RTSO-2002
Product Manual

Realtimes Beijing Technology Co., LTD.
Fax： 400-100-8358
Email: info@realtimes.cn
Web Page: http://www.realtimesai.com
Address: 11th Floor, Block B, 20th Heping Xiyuan, Pingxi Street, Chaoyang District, Beijing 100013,P.R.China

Revision History

Revision	Date	Reason for change	Applicable hardware version	Editor
V1.0	2022-11	Initial release	v1.0	RT0086
V2.0	2023-05	1. The SIM card is updated from two to one, and the MiniPCIe port and M.2B KEY port are shared 2. Replace the Sim card port model 3. Replace the model of the external output power port	v2.0	RT0086
V2.1	2024-08-01	Add RTST-2002-GMSL camera extension board and RTST-2002-SATA hard disk extension board information description	v2.0	RT0086

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Electronic components and circuits are very sensitive to electrostatic discharge. Although our company designs anti-static protection for the main interfaces on the card when designing circuit board products, it is difficult to achieve anti-static safety protection for all components and circuits. Therefore, it is recommended to observe anti-static safety precautions when handling any circuit board component (including RTS0-2002). Anti-static safety protection measures include, but are not limited to the following:

a) The smart box should be placed in an anti-static bag during transportation and storage, and then the board should not be taken out during installation and deployment.
b) Before touching the smart box, discharge the static electricity stored in the body: wear a discharge grounding wrist strap.
c) Operate the smart box only within the safe area of the electrostatic discharge point.
d) Avoid moving smart boxes in carpeted areas.

Precautions and after-sales maintenance

matters needing attention

Before using the product, please read this manual carefully and keep it for future reference;

- Please pay attention to and follow all warning and guidance information marked on the product;
- Please use matching power adapter to ensure the stability of voltage and current;
- Please use this product in a cool, dry and clean place;
- Do not use this product in cold and hot alternate environment to avoid condensation damage components;
- Do not splash any liquid on the product. Do not use organic solvent or corrosive liquid to clean the product;
- Do not use the product in dusty and messy environment. If it is not used for a long time, please pack the product;
- Do not use in the environment with excessive vibration, any dropping or knocking may damage the circuit and components;
- Do not plug and unplug the core board and peripheral modules when power is on;
- Please do not repair or disassemble the product by yourself. In case of any fault, please contact our company in time for maintenance;
- Do not modify or use unauthorized accessories by yourself, and the damage caused will not be warranted;

After sales maintenance

1) Warranty period

- Base plate, core plate : 3 year (non-human damage)
- Other peripherals sold by the company:1year(non-human damage)

2) Warranty description

- Within 7 days: the product (base plate, core module) is not damaged by human, our company will replace / repair it free of charge, and bear the return freight; (because the core module needs NVIDIA to confirm that it can meet the requirements of repair, it will take a long time, we will coordinate as soon as possible, please forgive for the inconvenience)
- From 7 days to 36 months: the product (base plate, core module) is not damaged by human, our company will repair it free of charge, and bear the return freight; (because the core module needs NVIDIA to confirm that it can meet the requirements of repair, it will take a long time, we will coordinate as soon as possible, please forgive for the inconvenience)
- Artificial damage in more than 3 year or 3 year: the product (carrier plate) shall be tested after it is sent to the customer, and the customer shall be informed of whether it can be repaired and the maintenance cost in detail. After reaching an agreement, the product shall be repaired and returned to the customer, and the company shall bear the return freight;
- The starting time shall be subject to the date of express delivery receipt;

3) Contact information

Official website: www.realtimesai.com

Taobao website: https://shop340963258.taobao.com/

Address: 11, block B, Heping Xiyuan, Heping West Street, Chaoyang District, Beijing

Attention: RMA

Tel: 400-100-8358

Mailing notice: contact with the company's sales department in advance, arrange technical support personnel to check and eliminate errors caused by misoperation as soon as possible, fill in the product after-sale return to factory maintenance form after verification, and send it to rma@realtimes.cn Mail box, please attach the list of items to facilitate verification, so as to avoid loss and loss in the process of express delivery. The company does not receive any delivery

Technical support and development customization

1. Scope of technical support

1) The company releases the electrical characteristics and use of industrial carrier boards and modules;

2) Physical dimension of hardware, relevant structure diagram and line sequence definition of specific interface;

3) Burn in verification of all BSP support packages provided by the company;

4) The company released burn environment construction, entry-level use. ;

5) Various peripheral module drivers released by the company;

6) The company's product fault diagnosis and after-sales maintenance services;

2. Scope of technical discussion

Due to the wide range of embedded system knowledge and various types of involvement, we can not guarantee that all kinds of questions can be answered one by one. The following content is not available for technical support, only suggestions can be provided.

1) Knowledge beyond the course published by our company;
2) Specific software program design;
3) Technical support for industrial carrier not issued by the company;
4) All kinds of driving support for industrial carrier board not issued by the company;
5) Hardware principle and drive design of peripheral module not issued by our company;

3. Technical support mode

1)Official website or email questions (recommended):https://www.realtimesai.com/cn/download.html techsupport@realtimes.cn
2) Official Taobao through Alibaba Wangwang consultation: https://shop340963258.taobao.com/
3) Wechat group consultation (wechat Group No. consults Taobao customer service or sales, and Taobao purchase order No. needs to be provided for verification);
4) Technical support email: techsupport@realtimes.cn
5) Tel: 400-100-8358

4. Technical support time

Monday to Friday; 8:30-12:00 am; 1:00-17:30 PM;
The company arranges the rest according to the national legal holidays, during which it may not be able to provide technical support, please send the problem to the technical support email. We will reply to you as soon as possible on weekdays.

5. Complaints and suggestions

If you are not satisfied with us or have suggestions, you can send an email to yu.qin @ realtimes.cn For feedback, please call 400-100-8358 for further improvement.

6. Customized development services

The company provides the embedded operating system driver based on NVIDIA Jetson series and the paid customized development service of hardware carrier board to shorten your product development cycle.
Please email the request to info@realtimes.cn

Data acquisition and subsequent update

1. Access to information

Download on our website

The company's website contains supporting information of its products, including product user manual, NVIDIA Jetson series module data manual, BSP driver support package for carrier board, supporting peripheral driver files, interface test verification method, FAQ, system burning guide, etc. get into www.realtimesai.com , select "data download" in the navigation bar, find the data you need, and click download.

2. . Subsequent updates

Updates of subsequent documents, BSP, driver files and other official account will be updated in time. We will pay close attention to our developments in order to ensure that your information is up to date. We will push through WeChat public.

Product presentation

1 Introduction

RTSO-2002 project is based on NVIDIA Jetson AGX Orin's powerful computing power, video engine and rich interface resources, designed and developed for specific target customers with strong environmental awareness capabilities of visual products. Use the various interface resources of the module to expand 5 independent Gigabit Ethernet, 4 USB3.0 interfaces and other conventional communication interfaces, and reserve high-speed connectors for later expansion of camera, SATA and other functions. The product has a wide range of applications in the field of pan-automatic driving, AGV car, logistics vehicle, robot and so on.

1.1 Features

PN / Interface	RTSO-2002
AI Core	AGX Orin
Preinstalled system	Ubuntu20.04
Display	1 x HDMI TYPE A interface;
USB	4 x USB TYPE A 3.0 ports GEN1, support usb2.0, usb3.1 signals, provide 1A output current;1 x Micro USB port for system flash;
Network	5 x Gigabit Ethernet (10/100/1000Mbps adaptive; Half-duplex/full-duplex adaptive)
Storage	1 x Micro SD card slot;
SIM	1 x Micro SIM card slot;
PCIe	1 x Mini PCIe port,, support 4G/WIFI5/WIFI6;
M.2	1 x M.2 key M port,Support NVMe SSD hard disk; 1 x M.2 key B port,Support 4G/5G;
Output Power	1 x Power output port (consistent with input voltage), the maximum bearing current 6A;
Expansion Interface	1 x High-speed expansion connector, 2 x Low-speed expansion double-row pins; (Scalable GMSL camera or SATA storage)
Multi-function interface	2 x Multifunctional double-row pins; (support 2 x I2C,2 x SPI, 1 x Debug RS232,2 x RS232,2 x RS485,4 x GPI, 4 x GPO, 2 x CAN,1 x SYNC_IN,1 x SYNC_OUT, 1 x SYNC_PPS, 1 x POWER OUT)
RTC	2 x RTC battery ports, 1 x CR2032 button battery support, 1 x 2Pin socket;
FAN	Support 5V/12V fan (optional) (default 5V, if you need 12V fan, please contact to confirm before ordering);
Audio	1 x Audio port, support Line_IN, MIC_IN, Line_OUT;
Encryption Chip	It supports encryption function and meets the design requirements of EAL4+ security level. Part number LKT4110U;
Indicator Light	4 x External indicators, including POWER, USER, ALARM, HDD;
Button	1 x Reset button; 1 x Recovery button; 1 x Power button;
Size	200mm×200mm×28mm
Power Requirement	9-36VDC input voltage range

