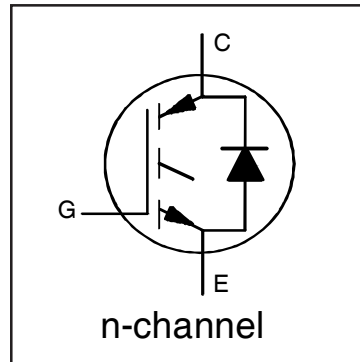


**INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRA-LOW V_F DIODE
FOR INDUCTION HEATING AND SOFT SWITCHING APPLICATIONS**

Features

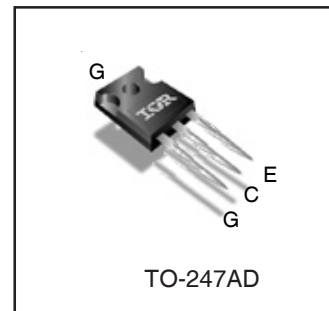
- Low V_{CE(ON)} trench IGBT technology
- Low switching losses
- Square RBSOA
- Ultra-low V_F Diode
- 1300Vpk repetitive transient capacity
- 100% of the parts tested for I_{LM} ①
- Positive V_{CE(ON)} temperature co-efficient
- Tight parameter distribution
- Lead free package



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



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	Parameter	Max.	Units
V _{CES}	Collector-to-Emitter Voltage	1200	V
V _{(BR) Transient}	Repetitive Transient Collector-to-Emitter Voltage ②	1300	
I _C @ T _C = 25°C	Continuous Collector Current	85 ③	A
I _C @ T _C = 100°C	Continuous Collector Current	45	
I _{CM}	Pulse Collector Current, V _{GE} =15V ②③	200	
I _{LM}	Clamped Inductive Load Current, V _{GE} =20V ①	120	
I _F @ T _C = 25°C	Diode Continuous Forward Current	70	
I _F @ T _C = 100°C	Diode Continuous 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	Parameter	Min.	Typ.	Max.	Units
R _{θJC} (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) ④	—	—	0.4	°C/W
R _{θJC} (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ④	—	—	1.05	
R _{θCS}	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
R _{θJA}	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	40	—	

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	1200	—	—	V	$V_{GE} = 0V, I_C = 100\mu\text{A}$ ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.2	—	V/°C	$V_{GE} = 0V, I_C = 2.0\text{mA}$ (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.7	2.0	V	$I_C = 30A, V_{GE} = 15V, T_J = 25^\circ\text{C}$
		—	2.0	—		$I_C = 30A, V_{GE} = 15V, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	$V_{CE} = V_{GE}, I_C = 1.0\text{mA}$
g_{fe}	Forward Transconductance	—	32	—	S	$V_{CE} = 50V, I_C = 30A, PW = 80\mu\text{s}$
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	100	μA	$V_{GE} = 0V, V_{CE} = 1200V$
		—	230	—		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	1.15	1.30	V	$I_F = 30A$
		—	1.10	—		$I_F = 30A, T_J = 150^\circ\text{C}$
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)	—	180	270	nC	$I_C = 30A$ $V_{GE} = 15V$ $V_{CC} = 600V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	24	36		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	70	110		
E_{off}	Turn-Off Switching Loss	—	1210	1450	μJ	$I_C = 30A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu\text{H}, T_J = 25^\circ\text{C}$ Energy losses include tail
$t_{d(off)}$	Turn-Off delay time	—	270	290	ns	$I_C = 30A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu\text{H}, T_J = 25^\circ\text{C}$
t_f	Fall time	—	35	43		
E_{off}	Turn-Off Switching Loss	—	1936	—	μJ	$I_C = 30A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu\text{H}, T_J = 150^\circ\text{C}$ Energy losses include tail
$t_{d(off)}$	Turn-Off delay time	—	300	—	ns	$I_C = 30A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu\text{H}, T_J = 150^\circ\text{C}$
t_f	Fall time	—	160	—		
C_{ies}	Input Capacitance	—	3390	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0\text{Mhz}$
C_{oes}	Output Capacitance	—	130	—		
C_{res}	Reverse Transfer Capacitance	—	83	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 120A$ $V_{CC} = 960V, V_p = 1200V$ $R_g = 10\Omega, V_{GE} = +20V \text{ to } 0V$

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 22\mu\text{H}, R_G = 10\Omega$.
- 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 $V_{GE} = 0V, T_J = 75^\circ\text{C}, PW \leq 10\mu\text{s}$.

