

AIM-Edge TOP1 AI Computing Device

User Manual

3 September 2024
Version 1.4

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Revision History

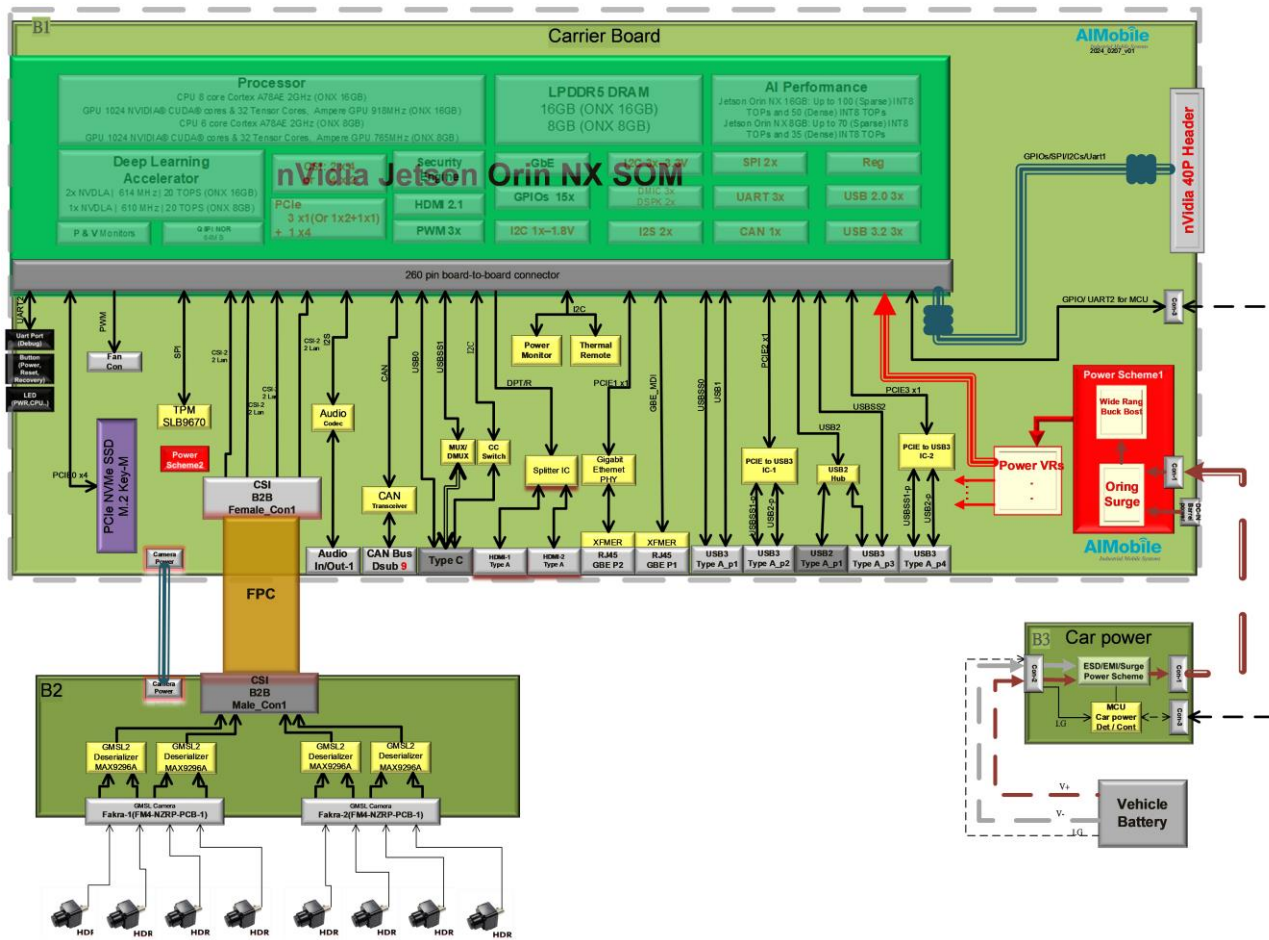
Date	Version	Modification
2024/06/18	1.0	Creation
2024/07/01	1.1	1. Add DC battery connector model number 2. Specify pin 1 location of 40-pin header 3. Add a known issue the device may reboot with heavy CPU/GPU load under high temperature
2024/07/04	1.2	Add GMSL connector/cable type
2024/07/09	1.3	Add backup/restore image and enter USB recovery mode
2024/09/03	1.4	1. Describe class A in instruction manuals 2. Revise known issue list

1. Introduction

AIM-Edge TOP1 is a Nvidia Jetson AI computing device running on Linux platform, it supports NVidia Orin NX SOM.

