

# International IR Rectifier

PD-94920

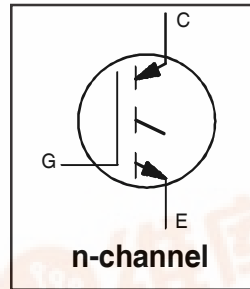
## IRG4PC30FPbF

INSULATED GATE BIPOLAR TRANSISTOR

Fast Speed IGBT

### Features

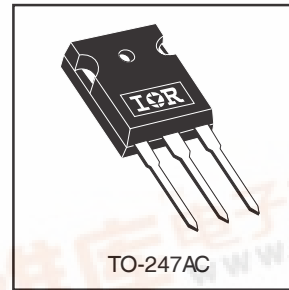
- Fast: Optimized for medium operating frequencies ( 1-5 kHz in hard switching, >20 kHz in resonant mode).
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.59V$
@ $V_{GE} = 15V, I_C = 17A$

### Benefits

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



### 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	31	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	17	
$I_{CM}$	Pulsed Collector Current ①	120	
$I_{LM}$	Clamped Inductive Load Current ②	120	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	10	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	100	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	42	
$T_J$	Operating Junction and Storage Temperature Range	-55 to + 150	$^\circ C$
$T_{STG}$			
	Soldering Temperature, for 10 seconds	300 (0.063 in. (1.6mm from case )	
	Mounting torque, 6-32 or M3 screw.	10 lbf·in (1.1N·m)	

### Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	---	1.2	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	---	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	---	40	
$Wt$	Weight	6 (0.21)	---	g (oz)



## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

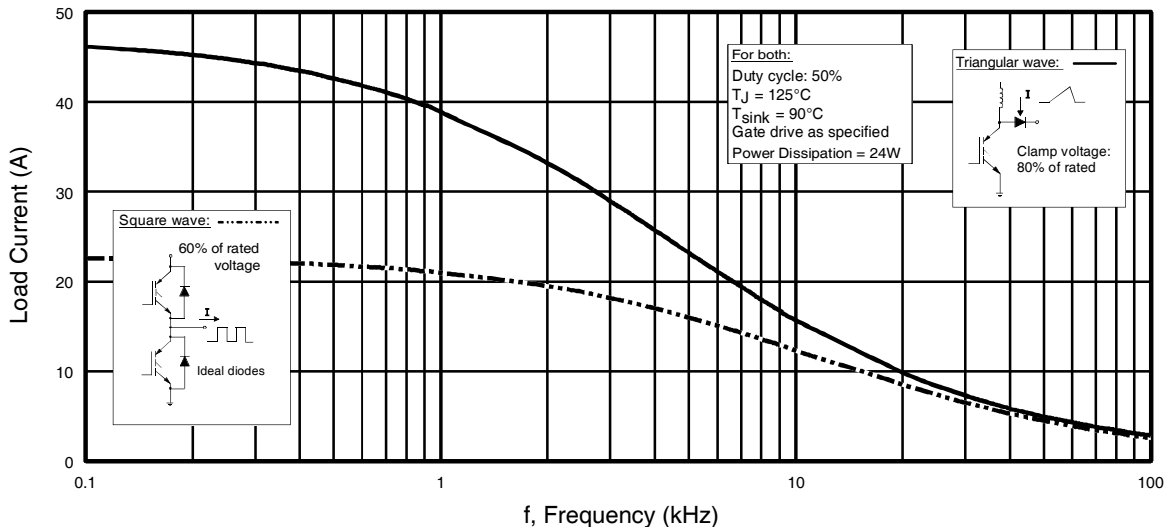
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>(BR)ECS</sub>	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A
ΔV <sub>(BR)CES/ΔT<sub>J</sub></sub>	Temperature Coeff. of Breakdown Voltage	—	0.69	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0mA
V <sub>CE(ON)</sub>	Collector-to-Emitter Saturation Voltage	—	1.59	1.8	V	I <sub>C</sub> = 17A V <sub>GE</sub> = 15V
		—	1.99	—		I <sub>C</sub> = 31A See Fig.2, 5
		—	1.7	—		I <sub>C</sub> = 17A, T <sub>J</sub> = 150°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
g <sub>fe</sub>	Forward Transconductance ⑤	6.1	10	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 17A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		—	—	2.0		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, T <sub>J</sub> = 25°C
		—	—	1000		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

