

IRG4PSH71UD

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

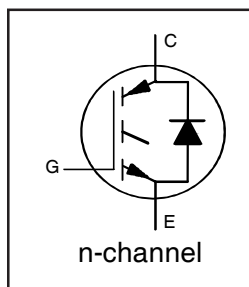
UltraFast Copack IGBT

Features

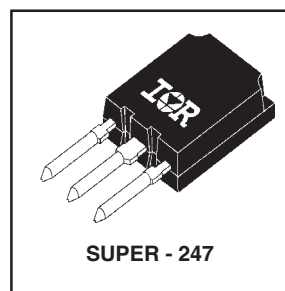
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark 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™ antiparallel Diode minimizes switching losses and EMI



$V_{CES} = 1200V$
$V_{CE(on)} \text{ typ.} = 2.52V$
@ $V_{GE} = 15V, I_C = 50A$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	99	A
$I_C @ T_C = 100^\circ C$	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
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	70	W
I_{FM}	Diode Maximum Forward Current	200	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
T_J	Operating Junction and	-55 to +150	$^\circ C$
T_{STG}	Storage Temperature Range		
	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	$^\circ C/W$
$R_{\theta JC}$	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.)

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Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ③	1200	—	—	V $V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	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	—	$I_C = 70A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V $V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-9.2	—	mV/°C $V_{CE} = V_{GE}, I_C = 1.0mA$
g_{fe}	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	$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	2.92	3.9	V $I_F = 70A$ See Fig.13
		—	2.88	3.7	$I_F = 70A, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA $V_{GE} = \pm 20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	380	570	nC $I_C = 70A$ $V_{CC} = 400V$ See Fig.8 $V_{GE} = 15V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	61	24	
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	130	200	
$t_{d(on)}$	Turn-On delay time	—	46	—	ns $I_C = 70A, V_{CC} = 960V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 9, 10, 11, 14
t_r	Rise time	—	77	—	
$t_{d(off)}$	Turn-Off delay time	—	250	350	
t_f	Fall time	—	220	330	
E_{on}	Turn-On Switching Loss	—	8.8	—	
E_{off}	Turn-Off Switching Loss	—	9.4	—	
E_{tot}	Total Switching Loss	—	18.2	19.7	mJ $T_J = 150^\circ\text{C}$, See Fig. 9, 10, 11, 14 $I_C = 70A, V_{CC} = 960V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail"
$t_{d(on)}$	Turn-On delay time	—	43	—	
t_r	Rise time	—	78	—	
$t_{d(off)}$	Turn-Off delay time	—	330	—	
t_f	Fall time	—	480	—	
E_{TS}	Total Switching Loss	—	26	—	mJ
L_E	Internal Emitter Inductance	—	13	—	nH Measured 5mm from package
C_{ies}	Input Capacitance	—	6640	—	pF $V_{GE} = 0V$ $V_{CC} = 30V$, See Fig.7 $f = 1.0MHz$
C_{oes}	Output Capacitance	—	420	—	
C_{res}	Reverse Transfer Capacitance	—	60	—	
t_{rr}	Diode Reverse Recovery Time	—	110	170	ns $T_J = 25^\circ\text{C}$ See Fig. 14 $T_J = 125^\circ\text{C}$ 14 $I_F = 70A$ $V_R = 200V$
		—	180	270	
I_{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	
		—	8.9	13	
Q_{rr}	Diode Reverse Recovery Charge	—	350	530	
		—	870	1300	
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	150	230	A/ μs $T_J = 25^\circ\text{C}$ See Fig. 16 $T_J = 125^\circ\text{C}$ 16 $di/dt = 200A/\mu s$
		—	130	200	

