

**INSULATED GATE BIPOLAR TRANSISTOR**

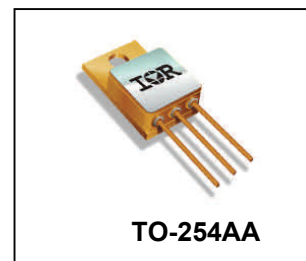
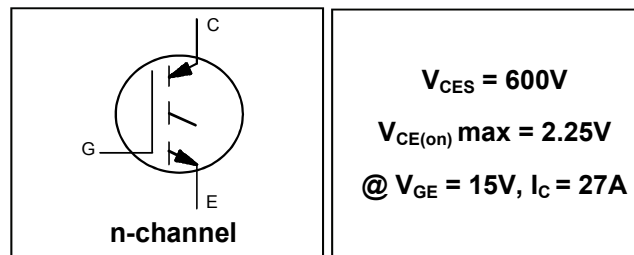
**UltraFast Speed IGBT**

**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
- Ceramic Eyelets

**Benefits**

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



Insulated Gate Bipolar Transistors (IGBTs) from IR HiRel have higher usable current densities than comparable polar 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.

**Absolute Maximum Ratings**

	Parameter		Units
$V_{CES}$	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	35*	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	27	
$I_{CM}$	Pulsed Collector Current ①	140	
$I_{LM}$	Clamped Inductive Load Current ②	140	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	150	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	60	
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Lead Temperature	300 (0.063 in. /1.6 mm from case for 10s)	
	Weight	9.3 (Typical)	

**Thermal Resistance**

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.83	°C/W

\* Current is limited by package.

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

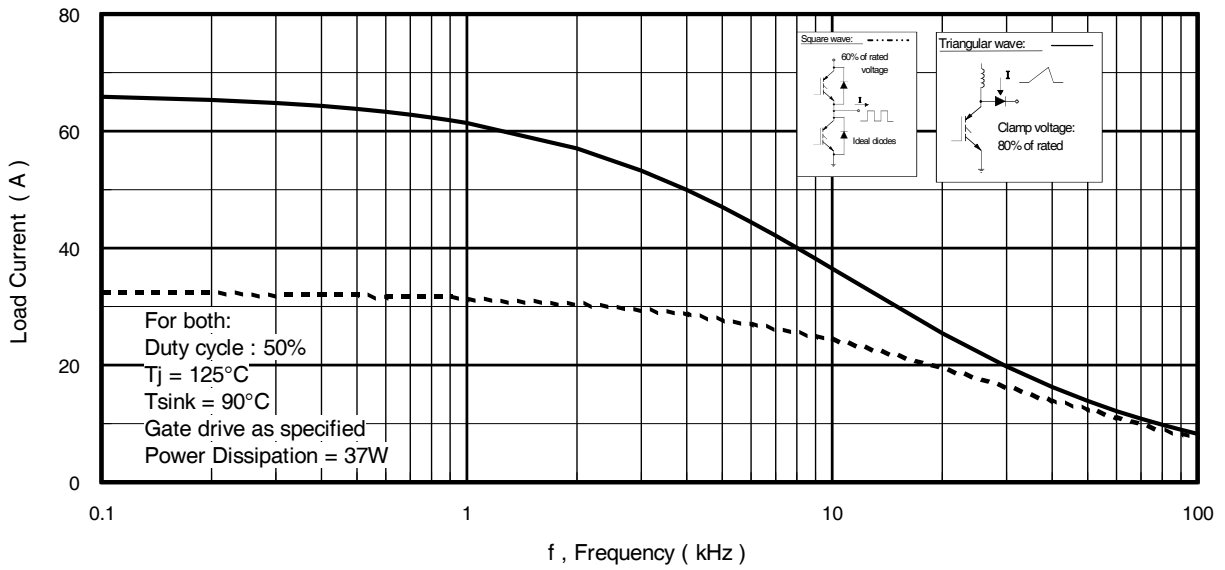
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 1.0mA$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage <sup>③</sup>	17	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.56	—	V/°C	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	—	2.25	V	$I_C = 27A, V_{GE} = 15V$ , See Fig. 2,5
		—	—	2.75		$I_C = 35A, V_{GE} = 15V$ , See Fig. 2,5
		—	—	2.0		$I_C = 27A, V_{GE} = 15V, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	$V_{CE} = V_{GE}, I_C = 1.0mA$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-14	—	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
gfe	Forward Transconductance <sup>④</sup>	16	—	—	S	$V_{CE} = 15V, I_C = 27A$
$I_{CES}$	Collector-to-Emitter Leakage Current	—	—	50	$\mu A$	$V_{GE} = 0V, V_{CE} = 480V$
		—	—	2000		$V_{GE} = 0V, V_{CE} = 480V, T_J = 125^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V$

