

SBC3576 Linux6.1 User Manual

V1.0



Boardcon Embedded Designer

Overview

The content of this document is intended solely for the SBC3576 development board, aiming to help users quickly understand, apply, and test the SBC3576 development board.

System Support

Development Board	Debian12	Buildroot
MINI3576 V1 SBC3576-V2	Y	Y

Revision History

Version	Date	Author	Revision History
V1.0	2025-06-19	Boardcon Team	Initial version

Disclaimer

The information in this manual is for reference only. While Boardcon strives to ensure its accuracy, no guarantees are made regarding its completeness or correctness. All content is subject to change without prior notice. Boardcon reserves the right to revise the content of this manual without prior notification.

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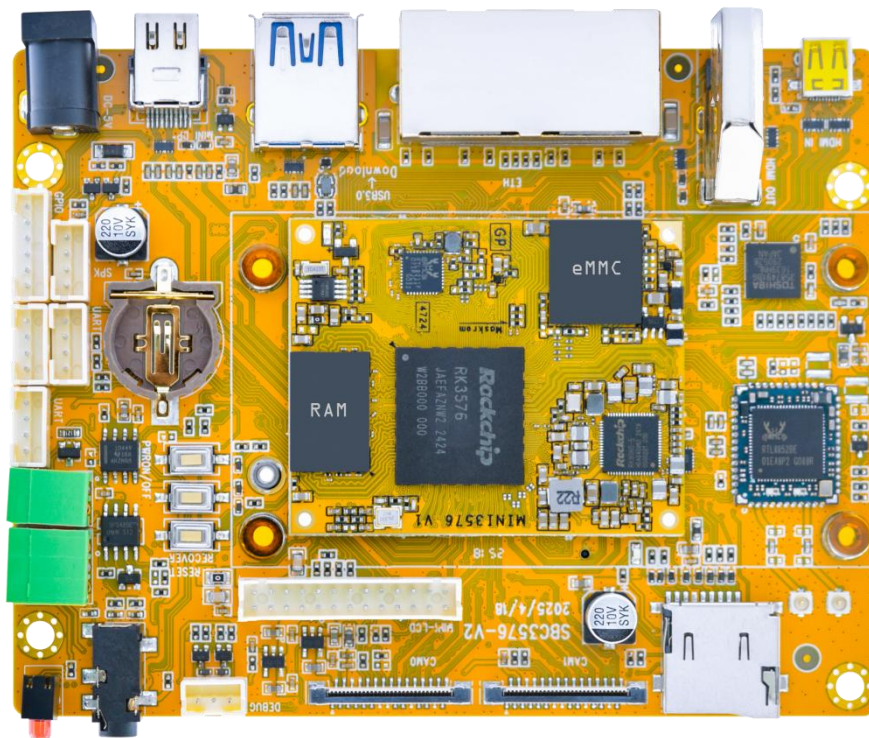
1.Introduction

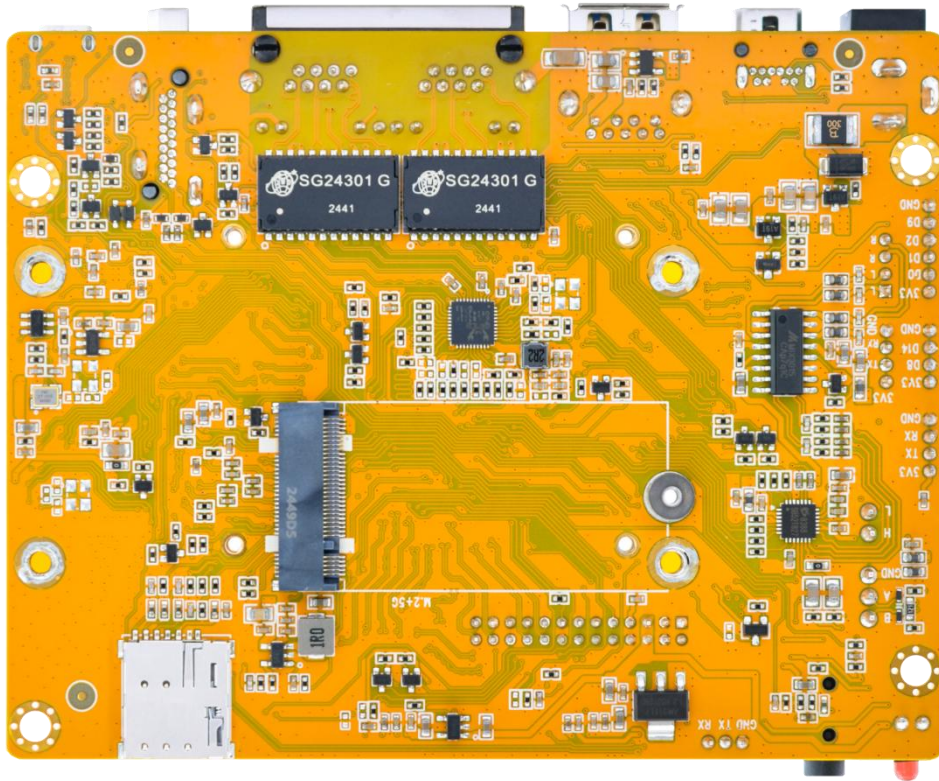
1.1 Overview

The SBC3576 development board is equipped with the RK3576 processor, featuring a quad-core Cortex-A72 and a quad-core Cortex-A53 architecture, providing powerful computing performance for smart devices and edge computing.

The 6 TOPS for INT8 operations integrated AI computing unit supports popular neural network frameworks and offers robust inference capabilities to meet AI application needs. It also support for high-resolution displays and smooth video playback.

The separation of the baseboard and core board allows for easy upgrades and customization, ensuring that the SBC3576 remains relevant and adaptable to future technological advancements. Additionally, its compact form factor makes it an excellent fit for space-constrained environments. The board is equipped with a variety of peripheral interfaces, allowing flexible expansion and supporting diverse application scenarios to meet the requirements of different devices and applications.





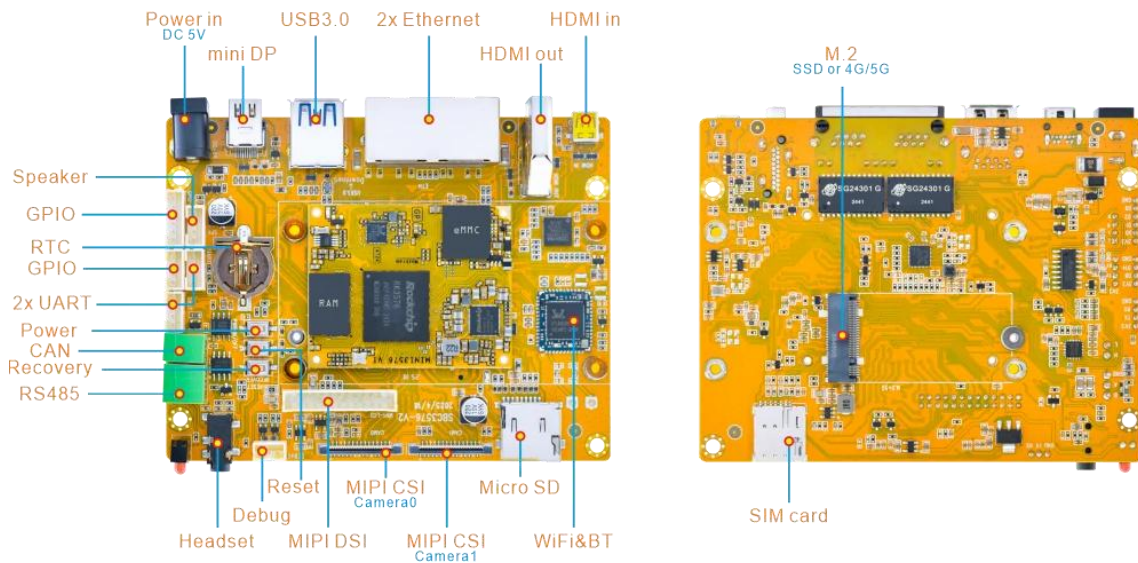
1.2 Product Parameters

Basic Parameters	
SOC	RK3576
CPU	<ul style="list-style-type: none"> • Octa-core 64-bit architecture (Quad-core Cortex-A72 + Quad-core Cortex-A53)
GPU	<ul style="list-style-type: none"> • ARM Mali-G52 MC3 • Support OpenGL ES 1.1/2.0/3.2 • Support Vulkan 1.1 • Support OpenCL 2.0 • Support AFBC
NPU	<ul style="list-style-type: none"> • 6 TOPS for INT8 operations. • Supports int4, int8, int16, FP16, BF16, TF32 operation
Video	<ul style="list-style-type: none"> • Supports up to 8K@30fps for H.265/HEVC, VP9, AVS2, and AV1 video decoding
	Decoder

		<ul style="list-style-type: none"> • Supports up to 4K@120fps for H.265/HEVC, VP9, AVS2, and AV1 video decoding • Supports up to 4K@60fps for H.264/AVC and MVC video decoding
	Encoder	<ul style="list-style-type: none"> • Supports H.264/H.265 video encoding up to 4K@60fps
RAM	4GB LPDDR4X	
ROM	32GB eMMC	
Support system	Android, Debian, Buildroot	
Hardware Parameters		
Extended Storage	<ul style="list-style-type: none"> • Support 1x M.2 PCIe2.1 SSD (optional. multiplexed with 4G module) • Support 1x MicroSD Card 	
Display	<ul style="list-style-type: none"> • Support 1x HDMI2.1 output, up to 4K@120fps • Support 1xMIPI output, up to 2560x1600@60fps • Support 1x DP AIT mode output, up to 4K@120fps 	
Audio	<ul style="list-style-type: none"> • Support 1x HDMI TX audio output • Support 1x DP AIT mode audio output • Support 1x Headphone output/input • Support 1x HDMI IN audio input • Support 1x Speaker audio output 	
USB	<ul style="list-style-type: none"> • Support 1x USB3.0 	
Network	<ul style="list-style-type: none"> • Support 2x Gigabit Ethernet • Support 1x WIFI/BT module • Support 1x 4G module(optional. multiplexed with SSD) 	
Camera	<ul style="list-style-type: none"> • Support 2x IMX415 Camera 	
Peripheral communication	<ul style="list-style-type: none"> • Support 1x CAN • Support 1x RS485 • Support 2x UART 	

Other parameters	Support 1x Debug, 1x RTC, 6x GPIO
Electrical Parameters	
Power supply input voltage	5V/3A
RTC input voltage	3V/0.6uA
Operating temperature	0~70°
Storage temperature	-40~85°
Structural Parameters	
Core board dimensions	50.0mm x 40.0mm
Motherboard dimensions	110.0mm x 85.0mm

1.3 Hardware Interface Introduction



Interface parameters	
Power in DC 12V	5V/3A DC power input interface
2x Camera	2-channel camera input interface
HDMI	HDMI2.1 TX interface

HDMI IN	HDMI in interface
2x Ethernet	Gigabit Ethernet RJ45 interface
Mini DP	DP interface
USB Host	USB3.0/download interface
Speaker	4-pin connector for speaker
Headset	Audio in/out interface
RS485	RS485 communication interface
CAN	CAN communication interface
Micro SD	Micro SD card slot
M.2	M.2 interface for connecting SSD/4G
SIM card	Nano SIM card
MIPI DSI	MIPI DSI interface
GPIO	General Purpose Input/Output pins
Debug	debug the serial port
UART	<ul style="list-style-type: none"> • UART10, TTL level serial interface • UART11, TTL level serial interface
WIFI&BT	WIFI&Bluetooth module
RTC	RTC coin cell connector
Recovery	Recovery key
Reset	Reset key
Power	Power key

2.Install Drivers and Tool

To download firmware and debug in the terminal, the following drivers and software need to be installed (for Windows computers):

Number	Driver name	Driver	Use
--------	-------------	--------	-----

1	RK Driver Assitant	DriverInstall.exe	OTG USB driver installation assitant
2	CH9102x	SETUP.EXE	Serial port debugging driver
3	Serial Terminal Tool	SecureCRT.exe	Debugging tool

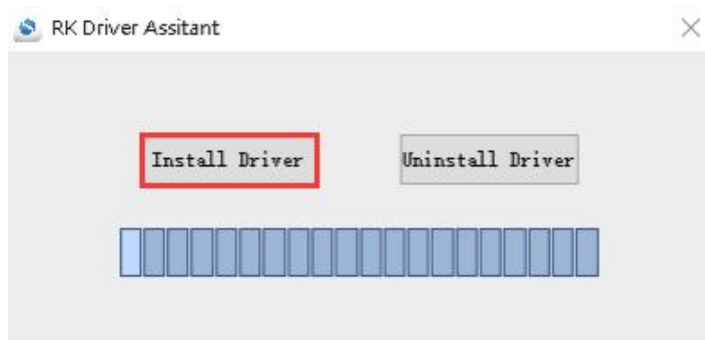
2.1 Install RK Driver Assitant

Step 1: Open *DriverAssitant_v5.1.3/DriverInstall.exe*.

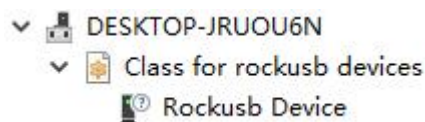
Step 2: To avoid driver conflicts, click “**Uninstall Driver**” to uninstall the driver.



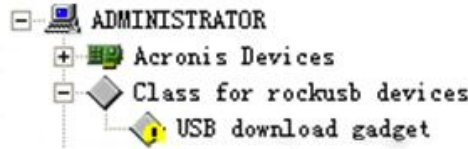
Step 3: Click button “**Install Driver**” to install.



Step 4: After the installation is complete, connect the board and PC with Type_C USB cable and press the **Recovery** key and hold then power the board, the following information is displayed in the Computer **Device Manager**, indicating that the USB driver was successfully installed.

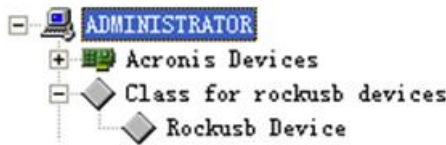


Step 5: If the following device information appears in the **Device Manager** after the operation in Step 4, user need to proceed to the next step.



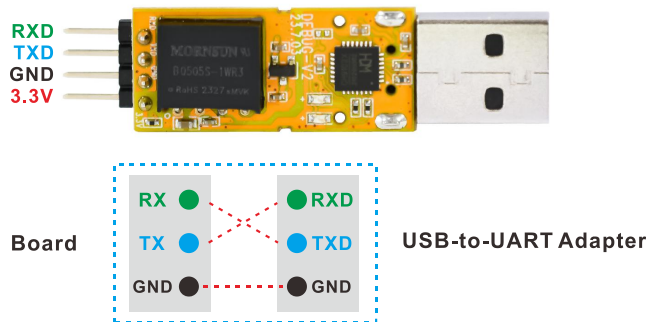
Step 6: The WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: *DriverAssitant_v5.1.1/ADBDriver*.

Step 7: After the installation is completed, the following device information can be seen in the Computer **Device Manager**.



2.2 Install CH9102X Driver

2.2.1 How to Connect the Serial Port Tool



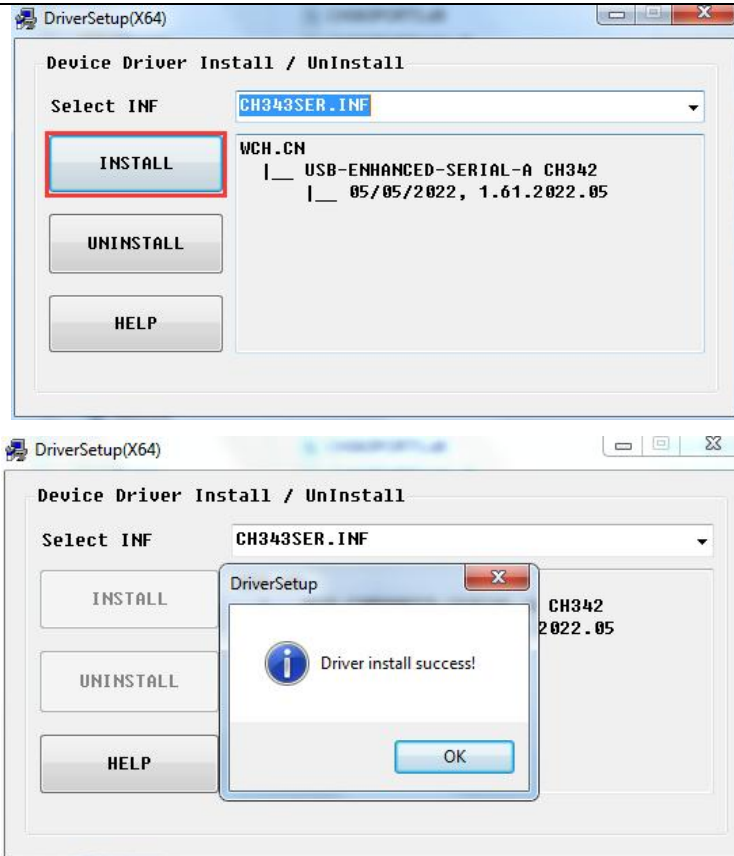
Pin	Connection Description
RXD	Receive, connect to TX pin of the board.
TXD	Transmit, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
3V3	No need to connect.

2.2.2 Install Driver

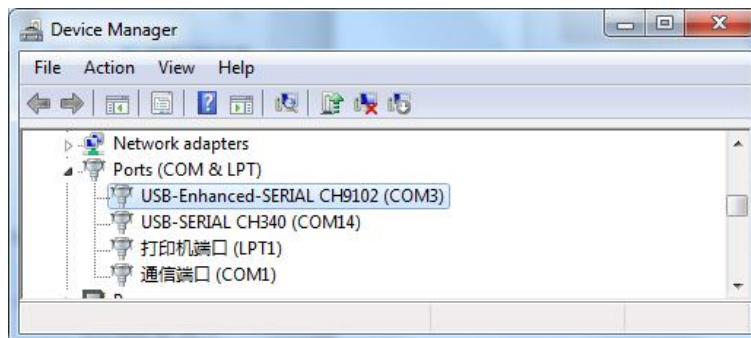
Step 1: Plug the CH9102X Module to the PC

Step 2: Unzip *CH343SER.ZIP* on Windows.

Step 3: Select and install the corresponding *SETUP.EXE* according to the computer properties.



Step 4: After the installation is completed, the device will be listed under **Device Manager** ports with unique serial port assigned.

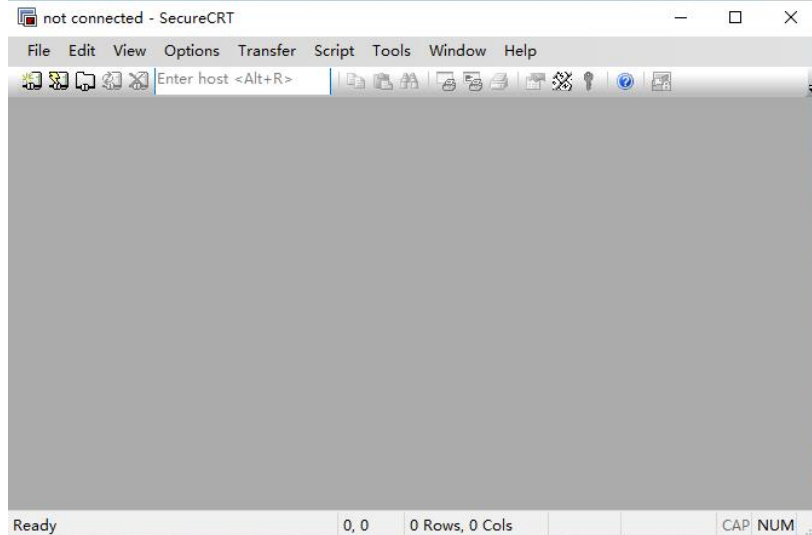


2.3 Install Serial Terminal Tool

The serial terminal SecureCRT is used for debugging in Windows. It can be used directly after decompression.

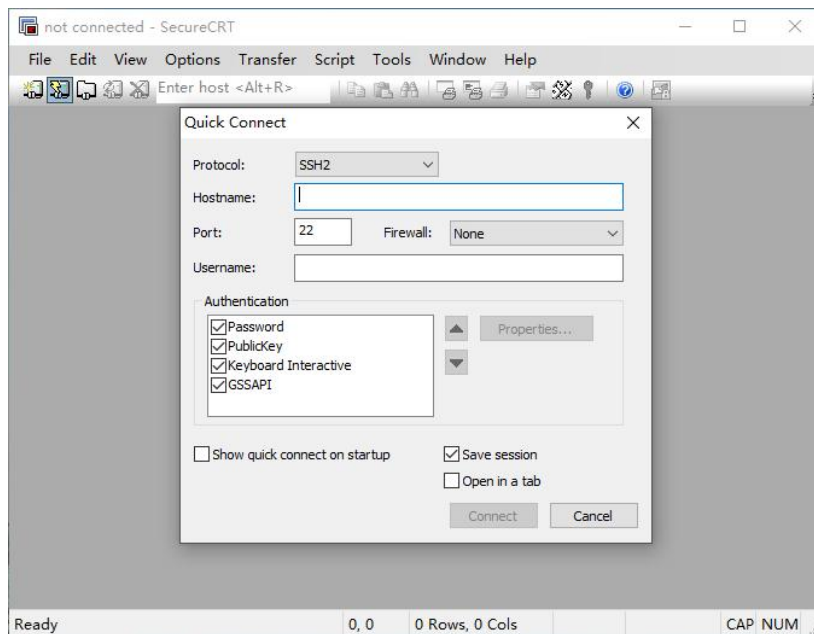
Step 1: Unzip *Platform/SecureCRT.rar* on PC.

Step 2: Click *SecureCRT/SecureCRT.exe* open the SecureCRT.

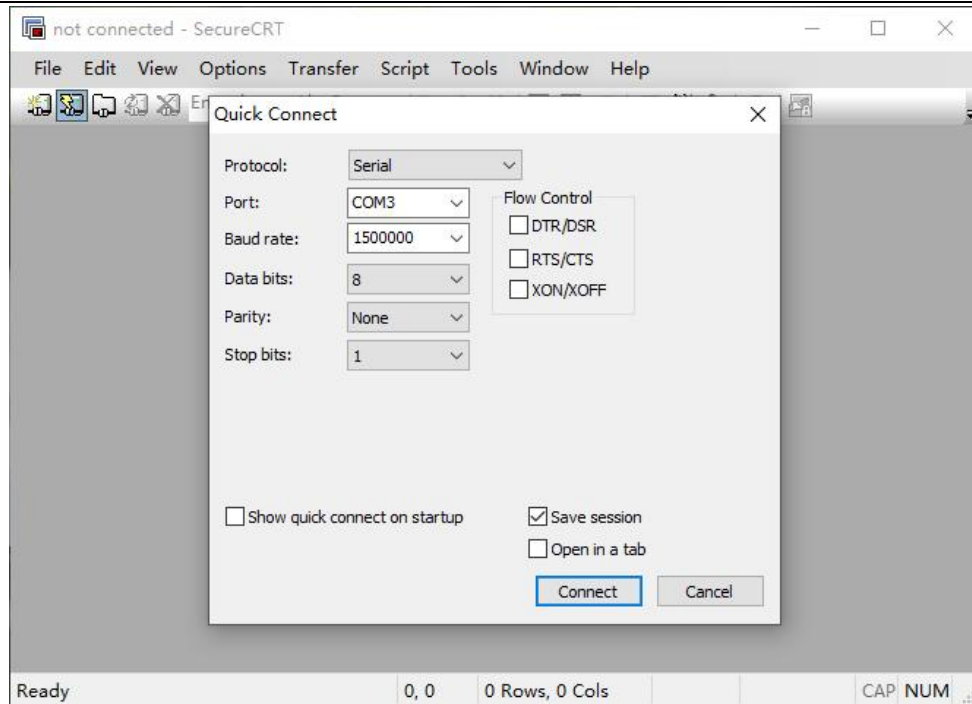


Step 3: Confirm that the CH9102X driver has been installed and the CH9102X module is connecting to the PC.

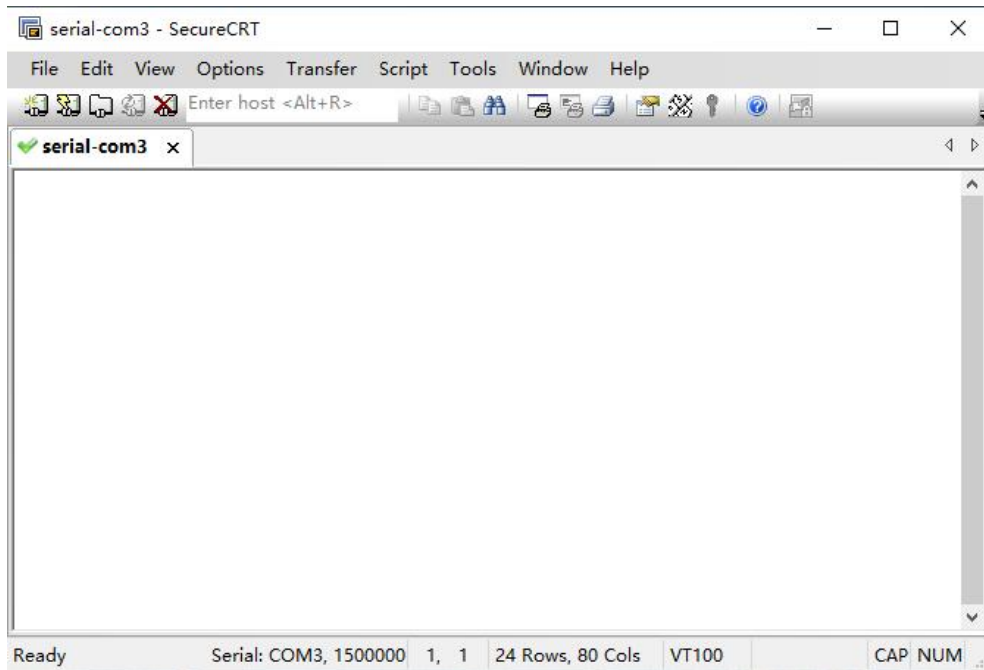
Step 4: Click the “Quick Connect” button to go to the Quick Connect configuration screen.



