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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V_{GE} = 0V, I_C = 500µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.99	—	V/°C	V_{GE} = 0V, I_C = 1mA (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Voltage	1.50	1.70	2.10	V	I_C = 10A, V_{GE} = 15V, T_J = 25°C
		—	2.05	2.35		I_C = 10A, V_{GE} = 15V, T_J = 150°C
		—	2.06	2.35		I_C = 10A, V_{GE} = 15V, T_J = 175°C
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 1mA (25°C-150°C)
gfe	Forward Transconductance	—	5.0	—	S	V_{CE} = 50V, I_C = 10A, PW = 80µs
I_{CES}	Zero Gate Voltage Collector Current	—	1.0	150	µA	V_{GE} = 0V, V_{CE} = 600V
		—	90	250		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
		—	150	400		V_{GE} = 0V, V_{CE} = 600V, T_J = 175°C
V_{FM}	Diode Forward Voltage Drop	—	1.80	2.40	V	I_F = 5.0A, V_{GE} = 0V
		—	1.32	1.74		I_F = 5.0A, V_{GE} = 0V, T_J = 150°C
		—	1.23	1.62		I_F = 5.0A, V_{GE} = 0V, T_J = 175°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V, V_{CE} = 0V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	41	62	nC	I_C = 10A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	4.6	6.9		V_{CC} = 400V
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	19	29		V_{GE} = 15V
E_{on}	Turn-On Switching Loss	—	156	264	µJ	I_C = 10A, V_{CC} = 400V
E_{off}	Turn-Off Switching Loss	—	165	273		V_{GE} = 15V, R_G = 50Ω, L = 1.07mH
E_{tot}	Total Switching Loss	—	321	434		Ls= 150nH, T_J = 25°C ②
$t_{d(on)}$	Turn-On delay time	—	25	33	ns	I_C = 10A, V_{CC} = 400V
t_r	Rise time	—	24	34		V_{GE} = 15V, R_G = 50Ω, L = 1.1mH
$t_{d(off)}$	Turn-Off delay time	—	180	250		Ls= 150nH, T_J = 25°C
t_f	Fall time	—	62	87		
E_{on}	Turn-On Switching Loss	—	261	372	µJ	I_C = 10A, V_{CC} = 400V
E_{off}	Turn-Off Switching Loss	—	313	425		V_{GE} = 15V, R_G = 50Ω, L = 1.07mH
E_{tot}	Total Switching Loss	—	574	694		Ls= 150nH, T_J = 150°C ②
$t_{d(on)}$	Turn-On delay time	—	22	31	ns	I_C = 8.0A, V_{CC} = 400V
t_r	Rise time	—	24	34		V_{GE} = 15V, R_G = 50Ω, L = 1.07mH
$t_{d(off)}$	Turn-Off delay time	—	240	340		Ls= 150nH, T_J = 150°C
t_f	Fall time	—	48	67		
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5 mm from package
C_{ies}	Input Capacitance	—	610	915	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	66	99		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	23	35		f = 1.0MHz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 32A, Vp = 600V V_{CC}=500V,V_{GE} = +15V to 0V,R_G = 50Ω
SCSOA	Short Circuit Safe Operating Area	10	—	—	µs	T_J = 150°C, Vp = 600V, R_G = 50Ω V_{CC}=360V,V_{GE} = +15V to 0V
$I_{SC\ (PEAK)}$	Peak Short Circuit Collector Current	—	100	—	A	
E_{rec}	Reverse Recovery Energy of the Diode	—	99	128	µJ	T_J = 150°C
t_{rr}	Diode Reverse Recovery Time	—	79	103	ns	V_{CC} = 400V, I_F = 10A, L = 1.07mH
I_{rr}	Peak Reverse Recovery Current	—	14	18	A	V_{GE} = 15V, R_G = 50Ω
Q_{rr}	Diode Reverse Recovery Charge	—	553	719	nC	di/dt = 500A/µs

① Vcc =80% (V_{CES}), V_{GE} = 20V, L =100µH, R_G = 50Ω.

② Energy losses include "tail" and diode reverse recovery.

