kryo™ 670 CPU running from 1.9 GHz up to 2.7 GHz, an integrated Adreno™ 643 GPU, and up to 12.3 TOPS iNPU performance.

Designed for rugged applications, the board features 8GB of onboard LPDDR5 memory and 128GB of UFS storage. I/O interfaces include Mini DisplayPort, one 2.5GbE port, two CAN-FD interfaces, two USB Type-C ports, two I2C interfaces, three UART interfaces, and five MIPI-CSI interfaces. Expansion options include M.2 E-Key and M.2 B-Key slots.

The ASR-D501 supports Ubuntu and is compatible with the Advantech Robotic Suite, including ROS 2 and MAVLink/MAVROS/MAVSDK integration.

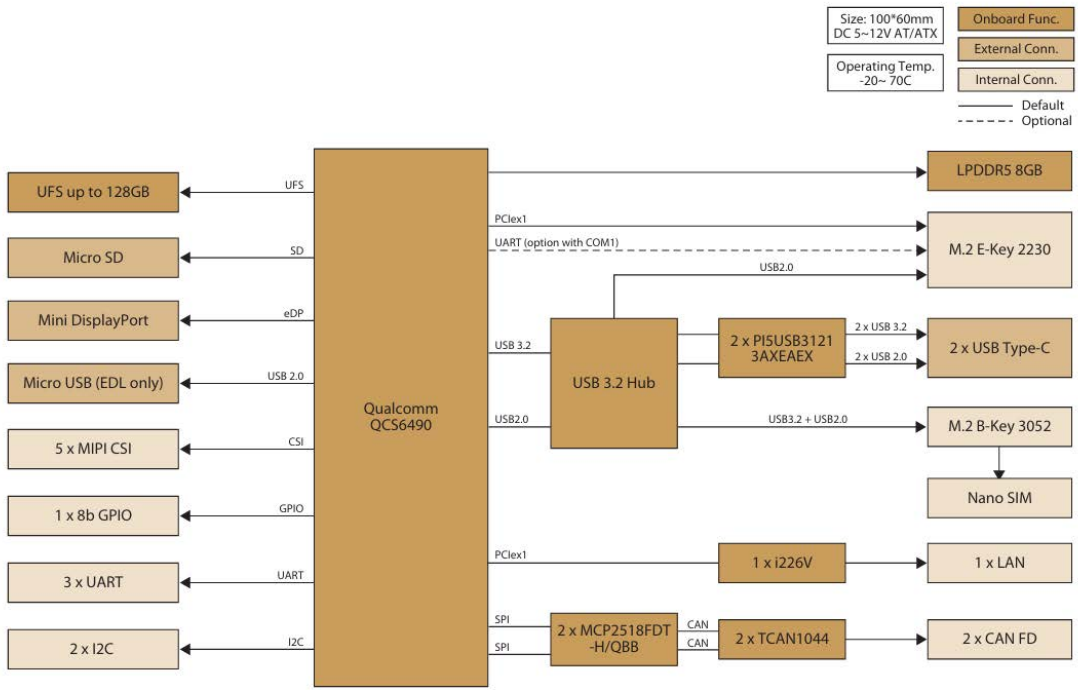
1.2 Specifications

Table 1.1: Specifications

CPU	SoC	QCS6490
	Clock Speed	1 x A78 @ 2.7 GHz, 3x A78 @ 2.4 GHz, 4 x A55 @ 1.9 GHz
	Number of CPU Cores	8
Memory	Technology	LPDDR5 8533MT/s
	Max. Capacity	Up to 8GB
Storage	UFS	Up to 128GB
GPU & AI	GPU	Adreno™ 643
	Clock Speed	Up to 812 MHz
	AI DSP	Hexagon™ 770
	Clock Speed	1.45 GHz
Display I/F	LCD	1 x eDP1.4, up to 4096 x 2160 @60Hz
	Single Display	Mini DisplayPort
Ethernet	Controller	i226V
	Speed	2.5 GbE (GH connector)
External I/O	Mini DisplayPort	1
	Micro SD	1
	USB Type-C	2 x USB3.2 Gen. 2 (10Gbps)
	Micro USB	1 (for EDL only)
Internal I/O	Serial Bus	2 x I2C
	UART	3 x UART 3.3V
	MIPI-CSI	5 x 4-Lane MIPI-CSI
	GPIO	8-bit general purpose input output I/O
	CANBus	2 x CAN-FD
	Front Panel Control	External Power Button, and 3.3V

Table 1.1: Specifications		
Board Features	Security	Qualcomm® Trusted Execution Environment (TEE) v5.3
Expansion	M.2 E-Key	1 x E-Key 2230 (PCIe x1, USB2.0)
	M.2 B-Key	1 x B-Key 3052 (USB3.2 Gen1, USB 2.0) w/ Nano-SIM
Power	Supply Voltage	Vin: DC 5V~12V; RTC Battery: Lithium 3V/ 200mAH, support w/o CMOS Battery
	Connector	2-pin Phoenix connector
	Power Management	AT, ATX
	Max. Consumption (*Ref. data. Contact FAE for adapter selection.)	TBD
	Idle Consumption	TBD
Environment	Temperature	Operating: Extend: -20~70°C (-4~158°F) with 0.7m/s airflow Storage: -40 ~ 85°C (-40 ~ 185°F)
	Humidity	Operating: 40°C @ 95% relative humidity, non-condensing Storage: 60°C @ 95% relative humidity, non-condensing
	Vibration Resistance	3.5 Grms
Certification	EMC	CE, FCC Class B, ESD 8KV/15KV Criteria A
Mechanical	Dimensions	100 x 60 mm (3.9" x 2.4")
	Net Weight	50g (without Heatsink)
Operating system	Linux	Ubuntu 24.04

1.3 Block Diagram



Chapter 2

Mechanical

This chapter gives mechanical information on the ASR-D501

Sections include:

- Mechanical Drawing
- Assembly Drawing

2.1 Introduction

This ASR-D501 compact form factor SBC features a variety of mechanical improvements. The following is a quick installation guide for Advantech's thermal solution. This chapter comprises assembly instructions for standard and optional thermal solutions as well as board dimension diagrams.

