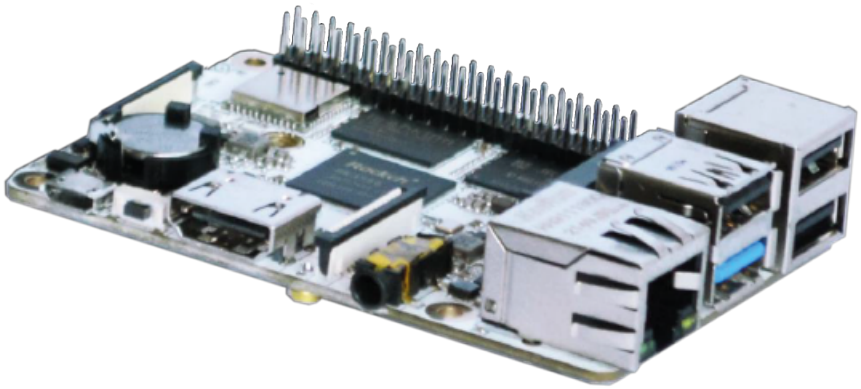
URVE

URVE Board PI

User Manual



www.urveboard.com

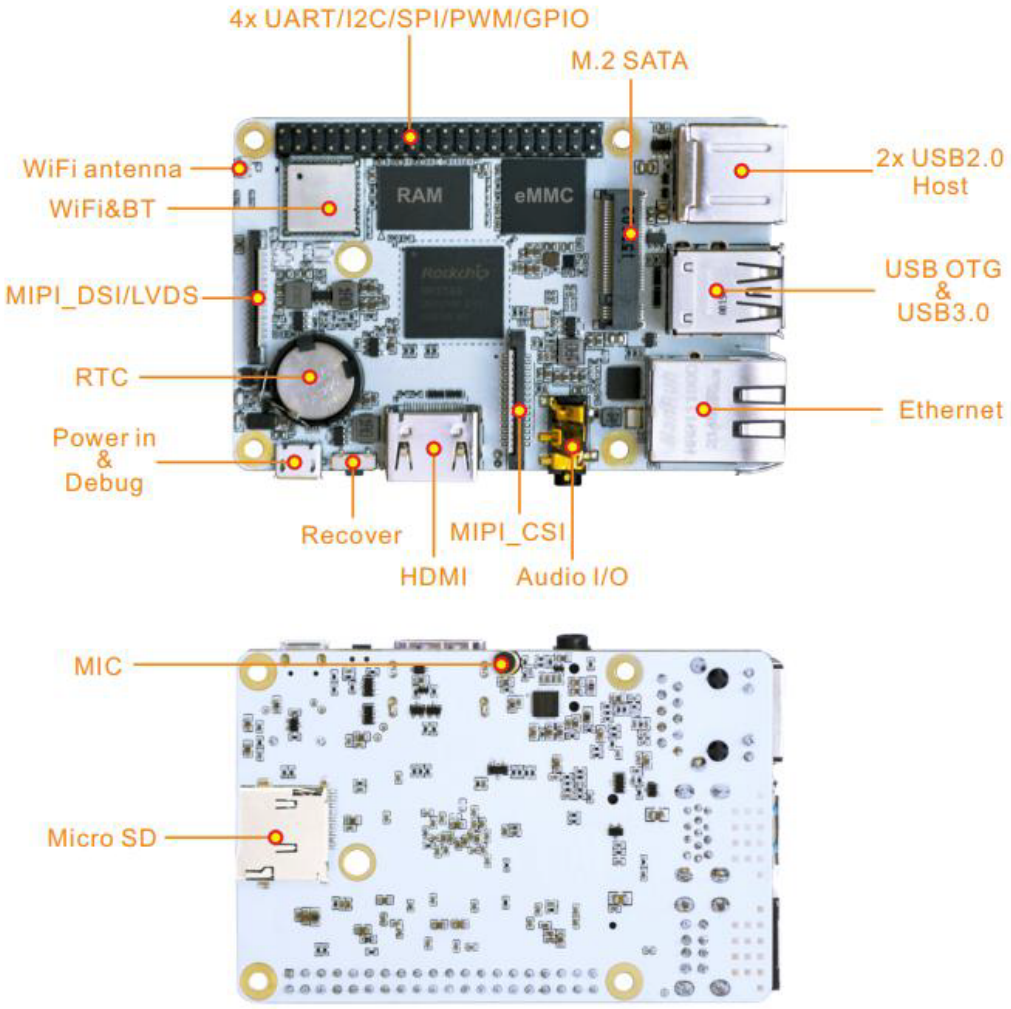
Content

Quick Start

1. URVE Board PI Introduction

URVE Board PI is a credit card-sized single board computer (SBC) based on the Rockchip RK3566 Quad-core Cortex-A55 processor designed for IoT devices, such as home security system, Face Recognizing Robot, drones and HMI.

The small computing platform has a high-performance and low power processor with USB ports, Gigabit Ethernet, 2.4G/5G WiFi, M.2, micro-SD card slot, MIPI CSI camera connector, MIPI DSI (or LVDS) and HDMI port that support 4K monitors.



Specifications	
CPU	Rockchip RK3566 Quad-core Cortex-A55, 1.8 GHz
GPU	ARM Mali-G52 2EE GPU with support for OpenGL ES 1.1/2.0/3.2. OpenCL 2.0. Vulkan 1.1
NPU	0.8 TOPS
Memory	2/4/8GB LPDDR4 or LPDDR4X RAM

Storage	8/16/32/64/128GB eMMC flash M.2 PCIe 2.0 socket NVMe SSD MicroSD card slot
Power Supply	5V/2A via Micro USB
USB	1x USB2.0 OTG (USB-AF) 2x USB2.0 Host 1x USB 3.0
Networking	Gigabit Ethernet RJ45 port via Realtek RTL8211F-CG controller 2.4G/5G WiFi(802.11 a/b/g/n/ac) with Bluetooth 4.2
Debugging	Micro USB
Display	MIPI DSI/LVDS, HDMI2.0 output
Audio	ES8388 audio codec. 1x 3.5mm audio I/O jack, 1x differential MIC
Camera (optional)	MIPI CSI Camera, 15-pin FPC connector.
Expansion	4x UART, SPI, I2C, PWM, SPDIF_TX and GPIO via 40-pin header
Misc	1x Recover button, 2x LED, RTC
Dimension	85 x 56mm (Raspberry Pi 3-like form factor)

2.Quick Setup

- Connect the board and monitor with a HDMI cable.
- Connect the Micro USB cable and power on the board.
- On your host PC, start a terminal emulation program (such as SecureCRTI) with the following serial port settings:

Baud Rate	Data Bits	Stop Bits	Parity	Flow Control
1500000	8	1	none	none

3.Shipping list (for reference only)

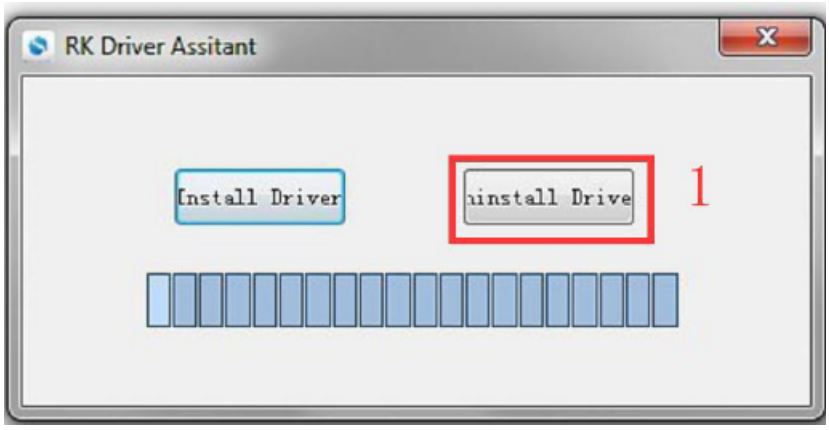
- 1 x URVE Board PI
- 1 x Micro USB cable
- 1 x USB cable
- 1 x Ethernet cable
- 1 x WIFI Antenna
- 1 x SD card

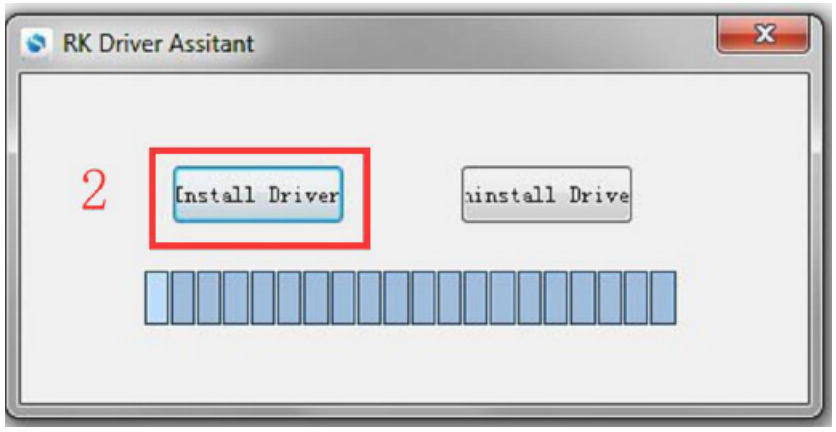
Install Debug Tools

1.Install Rockchip Driver Assistant

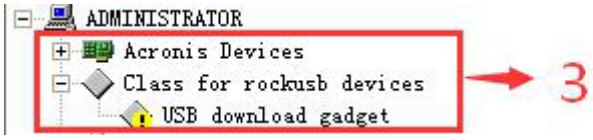
If it is the first time to download firmware in WINDOWS, you need to install Rockchip Driver.

Path: DriverAssitant_v5.1.1/DriverInstall.exe



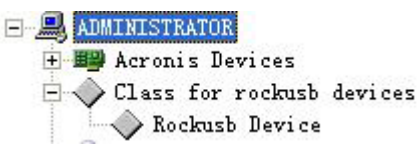


After the installation is complete, connect the board and PC with Type_C USB cable and press the "Recover" key and hold then power the board, in *Computer Management* can see the following information:



The WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select \DriverAssitant_v5.11\DriverAssitant_v5.1.1\ADBDriver.

After the installation is complete in *Computer Management* can see the following information:

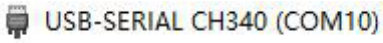


2.Install CH340 Driver

If you are doing system development and testing, the USB to serial TTL adapter is very useful for checking the system startup log and functional test results, especially when there is no graphical desktop display. The following shows how to use USB serial adapter CH340.

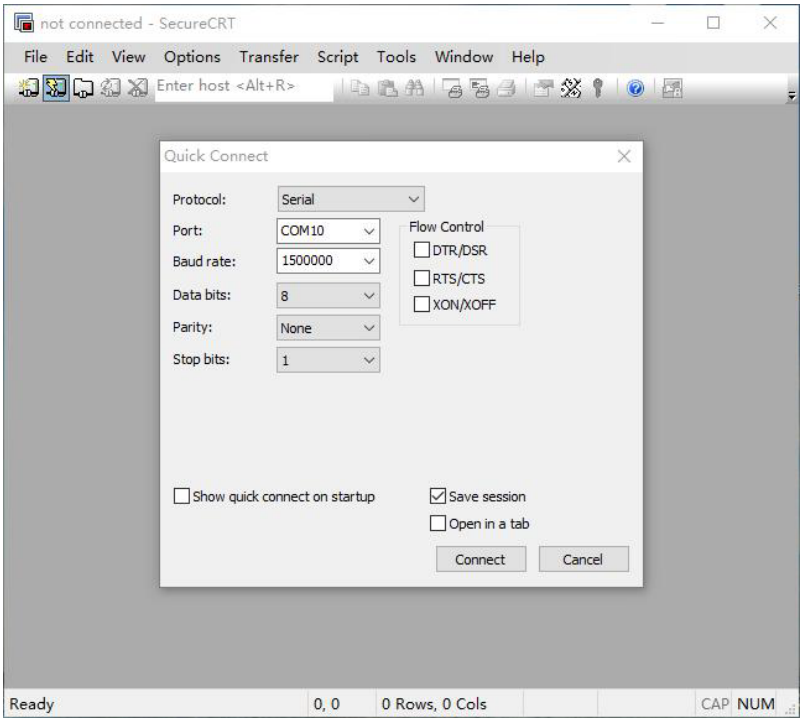
Plug the Micro USB cable to the PC, unzip CH341SER.zip on Windows, then click CH341SER.EXE to install.

Now the device will be listed under **Device Manager -> PORTS** with unique serial port assigned.



3.Serial Terminal Tool

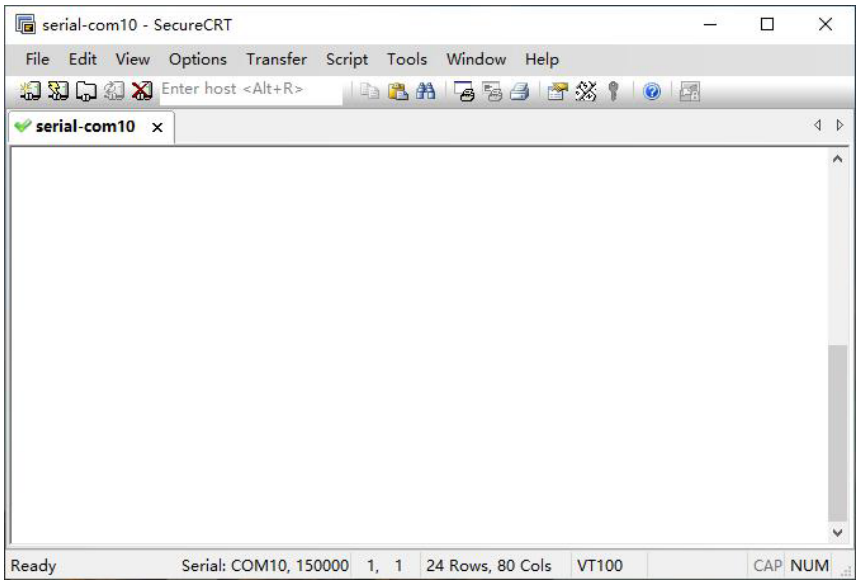
The Micro USB cable of **URVE Board PI** is both the power cable and the serial port debugging cable



Configuration parameters：

Protocol	Serial
Port	To be specified by user PC
Baud rate	1500000
Data bits	8
Parity	None
Stop bits	1
Please check XON/XOFF and RTS/CTS not selected	

After all, Check **Save session** and click **connect**.



Illusion: If open more than one serial terminal tools, and they use the same serial port, there will be reported the port is busy.

Solution: Turn off the serial tool that unnecessary.

Upgrade Firmware

1.Upgrade Mode

URVE Board PI supports two modes: Normal mode and upgrade mode.

Normal mode	Upgrade mode
eMMC Interface/SDMMC Interface	1. MASKROM mode 2. Loader mode 3. SD card mode

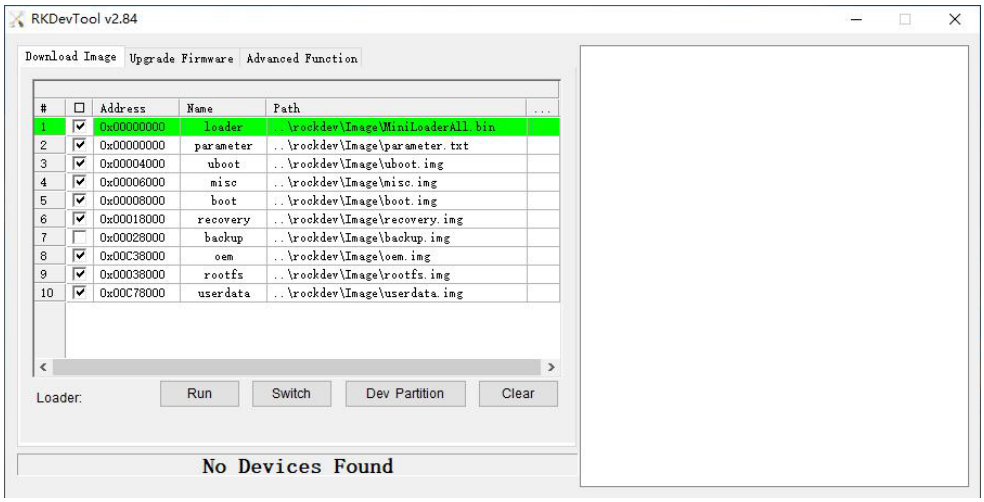
1.1 MASKROM mode

When the eMMC is empty, the board automatically enters the MASKROM mode when it is powered on. In general, there is no need to enter MASKROM Mode. Only when the bootloader verification fails (the IDB block cannot be read, or the bootloader is damaged), the BootRom code will enter this mode. At this time, the BootRom code waits for the host to transmit the bootloader code through the USB interface, load and run it. When the board becomes bricked and cannot start or upgrade the program normally need enter MASKROM Mode.

