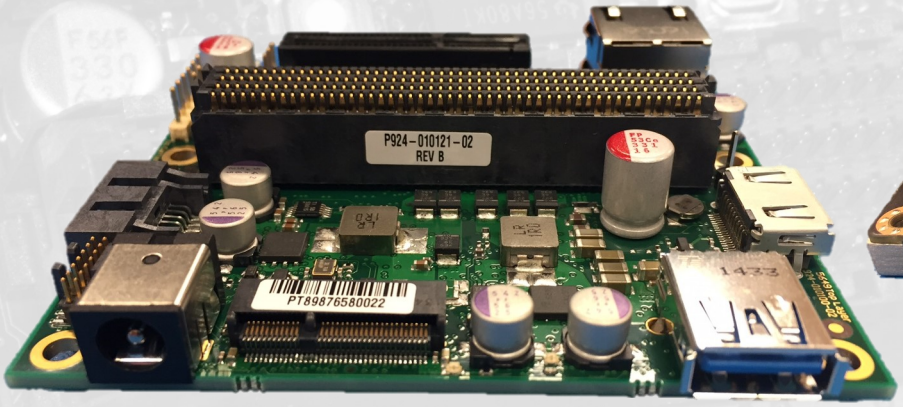
REFERENCE GUIDE

COLORADO ENGINEERING, Inc

X-Carrier Board | Rev B



X-CARRIER

TX1/TX2-SOM

Congratulations on the purchase of your TX product! This guide includes complete instructions on how to power up and flash your TX-SOM and X-CARRIER.

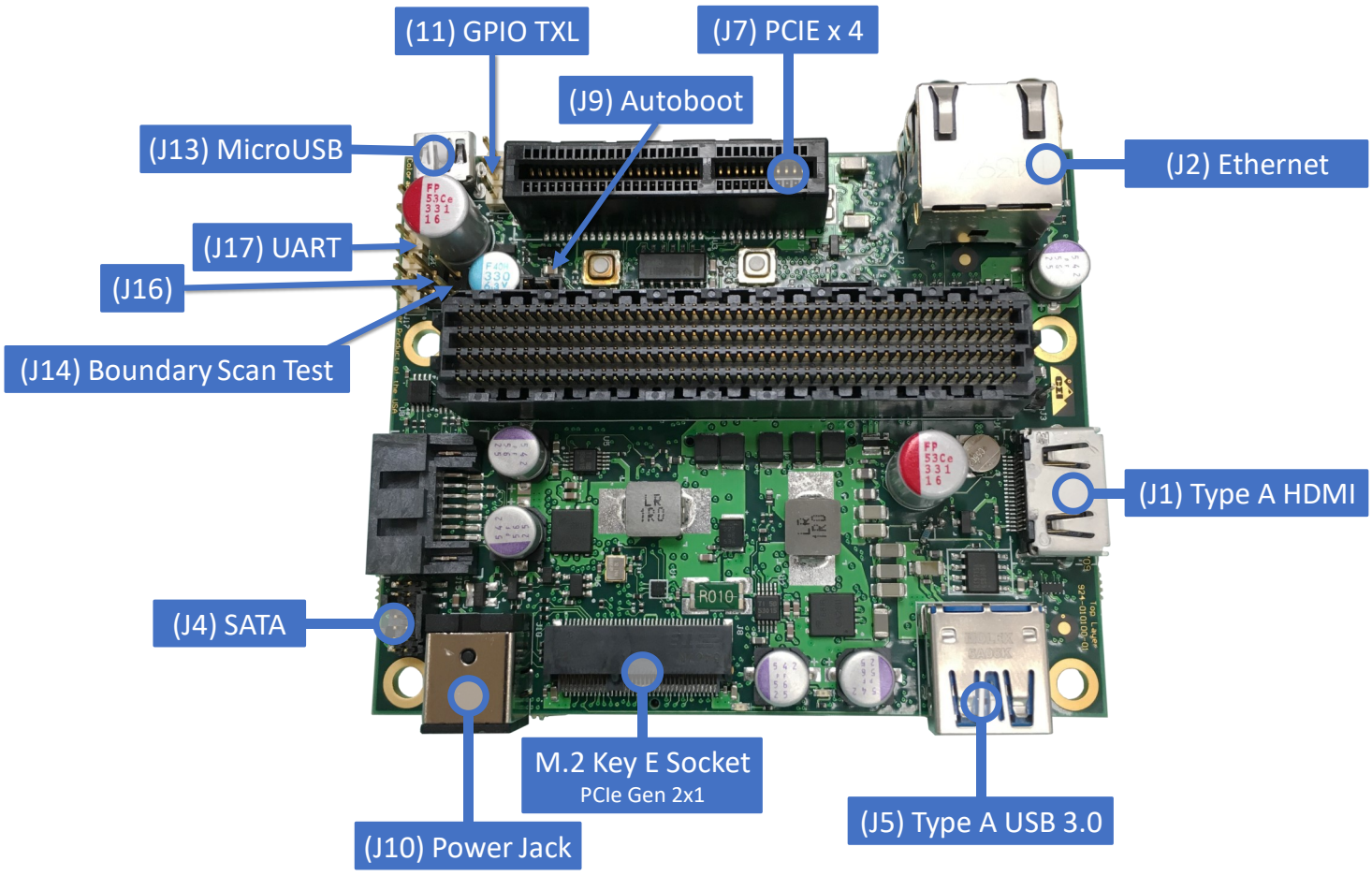
The TX-SOM is the latest of CEI's exciting embedded NVIDIA products! Designed to bring the power of the new Tegra Maxwell Architecture to the embedded market, the TX-SOM features a plethora of I/O to integrate into your system; including MIPI CSI-2, USB, Ethernet, PCIe, WiFi, Bluetooth, UART, SPI, I2C, I2S, and GPIO.

