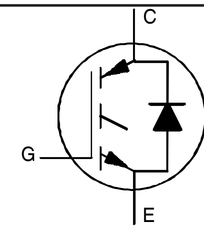
PD - 95613

International
IOR Rectifier

IRG4BC15UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

UltraFast CoPack IGBT



n-channel

V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 2.02V

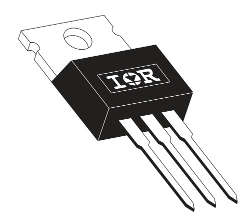
@V_{GE} = 15V, I_C = 7.8A

Features

- UltraFast: Optimized for high frequencies from10 to 30 kHz in hard switching
- IGBT Co-packaged with ultra-soft-recovery antiparallel diode
- Industry standard TO-220AB package
- Lead-Free

Benefits

- Best Value for Appliance and Industrial Applications
- High noise immune "Positive Only" gate drive- Negative bias gate drive not necessary
- For Low EMI designs- requires little or no snubbing
- Single Package switch for bridge circuit applications
- Compatible with high voltage Gate Driver IC's
- Allows simpler gate drive


TO-220AB

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	7.8	
I_{CM}	Pulsed Collector Current ①	42	
I_{LM}	Clamped Inductive Load Current ②	42	
I_F @ T_C = 100°C	Diode Continuous Forward Current	4.0	
I_{FM}	Diode Maximum Forward Current	16	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	49	W
P_D @ T_C = 100°C	Maximum Power Dissipation	19	
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)	
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	–––	–––	2.7	°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	–––	–––	80	
Wt	Weight	–––	2 (0.07)	–––	g (oz)

8/2/04

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	—	0.63	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.02	2.4	V	I_C = 7.8A, V_{GE} = 15V
		—	2.56	—		I_C = 14A
		—	2.21	—		I_C = 7.8A, 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	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ④	4.1	6.2	—	S	V_{CE} = 100V, I_C = 7.8A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V
		—	—	1400		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
		—	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)	—	23	35	nC	I_C = 7.8A	
Qge	Gate - Emitter Charge (turn-on)	—	4.0	6.0		V_{CC} = 400V	
Q_{gc}	Gate - Collector Charge (turn-on)	—	9.6	14		V_{GE} = 15V	
$t_{d(on)}$	Turn-On Delay Time	—	17	—	ns	T_J = 25°C	
t_r	Rise Time	—	20	—		I_C = 7.8A, V_{CC} = 480V	
$t_{d(off)}$	Turn-Off Delay Time	—	160	240		V_{GE} = 15V, R_G = 75Ω	
t_f	Fall Time	—	83	120		Energy losses include "tail" and	
E_{on}	Turn-On Switching Loss	—	0.24	—	mJ	diode reverse recovery.	
E_{off}	Turn-Off Switching Loss	—	0.26	—			
E_{ts}	Total Switching Loss	—	0.50	0.63			
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	T_J = 150°C,	
t_r	Rise Time	—	21	—		I_C = 7.8A, V_{CC} = 480V	
$t_{d(off)}$	Turn-Off Delay Time	—	180	—		V_{GE} = 15V, R_G = 75Ω	
t_f	Fall Time	—	220	—		Energy losses include "tail" and	
E_{ts}	Total Switching Loss	—	0.76	—	mJ	diode reverse recovery.	
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package	
C_{ies}	Input Capacitance	—	410	—	pF	V_{GE} = 0V	
C_{oes}	Output Capacitance	—	37	—		V_{CC} = 30V	
C_{res}	Reverse Transfer Capacitance	—	5.3	—		ƒ = 1.0MHz	
t_{rr}	Diode Reverse Recovery Time	—	28	42	ns	T_J = 25°C	
		—	38	57		T_J = 125°C	I_F = 4.0A
I_{rr}	Diode Peak Reverse Recovery Current	—	2.9	5.2	A	T_J = 25°C	
		—	3.7	6.7		T_J = 125°C	V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	40	60	nC	T_J = 25°C	
		—	70	110		T_J = 125°C	di/dt 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	280	—	A/µs	T_J = 25°C	
		—	240	—		T_J = 125°C	

