International Rectifier

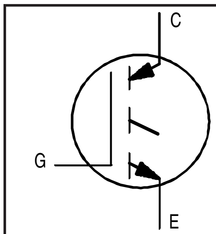
IRGVH50F

INSULATED GATE BIPOLAR TRANSISTOR

Fast Speed IGBT

Features

- Electrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- Fast Speed operation 3 kHz - 8 kHz
- High operating frequency
- Switching-loss rating includes all "tail" losses



n-channel

V_{CES} = 1200V

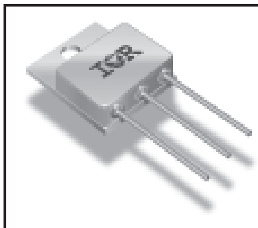
$V_{CE(on)\ max}$ = 2.9V

@V_{GE} = 15V, I_C = 25A

Description

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.

The performance of various IGBTs varies greatly with frequency. Note that IR now provides the designer with a speed benchmark ($f_{Ic/2}$, or the "half-current frequency "), as well as an indication of the current handling capability of the device.



TO-258AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	45	A
I_C @ T_C = 100°C	Continuous Collector Current	25	
I_{CM}	Pulsed Collector Current ①	180	
I_{LM}	Clamped Inductive Load Current ②	90	
V_{GE}	Gate-to-Emitter Voltage	±20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	200	W
P_D @ T_C = 100°C	Maximum Power Dissipation	80	
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	10.5 (typical)	g

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction-to-Case	—	—	0.625	°C/W	
R_{thCS}	Case-to-Sink	—	0.21	—		
R_{thJA}	Junction-to-Ambient	—	—	30		

For footnotes refer to the last page

02/20/02

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V_{GE} = 0V, I_C = 100 µA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ③	22	—	—	V	V_{GE} = 0V, I_C = 1.0 A
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.1	2.9	V	I_C = 25A, V_{GE} = 15V
		—	2.5	—		I_C = 45A, See Fig.2, 5
		—	2.4	—		I_C = 25A , T_J = 125°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		V_{CE} = V_{GE}, I_C = 250 µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-14	—	mV/°C	V_{CE} = V_{GE}, I_C = 250 µA
g_{fe}	Forward Transconductance ④	7.5	—	—	S	V_{CE} = 100V, I_C = 25A
I_{CES}	Zero Gate Voltage Collector Current	—	—	100	µA	V_{GE} = 0V, V_{CE} = 960V
		—	—	1200		V_{GE} = 0V, V_{CE} = 960V, 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)	—	—	100	nC	I_C = 25A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	—	21		V_{CC} = 400V See Fig. 8 ⑤
Q_{gc}	Gate - Collector Charge (turn-on)	—	—	43		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	—	68	ns	I_C = 25A, V_{CC} = 400V
t_r	Rise Time	—	—	26		V_{GE} = 15V, R_G = 2.35Ω ⑤
$t_{d(off)}$	Turn-Off Delay Time	—	—	480		Energy losses include "tail"
t_f	Fall Time	—	—	330		See Fig. 9, 10, 14
E_{on}	Turn-On Switching Loss	—	1.4	—	mJ	
E_{off}	Turn-off Switching Loss	—	4.5	—		
E_{ts}	Total Switching Loss	—	5.9	8.2		
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	T_J = 125°C
t_r	Rise Time	—	15	—		I_C = 25A, V_{CC} = 400V
$t_{d(off)}$	Turn-Off Delay Time	—	590	—		V_{GE} = 15V, R_G = 2.35Ω ⑤
t_f	Fall Time	—	500	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	13	—	mJ	See Fig. 11, 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	—	2400	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	140	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	28	—		f = 1.0MHz

Note: Corresponding Spice and Saber models are available on the Website.
For footnotes refer to the last page

