International
IOR Rectifier

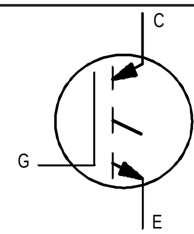
PD - 91710

IRG4PF50W

INSULATED GATE BIPOLAR TRANSISTOR

Features

- Optimized for use in Welding and Switch-Mode Power Supply applications
- Industry benchmark switching losses improve efficiency of all power supply topologies
- 50% reduction of Eoff parameter
- Low IGBT conduction losses
- Latest technology IGBT design offers tighter parameter distribution coupled with exceptional reliability



n-channel

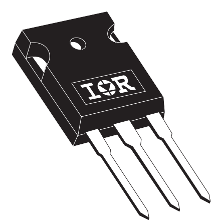
V_{CES} = 900V

$V_{CE(on)\ typ.}$ = 2.25V

@V_{GE} = 15V, I_C = 28A

Benefits

- Lower switching losses allow more cost-effective operation and hence efficient replacement of larger-die MOSFETs up to 100kHz
- Of particular benefit in single-ended converters and Power Supplies 150W and higher
- Reduction in critical Eoff parameter due to minimal minority-carrier recombination coupled with low on-state losses allow maximum flexibility in device application



TO-247AC

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	900	V
I_C @ T_C = 25°C	Continuous Collector Current	51	A
I_C @ T_C = 100°C	Continuous Collector Current	28	
I_{CM}	Pulsed Collector Current ①	204	
I_{LM}	Clamped Inductive Load Current ②	204	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	186	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	200	W
P_D @ T_C = 100°C	Maximum Power Dissipation	78	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (0.063 in. (1.6mm from case)	

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 (0.21)	——	g (oz)

4/15/98

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	900	——	——	V	V_{GE} = 0V, I_C = 250µA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	——	——	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	——	0.295	——	V/°C	V_{GE} = 0V, I_C = 3.5mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	——	2.25	2.7	V	I_C = 28A, V_{GE} = 15V
		——	2.74	——		I_C = 60A, See Fig.2, 5
		——	2.12	——		I_C = 28A , T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	——	6.0		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	——	-13	——	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA
g_{fe}	Forward Transconductance ⑤	26	39	——	S	$V_{CE} \geq$ 15V, I_C = 28A
I_{CES}	Zero Gate Voltage Collector Current	——	——	500	µA	V_{GE} = 0V, V_{CE} = 900V
		——	——	2.0		V_{GE} = 0V, V_{CE} = 10V, T_J = 25°C
		——	——	5.0	mA	V_{GE} = 0V, V_{CE} = 900V, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	——	——	±100	nA	V_{GE} = ±20V

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	——	160	240	nC	I_C = 28A
Q_{ge}	Gate - Emitter Charge (turn-on)	——	19	29		V_{CC} = 400V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	——	53	80		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	——	29	——	ns	
t_r	Rise Time	——	26	——		T_J = 25°C
$t_{d(off)}$	Turn-Off Delay Time	——	110	170		I_C = 28A, V_{CC} = 720V
t_f	Fall Time	——	150	220		V_{GE} = 15V, R_G = 5.0Ω
E_{on}	Turn-On Switching Loss	——	0.19	——	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	——	1.06	——		See Fig. 10, 11, 13, 14
E_{ts}	Total Switching Loss	——	1.25	1.7		
$t_{d(on)}$	Turn-On Delay Time	——	28	——	ns	T_J = 150°C,
t_r	Rise Time	——	26	——		I_C = 28A, V_{CC} = 720V
$t_{d(off)}$	Turn-Off Delay Time	——	280	——		V_{GE} = 15V, R_G = 5.0Ω
t_f	Fall Time	——	90	——		Energy losses include "tail"
E_{ts}	Total Switching Loss	——	3.45	——	mJ	See Fig. 13, 14
L_E	Internal Emitter Inductance	——	13	——	nH	Measured 5mm from package
C_{ies}	Input Capacitance	——	3300	——	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	——	200	——		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	——	45	——		f = 1.0MHz

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 = 10µH, R_G = 5.0Ω, (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.

