International
IOR Rectifier

PD -93960

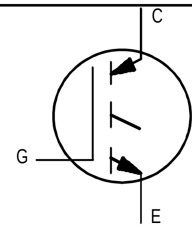
IRG4BH20K-S

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated
UltraFast IGBT

Features

- High short circuit rating optimized for motor control, t_{sc} =10µs @ V_{CC} = 720V , T_J = 125°C, V_{GE} = 15V
- Combines low conduction losses with high switching speed
- Latest generation design provides tighter parameter distribution and higher efficiency than previous generations
- Industry standard D^2Pak package



n-channel

V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 3.17V

@V_{GE} = 15V, I_C = 5.0A

Benefits

- As a Freewheeling Diode we recommend our HEXFRED[TM] ultrafast, ultrasoft recovery diodes for minimum EMI / Noise and switching losses in the Diode and IGBT
- Latest generation 4 IGBT's offer highest power density motor controls possible


D^2Pak

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	11	A
I_C @ T_C = 100°C	Continuous Collector Current	5.0	
I_{CM}	Pulsed Collector Current ①	22	
I_{LM}	Clamped Inductive Load Current ②	22	
t_{sc}	Short Circuit Withstand Time	10	µs
V_{GE}	Gate-to-Emitter Voltage	±20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	130	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	60	W
P_D @ T_C = 100°C	Maximum Power Dissipation	24	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	–––	2.1	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	–––	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	–––	40	
Wt	Weight	6 (0.21)	–––	g (oz)

8/17/00

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V_{GE} = 0V, I_C = 250µA	
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V_{GE} = 0V, I_C = 1.0A	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.13	—	V/°C	V_{GE} = 0V, I_C = 2.5mA	
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	3.17	4.3	V	I_C = 5.0A	V_{GE} = 15V
		—	4.04	—		I_C = 11A	See Fig.2, 5
		—	2.84	—		I_C = 5.0A , T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	—	6.5		$V_{CE} = V_{GE}$, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 1mA	
g_{fe}	Forward Transconductance ⑤	2.3	3.5	—	S	V_{CE} = 100 V, I_C = 5.0A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 1200V	
		—	—	2.0		V_{GE} = 0V, V_{CE} = 10V, T_J = 25°C	
		—	—	1000		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	28	43	nC	I_C = 5.0A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.4	6.6		V_{CC} = 400V See Fig.8
Q_{gc}	Gate - Collector Charge (turn-on)	—	12	18		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	23	—	ns	
t_r	Rise Time	—	26	—		T_J = 25°C
$t_{d(off)}$	Turn-Off Delay Time	—	93	140		I_C =5.0A, V_{CC} = 960V
t_f	Fall Time	—	270	400		V_{GE} = 15V, R_G = 50Ω
E_{on}	Turn-On Switching Loss	—	0.45	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	0.44	—		See Fig. 9,10,14
E_{ts}	Total Switching Loss	—	0.89	1.2		
t_{sc}	Short Circuit Withstand Time	10	—	—	µs	V_{CC} = 720V, T_J = 125°C V_{GE} = 15V, R_G = 50Ω
$t_{d(on)}$	Turn-On Delay Time	—	23	—	ns	T_J = 150°C,
t_r	Rise Time	—	28	—		I_C = 5.0A, V_{CC} = 960V
$t_{d(off)}$	Turn-Off Delay Time	—	100	—		V_{GE} = 15V, R_G = 50Ω
t_f	Fall Time	—	620	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	1.7	—	mJ	See Fig. 10,11,14
L_E	Internal Emitter Inductance	—	7.5	—	nH	Between lead and center of die contact
C_{ies}	Input Capacitance	—	435	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	44	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	8.3	—		f = 1.0MHz

Notes:

① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature. (See fig. 13b)

② V_{CC} = 80%(V_{CES}), V_{GE} = 20V, L = 10µH, R_G =50Ω, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

