THE DATASHEET OF

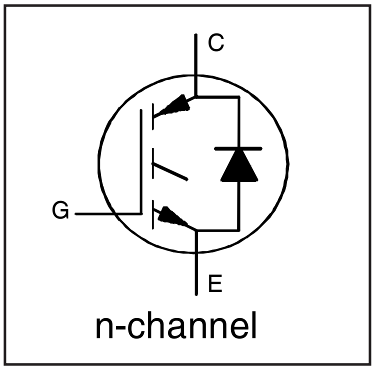
IRG7PSH50UDPBF

International
IOR Rectifier

PD - 97548

IRG7PSH50UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE



V_{CES} = 1200V

$I_{NOMINAL}$ = 50A

$T_{J(max)}$ = 150°C

$V_{CE(on)}$ typ. = 1.7V

Features

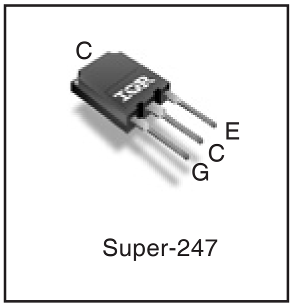
- Low $V_{CE\ (ON)}$ trench IGBT technology
- Low switching losses
- Square RBSOA
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE\ (ON)}$ temperature co-efficient
- Ultra fast soft recovery co-pak diode
- Tight parameter distribution
- Lead-Free

Benefits

- High efficiency in a wide range of applications
- Suitable for a wide range of switching frequencies due to low $V_{CE\ (ON)}$ and low switching losses
- Rugged transient performance for increased reliability
- Excellent current sharing in parallel operation

Applications

- U.P.S.
- Welding
- Solar Inverter
- Induction Heating



Super-247

G	C	E
Gate	Collector	Emitter

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current (Silicon Limited)	116	A
I_C @ T_C = 100°C	Continuous Collector Current (Silicon Limited)	70	
$I_{NOMINAL}$	Nominal Current	50	
I_{CM}	Pulse Collector Current, V_{GE} = 15V	150	
I_{LM}	Clamped Inductive Load Current, V_{GE} = 20V ①	200	
I_F @ T_C = 25°C	Diode Continous Forward Current	116	
I_F @ T_C = 100°C	Diode Continous Forward Current	70	
I_{FM}	Diode Maximum Forward Current ②	200	
V_{GE}	Continuous Gate-to-Emitter Voltage	±30	V
P_D @ T_C = 25°C	Maximum Power Dissipation	462	W
P_D @ T_C = 100°C	Maximum Power Dissipation	185	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw	10 lbf·in (1.1 N·m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) ④	–––	–––	0.27	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ④	–––	–––	0.37	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	–––	0.24	–––	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	–––	40	–––	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V_{GE} = 0V, I_C = 100µA ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.0	—	V/°C	V_{GE} = 0V, I_C = 1.0mA (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.7	2.0	V	I_C = 50A, V_{GE} = 15V, T_J = 25°C
		—	2.0	—		I_C = 50A, V_{GE} = 15V, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	V_{CE} = V_{GE}, I_C = 2.0mA
$\Delta V_{GE(th)}/\Delta TJ$	Threshold Voltage temp. coefficient	—	-17	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA (25°C - 150°C)
gfe	Forward Transconductance	—	55	—	S	V_{CE} = 50V, I_C = 50A, PW = 30µs
I_{CES}	Collector-to-Emitter Leakage Current	—	2.0	100	µA	V_{GE} = 0V, V_{CE} = 1200V
		—	3700	—		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	3.0	3.9	V	I_F = 50A
		—	2.7	—		I_F = 50A, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±200	nA	V_{GE} = ±30V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	290	440	nC	I_C = 50A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	40	60		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	110	170		V_{CC} = 600V
E_{on}	Turn-On Switching Loss	—	3600	4600	µJ	I_C = 50A, V_{CC} = 600V, V_{GE} = 15V
E_{off}	Turn-Off Switching Loss	—	2200	3200		R_G = 5.0Ω, L = 200µH,T_J = 25°C
E_{total}	Total Switching Loss	—	5800	7800		Energy losses include tail & diode reverse recovery
$t_{d(on)}$	Turn-On delay time	—	35	55	ns	
t_r	Rise time	—	40	60		
$t_{d(off)}$	Turn-Off delay time	—	430	500		
t_f	Fall time	—	45	65		
E_{on}	Turn-On Switching Loss	—	5080	—	µJ	I_C = 50A, V_{CC} = 600V, V_{GE}=15V
E_{off}	Turn-Off Switching Loss	—	3370	—		R_G=5.0Ω, L=200µH, T_J = 150°C ③
E_{total}	Total Switching Loss	—	8450	—		Energy losses include tail & diode reverse recovery
$t_{d(on)}$	Turn-On delay time	—	30	—	ns	
t_r	Rise time	—	40	—		
$t_{d(off)}$	Turn-Off delay time	—	480	—		
t_f	Fall time	—	170	—		
C_{ies}	Input Capacitance	—	6000	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	300	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	130	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 200A V_{CC} = 960V, Vp =1200V Rg = 5.0Ω, V_{GE} = +20V to 0V
Erec	Reverse Recovery Energy of the Diode	—	1510	—	µJ	T_J = 150°C
t_{rr}	Diode Reverse Recovery Time	—	190	—	ns	V_{CC} = 600V, I_F = 5.0A
I_{rr}	Peak Reverse Recovery Current	—	5760	—	A	Rg = 5.0Ω, L =1.0mH

Notes:

① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 200µH, R_G = 5.0Ω.

② Pulse width limited by max. junction temperature.

③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.

④ R_θ is measured at T_J of approximately 90°C.

