International
IOR Rectifier

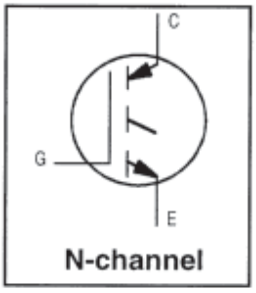
IRG4RC20FPbF

INSULATED GATE BIPOLAR TRANSISTOR

Fast Speed IGBT

Features

- Fast: Optimized for medium operating frequencies (1-5 kHz in hard switching, >20 kHz in resonant mode).
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than previous generation IGBTs.
- Industry standard TO-252AA package
- Combines very low $V_{CE(on)}$ with low switching losses
- Lead-Free



N-channel

V_{CES} = 600V

$V_{CE(on)}$ typ. = 1.82V

@V_{GE} = 15V, I_C = 12A

Benefits

- Generation 4 IGBTs offer highest efficiency
- Optimized for specific application conditions
- High power density and current rating



D-Pak
TO-252AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	22	A
I_C @ T_C = 100°C	Continuous Collector Current	12	
I_{CM}	Pulsed Collector Current ①	44	
I_{LM}	Clamped Inductive Load Current ②	44	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	5.0	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	66	W
P_D @ T_C = 100°C	Maximum Power Dissipation	26	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	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	—	1.9	°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

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	18	—	—	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.72	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.82	2.1	V	I_C = 12A V_{GE} = 15V
		—	2.42	—		I_C = 22A See Fig.2, 5
		—	2.04	—		I_C = 12A , 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	—	-11	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ⑤	5.2	7.75	—	S	V_{CE} = 100V, I_C = 12A
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)	—	27	40	nC	I_C = 12A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.8	6.8		V_{CC} = 400V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	11.4	17		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	26	—	ns	T_J = 25°C
t_r	Rise Time	—	24	—		I_C = 12A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	194	290		V_{GE} = 15V, R_G = 50Ω
t_f	Fall Time	—	226	340		Energy losses include "tail"
E_{on}	Turn-On Switching Loss	—	0.19	—	mJ	See Fig. 9, 10, 14
E_{off}	Turn-Off Switching Loss	—	0.92	—		
E_{ts}	Total Switching Loss	—	1.11	1.4		
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	T_J = 150°C,
t_r	Rise Time	—	26	—		I_C = 12A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	263	—		V_{GE} = 15V, R_G = 50Ω
t_f	Fall Time	—	443	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	1.89	—	mJ	See Fig. 11, 14
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	540	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	37	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	7.0	—		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 = 10µH, R_G = 50Ω, (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.

