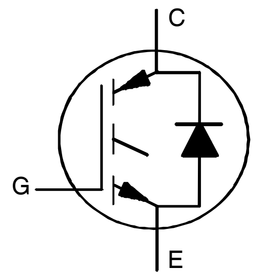
International
IOR Rectifier

IRG7PH42UD1MPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRA-LOW VF DIODE FOR INDUCTION HEATING AND SOFT SWITCHING APPLICATIONS

Features
- Low $V_{CE\ (ON)}$ trench IGBT technology
- Low switching losses
- Square RBSOA
- Ultra-low V_F Diode
- 1300Vpk repetitive transient capacity
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE\ (ON)}$ temperature co-efficient
- Tight parameter distribution
- Lead free package



n-channel

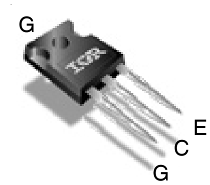
V_{CES} = 1200V

I_C = 45A, T_C = 100°C

$T_{J(max)}$ = 150°C

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

Benefits
- Device optimized for induction heating and soft switching applications
- High Efficiency due to Low $V_{CE(on)}$, low switching losses and Ultra-low V_F
- 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	
IRG7PH42UD1MPbF	TO-247AD	Tube	25	IRG7PH42UD1MPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$V_{(BR)\ Transient}$	Repetitive Transient Collector-to-Emitter Voltage ⑦	1300	
I_C @ T_C = 25°C	Continuous Collector Current	85⑤	A
I_C @ T_C = 100°C	Continuous Collector Current	45	
I_{CM}	Pulse Collector Current, V_{GE}=15V ②⑥	200	
I_{LM}	Clamped Inductive Load Current, V_{GE}=20V ①	120	
I_F @ T_C = 25°C	Diode Continous Forward Current	70	
I_F @ T_C = 100°C	Diode Continous Forward Current	35	
I_{FRM}	Diode Repetitive Peak Forward Current ②	120	
V_{GE}	Continuous Gate-to-Emitter Voltage	±30	V
P_D @ T_C = 25°C	Maximum Power Dissipation	313	W
P_D @ T_C = 100°C	Maximum Power Dissipation	125	
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)	Thermal Resistance Junction-to-Case-(each IGBT) ④	—	—	0.4	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ④	—	—	1.05	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$	Thermal Resistance, 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	1200	—	—	V	V_{GE} = 0V, I_C = 100μA ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.2	—	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
		—	2.0	—		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
gfe	Forward Transconductance	—	32	—	S	V_{CE} = 50V, I_C = 30A, PW = 80μs
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	100	μA	V_{GE} = 0V, V_{CE} = 1200V
		—	230	—		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	1.15	1.30	V	I_F = 30A
		—	1.10	—		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 (turn-on)	—	180	270	nC	I_C = 30A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	24	36		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	70	110		V_{CC} = 600V
E_{off}	Turn-Off Switching Loss	—	1210	1450	μJ	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V R_G = 10Ω, L = 200μH, T_J = 25°C Energy losses include tail
$t_{d(off)}$	Turn-Off delay time	—	270	290	ns	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V
t_f	Fall time	—	35	43		R_G = 10Ω, L = 200μH, T_J = 25°C
E_{off}	Turn-Off Switching Loss	—	1936	—	μJ	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V R_G = 10Ω, L = 200μH, T_J = 150°C Energy losses include tail
$t_{d(off)}$	Turn-Off delay time	—	300	—	ns	I_C = 30A, V_{CC} = 600V, V_{GE} = 15V
t_f	Fall time	—	160	—		R_G = 10Ω, L = 200μH, T_J = 150°C
C_{ies}	Input Capacitance	—	3390	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	130	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	83	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 120A V_{CC} = 960V, Vp =1200V Rg = 10Ω, V_{GE} = +20V to 0V

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.
⑥ FBSOA operating conditions only
⑦ V_{GE} = 0V, T_J = 75°C, PW ≤ 10μs.

