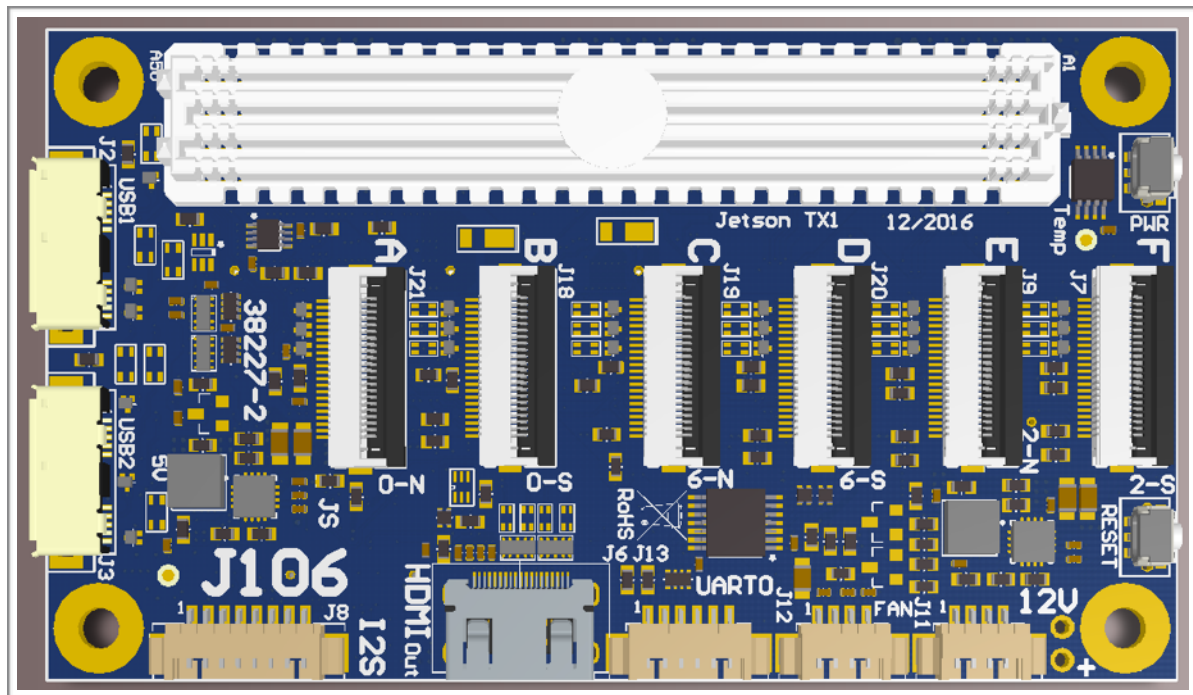


J106 Technical Reference

38227-x

Version 1.0



Preliminary

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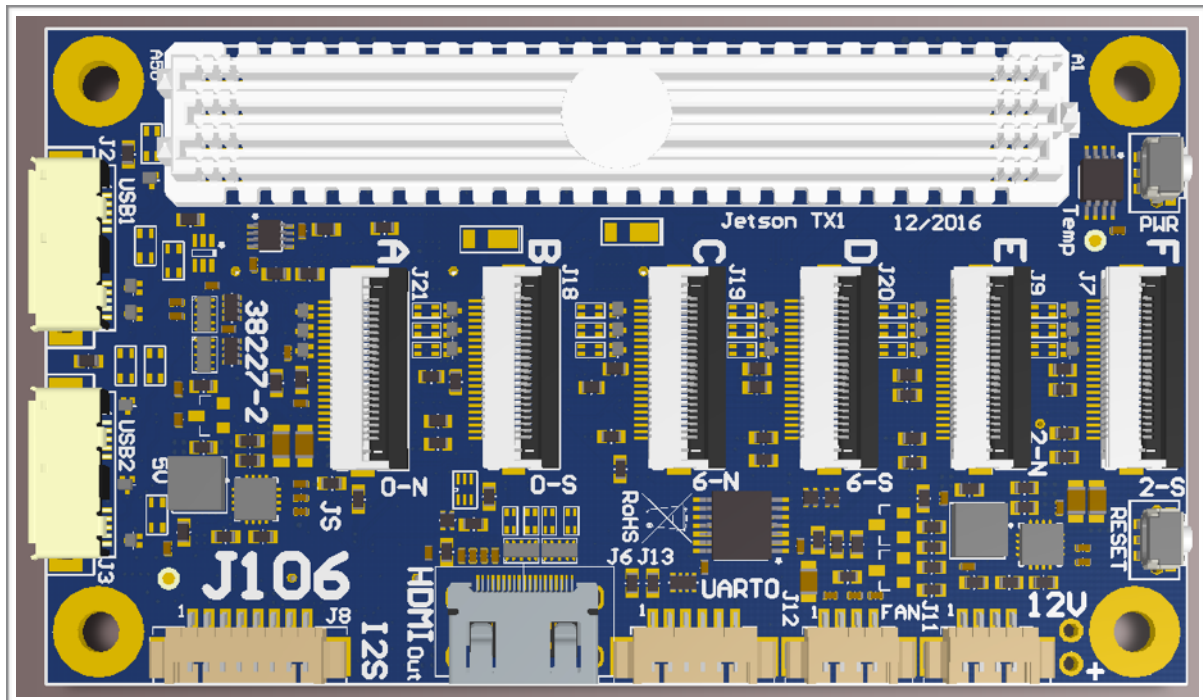
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Features

J106 carrier board for the NVIDIA® Jetson™ TX1 and TX2

The J106 carrier board has the same form factor and size as the TX compute module. It is plugged in below the TX1 and brings out many interfaces on connectors. Furthermore it can be plugged in a specifically designed modular motherboard to bring out more interfaces and to integrate it with other components for UAV applications.



