

IRGMVC50U

INSULATED GATE BIPOLAR TRANSISTOR
WITH ON-BOARD REVERSE DIODE

Ultra Fast Speed IGBT

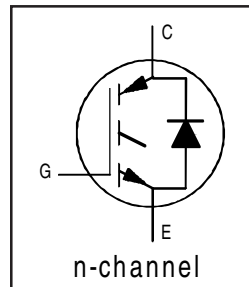
Features

- Electrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- Ultra Fast operation > 10 kHz
- Switching-loss rating includes all "tail" losses
- Ceramic Eyelets

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.

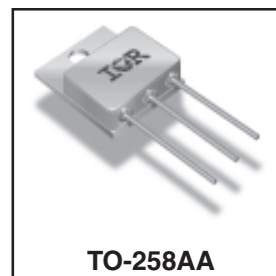
The performance of various IGBTs varies greatly with frequency. Note that IR now provides the designer with a speed benchmark ($f_{ic/2}$, or the "half-current frequency"), as well as an indication of the current handling capability of the device.



$$V_{CES} = 600V$$

$$V_{CE(on) \max} = 3.0V$$

$$@ V_{GE} = 15V, I_C = 27A$$



TO-258AA

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	45*	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	27	
I_{CM}	Pulsed Collector Current ①	220	
I_{LM}	Clamped Inductive Load Current ②	180	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	80	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	$^\circ C$
	Lead Temperature	300 (0.063in./1.6mm from case for 10s)	
	Weight	10.5 (typical)	
			g

*Current is limited by pin diameter

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction-to-Case-IGBT	—	—	0.625	$^\circ C/W$	
R_{thJC}	Junction-to-Case-Diode	—	—	1.0		
R_{thCS}	Case-to-Sink	—	0.21	—		
R_{thJA}	Junction-to-Ambient	—	—	30		

For footnotes refer to the last page

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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	$V_{GE} = 0V, I_C = 1.0\text{ mA}$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.6	—	$V/^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0\text{ mA}$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	—	3.0	V	$I_C = 27A, V_{GE} = 15V$
		—	—	3.25		$I_C = 45A, V_{GE} = 15V$
		—	—	2.85		$I_C = 27A, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5	$mV/^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-13	—		$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$
g_{fe}	Forward Transconductance ③	16	—	—	S	$V_{CE} = 100V, I_C = 27A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 480V$
		—	—	5000		$V_{GE} = 0V, V_{CE} = 480V, T_J = 125^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20$
V_{FM}	Diode Forward Voltage Drop	—	—	1.7	V	$I_C = 27A$
		—	—	1.5		$I_C = 27A, T_J = 125^\circ\text{C}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	—	140	nC	$I_C = 27A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	—	35		$V_{CC} = 300V, V_{GE} = 15V$
Q_{gc}	Gate - Collector Charge (turn-on)	—	—	70		See Fig. 8
$t_{d(on)}$	Turn-On Delay Time	—	—	50	ns	$I_C = 27A, V_{CC} = 480V$
t_r	Rise Time	—	—	75		$V_{GE} = 15V, R_G = 2.35\Omega$
$t_{d(off)}$	Turn-Off Delay Time	—	—	300		Energy losses include "tail"
t_f	Fall Time	—	—	210		See Fig. 10, 11, 13
E_{on}	Turn-On Switching Loss	—	0.12	—	mJ	$T_J = 125^\circ\text{C}$ $I_C = 27A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 2.35\Omega$ Energy losses include "tail"
E_{off}	Turn-off Switching Loss	—	1.6	—		
E_{ts}	Total Switching Loss	—	1.7	2.8		
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$T_J = 125^\circ\text{C}$ $I_C = 27A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 2.35\Omega$ Energy losses include "tail"
t_r	Rise Time	—	27	—		
$t_{d(off)}$	Turn-Off Delay Time	—	180	—		
t_f	Fall Time	—	130	—		
E_{ts}	Total Switching Loss	—	2.7	—	mJ	See Fig. 11, 13
$L_C + L_E$	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	—	2900	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	330	—		$V_{CC} = 30V$
C_{res}	Reverse Transfer Capacitance	—	41	—		$f = 1.0\text{MHz}$
T_{rr}	Diode Peak Reverse Recovery Time	—	—	100	ns	$di/dt = 200A/\mu\text{S}, I_F = 27A$ $V_R \leq 200V$
Q_{rr}	Diode Peak Reverse Recovery Charge	—	—	375	nC	$di/dt = 200A/\mu\text{S}, I_F = 27A$ $T_J = 125^\circ\text{C}, V_R \leq 200V$

