# VT-SBC35-3576
# Single Board Computer

# User Manual

Version: 1.3

# Revision History

| No. | Version | Description | Date |
|---|---|---|---|
| 1 | V1.0 | First release | Oct. 14, 2024 |
| 2 | V1.1 | Updated pinout description of GPIO | Nov. 26, 2024 |
| 3 | V1.2 | Added the power consumption readings when running different systems | Jan. 6, 2025 |
| 4 | V1.3 | Updated the description for connecting the M.2 B-Key slot | Feb. 7, 2025 |

# Table of Contents

# Foreword

Thank you for purchasing VT-SBC35-3576 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 engineer
- Other technically qualified personnel

## Copyright



## 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.

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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-SBC35-3576 single board computer comes in a 3.5-inch form factor that is ideal for integration into embedded devices. The board is powered by Rockchip RK3576 high-performance, low-power octa-core processor that integrates four Cortex-A72 cores and four Cortex-A53 cores, running at up to 2.2GHz. This processor also includes a NEON co-processor for efficient SIMD (Single Instruction, Multiple Data) operations. The Arm Mali-G52 MC3 GPU supports OpenGL ES1.1/2.0/3.2, OpenCL 2.1, and Vulkan 1.2 for enhanced 2D/3D graphic acceleration, along with H.264 and H.265 video codec support.

The built-in NPU offers 6 TOPS of processing performance, with support for mainstream deep-learning frameworks such as TensorFlow, TF-Lite, Pytorch, Caffe, Onnx NN, Android NN, etc. The board offers three MIPI CSI interfaces for camera use, supporting 16 Megapixel ISP.

For connectivity, VT-SBC35-3576 offers dual Gigabit Ethernet ports, a combo Wi-Fi 6 and Bluetooth 5.1 module, and optional 4G/5G cellular network for IoT applications. In addition, it provides rich peripherals for application in diverse settings, such as advertising HMIs, cash registers, smart whiteboards, gateways, industry-specific tablets, network video recorders, and Over the Top (OTT) services.

## 1.2 Product Feature

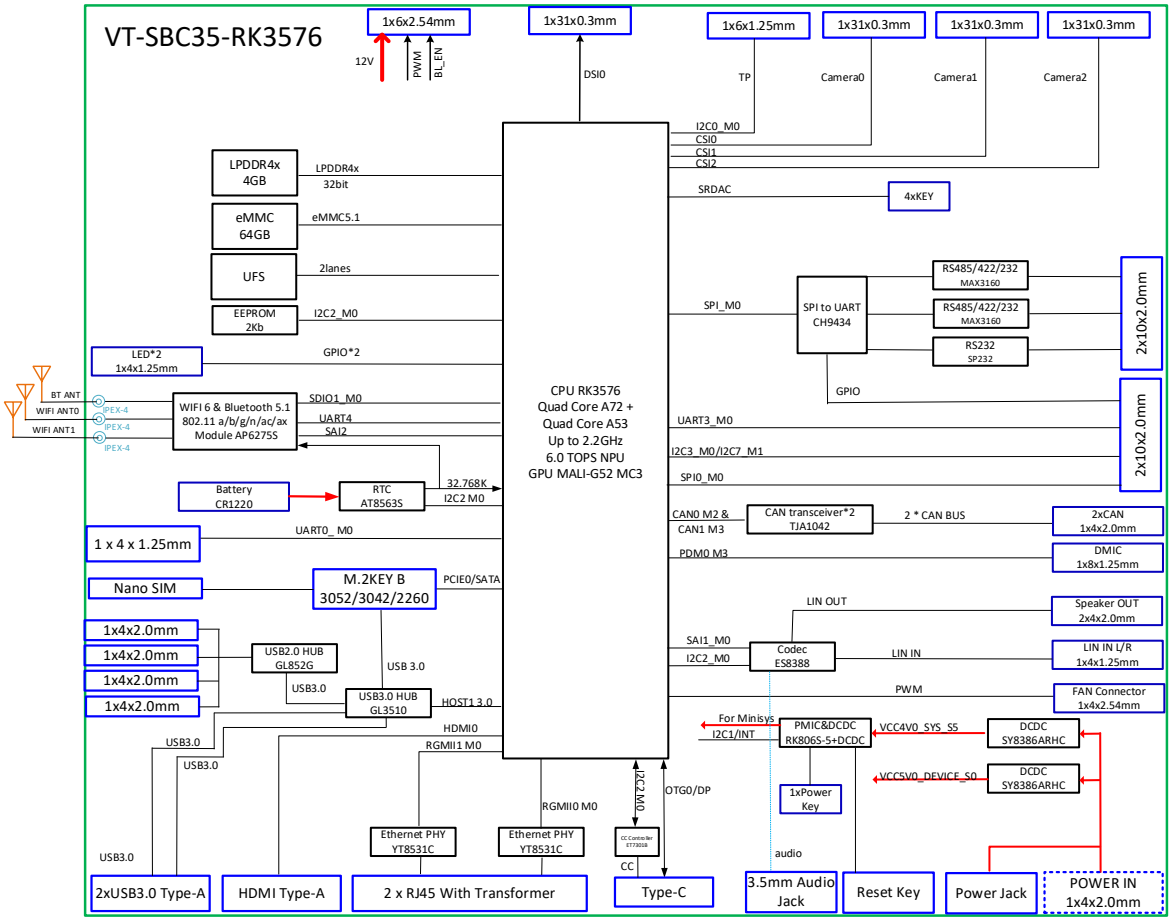
- Rockchip RK3576, quad-core ARM Cortex-A72 + quad-core ARM Cortex-A53 high-performance processor
- 4GB memory
- 128GB UFS 2.1 + 64GB eMMC 5.1 (UFS boot)
- 8K30 or 4K120 H.264/H.265/VP9/AV2/AVS2 decoder, 4K60 H.264/H.265 encoder
- Up to 2560 x 1600 @60Hz MIPI DSI output, up to 4K @120Hz HDMI & DP (USB-C) output
- Dual Ethernet, Wi-Fi 6, BT 5.1, optional 4G/5G connectivity
- Three MIPI CSI interfaces, supporting 16MP with HDR for camera ISP
- Rich interfaces for flexible expansion (GPIO, RS232/RS485/RS422, USB, CAN, $I^2C$, TP)
- Up to 6 TOPS processing performance, with support for mainstream AI frameworks
- 3.5-inch form factor for easy integration

## 1.3 Terminology/Acronym

Please refer to the table below for acronyms or terminologies used in this document, especially for those included in the pinout description of the device.

| Terminology/Acronym | Description |
|---|---|
| NC | No connection |
| VCC | Voltage common collector |
| GND | Ground |
| P (+) | Positive difference signal |
| N (-) | Negative difference signal |
| SCL | Serial clock |
| SDA | Serial data |
| I | Input |
| O | Output |
| I/O | Input/output |
| P | Power/ground |
| RX | Receive data |
| TX | Transmit data |
| PCIe | Peripheral component interconnect express |
| MDI | Media dependent interface |
| INT | Interrupt |
| RST | Reset |
| MISO | Master in slave out |
| MOSI | Master out slave in |

## 1.4 Block Diagram



## 1.5 Specifications

| VT-SBC35-3576 | | | |
|---|---|---|---|
| **System** | CPU | Rockchip RK3576, quad-core ARM Cortex-A72 + quad-core ARM Cortex-A53 processor, up to 2.2GHz | |
| | GPU | Arm Mali G52 MC3 GPU<br>OpenGL ES1.1/2.0/3.2, OpenCL 2.1, and Vulkan 1.2 supported | |
| | NPU | 6 TOPS | |
| | Memory | 4GB 32-bit LPDDR4x | |
| | Storage | 128GB UFS 2.1 (UFS boot)<br>64GB eMMC 5.1<br>Optional: SSD expansion (M.2 B-Key), up to 1TB | |
| **Communication** | Ethernet | 2 x RJ45, 10/100/1000Mbps | |
| | Wi-Fi & Bluetooth | Wi-Fi 6: 802.11 a/b/g/n/ac/ax + BT 5.1 | |
| | Cellular | Optional: 4G/5G (M.2 B-Key) | |
| **Media** | Display (extended mode) | 1 x MIPI DSI, up to 2560 x 1600 @60Hz<br>1 x HDMI 2.1, up to 4K @120Hz<br>1 x DisplayPort over USB-C, up to 4K @120Hz | |
| | Backlight | 1 x Backlight connector (for LVDS when necessary) | |
| | Video CODEC | 8K30 or 4K120 H.264/H.265/VP9/AV2/AVS2 decoder, 4K60 H.264/H.265 encoder | |
| | Audio | 4 x D-Mic with 2 PDM ports<br>1 x Line in<br>1 x 3.5mm combo audio jack (CTIA standard)<br>1 x Speaker amplifier connector | |
| | Camera | 3 x MIPI CSI-2, ISP: 16MP with HDR | |
| | Touch | 1 x $I^2C$ TP connector | |
| **I/O** | Serial port | 2 x RS232 | 2 x RS232/485/422 |
| | USB | 2 x USB 3.0 Type-A<br>4 x USB 2.0 connector<br>1 x USB 3.0 Type-C (OTG, DisplayPort 1.4) | |
| | CAN | 2 x CAN | |
| | GPIO | 1 x GPIO header, including 1 x SPI, 1 x UART, 1 x $I^2C$, 2 x GPIO | |
| | Fan | 1 x PWM fan connector (12V) | |
| | UART | 1 x Debug UART (3.3V) | |
| | SIM | 1 x Nano SIM slot | |
| | Antenna | 2 x Wi-Fi antenna connector (IPEX-4)<br>1 x Bluetooth antenna connector (IPEX-4) | |

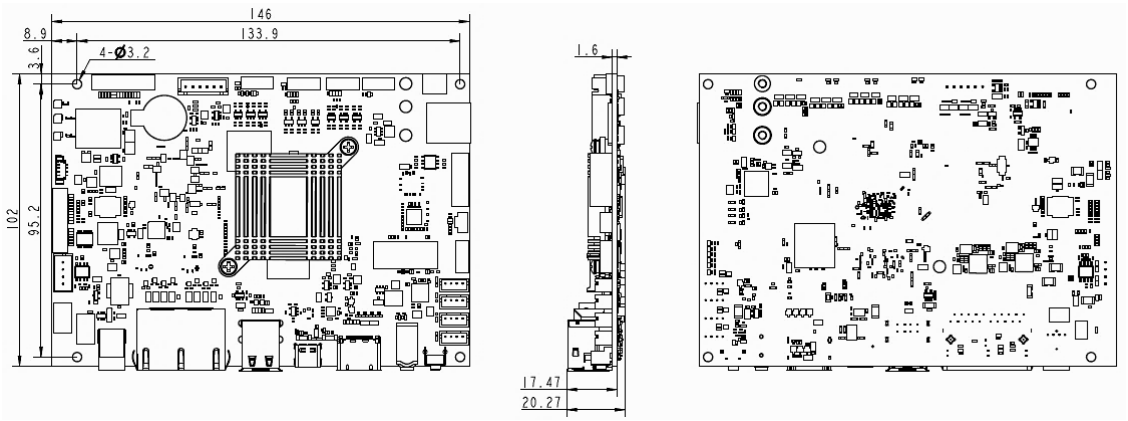
| VT-SBC35-3576 | | | |
|---|---|---|---|
| **Miscellaneous** | RTC | Supported | |
| | WDT | Supported | |
| **Expansion** | M.2 slot | 1 x M.2 B-Key (2260, SATA/PCIe 2.1 for SSD / 3042, USB 3.0 for 4G / 3052, USB 3.0/PCIe 2.1 for 5G) | |
| **System Control** | Button | 1 x Reset button, 1 x MaskROM button, 1 x Power button, 4 x Button (Volume +/-, ESC, Menu) | |
| | LED indicator | 2 x LED indicator (Red: Power on, Green: Normal operation; user definable) | |
| **Power** | Input | 12V DC<br>1 x Power jack | |
| | Consumption | Typical: 2.4W, Max.: 6W | |
| **Software** | Operating system | Android 14, Debian 11 | |
| **Mechanical** | Dimensions | 146mm x 102mm | |
| | Heat dissipation | Heat sink | |
| **Environment Condition** | Temperature | Operating: -20℃~+70℃<br>(Optional: -40℃~+85℃) | Storage: -30℃~+80℃<br>(Optional: -55℃~+85℃) |
| | Humidity | 20%-80% RH (Non-condensing) | |

## 1.6 Operating system

VT-SBC35-3576 supports Android 14 and Debian 11 operating systems.

## 1.7 Mechanical Dimensions

- 146mm x 102mm x 20.27mm




## 1.8 Power Supply and Consumption

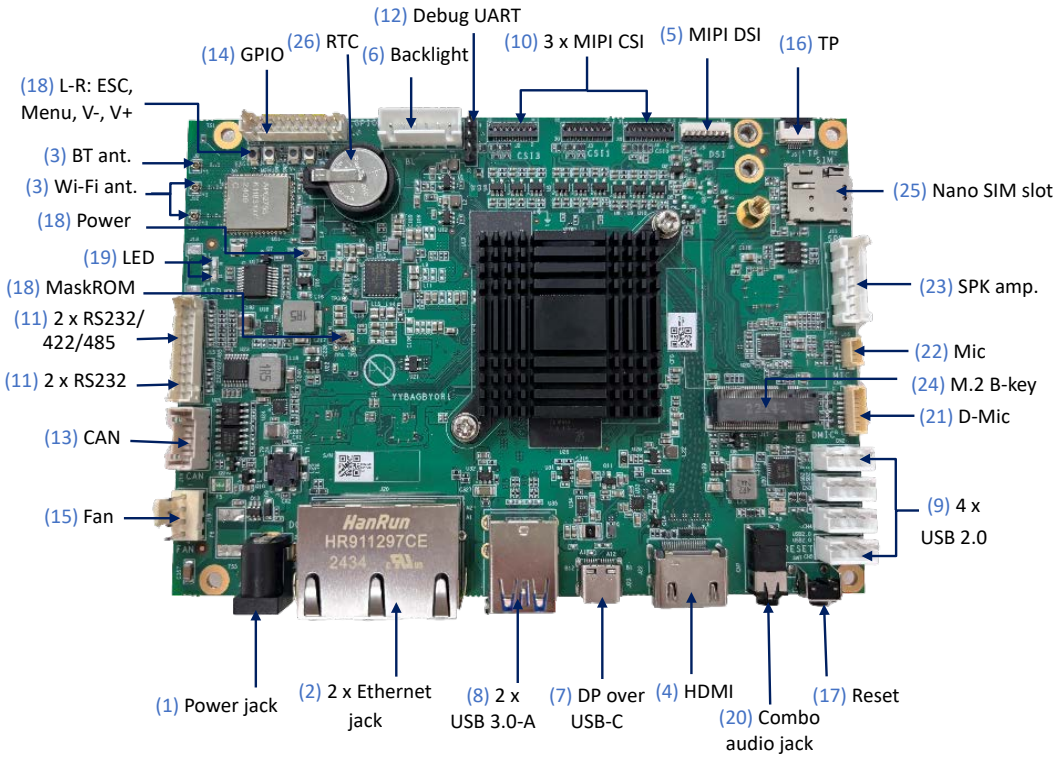
VT-SBC35-3576 works with 12V DC power supply. It consumes approximately 2.4W of power in typical conditions and up to 6W at full load.