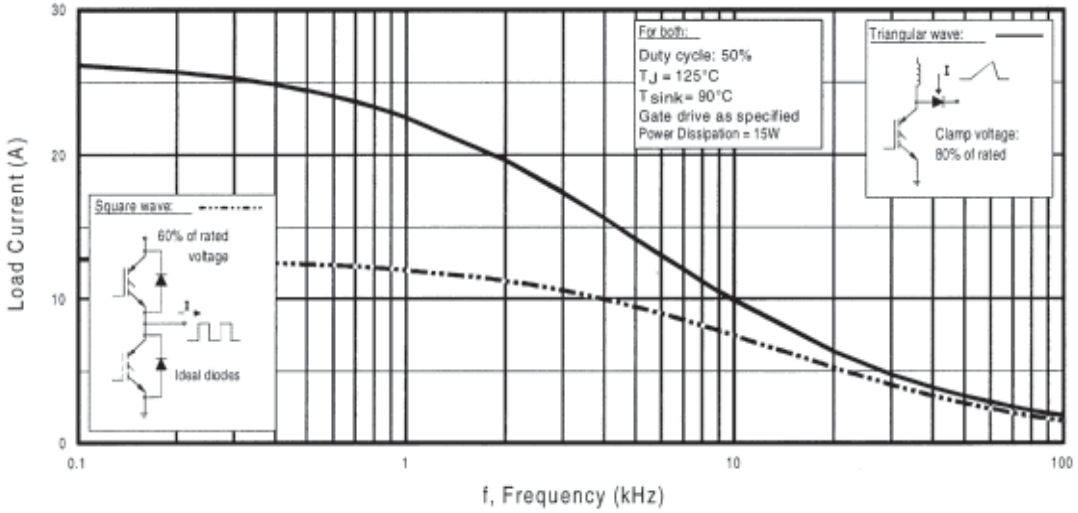


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

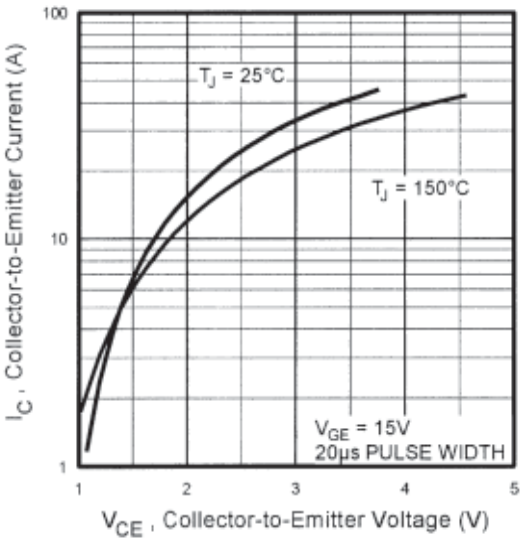


Fig. 2 - Typical Output Characteristics

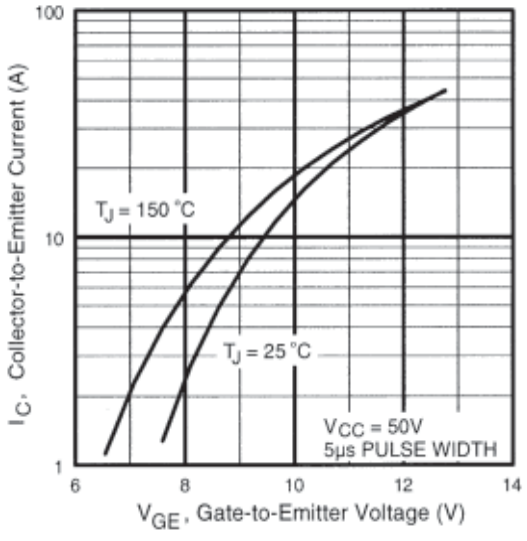


Fig. 3 - Typical Transfer Characteristics

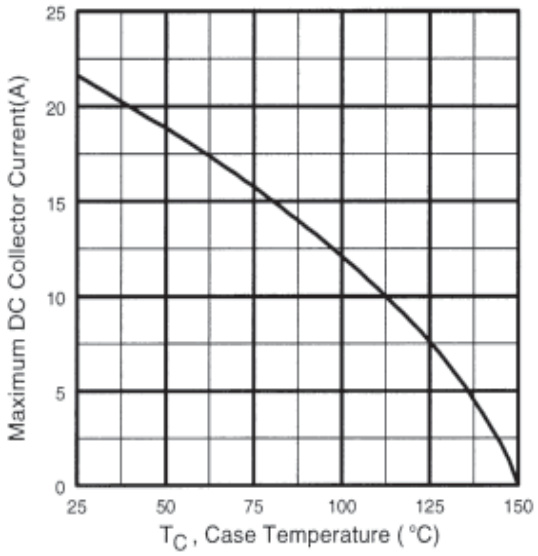


Fig. 4 - Maximum Collector Current vs. Case Temperature

