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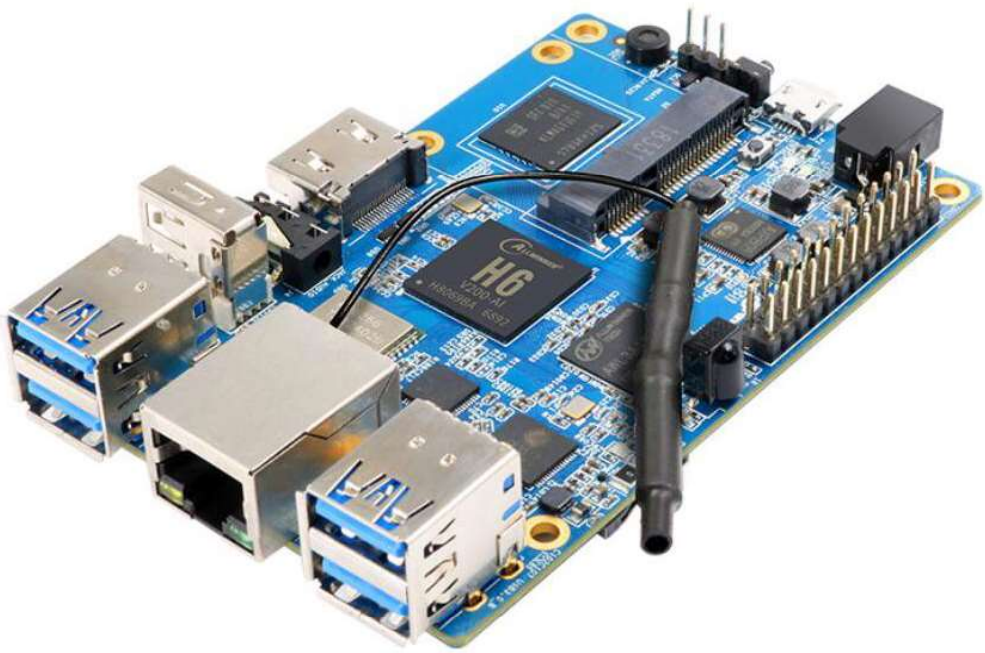
Orange Pi 3
User Manual



Contents

I. Basic Features of Orange Pi 3.....1
1. What is Orange Pi 3.....1
2. Use of Orange Pi 3.....1
3. Who is the Orange Pi 3 designed for?.....1
4. Orange Pi 3 hardware parameters.....2
5. GPIO specifications.....5
II. Development board instructions.....6
1. Prepare hardware and software tools.....6
2. Power supply mode of development board.....6
III. Android compilation environment.....7
1. Get SDK source code zip.....7
2. Build a compilation environment.....7
3. Compile SDK source code.....8
IV. Setting up a Linux compilation environment.....11
1. Get the Linux SDK source code from Github.....11
2. Get the source code of Linux SDK from Baidu Cloud Disk.....12
3. Set up a compilation environment.....13
4. Compile Linux and U-boot source code.....13
5. Linux SDK usage example.....14
V. Android firmware burning.....18
1. Android firmware burning steps (TF card start up).....18
2. Android firmware programming steps (programming to EMMC via TF card).....20
VI. Linux firmware burning.....23
1. Etcher installation method.....23
2. How to flash Linux firmware through Etcher.....23
3. Program Linux system into EMMC Flash chip through script.....24
VII. Instructions for use of Linux system.....26
1. Linux boot light description.....26
2. Login account and password.....26
3. extend rootfs partition.....26
4. Recording playback test method.....27
5. WIFI configuration method.....27
6. Test method of PCIE interface.....28
VIII. Introduction to serial debugging tools.....30
1. Use on Windows platform.....31
2. Use on Linux platform.....33

History

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I. Basic Features of Orange Pi 3

1. What is Orange Pi 3

Orange Pi is an open source single board card computer, a new generation of arm64 development board, which can run Android 7.0, Ubuntu and Debian operating systems. The Orange Pi single board computer uses Allwinner H6 system-on-chip and has 1GB or 2GB LPDDR3 memory.

2. Use of Orange Pi 3

We can use it to build:

- A computer
- A web server
- Game console
- HD video player
- Speaker
- Android
- . . . . . .

3. Who is the Orange Pi 3 designed for?

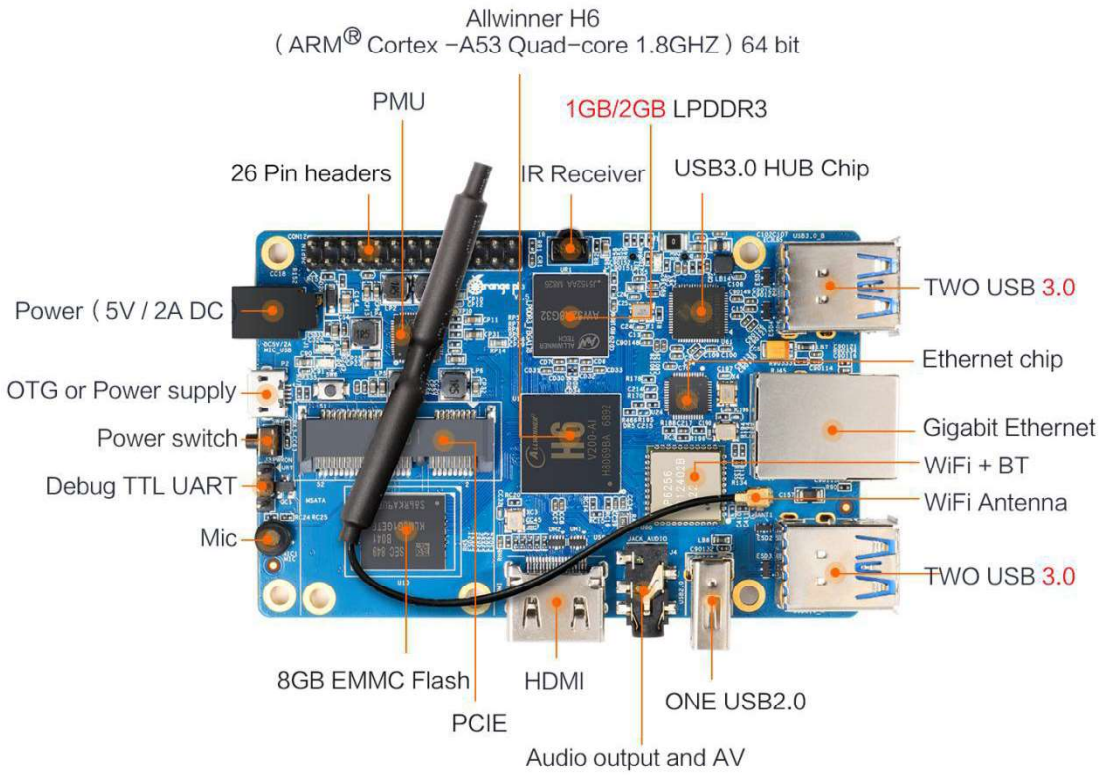
Orange Pi 3 is not just a consumer product, it is also designed for anyone who wants to use technology for creative creation. It is a very simple, fun and practical tool that you can use to build the world around you.

4. Orange Pi 3 hardware parameters

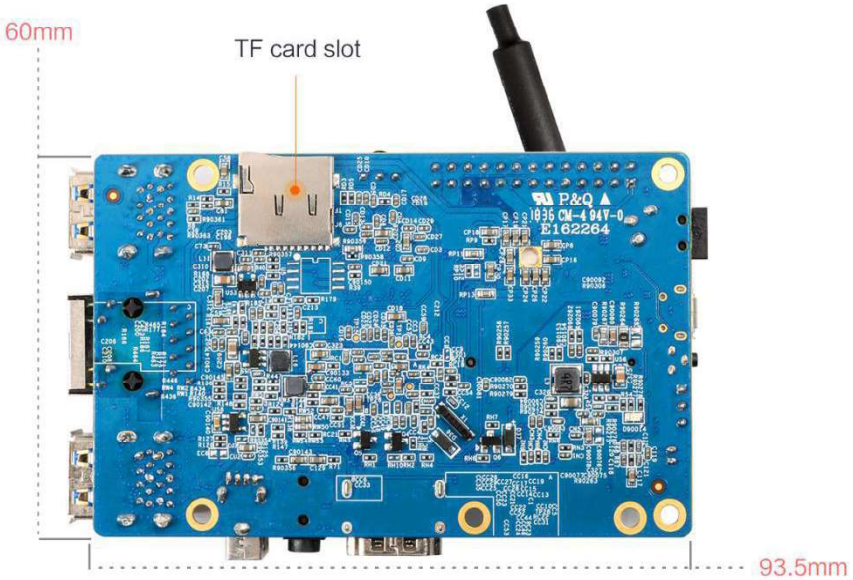
Hardware Specification	
CPU	H6 Quad-core 64-bit **1.8GHZ** ARM Cortex™-A53
GPU	• High-performance multi-core GPU Mali T720 • OpenGL ES3.1/3.0/2.0/1.1 • Microsoft DirectX 11 FL9_3 • ASTC(Adaptive Scalable Texture Compression) • Floating point operation greater than 70 GFLOPS
Memory+Onboard Storage	Four Types: 1GB LPDDR3 (shared with GPU)+EMMC(Default Empty) 2GB LPDDR3(shared with GPU)+EMMC(Default Empty) 1GB LPDDR3 (shared with GPU)+8GB EMMC Flash 2GB LPDDR3(shared with GPU)+8GB EMMC Flash
WIFI+BT	AP6256, IEEE 802.11 a/b/g/n/ac, BT5.0
Onboard Network	10/100M/1000M , ethernet RJ45
Network Chip	RTL8211
Audio Input	MIC
Audio Output	HDMI 2.0a and 3.5 mm AV Jack
Video Output	HDMI 2.0a and **CVBS**
Video Decoding	• H265/HEVC Main/Main10 profile@Level5.2 High-tier ;4K@60fps, up to 6Kx4K@30fps • H264/AVC BP/MP/HP@level5.1, MVC, 4K@30fps

