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How to Safely Overclock your Raspberry Pi 4 to 2.147GHz

By Shawn (/blog/author/shawn/)   9 months ago

The Raspberry Pi 4 is arguably the best Single Board Computer, but do you know you can overclock it to eek out even more performance? Yes, its base ARM Cortex-A72 processor with maximum clock speeds of 1.5GHz can be overclocked to achieve 2.147GHz clock speed!

Hence, in today's tutorial, we'll teach you how you can safely overclock your Pi 4! Do still try this at your own risk!

Steps to overclock your Raspberry Pi 4

Step 1: Preparing what you need

Before we get started, of course we'll first need go through what you'll need for this tutorial. Apart from your Raspberry Pi 4 board (https://www.seeedstudio.com/Raspberry-Pi-4-Computer-Model-B-4GB-p-4077.html?utm_source=blog&utm_medium=blog), you'll require:

- A Raspberry Pi 4 cooling solution
- NOOBS SD card with Raspbian OS up and running
- Reliable power supply option (https://www.seeedstudio.com/power-c-865.html?utm_source=blog&utm_medium=blog) (official version is highly recommended) to ensure your Pi is not being starved of power

Cooling solution? Recommendations

Undoubtedly the biggest issue with the Raspberry Pi 4 is thermal issues and throttling. With the Pi 4 capable of reaching insane temperatures (80°C and even beyond 85°C) without even overclocking attempts, you'll need a cooling solution on place.

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One of the hot favorites here at Seeed, is the Blink Blink ICE Tower CPU Cooling Fan for Raspberry Pi. It's capable of reducing temperatures from 80°C to 40°C and is designed by 52PI, a world's leading Raspberry Pi accessories manufacturer. To achieve such level of cooling, this fan includes a 5mm copper tube, multi-layer heat sinks, 7 blades powerful fan.

- However, if you're looking for a cooling solution that's more discrete, you can check out our list of Raspberry Pi cooling cases (https://www.seeedstudio.com/cases-c-850.html? utm_source=blog&utm_medium=blog) and heat sinks! (https://www.seeedstudio.com/heat-sink-c-849.html?utm_source=blog&utm_medium=blog)

Step 2: Update your Raspberry Pi 4 Firmware

For the latest overclocking capabilities on the Pi 4, you'll first have to update it to the latest experimental firmware. Although there could possibly be bugs, there's always new updates that bring about better performance/clock speeds all the time!

Here's how you can update your Pi 4 to the latest firmware:

- Open the serial terminal and enter the following code:

```
sudo apt update
sudo apt dist-upgrade
```

- Reboot the system afterwards, which restarts Raspbian:

```
sudo reboot
```

Step 3: Checking the default speed of CPU

The final step before you start overclocking your Pi 4 is to check your CPU base speed. You can do so by opening the terminal and entering the following:

```
cat /sys/devices/system/cpu/cpu0/cpufreq/
scaling_cur_freq
```

Chances are you'll receive 600000 back from the serial terminal, which would indicate your Pi 4 CPU base speed is 600MHz

- If not, you can simply divide the value returned by 1000 and you'll know your CPU default speed

Step 4: Let's start overclocking!

To overclock your Pi 4, we'll mainly be tinkering with the config.txt file under core configuration settings. To achieve this, we'll be entering a series of codes into the terminal window!

- Open your serial terminal window and enter the following code:

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

- Scroll down to the section marked:

```
#uncomment to overclock the arm. 700 MHz is
the default.
#arm_freq=800
```

- Change the config settings to:

```
#uncomment to overclock the arm. 700 MHz is
the default.
over_voltage=2
arm_freq=1750
```

- Save the file with CTRL+O (press RETURN) and use CTRL+X to exit Nano. Now, Restart your Raspberry Pi:

```
sudo reboot
```

- Once your Raspberry Pi boots up again, you can now see your new, faster clock speed:

```
watch -n 1 vcgencmd measure_clock arm
```

You can test your new clock speed by browsing a few webpages, where speeds will hover around 1.75GHz now!

Step 5: Overclocking your Pi 4 to even higher clock speed (2GHz)!

If you think overclocking it to around 1.75GHz is impressive, let's take things up a little notch, by cranking your Pi 4 CPU to 2.0GHz. Similarly to the previous step, we'll edit the config.txt by taking the over_voltage setting to 6. To achieve this, we'll enter the following:

```
over_voltage=6
arm_freq=2000
```

- Reboot your Raspberry Pi 4 now and run:

```
watch -n 1 vcgencmd measure_clock arm
```

You'll now see the clock speed limit to appear as 2.0GHz!

Step 6: Overclocking your Pi 4 to the Max level!

Now for the moment you've waiting for, to overclock your Pi 4 to 2.147GHz max clock speed, we'll have to boost the gpu_freq by editing the config.txt file once again. This time, we'll set the arm_freq to 2147 and gpu_freq to 750 by entering the following code:

```
over_voltage=6
arm_freq=2147
gpu_freq=750
```

- Save the file and exit Nano by CTRL+O and CTRL+X. Reboot your Pi 4 Now and you should see your device running at at 2.147GHz!

  NOTE: Do note that from testing, some Raspberry Pi 4 boards have failed to boot at this speed or slowed down due to overheating/undervoltage. It's unlikely for you to maintain your Pi 4 board at this max speed in the long run, hence we recommend you to settle for arm_freq=2000 or stop at step 5.

Before you go...

Summary

That's all for today's tutorial on how you can easily overclock your Raspberry Pi 4.

Overclocking your Pi 4 it's a way to eek out extra performance from your CPU, but you should understand the extreme limits that you can go when attempting to overclock by observing the the firmware warning icons here! (https://www.raspberrypi.org/documentation/configuration/warning-icons.md)

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