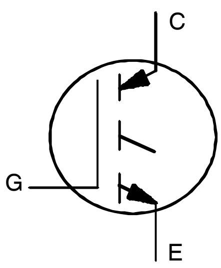
International IOR Rectifier

IRGP4062-EPbF

INSULATED GATE BIPOLAR TRANSISTOR

Features

- Low $V_{CE\ (ON)}$ Trench IGBT Technology
- Low switching losses
- Maximum Junction temperature 175 °C
- 5 µS short circuit SOA
- Square RBSOA
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE\ (ON)}$ Temperature co-efficient
- Tight parameter distribution
- Lead Free Package



n-channel

V_{CES} = 600V

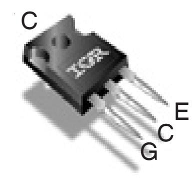
I_C = 24A, T_C = 100°C

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

$V_{CE(on)}$ typ. = 1.65V

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
- Low EMI



TO-247AD

G	C	E
Gate	Collector	Emitter

Base part number	Package Type	Standard Pack		Orderable part number
		Form	Quantity	
IRGP4062-EPbF	TO-247AD	Tube	25	IRGP4062-EPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	48	
I_C @ T_C = 100°C	Continuous Collector Current	24	
I_{CM}	Pulse Collector Current, V_{GE} = 15V	72	
I_{LM}	Clamped Inductive Load Current, V_{GE} = 20V ①	96	A
V_{GE}	Continuous Gate-to-Emitter Voltage	±20	V
	Transient Gate-to-Emitter Voltage	±30	
P_D @ T_C = 25°C	Maximum Power Dissipation	250	W
P_D @ T_C = 100°C	Maximum Power Dissipation	125	
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
$R_{\theta JC}$	Thermal Resistance Junction-to-Case	——	——	0.65	°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	

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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 ②
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.30	—	V/°C	V_{GE} = 0V, I_C = 1mA (25°C-175°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.60	1.95	V	I_C = 24A, V_{GE} = 15V, T_J = 25°C
		—	2.03	—		I_C = 24A, V_{GE} = 15V, T_J = 150°C
		—	2.04	—		I_C = 24A, V_{GE} = 15V, T_J = 175°C
$V_{GE(th)}$	Gate Threshold Voltage	4.0	—	6.5	V	V_{CE} = V_{GE}, I_C = 700μA
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-18	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA (25°C - 175°C)
gfe	Forward Transconductance	—	17	—	S	V_{CE} = 50V, I_C = 24A, PW = 80μs
I_{CES}	Collector-to-Emitter Leakage Current	—	2.0	25	μA	V_{GE} = 0V, V_{CE} = 600V
		—	775	—		V_{GE} = 0V, V_{CE} = 600V, T_J = 175°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	50	75	nC	I_C = 24A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	13	20		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	21	31		V_{CC} = 400V
E_{on}	Turn-On Switching Loss ③	—	115	201	μJ	I_C = 24A, V_{CC} = 400V, V_{GE} = 15V
E_{off}	Turn-Off Switching Loss	—	600	700		R_G = 10Ω, L = 200μH, L_S = 150nH, T_J = 25°C
E_{total}	Total Switching Loss	—	715	901		Energy losses include tail & diode reverse recovery
$t_{d(on)}$	Turn-On delay time	—	41	53	ns	I_C = 24A, V_{CC} = 400V, V_{GE} = 15V
t_r	Rise time	—	22	31		R_G = 10Ω, L = 200μH, L_S = 150nH, T_J = 25°C
$t_{d(off)}$	Turn-Off delay time	—	104	115		
t_f	Fall time	—	29	41		
E_{on}	Turn-On Switching Loss ③	—	420	—	μJ	I_C = 24A, V_{CC} = 400V, V_{GE}=15V
E_{off}	Turn-Off Switching Loss	—	840	—		R_G=10Ω, L= 200μH, L_S=150nH, T_J = 175°C
E_{total}	Total Switching Loss	—	1260	—		Energy losses include tail & diode reverse recovery
$t_{d(on)}$	Turn-On delay time	—	40	—	ns	I_C = 24A, V_{CC} = 400V, V_{GE} = 15V
t_r	Rise time	—	24	—		R_G = 10Ω, L = 200μH, L_S = 150nH
$t_{d(off)}$	Turn-Off delay time	—	125	—		T_J = 175°C
t_f	Fall time	—	39	—		
C_{ies}	Input Capacitance	—	1490	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	129	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	45	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 175°C, I_C = 96A V_{CC} = 480V, Vp =600V Rg = 10Ω, V_{GE} = +20V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V_{CC} = 400V, Vp =600V Rg = 10Ω, V_{GE} = +15V to 0V

Notes:

① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 100μH, R_G = 10Ω.
② Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
③ Turn-on energy is measured using the same co-pak diode as IRGP4062DPbF.

