



**TO-220 Full-Pak
Lead Free and RoHS Compliance Document**

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TO-220 Full-Pak

Component	Material Name	Material Mass (g/ea)	Element Name Composition	Substance Mass (per device) g	Material Analysis Weight (%)	% of Total Weight
Chip	Silicon	0.01207	Si	0.01207	100%	0.6%
Encapsulant	Epoxy Resin	0.99330	SiO ₂	0.79464	80%	37.1%
			Epoxy	0.14900	15%	7.0%
			Other	0.04966	5%	2.3%
Lead Frame	Copper	1.12350	Cu	1.11788	99%	52.2%
			Sn	0.00562	1%	0.3%
Die Attach	J-Alloy	0.00630	Sn	0.00410	65%	0.2%
			Ag	0.00158	25%	0.1%
			Sb	0.00062	10%	0.0%
Wire bond	Aluminum	0.00130	Al	0.00130	100%	0.1%
Lead Finish	Matte Tin	0.00510	Sn (PBF)	0.00510	100%	0.2%

Total Weight (g) **2.14157**

This part is compliant with EU Directive 2002/95/EC (RoHS) and does not contain lead, mercury, cadmium (0.01%), hexavalent chromium, PBB or PBDE in concentrations greater than 0.1%, except as permitted by Annex (7).

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TO-220 Full-Pak Tin Whisker Report

Objective: To evaluate the Tin whisker growth for various test conditions on PBF products

Part No: IRF614

Package Type: TO-220

TO-220 Full-Pak is tested by TO-220

Test	Room Temperature Storage	Temperature Humidity Unbias	Bake
Test Conditions	30+/-2°C, 60+/-3%RH	60+/-5°C, 85+3/-2%RH	55°C
Test Status / Readpoint	WFA / 6 mo	NWF / 6 mo	WFA / 6 mo

Examples:

Whisker Length (µm)	15	12	9

Abbreviation	NWF	WFA	WFO
Whisker length pass/fail criterion	No Whiskers Found Whisker length less than 10 µm is considered insignificant	Whiskers found within acceptable range Whisker length less than 40 µm is considered pass	Whiskers found over acceptable range Whisker length exceeding 40 µm is considered fail

Sn Plating descriptions:

Plating thickness (µin): >300 to 800

Annealing conditions: N/A

Plating finish: 100% Sn Matte

Sample size: 3 pieces per test

Reflow: N/A

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International IOR Rectifier


International Rectifier components and their homogeneous sub-components manufactured under the Lead Free Program ⁽¹⁾ are in compliance with European Union Directive 2002/95/EC (RoHS Directive) of the European Parliament and of the Council of 27 January 2003. IR parts that have been identified as RoHS compliant do not exceed the maximum limit for following 6 designated substances.

Substance	Maximum Limit (ppm)
Cadmium (Cd)	100
Lead (Pb)	1000 ⁽²⁾
Mercury (Hg)	1000
Hexavalent Chromium (Cr ⁶⁺)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl Ethers (PBDE)	1000


- (1) Part numbers typically contain a "PBF" suffix
- (2) Maximum limit (ppm) does not apply to applications for which exemptions have been granted by the RoHS Directive

Our statements in this letter regarding RoHS compliance and lead content do not extend to, or apply to any product subjected to unintended contamination, misuse, neglect, accident, improper installation, or to use in violation of instructions furnished by IR. We additionally note that IR products in certain specific large outline packages could contain high temperature solder die attach material having greater than 85% lead content, which is considered exempt from ELV Directive, Article 4(2)(a) by Annex II and RoHS Directive, Article 4(1) by Annex (7).

Authorized signatures for International Rectifier:

Name:  Greg Takagi Date: 8/23/2005

Position: Director, Global Environmental Health and Safety

Name:  Danny Narabal Date: 8/23/05

Position: Director, Package Engineering

The information contained in this letter is being provided for informational purposes only and to clarify certain information concerning IR products. Nothing provided in this letter is (i) a representation, warranty or agreement to indemnification by IR, (ii) a statement which may form the basis of reliance by IR, (iii) a modification of any of the terms and conditions of sale agreed to in writing between IR and its customers with respect to any IR products, whether previously sold or to be sold in the future.