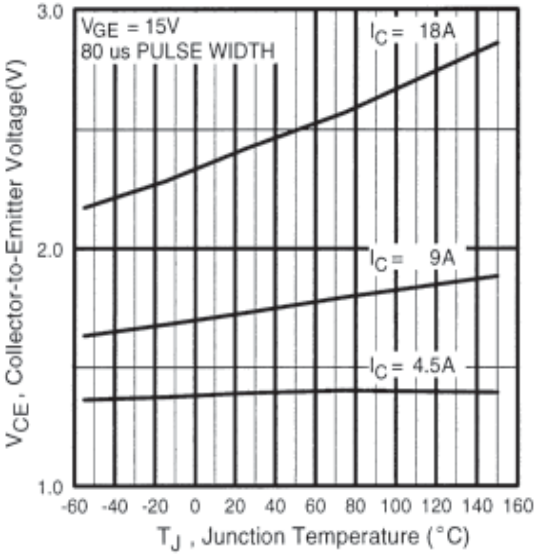


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

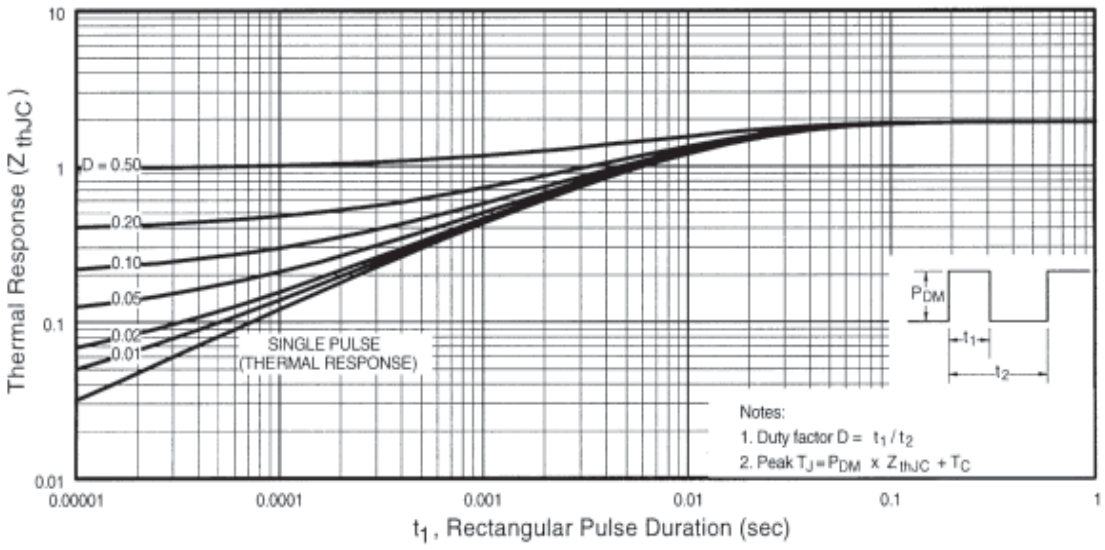


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

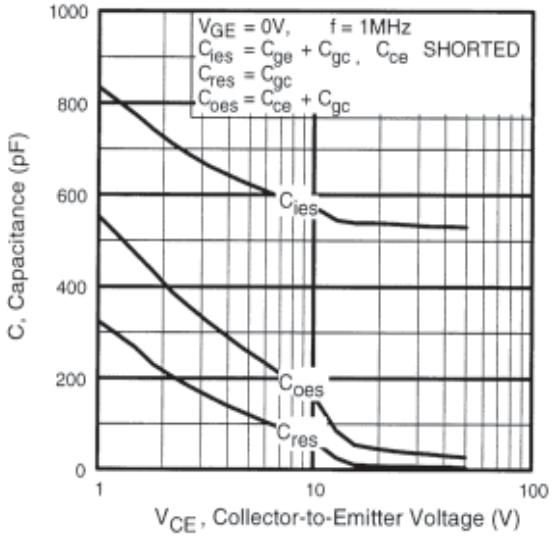


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

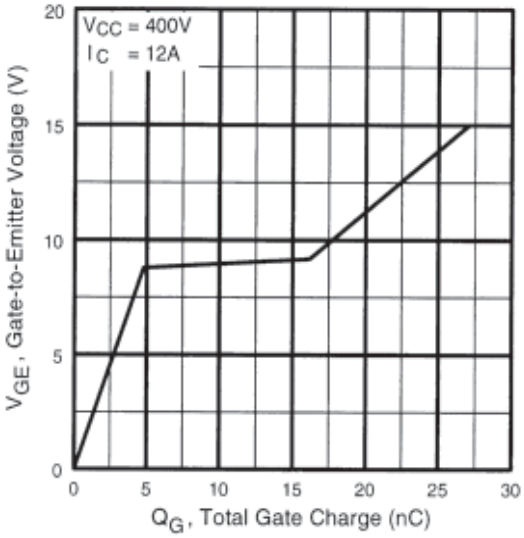


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