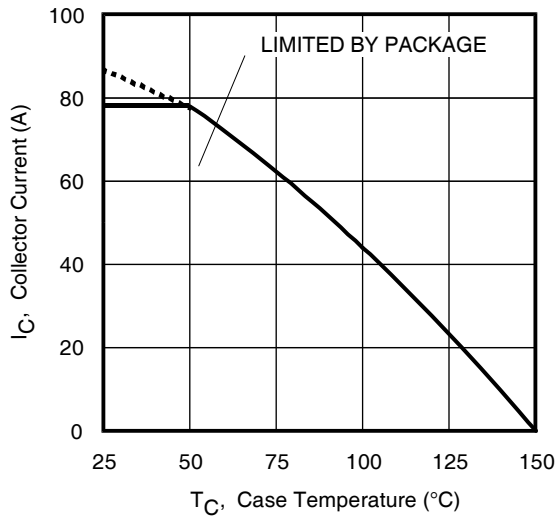


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

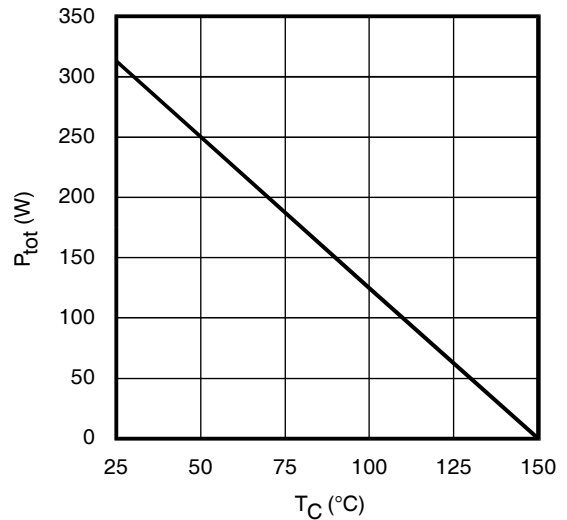


Fig. 2 - Power Dissipation vs. Case Temperature

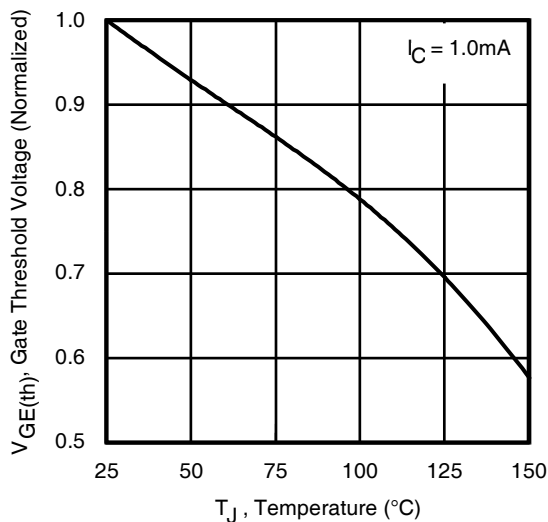


Fig. 3 - Typical Gate Threshold Voltage (Normalized) vs. Junction Temperature

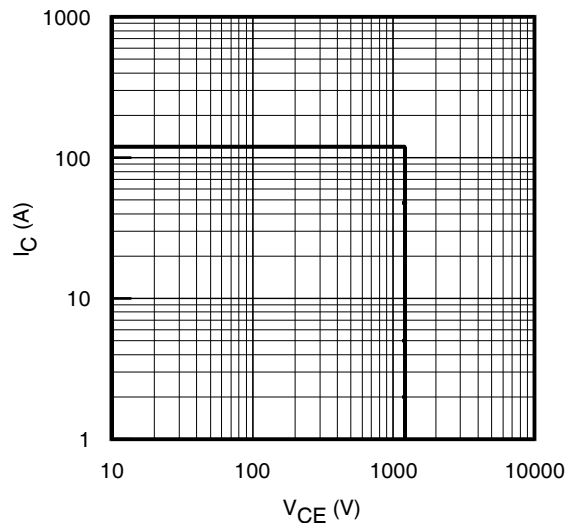


Fig. 4 - Reverse Bias SOA
 $T_J = 150^{\circ}\text{C}; V_{GE} = 20\text{V}$

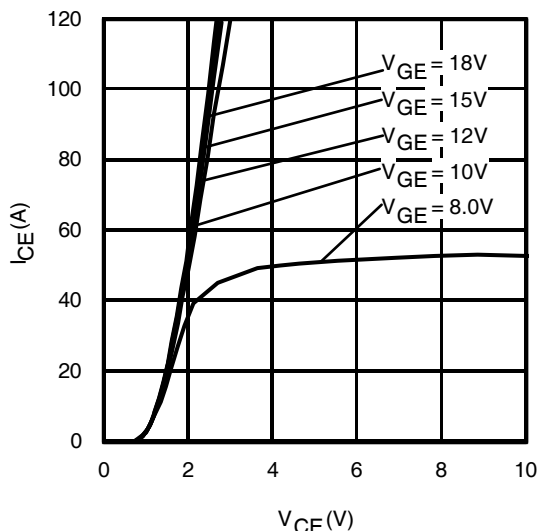


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^{\circ}\text{C}; t_p = 80\mu\text{s}$

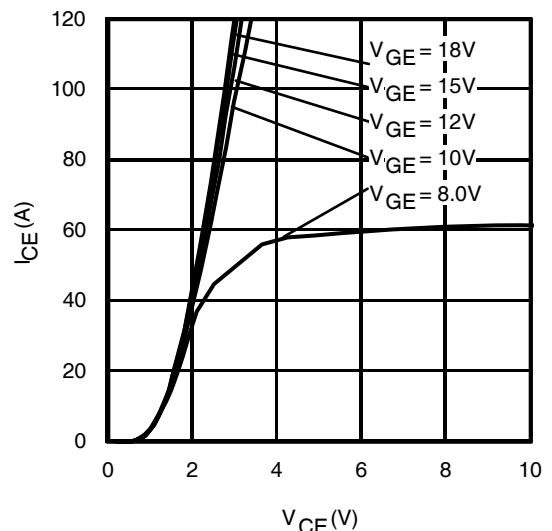


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^{\circ}\text{C}; t_p = 80\mu\text{s}$

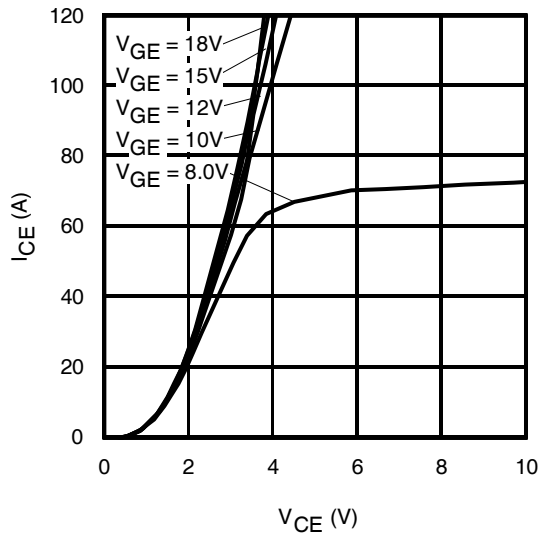


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 150^{\circ}\text{C}$; $t_p = 80\mu\text{s}$