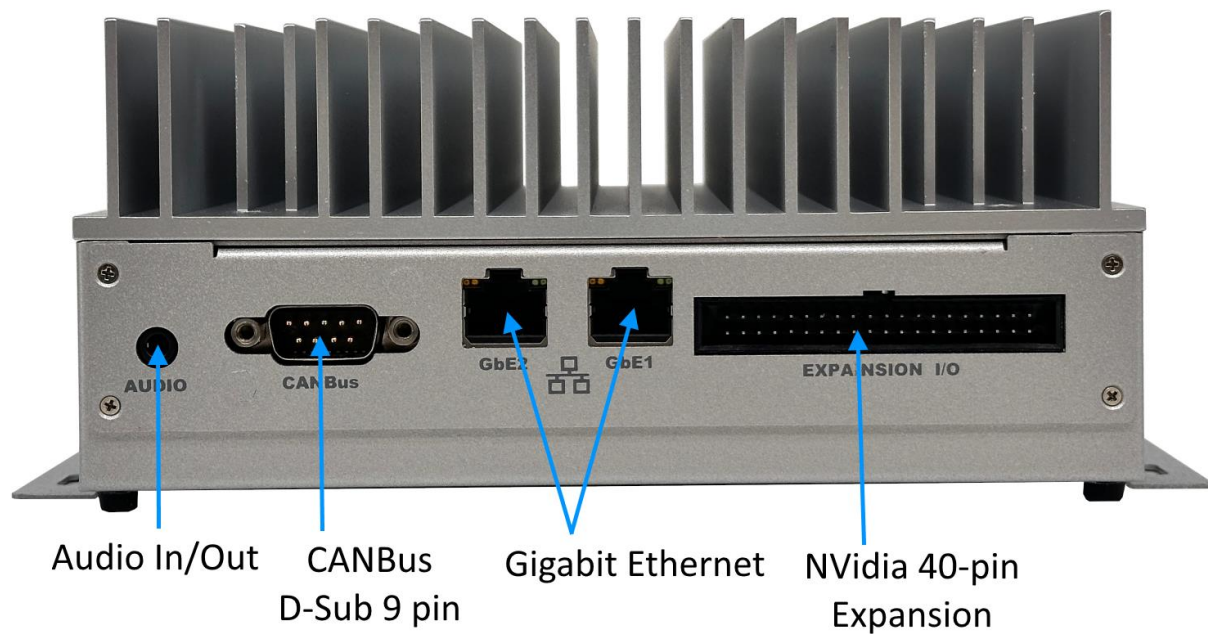
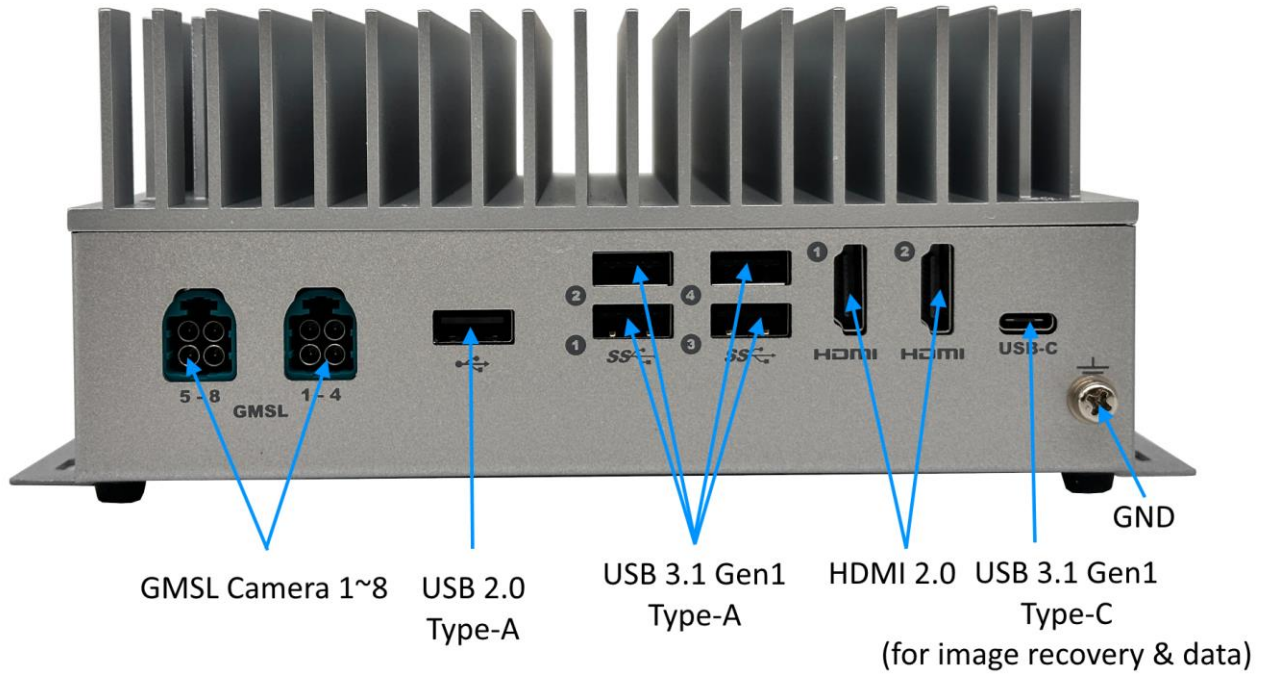
AIM-Edge TOP1 Specification	
SOM	NVIDIA Jetson Orin NX 16GB
OS	Ubuntu 20.04/Linux 5.10
TPM	Infineon TPM SLB9670
I/O	Gigabit Ethernet x 2 USB 3.1 Gen1 Type-A x 4 (Total bandwidth 5Gbps * 4 = 20Gbps) USB 2.0 Type-A x 1 USB 3.1 Gen1 Type-C x 1 (for image recovery & data) HDMI 2.0 x 2 GMSL Camera x 8 (4-in-1 x 2) Audio In/Out x 1 CANBus (D-Sub 9 pin) x 1 NVidia 40-pin expansion header x 1 (2x20, 2.54 mm pitch) Power LED x 1 PCIe NVMe SSD (internal M.2) x 1 Debug UART (internal) x 1
Power	Vehicle Battery 10V~32V DC-In 19V
Dimension	170mm(W)X145mm(L)X75mm(H)
Weight	1790g
Temperature	-20~60 °C (Operation)
Button/Key	1 x Power Button 1 x Recovery Button 1 x Reset Button

