

BOARD SUPPORT PACKAGE

For Connect Tech NVIDIA® Jetson Orin™ NX/Orin™ Nano Carriers

BSP Version: ORIN-NX-NANO-36.4.0 V002
Last Updated: 2024/11/12

1. Introduction

This Board Support Package adds support for the Connect Tech Jetson Orin™ NX and Orin™ Nano family of carrier boards to Linux4Tegra. It includes any extra files required to use all the features of Connect Tech carriers.

Please check Section 3 for supported features for your board and Section 8 for the changes made between versions. You can check which version of the BSP you have installed by running:

```
cat /etc/cti/CTI-L4T.version
```

Check for the Latest Version of the CTI-L4T BSP at:
<https://connecttech.com/resource-center/l4t-board-support-packages/>

2. Requirements

- x86/x64 based host machine running Ubuntu 20.04 or 22.04
- JetPack 6.1 / L4T 36.4.0 installed (see Section 4)
- Orin™ NX or Orin™ Nano module
- Connect Tech Orin™ NX/Orin™ Nano Carrier
- USB Cable for flashing

*L4T version can be found in /etc/nv_tegra_release and will look like this:
R36 (release), REVISION: 4.0

3. BSP Features

3.1 Product Specific Details

NGX003 (Photon)

- USB 3.0 Support
- USB OTG Supported in device mode.
- HDMI Support
- Micro SD Card Not Supported on Orin™ NX/Orin™ Nano
- NVMe Card Support
- PoE Support
- Wifi/Bluetooth Card Not Supported on Orin™ NX/Orin™ Nano
 - NVMe/Wifi-bluetooth mux switch must always be on NVMe
- Since device flashes onto NVMe!
- Cellular Card Support
- RGB LED Support
- UART Support
- I2C Support
- GPIO Support
- MIPI camera support

Supported Mipi Cameras:

- Raspberry Pi IMX219
- ArduCAM IMX477
- Vision Components IMX296

NGX007 (Boson)

- USB 3.0 Support
- USB OTG Support
- Display(HDMI)
- Micro SD Card Not Supported on Orin™ NX/Orin™ Nano
- GbE Phy Support
- CAN Support
- UART Support
- SPI Support
- I2C Support
- PWM Support
- Wifi/Bluetooth Support
- NVMe Card Support
- Framos Camera support
 - Note that CAM4 is disabled as CSI4 is unsupported on Orin™ NX/Orin™ Nano

Supported Framos Cameras:

- FSM-IMX464
- FSM-IMX565
- FSM-IMX568 (2-Cam only)
- FSM-IMX662 (2-Cam only)
- FSM-IMX676 (2-Cam only)

- FSM-IMX678 (2-Cam only)

NGX010 (Rudi-NX)

- USB 3.0 Support
- USB OTG Support
- HDMI Support
- NVMe Card Support
- CAN Support
- GbE Phy Support
- Cellular Card Support
- Wifi/Bluetooth card Support
- UART Support
- RS485 Support
- I2C Support
- GPIO Support
- SPI Support
- PWM Support
- RTC Battery Support

Supported GMSL Cameras:

- Tier4 C1 (ISX021)
- Tier4 C2 (IMX490)
- Stereolabs ZEDX
- Econ SturdeCAM20

NGX012 (Hadron)

- USB 3.0 Support
- USB OTG Support
- GbE Phy Support
- NVMe Card Support
- Wifi/Bluetooth support
- CAN Support
- UART Support
- I2C Support
- GPIO Support
- SPI Support
- PWM Support
- MIPI camera support

Supported MIPI Cameras:

- ArduCAM IMX477
- Raspberry PI IMX219
- Vision Components IMX296

NGX015 (Polaris)

- USB 3.0 Support
- USB OTG Support
- GbE Phy Support
- NVMe Card Support
- Wifi/Bluetooth support
- CAN Support
- M12 GBE sensor support
- M.2 B-Key modem support
- Wake on LAN Currently Not Supported
- Wake on gpio expander Currently Not Supported
- 2x fan and tach support
- Pressure/Temp sensor support
- BMS Support (for reading battery voltage)
- M12 Isolated I/O support
- GMSL Camera Support