## 1.9 Environmental Conditions

VT-SBC35-3576 operates within a temperature range of -20°C to +70°C, with an optional extended range of -40°C to +85°C. It is intended for storage within a temperature range of -30°C to +80°C, with an optional extended range of -55°C to +85°C. It is designed to function and be stored in environments with relative humidity between 20% and 80% for non-condensing purpose.

# CHAPTER 2 HARDWARE DESCRIPTION

## 2.1 Product Layout




*The 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 LPDDR4x RAM

VT-SBC35-3576 is equipped with a 4GB 32-bit LPDDR4x RAM.

### 2.2.2 Storage

VT-SBC35-3576 features 128GB of dual-lane UFS 2.1 for system boot and storage. It also includes a 64GB eMMC 5.1 flash for data storage.

Additionally, the board supports up to 1TB of SSD expansion via an M.2 Key B slot.

### 2.2.3 EEPROM

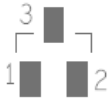
VT-SBC35-3576 provides a 2Kb EEPROM to store hardware configuration information.

## 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.



Typically, there will be numbers or markings next to the pins of a connector on the board to indicate the pinout configuration.




## 2.4 Connectors and Jumpers

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

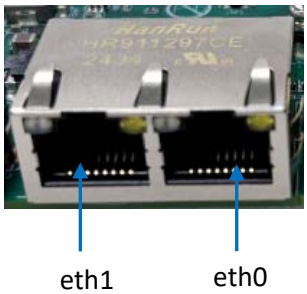
### 2.4.1 J21 Power input (1)

VT-SBC35-3576 implements a power jack (with an internal pin diameter of 2.5 mm) , through which 12V DC power can be supplied to the board.

### 2.4.2 J20 Ethernet port (2)

VT-SBC35-3576 offers two RJ45 Ethernet jacks, each featuring two LEDs— green for activity indication and yellow for link status. The Ethernet jacks support 10/100/1000 Mbps transfer speed.

The two Ethernet jacks are designated as WAN ports by default, intended for connecting to a router or switch to establish Internet access.



### 2.4.3 J9/J10/J12 Wi-Fi and BT antenna connector (3)

VT-SBC35-3576 offers a Wi-Fi and Bluetooth combo SiP module, supporting Wi-Fi 802.11 a/b/g/n/ac/ax and Bluetooth 5.1. The WLAN data rate is up to 1200 Mbps.

There are two IPEX-4 Wi-Fi antenna connectors (J10, J12) next to the SiP module for connecting primary and diversity antennas. An IPEX-4 Bluetooth antenna connector (J9) is also implemented for connecting a Bluetooth antenna.

### 2.4.4 J22 HDMI (4)

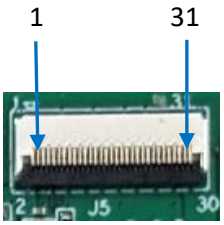
VT-SBC35-3576 offers an HDMI 2.1 Type-A interface for up to 4K @120Hz image output. The pinout description of the interface is in line with the pin assignment of a standard HDMI Type-A interface.

This port can be used simultaneously with other display ports to enable extended display mode.

### 2.4.5 J5 MIPI DSI (5)

VT-SBC35-3576 offers a MIPI DSI interface that supports MIPI C PHY and D PHY, allowing for the connection of a dual-channel display to enable extended display mode. It supports resolutions up to 2560 x 1600 at 60Hz. Additionally, the interface can be customized to an LVDS configuration, and the backlight connector is designed to interface with a backlight for the LVDS setup.

Specification: 1 x 31, 0.3mm, 0.2mm (FPC/FFC thickness)




Pinout description:

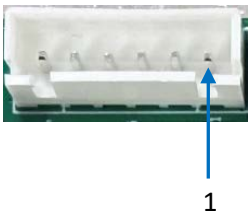
| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | VCC3V3_LCD | P | 3.3V power output |
| 2 | VCC3V3_LCD | P | 3.3V power output |
| 3 | VCC1V8_LCD | P | 1.8V power output |
| 4 | GND | | Ground |
| 5 | RST_LCD | P | LCD reset |
| 6 | ID | P | LCD ID |
| 7 | GND | P | Ground |

| | | | |
|---|---|---|---|
| 8 | MIPI_D3N | | MIPI DSI differential lane 3 - |
| 9 | MIPI_D3P | P | MIPI DSI differential lane 3 + |
| 10 | GND | P | Ground |
| 11 | MIPI_D0N | O | MIPI DSI differential lane 0 - |
| 12 | MIPI_D0P | O | MIPI DSI differential lane 0 + |
| 13 | GND | P | Ground |
| 14 | MIPI_CLK- | O | MIPI DSI differential clock lane - |
| 15 | MIPI_CLK+ | O | MIPI DSI differential clock lane + |
| 16 | GND | P | Ground |
| 17 | MIPI_D1N | O | MIPI DSI differential lane 1 - |
| 18 | MIPI_D1P | O | MIPI DSI differential lane 1 + |
| 19 | GND | P | Ground |
| 20 | MIPI_D2N | O | MIPI DSI differential lane 2 - |
| 21 | MIPI_D2P | O | MIPI DSI differential lane 2 + |
| 22 | GND | P | Ground |
| 23 | GND | P | Ground |
| 24 | NC | | |
| 25 | LED- | O | LED- |
| 26 | LED- | O | LED- |
| 27 | LED- | O | LED- |
| 28 | NC | | |
| 29 | LED+ | O | LED+ |
| 30 | LED+ | O | LED+ |
| 31 | LED+ | O | LED+ |

### 2.4.6 J7 Backlight connector (6)

VT-SBC35-3576 implements a backlight connector, designed to interface with a backlight for the LVDS interface that is customized from the MIPI DSI interface.

Specification: 1 x 6, 2.5mm




Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | VCC3V3_LCD | P | 3.3V power output |
| 2 | VCC3V3_LCD | P | 3.3V power output |
| 3 | VCC1V8_LCD | P | 1.8V power output |
| 4 | GND | | Ground |
| 5 | RST_LCD | P | LCD reset |
| 6 | ID | P | LCD ID |

### 2.4.7 J23 USB Type-C/DP (7)

VT-SBC35-3576 offers a USB 3.0 Type-C interface supporting the OTG feature. Users can use this interface for debugging or programming the board. This interface can also be used as DisplayPort 1.4 for image output, supporting resolutions up to 4K @120Hz.

### 2.4.8 USB Type-A (7)

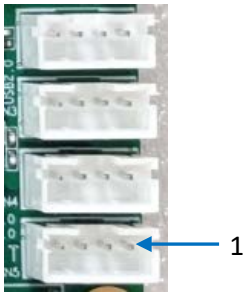
VT-SBC35-3576 offers two USB 3.0 Type-A in stacked configuration, allowing users to connect peripherals to expand the board function.

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

### 2.4.9 CN2/CN3/CN4/CN5 USB 2.0 connector (9)

VT-SBC35-3576 offers four USB 2.0 connectors, and users can connect peripherals such as USB keyboard, USB drives, and USB cameras through this connector using a USB adapter cable. The pinout of each connector is the same.

Specification: 1 x 4, 2.0mm




Adapter cable illustration

Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | USB2.0_VCC | P | 5V power output |
| 2 | USB2.0_DM | I/O | USB data - |
| 3 | USB2.0_DP | I/O | USB data + |
| 4 | GND | P | Ground |

### 2.4.10 J2/J3/J4 MIPI CSI (10)

VT-SBC35-3576 offers three MIPI CSI-2 connectors (Cam 0, Cam 1, Cam 3), with the same pinout. The connectors support MIPI D-PHY v1.2, MIPI C PHY / D PHY, each offering four differential data lanes for connecting a camera, with up to 16MP image signal processing capabilities.

Specification: 1 x 31, 0.3mm, 0.2mm (FPC/FFC thickness)

Pinout description of Cam 0:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | GND | P | Ground |
| 2 | CAM0_D3N | I | Camera 0 RX3 - |
| 3 | CAM0_D3P | I | Camera 0 RX3 + |
| 4 | GND | P | Ground |
| 5 | CAM0_D2N | I | Camera 0 RX2 - |
| 6 | CAM0_D2P | I | Camera 0 RX2 + |
| 7 | GND | P | Ground |
| 8 | CAM0_D1N | I | Camera 0 RX1 - |
| 9 | CAM0_D1P | I | Camera 0 RX1 + |
| 10 | GND | P | Ground |
| 11 | CAM0_D0N | I | Camera 0 RX0 - |
| 12 | CAM0_D0P | I | Camera 0 RX0 + |
| 13 | GND | P | Ground |
| 14 | CAM0_CLKN | I | MIPI CSI clock - |
| 15 | CAM0_CLKP | I | MIPI CSI clock + |
| 16 | GND | P | Ground |
| 17 | CAM0_SCL | O | Camera 0 $I^2C$ serial clock, 1.8V |
| 18 | CAM0_SDA | I/O | Camera 0 $I^2C$ serial data, 1.8V |
| 19 | CAM0_RST | O | Camera 0 reset signal, 1.8V |
| 20 | CAM0_PDN | O | Camera 0 power down signal, 1.8V |
| 21 | GND | P | Ground |
| 22 | CAM0_MCLK | O | Camera 0 main clock |
| 23 | GND | P | Ground |
| 24 | NC | | |
| 25 | IO_1V8_J | P | 1.8V Power output |
| 26 | IO_1V8_J | P | 1.8V Power output |
| 27 | Core_1V5_J | P | 1.5V Power output |
| 28 | AF_2V8_J | P | 2.8V Power output |
| 29 | PWR_2V8_J | P | 2.8V Power output |
| 30 | NC | | |
| 31 | GND | P | Ground |

The pinout of Cam 1 and Cam 3 is the same as Cam 0.

### 2.4.11 J15 RS232/RS485/RS422 (11)

VT-SBC35-3576 implements a 20-pin header, offering two RS232/RS485/RS422 ports (J0, J1) and two RS232 (J2, J3), with a baud rate range from 1200bps to 4Mbps.

Ports J0, J1, J2, J3 are mapped as ttyWCH0, ttyWCH1, ttyWCH2, and ttyWCH3, respectively in the software file system.

Specification: 2 x 10, 2.0mm


Pinout description:

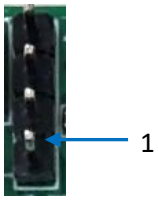
| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | BUS_5V | P | 5V Power output |
| 2 | BUS_5V | I | 5V Power output |
| 3 | RS422_Z/RS485_B/RS232_TXD_J0 | I | J0 RS422_Z/RS485_B/ RS232 TX |
| 4 | RS422_Z/RS485_B/RS232_TXD_J1 | P | J1 RS422_Z/RS485_B/ RS232 TX |
| 5 | RS422_Y/RS485_A_J0 | I | J0 RS422_Y/RS485_A |
| 6 | RS422_Y/RS485_A_J1 | I | J1 RS422_Y/RS485_A |
| 7 | RS422_B_J0 | P | J0 RS422_B |
| 8 | RS422_B_J1 | I | J1 RS422_B |
| 9 | RS422_A/RS232_RXD_J0 | I | J0 RS422_A/RS232 RX |
| 10 | RS422_A/RS232_RXD_J1 | P | J1 RS422_A/RS232 RX |
| 11 | GND | I | Ground |
| 12 | GND | I | Ground |
| 13 | BUS_5V | P | 5V Power output |
| 14 | BUS_5V | I | 5V Power output |

| Pin | Name | Type | Description |
|---|---|---|---|
| 15 | RS232_SPI_TXD_J2 | I/O | J2 RS232 TX |
| 16 | RS232_SPI_RXD_J2 | I/O | J2 RS232 RX |
| 17 | RS232_SPI_TXD_J3 | I/O | J2 RS232 TX |
| 18 | RS232_SPI_RXD_J3 | I/O | J2 RS232 RX |
| 19 | GND | P | Ground |
| 20 | GND | P | Ground |

### 2.4.12 J8 Debug UART (12)

As mentioned previously, VT-SBC35-3576 can be debugged via the USB Type-C port as well as a 4-pin debug UART.

Specification: 1 x 4, 2.54mm



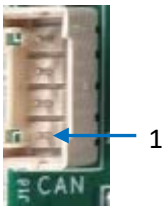

Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | VCC | P | 3.3V Power output |
| 2 | CPU_RXD_3.3V | I | Receive data (3.3V) |
| 3 | CPU_TXD_3.3V | O | Transmission data (3.3V) |
| 4 | GND | P | Ground |

### 2.4.13 J18 CAN (13)

VT-SBC35-3576 offers two CAN buses, supporting CAN FD protocol, with a data transmission rate up to 5Mbps.

Specification: 1 x 4, 2.5mm




Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | CAN0_H_C | I/O | CAN0 high level |
| 2 | CAN0_L_C | I/O | CAN0 low level |
| 3 | CAN1_H_C | I/O | CAN1 high level |
| 4 | CAN1_L_C | I/O | CAN1 low level |

### 2.4.14 J1 GPIO (14)

VT-SBC35-3576 implements a GPIO header that offers $I^2C$, UART, SPI, and GPIO signals. Users may choose to customize such signals as GPIO based on needs.

