National Aeronautics and Space Administration

EEE Parts Bulletin

Electrical, Electronic, and Electromechanical

A periodic newsletter of the JPL/OSMS Assurance Technology Program Office (ATPO), NASA EEE Parts Assurance Group (NEPAG), and Section 514, of the Jet Propulsion Laboratory.

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GIDEP FV5-P-09-02 Hybrid Class K Element Evaluation

International Rectifier detected some discrepancies in its internal Class K Element Evaluations performed on microcircuit and semiconductor die elements. Overall reliability impact is considered minimal. IR is taking steps to correct and will notify any affected customers. For more information contact Gary Bivins 818-393-1888.

GIDEP RS2-P-09-01 – Safe Operating Area (SOA) Failure JANTX2N5686 Power Transistor

This GIDEP Advisory applies to JANTX2N5686 parts from Microsemi with date code 0347. The parts failed continuous DC SOA per MIL-PRF-19500/464C, Group A, subgroup 5, SOA test 2. Contact Ray Smith 818-393-7547.

Aeroflex Weinschel Attenuators

Failures during testing of screened attenuators from Aeroflex Weinschel are being addressed by a joint working group of space organizations. The root cause of failure is improper, contaminated plating or contamination residue on smaller parts during attenuator assembly. Weinschel is now using a new plating company, and discarded all suspect piece parts received between Oct'08 and Jan'09. The joint working group recommends a procedure to screen parts in inventory. The procedure involves a monitored, thermal cycling with frequency sweeps. Weinschel will be incorporating this procedure in their screening for all future builds. Contact Shri Agarwal 818-354-5598.

Counterfeit Parts

JPL now offers a class covering visual inspection methods, non-destructive evaluation methods and destructive methods used to verify a part's authenticity. Counterfeit Parts Awareness training class is offered at parts related conferences as well as at other NASA centers. There are plans to coordinate additional studies of Non-Destructive Evaluation methods, create a die photo database, teach offsite classes and study authenticity trace ID methods. Contact Kathy Whittington 818-354-8749.

Maxwell EEPROM Failure Update

The JPL Maxwell EEPROM Tiger Team has completed their work. All EEPROM failures were traced to abnormally high resistance values (>1ohm) at a variety of the MCM EEPROM package pins. These high resistance values were the result of a mechanical separation and failure of the vias that make up the connection between different layers of the MCM package.

The primary driving force behind the mechanical failure is the Coefficient of Thermal Expansion (CTE) mismatch between the via material, the substrate base and the post via temperature processing. The mismatch occurs between the epoxy and AuSn solder bumps used in the stacking of the package layers. The ceramic package material and tungsten via material then crack mechanically resulting in

resistance conditions for the package pins that vary from 1 ohm to 100,000's of ohms. The maximum value for this individual pin resistance must be less than 1 ohm.

Failures were seen on parts that had been hand soldered as well as vapor phase soldered. Maxwell identified the time between epoxy fill and elevated temperature cure during the MCM manufacturing process as the root cause for setting the conditions that would drive the CTE mismatch and eventually lead to mechanical separation and failure.

Maxwell fixed this problem by changing their manufacturing process to ensure that epoxy fill-to-cure times are less than 2 hours. All parts are then subjected to a 10 cycle thermal cycle test from -55ºC to 125ºC.

JPL is in the process of issuing a GIDEP alert based on this work.

Contact Doug Sheldon 818-393-5113.

SEGR/SEB Test Results on Emerging HI-REL Power MOSFETs

Over the last two decades, spacecraft designers have seen a reduction in the number of manufacturers that produce radiation hardened power MOSFETs. But recently the Fuji Electric Device Co. Ltd (FDT) in conjunction with the Japanese Aerospace Exploration Agency (JAXA) developed a line of radiation hardened n-channel power MOSFETs with voltage ratings ranging from 100V to 500V. In March of 2009, the JPL Electronic Parts Engineering Office tested the 2SK4217 (a 100V rated device), 2SK4152 (130V), 2SK4155 (200V), and the 2SK4158 (250V) radiation hardened power MOSFETs for Single Event Gate Rupture (SEGR). The testing was performed according to the current NASA SEGR test standard for power MOSFETs and was executed at the Texas A&M University (TAMU) Cyclotron Facility. The safe-operating-area (SOA) was determined with incident LETs of 42.2 and 53.1 MeV cm2/mg. SEGR/SEB (Single Event Burn-out) test results show these devices are comparable to currently available radiation hardened technology. Further SEGR testing is underway, as well as tests of these devices' reliability for NASA missions. Contact Luis Selva 818-354-5751.

Upcoming Meetings:

IEEE 2009 Nuclear and Space Radiation Effects Conference, July 20-24
http://nsrec.com/brochure.htm
Military and Aerospace Programmable Logic Devices Aug. 31-Sept. 3
http://nepp.nasa.gov/mapld_2009

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