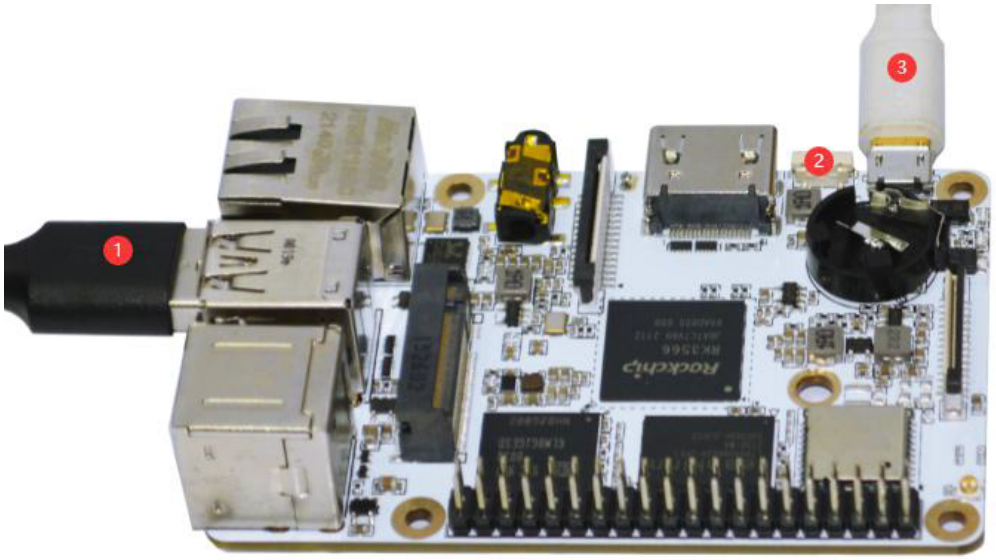
1.1.1 Software method

Step 1, unzip **RKDevTool.rar** on Windows.

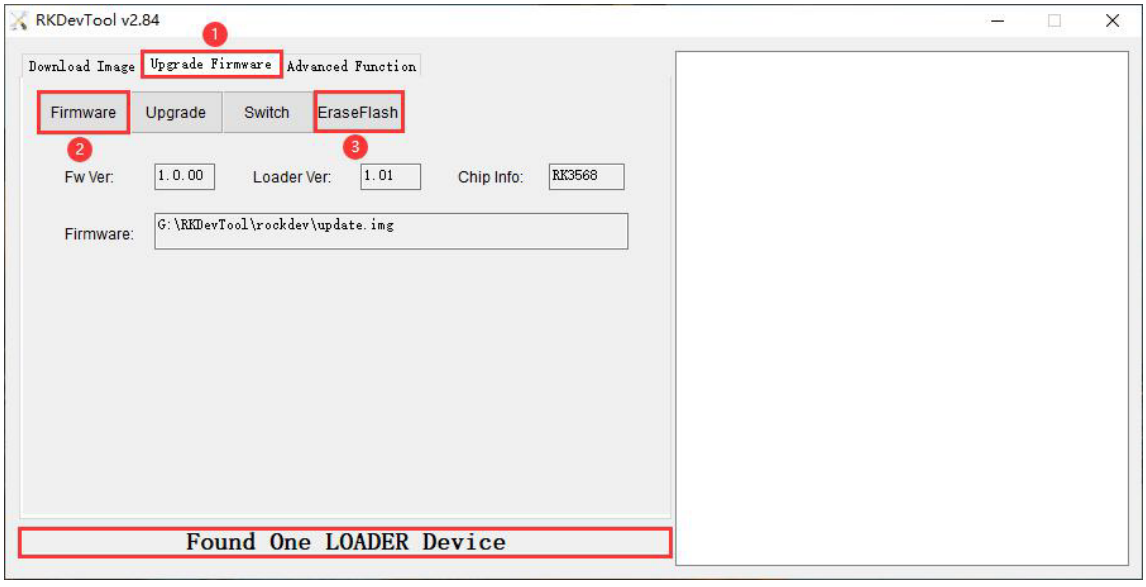
Step 2, open **RKDevTool.exe** (*Path:\RKDevTool\RKDevTool_Release*\RKDevTool.exe).



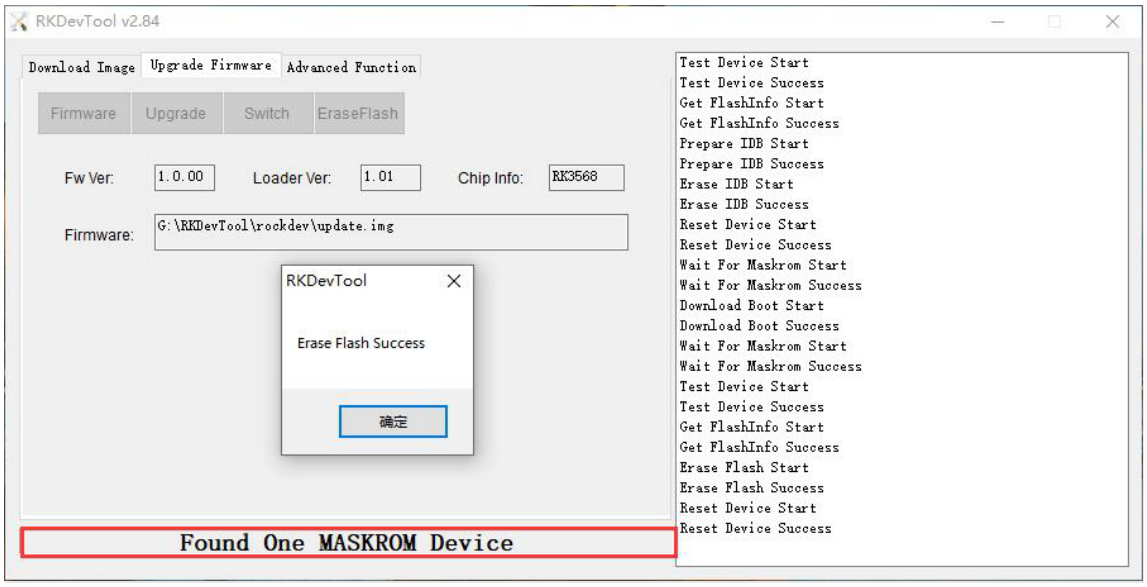
Step 3, connect PC and development board with OTG USB cable, keep pressing the **RECOVER** Key and power the board (connect Micro USB cable) until the windows PC shows **Found One LOADER Device.**



Step 4, click **Upgrade Firmware -> Firmware**, select update.img. Click **"EraseFlash"** to erase flash.



Step 5, after erase flash will enter MASKROM mode.



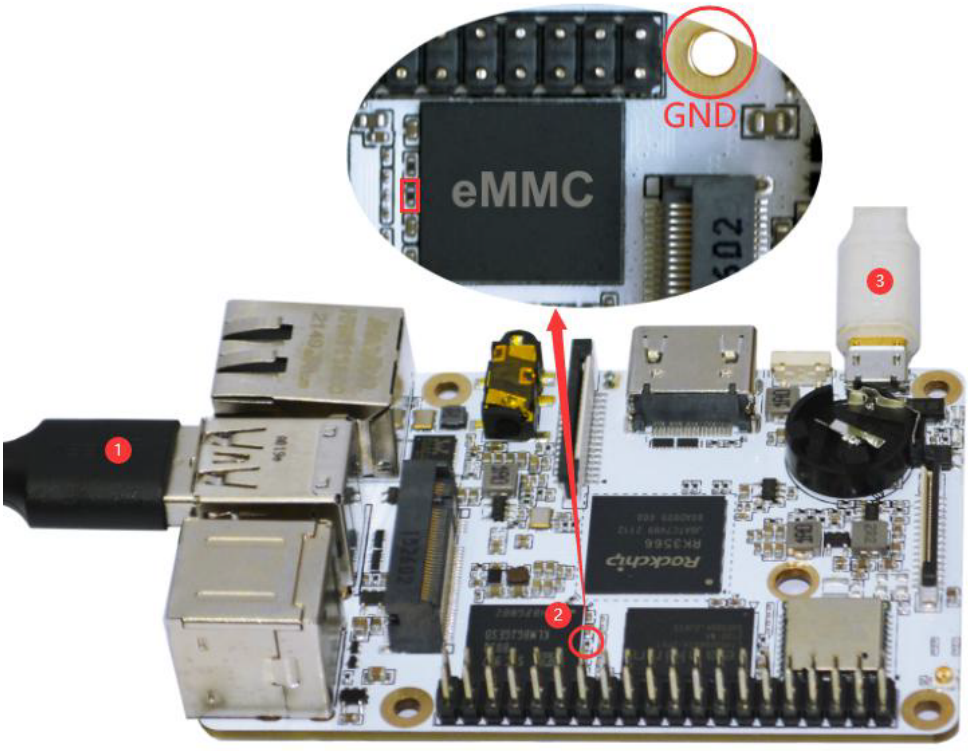
1.1.2 Hardware method

Please read and operate carefully! The operation steps are as follows:

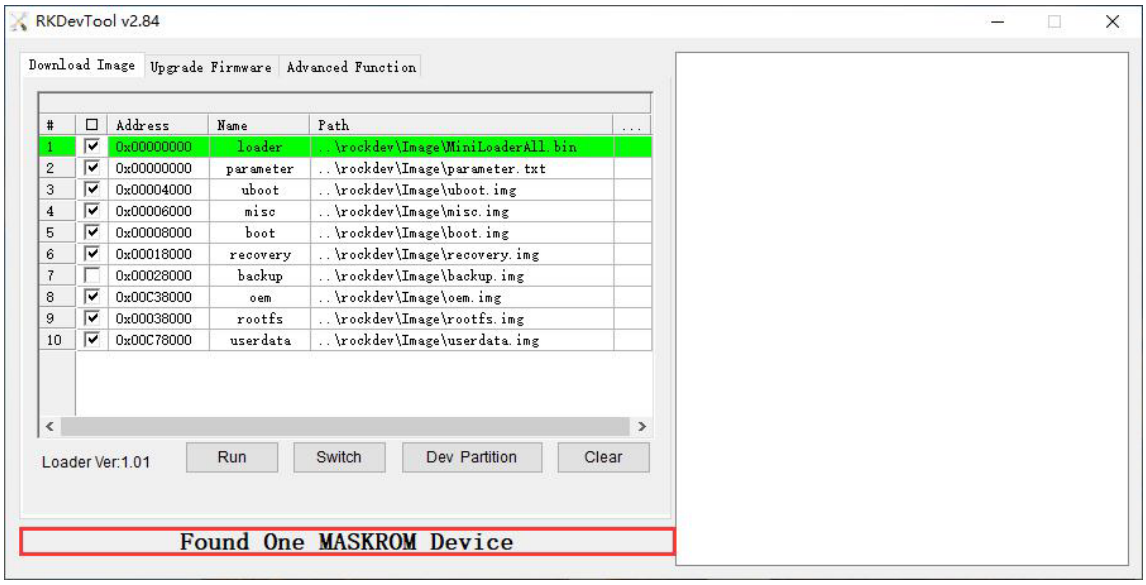
Step 1, connect PC and development board with USB OTG cable

Step 2, short the test point near eMMC to GND.

Step 3, connect PC and development board with Micro USB cable (power the board).



*Step 4,*at this time, the device should go into MASKROM mode.



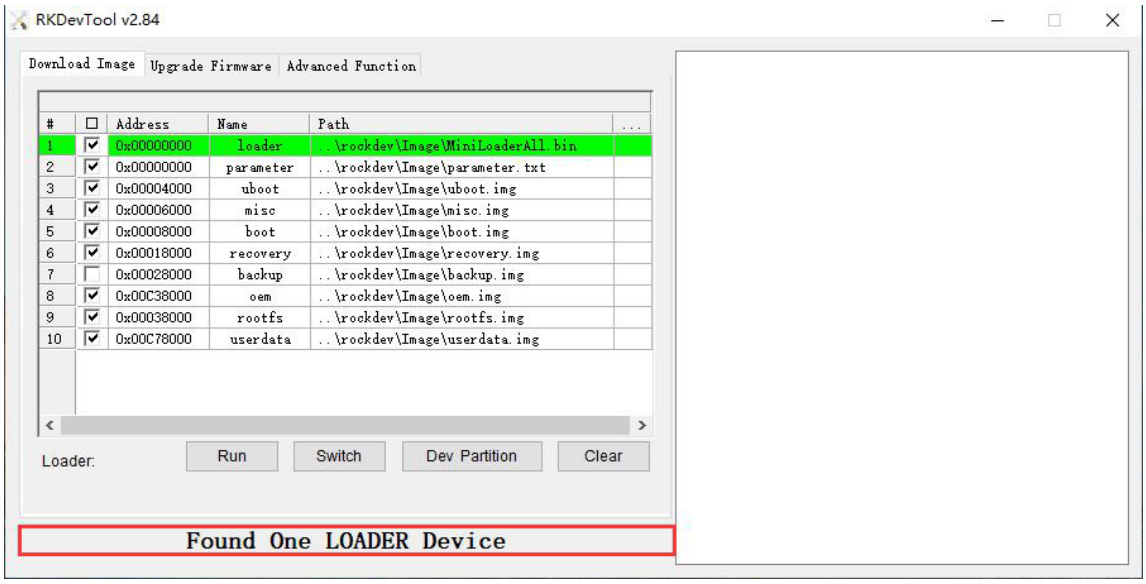
1.2 Loader mode

In Loader mode, the bootloader will waiting for host commands for firmware upgrades. To enter this mode, the USB is connected and the bootloader must detect a **RECOVERY** key press at startup.

Step 1, connect PC and development board USB OTG cable.

Step 2, keep press the **RECOVERY** key.

Step 3, connect PC and development board with Micro USB cable (power the board) until the windows PC shows **Found One LOADER Device** then release the **RECOVERY** key.

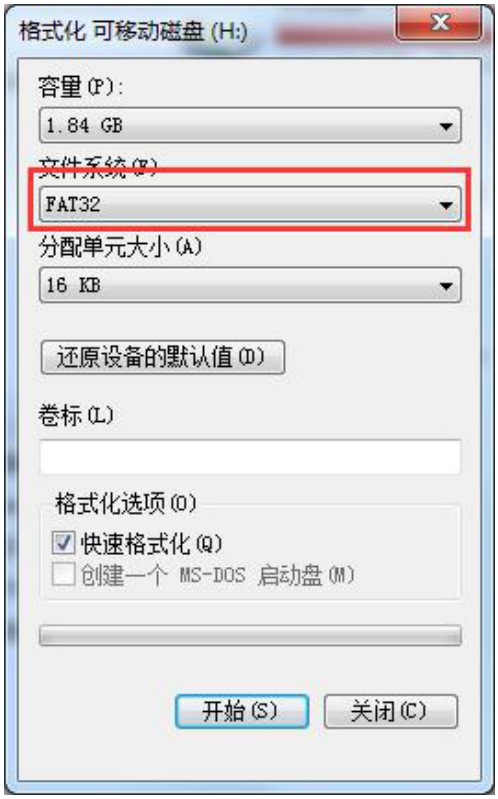


2.SD boot card

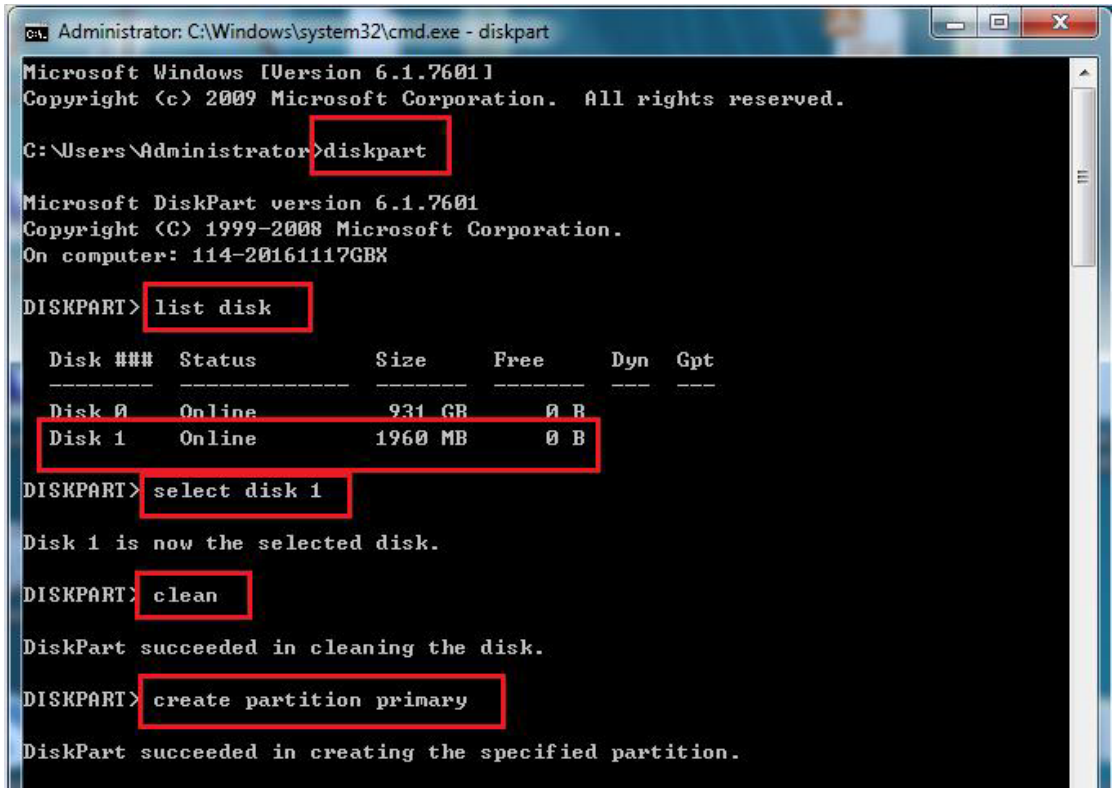
The image is stored in the sd card, and the system boots directly from the sd card. .The SD card must be formatted before make SD upgrade card,and make sure that the SD card has only one partition, otherwise it may cause the board to fail to boot.