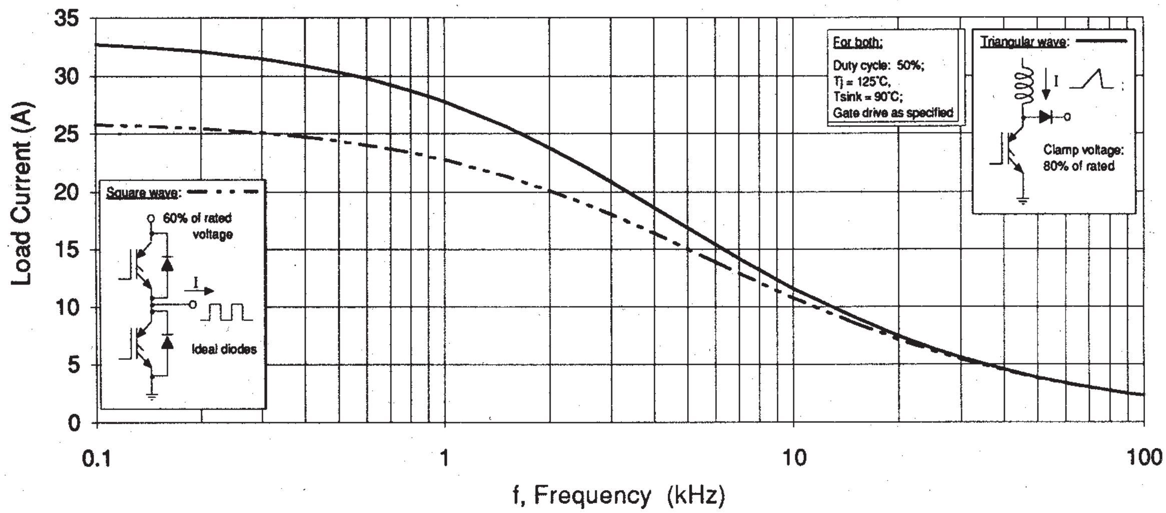


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

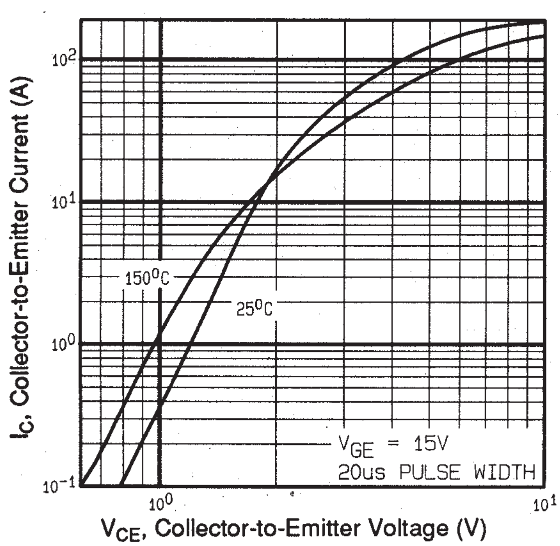


Fig. 2 - Typical Output Characteristics

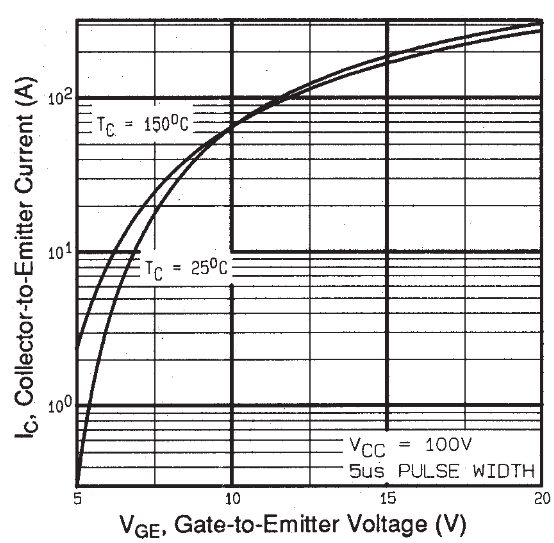


Fig. 3 - Typical Transfer Characteristics

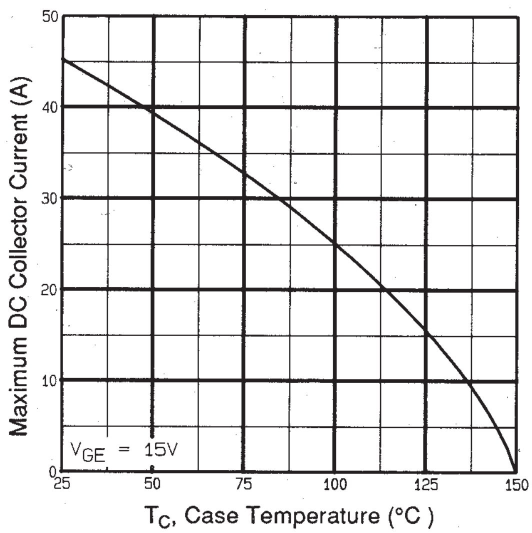


Fig. 4 - Maximum Collector Current vs. Case Temperature