Operating Temperature	-20℃~+80℃
Weight	About 395g

1.2 Ordering Information

Ordering Information	Ordering Information
RTSO-2002	Supports NVIDIA Jetson AGX Orin modules, 1 x HDMI 2.0, 4 x USB 3.0, 5 x GbE, 1 x Debug RS232, 2 x RS232, 2 x RS485, 4 x GPI, 4 x GPO, 1 x MiniPCIe, 1 x M.2 B Key, 1 x M.2 M Key, 2 x I2C, 2 xSPI, 1 x Audio, 1 x SYNC_IN, 1 x SYNC_OUT, 4 x GPI, 4 x GPO, 1 x minipcie, 1 x M.2 M key, 2 x I2C, 2 XSPI, 1 x Audio, 2 x CAN, 1 x sync_in, 1 x sync_out, 1 x SYNC_PPS, 1 x POWER OUT, 1 x FAN,2 x RTC, 3C certification, provides the Realtimes_L4T_R35.1.0_rtso-2002-v2.0_orin.tbz2 software support package.
RTST-2002-GMSL（Option）	GMSL camera extension board, adapted to RTSO-2002 carrier board, supports 8-channel GMSL2 camera
RTST-2002-SATA（Option）	SATA expansion board, suitable for RTSO-2002 carrier board, supports 2 channels of SATA3.0 interface (can connect 3.5 inch and 2.5 inch SATA disk)

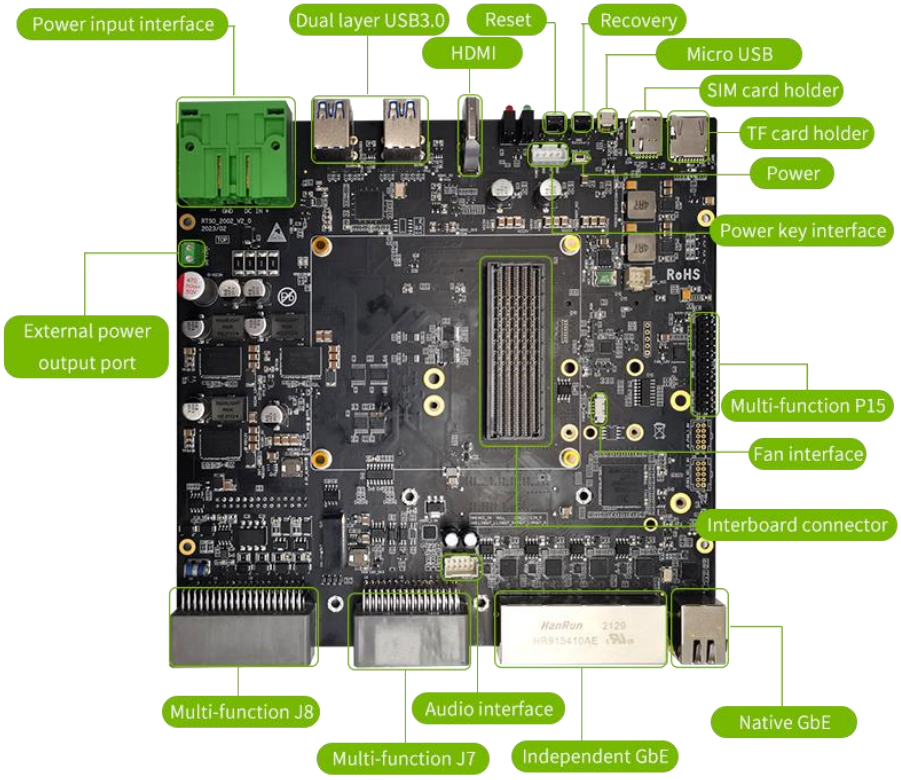
1.3 Adaptive cable package configuration

RTSO-2002 supporting cable package ordering model: RTSO-2002_Cables. Contains the following components:

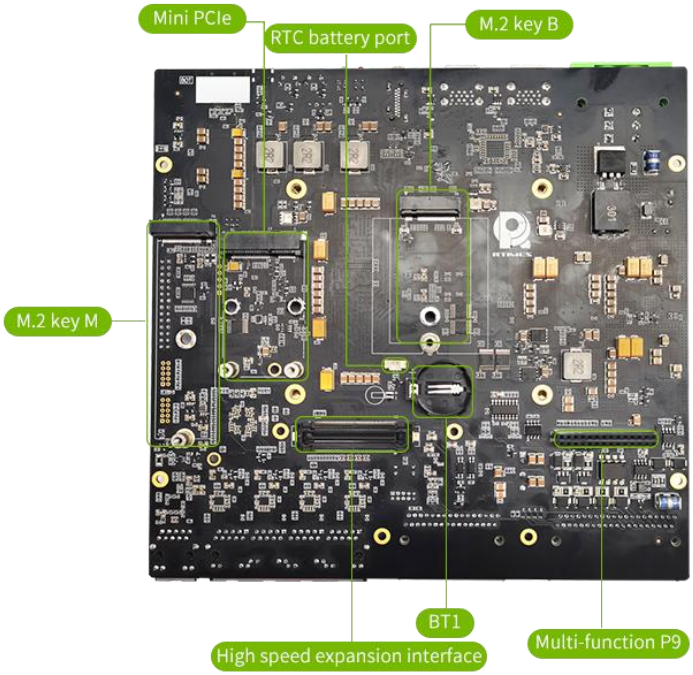
Ordering Information	**Quantity**	**Functional description**
RTSO-2002_Cables	1	Matching bag