2.1 Format sdcard

If your sdcard has only one partition, just format it as FAT32 in WINDOWS



If your sdcard has multiple partitions, you need to delete the partitions in CMD of WINDOWS as follow:



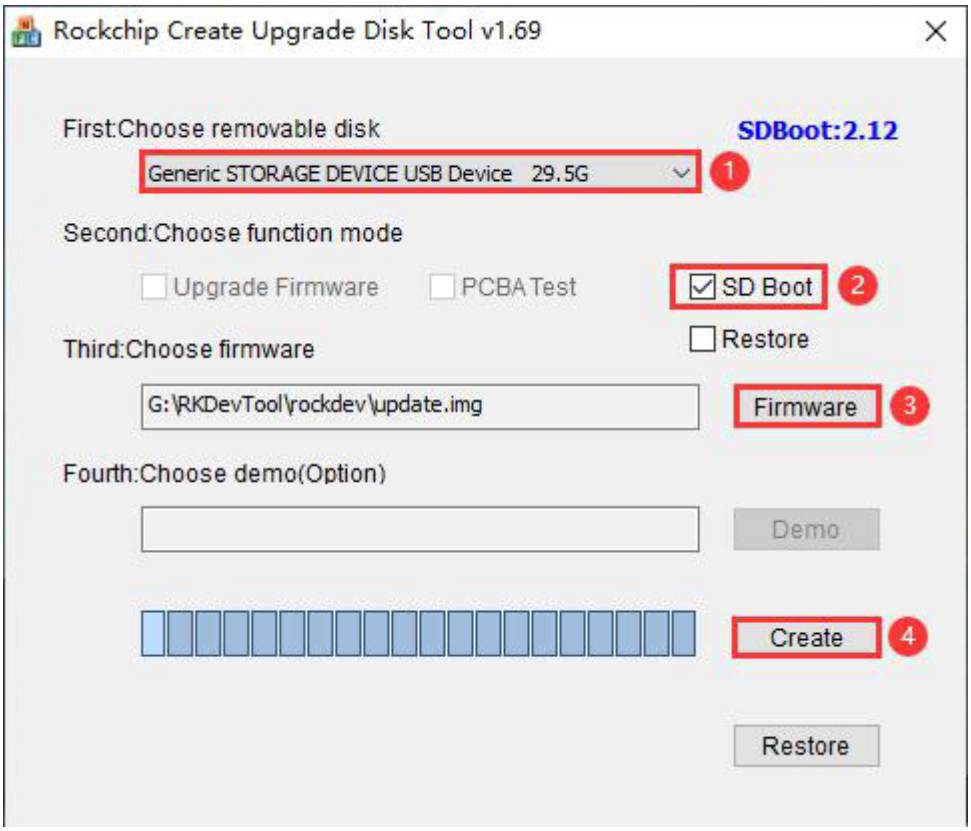
And then format it as FAT32.

2.2 make SD boot card

Step 1, unzip **SDDiskTool_v1.69.zip** on Windows.

Step 2, open **RKDevTool.exe** (Path:SDDiskTool_v1.69\SD_Firmware_Tool.exe).

Step 3, as shown in the figure, make SD upgrade card.



Parameter Description:

1	Select an SD card or USB flash drive from the **drop-down list.**
2	Select **"SD Boot"**.
3	Click Select **"Firmware"** and select **update.img** to upgrade the firmware.
4	lick **"Create"** to start creation.

Step 4, Insert the SD card into the card slot, power on and booting.

Debian10

1. Compiler Environment

It is recommended to use Ubuntu 18.04. If you encounter an error during compilation, you 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 40G. If you do	Ubuntu 18.04 system

multiple builds, you will need more hard drive space.	

2. Install Tools

PC OS: ubuntu18.04 system

Network: online

Permission: root

```
# sudo apt-get install repo git ssh make gcc libssl-dev liblz4-tool \
    expect g++ patchelf chrpath gawk texinfo chrpath diffstat binfmt-support \
    qemu-user-static live-build bison flex fakeroot cmake gcc-multilib g++-multilib unzip \
# sudo apt-get install device-tree-compiler
# sudo apt-get install python-pip
# sudo apt-get install ncurses-dev
```

3. Compile Source

Step 1, unzip the source

```
$ tar xvf rk3566_linux_source-20220708.tar.bz2
$ cd rk3566_linux_source
```

Step 2, set the compile board

```
$ ./build.sh -h                    (view the build command)
$ ./build.sh device/rockchip/rk356x/BoardConfig-rk3566-evb2-lp4x-v10.mk
```

Or use :

```
$ ./build.sh lunch
root@em-virtual-machine:/home/EM1126/rk3566_linux_source# ./build.sh lunch
processing option: lunch
You're building on Linux
Lunch menu...pick a combo:
0. default BoardConfig.mk
1. BoardConfig-rk3566-evb2-lp4x-v10-32bit.mk
2. BoardConfig-rk3566-evb2-lp4x-v10.mk
3. BoardConfig-rk3568-evb1-ddr4-v10-32bit.mk
4. BoardConfig-rk3568-evb1-ddr4-v10-spi-nor-64M.mk
5. BoardConfig-rk3568-evb1-ddr4-v10.mk
6. BoardConfig-rk3568-nvr-spi-nand.mk
7. BoardConfig-rk3568-nvr.mk
8. BoardConfig-rk3568-uvc-evb1-ddr4-v10.mk
9. BoardConfig.mk
Which would you like? [0]: 2    (BoardConfig-rk3566-evb2-lp4x-v10.mk)
switching to board:
/home/EM1126/rk3566_linux_source/device/rockchip/rk356x/BoardConfig-rk3566-evb2-lp4x-v10.mk
```

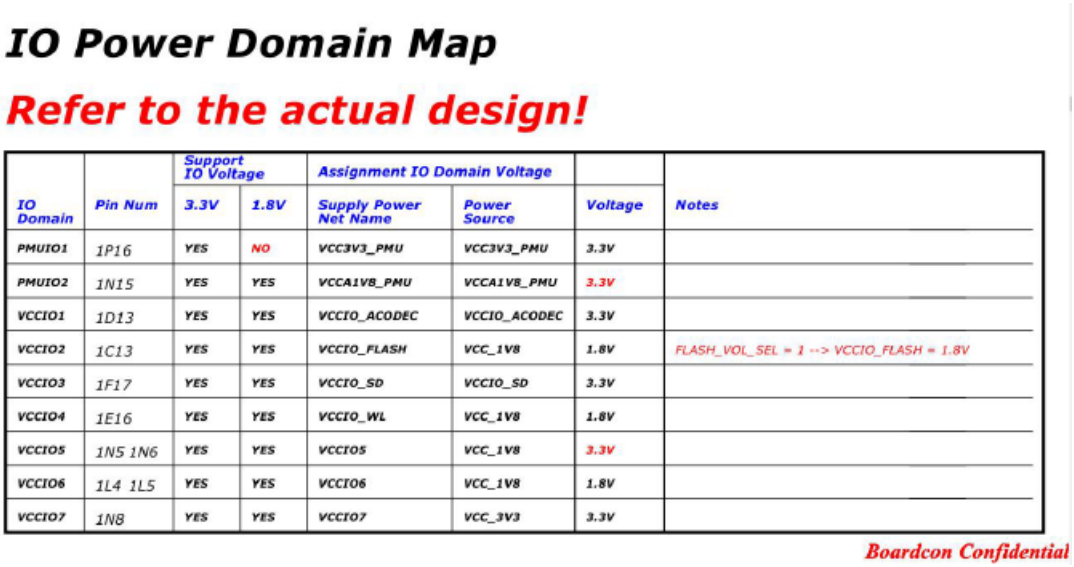
Step 3, compile uboot

$ ./build.sh uboot

Step 4, compile kernel

$ ./build.sh kernel

Note:it will pop out configuration the IO Domain Map power window when first time compile kernel, you need to accord to below form to configure it:



IO Power Domain Map

Refer to the actual design!

IO Domain	Pin Num	Support IO Voltage		Assignment IO Domain Voltage		Voltage	Notes
		3.3V	1.8V	Supply Power Net Name	Power Source		
PMUIO1	1P16	YES	NO	VCC3V3_PMU	VCC3V3_PMU	3.3V	
PMUIO2	1N15	YES	YES	VCCA1V8_PMU	VCCA1V8_PMU	3.3V	
VCCIO1	1D13	YES	YES	VCCIO_ACODEC	VCCIO_ACODEC	3.3V	
VCCIO2	1C13	YES	YES	VCCIO_FLASH	VCC_1V8	1.8V	FLASH_VOL_SEL = 1 --> VCCIO_FLASH = 1.8V
VCCIO3	1F17	YES	YES	VCCIO_SD	VCCIO_SD	3.3V	
VCCIO4	1E16	YES	YES	VCCIO_WL	VCC_1V8	1.8V	
VCCIO5	1N5 1N6	YES	YES	VCCIO5	VCC_1V8	3.3V	
VCCIO6	1L4 1L5	YES	YES	VCCIO6	VCC_1V8	1.8V	
VCCIO7	1N8	YES	YES	VCCIO7	VCC_3V3	3.3V	

Boardcon Confidential

kernel.img, resource.img and **boot.img** are generated in rk3566_linux_source\kernel directory.

If want to configure the kernel, execute follow command:

$ cd kernel

$ make ARCH=arm64 menuconfig

Kernel default use config file is: kernel\arch\arm64\configs\rockchip_linux_defconfig. After reconfigure the kernel, please use kernel\.config file to replace rockchip_linux_defconfig.

Step 5, compile recovery

$ ./build.sh recovery

Step 6, compile debian

sudo tar xvf debian.tar.bz2

sudo ./build.sh debian

After compile, will get the rootfs.img image in the debian directory, the file rootfs.img is finally we use to burn to board.

Step 7, Generated image file

$ ./mkfirmware.sh

$ cd rockdev

$ cp ../debian/rootfs.img ./

$ ls

Images are generated in current directory.

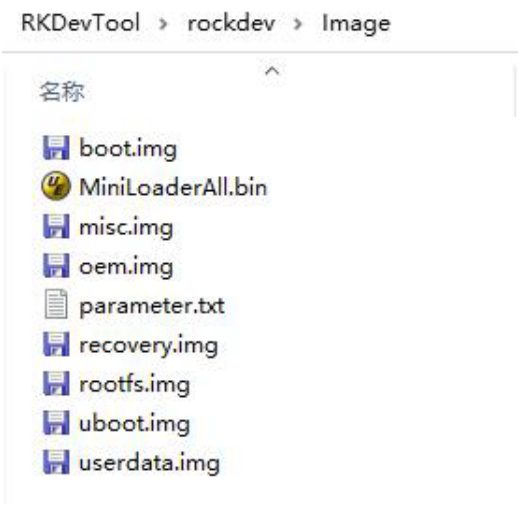
After compilation, execute the follow command to clean the build if need:

sudo ./build.sh cleanall

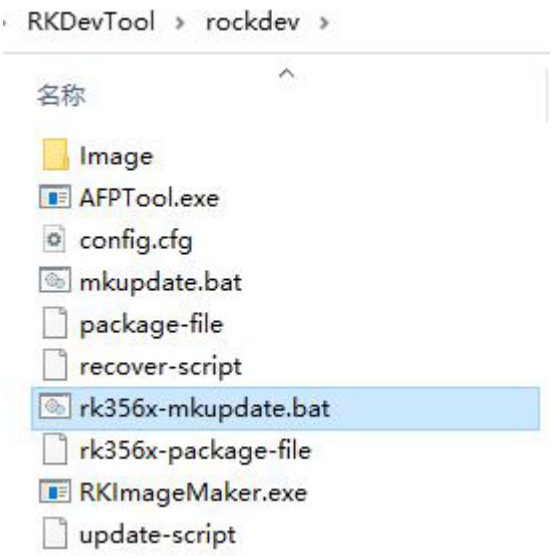
4. Images Operation

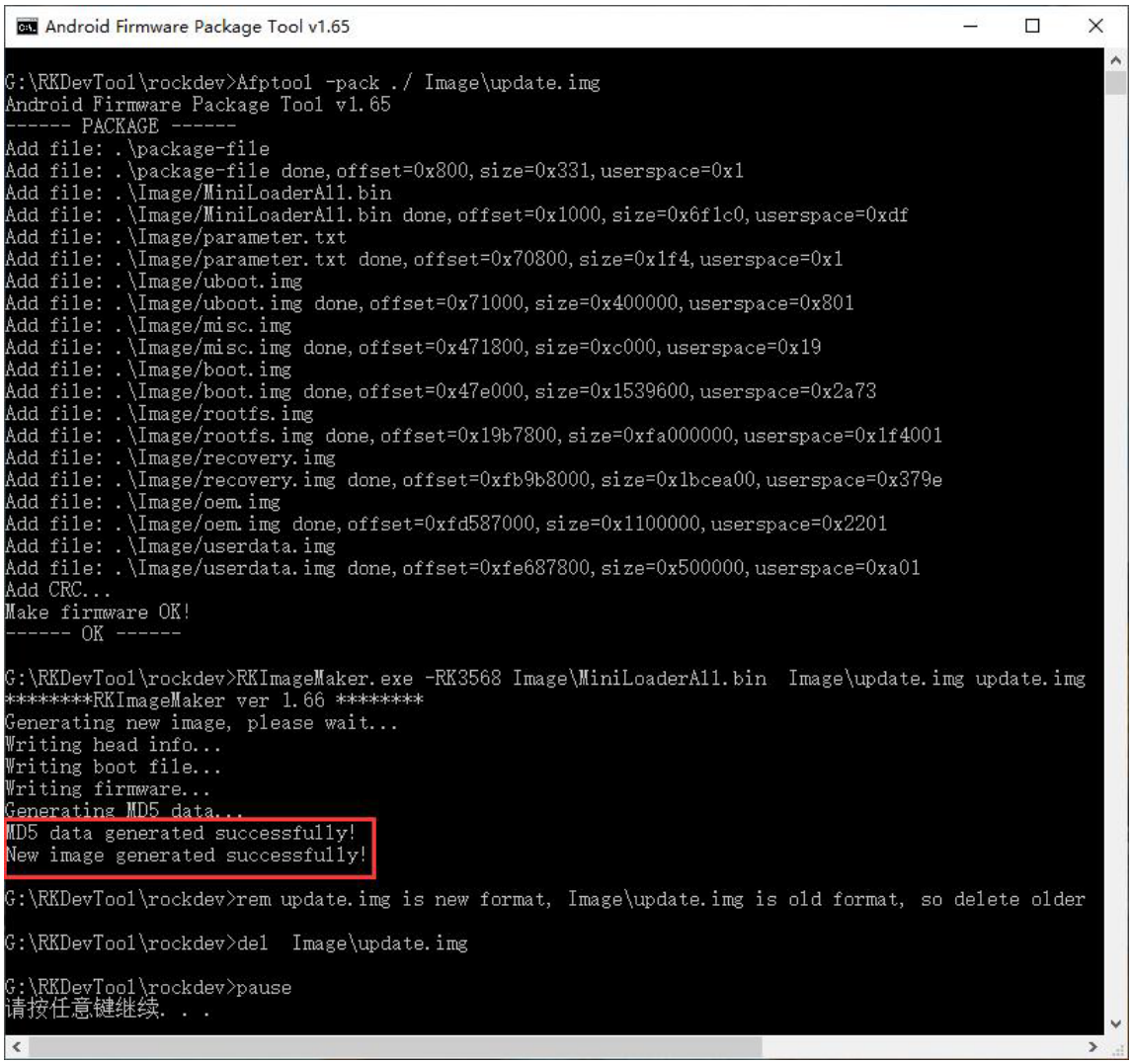
4.1 Pack Image

Step 1, copy all the files in debian directory **rockdev** to the windows **RKDevTooll/rockdev/Image.**

