PD - 94255

International
IOR Rectifier

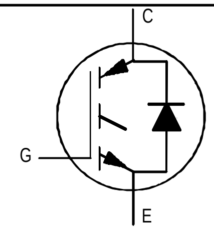
IRG4BC10SD-S
IRG4BC10SD-L

Standard Speed
CoPack IGBT

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

Features

- Extremely low voltage drop 1.1Vtyp. @ 2A
- S-Series: Minimizes power dissipation at up to 3 KHz PWM frequency in inverter drives, up to 4 KHz in brushless DC drives.
- Very Tight Vce(on) distribution
- IGBT co-packaged with HEXFRED™ ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard D^2Pak & TO-262 packages



n-channel

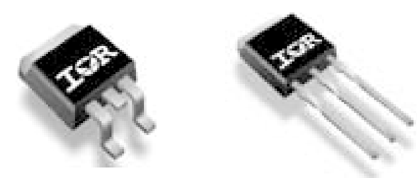
V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 1.10V

@V_{GE} = 15V, I_C = 2.0A

Benefits

- Generation 4 IGBT's offer highest efficiencies available
- IGBT's optimized for specific application conditions
- HEXFRED diodes optimized for performance with IGBT's . Minimized recovery characteristics require less/no snubbing
- Lower losses than MOSFET's conduction and Diode losses



D^2Pak IRG4BC10SD-S | TO-262 IRG4BC10SD-L

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	14	A
I_C @ T_C = 100°C	Continuous Collector Current	8.0	
I_{CM}	Pulsed Collector Current ①	18	
I_{LM}	Clamped Inductive Load Current ②	18	
I_F @ T_C = 100°C	Diode Continuous Forward Current	4.0	
I_{FM}	Diode Maximum Forward Current	18	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	38	W
P_D @ T_C = 100°C	Maximum Power Dissipation	15	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	——	——	3.3	°C/W
$R_{\theta JC}$	Junction-to-Case - Diode	——	——	7.0	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	——	0.50	——	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount ⑤	——	——	80	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state)⑥	——	——	40	
Wt	Weight	——	2.0(0.07)	——	g (oz)

06/12/01

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage③	600	—	—	V	V_{GE} = 0V, I_C = 250µA	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.64	—	V/°C	V_{GE} = 0V, I_C = 1.0mA	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.58	1.8	V	I_C = 8.0A	V_{GE} = 15V
		—	2.05	—		I_C = 14.0A	See Fig. 2, 5
		—	1.68	—		I_C = 8.0A, T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		V_{CE} = V_{GE}, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-9.5	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA	
g_{fe}	Forward Transconductance④	3.65	5.48	—	S	V_{CE} = 100V, I_C =8.0A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V	
		—	—	1000		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C	
V_{FM}	Diode Forward Voltage Drop	—	1.5	1.8	V	I_C =4.0A	See Fig. 13
		—	1.4	1.7		I_C =4.0A, 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)	—	15	22	nC	I_C = 8.0A	
Qge	Gate - Emitter Charge (turn-on)	—	2.42	3.6		V_{CC} = 400V See Fig. 8	
Q_{gc}	Gate - Collector Charge (turn-on)	—	6.53	9.8		V_{GE} = 15V	
$t_{d(on)}$	Turn-On Delay Time	—	76	—	ns	T_J = 25°C	
t_r	Rise Time	—	32	—		I_C = 8.0A, V_{CC} = 480V	
$t_{d(off)}$	Turn-Off Delay Time	—	815	1200		V_{GE} = 15V, R_G = 100Ω	
t_f	Fall Time	—	720	1080		Energy losses include "tail" and	
E_{on}	Turn-On Switching Loss	—	0.31	—	mJ	diode reverse recovery.	
E_{off}	Turn-Off Switching Loss	—	3.28	—		See Fig. 9, 10, 18	
E_{ts}	Total Switching Loss	—	3.60	10.9			
E_{ts}	Total Switching Loss	—	1.46	2.6	mJ	I_C = 5.0A	
$t_{d(on)}$	Turn-On Delay Time	—	70	—	ns	T_J = 150°C, See Fig. 10,11, 18	
t_r	Rise Time	—	36	—		I_C = 8.0A, V_{CC} = 480V	
$t_{d(off)}$	Turn-Off Delay Time	—	890	—		V_{GE} = 15V, R_G = 100Ω	
t_f	Fall Time	—	890	—		Energy losses include "tail" and	
E_{ts}	Total Switching Loss	—	3.83	—	mJ	diode reverse recovery.	
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package	
C_{ies}	Input Capacitance	—	280	—	pF	V_{GE} = 0V	
C_{oes}	Output Capacitance	—	30	—		V_{CC} = 30V See Fig. 7	
C_{res}	Reverse Transfer Capacitance	—	4.0	—		ƒ = 1.0MHz	
t_{rr}	Diode Reverse Recovery Time	—	28	42	ns	T_J = 25°C See Fig.	
		—	38	57		T_J = 125°C 14	I_F =4.0A
I_{rr}	Diode Peak Reverse Recovery Current	—	2.9	5.2	A	T_J = 25°C See Fig.	
		—	3.7	6.7		T_J = 125°C 15	V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	40	60	nC	T_J = 25°C See Fig.	
		—	70	105		T_J = 125°C 16	di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	280	—	A/µs	T_J = 25°C See Fig.	
	During t_b	—	235	—		T_J = 125°C 17	