1915 Jamboree Dr. | Colorado Springs, CO 80920
sales@coloradoengineering.com
www.ColoradoEngineering.com

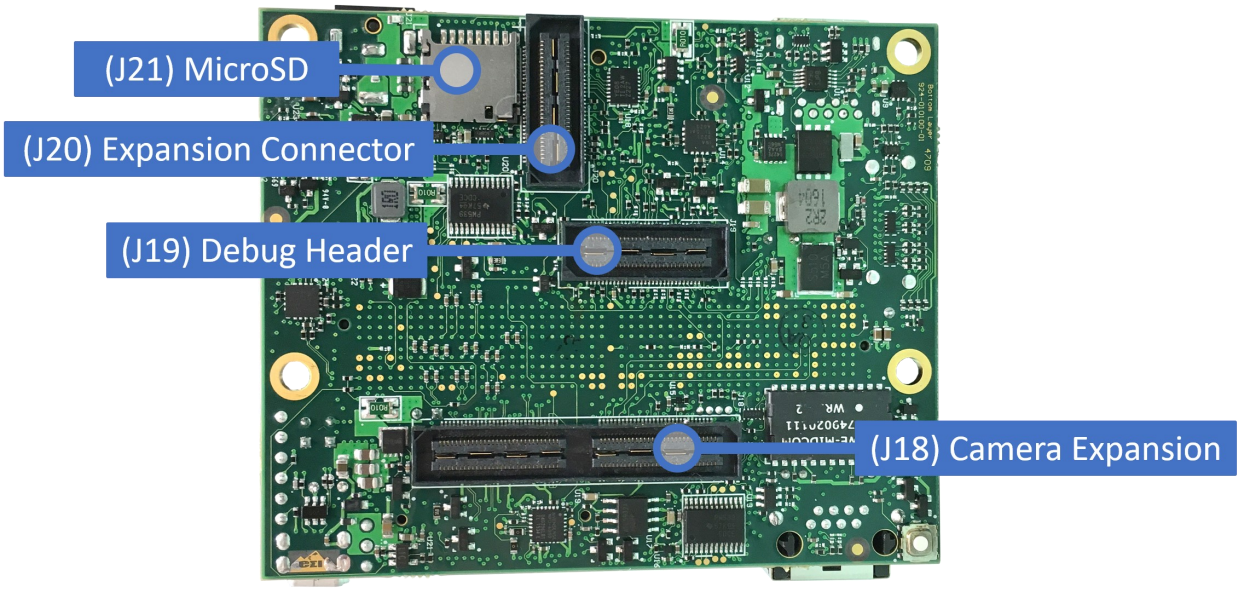
Software Instructions

The TX-SOM comes pre-flashed with the basic Linux for Tegra (L4T) software, including the graphical desktop. Instructions for setting up the software environment and flashing the TX-SOM board are also available for download. As new L4T distributions are released from NVIDIA, CEI will provide updated software patches as well. Packages such as CUDA and OpenCV4Tegra will need to be installed by the user. These packages can be found on the NVIDIA website: **https://developer.nvidia.com.**

