PD - 91733A

International
IOR Rectifier

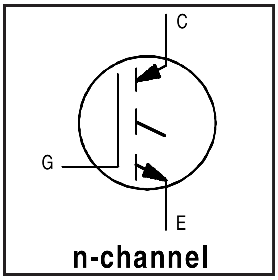
IRG4BC10K

Short Circuit Rated
UltraFast IGBT

INSULATED GATE BIPOLAR TRANSISTOR

Features

- Short Circuit Rated UltraFast: Optimized for high operating frequencies >5.0 kHz , and Short Circuit Rated to 10µs @ 125°C, V_{GE} = 15V
- Generation 4 IGBT design provides higher efficiency than Generation 3
- Industry standard TO-220AB package



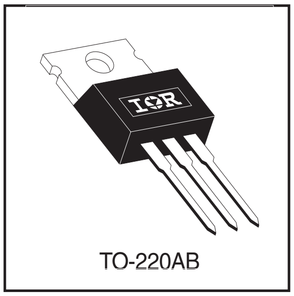
V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 2.39V

@V_{GE} = 15V, I_C = 5.0A

Benefits

- Generation 4 IGBTs offer highest efficiency available
- IGBTs optimized for specified application conditions



TO-220AB

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	9.0	A
I_C @ T_C = 100°C	Continuous Collector Current	5.0	
I_{CM}	Pulsed Collector Current ①	18	
I_{LM}	Clamped Inductive Load Current ②	18	
t_{sc}	Short Circuit Withstand Time	10	µs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	34	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	38	W
P_D @ T_C = 100°C	Maximum Power Dissipation	15	
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)	
	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	——	3.3	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	——	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	——	80	
Wt	Weight	2.0 (0.07)	——	g (oz)

4/24/2000

Electrical Characteristics @ T_J = 25°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 = 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	—	0.58	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.39	2.62	V	I_C = 5.0A V_{GE} = 15V
		—	3.25	—		I_C = 9.0A See Fig.2, 5
		—	2.63	—		I_C = 5.0A , T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.5		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ⑤	1.2	1.8	—	S	V_{CE} = 50 V, I_C = 5.0A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V
		—	—	2.0		V_{GE} = 0V, V_{CE} = 10V, T_J = 25°C
		—	—	1000		V_{GE} = 0V, V_{CE} = 600V, 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)	—	19	29	nC	I_C = 5.0A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	2.9	4.3		V_{CC} = 400V See Fig.8
Q_{gc}	Gate - Collector Charge (turn-on)	—	9.8	15		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	
t_r	Rise Time	—	24	—		T_J = 25°C
$t_{d(off)}$	Turn-Off Delay Time	—	51	77		I_C = 5.0A, V_{CC} = 480V
t_f	Fall Time	—	190	290		V_{GE} = 15V, R_G = 100Ω
E_{on}	Turn-On Switching Loss	—	0.16	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	0.10	—		See Fig. 9,10,14
E_{ts}	Total Switching Loss	—	0.26	0.32		
t_{sc}	Short Circuit Withstand Time	10	—	—	µs	V_{CC} = 400V, T_J = 125°C V_{GE} = 15V, R_G = 100Ω , V_{CPK} < 500V
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	T_J = 150°C,
t_r	Rise Time	—	27	—		I_C = 5.0A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	67	—		V_{GE} = 15V, R_G = 100Ω
t_f	Fall Time	—	350	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	0.47	—	mJ	See Fig. 10,11,14
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	220	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	29	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	7.5	—		ƒ = 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 = 100Ω, (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.

