

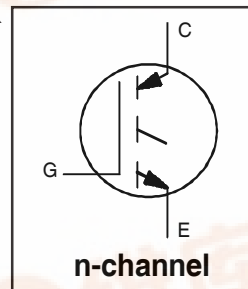
International
IR Rectifier

PROVISIONAL

PD - 97289
IRG4PC20UPbF
UltraFast Speed IGBT

INSULATED GATE BIPOLAR TRANSISTOR Features

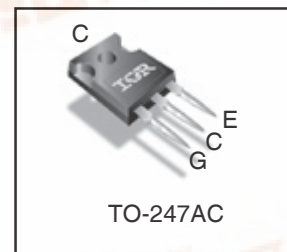
- UltraFast: optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.85V$
@ $V_{GE} = 15V, I_C = 6.5A$

Benefits

- Generation 4 IGBTs offer highest efficiency available
- IGBTs optimized for specified application conditions
- Designed to be a "drop-in" replacement for equivalent industry-standard Generation 3 IR IGBTs



G	C	E
Gate	Collector	Emitter

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current, $V_{GE} @ 15V$	13	A
$I_C @ T_C = 100^\circ C$	Continuous Collector, $V_{GE} @ 15V$	6.5	
I_{CM}	Pulsed Collector Current ①	52	
I_{LM}	Clamped Inductive Load Current ②	52	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	5.0	mJ
$P_D @ T_C = 25^\circ C$	Power Dissipation	60	W
$P_D @ T_C = 100^\circ C$	Power Dissipation	24	
T_J	Operating Junction and	-55 to + 150	$^\circ C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature for 10 seconds	300 (0.063 in.) (1.6mm from case)	
	Mounting Torque, 6-32 or M3 Screw	10lb·in (1.1N·m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.1	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	40	
Wt	Weight	6.0 (0.21)	—	g (oz)



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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	600	—	—	V	$V_{GE} = 0V, I_{CE} = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage④	18	—	—	V	$V_{GE} = 0V, I_{CE} = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.69	—	V/°C	$V_{GE} = 0V, I_{CE} = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.85	2.1	V	$V_{GE} = 15V, I_{CE} = 6.5A$
		—	2.27	—		$V_{GE} = 15V, I_{CE} = 13A$
		—	1.87	—		$V_{GE} = 15V, I_{CE} = 6.5A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	$V_{CE} = V_{GE}, I_{CE} = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-11	—	mV/°C	
g_{fe}	Forward Transconductance ⑤	1.4	4.3	—	S	$V_{CE} = 100V, I_{CE} = 6.5A$
I_{CES}	Collector-to-Emitter Leakage Current	—	—	250	μA	$V_{CE} = 600V, V_{GE} = 0V$
		—	—	2.0		$V_{CE} = 10V, V_{GE} = 0V, T_J = 25^\circ\text{C}$
		—	—	1000		$V_{CE} = 600V, V_{GE} = 0V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Forward Leakage	—	—	100	nA	$V_{GE} = 20V$
	Gate-to-Emitter Reverse Leakage	—	—	-100		$V_{GE} = -20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Q_g	Total Gate Charge (turn-on)	—	27	41	nC	$V_{CE} = 400V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	4.5	6.8		$I_C = 6.5A$
Q_{gc}	Gate-to-Collector Charge	—	10	16		$V_{GE} = 15V$ ③
$t_{d(on)}$	Turn-On delay time	—	21	—	ns	$I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ $T_J = 25^\circ\text{C}$
t_r	Rise time	—	13	—		
$t_{d(off)}$	Turn-Off delay time	—	86	130		
t_f	Fall time	—	120	180		
$E_{(on)}$	Turn-On Switching Loss	—	0.10	—	mJ	Energy losses include "tail"
$E_{(off)}$	Turn-Off Switching Loss	—	0.12	—		
E_{ts}	Total Switching Loss	—	0.22	0.4		
$t_{d(on)}$	Turn-On delay time	—	20	—	ns	$I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ $T_J = 150^\circ\text{C}$
t_r	Rise time	—	14	—		
$t_{d(off)}$	Turn-Off delay time	—	190	—		
t_f	Fall time	—	140	—		
E_{ts}	Total Switching Loss	—	0.42	—	mJ	Energy losses include "tail"
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	530	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	39	—		$V_{CE} = 30V$
C_{res}	Reverse Transfer Capacitance	—	7.4	—		$f = 1.0MHz$

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature.
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 50\Omega$.
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu s$, single shot.