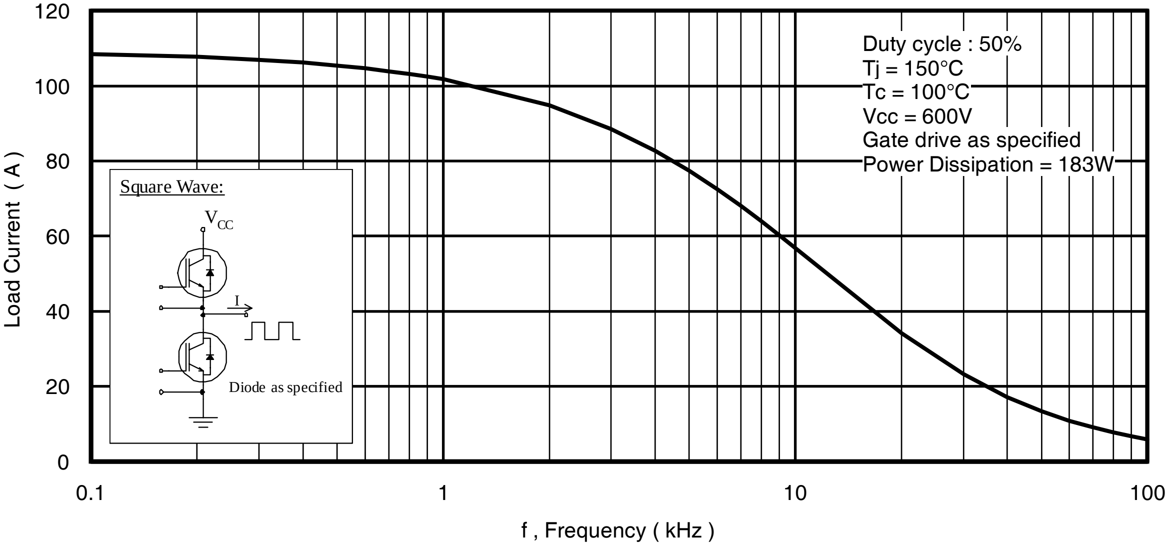


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

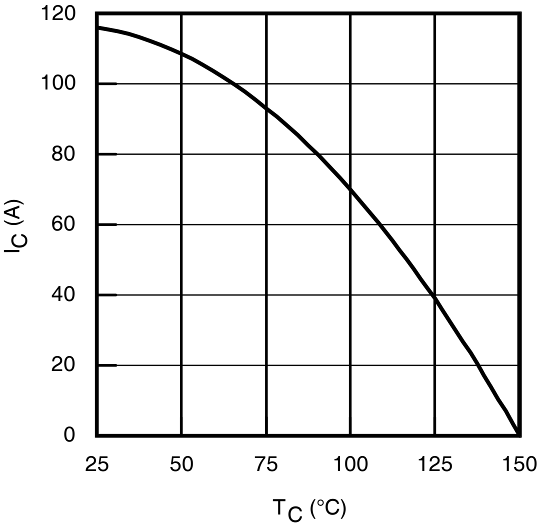


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

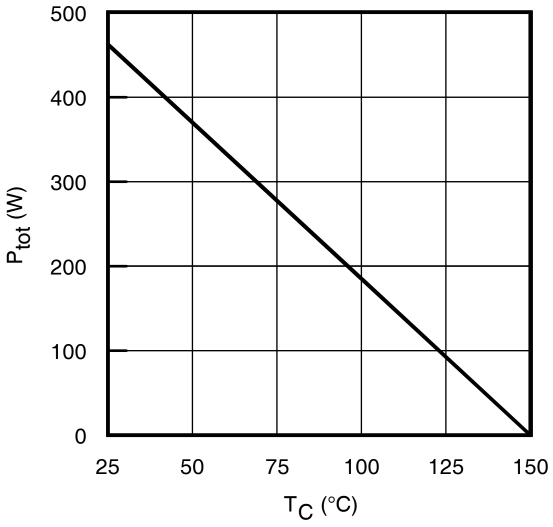


Fig. 2 - Power Dissipation vs. Case Temperature

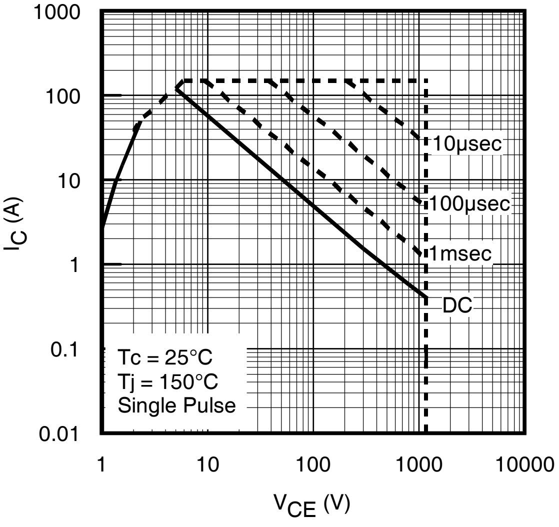


Fig. 3 - Forward SOA
$T_C = 25°C, T_J \leq 150°C; V_{GE} = 15V$

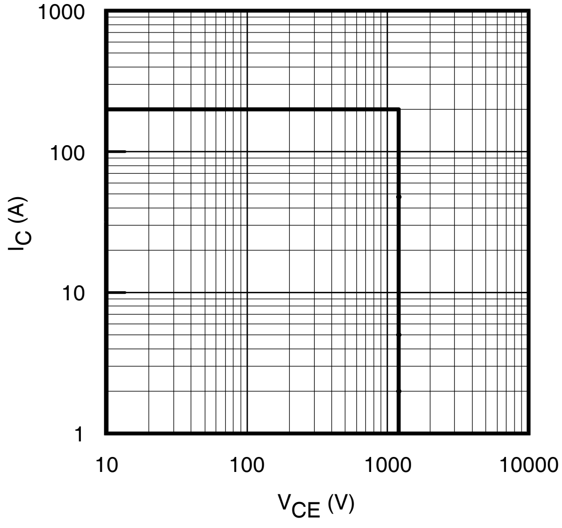


Fig. 4 - Reverse Bias SOA
$T_J = 150°C; V_{GE} = 20V$

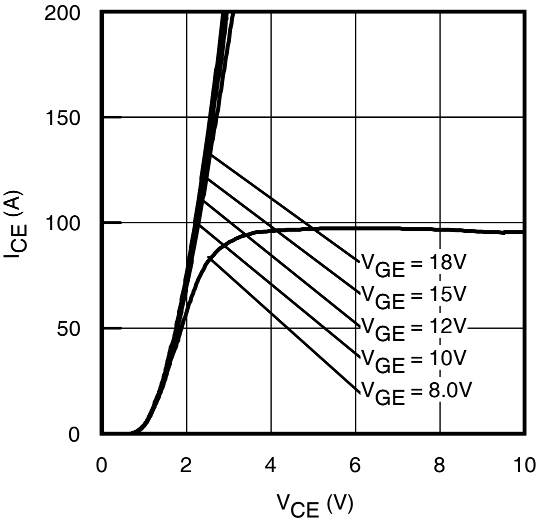


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 30µs

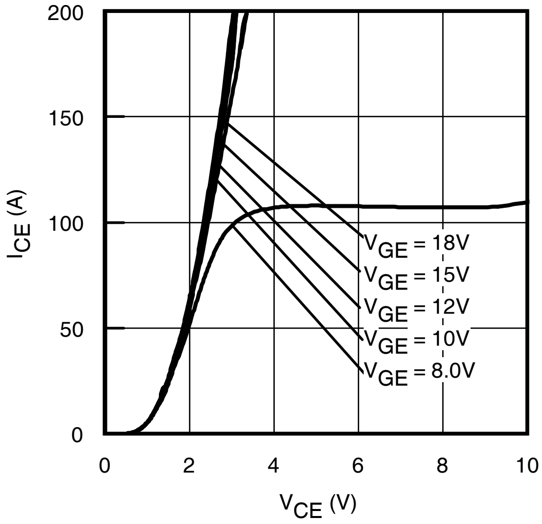