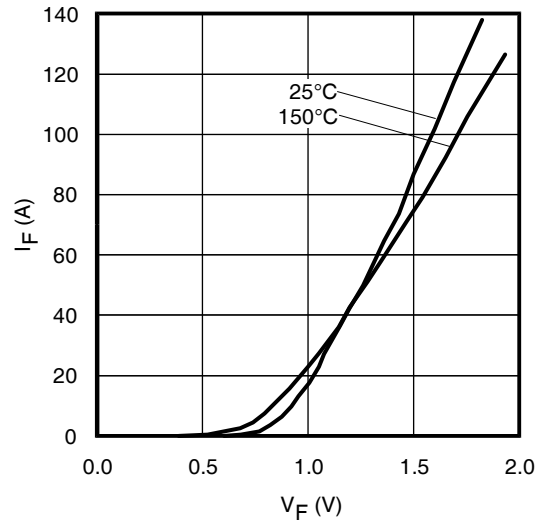


Fig. 8 - Typ. Diode Forward Voltage Drop Characteristics

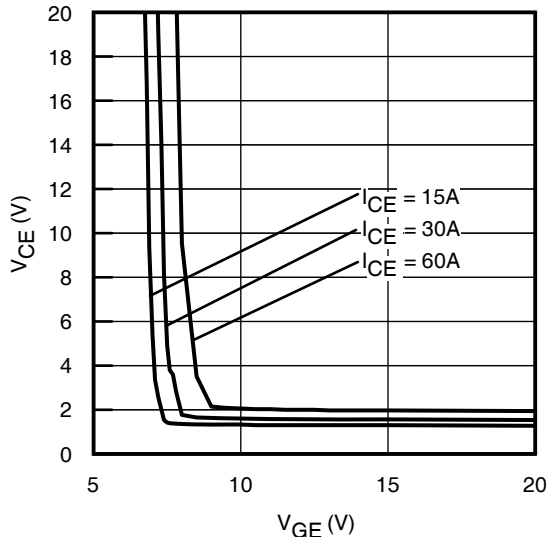


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^{\circ}\text{C}$