X-Carrier Board | Top



X-Carrier Board | Bottom



J 11 Pin	Function
1	VDD_3V3_SYS
2	VDD_GPIO_TXL8
3	VDD_1V8

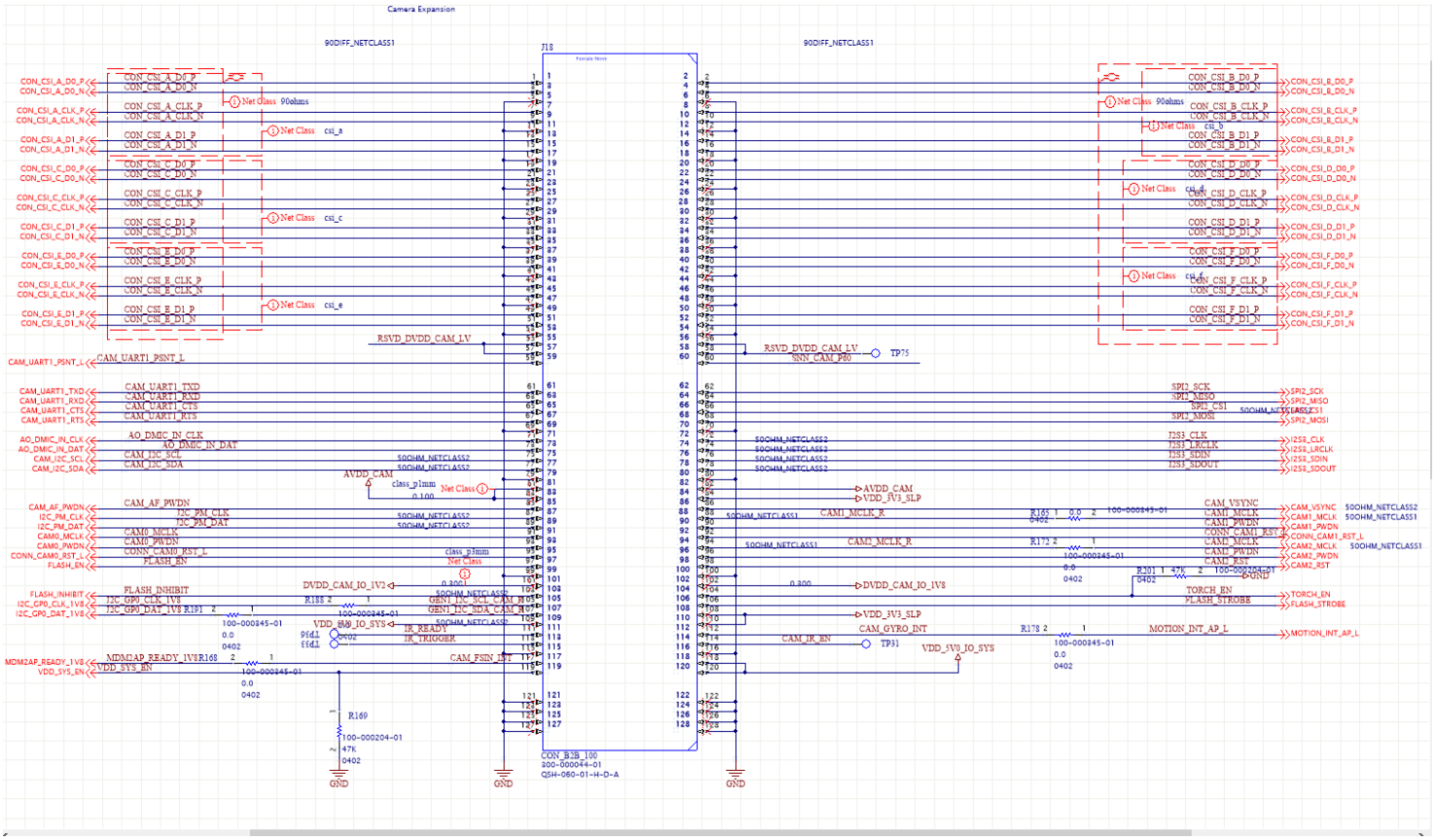
J9 Pin	Function
1	P2oj
2	POWER_BTN_R

J14 Pin	Function
1	RESET_OUT_L
2	GND

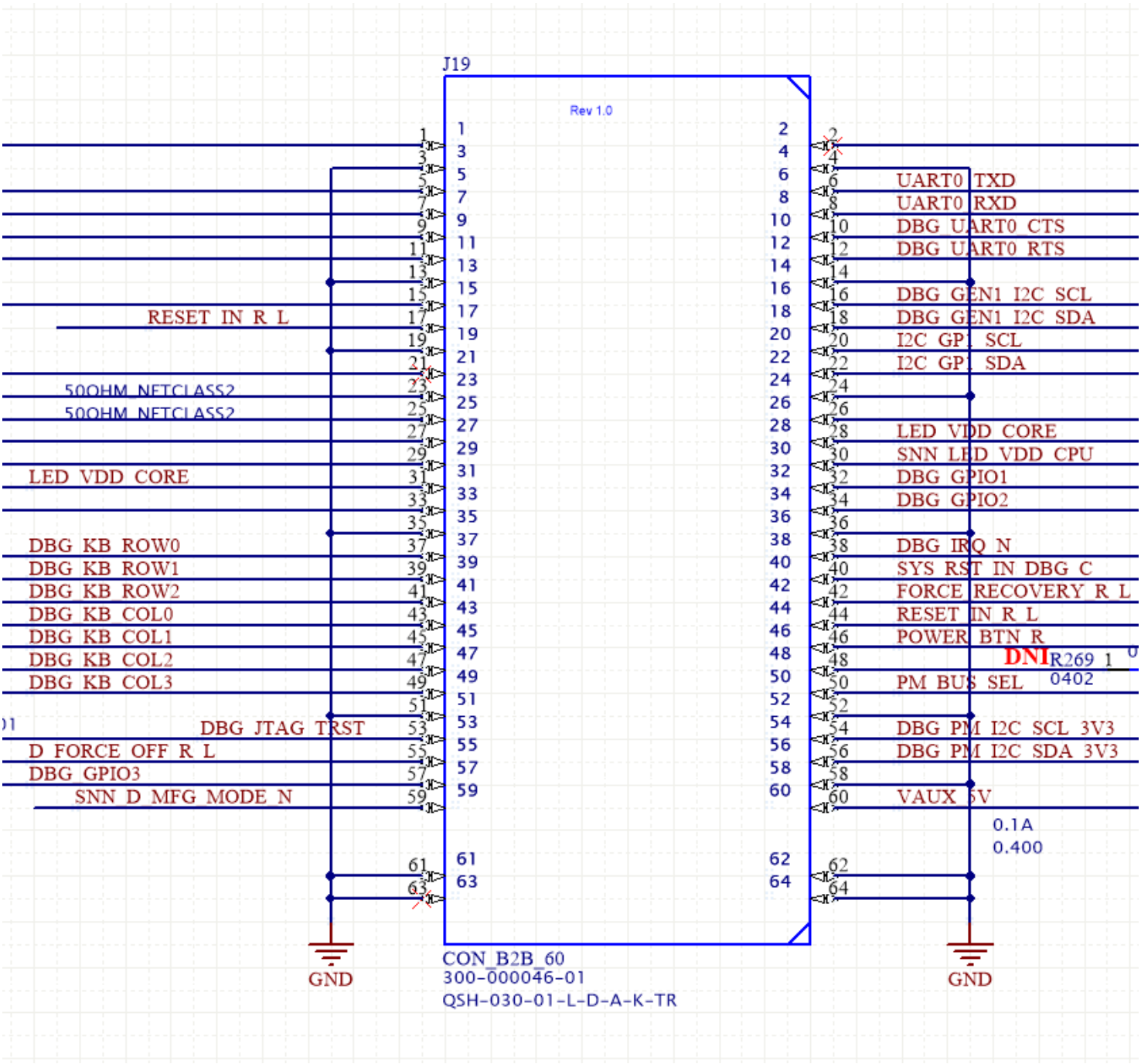
J16 Pin	Function
1	D_FORCE_OFF_L
2	GND

J 17 Pin	Function
1	GND
2	UART_RTS_3V3_L
3	NC
4	UART1_RXD_3V3
5	UART1_TXD_3V3
6	UART1_CTS_3V3_L

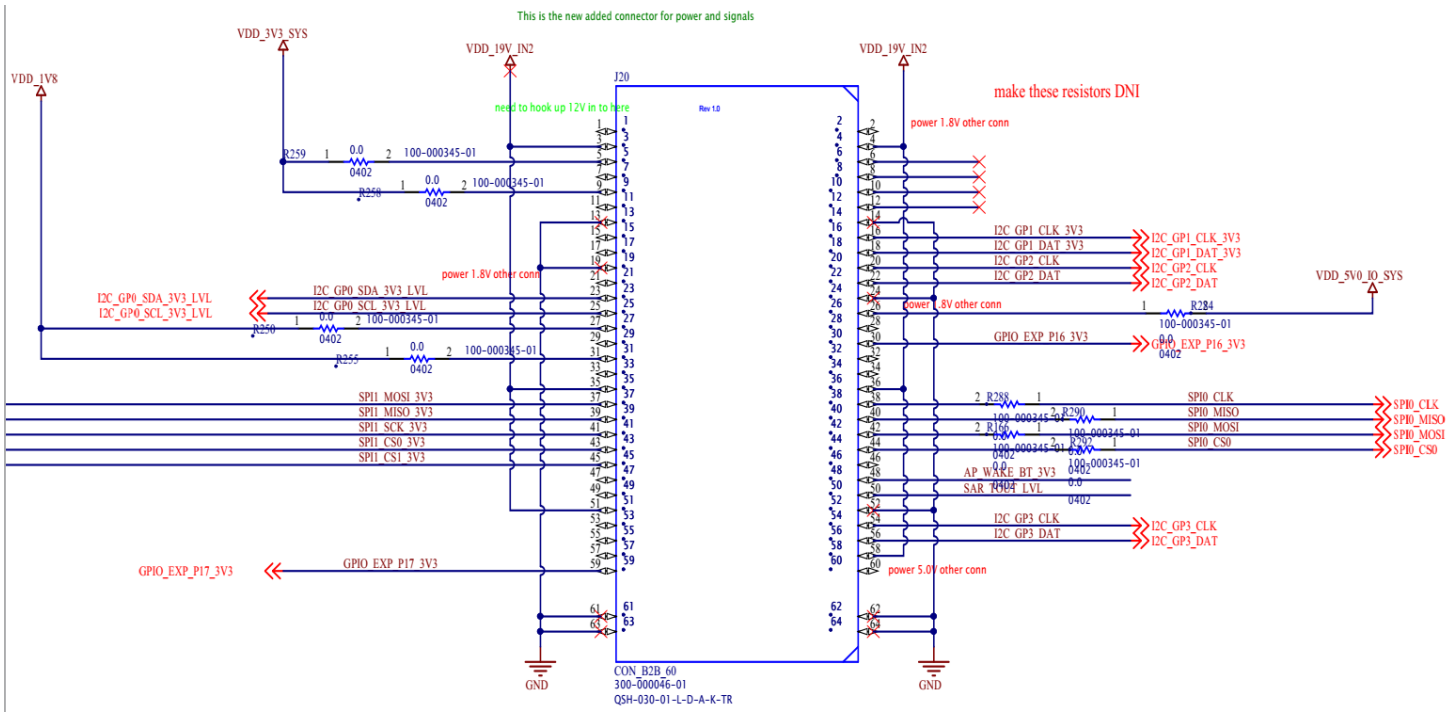
J18


Camera Expansion
90DIFF_NETCLASS1
J18
90DIFF_NETCLASS1
CON_CSI_A_D0_P
CON_CSI_A_D0_N
CON_CSI_A_CLK_P
CON_CSI_A_CLK_N
CON_CSI_A_D1_P
CON_CSI_A_D1_N
CON_CSI_C_D0_P
CON_CSI_C_D0_N
CON_CSI_C_CLK_P
CON_CSI_C_CLK_N
CON_CSI_C_D1_P
CON_CSI_C_D1_N
CON_CSI_E_D0_P
CON_CSI_E_D0_N
CON_CSI_E_CLK_P
CON_CSI_E_CLK_N
CON_CSI_E_D1_P
CON_CSI_E_D1_N
Net Class 90ohms
Net Class csi_a
Net Class csi_c
Net Class csi_e