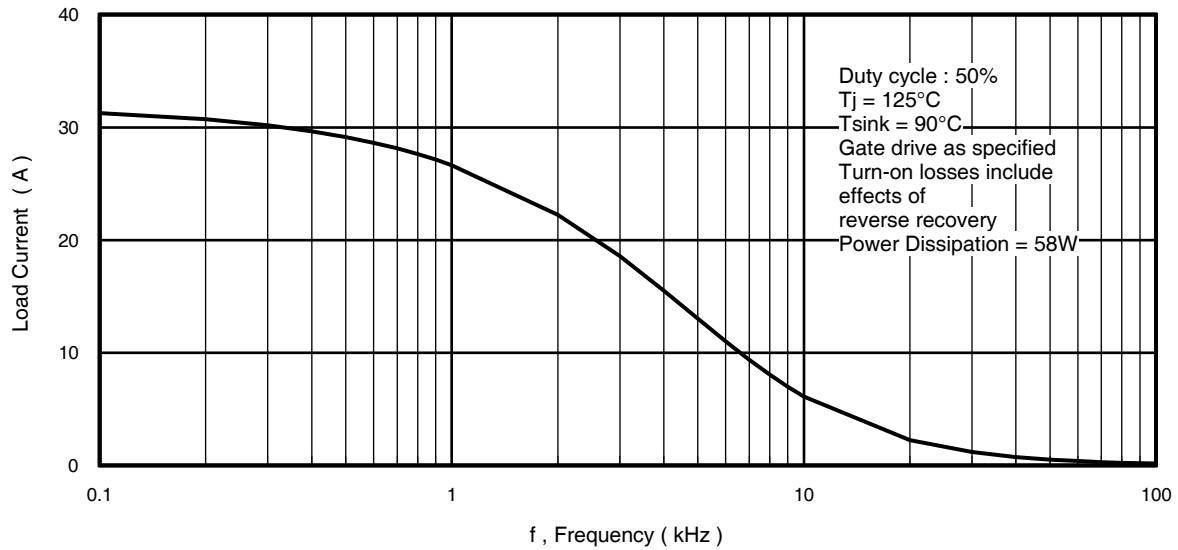


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

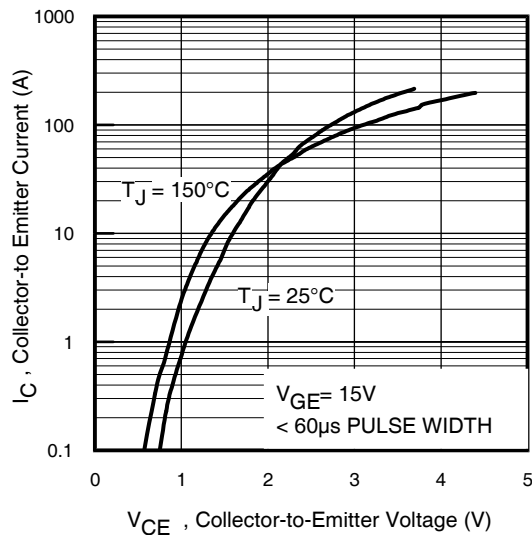


Fig. 2 - Typical Output Characteristics

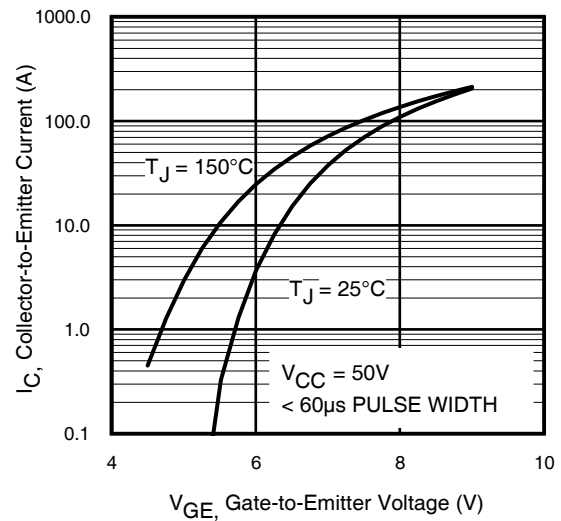