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

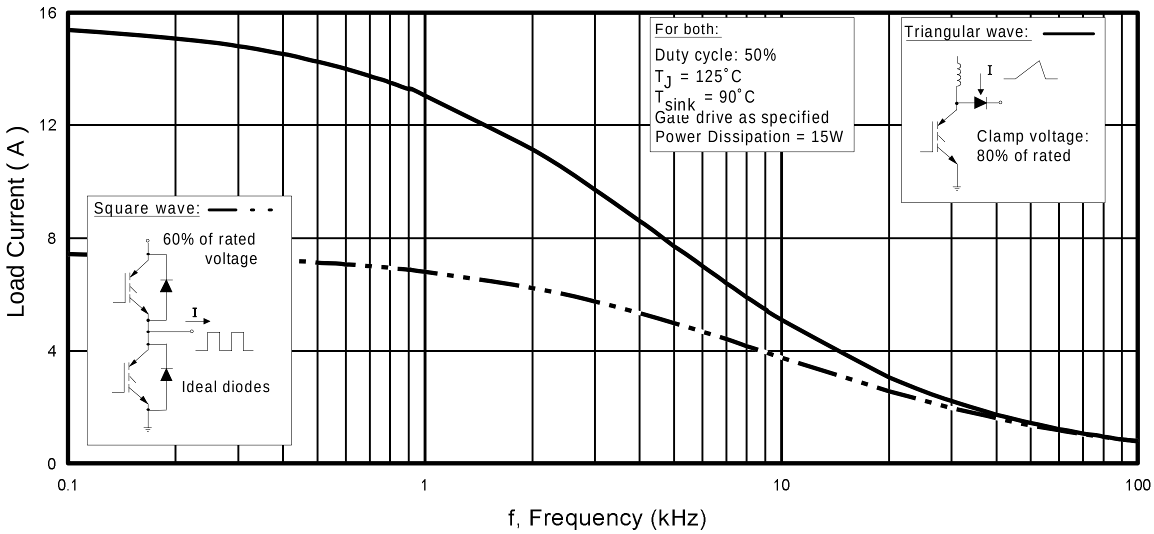


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

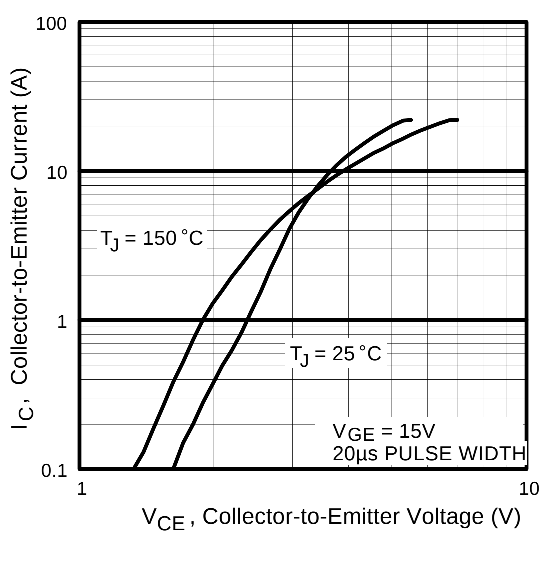


Fig. 2 - Typical Output Characteristics

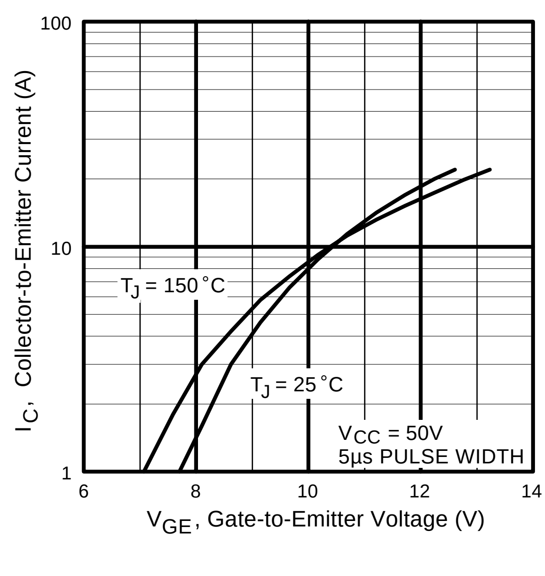


Fig. 3 - Typical Transfer Characteristics

