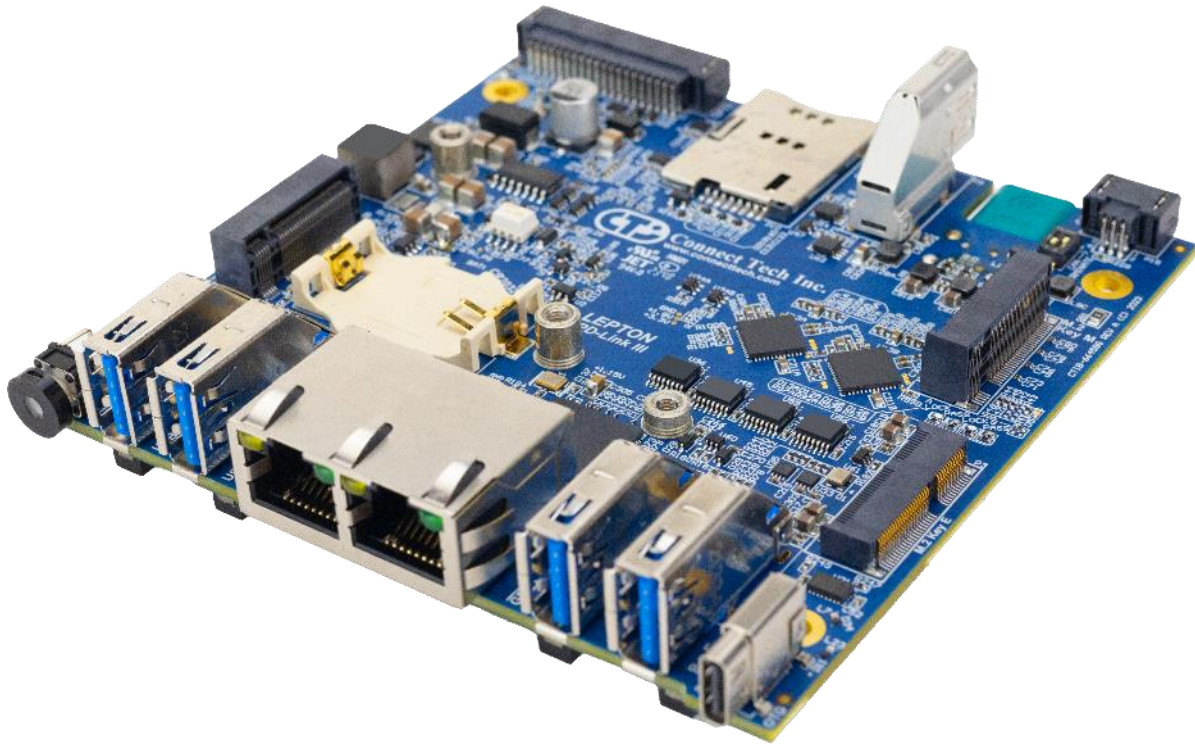




Connect Tech Inc.
Embedded Computing Experts

USERS GUIDE



Lepton

CTIM-00107(0.00) 2024-04-29



CONNECT TECH

www.connecttech.com
support@connecttech.com

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PREFACE

Disclaimer

The information contained within this user’s guide, including but not limited to any product specification, is subject to change without notice.

Connect Tech assumes no liability for any damages incurred directly or indirectly from any technical or typographical errors or omissions contained herein or for discrepancies between the product and the user’s guide.

Customer Support Overview

If you experience difficulties after reading the manual and/or using the product, contact the Connect Tech reseller from which you purchased the product. In most cases the reseller can help you with product installation and difficulties.

In the event that the reseller is unable to resolve your problem, our highly qualified support staff can assist you. Our support section is available 24 hours a day, 7 days a week on our website at: <http://connecttech.com/support/resource-center/>. See the contact information section below for more information on how to contact us directly. Our technical support is always free.

Contact Information

Contact Information	
Mail/Courier	Connect Tech Inc. Technical Support 489 Clair Rd. W. Guelph, Ontario Canada N1L 0H7
Contact Information	sales@connecttech.com support@connecttech.com www.connecttech.com Toll Free: 800-426-8979 (North America only) Telephone: +1-519-836-1291 Facsimile: 519-836-4878 (on-line 24 hours)
Support	Please go to the Connect Tech Resource Center for product manuals, installation guides, device drivers, BSPs and technical tips. 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.

Limited Product Warranty

Connect Tech Inc. provides a one-year Warranty for this product. Should this product, in Connect Tech Inc.'s opinion, fail to be in good working order during the warranty period, Connect Tech Inc. will, at its option, repair or replace this product at no charge, provided that the product has not been subjected to abuse, misuse, accident, disaster or non-Connect Tech Inc. authorized modification or repair.

You may obtain warranty service by delivering this product to an authorized Connect Tech Inc. business partner or to Connect Tech Inc. along with proof of purchase. Product returned to Connect Tech Inc. must be pre-authorized by Connect Tech Inc. with an RMA (Return Material Authorization) number marked on the outside of the package and sent prepaid, insured and packaged for safe shipment. Connect Tech Inc. will return this product by prepaid ground shipment service.

The Connect Tech Inc. Limited Warranty is only valid over the serviceable life of the product. This is defined as the period during which all components are available. Should the product prove to be irreparable, Connect Tech Inc. reserves the right to substitute an equivalent product if available or to retract the Warranty if no replacement is available.

The above warranty is the only warranty authorized by Connect Tech Inc. Under no circumstances will Connect Tech Inc. be liable in any way for any damages, including any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, such product.