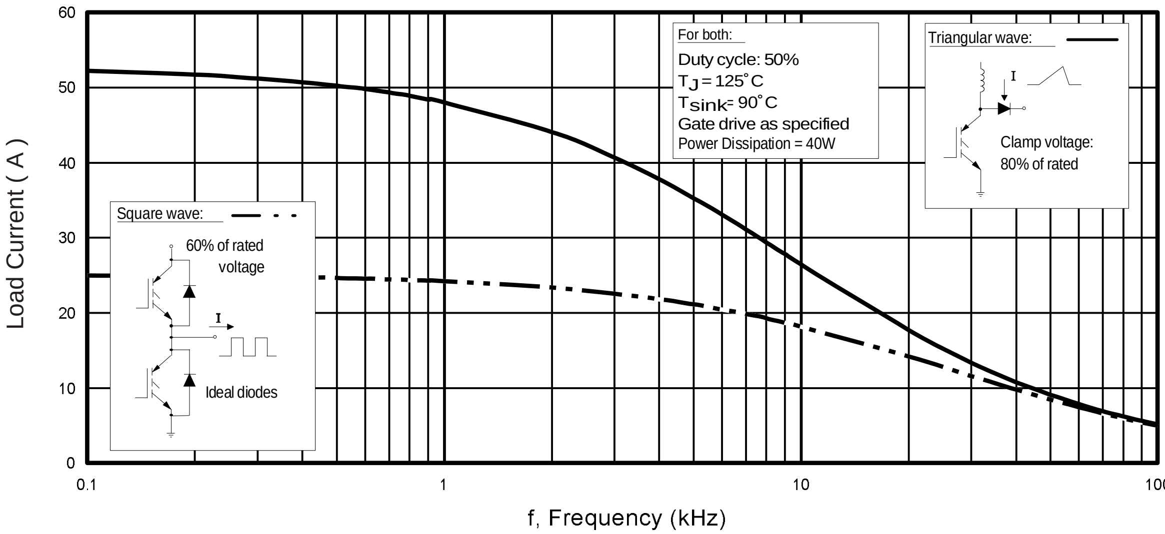


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

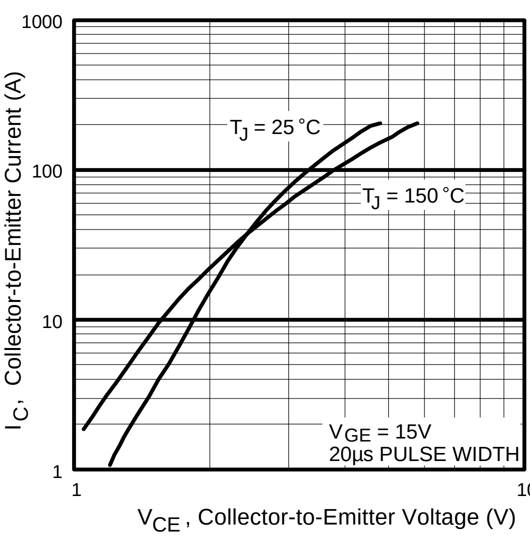


Fig. 2 - Typical Output Characteristics

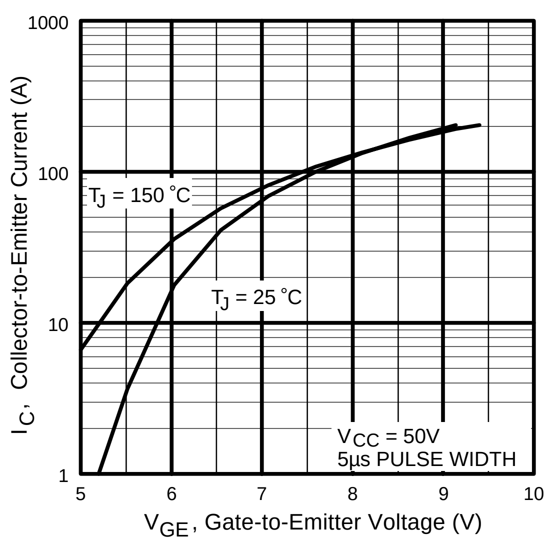


Fig. 3 - Typical Transfer Characteristics

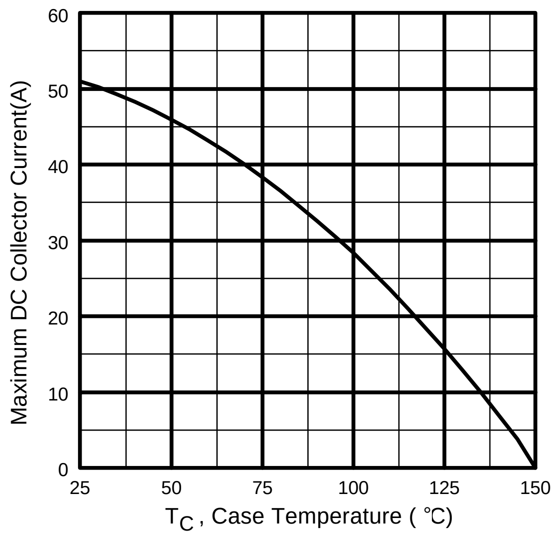


