4. Electrical and Reliability Performance of Molded Leadless Package for High-Voltage Application

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Abstract

This paper investigates the influence on electrical and reliability performance of molded leadless package for high-voltage power integrated circuit (IC) application. Semiconductor devices are mostly encapsulated by using epoxy molding compounds which act as protection for the ICs from damage to the harsh environment. Small (3 x 4 mm² body size) molded leadless package also known as Quad Flat No Lead (QFN) was selected since the application requirement for compact AC to DC portable adapter charger and more input and output (I/O) pin. High-voltage package was designed which followed IPC-2221 standard specification and creepage distance calculated under external component lead, uncoated. There are two epoxy molding compounds (EMCs) were used which type A and B. Key properties of EMCs were identified as well as trapped charge and volume resistivity were measured. The electrical tested at room temperature (25˚C) on high-voltage leakage current (I_{HV−700V}) at 700 volt was shown EMC B has no failure compared to EMC A. On top of that, electrical parametric distribution showed the Cpk of EMC B extremely robust compared to EMC A. Reliability test was conducted for high temperature operating life test (HTOL) at 115˚C showed EMC B was passed up to 1000 hours while EMC A was failed. Meanwhile for High Temperature Storage Life (HTSL) test at 150˚C and Temperature Humidity Bias Test (THBT) at condition 85˚C, 85% relative humidity (R.H.) were showed EMC B passed for 1000 hours however EMC A was failed at 168 hours. Nevertheless, both compounds A and B were passed delamination criteria by using scanning acoustic tomography (SAT) technique before and after subjected to moisture sensitivity level 1 (MSL 1).

Keywords: Epoxy Molding Compound; Molded Leadless Package; High Voltage; Reliability

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