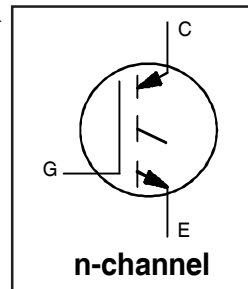


**INSULATED GATE BIPOLAR TRANSISTOR**

**Features**

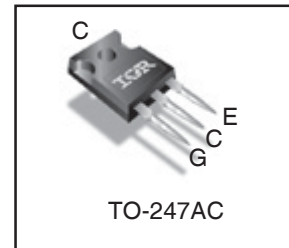
- UltraFast: optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Lead-Free



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

**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



<b>G</b>	<b>C</b>	<b>E</b>
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	$\pm 20$	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		
	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)

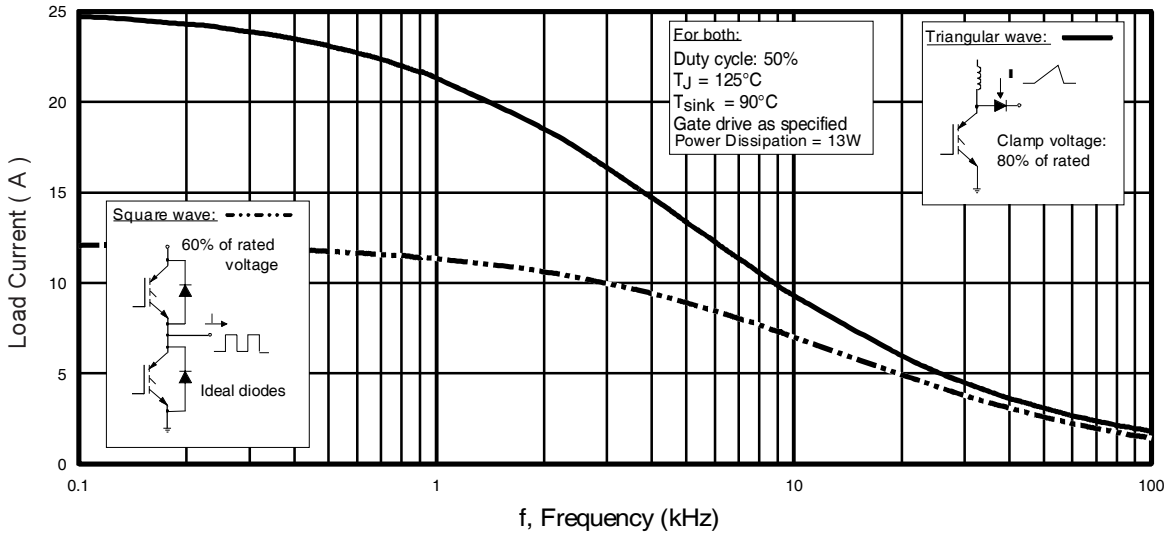
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_{CE} = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage <sup>①</sup>	18	—	—	V	$V_{GE} = 0V, I_{CE} = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	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 <sup>②</sup>	1.4	4.3	—	S	$V_{CE} = 100V, I_{CE} = 6.5A$
$I_{CES}$	Collector-to-Emitter Leakage Current	—	—	250	$\mu A$	$V_{CE} = 600V, V_{GE} = 0V$
		—	—	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)

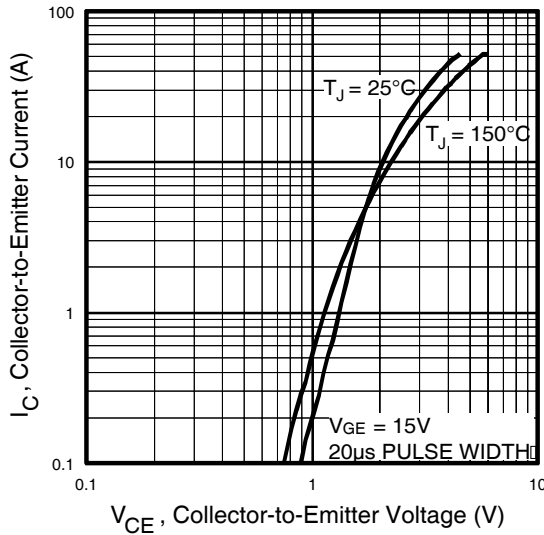
$Q_g$	Total Gate Charge (turn-on)	—	27	41	nC	$V_{CE} = 400V$ $I_C = 6.5A$ $V_{GE} = 15V$ <sup>③</sup>
$Q_{ge}$	Gate-to-Emitter Charge (turn-on)	—	4.5	6.8		
$Q_{gc}$	Gate-to-Collector Charge	—	10	16		
$t_{d(on)}$	Turn-On delay time	—	21	—	ns	$I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ $T_J = 25^\circ\text{C}$
$t_r$	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:

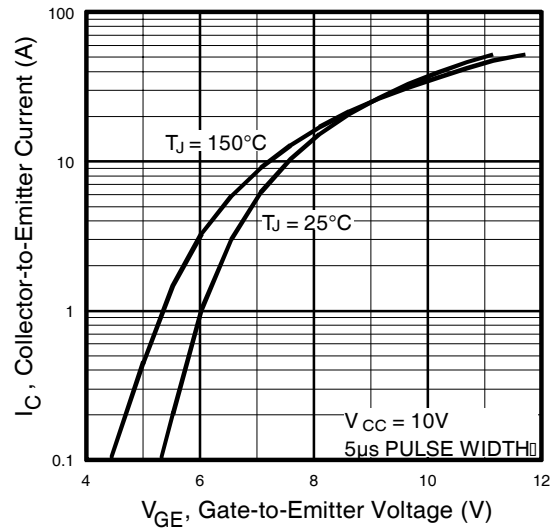
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature.
- ②  $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 50\Omega$ .
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$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

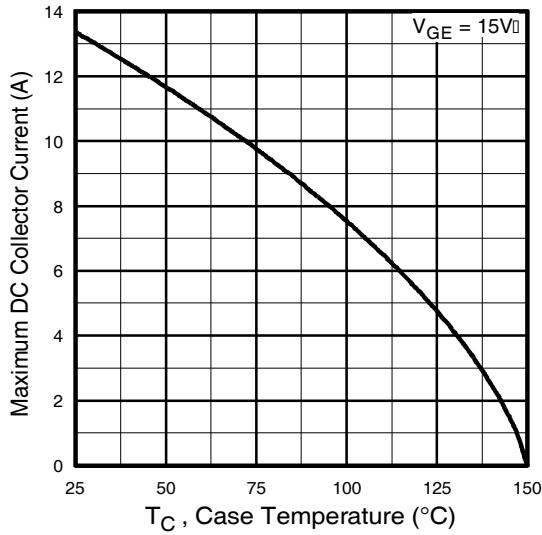


**Fig. 2 - Typical Output Characteristics**

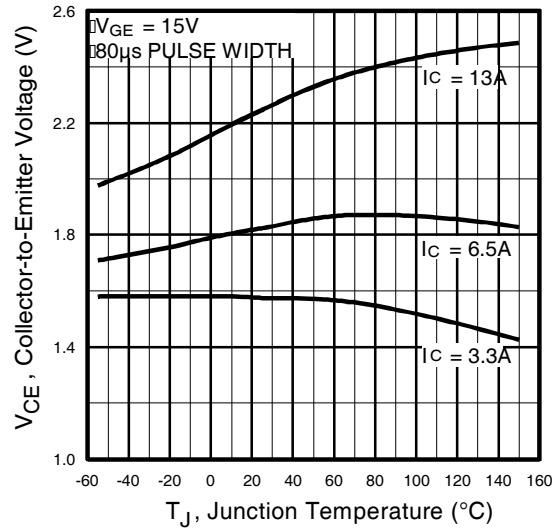


**Fig. 3 - Typical Transfer Characteristics**

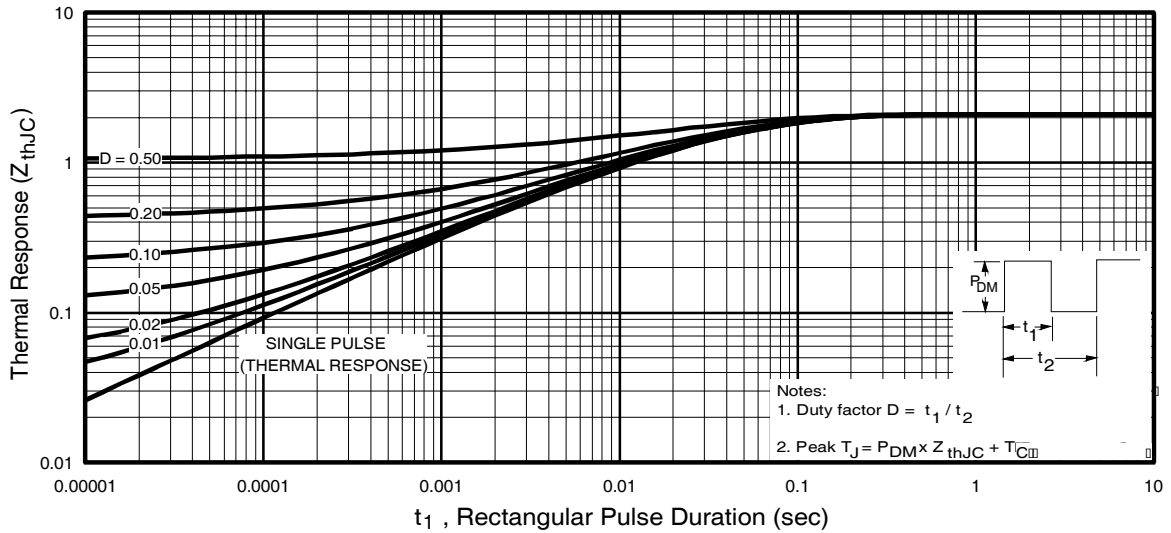