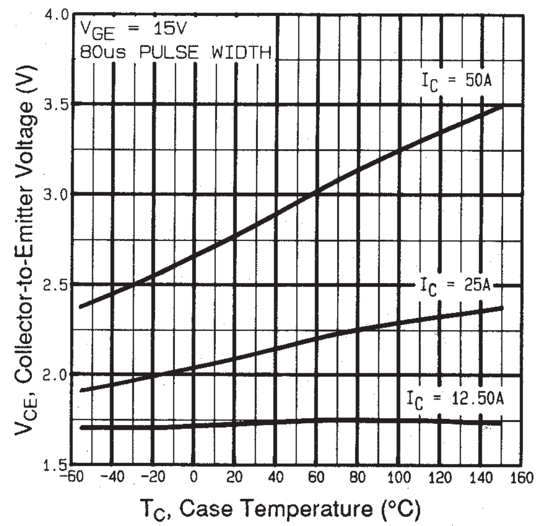


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

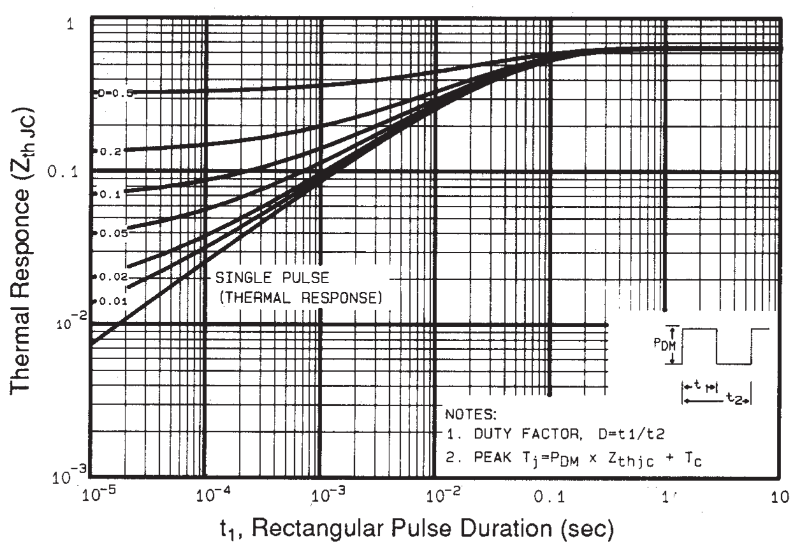


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

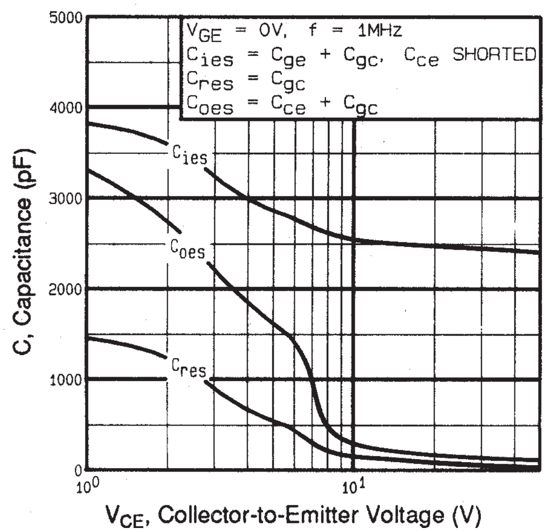


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

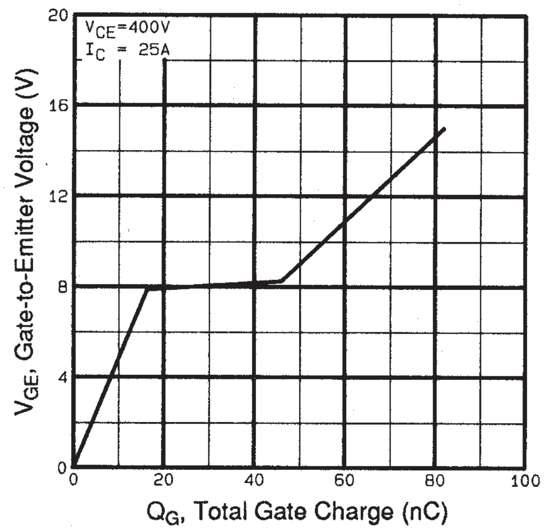


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