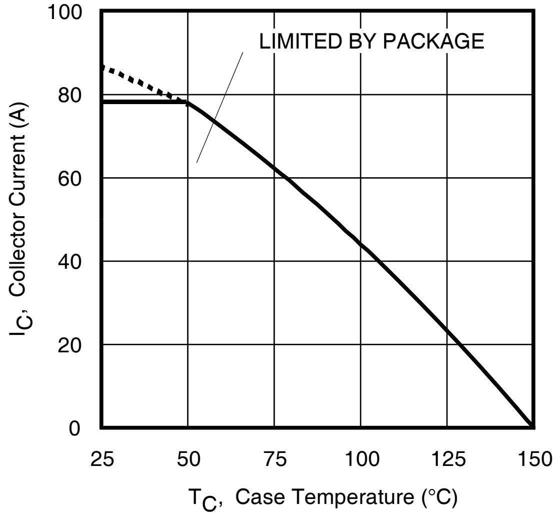


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

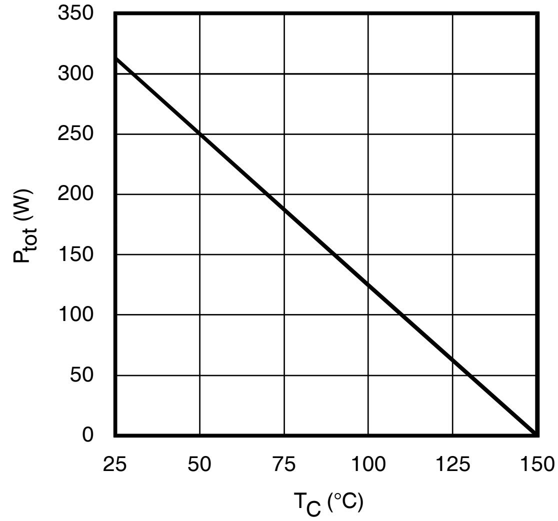


Fig. 2 - Power Dissipation vs. Case Temperature

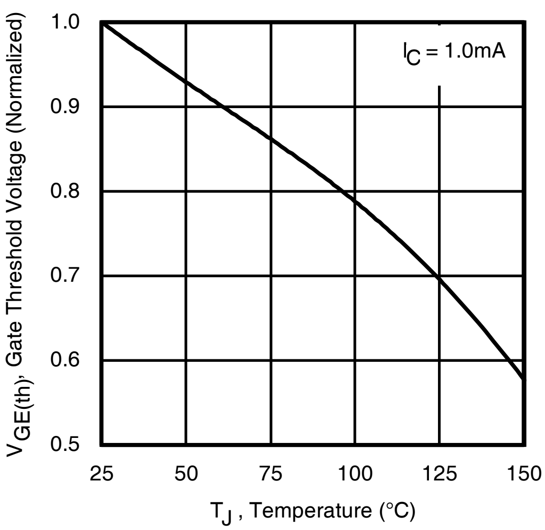


Fig. 3 - Typical Gate Threshold Voltage (Normalized) vs. Junction Temperature

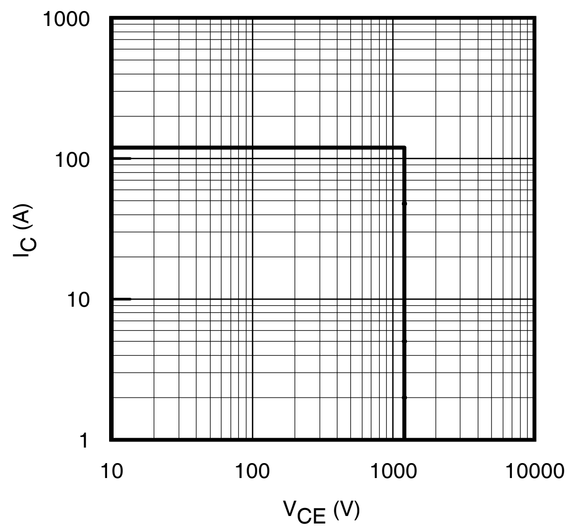


Fig. 4 - Reverse Bias SOA
T_J = 150°C; V_{GE} = 20V

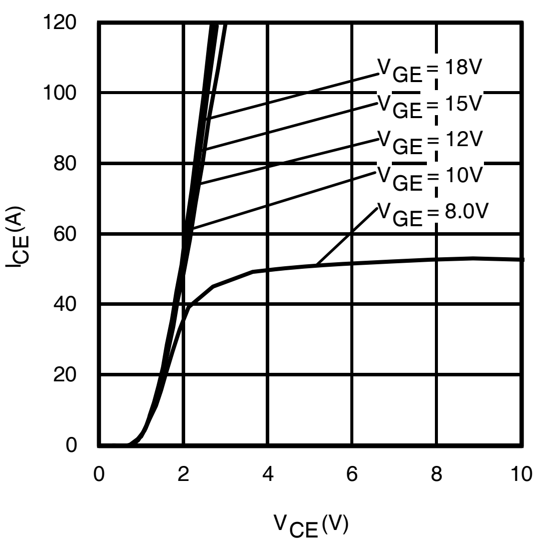


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80µs