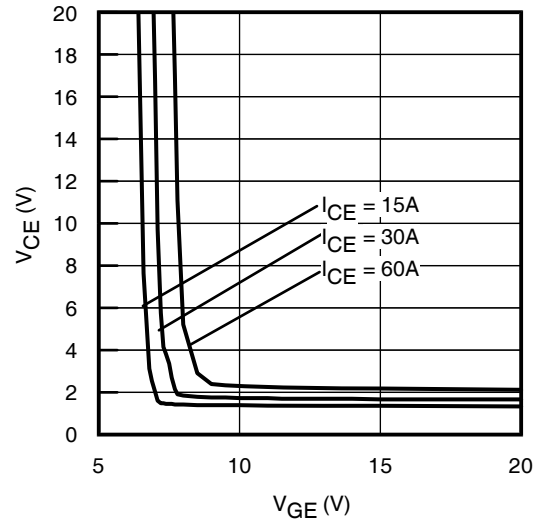


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^{\circ}\text{C}$

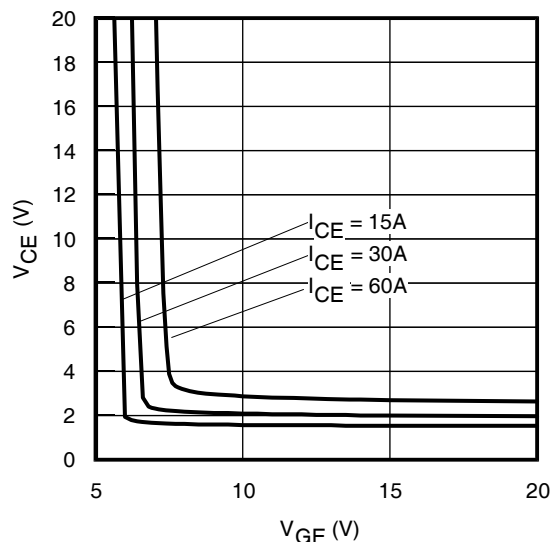


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^{\circ}\text{C}$