Supported GMSL Cameras:

- Tier4 C1 (ISX021)
- Tier4 C2 (IMX490)
- Stereolabs ZEDX
- Econ SturdeCAM20

NGX018 (Hadron GMSL)

- USB 3.0 Support
- USB OTG Support
- GbE Phy Support
- NVMe Card Support
- Wifi/Bluetooth support
- CAN Support
- UART Support
- I2C Support
- GPIO Support
- PWM Support
- GMSL Camera Support

Supported GMSL Cameras:

- Tier4 C1 (ISX021)
- Tier4 C2 (IMX490)
- Stereolabs ZEDX
- Econ SturdeCAM20

NGX020 (Boson for Orin)

- USB 3.0 Support
- USB OTG Support
- Display(HDMI)
- GbE Phy Support
- CAN Support
- UART Support
- SPI Support
- I2C Support
- PWM Support
- Wifi/Bluetooth Support
- NVMe Card Support
- Framos Camera Support

Supported Framos Cameras:

- FSM-IMX464
- FSM-IMX565
- FSM-IMX568 (2-Cam only)
- FSM-IMX662 (2-Cam only)
- FSM-IMX676 (2-Cam only)
- FSM-IMX678 (2-Cam only)

NGX021 (Boson22 for Orin)

- USB 3.0 Support
- USB OTG Support
- Display(HDMI)
- GbE Phy Support
- CAN Support
- UART Support
- SPI Support
- I2C Support
- PWM Support
- Wifi/Bluetooth Support
- NVMe Card Support
- 22-pin CSI camera connector Support
- MIPI camera support

Supported MIPI Cameras:

- ArduCAM IMX477
- Raspberry PI IMX219
- Vision Components IMX296

NGX022 (Lepton FPDLink III)

- USB 3.0 Support
- USB OTG Support
- Display(HDMI)
- GbE Phy Support
- CAN Support
- UART Support
- SPI Support
- I2C Support
- PWM Support
- Wifi/Bluetooth Support
- NVMe Card Support
- FPDLINK III Camera Support
- External Trigger Support

Supported Cameras:

- Econ NeduCAM25

NGX024 (Hadron Dual Mipi)

- USB 3.0 Support
- USB OTG Support
- GbE Phy Support
- NVMe Card Support
- Wifi/Bluetooth support
- CAN Support
- UART Support
- I2C Support
- GPIO Support
- SPI Support
- PWM Support
- x2 MIPI camera support

Supported MIPI Cameras:

- ArduCAM IMX477
- Raspberry PI IMX219
- Vision Components IMX296

3.1.1 Installing ZED X camera SDK

The ZED SDK is recommended to operate the ZED X camera. To use the SDK, Nvidia's CUDA, along with a few other dependencies, must first be installed (It is not installed automatically with this BSP).

To install these dependencies, run this command:

```
"sudo apt install zstd libqt5network5 libqt5opengl5 libqt5sql5 libqt5xml5 cuda"
```

The ZED SDK can then be downloaded onto your Jetson from the Stereolabs website here:
<https://www.stereolabs.com/developers/release/>

Click on "SDK Downloads", then the link for "ZED SDK for JetPack 6.0 (L4T 36.3)".

Note: ZED X drivers are already included in this BSP and do not need to be downloaded.

Once you have downloaded the executable onto your Jetson system, follow the rest of the instructions under "Download and Install the ZED SDK" at this link:
<https://www.stereolabs.com/docs/installation/jetson/>

Additional questions about the SDK and camera applications can be answered by Stereolabs at <https://support.stereolabs.com/hc/en-us/>

3.1.2 Tier4 C2 Camera Info

Note that the Following trigger modes have been verified for Orin-NX/Orin-NANO:

Mode	Index
MASTER_MODE_10FPS	0
MASTER_MODE_20FPS	2
MASTER_MODE_30FPS	4

Manual triggering in a slave mode has currently not been verified.

