

EX713AA Product Guide

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1. Scope & Product Outline

This document describes the detailed specifications and design parameters of Tegra TX1/TX2 Carrier Board with Multiple Video Sources Support. AVerMedia internal product model name is EX713AA and current PCB revision is A. It can operate with NVIDIA Tegra TX1/TX2 module to build up a high performance embedded system. EX713AA is fully compliance with RoHS. All components and all production procedures have already followed current RoHS rule to produce.

2. Features

Jetson Module Feature List

Applications Processor

- Tegra X1 or Tegra X2

Memory

- LPDDR4 DRAM & eMMC 5.1
- Memory sizes for DDR & eMMC vary depending on module – Check relevant Data Sheet

Network

- 10/100/1000 BASE-T Ethernet

Connectivity

- Jetson TX1/TX2 only: Dual U.FL RF connectors: Connects to 802.11a/b/g/n/ac WLAN/Bluetooth enabled devices.

Advanced power management

- Dynamic voltage and frequency scaling
- Multiple clock and power domains
- Thermal Transfer Plate & optional Fan/Heatsink

Carrier Board Feature List

Connection to Jetson Module

- 400-pin (8x50) Board-Board Connector

Storage

- Full Size SD Card Slot
- SATA Connector (Power & TX/RX)

USB

- USB 2.0 Micro B (Host & Device)
- USB 3.1 Gen1 Type A (Host only)

Wired Network

- Gigabit Ethernet (RJ45 Connector w/LEDs)

PCIe

- 2 x full-height miniPCIe expandability of connecting AVerMedia frame grabbers

HDMI Type A

- 2 x HDMI 2.0 output each up to 4096 x 2160 p60

Expansion Header

- 40-pin (2x20) header

- I2C, SPI, UART, I2S, Audio Clock/Control

UI & Indicators

- Power, Reset & Force Recovery Buttons
- LEDs: Main DC input, Main 3.3V (Power)/SOC

Debug/Serial

- JTAG Connector (Standard 20-pin header)
- Serial Port Signals (1x6 header)

Miscellaneous

- Fan Connector: 5V, PWM & Tach
- Mini-51 MCU for power on control

Power

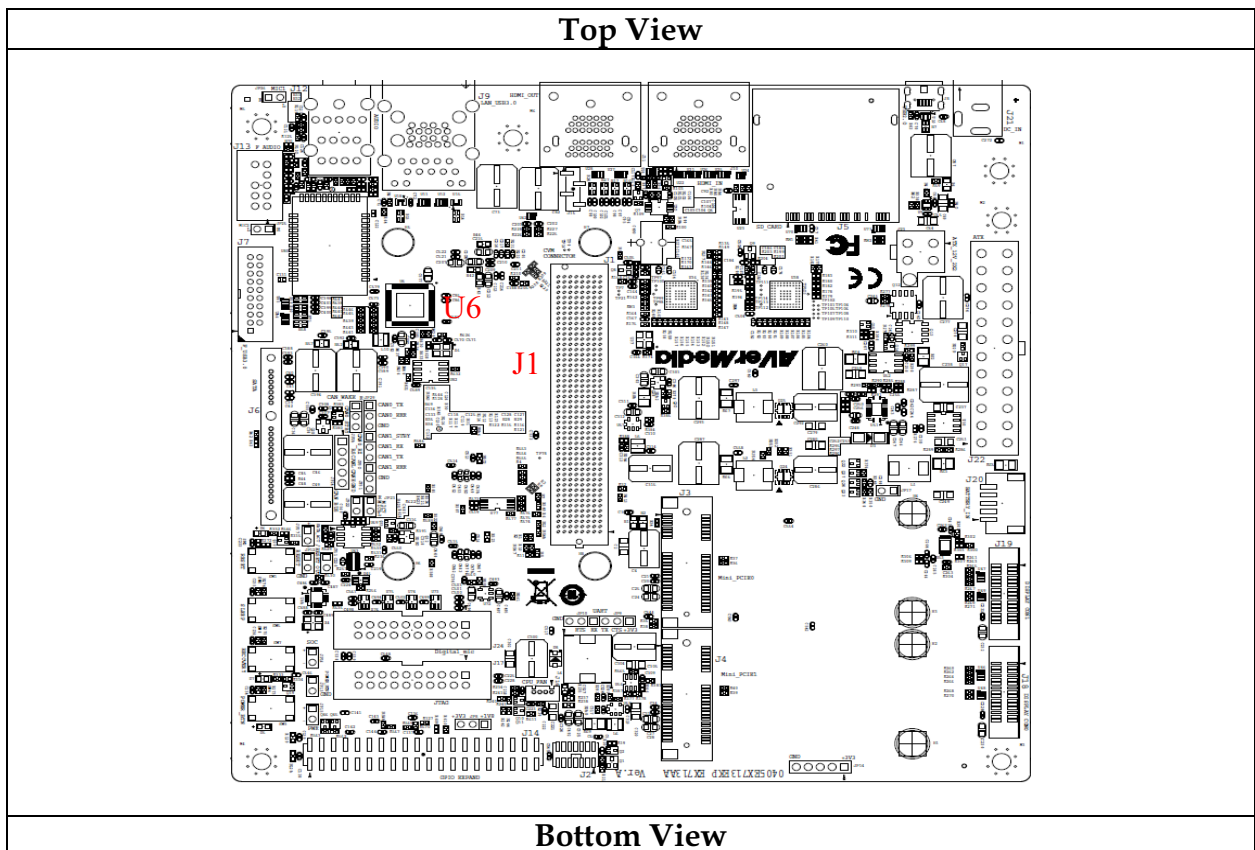
- DC Jack: 6V-14.9V
- ATX power 24 + 4 Pin