Copyright Notice

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ESD Warning



Electronic components and circuits are sensitive to ElectroStatic Discharge (ESD). When handling any circuit board assemblies including Connect Tech COM Express carrier assemblies, it is recommended that ESD safety precautions be observed. ESD safe best practices include, but are not limited to:

- Leaving circuit boards in their antistatic packaging until they are ready to be installed.
- Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static charge that may be present on you.
- Only handling circuit boards in ESD safe areas, which may include ESD floor and table mats, wrist strap stations and ESD safe lab coats.
- Avoiding handling circuit boards in carpeted areas.
- Try to handle the board by the edges, avoiding contact with components.

REVISION HISTORY

Revision	Date	Changes
0.00	2024-04-29	Preliminary Release

INTRODUCTION

Connect Tech’s Lepton brings a deployable NVIDIA® Jetson Orin™ NX to the market. The Lepton’s design includes a Locking Power Input (+9 to +36V), Dual Gigabit Ethernet, HDMI video, 4 x USB 3.0 Type A, 4 x FPD-Link III Cameras, USB Type-C (w/ OTG functionality), M.2 (B-Key 3042, M-Key 2280, and E-Key 2230 functionality; bottom access panel), 40 Pin Locking GPIO connector, 6-Pin Locking Isolated Full-Duplex CAN, RTC battery, 2FF (mini) SIM card slot, and a dual purpose Reset/Force Recovery pushbutton with Power LED.

Lepton is compatible with NVIDIA® Jetson Orin™ NX and Orin™ Nano modules. Some I/O performance will change across modules. **Not compatible with NVIDIA® Jetson Xavier™ NX or Xavier™ Nano.**

Product Feature and Specifications (Carrier Only)

Feature	Lepton
Module Compatibility	NVIDIA® Jetson Orin™ NX NVIDIA® Jetson Orin™ Nano
Mechanical Dimensions	104mm x 110mm x 34mm
USB	4x USB 3.0 (Connector: USB Type-A) 1x USB 3.1 OTG (Type-C) 1x USB 3.0 + 2.0 Port to M.2 B-Key 1x USB 2.0 to M.2 E-Key
GMSL Cameras	4x FPD-Link III Camera Inputs (Connector: Quad Micro COAX) Deserializers Embedded On Carrier Board
Display	1x HDMI 2.0 Type-A
Networking	2x 10/100/1000BASE-T Uplink (1 Port From PCIe PHY Controller)
Storage	1x NVMe (M.2 2280 M-KEY)
Wireless Expansion	1x WiFi Module (M.2 2230 E-KEY) 1x LTE Module (M.2 3042 B-KEY) w/ 2FF SIM Card Connector
Misc. I/O	1x SPI 2x Isolated Camera Trigger Input 2x UART (1x Console, 1x 3.3V) 1x RS-485 2x I2C 2x PWM OUT 4x GPIO (2x IN, 2x OUT) 2x 5V 2x 3.3V 9x GND
CAN	1x Isolated CAN FD (1Mbps max)

RTC Battery	CR2032 Battery Holder
Pushbutton	Dual Purpose Reset/Force Recovery Functionality
Status LED	Power Good LED
Power Input	+9V to +36V DC Power Input (Mini-Fit Jr. 4-Pin Locking)
Operating Temperature	-40 C to +80 C
Weight	127g (carrier only)
Warranty and Support	1 Year Warranty and Free Support

