PD-94305F

International
IOR Rectifier

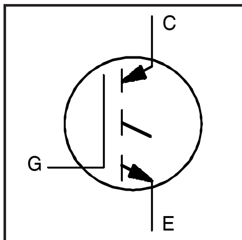
IRG4MC40U

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

Features

- Electrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- UltraFast Speed Operation 8KHz - 40KHz, > 200KHz in Resonent Mode
- High Operating Frequency
- Switching-loss Rating includes all "tail" Losses
- Ceramic Eyelets



N-Channel

V_{CES} = 600V

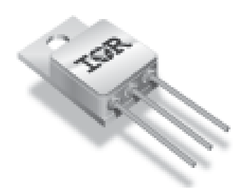
$V_{CE(on)max}$ = 2.1V

@V_{GE} =15V, I_C = 20A

Benefits

- Generation 4 IGBTs offer highest efficiency available
- IGBT's optimized for specified application conditions
- Designed to be a "drop-in" replacement for equivalent IR A&D Generation 3 IGBTs

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.



TO-254AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	35*	A
I_C @ T_C = 100°C	Continuous Collector Current	20	
I_{CM}	Pulsed Collector Current ①	140	
I_{LM}	Clamped Inductive Load Current ②	140	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	114	W
P_D @ T_C = 100°C	Maximum Power Dissipation	45	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Lead Temperature	300 (0.063in./1.6mm from case for 10s)	
	Weight	9.3 (typical)	g

* Current is limited by package

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction-to-Case	—	—	1.1	°C/W	

06/23/08

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 = 1.0 mA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ③	17	——	——	V	V_{GE} = 0V, I_C = 1.0 A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	——	0.5	——	V/°C	V_{GE} = 0V, I_C = 1.0 mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	——	——	2.1	V	I_C = 20A; V_{GE} = 15V
		——	——	2.5		I_C = 35A; See Fig.2, 5
		——	——	2.1		I_C = 20A , T_J = 125°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	——	6.0		V_{CE} = V_{GE}, I_C = 1.0 mA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	——	-12	——	mV/°C	V_{CE} = V_{GE}, I_C = 250 µA
g_{fe}	Forward Transconductance ④	11	——	——	S	$V_{CE} \geq$ 15V, I_C = 20A
I_{CES}	Zero Gate Voltage Collector Current	——	——	50	µA	V_{GE} = 0V, V_{CE} = 480V
		——	——	2000		V_{GE} = 0V, V_{CE} = 480V, T_J = 125°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)	——	——	150	nC	I_C = 20A
Q_{ge}	Gate - Emitter Charge (turn-on)	——	——	25		V_{CC} = 300V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	——	——	60		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	——	——	50	ns	T_J = 25°C
t_r	Rise Time	——	——	42		I_C = 20A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	——	——	190		V_{GE} = 15V, R_G = 9.1Ω
t_f	Fall Time	——	——	150		Energy losses include "tail"
E_{ts}	Total Switching Loss	——	——	1.0	mJ	See Fig. 10, 11, 13, 14
$t_{d(on)}$	Turn-On Delay Time	——	——	40	ns	T_J = 125°C,
t_r	Rise Time	——	——	40		I_C = 20A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	——	——	300		V_{GE} = 15V, R_G = 9.1Ω
t_r	Rise Time	——	——	250		Energy losses include "tail"
E_{ts}	Total Switching Loss	——	——	1.8	mJ	See Fig. 13, 14
L_C+L_E	Total Inductance	——	6.8	——	nH	Measured from Collector lead (6mm/ 0.25in. from package) to Emitter lead (6mm / 0.25in. from package)
C_{ies}	Input Capacitance	——	2215	——	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	——	135	——		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	——	25	——		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 = 100µH, R_G = 9.1Ω, (See Fig.13a)