Specification: 2 x 10, 2.0mm


Pinout description:

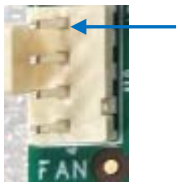
| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | IO_5V | P | 5V output |
| 2 | IO_5V | P | 5V output |
| 3 | SPI4_CLK_J | I/O | SPI clock output (3.3V) |
| 4 | UART5_TXD_3V3_J | I/O | UART TXD (3.3V) |
| 5 | SPI4_CSB_J | I/O | SPI chip select input (3.3V) |
| 6 | UART5_RXD_3V3_J | I/O | UART RXD (3.3V) |

| Pin | Name | Type | Description |
|---|---|---|---|
| 7 | SPI4_MI_J | I/O | SPI master input slave output (3.3V) |
| 8 | UART5_CTS_3V3_J | I/O | UART clear to send (3.3V) |
| 9 | SPI4_MO_J | I/O | SPI master output slave input (3.3V) |
| 10 | UART5_RTS_3V3_J | I/O | UART request to send (3.3V) |
| 11 | GND | P | Ground |
| 12 | GND | P | Ground |
| 13 | IO_5V | P | 5V output |
| 14 | IO_5V | P | 5V output |
| 15 | GPIO_OUT1_J | I/O | GPIO 1 (3.3V) |
| 16 | I2C8_SCL_3V3_J | I/O | $I^2C$ serial clock (3.3V) |
| 17 | GPIO_OUT2_J | I/O | GPIO 2 (3.3V) |
| 18 | I2C8_SDA_3V3_J | I/O | $I^2C$ serial data (3.3V) |
| 19 | GND | P | Ground |
| 20 | GND | P | Ground |

### 2.4.15 J19 Fan connector (15)

There is a fan connector on the board for connecting a fan to cool down the board, and the speed is adjusted via pulse width modulation.

Specification: 1 x 4, 2.0mm



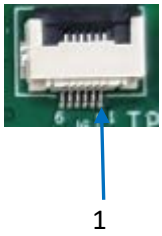

Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | GND | P | Ground |
| 2 | FAN_12V_CON | P | 12V power supply |
| 3 | GND | P | Ground |
| 4 | FAN_PWM_Control | I/O | PWM control output |

### 2.4.16 J6 I²C TP (16)

VT-SBC35-3576 offers an I²C touch panel header that enables touch control of a connected display.

Specification: 1 x 6, 0.5mm, 0.3mm (FPC/FFC thickness)




Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | TP_VDD_3.3V | P | 3.3V power output |
| 2 | TP_I2C_SDA | I/O | I²C TP serial data (3.3V) |
| 3 | TP_I2C_SCL | I/O | I²C TP serial clock (3.3V) |
| 4 | TP_INT | I/O | TP interrupt signal (3.3V) |
| 5 | TP_RST | I/O | TP reset signal (3.3V) |
| 6 | GND | I/O | Ground |

### 2.4.17 SW7 Reset button (17)

Pressing the reset button briefly (less than 3 seconds) will restart the system.

### 2.4.18 Function buttons (18)

VT-SBC35-3576 offers multiple function buttons, including:

SW1: Menu; SW2: Volume -; SW3: Volume +; SW4: ESC

SW5: Power button, for turning on/off the system

SW6: MASKROM button, for firmware upgrade.

### 2.4.19 LED indicator (19)

VT-SBC35-3576 features two customizable LED indicators, allowing users to assign functions according to their needs. By default, the LEDs will light up red and green, respectively, when the system is powered on.

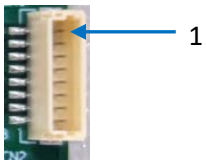
### 2.4.20 CN7 Audio jack (20)

VT-SBC35-3576 offers a 3.5mm four-section combo audio jack, supporting audio cables that comply with the CITA standard (defined as follows).


### 2.4.21 CN1 D-Mic (21)

VT-SBC35-3576 offers two D-mic channels that support pulse density modulation (PDM). Users can connect external microphones via the channels for high-quality audio input.

Specification: 1 x 8, 1.0mm



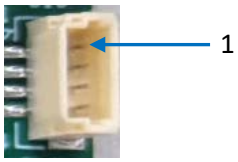

Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | DMICBIAS | P | 1.8V power output |
| 2 | DMIC_CLK1 | I/O | D-mic clock 1 |
| 3 | DMIC_DAT1 | I/O | D-mic data 1 |
| 4 | GND | P | Ground |
| 5 | DMICBIAS | P | 1.8V output |
| 6 | DMIC_CLK2 | I/O | D-mic clock 2 |
| 7 | DMIC_DAT2 | I/O | D-mic data 2 |
| 8 | GND | P | Ground |

### 2.4.22 J16 A-Mic (22)

The A-mic supports dual-channel, high-power audio recording.

Specification: 1 x 4, 1.0mm



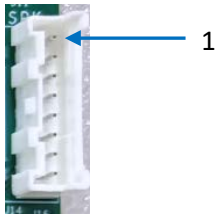

Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | VCC_AU_VIN1_J | P | 3.3V output |
| 2 | AU_VIN0_L_J | O | Left channel input |
| 3 | AU_VIN0_R_J | O | Right channel input |
| 4 | GND | P | Ground |

### 2.4.23 J14 Speaker amplifier (23)

The power amplifier delivers a 12V DC output with a current of up to 160mA, enabling the connection of an external power amplifier, which can then be linked to a speaker for audio output.

Specification: 1 x 8, 2.0mm




Pinout description:

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | GND | P | Ground |
| 2 | AU_LON_J | O | Audio output - |
| 3 | PA_MUTE_J | O | Mute |
| 4 | AU_LOP_J | O | Audio output + |

| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | GND | P | Ground |
| 2 | GND | P | Ground |
| 3 | 12V PWR | P | 12V power output |
| 4 | 12V PWR | P | 12V power output |

### 2.4.24 J17 M.2 B-Key slot (24)

VT-SBC35-3576 offers an M.2 Key B slot that supports SATA/PCIe 2.1 (2260) for interfacing with an SSD for storage expansion, or USB 3.0 (3042) for connecting a 4G module or USB 3.0/PCIe 2.0 (3052) for connecting a 5G module for cellular communication.

### 2.4.25 J11 Nano SIM slot (21)

VT-SBC35-3576 offers a Micro SIM card slot for cellular communication.

Specification: Micro SIM, push-push, hot pluggable

### 2.4.26 RTC

The board offers a real-time clock for keeping track of the current time and date even when the board is turned off or rebooted. This ensures the board operates efficiently and reliably with respect to time-sensitive tasks and functions.

Specification of the battery:

Nominal voltage: 3V; nominal capacity: 35mAh; continuous drain: 0.1mA; operating temperature: -30℃ ~ +85℃.

# CHAPTER 3 ANDROID SYSTEM MANUAL

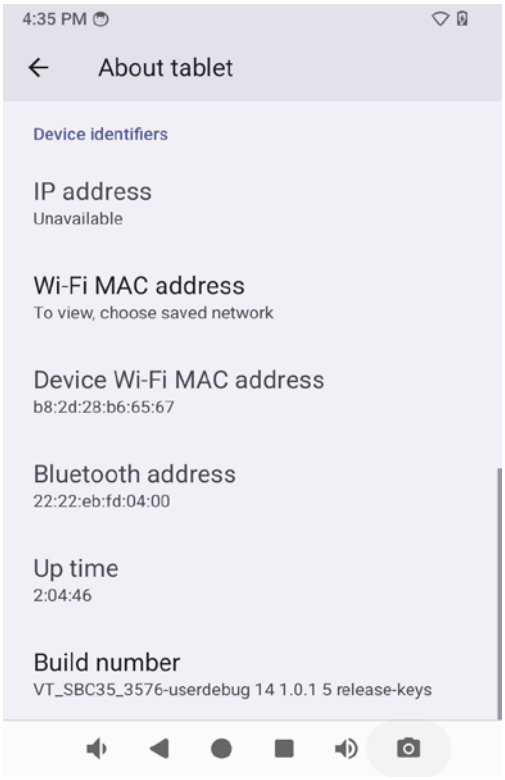
VT-SBC35-3576 is running Android 14 operating system. To test the functionality of the board described in this chapter, you are advised to connect the board to a mouse, keyboard, and monitor for easier operations.

Upon startup, the board will automatically log in without requiring the input of the password. You can access the application drawer by swiping up the screen.

## 3.1 Enable Developer Options

The Developer Options feature on VT-SBC35-3576 grants more control and access to tools that are crucial for app development, debugging, and optimizing device performance. You can follow the steps below to enable the feature:

1. Power on the board and swipe up to access the application drawer;
2. Navigate to **Settings** > **About tablet**;
3. Scroll down to **Build number**, and click it consecutively for at least 7 times until you see a prompt indicating you are now a developer;




4. Go back to **Settings > System > Advanced > Developer options** and toggle on **USB debugging** (under the DEBUGGING sub-menu), then you can customize the board settings.

*Generally, the USB debugging option is enabled by default once you activate Developer Options.*

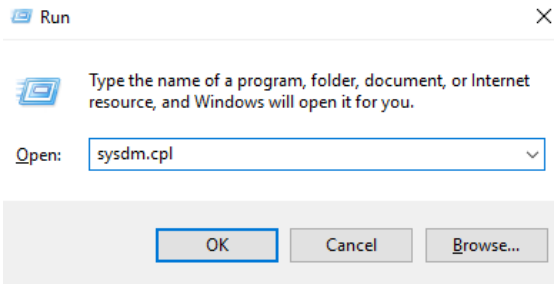
## 3.2 ADB Setup on the Windows Host

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.

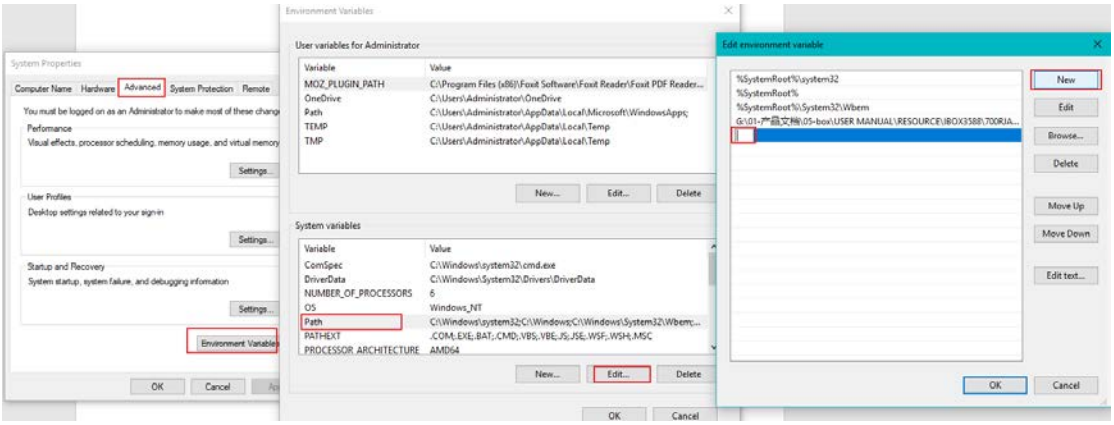
Adding the ADB executable file to the system's environment variable allows you to run the ADB tool regardless of your current working directory.

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

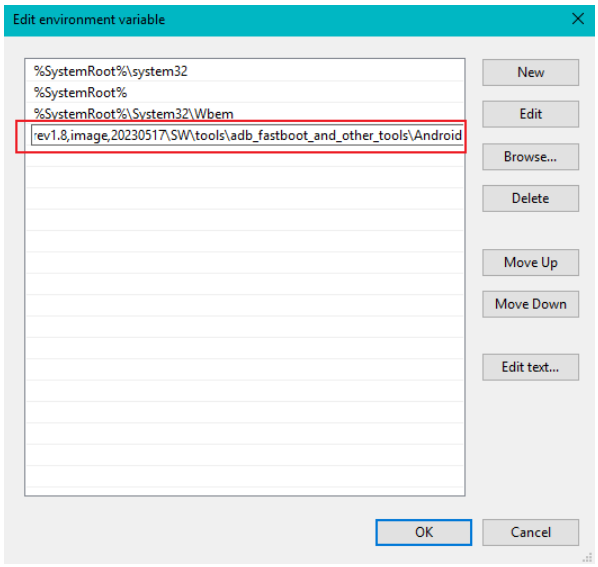
1. Unzip the software release package and navigate to the following directory: \SW\tools;
2. Extract the **adb_fastboot_and_other_tools_for_windows** zip file;
3. Navigate to the **Android** folder that contains the ADB tool kit and copy the folder path;
4. Press "Win + R" and input sysdm.cpl in the dialogue box to open the settings interface;



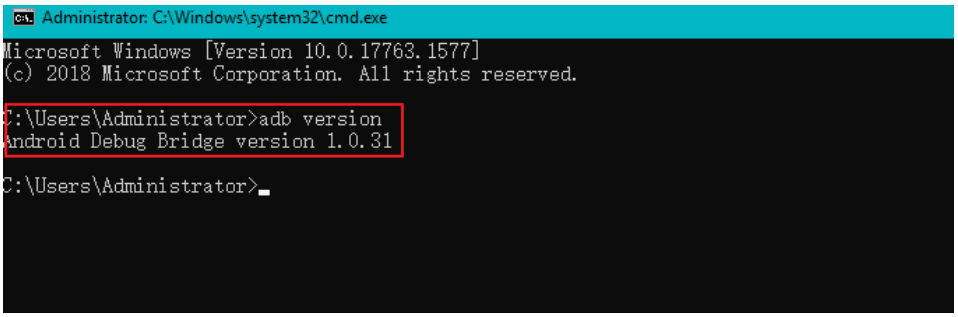

5. Click in sequence **Advanced > Environment Variables > System Variables > Path > Edit**, and click **New** in the pop-up;



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




7. Press “Win + R” and input cmd in the dialogue box to open the command prompt;
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. All tools to be used for the installation are available in the product release package provided by Vantron.

Users can install apps as long as the ADB tool is installed and accessible on the host computer.

1. Connect VT-SBC35-3576 to the host computer via a USB Type-A to Type-C cable;
2. Press "Win + R" and input cmd in the dialogue box to open the command prompt;
3. Input adb devices -l in the command prompt to check if the board is connected to the host computer;


4. When the device information is displayed under the command, you can copy the serial number (squared as shown above) for 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 is input and the result of installation will be displayed below;


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

*The screenshot is for illustration only and is not intended to indicate 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.*

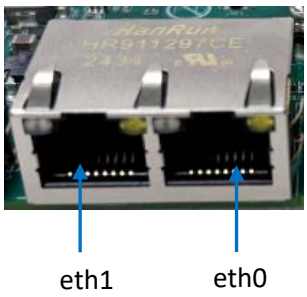
## 3.4 Network Connectivity

VT-SBC35-3576 follows a networking priority of Ethernet > Wi-Fi > 4G/5G.

