

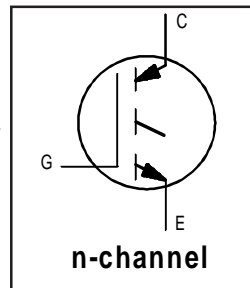
IRG4PC60U-P

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

Features

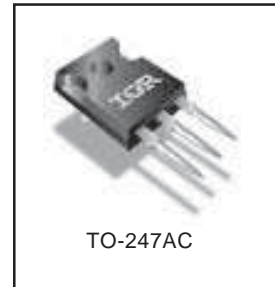
- UltraFast: Optimized for high operating frequencies up to 50 kHz in hard switching and >200 kHz in resonant mode.
- Application in UPS, Welding and High Current power supply.
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency.
- Solder plated version of industry standard TO-247AC package.



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.6V$
@ $V_{GE} = 15V, I_C = 40A$

Benefits

- Generation 4 IGBT's offer highest efficiency available.
- Solder plated version of the TO-247 allows the reflow soldering of the package heatsink to a substrate material.
- Designed for best performance when used with IR HEXFRED & IR FRED companion diodes.



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	75	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	40	
I_{CM}	Pulsed Collector Current ①	300	
I_{LM}	Clamped Inductive Load Current ②	300	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	200	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	520	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	210	
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)	
	Maximum Reflow Temperature⑦	230 (Time above 183°C should not exceed 100s)	$^\circ C$

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	----	0.24	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	----	
$R_{\theta JA}$	Junction-to-Ambient (Typical Socket Mount)	----	40	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, Steady State)⑥	----	20	
Wt	Weight	6 (0.21)	----	g (oz)

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	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	17	----	----	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	----	0.28	----	V/°C	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	----	1.7	2.0	V	$I_C = 40A$ $V_{GE} = 15V$ $I_C = 75A$ See Fig.2, 5 $I_C = 40A, T_J = 150^\circ\text{C}$
		----	1.9	----		
		----	1.6	----		
$V_{GE(th)}$	Gate Threshold Voltage	3.0	----	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	----	-12	----	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	44	59	----	S	$V_{CE} \geq 100V, I_C = 40A$
I_{CES}	Zero Gate Voltage Collector Current	----	----	250	μA	$V_{GE} = 0V, V_{CE} = 600V$ $V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$ $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
		----	----	2.0		
		----	----	5000		
I_{GES}	Gate-to-Emitter Leakage Current	----	----	± 100	nA	$V_{GE} = \pm 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	----	310	320	nC	$I_C = 40A$ $V_{CC} = 480V$ $V_{GE} = 15V$ See Fig. 8
Q_{ge}	Gate - Emitter Charge (turn-on)	----	41	46		
Q_{gc}	Gate - Collector Charge (turn-on)	----	110	120		
$t_{d(on)}$	Turn-On Delay Time	----	39	----	ns	$T_J = 25^\circ\text{C}$ $I_C = 40A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 10, 11, 13, 14
t_r	Rise Time	----	42	----		
$t_{d(off)}$	Turn-Off Delay Time	----	200	----		
t_f	Fall Time	----	100	----		
E_{on}	Turn-On Switching Loss	----	0.28	----	mJ	See Fig. 10, 11, 13, 14
E_{off}	Turn-Off Switching Loss	----	1.1	----		
E_{is}	Total Switching Loss	----	1.3	1.8		
$t_{d(on)}$	Turn-On Delay Time	----	36	----	ns	$T_J = 150^\circ\text{C},$ $I_C = 40A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 13, 14
t_r	Rise Time	----	42	----		
$t_{d(off)}$	Turn-Off Delay Time	----	300	----		
t_f	Fall Time	----	160	----		
E_{is}	Total Switching Loss	----	2.6	----	mJ	
L_E	Internal Emitter Inductance	----	13	----	nH	Measured 5mm from package
C_{ies}	Input Capacitance	----	5860	----	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$ See Fig. 7
C_{oes}	Output Capacitance	----	370	----		
C_{res}	Reverse Transfer Capacitance	----	75	----		

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, R_G = 5.0\Omega$. (See fig. 13a)
- 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.
- ⑥ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑦ Refer to application note # 1023, "Surface Mounting of Larger Devices."