**Compliance with Mini-ITX dimension
ROHS Compliant**

3. Hardware

3.1 Key Component List

Table 1:



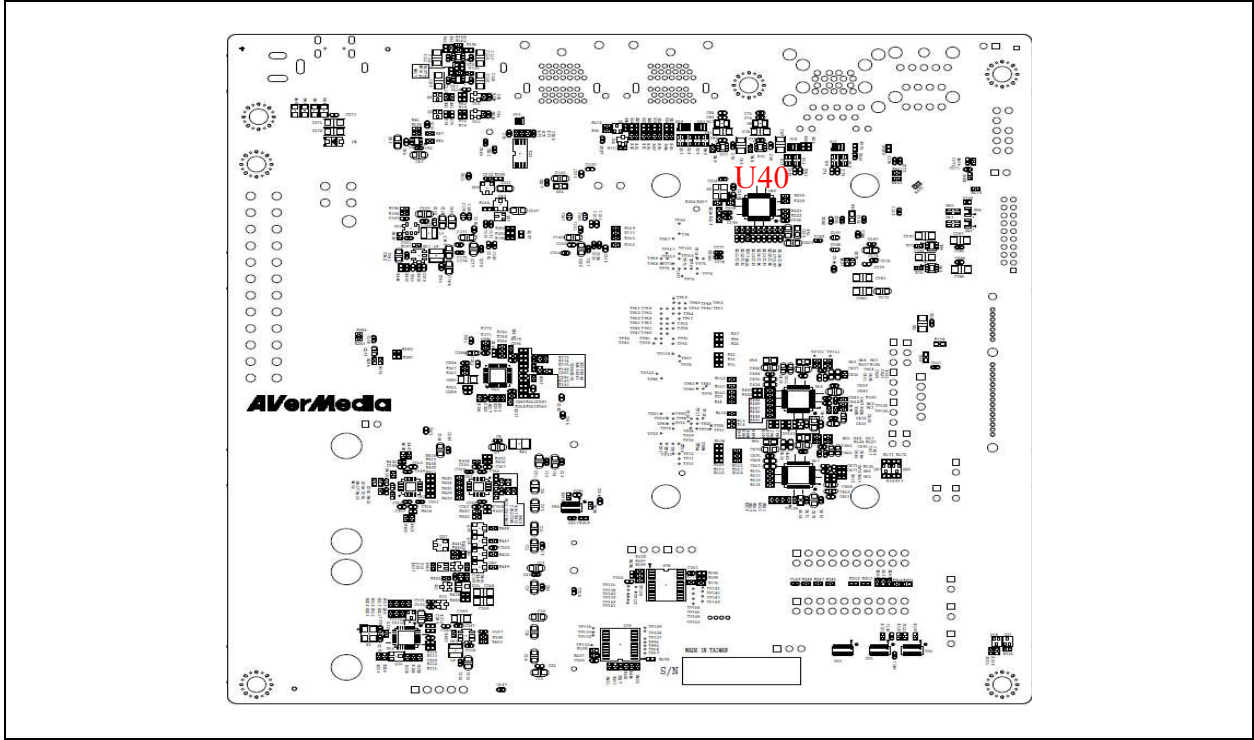


Table 2:

Locations	Descriptions of Components
J1	SOCKET_OPEN PIN FIELD_400PIN_180° for NVIDIA Jetson TX1/TX2 System-on-Module
U6	USB 3.1 Gen 1 Hub Controller
U40	DP to HDMI Protocol Converter

3.2 Block Diagram

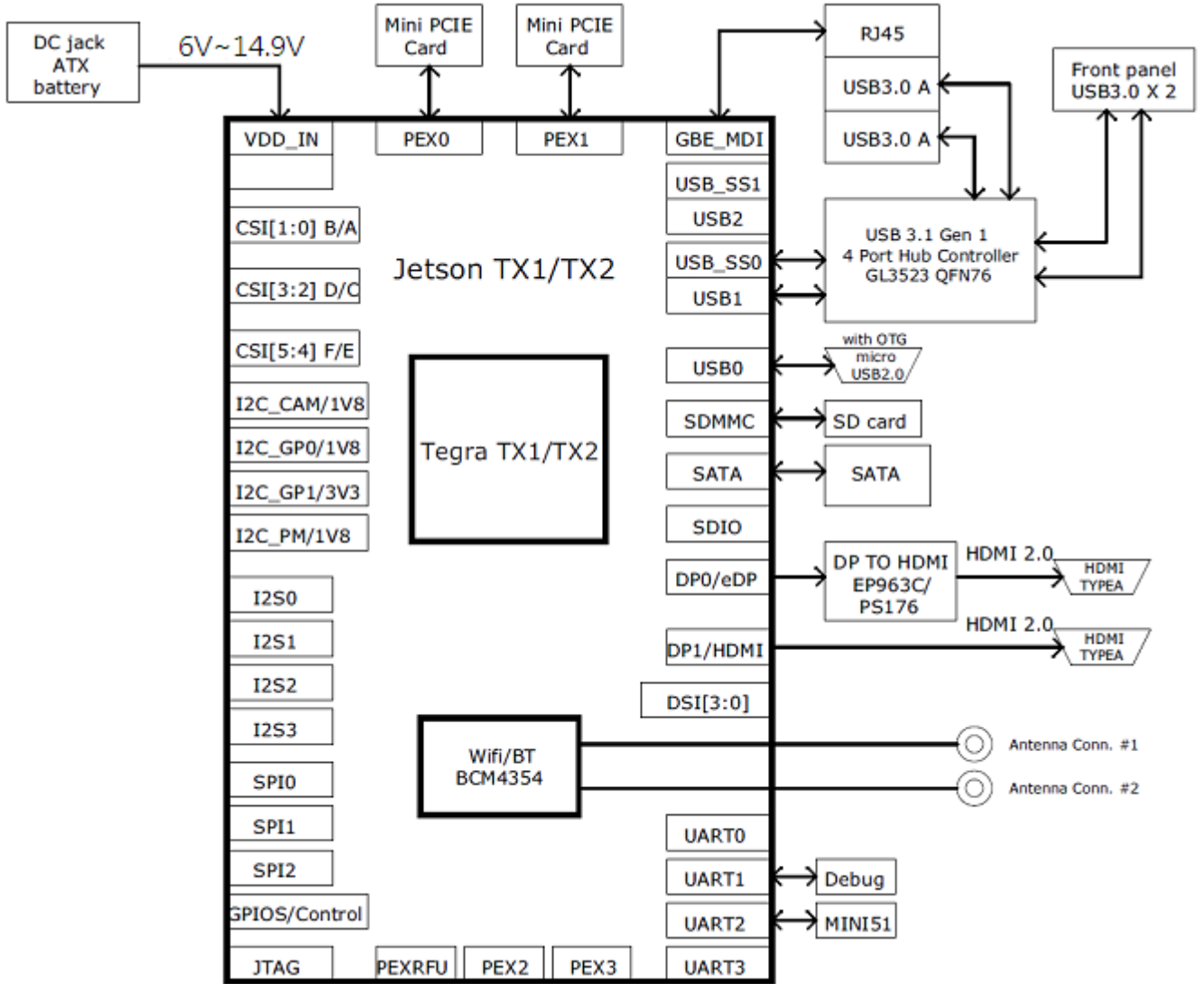


Figure1. Block Diagram.

