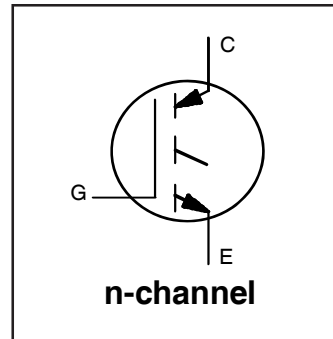


# IRG7PSH73K10PbF

## INSULATED GATE BIPOLAR TRANSISTOR

### Features

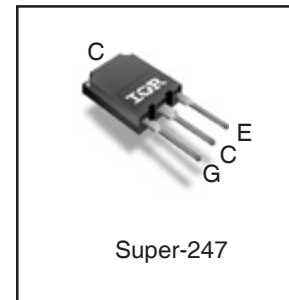
- Low  $V_{CE(ON)}$  Trench IGBT Technology
- Low Switching Losses
- Maximum Junction Temperature 175 °C
- 10  $\mu$ S short Circuit SOA
- Square RBSOA
- 100% of The Parts Tested for  $I_{LM}$
- Positive  $V_{CE(ON)}$  Temperature Coefficient
- Tight Parameter Distribution
- Lead Free Package



$V_{CES} = 1200V$
$I_{C(Nominal)} = 75A$
$t_{SC} \geq 10\mu s, T_{J(max)} = 175^{\circ}C$
$V_{CE(on)} \text{ typ.} = 2.0V$

### 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



<b>G</b>	<b>C</b>	<b>E</b>
Gate	Collector	Emitter

### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^{\circ}C$	Continuous Collector Current	220 <sup>Ⓢ</sup>	A
$I_C @ T_C = 100^{\circ}C$	Continuous Collector Current	130	
$I_{NOMINAL}$	Nominal Current	75	
$I_{CM}$	Pulse Collector Current, $V_{GE}=15V$	225	
$I_{LM}$	Clamped Inductive Load Current, $V_{GE}=20V$ <sup>Ⓢ</sup>	300	
$V_{GE}$	Continuous Gate-to-Emitter Voltage	$\pm 30$	V
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	1150	W
$P_D @ T_C = 100^{\circ}C$	Maximum Power Dissipation	580	
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +175	°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) <sup>Ⓢ</sup>	—	—	0.13	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface) <sup>Ⓢ</sup>	—	0.24	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	40	—	

## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

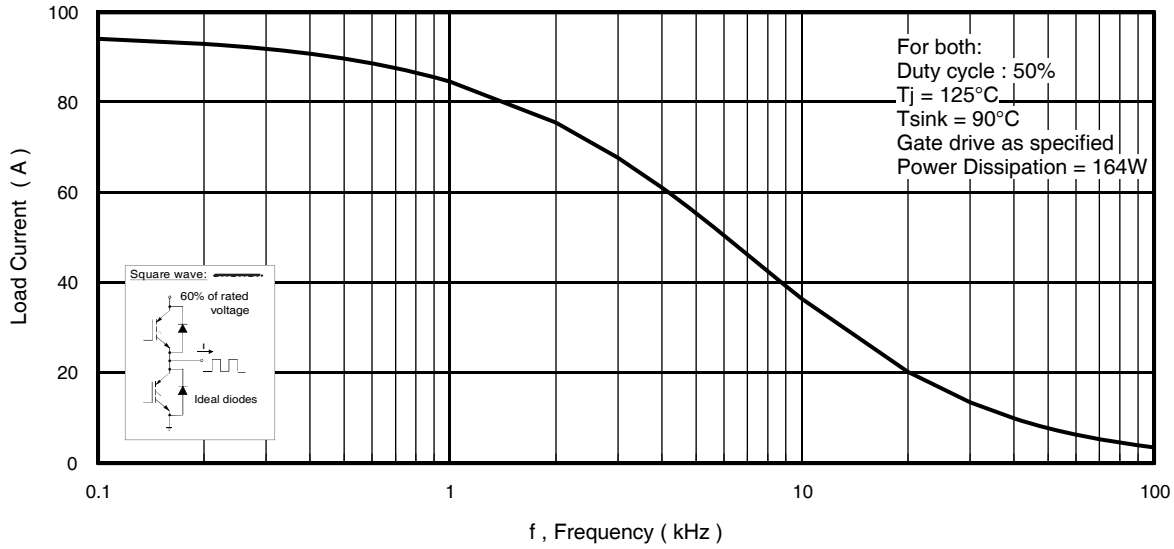
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA ④
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	1.58	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 5.0mA (25°C-175°C) ④
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	2.0	2.3	V	I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 25°C ③
		—	2.50	—		I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 150°C ③
		—	2.60	—		I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 175°C ③
V <sub>GE(th)</sub>	Gate Threshold Voltage	5.0	—	7.5	V	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 3.5mA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Threshold Voltage temp. coefficient	—	-18	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 3.5mA (25°C - 175°C)
g <sub>fe</sub>	Forward Transconductance	—	53	—	S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 75A, PW = 80μs
I <sub>CES</sub>	Collector-to-Emitter Leakage Current	—	1.0	25	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V, T <sub>J</sub> = 25°C
		—	2340	—		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V, T <sub>J</sub> = 175°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±400	nA	V <sub>GE</sub> = ±30V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

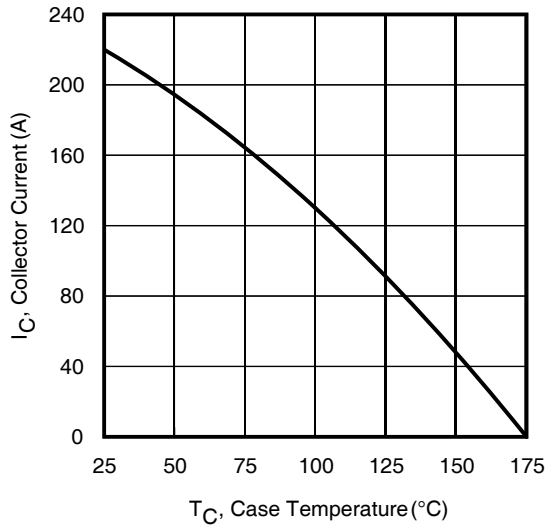
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	360	540	nC	I <sub>C</sub> = 75A ③ V <sub>GE</sub> = 15V V <sub>CC</sub> = 600V
Q <sub>ge</sub>	Gate-to-Emitter Charge (turn-on)	—	87	130		
Q <sub>gc</sub>	Gate-to-Collector Charge (turn-on)	—	180	270		
E <sub>on</sub>	Turn-On Switching Loss	—	7.7	8.7	mJ	I <sub>C</sub> = 75A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V ③ R <sub>G</sub> = 4.7Ω, L = 200μH, T <sub>J</sub> = 25°C Energy losses include tail & diode reverse recovery
E <sub>off</sub>	Turn-Off Switching Loss	—	4.6	5.6		
E <sub>total</sub>	Total Switching Loss	—	12.3	14.3		
t <sub>d(on)</sub>	Turn-On delay time	—	63	81	ns	I <sub>C</sub> = 75A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V ③ R <sub>G</sub> = 4.7Ω, L = 200μH, T <sub>J</sub> = 25°C
t <sub>r</sub>	Rise time	—	118	138		
t <sub>d(off)</sub>	Turn-Off delay time	—	267	291		
t <sub>f</sub>	Fall time	—	114	134		
E <sub>on</sub>	Turn-On Switching Loss	—	11	—	mJ	I <sub>C</sub> = 75A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V ③ R <sub>G</sub> = 4.7Ω, L = 200μH, T <sub>J</sub> = 175°C Energy losses include tail & diode reverse recovery
E <sub>off</sub>	Turn-Off Switching Loss	—	7.4	—		
E <sub>total</sub>	Total Switching Loss	—	18.4	—		
t <sub>d(on)</sub>	Turn-On delay time	—	62	—	ns	I <sub>C</sub> = 75A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V ③ R <sub>G</sub> = 4.7Ω, L = 200μH T <sub>J</sub> = 175°C
t <sub>r</sub>	Rise time	—	110	—		
t <sub>d(off)</sub>	Turn-Off delay time	—	330	—		
t <sub>f</sub>	Fall time	—	237	—		
C <sub>ies</sub>	Input Capacitance	—	9450	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0Mhz
C <sub>oes</sub>	Output Capacitance	—	340	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	230	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				I <sub>C</sub> = 300A V <sub>CC</sub> = 960V, V <sub>p</sub> = 1200V R <sub>G</sub> = 4.7Ω, V <sub>GE</sub> = +20V to 0V, T <sub>J</sub> = 175°C
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	V <sub>CC</sub> = 600V, V <sub>p</sub> = 1200V, T <sub>J</sub> = 150°C R <sub>G</sub> = 4.7Ω, V <sub>GE</sub> = +15V to 0V

### Notes:

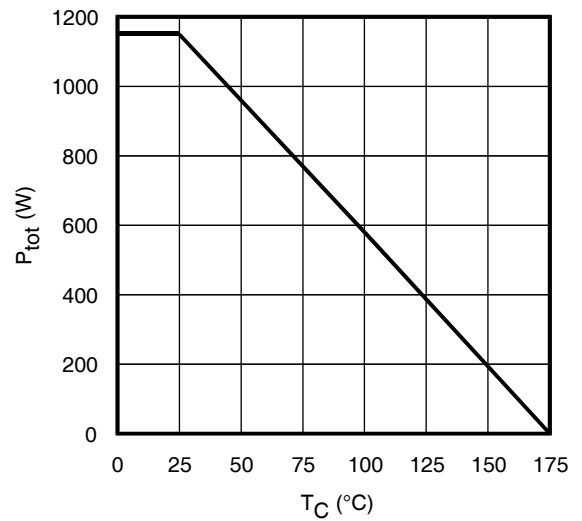
- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 195A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)
- ② V<sub>CC</sub> = 80% (V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 20μH, R<sub>G</sub> = 5.0Ω.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ Refer to AN-1086 for guidelines for measuring V<sub>(BR)CES</sub> safely.
- ⑤ R<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.



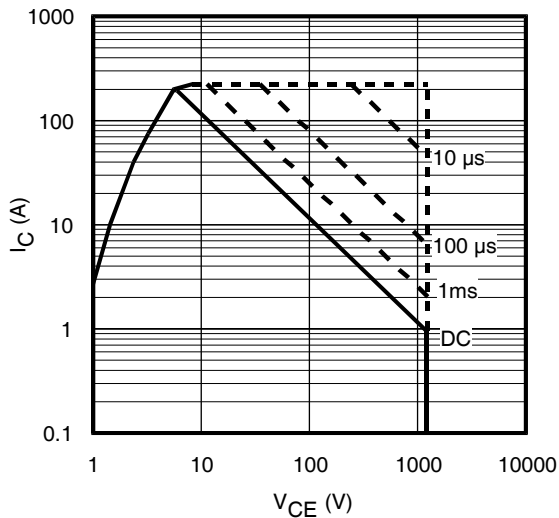
**Fig. 1 - Typical Load Current vs. Frequency**



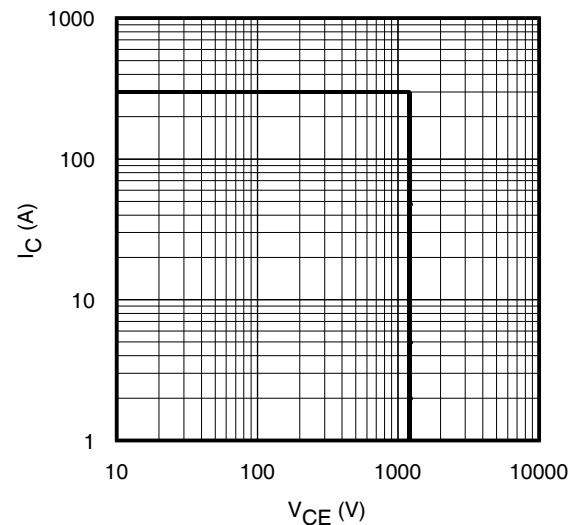
**Fig. 2 - Maximum DC Collector Current vs. Case Temperature**



**Fig. 3 - Power Dissipation vs. Case Temperature**

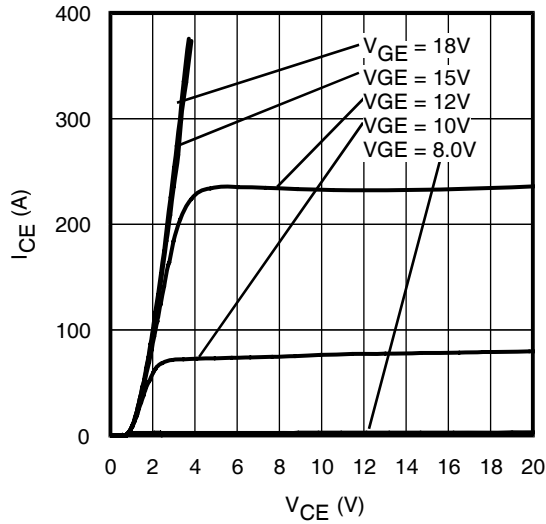


**Fig. 4 - Forward SOA**  
 $T_C = 25^{\circ}\text{C}$ ,  $T_J \leq 175^{\circ}\text{C}$ ;  $V_{GE} = 15\text{V}$

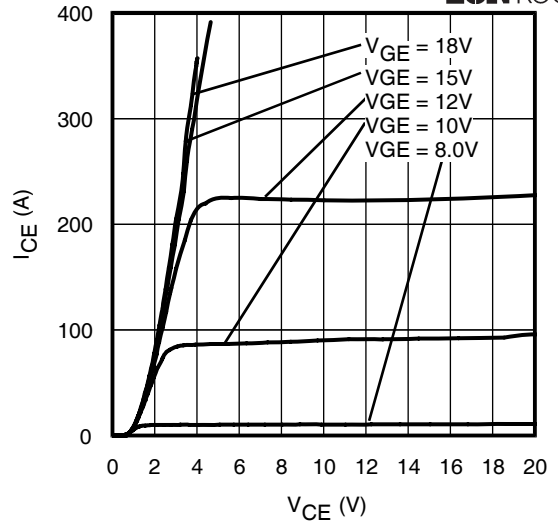


**Fig. 5 - Reverse Bias SOA**  
 $T_J = 175^{\circ}\text{C}$ ;  $V_{GE} = 20\text{V}$

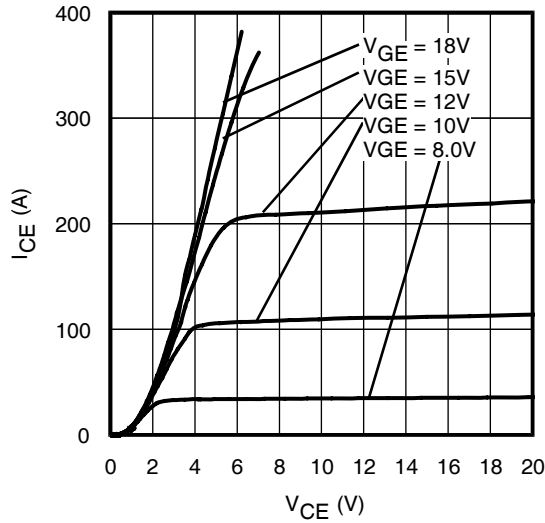
# IRG7PSH73K10PbF



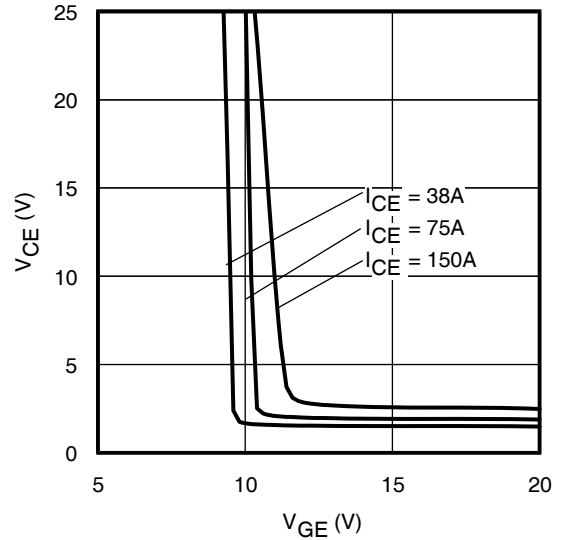
**Fig. 6** - Typ. IGBT Output Characteristics  
 $T_J = -40^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



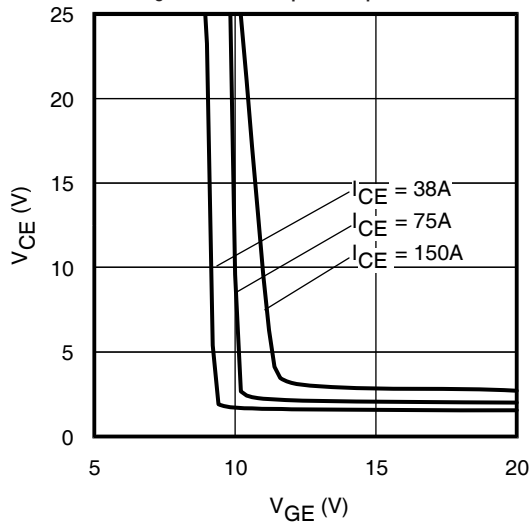
**Fig. 7** - Typ. IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



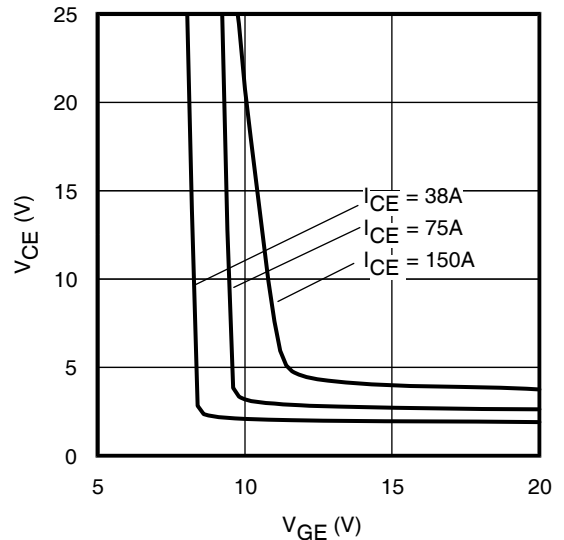
**Fig. 8** - Typ. IGBT Output Characteristics  
 $T_J = 175^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



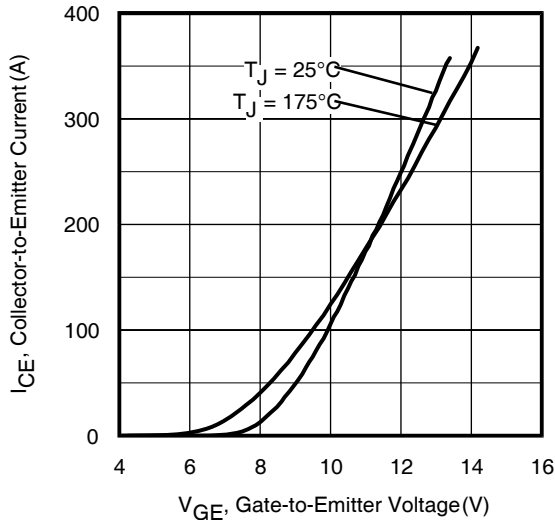
**Fig. 9** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = -40^\circ\text{C}$



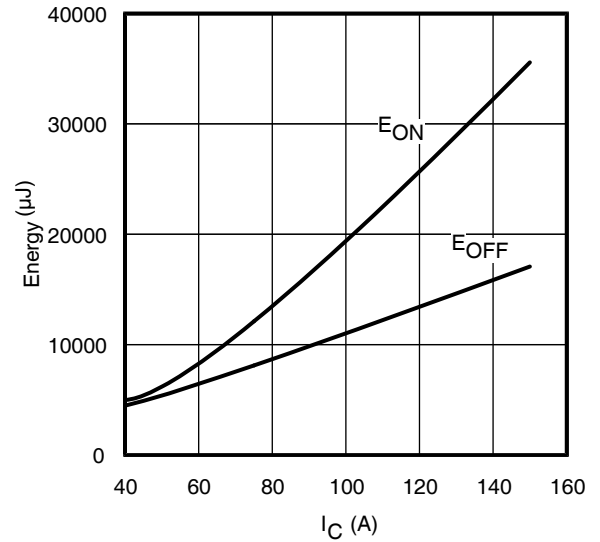
**Fig. 10** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$



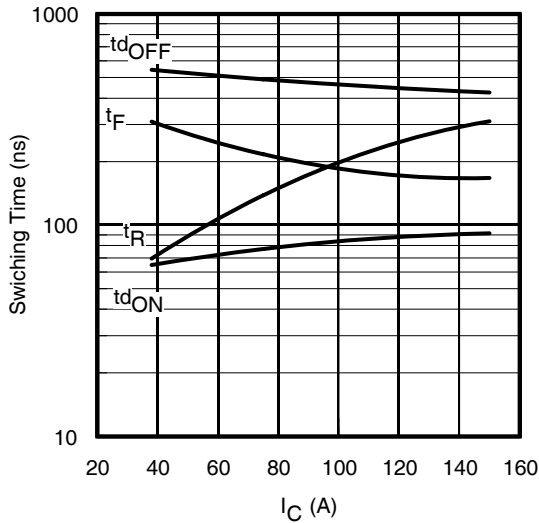
**Fig. 11** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 175^\circ\text{C}$



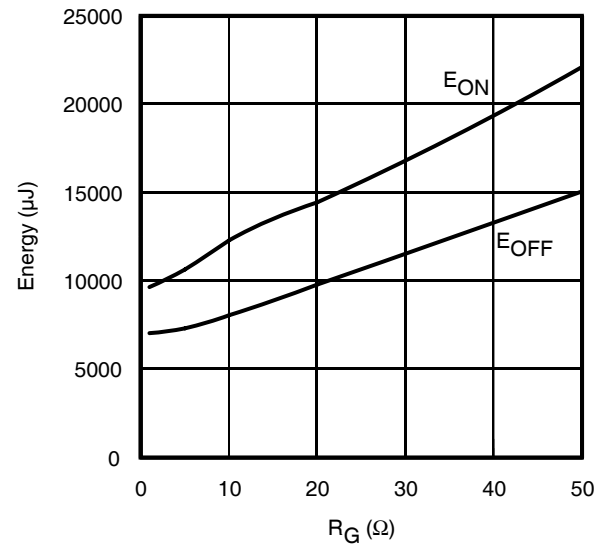
**Fig. 12- Typ. Transfer Characteristics**  
 $V_{CE} = 50V$ ;  $t_p = 10\mu s$



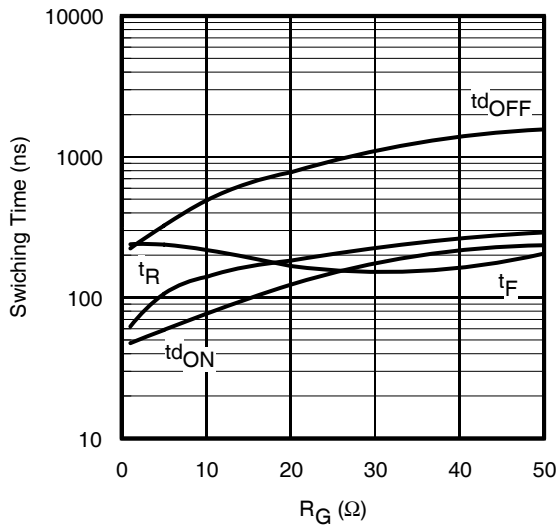
**Fig. 13 - Typ. Energy Loss vs.  $I_C$**   
 $T_J = 175^\circ C$ ;  $L = 200\mu H$ ;  $V_{CE} = 600V$ ,  $R_G = 5.0\Omega$ ;  $V_{GE} = 15V$



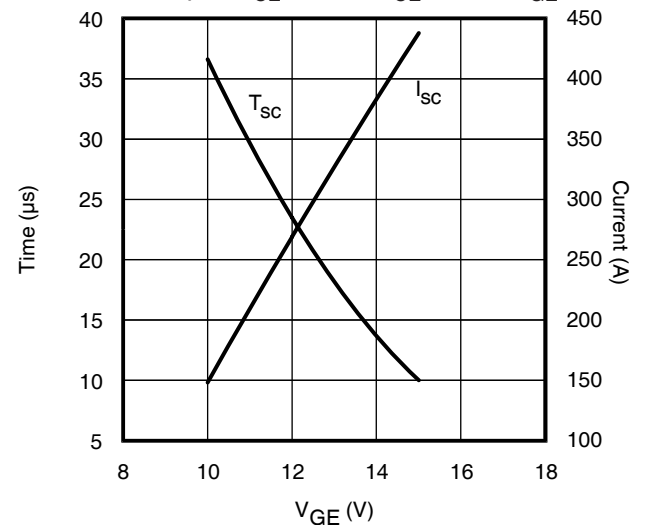
**Fig. 14 - Typ. Switching Time vs.  $I_C$**   
 $T_J = 175^\circ C$ ;  $L = 200\mu H$ ;  $V_{CE} = 600V$ ,  $R_G = 5.0\Omega$ ;  $V_{GE} = 15V$



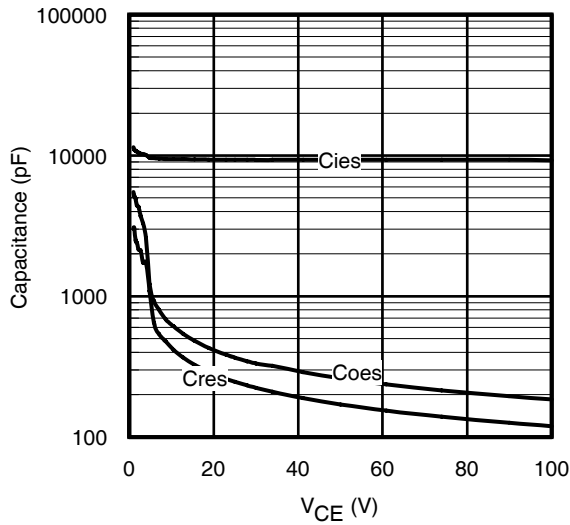
**Fig. 15 - Typ. Energy Loss vs.  $R_G$**   
 $T_J = 175^\circ C$ ;  $L = 200\mu H$ ;  $V_{CE} = 600V$ ,  $I_{CE} = 75A$ ;  $V_{GE} = 15V$



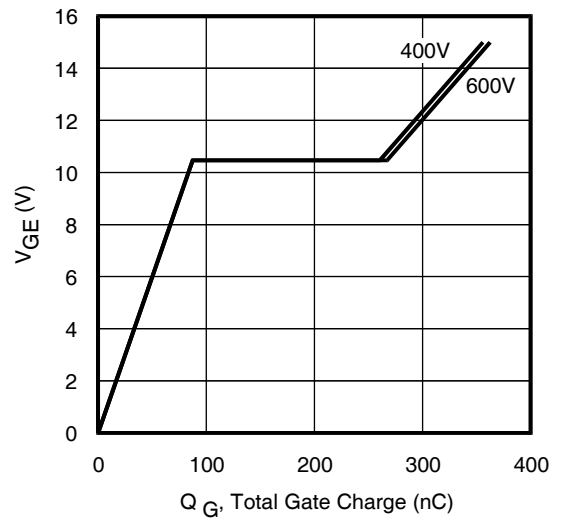
**Fig. 16 - Typ. Switching Time vs.  $R_G$**   
 $T_J = 175^\circ C$ ;  $L = 200\mu H$ ;  $V_{CE} = 600V$ ,  $I_{CE} = 75A$ ;  $V_{GE} = 15V$



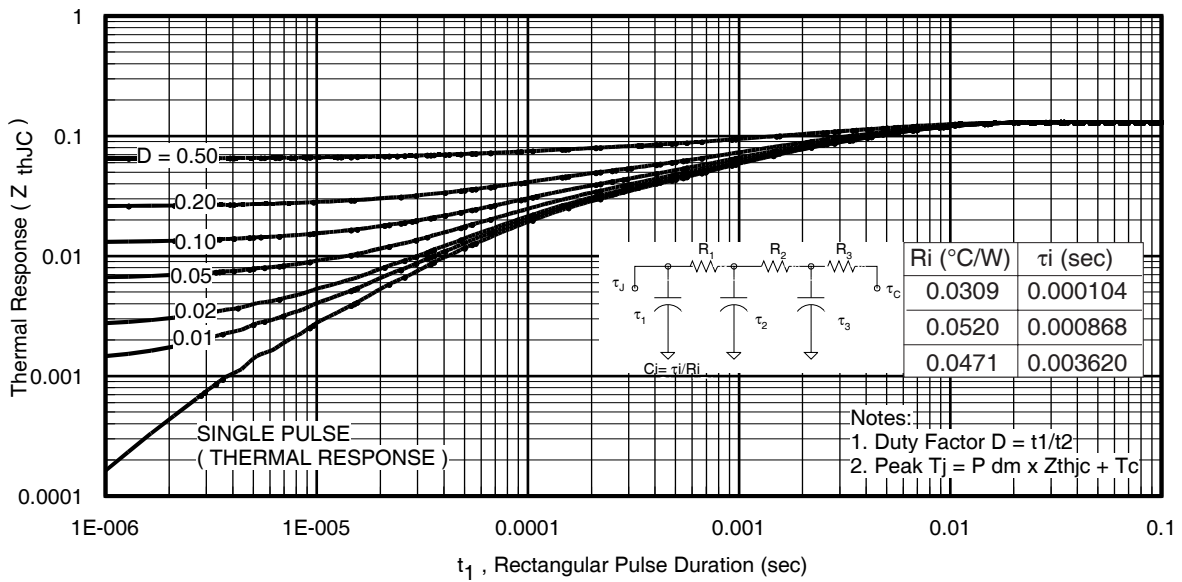
**Fig. 17 -  $V_{GE}$  vs. Short Circuit Time**  
 $V_{CC} = 600V$ ;  $T_C = 150^\circ C$



**Fig. 18** - Typ. Capacitance vs.  $V_{CE}$   
 $V_{GE} = 0V$ ;  $f = 1MHz$



**Fig. 19**- Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 75A$ ;  $L = 330\mu H$



**Fig 20.** Maximum Transient Thermal Impedance, Junction-to-Case

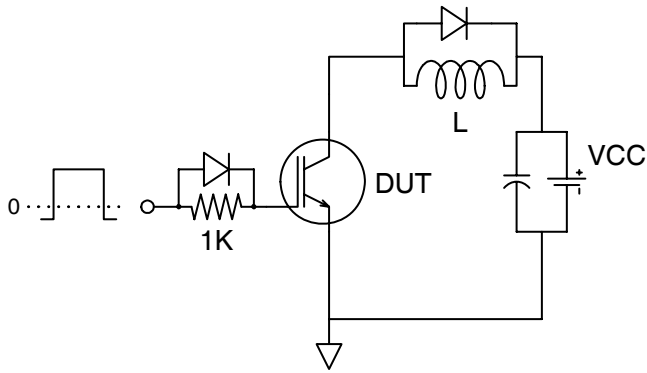


Fig.C.T.1 - Gate Charge Circuit (turn-off)

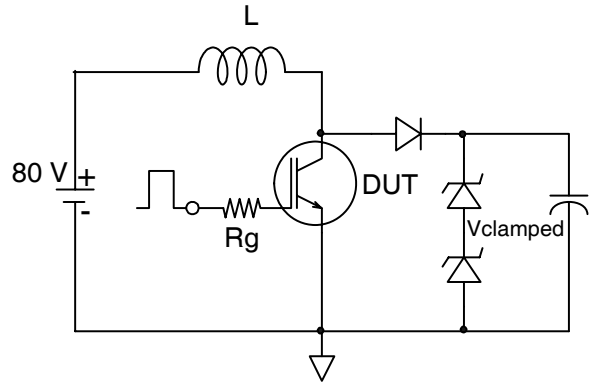


Fig.C.T.2 - RBSOA Circuit

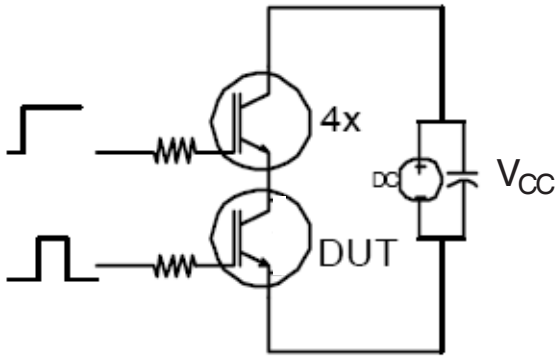


Fig.C.T.3 - S.C. SOA Circuit

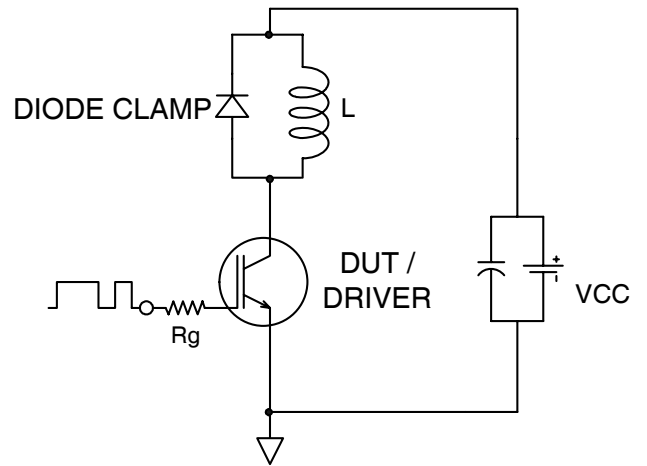


Fig.C.T.4 - Switching Loss Circuit

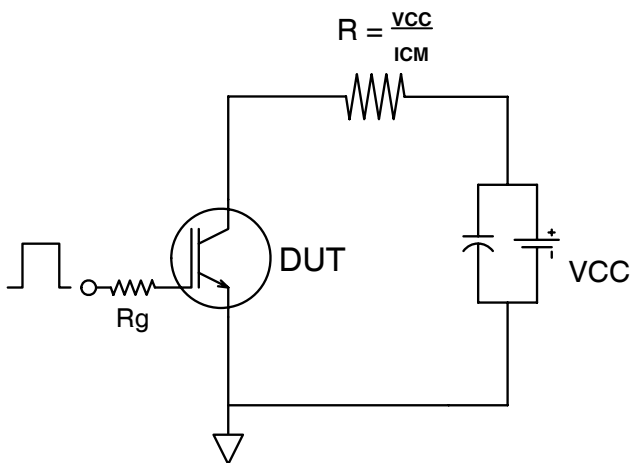


Fig.C.T.5 - Resistive Load Circuit

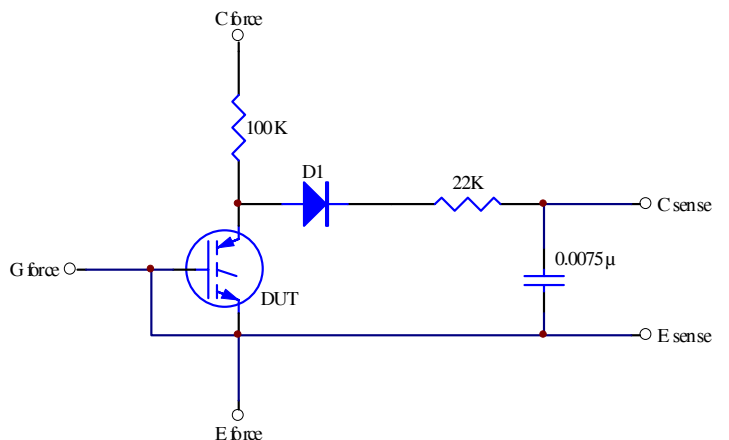
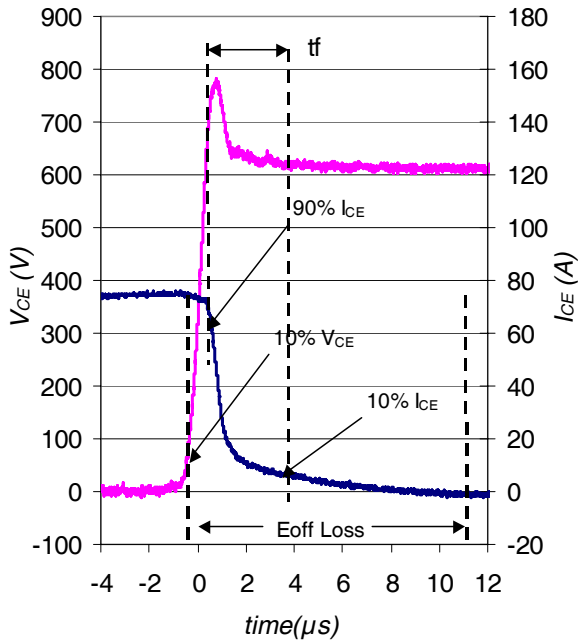
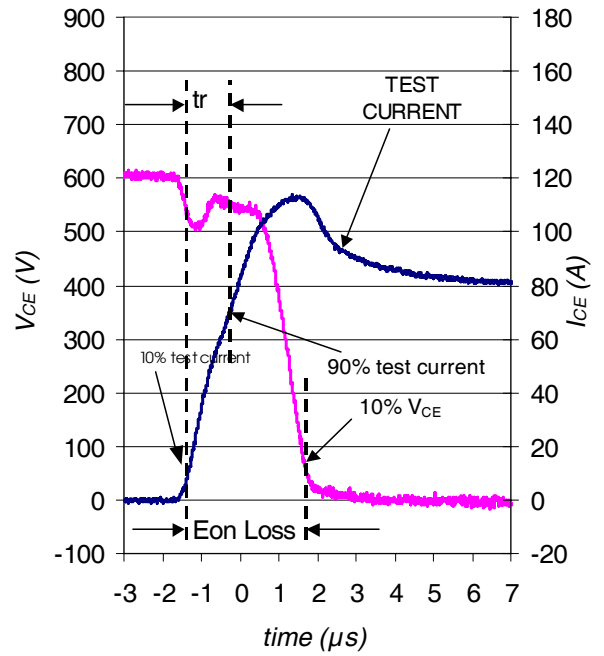


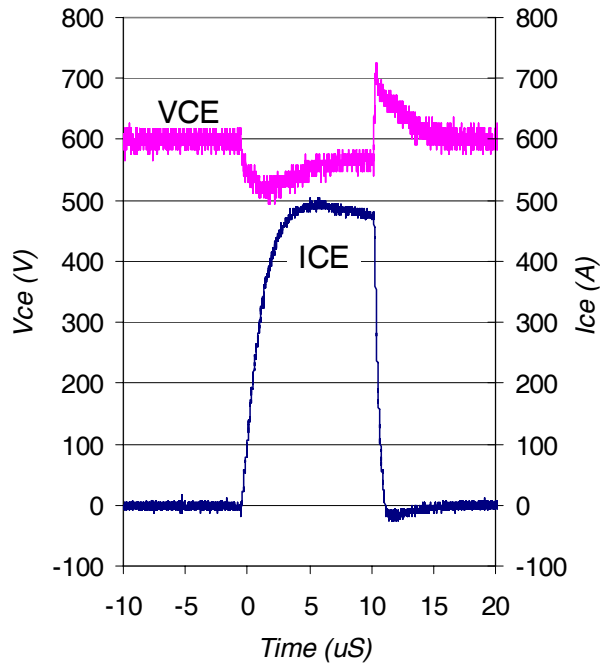
Fig.C.T.6 - BVCES Filter Circuit



**Fig. WF1** - Typ. Turn-off Loss Waveform  
@  $T_J = 175^\circ\text{C}$  using Fig. CT.4



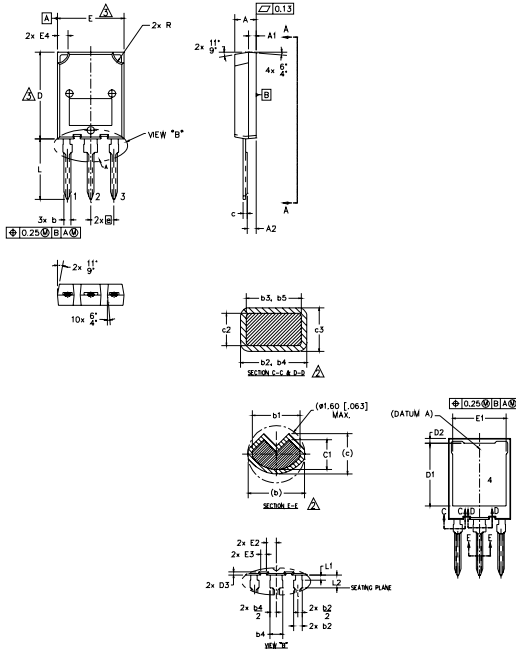
**Fig. WF2** - Typ. Turn-on Loss Waveform  
@  $T_J = 175^\circ\text{C}$  using Fig. CT.4



**Fig. WF3** - Typ. S.C. Waveform  
@  $T_J = 150^\circ\text{C}$  using Fig. CT.3



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 [0.005"] 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	
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

MOSEFET

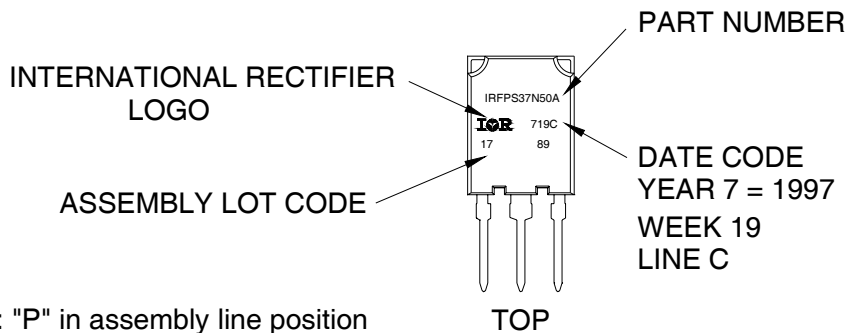
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

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"



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.