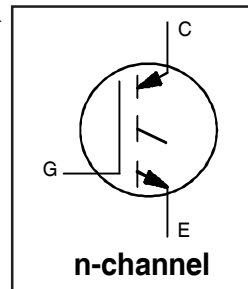


INSULATED GATE BIPOLAR TRANSISTOR

Features

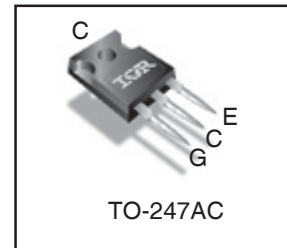
- UltraFast: optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Lead-Free



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

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	°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)	N

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.1	°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)

IRG4PC20UPbF

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 Voltage ^①	18	—	—	V	$V_{GE} = 0V, I_{CE} = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.69	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_{CE} = 1.0mA$
$V_{CE(on)}$	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/ $^\circ\text{C}$	
g_{fe}	Forward Transconductance ^②	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	$V_{CE} = 400V$ $I_C = 6.5A$ $V_{GE} = 15V$ ^③
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	4.5	6.8		
Q_{gc}	Gate-to-Collector Charge	—	10	16		
$t_{d(on)}$	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	$I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ $T_J = 150^\circ\text{C}$ Energy losses include "tail"
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	
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	530	—	pF	$V_{GE} = 0V$ $V_{CE} = 30V$ $f = 1.0MHz$
C_{oes}	Output Capacitance	—	39	—		
C_{res}	Reverse Transfer Capacitance	—	7.4	—		

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.

