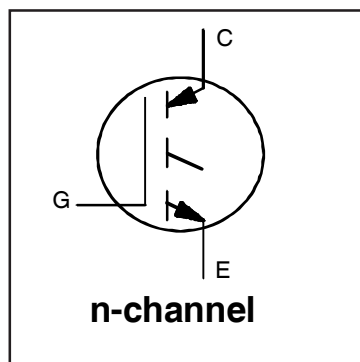


IRG7SC12FPbF

INSULATED GATE BIPOLAR TRANSISTOR

Features

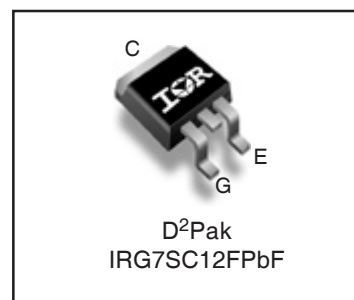
- Low $V_{CE(ON)}$ Trench IGBT Technology
- Maximum Junction temperature 150 °C
- 3 μ S short circuit SOA
- Square RBSOA
- Positive $V_{CE(ON)}$ Temperature co-efficient
- Tight parameter distribution
- Lead Free Package



$V_{CES} = 600V$
$I_C = 8A, T_C = 100^\circ C$
$t_{SC} \geq 3\mu s, T_{J(max)} = 150^\circ C$
$V_{CE(on)} \text{ typ.} = 1.60V$

Benefits

- High Efficiency in a HVAC, Refrigerator applications
- Rugged transient Performance for increased reliability
- Excellent Current sharing in parallel operation
- Low EMI



G	C	E
Gate	Collector	Emitter

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	24	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	13	
$I_{NOMINAL}$	Nominal Current	8	
I_{CM}	Pulse Collector Current	24	
I_{LM}	Clamped Inductive Load Current ①	32	V
V_{GE}	Gate-to-Emitter Voltage	± 30	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	69	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	28	
T_J	Operating Junction and	-55 to +150	$^\circ C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance Junction-to-Case ③	—	—	1.8	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.50	—	
$R_{\theta JA}$	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	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.58	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.60	1.85	V	$I_C = 8A, V_{GE} = 15V, T_J = 25^\circ\text{C} \text{ ②}$
		—	1.60	—		$I_C = 8A, V_{GE} = 15V, T_J = 150^\circ\text{C} \text{ ②}$
$V_{GE(th)}$	Gate Threshold Voltage	4.5	—	7.0	V	$V_{CE} = V_{GE}, I_C = 350\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-12	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA (25^\circ\text{C} - 150^\circ\text{C})$
g_{fe}	Forward Transconductance	—	6.2	—	S	$V_{CE} = 50V, I_C = 8A, PW = 60\mu s$
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	20	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	80	—		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 30V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	34	51	nC	$I_C = 8A$ $V_{GE} = 15V$ $V_{CC} = 400V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	6.2	9.3		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	16	24		
E_{on}	Turn-On Switching Loss	—	390	610	μJ	$I_C = 8A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 47\Omega, L = 1.0mH, L_S = 150nH$ $T_J = 25^\circ\text{C}$
E_{off}	Turn-Off Switching Loss	—	280	440		
E_{total}	Total Switching Loss	—	670	1050		
$t_{d(on)}$	Turn-On delay time	—	40	60	ns	$I_C = 8A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 47\Omega, L = 1.0mH, L_S = 150nH$ $T_J = 25^\circ\text{C}$
t_r	Rise time	—	20	40		
$t_{d(off)}$	Turn-Off delay time	—	210	270		
t_f	Fall time	—	120	180		
E_{on}	Turn-On Switching Loss	—	515	—	μJ	$I_C = 8A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 47\Omega, L = 1.0mH, L_S = 150nH$ $T_J = 150^\circ\text{C}$
E_{off}	Turn-Off Switching Loss	—	570	—		
E_{total}	Total Switching Loss	—	1085	—		
$t_{d(on)}$	Turn-On delay time	—	30	—	ns	$I_C = 8A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 47\Omega, L = 1.0mH, L_S = 150nH$ $T_J = 150^\circ\text{C}$
t_r	Rise time	—	20	—		
$t_{d(off)}$	Turn-Off delay time	—	250	—		
t_f	Fall time	—	285	—		
C_{ies}	Input Capacitance	—	880	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0Mhz$
C_{oes}	Output Capacitance	—	30	—		
C_{res}	Reverse Transfer Capacitance	—	20	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 32A$ $V_{CC} = 480V, V_p \leq 600V$ $R_G = 47\Omega, V_{GE} = +20V \text{ to } 0V$
SCSOA	Short Circuit Safe Operating Area	3	—	—	μs	$V_{GE} = 15V, V_{CC} = 400V, V_p \leq 600V$ $R_G = 47\Omega, R_{shunt} = 33m\Omega, V_{GE} = +15V \text{ to } 0V$

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 1.0mH, R_G = 47\Omega$.
- ② Pulse width limited by max. junction temperature.
- ③ R_θ is measured at T_J of approximately 90°C .