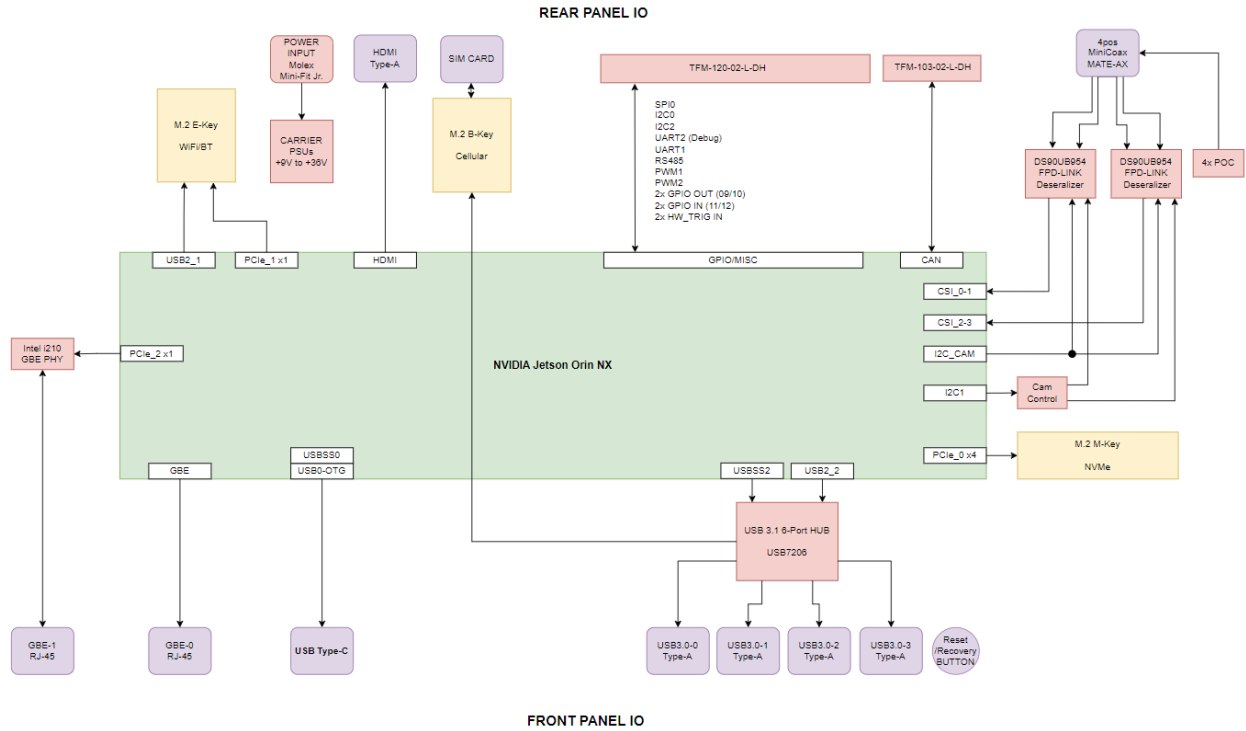
Part Numbers / Ordering Information

Part Number	Description	Jetson Module
NGX022	Lepton Carrier	-
NGX022-xx	Lepton Carrier with Jetson Module and NVME. Extra peripherals area available: M.2 WiFi 6 and M.2 LTE Modem	Jetson Orin™ NX or Orin™ Nano

Please refer to the Lepton webpage or contact sales@connecttech.com for the most up to date ordering information.