3.3 Board Dimensions

Table 3:

Form Factor	Mini-ITX
PCB Size	170 mm x 170mm
Thickness	1.6 mm

3.4 I/O Connector

Table 4: (Please refer to mechanical drawing for more detail)

I/O Connector	External	J21	DC jack (OD 5.5/2.5) x1
		J8	USB OTG x1 (USB 2.0 Micro B)
		J5	SD card slot x1
		J11-1(top)	HDMI 2.0 Output (Type A) from TX1/TX2
		J11-2(down)	HDMI 2.0 Output (Type A) from DP to HDMI(PS176 chip)
		J9-1(top)	Gigabit Ethernet X1 (RJ45)
		J9-2, J9-3	USB3.1 Gen1 type A x2 from USB 3.1 Gen 1 Hub Controller
	Internal	J22	ATX 24Pin (ATX Power input)
		J23	ATX 4Pin (ATX Power Input)
		J3	MiniPCIe0 Gen2.0 (TX1 Default Config 1; TX2 Default Config 2)
		J4	MiniPCIe1 Gen2.0 (TX1 Default Config 1 ; TX2 Not support)
		J7	USB 3.1 Gen1 X2 through 20pin (2.0mm pitch 2x10) USB 3.1 Gen1 Front Panel ; from USB 3.1 Gen 1 Hub Controller
		J13	Audio front Panel
		J6	SATA 2.0 with power 7+15P male
		J14	GPIO Expand 40pin (2x20 2.54mm pitch Pin header)
		JP8	GPIO Level shift voltage selection (Must be use Jumper select 1.8V or 3.3V)
		J16	FAN 1*4pin 1.25mm pitch wafer (Joint Tech_A1250WV-04PNLNT1N00B)
		J20	Battery 1*5pin 2mm pitch wafer (Option) (Aquatech 2016WRS-05-LPSNHF)

Fan connector (J16) Pin Descriptions

Wafer type : Joint Tech_A1250WV-04PNLNT1N00B			
Pin#	Signal Name	Usage/Description	Type/Dir Default
1	GND	Ground	Ground
2	VCC	5V Power Supply	Power
3	FAN_TACH	Fan Tachometer signal	Input
4	FAN_PWM	Fan Pulse Width Modulation signal	Output

Battery 1*5 pin 2mm Pitch Wafer

Wafer Type : Aquatech 2016WRS-05-LPSNHF ; Housing: JST PHR 5P			
Pin#	Signal Name	Usage/Description	Type/Dir Default
1	VDD_BAT	Battery + ,Support 2 Series Cells Li-ion/Li-Polymer Battery, Max Charge Current 4A	Power
2	VDD_BAT		Power
3	TS	Connect to Battery Thermistor (10K NTC resistor)	Input
4	BAT_GND	Ground	Ground
5	BAT_GND		Ground