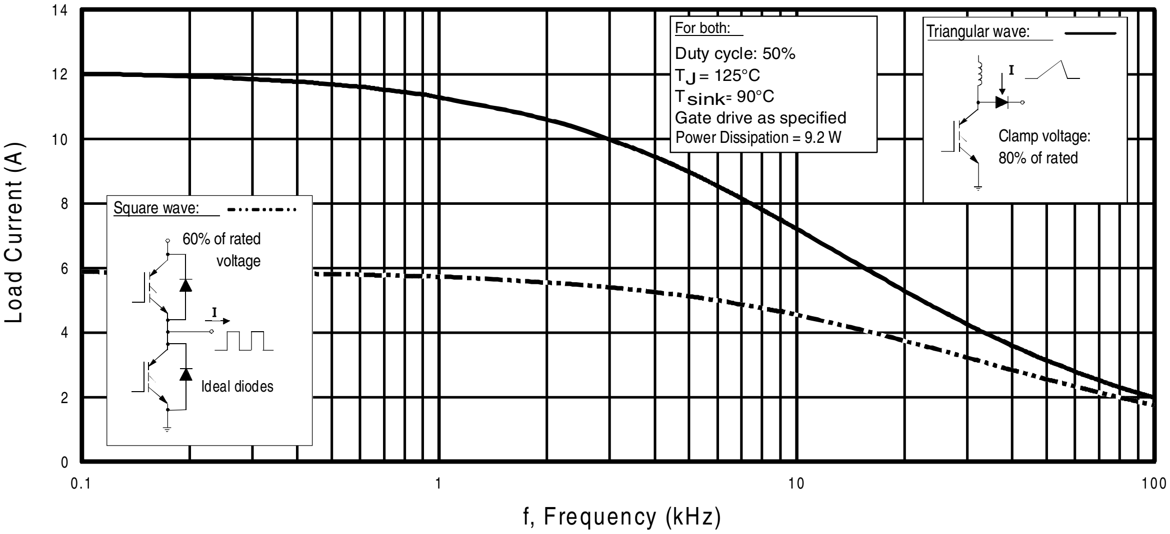


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

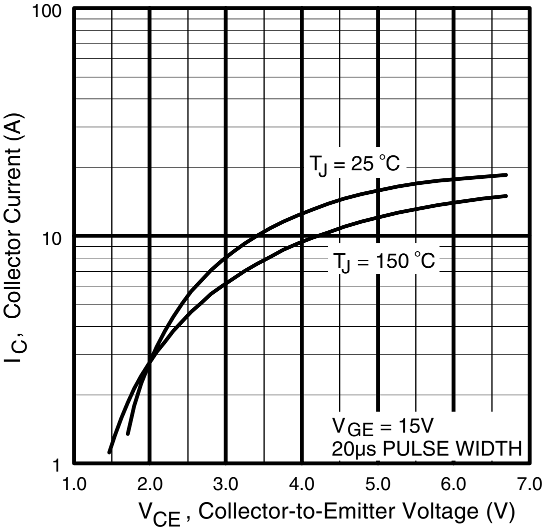


Fig. 2 - Typical Output Characteristics

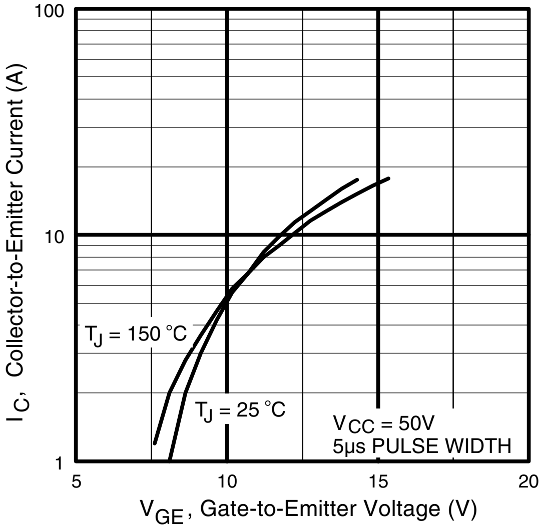


Fig. 3 - Typical Transfer Characteristics

5µs PULSE WIDTH

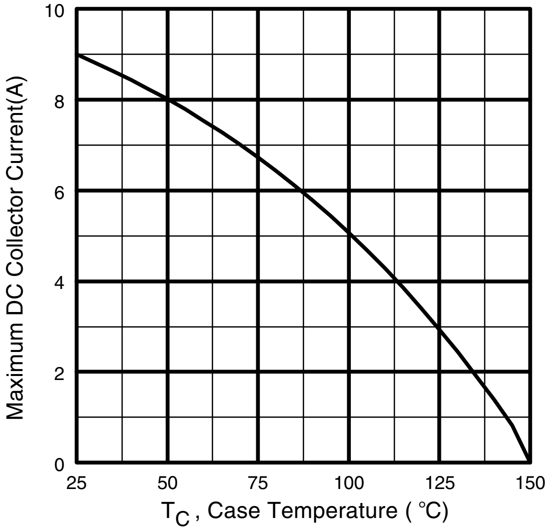


Fig. 4 - Maximum Collector Current vs. Case Temperature