CON_CSI_B_D0_P
CON_CSI_B_D0_N
CON_CSI_B_CLK_P
CON_CSI_B_CLK_N
CON_CSI_B_D1_P
CON_CSI_B_D1_N
CON_CSI_D_D0_P
CON_CSI_D_D0_N
CON_CSI_D_CLK_P
CON_CSI_D_CLK_N
CON_CSI_D_D1_P
CON_CSI_D_D1_N
CON_CSI_F_D0_P
CON_CSI_F_D0_N
CON_CSI_F_CLK_P
CON_CSI_F_CLK_N
CON_CSI_F_D1_P
CON_CSI_F_D1_N
Net Class csi_b
Net Class csi_d
Net Class csi_f
RSVD_DVDD_CAM_LV
CAM_UART1_PSNT_L
CAM_UART1_TXD
CAM_UART1_RXD
CAM_UART1_CTS
CAM_UART1_RTS
AO_DMIC_IN_CLK
AO_DMIC_IN_DAT
CAM_I2C_SCL
CAM_I2C_SDA
AVDD_CAM
CAM_AF_PWDN
I2C_PM_CLK
I2C_PM_DAT
CAM0_MCLK
CAM0_PWDN
CONN_CAM0_RST_L
FLASH_EN
FLASH_INHIBIT
I2C_GP0_CLK_1V8
I2C_GP0_DAT_1V8
MDM2AP_READY_1V8
VDD_SYS_EN
DVDD_CAM_IO_1V2
VDD_1V8_IO_SYS
IR_READY
IR_TRIGGER
CAM_FSIN_1V2
R169
100-000204-01
47K
0402
GND
CON_B2B_100
300-000044-01
QSH-060-01-H-D-A
TP75
SPI2_SCK
SPI2_MISO
SPI2_CS1
SPI2_MOSI
I2S3_CLK
I2S3_LRCLK
I2S3_SDIN
I2S3_SDOUT
