

IRG4PSH71UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

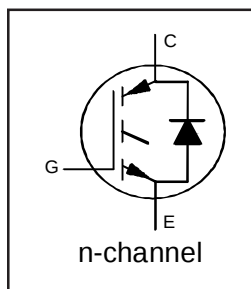
UltraFast Copack IGBT

Features

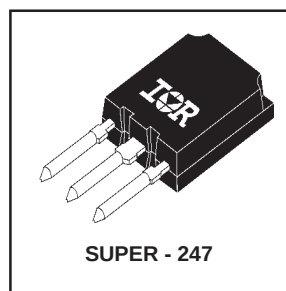
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark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

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°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 @ T _c = 100°C	Diode Continuous Forward Current	70	W
I _{FM}	Diode Maximum Forward Current	200	
P _D @ T _C = 25°C	Maximum Power Dissipation	350	
P _D @ T _C = 100°C	Maximum Power Dissipation	140	
T _J	Operating Junction and	-55 to +150	°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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International
IR Rectifier

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

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

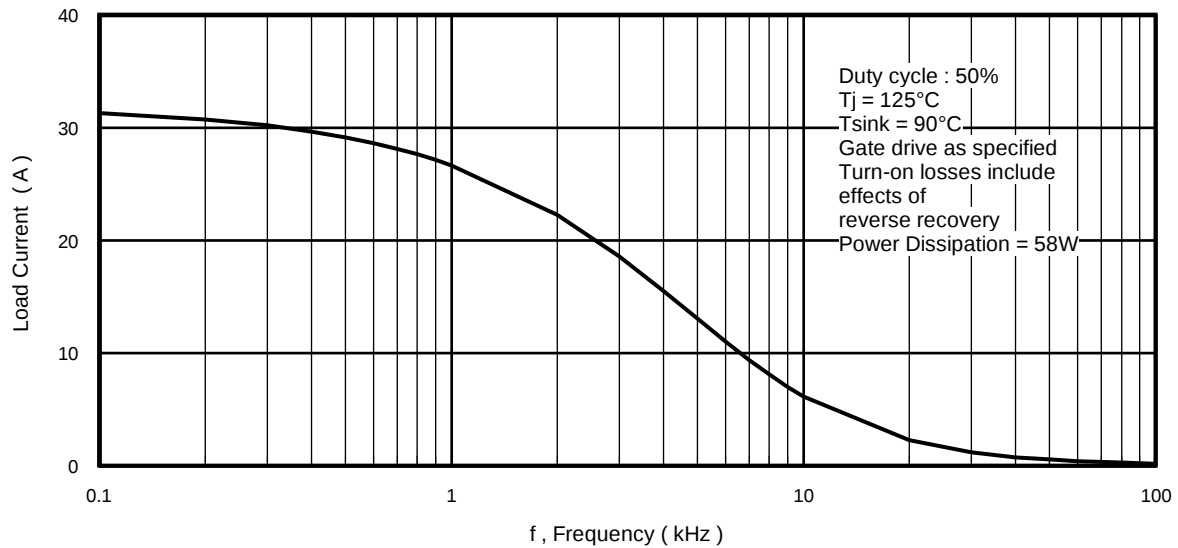


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

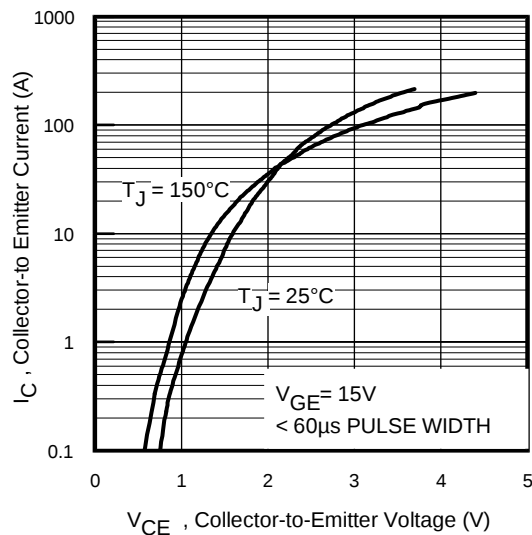


Fig. 2 - Typical Output Characteristics

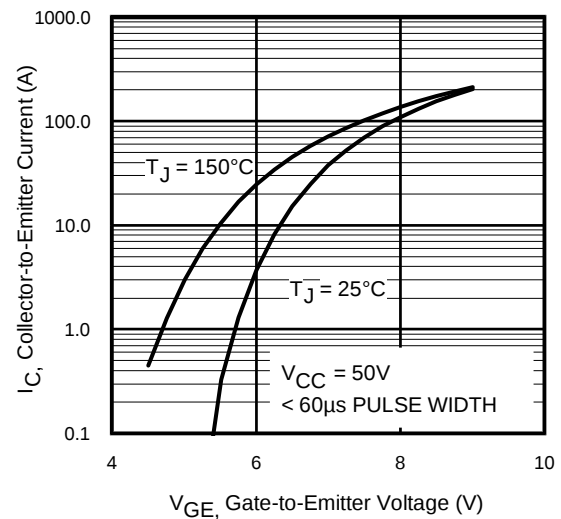


Fig. 3 - Typical Transfer Characteristics

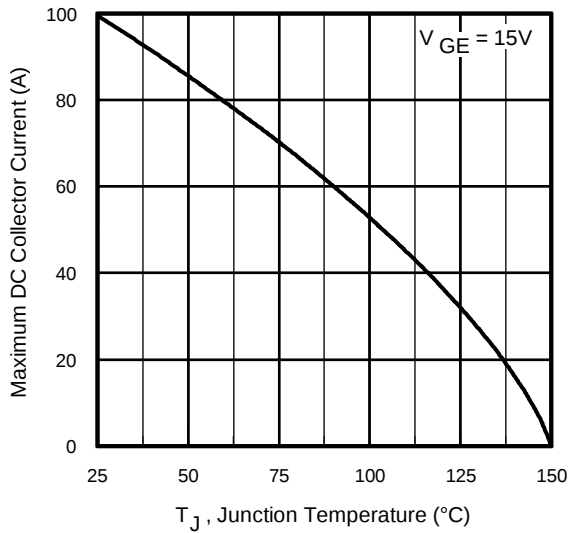


Fig. 4 - Maximum Collector Current vs. Case Temperature

