VT-SBC-3399 Single Board Computer

User Manual

Version: 1.5

Revision History

No.	Version	Description	Date
1	V1.0	First release	Mar. 16, 2021
2	V1.1	Updated the Android system description	Aug. 17, 2021
3	V1.2	Added the debugging of the serial port	Mar. 15, 2022
4	V1.3	Updated the pinout description of the I^2C port as per the design change	Dec. 19, 2022
5	V1.4	Added Debian system description as per the design change (GEN 3)	May 23, 2023
6	V1.5	Added pinout description of eDP, power key connector, and buzzer connector, added firmware upgrade of Android system	Sep. 26, 2023

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Foreword

Thank you for purchasing VT-SBC-3399 single board computer ("the Board" or "the Product"). This manual intends to provide guidance and assistance necessary on setting up, operating or maintaining the Product. Please read this manual and make sure you understand the functionality of the Product before putting it into use.

Intended Users

This manual is intended for:

- Embedded software developer
- Custom development software engineer
- Other technically qualified personnel

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Disclaimer

While all information contained herein has been carefully checked to assure its accuracy in technical details and typography, Vantron does not assume any responsibility resulting from any error or features of this manual, nor from improper uses of this manual or the software.

It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without notice.

Technical Support and Assistance

Should you have any question about the Product that is not covered in this manual, contact your sales representative for solution. Please include the following information in your question:

- Product name and PO number;
- Complete description of the problem;
- Error message you received, if any.

Vantron Technology, Inc.

Address: 48434 Milmont Drive, Fremont, CA 94538
Tel: (650) 422-3128
Email: sales@vantrontech.com

Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.

	Caution for latent damage to system or harm to personnel
	Attention to important information or regulations

General Safety Instructions

The Product is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the Product, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the Product. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.
- Keep the Product away from heat source, such as heater, heat dissipater, or engine casing.
- Do not insert foreign materials into any opening of the Product as it may cause the Product to malfunction or burn out.
- To ensure proper functioning and prevent overheating of the Product, do not cover or block the ventilation holes of the Product.
- Follow the installation instructions with the installation tools provided or recommended.
- The use or placement of the operation tools shall comply with the code of practice of such tools to avoid short circuit of the Product.
- Cut off the power before inspection of the Product to avoid human injury or product damage.

Precautions for Power Cables and Accessories

⚠ Use proper power source only. Make sure the supply voltage falls within the specified range.

⚠ Place the cables properly at places without extrusion hazards.

⚠ There is a coin cell battery for powering the RTC. Therefore, please avoid short circuit of the battery during transportation or operation at high temperatures.

⚠ Cleaning instructions:

- Power off before cleaning the Product
- Do not use spray detergent
- Clean with a damp cloth
- Do not try to clean exposed electronic components unless with a dust collector

⚠ Power off and contact Vantron technical support engineer in case of the following faults:

- The Product is damaged
- The temperature is excessively high
- Fault is still not solved after troubleshooting according to this manual

⚠ Do not use in combustible and explosive environment:

- Keep away from combustible and explosive environment
- Keep away from all energized circuits
- Unauthorized removal of the enclosure from the device is not allowed
- Do not change components unless the power cable is unplugged
- In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

CHAPTER 1 INTRODUCTION

1.1 Product Overview

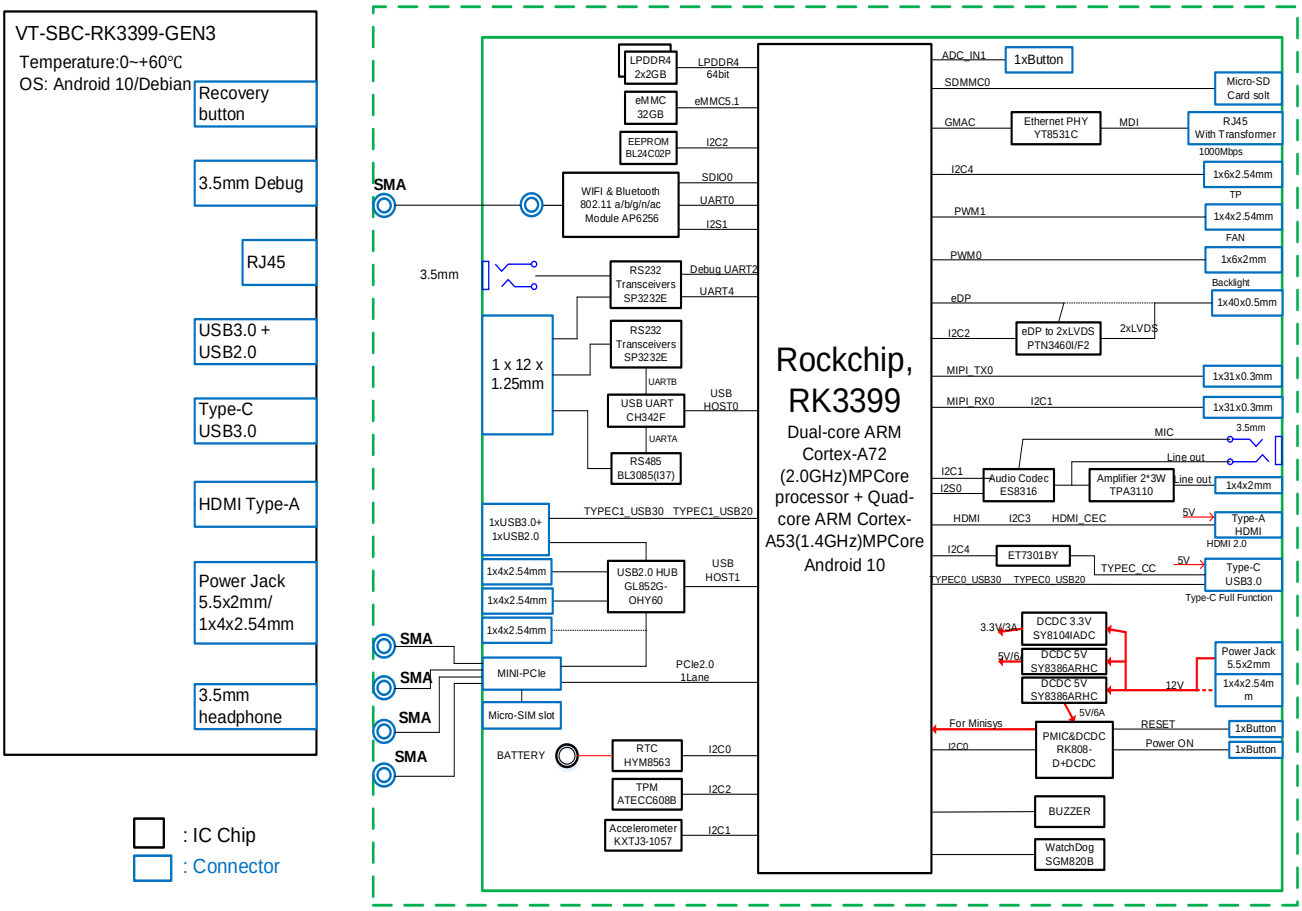
VT-SBC-3399 single board computer is based on Rockchip RK3399 processor that integrates dual-core Cortex-A72 and quad-core Cortex-A53 to provide optimized performance at lower power consumption. It supports high-quality video encoding and decoding to maximize display performance. With both wired and wireless network accesses available, user data is kept safe and secure in transmission. Meanwhile, the single board computer provides a complete set of on-board interfaces and customer expansion options to meet different application scenarios including smart retail, self-service terminals, industrial automation, intelligent medical health, and digital media.

Featuring high flexibility and high performance, the single board computer could work under extreme environments, making it a reliable industrial IoT solution.

1.2 Terminology/Acronym

Terminology/Acronym	Description
NC	No connection
VCC	Voltage common collector
GND	Ground
P (+)	Positive of difference signal
N (-)	Negative of difference signal
/	Active low signal
I	Input
O	Output
I/O	Input/output
P	Power or ground
A	Analog
OD	Open drain
CMOS	3.3V CMOS
LVCMOS	Low voltage CMOS
LVTTL	Low voltage TTL
CK/CLK	Clock
PWM	Pulse-width modulation
MISO	Master input slave output
MOSI	Master output slave input

1.3 Block Diagram



1.4 Specifications

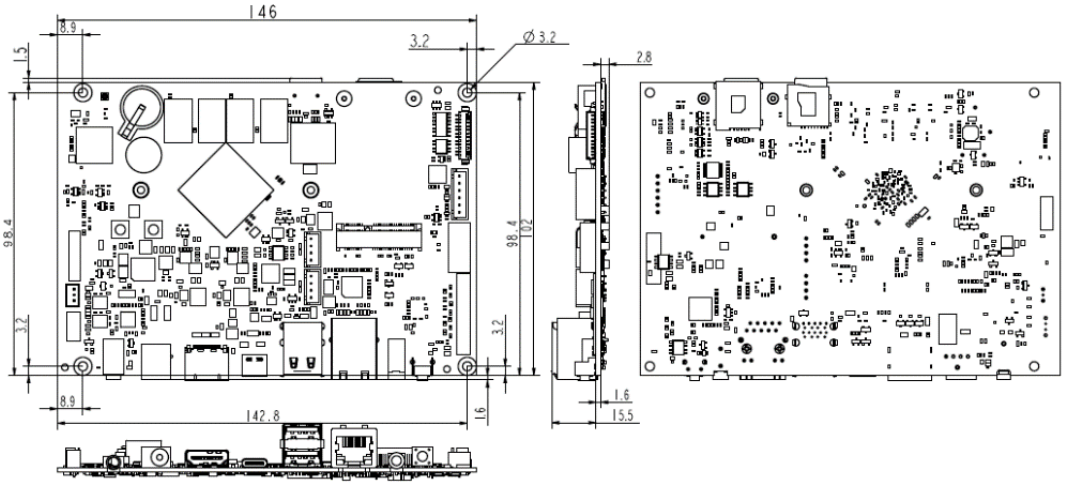
VT-SBC-3399			
System	CPU	Rockchip RK3399, dual-core ARM Cortex-A72 1.8GHz and quad-core ARM Cortex-A53 1.4GHz	
	GPU	Mali-T860MP4	
	Memory	4GB LPDDR4 (Optional: 2GB)	
	Storage	32GB eMMC 2Kb EEPROM	1 x Micro SD slot
Communication	Ethernet	1 x RJ45, 10/100/1000 Mbps	
	Wi-Fi & BT	Wi-Fi 802.11 a/b/g/n/ac + BT 5.0	
	4G LTE	Supported (Expansion by a mini PCIe slot)	
Media	Display	1 x HDMI, up to 4K @60Hz 1 x MIPI DSI, up to 1920 x 1080 @60Hz 1 x Dual LVDS, 1920 x 1080 @60Hz / 1 x 4-channel eDP, 2560 x 1600 @60Hz	
	Camera	1 x 4-Lane MIPI CSI, 5 MP, OV5640	
	Audio	1 x 3.5mm Combo audio jack	1x Speaker connector
I/Os	Serial	1 x RS485 2 x RS232	1 x RS232 for debugging
	USB	1 x USB 3.0 Host, Type-A 4 x USB 2.0 Host, Type-A	1 x USB 3.0 Type-C (OTG supported)
	Fan	1 x Fan connector	
	I^2C	1 x I^2C for TP	
	Buzzer	Supported	
	Debug	1 x Debug (3.5mm)	
	TPM	1 x TPM	
	RTC	Supported	
	WDT	Supported	
Expansion	Mini PCIe	1 x Mini PCIe for 4G LTE	
System Control	Button	1 x Power key	1 x Reset key
		1 x Recovery key	
	LED indicator	1 x Power indicator	
Power	Input	12V DC	1 x Power jack
Software	Operating system	Android, Linux	
	SDK	Available	
	Device management platform	BlueSphere MDM (Android device only)	
	OTA tool	BlueSphere OTA	
Mechanical	Dimensions	146mm x 102mm	
	Cooling mode	Fanless	
Environment Condition	Temperature	Operating: 0℃~+60℃	Storage: -40℃~+85℃
	Humidity	RH 5%-95% (Non-condensing)	

