PD - 95908

International
IOR Rectifier

IRG4PSH71UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

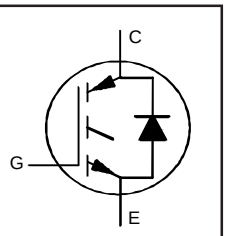
UltraFast Copack IGBT

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

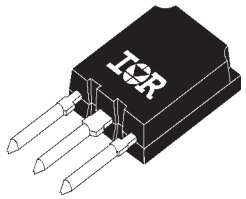


n-channel

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.)

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		I_C = 70A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	61	24	nC	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	—		I_C = 70A, V_{CC} = 960V
t_r	Rise time	—	77	—	ns	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	—		
E_{off}	Turn-Off Switching Loss	—	9.4	—	mJ	
E_{tot}	Total Switching Loss	—	18.2	19.7		
$t_{d(on)}$	Turn-On delay time	—	43	—		T_J = 150°C, See Fig. 9, 10, 11, 14
t_r	Rise time	—	78	—	ns	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	—		V_{GE} = 0V
C_{oes}	Output Capacitance	—	420	—	pF	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 14, I_F = 70A
		—	180	270		T_J=125°C
I_{rr}	Diode Peak Reverse Recovery Current	—	6.0	9.0	A	T_J=25°C See Fig 15, V_R = 200V
		—	8.9	13		T_J=125°C
Q_{rr}	Diode Reverse Recovery Charge	—	350	530	nC	T_J=25°C See Fig 16, di/dt = 200A/µs
		—	870	1300		T_J=125°C
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	150	230	A/µs	T_J=25°C See Fig 17
	During t_b	—	130	200		T_J=125°C