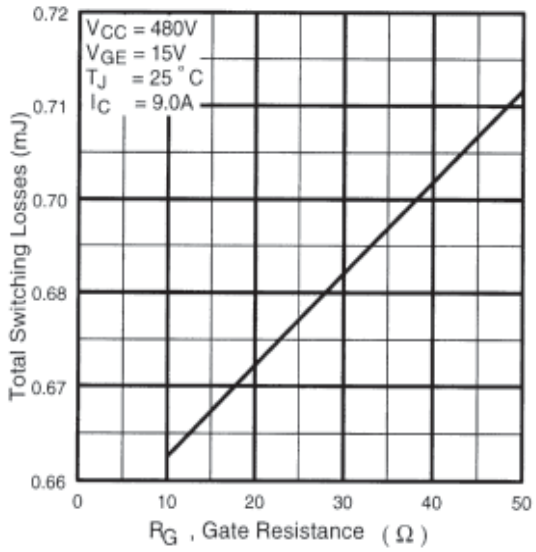


Fig. 9 - Typical Switching Losses vs. Gate Resistance

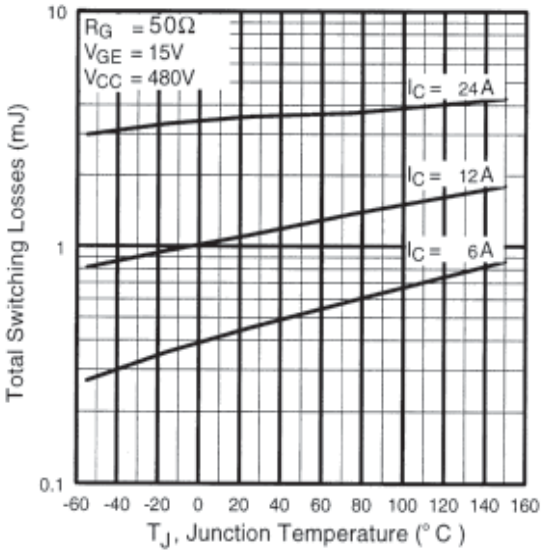


Fig. 10 - Typical Switching Losses vs. Junction Temperature

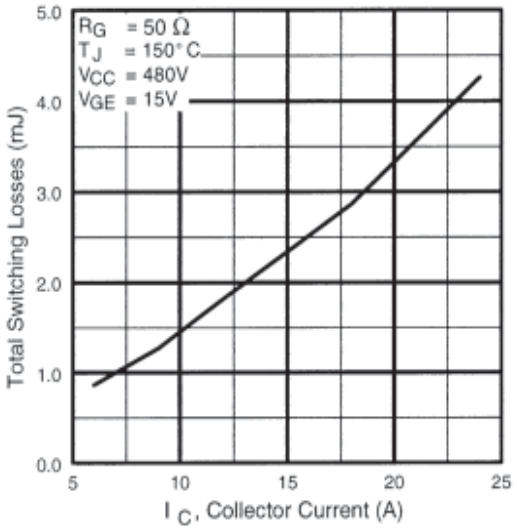


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

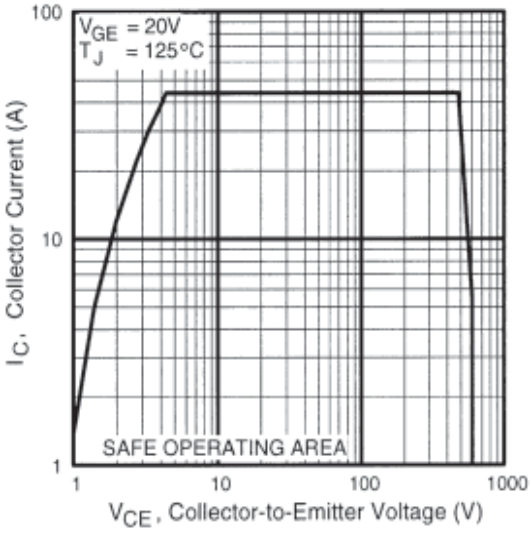


Fig. 12 - Turn-Off SOA