1.5 Operating System

VT-SBC-3399 supports Android and Debian operating systems.

1.6 Mechanical Dimensions

- 146mm x 102mm



1.7 Power Supply and Consumption

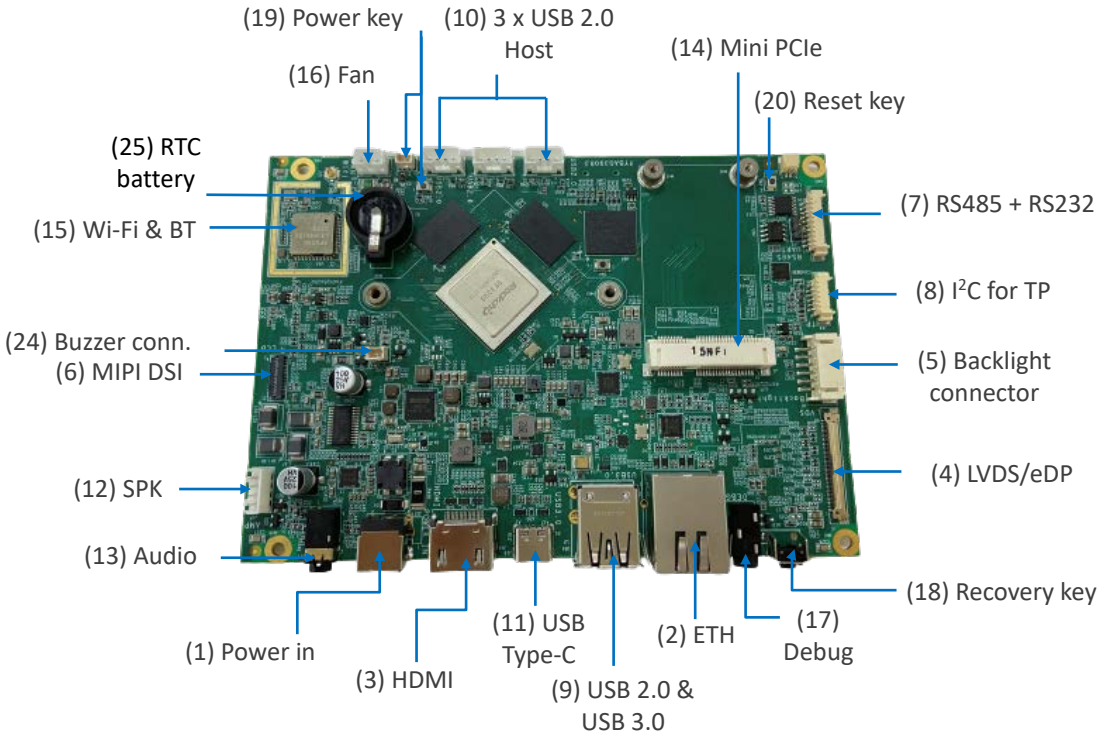
VT-SBC-3399 works at 12V DC power input supplied through a DC power jack.

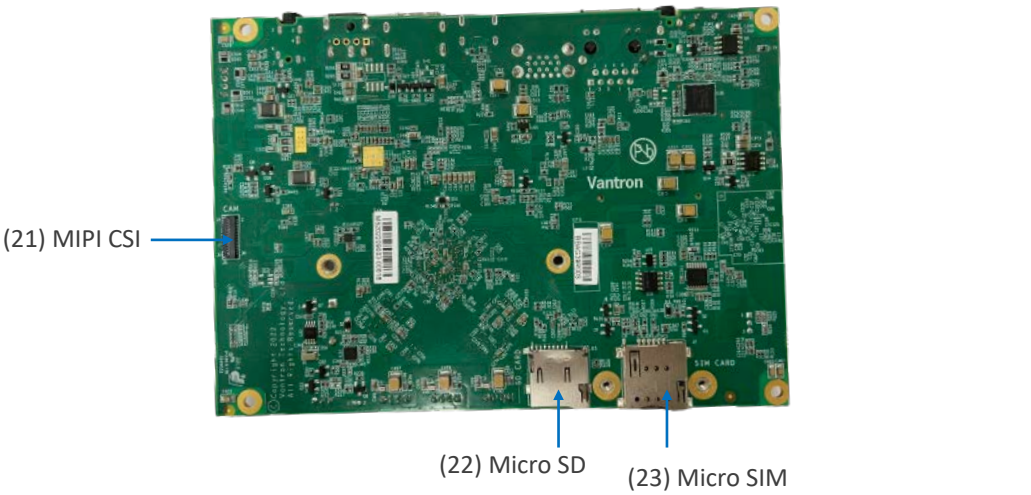
1.8 Environmental Specifications

VT-SBC-3399 works at a temperature ranging from 0℃ to +60℃ and at relative humidity of 5%-95% for non-condensing purpose. It is designed to be stored at a temperature ranging from -40℃ to +85℃.

CHAPTER 2 HARDWARE DESCRIPTION

2.1 Product Layout





The board I/Os will be described in detail in 2.4 Connectors and Jumpers following the sequencing numbers provided here.

2.2 Memory and Storage

2.2.1 LPDDR4 RAM

VT-SBC-3399 implements a 4GB LPDDR4 by default. Users also have the option of 2GB LPDDR4.

2.2.2 eMMC Flash

VT-SBC-3399 offers an eMMC 5.1 flash of 32GB, used as the default boot and storage device.

2.2.3 Micro SD Slot

VT-SBC-3399 also implements a Micro SD slot for expansion of RAM/storage capacity. It supports hot plug of the Micro SD card.

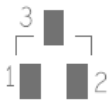
2.2.4 EEPROM

VT-SBC-3399 provides a 2Kb EEPROM to store hardware configuration information.

2.3 Identification of Pin 1

Unless otherwise stated, pin 1 of a connector is seated on a square pad that is different from the round pads used for other pins. Sometimes, pin 1 is next to a trigonal mark on the board. When there are two rows of pins on a connector, the row with pin 1 is composed of odd numbers and the other is composed of even numbers.

Usually, there will be numbers or marks next to the pins of a connector on the board to indicate the pinouts.



2.4 Connectors and Jumpers

This section is going to brief the connectors/jumpers on the Board with corresponsive pinout description.

2.4.1 J1 Power jack (1)

VT-SBC-3399 implements a power jack.

Specification: 5.5 x 2.1mm, adapter recommended: 12V/3A

2.4.2 J9 Ethernet jack (2)

VT-SBC-3399 implements one RJ45 Ethernet jack, supporting up to 1000Mbps of data transmission rate.

There are two link/activity LED indicators on the Ethernet jack. A solid green indicator means the network is functioning properly and a blinking amber indicator means there is data transmission.

2.4.3 J16 HDMI (3)

VT-SBC-3399 implements an HDMI Type-A interface that conforms to HDMI 2.0 standard, supporting resolution of up to 4K @60Hz. The pinout of this interface is in line with that of a standard HDMI 2.0 Type-A interface.

2.4.4 J5 LVDS/eDP (4)

VT-SBC-3399 implements a dual-channel LVDS connector for connection of a high-resolution display. It supports up to 1920 x 1080 @60Hz of resolution. Since the LVDS signal is converted from eDP signal, this connector is multiplexed as a 4-lane eDP connector that supports up to 2560 x 1600 @60Hz of resolution.

Specification: 1 x 40 x 0.5mm. To ensure the stability of the signal transmission, it is recommended that shielded twisted pair is used.