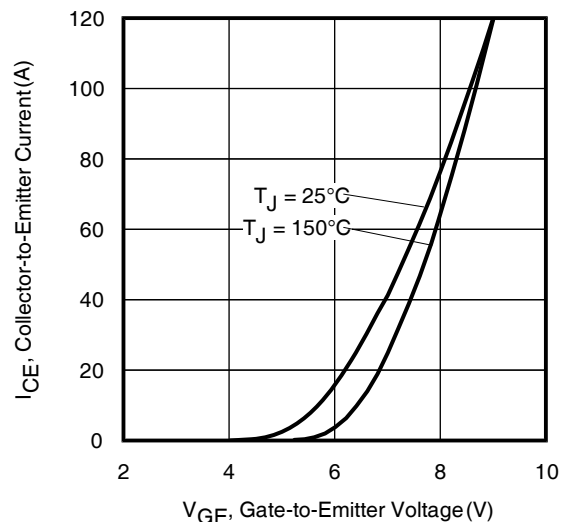
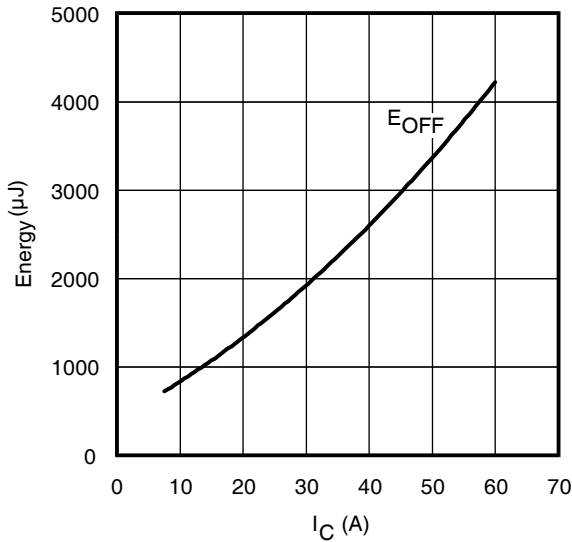
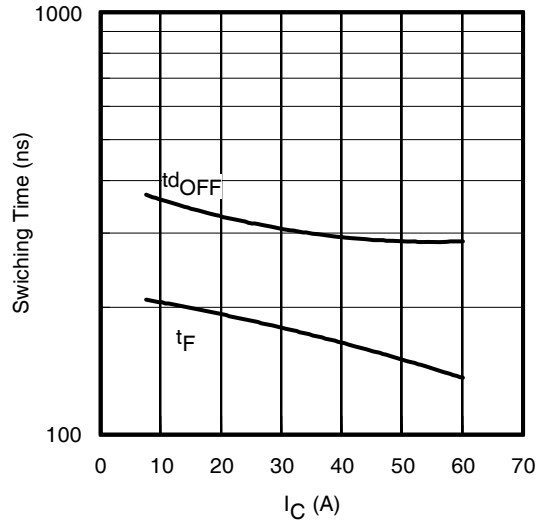
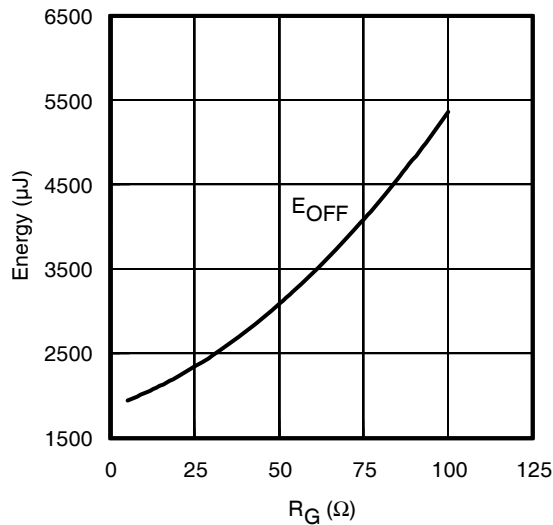
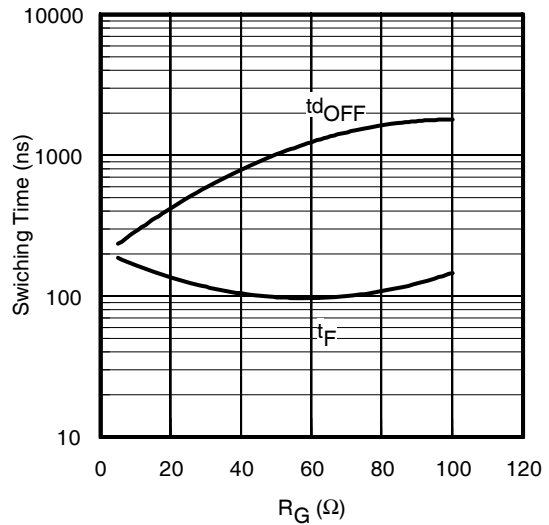
