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International
IOR Rectifier

PD - 91686

IRG4PSH71UD

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

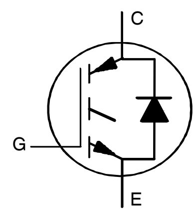
UltraFast Copack IGBT

Features

- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark Super-247 package with higher power handling capability compared to same footprint TO-247
- Creepage distance increased to 5.35mm

Benefits

- Generation 4 IGBT's offer highest efficiencies available
- Maximum power density, twice the power handling of the TO-247, less space than TO-264
- IGBTs optimized for specific application conditions
- Cost and space saving in designs that require multiple, paralleled IGBTs
- HEXFRED^{TM} antiparallel Diode minimizes switching losses and EMI

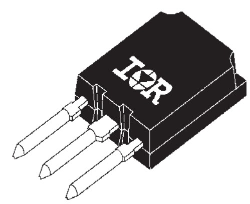


n-channel

V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 2.52V

@V_{GE} = 15V, I_C = 50A



SUPER - 247

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	99	A
I_C @ T_C = 100°C	Continuous Collector Current	50	
I_{CM}	Pulse Collector Current ①	200	
I_{LM}	Clamped Inductive Load current ②	200	
V_{GE}	Gate-to-Emitter Voltage	±20	V
I_F @ Tc = 100°C	Diode Continuous Forward Current	70	
I_{FM}	Diode Maximum Forward Current	200	
P_D @ T_C = 25°C	Maximum Power Dissipation	350	W
P_D @ T_C = 100°C	Maximum Power Dissipation	140	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Storage Temperature Range, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal / Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	–––	–––	0.36	°C/W
$R_{\theta JC}$	Junction-to-Case- Diode	–––	–––	0.36	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	–––	0.24	–––	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	–––	–––	38	
	Recommended Clip Force	20 (2.0)			N (kgf)
Wt	Weight	–––	6 (0.21)	–––	g (oz.)

5/24/04

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ③	1200	—	—	V	V_{GE} = 0V, I_C = 250µA	
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage	19	—	—	V	V_{GE} = 0V, I_C = 1.0A	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.78	—	V/°C	V_{GE} = 0V, I_C = 1mA	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.52	2.70	V	I_C = 70A	V_{GE} = 15V
		—	3.17	—		I_C = 140A	See Fig.2, 5
		—	2.68	—		I_C = 70A, T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}$, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-9.2	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 1.0mA	
gfe	Forward Transconductance ④	48	72	—	S	V_{CE} = 100V, I_C = 70A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	500	µA	V_{GE} = 0V, V_{CE} = 1200V	
		—	—	2.0		V_{GE} = 0V, V_{CE} = 10V	
		—	—	5000		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C	
V_{FM}	Diode Forward Voltage Drop	—	2.92	3.9	V	I_F = 70A See Fig.13	
		—	2.88	3.7		I_F = 70A, 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)	—	380	570	nC	I_C = 70A		
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	61	24		V_{CC} = 400V See Fig.8		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	130	200		V_{GE} = 15V		
$t_{d(on)}$	Turn-On delay time	—	46	—	ns	I_C = 70A, V_{CC} = 960V		
t_r	Rise time	—	77	—		V_{GE} = 15V, R_G = 5.0Ω		
$t_{d(off)}$	Turn-Off delay time	—	250	350		Energy losses include "tail"		
t_f	Fall time	—	220	330		See Fig. 9, 10, 11, 14		
E_{on}	Turn-On Switching Loss	—	8.8	—	mJ			
E_{off}	Turn-Off Switching Loss	—	9.4	—				
E_{tot}	Total Switching Loss	—	18.2	19.7				
$t_{d(on)}$	Turn-On delay time	—	43	—	ns	T_J = 150°C, See Fig. 9, 10, 11, 14		
t_r	Rise time	—	78	—		I_C = 70A, V_{CC} = 960V		
$t_{d(off)}$	Turn-Off delay time	—	330	—		V_{GE} = 15V, R_G = 5.0Ω		
t_f	Fall time	—	480	—		Energy losses include "tail"		
E_{TS}	Total Switching Loss	—	26	—	mJ			
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package		
C_{ies}	Input Capacitance	—	6640	—	pF	V_{GE} = 0V		
C_{oes}	Output Capacitance	—	420	—		V_{CC} = 30V, See Fig.7		
C_{res}	Reverse Transfer Capacitance	—	60	—		f = 1.0MHz		
t_{rr}	Diode Reverse Recovery Time	—	110	170	ns	T_J=25°C	See Fig	
		—	180	270		T_J=125°C	14	I_F = 70A
I_{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	A	T_J=25°C	See Fig	
		—	8.9	13		T_J=125°C	15	V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	350	530	nC	T_J=25°C	See Fig	
		—	870	1300		T_J=125°C	16	di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	150	230	A/µs	T_J=25°C	See Fig	
		—	130	200		T_J=125°C	17	

