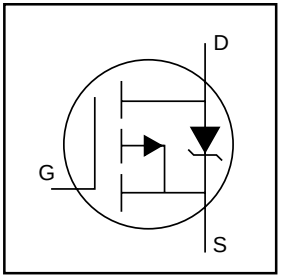
International
IOR Rectifier

PD - 90863A

IRFL9014

HEXFET® Power MOSFET

- Surface Mount
- Available in Tape & Reel
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- P-Channel
- Fast Switching
- Ease of Paralleling



V_{DSS} = -60V

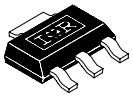
$R_{DS(on)}$ = 0.50Ω

I_D = -1.8A

Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-223 package is designed for surface-mount using vapor phase, infra red, or wave soldering techniques. Its unique package design allows for easy automatic pick-and-place as with other SOT or SOIC packages but has the added advantage of improved thermal performance due to an enlarged tab for heatsinking. Power dissipation of grreater than 1.25W is possible in a typical surface mount application.



SOT-223

Absolute Maximum Ratings

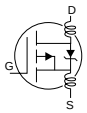
	Parameter	Max.	Units
I_D @ Tc = 25°C	Continuous Drain Current, V_{GS} @ -10 V	-1.8	A
I_D @ Tc = 100°C	Continuous Drain Current, V_{GS} @ -10 V	-1.1	
I_{DM}	Pulsed Drain Current ①	-14	
P_D @Tc = 25°C	Power Dissipation	3.1	W
P_D @T_A = 25°C	Power Dissipation (PCB Mount)**	2.0	
	Linear Derating Factor	0.025	W/°C
	Linear Derating Factor (PCB Mount)**	0.017	
V_{GS}	Gate-to-Source Voltage	-/+20	V
E_{AS}	Single Pulse Avalanche Energy②	140	mJ
I_{AR}	Avalanche Current①	-1.8	A
E_{AR}	Repetitive Avalanche Energy①	0.31	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-4.5	V/ns
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to + 150	°C
	Soldewring Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

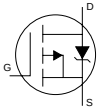
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-PCB	——	40	°C/W
$R_{\theta JA}$	Junction-to-Ambient. (PCB Mount)**	——	60	

** When mounted on 1" SQUARE pcb (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-60	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	-0.059	——	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.50	Ω	V_{GS} = -10V, I_D = 1.1A ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	——	-4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	1.3	——	——	S	V_{DS} = -25V, I_D = 1.1A ④
I_{DSS}	Drain-to-Source Leakage Current	——	——	-100	µA	V_{DS} = -60V, V_{GS} = 0V
		——	——	-500		V_{DS} = -48V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	-100	nA	V_{GS} = -20V
	Gate-to-Source Reverse Leakage	——	——	100		V_{GS} = 20V
Q_g	Total Gate Charge	——	——	12	nC	I_D =-6.7A
Q_{gs}	Gate-to-Source Charge	——	——	3.8		V_{DS} =-48V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	5.1		V_{GS} = -10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	——	11	——	ns	V_{DD} = -30V
t_r	Rise Time	——	63	——		I_D = -6.7A
$t_{d(off)}$	Turn-Off Delay Time	——	9.6	——		R_G = 24 Ω
t_f	Fall Time	——	31	——		R_D = 4.0 Ω, See Fig. 10 ④
L_D	Internal Drain Inductance	——	4.0	——	nH	Between lead, 6mm(0.25in) from package and center of die contact. 
L_S	Internal Source Inductance	——	6.0	——		
C_{iss}	Input Capacitance	——	270	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	170	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	31	——		f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-1.8	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	-14		
V_{SD}	Diode Forward Voltage	——	——	-5.5	V	T_J = 25°C, I_S = -1.8A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	80	160	ns	T_J = 25°C, I_F =-6.7A
Q_{rr}	Reverse RecoveryCharge	——	0.096	0.19	µC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② V_{DD}=-25V, starting T_J = 25°C, L =50 mH R_G = 25Ω, I_{AS} = -1.8A. (See Figure 12)

③ I_{SD} ≤ -6.7A, di/dt ≤90A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 150°C