Fig. 4 - Maximum Collector Current vs. Case Temperature

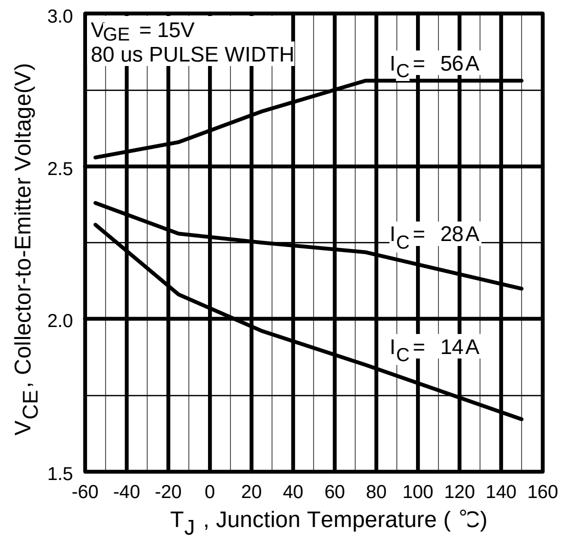


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

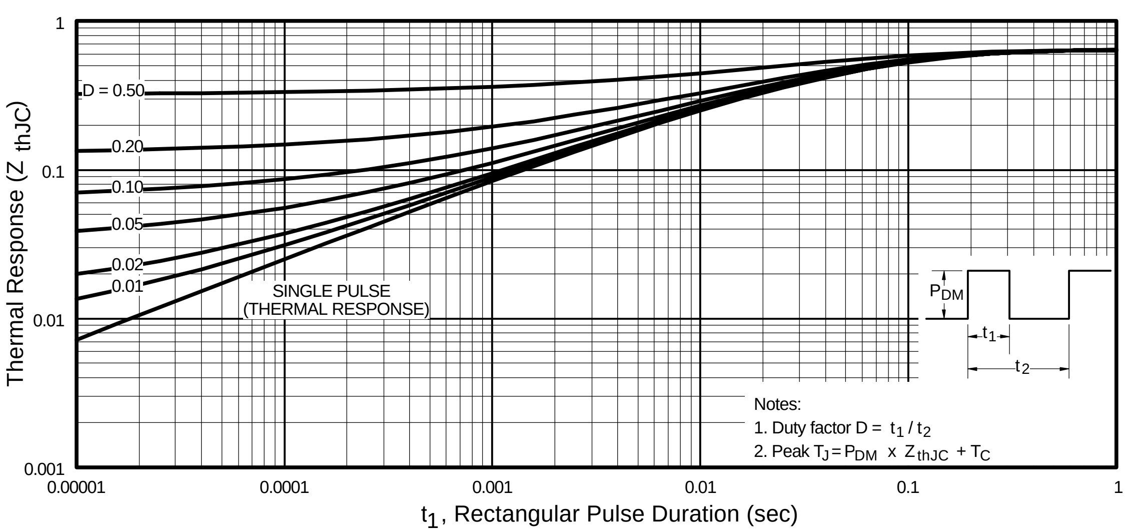


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

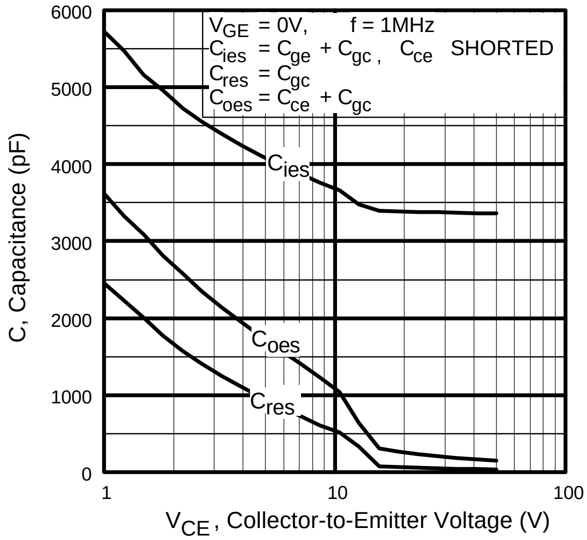


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

