AVer AI BOX at the Edge

AVer AI Box

Designed for NVIDIA® Jetson Tegra 2™ Module

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Preface

Disclaimer

The information contained in this user manual, including but not limited to any product specification is subject to change without notice. AVer AI 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 manual.

Revision History

Revision	Date	Updates
0.1	10/07/2019	Initial release

Limited Product Warranty

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

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

The limited product 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, AVer AI reserves the right to substitute an equivalent product if available or to retract the product warranty if no replacement is available.

The above product warranty is the only warranty authorized by AVer AI. Under no circumstances will AVer AI 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（Electro-Static discharge）Warning

Electronic components and circuits are sensitive to Electrostatic Discharge (ESD). When handling any circuit board assemblies including AVer AI BOX products, it is highly recommended that ESD safety precautions can be observed. ESD safe best practices can include, but are not limited to the following ones.

1. Leave the circuit board in the antistatic package until it is ready to be installed.
2. Use a grounded wrist strap when handling the circuit board. At a minimum, you need to touch a grounded metal object to dissipate any static charge, which may be present on you.
3. Avoid handling the circuit board in the carpeted areas.
4. Handle the board by the edges and avoid the contact with the components.
5. Only handle the circuit boards in ESD safe areas, which may include ESD floor and/or table mats, wrist strap stations, and ESD safe lab coats.

1.0 Introduction

AVer AI BOX (EX713-AAE5) is a fully featured edge device developed for NVIDIA® Jetson Tegra2™ module. It is specifically designed to have four GbE Ethernet ports with PoE (PSE, Power Sourcing Equipment) support.

Operating with NVIDIA® Jetson Tegra2™ module, EX713-AAE5 can process four channels of 4kp30 video stream, which makes it the perfect choice in building the high performance AI edge computing platform for the intelligent video analytics applications.

EX713-AAE5 has the dimensions of 226mm (L) x 122mm (W) x 60mm (H), which can fit to the commercial and industrial application. And it can operate in the temperature range from 0°C to 70°C. AI Box EX713-AAE5 provides not only the access to a great list of latest interfaces on Tegra2™ module but also 1x RS-485 interface, 1x CAN BUS, 1x wiegand, 1x micro controller unit (MCU), and 1x RTC battery as the function enrichment.

AVer AI BOX (EX713-AAE5) consists of the carrier board, the fanless chassis, and NVIDIA® Jetson Tegra2™ module. EX713-AAE5 can also accommodate an optional hard disk drive (HDD).

1.1 Product Specifications

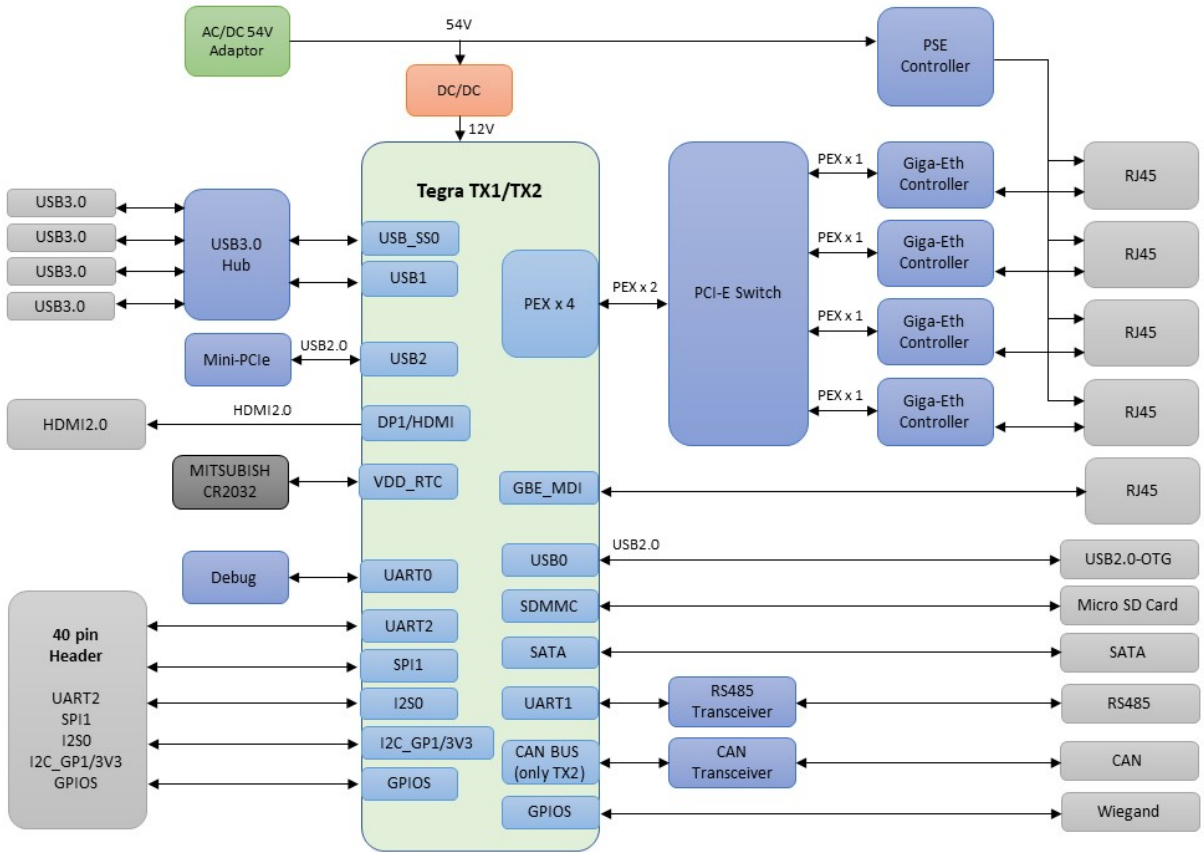
Product Name	Model Number	AVer AI BOX (EX713-AAE5)
Product Type	Fanless/Fan/Carrier Board	Fanless
Core	System on Module (SoM)	Fully support NVIDIA® Jetson Tegra2™
Front I/O	HDMI 2.0 Output	1x HDMI 2.0a/b Type-A supports maximum resolution 3840x2160 at 60Hz
	USB 2.0	1x USB 2.0 Micro-B for recovery
	USB 3.0	4x USB 3.0 Type-A
	GbE BASE-T Ethernet	1x GbE RJ-45
		4 PoE ports support (4x GbE RJ-45 PSE, Power Sourcing Equipment, IEEE 802.3 AT with power budget)
	Micro SD	1x, max 2T
	SATA Rev. 3.1	1x, need to change chassis for installing HDD
	Wiegand	1x Wiegand Euroblock (3 pins)
	CAN Bus	1x CAN Euroblock (3 pins)