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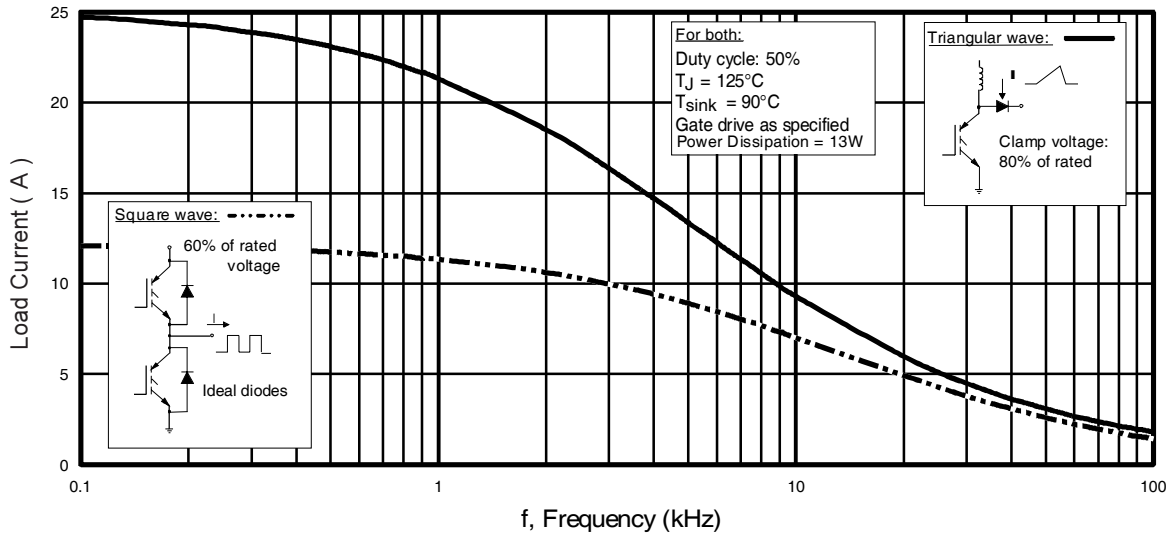


