EM3399 User Manual

V5.0

Boardcon Embedded Design

www.boardcon.com

Preface

Overview

The content of this document is only described for the development board EM3399, aiming to help users quickly understand, apply and develop the EM3399 development board.

System Support

Development Board	Android7	Debian10	Ubuntu16.04	Android11
EM3399_EVB_V5 PICO3399_V5	Y	Y	Y	Y

Revision History

Version	Date	Author	Revision History
V5.0	2023-02-22	Liu Yuan	Initial version

Version update instructions

Due to product version upgrades or other reasons, the content of this document will be updated from time to time. At the same time, it will be synchronized to the Boardcon website (www.boardcon.com or www.armdesigner.com).

If you have any questions, concerns or comments about what is stated in the document, please feel free to contact us.

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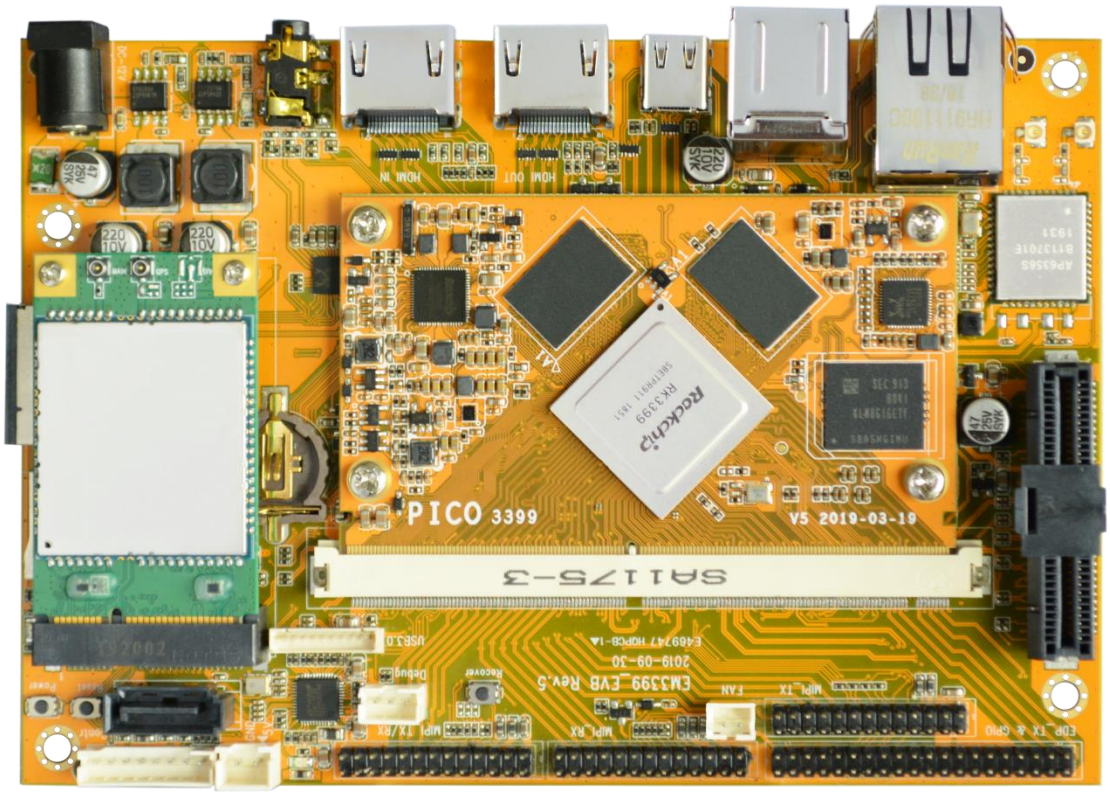
Content

Introduction

1.Overview

EM3399 is a development board designed based on Boardcon core board PICO3399. The core board of PICO3399 uses RK3399 as the core chip of the system, it integrates dual-core Cortex-A72 and quad-core Cortex-A53 with separate NEON coprocessor. RK3399 supports multi-format video decoders including H.264/H.265/VP9 up to 4Kx2K@60fps, especially, H.264/H.265 decoders support 10bits coding, and also supports H.264/MVC/VP8 encoders by 1080p@30fps, high-quality JPEG encoder/decoder, and special image preprocessor and postprocessor.

Target to 2in1 Android tablets, VR, TV-BOX, laptops, in-vehicle navigations, communications and other terminals covering industrial and consumer applications, including smart Device, advertising devices the all-in-one machines, POS systems, vehicle control terminals, thin-clients, VOIP video conferencing security monitoring policing, IoT, as well as other fields.



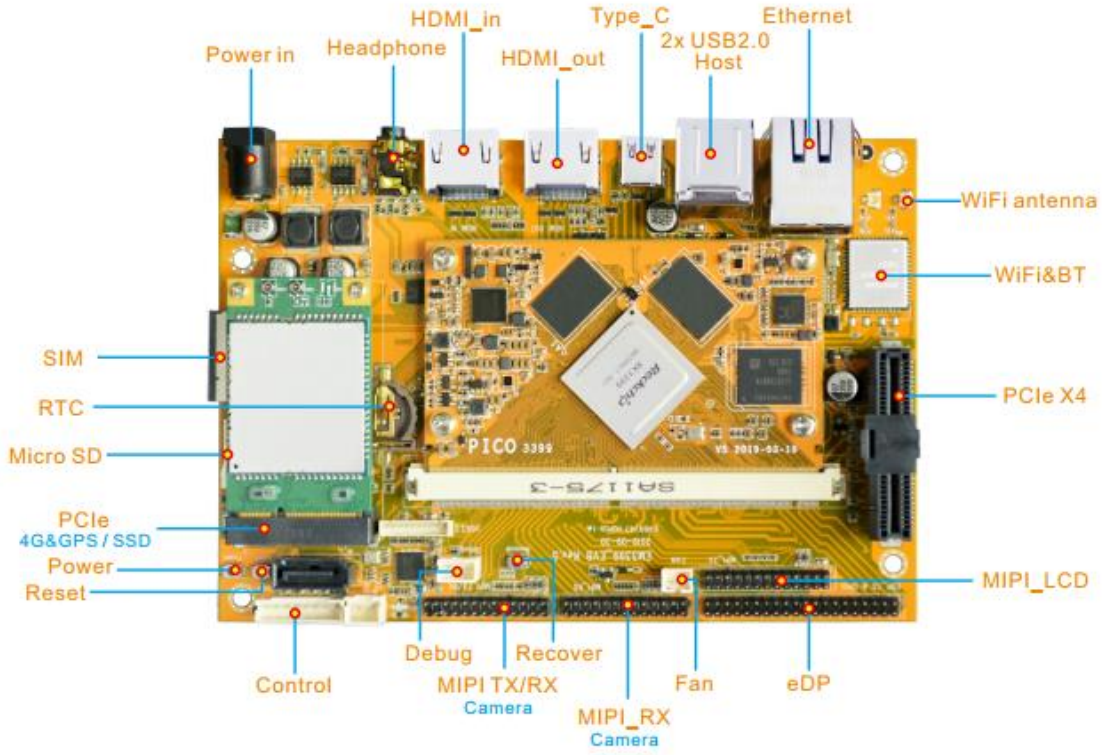
2.Product Parameters

Basic Parameters	
SOC	RK3399

CPU		Dual-core Cortex-A72@1.8GHz + Quad-core Cortex-A53 @1.4GHz
GPU		• Mali-T860 GPU, support OpenGL ES1.1/2.0/3.0/3.1/3.2, OpenCL1.2 • Support for AFBC (Frame buffering compression)
Video	Decoder	• Support 4K 60fps H.265/VP9 video decoding • Support 4K 30fps H.264 video decoding • Support 1080P@60fps VP8/VC-1/MPEG-4/2/1 video decoding
	Encoder	Support 1080P@60fps VP8/H.264 video encoding
RAM		4GB LPDDR4 (support upgrade)
ROM		8GB EMMC (support upgrade)
Support system		Android7, Debian10, ubuntu16.04, Android11
Hardware Parameters		
Extended Storage		• Support 1xSSD • Support 1x TF Card
Display		• Support 1x MIPI/EDP 1080P@60fps output • Support 1x HDMI OUT up to 4K@60fps output • Support 1x HDMI IN
Audio		• Support 1x HDMI audio output • Support 1x Headphone output/input
USB		• Support 2xUSB2.0 • Support 1x USB Type-C
Network		• Support 1x Gigabit Ethernet • Support 1x WIFI/BT module • Support 1x 4G module
Camera		• Support 2xCamera
Other parameters		• Support 1xDebug, 1xFAN, 1xRTC, 1X PCIEX4
Electrical Parameters		

Power supply input voltage	12V/3A
RTC input voltage	3V
Operating temperature	0~70°
Storage temperature	-40~85°
Structural Parameters	
Core board dimensions	50mm x 82mm
Motherboard dimensions	100mm x 145mm

3.Hardware Interface



Interface parameters	
Power in	12V DC power input interface
Headphone	Earphone output/input
HDMI_in	HDMI IN interface
HDMI_out	HDMI OUT interface
Type_C	USB type-C interface, support OTG, ADB, to HDMI/USB.
2xUSB2.0 Host	Dual-layer USB2.0 HOST interface

Gigabit Ethernet	Gigabit Ethernet RJ45 interface, via Realtek RTL8211E-VB-CG controller
WIFI antenna	WIFI antenna interface
WIFI&BT	AP6356S Module. 2.4/5G WiFi, Bluetooth 4.1
PCIex4	PCIE interface, can be used to connect adapter, such as USB, Network card, Disk array, etc.
MIPI_LCD	MIPI screen interface
eDP	EDP screen interface
Fan	Fan power interface
MIPI_RX	MIPI camera interface, multiplexing i2c2 data bus with hdmi in.
MIPI_TX/RX	MIPI camera interface
Recover	Recover key
Debug	UART2, debugging tool interface
Control	Key, IR control pin
Reset	Reset key
Power	Power key
PCIe	PCIE interface, connection 4G module or SSD.
Micro SD	MicroSD card slot
SIM	Nano SIM card port
RTC	RTC coin cell connector

Install Drivers and Tool

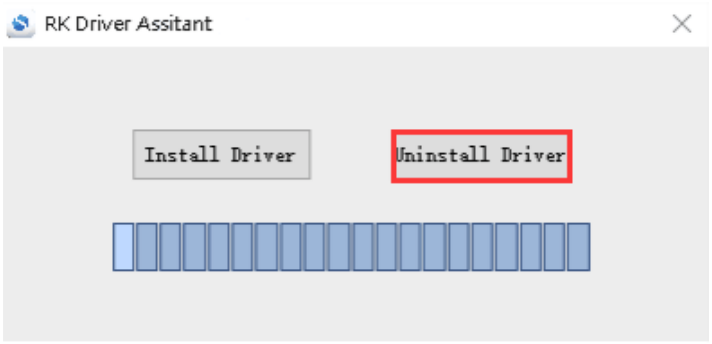
To download firmware and debug in the terminal, the following drivers and software need to be installed(for Windows computers):

Number	Driver name	Driver	Use
1	RK Driver Assitant	DriverInstall.exe	OTG USB driver installation assistant
2	CP210x	PreInstaller.exe	Serial port debugging driver
3	Serial Terminal Tool	SecureCRT.exe	Debugging tool

1.Install RK Driver Assitant

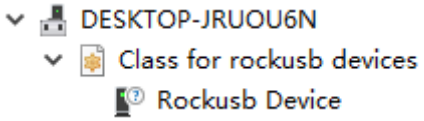
Step 1, open DriverAssitant_v5.12/DriverInstall.exe.

Step 2, to avoid driver conflicts, click **Uninstall Driver** to uninstall the driver.

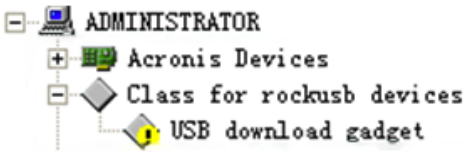


Step 3, click button **Install Driver** to install.

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 on the computer device manager after the operation in step 4, you need to proceed to the next step.



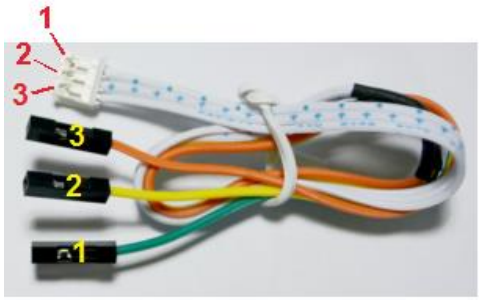
Step 6, the WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: \DriverAssitant_v5.12\ADBDriver.

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

2.Install CP210X Driver

2.1 How to connect the serial port tool

Pin	Connection Description
3V3	No need to connect.
TXD	Transmit, connect to TX pin of the board.
RXD	Receive, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
+5V	No need to connect.



Pin	Connection Description
1	RX, connect to RXD pin of the CP210X Module.
2	TX, connect to TXD pin of the CP210X Module.
3	Ground, connect to GND pin of the CP210X Module.

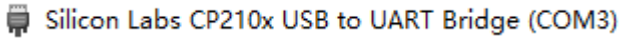
2.2 Install driver

Step 1, plug the CP2102 Module to the PC.

Step 2, unzip CP210x_Windows_Drivers_with_Serial_Enumeration.zip on Windows.

Step 3, select and install the corresponding PreInstaller.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.

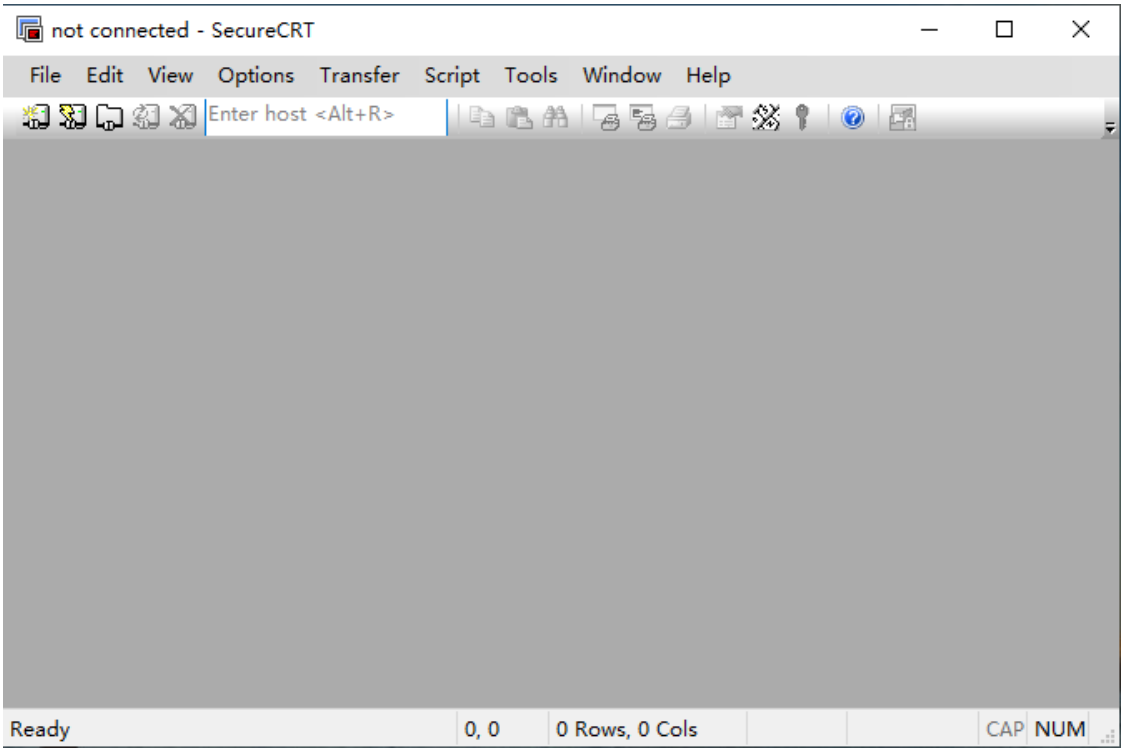


3.Install Serial Terminal Tool

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

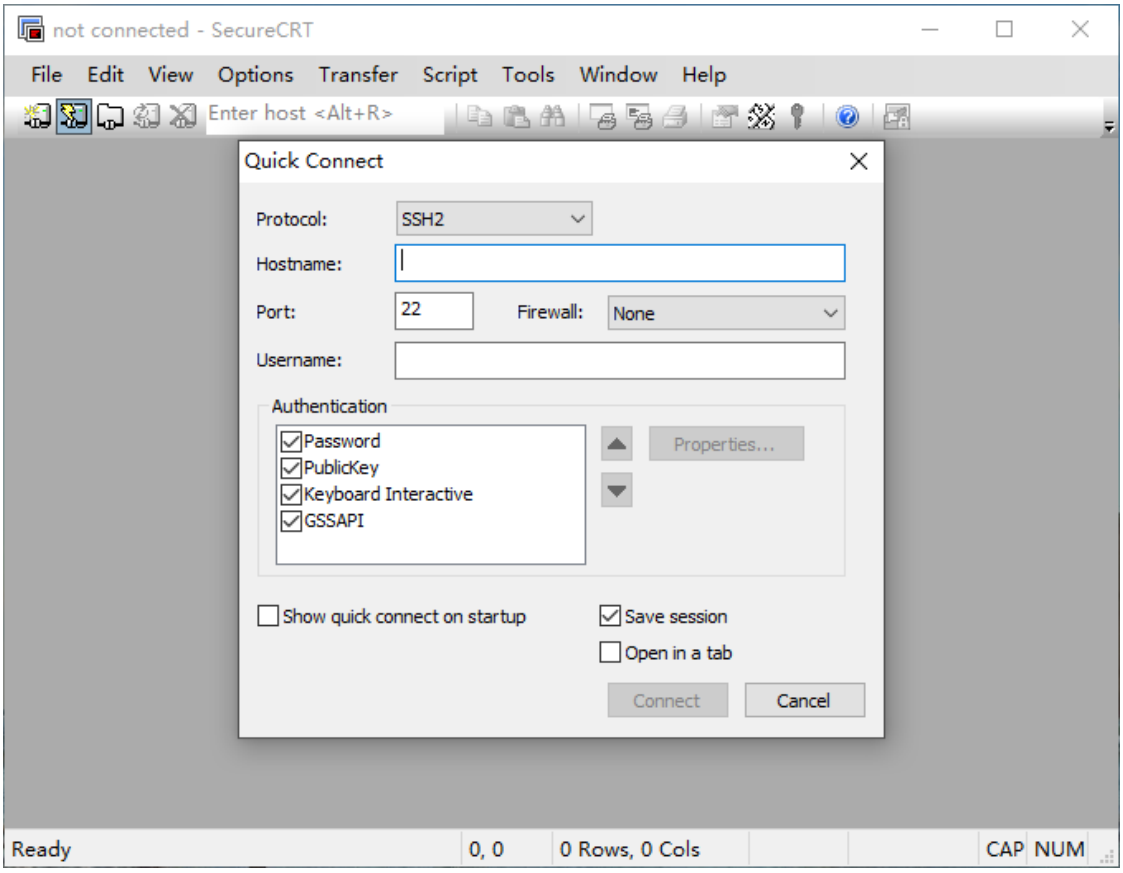
Step 1, unzip Platform/SecureCRT.rar on PC.

Step 2, click SecureCRT/SecureCRT.exe open the SecureCRT.

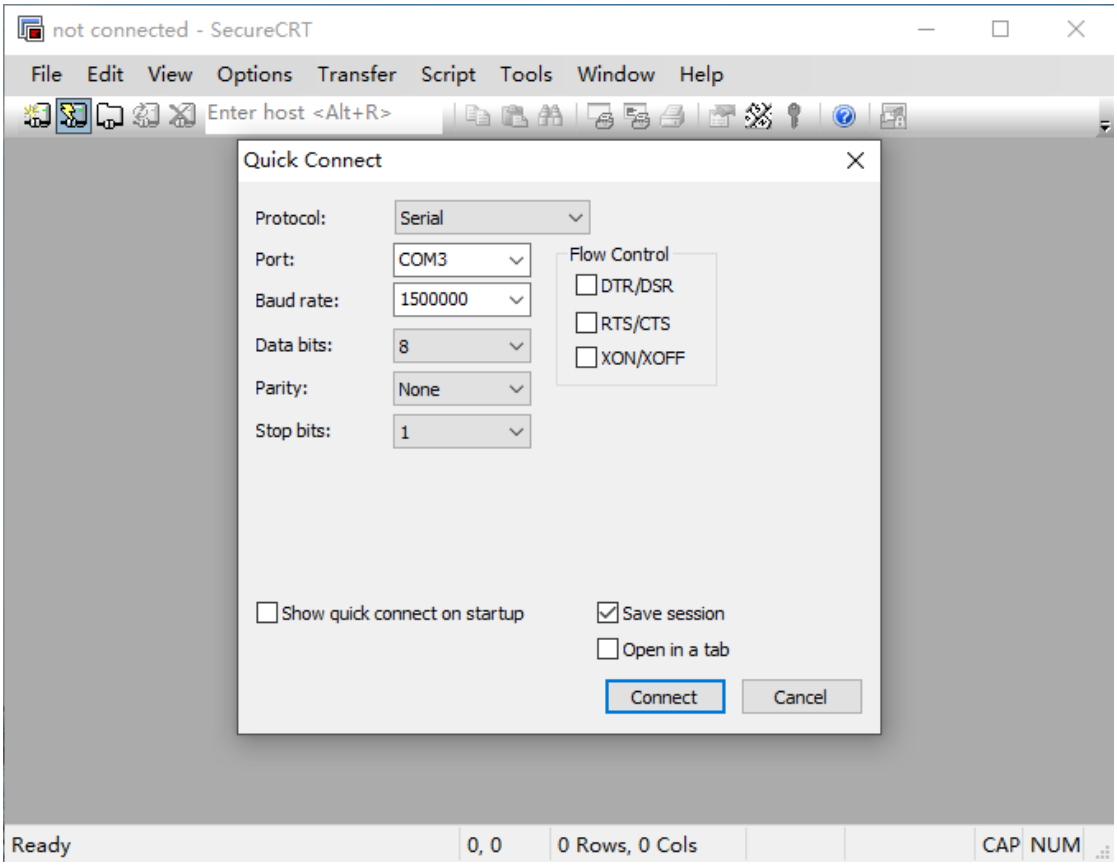


Step 3, confirm that the CP210x driver has been installed and the CP2102 module is connecting to the PC.

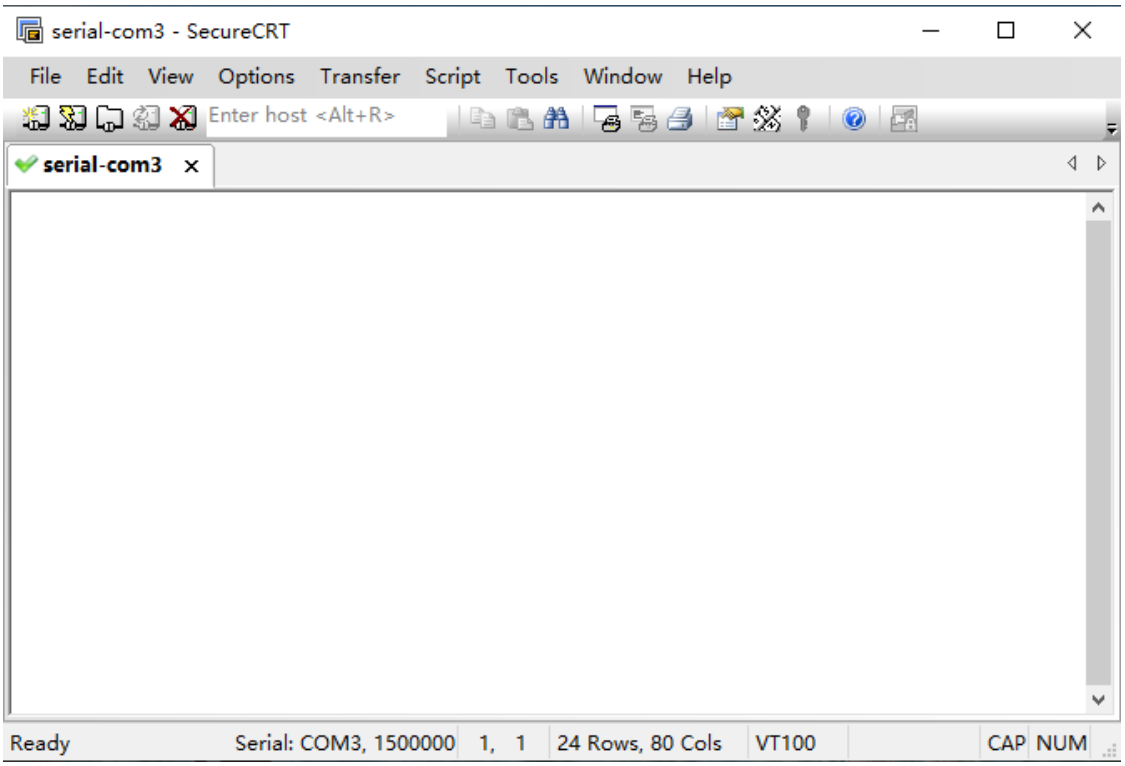
Step 4, click the **Quick Connect** button to go to the Quick Connect configuration screen.



Step 5, configure as shown in the following figure.



Step 6, after clicking connect button, the terminal serial interface will be successfully accessed.



Android11

1.Compiler Environment

It is recommended to use Ubuntu 18.04 system or higher version for compilation . 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 200G. If you do multiple builds, you will need more hard drive space.	Ubuntu 18.04 system

2.Install Tools

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: ubuntu system

Network: online

Permission: root

2.1 Install dependent packages

```
# sudo apt-get install u-boot-tools
# sudo apt-get install git gnupg flex bison gperf build-essential zip curl libc6-dev libncurses5-dev:i386 x11proto-core-dev libx11-dev:i386 libreadline6-dev:i386 libgl1-mesa-dri:i386 libgl1-mesa-dev g++-multilib tofrodos python-markdown libxml2-utils xsltproc zlib1g-dev:i386 dpkg-dev
# sudo apt-get install libncurses5-dev
# sudo apt-get install libsdl1.2-dev
# sudo apt-get install lib32z-dev ccache
# sudo apt-get install python-pyelftools python3-pyelftools -y
# sudo apt-get install libssl-dev
# sudo apt-get install liblz4-tool
# sudo apt-get install gcc-4.8
# sudo apt-get install g++-4.8
```

If the compilation encountered error, please according to the error message install the corresponding software package.

2.2 Install JDK

```
$ sudo apt-get update
$ sudo apt-get install openjdk-8-jdk
```

3.Compile Source

Step 1, unzip the source and set the compile board

```
$ tar xvf sdk-11.0_20230221_new-mipi.tar.bz2
$ cd sdk-11.0
```

Step 2, compile uboot

```
$ cd u-boot
$ ./make.sh rk3399
```

Step 3, compile the kernel

```
$ cd kernel/
$ make ARCH=arm64 rockchip_defconfig android-11.config
$ make ARCH=arm64 rk3399-sapphire-excavator-mipi-avb.img -j12
```

Android11 kernel.img and resource.img are included in boot.img, if you only update the kernel, you can compile the kernel separately with the following command. After compiling, you can directly flash the boot.img under kernel directory.

```
$ make ARCH=arm64 rockchip_defconfig android-11.config
$ make ARCH=arm64 BOOT_IMG=../rockdev/Image-rk3399_Android11/boot.img rk3399-sapphire-excavator-mipi-avb.img -j12
```

Step 4, compile Android

```
$ cd ../
$ source build/envsetup.sh
$ lunch rk3399_Android11-userdebug
$ make -j12
```

Step 5, generated image file

```
$ ./mkimage.sh
$ ./build.sh -u        (Package update.img)
$ cd rockdev
$ ls
```

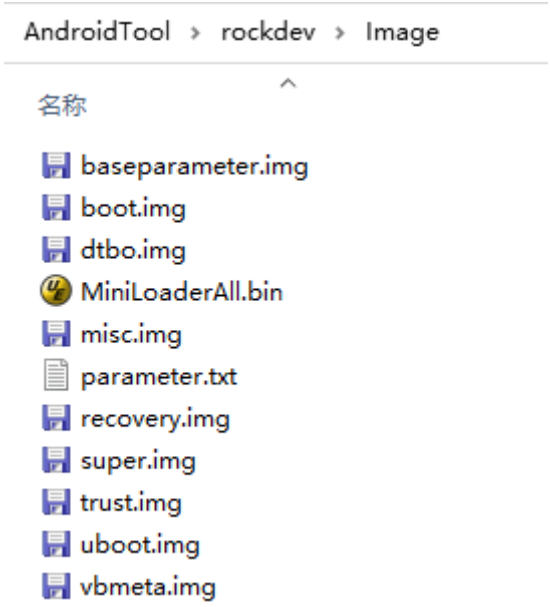
Images and update.img are generated in current directory.

4. Images Operation

4.1 Pack image

This section describes how to package image in Windows.

Step 1, copy the firmware file to be packaged to AndroidToo/rockdev/Image/.



Step 2, enter AndroidTool/rockdev/, double-click to run **mkupdate_rk3399.bat** .

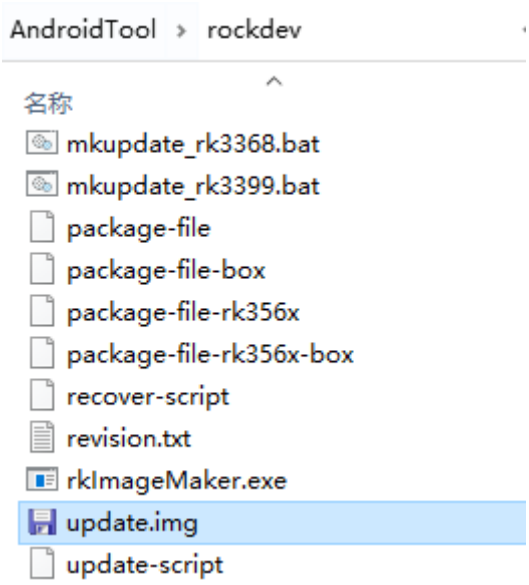
```
G:\AndroidTool\rockdev>Afptool -pack ./ Image\update.img
Android Firmware Package Tool v2.0
------ PACKAGE ------
Add file: .\package-file
package-file, Add file: .\package-file done, offset=0x800, size=0x2ac, userspace=0x1
Add file: .\Image/MiniLoaderAll.bin
bootloader, Add file: .\Image/MiniLoaderAll.bin done, offset=0x1000, size=0x7194e, userspace=0xe4
Add file: .\Image/parameter.txt
parameter, Add file: .\Image/parameter.txt done, offset=0x73000, size=0x292, userspace=0x1
Add file: .\Image/trust.img
trust, Add file: .\Image/trust.img done, offset=0x73800, size=0x400000, userspace=0x800
Add file: .\Image/uboot.img
uboot, Add file: .\Image/uboot.img done, offset=0x473800, size=0x400000, userspace=0x800
Add file: .\Image/misc.img
misc, Add file: .\Image/misc.img done, offset=0x873800, size=0xc000, userspace=0x18
Add file: .\Image/boot.img
boot, Add file: .\Image/boot.img done, offset=0x87f800, size=0x20e2800, userspace=0x41c5
Add file: .\Image/dtbo.img
dtbo, Add file: .\Image/dtbo.img done, offset=0x2962000, size=0x25f, userspace=0x1
Add file: .\Image/vbmeta.img
vbmeta, Add file: .\Image/vbmeta.img done, offset=0x2962800, size=0x1000, userspace=0x2
Add file: .\Image/recovery.img
recovery, Add file: .\Image/recovery.img done, offset=0x2963800, size=0x452f000, userspace=0x8a5e
Add file: .\Image/baseparameter.img
baseparameter, Add file: .\Image/baseparameter.img done, offset=0x6e92800, size=0x100000, userspace=0x200
Add file: .\Image/super.img
super, Add file: .\Image/super.img done, offset=0x6f92800, size=0x5a37de8c, userspace=0xb46fc
Add CRC...
Make firmware OK!
------ OK ------

G:\AndroidTool\rockdev>RKImageMaker.exe -RK330C Image\MiniLoaderAll.bin  Image\update.img update.img -os_type:an
********rkImageMaker ver 2.0********
Generating new image, please wait...
Writing head info...
Writing boot file...
Writing firmware...
Generating MD5 data...
MD5 data generated successfully!
New image generated successfully!

G:\AndroidTool\rockdev>rem update.img is new format, Image\update.img is old format, so delete older format

G:\AndroidTool\rockdev>del  Image\update.img
```

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

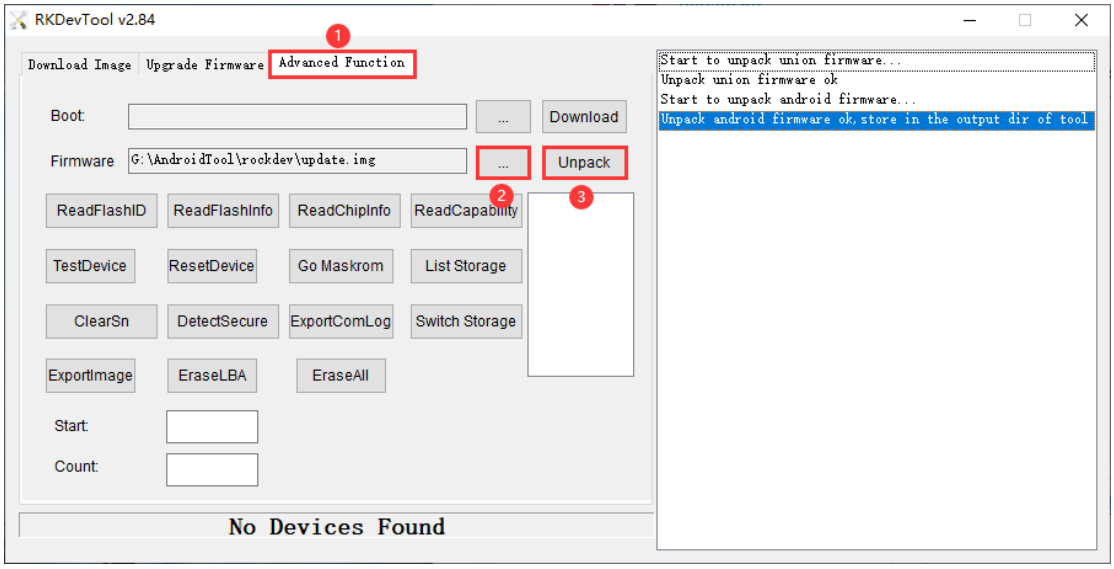


4.2 Unzip firmware

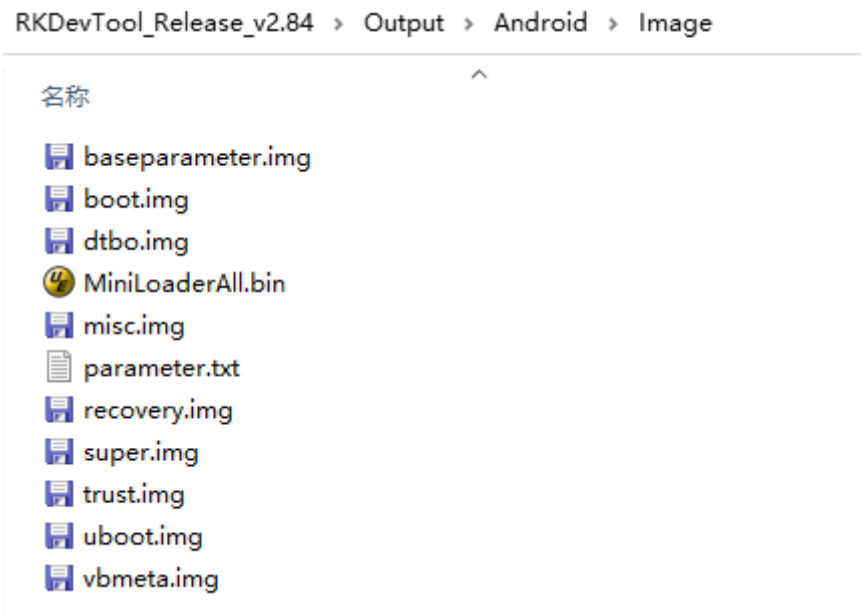
This section describes how to unzip firmware in Windows.