	• VP9，Profile 0/2, 4K@30fps • AVS+/AVS JIZHUN profile@level 6.0, 1080P@60fps
PCIE	• Supports RC mode • Supports x1 Gen2(5.0Gbps) lane • Complies with PCI Express Base 2.0 Specification
Power Source	DC input，MicroUSB (OTG)
PMU	AXP805
USB 2.0 Ports	1*USB 2.0 Host, 1*USB OTG 2.0
USB 3.0 Ports	4*USB 3.0 Host
Low-level peripherals	26 Pin
GPIO(1x3) pin	UART, ground.
LED	Power LED、Status LED and USB3.0 LED
IR	YES
Key	Power(SW4)
Supported OS	Android7.0, Ubuntu, Debian
• **Interface definition**	
Product size	90mm*64mm
Weight	75g
Orange Pi™ is a trademark of the Shenzhen Xunlong Software CO., Limited	

Top view

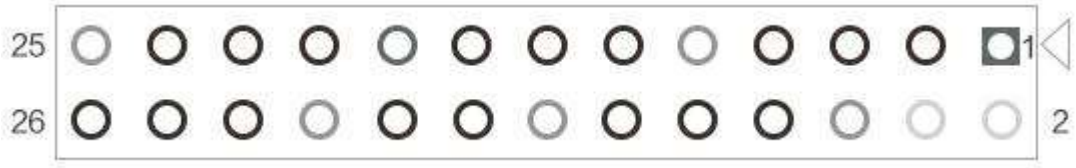


Bottom view



5. GPIO specifications

The following figure is the GPIO pin function diagram of Orange Pi 3:



Orange Pi 3 pin correspondence table		
CON12-P01	VCC-3.3V	VCC-IO
CON12-P02	VCC-5V	DCIN
CON12-P03	TWI0-SDA	PD26
CON12-P04	VCC-5V	DCIN
CON12-P05	TWI0-SCK	PD25
CON12-P06	GND	GND
CON12-P07	PWM0	PD22
CON12-P08	S-UART-TX	PL02
CON12-P09	GND	GND
CON12-P10	S-UART-RX	PL03
CON12-P11	UART3-RX	PD24
CON12-P12	PD18	PD18
CON12-P13	UART3-TX	PD23
CON12-P14	GND	GND
CON12-P15	PL10	PL10
CON12-P16	PD15	PD15
CON12-P17	VCC-3.3V	VCC-IO
CON12-P18	PD16	PD16
CON12-P19	SPI1_MOSI	PH05
CON12-P20	GND	GND
CON12-P21	SPI1_MISO	PH06
CON12-P22	PD21	PD21
CON12-P23	SPI1_CLK	PH04
CON12-P24	SPI1_CS	PH03
CON12-P25	GND	GND
CON12-P26	PL08	PL08

II. Development board instructions

1. Prepare hardware and software tools

Hardware requirements:

- Orange Pi 3 development board
- TF card, minimum 8GB capacity, class 10, it is recommended to use brand TF card, such as SanDisk 16G TF card
- For a compiling host, the configuration should preferably meet the following conditions:
  64bit CPU;
  8 GB and above;
  100GB of free disk space;
  The operating system is preferably
  Ubuntu14.04 (for compiling Android source code)
  Ubuntu18.04 (for compiling Linux source code)

Software Requirements:

- Orange Pi 3 SDK
- Orange Pi 3 firmware
- Android and Linux programming tools

The above software can be obtained through Github, Google Web Disk and Baidu Cloud Disk.

http://www.orangepi.org/downloadresources/
http://www.orangepi.cn/downloadresourcescn/

2. Power supply mode of development board

There are two ways to power the development board:

- DC (5V 2A) power supply: Power on after inserting the DC adapter
- Micro USB (5V 2A) OTG power supply:Plug in the Micro USB adapter to power on.

III. Android compilation environment

The following operations are performed on a PC with Ubuntu 14.04 installed. Other versions of Ubuntu systems or Linux distributions may have some differences.

1. Get SDK source code zip

After downloading the Android source package, first you need to combine multiple compressed files into one and then decompress them.

```
$ mkdir OrangePi_3
$ cat H6-2018-1-2.tar.gza* > OrangePi_3.tar
$ tar xf OrangePi_3.tar -C OrangePi_3
```

2. Build a compilation environment

- Install JDK

Android 7.0 development can only use the version of openjdk8, higher or lower than this version and Oracle's JDK will cause the compilation to fail. Openjdk-8 installation command is as follows:

```
$ sudo add-apt-repository ppa:openjdk-r/ppa
$ sudo apt-get update
$ sudo apt-get install openjdk-8-jdk
```

- Configure JAVA environment variables

For example, the installation path is / usr / lib / jvm / java-8-openjdk-amd64. You can run the following command in the terminal to configure the environment variables:

```
$ export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
$ export PATH=$JAVA_HOME/bin:$PATH
$ export CLASSPATH=.:$JAVA_HOME/lib:$JAVA_HOME/lib/tools.jar
```

- Install platform support software

For Ubuntu 14.04:

```
$ sudo apt-get update
```

```
$ sudo apt-get install git gnupg flex bison gperf build-essential \
zip curl zlib1g-dev gcc-multilib g++-multilib libc6-dev-i386 \
lib32ncurses5-dev x11proto-core-dev libx11-dev lib32z1-dev ccache \
libgl1-mesa-dev libxml2-utils xsltproc unzip

$ sudo apt-get install u-boot-tools
```

3. Compile SDK source code

After the SDK is decompressed, there will be two subdirectories andorid and lichee under the decompressed directory. The main contents of the lichee directory are as follows:

```
lichee/brandy/u-boot-2014.07              #uboot Code directory
lichee/bootloader/uboot_2014_sunxi_spl    #boot0 Code directory
lichee/linux-3.10                         #Kernel code
lichee/tools                      #Solution hardware configuration, packaging tools, etc.
```

- **Kernel compilation process**

Enter the following command in the lichee directory:

```
$ cd OrangePi_3/lichee
$ ./build.sh config

Welcome to mkscript setup progress
All available chips:
   0. sun50iw1p1
   1. sun50iw2p1
   2. sun50iw6p1
   3. sun8iw11p1
   4. sun8iw12p1
   5. sun8iw6p1
   6. sun8iw7p1
   7. sun8iw8p1
   8. sun9iw1p1
Choice: 2
All available platforms:
   0. android
   1. dragonboard
   2. linux
   3. eyeseelinux
Choice: 0
All available business:
```

```
   0. 5.1
   1. 4.4
   2. 7.x
Choice: 2
```

The output after compilation is as follows:

```
regenerate rootfs cpio
15757 blocks
17099 blocks
build_ramfs
Copy boot.img to output directory ...
Copy modules to target ...

sun50iw6p1 compile Kernel successful

INFO: build kernel OK.

INFO: build rootfs ...
INFO: skip make rootfs for android
INFO: build rootfs OK.
----------------------------------------
build sun50iw6p1 android 7.x lichee OK
----------------------------------------
```

The kernel code is in the lichee / linux-3.10 directory. Executing the above commands will automatically copy the configuration file from lichee / linux-3.10 / arch / arm64 / configs / sun50iw6p1smp_android_7.x_defconfig to lichee / linux-3.10 / .config as the default configuration before compiling , You can run ./build.sh directly in the lichee directory for the next compilation, and will continue to use the previous .config configuration.