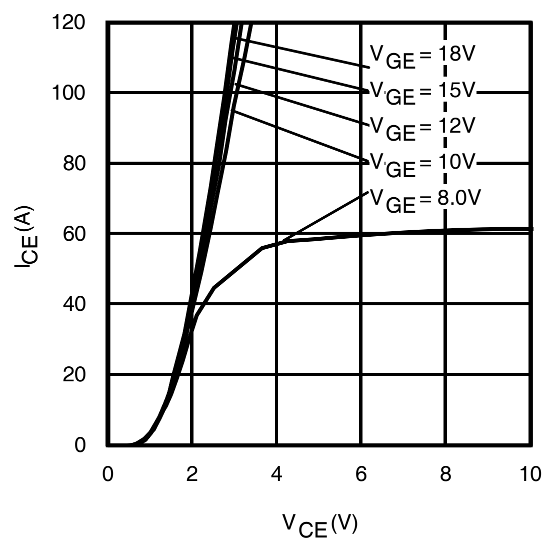


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

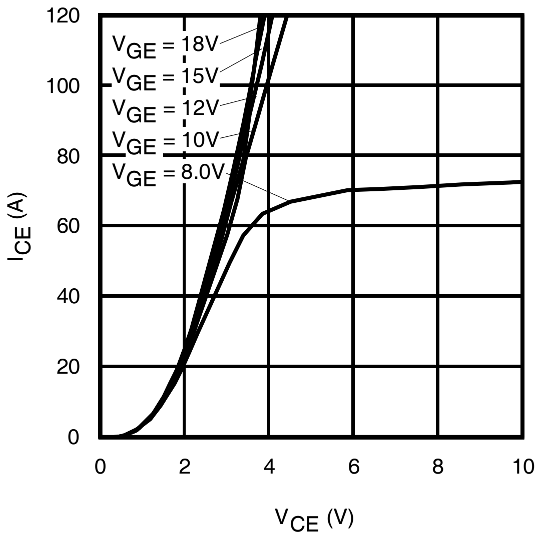


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 80µs

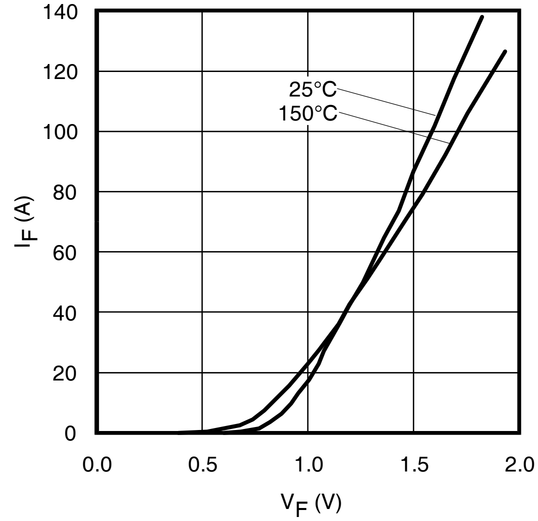


Fig. 8 - Typ. Diode Forward Voltage Drop Characteristics

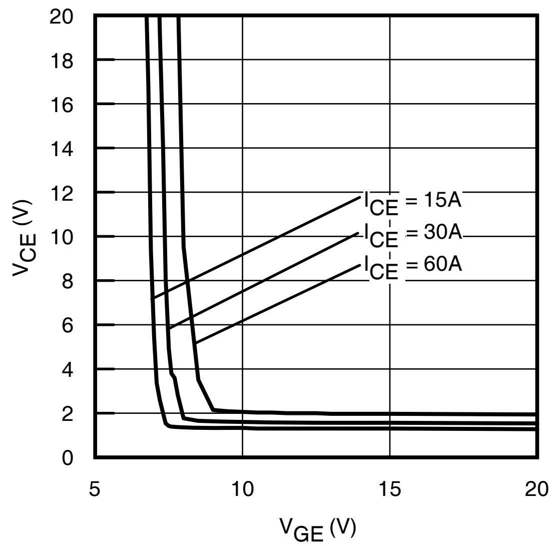


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

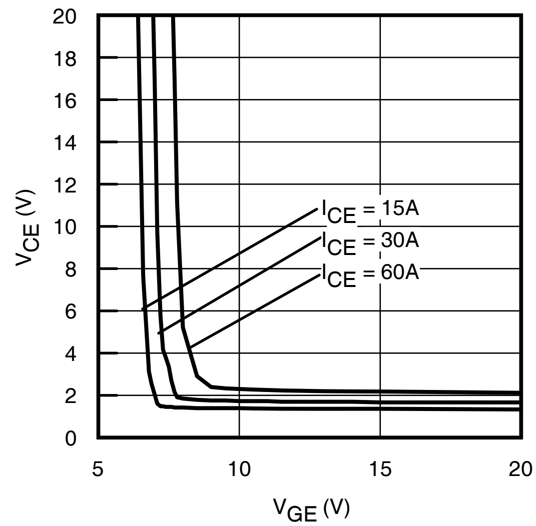


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