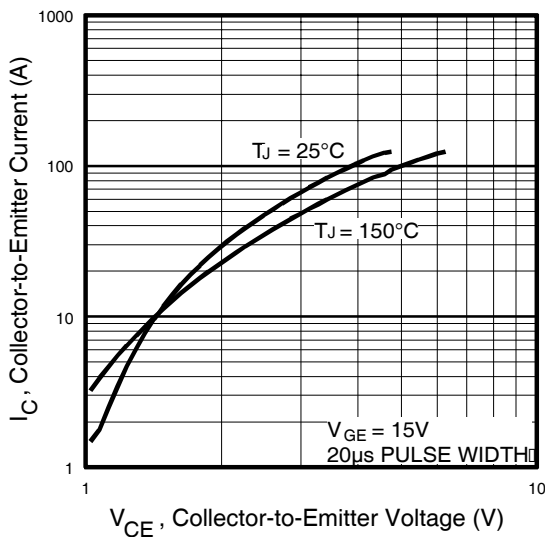
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	51	77	nC	I <sub>C</sub> = 17A
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	7.9	12		V <sub>CC</sub> = 400V See Fig. 8
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	19	28		V <sub>GE</sub> = 15V
t <sub>d(on)</sub>	Turn-On Delay Time	—	21	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 17A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 23Ω
t <sub>r</sub>	Rise Time	—	15	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	200	300		
t <sub>f</sub>	Fall Time	—	180	270		
E <sub>on</sub>	Turn-On Switching Loss	—	0.23	—	mJ	Energy losses include "tail" See Fig. 10, 11, 13, 14
E <sub>off</sub>	Turn-Off Switching Loss	—	1.18	—		
E <sub>ts</sub>	Total Switching Loss	—	1.41	2.0		
t <sub>d(on)</sub>	Turn-On Delay Time	—	20	—	ns	T <sub>J</sub> = 150°C, I <sub>C</sub> = 17A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 23Ω Energy losses include "tail" See Fig. 13, 14
t <sub>r</sub>	Rise Time	—	16	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	290	—		
t <sub>f</sub>	Fall Time	—	350	—		
E <sub>ts</sub>	Total Switching Loss	—	2.5	—	mJ	
L <sub>E</sub>	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	1100	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V See Fig. 7 f = 1.0MHz
C <sub>oes</sub>	Output Capacitance	—	74	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	14	—		

### Notes:

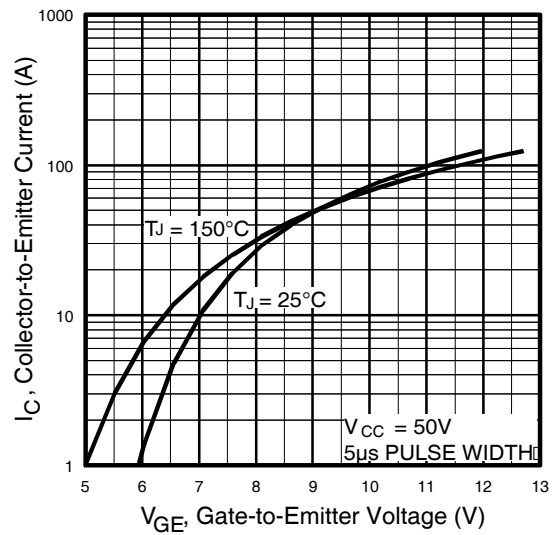
- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 23Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.