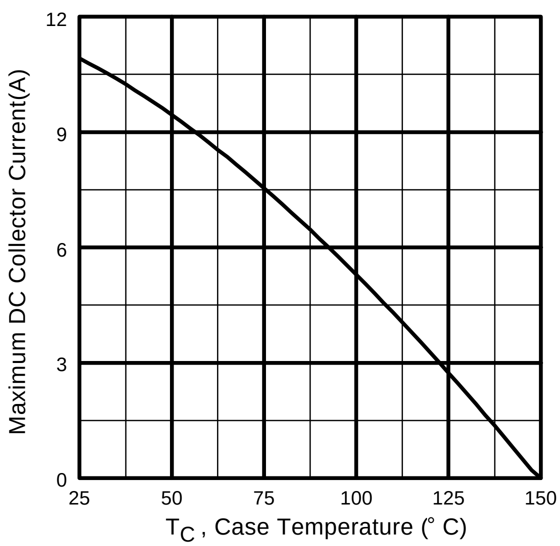


Fig. 4 - Maximum Collector Current vs. Case Temperature

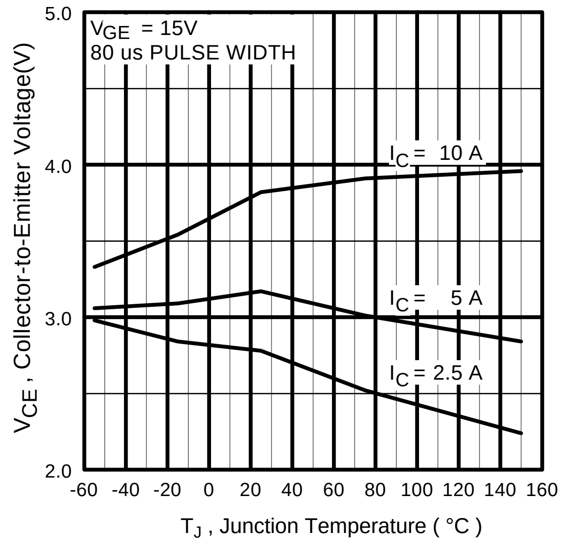


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

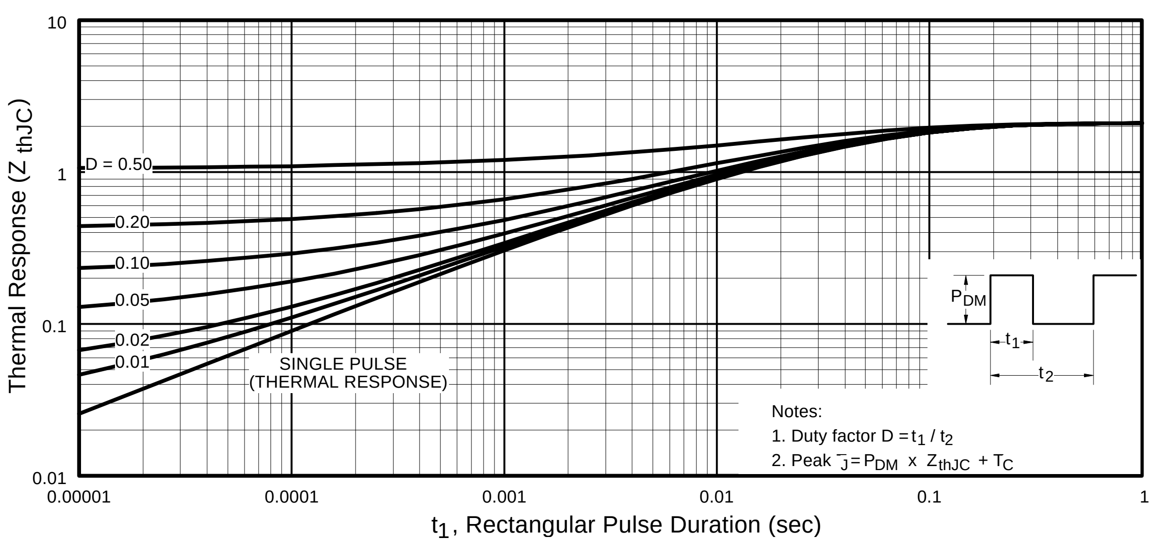


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

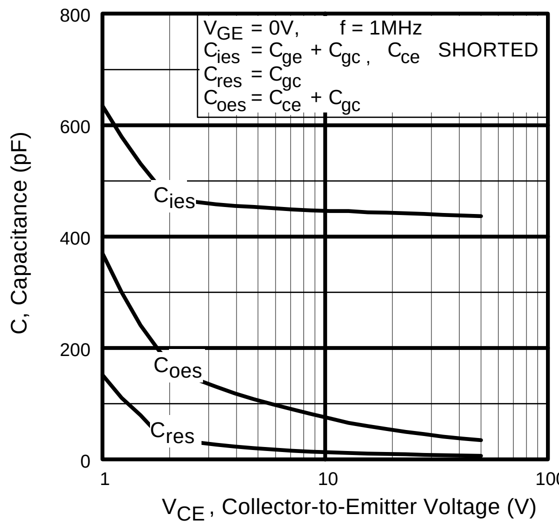