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 30µs

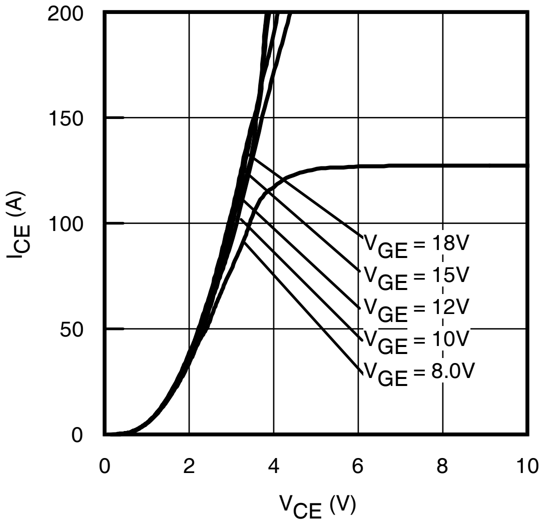


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 30µs

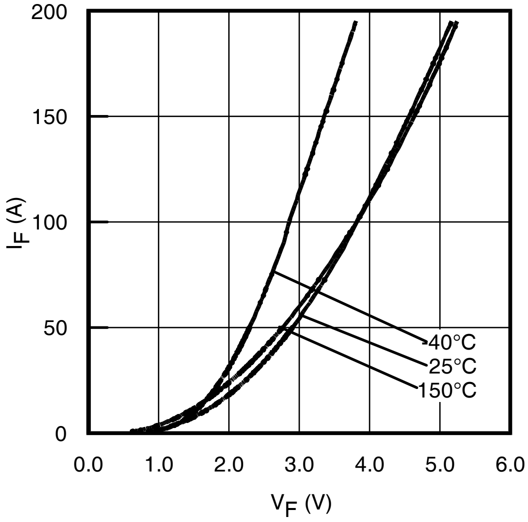


Fig. 8 - Typ. Diode Forward Characteristics
tp = 30µs

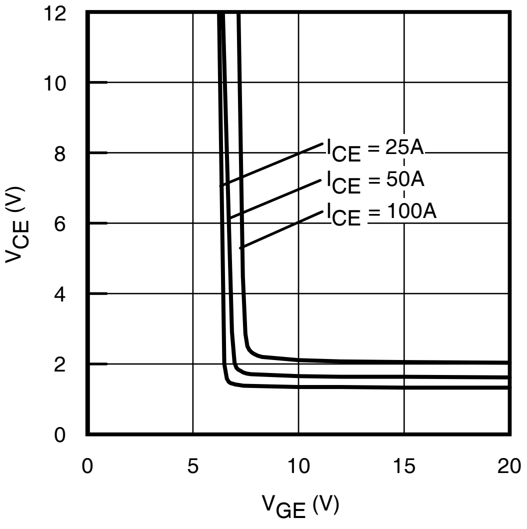


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

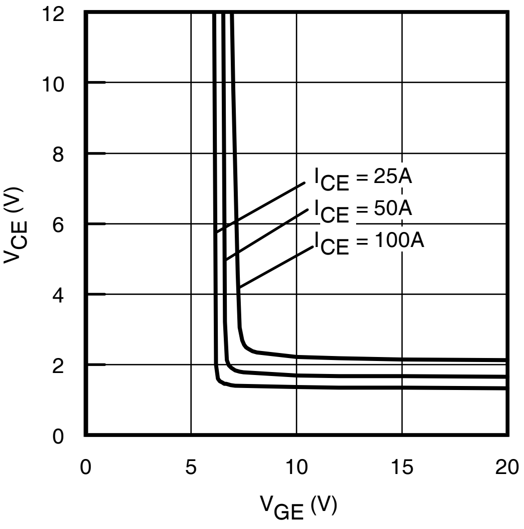


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

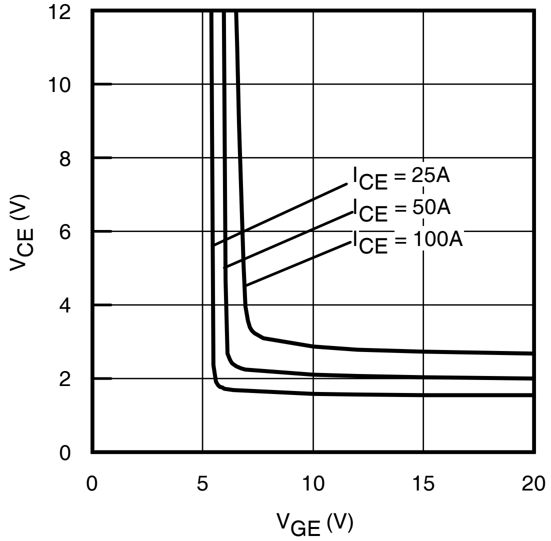


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

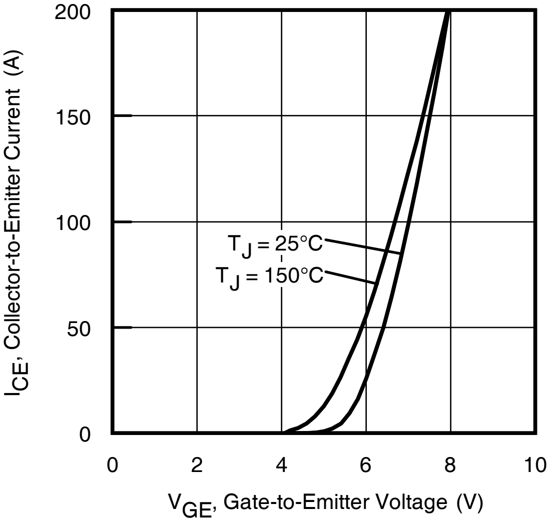