50OHM_NETCLASS2
AVDD_CAM
VDD_3V3_SLP
CAM1_MCLK_R
CAM2_MCLK_R
DVDD_CAM_IO_1V8
CAM_GYRO_INT
CAM_IR_EN
TP31
VDD_5V0_IO_SYS
CAM_VSYNC
CAM1_MCLK
CAM1_PWDN
CONN_CAM1_RST_L
CAM2_MCLK
CAM2_PWDN
CAM2_RST
TORCH_EN
FLASH_STROBE
MOTION_INT_AP_L
50OHM_NETCLASS1
100-000345-01
0402

J19


J19
Rev 1.0
RESET_IN_R_L
50OHM_NETCLASS2
50OHM_NETCLASS2
LED_VDD_CORE
DBG_KB_ROW0
DBG_KB_ROW1
DBG_KB_ROW2
DBG_KB_COL0
DBG_KB_COL1
DBG_KB_COL2
DBG_KB_COL3
DBG_JTAG_TRST
D_FORCE_OFF_R_L
DBG_GPIO3
SNN_D_MFG_MODE_N
UART0_TXD
UART0_RXD
DBG_UART0_CTS
DBG_UART0_RTS
DBG_GEN1_I2C_SCL
DBG_GEN1_I2C_SDA
I2C_GP1_SCL
I2C_GP1_SDA
LED_VDD_CORE
SNN_LED_VDD_CPU
DBG_GPIO1
DBG_GPIO2
DBG_IRQ_N
SYS_RST_IN_DBG_C
FORCE_RECOVERY_R_L
RESET_IN_R_L
POWER_BTN_R
DNI
R269 1
0402
PM_BUS_SEL
DBG_PM_I2C_SCL_3V3
DBG_PM_I2C_SDA_3V3
VAUX_5V
0.1A
0.400
GND
GND
CON_B2B_60
300-000046-01
QSH-030-01-L-D-A-K-TR