The default is set as MASTER_MODE_30FPS, but you can set the trigger mode at runtime through the filesystem:

```
echo <n> > /sys/module/tier4_imx490/parameters/trigger_mode  
where n is the Index shown in the table above.
```

3.2 Limitations and Known Issues

1. Micro SD card on CTI Xavier™ NX carriers will not work with Orin™ NX or Orin™ Nano as pin mapping for those pins has changed.

2. Camera Port 4 on the Boson Carrier designed for Xavier™ NX (NGX007) will not work with Orin™ NX or Orin™ Nano as they do not support CSI_4. Therefore only 2 camera 4-lane and 3 camera 2-lane configurations are provided.

A new carrier design "Boson for Orin (NGX020)" reroutes the csi lanes to stream on 4 ports. 4 camera 2-lane and 2 camera 4-lane configurations for the NGX020.

3. Suspend/Wake functionality causes system error on boot, and should not be enabled.
4. An error occurs when connecting the Polaris (NGX015) as a USB device through the OTG USB port, and then disconnecting and hotplugging a USB device into the OTG port, where the USB device does not register on the Polaris. Disconnecting and then reconnecting the USB device will cause the Polaris to correctly detect it.
5. Running the ZEDx API headless cannot be validated at this time. When running using A virtual desktop, ZEDx cameras appear to detect on NGX010 and NGX015 in the ZEDx API before throwing an unsupported resolution error. Cameras on NGX018 (Hadron-GMSL) also fail to detect altogether in the ZEDX API. Using a display when using the ZEDX API for NGX015 and NGX018 does work. As a headless only system, Hadron-GMSL has currently only been validated using v4l2 and argus.
6. Certain camera modes on Framos cameras are non-functioning. FSM-IMX662 camera modes 7 and 8 display at a reduced resolution from expected and become overexposed. FSM-IMX676 modes 4, 5, 6, and 7 do not display any image.

4. Installation

4.1 Obtaining NVIDIA® Jetpack

Before Installing the BSP you will need to install JetPack 6.1 on the host system using NVIDIA® SDK Manager (section 4.1.1) or from the NVIDIA® Embedded Download Center (section 4.1.2)

4.1.1 Installing JetPack from SDK Manager

For installing using sdkmanager, please follow installation steps from kdb373 for Jetpack 4.2+ <https://connecttech.com/resource-center/kdb373/>

4.1.2 Installing JetPack from NVIDIA® Embedded Download Center

1. Create a new directory for installing the Jetpack. Referred to as <BSP_ROOT> in these instructions.
2. Go to Jetpack Release Page <https://developer.nvidia.com/embedded/jetson-linux-r3640>
3. Download the "Driver Package (BSP)" and "Sample Root Filesystem" files for Orin modules (t234 platform).

4. Put the "L4T Driver Package (BSP)" and "Sample Root Filesystem" in <BSP_ROOT>.

Afterwards, you should have the following files in <BSP_ROOT>

- Jetson_Linux_R36.4.0_aarch64.tbz2
- Tegra_Linux_Sample-Root-Filesystem_R36.4.0_aarch64.tbz2

5. Extract the "L4T Driver Package" tarball:

```
cd <BSP_ROOT>
sudo tar -jxf Jetson_Linux_R36.4.0_aarch64.tbz2
```

6. You should now have a new directory called Linux_for_Tegra in your <BSP_ROOT> folder. Extract the "Sample Root Filesystem" into Linux_for_Tegra/rootfs.

```
sudo tar -C Linux_for_Tegra/rootfs/ -xjf Tegra_Linux_Sample-Root-Filesystem_R36.4.0_aarch64.tbz2
```

4.2 CTI BSP Installation

1. Copy the CTI-L4T-ORIN-NX-NANO-36.4.0-V###.tgz package into <BSP_ROOT>/Linux_for_Tegra.

If you are using Nvidia's SDK manager then "<BSP_ROOT>" will be:

```
~/nvidia/nvidia_sdk/<JetPack_Version>_Linux_JETSON_NX_ORIN_TARGETS/
```

or

```
~/nvidia/nvidia_sdk/<JetPack_Version>_Linux_JETSON_NANO_ORIN_TARGETS/
```

depending on your target module.