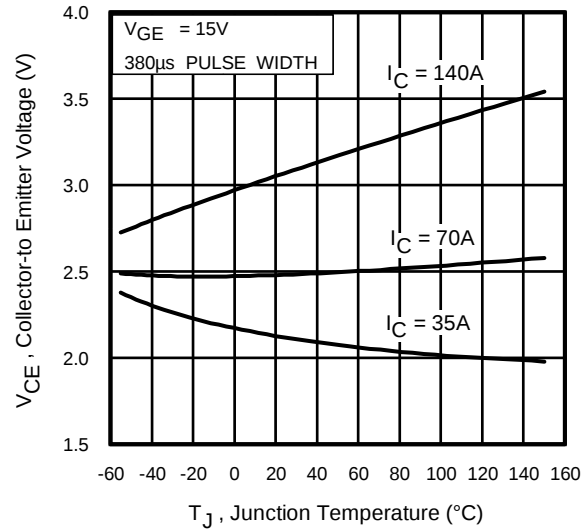


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

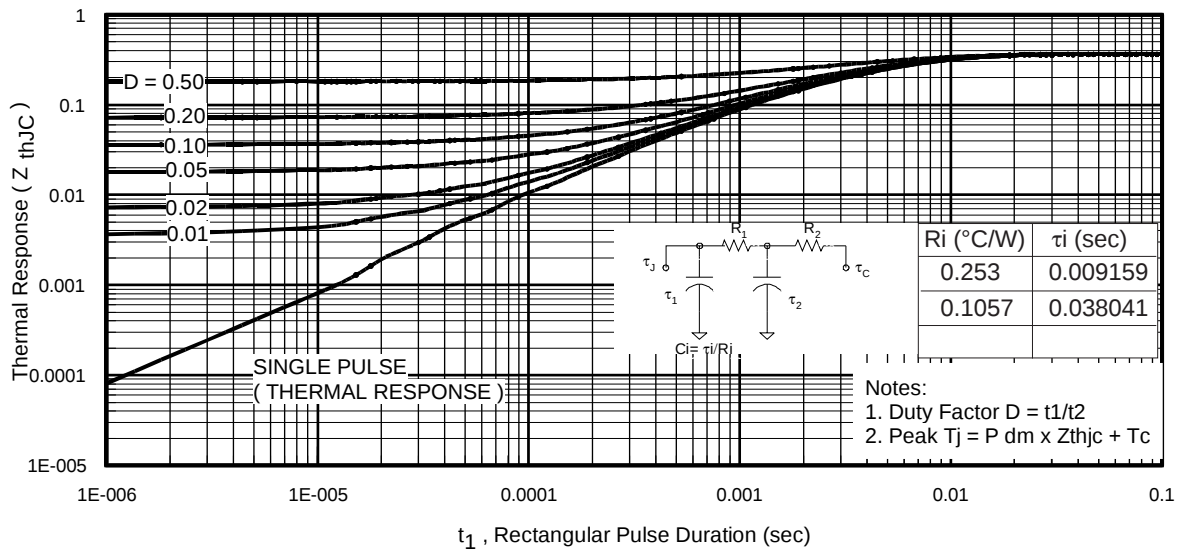


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

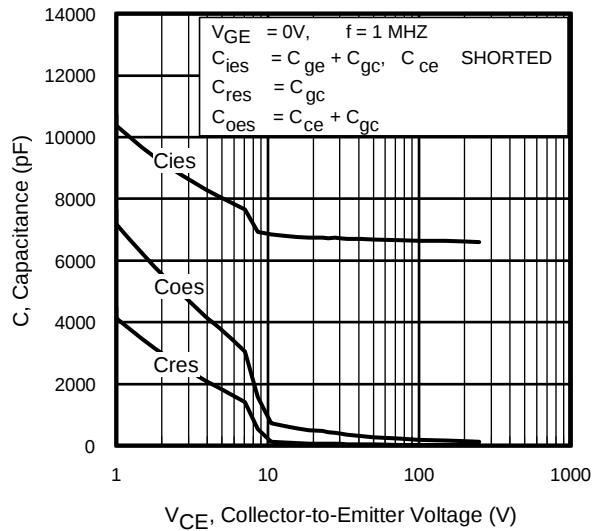


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

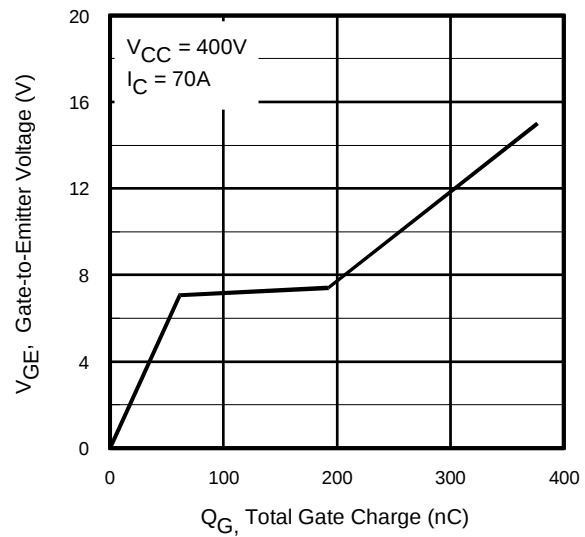


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