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



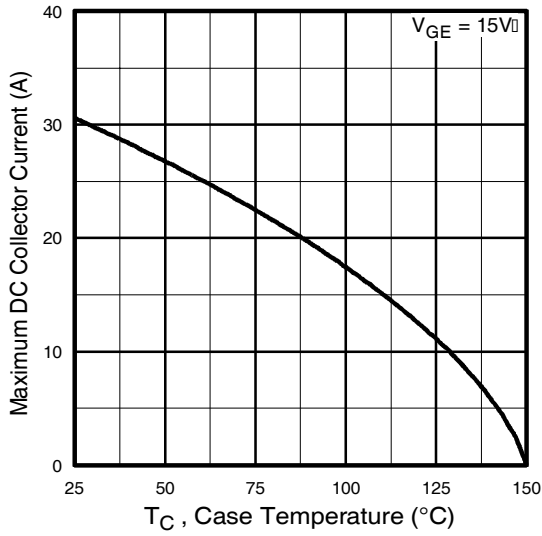
**Fig. 2 - Typical Output Characteristics**



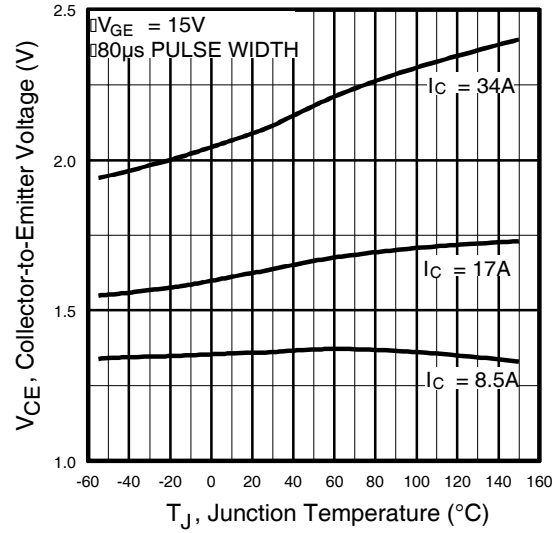
**Fig. 3 - Typical Transfer Characteristics**

# IRG4PC30FPbF

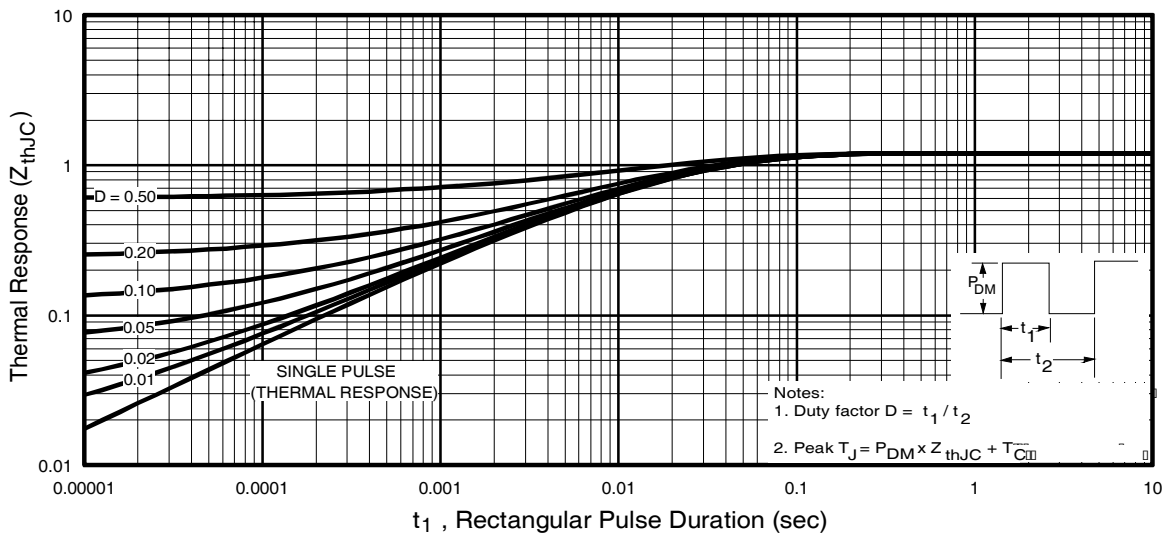
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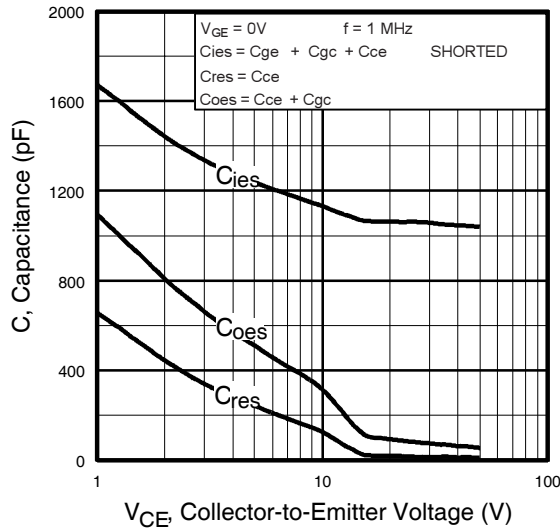
**Fig. 4 - Maximum Collector Current vs. Case Temperature**