- **uboot / boot0 compilation process (optional)**

Normally, you do not need to recompile uboot, but if you have custom modifications to uboot, you can compile. The compilation method is as follows:

```
cd lichee/brandy/u-boot-2014.07
make distclean && make sun50iw6p1_config && make -j5  # compile uboot

cd lichee/brandy/u-boot-2014.07
make distclean && make sun50iw6p1_config && make spl  # compile boot0
```

If uboot / boot0 is not compiled, the default is to use the pre-compiled results of lichee / tools / pack / chips / sun50iw6p1 / bin. After recompiling with the above command, the above files will be replaced automatically.

- **Android code compilation process**

```
$ cd android
$ source ./build/envsetup.sh
$ lunch petrel_fvd_p1-eng
$ extract-bsp
$ make -j8 && pack
```

The pack command is used to generate the firmware. If the compilation and packaging process passes successfully, the following message will be prompted:

```
Dragon execute image.cfg SUCCESS !
----------image is at----------

OrangePi_3/lichee/tools/pack/sun50iw6p1_android_petrel-p1_uart0.img

pack finish
```

According to the prompt, you can see the generated Android firmware sun50iw6p1_android_petrel-p1_uart0.img in the OrangePi_3 / lichee / tools / pack / directory. Below, please refer to the "Android Firmware Burning" section to complete the Android firmware burning.

IV. Setting up a Linux compilation environment

1. Get the Linux SDK source code from Github

- **Orange Pi Linux source downloader**

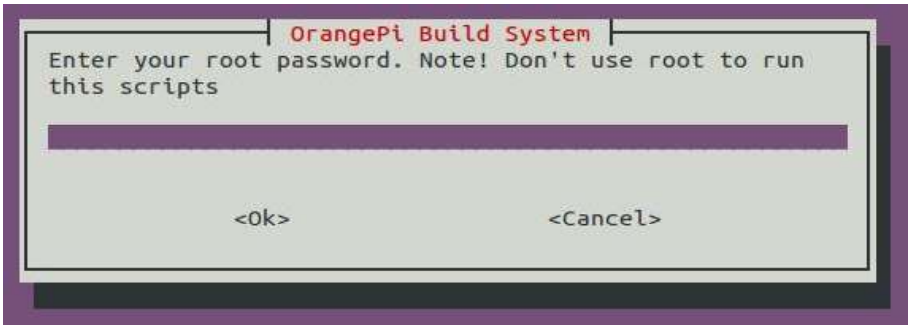
Orange Pi 3's Linux source code has been uploaded to GitHub. The currently supported kernel version is **Linux 4.9 and the mainline ker**nel (some drivers are still under development). We can use the Orange Pi Linux source-specific downloader to download and obtain the downloader source code. Here's the way:

```
$ sudo apt-get install git
$ git clone https://github.com/orangepi-xunlong/OrangePi_Build.git
$ cd OrangePi_Build
$ ls
Build_OrangePi.sh  lib  README.md
```

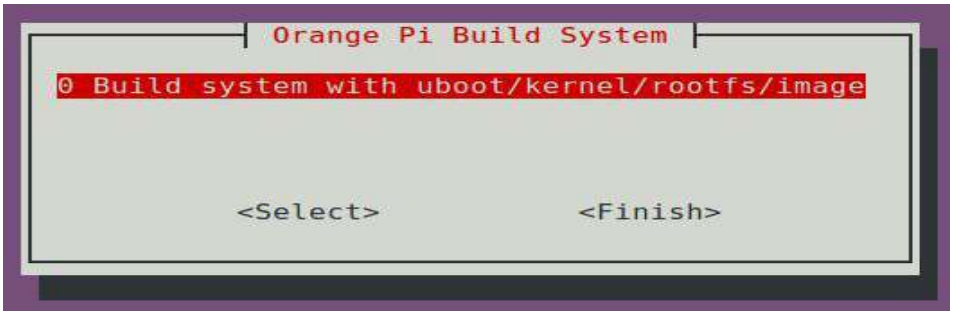
- **Run the downloader**

```
$ ./Build_OrangePi.sh
```

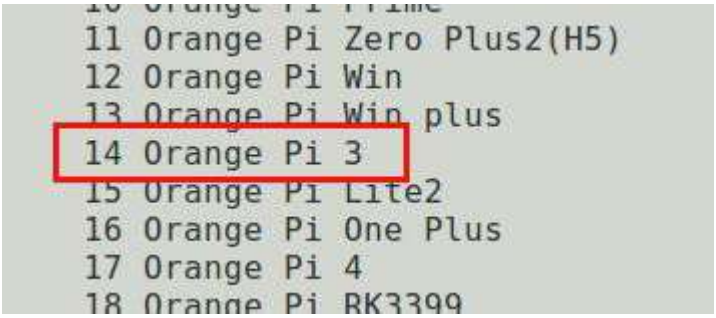
Enter the root password and press enter



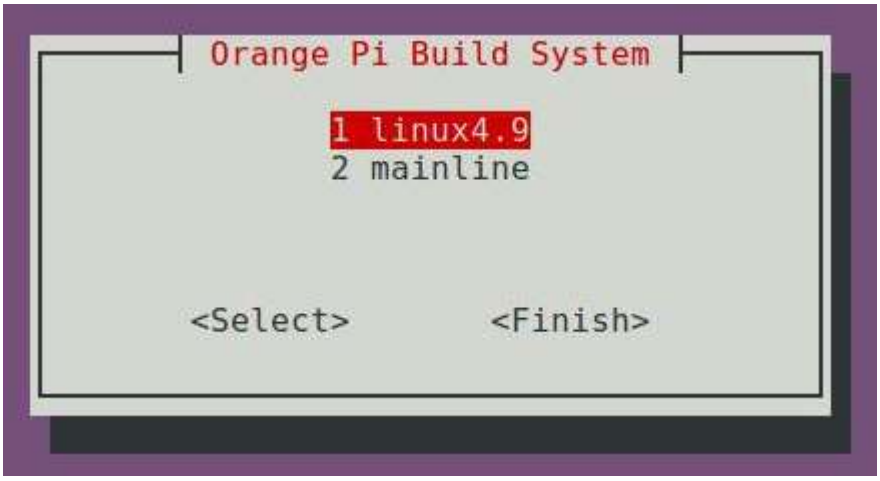
Select 0 Build system with uboot / kernel / rootfs / image to enter the interface of development board model selection.



Select orange pi 3, enter the kernel version selection interface after entering



At present, the orangepi 3 development board supports the kernel code of **Linux 4.9 and mainline**. Select one of them and press Enter to start downloading the corresponding SDK source code.



The downloaded source code will be stored in the same directory of OrangePi_Build

```
$ ls ../OrangePi_Build -l
  OrangePi_Build
  OrangePiH6_Linux4.9   (Where the kernel version is Linux4.9)
  OrangePiH6_mainline   (The current kernel version is Linux5.3.5)
```

2. Get the source code of Linux SDK from Baidu Cloud Disk

If GitHub fails to download the code, you can download the source code compression package of Linux SDK directly from Baidu Cloud Disk.
Download link is:

https://pan.baidu.com/s/15NOF_eAwbN9ah3dfWx0ArQ

3. Set up a compilation environment

Orange Pi H6 Linux SDK has only been tested on PCs with Ubuntu 18.04. Please prepare the host environment of ubuntu 18.04 before use.