Fig. 12 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 30µs

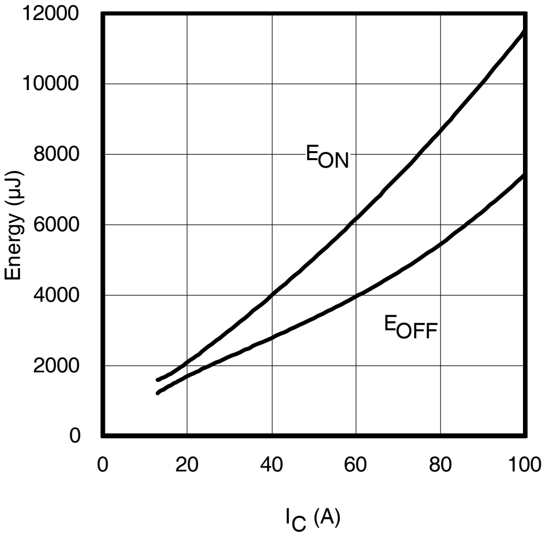


Fig. 13 - Typ. Energy Loss vs. I_C
T_J = 150°C; L = 200µH; V_{CE} = 600V, R_G = 5.0Ω; V_{GE} = 15V

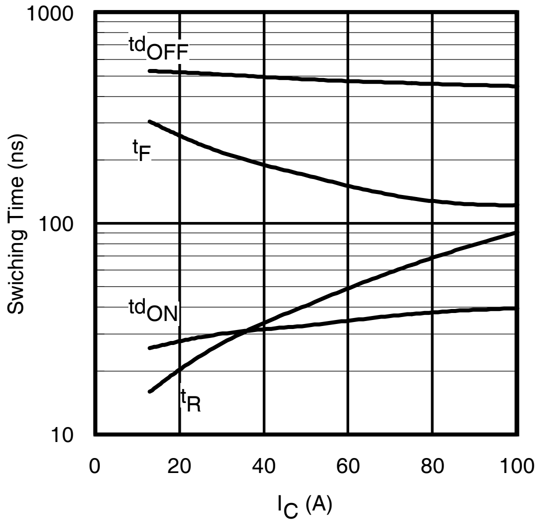


Fig. 14 - Typ. Switching Time vs. I_C
T_J = 150°C; L = 200µH; V_{CE} = 600V, R_G = 5.0Ω; V_{GE} = 15V

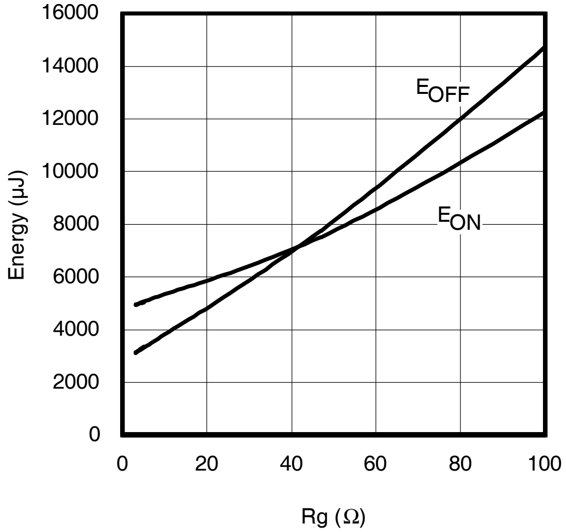


Fig. 15 - Typ. Energy Loss vs. R_G
T_J = 150°C; L = 200µH; V_{CE} = 600V, I_{CE} = 50A; V_{GE} = 15V

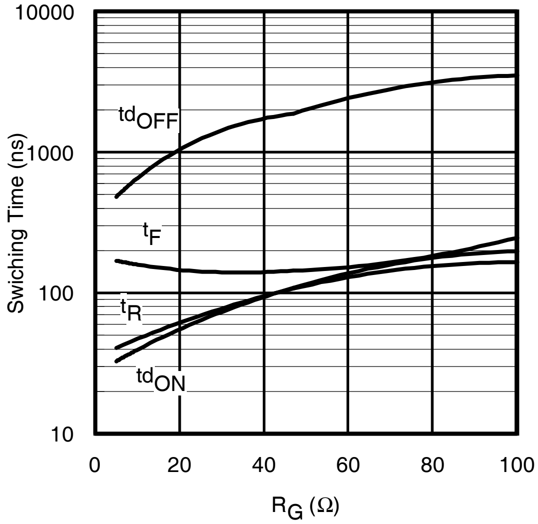


Fig. 16 - Typ. Switching Time vs. R_G
T_J = 150°C; L = 200µH; V_{CE} = 600V, I_{CE} = 50A; V_{GE} = 15V

