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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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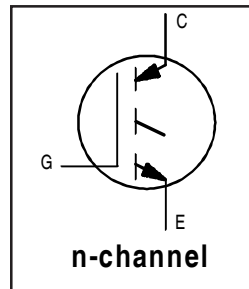
# IRG4PC40UPbF

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

## Features

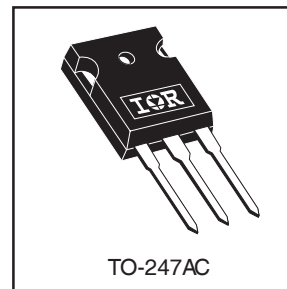
- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.72V$
@ $V_{GE} = 15V, I_C = 20A$

## 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 Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	40	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	20	
$I_{CM}$	Pulsed Collector Current ①	160	
$I_{LM}$	Clamped Inductive Load Current ②	160	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	15	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	160	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	65	
$T_J$	Operating Junction and Storage Temperature Range	-55 to +150	°C
$T_{STG}$			
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

## Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	-----	-----	0.77	°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 @ $T_J = 25^\circ\text{C}$ (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	18	----	----	V	$V_{GE} = 0V, I_C = 1.0A$ See Fig. 2, 5
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	----	0.63	----	$V/^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	----	1.72	2.1	V	$I_C = 20A, V_{GE} = 15V$
		----	2.15	----		
		----	1.7	----		
$V_{GE(th)}$	Gate Threshold Voltage	3.0	----	6.0		$I_C = 20A, T_J = 150^\circ\text{C}$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	----	-13	----	$mV/^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
$g_{fe}$	Forward Transconductance ⑤	11	18	----	S	$V_{CE} = 100V, I_C = 20A$
$I_{CES}$	Zero Gate Voltage Collector Current	----	----	250	$\mu A$	$V_{GE} = 0V, V_{CE} = 600V$
		----	----	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		----	----	2500		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	----	----	$\pm 100$	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)	----	100	150	nC	$I_C = 20A, V_{CC} = 400V, V_{GE} = 15V$ See Fig. 8
$Q_{ge}$	Gate - Emitter Charge (turn-on)	----	16	25		
$Q_{gc}$	Gate - Collector Charge (turn-on)	----	40	60		
$t_{d(on)}$	Turn-On Delay Time	----	34	----	ns	$T_J = 25^\circ\text{C}, I_C = 20A, V_{CC} = 480V, V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail"
$t_r$	Rise Time	----	19	----		
$t_{d(off)}$	Turn-Off Delay Time	----	110	175		
$t_f$	Fall Time	----	120	180		
$E_{on}$	Turn-On Switching Loss	----	0.32	----		
$E_{off}$	Turn-Off Switching Loss	----	0.35	----	mJ	See Fig. 10, 11, 13, 14
$E_{ts}$	Total Switching Loss	----	0.67	1.0		
$t_{d(on)}$	Turn-On Delay Time	----	30	----	ns	$T_J = 150^\circ\text{C}, I_C = 20A, V_{CC} = 480V, V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail"
$t_r$	Rise Time	----	19	----		
$t_{d(off)}$	Turn-Off Delay Time	----	220	----		
$t_f$	Fall Time	----	160	----		
$E_{ts}$	Total Switching Loss	----	1.4	----		
$L_E$	Internal Emitter Inductance	----	13	----	nH	Measured 5mm from package
$C_{ies}$	Input Capacitance	----	2100	----	pF	$V_{GE} = 0V, V_{CC} = 30V, f = 1.0MHz$ See Fig. 7
$C_{oes}$	Output Capacitance	----	140	----		
$C_{res}$	Reverse Transfer Capacitance	----	34	----		