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

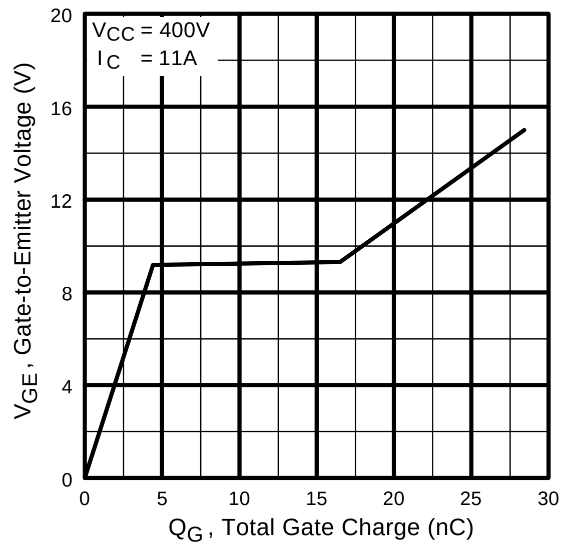


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

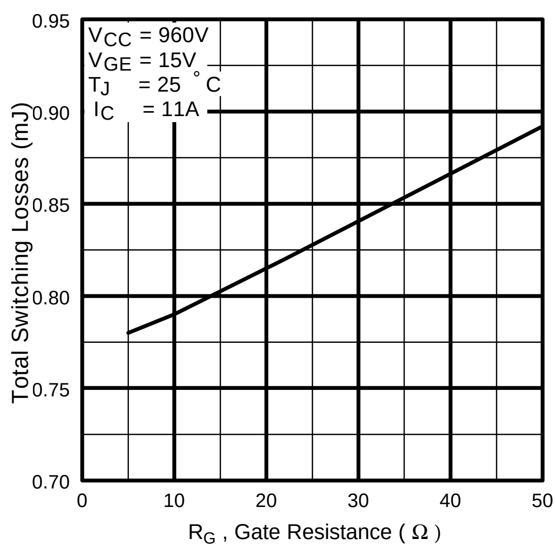


Fig. 9 - Typical Switching Losses vs. Gate Resistance

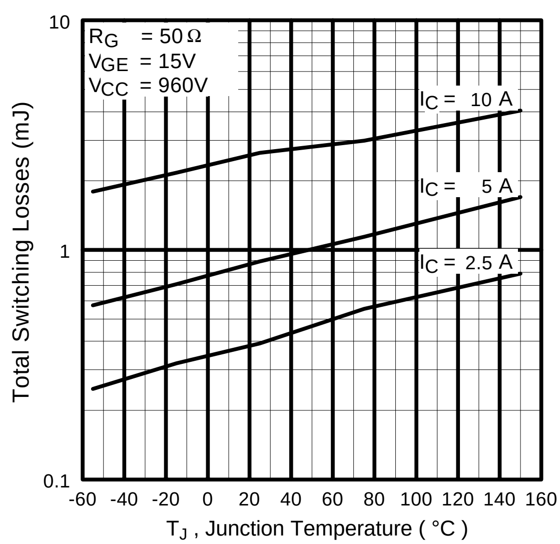


Fig. 10 - Typical Switching Losses vs. Junction Temperature