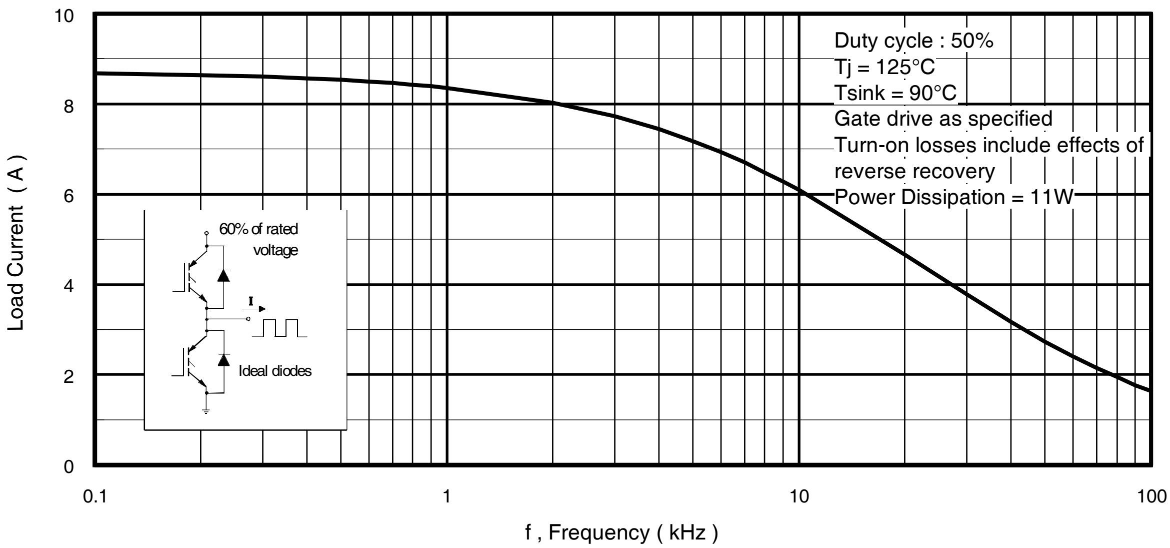


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

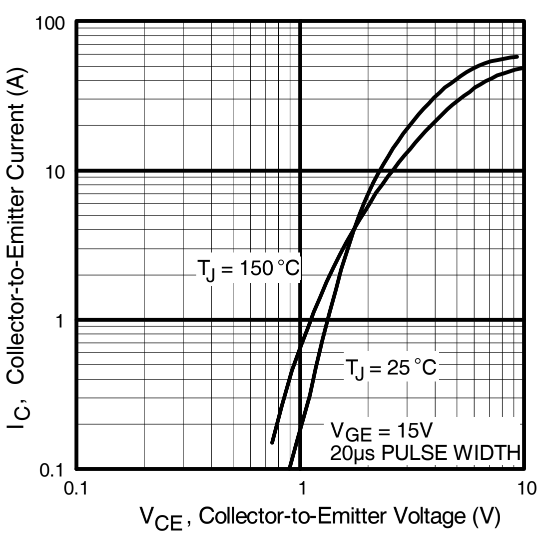


Fig. 2 - Typical Output Characteristics

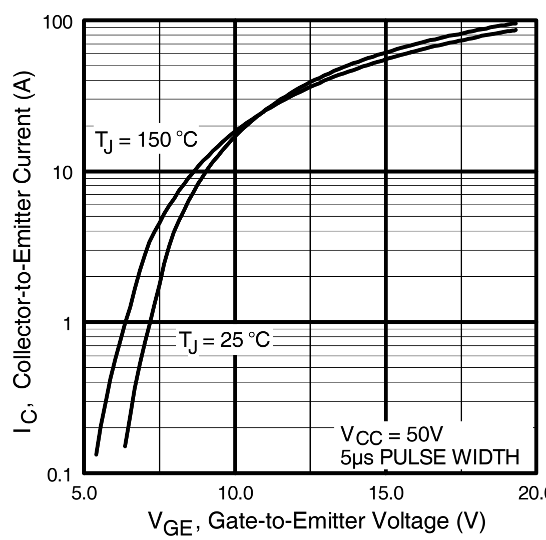


Fig. 3 - Typical Transfer Characteristics

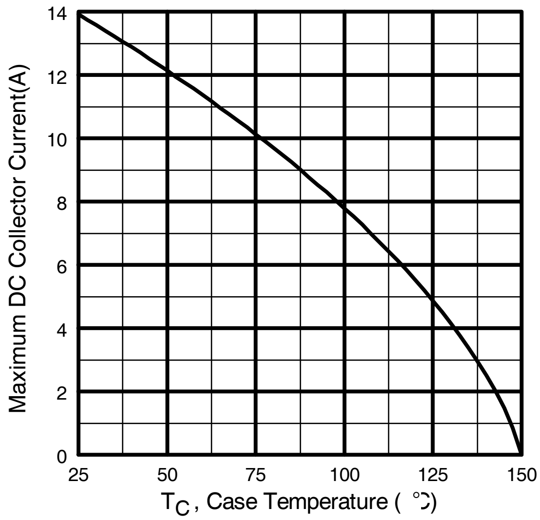


Fig. 4 - Maximum Collector Current vs. Case Temperature

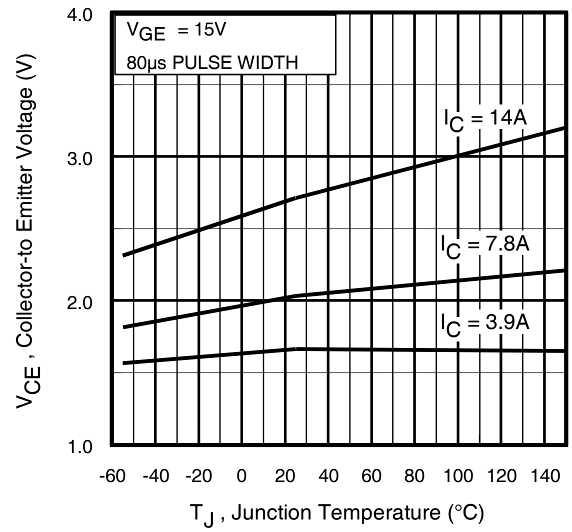


