PCIe TO M.2 Board (E)

From Waveshare Wiki
Jump to: navigation, search

Overview

PCIe TO M.2 Board (E)



(https://www.waveshare.com/pcie-to-m.2-board-e.htm)

PCIe TO M.2

Introduction

PCIe To M.2 Adapter Board (E) For Raspberry Pi 5, With Cooling Fan, Compatible With 2242 / 2230 Size NVMe Protocol M.2 SSD, High-speed Reading/Writing, Support Gen2 and Gen3 modes, Support Booting PI5 from SSD, Comes with Mini and Compact Heatsink.

Features

- Support NVMe protocol and M.2 solid state drive protocol, high-speed read/write, with high work efficiency.
- PCI-E×1 only supports Gen2 or Gen3 mode.
- Only supports PI5B.
- Compatible with M.2 solid state drive of 2230/2242 sizes.
- Onboard working indicator lights, with PWR on continuously when powered, and ACT blinking during read/write.

- Integrate heat dissipation and M.2 expansion.

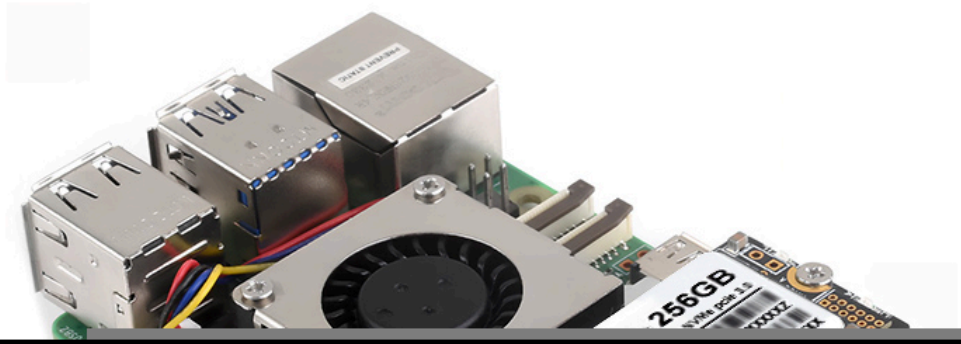
Note

- This HAT does not support NVME startup by default, which requires modification.