Note: Corresponding Spice and Saber models are available on the Website.

For footnotes refer to the last page

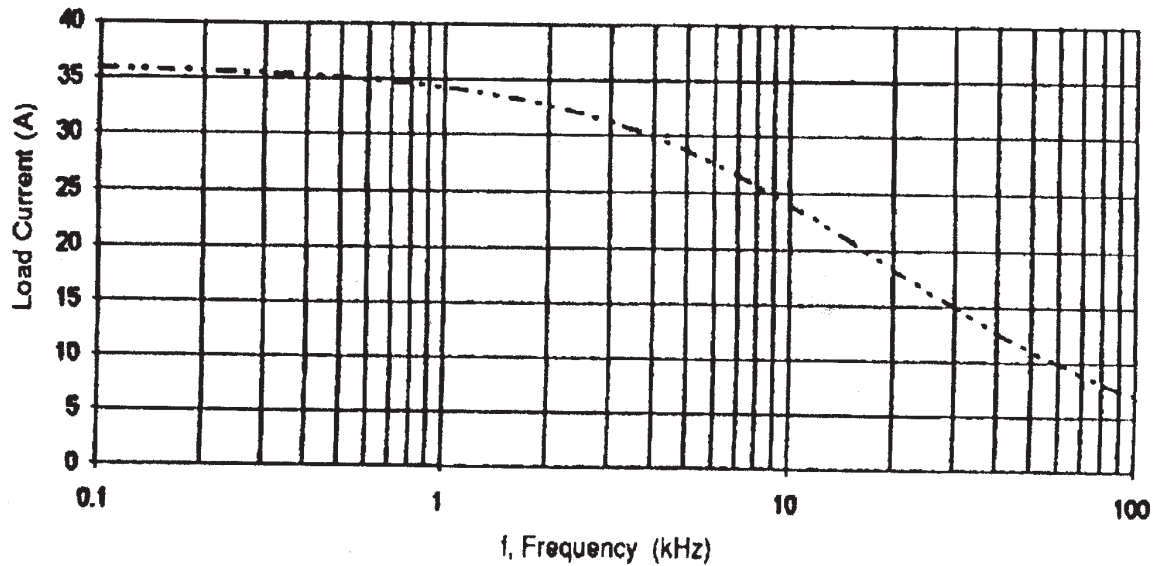


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

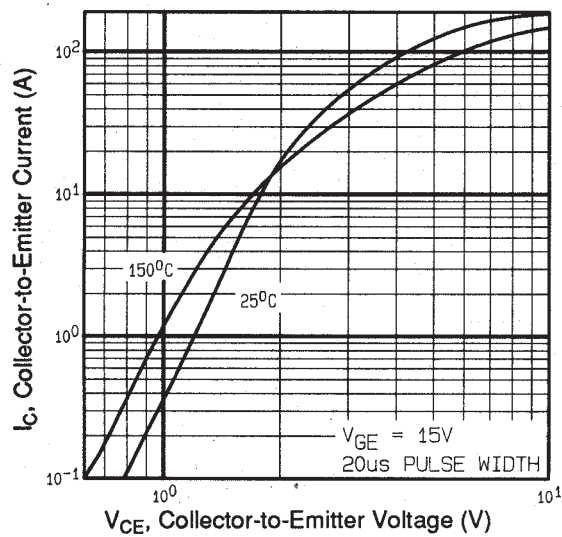


