PROBLEM ADVISORY

1. TITLE *(Class, Function, Type, etc.)*		2. DOCUMENT NUMBER
Hybrid Package Ceramic Seal Design		FV5-P-09-03
		3. DATE *(DD-MMM-YY)*
		23 JULY 2009

4. MANUFACTURER AND ADDRESS	5. PART NUMBER	6. NATIONAL STOCK NUMBER
International Rectifier, HiRel Business Unit 2270 Martin Ave. Santa Clara, CA 95050	FSC 5962	NOT AVAILABLE
	7. SPECIFICATION MIL-PRF-38534	8. TYPE DESIGNATOR NOT AVAILABLE
	9. LOT DATE CODE START NOT APPLICABLE	10. LOT DATE CODE END NOT APPLICABLE

11. MANUFACTURER'S POINT OF CONTACT	12. CAGE	13. MANUFACTURER'S FAX
Granville C. Rains	52467	NOT AVAILABLE
14. MFR. POC PHONE (408) 450-5886	15. MANUFACTURER'S E-MAIL grains1@irf.com	
16. CROSS REFERENCE VENDOR NOT APPLICABLE	17. CROSS REFERENCE CAGE NOT APPLICABLE	18. CROSS REFERENCE PART NOT APPLICABLE

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT

International Rectifier is concerned about numerous reports from agencies and customers of widespread package leakage issues with DC to DC converters. This is not true; International Rectifier has recently detected hermetic seal failures with one of its hybrid product (M3G series). The scope of failure involves 4 package lots, and from which a total of 48 hybrid units were shipped to two customers. These customers have been notified of the problem and those hybrids were contained. All other units at IR were dispositioned as scrap. This problem advisory can serve to advance state-of-the-art designs with hybrid packages.

The seal failures detected were latent and influenced by environmental stresses such as temperature cycling and/or changes in atmospheric pressure. Failure analysis revealed cracks in the hybrid package ceramic seals, which resulted in the loss of hermetic seal, and failure to meet the seal requirements of MIL-STD-883, TM1014.

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20. ACTION TAKEN/PLANNED

Following the discovery of the package nonconformance, International Rectifier has reviewed and contained all products affected by this nonconformance. Written notifications were issued to all customers in direct receipt of product affected, with recommendation for hybrid replacement.

Actions taken to prevent recurrence include:

1) Counter bore ceramic seal designs have been prohibited from IR hybrid package designs.

2) Counter sink ceramic seal designs on packages now specify the maximum depth of feature.

This Problem Advisory has been coordinated with DSCC-VQH prior to its release.

21. DATE MFR. NOTIFIED	22. MANUFACTURER'S RESPONSE	23. ORIGINATOR ADDRESS/POINT OF CONTACT
NOT APPLICABLE	☐ REPLY ATTACHED NOT APPLICABLE ☐ NO REPLY	Granville C. Rains, International Rectifier, HiRel (408) 450-5886 grains1@irf.com

24. GIDEP REPRESENTATIVE	25. SIGNATURE	26. DATE
Granville C. Rains	Granville C Rains	22 JULY 2009

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT (cont.)

Mechanical analysis of the hybrid package seal revealed that the side-wall compression force was not uniformly applied across the ceramic feed through. This variation in the mechanical load between the pin and frame causes a tensile force on the ceramic, leading to cracks. During temperature excursions, the compression force differential is further aggravated by the material CTE properties. Through empirical studies with cross sections and package leak data, it was determined that the tensile force on the ceramic acted in proportion to the depth of the counter sink or counter bore feature in the package side-wall, which is used to control the amount of braze runoff. The deeper the counter sinks or counter bores in relations with the side-wall thickness, the greater the risk of leak failure (or ceramic cracks). See Appendix A – D herein for further details.

Since this issue is not limited to a single manufacturer of hybrid packages, International Rectifier believes that this Basic Design Characteristic merits awareness and justifies the issue of this GIDEP to inform customers and manufacturers to avoid similar problems.