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

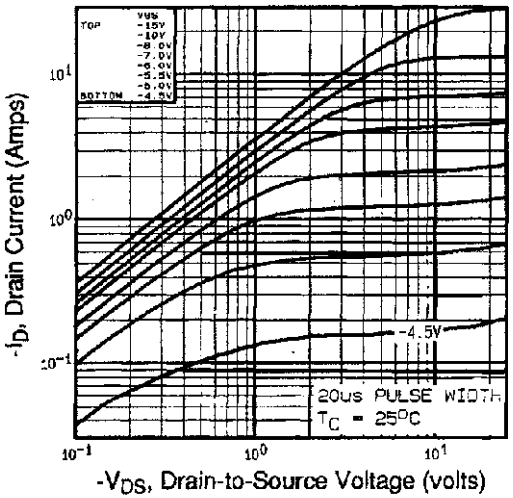


Fig 1. Typical Output Characteristics, T_C=25°C

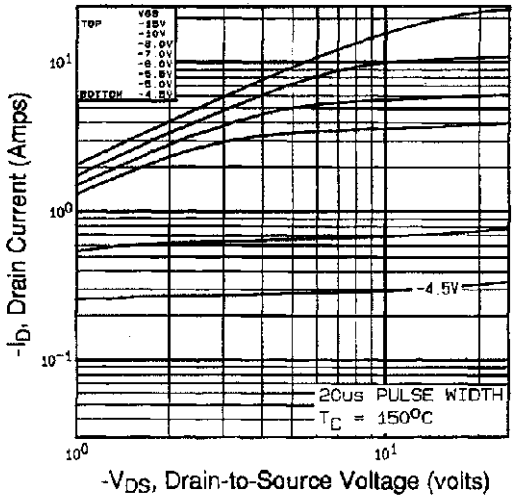


Fig 2. Typical Output Characteristics, T_C=150°C

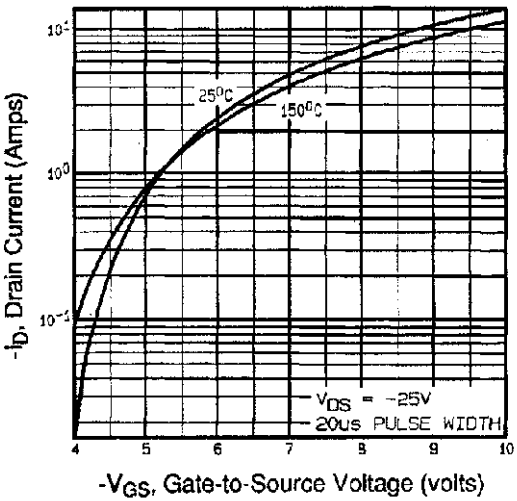


Fig 3. Typical Transfer Characteristics

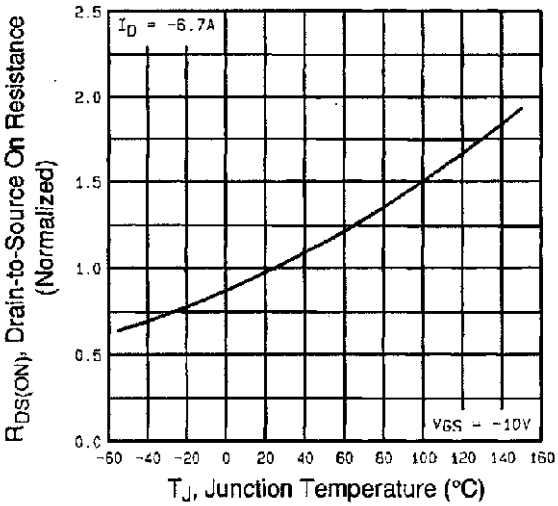


Fig 4. Normalized On-Resistance Vs. Temperature

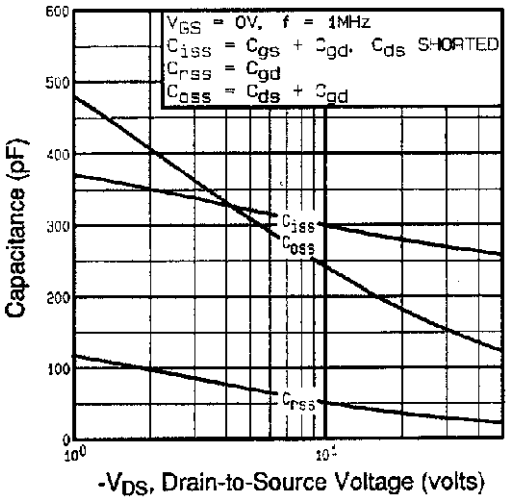


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