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

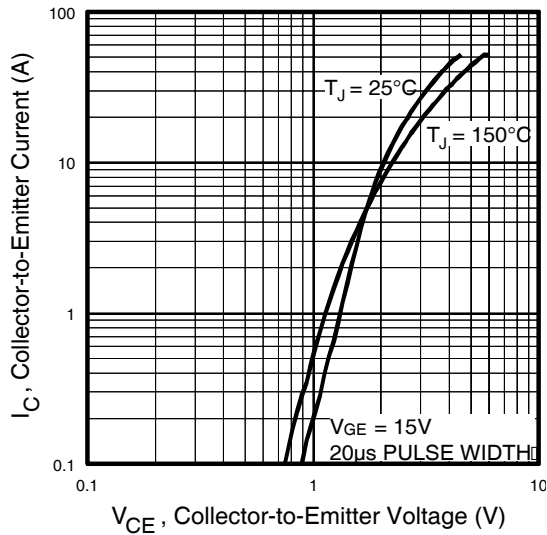


Fig. 2 - Typical Output Characteristics

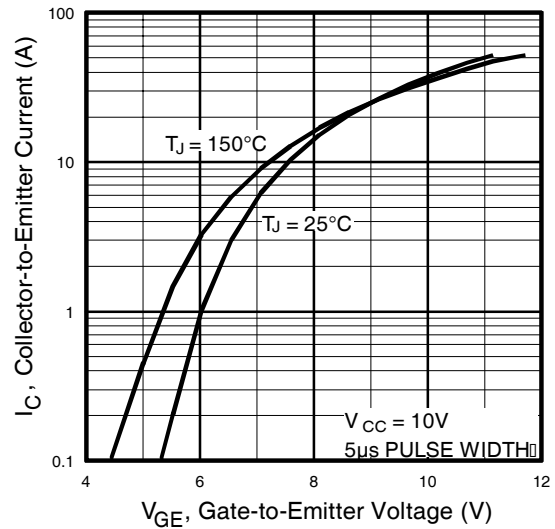


Fig. 3 - Typical Transfer Characteristics

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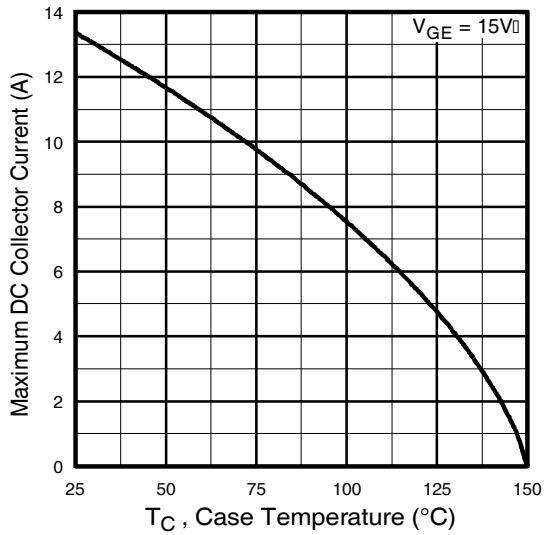