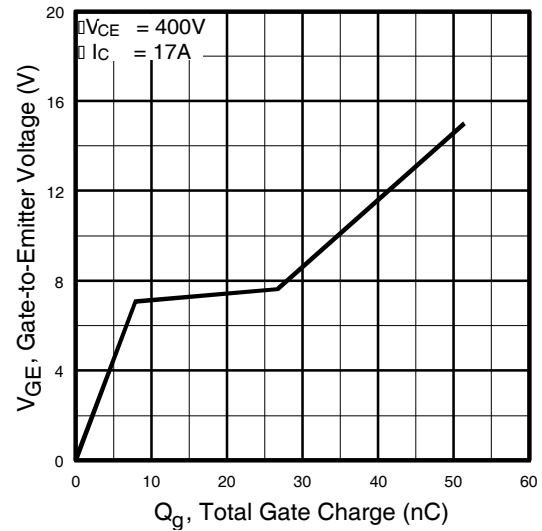
**Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature**



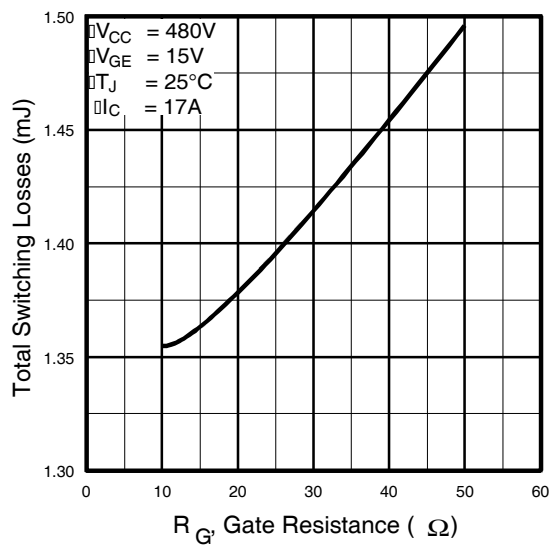
**Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**



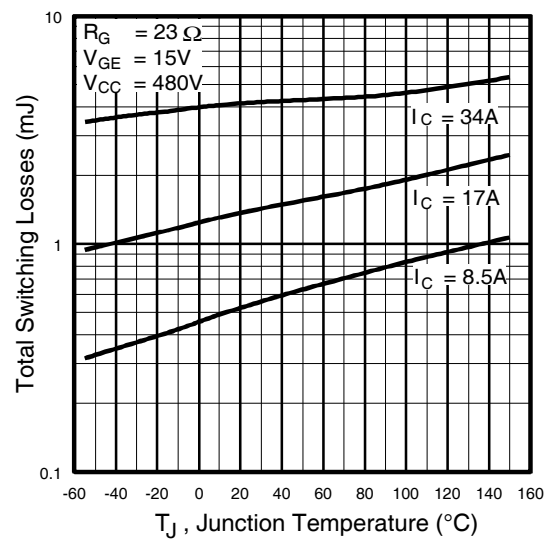
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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