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

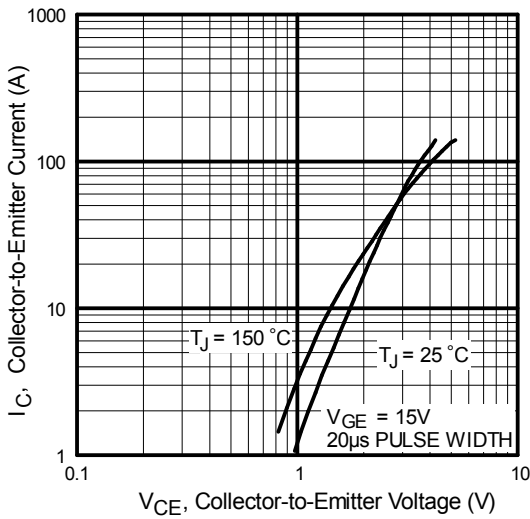
	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	—	270	nC	$I_C = 27A$
$Q_{ge}$	Gate-to-Emitter Charge (turn-on)	—	—	38		$V_{GE} = 15V$ See Fig. 8
$Q_{gc}$	Gate-to-Collector Charge (turn-on)	—	—	90		$V_{CC} = 480V$
$t_{d(on)}$	Turn-On delay time	—	—	75	ns	$T_J = 25^\circ\text{C}$
$t_r$	Rise time	—	—	75		$I_C = 27A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off delay time	—	—	150		$V_{GE} = 15V, R_G = 2.35\Omega$ ,
$t_f$	Fall time	—	—	100		Energy losses include tail
$E_{total}$	Total Switching Loss	—	—	0.9	mJ	See Fig. 10, 11, 13, 14
$t_{d(on)}$	Turn-On delay time	—	—	75	ns	$T_J = 125^\circ\text{C}$
$t_r$	Rise time	—	—	75		$I_C = 27A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off delay time	—	—	200		$V_{GE} = 15V, R_G = 2.35\Omega$
$t_f$	Fall time	—	—	150		Energy losses include tail
$E_{total}$	Total Switching Loss	—	—	2.0	mJ	See Fig. 10, 11, 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	—	4150	—	pF	$V_{GE} = 0V$
$C_{oes}$	Output Capacitance	—	250	—		$V_{CC} = 30V$ See Fig. 7
$C_{res}$	Reverse Transfer Capacitance	—	45	—		$f = 1.0MHz$

**Notes:**

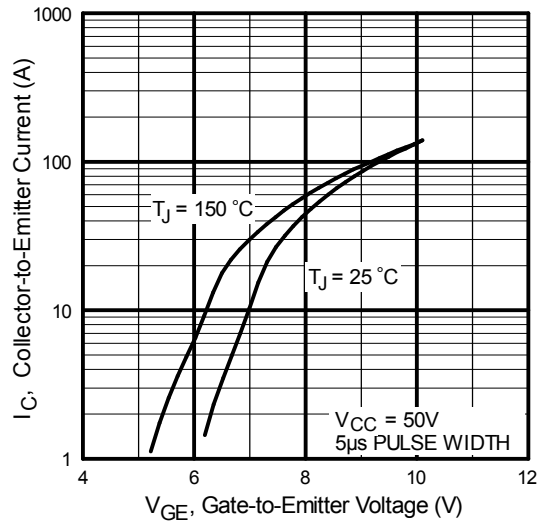
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See Fig. 13b).
- ②  $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 100\mu H, R_G = 2.35\Omega$ , (See Fig. 13a).
- ③ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ④ Pulse width  $5.0\mu s$ , single shot.