Step 1, unzip and open the tool RKDevTool_Release_v2.84\RKDevTool.exe.

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



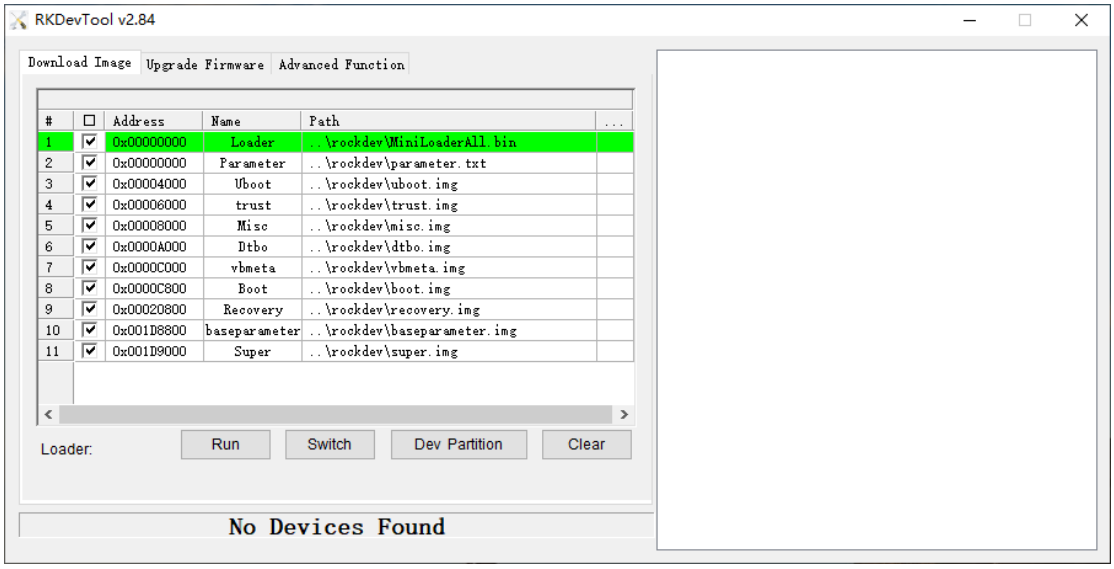
Step 3, the unzip files will be generated in \RKDevTool_Release_v2.84\Output\Android\Image directory.



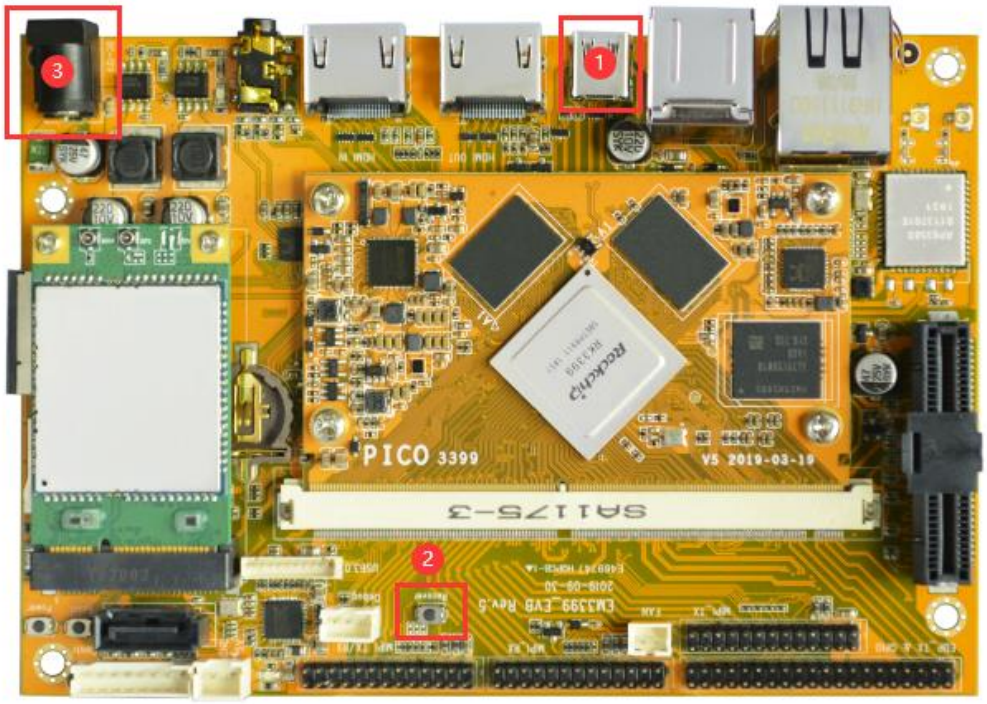
5.Burn Images

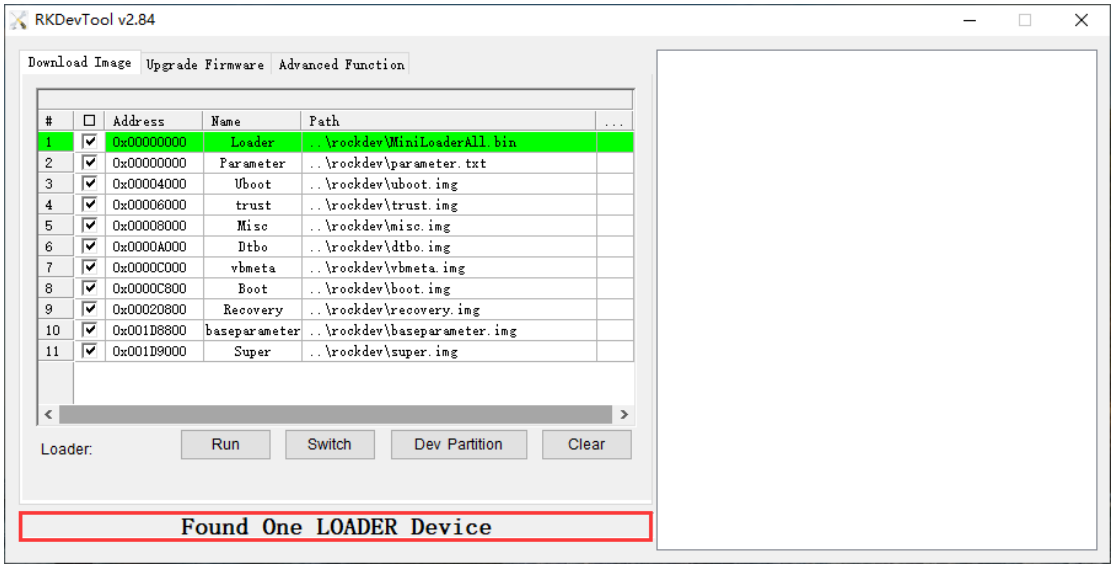
5.1 Burn update firmware

Step 1, unzip and open the tool RKDevTool_Release_v2.84\RKDevTool.exe.

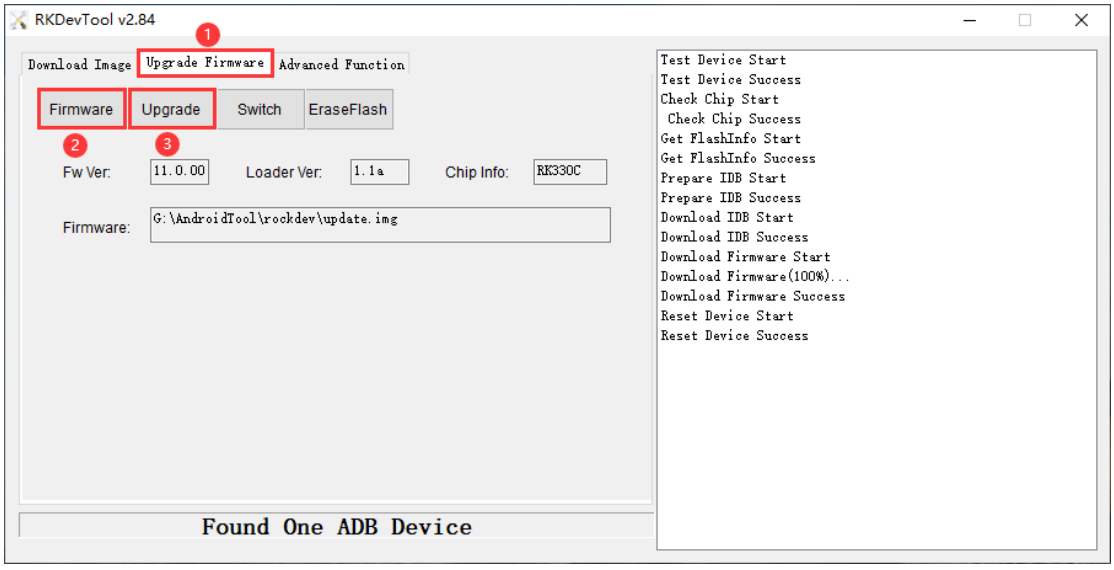


Step 2, connect PC and development board with Type-C USB cable, keep pressing the **Recover Key** and power the board until the windows PC shows **Found one LOADER Device.**





Step 3, click **Upgrade Firmware** -> **Firmware**, select **update.img**, then click **Upgrade** to flash.

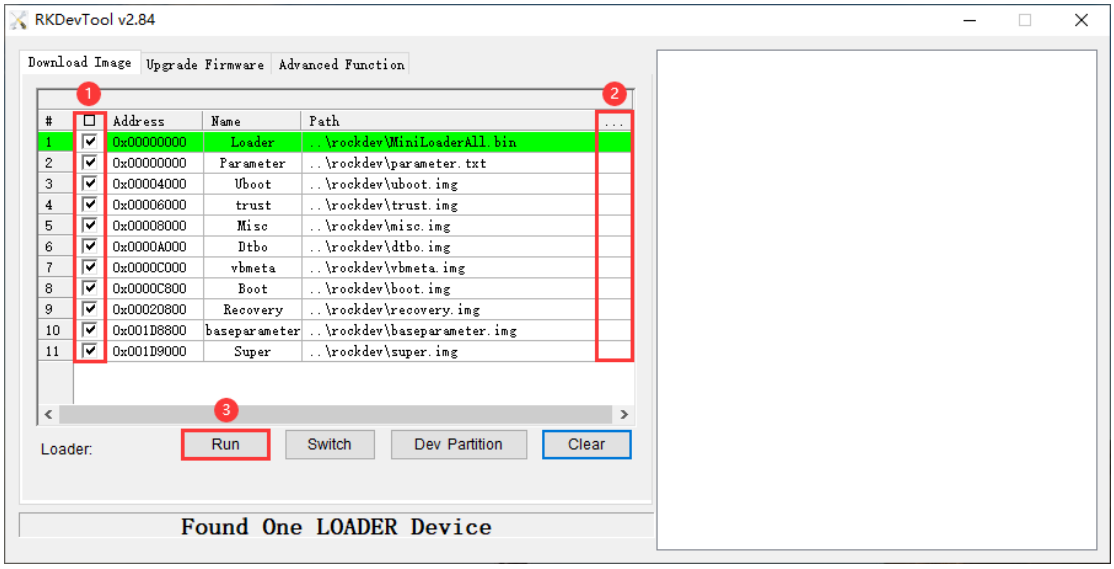


5.2 Burn split firmware

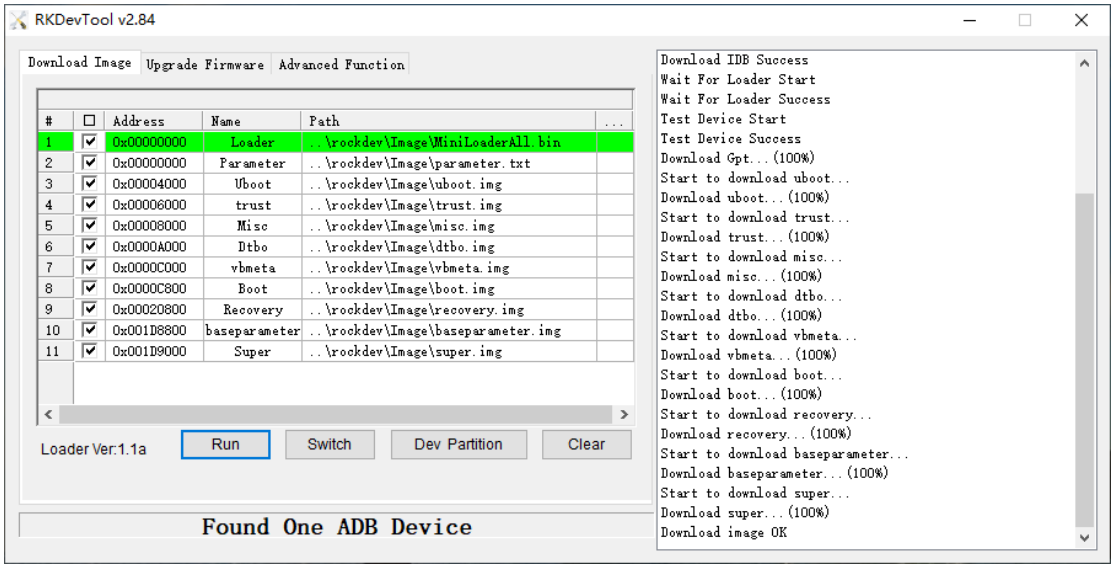
Step 1, select the checkbox on the left.

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.

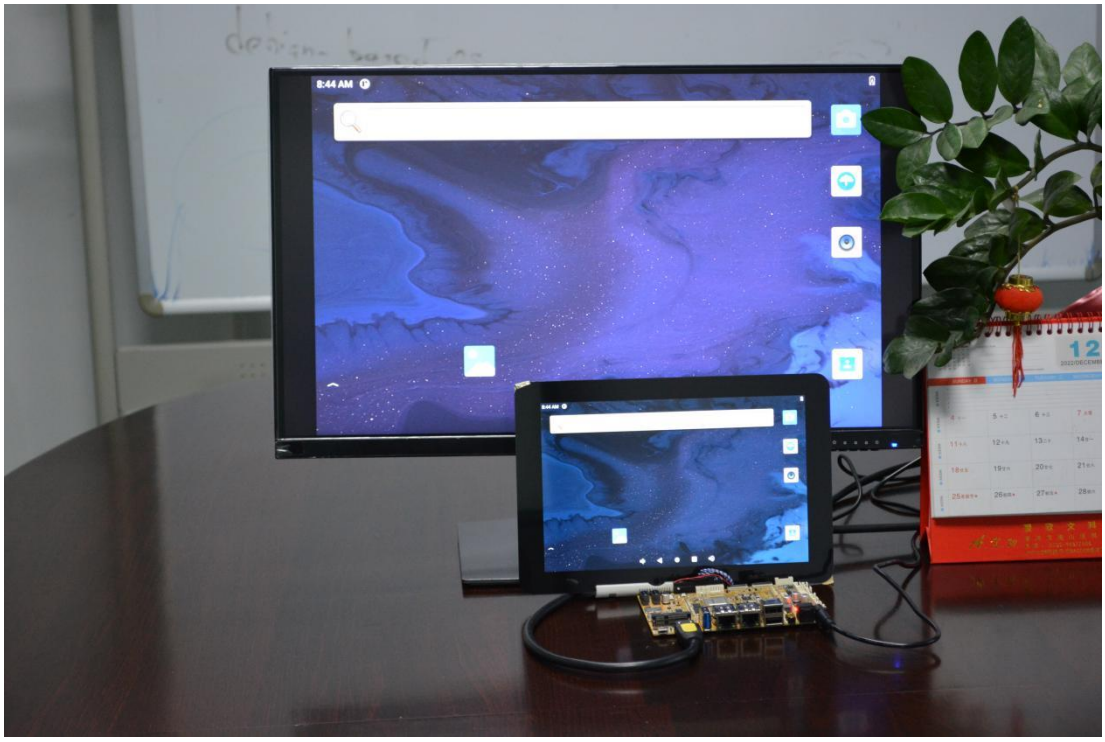


Step 4, wait for burning to complete.



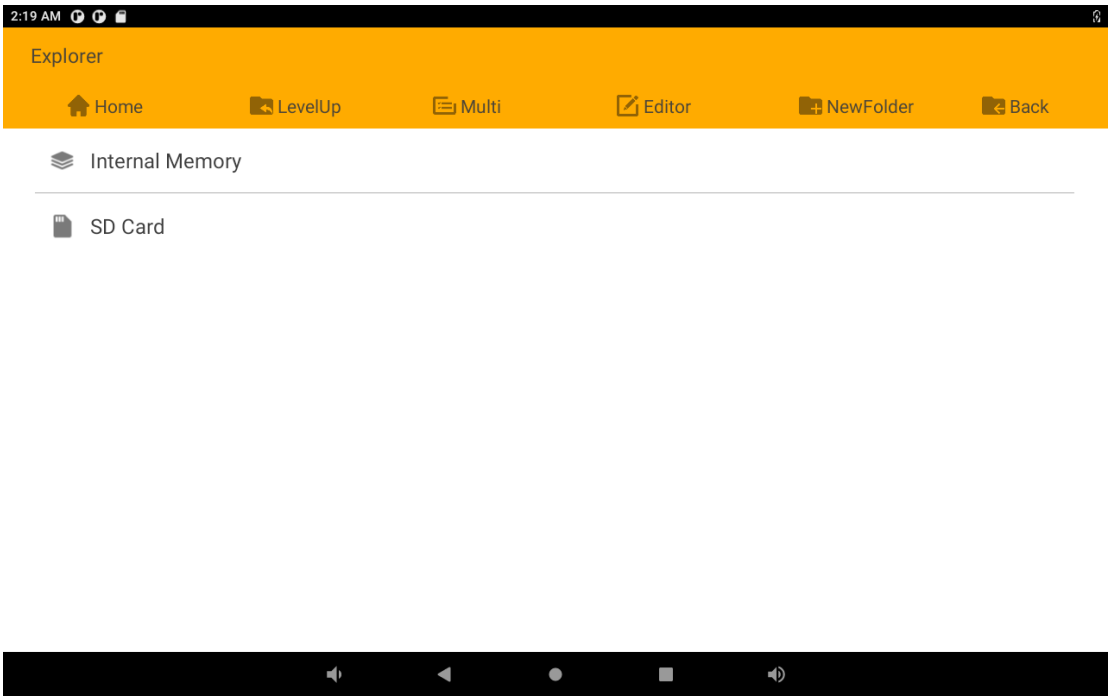
6.Android Application

6.1 Display

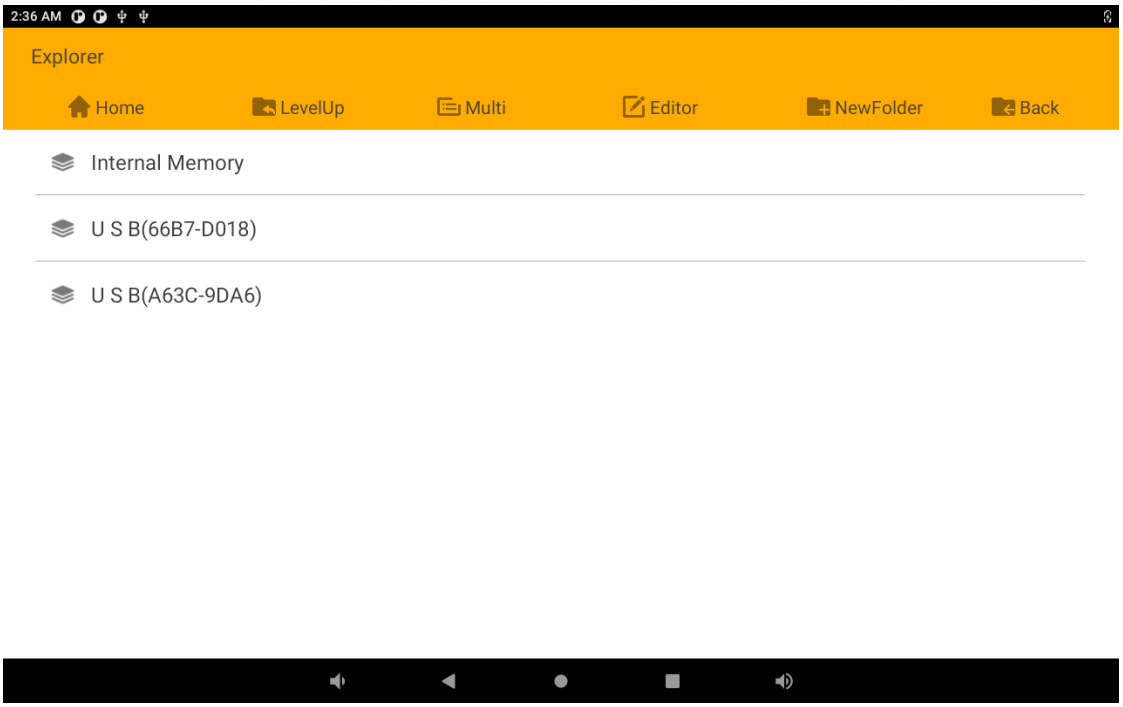


EM3568 supports both lvds and HDMI display, audio output priority: Headset > HDMI > Speaker.

6.2 SD card



6.3 USB2.0 host



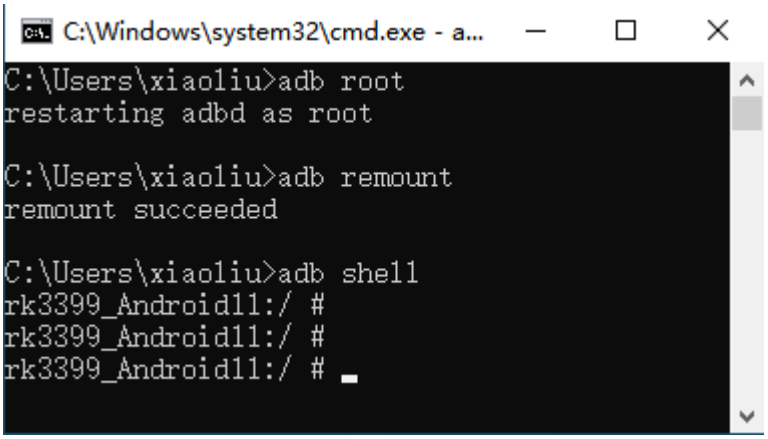
The USB Host can be used to connect USB mouse, USB keyboard, U-Disk or other USB devices.

6.4 Type-C

USB Type-c support ADB, Type-c to USB/HDMI.

(1) ADB is the command-line debugging tool for Android, and it can use for system logs, uploading and downloading the files, installing the applications, etc. Connect the board Type-C and PC host with Type-C data cable; Install the adb driver and commands on the windows system. Execute the follow commands to enable ADB.

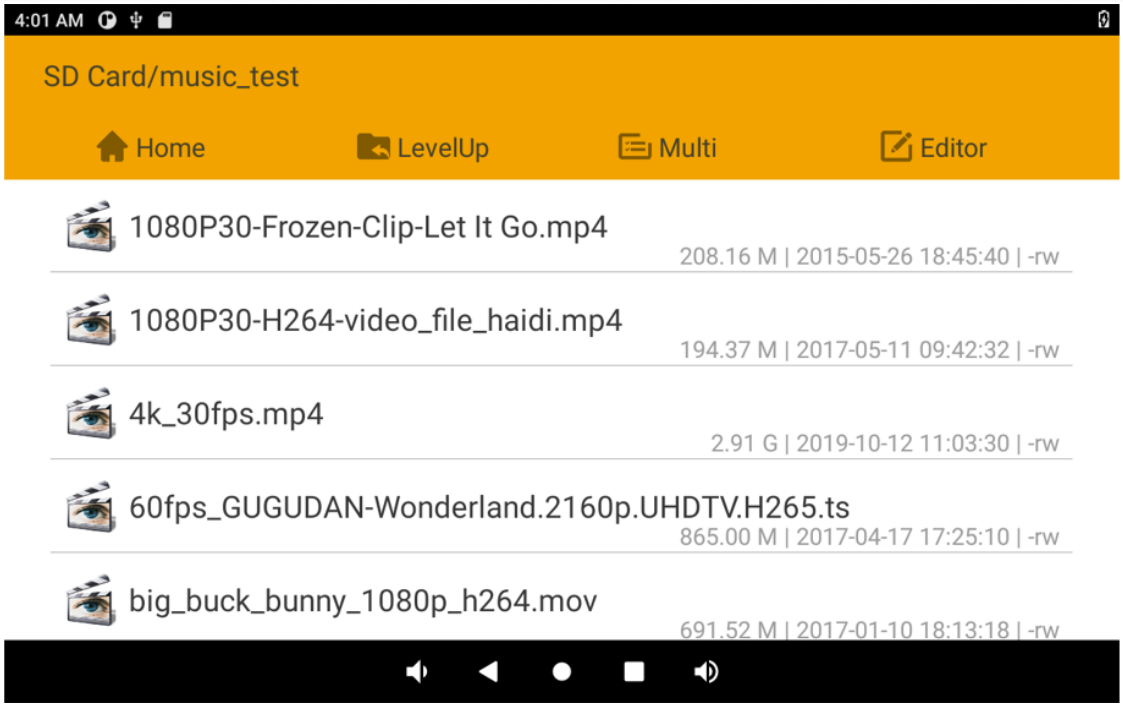
```
# adb root
# adb remount
# adb shell
```



(2) EM3399 supports Type-C to USB2.0/HDMI. The device can use directly without install any driver.

6.5 Video player

Copy video file to sdcard/udisk then insert it to the board, after system boot open sdcard/udisk.



Click video file to play.

6.6 Ethernet

```
# ifconfig
```

```
console:/ # ifconfig
eth0      Link encap:Ethernet  HWaddr 36:09:75:cc:9a:04  Driver rk_gmac-dwmac
          inet addr:192.168.0.190  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::8377:3e8a:384:dec4/64 Scope: Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:55 errors:0 dropped:0 overruns:0 frame:0
          TX packets:91 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:13792 TX bytes:9841
          Interrupt:41

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope: Host
          UP LOOPBACK RUNNING  MTU:65536  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 TX bytes:0

dummy0    Link encap:Ethernet  HWaddr 92:a2:59:68:d0:f6
          inet6 addr: fe80::90a2:59ff:fe68:d0f6/64 Scope: Link
          UP BROADCAST RUNNING NOARP  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 TX bytes:420

eth1      Link encap:Ethernet  HWaddr 32:09:75:cc:9a:04  Driver rk_gmac-dwmac
          inet addr:192.168.0.191  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::ac41:6777:3bdc:5a8/64 Scope: Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:43 errors:0 dropped:0 overruns:0 frame:0
          TX packets:66 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6574 TX bytes:8009
          Interrupt:46

console:/ #
```

When two Ethernet interfaces are used at the same time, eth0 ping the Internet and eth1 ping the Intranet by default.

```
# ping -I eth0 www.boardcon.com
# ping -I eth1 192.168.0.2
```

```
console:/ #
console:/ # ping -I eth0 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.0.190 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=43 time=248 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=43 time=241 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=11 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=12 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=13 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=14 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=15 ttl=43 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=16 ttl=43 time=242 ms
^C
--- www.boardcon.com ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 15020ms
rtt min/avg/max/mdev = 241.963/242.872/248.493/1.546 ms
console:/ #
```

```
1|console:/ #
1|console:/ # ping -I eth1 192.168.0.2
PING 192.168.0.2 (192.168.0.2) from 192.168.0.191 eth1: 56(84) bytes of data.
64 bytes from 192.168.0.2: icmp_seq=1 ttl=64 time=3.47 ms
64 bytes from 192.168.0.2: icmp_seq=2 ttl=64 time=2.07 ms
64 bytes from 192.168.0.2: icmp_seq=3 ttl=64 time=1.98 ms
64 bytes from 192.168.0.2: icmp_seq=4 ttl=64 time=2.03 ms
64 bytes from 192.168.0.2: icmp_seq=5 ttl=64 time=1.98 ms
64 bytes from 192.168.0.2: icmp_seq=6 ttl=64 time=2.09 ms
64 bytes from 192.168.0.2: icmp_seq=7 ttl=64 time=1.97 ms
64 bytes from 192.168.0.2: icmp_seq=8 ttl=64 time=2.09 ms
64 bytes from 192.168.0.2: icmp_seq=9 ttl=64 time=2.15 ms
64 bytes from 192.168.0.2: icmp_seq=10 ttl=64 time=2.51 ms
64 bytes from 192.168.0.2: icmp_seq=11 ttl=64 time=2.09 ms
64 bytes from 192.168.0.2: icmp_seq=12 ttl=64 time=1.91 ms
64 bytes from 192.168.0.2: icmp_seq=13 ttl=64 time=2.13 ms
64 bytes from 192.168.0.2: icmp_seq=14 ttl=64 time=2.13 ms
64 bytes from 192.168.0.2: icmp_seq=15 ttl=64 time=2.14 ms
^C
--- 192.168.0.2 ping statistics ---
15 packets transmitted, 15 received, 0% packet loss, time 14023ms
rtt min/avg/max/mdev = 1.919/2.188/3.479/0.370 ms
console:/ #
```

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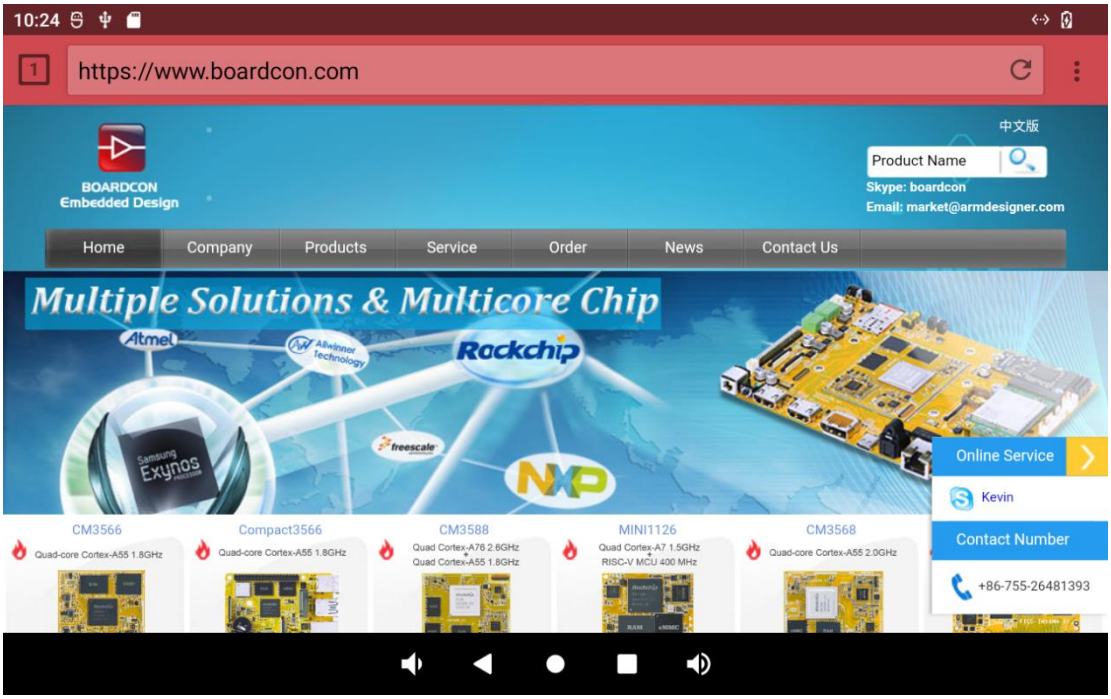
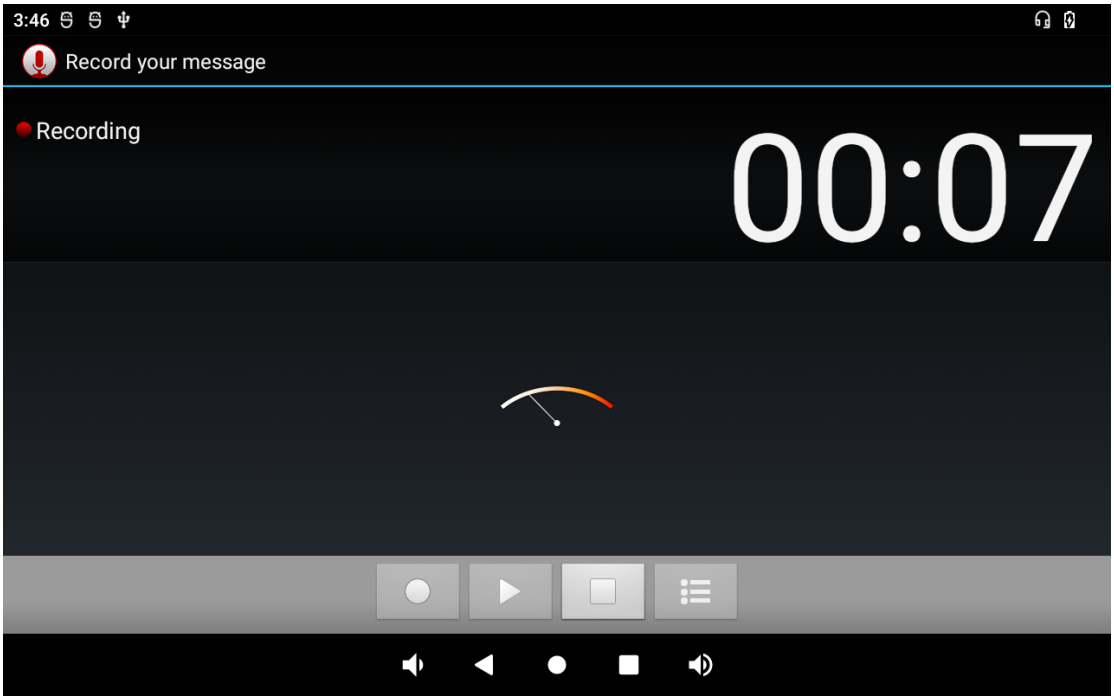


6.7 Record

EM3568 supports headset recording. After connecting the headset, you can start recording.



