AUVIDEA
audio video media

J140
technical reference manual
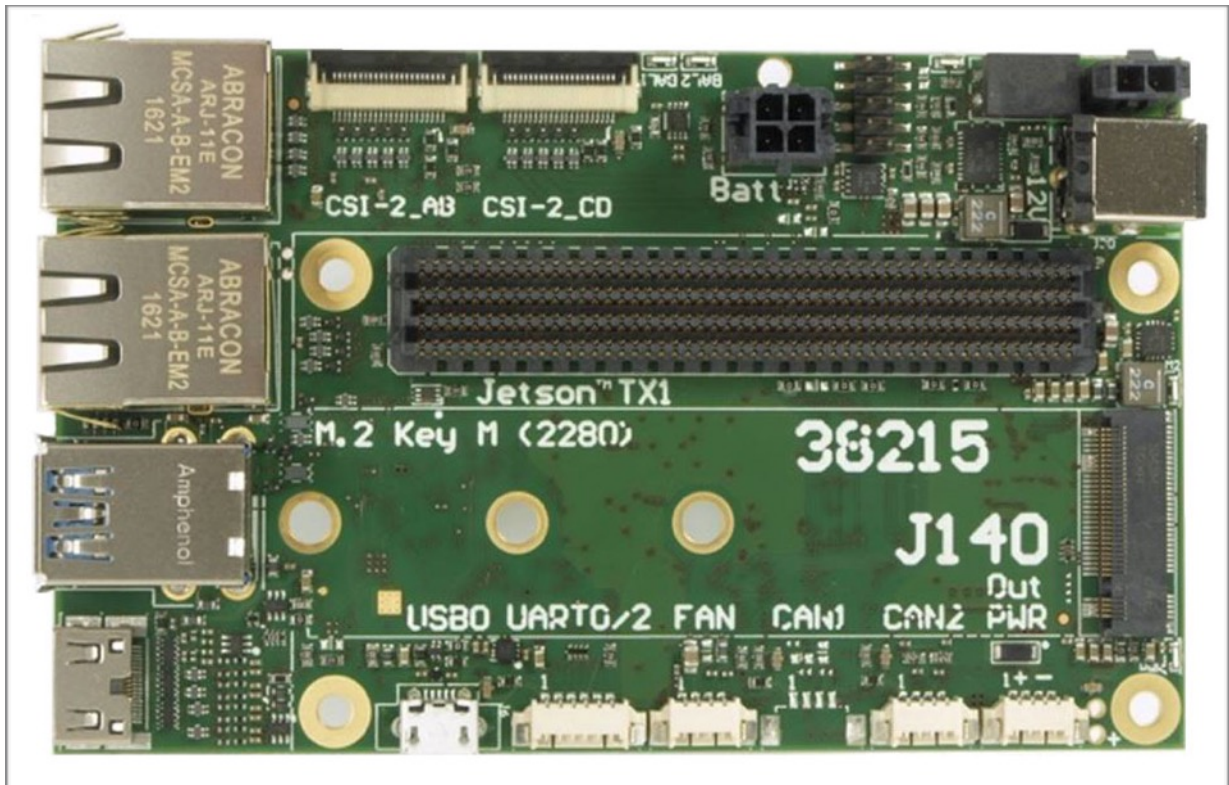
Preliminary

November 2016

Copyright Notice

Trademarks

NVIDIA, the NVIDIA logo, CUDA, Jetson, Maxwell,Tegra and VisionWorks are registered trademarks and/or trademarks of NVIDIA Corporation in the United States and other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

Features

J140 carrier board for the NVIDIA® Jetson™ TX1

The J140 carrier board is slightly larger than the TX1 compute module. It extends out, to make room for the USB3 and 2 RJ45 connectors. It is plugged in below the TX1 and brings out many interfaces on connectors.
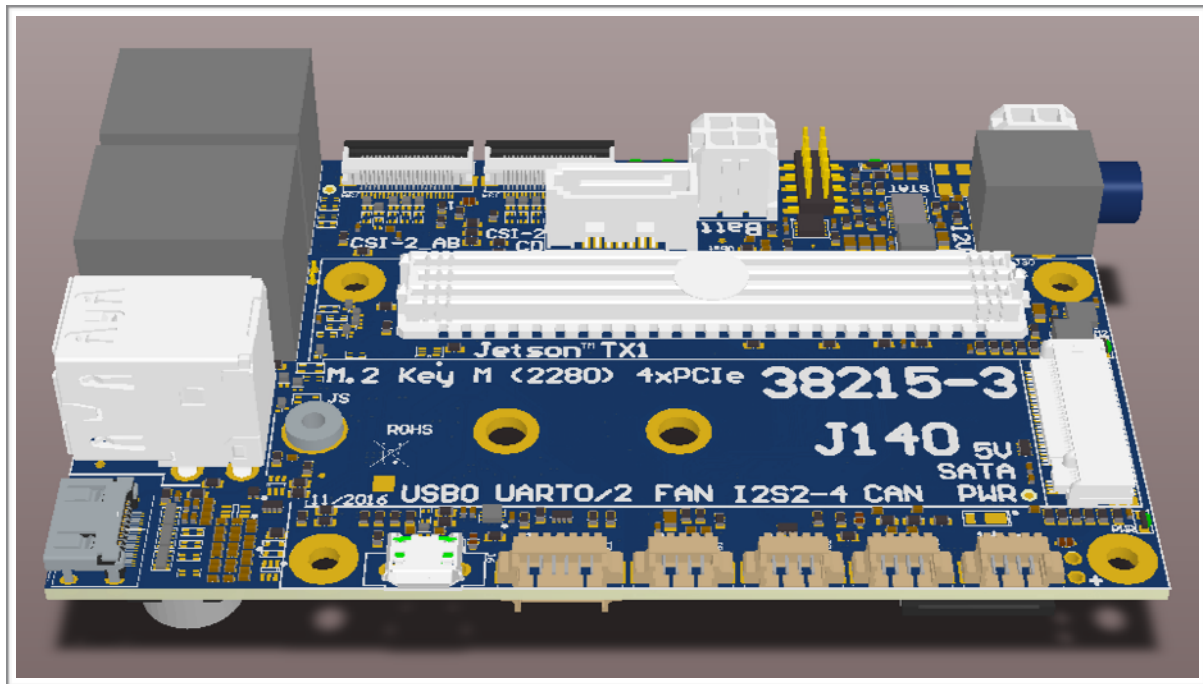
Technical details