J20


This is the new added connector for power and signals
VDD_3V3_SYS
VDD_19V_IN2
VDD_19V_IN2
VDD_1V8
J20
Rev 1.0
need to hook up 12V in to here
make these resistors DNI
power 1.8V other conn
R259
R258
100-000345-01
0.0
0402
I2C_GP1_CLK_3V3
I2C_GP1_DAT_3V3
I2C_GP2_CLK
I2C_GP2_DAT
power 1.8V other conn
power 1.8V other conn
I2C_GP0_SDA_3V3_LVL
I2C_GP0_SCL_3V3_LVL
I2C_GP0_SDA_3V3_LVL
I2C_GP0_SCL_3V3_LVL
R250
R255
VDD_5V0_IO_SYS
R284
GPIO_EXP_P16_3V3
SPI1_MOSI_3V3
SPI1_MISO_3V3
SPI1_SCK_3V3
SPI1_CS0_3V3
SPI1_CS1_3V3
SPI0_CLK
SPI0_MISO
SPI0_MOSI
SPI0_CS0
AP_WAKE_BT_3V3
SAR_RST_LVL
I2C_GP3_CLK
I2C_GP3_DAT
GPIO_EXP_P17_3V3
GPIO_EXP_P17_3V3
power 5.0V other conn
GND
GND
CON_B2B_60
300-000046-01
QSH-030-01-L-D-A-K-TR

Frequently Asked Questions

How long does it take to ship internationally?
Shipping time depends on your country and region - generally 4 days-2 weeks.

How much does it cost to ship to my country?
Shipping costs can be calculated on our website by adding the board to the cart and entering the destination info.

Do you ship to my country?
We ship to all countries via FedEx except those under U.S. embargo or sanction, which include Belarus, Burma Eritrea, Code d'Ivoire, Congo, Crimea (region of Ukraine), Cuba, Eritrea, Iran, Iraq, Lebanon, Liberia, Libya, North Korea, People's Republic of China, Somalia, Syria, The Republic of the Sudan, and Venezuela.

Are your carrier boards in stock?
We list the status of our boards on the website. They are currently 8-10 weeks out from arrival to our facilities. Each board will undergo testing and flashing before shipping, which may take several days.

How can I access the CAD/STEP files?
We grant access to these files only to those customers who have purchased one or more boards, and after a Non-disclosure agreement (NDA) is signed. Additional information will be required of international customers.
Please note: These files are also available on NVIDIA's website with a developer account:
https://developer.nvidia.com/embedded/downloads

How long are your boards guaranteed for?
Our warranty covers your board from manufacturer defects for 30 days after shipment. Please review our terms and conditions for further information – available on each product page.

What is your return policy?
Our terms and conditions state that you may return your board for repair if it's still under warranty at your expense. We will either repair or replace the board and return it to you at our expense. Before returning your board, please email sales@coloradoengineering.com and request an RMA number. Please review our terms and conditions for further information – available on each product page.

Is the X-Carrier board compatible with NVIDIA Jetson TX2? Do you provide BSP layer?
CEI's X-Carrier board is compatible with NVIDIA's Jetson TX1 and TX2. BSP is provided by NVIDIA and requires no modification.

What is included with the TX2/X-Carrier?
We also pre-flash the TX2 with the basic Jetpack 3.0.

- *X-carrier*
- *Jetson X2*
- *Transformer and power cord*
- *Antennae*

Does the X-Carrier have a "micro USB" or "mini-USB" connector?
The board uses a mini USB connector.

I am about to buy the X-Carrier board for the NVIDIA Jetson TX2 (I have the module already) and want to know if it comes with a power supply (220v) and heat sink.
The X-Carrier Board includes a power supply but not a heat sink. The board doesn't get hot enough to warrant using one.

Is the X-Carrier board compatible with Linux for Tegra?
Yes, as supported by TX1 or TX2 module.

Is more comprehensive documentation available than what is on your website?
We recommend signing up to be an NVIDIA developer to get more comprehensive documentation on the TX1/TX2. We cannot distribute these files. https://developer.nvidia.com/embedded/downloads

Frequently Asked Questions | Continued

How do I flash the TX1 embedded device, since there doesn't appear to be these buttons on it?
1. Hold Reset button down
2. power on board
3. 'lsusb' to verify NVIDIA device is there

Please note: many technical issues can be resolved by re-flashing the board – see below. Please consider re-flashing your board before requesting an RMA.

How do I re-flash my X-Carrier board?
The TX1 carrier board with TX1/TX2 module plugged on top can be programmed via Jetpack with the standard NVIDIA flash files (no custom BSP necessary).

Link for download of Jetpack:

https://urldefense.proofpoint.com/v2/url?u=https-3A__developer.nvidia.com_embedded_jetpack&d=DwIFaQ&c=clK7kQUTWtAVEOVIgvi0NU5BOUHhpN0H8p7CSfnc_gI&r=VWpxn-oQGtNpq0QCC9_NSw&m=ZHVECFY88IYq1u-ejjQIFYS5DPpQNPV1hlMeCUPLRd8&s=50L7oUEJrrFqsTNRae9jcVGurGA0ihxV9RAbWtm8Q3w&e=

Link for instructions on how to download and install Jetpack below:

https://urldefense.proofpoint.com/v2/url?u=http-3A__docs.nvidia.com_jetpack-2Dl4t_index.html-23developertools_mobile_jetpack_l4t_3.0_jetpack-5Fl4t-5Finstall.htm&d=DwIFaQ&c=clK7kQUTWtAVEOVIgvi0NU5BOUHhpN0H8p7CSfnc_gI&r=VWpxn-oQGtNpq0QCC9_NSw&m=ZHVECFY88IYq1u-ejjQIFYS5DPpQNPV1hlMeCUPLRd8&s=pvxgeBu1KxAyXwr4IeUikJwu6kd32QKUtLyOm4w9UGs&e=

How do I put the board in something like "recovery mode"?
To get our device into recovery mode all you have to do is hold the recovery button before turning on the device, then you should see an NVIDIA device in your list of usb's "lsusb" The error about CUDA drivers should be fixed on a new install/flash, it's just complaining that the driver versions are not matching.

