

International **IR** Rectifier

PD - 91581A

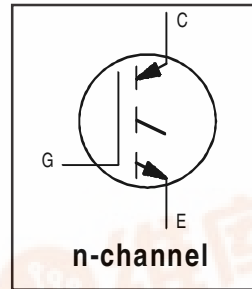
IRG4PC50S

INSULATED GATE BIPOLAR TRANSISTOR

Standard Speed IGBT

Features

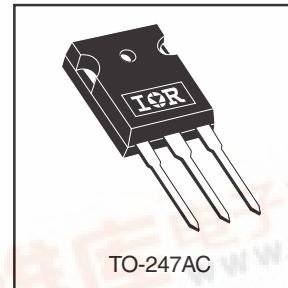
- Standard: Optimized for minimum saturation voltage and low operating frequencies (< 1kHz)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.28V$
@ $V_{GE} = 15V, I_C = 41A$

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	70	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	41	
I_{CM}	Pulsed Collector Current ^①	140	
I_{LM}	Clamped Inductive Load Current ^②	140	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ^③	20	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	78	
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		
	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	—	0.64	°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)

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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	$V_{GE} = 0\text{V}$, $I_C = 250\mu\text{A}$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0\text{V}$, $I_C = 1.0\text{A}$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.75	—	V/ $^\circ\text{C}$	$V_{GE} = 0\text{V}$, $I_C = 1.0\text{mA}$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.28	1.36	V	$I_C = 41\text{A}$ $V_{GE} = 15\text{V}$
		—	1.62	—		$I_C = 80\text{A}$ See Fig.2, 5
		—	1.28	—		$I_C = 41\text{A}$, $T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	$V_{CE} = V_{GE}$, $I_C = 250\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-9.3	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}$, $I_C = 250\mu\text{A}$
g_{fe}	Forward Transconductance ⑤	17	34	—	S	$V_{CE} = 100\text{V}$, $I_C = 41\text{A}$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0\text{V}$, $V_{CE} = 600\text{V}$
		—	—	2.0		$V_{GE} = 0\text{V}$, $V_{CE} = 10\text{V}$, $T_J = 25^\circ\text{C}$
		—	—	1000		$V_{GE} = 0\text{V}$, $V_{CE} = 600\text{V}$, $T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20\text{V}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	180	280	nC	$I_C = 41\text{A}$ $V_{CC} = 400\text{V}$ See Fig. 8 $V_{GE} = 15\text{V}$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	24	37		
Q_{gc}	Gate - Collector Charge (turn-on)	—	61	92		
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 41\text{A}$, $V_{CC} = 480\text{V}$ $V_{GE} = 15\text{V}$, $R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 9, 10, 14
t_r	Rise Time	—	30	—		
$t_{d(off)}$	Turn-Off Delay Time	—	650	980		
t_f	Fall Time	—	400	600		
E_{on}	Turn-On Switching Loss	—	0.72	—	mJ	Energy losses include "tail" See Fig. 9, 10, 14
E_{off}	Turn-Off Switching Loss	—	8.27	—		
E_{ts}	Total Switching Loss	—	8.99	13	mJ	$T_J = 150^\circ\text{C}$, $I_C = 41\text{A}$, $V_{CC} = 480\text{V}$ $V_{GE} = 15\text{V}$, $R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 11, 14
$t_{d(on)}$	Turn-On Delay Time	—	31	—		
t_r	Rise Time	—	31	—		
$t_{d(off)}$	Turn-Off Delay Time	—	1080	—		
t_f	Fall Time	—	620	—		
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	4100	—	pF	$V_{GE} = 0\text{V}$ $V_{CC} = 30\text{V}$ See Fig. 7 $f = 1.0\text{MHz}$
C_{oes}	Output Capacitance	—	250	—		
C_{res}	Reverse Transfer Capacitance	—	48	—		

Notes:

- ① Repetitive rating; $V_{GE} = 20\text{V}$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20\text{V}$, $L = 10\mu\text{H}$, $R_G = 5.0\Omega$, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu\text{s}$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu\text{s}$, single shot.