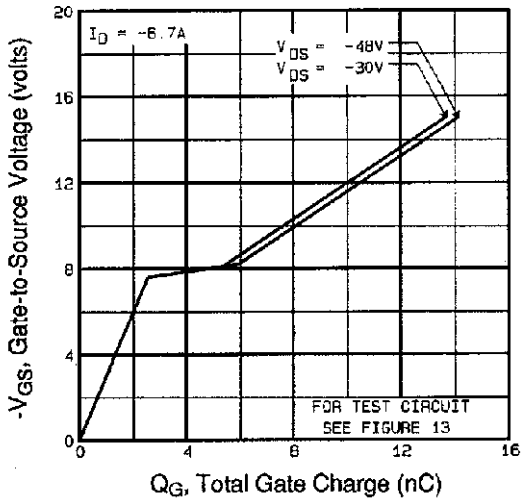


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

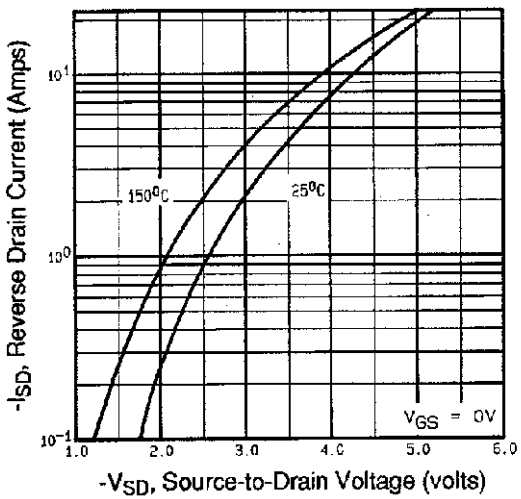


Fig 7. Typical Source-Drain Diode Forward Voltage

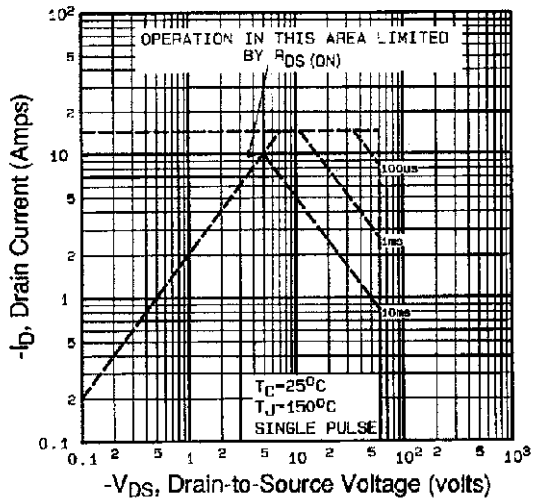


Fig 8. Maximum Safe Operating Area

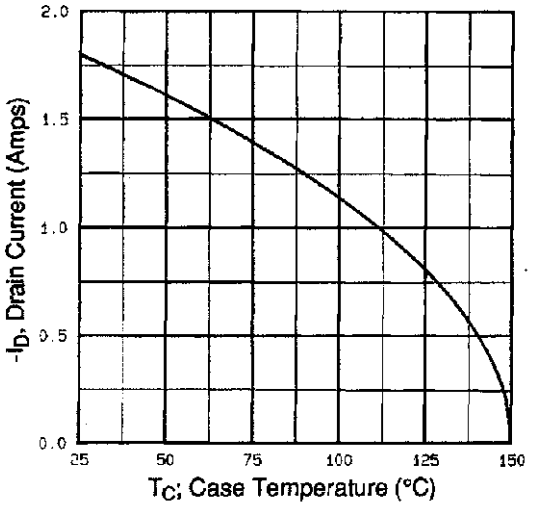


Fig 9. Maximum Drain Current Vs. Case Temperature

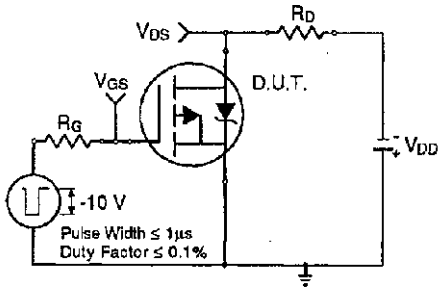


Fig 10a. Switching Time Test Circuit

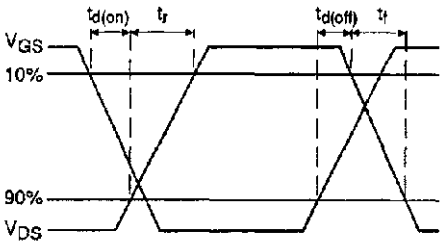