- carrier board for one NVIDIA® Jetson™ TX1 compute module
- standalone operation
- three 4 lane CSI-2 connectors (22 pin FPC 0.5mm pitch) - for B102 bridge or CSI-2 cameras
- micro SD card
- two USB3 type A
- two RJ45 connectors for 10/100/1000BT Ethernet (TX1 GbE and Intel i210 PCIe GbE)
- UART 0 and 2 (3.3V TTL) (6 pin) - console access and user UART
- one I2S digital audio (6 pins) plus extension I2S (for 8 audio channels total)
- mini HDMI out
- M.2 type M 2280
- size: 68 x 110 mm (size of the PCB)
- mounting: 4 M3 holes with 3.2mm each (42 x 79 mm spacing)
- model: 38215

Power

- power: 12V typical (5.5/2.5mm plug) or 2 pin Molex MicroFit 3mm connector
- range: 7V to 17V
- 2S Lipo charger and battery backup (with 2 cell balancer and battery monitor)
- do not use the 19V power supply of the Jetson TX1 dev kit - it will damage the J120 carrier board

How do the various models differ?

Feature	J100	J100 + M100	J120	J130	J140
Jetson TX1 compatible	✓	✓	✓	✓	✓
HDMI out	mini	mini	mini	standard	mini
USB 3.0 type A	-	-	2	4	1 + USB2
micro USB 3.0	2	2	-	1	-
micro USB 2.0 OTG	-	✓	✓	✓	✓
Wifi (2 antennas) on TX1 module	✓	✓	✓	v	✓
10/100/1000 Ethernet (RJ45)	-	1	1	1	2 (TX1 + i210)
IMU MPU-9250 (optional 9 axis sensor)	✓	✓	✓	✓	✓
CAN controllers	-	1	1	1	1
SATA	-	M.2 B 2242	-	standard	standard
4x PCIe	-	-	M.2 M 2280	PCIe slot	M.2 2280
micro SD card	✓	✓	✓	✓	✓
SPI/I2C	-	-	1/1		
UART	1	2	2	2	2
CSI-2 (22 pin - 4 lanes)	2	2	1	2 HDMI in	3
CSI-2 (15 pin - 2 lanes)	2	2	-	-	-
I2S (digital audio)	2	2	1 (2 channels)	2 HDMI in	1 (8 channels)
fan connector	✓	✓	✓	✓	✓
switches: power, reset, force recovery	-	✓	✓	✓	✓
size	50x87mm	98x87mm	50x110mm	74x110mm	68x110mm
power in	7 .. 17V	7..42V	7 .. 17V	7 .. 17V	7 .. 17V
battery charger & backup	-	-	-	-	2S Lipo

J100 + M100 (or M110)

The J100 may be plugged into the M100 motherboard. Three motherboard connectors carry signals for CAN, Ethernet, UART, power, PCIe, SATA, SPI, I2C and more. The M110 features standard connectors for SATA and PCIe (4 lanes).

J140 Rev 1 (38215)
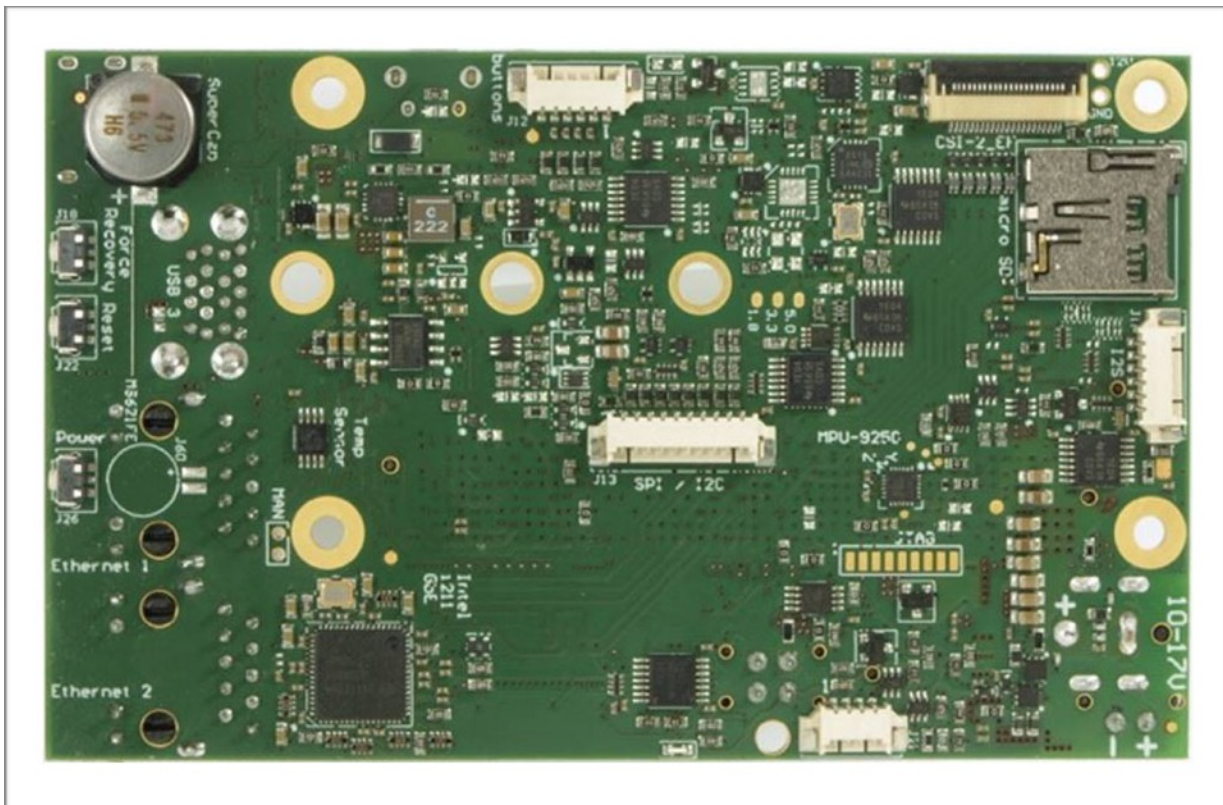
First revision of the J140. Very limited distribution.