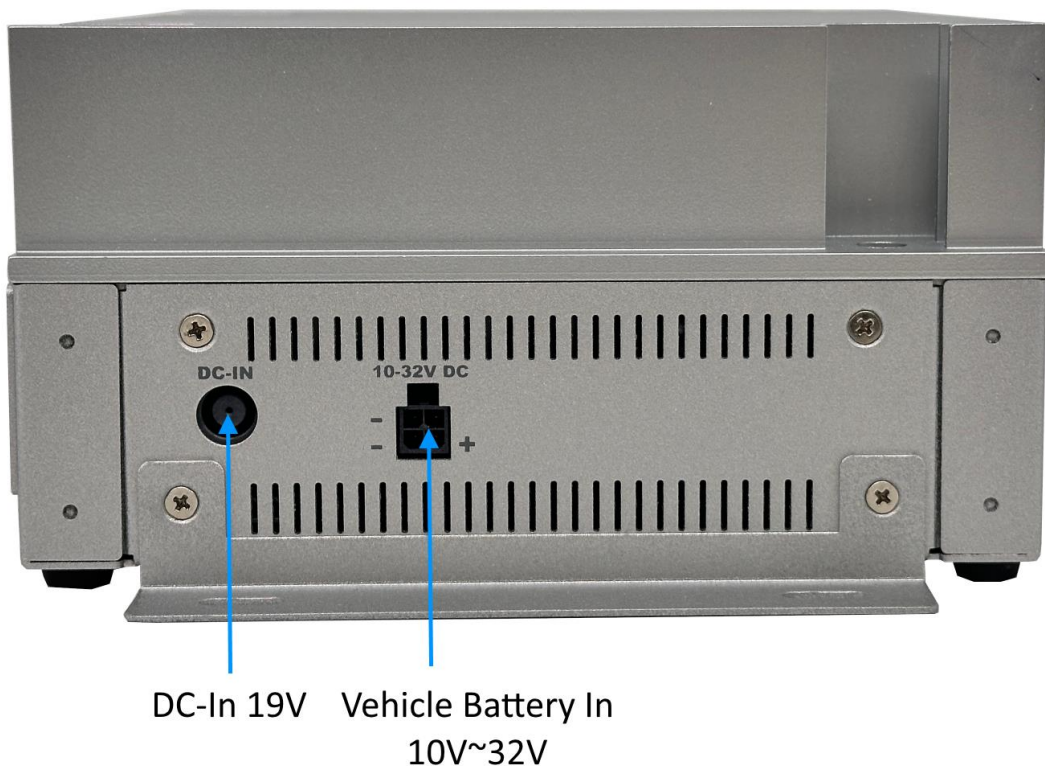
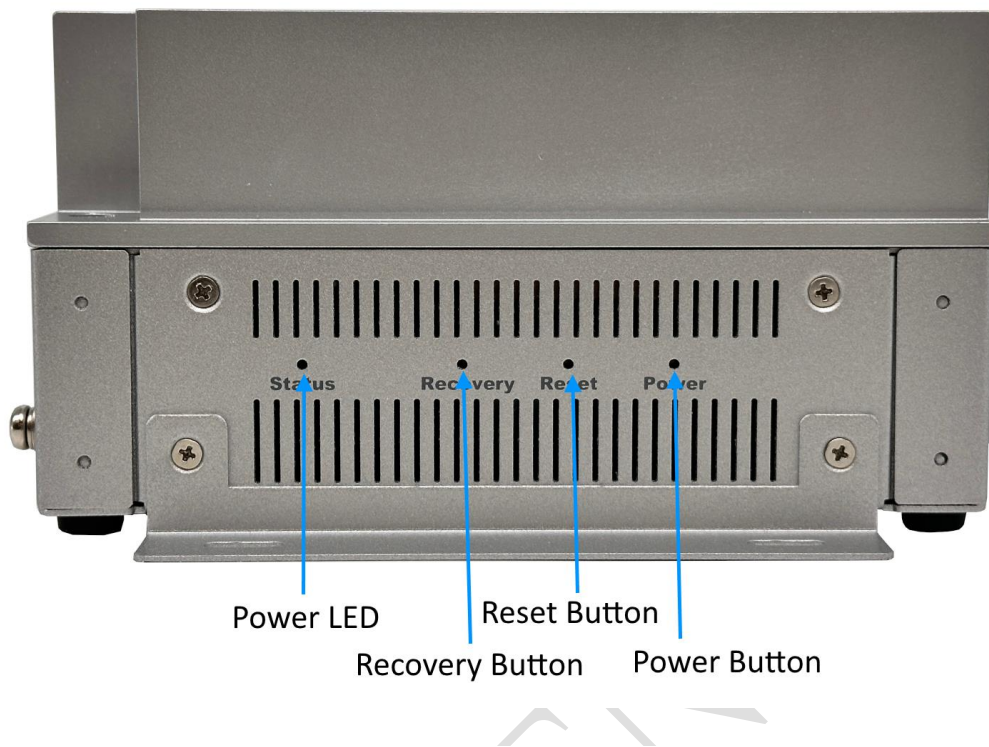
2. System Architecture