	RS-485	1x RS-485 Euroblock (3 pins)
	Expansion Header	40 pins (2x 20 Header) with 1 x 3.3V UART0, 1 x SPI, 1 x I2S, 1 x I2C, 7x GPIO
	Power Button	1x with a RGB tri-color LED
	Recovery Button	1x with a RGB tri-color LED
Back I/O	Wi-Fi	IEEE 802.11a/b/g/n/ac dual-band 2x2 MIMO (Optional)
	Antenna	2x SMA female connector (Optional)
Internal PCIe Sockets	Mini-PCIe	1x Mini-PCIe (USB 2.0)
	MCU Power Function	Automatically turn on system when the power input is connected
MCU	Watch Dog	RTC battery life monitor
	Power Input	54V/2.78A for PoE (PSE, IEEE 802.3 AT with power budget)
Power	Operating Temperature	0°C ~ 70°C
Environment	Storage Temperature	-20°C ~ 85°C
	Relative Humidity	40 °C @ 95%, Non-Condensing
	Vibration during Operation	With Desk/Wall/Din Rail Mount: 3 Grms, IEC 60068-2-64, random vibration, 5 ~ 500 Hz, 1 hr/axis
	Shock During Operation	30G, IEC60068-2-27, half sine, 11m duration
	Dimension	L:226mm x W:122mm x H:60mm
Physical Characteristics	Weight	2.Kg
	Thermal Solution	Fanless
System	Operating System	Linux for Tegra (L4T) File system: Ubuntu 18.04, kernel version 4.9
	SoM Power Consumption	7.5W (Max-Q) / 15W(Max-P)
	Temperature Range	-25°C ~ 80°C
	Memory	8GB 4ch x 32-bit LPDDR4 | 1866MHz
	GPU	Pascal 256-core
	FLOPS (fp16)	1.3 TFLOPS
	CPU Complex	NVIDIA Denver 2 Dual-core CPU ARM Cortex-A57 Quad-core CPU
	Maximum Operating Frequency	1.12GHz
	Storage	32GB eMMC v5.1
	Video Encode	Maximum Throughput: 2160p60 (H.265) | 2160p60(H.264) | 2160p30 (WEBM VP9)

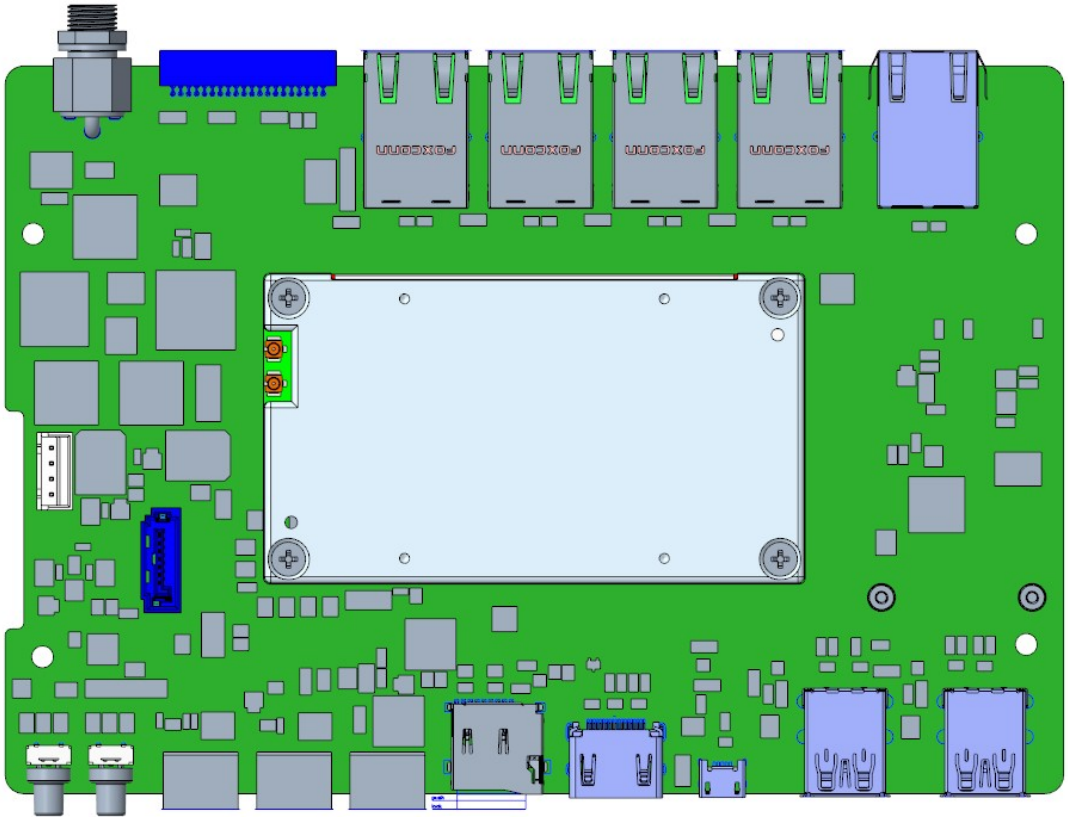
	Video Decode	Maximum Throughput: 2 x 2160p60 (H.265) | 2 x 2160p60 (H.264) | 2160p60 (WEBM VP9)
	EMC	FCC / ICES, VCCI, BSMI Class A
Regulation	Safety	UL, BSMI
	Accessory	1 x Power Adapter 54V / 2.78 A, 3 x Eurostyle Terminal Block, 1 x 40-pin I/O Adapter (1.27 mm to 2.54 mm), 1 x Quick Guide
Others		

