Connect Tech Inc.

Embedded Computing Experts

USERS GUIDE

NVIDIA Jetson® HDMI MIPI Vision Platform

CTIM-00103 Revision 0.00 2024-05-28

NVIDIA ELITE PARTNER

CONNECT TECH

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TABLE OF CONTENTS

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 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.

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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	2024-05-28	Initial Release

INTRODUCTION

Connect Tech's HDMI MIPI Vision Platform is an expansion board that allows up to 4 HDMI cameras to be connected to various Jetson platforms. The *NVIDIA Jetson® HDMI MIPI Vision Platform* strives for a seamless user experience, and is essentially plug and play. There are two connection types available: Micro HDMI, and the 30-pin KEL USL00-30L. Cameras using Micro HDMI require separate power and control signal connections, while cameras using the 30-pin interface receive power and control signals through that interface. The KEL connectors are designed specifically to be compatible with the Sony FCB-EW9500H and FCB-ER8530 cameras.

Product Features and Specifications

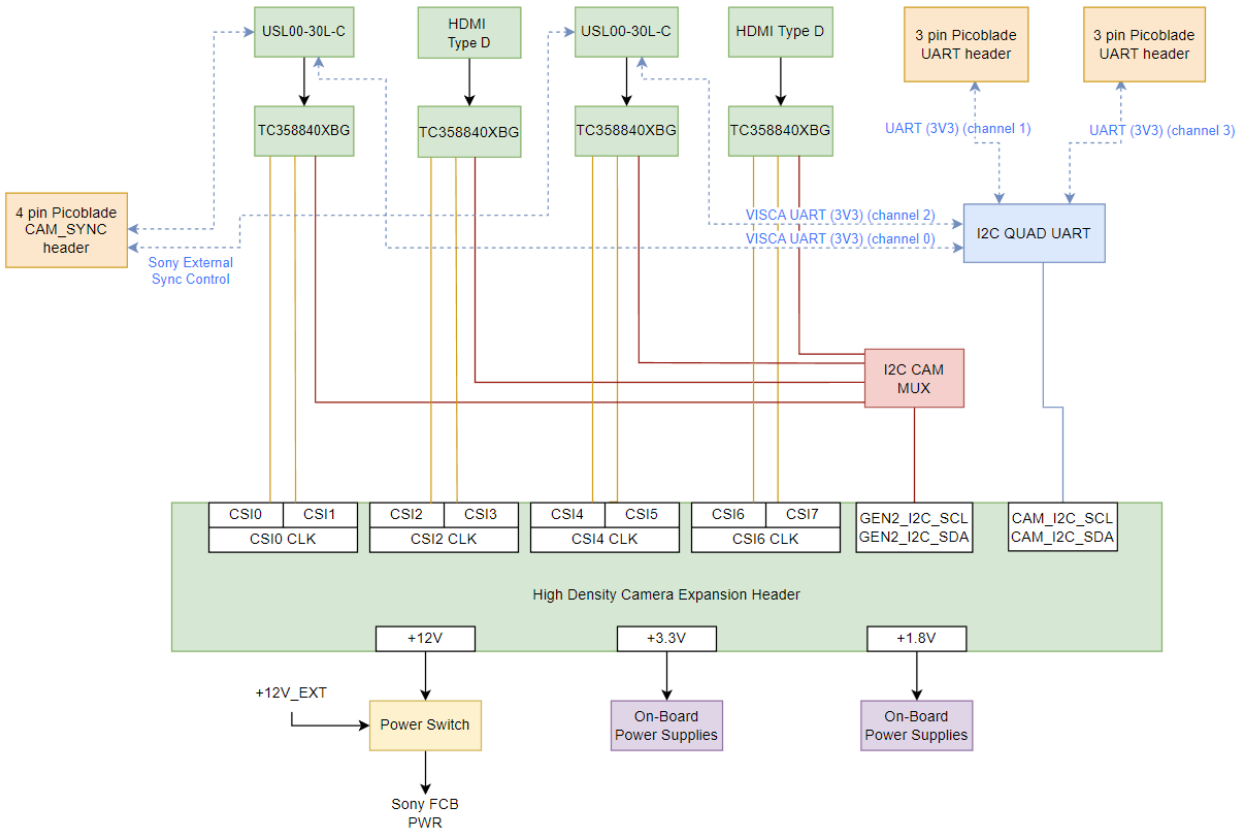
Specifications	
Size	75mm x 52mm
Weight	23g
NVIDIA Orin Connection (Uplink)	1x High Density Connector Camera Board will mate to the NVIDIA Jetson "Camera Expansion Header"
Camera Inputs	4x HDMI
Bridge	Toshiba TC358840XBG
MIPI Output	A single 4-lane MIPI CSI-2 v1.01 output from each Bridge (16-lanes total)
Camera Input Connectors	2x KEL USL00-30L 2x HDMI Type D (Micro HDMI)
Power	Directly powered from Camera Expansion Header
Operating Temperature	-30°C to +70°C (-22°F to +158°F)
Warranty and Support	1 Year Warranty and Free Technical Support

