International
IOR Rectifier

PD - 91572A

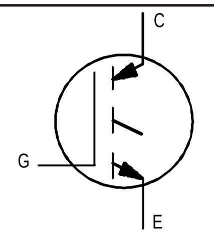
IRG4RC10U

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

Features

- UltraFast: Optimized for high operating frequencies (8-40 kHz in hard switching, >200 kHz in resonant mode)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than previous generation
- Industry standard TO-252AA package



n-channel

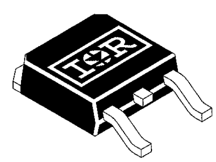
V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 2.15V

@V_{GE} = 15V, I_C = 5.0A

Benefits

- Generation 4 IGBT's offer highest efficiency available
- IGBT's optimized for specified application conditions



D-PAK
TO-252AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	8.5	A
I_C @ T_C = 100°C	Continuous Collector Current	5.0	
I_{CM}	Pulsed Collector Current ①	34	
I_{LM}	Clamped Inductive Load Current ②	34	
V_{GE}	Gate-to-Emitter Voltage	±20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	110	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	38	W
P_D @ T_C = 100°C	Maximum Power Dissipation	15	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	–––	3.3	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)*	–––	50	
Wt	Weight	0.3 (0.01)	–––	g (oz)

* When mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994

8/30/99

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 = 250µA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	14	—	—	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.54	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.15	2.6	V	I_C = 5.0A; V_{GE} = 15V
		—	2.61	—		I_C = 8.5A; See Fig.2, 5
		—	2.30	—		I_C = 5.0A , T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-8.7	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ⑤	2.8	4.2	—	S	V_{CE} = 100V, I_C = 5.0A
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°C
		—	—	1000		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°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)	—	15	22	nC	I_C = 5.0A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	2.6	4.0		V_{CC} = 400V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	5.8	8.7		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	19	—	ns	
t_r	Rise Time	—	11	—		T_J = 25°C
$t_{d(off)}$	Turn-Off Delay Time	—	116	240		I_C = 5.0A, V_{CC} = 480V
t_f	Fall Time	—	81	180		V_{GE} = 15V, R_G = 100Ω
E_{on}	Turn-On Switching Loss	—	0.08	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	0.16	—		See Fig. 9, 10, 14
E_{ts}	Total Switching Loss	—	0.24	0.36		
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	T_J = 150°C,
t_r	Rise Time	—	14	—		I_C = 5.0A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	180	—		V_{GE} = 15V, R_G = 100Ω
t_f	Fall Time	—	150	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	0.36	—	mJ	See Fig. 11, 14
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	270	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	21	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	3.5	—		ƒ = 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 = 10µH, R_G = 100Ω, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

