

RTSO-6002/E

Reference Manual

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Revision History

Revision	Date	Reason for change	Applicable hardware version
V1.0	2020-07	Initial release	V1.1



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 RTSO-6002E). 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: 010-84284669

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: 010-84284669

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 010-84284669 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.



Catalogue

1 ABSTRACT..... 6

 1.1 FEATURES..... 6

 1.2 ORDERING INFORMATION..... 7

2 CONNECTOR LOCATIONS..... 8

 2.1 FUNCTIONAL CONNECTOR..... 9

 2.2 BUTTON..... 9

3 INSTALLATION AND USE..... 10

 3.1 PICTURE OF PRODUCTS..... 10

 3.2 USAGE..... 10

 3.3 RECOVERY MODE..... 10

4 CONNECTORS DESCRIPTION..... 11

 4.1 MODULE INTERFACE..... 11

 4.2 FAN INTERFACE..... 11

 4.3 MICRO SIM & MICRO SD CARD SLOT..... 12

 4.4 MIPI CAMERA INTERFACE..... 12

 4.5 RTC BATTERY INTERFACE..... 13

 4.6 MINI PCIE SLOT..... 14

 4.7 POWER INTERFACE..... 15

 4.8 MINI HDMI..... 15

 4.9 ETHERNET..... 16

 4.10 USB..... 16

 4.11 OTG-USB2.0..... 17

 4.12 FUNCTION PIN..... 17

 4.13 UART & I2C..... 18

 4.14 SERIAL PORT..... 19

 4.15 SPI..... 19

 4.16 DIP SWITCH..... 20

5 HARDWARE UPDATE HISTORY..... 20

6 PRODUCT SIZE..... 21

7 SOFTWARE/BSP DETAILS..... 21

TERMS OF WARRANTY..... 22

1 Abstract

NVIDIA Jetson Nano and Xavier NX are NVIDIA's deep learning processors with powerful computing power and modules the size of a credit card. Mainly aimed at the rapid development of artificial intelligence market in recent years, such as unmanned aerial vehicle, automatic driving system, etc., has a relatively broad application prospect. Rtso-6002 /E is an industrial-grade load plate for Nano/Xavier NX, operating temperature -40°C -- $+80^{\circ}\text{C}$, low power consumption, high safety level, can meet all kinds of harsh conditions.

1.1 Features

- Compatible with nvidia Jetson Nano module and Xavier NX module
- 1x USB Type A , support usb2.0 and usb3.0 signal, 1A max output current
- 1x USB Type A , support usb2.0 signal only, 1A max output current
- 1x Micro USB, support usb host mode and usb device mode , 1A max output current
- 1x Gigabit Ethernet (10/100/1000Mbps Adaptive; Half duplex/full duplex adaptive; Native interface for Nano)
- 3.3V function port UART X 2, Debug UART X 1, I2C x 2, SPI X 1 and GPIO multiplexing
- 1x RTC battery interface
- 1x Mini- HDMI 2.0 (6Gbps, 24bpp, 4096x2160@60Hz)
- 1xMini-PCIe interface
- 2xMIPI interface
- 2xCAN 2.0 interface
- 1xFAN interface with PWM
- Size: 87mm×57mm×26.37mm
- Power input: +5V(Xavier NX power requirement +5V/10A)
- Temperature: $-40\sim+80^{\circ}\text{C}$
- Weight: 56g