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

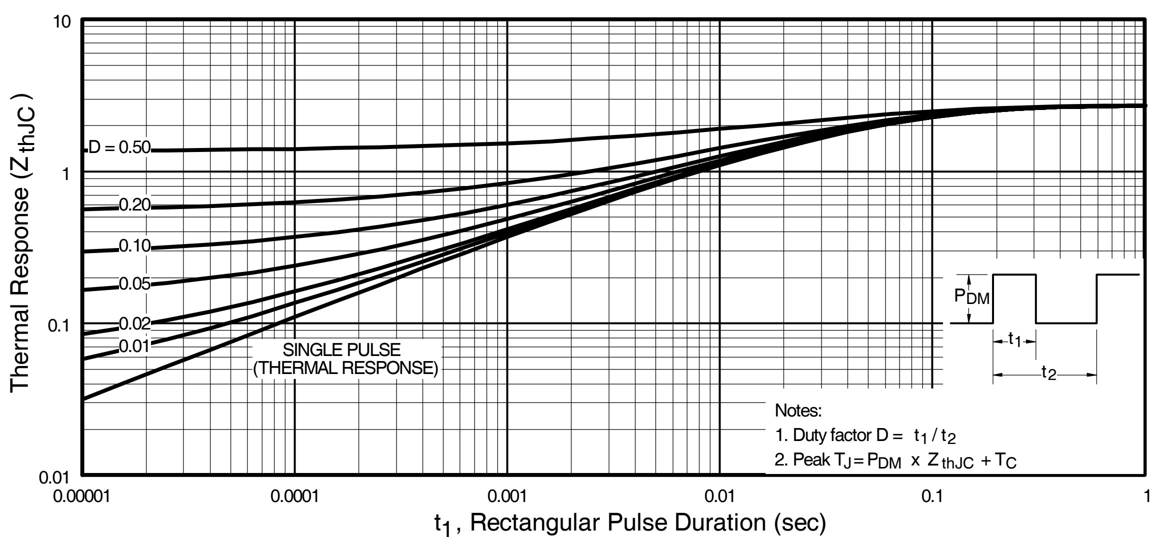


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

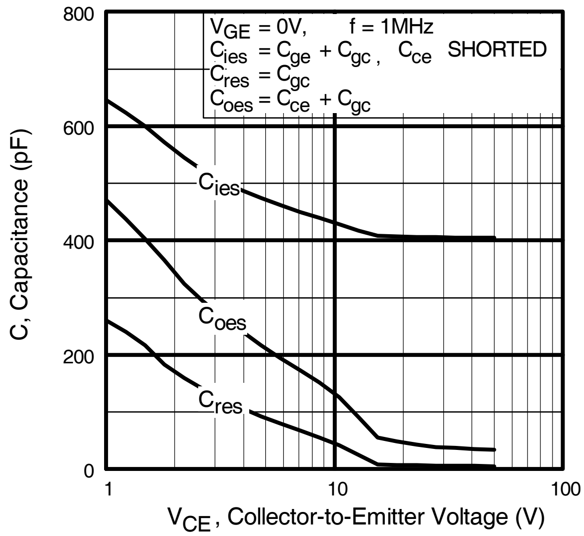


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

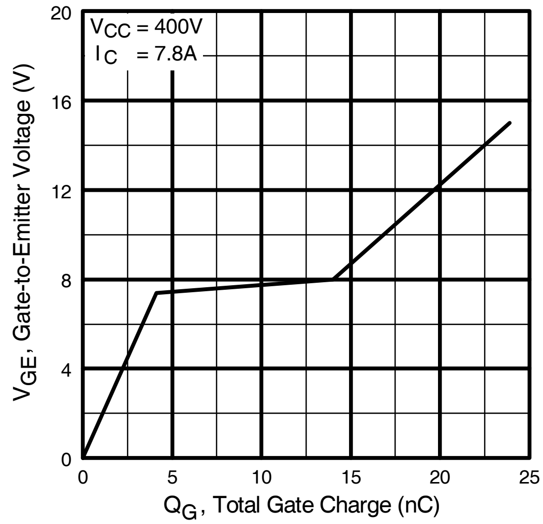


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

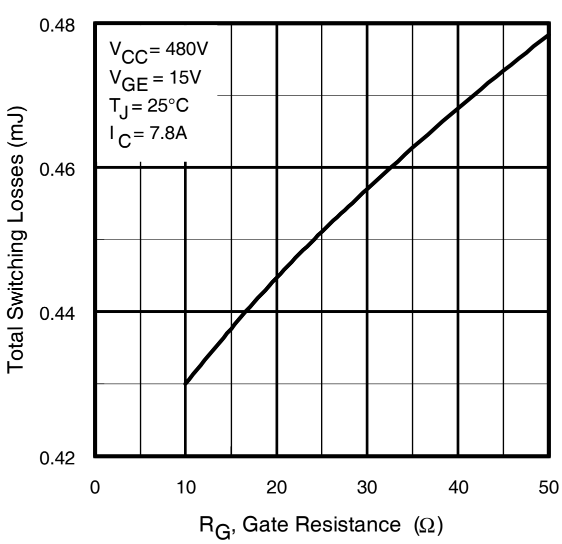


Fig. 9 - Typical Switching Losses vs. Gate Resistance