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

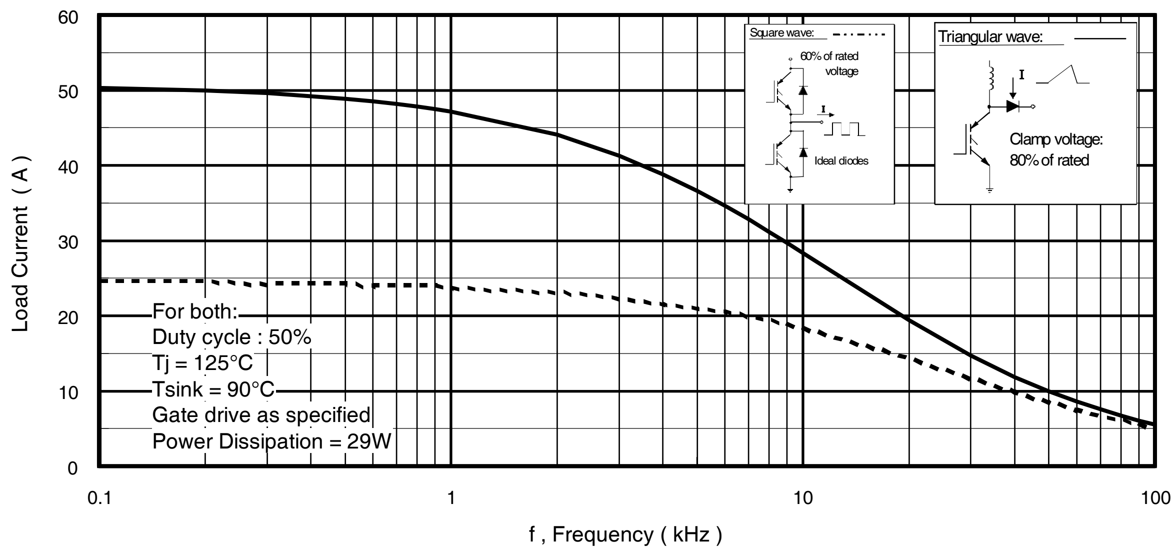


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

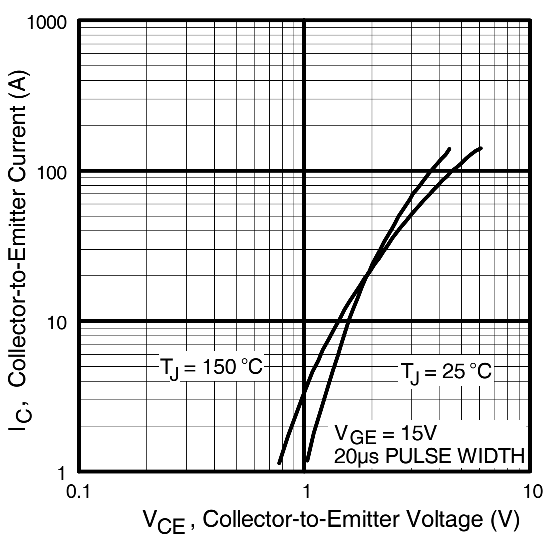


Fig. 2 - Typical Output Characteristics

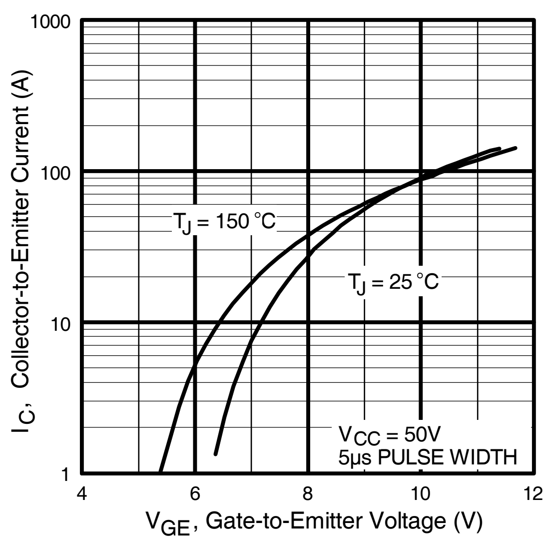


Fig. 3 - Typical Transfer Characteristics

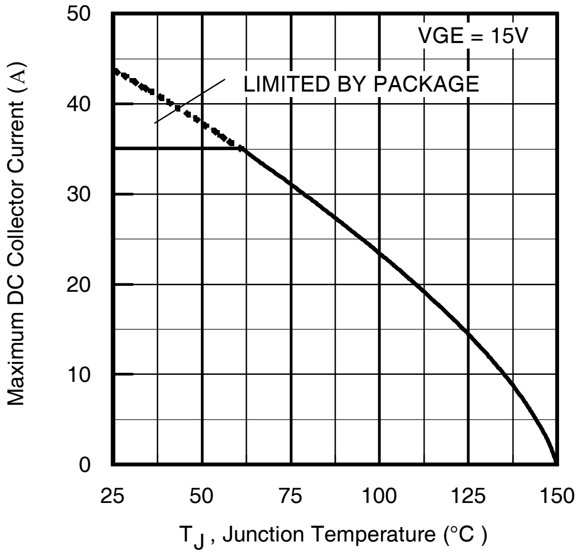


Fig. 4 - Maximum Collector Current vs. Case Temperature