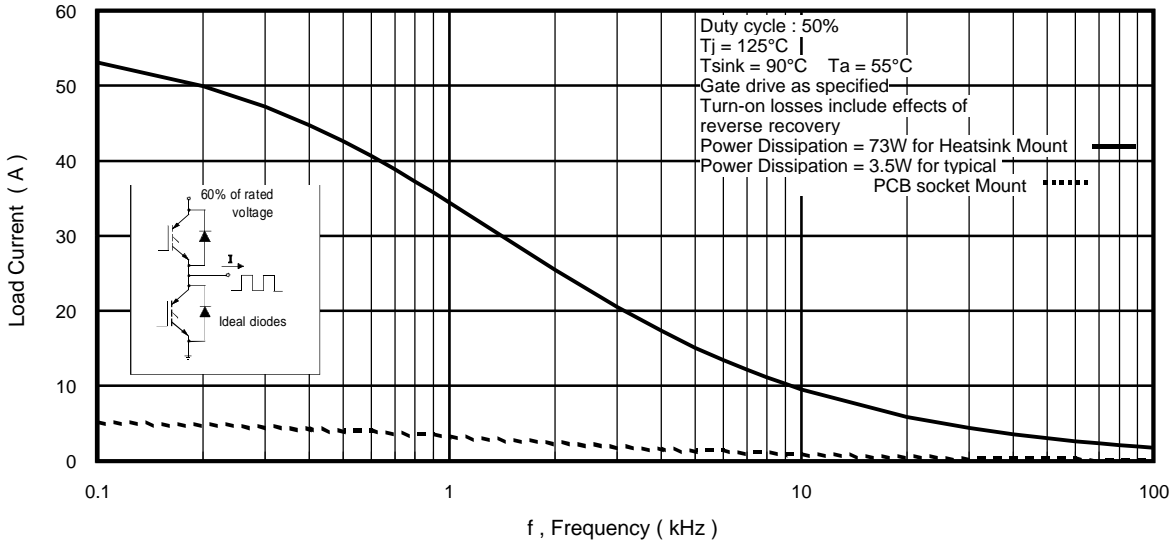


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

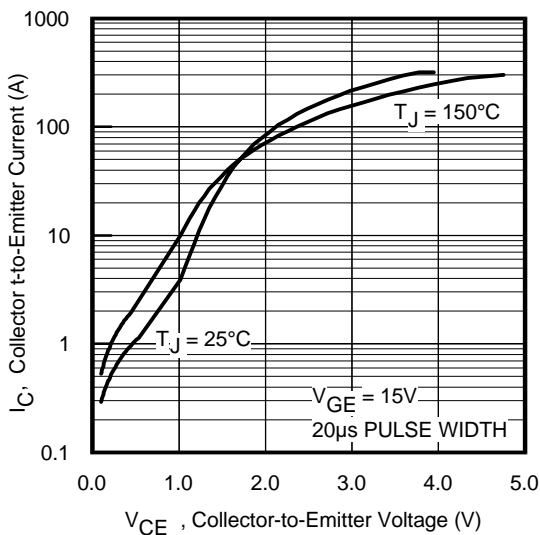


Fig. 2 - Typical Output Characteristics

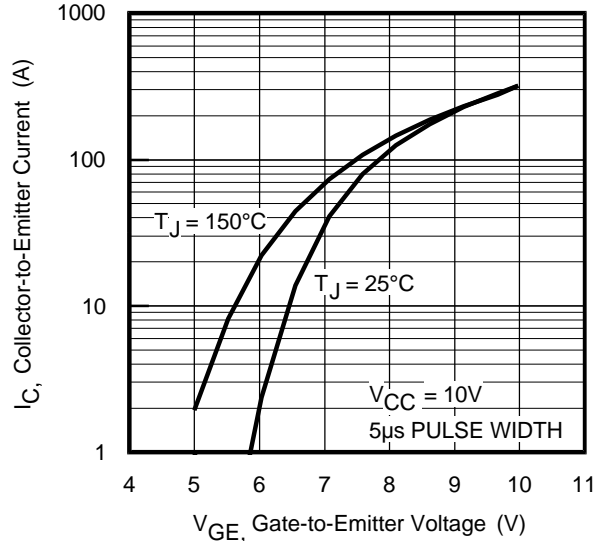


Fig. 3 - Typical Transfer Characteristics

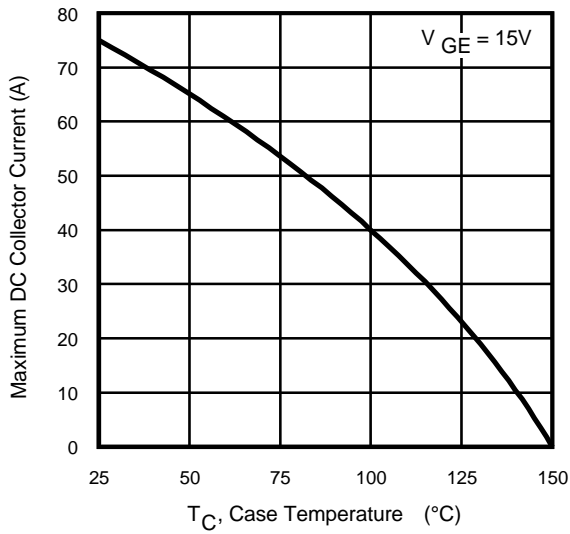