1.2 Ordering Information

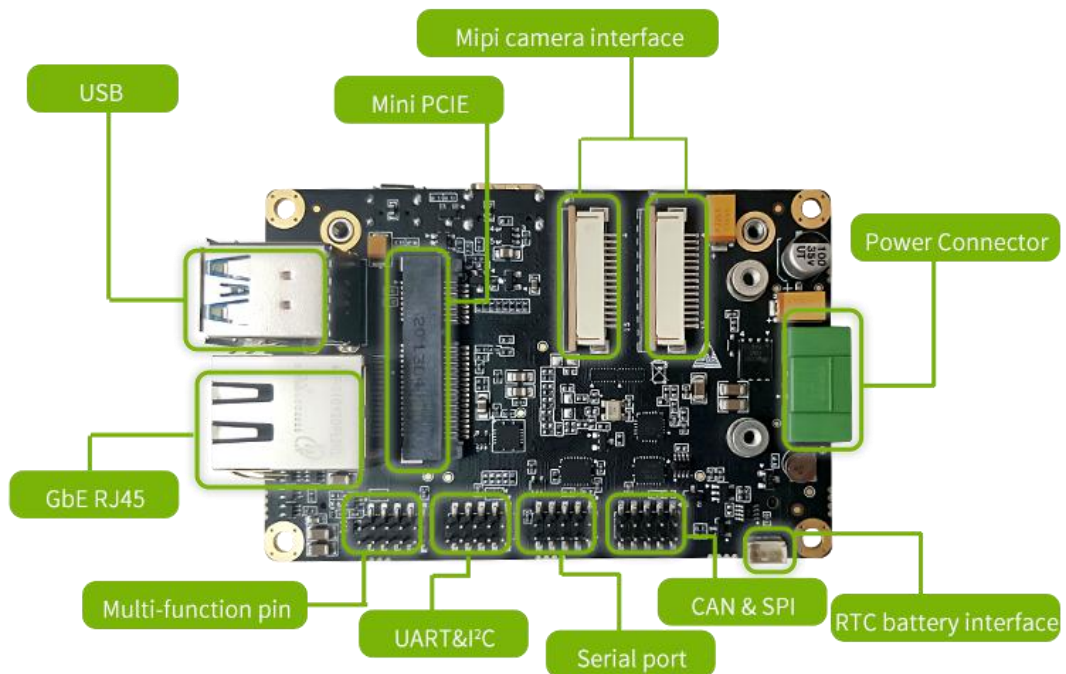
Model Options	Description
RTSO-6002	Jetson NANO/Xavier NX modules,1 X GbE,1 x Mini-PCIe,1x mini-HDMI,1 x MIPI CSI-2/2 Lane,1 x USB OTG, 1x USB 3.0,1 x USB 2.0,2 x I2C, 1X SPI,2 X CAN,2 X UART,12 X GPIOs(optional),4G module (optional),1 x Micro SIM,1 X Micro SD, with ROHS certification, provides RtSO-6002 /E Linux4Tegra software support package
RTSO-6002/E	Jetson NANO/Xavier NX modules,1 X GbE,1 x Mini-PCIe,1x mini-HDMI,1x MIPI CSI-2/2 Lane,1 x USB OTG, 1x USB 3.0,1 x USB 2.0,2 x I2C, 1X SPI,2 X CAN,2 X UART,12 X GPIOs(optional),4G module (optional), 1x Micro SIM,1 X eMMC,certified by ROHS, provides rtSO-6002 /E Linux4Tegra software support package
RTSO-6002-Cables(optional)	RTSO - 6002 / E wiring package
RTS-NANO-AC/DC(optional)	Rtso-6002/E(NANO)Special power adapter, 100-240VAC/5V/4A,20W
RTS-XavierNX-AC/DC(optional)	RTSO-6002/E(XavierNX) Special power adapter,100-240VAC/5V/10A,50W
RTS-NANO-HS02(optional)	Jetson NANO dedicated radiator
RTS-XavierNX-HS02(optional)	Jetson Xavier NX dedicated radiator
RPI Camera V2(optional)	Equipped with MIPI camera
RTS-RPV2-Cables(optional)	MIPI camera cable
Mini-pcie Video Capture Card (optional)	RTSV-6911i (8-channel D1 NTSC/PAL video input), RTSV-6901 (single-channel SDI video input), RTSV-6941 (single-channel HDMI Video Input)
M.2 transfer card (optional acquisition card for M.2 interface)	mini-PCIe To M.2 interface card
M.2 Video capture card (optional)	RTSV-6902 (dual-channel SDI video input), RTSV-6904 (four-channel SDI Video input)
ME909S-821(optional)	mini-PCIe Full netcom 4G module

