

International

IR Rectifier

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

PD - 95908

IRG4PSH71UDPbF

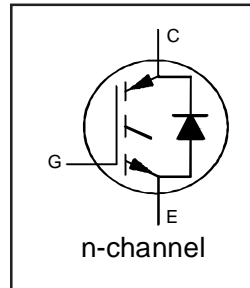
UltraFast Copack IGBT

Features

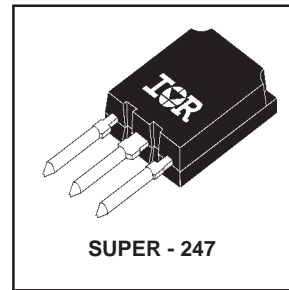
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark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



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



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 [Ⓢ]	200	
I_{LM}	Clamped Inductive Load current [Ⓢ]	200	
V_{GE}	Gate-to-Emitter Voltage	±20	V
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	70	
I_{FM}	Diode Maximum Forward Current	200	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
T_J	Operating Junction and	-55 to +150	
T_{STG}	Storage Temperature Range		°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.)

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

Parameter	Min.	Typ.	Max.	Units	Conditions	
V _{(BR)CES}	1200	—	—	V	V _{GE} = 0V, I _C = 250μA	
V _{(BR)ECS}	19	—	—	V	V _{GE} = 0V, I _C = 1.0A	
ΔV _{(BR)CES} /ΔT _J	—	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 I _C = 140A I _C = 70A, T _J = 150°C V _{GE} = 15V See Fig.2, 5
		—	3.17	—		
		—	2.68	—		
V _{GE(th)}	3.0	—	6.0		V _{CE} = V _{GE} , I _C = 250μA	
ΔV _{GE(th)} /ΔT _J	—	-9.2	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA	
g _{fE}	48	72	—	S	V _{CE} = 100V, I _C = 70A	
I _{CES}	Zero Gate Voltage Collector Current	—	—	500	μA	V _{GE} = 0V, V _{CE} = 1200V V _{GE} = 0V, V _{CE} = 10V V _{GE} = 0V, V _{CE} = 1200V, T _J = 150°C
		—	—	2.0		
		—	—	5000		
V _{FM}	Diode Forward Voltage Drop	—	2.92	3.9	V	I _F = 70A See Fig.13 I _F = 70A, T _J = 150°C
		—	2.88	3.7		
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	—	380	570	nC	I _C = 70A V _{CC} = 400V See Fig.8 V _{GE} = 15V	
Q _{ge}	—	61	24			
Q _{gc}	—	130	200			
t _{d(on)}	—	46	—	ns	I _C = 70A, V _{CC} = 960V V _{GE} = 15V, R _G = 5.0Ω Energy losses include "tail" See Fig. 9, 10, 11, 14	
t _r	—	77	—			
t _{d(off)}	—	250	350			
t _f	—	220	330			
E _{on}	—	8.8	—			mJ
E _{off}	—	9.4	—			
E _{tot}	—	18.2	19.7			
t _{d(on)}	—	43	—	ns	T _J = 150°C, See Fig. 9, 10, 11, 14 I _C = 70A, V _{CC} = 960V V _{GE} = 15V, R _G = 5.0Ω Energy losses include "tail"	
t _r	—	78	—			
t _{d(off)}	—	330	—			
t _f	—	480	—			
E _{TS}	—	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°C See Fig 14 T _J =125°C 14
		—	180	270		
I _{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	A	T _J =25°C See Fig 15 T _J =125°C 15
		—	8.9	13		
Q _{rr}	Diode Reverse Recovery Charge	—	350	530	nC	T _J =25°C See Fig 16 T _J =125°C 16
		—	870	1300		
di _{(rec)M} /dt	Diode Peak Rate of Fall of Recovery During t _b	—	150	230	A/μs	T _J =25°C See Fig 17 T _J =125°C 17
		—	130	200		