Fig 10b. Switching Time Waveforms

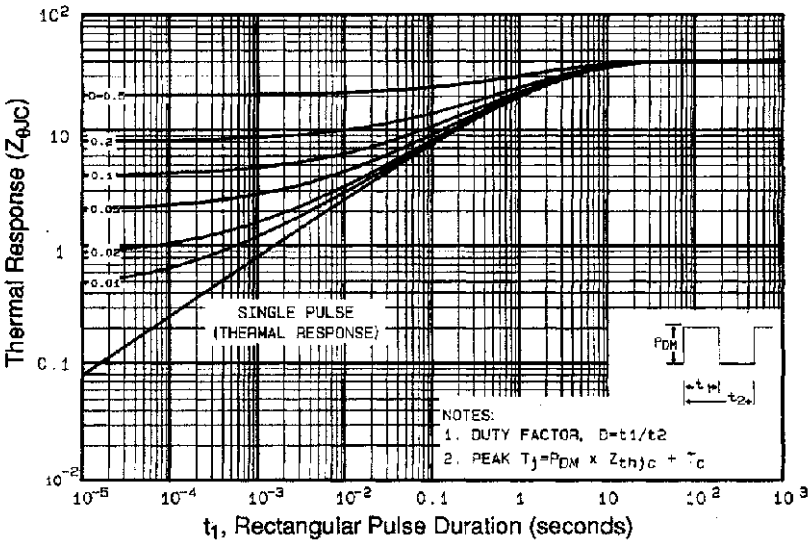


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

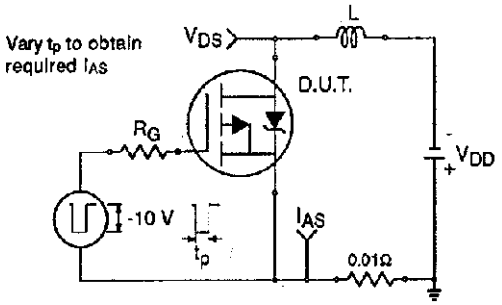


Fig 12a. Unclamped Inductive Test Circuit

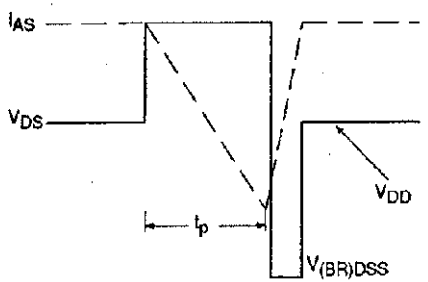


Fig 12b. Unclamped Inductive Waveforms

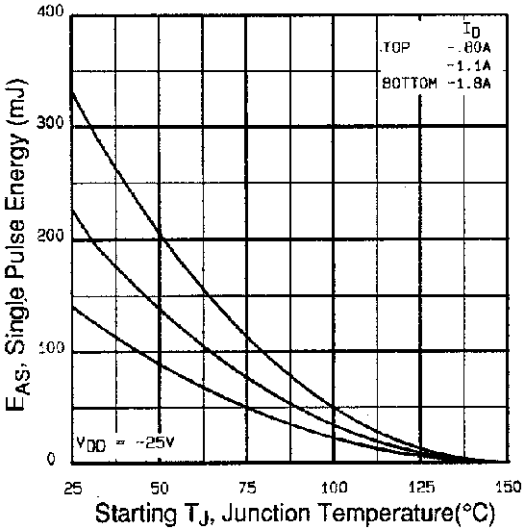


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

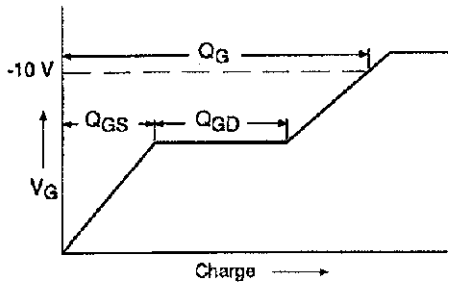


Fig 13a. Basic Gate Charge Waveform

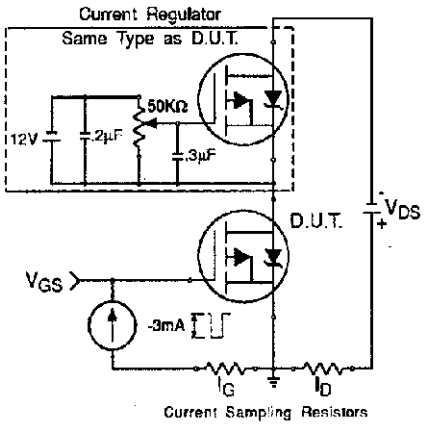