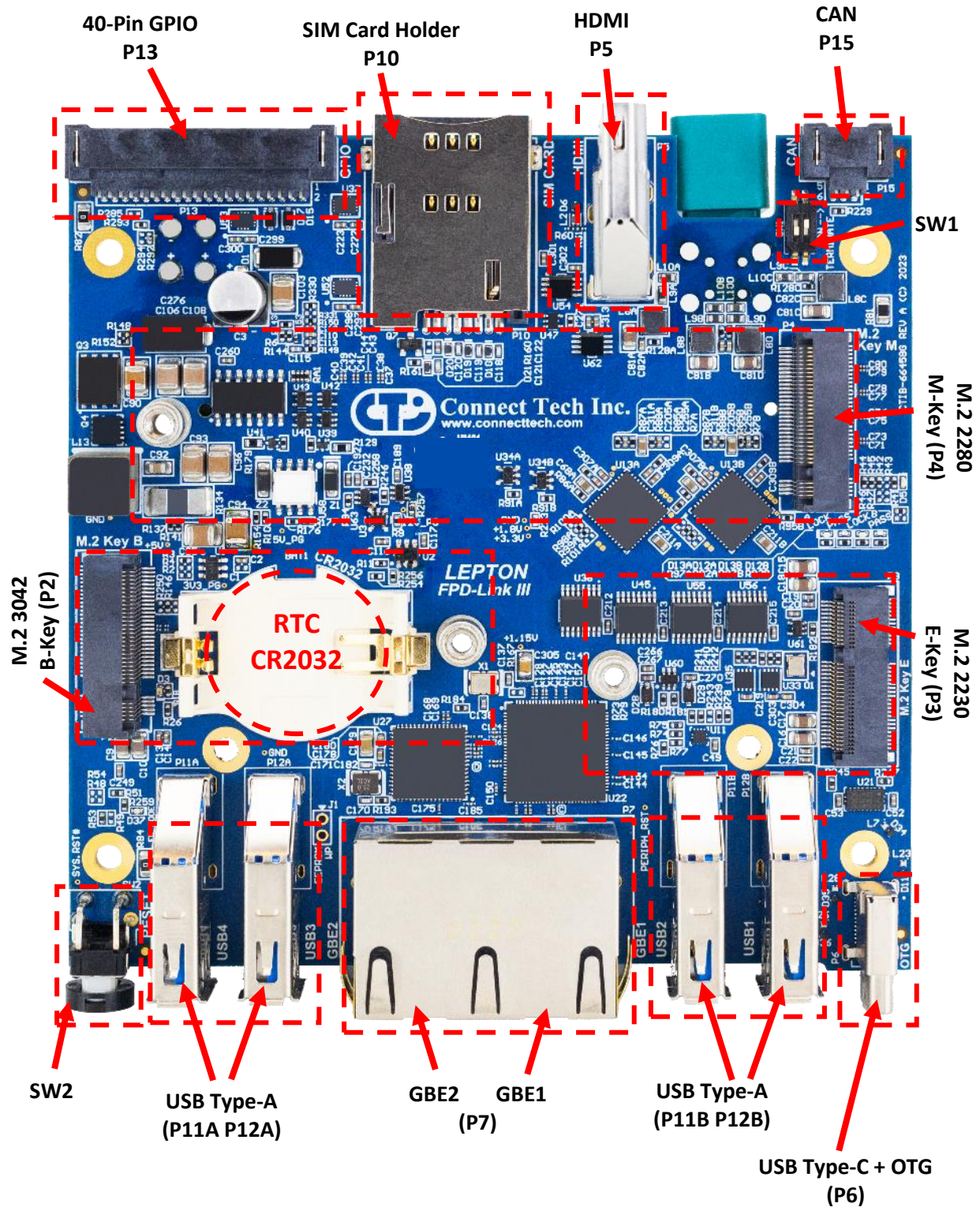
PRODUCT OVERVIEW

Block Diagram

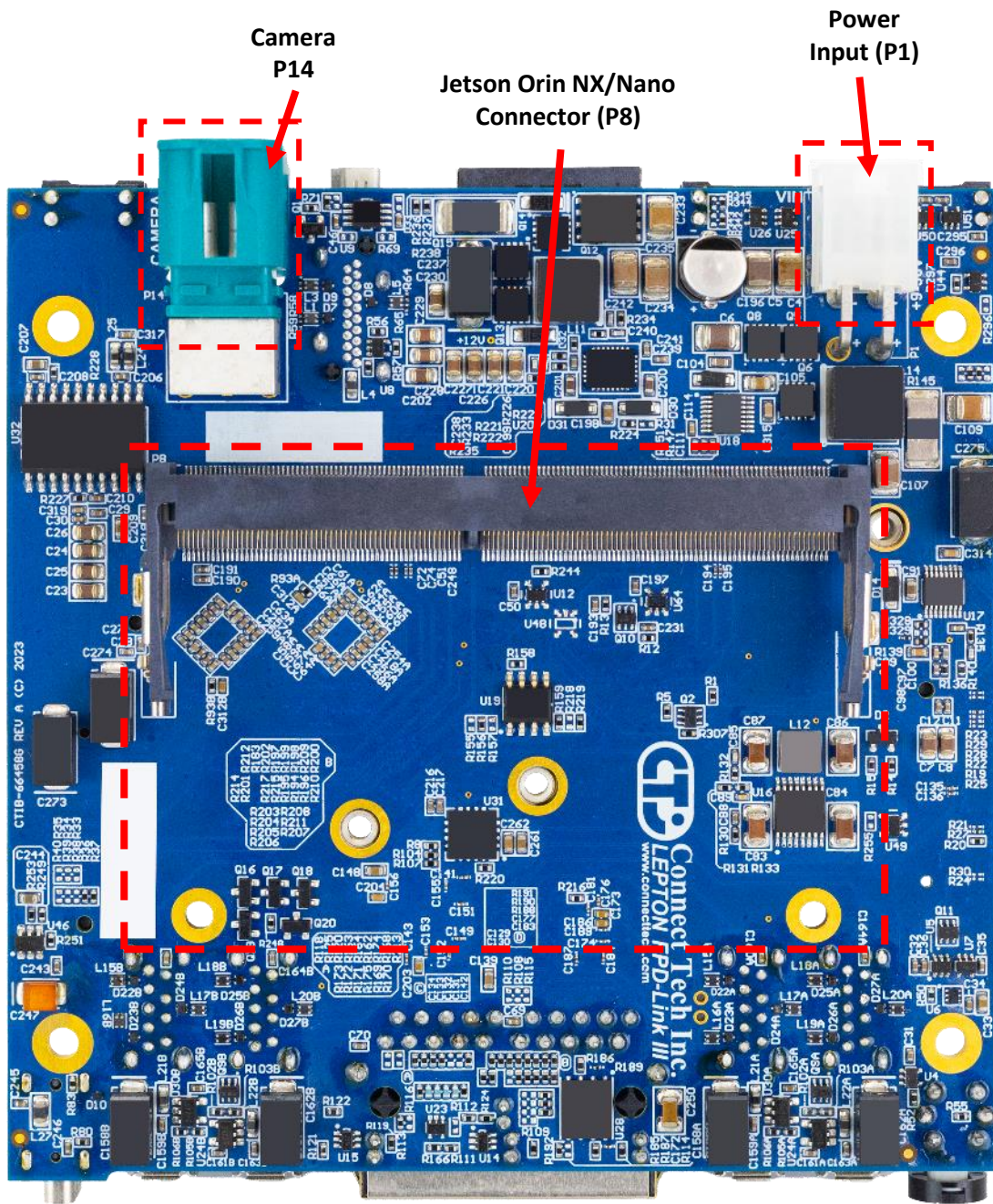


Connector Locations

TOP VIEW



BOTTOM VIEW



Connector Summary

Designator	Connector	Description
P1	0353180420	+9V to +36V Mini-Fit Jr. 4-Pin DC Power Input Connector
P2	10128796-001RLF	M.2 3042 B-Key 2G/3G/LTE Cellular Module Connector
P3	SM3ZS067U410AER1000	M.2 2230 E-Key WiFi/Bluetooth Module Connector
P4	10131758-001RLF	M.2 2280 M-Key NVMe SSD Connector
P5	2007435-3	HDMI Video Connector
P6	USB4200-03-A	USB3.1 OTG Type-C Connector
P7	JXD1-2015NL	Dual RJ-45 Gigabit Ethernet Connector
P8	2309413-1	NVIDIA® Jetson Orin™ NX NVIDIA® Jetson Orin™ Nano Module Board-To-Board Connector
P10	0475530001	SIM Card Connector
P11A, B	48404-0003	USB3.0 Type-A Connector
P12A, B	48404-0003	USB3.0 Type-A Connector
P13	TFM-120-02-L-DH-TR	40 Pin GPIO Connector
P14	2304168-9	FPD-Link III Quad Camera Connector
P15	TFM-103-02-L-DH-TR	6 Pin Isolated CAN Connector
BAT1	BHSD-2032-SM	CR2032 RTC Battery Connector

Switch Summary

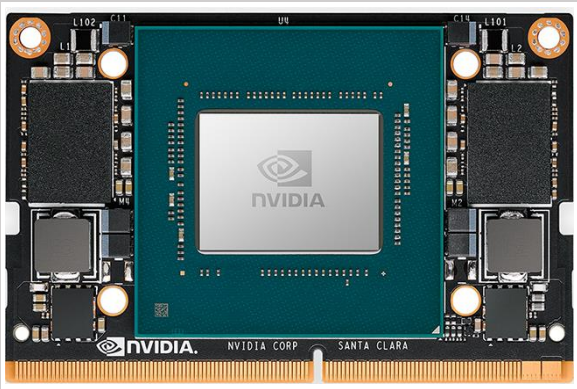
Designator	Connector	Description
SW1-1 SW1-2	1571983-1	Manufacturing Test Only CAN Termination Enable/Disable
SW2	TL1260BQRBLK	Dual Function Reset/Recovery Pushbutton

DETAILED FEATURE DESCRIPTION

Lepton NVIDIA® Jetson Orin™ NX/Nano Module Connector

The NVIDIA® Jetson Orin™ NX/Nano processor and chipset are implemented on the Jetson Orin™ NX/Nano Module. This connects to the NVIDIA® Jetson Orin™ NX/Nano to the Lepton via a TE Connectivity DDR4 SODIMM 260 Pin connector.