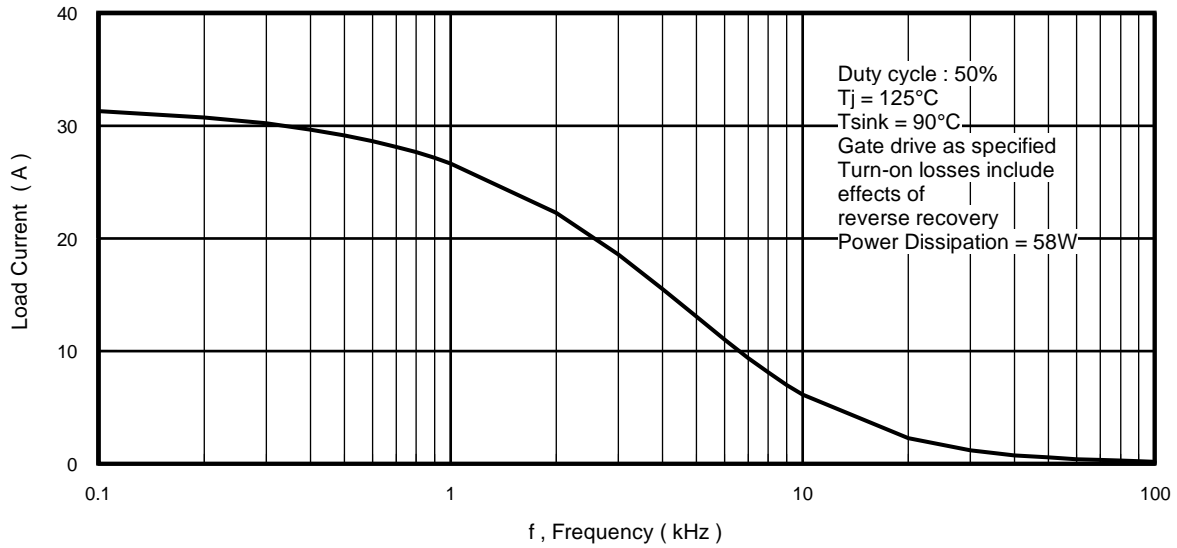


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

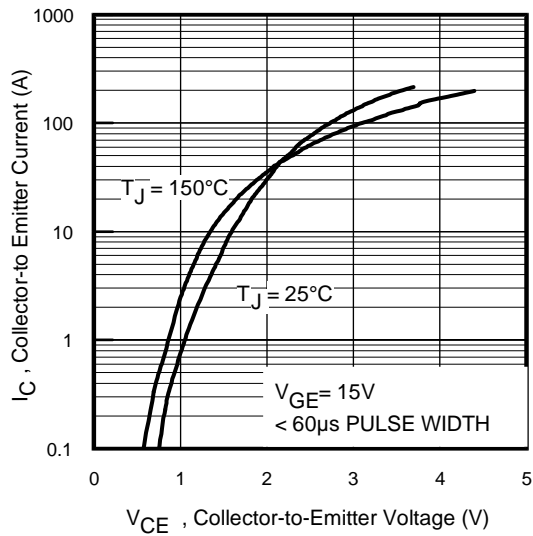


Fig. 2 - Typical Output Characteristics

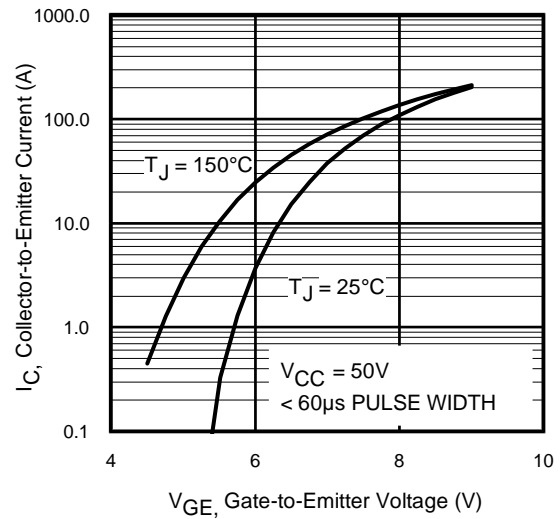


Fig. 3 - Typical Transfer Characteristics

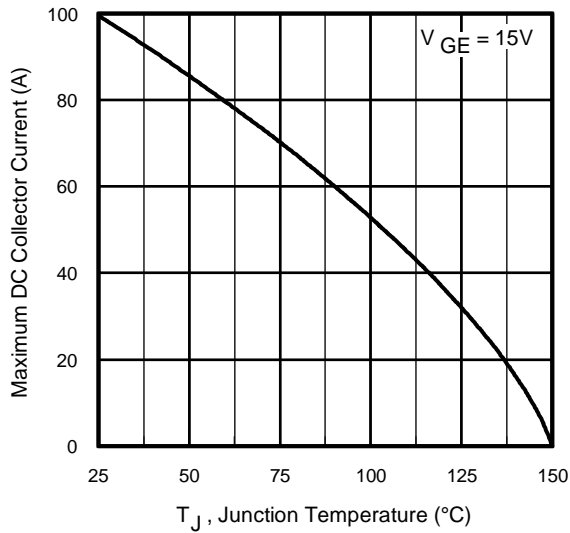