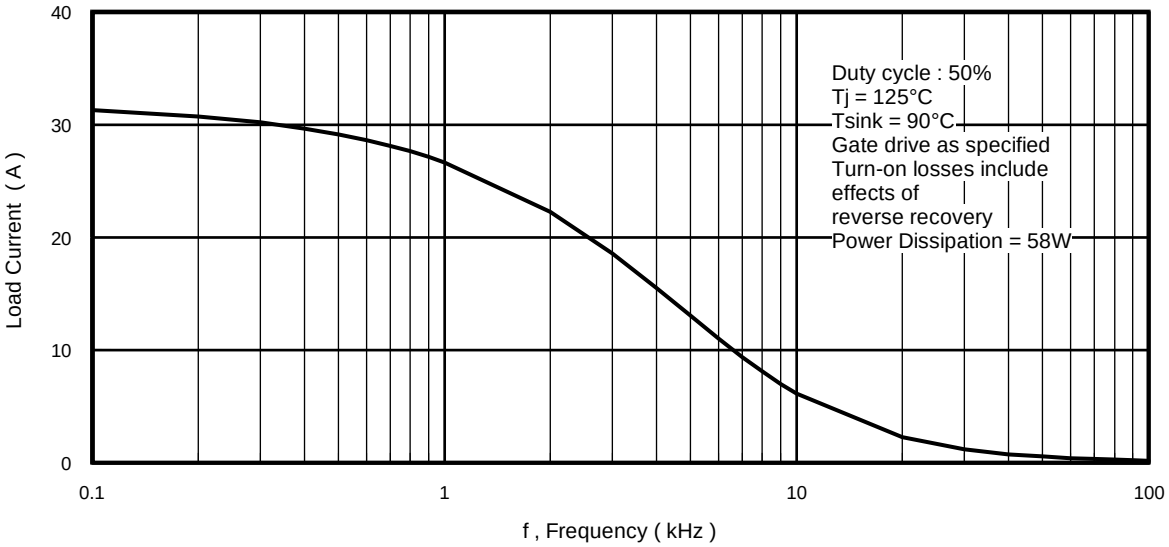


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

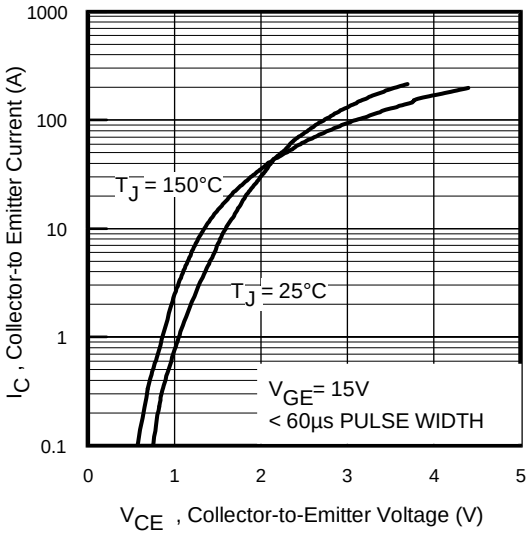


Fig. 2 - Typical Output Characteristics

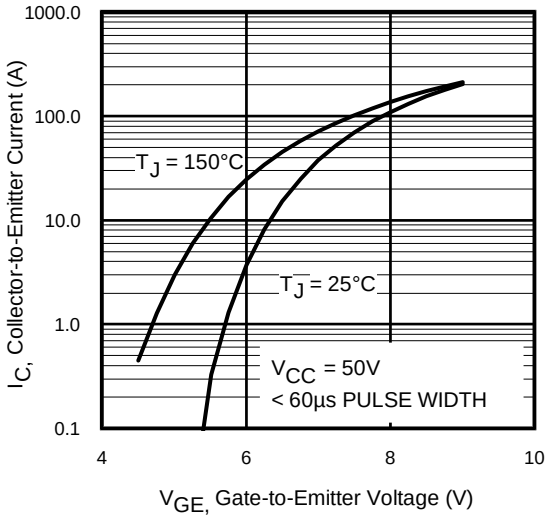


Fig. 3 - Typical Transfer Characteristics

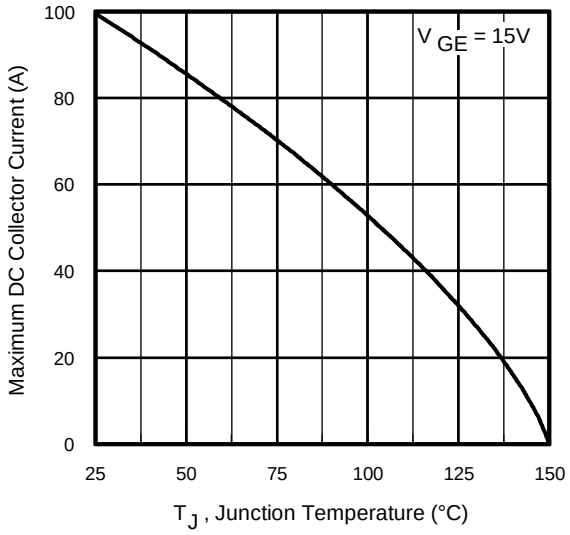


Fig. 4 - Maximum Collector Current vs. Case Temperature