After mounting a "blank" Jetson TX1 acquired from another company onto the board, I noticed on power up that the unit went directly into forced recovery mode without needing to use push buttons. Is this normal?
Blank TX's are in recovery mode out of the box for easier flashing. All the TX's we receive come out of the box in recovery mode so yes, that is normal.

I have been unsuccessful flashing a recovery image or a brand-new image from JetPack. There is a lot of discussion on the various forums about this but so far nothing is working. I am using an Ubuntu x86-64 machine as a host. Can you help?
Make sure you are using the latest JetPack installer and select TX module in the selections. If you just click through and the default option is TK, the module will not flash.

Is there a quantity discount?
CEI offers a 5% discount at 1,000 units.

Do you offer an educational discount?
No, we are already offering the X-Carrier Board at a substantial savings.

We also need 2 RS232 and I've found a couple of modules that can adapt the TTL port to RS232. Do you think that's feasible?
Yes, you can convert TTL to RS232.

Frequently Asked Questions | Continued

We will be using the TX-1 in a configuration that can't use your wall supply. Any technical information you have on the module would be helpful. I need to know how much power and what voltages to allocate.
The Average is 0.4Amps 4.8 Watts and the peak is 1.15Amps 14Watts with a 12V supply.

How do I power the module? What are the voltage and power requirements?
We do supply a 60W 12V wall supply with the board.

Does it need any firmware to work or it comes out of the box ready to use it with TX1?
All TX2 modules (from CEI) are shipped pre-flashed and tested so they will work out of the box.

Can you provide the pin out of this carrier board, your documentation claims that the UART interfaces are available, but it's unclear which pins these would be available on, are these 3.3 V, or full RS232?
UART is available as follows:

1. *The 0.100" pitch header designated J17 uses "Carrier Board UART1" (a.k.a. TX1 UART3") at 3.3V TTL. It is a general purpose UART that is usable for any 3.3V TTL UART purposes.*
   - J17_1 = GND; J17_2 = "RTS"; J17_3 = "NC"; J17_4 = "RXD"; J17_5 = "TXD"; J17_6 = "CTS_L"
2. *Another UART port goes to a Debug header designated J19 (MFR PN: QSH-030-01-L-D-A-K-TR). "Carrier Board UART0" (a.k.a. TX1 UART1) This will be a 1.8V TTL as there is no voltage translation on this UART. Design Guide says it is configured for a debug UART console, but with some effort in the kernel and header connections can be made a general purpose 1.8V TTL UART.*
   *- J19_6 "TXD" and J19_8 "RXD" *Connect in Null-Modem configuration for Debug Serial Console*
3. *There are Test Points for another 1.8V TTL (TP20="UART3_RXD" and TP24="UART3_TXD"). With some soldering (and assuming this is enabled in the kernel) this could also be used for general purpose 1.8V TTL UART.*

Does the board have pins suitable to power an SATA SSD or would an external power supply be necessary?
The board has pins that can be used to power external SATA SSD (3.3V or 5.0V) with some soldering. J11 pin 1 (furthest from edge of PCB) is 3.3V and 5.0V can be accessed through J18 pins 118, 120. Consequently, when we test the SATA port, we use an external supply since it is easier.

Is it possible to purchase this combo with a 3g/4g LTE support (including a socket for the sim)?
The wireless communication M.2 card is CE certified (should be sufficient for EU Com standard) although it looks like they are in sample phase now. (EM7455 is available now)
Wireless M.2 card: (EM7455 will work too but still needs USB adapter since it is also an M.2 Key B card):
https://www.sierrawireless.com/products-and-solutions/embedded-solutions/products/em7565/
One such USB Adapter: https://www.amazon.com/NGFF-Adapter-card-Slot-Module/dp/B01HB87HEA

On J20, there are nets labelled VDD_19V_IN2. Are these connected to the power input jack and may I use them to power the X-Carrier board?
There are six pins on J20 with net VDD_19V_IN2. These are connected to the power input jack AFTER the fuse F1. So yes, disconnecting the input jack J10 and connecting +19VDC would power the board; however, you run the risk of damaging the board if there is a power problem since the fuse will no longer be protected from an input overcurrent condition.

There are some nets labelled VDD_3V3_SYS. Are these a source output, if so, how much current can I draw from them?
VDD_3V3_SYS is a 3.3V rail sourced from the X-Carrier Board. It can source up to 8A, but it is unknown how much margin there is on that rail. A power analysis wasn't found since we just replicated NVIDIA design with a few removals.

May I use GPIO_EXP_P16_3V3 and GPIO_EXP_P17_3V3 as GPIOs or are they for specific functions?
GPIO_EXP_P16_3V3 goes from the i2c-gpio expander U20_p16 (pin 19) to J20 pin 30; it can be used for any 3.3V purpose.
GPIO_EXP_P17_3V3 goes from the i2c-gpio expander U20_p17 (pin 20) to J20 pin 59; it can also be used for any 3.3V purpose.

