
Chipsmall
深圳市津利帝科技有限公司
Geelead Technology Limited
采购部

International
IOR Rectifier

IRGR4607DPbF
IRGS4607DPbF
IRGB4607DPbF

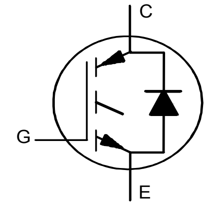
Insulated Gate Bipolar Transistor with Ultrafast Soft Recovery Diode

V_{CES} = 600V

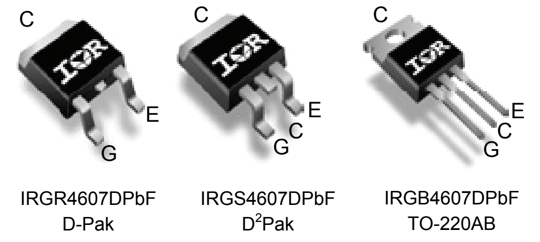
I_C = 7.0A, T_C =100°C

$t_{SC} \geq 5\mu s$, $T_{J(max)}$ = 175°C

$V_{CE(ON)}$ typ. = 1.75V @ Ic = 4.0A



n-channel



IRGR4607DPbF
D-Pak

IRGS4607DPbF
D^2Pak

IRGB4607DPbF
TO-220AB

G	C	E
Gate	Collector	Emitter

Applications

- Industrial Motor Drive
- UPS
- Solar Inverters
- Welding

Features	→ Benefits
Low $V_{CE(ON)}$ and Switching Losses	High Efficiency in a Wide Range of Applications
5µs Short Circuit SOA	Rugged Transient Performance
Square RBSOA	
Maximum Junction Temperature 175°C	Increased Reliability
Positive $V_{CE\ (ON)}$ Temperature Coefficient	Excellent Current Sharing in Parallel Operation

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRGR4607DPbF	D-Pak	Tube	75	IRGR4607DPbF
		Tape and Reel	2000	IRGR4607DTRPbF
		Tape and Reel Left	3000	IRGR4607DTRLPbF
		Tape and Reel Right	3000	IRGR4607DTRRPbF
IRGS4607DPbF	D^2Pak	Tube	50	IRGS4607DPBF
		Tape and Reel Right	800	IRGS4607DTRRPbF
		Tape and Reel Left	800	IRGS4607DTRLPbF
IRGB4607DPbF	TO-220AB	Tube	50	IRGB4607DPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	11	A
I_C @ T_C = 100°C	Continuous Collector Current	7.0	
I_{CM}	Pulse Collector Current, V_{GE} = 15V	12	
I_{LM}	Clamped Inductive Load Current, V_{GE} = 20V ①	16	
I_F @ T_C = 25°C	Diode Continuous Forward Current	8.0	
I_F @ T_C = 100°C	Diode Continuous Forward Current	5.0	
I_{FM}	Diode Maximum Forward Current ④	16	
V_{GE}	Continuous Gate-to-Emitter Voltage	±20	V
	Transient Gate-to-Emitter Voltage	±30	
P_D @ T_C = 25°C	Maximum Power Dissipation	58	W
P_D @ T_C = 100°C	Maximum Power Dissipation	29	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-40 to +175	°C
	Soldering Temperature, for 10 sec. (1.6mm) from case)	300 (0.063 in.	
	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 (IGBT) ②	——	——	2.6	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction-to-Case (Diode) ②	——	——	8.3	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface) (TO-220)	——	0.50	——	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (PCB Mount) (D-Pak) ⑥	——	——	50	
	Thermal Resistance, Junction-to-Ambient (PCB Mount) (D^2-Pak) ⑥	——	——	40	
	Thermal Resistance, Junction-to-Ambient (Socket Mount) (TO-220)	——	——	62	

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 = 100μA ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.52	—	V/°C	V_{GE} = 0V, I_C = 100μA (25°C-175°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.75	2.05	V	I_C = 4.0A, V_{GE} = 15V, T_J = 25°C
		—	2.15	—		I_C = 4.0A, V_{GE} = 15V, T_J = 150°C
		—	2.20	—		I_C = 4.0A, V_{GE} = 15V, T_J = 175°C
$V_{GE(th)}$	Gate Threshold Voltage	4.0	—	6.5	V	V_{CE} = V_{GE}, I_C = 100μA
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage Temperature Coeff.	—	-19	—	mV/°C	V_{CE} = V_{GE}, I_C =100μA (25°C-175°C)
gfe	Forward Transconductance	—	2.2	—	S	V_{CE} = 50V, I_C = 4.0A, PW = 20μs
I_{CES}	Collector-to-Emitter Leakage Current	—	0.50	25	μA	V_{GE} = 0V, V_{CE} = 600V
		—	100	—		V_{GE} = 0V, V_{CE} = 600V, T_J = 175°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V
V_F	Diode Forward Voltage Drop	—	1.7	2.3	V	I_F = 4.0A
		—	1.5	—		I_F = 4.0A, T_J = 175°C

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

	Parameter	Min.	Typ.	Max	Units	Conditions
Q_g	Total Gate Charge	—	9.0	—	nC	I_C = 4.0A
Q_{ge}	Gate-to-Emitter Charge	—	3.0	—		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge	—	4.0	—		V_{CC} = 300V
E_{on}	Turn-On Switching Loss	—	140	—	µJ	I_C = 4.0A, V_{CC} = 400V, V_{GE} = 15V R_G = 100Ω, T_J = 25°C Energy losses include tail & diode reverse recovery ⑤
E_{off}	Turn-Off Switching Loss	—	62	—		
E_{total}	Total Switching Loss	—	202	—		
$t_{d(on)}$	Turn-On delay time	—	27	—	ns	
t_r	Rise time	—	15	—		
$t_{d(off)}$	Turn-Off delay time	—	120	—		
t_f	Fall time	—	10	—		
E_{on}	Turn-On Switching Loss	—	220	—	µJ	I_C = 4.0A, V_{CC} = 400V, V_{GE} = 15V R_G = 100Ω, T_J = 175°C Energy losses include tail & diode reverse recovery ⑤
E_{off}	Turn-Off Switching Loss	—	92	—		
E_{total}	Total Switching Loss	—	312	—		
$t_{d(on)}$	Turn-On delay time	—	24	—	ns	
t_r	Rise time	—	27	—		
$t_{d(off)}$	Turn-Off delay time	—	81	—		
t_f	Fall time	—	14	—		
C_{ies}	Input Capacitance	—	250	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	20	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	7.1	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 175°C, I_C = 16A V_{CC} = 480V, Vp ≤ 600V V_{GE} = +20V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	µs	V_{CC} = 400V, Vp ≤ 600V V_{GE} = +15V to 0V
Erec	Reverse Recovery Energy of the Diode	—	7.4	—	µJ	T_J = 175°C
t_{rr}	Diode Reverse Recovery Time	—	48	—	ns	V_{CC} = 400V, I_F = 4.0A
I_{rr}	Peak Reverse Recovery Current	—	5.1	—	A	V_{GE} = 15V, Rg = 100Ω

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 Pulse width limited by max. junction temperature.

⑤ Values influenced by parasitic L and C in measurement.

⑥ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994: http://www.irf.com/technical-info/appnotes/an-994.pdf

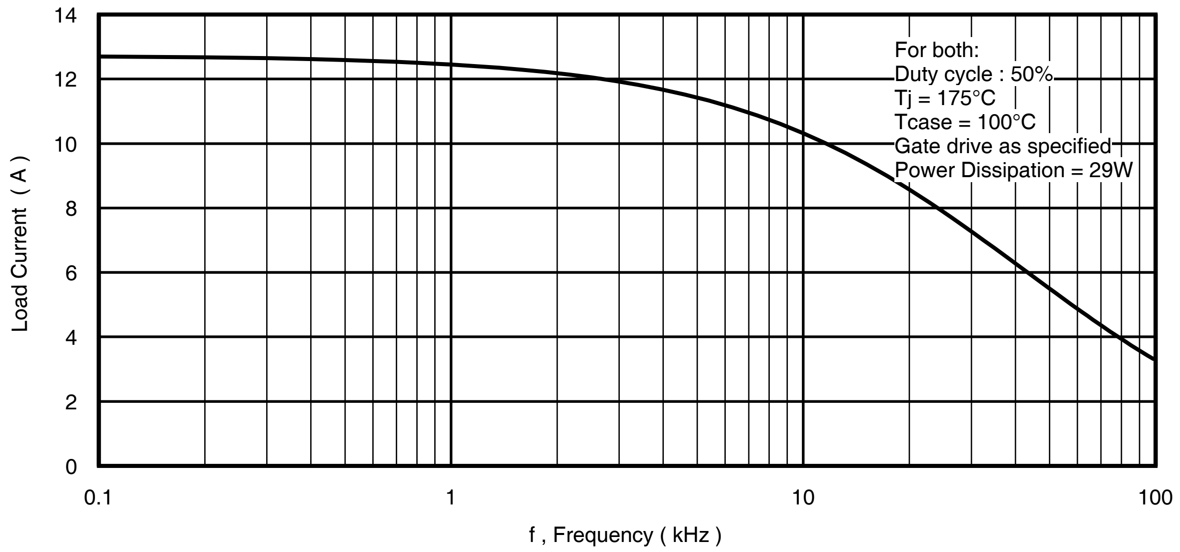


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = IRMS of fundamental)

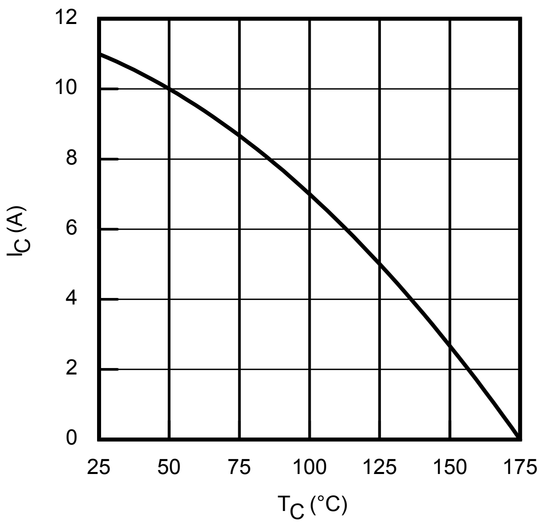


Fig. 2 - Maximum DC Collector Current vs. Case Temperature

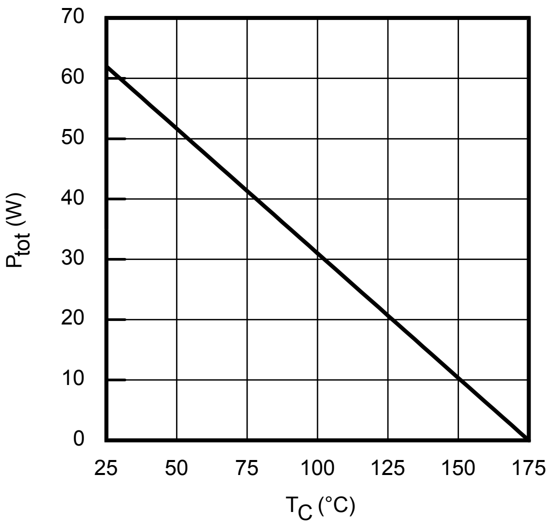


Fig. 3 - Power Dissipation vs. Case Temperature

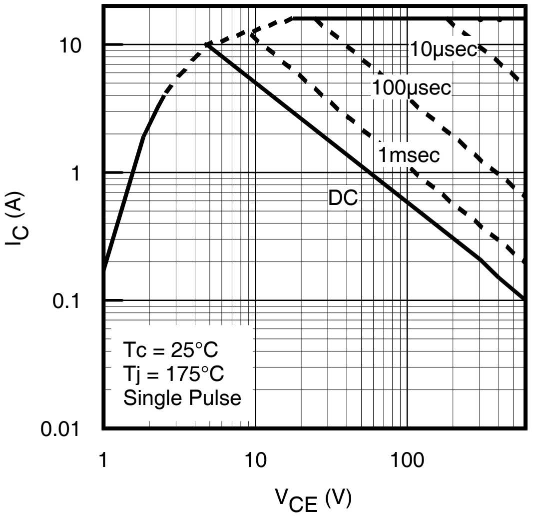


Fig. 4 - Forward SOA
T_C = 25°C; $T_J \le$ 175°C; V_{GE} = 15V

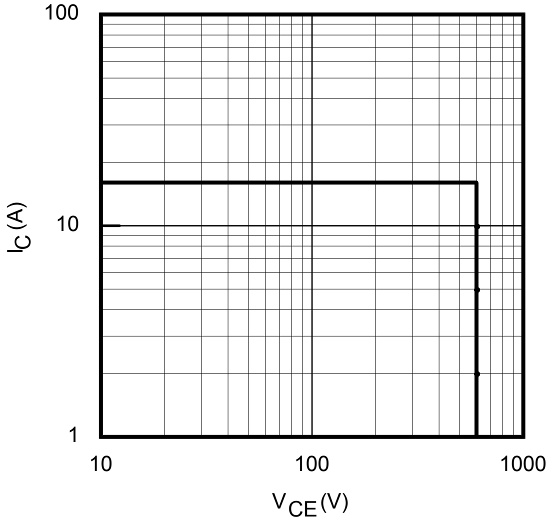


Fig. 5 - Reverse Bias SOA
T_J = 175°C; V_{GE} = 20V

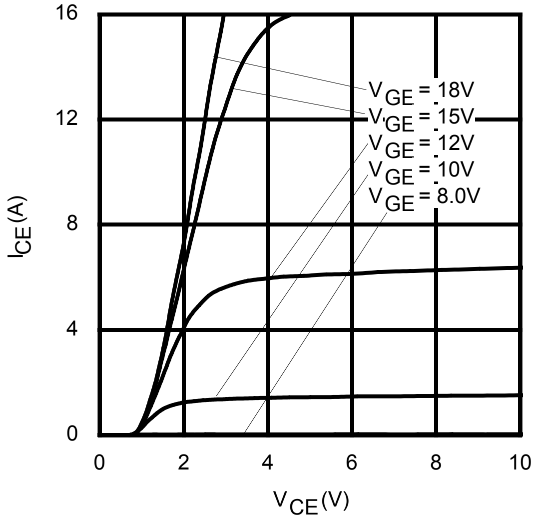


Fig. 6 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 20µs

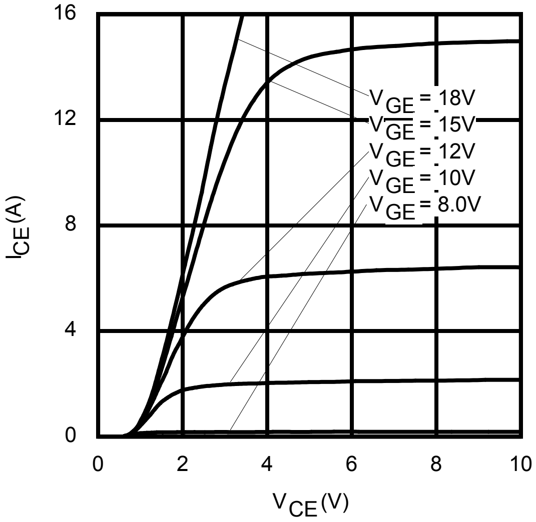


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 20µs

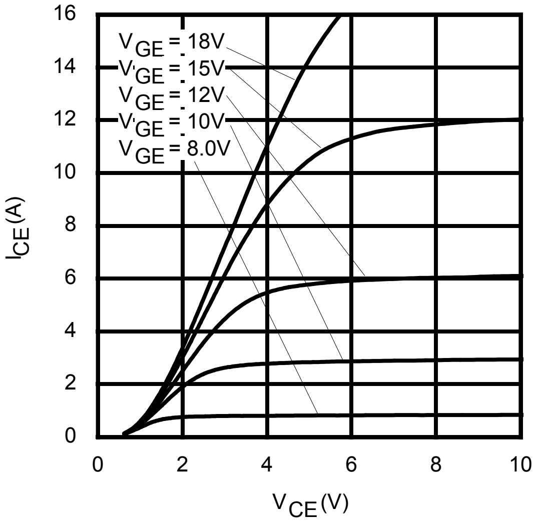


Fig. 8 - Typ. IGBT Output Characteristics
T_J = 175°C; tp = 20µs

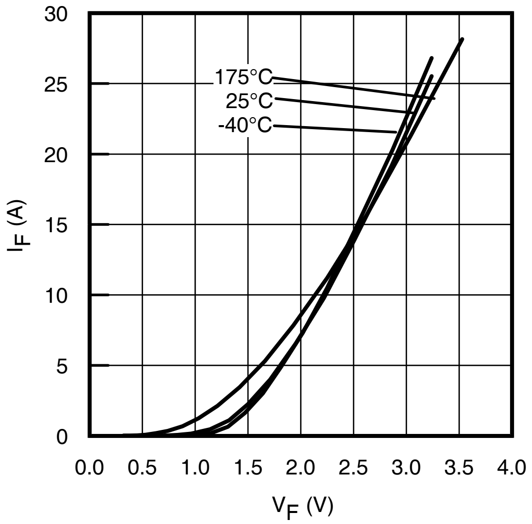


Fig. 9 - Typ. Diode Forward Voltage Drop Characteristics

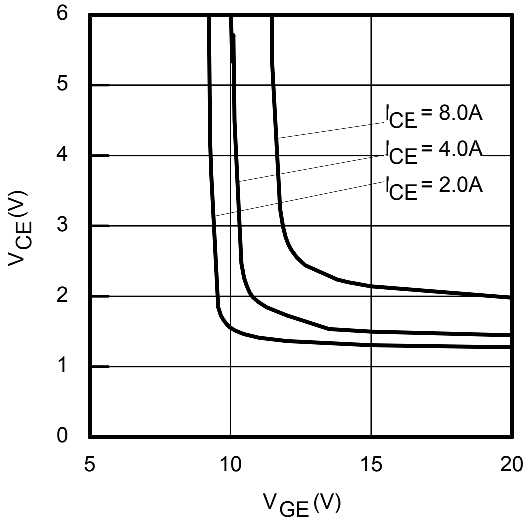


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

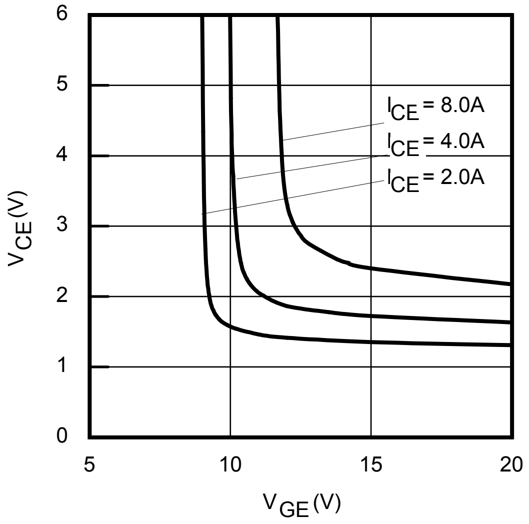


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

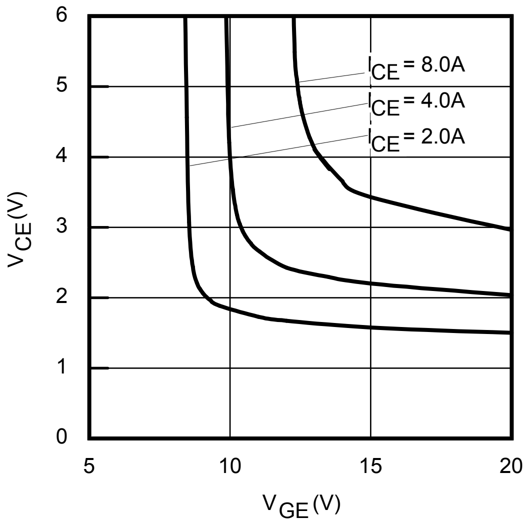


Fig. 12 - Typical V_{CE} vs. V_{GE}
T_J = 175°C

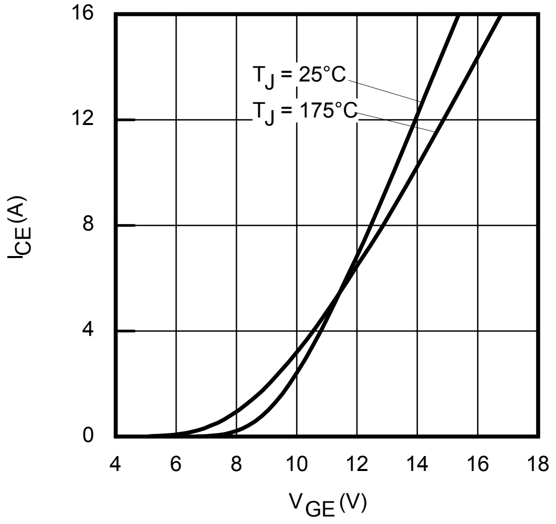


Fig. 13 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 20µs

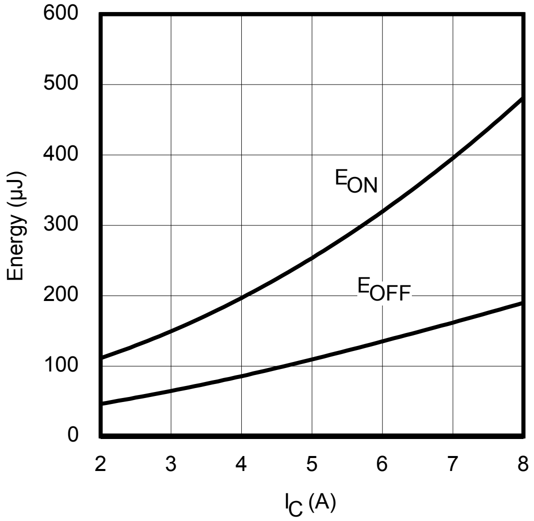


Fig. 14 - Typ. Energy Loss vs. I_C
T_J = 175°C; V_{CE} = 400V, R_G = 100Ω; V_{GE} = 15V

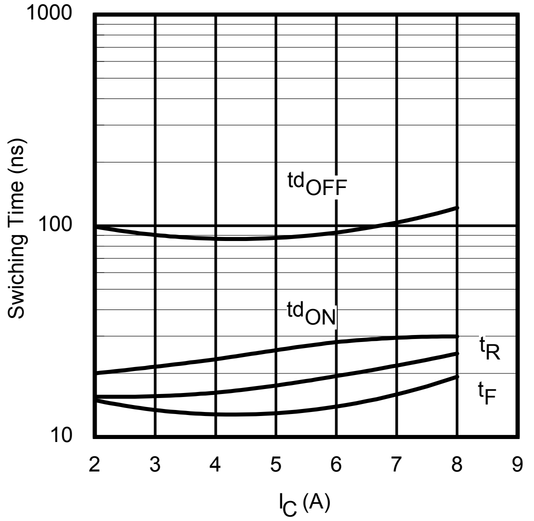


Fig. 15 - Typ. Switching Time vs. I_C
T_J = 175°C; V_{CE} = 400V, R_G = 100Ω; V_{GE} = 15V

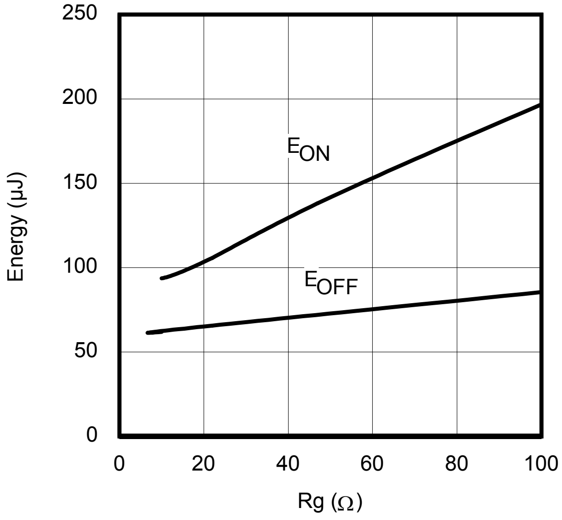


Fig. 16 - Typ. Energy Loss vs. R_G
T_J = 175°C; V_{CE} = 400V, I_{CE} = 4.0A; V_{GE} = 15V

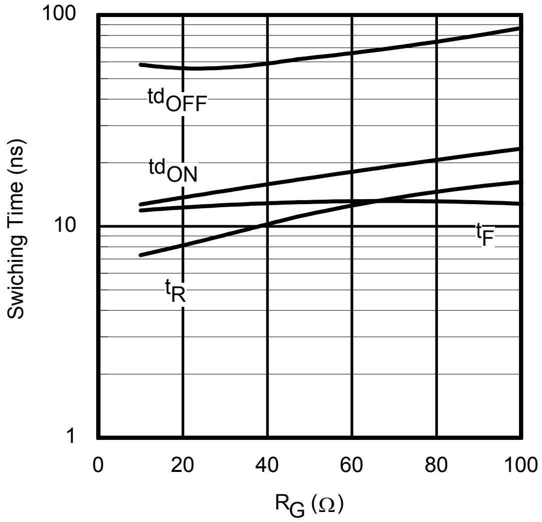


Fig. 17 - Typ. Switching Time vs. R_G
T_J = 175°C; V_{CE} = 400V, I_{CE} = 4.0A; V_{GE} = 15V

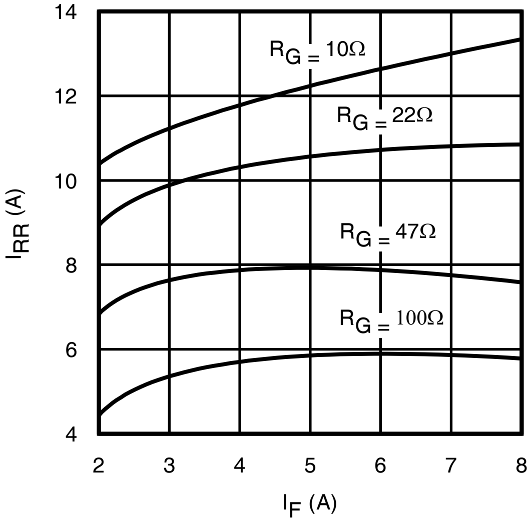


Fig. 18 - Typ. Diode I_{RR} vs. I_F
T_J = 175°C

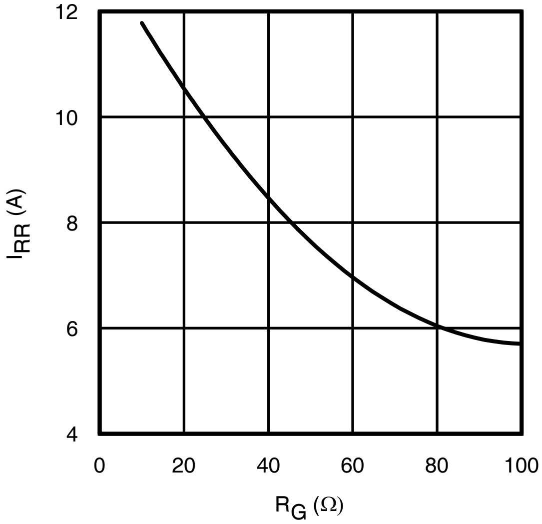


Fig. 19 - Typ. Diode I_{RR} vs. R_G
T_J = 175°C

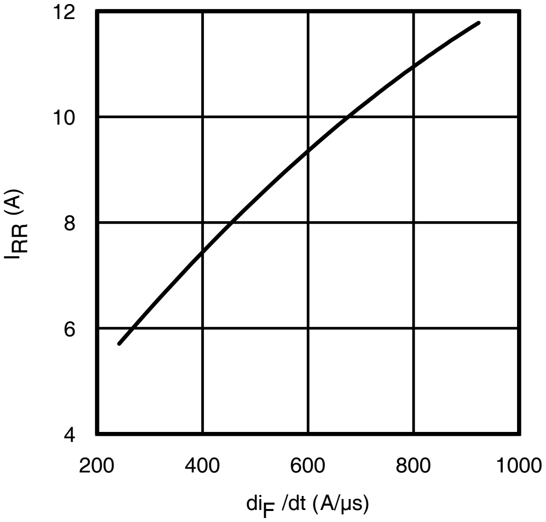


Fig. 20 - Typ. Diode I_{RR} vs. di_F/dt
V_{CC} = 400V; V_{GE} = 15V; I_F = 4.0A; T_J = 175°C

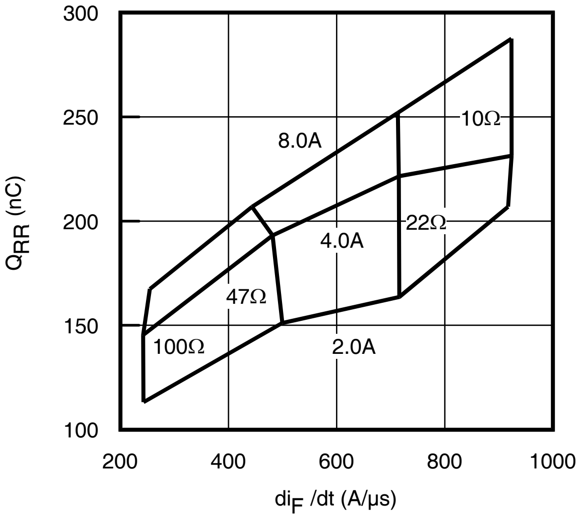


Fig. 21 - Typ. Diode Q_{RR} vs. di_F/dt
V_{CC} = 400V; V_{GE} = 15V; T_J = 175°C

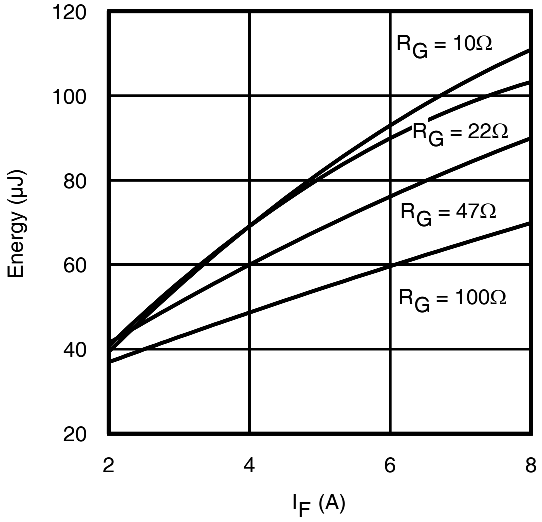


Fig. 22 - Typ. Diode E_{RR} vs. I_F
T_J = 175°C

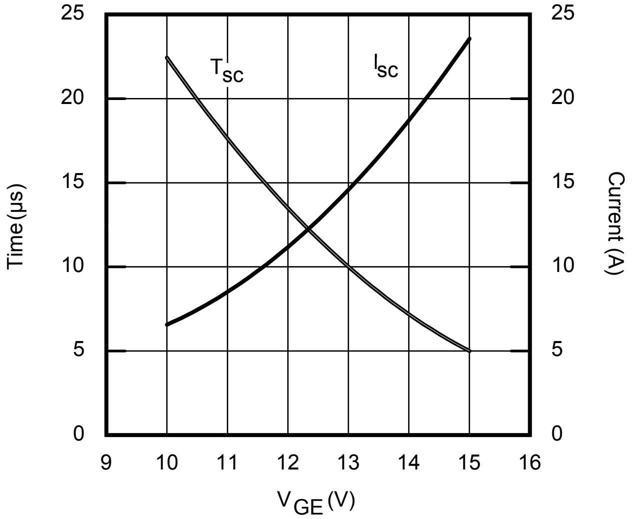


Fig. 23 - V_{GE} vs. Short Circuit Time
V_{CC} = 400V; T_C = 25°C

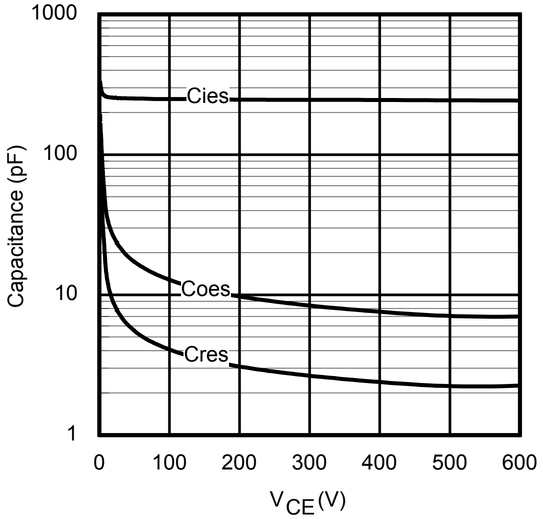


Fig. 24 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

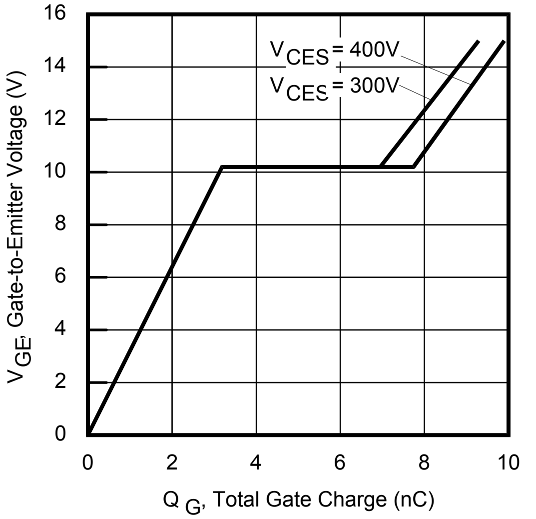
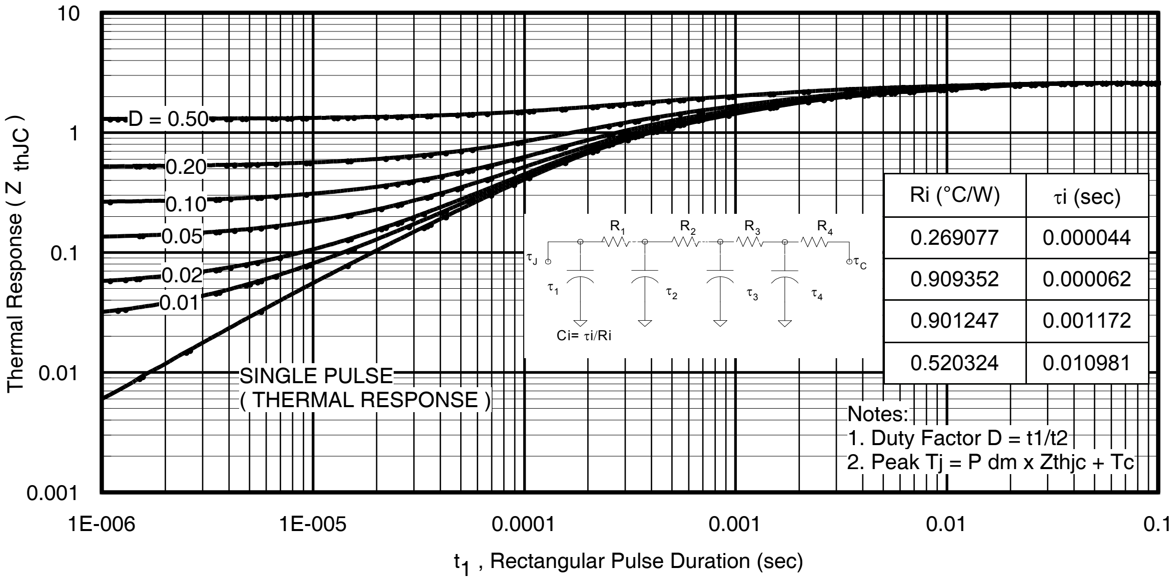
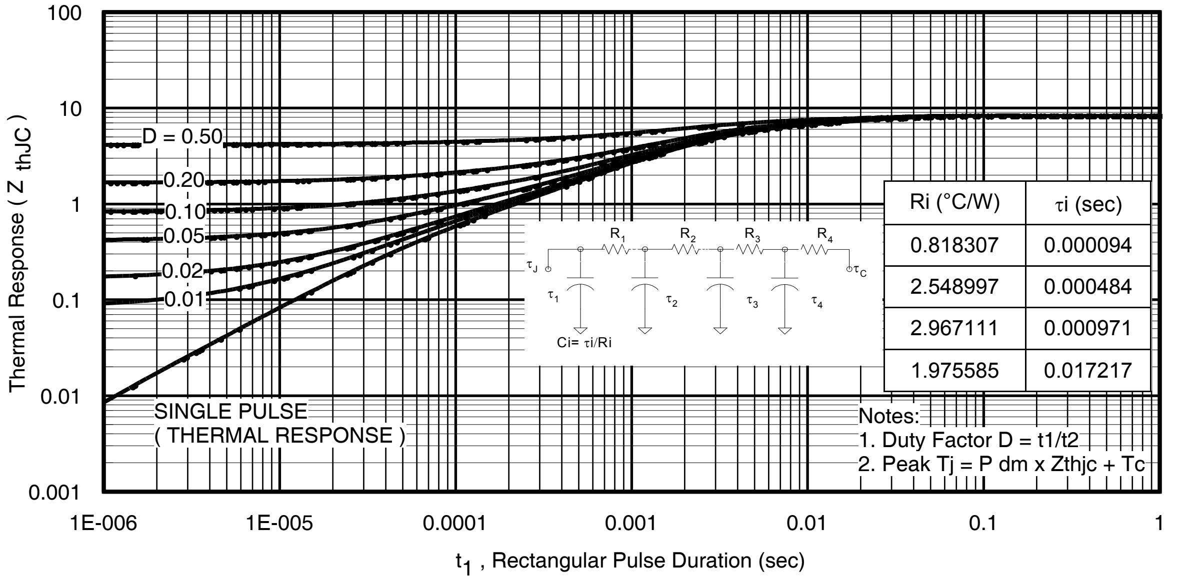


Fig. 25 - Typical Gate Charge vs. V_{GE}
I_{CE} = 4.0A



Ri (°C/W)	τi (sec)
0.269077	0.000044
0.909352	0.000062
0.901247	0.001172
0.520324	0.010981

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



Ri (°C/W)	τi (sec)
0.818307	0.000094
2.548997	0.000484
2.967111	0.000971
1.975585	0.017217

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

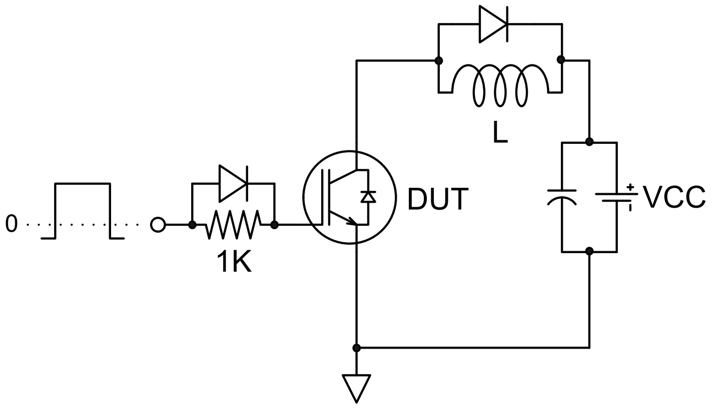


Fig.C.T.1 - Gate Charge Circuit (turn-off)

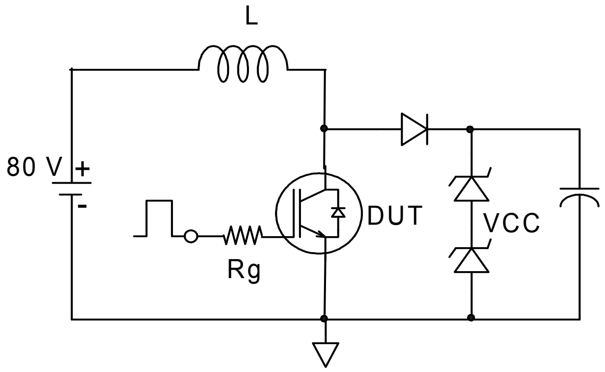


Fig.C.T.2 - RBSOA Circuit

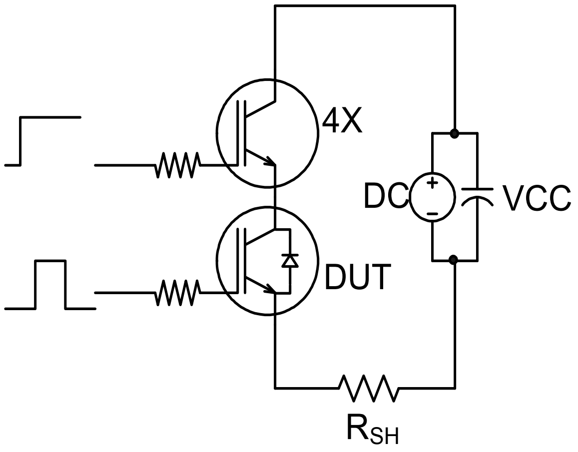


Fig.C.T.3 - S.C. SOA Circuit

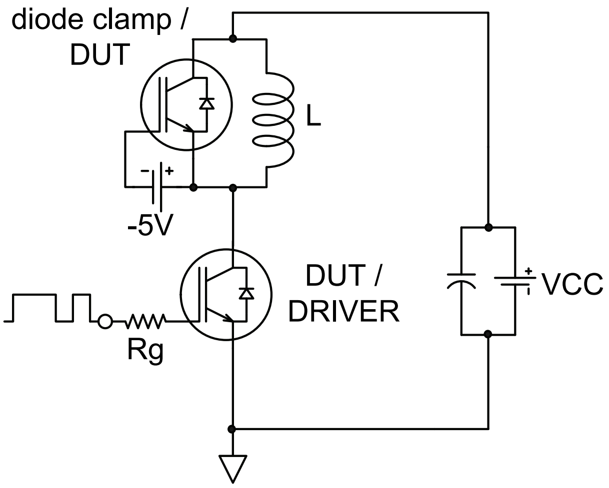


Fig.C.T.4 - Switching Loss Circuit

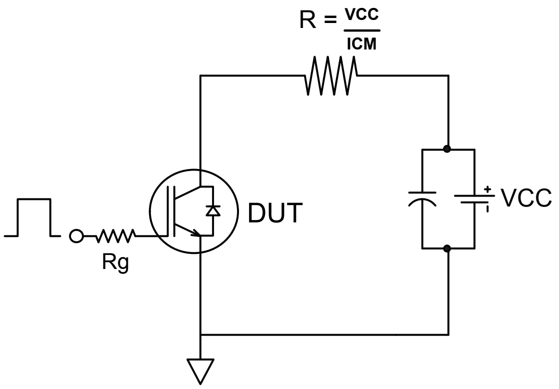


Fig.C.T.5 - Resistive Load Circuit

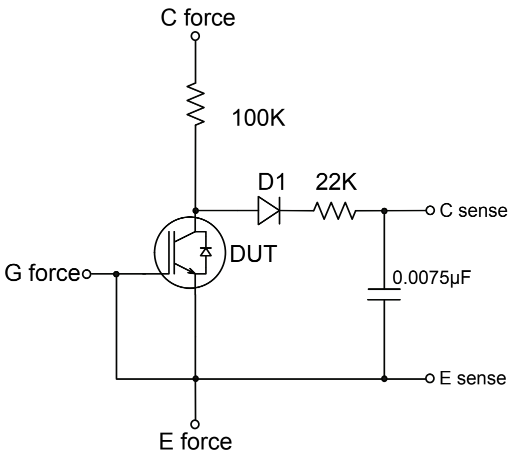


Fig.C.T.6 - BVCES Filter Circuit

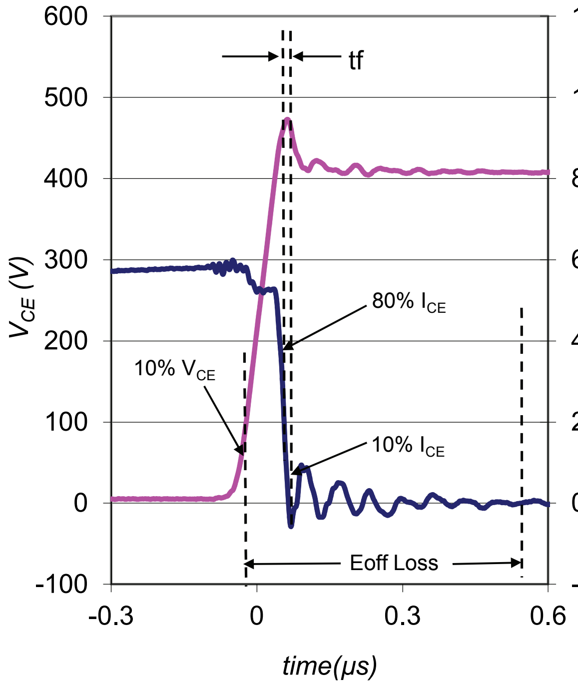


Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 175°C using Fig. CT.4

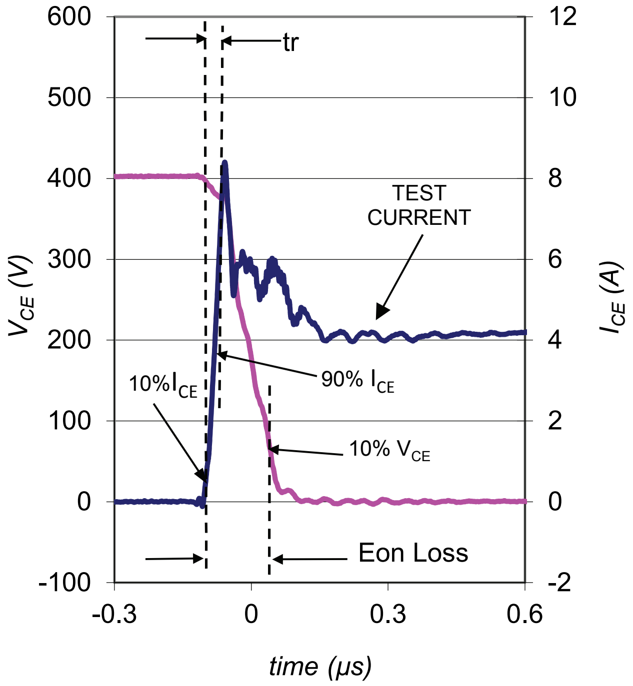


Fig. WF2 - Typ. Turn-on Loss Waveform
@ T_J = 175°C using Fig. CT.4

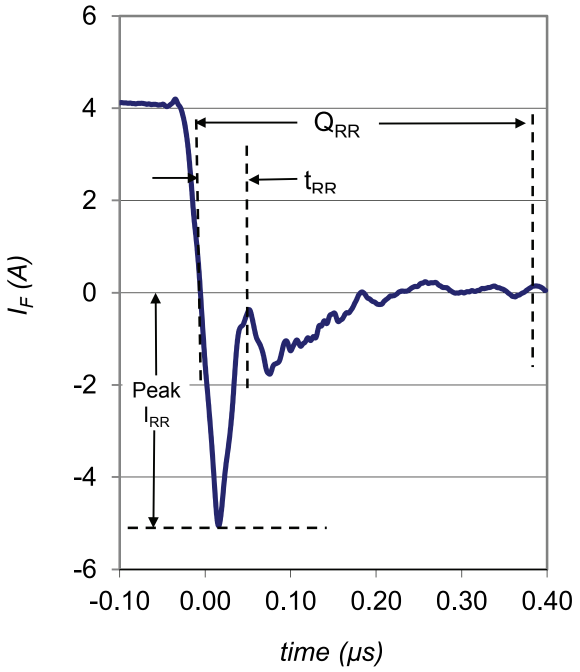


Fig. WF3 - Typ. Diode Recovery Waveform
@ T_J = 175°C using Fig. CT.4

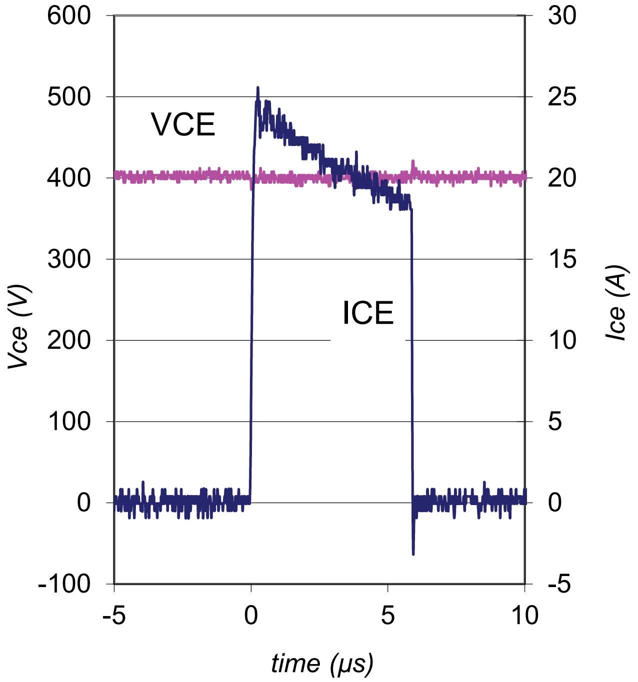
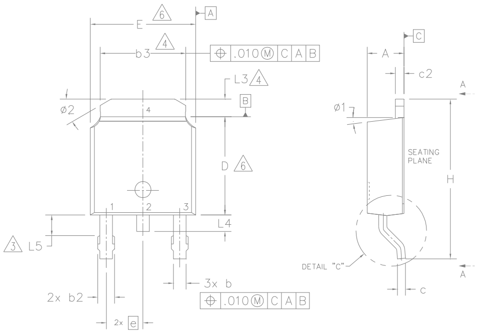
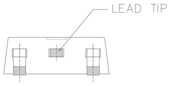


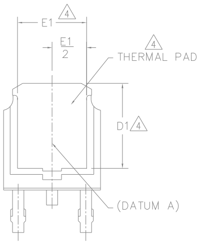
Fig. WF4 - Typ. S.C. Waveform
@ T_J = 150°C using Fig. CT.3

D-Pak (TO-252AA) Package Outline

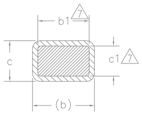
Dimensions are shown in millimeters (inches)



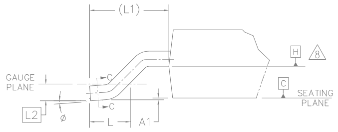




VIEW A–A



SECTION C–C



NOTES:

1.– DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994

2.– DIMENSION 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 .006 [0.15] 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	0.64	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°	10°	0°	10°	
ø1	0°	15°	0°	15°	
ø2	25°	35°	25°	35°	

LEAD ASSIGNMENTS

HEXFET

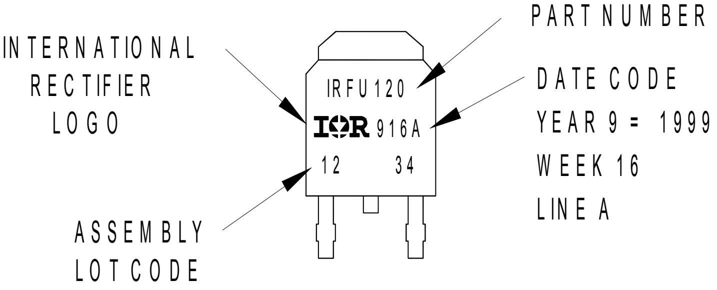
1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

IGBT & CoPAK

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

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

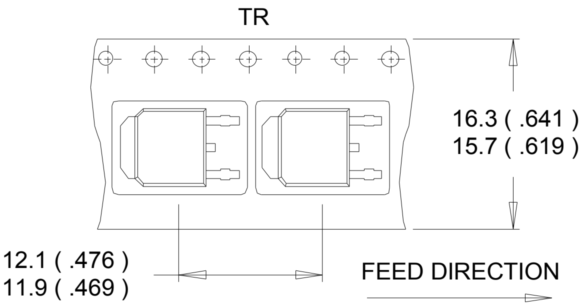
EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 1999
IN THE ASSEMBLY LINE "A"

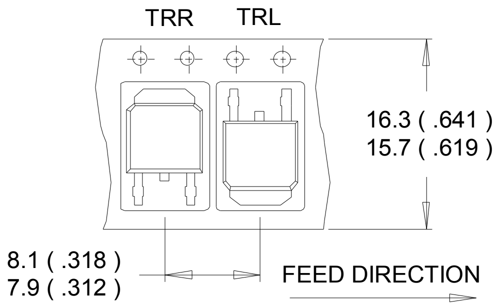


Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

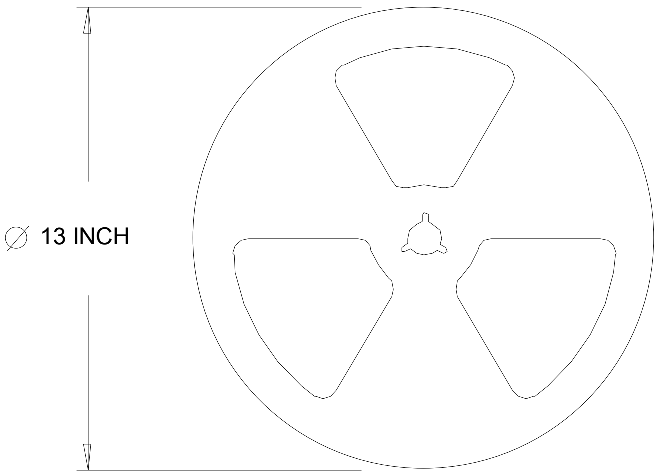
D-Pak (TO-252AA) Tape and Reel Information

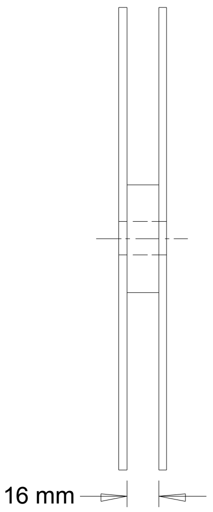
Dimensions are shown in millimeters (inches)





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



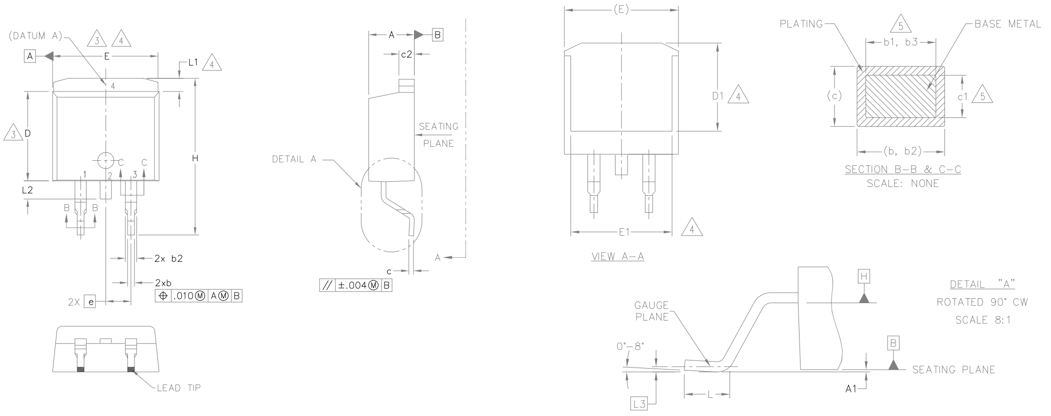


NOTES :
1. OUTLINE CONFORMS TO EIA-481.

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

D^2-PAK (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	–	.270	–	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245	–	4
e	2.54 BSC		.100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	–	1.68	–	.066	4
L2	–	1.78	–	.070	
L3	0.25 BSC		.010 BSC		

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 [.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, b3 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.

LEAD ASSIGNMENTS

DIODES

1.– ANODE (TWO DIE) / OPEN (ONE DIE)
2, 4.– CATHODE
3.– ANODE

HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

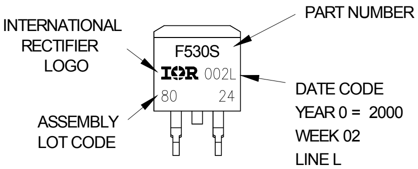
IGBTs, CoPACK

1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

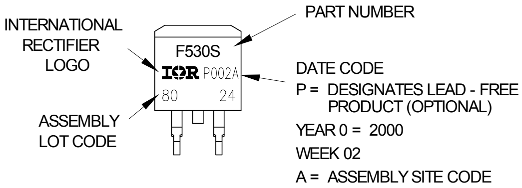
D^2-Pak (TO-263AB) Part Marking Information

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"



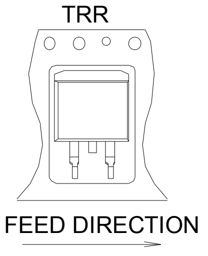
OR

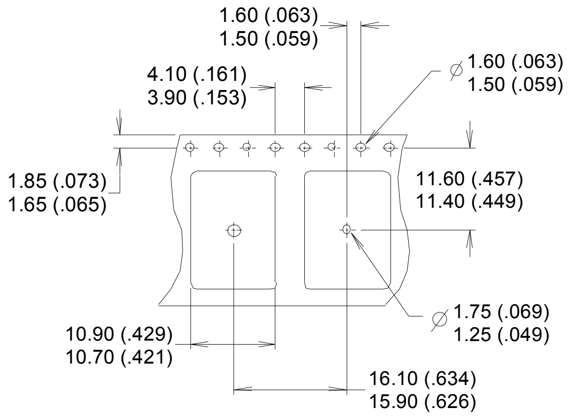


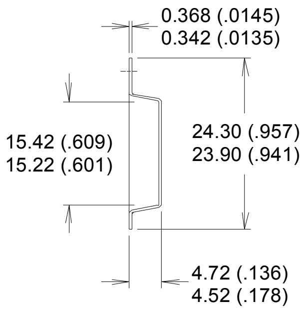
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

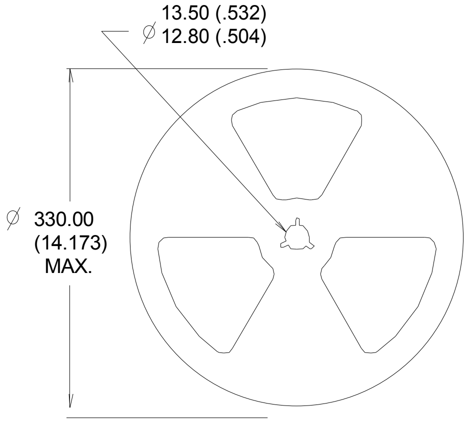
D^2Pak (TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)

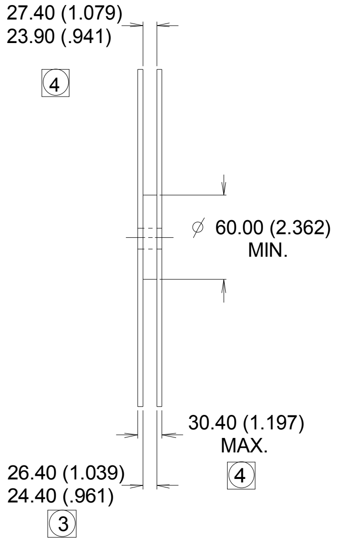








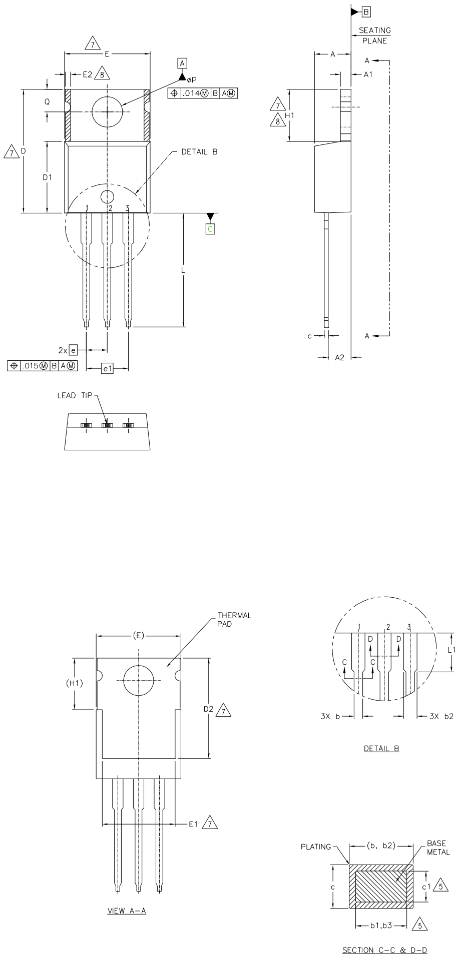
NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.



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

TO-220AB Package Outline

(Dimensions are shown in millimeters (inches))



NOTES:

1.– DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.– DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.– LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.– DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.– DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.– CONTROLLING DIMENSION : INCHES.
7.– THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8.– DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.– OUTLINE CONFORMS TO JEDEC TO–220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	1.14	1.40	.045	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	–	0.76	–	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2.– DRAIN
3.– SOURCE

IGBTs, CoPACK

1.– GATE
2.– COLLECTOR
3.– EMITTER

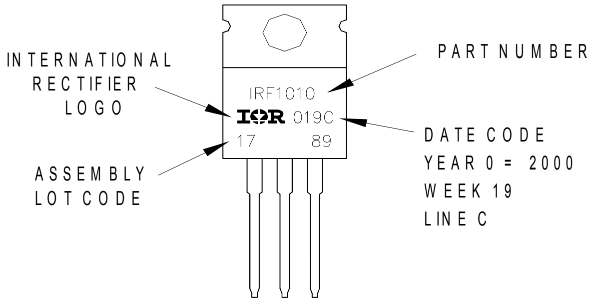
DIODES

1.– ANODE
2.– CATHODE
3.– ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

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



TO-220AB 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/

Qualification Information†

Qualification Level	Industrial (per JEDEC JESD47F) ††	
Moisture Sensitivity Level	D-Pak	MSL1
	D^2Pak	MSL1
	TO-220	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.

Revision History

Date	Comments
7/9/2014	• Updated typo on $V_{(BR)CES}$ test condition from "250uA" to "100uA" on page 2.
	• Updated Package outline on pages 11, 13 & 15.
11/14/2014	• Added note ④ to I_{FM} Diode Maximum Forward Current V_{GE} = 15V on page 1. • Removed note ④ from switching losses test condition on page 3.

International
IOR Rectifier