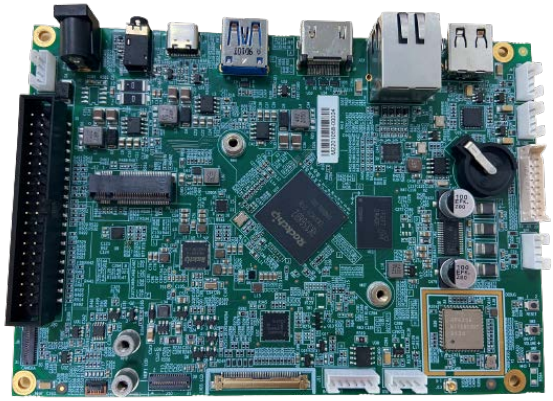
VT-SBC-3568 Single Board Computer



User Manual

Version: 1.2

Revision History

No.	Version	Description	Date
1	V1.0	First release	Jun 14, 2022
2	V1.1	Updated pinout description of GPIO	Jun 16, 2022
3	V1.2	Added a chapter for Yocto project development	Mar. 3, 2023

Table of Contents

Foreword

Thank you for purchasing VT-SBC-3568 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.

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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-3568 single board computer is based on Rockchip RK3568 processor that integrates quad-core ARM Cortex-A55 CPU and Mali G52 GPU to provide optimized performance at lower power consumption, and offer high-quality video encoding and decoding for better display performance.

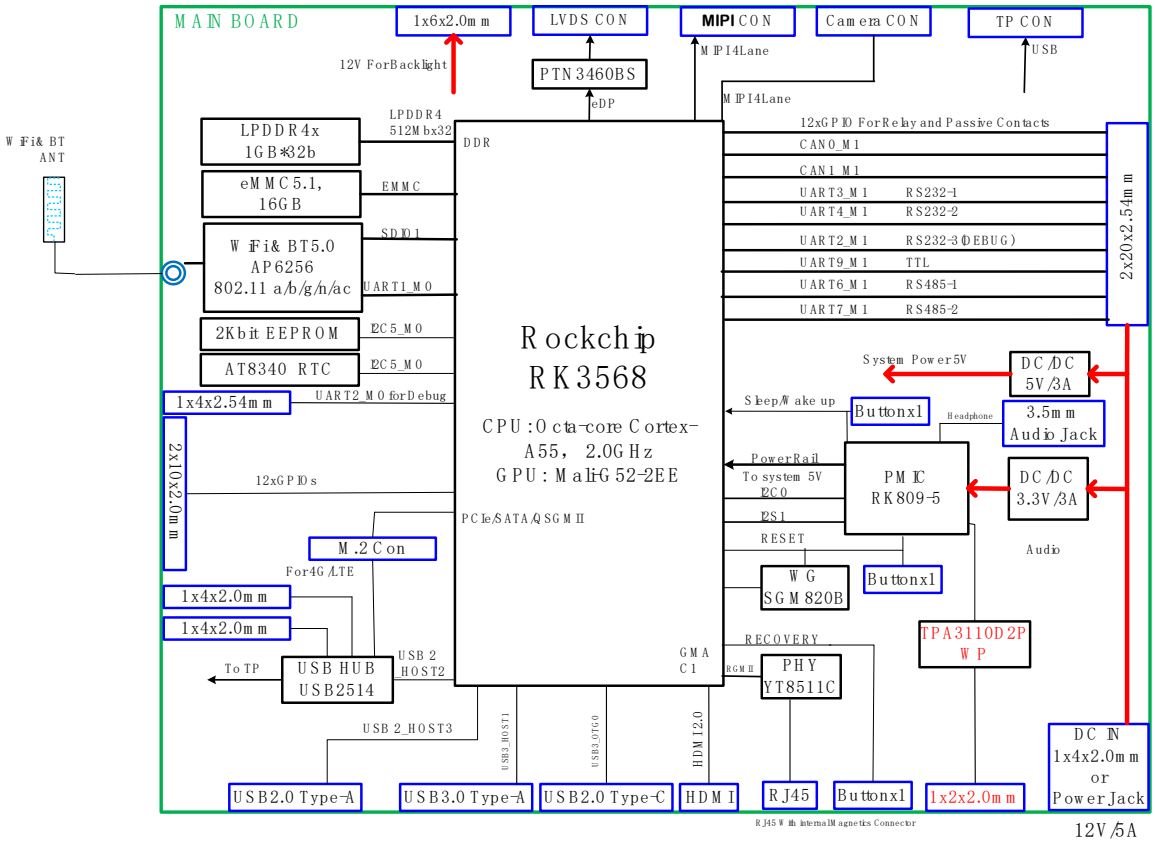
While both wired and wireless network accesses are available, user data is kept safe and secure in transmission. Meanwhile, VT-SBC-3568 provides a range of customer expansion options to meet the requirements of different application purposes, especially in industrial IoT scenarios.

Featuring high flexibility and high performance, VT-SBC-3568 could work under extreme environments at industrial-grade temperatures ranging from 0℃ to +60℃, making it a reliable industrial IoT solution.

1.2 Terminology

Terminology	Description
NC	No connection
VCC	Voltage common collector
GND	Ground
/	Active low signal
+	Positive of difference signal
-	Negative of difference signal
I	Input
O	Output
I/O	Input/output
P	Power or ground
A	Analog
OD	Open drain
CMOS	3.3 V CMOS
LVCMOS	Low Voltage CMOS
LVTTL	Low Voltage TTL
3.3V	3.3 V signal level
5V	5V signal level
USB	5V tolerant signal
PCIe	PCI Express signal, not 3.3 V tolerant
MMC	Multimedia Card

1.3 Block Diagram



1.4 Specifications

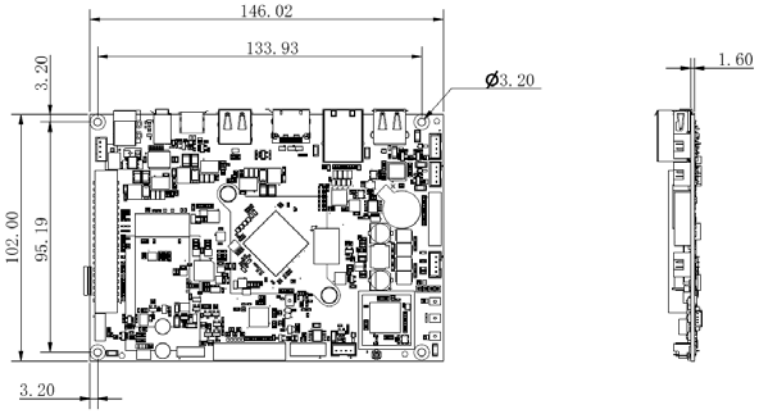
VT-SBC-3568		
System	CPU	RK3568, Quad-core ARM Cortex-A55 MPCore, up to 2.0 GHz
	GPU	ARM Mali-G52
	Memory	4GB LPDDR4 (Optional: 2GB)
	Storage	16GB eMMC V5.1, up to 128GB 2Kb EEPROM
Communication	Ethernet	1 x RJ45, 10/100/1000Mbps 100Base-T4 (surge suppression)
	Cellular	4G/5G (Optional)
	Wi-Fi & BT	802.11 a/b/g/n/ac & BT 5.0
Media	Display	Dual LVDS, Resolution up to 1920 x 1080, with backlight connector (Optional: eDP, Resolution up to 2K)
		1 x MIPI DSI
	TP	Infrared touch panel (Optional)
	HDMI	1 x HDMI 2.0
	Camera	1 x 4-lane MIPI CSI
	Audio	1 x 3.5mm Audio jack 1 x Speaker, up to 15W
I/Os	Serial	5 x UART (RS232 & RS485) 1 x UART for debug
	USB	1 x USB 3.0 3 x USB 2.0 1 x USB 2.0 Type-C
	GPIO	24 x GPIO
	SIM slot	1 x Micro SIM slot
	RTC	Supported
	WDT	Supported
Expansion	Bus	2 x CAN, without transmitter 1 x I^2C for TP 1 x USB 2.0 host for TP 1 x M.2 key B for 4G/5G module or SATA SSD
System Control	Button	1 x Reset 1 x Power button 1 x Volume button
Power	Input	12V/3A DC
Software	Operating system	Debian 10, Android 11+
Mechanical	Dimensions	146.02 x 102mm
	Cooling mode	Fanless
Environment Condition	Temperature	Operating: 0°C~+60°C (RK3568), -20°C~+70°C (RK3568J) Storage: -20°C~+70°C (RK3568), -40°C~+85°C (RK3568J)
	Humidity	≤96%RH (Non-condensing)

1.5 Operating system

VT-SBC-3568 supports Debian 10 and Android 11+ operating systems.