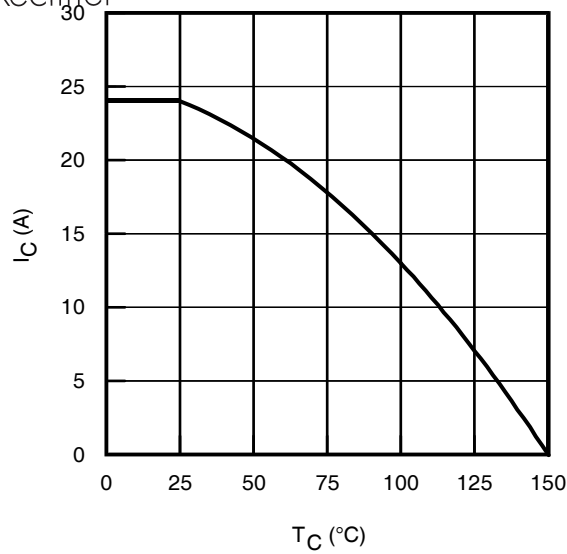


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

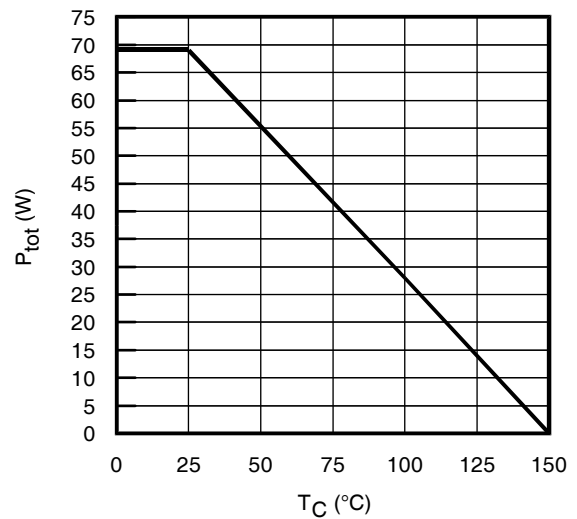


Fig. 2 - Power Dissipation vs. Case Temperature

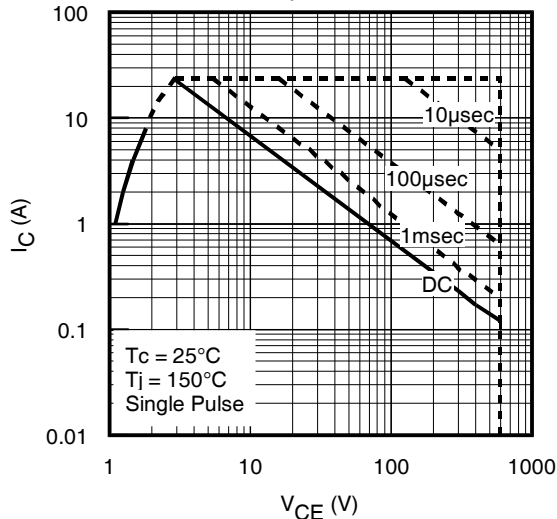


Fig. 3 - Forward SOA
 $T_C = 25^\circ\text{C}$, $T_J \leq 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