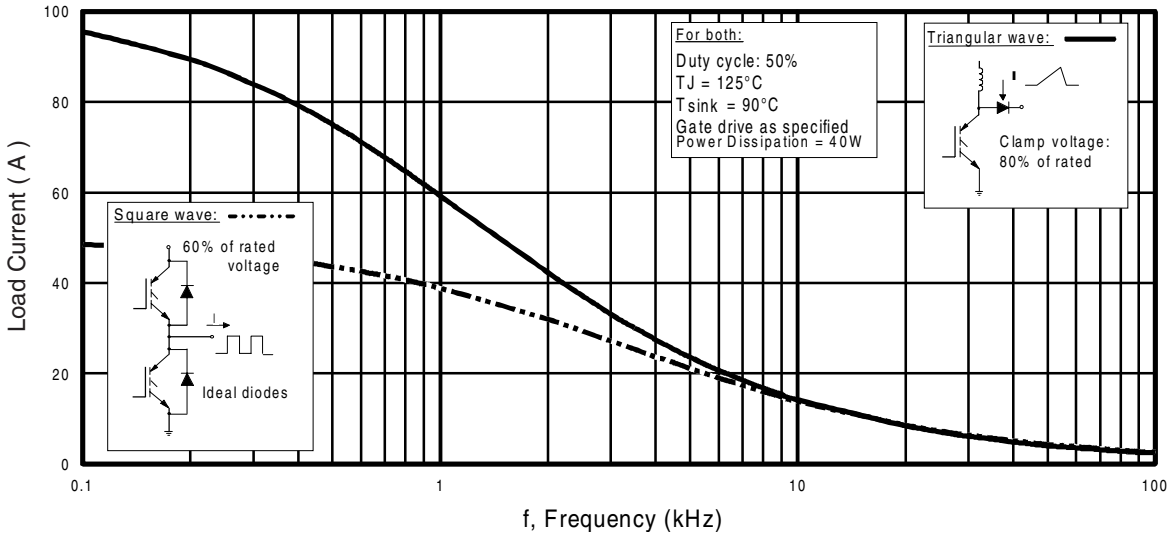


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

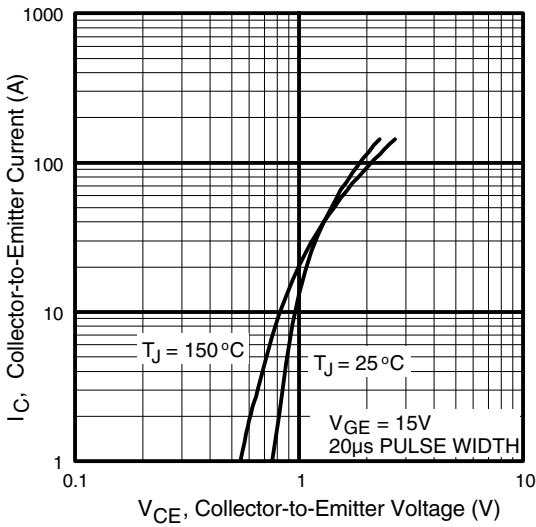


Fig. 2 - Typical Output Characteristics

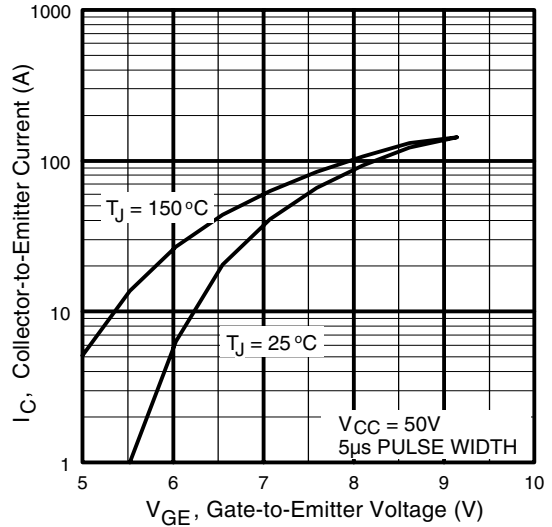


Fig. 3 - Typical Transfer Characteristics

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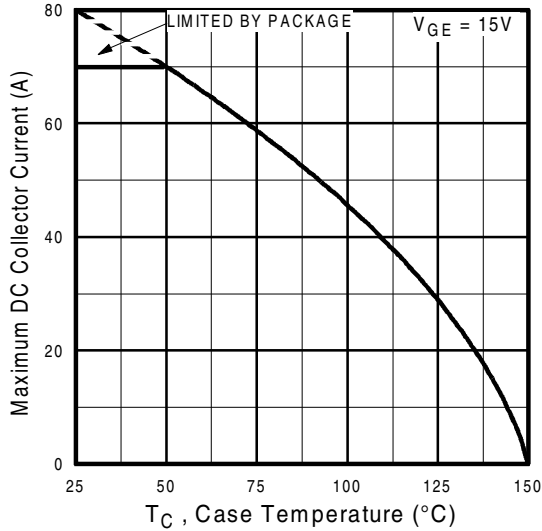