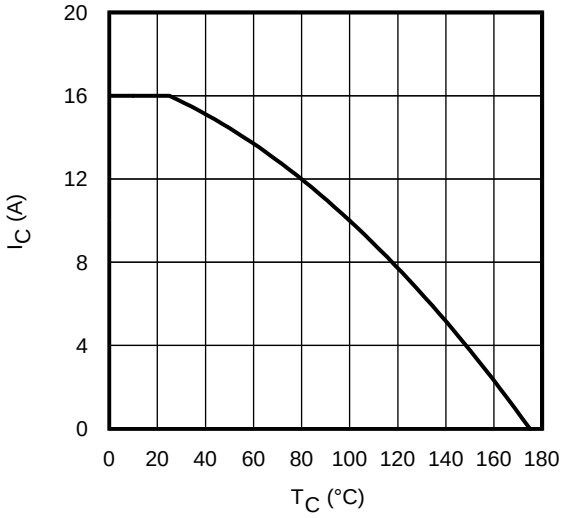


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

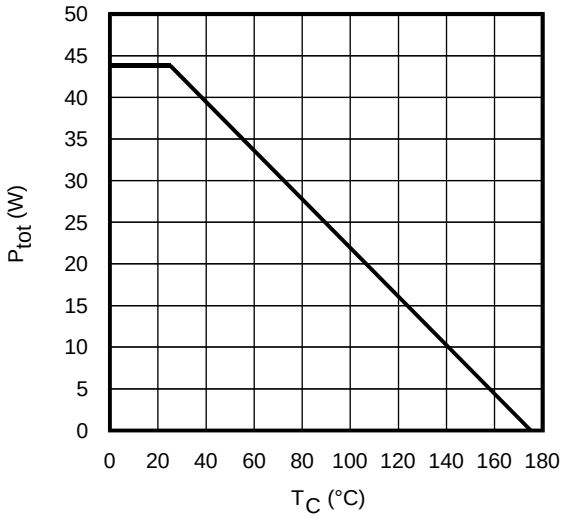


Fig. 2 - Power Dissipation vs. Case Temperature

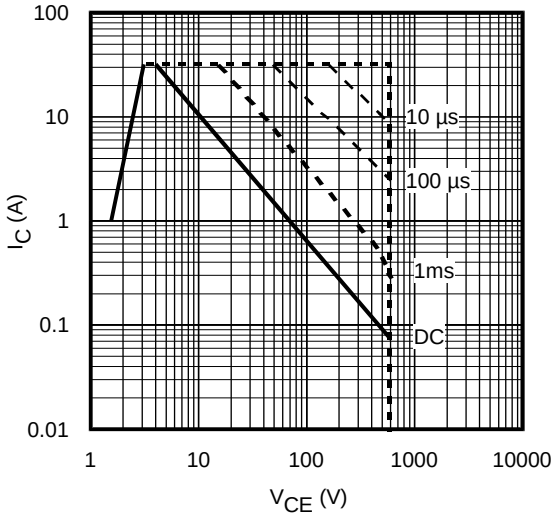


Fig. 3 - Forward SOA
T_C = 25°C; $T_J \leq$ 175°C

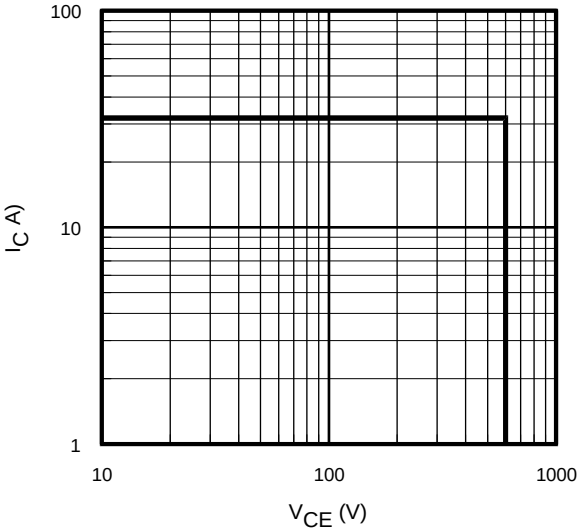


Fig. 4 - Reverse Bias SOA
T_J = 150°C; V_{GE} =15V

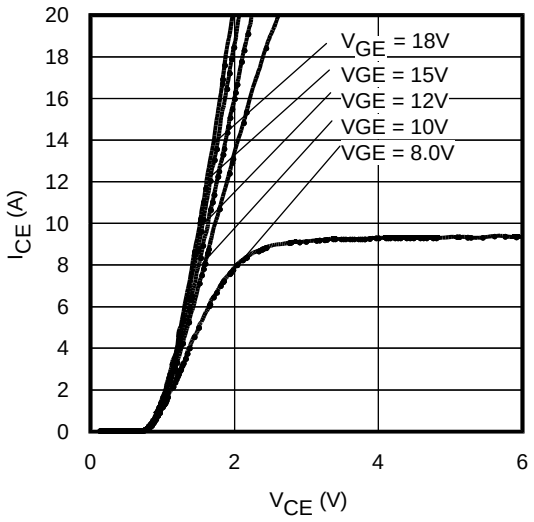


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80µs

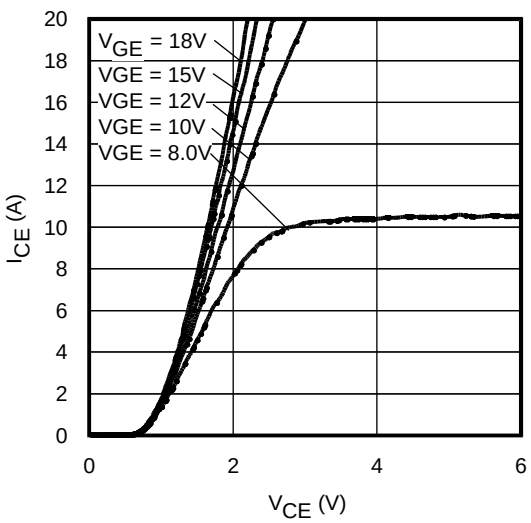


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

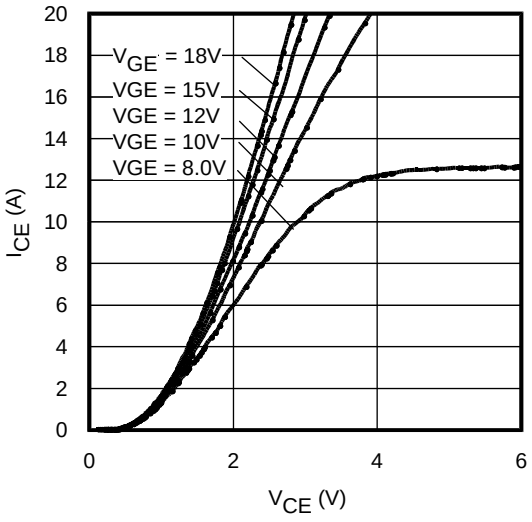


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 80µs