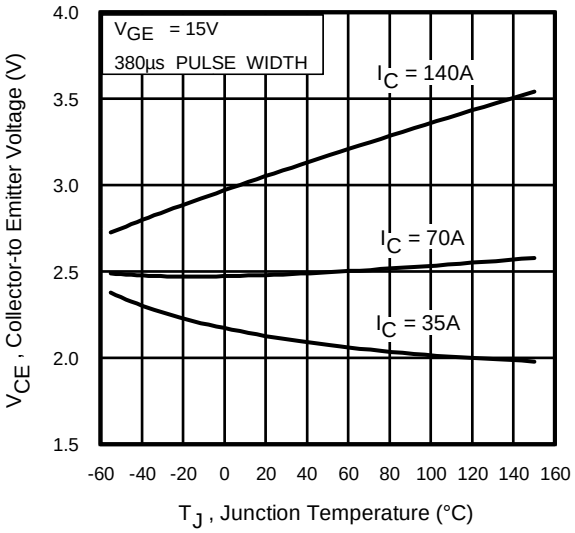


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

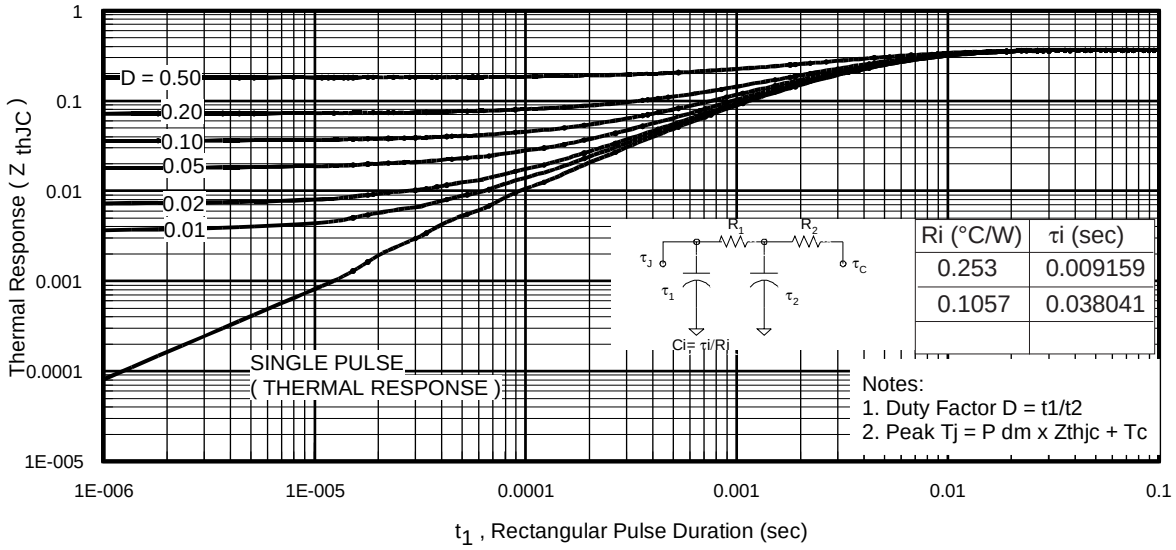


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

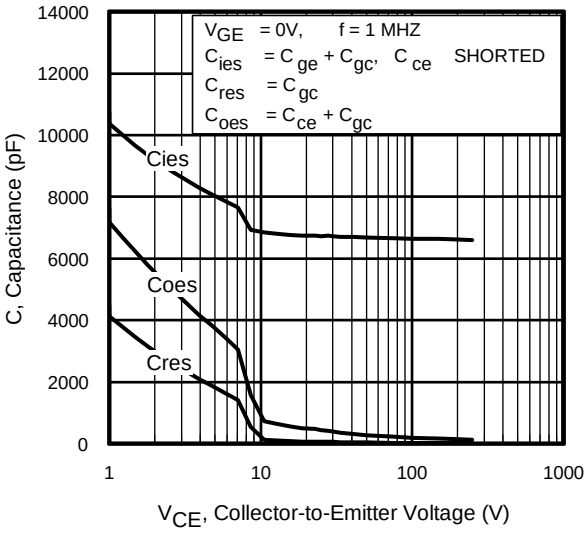


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

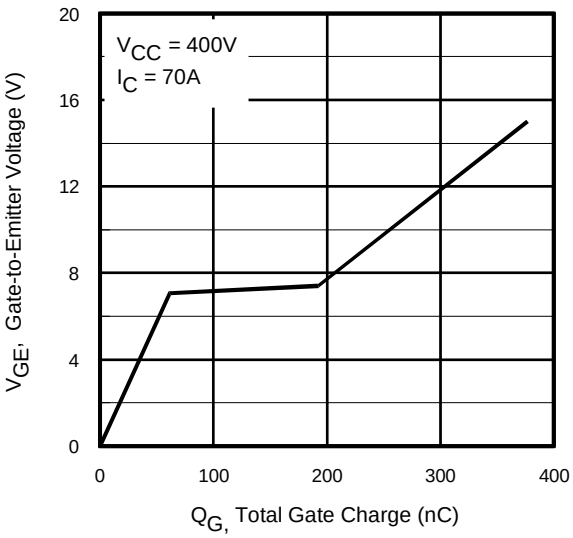


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