Product specifications

1 Connector Locations

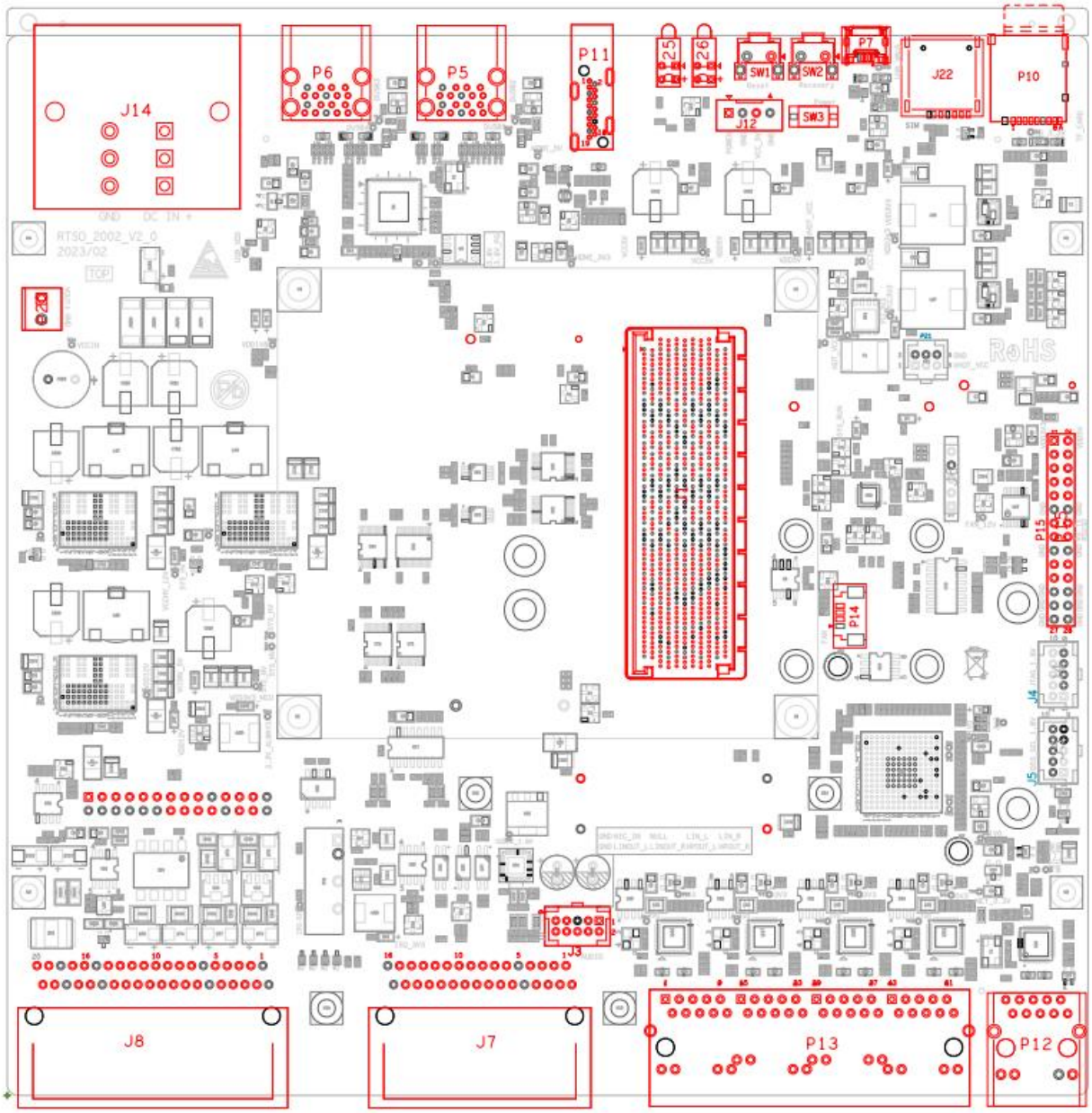


RTSO-2002 FRONT

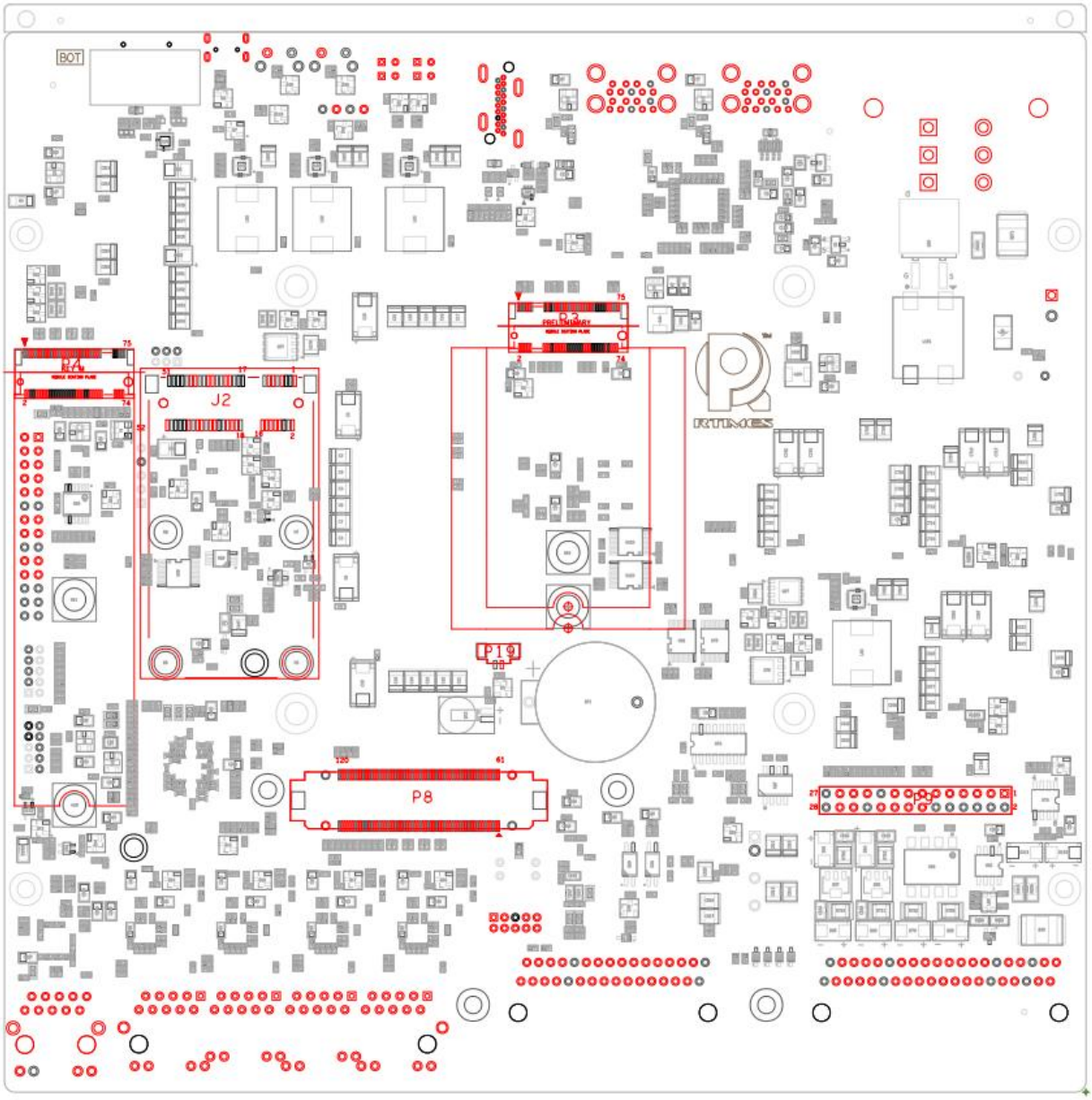


RTSO-2002 BACK

1.1 Component location diagram



RTSO-2002 FRONT



RTSO-2002 BACK

1.2 Functional connector

Marking	Function description
J1	699-Pin that connects to the NVIDIA Jetson AGX Orin core module
P12	Native Gigabit interface
P13	Four independent Gigabit network ports
J22	Self-ejecting SIM card with MiniPCIe port and M.2B KEY port
P5/P6	Dual layer USB3.0 interface
P7	MicroUSB interface (system flash port)
P11	HDMI interface
J2	MiniPCIe interface
P3	M.2 KEY B interface
P4	M.2 KEY M interface
P10	TF card interface
J3	Audio interface
P14	Fan interface
P15/P9	Multifunction extension interface
J12	Power button interface
J7/J8	External multifunctional interface
P8	High speed expansion interface
BT1/P19	RTC battery port
P20	External power output port
J14	Power input interface

1.3 Button

Marking	Function description
SW1	RESET button,Indicates the system reset button
SW2	RECOVERY button，enable the core module to enter the recovery mode
SW3	POWER button，Switches on and off the machine

1.4 LED indicator light

Marking	Function description
D125-substratum	HDD LED: Red light, SSD running indicator, off when the storage device is not inserted
D125-superstratum	ALEAM LED: Red light, off by default, software programmable. (GPIO Number 486)
D126-substratum	USER LED: Green light, off by default, software programmable. (GPIO No. 488)
D126-superstratum	POWER LED: Green light, power indicator, blinking during normal operation

Note:

USER LED:

sudo echo 488 > /sys/class/gpio/export

echo 1 or 0 > /sys/class/gpio/PAC.02/value 1: On 0:Off

ALEAM LED:

sudo echo 486 > /sys/class/gpio/export

echo 1 or 0 > /sys/class/gpio/PAC.00/value 1: On 0:Off

1.5 Encryption chip

Function	Key code protection, contrast authentication, parameter protection, etc
Chip type	LKT4110U
Chip parameter	28K-Bytes program storage, 4K-Bytes NVM data storage, 4K-Bytes RAM
Main machine interface	/dev/I2C-2
Chip address	0x50

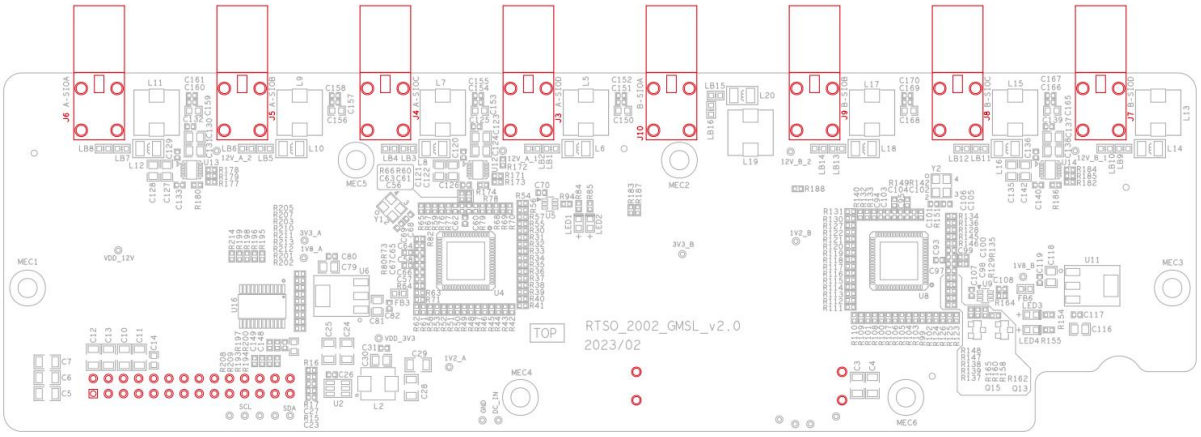
Note: * Please refer to the LKT4110U chip development manual for detailed usage

2 External ports on the GMSL2 expansion board

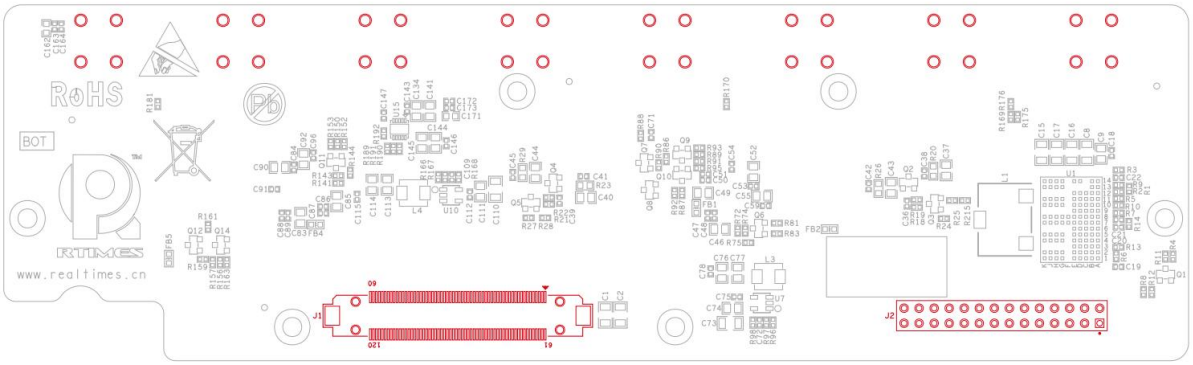
GMSL Expansion Board Front

GMSL Expansion Board Back

2.1 Component location diagram



GMSL Expansion Board Front

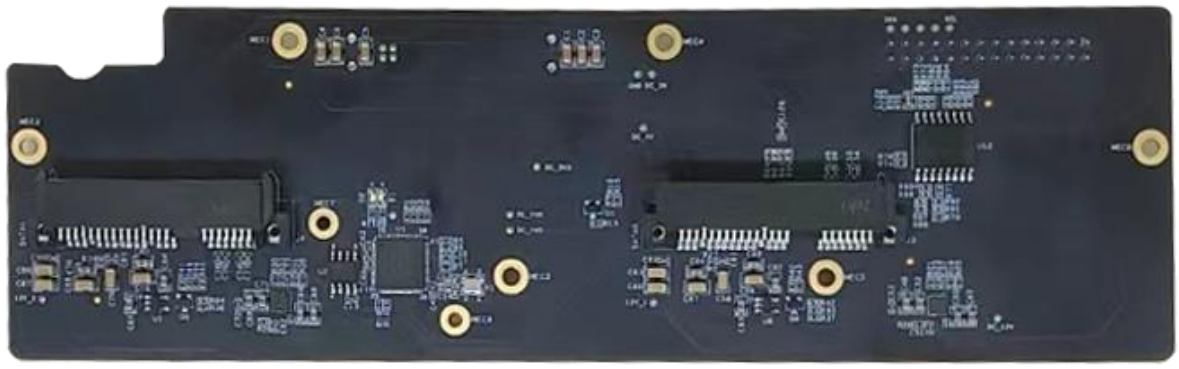


GMSL Expansion Board Back

2.2 Functional connector

Marking	Function description
J1	High speed signal connector for connecting carrier board
J2	Low speed signal connector for connecting carrier board
J3~J10	GSML2 camera interface