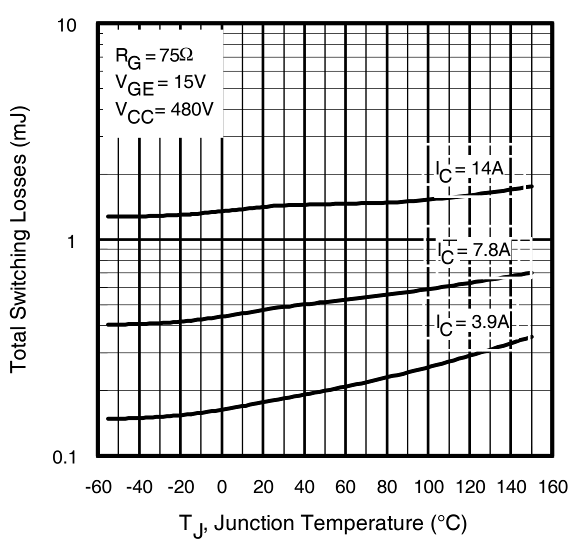


Fig. 10 - Typical Switching Losses vs. Junction Temperature

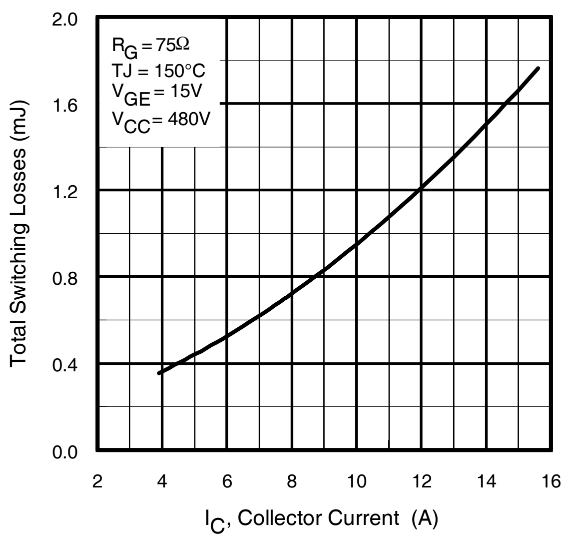


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

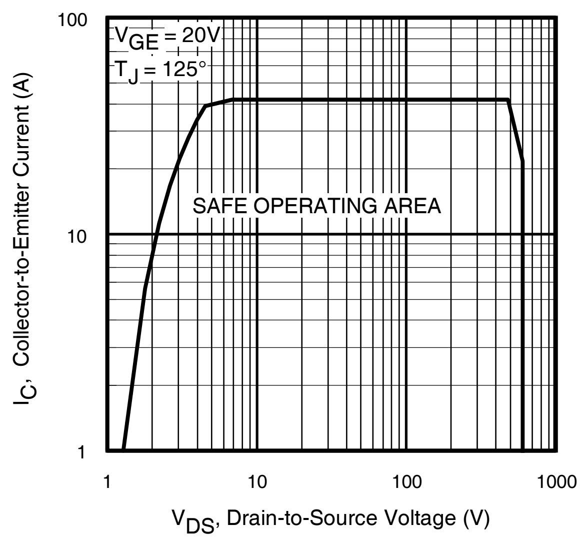


Fig. 12 - Turn-Off SOA

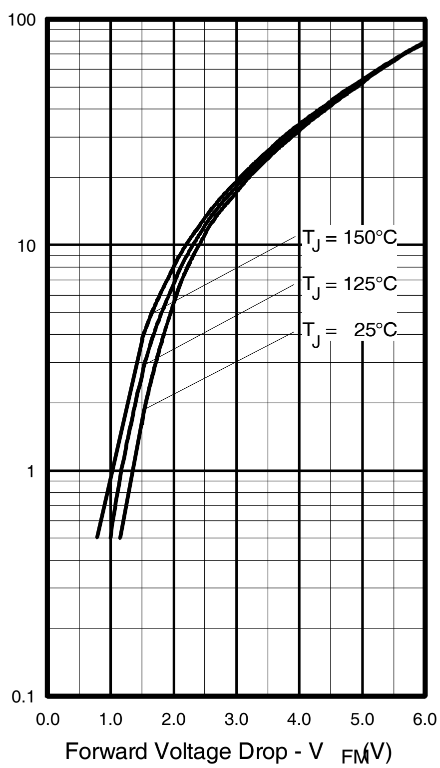


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

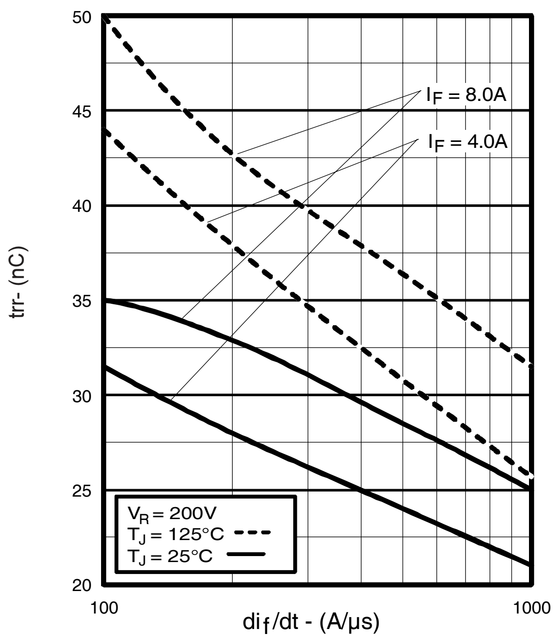