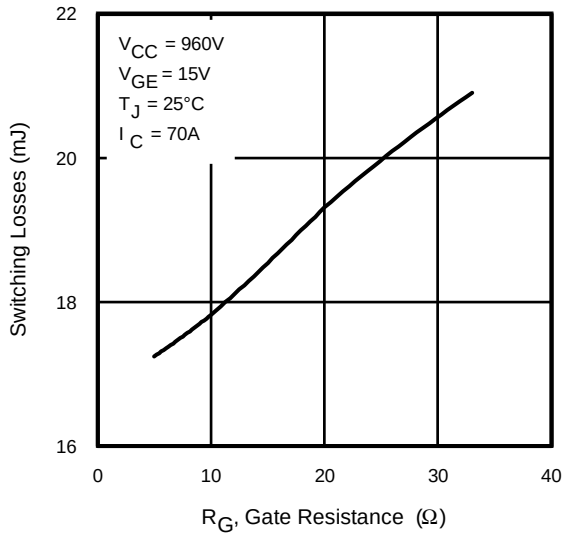


Fig. 9 - Typical Switching Losses vs. Gate Resistance

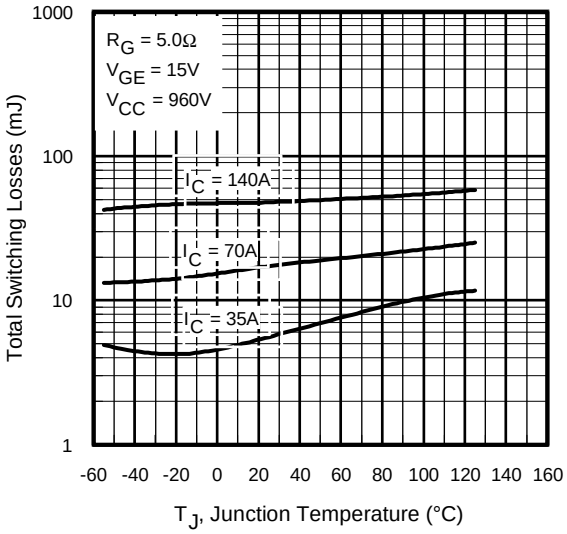


Fig. 10 - Typical Switching Losses vs. Junction Temperature

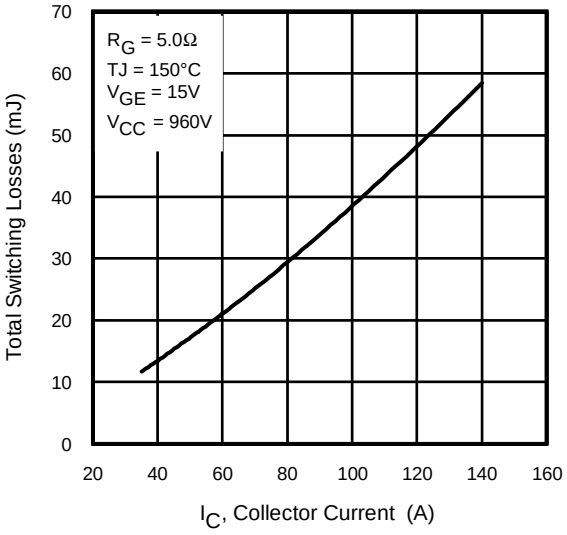


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

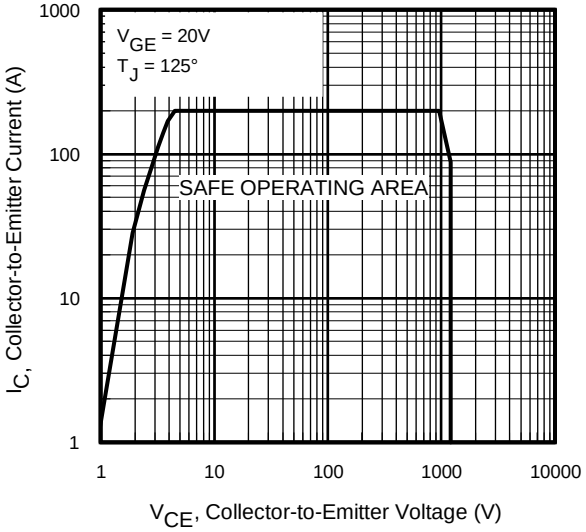


Fig. 12 - Turn-Off SOA

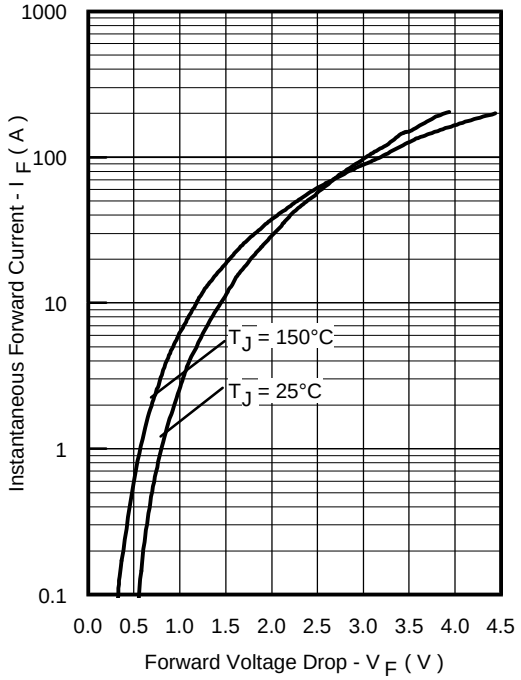