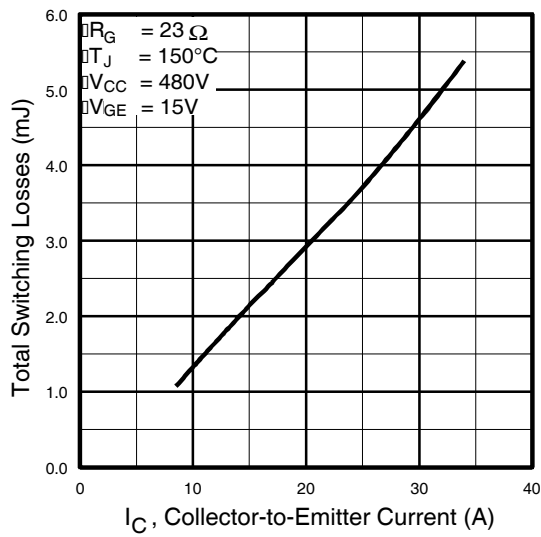
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



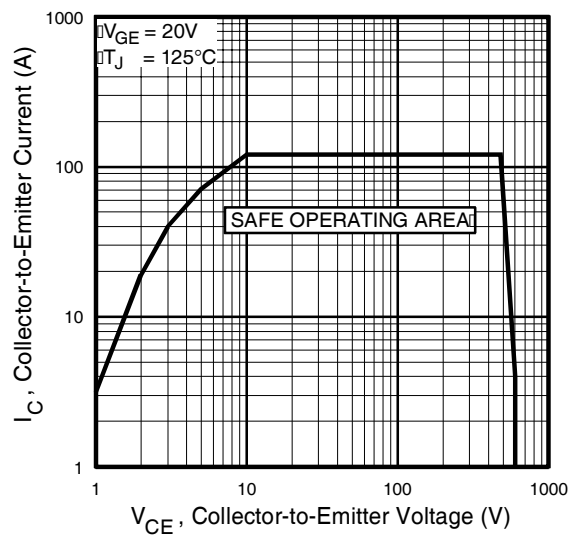
**Fig. 10** - Typical Switching Losses vs. Junction Temperature

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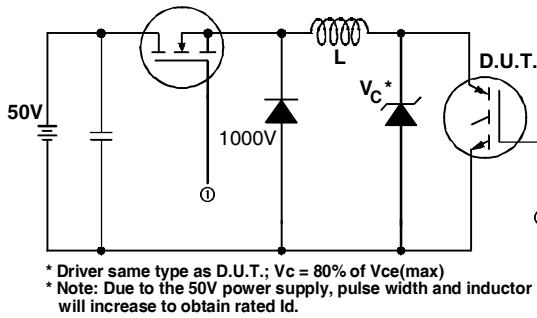
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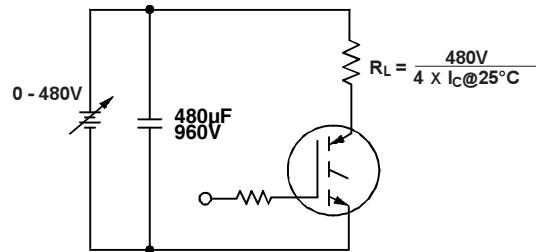
**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current