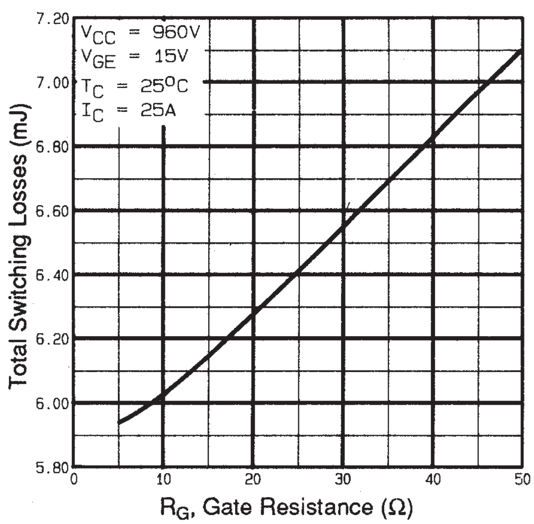


Fig. 9 - Typical Switching Losses vs. Gate Resistance

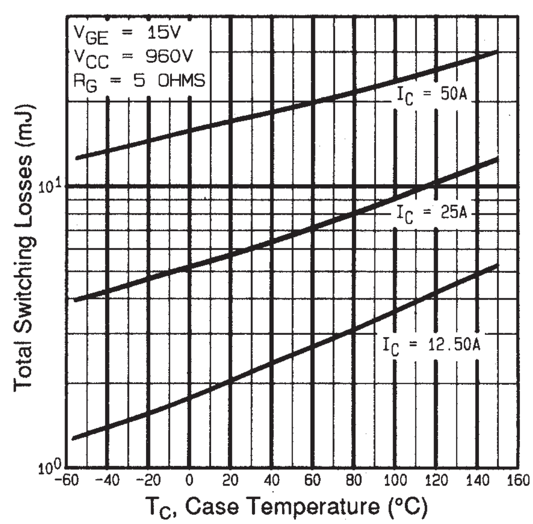


Fig. 10 - Typical Switching Losses vs. Junction Temperature

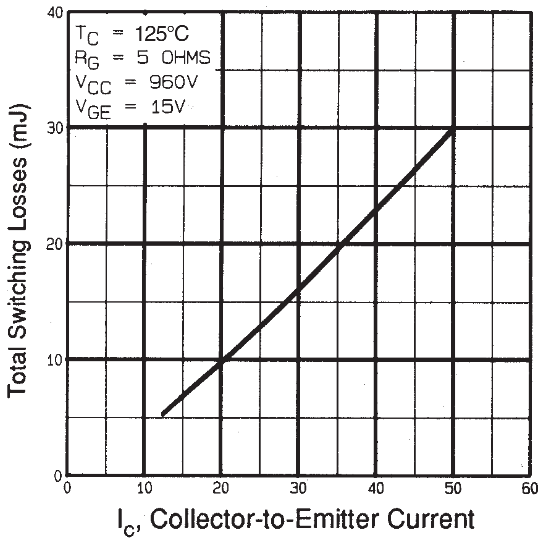


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

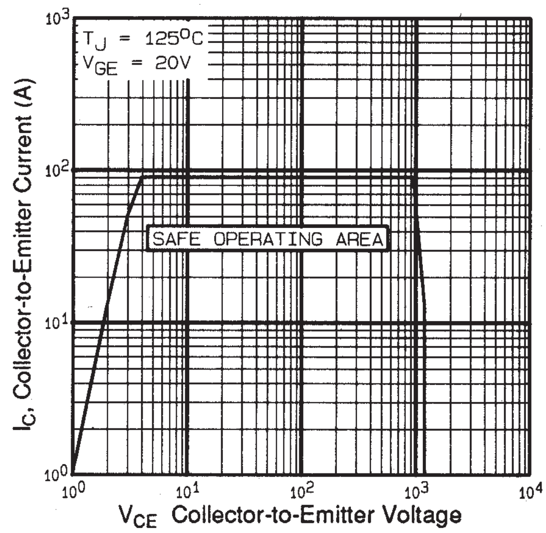
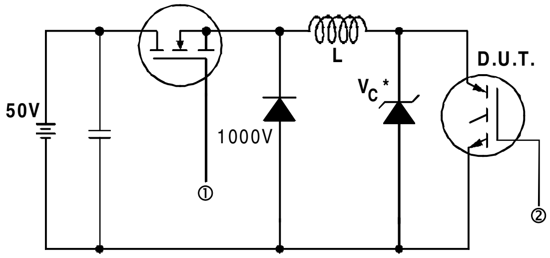