Fig. 4 - Maximum Collector Current vs. Case Temperature

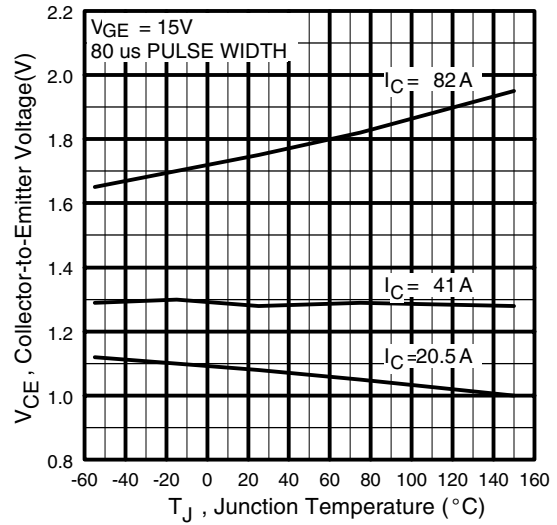


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

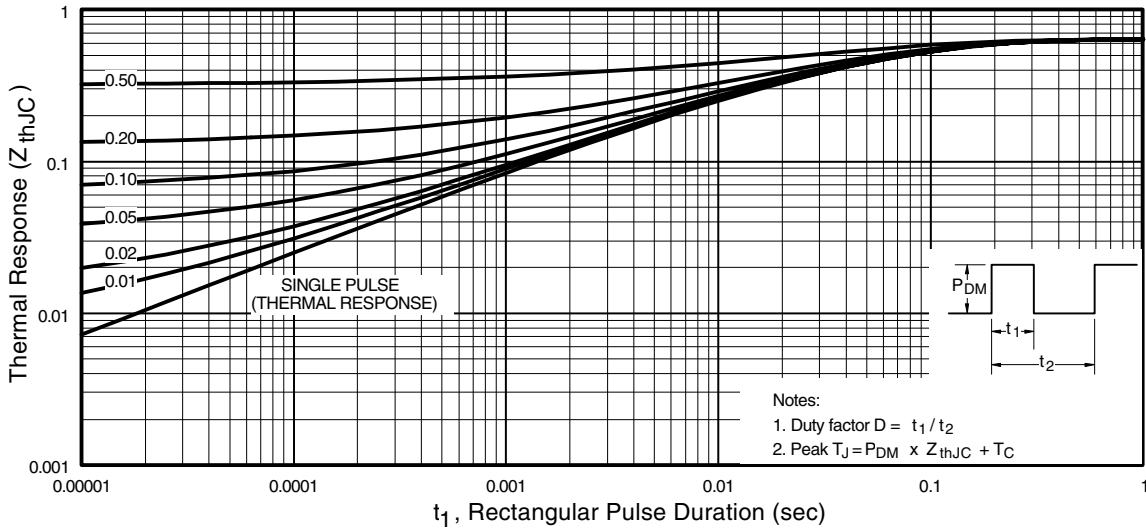


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

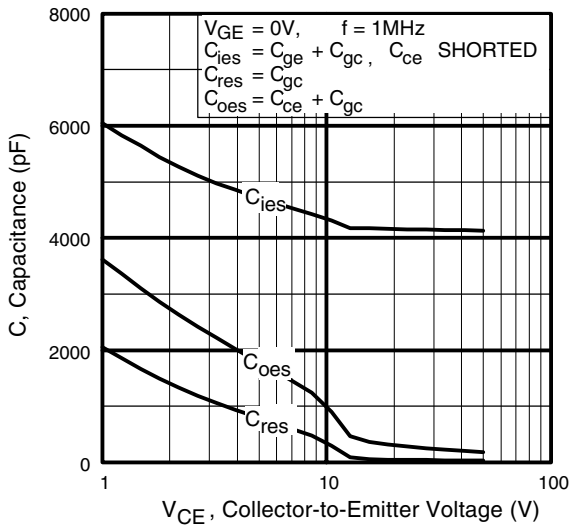


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

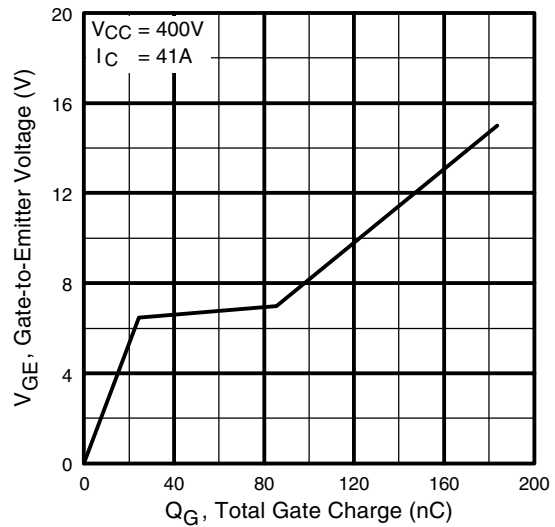


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