Associated Part Number Ordering Information

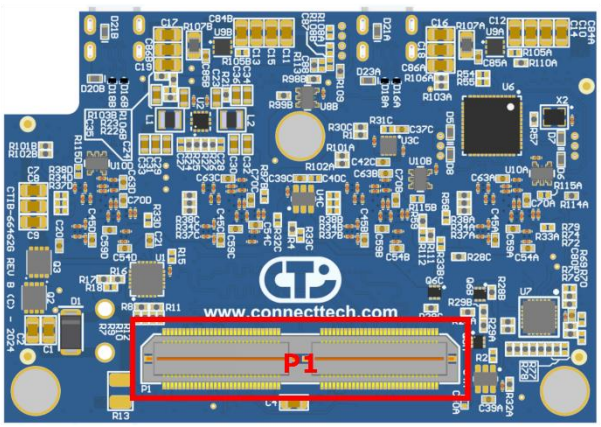
Part Number	Description
JCB010	HDMI MIPI Vision Platform
AGX201-XXX	Forge Carrier with HDMI MIPI Vision Platform Integrated – please see https://connecttech.com/product/nvidia-jetson-hdmi-camera-platform/ for full listing
AGX202-XXX	Rogue for Orin Carrier with HDMI MIPI Vision Platform Integrated – please see https://connecttech.com/product/nvidia-jetson-hdmi-camera-platform/ for full listing
AGX203-XXX	Rogue-RX Carrier with HDMI MIPI Vision Platform Integrated – please see https://connecttech.com/product/nvidia-jetson-hdmi-camera-platform/ for full listing

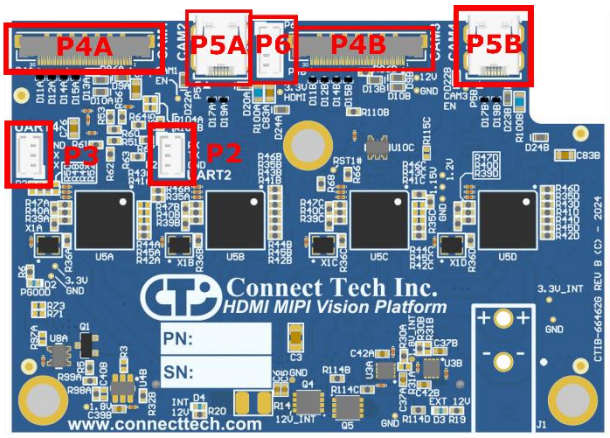
PRODUCT OVERVIEW

Block Diagram



Connector Summary & Locations



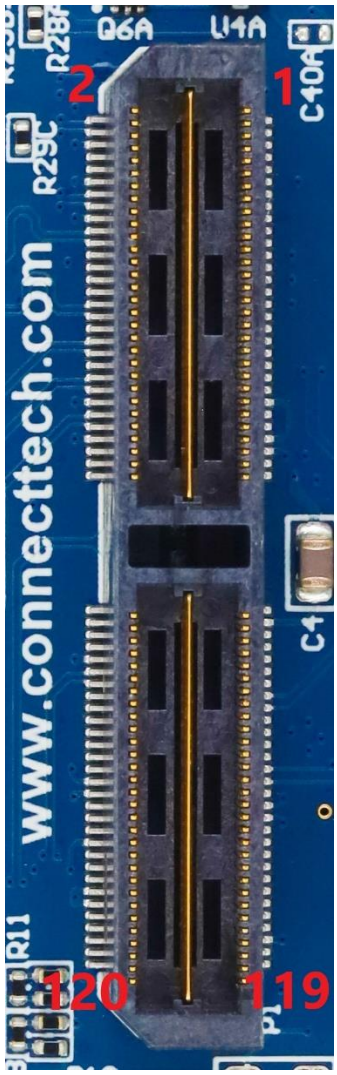


Designator	Connector Description
P1	MIPI Camera Expansion connector (Samtec QTH)
P2, P3	3-pin UART connectors (Molex Picoblade)
P4A, P4B	30-pin micro coaxial FCB camera connectors (KEL USL00-30L)
P5A, P5B	Micro HDMI connectors
P6	4-pin Sony Camera External Sync (Molex Picoblade)

