State of the Art, Inc.
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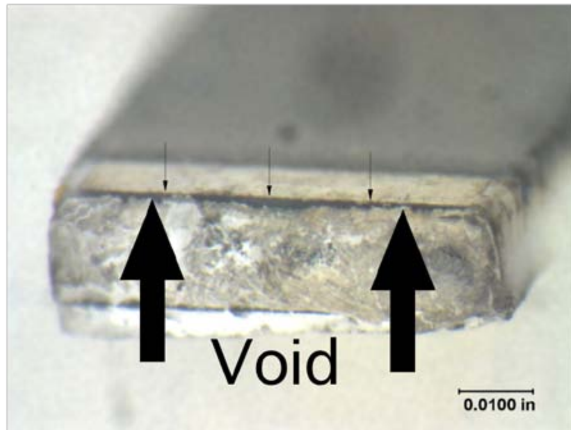
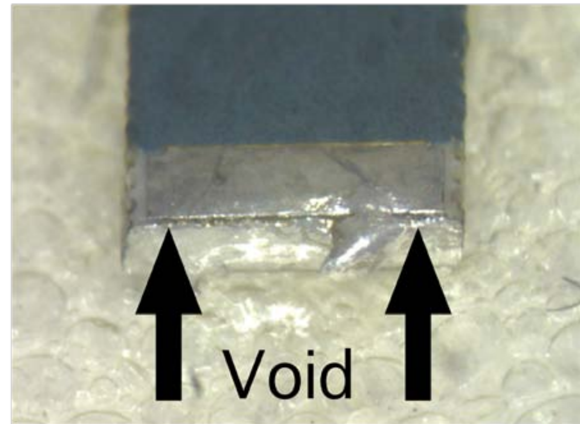
Thin film MIL-PRF-55342 termination material B (solderable) metal voids

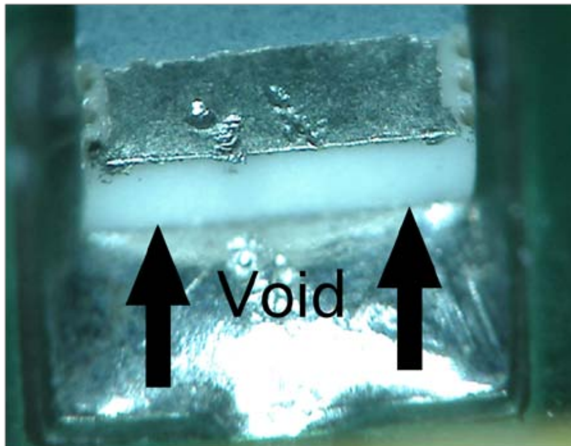
Three customers have reported a total of four thin film B termination material MIL-PRF-55342 devices exhibiting open circuit conditions after reflow solder mounting (Figure 1). All four devices were identified by routine electrical and visual inspection of the mounted devices. The assembly failures were reported on Feb. 5th 2009, August 31st 2010, Oct. 19th 2010, and February 14th 2011. No post assembly failures have been reported, nor have there been any life test failures. *(The thin film devices in question are identified by B termination material and either characteristic symbol E and H or resistance tolerance and multiplier symbols A, B, and C (0.1%).)*



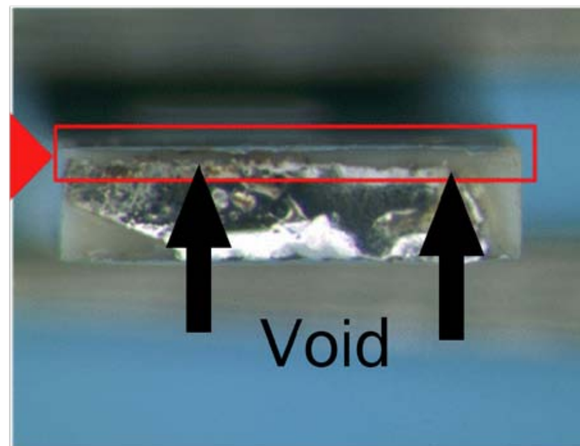
D55342E07B10B0R, 0728J, BA2685



D55342E07B44B2R, 0902J, BR35669



M55342E06B1B00R, 0902J, BR35205



D55342H07B10E0T, 0644J, BR33288

Figure 1. Devices with end face metal voids reported by our customers.

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The investigation of the affected lots indicates that the cause of the termination failure is due to voids in the end face metal. The cause of the voids is foreign material contamination preventing the adhesion of the sputtered TiW material to the alumina substrate. The foreign material was identified as potassium contamination from the cascade rinse tank used prior to the wraparound process. Our wraparound construction consists of sputtered TiW and gold, followed by electroplated Ni and SN60 solder (Figure 2).

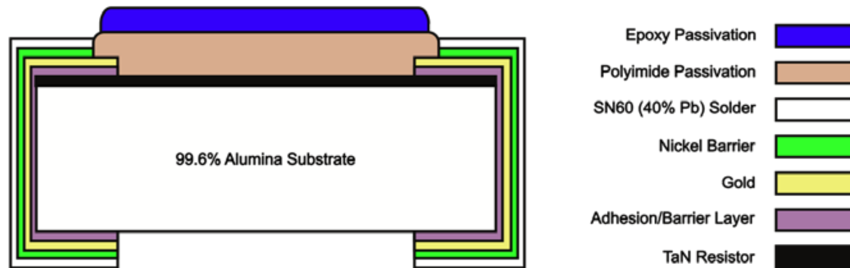

Figure 2. Schematic cross section of a thin film, solderable, MIL-PRF-55342 resistor.

A wider assessment of our solderable thin film stock from manufacturing lots produced in the last ten years (Jan. 2000 to Dec. 2010) found other lots exhibiting end face voids after solder immersion. To date 454,709 devices have been tested and we found 85 devices that would result in assembly defects. This is a defect rate of 187 ppm.

The voids are not visible prior to soldering, but a post assembly visual inspection will reveal the defects. A screening process has been developed using hot solder dip and 100% visual examination to remove devices that have the propensity for voiding. As of January 17th 2011 all shipments of thin film MIL-PRF-55342 solderable devices have been screened to mitigate the shipment of potentially defective devices.

A revised pre-wraparound cleaning and inspection procedure was implemented on January 28th 2011, and the results indicate that the end band voiding has been eliminated. To date 57,611 pieces of the revised cleaning procedure have been assessed with no defectives found. We will continue to sample a significant portion of current production to assure end band termination quality. In addition, we are pursuing alternative construction for the wrap around process to simplify the process, make visual examination of the base layer metalization stack possible, and provide a more robust product.

NOTE: All of the product in question was tested in accordance with MIL-PRF-55342. The specification does not provide 100% compliant product, and the reported level of defects (187 ppm) meets the requirements.

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