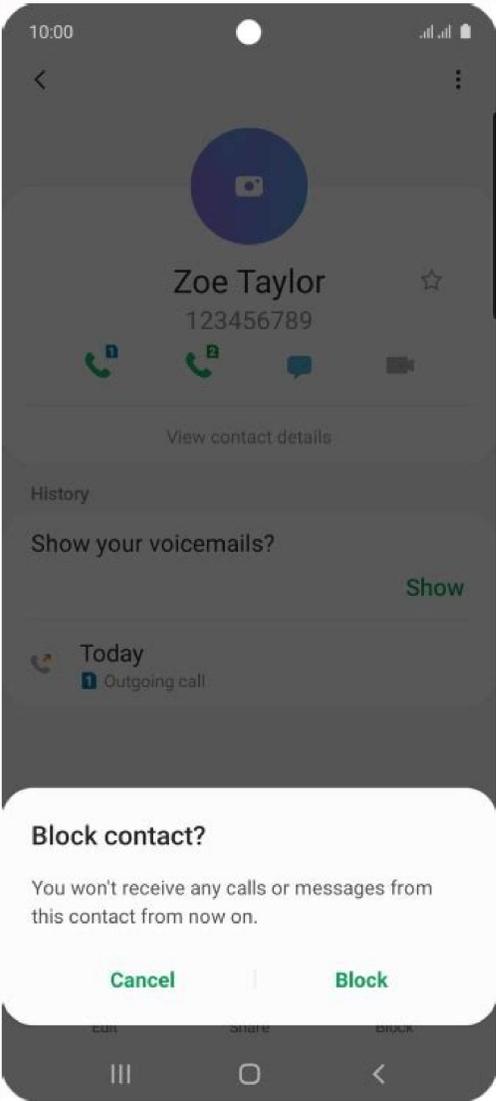


How to overclock my phone

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For a long time, AMD played second fiddle to Intel in all but the most budget-focused builds. Ryzen changed that, providing plenty of CPU cores with solid performance for a great all-around CPU—and you can push that CPU a little farther than its out-of-the-box speed with a bit of overclocking. While overclocking is fairly easy these days, it comes with a small amount of risk. If you aren't careful, you could degrade your CPU's lifespan or damage it permanently. In most cases, your computer will automatically shut down to prevent this from happening, but it's best to be cautious and go slowly. (Oh, and this will void your warranty, just in case you were wondering.) Many of AMD's newest chips, like the Ryzen 5 3600X and Ryzen 7 3700X are great processors but don't have a ton of overclocking headroom, so there's probably little benefit to pushing them further. AMD's Precision Boost will make sure you aren't leaving any performance on the table. The non-X chips, like the AMD Ryzen 5 3600, have a bit more, but still have diminishing returns compared to some of the older Ryzen chips, like the 1000 and 2000 series. If you want to see how far you can push your processor, though, it just takes a few tweaks in your computer's BIOS. Here's how to do it. Advertisement Unlike Intel, which only allows overclocking on certain chips, all AMD Ryzen processors are overclock-ready—as are most of the motherboards, so gathering your hardware should be pretty easy. You only need two pieces of hardware to overclock your chip. A motherboard that supports overclocking: AMD's B350, X370, B450, X470, B550, and X570 chipsets all support overclocking—basically, as long as your motherboard doesn't have an "A" series chipset, you're in the clear. I'll be using an MSI X470 Gaming Pro Carbon for this guide, but most of the settings we'll discuss should be available on other boards as well. A good CPU cooler: While AMD's included Wraith Spire cooler can handle a little overclocking, it'll likely get hot pretty fast. I recommend buying a larger heatsink, like the Cryorig R1 Ultimate CR-R1A (Opens in a new window) (pictured), or a liquid cooling loop to eke the most possible performance out of your CPU. When it comes time to overclock your CPU, you will need a software tool to monitor your progress, as well as something to record the results. OCCT (Opens in a new window): Ask five overclockers what tools they use, and you'll get five different answers. I prefer OCCT, since it contains multiple stress tests within one program, as well as a host of monitoring features to help keep an eye on those CPU temperatures. AMD's own Ryzen Master (Opens in a new window) and HWINFO (Opens in a new window) are arguably better at monitoring temperature readings, and have a lot of other useful stats, but OCCT should be good enough if you're just starting out and aren't pushing your CPU to its absolute limit. A notepad, digital or physical: This is a trial-and-error process, so you'll want to keep notes as you go of which settings you've tried, and whether they were successful. Trust me, it'll make the process a whole lot easier. There are no guarantees with overclocking. You're pushing the chip beyond its rated limits, and every single chip is different. Even if someone on the internet achieved a certain overclock doesn't mean you will. Even with the exact same model CPU, every motherboard has a slightly different selection of overclocking features. Since newer model Ryzen processors are so great at boosting out-of-the-box, overclocking may or may not have a huge impact on your work. You'll notice the benefits of overclocking most in multi-threaded tasks, like editing or rendering video, and even then, your mileage may vary. Overclocking my Ryzen 5 2600 shaved about 20 minutes off a typical 2.5-hour 4K Blu-ray conversion in Handbrake, which is nothing to sneeze at. If you decide to overclock, it's a good idea to research your motherboard, your CPU, and what kind of results other people are getting. Even though it won't guarantee the same results for you, you'll still get a general idea of what's reasonable. This guide outlines the basic steps, but there are always ways to push it a little farther if you learn more about your motherboard's advanced features. I don't usually recommend the auto-overclocking (or Auto OC) features you find on most motherboards, though they have gotten interesting lately. AMD's Precision Boost Overdrive (PBO), for