Function	Description
Location	Internal to Lepton
Type	Module
Pinout	Refer to NVIDIA® Jetson Orin™ NX/Nano Datasheet.
Features	Refer to NVIDIA® Jetson Orin™ NX/Nano Datasheet.

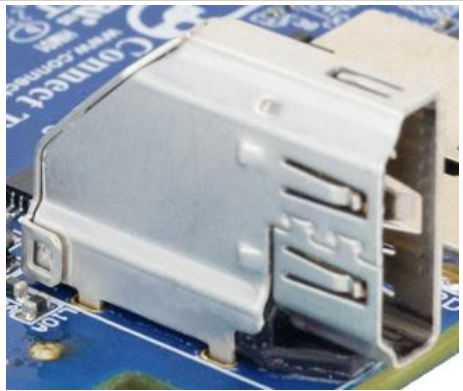


The image shows the NVIDIA Jetson Orin NX/Nano module, a green printed circuit board (PCB) with a central silver NVIDIA processor chip. The board is populated with various components, including capacitors and connectors. The NVIDIA logo and 'NVIDIA CORP SANTA CLARA' are visible on the bottom edge of the board.

Lepton HDMI Connector

The NVIDIA® Jetson Orin™ NX/Nano module will output video via the Lepton vertical HDMI connector that is HDMI 2.0 capable.

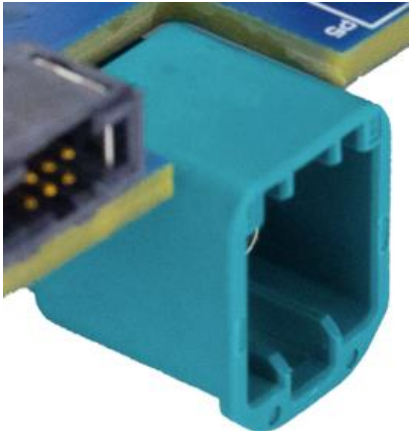
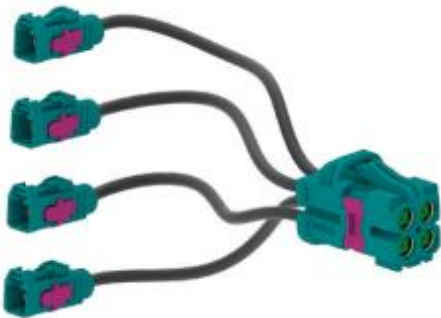
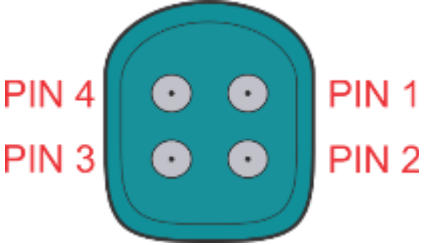
Function	Description
Location	Rear
Type	HDMI Vertical Connector
Mating Connector	HDMI Type-A Cable
Pinout	Refer to HDMI Standard



The image shows a close-up of a white HDMI vertical connector mounted on a blue PCB. The connector is designed for vertical insertion and is used for video output from the module.

Lepton Camera Connector

The Lepton allows FPD-Link III through the Quad MATE-AX connector. The FPD-Link III to MIPI Deserializers are embedded on the carrier board which use 4-Lane MIPI video per 2 cameras. Additionally, the Lepton outputs +12V Power Over COAX (POC) with a 2A current capability (500mA per camera).

Function		Description	
Location		Rear	
Type		Camera Coax Connector	
Mating Cable		Quad Fakra Cable 4 Position MATE-AX to 4 x FAKRA Z-code 50Ω RG174 Cable CTI P/N: CBG341 (1 meter)	
Pin	MIPI-Lanes	Description	
1	CSI 2/3	Camera Connector	
2	CSI 2/3	Camera Connector	
3	CSI 0/1	Camera Connector	
4	CSI 0/1	Camera Connector	

Lepton USB 3.0 Type-A Connector

The Lepton incorporates 4 vertical USB 3.0 Type-A connectors with a 2A current limit per connector. All USB 3.0 Type-A ports are 5Gbps capable.


Function	Description
Location	Front
Type	USB Type-A Connector
Mating Connector	USB Type-A Cable
Pinout	Refer to USB Standard



Lepton 10/100/1000 Dual Ethernet Connector


The Lepton implements 2 x RJ-45 ethernet connectors for internet communication. Connector GbE1 is connected directly to the NVIDIA® Jetson Orin™ NX/Nano module. Connector GbE2 is connected through a PCIe Gigabit Ethernet PHY.

Function	Description
Location	Front
Type	RJ-45 Connector
Mating Connector	RJ-45 Ethernet Cable
Pinout	Refer to Ethernet Standard



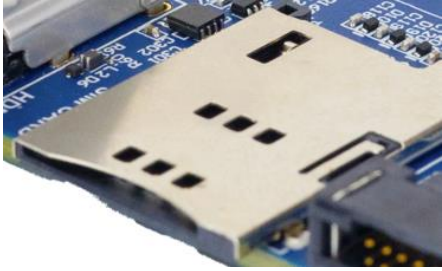
Lepton USB3.1 OTG Connector

The Lepton implements a USB3.1 Type-C connector to allow host mode access to the module or OTG flashing of the module. This connector can also be used as a regular USB port with 10Gbps link speed. Max current is 2A.