Fig. 4 - Maximum Collector Current vs. Case Temperature

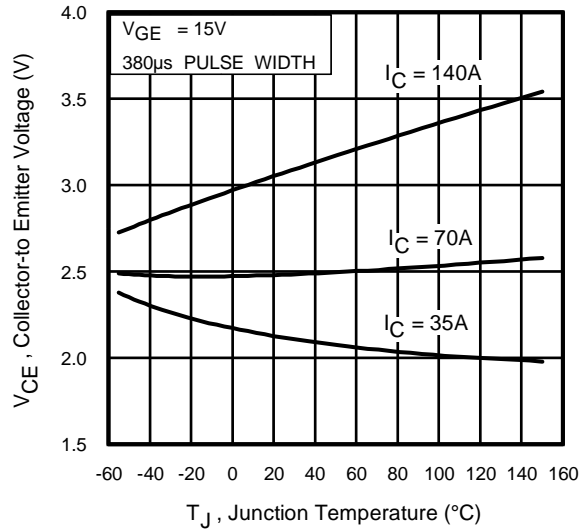


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

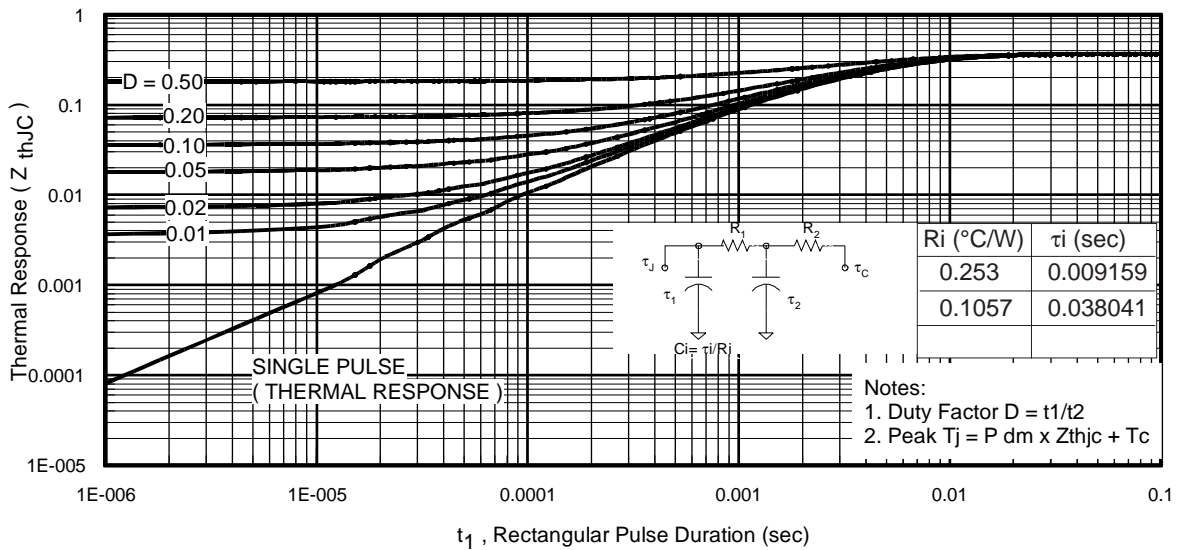


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

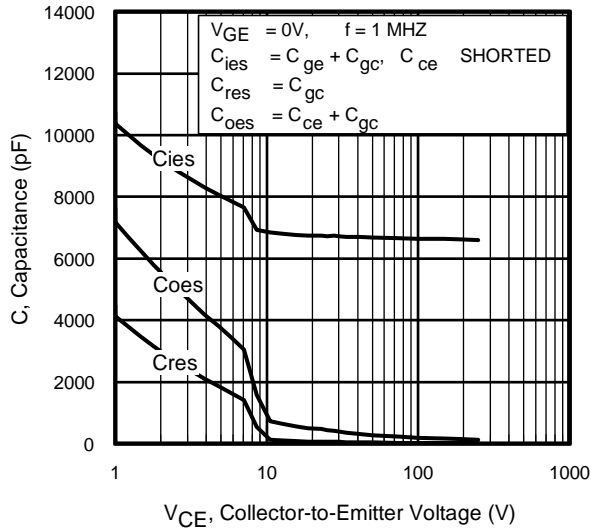


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