Technical details

- carrier board for one NVIDIA® Jetson™ TX1 or TX2 compute module
- standalone or mounted on modular motherboard (like the M90, M100 or M110)
- six 2 lane CSI-2 (15 pin FPC 1.0mm pitch) - B101/B102, Raspberry Pi camera or other cameras
- micro SD card
- 2 USB3 type A (10 pin micro USB3)
- UART 0 (3.3V TTL) (6 pin) - console access
- I2S digital audio (8 pin, up to 8 channels)
- fan connector (4 pin)
- mini HDMI out
- UART, Gb Ethernet, I2C, USB2, SATA, 4x PCIe and 1x CAN (on 3 motherboard connectors on the bottom)
- power: 12V (4 pin) - alternatively powered by motherboard (redundant), range: 7V to 17V
- size: 50 x 87 mm (same size as TX1 or TX2)
- height: 16 mm (incl. TX1 without heatsink without height of bottom side components of J106)
- height: 21 mm (incl. TX1 without heatsink including height of bottom side components of J106)
- weight: 26 grams (just the J106)
- TX1 weight: 144 grams (TX1 with heatsink), 75 grams (TX1 w/o heatsink)
- mounting: 4 M3 holes with 3.2mm each (42 x 79 mm spacing - 4 mm from each edge)
- model: 38227-2 (J106 rev 2)

Rev 1 (38227)

First revision of the J106. Very limited distribution. Bug fixes for I2C address shifter and I2C pull-ups for Raspberry Pi cameras.

Rev 2 (38227-2)

Second revision of the J106. No hardware bug fixes required.

- 3 solder jumpers (P1 to P3) to change address shift from 2 to 1

Testing of the J106

Please have a look at the test report which is included with the shipment.

Getting started

Applying power

The J106 may be either powered by the on-board power connector (J11) with a regulated 12V power supply. Alternatively it may be plugged into a modular motherboard. Power is then supplied via the connectors J15 (60 pin) and J17 (30 pin). Each of the 3 separate power inputs features a Schottky diode. These 3 diodes OR all power inputs together. So 3 independent power inputs are provided to achieve redundant powering.

Auto start

The J106 automatically powers up the TX1 or TX2 with a digital one shot which pulls the POWER-BTN input of the TX1 low for approximately 1 second after power is applied. When the TX1 raises the CARRIER_PWR (A48) line, the power supplies on the J106 are powered up. This is indicated by lighting up the green power LED below the fan connector.

The auto start logic is powered by the 12V power input. For auto start to work, please power down the TX1 for at least 2 seconds. This allows time for the 12V supply to drain and the enable auto start, when power is applied again.

Console access

The console port of the TX1 is UART 0. The J106 converts this UART port to standard 3.3V TTL levels. So a standard USB to TTL serial converter may be used to connect to the console. Just connect TXD, RXD and GND to the USB converter. Make sure that you connect TXD to the RXD input of the USB TTL converter. Standard baud rate is 115200. Settings: 8/1/N.

Firmware upgrade of the TX1

The J106 does not support a direct firmware upgrade of the TX1. There are the following alternatives:

1. plug the TX1 module into the development board to perform the upgrade there.
2. plug the J100 into a modular motherboard like the M100 or M110, which supports on-board firmware upgrade by providing three buttons (power, reset and force recovery) and the USB 2.0 OTG port.
3. use a carrier board like the J120, which supports a firmware upgrade.

Outputs (GPIOs, I2S, SPI) on the J106

The J106 converts the 1.8V level output signals to 3.3V. It uses a bidirectional level converter, which automatically detects the direction of the signal. For the level conversion to work properly, caution must be taken, if there is a pull-up resistor on any output. This applies to all outputs including GPIOs and special function outputs like SPI, I2S. If there are any pull-up resistors on these outputs, they must have more than 50 kOhm. If there is a pull-up resistor with a lower value, than the level converter may determine that the signal is driven from the outside, and that this pin should be treated as input.

Inputs (GPIOs, I2S, SPI) on the J106

The J106 converts the 1.8V level input pins to 3.3V. It uses a bidirectional level converter, which automatically determines the direction of the signal. This requires a signal driver with 2mA min.

Devices

Ethernet

There are three green network LEDs on the bottom side of the J106. The Ethernet connection is available on the motherboard connector 1. The physical Ethernet connector is provided by the motherboard which the J106 is plugged into. If you prefer an Ethernet connector right on the carrier board, please have a look at the J120.

| LED | Function | Jetson TX1 | Description |
|------|---------------|------------|-----------------------|
| GBE0 | GBE_LINK_ACT* | E47 | Ethernet activity LED |
| GBE1 | GBE_LINK_100 | F50 | 100Mbit link LED |
| GBE2 | GBE_LINK_1000 | F46 | 1000Mbit link LED |

IMU (MPU-9250)

A 9 axis sensor is connected to the SPI0 bus of the TX1. Pin 8 (VddIO) of the IMU is connected to 1.8V. Please set the INT output of the IMU by software to „totem pole“ mode as there is no pull-up on the INT output.