Appendix A – Hybrid Package Overview

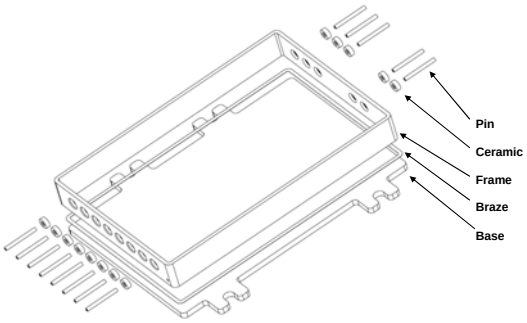


Figure 1 – Illustration of Hybrid Package Assembly Parts

Figure 2 – Photograph of Hybrid Package Ceramic Seal

Appendix B – Ceramic Seal Designs / Cross Sectional View

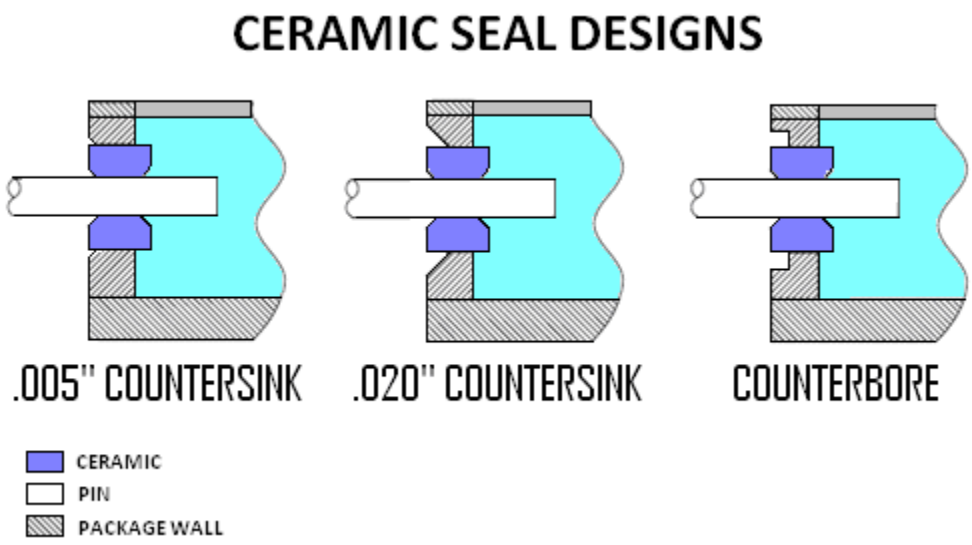


Figure 3 – Illustrations of different ceramic seal designs for 0.040 inch side walls. The 0.005 inch countersink in the side-wall is considered safe.

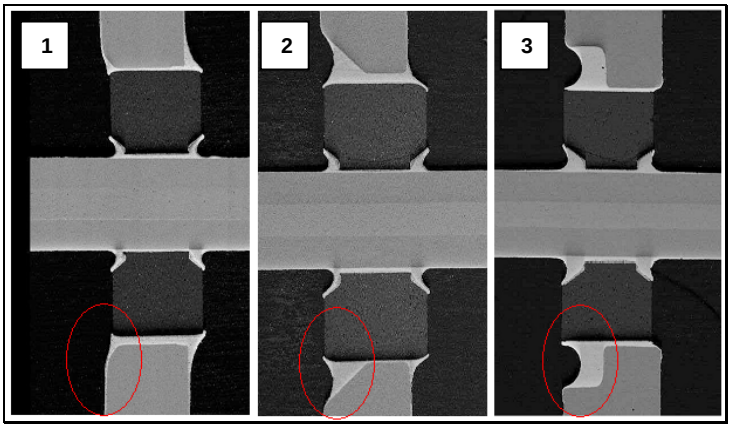
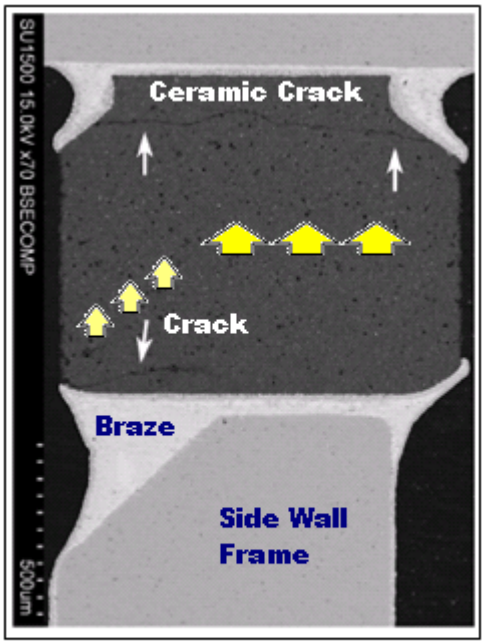