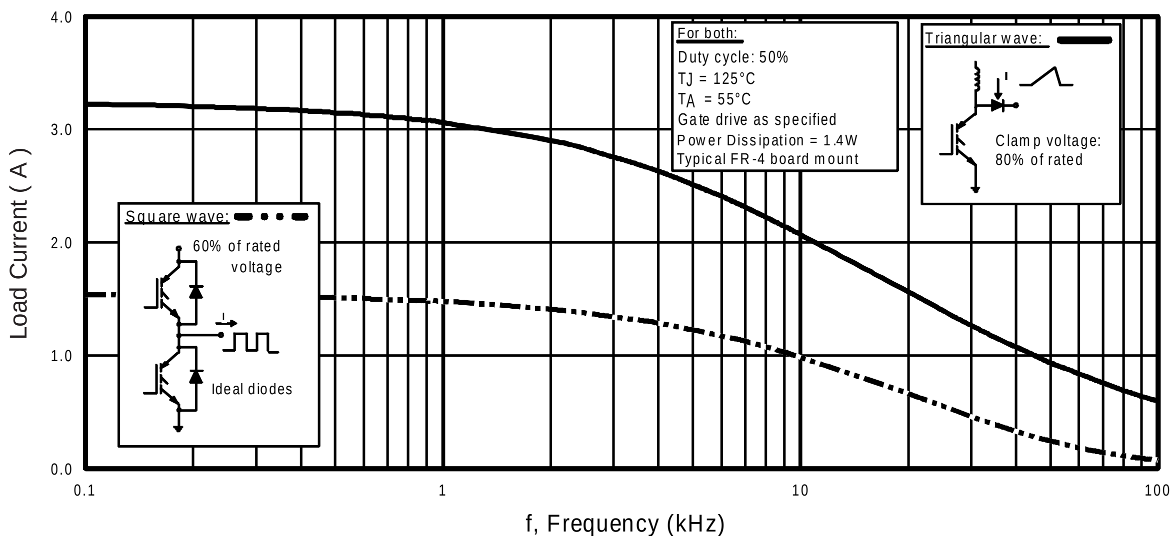


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

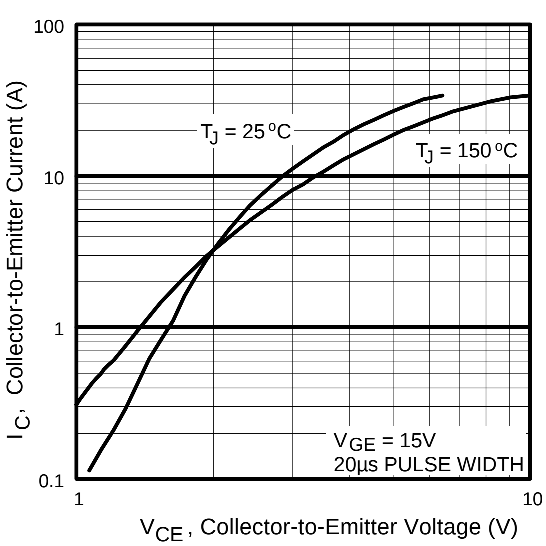


Fig. 2 - Typical Output Characteristics

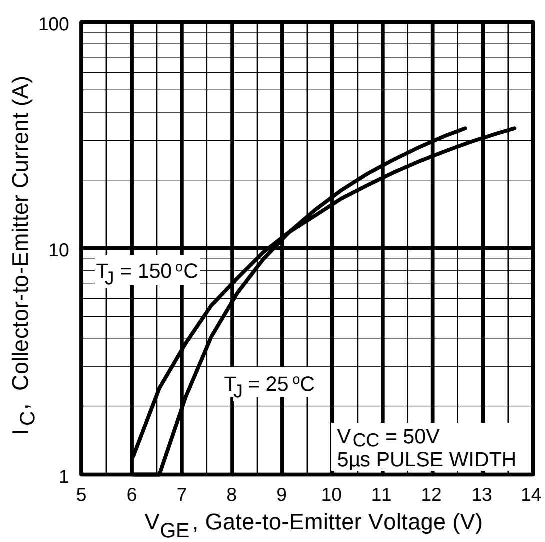


Fig. 3 - Typical Transfer Characteristics

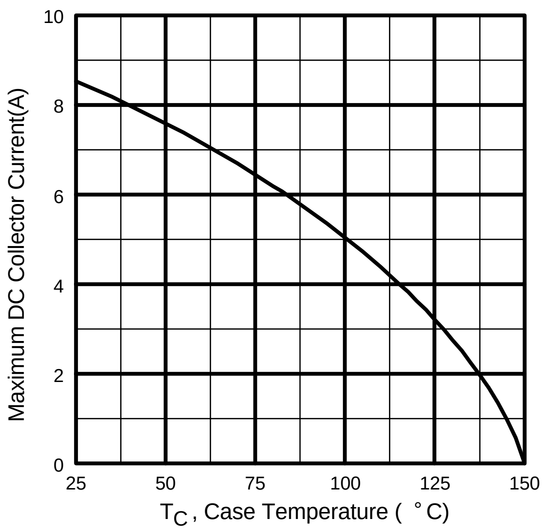


Fig. 4 - Maximum Collector Current vs. Case Temperature