Function	Description	
Location	Front	
Type	USB Type-C Connector	
Mating Connector	USB Type-C Plug	
Pinout	Refer to USB Standard	

Lepton SIM Card Connector

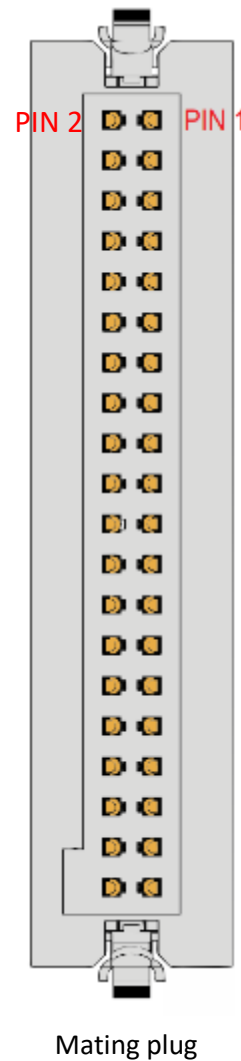
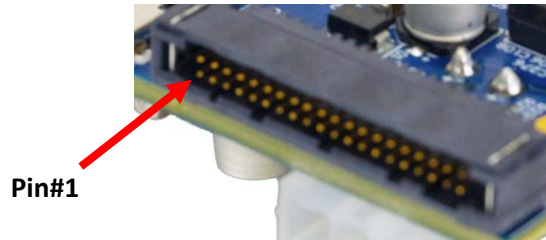
The Lepton implements a mini (2FF) SIM Card connector.

Function	Description	
Location	Rear	
Type	2FF (mini) SIM Card Connector	
Pinout	Refer to SIM Card Standard	

Lepton GPIO Connector

The Lepton implements a Samtec TFM-120-02-L-DH-TR Connector to allow for additional user control.

Function		Description	
Location		Rear	
Type		GPIO Expansion Connector	
Carrier Connector		TFM-120-02-L-DH-TR	
Mating Cable		SFSD-20-28C-G-12.00-SR	
Pinout	Colour	Description	I/O Type
1	Brown	+5V ¹	Power
2	Red	SPIO_MOSI ²	O
3	Orange	SPIO_MISO ²	I
4	Yellow	SPIO_SCK ²	O
5	Green	SPIO_CS0# ²	O
6	Violet	+3.3V ¹	Power
7	Gray	GND	Power
8	White	HW_TRIG_0_P ⁴	I
9	Black	HW_TRIG_0_N ⁴	I
10	Blue	HW_TRIG_1_P ⁴	I
11	Brown	HW_TRIG_1_N ⁴	I
12	Red	GND	Power
13	Orange	UART2_TX_DEBUG ²	O
14	Yellow	UART2_RX_DEBUG ²	I
15	Green	GND	Power
16	Violet	I2C0_SCL	I/O
17	Gray	I2C0_SDA	I/O
18	White	GND	Power
19	Black	I2C2_SCL	I/O
20	Blue	I2C2_SDA	I/O
21	Brown	GND	Power
22	Red	GPIO09 ²	O
23	Orange	GPIO10 ²	O
24	Yellow	GPIO11 ²	I
25	Green	GPIO12 ²	I



26	Violet	GND	Power
27	Gray	GPIO13 ² (PWM1)	O
28	White	GPIO14 ² (PWM2)	O
29	Black	GND	Power
30	Blue	RXD+ (RS485)	I
31	Brown	RXD- (RS485)	I
32	Red	TXD+ (RS485)	O
33	Orange	TXD- (RS485)	O
34	Yellow	RTS (RS485)	O
35	Green	+5V ¹	Power
36	Violet	UART1_TX ²	O
37	Gray	UART1_RX ²	I
38	White	+3.3V ¹	Power
39	Black	GND	Power
40	Blue	GND	Power

Notes	Jetson Orin™ NX SW Interface Cross Reference ³																																								
	<table border="1"> <thead> <tr> <th>Signal Name</th> <th>Module ID</th> <th>Controller ID</th> </tr> </thead> <tbody> <tr> <td>GPIO09</td> <td>GPIO09</td> <td>PAC.06</td> </tr> <tr> <td>GPIO10</td> <td>GPIO10</td> <td>PEE.02</td> </tr> <tr> <td>GPIO11</td> <td>GPIO11</td> <td>PQ.06</td> </tr> <tr> <td>GPIO12</td> <td>GPIO12</td> <td>PN.01</td> </tr> <tr> <td>GPIO13 (PWM)</td> <td>pwmchip1</td> <td>32c0000.pwm</td> </tr> <tr> <td>GPIO14 (PWM)</td> <td>pwmchip0</td> <td>32a0000.pwm</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Signal Name</th> <th>SW/Dev ID</th> <th>DTB ID</th> </tr> </thead> <tbody> <tr> <td>SPI0</td> <td>spidev0.0</td> <td>spi@3210000</td> </tr> <tr> <td>I2C0</td> <td>i2c-1</td> <td>i2c@c240000</td> </tr> <tr> <td>I2C2</td> <td>i2c-0</td> <td>i2c@3160000</td> </tr> <tr> <td>RS485</td> <td>ttyTHS1</td> <td>serial@3110000</td> </tr> <tr> <td>UART1</td> <td>ttyTHS0</td> <td>serial@3100000</td> </tr> </tbody> </table>			Signal Name	Module ID	Controller ID	GPIO09	GPIO09	PAC.06	GPIO10	GPIO10	PEE.02	GPIO11	GPIO11	PQ.06	GPIO12	GPIO12	PN.01	GPIO13 (PWM)	pwmchip1	32c0000.pwm	GPIO14 (PWM)	pwmchip0	32a0000.pwm	Signal Name	SW/Dev ID	DTB ID	SPI0	spidev0.0	spi@3210000	I2C0	i2c-1	i2c@c240000	I2C2	i2c-0	i2c@3160000	RS485	ttyTHS1	serial@3110000	UART1	ttyTHS0
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RS485	ttyTHS1	serial@3110000																																							
UART1	ttyTHS0	serial@3100000																																							
	<ol style="list-style-type: none"> +3.3V and +5V power pins are outputs only, DO NOT feed power to these pins. GPIO/UART/SPI/I2C are +3.3V. 																																								

