IR HiRel
An Infineon Technologies Company

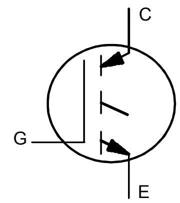
IRG4MC50F

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
- Ceramic Eyelets

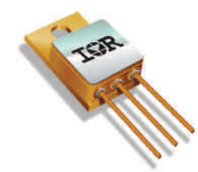


n-channel

V_{CES} = 600V

$V_{CE(on)}$ max = 2.0V

@ V_{GE} = 15V, I_C = 30A



TO-254AA

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°C	Continuous Collector Current	35*	A
I_C @ T_C = 100°C	Continuous Collector Current	30	
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	150	W
P_D @T_C = 100°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)	g

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°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 ③	17	—	—	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.58	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	—	2.0	V	I_C = 30A, V_{GE} = 15V, See Fig. 2,5
		—	—	2.2		I_C = 35A, V_{GE} = 15V, See Fig. 2,5
		—	—	1.9		I_C = 30A, V_{GE} = 15V, T_J = 125°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	—	-11.8	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
gfe	Forward Transconductance ④	21	—	—	S	V_{CE} = 15V, I_C = 30A
I_{CES}	Collector-to-Emitter Leakage Current	—	—	250	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)	—	—	290	nC	I_C = 30A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	—	42		V_{GE} = 15V See Fig. 8
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	—	97		V_{CC} = 480V
$t_{d(on)}$	Turn-On delay time	—	—	50	ns	T_J = 25°C
t_r	Rise time	—	—	25		I_C = 30A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off delay time	—	—	350		V_{GE} = 15V, R_G = 2.35Ω,
t_f	Fall time	—	—	300		Energy losses include tail
E_{total}	Total Switching Loss	—	—	3.0	mJ	See Fig. 10, 11, 13, 14
$t_{d(on)}$	Turn-On delay time	—	—	50	ns	T_J = 125°C
t_r	Rise time	—	—	25		I_C = 30A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off delay time	—	—	475		V_{GE} = 15V, R_G = 2.35Ω
t_f	Fall time	—	—	400		Energy losses include tail
E_{total}	Total Switching Loss	—	—	6.0	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	—	4100	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	250	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	49	—		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 = 2.35Ω, (See Fig. 13a).

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

④ Pulse width 5.0µs, single shot.