Fig. 4 - Maximum Collector Current vs. Case Temperature

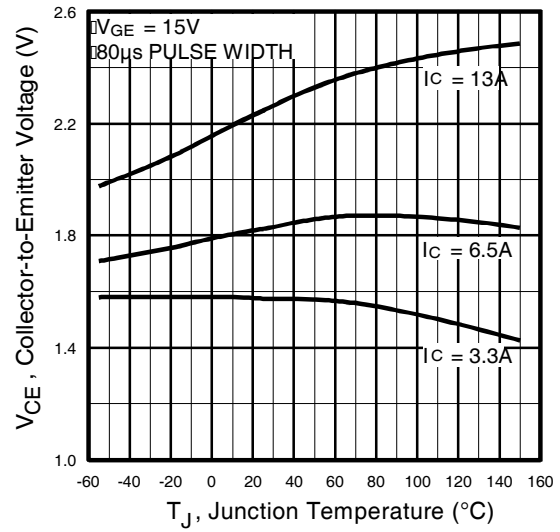


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

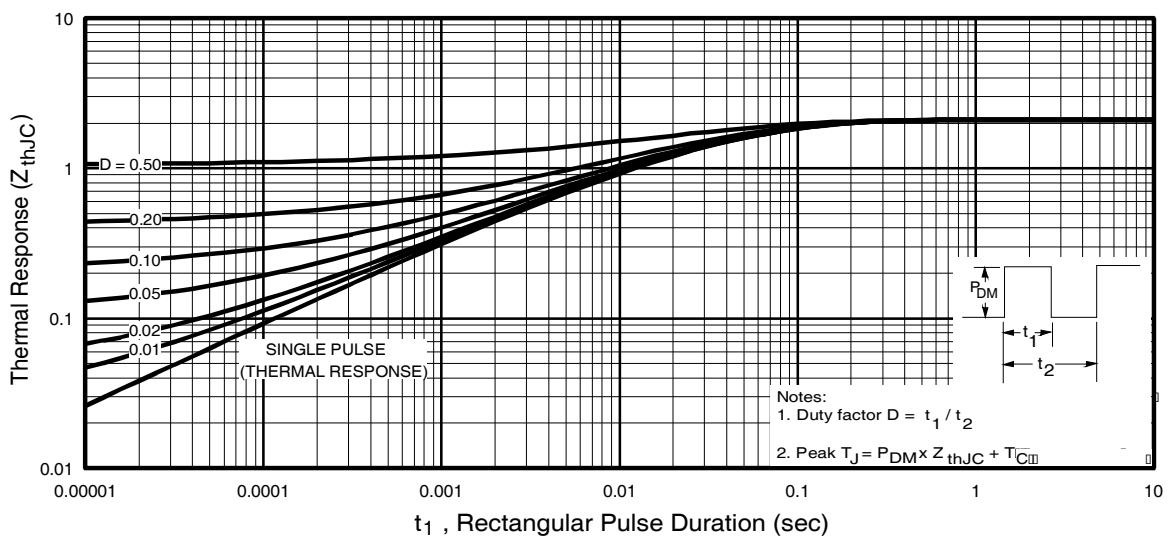
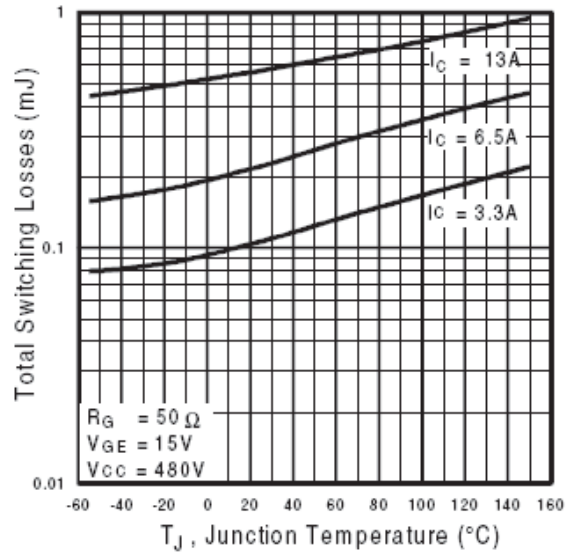
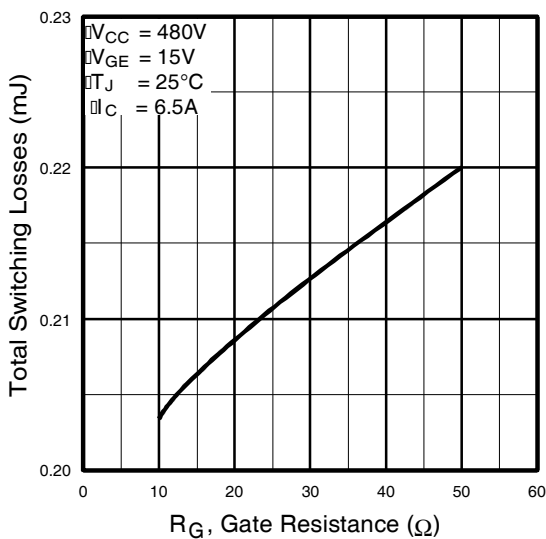
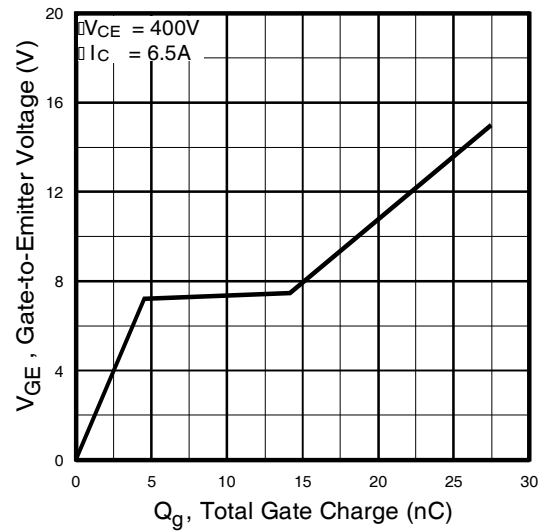
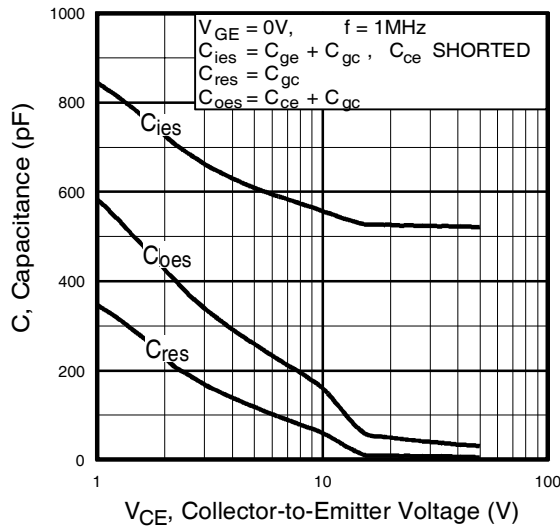