6.7 RTC

```
# hwclock
```

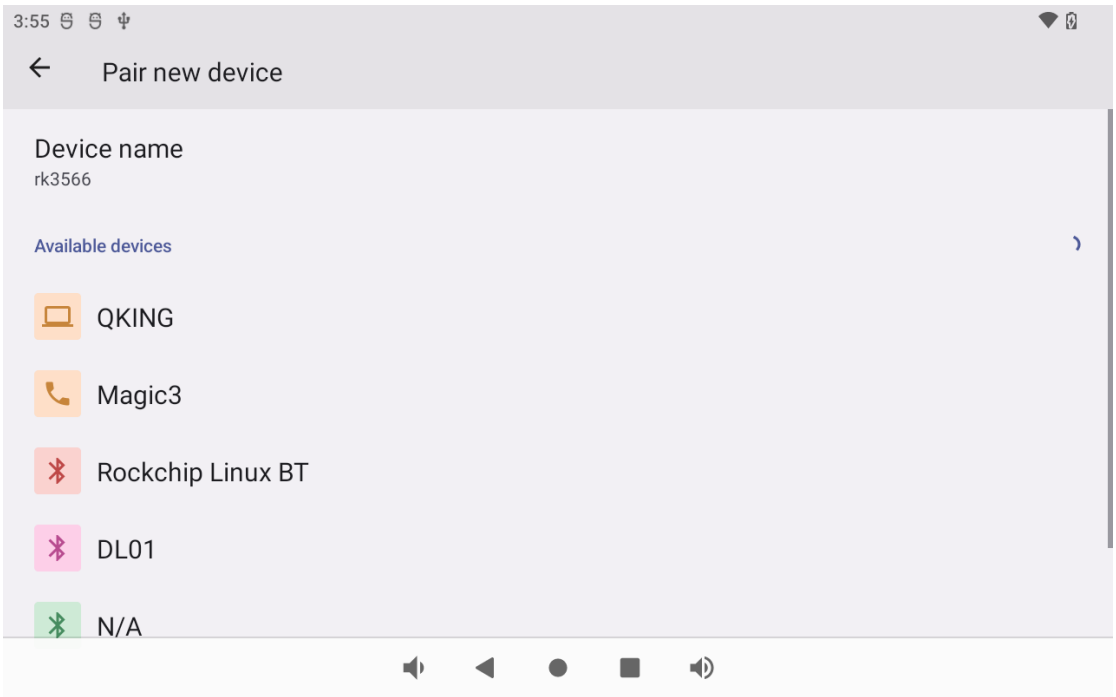
```
console:/ # hwclock
2023-01-09 02:47:29+0000
console:/ # hwclock
2023-01-09 02:47:55+0000
console:/ # hwclock
2023-01-09 02:48:35+0000
console:/ # hwclock
2023-01-09 02:48:49+0000
console:/ # hwclock
2023-01-09 02:49:02+0000
console:/ # hwclock
2023-01-09 02:49:12+0000
console:/ #
```

As shown above, the RTC operates normally. If the network is connected, the RTC can synchronize with the network time. If there is a button battery on the board, the time can also be saved.

6.8 WiFi

After connected, user can ping URL/IP at terminal or open the browser to test Network.

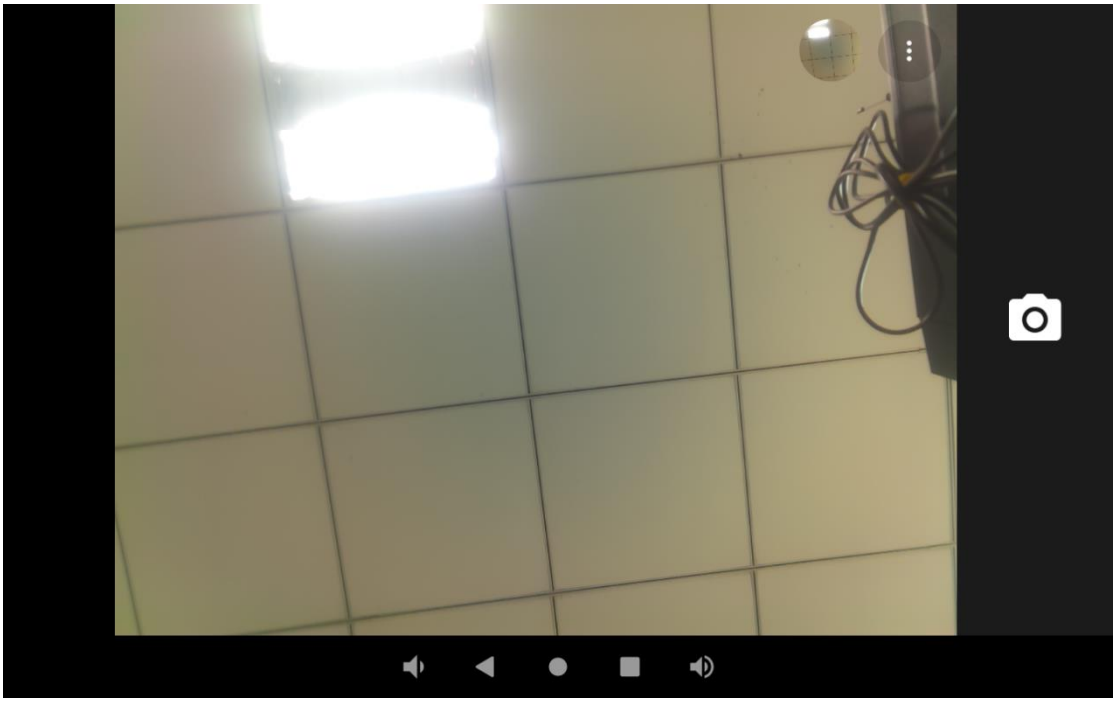
6.9 Bluetooth



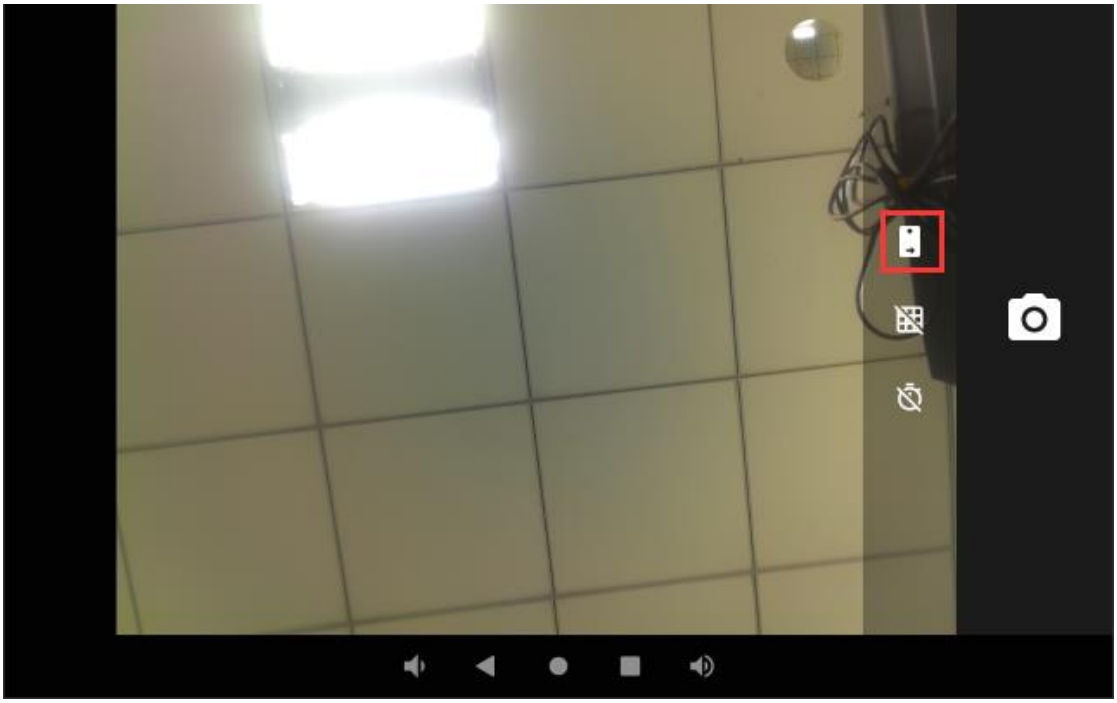
After pairing, Bluetooth communication can be conducted between devices.

6.10 Camera

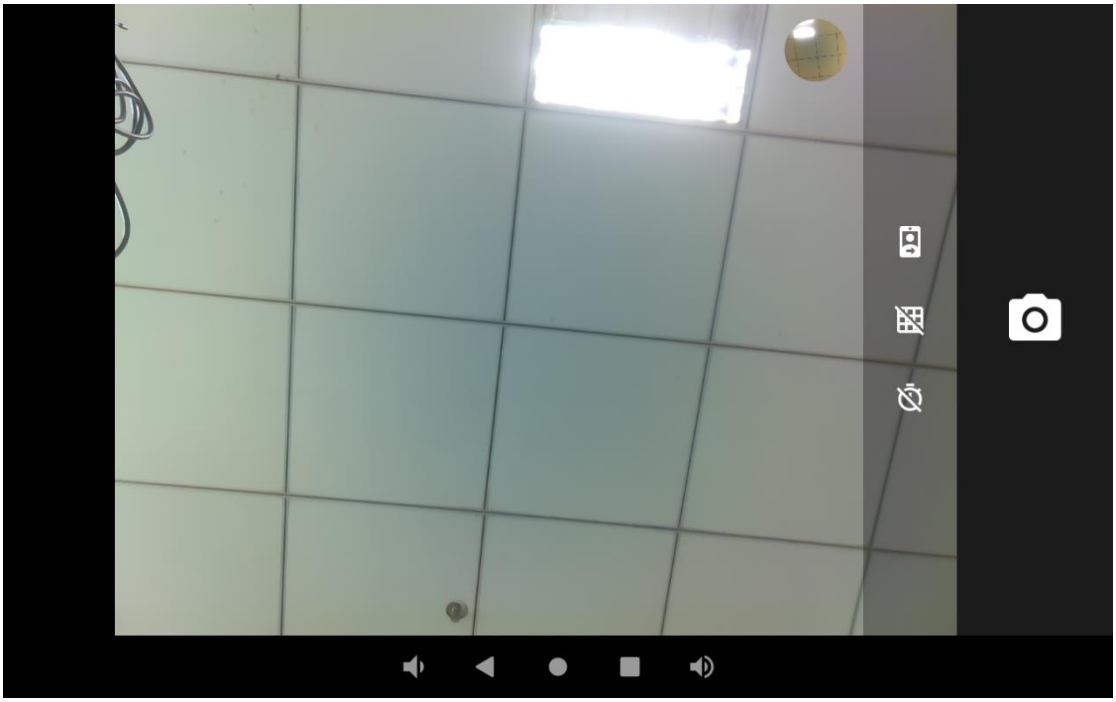
Front camera:



Switch buttons for front and back cameras:

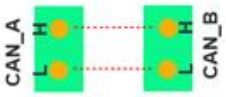


Back camera:



6.11 CAN

Step 1, connect the CAN ports of board A and board B as follows:



Step 2, execute the following commands on the serial terminal of board A and board B respectively.

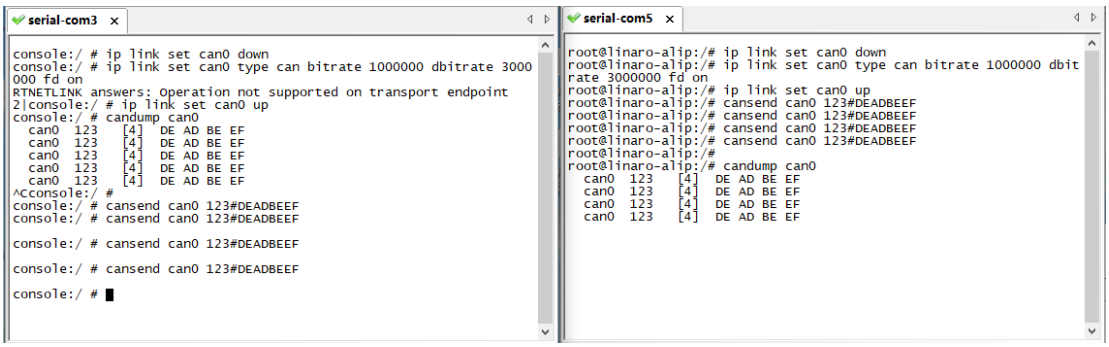
```
# ip link set can0 down
# ip link set can0 type can bitrate 1000000 dbitrate 3000000 fd on
# ip link set can0 up
```

Step 3, execute the following instructions as the receiver.

```
# candump can0                    // set CAN0 as receive
```

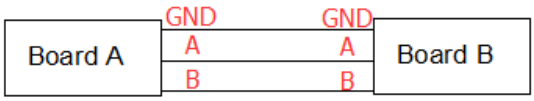
Step 4, execute the following commands as the transmitter.

```
# cansend can0 123#DEADBEEF       // CAN0 send characters 0xDE 0xAD 0xBE 0xEF
```



6.12 RS485

Step 1, connect the RS485 ports of board A and board B as follows:



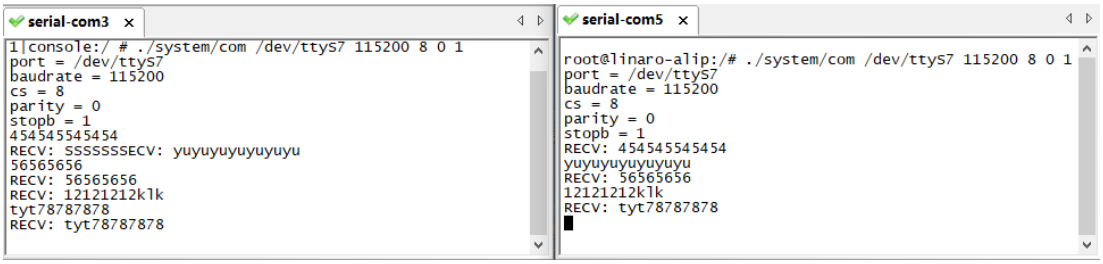
Step 2, use ADB to push the file com into board A and board B.

```
# adb root
# adb remount
# adb push \xx\com /system    // \xx\ is the absolute path to store com files
# adb shell
# chmod 777 /system/com      // Modify com file properties
```

Step 3, execute the following commands on the terminal serial ports of board A and board B respectively.

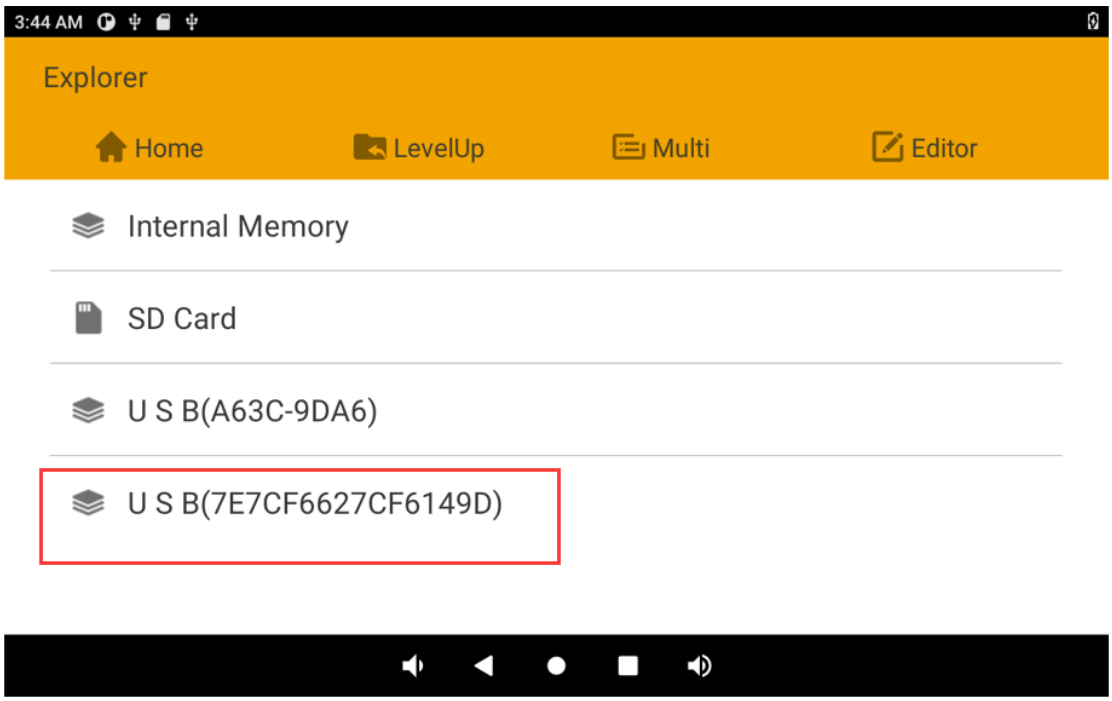
```
# ./system/com /dev/ttyS7 115200 8 0 1
```

Step 4, at this time, you can test the RS485 communication.



The method for testing RS485 is not unique, and the above method is only for reference.

6.13 SATA

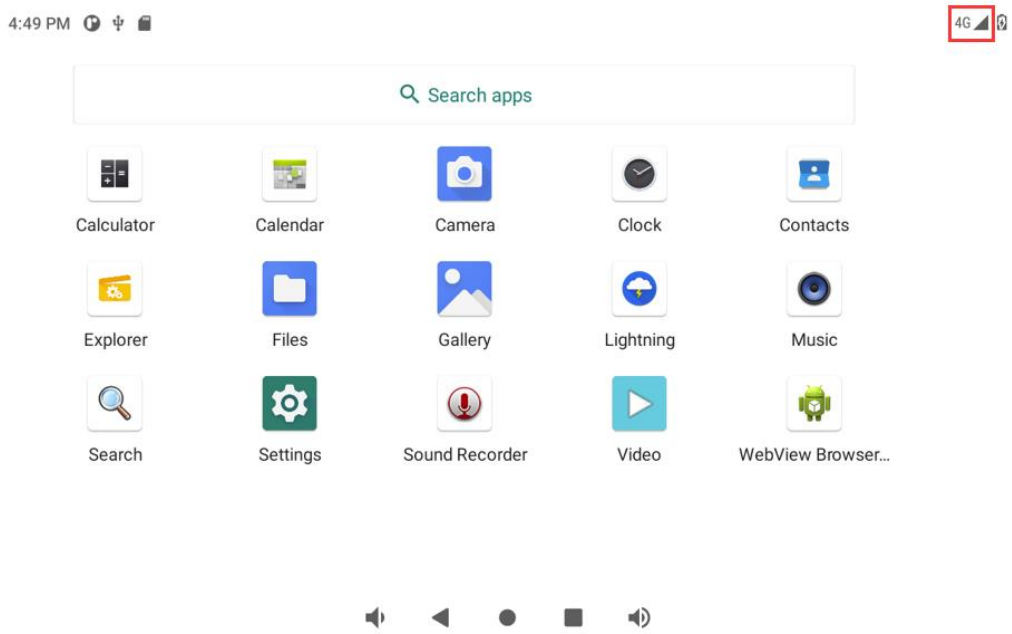


6.14 4G(EC20)

Step 1, insert 4G module to PCIe slot (4G model:EC20).

Step 2, connect antenna and insert SIM card.

Step 3, the default connection is 4G network after power on.



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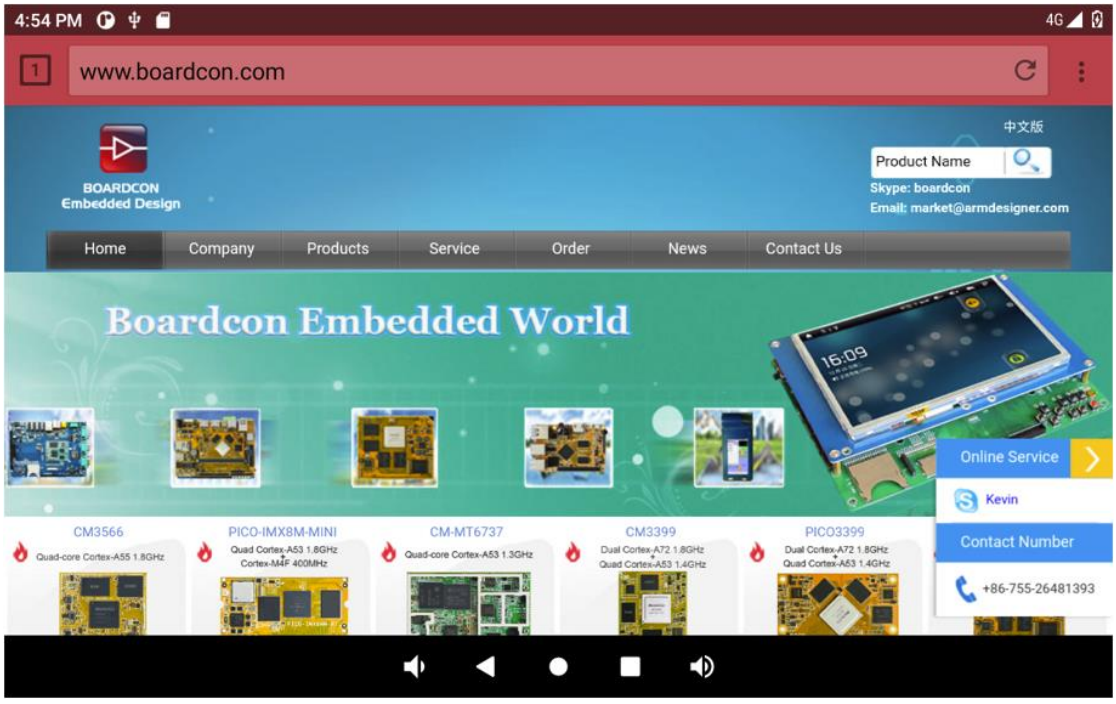


6.15 UART

Step 1, use ADB to push the com file into the test board.

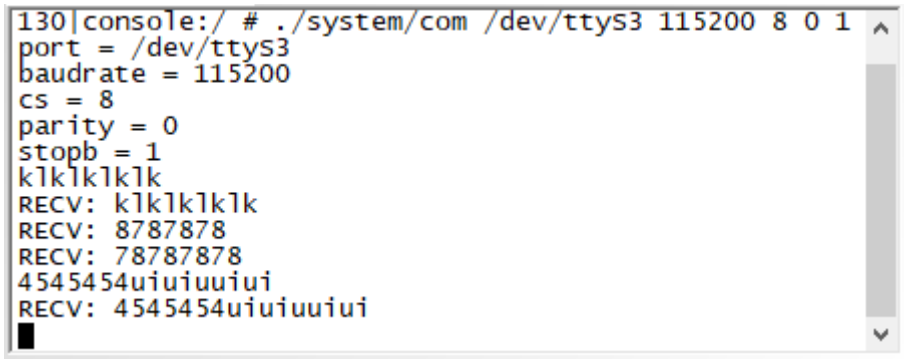
```
# adb root
# adb remount
# adb push \xx\com /system    // \xx\ is the absolute path to store com files
```

```
# adb shell
# chmod 777 /system/com      // modify com file properties
```

Step 2, short circuit RX and TX pins of UART.

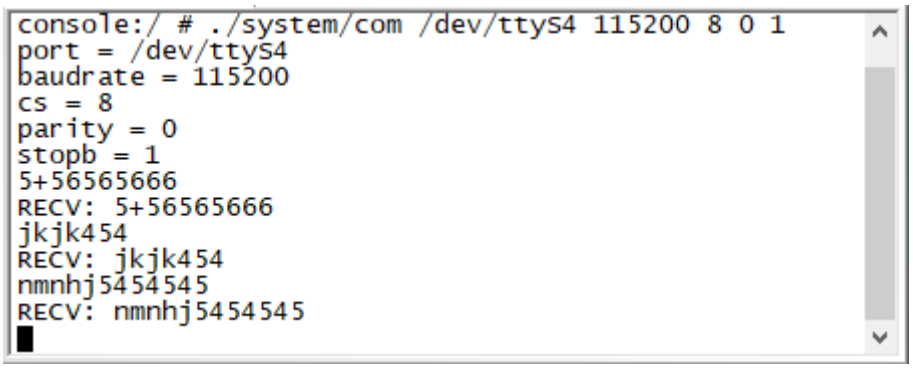
Step 3, UART3 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS3 115200 8 0 1
```



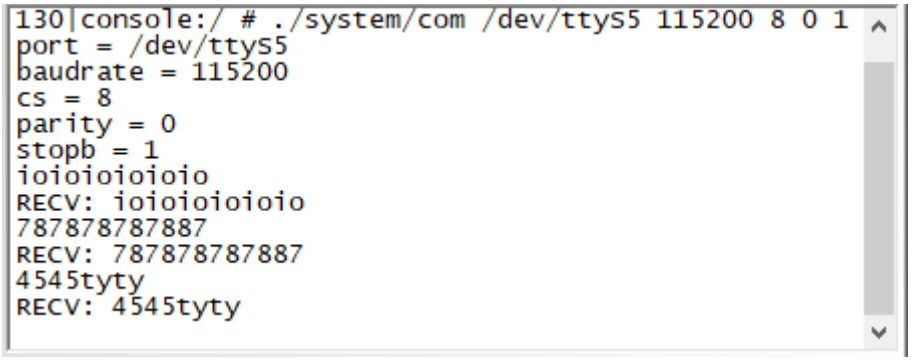
Step 4, UART4 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS4 115200 8 0 1
```



Step 5, UART5 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS5 115200 8 0 1
```



The method for testing UART is not unique, and the above methods are for reference only.

Debian11

1.Compiler Environment

It is recommended to use Ubuntu 20.04 system or above. If you encounter an error during compilation, you can check the error message and install the corresponding software packages accordingly. Other Ubuntu 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 80G. If you do multiple builds, you will need more hard drive space.	Ubuntu 22.04 system

2.Install Tools

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: ubuntu 22.04 system
Network: online
Permission: root

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

3.Compile Source

Step 1, unzip the source

```
$ tar xvf EM3568_debian11.tar.bz2
$ cd EM3568_debian11/
```

Step 2, set the compile board

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

processing option: lunch
You're building on Linux
Lunch menu...pick a combo:

0. default BoardConfig.mk
1. BoardConfig-ab-base.mk

2. BoardConfig-rk3566-evb2-lp4x-v10-32bit.mk
3. BoardConfig-rk3566-evb2-lp4x-v10.mk
4. BoardConfig-rk3568-evb1-ddr4-v10-32bit.mk
5. BoardConfig-rk3568-evb1-ddr4-v10-spi-nor-64M.mk
6. BoardConfig-rk3568-evb1-ddr4-v10.mk
7. BoardConfig-rk3568-evb2-lp4x-v10-linux.mk
8. BoardConfig-rk3568-uvc-evb1-ddr4-v10.mk
9. BoardConfig-security-base.mk
10. BoardConfig.mk

Which would you like? [0]: 7 // select:7. BoardConfig-rk3568-evb2-lp4x-v10-linux.mk

switching to board: /home/liuyuan/opt/EM3568_debian11/device/rockchip/rk356x/BoardConfig-rk3568-evb2-lp4x-v10-linux.mk

Step 3, compile uboot

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

Step 4, compile the kernel

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

If you need to configure the kernel, execute the following command:

```
$ cd kernel
$ make ARCH=arm64 menuconfig
```

Kernel use default config file is: kernel\arch\arm64\configs\rockchip_linux_defconfig.
After reconfiguring the kernel, the configuration content is saved in the kernel/.config file by default, please update the contents of the rockchip_linux_defconfig file before recompiling the kernel.

Step 5, compile recovery

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

Step 6, compile debian