Order online

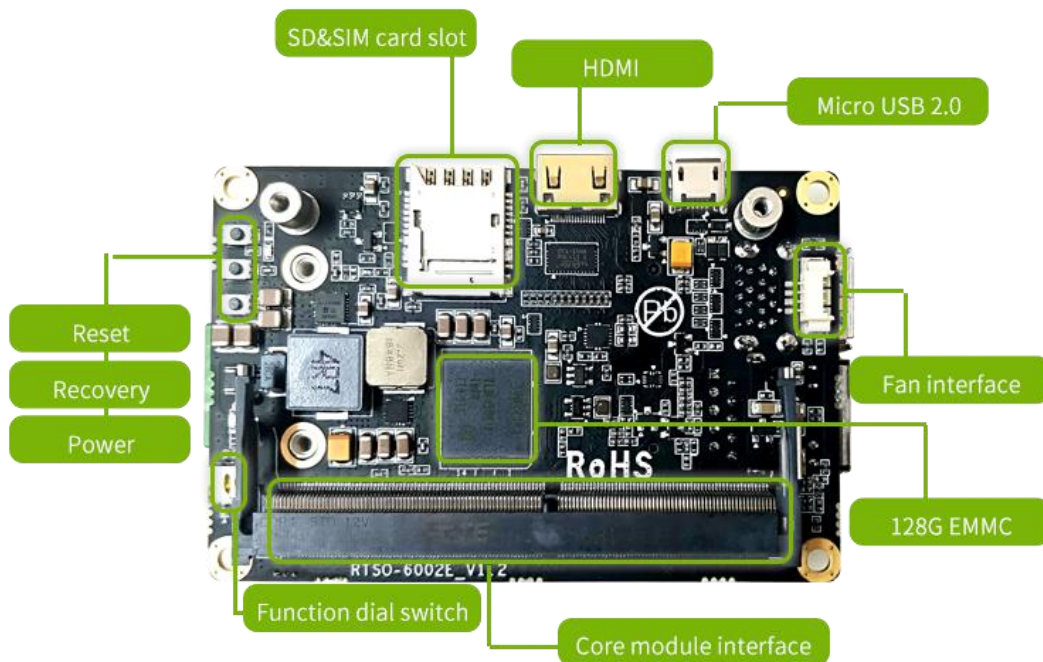
Taobao shops: <https://shop340963258.taobao.com>

Jingdong shops: <https://mall.jd.com/index-824786.html>

2 Connector Locations



RTSO-6002E-TOP SIDE



RTSO-6002E-BOTTOM SIDE

2.1 Functional connector

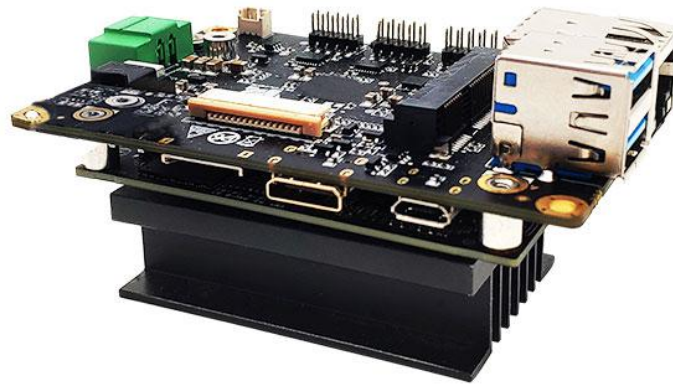
指示标识	功能描述
U1	260 Pin,Connect to the NVIDIA Jetson NANO/Xavier_NX core module
J14	Connect external cooling fans
J4	Micro SIM &Micro SD card slot
J8/J21	MiPi Camera interface
J16	RTC The battery pin
J6	Mini PCIE slot
J18	Power input terminal
J13	Ethernet connector
J2	USB connector
J7	Mini HDMI interface
J1	OTG USB 2.0 Micro Type-B interface
J20	Function button pin insertion
J11	UART && I2C
J12	Serial port pin
J10	SPI port pin
J3	Dial switch