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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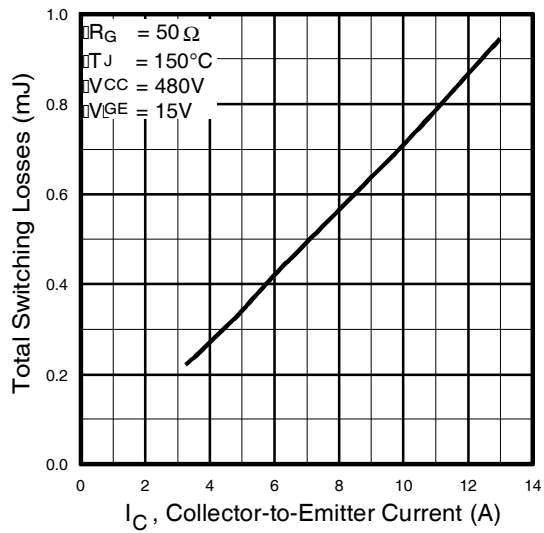


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

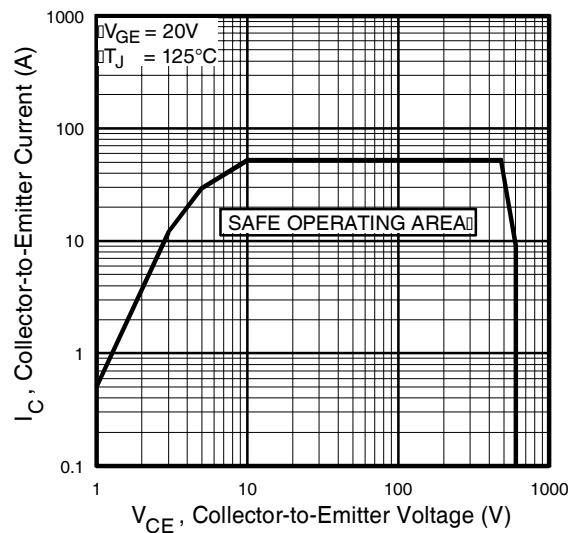


Fig. 12 - Turn-Off SOA

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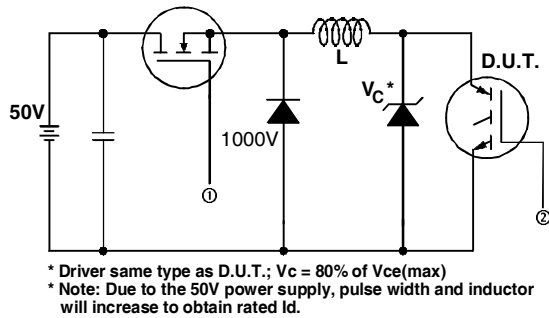