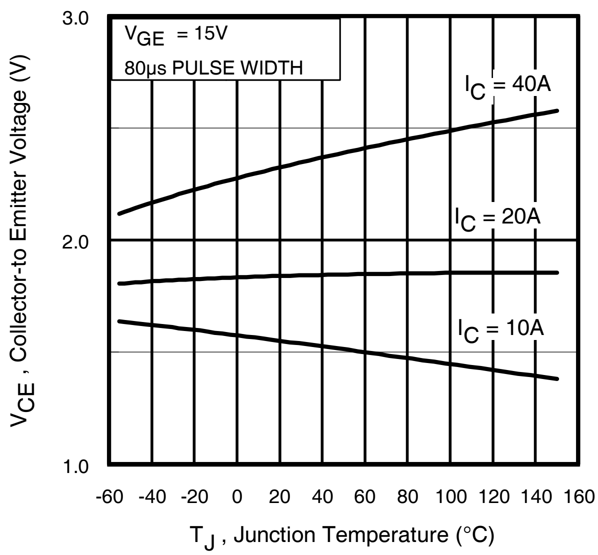


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

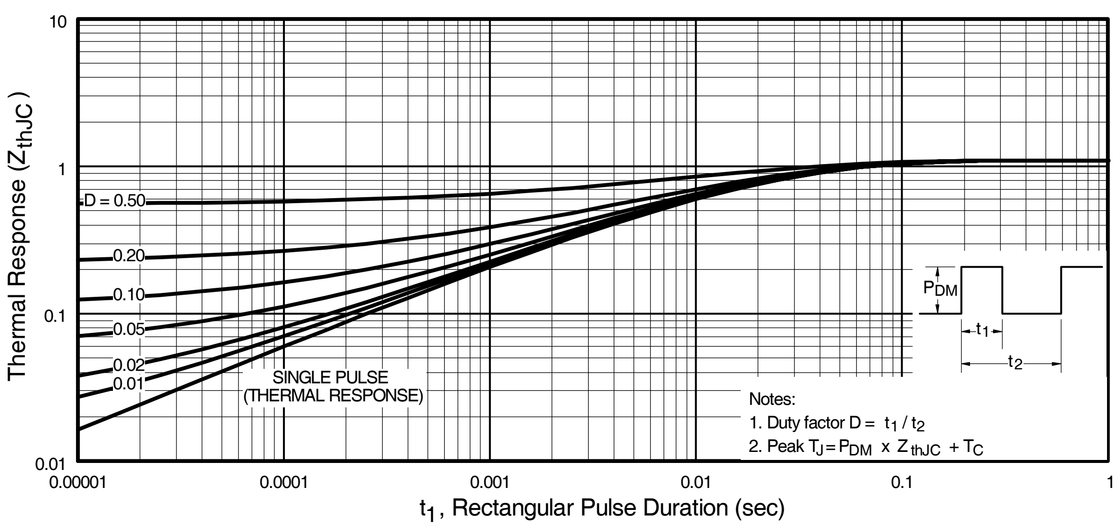


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

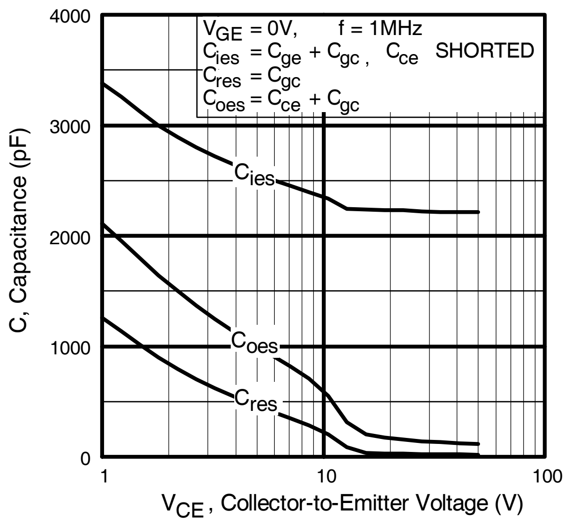


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

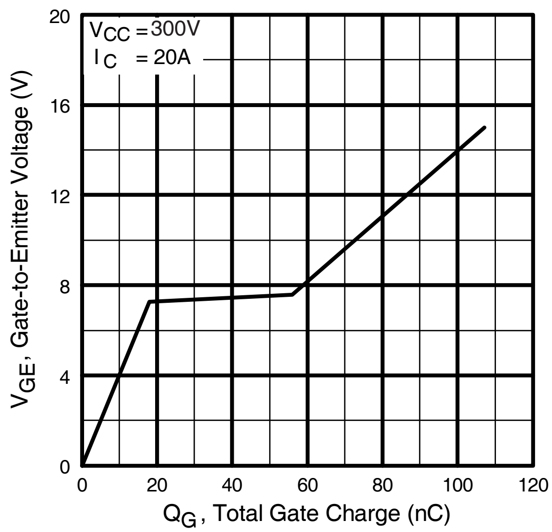


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

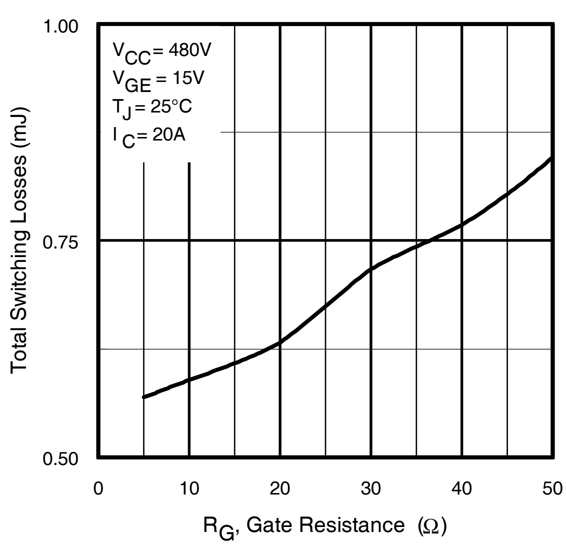