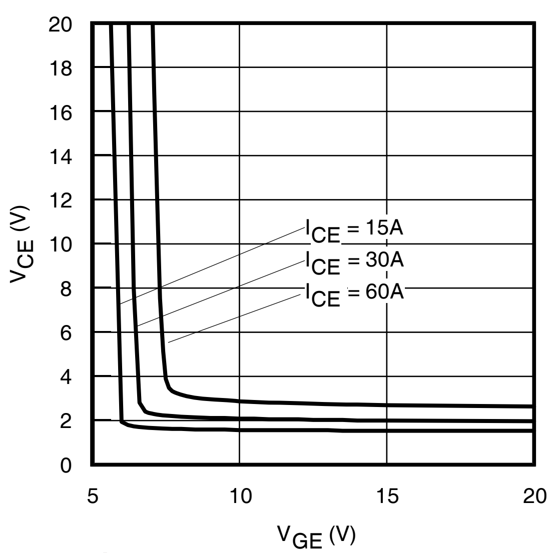


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

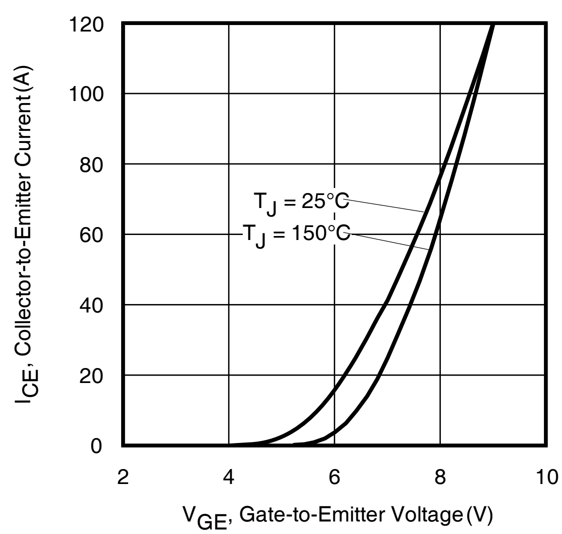


Fig. 12 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

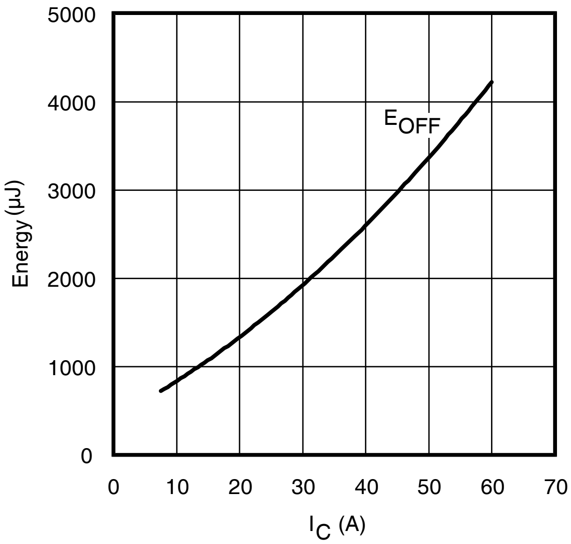


Fig. 13 - Typ. Energy Loss vs. I_C
T_J = 150°C; L = 200µH; V_{CE} = 600V, R_G = 10Ω; V_{GE} = 15V

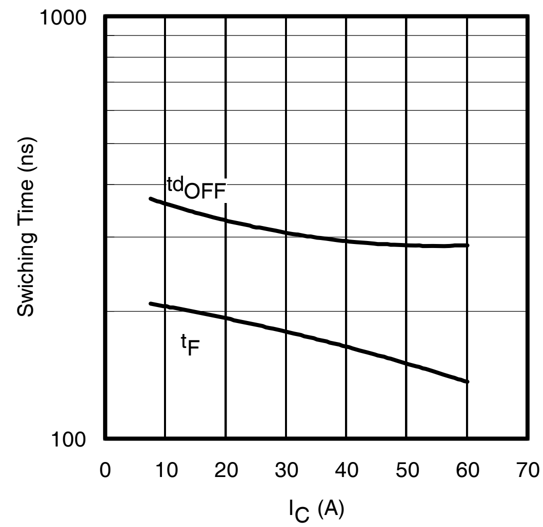


Fig. 14 - Typ. Switching Time vs. I_C
T_J = 150°C; L = 200µH; V_{CE} = 600V, R_G = 10Ω; V_{GE} = 15V