The Linux source directory structure for Orange Pi H6 is shown below:

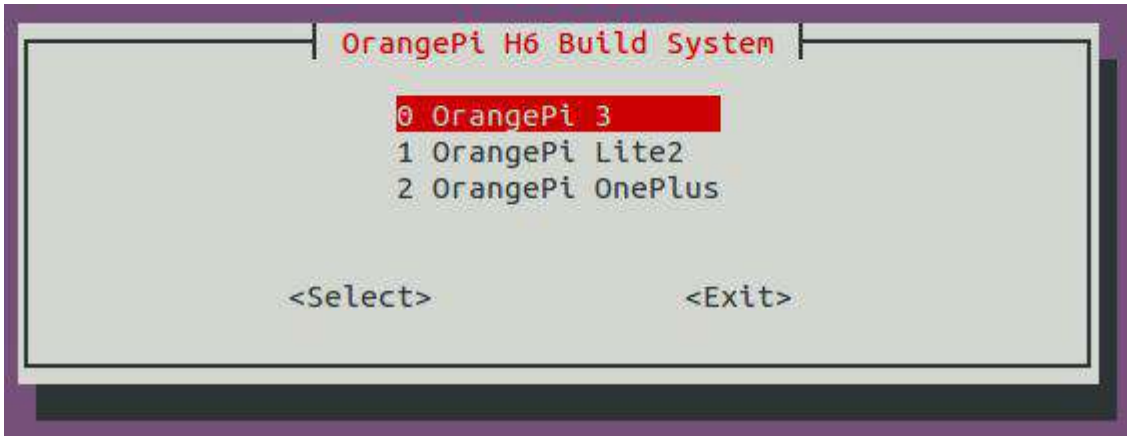
```
$ cd OrangePiH6_Linux4.9
$ tree -L 1
.
├── build.sh -> scripts/build.s    Compile startup script
├── external                       Store additional configuration files
├── kernel                         Linux kernel source
├── output       Store output files, only generated after compiling source code
├── scripts                        Script files used during compilation
├── toolchain      Cross-compilation toolchain used by the kernel and u-boot
└── uboot                          Store boot0 and u-boot source code6
directories, 1 file
```

4. Compile Linux and U-boot source code

- **execute the compilation start up script**

```
$ cd OrangePiH6_Linux4.9
$ sudo ./build.sh
```

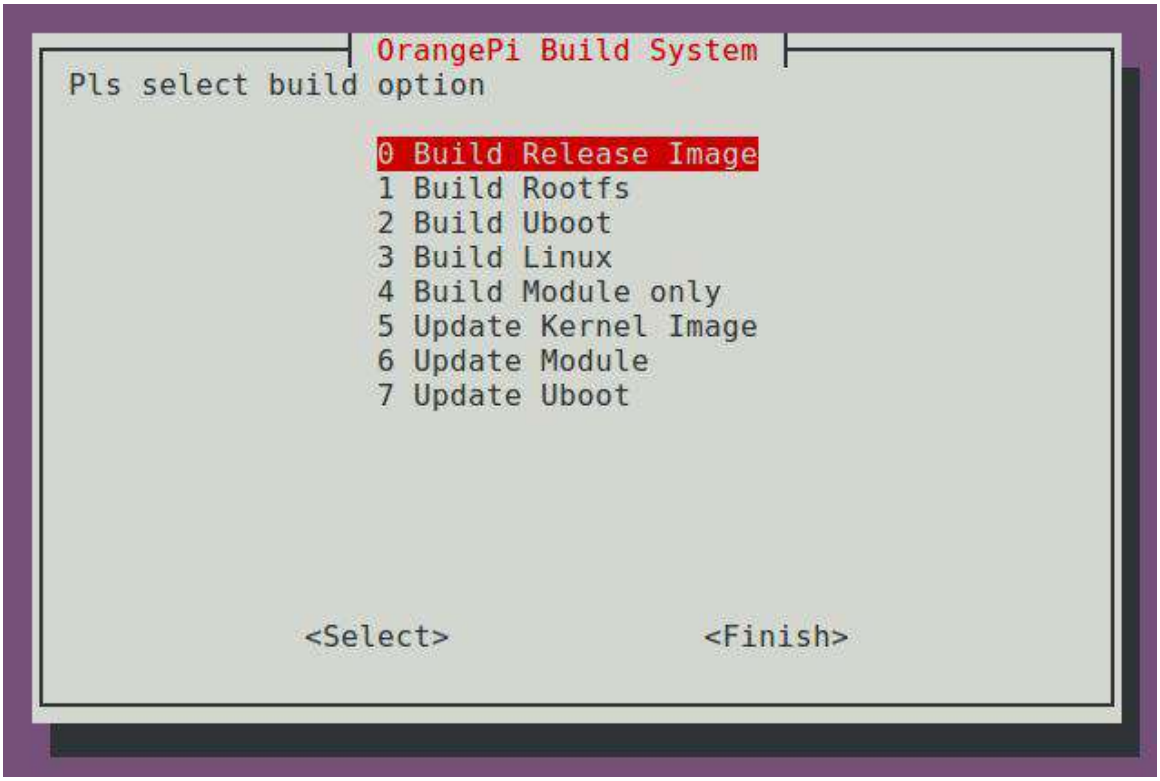
Select OrangePi 3 and press Enter



The functions of each option are as follows:

- **0 Build Release Image —— Compile ubuntu or debian distribution images**
- **1 Build Rootfs —— Compile rootfs for ubuntu or debian**
- **2 Build Uboot —— Compile boot0 and u-boot source code**
- **3 Build Linux —— Compile Linux kernel source code**

- **4 Build Module only —— Compile Linux kernel modules**
- **5 Update kernel Image —— Update kernel in SD card Linux system**
- **6 Update Module —— Update the kernel module in SD card Linux system**
- **7 Update Uboot —— Update boot0 and u-boot and dtb configuration of SD card Linux system**



The final file generated by the compilation will be saved in the output directory

```
$ cd output
$ tree -L 2
.
├── images                    //Generated image file
│   └── OrangePi_3_ubuntu_xenial_server_linux4.9.118_v2.0.2.img
├── kernel                    //Compile the generated kernel
│   └── uImage_3
├── rootfs                    //Compile the generated rootfs
├── uboot                     //Compile the generated uboot image
│   ├── boot0_sdcard_sun50iw6p1.bin
│   ├── H6.dtb
│   └── u-boot-sun50iw6p1.bin
└── xenial_arm64_server_rootfs.tar.gz
```

5. Linux SDK usage example

The following will fully demonstrate the use of the Linux SDK by adding a

rtl8812AU USB WIFI kernel module to the kernel source.

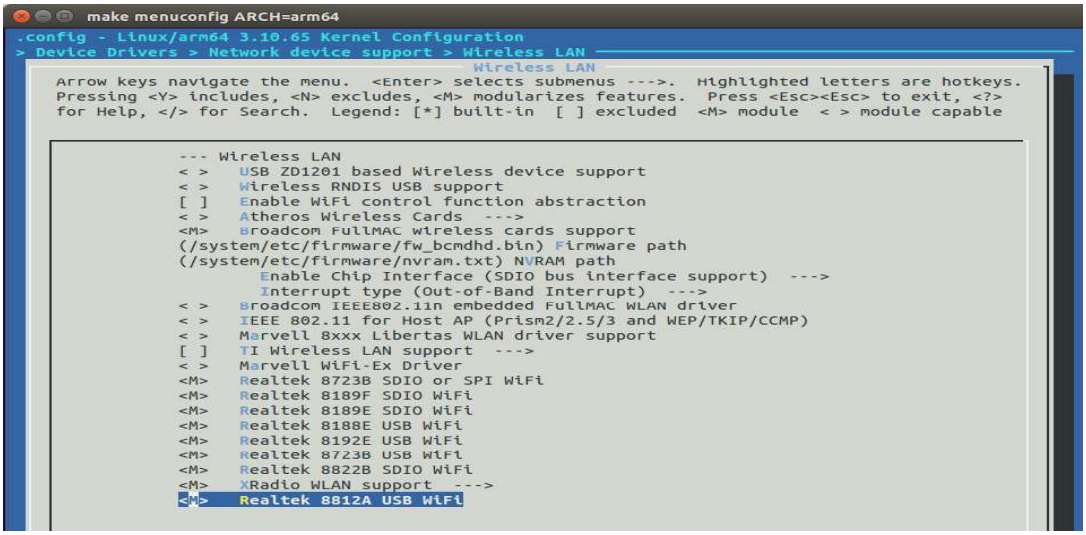
- **Get the source code of rtl8812AU from github**

```
$ cd OrangePiH6_Linux4.9/kernel/drivers/net/wireless
$ git clone https://github.com/diederikdehaas/rtl8812AU.git
Cloning into 'rtl8812AU'...
remote: Counting objects: 2347, done.
Receiving objects: 100% (2347/2347), 7.87 MiB | 22.00 KiB/s, done.
Resolving deltas: 100% (1292/1292), done.
Checking connectivity... done.
```

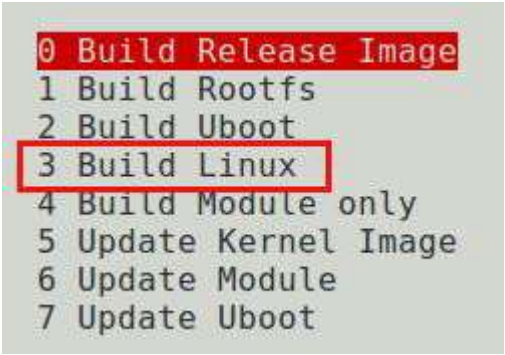
- **Add the configuration of rtl8812AU**

```
$ cd OrangePiH6_Linux4.9/kernel/drivers/net/wireless
$ git diff .
diff --git a/drivers/net/wireless/Kconfig
b/drivers/net/wireless/Kconfig
index 373666b..b7ebd5c 100755
--- a/drivers/net/wireless/Kconfig
+++ b/drivers/net/wireless/Kconfig
@@ -294,4 +294,5 @@ source "drivers/net/wireless/rtl8192eu/Kconfig"
+source "drivers/net/wireless/rtl8812AU/Kconfig"
 endif # WLAN

diff --git a/drivers/net/wireless/Makefile
b/drivers/net/wireless/Makefile
index fd8a466..3aef800 100755
--- a/drivers/net/wireless/Makefile
+++ b/drivers/net/wireless/Makefile
@@ -66,3 +66,4 @@ obj-$(CONFIG_XR_WLAN) += xradio/
+obj-$(CONFIG_RTL8812AU)         += rtl8812AU/
```