Hardware Description

Hardware Connection

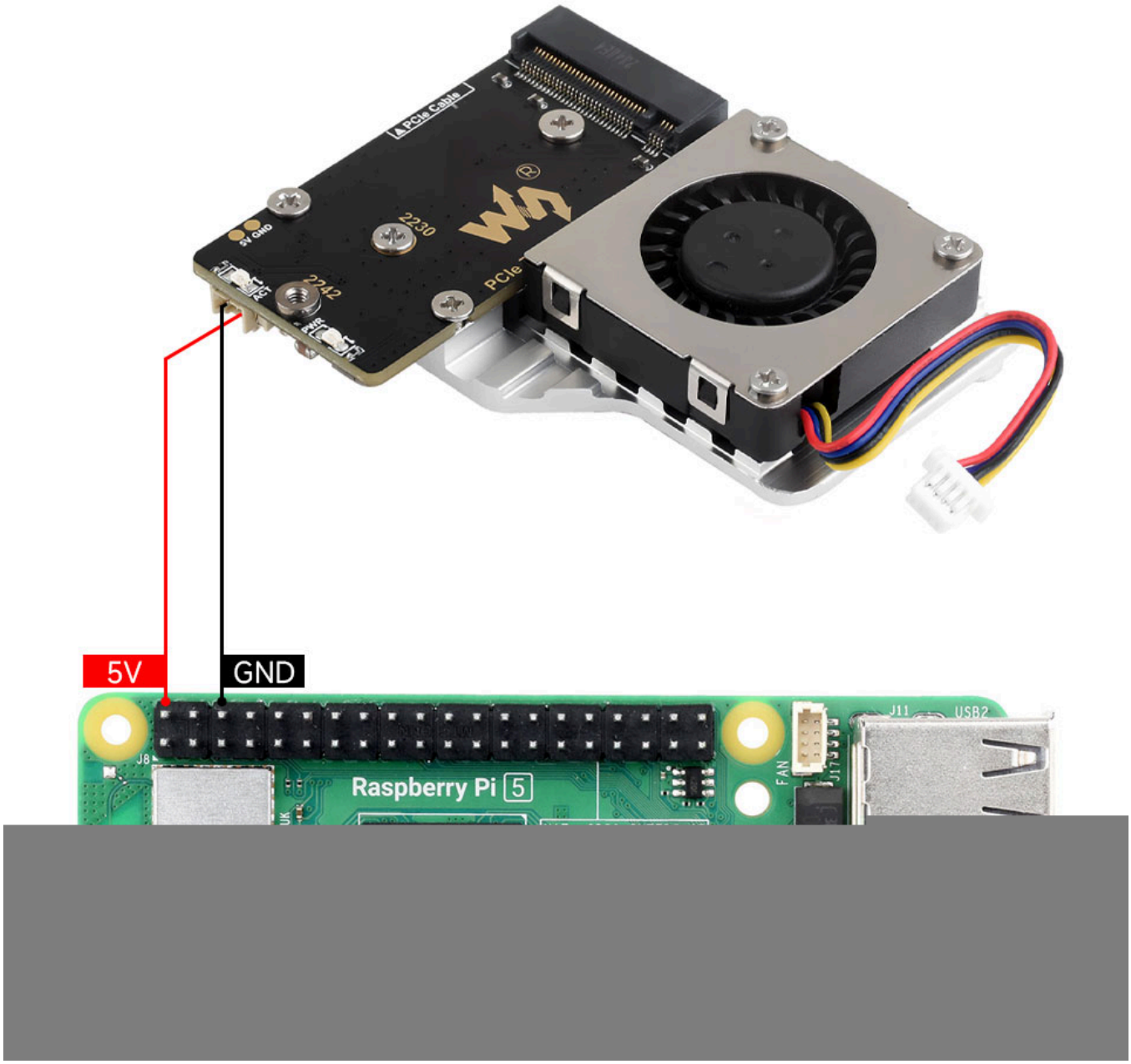
Pay attention to the direction of the cable and connect it as shown in the figure:



(/wiki/File:PCIe-TO-M.2-Board-E-details-3.jpg)

Additional power supply

Connect the power supply via a 2PIN cable (red connects to 5V, black connects to GND)
The PCIE cable only supplies 5W, and the device is underpowered through this 2PIN cable



(/wiki/File:PCIe-TO-M.2-Board-E-details-8(1).jpg)

Load

1: Enable PCIe Interface:

PCIE interface is enabled on the PI5B by default.
If the PCIE interface is not enabled, you add the following content in "/boot/firmware/config.txt":

```
dtparam=pciex1
```

2: The default mode of PCIe is gen2. If you need to enable PCIe Gen3, you need to add the following content at /boot/firmware/config.txt:

```
dtparam=pciex1_gen=3
```

3: After modifying it and restarting PI5, you can recognize the device.

As shown below, the identified SM2263 is my SSD, 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 PCI bridge: ASMedia Technology Inc. ASM1182e 2-Port PCIe x1 Gen2 Packet Switch
0000:02:03.0 PCI bridge: ASMedia Technology Inc. ASM1182e 2-Port PCIe x1 Gen2 Packet Switch
0000:02:07.0 PCI bridge: ASMedia Technology Inc. ASM1182e 2-Port PCIe x1 Gen2 Packet Switch
0000:03:00.0 Non-Volatile memory controller: Sandisk Corp WD Blue SN580 NVMe SSD (DRAM-less) (rev 01)
0000:04:00.0 Non-Volatile memory controller: Sandisk Corp WD Blue SN580 NVMe SSD (DRAM-less) (rev 01)
0001:00:00.0 PCI bridge: Broadcom Inc. and subsidiaries Device 2712 (rev 21)
0001:01:00.0 Ethernet controller: Device 1de4:0001
```

(/wiki/File:PCIe_TO_2-ch_M.2_HAT%2B_W_1.png)

4: Note that skip this step if you have partitioned and formatted on other platforms (will delete all data from the SSD and proceed with caution).

lsblk for viewing the disk (If you want to see the details run sudo fdisk -l)