Step 5: Configure as shown in the following figure.



Step 6: After clicking “**Connect**” button, the terminal serial interface will be successfully accessed.



3. Upgrade Introduction

3.1 Upgrade Mode

The firmware can be upgraded via USB cable in two modes:

1. Loader Mode:

The standard mode used for firmware upgrades.

2. MaskRom Mode:

A last-resort mode used when the device is bricked. Entering MaskRom mode requires hardware manipulation, which involves certain risks. It should only be attempted if Loader mode is unavailable.

• Prerequisite

Before upgrading the firmware via USB cable, ensure that the necessary drivers are installed. For installation instructions, refer to the section [Install RK Driver Assistant](#).

3.1.1 How to Enter Loader Mode

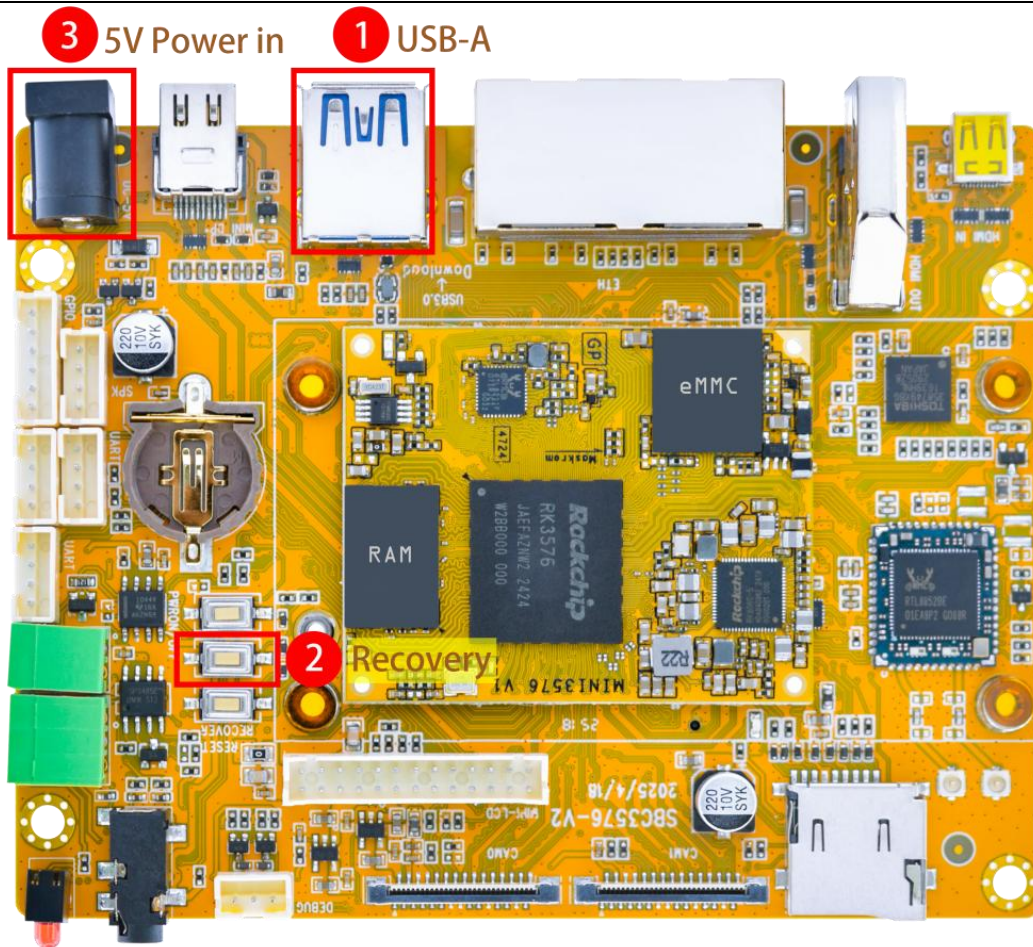
3.1.1.1 Hardware

Step 1: Disconnect the power adapter.

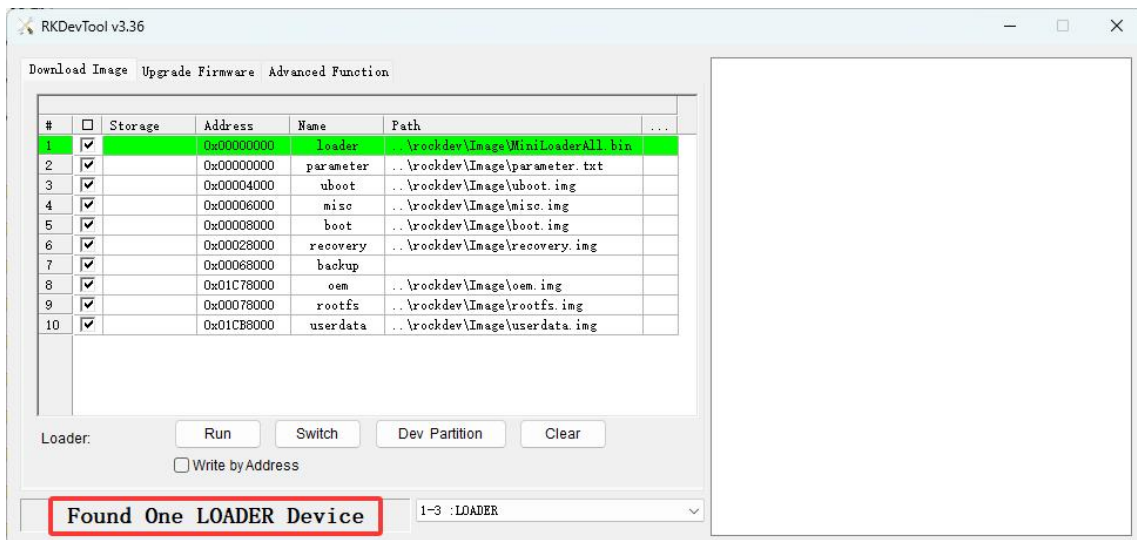
Step 2: Connect one end of the USB cable to the host and the other end to the development board.

Step 3: Press and hold the **Recovery** button on the board

Step 4: Connect the power supply.



Step 5: After a few seconds, release the **Recovery** button when the flashing tool shows **“Found one LOADER Device”**.



3.1.1.2 Software

After connecting the USB cable, execute the following command in the serial debug

terminal or adb shell.

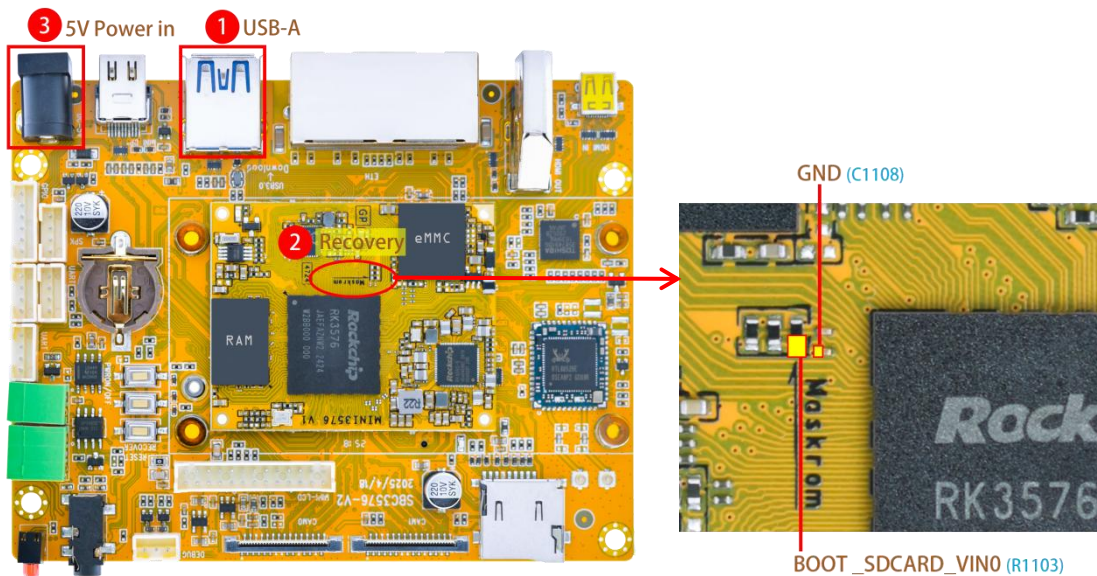
```
# reboot loader
```

3.1.2 How to Enter MaskRom Mode

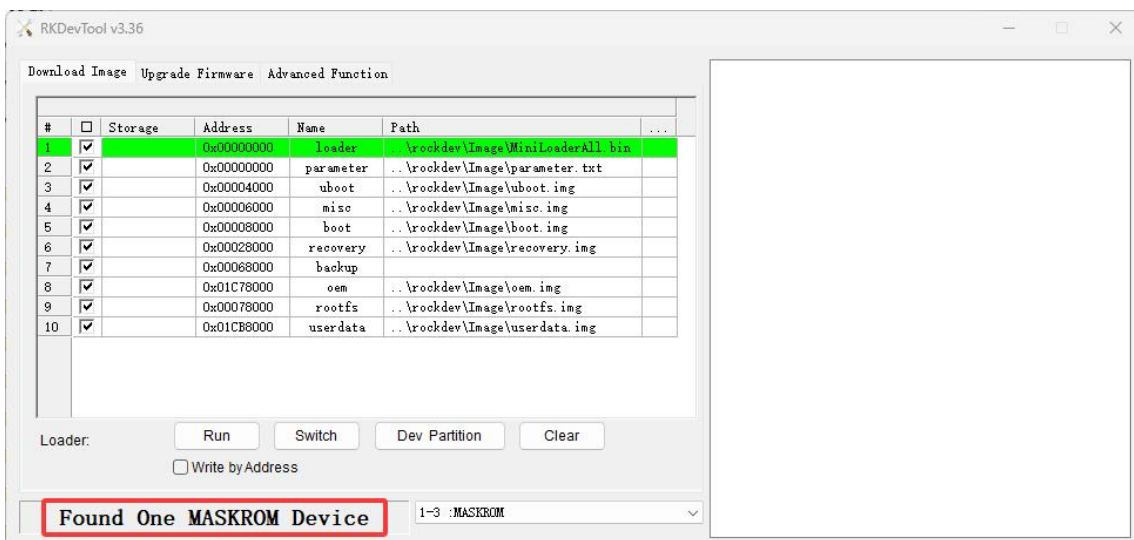
Step 1: Disconnect the power adapter.

Step 2: Connect one end of the Type_C cable to the host and the other end to the development board.

Step 3: Use tweezers to short the two test points on the CM3576.



Step 4: After connecting the power cable, the device will enter MaskRom mode.



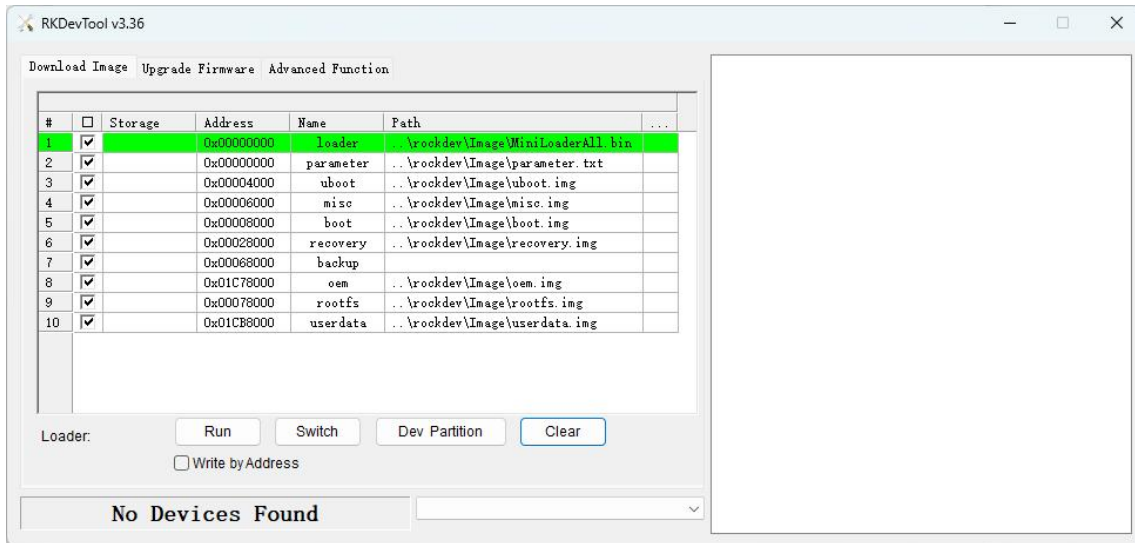
3.2 Burn firmware

Environment: Windows OS (Operating System).

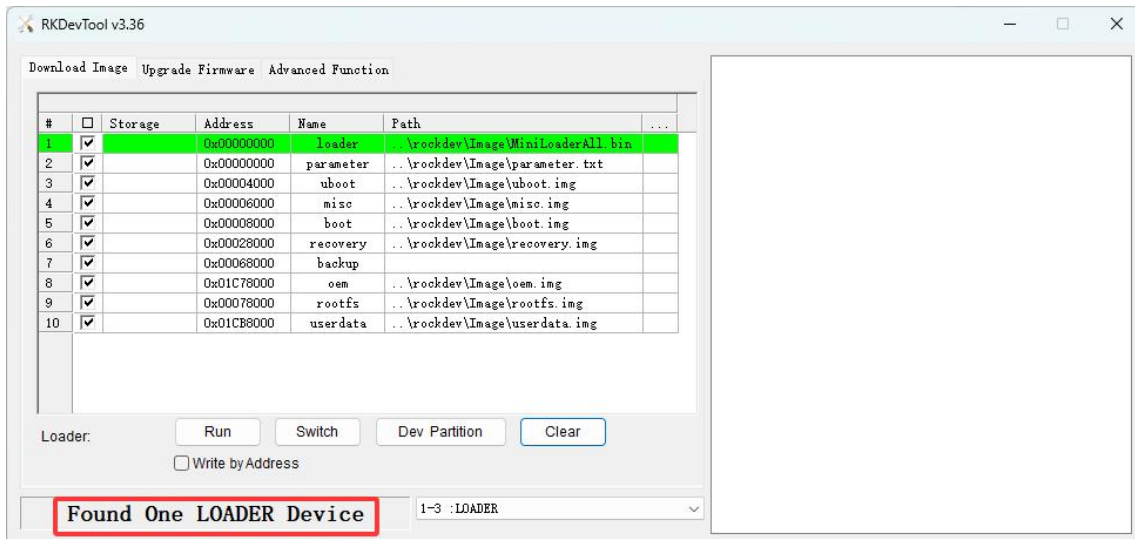
3.2.1 Burn Update.img Firmware

Step 1: Unzip *RKDevTool.rar* on Windows.

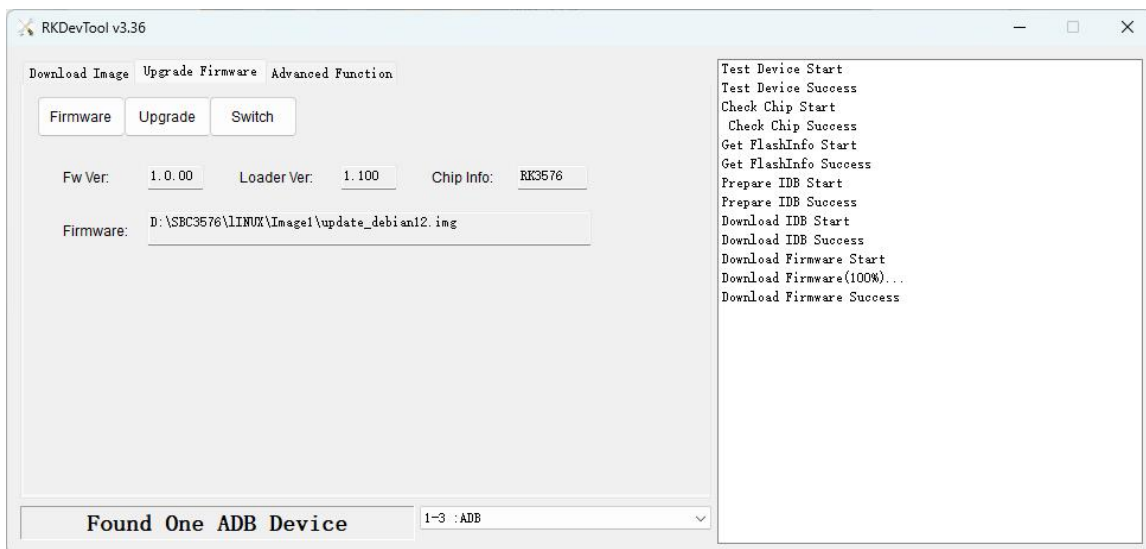
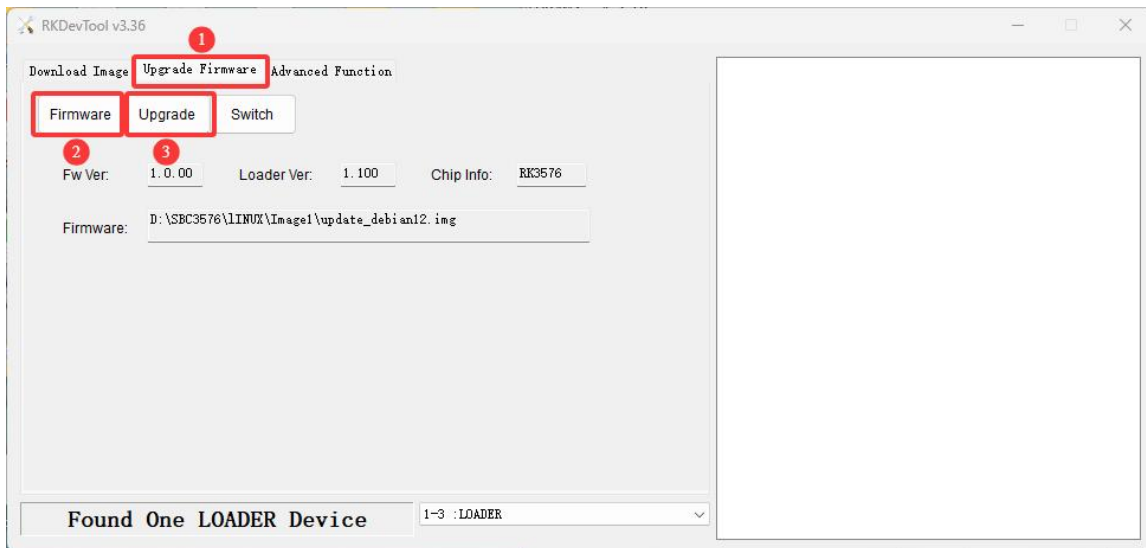
Step 2: Open *RKDevTool\RKDevTool_Release\RKDevTool.exe*.



Step 3: Switch to loader mode. ([How to Enter Loader Mode](#))



Step 4: Click **Upgrade Firmware** -> **Firmware**, select **update.img**, then click **Upgrade** to flash.



After the flashing is complete, the board will automatically reboot.

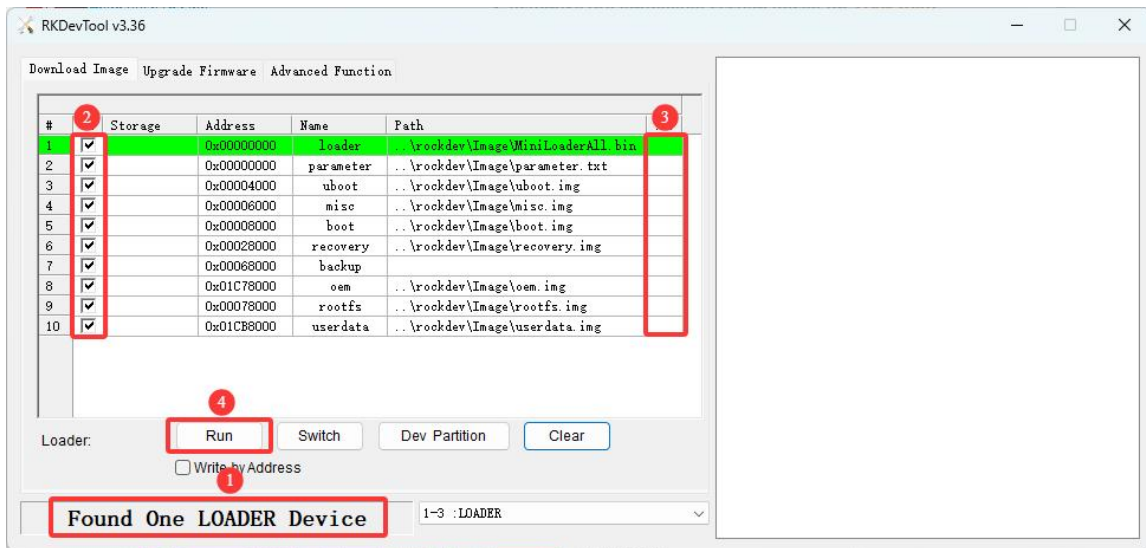
3.2.2 Burn Split Firmware

Step 1: Switch to **Loader mode**.

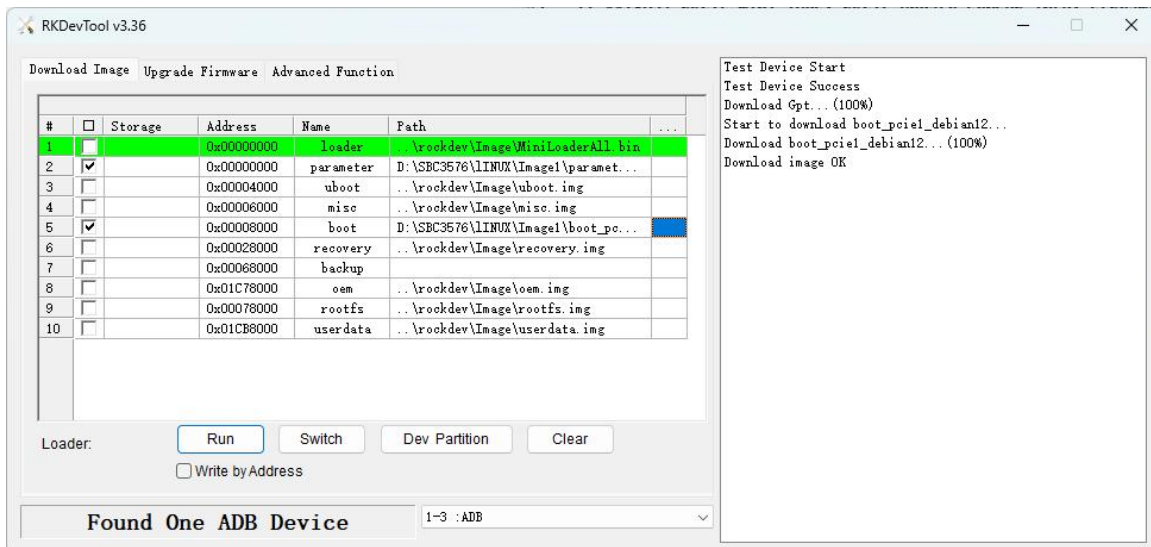
Step 2: Check the partitions to be flashed, multiple partitions can be selected.

Step 3: Ensure the image file path is correct. If necessary, click the blank cell next to the path to reselect it.

Step 4: Click the **Run** button to flash the image.



After the flashing is complete, the board will automatically reboot.



Note

- ① Without burning the `parameter.txt` file, please check the "Write by Address" checkbox, otherwise the flashing may fail with the "Image is larger than partition size" error.

4. Development Environment

4.1 Preparing the Development Environment

It is recommended to use Ubuntu 22.04 or higher version for compilation. If you encounter an error during compilation, user can check the error message and install the corresponding software packages accordingly. Other Linux versions may need to adjust the software package accordingly. In addition to the system requirements, there are other hardware and software requirements.

Hardware requirements	Software requirements
64-bit system, hard disk space should be greater than 60G. If you do multiple builds, you will need more hard drive space.	Ubuntu 22.04

4.2 Installing Libraries and Toolkits

The contents of this directory only provide the software package installation commands that are needed to build the compiled SDK environment. Please install other tools such as samba and ssh yourself.

PC OS	Network	Permission
Ubuntu 22.04	online	root

To install the required tools, execute the following commands:

```
$ sudo apt-get install git ssh make gcc libssl-dev liblz4-tool libmpc-dev
$ sudo apt-get install expect g++ patchelf chrpath gawk texinfo chrpath diffstat
$ sudo apt-get install binfmt-support live-build bison flex fakeroot libgmp-dev
$ sudo apt-get install cmake gcc-multilib g++-multilib unzip device-tree-compiler
$ sudo apt-get install ncurses-dev libgucharmap-2-90-dev bzip2 expat gpgv2
$ sudo apt-get install cpp-aarch64-linux-gnu g++-aarch64-linux-gnu
$ sudo apt install python2 python-is-python3
```

5. Compile Source

Note

- ① The Debian system, Buildroot system use the same SDK source package.
- ② The difference is in the `rootfs.img`, resulting in different filesystem building steps, while all other steps remain the same.