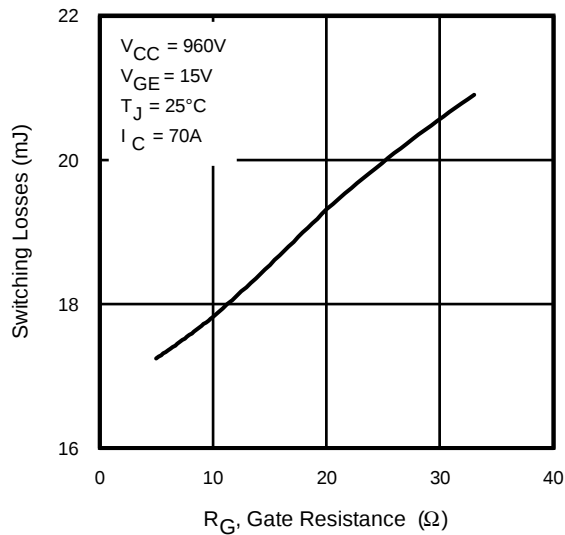


Fig. 9 - Typical Switching Losses vs. Gate Resistance

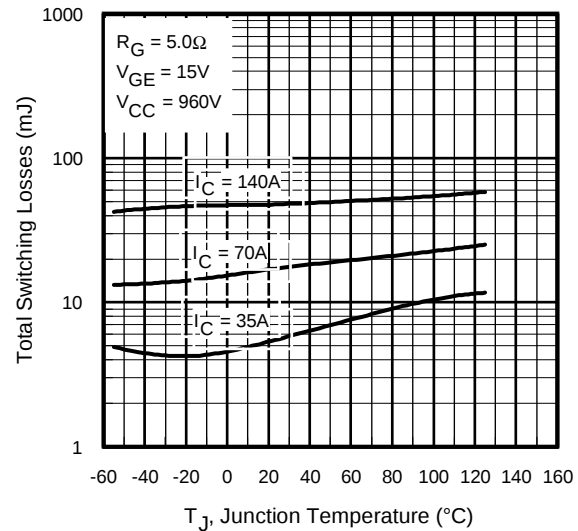


Fig. 10 - Typical Switching Losses vs. Junction Temperature

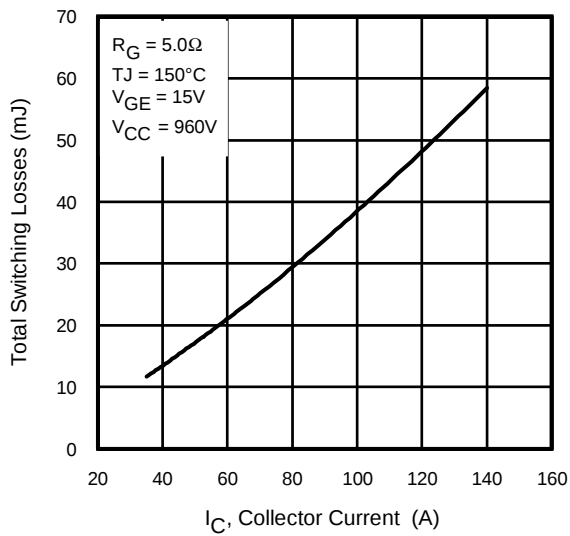


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

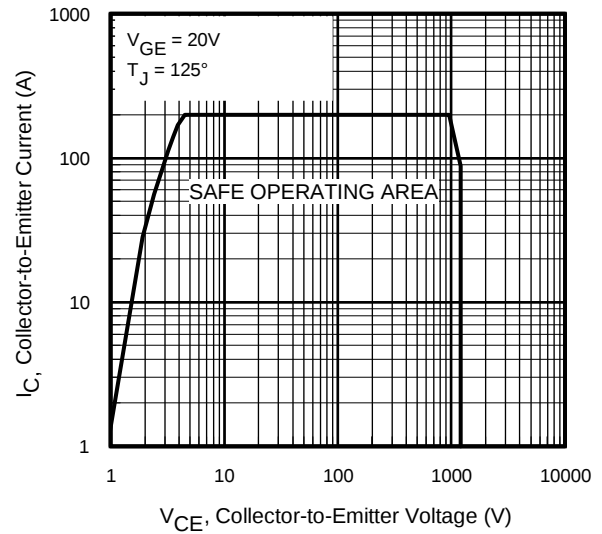


Fig. 12 - Turn-Off SOA

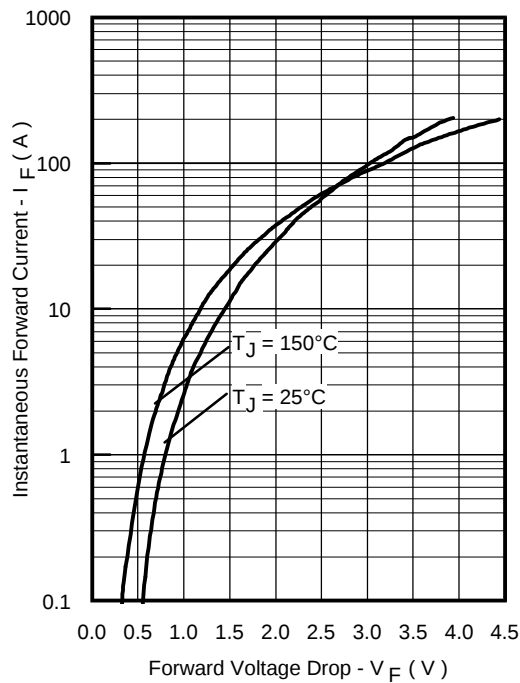