- **Select Realtek 8812A USB WiFi in the kernel configuration and compile it into a kernel module**



- **Recompile the kernel according to the method of `` Compiling Linux and U-boot Source ''**



Partially compiled log looks like this:

```
Start Compile.....
Start Compile Module
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_cmd.o
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_security.o
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_debug.o
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_io.o
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_ioctl_query.o
  CC [M]  drivers/net/wireless/rtl8812AU/core/rtw_ioctl_set.o
```

After compiling, you can find the compiled kernel module in output / lib / modules / 4.9.118 + / kernel / drivers / net / wireless / rtl8812AU

```
$ cd output/lib/modules/4.9.118+/kernel/drivers/net/wireless/rtl8812AU
$ ls
8812au.ko
```

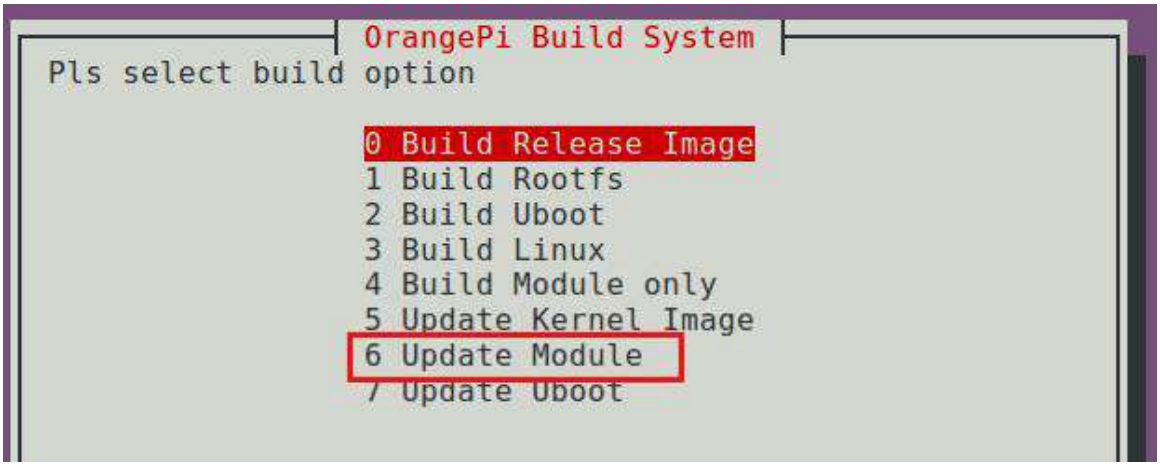
- **Update kernel module**

First, insert the SD card that has been burned with Linux firmware into a PC used

to compile Linux source code (physical or virtual machine with Ubuntu 18.04 installed). After the system recognizes and successfully mounts the inserted SD card, we can / media / $ LOGNAME see the name of the corresponding partition.

```
$ cd /media/$LOGNAME
$ ls
BOOT      Store the kernel
rootfs    Root file system
```

Then choose 6 Update Module to update the kernel module according to the instructions in the section `` Compiling Linux and U-boot Source "



Next, you can start the system through the SD card and use the new 8812au.ko kernel module to drive the USB WIFI network card.

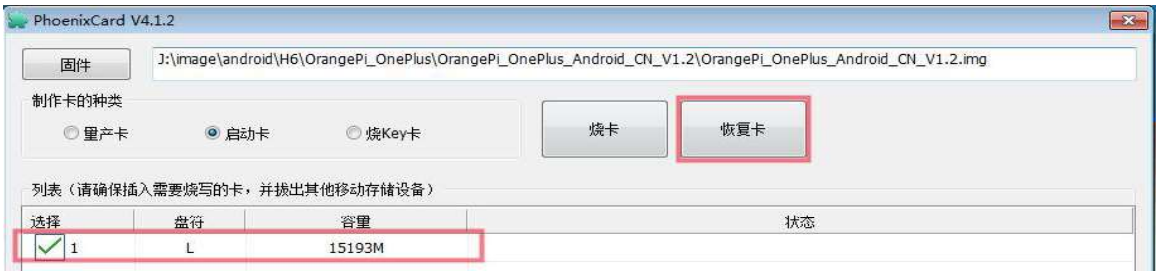
V. Android firmware burning

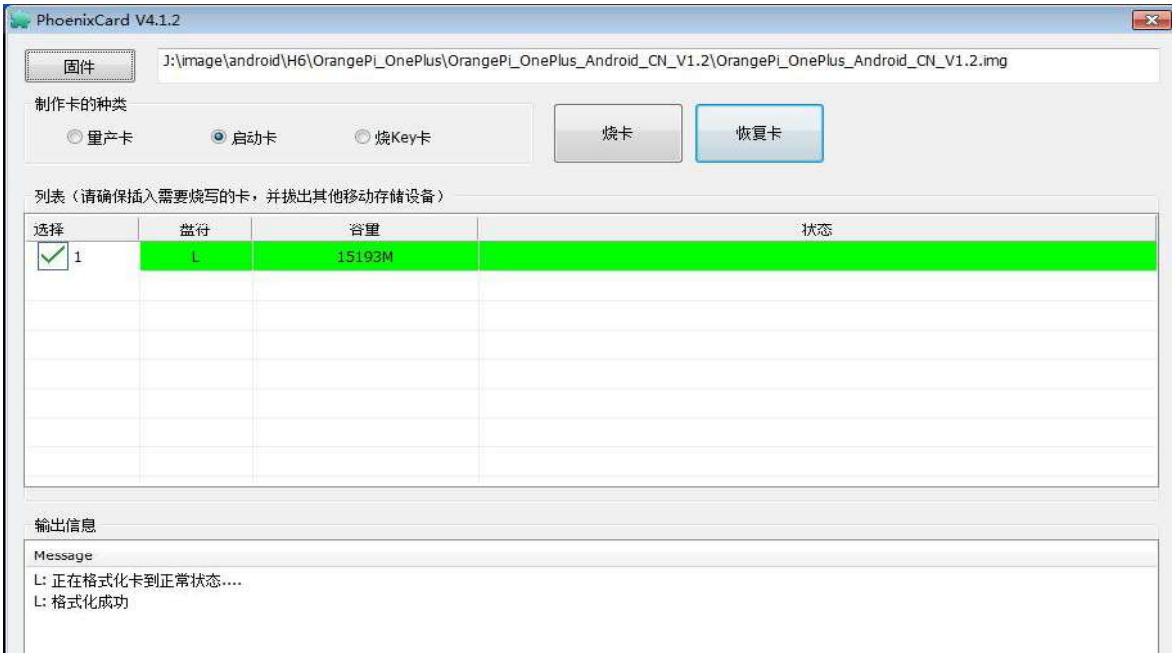
Android firmware cannot be written to the TF card via the dd command in Linux or the Win32 Diskimager tool in Windows. Need to use the tool PhoenixCard to write, PhoenixCard current latest version is PhoenixCard V4.1.2, can be downloaded from the official tool on the official website download page.