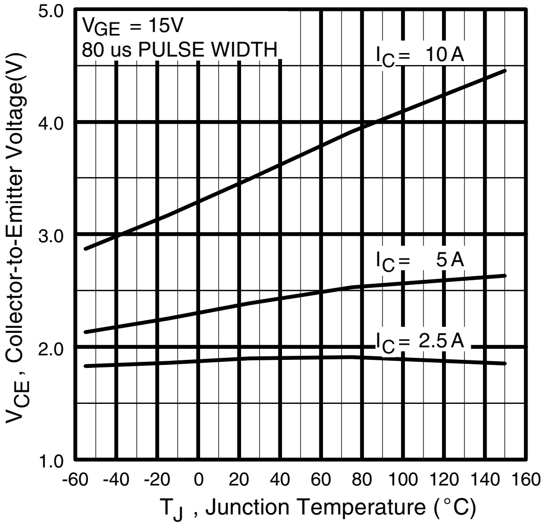


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

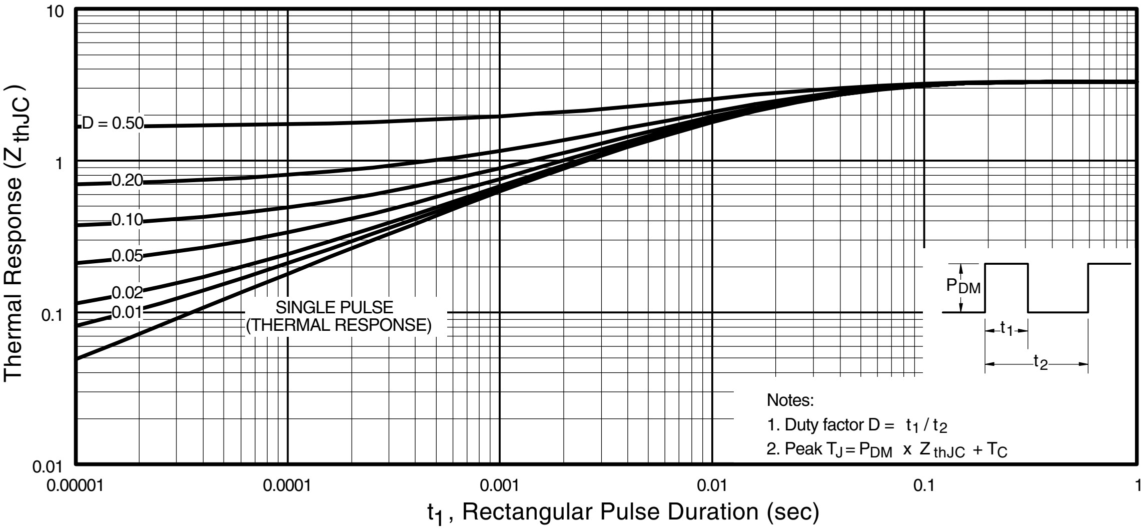


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

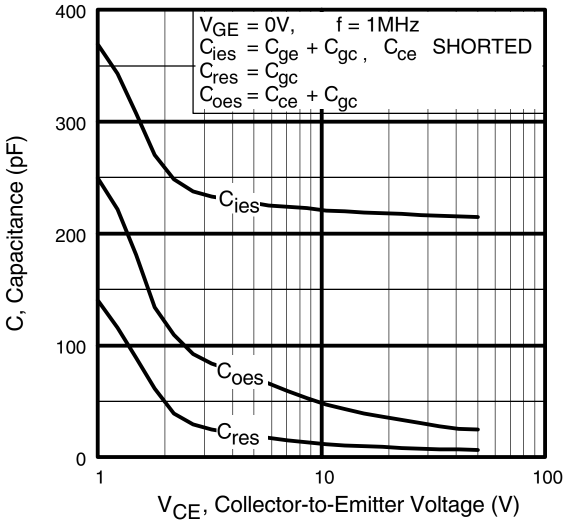


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

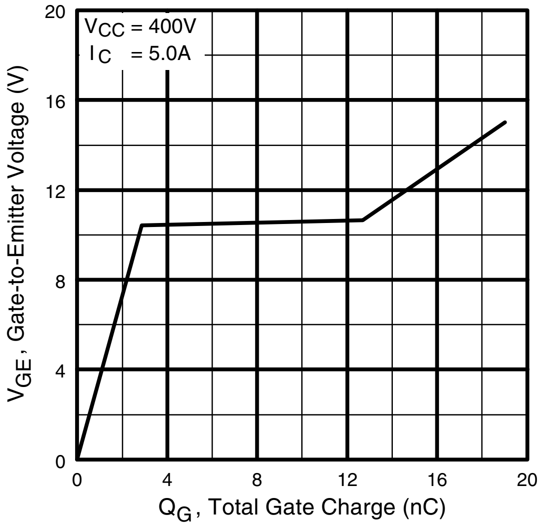


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