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

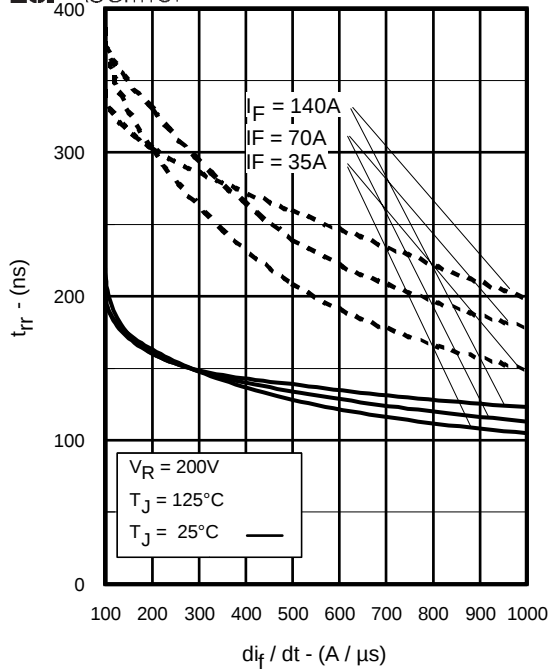


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

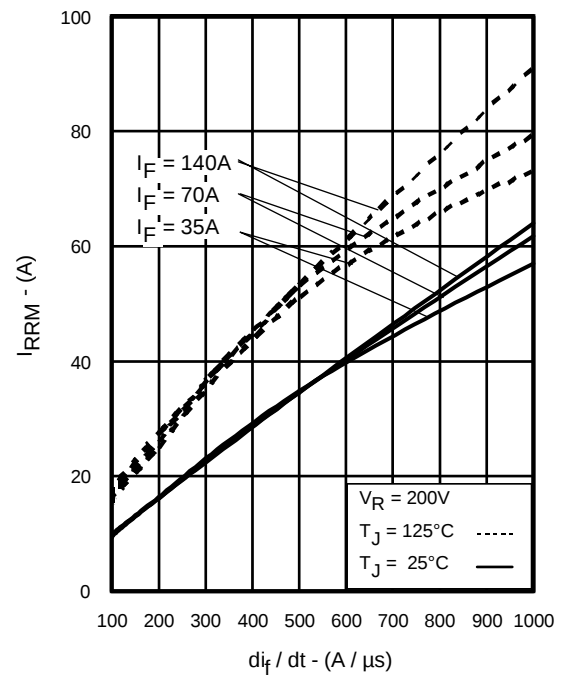


Fig. 15 - Typical Recovery Current vs. di_f/dt

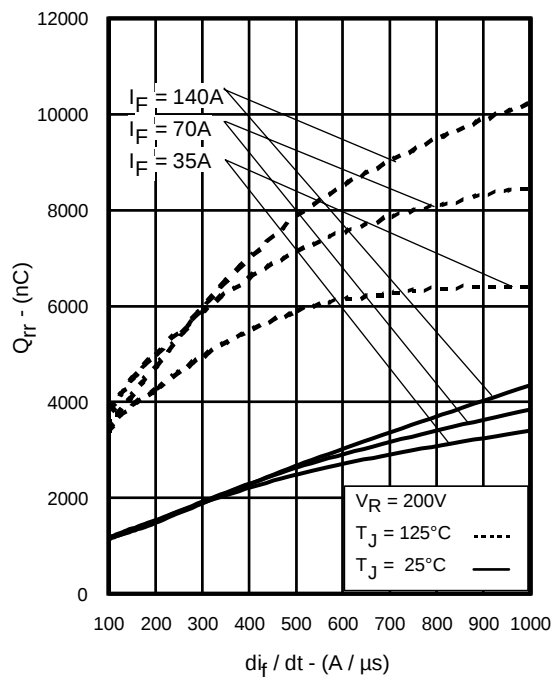


Fig. 16 - Typical Stored Charge vs. di_f/dt
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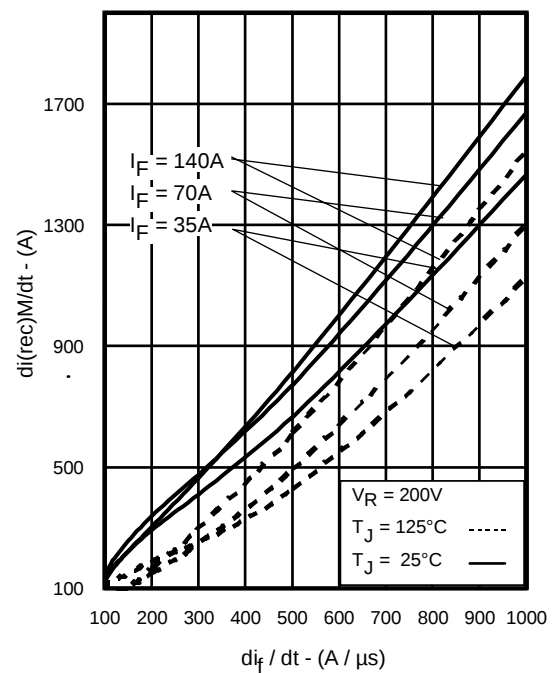