2.2 Board Layout: Dimensions

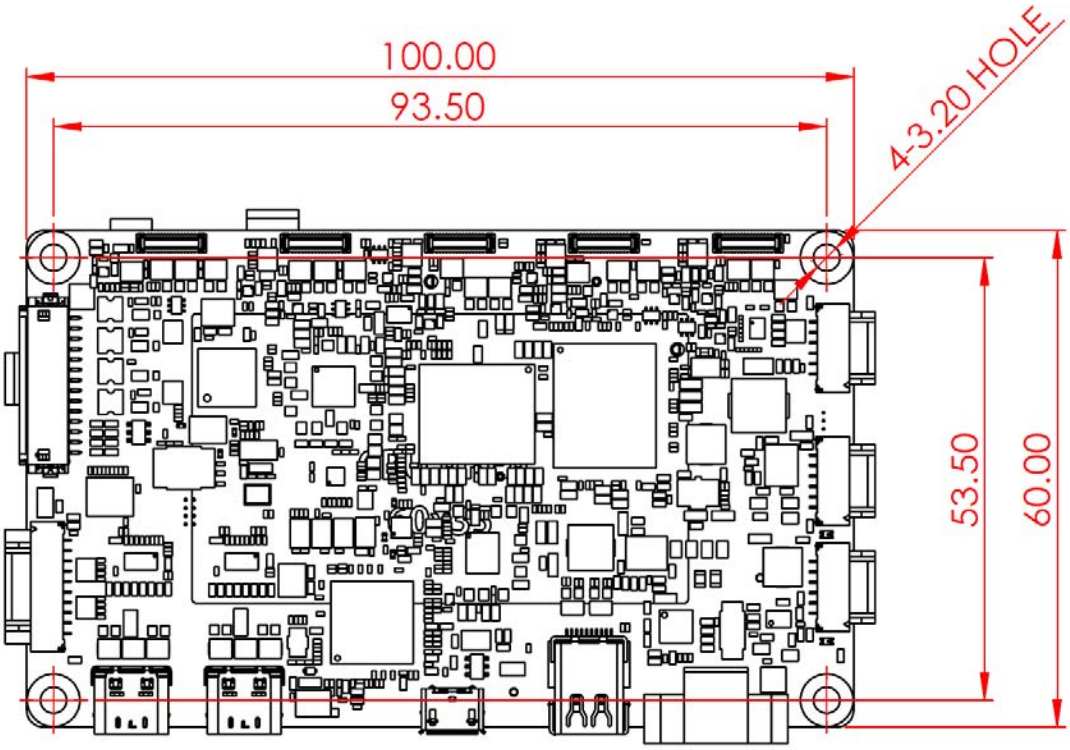


Figure 2.1 ASR-D501 Mechanical Drawing (Top Side)

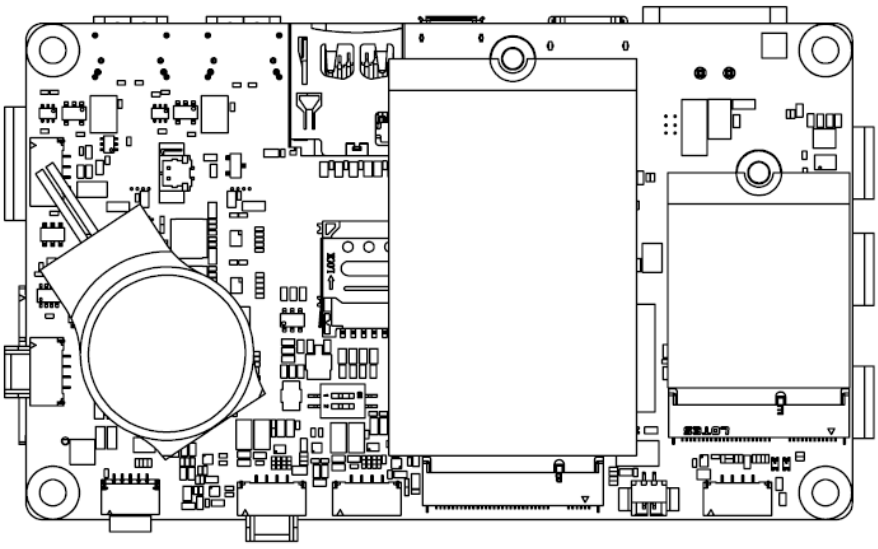


Figure 2.2 ASR-D501 Mechanical Drawing (Bottom Side)

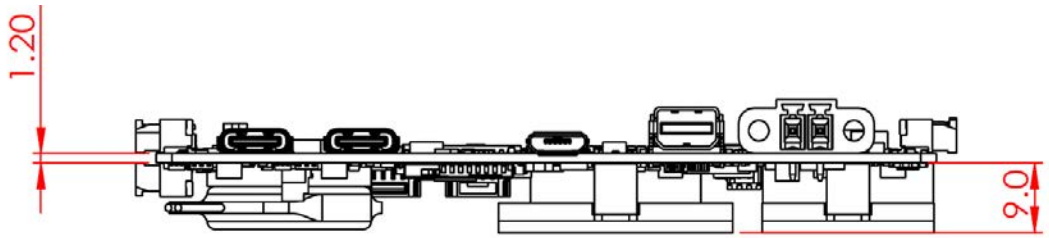


Figure 2.3 ASR-D501 Mechanical Drawing (Coastline)

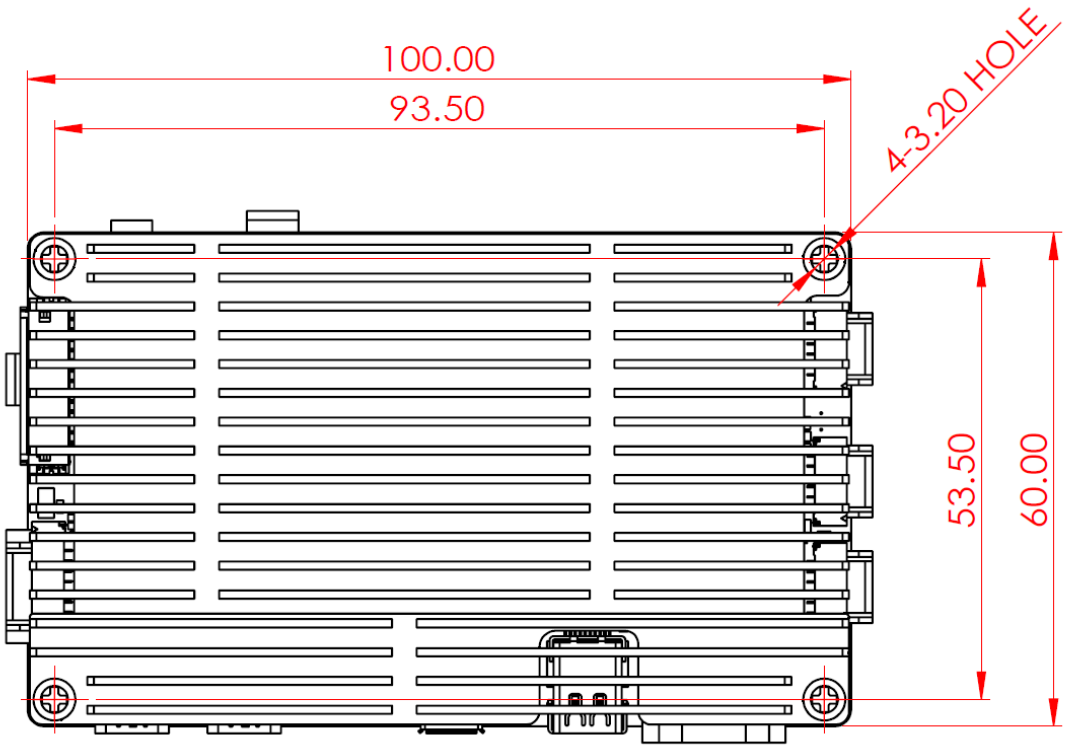


Figure 2.4 Mechanical Drawing with Heatsink (Top Side)