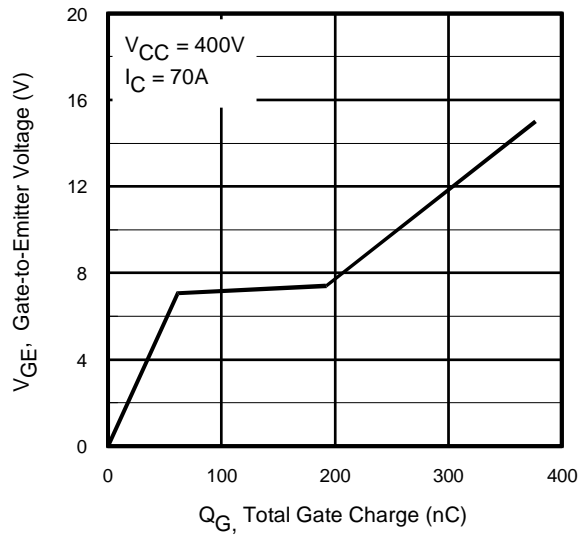


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

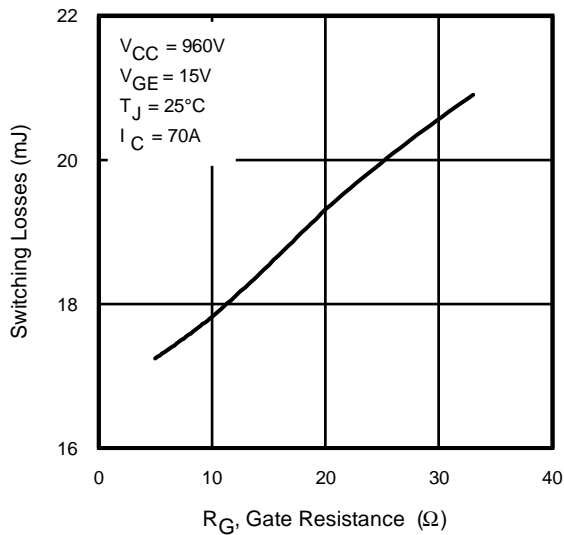


Fig. 9 - Typical Switching Losses vs. Gate Resistance

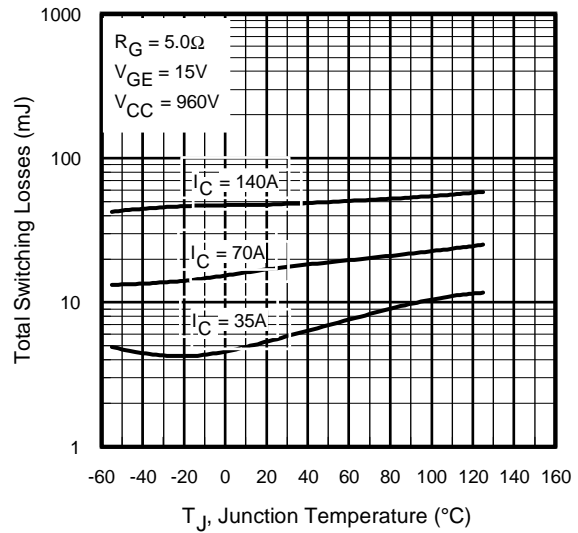


Fig. 10 - Typical Switching Losses vs. Junction Temperature