Fig. 4 - Maximum Collector Current vs. Case Temperature

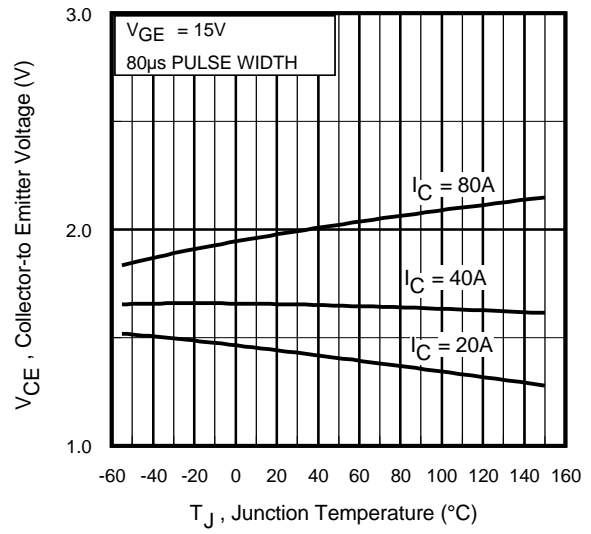


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

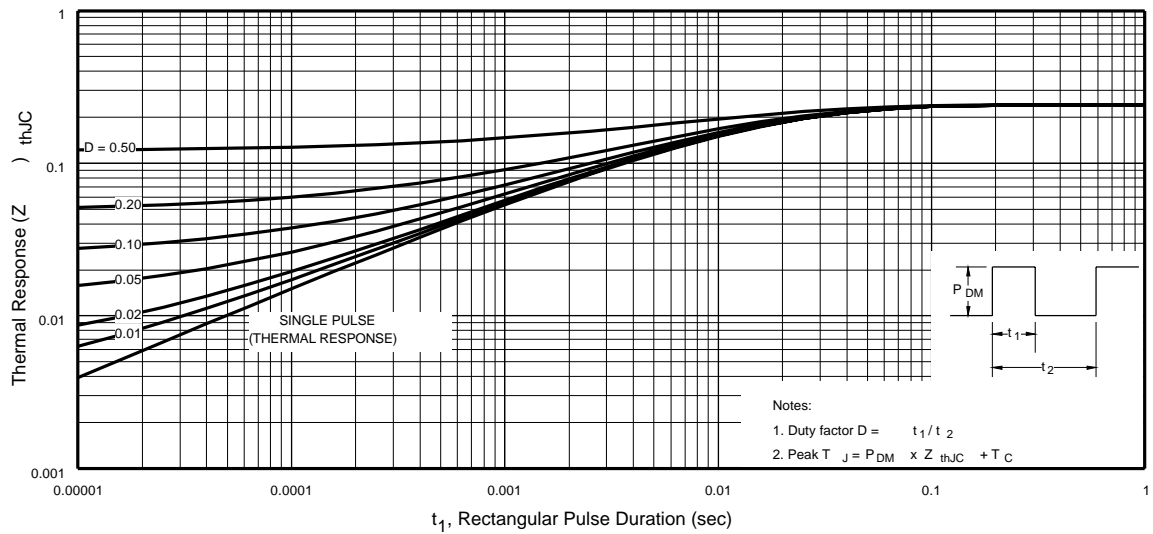


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

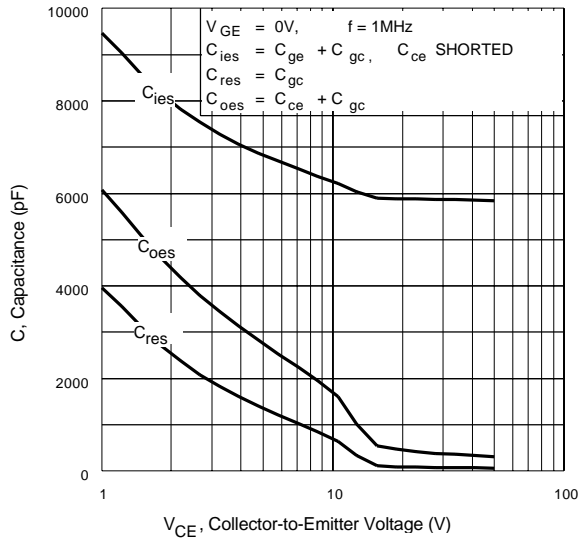