Fig. 2 - Typical Output Characteristics

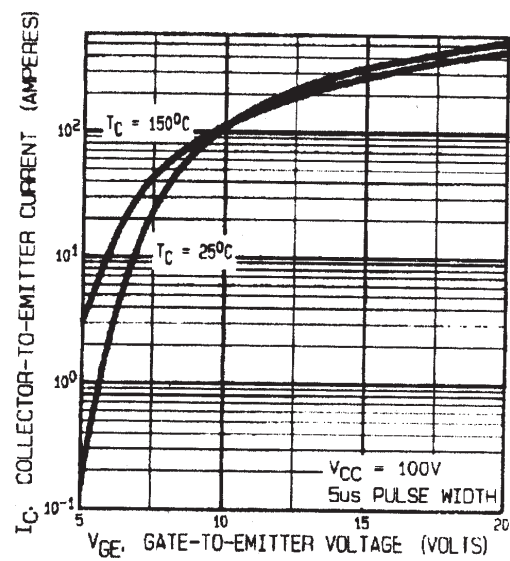


Fig. 3 - Typical Transfer Characteristics

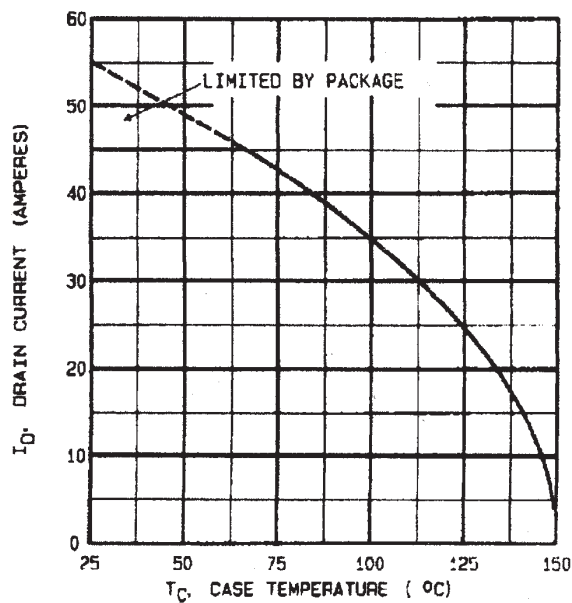


Fig. 4 - Maximum Collector Current vs. Case Temperature

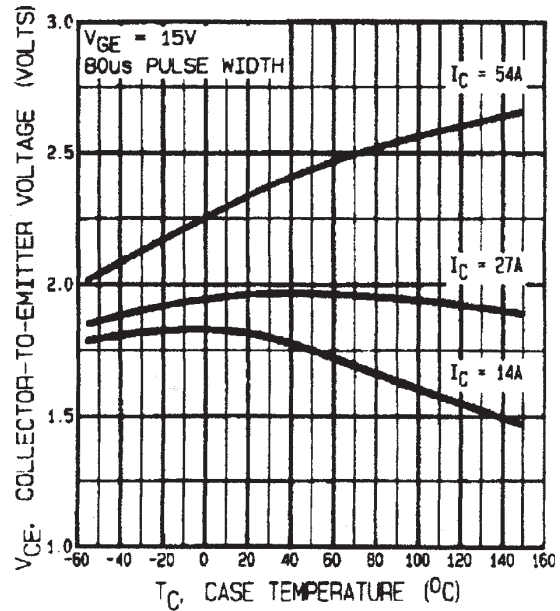