ELEMENTAL CONTAMINATION TEST RESULTS

Testing performed by:



Air Liquide - Balazs Analytical Services
46409 Landing Parkway, Fremont CA 94538
Telephone (510) 657-0600 Fax (510) 657-2292
Web <http://www.balazs.com>

Analysis Technique:

Analysis was performed on twelve (12) IC samples to determine the amount of elemental contamination (Cd, Pb, Hg, and As), PVC and PVC blends, asbestos, hexavalent chromium, and organic bromide compounds present in the samples.

Analysis Technique:

Each sample set was ground to pass a 200 mesh screen. Individual samples were analyzed in accordance with the document labeled "**Plastics - Determination of cadmium - Wet decomposition method**", EN1122, ICS 83.080.01, Method "A". Individual were weighed to +0.01 mg. followed by analysis using ISO 3613: 2000(E), "Chromate Conversion Coatings on Zinc, Cadmium, Aluminum-Zinc Alloys and Zinc-Aluminum alloys---Test Methods." Each sample set was ground to pass a 200 mesh screen. Individual samples were analyzed in accordance with the document labeled "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", EPA-600/M4-82-020, Dec. 1982. Samples were measured utilizing a Leica DMLM compound binocular microscope.

Each sample set was prepared for reflectance mode FTIR utilizing a BioRad FTS6000 FTIR system coupled to a UMA 500 FTIR microscope. The FTIR spectra for reference areas were collected on adjacent clear areas of a control wafer. Infrared spectra were then collected at 8 cm⁻¹ resolution with 1024 scans co-added together prior to Fourier Transformation.

Individual samples were analyzed in accordance with EPA-600 Method 1614 draft method, in conjunction with the appropriate preparation technique.

Elemental Results:

	As	Cd	Hg	Pb
Sample Name	ppm (wt.)	ppm (wt.)	ppm (wt.)	ppm (wt.)
Blank	<1.0	<1.0	<1.0	<1.0
IRF4905PBF (TO-220)	<1.0	<1.0	<1.0	4.1
IRFP450PBF (TO-247)	<1.0	<1.0	<1.0	11.6
IRF740SPBF (D2-PAK)	<1.0	<1.0	<1.0	14600
IRFR3707ZPBF (D-PAK)	<1.0	<1.0	<1.0	4864
IRLL2705PBF (SOT-223)	<1.0	<1.0	<1.0	11100
IRF6603 (DirectFET)	<1.0	<1.0	<1.0	19.2
IRLML6401TRPBF (Micro-3)	<1.0	<1.0	<1.0	6.4
IRLMS6802TRPBF (Micro-6)	<1.0	<1.0	<1.0	9.5
IRF7821PBF(SO-8)	<1.0	<1.0	<1.0	7.6
IR2153PBF (8L PDIP)	<1.0	<1.0	<1.0	9.4
IRF7503TRPBF (Micro-8)	<1.0	<1.0	<1.0	15.8
IR3086AMPBF (20L MLPQ)	<1.0	<1.0	<1.0	8.9

The re-analysis of the IRF740SPBF, IRFR3707ZPBF, IRLL2705PBF indicate that the high Pb is coming from a single internal layer and is exempt per the specifications

Results:

	PBB/PDBE	Cr(VI)	PVC	Asbestos
Sample Name	ppm (wt.)	ppm (wt.)	ppm (wt.)	P/NP
Blank	<10.	<1.0	<1.0	NP
IRF4905PBF (TO-220)	<10.	<1.0	<1.0	NP
IRFP450PBF (TO-247)	<10.	<1.0	<1.0	NP
IRF740SPBF (D2-PAK)	<10.	<1.0	<1.0	NP
IRFR3707ZPBF (D-PAK)	<10.	<1.0	<1.0	NP
IRLL2705PBF (SOT-223)	<10.	<1.0	<1.0	NP
IRF6603 (DirectFET)	<10.	<1.0	<1.0	NP
IRLML6401TRPBF (Micro-3)	<10.	<1.0	<1.0	NP
IRLMS6802TRPBF (Micro-6)	<10.	<1.0	<1.0	NP
IRF7821PBF(SO-8)	<10.	<1.0	<1.0	NP
IR2153PBF (8L PDIP)	<10.	<1.0	<1.0	NP
IRF7503TRPBF (Micro-8)	<10.	<1.0	<1.0	NP
IR3086AMPBF (20L MLPQ)	<10.	<1.0	<1.0	NP