### Notes:

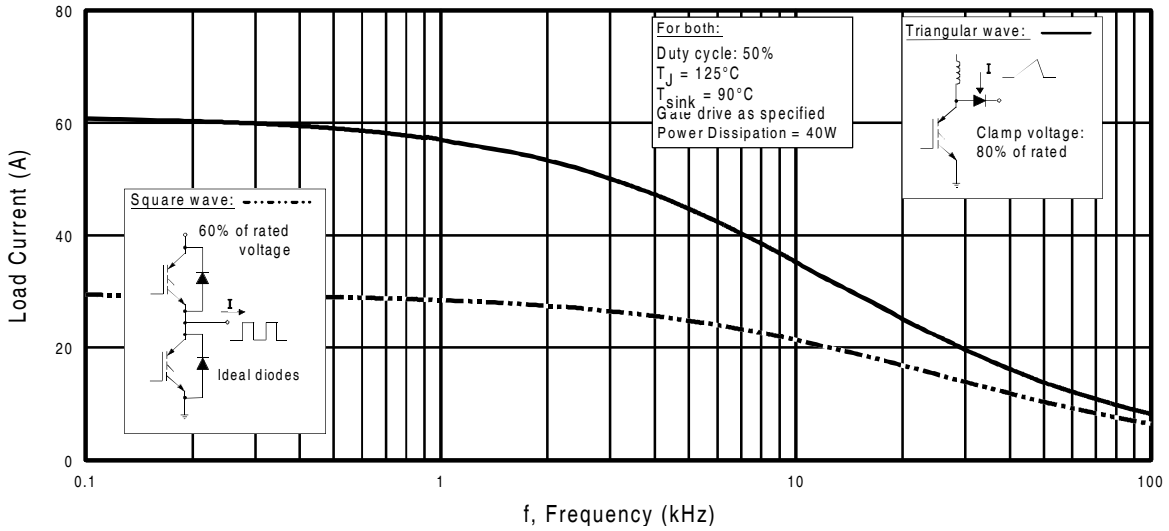
① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 13b )

②  $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 10\Omega$ , (See fig. 13a)

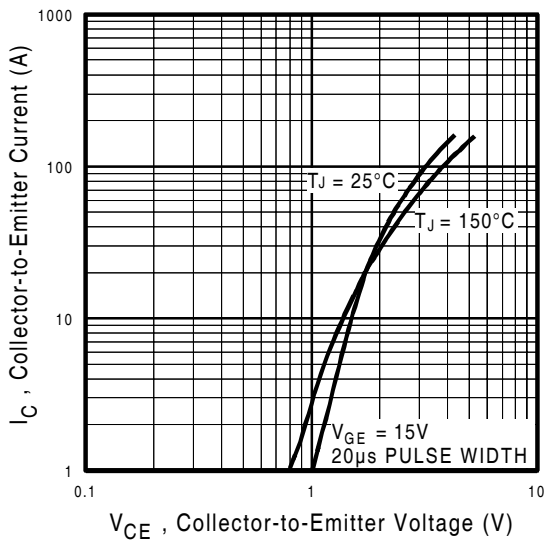
③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .

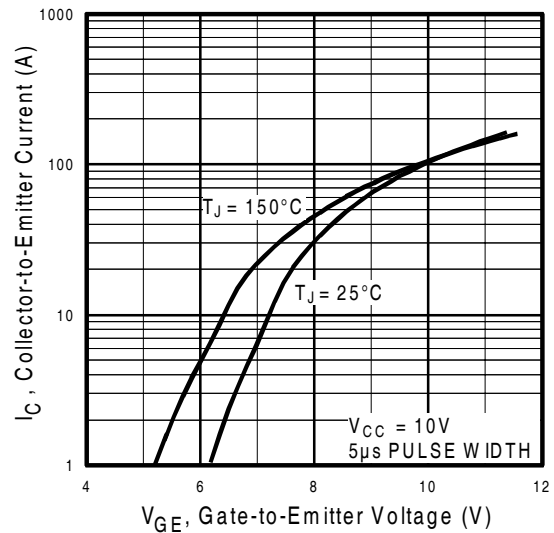
⑤ Pulse width  $5.0\mu s$ , single shot.