Step 1: Unzip the Source

To extract the source files, execute the following commands:

```
$ tar xvfj rk3576_linux6.1_sdk-*.tar.bz2
$ cd rk3576_linux6.1_sdk
```

Step 2: Configure the Compiled Board

To configure the board, execute:

```
$ ./build.sh lunch
```

```
##### Rockchip Linux SDK #####
Manifest: rk3576_linux6.1_release_v1.0.1_20240920.xml
Log colors: message notice warning error fatal
Log saved at /home/qinxueqin/3576/linux/linux6.1/output/sessions/2024-12-10_16-03-09
Pick a defconfig:
1. rockchip_defconfig
2. rockchip_rk3576_evb1_v10_defconfig
3. rockchip_rk3576_industry_evb_v10_defconfig
4. rockchip_rk3576_iotest_v10_defconfig
5. rockchip_rk3576_ipc_evb1_v10_defconfig
6. rockchip_rk3576_multi_ipc_evb1_v10_defconfig
7. rockchip_rk3576_test1_v10_defconfig
8. rockchip_rk3576_test2_v10_defconfig
9. rockchip_rk3576_vehicle_evb_v10_defconfig
10. rockchip_rk3576_vehicle_evb_v20_mos_defconfig
Which would you like? [1]: 2
```

Step 3: Compile U-Boot

To compile uboot, execute the following command:

```
$ ./build.sh uboot
```

Step 4: Compile Kernel

To compile kernel, execute the following command:

```
$ ./build.sh kernel
```

Step 5: Compile Recovery

To compile recovery, execute the following command:

```
$ ./build.sh recovery
```

Step 6: Compile rootfs

(1) Compile Debian12 (Permission: root)

To compile debian12, execute the following command:

```
$ sudo ./build.sh debian
```

After compilation, a [linaro-rootfs.img](#) is generated in the *debian/* directory.

Note: Related dependencies must be installed beforehand.

```
$ cd debian
$ sudo apt-get install binfmt-support qemu-user-static live-build
$ sudo dpkg -i ubuntu-build-service/packages/*
$ sudo apt-get install -f
```

(2) Compile Buildroot

To compile buildroot, execute the following command:

```
$ ./build.sh buildroot
```

Step 7: Generate and Check Firmwares

To generate firmware, execute the following command:

```
$ ./build.sh firmware
```

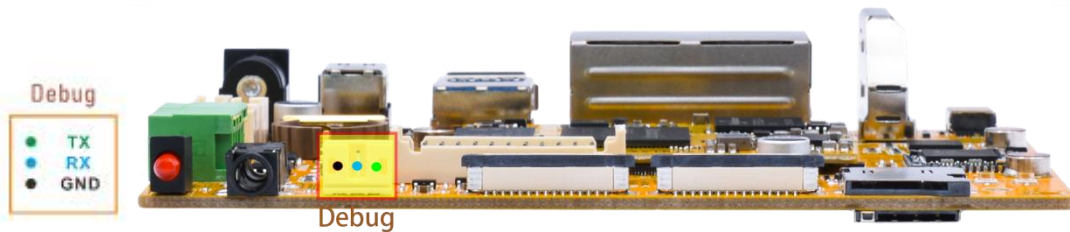
Images and [update.img](#) are generated in *rockdev/* directory.

6. Debian12 Test

Account: `linaro`

Password: `linaro`

6.1 Serial Terminal



Connect the board and PC with USB Serial cable, then power on, the terminal will output boot information. The default baudrate is 1500000.

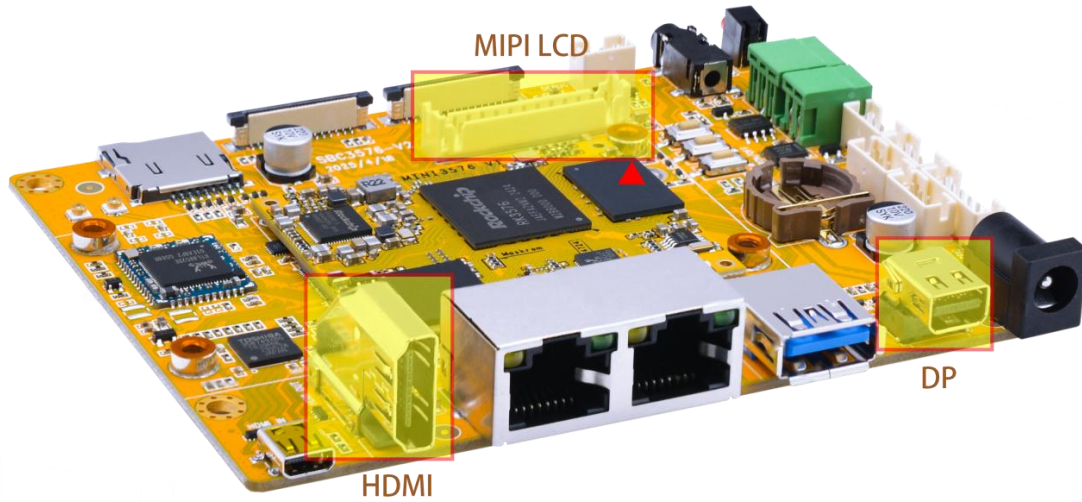
```
serial-com3 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com3 x
[ 21.093563] rkCIF-mipi-lvds: rkCIF_update_sensor_info: stream[1] get remote termina
| sensor failed!
[ 21.093570] rkCIF_tools_id1: update sensor info failed -19
[ 21.117921] Freeing drm_logo memory: 2768K
[ 21.129765] [BT_RFKILL]: DISABLE UART_RTS
[ 21.129824] [BT_RFKILL]: bt turn on power
[ 21.130005] [BT_RFKILL]: Request irq for bt wakeup host
[ 21.130340] [BT_RFKILL]: ** disable irq
[ 21.656359] Bluetooth: HCI UART driver ver 2.2.8d685df.20240508-150224
[ 21.656381] Bluetooth: HCI H4 protocol initialized
[ 21.656388] Bluetooth: HCI Realtek H5 protocol initialized
[ 21.656393] rtk_btcoex: rtk_btcoex_init: version: 1.2
[ 21.656398] rtk_btcoex: create workqueue
[ 21.656594] rtk_btcoex: alloc buffers 1792, 2432 for ev and l2
[ 22.165291] of_dma_request_slave_channel: dma-names property of node '/serial@2ad70
000' missing or empty
[ 22.165344] dw-apb-uart 2ad70000.serial: failed to request DMA, use interrupt mode
[ 22.909788] Bluetooth: h5_open
[ 22.909805] Bluetooth: hci_uart_register_dev
[ 22.909999] rtk_btcoex: Open BTCOEX
[ 22.910021] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc1b
[ 22.913208] rtk_btcoex: BTCOEX hci_rev 0xdec8
[ 22.913236] rtk_btcoex: BTCOEX lmp_subver 0x34cf
[ 23.021374] Bluetooth: MGMT ver 1.22
[ 25.726148] dwhdmi-rockchip 27da0000.hdmi: use tmds mode

root@linaro-alip:/#
root@linaro-alip:/#
root@linaro-alip:/#
root@linaro-alip:/#

Ready Serial: COM12, 150000 30, 1 30 Rows, 86 Cols VT100 CAP NUM
```

6.2 Display

The SBC3576 supports three independent displays, with default support for MIPI DSI, MINI DP and HDMI interfaces.



The display effect diagram is as follows:



6.3 USB 3.0(Loader/ADB/USB3.0)



6.3.1 ADB

Step 1: Connect the board and PC host with USB cable.

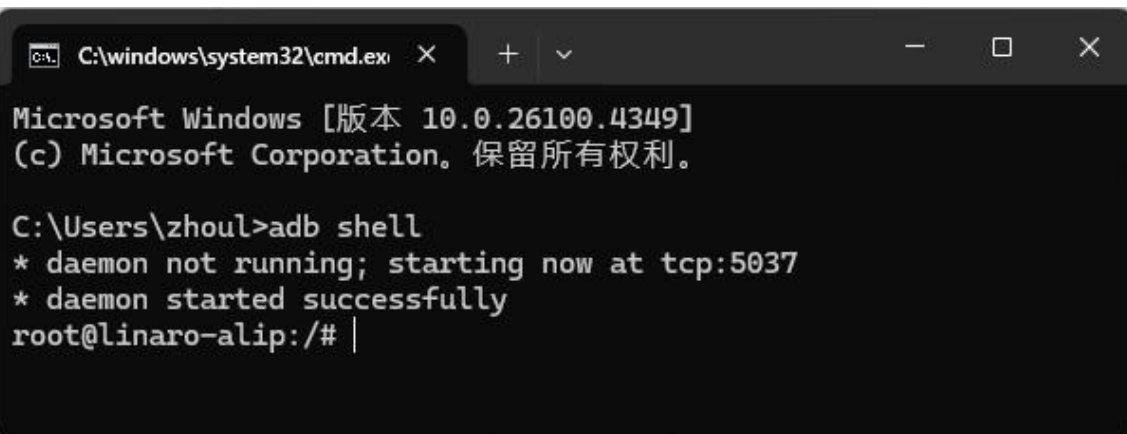


Step 2: Install ADB driver on Windows system.

Step 3: Press **Windows + R** to open the Run program. Type “cmd” and press Enter.

Step 4: Execute the following command to enable ADB.

```
# adb shell
```



```
C:\windows\system32\cmd.exe x + v - □ x
Microsoft Windows [版本 10.0.26100.4349]
(c) Microsoft Corporation。保留所有权利。

C:\Users\zhoul>adb shell
* daemon not running; starting now at tcp:5037
* daemon started successfully
root@linaro-alip:/# |
```

6.3.2 USB3.0

After the SBC3576 is powered on, when the system is running normally, USB3.0 OTG defaults to USB3.0 Device mode. Through software method, force USB3.0 OTG to work in Host mode or Device mode without being affected by USB hardware circuit.

(1) Force Host mode

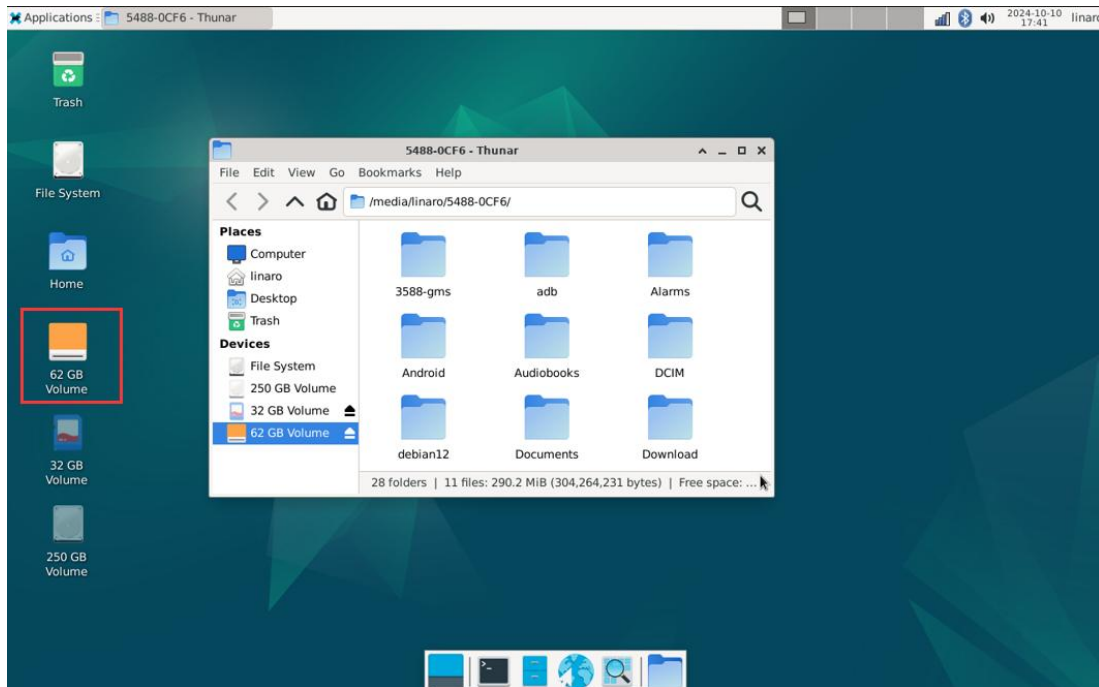
```
# echo host >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\usb2-phy@0/otg_mode
```

```
root@linaro-alip:/# root@linaro-alip:/# echo host >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\usb2-phy@0/otg_mode
bash: root@linaro-alip:/#: No such file or directory
root@linaro-alip:/# root@linaro-alip:/# [ 31.249800] dwc3 23000000.usb: request 000000038b18a6e was not
queued to ep0out
bash: root@linaro-alip:/#: No such file or directory
root@linaro-alip:/# [ 31.249952] android_work: did not send uevent (0 0 0000000000000000)
bash: syntax error near unexpected token `('
root@linaro-alip:/# [ 31.359009] phy phy-2602e000.syscon:usb2-phy@0.0: illegal mode
bash: [: missing `)'
root@linaro-alip:/# [ 31.359089] xhci-hcd xhci-hcd.9.auto: xHCI Host Controller
bash: [: missing `)'
root@linaro-alip:/# [ 31.359818] xhci-hcd xhci-hcd.9.auto: new USB bus registered, assigned bus number
1
bash: [: missing `)'
root@linaro-alip:/# [ 31.360111] xhci-hcd xhci-hcd.9.auto: hcc params 0x0220fe64 hci version 0x110 quirks
0x0000808002010010
bash: [: missing `)'
root@linaro-alip:/# [ 31.360189] xhci-hcd xhci-hcd.9.auto: irq 72, io mem 0x23000000
bash: [: missing `)'
root@linaro-alip:/# [ 31.360442] xhci-hcd xhci-hcd.9.auto: xHCI Host Controller
bash: [: missing `)'
root@linaro-alip:/# [ 31.360928] xhci-hcd xhci-hcd.9.auto: new USB bus registered, assigned bus number
2
bash: [: missing `)'
root@linaro-alip:/# [ 31.360973] xhci-hcd xhci-hcd.9.auto: Host supports USB 3.0 SuperSpeed
bash: [: missing `)'
root@linaro-alip:/# [ 31.361233] usb usb1: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice=
6.01
bash: [: missing `)'
root@linaro-alip:/# [ 31.361268] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
bash: [: missing `)'
root@linaro-alip:/# [ 31.361293] usb usb1: Product: xHCI Host Controller
bash: [: missing `)'
bash: [: missing `)'[ 31.361316] usb usb1: Manufacturer: Linux 6.1.99 xhci-hcd
root@linaro-alip:/# [ 31.361339] usb usb1: SerialNumber: xhci-hcd.9.auto
bash: [: missing `)'
root@linaro-alip:/# [ 31.362410] hub 1-0:1.0: USB hub found
bash: [: missing `)'
root@linaro-alip:/# [ 31.362499] hub 1-0:1.0: 1 port detected
```

Then the USB3.0 OTG has been switched to host mode. The USB host can be used to connect devices such as USB mouse, USB keyboards, USB flash drives, and other USB peripherals.

After connecting the USB flash drive, if the device is successfully recognized, an icon will appear on the desktop. Users need to click the icon in order to access the files on the

device.



Execute the following commands to view the USB flash disk node, it is mounted to the /mnt/udisk path.

```
# df -h
```

```
root@linaro-alip:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   3.8G  9.4G  29% /
devtmpfs        1.9G   8.0K  1.9G   1% /dev
tmpfs           2.0G     0   2.0G   0% /dev/shm
tmpfs           780M   1.9M  778M   1% /run
tmpfs           5.0M   20K   5.0M   1% /run/lock
/dev/mmcblk0p7  123M   12M  108M  10% /oem
/dev/mmcblk0p8  15G   288K   15G   1% /userdata
tmpfs          390M   36K  390M   1% /run/user/1000
/dev/mmcblk1p1  59G   54G  4.3G  93% /media/linaro/6AEA-5795
/dev/sdb1       118G   27M  118G   1% /media/linaro/HIKSEMI
root@linaro-alip:/#
```

(2) Force peripheral mode

```
# echo peripheral >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
```

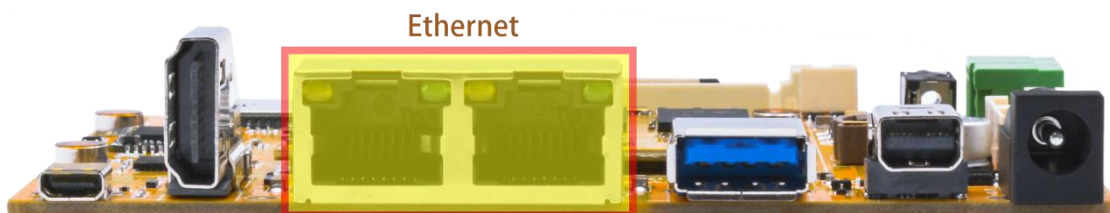
Then the USB3.0 OTG has been restored to Device mode, and features such as LOADER and ADB can be used.

```

root@linaro-alip:/# echo peripheral >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
root@linaro-alip:/# [ 1182.991123] xhci-hcd xhci-hcd.9.auto: remove, state 1
[ 1182.991203] usb usb2: USB disconnect, device number 1
[ 1182.991233] usb 2-1: USB disconnect, device number 3
[ 1183.030502] xhci-hcd xhci-hcd.9.auto: USB bus 2 deregistered
[ 1183.031057] xhci-hcd xhci-hcd.9.auto: remove, state 4
[ 1183.031098] usb usb1: USB disconnect, device number 1
[ 1183.037561] xhci-hcd xhci-hcd.9.auto: USB bus 1 deregistered
[ 1183.163721] dwc3 23000000.usb: device reset
[ 1197.413865] dwc3 23000000.usb: device reset
[ 1197.502028] android_work: sent uevent USB_STATE=CONNECTED
[ 1197.550900] android_work: sent uevent USB_STATE=CONFIGURED
  
```

6.4 Ethernet

Step 1: Connect the network cable to the Ethernet port.



According to the log, it can be seen that the Gigabit Ethernet recognition is successful.

```

root@linaro-alip:/# [ 62.827790] rk_gmac-dwmac 2a230000.ethernet end1: Link is Down
[ 65.771098] rk_gmac-dwmac 2a220000.ethernet end0: Link is Down
[ 69.868826] rk_gmac-dwmac 2a220000.ethernet end0: Link is Up - 1Gbps/Full - flow control rx/tx
[ 75.115418] rk_gmac-dwmac 2a230000.ethernet end1: Link is Up - 1Gbps/Full - flow control rx/tx
  
```

Step 2: View network interface information.

```
# ifconfig
```

```

root@linaro-alip:/# ifconfig
end0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.36 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::b66d:84e0:9d4e:4090 prefixlen 64 scopeid 0x20<link>
    ether 12:df:7d:ae:af:8d txqueuelen 1000 (Ethernet)
    RX packets 785 bytes 74761 (73.0 KiB)
    RX errors 0 dropped 133 overruns 0 frame 0
    TX packets 266 bytes 23535 (22.9 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 67

end1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.108 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::6df2:5b1c:75e:f82d prefixlen 64 scopeid 0x20<link>
    ether 16:df:7d:ae:af:8d txqueuelen 1000 (Ethernet)
    RX packets 509 bytes 49011 (47.8 KiB)
    RX errors 0 dropped 127 overruns 0 frame 0
    TX packets 28 bytes 2438 (2.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 69
  
```

Step 3: Users can test network connectivity using the desktop's built-in browser or

verify it through the following command method.

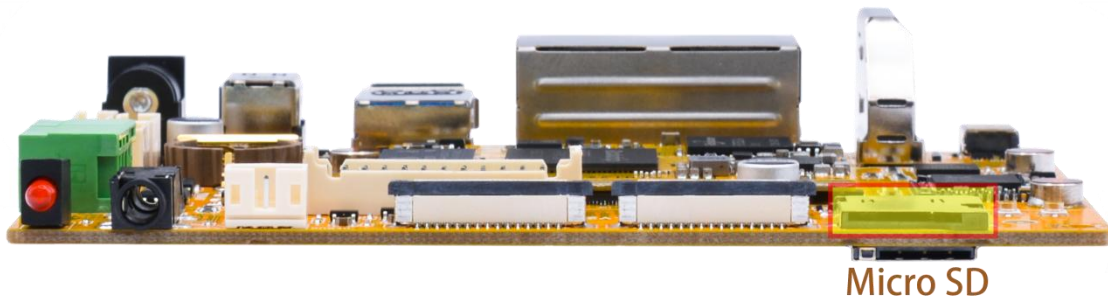
```
# ping -I end0 www.armdesigner.com
# ping -I end1 www.armdesigner.com
```

```
root@linaro-alip:/# ping -I end0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.36 end0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=194 ms
^C64 bytes from 67.222.54.196: icmp_seq=5 ttl=50 time=193 ms

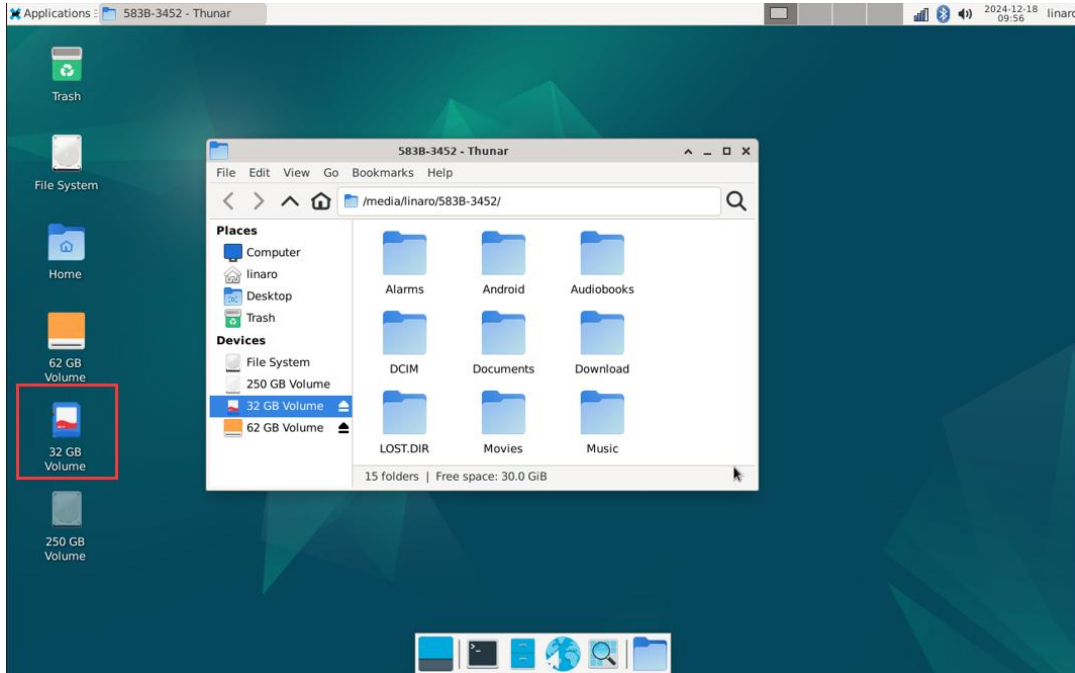
--- www.armdesigner.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 193.289/193.537/193.809/0.199 ms
root@linaro-alip:/#
root@linaro-alip:/#
root@linaro-alip:/# ping -I end1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.108 end1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=196 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=50 time=193 ms
^C
--- www.armdesigner.com ping statistics ---
6 packets transmitted, 5 received, 16.6667% packet loss, time 5012ms
rtt min/avg/max/mdev = 192.989/193.819/195.764/1.001 ms
root@linaro-alip:/#
```

6.5 SD Card

Step 1: Insert the micro SD card into the card slot.



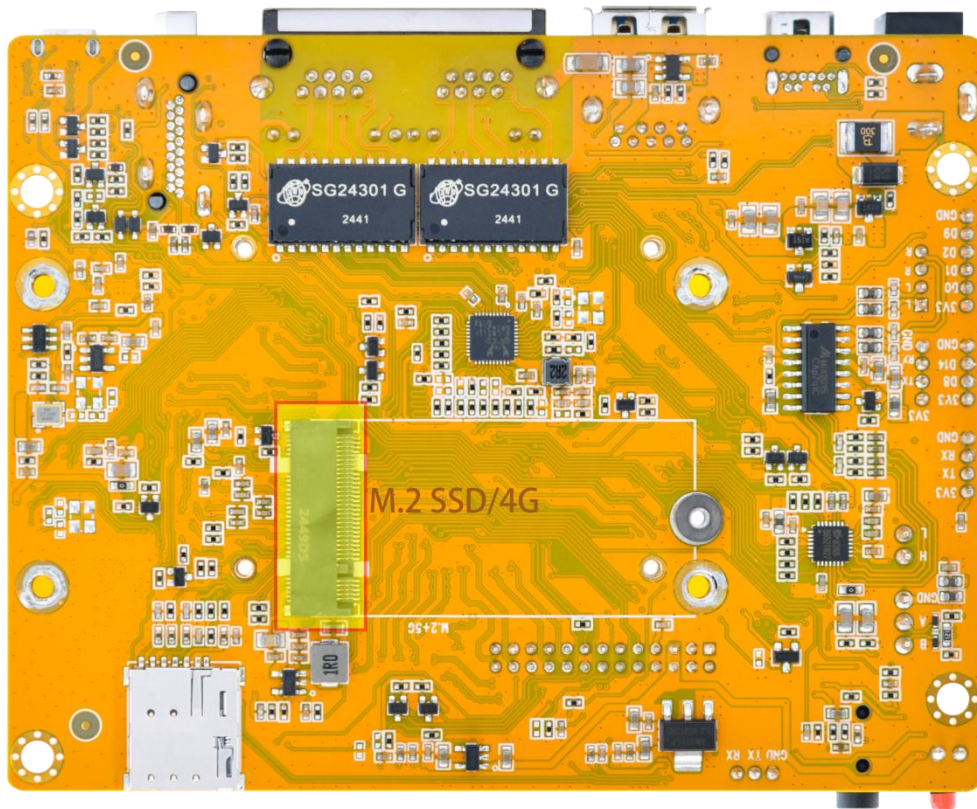
Step 2: After inserting the SD card, if it is recognized successfully, an icon will appear on the desktop. Users need to click the icon in order to access the SD card.