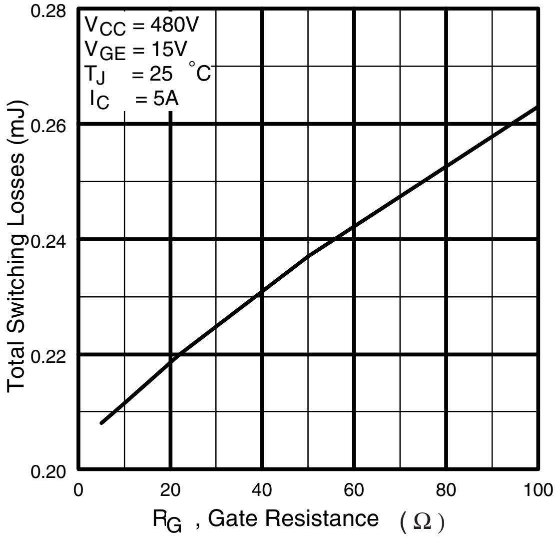


Fig. 9 - Typical Switching Losses vs. Gate Resistance

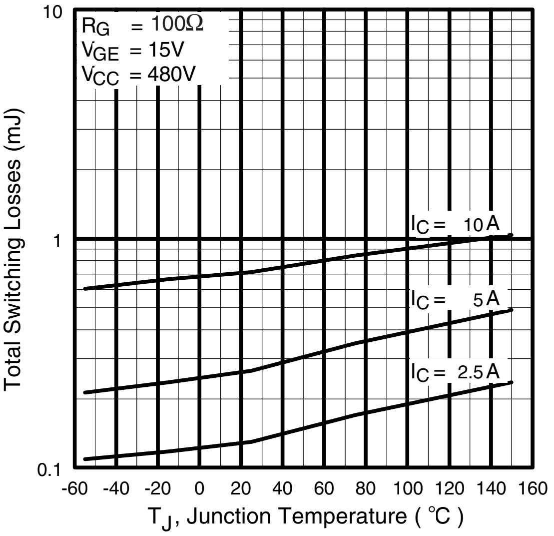


Fig. 10 - Typical Switching Losses vs. Junction Temperature

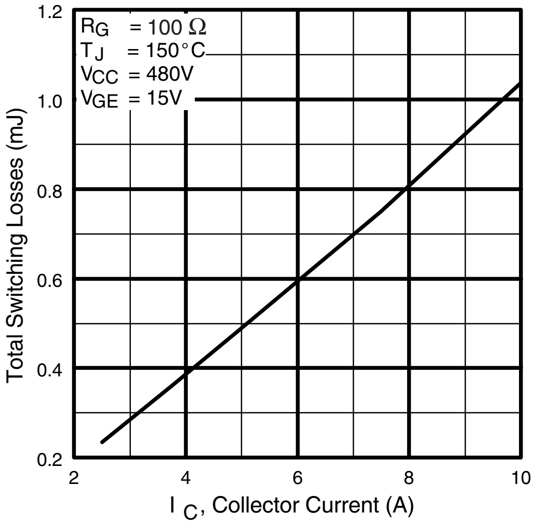


Fig. 11 - Typical Switching Losses vs. Collector Current

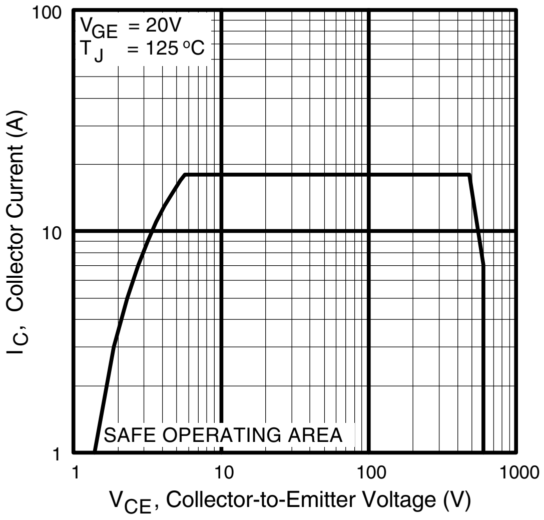
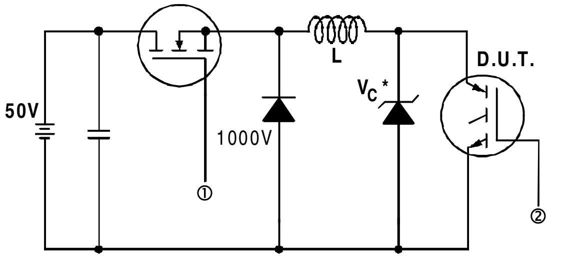