1.6 Mechanical Dimensions

- 146.02mm x 102mm



1.7 Power Supply and Consumption

VT-SBC-3568 works with 12V/3A DC power supply.

The power consumption of the Board is 30W at the maximum. It should be pointed out that power consumption is largely determined by the RAM, storage capacity, and other configurations of the board.

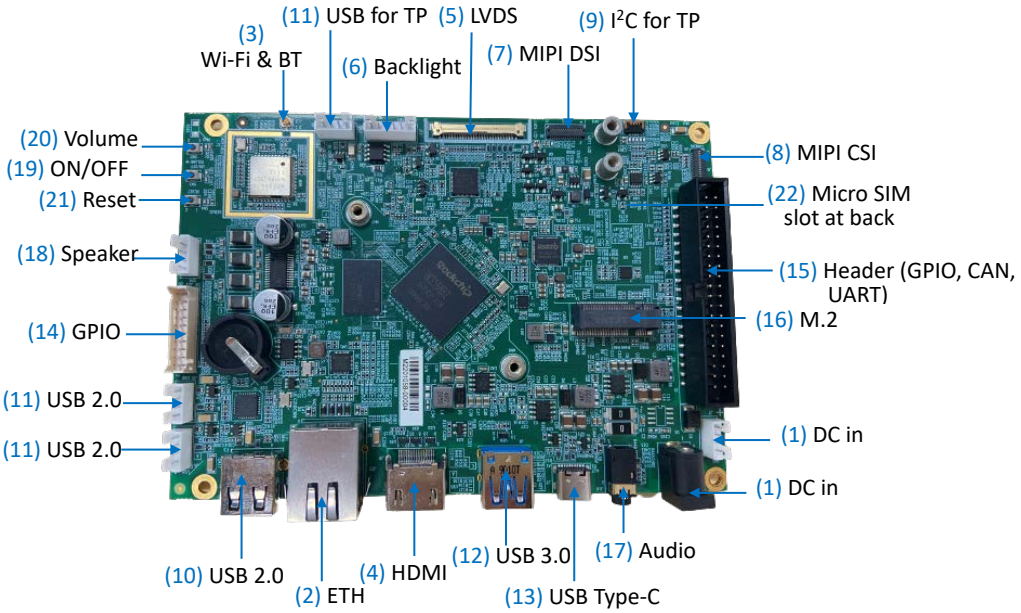
1.8 Environmental Specifications

VT-SBC-3568 works at a temperature ranging from 0℃ to +60℃ (for 3568J: -20℃ to +70℃) and is designed to be stored at a temperature ranging from -20℃ to +70℃ (for 3568J: -40°C~+85°C) and at relative humidity of no more than RH 96% for non-condensing purpose.

CHAPTER 2

CONNECTOR DESCRIPTION

2.1 Board Layout



2.2 Memory and Storage

2.2.1 LPDDR4 RAM

VT-SBC-3568 is equipped with a 4GB LPDDR4 RAM by default, and users also have the option of 2GB RAM.

2.2.2 eMMC Flash

VT-SBC-3568 provides an eMMC 5.1 flash up to 128 GB, and the default capacity is 16GB. It is used as the default boot and storage device.

2.2.3 EEPROM

VT-SBC-3568 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.

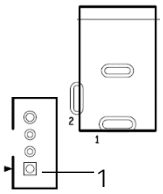
Usually, there will be numbers or marks next to the pins of a connector on the board to indicate the pinouts.

2.4 Connector

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

2.4.1 Power input (1)

VT-SBC-3568 provides a 4-pin power connector and a power jack to supply power for the Board.



Pinout description of the 4-pin power connector:

Pin	Name	Type	Description
1	+VDC	P	DC-IN POWER +
2	+VDC	P	DC-IN POWER +
3	-VDC	P	DC-IN POWER -
4	-VDC	P	DC-IN POWER -

2.4.2 J23 Ethernet port (2)

VT-SBC-3568 offers an RJ45 Ethernet jack with two LEDs, green for activity indication and yellow for link indication. The port supports 10/100/1000 Mbps transmission rate.

2.4.3 J13 Wi-Fi and Bluetooth (3)

VT-SBC-3568 offers an AP6256 1T1R combo SiP module, combining Wi-Fi 802.11 a/b/g/n/ac and Bluetooth 5.0. There is an antenna interface next to the module for connecting the Wi-Fi & Bluetooth antenna.

2.4.4 J9 HDMI (4)

VT-SBC-3568 offers a standard HDMI Type-A interface for image output. The pinout description of the interface is in line with the pin assignment of standard HDMI Type-A interface.

2.4.5 J11 LVDS (5)

VT-SBC-3568 offers a dual LVDS interface to connect high-definition displays (resolution up to 1920 x 1080).

Specifications: 1 x 40，0.5mm, 0.5A, 1.00mm (H), male, RA, SMT, RoHS (IPEX: 20455-040E66).

Pinout description:

Pin	Name	Type	Description
1	PANEL_BL_PWM	O	LCD backlight PWM control output
2	PANEL_BKLTEN	O	LCD backlight power control output
3	LVDS_B_D3+	O	LVDS B Lane3 +
4	LVDS_B_D3-	O	LVDS B Lane3 -
5	LVDS_B_CLK+	O	LVDS B CLK+
6	LVDS_B_CLK-	O	LVDS B CLK-
7	NC		
8	LVDS_B_D2+	O	LVDS B Lane2 +
9	LVDS_B_D2-	O	LVDS B Lane2 -
10	LVDS_B_D1+	O	LVDS B Lane1 +
11	LVDS_B_D1-	O	LVDS B Lane1 -
12	SEL68	O	

13	NC		
14	eDP_HPD	I	Hot Plug Detect signal
15	LVDS_B_D0+	O	LVDS B Lane0 +
16	LVDS_B_D0-	O	LVDS B Lane0 -
17	LVDS_DDC_DATA	I/O	I2C_SDA
18	LVDS_DDC_CLK	O	I2C_SCL
19	GND	P	Ground
20	LVDS_A_D3+	O	LVDS A Lane3 +
21	LVDS_A_D3-	O	LVDS A Lane3 -
22	GND	P	Ground
23	LVDS_A_CLK+	O	LVDS A CLK +
24	LVDS_A_CLK-	O	LVDS A CLK -
25	GND	P	Ground
26	LVDS_A_D2+	O	LVDS A Lane2 +
27	LVDS_A_D2-	O	LVDS A Lane2 -
28	GND	P	Ground
29	LVDS_A_D1+	O	LVDS A Lane1 +
30	LVDS_A_D1-	O	LVDS A Lane1 -
31	GND	P	Ground
32	LVDS_A_D0+	O	LVDS A Lane0 +
33	LVDS_A_D0-	O	LVDS A Lane0 -
34	GND	P	Ground
35	NC		
36	NC		
37	LCD_VDD	P	Power supply for LCD
38	LCD_VDD	P	Power supply for LCD
39	LCD_VDD	P	Power supply for LCD
40	LCD_VDD	P	Power supply for LCD

2.4.6 J12 Backlight connector (6)

VT-SBC-3568 offers a backlight connector that is designed to connect a backlight to increase readability of the LCD in low light conditions.

Specifications: 1 x 6, 2.0mm, 2A, 6mm (H), male, RA, -25℃～85℃, THR, RoHS (JST: B6B-PH-K-S (LF) (SN)

Pinout description:

Pin	Name	Type	Description
1	LCD_BLK	P	Power supply 12V for backlight
2	LCD_BLK	P	Power supply 12V for backlight
3	PANEL_BKLTEN	O	LCD backlight power control output
4	PANEL_BL_PWM	O	LCD backlight PWM control output
5	GND	P	Ground
6	GND	P	Ground

2.4.7 J10 MIPI DSI (7)

VT-SBC-3568 offers a 4-lane MIPI DSI connector for connecting displays.