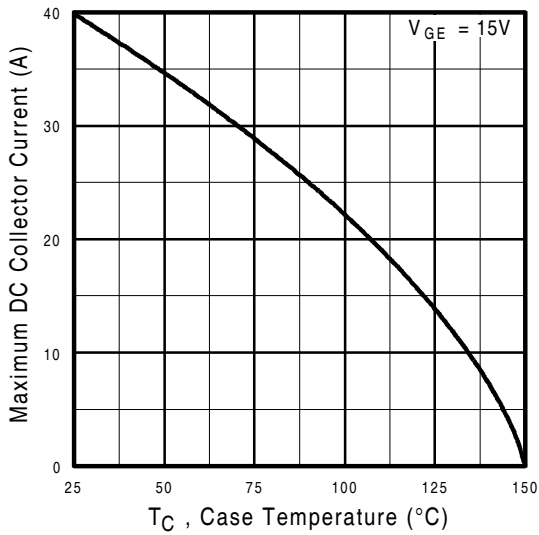
**Fig. 1 - Typical Load Current vs. Frequency**  
(For square wave,  $I = I_{RMS}$  of fundamental; for triangular wave,  $I = I_{PK}$ )



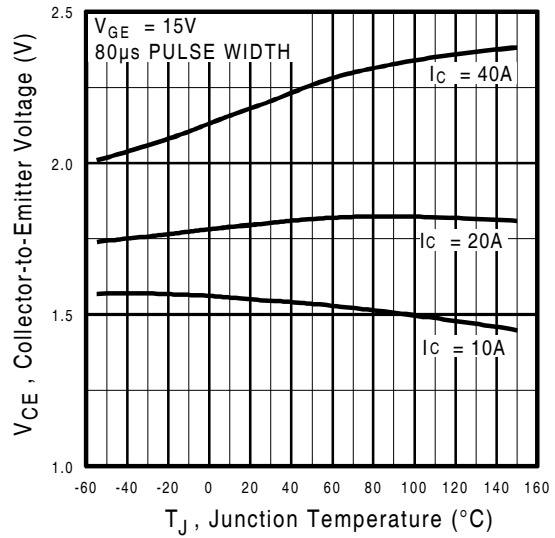
**Fig. 2 - Typical Output Characteristics**



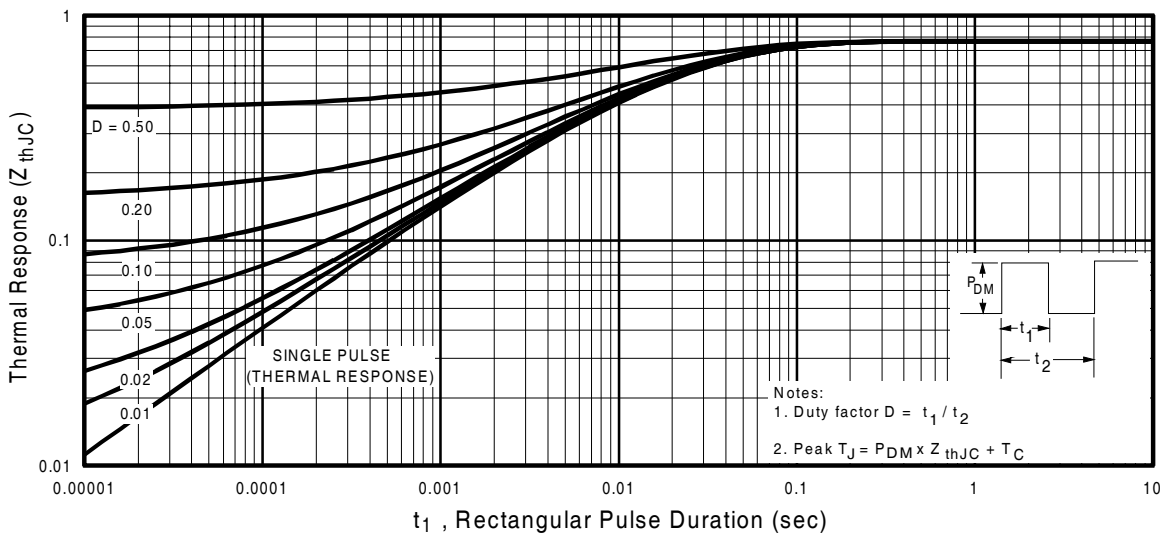
**Fig. 3 - Typical Transfer Characteristics**