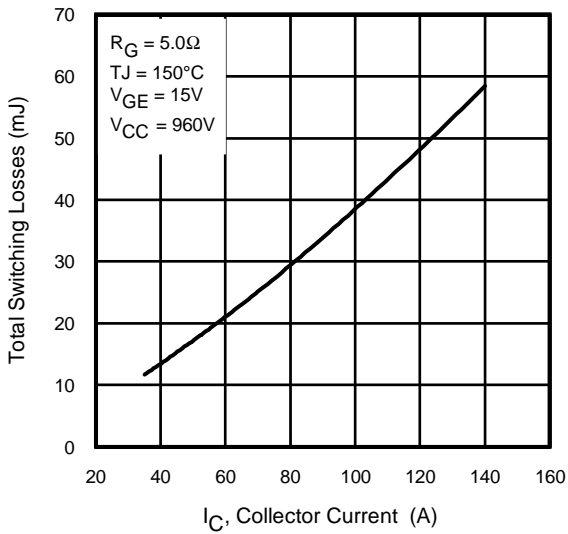


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

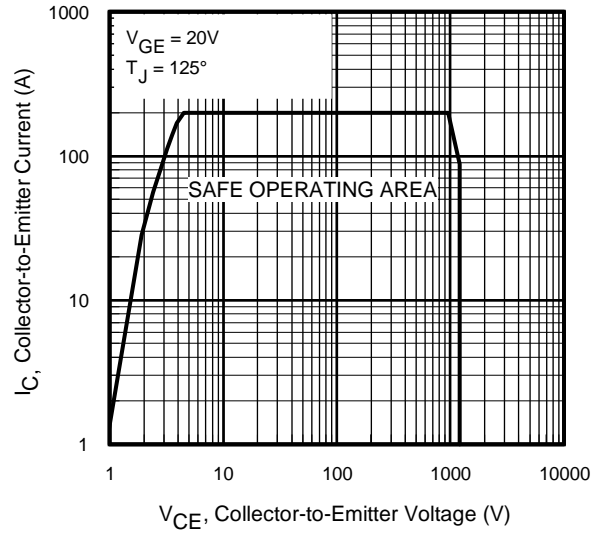


Fig. 12 - Turn-Off SOA

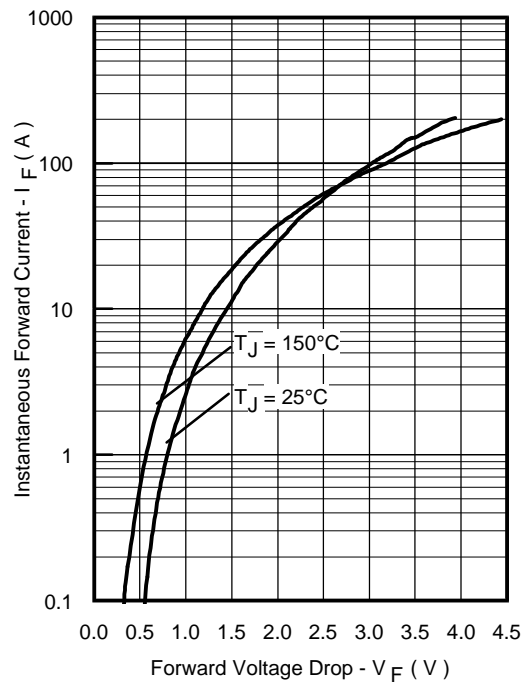


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

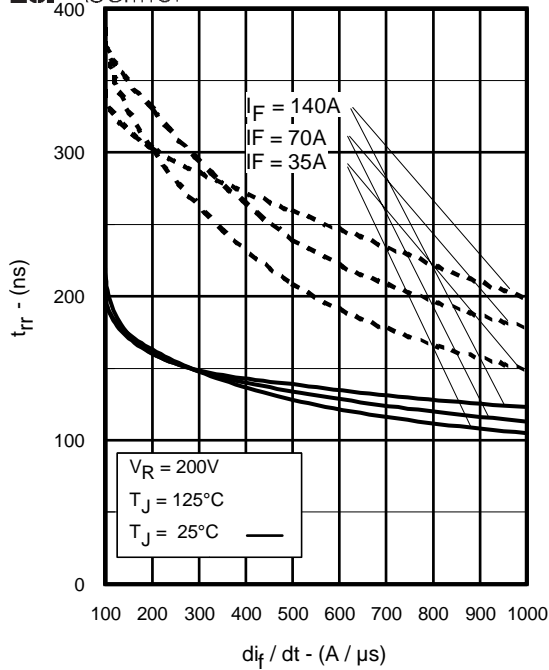