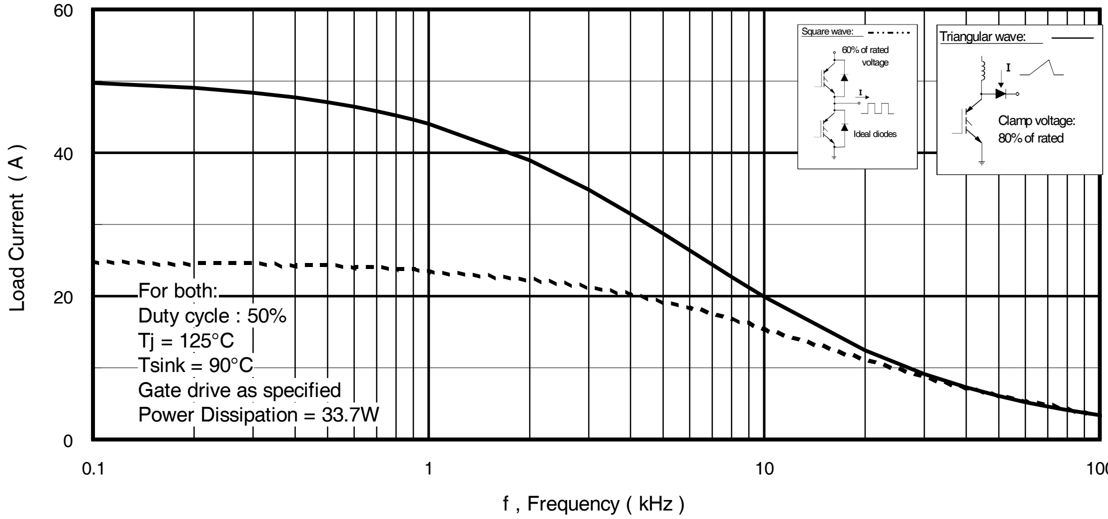


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

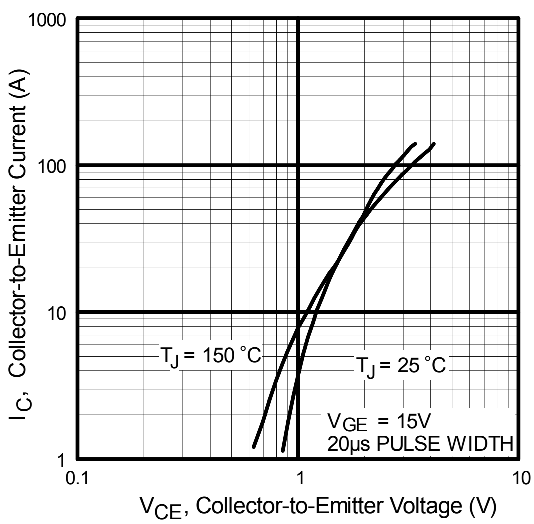


Fig 2. Typical Output Characteristics

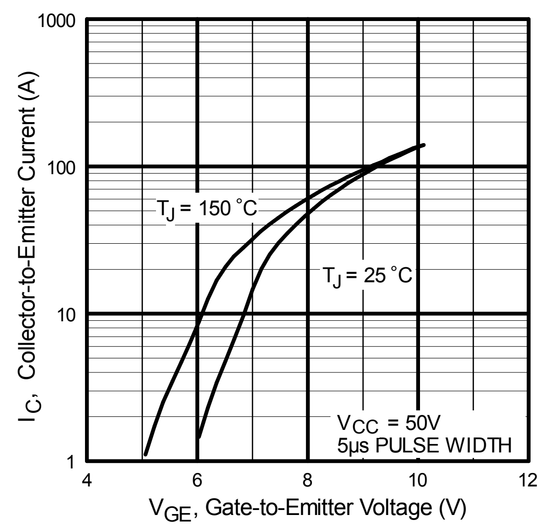


Fig 3. Typical Transfer Characteristics

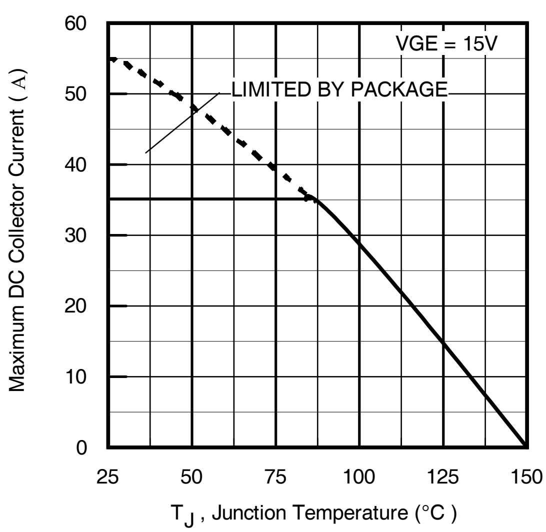


Fig 4. Maximum Collector Current Vs. Case Temperature

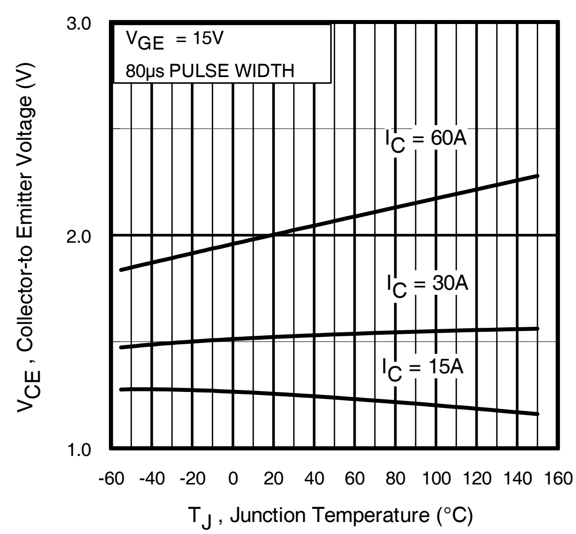