Pinout description of LVDS:

Pin	Name	Type	Description
1	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
2	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
3	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
4	NC		NC
5	LVDS_A_D0-	O	Channel A data lane 0 differential output -
6	LVDS_A_D0+	O	Channel A data lane 0 differential output +
7	GND	P	Ground
8	LVDS_A_D1-	O	Channel A data lane 1 differential output -
9	LVDS_A_D1+	O	Channel A data lane 1 differential output +
10	GND	P	Ground
11	LVDS_A_D2-	O	Channel A data lane 2 differential output -
12	LVDS_A_D2+	O	Channel A data lane 2 differential output +
13	GND	P	Ground
14	LVDS_A_CLK-	O	Channel A clock differential output -
15	LVDS_A_CLK+	O	Channel A clock differential output +
16	GND	P	Ground
17	LVDS_A_D3-	O	Channel A data lane 3 differential output -
18	LVDS_A_D3+	O	Channel A data lane 3 differential output +
19	NC		NC
20	LVDS_B_D0-	O	Channel B data lane 0 differential output -
21	LVDS_B_D0+	O	Channel B data lane 0 differential output +
22	GND	P	Ground
23	LVDS_B_D1-	O	Channel B data lane 1 differential output -
24	LVDS_B_D1+	O	Channel B data lane 1 differential output +
25	GND	P	Ground
26	LVDS_B_D2-	O	Channel B data lane 2 differential output -
27	LVDS_B_D2+	O	Channel B data lane 2 differential output +
28	GND	P	Ground
29	LVDS_B_CLK-	O	Channel B clock differential output -
30	LVDS_B_CLK+	O	Channel B clock differential output +
31	GND	P	Ground
32	LVDS_B_D3-	O	Channel B data lane 3 differential output -
33	LVDS_B_D3+	O	Channel B data lane 3 differential output +

34	PANEL_BKLTEN	O	LCD backlight enable output, 5V level (3.3V opt.)
35	PANEL_BKLTCTL	O	LCD backlight brightness control output, 5V level (3.3V opt.)
36	NC		
37	NC		
38	LCD_BLK	P	12V backlight power supply
39	LCD_BLK	P	12V backlight power supply
40	LCD_BLK	P	12V backlight power supply

Pinout description of eDP:

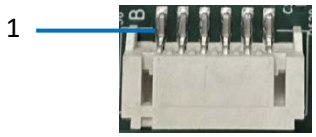
Pin	Name	Type	Description
1	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
2	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
3	LCD_VDD	P	5V power supply (def.), 3.3V (opt.)
4	NC		
5	EDP_TX0-	O	eDP data lane 0 differential output -
6	EDP_TX0+	O	eDP data lane 0 differential output +
7	GND	P	Ground
8	EDP_TX1-	O	eDP data lane 1 differential output -
9	EDP_TX1+	O	eDP data lane 1 differential output +
10	GND	P	Ground
11	EDP_TX2-	O	eDP data lane 2 differential output -
12	EDP_TX2+	O	eDP data lane 2 differential output +
13	GND	P	Ground
14	EDP_TX3-	O	eDP data lane 3 differential output -
15	EDP_TX3+	O	eDP data lane 3 differential output +
16	GND	P	Ground
17	EDP_AUXN	O	eDP AUX differential output -
18	EDP_AUXP	O	eDP AUX differential output +
19	NC		
20	NC		NC
21	NC		NC
22	GND	P	Ground
23	NC		NC
24	NC		NC

25	GND	P	Ground
26	NC		NC
27	NC		NC
28	GND	P	Ground
29	NC		NC
30	NC		NC
31	GND	P	Ground
32	NC		NC
33	NC		NC
34	PANEL_BKLTEN	O	LCD backlight enable output, 5V level (3.3V opt.)
35	PANEL_BKLTCTL	O	LCD backlight brightness control output, 5V level (3.3V opt.)
36	NC		NC
37	NC		NC
38	LCD_BLK	P	12V backlight power supply
39	LCD_BLK	P	12V backlight power supply
40	LCD_BLK	P	12V backlight power supply

2.4.5 J15 Backlight connector (5)

VT-SBC-3399 offers a backlight connector that is designed to connect a backlight to increase readability of the LCD in low light conditions.

Specification: 1 x 6, 2.0mm.



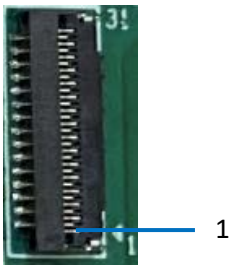
Pinout description:

Pin	Name	Type	Description
1	LCD_BLK	P	12V backlight power supply
2	LCD_BLK	P	12V backlight power supply
3	PANEL_BKLTEN	O	LCD backlight enable output, 5V level (3.3V opt.)
4	PANEL_BKLTCTL	O	LCD backlight brightness control output, 5V level (3.3V opt.)
5	GND	P	Ground
6	GND	P	Ground

2.4.6 J16 MIPI DSI (6)

VT-SBC-3399 implements a MIPI DSI connector supporting up to 1920 x 1080 @60Hz of resolution.

Specification: 1 x 31, 0.3mm



Pinout description:

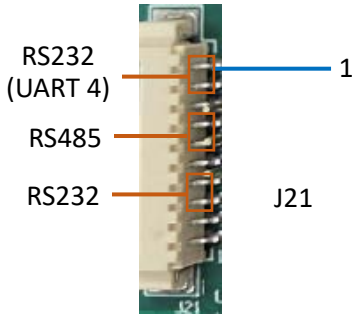
Pin	Name	Type	Description
1	VCC_LED0_A_MIPI	P	LED anode
2	VCC_LED0_A_MIPI	P	LED anode
3	VCC_LED0_A_MIPI	P	LED anode
4	NC		NC
5	VCC_LED0_K_MIPI	P	LED cathode
6	VCC_LED0_K_MIPI	P	LED cathode
7	VCC_LED0_K_MIPI	P	LED cathode
8	VCC_LED0_K_MIPI	P	LED cathode
9	GND	P	Ground
10	GND	P	Ground
11	MIPI_TX0_D2P	O	MIPI TX data lane 2 differential output +
12	MIPI_TX0_D2N	O	MIPI TX data lane 2 differential output -
13	GND	P	Ground
14	MIPI_TX0_D1P	O	MIPI TX data lane 1 differential output +
15	MIPI_TX0_D1N	O	MIPI TX data lane 1 differential output -
16	GND	P	Ground
17	MIPI_TX0_CLKP	O	MIPI clock differential output +
18	MIPI_TX0_CLKN	I/O	MIPI clock differential output -
19	GND	P	Ground
20	MIPI_TX0_D0P	O	MIPI TX data lane 0 differential output +
21	MIPI_TX0_D0N	O	MIPI TX data lane 0 differential output -
22	GND	P	Ground
23	MIPI_TX0_D3P	O	MIPI TX data lane 3 differential output +
24	MIPI_TX0_D3N	O	MIPI TX data lane 3 differential output -
25	GND	P	Ground
26	NC		NC
27	LCM_RST	O	MIPI LCD reset signal, 1.8V
28	NC		NC
29	VCC1V8_LCD	P	1.8V power output
30	VCC3V3_S0	P	3.3V power output
31	VCC3V3_S0	P	3.3V power output

2.4.7 J21 RS232 & RS485 (7)

VT-SBC-3399 offers 2 RS232 connectors and 1 RS485 connector. One RS232 connector (UART4) has its signal derived from the CPU, mapped as /dev/ttyS4 in the software system. The other RS232 connector and RS485 connector are expanded from an independent chipset, mapped as /dev/ttyACM1 and /dev/ttyACM0, respectively. JP1 is for connection of a 120Ω termination resistor for RS485.

J21 specification: 1 x 10, 1.25mm

JP1 specification: 1 x 3, 2mm



J21 pinout description:

Pin	Name	Type	Description
1	UART4_T	O	RS232_1 data output
2	UART4_R	I	RS232_1 data input
3	GND	P	Ground
4	RS485_A	I/O	RS485 Bus2 I/O port, A
5	RS485_B	I/O	RS485 Bus2 I/O port, B
6	GND	P	Ground
7	UARTB_T	O	RS232_2 data output
8	UARTB_R	I	RS232_2 data input
9	GND	P	Ground
10	NC		NC

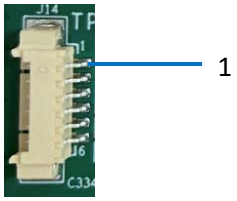
JP1 pinout description:

Pin	Name	Type	Description
1	485_A_1		RS485 Bus1 I/O port A, connecting 120Ω resistor
2	485_B_1		RS485 Bus1 I/O port B
3	NC		NC

2.4.8 J14 I²C connector (8)

VT-SBC-3399 implements an I²C connector to connect a touch panel.

Specification: 1 x 6, 1.25mm



Pinout description:

Pin	Name	Type	Description
1	VCC3V0_TOUCH	P	3.0V power output
2	I2C4_SCL_TP	O	I2C clock, 3.0V level
3	I2C4_SDA_TP	I/O	I2C data, 3.0V level
4	RS485_A	I/O	RS485 Bus2 I/O port A
5	TOUCH_INT_L	O	TP interruption, 3.0Vlevel
6	GND	P	Ground

2.4.9 U2 USB 2.0 Type-A & USB 3.0 Type-A (9)

VT-SBC-3399 implements a USB 2.0 Type-A and a USB 3.0 Type-A that are stacked in layers to connect peripherals.

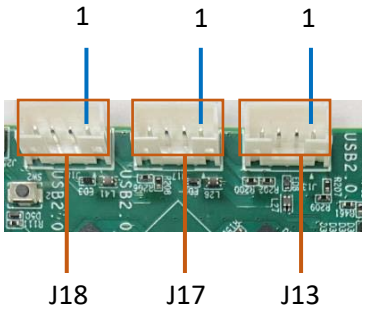
The maximum output of USB 3.0 Type-A is 5V/1A, and the maximum output of USB 2.0 Type-A is 5V/0.5A.

The pinout of the interfaces is in line with the pin assignment of standard USB 2.0 Type-A and USB 3.0 Type-A.

2.4.10 J13/J17/J18 USB 2.0 Host connectors (10)

VT-SBC-3399 has 3 USB 2.0 HOST connectors. J13 is designed not to be used simultaneously with the USB 2.0 interface of the Mini-PCIe socket.

Specification: 1 x 4, 2.0mm. The maximum output of each connector is 5V/0.5A.



J13 Pinout description:

Pin	Name	Type	Description
1	HUB20_HOST4	P	5V power output, current limit 0.5A
2	USBH4-		USB host data -
3	USBH4+		USB host data +
4	GND	P	Ground

J17 Pinout description:

Pin	Name	Type	Description
1	HUB20_HOST3	P	5V power output, current limit 0.5A
2	USBH3-		USB host data -
3	USBH3+		USB host data +
4	GND	P	Ground

J18 Pinout description:

Pin	Name	Type	Description
1	HUB20_HOST2	P	5V power output, current limit 0.5A
2	USBH2-		USB host data -
3	USBH2+		USB host data +
4	GND	P	Ground

2.4.11 J19 USB 2.0 Type-C (11)

VT-SBC-3399 offers a USB 2.0 Type-C interface that supports USB 3.0 OTG and DP 1.2 display output. The maximum output of this interface is 5V/1A.

2.4.12 J12 Speaker connector (12)

VT-SBC-3399 offers a left/right speaker connector to connect external speakers (2 x 5W).