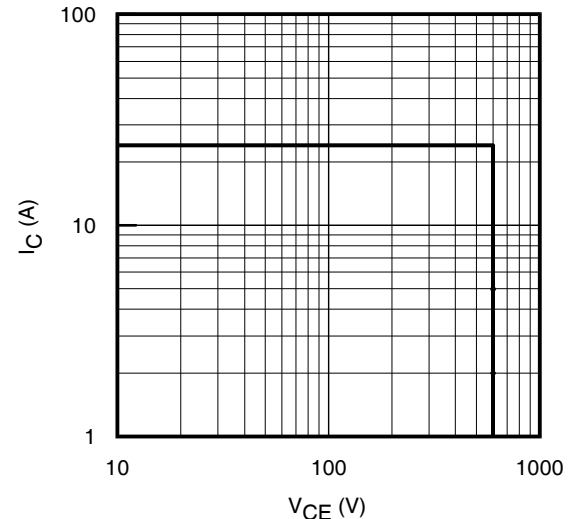


Fig. 4 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

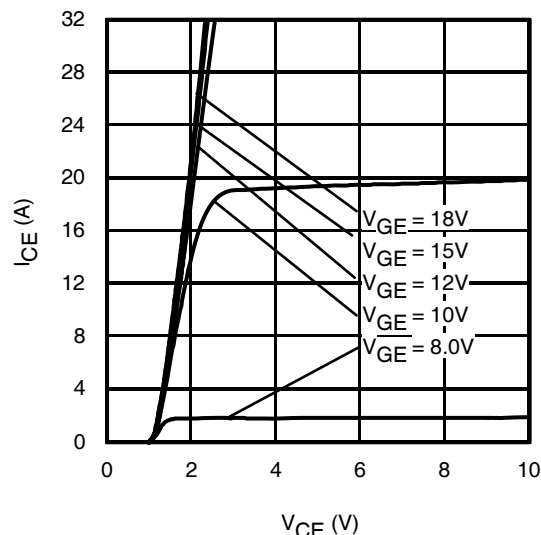


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 60\mu\text{s}$

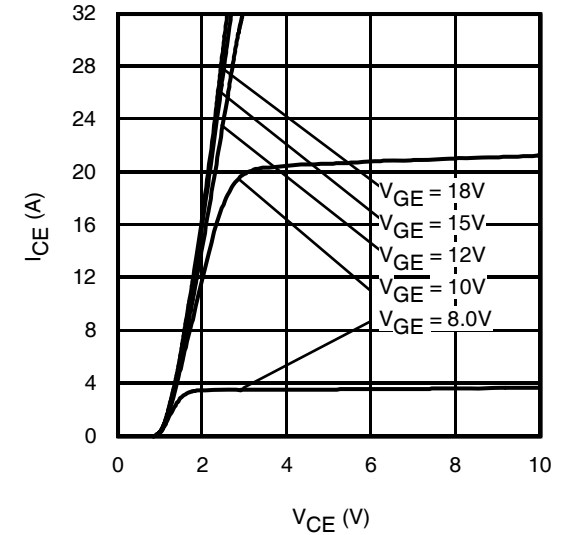


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 60\mu\text{s}$

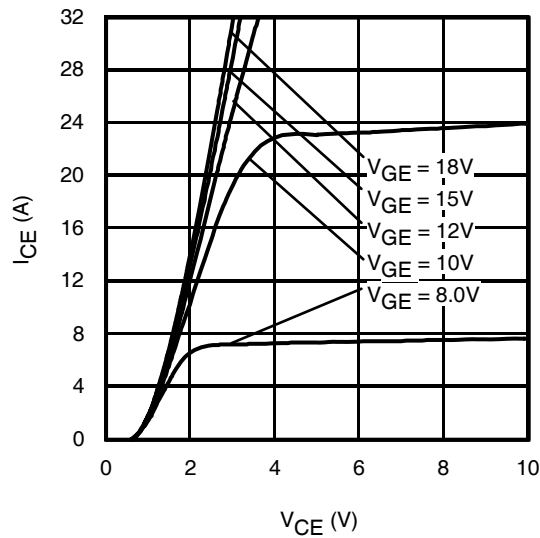


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 150^{\circ}\text{C}$; $t_p = 60\mu\text{s}$