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

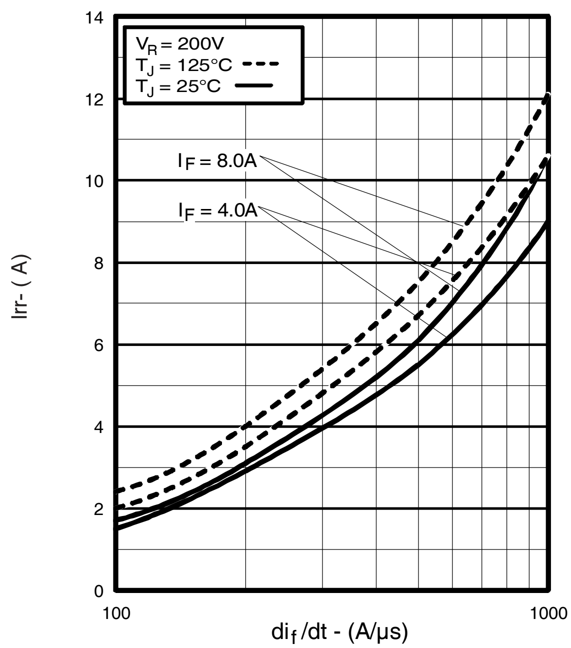


Fig. 15 - Typical Recovery Current vs. di_f/dt

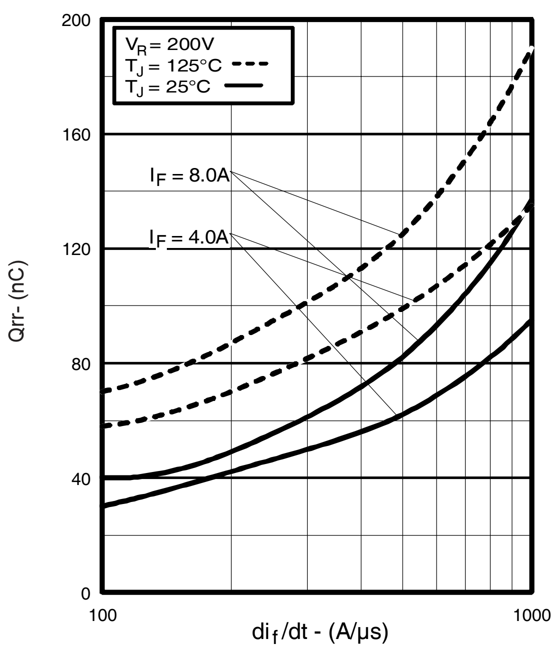


Fig. 16 - Typical Stored Charge vs. di_f/dt

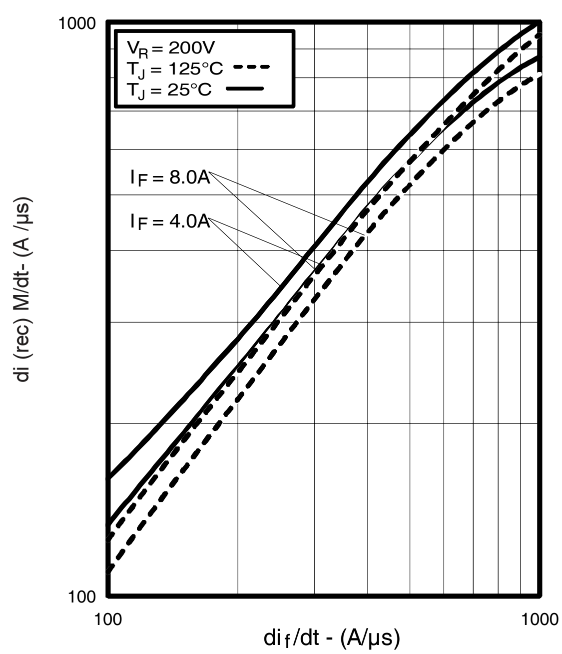


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt,

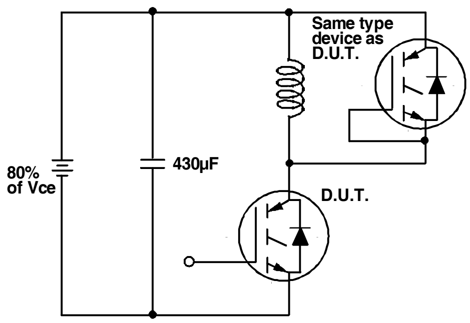


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