2.0 Product Overview

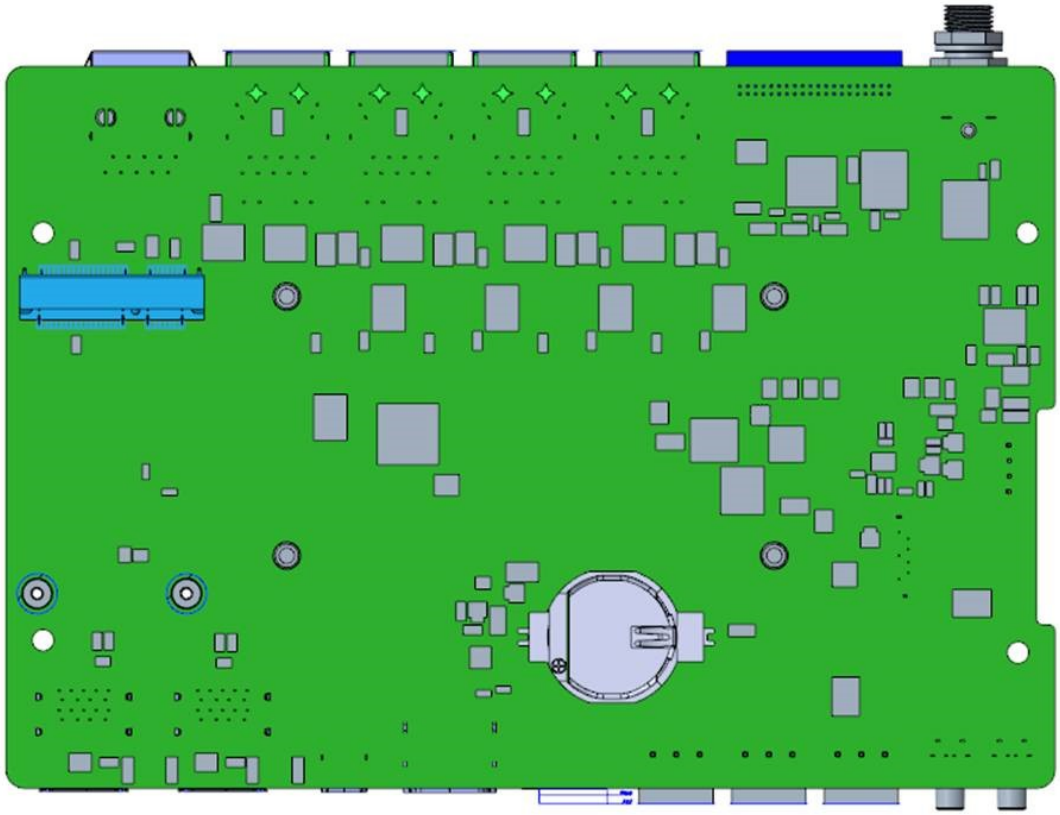
2.1 Block Diagram



2.2 Top View of Carrier Board



2.3 Bottom View of Carrier Board



2.4 Connector Summary

Designation	Description
J1	RJ45 Gb single-port Ethernet connector with POE support
J2	RJ45 Gb single-port Ethernet connector with POE support
J3	RJ45 Gb single-port Ethernet connector with POE support
J4	RJ45 Gb single-port Ethernet connector with POE support
J5	RJ45 1Gb single-port Ethernet connector
J6	NVIDIA® Jetson Tegra2™ module
J7	USB 3.1 Gen 1 2-port connector with 900mA x2
J8	USB 3.1 Gen 1 2-port connector with 900mA x2
J9	OTG/USB micro-type connector
J10	HDMI video output connector
J11	micro SD card slot
J12	Wiegand Connector
J13	CAN BUS connector
J14	RS485 connector
J15	SATA connector
J16	Mini card connector (USB 2.0)
J17	54VDC power jack
J18	40-pin header UART console for debug, I2C, GPIO
BT1	RTC battery connector

The above listed connectors are located on the carrier board, and most of them are accessible from the front panel and the rear panel of AVer AI BOX (EX713-AAE5), where the names of the associated connectors are printed.