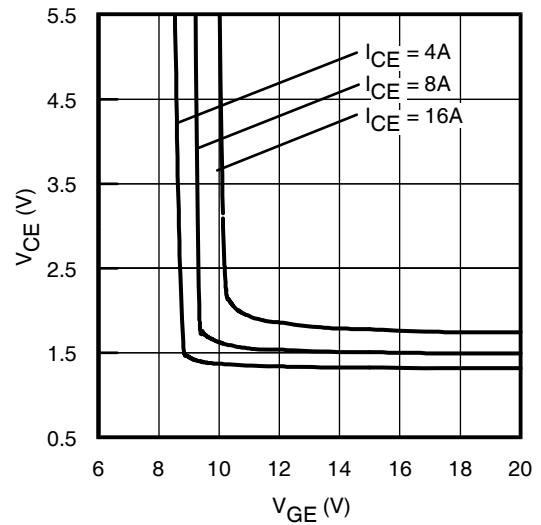


Fig. 8 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^{\circ}\text{C}$

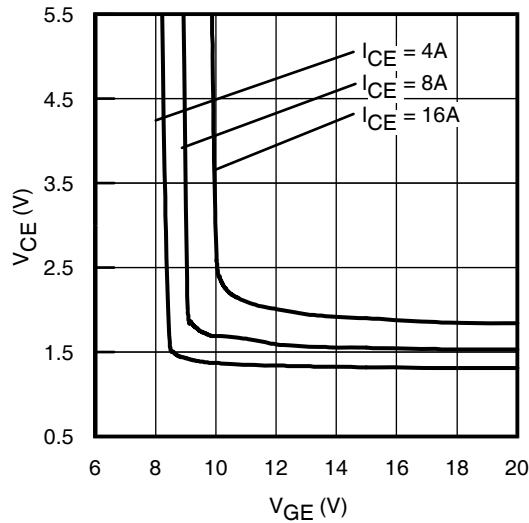


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^{\circ}\text{C}$

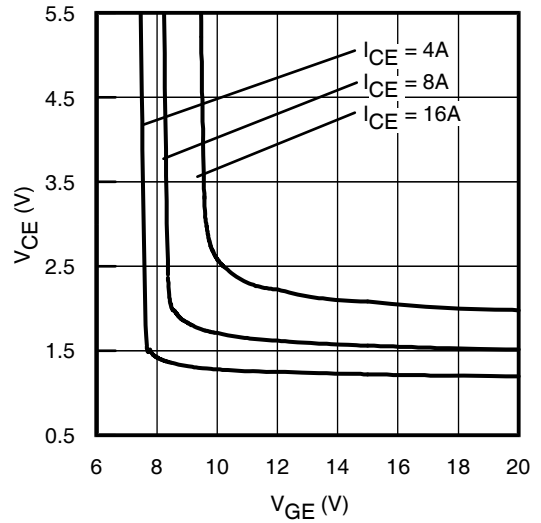


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^{\circ}\text{C}$

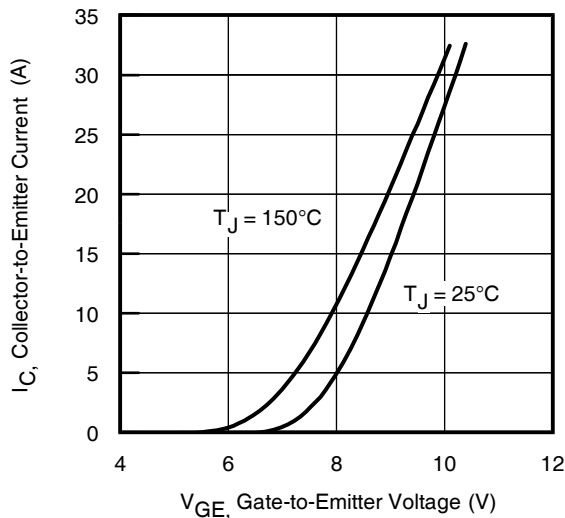


Fig. 11 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 60\mu\text{s}$

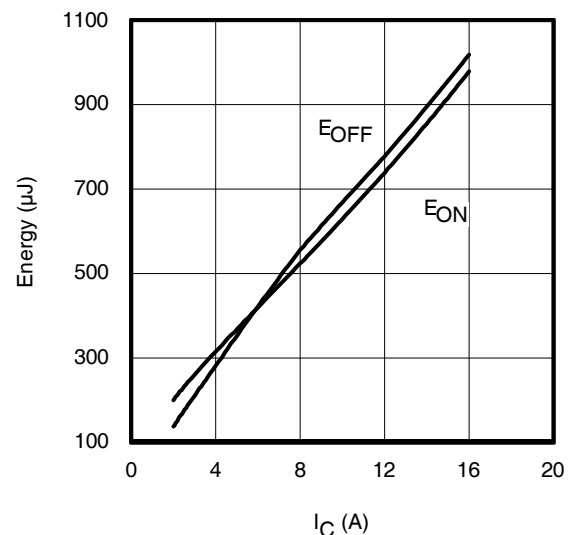


Fig. 12 - Typ. Energy Loss vs. I_C
 $T_J = 150^{\circ}\text{C}$; $L = 1.0\text{mH}$; $V_{CE} = 400\text{V}$; $R_G = 47\Omega$; $V_{GE} = 15\text{V}$

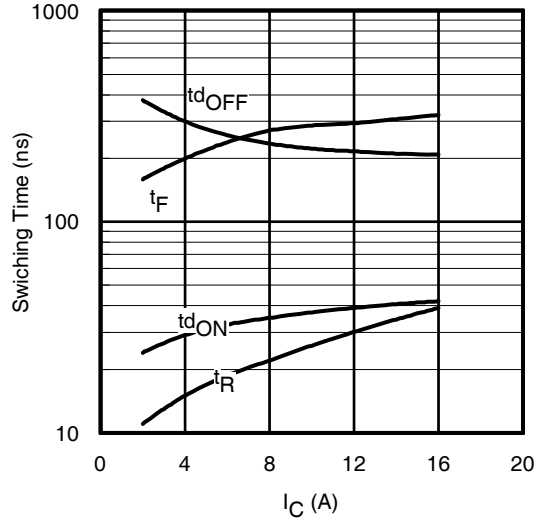


Fig. 13 - Typ. Switching Time vs. I_C

$T_J = 150^\circ\text{C}$; $L = 1.0\text{mH}$; $V_{CE} = 400\text{V}$; $R_G = 47\Omega$; $V_{GE} = 15\text{V}$