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

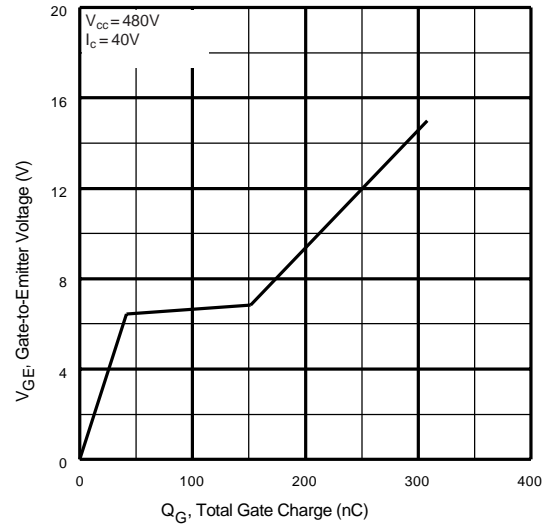


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

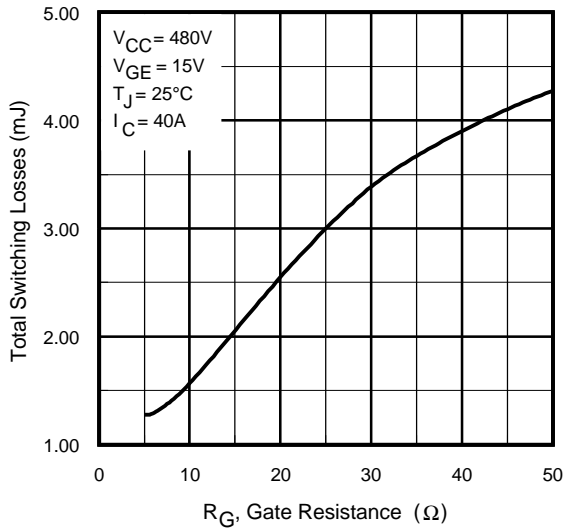


Fig. 9 - Typical Switching Losses vs. Gate Resistance

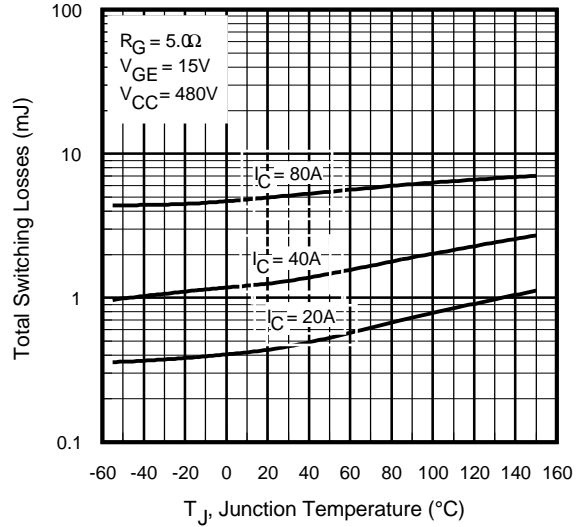