example, doesn't boost clock speeds higher than what you see on the box. However, it will allow your CPU to boost to that advertised clock speed more often, for longer periods of time, or in situations where it otherwise wouldn't be able to reach those speeds. It's not exactly overclocking, but it also isn't considered "stock," and is thus not covered by your warranty. It is designed to be used in conjunction with an Auto OC feature on your motherboard, but if you overclock manually using the instructions below, you shouldn't have any use for PBO, and you can turn it off. I prefer the tried-and-true certainty of a manual overclock, so that's what we'll be focusing on in this guide. Next, it's a good idea to run an initial stress test to make sure everything is okay at stock settings, ruling out a defective chip or other stability issues that may hamper your overclocking endeavors. Start OCCT and, in the Monitoring window, click the little graph button in the toolbar until you see a table, like in the screenshot above. In my opinion, this table is easier to read than the graphs, and has all the info you'll need to monitor your CPU. In the main OCCT window, click the CPU: LINPACK tab and check all three of the boxes in the middle: 64 Bits, AVX Capable Linpack, and Use All Logical Cores. This will set OCCT to stress your CPU as much as possible—more so than you'll probably see in regular usage. If it's stable under OCCT, it'll definitely be stable for your day-to-day work. Click the On button and OCCT will begin the stress test. Let it run for about 15 minutes and, if you don't encounter any freezes or blue screens, reboot your computer and head into the BIOS for some overclocking. Your CPU's clock speed is a result of two other values: the Base Clock, which guides a number of motherboard functions, and the CPU Multiplier. Most modern chips use a base clock of 100MHz, which makes the math very easy: 100MHz x 34, for example, will give you 3.4GHz, the stock frequency of our Ryzen 5 2600. Individual cores can "boost" higher than that, but we're going to overclock all cores manually, meaning you'll get the same speed on every core, no matter how many are in use at the time. The easiest way to overclock is by slowly raising that multiplier value—it's possible to raise the base clock too, but the base clock affects other components of your system as well, making it much harder to keep things stable—so we won't touch it today. Find the multiplier option (sometimes called Core Ratio or something similar), set it to Manual or Sync All Cores, if the BIOS gives you such a choice, then choose a number for your initial overclock. You may have to research your CPU to find a good starting point, but for my Ryzen 2600, I started at 37, a few notches above its default multiplier of 34. (Note: some people like to use the aforementioned Ryzen Master for

tweaking the multiplier, and that's the fine for the testing phases—I prefer to make all the BIOS itself.) Once you've set a multiplier, you'll need to set the CPU Core Voltage option—sometimes called "Vcore"—and set it to Manual instead of Auto (since Auto tends to be overly aggressive). Again, you may want to research your CPU to find a good starting point, but for my Ryzen 2600, I used a voltage of just under 1.24v, which I knew should work at 3.7GHz. Save your BIOS settings, reboot, and launch OCCT again, running the same 15-minute stress test you did before. If it runs without any issues, reboot into your BIOS, raise the multiplier by 1, and repeat the process. At a certain point, you'll either run into an error, your computer will freeze, or you'll see the dreaded Blue Screen of Death. This means your GPU isn't getting enough voltage to sustain the desired clock speed, so you'll need to give it a bit more juice. Go back to the BIOS, raise the Core Voltage by 0.01 volts or so, then run that stress test again. As you do this, write down the results of each stress test on your notepad so you can keep track of your progress. As with all experiments, it's best to change only one variable at a time. In addition, watch your CPU temperatures when you stress test. As your voltage increases, so will the level of heat inside your CPU. You'll want to Google around to find your CPU's temperature limit, but I recommend giving yourself some breathing room below that. If you can keep it under 85°C/185°F, you should be in the clear, especially since you'll rarely see those temperatures in daily use. I wouldn't push it higher than that, since hotter temperatures can decrease the chip's lifespan, even