[P1] MIPI Camera Expansion Connector Pinout

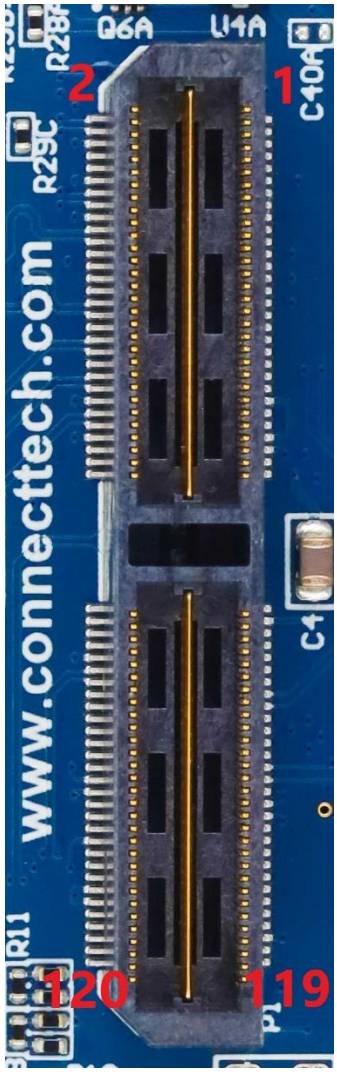
Function	8 MIPI CSI-2 Camera Interface		
Location	P1		
Pin	**Description**	**Pin**	**Description**
1	CSI0_D0_P	2	CSI1_D0_P
3	CSI0_D0_N	4	CSI1_D0_N
5	GND	6	GND
7	CSI0_CLK_P	8	NC
9	CSI0_CLK_N	10	NC
11	GND	12	GND
13	CSI0_D1_P	14	CSI1_D1_P
15	CSI0_D1_N	16	CSI1_D1_N
17	GND	18	GND
19	CSI2_D0_P	20	CSI3_D0_P
21	CSI2_D0_N	22	CSI3_D0_N
23	GND	24	GND
25	CSI2_CLK_P	26	NC
27	CSI2_CLK_N	28	NC
29	GND	30	GND
31	CSI2_D1_P	32	CSI3_D1_P
33	CSI2_D1_N	33	CSI3_D1_N
35	GND	36	GND
37	CSI4_D0_P	38	CSI6_D0_P
39	CSI4_D0_N	40	CSI6_D0_N
41	GND	42	GND
43	CSI4_CLK_P	44	CSI6_CLK_P
45	CSI4_CLK_N	46	CSI6_CLK_N
47	GND	48	GND
49	CSI4_D1_P	50	CSI6_D1_P
51	CSI4_D1_N	52	CSI6_D1_N
53	GND	54	GND
55	+12V	56	+12V

This camera platform is not compatible with the NVIDIA Development Kit.



Pin	Description	Pin	Description
57	+12V	58	+12V
59	CSI5_D0_P	60	CSI7_D0_P
61	CSI5_D0_N	62	CSI7_D0_N
63	GND	64	GND
65	NC	66	NC
67	NC	68	NC
69	GND	70	GND
71	CSI5_D1_P	72	CSI7_D1_P
73	CSI5_D1_N	74	CSI7_D1_N
75	I2C3_SCL	76	NC
77	I2C3_SDA	78	NC
79	GND	80	GND
81	NC	82	NC
83	NC	84	CAM_ERROR3
85	NC	86	NC
87	I2C2_SCL	88	NC
89	I2C2_SDA	90	CAM1_PWDN
91	NC	92	CAM1_RST#
93	CAM0_PWDN	94	NC
95	CAM0_RST#	96	NC
97	NC	98	NC
99	GND	100	GND
101	NC	102	+1.8V
103	NC	104	NC
105	NC	106	NC
107	NC	108	+3.3V
109	NC	110	+3.3V
111	NC	112	NC
113	NC	114	NC
115	GND	116	GND
117	NC	118	NC
119	NC	120	NC

This camera platform is not compatible with the NVIDIA Development Kit.