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

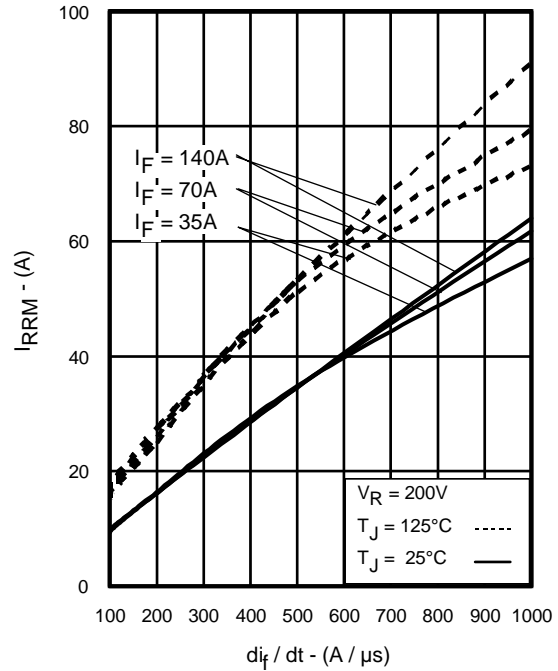


Fig. 15 - Typical Recovery Current vs. di_f/dt

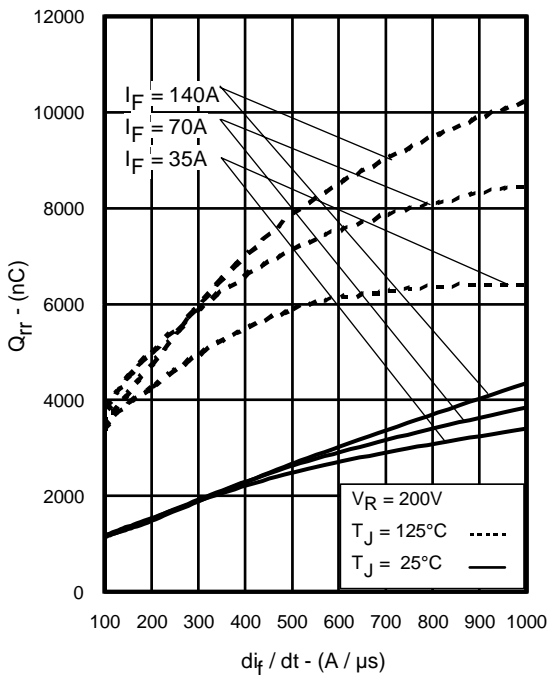


Fig. 16 - Typical Stored Charge vs. di_f/dt
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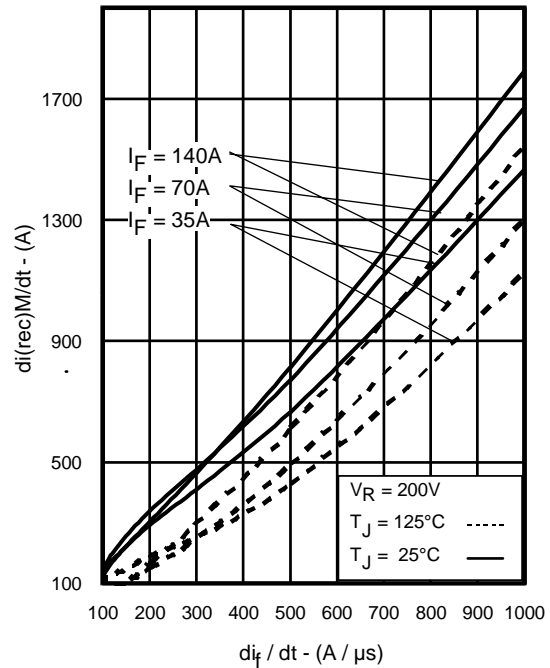