Fig. 3 - Typical Transfer Characteristics

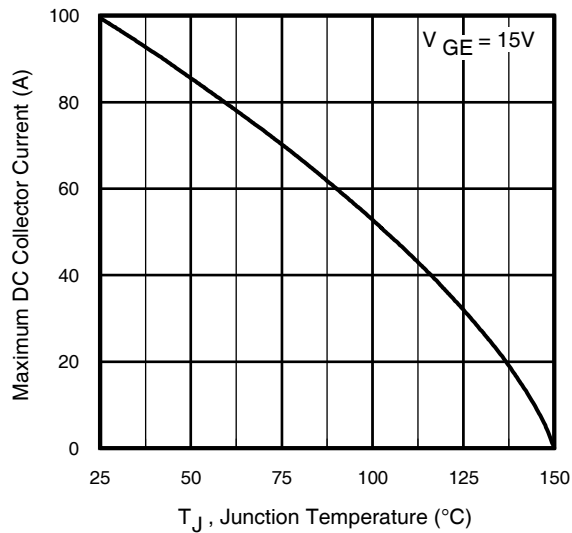


Fig. 4 - Maximum Collector Current vs. Case Temperature

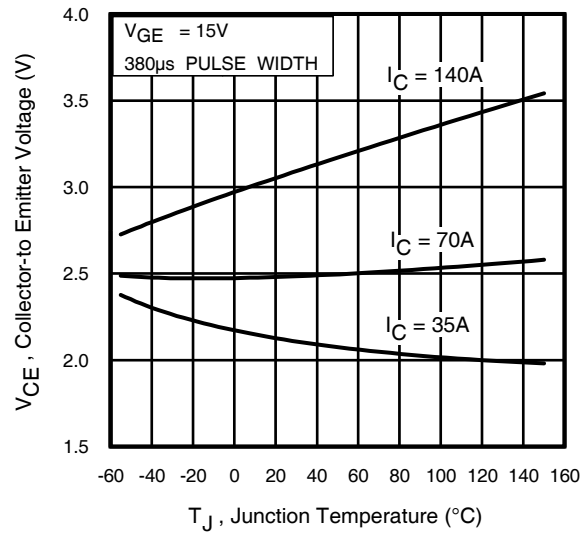


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