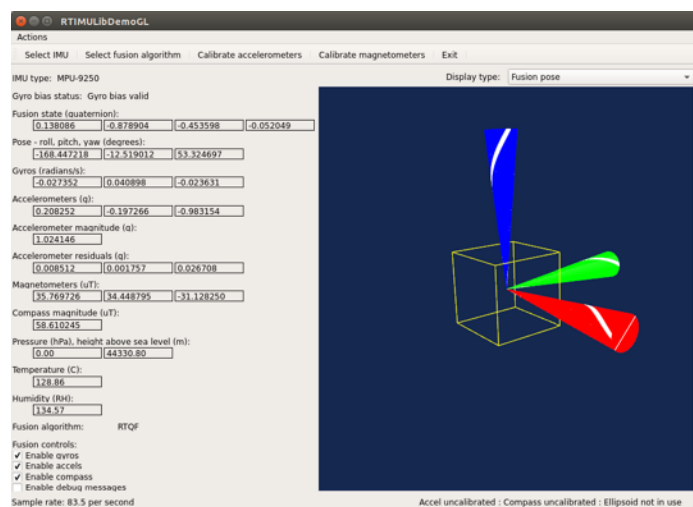
This IMU is optional. Only some J100 models are equipped with this function.

| Pin | Function | Jetson TX1 | Description |
|-----|----------|------------|--|
| 9 | AD0/SDO | E4 | SPI0_MISO (1.8V) |
| 24 | SDA/SDI | F4 | SPI0_MOSI (1.8V) |
| 23 | SCL/SCLK | E3 | SPI0_CLK (1.8V) |
| 22 | /CS | F3 | SPI0_CS0 (1.8V) |
| 12 | INT | G14 | INT is inverted and connected to GPIO9_MOTION_INT (1.8V) |

Test of the IMU with the RTIMULibDemo

This demo may be downloaded from Github. Please install qtcreator first. Next please make sure that the spidev3.0 device in /dev is loaded. Edit the RTIMULibDemo.ini file with the SPI settings for the IMU (bus 3, select 0). Start the demo as root so it gets access to the SPI bus.

The IMU chip is located on the bottom side next to the JTAG connector. The IMU is optional on the J100. Please make sure that your J100 has the IMU installed.



J106: I2C busses of the Jetson TX1

The Jetson TX1 features 7 I2C devices: I2C0 to I2C6. The table below lists how these I2C devices are mounted.

| Bus | device | physical bus | Use |
|------|--------|--------------|--|
| I2C0 | 0 | I2C0 | CSI-A and CSI-B (CSI-B is shifted by 1 or 2) - 2 is the default - change to 1 by putting solder bridge on P1 |
| I2C1 | 1 | I2C1 | |
| I2C2 | 2 | I2C_PM | CSI-E and CSI-F (CSI-F is shifted by 1 or 2) - 2 is the default - change to 1 by putting solder bridge on P3 |
| I2C3 | 3 | ? | |
| I2C4 | 4 | ? | |
| I2C5 | 5 | ? | |
| I2C6 | 6 | I2C_CAM | CSI-C and CSI-D (CSI-D is shifted by 1 or 2) - 2 is the default - change to 1 by putting solder bridge on P2 |

On the J106 3 I2C busses are used for the 6 CSI-2 connectors. It is allowed to use 6 identical CSI-2 devices, as the J106 incorporates a unique I2C address shifter for 3 of the 6 CSI-2 connectors.

| Interface | lanes | I2C bus | device | shifted | marked | Use |
|-----------|-------|---------|--------|---------|--------|---|
| CSI-A | 2 | I2C0 | 0 | - | 0-N | B101/B102 module or CSI-2 camera with 2 lanes |
| CSI-B | 2 | I2C0 | 0 | yes | 0-S | B101/B102 module or CSI-2 camera with 2 lanes |
| CSI-C | 2 | I2C_CAM | 6 | - | 6-N | B101/B102 module or CSI-2 camera with 2 lanes |
| CSI-D | 2 | I2C_CAM | 6 | yes | 6-S | B101/B102 module or CSI-2 camera with 2 lanes |
| CSI-E | 2 | I2C_PM | 2 | - | 2-N | B101/B102 module or CSI-2 camera with 2 lanes |
| CSI-F | 2 | I2C_PM | 2 | yes | 2-S | B101/B102 module or CSI-2 camera with 2 lanes |

The address shift is programmable. The default value is 2. By installing a solder jumper (P1, P2 or P3) on the bottom side of the J106 the address shift may be changed to 1. This may be required for CSI-2 devices which have multiple I2C addresses.

Example

A B101/B102 module is connected to the CSI-E connector. The Toshiba TC358743 HDMI to CSI-2 converter chip is on the 7 bit I2C address 0x0F, as it can be seen in the terminal output below. Please use the -r option to show the device.

Cameras like the Raspberry Pi camera 2.1 (with IMX219 sensor) use pin 6 of the 22 pin camera connector as low active RESET (CAM-RST). The pin 6 of all 6 CSI-2 connectors are connected together and are driven by the TX1 pin H8 (GPIO2_CAM0_RST).

Now it needs to be determined how this GPIO pin can be controlled by software. The file gpio_names.h lists all pin names and relates them to a number.

```
GPIO2/CAM1_RST = GPIO 148
```

Please execute the instructions below at power up to configure this pin as GPIO output and to toggle it low briefly, so the cameras are reset properly at power up.

```
root@tegra-ubuntu:~# echo 148 > /sys/class/gpio/export
root@tegra-ubuntu:~# echo out > /sys/class/gpio/gpio148/direction
root@tegra-ubuntu:~# echo 1 > /sys/class/gpio/gpio148/value
root@tegra-ubuntu:~# echo 0 > /sys/class/gpio/gpio148/value
```

```
root@tegra-ubuntu:~# echo 1 > /sys/class/gpio/gpio148/value
root@tegra-ubuntu:~# sudo i2cdetect -y -r 2
   0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- -- -- 0f
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- -- --
```


CAN

The J106 features 1 CAN interface. As the Jetson TX1 does not have native CAN interfaces, the J106 features 1 SPI based CAN controller (Microchip MCP2515). Please install the Kernel and support package with the MCP2515 driver, which is provided by Auvideo.

```
$ sudo modprobe mcp251x

$ sudo ip link set can0 up type can bitrate 1000000

$ ifconfig
can0      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

eth0      Link encap:Ethernet  HWaddr 00:04:4b:57:29:32
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:549 errors:0 dropped:0 overruns:0 frame:0
          TX packets:549 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:46707 (46.7 KB)  TX bytes:46707 (46.7 KB)
```

CAN controller (MCP2515T-I/ML)

This SPI to CAN controller adds a CAN bus interface to the TX1, as there is no internal CAN controller in the TX1. The CAN bus is available on the motherboard connector 1. The physical CAN connector is provided by the motherboard which the J106 is plugged into. If you prefer CAN connectors on the carrier board itself please have a look at the J120.

