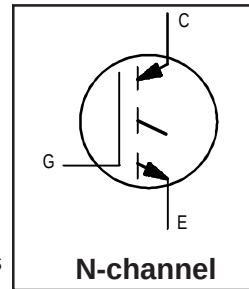


INSULATED GATE BIPOLAR TRANSISTOR

Features

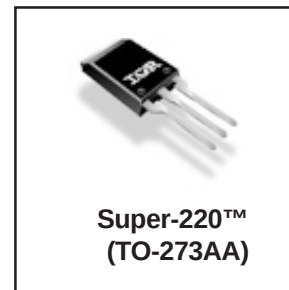
- Designed expressly for switch-mode power supply and PFC (power factor correction) applications
- Industry-benchmark switching losses improve efficiency of all power supply topologies
- 50% reduction of E_{off} parameter
- Low IGBT conduction losses
- Latest generation IGBT design and construction offers tighter parameters distribution, exceptional reliability



$V_{CES} = 600V$
$V_{CE(on) \max.} = 2.30V$
@ $V_{GE} = 15V, I_C = 27A$

Benefits

- Lower switching losses allow more cost-effective operation than power MOSFETs up to 150kHz ("hard switched" mode)
- Of particular benefit to single-ended converters and boost PFC topologies 150W and higher
- Low conduction losses and minimal minority-carrier recombination make these an excellent option for resonant mode switching as well (up to >300kHz)



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	55	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	220	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	170	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	78	
T_J	Operating Junction and	-55 to + 150	$^\circ C$
T_{STG}	Storage Temperature Range		
	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	—	0.64	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	40	
Wt	Weight	TBD	—	g (oz)

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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	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)CES}$	Emitter-to-Collector Breakdown Voltage „	18	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.41	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 5.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.93	2.3	V	$I_C = 27A, V_{GE} = 15V$
		—	2.25	—		$I_C = 55A$ See Fig.2, 5
		—	1.71	—		$I_C = 27A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA$
g_{fe}	Forward Transconductance ...	27	41	—	S	$V_{CE} = 100V, I_C = 27A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	5000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 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)	—	180	270	nC	$I_C = 27A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	24	36		$V_{CC} = 400V$ See Fig.8
Q_{gc}	Gate - Collector Charge (turn-on)	—	63	95		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	46	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 27A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 9, 10, 14
t_r	Rise Time	—	33	—		
$t_{d(off)}$	Turn-Off Delay Time	—	120	180		
t_f	Fall Time	—	57	86	mJ	$T_J = 150^\circ\text{C},$ $I_C = 27A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 10,11, 14
E_{on}	Turn-On Switching Loss	—	0.08	—		
E_{off}	Turn-Off Switching Loss	—	0.32	—		
E_{ts}	Total Switching Loss	—	0.40	0.5	ns	$T_J = 150^\circ\text{C},$ $I_C = 27A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 10,11, 14
$t_{d(on)}$	Turn-On Delay Time	—	31	—		
t_r	Rise Time	—	43	—		
$t_{d(off)}$	Turn-Off Delay Time	—	210	—	mJ	Measured 5mm from package
t_f	Fall Time	—	62	—		
E_{ts}	Total Switching Loss	—	1.14	—		
L_C	Internal Collector Inductance	—	2.0	—	nH	$V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 7 $f = 1.0MHz$
L_E	Internal Emitter Inductance	—	5.0	—		
C_{ies}	Input Capacitance	—	3700	—		
C_{oes}	Output Capacitance	—	260	—	pF	
C_{res}	Reverse Transfer Capacitance	—	68	—		

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See Fig. 13b)
- ② $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 5.0\Omega$, (See Fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu s$, single shot.