J140 Rev 2 (38215-2)

- first customer samples

J140 Rev 3 (38215-3)

- 3 GPIOs for charger control and status
- battery connector rotated (180°)
- I2S2 replaced by I2S0 (plus audio extension to 8 audio channels)
- added SATA connector
- power out: 5V for SATA SSD
- added M.2 spacer to fix 2280 SSD card

J140 rev 1 bottom side

The optional super cap is the tallest component on the bottom side (5.5mm high). The capacity of the super cap is 47mF. Optionally the RTC (realtime clock of the Jetson TX1) may be powered by a Lithium cell (MS621FE-FL11E). It is located next to the power button. If the super cap and the Lithium cell are not populated, RTC power may be provided on the buttons connector (J12 pin 1).

Testing of the J140

The following functions are tested:

- HDMI out
- 1000BT Ethernet (2 ports)
- USB 3.0 on USB1
- USB 2.0 on USB2 (USB 3 mode requires modification of device tree file)
- micro SD card
- power consumption with 12 V power supply (Ubuntu booted and system idle)
- CSI-2 interface with B102 HDMI to CSI-2 module
- CAN bus (communicating with Autoquad flight controller)
- IMU (with qtcreator test program)
- M.2 2280 PCIe SSD

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

STEP (3D) models

J140 rev 1: http://www.auvidea.eu/download/step/38198.step.zip

Getting started

Applying power

The J140 is powered by the on-board power connectors (J20 and J30). J30 is a standard 5.5/2.5mm power jack for standard 12V power supplies. J20 is a 2 pin Molex MicroFit connector (MOLEX 436500216).

Auto start

The J140 automatically powers up the TX1 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 J140 are powered up. This is indicated by lighting up the green power LED on the top side next to the M.2 connector.

The auto start logic is powered by the 12V main power supply. It detects when power is applied. Alternatively power up the J140 by pressing the power button.

Console access

The console port of the TX1 is UART 0. The J140 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 it 115200. Settings: 8/1/N.

Firmware upgrade of the TX1

The J140 does support a direct firmware upgrade of the TX1 via the USB2 OTG port. Alternatively please perform the firmware upgrade on the TX1 development board.
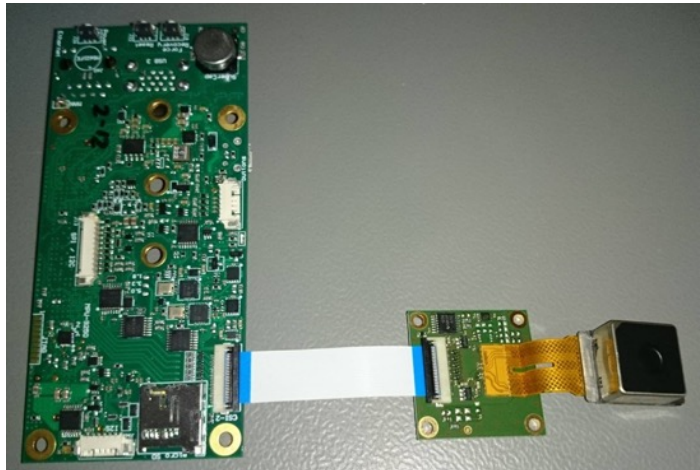
CSI-2 video in

CSI-2 connector

The J140 features three CSI-2 connectors with 4 data lanes each. These are 22 pin FPC connectors with 0.5mm pitch. They have the same pin out as the 22 pin CSI-2 connector found on the carrier board for the Raspberry Pi compute module. Support for the Raspberry Pi cameras is planned.

B102

The B102 is an HDMI to CSI-2 converter module, which may directly be connected to the CSI-2 connector of the J140. It provides raw uncompressed video to the Jetson TX1 with a resolution up to 1080p60. This video then may be compressed or processed in the TX1. A typical application for this task is the GStreamer. A driver developed by Ridgerun is provided and included in the Auvidea TX1 firmware. Please contact us for the source code of the driver.

Toshiba 41M Pixel Camera

Raytrix provides the C41 camera module. Auvidea has developed a small interface board to connect the C41 camera module to the J120. A resolution up the 4kp60 is supported (2160p60). The Bayer encoded video is provided raw to the TX1 and converted in the graphics engine of the TX1. The picture on the right shows the J120 connected to the camera interface module and the C41 camera.
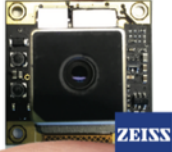
J140 connected to three 4k cameras. Raytrix has shown this setup at the Vison show in Stuttgart/Germany.
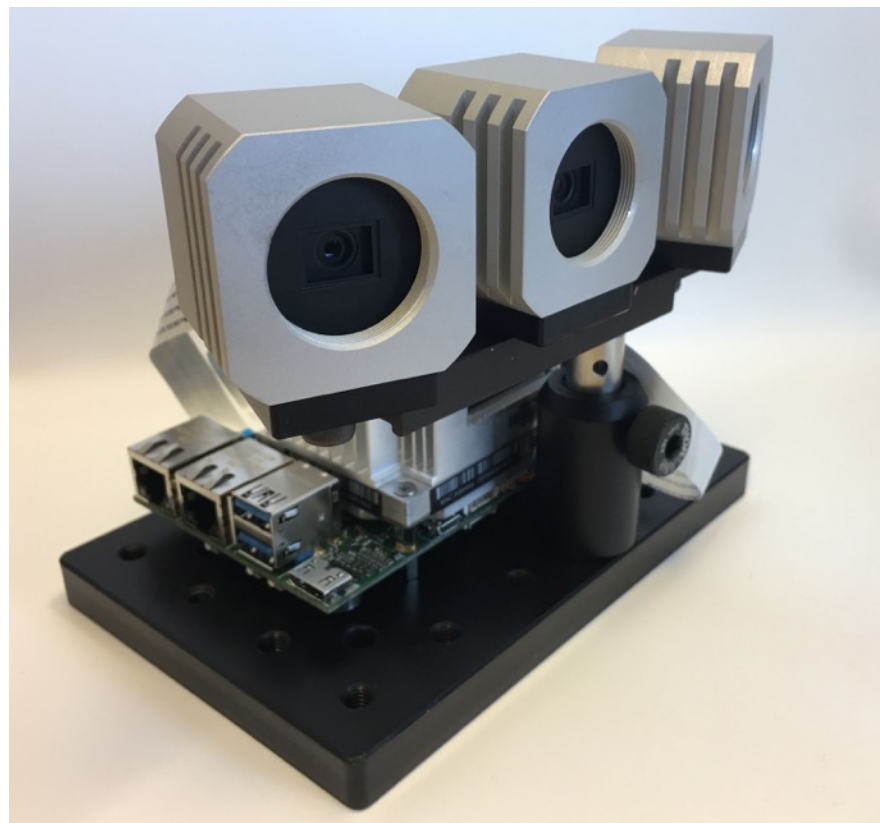
Devices

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 J140 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)

SPI busses with the Jetson TX1

The Jetson TX1 features 3 SPI busses: SPI0 to SPI2. The table below lists how these SPI devices are mounted. Please note how the 5 physical SPI devices relate to the 5 spidevs.