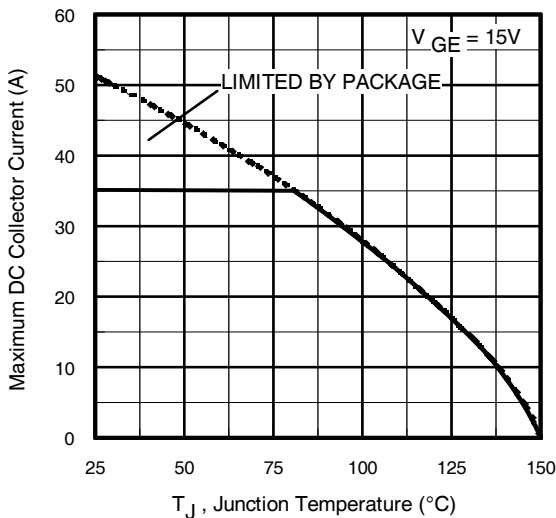
**Fig. 1 - Typical Load Current vs. Frequency**



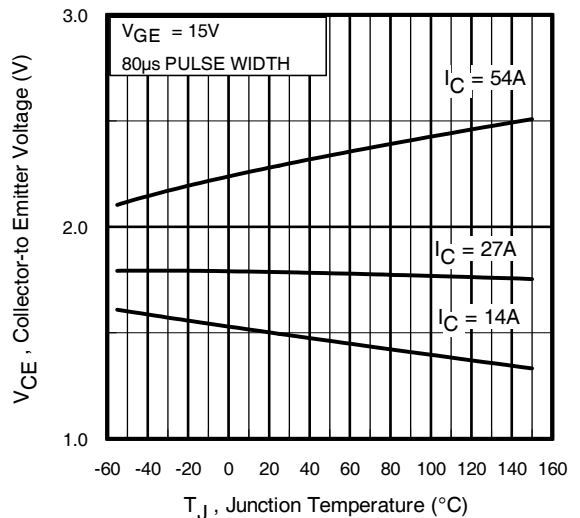
**Fig 2. Typical Output Characteristics**



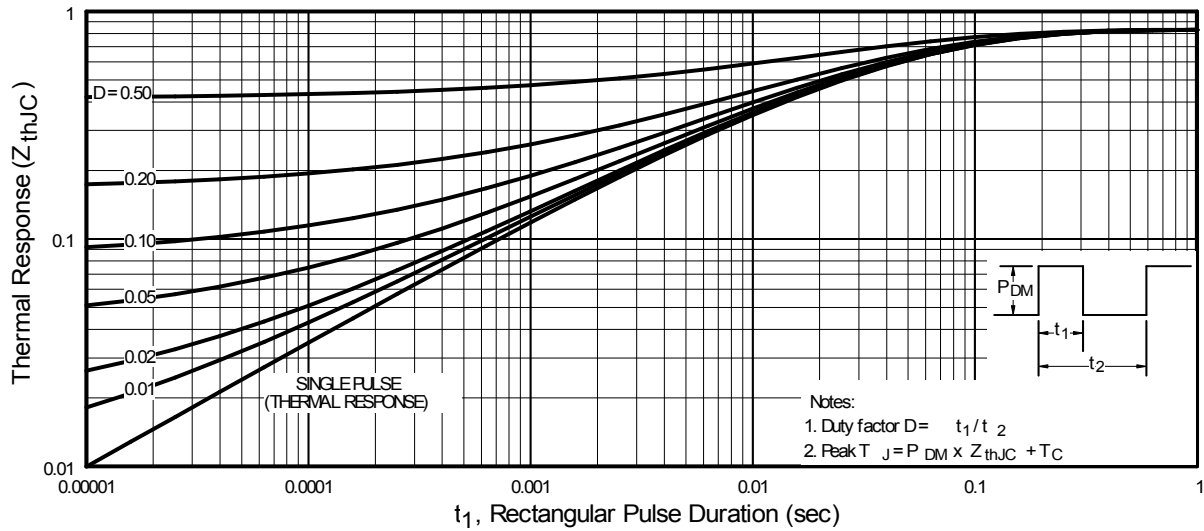
**Fig 3. Typical Transfer Characteristics**