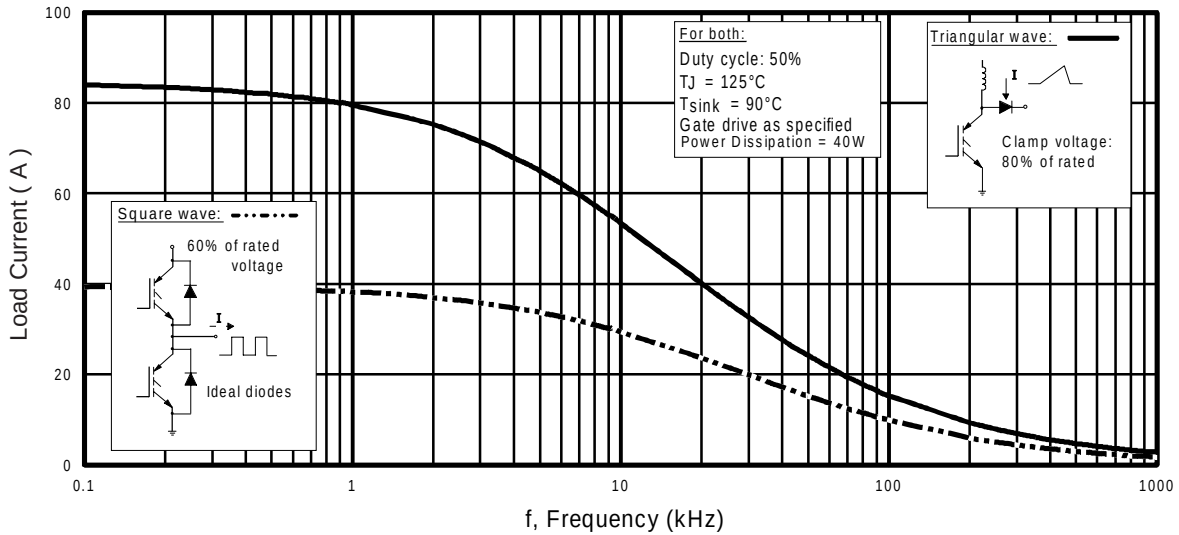


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

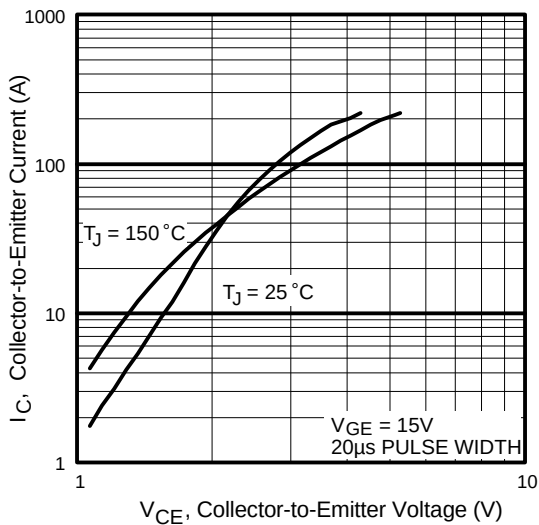


Fig. 2 - Typical Output Characteristics

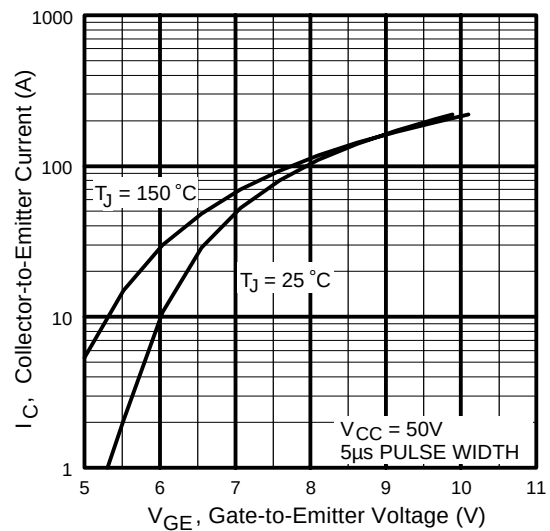


Fig. 3 - Typical Transfer Characteristics

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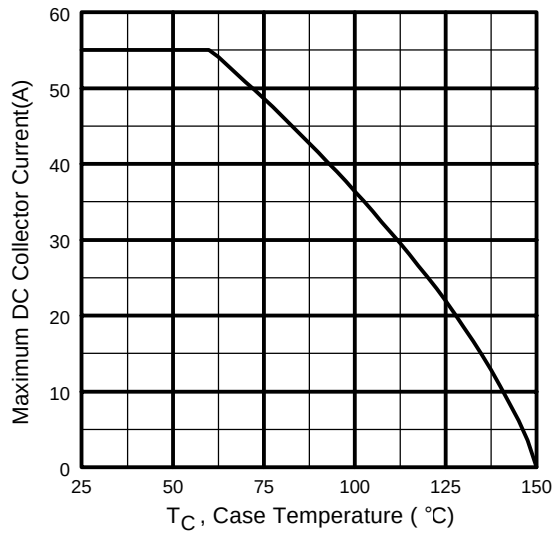