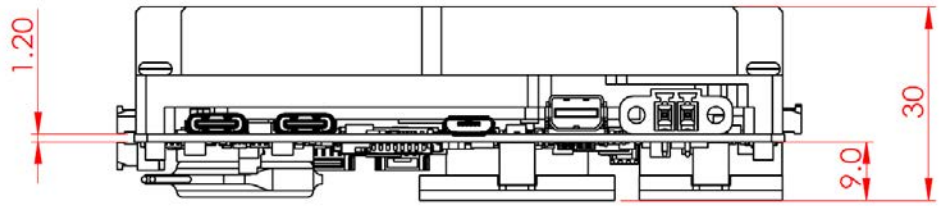


Figure 2.5 ASR-D501 Mechanical Drawing with Heatsink (Coastline)

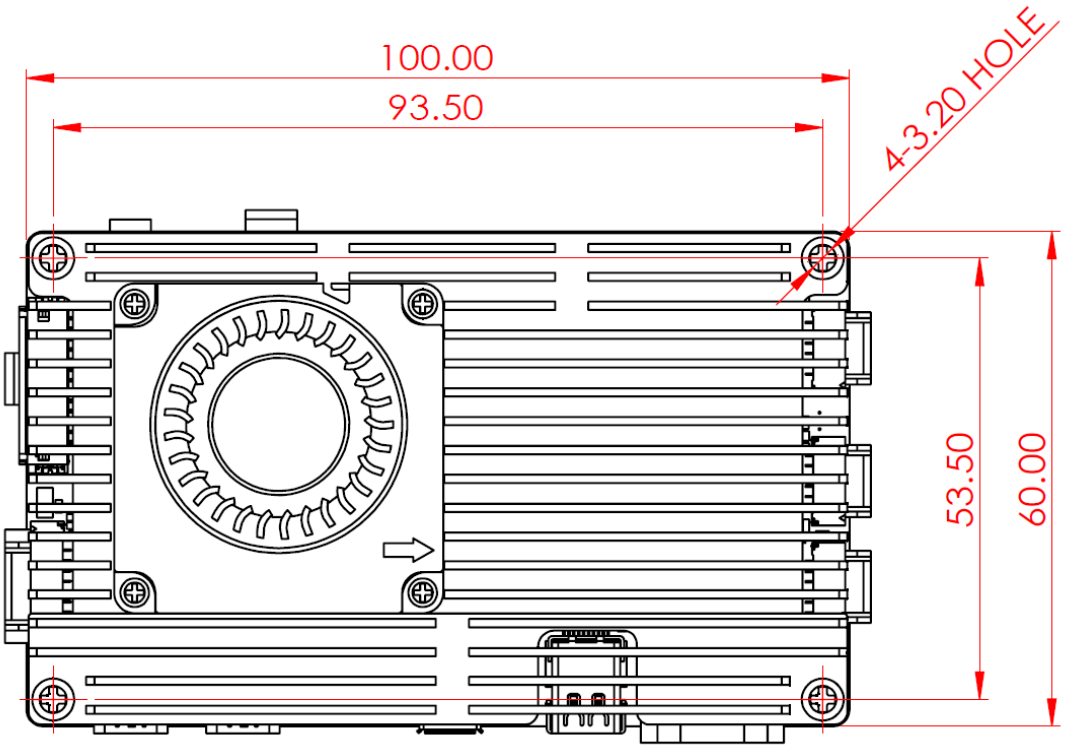


Figure 2.6 ASR-D501 Mechanical Drawing with Active Cooler (Top Side)

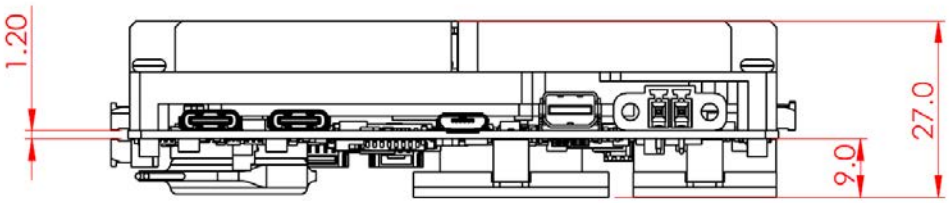
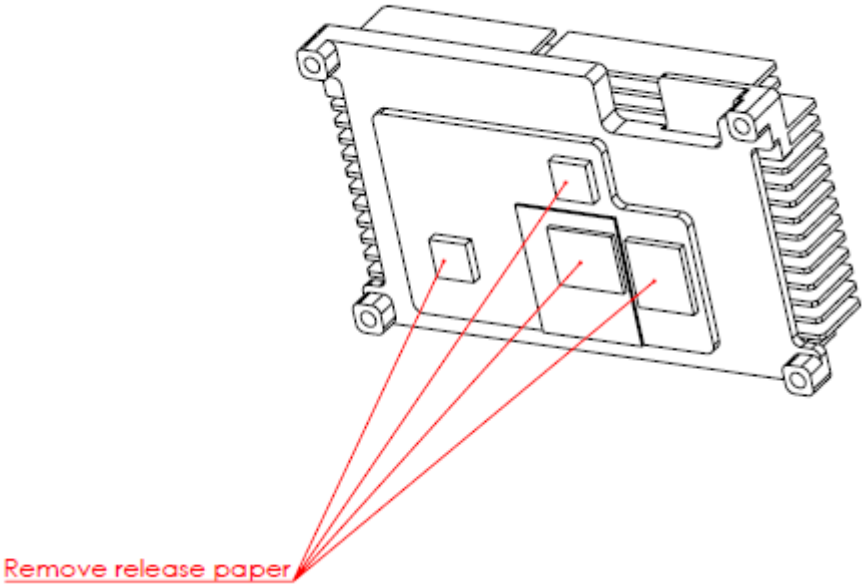


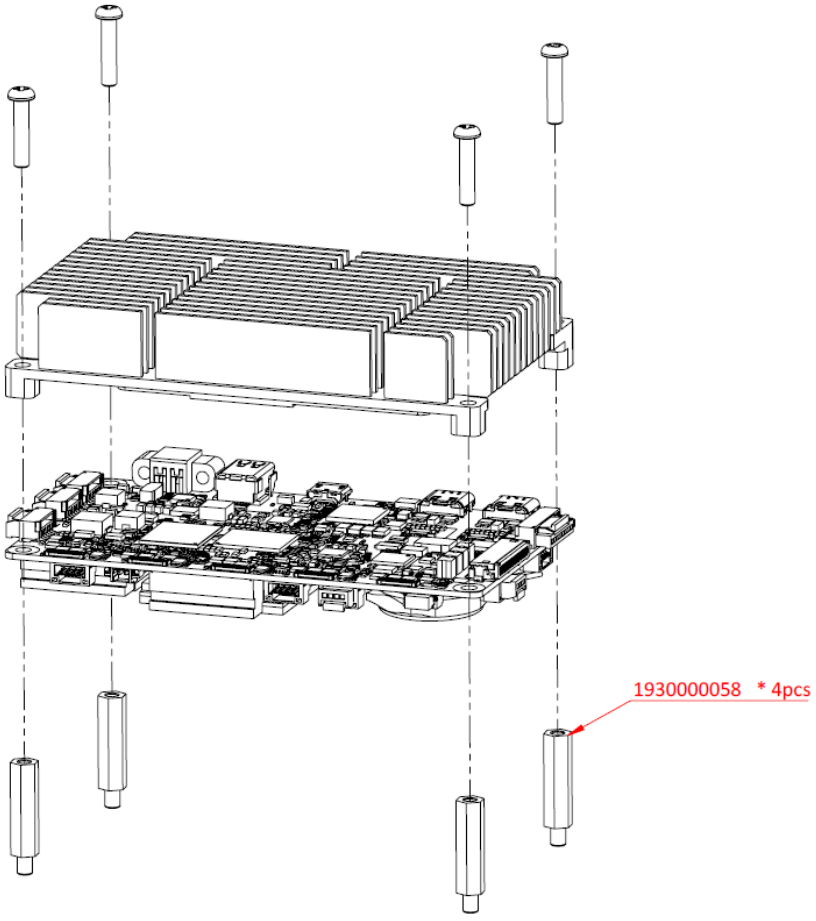
Figure 2.7 ASR-D501 Mechanical Drawing with Active Cooler (Coastline)