Fig. 9 - Typical Switching Losses vs. Gate Resistance

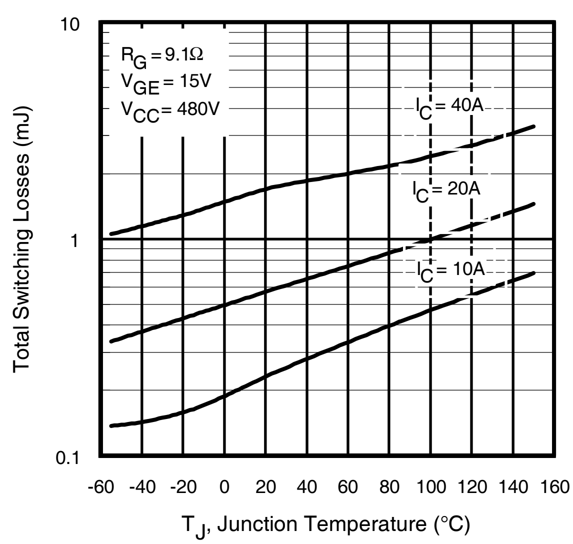


Fig. 10 - Typical Switching Losses vs. Junction Temperature

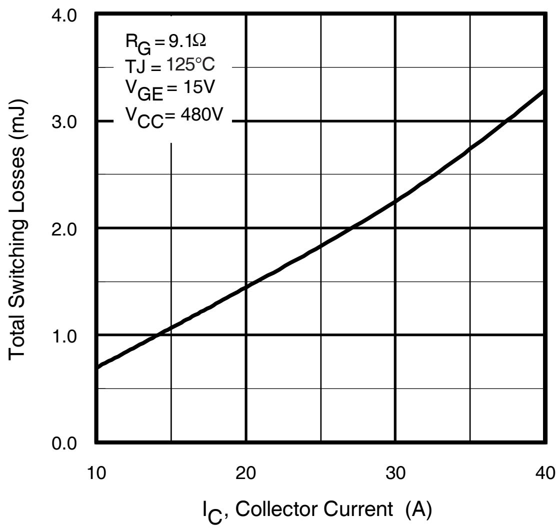


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

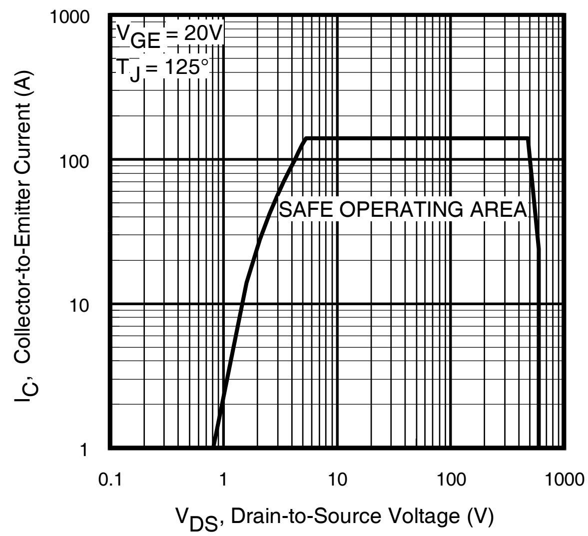


Fig. 12 - Turn-Off SOA

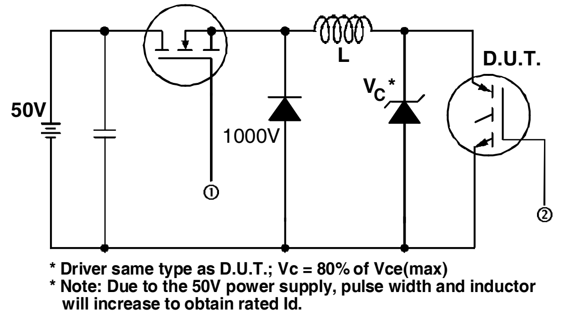


Fig. 13a - Clamped Inductive Load Test Circuit

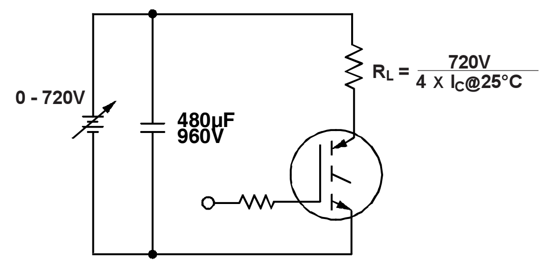