Specifications: 1 x 31, 0.3mm, 1.0mm(H), RA, Bot, WDT, SMT, RoHS (LZR: FPC031003-31LG)

1

Pinout description:

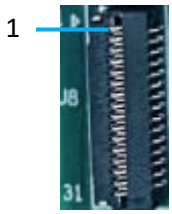
Pin	Name	Type	Description
1	LED+	P	Power supply for backlight
2	LED+	P	Power supply for backlight
3	LED+	P	Power supply for backlight
4	NC		
5	LED-	P	Feedback for current of backlight
6	LED-	P	Feedback for current of backlight
7	LED-	P	Feedback for current of backlight
8	LED-	P	Feedback for current of backlight
9	GND	P	Ground
10	GND	P	Ground
11	MIPI_D2P	O	MIPI DSI Lane2 +
12	MIPI_D2N	O	MIPI DSI Lane2 -
13	GND	P	Ground
14	MIPI_D1P	O	MIPI DSI Lane1 +
15	MIPI_D1N	O	MIPI DSI Lane1 -
16	GND	P	Ground
17	MIPI_CLK+	O	MIPI DSI CLK+
18	MIPI_CLK-	O	MIPI DSI CLK-
19	GND	P	Ground
20	MIPI_D0P	O	MIPI DSI Lane0 +

21	MIPI_D0N	O	MIPI DSI Lane0 -
22	GND	P	Ground
23	MIPI_D3P	O	MIPI DSI Lane3 +
24	MIPI_D3N	O	MIPI DSI Lane3 -
25	GND	P	Ground
26	ID	I	LCD ID
27	RST_LCD	O	LCD RESET
28	NC		
29	VCCIO_1V8	P	power supply 1.8V
30	VCC3V3_LCD	P	power supply 3.3V
31	VCC3V3_LCD	P	power supply 3.3V

2.4.8 J8 MIPI CSI (8)

VT-SBC-3568 offers a 4-lane MIPI CSI connector for connecting cameras.

Specifications: 1 x 31, 0.3mm, 1.0mm(H), RA, Bot, WDT, SMT, RoHS (LZR: FPC031003-31LG)



Pinout description:

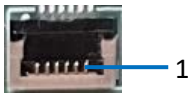
Pin	Name	Type	Description
1	GND	P	Ground
2	MIPI_CSI_D3N	A	MIPI CSI Lane3 -
3	MIPI_CSI_D3P	A	MIPI CSI Lane3 +
4	GND	P	Ground
5	MIPI_CSI_D2N	A	MIPI CSI Lane2 -
6	MIPI_CSI_D2P	A	MIPI CSI Lane2 +
7	GND	P	Ground
8	MIPI_CSI_D1N	A	MIPI CSI Lane1 -
9	MIPI_CSI_D1P	A	MIPI CSI Lane1 +
10	GND	P	Ground
11	MIPI_CSI_D0N	A	MIPI CSI Lane0 -
12	MIPI_CSI_D0P	A	MIPI CSI Lane0 +
13	GND	P	Ground
14	MIPI_CSI_CLK0N	A	MIPI CSI CLK-
15	MIPI_CSI_CLK0P	A	MIPI CSI CLK+
16	GND	P	Ground

17	I2C2_SCL_M1_1V8	O	I2C_SCL
18	I2C2_SDA_M1_1V8	I/O	I2C_SDA
19	MIPI_CAM_RST	O	Camera RESET
20	MIPI_CAM_PWN	O	Camera Power Down
21	GND	P	Ground
22	MIPI_CAM_MCLK	O	Camera Main CLK
23	GND	P	Ground
24	NC		
25	VCC1V8_DVP	P	Power supply 1.8V
26	VCC1V8_DVP	P	Power supply 1.8V
27	VCC1V5_DVP	P	Power supply 1.5V
28	VCC2V8_DVP	P	Power supply 2.8V
29	VCC2V8_DVP	P	Power supply 2.8V
30	NC		
31	GND	P	Ground

2.4.9 J22 I²C (9)

VT-SBC-3568 offers an I²C interface for connecting a touch panel.

Specifications: 1 x 6, 0.5mm, 0.4A, 0.9mm(H), female, RA, WDT, SMT, RoHS (UJU: PF050-B06B-C09-A)



Pinout description:

Pin	Name	Type	Description
1	VCC3V3_PMU	P	Power supply 3.3V
2	GND	P	Ground
3	I2C1_SCL_TP	O	I2C_SCL for TP
4	I2C1_SDA_TP	I/O	I2C_SDA for TP
5	TP_INT	I	TP interrupt
6	TP_RST	O	TP RESET

2.4.10 U40 USB 2.0 Type-A (10)

VT-SBC-3568 is designed to connect peripherals via the USB 2.0 Type-A interface to expand the functions.

The pinout description of the USB 2.0 Type-A interface is in line with the pin assignment of standard USB 2.0 Type-A.

USB 2.0 Type-A

2.4.11 J3/J4/J5 USB 2.0 (11)

There are three USB 2.0 connectors, one could be used for connection of a touch panel, and the other two are in host mode by default (chipset USB2514).

Specifications: 1 x 4, 2.0mm, 2A, 6mm(H), male, RA, WDT, THR, RoHS (JST: B4B-PH-K-S (LF) (SN))

Pinout description:

Pin	Name	Type	Description
1	GND	P	Ground
2	HUB_HOST_DP	I/O	USB DATA+
3	HUB_HOST_DM	I/O	USB DATA-
4	HUB_HOST_5V	P	Power supply 5V for USB

2.4.12 J6 USB 3.0 (12)

VT-SBC-3568 offers a USB 3.0 (Type-A) interface with pinout in line with the pin assignment of standard USB 3.0 Type-A.

USB 3.0

2.4.13 J7 USB 2.0 Type-C (13)

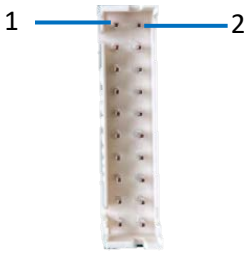
VT-SBC-3568 offers a USB 2.0 Type-C interface.

Specifications: Max. current output: 0.5A, OTG supported.

2.4.14 J21 GPIO (14)

There is a GPIO header supporting 12 GPIOs and user can customize the use of the pins.

Specification: 2 x 10, 2.0 mm, 6.5 mm (H), Vert, -25~85℃, THR, RoHS (JST: B20B-PHDSS (LF) (SN))



Pinout description (a user case is that the pins are used for LED and buttons):

Pin	Name	Type	Description
1	LED_1	O	LED output signal
2	BUTTON_1	I	Button input data
3	LED_2	O	LED output signal
4	BUTTON_2	I	Button input data
5	LED_3	O	LED output signal
6	BUTTON_3	I	Button input data
7	LED_4	O	LED output signal
8	BUTTON_4	I	Button input data
9	LED_5	O	LED output signal
10	BUTTON_5	I	Button input data
11	LED_6	O	LED output signal
12	BUTTON_6	I	Button input data
13	VCC3V3_EXT	P	Power supply 3.3V
14	VCC3V3_EXT	P	Power supply 3.3V
15	GND	P	Ground

16	GND	P	Ground
17	VCC_1V8	P	Power supply 1.8V
18	VCC_1V8	P	Power supply 1.8V
19	GND	P	Ground
20	GND	P	Ground

2.4.15 J20 40-pin header (15)

The 40-pin header on VT-SBC-3568 supports 2 CAN buses, 6 UART ports, and 12 GPIOs (customized as alarm in and out in the following description). Among the 6 UART ports, there are 2 RS485 ports (UART 6 & UART 7, corresponding to nodes ttyS6 & ttyS7), 1 TTL (UART 9, corresponding to ttyS9), 2 RS232 (UART 3 & UART 4, corresponding to ttyS3 and ttyS4), and 1 RS232 (UART 2) used for debugging.