2.3 Quick Installation Guide

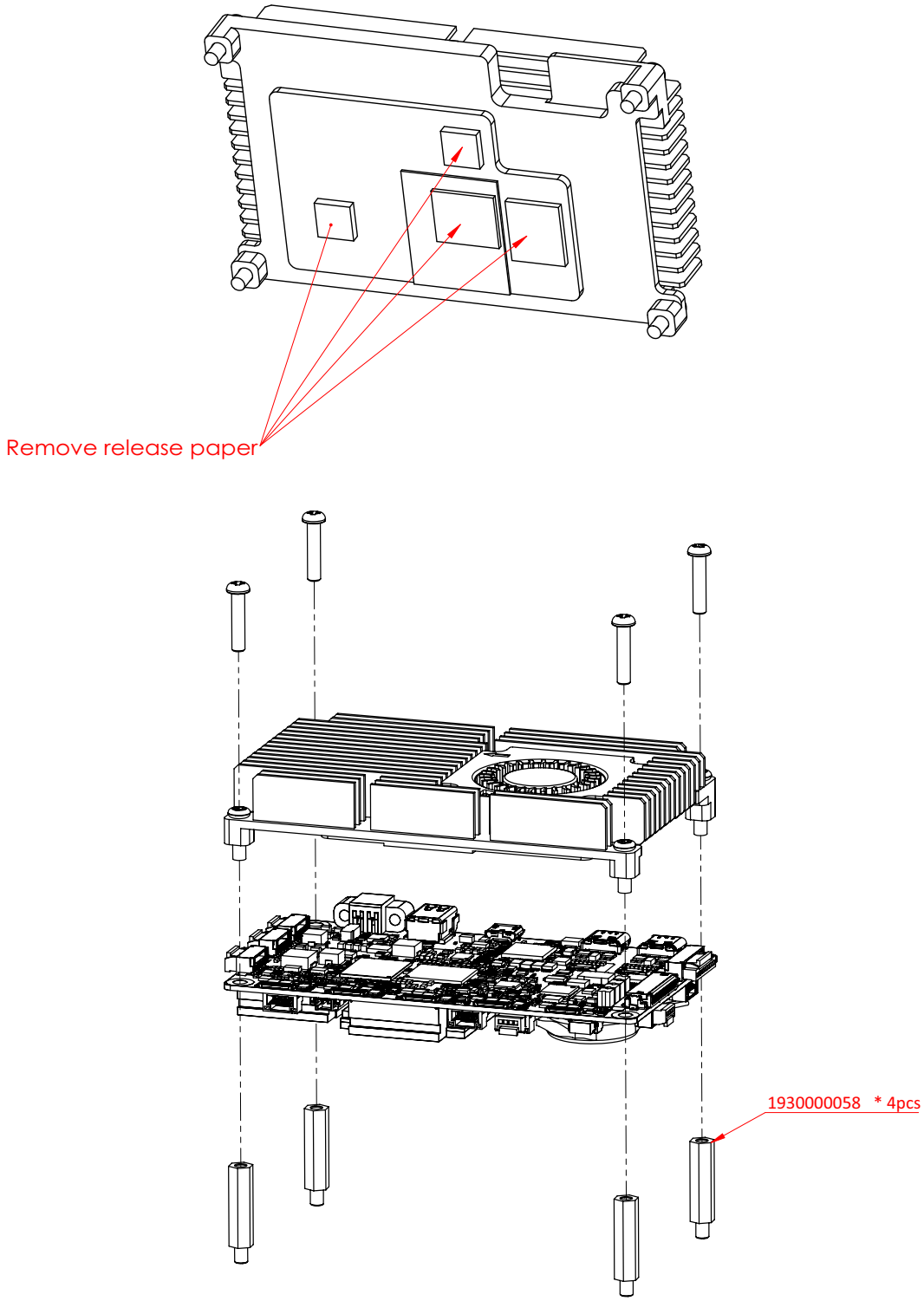
There is a Heatsink (or optional active cooler) in the white box inside the package. Follow the exploded diagram below to assemble it.

2.3.1 Heatsink





2.3.2 Cooler



Chapter 3

Installation

This chapter explains the setup procedures of the ASR-D501 hardware, including instructions on setting jumpers and connecting peripherals, switches and indicators. Be sure to read all safety precautions before you begin the installation procedure.

3.1 Jumpers & Switches

The ASR-D501 has a number of jumpers that allow you to configure your system to suit your application. The table below lists the functions of the various jumpers.

Table 3.1: Jumpers & Switches

No.	Description	Location Name
1	Multi-function Switch	SW2

3.2 Connectors

Onboard connectors link the ASR-D501 to external devices such as hard disk drives, a keyboard. The table below lists the function of each of the board's connectors.

Table 3.2: Connector and Header List

No.	Description	Location Name
1	DC Input Connector	DCIN1
2	GPIO Connector	GPIO1
3	LAN Connector	LAN_CN1
4	Camera Connector	CAM1
5	Camera Connector	CAM2
6	Camera Connector	CAM3
7	Camera Connector	CAM4
8	Camera Connector	CAM5
9	UART Connector	COM1
10	UART Connector	COM2
11	UART Connector	COM3
12	Mini Display port	DP1
13	USB Type C	TYPEC2
14	USB Type C	TYPEC1
15	Front Panel Connector	FP1
16	FAN connector	FAN1
17	M.2 Key B (USB3.2 Gen1/USB2.0)	M2B_CN1
18	I2C Connector	I2C2
19	I2C Connector	I2C1
20	Debug Connector	Debug1
21	CAN Bus Connector	CAN1
22	CAN Bus Connector	CAN2
23	RTC Battery Connector	BAT1
24	M.2 Key E (PCIe x1/USB2.0)	M2E_CN1
25	SIM Slot	SIM1
26	SD Card	SD_CARD1