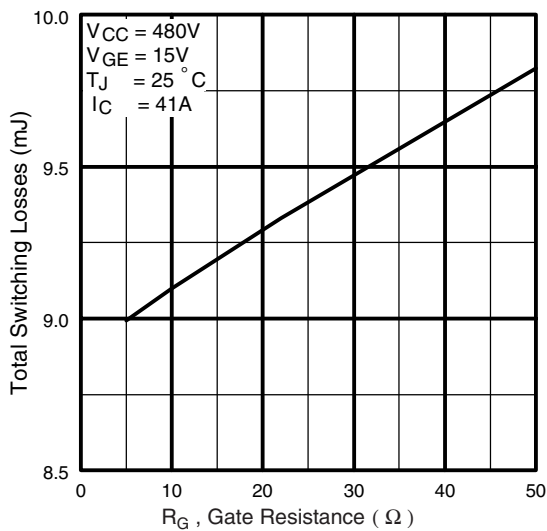


Fig. 9 - Typical Switching Losses vs. Gate Resistance

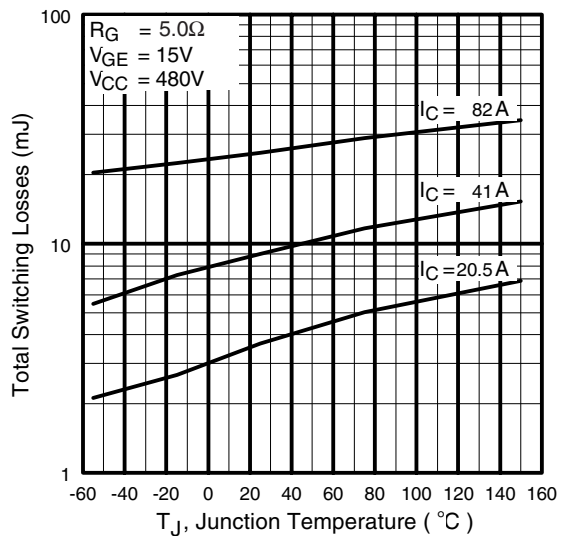


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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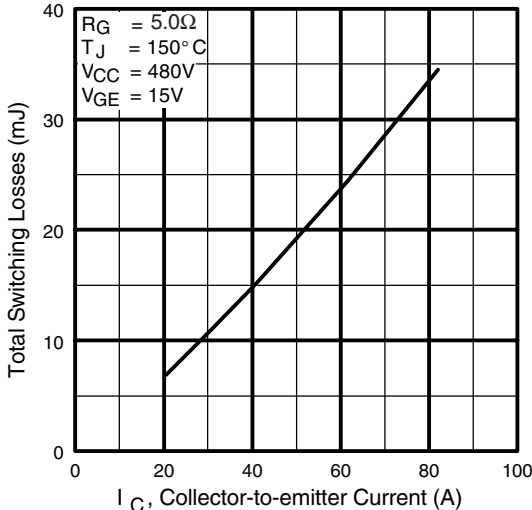


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

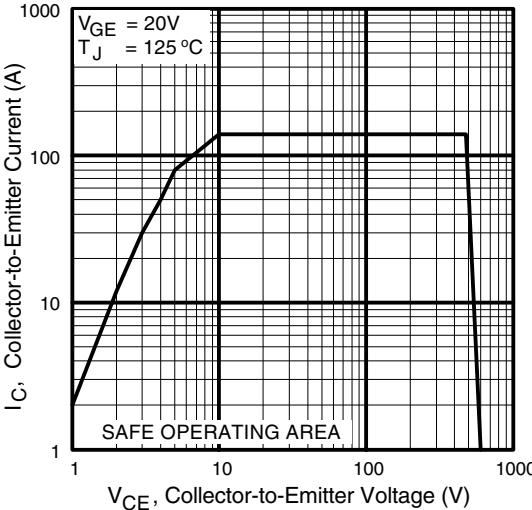
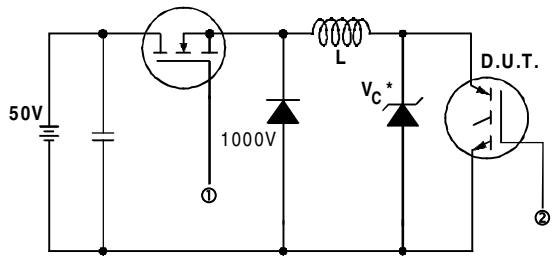