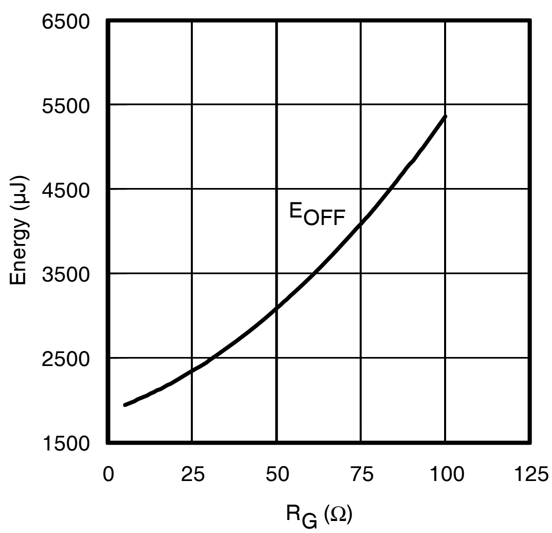


Fig. 15 - Typ. Energy Loss vs. R_G
T_J = 150°C; L = 200µH; V_{CE} = 600V, I_{CE} = 30A; V_{GE} = 15V

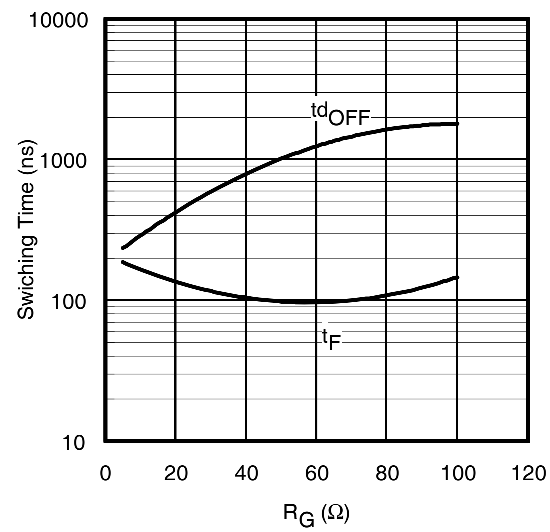


Fig. 16 - Typ. Switching Time vs. R_G
T_J = 150°C; L = 200µH; V_{CE} = 600V, I_{CE} = 30A; V_{GE} = 15V