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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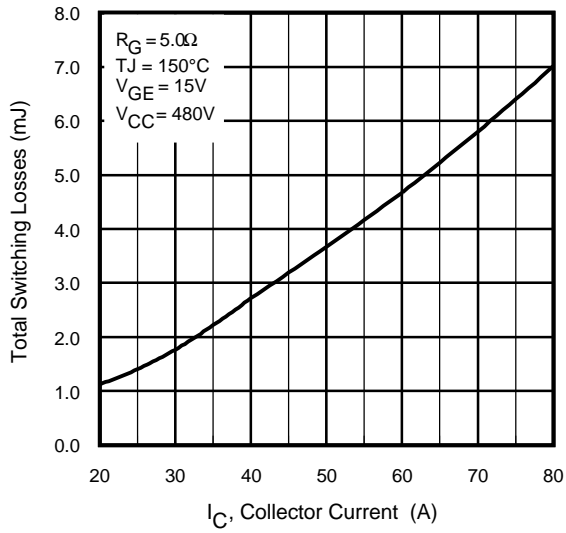


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

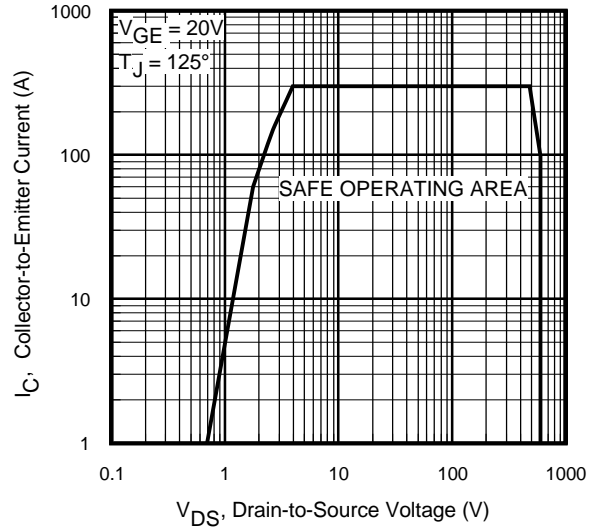
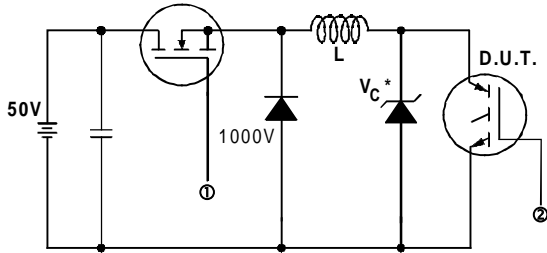