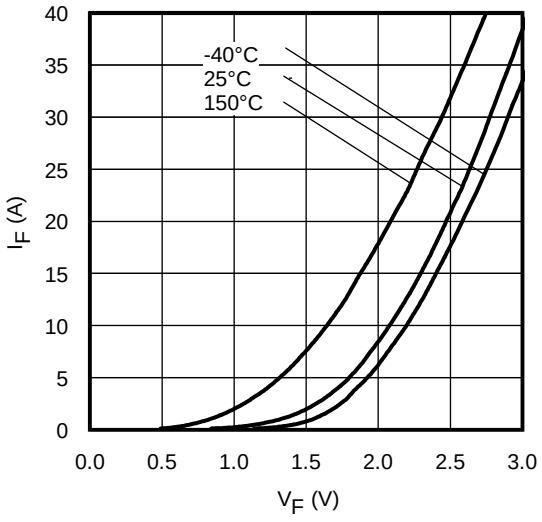


Fig. 8 - Typ. Diode Forward Characteristics
tp = 80µs

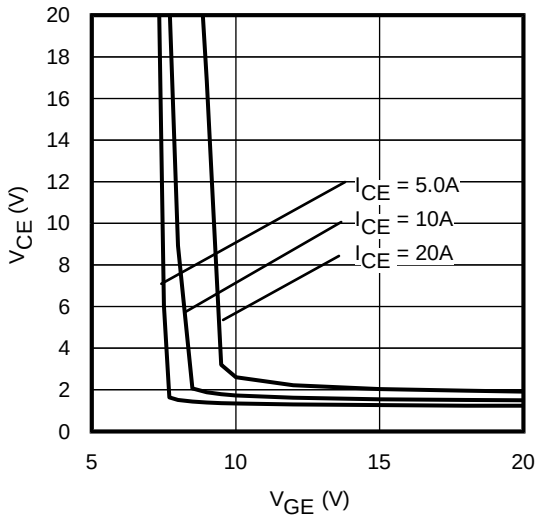


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

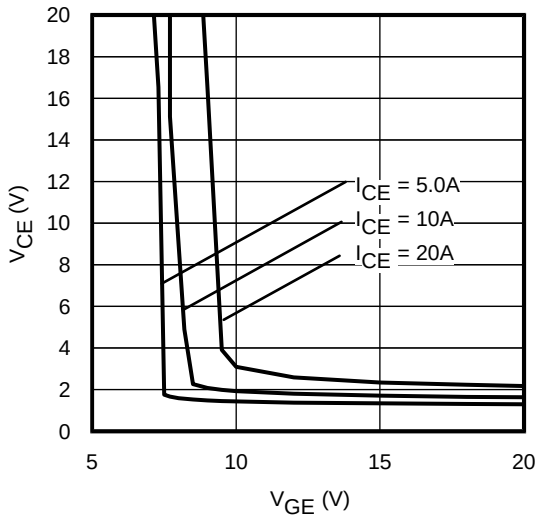


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

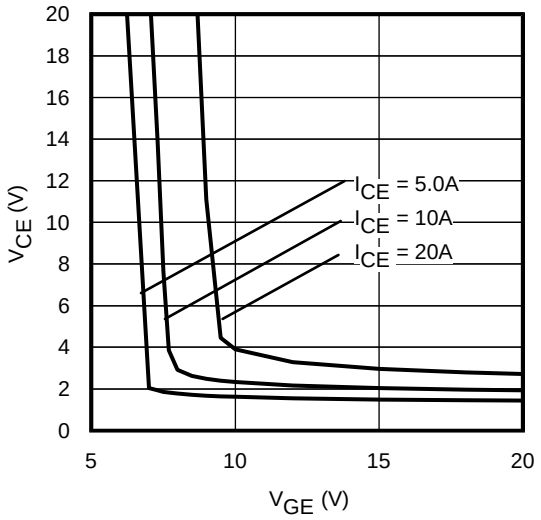


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

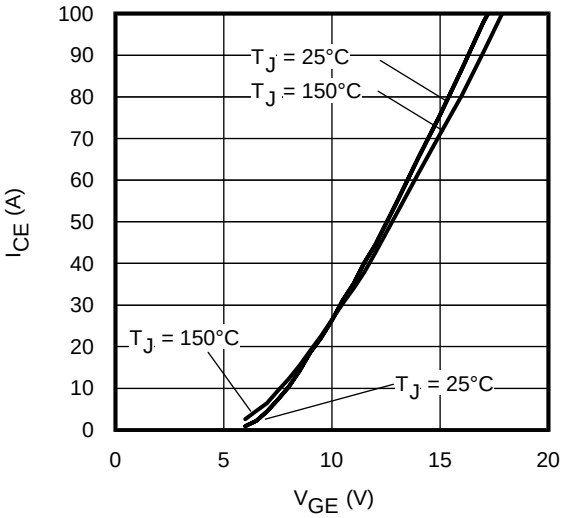


Fig. 12 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

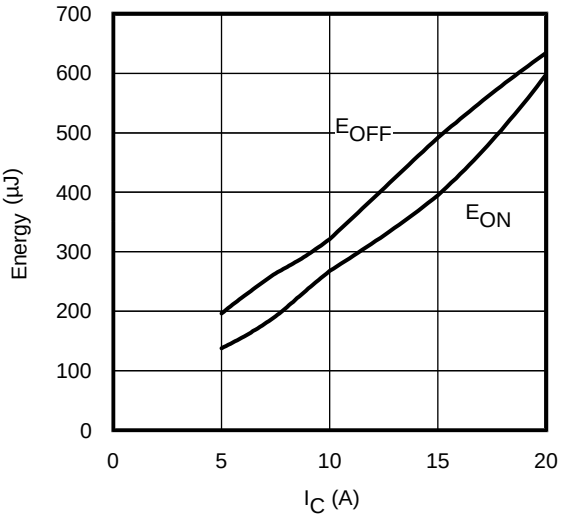


Fig. 13 - Typ. Energy Loss vs. I_C
T_J = 150°C; L=1.07mH; V_{CE}= 400V
R_G= 50Ω; V_{GE}= 15V