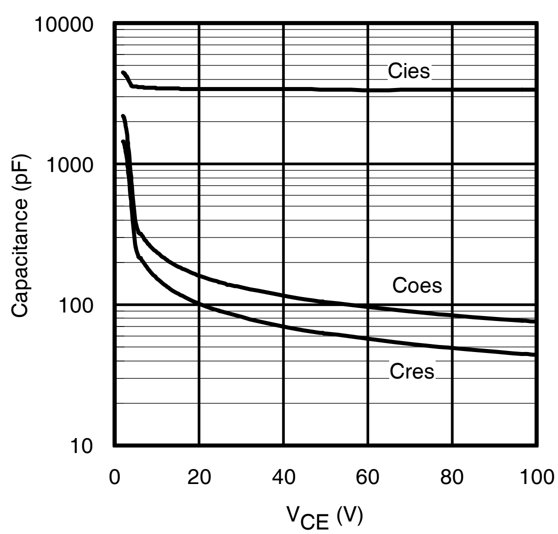


Fig. 17 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

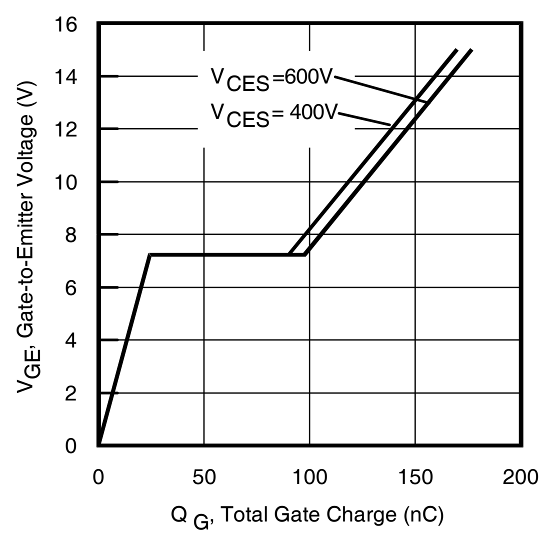
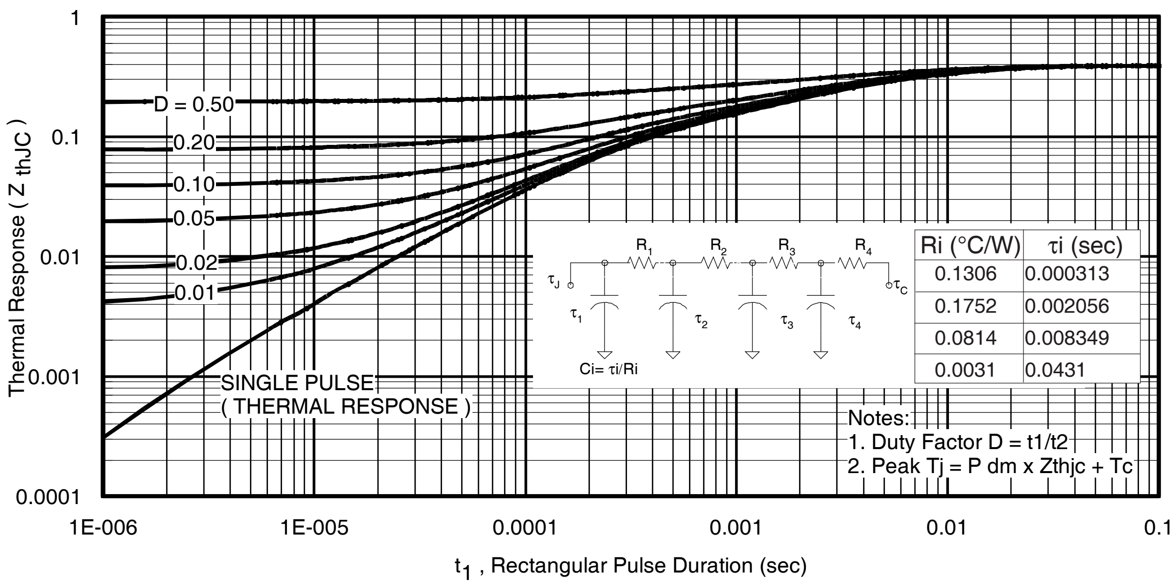
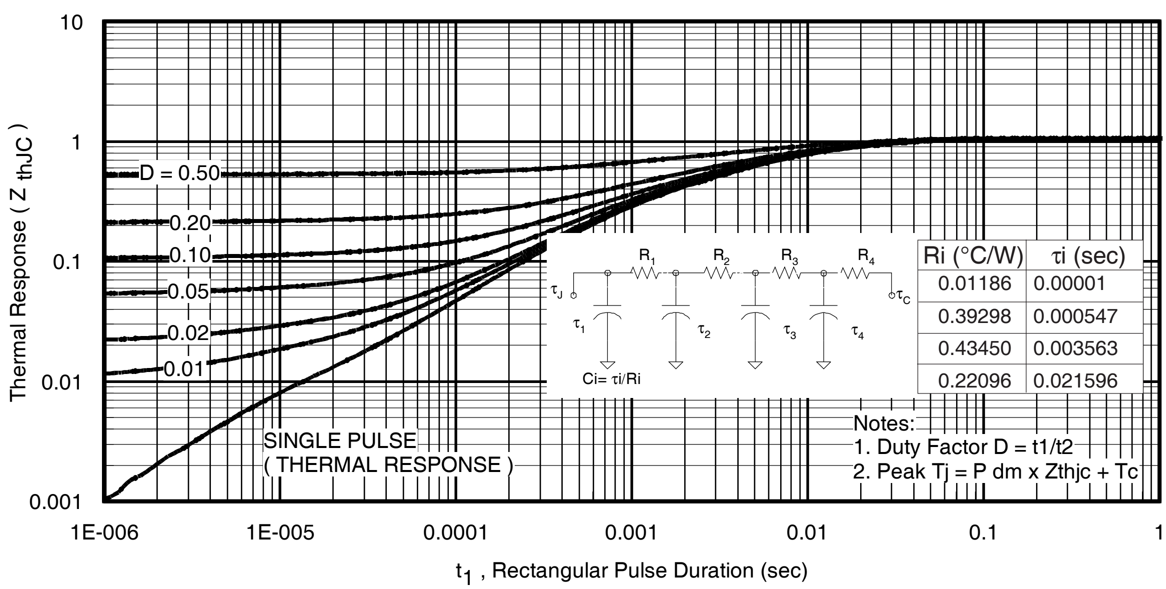