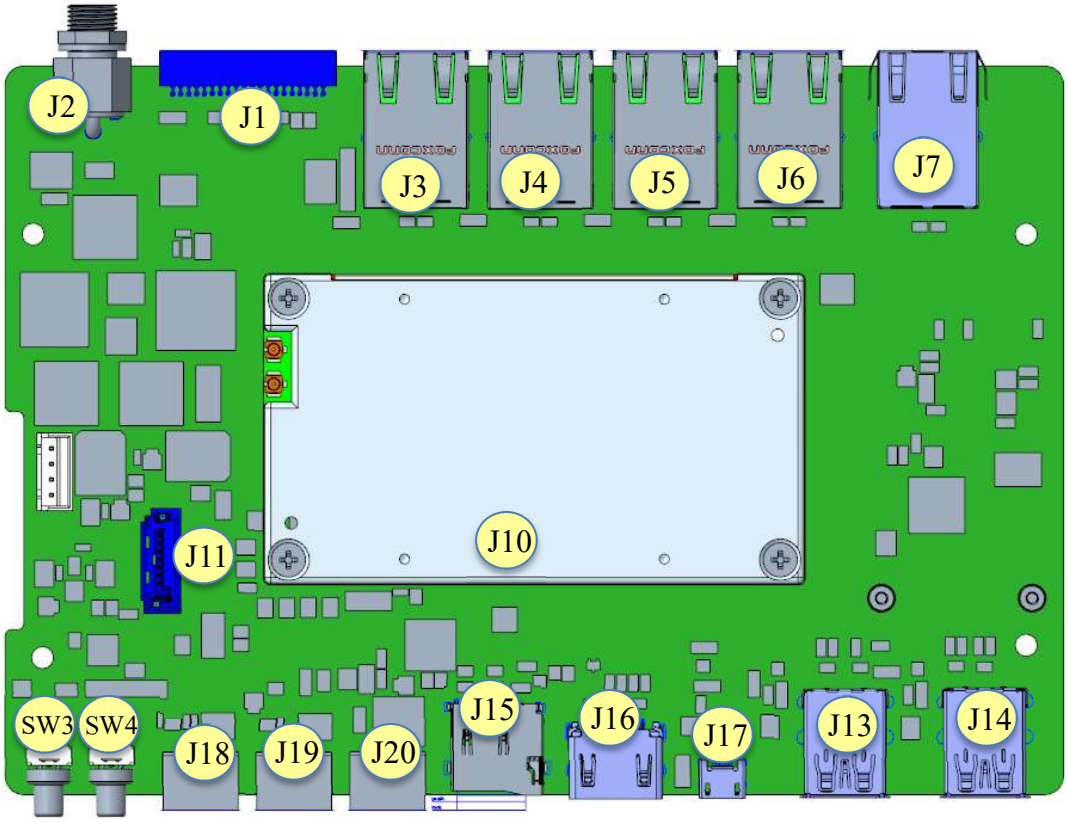
2.5 Switch Summary

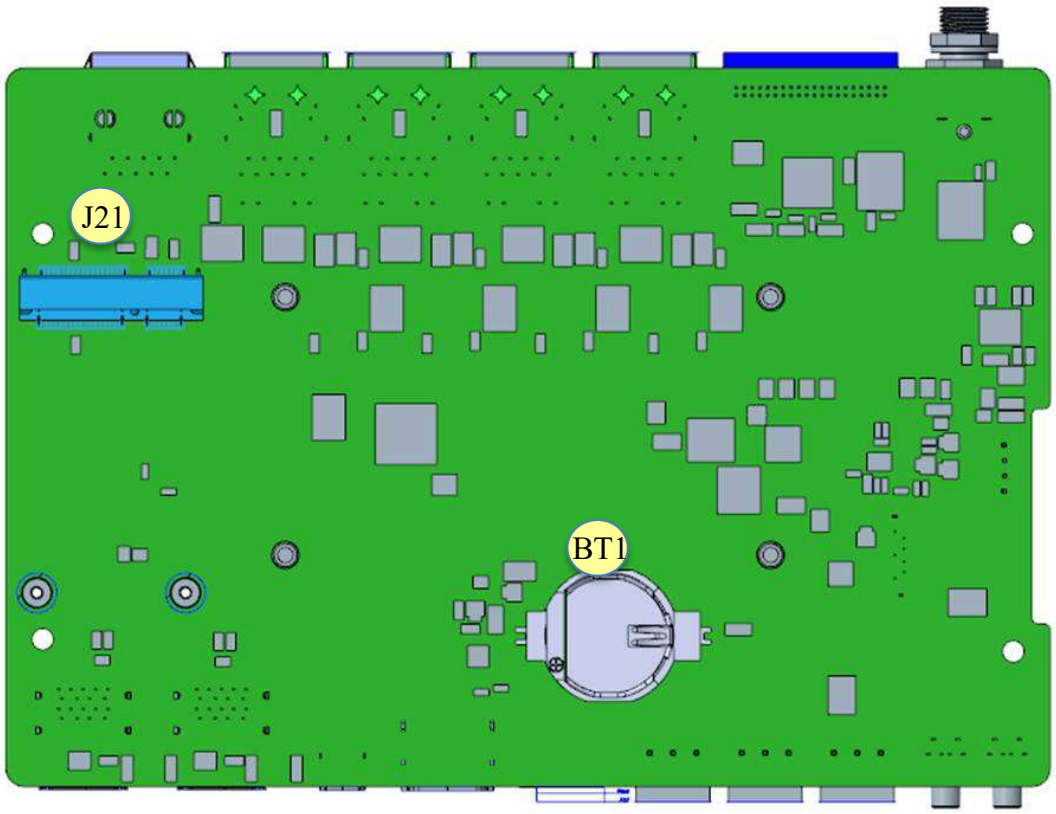
Designation	Description
SW8	Recovery button
SW9	Power on button

The above listed switches are located on the carrier board. SW8 and SW9 are accessible from the front panel and the rear panel of AVer AI BOX (EX713-AAE5), where the names of Recovery and Power are printed.