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

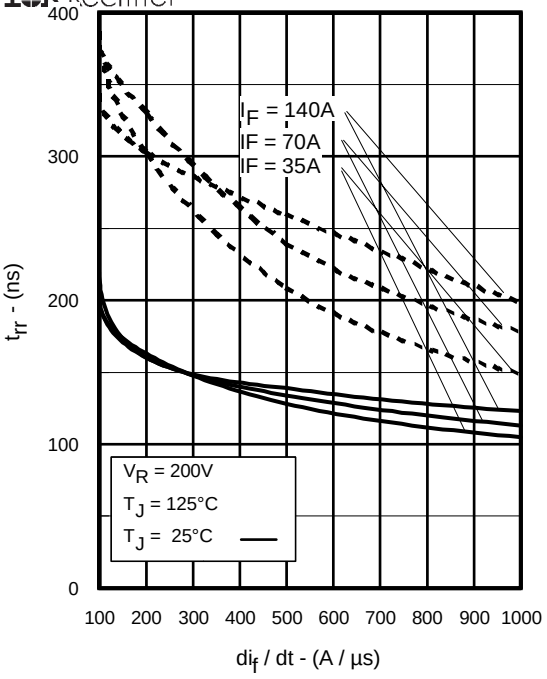


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

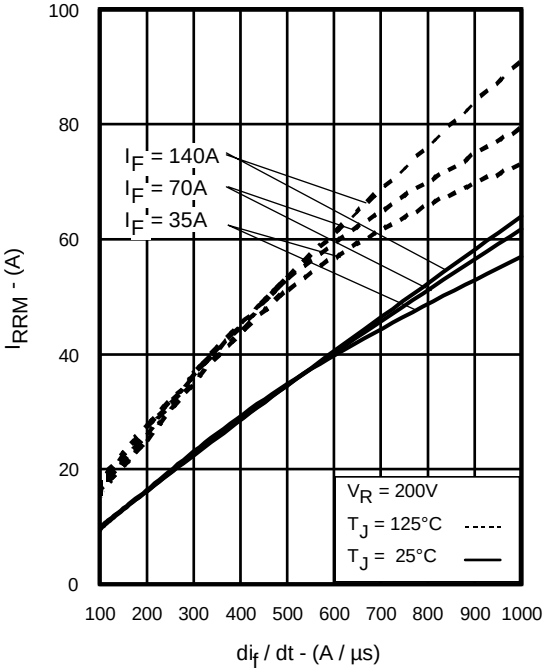


Fig. 15 - Typical Recovery Current vs. di_f/dt

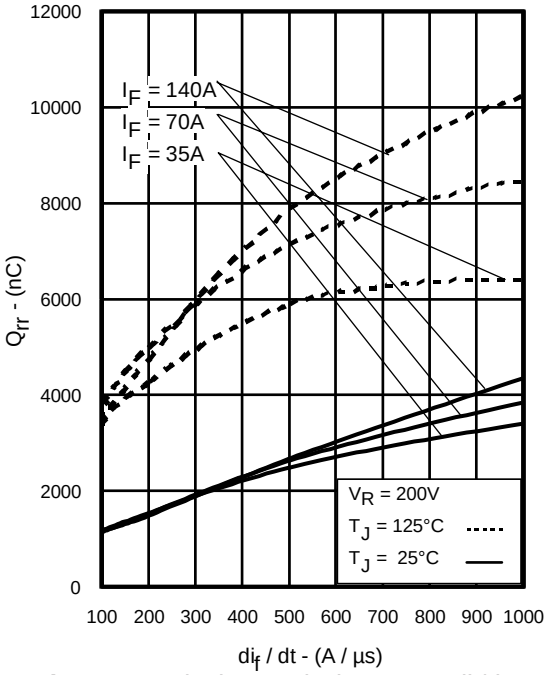


Fig. 16 - Typical Stored Charge vs. di_f/dt

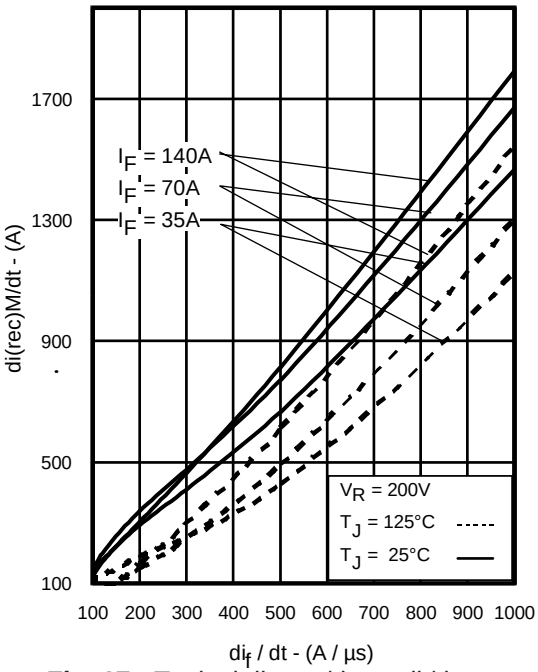