Fig. 18 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A; L = 680µH



Ri (°C/W)	τi (sec)
0.1306	0.000313
0.1752	0.002056
0.0814	0.008349
0.0031	0.0431

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



Ri (°C/W)	τi (sec)
0.01186	0.00001
0.39298	0.000547
0.43450	0.003563
0.22096	0.021596

Fig. 20. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

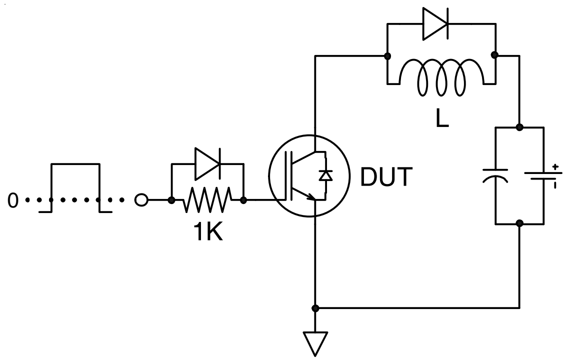


Fig.C.T.1 - Gate Charge Circuit (turn-off)

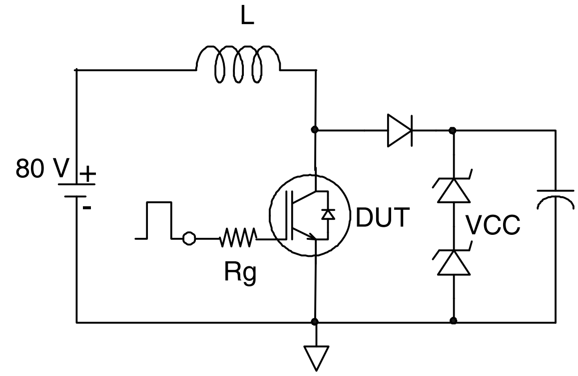


Fig.C.T.2 - RBSOA Circuit

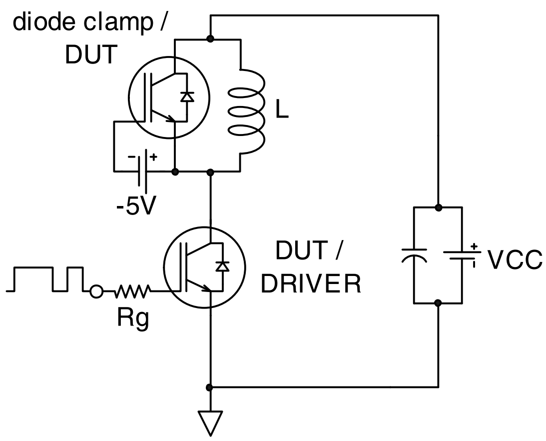


Fig.C.T.3 - Switching Loss Circuit

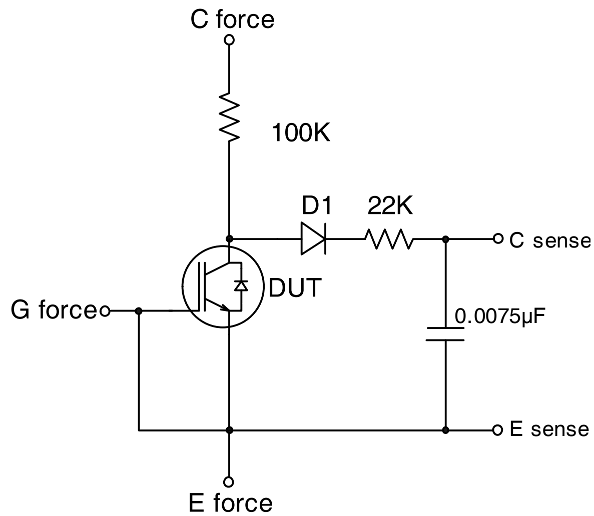


Fig.C.T.4 - BVCES Filter Circuit

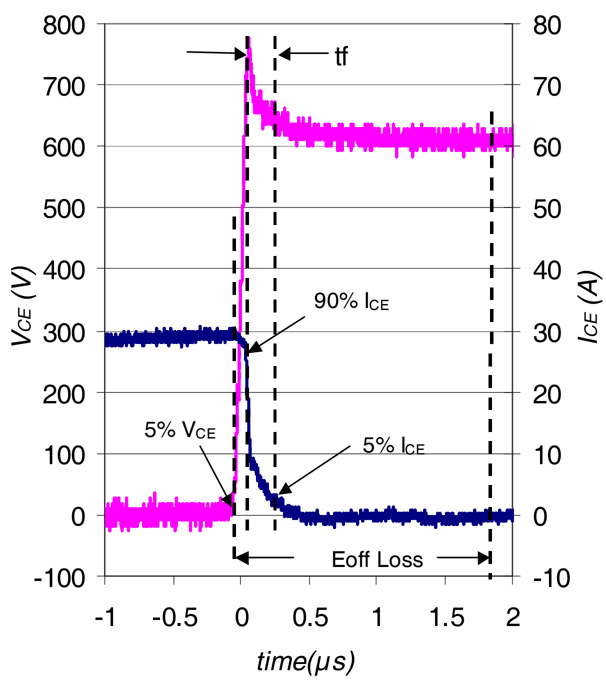
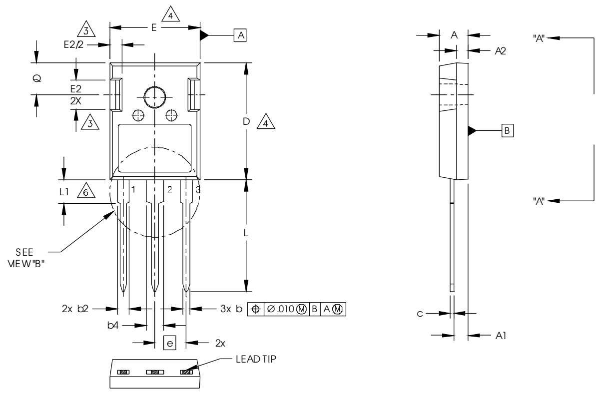


Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.3

TO-247AD Package Outline (Dimensions are shown in millimeters (inches))



SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.190	.204	4.83	5.20	
A1	.090	.100	2.29	2.54	
A2	.075	.085	1.91	2.16	
b	.042	.052	1.07	1.33	
b2	.075	.094	1.91	2.41	
b4	.113	.133	2.87	3.38	
c	.022	.026	0.55	0.68	
D	.819	.830	20.80	21.10	4
D1	.640	694	16.25	17.65	5
E	.620	.635	15.75	16.13	4