GPIO Expand (J14) Pin Descriptions

Wafer type : PINREX Tech_212-92-20GBEL

Pin	Signal Name	Device Directly Connected to Signal	Associated Jetson Module Pin Name	Usage/Description	Type/Direction	GPIO Max Drive or Power Pin Current Capability	Notes
1	+3V3_SYSTEM	TPS51220 3.3V Supply	-	Main 3.3V Supply	Power	1A	1
2	+5V_SYSTEM	TPS51220 5V Supply	-	Main 5.0V Supply	Power	1A	1
3	I2C_GP0_DATA_3V3	2SK3019	I2C_GP0_DATA	General I2C #0 Data (3.3V)	Bidir/OD	3.3mA	2
4	+5V_SYSTEM	TPS51220 5V Supply	-	Main 5.0V Supply	Power	1A	1
5	I2C_GP0_CLK_3V3	2SK3019	I2C_GP0_CLK	General I2C #0 Clock (3.3V)	Bidir/OD	3.3mA	2
6	GND	-	-	Ground	Ground	-	
7	I2S_3V3_MCK	TXB0108	AUDIO_MCLK	Audio Master Clock (1.8/3.3V)	Bidir	20uA	3
8	UART0_TX_3V3	TXB0108	UART0_TX	UART #0 Transmit	Output	20uA	3
9	GND	-	-	Ground	Ground	-	
10	UART0_RX_3V3	TXB0108	UART0_RX	UART #0 Receive	Input	20uA	
11	UART0_RTS_3V3	TXB0108	UART0_RTS#	UART #0 Request to Send	Output	20uA	3
12	I2S0_3V3_BCLK	TXB0108	I2S0_SCLK	Audio I2S #0 Clock	Bidir	20uA	3
13	AUDIO_CODEC_3V3_IRQ	TXB0108	GPIO_PE6	Audio Codec Interrupt	Bidir	20uA	3
14	GND	-	-	Ground	Ground	-	
15	GPIO_EXP_P17_3V3	PCA9539A	-	From GPIO Expander (P17)	Bidir	-10mA Hi / 25mA Lo	5
16	AO_DMIC_IN_3V3_DAT	TXB0108	AO_DMIC_IN_DAT	Digital Mic Input	Input	20uA	8
17	+3V3_SYSTEM	TPS51220 3.3V Supply	-	Main 3.3V Supply	Power	1A	1
18	MDM_WAKE_3V3_AP	TXB0108	GPIO16_MDM_WAKE_AP	Modem Wake AP GPIO	Input	20uA	3,8
19	SPI1_3V3_MOSI	TXB0108	SPI1_MOSI	SPI #1 Master Out/Slave In (1.8/3.3V)	Bidir	20uA	3
20	GND	-	-	Ground	Ground	-	
21	SPI1_3V3_MISO	TXB0108	SPI1_MISO	SPI #1 Master In/Slave Out (1.8/3.3V)	Bidir	20uA	3
22	GPIO_EXP_P16_3V3	PCA9539A	-	From GPIO Expander (P16)	Bidir	-10mA Hi / 25mA Lo	5
23	SPI1_3V3_CLK	TXB0108	SPI1_CLK	SPI #1 Shift Clock (1.8/3.3V)	Bidir	20uA	3
24	SPI1_3V3_CS0	TXB0108	SPI1_CS0#	SPI #1 Chip Select #0 (1.8/3.3V)	Bidir	20uA	3
25	GND	-	-	Ground	Ground	-	
26	SPI1_3V3_CS1	TXB0108	SPI1_CS1#	SPI #1 Chip Select #1 (1.8/3.3V)	Bidir	20uA	3
27	I2C_GP1_DATA_3V3M	Tegra	I2C_GP1_DAT	General I2C #1 Data (3.3V)	Bidir/OD		6
28	I2C_GP1_CLK_3V3M	Tegra	I2C_GP1_CLK	General I2C #1 Clock (3.3V)	Bidir/OD		6
29	AUDIO_CODEC_3V3_RST	TXB0108	GPIO19_AUD_RST	Audio Reset (1.8/3.3V)	Output	20uA	3,8
30	GND	-	-	Ground	Ground	-	
31	MOTION_3V3_INT	TXB0108	GPIO9_MOTION_INT	Motion Interrupt (3.3V)	Input/OD	20uA	3
32	AO_DMIC_IN_3V3_CLK	TXB0108	AO_DMIC_IN_CLK	Digital Mic Clock	Output	20uA	3,8
33	AP_WAKE_3V3_BT	TXB0108	GPIO11_AP_WAKE_BT	AP Wake Bt GPIO	Bidir	20uA	3,8
34	GND	-	-	Ground	Ground	-	
35	I2S0_3V3_LRCK	TXB0108	I2S0_LRCLK	AUDIO I2S #0 Left/Right Clock	Bidir	20uA	3
36	UART0_CTS_3V3	TXB0108	UART0_CTS#	UART #0 Clear to Send (3.3V)	Output/OD	20uA	3
37	ALS_PROX_3V3_INT	TXB0108	GPIO8_ALS_PROX_INT		Input	20uA	
38	I2S0_3V3_DIN	TXB0108	I2S0_SDIN	Audio I2S #0 Data in	Input	20uA	3,8
39	GND	-	-	Ground	Ground	-	
40	I2S0_3V3_DOUT	TXB0108	I2S0_SDOUT	Audio I2S #0 Data Out	Output	20uA	3,8

Legend	Ground	Power	Not available on Jetson TX1	Not available on Jetson TX2	Reserved	Unassigned on carrier board
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Notes:

1. This is current capability per power pin.
2. These pins are connected to Tegra signals through either an I2C or FET level shifter.
3. Due to the design of these level translators, the output drivers are very weak so they can be overdriven by another connected device output for bidirectional support.
4. The buffer is powered at 3.3V on the Expansion Header side. (Not use)
5. These signals come from the GPIO expanders.
6. These pins are directly connected to Tegra. The max drive that meets full Data Sheet VOL/VOH is 1mA. 2mA drive is supported at restricted VOL/VOH levels. See the associated OEM Product Design Guide Pads section for details.
7. In the Type/Dir column, Output is to Expansion Module. Input is from Expansion Module. Bidir is for Bidirectional signals.
8. The direction indicated matches that indicated in the reference design schematics. These signals can be bidirectional.