Fig. 17 - Typical $di_{(rec)}M/dt$ vs. di_f/dt

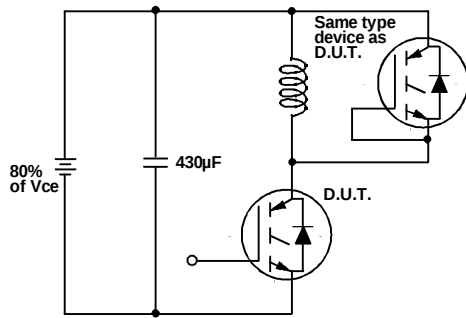


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

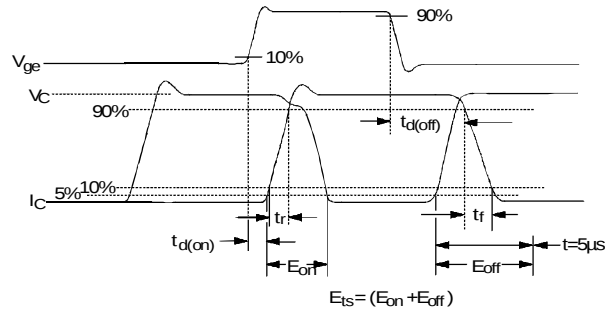


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

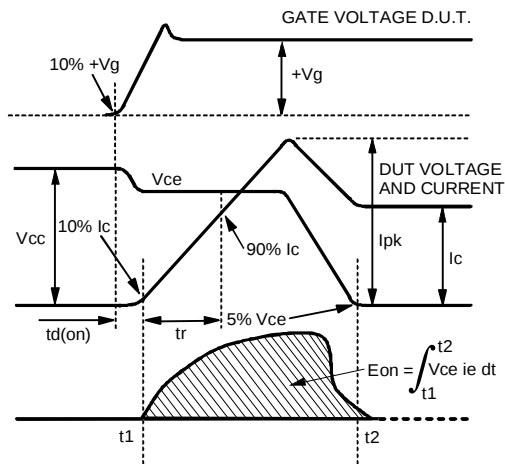


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

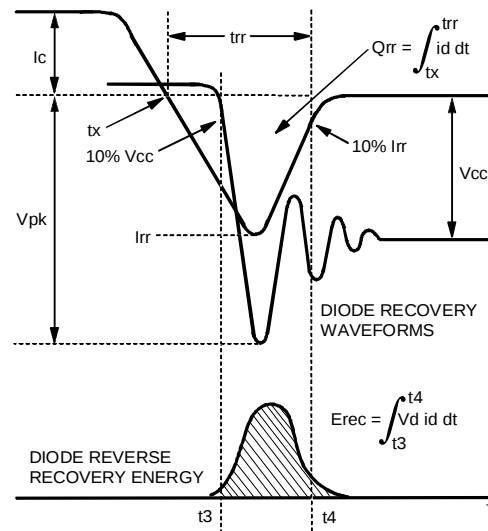


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

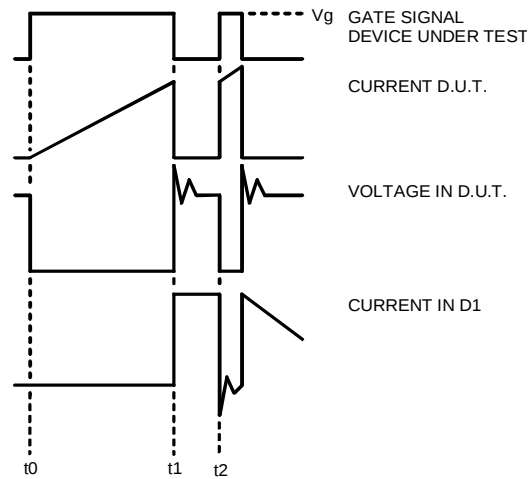


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

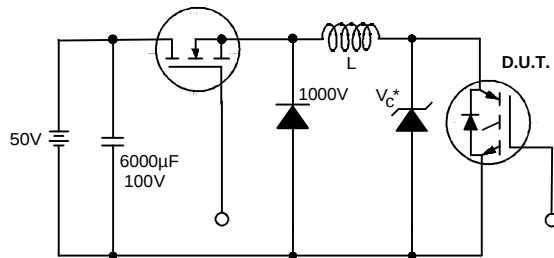


Figure 19. Clamped Inductive Load Test Circuit