Specification: 1 x 4, 2.0mm

Pinout description:

Pin	Name	Type	Description
1	OUTL-	O	Left speaker output -
2	OUTL+	O	Left speaker output +
3	OUTR-	O	Right speaker output -
4	OUTR+	O	Right speaker output +

2.4.13 J11 Audio jack (13)

VT-SBC-3399 implements a 3.5mm audio jack, supporting 4-section headphones.

2.4.14 J3 Mini PCIe (14)

VT-SBC-3399 implements a Mini PCIe socket, supporting USB 2.0 for 4G module expansion or PCIe 2.0 x 1 for 5G module expansion.

The pinout of the socket is in line with the pin assignment of standard Mini PCIe socket.

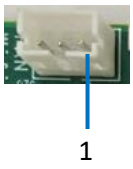
2.4.15 U43 Wi-Fi and Bluetooth (15)

VT-SBC-3399 implements an AP6256 combo SiP module, combining Wi-Fi 802.11 a/b/g/n/ac and Bluetooth 5.0. The Wi-Fi interface employs SDIO2.0/SDIO 3.0, and the Bluetooth uses UART for communication. There is an antenna interface next to the module for connecting the Wi-Fi & Bluetooth antenna.

2.4.16 J20 Fan connector (16)

VT-SBC-3399 implements a fan connector. The rotating speed of the fan depends on the temperature of the CPU and is controlled by pin PWM1. It is recommended that the power of the fan is less than 6W (12V/0.5A).

Specification: 1 x 3, 2mm



Pinout description:

Pin	Name	Type	Description
1	FAN_12V	P	12V power output, current limit 0.5A
2	FAN_PWM	O	PWM output, voltage domain 5V
3	GND	P	Ground

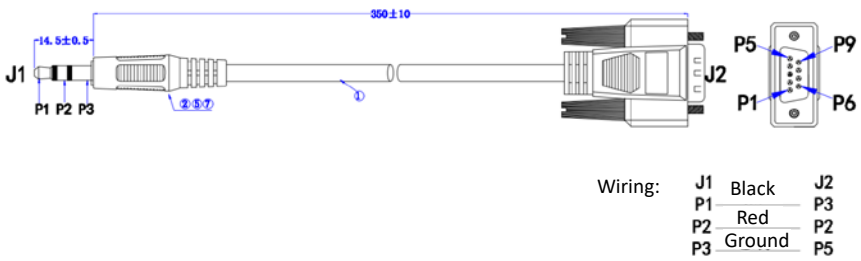
2.4.17 J4 Debug port (17)

The debug port is a 3-section 3.5mm headphone jack.

Pinout description:

Pin	Name	Type	Description
1	GND	P	Ground
2	RS232_TX	O	RS232 data output, default baud rate 115200bps
3	RS232_RX	I	RS232 data input, default baud rate 115200bps

Please use a DB9 to 3.5mm adapter cable to connect the Board and the host computer before debugging. You are recommended to use the self-made adapter cable (YC1083R035) with description as follows:



The pins of the debug port correspond to that of the adapter cable as follows:

J4 (debug port)	J1 (audio end of the adapter cable)
GND	P3
RS232_RX	P1
RS232_TX	P2

2.4.18 SW1 Recovery key (18)

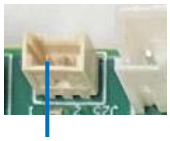
A short press of the Recovery key may increase the volume. Pressing and holding the Recovery key while briefly pressing the Reset key will restart the Board in Loader mode.

2.4.19 SW2 Power key (19)

The Power key acts as both the on/off key and the sleep/wakeup key. To put the board to sleep or wake it up, simply press the Power key briefly. To shut down the board, press and hold the Power key for approximately 7 seconds after the board has been powered on. To power the board back on after it has been shut down, press and hold the Power key for approximately 3 seconds.

J25 Power key connector (19)

There is a power key connector next to the power key for connecting an external power key that has the same functionality as the power key mentioned above.



Pinout description:

Pin	Name	Type	Description
1	PWRON	I	Power key control input
2	GND	P	Ground

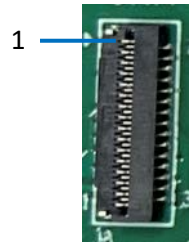
2.4.20 SW3 Reset key (20)

A short press of the Reset key will restart the Board.

2.4.21 J8 MIPI CSI (21)

VT-SBC-3399 implements a MIPI DSI interface for connecting a camera.

Specification: 1 x 31, 0.3mm



Pinout description:

Pin	Name	Type	Description
1	GND	P	Ground
2	MIPI_RX0_D3N	I	MIPI differential RX data lane 3 input -
3	MIPI_RX0_D3P	I	MIPI differential RX data lane 3 input +
4	GND	P	Ground
5	MIPI_RX0_D2N	I	MIPI differential RX data lane 2 input -
6	MIPI_RX0_D2P	I	MIPI differential RX data lane 2 input +
7	GND	P	Ground
8	MIPI_RX0_D1N	I	MIPI differential RX data lane 1 input -
9	MIPI_RX0_D1P	I	MIPI differential RX data lane 1 input +
10	GND	P	Ground
11	MIPI_RX0_D0N	I	MIPI differential RX data lane 0 input -
12	MIPI_RX0_D0P	I	MIPI differential RX data lane 0 input +
13	GND	P	Ground
14	MIPI_RX0_CLKN	I	MIPI differential RX clock -
15	MIPI_RX0_CLKP	I	MIPI differential RX clock +
16	GND	P	Ground
17	I2C1_SCL_CAM	O	I2C serial clock, voltage domain 1.8V
18	I2C1_SDA_CAM	I/O	I2C serial data, voltage domain 1.8V
19	MIPI_CAM_RST	O	Camera reset, voltage domain 1.8V
20	MIPI_CAM_PWN	O	Camera power down output, voltage domain 1.8V
21	GND	P	Ground
22	MIPI_MCLK	O	Camera master clock output, voltage domain 1.8V
23	GND	P	Ground
24	NC		
25	VCC1V8_DVP	P	1.8V power output

26	VCC1V8_DVP	P	1.8V power output
27	VCC1V5_DVP	P	1.5V power output, adjustable via HW
28	VCC2V8_DVP_AF	P	2.8V motor power output
29	VCC2V8_DVP	P	2.8V power output
30	NC		
31	GND	P	Ground

2.4.22 J15 Micro SD slot (22)

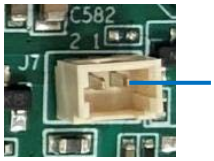
VT-SBC-3399 implements a Micro SD card slot on the back, supporting SD/MMC interface. The Micro SD card can be used as mobile storage and it supports Micro SD card hot plugging.

2.4.23 J2 Micro SIM slot (23)

VT-SBC-3399 implements a Micro SIM card slot, supporting Micro SIM card hot plug.

2.4.24 J7 Buzzer connector (24)

There is a buzzer connector on the Board that is designed to connect a buzzer. The buzzer is set to beep when the system has booted up successfully. Users can enable/disable the buzzer with commands.



Pinout description:

Pin	Name	Type	Description
1	Buzzer+	I/O	Buzzer +, 5V level
2	Buzzer-	I/O	Buzzer -

2.4.25 B1 RTC battery socket (25)

The Board features an RTC battery socket which is designed to hold a coin cell battery (not rechargeable, 3V recommended) to power the RTC.

CHAPTER 3 ANDROID SYSTEM MANUAL

Prerequisites:

- VT-SBC-RK3399
- A Windows host computer
- Software release package of VT-SBC-RK3399
- A USB mouse, keyboard, and monitor for connecting the Board for easier operation
- A 12V adapter for booting the Board
- A USB Type-A to Type-C cable for connecting the Board and the host computer

3.1 Enable Developer Options

To enable Developer options of VT-SBC-3399, follow the steps below:

1. Connect the Board to a mouse, a keyboard, and a display for easier operations;
2. After the system has booted, swipe up to access the application drawer;
3. Click **Settings** > **About <device>** in sequence;
4. Scroll down to **Build number**, and click it consecutively for at least 7 times to enable **Developer options**;
5. Go back to **Settings > System > Advanced > Developer options** and toggle on **USB debugging**, then you can customize the Board settings.

Depending on the Android version, the entry might vary slightly.

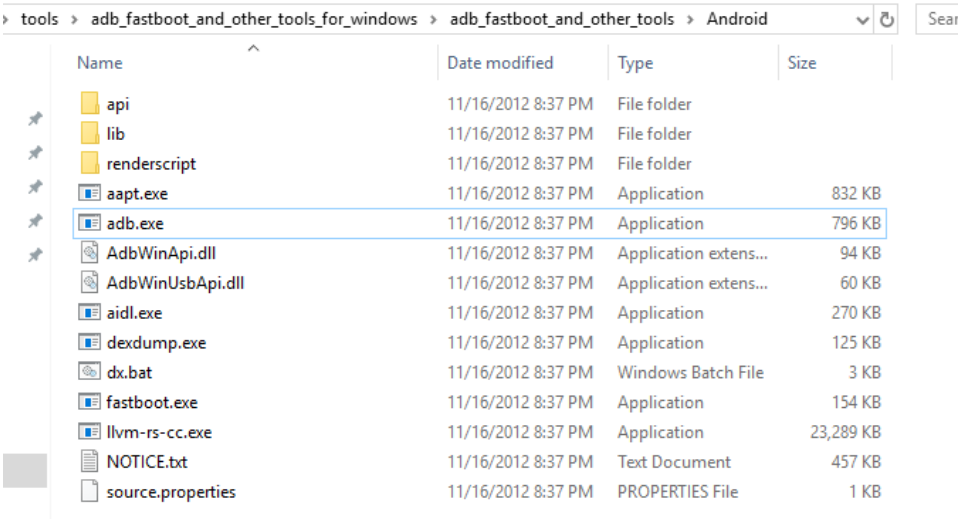
3.2 ADB Setup on the Windows Host

Android Debug Bridge (ADB) is a tool that is designed to connect your development workstation directly to your Android device for debugging, device upgrading, app installation, etc.