Fig 5. Collector-to-Emitter Voltage Vs. Junction Temperature

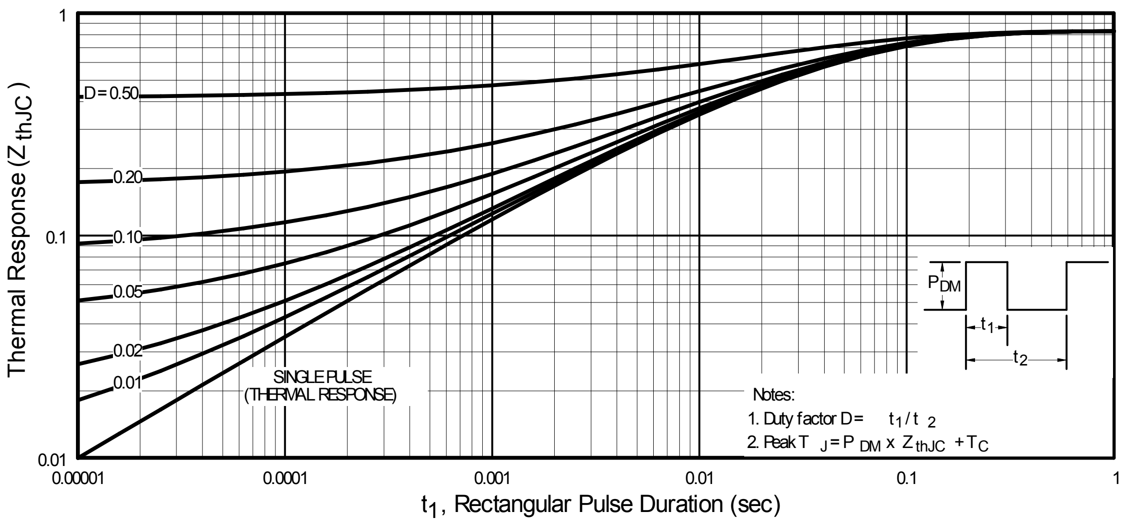


Fig 6. Maximum Effective Transient Thermal Impedance, Junction-to-Case

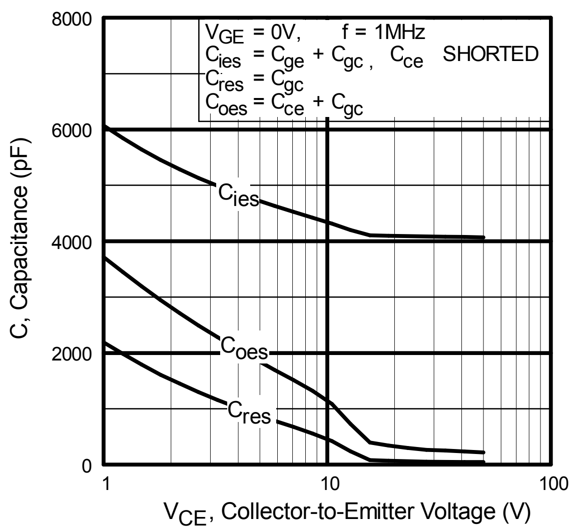


Fig 7. Typical Capacitance Vs. Collector-to-Emitter Voltage

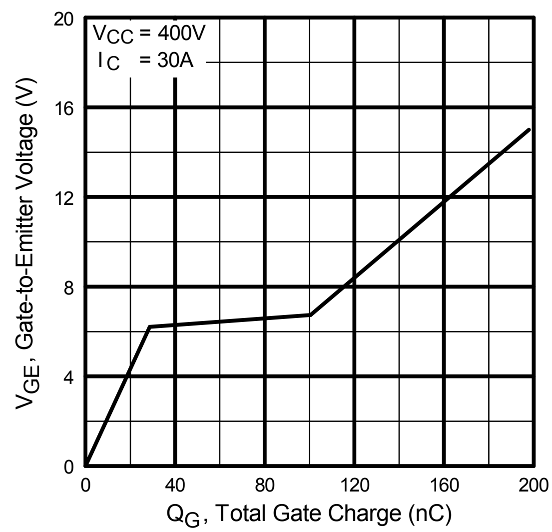


Fig 8. Typical Gate Charge Vs. Gate-to-Emitter Voltage

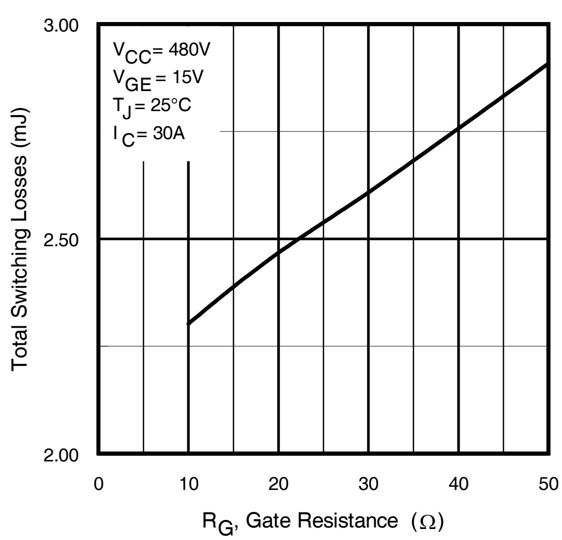