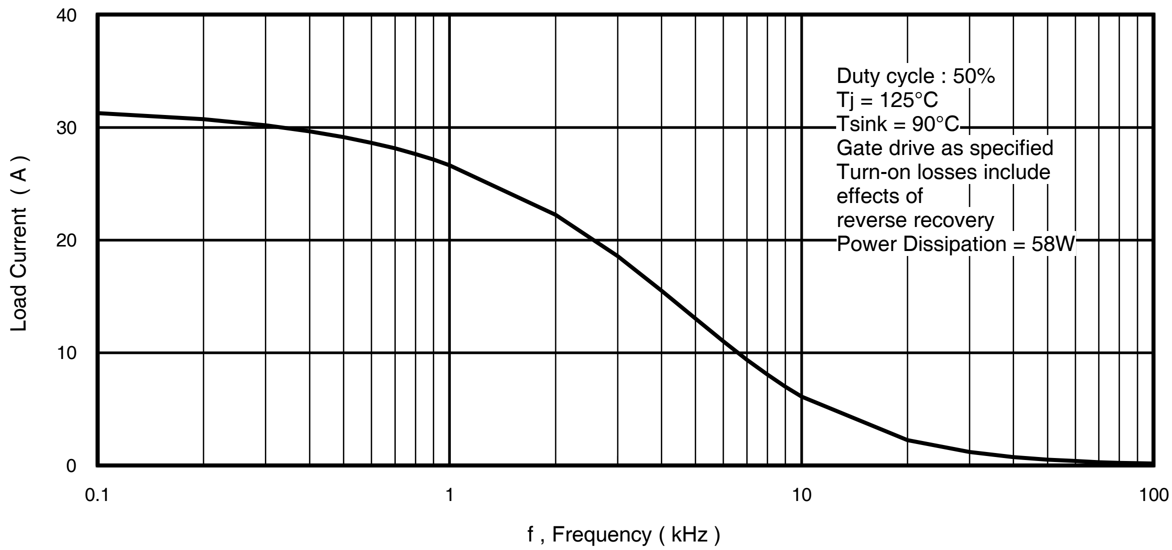


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

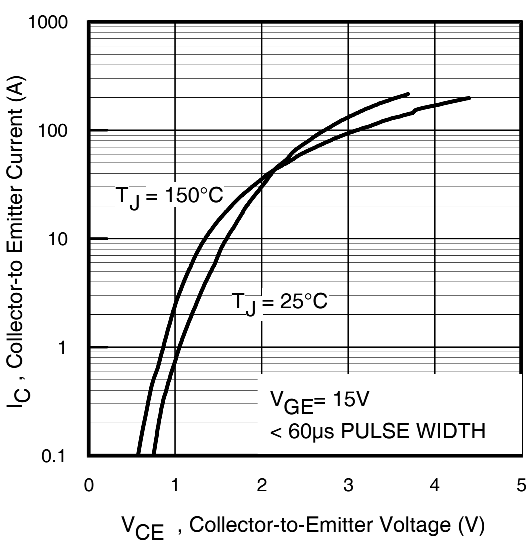


Fig. 2 - Typical Output Characteristics

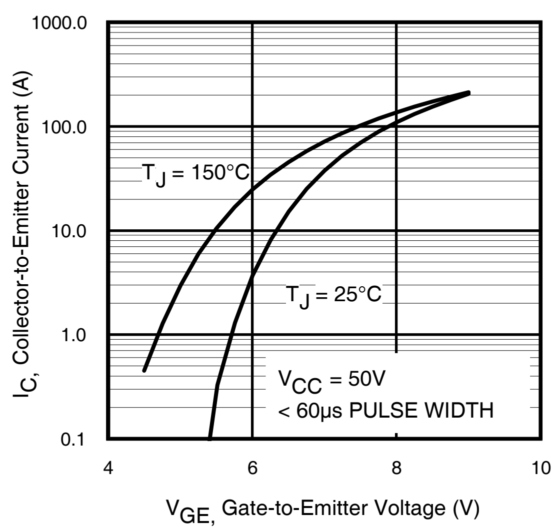