Bus	CS	Tegra X1	SPI device	Use
SPI0	0	SPI4	spidev3.0	IMU MPU-9250
SPI1	0	SPI1	spidev0.0	CAN controller 1 (MCP2515)
SPI1	1	SPI1	spidev0.1	CAN Controller 2 (MCP2515)
SPI2	0	SPI2	spidev1.0	I2C/SPI connector J13
SPI2	1	SPI2	spidev1.1	I2C/SPI connector J14

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 J140. Please make sure that your J140 has the IMU installed.
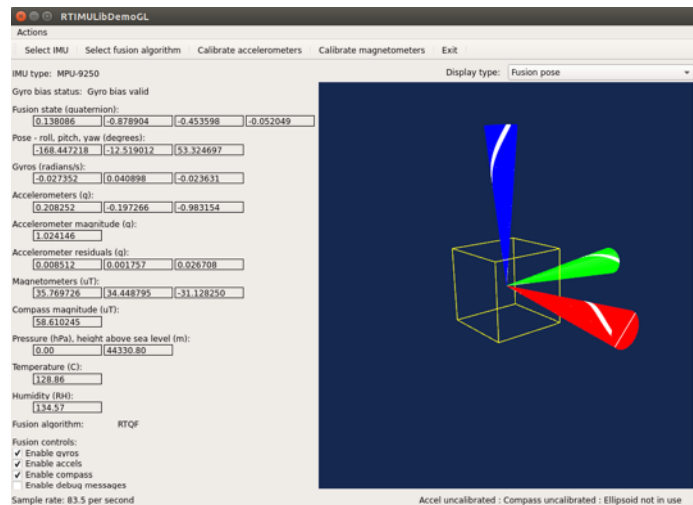
I2C busses with the Jetson TX1

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	
I2C1	1	I2C1	CSI-2 AB connector, LM75ADP temp. sensor, STC3100 battery monitor
I2C2	2	I2C_PM	CSI-2 EF connector
I2C3	3	?	
I2C4	4	?	
I2C5	5	?	
I2C6	6	I2C_CAM	CSI-2 CD connector

A B102 module may be connected to the CSI-2 EF 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.

```
$ 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: 50 51 52 53 -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

CAN

The J140 features 1 CAN interface. As the Jetson TX1 does not have native CAN interfaces, the J140 features an SPI based CAN controller (Microchip MCP2515). Please install the Kernel and support package with the MCP2515 driver, which is provided by Auvidea.

```
$ 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)
```

M.2 SSD 2280

The J140 features a very high performance SSD of the NGFF (next generation form factor) kind called now M.2. There are two types available: SATA and 4x PCIe. The J140 only supports the 4x PCIe type (type M). We have tested the Samsung SM951 128GB module (MZ-VPV1280). Please see the picture on the right with the J120.

How can the type M card be identified?

M.2 type M card have just one notch on the right side on the bottom. Please see the picture on the right. M.2 type B (SATA) cards have a notch on the right side on top or they have two notches. So M.2 type B (SATA) cards may fit mechanically, but they will not work. Please make sure that the M.2 card for the J120 has just one notch.
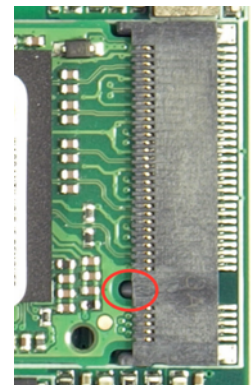
Examples of M.2 type M SSDs with PCIe interface:

• Samsung 950 Pro 256GB (MZ-V5P256BW)

• Samsung PM961 128GB (MZVLW128HEGR)

• Samsung SM951 512GB (MZVPV512HDGL)

M.2 NVMe software support on the Jetson TX1

In order to use a M.2 key B SSD on the Jetson TX1, a kernel module supporting NVMe is needed. This module is not part of the dev kit default kernel configuration, so the kernel module needs to compiled. Because of the mixture of 32 bit user space and 64 bit kernel, it is recommended to cross compile the kernel on a Ubuntu 14.04 LTS host machine. For details on cross-compiling a kernel for L4T please visit the Ridgerun wiki.

https://developer.ridgerun.com/wiki/index.php?title=Compiling_Tegra_X1_source_code#Kernel

The required module '.config' parameter is

