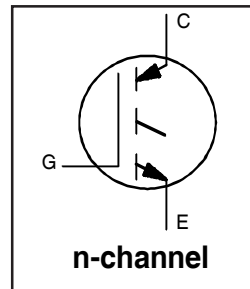


# IRGP4050

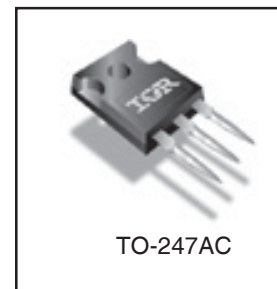
## PDP Switch

### Features

- Key parameters optimized for PDP sustain & Energy recovery applications
- 104A continuous collector current rating reduces component count
- High pulse current rating makes it ideal for capacitive load circuits
- Low temperature co-efficient of  $V_{CE(ON)}$  ensures reduced power dissipation at operating junction temperatures
- Reverse voltage avalanche rating improves the robustness in sustain driver application
- Short fall & rise times for fast switching



$V_{CES} = 250V$
$V_{CE(on) typ.} = 1.64V$
@ $V_{GE} = 15V, I_C = 30A$



### Description

This IGBT is specifically designed for sustain & energy recovery application in plasma display panels. This IGBT features low  $V_{CE(ON)}$  and fast switching times to improve circuit efficiency and reliability. Low temperature co-efficient of  $V_{CE(ON)}$  makes this IGBT an ideal device for PDP sustain driver application.

### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	250	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	104*	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	56	
$I_{CM}$	Pulse Collector Current ①	208	
$I_{LM}$	Clamped Inductive Load current ②	290	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	1240	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	330	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	130	
$T_J$	Operating Junction and Storage Temperature Range	-55 to +150	°C
$T_{STG}$			
	Solder Temperature Range, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

### Thermal / Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	—	—	0.38	°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.)

\*Package limited to 60A.

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

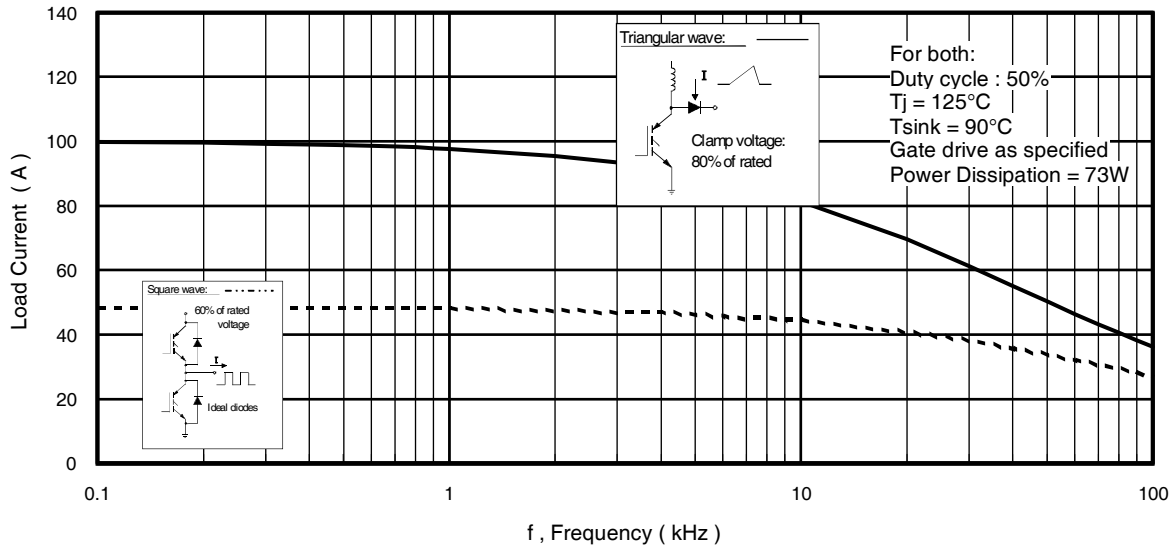
Parameter	Min.	Typ.	Max.	Units	Conditions	
V <sub>(BR)CES</sub>	250	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA	
V <sub>(BR)ECS</sub>	18	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A	
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	—	8.2	—	mV/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1mA	
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	1.64	1.90	V	I <sub>C</sub> = 30A I <sub>C</sub> = 56A I <sub>C</sub> = 104A, T <sub>J</sub> = 150°C V <sub>GE</sub> = 15V See Fig. 2, 5
		—	2.04	—		
		—	2.60	—		
V <sub>GE(th)</sub>	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA	
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	—	-11	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 0.25mA	
g <sub>fe</sub>	34	51	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 56A	
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 250V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 250V, T <sub>J</sub> = 150°C
		—	—	2.0		
		—	—	5000		
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)