Fig. 3 - Typical Transfer Characteristics

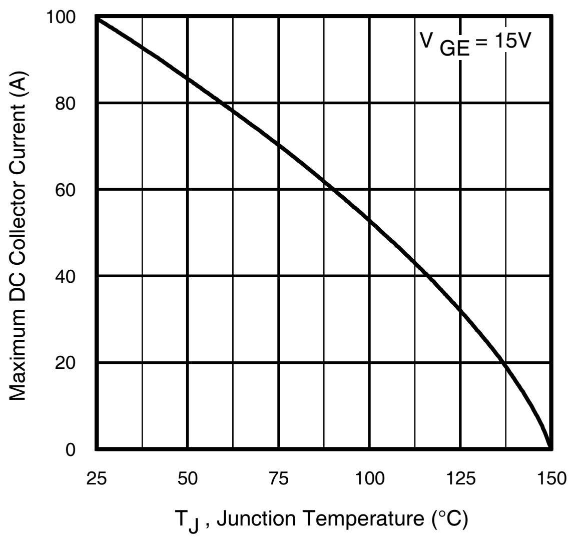


Fig. 4 - Maximum Collector Current vs. Case Temperature

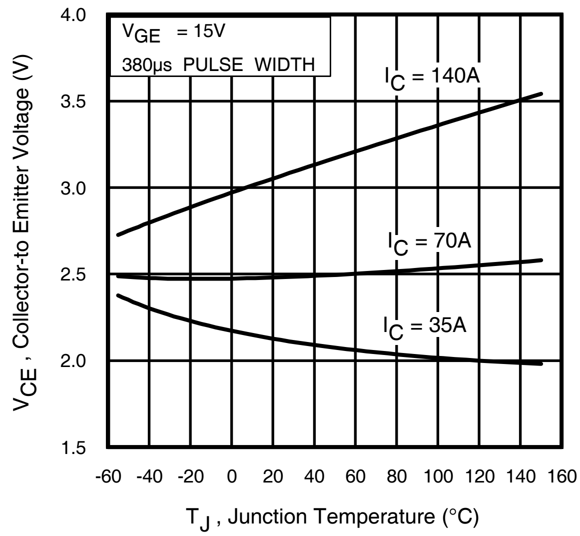
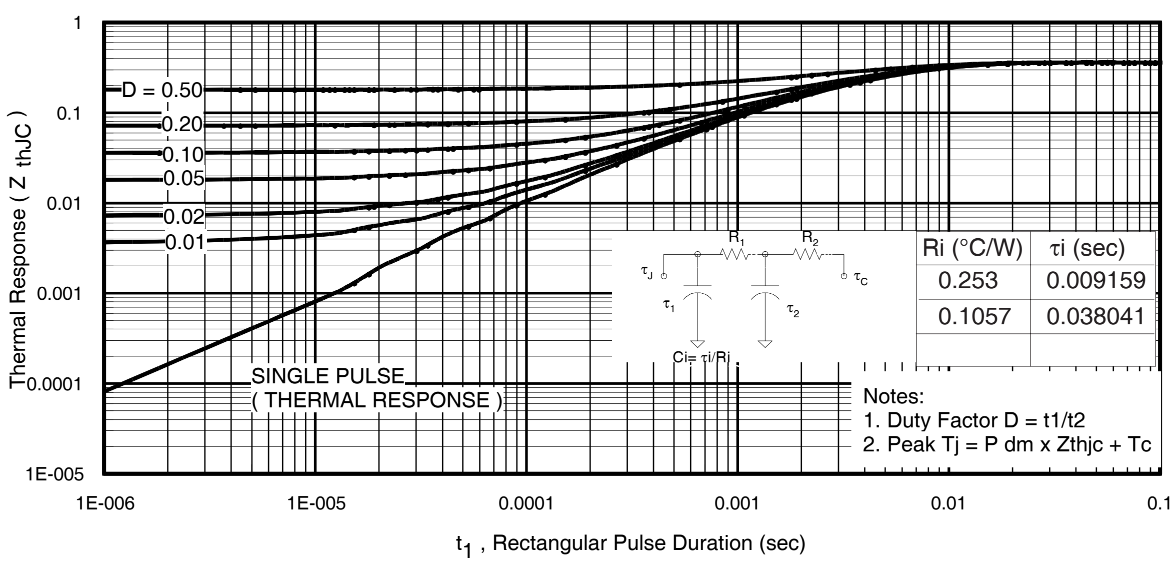