E1	.512	.570	13.00	14.50	
E2	.145	.196	3.68	5.00	
e	.215 Typical		5.45 Typical		
L	.780	.800	19.80	20.32	
L1	.161	.173	4.10	4.40	
ø P	.138	.143	3.51	3.65	
Q	.216	.236	5.49	6.00	
S	.238	.248	6.04	6.30	

LEAD ASSIGNMENTS

HEXFET

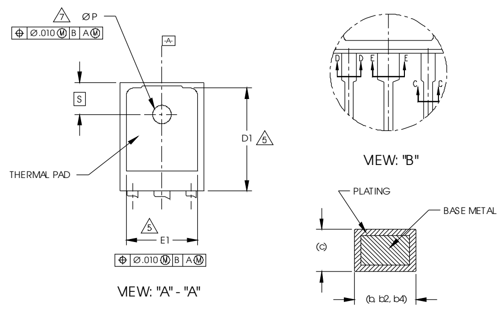
1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

IGBTs, CoPACK

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

DIODES

1.– ANODE/OPEN
2.– CATHODE
3.– ANODE



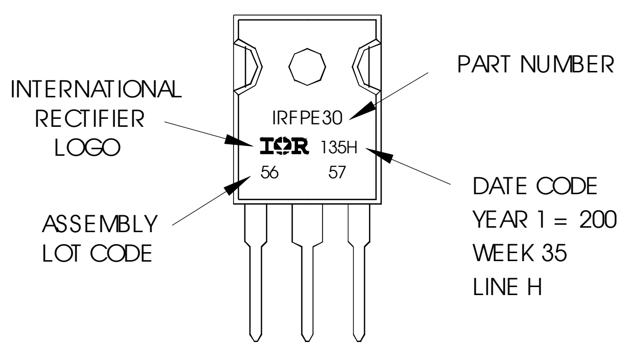
NOTES:

1 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2 DIMENSIONS ARE SHOWN IN INCHES AND MILLIMETERS.
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 ø P TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.

TO-247AD Part Marking Information

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-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-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.

Revision History

Date	Comments
4/25/2013	Corrected part number from "IRG7PH42UD1M" to "IRG7PH42UD1MPbF".

Data and specifications subject to change without notice.

International Rectifier

IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd.., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.