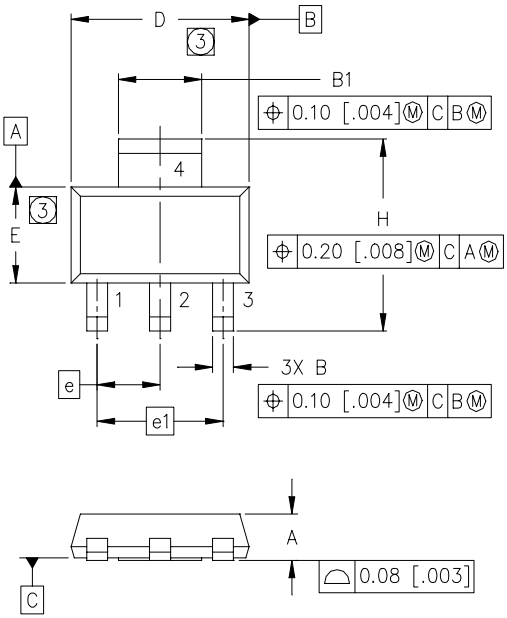


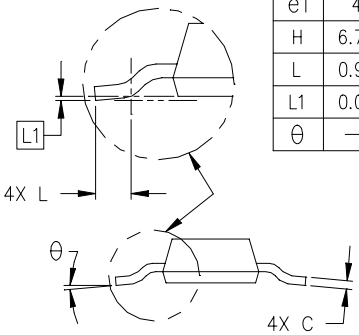
Fig 13b. Gate Charge Test Circuit

Package Outline

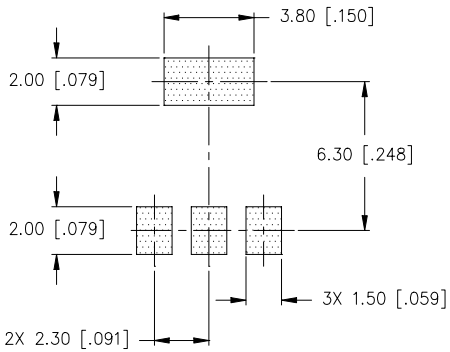
SOT-223 (TO-261AA) Outline



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.55	1.80	.061	.071
B	0.65	0.85	.026	.033
B1	2.95	3.15	.116	.124
C	0.25	0.35	.010	.014
D	6.30	6.70	.248	.264
E	3.30	3.70	.130	.146
e	2.30 BSC		.0905 BSC	
e1	4.60 BSC		.181 BSC	
H	6.71	7.29	.264	.287
L	0.91	—	.036	—
L1	0.061 BSC		.0024 BSC	
θ	—	10°	—	10°