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature



Ri (°C/W)	τi (sec)
0.253	0.009159
0.1057	0.038041

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

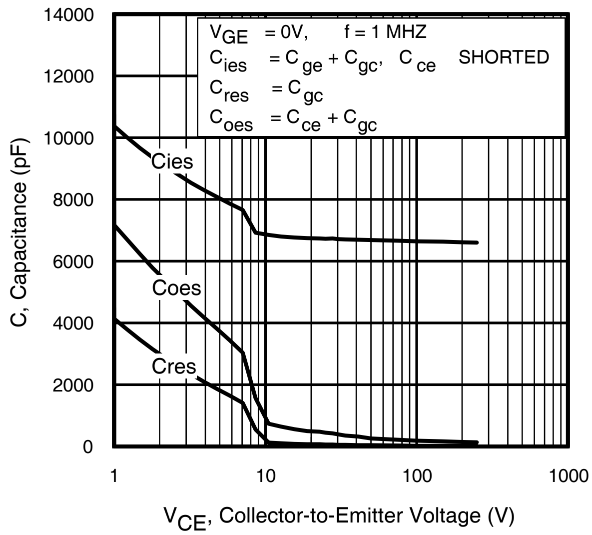


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

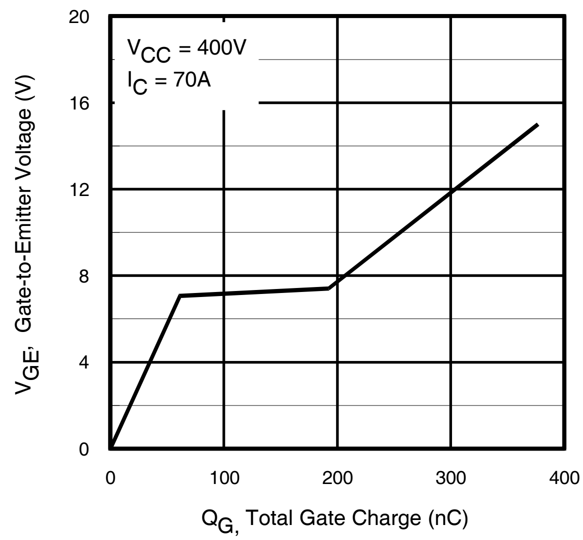


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

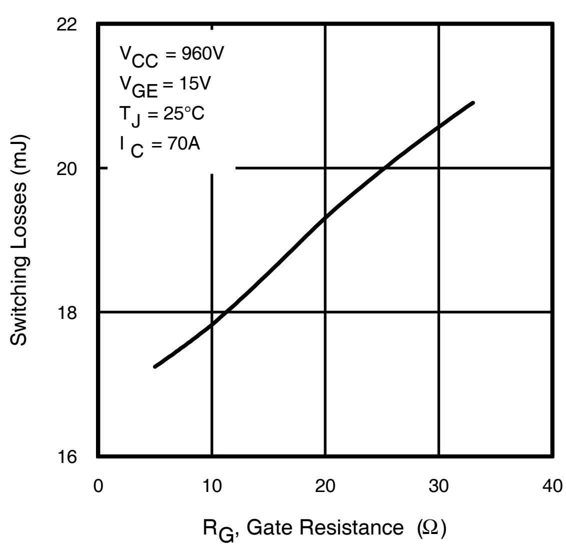


Fig. 9 - Typical Switching Losses vs. Gate Resistance

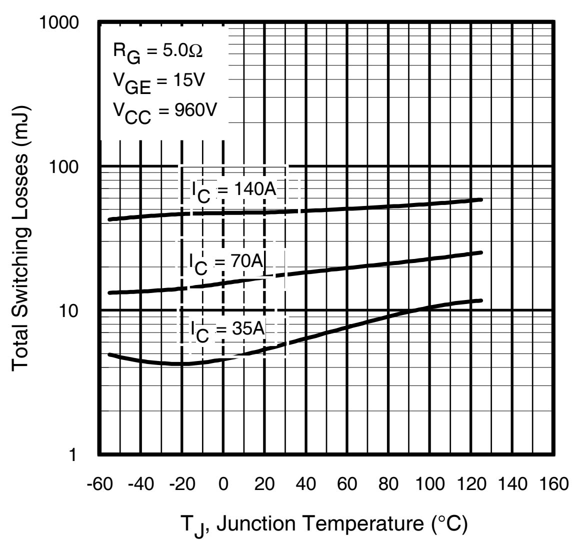