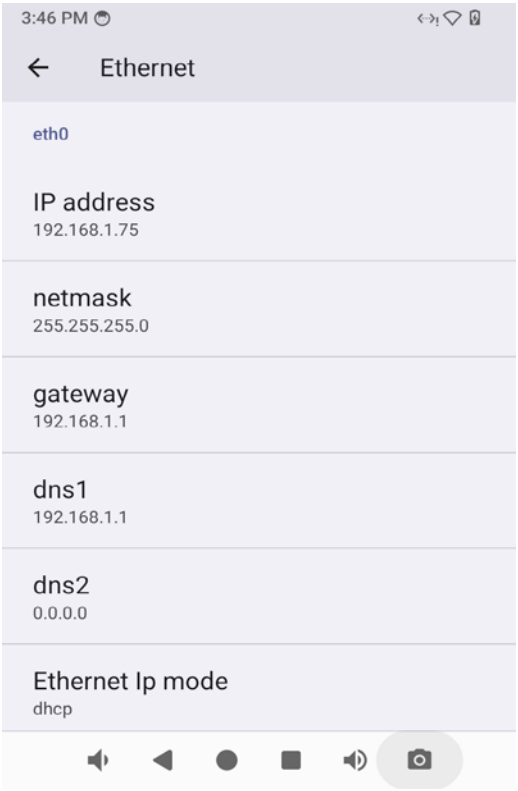
### 3.4.1 Ethernet

VT-SBC35-3576 offers two RJ45 Ethernet jacks, designated as WAN ports for connecting to a router or switch to establish Internet access.

They are mapped as eth1 and eth0, respectively in the system. You can view the port configurations via the following steps.

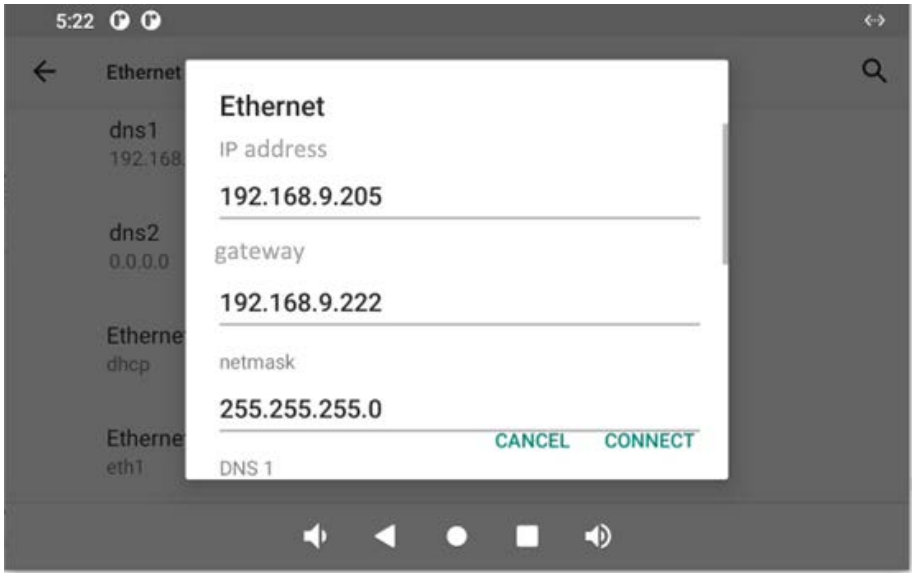



1. Plug one end of an Ethernet cable into a router or switch and the other end into an Ethernet jack on the board;
2. Access the App drawer, and navigate to **Settings > Network & internet > Ethernet** to check the connectivity;



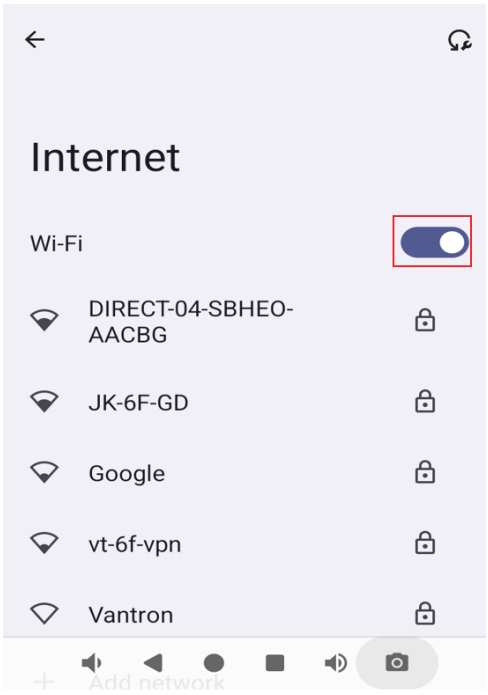
*Information of the **eth0** interface is displayed by default. If you connect the cable to the eth1 port on the board, the network will function properly, but the interface information will not be displayed currently.*

*You can click on the **Ethernet IP mode** option to manually assign an IP of the same network segment to the board. Remember to click **CONNECT** before exit.*

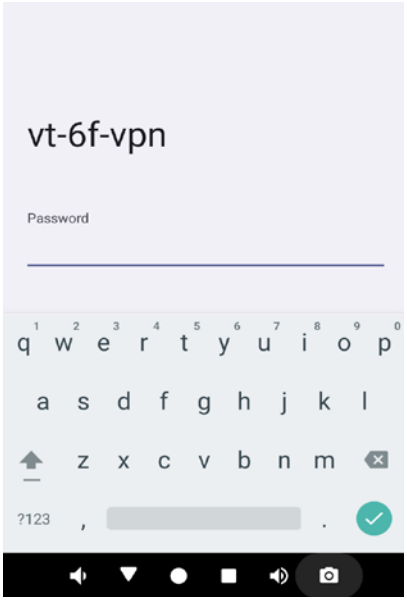



### 3.4.2 Wi-Fi & Tethering

Before connecting to a Wi-Fi network, please install the IPEX-4 Wi-Fi antennas to J10 and J12 connectors for improved signal strength. To connect to a Wi-Fi hotspot, navigate to **Settings > Network & internet > Internet,** and toggle on the Wi-Fi feature.



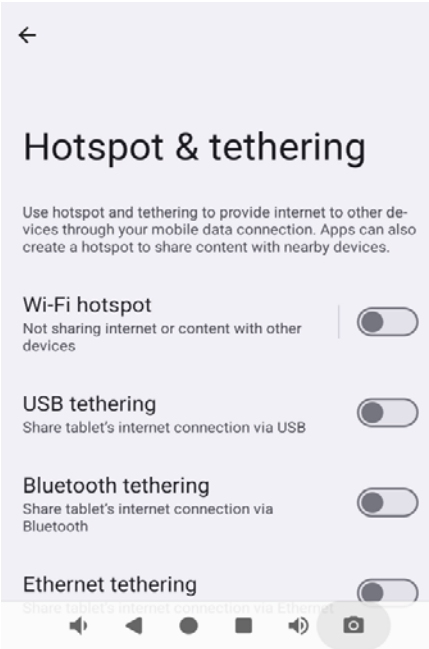
1. After enabling the Wi-Fi feature, the access point list will automatically refresh. If the target access point does not appear, you can click the refresh icon above the list;
2. Click the target access point, and input the password as promoted (if applicable);




3. When the board successfully connects to the network, the wireless icon on the top will turn solid.

The **Hotspot &Tethering** feature allows the board to share its network connectivity with other devices. Hotspot enables the board to act as a Wi-Fi hotspot, while tethering can be achieved though USB, Bluetooth, and Ethernet.

By navigating to **Settings > Network & internet > Hotspot & Tethering**, you can share the network via any option provided.



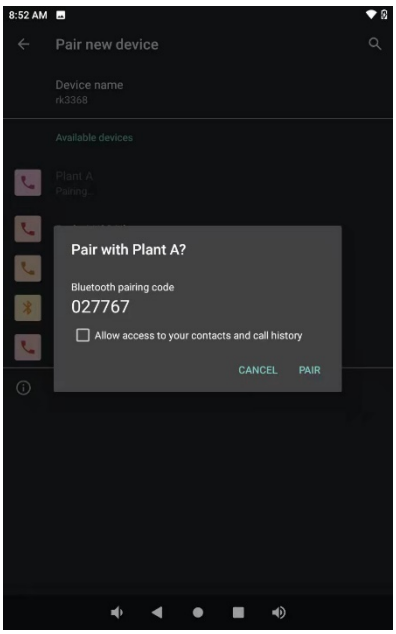
### 3.4.3 Cellular

VT-SBC35-3576 supports connecting a 4G/5G module via the M.2 B-Key slot for cellular communication. If you select the module provided by Vantron, it comes with a pre-configured script that automatically sets up the system upon bootup. When an activated SIM card is inserted into the Nano SIM slot, the system will automatically register the card and establish an internet connection.

### 3.4.4 Bluetooth

- **Pairing with a Bluetooth device**

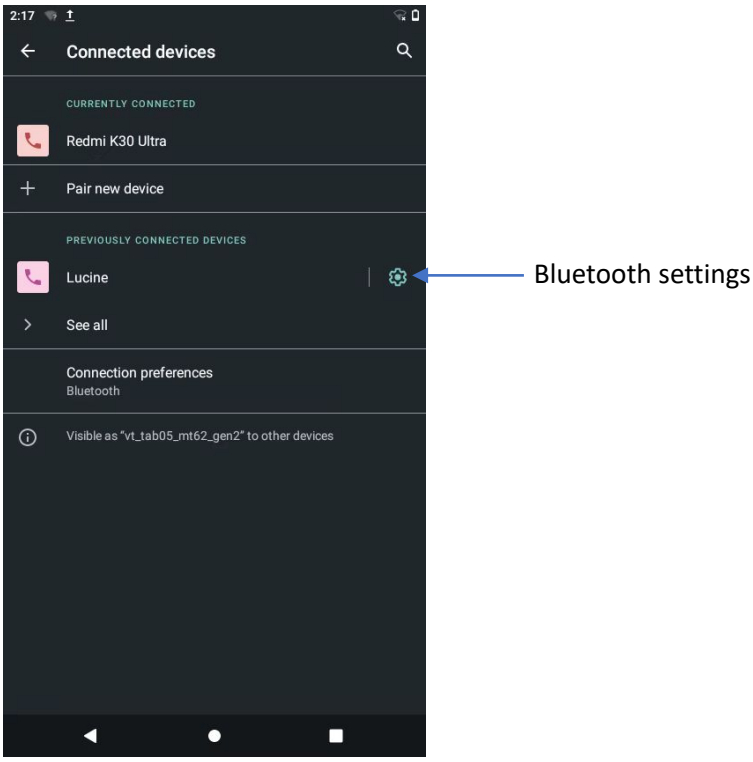
1. Navigate to **Settings > Connected devices > Pair new device**, and the board will automatically start to scan available devices with Bluetooth on and display the IDs of all devices in range;
2. Click the target Bluetooth device. If it does not show in the list, you can type the name of the device in the search box;
3. Confirm the consistency of the pairing code on the board and the Bluetooth device, and click **PAIR**;




4. After pairing, the device name will show in the **Connected device** list as **CURRENTLY CONNECTED** above **PREVIOUSLY CONNECTED DEVICES**.

- **Removing a Bluetooth device**

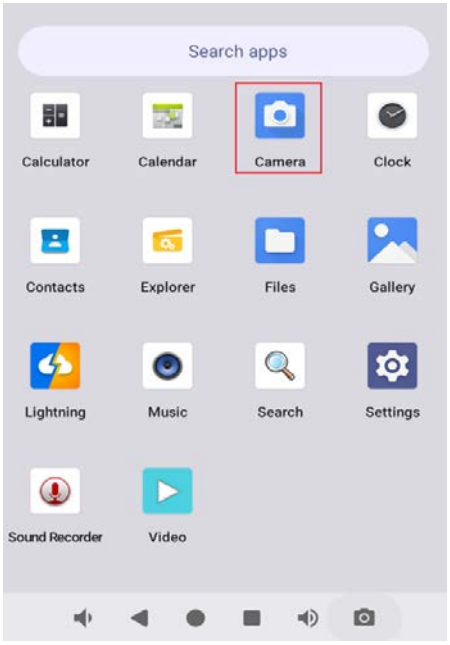
1. Click the cog icon behind the device name in the **PREVIOUSLY CONNECTED DEVICES** list to access the Bluetooth device settings;




2. Click **FORGET** to remove the saved Bluetooth device from the history list, or click **CONNECT** to pair with the device;
3. When the Bluetooth device is removed, you will need to pair the device again next time before data transfer.

## 3.5 Camera

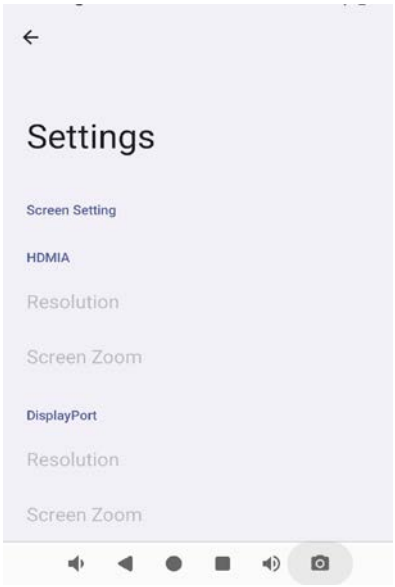
By connecting a camera to the board using an FPC/FFC cable via the MIPI CSI interface, you can open and use the camera using the **Camera** application.

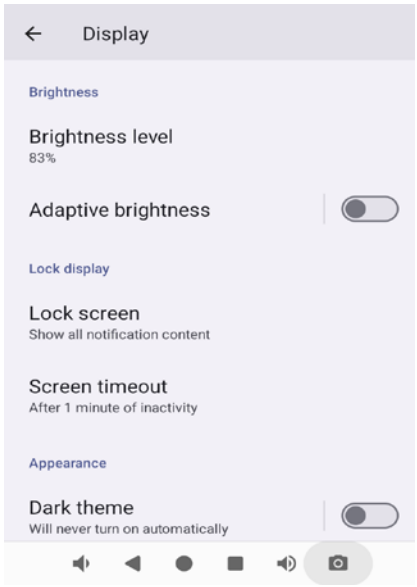



## 3.6 Display

VT-SBC35-3576 supports connecting a display via the HDMI/MIPI DSI/USB Type-C (DisplayPort) interface. Configurations of the display connected via HDMI or DisplayPort are accessible via **Settings > Display > HDMIA/DisplayPort**.

The brightness, screen timeout settings, and other parameters can be adjusted via the **Settings > Display** page.



## 3.7 Peripheral I/Os

VT-SBC35-3576 offers serial ports and other peripheral I/Os for flexible connectivity. Users can connect the board to a host computer via the USB Type-C port or the debug UART. Once connected, adb commands can be used to access the board's shell, allowing users to test the functionality of the I/Os.