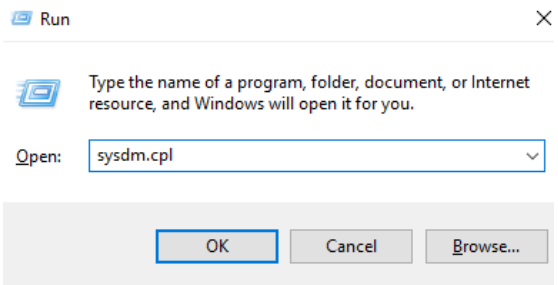
Adding the ADB executable file to the system's environment variable allows you to run the ADB tool regardless of your current working directory.

Follow the steps below to set up the ADB on the Windows host computer.

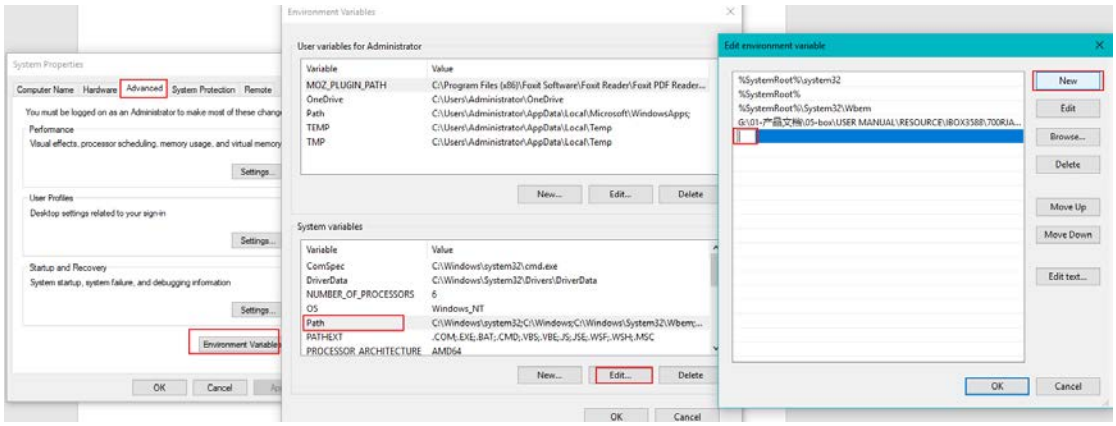
1. Unzip the software release package and navigate to the following directory: \SW\tools;
2. Extract the **adb_fastboot_and_other_tools_for_windows** zip file;
3. Navigate to the **Android** folder that contains the ADB tool kit, and copy the folder path;



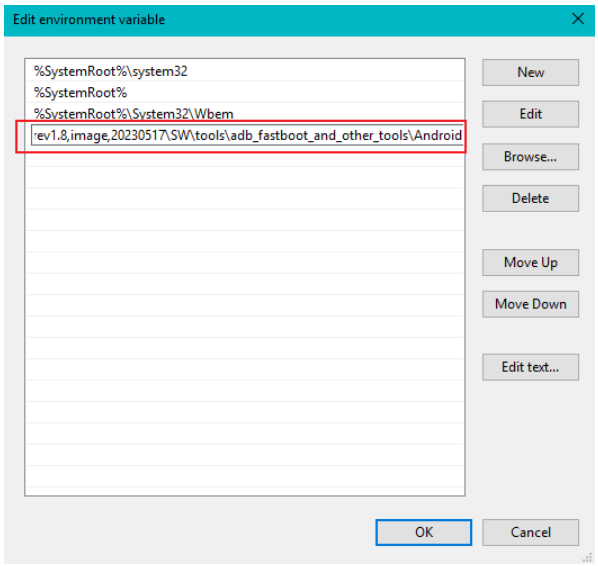
4. Press "Win + R" and input sysdm.cpl in the dialogue box to open the settings interface;



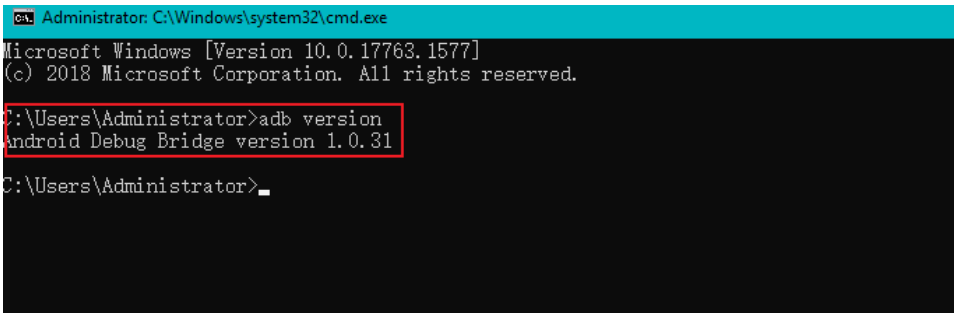
5. Click in sequence **Advanced > Environment Variables > System Variables > Path > Edit**, and click **New** in the pop-up;



6. Paste the path of the **Android** folder, and click **OK** one by one to confirm and exit;



7. Press “Win + R” and input cmd in the dialogue box;
8. Input adb version in the command prompt to check if the ADB tool is installed.



3.3 App Installation via ADB Commands

In addition to the standard pre-installed Android applications, users can install their own applications on the Board provided that it runs Android system and the ADB tool kit is installed and accessible on the Windows host computer.

1. Connect VT-SBC-3399 and the host computer via the USB type-A to type-C cable;
2. Press "Win + R" and input cmd in the dialogue box;
3. Input adb devices -l in the command prompt to check if the Board is connected to the host computer;

```
C:\Users\Administrator>adb devices -l
List of devices attached
674cc0aaede7d049       device product:occam model:Nexus_4 device:mako transport_id:1
```

4. When the device information is displayed under the command, you can copy the serial number (squared as shown above) for the next-step use;
5. Input the following command line to install the app;

```
adb -s <serial number> install <APP path>
```

6. The installation will be executed after the command line is input and the result of installation will be displayed below;

```
C:\Users\Administrator>adb -s 674cc0aaede7d049 install "C:\Users\Administrator\Desktop\Libraries for
developers_v3.83_apkpure.com.apk"
Performing Streamed Install
Success
```

7. The newly installed app will be displayed on the App drawer in the Alphabetic order.

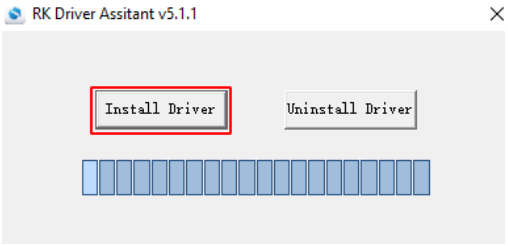
The screenshots are for illustration only and are not intended to represent the actual device number and other information of the device currently in your possession.

In step 5 shown above, you can drag the .apk file from the local directory to the command line to replace the <App path> you typed in manually.

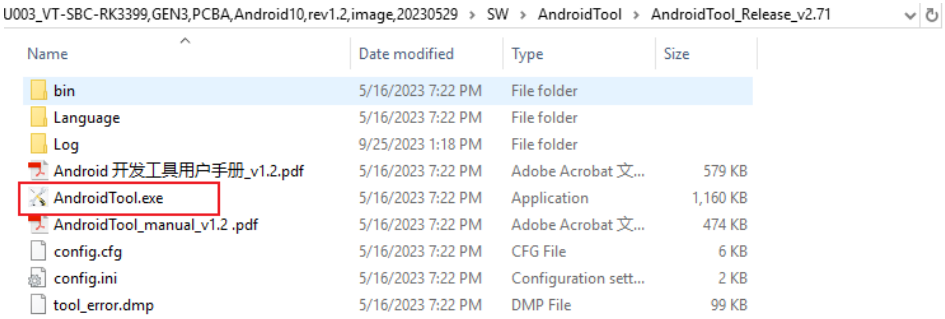
If you failed to install the apk, try using the absolute path of the .apk file enclosed in double quotation marks.

3.4 Firmware Upgrade in Windows Environment

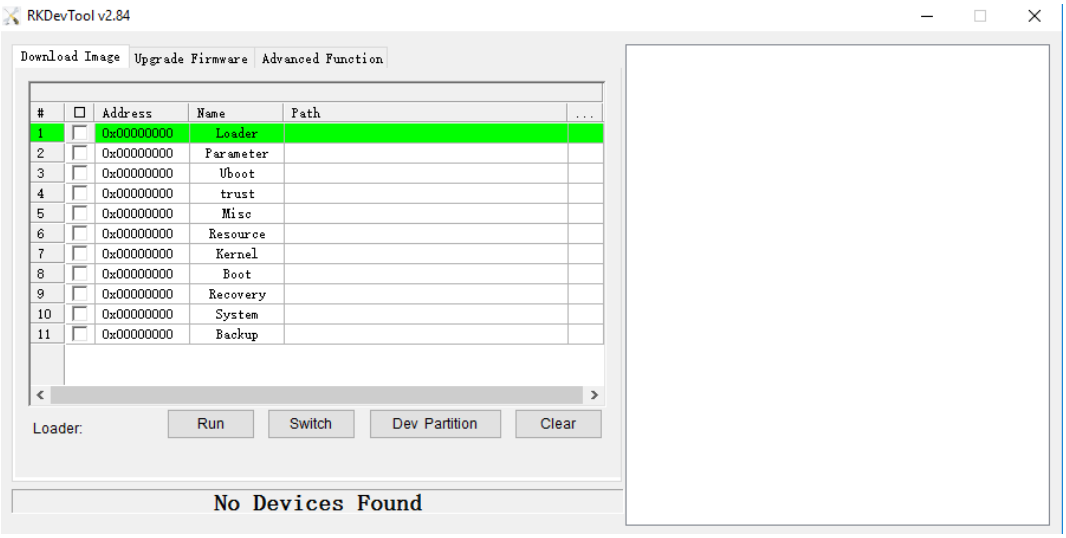
1. Follow the steps in 3.2 to finish ADB setup on the host computer
2. Unzip the release package and open the directory of the upgrade driver (\SW\ AndroidTool\DriverAssitant_vxxx.zip);
3. Right click the mouse and run the driver program **DriverInstall.exe** as administrator;
4. Click **Install Driver** and wait for the installation to complete;



5. Open the directory of the upgrade tool (\SW\AndroidTool\AndroidTool_Release_vxxx);
6. Double click the driver for the upgrade tool **AndroidTool.exe**;