2.2 Button

Marking	Function description
K1	POWER button is used for system shutdown and POWER on after soft shutdown
K2	RECOVERY button is used to put the core module into recovery mode
K3	RESET button is used to restart the core module

3 Installation and use

3.1 picture of products



3.2 usage

- a) Ensure that all external system voltages are switched off
- b) Install the Nano/Xavier NX core module on the 260 Pin SO-DIMM connector. Pay attention to the alignment between the connectors during the installation, apply even force, and install the fixing screws.
- c) Install necessary external cables. (e.g., the display cable to the HDMI display, the power input cable to power the system, the USB cable to link the keyboard and mouse...)
- d) Connect the power cord to the power supply.
- e) Rts0-6002 /E adopts automatic/manual power on design, turn on the power and the system starts to work.
- f) For the system without protective enclosure, please avoid moving the whole system after the system is powered on. It is strictly prohibited to use the body to touch the circuit board and its electronic components.

3.3 Recovery MODE


Jetson Nano core module can work in normal mode and Recovery mode, under which file system update, kernel update, Boot Loader update, BCT update and other operations can be performed.

The steps to enter the Recovery mode are as follows:


- a) Power down the device.
- b) use USB cable to connect otg-usb port (P4) of RTSO-6001B with Jetson to develop host USB port.
- c) Press the RECOVERY button without releasing it to power the system. The power supply should be maintained for more than 3 seconds, and then release the RECOVERY button.
- d) After the system enters the Recovery mode, subsequent operations can be carried out.

4 Connectors Description

4.1 module interface

Function	Connect NVIDIA Jetson Nano or Xavier NX core module	
Marking	U1	
Type	260 Pin DDR4 SO-DIMM	
Pin define	Refer to the pin definition instructions in the NVIDIA Jetson Nano or Xavier NX core module data book.	

4.2 Fan interface

Function	Connect external cooling fan															
Marking	J14															
Type	Molex PicoBlade Header															
Pin define	<table border="1"> <thead> <tr> <th>Pin</th> <th>Signal</th> <th>Pin</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>GND</td> <td>2</td> <td>+5V</td> </tr> <tr> <td>3</td> <td>TACH</td> <td>4</td> <td>PWM</td> </tr> </tbody> </table>					Pin	Signal	Pin	Signal	1	GND	2	+5V	3	TACH	4
Pin	Signal	Pin	Signal													
1	GND	2	+5V													
3	TACH	4	PWM													

4.3 Micro SIM & Micro SD card slot

Function	Micro SIM & Micro SD card slot			
Marking	J4			
Type	Micro SIM & Micro SD			
Pin define	Micro SIM card slot (substratum)			
	Pin	Signal	Pin	Signal
	1	SDIO_DATA2	2	SDIO_DATA3
	3	SDIO_CMD	4	SDIO_VCC
	5	SDIO_CLK	6	GND
	7	SDIO_DATA0	8	SDIO_DATA1
	9	GND	10	SDIO_CD
	Micro SD card slot (superstratum)			
	Pin	Signal	Pin	Signal
	T1	SDIO_DATA2	T2	SDIO_DATA3
	T3	SDIO_CMD	T4	SDIO_VCC
	T5	SDIO_CLK	T6	GND
	T7	SDIO_DATA0	T8	SDIO_DATA1
	T9	SDIO_CD		
	SIM card facing: notch facing inward			