AIM-Edge TOP1 Block Diagram

3. I/O Port Overview





Note: the DC battery connector model number is Molex 430450400.

4. Getting Started

4.1. Power Up

1. Connect a USB keyboard to the USB Type A connector of your device.
2. Connect an HDMI-compatible display to the HDMI connector on your device.
3. Connect the DC 19V adapter to the DC-in connector of your device.
4. Plug the power adapter into an appropriately rated electrical outlet. The system should power on directly. If not, press and release the power button in the device by paperclip.
5. When prompted, enter username and password (Username: **aim** /Password: **aim12345**).

4.2. Enter Force USB Recovery Mode

To update your device, you must be in Force USB Recovery Mode so that you can transfer system image to the Jetson device. To place device in Force USB Recovery Mode,

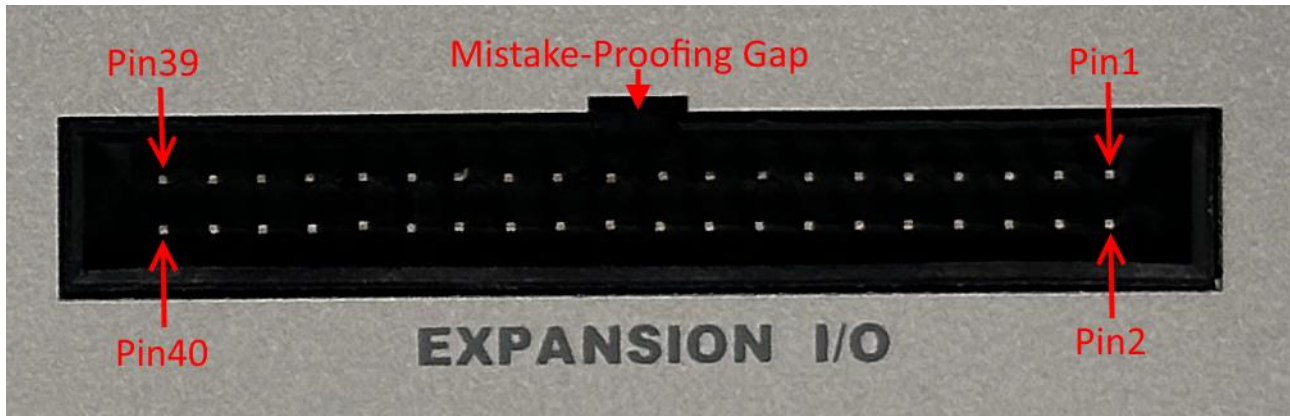
1. Power down the device. If connected, remove the DC power from the device. The device must be powered OFF, and not in a suspend or sleep state.
2. Connect the Type-C plug on the USB cable to the Recovery (USB Type-C) Port on the device and the other end to an available USB port on the host PC.
3. Connect the power adapter to the device.
4. With the system powered on:
 - Press and hold the RECOVERY button with paperclip.
 - While pressing the RECOVERY button, press and release the RESET button with paperclip.
 - Wait 2 seconds and release the RECOVERY button.
5. After TOP1 enter Force USB Recovery Mode, if it connected to Linux Host PC/NB already, execute “lsusb” command on Host PC/NB, a “0955:7323 NVidia Corp.” device will appear. If not, perform Step 4 above again.