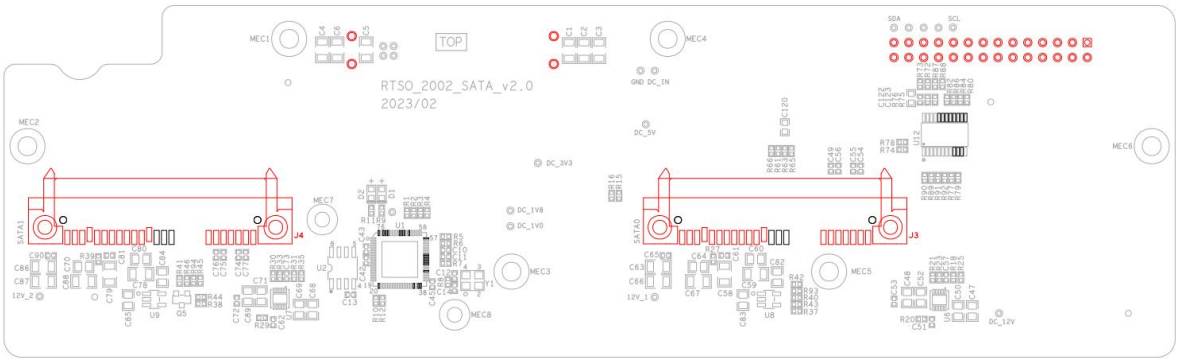
3 External ports on the SATA expansion board



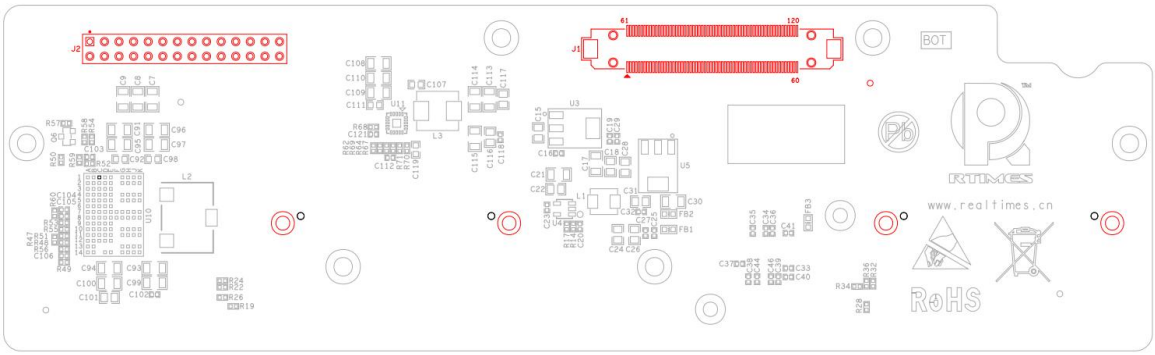
SATA Expansion Board Front

SATA Expansion Board Back

3.1 Component location diagram



SATA Expansion Board Front



SATA Expansion Board Back

3.2 Functional connector

Marking	Function description
J1	High speed signal connector for connecting carrier board
J2	Low speed signal connector for connecting carrier board
J3、J4	22Pin SATA hard drive socket

4 Connectors Description

4.1 Connectors Description

Function	Connect the NVIDIA Jetson AGX Orin core module
Marking	J1
Type	699-Pin SO-DIMM
Pin define	For pin definitions of this connector, refer to the pin definition instructions in the NVIDIA Jetson AGX Orin Core Module data Book.

4.2 Gigabit network interface

Function	Gigabit network connector
Marking	P12
Type	RJ45/48F-01GY2DPL2NL
Pin define	

Pin	Signal	Pin	Signal
1	TP0+	2	TP0-
3	TP1+	4	TP1-
5	TP2+	6	TP2-
7	TP3+	8	TP3-

4.3 Four Gigabit network ports

Function	Gigabit network connector
Marking	P13
Type	RJ45/48F-01GY2DPL2NL
Pin define	

Pin	Signal	Pin	Signal
1	TP0+	2	TP0-
3	TP1+	4	TP1-
5	TP2+	6	TP2-
7	TP3+	8	TP3-

Note: The four network ports from left to right correspond to eth1-eth4 of the system.

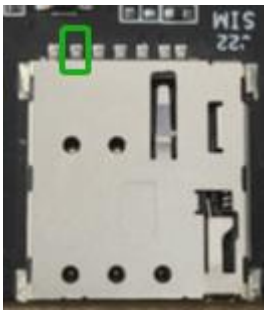
4.4 SIM card slot

Function	SIM card slot
Marking	J22
Type	SIM card slot/SNO-1303-X
Pin define	

Pin	Signal	Pin	Signal
1	VCC	2	RST
3	CLK	4	GND
5	VPP	6	DATA

Pin1: marked in the green box on the right.

Note: SIM card gap facing inward, 4G, 5G network switching, see Appendix I below the document

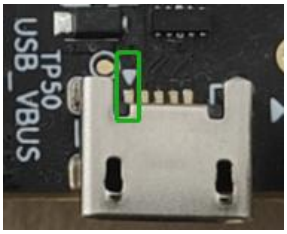


4.5 Micro USB

Function	Micro USB
Marking	P7
Type	Micro USB/MC-142PD
Pin define	

Pin	Signal	Pin	Signal
1	VBUS	2	DN
3	DP	4	ID
5	GND		

Pin1: marked in the green box on the right.



4.6 USB3.0 interface

Function	Dual layer USB3.0 connector
Marking	P5/P6
Type	Dual-layer USB TYPE-A port /U30-021D
Pin define	

Level	**Superstratum**		
Type	**USB 3.0**		
Pin	**Signal**	**Pin**	**Signal**
10	VBUS	11	USB 2.0 D-
12	USB 2.0 D+	13	GND
14	SSRX-	15	SSRX+
16	GND	17	SSTX-
18	SSTX+		
Level	**Substratum**		
Level	**USB 3.0**		
Pin	**Signal**	**Pin**	**Signal**
1	VBUS	2	USB 2.0 D-
3	USB 2.0 D+	4	GND
5	SSRX-	6	SSRX+
7	GND	8	SSTX-
9	SSTX+		

Note: Four USB3.0 TYPE A ports share 5Gbps bandwidth.

4.7 Display interface

Function	HDMI Display interface
Marking	P11
Type	Vertical HDMI interface /HDMI 019F
Pin define	

Pin	**Signal**	**Pin**	**Signal**
1	TMDS Data2+	2	TMDS Data2 GND
3	TMDS Data2-	4	TMDS Data1+
5	TMDS Data1 GND	6	TMDS Data1-
7	TMDS Data0+	8	TMDS Data0 GND
9	TMDS Data0-	10	TMDS Clock+
11	TMDS Clock GND	12	TMDS Clock-
13	CEC	14	No Connect
15	DDC clock	16	DDC data
17	DDC GND	18	+5V Power
19	Hot Plug Detect		

4.8 Extension interface 1

Function	Multifunction extension interface
Marking	P15
Type	2.54mm-2x14pin double row pins
Pin define	

Pin	Signal	Pin	Signal
1	VCC-3V3	2	VCC-5V
3	SPI1_CLK_3V3	4	SPI3_CLK_3V3
5	SPI1_MOSI_3V3	6	SPI3_MOSI_3V3
7	SPI1_MISO_3V3	8	SPI3_MISO_3V3
9	SPI1_CS_3V3	10	SPI3_CS_3V3
11	GND	12	GND
13	I2C0_SCL_3V3	14	TXD-232(CONSOLE)
15	I2C0_SDA_3V3	16	RXD-232(CONSOLE)
17	GND	18	GND
19	I2C1_SCL_3V3	20	GPIO01_3V3
21	I2C1_SDA_3V3	22	GPIO02_3V3
23	GND	24	GND
25	GND	26	GND
27	GND	28	GND

Pin1: green box marked on the right.

Pin2: red box marked on the right.

In Linux,The mapping file for SPI1 is spi0.0 in the /dev directory

In Linux,The mapping file for SPI3 is spi2.0 in the /dev directory

In Linux,The mapping file for I2C0 is I2C-16 in the /dev directory

In Linux,The mapping file for I2C1 is I2C-15 in the /dev directory

Note:

1.SPI, I2C, PWM01_3V3, GPIO29_3V3 are 3.3V level standards

2.TXD-232 and RXD-232 are debugging serial ports with standard RS-232 level. The serial port configuration parameters are: 115200, 8, n, 1

3.spi driver loading method :sudo modprobe spidev

4. For details about how to use GPIO01 and GPIO02, see Appendix 5 below the document

4.9 Extension interface 2

Function	Multifunction extension interface
Marking	P9
Type	2.54mm-2x14pin Dual female holder

Pin define

Pin	Signal	Pin	Signal
1	VCC_IN	2	GND
3	VCC_IN	4	GND
5	VCC_IN	6	GND
7	VCC_IN	8	GND
9	VCC_IN	10	GND
11	VCC_IN	12	GND
13	ORIN_GPIO0_IN	14	MCLK02-1V8
15	ORIN_GPIO1_IN	16	MCLK03-1V8
17	ORIN_GPIO2_IN	18	MCLK04-1V8
19	GND	20	MCLK05-1V8
21	GPIO3C00	22	GND
23	GPIO3C01	24	I2C_SCL_3V3
25	GPIO3C02	26	I2C_SDA_3V3
27	GND	28	GND

Pin1: green box marked on the right.