Fig 9. Typical Switching Losses Vs. Gate Resistance

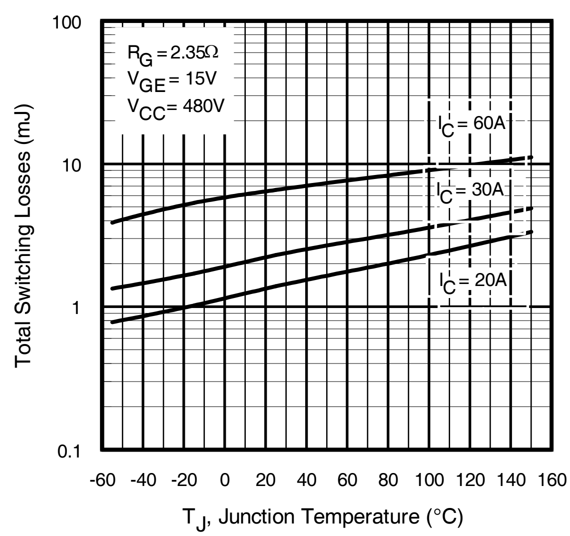


Fig 10. Typical Switching Losses Vs. Junction Temperature

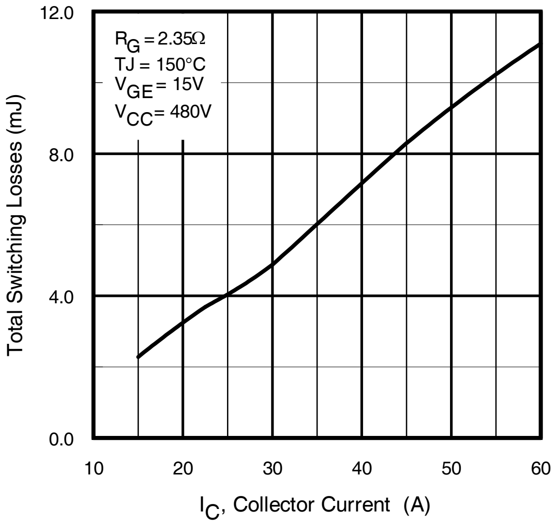


Fig 11. Typical Switching Losses Vs. Collector-to-Emitter Current

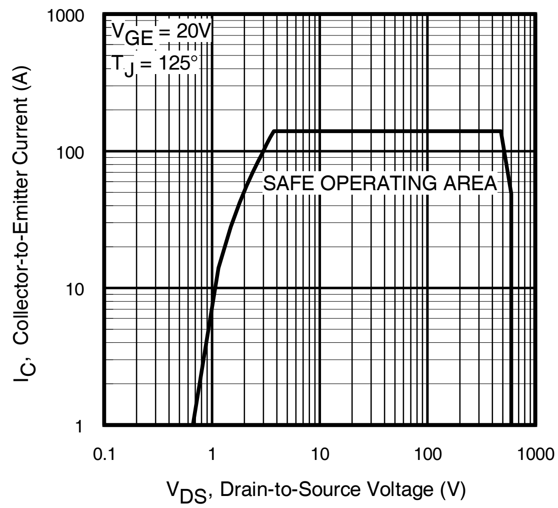


Fig 12. Turn-Off SOA

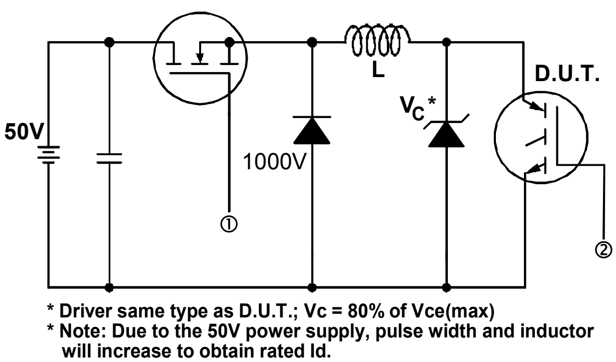


Fig 13a. Clamped Inductive Load Test Circuit