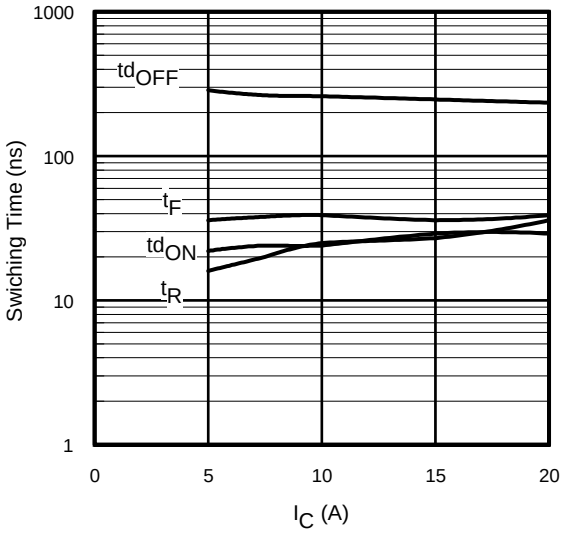


Fig. 14 - Typ. Switching Time vs. I_C
T_J = 150°C; L=1.07mH; V_{CE}= 400V
R_G= 50Ω; V_{GE}= 15V

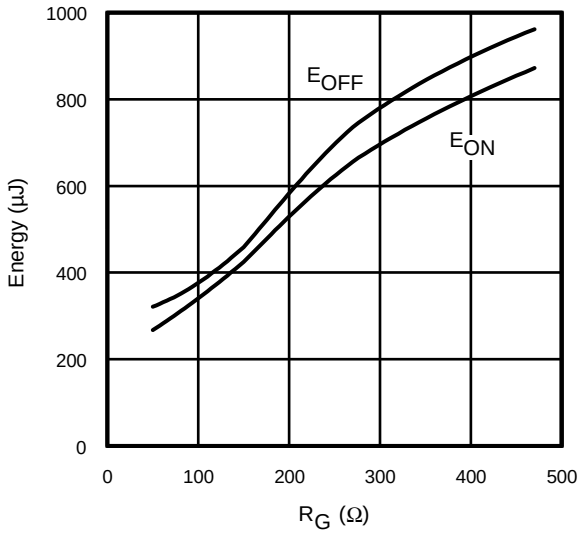


Fig. 15 - Typ. Energy Loss vs. R_G
T_J = 150°C; L=1.07mH; V_{CE}= 400V
I_{CE}= 10A; V_{GE}= 15V

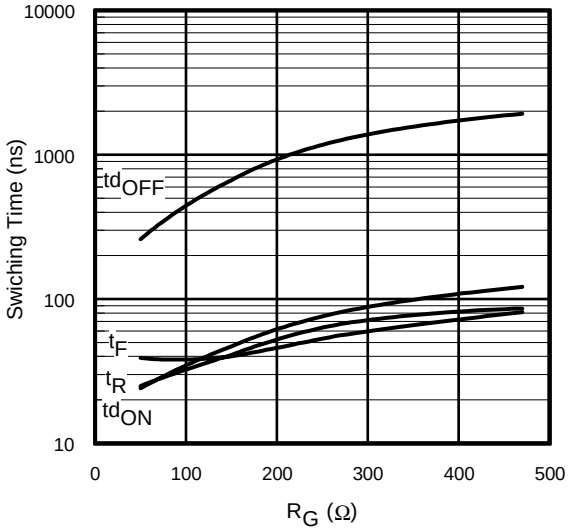


Fig. 16 - Typ. Switching Time vs. R_G
T_J = 150°C; L=1.07mH; V_{CE}= 400V
I_{CE}= 10A; V_{GE}= 15V

