

X503N

Product Manual

Realtimes Beijing Technology Co., LTD.

Fax: +86 010-84284669 / 84280996

Email: info@realtimes.cn

Web Page: <https://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	Modified by
V1.0	2020.2	Initial release	V1.0	
V2.0	2020.6	Add notes and indicators	V1.0	
V2.1	2020.9	Modify interface information and add line package configuration	V1.0	RT0086
V2.2	2022-1-7	Add software version supporting instructions	V1.0	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 X503N). 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: 1 year (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 Product 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

X503N is a cloud intelligence box designed based on NVIDIA Jetson™ TX2. It integrates NVIDIA Jetson™ TX2 modules based on the brand new NVIDIA Pascal™ architecture. It comes with 256 NVIDIA CUDA cores and 64-bit ARM Cpus, with over 1 teraflop of data processing power.

X503N is equipped with 8GB LPDDR4 memory, 32GB eMMC storage, WiFi, Bluetooth, USB3.0, USB2.0, HDMI, serial port, gigabit network port, GPIO, microSD card socket, the system is an excellent platform for deep learning, computer vision, image processing and GPU computing. X503N adopts a strong aluminum alloy shell, conductive heat dissipation design, working temperature is: -25 -- +55°C

1.1 Features

- Compatible with nvidia Jetson TX2/TX2i/TX2 4GB module
 - ◆ GPU: NVIDIA Jetson™ TX2 256 core with NVIDIA Pascal™ architecture (1.3trillion floating-point operations per second)
 - ◆ CPU: 6-core 64-bit CPU (NVIDIA Jetson™ TX2)
 - ◆ Operating system: Linux pre-installed
 - ◆ Memory: 8GB LPDDR4
 - ◆ WiFi: IEEE 802.11ac
 - ◆ Bluetooth: Bluetooth 4.0 (24Mb / s)
 - ◆ Storage: Built-in 32GB eMMC, expandable TF card slot (up to 1TB SSD)
- 2 x USB3.0(5Gbps,1A max output current)
- 1 x Micro USB2.0(OTG) port
- 2 x CAN
- 2 x Serial port (1 x RS232, 1 x Debug RS232)
- 1 x Gigabit Ethernet
- 4 x GPIO compliance with 3.3V voltage level
- 1 x RTC port
- 1 x HDMI 2.0 (6Gbps, 24bpp, 4096x2160@60Hz)
- 1 x Micro SD card port
- 1 x I2C with 3.3V voltage level
- 1 x Fan port
- Size: 132.8mm×147.5mm×61mm
- Power input: +7V~+19V
- Temperature: -25°C~+55°C
- Operating humidity: 95% humidity without condensation
- Weight:480g

1.2 Ordering Information

Model Options	Functional Description
RTSS-X503N	TX2 Cloud Intelligence box, built-in Jetson TX2 module, pre-installed Ubuntu 18.04, built-in 32GB eMMC; 2 x USB 3.0, 1 x Micro USB 2.0, 1 x HDMI, 1 x GbE, 1 x Micro SD, 2 x RS232, 1 x 12C, 4 x GPIO, 2 x CAN,WIFI and Bluetooth; Power indicator light, power switch button, -25 -- +55°C; Including cable package(DB9 button*1, Micro USB to USB TYPE-A male system flash cable*1);Includes power adapter, provides Realtimes Linux4Tegra BSP, 3C&CE certification
RTS-TXX-AC/DC-PS	X503N Special power adapter,100-240VAC/12VDC,36W
RTS-TXX-AT01(optional)	2.4GHz/5GHz Dual-band BT&WIFI antenna
Me909s-821 (optional)	Mini PCIe LTE 4G module
RTSV-6911i (optional) Pro Capture Mini SDI (optional) Pro Capture Mini HDMI (optional)	Mini PCIe Video Capture Card ,RTSV-6911i (8-channel D1 NTSC/PAL video input), Pro Capture Mini SDI (single-channel SDI video input),Pro Capture Mini HDMI (single-channel HDMI Video Input)

Order online:

<https://shop340963258.taobao.com>

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

1.3 Wiring package configuration

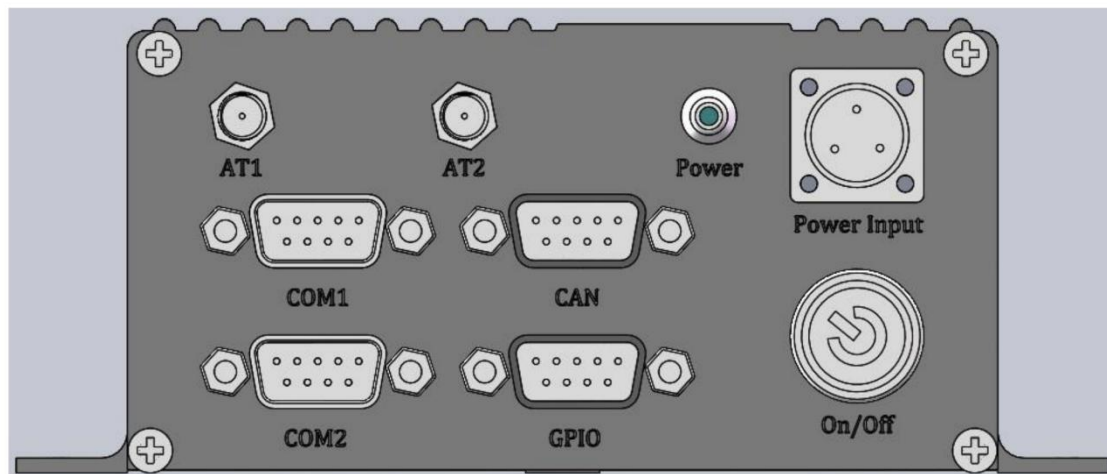
Component	Number	Functional Description
System flash cable	1	Micro USB to USB TYPE-A male system flash cable
DB9 button cable	1	DB9 button

Product specifications

1 External interface function and location



X503N FRONT

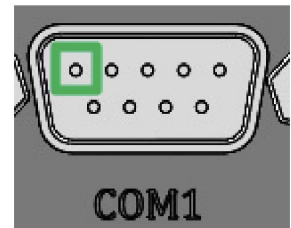


X503N BACK

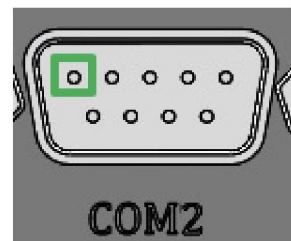
2 Connectors Description

2.1 Serial connector

Function	Serial port			
marking	COM1			
Type	DB9			
Pin define	Pin		Signal	
	1	NC	2	RXD1
	3	TXD1	4	NC
	5	GND	6	NC
	7	NC	8	NC
	9	NC		
	<p>Pin 1 location: The green frame on the right.</p> <p>The COM1 serial port that leads out is 3.3V RS232 logic level. The mapping file in the Linux system is ttyS0 in the /dev directory.</p> <p>COM1 defaults to the kernel debug serial port, which is used to output C-BOOT, U-BOOT, and Linux kernel information. After the Linux kernel is started, it is used as the serial port of the display terminal. TX1 / TX2 default serial port settings are: 115200bps, 8N1.</p>			



Function	Serial port			
marking	COM2			
Type	DB9			
Pin define	Pin		Signal	
	1	NC	2	RXD2
	3	TXD2	4	NC
	5	GND	6	NC
	7	NC	8	NC
	9	NC		
	<p>Pin 1 location: The green frame on the right.</p> <p>The COM2 serial port that leads out is 3.3V RS232 logic level. The mapping file in the Linux system is ttyTHS2 in the /dev directory.</p>			



2.2 GPIO and function button connectors

Function	GPIO and function button connectors			
marking	GPIO			
Type	DB9			
Pin define	Pin		Signal	
	1	RESET	2	POWER BUTTON
	3	RECOVERY	4	GND
	5	GND	6	GPIO8(GPO)
	7	GPIO9(GPO)	8	GPIO_EXP0_INT(GPI)
	9	GPIO_EXP1_INT(GPI)		
	Pin 1 location: The green frame on the right. The sysfs mapping numbers of the GPIO8, GPIO9, GPIO_EXP0_INT, and GPIO_EXP1_INT in the TX1 system are: 187, 186, 89, 202. The sysfs mapping numbers in the TX2 system are: 388, 298, 480, 486.			



2.3 CAN connectors

Function	CAN connectors			
marking	CAN			
Type	DB9			
Pin define	Pin		Signal	
	1	CAN1H	2	CAN1L
	3	CAN0H	4	CAN0L
	5	GND	6	NC
	7	NC	8	NC
	9	NC		
Pin 1 location: The green frame on the right. CAN bus interface function is not available when used with Jetson TX1 module.				