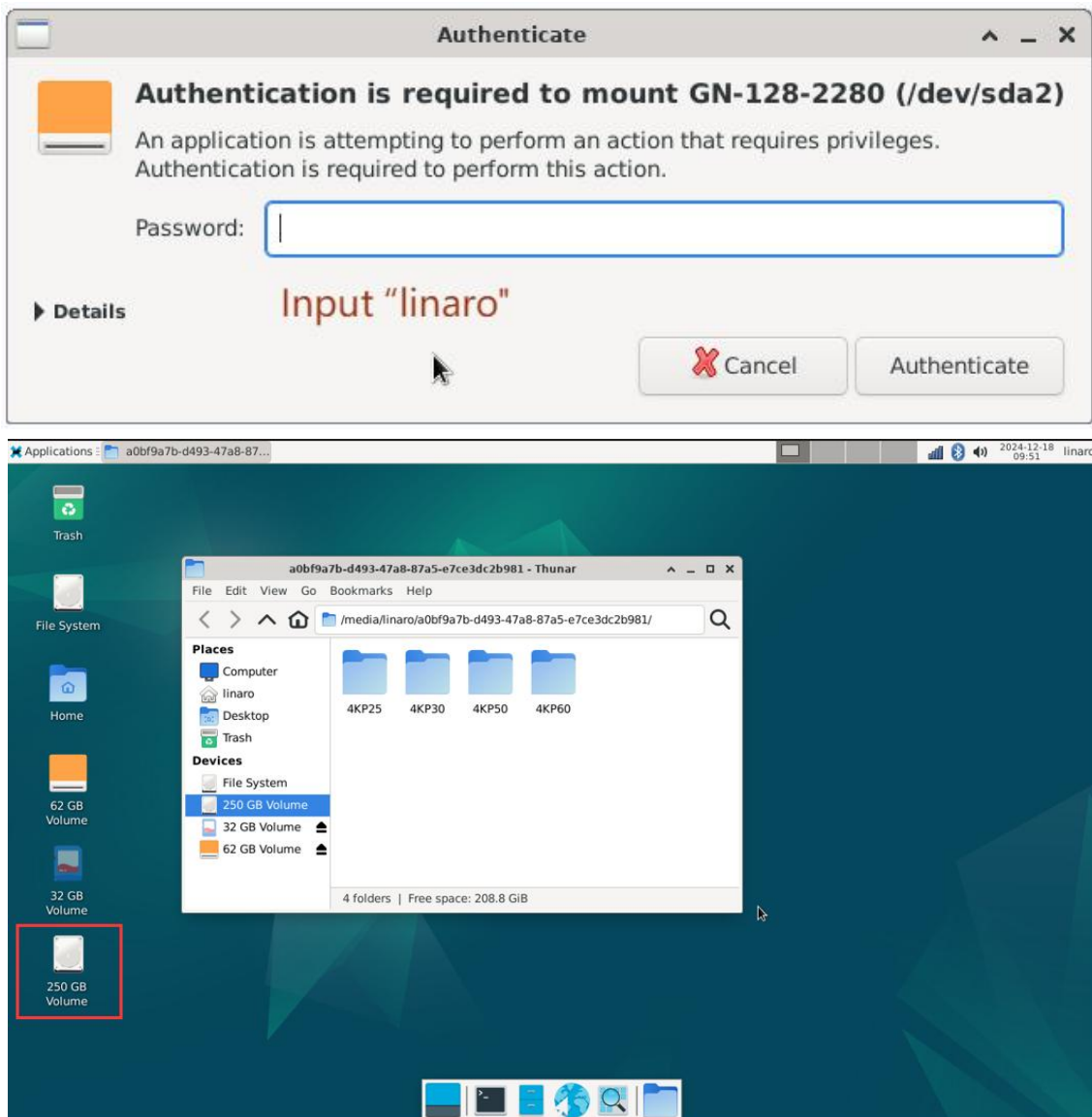
6.6 M.2 NVME SSD (Multiplexed with 4G)

The SSD on Debian12 only supports the ext4 format.

Step 1: Connect the SSD, then power on.



Step 2: If the SSD device is successfully recognized, an icon will appear on the desktop. Users can click the icon to input Password “linaro” then access the SSD device.



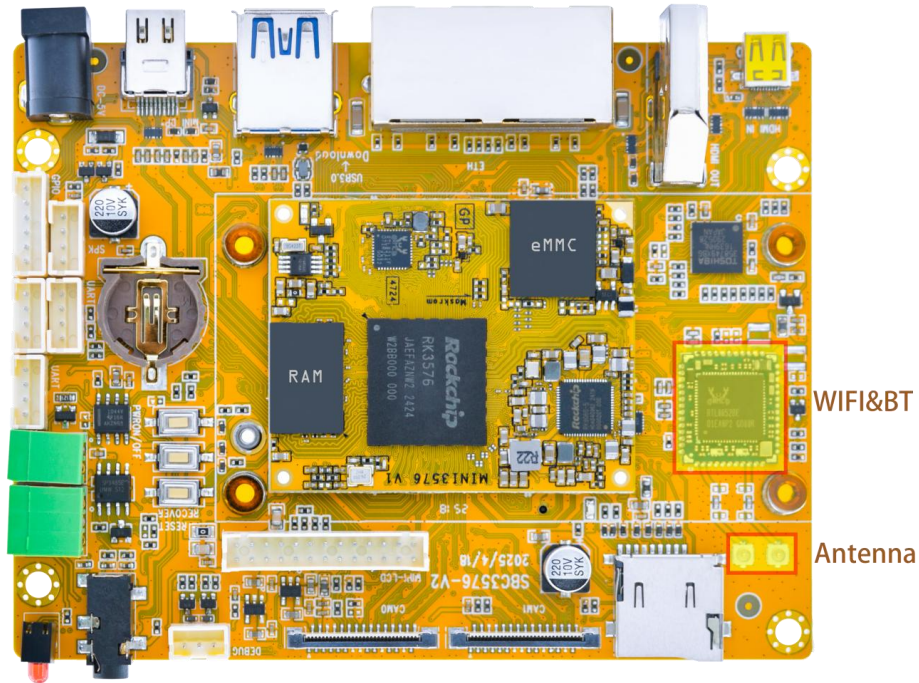
Note: If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

```
# mke2fs -t ext4 /dev/sda2
```

- Note**
1. The update.img supports 4G functionality by default. If SSD functionality is required, users need to reflash the kernel image: `boot_sata.img`.
 2. USB3.0 functionality cannot be used when SSD is in use ! USB2.0 functionality can be used.

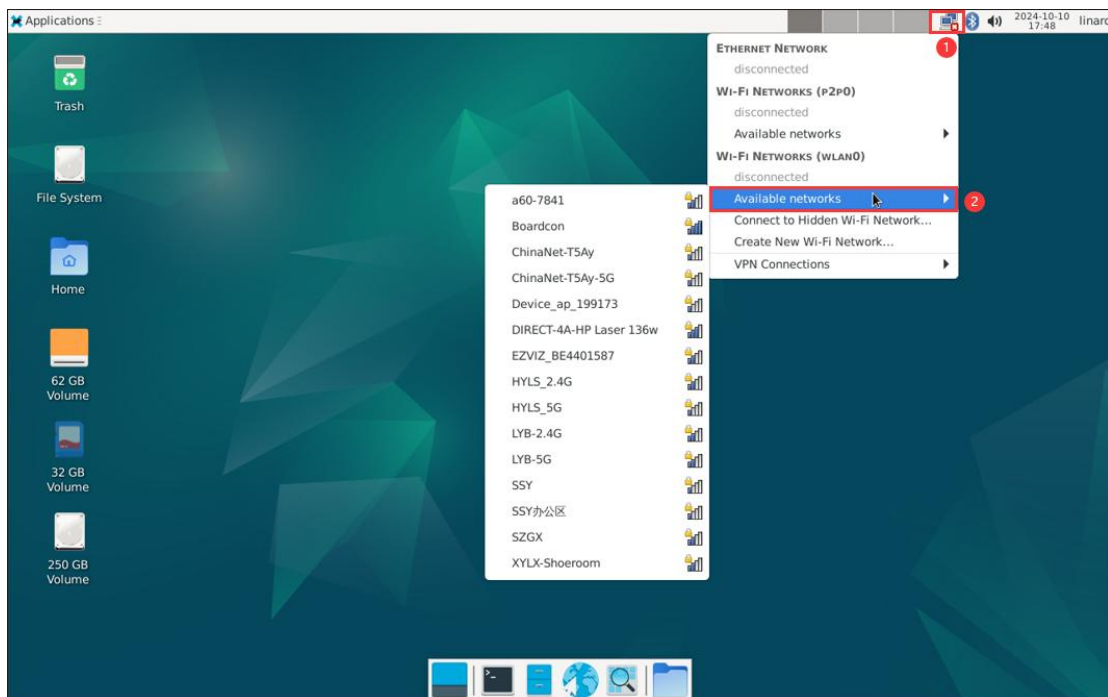
6.7 WiFi & Bluetooth

To use Wi-Fi and Bluetooth functions properly, the antenna needs to be connected.



6.7.1 WiFi

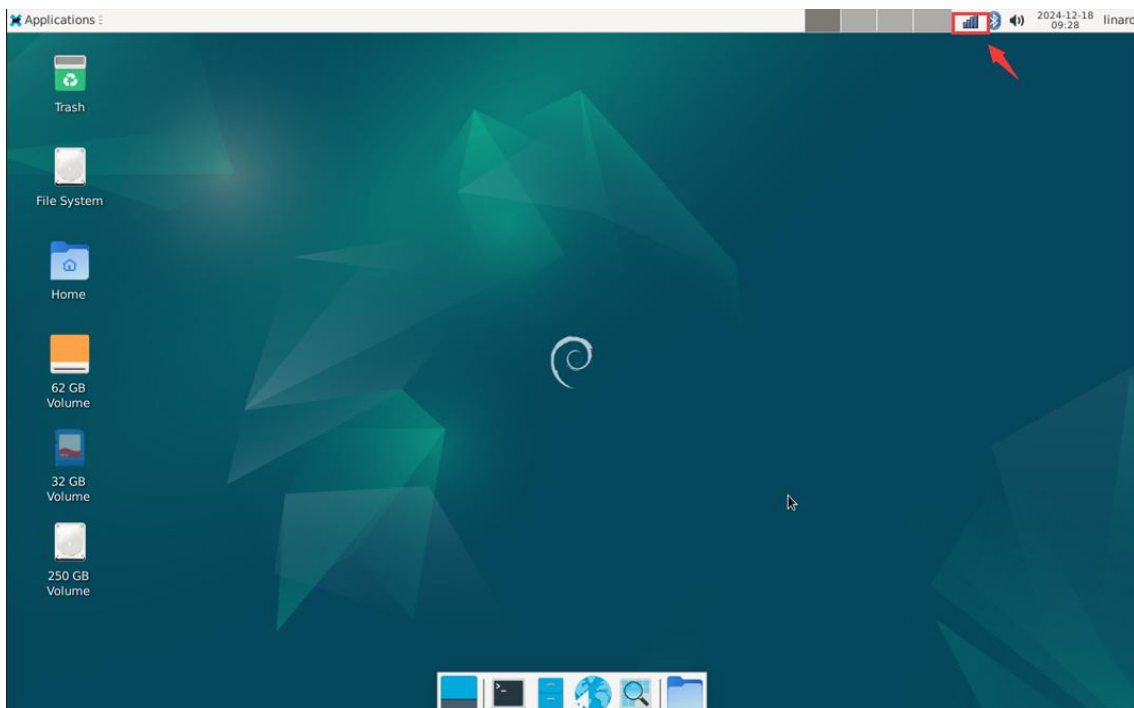
Step 1: Click the network icon in the top right corner of the interface, then select the "Available Networks" option to view the list of available hotspots.



Step 2: Select the SSID from the list of available networks and enter the password.



Step 3: After the WiFi successfully connects to the hotspot, the system will display the corresponding connection status icon in the top right corner.



Step 4: Users can test network connectivity using the desktop's built-in browser or verify it through the following command method.

(1) View network interface information.

```
# ifconfig
```

```
root@linaro-alip:/# ifconfig
p2p0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
ether 3a:7a:cc:2a:11:87 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.0.217 netmask 255.255.255.0 broadcast 192.168.0.255
inet6 fe80::3bcd:d135:688e:82e prefixlen 64 scopeid 0x20<link>
ether 38:7a:cc:2a:11:87 txqueuelen 1000 (Ethernet)
RX packets 462 bytes 73121 (71.4 KiB)
RX errors 0 dropped 66 overruns 0 frame 0
TX packets 182 bytes 21007 (20.5 KiB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

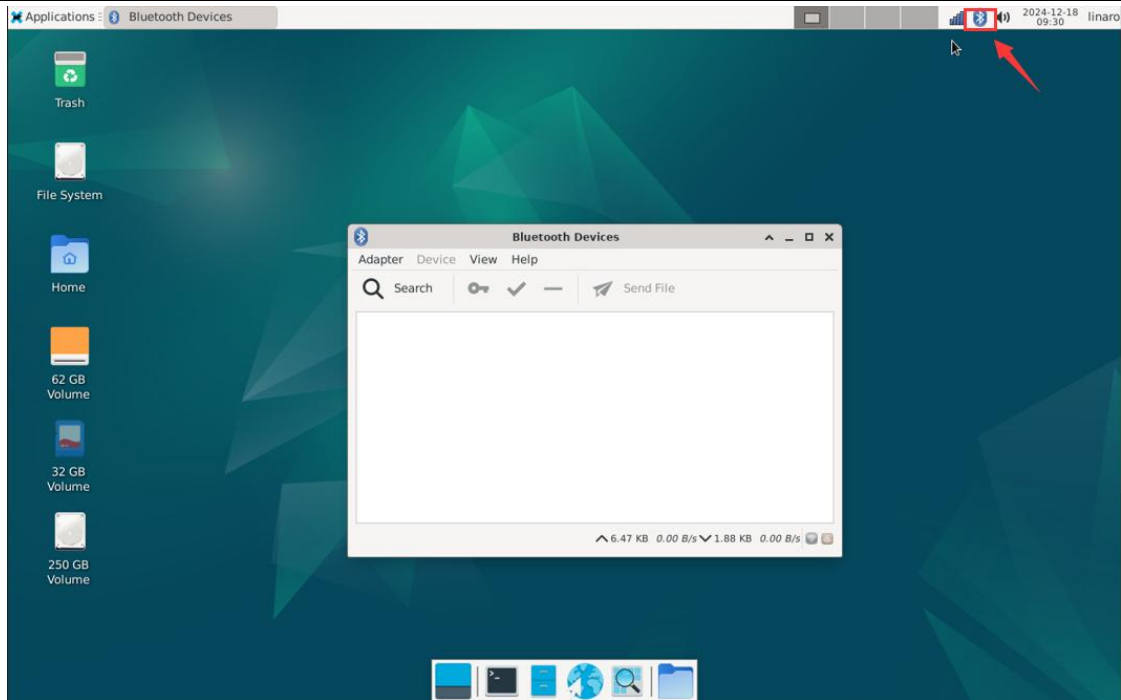
(2) Network connection test.

```
# ping -I wlan0 www.armdesigner.com
```

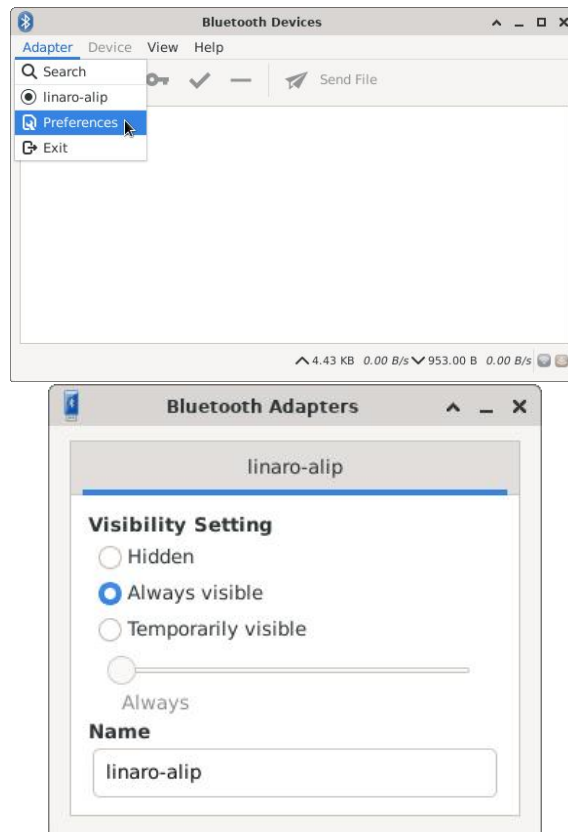
```
root@linaro-alip:/# ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.217 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=204 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=205 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=197 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=199 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=204 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=48 time=200 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=48 time=196 ms
^C
--- www.armdesigner.com ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9013ms
rtt min/avg/max/mdev = 194.830/199.155/205.357/3.958 ms
```

6.7.2 Bluetooth

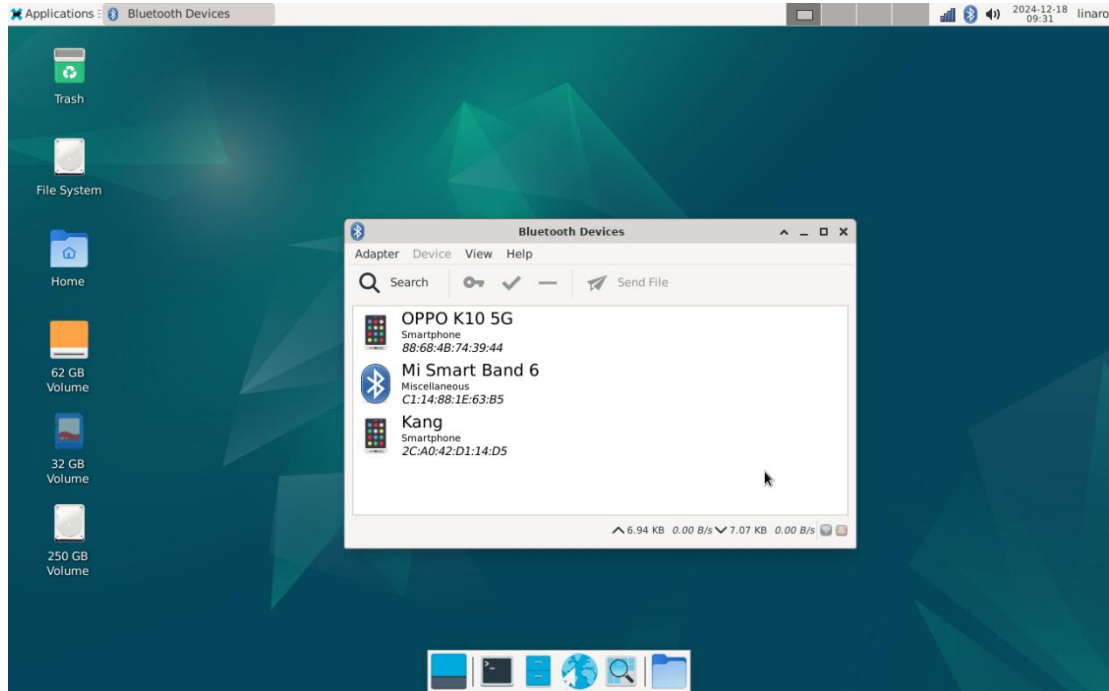
Step 1: Click the Bluetooth icon in the top right corner of the desktop.



Step 2: The Bluetooth device name is hidden by default. Set it to be visible by clicking **Adapter -> Preferences -> Always visible**.



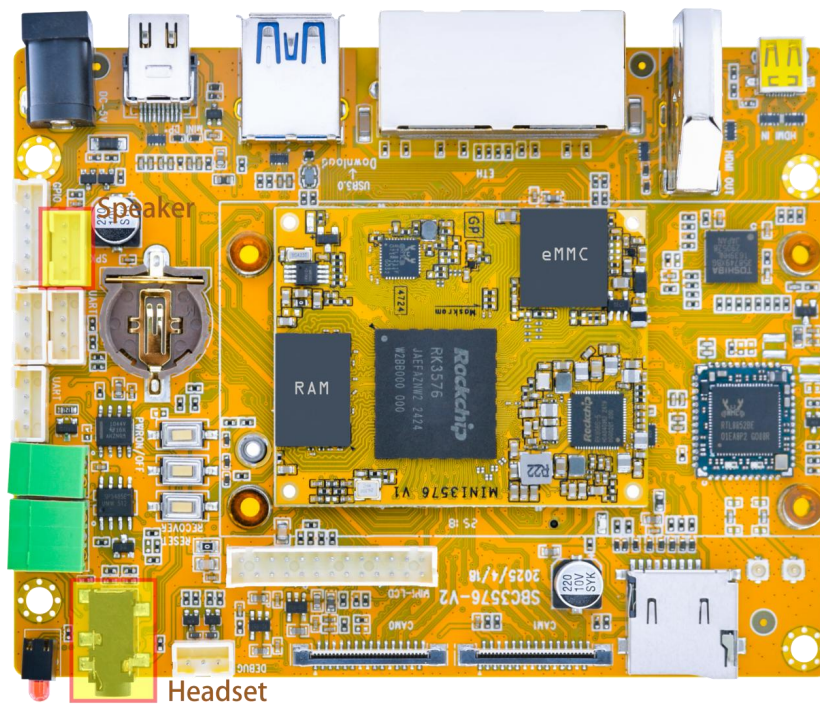
Step 3: Click Search to start searching and select the available device in the list to pair.



After successful configuration, Bluetooth devices can communicate with each other directly.

6.8 Audio

The audio input supports one channels: headset. And audio output supports two channels: headset and speaker.



6.8.1 Audio input

Step 1: Plug the headset into the headset jack.

Step 2: Verify that the sound card is successfully registered with proc fs, and get the device number for each sound card

```
# cat /proc/asound/cards
```

```
root@linaro-alip:/# cat /proc/asound/cards
0 [rockchipes8388 ]: rockchip-es8388 - rockchip-es8388
  rockchip-es8388
1 [rkhdmintc35874]: simple-card - rk,hdmiiin-tc358749x-codec
  rk,hdmiiin-tc358749x-codec
2 [rockchipdp0   ]: rockchip-dp0 - rockchip-dp0
  rockchip-dp0
3 [rockchiphdmi  ]: rockchip-hdmi - rockchip-hdmi
  rockchip-hdmi
root@linaro-alip:/#
```

Step 3: Execute the following command to start recording by headset.

```
# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
```

```
root@linaro-alip:/# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

6.8.2 Audio output

Step 1: View sound card.

```
# aplay -l
```

```
root@linaro-alip:/# aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchipes8388 [rockchip-es8388], device 0: dailink-multicodecs ES8323 HiFi-0 [dailink-multicodecs ES8323 HiFi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 1: rkhdmintc35874 [rk,hdmiiin-tc358749x-codec], device 0: 2a610000.sai-dummy_codec dummy_codec-0 [2a610000.sai-dummy_codec dummy_codec-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 2: rockchipdp0 [rockchip-dp0], device 0: rockchip-dp0 spdif-hifi-0 [rockchip-dp0 spdif-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 3: rockchiphdmi [rockchip-hdmi], device 0: rockchip-hdmi i2s-hifi-0 [rockchip-hdmi i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
root@linaro-alip:/#
```

Step 2: Execute the following command to play audio and output it through headset.

```
# aplay -Dhw:0,0 test.wav
```

```
root@linaro-alip:/# aplay -Dhw:0,0 test.wav
Playing WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 test.wav // headset/speaker audio output(Priority:Headset > speaker)
# aplay -Dhw:2,0 test.wav // DP mode audio output
# aplay -Dhw:3,0 test.wav // HDMI TX audio output
```

6.9 RTC

Step 1: Install the coin cell battery.



Step 2: Set the system time.

```
# date -s "2025-06-24 09:45:00"
```

Step 3: Write the system time to the hardware clock.

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

```
# hwclock
```

```
root@linaro-alip:/# date -s "2025-06-24 09:45:00"
Tue Jun 24 09:45:00 AM UTC 2025
root@linaro-alip:/# hwclock -w
root@linaro-alip:/# hwclock
2025-06-24 09:45:07.797747+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:45:08.735005+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:45:09.686362+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:45:10.693603+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:45:11.773295+00:00
root@linaro-alip:/#
```

Step 5: Power off, after a period of time to turn on the power again, check whether the time is saved.

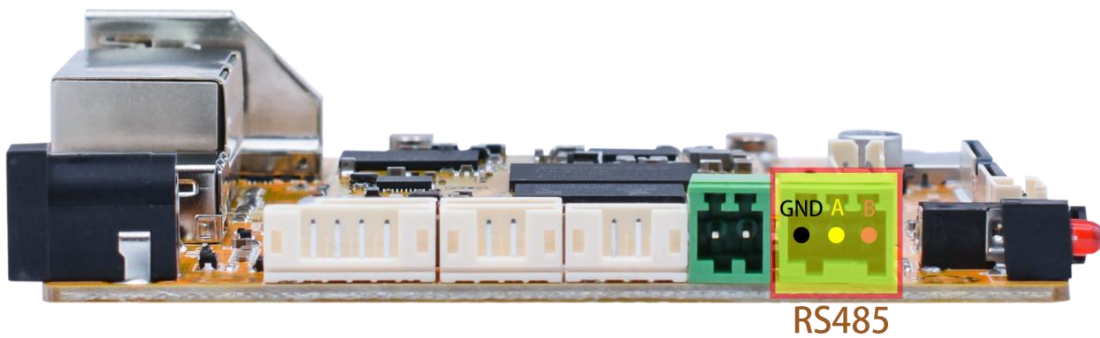
```

root@linaro-alip:/# hwclock
2025-06-24 09:48:15.229967+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:48:16.782520+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:48:17.785984+00:00
root@linaro-alip:/# hwclock
2025-06-24 09:48:18.779956+00:00
root@linaro-alip:/#

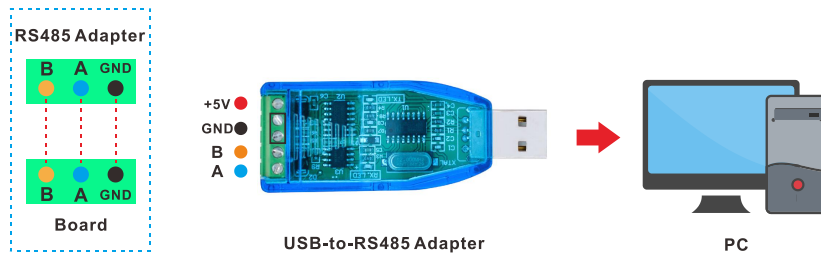
```

The system time is automatically synchronized with the network time, execute “hwclock -w” the RTC time is synchronized with the system time.