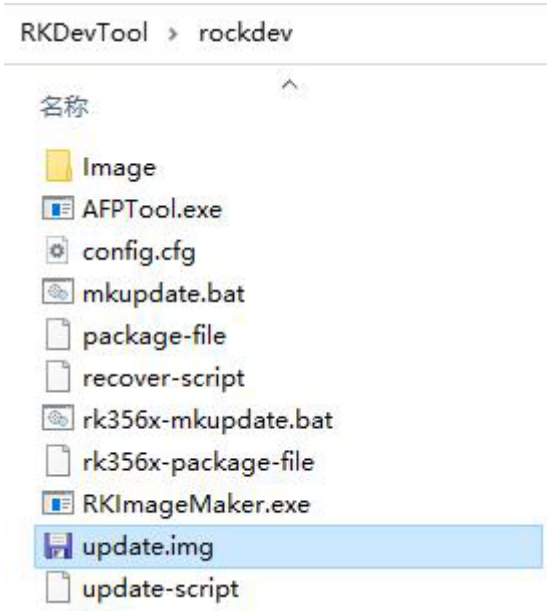


Step 2, enter **RKDevTool/rockdev/**, double-click to run **rk356x-mkupdate.bat.**





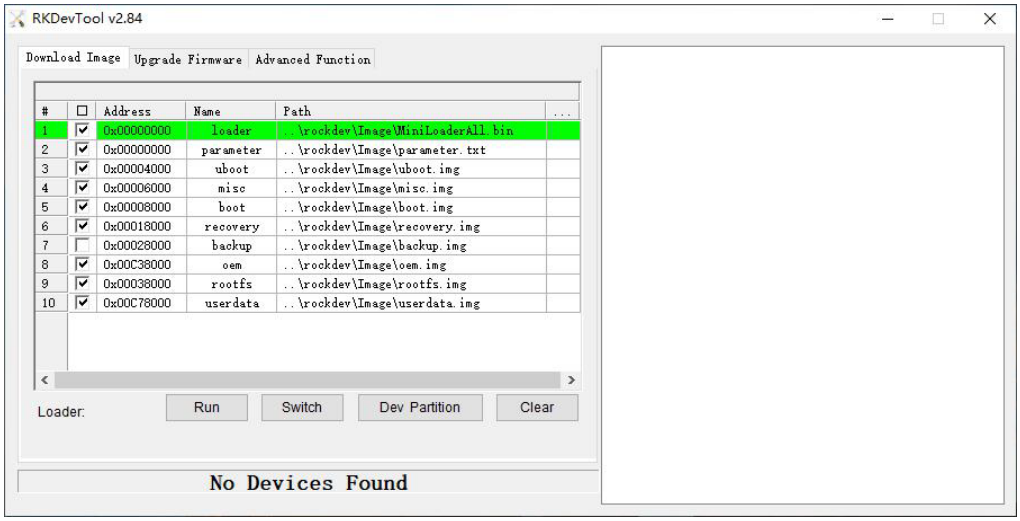
Step 3, the **update.img** will be generated in **rockdev** directory.



4.2 Unzip Firmware

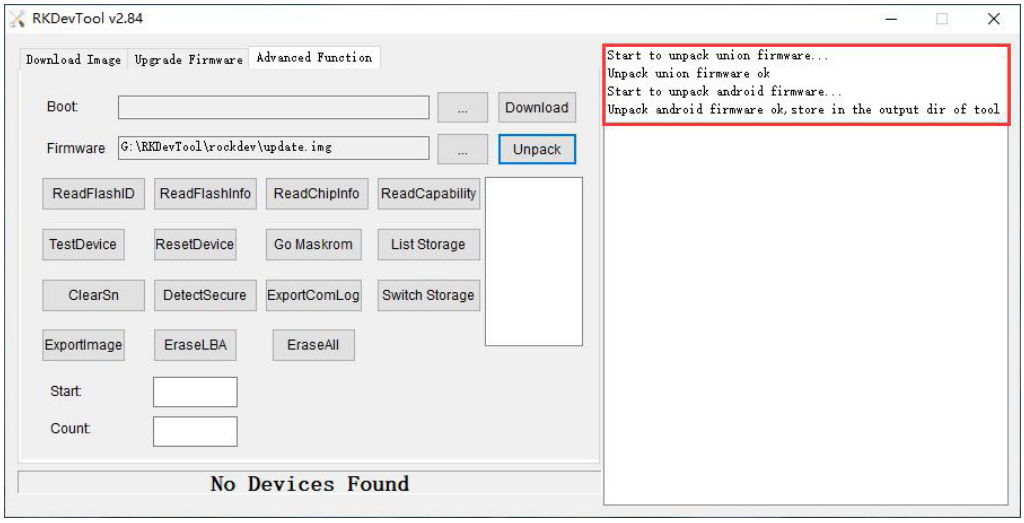
Unzip Firmware in windows.

Step 1, open **RKDevTool.exe** (*Path:RKDevTool\RKDevTool_Release*\RKDevTool.exe).

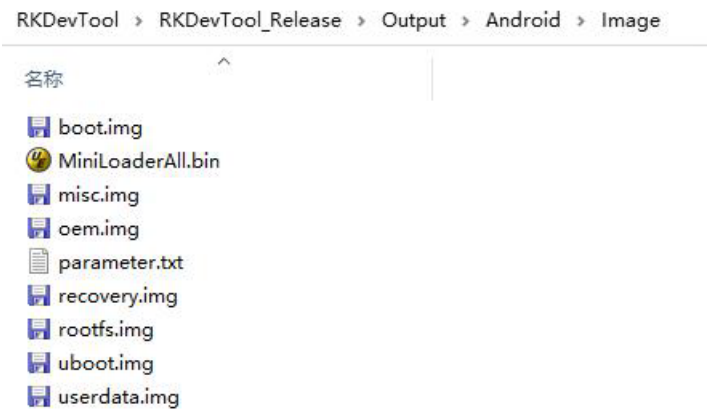


Step 2, click **Advanced Function** -> **Firmware**, select update.img. Click **Unpack** to Unzip.

Step 3, unpack finish as follow:



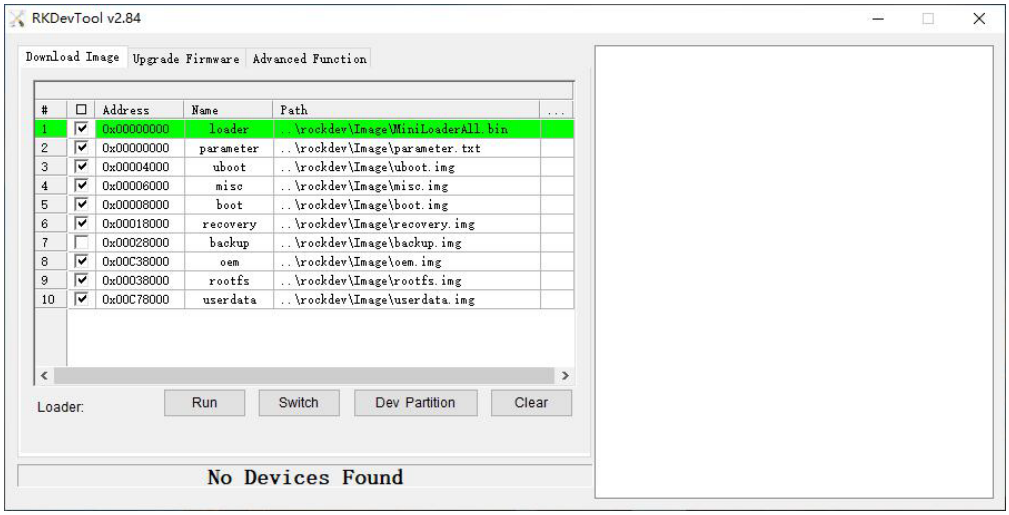
The unzip files will be generated in **\RKDevTool\RKDevTool_Release\Output\Android\Image** directory.



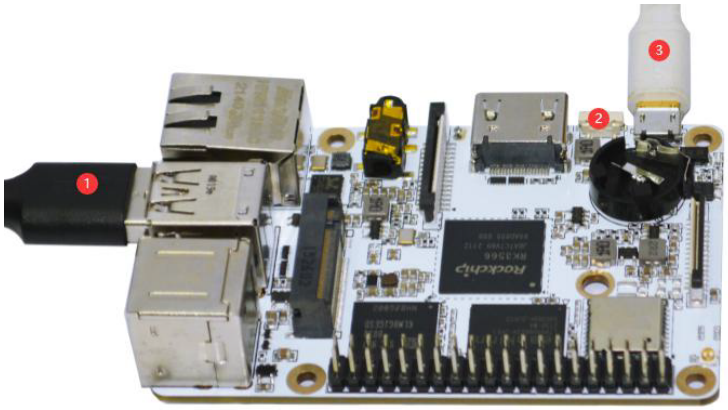
5. Burn Images

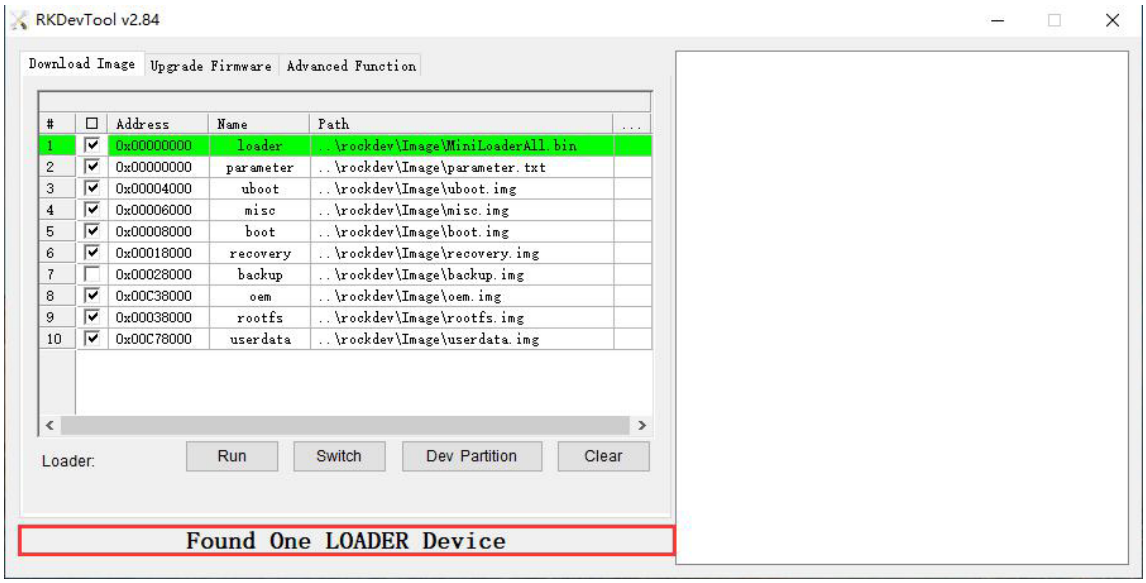
Step 1, unzip **RKDevTool.rar** on Windows.

Step 2, open **RKDevTool.exe** (*Path:RKDevTool\RKDevTool_Release*\RKDevTool.exe).

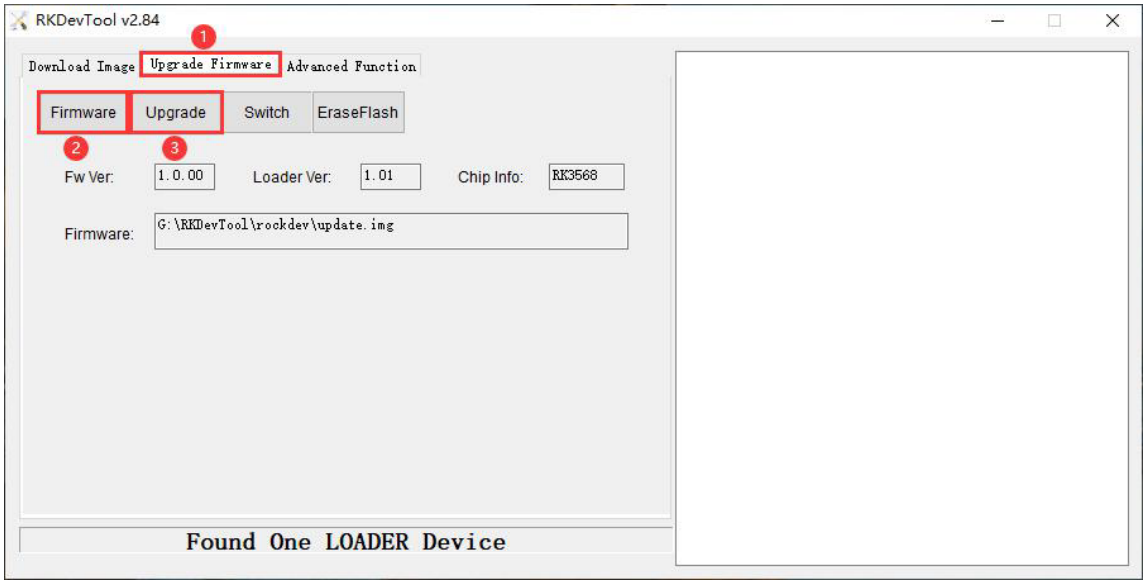


Step 3, connect PC and development board with USB OTG cable, keep pressing the **RECOVERY** Key and power the board (connect Micro USB cable) until the windows PC shows **Found One LOADER Device.**

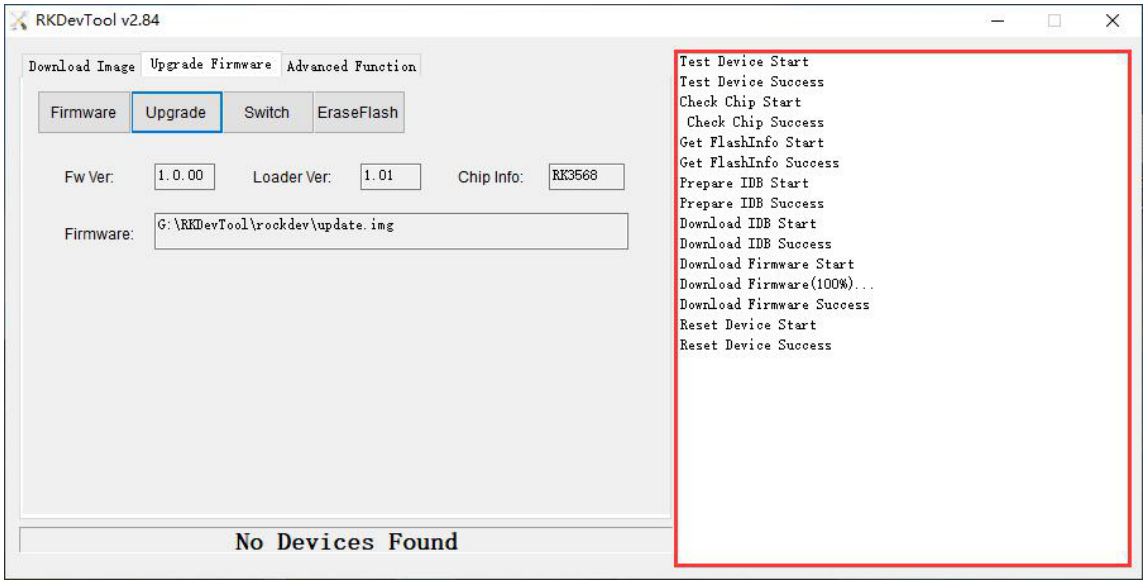




Step 4, click **Upgrade Firmware -> Firmware**, select update.img. Click **Upgrade** to flash.



*Step 4,*after burning the image successfully, as shown in the figure.