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

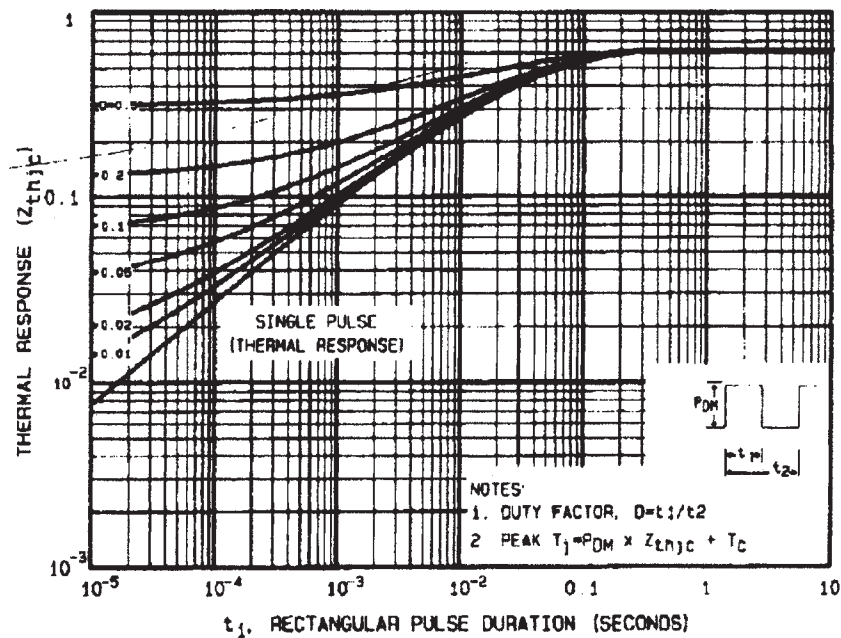
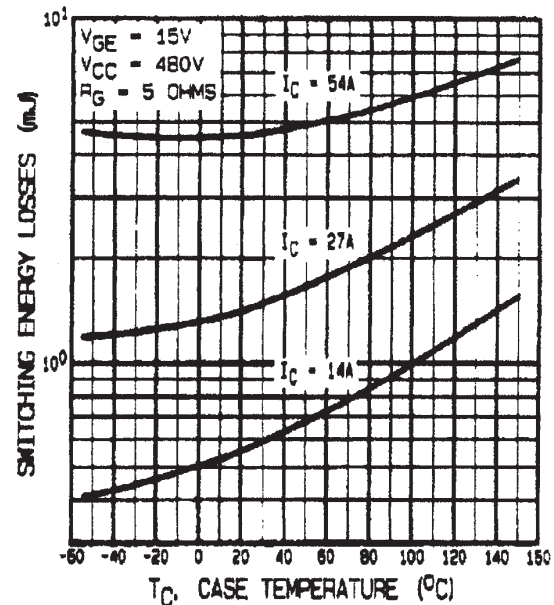
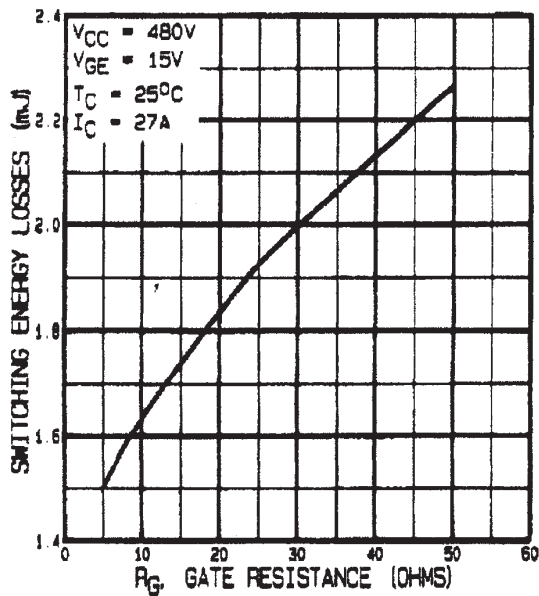
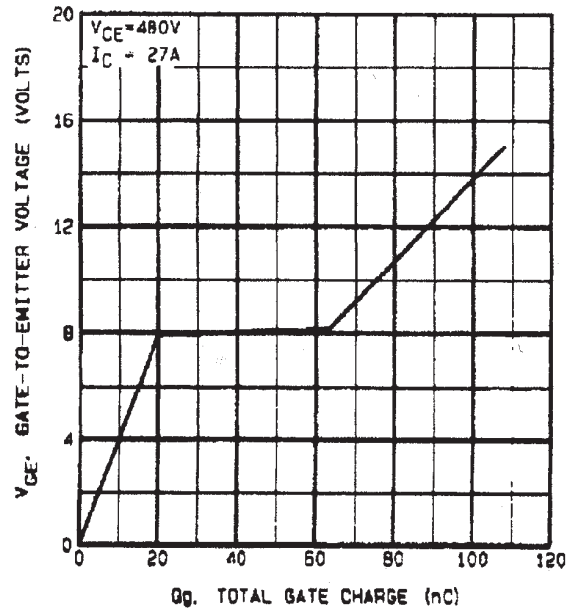
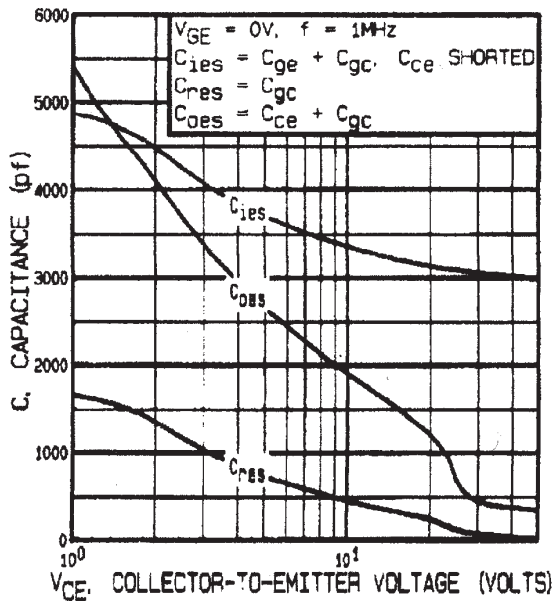