Fig. 12 - Turn-Off SOA



* 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

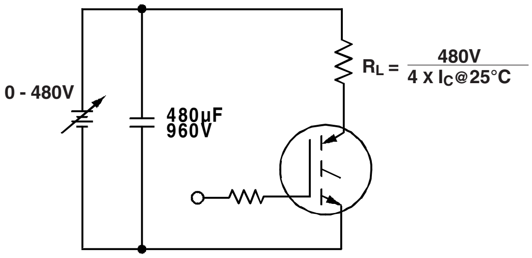


Fig. 13b - Pulsed Collector Current Test Circuit

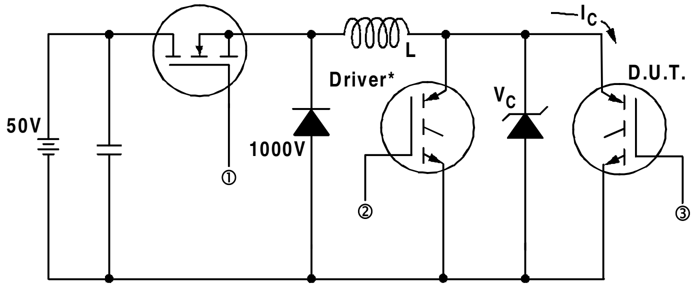


Fig. 14a - Switching Loss Test Circuit

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

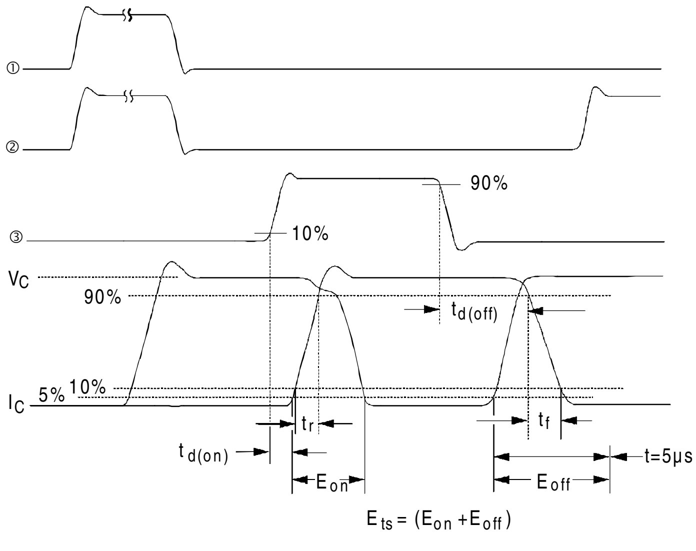
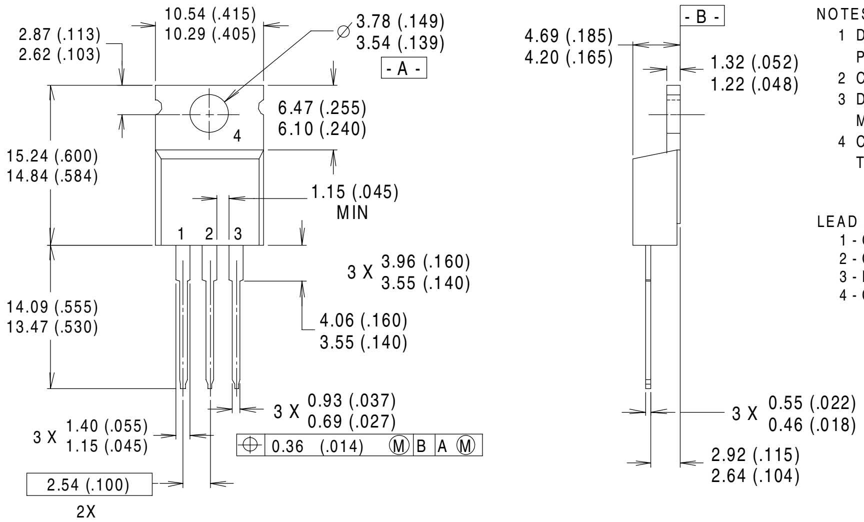


Fig. 14b - Switching Loss Waveforms

Case Outline and Dimensions — TO-220AB



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-220AB.

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

CONFORMS TO JEDEC OUTLINE TO-220AB
Dimensions in Millimeters and (Inches)

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
IR EUROPEAN REGIONAL CENTRE: 439/445 Godstone Rd, Whyteleafe, Surrey CR3 OBL, UK Tel: ++ 44 (0)20 8645 8000
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111
IR JAPAN: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630
IR TAIWAN:16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936