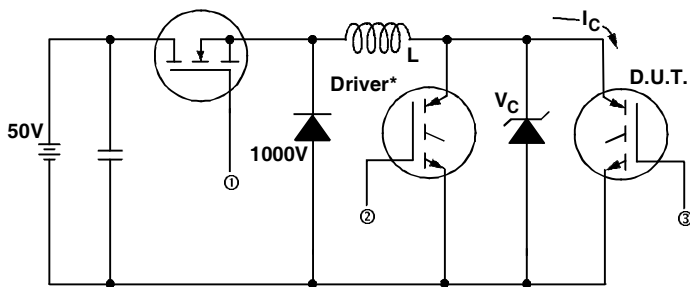
**Fig. 12** - Turn-Off SOA



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

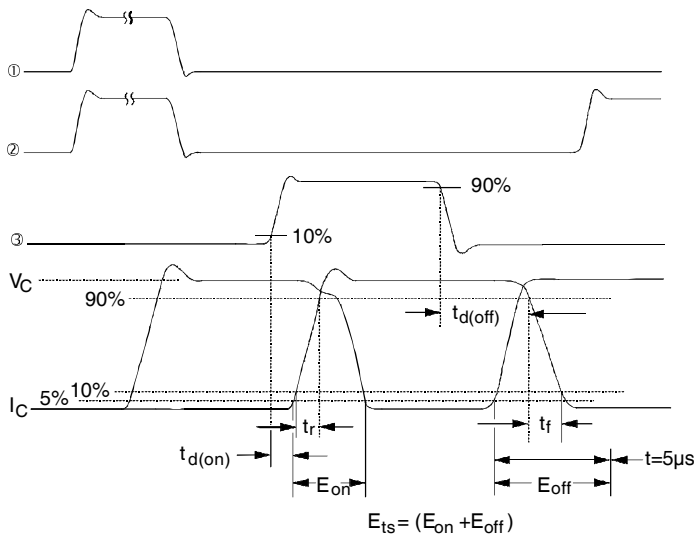


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

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



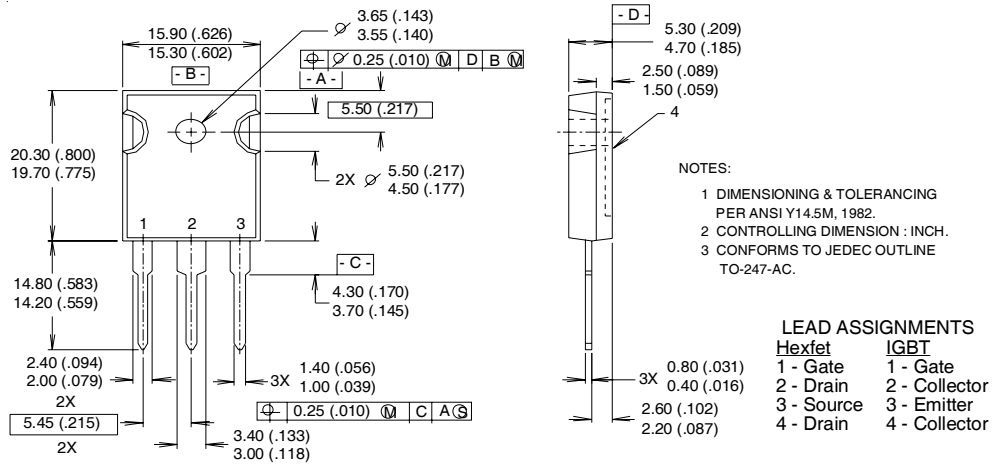
**Fig. 14b** - Switching Loss Waveforms

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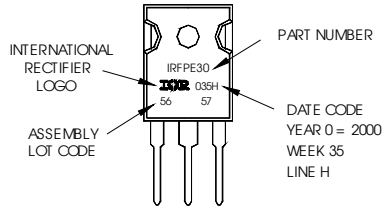
## TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30  
WITH ASSEMBLY  
LOT CODE 5657  
ASSEMBLED ON VVV 35, 2000  
IN THE ASSEMBLY LINE "H"  
**Note:** \*P\* in assembly line  
position indicates "Lead-Free"



Data and specifications subject to change without notice.

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**IR** Rectifier

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Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>