Fig. 4 - Maximum Collector Current vs. Case Temperature

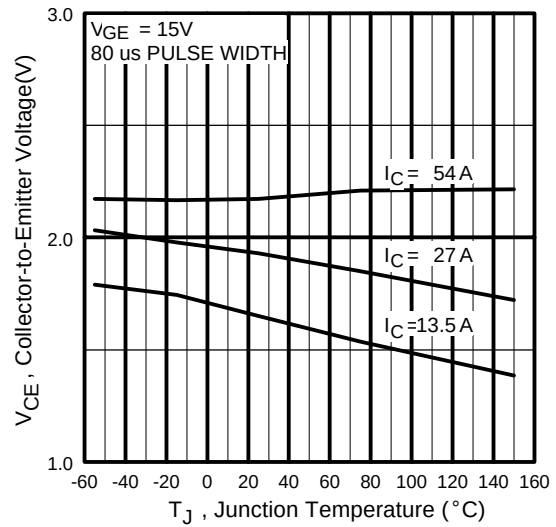


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

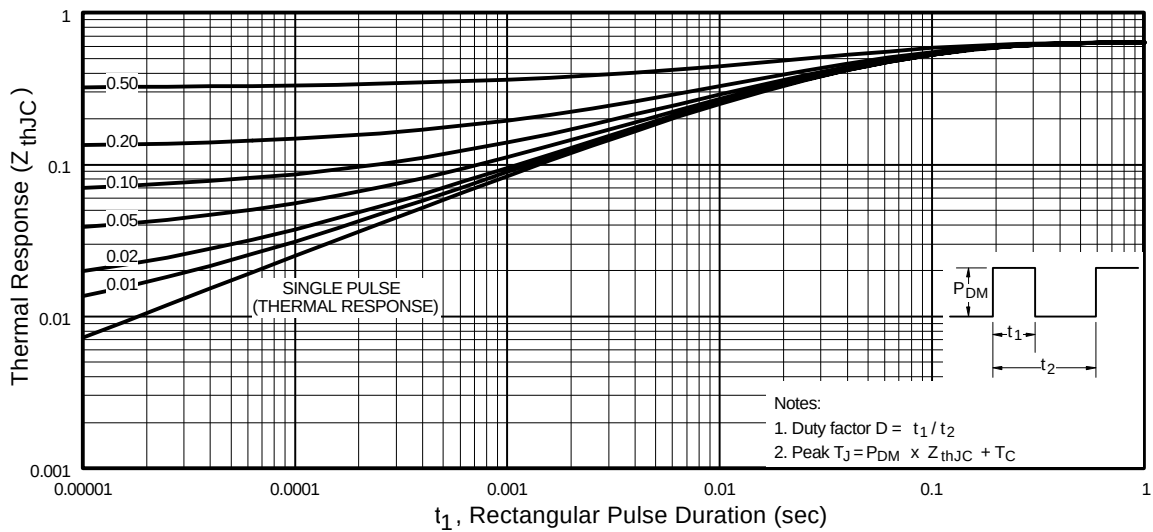


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

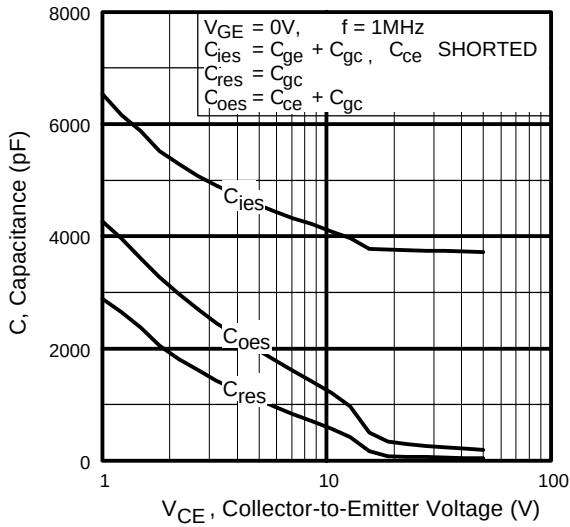


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

