FlowCAD

IR-Drop on PCBs

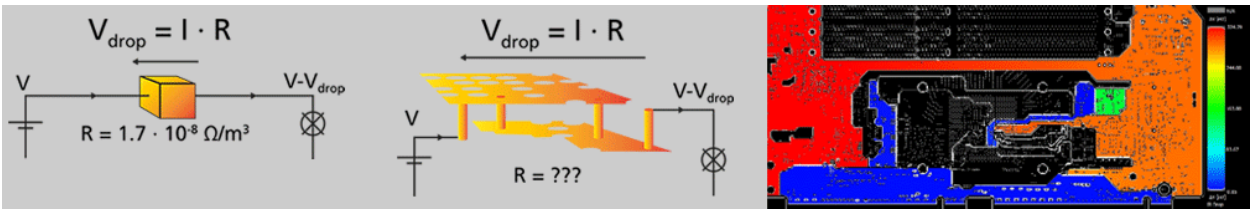
Electronic components on printed circuit boards operate with different supply voltages like 5V, 3.3V, 2.5V or less. The components work as specified when the supply voltage is stable within a given tolerance as specified in the datasheet i.e. +/- 10%.

A voltage drop is called IR-drop on PCBs and happens, when a voltage is connected to the device pin with a trace or plane, which has an ohm resistance. If the trace or plane is thick and wide the resistance will be low. But when space on a PCB is limited, the track width is often small and supply planes have many wholes. In such a case there will be loss of voltage due to Ohm's law. Energy is transformed from electrical energy into thermal energy and the value for the voltage goes down.

$V_{drop} = I * R$ (V_{drop} is called IR-Drop)

$P = I * V_{drop} * R$ (P is the power converted from electrical to thermal energy)

With IR-drop analysis the PCB designer can see where a plane has too many wholes, a trace is to narrow and too long or there are not enough vias placed. In these cases, the voltage drops. The resistance can be calculated with a field solver and a simulation shows the results for current, voltage drop and temperature increase.



Power / ground paths should have low resistance. The goal is to ensure that minimum power is dissipated as heat in the system. Each voltage drop will generate heat and might cause thermal issues with some components close by.

When the voltage drops to much, the supply voltage might reach the lower tolerance of the supply voltage and the electronic components fail.

Power integrity is an important consideration in advanced devices as it is deeply related to many signal integrity problems.