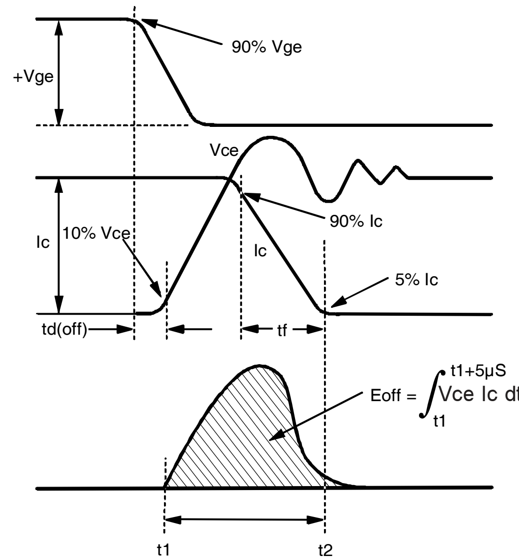


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

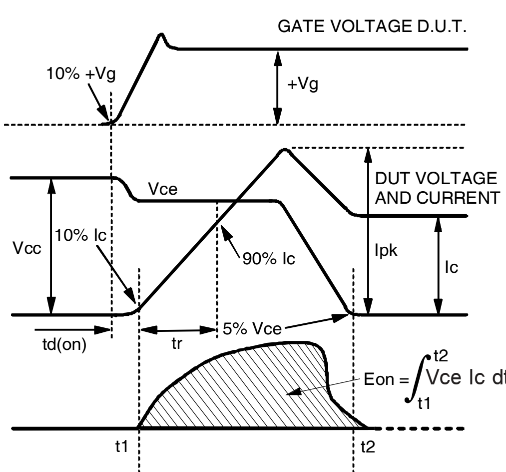


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

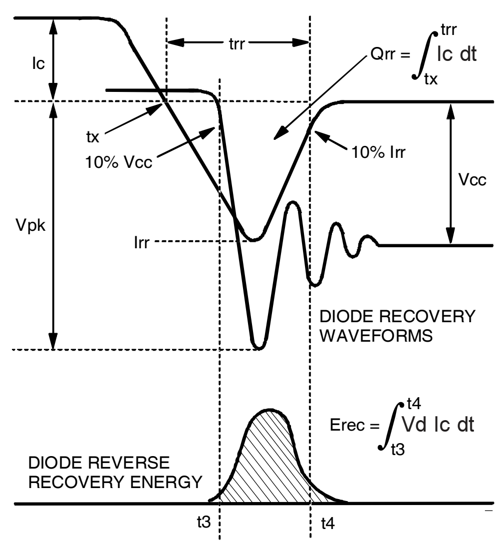


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

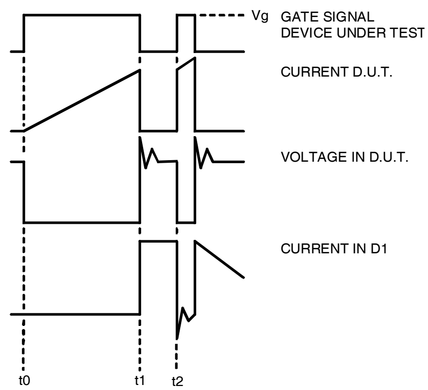


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