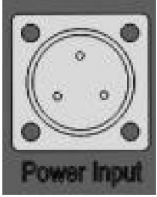


2.4 WiFi antenna connector


Function	WiFi antenna interface	
marking	AT1 AT2	
Type	ipex to sma female	



2.5 Power input port

Function	Power input port				
marking	Power Input				
Type	SF1213/S3				
Pin define	Pin	Signal	Pin	Signal	
	1	VIN+	2	VIN-	
	3	NC			
Input voltage range: +7V to +19V.					


2.6 Power switch button

Function	Power switch	
marking	On/Off	

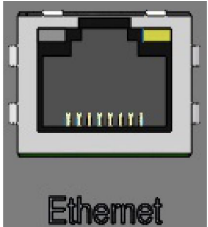
2.7 LED

Mandatory Sign	Functional Description	Status description
Power	Power indicator	Normally on - Power on


2.8 HDMI connector

Function	HDMI output interface	
marking	HDMI	
Type	HDMI connector	


2.9 Ethernet connector

Function	Gigabit Ethernet connector	
marking	Ethernet	
Type	RJ45	

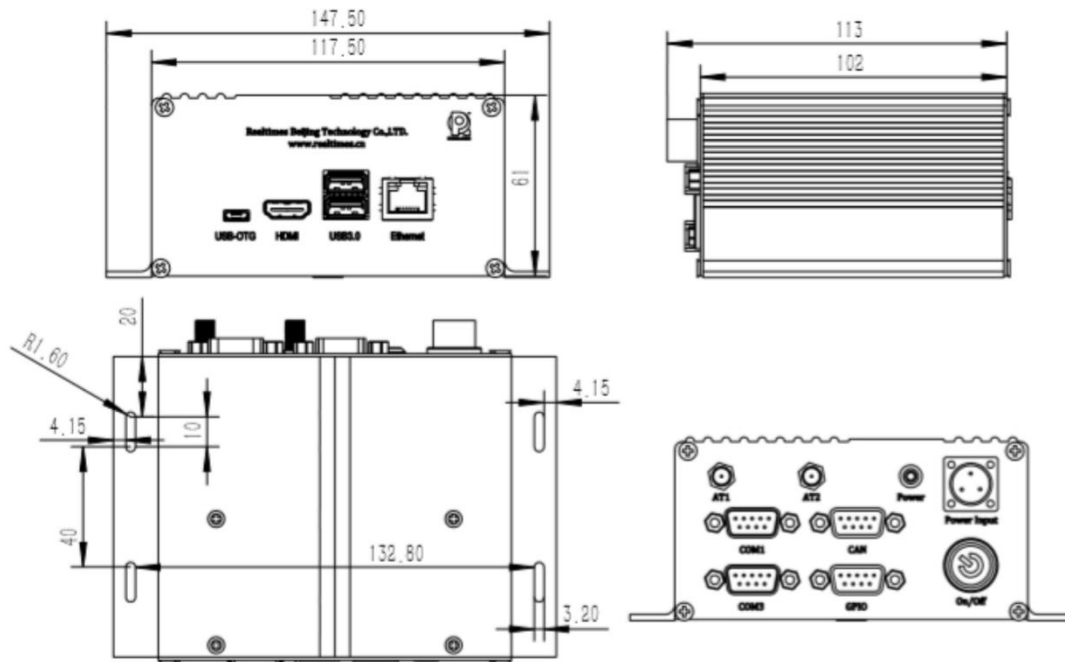
2.10 USB3.0 connector

Function	USB3.0 connectors	 <p>USB3.0</p>
marking	USB3.0	
Type	UBS3.0 Type-A	

2.11 OTG-USB2.0 connector

Function	USB2.0 connectors	 <p>USB-OTG</p>
marking	USB-OTG	
Type	UBS3.0 Micro Type-B	

3 Product size diagram



4 Hardware update history

X503N hardware update history

edition	Updata description
V1.0	Initial release

Software version supporting instructions

X503N is a complete product with Jetson TX2 module as the core. Provide developers with one-stop terminal equipment to assist developers in application development.

