

Monday, November 26, 2007

## **What are the differences between Conduction, Convection and Radiant Cooling of Power Devices?**

All power devices generate heat. This is due to the unavoidable internal losses of all power circuits due to their inefficiencies. The higher the efficiency rating of the power device, the less internal heat is generated within it. If we could achieve 100% efficiency, there would be no heat generated within the power device and no cooling required.

There are three methods of transferring or removing heat from power devices: These are *conduction*, *convection* and *radiant*. In all cases, the heat is being transferred from the power device to another medium that is at a lower temperature. Heat is constantly seeking to move to any object or medium that is cooler.

**Conduction Cooling:** This is defined as the transfer of heat from one hot part to another cooler part by direct contact. For example, many DC-DC converters have a flat surface that is designed to mount directly to an external heat sink or cold plate that will conduct the heat away from the power device by direct contact, thereby cooling it. Conduction is the most widely used method of heat transfer. All power supplies use internal heatsinks to help conduct the heat away from the hot devices.

**Convection Cooling:** This involves the transfer of heat from a power device by the action of the natural air flow (a low density fluid) surrounding and contacting the device. Many power devices are rated for natural convection cooling as long as the air surrounding the unit remains within a limited temperature range that is cooler than the device. The advantage of this method of cooling is that no electromechanical fans are required.

Another type of convection cooling requires forced-air-flow via fans or blowers across the power device. Many power supplies come with a build-in fan to provide this forced air type of convection cooling. Other types of power supplies specify the amount of air flow that must pass through or around the device (in cubic-feet-per-minute) in order for the supply to provide its maximum rated output power.

Some power devices with heat sinks depend on convection cooling (with or without forced air) to assist in transferring the heat away from the power devices to the cooler air.

**Radiant Cooling:** This is the transfer of heat by means of electromagnetic radiation (energy waves) that flow from a hot object (power device) to a cooler object. True radiant heat transfer can take place in a vacuum and does not require air. It should be noted that conduction cooled power devices also give off radiant heat; however, radiant heat transfer is less effective as a means to cool a power device than are conduction or convection cooling described above.

Posted by [Power Guy](#)