Fig. 13a - Clamped Inductive Load Test Circuit

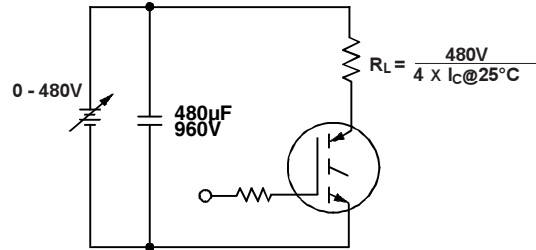


Fig. 13b - Pulsed Collector Current Test Circuit

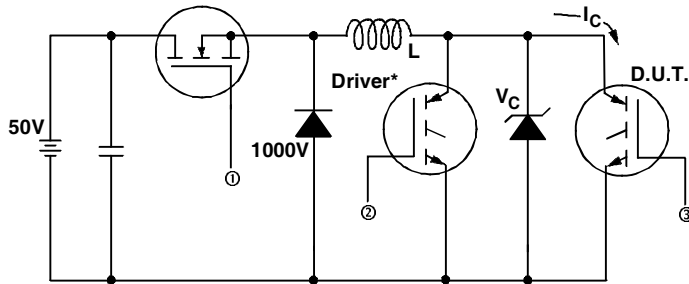


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., $V_C = 480V$

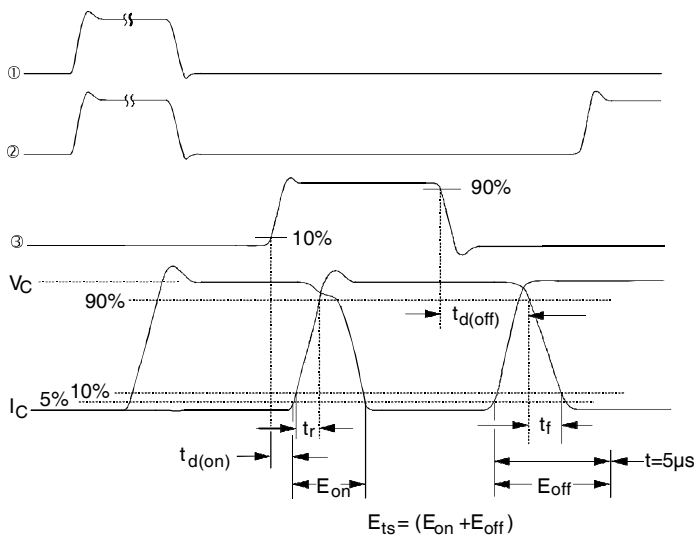


Fig. 14b - Switching Loss Waveforms

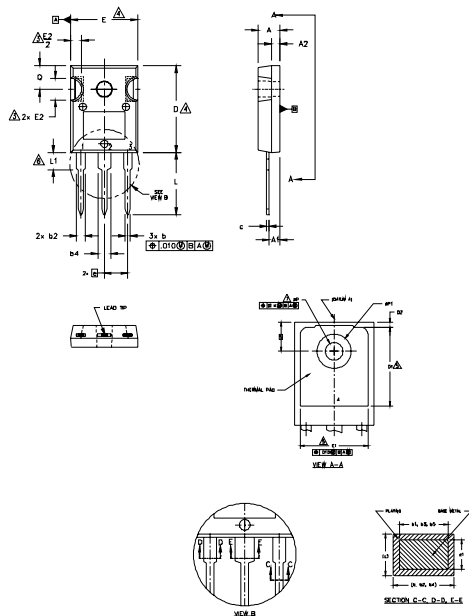
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TO-247AC Package Outline

Dimensions are shown in millimeters (inches)

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- 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	
Ø	.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

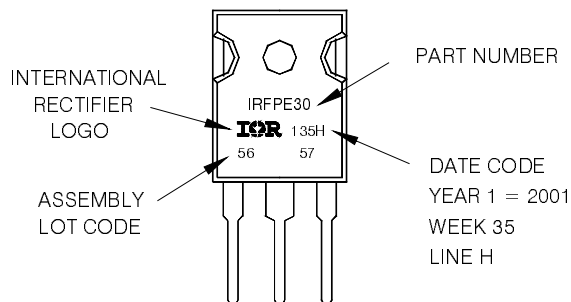
DIODES

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

TO-247AC Part Marking Information

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/>

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial market.
Qualification Standards can be found on IR's Web site.

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