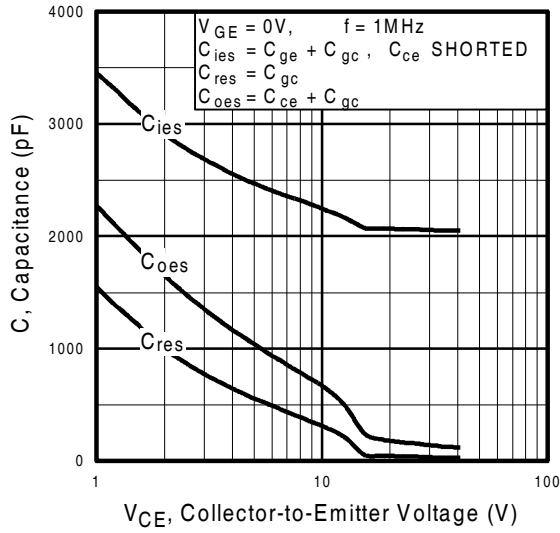
**Fig. 4** - Maximum Collector Current vs. Case Temperature



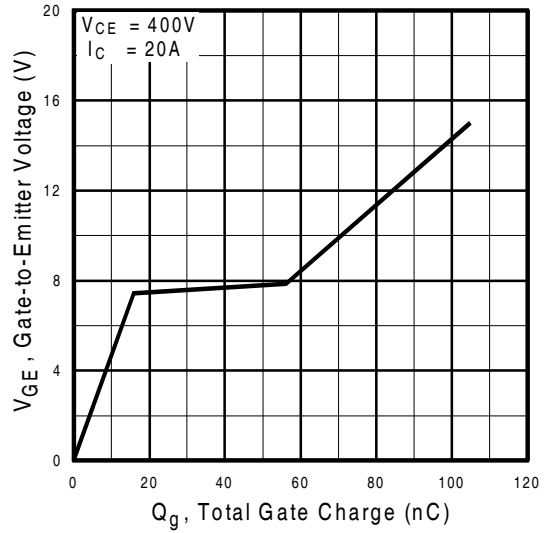
**Fig. 5** - Collector-to-Emitter Voltage vs. Junction Temperature



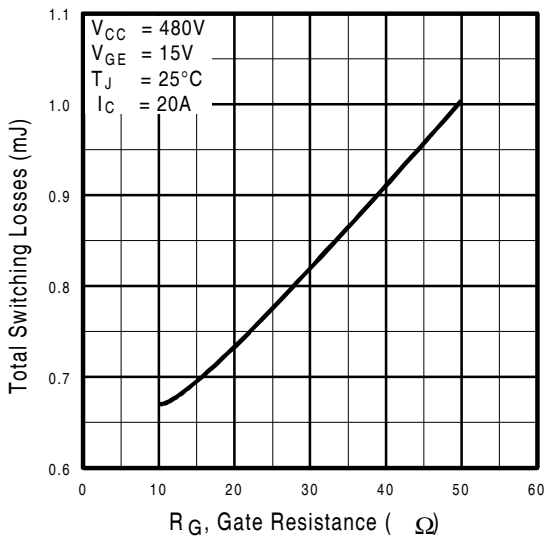
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



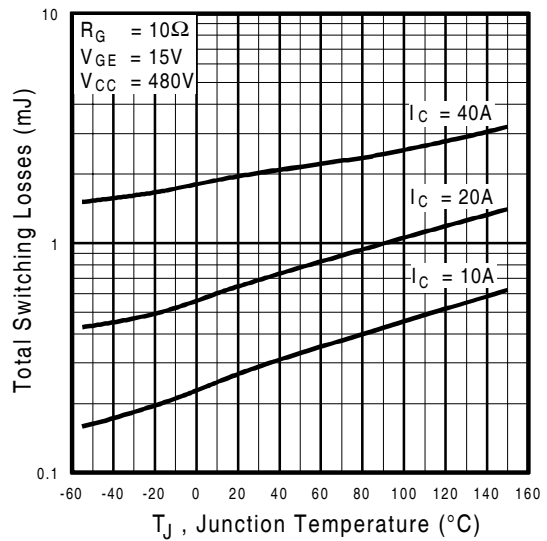
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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

