

$$V_{CES} = 1200V$$

$$I_C = 65A, T_C = 100^\circ C$$

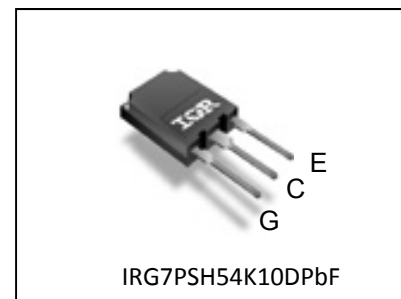
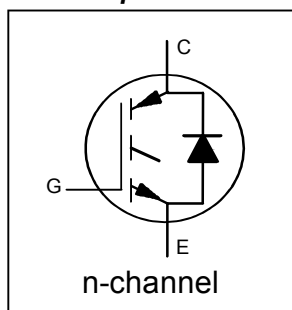
$$t_{SC} \geq 10\mu s, T_{J(max)} = 150^\circ C$$

$$V_{CE(ON)} \text{ typ.} = 1.9V @ I_C = 50A$$

Applications

- Industrial Motor Drive
- UPS
- Solar Inverters
- Welding

Insulated Gate Bipolar Transistor with Ultrafast Soft Recovery Diode



G	C	E
Gate	Collector	Emitter

Features	Benefits
Low $V_{CE(ON)}$ and switching losses	High efficiency in a Wide Range of Applications
10 μs Short Circuit SOA	Rugged Transient Performance
Square RBSOA	Increased Reliability
Maximum Junction Temperature 150 $^\circ C$	Excellent Current Sharing in Parallel Operation
Positive $V_{CE(ON)}$ Temperature Coefficient	

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRG7PSH54K10DPbF	Super-247	Tube	25	IRG7PSH54K10DPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	120	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	65	
I_{CM}	Pulse Collector Current, $V_{GE}=20V$	200	
I_{LM}	Clamped Inductive Load Current, $V_{GE}=20V$ ①	200	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	50	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	25	V
V_{GE}	Continuous Gate-to-Emitter Voltage	± 30	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	520	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	210	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-40 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) ②	—	—	0.24	$^\circ C/W$
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ②	—	—	0.70	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	—	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$ ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.3	—	V/°C	$V_{GE} = 0V, I_C = 5mA$ (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.9	2.4	V	$I_C = 50A, V_{GE} = 15V, T_J = 25^\circ\text{C}$
		—	2.4	—		$I_C = 50A, V_{GE} = 15V, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	5.0	—	7.5	V	$V_{CE} = V_{GE}, I_C = 2.4mA$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage Temperature Coeff.	—	-15	—	mV/°C	$V_{CE} = V_{GE}, I_C = 2.4mA$ (25°C-150°C)
g_{fe}	Forward Transconductance	—	36	—	S	$V_{CE} = 50V, I_C = 50A, PW = 20\mu s$
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	45	μA	$V_{GE} = 0V, V_{CE} = 1200V$
		—	1800	—		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 200	nA	$V_{GE} = \pm 30V$
V_F	Diode Forward Voltage Drop	—	2.5	3.5	V	$I_F = 16A$
		—	2.1	—		$I_F = 16A, T_J = 150^\circ\text{C}$

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

	Parameter	Min.	Typ.	Max④	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	290	435	nC	$I_C = 50A$ $V_{GE} = 15V$ $V_{CC} = 600V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	60	90		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	130	195		
E_{on}	Turn-On Switching Loss	—	4.8	5.7	mJ	$I_C = 50A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 5\Omega, T_J = 25^\circ\text{C}$
E_{off}	Turn-Off Switching Loss	—	2.8	3.7		
E_{total}	Total Switching Loss	—	7.6	9.4		
$t_{d(on)}$	Turn-On delay time	—	110	130	ns	Energy losses include tail & diode reverse recovery ⑤⑥
t_r	Rise time	—	80	105		
$t_{d(off)}$	Turn-Off delay time	—	490	520		
t_f	Fall time	—	70	90		
E_{on}	Turn-On Switching Loss	—	6.8	—	mJ	$I_C = 50A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 5\Omega, T_J = 150^\circ\text{C}$
E_{off}	Turn-Off Switching Loss	—	4.7	—		
E_{total}	Total Switching Loss	—	11.5	—		
$t_{d(on)}$	Turn-On delay time	—	85	—	ns	Energy losses include tail & diode reverse recovery ⑤⑥
t_r	Rise time	—	90	—		
$t_{d(off)}$	Turn-Off delay time	—	490	—		
t_f	Fall time	—	290	—		
C_{ies}	Input Capacitance	—	5700	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$
C_{oes}	Output Capacitance	—	290	—		
C_{res}	Reverse Transfer Capacitance	—	150	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 200A$ $V_{CC} = 960V, V_p \leq 1200V$ $V_{GE} = +20V$ to 0V
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	$T_J = 150^\circ\text{C}, V_{CC} = 600V, V_p \leq 1200V$ $V_{GE} = +15V$ to 0V
E_{rec}	Reverse Recovery Energy of the Diode	—	640	—	μJ	$T_J = 150^\circ\text{C}$
t_{rr}	Diode Reverse Recovery Time	—	170	—	ns	$V_{CC} = 600V, I_F = 16A$
I_{rr}	Peak Reverse Recovery Current	—	25	—	A	$V_{GE} = 15V, R_g = 5\Omega$

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V$
- ② R_θ is measured at T_J of approximately 90°C .
- ③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
- ④ Maximum limits are based on statistical sample size characterization.
- ⑤ Pulse width limited by max. junction temperature.
- ⑥ Values influenced by parasitic L and C in measurement.