if they don't hit the CPU's actual upper limit. It's also a good idea to monitor the clock speed in OCCT's leftmost window to make sure it's adhering to the clock speed you set. If it's much lower, your chip may be throttling for some reason, and you'll have to do some digging to uncover the problem. Repeat the above steps, raising your multiplier and voltage one after the other, until you can't go any further. Maybe you just can't get the next step up to keep stable, or perhaps your temperatures get uncomfortably high. Write down your highest stable settings and take a breather. (I achieved a multiplier of 40 with a core voltage of 1.2625.) If you want, you can stop there. But if you're still hungry for more performance, there are a few other things you can check out in your BIOS. **Load-Line Calibration:** When your CPU requests voltage, it can sometimes experience something called "Vdroop," where the voltage drops below its specified level under load. Load-line calibration, also called LLC, combats this by making voltage delivery a bit more precise. If you're trying to get things a bit more stable at a higher clock, LLC can help bridge that gap, and if your motherboard is delivering too much voltage, LLC can help get your temperatures just a bit lower. Just make sure you don't set LLC too high, though, since it can cause your voltage to overshoot instead of undershoot, causing temperature spikes. Do a bit of research on your motherboard and how it implements LLC—some boards use "1" as the highest setting, while others use it as the lowest. Do a little trial and error to see which option gets you closest to the Vcore you set in the BIOS (you can see the voltage being provided to your CPU in OCCT, or your monitoring app of choice). My motherboard's auto setting was actually pretty good, but I've used motherboards that were way off, and in those cases, LLC can help quite a bit. **XMP and RAM Overclocking:** Unlike some older CPUs, Ryzen's Infinity Fabric (Opens in a new window) architecture causes higher RAM speeds to give noticeable performance boosts. So once you hit a wall with your CPU speed, try kicking your RAM speeds up a notch. You can do this easily by enabling XMP (sometimes called AMP, DOCP, or EOCX on AMD boards), which will run your RAM at its rated speed instead of its lowest supported speed. You can also manually set the RAM frequency, timings, and voltage, but for most people, XMP should work well in just a few keystrokes. If you tweak it manually, you might even be able to push it farther than the specs on the box indicate. Whatever you set your RAM to, you should definitely do a full round of Memtest86+ (Opens in a new window) to ensure its stability. When you're done tweaking, you should have a collection of settings that are stable for 15 minutes of OCCT's Linpack testing. That's a good start, but we want this overclock to be rock-solid, which means running it through a few longer tests. Start by running that same OCCT Linpack test for three hours. Some overlocks might be stable for 15 minutes but can't hold up to longer bouts of stress. After that, I like to run a few other types of stress tests, since they can push different parts of the CPU and uncover instabilities Linpack didn't trigger. Try three hours of the CPU: OCCT tab, or 12 to 24 hours of Prime95's Blend test (Opens in a new window) if you want to go old-school. If your CPU can handle those, it can handle just about anything. If you run into any freezing or crashing—either during these tests, or in the course of normal gaming binges—you'll need to either increase your voltage or decrease your multiplier. When all was said and done, my Ryzen 5 2600 kept stable at 4.0GHz on all six cores, which is a nice little jump from the 3.6GHz-to-3.7GHz all-core boost I was seeing at stock settings. Sign up for Tips & Tricks newsletter for expert advice to get the most out of your technology. This newsletter may contain advertising, deals, or affiliate links. Subscribing to a newsletter indicates your consent to our Terms of Use and Privacy Policy. You may unsubscribe from the newsletters at any time. > Table of Contents Return to The Top What You Need to Overclock: Hardware What You Need to Overclock: Testing and Monitoring What to Know Before Overclocking Ryzen Auto-Overclocking Step 1: Reset Your Motherboard's BIOS Step 2: Run a Stress Test Step 3: Increase Your CPU Multiplier Step 4: Reset Voltage and Run Another Stress Test Step 5: Push Even Further Step 6: Run a Final Stress Test

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