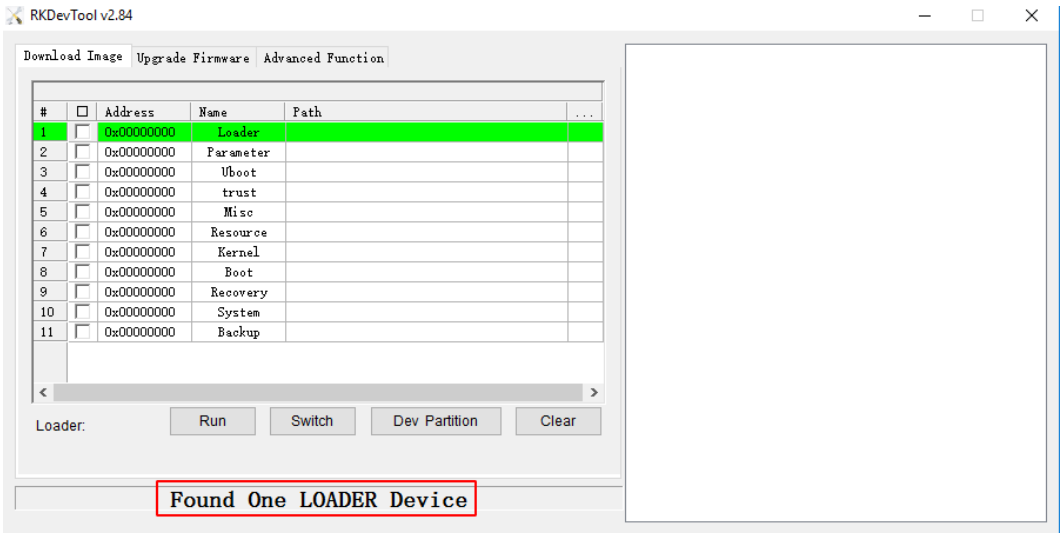


7. Open the upgrade window;

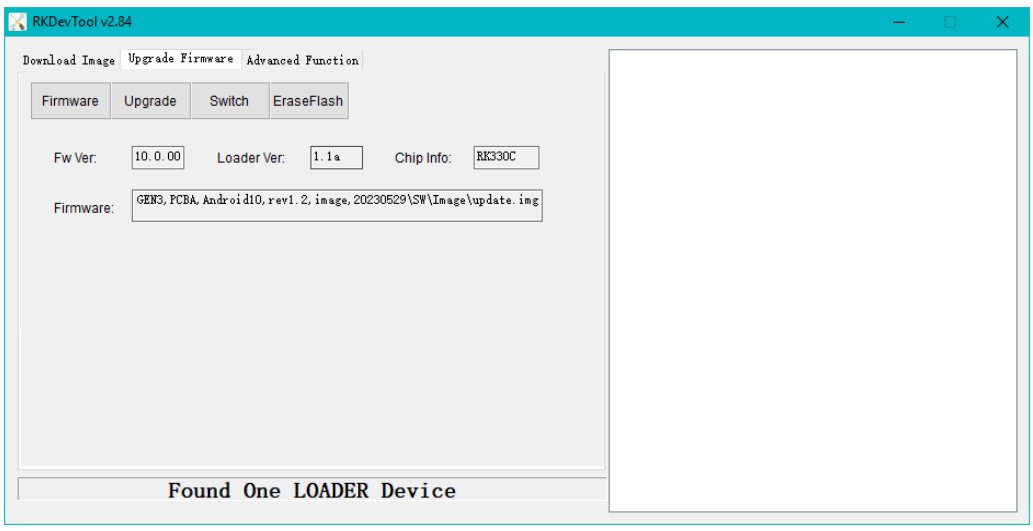


8. Connect VT-SBC-RK3399 to the Windows host computer using the USB Type-A to Type-C cable;

9. Press “Win + R” and input cmd in the dialog box to open the command prompt;
10. Input adb devices in the command prompt to check if the Board is connected to the Windows host computer (refer to 3.2 for the ADB setup on the Widows host computer);
11. Once the Board is identified by the Windows host computer, input adb reboot loader to reboot the Board into the bootloader mode;
12. Then the upgrade window will prompt for the existence of a Loader device, indicating that the upgrade process is ready;



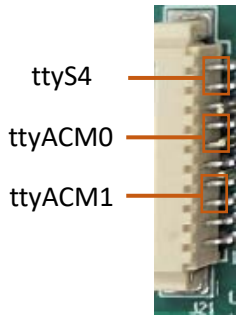
13. Click **Upgrade Firmware** > **Firmware** in the upgrade window;
14. Select the upgrade file (**update.img)** from the directory (\SW\Image) and click **Open**, and the firmware details will be automatically populated in the boxes;



15. Click the **Upgrade** button and the Board will start to download the image and upgrade the firmware automatically;
16. When the upgrade finishes, the Board will reboot automatically.

3.5 Serial Port

VT-SBC-3399 offers two RS232 connectors and one RS485 connector. One RS232 connector (UART4) has its signal derived from the CPU, mapped as **/dev/ttyS4** in the software system. The other RS232 connector and RS485 connector are expanded from an independent chipset, mapped as **/dev/ttyACM1** and **/dev/ttyACM0**, respectively.



To test if the serial ports function properly, use a USB-to-serial adapter to connect a serial port and the host computer first (TX-RX, RX-TX, GND-GND for RS232 wiring, A-A, B-B, GND-GND for RS485 wiring), then use a serial communication program to check if the serial port functions properly.

Use the following command to open a port (UART 4 for instance):

```
# minicom -D /dev/ttyS4 -b 115200
```

3.6 Buzzer on/off

When you have connected a buzzer to the Board via the buzzer connector, you can use the following commands to turn on/off the buzzer.

```
#echo 1 > /sys/van-misc/beep_on          // to turn on the buzzer
#echo 0 > /sys/van-misc/beep_on          // to turn off the buzzer
```

3.7 Watchdog Timer

Use the following commands to test the functionality of the watchdog timer.

1. Stop the watchdog timer, then trigger a watchdog event and reset the watchdog timer:

```
#stop watchdogd
#watchdog-test -e 1
```

2. Disable the watchdog timer:

```
#watchdog-test -d 1
```

3. Set a 10-second timeout period for the watchdog timer:

```
#watchdog-test -t 10
```

4. Pet the watchdog at an interval of 10 seconds resetting the watchdog timer and preventing it from initiating a system restart:

```
#watchdog-test -p 10
```

CHAPTER 4 DEBIAN SYSTEM MANUAL

This chapter is mainly about the first-use debugging of interfaces and software applications, and most of the operations are done in the console of VT-SBC-3399.

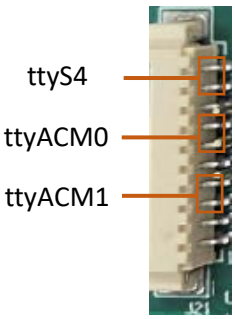
On the other hand, you can also use a USB Type-A to Type-C cable to connect the Board to a Linux host for the debugging purpose.

*Please execute all the commands as a root user, and **no** password is required.*

4.1 Interface Definition

4.1.1 Serial Port

VT-SBC-3399 offers two RS232 connectors and one RS485 connector. One RS232 connector (UART4) has its signal derived from the CPU, corresponding to device node **ttyS4**. The other RS232 connector and RS485 connector are signaled from an independent chipset, corresponding to device nodes **ttyACM1** and **ttyACM0**.



To test if the serial ports function properly, use a USB-to-serial adapter to connect a serial port and the host computer first (TX-RX, RX-TX, GND-GND for RS232 wiring, A-A, B-B, GND-GND for RS485 wiring), then use a serial communication program to check if the serial port functions properly.

Alternatively, you can cross connect any two serial ports and test the function of the serial ports in the device console.

Use the following commands to test the status of the serial port for the purpose of serial communication (UART4 for instance). Default parameters of the serial connectors include baud rate: 115200 and parity: none.

1. Open the settings of the serial communication tool (e.g., minicom):

```
$ sudo minicom -s
```

2. Select a serial port and change the parameters (Bps/Par/Bits) to the default (115200 8N1);
3. Save the changes as default settings and exit the minicom;
4. Open the port:

```
# minicom -D /dev/ttyS4 -b 115200
```

5. Send data 0xaa to the port:

```
# echo 0xaa > /dev/ttyS4
```

6. Receive data:

```
# cat /dev/ttyS4
```

4.1.2 USB interface

Insert a USB device to a USB interface of the Board, and input the following commands to check/configure the USB interface.

1. Check the information of the USB device:

```
# lsusb
```

2. Mount the USB device to /mnt directory:

```
# mount /dev/xxx /mnt
```

3. Check the mounted content:

```
# ls /mnt
```

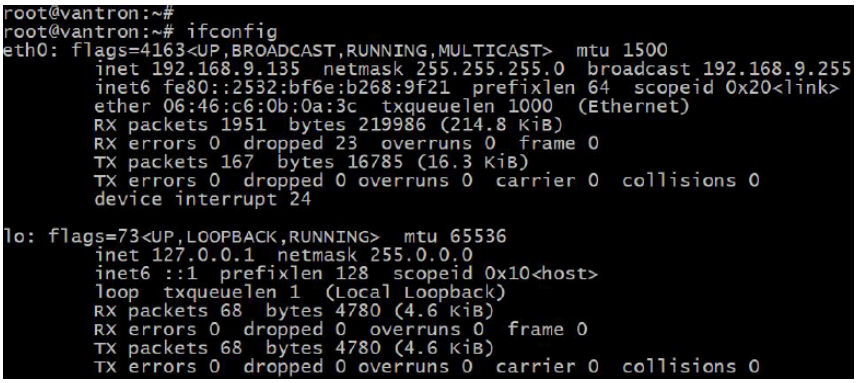
4. Unmount the USB device:

```
# umount /dev/xxx
```

4.2 Ethernet

Connect the Ethernet jack of the Board to switch/gateway with an Ethernet cable, then check the settings of the Ethernet jack.

```
# ifconfig
```



Judging from the above screenshot, the Ethernet jack is identified as eth0 in the system with an IP address 192.168.9.135.