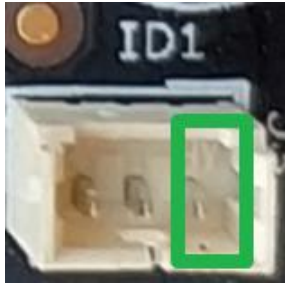
4.4 MiPi camera interface

Function	MiPi camera			
Marking	J8/J21			
Type	FPC connector			
Pin define	Pin	Signal	Pin	Signal
	1	GND	2	CON_CSI_A_D0_N
	3	CON_CSI_A_D0_P	4	GND
	5	CON_CSI_A_D1_N	6	CON_CSI_A_D1_P
	7	GND	8	CON_CSI_A_CLK_N
	9	CON_CSI_A_CLK_P	10	GND
	11	CON_CAM1_PWDN	12	CON_CAMA_MCLK
	13	CAM_I2C_SCL	14	CAM_I2C_SDA
	15	VDD_3V3	16	



4.5 RTC battery interface

Function	RTC battery pin			
Marking	J16			
Type	1.27mm Pitch 1x3Pin SIP			
Pin define	Pin	Signal	Pin	Signal
	1	GND	2	NC
	3	+3V	4	
Pin-1: The green box on the right .				




4.6 Mini PCIE slot

Function	Mini PCIE slot																																																																																																															
Marking	J6																																																																																																															
Type	Mini PCIE																																																																																																															
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51	NC	52	3.3V																																																																																																													




4.7 Power interface

Function	Power IN			
Marking	J18			
Type	3.5 mm			
Pin define	Pin		Signal	
	1	VCC (+)	2	GND (-)
	Pin-1: The green box on the right . Max in: single +5V Cable connection is strictly prohibited!			




4.8 Mini HDMI

Function	HDMI			
Marking	J7			
Type	Mini HDMI			
Pin define	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		



4.9 Ethernet

Function	Gigabit Ethernet			
Marking	J13			
Type	RJ45			
Pin define	Pin		Signal	
	1	TP0+	2	TP0-
	3	TP1+	4	TP2+
	5	TP2-	6	TP1-
	7	TP3+	8	TP3-
				

4.10 USB

Function	USB			
Marking	J2			
Type	Double USB Type-A			
Pin define	layer		top	
	Type		USB 3.0	
	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+		
	layer		bottom	
	Type		USB 2.0	
	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+		
				
<p style="color: red;">USB2.0 enable depends on the dialing switch 1 located at the OFF position</p>				

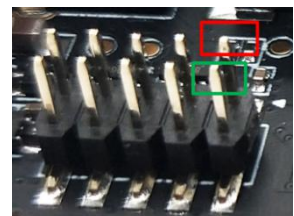
4.11 OTG-USB2.0

Function	USB2.0			
J1				
Type	USB 2.0 MicroType-B			
Pin define	Pin		Signal	
	1	VBUS	2	USB 2.0 D-
	3	USB 2.0 D+	4	USB ID
	5	GND		
	When usb-otg is in host mode, the USB ID Pin needs to float. When usb-otg is slave mode, USB ID Pin needs to be grounded.			



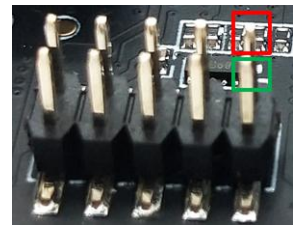
4.12 Function pin

Function	Function pin			
Marking	J20			
Type	2.0mm pitch 2x5Pin Dip			
Pin define	Pin		Signal	
	1	DEV_3V3	2	GND
	3	DEV_3V3	4	GND
	5	BUTTON_PWR_ON	6	GND
	7	FORCE_RECOVERY	8	GND
	9	PMIC_SYS_RST	10	GND
Pin-1: the mark in the red box on the right side of the picture. Pin-2: the mark in the green box of the picture on the right.				
Pin location: marked by the blue box on the right.				