3.3 Locating Connectors

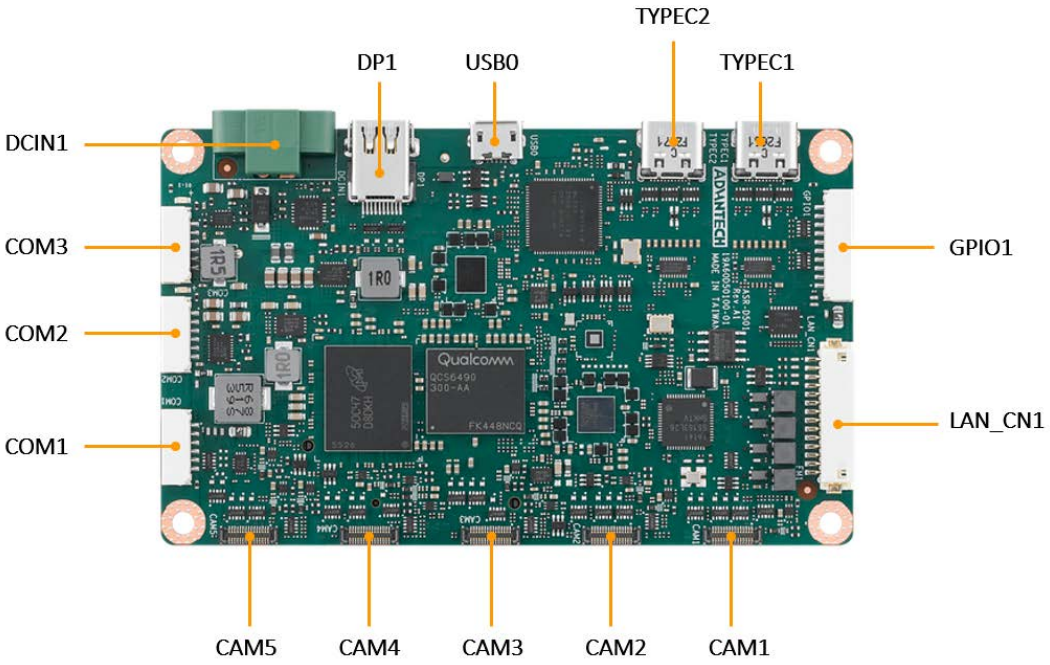


Figure 3.1 ASR-D501 Connector Locations (Top Side)

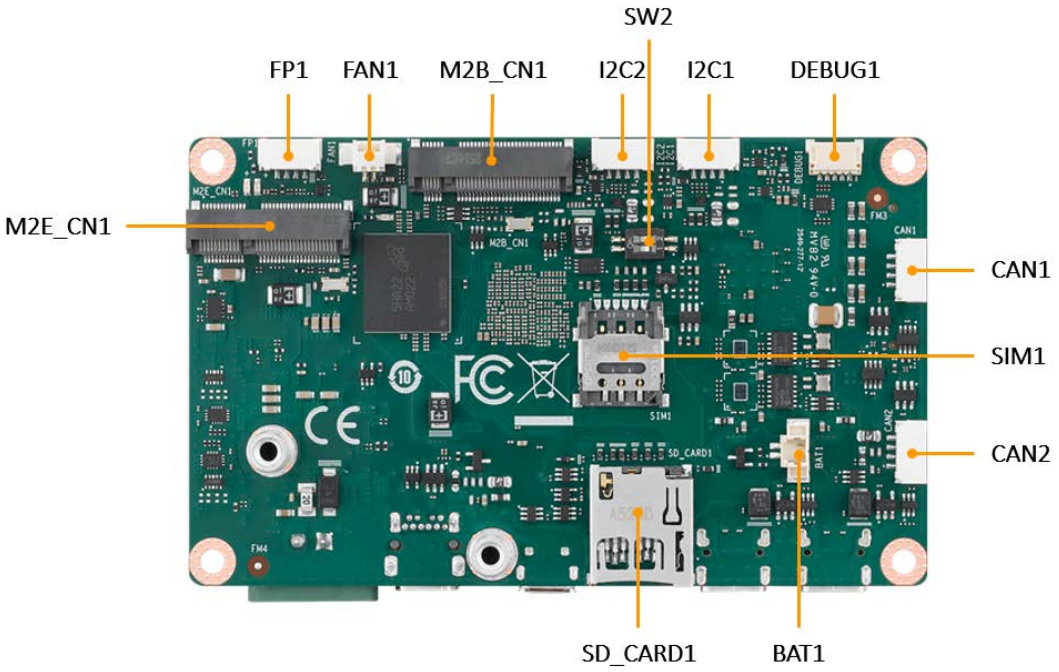


Figure 3.2 ASR-D501 Connector Locations (Bottom Side)

3.4 Jumpers & Switches

Table 3.3: Multi-function Switch		
Function	**Switch Setting**	
AT/ATX election		
	ATX mode	AT mode
USB download		
	Normal	USB Download

3.4.1 Auto Power On Selection Switch: AT/ATX Selection

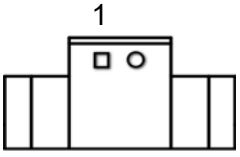
Table 3.4: Auto Power On Selection Switch: AT/ATX Selection		
Function	**Switch Setting**	
2: AT/ATX slection		
	ATX mode	AT mode

3.4.2 USB Download Switch

Table 3.5: USB Download Switch		
Function	**Switch Setting**	
1: USB Download		
	Normal	USB Download

3.4.3 DC Input Connector

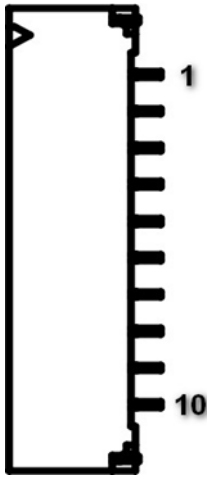
Table 3.6: DC Input Connector	
Pin	**Signal Pin Definition**
1	GND
2	+VDCIN



3.4.4 GPIO Connector

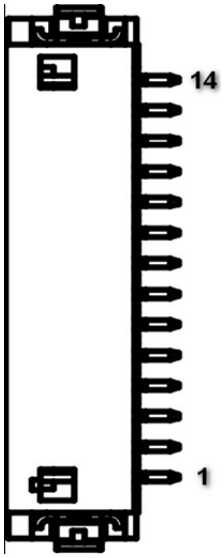
Table 3.7: GPIO Connector

Pin	Signal Pin Definition
1	+V3.3_GPIO
2	GPIO1
3	GPIO2
4	GPIO3
5	GPIO4
6	GPIO5
7	GPIO6
8	GPIO7
9	GPIO8
10	GND



3.4.5 LAN Connector

Table 3.8: LAN Connector	
Pin	**Signal Pin Definition**
1	LAN1_LINK1000#
2	LAN1_LINK100#
3	LAN1_ACT#
4	+V3.3_LAN1
5	NC
6	NC
7	LAN1_MDI3-
8	LAN1_MDI3+
9	LAN1_MDI2-
10	LAN1_MDI2+
11	LAN1_MDI1-
12	LAN1_MDI1+
13	LAN1_MDI0-
14	LAN1_MDI0+



3.4.6 CAM Connector

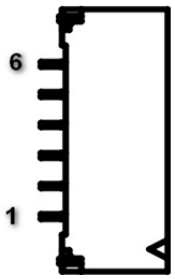
Table 3.9: CAM Connector

Pin	Signal Pin Definition
1	NC
2	NC
3	+V2.8_AVDD_CAM
4	NC
5	CAM_RESET#
6	GND
7	CSI_D2+
8	CSI_D2-
9	GND
10	CSI_D0+
11	CSI_D0-
12	GND
13	CSI_D3+
14	CSI_D3-
15	CAM_PWR_SWITCH
16	GND
17	CSI_D1-
18	CSI_D1+
19	GND
20	CSI_CK-
21	CSI_CK+
22	GND
23	CAM_MCLK
24	GND
25	CAM_SCL
26	CAM_SDA
27	CAM_PWDN
28	+V1.8_DOVDD_CAM
29	NC
30	+V1.2_DVDD_CAM



