Why Doesn't Windows® Recognize All of My Memory?

The maximum amount of memory that your system can use is limited in two ways. There is a maximum amount of memory that your computer motherboard can accept, there is also a maximum amount of memory that your operating system (OS) can accept.

For instance, when you install 4GB of memory in a 32-bit Windows® operating system your system will see (and utilize) only 3GB or 3.5GB. Is the problem bad memory?

There isn't a problem with the memory in this instance. Windows allows for 4GB of memory to be addressed, but this isn't 100 percent the same as having 4GB of physical memory.

What happens is that some of the addressable memory (regardless of how much you have physically installed) is reserved for use by page files or by some of the devices that you are using, such as a graphics card, PCI card, integrated network connections, etc., so it's unavailable for use as normal main memory.

The amount of memory needed for these devices is calculated by your system at startup; if you haven't maxed out the memory in your system, it's invisible to you, and all your physical memory (the RAM that's installed) is available for use. However, if you've maxed out the DRAM in your system, this amount will be deducted from your physical memory, so you can't use 100% of your DRAM.

The maximum memory limitation varies by operating system; for instance, the 4GB memory limitation doesn't exist in 64-bit versions of Windows.

Memory maximums for current Microsoft® Windows OSs include:

Windows 10 (64 bit)

- Enterprise: 2 TB
- Education: 2 TB
- Pro: 2 TB
- Home: 128 GB

Windows 10 (32 bit)

- Enterprise: 4 GB
- Education: 4 GB
- Professional: 4 GB
- Home: 4 GB

Windows 8 (64 bit)

- Enterprise: 512 GB
- Professional: 512 GB
- Home: 128 GB

Windows 8 (32 bit)

- Enterprise: 4 GB
- Professional: 4 GB
- Home: 4 GB

Windows 7 (64 bit)

- Ultimate: 192 GB
- Enterprise: 192 GB
- Professional: 192 GB
- Home Premium: 16 GB
- Home Basic: 8 GB

Windows 7 (32 bit)

- Ultimate: 4 GB
- Enterprise: 4 GB
- Business: 4 GB
- Home Premium: 4 GB
- Home Basic: 4 GB
- Starter: 2 GB

Windows Vista (64 bit)

- Ultimate: 128 GB
- Enterprise: 128 GB
- Business: 128 GB
- Home Premium: 16 GB
- Home Basic: 8 GB

Windows Vista (32 bit)

- Ultimate: 4 GB
- Enterprise: 4 GB
- Business: 4 GB
- Home Premium: 4 GB
- Home Basic: 4 GB
- Starter: 1 GB

Windows XP (64 bit)

- Professional: 128 GB
- Windows Server 2003 (64 bit)
- Datacenter SP2: 2 TB
- Enterprise SP2: 2 TB
- Standard SP1: 32 GB
- Datacenter R2: 1 TB
- Enterprise R2: 1 TB
- Standard R2: 32 GB
- Small Business Edition: 128 GB

Windows XP (32 bit)

- Professional: 4 GB
- Home: 4 GB
- Starter Edition: 512 MB

Windows Server 2016 (64 bit)

- Datacenter: 24TB
- Standard: 24TB

Windows Server 2012 (64 bit)

- Datacenter: 4 TB
- Standard: 4 TB
- Essentials: 64 GB
- Foundation: 32 GB
- Storage Server 2012 Workgroup: 32 GB
- Storage Server 2012 Standard: 4 TB
- Hyper-V Server 2012: 4 TB

Windows Server 2008 R2 (64 bit)

- R2 Datacenter: 2 TB
- R2 Enterprise: 2 TB
- R2 For Itanium-Based Systems: 2TB on IA64
- R2 Foundation: 8GB
- R2 Standard: 32 GB
- HPC Server 2008 R2: 128GB
- Web Server 2008 R2: 32 GB

Windows Server 2008 (64 bit)

- Datacenter: 1 TB
- Enterprise: 1 TB
- HPC Edition: 128GB

- Standard: 32 GB
- 2008 For Itanium-Based Systems: 2TB on IA64
- Small Business Server: 32GB
- Web Server: 32 GB

Windows Server 2008 (32 bit)*

- Datacenter: 64GB
- Enterprise: 64GB
- Standard: 4GB
- Small Business Server: 4GB
- Web Server: 4GB