CAN controller:

| Pin | Function | Jetson TX1 | Description |
|-----|----------|------------|--|
| 15 | SO | F14 | SPI1_MISO (level shifted to 3.3V) |
| 14 | SI | F13 | SPI1_MOSI (level shifted to 3.3V) |
| 12 | SCK | G13 | SPI1_CLK (level shifted to 3.3V) |
| 22 | /CS | E13 | SPI1_CS1 (level shifted to 3.3V) |
| 12 | /INT | H3 | AUDIO_CDC_IRQ |
| 17 | /RESET | D7 | GPIO5_CAM_FLASH_EN is inverted and connected to the RESET input GPIO5_CAM_FLASH_EN has a pull-down resistor. So RESET is high (inactive) if GPIO5_CAM_FLASH_EN is not configured as output. |

Connectors

Auvideo supplies cable kits for the connectors with 1.25 mm pitch. Please check the website for details. These are Molex PicoBlade compatible.

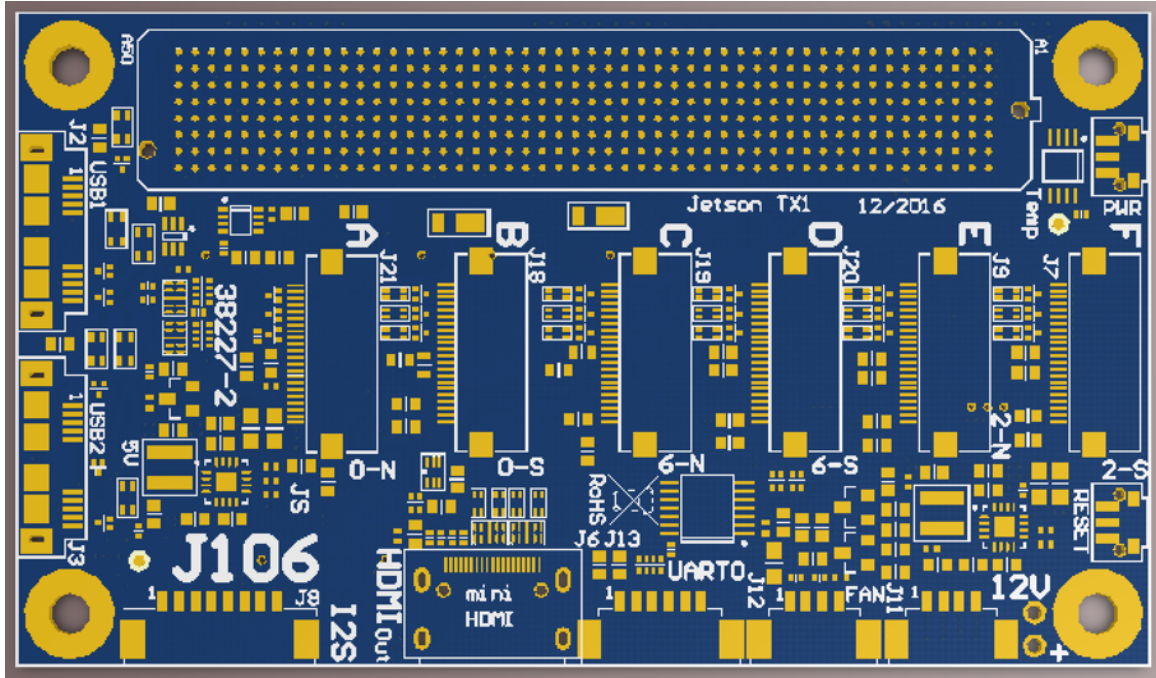


Figure 1: connectors on the top side

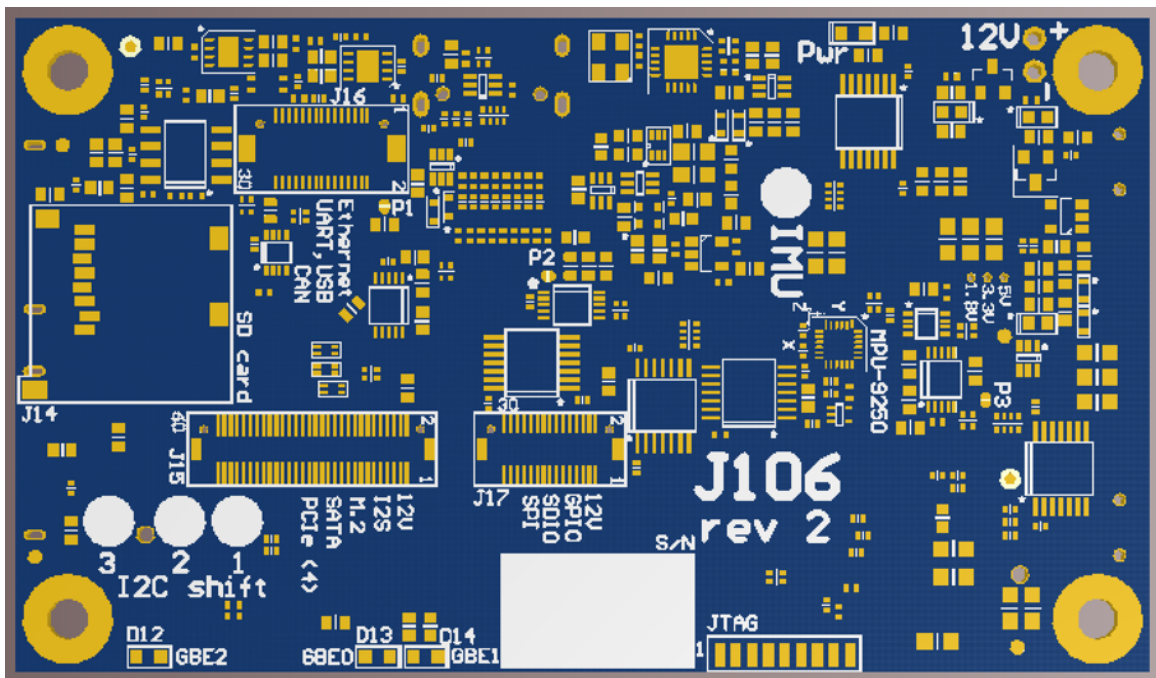


Figure 2: connectors on the bottom side

USB1 (J2)

This is a micro USB 3 connector (Amphenol GSB343K33HR). To get a standard USB 3.0 type A connector please use a cable like DeLOCK 83469 (http://www.delock.de/produkte/G_83469/merkmale.html?setLanguage=en).

| Pin | Function | Jetson TX1 | Description |
|-----|-----------|------------|---|
| 1 | 5V | - | 5V power controlled by USB1_EN_OC (A19) - max. 900 mA |
| 2 | USB1-D- | A39 | USB 2.0 data |
| 3 | USB1-D+ | A38 | USB 2.0 data |
| 4 | USB ID | - | not connected |
| 5 | GND | - | Ground |
| 6 | USB3_RX1- | F44 | USB 3.0 receive data |
| 7 | USB3_RX1+ | F43 | USB 3.0 receive data |
| 8 | GND | - | Ground |
| 9 | USB3_TX1- | C44 | USB 3.0 transmit data |
| 10 | USB3_TX1+ | C43 | USB 3.0 transmit data |

USB2 (J3)

This is a micro USB 3 connector (Amphenol GSB343K33HR). The second USB 3 port of the TX1 must be enabled in software (device tree file) as by default it is the SATA port.

| Pin | Function | Jetson TX1 | Description |
|-----|-----------|------------|---|
| 1 | 5V | - | 5V power controlled by USB1_EN_OC (A19) - max. 900 mA |
| 2 | USB2-D- | B43 | USB 2.0 data |
| 3 | USB2-D+ | B42 | USB 2.0 data |
| 4 | USB ID | - | not connected |
| 5 | GND | - | Ground |
| 6 | USB3_RX2- | H42 | USB 3.0 receive data |
| 7 | USB3_RX2+ | H41 | USB 3.0 receive data |
| 8 | GND | - | Ground |
| 9 | USB3_TX2- | E42 | USB 3.0 transmit data |
| 10 | USB3_TX2+ | E41 | USB 3.0 transmit data |

CSI-A (J21)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-A_D0- | F28 | CSI-2 bus A lane 0 |
| 20 | CSI-A_D0+ | F29 | CSI-2 bus A lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-A_D1- | H26 | CSI-2 bus A lane 1 |