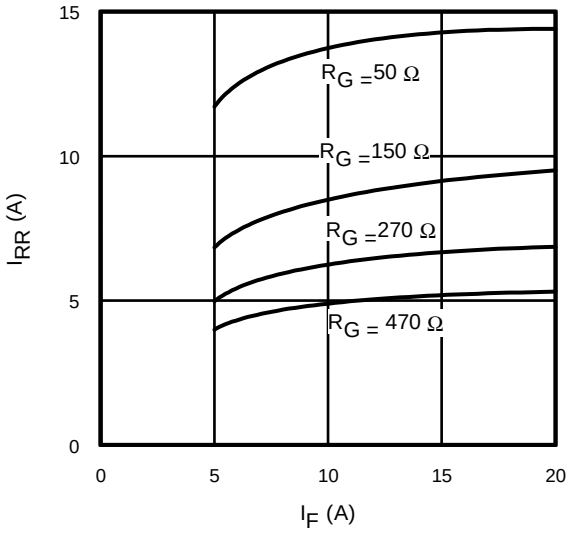


Fig. 17 - Typical Diode I_{RR} vs. I_F
T_J = 150°C

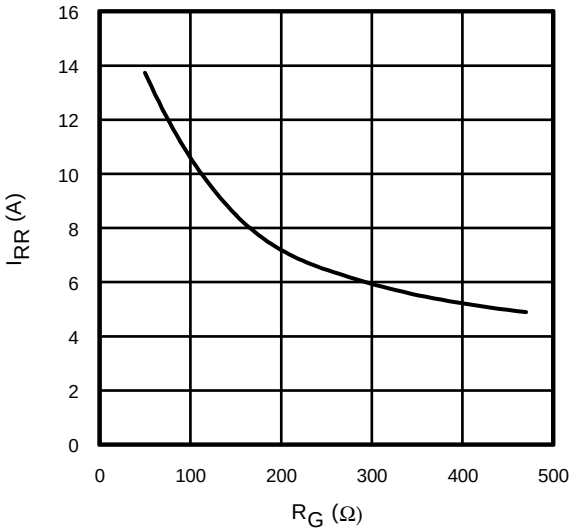


Fig. 18 - Typical Diode I_{RR} vs. R_G
T_J = 150°C; I_F = 10A

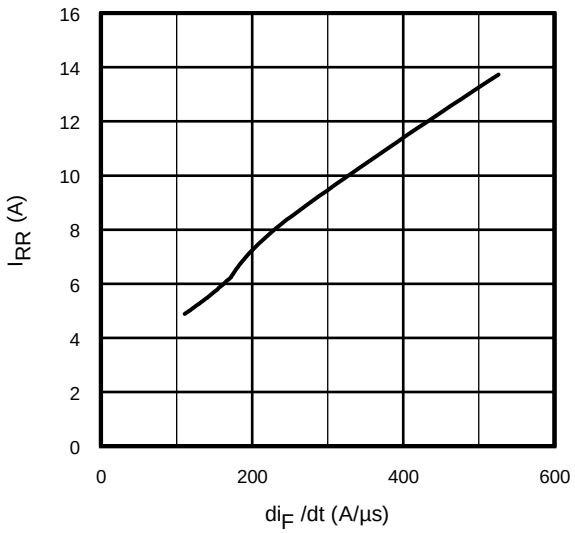


Fig. 19- Typical Diode I_{RR} vs. di_F/dt
V_{CC}= 400V; V_{GE}= 15V;
I_{CE}= 10A; T_J = 150°C