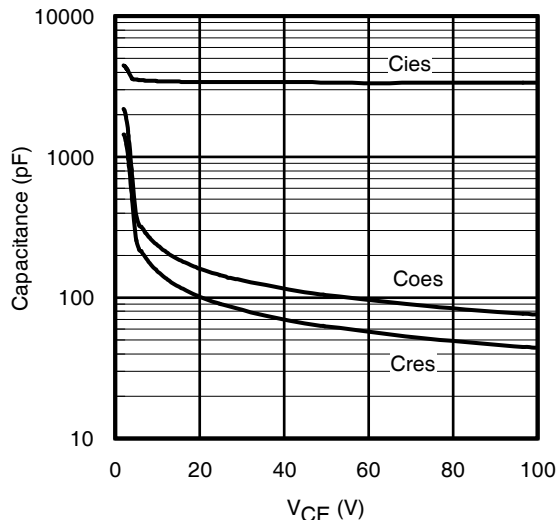
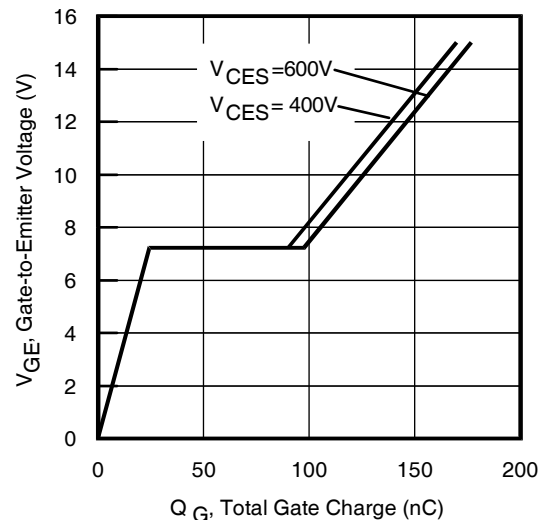
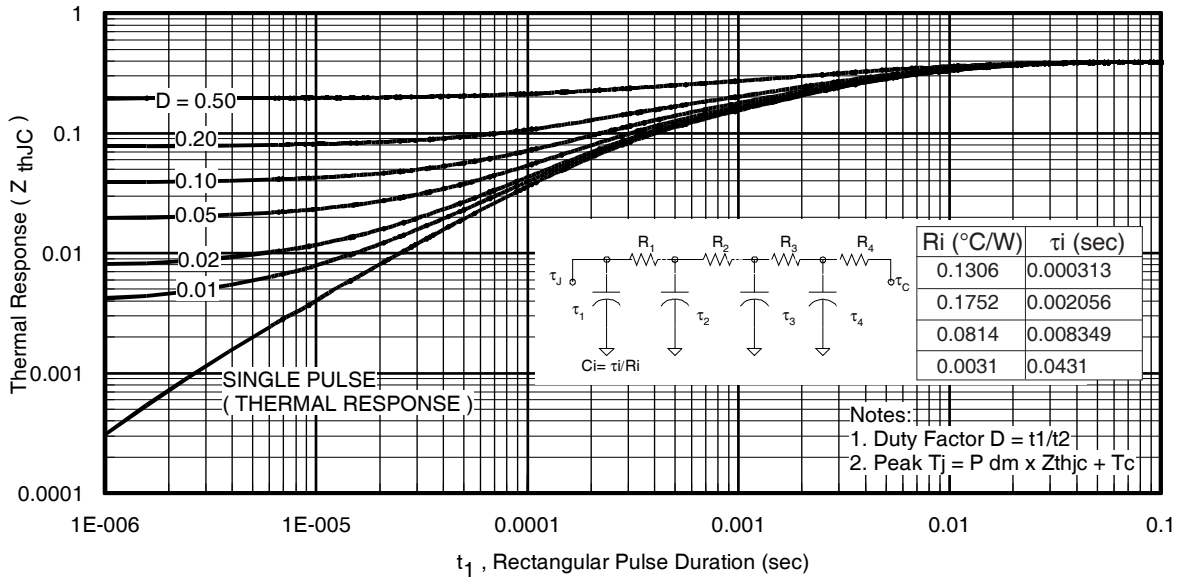
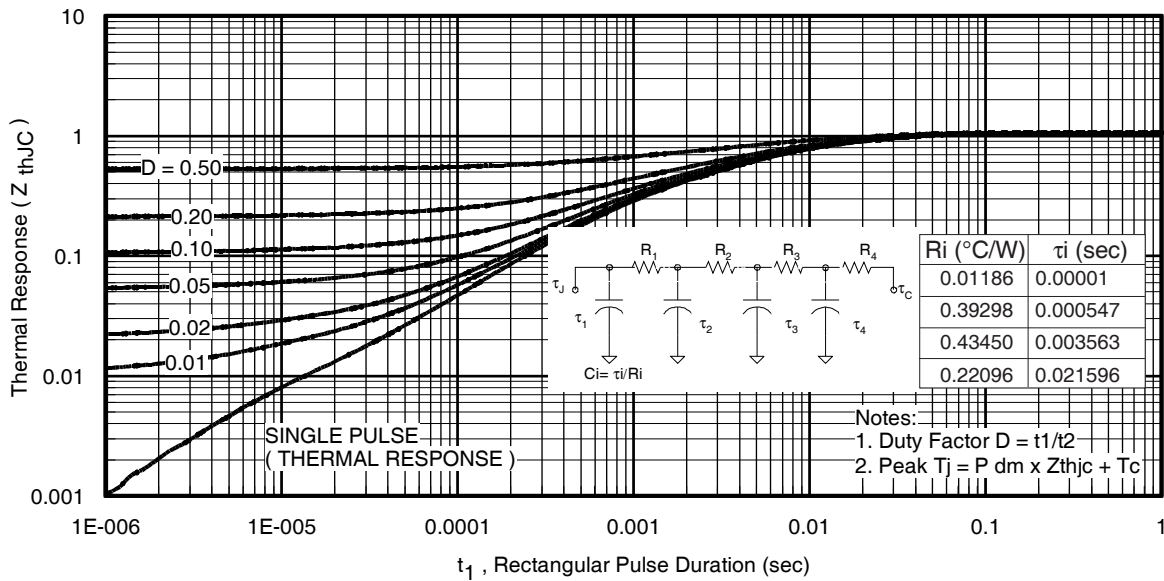
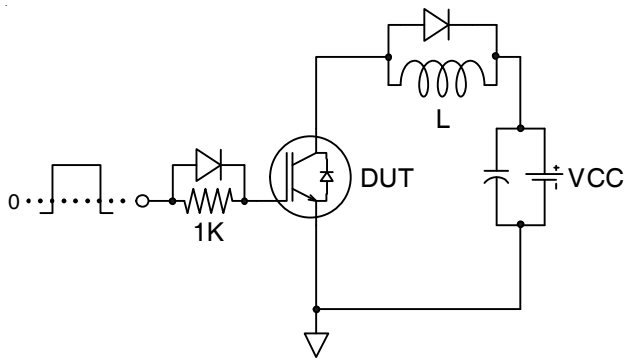