| 17 | CSI-A_D1+ | H27 | CSI-2 bus A lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-A_CLK- | G27 | CSI-2 bus A clock |
| 14 | CSI-A_CLK+ | G28 | CSI-2 bus A clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C0_CLK | E15 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 0 |
| 2 | I2C0_DAT | D15 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 0 |
| 1 | 3.3V | - | 3.3V power supply |

CSI-B (J18)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-B_D0- | C28 | CSI-2 bus B lane 0 |
| 20 | CSI-B_D0+ | C29 | CSI-2 bus B lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-B_D1- | E26 | CSI-2 bus B lane 1 |
| 17 | CSI-B_D1+ | E27 | CSI-2 bus B lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-B_CLK- | D27 | CSI-2 bus B clock |
| 14 | CSI-B_CLK+ | D28 | CSI-2 bus B clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C0_CLK | E15 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 0 |
| 2 | I2C0_DAT | D15 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 0 |
| 1 | 3.3V | - | 3.3V power supply |

CSI-C (J19)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|-------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-C-D0- | F25 | CSI-2 bus C lane 0 |
| 20 | CSI-C-D0+ | F26 | CSI-2 bus C lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-C-D1- | H23 | CSI-2 bus C lane 1 |
| 17 | CSI-C-D1+ | H24 | CSI-2 bus C lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-C_CLK- | G24 | CSI-2 bus C clock |
| 14 | CSI-C_CLK+ | G25 | CSI-2 bus C clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C_CAM_CLK | E15 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 6 |
| 2 | I2C_CAM_DAT | D15 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 6 |
| 1 | 3.3V | - | 3.3V power supply |

CSI-D (J20)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|-------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-D-D0- | C26 | CSI-2 bus D lane 0 |
| 20 | CSI-D-D0+ | C25 | CSI-2 bus D lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-D_D1- | E23 | CSI-2 bus D lane 0 |
| 17 | CSI-D_D1+ | E24 | CSI-2 bus D lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-D_CLK- | D24 | CSI-2 bus D clock |
| 14 | CSI-D_CLK+ | D25 | CSI-2 bus D clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C_CAM_CLK | E15 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 6 |
| 2 | I2C_CAM_DAT | D15 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 6 |
| 1 | 3.3V | - | 3.3V power supply |