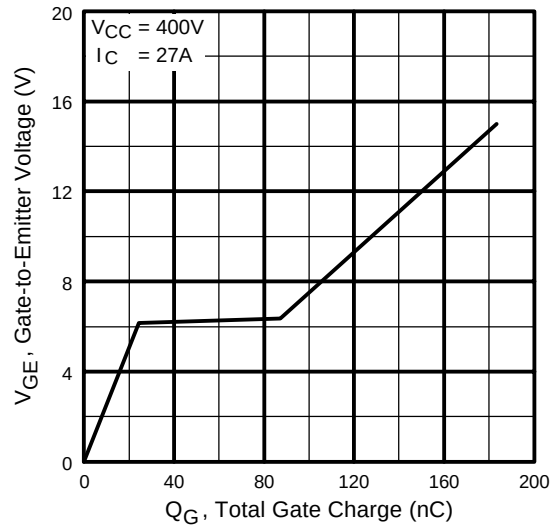


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

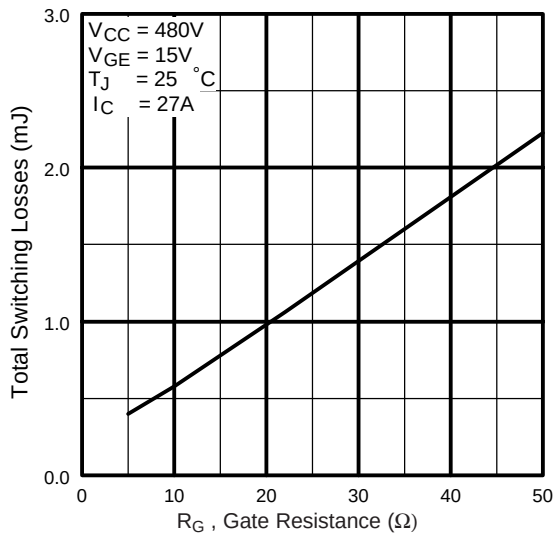


Fig. 9 - Typical Switching Losses vs. Gate Resistance

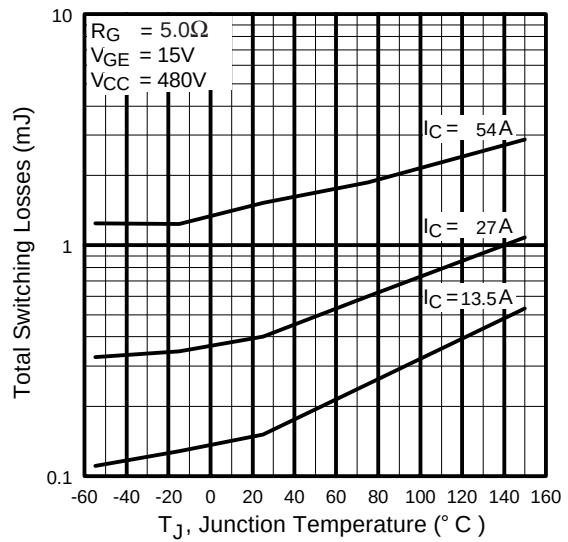


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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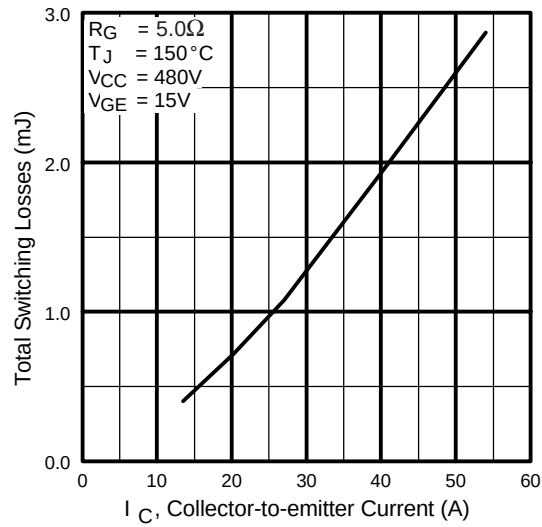