```
# cd debian
# sudo apt-get install binfmt-support qemu-user-static
# sudo dpkg -i ubuntu-build-service/packages/*
# sudo apt-get install -f
# RELEASE=bullseye TARGET=desktop ARCH=arm64 ./mk-base-debian.sh
# VERSION=debug ARCH=arm64 ./mk-rootfs-bullseye.sh
# ./mk-image.sh
```

Step 7, generated image file

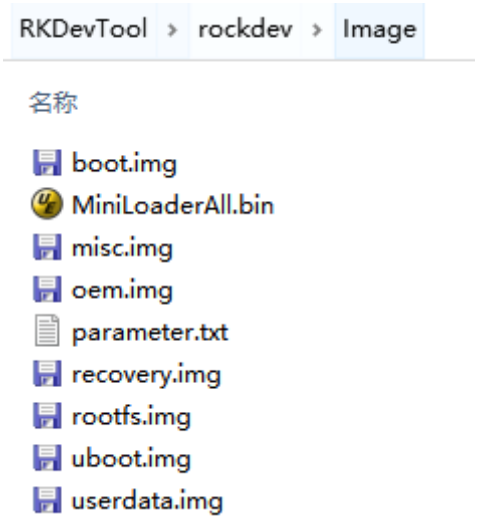
```
$ ./mkfirmware.sh
$ export RK_ROOTFS_SYSTEM=debian
$ ./build.sh updateimg
```

Images are generated in rockdev/ directory.

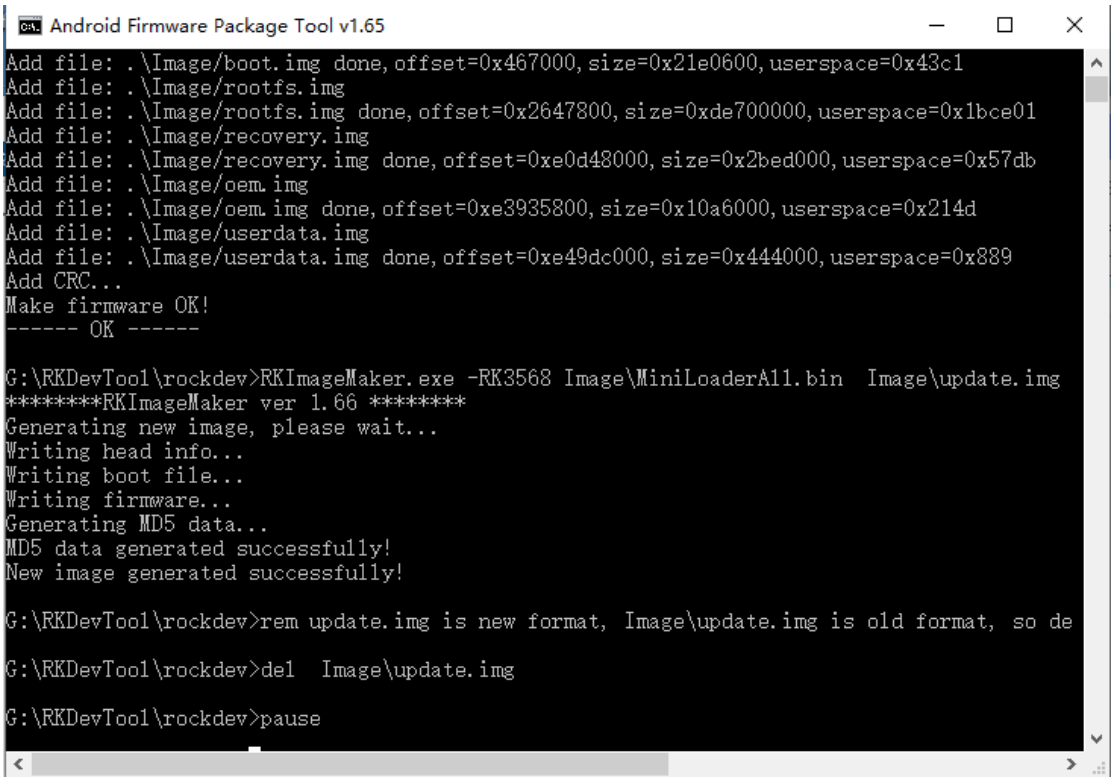
4.Images Operation

4.1 Pack image

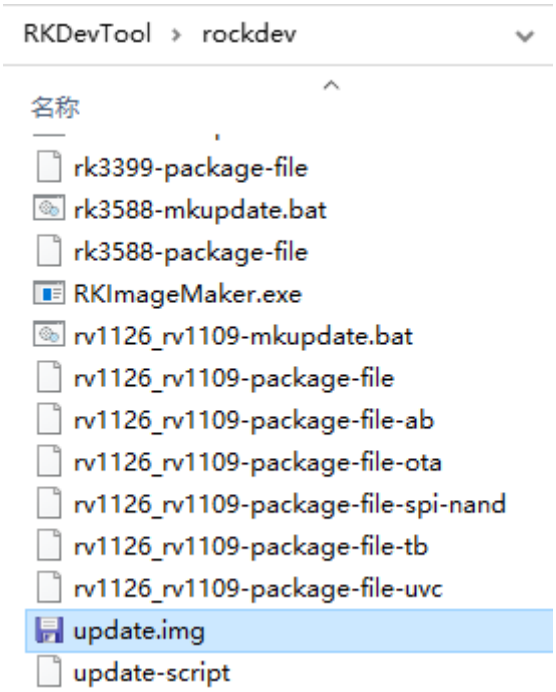
Step 1, copy the firmware file to be packaged to windows RKDevTool/rockdev/Image.



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



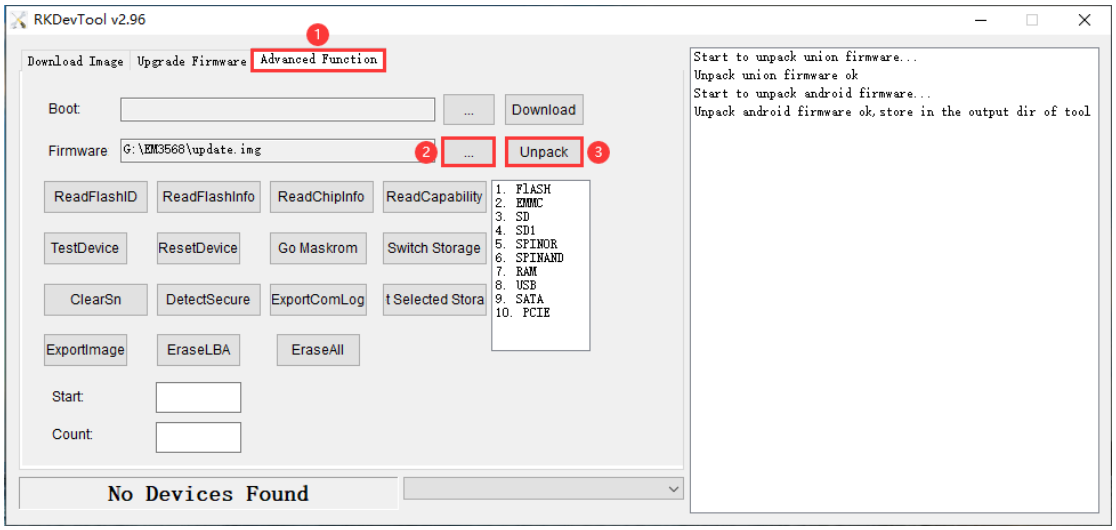
Step 3, the **update.img** will be generated in rockdev/ directory.



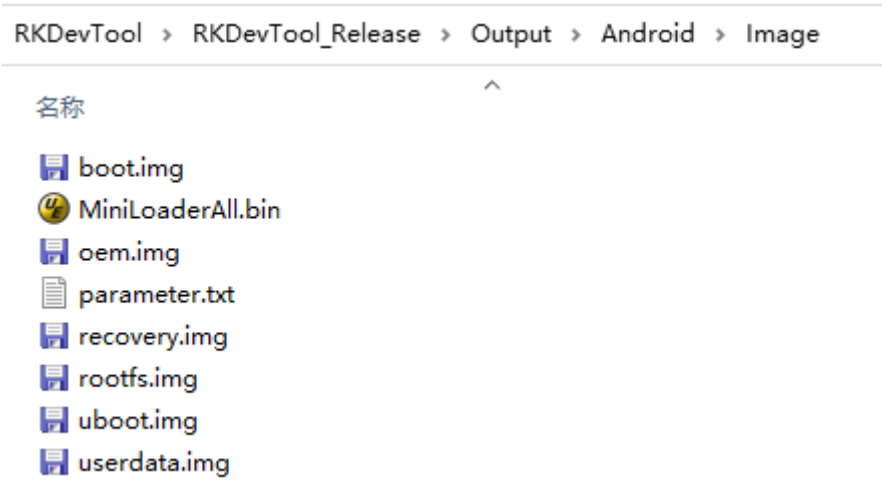
4.2 Unzip firmware

Step 1, open RKDevTool_Release\RKDevTool.exe.

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



Step 3, the unzip files will be generated in \RKDevTool\RKDevTool_Release\Output\Android\Image directory.

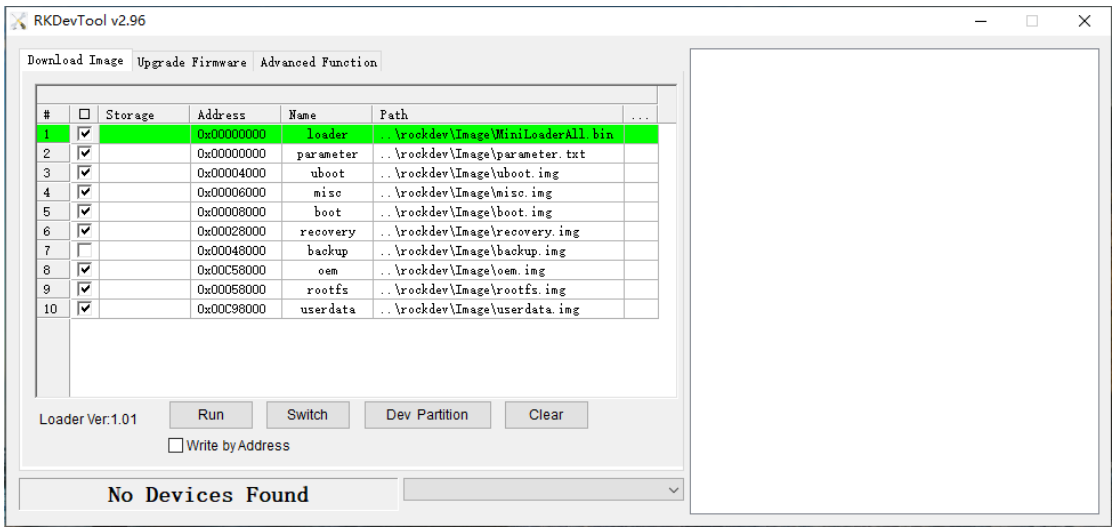


5.Burn Images

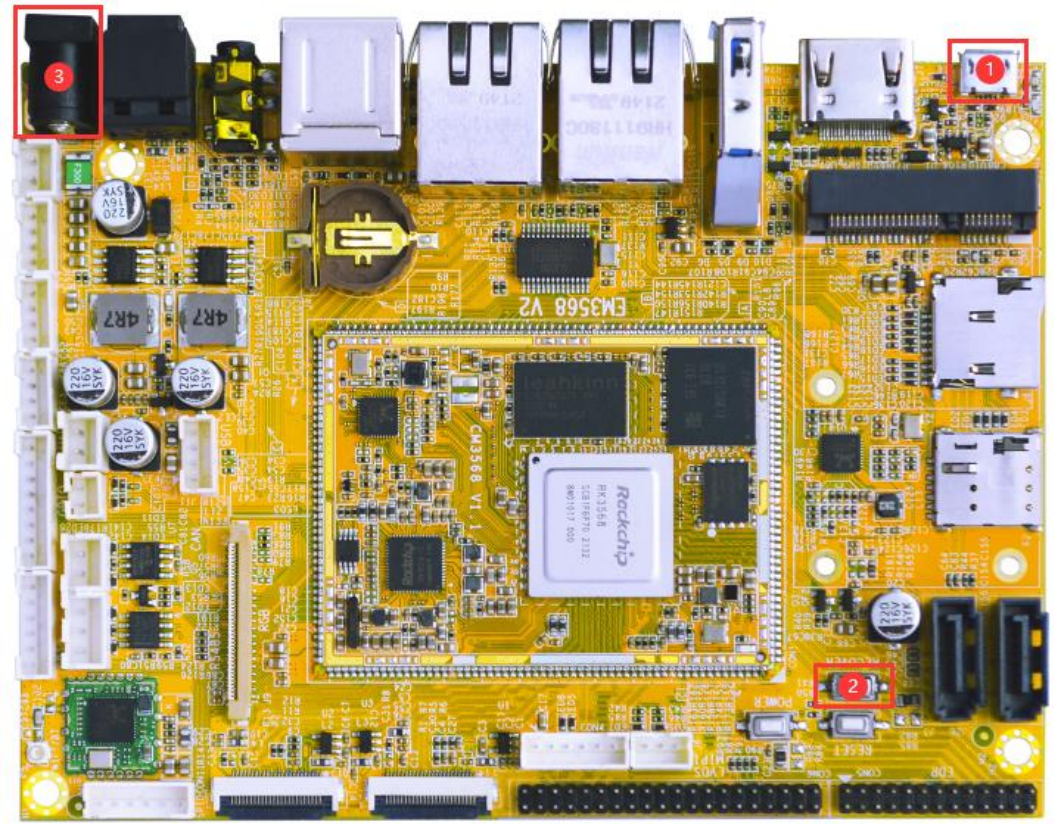
5.1 Burn update firmware

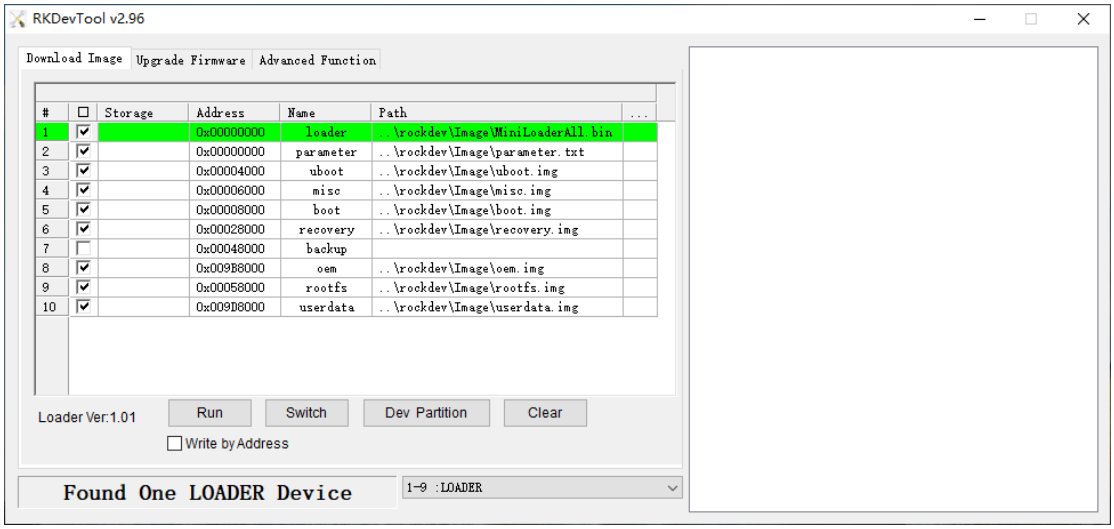
Step 1, unzip RKDevTool.rar on Windows.

Step 2, open RKDevTool_Release\RKDevTool.exe.

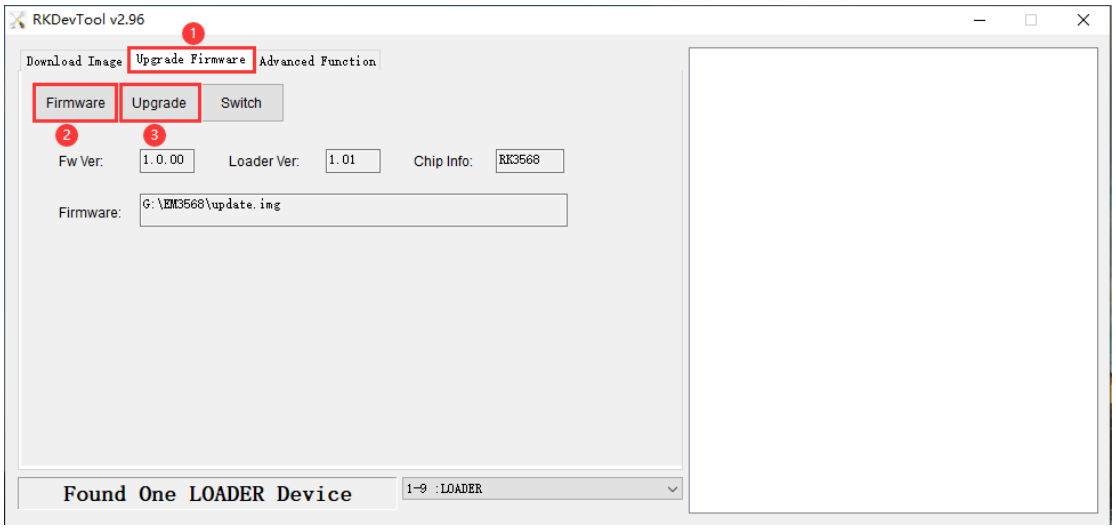


Step 3, connect PC and development board withType-C USB cable, keep pressing the **Recovery Key** and power the board until the windows PC shows **Found one LOADER Device** release the **Recovery** Key .

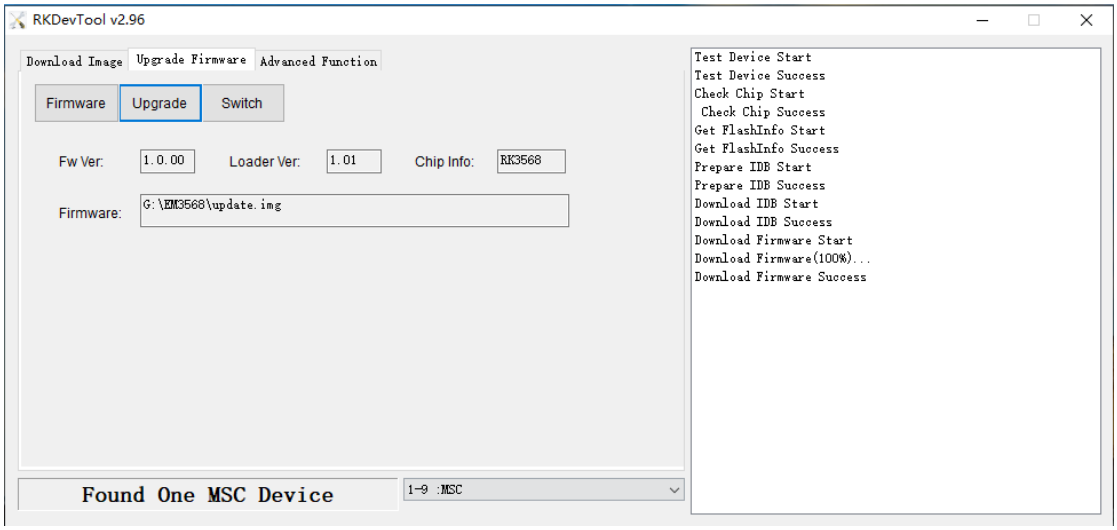




Step 4, click **Upgrade Firmware** -> **Firmware**, select update.img, then click **Upgrade** to flash.



Step 5, wait for the completion of burning.

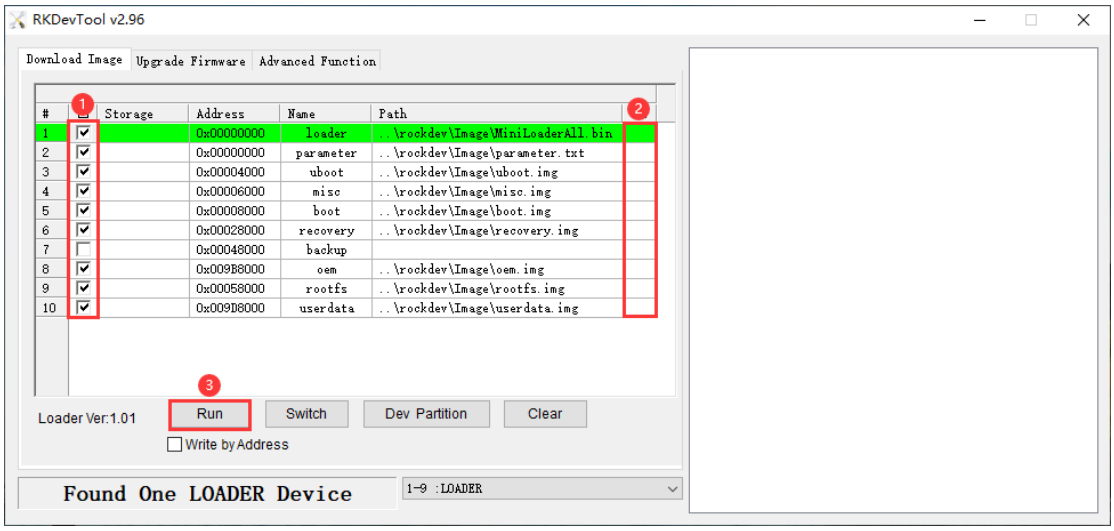


5.2 Burn split firmware

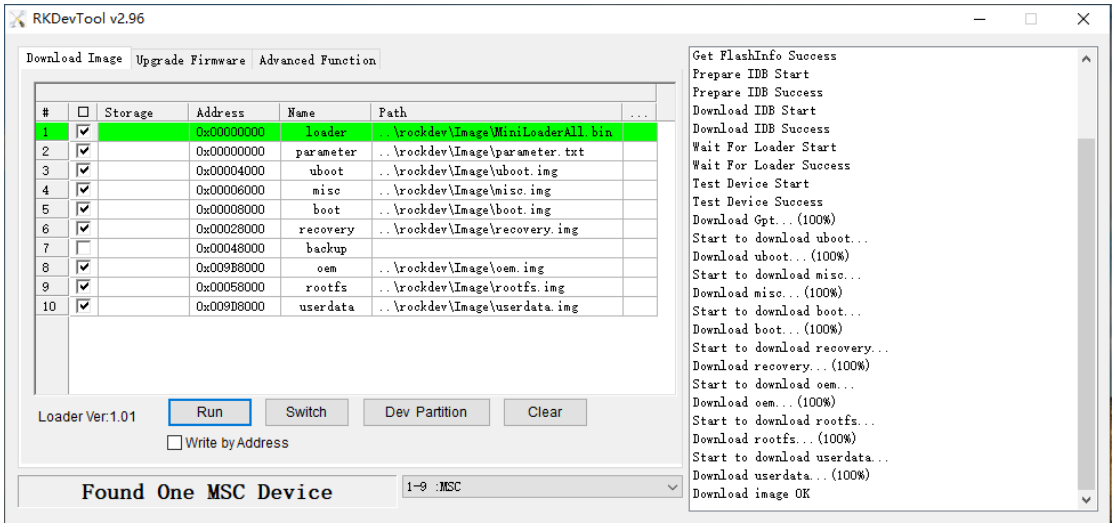
Step 1, select the checkbox on the left.

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

Step 3, click **run** button to flash the image.

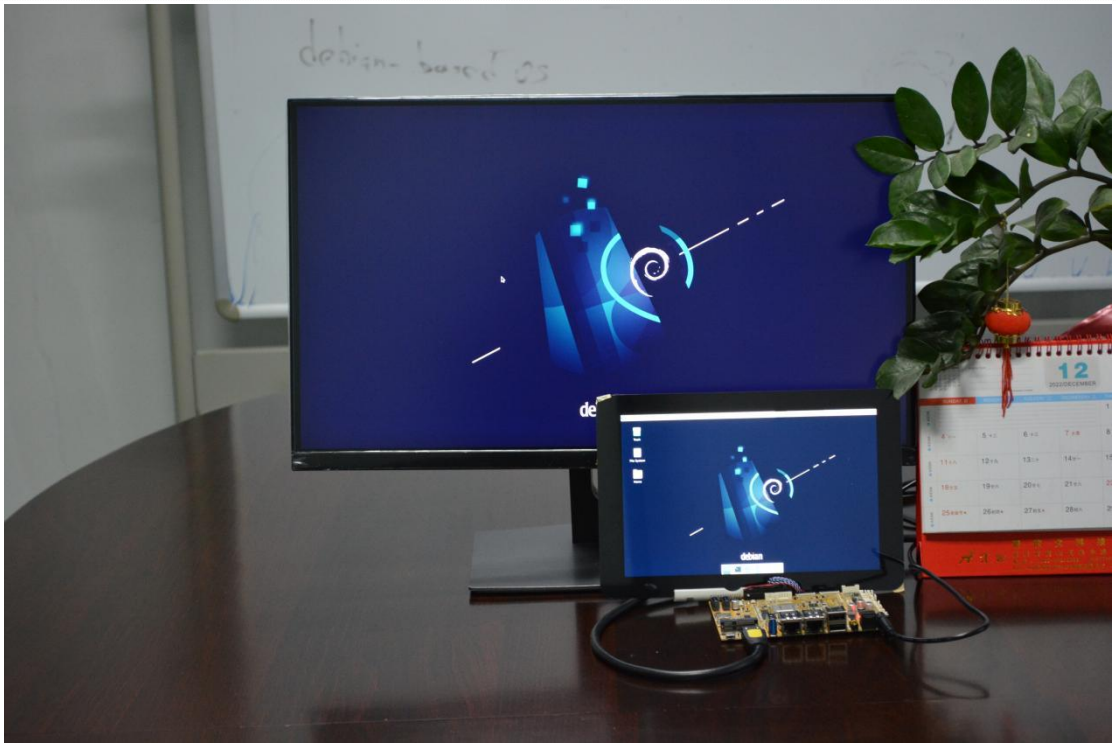


Step 4, wait for the completion of burning.



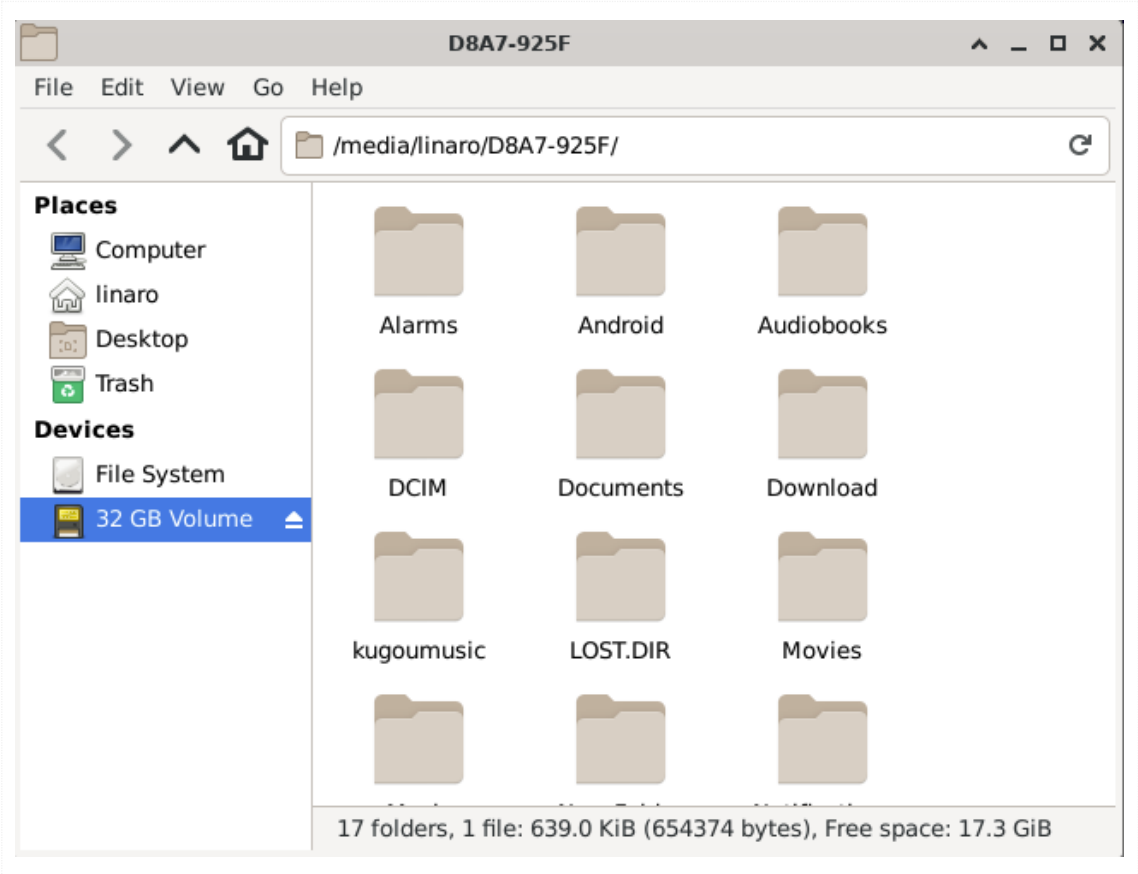
6.Debian Application

6.1 Display

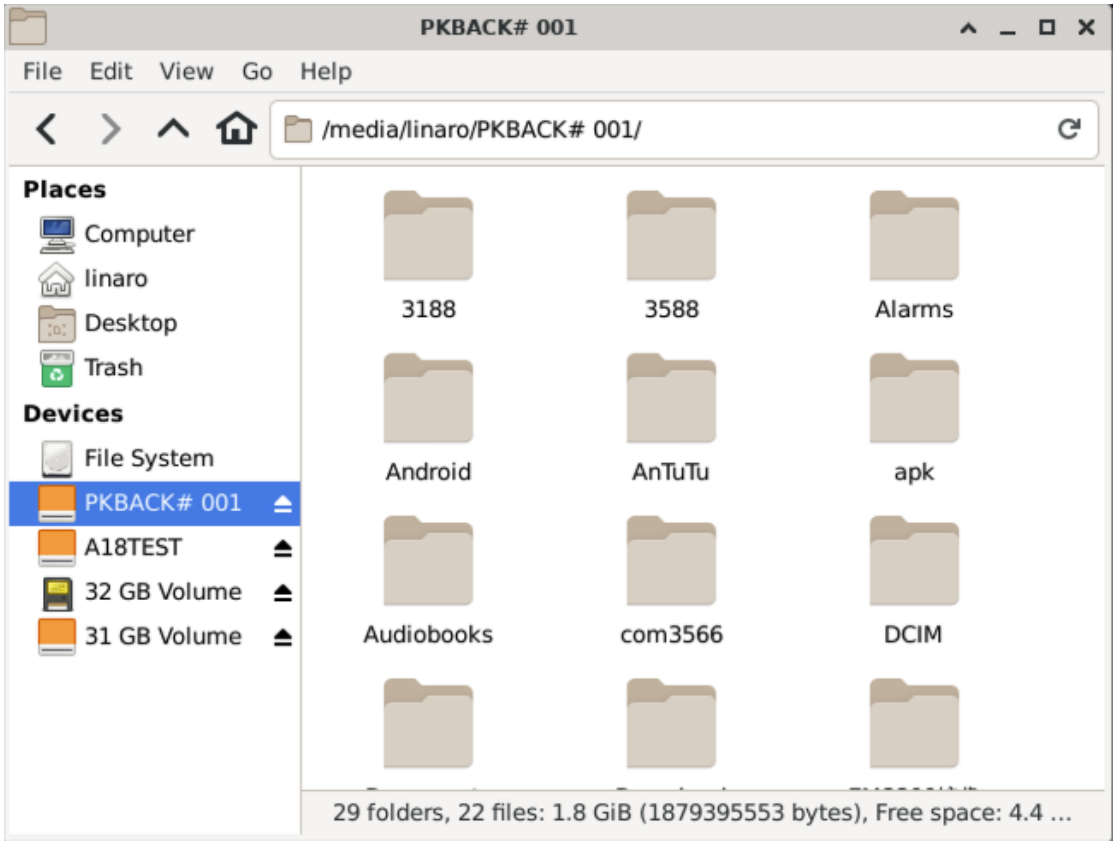


LVDS capacitive touch screen and HDMI default differential display.

6.2 SD card

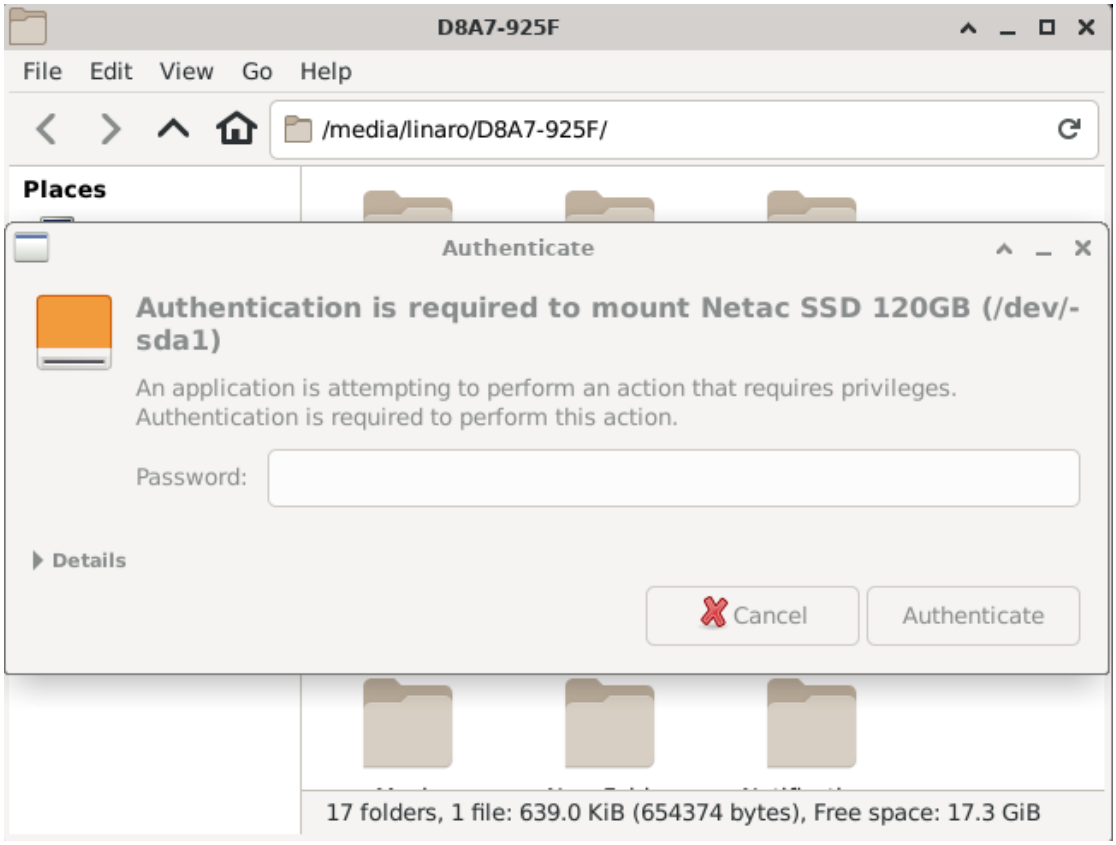

D8A7-925F
File Edit View Go Help
/media/linaro/D8A7-925F/
Places
Computer
linaro
Desktop
Trash
Devices
File System
32 GB Volume
Alarms
Android
Audiobooks
DCIM
Documents
Download
kugoumusic
LOST.DIR
Movies
17 folders, 1 file: 639.0 KiB (654374 bytes), Free space: 17.3 GiB

6.3 USB host



The USB Host can be used to connect USB mouse, USB keyboard, U-Disk or other USB devices.

6.4 SATA2.0



6.5 Audio

Step 1, view sound card:

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

```
root@linaro-alip:/# cat /proc/asound/cards
 0 [rockchiprk809co]: rockchip_rk809- - rockchip,rk809-codec
                      rockchip,rk809-codec
 1 [rockchiphdmi   ]: rockchip_hdmi - rockchip,hdmi
                      rockchip,hdmi
root@linaro-alip:/#
```

Step 2, headset recording:

```
# arecord -Dhw:0,0 -f cd record.wav
```

```
root@linaro-alip:/# arecord -Dhw:0,0 -f cd record.wav
Recording WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
^CAborted by signal Interrupt...
root@linaro-alip:/#
```

Step 3, play audio:

```
# aplay -Dhw:0,0 record.wav      // Priority: headphone output>speaker output
# aplay -Dhw:1,0 record.wav      // HDMI
```

```
root@linaro-alip:/# aplay -Dhw:0,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
root@linaro-alip:/#
root@linaro-alip:/# aplay -Dhw:1,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
[  725.385884] dwhdmi-rockchip fe0a0000.hdmi: Rate 0 missing; compute N dynamical
ly
root@linaro-alip:/#
```

6.6 Video playing

1. non 4k video playback:

```
# gst-play-1.0 --videosink=xvimagesink XXX
```

```
root@linaro-alip:/# gst-play-1.0 --videosink=xvimagesink /media/linaro/D8A7-925F/video/mu
sic/haidi.mp4
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/D8A7-925F/video/music/haidi.mp4
Redistribute latency...
0:00:19.0 / 0:04:09.2
```

2. 4k video playback:

Step 1, be sure to set AFBC:

```
# export GST_MPP_VIDEODEC_DEFAULT_ARM_AFBC=1
```

Step 2, view the plane id (select Cluster0-win0):

```
# cat /sys/kernel/debug/dri/0/state | grep "plane\["
```

```
root@linaro-alip:/# export GST_MPP_VIDEODEC_DEFAULT_ARM_AFBC=1
root@linaro-alip:/# cat /sys/kernel/debug/dri/0/state | grep "plane\["
plane[54]: Smart1-win0
plane[68]: Cluster1-win0
plane[88]: Smart0-win0
plane[102]: Cluster0-win0
plane[122]: Esmart1-win0
plane[136]: Esmart0-win0
root@linaro-alip:/#
root@linaro-alip:/#
```

Step 3, play video command:

```
# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane-id=102" XXX
```

```
root@linaro-alip:/#
root@linaro-alip:/# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane
-id=102" /media/linaro/D8A7-925F/video/4K60_live_you.mp4
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/D8A7-925F/video/4K60_live_you.mp4
0:00:01.985091991  1513   0x7f78084300 INFO                 mppdec gstmppdec.c:492:gst
_mpp_dec_apply_info_change:<mppvideodec0> applying NV12(AFBC) 3840x2160 (3840x2176)
0:00:02.045511039  1513   0x7f78084300 INFO                 mppdec gstmppdec.c:913:gst
_mpp_dec_loop:<mppvideodec0> video info changed
Redistribute latency...
0:00:02.147023007  1513   0x7f78084300 WARN                 mppdec gstmppdec.c:563:gst
_mpp_dec_get_frame:<mppvideodec0> MPP is not able to generate pts
0:00:24.7 / 0:04:10.5
```

Specify audio channel output:

```
# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane-
id=102" /media/linaro/D8A7-925F/video/4K60_live_you.mp4 --
audiosink="alsasink device=hw:1,0"
```

```
root@linaro-alip:/#
root@linaro-alip:/# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane-id=
102" /media/linaro/D8A7-925F/video/4K60_live_you.mp4 --audiosink="alsasink device=hw:1,0"
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/D8A7-925F/video/4K60_live_you.mp4
0:00:01.766547885  1539   0x7f7c086300 INFO                 mppdec gstmppdec.c:492:gst_mpp
_dec_apply_info_change:<mppvideodec0> applying NV12(AFBC) 3840x2160 (3840x2176)
WARNING No volume control found
WARNING debug information: ../gst/playback/gstplaysink.c(2893): gen_audio_chain (): /GstPla
yBin:playbin/GstPlaySink:playsink:
Volume/mute is not available
[ 2448.587427] dwhdmi-rockchip fe0a0000.hdmi: Rate 0 missing; compute0:00:01.835157809  153
9   0x7 f7c086300 INFO                 mppdec gstmppdec.c:913:gst_mpp_dec_loop:<mNppvideod
ec0> video info chang ed
dynamically
Redistribute latency...
0:00:01.865789520  1539   0x7f7c086300 WARN                 mppdec gstmppdec.c:563:gst_mpp
_dec_get_frame:<mppvideodec0> MPP is not able to generate pts
0:00:13.1 / 0:04:10.5
```

6.7 Ethernet

ifconfig

```
root@linaro-alip:/#
root@linaro-alip:/#
root@linaro-alip:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.139  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::8c16:b07b:f836:fc3  prefixlen 64  scopeid 0x20<link>
        ether 36:31:c3:de:ed:19  txqueuelen 1000  (Ethernet)
        RX packets 212  bytes 13864 (13.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 13  bytes 1572 (1.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 51

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.138  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::c9b7:8ee6:dfb7:a851  prefixlen 64  scopeid 0x20<link>
        ether 32:31:c3:de:ed:19  txqueuelen 1000  (Ethernet)
        RX packets 59  bytes 4130 (4.0 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 11  bytes 1424 (1.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 56
```

ping -I eth0 www.boardcon.com

ping -I eth1 www.boardcon.com

```
root@linaro-alip:/#
root@linaro-alip:/# ping -I eth0 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.0.139 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=47 time=215 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=47 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=47 time=211 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=47 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=11 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=12 ttl=47 time=211 ms
^C
--- www.boardcon.com ping statistics ---
13 packets transmitted, 11 received, 15.3846% packet loss, time 16277ms
rtt min/avg/max/mdev = 211.033/212.315/214.843/1.009 ms
root@linaro-alip:/#
root@linaro-alip:/# ping -I eth1 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.0.138 eth1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=47 time=214 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=47 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=11 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=12 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=13 ttl=47 time=212 ms
^C
--- www.boardcon.com ping statistics ---
13 packets transmitted, 12 received, 7.69231% packet loss, time 12027ms
rtt min/avg/max/mdev = 211.639/212.371/214.058/0.561 ms
root@linaro-alip:/#
```

6.8 RTC

```
# hwclock
```

```
root@linaro-alip:/# hwclock
2022-12-12 11:03:10.542088+00:00
root@linaro-alip:/# hwclock
2022-12-12 11:03:16.925155+00:00
root@linaro-alip:/# hwclock
2022-12-12 11:03:29.116537+00:00
root@linaro-alip:/# hwclock
2022-12-12 11:03:35.918178+00:00
root@linaro-alip:/# hwclock
2022-12-12 11:03:47.021173+00:00
root@linaro-alip:/# hwclock
2022-12-12 11:04:03.590579+00:00
root@linaro-alip:/#
```

As shown above, the RTC operates normally. If the network is connected, the RTC can synchronize with the network time. If there is a button battery on the board, the time can also be saved.

6.9 4G(EC20)

Step 1, execute the following command to realize ppp dialing:

```
# pppd call quectel-ppp &
```

```
root@linaro-alip:~# pppd call quectel-ppp &
[1] 1383
root@linaro-alip:~# pppd options in effect:
debug           # (from /etc/ppp/peers/quectel-ppp)
nodetach                # (from /etc/ppp/peers/quectel-ppp)
dump            # (from /etc/ppp/peers/quectel-ppp)
noauth          # (from /etc/ppp/peers/quectel-ppp)
user test               # (from /etc/ppp/peers/quectel-ppp)
password ??????         # (from /etc/ppp/peers/quectel-ppp)
remotename 3gppp                # (from /etc/ppp/peers/quectel-ppp)
/dev/ttyUSB3            # (from /etc/ppp/peers/quectel-ppp)
115200          # (from /etc/ppp/peers/quectel-ppp)
lock            # (from /etc/ppp/peers/quectel-ppp)
connect chat -s -v -f /etc/ppp/peers/quectel-chat-connect               # (from /etc/ppp/peers/qu
-ppp)
disconnect chat -s -v -f /etc/ppp/peers/quectel-chat-disconnect         # (from /etc/ppp/peers/qu
-ppp)
nocrtscts               # (from /etc/ppp/peers/quectel-ppp)
modem           # (from /etc/ppp/peers/quectel-ppp)
asyncmap 0              # (from /etc/ppp/options)
lcp-echo-failure 4              # (from /etc/ppp/options)
lcp-echo-interval 30            # (from /etc/ppp/options)
hide-password           # (from /etc/ppp/peers/quectel-ppp)
novj            # (from /etc/ppp/peers/quectel-ppp)
novjccomp               # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-local               # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-remote              # (from /etc/ppp/peers/quectel-ppp)
ipparam 3gppp           # (from /etc/ppp/peers/quectel-ppp)
noipdefault             # (from /etc/ppp/peers/quectel-ppp)
ipcp-max-failure 30             # (from /etc/ppp/peers/quectel-ppp)
defaultroute            # (from /etc/ppp/peers/quectel-ppp)
usepeerdns              # (from /etc/ppp/peers/quectel-ppp)
noccp           # (from /etc/ppp/peers/quectel-ppp)
```

Step 2, execute the following to view the network interface status:

```
# ifconfig
```

```
ppp0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST>  mtu 1500
        inet 10.229.160.115  netmask 255.255.255.255  destination 10.64.64.64
        ppp  txqueuelen 3  (Point-to-Point Protocol)
        RX packets 4  bytes 52 (52.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 14  bytes 198 (198.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Step 3, execute the following to check the connectivity of the detection network:

ping www.boardcon.com

```
root@linaro-alip:/# ping www.boardcon.com
PING www.boardcon.com (67.222.54.196) 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=41 time=235 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=41 time=227 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=41 time=226 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=41 time=232 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=41 time=227 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=41 time=225 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=41 time=290 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=41 time=236 ms
^C
--- www.boardcon.com ping statistics ---
9 packets transmitted, 8 received, 11.1111% packet loss, time 8012ms
rtt min/avg/max/mdev = 224.947/237.214/290.017/20.337 ms
root@linaro-alip:/#
```

6.10 GPS(EC20)

echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2

cat /dev/ttyUSB1

```
root@linaro-alip:~# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
root@linaro-alip:~# cat /dev/ttyUSB1
$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPGSV,1,1,01,39,,,34*75

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPGSV,1,1,01,39,,,34*75
```

6.11 WiFi

Step 1, connect the WiFi antenna, then click the network icon in the top right corner of the UI interface, select the SSID from the list of available networks and enter the password.

Step 2, execute the following to view the network interface status:

```
# ifconfig
```

```
wlx327bc97a6656: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.2.162  netmask 255.255.255.0  broadcast 192.168.2.255
        inet6 fe80::3b64:ecc6:ee9:8ce7  prefixlen 64  scopeid 0x20<link>
        ether 32:7b:c9:7a:66:56  txqueuelen 1000  (Ethernet)
        RX packets 28  bytes 2742 (2.6 KiB)
        RX errors 0  dropped 21  overruns 0  frame 0
        TX packets 15  bytes 1941 (1.8 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

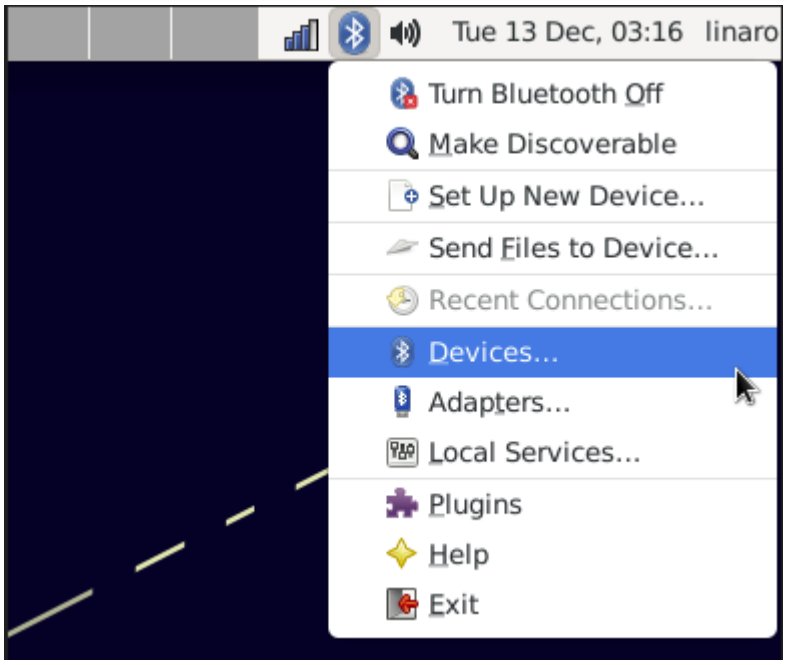
Step 3, execute the following to check the connectivity of the detection network:

```
# ping -I wlx327bc97a6656 www.boardcon.com
```

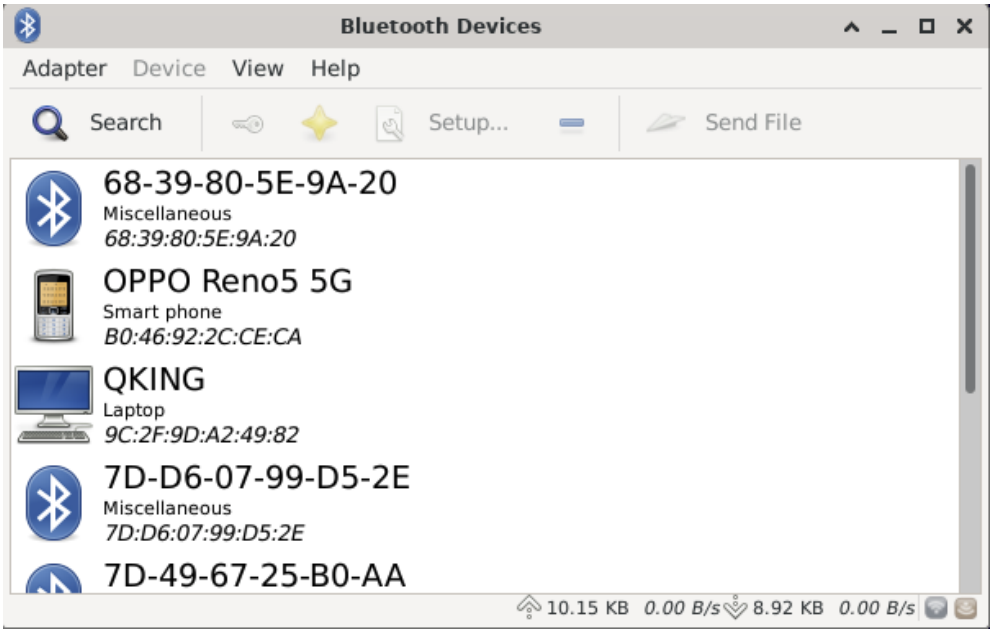
```
root@linaro-alip:~# ping -I wlx327bc97a6656 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.2.162 wlx327bc97a6656: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=46 time=207 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=46 time=239 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=46 time=248 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=46 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=46 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=46 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=46 time=229 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=46 time=212 ms
^C
--- www.boardcon.com ping statistics ---
9 packets transmitted, 8 received, 11.1111% packet loss, time 8010ms
rtt min/avg/max/mdev = 207.440/221.496/247.716/14.053 ms
root@linaro-alip:~#
```

6.12 Bluetooth

Step 1, open **bluetooth devives**:

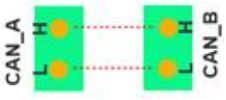


Step 2, click **Search** and pair Bluetooth devices.



6.13 CAN

Step 1, connect the CAN ports of board A and board B as follows:



Step 2, execute the following commands on the serial terminal of board A and board B respectively.

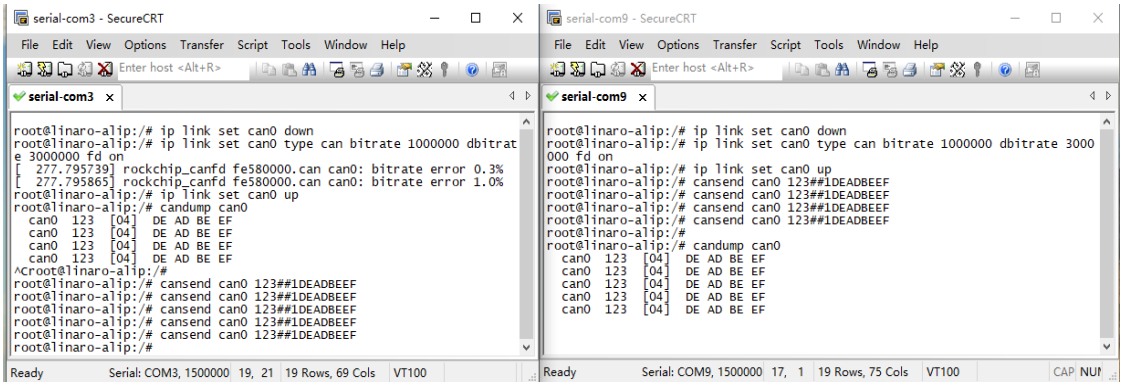
```
# ip link set can0 down
# ip link set can0 type can bitrate 1000000 dbitrate 3000000 fd on
# ip link set can0 up
```

Step 3, execute the following instructions as the receiver.

```
# candump can0                    // set CAN0 as receive
```

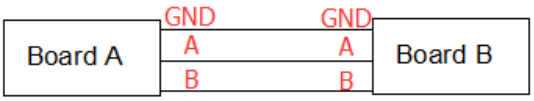
Step 4, execute the following commands as the transmitter.

```
# cansend can0 123##1DEADBEEF     // CAN0 send characters 0xDE 0xAD 0xBE 0xEF
```



6.14 RS485

*Step 1,*connect the RS485 ports of board A and board B as follows:



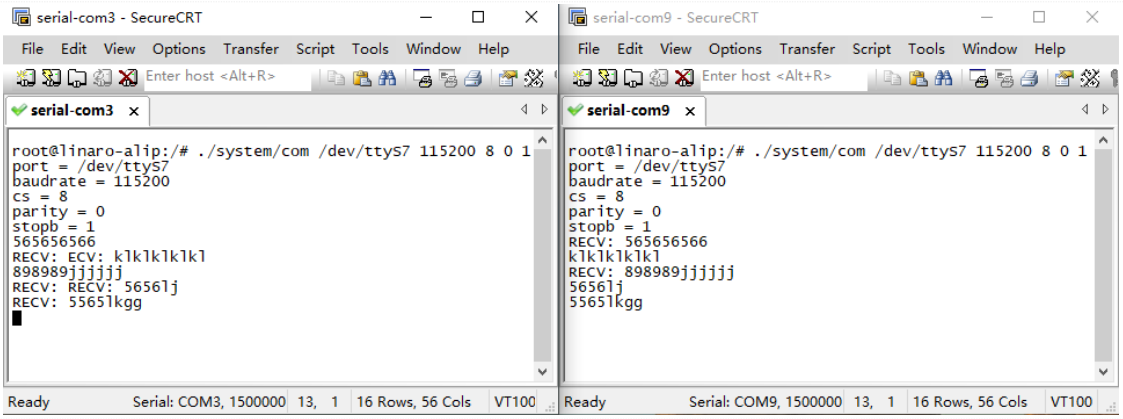
*Step 2,*use ADB to push the file com into board A and board B.

```
# adb remount
# adb push \xx\com /system      // \xx\ is the absolute path to store com files
# adb shell
# chmod 777 /system/com         // modify com file properties
```

*Step 3,*execute the following commands on the terminal serial ports of board A and board B respectively.

```
# ./system/com /dev/ttyS7 115200 8 0 1
```

*Step 4,*at this time, can test the RS485 communication.



The method for testing RS485 is not unique, and the above method is only for reference.

6.15 UART

Step 1, use ADB to push the com file into the test board.

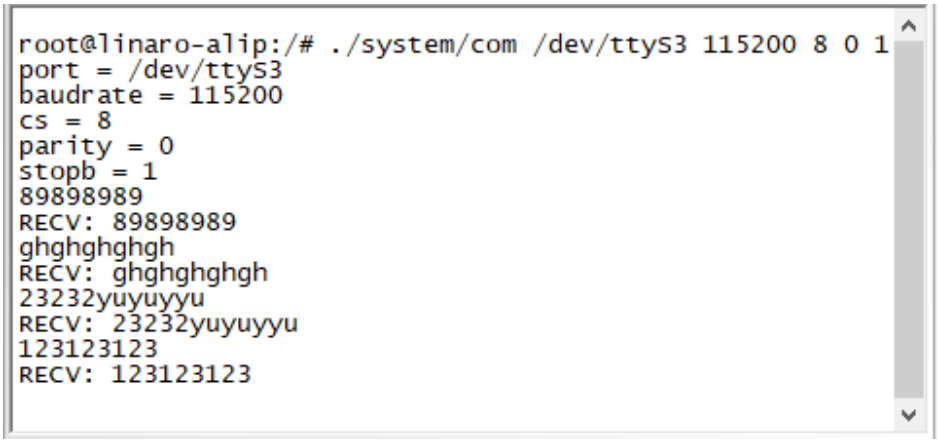
```
# adb remount
```

```
# adb push \xx\com /system    // \xx\ is the absolute path to store com files
# adb shell
# chmod 777 /system/com       // modify com file properties
```

Step 2, short circuit RX and TX pins of UART.

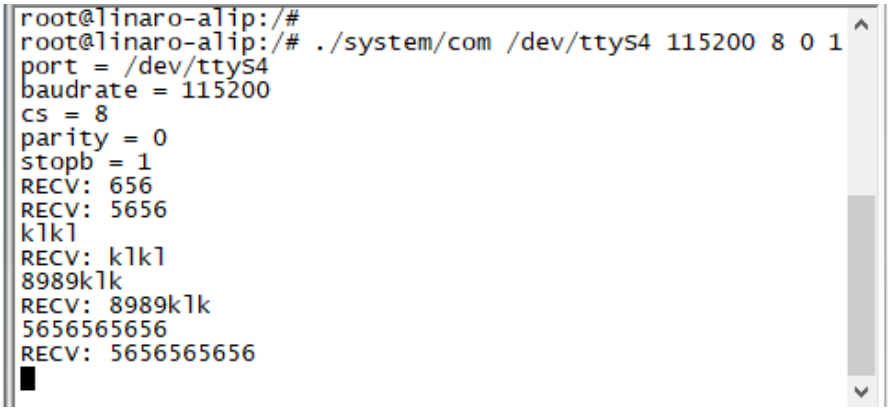
Step 3, UART3 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS3 115200 8 0 1
```



Step 4, UART4 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS4 115200 8 0 1
```



Step 5, UART5 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS5 115200 8 0 1
```

```
root@linaro-alip:/# ./system/com /dev/ttyS5 115200 8 0 1
port = /dev/ttyS5
baudrate = 115200
cs = 8
parity = 0
stopb = 1
123456123456
RECV: 123456123456
sdfghkkkl
RECV: sdfghkkkl
5656kjkjkj
RECV: 5656kjkjkj
1133
RECV: 1133
```

The method for testing UART is not unique, and the above methods are for reference only.

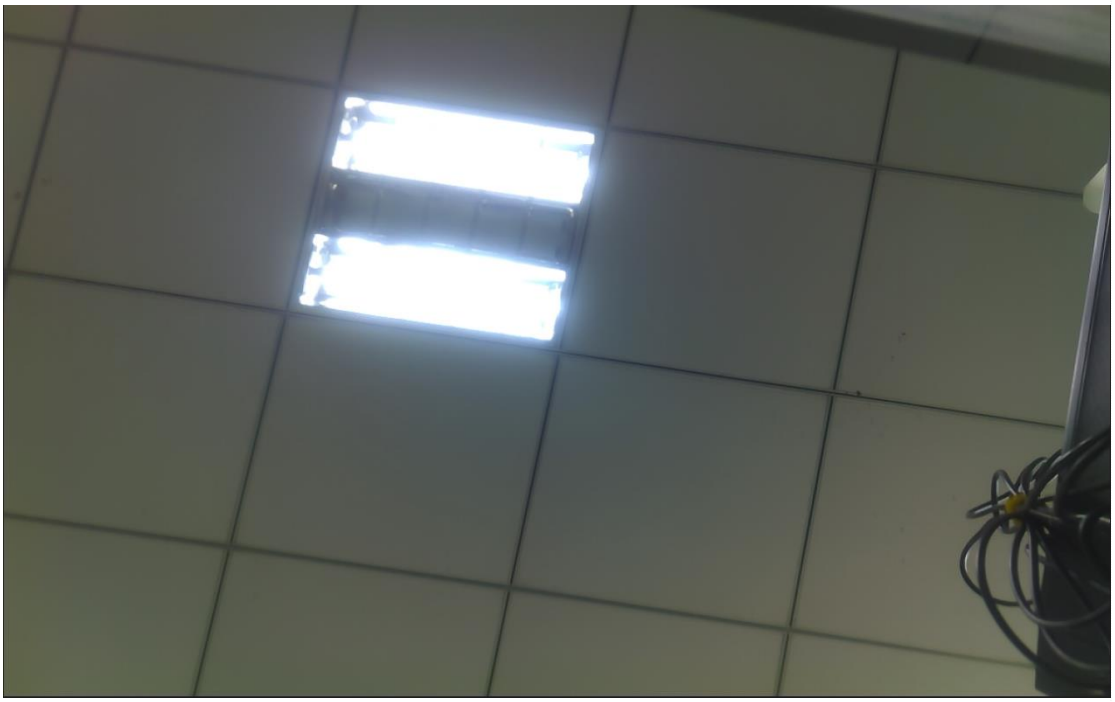
6.16 Camera(ov13850)

Step 1, execute the following command to start rkaiq_3A_server:

```
# /etc/init.d/rkaiq_3A.sh start
```

Step 2, camera0 preview command:

```
# gst-launch-1.0 v4l2src device=/dev/video6 ! video/x-
raw,format=NV16,width=1280,height=800, framerate=30/1 ! kmssink
```



Step 3, camera1 preview command:

```
# gst-launch-1.0 v4l2src device=/dev/video15 ! video/x-
raw,format=NV16,width=1280,height=800, framerate=30/1 ! kmssink
```

Buildroot

1.Compiler Environment

It is recommended to use Ubuntu 20.04 system or above. If you encounter an error during compilation, you can check the error message and install the corresponding software packages accordingly. Other Ubuntu 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 80G. If you do multiple builds, you will need more hard drive space.	Ubuntu 22.04 system

2.Install Tools

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: ubuntu 22.04 system

Network: online

Permission: root

```
# sudo apt-get install git ssh make gcc libssl-dev liblz4-tool expect
# sudo apt-get install g++ patchelf chrpath gawk texinfo chrpath diffstat binfmt-support
# sudo apt-get install qemu-user-static live-build bison flex fakeroot cmake gcc-multilib
# sudo apt-get install g++-multilib unzip device-tree-compiler ncurses-dev libgucharmap-2-90-dev
```

```
# sudo apt-get install bzip2 expat gpgv2 cpp-aarch64-linux-gnu g++-aarch64-linux-gnu
# sudo apt-get install python2 python-is-python3
```

3.Compile Source

Step 1, unzip the source

```
$ tar xvf EM3568_Buildroot.tar.bz2
$ cd EM3568_Buildroot/
```

Step 2, set the compile board

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

processing option: lunch
You're building on Linux
Lunch menu...pick a combo:

0. default BoardConfig.mk
1. BoardConfig-ab-base.mk
2. BoardConfig-rk3566-evb2-lp4x-v10-32bit.mk
3. BoardConfig-rk3566-evb2-lp4x-v10.mk
4. BoardConfig-rk3568-evb1-ddr4-v10-32bit.mk
5. BoardConfig-rk3568-evb1-ddr4-v10-spi-nor-64M.mk
6. BoardConfig-rk3568-evb1-ddr4-v10.mk
7. BoardConfig-rk3568-evb2-lp4x-v10-linux.mk
8. BoardConfig-rk3568-uvc-evb1-ddr4-v10.mk
9. BoardConfig-security-base.mk
10. BoardConfig.mk
Which would you like? [0]: 7 // Select 7. BoardConfig-rk3568-evb2-lp4x-v10-linux.mk
switching to board: /home/liuyuan/opt/EM3568_Buildroot/device/rockchip/rk356x/BoardConfig-rk3568-evb2-lp4x-v10-linux.mk

Step 3, compile uboot

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

Step 4, compile the kernel

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

If you need to configure the kernel, execute the following command:

```
$ cd kernel
$ make ARCH=arm64 menuconfig
```

Kernel use default config file is: kernel\arch\arm64\configs\rockchip_linux_defconfig.
After reconfiguring the kernel, the configuration content is saved in the kernel/.config file by default, please update the contents of the rockchip_linux_defconfig file before recompiling the kernel.

Step 5, compile recovery

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

Step 6, compile buildroot

```
$ ./build.sh rootfs
```

Step 7, generated image file

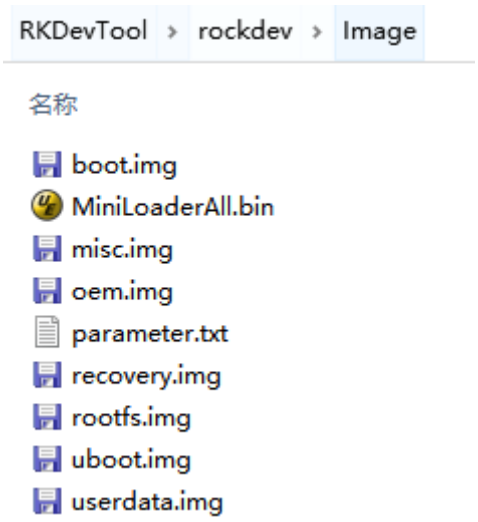
```
$ ./mkfirmware.sh
$ ./build.sh updateimg
```

Images are generated in rockdev/ directory.

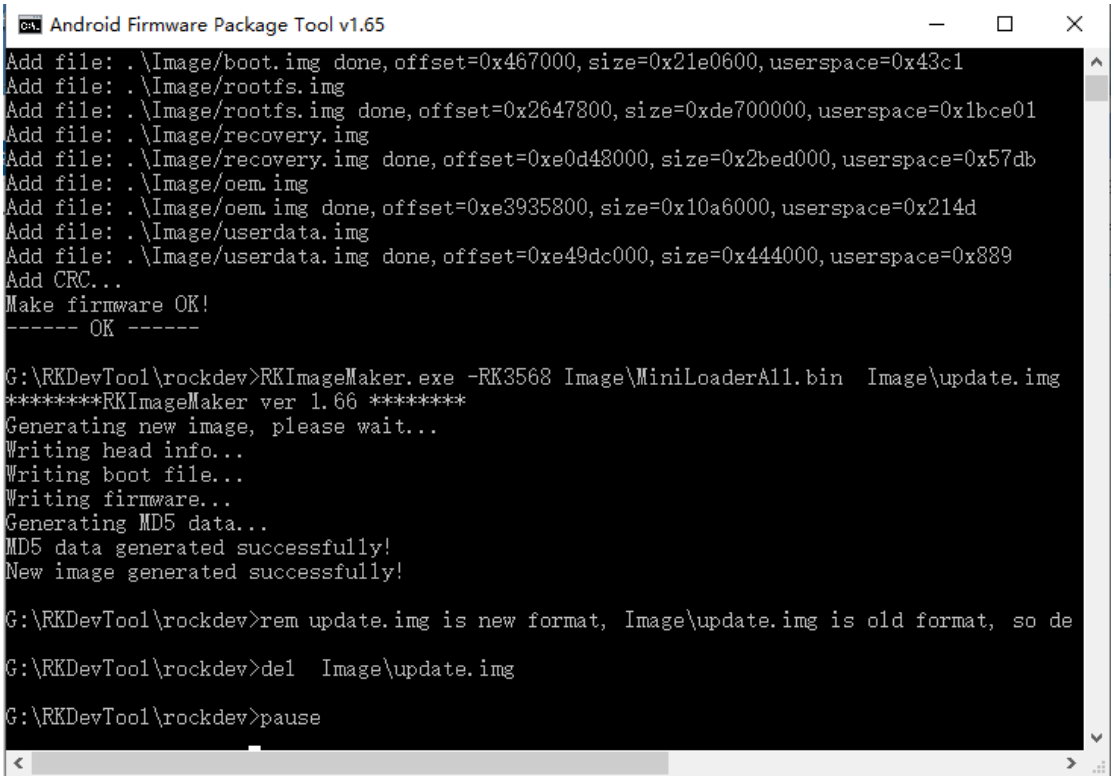
4.Images Operation

4.1 Pack image

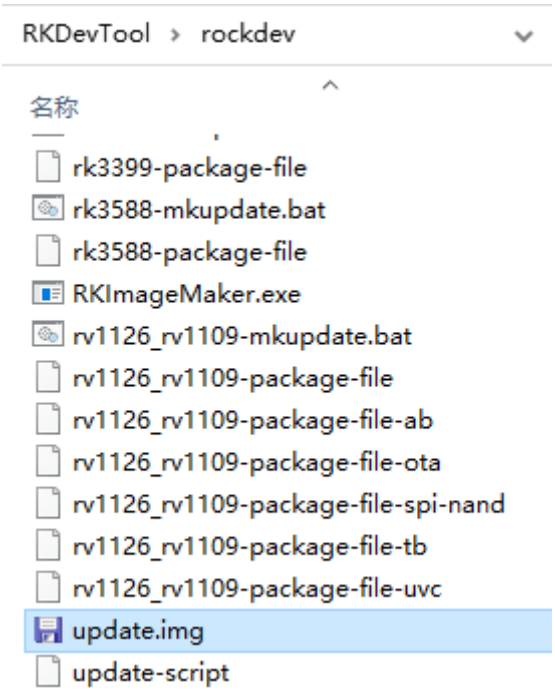
Step 1, copy the firmware file to be packaged to windows RKDevTool/rockdev/Image.