CSI-E (J9)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-E-D0- | F22 | CSI-2 bus E lane 0 |
| 20 | CSI-E-D0+ | F23 | CSI-2 bus E lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-E-D1- | H20 | CSI-2 bus E lane 1 |
| 17 | CSI-E-D1+ | H21 | CSI-2 bus E lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-E_CLK- | G21 | CSI-2 bus E clock |
| 14 | CSI-E_CLK+ | G22 | CSI-2 bus E clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C_PM_CLK | A6 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 2 |
| 2 | I2C_PM_DAT | B6 | 3.3V level (converted from 1.8V of the Jetson TX1) - device 2 |
| 1 | 3.3V | - | 3.3V power supply |

CSI-F (J7)

This is a 22 pin 2 lane CSI-2 connector with 0.5 mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi Zero. To connect a Pi camera with 15 pin connector a 22 to 15 adapter is required (38237 in the Auvideo online shop). The contacts are on the bottom.

| Pin | Function | Jetson TX1 | Description |
|-----|------------|------------|---|
| 22 | GND | - | Ground |
| 21 | CSI-F-D0- | C22 | CSI-2 bus F lane 0 |
| 20 | CSI-F-D0+ | C23 | CSI-2 bus F lane 0 |
| 19 | GND | - | Ground |
| 18 | CSI-F_D1- | E20 | CSI-2 bus F lane 0 |
| 17 | CSI-F_D1+ | E21 | CSI-2 bus F lane 1 |
| 16 | GND | - | Ground |
| 15 | CSI-F_CLK- | D21 | CSI-2 bus F clock |
| 14 | CSI-F_CLK+ | D22 | CSI-2 bus F clock |
| 13 | GND | - | Ground |
| 12 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 11 | - | - | optionally 5V (requires installation of 0603 size bead) |
| 10 | GND | - | Ground |
| 9 | - | - | - |
| 8 | - | - | - |
| 7 | GND | - | Ground |
| 6 | CAM0_RST | H8 | GPIO2/CAM1_RST = GPIO 148 |
| 5 | CAM0_MCLK | F9 | CAM0_MCLK |
| 4 | GND | - | Ground |
| 3 | I2C_PM_CLK | A6 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 2 |
| 2 | I2C_PM_DAT | B6 | 3.3V level (converted from 1.8V of the Jetson TX1) and address shift by 1 or 2 (default) - device 2 |
| 1 | 3.3V | - | 3.3V power supply |

HDMI (J6)

This is a 19 pin mini HDMI connector. Please note that the HDMI and mini HDMI connector have different pin outs. This is the pinout for rev 2 (38188-2) and newer versions. Rev 1 (38188) had the data lanes swapped.

| Pin | Function | Jetson TX1 | Description |
|-----|--------------|------------|-----------------------------------|
| 1 | GND | - | Ground |
| 2 | DP1_TXD0+ | E39 | HDMI data lane 2 |
| 3 | DP1_TXD0- | E38 | HDMI data lane 2 |
| 4 | GND | - | Ground |
| 5 | DP1_TXD1+ | C38 | HDMI data lane 1 |
| 6 | DP1_TXD1- | C37 | HDMI data lane 1 |
| 7 | GND | - | Ground |
| 8 | DP1_TXD2+ | D37 | HDMI data lane 0 |
| 9 | DP1_TXD2- | D36 | HDMI data lane 0 |
| 10 | GND | - | Ground |
| 11 | DP1_TXD3+ | E36 | HDMI clock |
| 12 | DP1_TXD3- | E35 | HDMI clock |
| 13 | GND | - | Ground |
| 14 | CEC | B33 | HDMI_CEC |
| 15 | HDMI_DDC_SCL | A35 | DP1_AUX_CH |
| 16 | HDMI_DDC_SDA | A34 | DP1_AUX_CH* |
| 17 | reserved | - | not connected |
| 18 | PWR | - | 5V power |
| 19 | HPD | A33 | inverted and connected to DP1_HPD |

UART 0 (J13)

This is a 6 pin connector with 1.25 mm pitch. Please connect to USB TTL serial converter (3.3V TTL level). Normally just connect TXD, RXD, and GND. Swap data lines. Default speed: 115200 bps.

| Pin | Function | Jetson TX1 | Description |
|-----|-----------|------------|--|
| 1 | 5V | - | 5V power output |
| 2 | UART0_TXD | H12 | UART 0 console port (3.3V TTL level): transmit data output |
| 3 | UART0_RXD | G12 | UART 0 console port (3.3V TTL level): receive data input |
| 4 | UART0_CTS | H11 | UART 0 console port (3.3V TTL level): clear to send |
| 5 | UART0_RTS | G11 | UART 0 console port (3.3V TTL level): ready to send |
| 6 | GND | - | Ground |

FAN (J12)

This is a 4 pin connector with 1.25 mm pitch. This is the same pinout as the fan connector on the Jetson TX1 development kit. With the J100 the fan is on by default. Use the „fan disable“ feature to turn off the fan.