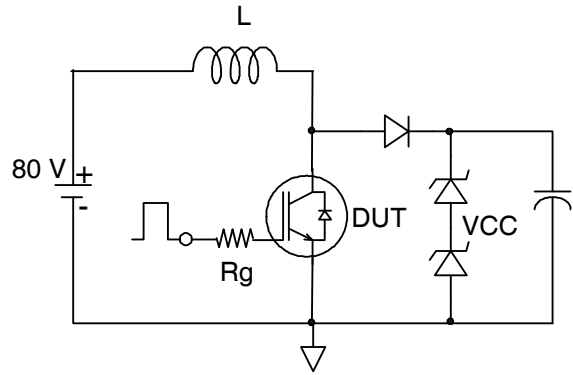
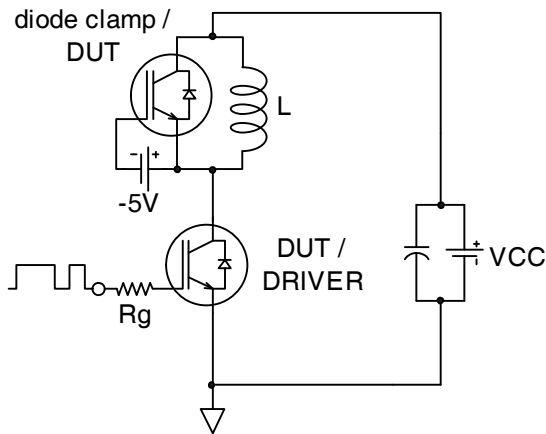
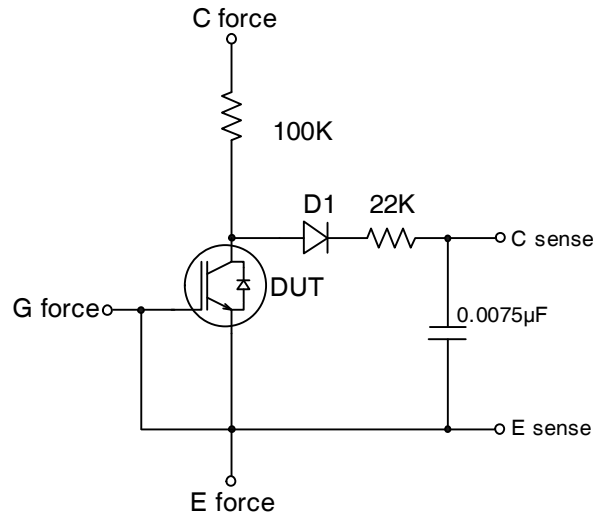
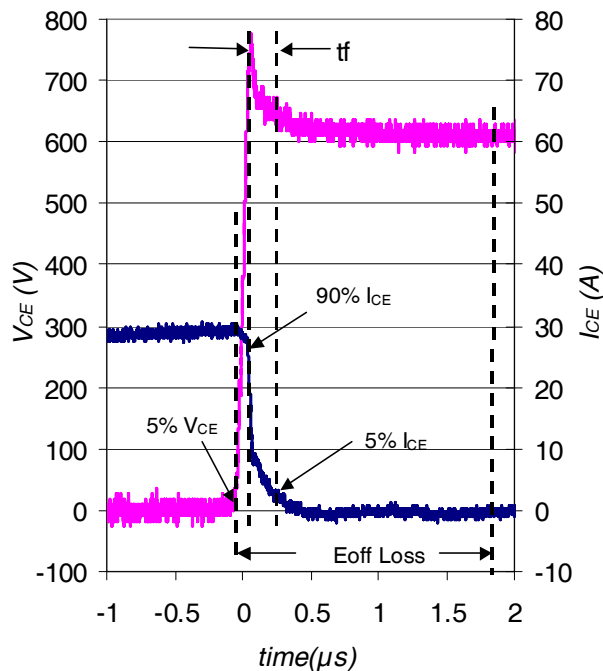
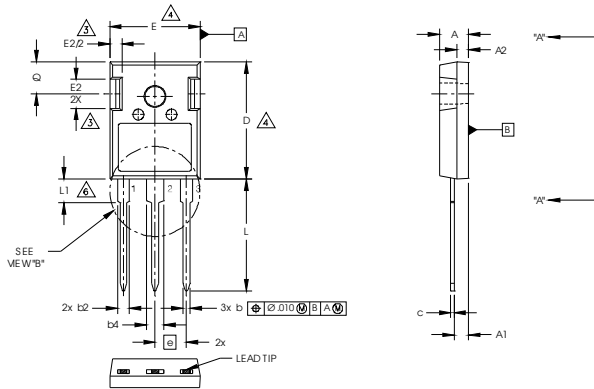


