

Raspberry mounted PCIE

Hardware connection PCIE

1. Use the cable to connect the cable interface of the Raspberry Pi, as shown in the figure below



2. Connect the solid state drive to the PCIE and fix it on the board. After confirming that it is correct, power the Raspberry Pi 5, as shown in the figure

Tips: Remember to connect the SD card that can boot into the system to the Raspberry

Pi.



System mount (used as expansion space)

1. The PCIe interface is not enabled by default on Raspberry Pi 5. Select one of the statements in `/boot/firmware/config.txt` and add it to the last file:

```
sudo nano /boot/firmware/config.txt
```

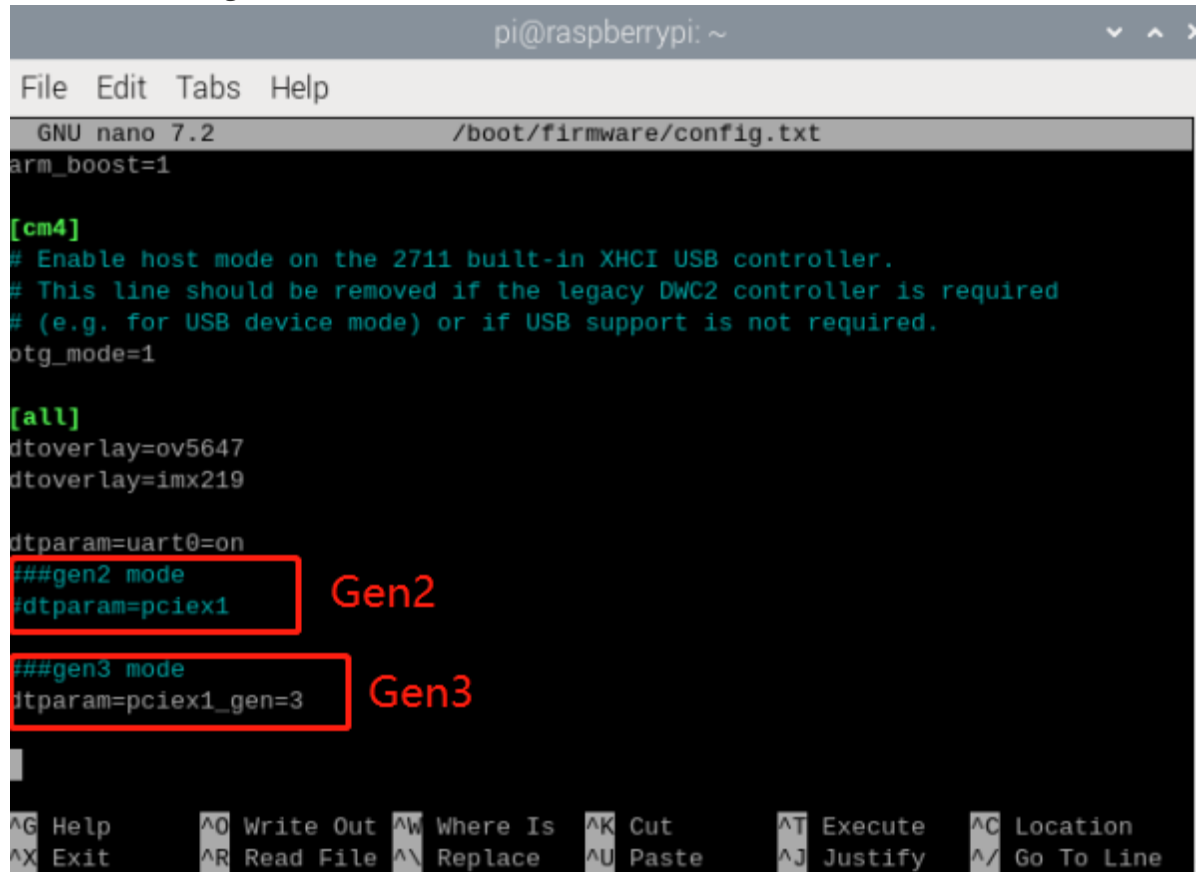
```
#Gen2 low speed mode
```

```
dtparam=pciex1
```

```
#Gen3 high speed mode
```

```
dtparam=pciex1_gen=3
```