```
pi@raspberrypi:~ $ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
mmcblk0     179:0    0  29.7G  0 disk
├─mmcblk0p1 179:1    0   512M  0 part /boot/firmware
└─mmcblk0p2 179:2    0  29.2G  0 part /
nvme0n1     259:0    0 119.2G  0 disk
└─nvme0n1p1 259:1    0 119.2G  0 part
```

(/wiki/File:PCIe_TO_M.2_HAT%2B_W_2.png)

Partition

sudo fdisk /dev/nvme0n1   The device number is the total device number, don't add p1, that's just one partition

How to use fdisk partition tool

n New Partition
q Exit without saving
p Print partition table
m Print selection menu
d Delete Partition
w Save to exit
t Modify ID number

Execute n to add the partition, and then execute w to save and exit.

5: Format:

sudo mkfs. Then press the tab to see a variety of different suffixes, the different suffixes are the formats you need to format.

```
pi@raspberrypi:~ $ sudo mkfs.
mkfs.bfs     mkfs.cramfs  mkfs.exfat   mkfs.ext2    mkfs.ext3    mkfs.ext4    mkfs.fat     mkfs.minix   mkfs.msdos   mkfs.ntfs    mkfs.vfat
```

(/wiki/File:PCIe_TO_M.2_HAT%2B_W_3.png)

If I want to format to the ext4 file format, execute the following command:

sudo mkfs.ext4 /dev/nvme0n1p1

Wait for a few moments, when done has appeared, it means that the formatting has been carried out.

```
pi@raspberrypi:~ $ sudo mkfs.ext4 /dev/nvme0n1p1
mke2fs 1.47.0 (5-Feb-2023)
Discarding device blocks: done
Creating filesystem with 31258368 4k blocks and 7815168 inodes
Filesystem UUID: 1a84fb29-5460-475f-afb7-0a90271ef975
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Allocating group tables: done
Writing inode tables: done
Creating journal (131072 blocks): done
Writing superblocks and filesystem accounting information: done
```

(/wiki/File:PCIe_TO_M.2_HAT%2B_W_4.png)

6: Mount:

```
Create Mount Directory
sudo mkdir toshiba
Mount the device
sudo mount /dev/nvme0n1p1 ./toshiba
Checking disk status
df -h
```

Read/Write Test

Enter the directory where the disk is mounted:

```
cd toshiba
```

- Release memory:

```
sudo sh -c "sync && echo 3 > /proc/sys/vm/drop_caches"
```

- Copying the contents of the Raspberry Pi's memory to the hard drive (Write):

```
sudo dd if=/dev/zero of=./test_write count=2000 bs=1024k
```

```
pi@raspberrypi:~/toshiba $ sudo dd if=/dev/zero of=./test_write count=2000 bs=1024k
2000+0 records in
2000+0 records out
2097152000 bytes (2.1 GB, 2.0 GiB) copied, 3.78947 s, 553 MB/s
```

(/wiki/File:PCIe_TO_M.2_HAT%2B_W_5.png)

- Copying the contents of the hard drive to the Raspberry Pi's memory ("/etc/fstab" for reading):

```
sudo dd if=./test_write of=/dev/null count=2000 bs=1024k
```

```
pi@raspberrypi:~/toshiba $ dd if=./test_write of=/dev/null count=2000 bs=1024k
2000+0 records in
2000+0 records out
2097152000 bytes (2.1 GB, 2.0 GiB) copied, 3.53634 s, 593 MB/s
```

(/wiki/File:Pcie-m2-6new.png)

- Note: Different cards and environments make different test results. As the Raspberry Pi is more vulnerable to being affected, if you want to test the exact performance, you can use a PC to test.

Auto-mounting

If the testing is sound and you don't need it as a system disk and only use an extended disk, you can set up an automatic mounting.