```
        CONFIG_BLK_DEV_NVME=y
```

or in menuconfig under

```
        Device Drivers -> Block Devices -> NVM Express block device
```

Connectors

Auvidea supplies cable kits for the connectors with 1.25 mm pitch. Please check the website for details. Figure 1 and 2 show the J140 rev 3 but the connector placement and pin numbering also applies to the other revs. Below are the top side and bottom side of the J140.
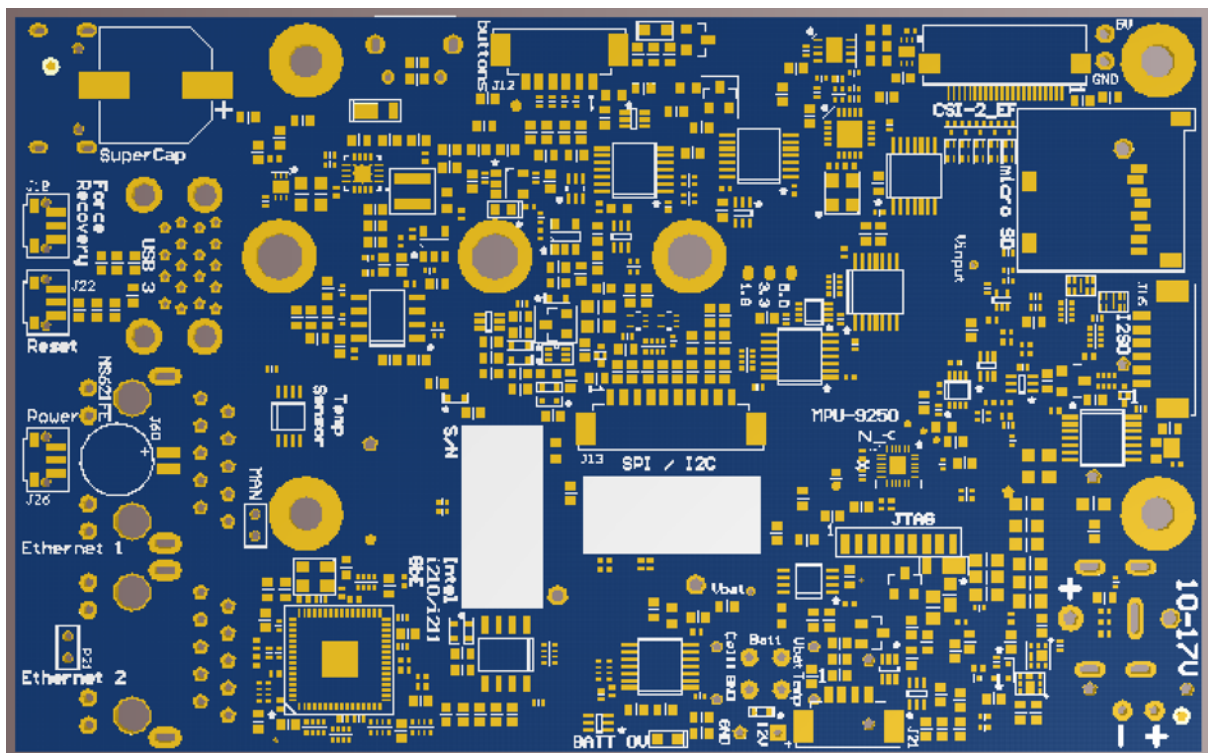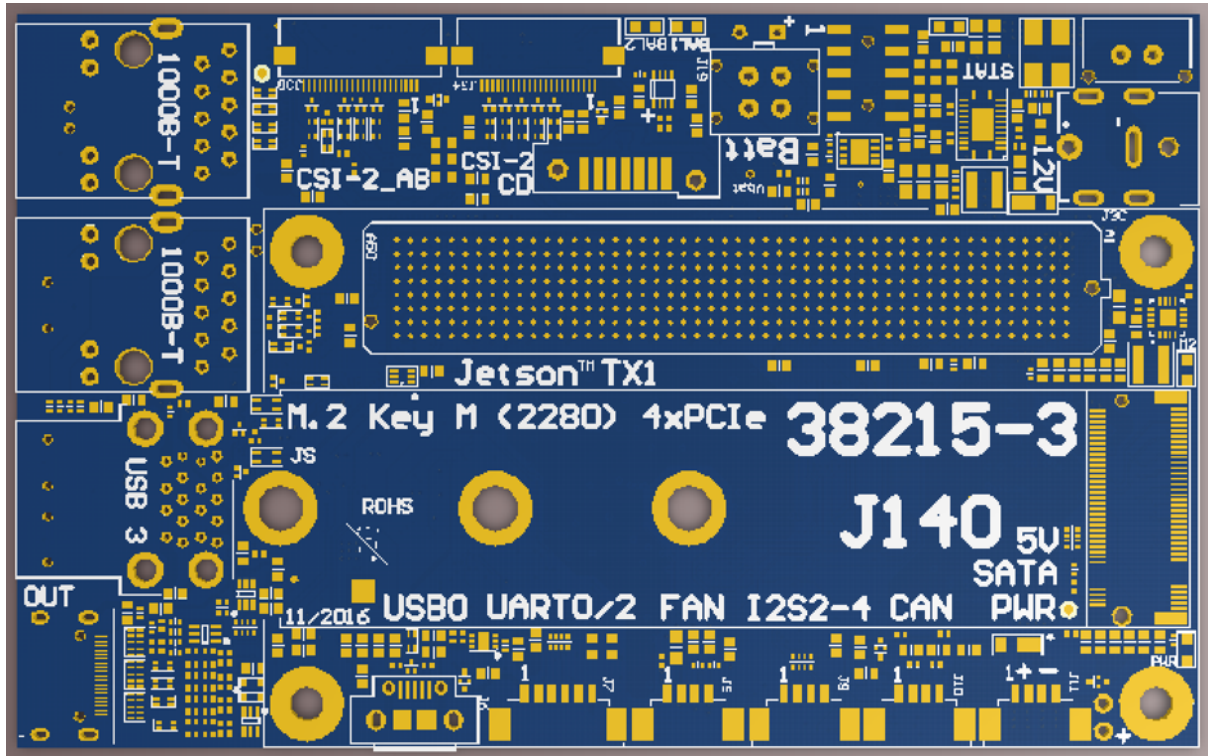
USB 3.0 (J2)

This is dual USB 3.0 type a connector. Pin 1-9 is the bottom connector (USB 2.0) and pin 10-18 is the top connector (USB 3.0).

Pin	Function	Jetson TX1	Description
1	5V	-	5V power controlled by USB2_EN_OC (A19) - max. 900 mA
2	USB2-D-	B43	USB 2.0 data
3	USB2-D+	B42	USB 2.0 data
4	GND	-	Ground
5	-	-	-
6	-	-	-
7	GND	-	Ground
8	-	E42	-
9	-	E41	-
10	5V	-	5V power controlled by USB1_EN_OC (A18) - max. 900 mA
11	USB1-D-	A39	USB 2.0 data
12	USB1-D+	A38	USB 2.0 data
13	GND	-	Ground
14	USB3_RX1-	F44	USB 3.0 receive data
15	USB3_RX1+	F43	USB 3.0 receive data
16	GND	-	Ground
17	USB3_TX1-	C44	USB 3.0 transmit data
18	USB3_TX1+	C43	USB 3.0 transmit data

USB 2.0 (J6)

USB 2.0 port for firmware upgrades or for USB 2.0 devices like mouse and keyboard.

Pin	Function	Jetson TX1	Description
1	5V	-	5V power controlled by USB0_EN_OC* (A17) - max. 500 mA
2	USB0-D-	B40	USB 2.0 data
3	USB0-D+	B39	USB 2.0 data
4	USB0_ID	A36	connected to 3.3V with 10k pullup
5	GND	-	Ground
-	USB0_VBUS	B37	connected to pin 1 of this connector

CAN controller (MCP2515T-I/ML)

The SPI to CAN controller adds a CAN bus interface to the TX1, as there is no internal CAN controller in the TX1. The SPI1_CS1 selects the controller. The CAN bus is available on J10 (CAN).

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	GPIO20_AUD_INT (low active with 10k pull-up to 3.3V)
17	/RESET	D7	GPIO5_CAM_FLASH_EN is inverted and connected to the RESET inputs

CAN connector (J10):

Pin	Function	Jetson TX1	Description
1	5V	-	5V power for the CAN bus (500 mA)
2	CAN_H	-	CAN data high
3	CAN_L	-	CAN data low
4	GND	-	Ground (0V)

CSI-AB (J38)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm 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 compute module carrier board. The contacts are on the bottom.

Pin	Function	Jetson TX1	Description
1	3.3V	-	3.3V power supply
2	I2C1_DAT_3V3	B6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 1
3	I2C1_CLK_3V3	A6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 1
4	GND	-	Ground
5	CAM1_MCLK	F8	CAM1_MCLK
6	CAM1_GPIO	F7	GPIO1_CAM1_PWR*
7	GND	-	Ground
8	CSI-B_D1+	E27	CSI-2 bus B lane 1
9	CSI-B_D1-	E26	CSI-2 bus B lane 1
10	GND	-	Ground
11	CSI-B-D0-	C29	CSI-2 bus B lane 0
12	CSI-B-D0-	C28	CSI-2 bus B lane 0
13	GND	-	Ground
14	CSI-A_CLK+	G28	CSI-2 bus A clock
15	CSI-A_CLK-	G27	CSI-2 bus A clock
16	GND	-	Ground
17	CSI-A-D1+	H27	CSI-2 bus A lane 1
18	CSI-A-D1-	H26	CSI-2 bus A lane 1
19	GND	-	Ground
20	CSI-A-D0+	F29	CSI-2 bus A lane 0
21	CSI-A-D0-	F28	CSI-2 bus A lane 0
22	GND	-	Ground

CSI-CD (J14)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm 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 compute module carrier board. The contacts are on the bottom.

Pin	Function	Jetson TX1	Description
1	3.3V	-	3.3V power supply
2	CAM_I2C_DAT	D6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 6
3	CAM_I2C_CLK	C6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 6
4	GND	-	Ground

Pin	Function	Jetson TX1	Description
5	CAM0_MCLK	F9	CAM2_MCLK
6	CAM0_GPIO	G8	GPIO0_CAM0_PWR*
7	GND	-	Ground
8	CSI-D_D1+	E24	CSI-2 bus D lane 1
9	CSI-D_D1-	E23	CSI-2 bus D lane 1
10	GND	-	Ground
11	CSI-D-D0-	C26	CSI-2 bus D lane 0
12	CSI-D-D0-	C25	CSI-2 bus D lane 0
13	GND	-	Ground
14	CSI-C_CLK+	G25	CSI-2 bus C clock
15	CSI-C_CLK-	G24	CSI-2 bus C clock
16	GND	-	Ground
17	CSI-C-D1+	H24	CSI-2 bus C lane 1
18	CSI-C-D1-	H23	CSI-2 bus C lane 1
19	GND	-	Ground
20	CSI-C-D0+	F26	CSI-2 bus C lane 0
21	CSI-C-D0-	F25	CSI-2 bus C lane 0
22	GND	-	Ground

CSI-EF (J14)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm 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 compute module carrier board. The contacts are on the bottom.

Pin	Function	Jetson TX1	Description
1	3.3V	-	3.3V power supply