Pin2: red box marked on the right.

VCC_IN:9~36V Consistent with the input voltage

In Linux， The mapping file for I2C is i2c-11 in the /dev directory

Note:

1, I2C, ORIN_GPIO0_IN, ORIN_GPIO1_IN, ORIN_GPIO2_IN are 3.3V level standards

2, MCLK02-1V8, MCLK03-1V8, MCLK04-1V8, MCLK05-1V8, GPIO3C00, GPIO3C01, GPIO3C02 are 1.8V level standards

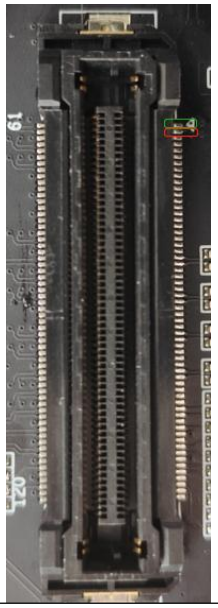
* Used with high-speed connector P8, cannot be used alone

4.10 High speed expansion interface

Function	High speed expansion interface
Marking	P8
Type	FX23L-120S-0.5SV

Pin define

Pin	Signal	Pin	Signal
123	GND	121	VCC_IN
1	CSI_6_D0_P	61	CSI_0_D0_P
2	CSI_6_D0_N	62	CSI_0_D0_N
3	GND	63	GND
4	CSI_6_D1_P	64	CSI_0_D1_P
5	CSI_6_D1_N	65	CSI_0_D1_N
6	GND	66	GND
7	CSI_6_CLK_P	67	CSI_0_CLK_P
8	CSI_6_CLK_N	68	CSI_0_CLK_N



9	GND	69	GND
10	CSI_7_D0_P	70	CSI_1_D0_P
11	CSI_7_D0_N	71	CSI_1_D0_N
12	GND	72	GND
13	CSI_7_D1_P	73	CSI_1_D1_P
14	CSI_7_D1_N	74	CSI_1_D1_N
15	GND	75	GND
16	CSI_7_CLK_P	76	CSI_1_CLK_P
17	CSI_7_CLK_N	77	CSI_1_CLK_N
18	GND	78	GND
19	PCIE7_CLK_P	79	CSI_2_D0_P
20	PCIE7_CLK_N	80	CSI_2_D0_N
21	GND	81	GND
22	UPHY_TX2_P	82	CSI_2_D1_P
23	UPHY_TX2_N	83	CSI_2_D1_N
24	GND	84	GND
25	UPHY_RX2_P	85	CSI_2_CLK_P
26	UPHY_RX2_N	86	CSI_2_CLK_N
27	GND	87	GND
28	UPHY_TX3_P	88	CSI_3_D0_P
29	UPHY_TX3_N	89	CSI_3_D0_N
30	GND	90	GND
31	UPHY_RX3_P	91	CSI_3_D1_P
32	UPHY_RX3_N	92	CSI_3_D1_N
33	GND	93	GND
34	UPHY_TX4_P	94	CSI_3_CLK_P
35	UPHY_TX4_N	95	CSI_3_CLK_N
36	GND	96	GND
37	UPHY_RX4_P	97	CSI_4_D0_P
38	UPHY_RX4_N	98	CSI_4_D0_N
39	GND	99	GND
40	UPHY_TX5_P	100	CSI_4_D1_P
41	UPHY_TX5_N	101	CSI_4_D1_N
42	GND	102	GND
43	UPHY_RX4_P	103	CSI_4_CLK_P
44	UPHY_RX4_N	104	CSI_4_CLK_N
45	GND	105	GND
46	PCIE_WAKE	106	CSI_5_D0_P
47	PCIE7_RST	107	CSI_5_D0_N
48	GND	108	GND
49	PCIE7_CLKREQ	109	CSI_5_D1_P
50	GND	110	CSI_5_D1_N

	51	GND	111	GND
	52	I2C2_CLK_1V8	112	CSI_5_CLK_P
	53	I2C2_SDA_1V8	113	CSI_5_CLK_N
	54	GND	114	GND
	55	I2C8_CLK_1V8	115	GPIO6_AON_3V3
	56	I2C8_SDA_1V8	116	GPIO7_AON_3V3
	57	GPIO3_OUT_3V3	117	GND
	58	GPIO4_OUT_3V3	118	CARRIER_PWR_ON
	59	GPIO3A06	119	GPIO3A05
	60	GND	120	GND
	122	VCC_IN	124	GND

Pin1: green box marked on the right.

Pin2: red box marked on the right.

VCC_IN:9~36V Consistent with the input voltage

In Linux,The mapping file for I2C2 is I2C-1 in the /dev directory

In Linux,The mapping file for I2C8 is I2C-7 in the /dev directory

Note: Used with SATA, GMSL expansion board, can not be used alone.

4.11 Multifunctional connector 1

Function	Multifunctional connector
Marking	J7
Type	Multifunctional connector/ MX34032NF2
Pin define	

Pin	Signal	Pin	Signal
1	FAN_VCC	17	SPI3_CLK_3V3
2	FAN_VCC	18	SPI3_MOSI_3V3
3	FAN_PWM_OUT	19	SPI3_MISO_3V3
4	FAN_TACH_IN	20	SPI3_CS_3V3
5	GND	21	GND
6	MIC_IN	22	LINELOUT
7	LINELIN	23	LINEROUT
8	LINERIN	24	AUDIO_GND
9	AUDIO_GND	25	AUDIO_GND
10	ISO_SYNC_IN	26	ISO_SYNC_IN_B
11	ISO_PPS_IN_3V3	27	ISO_SYNC_IN_A
12	ISO_SYNC_OUT_3V3	28	ISO_GND
13	ISO_GND	29	ISO_GND
14	I2C1_SCL_3V3	30	I2C0_SCL_3V3
15	I2C1_SDA_3V3	31	I2C0_SDA_3V3
16	GND	32	GND

	Pin1: green box marked on the right. Pin2: red box marked on the right. FAN_VCC:5V or 12V In Linux,the mapping file for SPI3 is spi2.0 in the /dev directory In Linux,the mapping file for I2C0 is I2C-16 in the /dev directory In Linux,the mapping file for I2C1 is I2C-15 in the /dev directory Note: 1, SPI, I2C, ISO_SYNC_OUT_3V3, ISO_PPS_IN_3V3 are 3.3V level standards 2, ISO_SYNC_IN, differential ISO_SYNC_IN (ISO_SYNC_IN_A, ISO_SYNC_IN_B) Maximum voltage 12V, low level (0~1V), high level (1~12V) 3. ISO_SYNC_IN_A and ISO_SYNC_IN_B pins are suspended, ISO_SYNC_IN pin status is valid, ISO_SYNC_IN is pulled up to a high level, and differential signals (ISO_SYNC_IN_A and ISO_SYNC_IN_B) are valid 4. See Appendix 3 for test methods.	

4.12 Multifunctional connector 2

Function	Multifunctional connector
Marking	J8
Type	Multifunctional connector/ MX34040NF2
Pin define	

Pin	Signal	Pin	Signal
1	GND	21	GND
2	RS232_1_TX	22	RS232_2_TX
3	RS232_1_RX	23	RS232_2_RX
4	RS232_1_RTS	24	RS232_2_RTS
5	RS232_1_CTS	25	RS232_2_CTS
6	GND	26	GND
7	IN1+	27	OUT1+
8	IN1-	28	OUT1-
9	IN2+	29	OUT2+
10	IN2-	30	OUT2-
11	IN3+	31	OUT3+
12	IN3-	32	OUT3-
13	IN4+	33	OUT4+
14	IN4-	34	OUT4-
15	GND	35	GND
16	CAN2.0_0_H	36	CAN2.0_1_H
17	CAN2.0_0_L	37	CAN2.0_1_L
18	GND	38	GND

19	RS485_2_B	39	RS485_1_B	
20	RS485_2_A	40	RS485_1_A	

Pin1: green box marked on the right.

Pin2: red box marked on the right.

In Linux, the mapping file for RS232_1 is ttyTHS0 in the /dev directory

In Linux, the mapping file for RS232_2 is ttyTHS4 in the /dev directory

In Linux, the mapping file for RS485_1 is ttyTHS3 in the /dev directory

In Linux, the mapping file for RS485_2 is ttyTHS1 in the /dev directory

In Linux,the mapping file for CAN_0 is can0 in the /dev directory

In Linux,the mapping file for CAN_1 is can1 in the /dev directory

The gpio number of IN1 in Linux is GPIO-341

The gpio number of IN2 in Linux is GPIO-457

The gpio number of IN3 in Linux is GPIO-452

The gpio number of IN4 in Linux is GPIO-428

The gpio number of OUT1 in Linux is GPIO-348

The gpio number of OUT2 in Linux is GPIO-349

The gpio number of OUT3 in Linux is GPIO-431

The gpio number of OUT4 in Linux is GPIO-351

GPIO and CAN driver loading methods: See Appendix 2

Note:

IN+ and IN- Voltage ranges from 5 to 48VDC

OUT+, OUT- Maximum driving current 100mA

The hardware of the RS485 supports switchover between incoming and outgoing packets, but the software does not need to control the switchover

4.13 TF card holder

Function	TF card holder
Marking	P10
Type	TF card holder/TF-013
Pin define	

Pin	Signal	Pin	Signal
1	DATA2	2	DATA3/CD
3	CMD	4	VDD
5	CLK	6	VSS
7	DATA0	8	DATA1
A	DETECT	B	DETECT

Pin1: green box marked on the right.

