Application Notes

Application Note 150

Top 12 reasons for specifying DC track resistance.

DC Track resistance is increasingly being specified on PCBs, here are some of the reasons that engineers point out to us why they needing to know and control DC trace resistance...

1. Because supply voltages and consequently logic thresholds are reducing

- 1v is not uncommon and this leaves precious little noise margin. Especially with processor and high current devices drawing several amps of supply current.

2. LVDS and Gigabit Ethernet have DC terminated transmission lines

Too much trace resistance causes common mode problems at the receiver.

3. With fine traces series loss attenuates the signal too much

Long fine traces and high speed serial busses such as the above mentioned Gigabit Ethernet and LVDS can suffer from too much signal attenuation if the trace is too resistive.

4. Because major OEMS say so!

- on traces 3 mils (75 microns) and below

5. Some traces are deliberately resistive to reduce inrush current

On hot swap PC cards, this is just one of a range of intentional uses for using inherent resistance as a low cost way to perform a useful function without adding physical components, others of note are sense resistors in switching power supplies, or even heater traces in low temperature applications.

6. The proliferation of power supply rails

Means that designers are going back to tracking power as there just aren't enough planes to go around... Added to the increase in low voltage logic, knowing the series resistance of these power tracks is important as the low voltage environment means that although power supply tolerances are the same in % terms, the actual number of mV you can lose before starting to see problems has reduced

7. Some microvia boards exhibit via bond failure mechanisms...

Which may be picked up in early life as the trace resistance through the microvia is higher than anticipated.

8. PCB fabricators control impedance by altering line width

Whilst in general this is a common and acceptable practice, as lines get finer, a point is reached where reducing the line width further will increase attenuation and degrade rise time along a transmission line.

9. Designers may want to reduce high frequency harmonic content to reduce EMC

This is almost the opposite of point 9 where the inherent bulk resistance of a thin trace is used as a cost effective way of "killing off" the higher frequency content of a clock or high speed data line to ensure a product meets EMC regulations.

10. Not only are tracks getting thinner but:

There are some moves to 1/4 ounce Cu foils (0.35 thousandths of an inch) these shrinking geometries make an element of series loss an unavoidable fact.

11. Designers are better able to simulate performance

Of the finished product if they have a reasonable idea of the finished Rdc to use in modeling and simulation tools.

12. In mobile communications

Where size and space constrain designs, the dc resistance is especially important in the efficient design of the antenna.

Summary

Power designers have always needed to keep an eye on DC resistance, however increasing board operating speeds, shrinking geometries combined with lower supply voltages mean that DC resistance can become a major contributor in the losses encountered in high speed designs. Sometimes these losses are helpful (EMC) but in most other cases they limit maximum operating speeds and line lengths. Knowledge of the actual resistance and the likely production variation helps designers.

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