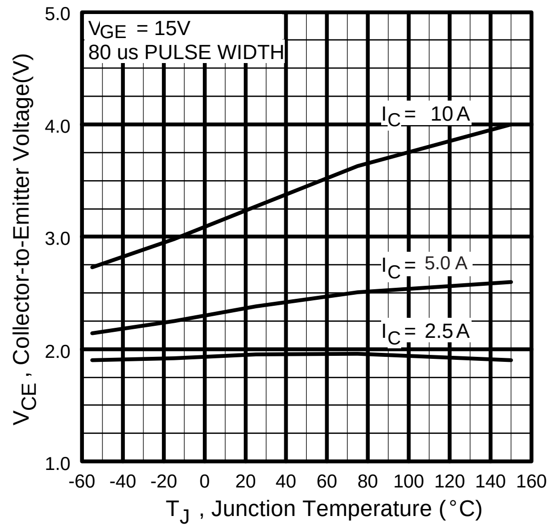


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

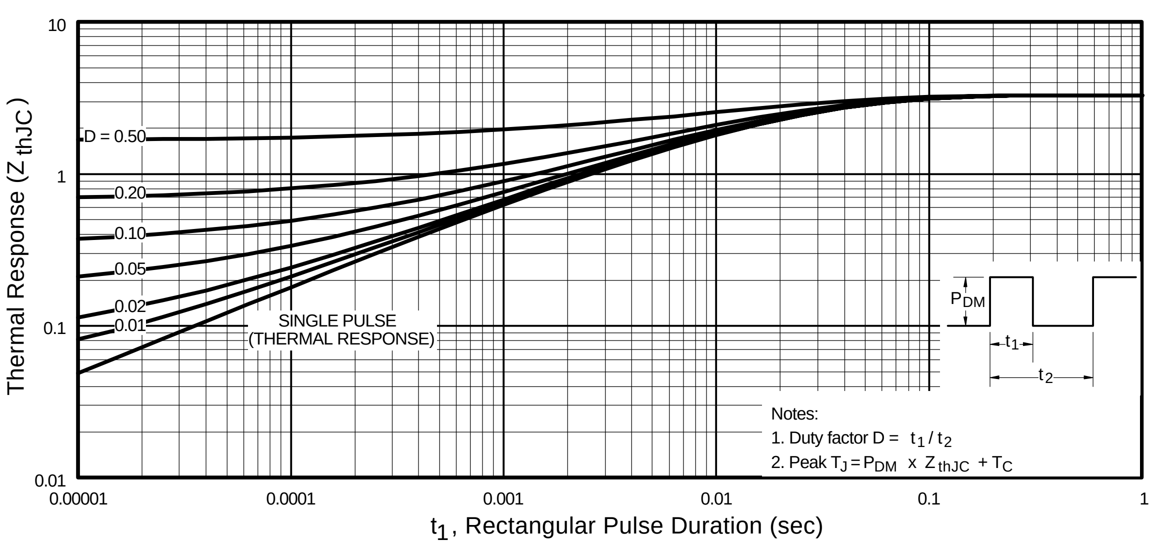


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

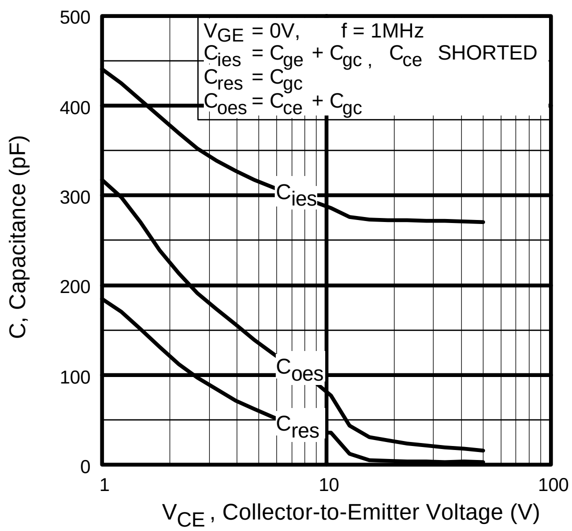


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

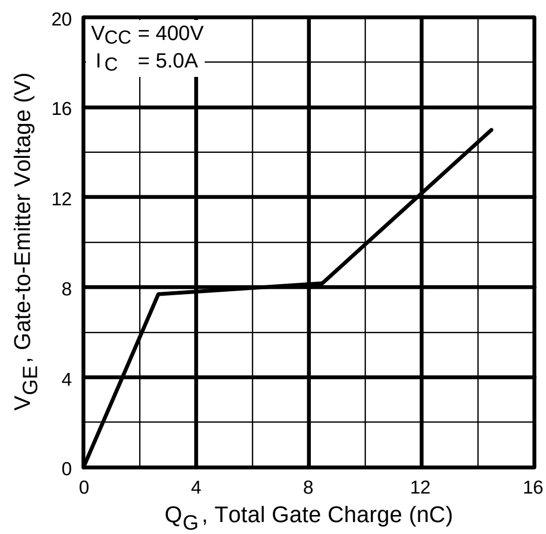


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