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



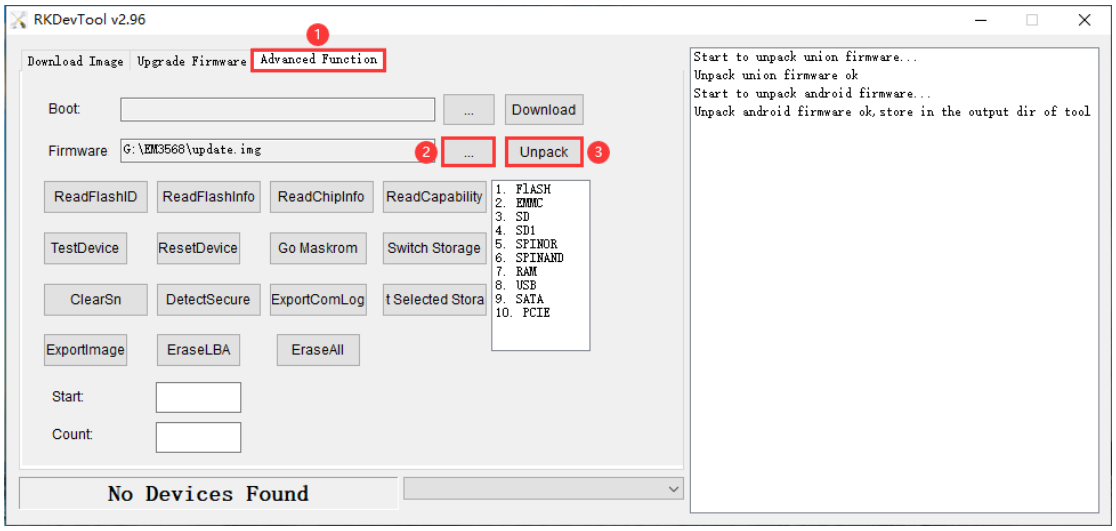
Step 3, the **update.img** will be generated in rockdev/ directory.



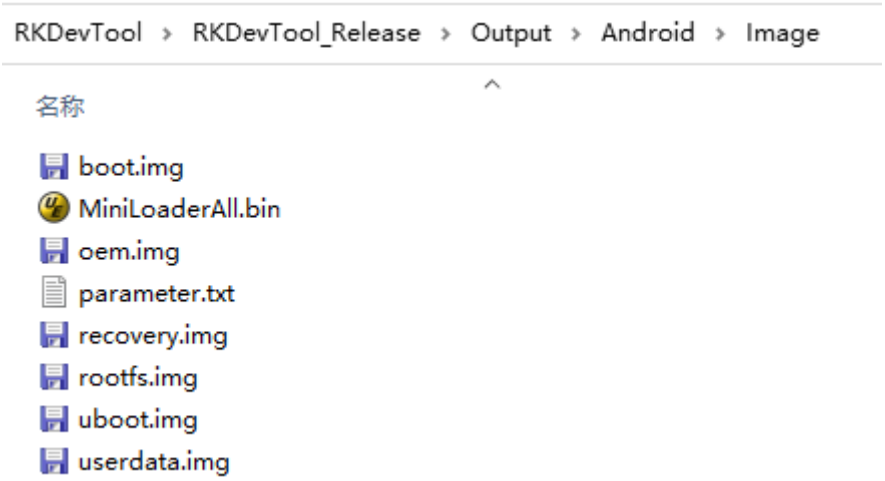
4.2 Unzip firmware

Step 1, open RKDevTool_Release\RKDevTool.exe.

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



Step 3, the unzip files will be generated in \RKDevTool\RKDevTool_Release\Output\Android\Image directory.

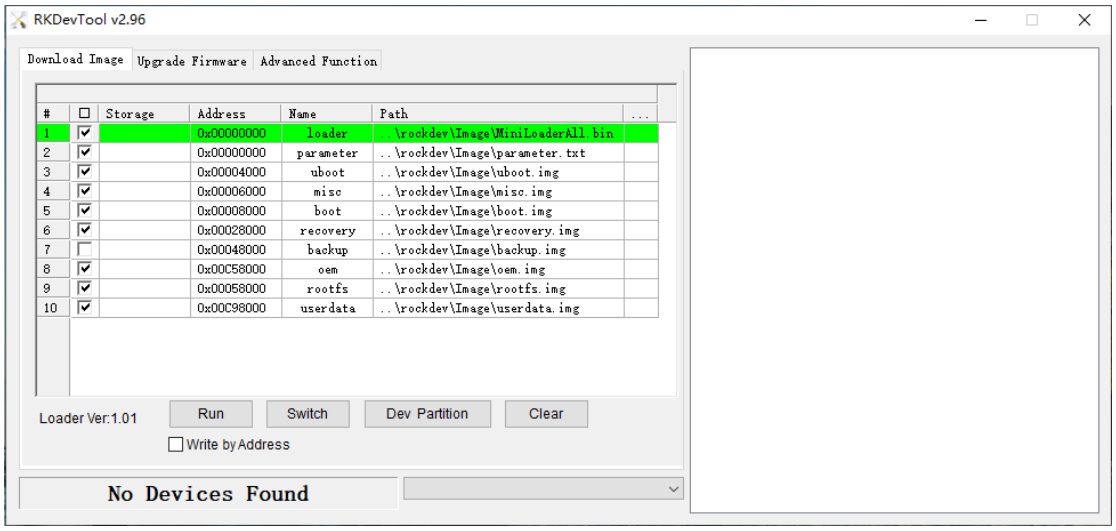


5.Burn Images

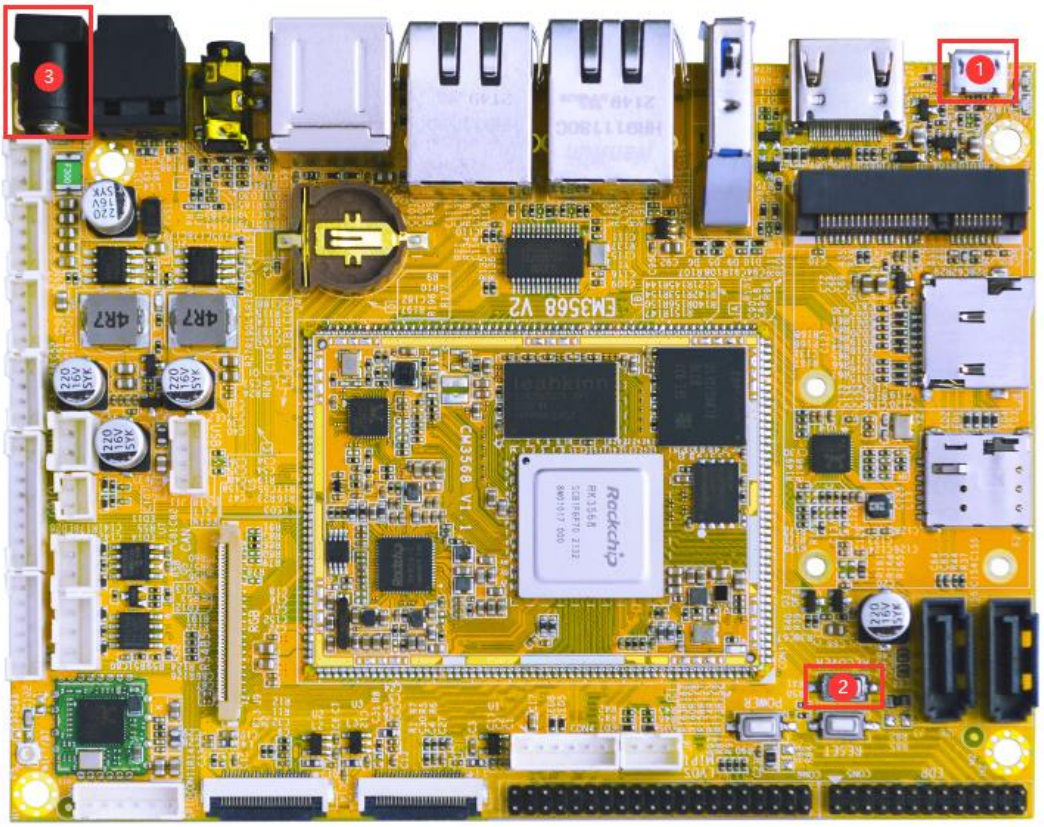
5.1 Burn update firmware

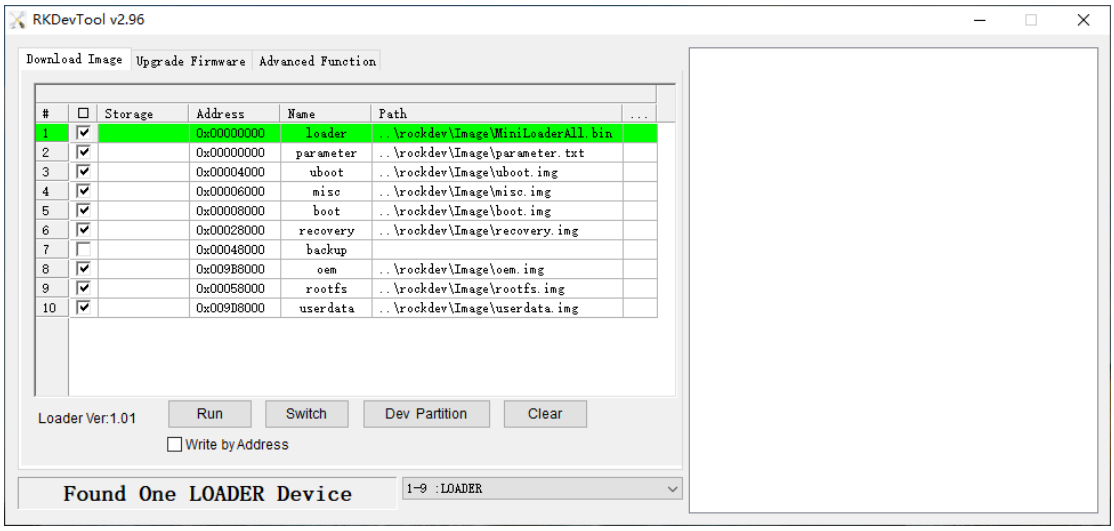
Step 1, unzip RKDevTool.rar on Windows.

Step 2, open RKDevTool_Release\RKDevTool.exe.

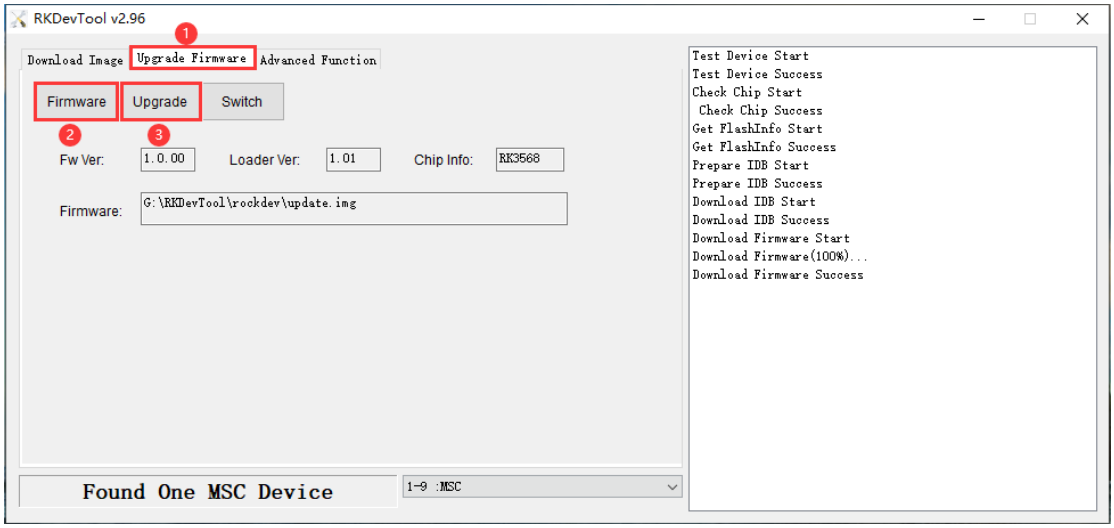


Step 3, connect PC and development board withType-C USB cable, keep pressing the **Recovery Key** and power the board until the windows PC shows **Found one LOADER Device** release the **Recovery** Key .





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

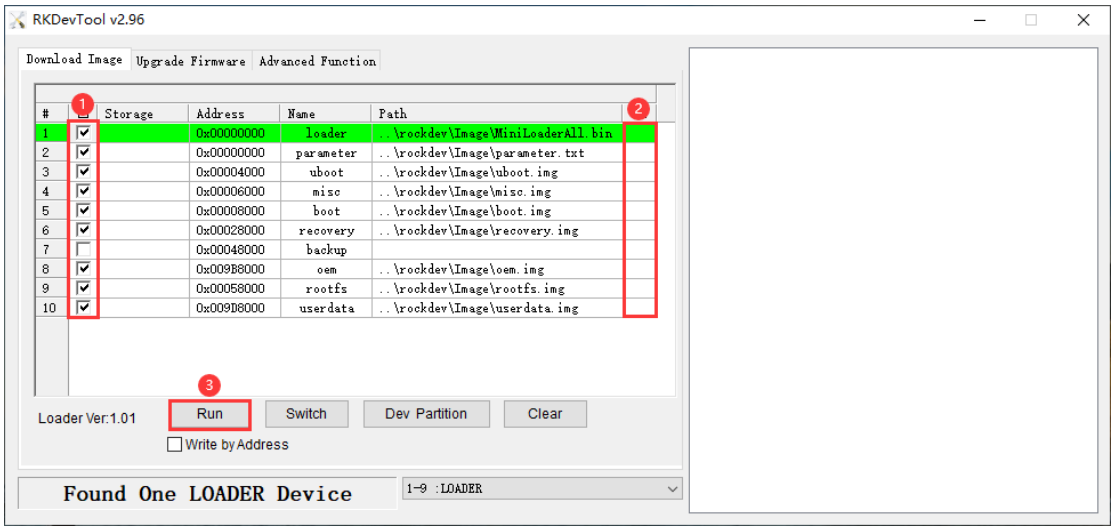


5.2 Burn split firmware

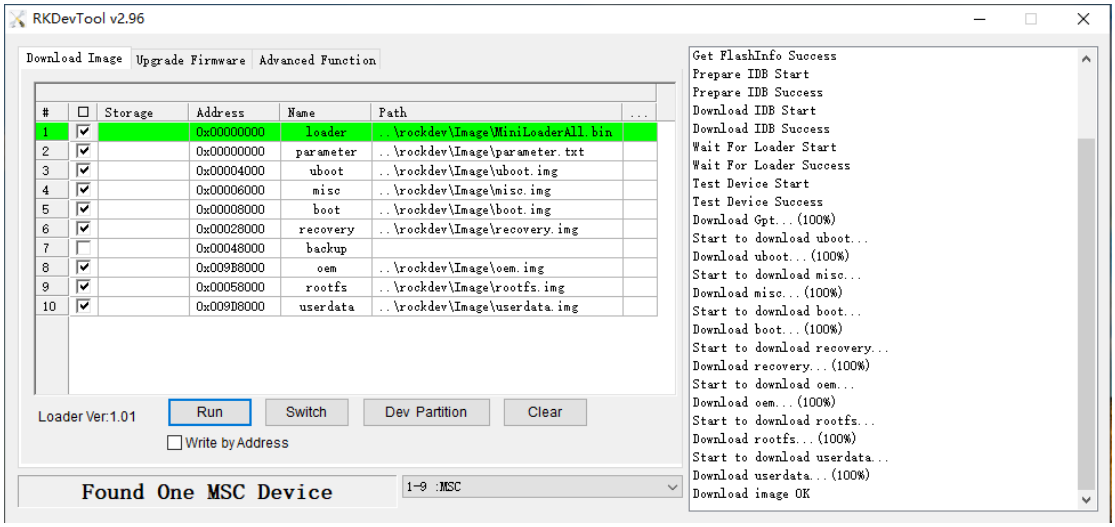
Step 1, select the checkbox on the left.

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

Step 3, click **run** button to flash the image.



Step 4, wait for the completion of burning.



6.Buildroot Application

6.1 Display

EM3568 supports both lvds and HDMI display.

6.2 SD card

```
# ls dev/
```

```
hwrng           mmcblk0p8     tty13   tty46   usbmon3      video20
i2c-0           mmcblk0rpmb   tty14   tty47   usbmon4      video21
i2c-1           mmcblk1       tty15   tty48   usbmon5      video22
i2c-2           mmcblk1p1     tty16   tty49   usbmon6      video3
i2c-3           mpp_service   tty17   tty5    v4l          video4
i2c-4           null          tty18   tty50   v4l-subdev0  video5
i2c-5           port          tty19   tty51   v4l-subdev1  video6
i2c-6           ppp           tty2    tty52   v4l-subdev2  video7
iio:device0     ptmx          tty20   tty53   v4l-subdev3  video8
input           ptp0          tty21   tty54   v4l-subdev4  video9
kmsg            ptp1          tty22   tty55   v4l-subdev5  watchdog
log             pts           tty23   tty56   v4l-subdev6  watchdog0
loop-control    ram0          tty24   tty57   vcs          zero
loop0           random        tty25   tty58   vcs1         zram0
root@RK356X:/#
```

```
# mount /dev/mmcblk1p1 /mnt/external_sd
# ls /mnt/external_sd
```

```
root@RK356X:/#
root@RK356X:/# mount /dev/mmcblk1p1 /mnt/external_sd
root@RK356X:/# ls /mnt/external_sd
 Alarms        Download       Notifications                com
 Android       LOST.DIR       Pictures                     kugoumusic
 Audiobooks    Movies         Podcasts                     video
 DCIM          Music          Ringtones
 Documents    'New Folder'   'System Volume Information'
root@RK356X:/#
```

6.3 USB host

USB2.0 Host:

```
# ls /dev
```

```
root@RK356X:/# ls /dev
block             loop1         rfkill   tty26  tty59        vcsa
bsg               loop2         rga      tty27  tty6         vcsa1
bus               loop3         rtc      tty28  tty60        vcsu
cec0              loop4         rtc0     tty29  tty61        vcsu1
char              loop5         sda      tty3   tty62        vendor_storage
console           loop6         sda1     tty30  tty63        vhci
cpu_dma_latency   loop7         sdb      tty31  tty7         video-camera0
crypto            mali0         sdb1     tty32  tty8         video-dec0
disk              media0        sdc      tty33  tty9         video-enc0
dma_heap          media1        sdc1     tty34  ttyFIQ0      video0
dri               media2        shm      tty35  ttyS3        video1
fb0               mem           snd      tty36  ttyS4        video10
fd                mmcblk0       stderr   tty37  ttyS5        video11
full              mmcblk0boot0  stdin    tty38  ttyS7        video12
fuse              mmcblk0boot1  stdout   tty39  ubi_ctrl     video13
gpiochip0         mmcblk0p1     sw_sync  tty4   uhid         video14
gpiochip1         mmcblk0p2     tty      tty40  uinput       video15
gpiochip2         mmcblk0p3     tty0     tty41  urandom      video16
gpiochip3         mmcblk0p4     tty1     tty42  usb-ffs      video17
```

USB3.0 Host:

```
root@RK356X:/# [ 1231.009290] usb 6-1: new SuperSpeed Gen 1 USB device number 3 using xhci-hcd
[ 1231.036998] usb 6-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[ 1231.037144] usb 6-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 1231.037177] usb 6-1: Product: OnlyDisk
[ 1231.037200] usb 6-1: Manufacturer: Netac
[ 1231.037224] usb 6-1: SerialNumber: 1BD4E2102A680062
[ 1231.042993] usb-storage 6-1:1.0: USB Mass Storage device detected
[ 1231.045200] scsi host4: usb-storage 6-1:1.0
[ 1232.067462] scsi 4:0:0:0: Direct-Access     Netac    OnlyDisk         8.01 PQ: 0 ANSI: 6
[ 1232.073405] sd 4:0:0:0: [sdd] 60825600 512-byte logical blocks: (31.1 GB/29.0 GiB)
[ 1232.073983] sd 4:0:0:0: [sdd] Write Protect is off
[ 1232.074494] sd 4:0:0:0: [sdd] Write cache: disabled, read cache: enabled, doesn't support DP
O or FUA
[ 1232.092872]  sdd: sdd1
[ 1232.096404] sd 4:0:0:0: [sdd] Attached SCSI removable disk
[ 1232.364016] FAT-fs (sdd1): utf8 is not a recommended IO charset for FAT filesystems, filesys
tem will be case sensitive!
[ 1232.368322] FAT-fs (sdd1): Volume was not properly unmounted. Some data may be corrupt. Plea
se run fsck.

root@RK356X:/#
```

```
# ls /dev
```

```
root@RK356X:/# ls /dev
block             loop2         rtc      tty27  tty60        vcsu1
bsg               loop3         rtc0     tty28  tty61        vendor_storage
bus               loop4         sda      tty29  tty62        vhci
cec0              loop5         sda1     tty3   tty63        video-camera0
char              loop6         sdb      tty30  tty7         video-dec0
console           loop7         sdb1     tty31  tty8         video-enc0
cpu_dma_latency   mali0         sdc      tty32  tty9         video0
crypto            media0        sdc1     tty33  ttyFIQ0      video1
disk              media1        sdd      tty34  ttyS3        video10
dma_heap          media2        sdd1     tty35  ttyS4        video11
dri               mem           shm      tty36  ttyS5        video12
fb0               mmcblk0       snd      tty37  ttyS7        video13
```

The USB Host can be used to connect USB mouse, USB keyboard, U-Disk or other USB devices.

6.4 SATA2.0

```
# ls dev/
```

```
root@RK356X:/# ls dev
block             loop2         rtc      tty25  tty59        vcsa1
bsg               loop3         rtc0     tty26  tty6         vcsu
bus               loop4         sda      tty27  tty60        vcsu1
cec0              loop5         sda1     tty28  tty61        vendor_storage
char              loop6         sdb      tty29  tty62        vhci
console           loop7         sdb1     tty3   tty63        video-camera0
cpu_dma_latency   mali0         sdc      tty30  tty7         video-dec0
crypto            media0        sdc1     tty31  tty8         video-enc0
disk              media1        sdd      tty32  tty9         video0
dma_heap          media2        sdd1     tty33  ttyFIQ0      video1
dri               mem           sde      tty34  ttyS3        video10
fb0               mmcblk0       sde1     tty35  ttyS4        video11
fd                mmcblk0boot0  shm      tty36  ttyS5        video12
full              mmcblk0boot1  snd      tty37  ttyS7        video13
```

```
# mount /dev/sde1 /mnt/udisk/
# ls /mnt/udisk/
```

```
root@RK356X:/#
root@RK356X:/# mount /dev/sde1 /mnt/udisk/
root@RK356X:/# ls /mnt/udisk/
 2.png
 3.png
 4videosoft-4k-video-converter-6.2.26.exe
 Alarms
 AnTuTu
 Android
 Android12
 AndroidTool
 Audiobooks
 CH341SER
 CP210x_Windows_Drivers_with_Serial_Enumeration
 DCIM
 Documents
 Download
 DriverAssitant_v5.11
 DriverAssitant_v5.11.zip
 EM2416-v3.2-toshiba-8bit-ecc
 EM3399_Use_ADB
 I.O.I-Dream.Girl.2160p.UHDTV.H265.ts
```

6.5 Audio

Step 1, view sound card:

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

```
root@RK356X:/# cat /proc/asound/cards
 0 [rockchiprk809  ]: rockchip-rk809 - rockchip-rk809
                      rockchip-rk809
 1 [rockchiphdmi   ]: rockchip_hdmi - rockchip,hdmi
                      rockchip,hdmi
root@RK356X:/#
```

Step 2, headset recording:

```
# arecord -Dhw:0,0 -f cd record.wav
```

```
root@RK356X:/#
root@RK356X:/# arecord -Dhw:0,0 -f cd record.wav
Recording WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
^CAborted by signal Interrupt...
root@RK356X:/#
```

Step 3, play audio:

```
# aplay -Dhw:0,0 record.wav     // Priority: headphone output>speaker output
# aplay -Dhw:1,0 record.wav     // HDMI
```

```
root@RK356X:/# aplay -Dhw:0,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
root@RK356X:/#
root@RK356X:/# aplay -Dhw:1,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
[  902.863560] dwhdmi-rockchip fe0a0000.hdmi: Rate 0 missing; compute N dynamically
root@RK356X:/#
```

6.6 Video playing

1. non 4k video playback:

```
# gst-play-1.0 --videosink=xvimagesink XXX
```

```
root@RK356X:/# mount /dev/mmcblk1p1 /mnt/sdcard/
root@RK356X:/#
i.mp4RK356X:/# gst-play-1.0 --videosink=xvimagesink /mnt/sdcard/video/music/haidi

(gst-play-1.0:889): gst-play-1.0-WARNING **: 03:45:20.262: Couldn't create specified video sink 'xvimagesi
nk'
Press 'k' to see a list of keyboard shortcuts.
Now playing /mnt/sdcard/video/music/haidi.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:00:17.3 / 0:04:09.2
```

2. 4k video playback:

Step 1, be sure to set AFBC:

```
# export GST_MPP_VIDEODEC_DEFAULT_ARM_AFBC=1
```

Step 2, view the plane id (select Cluster0-win0):

```
# cat /sys/kernel/debug/dri/0/state | grep "plane\["
```

```
root@RK356X:/# export GST_MPP_VIDEODEC_DEFAULT_ARM_AFBC=1
root@RK356X:/# cat /sys/kernel/debug/dri/0/state | grep "plane\["
plane[54]: Smart1-win0
plane[68]: Cluster1-win0
plane[88]: Smart0-win0
plane[102]: Cluster0-win0
plane[122]: Esmart1-win0
plane[136]: Esmart0-win0
root@RK356X:/#
root@RK356X:/#
```

Step 3, play video command:

```
# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane-id=102" XXX
```

```
root@RK356X:/#
root@RK356X:/# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink
ne-id=102" /mnt/sdcard/video/4K60_live_you.mp4
Press 'k' to see a list of keyboard shortcuts.
Now playing /mnt/sdcard/video/4K60_live_you.mp4
0:00:00.604869769   953   0x7f74086b00 INFO                    mppdec gstmppde
c.c:492:gst_mpp_dec_apply_info_change:<mppvideodec0> applying NV12(AFBC) 384
0x2160 (3840x2176)
0:00:00.650620316   953   0x7f74086b00 INFO                    mppdec gstmppde
c.c:913:gst_mpp_dec_loop:<mppvideodec0> video info changed
Redistribute latency...
Redistribute latency...
0:00:00.739613658   953   0x7f74086b00 WARN                    mppdec gstmppde
c.c:563:gst_mpp_dec_get_frame:<mppvideodec0> MPP is not able to generate pts
Redistribute latency...
0:00:07.3 / 0:04:10.5
```

Specify audio channel output:

```
# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="kmssink plane-
id=102" /mnt/sdcard/video/4K60_live_you.mp4 --audiosink="alsasink device=hw:1,0"
```

```
root@RK356X:/# GST_DEBUG=*mpp*:4 gst-play-1.0 --flags=3 --videosink="k
ne-id=102" /mnt/sdcard/video/4K60_live_you.mp4 --audiosink="alsasink d
,0"ce=hw:1,
Press 'k' to see a list of keyboard shortcuts.
Now playing /mnt/sdcard/video/4K60_live_you.mp4
0:00:00.903128674   933   0x7f78088b00 INFO                    mppdec gs
tmppdec.c:492:gst_mpp_dec_apply_info_change:<mppvideodec0> applying NV
12(AFBC) 3840x2160 (3840x2176)
WARNING No volume control found
WARNING debug information: ../gst/playback/gstplaysink.c(2903): gen_au
dio_chain (): /GstPlayBin:playbin/GstPlaySink:playsink:
Volume/mute is not available
0:00:00.946880720   933   0x7f78088b00 INFO                    mppdec gs
tmppdec.c:913:gst_mpp_dec_loop:<mppvideodec0> video info changed
Redistribute latency...
Redistribute latency...
0:00:00.979717723   933   0x7f78088b00 WARN                    mppdec gs
tmppdec.c:563:gst_mpp_dec_get_frame:<mppvideodec0> MPP is not able to
generate pts
Redistribute latency...
0:00:09.5 / 0:04:10.5
```

6.7 Ethernet

```
# ifconfig
```

```
root@RK356X:/#
root@RK356X:/#
root@RK356X:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 36:31:C3:DE:ED:19
          inet addr:192.168.0.139  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::4537:204f:fb44:187/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:115 errors:0 dropped:0 overruns:0 frame:0
          TX packets:18 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7524 (7.3 KiB)  TX bytes:1772 (1.7 KiB)
          Interrupt:51

eth1      Link encap:Ethernet  HWaddr 32:31:C3:DE:ED:19
          inet addr:192.168.0.138  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::7707:a560:fde4:a33f/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:357 errors:0 dropped:0 overruns:0 frame:0
          TX packets:43 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:23942 (23.3 KiB)  TX bytes:3826 (3.7 KiB)
          Interrupt:56
```

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

```
root@RK356X:/#
root@RK356X:/# ping -I eth0 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.0.139 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=47 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=11 ttl=47 time=212 ms
^C
--- www.boardcon.com ping statistics ---
12 packets transmitted, 10 received, 16.6667% packet loss, time 11036ms
rtt min/avg/max/mdev = 211.672/212.134/212.644/0.269 ms
root@RK356X:/#
root@RK356X:/# ping -I eth1 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.0.138 eth1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=47 time=214 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=47 time=211 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=47 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=47 time=212 ms
^C
--- www.boardcon.com ping statistics ---
11 packets transmitted, 10 received, 9.09091% packet loss, time 14238ms
rtt min/avg/max/mdev = 210.843/212.081/213.713/0.668 ms
root@RK356X:/#
root@RK356X:/#
root@RK356X:/#
```

6.8 RTC

```
# hwclock
```

```
root@RK356X:/# hwclock
Wed Dec 14 03:57:01 2022  0.000000 seconds
root@RK356X:/# hwclock
Wed Dec 14 03:57:04 2022  0.000000 seconds
root@RK356X:/# hwclock
Wed Dec 14 03:57:06 2022  0.000000 seconds
root@RK356X:/# hwclock
Wed Dec 14 03:57:07 2022  0.000000 seconds
root@RK356X:/# hwclock
Wed Dec 14 03:57:08 2022  0.000000 seconds
root@RK356X:/# hwclock
Wed Dec 14 03:57:08 2022  0.000000 seconds
root@RK356X:/#
```

As shown above, the RTC operates normally. If the network is connected, the RTC can synchronize with the network time. If there is a button battery on the board, the time can also be saved.