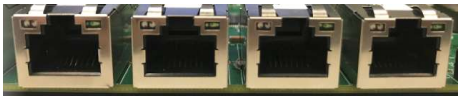
3.0 Feature Description

3.1 Connector and Switch Locations

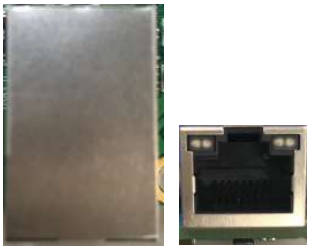




3.2 Gb single-Port Ethernet Connectors

Function	Gb single-port Ethernet connectors, used to connect IP cameras and/or the network switches.	
Location	J3, J4, J5, J6	
Type Description	4-pin (12-36) RJ45 with integrated magnetics for PoE application	
Mating Connector	Any standard Gb Ethernet mating connector can be applicable.	
Pinout	Comply with Ethernet standards.	
Remarks	POE support is enabled on J3, J4, J5, J6	

3.3 1Gb Single-Port Ethernet Connector

Function	1Gb single-port Ethernet connector, used to connect to the host system.	
Location	J7	
Type Description	8-pin RJ45 with integrated magnetics	
Mating Connector	Any standard 1Gb Ethernet mating connector can be applicable.	
Pinout	Comply with Ethernet standards.	
Remarks	None	

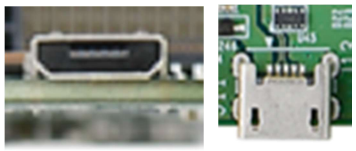
3.4 SATA Power Wafer and SATA Connector

Function	3.5mm surveillance hard drive	
Location	J11	
Type Description	SATA HDD connector	
Mating Connector	4-pin wafer and SATA 3.0 connector	
Pinout	Please refer to SATA 3.0 standard	
Remarks	None	

3.5 USB 3.1 Gen 1 2-Port Connector

Function	USB 3.1 Gen 1 device connector	
Location	J13 and J14	
Type Description	2-port USB Type-A female connector	
Mating Connector	Any USB standard Type-A interface cable or device.	
Pinout	Please refer to USB 3.1 Gen 1 standard.	
Remarks	Support 900mA x2	

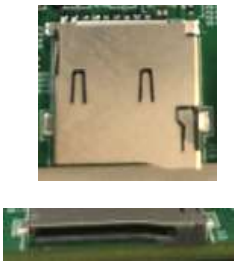
3.6 OTG/USB Micro-Type Connector

Function	OTG programming recovery	
Location	J17	
Type Description	USB Micro-type female connector	
Mating Connector	Any USB standard Micro-type interface cable or device.	
Pinout	Please refer to USB Micro-type standard.	
Remarks	None	

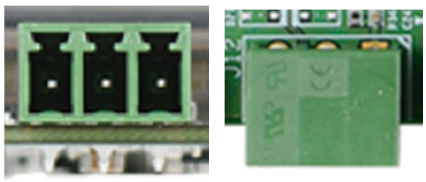
3.7 HDMI Video Output Connector

Function	HDMI Type-A TX connector	
Location	J16	
Type Description	HDMI Type-A female connector	
Mating Connector	Any HDMI standard Type-A interface cable or device.	
Pinout	Please refer to HDMI standard.	
Remarks	None	

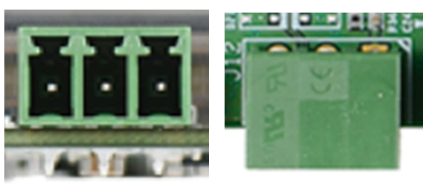
3.8 Micro SD card slot

Function	Micro SD card storage	
Location	J15	
Type Description	Micro SD card slot	
Mating Connector	Micro SD card, max to 2T	
Pinout	Please refer to micro SD card standard.	
Remarks	None	

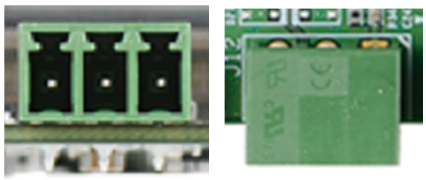
3.9 Wiegand Connector

Function	Wiegand interface	
Location	J20	
Type Description	3-pin terminal block	
Mating Connector	Combination with the plug terminal block from DECA	
Pinout	Pin Number / Description 1 / D1 (GPIO 231) 2 / D0 (GPIO 229) 3 / GND	
Remarks	With Eurostyle Terminal Block	

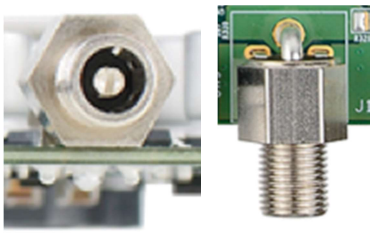
3.10 CAN BUS Connector

Function	CAN BUS interface from Jetson Tegra2 module	
Location	J19	
Type Description	3-pin terminal block	
Mating Connector	Combination with the plug terminal block from DECA	
Pinout	Pin Number / Description 1 / - 2 / GND 3 / +	
Remarks	With Eurostyle Terminal Block Default is terminal	