3.5 Component Characteristics

3.5.1 DP to HDMI Protocol Converter (**Parade PS176**)

- Compliant with HDMI 2.0 specification with data rate up to 6Gbps.
- supports HDCP 1.4 and HDCP 2.2 repeater for downstream sink with an embedded key
- Integrated an on-chip microcontroller for system configuration purposes.
- Supports multiple color formats:
 - - DP: RGB 6/8/10/12-bit per component (bpc) and YCbCr4:4:4, YCbCr4:2:2 bpc 8/10/12 bpc
 - - HDMI: RGB 8/10/12 bpc; YCbCr4:4:4, YCbCr4:2:2 and YCbCr4:2:0 8/10/12 bpc
- Supports up to 8-channel LPCM, compressed audio (AC-3, DTS) and HBR audio formats
- Supports up to 192kHz audio frame rate and up to 24-bit audio sample size

DISPLAY RESOLUTIONS FOR TMDS OUTPUT

Following tables provide the popular video modes that PS176 may support. PS176 will also support other video modes as long as they are within available DisplayPort™ bandwidth, TMDS clock frequency range of 25MHz to 340MHz (HDMI Specification 1.4b) and TMDS character rate (1/4 of TMDS clock frequency) range of 85MHz to 150MHz (HDMI Specification 2.0).

Table 1. Video clock table for monitors

Resolution	Refresh Rate	Horizontal Frequency	Pixel Frequency	Standard Type	Original Document	Date
640 x 350	85 Hz	37.9 kHz	31.500 MHz	VESA Standard	VDMTPROP	3/1/96
640 x 400	85 Hz	37.9 kHz	31.500 MHz	VESA Standard	VDMTPROP	3/1/96
720 x 400	85 Hz	37.9 kHz	35.500 MHz	VESA Standard	VDMTPROP	3/1/96
640 x 480	60 Hz	31.5 kHz	25.175 MHz	Industry Standard	n/a	n/a
	72 Hz	37.9 kHz	31.500 MHz	VESA Standard	VS901101	12/2/92
	75 Hz	37.5 kHz	31.500 MHz	VESA Standard	VDMT75HZ	10/4/93
	85 Hz	43.3 kHz	36.000 MHz	VESA Standard	VDMTPROP	3/1/96
800 x 600	56 Hz	35.1 kHz	36.000 MHz	VESA Guidelines	VG900601	8/6/90
	60 Hz	37.9 kHz	40.000 MHz	VESA Guidelines	VG900602	8/6/90
	72 Hz	48.1 kHz	50.000 MHz	VESA Standard	VS900603A	8/6/90
	75 Hz	46.9 kHz	49.500 MHz	VESA Standard	VDMT75HZ	10/4/93
	85 Hz	53.7 kHz	56.250 MHz	VESA Standard	VDMTPROP	3/1/96