Details of note ① through ④ are on the last page

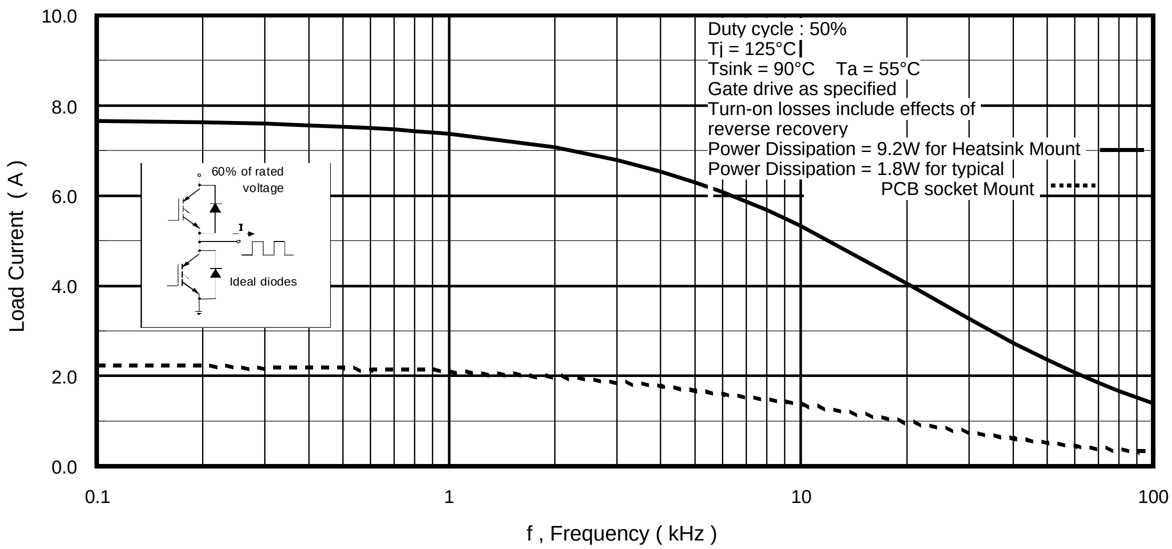


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

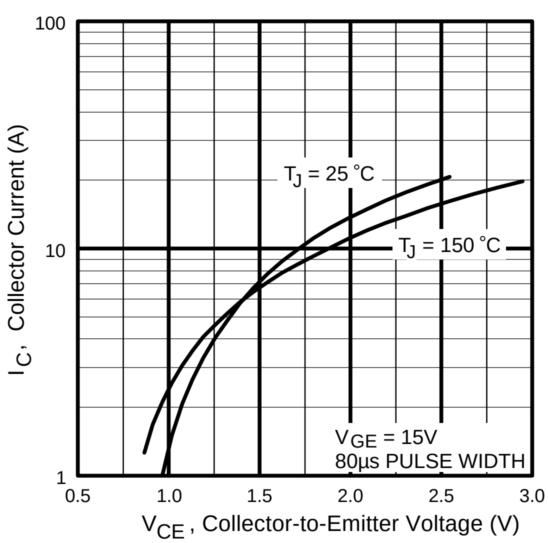


Fig. 2 - Typical Output Characteristics

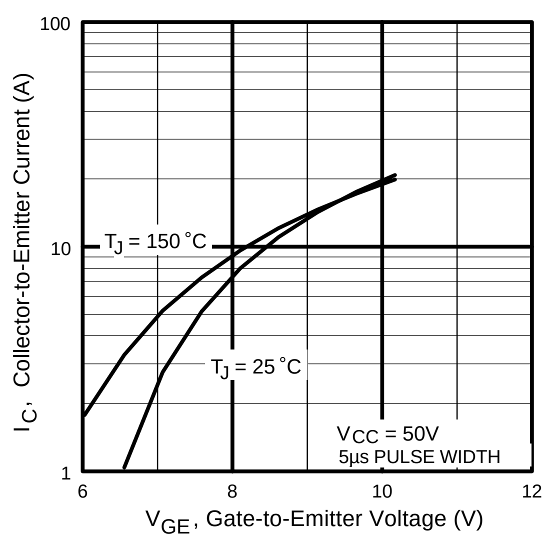


Fig. 3 - Typical Transfer Characteristics

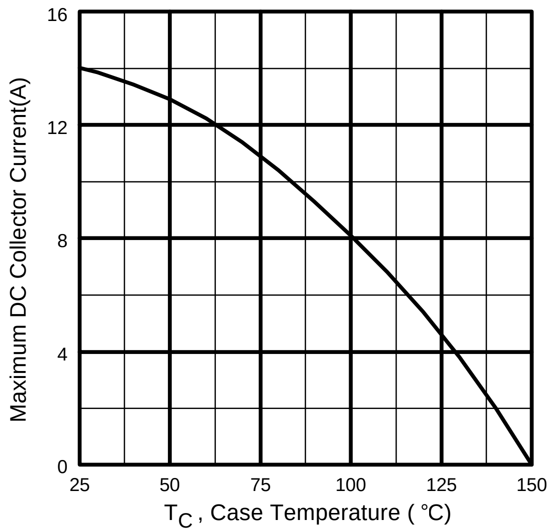


Fig. 4 - Maximum Collector Current vs. Case Temperature