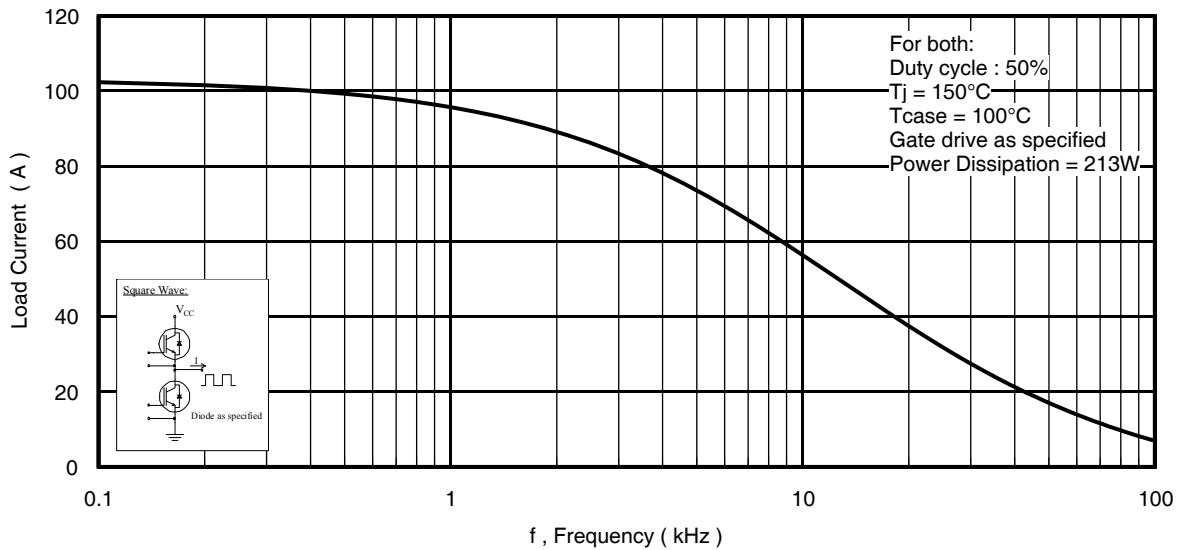


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

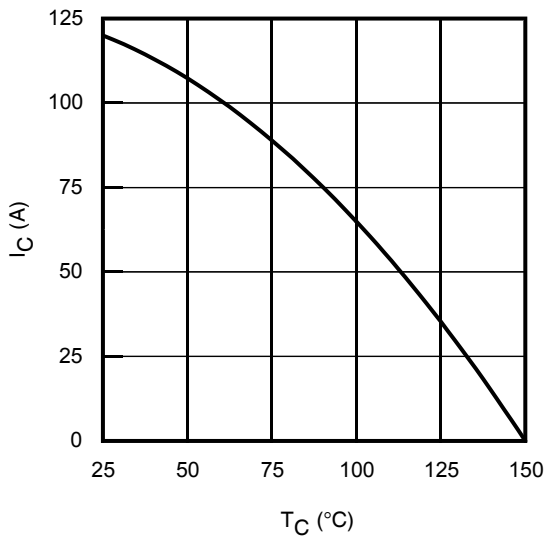


Fig. 2 - Maximum DC Collector Current vs. Case Temperature

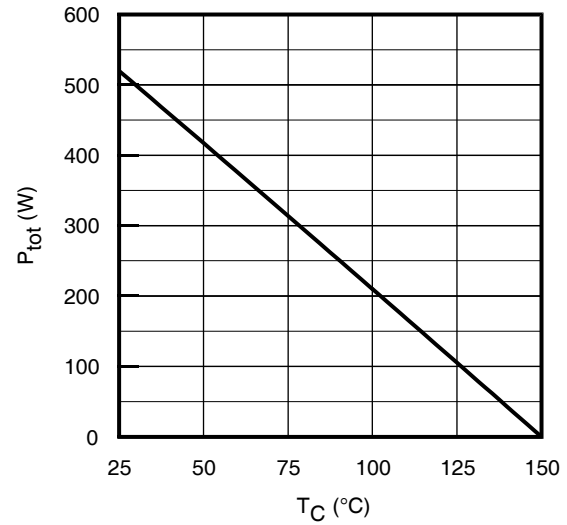


Fig. 3 - Power Dissipation vs. Case Temperature

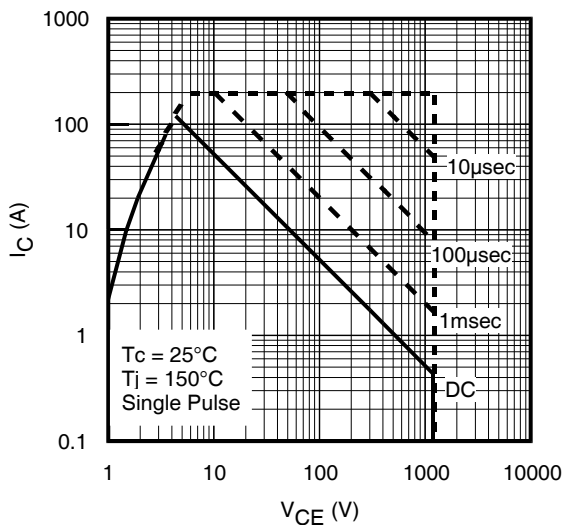


Fig. 4 - Forward SOA
 $T_c = 25^{\circ}\text{C}$, $T_j \leq 150^{\circ}\text{C}$, $V_{\text{GE}} = 15\text{V}$

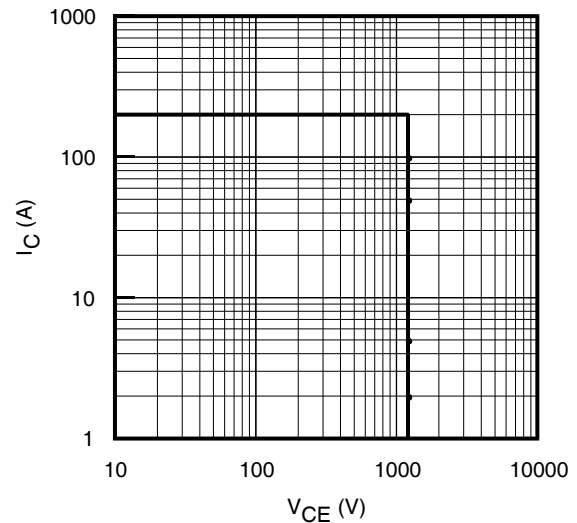


Fig. 5- Reverse Bias SOA
 $T_j = 150^{\circ}\text{C}$; $V_{\text{GE}} = 20\text{V}$

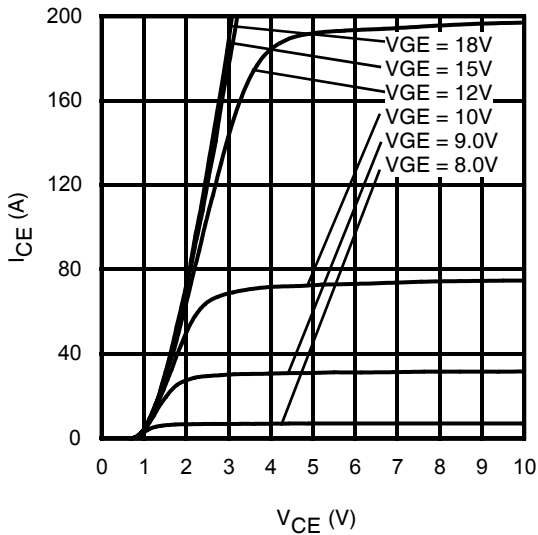


Fig. 6 - Typ. IGBT Output Characteristics
T_J = -40°C; t_p = 20μs

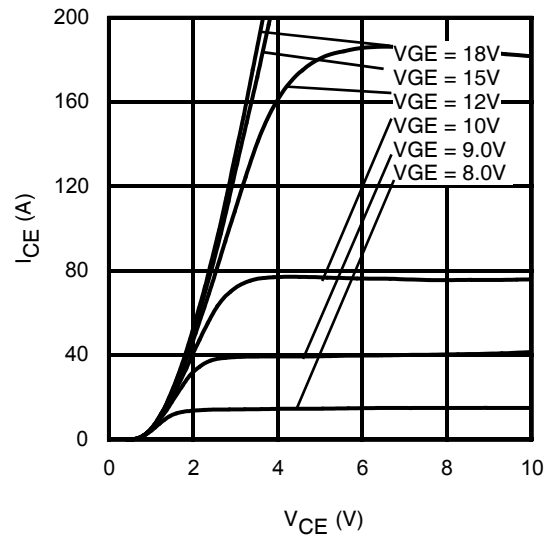


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 25°C; t_p = 20μs

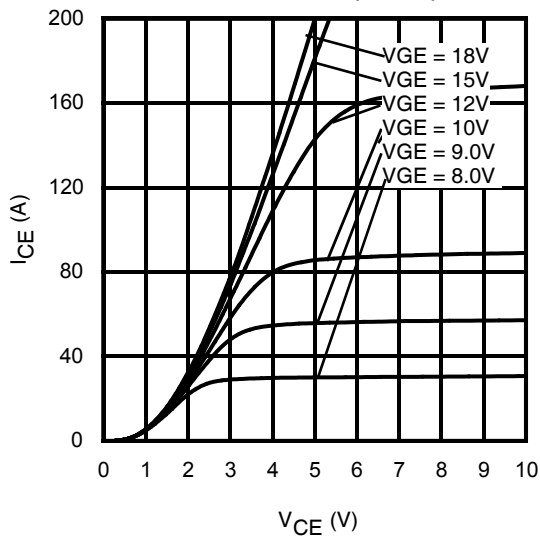


Fig. 8 - Typ. IGBT Output Characteristics
T_J = 150°C; t_p = 20μs

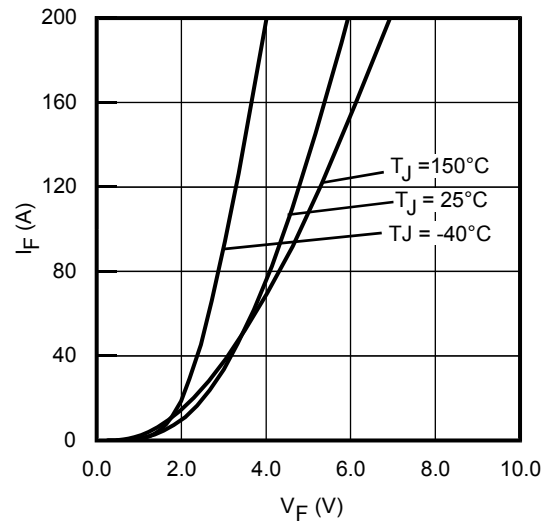


Fig. 9 - Typ. Diode Forward Characteristics
t_p = 20μs

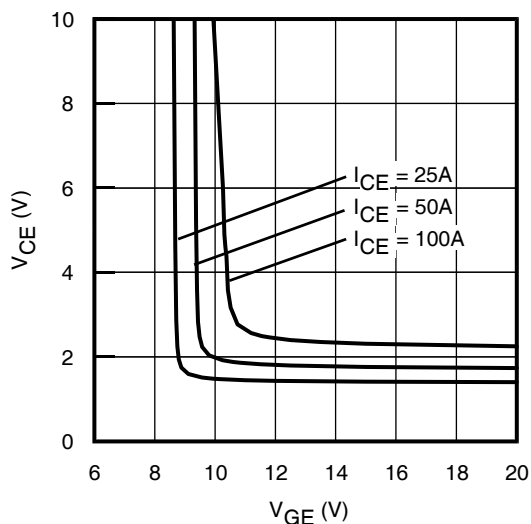


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

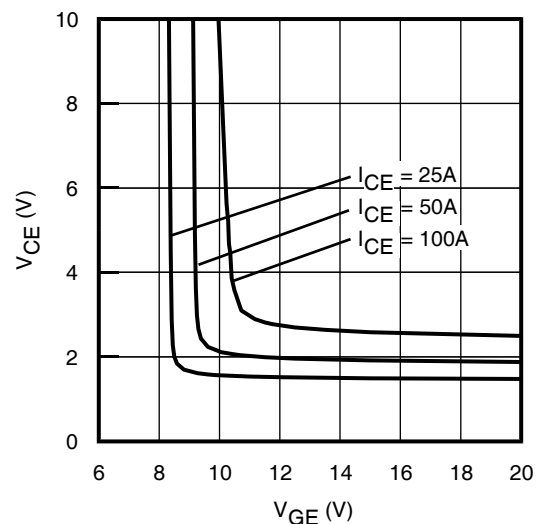


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

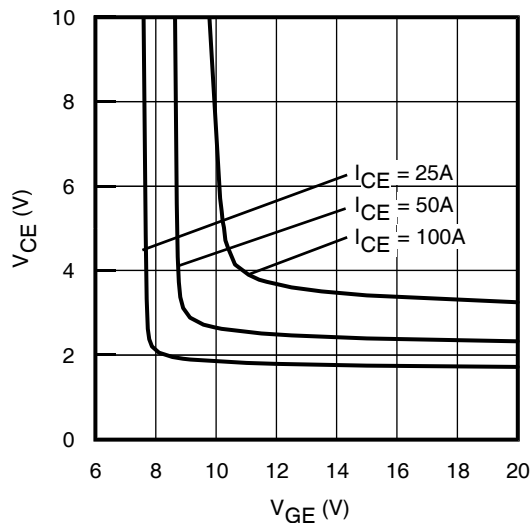


Fig. 12 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^\circ\text{C}$

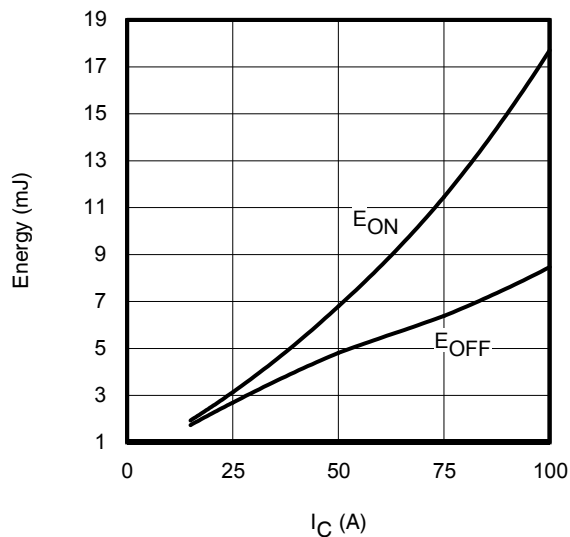


Fig. 14 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $V_{CE} = 600\text{V}$, $R_G = 5\Omega$; $V_{GE} = 15\text{V}$

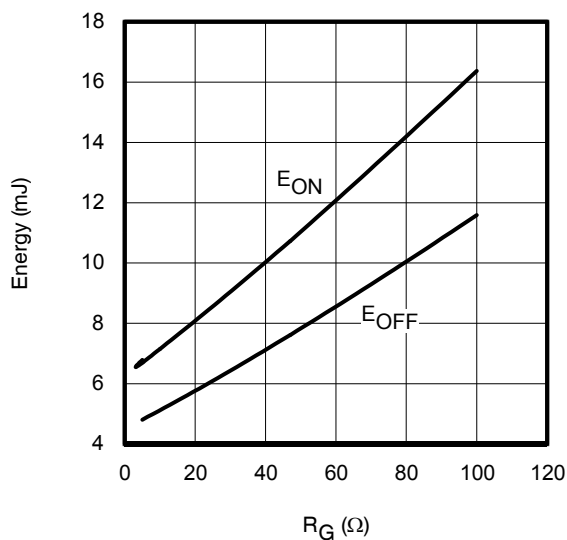


Fig. 16 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $V_{CE} = 600\text{V}$, $I_{CE} = 50\text{A}$; $V_{GE} = 15\text{V}$

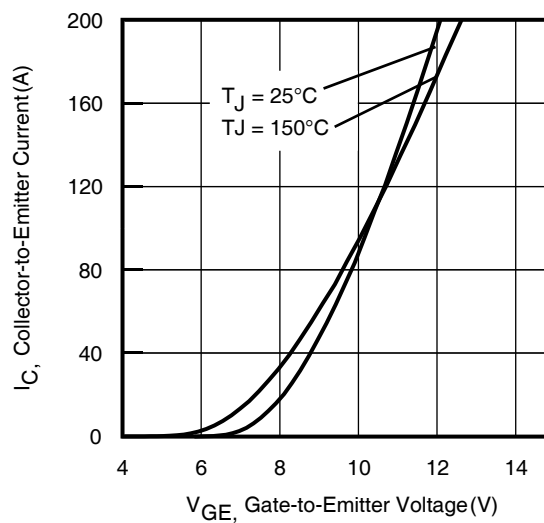


Fig. 13 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 20\mu\text{s}$

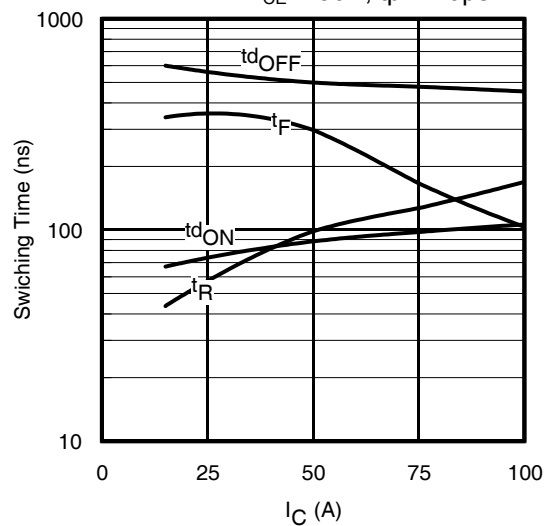


Fig. 15 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $V_{CE} = 600\text{V}$, $R_G = 5\Omega$; $V_{GE} = 15\text{V}$

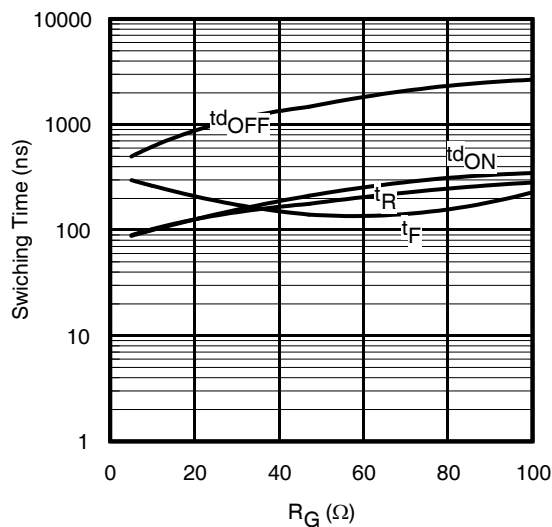


Fig. 17 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $V_{CE} = 600\text{V}$, $I_{CE} = 50\text{A}$; $V_{GE} = 15\text{V}$

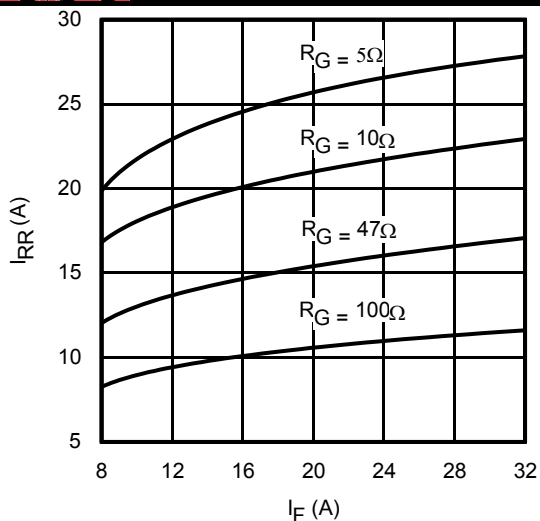


Fig. 18 - Typ. Diode I_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

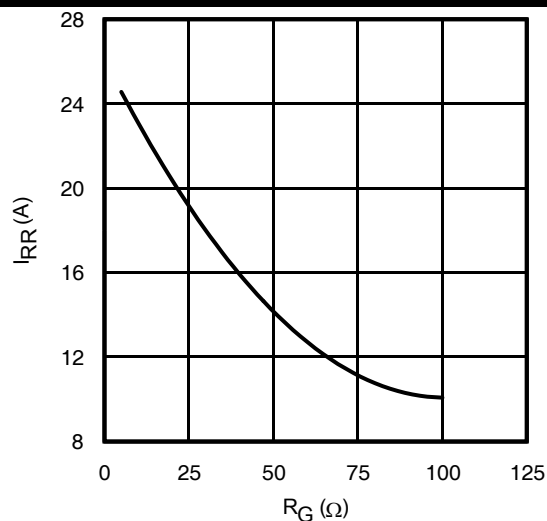


Fig. 19 - Typ. Diode I_{RR} vs. R_G
 $T_J = 150^\circ\text{C}$

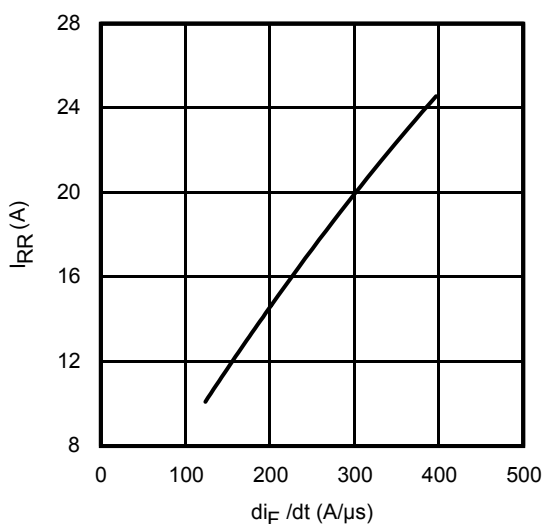


Fig. 20 - Typ. Diode I_{RR} vs. di_F/dt
 $V_{CC} = 600\text{V}$; $V_{GE} = 15\text{V}$; $I_F = 16\text{A}$; $T_J = 150^\circ\text{C}$

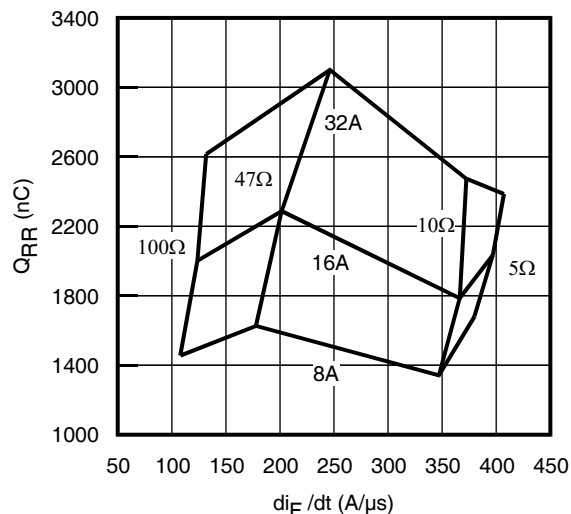


Fig. 21 - Typ. Diode Q_{RR} vs. di_F/dt
 $V_{CC} = 600\text{V}$; $V_{GE} = 15\text{V}$; $T_J = 150^\circ\text{C}$

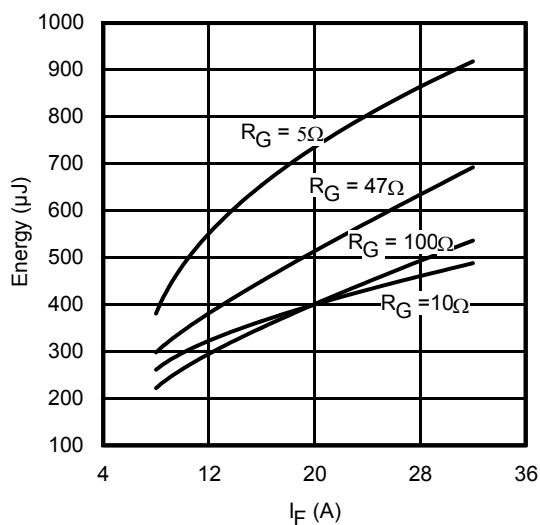


Fig. 22 - Typ. Diode E_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

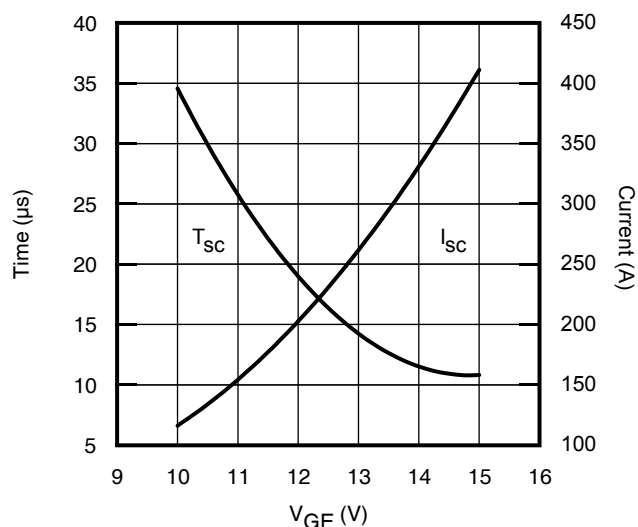


Fig. 23 - V_{CE} vs. Short Circuit Time
 $V_{CC} = 600\text{V}$; $T_C = 150^\circ\text{C}$

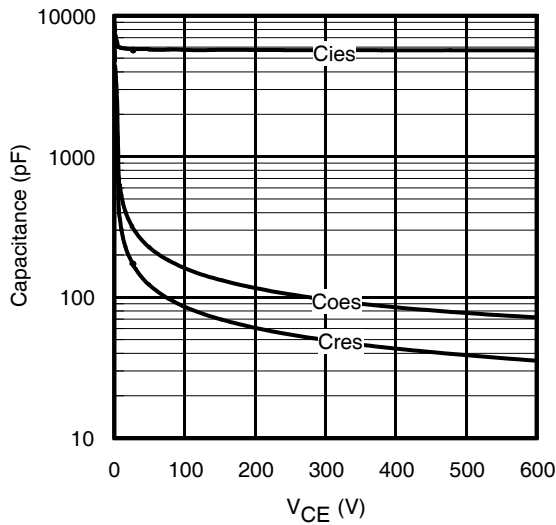


Fig. 24 - Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0V$; $f = 1MHz$

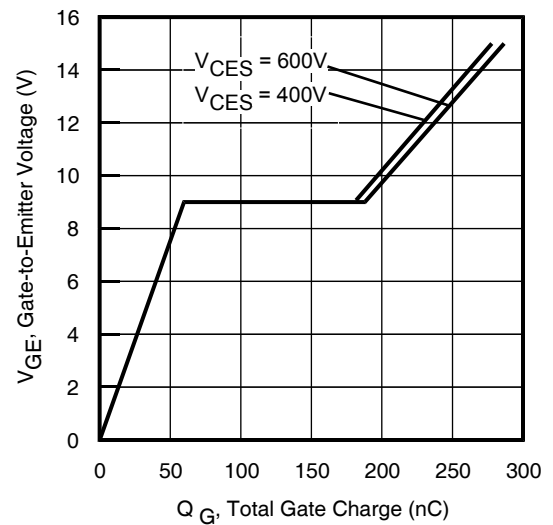


Fig. 25 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 50A$

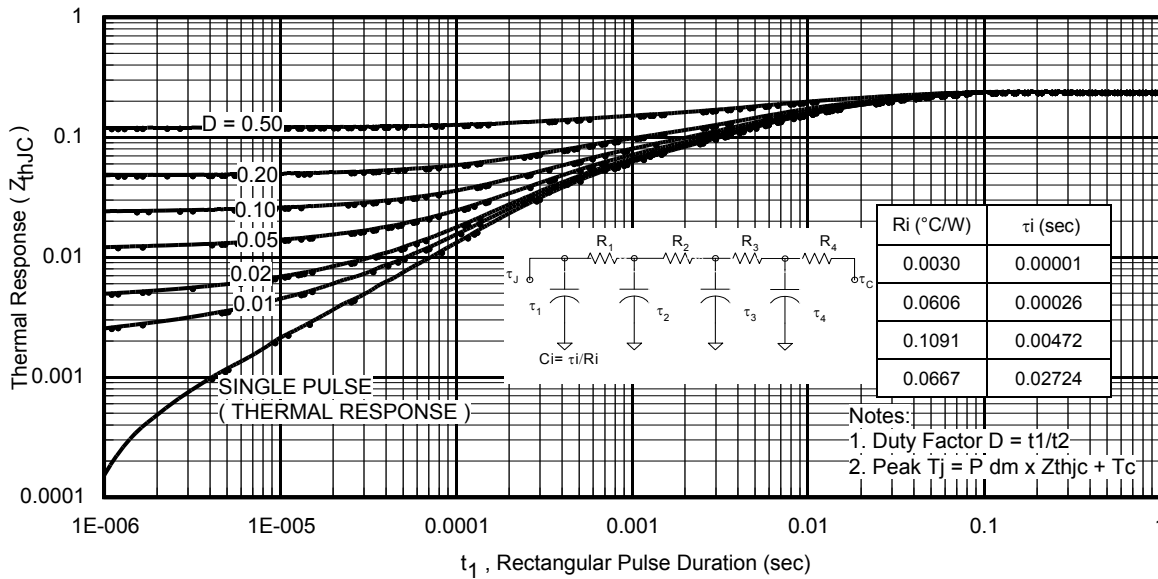


Fig. 26 Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

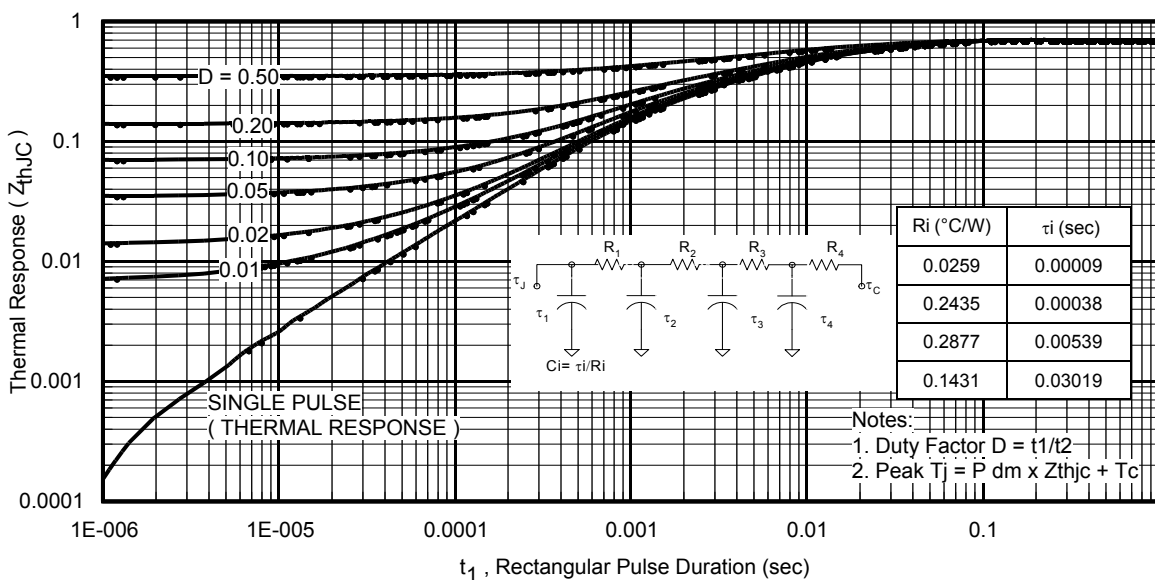
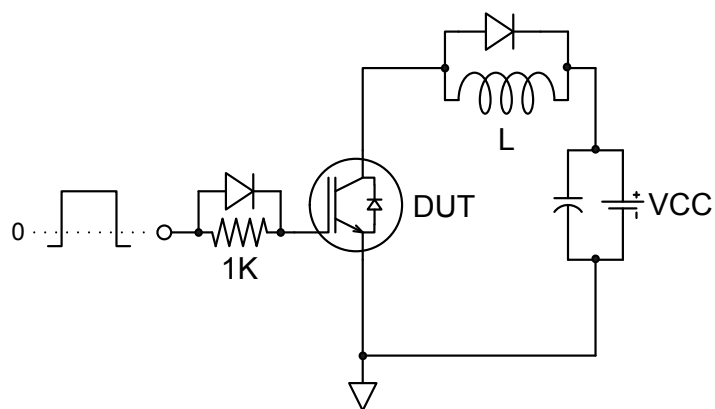
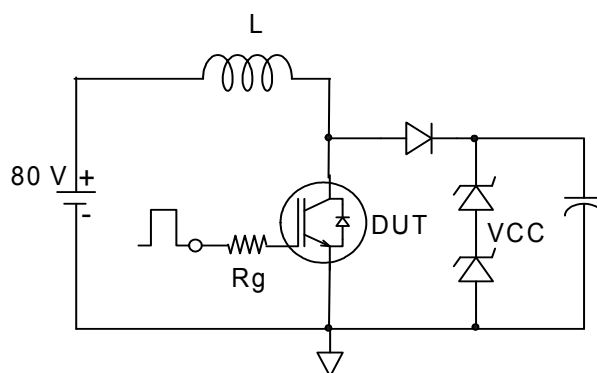
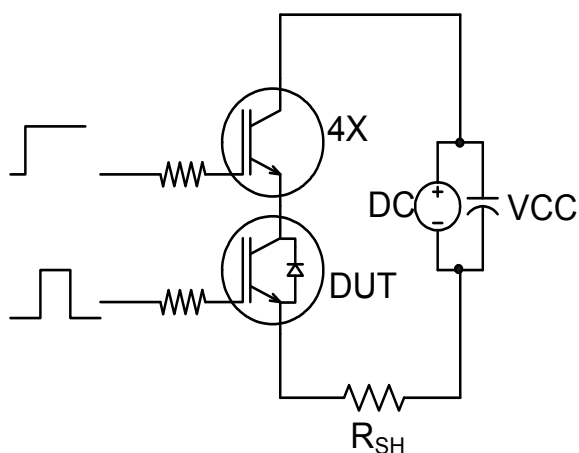
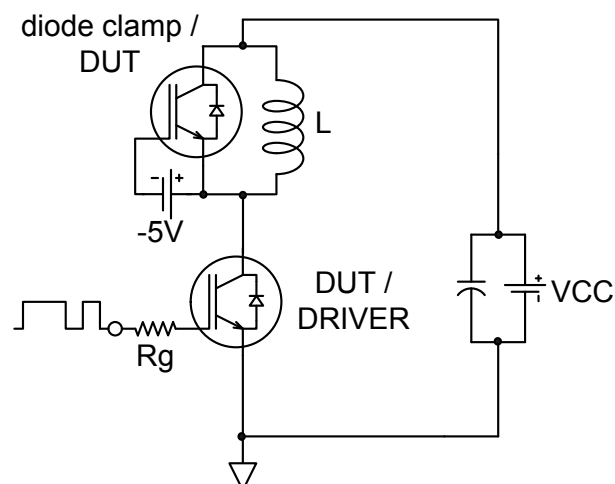
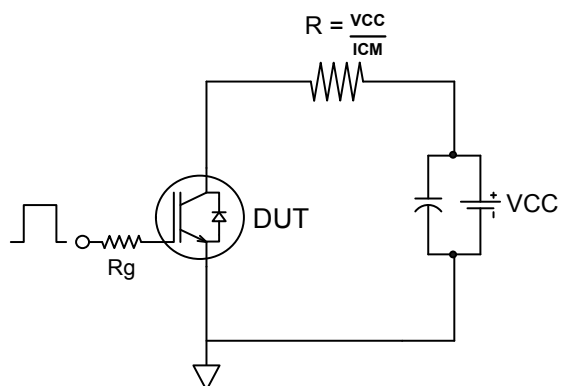
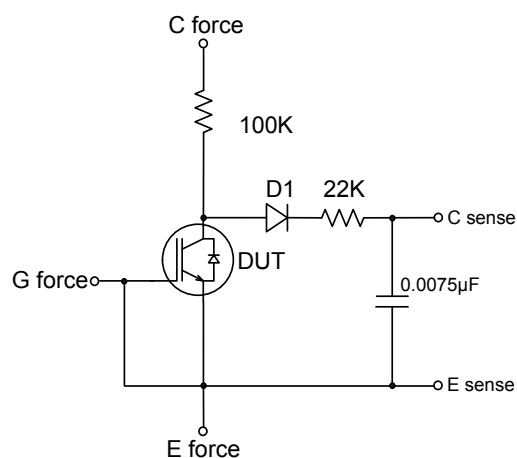


Fig. 27 Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)


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.C.T.6 - BVCES Filter Circuit

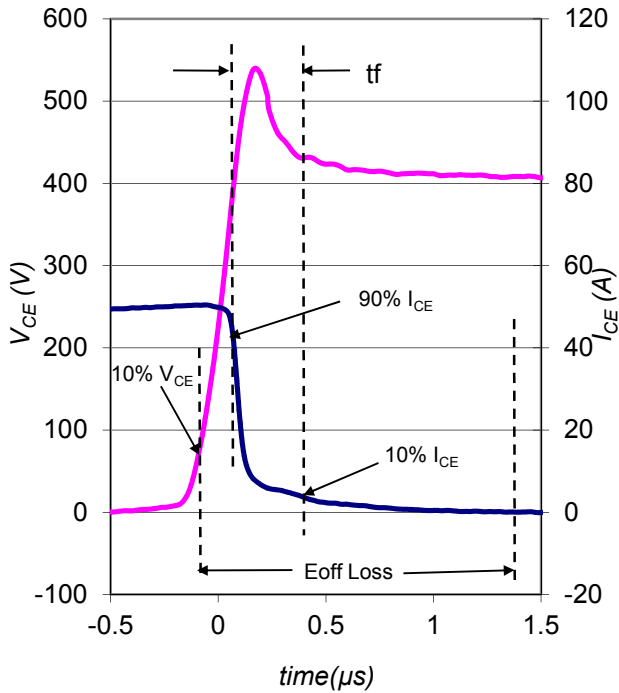


Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

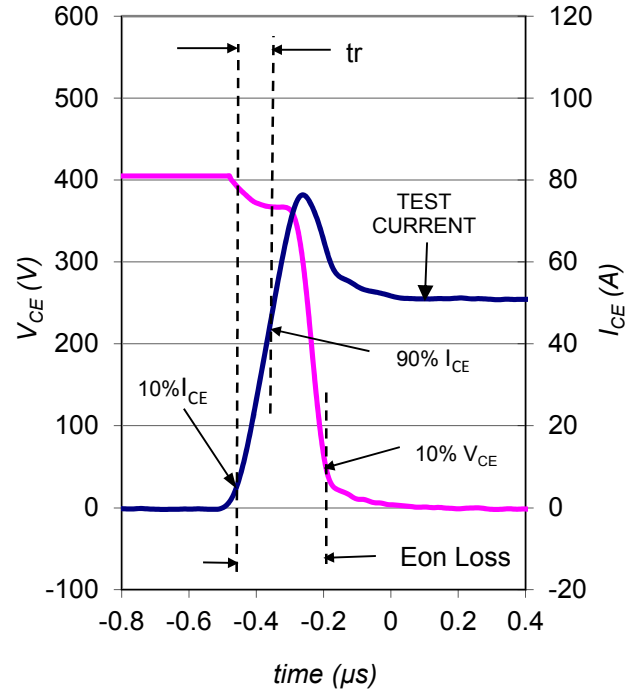


Fig. WF2 - Typ. Turn-on Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

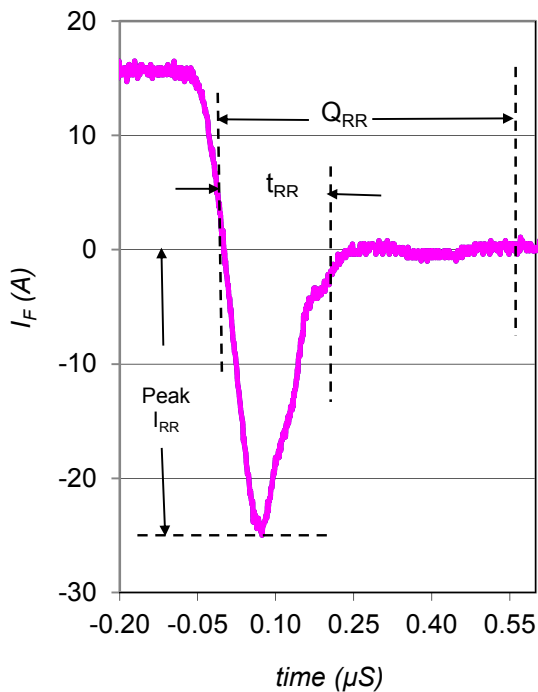


Fig. WF3 - Typ. Diode Recovery Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

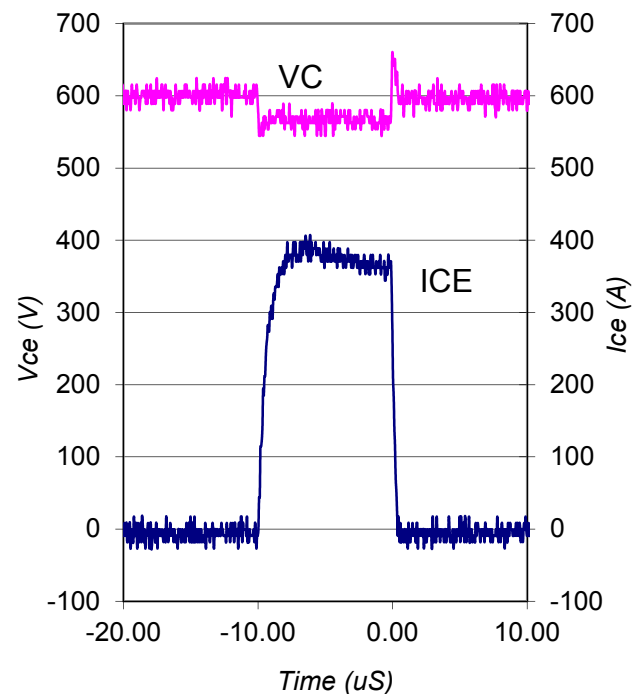
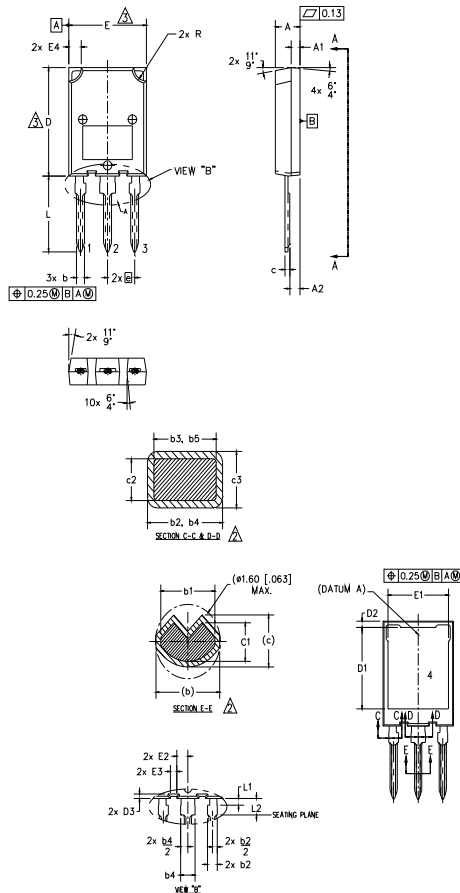


Fig. WF4 - Typ. S.C. Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.3

Super -247(TO-274AA) Package Outline

Dimensions are shown in millimeters (inches)



Qualification Information[†]

Qualification Level	Industrial (per JEDEC JESD47F) ^{††}	
Moisture Sensitivity Level	Super-247	N/A
RoHS Compliant	Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability/>

^{††} Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

International
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