



# ALERT

1. TITLE (Class, Function, Type, etc.) <b>Component Package, LCC-18, Ceramic Crack</b>		2. DOCUMENT NUMBER <b>FV5-A-07-01B</b>
		3. DATE (DD-MMM-YY) <b>01 August 2007</b>
4. MANUFACTURER AND ADDRESS <b>International Rectifier Aerospace and Defense 204 Crawford Street Leominster, MA 01453</b>	5. PART NUMBER <b>See Document</b>	6. NATIONAL STOCK NUMBER <b>See Database</b>
	7. SPECIFICATION <b>MIL-PRF-19500</b>	8. TYPE DESIGNATOR <b>Not Available</b>
	9. LOT DATE CODE START <b>See Document</b>	10. LOT DATE CODE END <b>See Document</b>
11. MANUFACTURER'S POINT OF CONTACT <b>Soon Ng / Customer Services Paul Hebert / Technical Contact</b>	12. CAGE <b>69210</b>	13. MANUFACTURER'S FAX <b>(978) 537-4246</b>
14. MFR. POC PHONE <b>(978) 534-5776</b>	15. MANUFACTURER'S E-MAIL <b>Sng2@irf.com, phebert@irf.com</b>	
16. CROSS REFERENCE VENDOR <b>Not Available</b>	17. CROSS REFERENCE CAGE <b>Not Available</b>	18. CROSS REFERENCE PART <b>Not Available</b>
19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT <p><b>THIS REVISION PROVIDES NEW INFORMATION FROM INTERNATIONAL RECTIFIER CONCERNING THE LCC-18 PRODUCT. PAGE 1 AND PAGE 2 CONTAINS ORIGINAL DOCUMENT. PAGE 3 AND PAGE 4 CONTAINS AMENDMENT "A". REVISION "B" UPDATE TO SECTION 19 PROBLEM DESCRIPTION / DISCUSSION / EFFECT. PAGE 5 THROUGH PAGE 7 CONTAINS AMENDMENT "B". THIS AMENDMENT IS COMPLETE.</b></p> <p>Update 7/31/07:  1B) Reference Attachment 1 (LCC-18 Ceramic Micro-crack Technical Review) for test results.  2B) After performing additional hermetic seal performance tests and RGA to validate results, IR believes that the anomaly stated with reference to the detection of penetrant dye trace inside the device cavity (see section 19, item 4 herein), following fine and gross leak tests was due to physical damage. Further review of this anomaly suggests that the delidding operation (mechanical grind) caused the ingress of dye as observed during the internal cavity inspection.</p> <p>International Rectifier has experienced a manufacturing process anomaly, which resulted in possible physical damage to LCC-18 packaged products. More specifically, a lateral crack was detected in some LCC-18 ceramic package sidewalls. The ceramic crack fails to meet the visual requirements of MIL-STD-750, method 2071. An investigation conducted revealed that the parts passed all other test requirements, including fine and gross leak tests.</p> 1) The cracks detected in the LCC-18 package have been observed in a portion of the LCC-18 device lots (approximately 10 to 30%). These cracks are typically detected on a single side of the LCC-18 sidewall. The ceramic cracks are detectable at a magnification of 30X with proper illumination. 2) The cracks observed in the LCC-18 packages were caused by the lid seal welding process. Resistive welding is used to weld a lid and hermetically seal the LCC-18 package. Cracks in the LCC-18 ceramic sidewall resulted from a combination of welding electrode force and thermal stress produced during the lid seal welding process. 3) All other ceramic package families were reviewed for cracks. None were found. The problem was isolated to the LCC-18 package only. <b>Section continued on Page 2</b>		
20. ACTION TAKEN/PLANNED 1. International Rectifier has determined that devices from the products listed herein may contain cracks in the ceramic side wall. As part of containment activity, written notifications will be issued to customers in direct receipt of this material and recommend that the subject product be returned for inspection and replacement as necessary. Customers may also choose to perform visual inspection at 30X to determine if the product is affected. Affected product may be returned for replacement. For assistance in returning the product, contact the local manufacturer's representative or customer services at (978) 534-5776.  2. Product affected includes those manufactured in both Tijuana, Mexico and Leominster, USA facilities, using the same type of welder and program. International Rectifier has since corrected the manufacturing seal process (starting with DC 0711).  <b>Section continued on Page 2</b>		
21. DATE MFR. NOTIFIED <b>Not Applicable</b>	22. MANUFACTURER'S RESPONSE <input type="checkbox"/> REPLY ATTACHED <input checked="" type="checkbox"/> <b>Not Applicable</b> <input type="checkbox"/> NO REPLY	23. ORIGINATOR ADDRESS/POINT OF CONTACT <b>International Rectifier Aerospace and Defense 204 Crawford Street Leominster, MA 01453</b>
24. REPRESENTATIVE <b>Paul Hebert</b>	25. SIGNATURE 	26. DATE <b>31 July 2007</b>

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT - Continued

4) Further experiments were conducted on samples to verify the package seal integrity and detect crack propagation failures. Experiments included extensive environmental conditioning through temperature cycling (100 temperature cycles, -55C to 175C). Following conditioning, the LCC-18 parts were tested for fine and gross leak test in accordance with MIL-STD-750, method 1071, condition H2 and C. All parts were found to pass the hermetic seal tests.