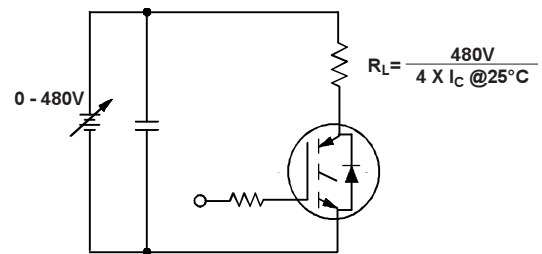
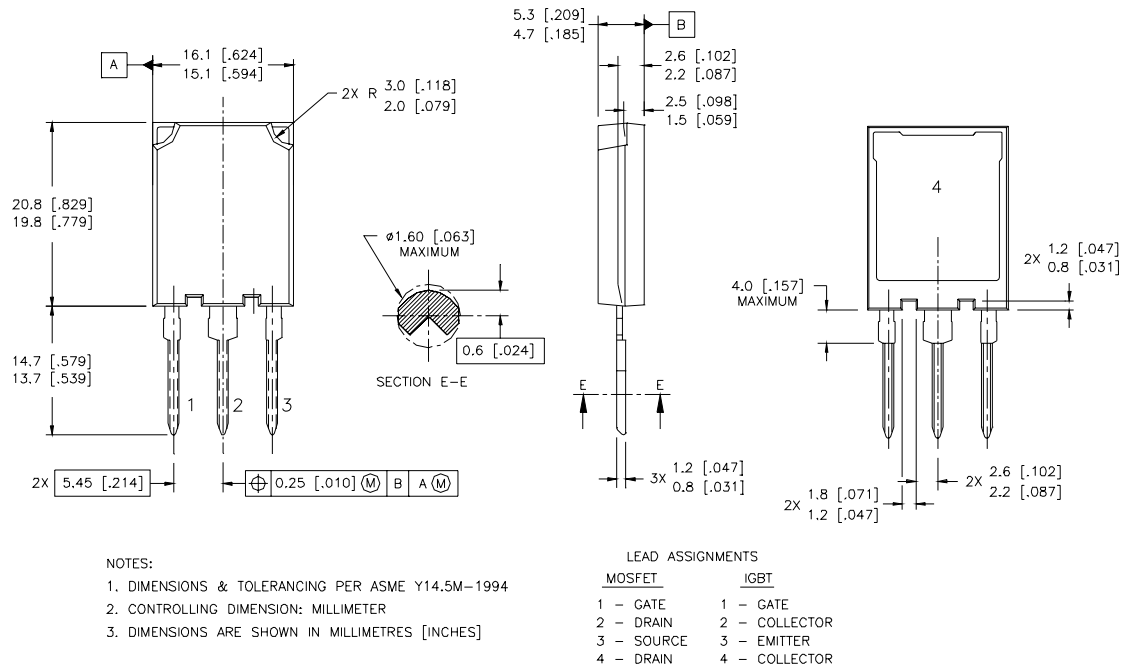


Figure 20. Pulsed Collector Current Test Circuit

Case Outline and Dimensions — Super-247



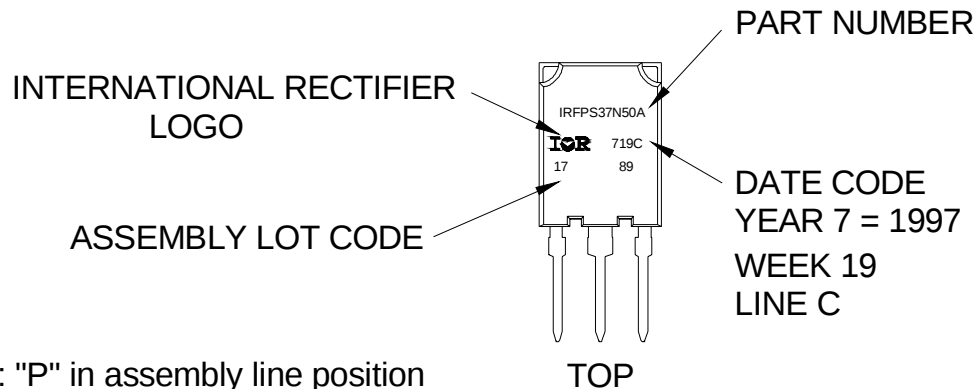
Super TO-247™ package is not recommended for Surface Mount Application.

Notes:

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

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

EXAMPLE: THIS IS AN IRFPS37N50A WITH
ASSEMBLY 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 Consumer market.
Qualification Standards can be found on IR's Web site.

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