# **How Heat Sinks Work** https://computer.howstuffworks.com/heat-sink.htm

Though the term heat sink probably isn't one most people think of when they hear the word [computer](https://computer.howstuffworks.com/10-types-of-computers.htm), it should be. Without heat sinks, modern computers couldn't run at the speeds they do. Just as you cool down with a cold bottle of Gatorade after a high impact workout, heat sinks cool down your computer's [processor](https://computer.howstuffworks.com/microprocessor.htm) after it runs multiple programs at once. And without a quality heat sink, your computer processor is at risk of overheating, which could destroy your entire system, costing you hundreds, even thousands of dollars.

But what exactly is a heat sink and how does it work? Simply put, a heat sink is an object that disperses heat from another object. They're most commonly used in computers, but are also found in [cell phones](https://electronics.howstuffworks.com/cell-phone.htm), DVD players and even refrigerators. In computers, a heat sink is an attachment for a chip that prevents the chip from overheating and, in modern computers, it's as important as any other component.

If you aren't very tech-savvy, think of the heat sink like a car radiator. The same way a radiator draws heat away from your car's engine, a heat sink draws heat away from your computer's central processing unit (CPU). The heat sink has a thermal conductor that carries heat away from the CPU into fins that provide a large surface area for the heat to dissipate throughout the rest of the computer, thus cooling both the heat sink and processor. Both a heat sink and a radiator require airflow and, therefore, both have fans built in.

Before the 1990s, heat sinks were usually only necessary in large computers where the heat from the processor was a problem. But with the introduction of faster processors, heat sinks became essential in almost every computer because they tended to overheat without the aid of a cooling mechanism.

[Thermal Conductivity](https://computer.howstuffworks.com/heat-sink.htm" \l "page1)

Heat can be transferred in three different ways: convection, radiation and conduction. Conduction is the way heat is transferred in a solid, and therefore is the way it is transferred in a heat sink. Conduction occurs when two objects with different temperatures come into contact with one another. At the point where the two objects meet, the faster moving molecules of the warmer object crash into the slower moving molecules of the cooler object. When this happens, the faster moving molecules from the warmer object give energy to the slower moving molecules, which in turn heats the cooler object. This process is known as thermal conductivity, which is how heat sinks transfer heat away from the computer's processor.

Heat sinks are usually made of metal, which serves as the thermal conductor that carries heat away from the CPU. However, there are pros and cons to using every type of metal. First, each metal has a different level of thermal conductivity. The higher the thermal conductivity of the metal, the more efficient it is at transferring heat.

One of the most common metals used in heat sinks is aluminum. Aluminum has a thermal conductivity of 235 watts per Kelvin per meter (W/mK). (The thermal conductivity number, in this case 235, refers to the metal's ability to conduct heat. Simply put, the higher the thermal conductivity number of a metal, the more heat that metal can conduct.) Aluminum is also cheap to produce and is lightweight. When a heat sink is attached, its weight puts a certain level of stress on the motherboard, which the motherboard is designed to accommodate. Yet the lightweight make up of aluminum is beneficial because it adds little weight and stress to the motherboard.

One of the best and most common materials used to make heat sinks is copper. Copper has a very high thermal conductivity of 400 W/mK. It is, however, heavier than aluminum and more expensive. But for operating systems that require an extensive amount of heat dissipation, copper is frequently used.

So where does the heat go once it's been conducted from the processor through the heat sink? A fan inside the computer moves air across the heat sink and out the computer. Most computers also have an additional fan installed directly above the heat sink to help properly cool the processor. Heat sinks with these additional fans are called active heat sinks, while those with the single fan are called passive heat sinks. The most common fan is the case fan, which draws cool air from outside the computer and blows it through the computer, expelling the hot air out of the rear.