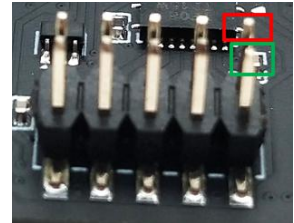
4.13 UART & I2C

Function	UART & I2C			
Marking	J11			
Type	2.0mm pitch 2x5Pin Dip			
Pin define	Pin	Signal	Pin	Signal
	1	GEN1_I2C_SCL	2	GEN2_I2C_SCL
	3	GEN1_I2C_SDA	4	GEN2_I2C_SDA
	5	DEV_3V3	6	DEV_3V3
	7	UART1_TXD_DBG	8	UART1_RXD_DBG
	9	GND	10	GND
<p>Pin-1: the mark in the red box on the right side of the picture. Pin-2: the mark in the green box of the picture on the right.</p> <p>Pin location: marked by the blue box on the right.</p> <p>UART1 Debug serial port, 3.3V TTL logic level The mapping file on the Linux system is ttyS0 in the /dev directory.</p> <p>The derived GEN1_I2C and GEN2_I2C buses correspond to the iic-1 and iic-0 buses in the Linux system.</p>				



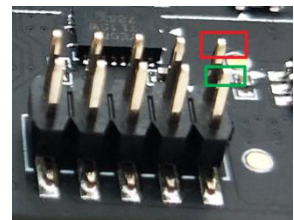
4.14 Serial port

Function	Serial port			
Marking	J12			
Type	2.0mm pitch 2x5Pin Dip			
Pin define	Pin	Signal	Pin	Signal
	1	UART2_RXD	2	UART2_TXD
	3	UART2_CTS	4	UART2_RTS
	5	UART3_RXD	6	UART3_TXD
	7	UART3_CTS	8	UART3_RTS
	9	DEV_3V3	10	GND
<p>Pin-1: the mark in the red box on the right side of the picture. Pin-2: the mark in the green box of the picture on the right.</p> <p>Pin location: marked by the blue box on the right.</p> <p>The two serial ports, UART2~ UART3, are both 3.3v TTL logic level. The mapping files for UART2 and UART3 on the Linux system are ttyTHS1 and ttyTHS2 in the /dev directory.</p>				

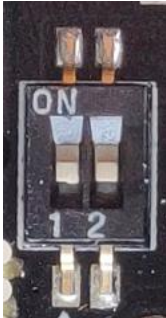


4.15 SPI

Function	SPI			
Marking	J10			
Type	2.0mm pitch 2x5Pin Dip			
Pin define	Pin	Signal	Pin	Signal
	1	CAN1_H	2	CAN0_H
	3	CAN1_L	4	CAN0_L
	5	SPI2_SCK	6	SPI2_MISO
	7	SPI2_MOSI	8	SPI2_CS0
	9	DEV_3V3	10	GND
<p>Pin-2: the mark in the red box on the right side of the picture. Pin-1: the mark in the green box of the picture on the right.</p> <p>Pin location: marked by the blue box on the right.</p> <p>The mapping files for SPI1 and SPI2 on Linux systems are spi0.0 and spi1.0 in the /dev directory.</p>				