As shown in the figure:



```
pi@raspberrypi: ~
File Edit Tabs Help
GNU nano 7.2 /boot/firmware/config.txt
arm_boost=1

[cm4]
# Enable host mode on the 2711 built-in XHCI USB controller.
# This line should be removed if the legacy DWC2 controller is required
# (e.g. for USB device mode) or if USB support is not required.
otg_mode=1

[all]
dtoverlay=ov5647
dtoverlay=imx219

dtparam=uart0=on
##gen2 mode
dtparam=pciex1
Gen2

##gen3 mode
dtparam=pciex1_gen=3
Gen3

^G Help      ^O Write Out ^W Where Is  ^K Cut       ^T Execute   ^C Location
^X Exit      ^R Read File ^\ Replace   ^U Paste     ^J Justify   ^_ Go To Line
```

2. Then restart the Raspberry Pi

```
sudo reboot
```

3. Enter the following command to detect PCIE

```
lspci
```

As shown below, SM2263 is my SSD solid state, and the other PI5 is the RPI chip

```
pi@raspberrypi:~ $ lspci
0000:00:00.0 PCI bridge: Broadcom Inc. and subsidiaries Device 2712 (rev 21)
0000:01:00.0 Non-Volatile memory controller: Silicon Motion, Inc. SM2263EN/SM2263XT SSD Controller (rev 03)
0001:00:00.0 PCI bridge: Broadcom Inc. and subsidiaries Device 2712 (rev 21)
0001:01:00.0 Ethernet controller: Device 1de4:0001
```

4. Start mounting

```
#Create a mount directory
sudo mkdir yahboomba
#Mount device
sudo mount /dev/nvme0n1p1 ./yahboomba
#Check disk status
df -h
```

Before mounting

```
pi@raspberrypi:~ $ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            1.9G   0    1.9G   0% /dev
tmpfs           405M   6.0M  399M   2% /run
/dev/mmcblk0p2  21G   17G   3.1G  85% /
tmpfs           2.0G  256K   2.0G   1% /dev/shm
tmpfs           5.0M   48K   5.0M   1% /run/lock
/dev/mmcblk0p1  510M   74M   437M  15% /boot/firmware
tmpfs           405M  160K   404M   1% /run/user/1000
pi@raspberrypi:~ $
```

Successfully mounted

```
pi@raspberrypi:~ $ sudo mkdir toshiba
pi@raspberrypi:~ $ sudo mount /dev/nvme0n1p1 ./toshiba
The disk contains an unclean file system (0, 0).
The file system wasn't safely closed on Windows. Fixing.
mount: (hint) your fstab has been modified, but systemd still uses
the old version; use 'systemctl daemon-reload' to reload.
pi@raspberrypi:~ $ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            1.9G   0    1.9G   0% /dev
tmpfs           405M   6.0M  399M   2% /run
/dev/mmcblk0p2  21G   17G   3.1G  85% /
tmpfs           2.0G  256K   2.0G   1% /dev/shm
tmpfs           5.0M   48K   5.0M   1% /run/lock
/dev/mmcblk0p1  510M   74M   437M  15% /boot/firmware
tmpfs           405M  160K   404M   1% /run/user/1000
/dev/nvme0n1p1  120G   93M  120G   1% /home/pi/toshiba
pi@raspberrypi:~ $
```

Difference between Gen2 and Gen3 modes

- Gen2 mode:

SD card read speed:

```
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 264 MB in 3.01 seconds = 87.76 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 264 MB in 3.01 seconds = 87.83 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 264 MB in 3.01 seconds = 87.68 MB/sec
pi@raspberrypi:~ $
```

SD card speed

nvme read speed:

```
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 1188 MB in 3.00 seconds = 395.41 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 1186 MB in 3.00 seconds = 395.29 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 1186 MB in 3.00 seconds = 395.25 MB/sec
pi@raspberrypi:~ $
```

- Gen3 mode:

SD card read speed:

```
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 264 MB in 3.01 seconds = 87.66 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 228 MB in 3.03 seconds = 75.32 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 266 MB in 3.02 seconds = 88.01 MB/sec
^[[A
pi@raspberrypi:~ $ sudo hdparm -t /dev/mmcblk0p1
/dev/mmcblk0p1:
Timing buffered disk reads: 262 MB in 3.02 seconds = 86.73 MB/sec
pi@raspberrypi:~ $
```

nvme read speed:

```
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 2310 MB in 3.00 seconds = 769.25 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 2326 MB in 3.00 seconds = 774.70 MB/sec
pi@raspberrypi:~ $ sudo hdparm -t /dev/nvme0n1
/dev/nvme0n1:
Timing buffered disk reads: 2334 MB in 3.00 seconds = 777.93 MB/sec
pi@raspberrypi:~ $
```

Conclusion: The SD card slot is not affected by the mode, but the PCIE board is affected by the mode. The Gen3 mode is much faster than the Gen2 mode.

Use nvme solid state drive as system boot disk

1. Modify boot information, enter the following command

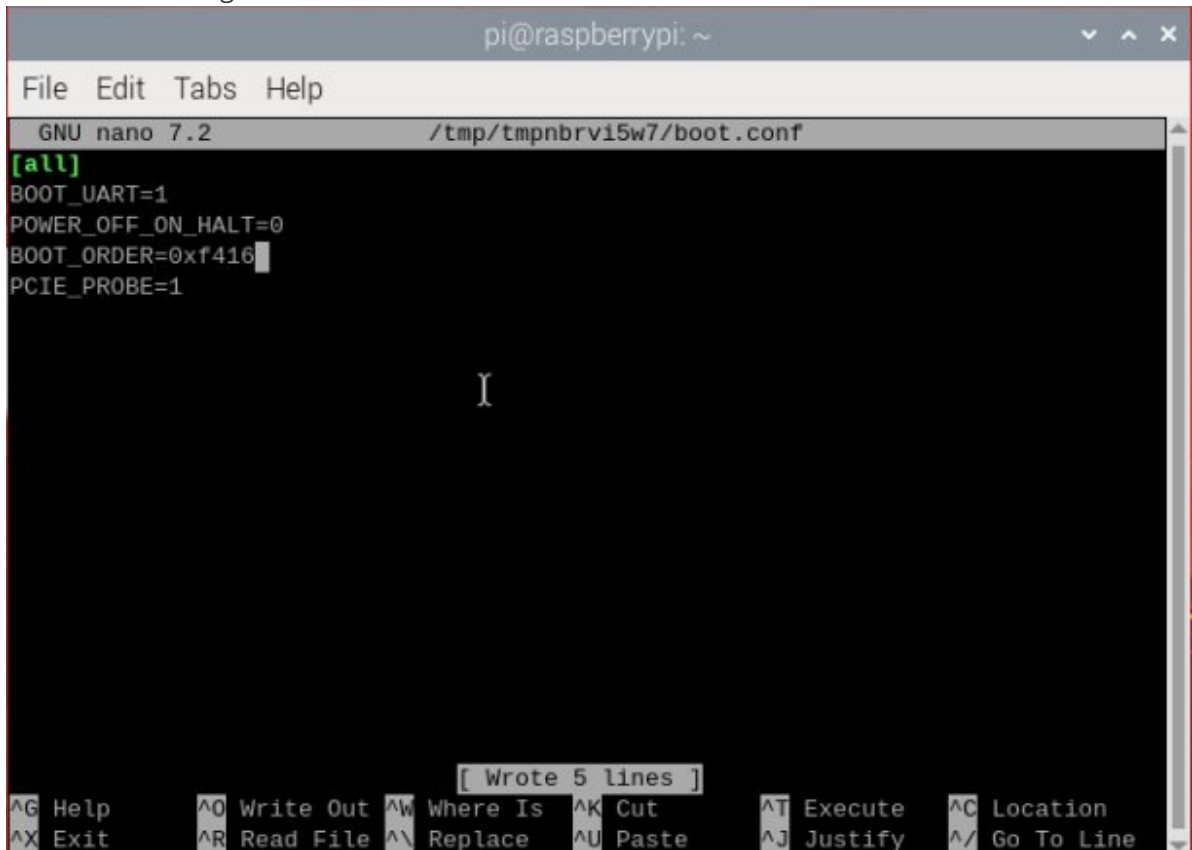
```
sudo rpi-eeeprom-config --edit
```

Modify BOOT_ORDER to: BOOT_ORDER=0xf416

Enable PCIE_PROBE: PCIE_PROBE=1

Then save, exit and reboot.