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



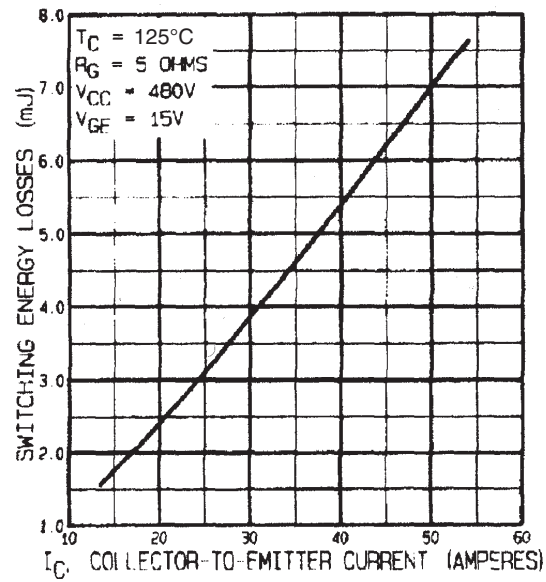


Fig. 11 - Typical Switching Losses vs.
Collector-to-Emitter Current

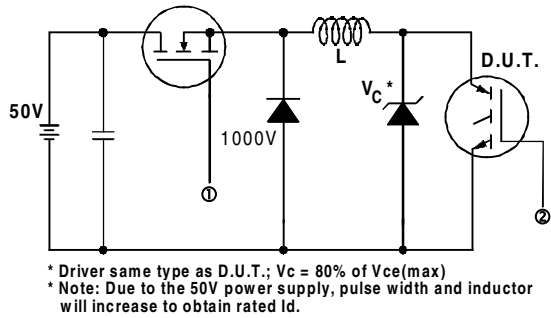


Fig. 12a - Clamped Inductive Load Test Circuit

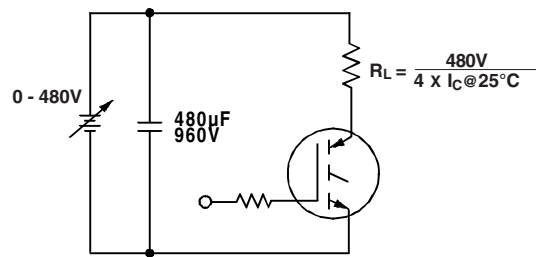


Fig. 12b - Pulsed Collector Current Test Circuit

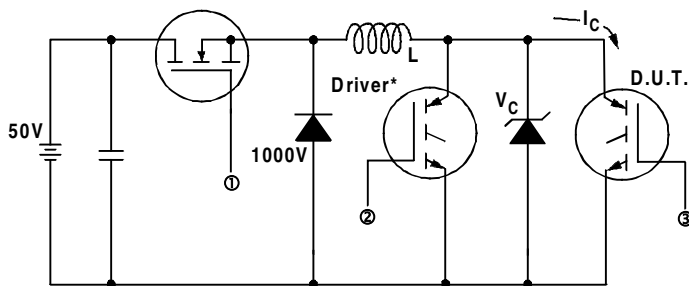


Fig. 13a - Switching Loss Test Circuit