Otherwise if manually installing from the NVIDIA® Embedded Download Center <BSP_ROOT> will be the folder created previously

```
cp CTI-L4T-ORIN-NX-NANO-36.4.0-V###.tgz <BSP_ROOT>/Linux_for_Tegra
```

2. Extract the BSP: tar -xzf CTI-L4T-ORIN-NX-NANO-36.4.0-V###.tgz

```
cd <BSP_ROOT>/Linux_for_Tegra
```

```
sudo tar -xzf CTI-L4T-ORIN-NX-NANO-36.4.0-V###.tgz
```

3. Change into the CTI-L4T directory:

```
cd <BSP_ROOT>/Linux_for_Tegra/CTI-L4T
```

4. Run the install script (as root or sudo) to automatically install the BSP files to the correct locations:

```
sudo ./install.sh
#return to Linux_for_Tegra
```

```
cd ..
```

5. The CTI-L4T BSP is now installed on the host system and it should now be able to flash the Orin™ NX/Orin™ Nano module.

5. Flashing Orin™ NX/Orin™ Nano Modules

1. Connect an NVMe m.2 card to one of the m.2 slots on your Orin™ NX/Orin™ Nano carrier.
2. Connect the Orin™ NX/Orin™ Nano and Carrier to the computer via USB, following the instructions in the appropriate manual.
3. Put the system to be flashed into recovery mode, following the instructions in the appropriate manual

4. There are two options for flashing Jetson modules:

Using CTI's automated script:

```
./cti-flash.sh
```

Follow the menu and select your desired configuration. Once selected, the device will start to flash.

Using the Manual Method with cti-nvme-flash:

Note do not add the ".conf" file extension to the <config> parameter:

```
Manual Flash: ./cti-nvme-flash.sh cti/<module>/<boardname>/<config>
```

<module> is either orin-nx or orin-nano depending on your module.

Examples:

```
./cti-nvme-flash.sh cti/orin-nx/boson/base  
./cti-nvme-flash.sh cti/orin-nano/boson/base
```

5. Once the flashing has completed, the Orin™ NX/Orin™ Nano will reboot

6. Upgrading to a New Package Release

Upgrading L4T or CTI-BSP versions without reflashing is not currently supported.

7. Switching Profiles on Orin™ NX/Orin™ Nano

1. Open a terminal on the Orin™ NX/Orin™ Nano
2. Run "sudo cti-orin-nx-nano-fdt.sh"
3. Select the profile you wish to switch to from the menu.
4. Select the target module (Orin-NX or Orin-NANO) from the menu.
5. Restart the system

Note: This script updates the dtb by appending/replacing the FDT variable in extlinux.conf

8. Change Log

Version ORIN-NX-NANO-36.4.0 V002, Nov 12, 2024

- Added support for Econ SturdeCam20
- Added support for Econ Neducam25
- Extended Framos support from V001 to NGX007

Version ORIN-NX-NANO-36.4.0 V001, Nov 8, 2024

- Initial release of Jetpack 6.1 (l4t 36.4.0) for Orin™ NX/Orin™ Nano
- Added support for Tier4 C1 and C2 GMSL cameras
- Added support for Vision Components IMX296 MIPI camera
- Added support for Stereolabs ZEDX GMSL camera
- Added support for Framos IMX568, IMX662, IMX676, and IMX678 MIPI cameras

Contact Connect Tech

If you have any problems, questions or suggestions regarding the Board Support Package and hardware, please feel free to contact Connect Tech Inc.

Contact Information	
Support	<p>Please go to the Connect Tech Resource Center for product manuals, installation guides, device drivers, BSPs and technical tips.</p> <p>Submit your technical support questions to our support engineers. Technical Support representatives are available Monday through Friday, from 8:30 a.m. to 5:00 p.m. Eastern Standard Time.</p>



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