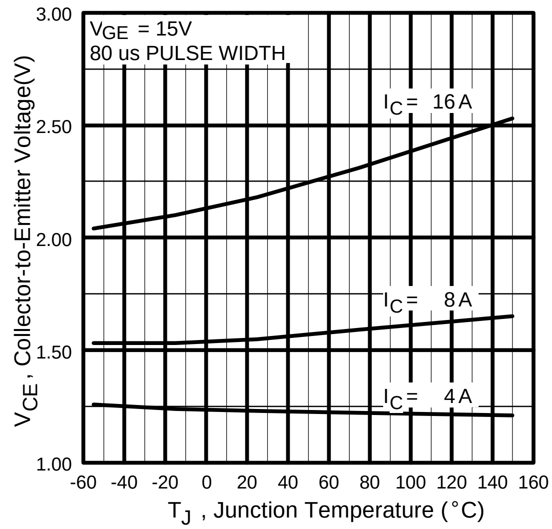


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

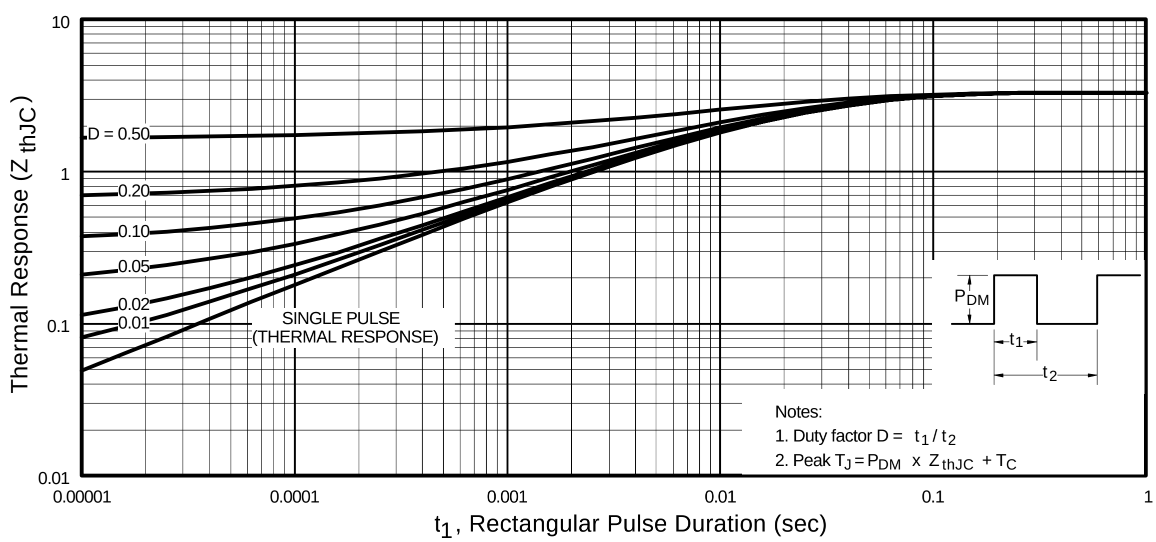


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

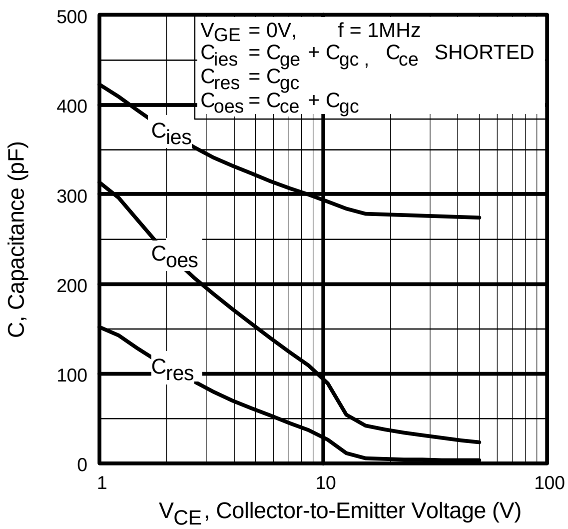


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

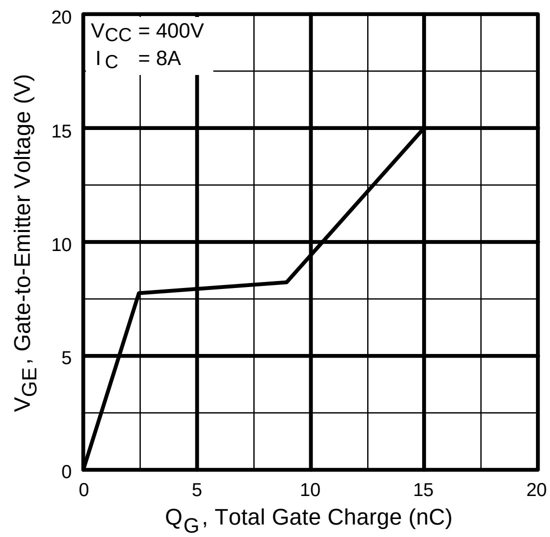


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

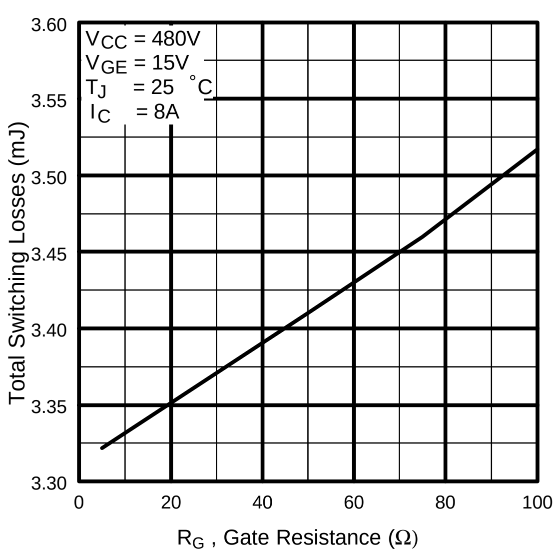