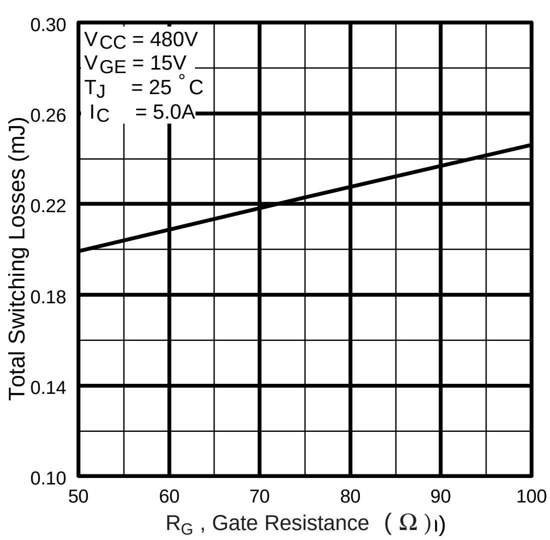


Fig. 9 - Typical Switching Losses vs. Gate Resistance

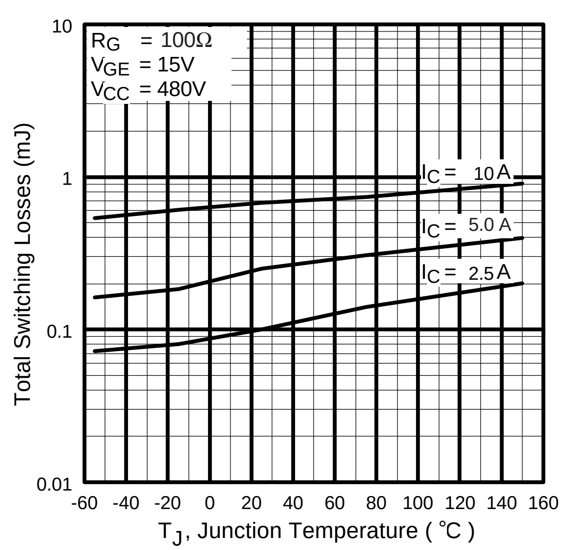


Fig. 10 - Typical Switching Losses vs. Junction Temperature

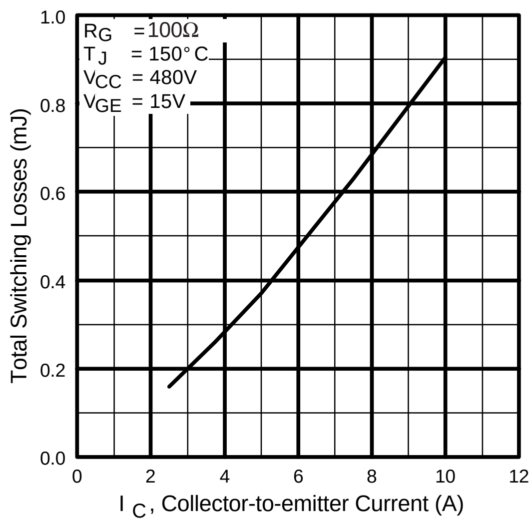


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

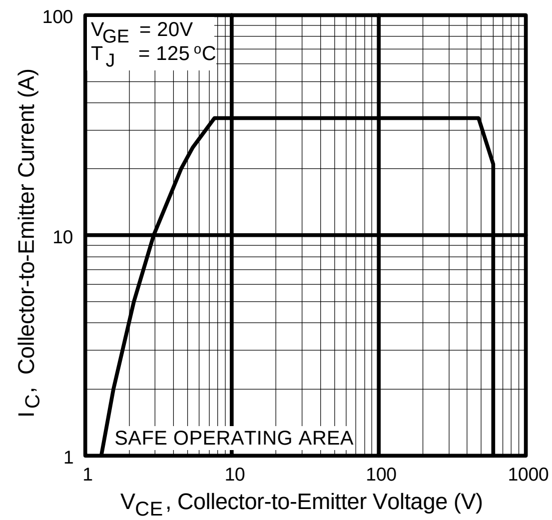


Fig. 12 - Turn-Off SOA

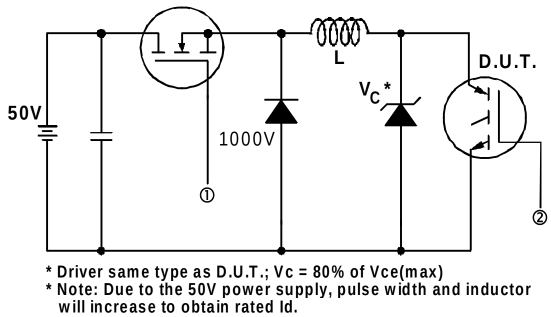