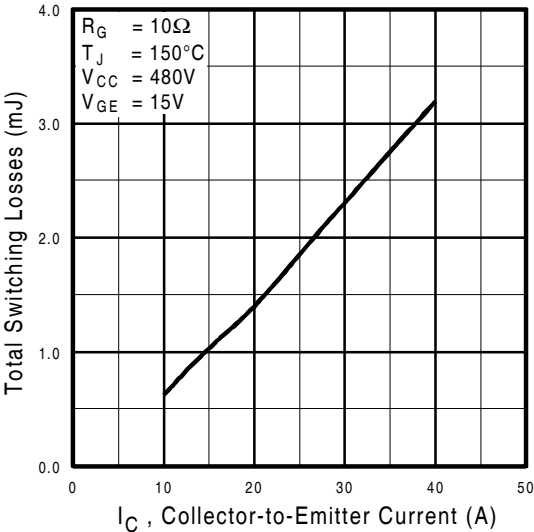


**Fig. 9** - Typical Switching Losses vs. Gate Resistance

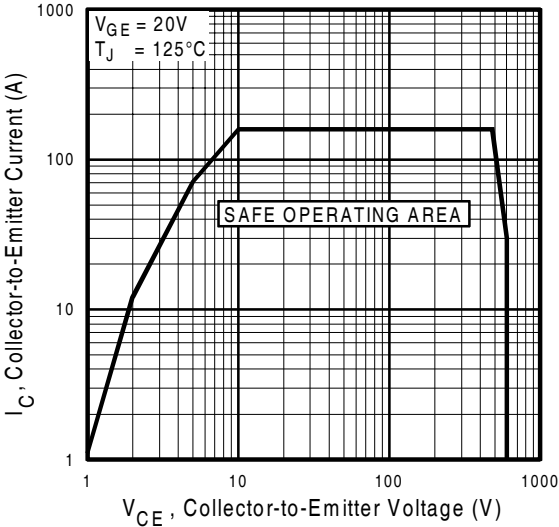


**Fig. 10** - Typical Switching Losses vs. Junction Temperature

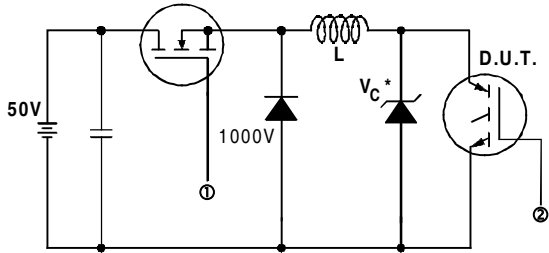
# IRG4PC40UPbF



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

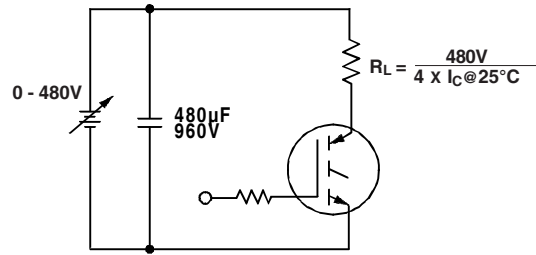


**Fig. 12** - Turn-Off SOA

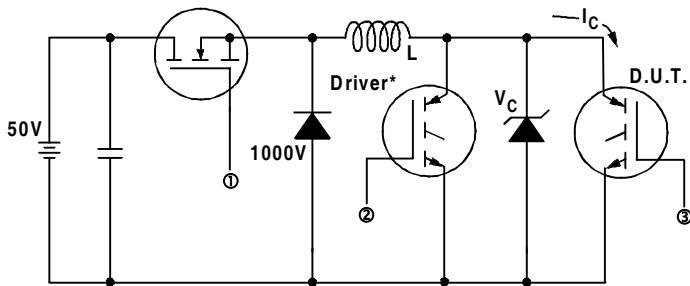


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

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

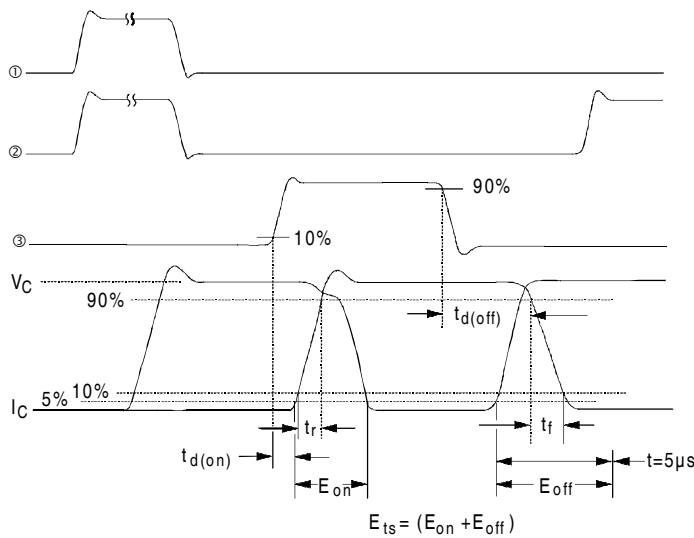


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

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