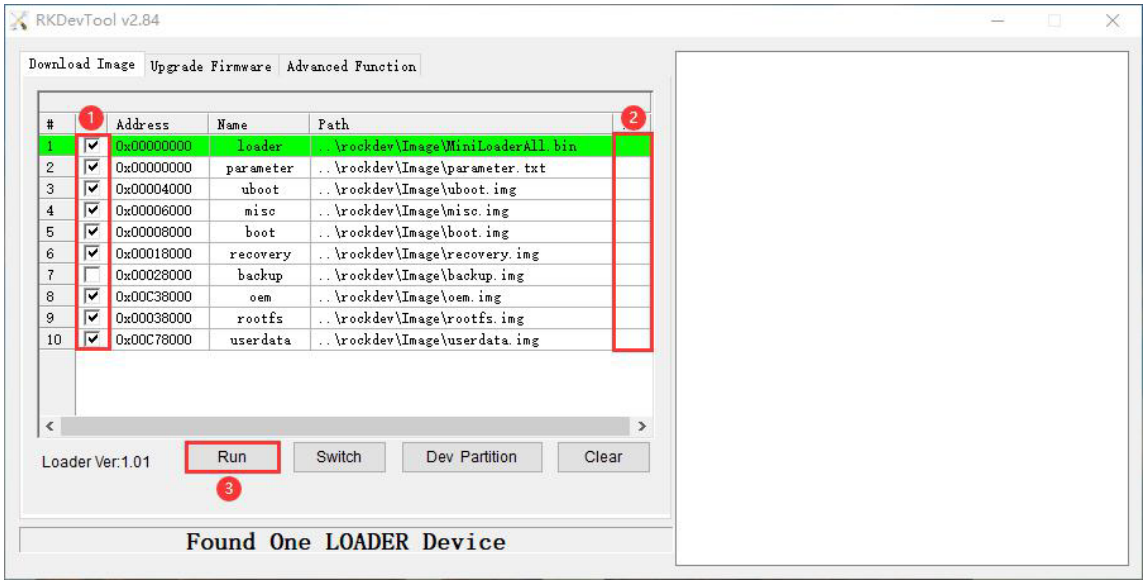


User can also update the firmware separately.

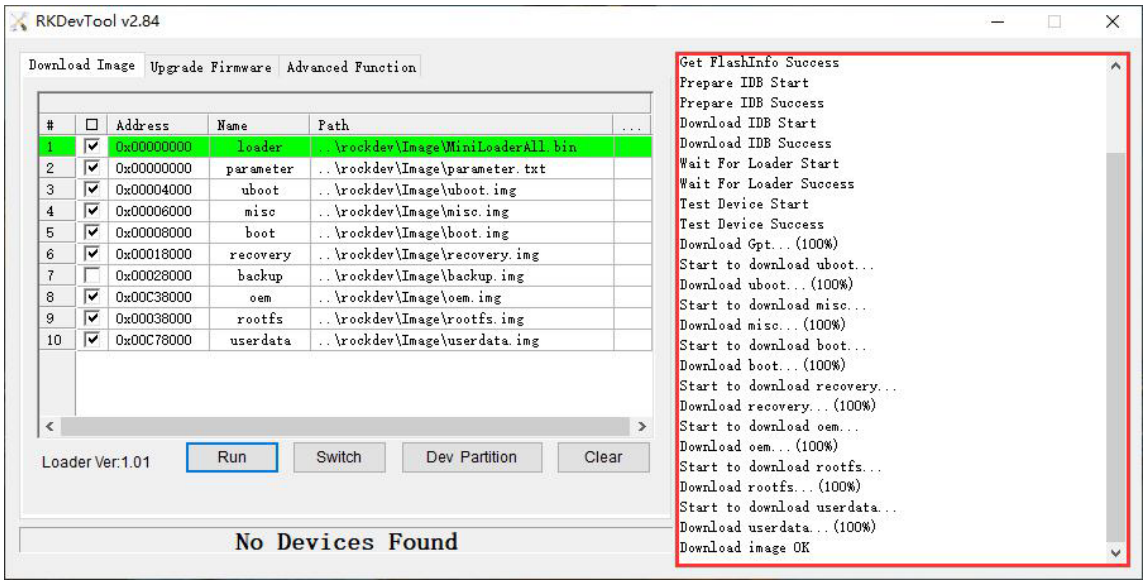
Step 1, select the checkbox on the left.

Step 2, click the column on the right side for the path of the file want to flash.

Step 3, click “run” to flash the image.



Step 4, after burning the image successfully, as shown in the figure.



6. Debian10 Application

6.1 Display

6.1.2 LVDS Display

After connecting the lvds screen(1280x800), power on.

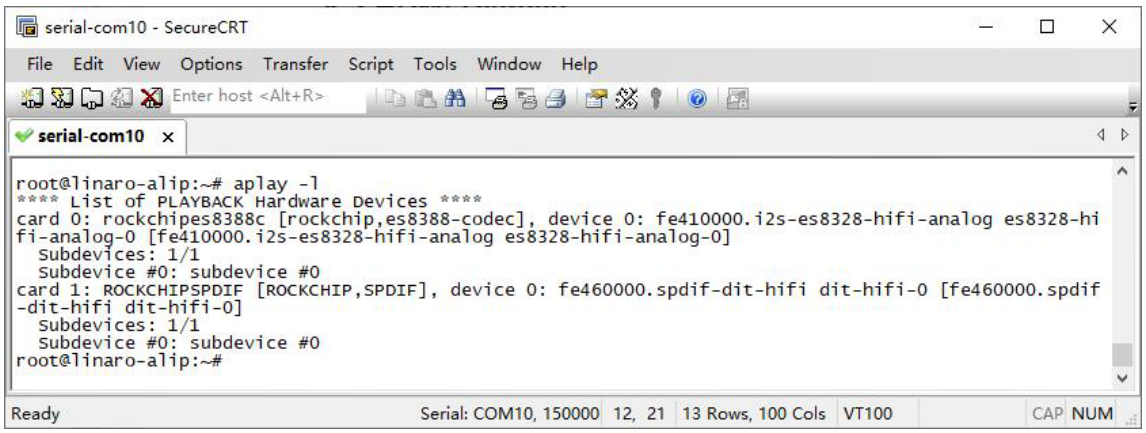
6.1.2 HDMI Display

Connect the board and monitor with a HDM I cable, then start up.

NOTE: The board default support HDMI display. If use lvds need to flash the boot-lvds.img separately.

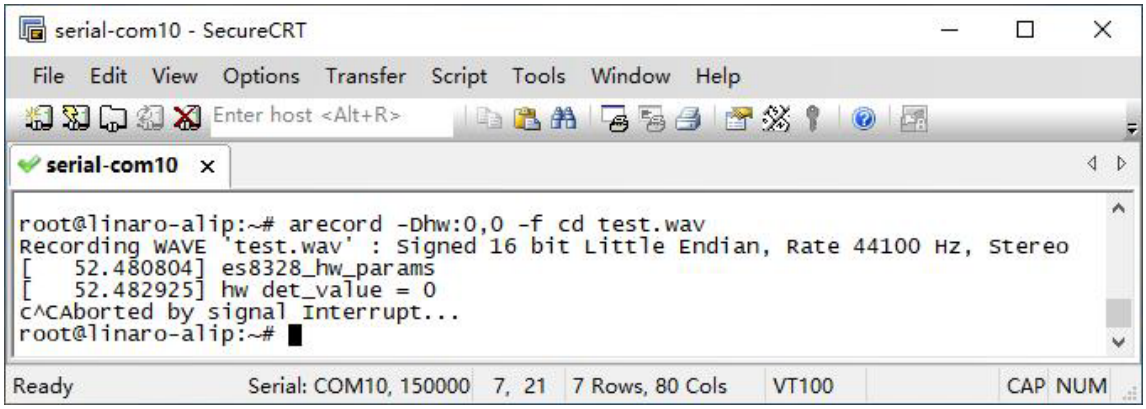
6.2 Audio I/O

aplay -l (View sound card devices)



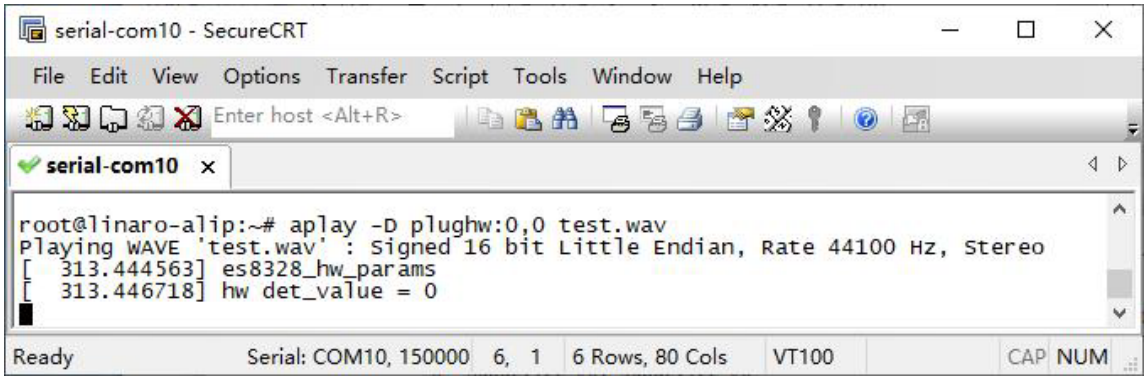
Record audio file, when the headset is not connected, the microphone on the board is used, and the input recording command will output hw det_value = 0; when the headset is plugged in, the microphone on the headset is used, and the recording command will output hw det_value = 1.

arecord -Dhw:0,0 -f cd test.wav (sound card 0, device 0)



play audio file:

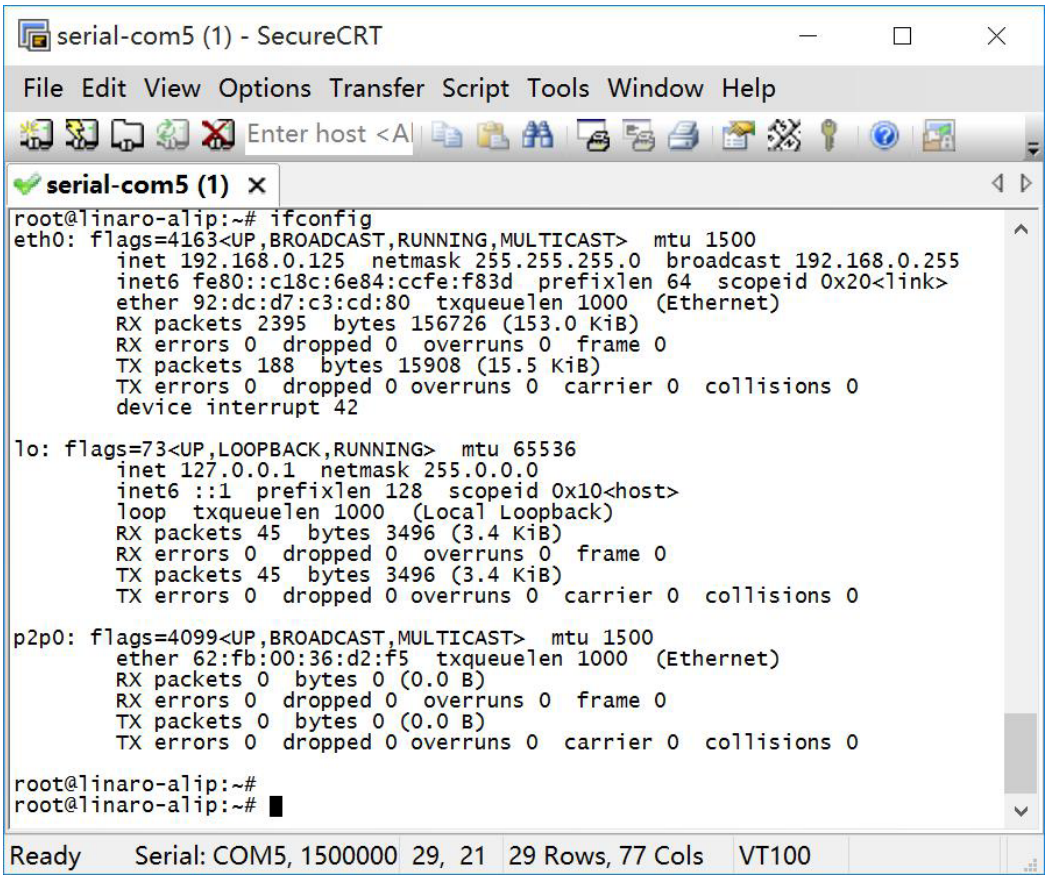
aplay -D plughw:0,0 test.wav (sound card 0, device 0)



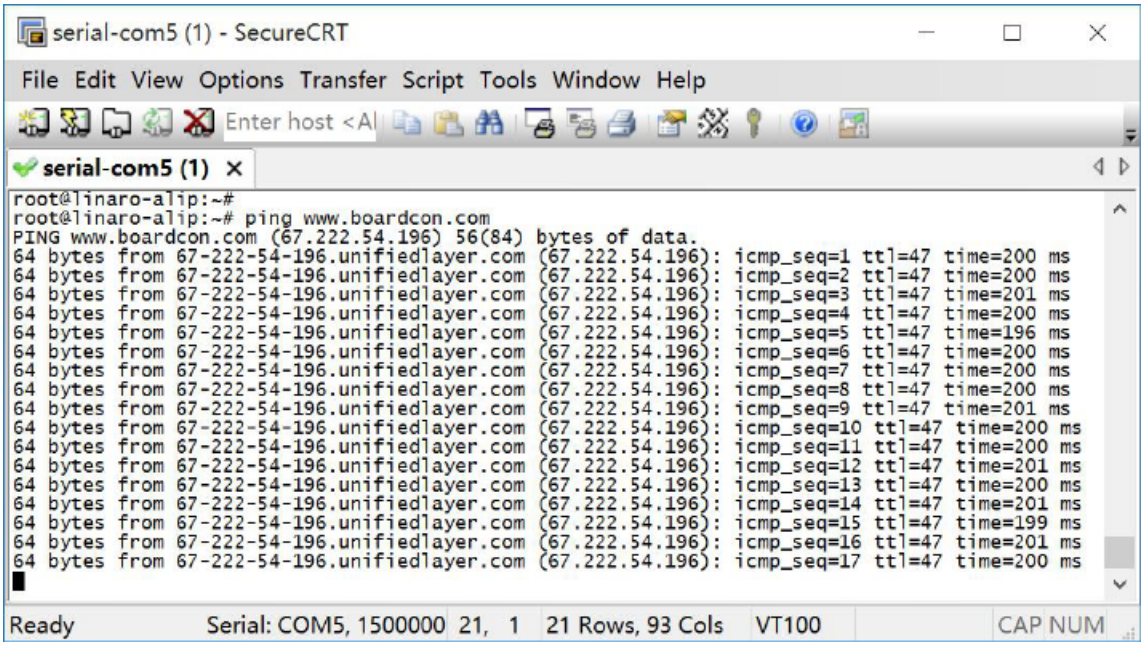
6.3 Ethernet

Connect the Board and router with an Ethernet cable (default DHCP=Yes). User can ping URL/IP at terminal. or open the browser to test Network.