Fig. 13a - Clamped Inductive Load Test Circuit

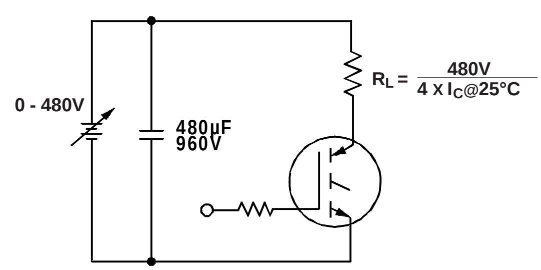


Fig. 13b - Pulsed Collector Current Test Circuit

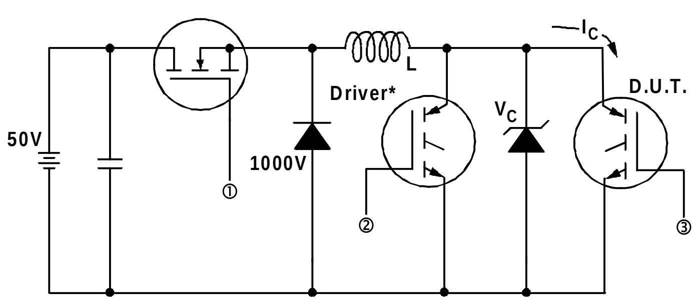


Fig. 14a - Switching Loss Test Circuit

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

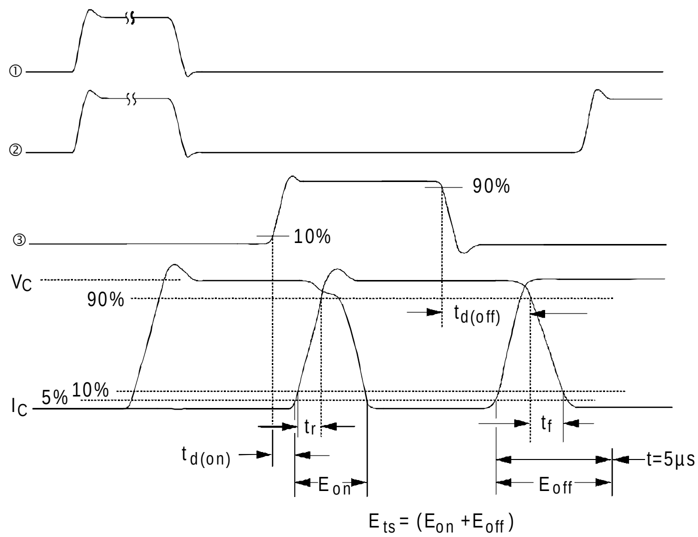
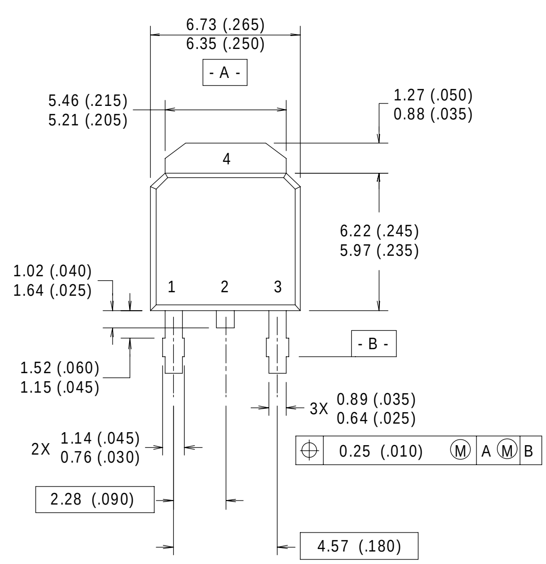