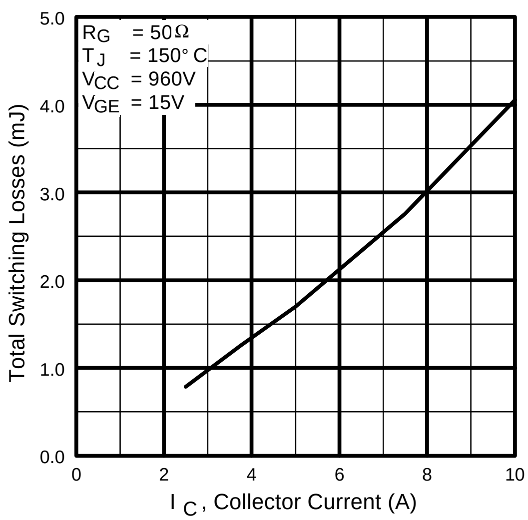


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

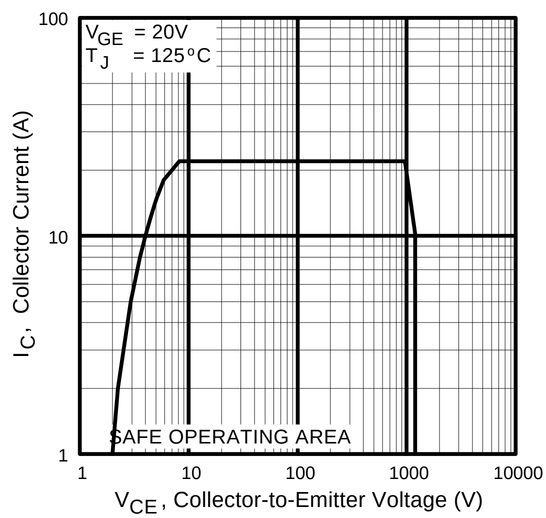
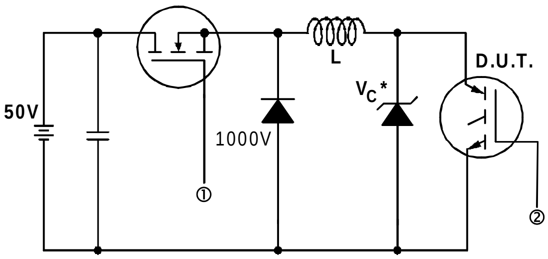


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; Vc = 80% of Vce(max)
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated Id.