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

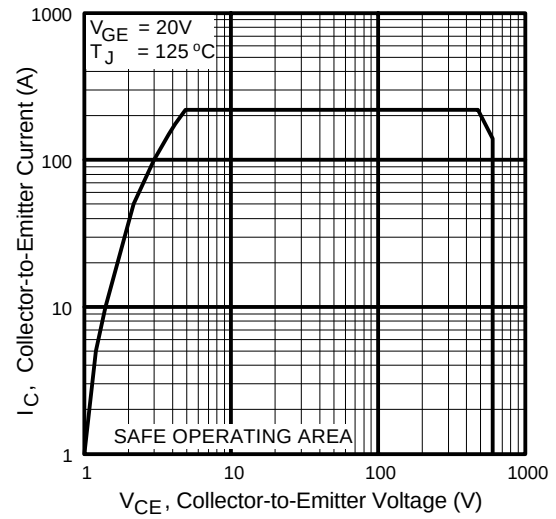


Fig. 12 - Turn-Off SOA

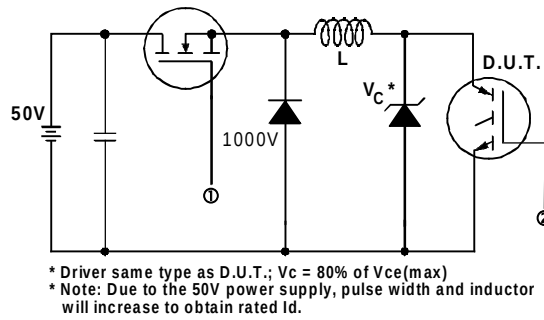


Fig. 13a - Clamped Inductive Load Test Circuit

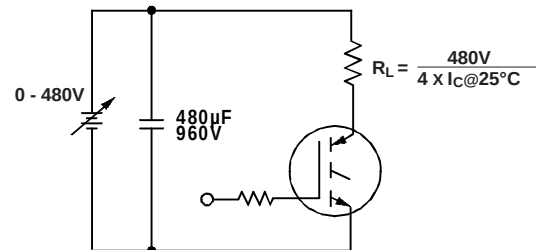


Fig. 13b - Pulsed Collector Current Test Circuit

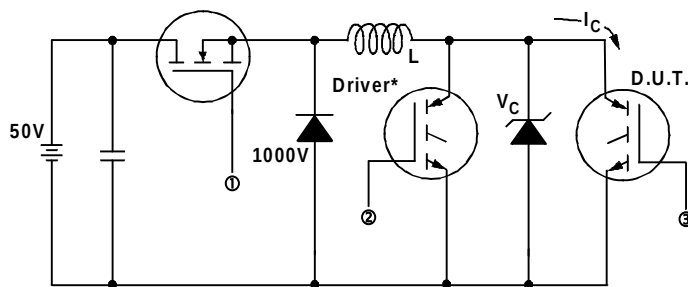


Fig. 14a - Switching Loss Test Circuit

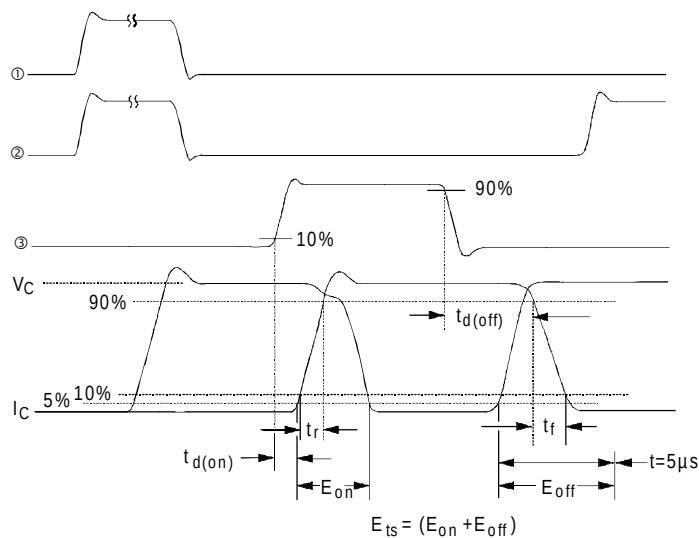


Fig. 14b - Switching Loss Waveforms

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Technical drawing of a 3-pin connector. The drawing shows a top view and a side view. The top view is a rectangle with a dashed center line. The side view shows the profile of the connector with three pins. Dimensions are given in inches and millimeters.

Dimensions:

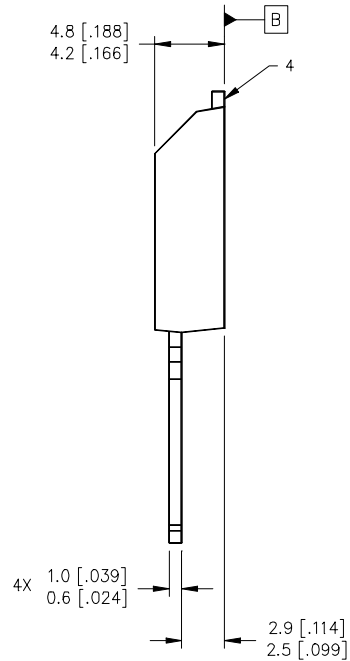
- Overall width: 11.1 [.437] inches, 10.1 [.398] inches
- Pin spacing (center-to-center): 9.25 [.364] inches MAXIMUM
- Pin diameter: 1.2 [.047] inches MAXIMUM
- Pin length: 16.1 [.633] inches, 15.1 [.595] inches
- Pin diameter (bottom): 14.1 [.555] inches, 13.1 [.516] inches
- Pin diameter (top): 3.3 [.129] inches MAXIMUM
- Pin diameter (bottom): 1.2 [.047] inches, 0.8 [.032] inches
- Pin diameter (bottom): 2.54 [.100] inches
- Pin diameter (bottom): 3X
- Pin diameter (bottom): 2X

Material: 0.25 [.010] inches MAXIMUM

Material: B

Material: A

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.



<u>MOSFET</u>	<u>IGBT</u>
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1 – GATE	1 – GATE
2 – DRAIN	2 – COLLECTOR
3 – SOURCE	3 – EMITTER
4 – DRAIN	4 – COLLECTOR

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Data and specifications subject to change without notice. 1/2000