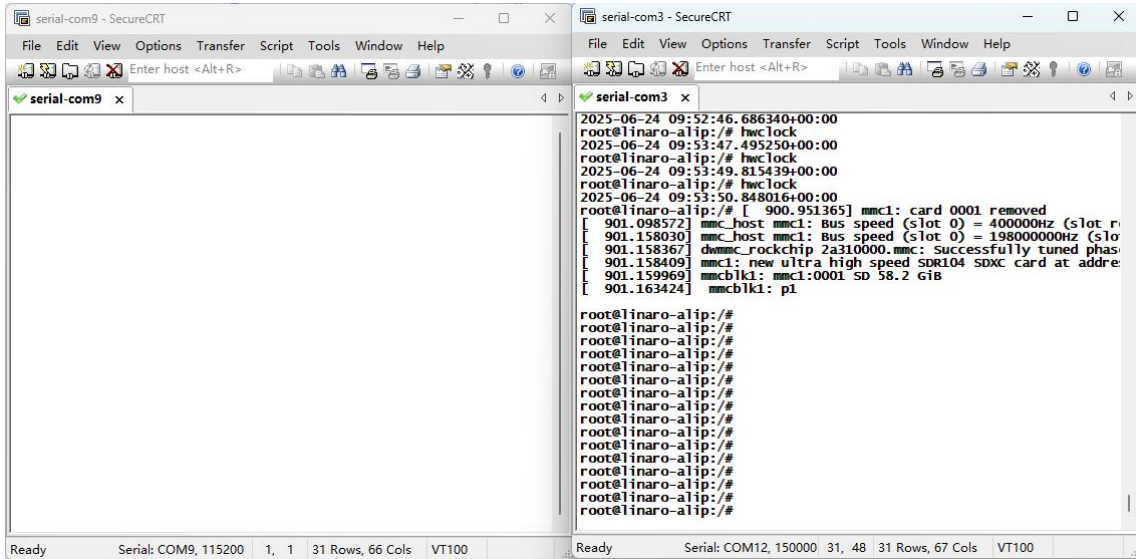
6.10 RS485



Step 1: As shown in the diagram, connect the RS485 test tool to the development board.

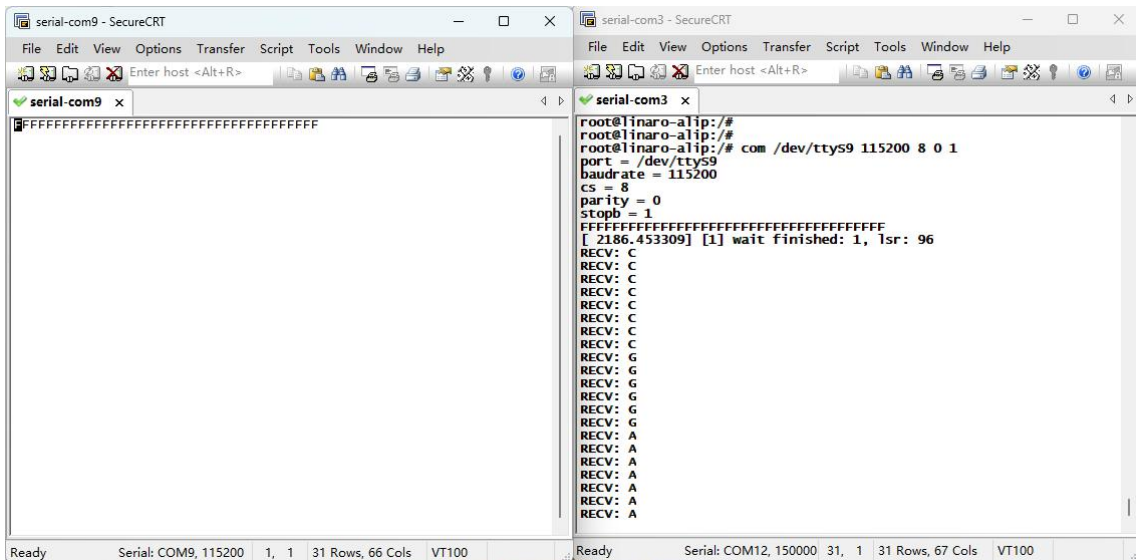


Step 2: Open the corresponding serial terminal, set the baud rate of the board to 1500000, and set the baud rate of the RS485 test tool to 115200.



Step 3: Execute the following command on the board to test the RS485 transmission and reception functionality.

```
# com /dev/ttyS9 115200 8 0 1
```



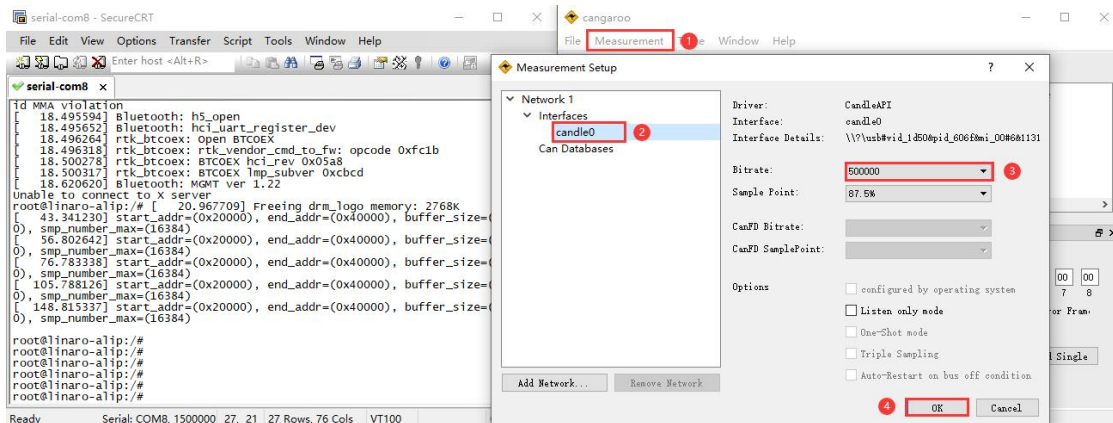
6.11 CAN



Step 1: Connect the CAN test tool to the board as shown in the diagram below.

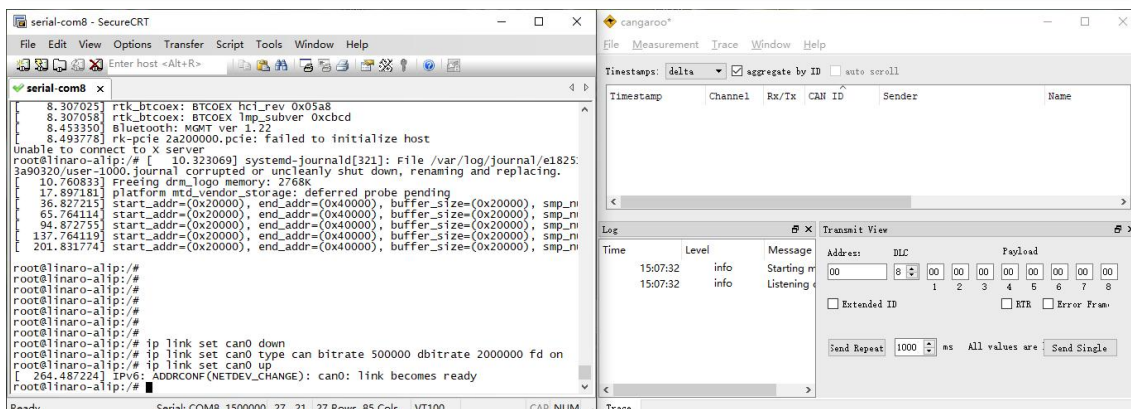


Step 2: Open the CAN test software and set the baud rate to 500000.



Step 3: Set up and activate the CAN network in CAN FD mode, with a nominal bitrate of 500000 and a data bitrate of 2000000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000 dbitrate 2000000 fd on
# ip link set can0 up
```



Step 4: Configure CAN as the receiver.

```
# candump can0
```


Step 2: UART10 test.

```
# com /dev/ttyS10 115200 8 0 1
```

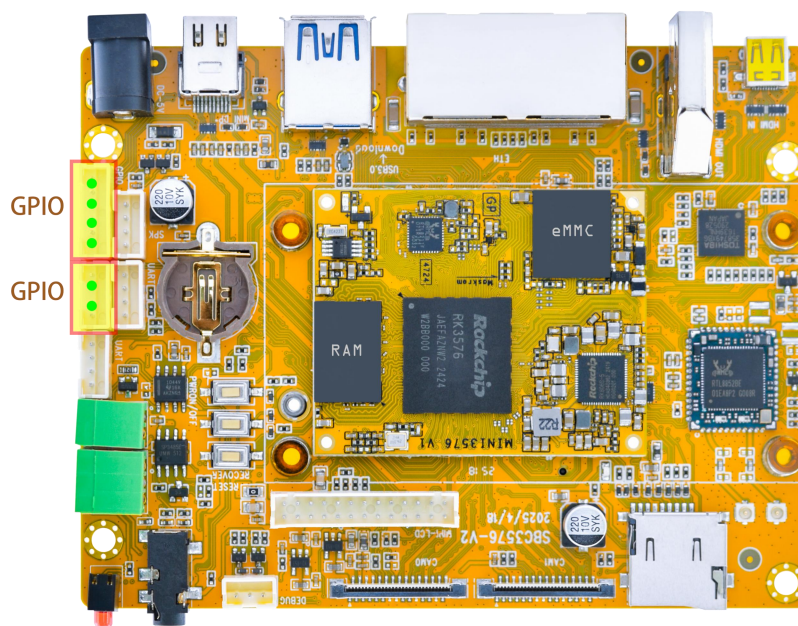
```
root@linaro-alip:/# com /dev/ttyS10 115200 8 0 1
port = /dev/ttyS10
baudrate = 115200
cs = 8
parity = 0
stopb = 1
GGGGGGGGG
RECV: GGGGGGGGG
IIIIII22222
RECV: IIIIII22222
5656565656
RECV: 5656565656
UUU
RECV: UUU
```

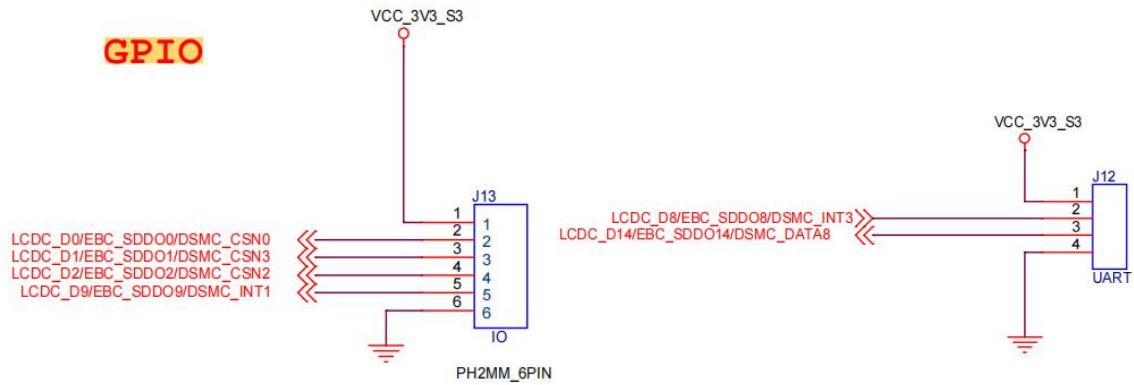
Step 3: UART1 test.

```
# com /dev/ttyS1 115200 8 0 1
```

```
root@linaro-alip:/# com /dev/ttyS1 115200 8 0 1
port = /dev/ttyS1
baudrate = 115200
cs = 8
parity = 0
stopb = 1
HHHHHHHHHHHHHHHHHH
RECV: HHHHHHHHHHHHHHH
UUUUUUUUUUUUUUUU
RECV: UUUUUUUUUUUUUUU
^C
root@linaro-alip:/#
```

6.13 GPIO





LCDDDO0/DSMC_CSN0 -> 114

LCDC_D1/EBC_SDDO1/DSMC_CSN3 -> 121

LCDC_D2/EBC_SDDO2/DSMC_CSN2 -> 122

LCDC_D9/EBC_SDDO9/DSMC_INT1 -> 123

LCDC_D8/EBC_SDDO8/DSMC_INT3 -> 109

LCDC_D14/EBC_SDDO14/DSMC_DATA8 -> 115

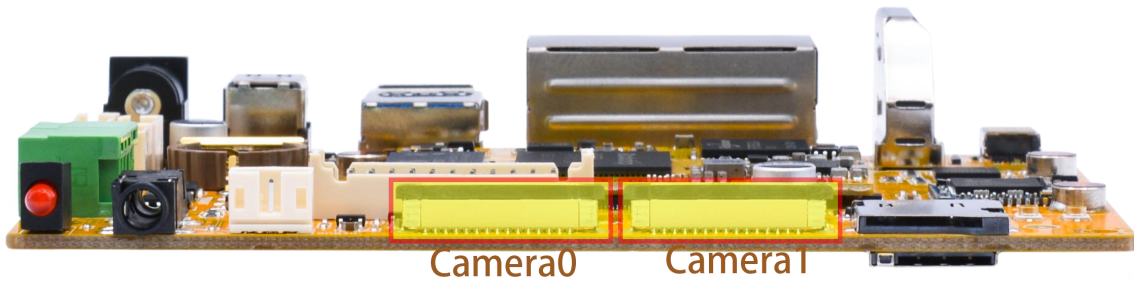
Execute the follow command to test GPIO.

```
# echo 114 > /sys/class/gpio/export
# echo "out" > /sys/class/gpio/gpio114/direction
# echo 0 > /sys/class/gpio/gpio114/value // The GPIO will output low voltage
# echo 1 > /sys/class/gpio/gpio114/value //The GPIO will output high voltage
```

```
root@linaro-alip:/# echo 114 > /sys/class/gpio/export
root@linaro-alip:/# echo "out" > /sys/class/gpio/gpio114/direction
root@linaro-alip:/#
root@linaro-alip:/# echo 0 > /sys/class/gpio/gpio114/value
root@linaro-alip:/#
root@linaro-alip:/# echo 1 > /sys/class/gpio/gpio114/value
root@linaro-alip:/# echo 0 > /sys/class/gpio/gpio114/value
```

Other GPIO use same test method.

6.14 Camera



- View camera device node.

```
# grep "" /sys/class/video4linux/v*/name | grep mainpath
```

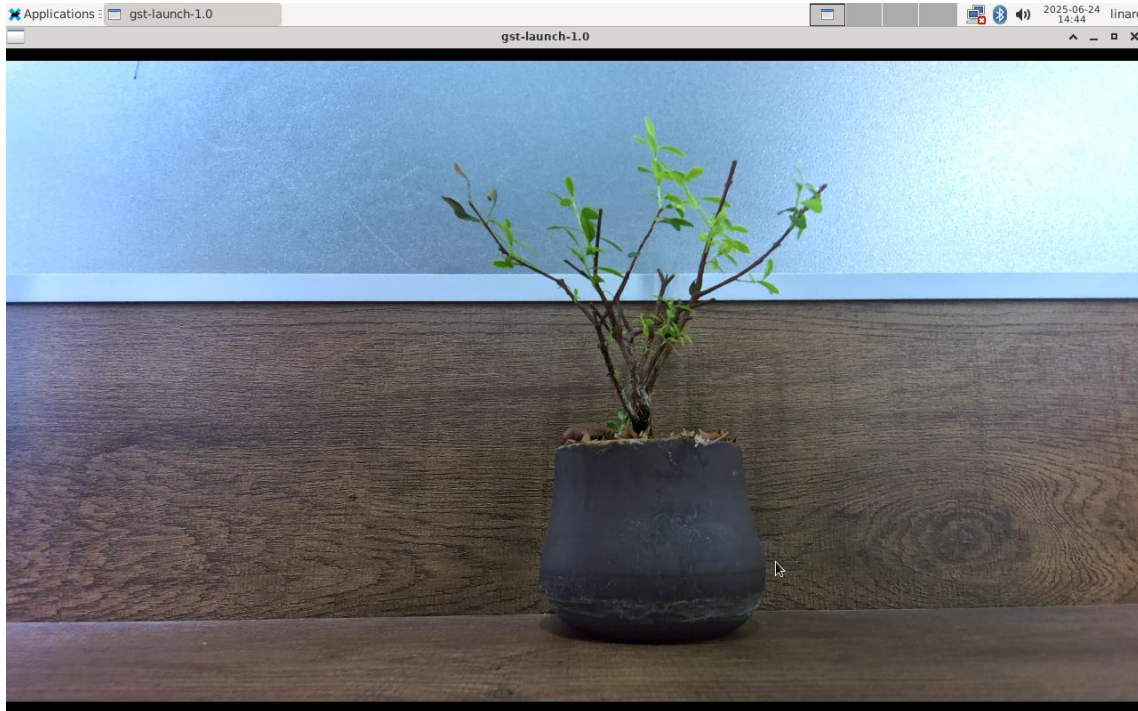
```
root@linaro-alip:/# grep "" /sys/class/video4linux/v*/name | grep mainpath
/sys/class/video4linux/video33/name:rkisp_mainpath
/sys/class/video4linux/video42/name:rkisp_mainpath
root@linaro-alip:/#
```

- Execute follow command to test single-camera preview.

```
# gst-launch-1.0 v4l2src device=/dev/video33 !
video/x-raw,format=NV16,width=1920,height=1080, framerate=25/1 ! xvimagesink
Or
# gst-launch-1.0 v4l2src device=/dev/video42 !
video/x-raw,format=NV16,width=1920,height=1080, framerate=25/1 ! xvimagesink
```

```
root@linaro-alip:/# gst-launch-1.0 v4l2src device=/dev/video33 !
video/x-raw,format=NV16,width=1920,height=1080Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[ 317.461643] rkisp_hw 27c00000.isp: set isp clk = 396000000Hz
[ 317.487733] rkisp rkisp-vir0: first params buf queue

[ 317.494027] rockchip-csi2-dphy0: dphy0, data_rate_mbps 892
[ 317.494493] rockchip-csi2-dphy csi2-dcphy0: csi2_dphy_s_stream stream on:1, dphy0, ret 0
[ 317.494506] imx415 2-0036: s_stream: 1. 3864x2192, hdr: 0, bpp: 10
[ 317.633942] (0x27c80000)MIPI_CSI2 ERR2:0xf0000
[ 317.666339] rkCIF-mipi-lvds: Warning: vblank need >= 1000us if isp work in online, cur 859 us
[ 317.699674] rkCIF-mipi-lvds: Warning: vblank need >= 1000us if isp work in online, cur 859 us
Redistribute latency...
0:00:07.7 / 99:99:99.
```



- Execute follow command to take a video.

```
# gst-launch-1.0 v4l2src device=/dev/video33 num-buffers=100 ! \
video/x-raw,format=NV12,width=1920,height=1088,framerate=30/1 ! \
videoconvert ! mpph264enc ! h264parse ! mp4mux ! \
filesink location=/tmp/h264.mp4
```

- Execute follow command to take picture.

```
# gst-launch-1.0 -v v4l2src device=/dev/video22 num-buffers=10 ! \
video/x-raw,format=NV12,width=1280,height=800 ! mppjpegenc ! \
multifilesink location=/tmp/test%05d.jpg
```

6.15 Video Playback

- (1) The directory for the built-in video testing scripts in the system: */rockchip-test/video*

```
root@linaro-alip:/# ls /rockchip-test/video/
test_dec-gst.sh      test_enc-gst.sh      test_gst_video.sh
test_dec-mpv.sh     test_gst_multivideo.sh video_stresstest.sh
test_dec-parole.sh  test_gst_video_fps.sh video_test.sh
test_dec-qt.sh      test_gst_video_maxfps.sh
```

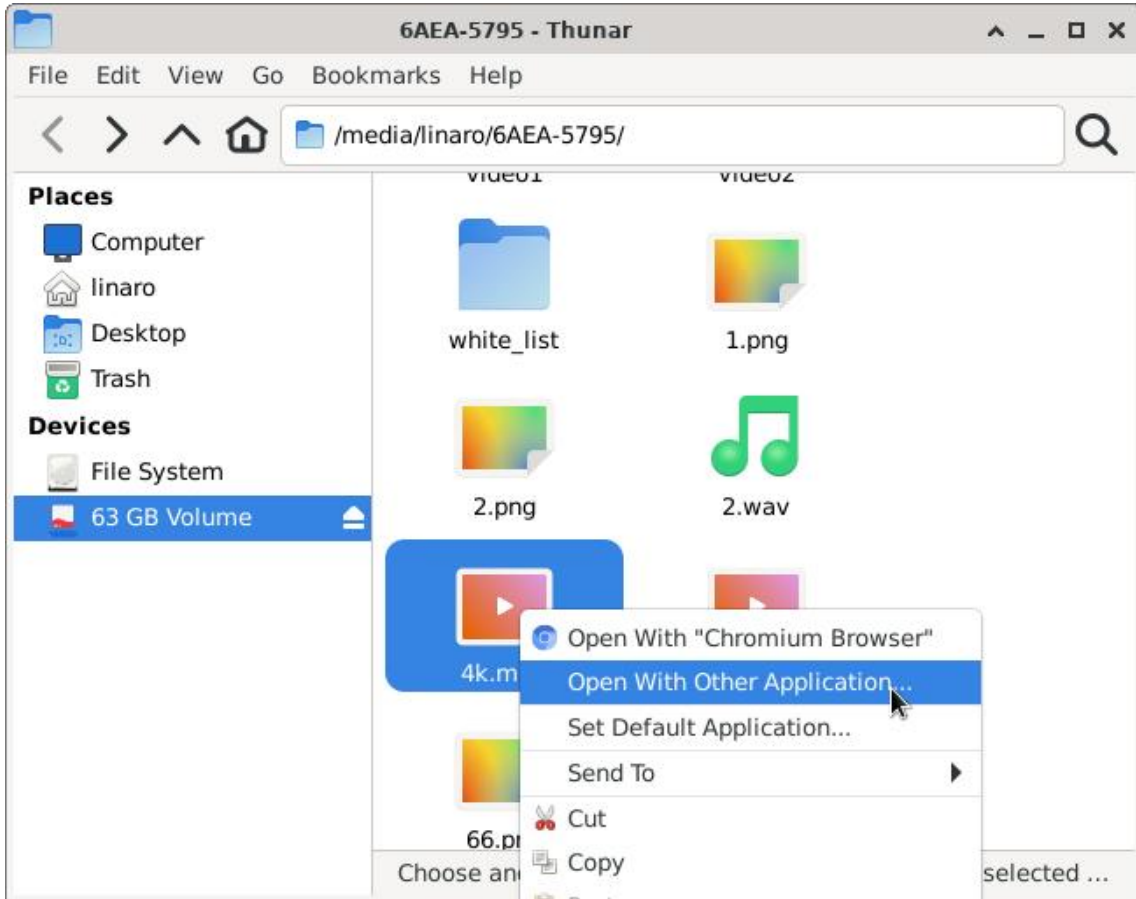
Execute the script.



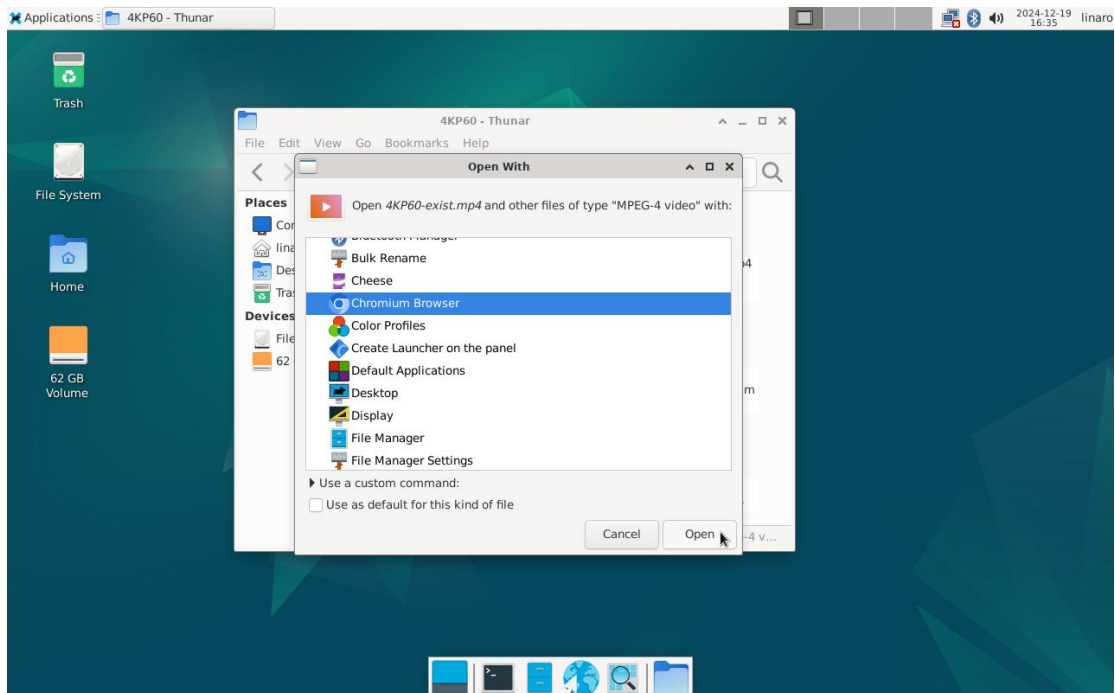
(2) Play the video using Google Chrome.

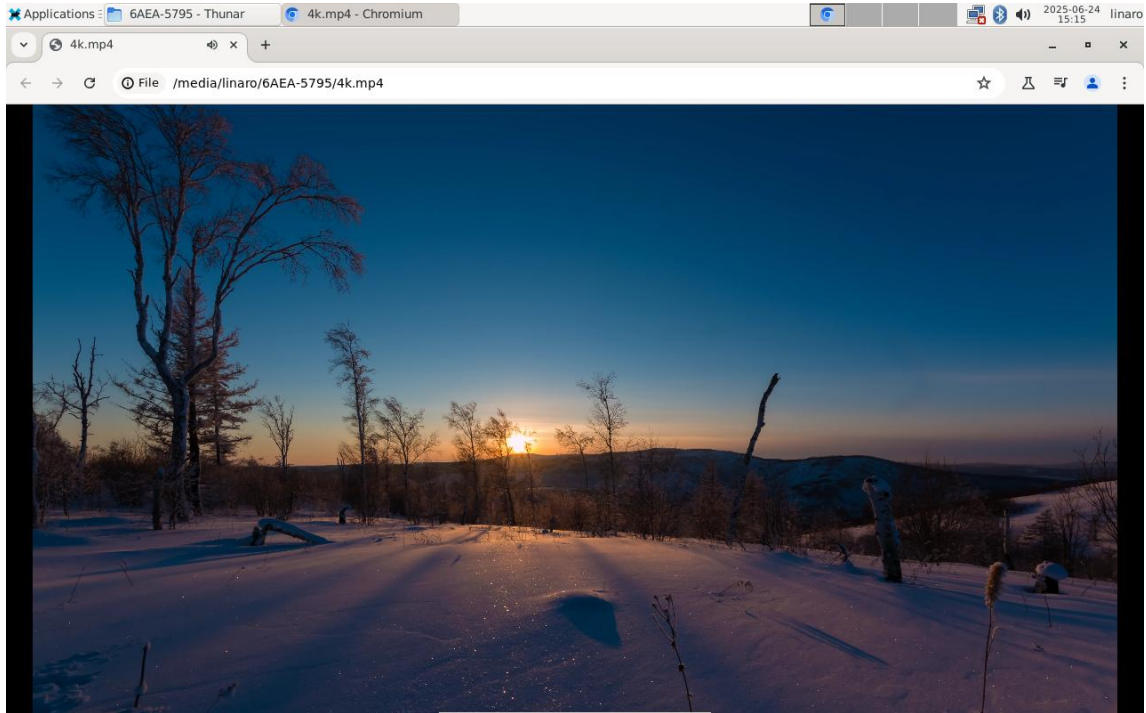
- Google Chrome supports video playback up to 4K at 60Hz, with support for the following decoding formats: VP8, H.264, H.265, VP9, and AV1.
- However, it is only compatible with certain H.265 video files.

Step 1: Select the video file, right-click, and choose **“Open With Other Application...”**.



Step 2: Find **Chromium Browser** in the list, select it, and click “**Open**” to play the video file.





(3) Use the `gst-play-1.0` command to play the video.