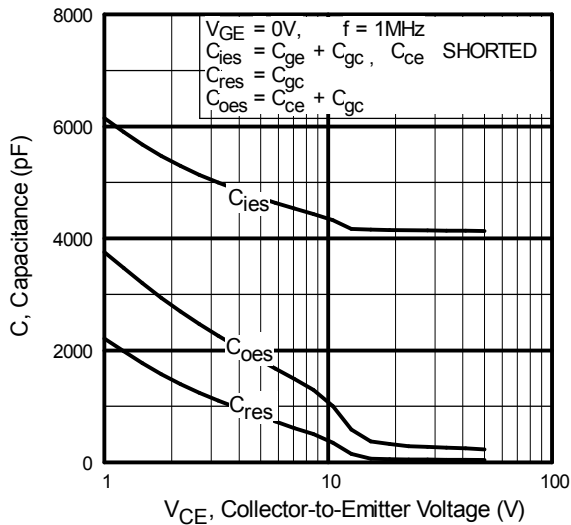
**Fig 4. Maximum Collector Current Vs. Case Temperature**



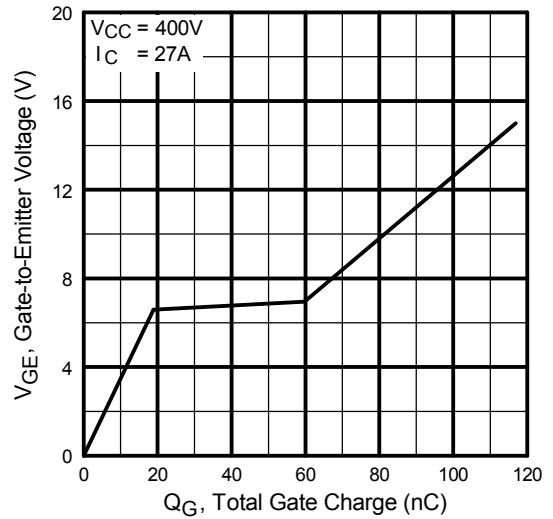
**Fig 5. Collector-to-Emitter Voltage Vs. Junction Temperature**



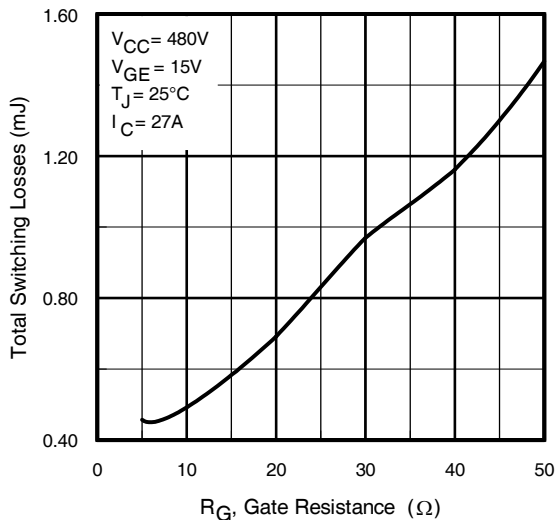
**Fig 6.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



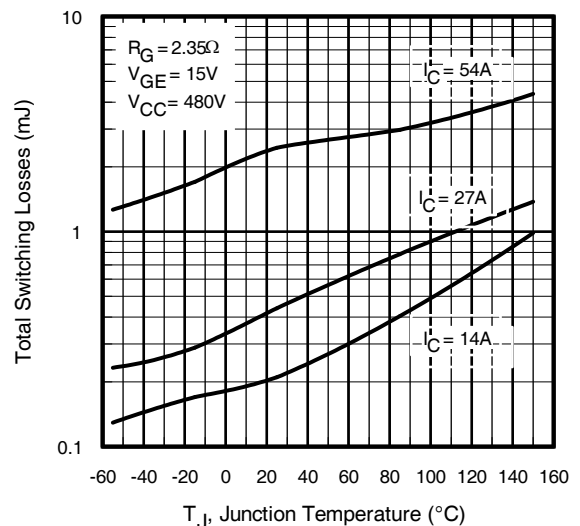
**Fig 7.** Typical Capacitance Vs. Collector-to-Emitter Voltage