Fig. 9 - Typical Switching Losses vs. Gate Resistance

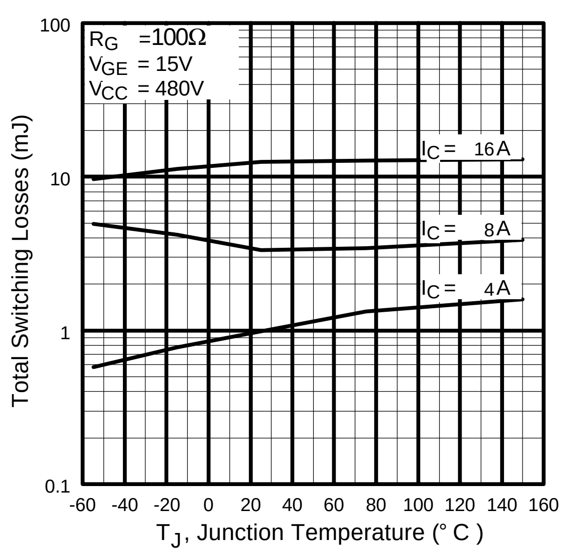


Fig. 10 - Typical Switching Losses vs. Junction Temperature

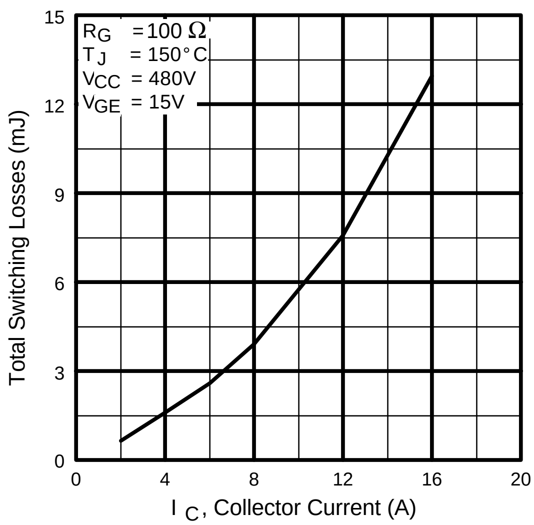


Fig. 11 - Typical Switching Losses vs. Collector Current

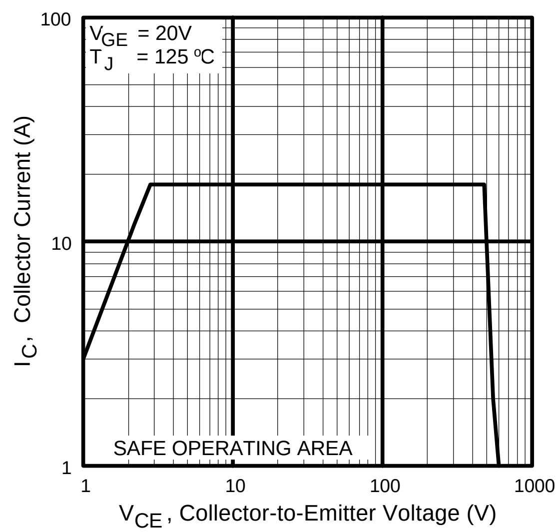


Fig. 12 - Turn-Off SOA

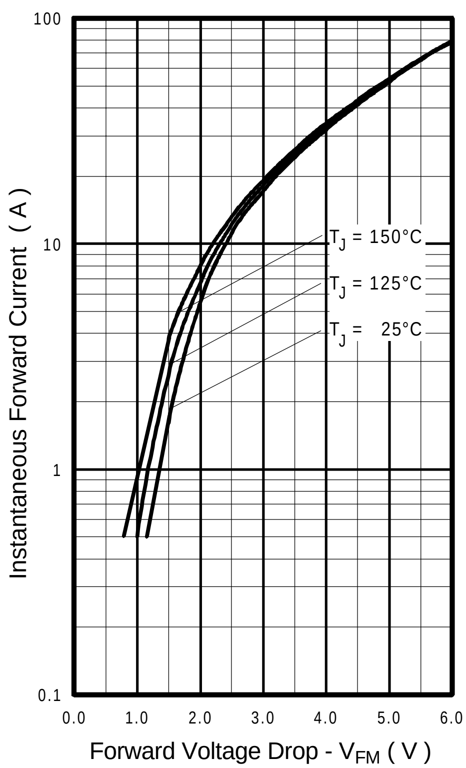


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