Fig. 12 - Turn-Off SOA



* 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

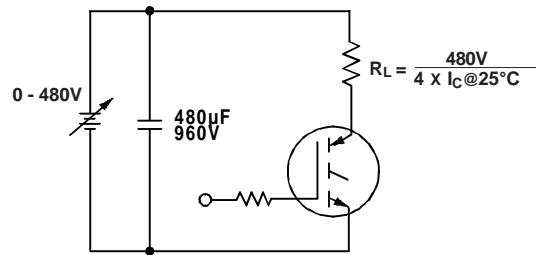


Fig. 13b - Pulsed Collector Current Test Circuit

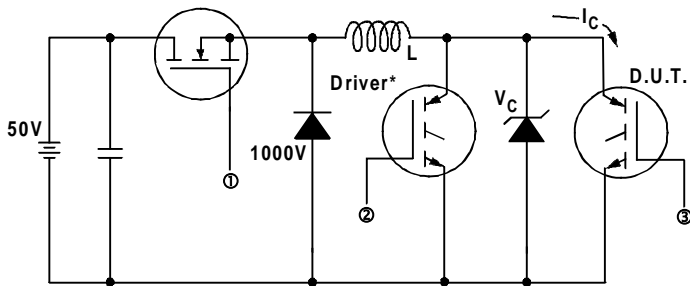


Fig. 14a - Switching Loss Test Circuit

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

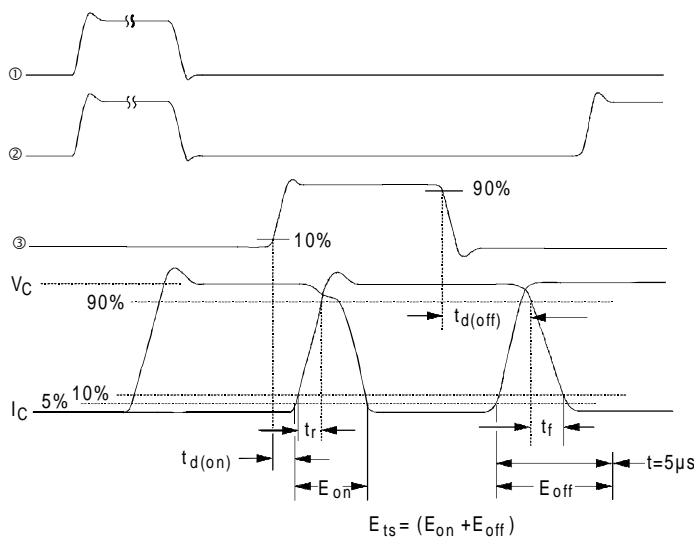


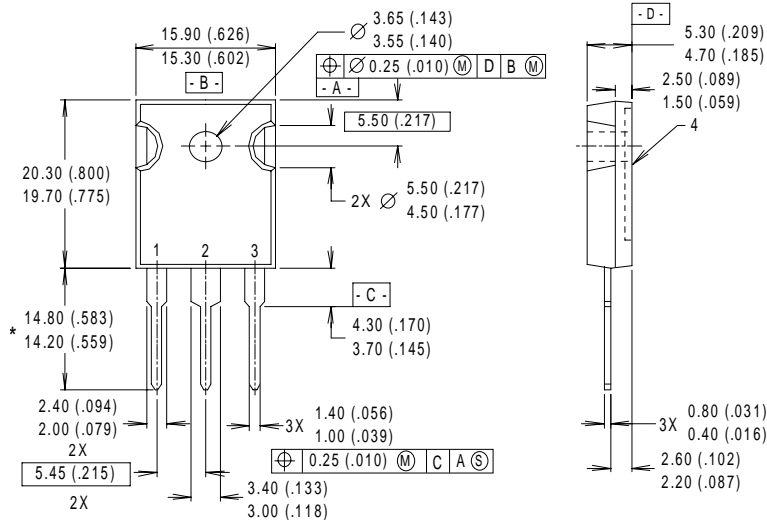
Fig. 14b - Switching Loss Waveforms

IRG4PC60U-P

International
IR Rectifier

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1 DIMENSIONS & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH.
- 3 DIMENSIONS ARE SHOWN MILLIMETERS (INCHES).
- 4 CONFORMS TO JEDEC OUTLINE TO-247AC.

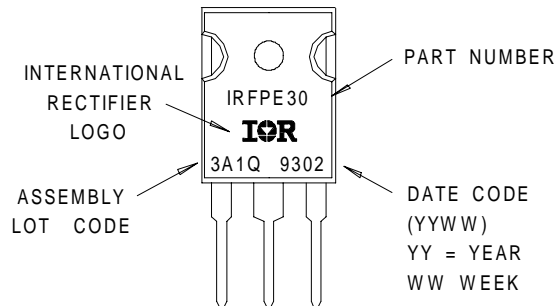
LEAD ASSIGNMENTS

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER
- 4 - COLLECTOR

* LONGER LEADED (20mm) VERSION AVAILABLE (TO-247AD) TO ORDER ADD "-E" SUFFIX TO PART NUMBER

Solderable TO-247AC Part Marking Information

EXAMPLE : THIS IS AN IRFPE30 WITH ASSEMBLY LOT CODE 3A1Q



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

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.04/02

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