Set a static IP address to the Ethernet jack and verify the IP address:

```
# ifconfig eth0 192.168.9.10

# ping 192.168.9.10

PING 192.168.9.10 (192.168.9.10): 56 data bytes

64 bytes from 192.168.9.10: seq=0 ttl=64 time=1.296 ms

64 bytes from 192.168.9.10: seq=1 ttl=64 time=1.358 ms
```

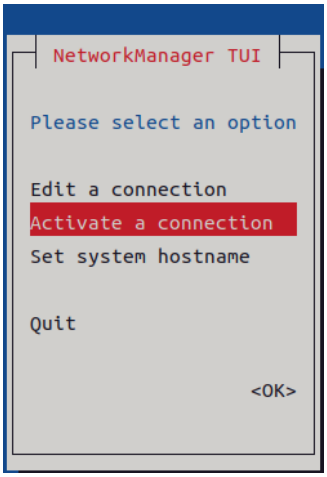
4.3 Wi-Fi

VT-SBC-3399 supports Wi-Fi and Bluetooth functions. You are recommended to use nmtui to connect the Board to an existing Wi-Fi access point.

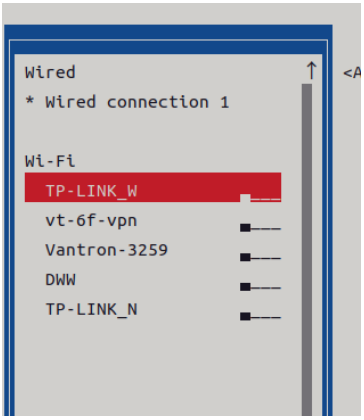
1. Open a terminal and input the following command to set up the network;

```
$ nmtui
```

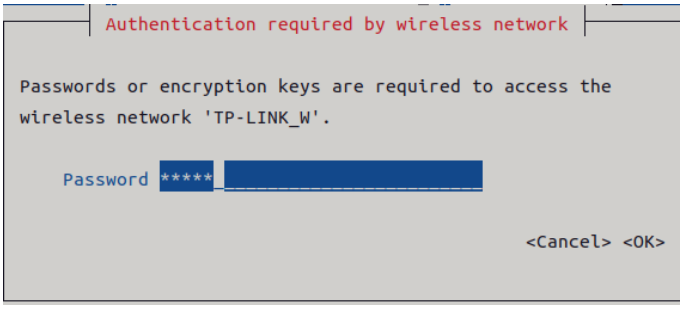
2. Use the arrows on the keyboard to navigate to **Activate a connection** and press **Enter**;



3. Select a Wi-Fi network from the list;



4. Input the password of the access point and verify;

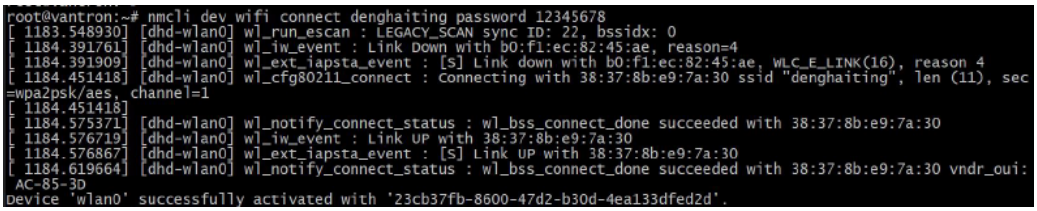


5. You will connect to the access point after successful verification.

You can also connect a Wi-Fi network using commands.

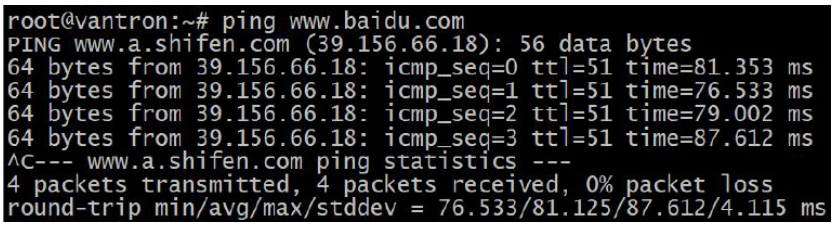
1. Input the following command in the terminal:

```
# nmcli dev wifi connect <SSID> password <PASSWD>
```



2. Use the ping command to check if the network is connected properly;

```
# ping www.baidu.com
```



3. If the data packets are transmitted and received properly, the network is connected properly.

4.4 Cellular Network

VT-SBC-3399 implements a mini PCIe slot for connecting a 4G cellular module for wireless communication.

Before you set up the cellular network, please insert a cellular module to the mini PCIe slot, install the antennas and plug in an activated SIM card. Generally, when the Board is powered up, the cellular module will be booted.

Insert the activated SIM card and wait for the loading of the USB driver to obtain the name of the USB port:

1. Display the module information;

```
# lsusb
```

2. List the serial interface (ttyUSB) enumerate by the cellular module.

```
# ls /dev/ttyUSB*
```

In the following section, a Quectel module is used to illustrate the steps for debugging the cellular module. Please refer to the manual of your own cellular module to determine which interface is used for the module debugging using AT commands and the general AT commands for that purpose.

- PPP dial-up

  Assume the device name of the cellular module is mapped as /dev/ttyUSB2 in the system.

  There are two ways to start PPP dial-up:

```
# pppd call quectel-ppp &          // method 1

#  /etc/ppp/peers/quectel-pppd.sh  /dev/ttyUSB2  <APN>  <username>  <password>
  // method 2
```

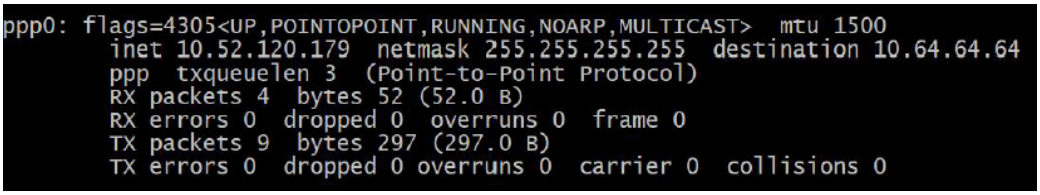
APN, username and password are provided by the carrier. Please modify the arguments based on the actual information (the screenshots below are for illustration only).

```
root@vantron:~# /etc/ppp/peers/quectel-pppd.sh /dev/ttyUSB2 3gnet
quectel-pppd options in effect:
devname   /dev/ttyUSB2    # (from command line)
apn       3gnet    # (from command line)
user      user   # (default)
password  passwd   # (default)
root@vantron:~# pppd options in effect:
debug             # (from command line)
nodetach                  # (from command line)
dump              # (from command line)
noauth            # (from command line)
user user                 # (from command line)
password ??????           # (from command line)
/dev/ttyUSB3              # (from command line)
115200            # (from command line)
lock              # (from command line)
connect ''chat -s -v ABORT BUSY ABORT \"NO CARRIER\" ABORT \"NO DIALT
 OK ATE0 OK ATI\\;+CSUB\\;+CSQ\\;+CPIN?\\;+COPS?\\;+CGREG?\\;\\&D2 OK
ONNEC
                  # (from command line)
disconnect chat -s -v ABORT ERROR ABORT \"NO DIALTONE\" SAY \"\\nSend
AY \"\\nGood bay\\n\"            # (from command line)
nocrtscts                 # (from command line)
modem             # (from command line)
asyncmap 0                # (from /etc/ppp/options)
lcp-echo-failure 4                # (from /etc/ppp/options)
```

……

```
rcvd [PAP AuthAck id=0x1 "" 00]
PAP authentication succeeded
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
rcvd [IPCP ConfReq id=0x2]
sent [IPCP ConfNak id=0x2 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 10.52.120.179> <ms-dns1 119.7.7.7> <ms-dns2 119.
6.6.6>]
sent [IPCP ConfReq id=0x2 <addr 10.52.120.179> <ms-dns1 119.7.7.7> <ms-dns2 119.
6.6.6>]
rcvd [IPCP ConfReq id=0x3]
sent [IPCP ConfAck id=0x3]
rcvd [IPCP ConfAck id=0x2 <addr 10.52.120.179> <ms-dns1 119.7.7.7> <ms-dns2 119.
6.6.6>]
Could not determine remote IP address: defaulting to 10.64.64.64
not replacing default route to usb0 [192.168.43.1]
local  IP address 10.52.120.179
remote IP address 10.64.64.64
primary   DNS address 119.7.7.7
secondary DNS address 119.6.6.6
Script /etc/ppp/ip-up started (pid 1213)
Script /etc/ppp/ip-up finished (pid 1213), status = 0x0
```

If the above steps go smoothly, users can input **ifconfig** in the terminal to check the network information, including the name of the network card ("ppp0" in this case).



- IP/DNS/Route

1. Check the DNS

```
# /etc cat resolv.conf
```

If PPPD acquires the IP and DNS, the /etc/ppp/ip-up script will be called to set the system DNS. The DNS will be automatically saved to /etc/ resolv.conf after the setting.

2. Check the route

```
# /etc route -n
```

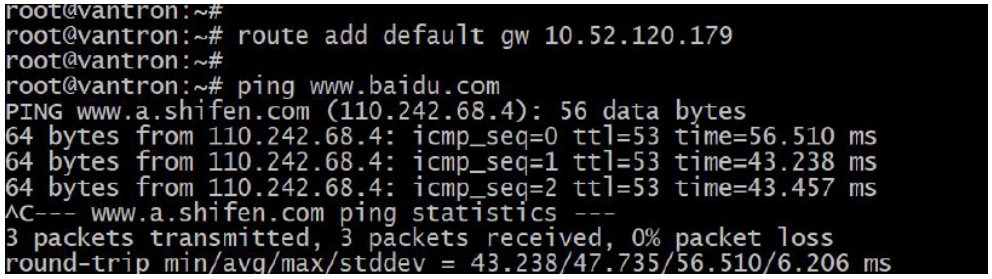
3. Test the network connection

```
# ping www.baidu.com
```

4. If the network connection fails, please try to add a default route and continue to test the network connection

```
# route add default gw <xx.xx.xx.xx>
```

xx.xx.xx.xx is the IP address of the route (ppp0)



4.5 RTC

RTC module provides accurate time and date information to the system. Before the test, make sure a coin cell battery is installed on the Board and the voltage is kept at 3.0V.

If you are using the RTC for the first time, please calibrate the RTC time to the system time.

1. Set the system date & time;

```
# date -s "2023-02-24 14:38:10"
```

2. Synchronize the RTC time with the system time;

```
# hwclock -w
```

3. Reboot the Board;

```
# reboot
```

4. Check the RTC time information.

```
# hwclock -r
```

4.6 Watchdog Timer

The watchdog timer is turned on by default and the system will reboot automatically if the feed frequency is not set. If the watchdog timer is killed, the dog will not be fed and the system will reboot automatically after 10 seconds.