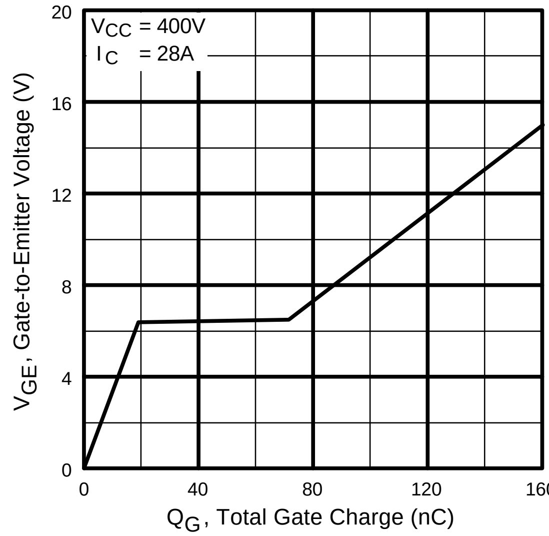


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

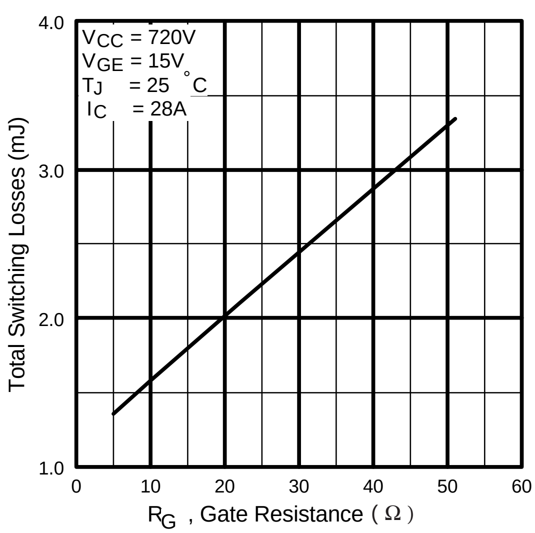


Fig. 9 - Typical Switching Losses vs. Gate Resistance

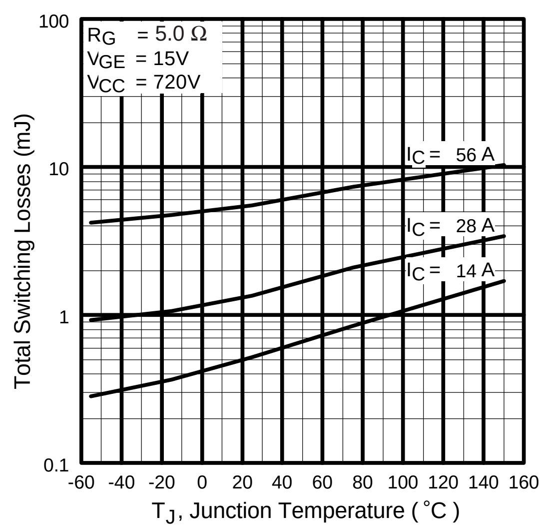


Fig. 10 - Typical Switching Losses vs. Junction Temperature