3. Software information refers to JetPack 5 and may change if using a different JetPack version.
4. HW Trigger details:

Signal Name	I2C Device Pin#	I2C Mux Signal Name
HW_TRIG_0	6	S5
HW_TRIG_1	7	S6

I2C Device Address	Connected to DS90UB954
0x48	CHA GPIO0
0x49	CHA GPIO1
0x4A	CHB GPIO0
0x4B	CHB GPIO1

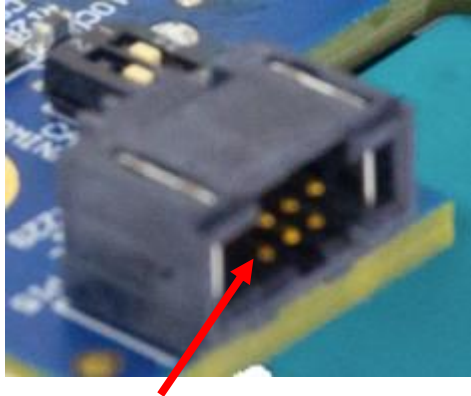
I2C device bus information:

I2C Device	SW/Dev ID	DTB ID
I2C1	i2c-7	i2c@c250000

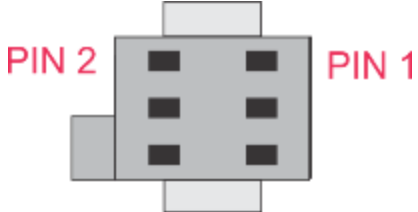
Lepton Isolated CAN Connector

The Lepton implements a Samtec TFM-103-02-L-DH-TR Connector to allow for Isolated CAN with built-in 120Ω termination. 1 x Isolated Power (+5V), 1 x Isolated CANH, 1 x Isolated CANL, 3 x Isolated Ground.

Function		Description
Location		Rear
Type		Isolated CAN Connector
Carrier Connector		TFM-103-02-L-DH-TR
Mating Cable		SFSD-03-28C-G-12.00-SR
Pinout	Colour	Description
1	Brown	GND
2	Red	+5V Isolated
3	Orange	GND
4	Yellow	CANH
5	Green	GND
6	Violet	CANL




Pin#1



Note: Built-in 120Ω termination can be removed with customer request. Please contact Connect Tech Inc. for further details.

Lepton Reset & Force Recovery Pushbutton

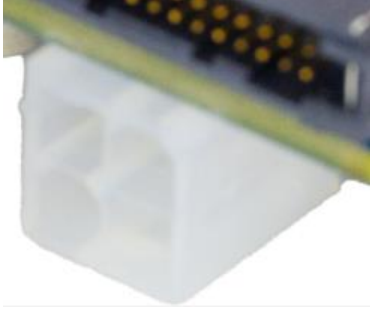
The Lepton implements a dual functionality pushbutton for both Reset and Recovery of the platform. To Reset the module, simply press and hold the pushbutton for a minimum of 250 milliseconds. To put the Jetson Orin™ NX/Nano module into Force Recovery mode, press and hold the pushbutton for a minimum of 10 seconds.

Function	Description	
Location	Front	
Type	Pushbutton	
Reset Button Press	Minimum 250ms (typ.)	
Recovery Button Press	Minimum 10s (typ.)	

Note: A full power cycle of the Lepton Platform must be performed after module flashing.

Lepton Power Connector

The Lepton implements a Mini-Fit Jr. 4-Pin Power Connector that accepts +9V to +36V DC power.

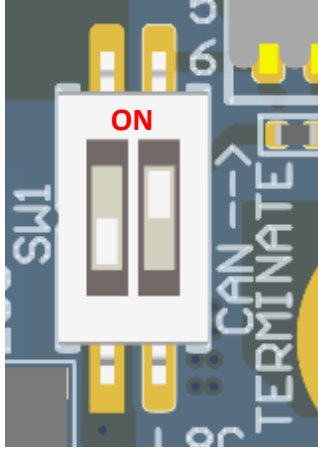
Function	Description	
Location	Rear	
Type	Mini-Fit Jr. 4-Pin Connector	
Minimum Input Voltage	+9V DC	
Maximum Input Voltage	+36V DC	
CTI Mating Cable	CTI PN: CBG408	

Note: A Power Supply capable of 120W or more is required to operate the Lepton with all peripherals running at their respective maximum rating.

Lepton CAN Termination Enable/Disable DIP Switch Selection

The Lepton internally implements 2 position DIP Switch for Enabling or Disabling the CAN Termination Resistor of 120Ω.