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

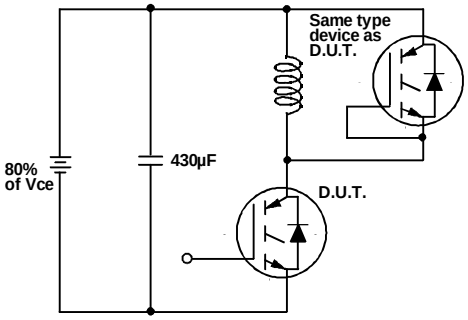


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

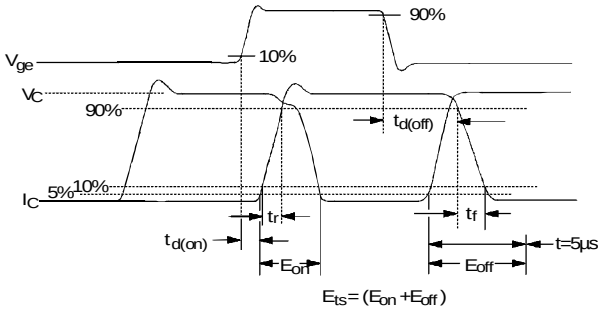


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

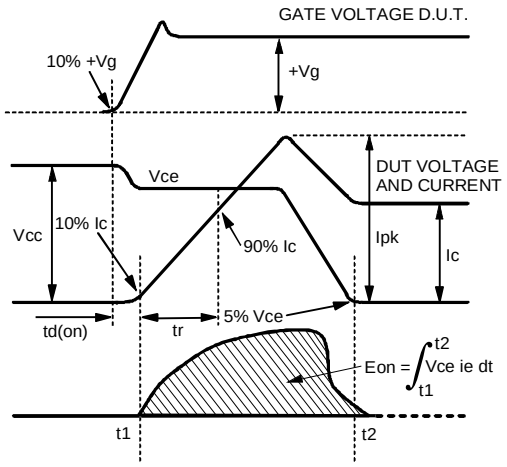


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

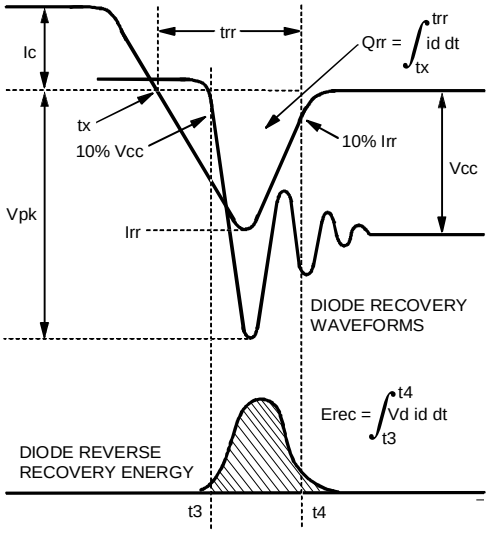