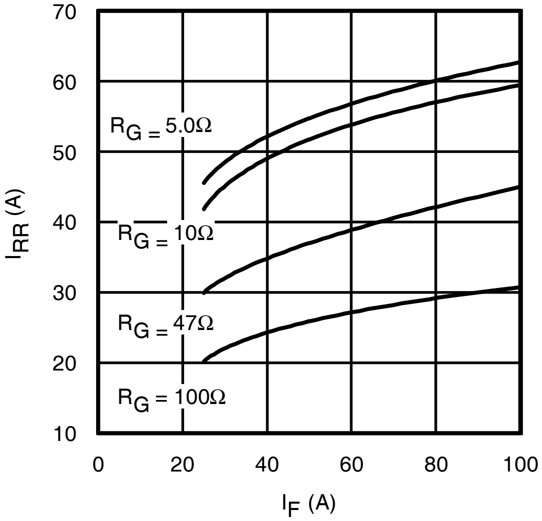


Fig. 17 - Typ. Diode I_{RR} vs. I_F
$T_J = 150°C$

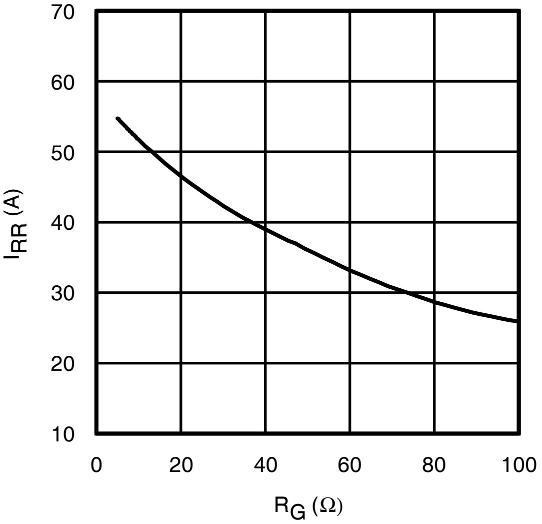


Fig. 18 - Typ. Diode I_{RR} vs. R_G
$T_J = 150°C$

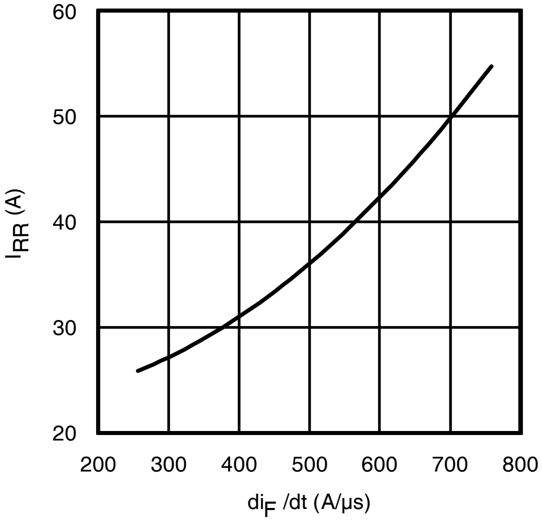


Fig. 19 - Typ. Diode I_{RR} vs. di_F/dt
$V_{CC} = 600V$; $V_{GE} = 15V$; $I_F = 50A$; $T_J = 150°C$

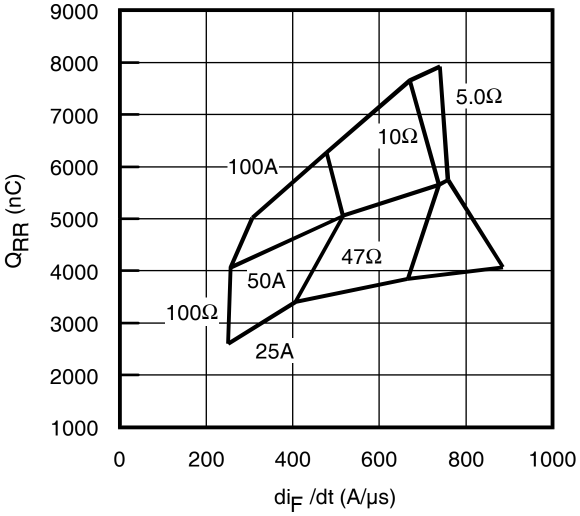


Fig. 20 - Typ. Diode Q_{RR} vs. di_F/dt
$V_{CC} = 600V$; $V_{GE} = 15V$; $T_J = 150°C$