ifconfig

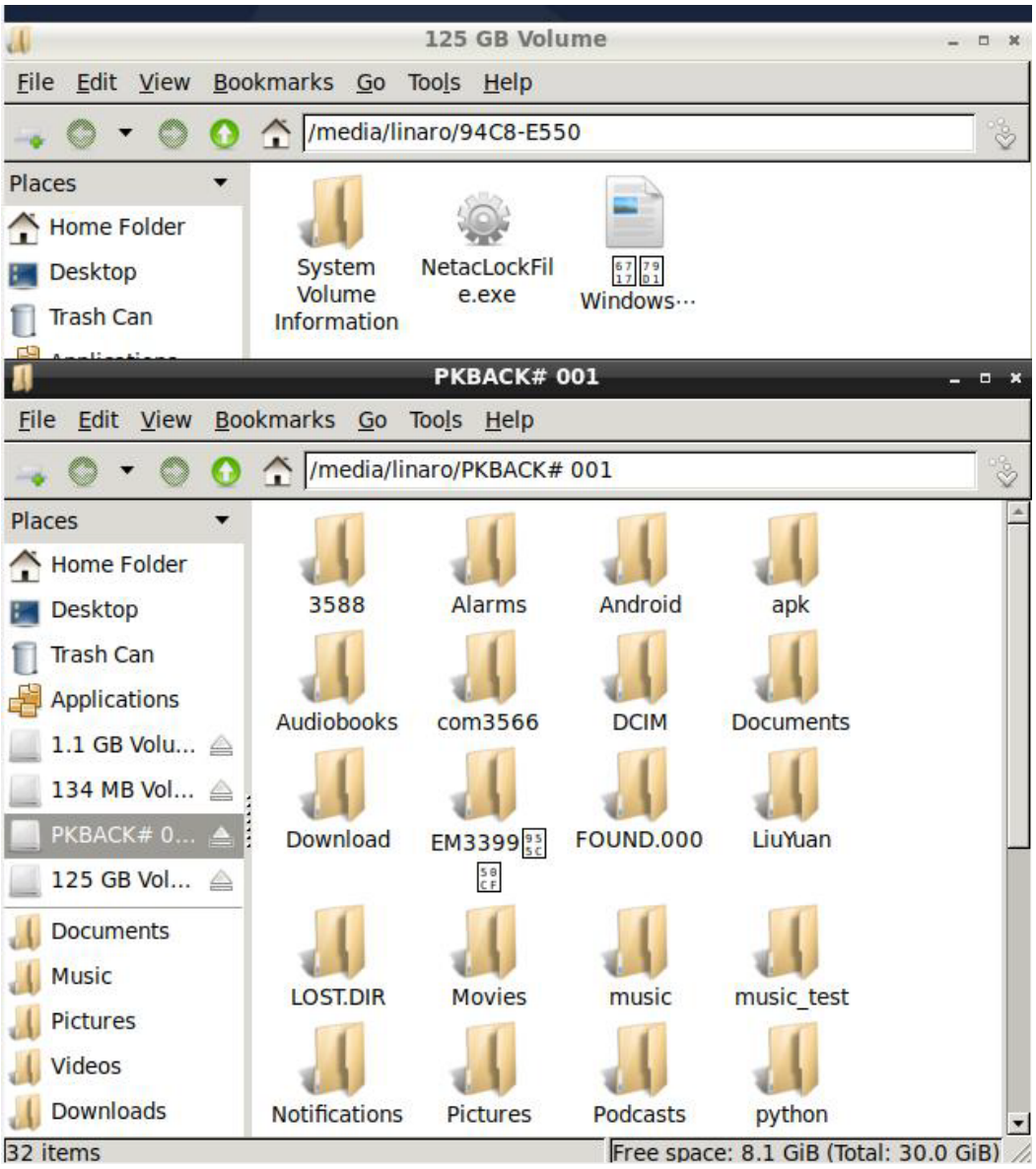


ping www.urveboard.com

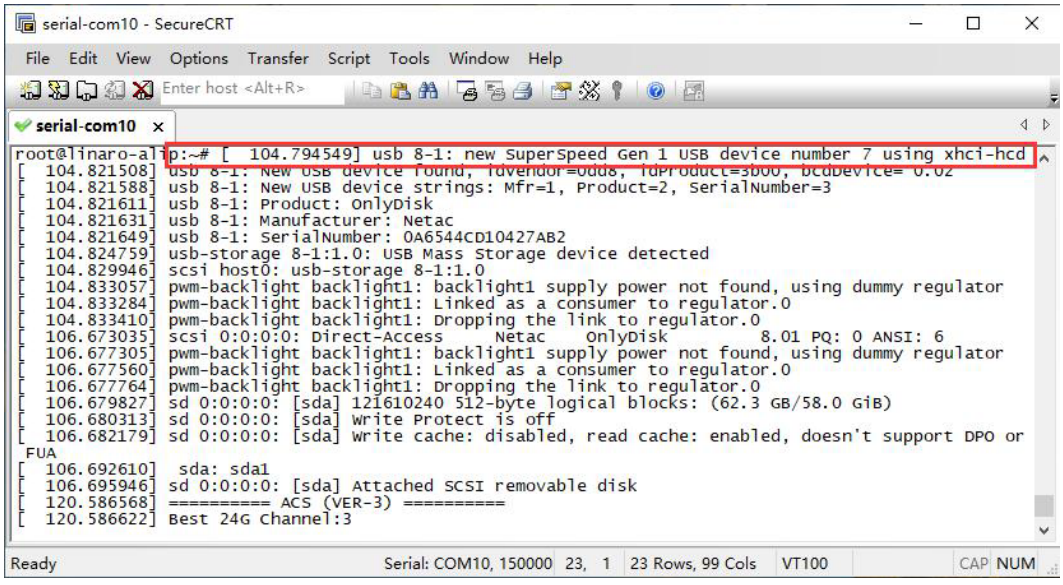


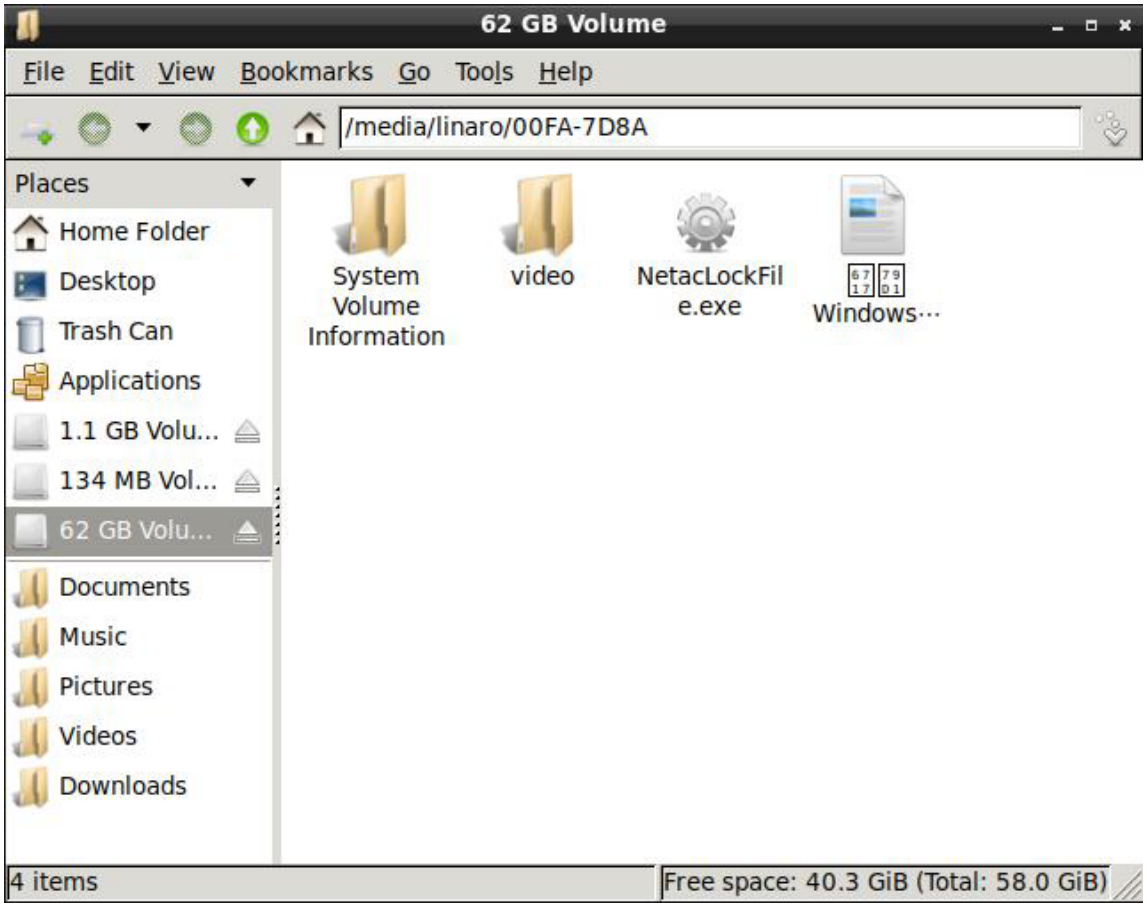
6.4 USB Host

6.4.1 USB2.0x3:(USB OTG use for host)


125 GB Volume
File Edit View Bookmarks Go Tools Help
/media/linaro/94C8-E550
Places
Home Folder
Desktop
Trash Can
System Volume Information
NetacLockFile.exe
Windows···
PKBACK# 001
File Edit View Bookmarks Go Tools Help
/media/linaro/PKBACK# 001
Places
Home Folder
Desktop
Trash Can
Applications
1.1 GB Volu...
134 MB Vol...
PKBACK# 0...
125 GB Vol...
Documents
Music
Pictures
Videos
Downloads
3588
Alarms
Android
apk
Audiobooks
com3566
DCIM
Documents
Download
EM3399
FOUND.000
LiuYuan
LOST.DIR
Movies
music
music_test
Notifications
Pictures
Podcasts
python
32 items
Free space: 8.1 GiB (Total: 30.0 GiB)

6.4.2 USB3.0:

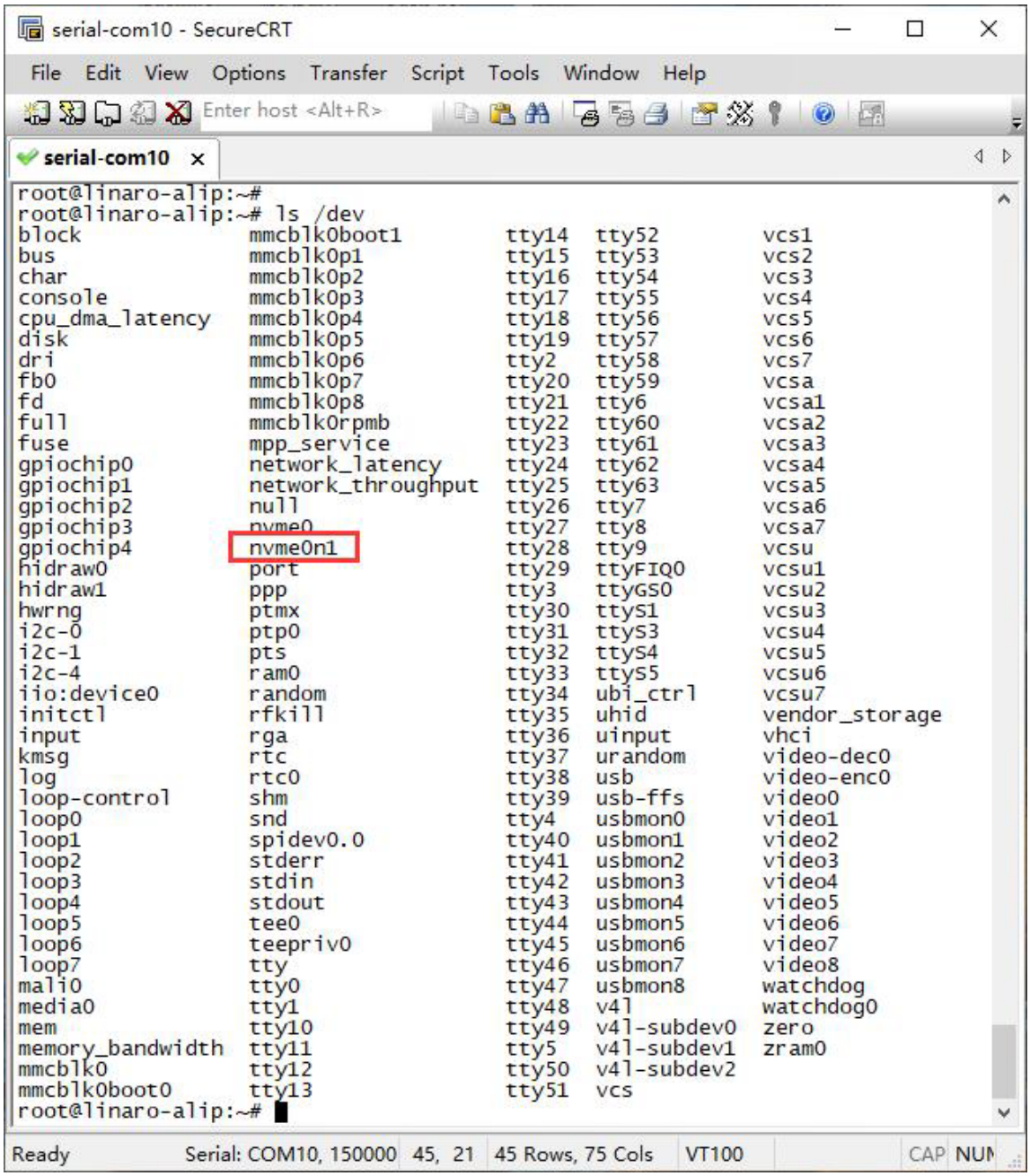

serial-com10 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com10
root@linaro-alip:~# [104.794549] usb 8-1: new SuperSpeed Gen 1 USB device number 7 using xhci-hcd
[104.821508] usb 8-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[104.821588] usb 8-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[104.821611] usb 8-1: Product: OnlyDisk
[104.821631] usb 8-1: Manufacturer: Netac
[104.821649] usb 8-1: SerialNumber: 0A6544CD10427AB2
[104.824759] usb-storage 8-1:1.0: USB Mass Storage device detected
[104.829946] scsi host0: usb-storage 8-1:1.0
[104.833057] pwm-backlight backlight1: backlight1 supply power not found, using dummy regulator
[104.833284] pwm-backlight backlight1: Linked as a consumer to regulator.0
[104.833410] pwm-backlight backlight1: Dropping the link to regulator.0
[106.673035] scsi 0:0:0:0: Direct-Access Netac OnlyDisk 8.01 PQ: 0 ANSI: 6
[106.677305] pwm-backlight backlight1: backlight1 supply power not found, using dummy regulator
[106.677560] pwm-backlight backlight1: Linked as a consumer to regulator.0
[106.677764] pwm-backlight backlight1: Dropping the link to regulator.0
[106.679827] sd 0:0:0:0: [sda] 121610240 512-byte logical blocks: (62.3 GB/58.0 GiB)
[106.680313] sd 0:0:0:0: [sda] Write Protect is off
[106.682179] sd 0:0:0:0: [sda] Write cache: disabled, read cache: enabled, doesn't support DPO or FUA
[106.692610] sda: sda1
[106.695946] sd 0:0:0:0: [sda] Attached SCSI removable disk
[120.586568] ========== ACS (VER-3) ==========
[120.586622] Best 24G Channel:3
Ready
Serial: COM10, 150000 23, 1 23 Rows, 99 Cols VT100
CAP NUM



6.5 M.2 SSD

Connect the SSD to the development board before power on. Then execute follow command to erase SSD and mount.

ls /dev (View SSD device name)

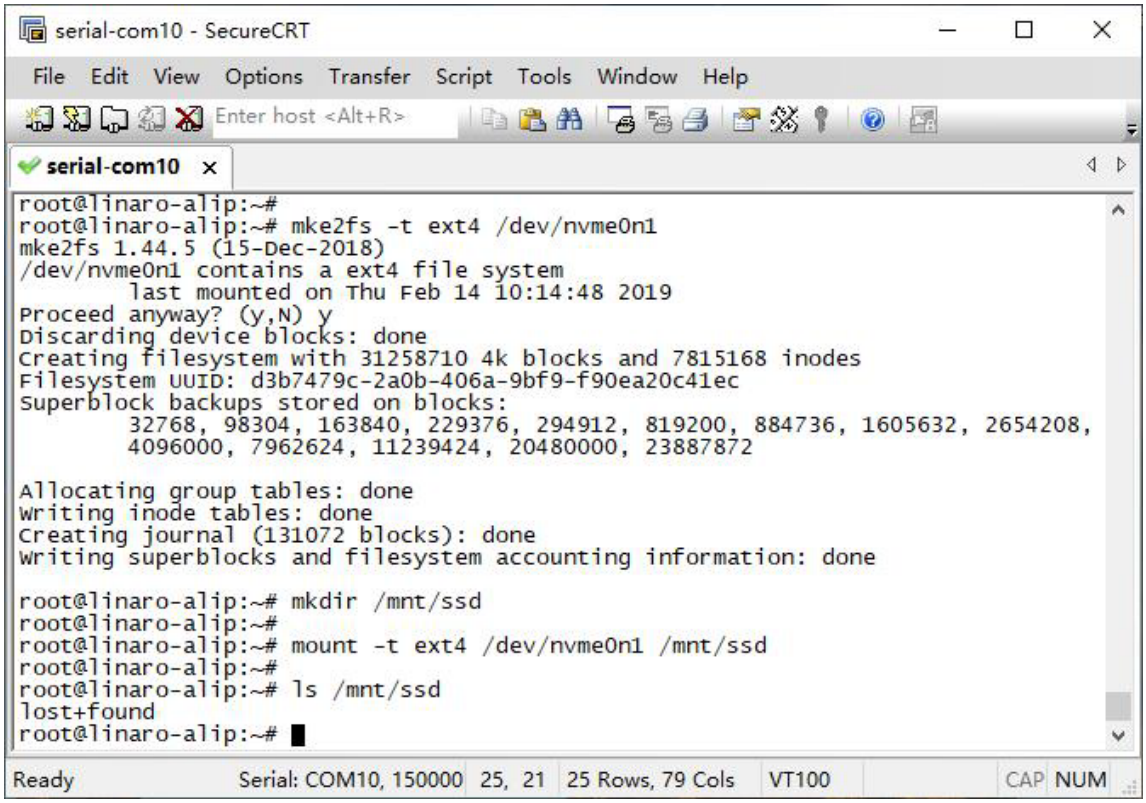


mke2fs -t ext4 /dev/nvme0n1 (If SSD is not ext4 format, format it to ext4 file system)

mkdir /mnt/ssd (Create a new directory file)

mount -t ext4 /dev/nvme0n1 /mnt/ssd (Mount SSD to the new directory)