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

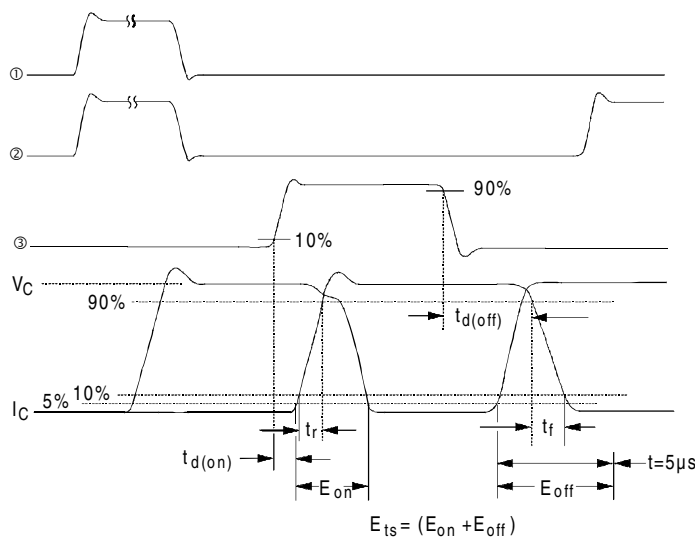


Fig. 13b - Switching Loss Waveforms

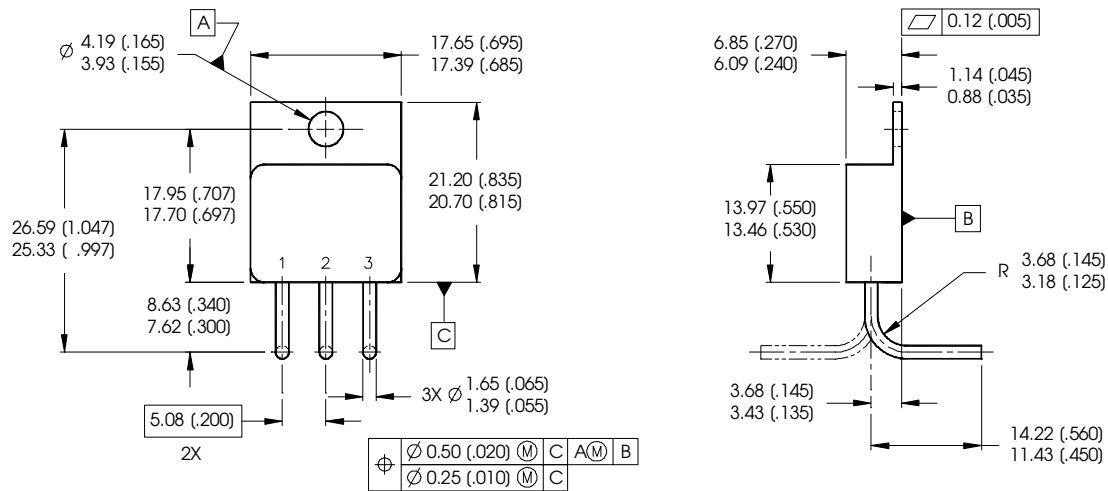
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Notes:

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

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

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