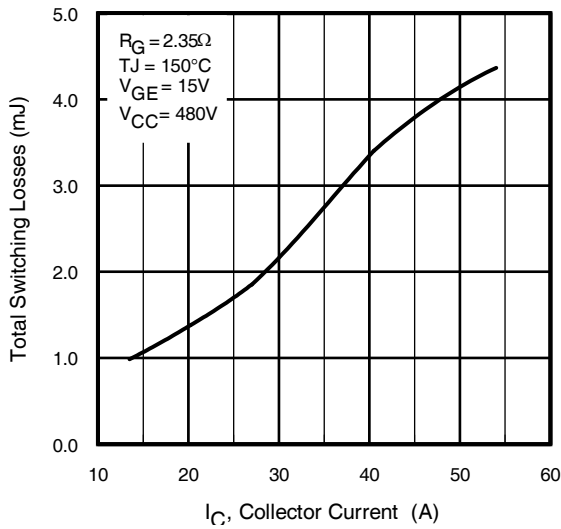
**Fig 8.** Typical Gate Charge Vs. Gate-to-Emitter Voltage



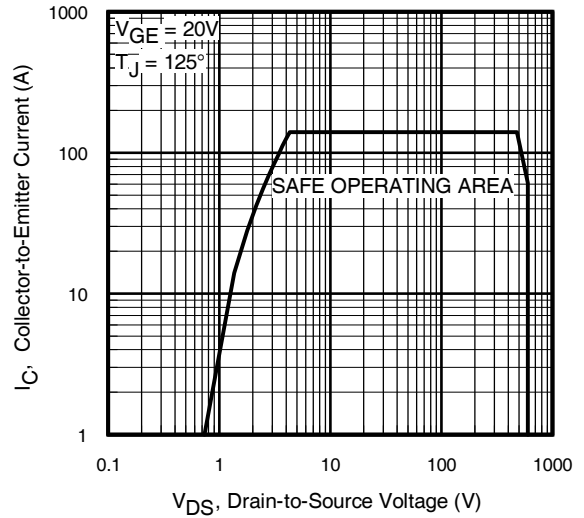
**Fig 9.** Typical Switching Losses Vs. Gate Resistance



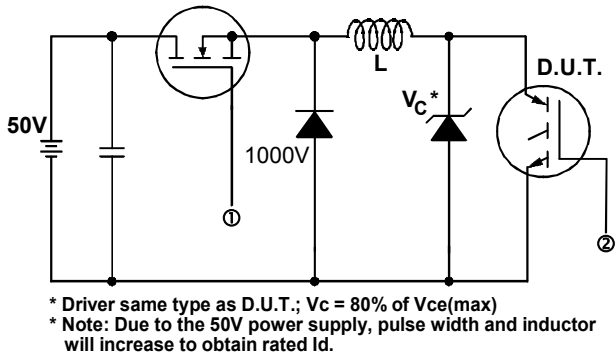
**Fig 10.** Typical Switching Losses Vs. Junction Temperature



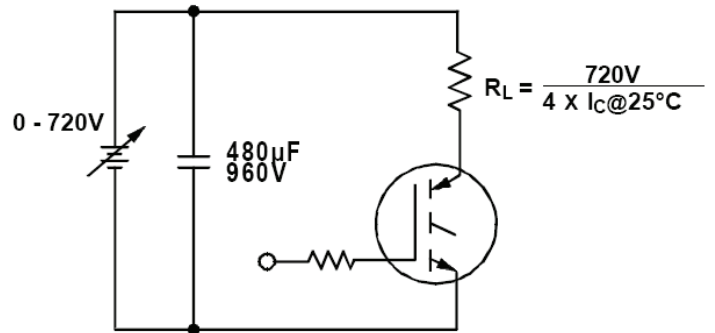
**Fig 11.** Typical Switching Losses Vs. Collector-to-Emitter Current