**Note:** Following testing, parts were submitted to a penetrant dye gross leak test. A portion of the sample exhibited evidence of dye at the crack site inside the LCC-18 cavity, even though the parts passed the hermeticity test cited above. Additional tests are in progress to further detail this anomaly.

Products listed herein (Table I) are suspect of physical damage, as determined by the weld/seal equipment logs. All devices in finish goods at IR were inspected for sidewall cracks. Devices exhibiting cracks were removed and contained.

20. ACTION TAKEN/PLANNED - Continued

3. All affected customers in direct receipt of the material will be notified of the problem via Notification Letter. Reference Table I herein for part numbers and date code range.

4. All LCC-18 product in process and finish goods at IR were inspected for sidewall cracks. Devices exhibiting cracks were removed and contained.

Table 1 - Product Affected and Date Code range

Part Number	Date Code
5EQ100	0420
IRHE9110SCS	0433
8EQ045SCX	0613
IR2110E4	0431-0432, 0506-0507, 0516-0517
IR2113E6	0508-0509, 0549-0550, 0608-0609
IRFE024	0524-0525
IRFE130	0511-0513
IRFE330	0507-0508
IRFE9130	0450-0451, 0535-0536
IRFEA240	0441-0442
IRHE7330SE	0450-0451
IRHE9110SCS	0516
IRHE9130	0450-0451
JANSF2N7389U	0509
JANSR2N7262U	0543, 0617
JANSR2N7389U	0420
JANSR2N7496U5	0451-0452, 0618
JANSR2N7502U5	0443-0444
JANTX2N6782U	0418, 0535
JANTX2N6796U	0435, 0442, 0445, 0506, 0518, 0524, 0531
JANTX2N6798U	0420, 0519
JANTX2N6800U	0512
JANTX2N6849U	0424, 0535
JANTXV2N6796U	0506
JANTXV2N6798U	0423, 0438, 0519
JANTXV2N6849U	0426
JANTXVR2N7261U	0523
RIC7113E4SCS	0411, 0605-0606, 0618,
RIC7113E4	0507-0508
RA.0808.007.10	0417, 0445, 0521
361A9946P1	0607

Part Number	Date Code
IRFE024	M0538 to M0710
IRFE110	M0538 to M0710
IRFE130	M0538 to M0710
IRFE220	M0538 to M0710
IRFE430	M0538 to M0710
IRFE9110	M0538 to M0710
IRFE9120	M0538 to M0710
IRFE9130	M0538 to M0710
IRFE9220	M0538 to M0710
IRFE9230	M0538 to M0710
JANTX2N6782U	M0538 to M0710
JANTX2N6796U	M0538 to M0710
JANTX2N6798U	M0538 to M0710
JANTX2N6845U	M0538 to M0710
JANTX2N6849U	M0538 to M0710
JANTX2N6851U	M0538 to M0710
JANTXV2N6796U	M0538 to M0710
JANTXV2N6798U	M0538 to M0710
JANTXV2N6800U	M0538 to M0710
JANTXV2N6849U	M0538 to M0710

## 19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT – Continued

Update 6/20/07: IR conducted additional testing to verify the effects of temperature cycling on LCC-18 product that exhibited a micro-crack in the sidewall. The evaluation tests involved conditioning 15 LCC-18 parts through temperature cycling in accordance with MIL-STD-883, method 1010, condition B (100 cycles, -55C to 125C). After conditioning, the parts were tested for fine and gross leak. All parts passed the hermetic seal tests. The 15 parts were then submitted to RGA in accordance with MIL-STD-750, method 1018. The level of moisture content detected inside the cavity indicates that the parts maintained their hermetic seal property through temperature cycling. Moisture content measured nominal with 1,200 ppm detected on average.

## 20. ACTION TAKEN/PLANNED - Continued

5. Beginning 6/20/2007, material returned to IR for micro-crack verification will be marked to indicate acceptance. IR will add a Green Dot marking to those returned devices that have passed 100% inspection for sidewall micro-crack. LCC-18 product returned to the field with the Green Dot will provide positive identification of the inspection for micro-crack and acceptability thereof. Packages inspected that are found to exhibit a micro-crack will be segregated for scrap disposition. See picture below for Green Dot reference.