```
# gst-play-1.0 --videosink=xvimagesink /media/linaro/6AEA-5795/4k.mp4
--audiosink="alsasink device=hw:0,0"
```

Command explanation:

- `/media/linaro/6AEA-5795/4k.mp4`: is the media file path to be played.
- `--audiosink="alsasink device=hw:0,0"`: Specifies the audio output device as `hw:0,0`.

```
root@linaro-alip:/# gst-play-1.0 --videosink=xvimagesink /media/linaro/6AEA-5795/4k.mp4
--audiosink="alsasink device=hw:0,0"
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/6AEA-5795/4k.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:00:02.0 / 0:04:35.0
```

6.16 HDMI IN



HDMI IN

After connecting the HDMI OUT port of the source device to the HDMI IN port of the SBC3576, The log will show:

```
root@linaro-alip:/# [ 141.717188] m03_b_tc35874x 4-000f: tc35874x_format_change: New format: 1920x1080p60.00 (2200x1125)
```

then execute the following commands to start the preview.

- **Video Preview:**

```
# gst-launch-1.0 v4l2src device=/dev/video11 !
video/x-raw,format=NV12,width=1920,height=1080, framerate=30/1 ! xvimagesink
```

```
root@linaro-alip:/# gst-launch-1.0 v4l2src device=/dev/video11 !
video/x-raw,format=NV12,width=1920,height=1080, framerate=30/1 ! xvimagesink
[ 196.826887] rkCIF-mipi-lvds: rkCIF_update_sensor_info: stream[0] get remote terminal sensor failed!
[ 196.826915] stream_cif_mipi_id0: update sensor info failed -19
[ 196.827020] rkCIF-mipi-lvds: rkCIF_update_sensor_info: stream[1] get remote terminal sensor failed!
[ 196.827027] stream_cif_mipi_id1: update sensor info failed -19
[ 196.827129] rkCIF-mipi-lvds: rkCIF_update_sensor_info: stream[2] get remote terminal sensor failed!
[ 196.827136] rkCIF_tools_id2: update sensor info failed -19
[ 196.827236] rkCIF-mipi-lvds: rkCIF_update_sensor_info: stream[2] get remote terminal sensor failed!
Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[ 197.030857] rkCIF-mipi-lvds3: stream[0] start streaming
[ 197.033415] rkCIF-mipi-lvds3: Allocate dummy buffer, size: 0x003f5000
[ 197.050904] rockchip-mipi-csi2 mipi3-csi2: stream on, src_sd: 00000000d4626ffe,
sd_name:rockchip-csi2-dphy3
[ 197.050935] rockchip-mipi-csi2 mipi3-csi2: stream ON
[ 197.050971] rockchip-csi2-dphy3: dphy3, data_rate_mbps 620
[ 197.051004] rockchip-csi2-dphy csi2-dphy3: csi2_dphy_s_stream stream on:1, dphy3, ret 0
[ 197.065871] rkCIF-mipi-lvds3: ERROR: csi size err, intstat:0x1, size:0x0,0x0,0x0,0x0, cnt 1
Redistribute latency...
0:00:02.2 / 99:99:99.
```

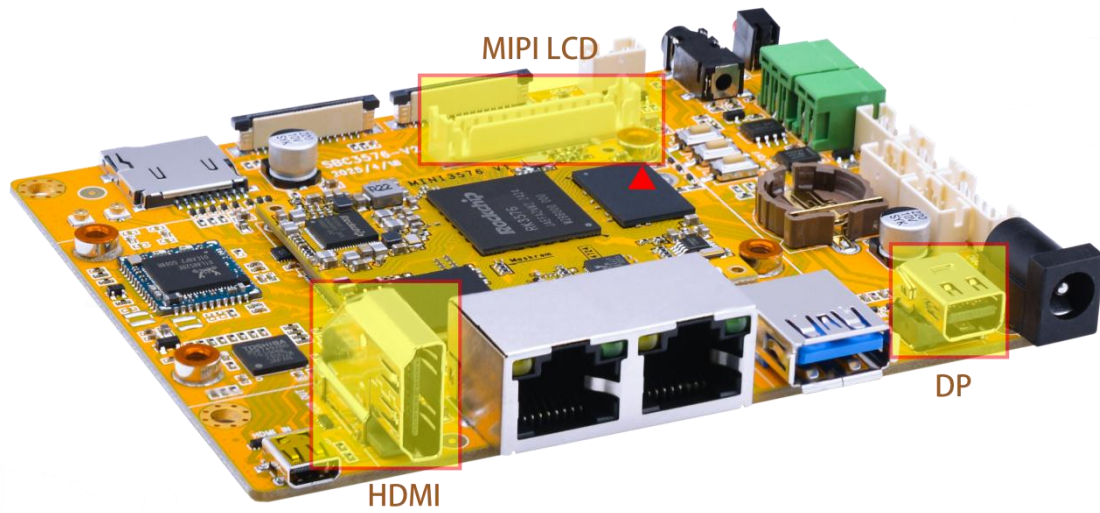
- **Capture Audio from HDMI Output:**

```
# arecord -D hw:1,0 -f cd -r 44100 -c 2 -t wav testin.wav
# aplay -D plughw:3,0 test.wav
```

Parameter Description:

```
root@linaro-alip:/# cat /proc/asound/cards
0 [rockchip-es8388 ]: rockchip-es8388 - rockchip-es8388
    rockchip-es8388                /* Headset audio output */
1 [rkhdmiiintc35874]: simple-card - rk,hdmiiin-tc358749x-codec
    rk,hdmiiin-tc358749x-codec     /* HDMI RX audio output */
2 [rockchipdp0   ]: rockchip-dp0 - rockchip-dp0
    rockchip-dp0                  /* DP audio output */
3 [rockchiphdmi  ]: rockchip-hdmi - rockchip-hdmi
    rockchip-hdmi                 /* HDMI TX audio output */
root@linaro-alip:/#
```


MINI DP and HDMI interfaces.



The display effect diagram is as follows:



7.3 USB 3.0(Loader/ADB/USB3.0)



7.3.1 ADB

Step 1: Connect the board and PC host with USB cable.

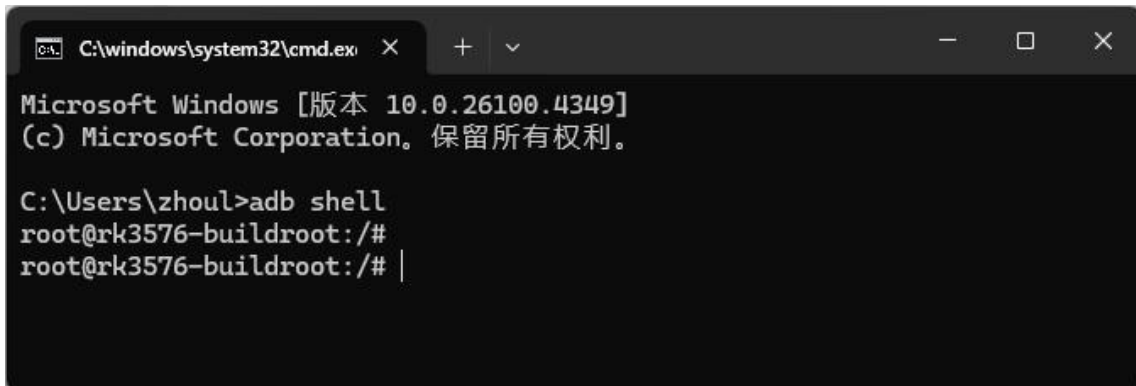


Step 2: Install ADB driver on Windows system.

Step 3: Press **Windows + R** to open the Run program. Type “cmd” and press Enter.

Step 4: Execute the following command to enable ADB.

```
# adb shell
```



```
C:\windows\system32\cmd.exe x + v
Microsoft Windows [版本 10.0.26100.4349]
(c) Microsoft Corporation. 保留所有权利。

C:\Users\zhoul>adb shell
root@rk3576-buildroot:/#
root@rk3576-buildroot:/# |
```

7.3.2 USB3.0

After the SBC3576 is powered on, when the system is running normally, USB3.0 OTG defaults to USB3.0 Device mode. Through software method, force USB3.0 OTG to work in Host mode or Device mode without being affected by USB hardware circuit.

(3) **Force Host mode**

```
# echo host >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
```

```
root@rk3576-buildroot:/# echo host >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
root@rk3576-buildroot:/# [ 207.222708] dwc3 23000000.usb: request 00000000cf861bc8 was not queued to ep0out
[ 207.224322] android_work: sent uevent USB_STATE=DISCONNECTED
[ 207.331674] phy phy-2602e000.syscon:usb2-phy@0.0: illegal mode
[ 207.331727] xhci-hcd xhci-hcd.10.auto: xHCI Host Controller
[ 207.332133] xhci-hcd xhci-hcd.10.auto: new USB bus registered, assigned bus number 3
[ 207.332268] xhci-hcd xhci-hcd.10.auto: hcc params 0x0220fe64 hci version 0x110 quirks 0x0000808002010010
[ 207.332311] xhci-hcd xhci-hcd.10.auto: irq 71, io mem 0x23000000
[ 207.332449] xhci-hcd xhci-hcd.10.auto: xHCI Host Controller
[ 207.332659] xhci-hcd xhci-hcd.10.auto: new USB bus registered, assigned bus number 4
[ 207.332685] xhci-hcd xhci-hcd.10.auto: Host supports USB 3.0 SuperSpeed
[ 207.332814] usb usb3: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.01
[ 207.332825] usb usb3: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 207.332832] usb usb3: Product: xHCI Host Controller
[ 207.332838] usb usb3: Manufacturer: Linux 6.1.99 xhci-hcd
[ 207.332844] usb usb3: SerialNumber: xhci-hcd.10.auto
[ 207.333256] hub 3-0:1.0: USB hub found
[ 207.333297] hub 3-0:1.0: 1 port detected
[ 207.333867] usb usb4: We don't know the algorithms for LPM for this host, disabling LPM.
[ 207.333962] usb usb4: New USB device found, idVendor=1d6b, idProduct=0003, bcdDevice= 6.01
[ 207.333972] usb usb4: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 207.333980] usb usb4: Product: xHCI Host Controller
[ 207.333986] usb usb4: Manufacturer: Linux 6.1.99 xhci-hcd
[ 207.333992] usb usb4: SerialNumber: xhci-hcd.10.auto
[ 207.334402] hub 4-0:1.0: USB hub found
[ 207.334438] hub 4-0:1.0: 1 port detected
[ 207.587363] usb 3-1: new high-speed USB device number 2 using xhci-hcd
[ 207.737741] usb 3-1: New USB device found, idVendor=346d, idProduct=5678, bcdDevice= 3.20
[ 207.737837] usb 3-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 207.737873] usb 3-1: Product: HIKSEMI
[ 207.737903] usb 3-1: Manufacturer:
[ 207.737931] usb 3-1: SerialNumber: FC015D057334E
[ 207.740545] usb-storage 3-1:1.0: USB Mass Storage device detected
[ 207.741462] scsi host0: usb-storage 3-1:1.0
[ 208.768827] scsi 0:0:0:0: Direct-Access HIKSEMI 3.20 PQ: 0 ANSI: 4
[ 208.770622] sd 0:0:0:0: [sda] 245760000 512-byte logical blocks: (126 GB/117 GiB)
[ 208.770809] sd 0:0:0:0: [sda] Write Protect is off
[ 208.770967] sd 0:0:0:0: [sda] No Caching mode page found
[ 208.770978] sd 0:0:0:0: [sda] Assuming drive cache: write through
[ 208.773540] sda: sda1
[ 208.773992] sd 0:0:0:0: [sda] Attached SCSI removable disk
[ 208.982578] FAT-fs (sda1): utf8 is not a recommended IO charset for FAT filesystems, filesystem will be
case sensitive!
[ 208.987214] FAT-fs (sda1): Volume was not properly unmounted. Some data may be corrupt. Please run fsck.
```

Then the USB3.0 OTG has been switched to host mode. The USB host can be used to connect devices such as USB mouse, USB keyboards, USB flash drives, and other USB peripherals.

After connecting the USB flash drive, the system will automatically mount the device. Use the following command to check the directory information of the automatically mounted device:

```
# df -h
```

```

root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  699M   13G   6% /
devtmpfs        1.9G   8.0K  1.9G   1% /dev
tmpfs           2.0G  140K  2.0G   1% /tmp
tmpfs           2.0G  508K  2.0G   1% /run
tmpfs           2.0G  192K  2.0G   1% /var/log
tmpfs           2.0G   0  2.0G   0% /dev/shm
/dev/mmcblk0p7  123M   12M  108M  10% /oem
/dev/mmcblk0p8   15G  364K   15G   1% /userdata
/dev/sda1       118G   27M  118G   1% /mnt/udisk
root@rk3576-buildroot:/#
  
```

(4) Force peripheral mode

```

# echo peripheral >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
  
```

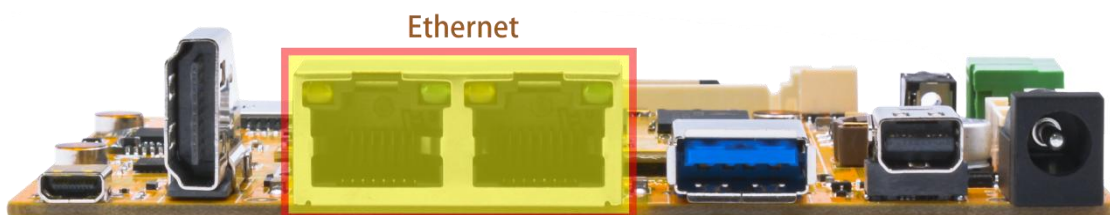
Then the USB3.0 OTG has been restored to Device mode, and features such as LOADER and ADB can be used.

```

root@rk3576-buildroot:/# echo peripheral >
/sys/devices/platform/2602e000.syscon/2602e000.syscon\:usb2-phy@0/otg_mode
root@rk3576-buildroot:/# [ 594.601008] xhci-hcd xhci-hcd.10.auto: remove, state 4
[ 594.601053] usb usb4: USB disconnect, device number 1
[ 594.601689] xhci-hcd xhci-hcd.10.auto: USB bus 4 deregistered
[ 594.601922] xhci-hcd xhci-hcd.10.auto: remove, state 4
[ 594.601945] usb usb3: USB disconnect, device number 1
[ 594.602766] xhci-hcd xhci-hcd.10.auto: USB bus 3 deregistered
[ 595.602280] read descriptors
[ 595.602316] read strings
[ 595.839599] dwc3 23000000.usb: device reset
[ 596.176484] dwc3 23000000.usb: device reset
[ 596.264345] android_work: sent uevent USB_STATE=CONNECTED
[ 596.306187] android_work: sent uevent USB_STATE=CONFIGURED
  
```

7.4 Ethernet

Step 1: Connect the network cable to the Ethernet port.



According to the log, it can be seen that the Gigabit Ethernet recognition is successful.

```

root@rk3576-buildroot:/# [ 777.027360] rk_gmac-dwmac 2a220000.ethernet eth0: Link is Up - 1Gbps/Full - flow control rx/tx
[ 777.027493] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
[ 793.539299] rk_gmac-dwmac 2a230000.ethernet eth1: Link is Up - 1Gbps/Full - flow control rx/tx
  
```

Step 2: View network interface information.

```

# ifconfig
  
```

```
root@rk3576-buildroot:/# ifconfig
eth0    Link encap:Ethernet HWaddr 12:DF:7D:AE:AF:8D
        inet addr:192.168.0.36 Bcast:192.168.0.255 Mask:255.255.255.0
        inet6 addr: fe80::61ee:3476:c576:1100/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:232 errors:0 dropped:62 overruns:0 frame:0
        TX packets:11 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:24426 (23.8 KiB) TX bytes:1410 (1.3 KiB)
        Interrupt:67

eth1    Link encap:Ethernet HWaddr 16:DF:7D:AE:AF:8D
        inet addr:192.168.0.108 Bcast:192.168.0.255 Mask:255.255.255.0
        inet6 addr: fe80::1b5b:3280:b6ad:fd0f/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:203 errors:0 dropped:2 overruns:0 frame:0
        TX packets:18 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:21073 (20.5 KiB) TX bytes:2268 (2.2 KiB)
        Interrupt:69
```

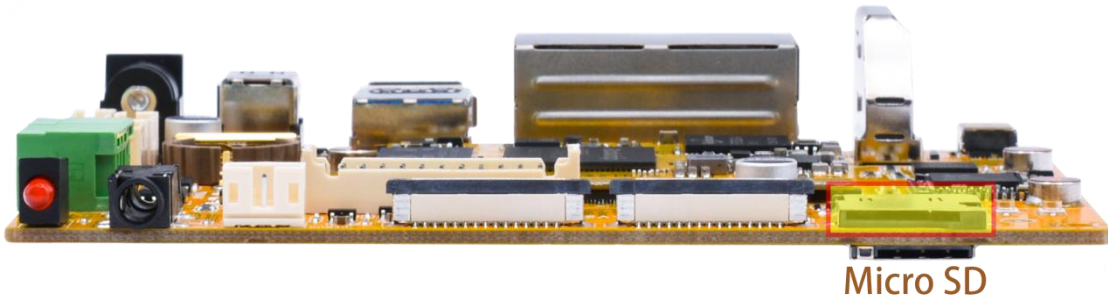
Step 3: Users can test network connectivity using the desktop's built-in browser or verify it through the following command method.

```
# ping -I eth0 www.armdesigner.com
# ping -I eth1 www.armdesigner.com
```

```
root@rk3576-buildroot:/# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.36 eth0: 56(84) bytes of data.
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=1 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=2 ttl=50 time=193 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=3 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=4 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=5 ttl=50 time=193 ms
^C
--- www.armdesigner.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 189.744/191.155/193.070/1.566 ms
root@rk3576-buildroot:/#
root@rk3576-buildroot:/# ping -I eth1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.108 eth1: 56(84) bytes of data.
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=1 ttl=50 time=193 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=2 ttl=50 time=194 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=3 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=4 ttl=50 time=193 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=5 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=6 ttl=50 time=190 ms
^C
--- www.armdesigner.com ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5001ms
rtt min/avg/max/mdev = 189.520/191.551/193.735/1.809 ms
root@rk3576-buildroot:/#
```

7.5 SD Card

Step 1: Insert the micro SD card into the card slot.



Step 2: The system will automatically mount it, view the device mount path.

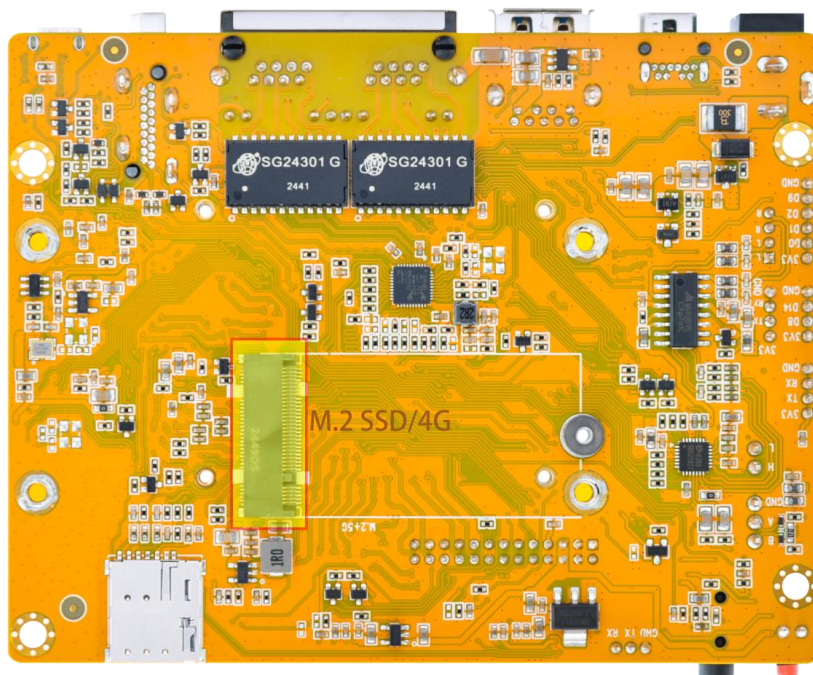
```
# df -h
```

```
root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M  13G   6% /
devtmpfs        966M   8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  512K  977M   1% /run
tmpfs           978M  208K  978M   1% /var/log
tmpfs           978M   0    978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  110M  10% /oem
/dev/mmcblk2p8   15G   332K   15G   1% /userdata
/dev/sda1        58G   47G   12G   81% /mnt/udisk
/dev/sdb1        31G   28G   2.2G  93% /media/udisk1
/dev/mmcblk1p1  30G   608K   30G   1% /mnt/sdcard
```

7.6 M.2 NVME SSD

The SSD on Buildroot only supports the ext4 format.

Step 1: Connect the SSD, then power on.



Step 2: Execute the follow command to mount.