As shown in the figure:



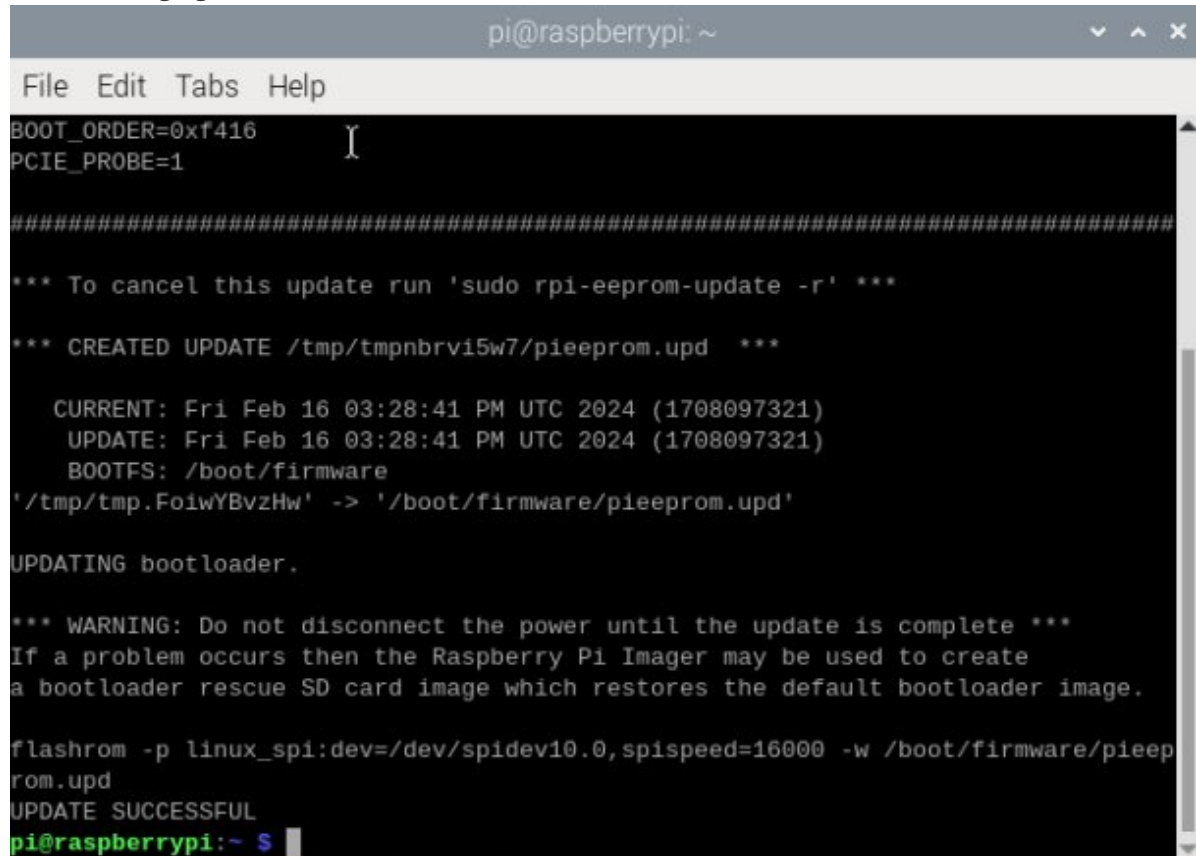
```
pi@raspberrypi: ~
File Edit Tabs Help
GNU nano 7.2 /tmp/tmpnbrv15w7/boot.conf
[all]
BOOT_UART=1
POWER_OFF_ON_HALT=0
BOOT_ORDER=0xf416
PCIE_PROBE=1

[ Wrote 5 lines ]
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^_ Go To Line
```

Note:

If you find that you cannot modify after multiple modifications, please connect to the network before modifying (wait for the network to self-synchronize), or set the correct time before modifying the file.