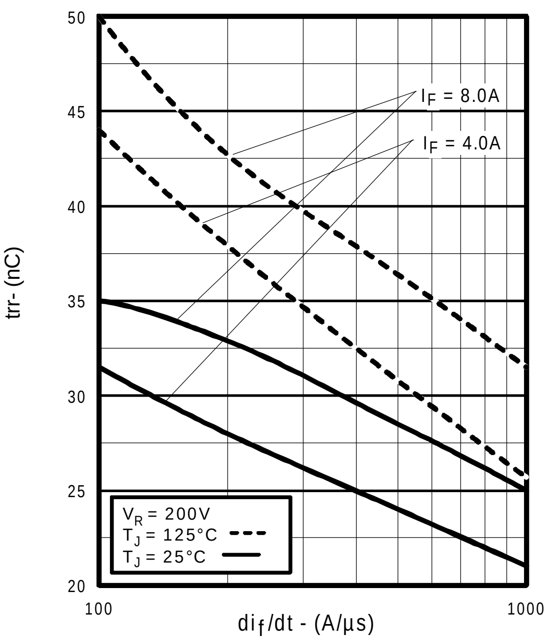


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

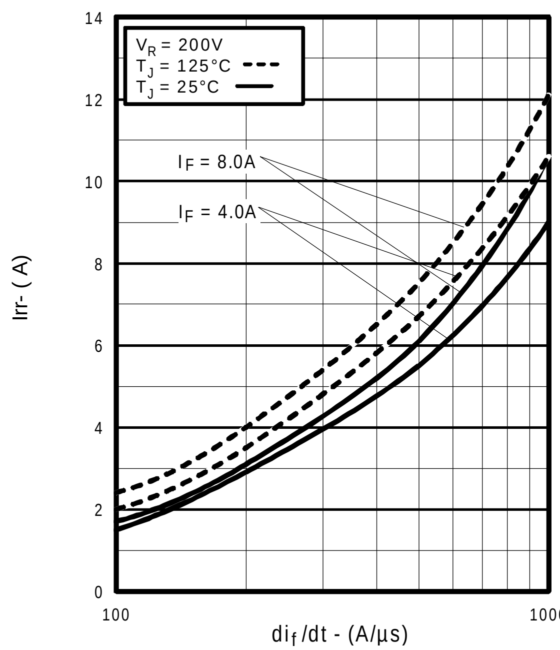


Fig. 15 - Typical Recovery Current vs. di_f/dt

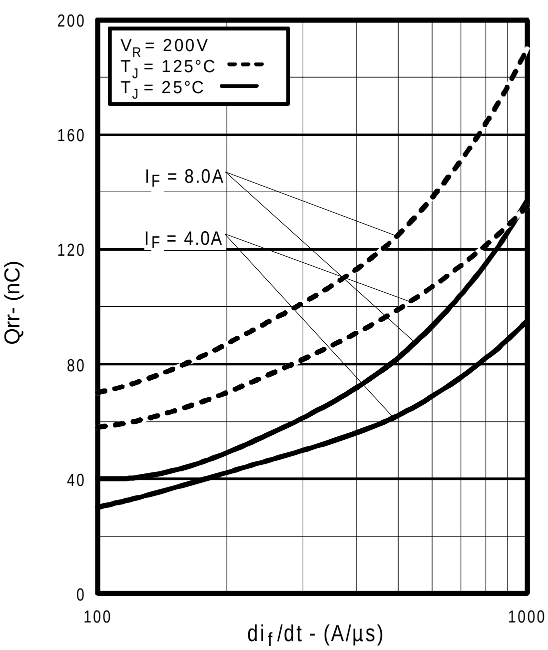


Fig. 16 - Typical Stored Charge vs. di_f/dt

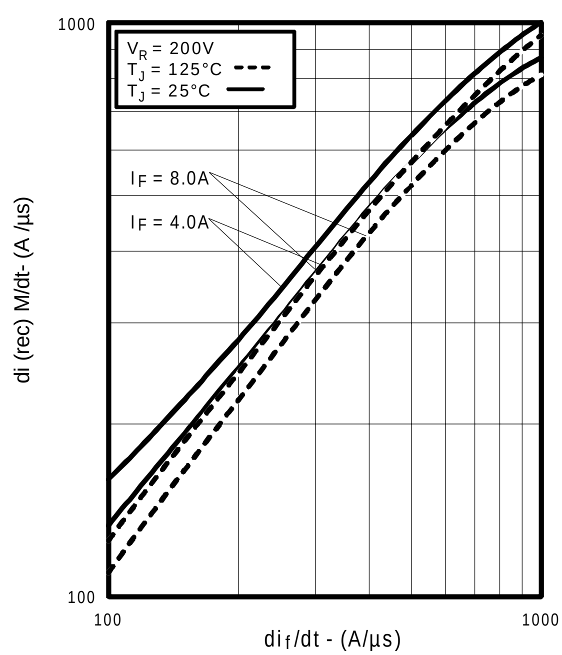


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt,

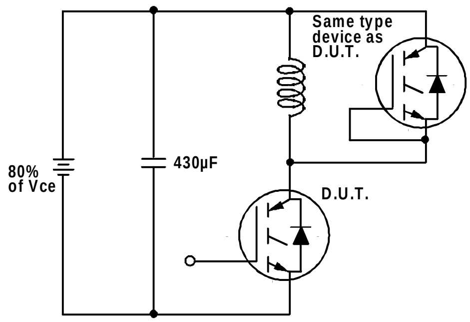