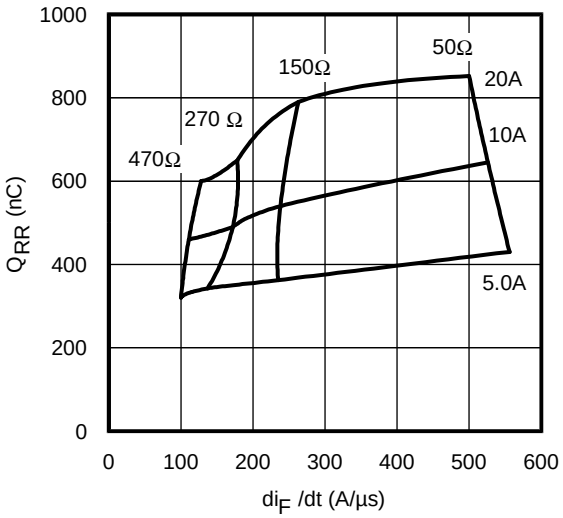


Fig. 20 - Typical Diode Q_{RR}
V_{CC}= 400V; V_{GE}= 15V;T_J = 150°C

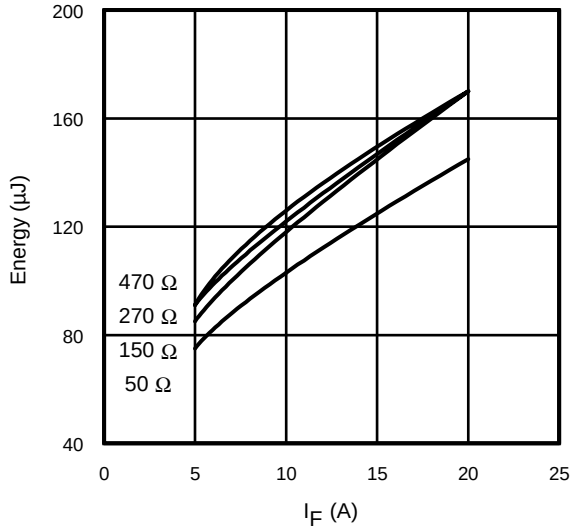


Fig. 21 - Typical Diode E_{RR} vs. I_F
T_J = 150°C

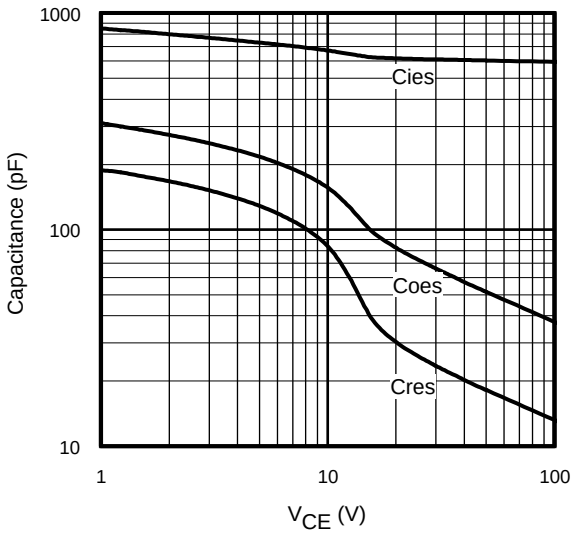


Fig. 22- Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

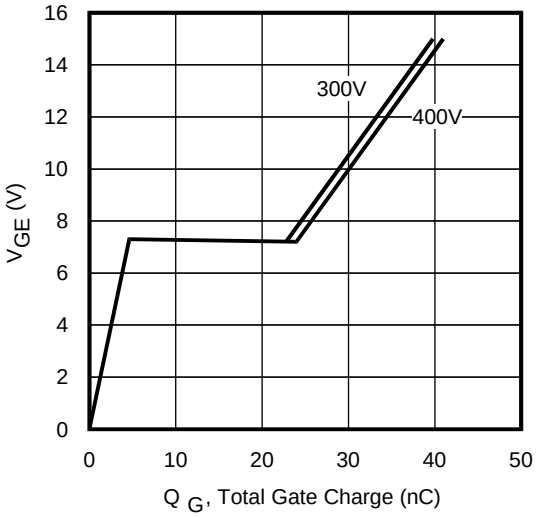


Fig. 23 - Typical Gate Charge vs. V_{GE}
I_{CE} = 10A; L = 2500µH

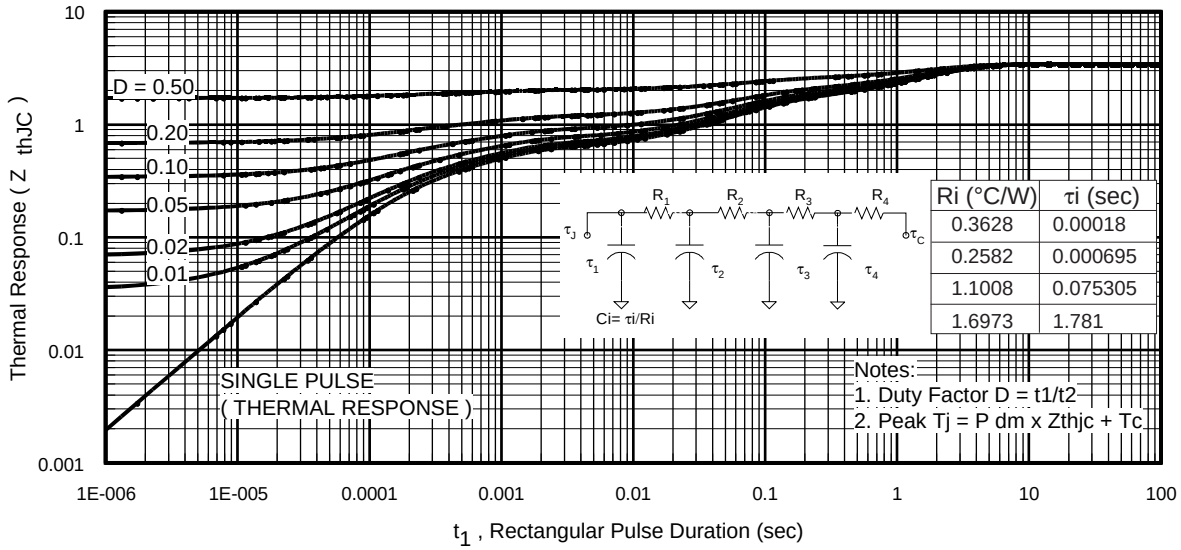


Fig 24. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

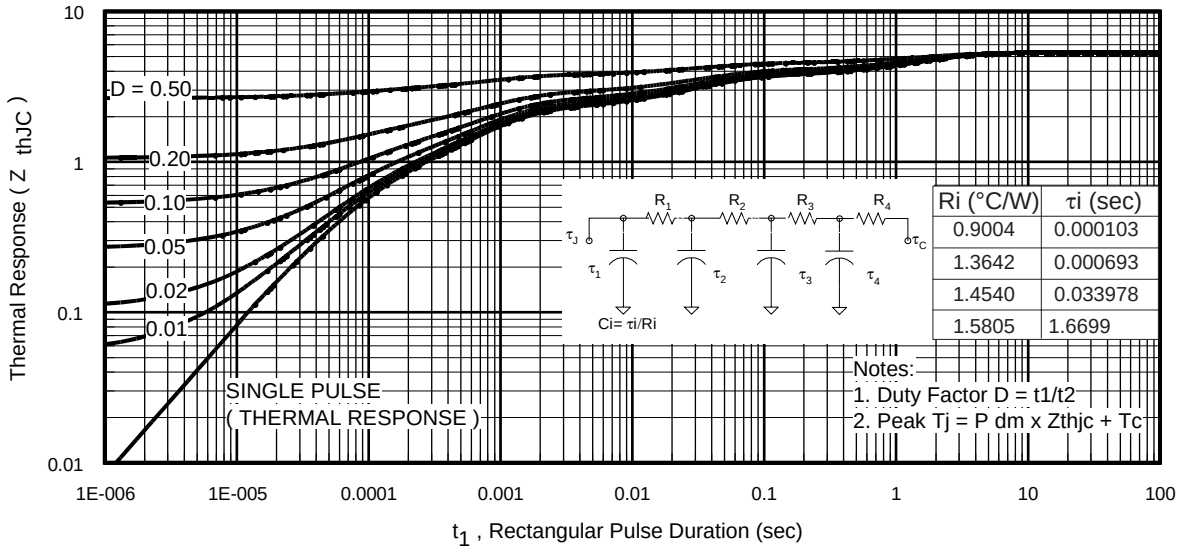


Fig 25. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

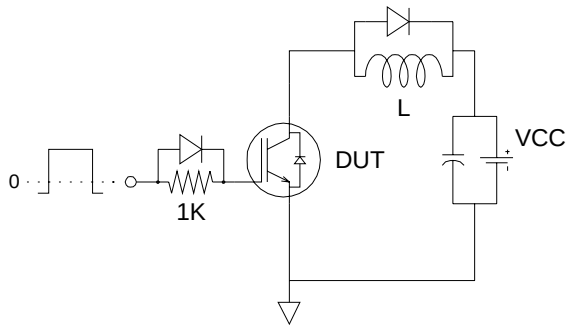


Fig.C.T.1 - Gate Charge Circuit (turn-off)