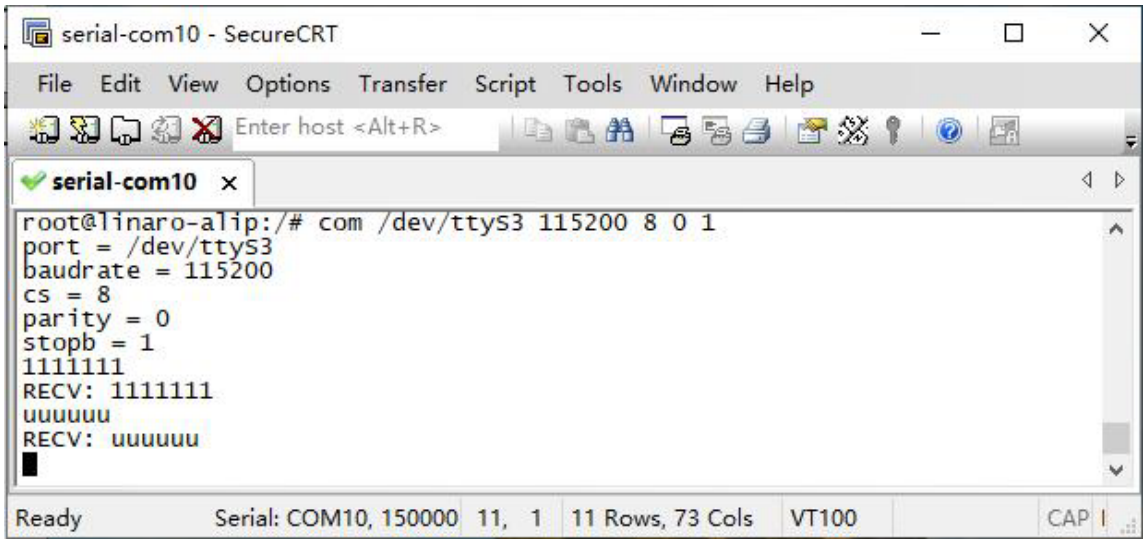
ls /mnt/ssd (View the contents of the ssd)



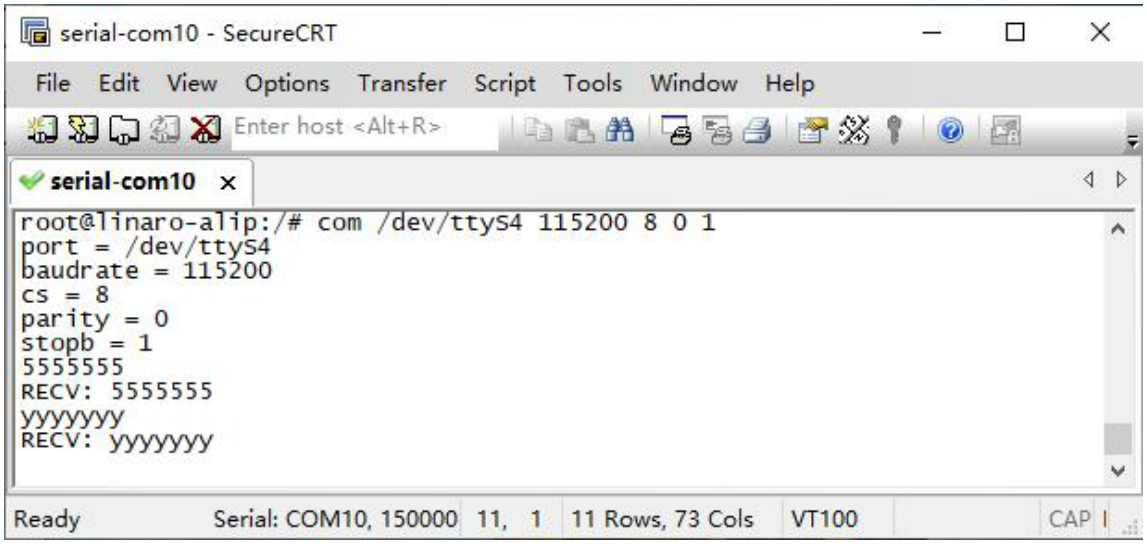
6.6 UART

Connect the UART RX and TX with the test line. Execute the follow command to test.

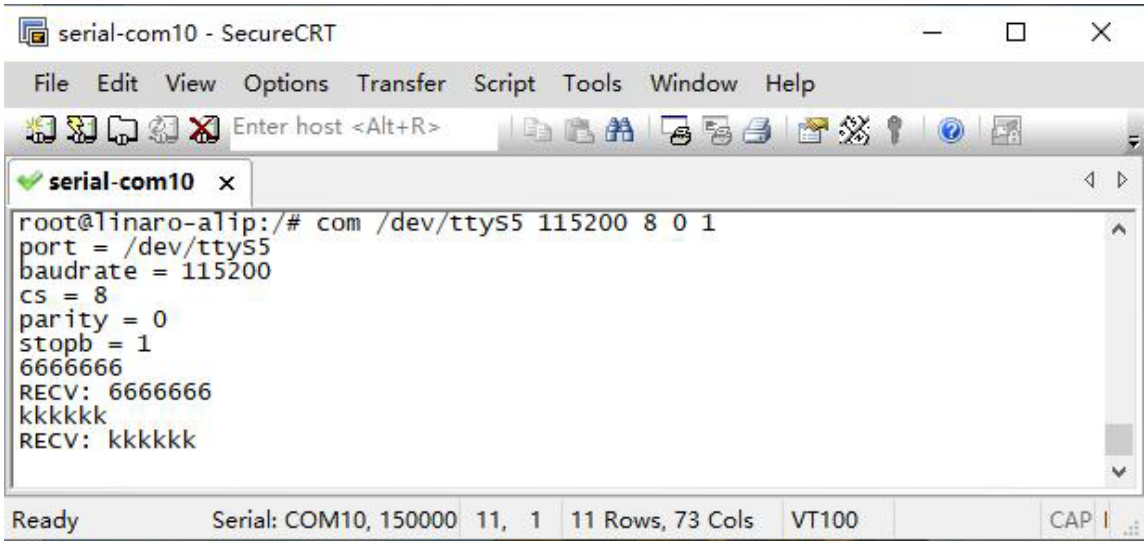
com /dev/ttyS3 115200 8 0 1 (CON3 PIN3&PIN5)



com /dev/ttyS4 115200 8 0 1 (CON3 PIN11&PIN12)



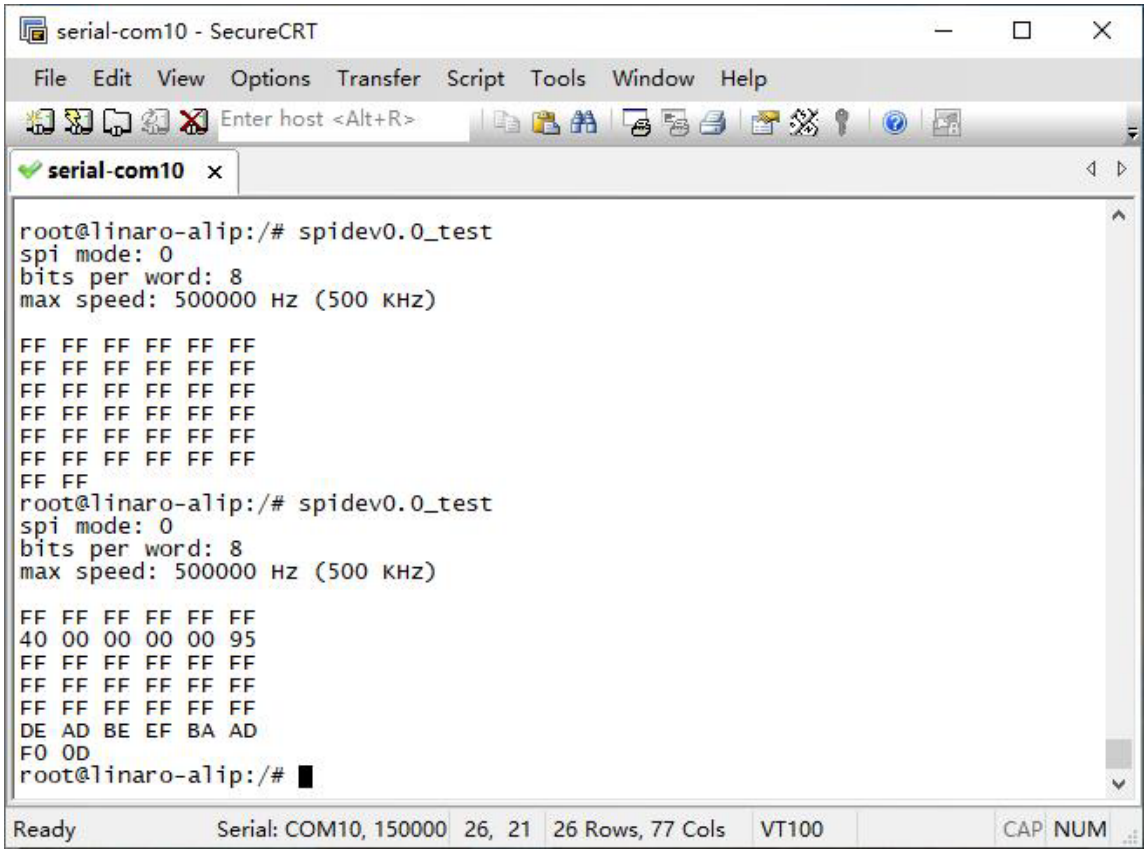
com /dev/ttyS5 115200 8 0 1 (CON3 PIN8&PIN10)



6.7 SPI

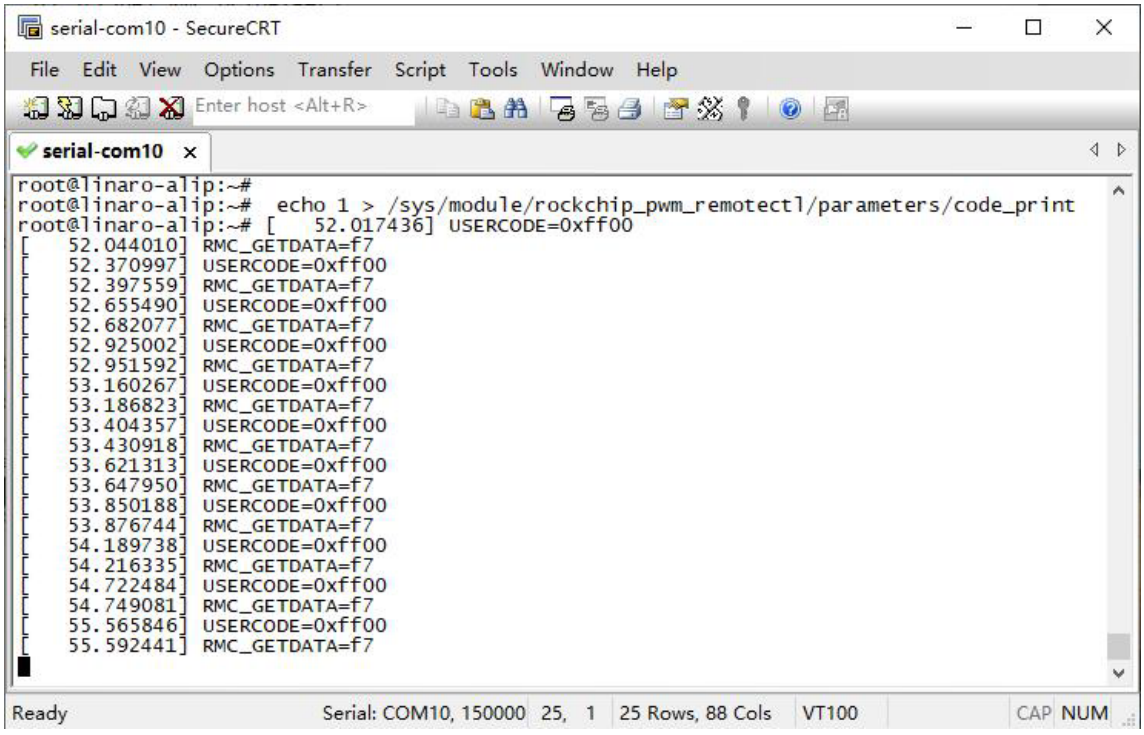
Execute the following command after short-circuiting the signal pin(CON3 PIN19&PIN21), you can see the value change.

spidev0.0_test



6.8 IR

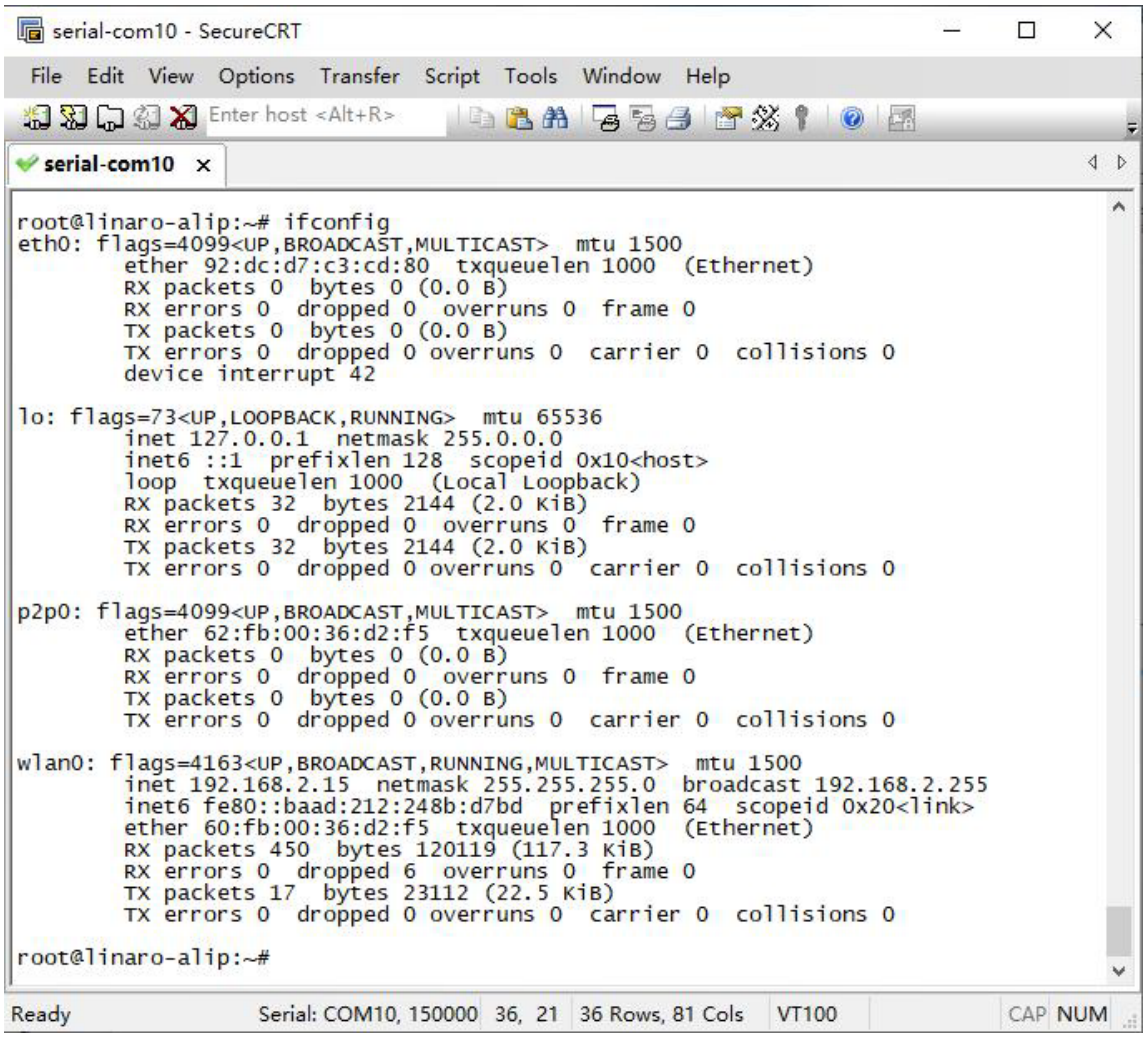
echo 1 > /sys/module/rockchip_pwm_remotectl/parameters/code_print