```
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 074: ID 0955:7323 NVidia Corp.
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

Jetson SoM	USB ID
Orin NX 16GB	0955:7323
Orin NX 8GB	0955:7423
Orin Nano 8GB	0955:7523
Orin Nano 4GB	0955:7623

4.3. NVidia 40-pin expansion header

The 40-pin connector follows NVidia Orin NX development kit pin definition as the picture below. User can check [NVidia on-line document](#) about how to configure the expansion header.

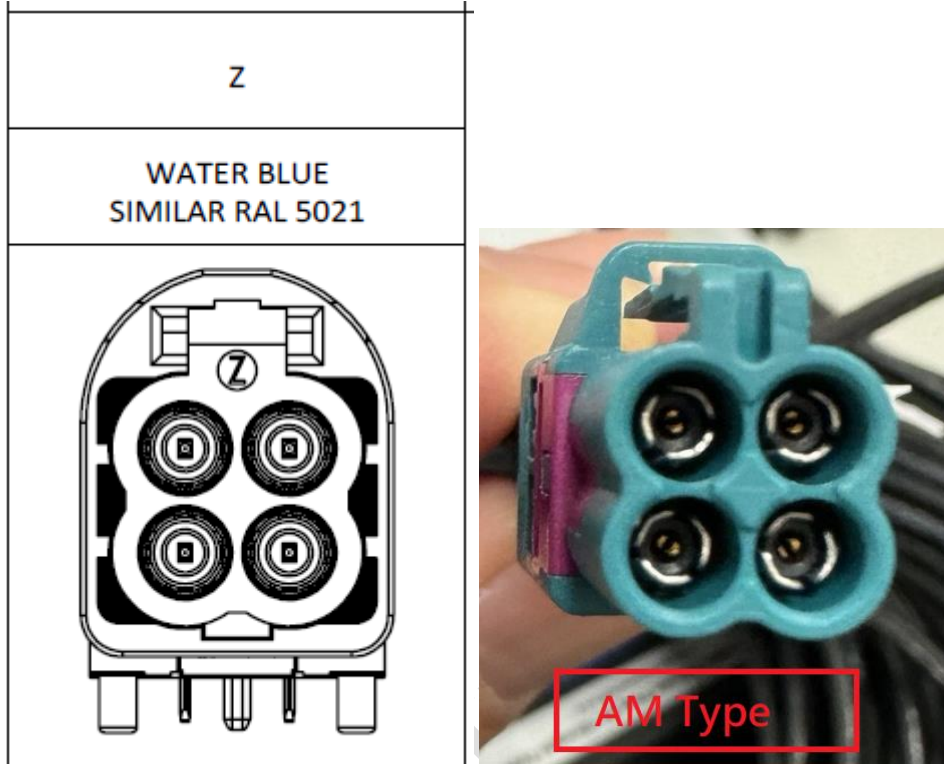


3.3V	1		2	5.0V
I2C1_SDA	3		4	5.0V
I2C1_SCL	5		6	GND
GPIO09	7		8	UART1_TXD
GND	9		10	UART1_RXD
UART1_RTS*	11		12	I2S0_SCLK
SPI1_SCK	13		14	GND
GPIO12	15		16	SPI1_CS1*
3.3V	17		18	SPI1_CS0*
SPI0_MOSI	19		20	GND
SPI0_MISO	21		22	SPI1_MISO
SPI0_SCK	23		24	SPI0_CS0*
GND	25		26	SPI0_CS1*
I2C0_SDA	27		28	I2C0_SCL
GPIO01	29		30	GND
GPIO11	31		32	GPIO07
GPIO13	33		34	GND
I2S0_FS	35		36	UART1_CTS*
SPI1_MOSI	37		38	I2S0_DIN
GND	39		40	I2S0_DOUT

Note: Pin 7/GPIO09 is not connected.

4.4. GMSL Camera

The TOP1 device supports up to 8 GMSL cameras, there are two 4-in-1 GMSL camera ports on the TOP1 device, the MAXIM MAX9296A is used as the GMSL de-serializer. The GMSL camera connector part number is Mini FAKRA 2x2 / AM Type / Z Code.



The camera driver of oToBrite oToCAM223 camera module is pre-integrated. It will need to load corresponding camera driver for other camera modules. Here below are examples for camera operations by gstreamer.

Camera preview:

```
gst-launch-1.0 v4l2src device=/dev/video0 ! videoconvert ! ximagesink
```

Capture camera pictures:

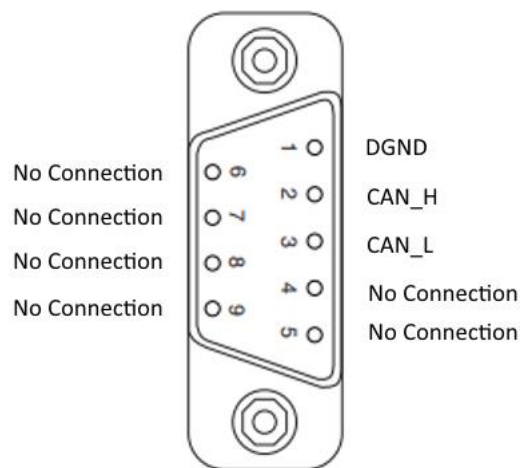
```
gst-launch-1.0 v4l2src num-buffers=1 device=/dev/video0 ! "video/x-raw, format=UYVY, width=1920, height=1536, framerate=30/1" ! nvvidconv ! nvjpegenc ! filesink location=cam0.jpg -e
```

Record camera video:

```
gst-launch-1.0 v4l2src device=/dev/video0 num-buffers=300 ! video/x-raw,format=UYVY, width=1920, height=1536,
framerate=30/1 ! nvvidconv ! nvv4l2h264enc ! h264parse ! qtmux ! filesink location=a.mp4
```

4.5. CANBus D-Sub 9 pin

The CANBus port uses D-Sub 9 pin connector, the pin definition is as the picture below.



Enable CANBus port:

```
sudo modprobe can

sudo modprobe can-raw

sudo modprobe can-dev

sudo modprobe mttcan

sudo ip link set can0 type can bitrate 1000000

sudo ip link set up can0
```

Send data via CANBus:

```
ifconfig can0 down

ip link set can0 up type can bitrate 1000000

ifconfig can0 up

cansend can0 008#11.22.33.44.55.66.77.88
```

Receive data via CANBus:

```
ifconfig can0 down

ip link set can0 up type can bitrate 1000000

ifconfig can0 up

candump -n1 -T 2000 can0
```

Reset CANBus port:

```
sudo ip link set down can0

sudo rmmod mttcan

sudo modprobe can

sudo modprobe can-raw

sudo modprobe can-dev

sudo modprobe mttcan

sudo ip link set can0 type can bitrate 1000000

sudo ip link set up can0
```

4.6. TPM Module

Infineon TPM SLB9670 is used in TOP1 device to support TPM functions. Here below is an example for RSA file encryption by TPM module.

Create an RSA key:

```
tpm2_createprimary -c rsa.ctx

tpm2_create -C rsa.ctx -Grsa2048 -u rsakey.pub -r rsakey.priv

tpm2_load -C rsa.ctx -u rsakey.pub -r rsakey.priv -c rsakey.ctx
```

Encrypt a file with the RSA key:

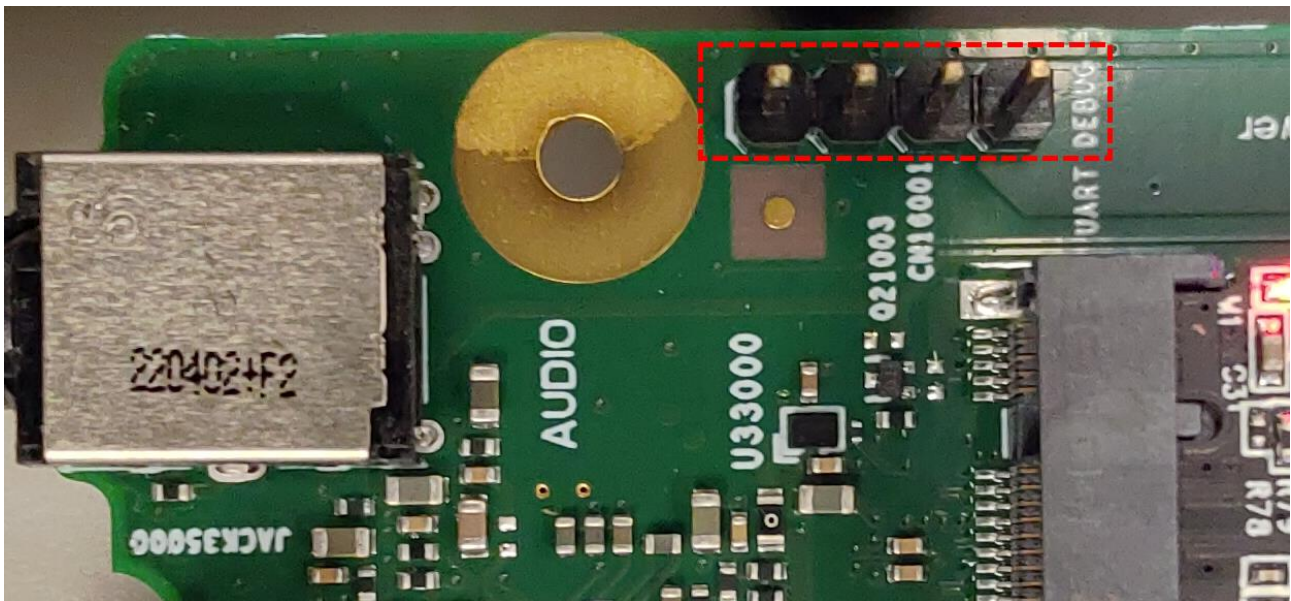
```
echo "my message" > data.txt