Please note, that the „fan disable“ requires a software change when compared to the dev kit. On the dev kit „fan disable“ is controlled by an I2C port expander line. On the J100 „fan disable“ is connected to GPIO19_AUD_RST (through an inverting MOSFET). Pull the GPIO19 high to disable the fan (pin 4 becomes low). A low or floating signal on GPIO19 will not disable the fan.

| Pin | Function | Jetson TX1 | Description |
|-----|----------|------------|---|
| 1 | GND | - | Ground |
| 2 | 5V | - | 5V power supply to the fan |
| 3 | FAN_TACH | B17 | tachometer from the fan (open drain input with 100k pull-up to 1.8V) |
| 4 | FAN_PWM | C16 | PWM control to the fan (open drain output: controlled by FAN_PWM and „disable fan“ with GPIO19) |

Power (J11)

This is a 4 pin connector with 1.25 mm pitch. Power in 1 and power in 2 are shorted together.

| Pin | Function | Jetson TX1 | Description |
|-----|------------|------------|---|
| 1 | power in 1 | - | power input: typical 12V (range: 7V to 17V) |
| 2 | power in 2 | - | power input: typical 12V (range: 7V to 17V) |
| 3 | GND | - | power ground |
| 4 | GND | - | power ground |

I2S (J8)

This is a 8 pin connector with 1.25 mm pitch. The TX1 has 4 I2S digital interfaces with one I2S data input for 2 audio channels. On the J106 these 4 I2S busses are tied together. The I2S0 bus is the master bus. The other 3 I2S busses should be configured for slave mode where LRCLK and CLK are configured as input.

The I2S0_CLK drives via 3 series resistors of 0 Ohm the I2S1_CLK, I2S2_CLK and I2S3_CLK inputs. The I2S0_LRCLK drives via 3 series resistors of 0 Ohm the I2S1_LRCLK, I2S2_LRCLK and I2S3_LRCLK inputs.

| Pin | Function | Jetson TX1 | Description |
|-----|-----------|-----------------|---|
| 1 | I2S0_SIN | G1 | digital audio interface: audio input 0 (3.3V) |
| 2 | I2S1_SIN | C14 | digital audio interface: audio input 1 (3.3V) |
| 3 | I2S2_SIN | G6 | digital audio interface: audio input 2 (3.3V) |
| 4 | I2S3_SIN | E5 | digital audio interface: audio input 3 (3.3V) |
| 5 | I2S_MCLK | F1 | digital audio interface: master clock (3.3V) |
| 6 | I2S_CLK | G2, C15, G5, E6 | digital audio interface: bit clock (3.3V) - all four interfaces tied together - I2S0 should be master, the other slaves |
| 7 | I2S_LRCLK | H1, D13, H5, F5 | digital audio interface: word clock (3.3V) |
| 8 | GND | - | Ground |

Motherboard connector 1 (J16)

This is a 30 pin female DF17 motherboard connector (DF17(2.0)-30DP-0.5V(57)). All signals on the three motherboard connectors must be protected with TVS diodes externally. Also please pay attention to the I/O voltage. Some signals are directly connected to the TX1 and have an I/O voltages of 1.8V.

| Pin | Function | Jetson TX1 | Description |
|-----|-----------|------------|---|
| 1 | 5V -2 | - | not connected (normally 5V power input) |
| 2 | 3.3V | - | 3.3V power output to power the motherboard |
| 3 | FORCE_REC | E1 | force recovery button (open drain, 1.8V) |
| 4 | GBE_MDI3- | H48 | Gigabit Ethernet (lane 3) |
| 5 | POWER_BTN | (B50) | power button (open drain, Vdd_RTC - 2.5V) |
| 6 | GBE_MDI3+ | H47 | Gigabit Ethernet (lane 3) |
| 7 | GND | - | Ground |
| 8 | GBE_MDI2- | G49 | Gigabit Ethernet (lane 2) |
| 9 | USB0-D+ | B39 | USB 2.0: for firmware upgrade |
| 10 | GBE_MDI2+ | G48 | Gigabit Ethernet (lane 2) |
| 11 | USB0-D- | B40 | USB 2.0: for firmware upgrade |
| 12 | GBE_MDI1- | F48 | Gigabit Ethernet (lane 1): RX for 100BT |
| 13 | GND | - | Ground |
| 14 | GBE_MDI1+ | F47 | Gigabit Ethernet (lane 1): RX for 100BT |
| 15 | UART1_RXD | D10 | UART 1 receive data input (3.3V TTL level) |
| 16 | GBE_MDI0- | E49 | Gigabit Ethernet (lane 0): TX for 100BT |
| 17 | UART1_TXD | D9 | UART 1 transmit data output (3.3V TTL level) |
| 18 | GBE_MDI0+ | E48 | Gigabit Ethernet (lane 3): TX for 100BT |
| 19 | CAN2_L | - | CAN_L of CAN bus 2 |
| 20 | GND | - | Ground |
| 21 | CAN2_H | - | CAN_H of CAN bus 2 |
| 22 | reserved | - | not connected |
| 23 | CAN1_L | - | CAN_L of CAN bus 1 |
| 24 | RESET-IN | (A47) | reset button (open drain input, 1.8V) |
| 25 | CAN1_H | - | CAN_H of CAN bus 1 |
| 26 | USB0_VBUS | B37 | connect to VBUS voltage of USB 0 port (5V) |
| 27 | USB0_EN | (A17) | inverted (so it is active low) open drain output with 10k pullup to 3.3V |
| 28 | GBE_CTREF | (H50) | reserved (connected to GND on 38188-2) |
| 29 | 3.3V | - | 3.3V power output to power the motherboard |
| 30 | 5V -1 | - | not connected (normally 5V power input) |

Motherboard connector 2 (J17)

This is a 30 pin female DF12 motherboard connector (DF12(5.0)-30DP-0.5V(86)).