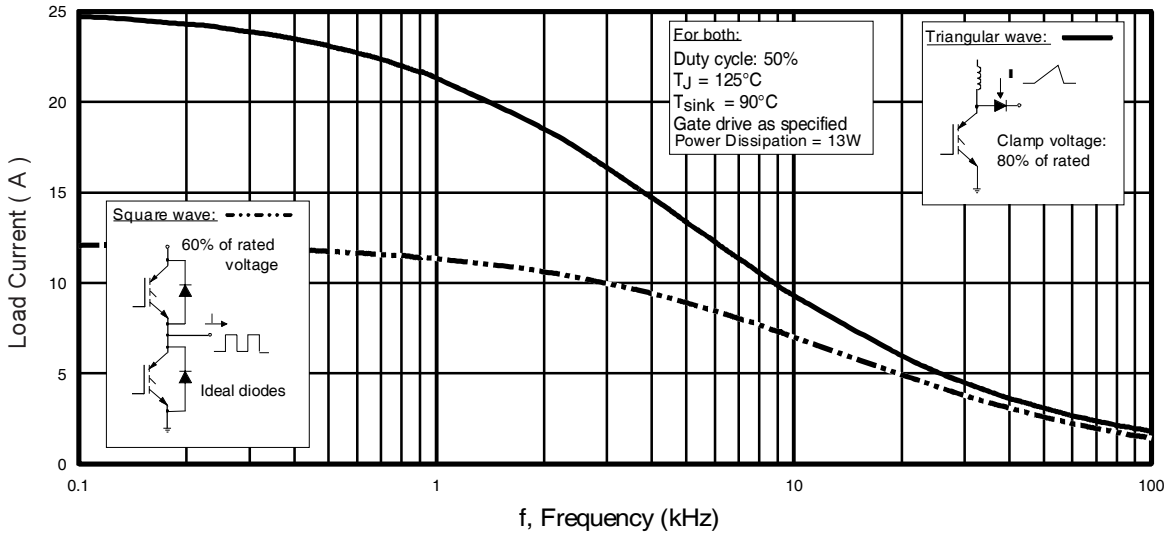


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

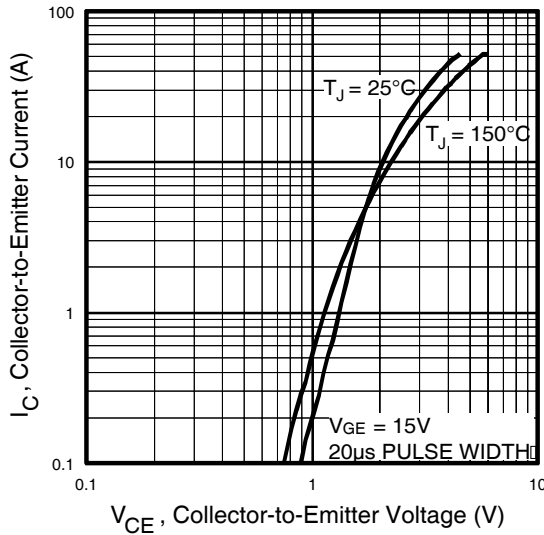


Fig. 2 - Typical Output Characteristics

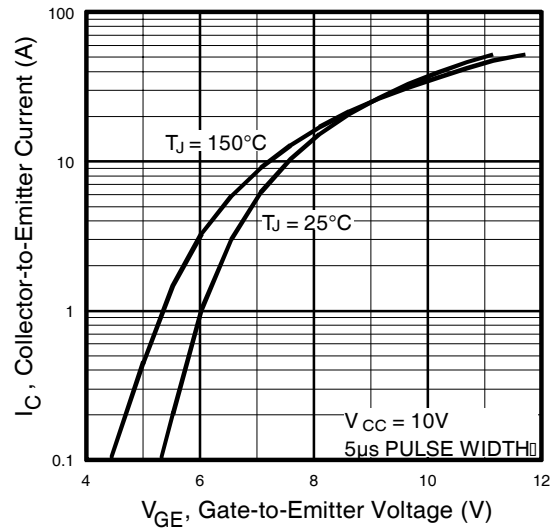


Fig. 3 - Typical Transfer Characteristics

IRG4PC20UPbF

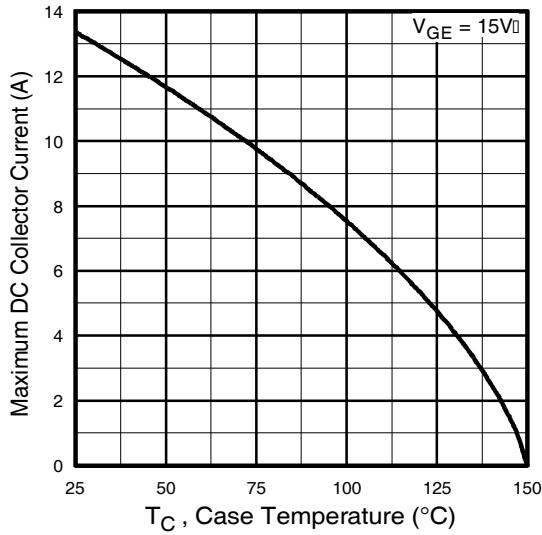


Fig. 4 - Maximum Collector Current vs. Case Temperature

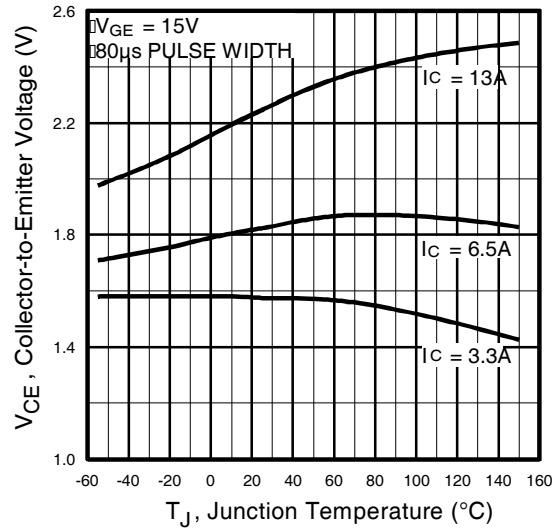


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

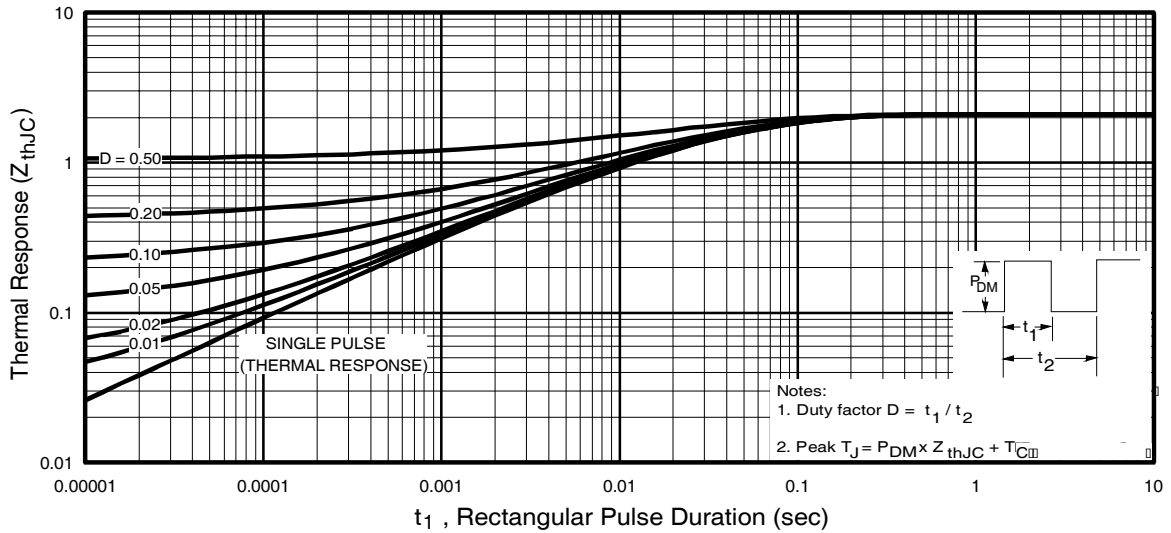


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRG4PC20UPbF