Fig. 12 - Turn-Off SOA



* 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

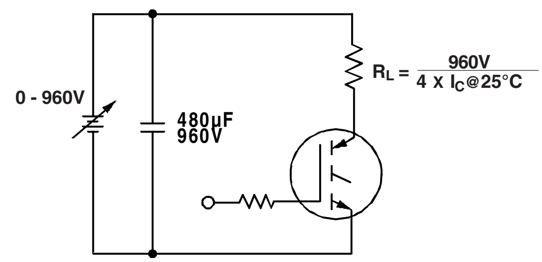


Fig. 13b - Pulsed Collector Current Test Circuit

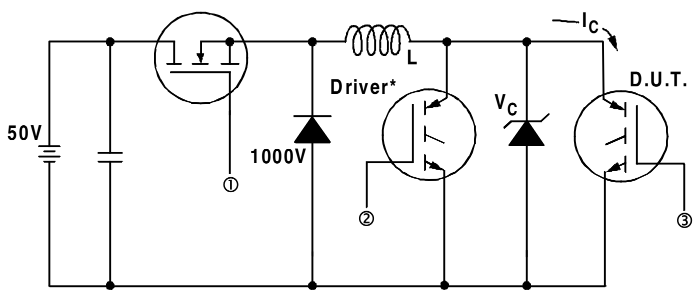


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., VC = 960V

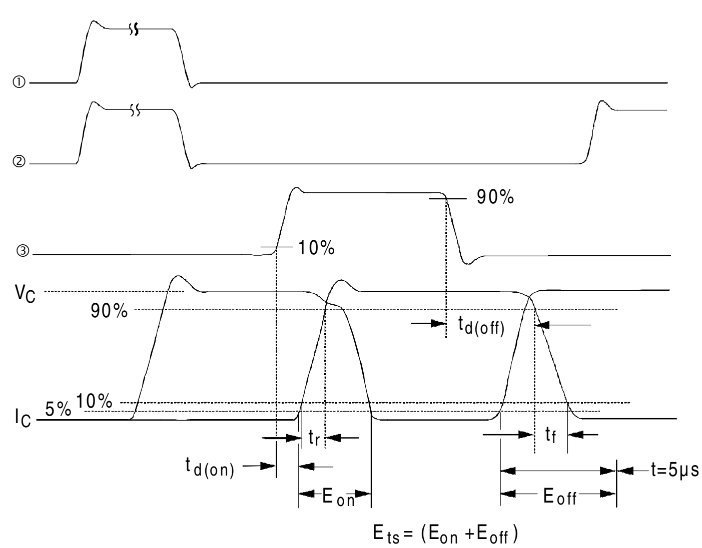


Fig. 14b - Switching Loss Waveforms

Notes:

① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature.

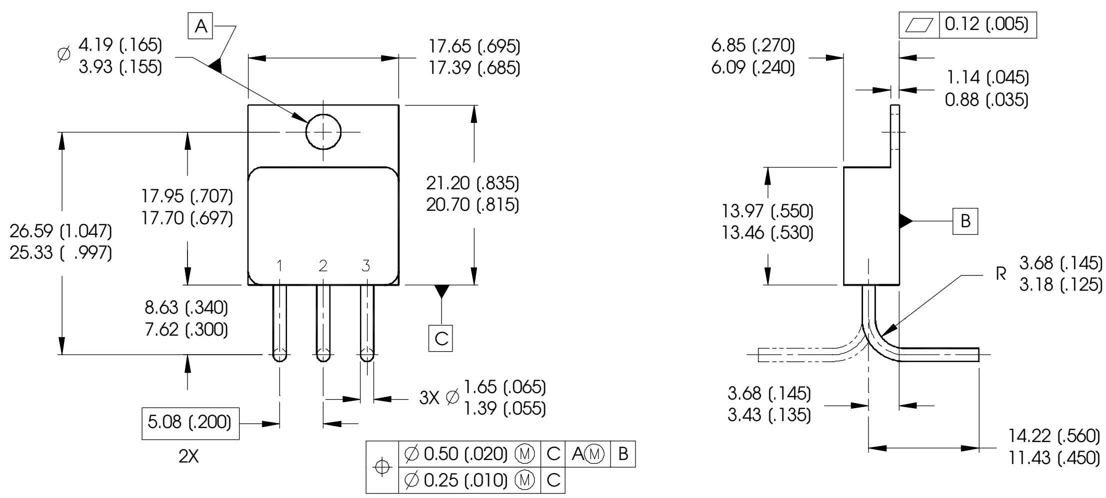
② V_{CC} = 80%(V_{CES}), V_{GE} = 20V, L = 10µH, R_G = 5.0Ω

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

④ Pulse width 5.0µs, single shot.

⑤ Equipment limitation.

Case Outline and Dimensions — TO-258AA



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-258AA BEFORE LEADFORMING.

LEGEND
1 = COLLECTOR
2 = EMITTER
3 = GATE

International IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.