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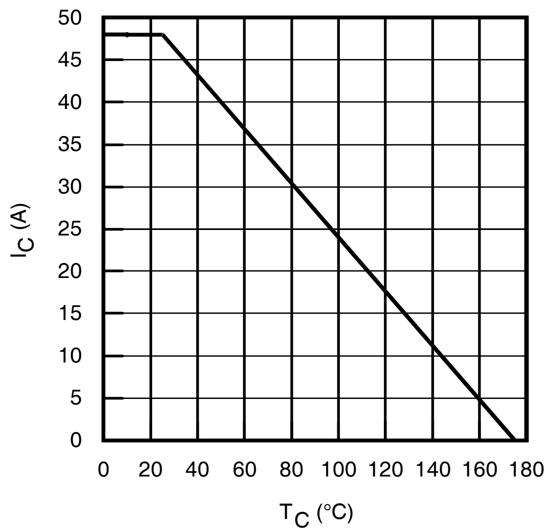

Fig. 1 - Maximum DC Collector Current vs. Case Temperature

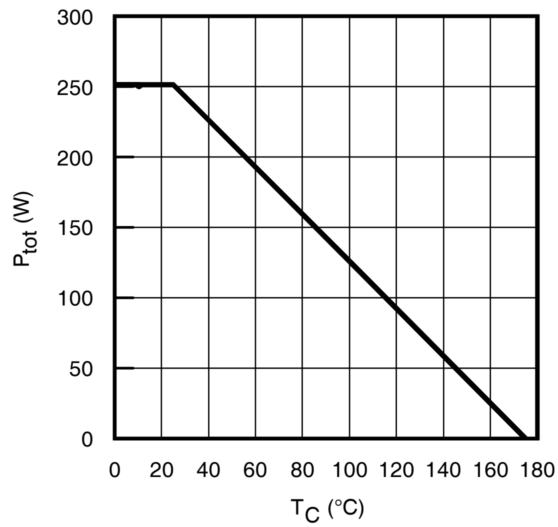

Fig. 2 - Power Dissipation vs. Case Temperature

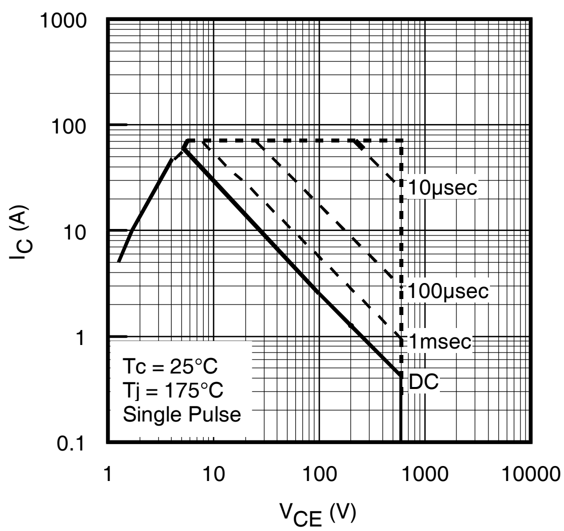

Fig. 3 - Forward SOA
$T_C = 25°C, T_J \leq 175°C; V_{GE} = 15V$

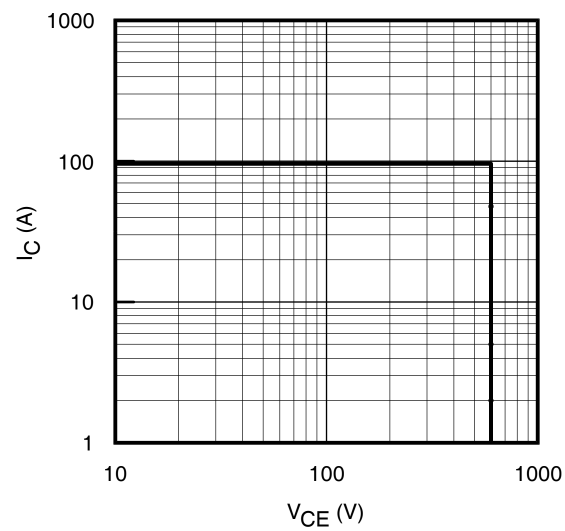

Fig. 4 - Reverse Bias SOA
$T_J = 175°C; V_{GE} = 20V$

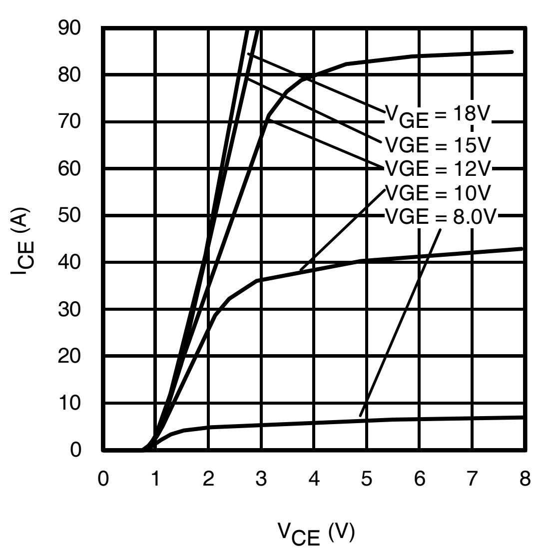

Fig. 5 - Typ. IGBT Output Characteristics
$T_J = -40°C$; tp = 80µs

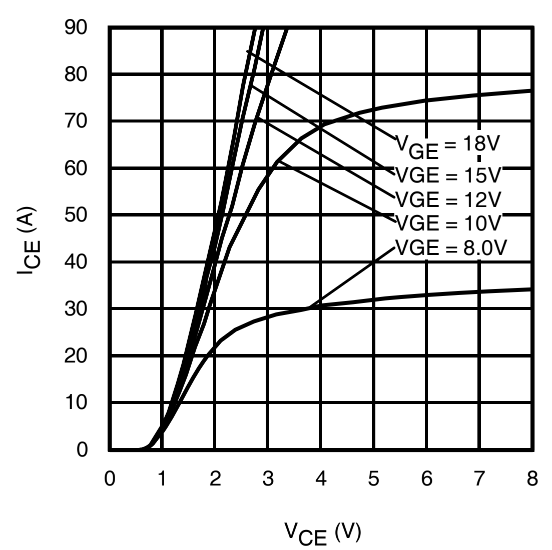

Fig. 6 - Typ. IGBT Output Characteristics
$T_J = 25°C$; tp = 80µs

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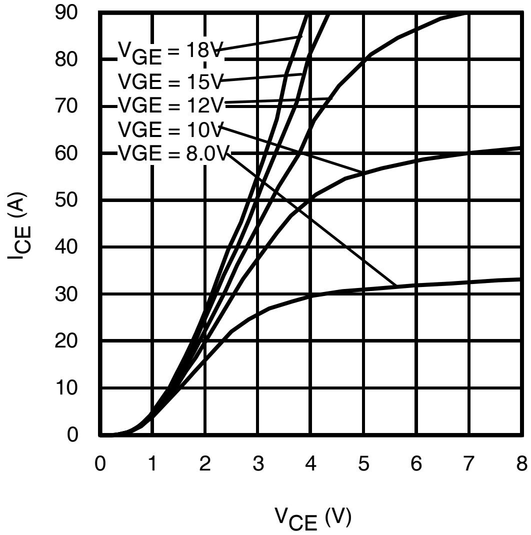