[P2, P3] 3-pin UART Connector Pinout

These headers ("UART2" and "UART4") are provided as an optional camera control interface. The connectors provide access to a 3.3V TTL UART which is interfaced with the Jetson on the I2C3 bus.

Pin	Description	
1	RX	
2	TX	
3	GND	

[P5A, P5B] Micro HDMI Connector Pinout

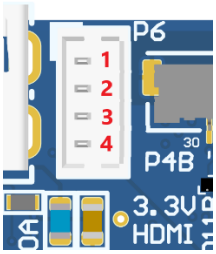
Pin	Description
1	Hot Plug Detect
2	Reserved (NC on device)
3	TMDS Data2+
4	TMDS Data2 Shield
5	TMDS Data2-
6	TMDS Data1+
7	TMDS Data1 Shield
8	TMDS Data1-
9	TMDS Data0+
10	TMDS Data0 Shield
11	TMDS Data0-
12	TMDS Clock+
13	TMDS Clock Shield
14	TMDS Clock-
15	CEC
16	DDC/CEC Ground
17	DDC Clock
18	DDC Data
19	+5V

[P4A, P4B] 30-pin KEL USL00-30L Connector Pinout

Pin	Connector Description
1	+12V
2	+12V
3	+12V
4	+12V
5	RESET# (active low)
6	VISCA TXD
7	VISCA RXD
8	NC
9	NC
10	NC
11	NC
12	NC
13	Shorted to pin 14 (for FCB-ER8530 compatibility)
14	Shorted to pin 13 (for FCB-ER8530 compatibility)
15	EXT_SYNC_LOCK (for FCB-ER8550 compatibility)
16	EXT_SYNC (for FCB-ER8550 compatibility)
17	NC
18	GND
19	TMDS Data 2 +
20	TMDS Data 2 -
21	GND
22	TMDS Data 1 +
23	TMDS Data 1 -
24	GND
25	TMDS Data 0 +
26	TMDS Data 0 -
27	GND
28	TMDS Clock +
29	TMDS Clock -
30	GND

[P6] 4-pin Camera Sync Connector Pinout

This header allows the user to connect to the EXT_SYNC and EXT_SYNC_LOCK pins of P4A and P4B.

Pin	Description	
1	EXT_SYNC	
2	EXT_SYNC_LOCK_A (CAM1)	
3	EXT_SYNC_LOCK_B (CAM3)	
4	GND	

TYPICAL INSTALLATION AND USAGE

Software setup

Prior to hardware installation, make sure you have the correct software installed on the Orin Module. Installation instructions can be found at https://connecttech.com/resource-center/kdb373/.

Devices connected through the HDMI ports (CAM2 and CAM4) require no configuration of the JCB010 – all the user needs to do is run GStreamer as described in the Camera Streaming section.

When using Sony FCB cameras via the USL00-30L connectors (CAM1 and CAM3), camera control software is written by the user for their specific application. The FCB cameras are controlled with the 3.3V CMOS VISCA protocol, which is interfaced with the Jetson through the MAX14830 (I2C to Quad UART) on the I2C3 bus (shows up as I2C-2 in Linux for Tegra).

Power to the cameras can be controlled individually:

Camera Port	Module Pin	GPIO Port (sysfs)	Default State	Active Type
CAM1	CAM0_PWDN (UART4_CTS)	PH.07	Power disabled	Active high (0 = disabled, 1 = enabled)
CAM3	CAM1_PWDN (GPIO15)	PAC.00	Power disabled	

Additionally, the camera's RESET# pin can be toggled with:

Camera Port	Module Pin	GPIO Port (sysfs)	Default State	Active Type
CAM1	CAM0_RST# (UART4_TX)	PI.00	Reset untoggled	Active low (0 = RESET, Hi-Z = enabled)
CAM3	CAM1_RST# (GPIO16)	PAC.01	Reset untoggled	

CTI BSP JetPack files can be found here:
http://www.connecttech.com/resource-center/l4t-board-support-packages/

I2C MUX Details
Manufacturer: Texas Instruments
Part Number: TCA9548A
Datasheet: https://www.ti.com/lit/gpn/tca9548a
I2C Address: 0x70

I2C to Quad UART Details
Manufacturer: Maxim/ADI
Part Number: MAX14830
Datasheet: https://www.analog.com/media/en/technical-documentation/data-sheets/max14830.pdf
I2C Addresses: 0x6C (UART0), 0x5C (UART1), 0x2C (UART2), 0x1C (UART3)