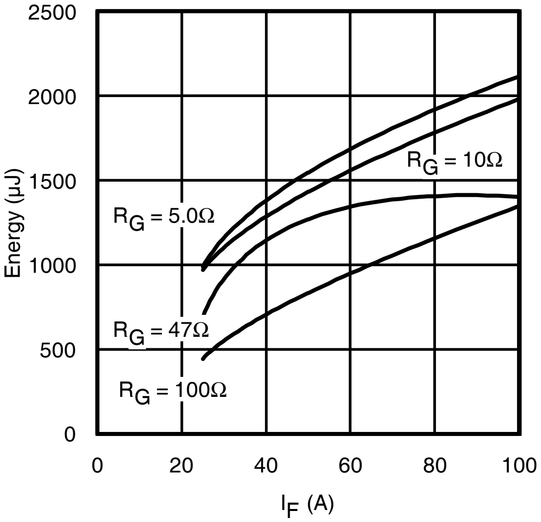


Fig. 21 - Typ. Diode E_{RR} vs. I_F
$T_J = 150°C$

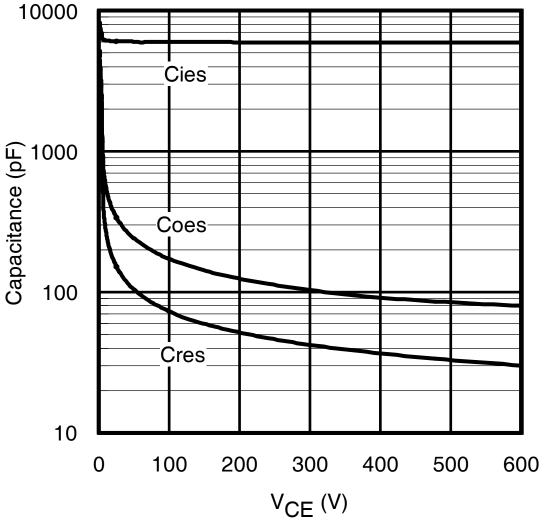


Fig. 22 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

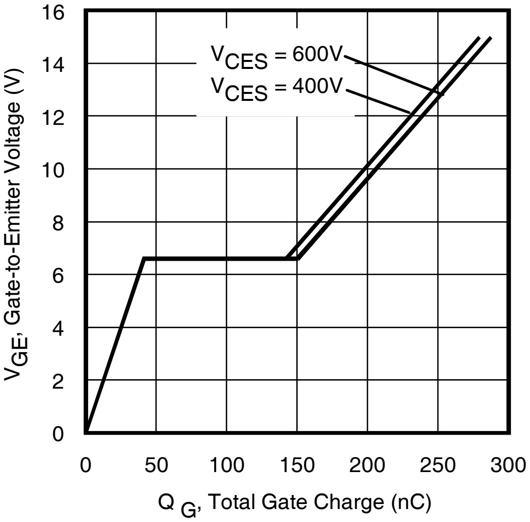
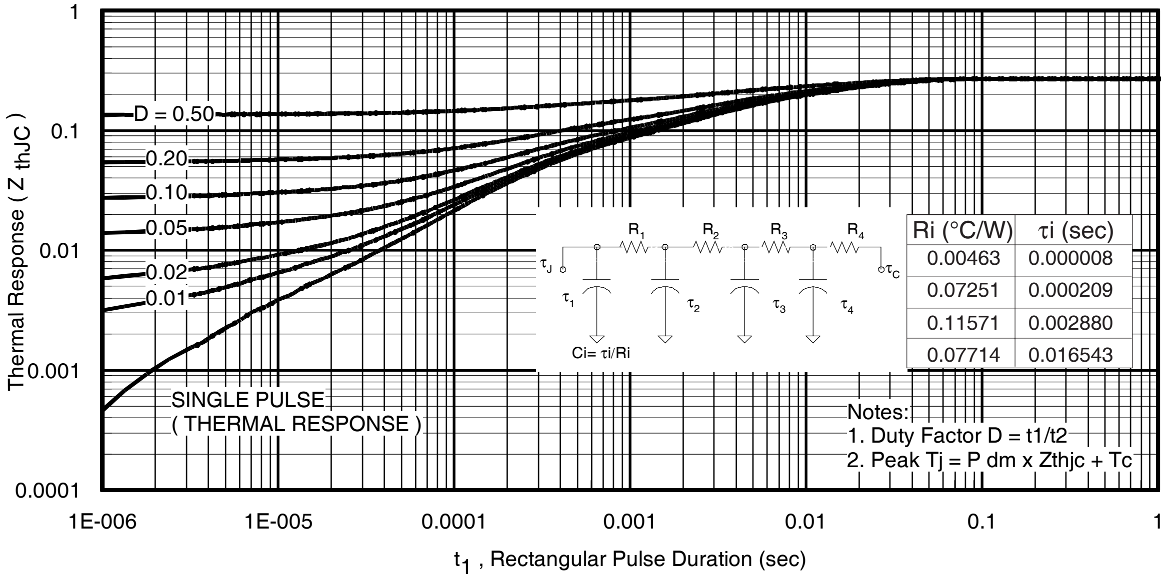


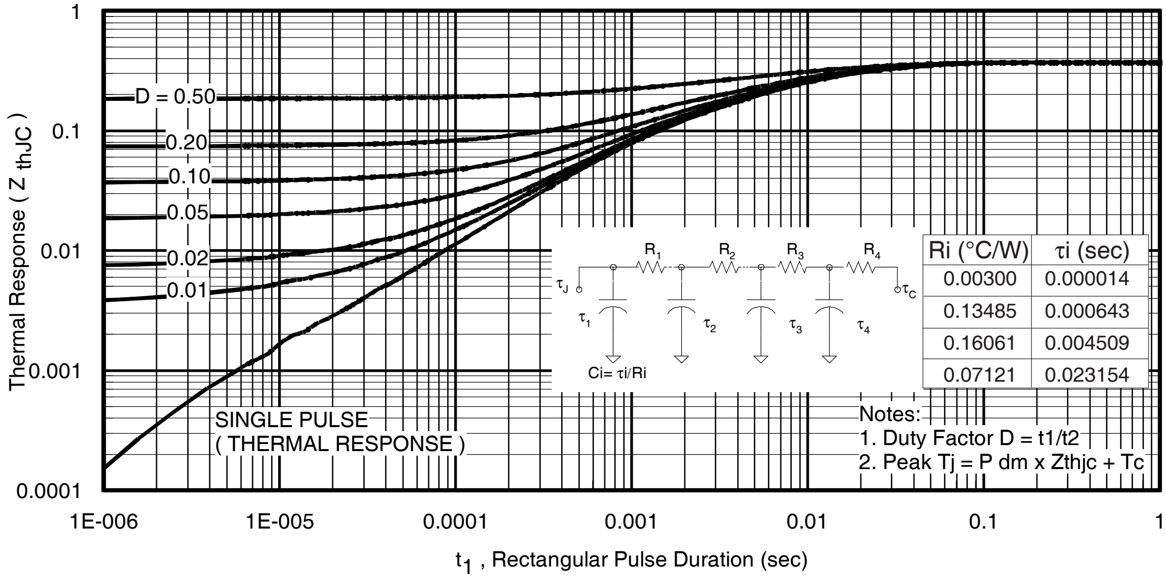
Fig. 23 - Typical Gate Charge vs. V_{GE}
I_{CE} = 50A



Ri (°C/W)	τi (sec)
0.00463	0.000008
0.07251	0.000209
0.11571	0.002880
0.07714	0.016543

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthjc + Tc

Fig 24. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)



Ri (°C/W)	τi (sec)
0.00300	0.000014
0.13485	0.000643
0.16061	0.004509
0.07121	0.023154

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthjc + Tc

Fig. 25. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

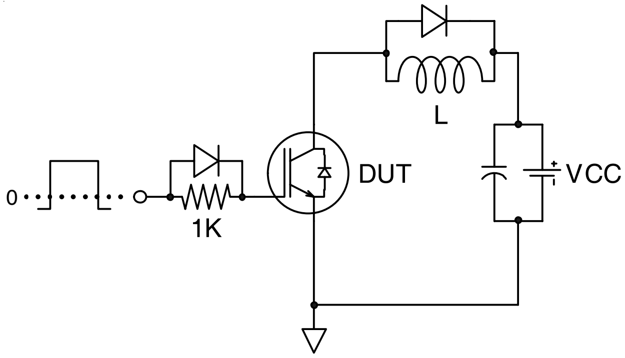


Fig.C.T.1 - Gate Charge Circuit (turn-off)