Fig. 7 - Typ. IGBT Output Characteristics
T_J = 175°C; tp = 80µs

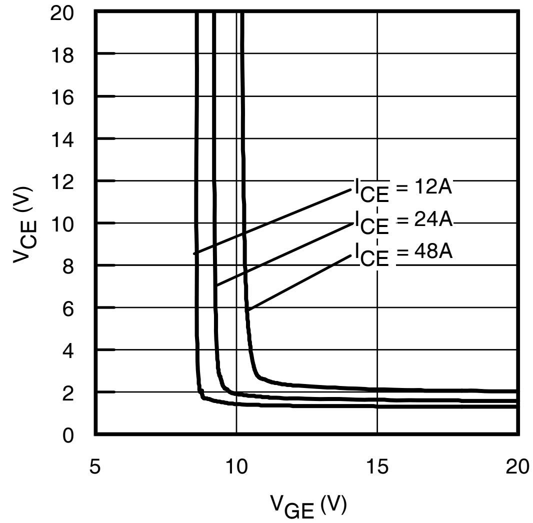

Fig. 8 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

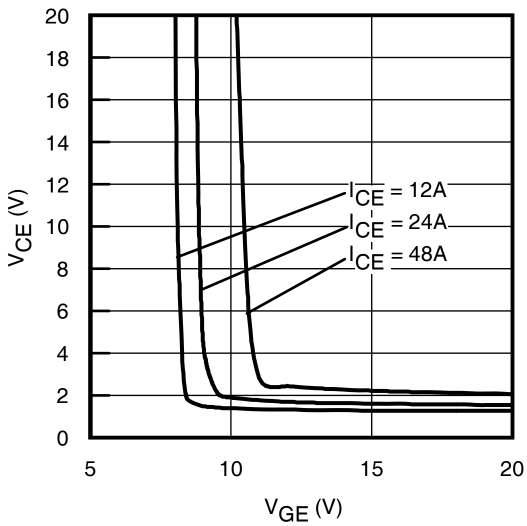

Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

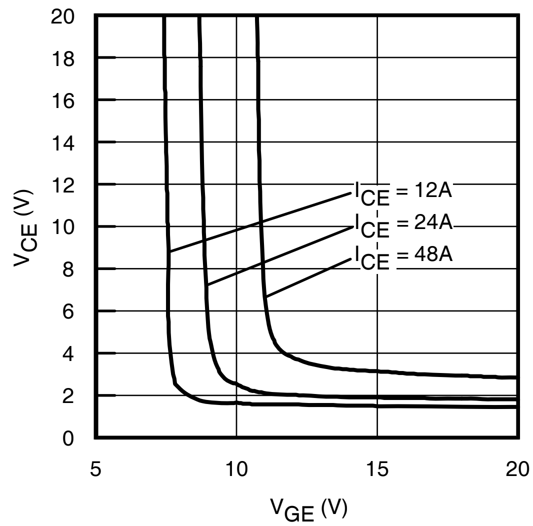

Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 175°C

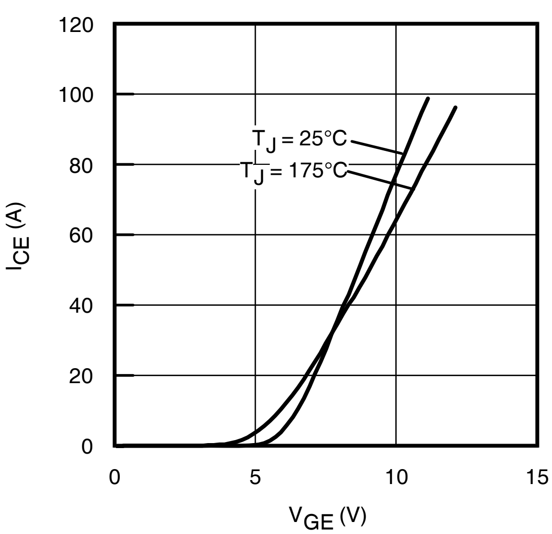

Fig. 11 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