Fig. 17 - Typical $di_{(rec)}M/dt$ vs. di_f/dt

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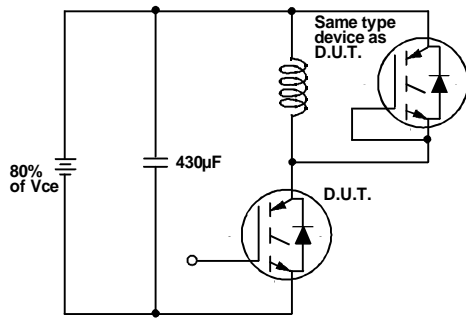


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , E_{off} (diode), t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

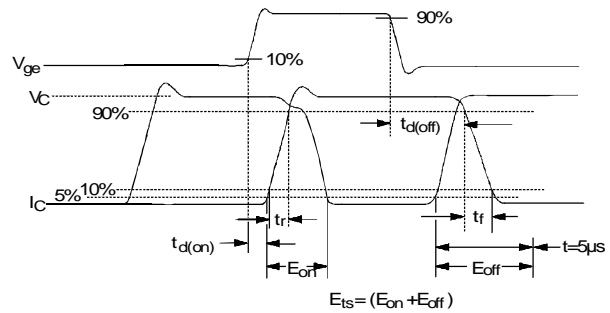


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

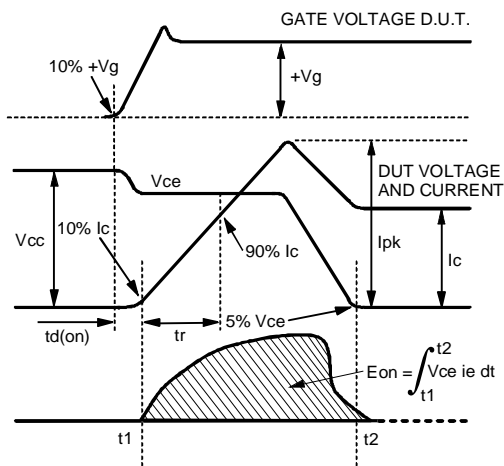


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

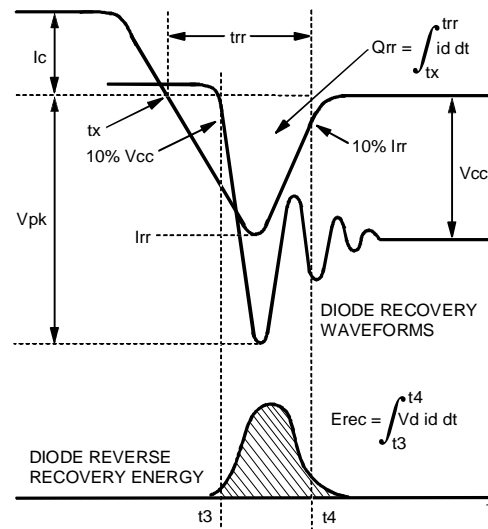


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

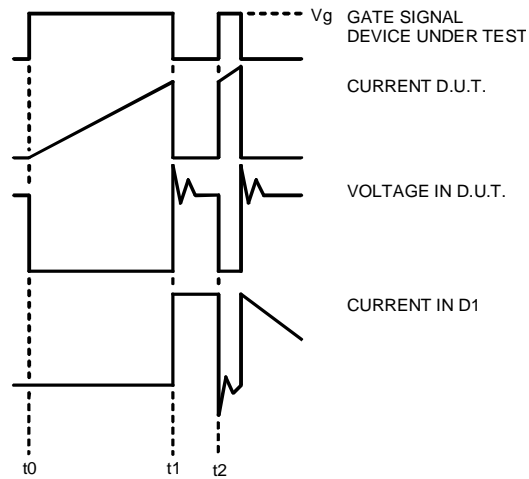


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

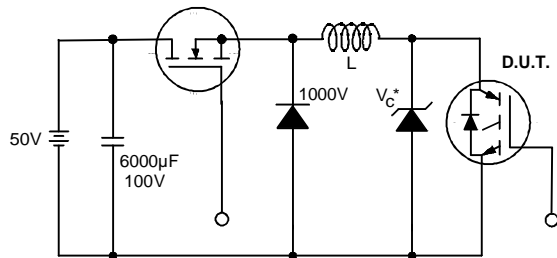