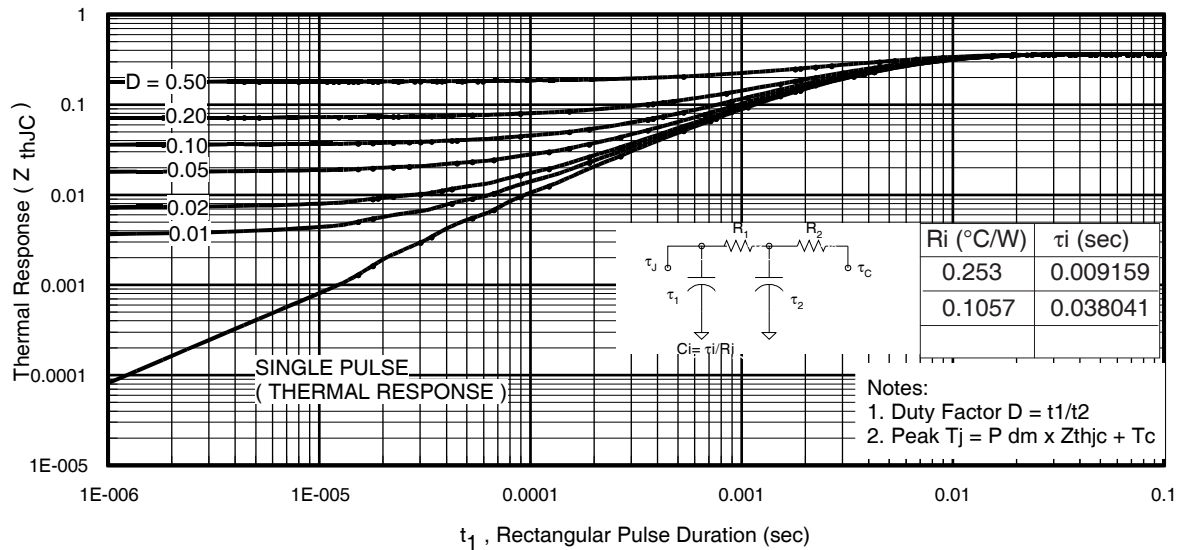
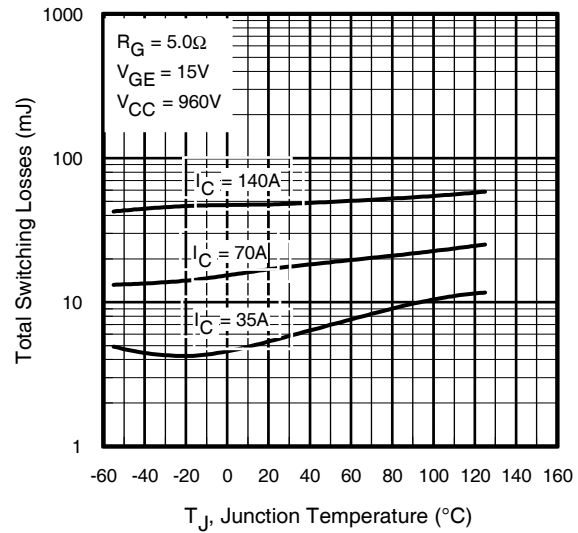
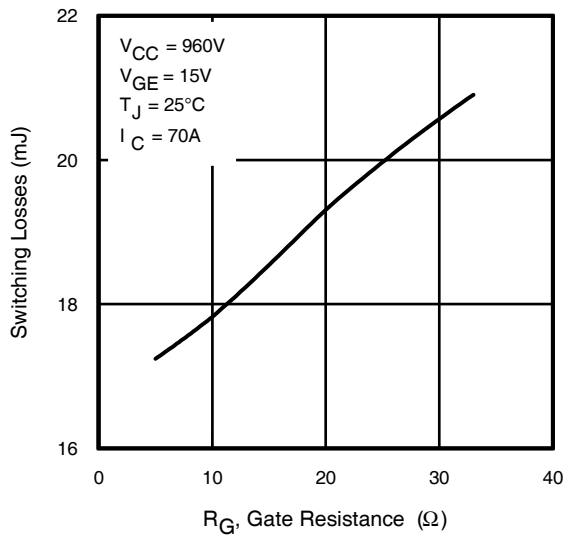
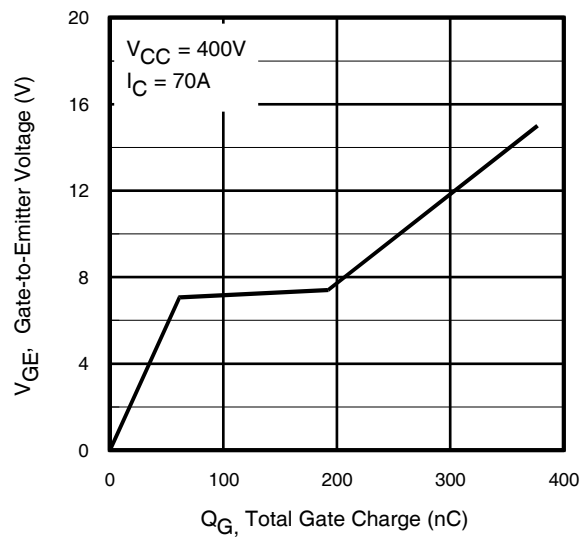
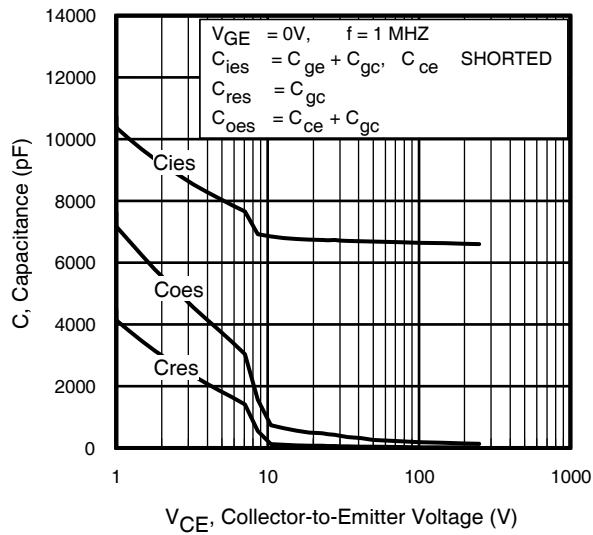