6.9 4G(EC20)

Step 1, execute the following command to realize ppp dialing:

```
# pppd call quectel-ppp &
```

```
root@RK356X:/# pppd call quectel-ppp &
[1] 878
root@RK356X:/# pppd options in effect:
debug            # (from /etc/ppp/peers/quectel-ppp)
nodetach                 # (from /etc/ppp/peers/quectel-ppp)
dump             # (from /etc/ppp/peers/quectel-ppp)
noauth           # (from /etc/ppp/peers/quectel-ppp)
user test                # (from /etc/ppp/peers/quectel-ppp)
password ??????          # (from /etc/ppp/peers/quectel-ppp)
remotename 3gppp                 # (from /etc/ppp/peers/quectel-ppp)
/dev/ttyUSB3             # (from /etc/ppp/peers/quectel-ppp)
115200           # (from /etc/ppp/peers/quectel-ppp)
lock             # (from /etc/ppp/peers/quectel-ppp)
connect chat -s -v -f /etc/ppp/peers/quectel-chat-connect          #
 (from /etc/ppp/peers/quectel-ppp)
disconnect chat -s -v -f /etc/ppp/peers/quectel-chat-disconnect    #
 (from /etc/ppp/peers/quectel-ppp)
nocrtscts                # (from /etc/ppp/peers/quectel-ppp)
modem            # (from /etc/ppp/peers/quectel-ppp)
hide-password            # (from /etc/ppp/peers/quectel-ppp)
novj             # (from /etc/ppp/peers/quectel-ppp)
novjccomp                # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-local                # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-remote               # (from /etc/ppp/peers/quectel-ppp)
ipparam 3gppp            # (from /etc/ppp/peers/quectel-ppp)
noipdefault              # (from /etc/ppp/peers/quectel-ppp)
ipcp-max-failure 30              # (from /etc/ppp/peers/quectel-ppp)
defaultroute             # (from /etc/ppp/peers/quectel-ppp)
usepeerdns               # (from /etc/ppp/peers/quectel-ppp)
noccp            # (from /etc/ppp/peers/quectel-ppp)
abort on (BUSY)
abort on (NO CARRIER)
abort on (NO DIALTONE)
abort on (ERROR)
abort on (NO ANSWER)
timeout set to 30 seconds
```

Step 2, execute the following to view the network interface status:

```
# ifconfig
```

```
ppp0      Link encap:Point-to-Point Protocol
          inet addr:10.173.70.28  P-t-P:10.64.64.64  Mask:255.255.255.255
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:50 errors:0 dropped:0 overruns:0 frame:0
          TX packets:51 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:5277 (5.1 KiB)  TX bytes:3466 (3.3 KiB)
```

Step 3, execute the following to check the connectivity of the detection network:

```
# ping www.boardcon.com
```

```
root@RK356X:/# ping www.boardcon.com
PING www.boardcon.com (67.222.54.196) 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=40 time=245 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=40 time=243 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=40 time=245 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=40 time=278 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=40 time=243 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=40 time=243 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=40 time=243 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=40 time=242 ms
^C
--- www.boardcon.com ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7001ms
rtt min/avg/max/mdev = 242.462/247.699/277.894/11.442 ms
root@RK356X:/#
```

6.10 GPS(EC20)

```
# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
```

```
# cat /dev/ttyUSB1
```

```
root@RK356X:/# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
root@RK356X:/# cat /dev/ttyUSB1
$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPGSV,1,1,01,33,,,34*7F
```

6.11 WiFi

Step 1, connect the WiFi antenna, execute the following command to search for wireless hotspotsrd.

```
# ifconfig wlan0 up
# iwlist wlan0 scan
```

```
root@RK356X:/# iwlist wlan0 scan
wlan0     Scan completed :
          Cell 01 - Address: B8:F8:83:E9:1E:21
                    ESSID:"TP-LINK_1E508"
                    Protocol:IEEE 802.11bgn
                    Mode:Master
                    Frequency:2.437 GHz (Channel 6)
                    Encryption key:on
                    Bit Rates:300 Mb/s
                    Extra:wpa_ie=dd160050f20101000050f20401000050f20401000050f202
                    IE: WPA Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    Extra:
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    Quality=33/100  Signal level=13/100
                    Extra:fm=0003
          Cell 02 - 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:300 Mb/s
                    Extra:wpa_ie=dd160050f20101000050f20401000050f20401000050f202
                    IE: WPA Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
```

Step 2, configure the wireless hotspot to be connected:

```
# vi /data/cfg/wpa_supplicant.conf
```

```
ctrl_interface=/var/run/wpa_supplicant
ap_scan=1
update_config=1

network={
        ssid="Boardcon"
        psk="1234567890"
        key_mgmt=WPA-PSK
}
~
```

Step 3, execute the following command to restart wifi and connect to the hotspot:

```
# ifconfig wlan0 down
# killall wpa_supplicant
# ifconfig wlan0 up
# wpa_supplicant -B -i wlan0 -c /data/cfg/wpa_supplicant.conf
```

```
root@RK356X:/#
root@RK356X:/# ifconfig wlan0 down
root@RK356X:/# killall wpa_supplicant
root@RK356X:/# ifconfig wlan0 up
root@RK356X:/# wpa_supplicant -B -i wlan0 -c /data/cfg/wpa_supplicant.conf
Successfully initialized wpa_supplicant
nl80211: kernel reports: Authentication algorithm number required
root@RK356X:/# [  705.463266] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes
ready
```

Step 2, execute the following to view the network interface status:

```
# ifconfig
```

```
wlan0     Link encap:Ethernet  HWaddr 30:7B:C9:7A:66:56
          inet addr:169.254.140.174  Bcast:169.254.255.255  Mask:255.255.0.0
          inet6 addr: fe80::5b24:74ec:ccfc:1fac/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:28 errors:0 dropped:1 overruns:0 frame:0
          TX packets:38 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:3068 (2.9 KiB)  TX bytes:4829 (4.7 KiB)
```

Step 3, execute the following to check the connectivity of the detection network:

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

```
root@RK356X:/# ping -I wlan0 www.boardcon.com
PING www.boardcon.com (67.222.54.196) from 192.168.2.233 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=46 time=205 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=46 time=206 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=46 time=220 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=46 time=221 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=46 time=212 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=46 time=206 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=46 time=207 ms
^C
--- www.boardcon.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6005ms
rtt min/avg/max/mdev = 205.194/210.830/221.036/6.436 ms
root@RK356X:/#
```

6.12 Bluetooth

Step 1, open bluetooth devives:

```
# echo 0 > /sys/class/rfkill/rfkill0/state
# echo 0 > /proc/bluetooth/sleep/btwrite
# sleep 0.5
# echo 1 > /sys/class/rfkill/rfkill0/state
# echo 1 > /proc/bluetooth/sleep/btwrite
# sleep 0.5
```

```
root@RK356X:/#
root@RK356X:/# echo 0 > /sys/class/rfkill/rfkill0/state
[ 1789.077019] [BT_RFKILL]: bt shut off power
root@RK356X:/# echo 0 > /proc/bluetooth/sleep/btwrite
[ 1789.089982] [BT_RFKILL]: bt shut off power
root@RK356X:/# sleep 0.5
root@RK356X:/# echo 1 > /sys/class/rfkill/rfkill0/state
[ 1797.211907] [BT_RFKILL]: bt turn on power
root@RK356X:/# echo 1 > /proc/bluetooth/sleep/btwrite
[ 1797.215034] [BT_RFKILL]: bt turn on power
root@RK356X:/# sleep 0.5
```

```
# insmod /usr/lib/modules/rtk_btusb.ko
```

```
root@RK356X:/# insmod /usr/lib/modules/rtk_btusb.ko
[ 1857.617796] rtk_btusb: Realtek Bluetooth USB driver ver 3.1.969e923.20210423-153
940
[ 1857.617914] rtk_btcoex: rtk_btcoex_init: version: 1.2
[ 1857.617923] rtk_btcoex: create workqueue
[ 1857.618520] rtk_btcoex: alloc buffers 1792, 2432 for ev and l2
[ 1857.618888] rtk_btusb: btusb_probe intf->cur_altsetting->desc.bInterfaceNumber 0
[ 1857.618901] rtk_btusb: btusb_probe can_wakeup 1, may wakeup 0
[ 1857.618908] rtk_btusb: patch_add
[ 1857.618915] rtk_btusb: auto suspend is disabled
[ 1857.618927] rtk_btusb: pid = 0xd723
[ 1857.618937] rtk_btusb: patch_add: Reset gEVersion to 0xff
[ 1857.618972] rtk_btusb: set_bit(HCI_QUIRK_RESET_ON_CLOSE, &hdev->quirks);
[ 1857.619919] rtk_btusb: btusb_probe: done
[ 1857.619945] rtk_btusb: btusb_open start
[ 1857.619951] rtk_btusb: btusb_open hdev->promisc ==0
[ 1857.619958] rtk_btusb: download_patch start
[ 1857.619965] rtk_btusb: chip type value: 0x71
[ 1857.6root@RK356X:/# 20095] rtk_btusb: HCI reset.
[ 1857.621172] usbcore: registered new interface driver rtk_btusb
[ 1857.630624] rtk_btusb: read_ver_rsp->lmp_subver = 0x8723
[ 1857.630698] rtk_btusb: read_ver_rsp->hci_rev = 0xd
[ 1857.630709] rtk_btusb: patch_entry->lmp_sub = 0x8723
[ 1857.630717] rtk_btusb: load_firmware start
[ 1857.630724] rtk_btusb: lmp_version = 0x8723
[ 1857.630733] rtk_btusb: config filename rtl8723du_config
[ 1857.632198] rtk_btusb: no bdaddr file /opt/bdaddr
[ 1857.632221] rtk_btusb: Origin cfg len 22
[ 1857.632229] rtk_btusb: 55 ab 23 87 10 00 d9 00 01 0f e4 00 01 08 8d 00
[ 1857.632237] rtk_btusb: 01 fa 8f 00 01 bf
[ 1857.632248] rtk_btusb: New cfg len 22
[ 1857.632253] rtk_btusb: 55 ab 23 87 10 00 d9 00 01 0f e4 00 01 08 8d 00
[ 1857.632261] rtk_btusb: 01 fa 8f 00 01 bf
[ 1857.632293] rtk_btusb: fw name is  rtl8723du_fw
[ 1857.633222] rtk_btusb: This is not 8723a, use new patch style!
```

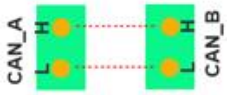
Step 2, view hci0 node:

```
# hciconfig -a
```

```
root@RK356X:/# hciconfig -a
hci0:   Type: Primary  Bus: USB
        BD Address: 30:7B:C9:7A:66:57  ACL MTU: 1021:8  SCO MTU: 255:12
        UP RUNNING
        RX bytes:1530 acl:0 sco:0 events:58 errors:0
        TX bytes:3194 acl:0 sco:0 commands:58 errors:0
        Features: 0xff 0xff 0xff 0xfa 0xdb 0xbd 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 5.62'
        Class: 0x2c0000
        Service Classes: Rendering, Capturing, Audio
        Device Class: Miscellaneous,
[ 1941.467664] rtk_btcoex: BTCOEX hci_rev 0x82a8
[ 1941.467736] rtk_b    HCI Version: 4.1 (0x7)  Revision: 0x82a8
        LMP Version: 4.1t (0x7)  Subversion: 0xa133
        cManufacturer: Realtek Semiconductor Corporation (93)
ex: B
TCOEX lmp_subver 0xa133
root@RK356X:/#
```

6.13 CAN

Step 1, connect the CAN ports of board A and board B as follows:



Step 2, execute the following commands on the serial terminal of board A and board B respectively.

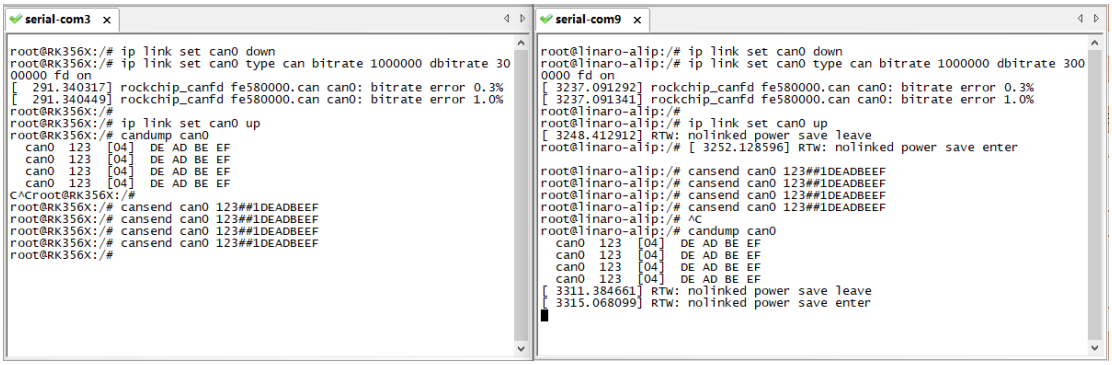
```
# ip link set can0 down
# ip link set can0 type can bitrate 1000000 dbitrate 3000000 fd on
# ip link set can0 up
```

Step 3, execute the following instructions as the receiver.

```
# candump can0                    // set CAN0 as receive
```

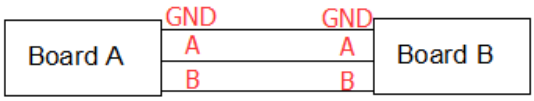
Step 4, execute the following commands as the transmitter.

```
# cansend can0 123##1DEADBEEF     // CAN0 send characters 0xDE 0xAD 0xBE 0xEF
```



6.14 RS485

*Step 1,*connect the RS485 ports of board A and board B as follows:



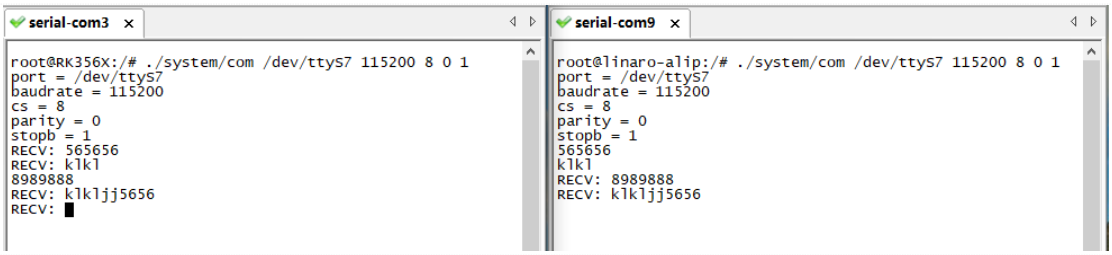
*Step 2,*use ADB to push the file com into board A and board B.

```
# adb remount
# adb push \xx\com /system      // \xx\ is the absolute path to store com files
# adb shell
# chmod 777 /system/com        // modify com file properties
```

*Step 3,*execute the following commands on the terminal serial ports of board A and board B respectively.

```
# ./system/com /dev/ttyS7 115200 8 0 1
```

*Step 4,*at this time, can test the RS485 communication.



The method for testing RS485 is not unique, and the above method is only for reference.

6.15 UART

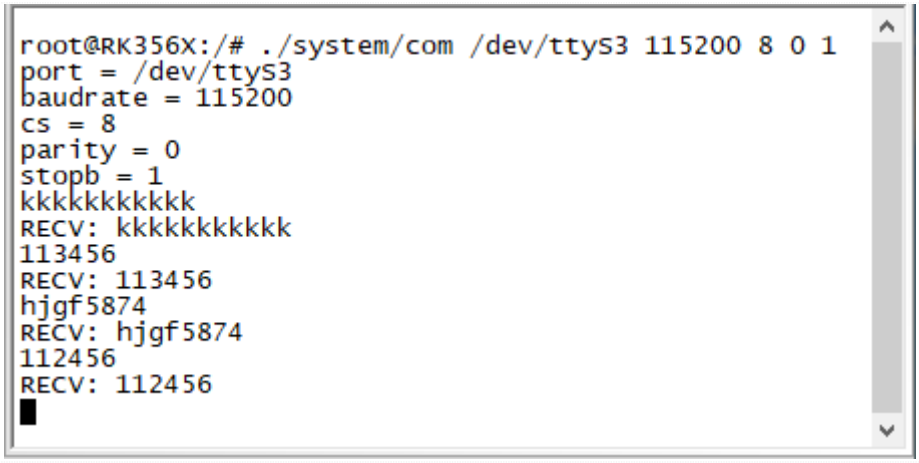
Step 1, use ADB to push the com file into the test board.

```
# adb remount
# adb push \xx\com /system      // \xx\ is the absolute path to store com files
# adb shell
# chmod 777 /system/com        // modify com file properties
```

Step 2, short circuit RX and TX pins of UART.

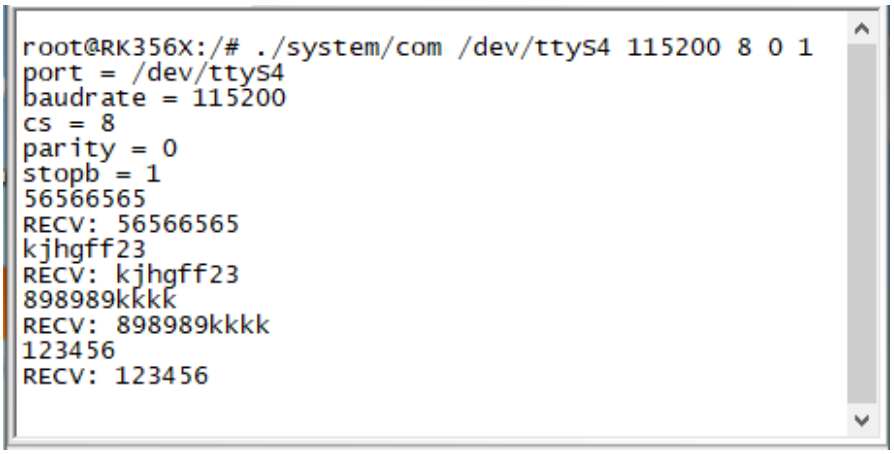
Step 3, UART3 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS3 115200 8 0 1
```



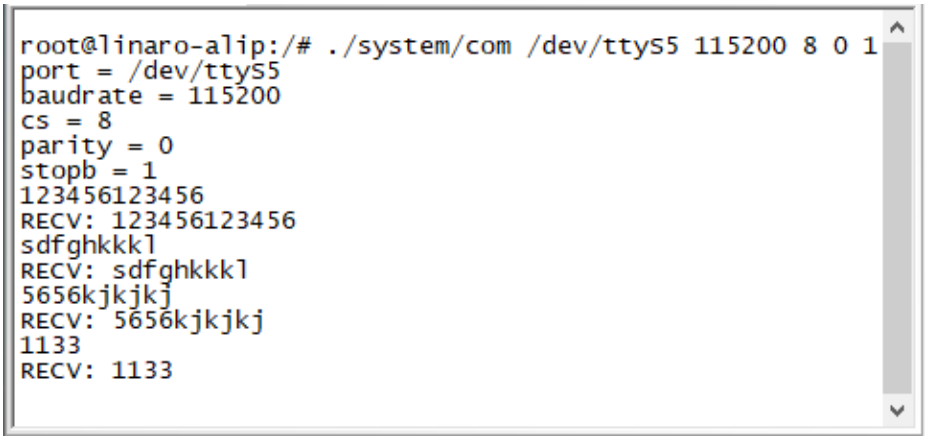
Step 4, UART4 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS4 115200 8 0 1
```



Step 5, UART5 test: after the terminal serial port executes the following instructions, the data can be automatically received.

```
# ./system/com /dev/ttyS5 115200 8 0 1
```



The method for testing UART is not unique, and the above methods are for reference only.

6.16 Camera(ov13850)

Step 1, camera0 preview command:

```
# gst-launch-1.0 v4l2src device=/dev/video5 ! video/x-raw,format=NV12,width=1280,height=800, framerate=30/1 ! kmssink
```

```
root@RK356X:/# gst-launch-1.0 v4l2src device=/dev/video5 ! video
12,width=1280,height=800, framerate=30/1 ! kmssink
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
[  389.259805] rkisp_hw fdff0000.rkisp: set isp clk = 500000000H
z
[  389.261769] rkisp rkisp-vir0: some iq features(0x9f0856a473b,
 0x3fbfffe67ff) are not supported
[  389.261801] rkisp rkisp-vir0: some iq features(0x9f0856a473b,
 0x3fbfffe67ff) are not supported
[  389.261836] rockchip-csi2-dphy1: dphy1, data_rate_mbps 600
[  389.261871] rockchip-csi2-dphy csi2-dphy1: csi2_dphy_s_stream
 stream on:1, dphy1
[  389.334069] rkisp-vir0: tx stream:4 lose frame:0, isp state:0
x201 frame:294
Redistribute latency...
0:00:07.4 / 99:99:99.
```

Step 2, camera1 preview command:

```
# gst-launch-1.0 v4l2src device=/dev/video15 ! video/x-
raw,format=NV16,width=1280,height=800, framerate=30/1 ! kmssink
```

```
root@RK356X:/# gst-launch-1.0 v4l2src device=/dev/video15 ! vide
V16,width=1280,height=800, framerate=30/1 ! kmssink
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
[  358.180137] rkisp_hw fdff0000.rkisp: set isp clk = 500000000H
z
[  358.180368] rkcif_mipi_lvds: sditf_reinit_mode, mode->rdbk_mo
de 1, mode->name rkisp-vir1, link_mode 0
[  358.190262] rkcif_mipi_lvds: stream[0] start streaming
[  358.191200] rkisp rkisp-vir1: some iq features(0x9f0856a473b,
 0x3fbfffe67ff) are not supported
[  358.191247] rkisp rkisp-vir1: some iq features(0x9f0856a473b,
 0x3fbfffe67ff) are not supported
[  358.191660] rkcif_mipi_lvds: Allocate dummy buffer, size: 0x0
0436000
[  358.191721] rockchip-mipi-csi2 fdfb0000.mipi-csi2: stream on,
 src_sd: 00000000a8f0d0bd, sd_name:rockchip-csi2-dphy2
[  358.191730] rockchip-mipi-csi2 fdfb0000.mipi-csi2: stream ON
[  358.191768] rockchip-csi2-dphy2: dphy2, data_rate_mbps 600
[  358.191800] rockchip-csi2-dphy csi2-dphy2: csi2_dphy_s_stream
 stream on:1, dphy2
[  358.191807] rockchip-csi2-dphy csi2-dphy2: csi2_dphy_s_stream
 stream on:1, dphy2
Redistribute latency...
0:00:05.2 / 99:99:99.
```

Tool Usage

1.Driver

1.1 USB driver

Rockchip USB driver install package includes ADB and image flashing driver.

RKTools\windows\DriverAssitant_v5.1.1.zip

1.2 Debug serial port driver

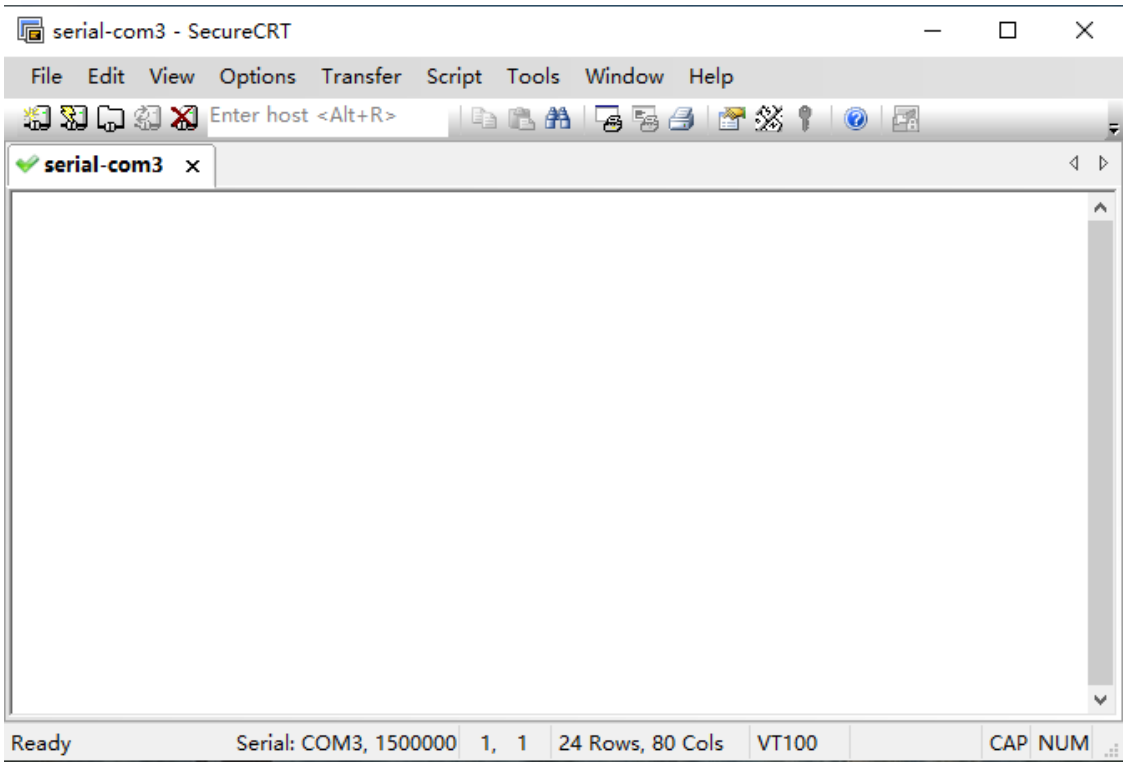
Boardcon will provide debugging serial port drivers and tools. If you need to debug on the serial port, you need to install this driver.

CP210x_Windows_Drivers_with_Serial_Enumeration.zip

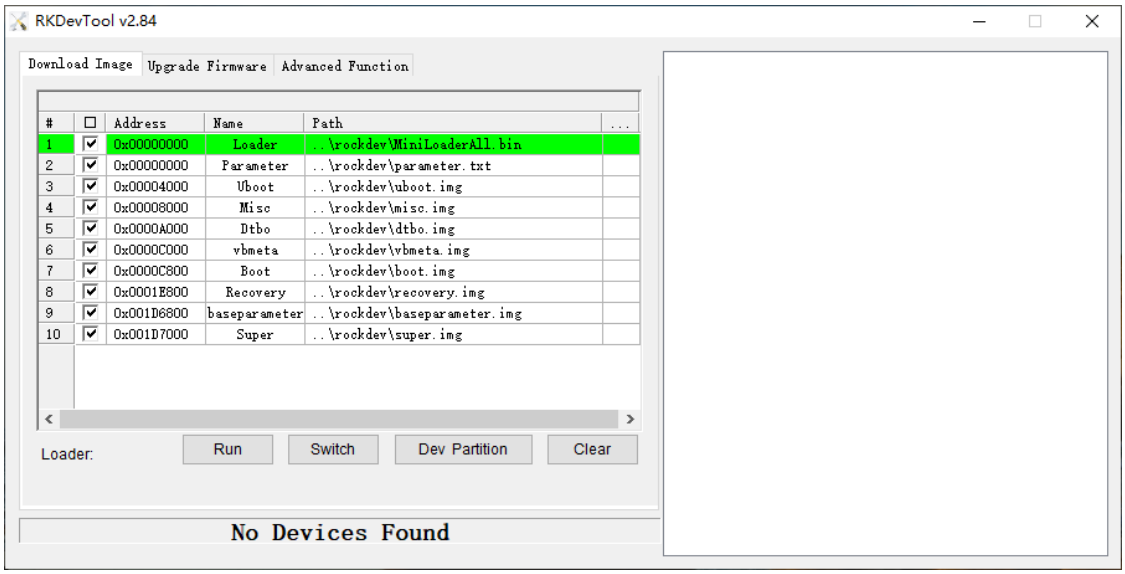
2.Debug Tool

Boardson recommends using SecureCRT. If you have a better choice, you can use other tools instead.

Platform/SecureCRT.rar



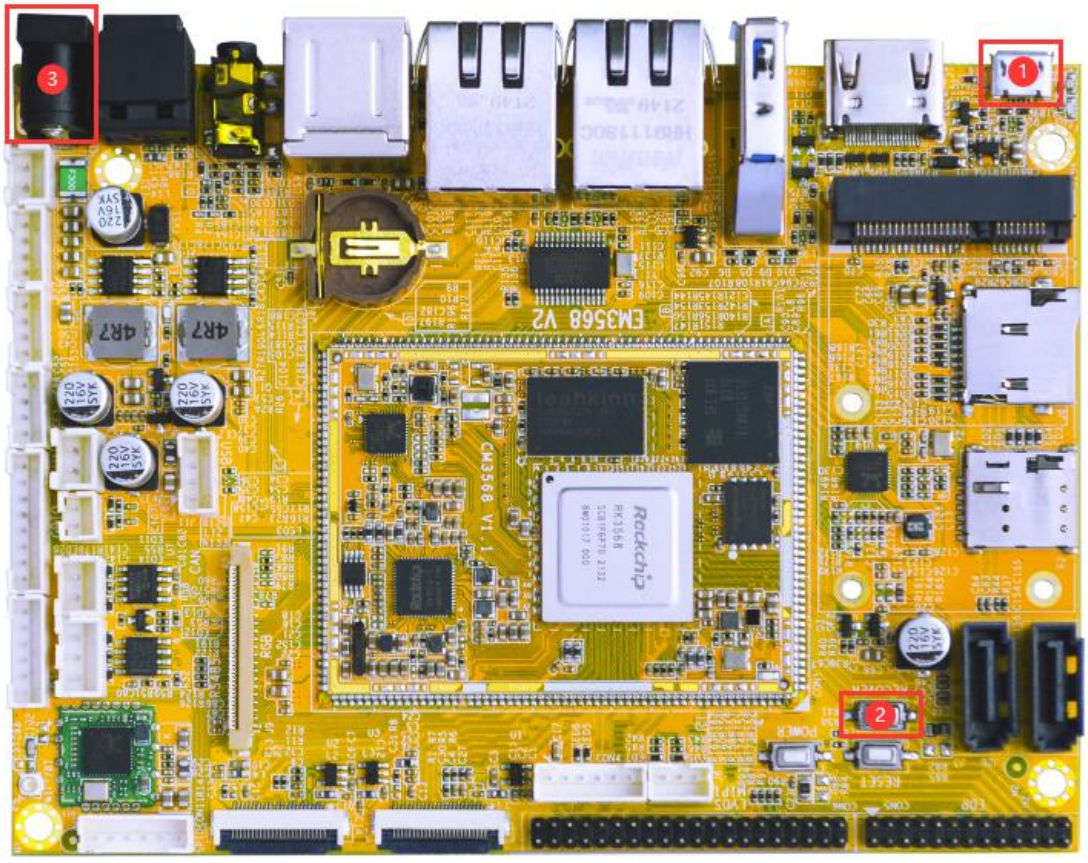
3.Development Flashing Tool



3.1 Loader mode

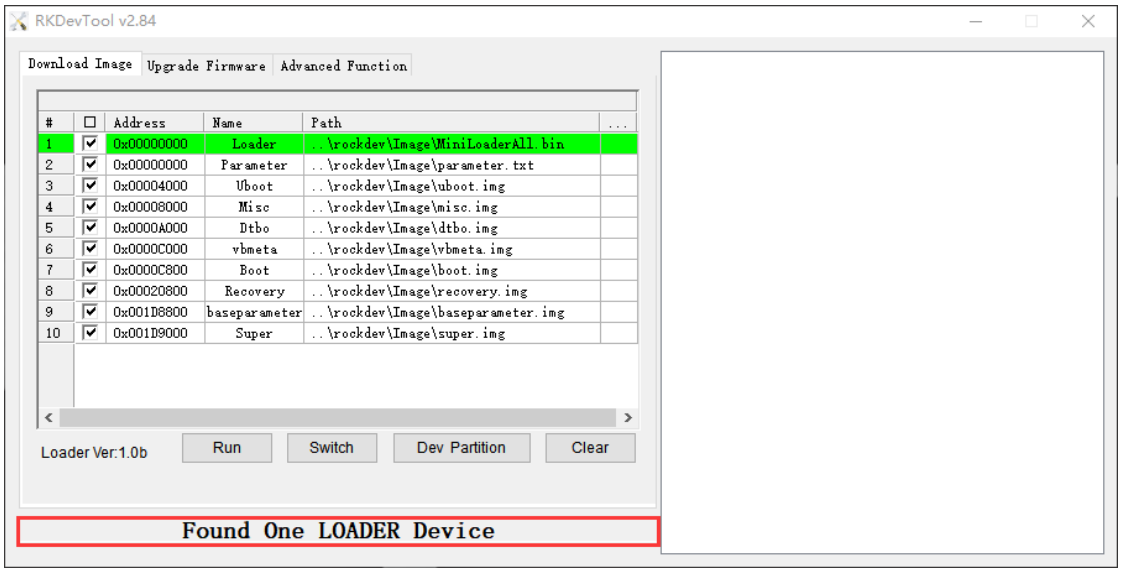
The normal burning mode is the loader mode. You can enter the loader mode through the following methods:

(1) Connect PC and development board withType-C USB cable, keep pressing the **Recover Key** and power the board until the windows PC shows **Found one LOADER Device.**



(2) When USBType-C cable and serial port cable have been connected, enter the following command in the debugging serial port tool to enter the loader mode:

```
$: reboot loader
```

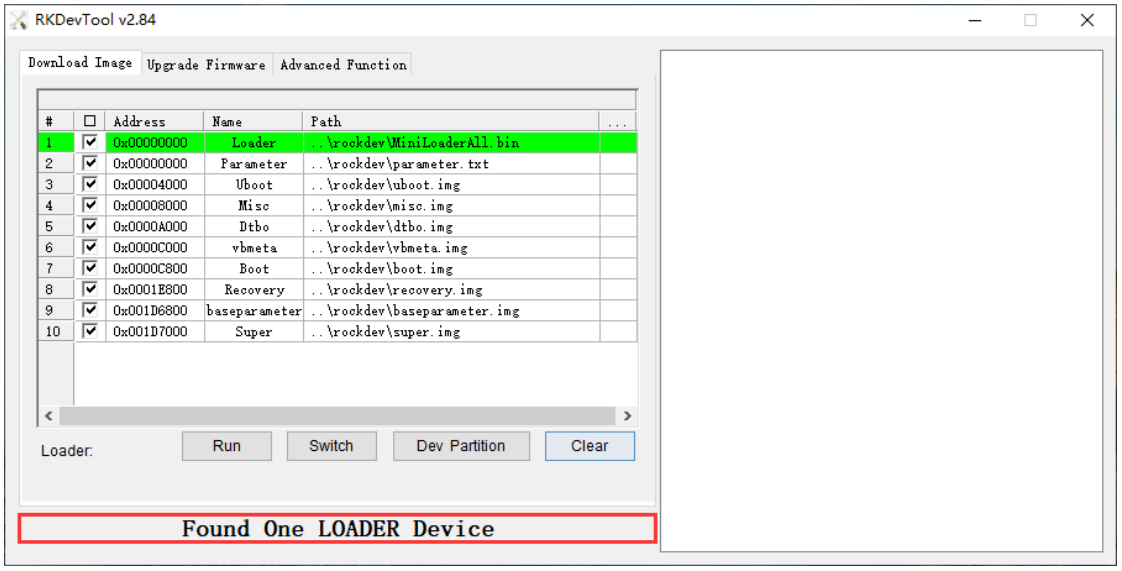


3.2 Maskrom mode

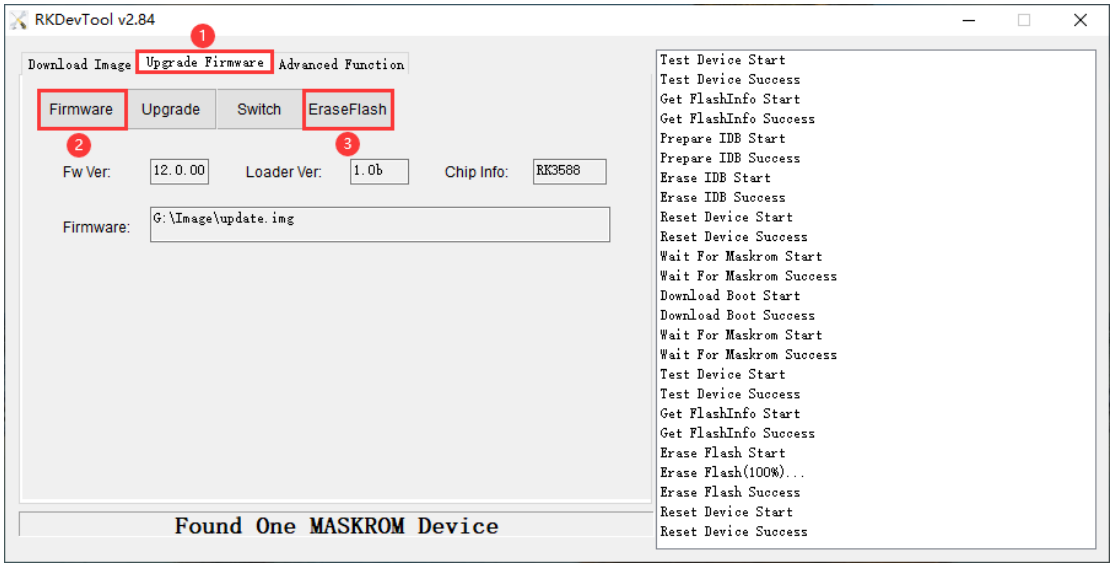
MaskRom mode is mainly used to repair the system when bootloader is damaged. Generally, you do not need to enter MaskRom mode. Only when bootloader verification fails (cannot read IDR block or bootloader is damaged), will choose to use markrom mode to burn firmware. Here are two ways to enter the maskrom mode:

(1) In the Loader mode, use the firmware to erase the emmc before entering the maskrom mode.