2	I2C_PM_DAT	B6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 2
3	I2C_PM_CLK	A6	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 2
4	GND	-	Ground
5	CAM2_MCLK	E7	CAM2_MCLK
6	CAM3_GPIO	H7	GPIO3_CAM1_RST*
7	GND	-	Ground
8	CSI-F_D1+	E21	CSI-2 bus F lane 0
9	CSI-F_D1-	E20	CSI-2 bus F lane 1
10	GND	-	Ground
11	CSI-F-D0-	C23	CSI-2 bus F lane 0
12	CSI-F-D0-	C22	CSI-2 bus F lane 0

Pin	Function	Jetson TX1	Description
13	GND	-	Ground
14	CSI-E_CLK+	G22	CSI-2 bus E clock
15	CSI-E_CLK-	G21	CSI-2 bus E clock
16	GND	-	Ground
17	CSI-E-D1+	H21	CSI-2 bus E lane 1
18	CSI-E-D1-	H20	CSI-2 bus E lane 1
19	GND	-	Ground
20	CSI-E-D0+	F23	CSI-2 bus E lane 0
21	CSI-E-D0-	F22	CSI-2 bus E lane 0
22	GND	-	Ground

1st GbE Ethernet (J1)

The J140 features an on-board RJ45 connector with integrated magnetics for 10/100/1000BT (GbE) Ethernet with 2 LEDs.

LED	Function	Jetson TX1	Description
GBE0	GBE_LINK_ACT*	E47	left LED
GBE1	GBE_LINK_100	F50	right LED

2nd GbE Ethernet (J17)

The J140 features a second 10/100/1000BT (GbE) connector with Intel i210 GbE controller. This controller is connected to the PCIe (1x) bus of the TX1. To enable this function, an appropriate driver needs to be compiled into the kernel.

HDMI (J3)

This is a 19 pin mini HDMI connector. Please note that the HDMI and mini HDMI connector have different pin outs.

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 (max. 500 mA)
19	HPD	A33	inverted and connected to DP1_HPD

UART 0 / UART 2 (J7)

This is the configuration for the J120 rev 2 with a serial number > 2020. All 4 pins are passed through a bi-directional level converter with 3.3V level outputs (TXB0104PWR) and through 33 Ohm series resistors (in a tiny 0804 size resistor array). To limit the power dissipation in the resistor array, it is advised to sink or source a maximum current of 1 mA.

Pin	Function	Jetson TX1	GPIO	Description
1	5V	-	-	5V power output
2	UART0_TXD	H12	GPIO3_PU.00	UART 0 console port (3.3V TTL level): transmit data output
3	UART0_RXD	G12	GPIO3_PU.01	UART 0 console port (3.3V TTL level): receive data input
4	UART2_TXD	B16	-	UART 2 console port (3.3V TTL level): transmit data output
5	UART2_RXD	B15	-	UART 2 console port (3.3V TTL level): receive data output
6	GND	-	-	Ground

FAN (J8)

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 (F2) 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 - F2)

SATA Power Out (J11)

This is a 4 pin connector with 1.25 mm pitch. Power out 1 and power out 2 are shorted together. This power out is intended to power external SARA SSD drives.
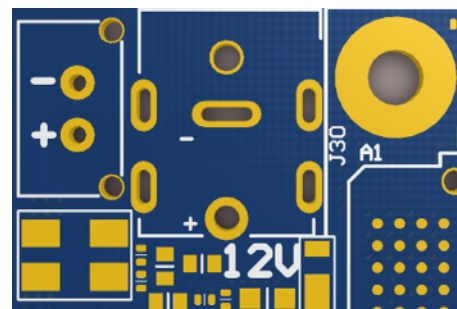
Pin	Function	Jetson TX1	Description
1	power out 1	-	power output: 5V supply for the external SATA SSD drive
2	power out 2	-	power output: 5V supply for the external SATA SSD drive
3	GND	-	power ground
4	GND	-	power ground

12V Power In (J30)

This is a 2 pin power jack for 5.5/2.5mm power plugs. The outside pin is "-", the inside pin is "+". This is the same connector as TX1 dev kit and the TX1 dev kit power supply.

Attention:
Do not use this 19V power supply with the J140, as this exceeds the power input spec of 17 Volts.

Pin	Function	Jetson TX1	Description
1	12V power in	-	center pin - positive supply pin
2	Ground	-	outside pin - negative supply pin

12V Power In (J20)

This is a 2 pin Molex MicroFit power connector for the 12V power input. Either J20 or J30 may be used to power the J140. The power pins are shorted together. Molex connector on the J140: 436500216.

Pin	Function	Jetson TX1	Description
1	Ground	-	negative supply pin (do not short to GND of the J140)
2	12V power in	-	positive supply pin

Battery (J20)

This is a 4 pin Molex MicroFit connector for the connection of the 2S Lipo battery. Molex connector on the J140: 430450413.

Pin	Function	Description
1	Bat	positive supply pin of the 2S Lipo battery
2	Cell1	positive voltage of cell1 (negative voltage of cell2)
3	Bat_Temp	battery temperature sensor (10kOhm Semitec 103AT-2 NTC termistor)
4	Ground	negative supply pin of the 2S Lipo battery

Please connect the 2nd pin of the temperature sensor to pin 4 of the connector. The picture on the right shows the MicroFit connector shows the pinout of the battery connector on the J140.