Fig. 12 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$


Fig. 13 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}; L = 200\mu\text{H}; V_{CE} = 600\text{V}, R_G = 10\Omega; V_{GE} = 15\text{V}$

Fig. 14 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}; L = 200\mu\text{H}; V_{CE} = 600\text{V}, R_G = 10\Omega; V_{GE} = 15\text{V}$

Fig. 15 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}; L = 200\mu\text{H}; V_{CE} = 600\text{V}, I_{CE} = 30\text{A}; V_{GE} = 15\text{V}$

Fig. 16 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}; L = 200\mu\text{H}; V_{CE} = 600\text{V}, I_{CE} = 30\text{A}; V_{GE} = 15\text{V}$

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

Fig. 18 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 30\text{A}; L = 680\mu\text{H}$


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

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
 @ $T_J = 150^\circ\text{C}$ 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	
∅ P	.138	.143	3.51	3.65	
Q	.216	.236	5.49	6.00	
S	.238	.248	6.04	6.30	

LEAD ASSIGNMENTS
HEXFET

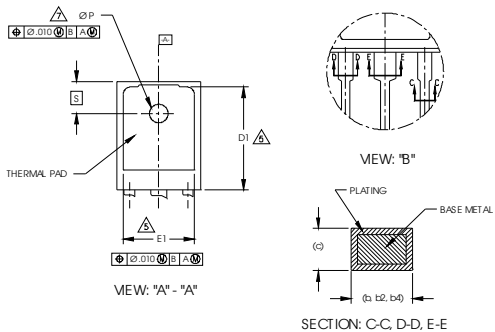
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

IGBTs, CoPACK

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

DIODES

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

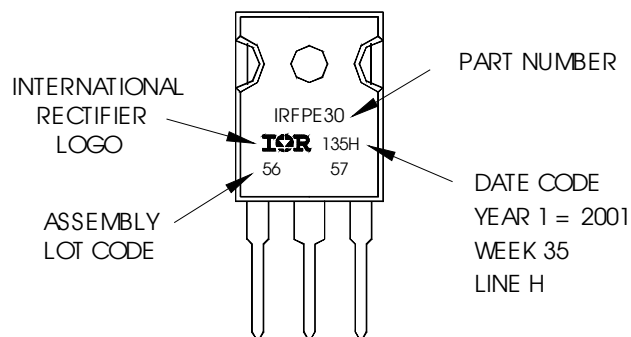

NOTES:

- 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 ∅ 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

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