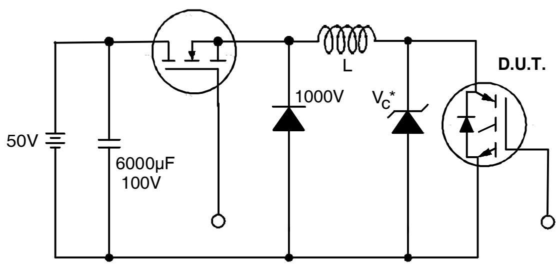


Figure 19. Clamped Inductive Load Test Circuit

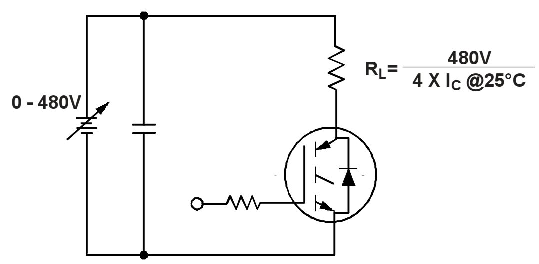


Figure 20. Pulsed Collector Current Test Circuit

Notes:

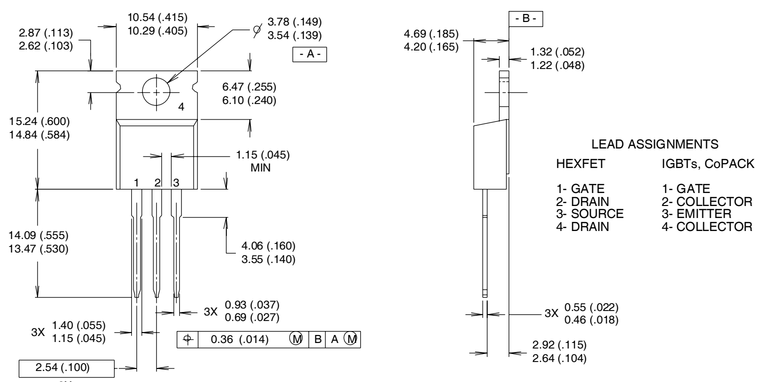
① Repetitive rating: V_{GE}=20V; pulse width limited by maximum junction temperature

② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G = 75Ω

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

④ Pulse width 5.0µs, single shot.

TO-220AB Package Outline



NOTES:

1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.

2 CONTROLLING DIMENSION : INCH

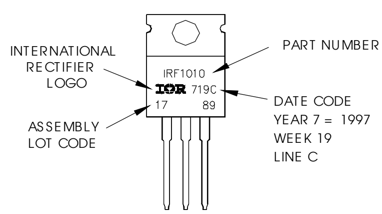
3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.

4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"



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

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