Picture showing Green Dot and location

**Table 1 - Product Affected and Date Code range**

-Eliminate Part Number 361A9946P1 from the list

-Add Date Code 0535-0536 to IRHE9130

-Revised table (Updated 6/20/07)

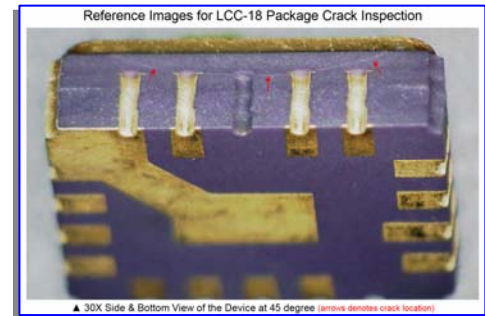
Parts from IR Leominster, MA manufacturing site	
Part Number	Date Code
5EQ100	0420
IRHE9110SCS	0433
8EQ045SCX	0613
IR2110E4	0431-0432, 0506-0507, 0516-0517
IR2113E6	0508-0509, 0549-0550, 0608-0609
IRFE024	0524-0525
IRFE130	0511-0513
IRFE330	0507-0508
IRFE9130	0450-0451, <b>0535-0536</b>
IRFEA240	0441-0442
IRHE7330SE	0450-0451
IRHE9110SCS	0516
IRHE9130	0450-0451, 0535-0536
JANSF2N7389U	0509
JANSR2N7262U	0543, 0617
JANSR2N7389U	0420
JANSR2N7496U5	0451-0452, 0618
JANSR2N7502U5	0443-0444
JANTX2N6782U	0418, 0535
JANTX2N6796U	0435, 0442, 0445, 0506, 0518, 0524, 0531
JANTX2N6798U	0420, 0519
JANTX2N6800U	0512
JANTX2N6849U	0424, 0535
JANTXV2N6796U	0506
JANTXV2N6798U	0423, 0438, 0519
JANTXV2N6849U	0426
JANTXVR2N7261U	0523
RIC7113E4SCS	0411, 0605-0606, 0618
RIC7113E4	0507-0508
RA.0808.007.10	0417, 0445, 0521

Parts from IR Tijuana, MX manufacturing site	
Part Number	Date Code
IRFE024	M0538 to M0710
IRFE110	M0538 to M0710
IRFE130	M0538 to M0710
IRFE220	M0538 to M0710
IRFE430	M0538 to M0710
IRFE9110	M0538 to M0710
IRFE9120	M0538 to M0710
IRFE9130	M0538 to M0710
IRFE9220	M0538 to M0710
IRFE9230	M0538 to M0710
JANTX2N6782U	M0538 to M0710
JANTX2N6796U	M0538 to M0710
JANTX2N6798U	M0538 to M0710
JANTX2N6845U	M0538 to M0710
JANTX2N6849U	M0538 to M0710
JANTX2N6851U	M0538 to M0710
JANTXV2N6796U	M0538 to M0710
JANTXV2N6798U	M0538 to M0710
JANTXV2N6800U	M0538 to M0710
JANTXV2N6849U	M0538 to M0710

## LCC-18 Ceramic Micro-crack Technical Review

### Supplemental Data for [GIDEP FV5-A-07-01](#)

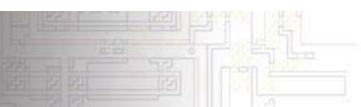
The following experiments were conducted to measure the performance of the LCC-18 parts that exhibit a micro-crack as reported in GIDEP FV5-A-07-01A. The data and results presented herein may be used to mitigate risk in certain field applications as it relates to hermetic seal performance and associated reliability following environmental stress conditioning. The device performance was verified by conducting fine and gross leak tests IAW MIL-STD-750 test methods and later validated by analyzing the internal gas content of the device by submitting to RGA (Residual Gas Analysis, MIL-STD-750, TM1018).



### Experiments:

Three separate groups of LCC-18 devices (MOSFET) were obtained and subjected to environmental stress conditioning in order to assess performance and reliability associated with hermetic seal. All samples exhibited a micro-crack on the ceramic side wall. The samples were composed of metallurgically bonded semiconductor die (MOSFET). Reference the flows below for group test details.