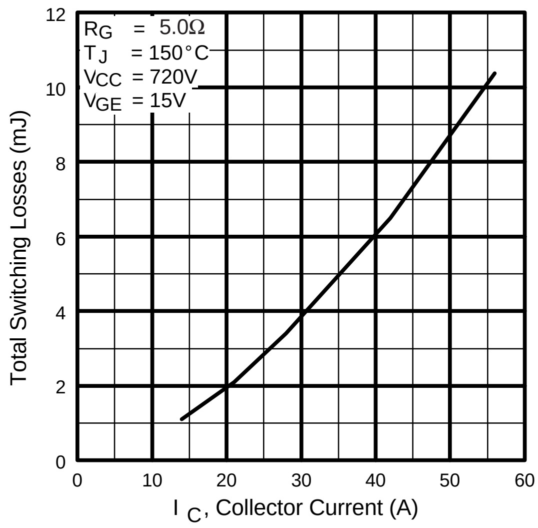


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

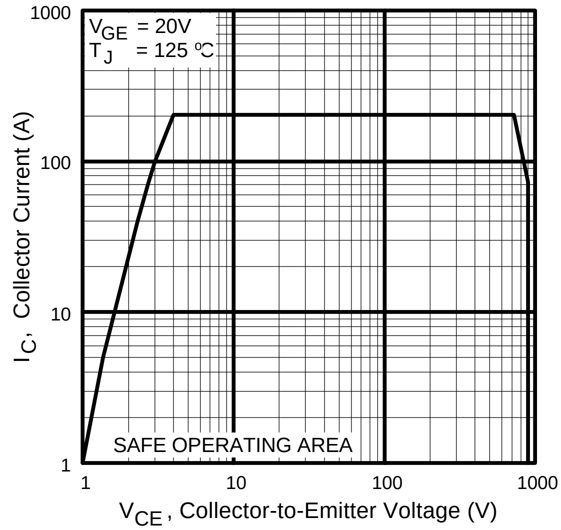
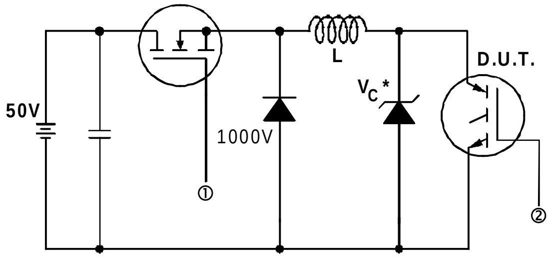


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; Vc = 80% of Vce(max)
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated Id.