### 3.7.1 RS232/RS485/RS422

VT-SBC35-3576 implements a 20-pin GPIO header that offers two RS232/RS485/RS422 ports (J0, J1) and two RS232 ports (J2, J3). Please refer to2.4.11 for the pinout.

J0, J1, J2, J3 are mapped as ttyWCH0, ttyWCH1, ttyWCH2, and ttyWCH3 in the software file system. Users can set the baud rate and other parameters based on needs.

You can follow the steps below to verify the functionality of the serial ports.

1. Wire the testing pins (RS232: TX-RX, RX-TX, GND-GND / RS485: A-A, B-B, GND-GND / RS422: A-Y, B-Z);
2. Connect VT-SBC35-3576 to a host computer through the USB Type-C port using a USB type-A to Type-C cable (or through the debug UART based on the pinout provided in 2.4.12);
3. Open a terminal on the host computer and access the board's shell;

```
$ adb shell
```

4. Switch to the root privilege;

```
$ su
```

5. Open the serial port using the following command (with user-defined baud rate);

```
# microcom -s 1500000 /dev/ttyWCHx
```

6. Input data to check data receiving on the serial port.

The multiplexers (ttyWCH0, ttyWCH1) are operating **in RS232 mode by default**. If you need switch the mode of the multiplexers, refer to the commands below. Please change the wiring after switching the work mode of the multiplexers.

**RS485 mode:**

```
echo 1  > /sys/van-uart/ttywch0_config        // (ttyWCH0 RS485 transmit data)
echo 1  > /sys/van-uart/ttywch1_config        // (ttyWCH1 RS485 transmit data)
echo 2  > /sys/van-uart/ttywch0_config        // (ttyWCH1 RS485 receive data)
echo 2  > /sys/van-uart/ttywch1_config        // (ttyWCH1 RS485 receive data)
```

**RS422 mode:**

```
echo 2  > /sys/van-uart/ttywch0_config
echo 2 > /sys/van-uart/ttywch1_config
```

**RS232 mode:**

```
echo 0 > /sys/van-uart/ttywch0_config
echo 0 > /sys/van-uart/ttywch1_config
```

### 3.7.2 CAN

VT-SBC35-3576 offers two CAN buses (CAN0 and CAN1), supporting CAN FD protocol. Please refer to 2.4.13 for the pinout.

Take **CAN0** for example to verify its functionality.

1. Connect CAN0 to a CAN analyzer  (H-H, L-L, GND-GND);
2. Connect VT-SBC35-3576 to a host computer through the USB Type-C port using a USB type-A to Type-C cable (or through the debug UART based on the pinout provided in 2.4.12);
3. Open a terminal on the host computer and access the board's shell;

   ```
   $ adb shell
   ```

4. Switch to the root privilege;

   ```
   $ su
   ```

5. Check the network interface of the board to confirm interface CAN0 exits;

   ```
   # ifconfig
   ```

6. Disable CAN0;

   ```
   # ip link set can0 down
   ```

7. Set the arbitration phase bitrate (e.g., 1M) and data phase bitrate (e.g., 3M) for CAN0;

   ```
   # ip link set can0 type can bitrate 1000000 dbitrate 3000000 fd on
   ```

8. Enable CAN0;

   ```
   # ip link set can0 up
   ```

9. Receive the data transmitted from the CAN analyzer;

   ```
   # candump can0
   ```

10. Send data to the CAN analyzer.

    ```
    # cansend can0 123#1DEADBEEF
    ```

### 3.7.3 LED indicators

VT-SBC35-3576 features two customizable LED indicators that will light up red and green, respectively, when the system is powered on. The LEDs can be controlled via the following commands:

Open the red indicator: `# echo 1 > sys/class/leds/work1/brightness`;

Close the red indicator: `# echo 0 > sys/class/leds/work1/brightness`;

Open the green indicator: `# echo 1 > sys/class/leds/work2/brightness`;

Close the green indicator: `# echo 0 > sys/class/leds/work2/brightness`.

### 3.7.4 GPIO

VT-SBC35-3576 implements a GPIO header, offering $I^2C$, UART, SPI, and GPIO signals. Please refer to 2.4.14 for the pinout.

The node name of $I^2C$, UART, and SPI interfaces follows the **gpioX_YN** format, where Y=A=0, Y=B=1, Y=C=2, Y=D=3 when calculating the GPIO index of a pin. The calculation formula is as follows:

**GPIO Index = X*32 + Y*8 + N**

As a result, the node name and GPIO index of the above signals are as follows:

- $I^2C$:

| Pin | Node name | GPIO index |
|---|---|---|
| i2c8_scl | gpio2_A0 | 2*32+0*8+0=64 |
| i2c8_sda | gpio2_A1 | 2*32+0*8+1=65 |

- UART:

| Pin | Node name | GPIO index |
|---|---|---|
| UART5_RTS | gpio2_A2 | 2*32+0*8+2=66 |
| UART5_CTS | gpio2_A3 | 2*32+0*8+3=67 |
| UART5_RX | gpio2_A4 | 2*32+0*8+4=68 |
| UART5_TX | gpio2_A5 | 2*32+0*8+5=69 |

- SPI:

| Pin | Node name | GPIO index |
|---|---|---|
| SPI4_CS | gpio3_A0 | 3*32+0*8+0=96 |
| SPI4_MOSI | gpio3_A1 | 3*32+0*8+1=97 |
| SPI4_MISO | gpio3_A2 | 3*32+0*8+2=98 |
| SPI4_CLK | gpio3_A3 | 3*32+0*8+3=99 |

After acquiring the GPIO index, pin operations are made easy. Take i2c8_scl (gpio2_A0) for example, its GPIO index is 64, and you can perform the following:

- Export the pin: # echo 64 > sys/class/gpio/export
- Set the pin's direction as output: # echo out > sys/class/gpio/gpio64/direction
- Set the pin's direction as output: # echo in > sys/class/gpio/gpio64/direction
- Set the pin's output to high: # echo 1 > sys/class/gpio/gpio64/value
- Set the pin's output to low: # echo 0 > sys/class/gpio/gpio64/value

The two GPIOs are configured as follows:

GPIO_OUT1: gpio8(ch9434m) n=8

GPIO_OUT2: gpio9(ch9434m) n=9

IO5V_EN1: gpio23(ch9434m) n=23 (this node controls all four power pins on the header)

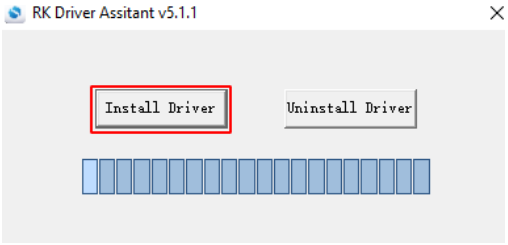
Operation:

- Pull up: GPIO_OUT1: # echo 8 1 1 1 1 > /sys/ch9434/gpio
- Pull down: GPIO_OUT1: # echo 8 1 0 1 0 > /sys/ch9434/gpio

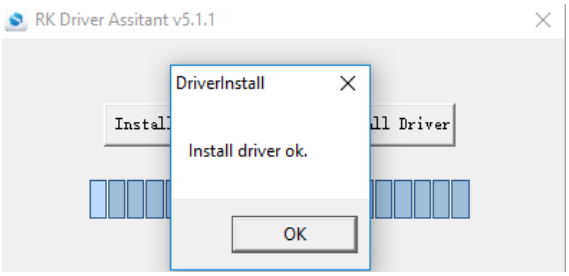
## 3.8 Firmware Upgrade in the Windows Environment

The following steps also apply to Android firmware flashing on other operating systems.

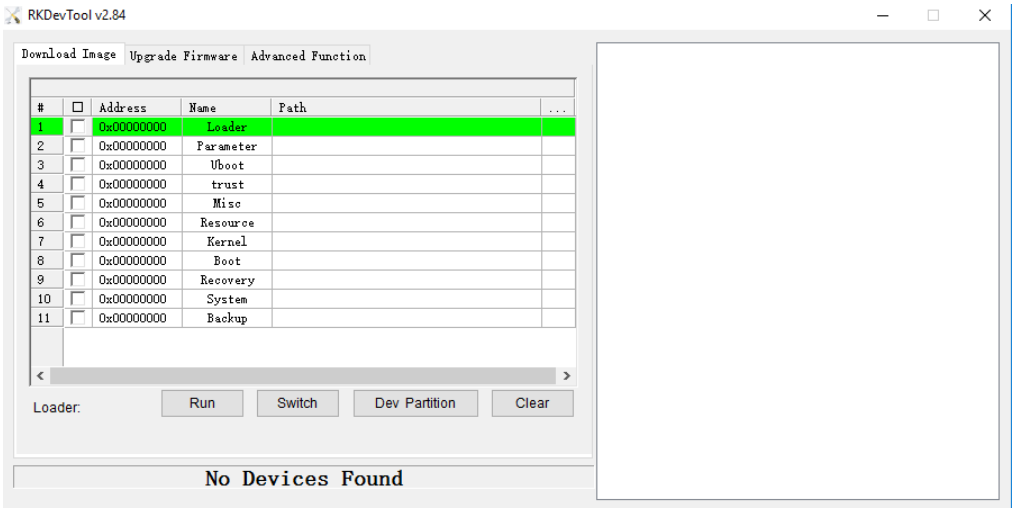
1. Follow the instructions in 3.2 to finish ADB setup on the windows host computer;
2. Unzip the release package, and open the directory of the upgrade driver (\SW\ AndroidTool\DriverAssitant_vxxx);
3. Unzip the driver folder, then Right click the mouse and run the driver program **DriverInstall.exe**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



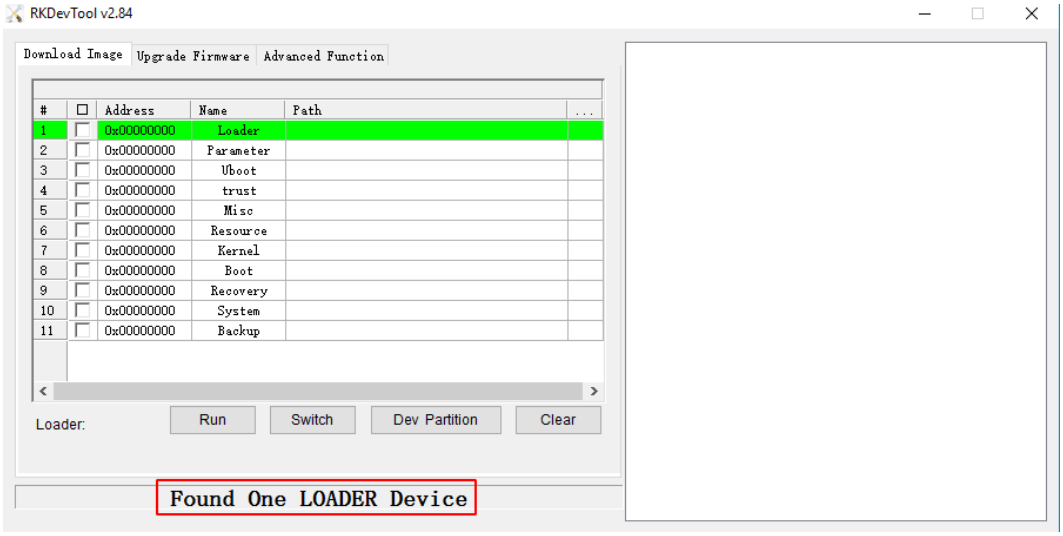

5. A pop-up will appear in a second suggesting the driver is installed;



6. Open the directory of the upgrade tool and unzip the folder (\SW\AndroidTool);
7. Double click the driver for the upgrade tool **RKDevTool.exe** to open the upgrade window;



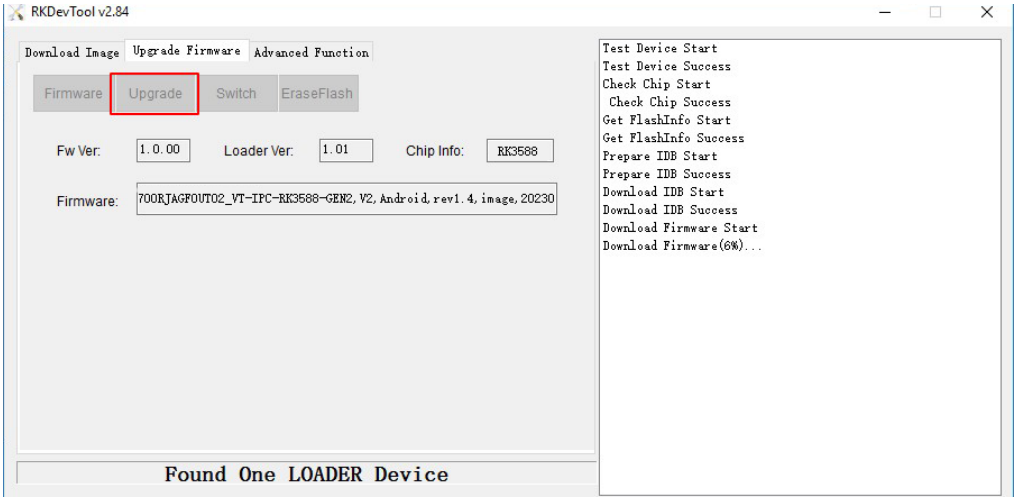

8. Connect VT-SBC35-3576 to the Windows computer via the USB Type-C or debug UART;
9. Press “Win + R” and input cmd in the dialog box to open the command prompt;
10. Input adb devices in the command prompt to check if the board is connected to the Windows computer (make sure the ADB tool is available on the Widows host);
11. Once the board is identified by the Windows computer, input adb reboot loader to reboot the board into the Loader mode;
12. Then the upgrade window will prompt for the existence of a Loader device, indicating that the upgrade process is ready;




13. Navigate to **Upgrade Firmware** > **Firmware**on the upgrade window;

14. Select the upgrade file (**update.img)** from the release package (\SW\release) and click **Open**, and the firmware details will be automatically populated in the boxes;

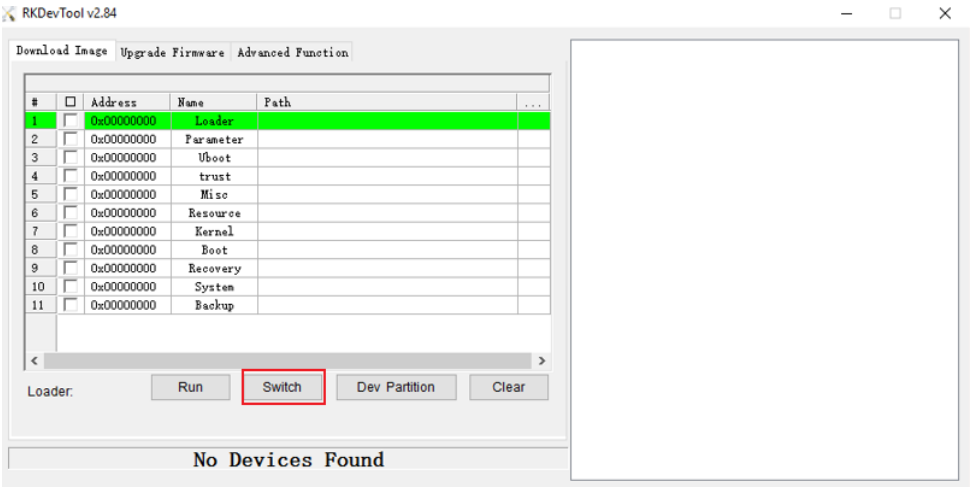
15. Click the **Upgrade** button and the board will start to download the image and upgrade the firmware automatically;




16. When the upgrade finishes, the board will reboot automatically.

If the board cannot enter the Loader mode via ADB commands, you can

- Keep the connection between the board and the Windows computer, and click the **Switch** button on the upgrade window to enter the Loader mode. Then follow the above steps to finish the upgrade.




