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Electronic Device Robustness against Electrostatic Discharges

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Abstract : This paper is intended to reveal the severity of electrostatic discharge (ESD) effects in electronic and optoelectronic devices by performing sensitivity tests based on Human Body Model (HBM) standard. We explain here the HBM standard in detail together with the typical failure modes associated with electrostatic discharges. In addition, a prototype of electrostatic charge generator has been designed, fabricated, and verified to stress electronic devices, which features a compact high voltage source. This prototype is inexpensive and enables one to do a battery of pre-compliance tests aimed at detecting unexpected weaknesses to static discharges at the component level. Some tests with different devices were performed to illustrate the behavior of the proposed generator. A set of discharges was applied according to the HBM standard to commercially available bipolar transistors, complementary metal-oxide-semiconductor transistors and light emitting diodes. It is observed that high current and voltage ratings in electronic devices not necessarily provide a guarantee that the device will withstand high levels of electrostatic discharges. We have also compared the result obtained by performing the sensitivity tests based on HBM with a real discharge generated by a human. For this purpose, the charge accumulated in the person is monitored, and a direct discharge against the devices is generated by touching them. Every test has been performed under controlled relative humidity conditions. It is believed that this paper can be of interest for research teams involved in the development of electronic and optoelectronic devices which need to verify the reliability of their devices in terms of robustness to electrostatic discharges.

Keywords : human body model, electrostatic discharge, sensitivity tests, static charge monitoring
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