

IRG7RC07SDPbF

Optimized for line frequency, 50/60Hz switching frequency

Features

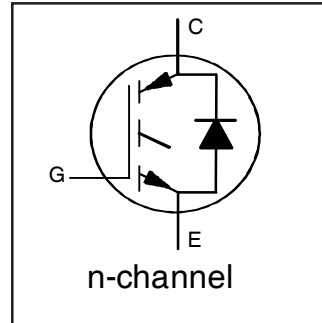
- Standard speed IGBT for switching frequency less than 1KHz
- Very low $V_{CE(ON)}$
- Ultra fast soft recovery diode

Benefits

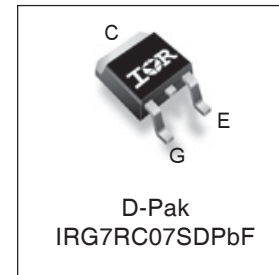
- High efficiency for line frequency applications
- Higher reliability from reduced conduction losses
- Ultra fast diode optimized for high frequency commutation

Applications

- Solar Inverters (50/60Hz Switch)
- Welding machine output stage
- Steering Switch in BLDC motor
- Induction heating operating in capacitive mode



$V_{CES} = 600V$
$I_C = 8.5A, T_C = 100^\circ C$
$V_{CE(on)} \text{ typ. } = 1.2V @ I_C = 3A$



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	16	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	8.5	
I_{CM}	Pulse Collector Current	18	
I_M	Clamped Inductive Load Current ①	6.0	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	16	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	8.5	
I_{FM}	Diode Maximum Forward Current②	16	V
V_{GE}	Gate-to-Emitter Voltage	± 30	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	39	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	16	
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
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) ③	—	—	3.2	$^\circ C/W$
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ③	—	—	6.1	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.50	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (PCB mount Steady state)	—	50	—	

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	—	0.72	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 250\mu A$ (25 $^\circ\text{C}$ -150 $^\circ\text{C}$)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.2	1.5	V	$I_C = 3.0A, V_{GE} = 15V, T_J = 25^\circ\text{C}$
		—	1.2	—		$I_C = 3.0A, V_{GE} = 15V, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5	V	$V_{CE} = V_{GE}, I_C = 100\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-8.3	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA$ (25 $^\circ\text{C}$ - 150 $^\circ\text{C}$)
g_{fe}	Forward Transconductance	—	4.3	—	S	$V_{CE} = 50V, I_C = 3.0A$
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	20	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	100	—		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.8	V	$I_F = 3.0A$
		—	1.1	—		$I_F = 3.0A, T_J = 150^\circ\text{C}$
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)	—	13	20	nC	$I_C = 3.0A$ $V_{GE} = 15V$ ① $V_{CC} = 400V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	2.0	3.0		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	5.0	7.5		
E_{on}	Turn-On Switching Loss	—	80	170	μJ	$I_C = 3.0A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 100\Omega, L = 1mH, T_J = 25^\circ\text{C}$ ② Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	620	790		
E_{total}	Total Switching Loss	—	700	960		
$t_{d(on)}$	Turn-On delay time	—	20	40	ns	$I_C = 3.0A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 100\Omega, L = 1mH, T_J = 25^\circ\text{C}$ ②
t_r	Rise time	—	10	30		
$t_{d(off)}$	Turn-Off delay time	—	580	730		
t_f	Fall time	—	550	670		
E_{on}	Turn-On Switching Loss	—	140	—	μJ	$I_C = 3.0A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 100\Omega, L = 1mH, T_J = 150^\circ\text{C}$ Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	1100	—		
E_{total}	Total Switching Loss	—	1240	—		
$t_{d(on)}$	Turn-On delay time	—	20	—	ns	$I_C = 3.0A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 100\Omega, L = 1mH, T_J = 150^\circ\text{C}$
t_r	Rise time	—	15	—		
$t_{d(off)}$	Turn-Off delay time	—	870	—		
t_f	Fall time	—	1020	—		
C_{ies}	Input Capacitance	—	350	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$
C_{oes}	Output Capacitance	—	22	—		
C_{res}	Reverse Transfer Capacitance	—	7.0	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 6A$ $V_{CC} = 480V, V_p = 600V$ $R_G = 100\Omega, V_{GE} = +20V$ to 0V
E_{rec}	Reverse Recovery Energy of the Diode	—	21	—	μJ	$T_J = 150^\circ\text{C}$
t_{rr}	Diode Reverse Recovery Time	—	64	—	ns	$V_{CC} = 400V, I_F = 3.0A$
I_{rr}	Peak Reverse Recovery Current	—	7.3	—	A	$V_{GE} = 15V, R_G = 100\Omega, L = 1mH$

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 1mH, R_G = 100\Omega$.
- ② Pulse width limited by max. junction temperature.
- ③ R_G is measured at T_J of approximately 90 $^\circ\text{C}$.
- ④ Max limit based on statistical sample size characterization.

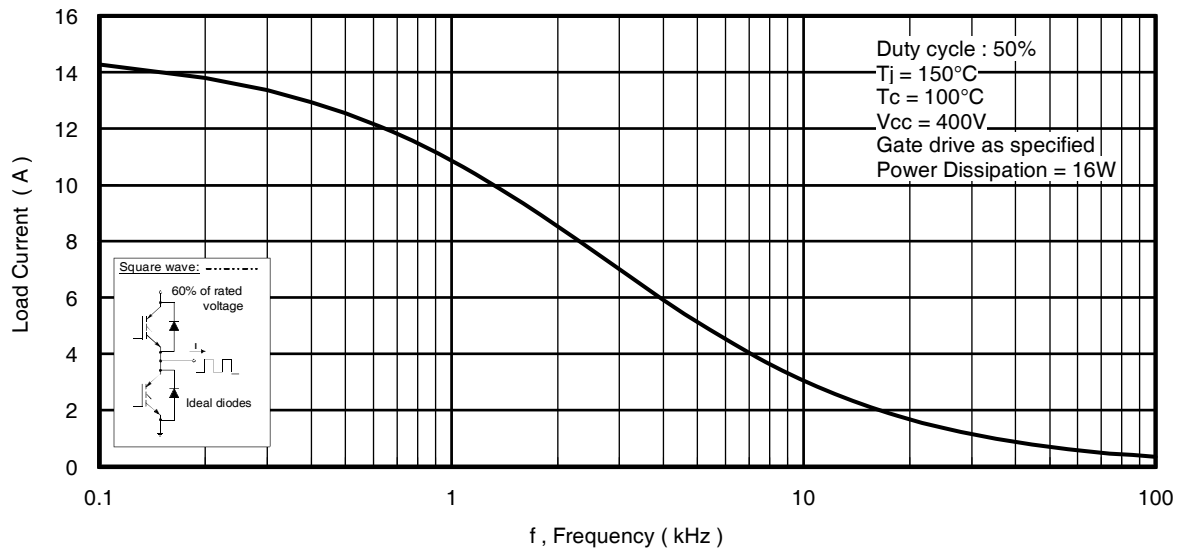


Fig. 1 - Typical Load Current vs. Frequency

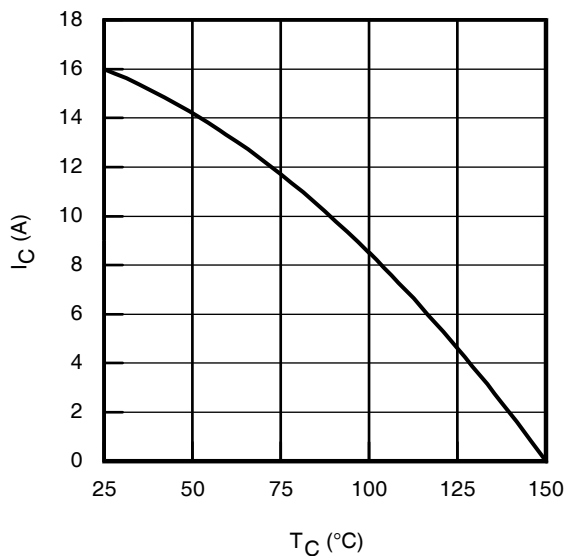


Fig. 2 - Maximum DC Collector Current vs. Case Temperature

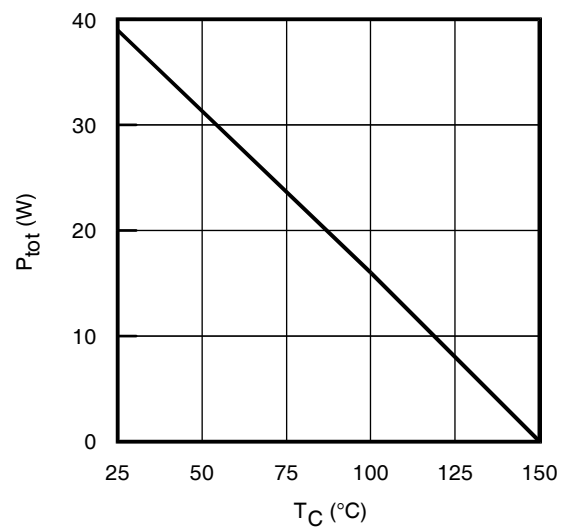


Fig. 3 - Power Dissipation vs. Case Temperature

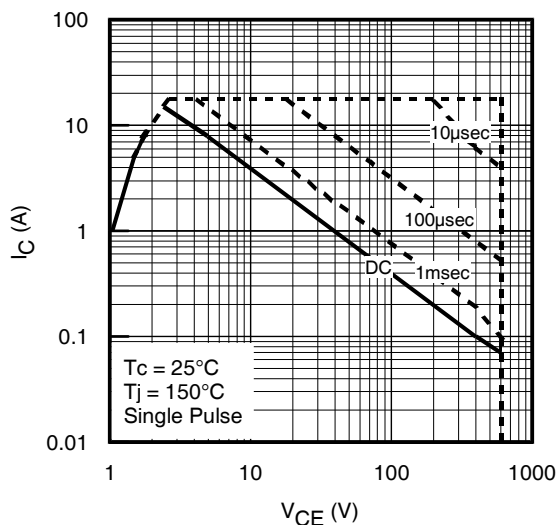


Fig. 4 - Forward SOA
 $T_C = 25^{\circ}\text{C}$, $T_J \leq 150^{\circ}\text{C}$; $V_{GE} = 15\text{V}$

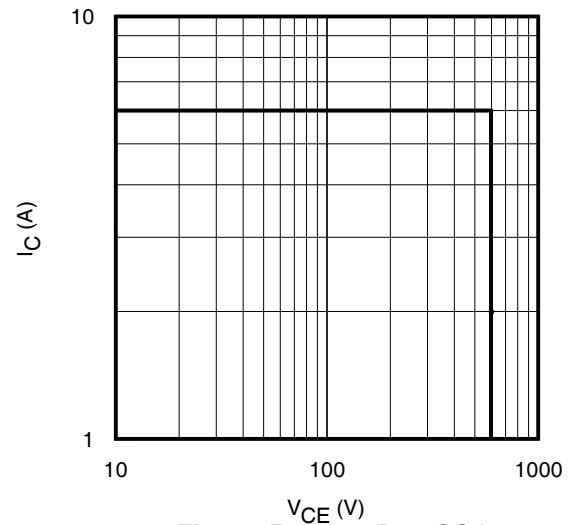


Fig. 5 - Reverse Bias SOA
 $T_J = 150^{\circ}\text{C}$; $V_{GE} = 20\text{V}$

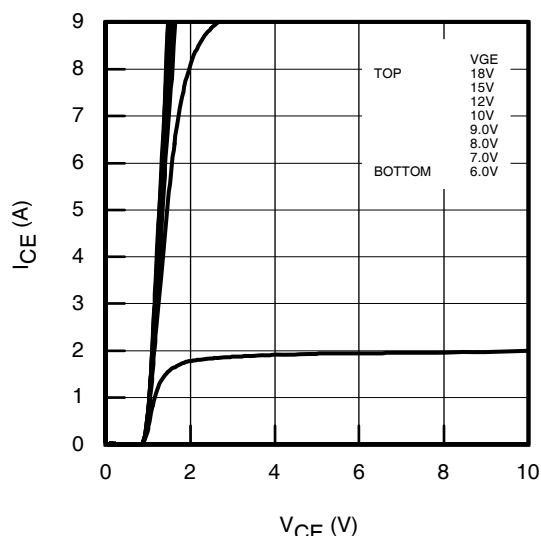


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 20\mu\text{s}$

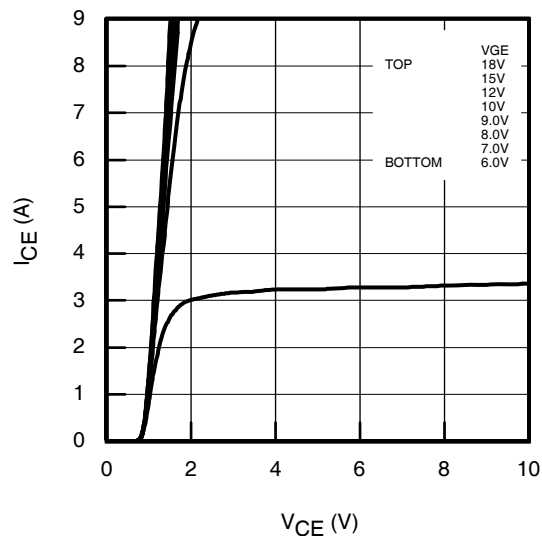


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 20\mu\text{s}$

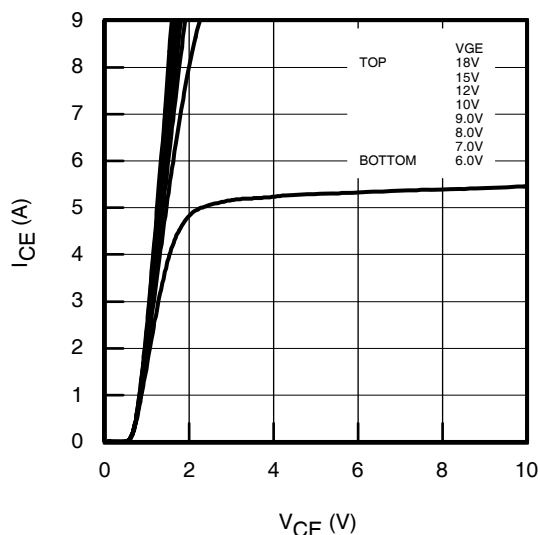


Fig. 8 - Typ. IGBT Output Characteristics
 $T_J = 150^\circ\text{C}$; $t_p = 20\mu\text{s}$

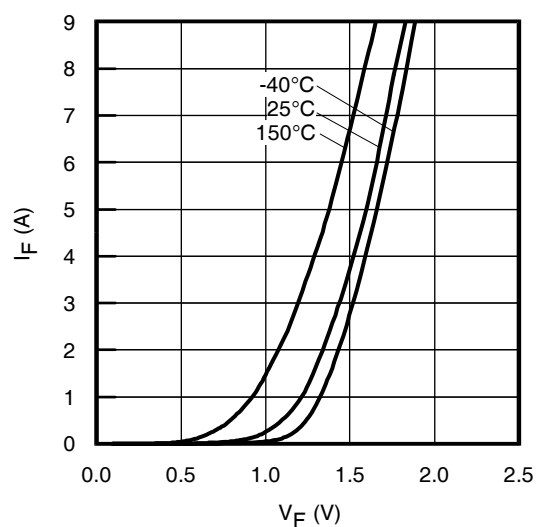


Fig. 9 - Typ. Diode Forward Characteristics
 $t_p = 20\mu\text{s}$

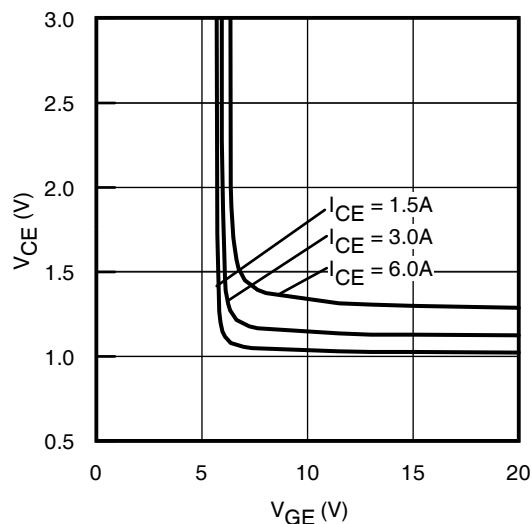


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

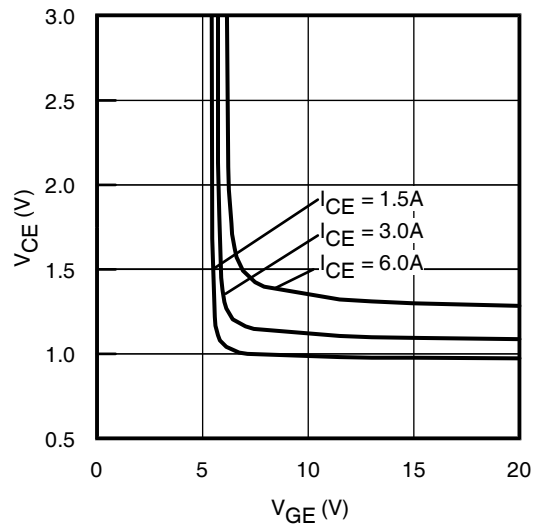


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

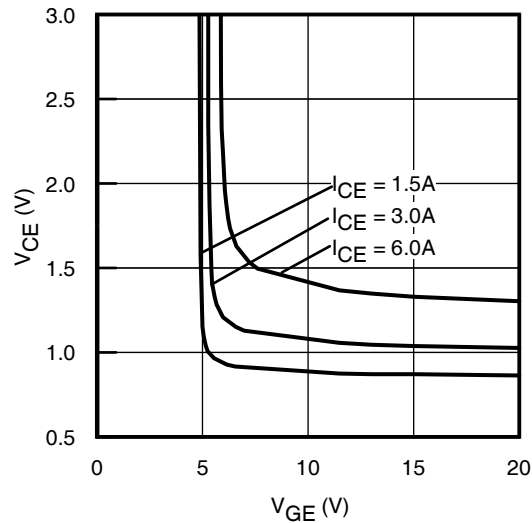


Fig. 12 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^\circ\text{C}$

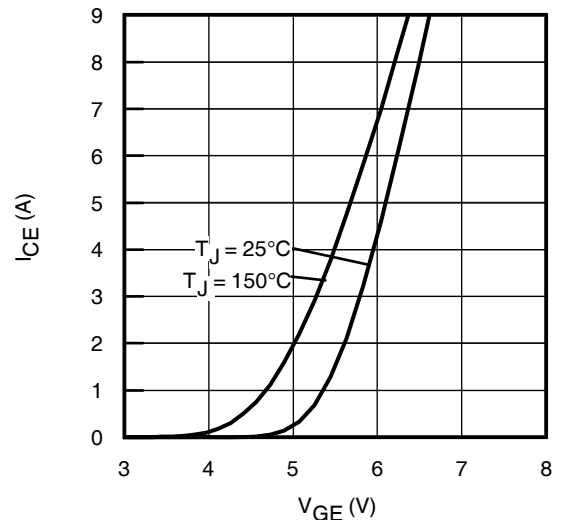


Fig. 13 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 20\mu\text{s}$

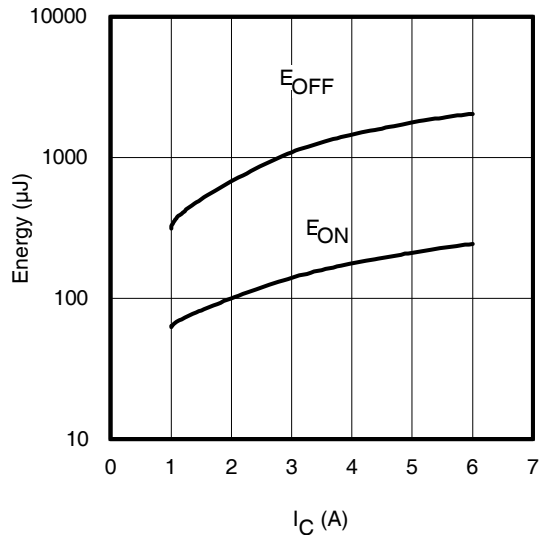


Fig. 14 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 400\text{V}$; $R_G = 100\Omega$; $V_{GE} = 15\text{V}$

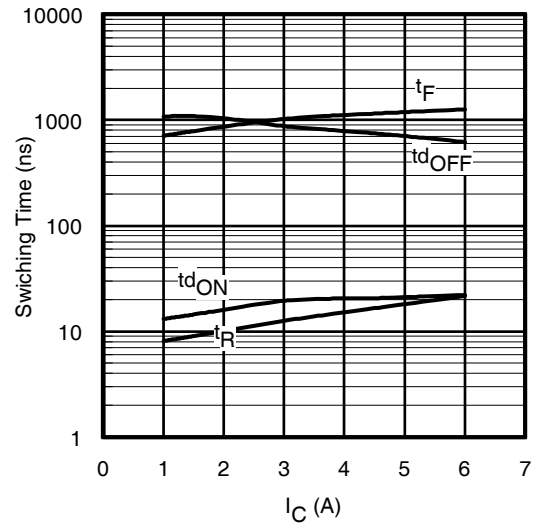


Fig. 15 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 400\text{V}$; $R_G = 100\Omega$; $V_{GE} = 15\text{V}$

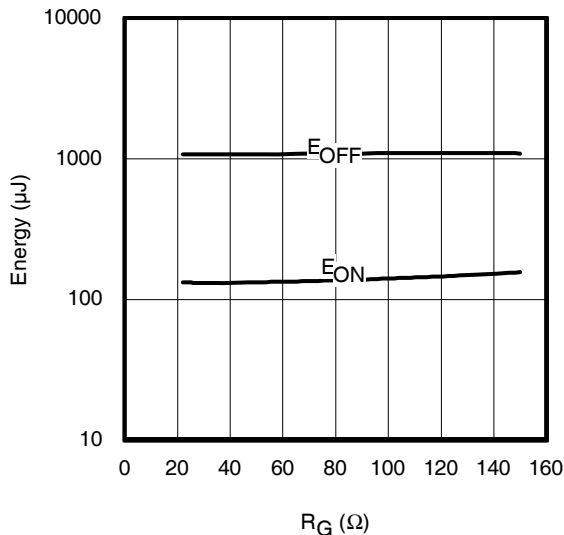


Fig. 16 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 400\text{V}$; $I_{CE} = 3.0\text{A}$; $V_{GE} = 15\text{V}$

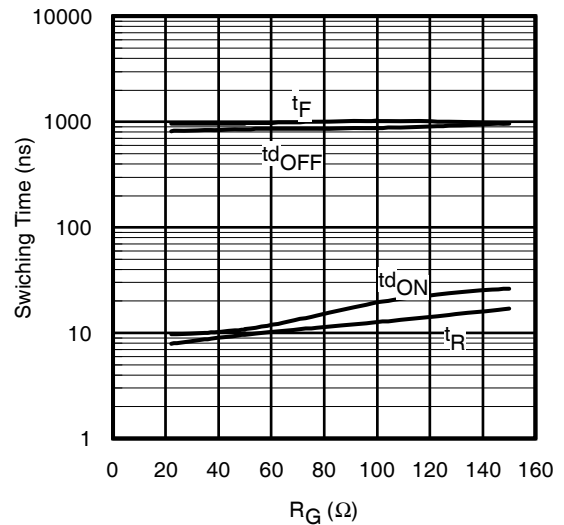


Fig. 17 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 400\text{V}$; $I_{CE} = 3.0\text{A}$; $V_{GE} = 15\text{V}$

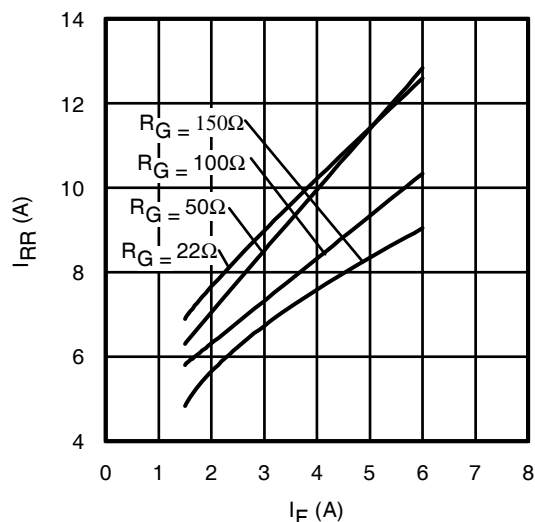


Fig. 18 - Typ. Diode I_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

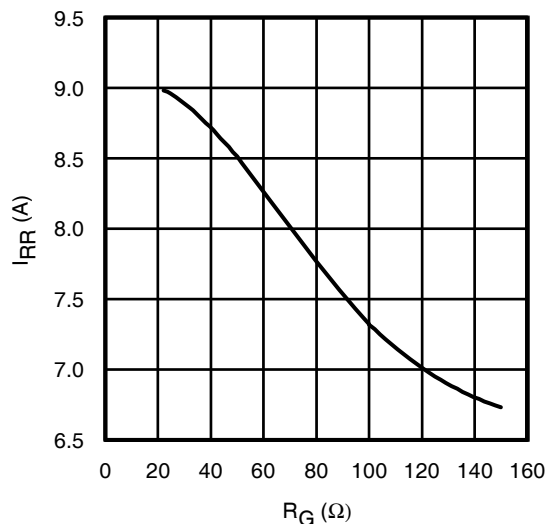


Fig. 19 - Typ. Diode I_{RR} vs. R_G
 $T_J = 150^\circ\text{C}$

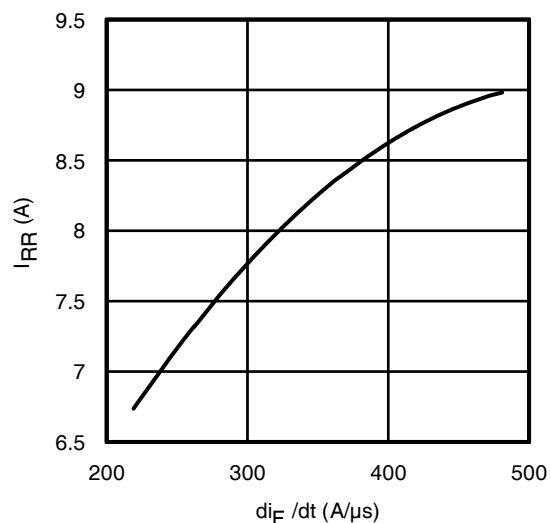


Fig. 20 - Typ. Diode I_{RR} vs. di_F/dt
 $V_{CC} = 400\text{V}$; $V_{GE} = 15\text{V}$; $I_F = 3.0\text{A}$; $T_J = 150^\circ\text{C}$

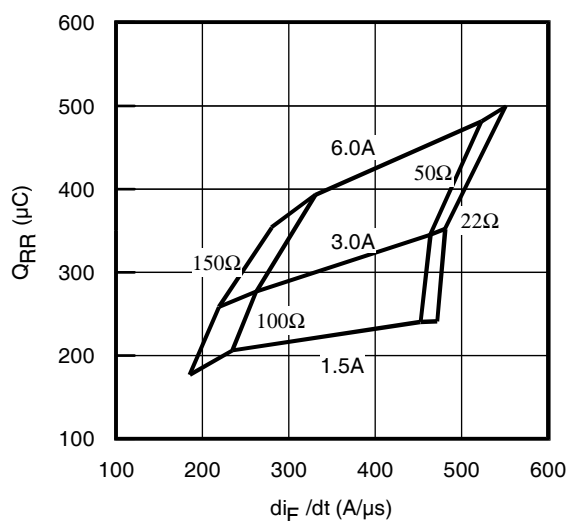


Fig. 21 - Typ. Diode Q_{RR} vs. di_F/dt
 $V_{CC} = 400\text{V}$; $V_{GE} = 15\text{V}$; $T_J = 150^\circ\text{C}$

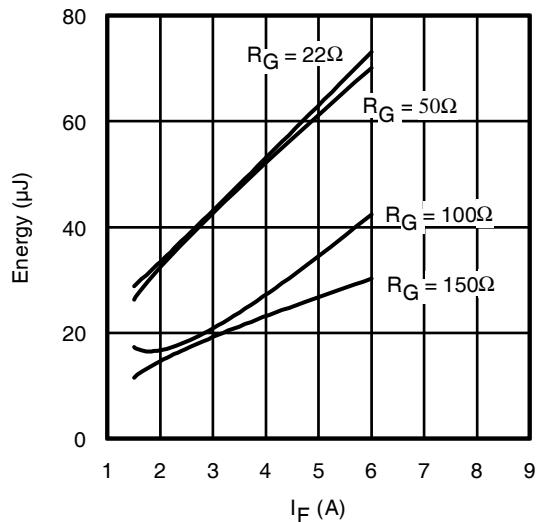


Fig. 22 - Typ. Diode E_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

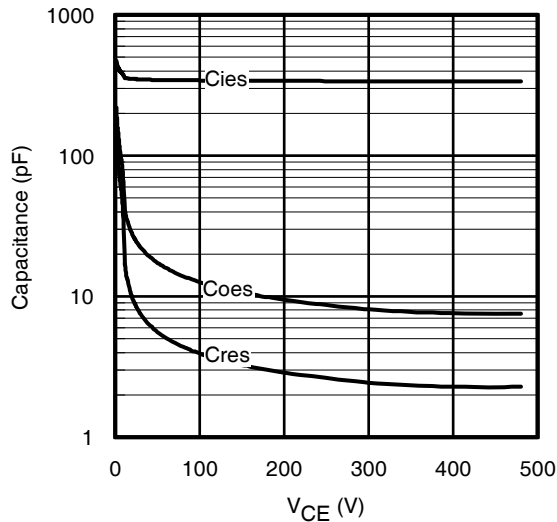


Fig. 23 - Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0V$; $f = 1MHz$

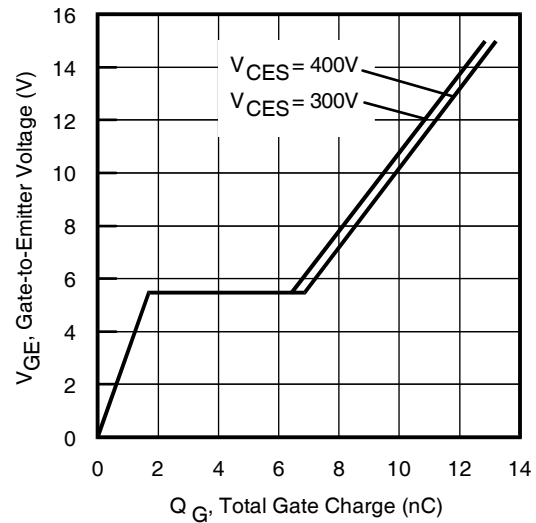


Fig. 24- Typical Gate Charge vs. V_{GE}
 $I_{CE} = 3.0A$

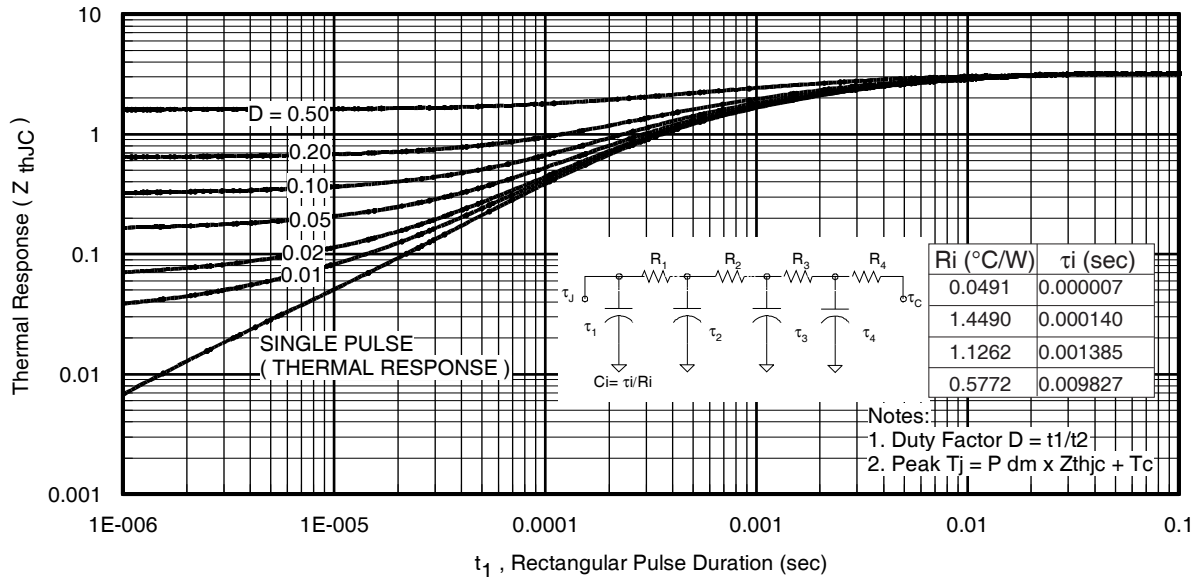


Fig. 25. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

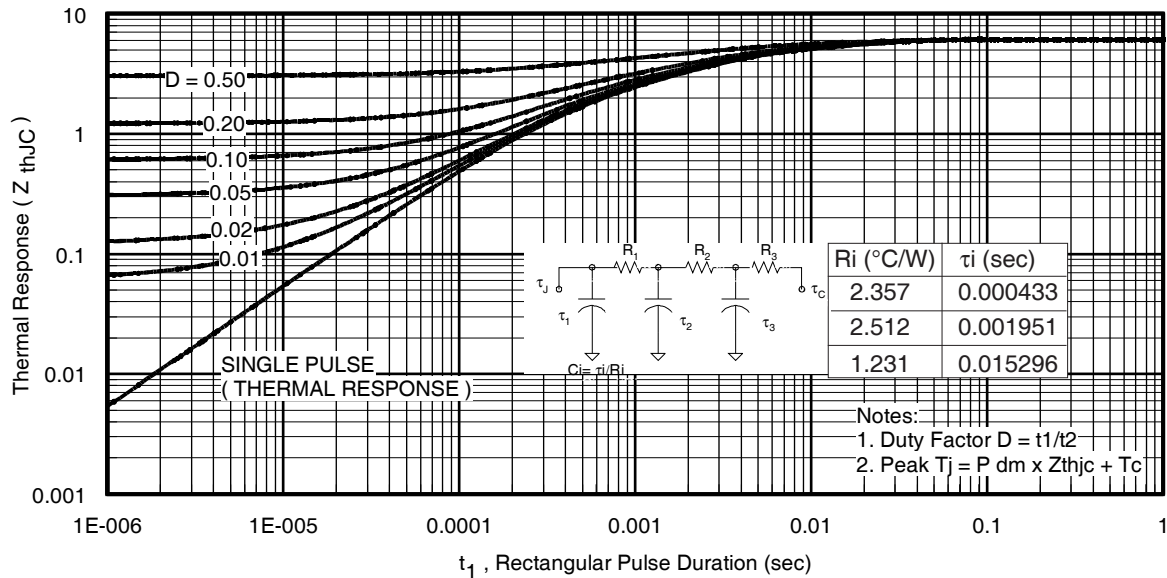


Fig. 26. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

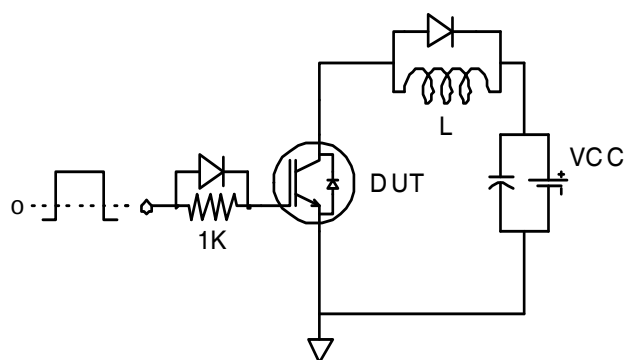


Fig.C.T.1 - Gate Charge Circuit (turn-off)

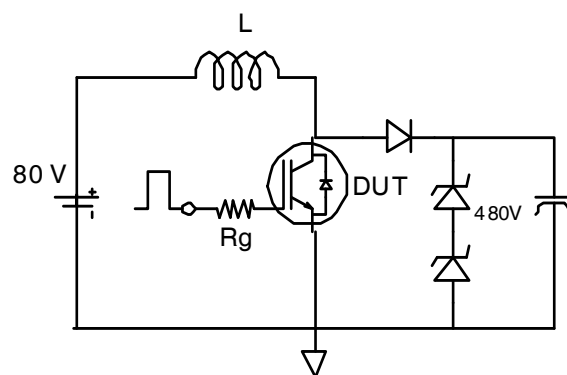


Fig.C.T.2 - RBSOA Circuit

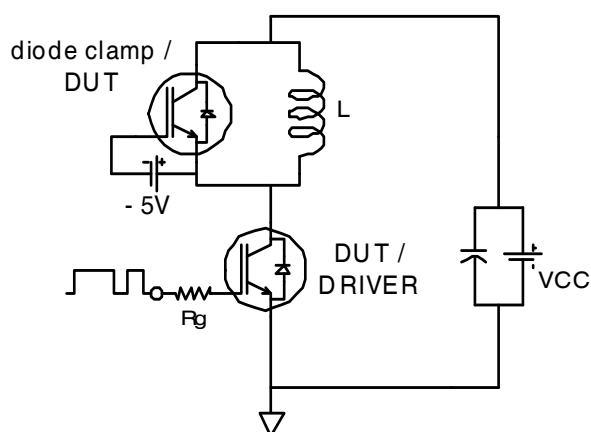


Fig.C.T.3 - Switching Loss Circuit

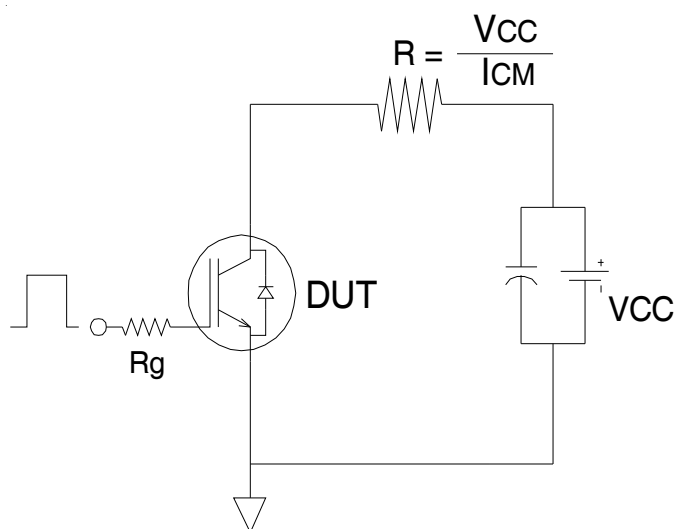


Fig.C.T.4 - Resistive Load Circuit

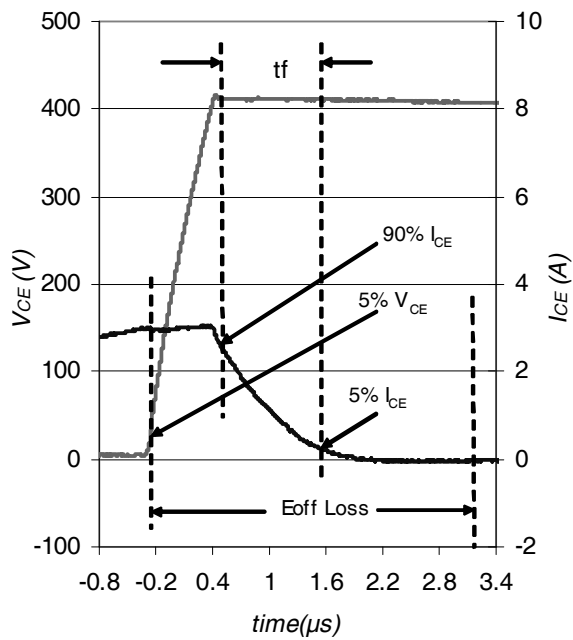


Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.3

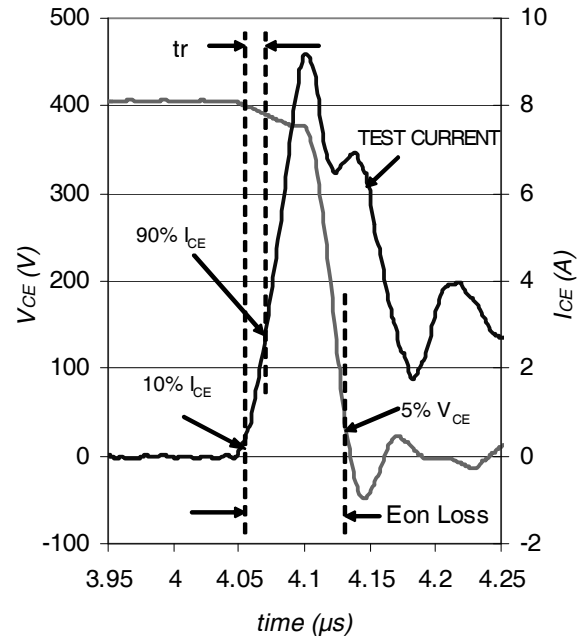


Fig. WF2 - Typ. Turn-on Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.3

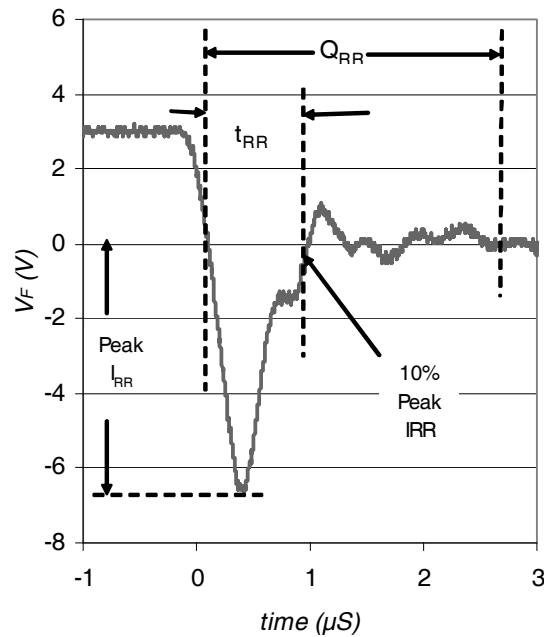
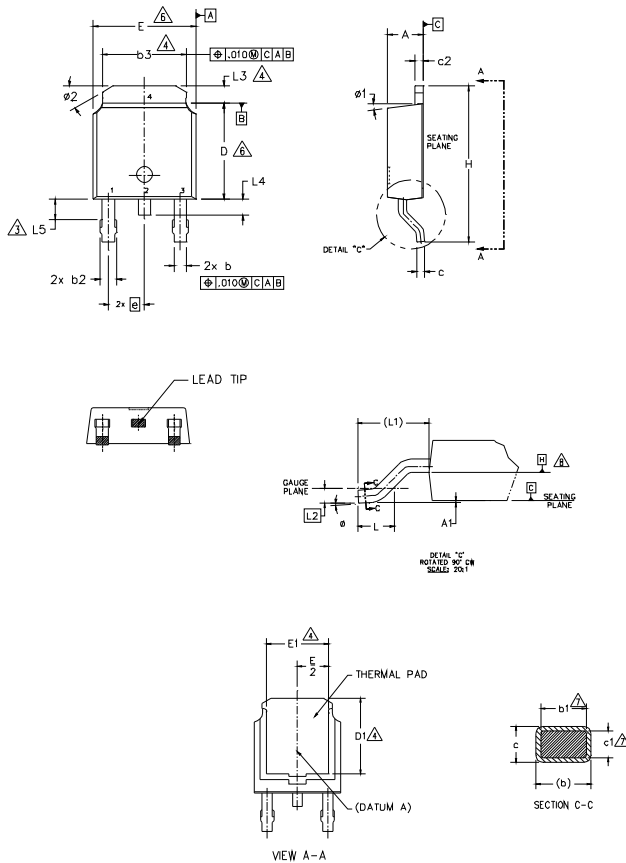


Fig. WF3 - Typ. Diode Recovery Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.3

D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3.- LEAD DIMENSION UNCONTROLLED IN L5.
- 4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
- 6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- 7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
- 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	—	0.13	—	.005	
b	0.64	0.89	.025	.035	
b1	0.65	0.79	.025	.031	7
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	7
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	6
D1	5.21	—	.205	—	4
E	6.35	6.73	.250	.265	6
E1	4.32	—	.170	—	4
e	2.29 BSC		.090 BSC		
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 BSC		.108 REF.		
L2	0.51 BSC		.020 BSC		
L3	0.89	1.27	.035	.050	4
L4	—	1.02	—	.040	
L5	1.14	1.52	.045	.060	3
ø	0" 0'	10" 0'	0" 0'	10" 0'	
ø1	0" 0'	15" 0'	0" 0'	15" 0'	
ø2	25" 0'	35" 0'	25" 0'	35" 0'	

LEAD ASSIGNMENTS

HEXFET

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

IGBT & CoPAK

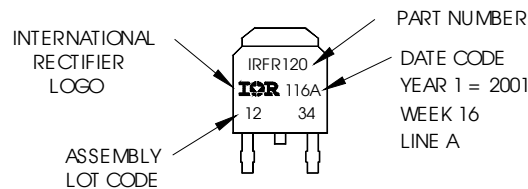
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

D-Pak (TO-252AA) Part Marking Information

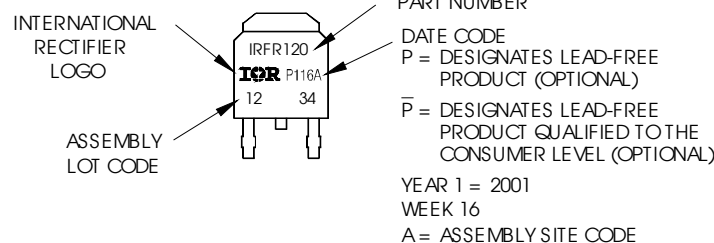
EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 2001
IN THE ASSEMBLY LINE "A"

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

"P" in assembly line position indicates
"Lead-Free" qualification to the consumer-level



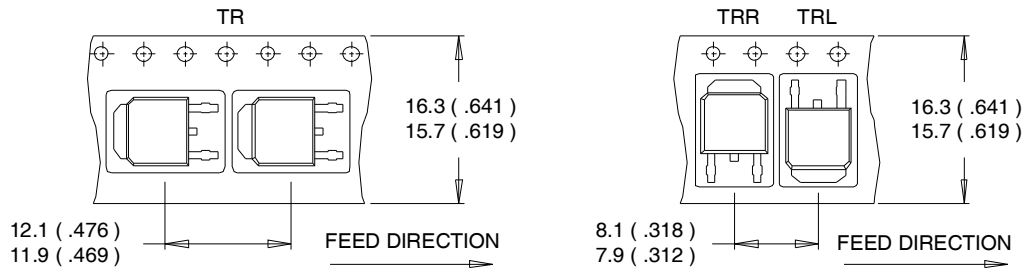
OR



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

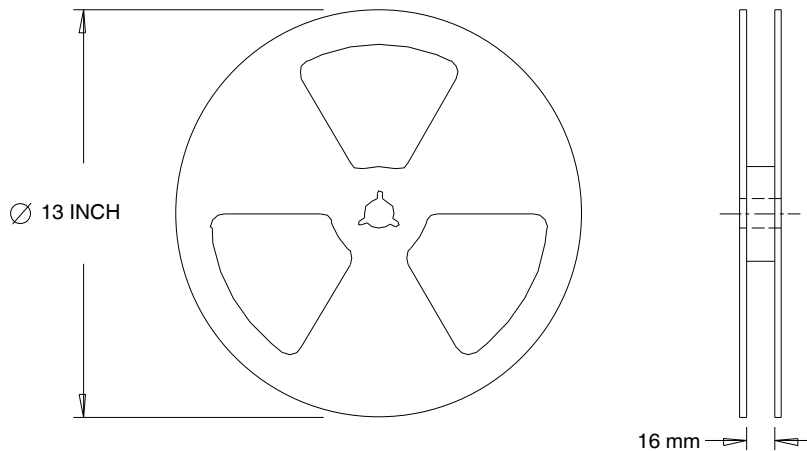
D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES :

1. OUTLINE CONFORMS TO EIA-481.

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
IR Rectifier

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