Fig. 13a - Clamped Inductive Load Test Circuit

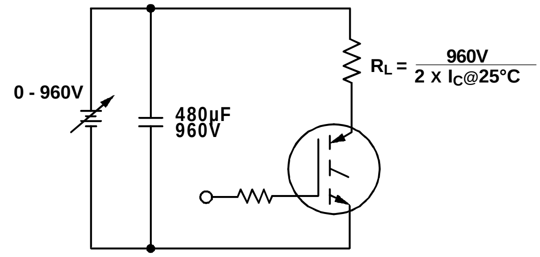


Fig. 13b - Pulsed Collector Current Test Circuit

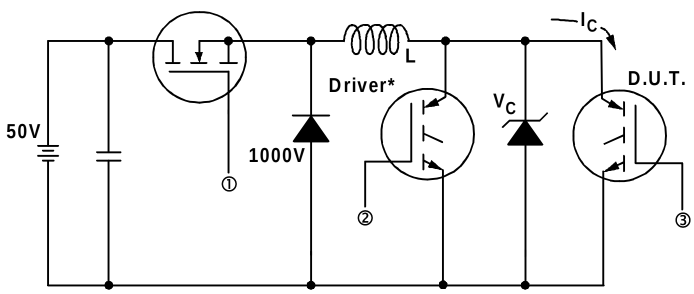


Fig. 14a - Switching Loss Test Circuit

*** Driver same type as D.U.T., VC = 960V**

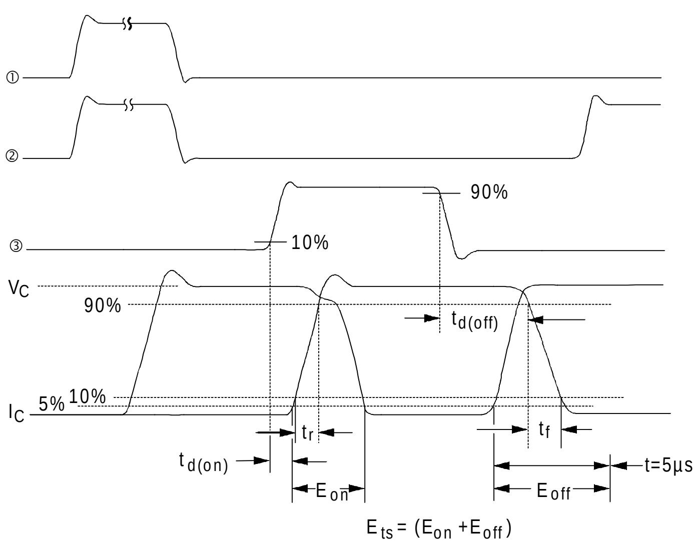
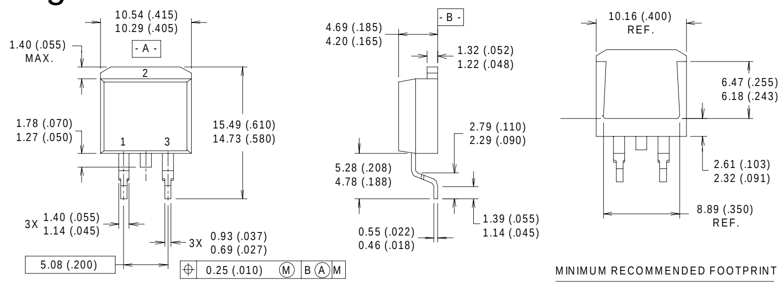
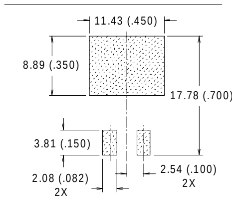


Fig. 14b - Switching Loss Waveforms

D[2]Pak Package Outline



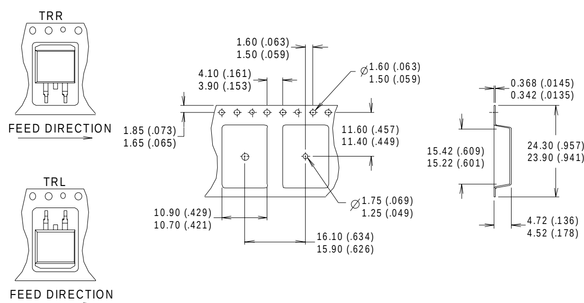
MINIMUM RECOMMENDED FOOTPRINT

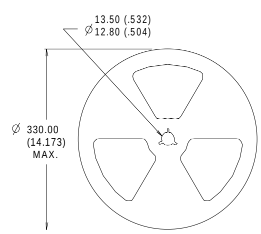


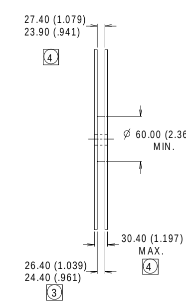
NOTES:
1 DIMENSIONS AFTER SOLDER DIP.
2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
3 CONTROLLING DIMENSION : INCH.
4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

LEAD ASSIGNMENTS
1 - GATE
2 - DRAIN
3 - SOURCE

D[2]Pak Tape and Reel







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

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
IR EUROPEAN REGIONAL CENTER: 439/445 Godstone Rd, Whyteleafe, Surrey CR3 OBL, UK Tel: ++ 44 (0)20 8645 8000
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111
IR JAPAN: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630
IR TAIWAN: 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936

Data and specifications subject to change without notice. 8/00