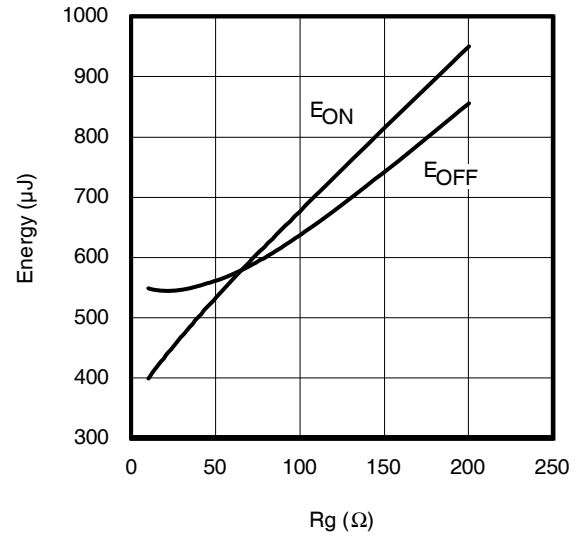


Fig. 14 - Typ. Energy Loss vs. R_G

$T_J = 150^\circ\text{C}$; $L = 1.0\text{mH}$; $V_{CE} = 400\text{V}$; $I_{CE} = 8\text{A}$; $V_{GE} = 15\text{V}$

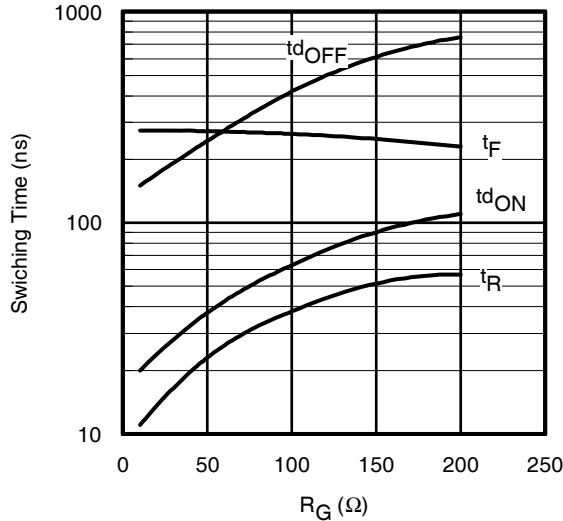


Fig. 15 - Typ. Switching Time vs. R_G

$T_J = 150^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 400\text{V}$; $I_{CE} = 8\text{A}$; $V_{GE} = 15\text{V}$

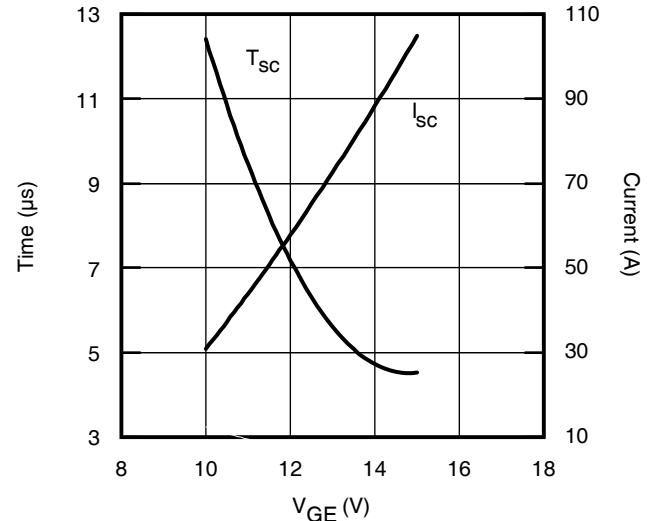


Fig. 16 - V_{GE} vs. Short Circuit Time

$V_{CC} = 400\text{V}$; $T_C = 25^\circ\text{C}$

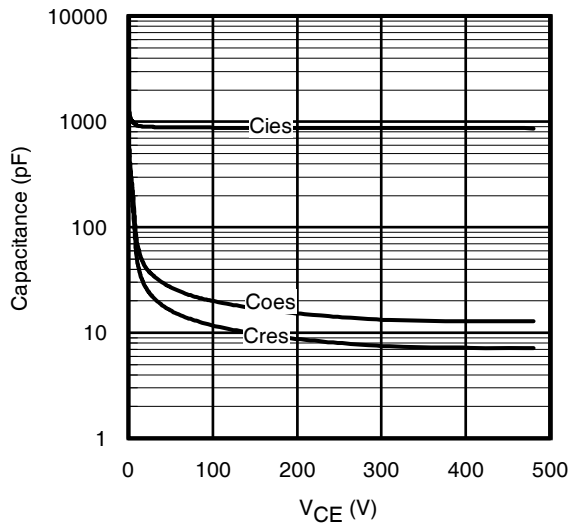


Fig. 17 - Typ. Capacitance vs. V_{CE}

$V_{GE} = 0\text{V}$; $f = 1\text{MHz}$

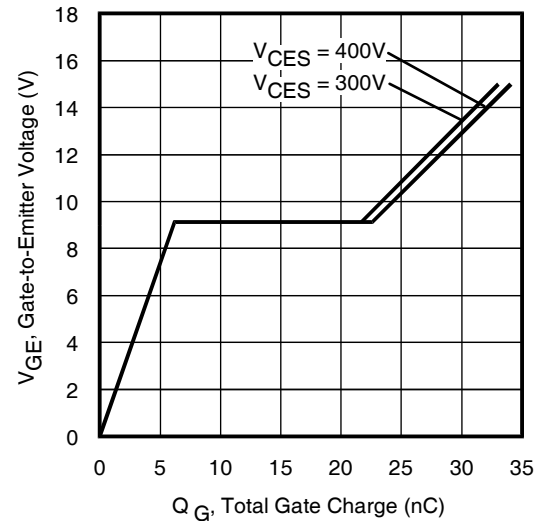


Fig. 18 - Typical Gate Charge vs. V_{GE}

$I_{CE} = 8\text{A}$; $L = 2.4\text{mH}$

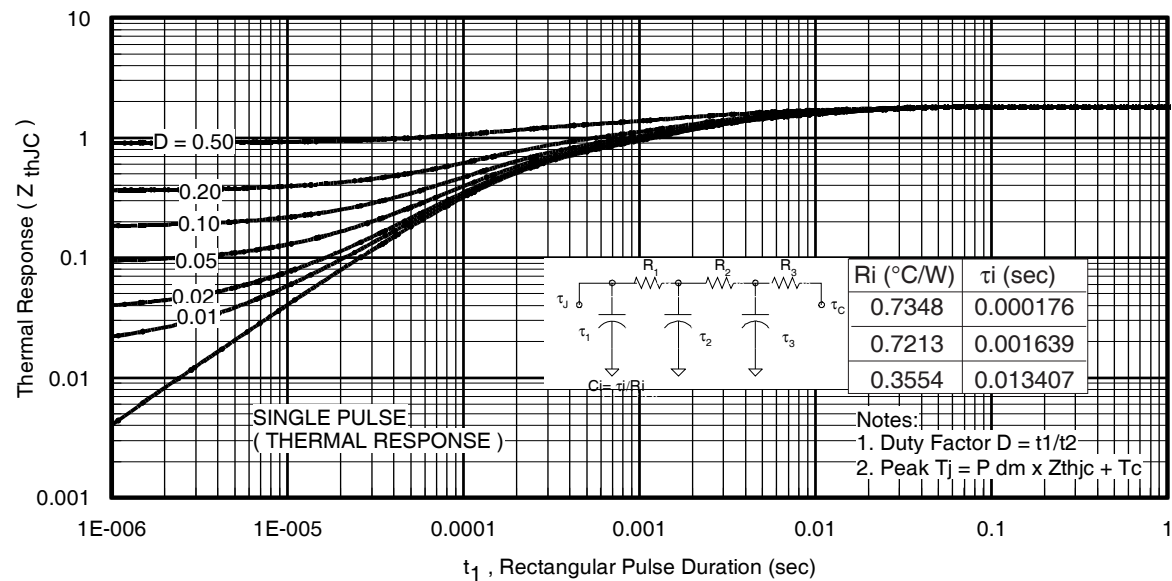


Fig 19. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

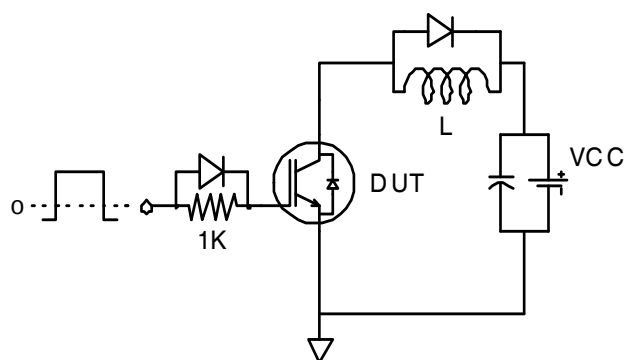


Fig.C.T.1 - Gate Charge Circuit (turn-off)

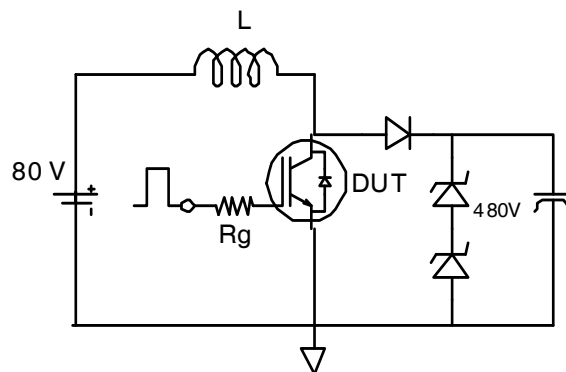


Fig.C.T.2 - RBSOA Circuit

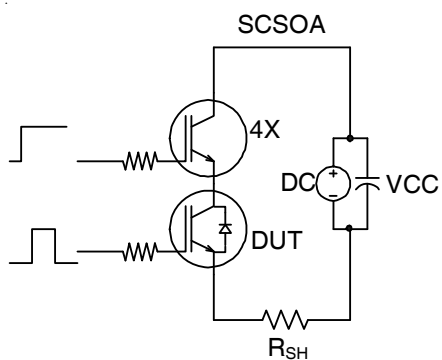


Fig.C.T.3 - S.C. SOA Circuit

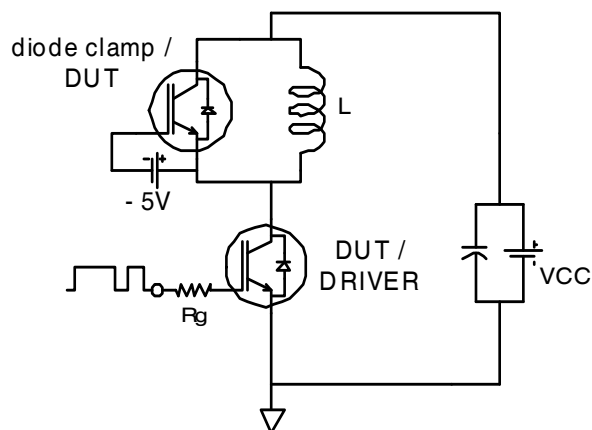


Fig.C.T.4 - Switching Loss Circuit

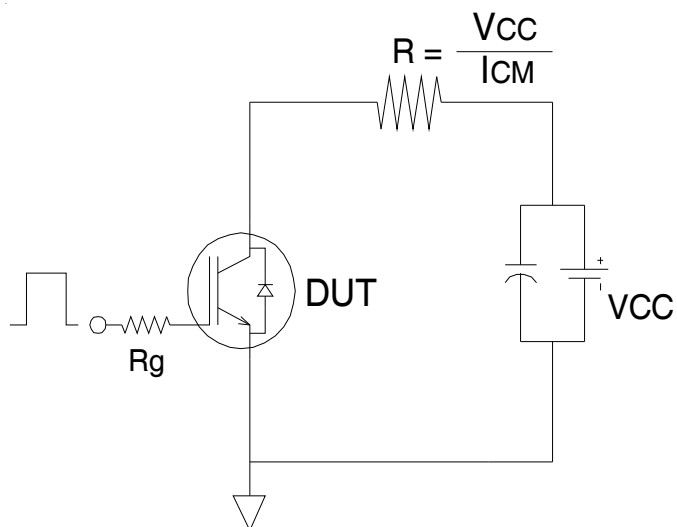


Fig.C.T.5 - Resistive Load Circuit

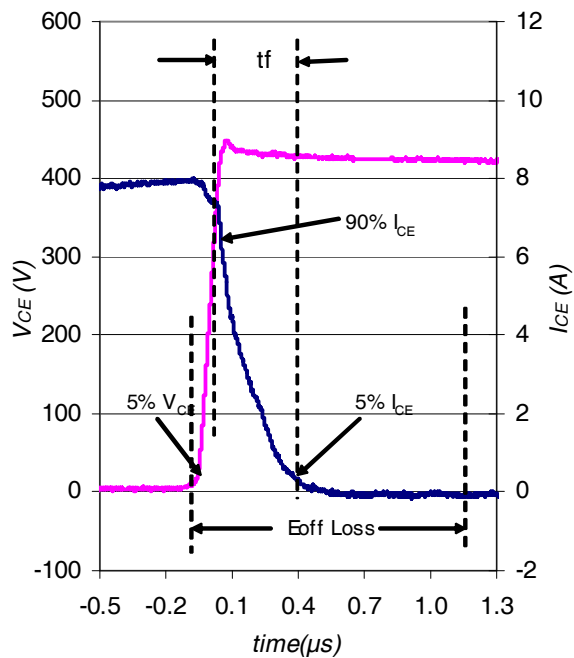


Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

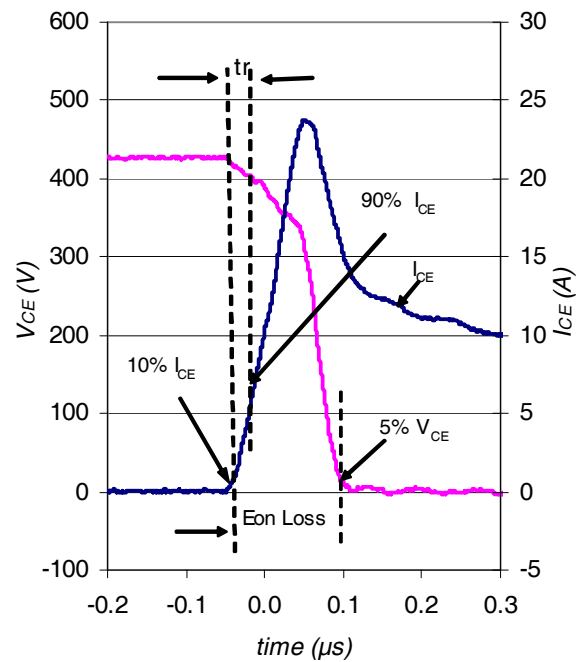


Fig. WF2 - Typ. Turn-on Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

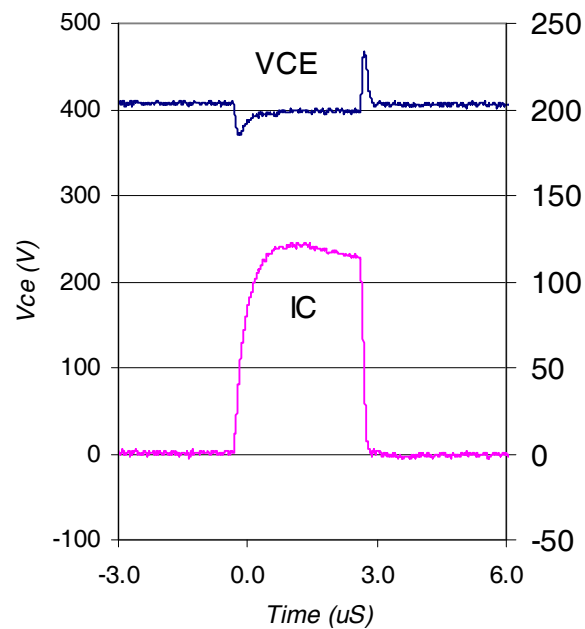
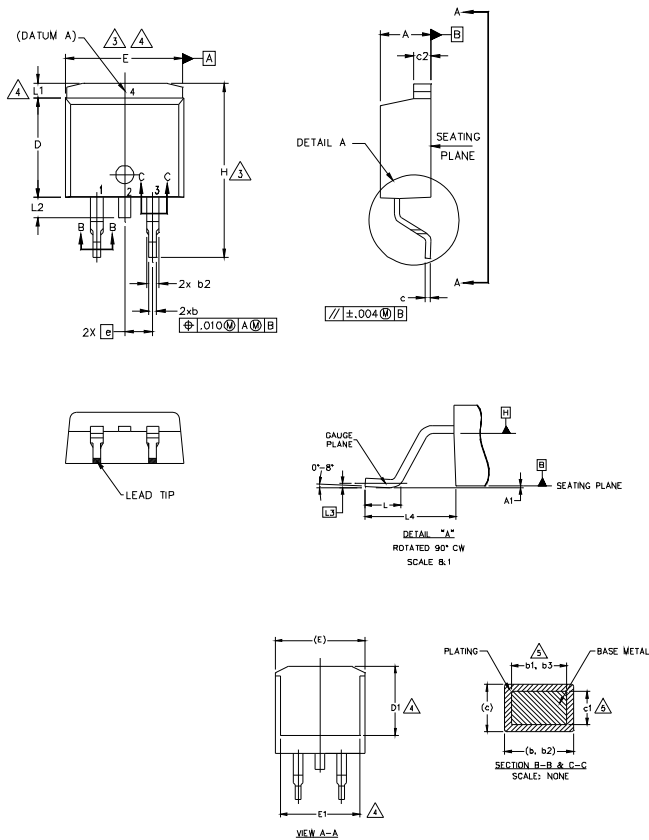


Fig. WF3 - Typ. S.C. Waveform
@ $T_J = 25^\circ\text{C}$ using Fig. CT.3

D²Pak (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
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 OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	5
b3	1.14	1.73	.045	.068	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	
c2	1.14	1.65	.045	.065	5
D	8.38	9.65	.330	.380	
D1	6.86	—	.270	—	
E	9.65	10.67	.380	.420	
E1	6.22	—	.245	—	3,4
e	2.54 BSC		.100 BSC		4
H	14.61	15.88	.575	.625	4
L	1.78	2.79	.070	.110	
L1	—	1.65	—	.066	
L2	1.27	1.78	—	.070	
L3	0.25 BSC		.010 BSC		4
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DIODES

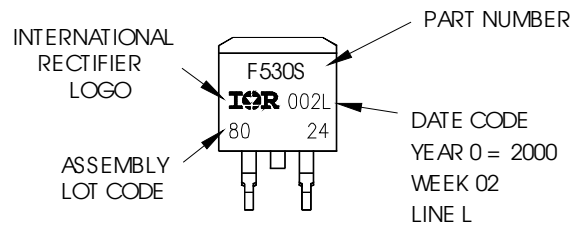
- 1.— ANODE *
- 2, 4.— CATHODE
- 3.— ANODE

* PART DEPENDENT.

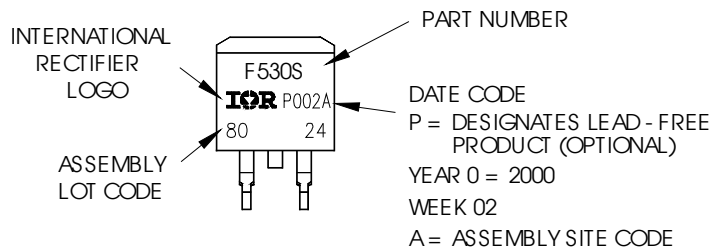
D²Pak (TO-263AB) Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

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



OR



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

Dimensions are shown in millimeters (inches)



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IOR Rectifier

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