HDMI – MIPI Bridge
Manufacturer: Toshiba
Part Number: TC358840XBG
Datasheet: *Available through Toshiba NDA Only*
I2C Address: 0x0F (accessible through I2C mux)
The I2C busses used by the JCB are described below:

I2C Bus	Linux for Tegra Designation	Connected Device	Notes
I2C2	I2C-1	TCA9548A (I2C Mux)	Multiplexes the I2C connection to talk to each TC358840.
I2C3	I2C-2	MAX14830 (Quad UART)	

NOTES: channel numbering in software follows zero-based indexing (i.e. channels 0 thru 3 are used). On the physical board, channels use one-based indexing (i.e. channels are labelled 1 thru 4). For simplicity, the relationship is defined as HW_ch = SW_ch + 1.

Installation of the HDMI MIPI Vision Platform with AGX Carrier

1. Ensure all external system power supplies are off
2. Install JCB010 onto the AGX Carrier's MIPI CSI Camera Expansion Connector
3. Install 3x 8mm M2.5 screws provided with the hardware kit
4. Switch ON the Power Supply. DO NOT power up your system by plugging in live power.

Camera Installation

Ensure system is off prior to camera installation.

Camera Streaming

GStreamer is natively part of the JetPack OS. Example of a gst-launch-1.0 command:
gst-launch-1.0 v4l2src device=/dev/video0 ! videoconvert ! autovideosink

Supported Cameras

The FCB-EW9500H and FCB-ER8530 are compatible with the KEL connectors. More generally speaking, any HDMI compliant sources (up to full HD) should be compatible with this platform, however please refer to Connect Tech's Support Cameras page.

https://connecttech.com/supported-cameras/

Cables

It is recommended to use the cables provided with your camera kit to connect to the board. Note that you may need an HDMI to Micro HDMI adapter, depending on the type of cable you have. Compatible KEL micro coaxial cables have the following part numbering scheme:

USL20-30SS-xxx.x-C

For example: USL20-30SS-020.0-C is the part number for a 30 pin, 200mm cable with pin 1 to pin N wiring.

POWER

Power Consumption

Test setup:

- Forge AGX minimal setup carrier powered at +12.02V
- Up to 4 HDMI sources connected (including 2 Sony FCB cameras)
- Keyboard, mouse and display (Display Port) connected to carrier

Typical power consumption for the Sony cameras is (as specified in their datasheets):

- FCB-EW9500H: 4.6W (6.3W with motors operating)
- FCB-ER8530: 3.0W (4.0W with motors operating)

Parameter	Min	Typ.	Max	Units
All configurations				
Voltage	-	12.02	-	V
Forge (idle, no JCB connected)				
Current	0.79	0.85	0.98	A
Power	9.50	10.22	11.78	W
Forge + JCB010 (idle, no cameras/sources)				
Current	0.96	1.02	1.10	A
Power	11.54	12.26	13.22	W
1 Source Connected to Micro HDMI, Jetson Not Streaming				
Current	0.87	0.90	0.98	A
Power	10.46	10.82	11.78	W
1 Source Connected to Micro HDMI, Jetson Streaming				
Current	1.24	1.25	1.31	A
Power	14.90	15.03	15.75	W
1 Camera Connected (FCB-EW9500H), Jetson Streaming				
Current	1.49	1.53	1.59	A
Power	17.91	18.39	19.11	W
1 Camera Connected (FCB-ER8530), Jetson Streaming				
Current	1.38	1.39	1.48	A
Power	16.59	16.71	17.79	W
2 Cameras (FCB-EW9500H + FCB-ER8530), Jetson Streaming				
Current	1.76	1.82	1.88	A
Power	21.16	21.88	22.60	W
2 Cameras + 1 HDMI Source, Jetson Streaming				
Current	1.77	1.83	1.88	A
Power	21.28	22.00	22.60	W
2 Cameras + 2 HDMI Sources, Jetson Streaming				
Current	1.91	1.95	2.06	A
Power	22.96	23.44	24.76	W

NOTES:

1. Jetson power mode: MAXN
2. Minimum current is the lowest observed current draw, maximum is the peak surge current and typical is the most frequently observed current consumption.
3. These values are meant to be used as an example of what range of power consumption users may experience. Individual results will depend on many factors.

MECHANICAL DRAWINGS & MODELS