Frequently Asked Questions | Continued

May I remap the serial ports for SPI and I2C for GPIO?
You can remap the following I2C and SPI ports: I2C_GP2_[CLK,DAT]_3V3, I2C_GP3_[CLK,DAT]_3V3, SPI0 (J20_[38,40,42,44] or series 0Ohm Resistors: R288, R290, R166, R292), SPI1 (J20_[37,39,41,43,45] are not connected to anything that requires SPI), SPI2 (If J18_[62,64,66,68] are Not connected to any camera expansion devices). Depending on what peripherals are being used, there may be more ports that can be remapped if more GPIO is required. Note this will require re-pinmuxing and declaring the re-pinmuxed signals as GPIO; thus, building a custom Board Support Package (BSP) to flash the TX1 with (no longer able to use JetPack to flash standard TX1 files). Alternatively, it's possible to use the GPIO expander Test Points to get 13 more GPIO without creating a custom BSP.

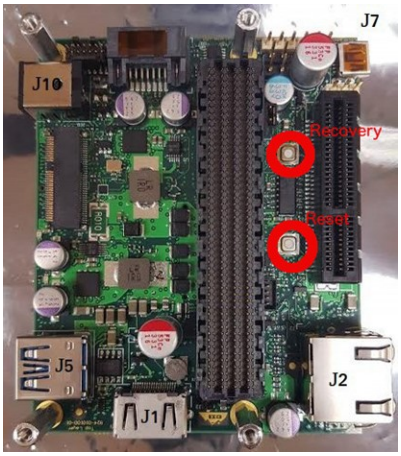
Do you sell an interface board that converts the existing CSI connector to a 15-pin standard connector (like the one that exists on Raspberry Pi-3)?
No, we do not offer this product.

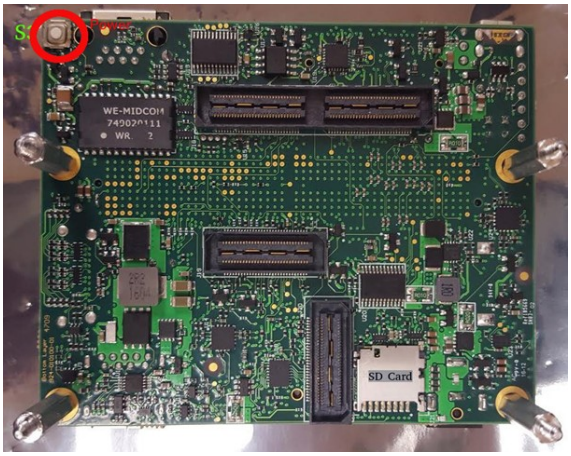
Do your Jetson TX2 carrier boards meet the following requirement? Extended temperature range, support for 1-3 PCIe card slot (for data acquisition cards)
There are two PCIe card slots on the TX carrier board. One is a Gen2 x4 standard PCIe card slot, and the second is an M.2 mini card mount (hanging off edge); that is a Gen2 x1 PCIE interface. Therefore, there are two PCIe slots, and they are different form factors. The X-Carrier's temperature range: Operating -20 C to 55 C; Storage : -40 C to 75 C.

Is the 5MP camera on the Jetson X1 development board by NVIDIA compatible electrically and mechanically with the X-Carrier Board's camera connector?
The 5MP camera is fully compatible with the Jetson X1 development kit.

Is there a known workaround to attach a camera and/or a 4G module?
Most USB cameras that are compatible with Ubuntu Linux should work with our Jetson boards. Any 4G LTE M.2 modem that is compatible with the Jetson X1 dev kit should be compatible with CEI's X-Carrier. NVIDIA forums can help with connecting a camera or 4G LTE module.

What are the three buttons for?
Recovery, Reset and Power as shown below:





Frequently Asked Questions | Continued

I want to plug one 4x PCIE-2.0 board into the PCIE socket, but there is one RJ45 nearby. Is this an issue?
There shouldn't be any issues connecting to the PCIe slot, even with the RJ45 connection nearby.

How do you connect to the J19 Debug Header? Do you use a daughter board?
We have never used J19. The pinout is readily available online, so we suggest finding a compatible cable or building one.

Which port of the carrier is disposed as video input and which one could be used as output? If I use the carrier board HDMI port, can I record a 4K 30fps video stream?
The only video input is the CSI port. We suggest this board for HMDI etc:

https://blog.zhaw.ch/high-performance/2016/05/20/4k-hdmi-to-csi-interface-for-tx1-evalboard/

How many GPIOs dedicated to managing drivers are there? Can I extend the USB 3.0 port to two or three more USB ports?
Any USB extender will allow for more USB ports. For detailed information, please review our reference guide:

http://coloradoengineering.com/wp-content/uploads/2016/10/Reference-Guide_TX_Final.pdf

Is there a difference of the processor part compared to the architecture of the TX1? For example, if we have an algorithm running on the TX1, is it possible to transfer this code easily to your platform?
Our Jetson TX1 and X-Carrier run off the same processor as the Jetson Kit - straight from NVIDIA. You should be able to port your code over without any issues.