

Effective Chassis Grounding Techniques

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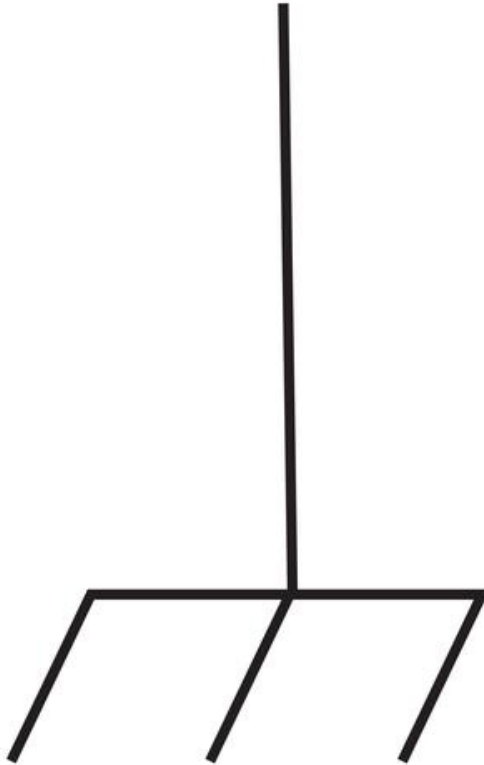
Key Takeaways

- Understand what a chassis ground is.
- Learn why chassis grounding is important.
- Explore chassis grounding techniques that work.

Have you ever tried doing sit-ups on a mattress? I did, as I was too lazy to drag myself out of bed one morning. I can tell you, it is never a good idea. While a mattress is comfortable for sleeping, the soft surface means that the foundation is inadequate for sit-ups or any form of exercise.

I decided to set up a yoga mat in the bedroom and found sit-ups worked out much better on a more solid surface. In electronics, you will want the same type of stability in your PCB ground. This is where good chassis grounding techniques come into play, as they prevent the component from sitting on a soft, shifting mattress-like ground.

What Is a Chassis Ground?



Schematic symbol for chassis ground.

You'll come across various types of grounds in electronics: signal ground, power ground, earth ground, and in this case, chassis ground. Each of the ground types is defined by where and how they are placed, and they serve as a return path for current that flows through the electronics.

Some electronics are mounted in a metallic enclosure. A chassis ground refers to a ground connection that connects all of the metal parts to the earth ground. A couple of examples of chassis grounds are an oven's metallic enclosure if it's safely grounded to the earth and a vehicle's metallic body.

Why Is Chassis Grounding Important?



Chassis grounding channels excessive current safely to earth.

In theory, a ground is an electrically-neutral point. In reality, a ground will never be at a theoretical 'zero' voltage. Like signal traces, ground planes have impedance and when measured they will be at small voltage levels.

While the non-zero voltage of ground rarely causes trouble, chassis [grounding](#) is still important, as ground planes are susceptible to transient events that cause a sudden surge in current. There needs to be a safe channel for excess current to flow or it will cause damage to the components. The chassis ground is a safe and effective path to divert that excess current.

Ground is portrayed as a stable reference plane for electronics signals but realistically, it is anything but. All signals need a [return path](#) and the [ground plane](#) serves as one. A signal ground plane that becomes the return path of a digital signal is considerably noisy. Chassis grounding is an important part of the ground separation strategy to reduce ground noise. It provides a dedicated return path for the ground current to earth ground.

Chassis grounding not only helps in protecting the PCB from surges and ground noise, but it may also act as a [shield against EMI](#). A grounded, enclosed chassis can be an effective Faraday cage, which protects the PCB from external interference.