Fig. 10 - Typical Switching Losses vs. Junction Temperature

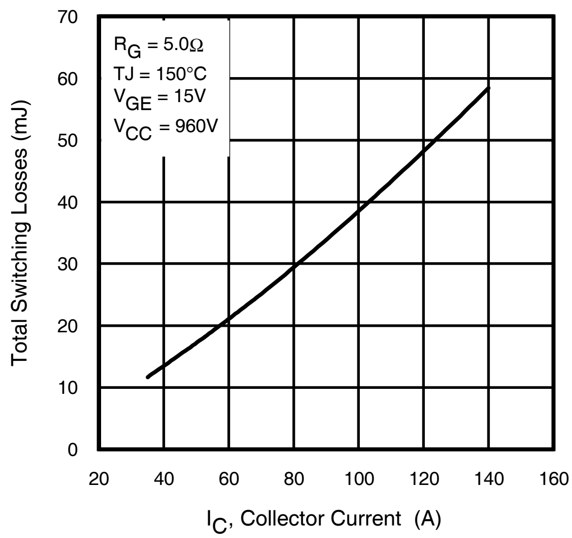


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

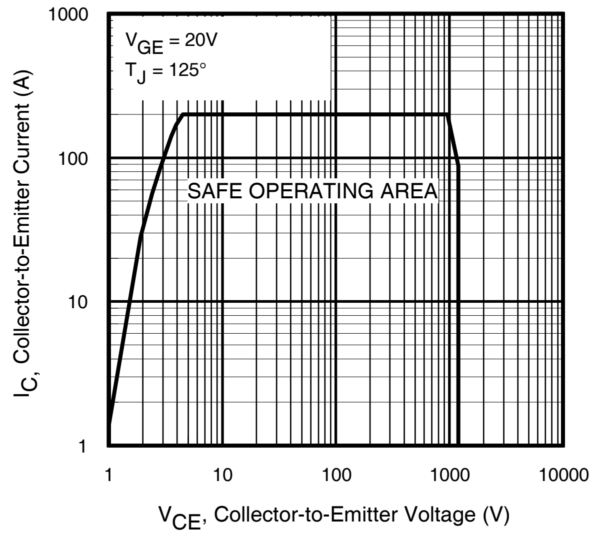


Fig. 12 - Turn-Off SOA

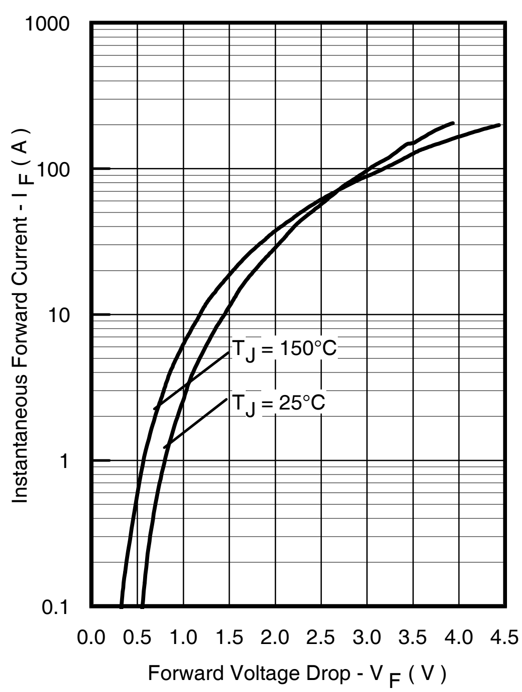


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

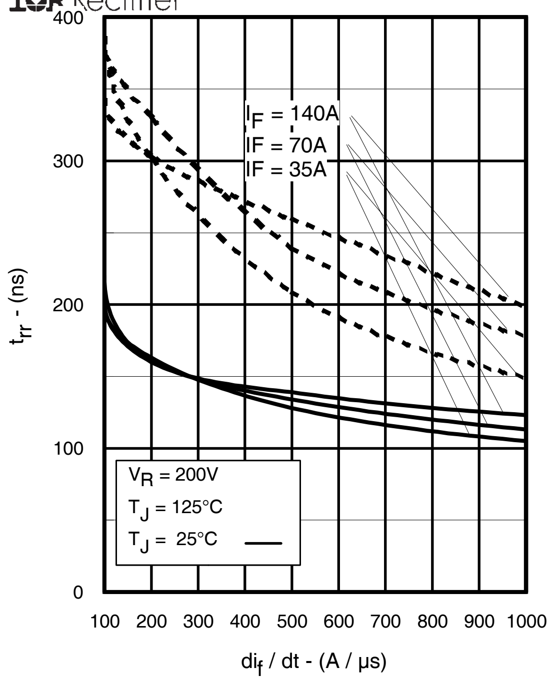


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

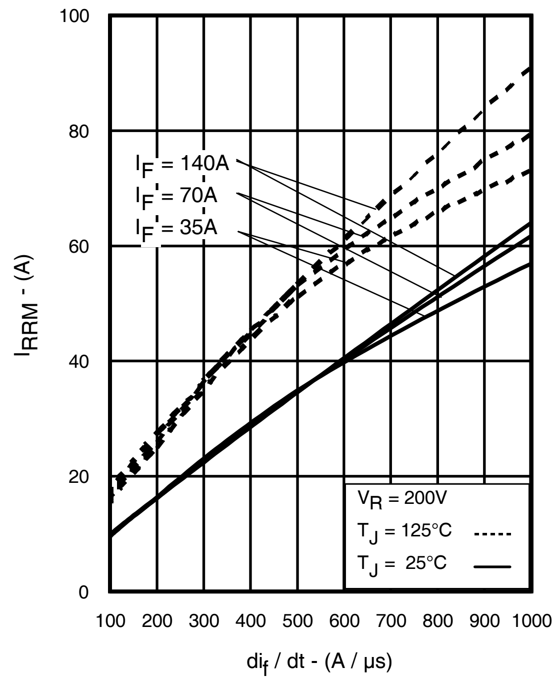