Group 4 n=15	Group 5 n=10	Group 6 n=10
Fine & Gross Leak Test MIL/750 m1071, Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>	Fine & Gross Leak Test MIL/750 m1071, Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>	Fine & Gross Leak Test MIL/750 m1071, Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>
100 Temperature Cycles MIL/883 m1010 (-55C to 125C)	100 Temperature Cycles MIL/750 m1051 (-55C to 150C)	Reflow Simulation Peak temp @ 240C
Fine & Gross Leak Test MIL/750 m1071 Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>	Fine & Gross Leak Test MIL/750 m1071 Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>	Fine & Gross Leak Test MIL/750 m1071 Condition H2 and C1 <b>Pass Fine &amp; Gross Leak</b>
RGA Test MIL/750 m1018 Moisture ppm < 5,000 <b>Pass RGA</b>	Dye Penetrant Test Pressurize @ 60 psig for 2 hours	RGA Test MIL/750 m1018 Moisture ppm < 5,000 <b>Pass RGA</b>
	RGA Test MIL/750 m1018 Moisture ppm < 5,000 <b>Pass RGA</b>	
	Internal Visual Inspection under UV light <b>No Dye Ingress Detected</b>	



## Hermetic Seal Test Details:

The following conditions and test limits were applied to verify hermetic seal integrity.

Package Type: LCC-18  
Internal Cavity: 0.066 cc

Fine Leak  
Condition H2  
He Pressurization: 60 psig for 2 hours  
Leak Rate Limit:  $1 \times 10^{-8}$  atm cm<sup>3</sup>/s He

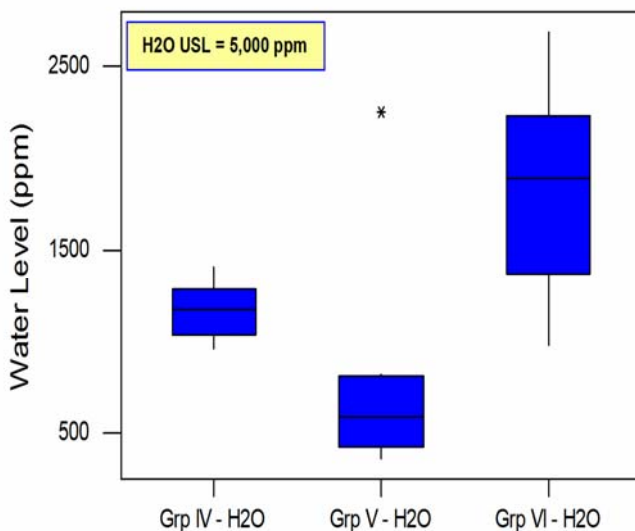
Gross Leak  
Condition C1  
Vacuum Cycle: 30 minutes  
Pressurization: 90 psig in for 1 hour in FC Type I Fluid  
Detection: No Bubbles in FC Type II Fluid @ 125C (30 seconds)

Fluids: Type I Golden DET for pressurization (boiling point is 91C) and Type II Golden D02 for bubble detection at 125C (boiling point is 175C).

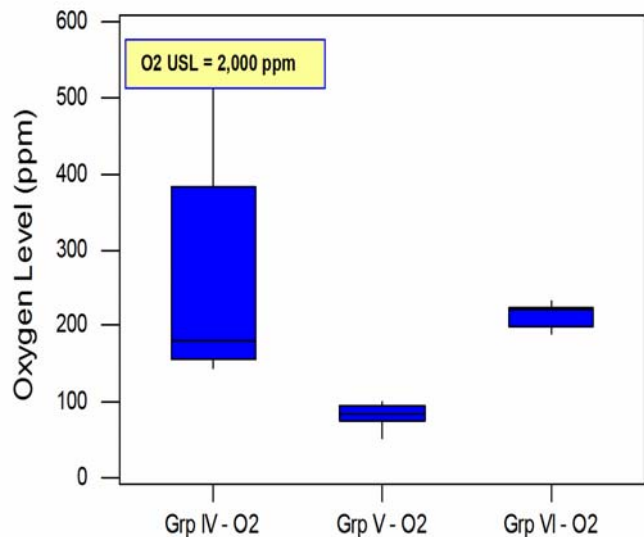
## RGA Test Details:

Gas and moisture contents were obtained from each of the three groups. Parts were submitted and tested by an outside laboratory IAW MIL-STD-750, method 1018 (Pernicka Corp.). Note that the water moisture content limit (USL) is specified at 5,000 ppm and the upper limit for oxygen content is 2,000 ppm. All gases were found to read within nominal range. No indication of hermetic seal failure was detected as evidenced by gas level and content. Reference Boxplot exhibits below for key gas measure for each test group.

### WATER CONTENT (ppm)



### OXYGEN CONTENT (ppm)



**Conclusion:**

As evident from fine and gross leak testing and residual gas analysis results presented herein, the LCC-18 devices exhibiting micro-cracks as reported in GIDEP FV5-A-07-01A, were found to maintain their hermetic seal properties following environmental stress conditioning. Stress conditioning included 100 temperature cycles from -55C to 150C range and exposure to high temperature, such as those found in circuit card assembly solder reflow profiles. The parts met the specifications of fine and gross leak tests and internal gas limitations as specified in MIL-STD-750 and MIL-PRF-19500.

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**July 20, 2007**

**M. Daly**  
**Director of Quality Assurance**