Windows Server 2003 R2 (64 bit)

- Datacenter R2: 1TB
- Enterprise R2: 1TB
- Standard R2: 32GB

Windows Server 2003 R2 (32 bit)

- Datacenter R2: 64GB
- Enterprise R2: 64GB
- Standard R2: 4GB

Windows Server 2003 (64 bit)

- Datacenter SP2: 1TB
- Enterprise SP2: 1TB
- Standard SP2: 32GB
- Datacenter SP2: 1TB
- Enterprise: 1TB

Windows Server 2003 (32 bit)*

- Datacenter: 64GB
- Enterprise: 64GB
- Standard: 4 GB
- Web Edition: 2GB
- Small Business Server: 4GB
- Enterprise Edition: 8GB
- Storage Server: 4GB

*Certain Microsoft server operating systems can support over 4GB of memory via Physical Address Extension (PAE). Please refer to Microsoft for more information.

Software for Diagnosing Memory Problems

To help determine if a system problem is caused by hardware or software issues several diagnostic tools are available, depending on your operating system. The Windows® Memory Diagnostic tool is built into Windows Vista and later, is simple to use and provides a great first step for narrowing down the problem. Microsoft® support features walkthroughs for using their testing utility depending on your Windows version.

Windows 8/8.1/10

Windows Vista/7

If you are using another operating system, we recommend Memtest86+® to determine if memory is causing issues.

Rember is a free front-end for the Mac OS X® operating system to run an OS X variation of Memtest easily and quickly, available for download here.

Otherwise, Memtest86+ is a standalone memory testing program that can test your memory independently from the operating system to eliminate the possibility of drivers or other software causing the errors.

How to use:

1. Memtest86+ can be downloaded free of charge here
2. Click the link **Download the zip file (Download - Pre-Compiled Bootable ISO)** and extract the contents
3. Use your preferred CD burning or .ISO management software to create a CD or bootable USB drive from the downloaded ISO file. Please note that simply copying the ISO file to the media will not work. The ISO file is a disk image and is used by the burning software to create the Memtest86+ disk. For more information how to do this consult the burning software's documentation. Leave the CD or USB drive in place and restart the system
4. When your system reboots the system will auto-load Memtest86+. This software will then start to test the memory and report if it finds any errors. If the disk fails to load and the operating system continues to load as normal please make sure that the CD-ROM/USB device is set as the first boot device within the system BIOS
5. When Memtest86+ is running, it will run through various different tests. After it has finished the tests it starts all over again in a continuous loop. To exit Memtest86+ and allow the system to boot remove the CD/USB drive and press **Escape (ESC)**

If any of the above tools show errors then the memory might have developed a fault or is incorrectly setup in the BIOS, and our support options can assist you in further troubleshooting or a warranty replacement of parts. If no errors are reported, the problem could be driver or software related; please update all hardware drivers or in the worst-case scenario reinstall the operating system.

Differences in Memory Speed and Data Rate

What is the difference between DDR3-1600 (PC3-12800), DDR4-2133 (PC4-17066), and DDR4-2400 (PC4-19200)?

Although these are all types of DDR (double data rate) memory, the varying numbers refer to the different speeds of memory, and even different memory generation types. When looking at the data rate, or speed PC (per clock transfers), it is important to note that systems can only handle certain types of memory. This is why it's important to use either our Crucial Advisor™ tool or Crucial System Scanner when looking for compatible memory to install in your system.

It is easy to get data rate and speed mixed up because they are often interchangeable when someone is talking about how "fast" memory is. Data rate is how many bits a module can transfer in a given time, and speed is how many bytes it can transfer. Because there are 8 bits in a byte, we multiply the data rate by 8, and get the speed of the memory: 1600x8=12800, 2400x8=19200, where these results are your transfer rates in Megabytes per second (MB/s). When looking at both the data rate and speed, the particular generation of memory will be listed as well. An example of this when PC3 prefaces DDR3 speeds, and PC4 prefaces DDR4 speeds.

Below is a list of common memory speeds and associated data rates. There might be some higher and lower end speeds that are missing, and slight differences depending on how numbers are rounded, but it is a good general overview of common memory performance attributes.