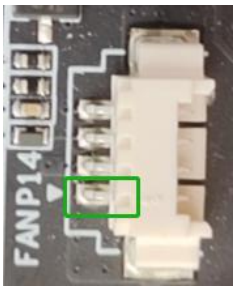
4.14 Fan interface

Function	Connect the cooling fan
Marking	P14
Type	53261-0471
Pin define	

Pin	Signal	Pin	Signal
1	GND	2	FAN_VDD
3	TACH	4	PWM

Pin1: green box marked on the right.

Note: The default fan is 5V, 12V is optional.



4.15 Audio interface

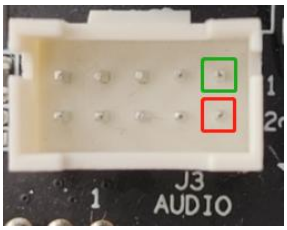
Function	Connect audio devices
Marking	J3
Type	PHB-2X5A
Pin define	

Pin	Signal	Pin	Signal
1	LINEIN_R	2	HPOUT_R
3	LINEIN_L	4	HPOUT_L
5	NULL	6	LINEOUT_R
7	MIC_IN	8	LINEOUT_L
9	AUDIO_GND	10	AUDIO_GND

Pin1: green box marked on the right.

Pin2: red box marked on the right.

Note: In the /etc/realtimes directory, run the audio script./audio, see directory 4 for details.

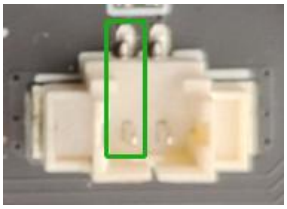


4.16 RTC battery port

Function	RTC battery port
Marking	P19
Type	AFC12-S02CCC-00
Pin define	

Pin	Signal	Pin	Signal
1	+	2	-

Pin1: green box marked on the right.



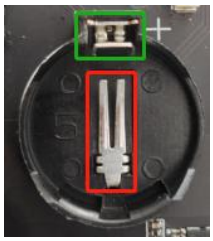
4.17 RTC battery holder

Function	RTC battery holder
Marking	BT1
Type	CR2032
Pin define	

Pin	Signal	Pin	Signal
1	+	2	-

Pin1: green box marked on the right.

Pin2: red box marked on the right.



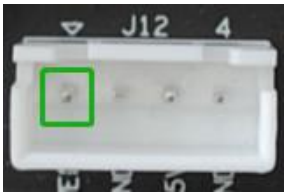
4.18 Expand the port for Power button

Function	Expand the port for Power button
Marking	J12
Type	XH-2.54-4
Pin define	

Pin	Signal	Pin	Signal
1	POWER_BTN	2	GND
3	POWER_LED	4	GND

Pin1: green box marked on the right.

Note: POWER LED output voltage 5VDC, current 5mA.



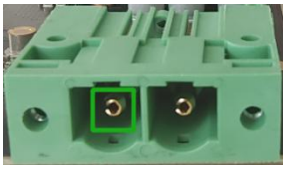
4.19 Power input interface

Function	Power input interface
Marking	J14
Type	KF2EDGSRAM-10.16-2p
Pin define	

Pin	Signal	Pin	Signal
1	+	2	-

Pin1: green box marked on the right.

Power supply voltage range:+9~+36V



4.20 Power output interface

Function	Power output interface
Marking	P20
Type	1727010
Pin define	

Pin	Signal	Pin	Signal
1	VCC_OUT	2	GND

Pin1: green box marked on the right.

	VCC_OUT:9~36V consistent with the power supply voltage, the maximum withstand current 6A.	

4.21 GMSL2 Expansion board Camera port

Function	GMSL2 Camera port	
Marking	J3~J10	
Type	7.03A0.00082D	
Pin define		

Pin	Signal	Pin	Signal
1	GMSL-IN	2	GND

Pin1: red box marked on the right.

Note:

J6-J3 connects to a camera device. The mapping files in the Linux operating system are /dev/video0-video3.

J10-J7 connects to a camera device. The mapping files in the Linux operating system are /dev/video4-video7.

Execute the script /etc/realtimes./ test_camera.sh to turn on the camera,

If the screen flashes, switch to the root mode and run the./fsync-test file.

4.22 SATA3.0 expansion interface

Function	22Pin SATA hard drive socket	
Marking	J3、J4	
Type	LD2122F-S04T3	
Pin define		

Pin	Signal	Pin	Signal
1	GND	2	TX+
3	TX-	4	GND
5	RX+	6	RX-
7	GND	8	NULL
9	NULL	10	NULL
11	GND	12	GND
13	GND	14	5V
15	5V	16	5V
17	GND	18	NULL
19	GND	20	12V
21	12V	22	12V

Pin1: red box marked on the right.

Appendix 1:

4G、5G network switcher：

The default port is M.2 key B (5G network). The switching modes between 4G and 5G networks are as follows:

1. Go to the /etc/realtimes directory and run the./simcard_switch.sh minipcie script to switch the SIM to the Mini PCIe port (4G network), power off, and restart.

2. Go to the /etc/realtimes directory and run the./simcard_switch.sh m2keyb script to switch the SIM to the M.2 Key B port (5G network), power off, and restart.

Appendix 2:

Usage of GPIO: Switch to the root mode

```
echo 348   > /sys/class/gpio/export          //OUT1
echo 349   > /sys/class/gpio/export          //OUT2
echo 431   > /sys/class/gpio/export          //OUT3
echo 351   > /sys/class/gpio/export          //OUT4

echo 1 or 0 > /sys/class/gpio/PA.00/value
echo 1 or 0> /sys/class/gpio/PA.01/value
echo 1 or 0> /sys/class/gpio/PM.07/value
echo 1 or 0> /sys/class/gpio/PA.03/value

echo 341   > /sys/class/gpio/export          //IN1
echo 457   > /sys/class/gpio/export          //IN2
echo 452   > /sys/class/gpio/export          //IN3
echo 428   > /sys/class/gpio/export          //IN4

cat /sys/class/gpio/PEE.02/value
cat /sys/class/gpio/PR.01/value
cat /sys/class/gpio/PQ.04/value
cat /sys/class/gpio/PM.04/value
```

CAN driver loading:

```
sudo modprobe can       // Load the can module
sudo modprobe can-raw
sudo modprobe mttcan
sudo ip link set can0 up type can bitrate 500000   // Set the baud rate
sudo ip link set can1 up type can bitrate 500000   // Set the baud rate
candump can0 &    // Receive can0 data
candump can1 &    // Receive can1 data
cansend can0 123#abcd        // Send can0 data
cansend can1 123#abcd        // Send can1 data
```

Appendix 3:

Sync-in/out test method:

1. Short-circuit Sync out to Sync in.
2. Initiate the timestamp event by entering the following command to start the application:

```
./gte_mon -d gtechip0 -g 324 -r -f
```

GPIO324 is mapped to port BB0 of AON, that is, SYNC-IN.

Data input detected:

```
nvidia@tegra-ubuntu:~$ sudo ./gte_mon -d gtechip0 -g 324 -r -f
[sudo] password for nvidia:
Monitoring line 324 on gtechip0
HW timestamp GPIO EVENT 2493772432832
HW timestamp GPIO EVENT 2493872466720
HW timestamp GPIO EVENT 2493972432800
HW timestamp GPIO EVENT 2494072466688
HW timestamp GPIO EVENT 2494172432832
HW timestamp GPIO EVENT 2494272466688
HW timestamp GPIO EVENT 2494272466688
HW timestamp GPIO EVENT 2494272466688
HW timestamp GPIO EVENT 2494372432832
HW timestamp GPIO EVENT 2494472466688
HW timestamp GPIO EVENT 2494572432832
HW timestamp GPIO EVENT 2494672466752
HW timestamp GPIO EVENT 2494772432832
HW timestamp GPIO EVENT 2494872466688
HW timestamp GPIO EVENT 2494972432800
```

Sync-pps test method:

1.Whenever the GPS PPS comes, an interrupt signal will be generated at the corresponding GPIO falling edge, and a timestamp will be generated at this time, which can be viewed by the following command:

```
n@n-desktop:~$ cat /sys/class/pps/pps0/assert
1691986383.752656412#3521
```

Test PPS：

Installation tools: sudo apt install pps-tools

Use the command sudo ppstest /dev/pps0 to see output similar to the following:

trying PPS source "/dev/pps0"

found PPS source "/dev/pps0"

ok, found 1 source(s), now start fetching data...

source 0 - assert 1421066632.974111422, sequence: 1698 - clear 0.000000000, sequence: 0

source 0 - assert 1421066633.974045488, sequence: 1699 - clear 0.000000000, sequence: 0

Run the cat /proc/interrupts | grep pps command to check the number of interrupts of the PPS:

1. GPSD installation:

GPSD is a special software used to obtain and parse GPS data, which works in the form of a daemon process, and places the GPS data after obtaining and parsing on a specific TCP port for further reading by other applications (such as: ntpd chronyd).