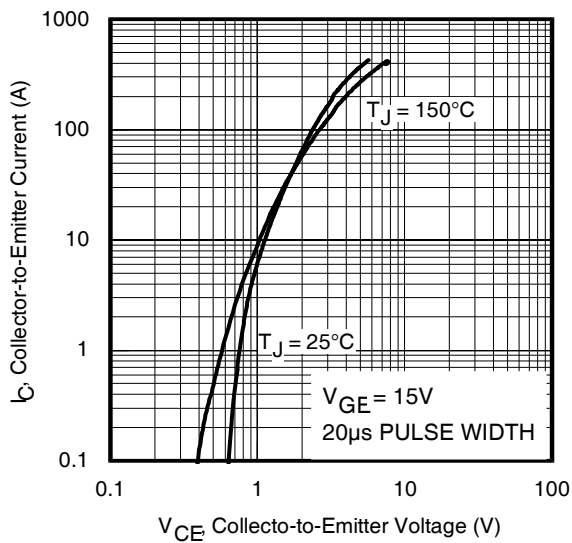
Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	—	230	350	nC	I <sub>C</sub> = 56A V <sub>CC</sub> = 200V V <sub>GE</sub> = 15V See Fig. 8
Q <sub>ge</sub>	—	37	56		
Q <sub>gc</sub>	—	78	120		
t <sub>d(on)</sub>	—	37	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 30A, V <sub>CC</sub> = 180V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" See Fig. 9, 10, 14
t <sub>r</sub>	—	35	—		
t <sub>d(off)</sub>	—	120	180		
t <sub>f</sub>	—	59	89		
E <sub>on</sub>	—	45	—		
E <sub>off</sub>	—	125	—	μJ	
E <sub>TS</sub>	—	170	—		
t <sub>d(on)</sub>	—	35	—	ns	T <sub>J</sub> = 150°C I <sub>C</sub> = 30A, V <sub>CC</sub> = 180V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" See Fig. 11, 14
t <sub>r</sub>	—	35	—		
t <sub>d(off)</sub>	—	130	—		
t <sub>f</sub>	—	120	—		
E <sub>TS</sub>	—	280	—		
L <sub>E</sub>	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	—	4650	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V, f = 1.0MHz See Fig. 7
C <sub>oes</sub>	—	480	—		
C <sub>res</sub>	—	92	—		

### Notes:

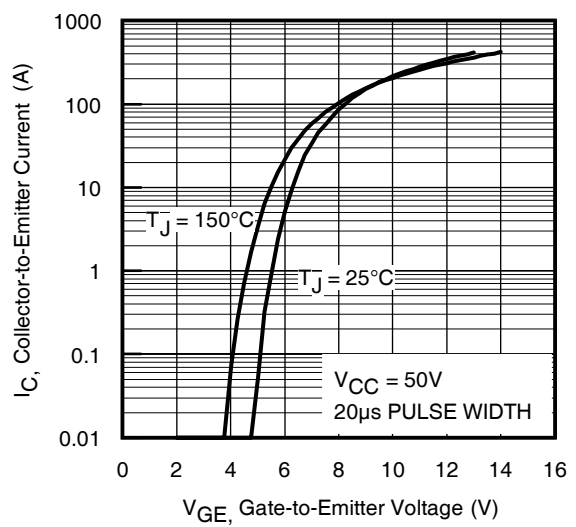
- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 5.0Ω, (See fig. 13a).
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 2.5ms; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.