The following figure is a screenshot of the successful modification:



```
pi@raspberrypi: ~
File Edit Tabs Help
BOOT_ORDER=0xf416
PCIE_PROBE=1

#####

*** To cancel this update run 'sudo rpi-eeeprom-update -r' ***

*** CREATED UPDATE /tmp/tmpnbrvi5w7/pieeprom.upd ***

CURRENT: Fri Feb 16 03:28:41 PM UTC 2024 (1708097321)
UPDATE: Fri Feb 16 03:28:41 PM UTC 2024 (1708097321)
BOOTFS: /boot/firmware
'/tmp/tmp.FoiwYBvzHw' -> '/boot/firmware/pieeprom.upd'

UPDATING bootloader.

*** WARNING: Do not disconnect the power until the update is complete ***
If a problem occurs then the Raspberry Pi Imager may be used to create
a bootloader rescue SD card image which restores the default bootloader image.

flashrom -p linux_spi:dev=/dev/spidev10.0,spispeed=16000 -w /boot/firmware/pieep
rom.upd
UPDATE SUCCESSFUL
pi@raspberrypi:~ $
```

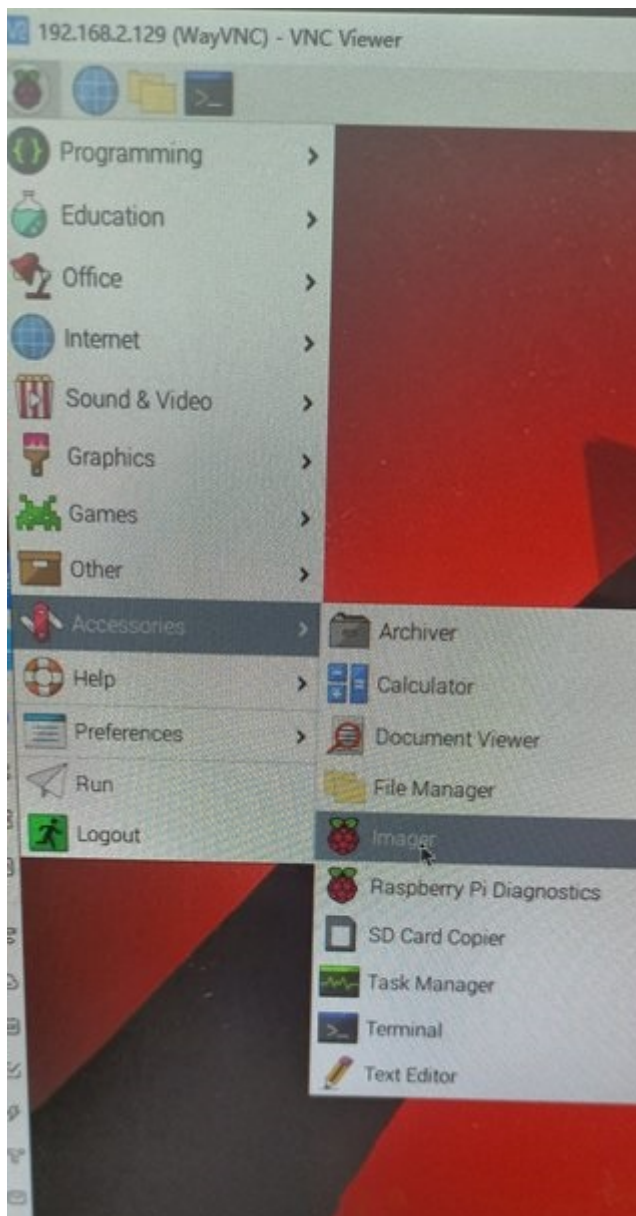
2. Method of downloading the system from nvme

Method 1:

Enter the following command

```
sudo apt update
sudo apt install rpi-imager
```

Then, by clicking on the image installation on the desktop, you can download the system to nvme



Specific operation method:

- <https://blog.csdn.net/timelockerCSDN/article/details/135793432>

Method 2:

Or use a solid-state box to burn a Raspberry Pi system to nvme.

3. Remove the SD card from the Raspberry Pi card slot, install PCIE on the Raspberry Pi 5, and then boot it.

As shown in the figure:



You can see that the boot disk of the Raspberry Pi 5 is nvme.



4. If you want to change back to SD card boot, you can directly remove PCIE and it will return to SD card boot.