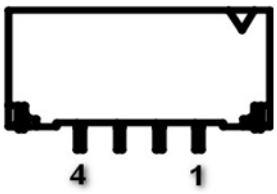
3.4.7 UART Connector

Table 3.10: UART Connector	
Pin	**Signal Pin Definition**
1	+V3.3_COM
2	UART_TX
3	UART_RTS#
4	UART_RX
5	UART_CTS#
6	GND



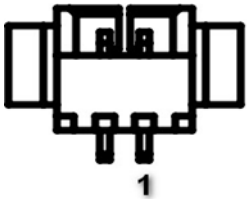
3.4.8 Front Panel Connector

Table 3.11: Front Panel Connector	
Pin	**Signal Pin Definition**
1	PWRBTN#
2	GND
3	PWR_LED
4	GND



3.4.9 FAN Connector

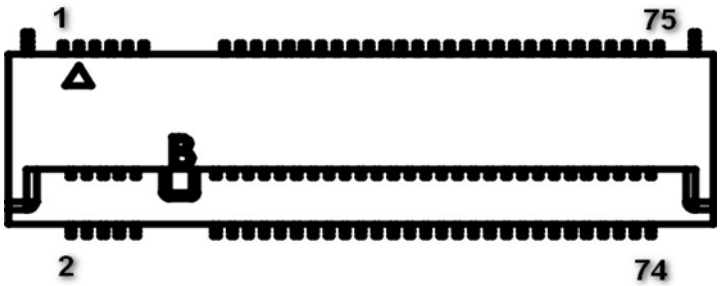
Table 3.12: FAN Connector	
Pin	**Signal Pin Definition**
1	+V5
2	GND



3.4.10 M.2 Key B (USB3.2 Gen1/USB2.0)

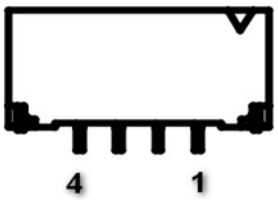
Table 3.13: M.2 Key B (USB3.2 Gen1/USB2.0)

Pin	Signal Pin Definition	Pin	Signal Pin Definition
74	3.8V (Suspend)	75	NC
72	3.8V (Suspend)	73	GND
70	3.8V (Suspend)	71	GND
68	SUSCLK (3.3V)	69	NC
66	NC	67	RESET# (1.8V)
64	NC	65	NC
62	NC	63	NC
60	NC	61	NC
58	NC	59	ANTCTL0
56	NC	57	GND
54	NC	55	NC
52	NC	53	NC
50	PERST# (3.3V)	51	GND
48	NC	49	NC
46	NC	47	NC
44	ALERT# (1.8V)	45	GND
42	NC	43	NC
40	NC	41	NC
38	NC	39	GND
36	UIM_PWR	37	USB3.2 Gen1-Rx+
34	UIM_DATA	35	USB3.2 Gen1-Rx-
32	UIM_CLK	33	GND
30	UIM_RESET	31	USB3.2 Gen1-Tx+
28	NC	29	USB3.2 Gen1-Tx-
26	W_DISABLE2# (1.8V)	27	GND
24	NC	25	DPR
22	NC	23	NC
20	NC	21	NC
29	NC	29	NC
30	M2B1_SATA_DEVSLP_R	30	M2B1_SATA_DEVSLP_R
31	GND	31	GND
32	NC	32	NC
10	LED_1# (3.3V)	11	GND
8	W_DISABLE1# (1.8V)	9	USB_D-
6	POWER_OFF# (1.8V)	7	USB_D+
4	3.8V (Suspend)	5	GND
2	3.3V (Suspend)	3	GND
		1	NC



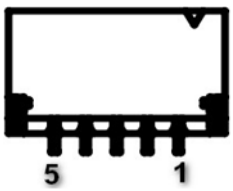
3.4.11 I2C Connector

Table 3.14: I2C Connector	
Pin	**Signal Pin Definition**
1	+V3.3
2	I2C_SDA (3.3V)
3	I2C_SCL (3.3V)
4	GND



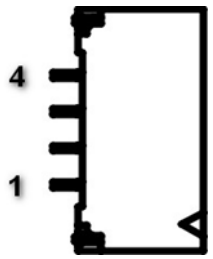
3.4.12 Debug Connector

Table 3.15: Debug Connector	
Pin	**Signal Pin Definition**
1	+V3.3
2	UART_DEBUG_TX
3	UART_DEBUG_RX
4	NC
5	GND



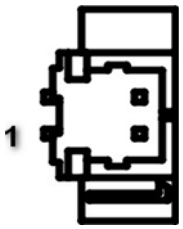
3.4.13 CAN Bus Connector

Table 3.16: CAN Bus Connector	
Pin	**Signal Pin Definition**
1	+V5
2	CAN_D+
3	CAN_D-
4	GND



3.4.14 RTC Battery Connector

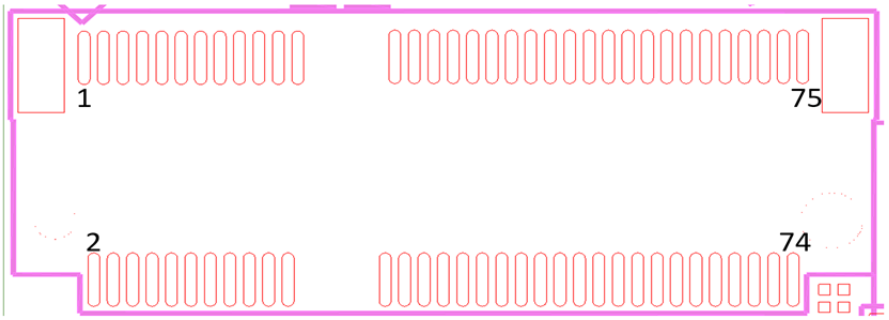
Table 3.17: RTC Battery Connector	
Pin	**Signal Pin Definition**
1	+VBAT
2	GND



3.4.15 M.2 Key E (PCIe x1/USB2.0)

Table 3.18: M.2 Key E (PCIe x1/USB2.0)