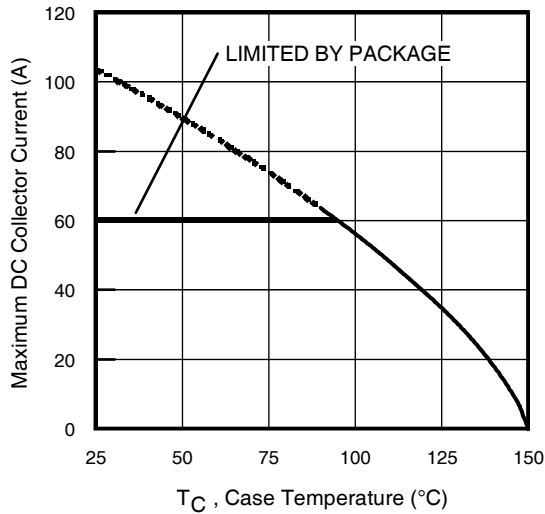
**Fig. 1 - Typical Load Current vs. Frequency**  
(Load Current =  $I_{RMS}$  of fundamental)



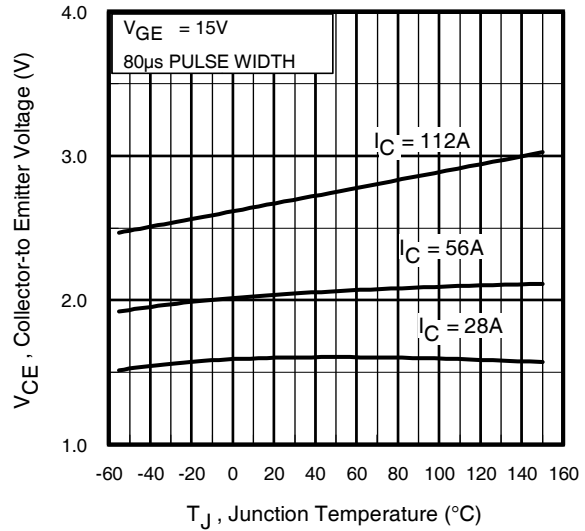
**Fig. 2 - Typical Output Characteristics**



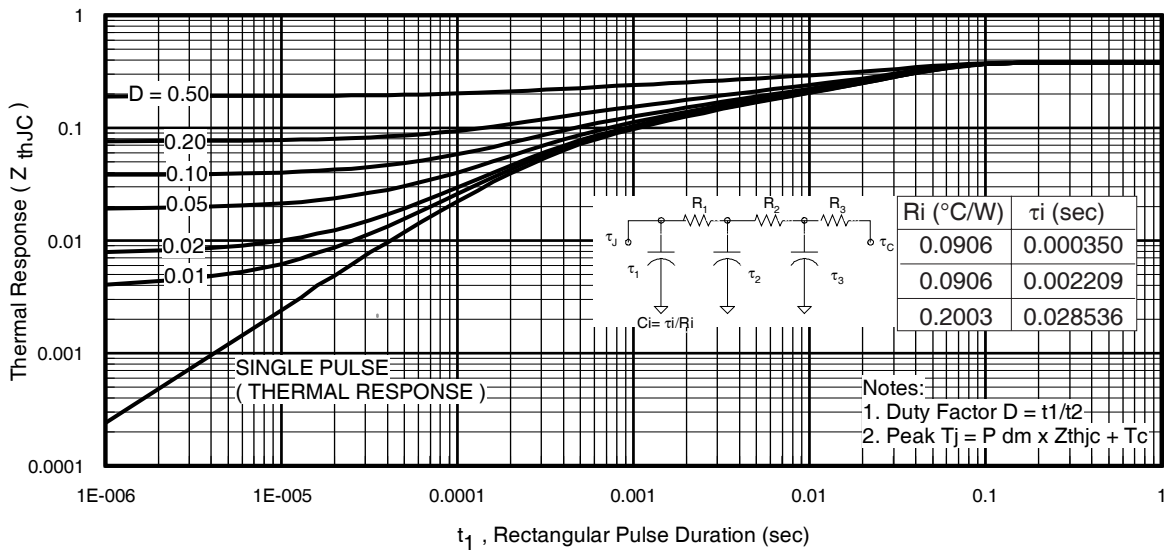
**Fig. 3 - Typical Transfer Characteristics**