3.11 RS485 Connector

<table>
<tr><td>Function</td><td>RS485 interface from Jetson Tegra2 module UART control</td><td rowspan="5">  </td></tr>
<tr><td>Location</td><td>J18</td></tr>
<tr><td>Type Description</td><td>3-pin terminal block</td></tr>
<tr><td>Mating Connector</td><td>Combination with the plug terminal block from DECA</td></tr>
<tr><td>Pinout</td><td><table><tr><th>Pin Number</th><th>Description</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>B</td></tr><tr><td>3</td><td>A</td></tr></table></td></tr>
<tr><td>Remarks</td><td>With Eurostyle Terminal Block
Default is terminal</td></tr>
</table>

3.12 54VDC Power Jack

<table>
<tr><td>Function</td><td>54V DC power input</td><td rowspan="5">  </td></tr>
<tr><td>Location</td><td>J2</td></tr>
<tr><td>Type Description</td><td>2.5 mm power jack</td></tr>
<tr><td>Mating Connector</td><td>Any 2.5mm power plug cable</td></tr>
<tr><td>Pinout</td><td><table><tr><th>Pin Number</th><th>Description</th></tr><tr><td>3</td><td>GND</td></tr><tr><td>1</td><td>54V Power</td></tr><tr><td>2</td><td>GND</td></tr></table></td></tr>
<tr><td>Remarks</td><td>None</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

3.13 40-Pin Header

<table>
<tr><td>Function</td><td>UART console for debug, SPI, I2C, I2S, GPIO</td><td rowspan="5">
 </td></tr>
<tr><td>Location</td><td>J1</td></tr>
<tr><td>Type Description</td><td>1.27 mm pitch 2*20 header</td></tr>
<tr><td>Mating Connector</td><td>Any 1.27mm pitch DuPont wire</td></tr>
<tr><td>Pinout</td><td>Extension Header Layout
Extension Header Table</td></tr>
<tr><td>Remarks</td><td>With 40 pin convertor (1.27mm to 2.54mm)</td></tr>
</table>

Extension Header Layout																			
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39

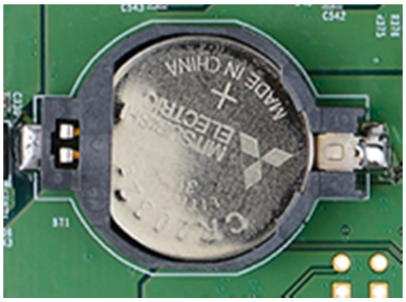
Extension Header Table					
Pin	**Connector Label**	**GPIO Export ID**	**Pin**	**Connector Label**	**GPIO Export ID**
1	5.0 VDC Power		2	3.3 VDC Power	
3	5.0 VDC Power		4	SDA1 General I2C Data 3.3.V, I2C Bus 1	
5	GND		6	SCL1 General I2C Clock 3.3.V, I2C Bus 1	
7	TXD0 UART #0 Transmit		8	GPIO_GCLK Audio Master Clock (1.8/3.3.V)	396
9	RXDO UART #0 Receive		10	GND	
11	GPIO_GEN1 Audio I2S #0 Clock	392	12	GPIO_GEN0 UART #0 Request to Send	466
13	GND		14	GPIO_GEN2 Audio Code Interrupt	397
15	GPIO_GEN4 Unused		16	GPIO_GEN3 From GPIO Expander (P17)	255
17	GPIO_GEN5 Modem Wake AP GPIO	481	18	3.3 VDC Power	
19	GND		20	SPI_MOSI SPI #1 Master Out/Slave In	429

21	GPIO_GEN6 From GPIO Epander (P16)	254	22	SPI1_MISO SPI #1 Master In/Slave Out	428
23	SPI_CE0_N SPI Chip Select #0	430	24	SPI_SCLK SPI #1 Shift Clock	427
25	SPI_CE1_N SPI #1 Chip Select #1		26	GND	
27	ID_SC General I2C #1 Clock (3.3V), I2C Bus 0		28	ID_SD General I2C #1 Data (3.3V), I2C Bus 0	
29	GND		30	GPIO5 Audio Reset (1.8/3.3V)	398
31	GPIO12 Unused		32	GPIO6 Motion Interrupt (3.3V)	298
33	GND		34	GPIO13 AP Wake Bt GPIO	389
35	GPIO16 UART #0 Clear to Send	467	36	GPIO19 AUDIO I2S #0 Left/Right Clock	395
37	GPIO20 Audio I2S #0 Data in	394	38	GPIO26 (3.3V)	388
39	GPIO21 Audio I2S #0 Data in	393	40	GND	

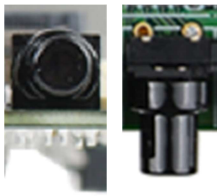
3.14 Mini Card Connector

Function	LTE
Location	J21
Type Description	Mini-Card (USB 2.0)
Mating Connector	Any Mini-Card standard interface device.
Pinout	Please refer to Mini-Card standard for the pinout details.
Remarks	Support USB 2.0 only, not PCIe