Specifications: 2 x 20, 2.54mm, 8.8 mm(H), Vert, -45~105℃, SMT, RoHS

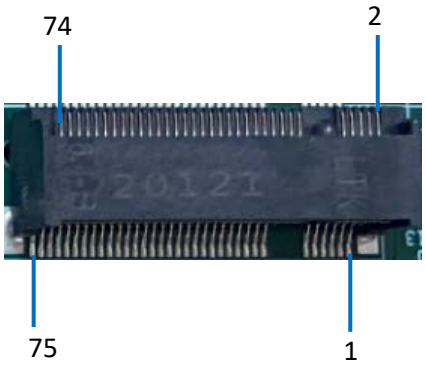
Pinout description:

Pin	Name	Type	Description
1	CAN0_RX_M1	I	CAN0 serial port data input
3	CAN0_TX_M1	O	CAN0 serial port data output
5	CAN1_RX_M1	I	CAN1 serial port data input
7	CAN1_TX_M1	O	CAN1 serial port data output
9	ALARM_OUT1	O	Alarm output
11	ALARM_OUT2	O	Alarm output
13	ALARM_OUT3	O	Alarm output
15	ALARM_OUT4	O	Alarm output
17	ALARM_IN1	I	Alarm input
19	ALARM_IN2	I	Alarm input
21	ALARM_IN3	I	Alarm input
23	ALARM_IN4	I	Alarm input
25	ALARM_IN5	I	Alarm input
27	ALARM_IN6	I	Alarm input
29	ALARM_IN7	I	Alarm input

31	EXGND	P	Ground
33	EXGND	P	Ground
35	EXGND	P	Ground
37	EXGND	P	Ground
39	EXGND	P	Ground
2	UART9_RX_M1	I	UART9 receive data
4	UART9_TX_M1	O	UART9 transmit data
6	UART2_RX_M0_DEBUG	I	UART2 receive data
8	UART2_TX_M0_DEBUG	O	UART2 transmit data
10	UART4_RX_M1	I	UART4 receive data
12	UART4_TX_M1	O	UART4 transmit data
14	UART3_RX_M1	I	UART3 receive data
16	UART3_TX_M1	O	UART3 transmit data
18	UART7_RX_M1	I	UART7 receive data
20	UART7_TX_M1	O	UART7 transmit data
22	RS485_DIR1_GPIO3_B5	I/O	RS485_1 control output signal
24	UART6_RX_M1	I	UART6 receive data
26	UART6_TX_M1	O	UART6 transmit data
28	RS485_DIR2_GPIO3_B6	I/O	RS485_2 control output signal
30	ALARM_IN8	I	Alarm input
32	DC_IN	P	Power input
34	DC_IN	P	Power input
36	DC_IN	P	Power input
38	DC_IN	P	Power input
40	DC_IN	P	Power input

2.4.16 J17 M.2 Key B slot (16)

VT-SBC-RK3568 offers an M.2 Key B slot, supporting PCIe to connect a 3G/4G/5G module and supporting SATA to connect an SSD.



Pinout description:

Pin	Name	Type	Description	Comment
1, 20, 22, 23, 24, 28, 29, 31, 35, 37, 38, 40, 42, 44, 46, 48, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 68	NC	NC		
2, 4, 70, 72, 74	PCIE_3V3	P		
3, 5, 11, 27, 33, 39, 45, 51, 57, 71, 73, 76, 77	GND	P	Ground	
36	5G_USIM_PWR	P	USIM power output	Either 1.8 V or 3.0 V is supported by the module automatically.
34	5G_USIM_DATA	I/O	USIM data signal	
32	5G_USIM_CLK	I	USIM clock signal	
30	5G_USIM_RESET	I	USIM reset signal	
66	SIM_DETECT1	O	USIM Plug Detect signal	
7	USBDP_DN4	IO	USB data+	
9	USBDM_DN4	IO	USB data-	
41	PCIE_TXN_A	O	PCIE 2.0 transmit data-	
43	PCIE_TXP_A	O	PCIE 2.0 transmit data+	
47	PCIE_RXN_A	I	PCIE 2.0 receive data-	
49	PCIE_RXP_A	I	PCIE 2.0 receive data+	
53	PCIE_CLKN_A	I	PCIE 2.0 CLK-	
55	PCIE_CLKP_A	I	PCIE 2.0 CLK+	
6	5G_PWR_OFF#1_1V8	I	5G power on and off control	1.8 V power domain
8	5G_DISABLE#1_1V8	O	5G Flight mode control data	
67	WWAN_RESET#1	I	5G RESET	

2.4.17 J16 Audio jack (17)

VT-SBC-RK3568 offers a 3.5mmaudio jack.

2.4.18 J15 Speaker connector (18)

VT-SBC-RK3568 offers a left/right speaker connector that is designed to connect a 5W/8Ω speaker.

specifications: 1 x 4, 2.0mm, 2A, 6mm (H), male, Vert, WDT, THR, RoHS (JST: B4B-PH-K-S (LF) (SN))

Pinout description:

Pin	Name	Type	Description
1	OUTL+A	A	5W speaker +
2	OUTL-A	A	5W speaker -
3	OUTR-A	A	5W speaker -
4	OUTR+A	A	5W speaker +

2.4.19 Buttons (19-21)

VT-SBC-3568 offers three buttons, including a volume button, an on/off button, and a reset button.

2.4.20 J18 Micro SIM (22)

VT-SBC-3568 offers a Micro SIM card slot.

Specifications: Micro SIM, push-push, -25℃~90℃, No WP, SMT, RoHS

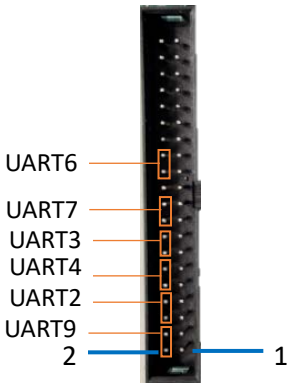
CHAPTER 3

SOFTWARE CONNECTION

3.1 Interface Definition

3.1.1 Serial port

VT-SBC-3568 offers 6 UART ports, including 2 RS485 ports (UART 6 & UART 7, corresponding to nodes ttyS6 & ttyS7), 1 TTL (UART 9, corresponding to ttyS9), 2 RS232 (UART 3 & UART 4, corresponding to ttyS3 and ttyS4), and 1 RS232 (UART 2) used for debugging.



Use the following commands to test the status of the serial port for the purpose of serial communication:

1. Input the node of the serial port to enable serial communication (USRT6 for instance);

```
# rs485_active /dev/ttyS6
```

2. Send data (“TEST”) to the serial port and receive the data.

```
# echo TEST > /dev/ ttyS6

# cat /dev/ ttyS6 &
```

The serial port cannot receive and transmit data at the same time.

3.1.2 USB interface

Input the following commands to check/configure the USB interface.

1. Check the information of USB interfaces:

```
# lsusb
```

2. Mount a USB device to /mnt directory:

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

3. Check the mounted content:

```
# ls /mnt
```

4. Unmount the USB device:

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

3.1.3 CAN

VT-SBC-3568 implements two CAN buses (CAN0 & CAN1).

Run the following commands to configure the CAN buses:

```
# ip link set can0 up type can bitrate 125000
IPv6: ADDRCONF(NETDEV_CHANGE): can0: link becomes ready
# ip link set can1 up type can bitrate 125000
IPv6: ADDRCONF(NETDEV_CHANGE): can1: link becomes ready
#ifconfig
can0      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:12 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:44 (44.0 B)  TX bytes:20 (20.0 B)
          Interrupt:32
can1      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:12 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:44 (44.0 B)  TX bytes:24 (24.0 B)
          Interrupt:33
```

3.1.4 GPIO

1. Check the GPIO directory:

```
# cd /sys/class/gpio ls
```

2. Write a GPIO pin number to "/sys/class/gpio/export" to export the pin, for instance pin value = 20:

```
# echo 20 > /sys/class/gpio/export
```

3. Set the pin direction as input or output (in for input and out for output);

```
# echo out > /sys/class/gpio/gpio20/direction
```

4. If you configured an output pin in the prior step, now you can set its value to 0 or 1 (corresponding to low or high) as follows:

```
# echo 0 > /sys/class/gpio/gpio20/value   [set it low], or

# echo 1 > /sys/class/gpio/gpio20/value   [set it high]
```

5. Read the GPIO value;

```
# cat /sys/class/gpio/gpio20/value
```

6. When you finish using the pin, just unexport it. To do this, write the pin number to the unexport file:

```
# echo 20 > /sys/class/gpio/unexport
```

3.2 Ethernet

Connect the Ethernet jack of the Board to the host PC with an Ethernet cable, then check the settings of the Ethernet jack:

```
# ifconfig
```

```
root@vantron:~#
root@vantron:~# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.9.135  netmask 255.255.255.0  broadcast 192.168.9.255
        inet6 fe80::2532:bf6e:b268:9f21  prefixlen 64  scopeid 0x20<link>
        ether 06:46:c6:0b:0a:3c  txqueuelen 1000  (Ethernet)
        RX packets 1951  bytes 219986 (214.8 KiB)
        RX errors 0  dropped 23  overruns 0  frame 0
        TX packets 167  bytes 16785 (16.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 24

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1  (Local Loopback)
        RX packets 68  bytes 4780 (4.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 68  bytes 4780 (4.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

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
```

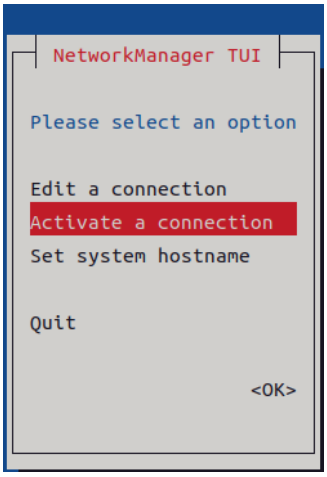
3.3 Wi-Fi

VT-SBC-3568 supports Wi-Fi and Bluetooth functions. You are recommended to use nmtui to set up the Wi-Fi network.