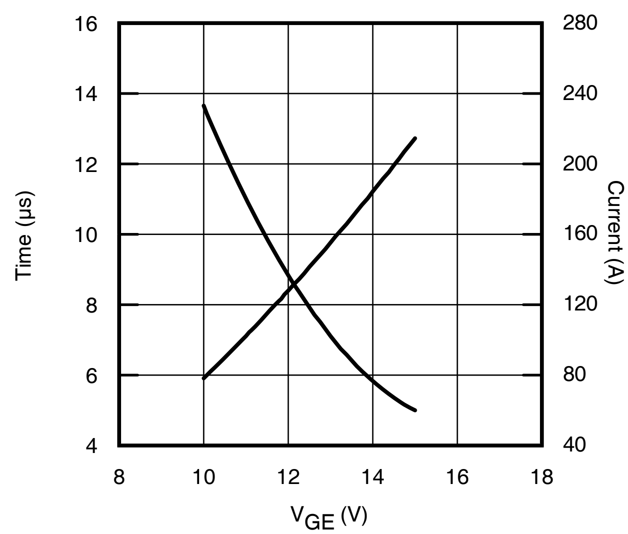

Fig. 12 - V_{GE} vs. Short Circuit Time
V_{CC} = 400V; T_C = 25°C

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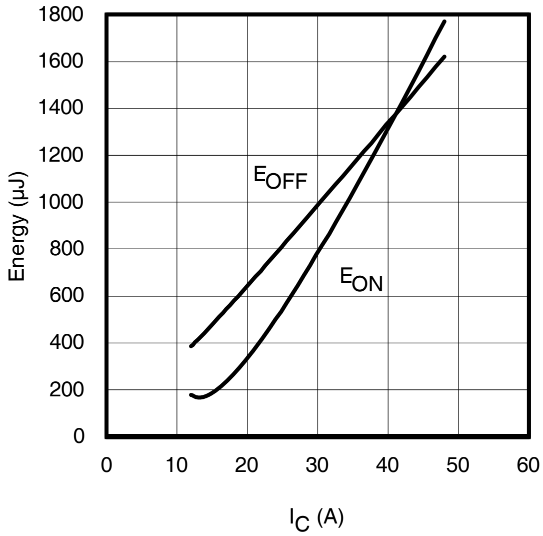

Fig. 13 - Typ. Energy Loss vs. I_C
T_J = 175°C; L = 200µH; V_{CE} = 400V, R_G = 10Ω; V_{GE} = 15V

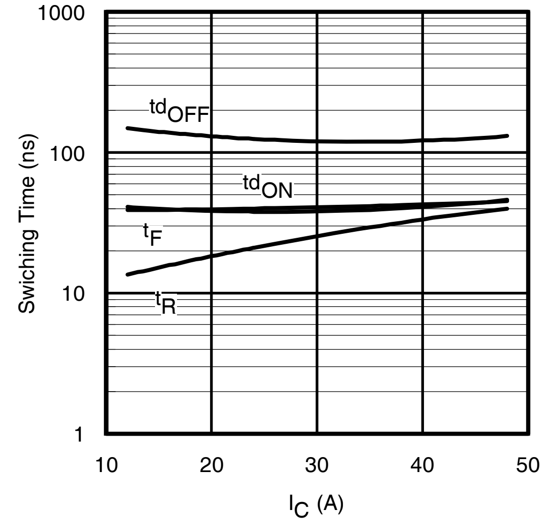

Fig. 14 - Typ. Switching Time vs. I_C
T_J = 175°C; L = 200µH; V_{CE} = 400V, R_G = 10Ω; V_{GE} = 15V

