Some ESD protection questions (spark gaps, earth/ground connection issues)

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2007−08/msg05357.html

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- *Date*: Mon, 27 Aug 2007 23:20:30 +0200

Hello,

I just wanted to ask the more experienced people here for some advice. I am currently working on a redesign of an existing board and I want to improve some ESD aspects of the board because we had some problems in this area in the past. The system is built from two components where the PCB in questions contains some micro controllers and a USB equipment and the other PCB is the power supply unit and contains additional internal modules.

I have to protect some I/O ports and an USB interface. I have chosen to use a TVS Diode Array (Littlefuse SP0502BA). I have chosen to place the diode array as near as possible to the I/O connectors of the system. What I am unsure about is whether to connect the common pins of the diode array. My first choice would be to use the earthing because if I connect it directly to the ground plane any discharge current will take the path from the I/O connector over the diode. From there to the ground plane and the PCB FCC connector cable to the power supply board and then to earthing. In my opinion this can cause some signal and system stability problems although the device on the PCB will not be damaged. Does anybody support this claim?

The next question I would like to ask what you people think about spark gaps as a cheap alternative ESD protection for onboard I/O ports. That is I would add add a signal layer which surround the PCB connections using a very short distance (maybe 8 thou which is easily doable in a manufacturing house) and connect this to plane to the earthing. This would effectively limit the voltage to maybe 1−2kV.

What I have also read is that a small guard ring at the edges of the PCB (connected to ground) can help to improve ESD performance. Has anybody used and tried this?

I would be very grateful for some advice because I am still a bit new in the field. Another question is how I can verify my ESD protection without having to go to a special laboratory because of costs.

Kind regards,
Christian Walter
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