# IRG4PC20UPbF



**Fig. 4 - Maximum Collector Current vs. Case Temperature**

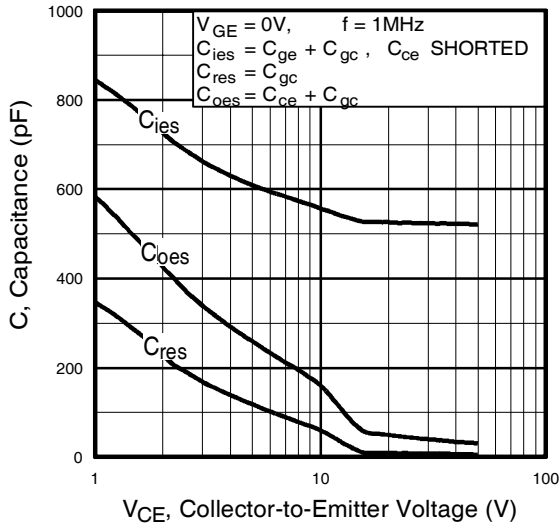


**Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature**

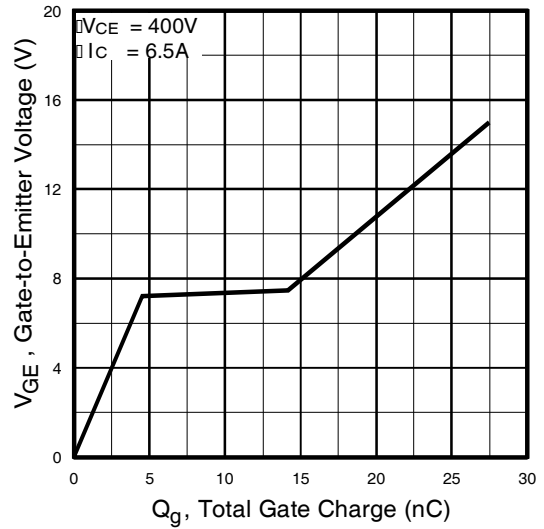


**Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

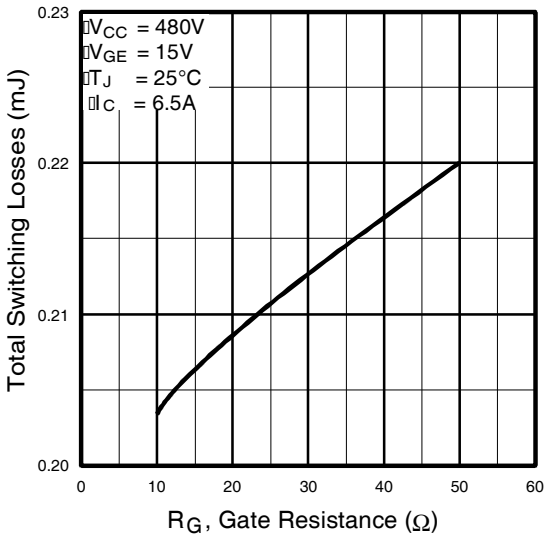
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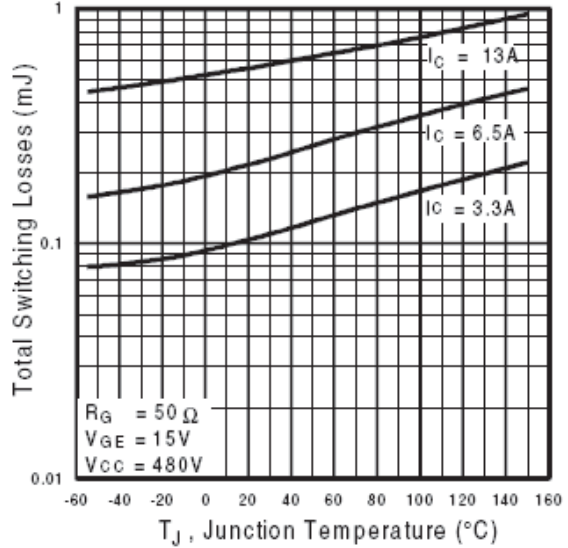
**Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage**



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

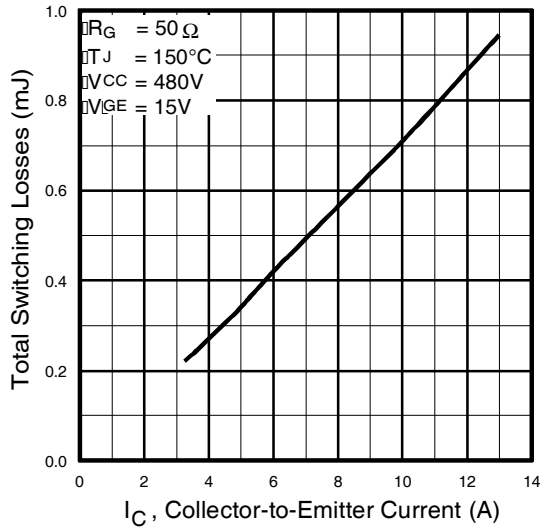


**Fig. 9 - Typical Switching Losses vs. Gate Resistance**

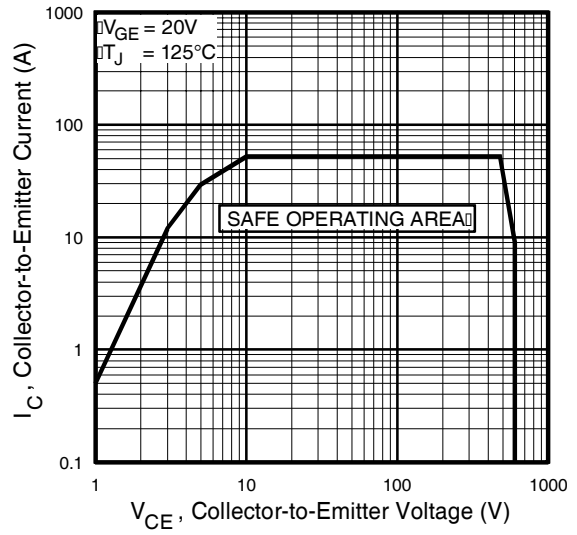


**Fig. 10 - Typical Switching Losses vs. Junction Temperature**

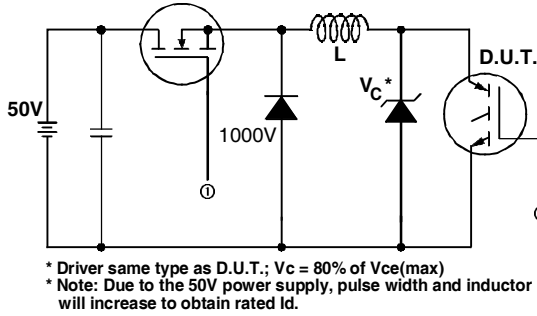
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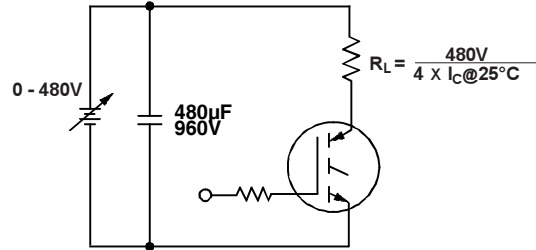
**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current