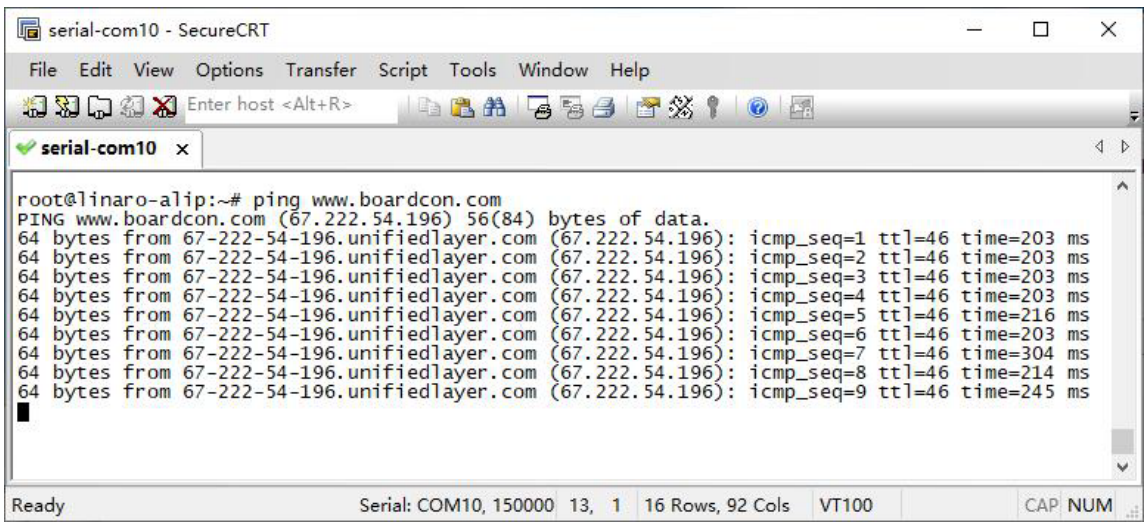
6.9 WIFI

Connect the WiFi antenna, then click the network icon in the lower right corner of the UI interface, select the SSID from the list of available networks and enter the password. After connected, can ping the URL/IP at the terminal.

ifconfig



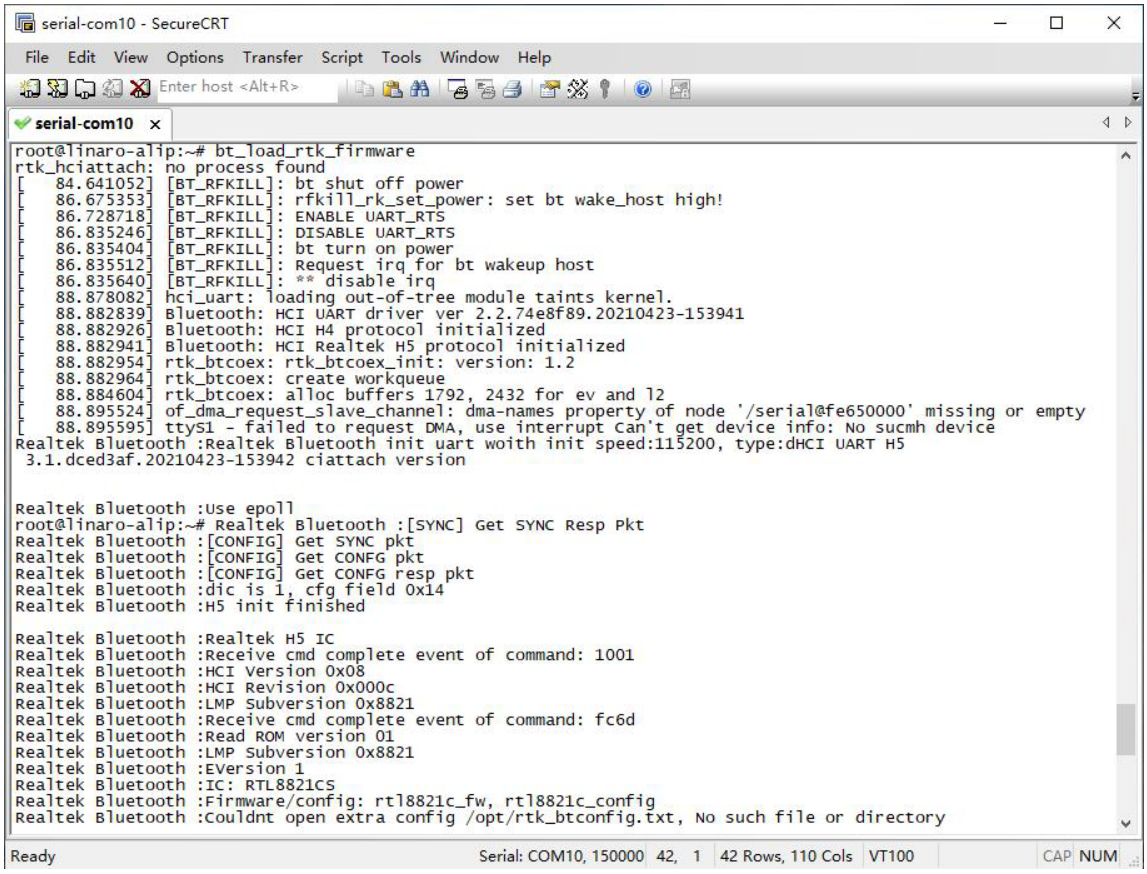
ping www.urveboard.com



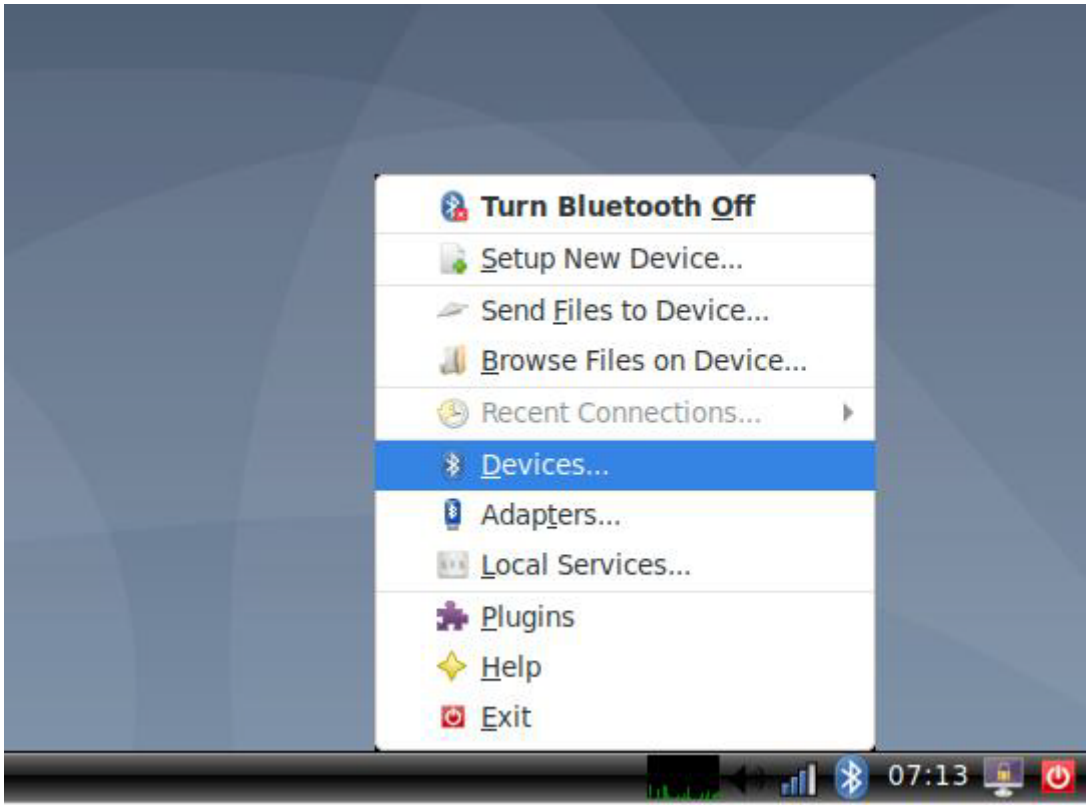
6.10 Bluetooth

Step 1, execute the following command to turn on bluetooth.

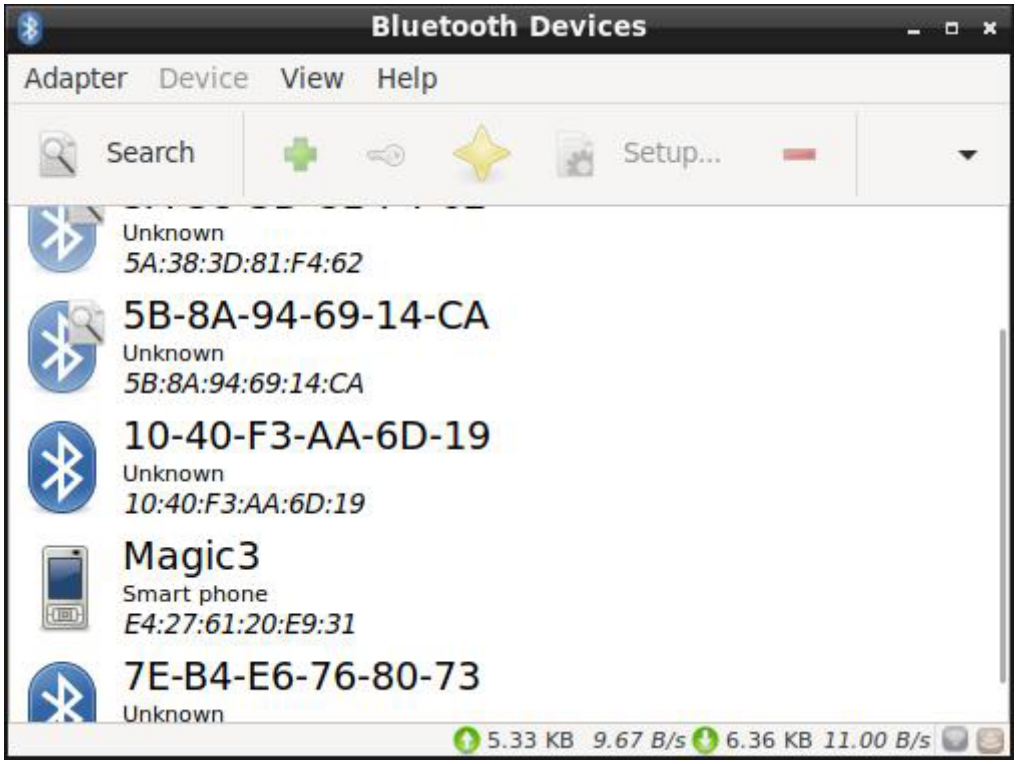
bt_load_rtk_firmware



Step 2, click the Bluetooth icon in the lower right corner of the desktop and select the "**Devices...**" option.



Step 3, click the **"Search"** button to start searching and select the available device in the list to pair.



Step 4, after pairing, devices can connect with each other automatically.

6.11 RTC

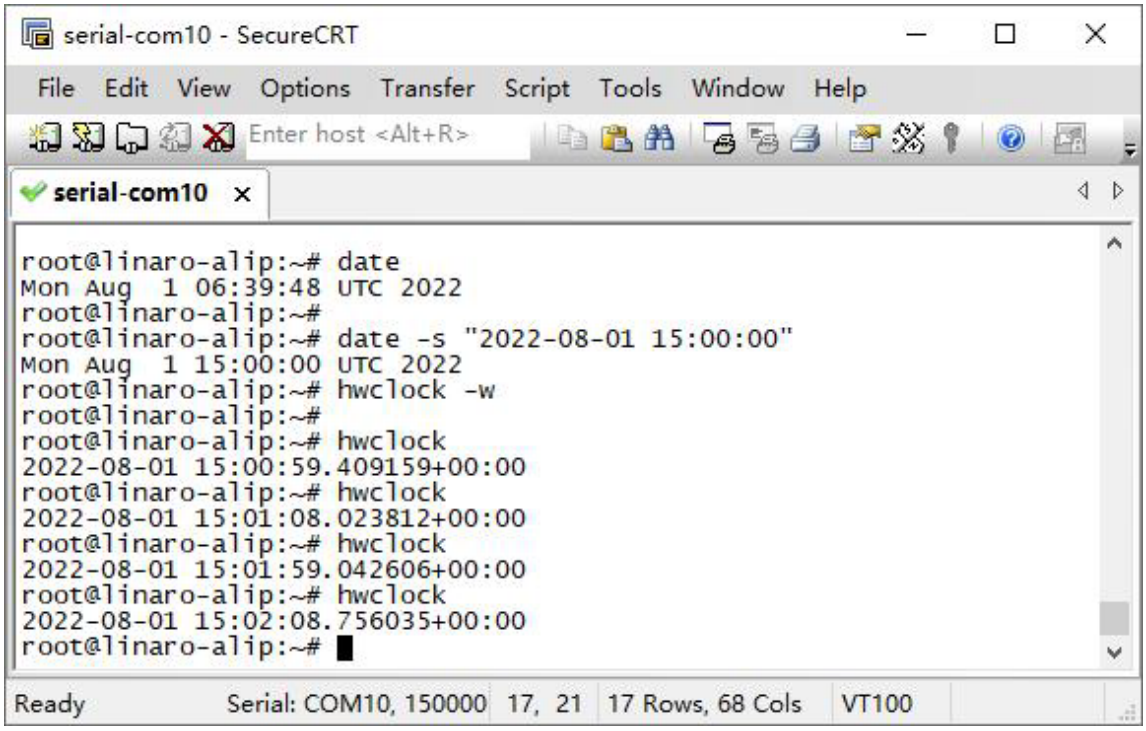
Execute the follow command to set the RTC time.

date -s "2022-08-01 15:00:00"

hwclock -w

Wait a minute then run hwclock again, it can be seen the time has changed.

hwclock



After the board is turned off, the RTC supports battery power supply, and RTC clock to be saved.

6.12 SD

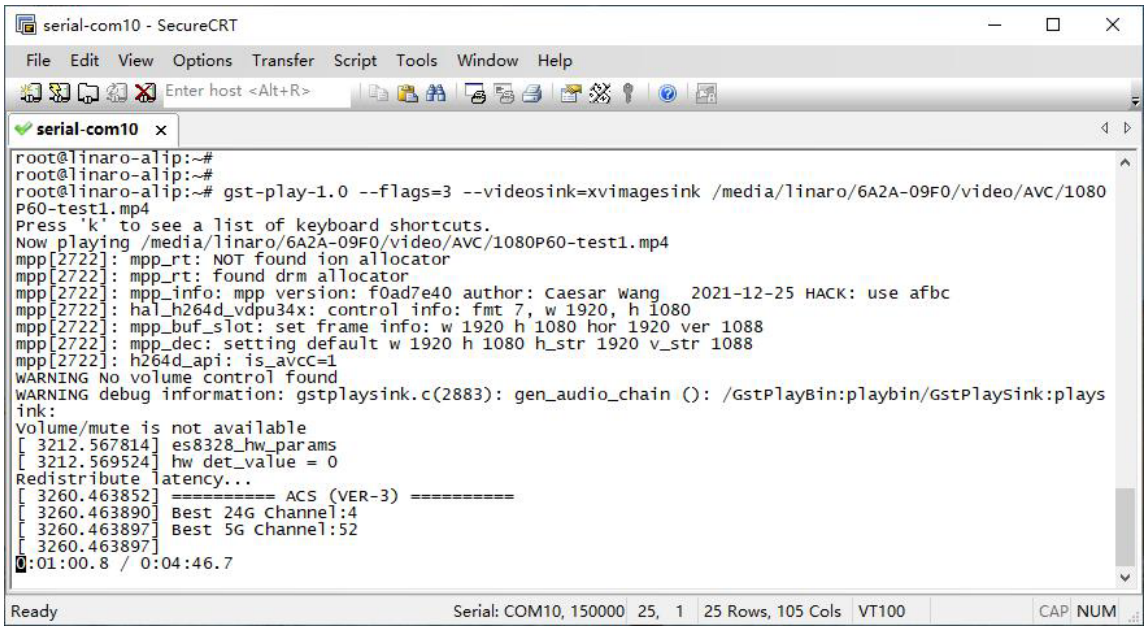
URVE Board PI supports SD Hot-plug.

6.13 Video Player

Copy the video file to sdcard/udisk and plug it into the board. After the system starts, open sdcard/udisk and execute the following command to play.

Test 1920x1080

gst-play-1.0 --flags=3 --videosink=xvimagesink /media/linaro/6A2A-09F0/video/AVC/1080P60-test1.mp4



Test 4K(max-fps to 50fps)

```
# echo performance | tee $(find /sys/devices -name *governor)
# echo 400000000 > /sys/kernel/debug/clk/aclk_rkvdec/clk_rate
# export GST_DEBUG=fpsdisplaysink:10
# export KMSSINK_DISABLE_VSYNC=1
# export GST_MPP_VIDEODEC_DEFAULT_ARM_AFBC=1
#GST_DEBUG=fpsdisplaysink:5 gst-play-1.0
/media/linaro/6A2A-09F0/video/HEVC/I.O.I-Dream.Girl.2160p.UHDTV.H265.ts --flags=3
--use-playbin3 --videosink="fpsdisplaysink    text-overlay=false video-sink=\"kmssink plane-id=87\"
sync=false"
```