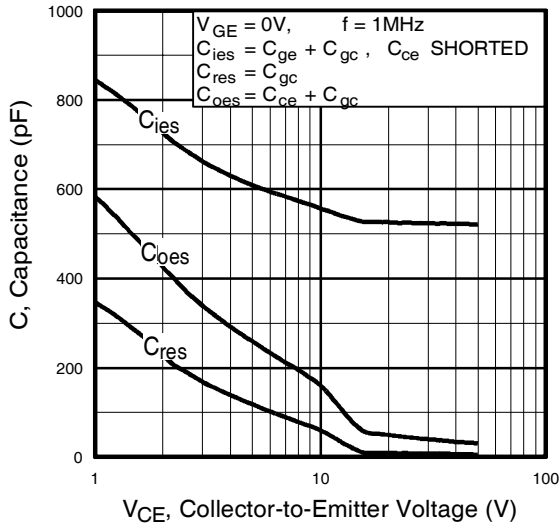


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

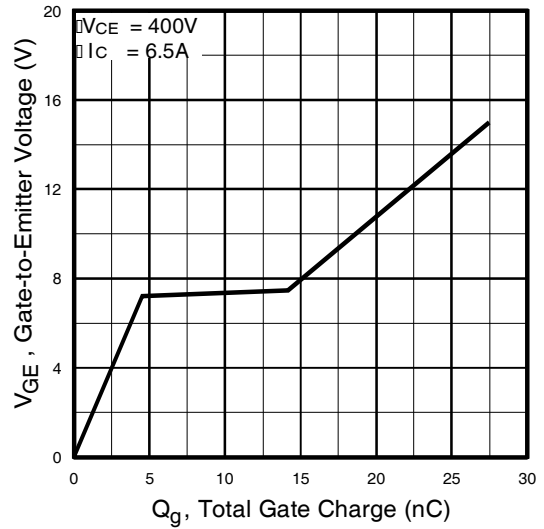


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

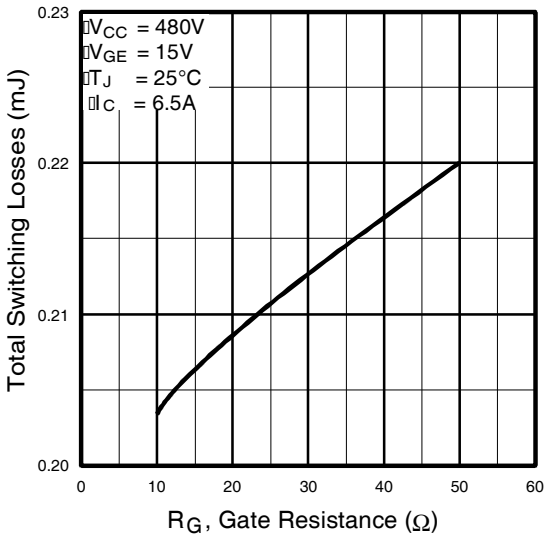


Fig. 9 - Typical Switching Losses vs. Gate Resistance

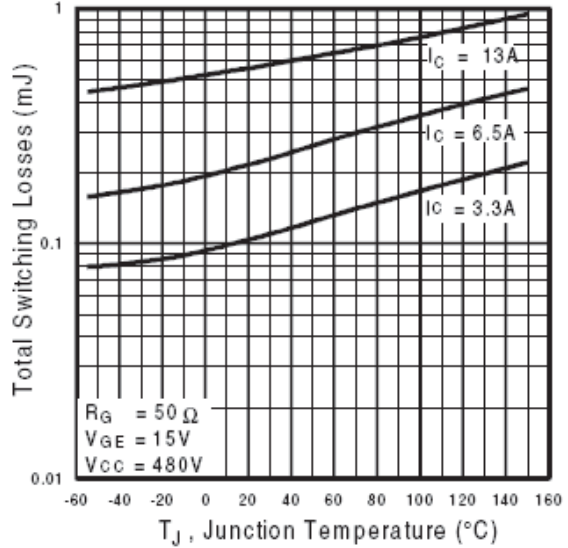


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4PC20UPbF

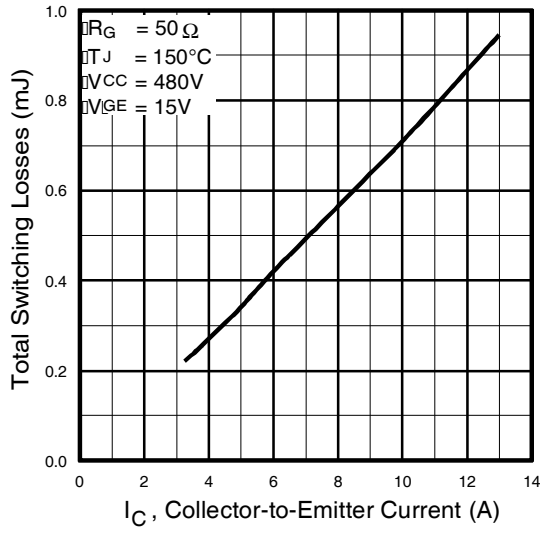


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

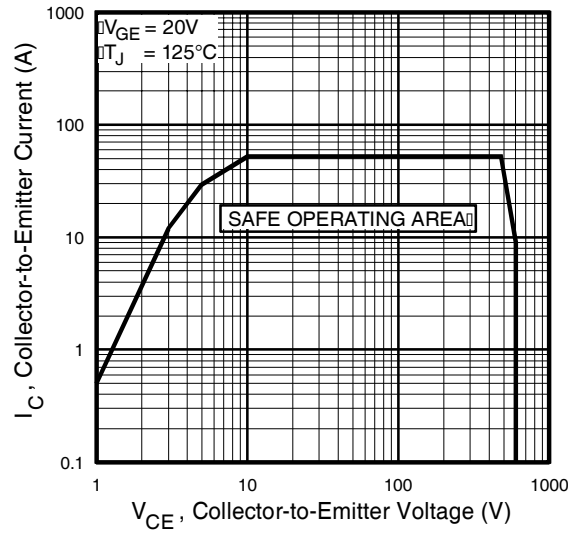


Fig. 12 - Turn-Off SOA