MINIMUM RECOMMENDED FOOTPRINT



LEAD ASSIGNMENTS

1 = GATE
2 = DRAIN
3 = SOURCE
4 = DRAIN

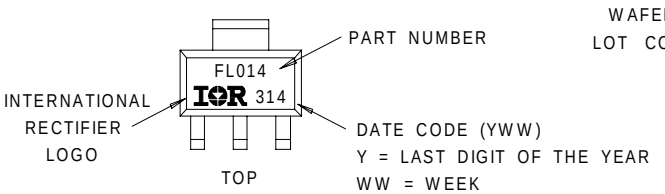
NOTES:

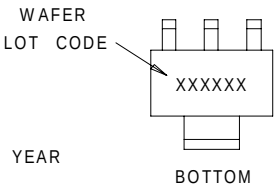
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS DO NOT INCLUDE MOLD FLASH.
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO–261AA.
5. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

Part Marking Information

SOT-223

EXAMPLE : THIS IS AN IRFL014

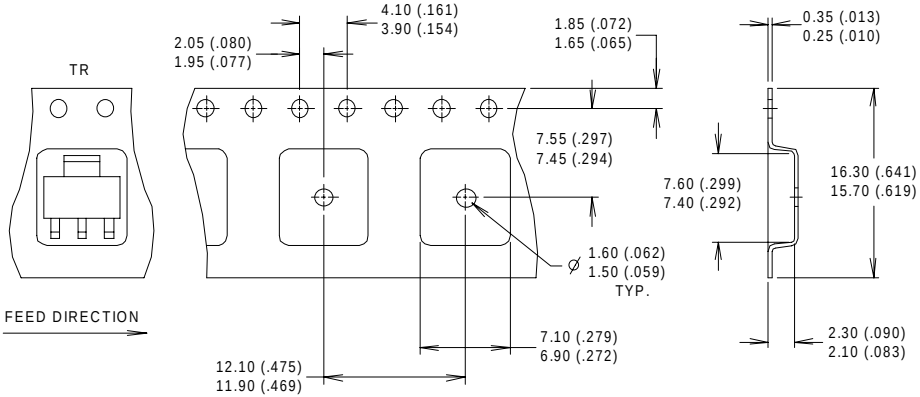




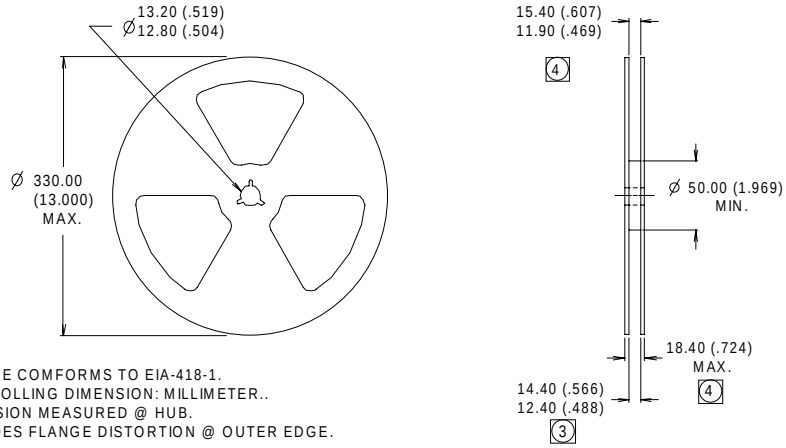
International
IOR Rectifier

Tape & Reel Information

SOT-223 Outline



NOTES :
1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH Ø330.00 (13.00) REEL CONTAINS 2,500 DEVICES.



NOTES :
1. OUTLINE COMFORMS TO EIA-418-1.
2. CONTROLLING DIMENSION: MILLIMETER..
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

International
IOR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331
IR GREAT BRITAIN: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 838 4630
IR TAIWAN:16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936
Data and specifications subject to change without notice. 2/99

Notice

The products described herein were acquired by Vishay Intertechnology, Inc., as part of its acquisition of International Rectifier's Power Control Systems (PCS) business, which closed in April 2007. Specifications of the products displayed herein are pending review by Vishay and are subject to the terms and conditions shown below.

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.

International Rectifier®, IR®, the IR logo, HEXFET®, HEXSense®, HEXDIP®, DOL®, INTERO®, and POWIRTRAIN® are registered trademarks of International Rectifier Corporation in the U.S. and other countries. All other product names noted herein may be trademarks of their respective owners.