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



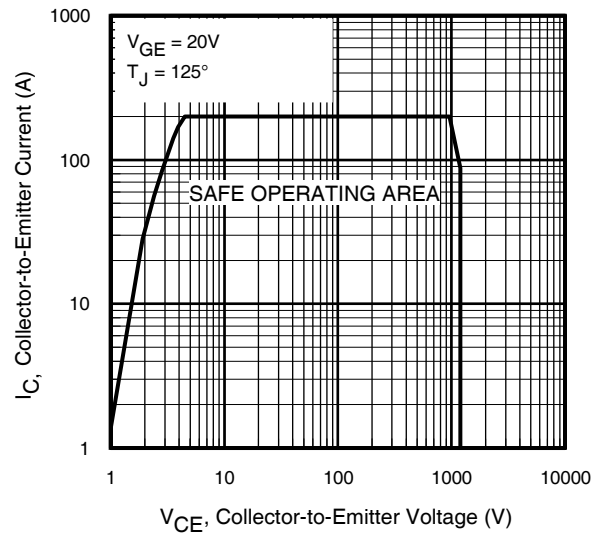
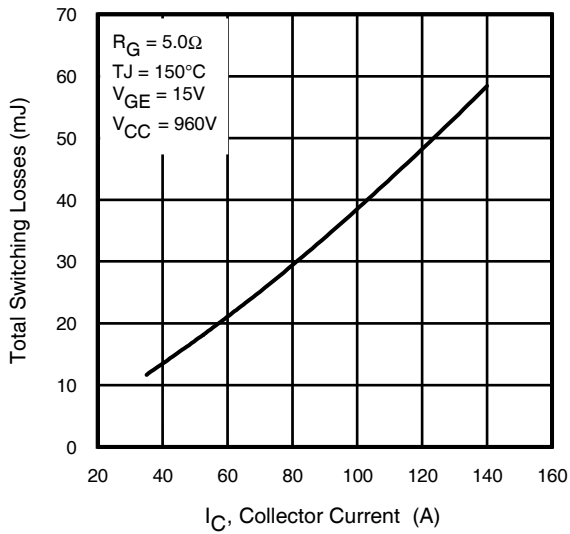