Fig. 13a - Clamped Inductive Load Test Circuit

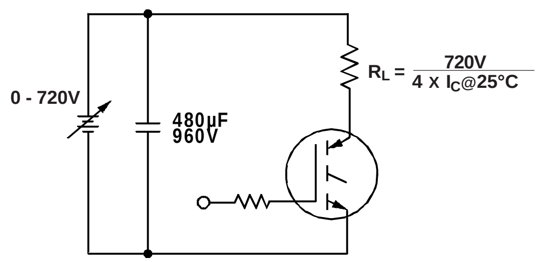


Fig. 13b - Pulsed Collector Current Test Circuit

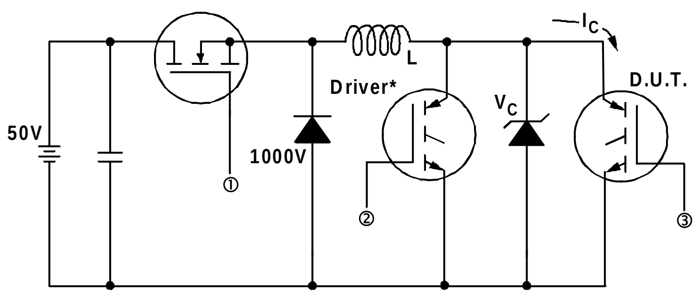


Fig. 14a - Switching Loss Test Circuit

*** Driver same type as D.U.T., VC = 720V**

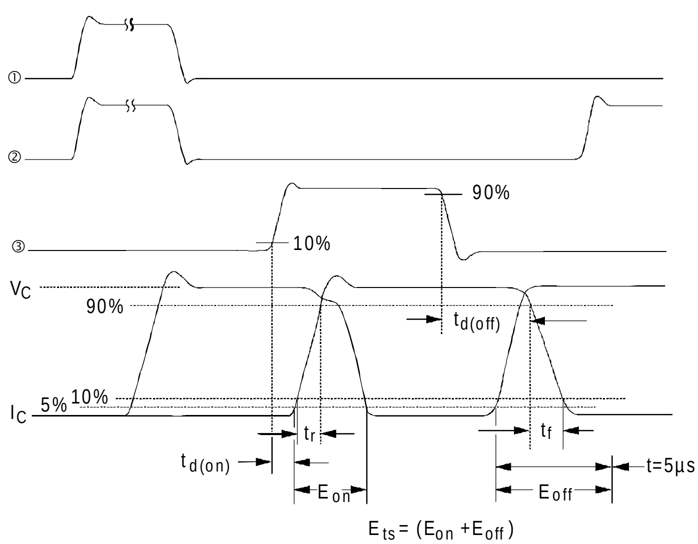
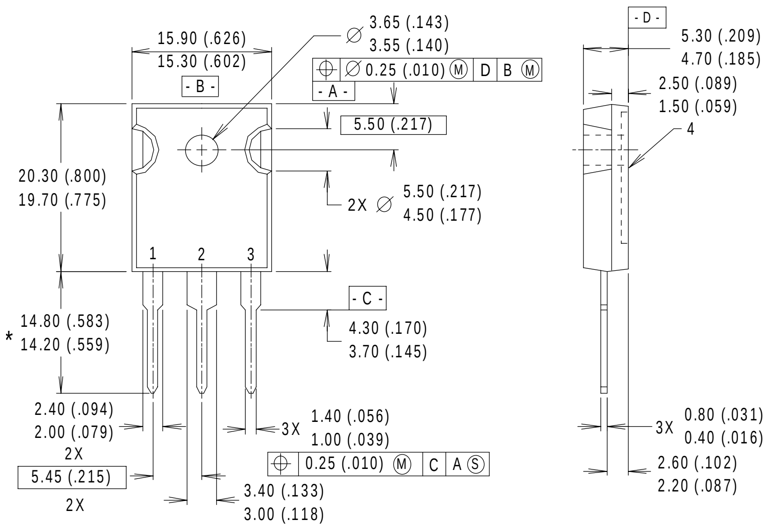


Fig. 14b - Switching Loss Waveforms

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)

International
IOR Rectifier
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IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T 3Z2, Tel: (905) 453 2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
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