Figure 19. Clamped Inductive Load Test Circuit

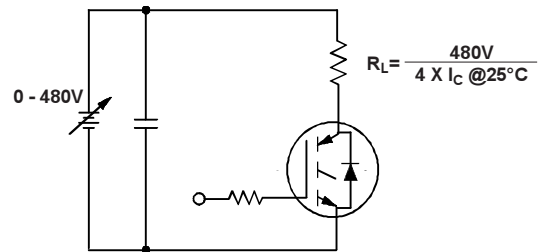
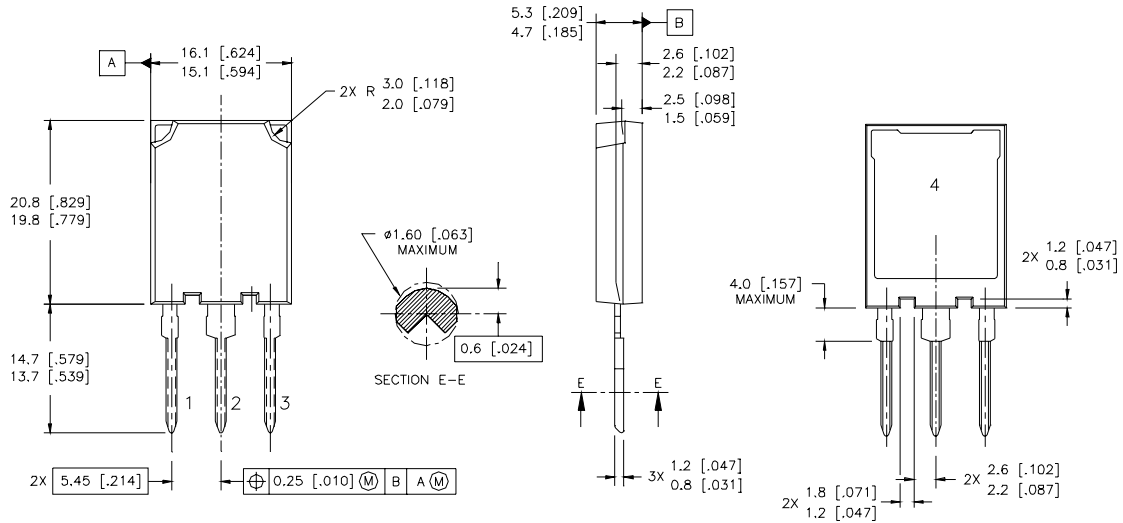


Figure 20. Pulsed Collector Current Test Circuit

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Case Outline and Dimensions — Super-247



NOTES:

1. DIMENSIONS & TOLERANCING PER ASME Y14.5M-1994
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETRES [INCHES]

LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

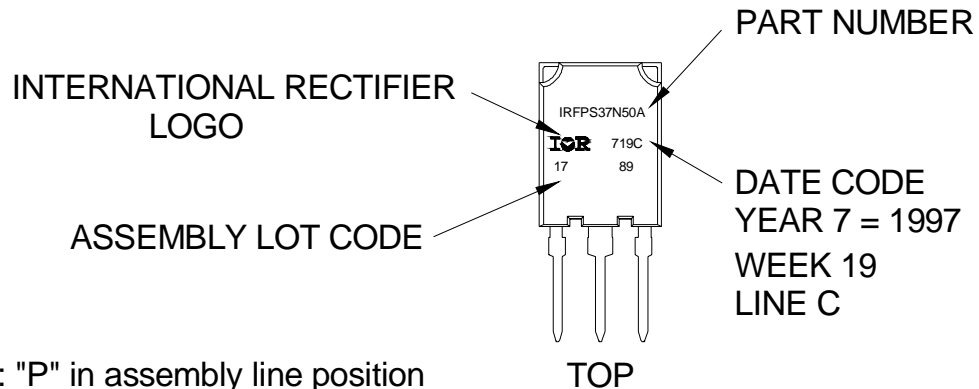
Super TO-247™ package is not recommended for Surface Mount Application.

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.

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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