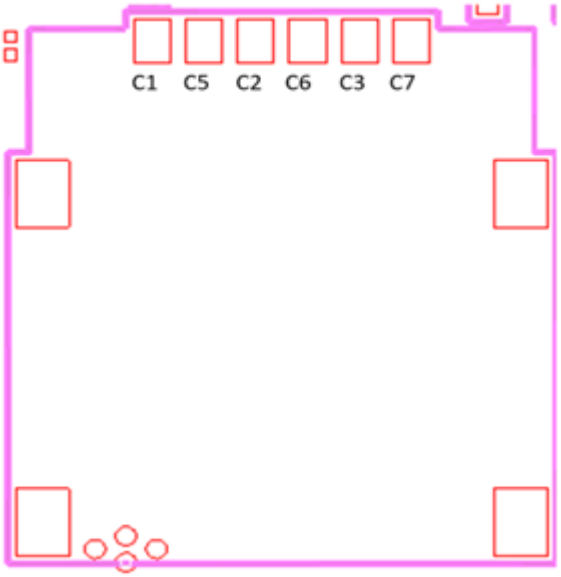
Pin	Signal Pin Definition	Pin	Signal Pin Definition
74	3.3V (Suspend)	75	GND
72	3.3V (Suspend)	73	NC
70	NC	71	NC
68	NC	69	GND
66	NC	67	NC
64	NC	65	NC
62	ALERT# (1.8V)	63	GND
60	I2C_SCL (1.8V)	61	NC
58	I2C_SDA (1.8V)	59	NC
56	W_DISABLE1# (3.3V)	57	GND
54	W_DISABLE2# (3.3V)	55	PEWAKE0# (3.3V)
52	PERST0# (3.3V)	53	CLKREQ0# (3.3V)
50	SUSCLK (3.3V)	51	GND
48	WLAN_COEX_UART_TX (1.8V)	49	REFCLKn0
46	WLAN_COEX_UART_RX (1.8V)	47	REFCLKp0
44	NC	45	GND
42	BT_DEV_WAKE# (1.8V)	43	PETn0
40	WL_DEV_WAKE# (1.8V)	41	PETp0
38	NC	39	GND
36	UART_RTS# (option function)	37	PERn0
34	UART_CTS# (option function)	35	PERp0
32	UART_TX (option function)	33	GND
29	NC	29	NC
30	M2B1_SATA_DEVSLP_R	30	M2B1_SATA_DEVSLP_R
31	GND	31	GND
32	NC	32	NC
22	UART_RX (option function)	23	NC
20	UR_WAKE#	21	NC
18	GND	19	NC
16	LED2	17	NC
14	WCN_BT_SLIMBUS_DATA (1.8V)	15	NC
12	NC	13	NC
10	NC	11	NC
8	WCN_BT_SLIMBUS_CLK (1.8V)	9	NC
6	LED1	7	GND
4	3.3V (Suspend)	5	USB_D-
2	3.3V (Suspend)	3	USB_D+
		1	GND



3.4.16 SIM Slot

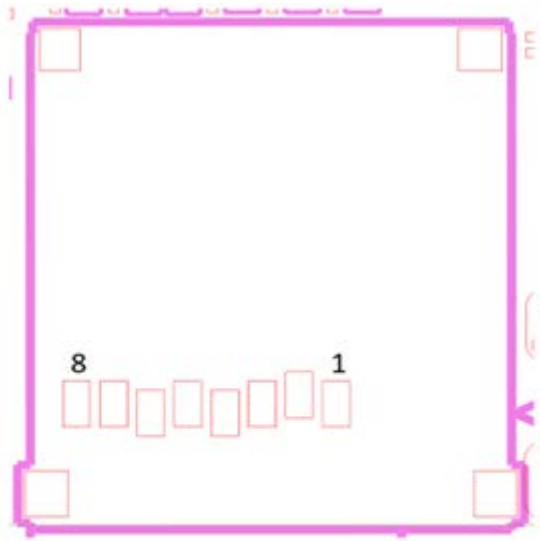
Table 3.19: SIM Slot

Pin	Signal Pin Definition
C1	VCC
C2	RST
C3	CLK
C4	Reserved
C5	GND
C6	VPP
C7	I/O
C8	Reserved



3.4.17 SD Card

Table 3.20: SD Card	
Pin	**Signal Pin Definition**
1	DAT2
2	CD/DAT3
3	CMD
4	VDD
5	CLK
6	VSS
7	DAT0
8	DAT1



Chapter 4

Software Functionality

This chapter details the software functions

4.1 CPU

8 * CPU core

```
cat /proc/cpuinfo
```

CPU Max MHz

```
cat /sys/devices/system/cpu/cpu0/cpufreq/cpuinfo_max_freq # 1958400
cat /sys/devices/system/cpu/cpu4/cpufreq/cpuinfo_max_freq # 2400000
cat /sys/devices/system/cpu/cpu7/cpufreq/cpuinfo_max_freq # 2707200
```

4.2 DDR

```
cat /proc/meminfo
# MemTotal: 7464736 kB
```

4.3 SD Card

```
mkdir ~/tmp
sudo mount /dev/mmcblk1p1 ~/tmp/
echo "123" > ~/tmp/sdcard-test
cat ~/tmp/sdcard-test
```

4.4 RS-232

4.4.1 Basic Settings

Run the following commands before testing:

Table 4.1: Commands

COM Port	UART Device Settings
COM1	UART_DEV=/dev/ttyHS1
COM2	UART_DEV=/dev/ttyHS2
COM3	UART_DEV=/dev/ttyHS2

```
sudo stty -F $UART_DEV -echo -onlcr 115200 raw
sudo cat $UART_DEV &
echo "Serial Port Test" | sudo tee $UART_DEV > /dev/null
sudo killall cat
```

4.5 SPI

```
sudo dmesg | grep mcp
# [   15.255061] mcp251xfd spi7.0 can0: MCP2518FD rev0.0 (-RX_INT -
PLL -MAB_NO_WARN +CRC_REG +CRC_RX +CRC_TX +ECC -HD o:0.00MHz
c:40.00MHz m:10.00MHz rs:10.00MHz es:0.00MHz rf:10.00MHz ef:0.00MHz)
successfully .
# [   15.306445] mcp251xfd spi12.0 can1: MCP2518FD rev0.0 (-RX_INT -
PLL -MAB_NO_WARN +CRC_REG +CRC_RX +CRC_TX +ECC -HD o:0.00MHz
c:40.00MHz m:10.00MHz rs:10.00MHz es:0.00MHz rf:10.00MHz ef:0.00MHz)
successfully.
```

4.6 CAN

Table 4.2: Connector Interface

CAN 1	can0
CAN 2	can1

Connect CAN1 and CAN2

```
sudo ip link set can1 up type can bitrate 1000000 dbitrate 8000000 fd on
sudo ip link set can2 up type can bitrate 1000000 dbitrate 8000000 fd on

# Monitor CAN2
candump -x can2 > can2.log &

# Send message from CAN1
cansend can1 111FFFFF#aa.00.cc.aa.33.61.aa.ab

# Send CAN-FD message from CAN1
cansend can1 123##1AABBCCDDEEFF00112233445566778899
```

Check the log:

```
cat can2.log
# can2  RX - -  111FFFFF   [8]  AA 00 CC AA 33 61 AA AB
# can2  RX B -       123  [16]  AA BB CC DD EE FF 00 11 22 33 44 55
66 77 88 99
```

4.7 GPIO

Table 4.3: DB9 Pin Signal Name GPIO Number gpiod (chip, offset)			
1	GND	N/A	N/A
2	GPIO_81	616	3, 0
3	GPIO_10	545	3, 1
4	GPIO_18	553	3, 2
5	GPIO_26	561	3, 3
6	GPIO_27	562	3, 4
7	GPIO_35	570	3, 5
8	GPIO_38	573	3, 6
9	GPIO_39	574	3, 7

4.7.1 Test with gpiod

Please refer to the table above to set the GPIO_CHIP and GPIO_OFFSET. Use GPIO_81 bit 0 as an example:

```
GPIO_CHIP=5
GPIO_OFFSET=0
```