```
sudo nano /etc/fstab

#Add the following content at the end:
/dev/nvme0n1p1  /home/pi/toshiba  ext4  defaults  0  0
#/dev/nvme0n1p1 is the device name, /home/pi/toshiba is the directory to be mounted, ext4 is the file system type, defaults are using the default mounting setting
#Make the modification take effect (make sure the test is sound before rebooting, otherwise it will lead to failure to mount or boot; if it cannot boot, you can remove the content added in /etc/fstab)
sudo mount -a

#And then reboot
Check the device through "lsblk"
```

Booting from NVMe SSD

1: First, you can use an SD card to boot the Raspberry Pi, just test it to make sure the hardware can work properly.
2: Use the SD card to boot the Raspberry Pi and modify the config file, modify BOOT_ORDER:

```
sudo rpi-eeprom-config --edit
```

Add:

```
NVME_CONTROLLER=1
```

Modify BOOT_ORDER=0xf41 as BOOT_ORDER=0xf416

Value	Mode	Description
0x0	SD CARD DETECT	Try SD then wait for card-detect to indicate that the card has changed - deprecated now that 0xf (RESTART) is available.
0x1	SD CARD	SD card (or eMMC on Compute Module 4).
0x2	NETWORK	Network boot - See Network boot server tutorial
0x3	RPIBOOT	RPIBOOT - See usbboot
0x4	USB-MSD	USB mass storage boot - See USB mass storage boot
0x5	BCM-USB-MSD	USB 2.0 boot from USB Type C socket (CM4: USB type A socket on CM4IO board). Not available on Raspberry Pi 5.
0x6	NVME	CM4 and Pi 5 only: boot from an NVMe SSD connected to the PCIe interface. See NVMe boot for more details.
0x7	HTTP	HTTP boot over ethernet. See HTTP boot for more details.
0xe	STOP	Stop and display error pattern. A power cycle is required to exit this state.
0xf	RESTART	Restart from the first boot-mode in the BOOT_ORDER field i.e. loop

(/wiki/File:PCIe_TO_M.2_HAT%2B_W_6.png)

For more details, you can refer to BOOT_ORDER (https://www.raspberrypi.com/documentation/computers/raspberry-pi.html#raspberry-pi-bootloader-configuration)

3: Reboot the Raspberry Pi:

If you fail after trying several times, you can connect it to the network before modify again (wait for network time synchronization), or set the correct time before modifying the file.

4: Flash the system to NVME, and then connect to the board, remove the SD card, and power it on again.

Fan Control

The PI5 fan works when the temperature reaches 50 degrees by default. If you want to modify it to work at other temperatures. you can add the corresponding demands as shown below at /boot/firmware/config.txt:

```
dtparam=fan_temp0=36000,fan_temp0_hyst=2000,fan_temp0_speed=90
dtparam=fan_temp1=40000,fan_temp1_hyst=3000,fan_temp1_speed=150
dtparam=fan_temp2=52000,fan_temp2_hyst=4000,fan_temp2_speed=200
dtparam=fan_temp3=58000,fan_temp3_hyst=5000,fan_temp3_speed=255
```

In which:

```
fan_temp0/1/2/3       #indicates the temperature (360000 is 36℃)

fan_temp0/1/2/3_speed #indicates the corresponding rotation speed (up to 255)

fan_temp0/1/2/3_hyst  #indicates hysteresis temperature
```

For more details, you can refer to this link (https://github.com/raspberrypi/linux/blob/7af85d54e39733bb9a236b95ea5ed1ab8277d560/arch/arm/boot/dts/overlays/README#L265).
Note: It can not be set to other temperatures except four temperatures "0/1/2/3" as shown above. The hysteresis temperature must not exceed the span of two temperatures

3D Drawing

PCIe_To_M.2_Board_E 3D Drawing (https://www.waveshare.net/w/upload/f/fa/PCIe_To_M.2_Board_E_3D.zip)

FAQ

Question: Does it suppport Hailo-8?

Answer:

It's fine to use it, but the rate is only supported when in GEN2 mode, and the other one has to take up the rate, so the performance will not be perfect.

Support

Technical Support

If you need technical support or have any feedback/review, please click the **Submit Now** button to submit a ticket, Our support team will check and reply to you within 1 to 2 working days. Please be patient as we make every effort to help you to resolve the issue.
Working Time: 9 AM - 6 PM GMT+8 (Monday to Friday)

Submit Now (https://service.waveshare.com/)

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