848 x 480	60 Hz	31.0 kHz	33.750 MHz	VESA Standard	AddDMT	3/4/03
1024 x 768	43 Hz Interlaced	35.5 kHz	44.900 MHz	Industry Standard	n/a	n/a
	60 Hz	48.4 kHz	65.000 MHz	VESA Guidelines	VG901101A	9/10/91
	70 Hz	56.5 kHz	75.000 MHz	VESA Standard	VS910801-2	8/9/91
	75 Hz	60.0 kHz	78.750 MHz	VESA Standard	VDMT75HZ	10/4/93
	85 Hz	68.7 kHz	94.500 MHz	VESA Standard	VDMTPROP	3/1/96
1152 x 864	75 Hz	67.5 kHz	108.000 MHz	VESA Standard	VDMTPROP	3/1/96
1280 x 768	60 Hz	47.4 kHz	68.250 MHz	CVT Red. Blanking	AddDMT	3/4/03
	60 Hz	47.8 kHz	79.500 MHz	CVT	AddDMT	3/4/03
	75 Hz	60.3 kHz	102.250 MHz	CVT	AddDMT	3/4/03
	85 Hz	68.6 kHz	117.500 MHz	CVT	AddDMT	3/4/03
1280 x 960	60 Hz	60.0 kHz	108.000 MHz	VESA Standard	VDMTPROP	3/1/96
	85 Hz	85.9 kHz	148.500 MHz	VESA Standard	VDMTPROP	3/1/96
1280 x 1024	60 Hz	64.0 kHz	108.000 MHz	VESA Standard	VDMTREV	12/18/96
	75 Hz	80.0 kHz	135.000 MHz	VESA Standard	VDMT75HZ	10/4/93
	85 Hz	91.1 kHz	157.500 MHz	VESA Standard	VDMTPROP	3/1/96
1360 x 768	60 Hz	47.7 kHz	85.500 MHz	VESA Standard	AddDMT	3/4/03
1400 x 1050	60 Hz	64.7 kHz	101.000 MHz	CVT Red. Blanking	AddDMT	5/13/03
	60 Hz	65.3 kHz	121.750 MHz	CVT	AddDMT	3/4/03
	75 Hz	82.3 kHz	156.000 MHz	CVT	AddDMT	3/4/03
	85 Hz	85.0 kHz	179.500 MHz	CVT	AddDMT	3/4/03
1440 x 900	60 Hz	55.5 kHz	88.750 MHz	CVT Red. Blanking	CVT 1.30MA	7/14/04
	60 Hz	59.9 kHz	106.500 MHz	CVT	CVT 1.30MA	7/14/04
	75 Hz	75.0 kHz	136.750 MHz	CVT	CVT 1.30MA	7/14/04
1600 x 1200	85 Hz	84.8 kHz	157.000 MHz	CVT	CVT 1.30MA	7/14/04
	60 Hz	75.0 kHz	162.000 MHz	VESA Standard	VDMTREV	12/18/96
	65 Hz	81.3 kHz	175.500 MHz	VESA Standard	VDMTREV	12/18/96
	70 Hz	87.5 kHz	189.000 MHz	VESA Standard	VDMTREV	12/18/96
	75 Hz	93.8 kHz	202.500 MHz	VESA Standard	VDMTREV	12/18/96
	85 Hz	106.3 kHz	229.500 MHz	VESA Standard	VDMTREV	12/18/96
1680 x 1050	60 Hz	64.7 kHz	119.000 MHz	CVT Red. Blanking	CVT 1.76MA	7/14/04
	60 Hz	65.3 kHz	146.250 MHz	CVT	CVT 1.76MA	7/14/04
	75 Hz	74.9 kHz	187.000 MHz	CVT	CVT 1.76MA	7/14/04
	85 Hz	93.9 kHz	214.75 MHz	CVT	CVT 1.76MA	7/14/04
1792 x 1344	60 Hz	83.64 kHz	204.750 MHz	VESA Standard	VDMTREV	9/17/98
1856 x 1392	60 Hz	86.33 kHz	218.250 MHz	VESA Standard	VDMTREV	9/17/98
1920 x 1200	60 Hz	74.0 kHz	154.000 MHz	CVT Red. Blanking	AddDMT	3/4/03
	60 Hz	74.6 kHz	193.250 MHz	CVT	AddDMT	3/4/03
	75 Hz	94.0 kHz	245.250 MHz	CVT	AddDMT	3/4/03
1920 x 1440	60 Hz	90.000 kHz	234.000 MHz	VESA Standard	VDMTREV	9/17/98

3.5.2 USB 3.1 Gen 1 Hub Controller

- Compliant with the USB 3.1 specification.
- Fully backward compatible to all USB 2.0 and USB 1.1 hosts.

3.6 Ability of Power Provision

The ability of carrier board to provide power is listed in Table 5.

Table 5:

Symbol	Min.	Max.	Total Power
DC Jack Input	6V	14.9V	60W(Max.)

3.7 Thermal Specifications

The case temperature of key components is listed in Table 6.

Table 6:

Components	Components Case Temperature Specifications
USB 3.1 Gen 1 Hub Controller (U6)	Tcase = 95°C
DP to HDMI Protocol Converter (U40)	Tcase = 95°C

3.8 EMI Specifications

EMI/EMS test specification are listed in Table 7

Table 7 :

Criteria	Specification	Reference
EMI	EN55022 standard	CE
EMS	ESD test standard	EN61000-4-2

3.9 Buttons and Indicators

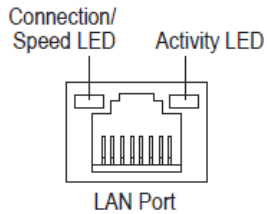
Buttons (Switches)

Button	Description	Usage
SW2	Reset button	Used to force a full system reset.
SW5	Volume down (Sleep) button	Used to put system into sleep mode.
SW7	Recovery button	Used to enter Force Recovery Mode. Button is held down while either system is first powered on, or by pressing & releasing reset button while Recovery button is pressed.
SW3	Power button	Used to power system up if off, or power down if on. If held for >10 seconds, will force a full system power cycle.

Indicators (LEDs)

LEDs	Description	Usage
D7	SOC Enable LED (Green)	Indicates when the VDD_CORE (SOC) supply is active.
D5	Power LED (Green)	Indicates when the carrier board is powered on (VDD_1V8 & VDD_3V3_SYS rails are valid).