To install third-party tools:

sudo apt-get install -y setserial gpsd gpsd-clients python-gps pps-tools

Modify the gpsd file in the /etc/default directory:

+DEVICES="/dev/ttyTHS1" //GPS sensor System port number

+GPSD_OPTIONS="-n -G"

Annotation:

-n = don’t wait for client connects to poll GPS

-G = make gpsd listen on INADDR_ANY

sudo stty -F /dev/ttyTHS1 38400

sudo gpsd /dev/ttyTHS1 -F /var/run/gpsd.sock

gpsd running service (starting from boot) :

sudo systemctl daemon-reload

sudo systemctl enable gpsd

sudo systemctl restart gpsd

At this time, you can use gpsmon or cgps tools to display GPS data parameters in a graphical interface.

Note: If the gpsmon GUI fails to open, run the **sudo stty -F /dev/ttyTHS1 38400** command again.

2. chrony installation:

chrony is a dedicated time server program that reads the data analyzed by GPSD. GPSD synchronizes system time by obtaining the time service provided by GPSD, similar to NTPD.

Installation command:

sudo apt install chrony -y

Then modify the /etc/chrony/chrony.conf file.

```
# Log files location.
logdir /var/log/chrony

maxdistance 16.0

# Stop bad estimates upsetting machine clock.
maxupdateskew 100.0

# This directive enables kernel synchronisation (every 11 minutes) of the
# real-time clock. Note that it can't be used along with the 'rtcfile' directive.
leapsectz right/UTC
#makestep 1.0 -1
rtcsync

refclock PPS /dev/pps0 lock GPSD prefer refid PPS
refclock SHM 0 offset 0.0 delay 0.3 refid GPSD

allow

# Step the system clock instead of slewing it if the adjustment is larger than
# one second, but only in the first three clock updates.
makestep 1 3
```

rtcsync --- The instruction will enable a kernel mode in which system time is copied to the Real-Time Clock (RTC) every 11 minutes.

allow / deny --- Here you can specify a host, subnet, or network to allow or deny NTP connections to machines acting as clock servers.

makestep --- Typically, chronyd will allow the system to gradually correct all time deviations by slowing down or speeding up the clock as needed. In some cases, the system clock may drift too fast, causing the adjustment process to take a long time to correct the system clock. This directive forces chronyd to step the system clock when the adjustment period is above a certain threshold, but only takes effect if there are no more clock updates because chronyd boot time exceeds the specified limit (a negative value can be used to disable the limit).

After setting parameters, restart the chrony service:

```
sudo service chrony restart
```

After the above preparation is complete, the test time synchronization.

View the time synchronization source and status:

```
chronyc sources
chronyc sources -v
chronyc sourcestats -v
systemctl status chronyd          // View the service status
chronyc tracking        // Calibrate the time server
timedatectl
```

For example:

```
z@z-desktop:/$ chronyc sources
210 Number of sources = 2
MS Name/IP address              Stratum Poll Reach LastRx Last sample
===============================================================================
#? PPS                          0   4     0   771    -202ms[ -6056h] +/-   39us
#* GPSD                         0   4   377    16     -40ms[  -43ms] +/-  167ms
```

Note: # preceded by a question mark "?" Or x, indicating that the synchronization is not successful. Asterisk *, indicating that the synchronization is successful.

```
chronyc sources -v
```

```
chronyc sourcestats -v

systemctl status chronyd        // View the service status
● chrony.service - chrony, an NTP client/server
     Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset: e
     Active: active (running) since Wed 2021-07-21 14:51:40 EDT; 8 months 8 days a
       Docs: man:chronyd(8)
             man:chronyc(1)
             man:chrony.conf(5)
  Main PID: 5527 (chronyd)
      Tasks: 1 (limit: 4915)
     CGroup: /system.slice/chrony.service
             └─5527 /usr/sbin/chronyd

Jul 21 14:51:40 z-desktop systemd[1]: Starting chrony, an NTP client/server...
Jul 21 14:51:40 z-desktop chronyd[5527]: chronyd version 3.2 starting (+CMDMON +
Jul 21 14:51:40 z-desktop chronyd[5527]: Frequency -5.074 +/- 8.364 ppm read fro
Jul 21 14:51:40 z-desktop chronyd[5527]: Using right/UTC timezone to obtain leap
Jul 21 14:51:40 z-desktop systemd[1]: Started chrony, an NTP client/server.
Jul 21 15:02:20 z-desktop chronyd[5527]: Selected source GPSD
Jul 21 15:02:20 z-desktop chronyd[5527]: System clock TAI offset set to 37 secon
Jul 21 15:02:20 z-desktop chronyd[5527]: System clock wrong by 21801086.045778 s
Mar 30 22:53:46 z-desktop chronyd[5527]: System clock was stepped by 21801086.04
chronyc tracking
Reference ID       : 47505344 (GPSD)
Stratum            : 1
Ref time (UTC)     : Thu Mar 31 03:03:45 2022
System time        : 0.001609250 seconds slow of NTP time
Last offset        : -0.001323730 seconds
RMS offset         : 0.001518739 seconds
Frequency          : 35.957 ppm fast
Residual freq      : -0.735 ppm
Skew               : 27.275 ppm
Root delay         : 0.300000012 seconds
Root dispersion : 0.018442914 seconds
Update interval : 16.0 seconds
Leap status        : Normal

z@z-desktop:/$ timedatectl
                      Local time: Wed 2022-03-30 23:28:32 EDT
                  Universal time: Thu 2022-03-31 03:28:32 UTC
                        RTC time: Thu 2022-03-31 03:28:32
                       Time zone: America/New_York (EDT, -0400)
       System clock synchronized: yes
```

systemd-timesyncd.service active: yes

RTC in local TZ: no

Appendix 4:

There are two types of audio input: line_in and mic_in.

In the /etc/realtimes directory, edit the audio script./audio.sh, and use line_in to modify the audio script as follows:

amixer -c 1 cset name="H40-SGTL Capture Mux" "LINE_IN"

#amixer -c 1 cset name="H40-SGTL Capture Mux" "MIC_IN"

After editing, save and exit and run./audio.sh

Audio input mac_in mode Changes as follows:

#amixer -c 1 cset name="H40-SGTL Capture Mux" "LINE_IN"

amixer -c 1 cset name="H40-SGTL Capture Mux" "MIC_IN"

After editing, save and exit and run./audio.sh

Appendix 5:

Usage of GPIO: Switch to the root mode

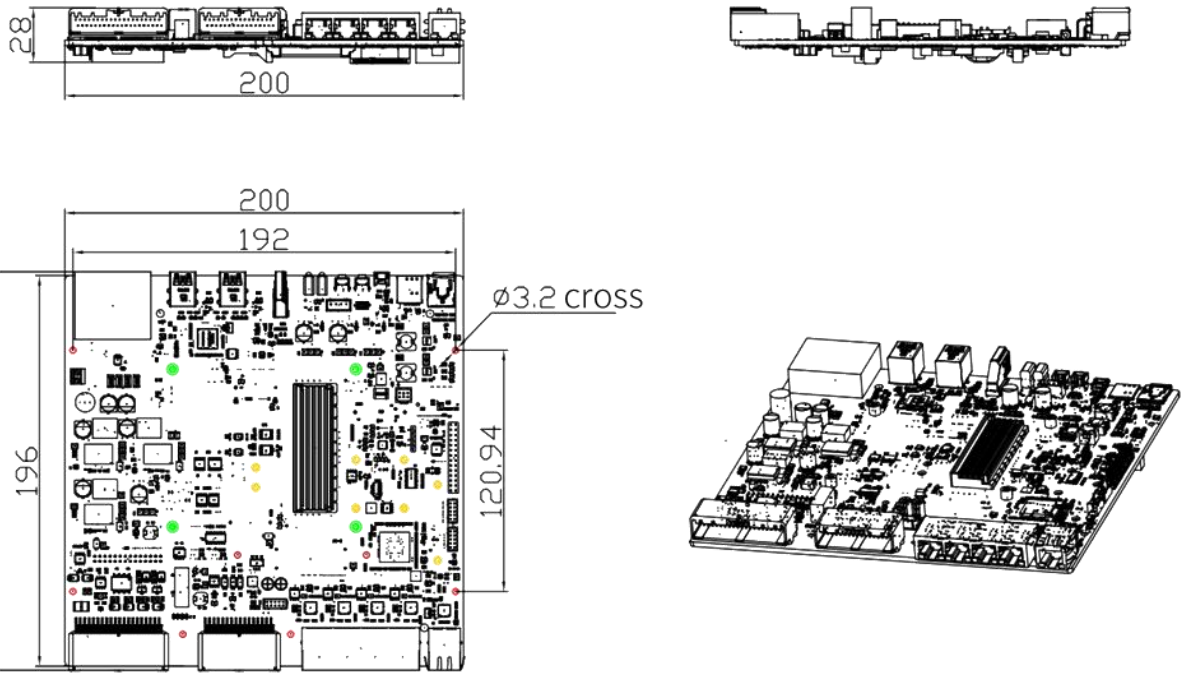
echo 456 > /sys/class/gpio/export //GPIO01

echo 485 > /sys/class/gpio/export //GPIO02

echo 1 or 0 > /sys/class/gpio/PR.01/value //GPIO01

echo 1 or 0> /sys/class/gpio/PZ.07/value //GPIO02

5 Product size



6 Hardware update history

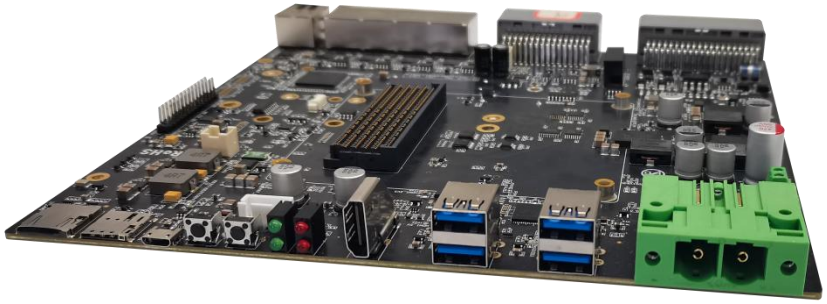
RTSO-2002 Board hardware update history

Version	Update description
v1.0	EVT version
v2.0	DVT version

Software package description

1 Installation and use

1.1 Picture of products



1.2 How to use the board

Before using the RTSO-2002 carrier board, you must verify that the Jetson AGX Orin core module is installed with the operating system loaded with Realtimes BSP.