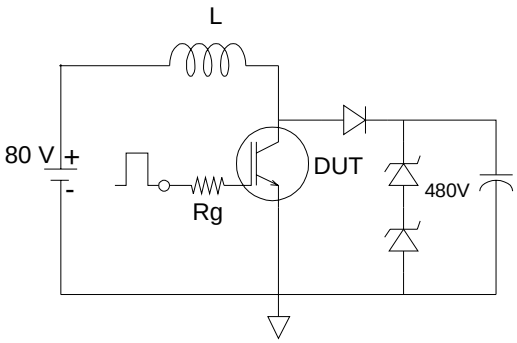


Fig.C.T.2 - RBSOA Circuit

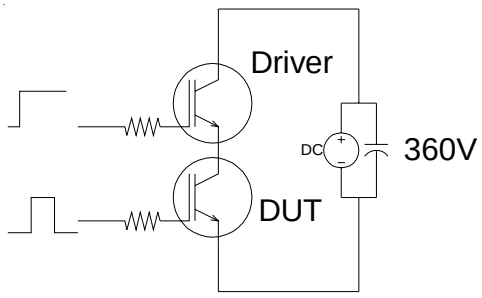


Fig.C.T.3 - S.C.SOA Circuit

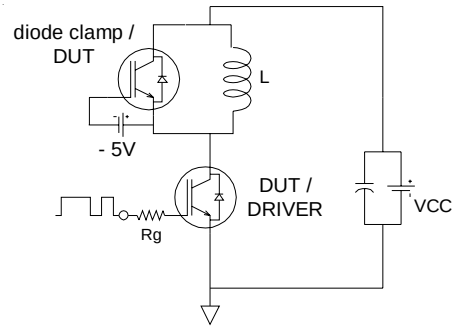


Fig.C.T.4 - Switching Loss Circuit

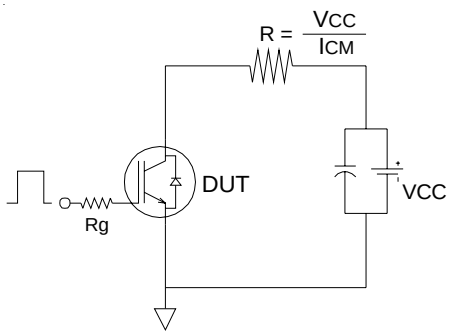


Fig.C.T.5 - Resistive Load Circuit

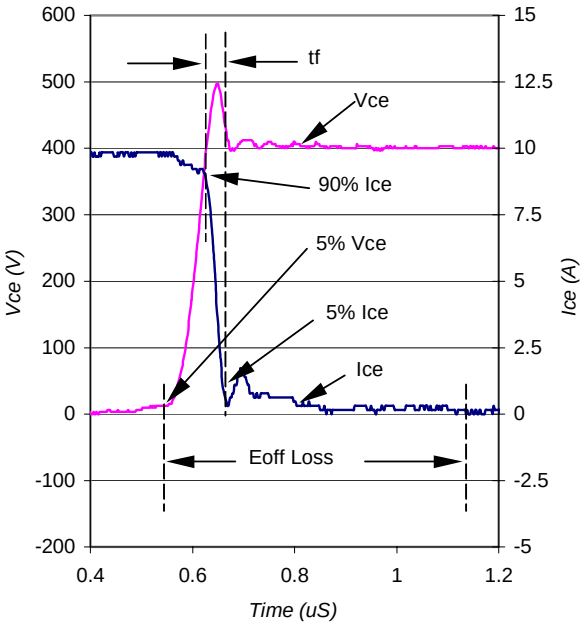


Fig. WF1- Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.4

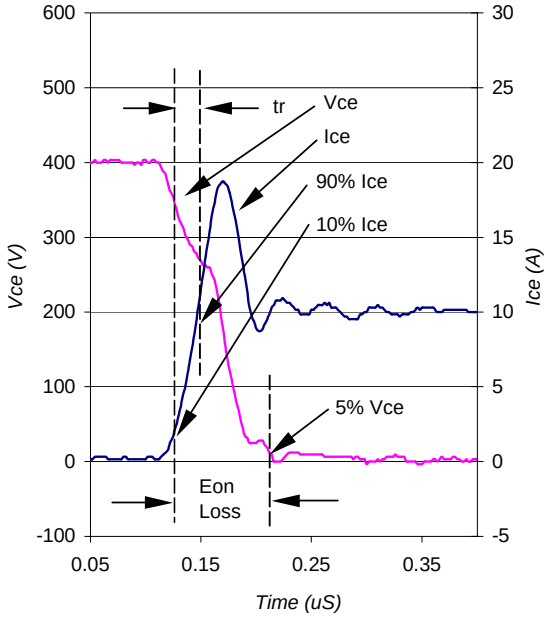


Fig. WF2- Typ. Turn-on Loss Waveform
@ T_J = 150°C using Fig. CT.4

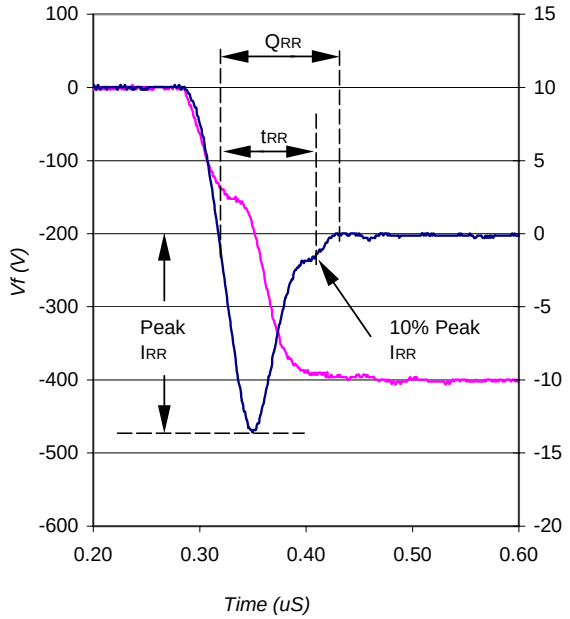


Fig. WF3- Typ. Diode Recovery Waveform