Check the watchdog device:

```
# ls /dev/watchdog

/dev/watchdog
```

If the device is identified, the watchdog driver is working properly.

Kill the watchdog program:

```
# killall watchdog

[ 197.034060] dw_wdt: unexpected close, system will reboot soon
```

If the system reboots in a short time, the program is turned off properly.

4.7 Fan Connector

The fan is turned on by default. Please use the following command to control the fan.

Turn off the fan:

```
# echo 0 > /sys/class/leds/fan_en/brightness
```

Turn on the fan:

```
# echo 255 > /sys/class/leds/fan_en/brightness
```

Enable PWM to control the fan:

```
# echo 0 > /sys/class/pwm/pwmchip1/export

# echo 10000 > /sys/class/pwm/pwmchip1/pwm0/period

# echo 5000 > /sys/class/pwm/pwmchip1/pwm0/duty_cycle

# echo 1 > /sys/class/pwm/pwmchip1/pwm0/enable
```

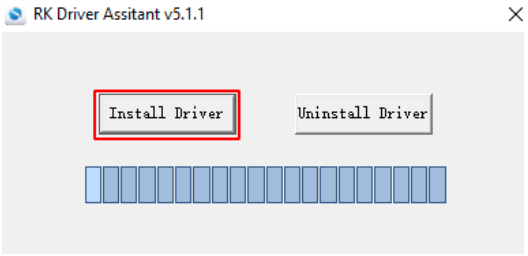
4.8 Firmware Upgrade in Windows System

4.8.1 Prerequisites

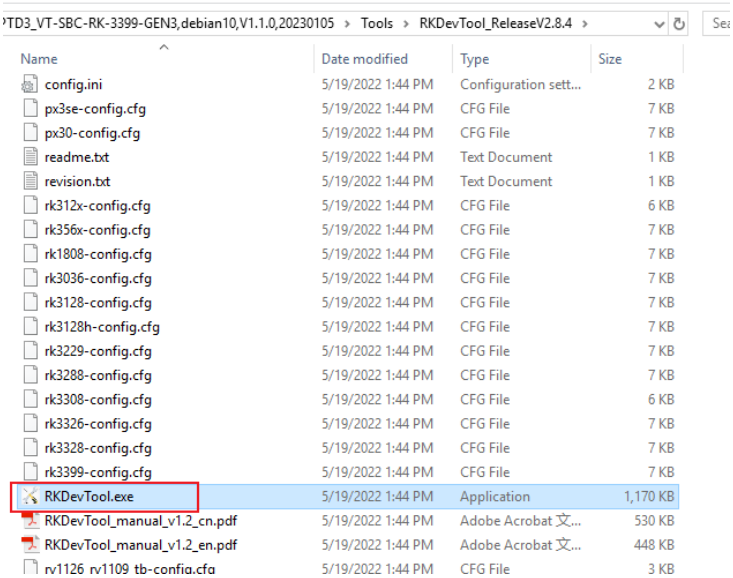
- VT-SBC-3399
- A Windows host computer
- Software release package of VT-SBC-RK3399
- USB Type-A to Type-C cable

4.8.2 System flashing

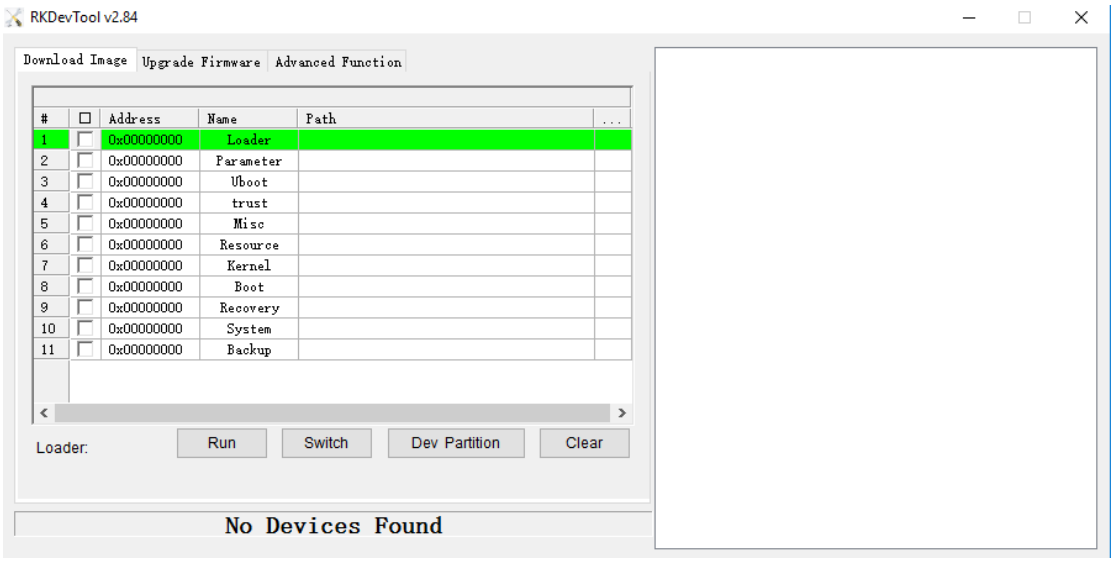
1. Unzip the release package, and open the directory of the upgrade driver (\Tools\DriverAssitant_vxxx);
2. Right click the mouse and run the driver program **DriverInstall.exe** as administrator;
3. Click **Install Driver** and wait for the installation to proceed;



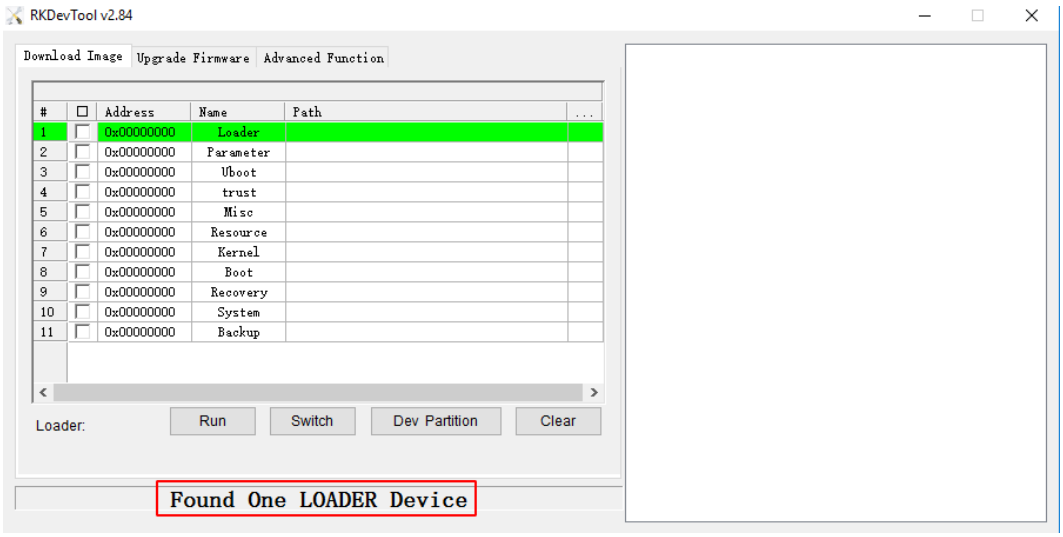
4. Open the directory of the upgrade tool (\Tools\RKDevTool_Release_vxxx);
5. Double click the driver for the upgrade tool **RKDevTool.exe**;



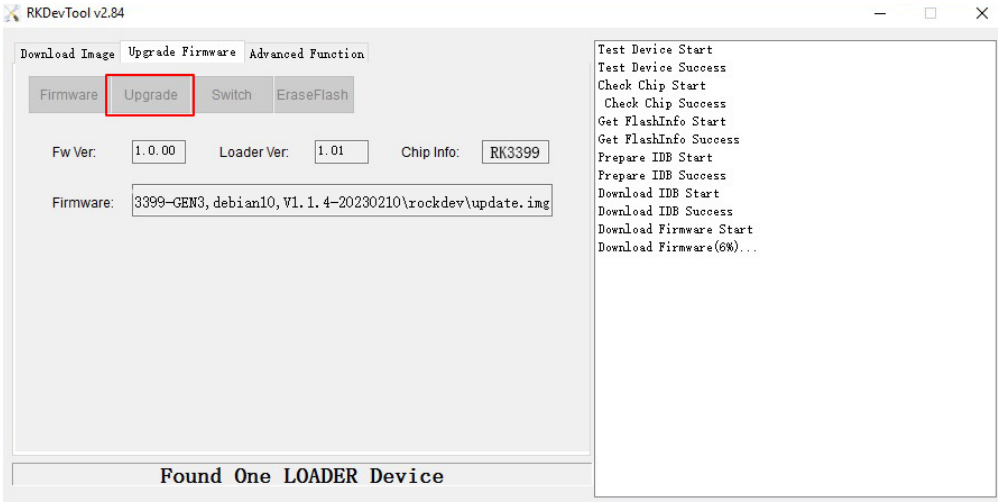
6. Open the upgrade window;



7. Connect VT-SBC-3399 to the Windows host computer using the USB Type-C to Type-A cable;
8. Press “Win + R” and input cmd in the dialog box to open the command prompt;
9. Input adb devices in the command prompt to check if the Board is connected to the Windows host computer (refer to 3.2 for the ADB setup on the Widows host computer);
10. Once the Board is identified by the Windows host computer, input adb reboot loader to reboot the Board into the bootloader mode;
11. Then the upgrade window will prompt for the existence of a Loader device, indicating that the upgrade process is ready;



12. Click **Upgrade Firmware** > **Firmware** in the upgrade window;
13. Open the image file **update.img** from the local directory (\rockdev\update), and the firmware details will be automatically populated;
14. Click the **Upgrade** button and the Board will start to download the image and upgrade the firmware automatically;



15. When the upgrade finishes, the device will reboot automatically.

CHAPTER 5 DISPOSAL AND WARRANTY

5.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of “explosive” should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people’s health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

5.2 Warranty

Product warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** depending on the Product after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply an RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON, VANTRON shall document such instances and notify the CUSTOMER immediately.