a) Make sure all external system voltages are off

b) Install the Jetson AGX Orin core module onto the 699-Pin SO-DIMM connector. Ensure that the connectors are aligned with even force while installing the fixing screws.

c) Install necessary external cables. (e.g. Cable to HDMI display, power input cable to power system, USB cable to connect keyboard and mouse...)

d) Connect the power cord to the power supply.

e) RTSO-2002 adopts automatic power-on design, power on, and the system starts to work.

f) For a system without a protective cover, do not move the entire system after the system is powered on. Do not touch the circuit board or its electronic components with your body.

1.3 Recovery mode

Jetson AGX Orin core module can work in normal mode and Recovery mode. In Recovery mode, file system update, kernel update, boot loader update, BCT update and other operations can be performed.

To enter the Recovery mode, perform the following steps:

a) Power off the system.

b) Use a Micro-USB cable to connect the Micro-USB port (P7) of the Jetson AGX Orin to the Host(PC) to develop the host USB port.

c) Press the RECOVERY button to power on the system. Hold the power supply for more than 3 seconds, and then release the RECOVERY button.

d) When the system enters Recovery mode, you can perform subsequent operations.

2 Board Support Package (BSP)

When the RTSO-2002 board works on a system burned using the official NVIDIA Linux For Tegra

(L4T), most of the hardware interfaces do not work properly, and the full support of the RTSO-2002 on-board interface requires a supporting driver patch.

NVIDIA's original LT4 package can be downloaded from the following link:

https://developer.nvidia.com/embedded/linux-tegra

For the RTSO-2002 driver patch support package, contact Realtimes.

3 Other related introductions

3.1 Jetpack

Nvidia jetpack sdk is the most comprehensive solution for building AI applications. It includes software libraries and APIs, samples, developer tools and documentation for the latest and previous versions of Jetson products.

3.1.1 Jetpack Component summary

This section briefly introduces each component of JetPack. For more detailed information about these components, please refer to JetPack's online documentation.

OS Image

JetPack includes a reference file system derived from Ubuntu. (Development kit system, no need to install)

Libraries and APIs

JetPack library and API include:

•TensorRT and cuDNN for high-performance deep learning applications

•CUDA for multi-domain GPU accelerated applications

•NVIDIA Container Runtime for containerized GPU accelerated applications

•Multimedia API package for camera application and sensor driver development

•VisionWorks, OpenCV and VPI for visual computing applications

•Sample application

3.1.2 How to install Jetpack

Overview of process steps

Installing JetPack to your Jetson device requires you to perform the following steps:

1. Download and install the NVIDIA SDK Manager on the Linux host.
2. Connect your jetson device to the Linux host (Micro USB or network (same network segment).
3. Test your device can connect via ssh.
4. Use SDK Manager to select and install the required components.

Download and install the NVIDIA SDK Manager on the Linux host.

You must have a Linux host with internet access to run SDK Manager and refresh the developer kit. The supported host operating systems are:

Ubuntu Linux x64 Version 18.04 or 16.04

Download and install NVIDIA SDK Manager.

sdkmanager Installation package： **sdkmanager-[version].[build#].deb**

The current version is： **sdkmanager_1.2.0**

sdkmanager install

$ sudo apt install ./sdkmanager-[version].[build#].deb

Connect your jetson device to the Linux host

Prepare your Jetson device for the following settings. (If the equipment system is not initialized, the system user needs to initialize after power-on)

- Connect the monitor, keyboard and mouse to the Jetson Feiyun smart box device (please refer to the interface description above).
- Use a USB cable to connect the Linux host and the Micro USB OTG interface of the RTSO-3004 carrier board (or network (same network segment))
- During the setup process, SDK Manager will provide internet connection to your jetson device via Micro USB or network connection.
- Connect the supplied power adapter to the DC jack of the Jetson device and plug the AC port into an AC outlet.

Test that your device can connect via ssh.

If connected via Micro USB, enter lsusb under the Linux host terminal to see the nvidia crop

The device can be accessed through ping or ssh commands

$ ping 192.168.55.1

or

$ ssh <jetson_user>@192.168.55.1

If connected via a network, check whether the device ip address is in the same network segment as the Linux host on the Feiyun Smart Box, and the Feiyun Smart Box device can be accessed through the ping or ssh command.

$ ping <jetson_ip>

or

$ ssh <jetson_user>@<jetson_device_ip>

Use SDK Manager to select and install the required components

NVIDIA SDK Manager supports installing software to Jetson core (Flying Cloud Smart Box). For complete instructions, please refer to Chapter 5 of "Orin NX System Programming Manual".

3.2 Developer tools

JetPack includes the following development tools. Some are used directly on the Jetson system, and some run on a Linux host connected to the Jetson system.

• Application development and debugging tools

• NSight Eclipse version for GPU-accelerated application development: runs on a Linux host. All Jetson products are supported.

• CUDA-GDB for application debugging: Runs on a Jetson system or a Linux host. All Jetson products are supported.

• CUDA-MEMCHECK to debug application memory errors: run on Jetson systems. All Jetson products are supported.

• Application analysis and optimization tools

• NSight Systems for application multi-core CPU profiling: runs on a Linux host. Helps you improve application performance by identifying slow parts of your code. All Jetson products are supported.

• NVIDIA® Nsight™ compute kernel profiler: an interactive profiling tool for CUDA applications. It provides detailed performance metrics and API debugging through the user interface and command line tools.

• NSight Graphics for Graphics Application Debugging and Profiling: A consolegrade tool for debugging and optimizing OpenGL and OpenGL ES programs. Running on a Linux host. All Jetson products are supported.

3. 3 Documentation

Documents related to developers using JetPack include:

• JetPack Documentation
• VisionWorks Documentation
• Nsight Eclipse Edition Documentation
• CUDA-GDB Documentation
• CUDA-MEMCHECK Documentation
• TensorRT Documentation
• cuDNN Documentation
• CUDA Toolkit
• NVIDIA Container Runtime
• OpenCV Documentation
• Jetson Linux Multimedia API Reference
• Nsight Systems
• nvprof
• Visual Profiler
• Nsight Graphics
• Nsight Compute CLI
• VPI–Vision Programming Interface

Terms of Warranty

Important note

Each embedded product provided by Realtimes Technology is free from any defects in material and process,fully in line with the specifications officially issued by the original factory.

Realtimes Technology warranty covers the original products,If the parts configured by the dealer are out of order, please consult with the dealer to solve the problem. All the baseplate and core modules provided by Ruitai New Era (Beijing) Technology Co., Ltd. are guaranteed for 3 years, while the other peripherals are guaranteed for 1 year (life-long maintenance service is provided if the warranty period is beyond the warranty period).The warranty period starts from the date of delivery, for the products repaired within the warranty period, the repair parts shall be extended for 12 months.Unless notified by Realtimes Technology, the date of your original invoice shall be the date of shipment.

How do I get warranty services

If the product does not work properly, Please contact Realtimes Technology or dealer for warranty service, please show invoice when product warranty(this is the proof for you getting warranty service).

Warranty solution

When you ask for warranty service, please follow Realtimes Technology warranty process,You will need to receive your first diagnosis from a technicial engineer by phone or by email,at that time,we need you to cooperate with us to fill in all the questions on the RMA form provided by us. Once we accurately determine the cause of the fault and the location of the damage ,we will provide the charge list for the out of warranty products,which needs your confirmation.Realtimes Technology keep the right to repair or replace the products. If the product is replaced or repaired, the replaced faulty product or the repaired and replaced faulty parts will be returned to Realtimes Technology.

For products under warranty,the customer shall bear the freight when the product is returned to the manufacturer,Realtimes Technology will bear the ship cost of the products after maintenance.

The following conditions are not covered by the warranty terms

a) Improper installation, improper use, misuse and abuse of products(Overloading, for example).
b) Improper maintenance and storage（Such as fire, explosion, etc）or natural disasters（such as lightning stroke,earthquake,typhoon,etc）
c) Personal unauthorized changing the product(such as changing circuit characteristics, mechanical characteristics, software characteristics,Conformal coating).
d) Other failures which are clearly due to misuse(such as overvoltage,polarity reversal, the pin bent or broken,the wrong connection,drop damage,transportation damage,damage due to over operating temperature and so on).
e) The logo and part number on the product have been deleted or removed.
f) The product is out of warranty.

Special concerns

If the same fault multiple occurrence for the products,in order to find out the reason causing the problem,we will request the users to provide the specific documents or information of peripheral equipment,such as monitor,I/O boards,cables,power supply, diagram and structure of the system,etc.If such documents or information are not available,we have the right to refuse to perform the warranty, the repairments will be charged accordingly.

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