Figure 4 – Cross Sections (SEM Images) showing assembly details of different seal designs. Images 2 and 3 show the deep counter sink and counter bore designs that were shown to be problematic. The braze material fills the areas around the pin (inside the counter sink and counter bore), but the braze does not carry the same compression force as the frame material.

Appendix C – Ceramic Seal Failure Mode Details



1. The deep counter sink does not allow sufficient compressive forces to be applied to the outer face of the ceramic.

2. The braze joint does not transfer enough compressive force from the frame to the ceramic.

3. This force imbalance creates a tensile force on the ceramic.

4. This condition can cause the ceramic to crack.

High Compression Force

Low Compression Force

Figure 5 – Shows cross sectional image of ceramic seal with deep counter sink and ceramic cracks due to high tensile force.

Appendix D – Empirical Leak Test Data

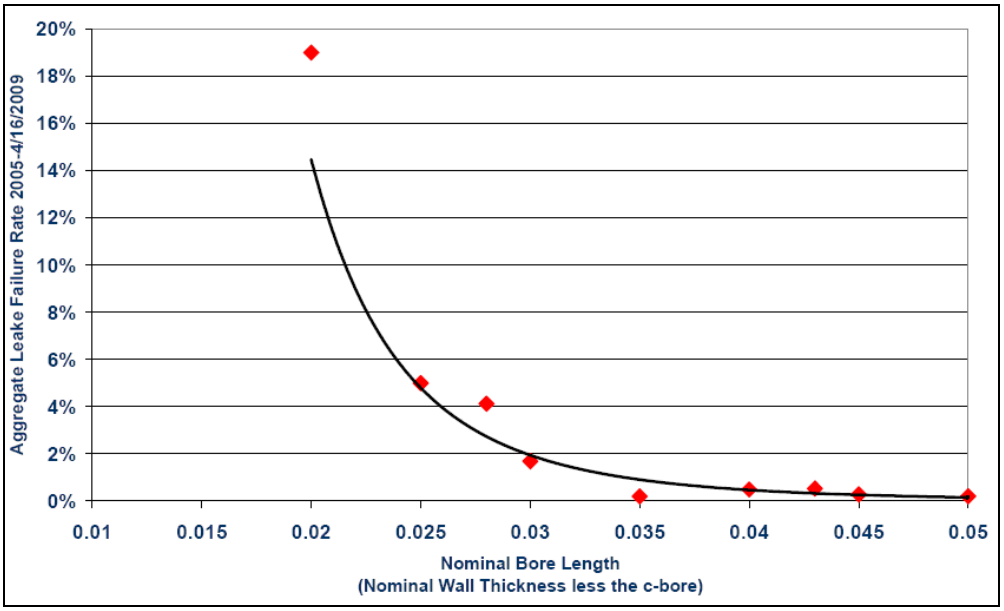


Figure 6 - Based on Package Manufacturing Yield Data: As the bore length of the frame increases, the hermetic failure rate decreases.