The J140 uses the vertical version of the MicroFit 3.0 connector. The mating connector for the battery cable is Molex 0430250400.

digikey.com/product-detail/en/molex-llc/0430250400/WM1784-ND/252497

Configuration jumper array (J31)

This is a 5x2 jumper array for 2mm jumpers. The standard 2.54mm jumpers will not fit. There are 5 jumper positions. Please place the jumper only vertically. Position 1 is on the left and is marked with "1"

Position	Function	Description
1	Charge M	medium charge current
2	Charge H	high charge current
3	reserved	do not use
4	/CBEN	battery balancer disable (install jumper to disable cell balancing)
5	no_sensor	install this jumper, if no battery temperature sensor is connected

5x2 jumper array

Please place a jumper in position 1 or 2 or in both (for maximum charge current). The charge current may be measured by connecting the 12V power input, booting up the TX1 and then shutting it down. Now the TX1 is in a low power state and all input power is used to charge the battery. An integrated DC converter reduces the input voltage to the battery voltage.

If the DC adapter is removed, the 2S Lipo battery powers the TX1. If the DC adapter is connected again, then then it powers the TX1 and charges the battery until it is fully charged. It is ok to use the J140 just with the DC power supply

Battery charger

The battery charger only supports Lipo batteries with 2 identical cells connected in series. At very low battery charge the cells are first pre-charged with 10% of the regular charge current. Then it switches to full charge current until a battery voltage of 8.4V (2x 4.2V) is reached. At this time it switches to constant voltage mode.

When the current reaches 10% of the charge current then the charge cycle is terminated. We have tested the J140 with two 18650 cells with 2700 mAh capacity each. These cells integrate a battery protection circuit for under/over voltage protection and over current protection.

Note:

The J140 must be used with Lipo batteries with integrated battery cell protection!

Battery cell balancing

If battery cell balancing is enabled (jumper in position 4 not installed), the J140 will detect, if the 2 cells have equal charge (equal voltage). If there is a voltage difference between two cells then the cells with the higher charged will be individually discharged. The discharge current is 8mA (499Ohm on rev 2) and 21mA (200 Ohm on rev 3+). If a higher discharge current is required, please attach an external resistor. The maximum discharge current with the external resistor is 210mA. The minimum balancing resistor is 20 Ohm. A 20 Ohm resistor will dissipate approximately 900mW of thermal power (4.2V * 210mA) and must a selected appropriately. Two LEDs on the top side (BAL1 and BAL2) indicate which cell is being discharged (balanced). External balancer LEDs may be connected to J21.

Balancing (J21)

This is a 4 pin 1.25mm pitch connector to connect the external cell balancing resistor and LEDs. This connector is located on the bottom side of the J140 below the battery connector.
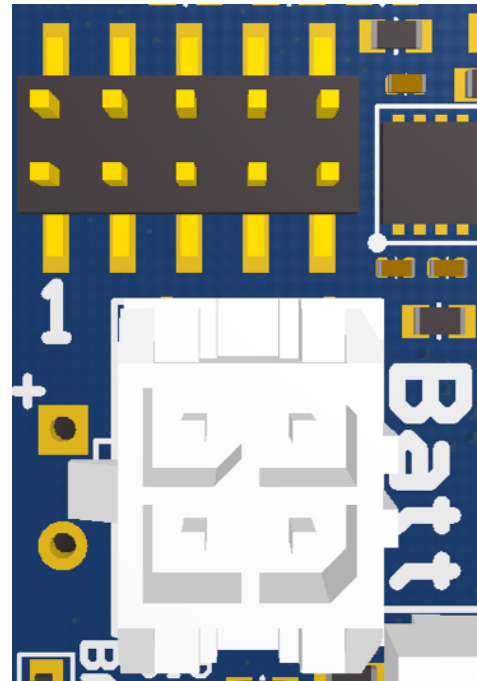
Pin	Function	Description
1	cell1	mid supply of battery (between cell1 and cell 2)
2	balancer	1. connected to Vbat (positive pin of cell 2) to balance cell 2 2. connected to ground to balance cell 1 3. floating for no operation
3	OV_DET	pulled low with open drain MOSFET, when over voltage on one cell is detected (maximum current into this in: 200mA)
4	Ground	GND of J140

External LEDs may be connected using a circuitry pictured on the right. The maximum voltage on cell1 is 4.2V. The "Balance" voltage is 0V, 8.4V or floating. Please adjust the value of R210, to get the desired current for the two LEDs.
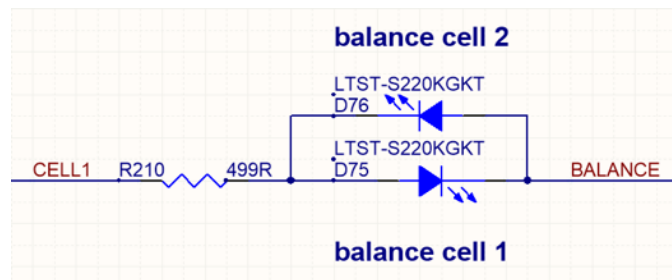
Overvoltage LED

The over voltage of one cells is flagged by lighting up the LED on the bottom of the J140 below the battery connector.

Charger status GPIOs

These 3 GPIOs have been connected with rev 3+ of the J140, to allow monitoring of the battery charger status by the TX1.

Function	GPIO	Pin	Description
CHRG_STAT	GPIO_EXP0_INT	A23	Low: status ok (STAT LED is turned on((TX1 input) Blinking: fault condition High:
CHRG_OFF	GPIO6_TOUCH_INT	B25	High: disable battery charging (TX1 output) Low or float: enable battery charging (default by 10k pull down)