- Alternatively, keep the connection between the board and the Windows computer, then press the SW3 button on the board and power it on. Wait a few seconds and release the SW3 button to enter the Loader mode. Then follow the above steps to finish the upgrade.

# CHAPTER 4 DEBIAN SYSTEM MANUAL

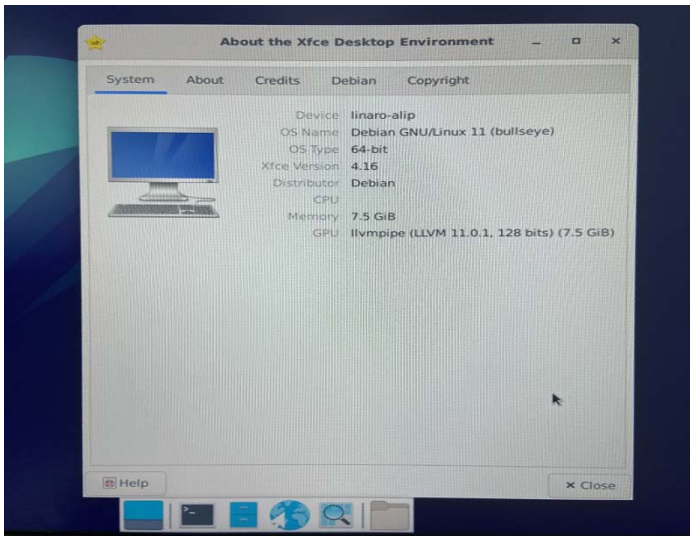
VT-SBC35-3576 is running Debian 11 operating system. To properly test the functionality of the board described in this chapter, you are advised to connect the board to a mouse, keyboard, and monitor for easier operations.

## 4.1 About the Device

Upon startup, the board will automatically log in without requiring the input of the password. However, the password for the default user “linaro” is “linaro” in case you need to switch users or create a new user. If you need to switch to the root user for higher privilege in the device terminal, simply use the `sudo su` command without the need to enter a password.

### 4.1.1 Device information

1. Power on the board and the system will log in to linaro as the default user;
2. Right click the mouse in an empty area to open the property dialogue of the board;
3. Click **Applications > About Xface** to enter the desktop environment, then you can check the system information like device name, operating system, copyright statement, etc.




You can also execute commands to check the device information.

1. Press Ctrl + Alt +T simultaneously or click the **LXTerminal** ( ) tool from the taskbar at the bottom of the screen to open a terminal;
2. Switch to the root user using the command `sudo su`;
3. Check the software version:

```
# cat /etc/versions
```

4. Check the kernel information:

```
# uname -a
```

### 4.1.2 System settings

By clicking on **linaro** on the top right corner of the screen, you can

- Lock the screen;
- Switch the user;
- Shut down/suspend the board;
- (Upon a click of the “Log out” option) Log out/restart/shut down/suspend the board or switch the user while saving the session for future logins.

The menu bar on the top of the screen allows the user to:

- Change the brightness and power settings of the board;
- Adjust the system volume and sound settings;
- Add the board to a Wi-Fi or Ethernet or mobile network and pair it with a Bluetooth device;
- Switch between different workspaces.

Other system settings are accessible from **Applications** on the top left corner of the screen or upon a right click of the mouse in an empty area of the screen.

### 4.1.3 EEPROM

EEPROM is a non-volatile memory that retains stored data even when the power is turned off. The device information is stored in the EEPROM.

1. Locate the EEPROM file:

```
# find /sys/devices -name "*eeprom*"
/sys/devices/platform/fdd40000.i2c/i2c-0/0-0050/eeprom
```

2. Set a software link for the EEPROM device for easy access:

```
# ln -s /sys/devices/platform/fdd40000.i2c/i2c-0/0-0050/eeprom /dev/eeprom
```

3. Clear the EEPROM information:

```
# vtvdm -i
```

4. Read the serial number of the board written in EEPROM:

```
# vtvdm -r sn
xxxx
```

### 4.1.4 RTC

Real-Time Clock (RTC) is a hardware component on the board that keeps track of the device time and date. Adjusting the RTC can help address issues related to time discrepancies or resets in software system time settings. To modify the time zone, date, or time, open a terminal and execute the following commands.

1. Execute the following command to enter time zone selection;

```
$ tzselect
```

2. Select the desire time zone and geographic region according to the on-screen prompt (e.g., Detroit, America);
3. Copy the time zone file to the local time directory (/etc/localtime);

```
$ sudo cp /usr/share/zoneinfo/America/Detroit /etc/localtime
```

4. Write the system time zone information to the hardware;

```
# hwclock --systohc
```

5. Check the current time zone information:

```
# cat /etc/timezone
```

6. Set the system date & time;

```
# date -s "Aug-04-2024 14:38:10"    // replace with your own date and time
```

7. Synchronize the RTC time with the system time;

```
# hwclock -w
```

8. Reboot the device;

```
# reboot
```

9. Check the RTC time information.

```
# hwclock -r
```

## 4.2 Network Connectivity

VT-SBC35-3576 follows a networking priority of Ethernet > Wi-Fi > 4G/5G.

### 4.2.1 Ethernet

After connecting VT-SBC35-3576 to a router or switch through either of the Ethernet jacks, you can use the GUI to configure the Ethernet network upon clicking the network icon (  ) on the taskbar in the upper right corner of the screen.

Alternatively, you can use the terminal to check the network information as shown below.

1. Open a terminal by pressing Ctrl + Alt + T;
2. Use the ifconfig command to check the information of the network interfaces:

```
# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.19.208  netmask 255.255.255.0  broadcast 192.168.19.255
        inet6 fe80::239b:dba1:dc0f:5535  prefixlen 64  scopeid 0x20<link>
        ether 12:34:24:00:9a:bc  txqueuelen 1000  (Ethernet)
        RX packets 2384  bytes 219409 (214.2 KiB)
        RX errors 0  dropped 961  overruns 0  frame 0
        TX packets 122  bytes 9667 (9.4 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 70

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
       inet 192.168.19.202  netmask 255.255.255.0  broadcast 192.168.19.255
        inet6 fe80::cc9f:7dd0:bc71:bc1d  prefixlen 64  scopeid 0x20<link>
        ether 12:88:66:00:9a:bc  txqueuelen 1000  (Ethernet)
        RX packets 224  bytes 2312 (2.2 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 17  bytes 2872 (2.8 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 73
```

3. Assign a static IP address of the same network segment to an Ethernet jack (e.g., eth0) and test the connectivity:

```
# ifconfig eth0 192.168.19.10
# ping 192.168.19.10
PING 192.168.19.10 (192.168.19.10): 56 data bytes
64 bytes from 192.168.19.10: seq=0 ttl=64 time=1.296 ms
64 bytes from 192.168.19.10: seq=1 ttl=64 time=1.358 ms
```

### 4.2.2 Wi-Fi

Before connecting to a Wi-Fi network, please install the IPEX-4 Wi-Fi antennas to J10 and J12 connectors for better signal strength. Use the GUI to connect to a Wi-Fi hotspot.

1. Click the network icon (  ) on the taskbar in the upper right corner of the screen;
2. Select the desired SSID from the available list;
3. Click the **More networks** option to expand the list, if needed;
4. Enter the password for the network;
5. Once the device is connected to the target network, a "**Connection Established**" prompt will be displayed, indicating the name of the network you are connected to, and the network icon will change to a wireless network icon (  );
6. You can click **Disconnect** below the SSID to disconnect the device from the network.

### 4.2.3 Pairing with a Bluetooth device

1. Click the Bluetooth icon (  ) on the taskbar in the bottom right corner of the screen;
2. Select the **Turn Bluetooth On** option;
3. Click the Bluetooth on icon (  ) and select the **Set Up New Device** option;
4. In the Bluetooth device setup window, Click **Next** and the available Bluetooth devices will be displayed;
5. Navigate through the list to locate the desired Bluetooth device, select it and click **Next**;
6. Select **Pair Device** as the pairing method and click **Next**;
7. Confirm the pair code on both devices;
8. In the final step, there will be a message indicating that the target device is successfully added and connected;
9. The Bluetooth icon on the taskbar will change accordingly (  ).

### 4.2.4 Sending a file to a Bluetooth device

1. Tap on the Bluetooth on icon ( ) and select the **Send Files to Device** option;
2. Select the file you intend to send and tap on **OK**;
3. Select the target device from the device list and tap on **OK**;
4. If the two devices are connected, the file transfer will be initiated immediately. Otherwise, the transfer may fail, and you'll need pair the devices before proceeding;
5. Wait for the file to be transferred.

### 4.2.5 Cellular

VT-SBC35-3576 supports connecting a 4G/5G module via the M.2 B-Key slot for cellular communication. If you select the module provided by Vantron, it comes with a pre-configured script that automatically sets up the system upon bootup. When an activated SIM card is inserted into the Nano SIM slot, the system will automatically register the card and establish an internet connection.

1. Check the 4G/5G network interface:

```
# ifconfig
```

2. Test the network connectivity:

```
# ping www.xxx.com
```

## 4.3 Peripheral I/Os

### 4.3.1 USB

Insert a USB device into any of the USB interfaces on the board, and input the following commands to check/configure the USB device.

1. Check the information of all connected USB devices:

```
$ lsusb
```

2. Display the details of the hard disks and their partitions:

```
$ fdisk -l
```

3. Mount a USB flash drive to a specified directory (e.g., /mnt):

```
$ mount /dev/xxx /mnt
```

4. Check the mounted content:

```
$ ls /mnt
```

5. Unmount the USB flash drive:

```
$ umount /dev/xxx
```

### 4.3.2 RS232/RS422/RS485

VT-SBC35-3576 implements a 20-pin GPIO header that offers two RS232/RS485/RS422 ports (J0, J1) and two RS232 ports (J2, J3). Please refer to2.4.11 for the pinout.

J0, J1, J2, J3 are mapped as ttyWCH0, ttyWCH1, ttyWCH2, and ttyWCH3 in the software file system. Users can set the baud rate and other parameters based on needs.

You can follow the steps below to verify the functionality of the serial ports through a loopback test.

1. Connect a keyboard, mouse, and display to VT-SBC35-3576 for easier operation;
2. Wire the testing pins (RS232: TX-RX, RX-TX, GND-GND / RS485: A-A, B-B, GND-GND / RS422: A-Y, B-Z);
3. Open the board's terminal and switch to the root privilege;

```
$ sudo su
```

4. Open the serial port using the following command (the baud rate is customizable);

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

5. Input data to check data receiving on the serial port.

The multiplexers (ttyWCH0, ttyWCH1) are operating **in RS232 mode by default**. If you need switch the mode of the multiplexers, refer to the commands below. Please change the wiring after switching the work mode of the multiplexers.

**RS485 mode:**

```
echo 1 > /sys/van-uart/ttywch0_config        // (ttyWCH0 RS485 transmit data)
echo 1 > /sys/van-uart/ttywch1_config        // (ttyWCH1 RS485 transmit data)
echo 2 > /sys/van-uart/ttywch0_config        // (ttyWCH1 RS485 receive data)
echo 2 > /sys/van-uart/ttywch1_config        // (ttyWCH1 RS485 receive data)
```

**RS422 mode:**

```
echo 2 > /sys/van-uart/ttywch0_config
echo 2 > /sys/van-uart/ttywch1_config
```

**RS232 mode:**

```
echo 0 > /sys/van-uart/ttywch0_config
echo 0 > /sys/van-uart/ttywch1_config
```

### 4.3.3 CAN

VT-SBC35-3576 offers two CAN buses (CAN0 and CAN1), supporting CAN FD protocol. Please refer to 2.4.13 for the pinout.

Take **CAN0** for example to verify its functionality.

1. Connect CAN0 to a CAN analyzer (H-H, L-L, GND-GND);
2. Connect a keyboard, mouse, and display to VT-SBC35-3576 for easier operation;
3. Open the board's terminal and switch to the root privilege;

```
$ sudo su
```

4. Check the network interface of the board to confirm interface CAN0 exits;

```
# ifconfig
```

5. Disable CAN0;

```
# ip link set can0 down
```

6. Set the arbitration phase bitrate (e.g., 1M) and data phase bitrate (e.g., 3M) for CAN0;

```
# ip link set can0 type can bitrate 1000000 dbitrate 3000000 fd on
```

7. Enable CAN0;

```
# ip link set can0 up
```

8. Receive the data transmitted from the CAN analyzer;

```
# candump can0
```

9. Send data to the CAN analyzer.

```
# cansend can0 123#1DEADBEEF
```

### 4.3.4 LED indicators

VT-SBC35-3576 features two customizable LED indicators that will light up red and green, respectively, when the system is powered on. The LEDs can be controlled via the following commands:

Open the red indicator: `# echo 1 > /sys/class/leds/red_led/brightness`;

Close the red indicator: `# echo 0 > /sys/class/leds/red_led/brightness`;

Open the green indicator: `# echo 1 > /sys/class/leds/green_led/brightness`;

Close the green indicator: `# echo 0 > /sys/class/leds/green_led/brightness`.

### 4.3.5 GPIO

VT-SBC35-3576 implements a GPIO header, offering I²C, UART, SPI, and GPIO signals. Please refer to 2.4.14 for the pinout.