Function	Description
Location	Internal to Lepton
Type	DIP Switch
SW1-1 – OFF SW1-2 – OFF	Manufacturing Test Only CAN Termination Disable (default)
SW1-1 – ON SW1-2 – ON	Manufacturing Test Only CAN Termination Enable



Note: CAN Termination Disabled by default upon shipment to customer.
Please contact Connect Tech Inc. if you would like to set the Termination to be Enabled before shipment.

Lepton Antenna Connectors

The Lepton can be equipped with one M.2 WiFi and M.2 LTE modem. Each WiFi and modem have their own antenna connections. Please consult individual datasheet for antenna connections.

TYPICAL INSTALLATION

The Lepton is an NVIDIA® Jetson Orin™ NX/Nano based carrier that can be configured in a variety of ways to suit the users environment and feature set. The basic install and power up conditions are as follows:

1. Ensure all external system power supplies are off and disconnected.
 2. Install the necessary modules:
 - a) NVIDIA® Jetson Orin™ NX or Nano into **P8**.
 - b) M.2 2280 NVME PCIe x4 Gen 3 or Gen 4 into **P4**. Minimum capacity is 64GB.
 3. Install optional modules:
 - a) If RTC clock is needed, install BR/CR2030 battery into RTC battery slot **BAT1**.
 - b) If WiFi and/or Bluetooth is needed, install WiFi/BT module into M.2 Key E slot **P3**.
 - c) If LTE modem is needed, install LTE modem module into M.3 Key B slot **P2**. Once this module is installed, access to **BAT 1** will be restricted. Then, insert 2FF mini SIM card into P10. SIM card **hot-plug is not supported**.
 4. Install the necessary cables for your application:
 - a) Ethernet cables.
 - b) HDMI video display cable.
 - c) Keyboard, Mouse, etc. via USB.
 - d) Other USB devices.
 - e) FPD-Link III Camera(s). **Not hot-plug capable**.
 - f) GPIO 40-Pin Connector. **Not hot-plug capable**.
 - g) CAN 6-Pin Connector. **Not hot-plug capable**.
 - h) Antennas for WiFi/Bluetooth (if applicable).
 - i) Antennas for LTE (if applicable).
- 3) Connect the Power Cable of the +9V to +36V Power Supply into the Mini-Fit Jr. 4-Pin power connector.
- 4) Plug the AC cable into the Power Supply and into the wall socket.

FORCE RECOVERY MODE

The USB Type-C port (P6) of the Lepton can be used to reprogram the Jetson Orin™ NX/Nano from another host platform running NVIDIA® Jetpack™.

1. Power down the system completely. The system power MUST be OFF, nor in suspend or sleep mode.
2. Connect the OTG USB port to another host device that will be supplying the new system file.
3. Hold down the main Push Button for approximately 10 seconds or until D37 LED emits.



4. Once D37 is emitted, release the button.
5. The Jetson Orin™ NX/Nano will show up on the host system USB list as a new NVIDIA® target device.
6. After successfully updating the system software, power off the system. A clean power up will revert the OTG port back into host mode.

THERMAL DETAILS

The Lepton has an Operating Temperature Range of -40°C to $+80^{\circ}\text{C}$.

However, it is important to note that the NVIDIA® Jetson Orin™ NX/Nano Modules have their own properties separate to that of the Lepton.

Customer responsibility requires proper implementation of a thermal solution that maintains the Lepton temperatures below the specified temperatures (shown in the tables below) under the maximum thermal load and system conditions for their use case.

NVIDIA® Jetson Orin™ NX/Nano

Parameter	Value	Units
Maximum Jetson Orin™ SoC Operating Temperature	99	$^{\circ}\text{C}$
Jetson Orin™ SoC Shutdown Temperature	105	$^{\circ}\text{C}$

CURRENT CONSUMPTION DETAILS

NVIDIA® Jetson Orin™ NX/Nano

Parameter	NX / Nano Value	Units	Temperature
NVIDIA® Jetson Orin™ NX/Nano Module, Passive Cooling, MAXN mode, Idle, HDMI, Ethernet, Mouse, and Keyboard plugged in	14 / TBD	W	25°C (typ.)
NVIDIA® Jetson Orin™ NX/Nano Module, Passive Cooling, MAXN mode, CPU stressed, GPU stressed, HDMI, Ethernet, all 5 USB ports loaded at 1.5A each, 2 cameras streaming	79 / TBD	W	25°C (typ.)

SOFTWARE / BSP DETAILS

All Connect Tech NVIDIA® Jetson based products are built upon a modified Linux for Tegra (L4T) Device Tree that is specific to each CTI product.

WARNING: The hardware configurations of CTI's products differ from that of the NVIDIA® supplied evaluation kit. Please review the product documentation and install **ONLY** the appropriate CTI L4T BSPs. Failure to follow this process could result in non-functional hardware.

CABLES INCLUDED

Description	Part Number	Qty
Power Input Cable	CBG408	1
GPIO Cable	SFSD-20-28C-G-12.00-SR	1
CAN Cable	SFSD-03-28C-G-12.00-SR	1

ACCESSORIES

Description	Part Number
19V / 120W AC/DC Power Supply	MSG085
Quad FAKRA FPD-Link III Cable	CBG341
Mounting Brackets	MSG067

APPROVED VENDORS CAMERAS

Manufacturer	Description	Part Number	Image Sensor
e-con Systems	FPD-Link III	NeduCAM25	AR0234

Please visit our Supported Cameras [chart](#) for additional cameras (if applicable).

MECHANICAL DETAILS

Lepton Assembly Procedure (TBD)