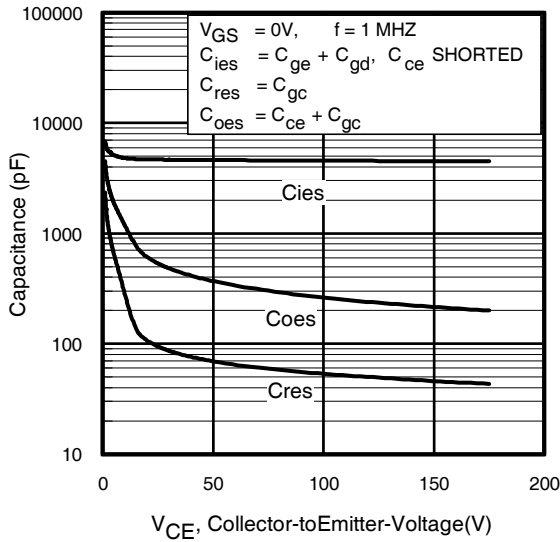
**Fig. 4 - Maximum Collector Current vs. Case Temperature**



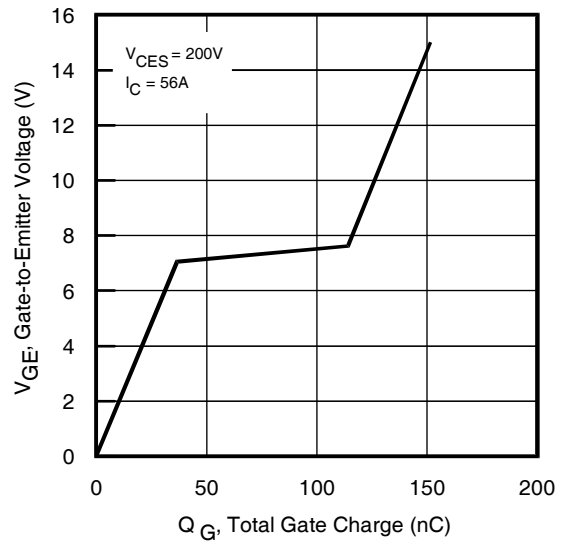
**Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature**



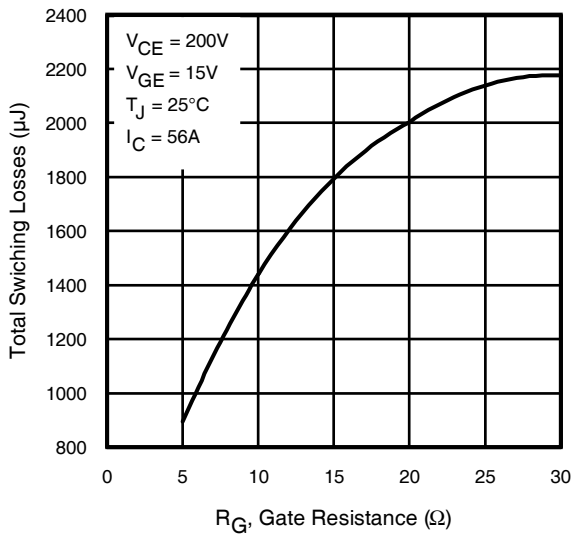
**Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**



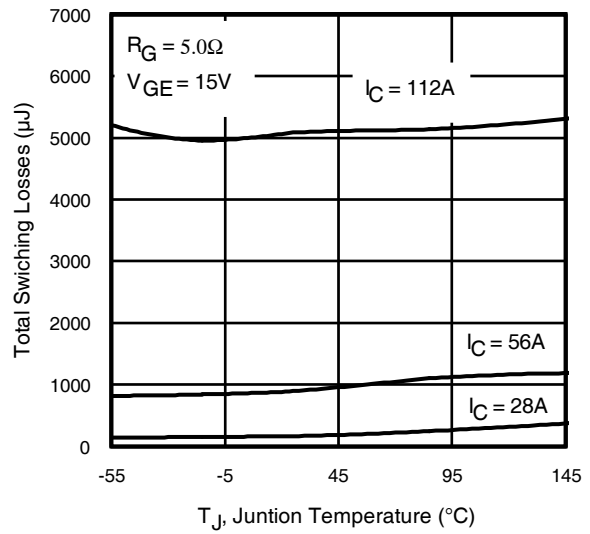
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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