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

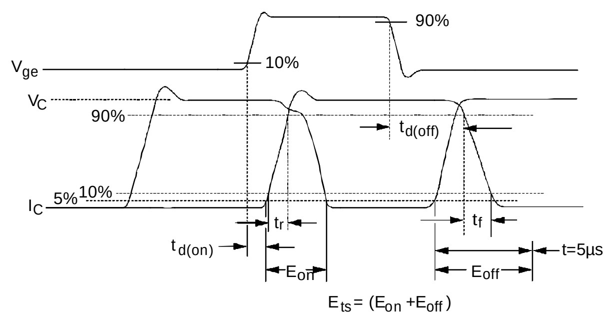


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

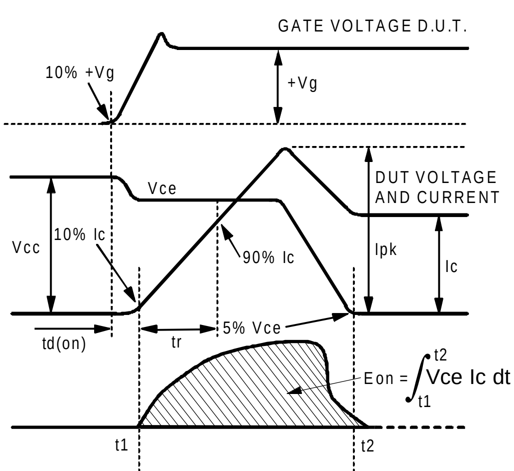


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

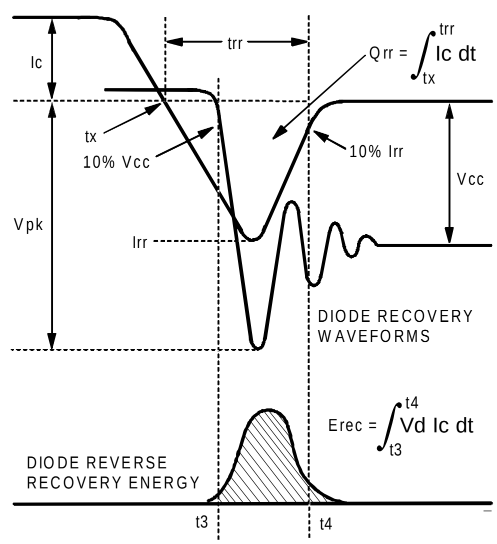


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

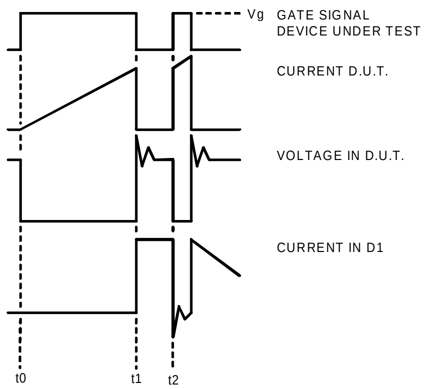