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

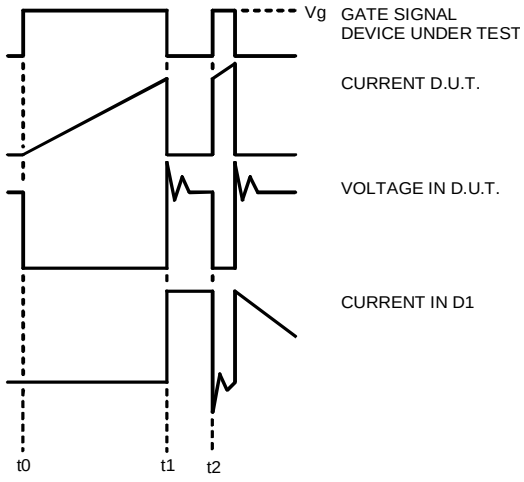


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

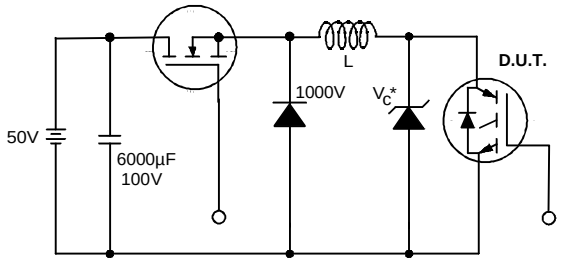


Figure 19. Clamped Inductive Load Test Circuit

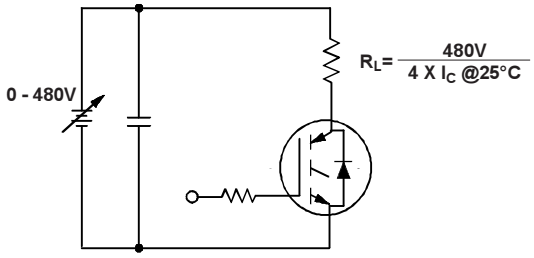
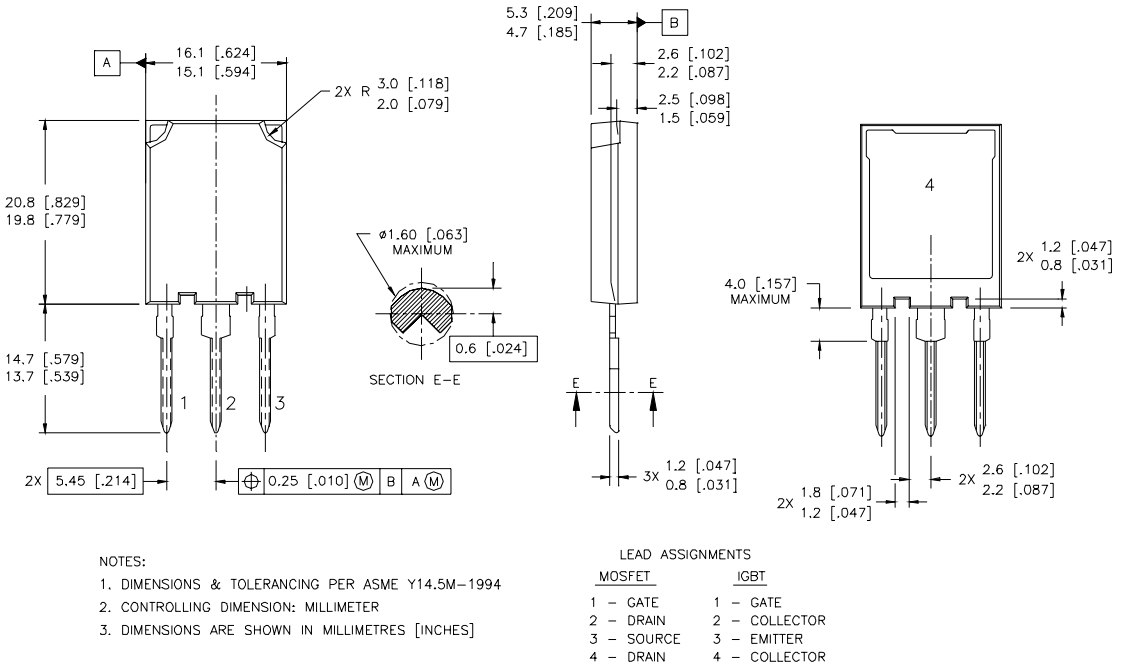


Figure 20. Pulsed Collector Current Test Circuit