1. Android firmware burning steps (TF card start up)

- **Format TF card**

Check whether the inserted TF card is consistent with the selected drive letter, click the "Restore Card" button to start formatting the TF



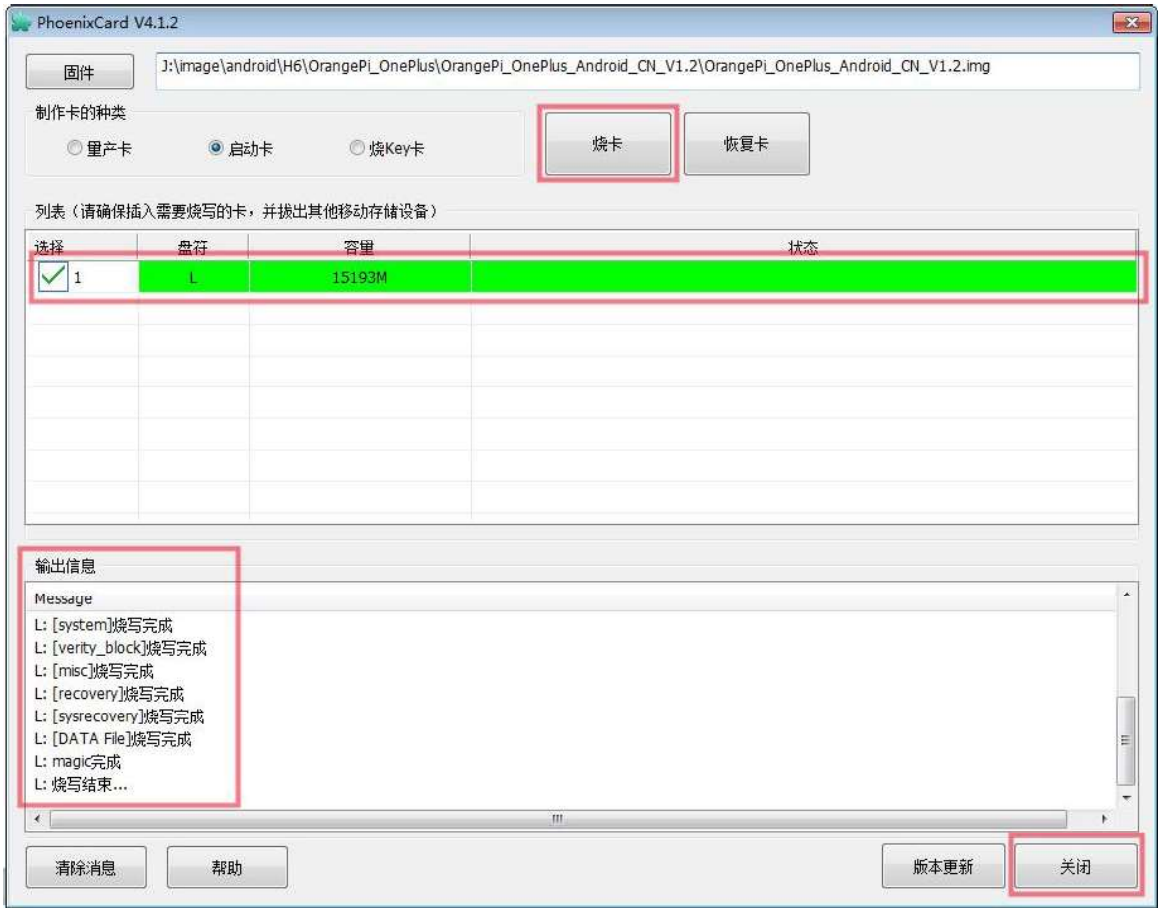


- **Then select the firmware, select the boot card**

Please note the red mark in the picture below:



- **Click "Burn Card" to start writing to the TF card, and wait for the completion of burning.**

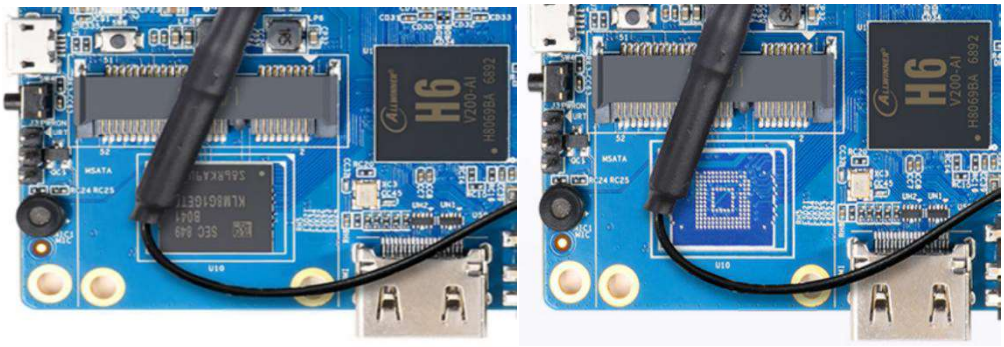


After the Android firmware is successfully programmed, click the "Close" button, and then you can insert the TF card into the development board to start the system

2. Android firmware programming steps (programming to EMMC via TF card)

If you purchased the Orange Pi 3 development board with EMMC Flash chip, you can also burn the Android image to EMMC through TF card, and then use the development board through the system in EMMC. If you purchased the development board of Orange Pi 3 without EMMC Flash, you can only start the system through TF card.

As shown in the figure below, the left side is the Orange Pi 3 development board with EMMC Flash chip attached, and the right side is not attached.



The steps to burn the system to EMMC Flash through TF card are as follows:

- **Format TF card**

Check if the inserted TF card is consistent with the selected drive letter, click the "Recover Card" button to start formatting the TF card.

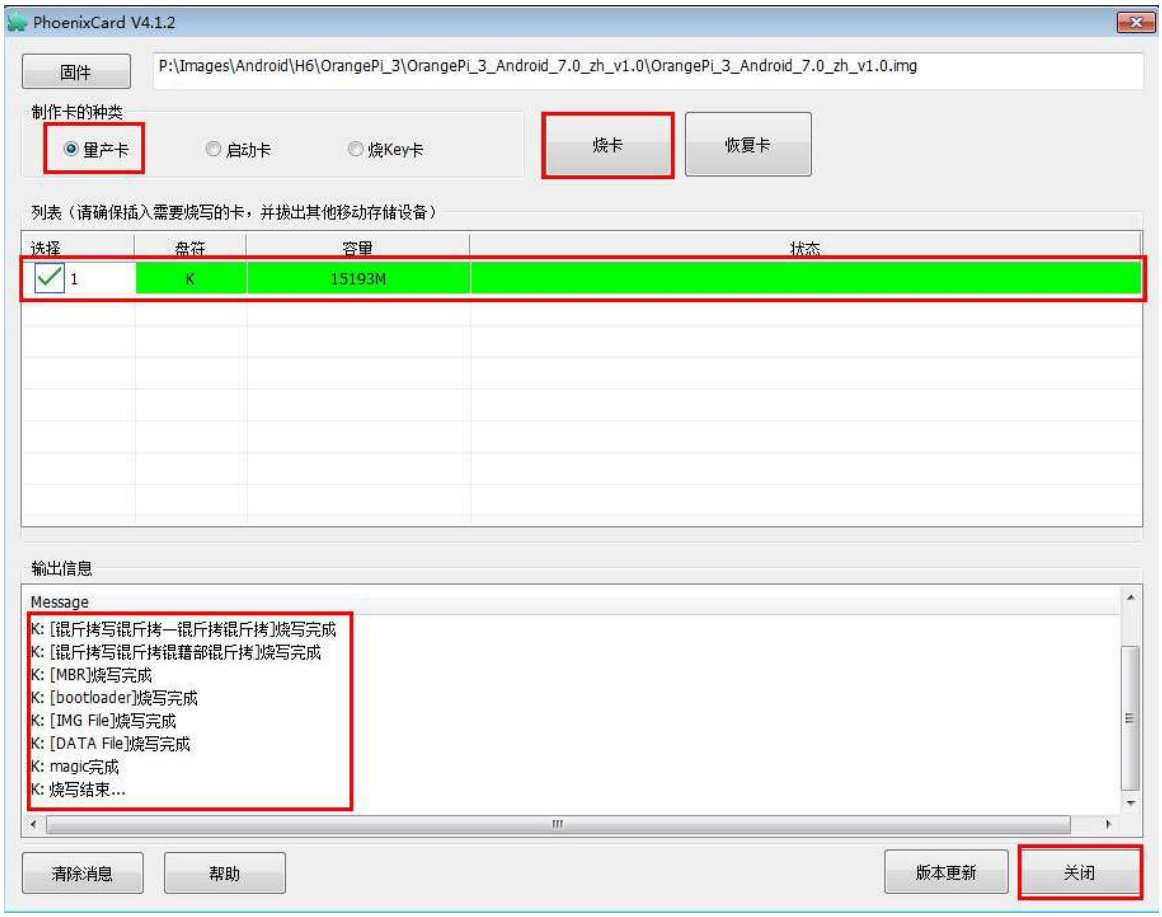


- **Then select the Android firmware of Orange Pi 3, choose the production card among the types of business cards**

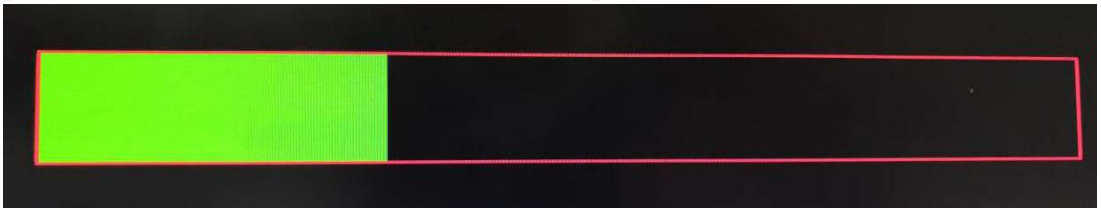
Please note the red mark in the picture below



- **Click "Burn Card" to start writing to the TF card, and wait for the completion of burning.**



After the Android firmware is successfully programmed, click the "Close" button, and then you can insert the TF card into the development board. After powering on, the system in the TF card will be automatically burned into the EMMC. During the burning process, the red light on the development board will start to flash, and the red light will stop flashing after the burning is completed. You can also see the following programming interface through the HDMI display.