| Pin | Function | Jetson TX1 | Description |
|-----|---------------|------------|---|
| 1 | CAN_WAKE | C20 | CAN_WAKE |
| 2 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 3 | CAN1_ERR | C19 | CAN1_ERR |
| 4 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 5 | WIFI2_WAKE | B20 | GPIO10_WIFI_WAKE_AP |
| 6 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 7 | BT2_EN | B21 | GPIO12_BT_EN |
| 8 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 9 | GNSS_PPS | B18 | GNSS_PPS |
| 10 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 11 | AP_WAKE_BT | B19 | GPIO11_AP_WAKE_BT |
| 12 | power input 3 | - | power input 3 (typical 12V, range: 7V to 17V) |
| 13 | WIFI_EN | A29 | SDIO_RST* |
| 14 | GND | - | Ground |
| 15 | GND | - | Ground |
| 16 | SPI2_CLK | H14 | SPI 2 port (1.8V level) |
| 17 | SDIO_CMD | B29 | SDIO port |
| 18 | SPI2_MISO | H15 | SPI 2 port (1.8V level) |
| 19 | SDIO_CLK | B30 | SDIO port |
| 20 | SPI_MOSI | G15 | SPI 2 port (1.8V level) |
| 21 | SDIO_D3 | A30 | SDIO port |
| 22 | SPI2_CS1 | F16 | SPI 2 port (1.8V level) |
| 23 | SDIO_D2 | A31 | SDIO port |
| 24 | SPI_CS0 | G16 | SPI 2 port (1.8V level) |
| 25 | SDIO_D1 | A32 | SDIO port |
| 26 | UART2_TXD | B16 | UART 2 transmit data output (3.3V TTL level) |
| 27 | SDIO_D0 | B32 | SDIO port |
| 28 | UART2_RXD | B15 | UART 2 receive data input (3.3V TTL level) |
| 29 | GND | - | Ground |
| 30 | GND | - | Ground |

Motherboard connector 3 (J15)

This is a 60 pin female DF12 motherboard connector (DF12(5.0)-60DP-0.5V(86)). The PCIe TX lines do not have a series cap. Therefore add one on the motherboard close to the J15 connector.

| Pin | Function | Jetson TX1 | Description |
|-----|---------------|------------|---|
| 1 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 2 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 3 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 4 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 5 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 6 | power input 4 | - | power input 4 (typical 12V, range: 7V to 17V) |
| 7 | GND | - | Ground |
| 8 | reserved | - | not connected |
| 9 | PEX_RX2+ | F40 | PCIe lane 2 (receive) |
| 10 | SATA_DEV_SLP | D47 | |
| 11 | PEX_RX2- | F41 | PCIe lane 2 (receive) |
| 12 | GND | - | Ground |
| 13 | GND | - | Ground |
| 14 | SATA_RX+ | G45 | |
| 15 | PEX_TX2+ | C40 | PCIe lane 2 (transmit) |
| 16 | SATA_RX- | G46 | |
| 17 | PEX_TX2- | C41 | PCIe lane 2 (transmit) |
| 18 | GND | - | Ground |
| 19 | GND | - | Ground |
| 20 | SATA_TX+ | D45 | |
| 21 | PEX_RX1+ | G39 | PCIe lane 1 (receive) |
| 22 | SATA_TX- | D46 | |
| 23 | PEX_RX1- | G40 | PCIe lane 1 (receive) |
| 24 | GND | - | Ground |
| 25 | GND | - | Ground |
| 26 | I2S0_SOUT | H2 | I2S digital audio data out (1.8V) |
| 27 | PEX_TX1+ | D39 | PCIe lane 1 (transmit) |
| 28 | I2S0_CLK | G2 | I2S digital audio bit clock (1.8V) |
| 29 | PEX_TX1- | D40 | PCIe lane 1 (transmit) |
| 30 | I2S0_LRCLK | H1 | I2S digital audio word clock (1.8V) |
| 31 | GND | - | Ground |
| 32 | I2S0_SIN | G1 | I2S digital audio data in (1.8V) |

| Pin | Function | Jetson TX1 | Description |
|-----|--------------|------------|-------------------------------------|
| 33 | PEX_RX3+ | G42 | PCIe lane 3 (receive) |
| 34 | reserved | - | do not connect |
| 35 | PEX_RX3- | G43 | PCIe lane 3 (receive) |
| 36 | reserved | - | do not connect |
| 37 | GND | - | Ground |
| 38 | reserved | - | do not connect |
| 39 | PEX_TX3+ | D42 | PCIe lane 3 (transmit) |
| 40 | reserved | - | do not connect |
| 41 | PEX_TX3- | D43 | PCIe lane 3 (transmit) |
| 42 | I2C1_CLK_3V3 | A21 | I2C1 bus (3.3V) |
| 43 | GND | - | Ground |
| 44 | I2C1_DAT_3V3 | A20 | I2C1 bus (3.3V) |
| 45 | PEX_CLK0+ | A44 | PCIe clock |
| 46 | GPIO_EXP0 | A23 | |
| 47 | PEX_CLK0- | A45 | PCIe clock |
| 48 | I2C0_CLK_3V3 | (E15) | I2C0 bus with level shifter to 3.3V |
| 49 | GND | - | Ground |
| 50 | I2C0_DAT_3V3 | (D15) | I2C0 bus with level shifter to 3.3V |
| 51 | PEX_RX4+ | H44 | PCIe lane 4 (receive) |
| 52 | BT2_WAKE_AP | B22 | |
| 53 | PEX_RX4- | H45 | PCIe lane 4 (receive) |
| 54 | PCIE_L1_RQ | C47 | |
| 55 | GND | - | Ground |
| 56 | PCIE_WAKE_L | D48 | |
| 57 | PEX_TX4+ | E44 | PCIe lane 4 (transmit) |
| 58 | PCIE0_LO_RST | C49 | |
| 59 | PEX_TX4- | E45 | PCIe lane 4 (transmit) |
| 60 | PCIE0_LO_RQ | C48 | |

FAQ

1. to be added

Disclaimer

Thank you for reading this manual. If you have found any typos or errors in this document, please let us know.

This is the preliminary version of this data sheet. Please treat all specifications with caution as there may be any typos or errors.

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