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

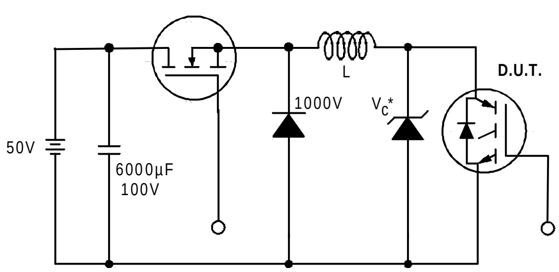


Figure 19. Clamped Inductive Load Test Circuit

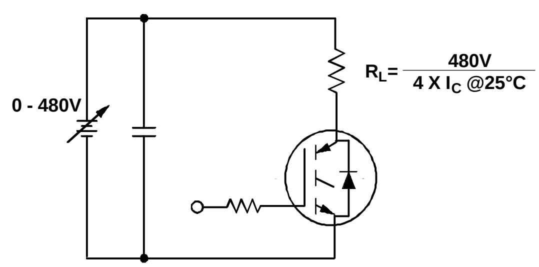
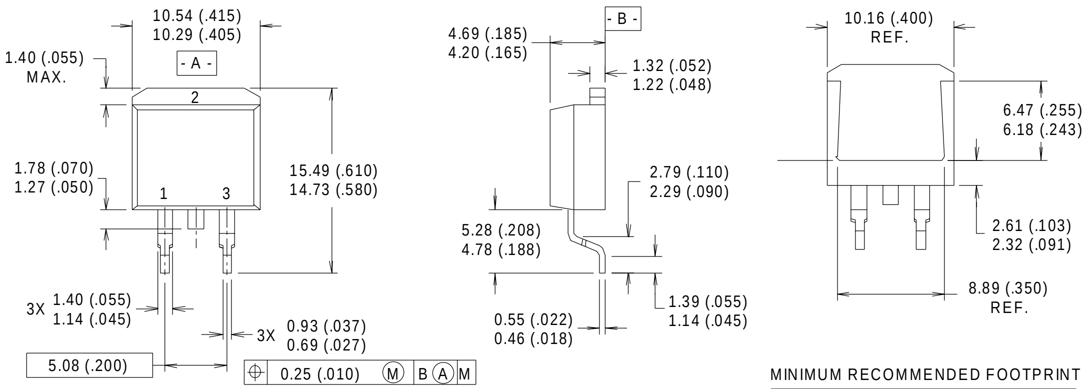
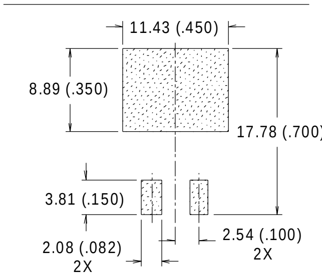


Figure 20. Pulsed Collector Current Test Circuit

D²Pak Package Outline



MINIMUM RECOMMENDED FOOTPRINT

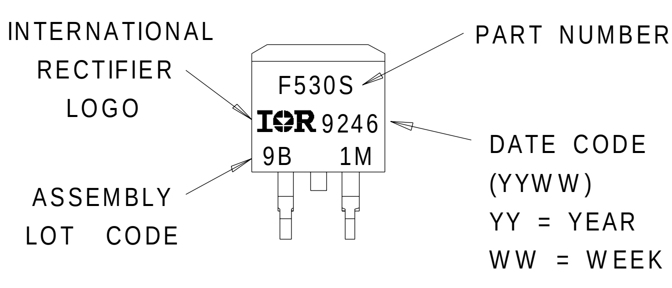


NOTES:

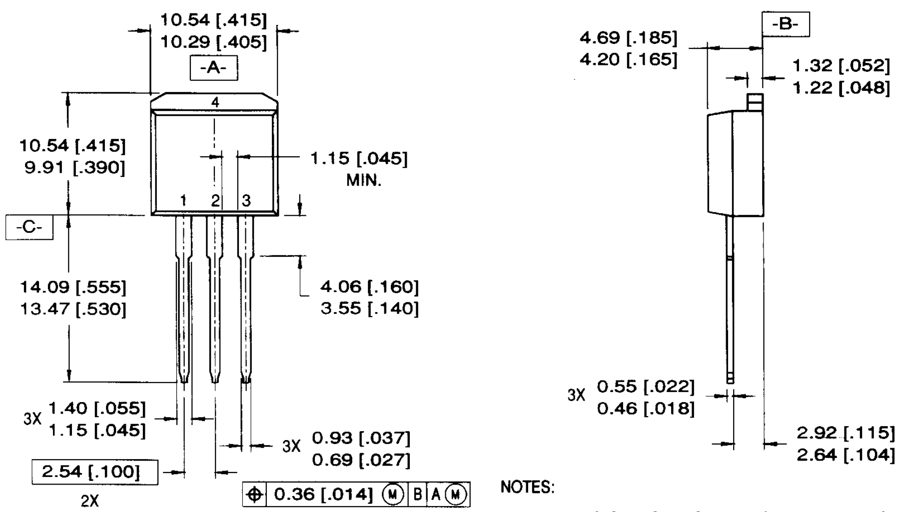
1. DIMENSIONS AFTER SOLDER DIP.
2. DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIMENSION : INCH.
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

LEAD ASSIGNMENTS
1 - GATE
2 - DRAIN
3 - SOURCE

D²Pak Part Marking Information



TO-262 Package Outline



LEAD ASSIGNMENTS

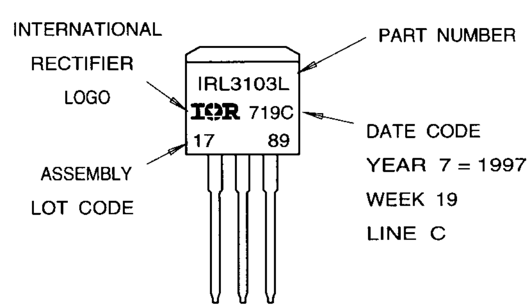
1 = GATE
2 = DRAIN
3 = SOURCE
4 = DRAIN

NOTES:

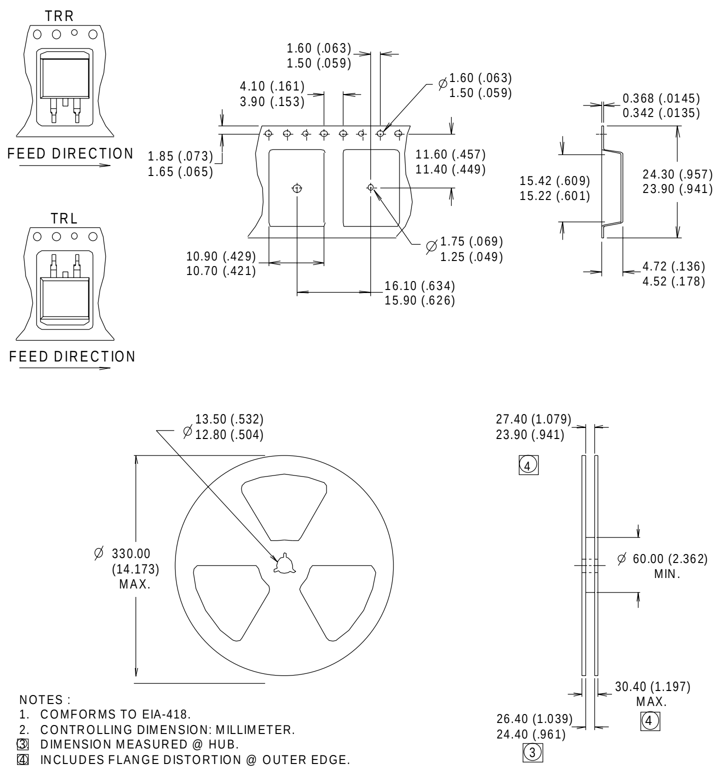
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



D^{2}Pak Tape & Reel Information



Notes:

① Repetitive rating: V_{GE}=20V; pulse width limited by maximum junction temperature (figure 20)

② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G = 100W (figure 19)

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

⑤ This only applies to TO-262 package.

⑥ This applies to D^{2}Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.06/01

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/