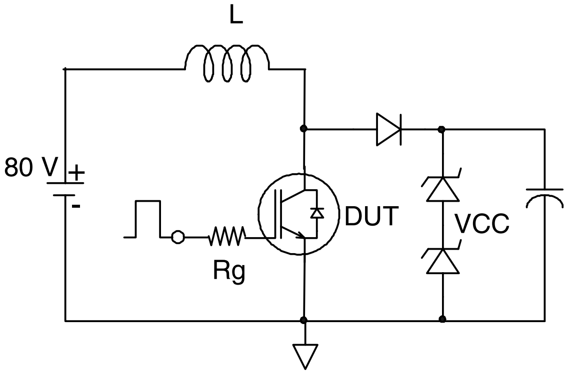


Fig.C.T.2 - RBSOA Circuit

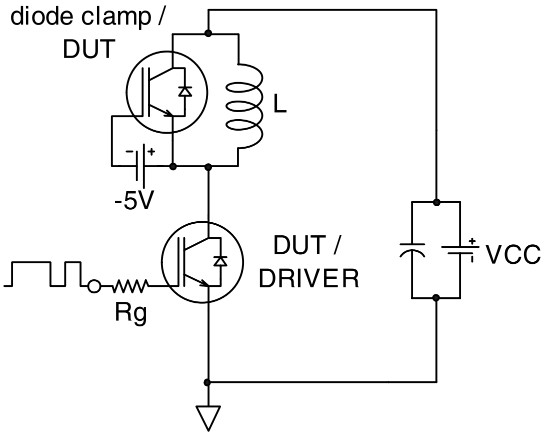


Fig.C.T.3 - Switching Loss Circuit

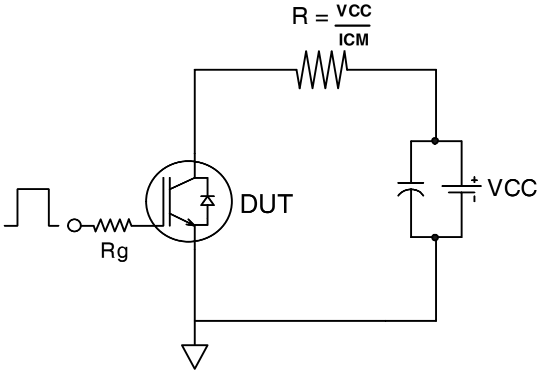


Fig.C.T.4 - Resistive Load Circuit

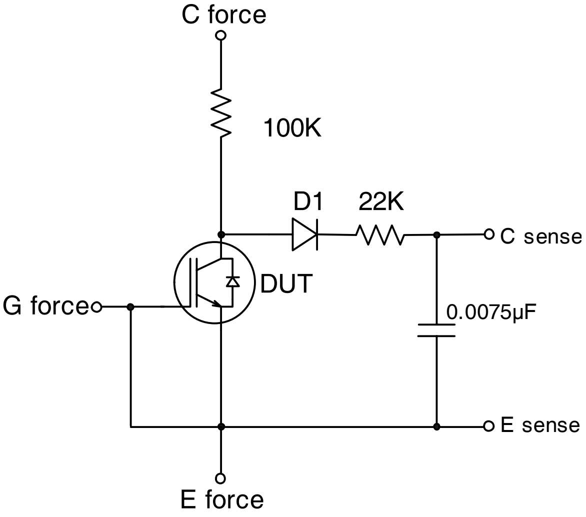


Fig.C.T.5 - BVCES Filter Circuit

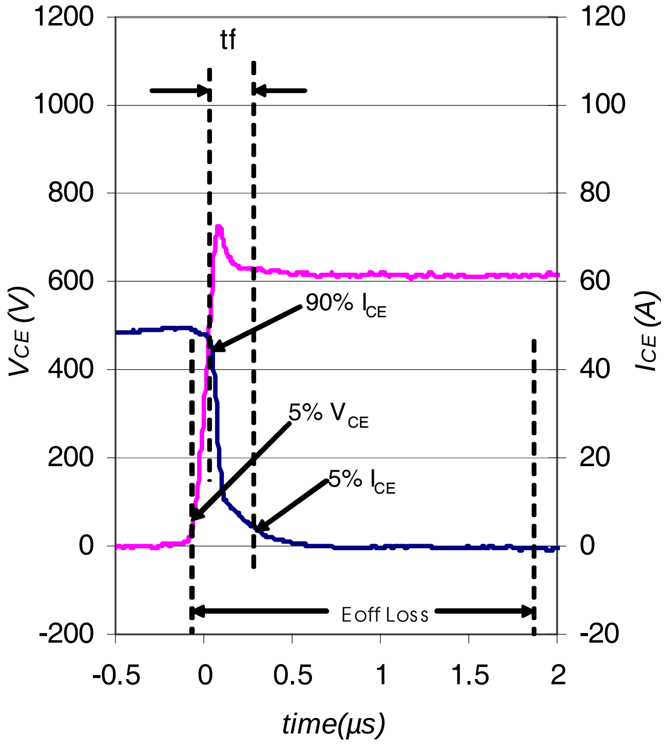


Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.4

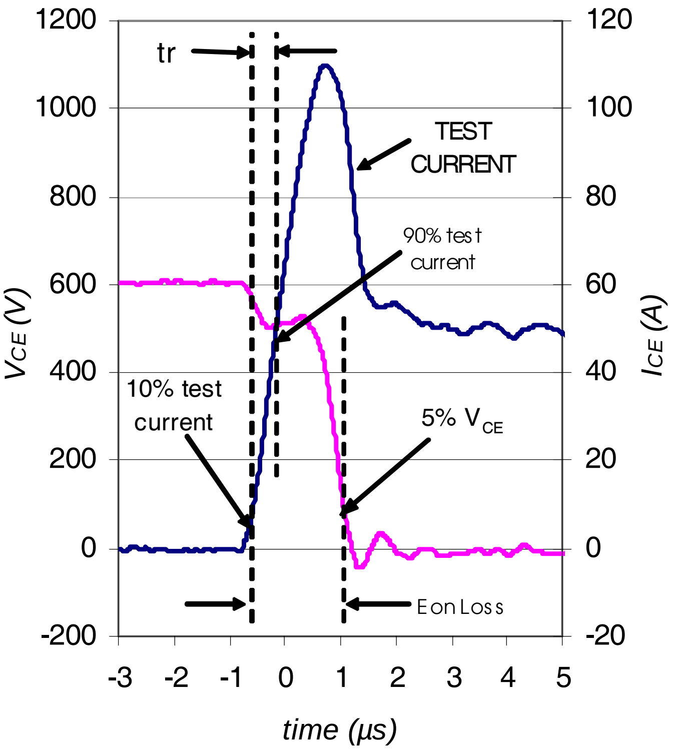


Fig. WF2 - Typ. Turn-on Loss Waveform
@ T_J = 150°C using Fig. CT.4

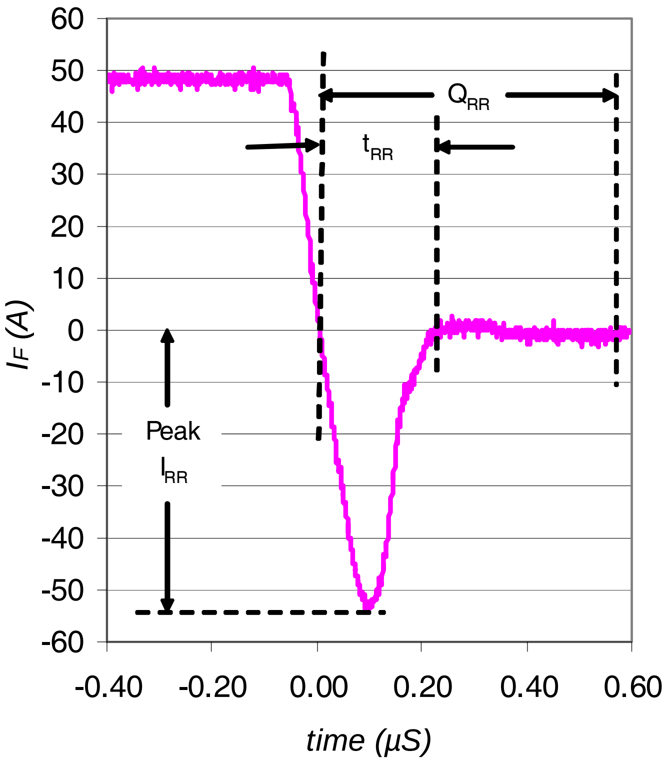
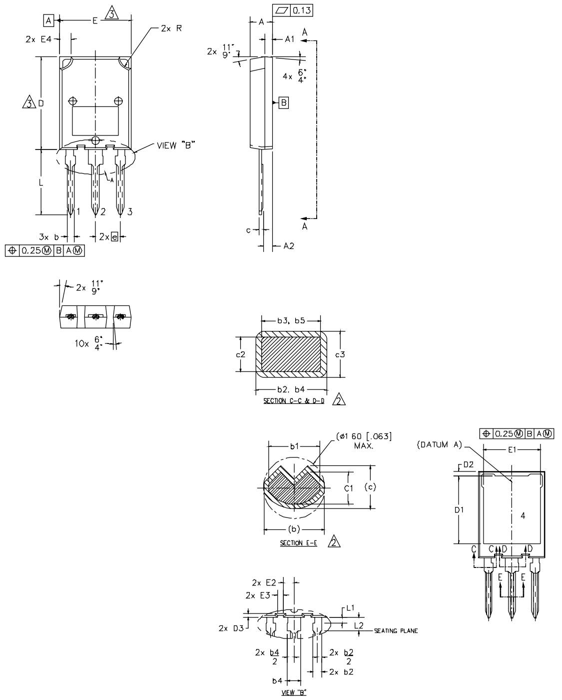


Fig. WF3 - Typ. Diode Recovery Waveform
@ T_J = 150°C using Fig. CT.4

Case Outline and Dimensions — Super-247



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
2. DIMENSIONS b1, b3, b5, c1 & c3 APPLY TO BASE METAL ONLY.
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER EXTREMES OF THE PLASTIC BODY.
4.- ALL DIMENSIONS SHOWN IN MILLIMETERS.
5.- CONTROLLING DIMENSION: MILLIMETER.
6.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-274AA

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.50	5.50	.177	.217	
A1	1.45	2.15	.057	.085	
A2	1.65	2.35	.065	.093	
b	1.45	1.60	.054	.063	