Data Rate	Speed
DDR2-667	PC2-5300
DDR2-800	PC2-6400
DDR2-1066	PC2-8500
DDR3-1066	PC3-8500
DDR3-1333	PC3-10600
DDR3-1600	PC3-12800
DDR3-1800	PC3-14400
DDR3-2000	PC3-16000
DDR3-2133	PC3-17000
DDR4-1866	PC4-14933
DDR4-2133	PC4-17066
DDR4-2400	PC4-19200
DDR4-2666	PC4-21300

Problems with Your New Memory?

Are you having problems with your new memory upgrade? The following guide addresses the most commonly reported errors our customers may see and their possible solutions.

Incompatible part

Your memory module could be incompatible with your system. There are a lot of considerations when choosing the correct memory for your system, including memory type, speeds, densities, and more. To take the guesswork out of this, use the Crucial System Scanner or Crucial Advisor tool to find a guaranteed compatible upgrade.

Improper installation

The memory might not have been seated correctly, or you have a bad or dirty memory socket. The first thing to try? Re-installing it. A video illustrating the process is here, but an important detail to note is that desktops require about 30 pounds of pressue for a memory module to fully seat. You will also see the locking clips rotate into place to lock the modules in if you are using enough force to ensure a full connection.

For laptops (and miniature desktops built with similar parts, such as the Intel® NUC series), a similar 30 pounds of force will be needed, pressing the modules into the slots, then laying them flat to lock them fully into place. In some cases, the memory modules will loosen while being laid flat to be locked into place. Maintaining some inward pressure on the memory module while laying it flat can resolve seating difficulties in these systems. A video showing this process is here.

If reseating the memory is not effective, switch the memory to different memory sockets if available, as well as testing multiple part configurations one memory module at a time. This can help determine whether the problem lies with a particular memory module or the memory socket, or whether old and new modules simply aren't compatible when mixed together.

Another option? Try cleaning the memory module and the socket using compressed air to blow dust off the socket. Watch our video on how to clean a dirty system prior to installing memory.

BIOS/System firmware conflict

This can be a problem especially with parts manufactured using technologies developed after a computer's release. A BIOS (Basic Input Output System) or system firmware (EFI/UEFI) updates might be required to add support for memory upgrades or higher memory totals. Refer to your system or motherboard manufacturer's support for any available resources, including documentation, on applying these updates.

Sometimes it is necessary to clear BIOS settings to solve boot-related issues. Your BIOS/UEFI may have a soft reset available for this process, or a jumper that can be used in place of the steps below but to otherwise manually clear the BIOS/CMOS install the memory and follow the instructions below:

1. Turn off the system and unplug it
2. Remove the case cover/panels
3. After the system is open touch an exposed/bare metal part of the computer to ground yourself
4. Looking at the motherboard you should see a small silver circular battery (like a watch battery). The battery will be held in place by a plastic holder
5. Remove the battery from the motherboard. This is usually done by gently pressing the metal clip on the plastic holder. The battery should pop up/out on its own
6. After the battery has been removed, leave the computer sitting like that for around 15 minutes
7. After 15 minutes replace the battery and the cover/panels
8. Reconnect all cables and power up the computer

Defective hardware

If you've tried everything and the memory still isn't working, you might have a defective module. If you are able to load into your operating system, software is available that can test modules for a possible faulty component.

If the memory still isn't working, you might have a defective module. If you purchased that module from Crucial.com, we make returns process hassle-free. Learn more about our returns process and our 45-day money-back guarantee here. For more memory troubleshooting tips, go here.

Neither New Nor Old Memory Working after an Attempted Install

If your old memory is no longer functioning after an unsuccesful install attempt, a likely cause of both issues is one of the following factors:

- *Improper Installation*: Double-check your install steps (install guides can be found here), paying special attention to ensure you are using enough force to seat your parts and using the appropriate slots for installation, to be certain the modules aren't simply incorrectly installed.

- *Power:* Be sure you've firmly reconnected power cables disconnected from your system when you began, both at the outlet and into the computer itself.
- *Loose Internal Cables:* Sometimes the force used when seating memory can flex your motherboard in such a way as to loosen your system's internal cables. Be sure all internal cables, especially between your internal power supply unit and motherboard, are still firmly connected.
- *BIOS Conflict*: Sometimes it is necessary to clear BIOS settings to solve boot related issues. Your BIOS/UEFI may have a soft reset available for this process, or a jumper which can be used in place of the below steps.