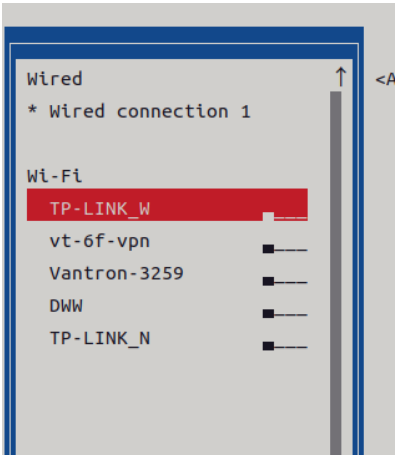
1. Open a terminal in the console, and input the following command to set up the network;

```
$ nmtui
```

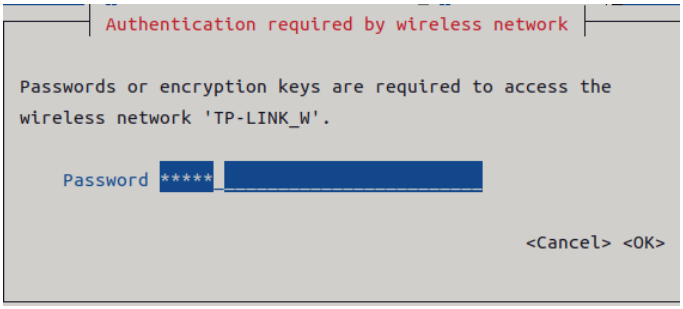
2. Use the arrows on the keyboard to navigate to **Activate a connection** and press **Enter**;



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



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

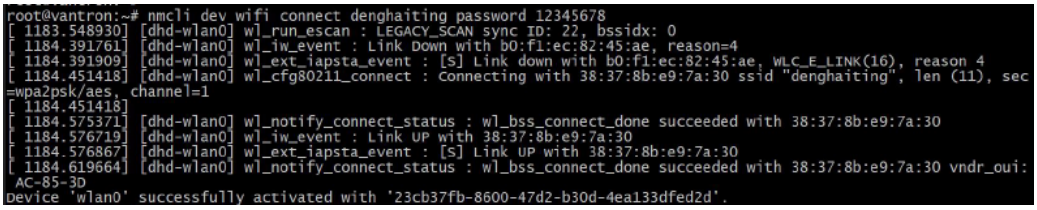


5. You will connect to the access point after successful verification.

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

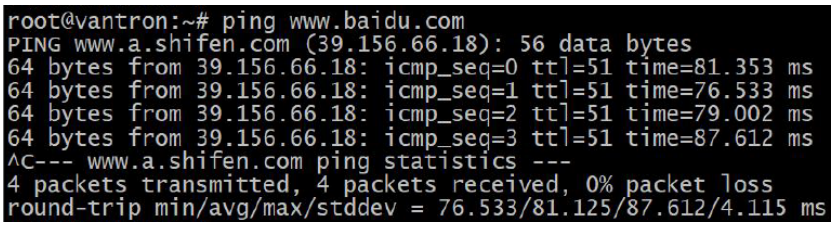
1. Input the following command in the terminal:

```
# 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.

3.4 Cellular Network

For boards that implement a cellular module, the module is powered up by default after the system boots up. Therefore, users don't need to power the board manually.

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

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

Taking EC20 for example, the functions of each port is explained as follows:

ttyUSB0 -> DIAG

ttyUSB1 -> GPS NMEA

ttyUSB2 -> AT

ttyUSB3 -> Modem

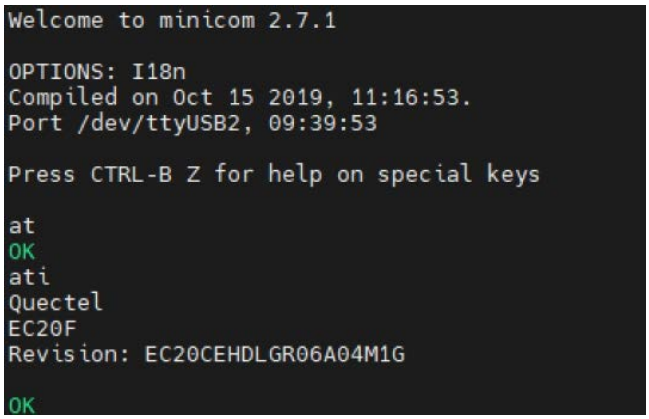
- AT control

  Use a serial port communication program (e.g., minicom) to configure serial port ttyUSB2 (only AT (ttyUSB2) and Modem (ttyUSB3) nodes of a serial port are used for sending AT commands) to send AT commands.

  1. Open ttyUSB2 via minicom;

     ```
     # minicom -D /dev/ttyUSB2 -b 115200
     ```

  2. In normal cases, the program will return the module information;

  3. Input the following commands to check/test relevant information.

     ATI -> Check product information

     AT+CPIN? -> Check if a SIM card is identified with the corresponding PIN code information

     AT+CSQ -> Check the signal quality

     AT+CREG? -> Check the registration status of the SIM card

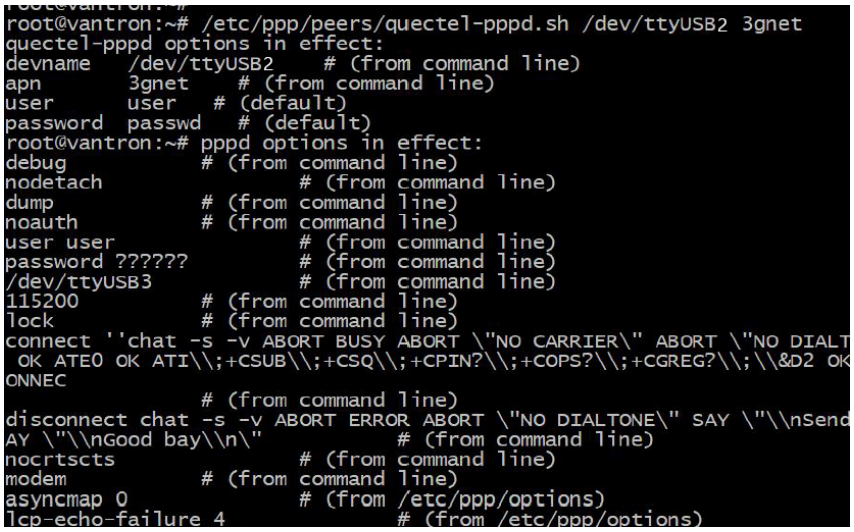
     AT+COPS? -> Check the carrier information

- PPP dial-up

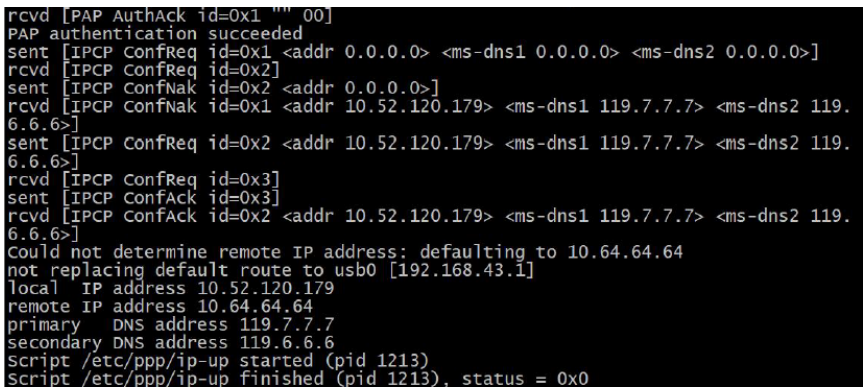
  There are two ways to start PPP dial-up:

```
# pppd call quectel-ppp &    // method 1
# /etc/ppp/peers/quectel-pppd.sh /dev/ttyUSB2 <APN> <username> <password>
  // method 2
```

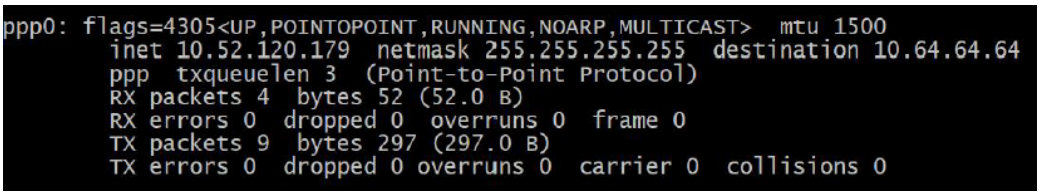
APN, username and password are provided by the carrier, and please modify the argument based on actual information (the figures below are for reference).



……



If the above steps go smoothly, the device will be connected. Users can input **ifconfig** in the console to check the network information, including the route (ppp0) and the IP address.



- 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)

```
root@vantron:~#
root@vantron:~# route add default gw 10.52.120.179
root@vantron:~#
root@vantron:~# ping www.baidu.com
PING www.a.shifen.com (110.242.68.4): 56 data bytes
64 bytes from 110.242.68.4: icmp_seq=0 ttl=53 time=56.510 ms
64 bytes from 110.242.68.4: icmp_seq=1 ttl=53 time=43.238 ms
64 bytes from 110.242.68.4: icmp_seq=2 ttl=53 time=43.457 ms
^C--- www.a.shifen.com ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 43.238/47.735/56.510/6.206 ms
```

3.5 RTC

RTC module provides accurate time and date information to the system. 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
```

3.6 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.

CHAPTER 4

YOCTO PROJECT DEVELOPMENT

Yocto Project is an open-source collaboration project for Linux-based systems regardless of the hardware architecture. The project provides a flexible set of tools and a space where embedded developers can share technologies, software stacks, configurations, and best practices to create tailored Linux images for embedded and IoT devices.

This chapter will brief on the basics to build a Yocto project.

4.1 Build Environment

4.1.1 Prerequisites

- It is best to have a native Linux machine function as the development host. Since the Yocto project is not compatible with Windows Subsystem for Linux (WSL), you are advised not to use a build host that is running WSL. This chapter is based on Ubuntu 18.04.
- Reserve at least 50GB of free disk space for image building. 120GB is recommended.
- Required Git, tar, and Python Versions:

  Git 1.8.3.1 or greater

  tar 1.27 or greater

  Python 3.4.0 or greater

Please refer to Yocto Project Reference Manual (System Requirements) for the supported Linux distributions and host requirements.

4.1.2 Dependency Installation

In order to complete a basic development or compilation task, you need install packages for the build host. For Ubuntu and Debian hosts, please install the following. Otherwise, please refer to Yocto Project Reference Manual (Required Packages for the Build Host).

```
$ sudo apt-get update
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
  build-essential chrpath socat cpio python3 python3-pip python3-pexpect \
  xz-utils debianutils iputils-ping python3-git python3-jinja2 libegl1-mesa libsdl1.2-dev \
  xterm
```

4.1.3 SDK installation

Run the installation script as follows:

```
$ ./vtlinux-x86_64-toolchain-4.0.4.sh
VtLinux - (A Yocto Project Based Distro) SDK installer version 4.0.4
==========================================================================
Enter target directory for SDK (default: /opt/vtlinux): /opt/rk3568
You are about to install the SDK to "/opt/rk3568". Proceed [Y/n]? Y
```

```
[sudo] password for hey:
Extracting
    SDK.....
    .....
    .....done
Setting it up...done
SDK has been successfully set up and is ready to be used.
Each time you wish to use the SDK in a new shell session, you need to source the
    environment setup script e.g.
 $ . /opt/rk3568/environment-setup-armv8a-vtlinux-linux
```

4.1.4 Test and verification

Use the “source” command to update the current environment script and initialize the compilation environment:

```
$ source /opt/rk3568/environment-setup-armv8a-vtlinux-linux
```

Check the environment variables:

```
$ echo $ARCH
arm64
```

```
$ echo $CROSS_COMPILE
aarch64-vtlinux-linux-
```

Check the GCC version:

```
$ $CC --version
aarch64-vtlinux-linux-gcc (GCC) 11.3.0
Copyright (C) 2021 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

Check the SDK version:

```
$ echo $OECORE_SDK_VERSION
4.0.4
```

If you get stuck at any of above steps, please re-install the SDK.

4.1.5 Compiling “Hello World”

```
$  cat hello.c
#include <stdio.h>
int main(void)
{
   printf("Hello World..\n");
   return 0;
}
$ CC hello.c -o hello
```

Copy the compiled program to the Board and run it:

```
$ ./hello
Hello World..
```

If the above steps go smoothly, the SDK environment is successfully built.

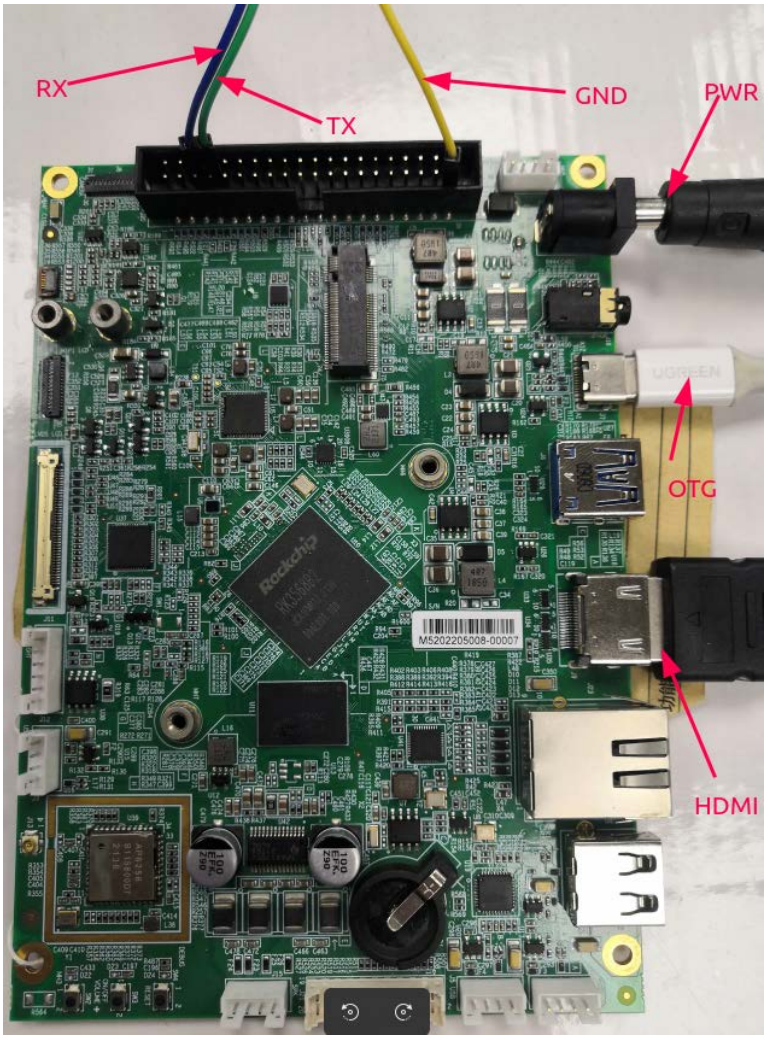
4.2 Image flashing

4.2.1 Prerequisites

- Software release package
- Device power supply: DC 12V 3A
- USB Type-C cable
- Serial port communication program, TTL serial cable
- A terminal host (Windows or Linux host with serial port communication program installed)

4.2.2 Hardware connection

Refer to the following figure to connect the Board with the host and peripheral.

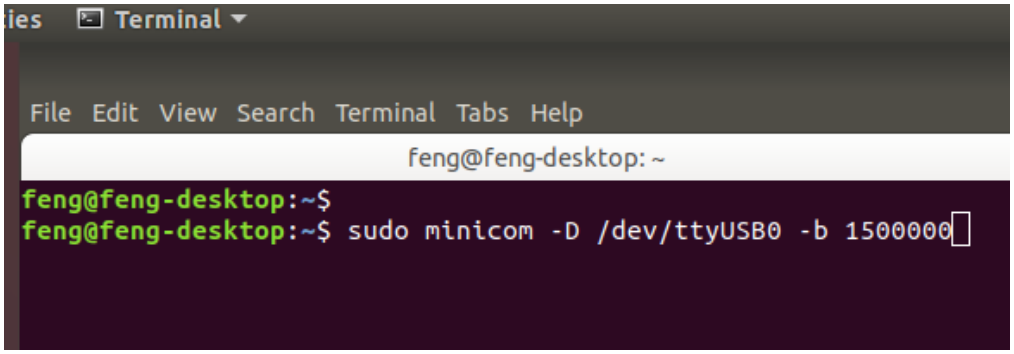


4.2.3 Preparation of the firmware package

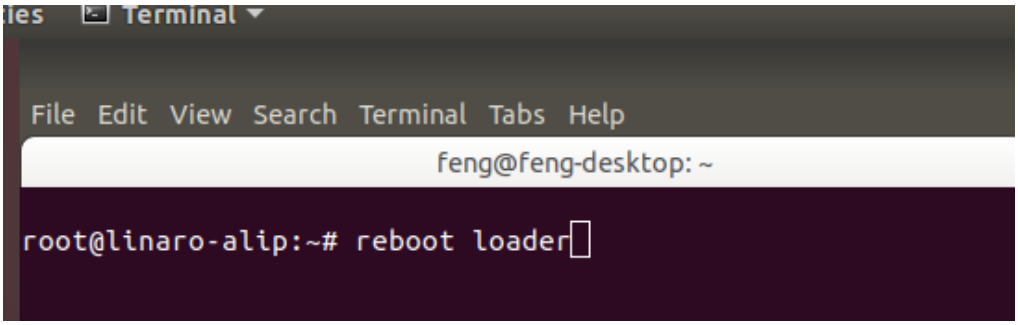
Please unzip the software release package sent by Vantron.

4.2.4 Image flashing

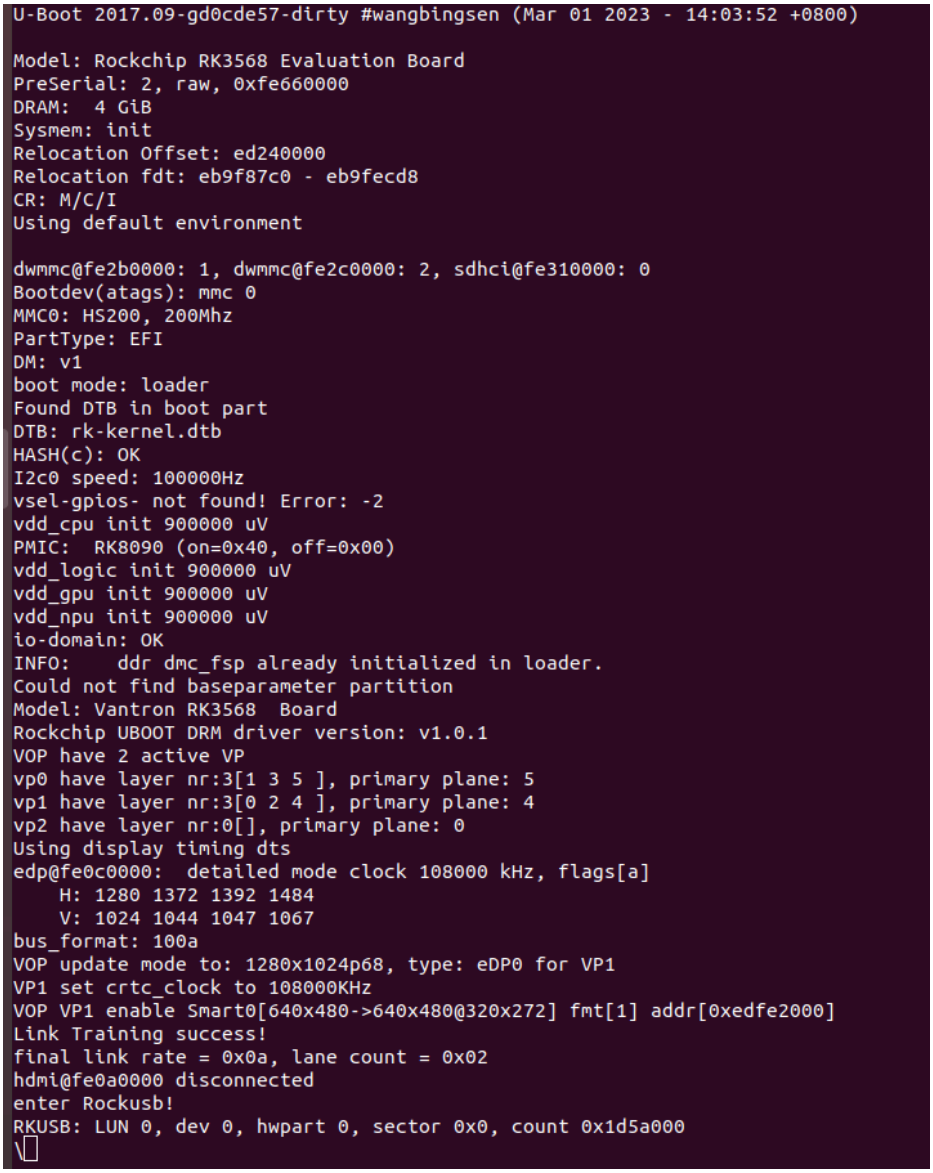
1. After connecting the debug serial port and power on the Board as indicated in 4.2.2, use the serial port communication program (e.g., minicom) to open the serial port with baud rate set to 1500000. The following example employs the Ubuntu system:



2. Run “reboot loader” command so that the Board enters the Loader mode to prepare for the image flashing;



3. The system will initialize for the flashing;



4. Copy the release package to the Ubuntu system or save the release package to a USB drive and mount the USB drive to the Ubuntu system;

5. Open the directory of the upgrade tool (“upgrade_tool”) in the Ubuntu system and right click the mouse in an empty space of the folder to open a terminal with the following command;