The node name of I²C, UART, and SPI interfaces follows the **gpioX_YN** format, where Y=A=0, Y=B=1, Y=C=2, Y=D=3 when calculating the GPIO index of a pin. The calculation formula is as follows:

**GPIO Index = X*32 + Y*8 + N**

As a result, the node name and GPIO index of the above signals are as follows:

- I²C:

| Pin | Node name | GPIO index |
|---|---|---|
| i2c8_scl | gpio2_A0 | 2*32+0*8+0=64 |
| i2c8_sda | gpio2_A1 | 2*32+0*8+1=65 |

- UART:

| Pin | Node name | GPIO index |
|---|---|---|
| UART5_RTS | gpio2_A2 | 2*32+0*8+2=66 |
| UART5_CTS | gpio2_A3 | 2*32+0*8+3=67 |
| UART5_RX | gpio2_A4 | 2*32+0*8+4=68 |
| UART5_TX | gpio2_A5 | 2*32+0*8+5=69 |

- SPI:

| Pin | Node name | GPIO index |
|---|---|---|
| SPI4_CS | gpio3_A0 | 3*32+0*8+0=96 |
| SPI4_MOSI | gpio3_A1 | 3*32+0*8+1=97 |
| SPI4_MISO | gpio3_A2 | 3*32+0*8+2=98 |
| SPI4_CLK | gpio3_A3 | 3*32+0*8+3=99 |

By executing the GPIO test script (gpio_test.sh), the pins will be pulled up and down repeatedly. Users can use a multimeter to measure the voltage on the pins to verify their state.

```
# chmod +x gpio_test.sh          // Add executable permission
#  ./gpio_test.sh                // Run the script
#!/bin/sh
while [ true ]
do
    for gpio in 64 65 66 67 68 69 96 97 98 99
    do
        [ ! -e /sys/class/gpio/gpio$gpio ] && echo $gpio > /sys/class/gpio/export
                                                    // Export the pin
        [ ! -e /sys/class/gpio/gpio$gpio ] && echo "Can not export GPIO" $gpio && exit 0
        echo out > /sys/class/gpio/gpio$gpio/direction  // Set the pin's direction as output
        echo 1 > /sys/class/gpio/gpio$gpio/value        // Set the pin's output to high
    done
    sleep 1
    for gpio in 64 65 66 67 68 69 96 97 98 99
    do
        echo 0 > /sys/class/gpio/gpio$gpio/value        // Set the pin's output to low
    done
    sleep 1
done
```

The two GPIOs are configured as follows:

GPIO_OUT1: gpio8(ch9434m) n=8

GPIO_OUT2: gpio9(ch9434m) n=9

IO5V_EN1:  gpio23(ch9434m) n=23 (this node controls all four power pins on the header)

Operation:

- Pull up: GPIO_OUT1: # echo 8 1 1 1 1 > /sys/ch9434/gpio
- Pull down: GPIO_OUT1: # echo 8 1 1 1 0 > /sys/ch9434/gpio

### 4.3.6 Audio

When testing the board's audio function, please connect an audio cable that supports audio recording or playback to the 3.5mm audio jack or connect a microphone to the D-Mic/A-Mic connector.

- **Use the microphone on the audio cable or use the A-Mic to record an audio clip:**

1. Check the audio devices on the board;

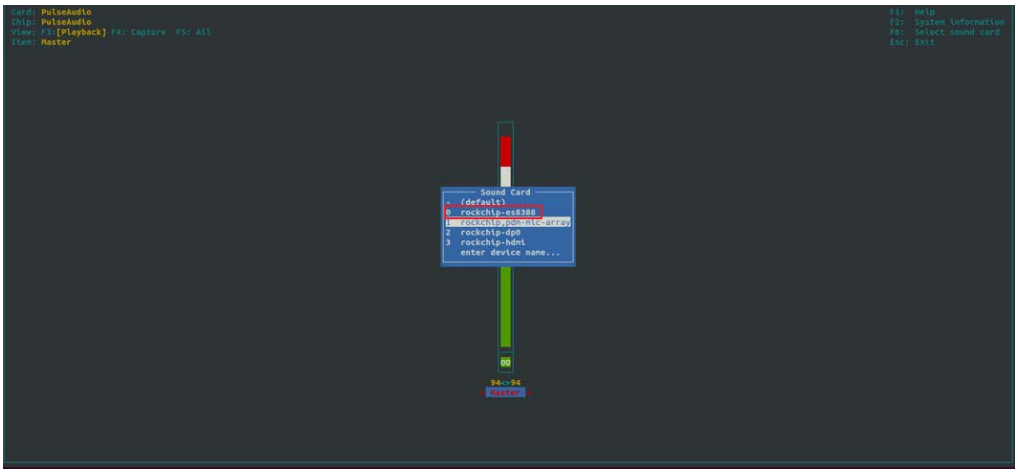
```
$ aplay -l
```

*rockchip-es8388 corresponds to the 3.5mm combo audio jack and A-Mic.*

2. Open the alsamixer program and press F6 to select the audio device;

```
$ alsamixer
```

3. Use the Up/Down arrow keys to select rockchip-es8388, then press Enter to configure the Playback channel;




4. Select **Out1** and **Out2** in sequence, and adjust the volume of Output1 and Output2 up;

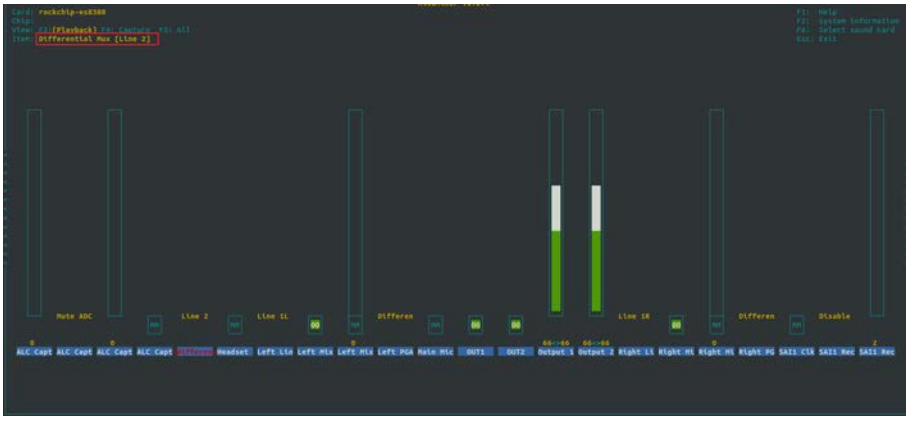
After finishing above setup:

If you use the **microphone of the audio cable** to record the audio clip and save it (for example as “test.wav”):

```
$ arecord -D hw:0,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le test.wav
// hw is followed by the audio device
```

If you use the A-Mic to record the audio clip and save it (for example as “test.wav”):

1) Set Differential Mux to Line 2;



2) Input the following command to record an audio clip:

```
$ arecord -D hw:0,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le
test.wav          // hw is followed by the audio device
```

- **Use the D-Mic to record an audio clip:**

1. Check the audio devices on the board;

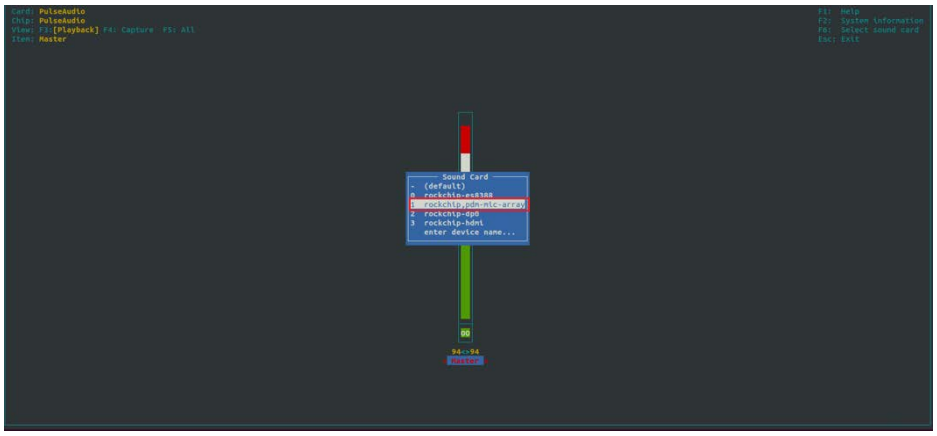
```
$ aplay -l
```

*rockchip, pdm-mic-array corresponds to the D-Mic.*

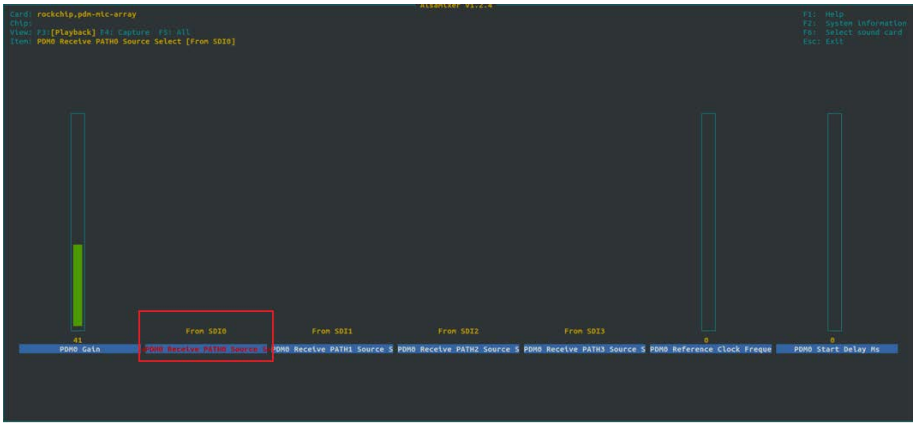
2. Open the alsamixer program and press F6 to select the audio device;

```
$ alsamixer
```

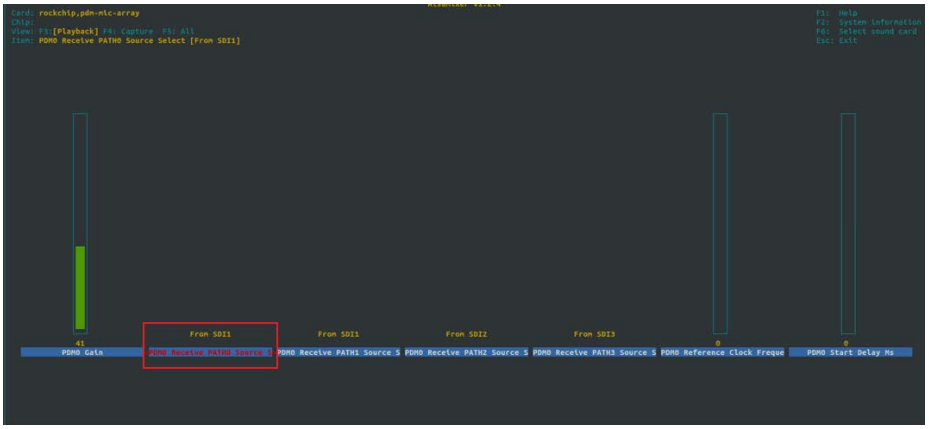
3. Use the Up/Down arrow keys to select rockchip, pdm-mic-array, then press Enter to configure the device;



4. Use the left microphone: set **PDM0 Receive PATH0 Source Select** to [From SDI0];




5. Use the right microphone: set **PDM0 Receive PATH0 Source Select** to [From SDI1];




6. Input the following command to record an audio clip and save it (for example as "test.wav"):

```
$ arecord -D hw:1,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le
test.wav          // hw is followed by the audio device
```

- **Play back the recorded audio clip (keep the settings same as those used for audio recording):**

```
$ aplay -D hw:0,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le
test.wav     // hw is followed by the audio device
```

- **Record audio and play it back in real-time:**

```
$ arecord -D hw:0,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le -t
raw | aplay -D hw:0,0 --period-size=1024 --buffer-size=4096 -r 48000 -c 2 -f s16_le -t
raw     // hw is followed by the audio device
```

- **Stop audio recording or playback:**

  Press the "Ctrl + C" buttons.

- **Play back the audio via the HDMI port:**

1. Use an HDMI cable to connect the board and the audio receiving device;
2. Check the audio devices on the board;

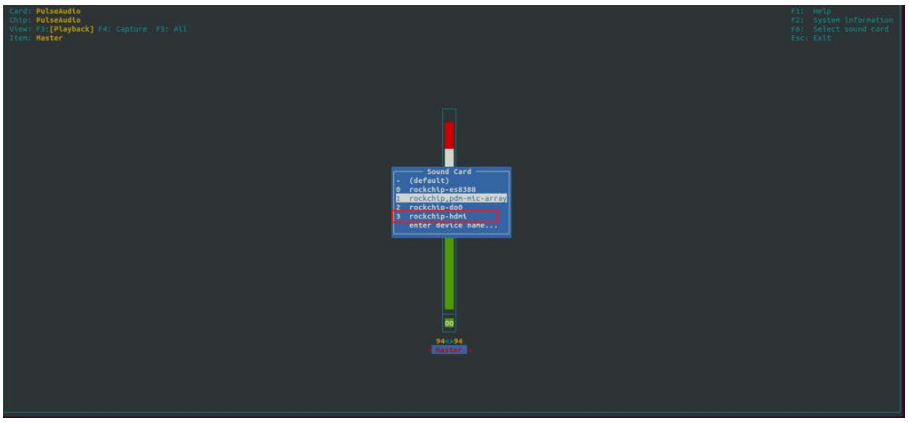
```
$ aplay -l
```

*rockchip-hdmi corresponds to the HDMI audio output port.*

3. Open the alsamixer program and press F6 to select the audio device;

```
$ alsamixer
```

4. Use the Up/Down arrow keys to select rockchip, pdm-mic-array, then press Enter to configure the device;




5. Use the following command to play back the audio clip.

```
$ aplay -D hw:3,0 test.wav      // hw is followed by the audio device
```

### 4.3.7 Video

When testing the video output function of the HDMI port on the board, please connect a video receiving device to the port using an HDMI cable.

Use the following command to play back

```
$ gst-play-1.0 1920x1080.mp4                    // name of the video clip
```

### 4.3.8 SSD

VT-SBC35-3576 implements an M.2 B-key slot for connecting either a 4G/5G cellular module for wireless communication or an SSD card for storage expansion.