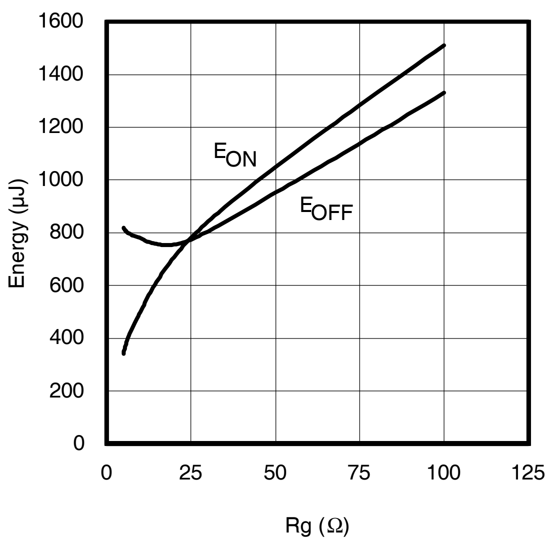

Fig. 15 - Typ. Energy Loss vs. R_G
T_J = 175°C; L = 200µH; V_{CE} = 400V, I_{CE} = 24A; V_{GE} = 15V

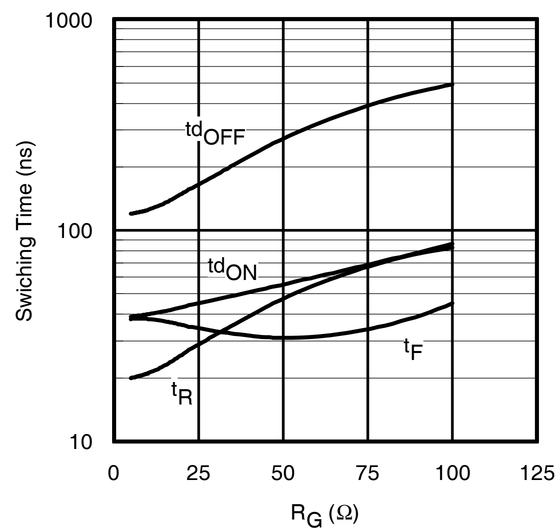

Fig. 16 - Typ. Switching Time vs. R_G
T_J = 175°C; L = 200µH; V_{CE} = 400V, I_{CE} = 24A; V_{GE} = 15V