```
# ls /dev

# mkdir /mnt/ssd

# mount /dev/sda2 /mnt/sdd

# ls /mnt/sdd
```

```
root@rk3576-buildroot:/# ls /dev
block          media1          stdout          tty42          v4l-subdev2    video3
bsg            media2          sw_sync         tty43          v4l-subdev3    video30
char           media3          tee0            tty44          v4l-subdev4    video31
console        media4          teepriv0        tty45          v4l-subdev5    video32
cpu_dma_latency media5          tty             tty46          v4l-subdev6    video33
crypto         media6          tty0            tty47          v4l-subdev7    video34
disk           mem             tty1            tty48          v4l-subdev8    video35
dma_heap       mmcblk0         tty10           tty49          v4l-subdev9    video36
dri            mmcblk0boot0   tty11           tty5           vcs             video37
drm_dp_aux0    mmcblk0boot1   tty12           tty50          vcs1            video38
fd             mmcblk0p1      tty13           tty51          vcsa            video39
full          mmcblk0p2      tty14           tty52          vcsa1           video4
fuse          mmcblk0p3      tty15           tty53          vcsu            video40
gpiochip0     mmcblk0p4      tty16           tty54          vcsu1           video41
gpiochip1     mmcblk0p5      tty17           tty55          vendor_storage  video42
gpiochip2     mmcblk0p6      tty18           tty56          vhci            video43
gpiochip3     mmcblk0p7      tty19           tty57          video-camera0   video44
gpiochip4     mmcblk0p8      tty2            tty58          video-dec0      video45
gpiochip5     mmcblk0rpmb    tty20           tty59          video-enc0      video46
hwrng         mmcblk1        tty21           tty6           video0          video47
i2c-0         mmcblk1p1     tty22           tty60          video1          video48
i2c-1         mpp_service    tty23           tty61          video10         video49
i2c-10        null           tty24           tty62          video11         video5
i2c-11        port           tty25           tty63          video12         video50
i2c-2         ppp            tty26           tty7           video13         video51
i2c-3         ptmx           tty27           tty8           video14         video52
i2c-4         ptp0           tty28           tty9           video15         video53
iio:device0   ptp1           tty29           ttyFIQ0        video16         video54
input         pts            tty3            ttyS1          video17         video55
kmsg          ram0           tty30           ttyS10         video18         video56
log           random         tty31           ttyS4          video19         video57
loop-control  rfkill        tty32           ttyS9          video2          video58
loop0         rga            tty33           ubi_ctrl       video20         video59
loop1         rtc            tty34           uhid           video21         video6
loop2         rtc0           tty35           uinput         video22         video7
loop3         sda            tty36           urandom        video23         video8
loop4         sda1           tty37           usb-ffs        video24         video9
loop5         sda2           tty38           usbmon0        video25         zero
loop6         shm            tty39           v41            video26         zram0
loop7         snd            tty4            v4l-subdev0    video27
mali0         stderr         tty40           v4l-subdev1    video28
media0        stdin          tty41           v4l-subdev10   video29

root@rk3576-buildroot:/# mkdir /mnt/ssd
root@rk3576-buildroot:/# mount /dev/sda2 /mnt/ssd
root@rk3576-buildroot:/# ls /mnt/ssd
'$RECYCLE.BIN'  Download          Pictures          test
Alarms         LOST.DIR         Podcasts         test.txt
Audiobooks     Movies           Recordings
DCIM           Music            Ringtones
Documents      Notifications    'System Volume Information'
```

Note: If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

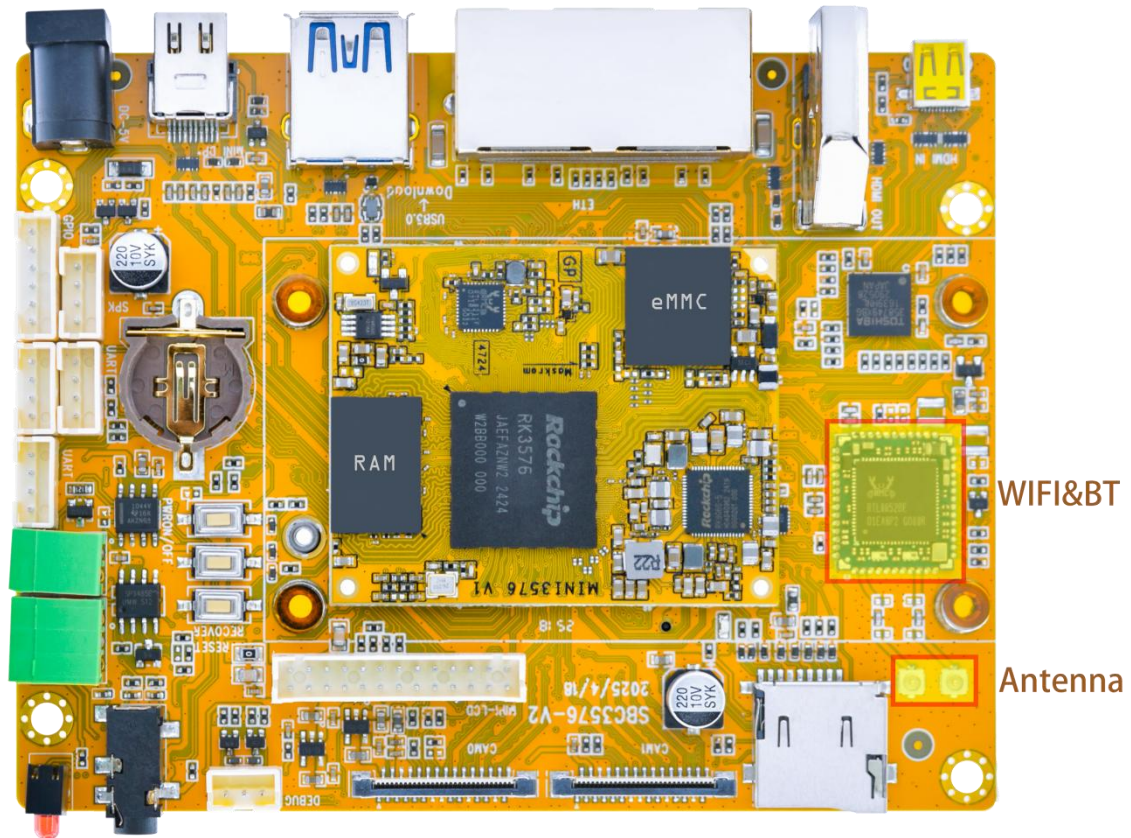
```
# mke2fs -t ext4 /dev/sda2
```

Note

3. The update.img supports 4G functionality by default. If SSD functionality is required, users need to reflash the kernel image: boot_sata.img.
4. USB3.0 functionality cannot be used when SSD is in use ! USB2.0 functionality can be used.

7.7 WiFi & Bluetooth

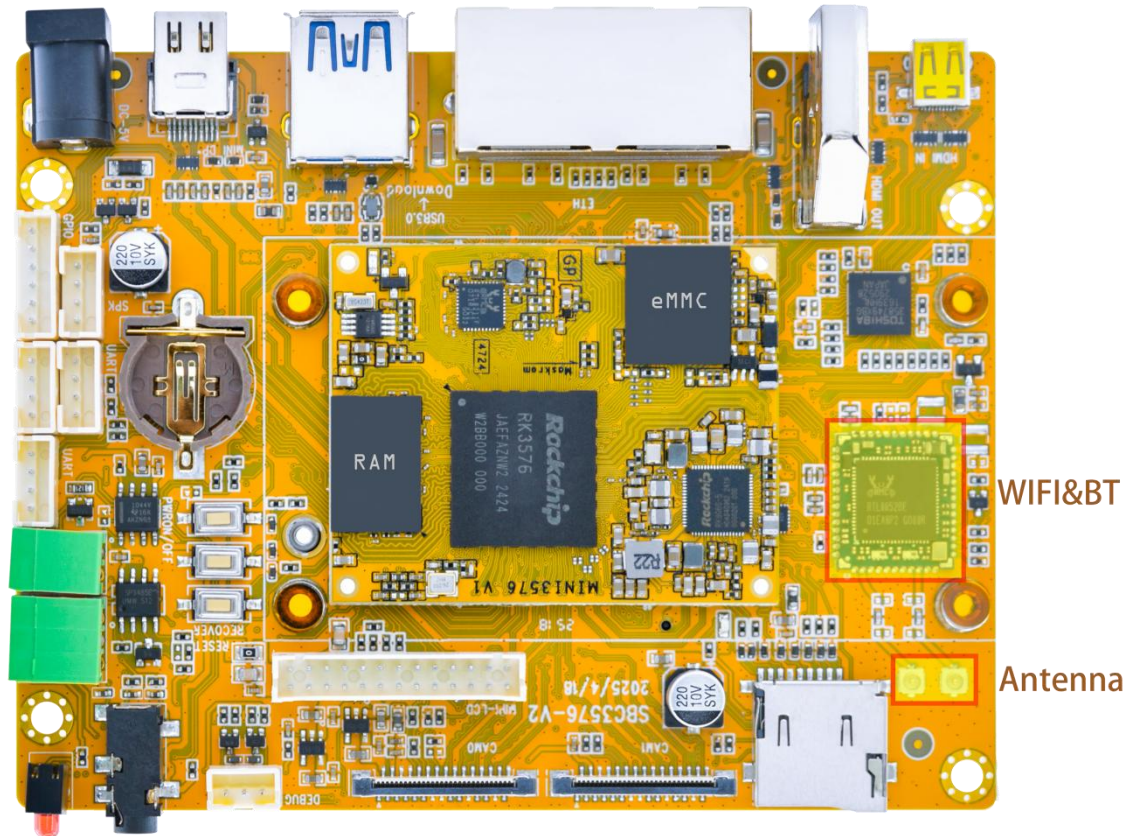
To use Wi-Fi and Bluetooth functions properly, the antenna needs to be connected.



7.7.1 WiFi

Step 1: View the device information.

```
# ifconfig
```



```
root@rk3576-buildroot:/# ifconfig
p2p0    Link encap:Ethernet HWaddr CE:64:1A:78:F0:54
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

wlan0   Link encap:Ethernet HWaddr CC:64:1A:78:F0:54
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root@rk3576-buildroot:/#
```

Step 2: Scan for available WiFi hotspots.

```
# iwlist wlan0 scan
```

```

root@rk3576-buildroot:/# iwlist wlan0 scan
wlan0 Scan completed :
  Cell 01 - Address: B4:F1:8C:6D:D1:24
           ESSID:"Boardcon"
           Protocol:IEEE 802.11bgn
           Mode:Master
           Frequency:2.437 GHz (Channel 6)
           Encryption key:on
           Bit Rates:780 Mb/s
           Extra:wpa_ie=dd1a0050f20101000050f20202000050f2040050f20201000050f202
           IE: WPA Version 1
              Group Cipher : TKIP
              Pairwise Ciphers (2) : CCMP TKIP
              Authentication Suites (1) : PSK
           Extra:
           IE: IEEE 802.11i/WPA2 Version 1
              Group Cipher : TKIP
              Pairwise Ciphers (2) : CCMP TKIP
              Authentication Suites (1) : PSK
           IE: Unknown:
           DD910050F204104A0001101044000102103B00010310470010123456789ABCDEF01234B4F18C6DD124102100194875617765692054
           6563686E6F6C6F677920436F2E2C4C74641023000B576972656C657373204150102400033132331042000531323334351054000800
           060050F2040001101100095443373130322D3130100800020780103C0001011049000600372A000120
           Quality=29/100 Signal level=29/100
           Extra:fm=0003
  Cell 02 - Address: B4:F1:8C:FD:D1:29
           ESSID:"Boardcon_Wi-Fi5"
           Protocol:IEEE 802.11bgn
           Mode:Master
           Frequency:2.437 GHz (Channel 6)
           Encryption key:on
           Bit Rates:780 Mb/s
           Extra:wpa_ie=dd1a0050f20101000050f20202000050f2040050f20201000050f202
           IE: WPA Version 1
              Group Cipher : TKIP
              Pairwise Ciphers (2) : CCMP TKIP
              Authentication Suites (1) : PSK
           Extra:
           IE: IEEE 802.11i/WPA2 Version 1
              Group Cipher : TKIP
              Pairwise Ciphers (2) : CCMP TKIP
              Authentication Suites (1) : PSK
           IE: Unknown:
           DD910050F204104A0001101044000102103B00010310470010123456789ABCDEF01234B4F18C6DD124102100194875617765692054
           6563686E6F6C6F677920436F2E2C4C74641023000B576972656C657373204150102400033132331042000531323334351054000800
           060050F2040001101100095443373130322D3130100800020780103C0001011049000600372A000120
           Quality=30/100 Signal level=30/100
           Extra:fm=0003
  
```

Step 3: Connect to the hotspot.

```
# wifi-connect.sh SSID PSK
```

```

root@rk3576-buildroot:/# wifi-connect.sh Boardcon Boardcon43435656
connect to Wifi ssid: Boardcon, Passwd: Boardcon43435656
Successfully initialized wpa_supplicant
[ 26.475462] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
  
```

Step 4: View the network interface status.

```
# ifconfig
```

```
root@rk3576-buildroot:/# ifconfig
p2p0    Link encap:Ethernet HWaddr 3A:7A:CC:2A:11:87
        UP BROADCAST MULTICAST MTU:1500 Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

wlan0   Link encap:Ethernet HWaddr 38:7A:CC:2A:11:87
        inet addr:192.168.0.217 Bcast:192.168.0.255 Mask:255.255.255.0
        inet6 addr: fe80::5468:66de:9c2a:5b0e/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:60 errors:0 dropped:2 overruns:0 frame:0
        TX packets:32 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:8817 (8.6 KiB) TX bytes:3872 (3.7 KiB)
```

Step 5: Test the WiFi network.

```
# ping -I wlan0 www.armdesigner.com
```

```
root@rk3576-buildroot:/# ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.217 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=196 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=251 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=200 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=201 ms
^C
--- www.armdesigner.com ping statistics ---
 9 packets transmitted, 8 received, 11.1111% packet loss, time 8011ms
 rtt min/avg/max/mdev = 193.266/203.254/250.975/18.241 ms
```

7.7.2 Bluetooth

Step 1: View the Bluetooth device status.

```
# hciconfig -a
```

```
root@rk3576-buildroot:/# hciconfig -a
hci0:   Type: Primary Bus: UART
        BD Address: 38:7A:CC:2A:11:88 ACL MTU: 1021:5 SCO MTU: 255:11
        UP RUNNING
        RX bytes:2127 acl:0 sco:0 events:60 errors:0
        TX bytes:4418 acl:0 sco:0 commands:77 errors:0
        Features: 0xff 0xff 0xff 0xfa 0xdb 0xbf 0x7b 0x87
        Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3
        Link policy: RSWITCH HOLD SNIFF PARK
        Link mode: PERIPHERAL ACCEPT
        Name: 'BlueZ 5.77'
        Class: 0x6c0414
        Service Classes: Rendering, Capturing, Audio, Telephony
        Device Class: Audio/Video, Loudspeaker
[ 185.882030] rtk_btcoex: BTCOEX hci_rev 0x05a8
[ 185.882081] rtk_btcoex: BTCOEX lmp_subver 0xcbcd
        HCI Version: 5.1 (0xa) Revision: 0x5a8
        LMP Version: 5.1 (0xa) Subversion: 0xcbcd
        Manufacturer: Realtek Semiconductor Corporation (93)
```

Step 2: Set the Bluetooth adapter to be discoverable.

```
# hciconfig hci0 piscan
```

Step 3: Control and configure the Bluetooth device.

```
# bluetoothctl
```

```
root@rk3576-buildroot:/# hciconfig hci0 piscan
root@rk3576-buildroot:/#
root@rk3576-buildroot:/# bluetoothctl
hci0 new_settings: powered connectable discoverable bondable ssp br/edr le secure-conn
Agent registered
[CHG] Controller 38:7A:CC:2A:11:88 Pairable: yes
[bluetooth]#
```

Step 4: Scanning for nearby Bluetooth devices.

- Run *scan on* to start searching for devices.
- After scanning, run *scan off* to stop the search and prevent continuous refreshing.
- Run *devices* to view the list of detected devices.

```
[bluetooth]# scan on
[bluetooth]# scan off
[bluetooth]# devices
```

```
[bluetooth]# scan on
SetDiscoveryFilter success
hci0 type 7 discovering on
Discovery started
[CHG] Controller 38:7A:CC:2A:11:88 Discovering: yes
[NEW] Device 88:68:4B:74:39:44 OPPO K10 5G
[NEW] Device 4B:73:65:34:5F:5D 4B-73-65-34-5F-5D
[NEW] Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
[NEW] Device 10:0E:A1:1C:13:A8 10-0E-A1-1C-13-A8
[CHG] Device A8:35:12:9A:EB:4D RSSI: 0xffffffe1 (-31)
[NEW] Device 7D:B8:B6:62:89:47 7D-B8-B6-62-89-47
[NEW] Device 2C:A0:42:D1:14:D5 Kang
[NEW] Device 5D:9A:E9:D5:D8:9B 5D-9A-E9-D5-D8-9B
[NEW] Device 14:DE:39:72:B3:C3 Mate 40 Pro
[NEW] Device 43:C7:3D:C0:16:E4 43-C7-3D-C0-16-E4
[CHG] Device 14:DE:39:72:B3:C3 RSSI: 0xffffffb3 (-77)
[NEW] Device 7B:7E:22:4C:1B:08 7B-7E-22-4C-1B-08
[bluetooth]# scan off
hci0 type 7 discovering off
Discovery stopped
[CHG] Device 7B:7E:22:4C:1B:08 TxPower is nil
[CHG] Device 7B:7E:22:4C:1B:08 RSSI is nil
[CHG] Device 43:C7:3D:C0:16:E4 RSSI is nil
[CHG] Device 14:DE:39:72:B3:C3 RSSI is nil
[CHG] Device 5D:9A:E9:D5:D8:9B TxPower is nil
[CHG] Device 5D:9A:E9:D5:D8:9B RSSI is nil
[CHG] Device 2C:A0:42:D1:14:D5 RSSI is nil
[CHG] Device 7D:B8:B6:62:89:47 TxPower is nil
[CHG] Device 7D:B8:B6:62:89:47 RSSI is nil
[CHG] Device A8:35:12:9A:EB:4D RSSI is nil
[CHG] Device 10:0E:A1:1C:13:A8 RSSI is nil
[CHG] Device D4:6C:27:DF:40:46 RSSI is nil
[CHG] Device 4B:73:65:34:5F:5D TxPower is nil
[CHG] Device 4B:73:65:34:5F:5D RSSI is nil
[CHG] Device 88:68:4B:74:39:44 RSSI is nil
[CHG] Controller 38:7A:CC:2A:11:88 Discovering: no
[bluetooth]# devices
Device A8:35:12:9A:EB:4D liuy
Device 88:68:4B:74:39:44 OPPO K10 5G
Device 4B:73:65:34:5F:5D 4B-73-65-34-5F-5D
Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
Device 10:0E:A1:1C:13:A8 10-0E-A1-1C-13-A8
Device 7D:B8:B6:62:89:47 7D-B8-B6-62-89-47
Device 2C:A0:42:D1:14:D5 Kang
Device 5D:9A:E9:D5:D8:9B 5D-9A-E9-D5-D8-9B
Device 14:DE:39:72:B3:C3 Mate 40 Pro
Device 43:C7:3D:C0:16:E4 43-C7-3D-C0-16-E4
Device 7B:7E:22:4C:1B:08 7B-7E-22-4C-1B-08
[bluetooth]#
```

Step 5: Pair the device.

```
[bluetooth]# pair A8:35:12:9A:EB:4D
```

```
[bluetooth]# pair A8:35:12:9A:EB:4D
Attempting to pair with A8:35:12:9A:EB:4D
hci0 device_flags_changed: A8:35:12:9A:EB:4D (BR/EDR)
  supp: 0x00000000 curr: 0x00000000
[bluetooth]# [ 173.017134] rtk_btcoex: hci create connection, start paging
[ 174.380179] rtk_btcoex: connected, handle 0001, status 0x00
[ 174.380268] rtk_btcoex: Page success
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 11
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [ 174.460956] rtk_btcoex: io capability request
Request confirmation
[agent] Confirm passkey 622774 (yes/no): yes
[liuy]# [ 178.036444] rtk_btcoex: link key notify
hci0 new_link_key A8:35:12:9A:EB:4D type 0x05 pin_len 0 store_hint 1
[CHG] Device A8:35:12:9A:EB:4D Bonded: yes
[liuy]# [ 178.187364] rtk_btcoex: l2cap op 2, len 16, out 0
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 8ce255c0-200a-11e0-ac64-0800200c9a66
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 9664aa26-d76c-43ad-9775-d310f253a408
[CHG] Device A8:35:12:9A:EB:4D ServicesResolved: yes
[CHG] Device A8:35:12:9A:EB:4D Paired: yes
Pairing successful
[DEL] Device 4C:3E:56:53:EC:2D 4C-3E-56-53-EC-2D
[liuy]# [ 181.164278] rtk_btcoex: l2cap op 6, len 16, out 1
[ 181.164408] rtk_btcoex: TX l2cap disconn req, hndl 0x0001, dcid 0x0059, scid 0x0040
[DEL] Device 2C:A0:42:D1:14:D5 Kang
[ 181.164442] rtk_btcoex: handle_l2cap_disconn_req: handle 0x0001, dcid 0x0059, scid 0x0040, dir 1
[DEL] Device 78:AE:22:6E:47:2C 78-AE-22-6E-47-2C
[DEL] Device CC:64:1A:B6:C3:AE ubuntu
[liuy]# connect [ 185.247311] rtk_btcoex: disconn compl evt: status 00, handle 0001, reason 13
hci0 A8:35:12:9A:EB:4D type BR/EDR disconnected with reason 3
[ 185.247391] rtk_btcoex: process_disconn_complete_event.
[CHG] Device A8:35:12:9A:EB:4D ServicesResolved: no
[CHG] Device A8:35:12:9A:EB:4D Connected: no
```

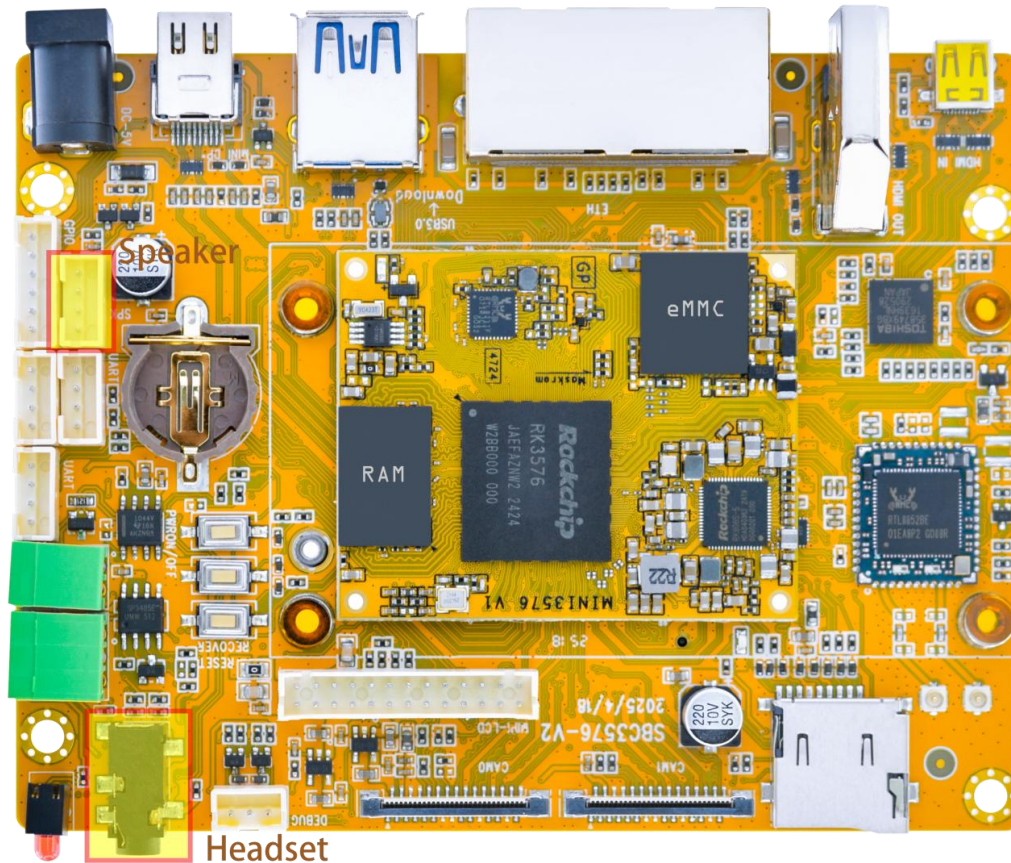
Step 6: Connect the device.

```
[bluetooth]# connect A8:35:12:9A:EB:4D
```

```
[bluetooth]# connect A8:35:12:9A:EB:4D
Attempting to connect to A8:35:12:9A:EB:4D
[bluetooth]# [ 189.910955] rtk_btcoex: hci create connection, start paging
[ 190.709669] rtk_btcoex: connected, handle 0002, status 0x00
[ 190.709733] rtk_btcoex: Page success
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 11
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [ 190.914878] rtk_btcoex: l2cap op 2, len 16, out 1
```

7.8 Audio

The audio input supports one channels: headset. And audio output supports two channels: headset and speaker.



7.8.1 Audio input

Step 1: Plug the headset into the headset jack.

Step 2: Verify that the sound card is successfully registered with proc fs, and get the device number for each sound card

```
# cat /proc/asound/cards
```

```
root@rk3576-buildroot:/# cat /proc/asound/cards
0 [rockchip-es8388 ]: rockchip-es8388 - rockchip-es8388
rockchip-es8388
1 [rkhdmintc35874]: simple-card - rk,hdmiiin-tc358749x-codec
rk,hdmiiin-tc358749x-codec
2 [rockchipdp0 ]: rockchip-dp0 - rockchip-dp0
rockchip-dp0
3 [rockchiphdmi ]: rockchip-hdmi - rockchip-hdmi
rockchip-hdmi
root@rk3576-buildroot:/#
```

Step 3: Execute the following command to start recording by headset.

```
# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
```

```
root@rk3576-buildroot:/# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

7.8.2 Audio output

Step 1: View sound card.

```
# aplay -l
```

```
root@rk3576-buildroot:/# aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: rockchip-es8388 [rockchip-es8388], device 0: daiLink-multicodecs ES8323 HiFi-0
[daiLink-multicodecs ES8323 HiFi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 1: rkhdmiintc35874 [rk,hdmiin-tc35874x-codec], device 0: 2a610000.sai-dummy_codec
dummy_codec-0 [2a610000.sai-dummy_codec dummy_codec-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 2: rockchipdp0 [rockchip-dp0], device 0: rockchip-dp0 spdif-hifi-0 [rockchip-dp0 spdif-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 3: rockchiphdmi [rockchip-hdmi], device 0: rockchip-hdmi i2s-hifi-0 [rockchip-hdmi i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
root@rk3576-buildroot:/#
```

Step 2: Execute the following command to play audio and output it through headset.

```
# aplay -Dhw:0,0 test.wav
```

```
root@rk3576-buildroot:/# aplay -Dhw:0,0 test.wav
Playing WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 test.wav // headset/speaker audio output (Priority: Headset >
speaker)
# aplay -Dhw:2,0 test.wav // DP mode audio output
# aplay -Dhw:3,0 test.wav // HDMI TX audio output
```

7.9 RTC

Step 1: Install the coin cell battery.



Step 2: Set the system time.

```
# date -s "2025-06-24 20:02:00"
```

Step 3: Write the system time to the hardware clock.