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=10µH, R_G= 5.0 Ω (figure 13a)

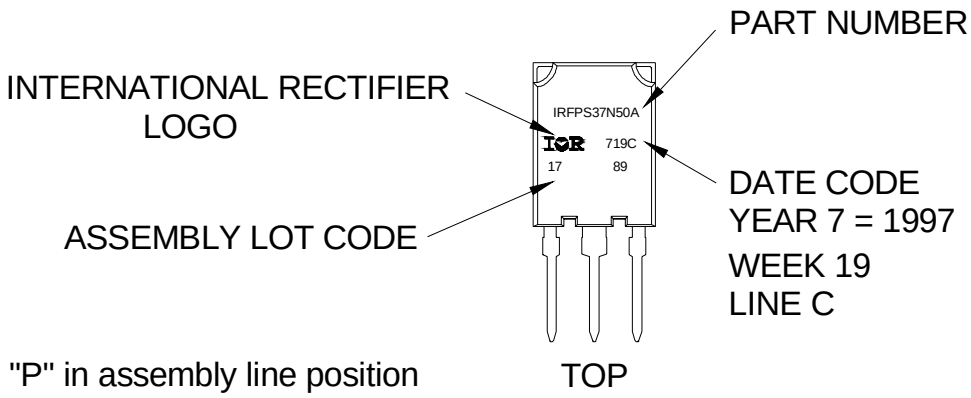
③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

⑤ Repetitive rating; pulse width limited by maximumjunction temperature.

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"

International
IOR Rectifier

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