Screens displayed during burning



Screen displayed after burning is completed

After programming, you can turn off the power, pull out the TF card, and then power on to start the system in EMMC Flash.

VI. Linux firmware burning

We can burn the Orange Pi 3's Linux firmware to the TF card through Etcher. If you purchased the Orange Pi 3 development board without the EMMC Flash chip, you can only start the system through the TF card. Etcher supports the following operating systems.

- Linux (most distributions, such as Ubuntu)
- MacOS 10.9 and later
- Windows 7 and later

The Etcher software installation package can be downloaded from its official website https://etcher.io/, or it can be downloaded from the official tool of the Orange Pi 3 official website download page

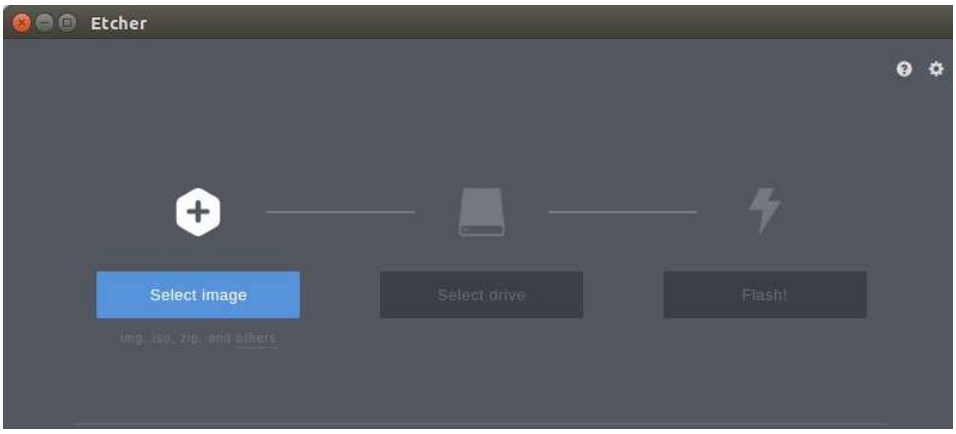
1. Etcher installation method

- The installation method of Etcher in Windows is the same as that of ordinary software, so I won't go into details here.
- Etcher is installed on Ubuntu and Debian systems as follows

```
1. Add Etcher Debian repository:
$ echo "deb https://dl.bintray.com/resin-io/debian stable etcher" | sudo
tee /etc/apt/sources.list.d/etcher.list

2. Download the key
$ sudo apt-key adv --keyserver hkp://pgp.mit.edu:80 --recv-keys
379CE192D401AB61

3. Update and install
$ sudo apt-get update && sudo apt-get install etcher-electron

4.Uninstallation method
$ sudo apt-get remove etcher-electron
$ sudo rm /etc/apt/sources.list.d/etcher.list && sudo apt-get update
```

2. How to flash Linux firmware through Etcher

- First open Etcher, its interface is shown below



- Then use "Select image" to select the Linux firmware to be burned
- Then insert the TF card, Etcher will automatically identify the corresponding drive
- Finally, click “Flash!” To start burning. After burning, you can insert the development board to start the system.



3. Program Linux system into EMMC Flash chip through script

If you purchased the Orange Pi 3 development board with EMMC Flash chip, after booting the Linux system through the TF card, you can also burn the Linux system into EMMC Flash through the install_to_emmc script.

Enter the install_to_emmc command in the Linux terminal, and then enter y as prompted, and the Linux system will automatically be burned into EMMC Flash. After the programming is complete, turn off the power, remove the TF card, and then power on the Linux system in EMMC Flash automatically.

```
root@OrangePi:~# install_to_emmc

WARNING: EMMC WILL BE ERASED !, Continue (y/N)?  y
Erasing EMMC ...
Creating new filesystem on EMMC ...
  New filesystem created on /dev/mmcblk0.
Partitioning EMMC ...
  Creating boot & linux partitions
  OK.
Formating fat partition ...
  fat partition formated.
Formating linux partition (ext4), please wait ...
  linux partition formated.

Instaling u-boot to EMMC ...

Mounting EMMC partitions...
FAT partitions mounted to /tmp/_fatdir
linux partition mounted to /tmp/_extdir

Copying file system to EMMC ...

  Creating "fstab"

********************************
Linux system installed to EMMC.
********************************
```

VII. Instructions for use of Linux system

1. Linux boot light description

- After booting, the on board LED light will first light up red, then the red light will turn off, and the yellow light will stay on.

2. Login account and password

- Username root, password: orangepi
- Username orangepi, password: orangepi

3. extend rootfs partition

After the system running card is prepared, the file system rootfs partition should be expanded immediately. This will greatly improve the system performance and avoid various tedious problems caused by insufficient space.

We can use the built-in script resize_rootfs.sh to expand the capacity after entering the system.

```
The amount of free space in the system before expansion
root@OrangePi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/mmcblk1p2  1.1G  981M   28M  98% /
devtmpfs        985M     0  985M   0% /dev
tmpfs           994M     0  994M   0% /dev/shm
tmpfs           994M  8.9M  985M   1% /run
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           994M     0  994M   0% /sys/fs/cgroup
/dev/mmcblk1p1   50M   15M   36M  30% /boot
tmpfs           199M     0  199M   0% /run/user/0
root@OrangePi:~#

Run the built-in expansion script
root@OrangePi:~# resize_rootfs.sh
```

```
The amount of space available in the system after the expansion
root@OrangePi:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/mmcblk1p2   15G  982M   13G   7% /
devtmpfs        985M     0  985M   0% /dev
tmpfs           994M     0  994M   0% /dev/shm
tmpfs           994M  8.9M  985M   1% /run
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           994M     0  994M   0% /sys/fs/cgroup
/dev/mmcblk1p1   50M   15M   36M  30% /boot
tmpfs           199M     0  199M   0% /run/user/0
```

4. Recording playback test method

Note: The Audio Codec audio driver for the mainline kernel is not yet available

- Test recording function

```
root@orangepi3:~# arecord -d 10 -f cd -D hw:1,0 -t wav Test.wav
Recording WAVE 'Test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz,
  Stereo
root@orangepi3:~#
```

- Test the HDMI playback function, just use the aplay command to play

```
root@orangepi3:~# aplay Test.wav
```

- Test headset playback

```
root@orangepi3:~# aplay -D hw:1,0 Test.wav
```

5. WIFI configuration method

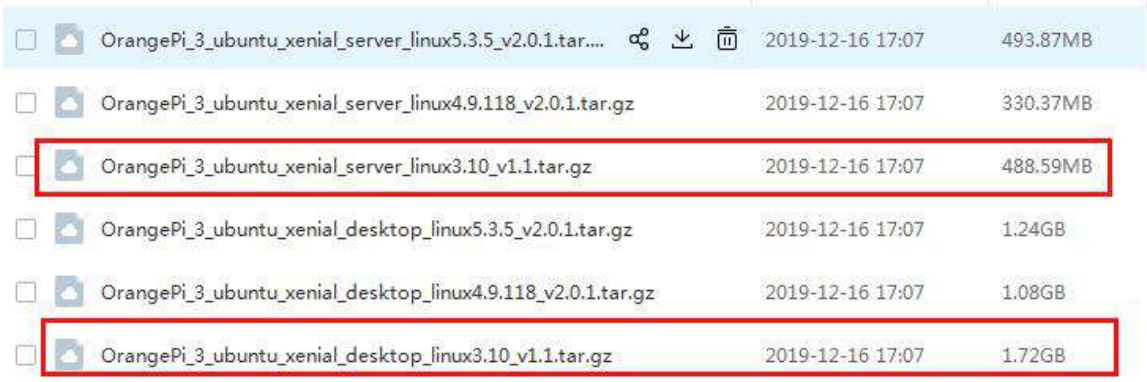
Add the following configuration to / etc / network / interface and restart

```
auto wlan0
iface wlan0 inet dhcp
wpa-ssid orangepi                  //Fill in the WIFI account here (orangepi)
wpa-psk orangepi                   //Fill in the WIFI password here (orangepi)
```

6. Test method of PCIE interface

When using the PCIE interface, it should be noted that if the PCIE interface is used, the USB2.0 interface cannot be used. If used at the same time, it will cause a system error.