b1	1.40	1.50	.055	.059	2
b2	2.00	2.40	.079	.094	
b3	1.95	2.35	.077	.093	2
b4	3.00	3.15	.118	.124	
b5	2.95	3.35	.116	.132	2
c	1.10	1.30	.043	.051	
c1	0.90	1.10	.035	.043	2
c2	0.65	0.85	.026	.033	
c3	0.50	0.70	.020	.028	2
D	19.80	20.80	.780	.819	3
D1	15.50	16.10	.610	.634	
D2	0.70	1.30	.028	.051	
D3	0.75	1.25	.030	.049	
E	15.10	16.10	.594	.634	3
E1	13.30	13.90	.524	.547	
E2	2.25	2.70	.089	.109	
E3	1.20	1.70	.047	.067	
E4	2.00	3.00	.079	.118	
e	5.45 BSC		.215 BSC		
L	13.80	14.80	.535	.583	
L1	1.00	1.60	.039	.063	
L2	3.85	4.25	.152	.167	
R	2.00	3.00	.079	.118	

LEAD ASSIGNMENTS

MOSFET

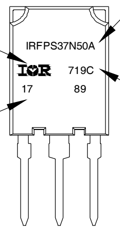
1.- GATE
2.- DRAIN
3.- SOURCE
4.- DRAIN

IGBT

1.- GATE
2.- COLLECTOR
3.- EMITTER
4.- COLLECTOR

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"



PART NUMBER

INTERNATIONAL RECTIFIER
LOGO

DATE CODE
YEAR 7 = 1997
WEEK 19
LINE C

ASSEMBLY LOT CODE

TOP

Note: "P" in assembly line position
indicates "Lead-Free"

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

Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

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

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information. 07/2010