Gigabit Ethernet (LAN Port LEDs)



Connection LED:		Activity LED (Yellow):	
Status	Description	State	Description
Green	Link	Yellow Blinking	Data transmission or receiving is occurring
		Off	No data transmission or receiving is occurring

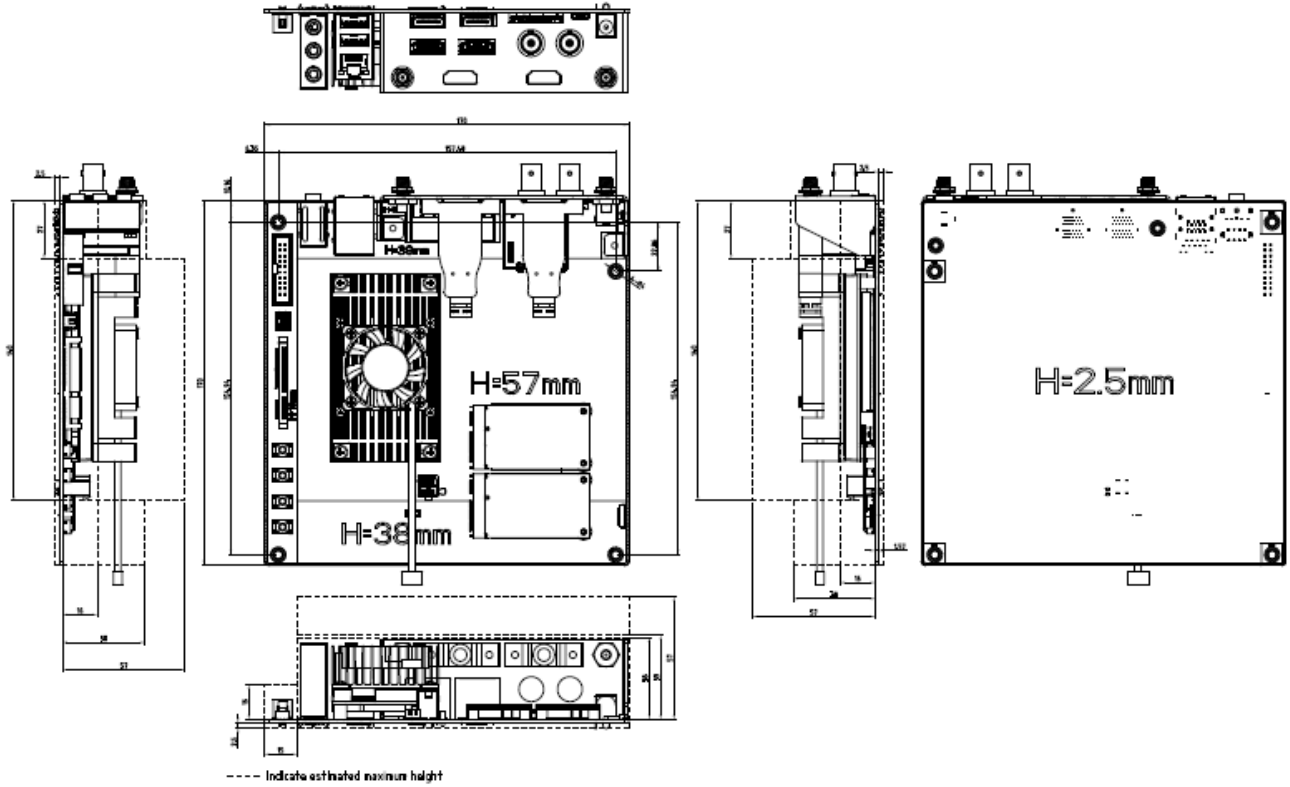
4. Software

BSP (board support package) : NVIDIA JETSON JETPACK 3.3 (R28.2)

5. Firmware

Item	Location	Firmware Version	Noted
Mini51	U54	180331	Own brand

6. ID Specifications



7. Reliability

Table 8:

Criteria	Specification	Reference
Low Temperature	Operating: 0 C/48 hrs	IEC 68-2-1
	Storage: -20 C/24 hrs	
High Temperature	Operating: 55 C/48 hrs	IEC 68-2-2
	Storage: 80 C /24 hrs	
High Humidity	Operating: 55C, 95%RH/48 hrs	IEC 68-2-30
	Storage: 80C, 95%RH/24 hrs	
Cold Start	Operating: 0 C/1hr	IEC 68-2-1
Hot Start	Operating: 55C, 95%RH/1hr	IEC 68-2-2
Package Drop	According to the ISTA 2A test standard	ISTA 2A