Otherwise, manually clear the BIOS/CMOS, install the memory, and follow the instructions below:

1. Turn off the system and unplug it
2. Remove case cover/panels
3. After the system is open touch an exposed/bare metal part of the computer to ground yourself
4. Looking at the motherboard you should see a small silver circular battery (like a watch battery). The battery will be held in place by a plastic holder
5. Remove the battery from the motherboard. This is usually done by gently pressing the metal clip on the plastic holder. The battery should pop up/out on its own
6. After the battery has been removed please leave the computer sitting like that for around 15 minutes
7. After 15 minutes replace the battery and the cover/panels
8. Reconnect all cables and power up the computer

If the steps above don't solve the issue, please contact us for further support.

How Can I Tell If My RAM In My Mac® Computer Is Bad?

If you are having performance issues, software "hangs" or random crashes—we recommend you run a memory test. For the mac OS®, a popular tester is Rember®, which can be found here.

Set Rember to test **All**, and check the box next to **Infinite** number of loops, and let the test run for at least half an hour. Because Rember is running from your desktop, it's important that you shut down all applications before you run the test. If you have any programs open, the test will be a lot less accurate.

If Rember finds errors with your RAM, you may need to replace it. To request an RMA, fill out the online request form, or contact Customer Service for your region.

Why Is My Memory Slower than Expected?

Due to anomalies in reporting software as well as system and configuration limitations, new memory may not function at full speeds or may report what appears to be lower performance than expected. There are several reasons for these issues, some of which are simply misunderstandings in how DRAM operates and others which can be overcome or offset by changes to your configuration.

A memory diagnostic tool is showing memory as running half as fast as it should

Modern DRAM modules support double data rate (DDR) transfers, meaning that although they function at a given clock speed, they transfer data during both the rise and fall of a CPU clock cycle, allowing for double the data transfers their native speed, or frequency, would suggest. Some diagnostic or system information software does not express this clearly, only reflecting the modules' frequency in megahertz (MHz), making such feedback suggest that your parts are only running at half their possible speed. For example, DDR3-1600 supports 1600 megatransfers per second (MT/s) due to its nature as DDR memory, but runs at 800 MHz.

Our M.O.D. Utility (DDR3 version, DDR4 version), shown above, expresses speeds using both MHz and MT values when the module reports this data.

The memory is not running at its full speed

Another factor in this reporting comes from your system's CPU and motherboard. One of these components (typically the CPU in mainstream hardware) will feature a memory controller which may only offer support for a particular maximum frequency of memory, and as a result can bottleneck your module performance. To verify what your other hardware will natively support in terms of DRAM speeds, refer to both your CPU and motherboard specifications.

This factor can be compounded by the MHz/MT reporting differences. A DDR3-1600 module in an environment capping its performance at DDR3-1333 speed may report 667 MHz during diagnostics under these conditions.

Multi-channel support from your system's motherboard results in additional performance above the installed memory's individual part capabilities. A dual-channel configuration using two identical DDR3-1600 parts effectively doubles their bandwidth, resulting in performance approaching 3200 MT/s. At this level, however, practical gains are not always easy to notice, and in some cases, simply increasing your memory total (for example adding a single 8GB part alongside an already installed 2GB module) may be most of the benefit you will receive from a given upgrade. We offer our parts in guaranteed matching kits to assist in taking full advantage of this feature in systems which support it.

Ballistix® Memory Troubleshooting

If your Ballistix memory is crashing, overheating or not running as expected, below is a list a considerations to troubleshoot the problem:

- Does your system have an adequate power supply? If you are unsure, use an online power supply calculator to help you calculate the power consumption of your system.
- Does your system have adequate cooling? Adding memory and other components to your system will increase the heat generated inside the case, which can cause instability issues if not properly ventilated. Case fans are relatively inexpensive to add to your system to improve air flow and aid with cooling.
- Did you verify that your chipset and CPU support the memory speed you are trying to run? Did you check your timings and voltage to make sure they are at the advertised settings? If these areas are not properly set up then your memory may lose stability. Please note that replacing the memory will not necessarily solve the problem because it is a symptom and not the root cause of the problem.
- Finally, it's recommended to perform a memory test (Memtest) on your Ballistix modules. Run the test from a cold boot with your DRAM timings and voltage at default or auto values in your BIOS.

If the problem continues, please contact our Support team.