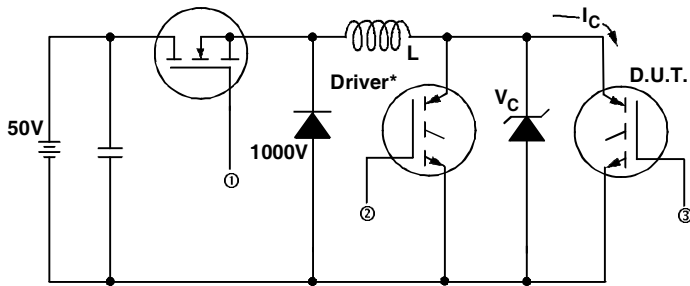
**Fig. 12** - Turn-Off SOA



**Fig. 13a** - Clamped Inductive Load Test Circuit

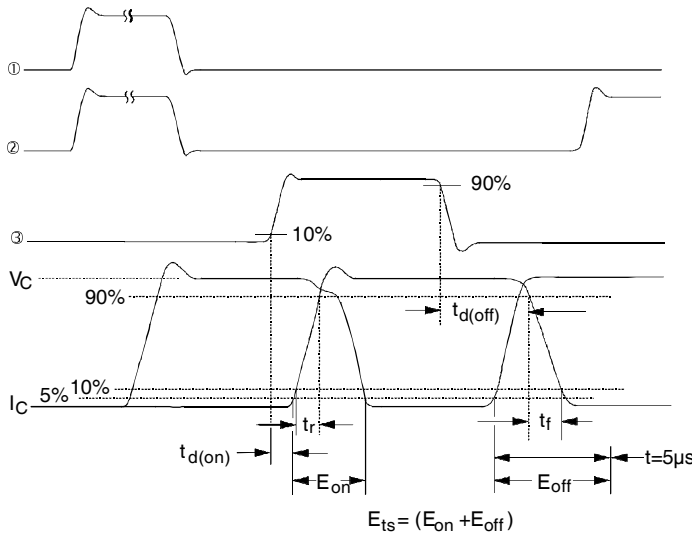


**Fig. 13b** - Pulsed Collector Current Test Circuit



**Fig. 14a** - Switching Loss Test Circuit

\* Driver same type as D.U.T., VC = 480V



**Fig. 14b** - Switching Loss Waveforms

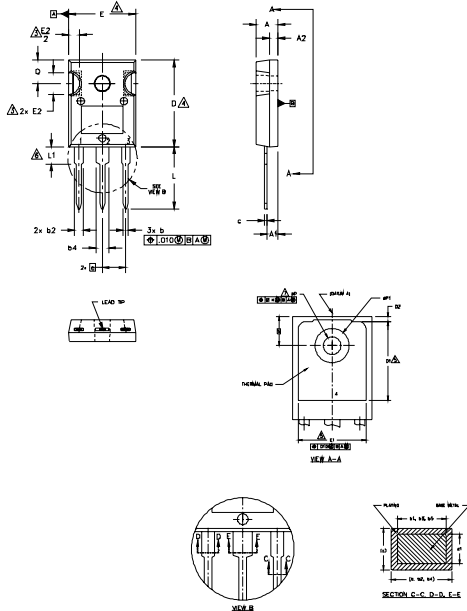
PROVISIONAL

# 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.  $\phi P$  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		
$\phi$	.010		0.25		
L	.559	.634	14.20	16.10	
L1	.146	.169	3.71	4.29	
$\phi P$	.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

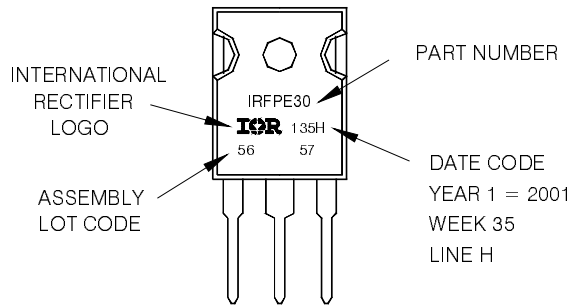
**DIODES**

- 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

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