X503N Feiyun Smart Box supporting software includes:

- L4T (Linux for Tegra): L4T provides "OS" for your Feiyun Smart Box, including Linux kernel, boot loader, board support package (BSP) and sample file system. (By default, the pure system has been installed for the device, Jetpack needs to be installed by itself)
- Jetpack: Jetpack sdk is the most comprehensive solution for building AI applications. It includes software libraries and apis, examples, developer tools and documentation for the latest and previous versions of Jetson products.

1 use

1.1 Smart box power on and start

- a) Ensure that the voltage of all external systems is turned off
- b) Install necessary external cables. (Such as: the display cable connected to the HDMI display, the power input cable to power the system, the USB cable connecting the keyboard and mouse ...)
- c) Connect the power cord to a power source.
- d) X503N adopts manual power-on design. Turn on the power and the system starts to work.

1.2 Recovery Mode

Jetson TX2 core modules can work in normal mode and Recovery mode. In Recovery mode, you can perform file system update, kernel update, boot loader update, BCT update and other operations.

To enter Recovery mode:

- a) Turn off the system power supply.
- b) Use a USB cable to connect the Micro USB(OTG) port of the X503N and the USB port of the Host(PC) development host.
- c) Short-circuit the 3 and 5 pins of the GPIO connector to power the system. Keep the power supply for more than 3 seconds, and then disconnect the 3 and 5 pins of the GPIO connector.
- d) The system enters Recovery mode, and you can perform subsequent operations at this time.

2 L4T (Linux for Tegra Abbreviation“L4T”)

L4T provides "OS" for your Feiyun Smart Box, including Linux kernel, boot loader, board support package (BSP) and sample file system.

X503N Smart Box is working on a system burned with the official original version of NVIDIA Linux For Tegra (L4T). HDMI, Gigabit Ethernet, USB2.0, serial port, GPIO, SD card, I2C bus can all be supported. But Mini-PCIe, M.2, USB3.0, fan interface, etc. cannot work normally.

For all support of X503N smart box interface, the supporting driver patch (BSP: Board Support Package) needs to be loaded. Use the flash method to program the system. SDK Manager to install all other JetPack components except L4T to make your Feiyun Smart Box up and running quickly.

For system programming documentation, please refer to "[TX2 system programming instruction manual](#)"

L4T and BSP can be downloaded from [Ruitai Cloud Space](#), and L4T can also be downloaded directly from the L4T main page on the Jetson developer site.

Please contact sales for the user and password of Ruitai Cloud Space.

3 Jetpack

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

3.1 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

3.2 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 Micro USB cable to connect Linux host and Jetson Feiyun Smart Box (or network (same network segment))
- During the setup process, SDK Manager will provide Internet connection for your jetson Feiyun Smart Box via USB or network connection.
- Connect the supplied power adapter to the DC jack of the Feiyun Smart Box, and plug the AC interface into an AC power 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 "[TX2 System Programming Manual](#)".

3.3 Sample application

JetPack includes several examples that demonstrate the use of JetPack components. They are stored in the reference file system and can be compiled in the developer toolkit.

Component	Location
TensorRT	/usr/src/tensorrt/samples/
cuDNN	/usr/src/cudnn_samples_/
CUDA	/usr/local/cuda-/samples/
Multimedia API	/usr/src/tegra_multimedia_api/
VisionWorks	/usr/share/visionworks/sources/samples/ /usr/share/visionworks-tracking/sources/samples/ /usr/share/visionworks-sfm/sources/samples/
OpenCV	/usr/share/OpenCV/samples/
VPI	/opt/nvidia/vpi/vpi-/samples

3.4 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. Support all Jetson products.
- [CUDA-GDB](#) for application debugging: Run on Jetson system or Linux host. Support all Jetson products.
- [CUDA-MEMCHECK](#) debug application memory error: run on Jetson system. Support all Jetson products.

•Application analysis and optimization tools

- [NSight Systems](#) for application multi-core CPU evaluation: run on a Linux host. Helps you improve application performance by identifying the slower parts of the code. Support all Jetson products.
- [NVIDIA@Nsight™ compute](#) Kernel Analyzer: An interactive analysis tool for CUDA applications. It provides detailed performance indicators and API debugging through user interface and command line tools.
- [NSight Graphics](#) for graphics application debugging and evaluation: a consolegrade tool for debugging and optimizing OpenGL and OpenGL ES programs. Run on the Linux host. Support all Jetson products.

3.5 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 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 repairsments will be charged accordingly.

Rev.C 6/2020

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