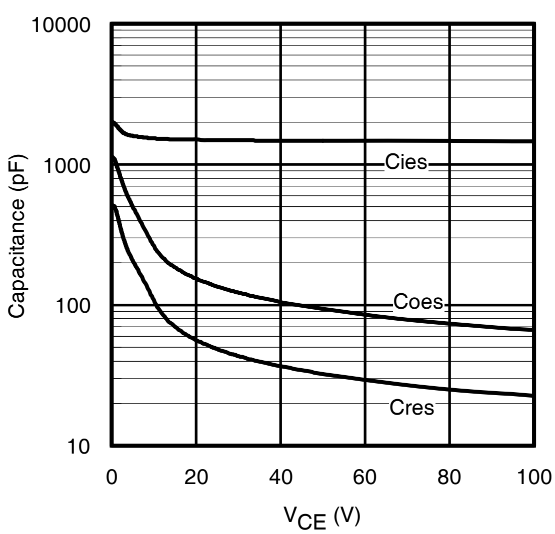

Fig. 17 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

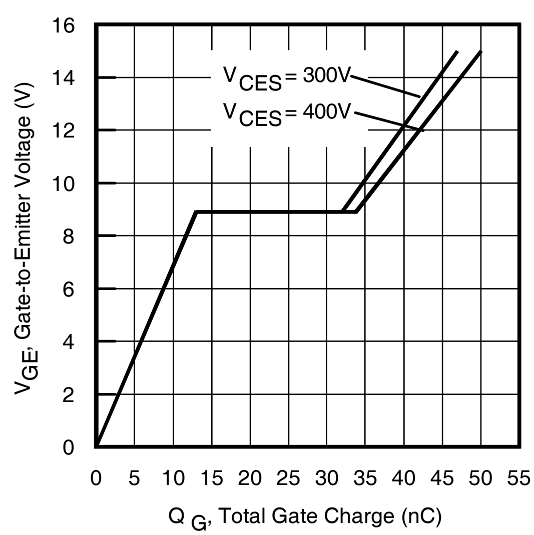

Fig. 18 - Typical Gate Charge vs. V_{GE}
I_{CE} = 24A; L = 600µH

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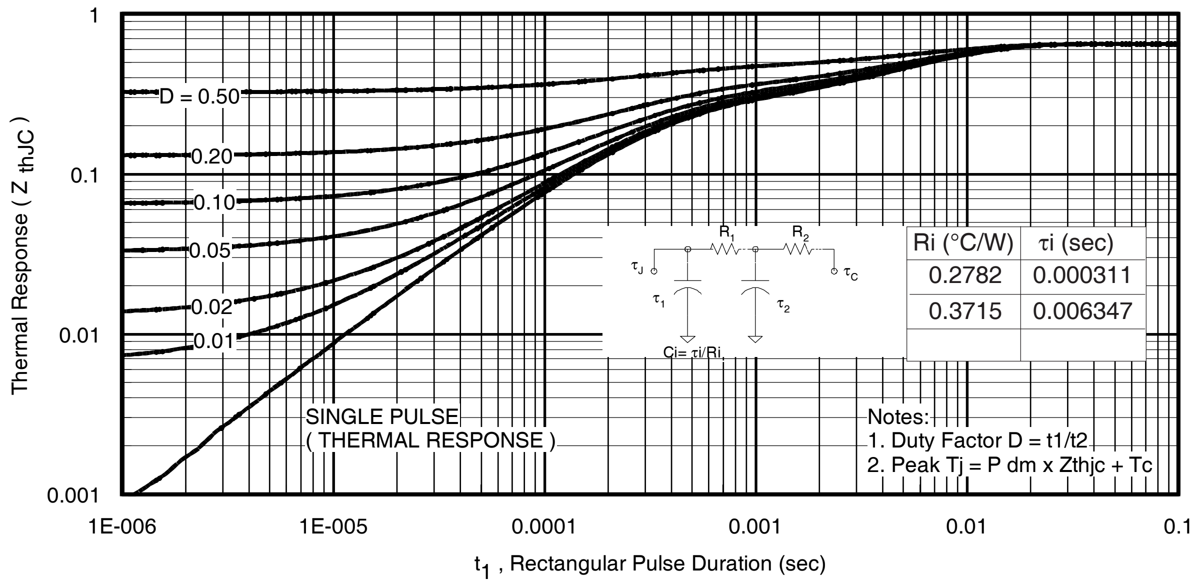

Fig. 19 Maximum Transient Thermal Impedance, Junction-to-Case

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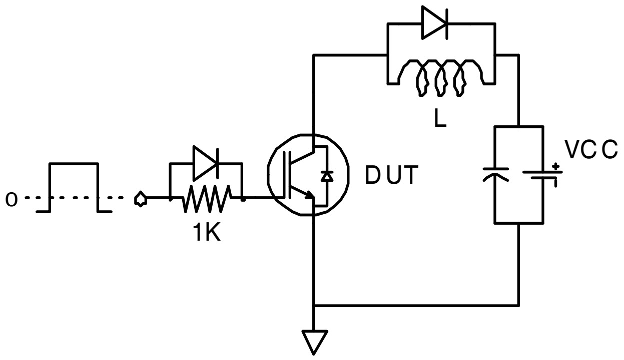

Fig.C.T.1 - Gate Charge Circuit (turn-off)

