ESD Open Forum
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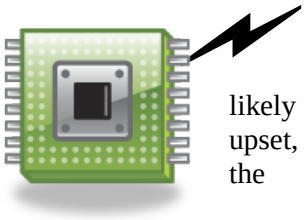
Cable Discharge Events (Part II)
CDEs Place in Testing

Where does CDE testing fit in the realm of ESD and EMC in general?
CDE ***is*** an ESD event. We know that the CDE has an initial rise and spike very much like other ESD events. Testing at the system level is done with a current waveform that has an initial rise time of 0.7ns to 1ns and we know that many real ESD events are much faster. The big difference is that at the system level, testing of input pins is not required for compliance to international standards but CDE is exactly that – a discharge to an input pin of a connector.

Because the ESD discharge current is directly into the pin of a connector, some kind of ESD protection directly at the input pins of a system is necessary to protect semiconductor devices that are likely to be directly connected to those pins. Some manufacturers may try to rely on the semiconductor manufacturer to provide this kind of protection, but there's a problem: semiconductors are tested for failure but systems are tested for upset.



A typical semiconductor device is tested to withstand ESD stress during handling. Pins are zapped at some voltage, the device is tested in a functional tester and if it passes, it can be rated to withstand that voltage. This is important, of course, and the higher the withstand level of the device, the less likely it will fail in operation; however, its ability to continue to function without upset, loss of data, or simply shutting down is completely unknown – and ***these*** are the criteria necessary to pass compliance testing! Although pin testing is not a *requirement* for some international standards, you wouldn't be happy with your

Standards
There are no industry wide standards for testing for the effects of CDE. TIA recommends using system level methods described in IEC 61000-4-2, and that's exactly what some manufacturers are now doing. Part of the threat really is the ESD like transient that occurs as the charged cable approaches it's mating connector. (Note: To get a discharge, the mating connector pins don't need to be at ground potential, but only at a potential that is different that of the charged cable – the two will try and equalize through a discharge.)

There's really no published information at this time to show exactly how manufacturers are testing their products, but there is enough anecdotal information to say that at least some manufacturers are simply using ESD simulators, such as those described in IEC 61000-4-2.
Others are charging up lengths of cable (probably using an ESD simulator of some kind) and then discharging the end of the cable directly into a connector. Still others might try using something like a TLP tester to produce a clean rectangular pulse.

One could make arguments for any of these methods, but if comparisons are to be made concerning the ability of a product to withstand such an event, a standardized method of performing the test and evaluating the results is necessary.

At the device level, semiconductor manufacturers have also expressed an interest in a test to determine if their devices will survive a CDE event, and the same thing applies here as with systems or finished products: no current standard method of testing exists, but to be able to compare the performance of one device to another, standards will need to be developed. As is the case with ESD events, the tests applicable to the semiconductor device directly may not be the same as those used at the equipment level.

Summary

It's clear that a problem exists in industry that requires some attention. Cable Discharge Events do occur and they do cause upset and device failure in equipment and systems. The problem is that there is no good data to quantify the event characteristics, and therefore no agreed upon process for evaluating products for the effects of CDE. In order to get to the point of a well defined test method, we first need an accepted metrology so that we can capture the events, then record and evaluate the data. After that come test standards, without which comparison of product performance to CDE events just isn't possible.

About the Author

Michael Hopkins has nearly 30 years experience in EMC as an independent consultant, an employee of Thermo Fisher Scientific working with the KeyTek product lines, and now working with Amber Precision Instruments. He has worked closely with manufacturers and laboratories world-wide providing training, applications help, and assistance with the development of interpretation of test standards, is the author of several papers and articles on Pulsed EMI phenomena, and has participated in numerous national and international seminars as author, speaker, and panelist. Michael has been an active member of several committees developing standards for industry including the ESD Association, IEC Technical Committees 77A and B for the development and maintenance of Basic EMC Standards (US Delegate to Maintenance Team 12 for all pulsed phenomena), IEEE/ANSI, SAE, and RTCA.