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

Fig. 12 - Turn-Off SOA

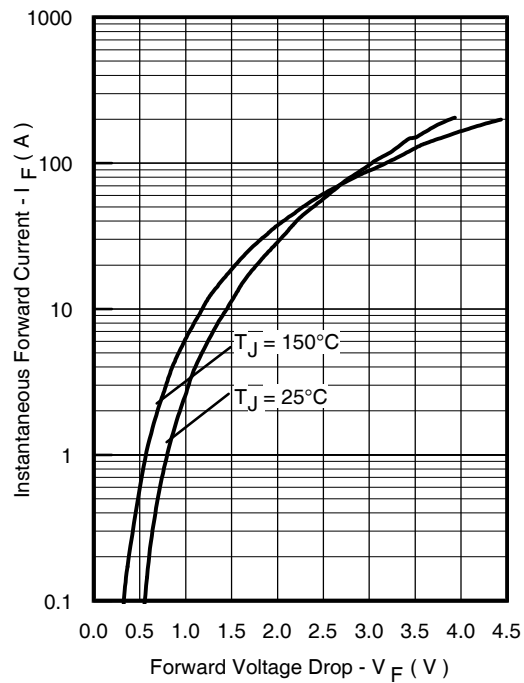


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

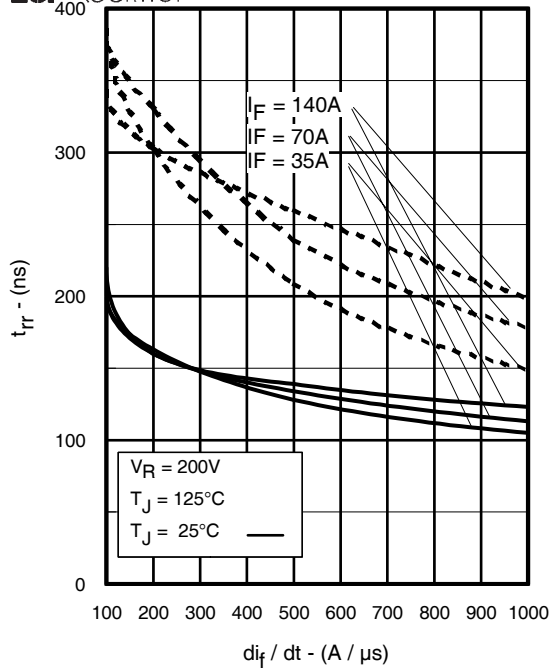


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

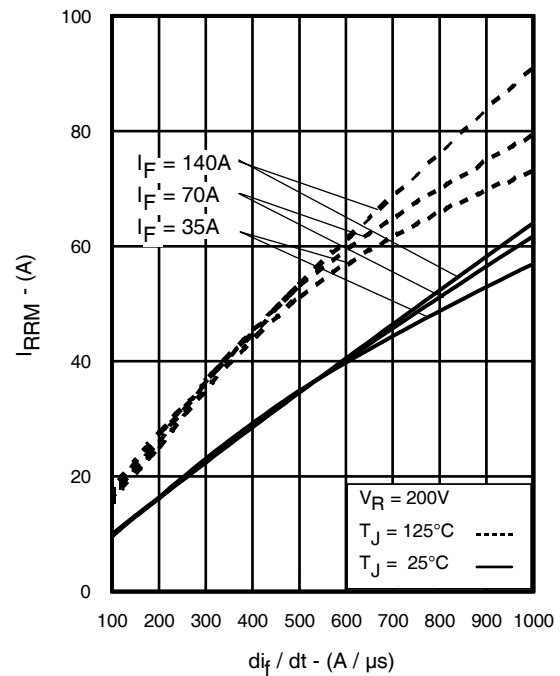


Fig. 15 - Typical Recovery Current vs. di_f/dt

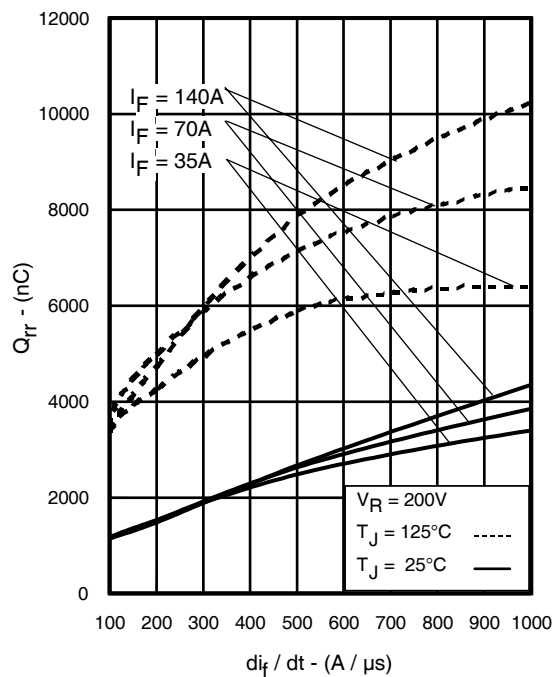


Fig. 16 - Typical Stored Charge vs. di_f/dt
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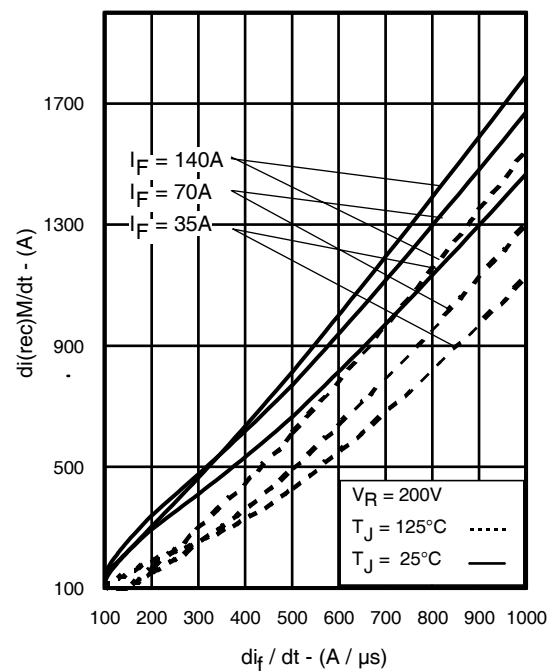