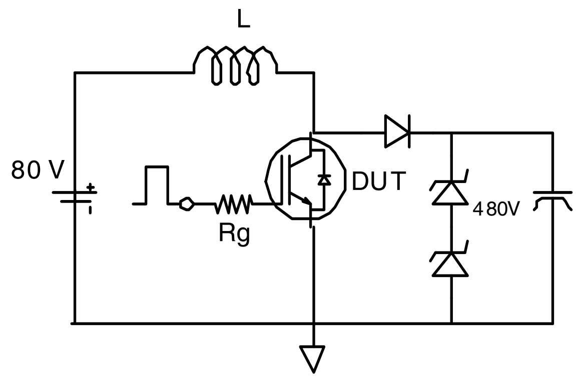

Fig.C.T.2 - RBSOA Circuit

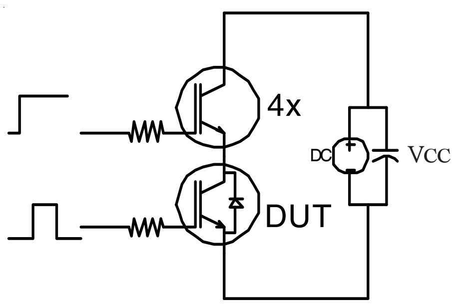

Fig.C.T.3 - S.C. SOA Circuit

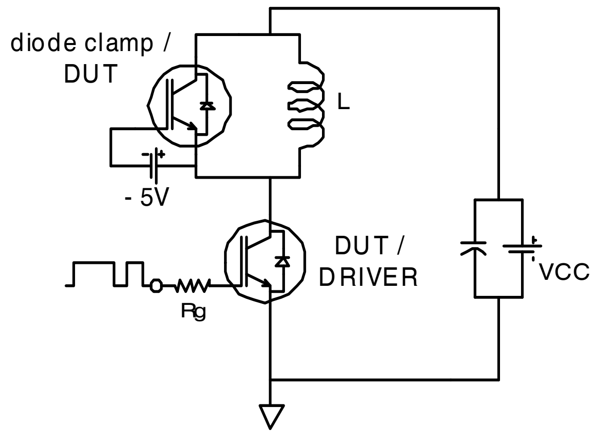

Fig.C.T.4 - Switching Loss Circuit

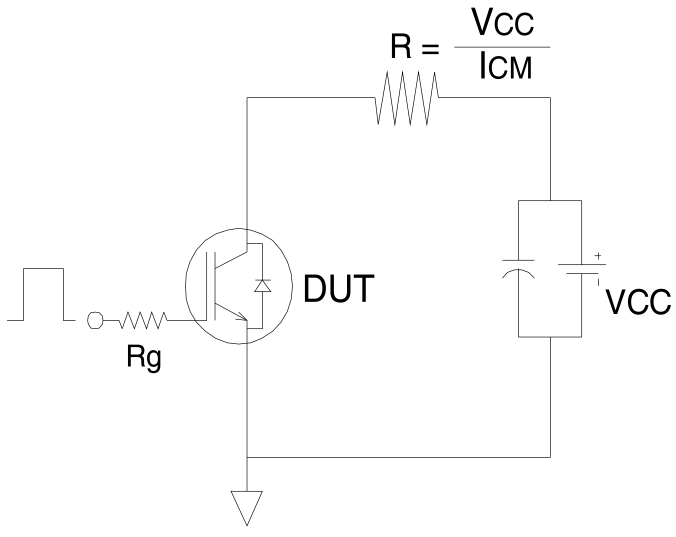

Fig.C.T.5 - Resistive Load Circuit

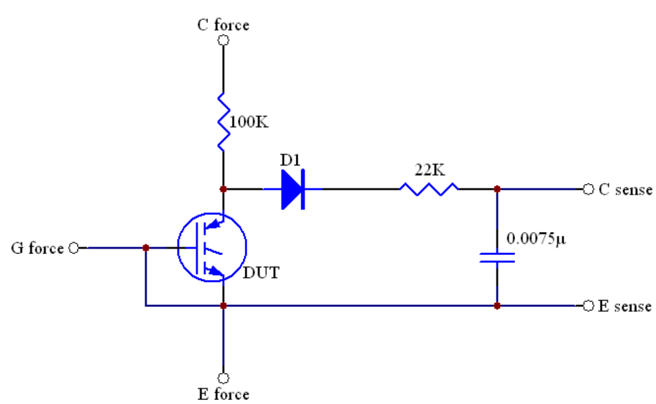

Fig.C.T.6 - BVCES Filter Circuit

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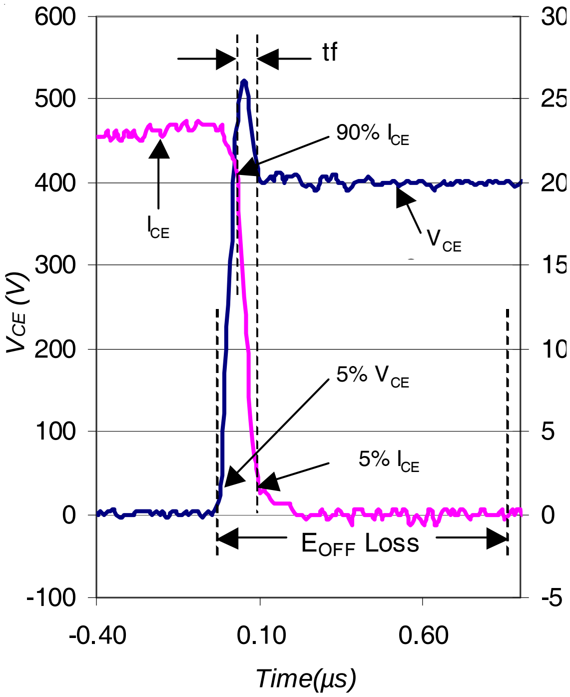

Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 175°C using Fig. CT.4

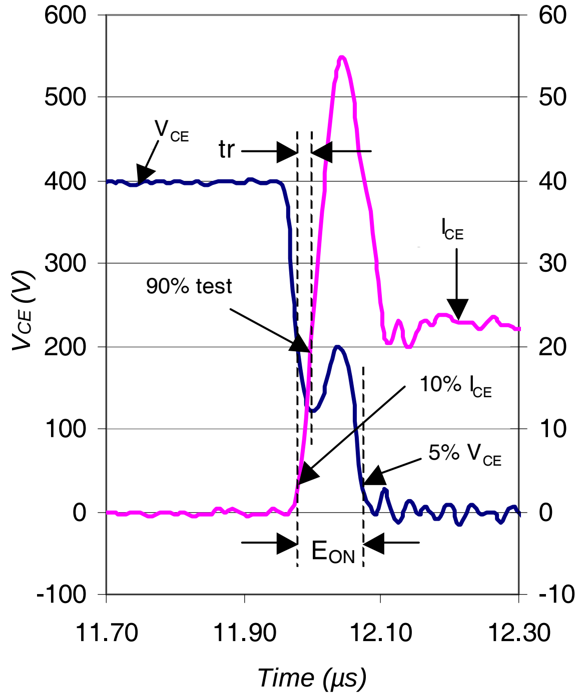

Fig. WF2 - Typ. Turn-on Loss Waveform
@ T_J = 175°C using Fig. CT.4

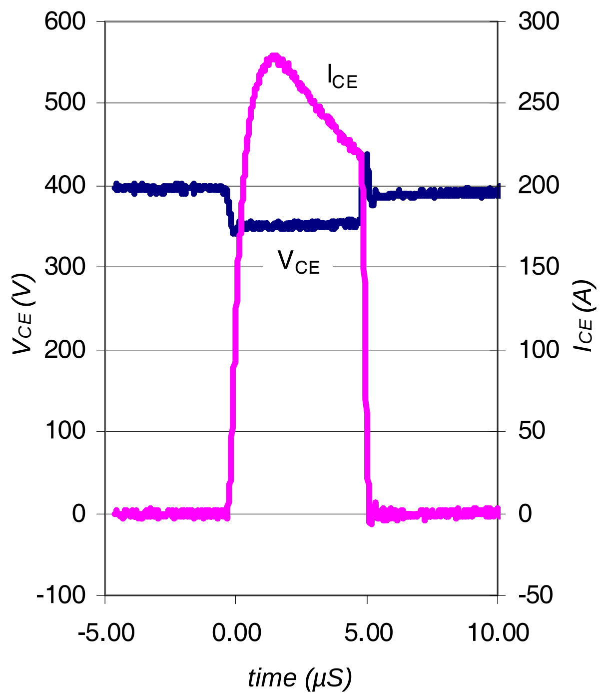

Fig. WF3 - Typ. S.C. Waveform
@ T_J = 25°C using Fig. CT.3

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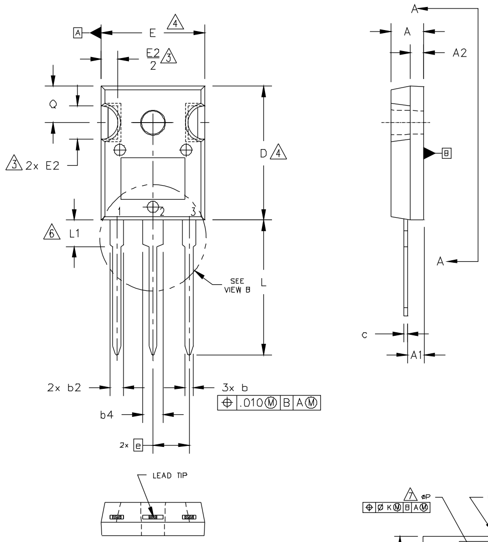
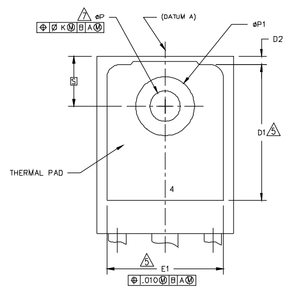
TO-247AD Package Outline

Dimensions are shown in millimeters (inches)





VIEW A–A

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

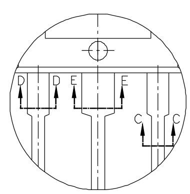
1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

IGBTs, CoPACK

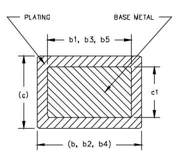
1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

DIODES

1.– ANODE/OPEN
2.– CATHODE
3.– ANODE



VIEW B

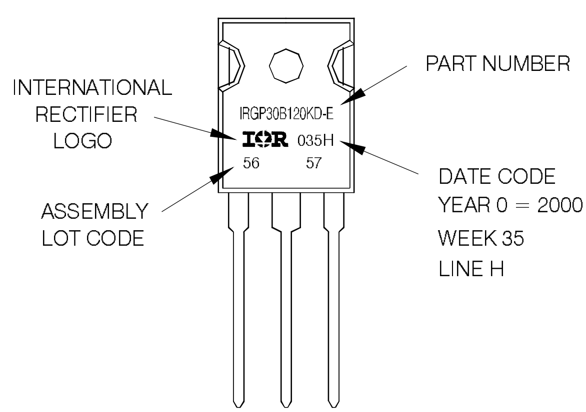


SECTION C–C, D–D, E–E

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"



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

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Qualification Information†

Qualification Level		Industrial (per International Rectifier's internal guidelines)	
Moisture Sensitivity Level		TO-247AD	N/A (per JEDEC J-STD-020D)
ESD	Machine Model	Class M4 (+/- 700V) (per AEC-Q101-002)	
	Human Body Model	Class H1C (+/- 2000V) (per AEC-Q101-001)	
	Charged Device Model	Class C5(+/- 2000V) (per AEC-Q101-005)	
RoHS Compliant		Yes	

† Qualification standards can be found at International Rectifier's web site: http://www.irf.com/product-info/reliability

Data and specifications subject to change without notice.

International Rectifier

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