Step 1, enter loader mode.



Step 2, click **Upgrade Firmware** -> **Firmware**, select update.img. Click **EraseFlash** button to erase flash. Then enter the maskrom mode.

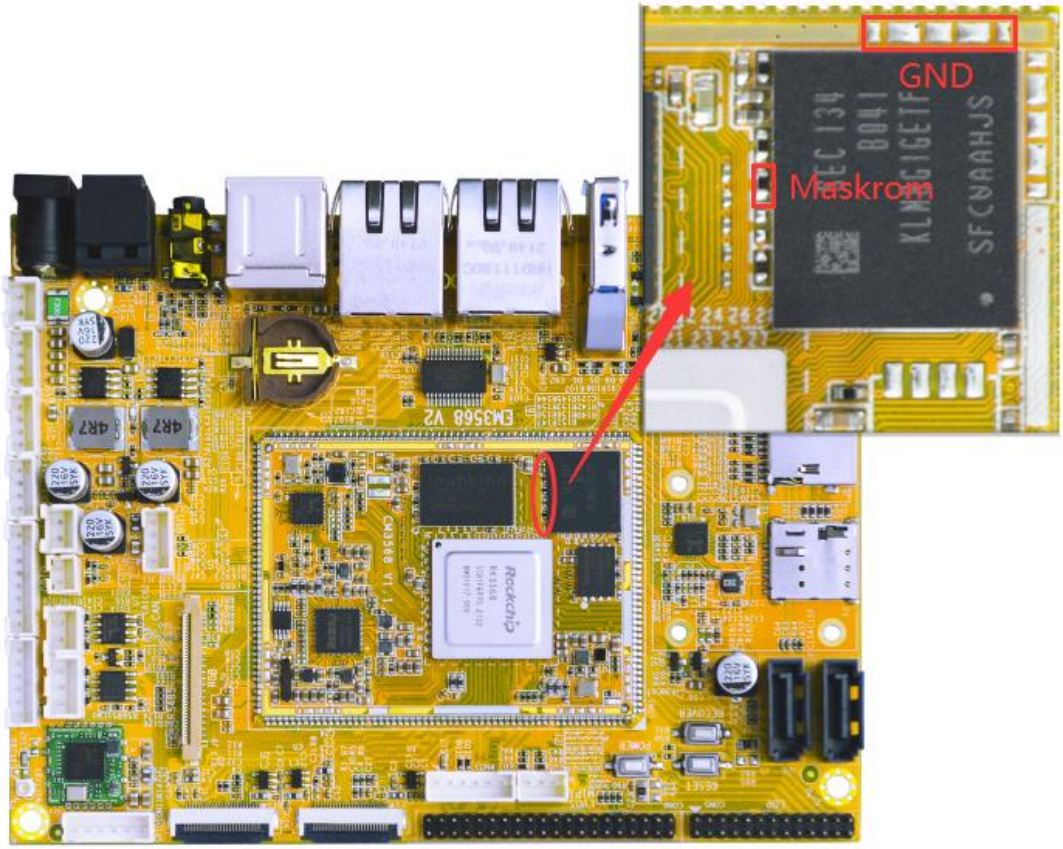


(2) Just short the two solder joints and then power on to enter the maskrom mode.

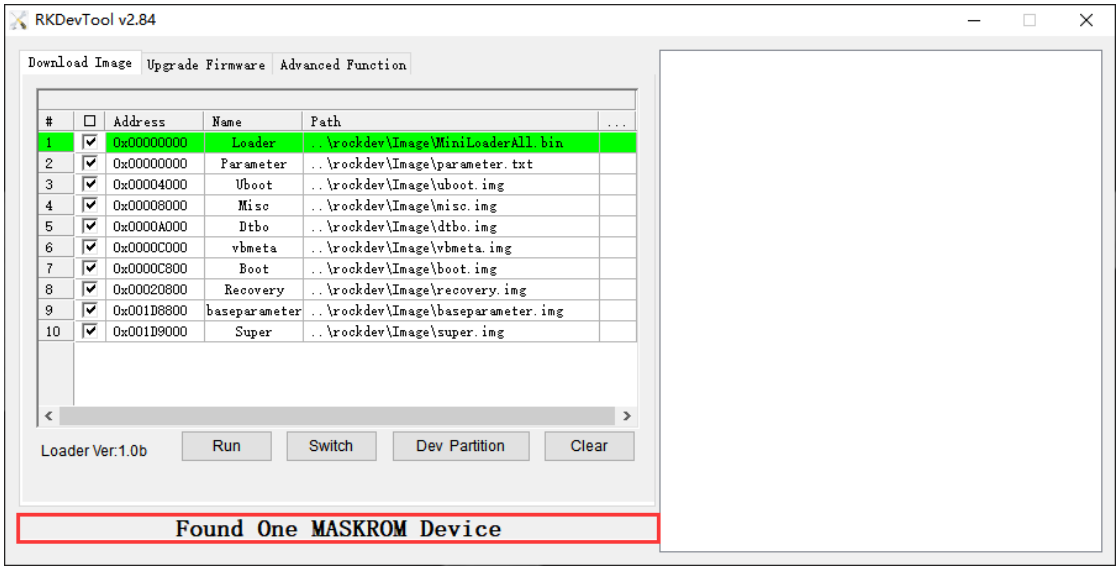
Step 1, connect PC and development board withType-C USB cable.

Step 2, short circuit the two test points near eMMC to enter MASKROM mode.(**Maskrom** short circuit to **GND**)

Step 3, connect power cables.

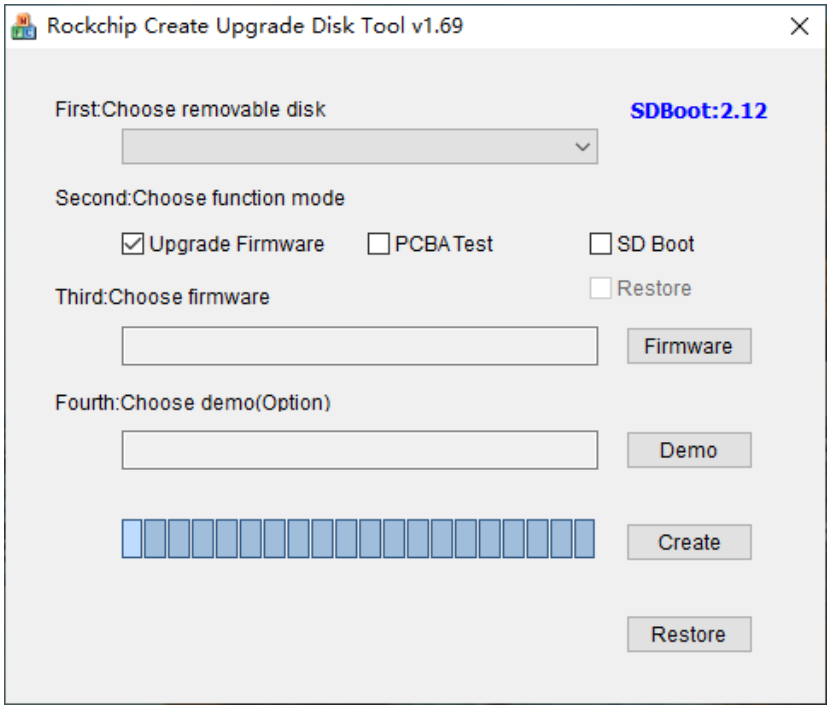


Step 4, after entering the maskrom mode, cancel the short circuit.



4.Tool to Implement SD Upgrading and Boot

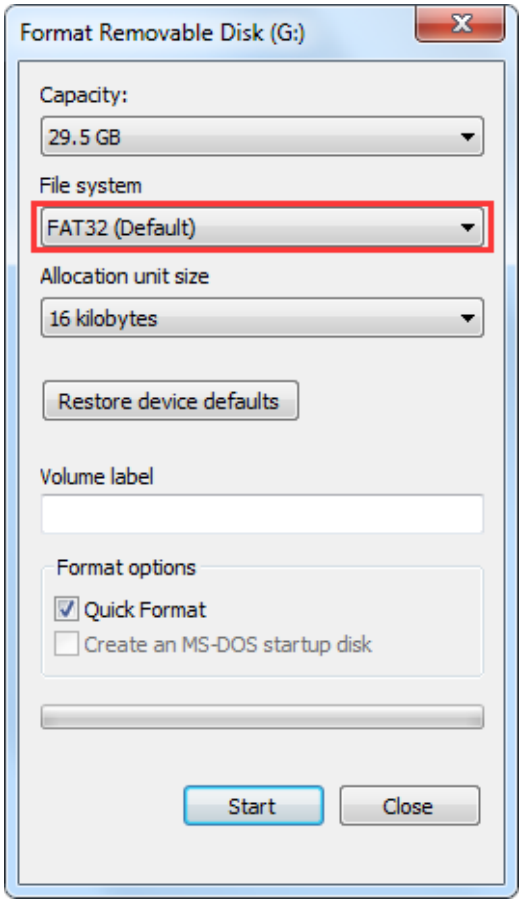
RKTools\windows\SDDiskTool_v1.69.zip



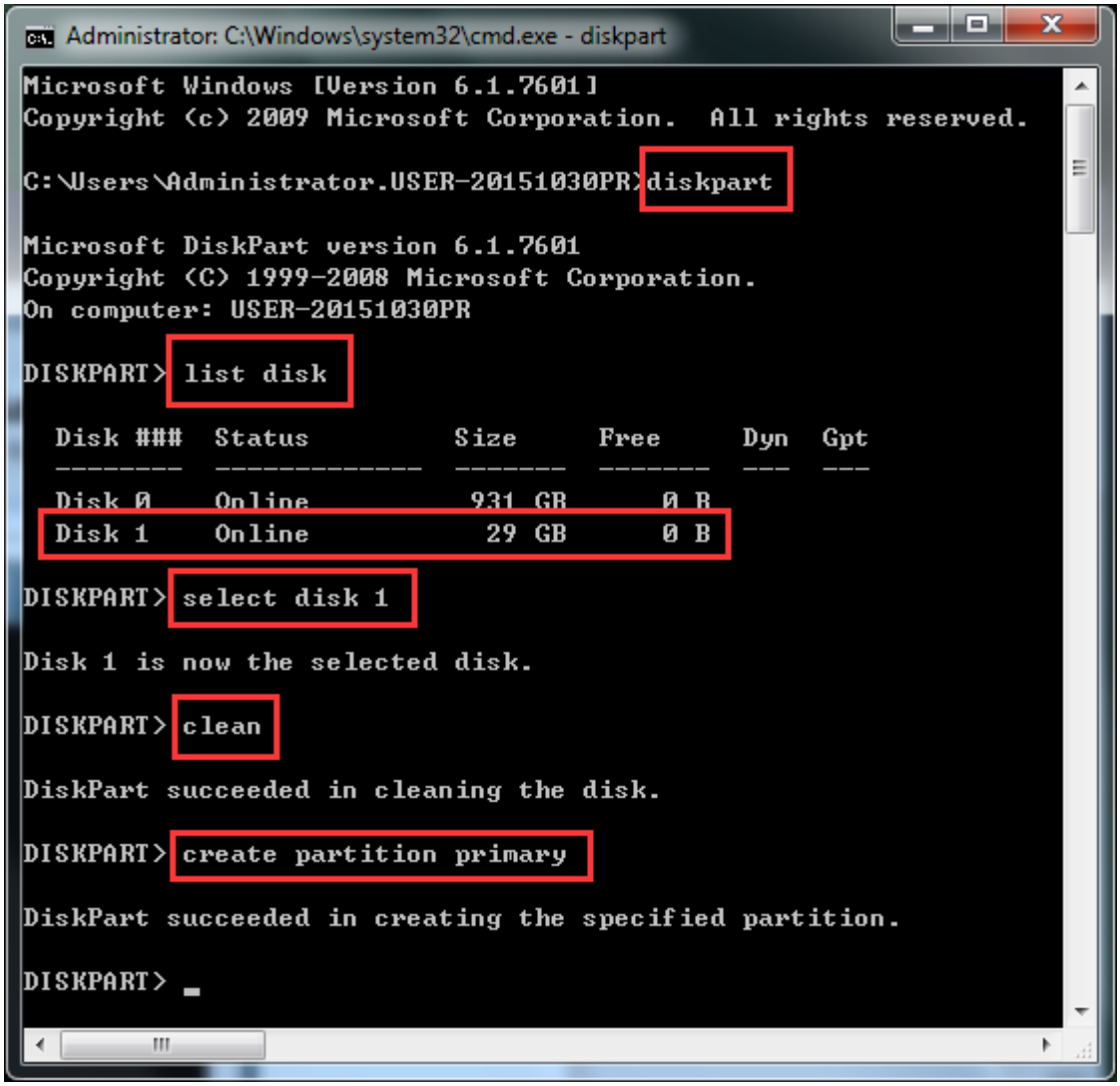
4.1 How to format sdcard

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 fail to boot.

(1) If your sdcard has only one partition, just format it as FAT32 in WINDOWS.



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

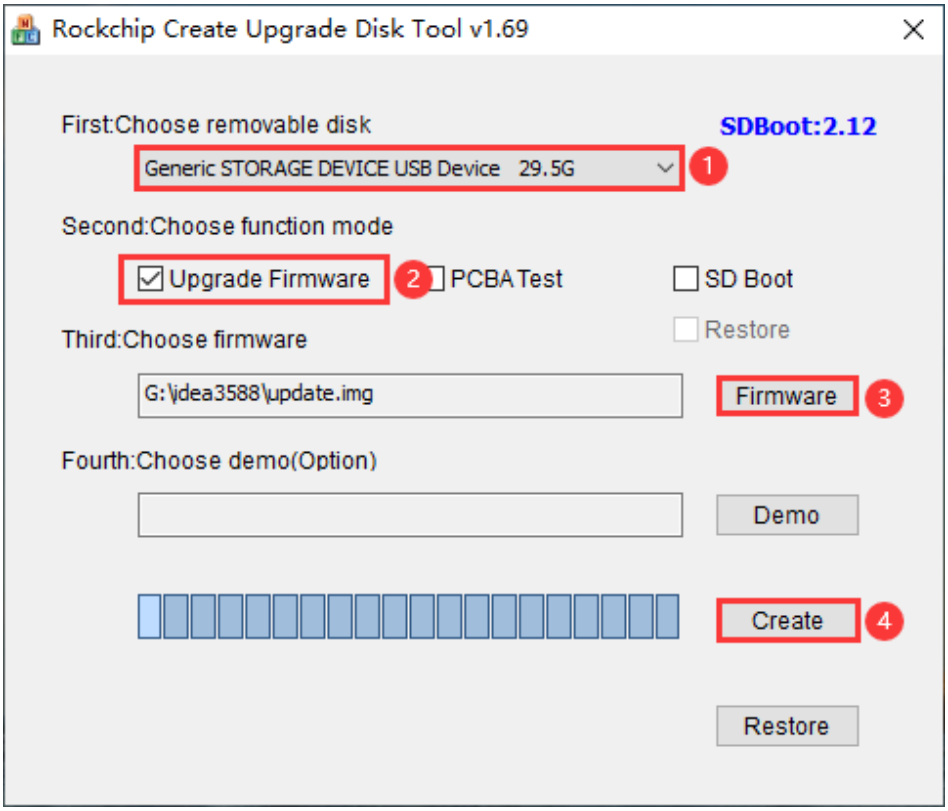


And then format it as FAT32.

4.2 How to make SD upgrade card

Step 1, open **SD_Firmware_Tool.exe** (SDDiskTool_v1.69\SD_Firmware_Tool.exe).

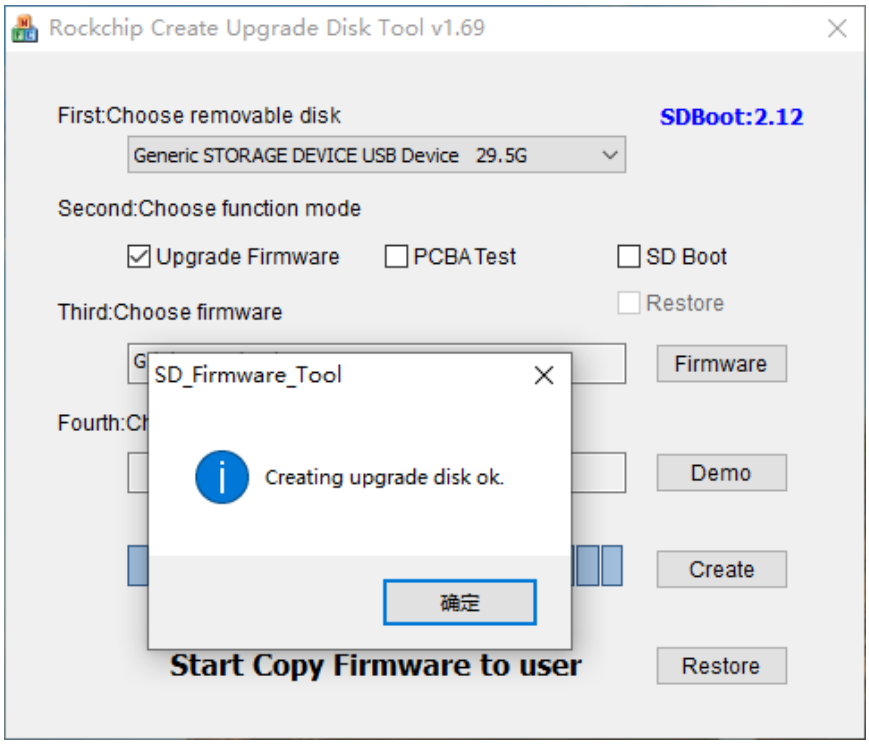
Step 2, as shown in the figure, make SD upgrade card.



Parameter Description:

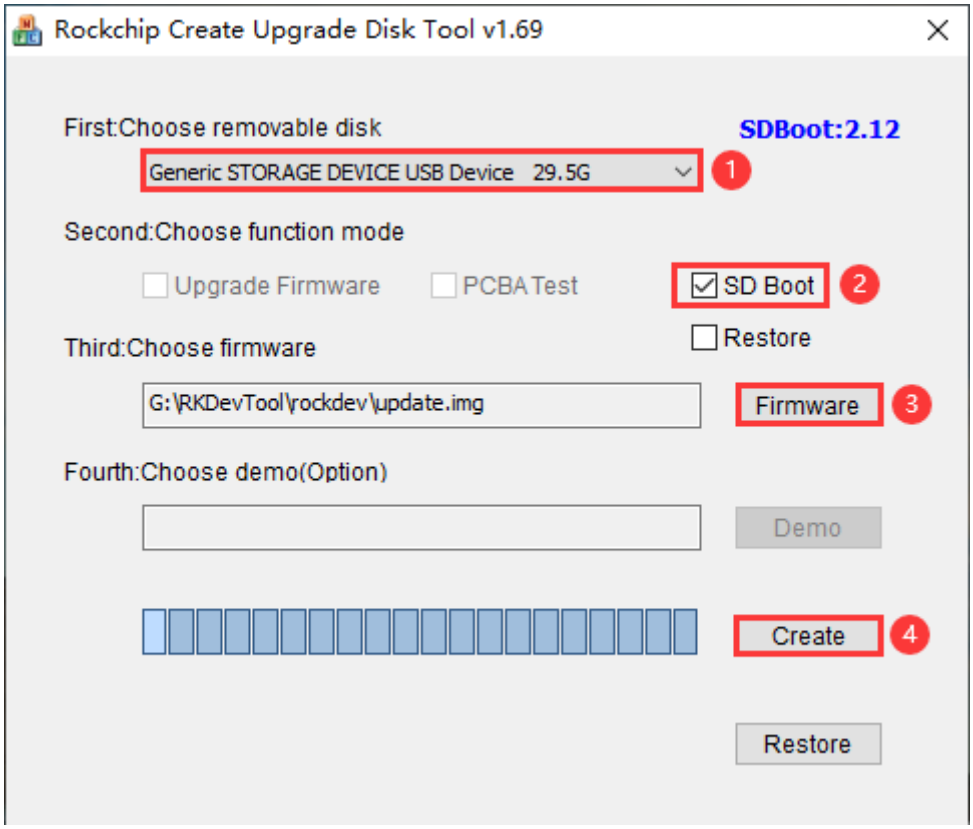
Step	Describe
1	Select an SD card or USB flash drive from the **drop-down list.**
2	Select **"Upgrade Firmware"**.
3	Click Select **Firmware** button and select **update.img** to upgrade the firmware.
4	Click **Create** button to start creation.

Step 3, wait for make SD upgrade card to finish.



4.3 How to make SD boot card

The card printing mode of SD card boot is similar to that of SD card upgrade, but the only difference is that the Choose function mode is different, as shown below:



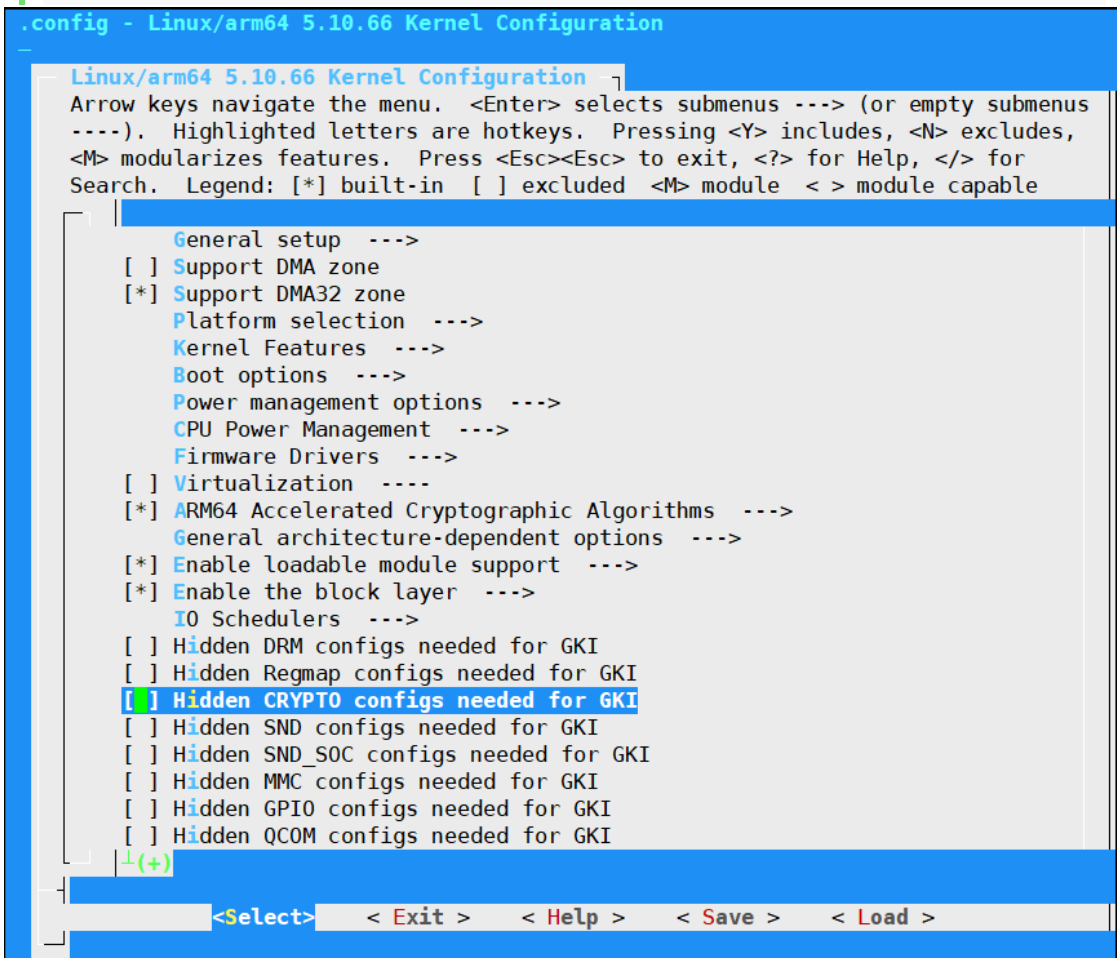
The SD card boot firmware is incompatible with the firmware burned to flash. You need to modify the SDK related configuration. If need to do so, please contact boardcon.

Common Issues

1.How do open the kernel configuration file

Use the following command to open the kernel configuration：

```
cd kernel
make ARCH=arm64 menuconfig
```



If the save directory is not modified, the configuration content is saved in the kernel/.config file by default, you need to manually update the latest configuration content to kernel/arch/arm64/configs/ rockchip_defconfig file, and then compile the kernel again.

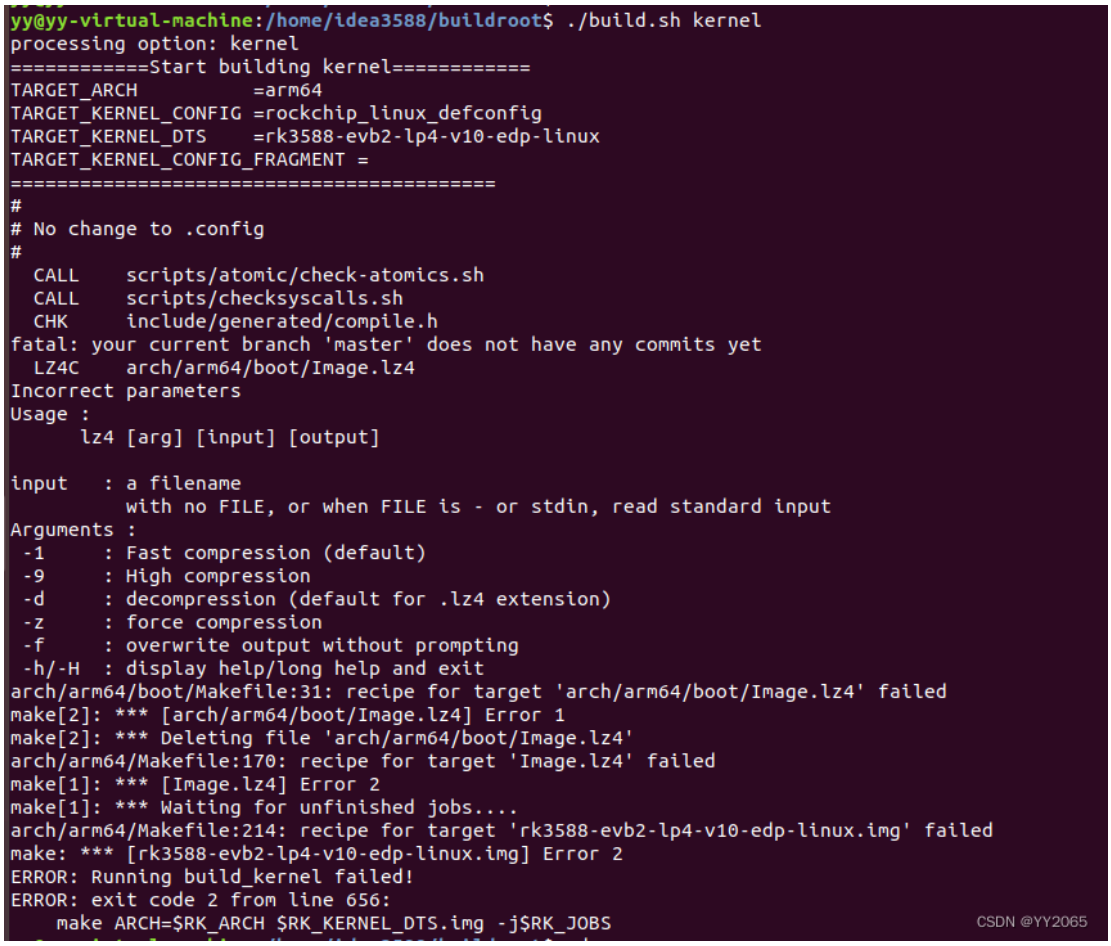
Note:

(1) Some SDK have multiple kernel directories (kernel, kernel-4.19, kernel-5.10). You can know which kernel directory is used according to kernel compilation instructions.

(2) Different systems used by default rockchip_defconfig configuration file may not be the same, according to the kernel compilation directives can know the specific use which configuration files in the kernel/arch/arm64/configs/ directory.

2.Error about lz4

If the following error occurs during compilation:



The built-in lz4 version is too low, requiring 1.8.3 or later versions, view the version number of the current lz4:

> $ lz4 -v

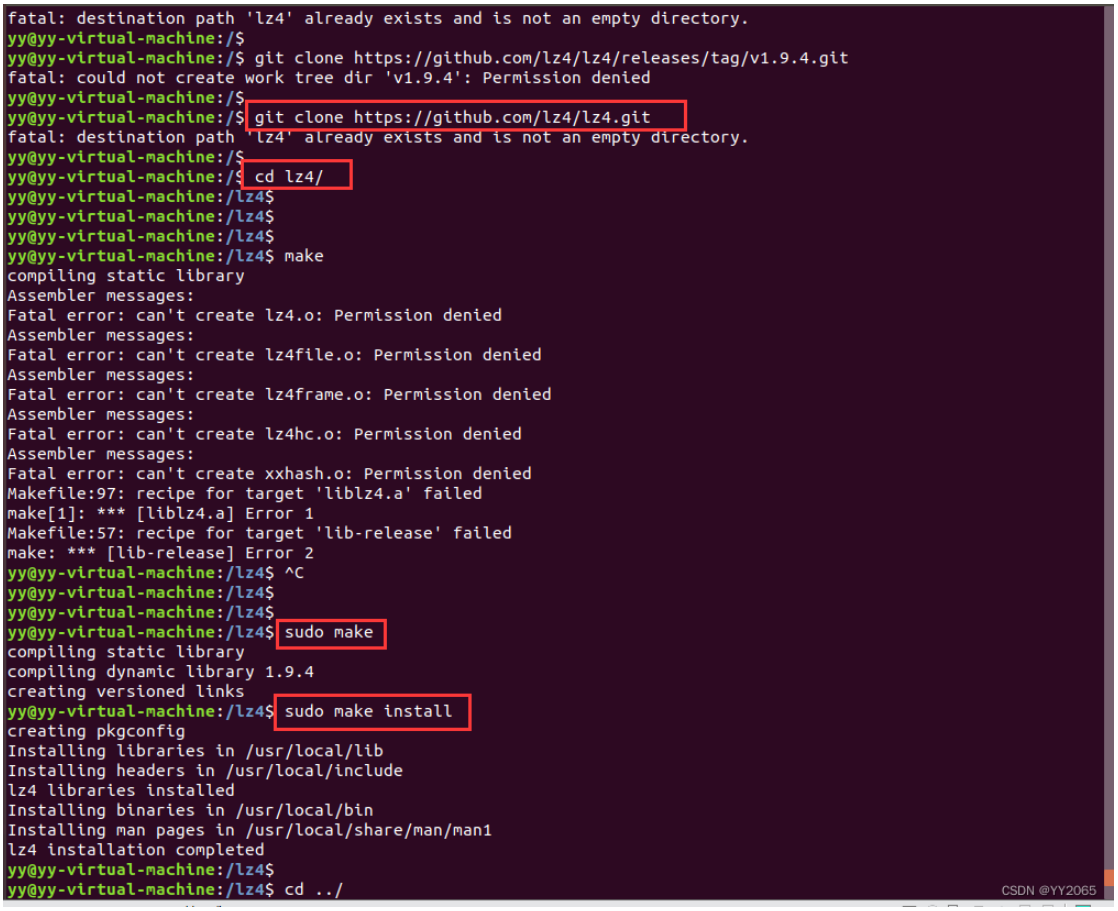
Solution:

Method (1) : Directly copy Android compiled lz4 overwrite system lz4:

> # sudo cp /out/host/linux-x86/bin/lz4 /usr/bin/lz4

Method (2) : Remove the built-in lz4 and download and install a new lz4:

```
# sudo apt-get remove  liblz4-tool
# sudo git clone https://github.com/lz4/lz4.git
# cd /lz4
# sudo make
# sudo make install
```



Configuration List

This list is the basic configuration, and the details are subject to the actual purchase.

Configuration Name	Note
EM3568	Bare board, built-in WIFI&BT module, no button battery, no display
Power adapter	12V/3A
USBType-C cable	Used to download
Serial port module	Serial port debugging
Ethernet cable	1.5M
WIFI Antenna	Used for signal enhancement
SD card	Contains CD data