Read GPIO status:

```
sudo gpioget $GPIO_CHIP $GPIO_OFFSET
```

1 Refers to High, 0 Refers to Low

Set GPIO status to High:

```
sudo gpioset $GPIO_CHIP $GPIO_OFFSET=1
```

Set GPIO status to Low:

```
sudo gpioset $GPIO_CHIP $GPIO_OFFSET=0
```

4.7.2 Test with sysfs

Please refer to the table above to set the GPIO_NUM. Use GPIO_81 bit 0 as an example:

```
GPIO_NUM=616
```

Read GPIO status:

```
echo $GPIO_NUM | sudo tee /sys/class/gpio/export
echo in | sudo tee /sys/class/gpio/gpio$GPIO_NUM/direction
sudo cat /sys/class/gpio/gpio$GPIO_NUM/value
echo $GPIO_NUM | sudo tee /sys/class/gpio/unexport
```

1 Refers to High, 0 Refers to Low

Set GPIO status to High:

```
echo $GPIO_NUM | sudo tee /sys/class/gpio/export
echo out | sudo tee /sys/class/gpio/gpio$GPIO_NUM/direction
echo 1 | sudo tee /sys/class/gpio/gpio$GPIO_NUM/value
echo $GPIO_NUM | sudo tee /sys/class/gpio/unexport
```

Set GPIO status to Low:

```
echo $GPIO_NUM | sudo tee /sys/class/gpio/export
echo out | sudo tee /sys/class/gpio/gpio$GPIO_NUM/direction
echo 0 | sudo tee /sys/class/gpio/gpio$GPIO_NUM/value
echo $GPIO_NUM | sudo tee /sys/class/gpio/unexport
```

4.8 WiFi

Ubuntu GUI Settings -> Wi-Fi

4.9 4G/5G

Ubuntu GUI Settings -> Mobile Network

4.10 Bluetooth

4.10.1 BT USB

Ubuntu GUI Settings -> Bluetooth

4.10.2 BT UART (Optional)

- Hardware short R350, R351, R352, R353
- Hardware remove R498, R496, R494, R492

Switch CDT

```
echo 5 | /tools/cdt/switch_cdt.sh
sudo stty -F /dev/ttyHS1
sudo hciattach /dev/ttyHS1 any 115200 flow
hciconfig
```

Ubuntu GUI Settings -> Bluetooth

4.11 Ethernet

Table 4.4: Connector Interface

LAN	enP1p1s0

Ubuntu GUI Settings -> Network -> Ethernet

4.12 Display

Ubuntu GUI Settings -> Displays

4.12.1 Hot Plug

```
cat /sys/class/drm/card0-DP-1/status
```

4.13 I2C

4.13.1 Internal I2C

- 0x32: RTC module
- 0x50: EEPROM

```
sudo i2cdetect -y -r 1
```

- Reserved

```
sudo i2cdetect -y -r 3
```

4.13.2 I2C Connector 1

```
sudo i2cdetect -y -r 9
```

Test EEPROM

```
sudo i2ctransfer -y 9 w2@0x54 0x00 0x00 r5@0x54
sudo i2ctransfer -y 9 w7@0x54 0x00 0x00 0x70 0x00 0xfd 0xdc 0x8a
sudo i2ctransfer -y 9 w2@0x54 0x00 0x00 r5@0x54
```

4.13.3 I2C Connector 2

```
sudo i2cdetect -y -r 2
```

Test EEPROM

```
sudo i2ctransfer -y 2 w2@0x54 0x00 0x00 r5@0x54
sudo i2ctransfer -y 2 w7@0x54 0x00 0x00 0x68 0x65 0x6c 0x6c 0x6f
sudo i2ctransfer -y 2 w2@0x54 0x00 0x00 r5@0x54
```

4.14 RTC

4.14.1 RTC Read and Write

```
sudo date 091710452025 && sudo hwclock -w && date
sudo date 010100002000 && sudo hwclock -r && date
sudo hwclock -s && date
```

4.14.2 RTC Wakeup

```
sudo rtcwake -m on -s 5 -d rtc0 # Test wakeup IRQ only # Check IRQ
triggered
sudo cat /sys/kernel/debug/wakeup_sources|grep 1-0032  # IRQ should
increase
sudo rtcwake -m mem -s 5 -d rtc0
```

4.15 WATCHDOG

4.15.1 Internal Watchdog

```
echo 6 | sudo tee /proc/sys/kernel/panic
echo c | sudo tee /proc/sysrq-trigger
```

The system will reboot after the system crash about 6 seconds.

4.16 Camera

- CAM1~2: IMX577
- CAM3~5: OV9282

4.16.1 Setting performance

```
sudo su

echo "performance" > /sys/devices/system/cpu/cpu*/cpufreq/scal-
ing_governor

for cpu in 0 1 2 3; do
    echo 1958400 | sudo tee /sys/devices/system/cpu/cpu${cpu}/cpu-
freq/scaling_m*
done

for cpu in 4 5 6; do
    echo 2400000 | sudo tee /sys/devices/system/cpu/cpu${cpu}/cpu-
freq/scaling_m*
 done

for cpu in 7; do
    echo 2707200 | sudo tee /sys/devices/system/cpu/cpu${cpu}/cpu-
freq/scaling_max_freq
done

echo 1958400 | sudo tee /sys/devices/system/cpu/cpufreq/policy0/
scaling_m*
echo 2400000 | sudo tee /sys/devices/system/cpu/cpufreq/policy4/
scaling_m*
echo 2707200 | sudo tee /sys/devices/system/cpu/cpufreq/policy7/
scaling_m*

echo "systemLogEnable=FALSE" | sudo tee /var/cache/camera/camxover-
ridesettings.txt

pkill cam-server
```

Camera 1 ~ 3

$c=0,1,2

```
gst-launch-1.0 -e qtiqmmfsrc name=camsrc camera=$c ! video/x-
raw,format=NV12,width=1280,height=720,framerate=30/1 ! waylandsink
```

Camera 4 and 5

$c=3,4

```
gst-launch-1.0 -e qtiqmmfsrc name=camsrc camera=$c ife-direct-
stream=1 ! video/x-raw,format=NV12,width=1280,height=720,framer-
ate=30/1 ! waylandsink
```

4.17 Power Button

4.17.1 On Board

1. When the system is in the power off state, it can be power on by short pressing the Power Key.
2. When the system is in the power on state, it can be power off by short pressing the Power Key.
3. It can force shutdown by pressing and holding the Power Key for 5 seconds.

4.18 LED Lights

4.18.1 Power LED

Table 4.5: Power LED

Mode	ON	OFF
PWR_LED	Green	N/A

4.18.2 Ethernet LED

- Link: Left LED
- Act: Right LED

Table 4.6: Ethernet LED

LED	Link Speed	Color	Status
Link	10M/100M	N/A	Off
Link	1G	Orange	On
Link	2.5G	Green	On
Act	Any	Green	Link established: On Activity detected: Blinking

How to force Ethernet speed

```
sudo ethtool -s enP1p1s0 speed 10 duplex full   # force 10m
sudo ethtool -s enP1p1s0 speed 100 duplex full  # force 100m
sudo ethtool -s enP1p1s0 speed 1000 duplex full # force 1G
sudo ethtool -s enP1p1s0 speed 2500 dupl
```

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