Fig. 15 - Typical Recovery Current vs. di_f/dt

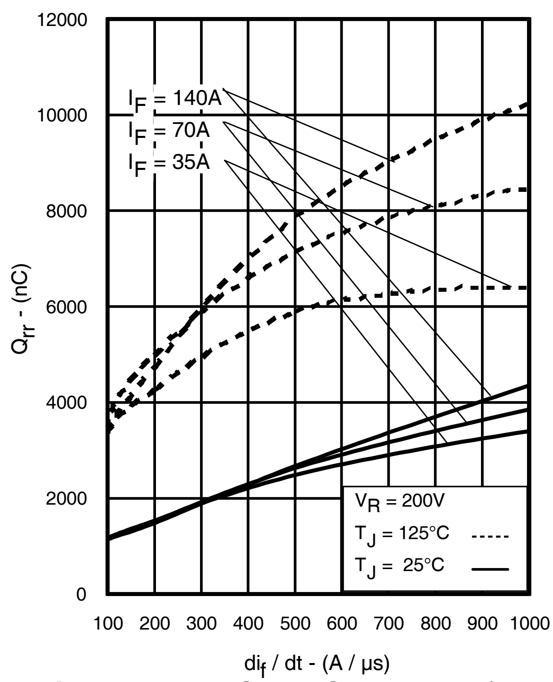


Fig. 16 - Typical Stored Charge vs. di_f/dt

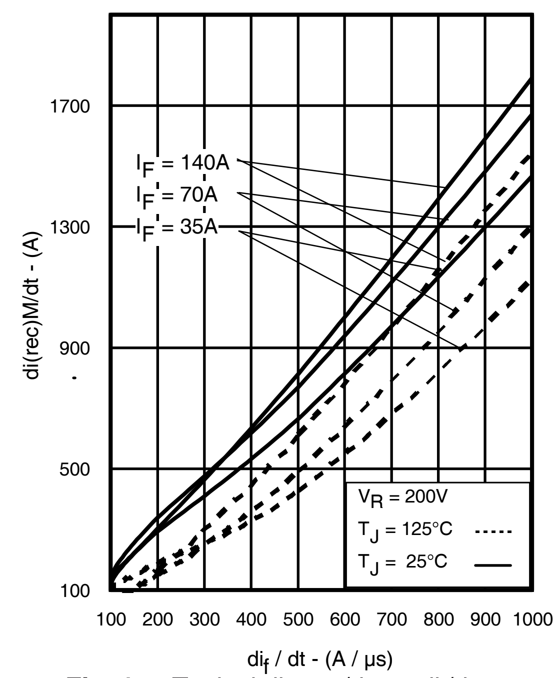


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

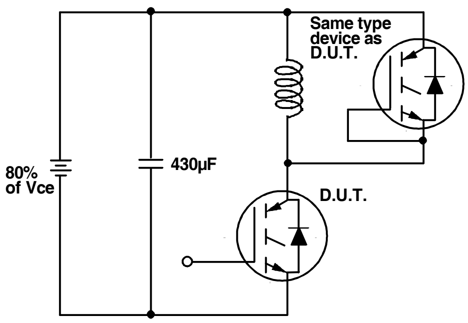


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

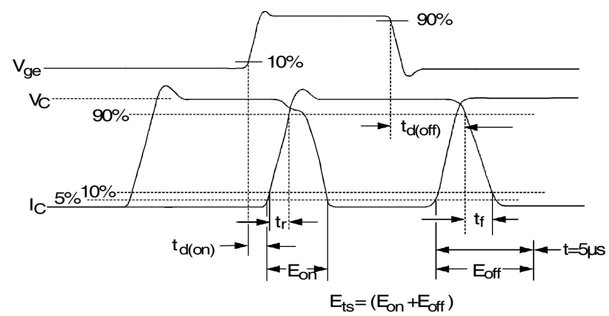


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

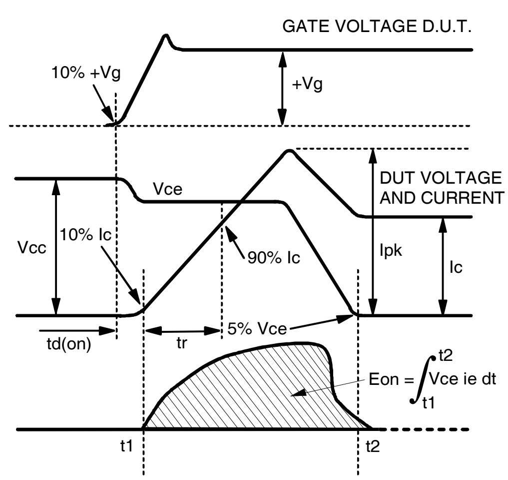


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