To use it for SSD expansion;

1. Insert a PCIe SSD card (2260) into the M.2 B-Key slot;
2. Check the SSD information:

```
$ lspci
```

```
root@linaro-alip:/# lspci
00:00.0 PCI bridge: Fuzhou Rockchip Electronics Co., Ltd Device 3576 (rev 01)
01:00.0 Non-Volatile memory controller: Sandisk Corp PC SN520 NVMe SSD (rev 01)
root@linaro-alip:/#
```

3. Check the hard disk information and corresponding partitions:

```
$ fdisk -l
```

```
root@linaro-alip:/# fdisk -l
Disk /dev/ram0: 4 MiB, 4194304 bytes, 8192 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes


Disk /dev/mmcblk1: 58.28 GiB, 62579015680 bytes, 122224640 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 38290000-0000-4E29-8000-2B0B00001A34

Device           Start       End  Sectors  Size Type
/dev/mmcblk1p1   16384     24575     8192    4M unknown
/dev/mmcblk1p2   24576     32767     8192    4M unknown
/dev/mmcblk1p3   32768    163839   131072   64M unknown
/dev/mmcblk1p4  163840    425983   262144  128M unknown
/dev/mmcblk1p5  425984    491519    65536   32M unknown
/dev/mmcblk1p6  491520  29851647 29360128   14G unknown
/dev/mmcblk1p7 29851648  30113791   262144  128M unknown
/dev/mmcblk1p8 30113792 122224575 92110784 43.9G unknown


Disk /dev/mmcblk1boot0: 4 MiB, 4194304 bytes, 8192 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/mmcblk1boot1: 4 MiB, 4194304 bytes, 8192 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/nvme0n1: 119.24 GiB, 128035676160 bytes, 250069680 sectors
Disk model: WDC PC SN520 SDAPMUW-128G-1101
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 7638A2FB-4A40-40D4-B6C0-65BB6C4EA1DD

Device         Start       End   Sectors   Size Type
/dev/nvme0n1p1  2048 250068991 250066944 119.2G Microsoft basic data
root@linaro-alip:/#
```

### 4.3.9 Fan

There is a fan connector on the board, allowing users to connect an external fan module to cool the board when needed.

To turn on the fan and adjust the fan speed:

```
# echo xxx > /sys/class/hwmon/hwmon6/pwm1
```

The value of xxx ranges from 0 to 255, where 0 represents the maximum fan speed, and 255 corresponds to the minimum speed, indicating the fan is turned off.

### 4.3.10 Watchdog timer

The watchdog timer is disabled by default. Once enabled, the watchdog timer monitors the system to ensure it's being regularly 'fed'. If the system fails to feed the watchdog within the timeout period, it will trigger a reboot, indicating a potential system or application failure.

To enable and feed the watchdog:

```
# echo 1 > /dev/watchdog0
```

## 4.4 Firmware Upgrade in Windows Environment

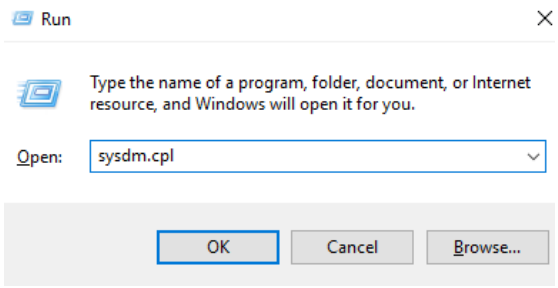
### 4.4.1 ADB setup on the Windows host

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.

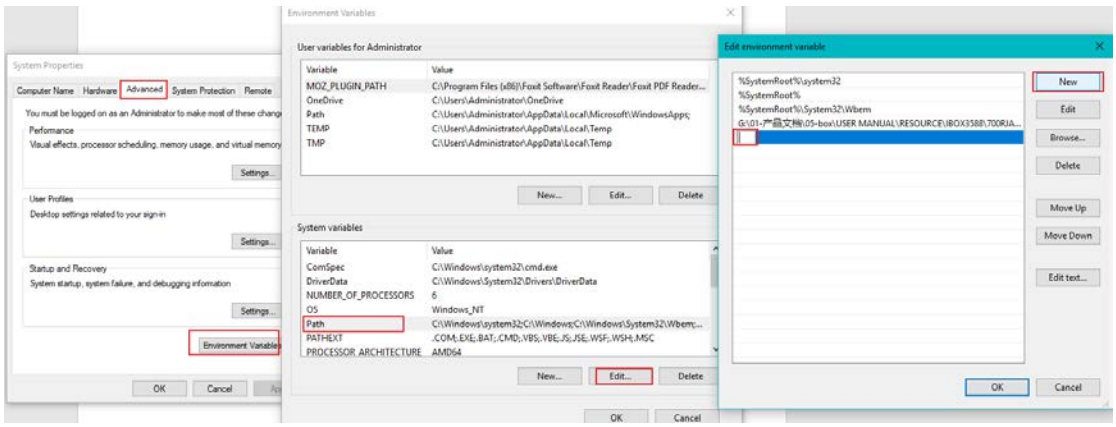
Adding the ADB executable file to the system's environment variable allows you to run the ADB tool regardless of your current working directory.

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

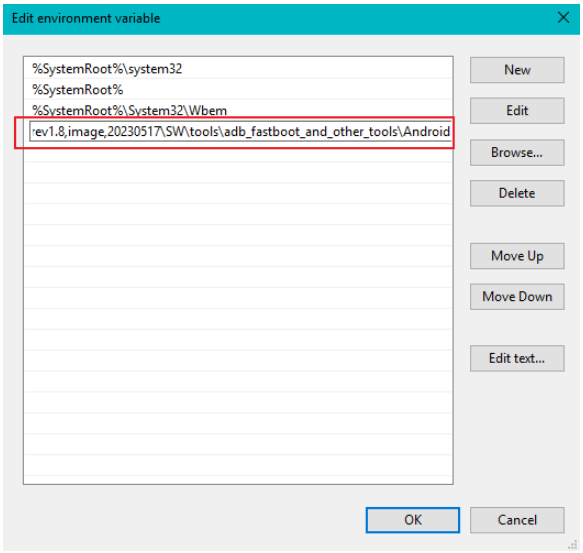
1. Unzip the software release package and navigate to the following directory: \SW\downloadetools\windows;
2. Extract the **adbtoolswindows** zip file;
3. Navigate to the **Android** folder that contains the ADB tool kit, and copy the folder path;
4. Press "Win + R" and input sysdm.cpl in the dialogue box to open the settings interface;




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

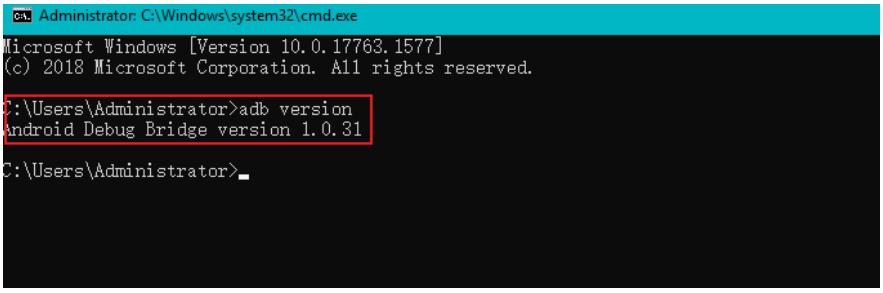


6. Paste the path of the **Android** folder, and click **OK** one by one to confirm and exit;



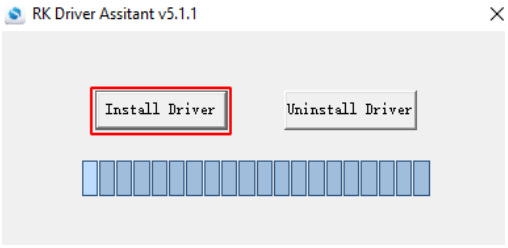

7. Press “Win + R” and input cmd in the dialogue box;

8. Input adb version in the command prompt to check if the ADB tool is installed.

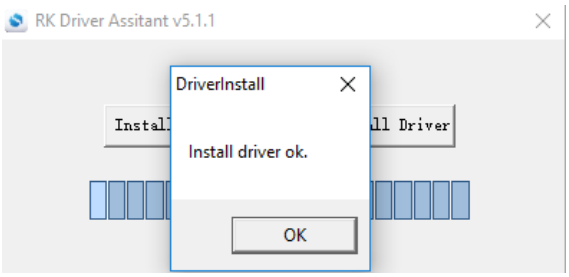


### 4.4.2 Firmware upgrade

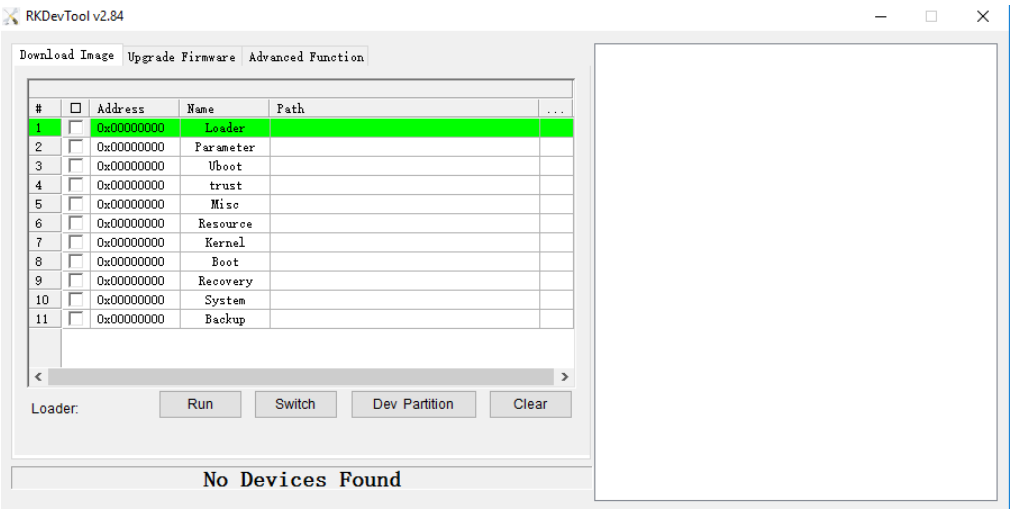
1. Unzip the release package and open the directory of the upgrade driver (\SW \downloadetools\windows\DriverAssitant_vxxx);
2. Right click the mouse and run the driver program **DriverInstall.exe** as administrator;
3. Click **Install Driver** and wait for the installation to proceed;




4. A pop-up will appear in a second suggesting the driver is installed;

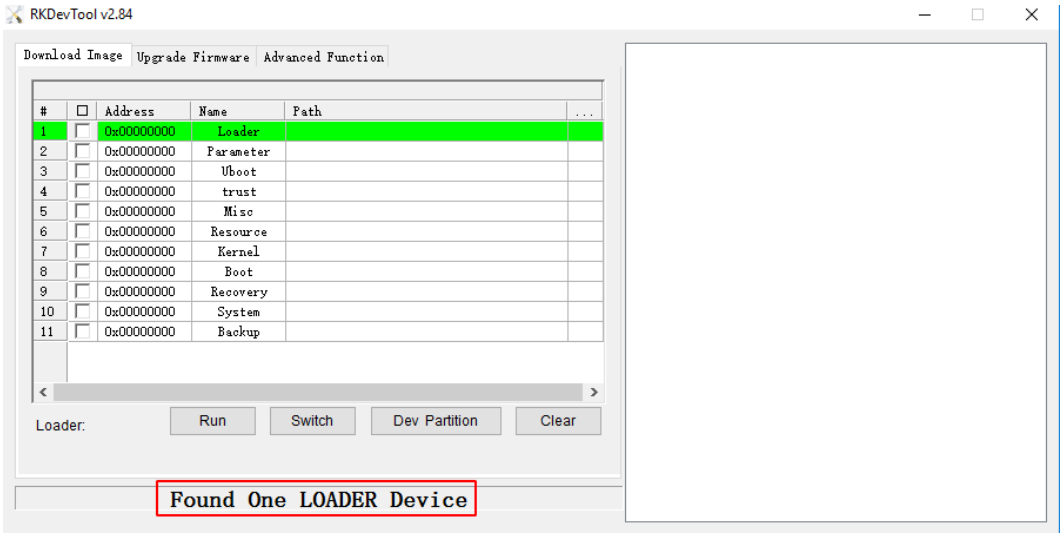



5. Open the directory of the upgrade tool (\SW\downloadetools\windows\ RKDevTool_Release_vxxx);
6. Double click the driver for the upgrade tool **RKDevTool.exe** to open the upgrade window;

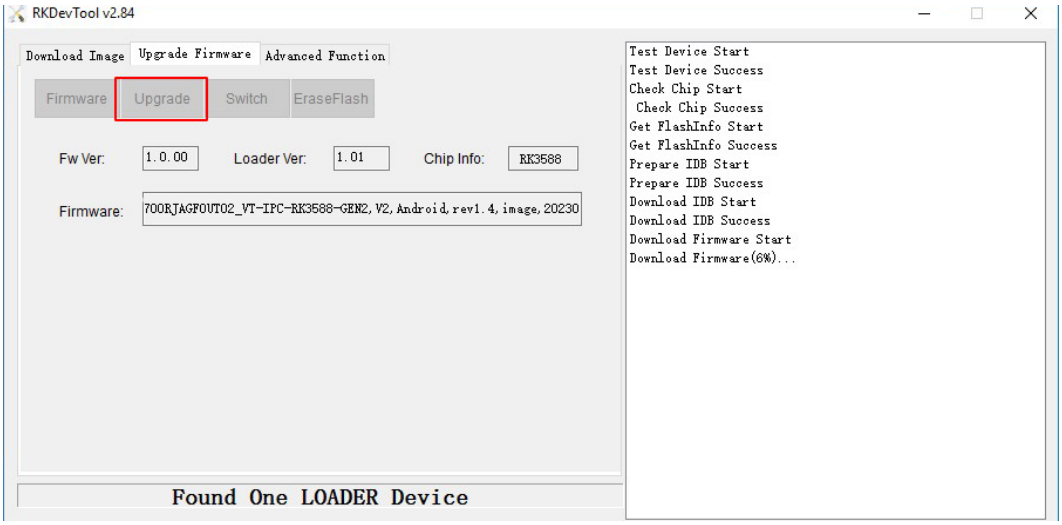



7. Connect VT-SBC35-3576 to the Windows host using a USB Type-A to Type-C cable;

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;
10. Once the board is identified by the Windows host, 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. 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;
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 Board will reboot automatically.

# CHAPTER 5 DISPOSAL AND PRODUCT 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** 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.