tpm2_rsaencrypt -c rsakey.ctx -o msg.enc data.txt
```

Decrypt a file with the RSA key:

```
tpm2_rsadecrypt -c rsakey.ctx -o msg.ptext msg.enc
```

4.7. Use Serial Debug Console (Internal only)



Any serial port console program should work as a debug console. Examples are PuTTY, gtkTerm, and minicom. Connection speed is 115200, with 8 bits, no parity, and 1 stop bit (115200 8N1). Flow control will be RTS/CTS.

5. Known Issues

1. Pin 7/GPIO09 of the 40-pin expansion header is not connected, it's a design limitation.

6. Appendix

6.1. Backup/Restore Image

To backup and restore image, user needs to get image backup/restore tool package from AIMobile. From the OneDrive screenshot below, the file [TOP1_5.1.3.tar.bz2](#) is the image backup/restore tool package file. User needs to download the file to Linux Host PC/NB, and extract it with the command “`tar -jxvf TOP1_5.1.3.tar.bz2`”. Besides, the [nvme0n1p1.tar.gz](#) is a bootable Jetpack 5.1.3 image, user may not need to download it.



User can use the [TOP1_backup.sh](#) script under the tool package extracted folder to backup the image from TOP1 device, the backup image [nvme0n1p1.tar.gz](#) can be found under the image backup folder “`./tools/backup_restore/images`”. And the [TOP1_restore.sh](#) script is to restore the image to TOP1 device. **Before the image restoring, user needs to ensure the image file [nvme0n1p1.tar.gz](#) under the image folder “`./tools/backup_restore/images`” is correct.** Besides, it needs to put TOP1 device to force USB recovery mode (refer to section 6.2) before restoring image.

D:\TOP1_5.1.3\TOP1_5.1.3.tar\TOP1_5.1.3\		
名稱	大小	封裝後大...
bootloader	682 302 447	682 549 ...
rootfs	5 126 081	5 141 504
nv_tegra	1 706	2 048
kernel	34 462 888	34 463 2...
tools	226 965 575	226 997 ...
jetson-orin-nano-devkit.conf	4 381	4 608
TOP1_backup.sh	89	512
l4t_flash_prerequisites.sh	2 375	2 560
p3767.conf.common	8 156	8 192
flash.sh	153 332	153 600
TOP1_restore.sh	89	512

6.2. Enter Force USB Recovery Mode

To update your device, you must be in Force USB Recovery Mode so that you can transfer system image to the Jetson device. To place device in Force USB Recovery Mode,

1. Power down the device. If connected, remove the DC power from the device. The device must be powered OFF, and not in a suspend or sleep state.
2. Connect the USB Type-C plug on the USB cable to the image recovery USB Type-C Port on the device and the other end to an available USB port on the host PC.
3. Connect the power adapter to the device.
4. With the system powered on:
 - Press and hold the RECOVERY button with paperclip.
 - While pressing the RECOVERY button, press and release the RESET button with paperclip.
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```

Jetson SoM	USB ID
Orin NX 16GB	0955:7323
Orin NX 8GB	0955:7423

この装置は、クラスA機器です。この装置を住宅環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI — A