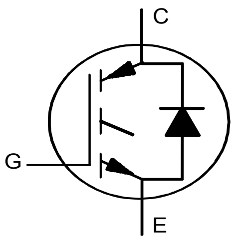
IRG7PG42UDPbF
IRG7PG42UD-EPbF

INSULATED GATE BIPOLAR TRANSISTOR



n-channel

V_{CES} = 1000V

I_C = 45A, T_C = 100°C

$T_{J(MAX)}$ = 150°C

$V_{CE(ON)}$ typ. = 1.7V @ I_C = 30A

Features

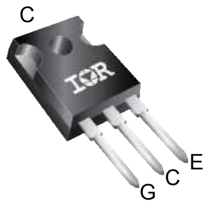
- Low $V_{CE\ (ON)}$ trench IGBT technology
- Low switching losses
- Square RBSOA
- 100% of the parts tested for I_{LM}①
- Positive $V_{CE\ (ON)}$ temperature co-efficient
- Ultra fast soft recovery co-pak diode
- Tight parameter distribution
- Lead-free package

Benefits

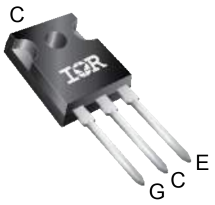
- High efficiency in a wide range of applications
- Suitable for a wide range of switching frequencies due to low $V_{CE(on)}$ and low switching losses
- Rugged transient performance for increased reliability
- Excellent current sharing in parallel operation

Applications

- U.P.S.
- Welding
- Solar Inverter
- Induction heating



IRG7PG42UDPbF
TO-247AC



IRG7PG42UD-EPbF
TO-247AD

G	C	E
Gate	Collector	Emitter

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRG7PG42UDPbF	TO-247AC	Tube	25	IRG7PG42UDPbF
IRG7PG42UD-EPbF	TO-247AD	Tube	25	IRG7PG42UD-EPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1000	V
I_C @ T_C = 25°C	Continuous Collector Current (Silicon Limited)	85⑤	A
I_C @ T_C = 100°C	Continuous Collector Current (Silicon Limited)	45	
I_{CM}	Pulse Collector Current, V_{GE} = 15V ②	90	
I_{LM}	Clamped Inductive Load Current, V_{GE} = 20V ①	120	
I_F @ T_C = 25°C	Diode Continuous Forward Current	85	
I_F @ T_C = 100°C	Diode Continuous Forward Current	45	
I_{FM}	Diode Maximum Forward Current ②	120	
V_{GE}	Continuous Gate-to-Emitter Voltage	±30	V
P_D @ T_C = 25°C	Maximum Power Dissipation	320	W
P_D @ T_C = 100°C	Maximum Power Dissipation	130	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 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)	Junction-to-Case (IGBT) ④	——	——	0.39	°C/W
$R_{\theta JC}$ (Diode)	Junction-to-Case (Diode) ④	——	——	0.56	
$R_{\theta CS}$	Case-to-Sink (flat, greased surface)	——	0.24	——	
$R_{\theta JA}$	Junction-to-Ambient (typical socket mount)	——	——	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1000	—	—	V	V_{GE} = 0V, I_C = 100μA ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.18	—	V/°C	V_{GE} = 0V, I_C = 2.0mA (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.7	2.0	V	I_C = 30A, V_{GE} = 15V, T_J = 25°C
		—	2.1	—		I_C = 30A, V_{GE} = 15V, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	V_{CE} = V_{GE}, I_C = 1.0mA
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-14	—	mV/°C	V_{CE}=V_{GE}, I_C = 1.0mA (25°C - 150°C)
gfe	Forward Transconductance	—	32	—	S	V_{CE} = 50V, I_C = 30A, PW = 80μs
I_{CES}	Collector-to-Emitter Leakage Current	—	4.4	100	μA	V_{GE} = 0V, V_{CE} = 1000V
		—	1200	—		V_{GE} = 0V, V_{CE} = 1000V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	2.0	2.4	V	I_F = 30A
		—	2.2	—		I_F = 30A, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±30V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	—	157	—	nC	I_C = 30A
Q_{ge}	Gate-to-Emitter Charge	—	21	—		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge	—	69	—		V_{CC} = 600V
E_{on}	Turn-On Switching Loss	—	2105	—	μJ	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V R_G = 10Ω, L = 200μH, T_J = 25°C Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	1182	—		
E_{total}	Total Switching Loss	—	3287	—		
$t_{d(on)}$	Turn-On delay time	—	25	—	ns	
t_r	Rise time	—	32	—		
$t_{d(off)}$	Turn-Off delay time	—	229	—		
t_f	Fall time	—	63	—		
E_{on}	Turn-On Switching Loss	—	2978	—	μJ	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V R_G = 10Ω, L = 200μH, T_J = 150°C Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	1968	—		
E_{total}	Total Switching Loss	—	4946	—		
$t_{d(on)}$	Turn-On delay time	—	19	—	ns	
t_r	Rise time	—	32	—		
$t_{d(off)}$	Turn-Off delay time	—	290	—		
t_f	Fall time	—	154	—		
C_{ies}	Input Capacitance	—	3338	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	124	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	75	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 120A V_{CC} = 800V, Vp ≤ 1000V Rg = 10Ω, V_{GE} = +20V to 0V
Erec	Reverse Recovery Energy of the Diode	—	1475	—	μJ	T_J = 150°C
t_{rr}	Diode Reverse Recovery Time	—	153	—	ns	V_{CC} = 600V, I_F = 30A
I_{rr}	Peak Reverse Recovery Current	—	34	—	A	Rg = 10Ω, L = 1.0mH

Notes:

① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 22μH, R_G = 10Ω.
② Pulse width limited by max. junction temperature.
③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
④ R_θ is measured at T_J of approximately 90°C.
⑤ Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 78A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.

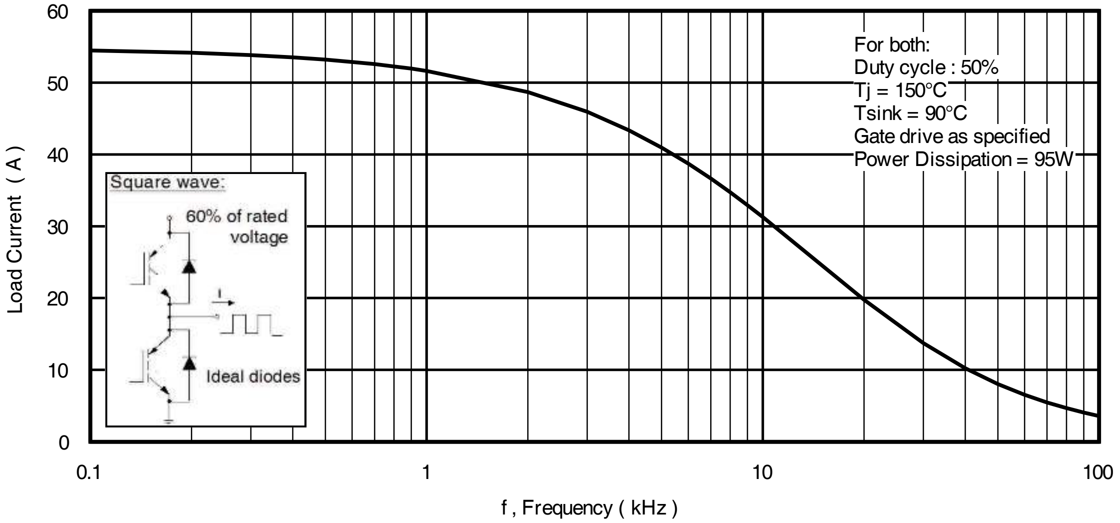


Fig. 1 - Typical Load Current vs. Frequency (Load Current = IRMS of fundamental)

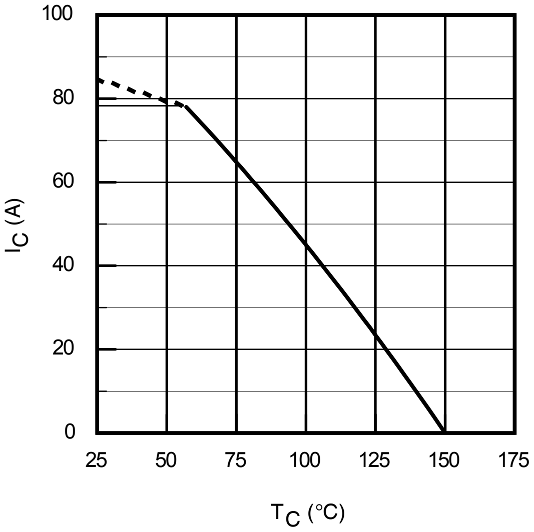


Fig. 2 - Maximum DC Collector Current vs. Case Temperature

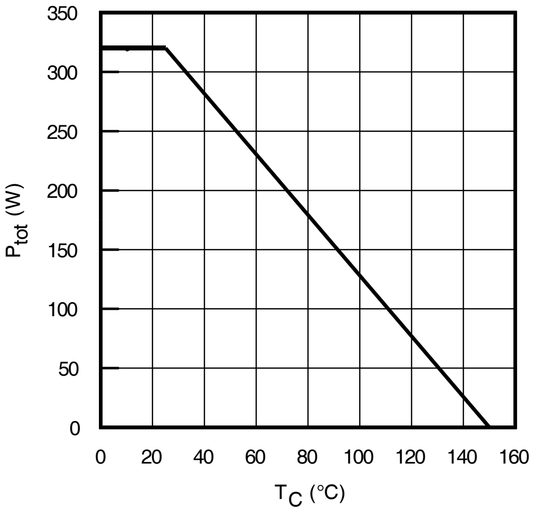


Fig. 3 - Power Dissipation vs. Case Temperature

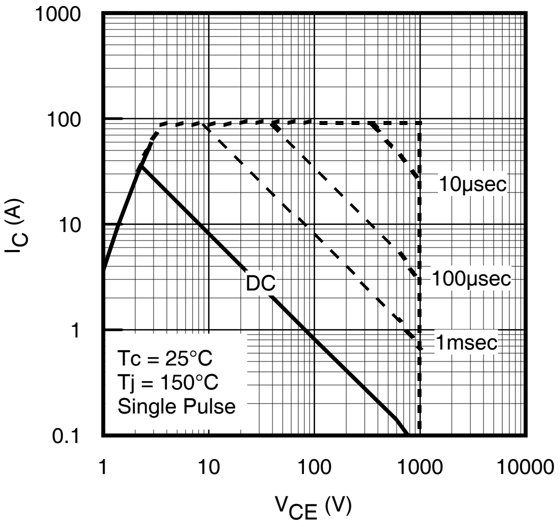


Fig. 4 - Forward SOA
T_C = 25°C, T_J ≤ 150°C; V_{GE} = 15V

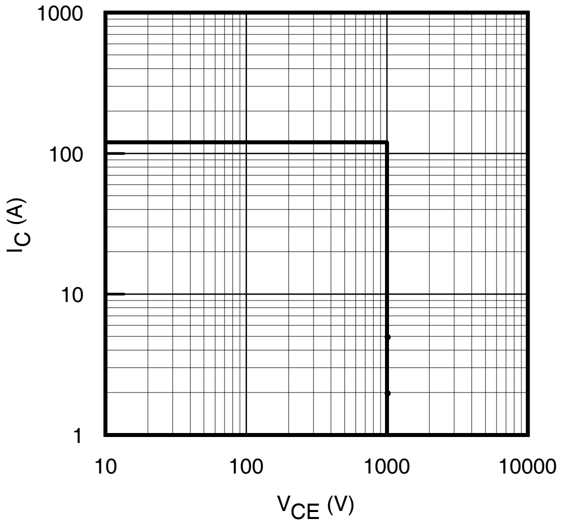


Fig. 5 - Reverse Bias SOA
T_J = 150°C; V_{GE} = 20V

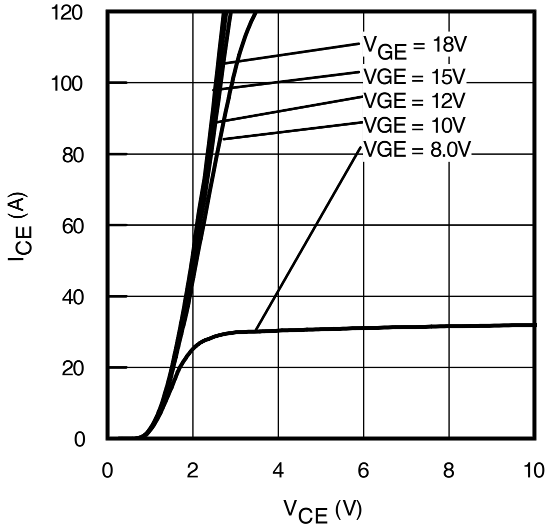


Fig. 6 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80µs

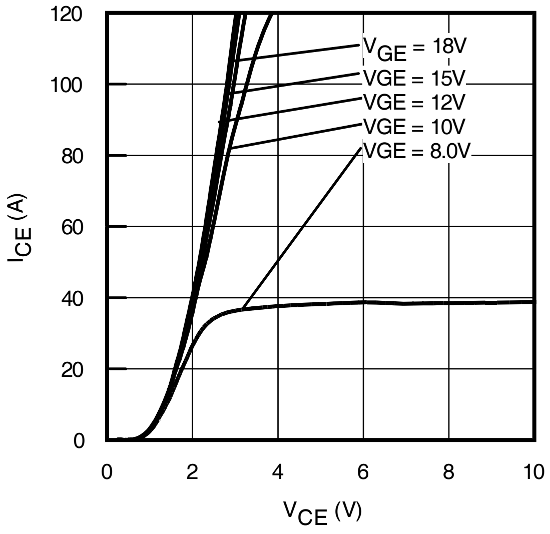


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

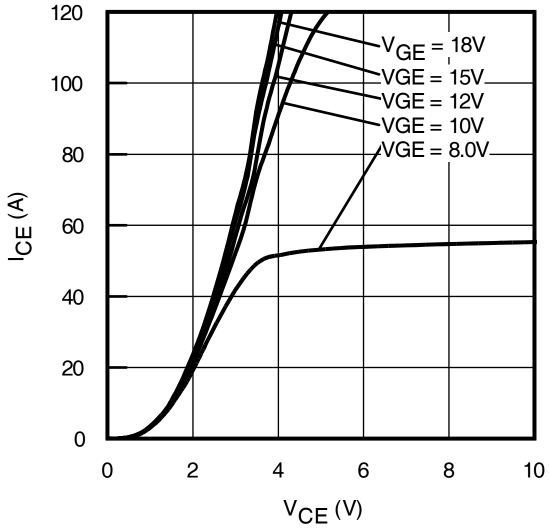


Fig. 8 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 80µs

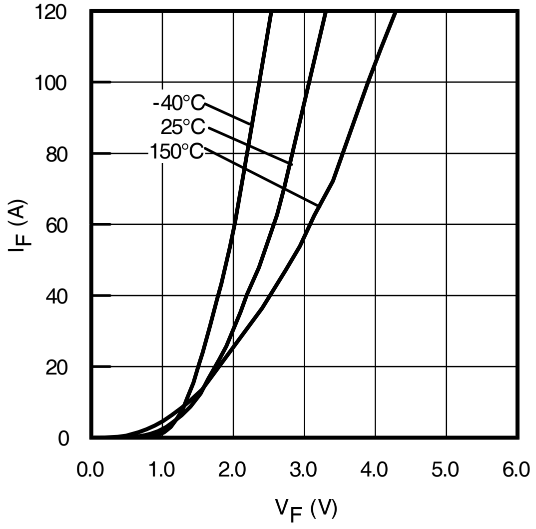


Fig. 9 - Typ. Diode Forward Voltage Drop Characteristics

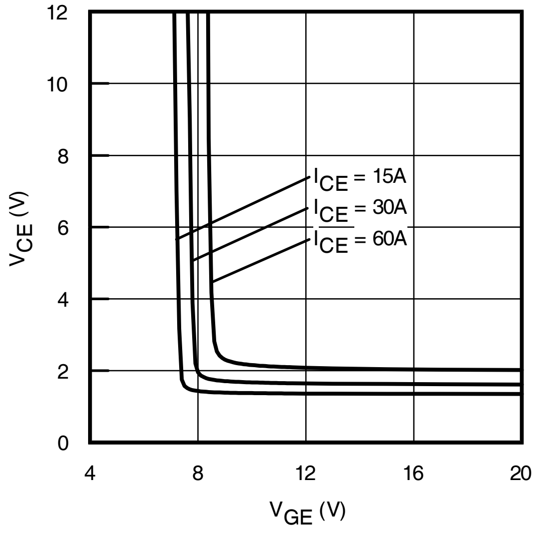


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

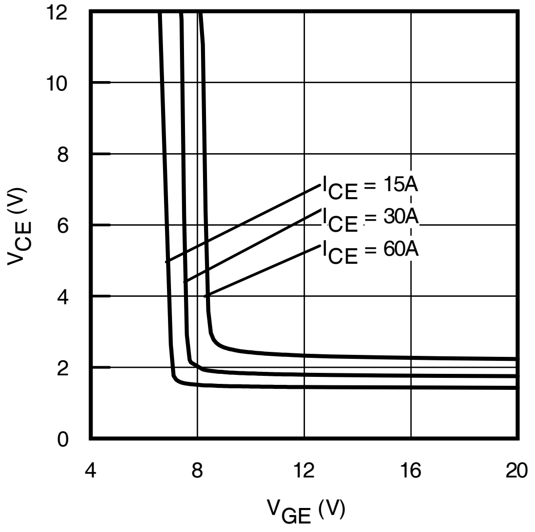


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

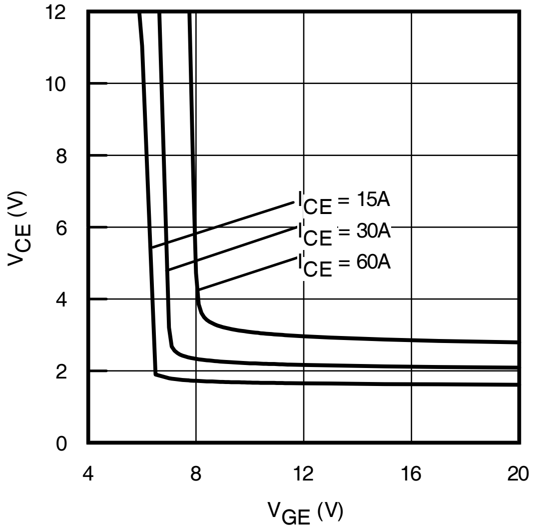


Fig. 12 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

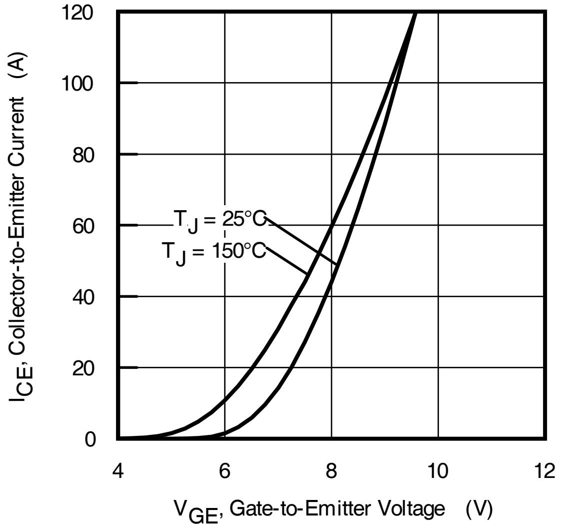


Fig. 13 - Typ. Transfer Characteristics
V_{CE} = 50V

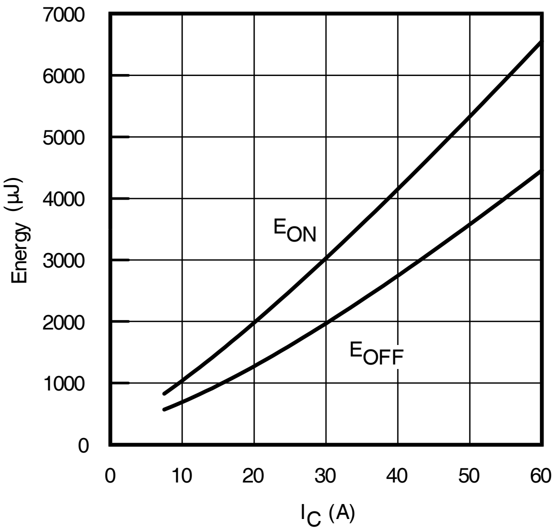


Fig. 14 - Typ. Energy Loss vs. I_C
T_J = 150°C; L = 200μH; V_{CE} = 600V, R_G = 10Ω; V_{GE} = 15V

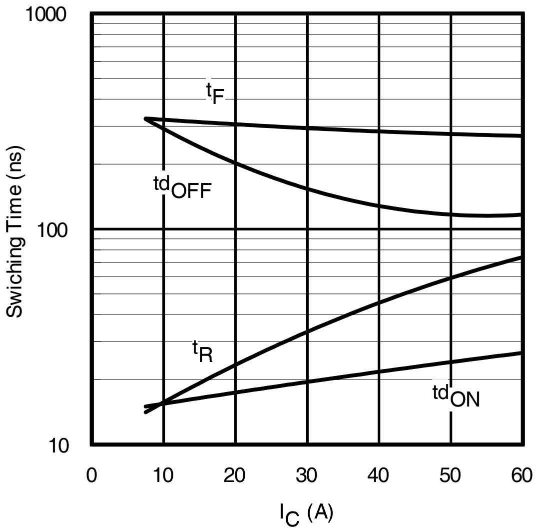


Fig. 15 - Typ. Switching Time vs. I_C
T_J = 150°C; L = 200μH; V_{CE} = 600V, R_G = 10Ω; V_{GE} = 15V

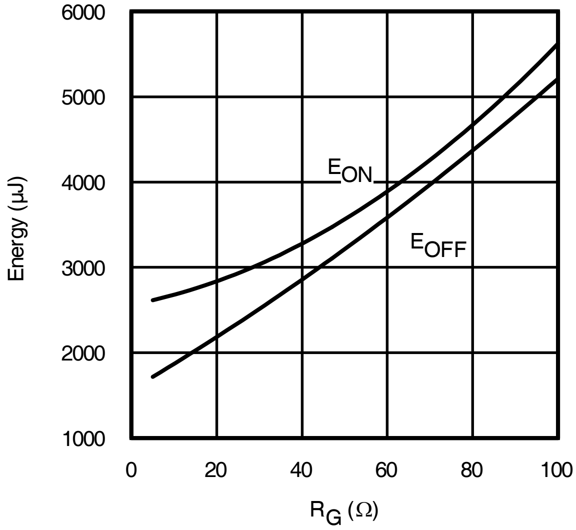


Fig. 16 - Typ. Energy Loss vs. R_G
T_J = 150°C; L = 200μH; V_{CE} = 600V, I_{CE} = 30A; V_{GE} = 15V

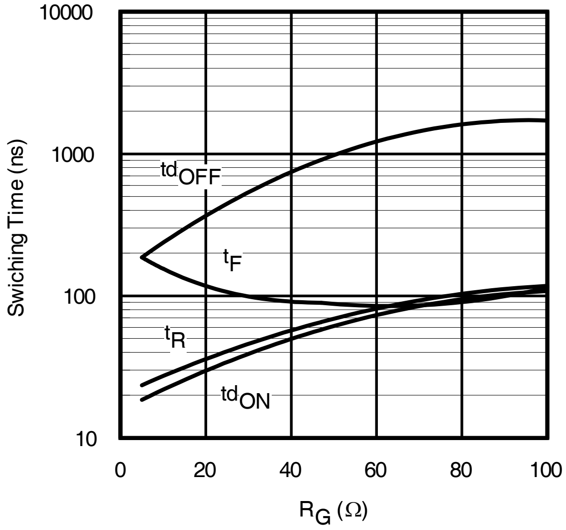


Fig. 17 - Typ. Switching Time vs. R_G
T_J = 150°C; L = 200μH; V_{CE} = 600V, I_{CE} = 30A; V_{GE} = 15V

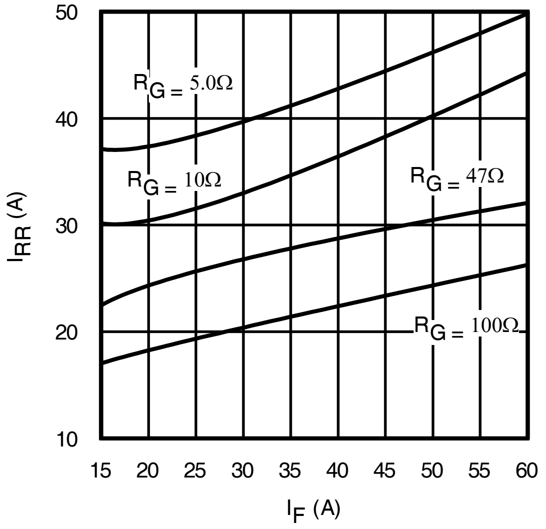


Fig. 18 - Typ. Diode I_{RR} vs. I_F
T_J = 150°C

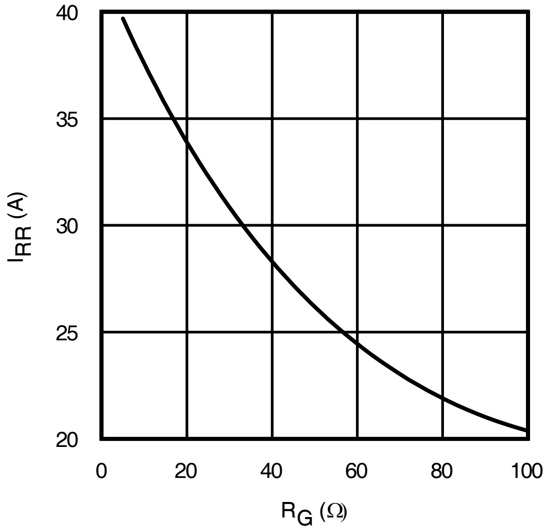


Fig. 19 - Typ. Diode I_{RR} vs. R_G
T_J = 150°C

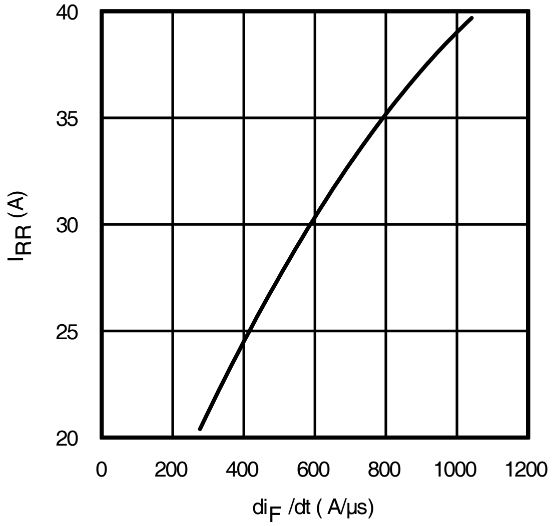


Fig. 20 - Typ. Diode I_{RR} vs. di_F/dt
V_{CC} = 600V; V_{GE} = 15V; I_F = 30A; T_J = 150°C

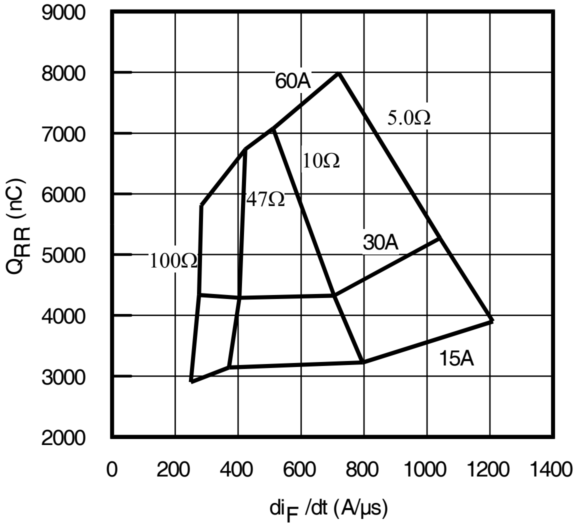


Fig. 21 - Typ. Diode Q_{RR} vs. di_F/dt
V_{CC} = 600V; V_{GE} = 15V; T_J = 150°C

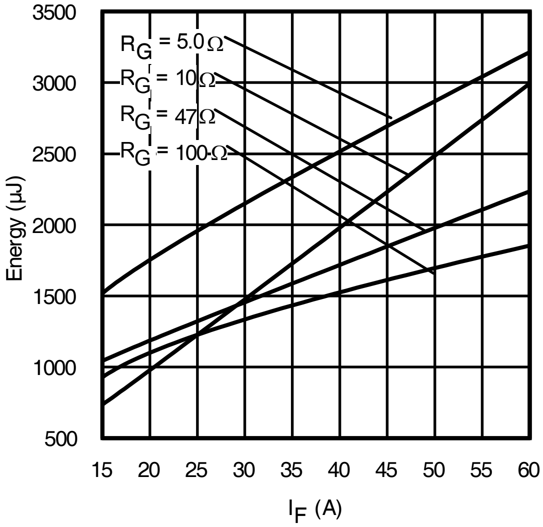


Fig. 22 - Typ. Diode E_{RR} vs. I_F
T_J = 150°C

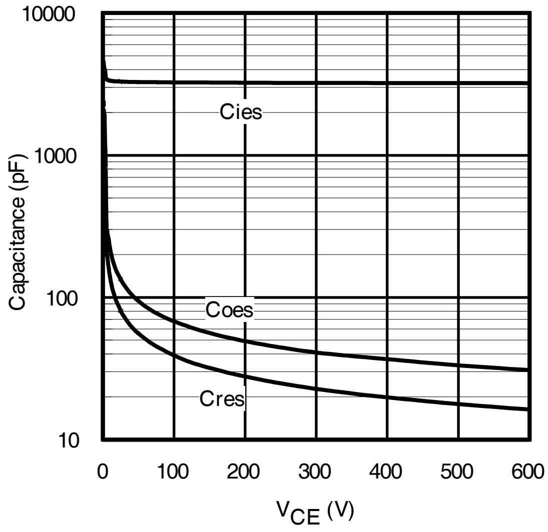


Fig. 23 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

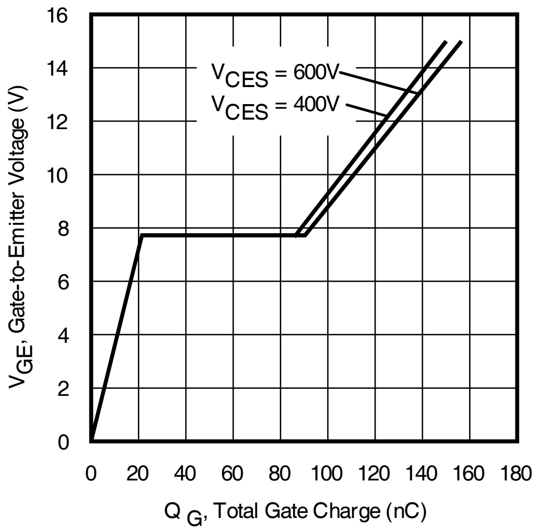
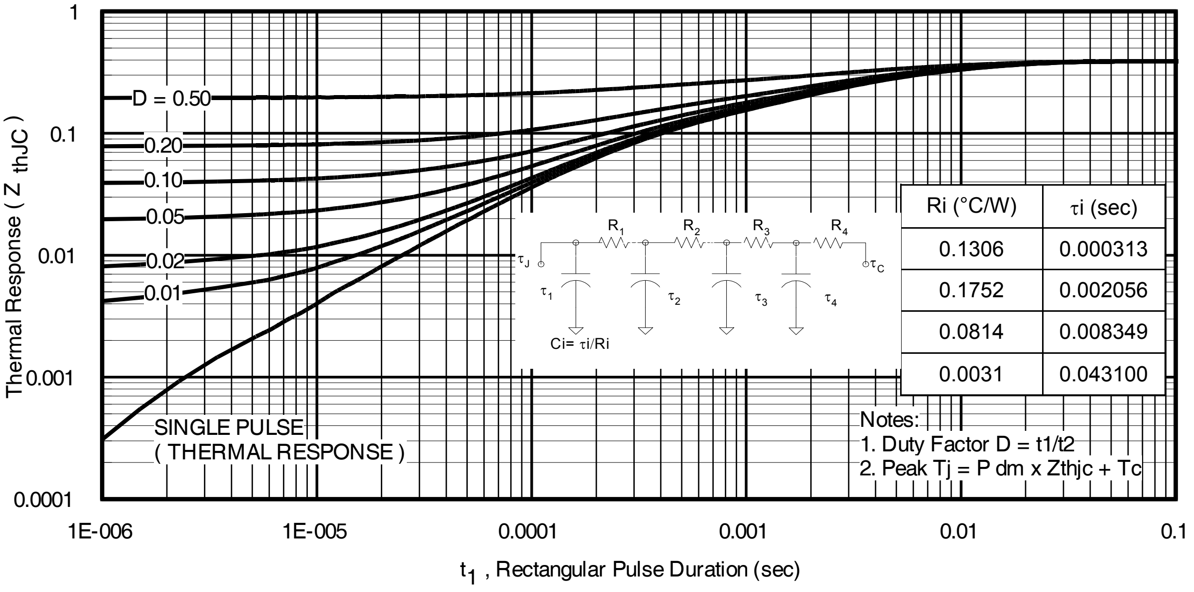
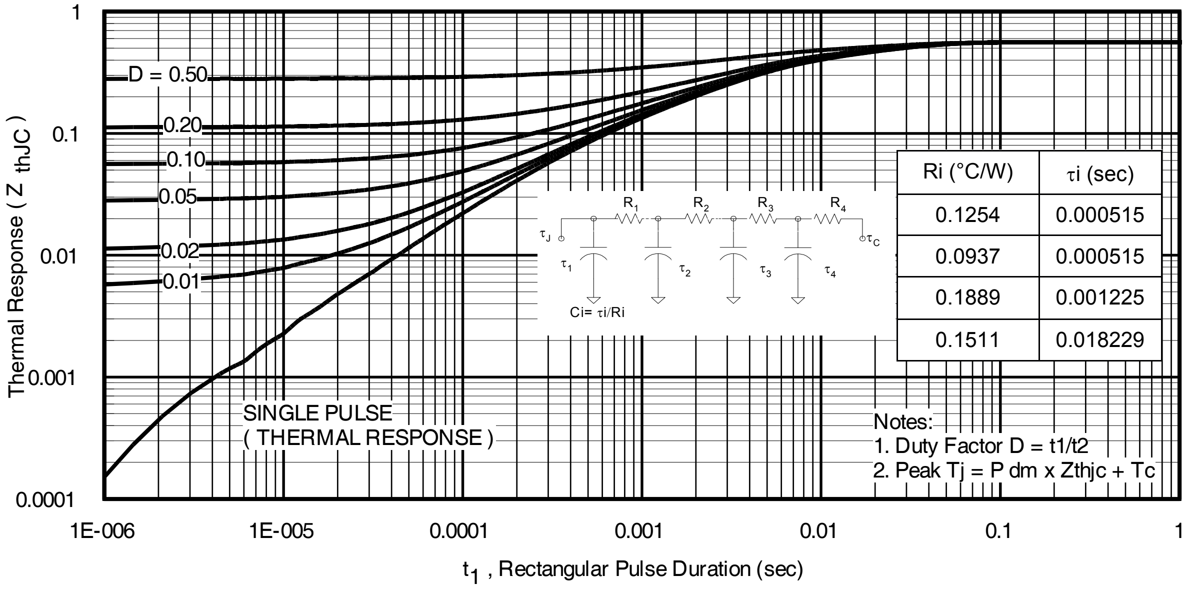


Fig. 24 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A



Ri (°C/W)	τi (sec)
0.1306	0.000313
0.1752	0.002056
0.0814	0.008349
0.0031	0.043100

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



Ri (°C/W)	τi (sec)
0.1254	0.000515
0.0937	0.000515
0.1889	0.001225
0.1511	0.018229

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

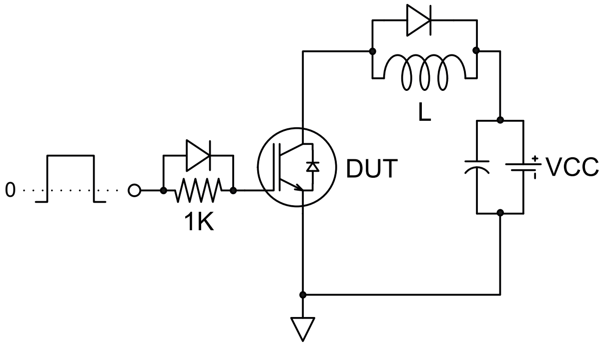


Fig.C.T.1 - Gate Charge Circuit (turn-off)

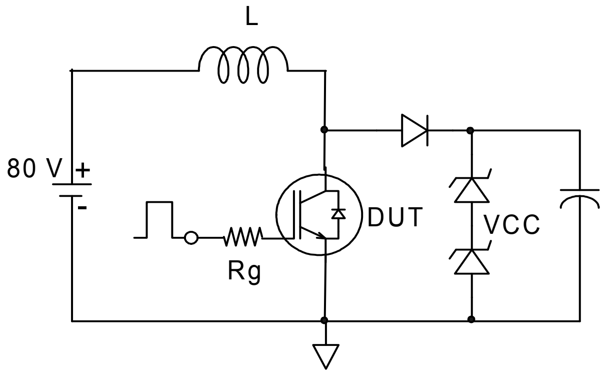


Fig.C.T.2 - RBSOA Circuit

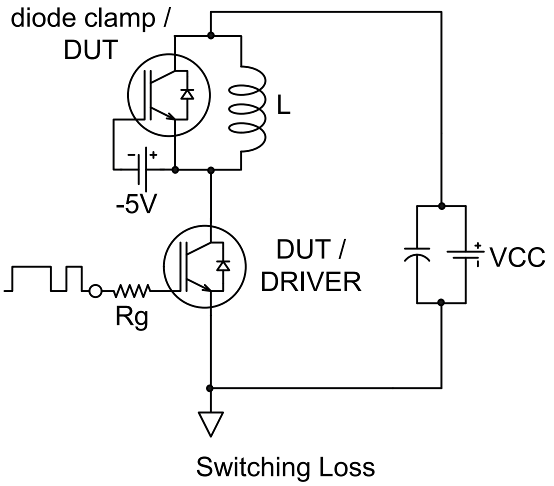


Fig.C.T.3 - Switching Loss Circuit

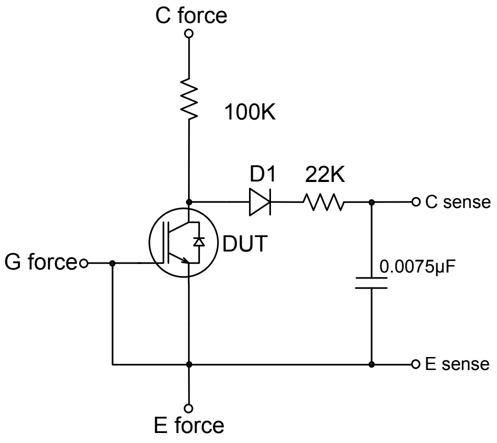


Fig.C.T.4 - BVCES Filter Circuit

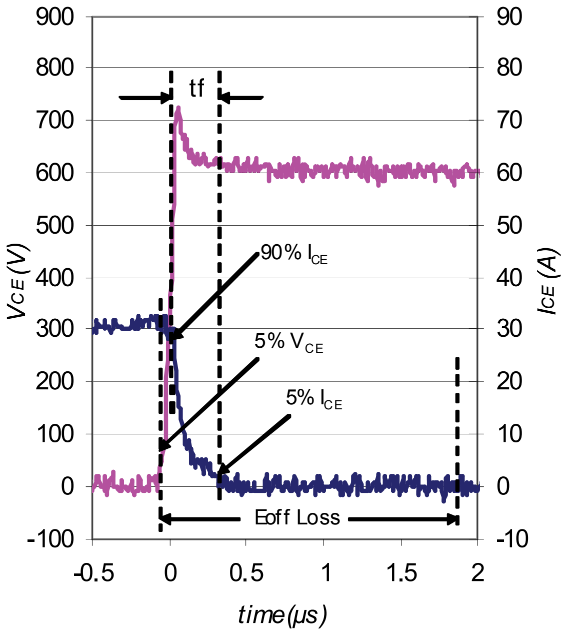
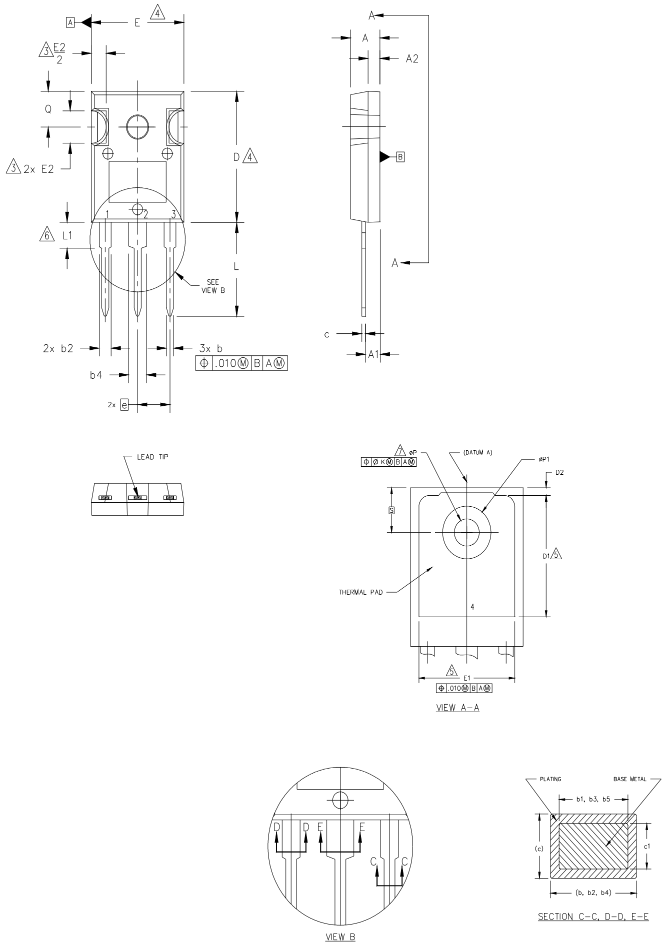


Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.3

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & 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. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. øP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AC .

SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.183	.209	4.65	5.31	
A1	.087	.102	2.21	2.59	
A2	.059	.098	1.50	2.49	
b	.039	.055	0.99	1.40	
b1	.039	.053	0.99	1.35	
b2	.065	.094	1.65	2.39	
b3	.065	.092	1.65	2.34	
b4	.102	.135	2.59	3.43	
b5	.102	.133	2.59	3.38	
c	.015	.035	0.38	0.89	
c1	.015	.033	0.38	0.84	
D	.776	.815	19.71	20.70	4
D1	.515	–	13.08	–	5
D2	.020	.053	0.51	1.35	
E	.602	.625	15.29	15.87	4
E1	.530	–	13.46	–	
E2	.178	.216	4.52	5.49	
e	.215 BSC		5.46 BSC		
øk	.010		0.25		
L	.559	.634	14.20	16.10	
L1	.146	.169	3.71	4.29	
øP	.140	.144	3.56	3.66	
øP1	–	.291	–	7.39	
Q	.209	.224	5.31	5.69	
S	.217 BSC		5.51 BSC		

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DIODES

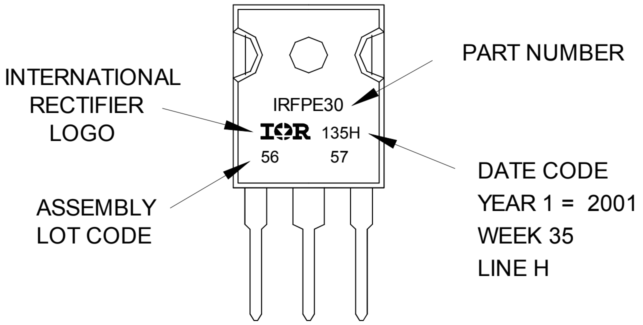
1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

TO-247AC Part Marking Information

Notes: This part marking information applies to devices produced after 02/26/2001

EXAMPLE: THIS IS AN IRFPE30
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2001
IN THE ASSEMBLY LINE "H"

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

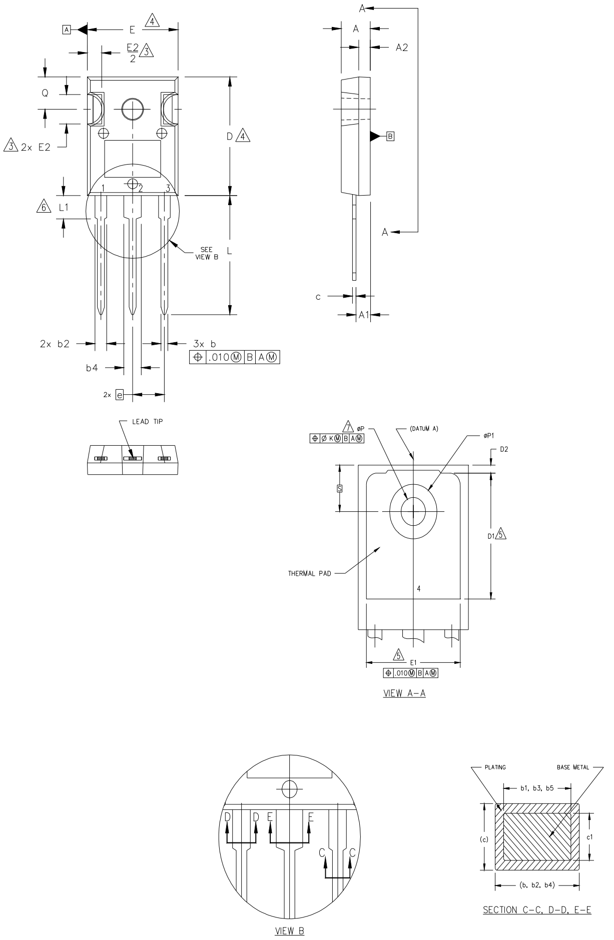


TO-247AC package is not recommended for Surface Mount Application.

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

TO-247AD Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & 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. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AD.

SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.183	.209	4.65	5.31	
A1	.087	.102	2.21	2.59	
A2	.059	.098	1.50	2.49	
b	.039	.055	0.99	1.40	
b1	.039	.053	0.99	1.35	
b2	.065	.094	1.65	2.39	
b3	.065	.092	1.65	2.34	
b4	.102	.135	2.59	3.43	
b5	.102	.133	2.59	3.38	
c	.015	.035	0.38	0.89	
c1	.015	.033	0.38	0.84	
D	.776	.815	19.71	20.70	4
D1	.515	–	13.08	–	5
D2	.020	.053	0.51	1.35	
E	.602	.625	15.29	15.87	4
E1	.530	–	13.46	–	
E2	.178	.216	4.52	5.49	
e	.215 BSC		5.46 BSC		
Øk	.010		0.25		
L	.780	.827	19.57	21.00	
L1	.146	.169	3.71	4.29	
ØP	.140	.144	3.56	3.66	
ØP1	–	.291	–	7.39	
Q	.209	.224	5.31	5.69	
S	.217 BSC		5.51 BSC		

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

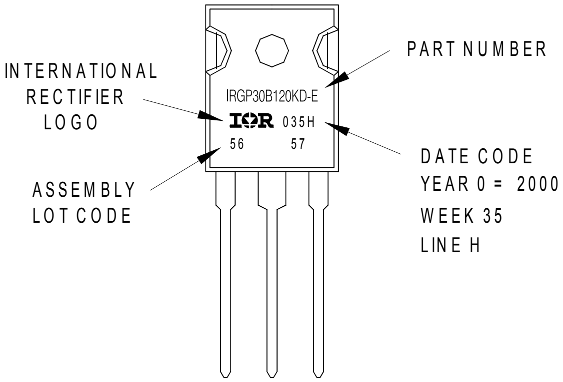
DIODES

1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

TO-247AD Part Marking Information

EXAMPLE: THIS IS AN IRGP30B120KD-E
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN THE ASSEMBLY LINE "H"

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



TO-247AD 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	TO-247AC	N/A
	TO-247AD	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.

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