4.16 Dip Switch

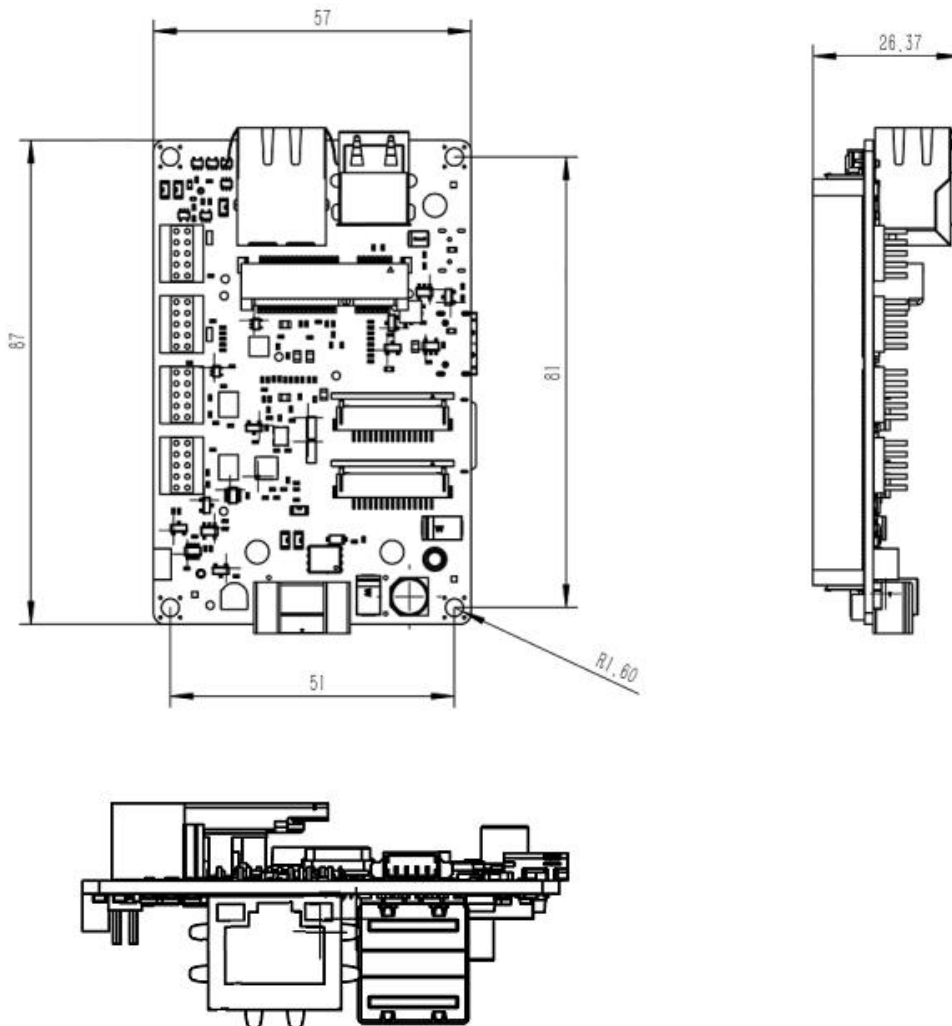
Function	Dip Switch			
Marking	J3			
Type	2BIT Dip Switch			
Pin define	bit	status	Fun	
	BIT1	OFF	default: enables USB2.0, Mini PCIE disables USB2.0	
		ON	disables USB2.0, Mini PCIE enables USB2.0	
	BIT2	OFF	default: enables Micro USB2.0 power supplies to carrier board	
ON		disables Micro USB2.0 power supplies to carrier board		
Pin define	bit	status	Fun	
	BIT1	OFF		
		ON		
	BIT2	OFF	default: Auto-PowerON	
ON		Manual-PowerON		

5 Hardware update history

RTSO-6002/E update history

Version	Reason for change
V1.0	Initial release

6 Product size



7 Software/BSP Details

Rtso-6002 /E boards work on systems that are burned using the official original NVIDIA Linux For Tegra (L4T). HDMI, Gigabit Ethernet, USB2.0, serial port, GPIO, I2C bus, fan interface, upper LAYER USB3.0 can be supported. But the SD card, the lower layer USB3.0 does not work properly.

Rtso-6002 /E onboard interface full support, need to load the supporting driver patch.

The NVIDIA Original LT4 package can be downloaded from the following link:

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

Rtso-6002 /E Driver Patch Support Package Download address:

[http:// www.realtimesai.com](http://www.realtimesai.com)



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 technical 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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