3.15 RTC Battery Connector

<table>
<tr><td>Function</td><td>RTC battery for module</td><td rowspan="5">  </td></tr>
<tr><td>Location</td><td>BT1</td></tr>
<tr><td>Type Description</td><td>RTC holder and RTC battery</td></tr>
<tr><td>Mating Connector</td><td>Any CR2032 3V battery</td></tr>
<tr><td>Pinout</td><td><table><tr><td>Pin Number</td><td>Description</td></tr><tr><td>1</td><td>3V Power</td></tr><tr><td>2</td><td>GND</td></tr></table></td></tr>
<tr><td>Remarks</td><td>Please be reminded to pay the proper attention on the polarity of this 3V battery, when it is being replaced. The correct placement is to keep the “+” mark on the battery outward, as shown in the above photo.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

3.16 Recovery Button

<table>
<tr><td>Function</td><td>Force recovery</td><td rowspan="5">  </td></tr>
<tr><td>Location</td><td>SW4</td></tr>
<tr><td>Type Description</td><td>Button with R, G, B LED</td></tr>
<tr><td>Mating Connector</td><td>N/A</td></tr>
<tr><td>Pinout</td><td>N/A</td></tr>
<tr><td>Remarks</td><td>None</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

3.17 Power on Button

<table>
<tr><td>Function</td><td>Power control button</td><td rowspan="5"> </td></tr>
<tr><td>Location</td><td>SW3</td></tr>
<tr><td>Type Description</td><td>Button with R, G, B LED</td></tr>
<tr><td>Mating Connector</td><td>N/A</td></tr>
<tr><td>Pinout</td><td>N/A</td></tr>
<tr><td>Remarks</td><td>The green light on LED is activated when the board is powered on.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

4.0 Installation

1. Check and ensure all the external system power supplies are turned off.
2. Install the necessary cables for the application. The cables can include the following ones. For the additional information of these mentioned cables, please refer to 8.0 Accessory Drawings in this manual.
   - Power cable to the input power connector (J17), DC 54V IN.
   - HDMI video display cable to HDMI video output connector (J10), HDMI OUT.
   - Mouse and keyboard cables to USB connectors (J7 and J8), USB 3.0.
3. Connect the power cable to the power adapter.
4. Turn on the power adapter. (Please be reminded NOT to power on the system by plugging in the live power.)

5.0 Software

For L4T (Linux for Tegra) BSP support and the other software support associated with NVIDIA® Jetson Tegra2™ module, BSP setup as below

AVer AI BOX (EX713-AAE5) BSP Setup Instructions

We will put BSP on google drive (need to update)

Install steps for L4T:

First, please download the BSP file :
After you download the BSP file and put the file in a Linux PC, please refer to the steps below to re-flash BSP.

1. Let the Tegra board to initiate recovery mode.

You have to keep pressing "Recovery" button and then power on the Tegra board to initiate recovery mode.

When you connect the Tegra board to a Linux PC via a MicroUSB to USB cable, you can check kernel messages with `dmesg` command in the Linux PC.

Once you see these messages in kernel messages, this means that the Tegra board is in the recovery mode.
[24685.080193] usb 1-7: new high-speed USB device number 25 using xhci_hcd [24685.229120] usb 1-7: New USB device found, idVendor=0955, idProduct=7c18 [24685.229125] usb 1-7: New USB device strings: Mfr=1, Product=2, SerialNumber=0 [24685.229129] usb 1-7: Product: APX [24685.229132] usb 1-7: Manufacturer: NVIDIA Corp

2. Follow the commands below in the Linux PC to start re-flashing BSP. TX2:

```
$ sudo tar zxvf EX713-AAE5.tgz (Need to update)
$ cd Linux_for_Tegra
$ sudo apt-get install python
$ sudo ./flash.sh jetson-tx2 mmcblk0p1
```

Note: sudo is necessary to re-flash the BSP.

For CUDA: $nvcc -V

For L4T: $ cat /etc/nv_tegra_releas

For cuDNN: $ dpkg -l | grep cudnn

6.0 Force Recovery Mode

OTG/USB 3.1 port (J11) of EX713-AAE5 can be used to re-program NVIDIA® Jetson Tegra2™ module by using the other host system running NVIDIA Jetpack™, as the procedure described below.