Fig. 13b - Pulsed Collector Current Test Circuit

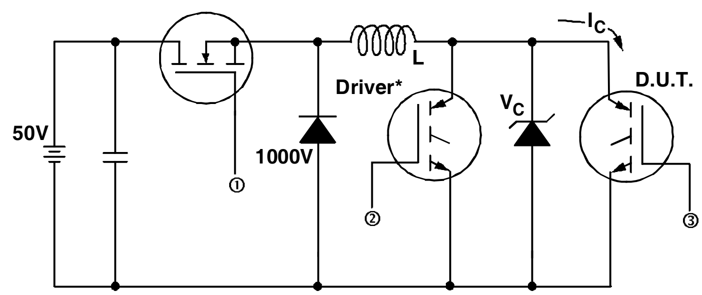


Fig. 14a - Switching Loss Test Circuit

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

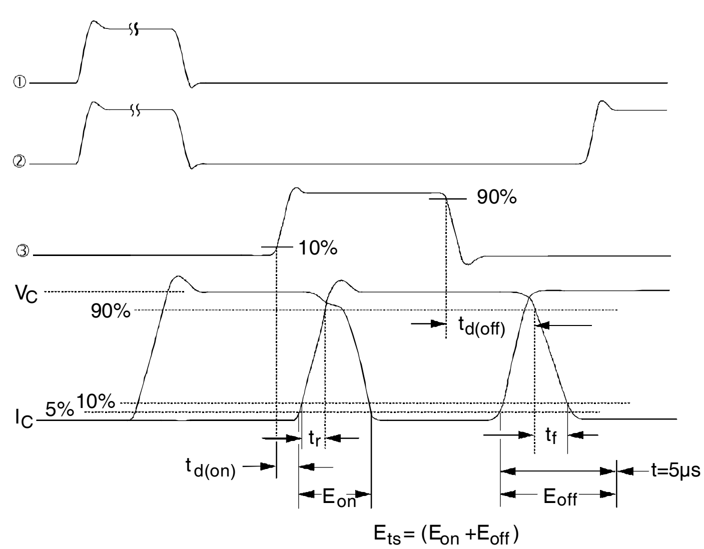
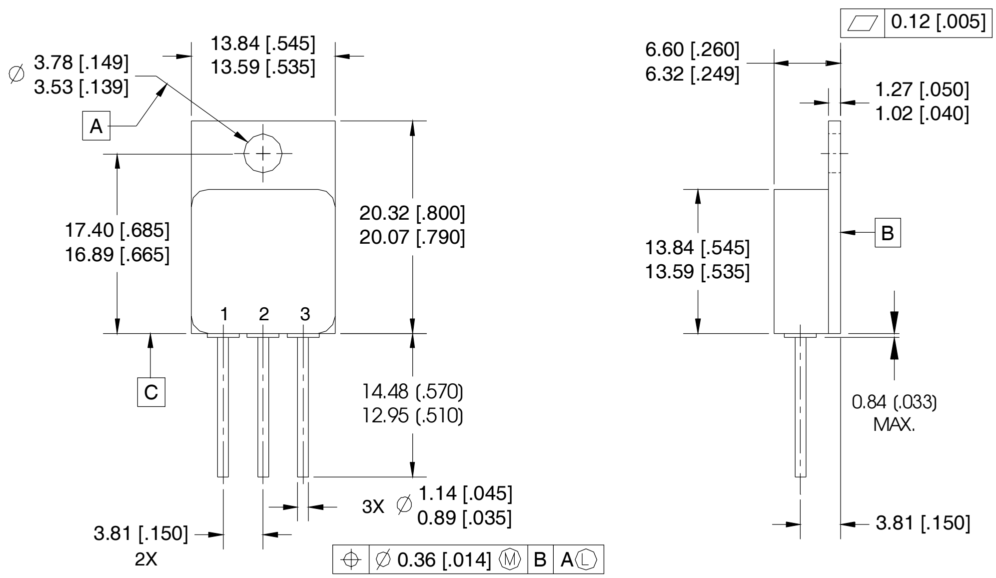


Fig. 14b - Switching Loss Waveforms

Case Outline and Dimensions — TO-254AA



NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. CONTROLLING DIMENSION: INCH.
4. CONFORMS TO JEDEC OUTLINE TO-254AA.

PIN ASSIGNMENTS

1 = COLLECTOR
2 = EMITTER
3 = GATE

CAUTION

BERYLLIA WARNING PER MIL-PRF-19500

Package containing beryllia shall not be ground, sandblasted, machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

International IOR Rectifier

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Data and specifications subject to change without notice. 06/2008