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

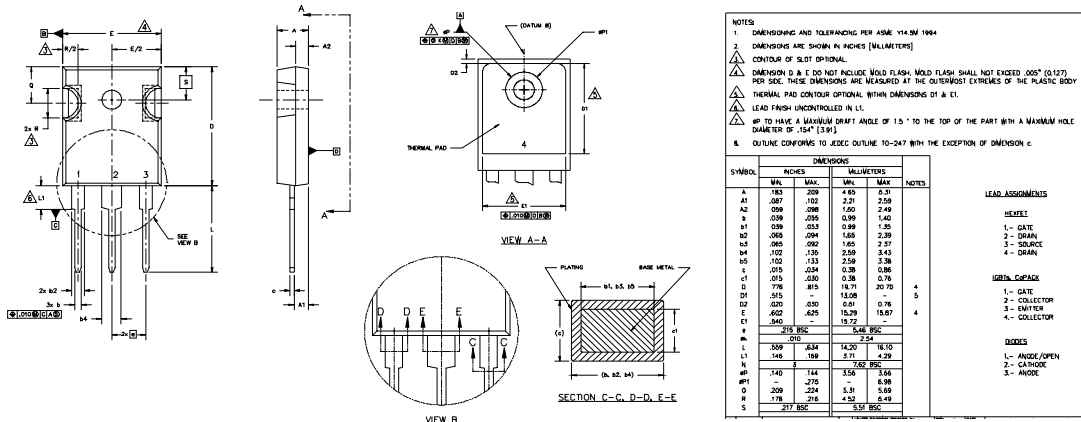


# IRG4PC40UPbF

International  
**IR** Rectifier

## TO-247AC Package Outline

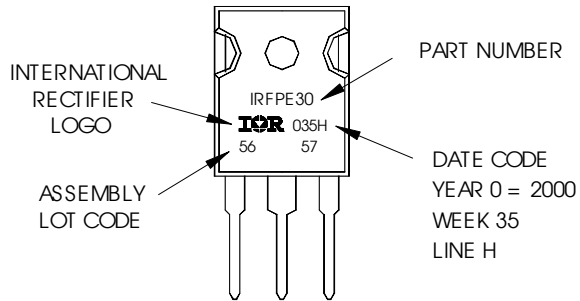
Dimensions are shown in millimeters (inches)



## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFP30  
WITH ASSEMBLY  
LOT CODE 5657  
ASSEMBLED ON WW 35, 2000  
IN THE ASSEMBLY LINE "H"

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



International  
**IR** Rectifier

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Data and specifications subject to change without notice. 04/04

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