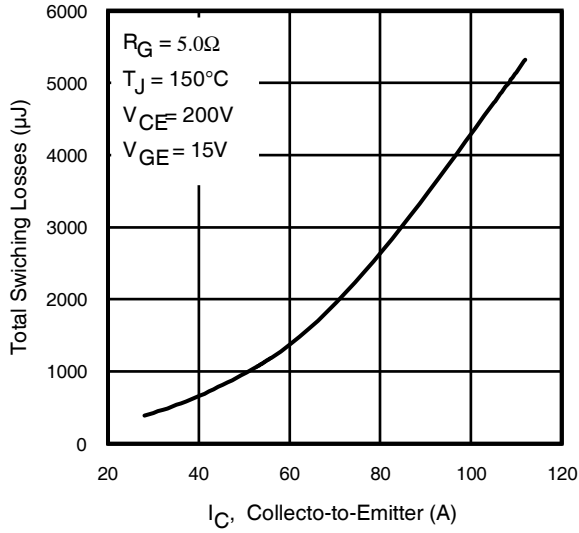


**Fig. 9** - Typical Switching Losses vs. Gate Resistance

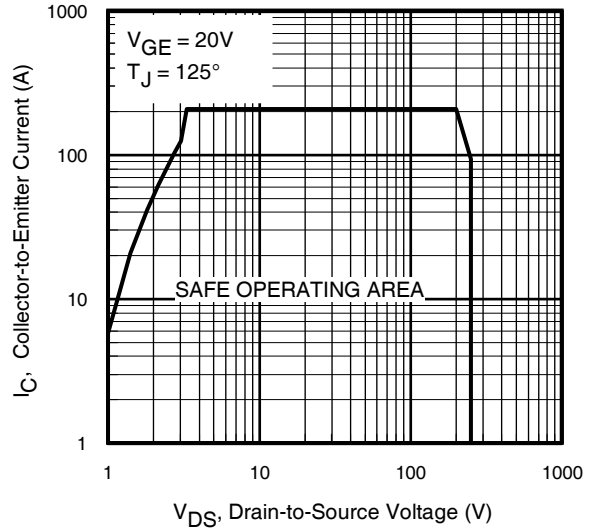


**Fig. 10** - Typical Switching Losses vs. Junction Temperature

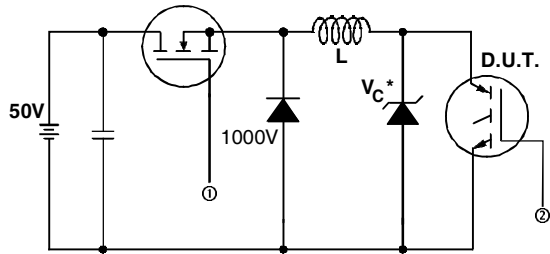
# IRGP4050



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

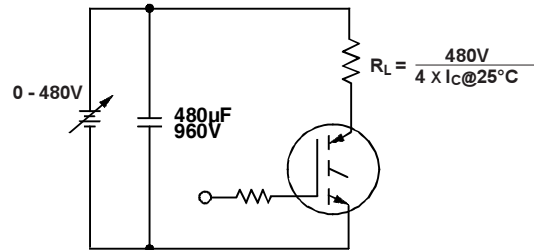


**Fig. 12** - Turn-Off SOA

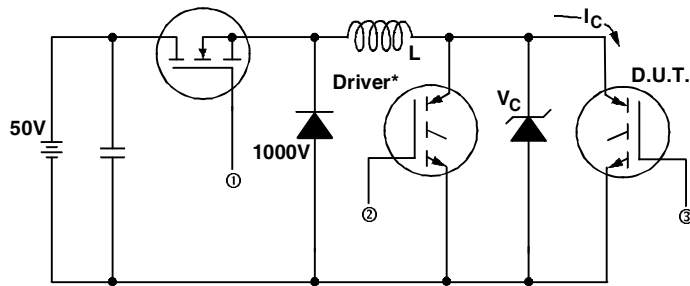


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

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

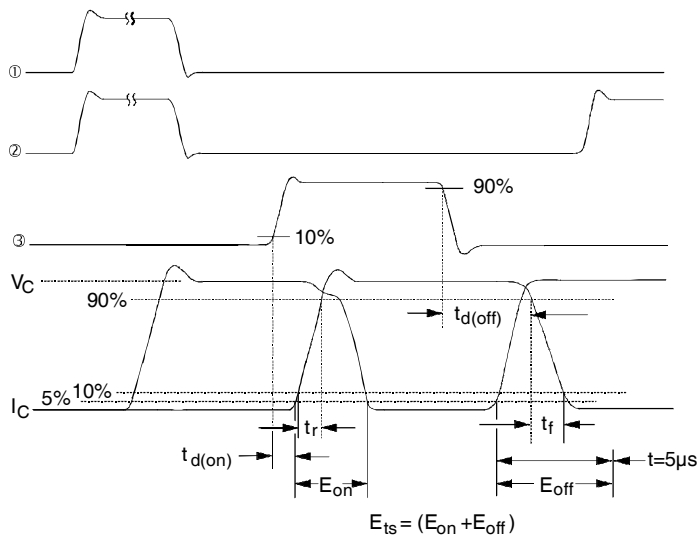


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

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



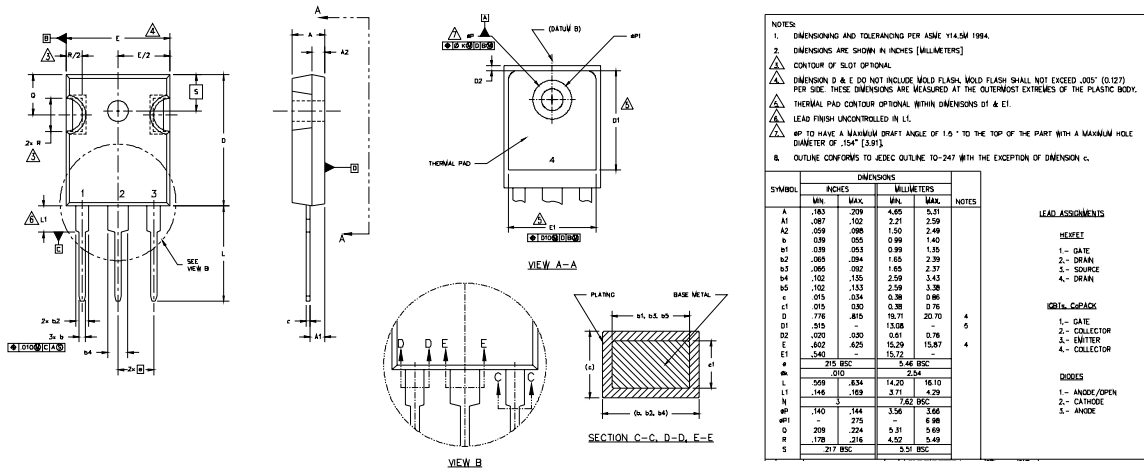
**Fig. 14b** - Switching Loss Waveforms

# IRGP4050

## TO-247AC Package Outline

Dimensions are shown in millimeters (inches)

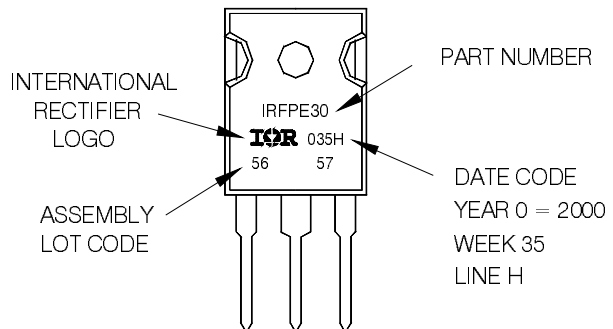
International  
**IR** Rectifier



## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30  
WITH ASSEMBLY  
LOT CODE 5657  
ASSEMBLED ON WW 35, 2000  
IN THE ASSEMBLY LINE "H"

**Note:** "P" in assembly line  
position indicates "Lead-Free"



**TO-247AC package is not recommended for Surface Mount Application.**

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

International  
**IR** Rectifier

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TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information.06/04



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