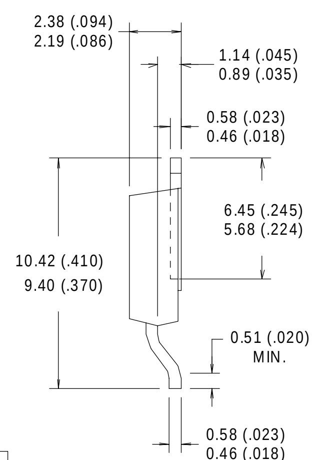
Fig. 14b - Switching Loss Waveforms

Package Outline

TO-252AA Outline

Dimensions are shown in millimeters (inches)





LEAD ASSIGNMENTS

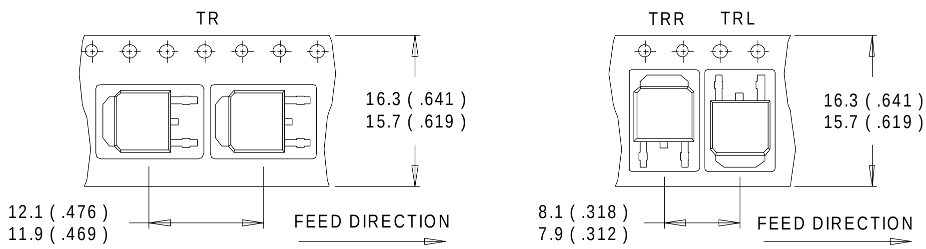
1 - GATE
2 - COLLECTOR
3 - EMITTER
4 - COLLECTOR

NOTES:

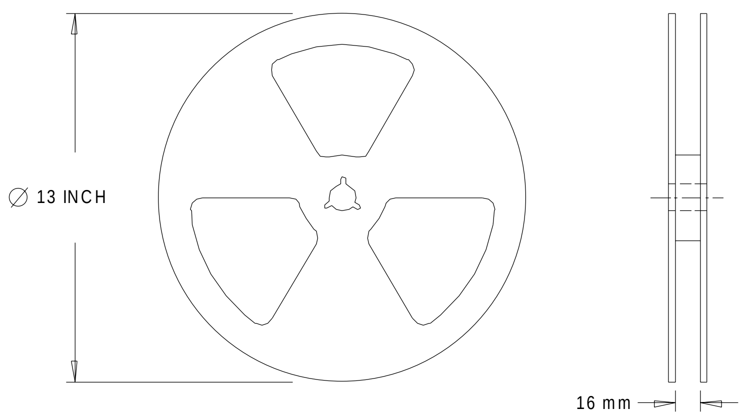
1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 CONFORMS TO JEDEC OUTLINE TO-252AA.
4 DIMENSIONS SHOWN ARE BEFORE SOLDER DIP, SOLDER DIP MAX. +0.16 (.006).

Tape & Reel Information

TO-252AA



NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES :
1. OUTLINE CONFORMS TO EIA-481.

International
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http://www.irf.com/ Data and specifications subject to change without notice. 12/98

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/