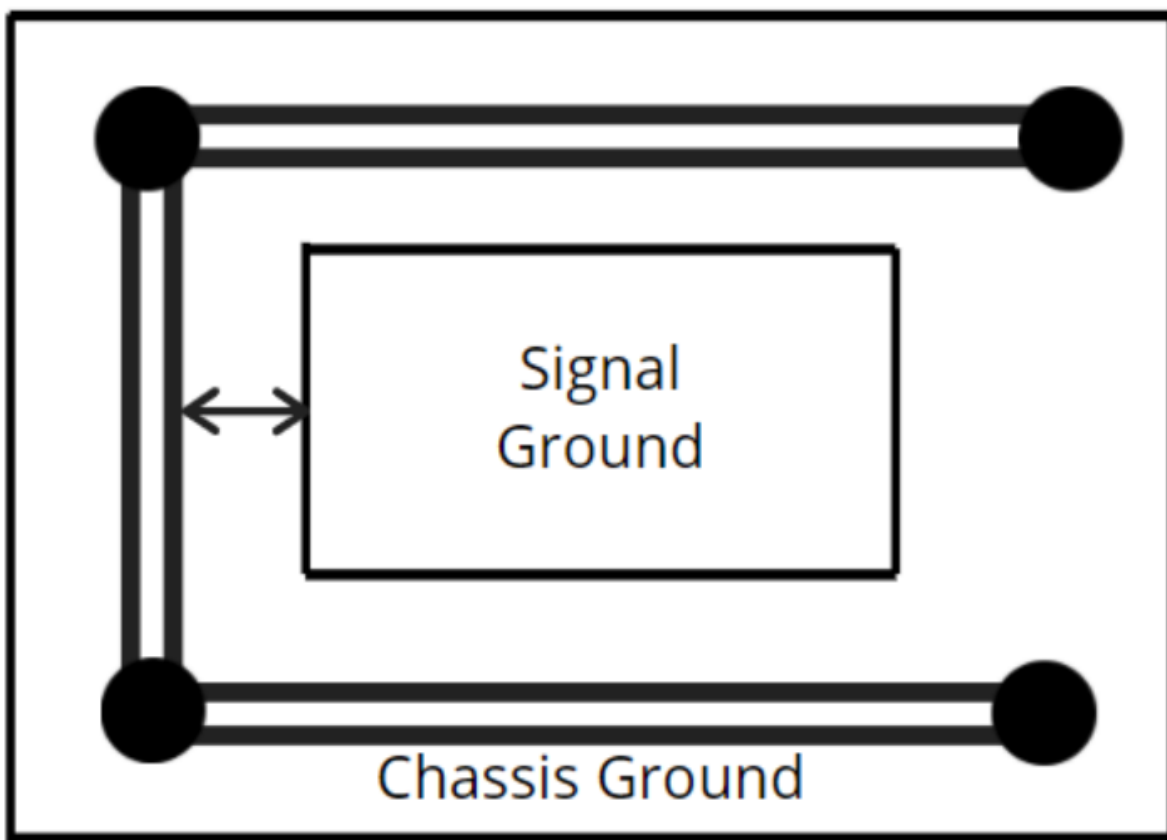
Applying Chassis Grounding Techniques

Chassis grounding can be tricky. If not done properly, you'll trade one problem for another. Here are a few strategies to keep in mind:

1. Use a Single Point for Ground Connection.

It's easy to introduce ground loops when connecting to the chassis ground. Ground loops can be a source of interference as current circulates and generates an electromagnetic field. Therefore, it's important to ensure that only a single ground connection is made between the signal ground and the chassis ground.

On your PCB, ensure that analog and digital grounds are connected to a single point. The signal ground should also connect to the chassis ground via a single point. Usually, mounting holes on the PCB are designated as chassis ground and they should be connected as follows:



Connect signal ground to chassis ground via a single point to prevent ground loops.

2. Connect Chassis to Earth Ground

The enclosure should never be left floating even if it's designated as a chassis ground. If possible, connect the chassis to earth ground so that excess current can be safely channeled to

earth. This also prevents external noise from affecting the circuits, as the transient current will be directed to the earth ground.

These chassis grounding strategies will help you to lessen noise on your PCB designs and keep your designs protected from current surges and EMI disruption.

If you're using the right [PCB design and analysis software](#), you shouldn't have any issues with creating the right ground patterns. [OrCAD](#), by Cadence, has an intuitive interface that allows you to create a good grounding system on your PCB designs.

If you're looking to learn more about how Cadence has the solution for you, [talk to us and our team of experts](#).