```
$ sudo upgrade_tool uf update-yocto-2023-2-10.img
```

“update-yocto-xxx.img” is the name of the image.

6. The system will reboot after image flashing.

CHAPTER 5

DEBIAN SYSTEM UPGRADE

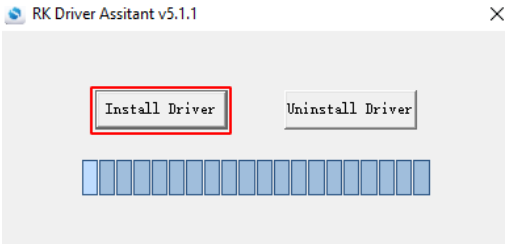
5.1 Firmware Upgrade in Windows Environment

5.1.1 Prerequisites

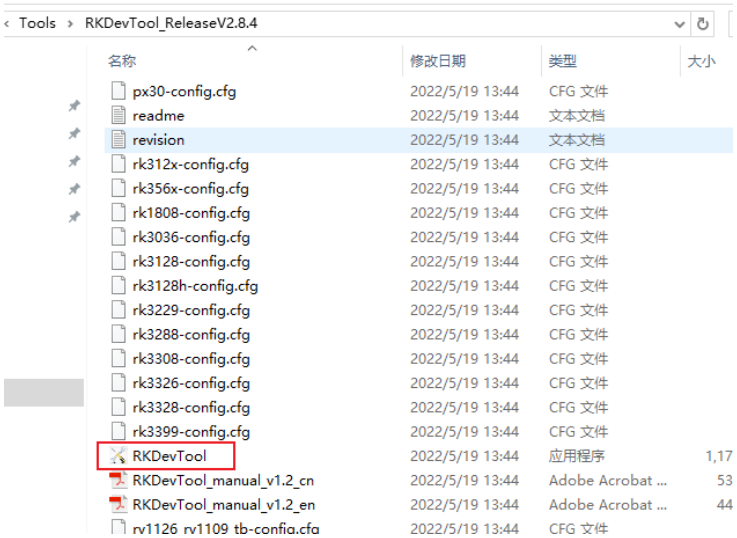
- VT-SBC-3568
- A host PC running Windows system (Windows 10 or later recommended)
- Release package
- USB Type-C cable

5.1.2 System flashing

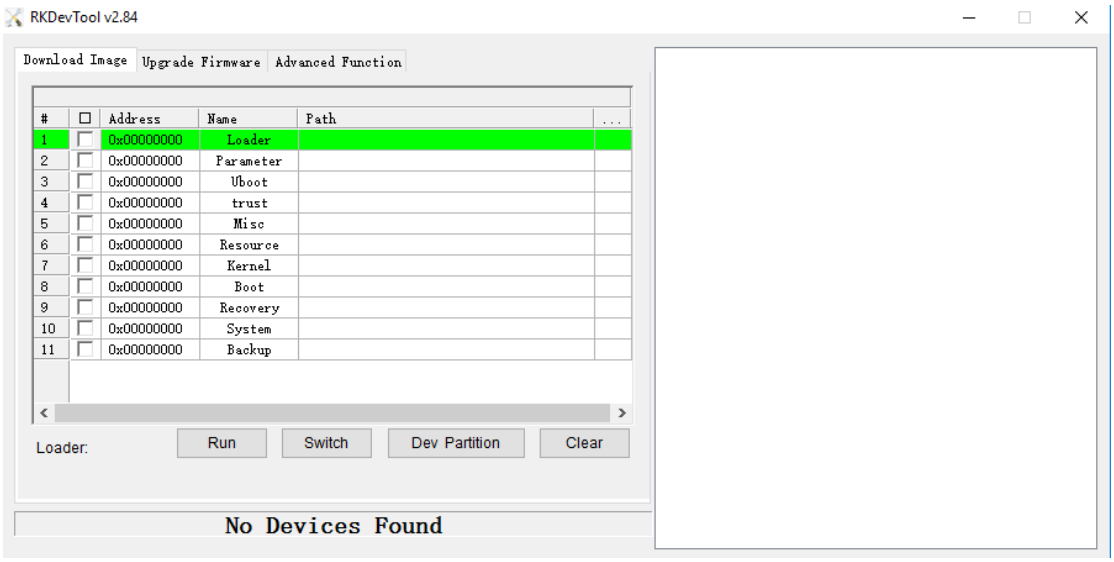
1. Unzip the release package, and open the directory of the upgrade driver (path: 700RBAGE0PC11_VT-SBC-RK3568,debianxxx,revxxx,Image_M,xxx \SW\downloadtools\windows\DriverAssitant_vxxx);
2. Right click the mouse and run the driver program **DriverInstall.exe** as administrator;
3. Click **Install Driver** and wait for the installation to proceed;



4. Open the directory of the upgrade tool (path: 700RBAGE0PC11_VT-SBC-RK3568,debianxxx,revxxx,Image_M,xxx \SW\downloadetools\windows\ RKDevTool_ Release_vxxx);
5. Double click the driver for the upgrade tool **RKDevTool.exe**;

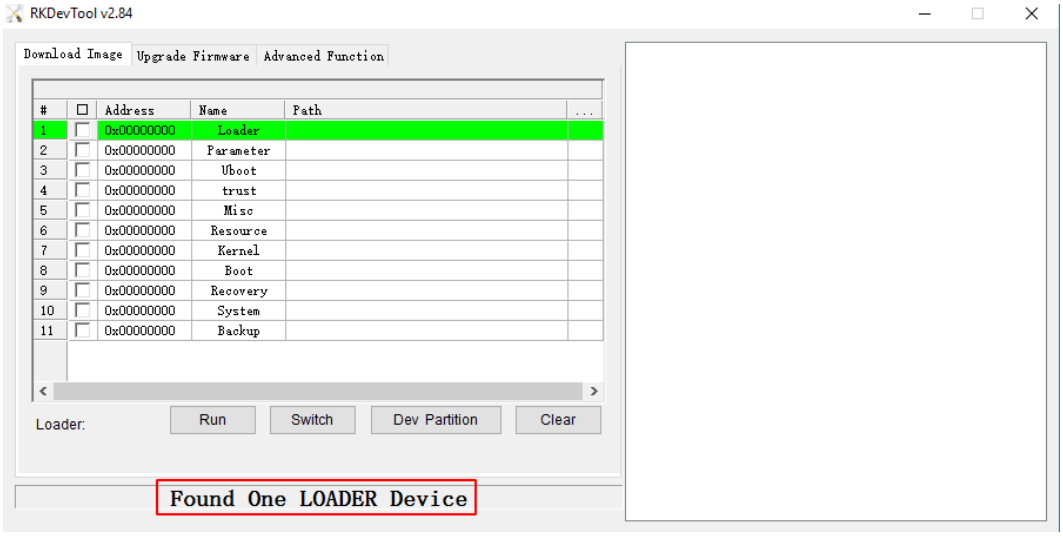


6. Open the upgrade window;



7. Connect VT-SBC-3568 to the Windows host with the USB Type-C cable;

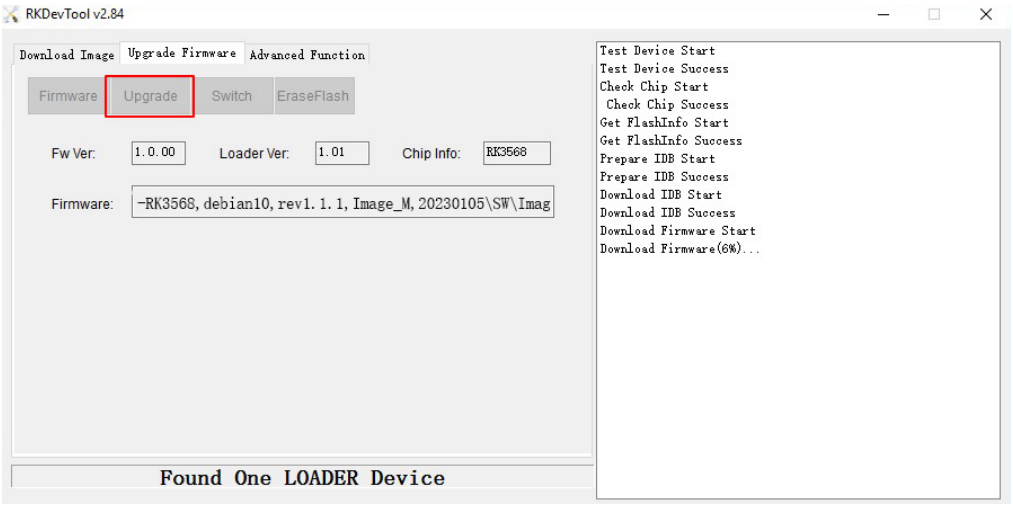
8. Input “reboot loader” command in a terminal to enter the Loader mode and the upgrade window will prompt for the existence of a Loader device;



9. Click **Upgrade Firmware** > **Firmware** in the upgrade window;

10. Select the upgrade file (**update.img)** from the directory (**SW\ Image**) and click **Open**, and the firmware details will be automatically populated in the firmware information box;

11. Click the **Upgrade** button and the dev ice will start to download the image and upgrade the firmware automatically;



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

5.2 Firmware Upgrade in Ubuntu Environment

5.2.1 Prerequisites

- VT-SBC-3568
- A host PC running Windows system (Windows 10 or later recommended)
- Release package
- USB Type-C cable

5.2.2 Image flashing

1. Connect VT-SBC-RK3568 to the Windows host with the USB Type-C cable;
2. Open a terminal and input “reboot loader” to enter the Loader mode;

```
root@vt-sbc-rk3568-gd32-ark:~# reboot loader
```

3. Copy the release package to the Ubuntu system or save the release package to a USB drive and mount the USB drive to the Ubuntu system;
4. Open the directory of the upgrade tool ("upgrade_tool") in the Ubuntu system (path: 700RBAGE0PC11_VT-SBC-RK3568,debianxxx,revxxx,Image_xxx\SW\ downloadetools\linux\Linux_Upgrade_Tool);
5. Right click the mouse in an empty space of the folder to open a terminal with the following command;

```
$ sudo ./upgrade_tool uf xxx/SW/update.img
```

> "xxx" is the name of the release package.

6. The system will start upgrading after the download finishes, and it will reboot automatically when the upgrade finishes.

CHAPTER 6

DISPOSAL AND PRODUCT WARRANTY

6.1 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.

6.2 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** 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 a 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.