OV_DET	GPIO2_CAM0_RST*	H8	Low: over voltage detected on one or two cells (TX1 input)

I2S (J16)

This is a 6 pin connector with 1.25 mm pitch. All signals are covered from 1.8V (TX1) to 3.3V (connector) with a bi-directional level converter. The data direction is automatically determined by the level converter.

Pin	Function	Jetson TX1	GPIO	Description
1	3.3V	-	-	3.3V power supply
2	I2S_MCLK	F1	GPIO3_PBB.00	digital audio interface: master clock (3.3V)
3	I2S0_SIN	G1	GPIO3_PB.01	digital audio interface 0: audio input (3.3V)
4	I2S0_CLK	G2	GPIO3_PB.03	digital audio interface 0: bit clock (3.3V)
5	I2S0_LRCLK	H1	GPIO3_PB.00	digital audio interface 0: word clock (3.3V)
6	GND	-	-	Ground

I2S extension for 8 channels (J9)

This is a 4 pin connector with 1.25 mm pitch. All signals are covered from 1.8V (TX1) to 3.3V (connector) with a bi-directional level converter. The data direction is automatically determined by the level converter.

It carries 3 additional I2S data inputs for 8 channels in total. The TX1 has 4 I2S interfaces with 2 channels each. On the J140 rev 3+ the four CLK pins and the four LRCLK pins of the the 4 I2S busses are shorted together, so that all four I2S busses share the same bit clock (CLK) and word clock (LRCLK). Just the data input

pins are separate, so that 4 data inputs with 2 channels each can be combined to feed it 8 channels of I2S digital audio data.

Pin	Function	Jetson TX1	GPIO	Description
1	I2S3_SDIN	E5	-	digital audio interface 3: audio input (3.3V)
2	I2S1_SDIN	C14	-	digital audio interface 1: audio input (3.3V)
3	I2S2_SDIN	G6	-	digital audio interface 2: audio input (3.3V)
4	WIFI2_WAKE	B20	GPIO3_PI.01	GPIO10_WIFI_WAKE_AP (3.3V)

SPI/I2C (J13)

This is a 10 pin connector with 1.25 mm pitch. It is located on the bottom side.

Pin	Function	Jetson TX1	GPIO	Description
1	5.0V	-	-	5.0V power supply
2	SPI2_CLK	H14	-	SPI2_CLK (level shifted to 3.3V)
3	SPI2_MISO	H15	-	SPI2_CLK (level shifted to 3.3V)
4	SPI2_MOSI	G15	-	SPI2_CLK (level shifted to 3.3V)
5	SPI2_CS0	G16	-	SPI2_CLK (level shifted to 3.3V)
6	SPI2_CS1	F16	-	SPI2_CLK (level shifted to 3.3V)
7	INT_SPI2	H13	GPIO3_PX.03	GPIO8_ALS_PROX_INT (due to level converter input only)
8	I2C0_CLK	E15	-	I2C0_CLK (level shifted to 3.3V with 10k pullup)
9	I2C0_DAT	F15	-	I2C0_DAT (level shifted to 3.3V with 10k pullup)
10	GND	-	-	Ground

Micro SD card (J15)

Micro SD card reader (Amphenol 101-00660-68-6). SDCARD_WP (F20) = 0 (inactive). No write protection support.

Pin	Function	Jetson TX1	Description
1	SD_DAT2	F19	SD card interface data 2
2	SD_DAT3	F18	SD card interface data 3
3	SD_CMD	G19	SD card interface command
4	3.3V	-	enabled by SDCARD_PWR_EN = 1 (H16)
5	SD_CLK	G18	SD card interface clock
6	GND	-	Ground
7	SD_DAT0	H18	SD card interface data 0
8	SD_DAT1	H17	SD card interface data 1
9	SD_CD	F17	GND

Buttons (J12)

6 pin connector with 1.25 mm pitch.

Pin	Function	Jetson TX1	GPIO	Description
1	Vdd_RTC	A50	-	Realtime clock power input from backup battery or super cap Do not connect if super cap or Lithium cell (J60) is populated on the J120. (rev 1: connected to GND)
2	power	B50	GPIO3_PX.05	power button (connect to GND)
3	sleep	E2	GPIO3_PY.00	sleep button (connect to GND)
4	force recv.	E1	GPIO3_PX.06	force recovery button (connect to GND)
5	reset	A47	-	reset in button (connect to GND)
6	GND	-	-	Ground

M.2 type M 2280 (J15)

This connector is powered by a 3.3V 3A power supply.

Form factor: 2242, 2260 or 2280 (22 x 80 mm)

Interface: four PCIe lanes for top performance (no SATA and SMBUS support). Please see the M.2 section in the beginning of this manual for more information.

JTAG header (P1)

This is a 9 pin connector with 1.25 mm pitch with surface mount pads on the edge of the board.

Pin	Function	Jetson TX1	Description
1	1.8V	-	1.8V power output
2	JTAG_AP_TRST_L	B13	JTAG port of Jetson TX1
3	JTAG_AP_TCK	B11	JTAG port of Jetson TX2
4	JTAG_AP_RTCK	A14	JTAG port of Jetson TX3
5	JTAG_AP_TDO	A13	JTAG port of Jetson TX4
6	JTAG_AP_TMS	A12	JTAG port of Jetson TX5
7	NVJTAG_SEL	A11	JTAG port of Jetson TX6
8	JTAG_AP_TDI	B12	JTAG port of Jetson TX7
9	GND	-	Ground

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.

The Auvidea Team