Currently, only the rtl8822be PCIE driver is integrated in the linux3.10 kernel. The drivers for other PCIE devices have not been adapted for the time being, and other versions of the kernel cannot currently use the PCIE function. If you need to test the function of the PCIE interface, please use the Linux 3.10 image or the Android image.



Insert the RTL8822BE wireless network card module according to the method shown in the figure below and start the system. The system will automatically identify and load the 88x2be.ko kernel module.



The lsmod command can be used to check whether the driver is successfully loaded. The ifconfig command can be used to check the network node corresponding to the PCIE wireless network card.

```
root@OrangePi:~# lsmod
Module                  Size  Used by
88x2be               2116402  0

root@OrangePi:~# ifconfig wlp1s0
wlp1s0    Link encap:Ethernet  HWaddr f8:da:0c:5a:00:6f
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:6 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

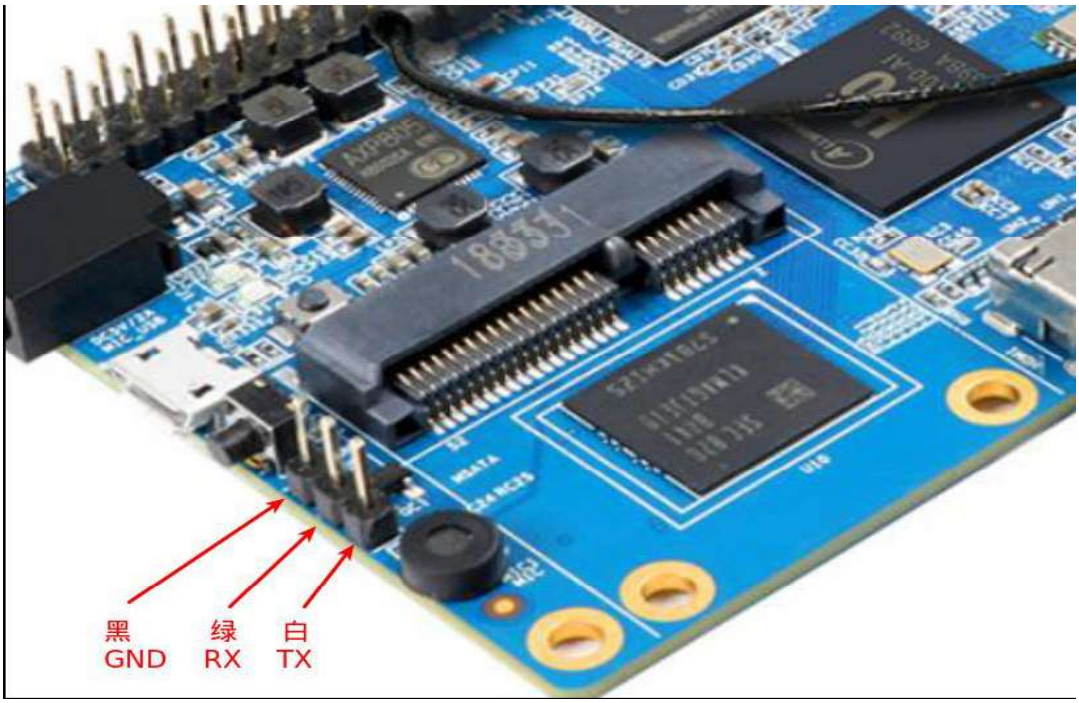
VIII. Introduction to serial debugging tools

First you need to prepare a USB to TTL serial cable similar to the picture below:



Connect the serial cable as shown in the figure below. The functions of the cables of different colors are as follows:

- Black——GND
- Green-RX
- White-TX



1. Use on Windows platform

In the process of using OrangePi for project development, in order to obtain more debugging information, OrangePi supports serial port information debugging by default. For developers, they only need to prepare the materials mentioned above to get serial debugging information. The serial debugging tools used by different host computers are similar. Basically, you can refer to the methods below to deploy. There are many tools for serial debugging on the Windows platform. The commonly used tool is putty. This section uses putty as an example to explain deployment.

- **Install USB driver**

Download the latest driver PL2303_Prolific_DriverInstaller_v130.zip, download and unzip.



Select application installation as administrator



Wait for the installation to complete



- **Download and install Putty**

Putty can be downloaded from the following address, please choose the version suitable for your development environment.

```
https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html
```

Double-click the downloaded putty.exe directly to open putty. The software interface is shown in the figure below.

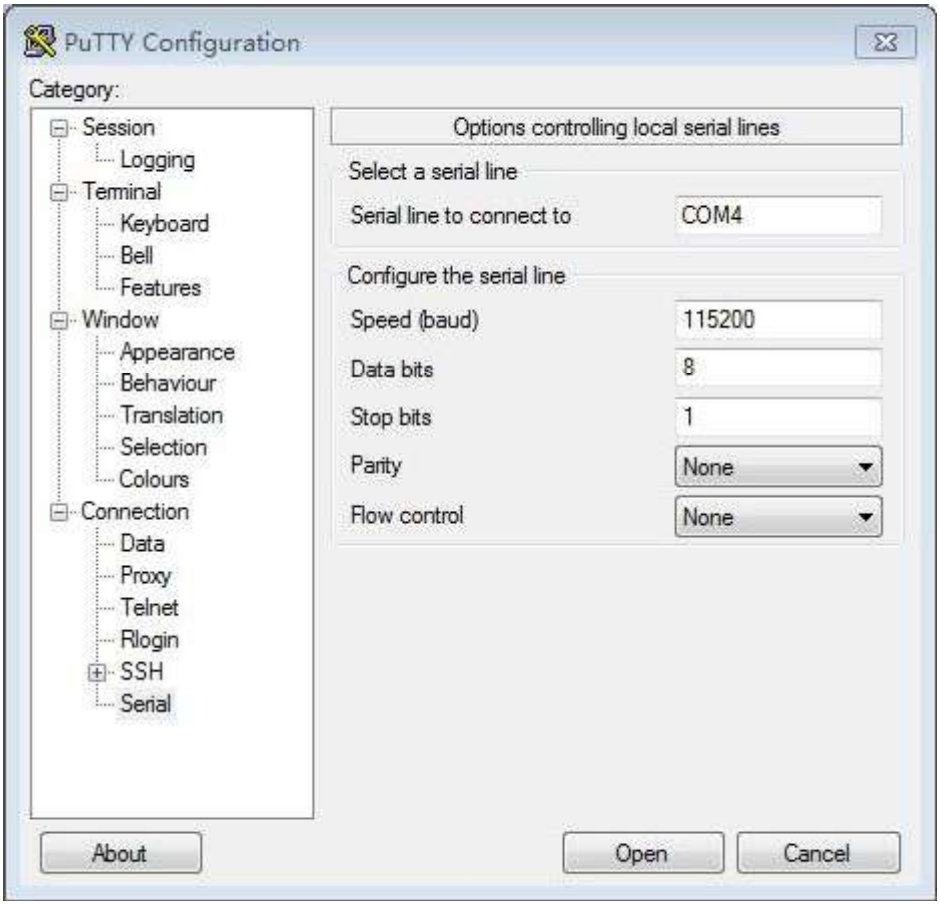
- **Acquisition of equipment information**

In Windows 7, we can check whether the serial port connection is normal and the device number of the serial port through the device manager. If the device is not recognized properly, please check if the driver is successfully installed. If there is a problem with the driver installation, you can try to scan and install the driver using 360 Driver Master.



- **Putty configuration**

Set the serial port to the corresponding port number (COM4), disable flow control, and set the speed to 115200



- Start debugging serial output

OrangePi is powered on and putty will automatically print serial port log information

2. Use on Linux platform

There is not much difference between using putty on the Linux platform and the Windows platform. The following mainly describes the operation steps where there are differences. All operations are based on Ubuntu 14.04 system.

- **Install and start Putty**

```
$ sudo apt-get install putty
$ sudo putty
```

- **Configure Putty**

The serial number can be viewed through ls / dev / ttyUSB *
Baud rate needs to be set to 115200
And turn off flow control


PuTTY Configuration
Category:
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Fonts
Connection
Data
Proxy
Telnet
Rlogin
SSH
Serial
Options controlling local serial lines
Select a serial line
Serial line to connect to
/dev/ttyUSB0
Configure the serial line
Speed (baud)
115200
Data bits
8
Stop bits
1
Parity
None
Flow control
None
About
Open
Cancel