Fig. 17 - Typical $di_{(rec)}M/dt$ vs. di_f/dt

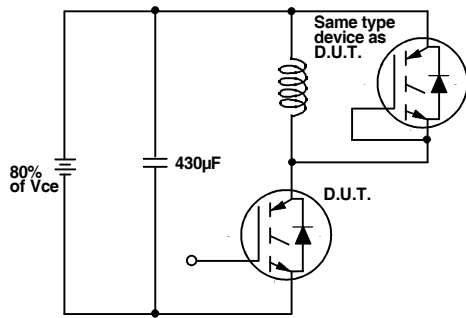


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

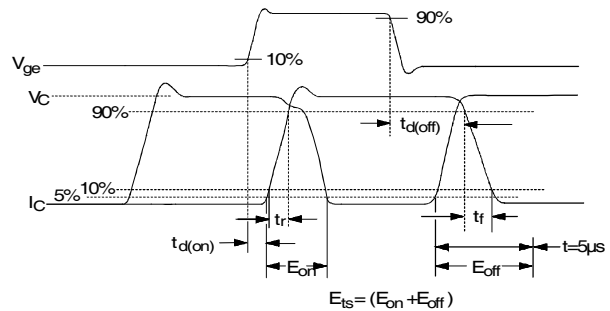


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

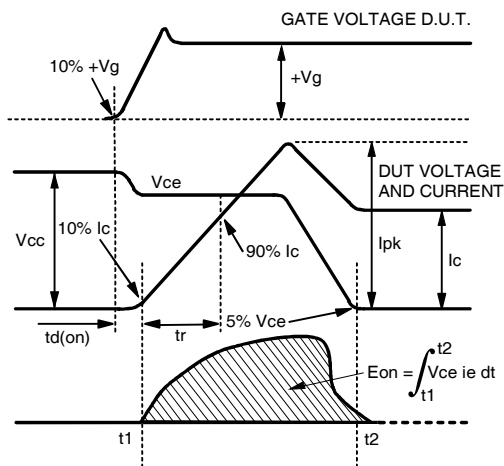


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

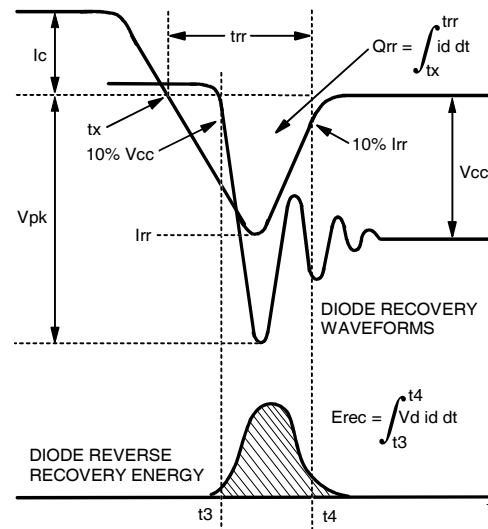


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

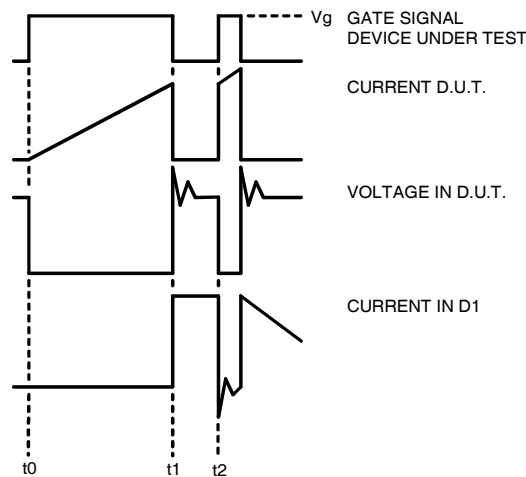


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

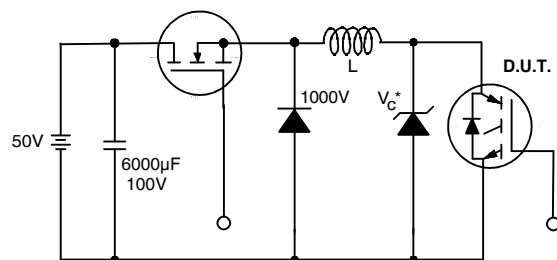


Figure 19. Clamped Inductive Load Test Circuit

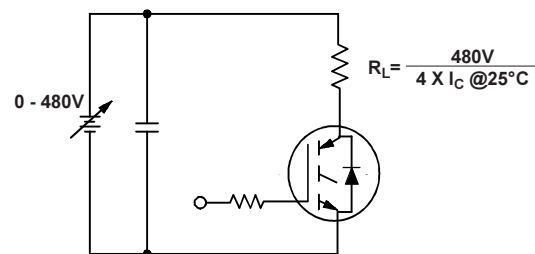
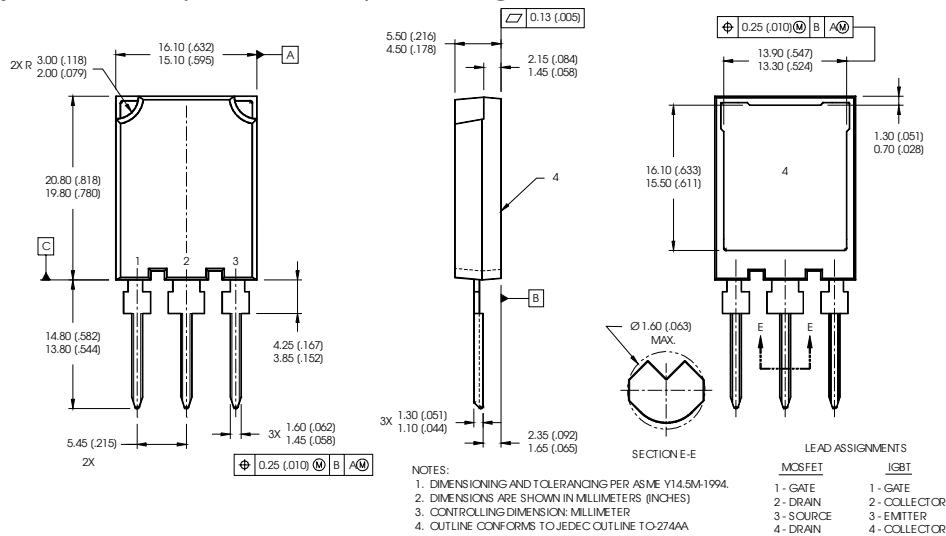


Figure 20. Pulsed Collector Current Test Circuit

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Super-247™ (TO-274AA) Package Outline

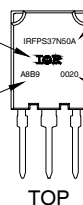


Super-247™ (TO-274AA) Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH
ASSEMBLY LOT CODE A8B9

INTERNATIONAL RECTIFIER
LOGO

ASSEMBLY LOT CODE



PART NUMBER

DATE CODE
(YYWW)
YY = YEAR
WW = WEEK

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 $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G=5.0\ \Omega$ (figure 13a)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ Repetitive rating; pulse width limited by maximum junction 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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