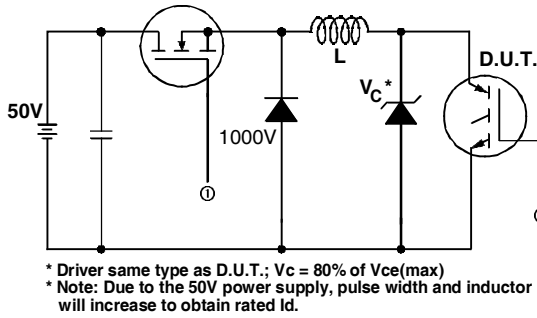


Fig. 13a - Clamped Inductive Load Test Circuit

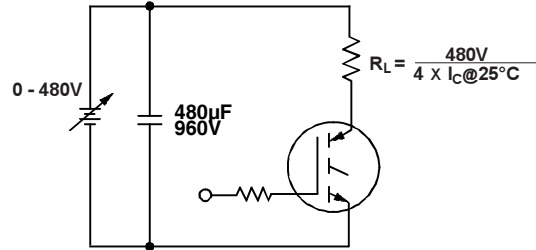


Fig. 13b - Pulsed Collector Current Test Circuit

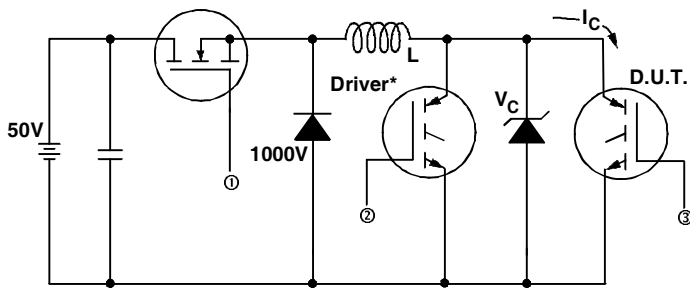


Fig. 14a - Switching Loss Test Circuit

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

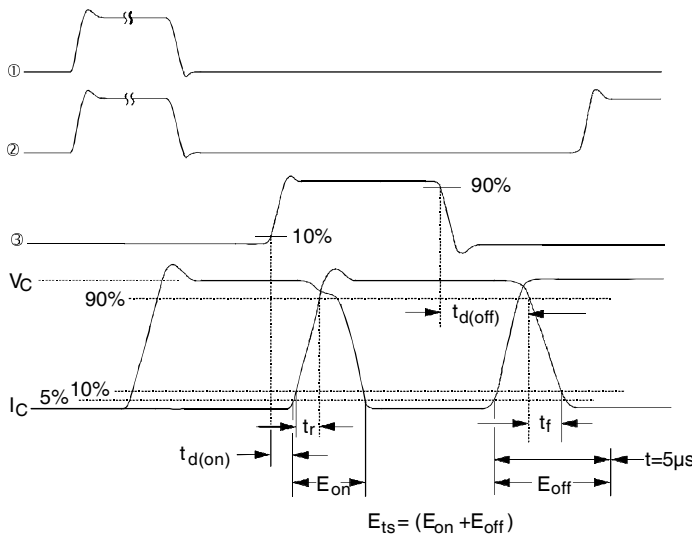


Fig. 14b - Switching Loss Waveforms

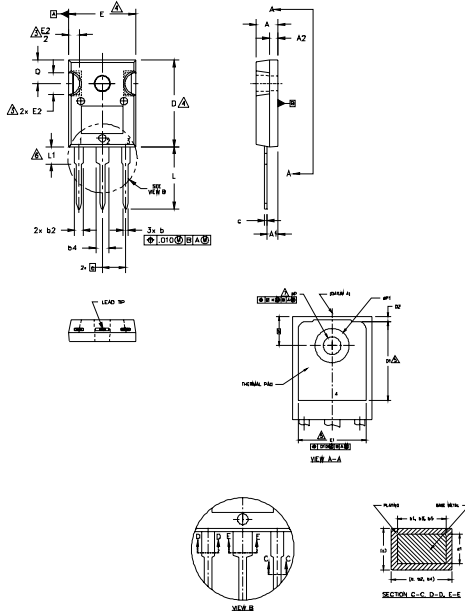
PROVISIONAL

IRG4PC20UPbF

International
IR Rectifier

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. ϕP 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	INCHES		MILLIMETERS		NOTES
	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		
ϕ	.010		0.25		
L	.559	.634	14.20	16.10	
L1	.146	.169	3.71	4.29	
ϕP	.140	.144	3.56	3.66	
$\phi P1$	-	.291	-	7.39	
O	.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

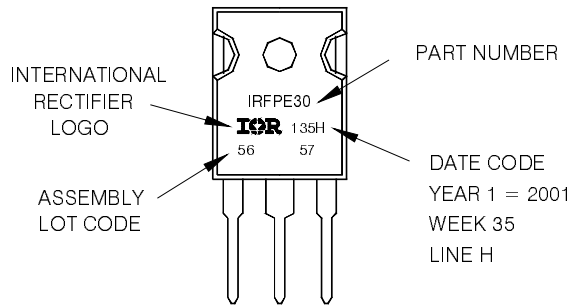
DIODES

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

TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFP30
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,

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 07/07

www.irf.com