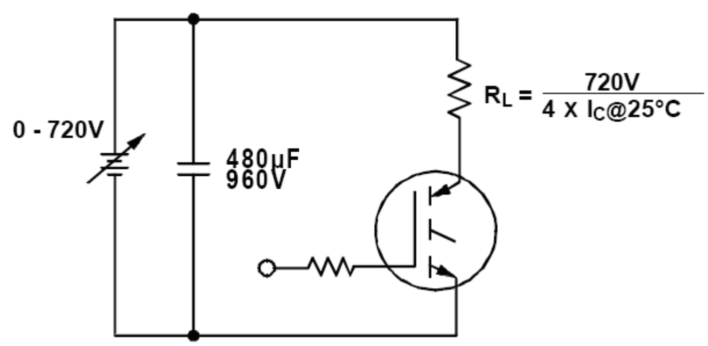


Fig 13b. Pulsed Collector Current Test Circuit

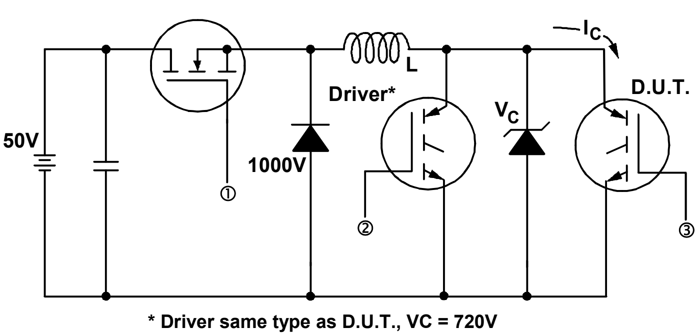


Fig 14a. Switching Loss Test Circuit

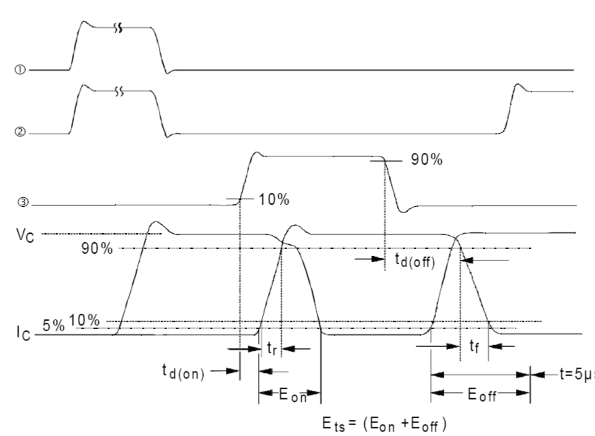
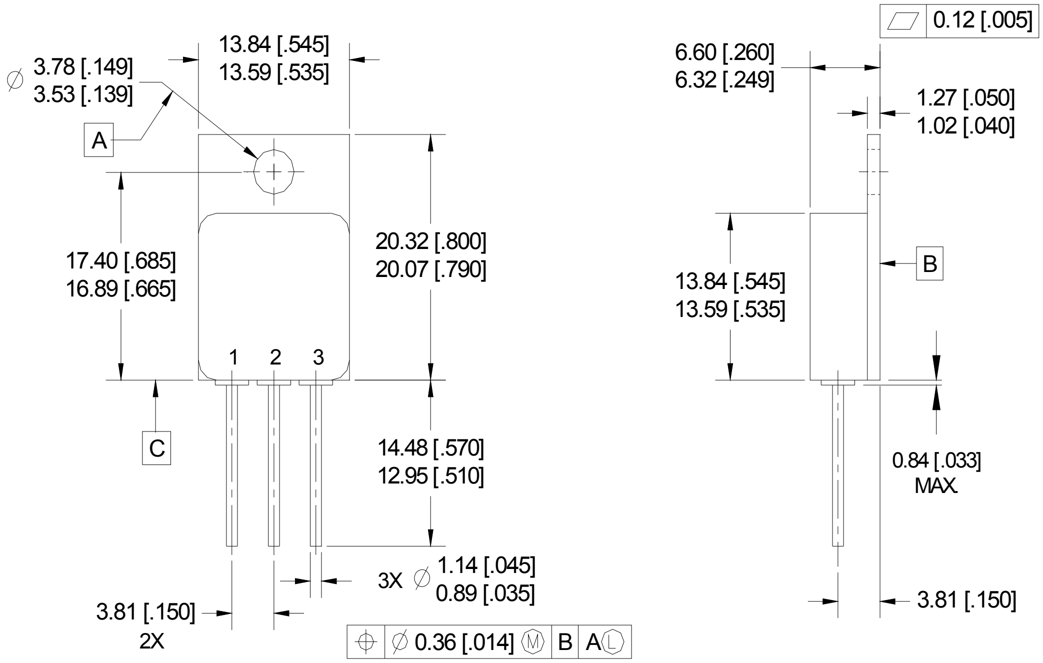


Fig 14b. Switching Loss Waveforms

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.

An Infineon Technologies Company

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