@ T_J = 150°C using Fig. CT.4

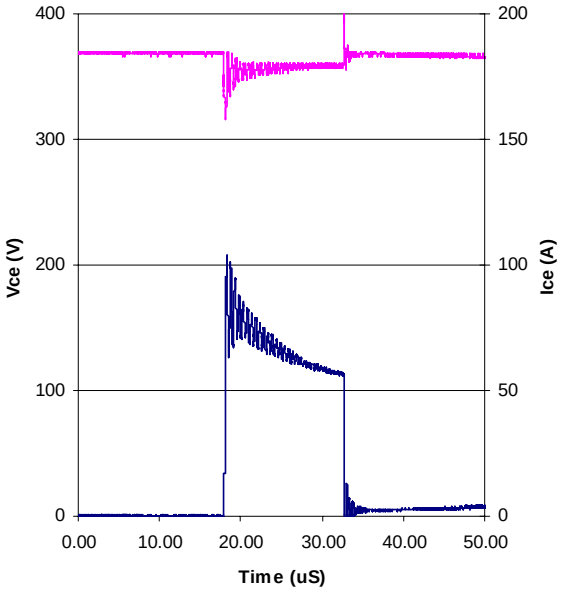
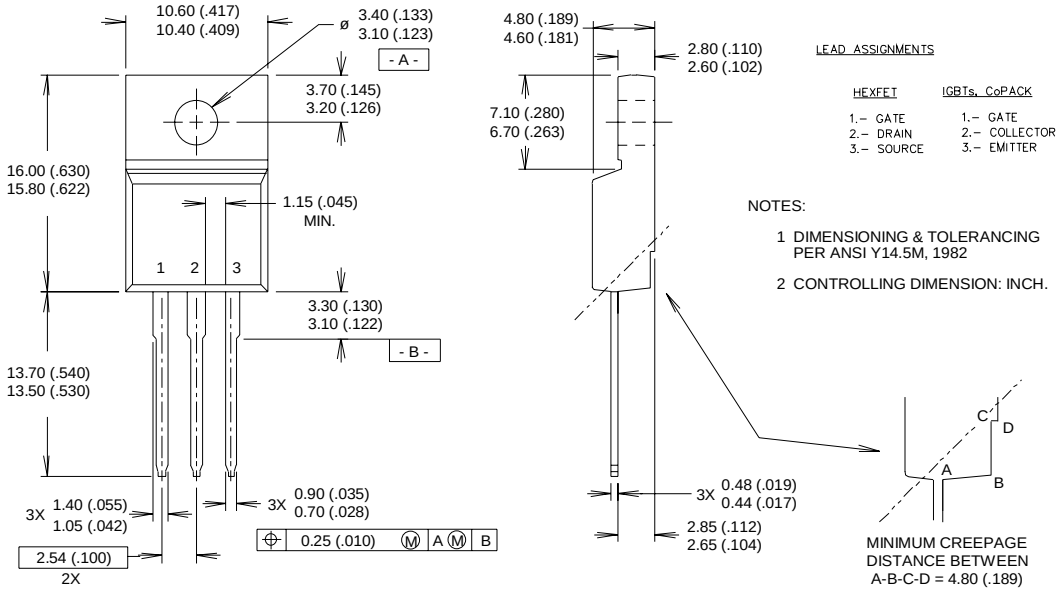


Fig. WF4- Typ. S.C Waveform
@ T_C = 150°C using Fig. CT.3

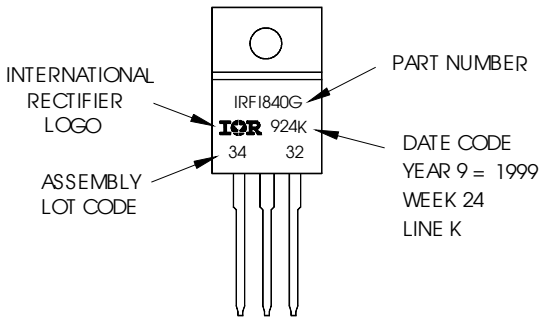
TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)



TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"



TO-220 Full-Pak package is not recommended for Surface Mount Application

Data and specifications subject to change without notice.
This product has been designed and qualified for the 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.2/04

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