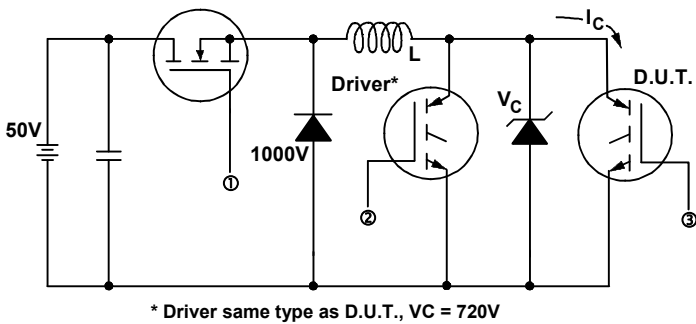
**Fig 12.** Turn-Off SOA



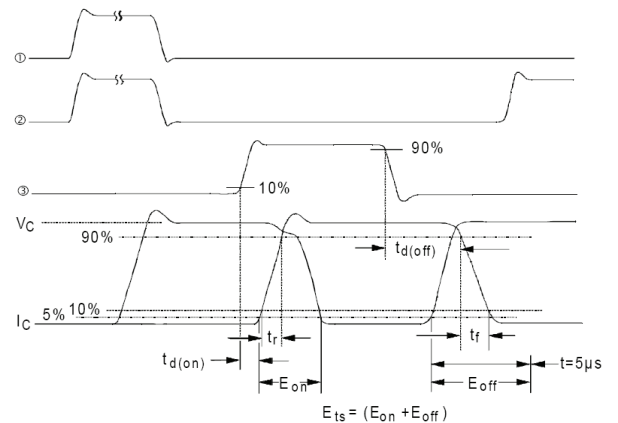
**Fig 13a.** Clamped Inductive Load Test Circuit



**Fig 13b.** Pulsed Collector Current Test Circuit

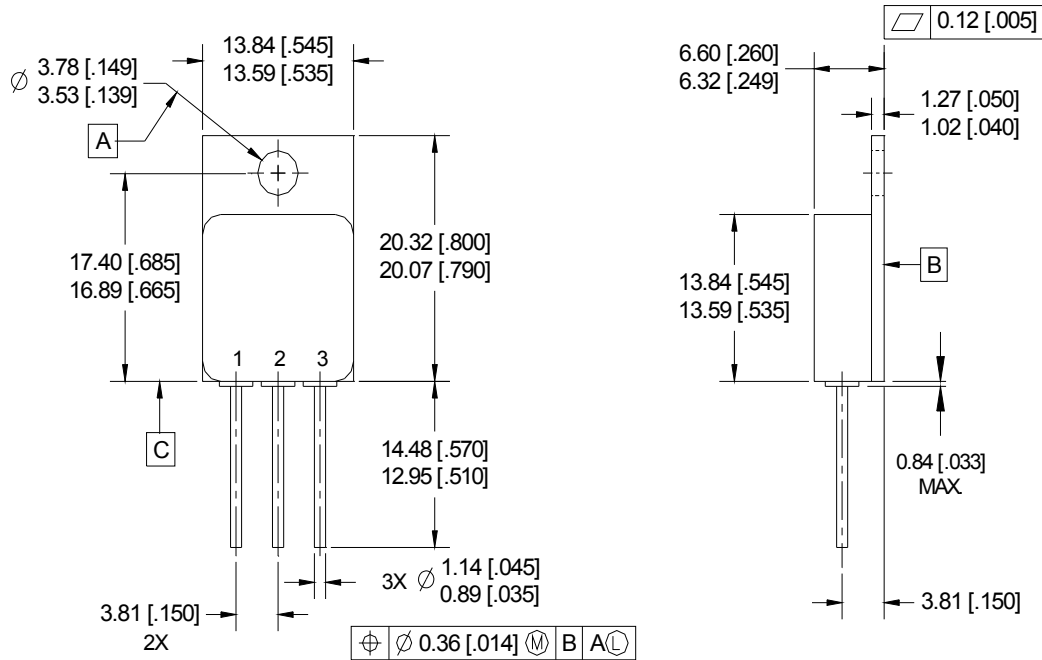


**Fig 14a.** Switching Loss Test Circuit



**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

**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.

### **IMPORTANT NOTICE**

The information given in this document shall be in no event regarded as guarantee of conditions or characteristic. The data contained herein is a characterization of the component based on internal standards and is intended to demonstrate and provide guidance for typical part performance. It will require further evaluation, qualification and analysis to determine suitability in the application environment to confirm compliance to your system requirements.

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