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

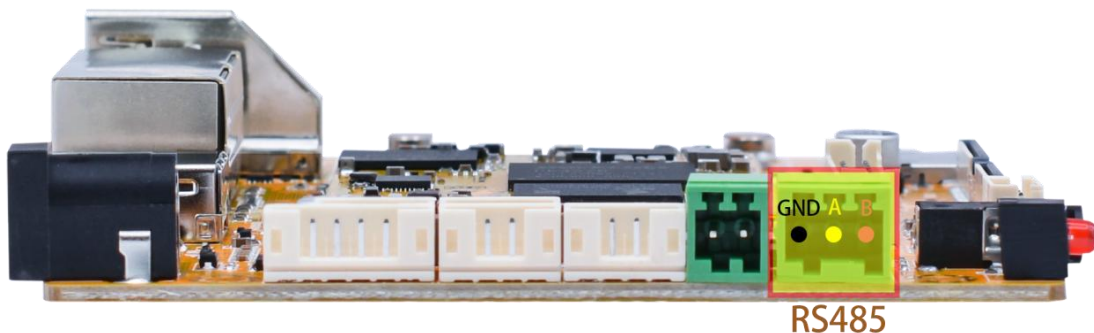
```
# hwclock
```

```
root@rk3576-buildroot:/# date -s "2025-06-24 20:02:00"
Tue Jun 24 20:02:00 UTC 2025
root@rk3576-buildroot:/# hwclock -w
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:02:14 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:02:15 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:02:16 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:02:17 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:02:17 2025  0.000000 seconds
```

Step 5: Power off, after a period of time to turn on the power again, check whether the time is saved.

```
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:04:07 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:04:09 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:04:09 2025  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Tue Jun 24 20:04:10 2025  0.000000 seconds
```

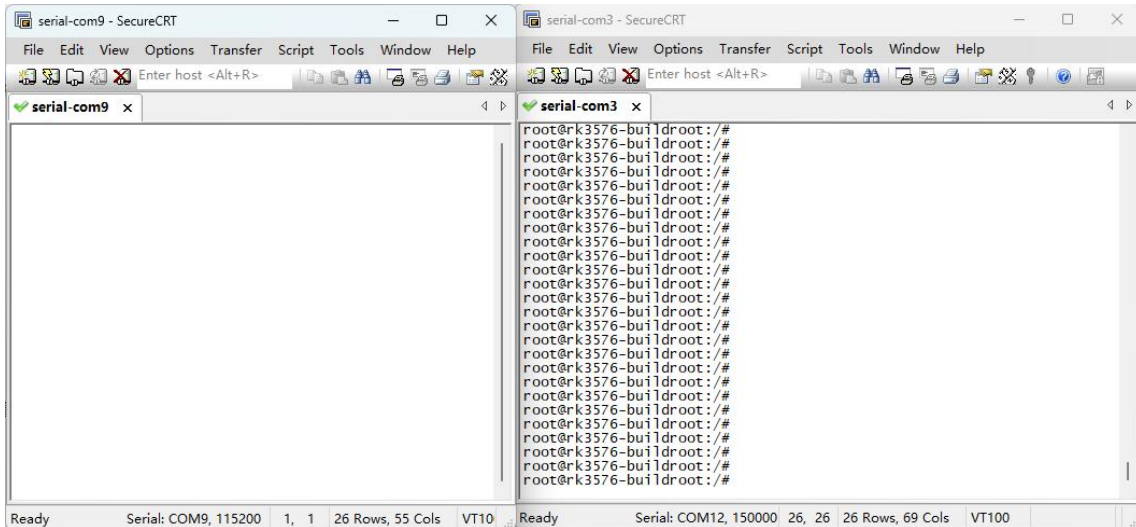
7.10 RS485



Step 1: As shown in the diagram, connect the RS485 test tool to the development board.

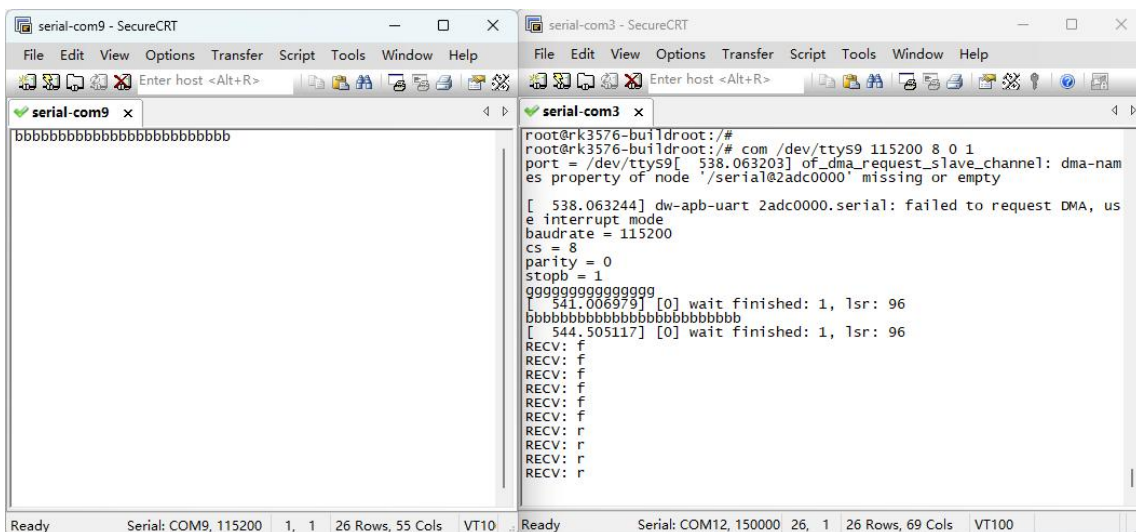


Step 2: Open the corresponding serial terminal, set the baud rate of the board to 1500000, and set the baud rate of the RS485 test tool to 115200.



Step 3: Execute the following command on the board to test the RS485 transmission and reception functionality.

```
# com /dev/ttyS9 115200 8 0 1
```



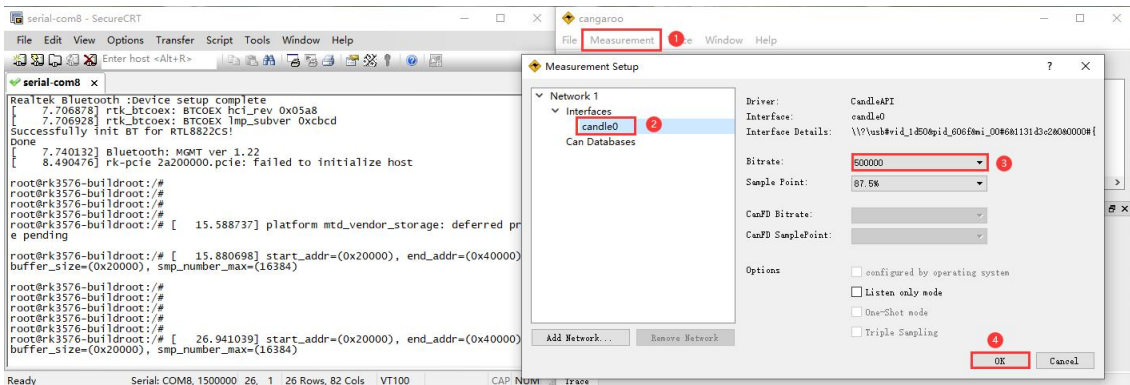
7.11 CAN



Step 1: Connect the CAN test tool to the board as shown in the diagram below.

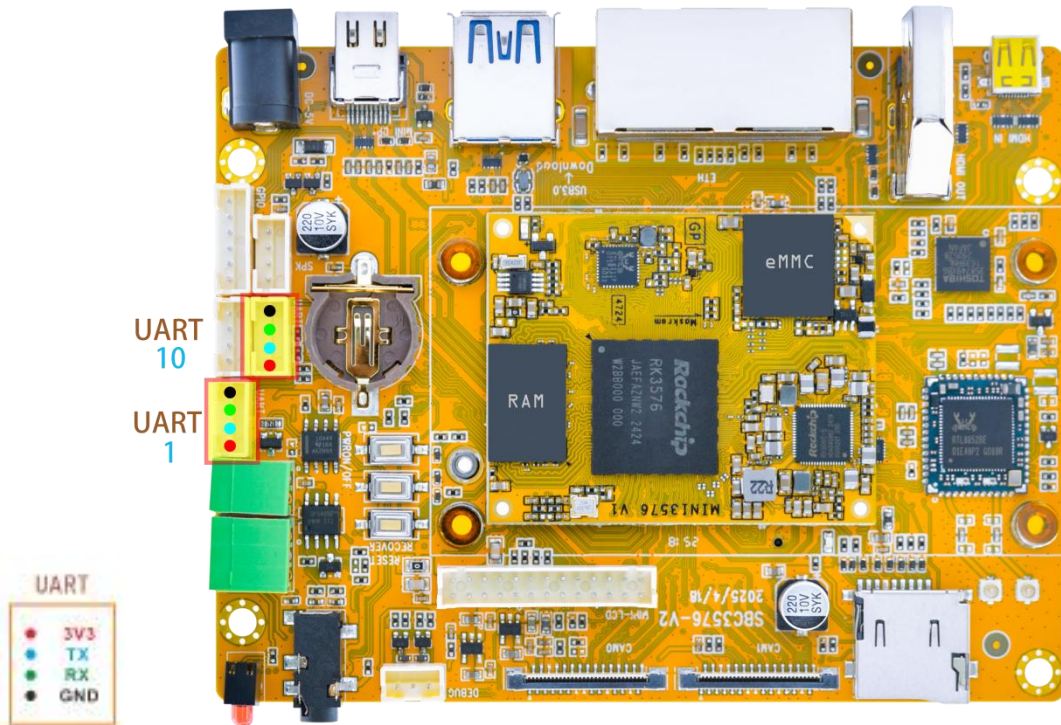


Step 2: Open the CAN test software and set the baud rate to 500000.



Step 3: Set up and activate the CAN network in CAN FD mode, with a nominal bitrate of 500000 and a data bitrate of 2000000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000 dbitrates 2000000 fd on
# ip link set can0 up
```

Step 2: UART10 test.

```
# com /dev/ttyS10 115200 8 0 1
```

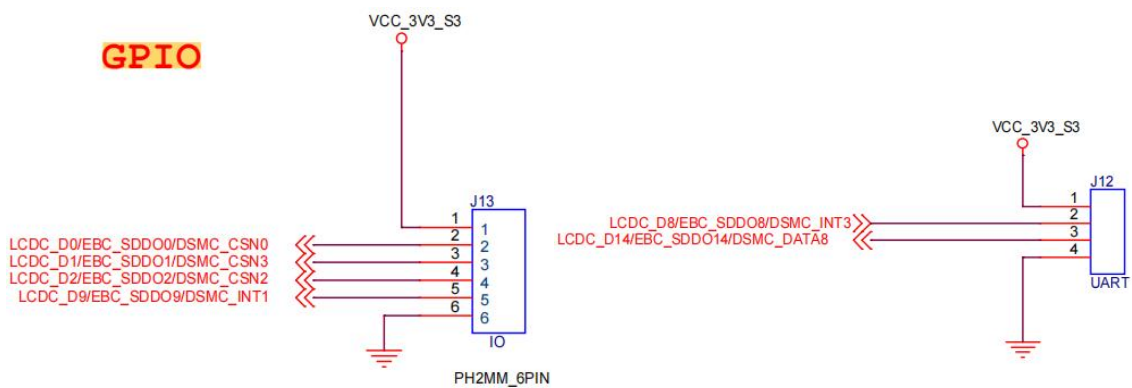
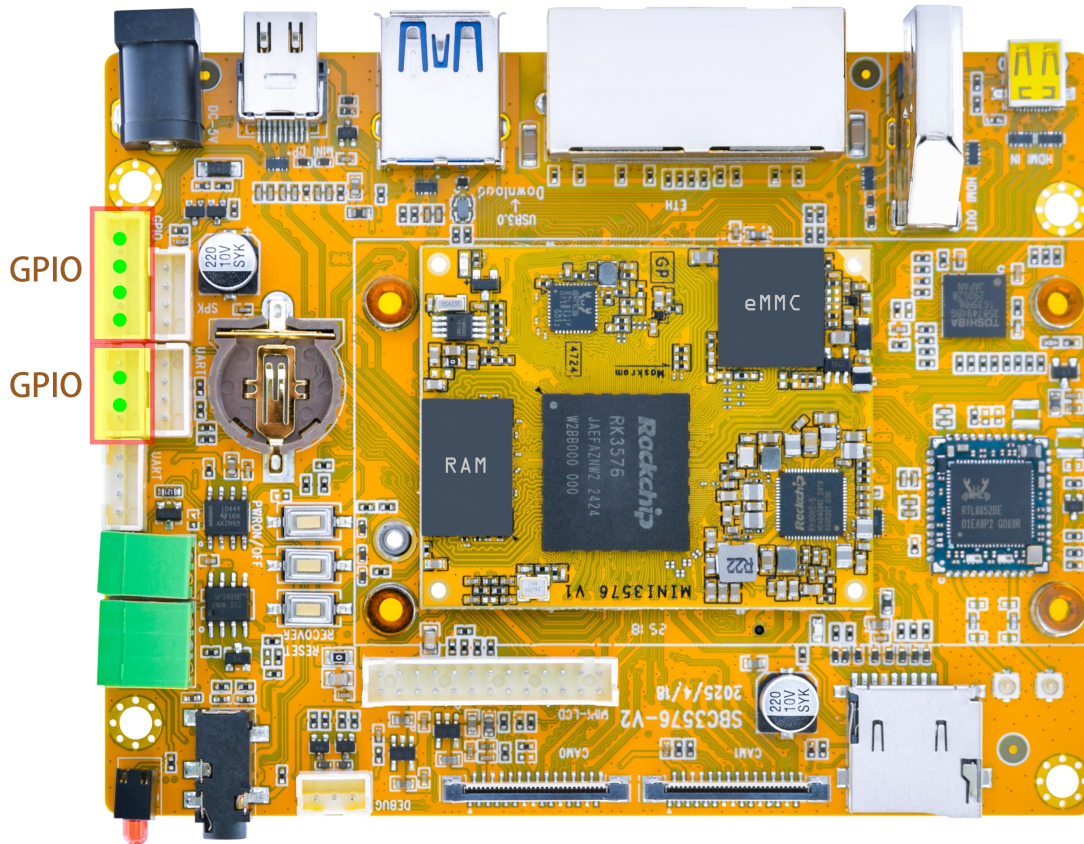
```
root@rk3576-buildroot:/# com /dev/ttyS10 115200 8 0 1
port = /dev/ttyS10
baudrate = 115200
cs = 8
parity = 0
stopb = 1
hhhhhhhhhhhhhhhh
RECV: hhhhhhhhhhhhhhhhh
yyyyyyyyyyyyyy
RECV: yyyyyyyyyyyyyyy
ddddddddddd
RECV: dddddddddddd
^C
root@rk3576-buildroot:/#
```

Step 3: UART1 test.

```
# com /dev/ttyS1 115200 8 0 1
```

```
root@rk3576-buildroot:/# com /dev/ttyS1 115200 8 0 1
port = /dev/ttyS1
baudrate = 115200
cs = 8
parity = 0
stopb = 1
RECV:
RECV:
jjjjjjjjjjjjj
RECV: jjjjjjjjjjjjj
iiiiiiiiiiiiiii
RECV: iiiiiiiiiiiiiii
yyyyyyyyyyyyyy
RECV: yyyyyyyyyyyyyyy
^C
```

7.13 GPIO



LCDDDO0/DSMC_CSN0 -> 114

LCDC_D1/EBC_SDDO1/DSMC_CSN3 -> 121

LCDC_D2/EBC_SDDO2/DSMC_CSN2 -> 122

LCDC_D9/EBC_SDDO9/DSMC_INT1 -> 123

LCDC_D8/EBC_SDDO8/DSMC_INT3 -> 109

LCDC_D14/EBC_SDDO14/DSMC_DATA8 -> 115

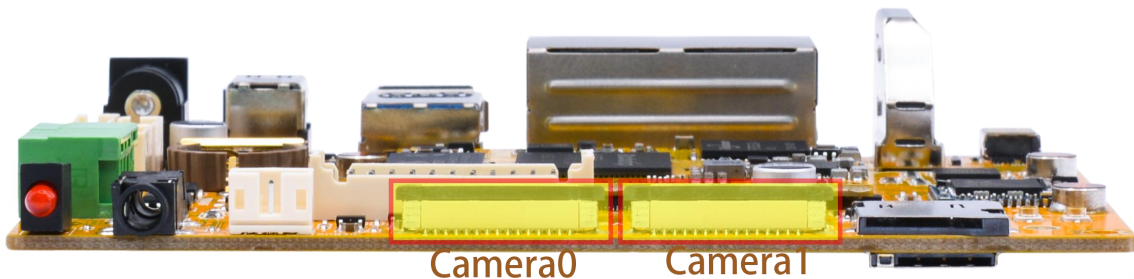
Execute the follow command to test GPIO.

```
# echo 114 > /sys/class/gpio/export
# echo "out" > /sys/class/gpio/gpio114/direction
# echo 0 > /sys/class/gpio/gpio114/value // The GPIO will output low voltage
# echo 1 > /sys/class/gpio/gpio114/value //The GPIO will output high voltage
```

```
root@rk3576-buildroot:/# echo 114 > /sys/class/gpio/export
root@rk3576-buildroot:/# echo "out" > /sys/class/gpio/gpio114/direction
root@rk3576-buildroot:/# echo 0 > /sys/class/gpio/gpio114/value
root@rk3576-buildroot:/# echo 1 > /sys/class/gpio/gpio114/value
root@rk3576-buildroot:/#
```

Other GPIO use same test method.

7.14 Camera



- View camera device node.

```
# grep "" /sys/class/video4linux/v*/name | grep mainpath
```

```
root@rk3576-buildroot:/# grep "" /sys/class/video4linux/v*/name | grep mainpath
/sys/class/video4linux/video33/name:rkisp_mainpath4linux/v*/name | grep mainpath
/sys/class/video4linux/video42/name:rkisp_mainpath
root@rk3576-buildroot:/#
```

- Execute follow command to test single-camera preview.

```
# gst-launch-1.0 v4l2src device=/dev/video33 !
video/x-raw,format=NV16,width=1920,height=1080, framerate=25/1 ! waylandsink
Or
# gst-launch-1.0 v4l2src device=/dev/video42 !
video/x-raw,format=NV16,width=1920,height=1080, framerate=25/1 ! waylandsink
```

```

root@rk3576-buildroot:/# gst-launch-1.0 v4l2src device=/dev/video33 !
video/x-raw,format=NV16,width=1920,height=1080,framerate=25/1 ! waylandsink
Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[ 114.721960] rkisp_hw 27c00000.isp: set isp clk = 396000000Hz
[ 114.722553] rkisp rkisp-vir0: virtual isp0 3840x2160 using frm buf
[ 114.723175] rkCIF-mipi-lvds: stream[0] start streaming
[ 114.726903] rkCIF-mipi-lvds: Allocate dummy buffer, size: 0x01028000
[ 114.727036] rockchip-mipi-csi2 mipi0-csi2: stream on, src_sd: 0000000e4ab2af0, sd_name:rockchip-csi2-dphy0
[ 114.727047] rockchip-mipi-csi2 mipi0-csi2: stream ON
[ 114.727079] rockchip-csi2-dphy0: dphy0, data_rate_mbps 892
[ 114.727498] rockchip-csi2-dphy0 csi2-dcphy0: csi2_dphy_s_stream stream on:1, dphy0, ret 0
[ 114.727510] imx415 2-0036: s_stream: 1. 3864x2192, hdr: 0, bpp: 10
[ 114.805145] (0x27c80000)MIPI_CSI2_ERR2:0xf0000
[ 114.837587] rkCIF-mipi-lvds: Warning: vblank need >= 1000us if isp work in online, cur 859 us
[ 114.870983] rkCIF-mipi-lvds: Warning: vblank need >= 1000us if isp work in online, cur 859 us
[ 114.870990] use of bytesused == 0 is deprecated and will be removed in the future,
[ 114.871063] use the actual size instead.
Redistribute latency...
[20:25:15.475] seeing the first app
0:00:10.3 / 99:99:99.

```



- Execute follow command to take a video.

```

# gst-launch-1.0 v4l2src device=/dev/video33 num-buffers=100 ! \
video/x-raw,format=NV12,width=1920,height=1088,framerate=30/1 ! \
videoconvert ! mpph264enc ! h264parse ! mp4mux ! \
filesink location=/tmp/h264.mp4

```

- Execute follow command to take picture.

```

# gst-launch-1.0 -v v4l2src device=/dev/video22 num-buffers=10 ! \
video/x-raw,format=NV12,width=1280,height=800 ! mppjpegenc ! \
multifilesink location=/tmp/test%05d.jpg

```

7.15 Video Playback

(1) The directory for the built-in video testing scripts in the system: `/rockchip-test/video`

```
root@rk3576-buildroot:/# ls /rockchip-test/video/  
test_gst_multivideo.sh  test_gst_video_fps.sh  video_stresstest.sh  
test_gst_video.sh      test_gst_video_maxfps.sh  video_test.sh
```

Simply execute the script.

```
root@rk3576-buildroot:/# ./rockchip-test/video/test_gst_video.sh  
Setting pipeline to PAUSED ...  
Pipeline is PREROLLING ...  
Redistribute latency...  
mpp[1568]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md  
mpp[1568]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md  
mpp[1568]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md  
mpp[1568]: mpp: unable to create enc vp8 for soc rk3576 unsupported  
mpp[1568]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md  
mpp[1568]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md  
Redistribute latency...  
mpp[1568]: h264d_api: is_avcC=1  
Pipeline is PREROLLED ...  
Prerolled, waiting for async message to finish...  
Setting pipeline to PLAYING ...  
Redistribute latency...  
New clock: GstSystemClock  
0:00:01.8 / 0:00:29.5 (6.3 %)
```

(2) Play the video using Google Chrome.

- Google Chrome supports video playback up to 4K at 60Hz, with support for the following decoding formats: VP8, H.264, H.265, VP9, and AV1.
- However, it is only compatible with certain H.265 video files.

Execute the following command to play the video using Google Chrome:

```
# chromium /mnt/sdcard/4k.mp4
```

Command explanation:

- `chromium`: Launches the Chromium browser.
- `/mnt/sdcard/4k.mp4`: The media file path to be played.

```

root@rk3576-buildroot:/# chromium /mnt/sdcard/4k.mp4
[1625:1643:1220/120107.505014:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1643:1220/120107.505194:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1643:1220/120107.505484:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1643:1220/120107.505563:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1643:1220/120107.556509:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1643:1220/120107.556585:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1644:1220/120107.598805:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1640:1220/120107.598919:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")

(process:1625): Glib-GIO-CRITICAL **: 12:01:07.602: g_settings_schema_source_lookup: assertion 'source !=
NULL' failed
[1625:1625:1220/120107.704406:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type;
[1625:1625:1220/120107.704451:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type;
[1625:1641:1220/120107.704673:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server address:
Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1625:1718:1220/120107.726120:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.Properties.Get: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1625:1718:1220/120107.726576:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.UPower.GetDisplayDevice: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1625:1718:1220/120107.727060:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.UPower.EnumerateDevices: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1625:1625:1220/120107.731131:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type;

```

(3) Use the `gst-play-1.0` command to play the video.

```
# gst-play-1.0 --videosink="waylandsink fullscreen=true" /mnt/sdcard/4k.mp4
--audiosink="alsasink device=hw:0,0"
```

Command explanation:

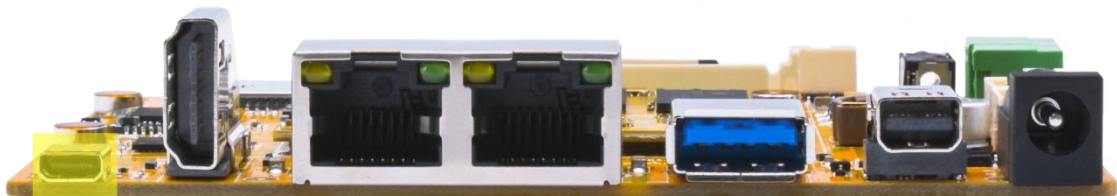
- `/mnt/sdcard/4k.mp4` : The media file path to be played.
- `--audiosink="alsasink device=hw:0,0"`: Specifies the audio output device as `hw:0,0`.

```

root@rk3576-buildroot:/# gst-play-1.0 --videosink="waylandsink fullscreen=true" /mnt/sdcard/4k.mp4
--audiosink="alsasink device=hw:0,0"
Press 'k' to see a list of keyboard shortcuts.
Now playing /mnt/sdcard/4k.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:00:00.9 / 0:04:35.0

```

7.16 HDMI IN



HDMI IN

After connecting the HDMI OUT port of the source device to the HDMI IN port of the SBC3576, The log will show:

```
root@rk3576-buildroot:/# [ 60.102582] m03_b_tc35874x 4-000f: tc35874x_format_change: New format:
1920x1080p60.00 (2200x1125)
```

then execute the following commands to start the preview.

- **Video Preview:**

```
# gst-launch-1.0 v4l2src device=/dev/video11 !
video/x-raw,format=NV12,width=1920,height=1080, framerate=30/1 ! waylandsink
```

```
root@rk3576-buildroot:/# gst-launch-1.0 v4l2src device=/dev/video11 !
video/x-raw,format=NV12,width=1920,height=1080, framerate=30/1 ! waylandsink
Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[ 70.912005] rkCIF-mipi-lvds3: stream[0] start streaming
[ 70.914604] rkCIF-mipi-lvds3: Allocate dummy buffer, size: 0x003f5000
[ 70.928892] rockchip-mipi-csi2 mipi3-csi2: stream on, src_sd: 0000000a33972d5,
sd_name:rockchip-csi2-dphy3
[ 70.928922] rockchip-mipi-csi2 mipi3-csi2: stream ON
[ 70.928959] rockchip-csi2-dphy3: dphy3, data_rate_mbps 620
[ 70.928999] rockchip-csi2-dphy csi2-dphy3: csi2_dphy_s_stream stream on:1, dphy3, ret 0
[ 70.934019] rkCIF-mipi-lvds3: ERROR: csi size err, intstat:0x1000001, size:0x0,0x0,0x0,0x0, cnt 1
Redistribute latency...
0:00:02.2 / 99:99:99.
```

- **Capture Audio from HDMI Output:**

```
# arecord -D hw:1,0 -f cd -r 44100 -c 2 -t wav testin.wav
# aplay -D plughw:3,0 test.wav
```

Parameter Description:

```
root@rk3576-buildroot:/# cat /proc/asound/cards
0 [rockchip-es8388 ]: rockchip-es8388 - rockchip-es8388
                        rockchip-es8388                /* Headset audio output */
1 [rkhdmiintc35874]: simple-card - rk,hdmiin-tc358749x-codec
                        rk,hdmiin-tc358749x-codec        /* HDMI RX audio output */
2 [rockchipdp0   ]: rockchip-dp0 - rockchip-dp0
                        rockchip-dp0                    /* DP audio output */
3 [rockchiphdmi  ]: rockchip-hdmi - rockchip-hdmi
                        rockchip-hdmi                    /* HDMI TX audio output */
root@rk3576-buildroot:/#
```