Fig. 12 - Turn-Off SOA



* 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

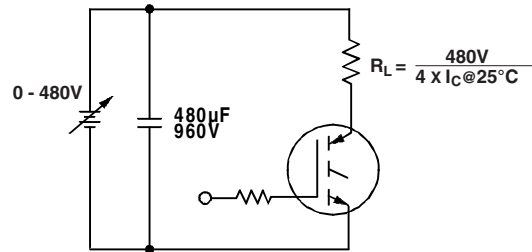


Fig. 13b - Pulsed Collector Current Test Circuit

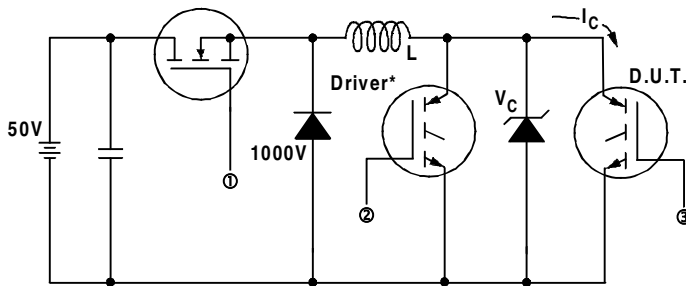


Fig. 14a - Switching Loss Test Circuit

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

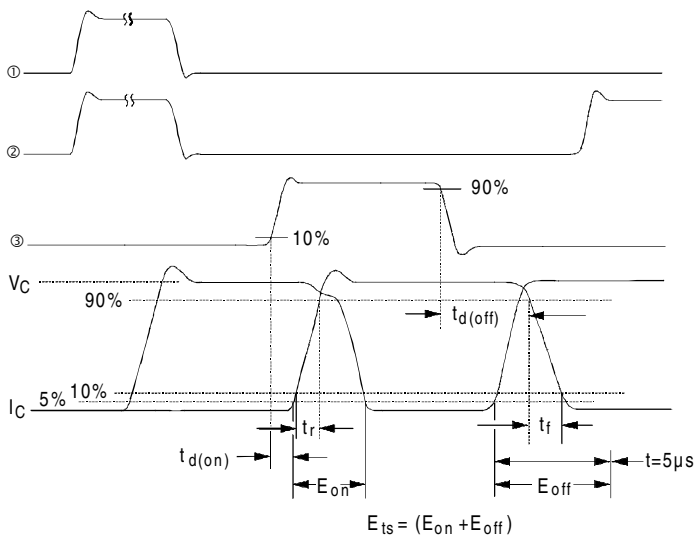
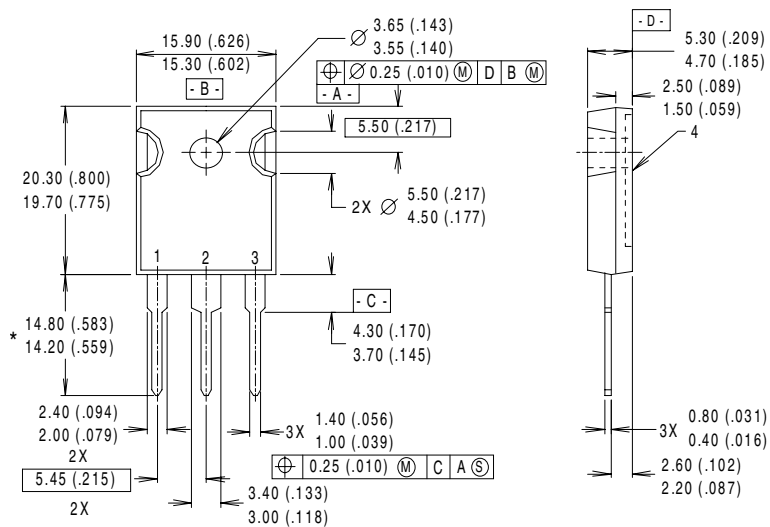


Fig. 14b - Switching Loss Waveforms

IRG4PC50S

Case Outline and Dimensions — TO-247AC



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

CONFORMS TO JEDEC OUTLINE TO-247AC (TO-3P)

Dimensions in Millimeters and (Inches)