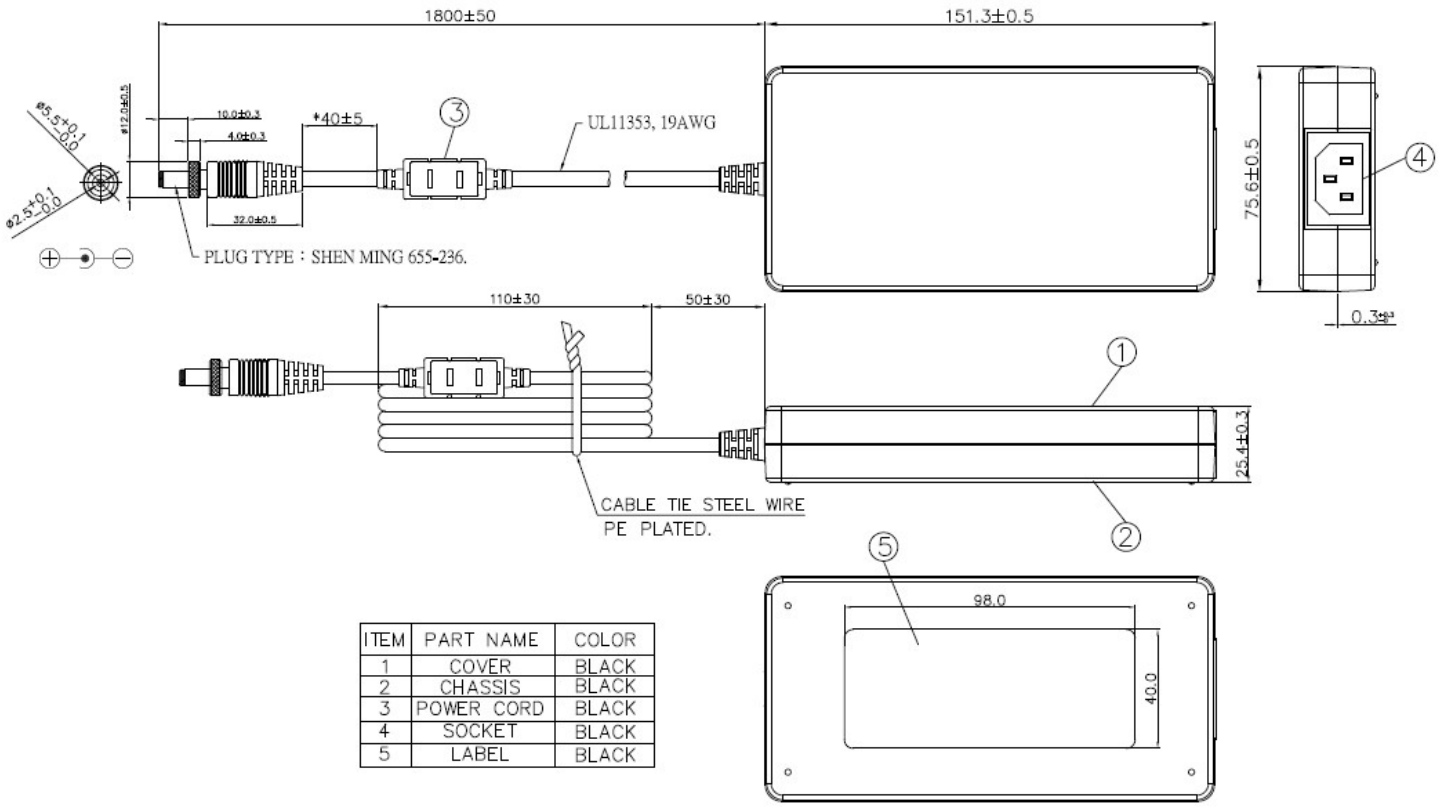
1. Power off the system. Ensure the system power must be completely OFF, instead of staying in the suspend mode or the sleep mode.
2. Connect a USB cable from OTG USB port to the other host system which will be used to re-program the new system file into NVIDIA® Jetson Tegra2™ module.
3. Press and hold down Recovery button (SW8) and then power on AVer AI BOX.
4. After three seconds, release Recovery button.
5. NVIDIA® Jetson Tegra2™ module will show up on the USB list of the host system as a new NVIDIA target device.
6. After the system software is updated successfully, please ensure to power off the system. A clean power-on will then revert □OTG port back to the host mode.

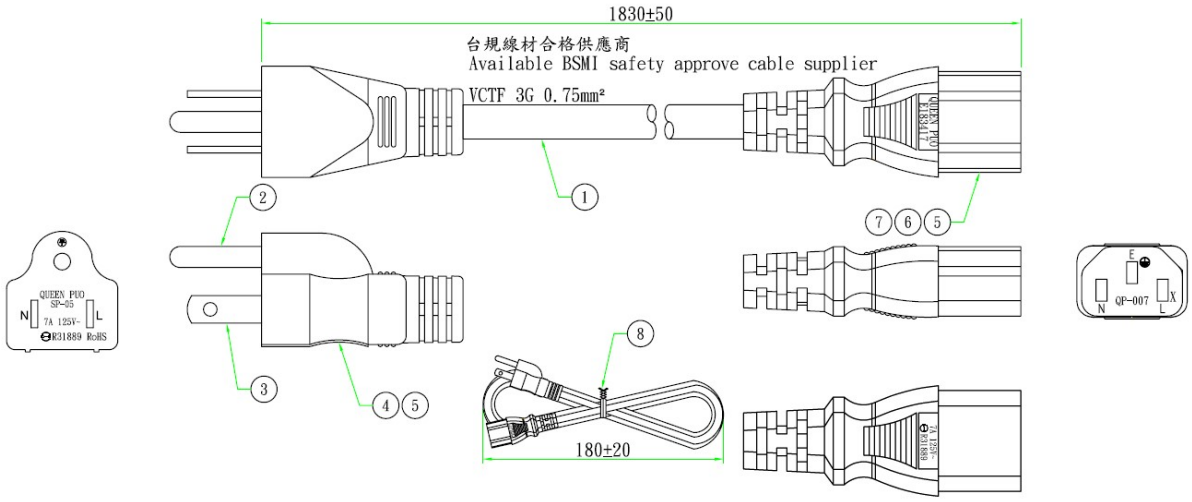
7.0 Power Consumption

Item Description		Power Consumption
Theoretical Maximum System Power Consumption		54V, 150.0W
Typical System Power Consumption	Idle mode: Tegra2 module ON. HDMI display, USB keyboard, and USB mouse are activated.	54V, 15.0W
	Suspend mode: Tegra2 module is in the suspend mode.	54V, 8.0W
	Normal operating mode:	The power consumption under normal operating mode depends on the application software running with NVIDIA® Jetson Tegra2™ module on AVer AI BOX.

8.0 Accessory Drawings

Power Adapter (54V, 2.78A)



ITEM	PART NAME	COLOR
1	COVER	BLACK
2	CHASSIS	BLACK
3	POWER CORD	BLACK
4	SOCKET	BLACK
5	LABEL	BLACK

Power Cord (TW version)