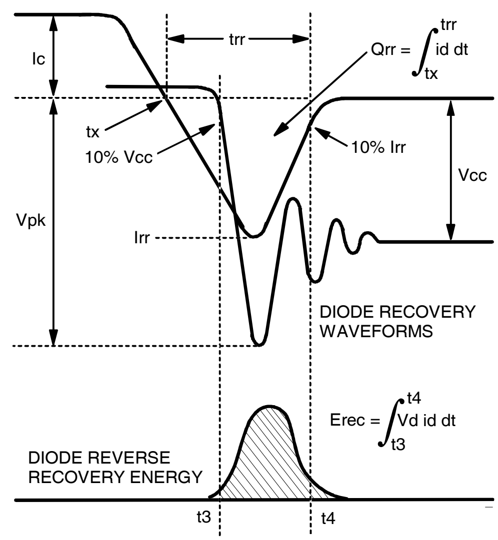


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

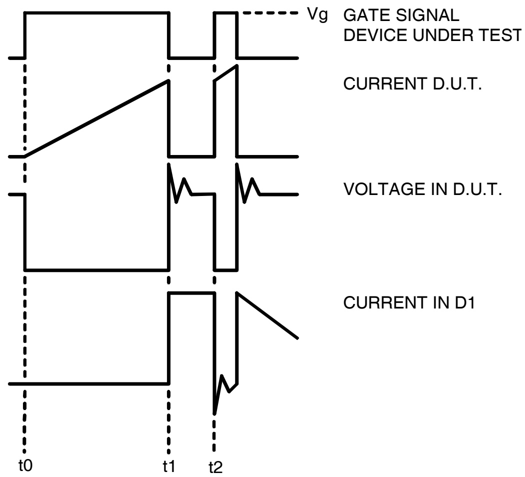


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

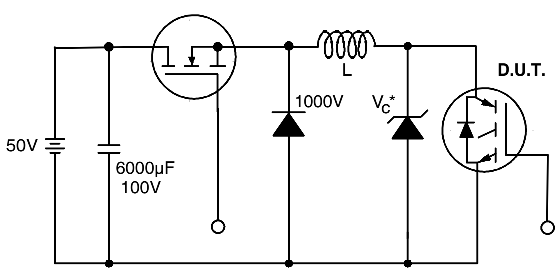


Figure 19. Clamped Inductive Load Test Circuit

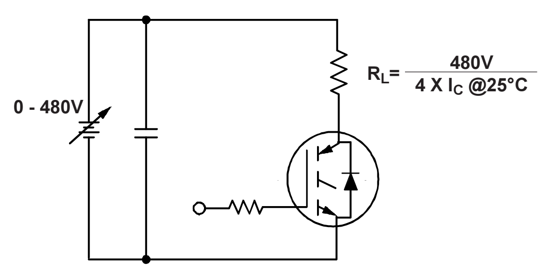
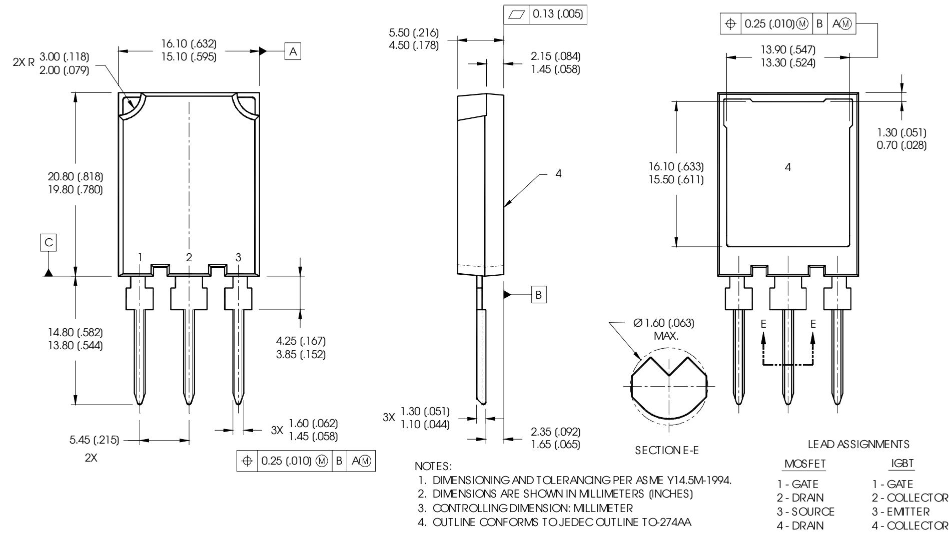
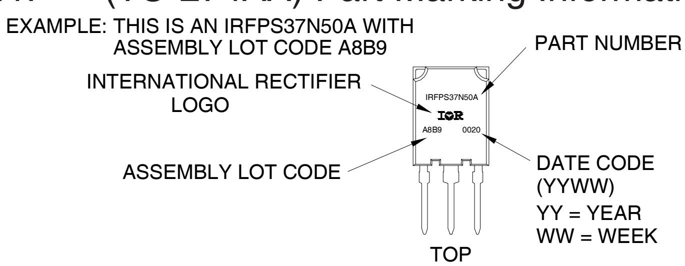


Figure 20. Pulsed Collector Current Test Circuit

Super-247™ (TO-274AA) Package Outline



Super-247™ (TO-274AA) Part Marking Information



Super TO-247™ package is not recommended for Surface Mount Application.

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= 5.0 Ω (figure 13a)

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

④ Pulse width 5.0µs, single shot.

⑤ Repetitive rating; pulse width limited by maximumjunction temperature.

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

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