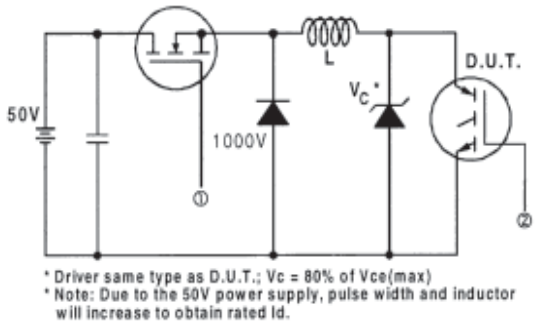


Fig. 13a - Clamped Inductive Load Test Circuit

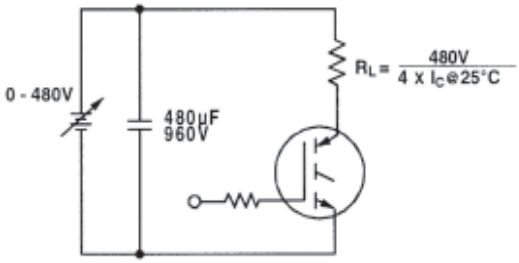


Fig. 13b - Pulsed Collector Current Test Circuit

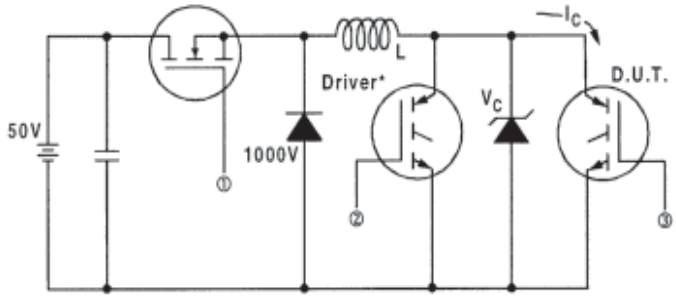


Fig. 14a - Switching Loss Test Circuit

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

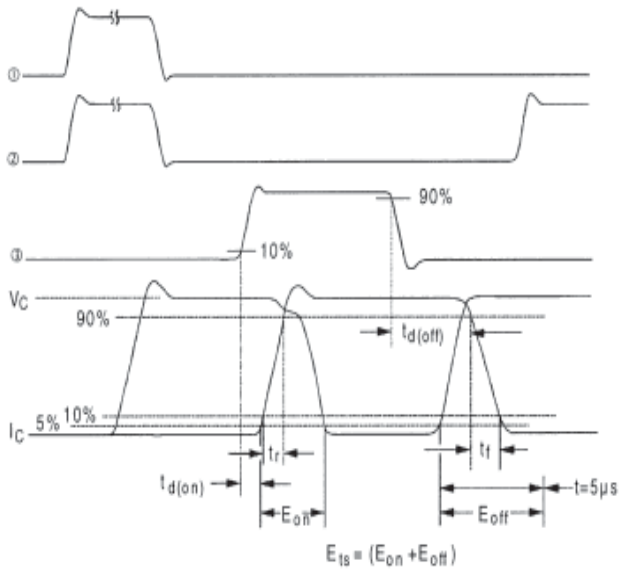
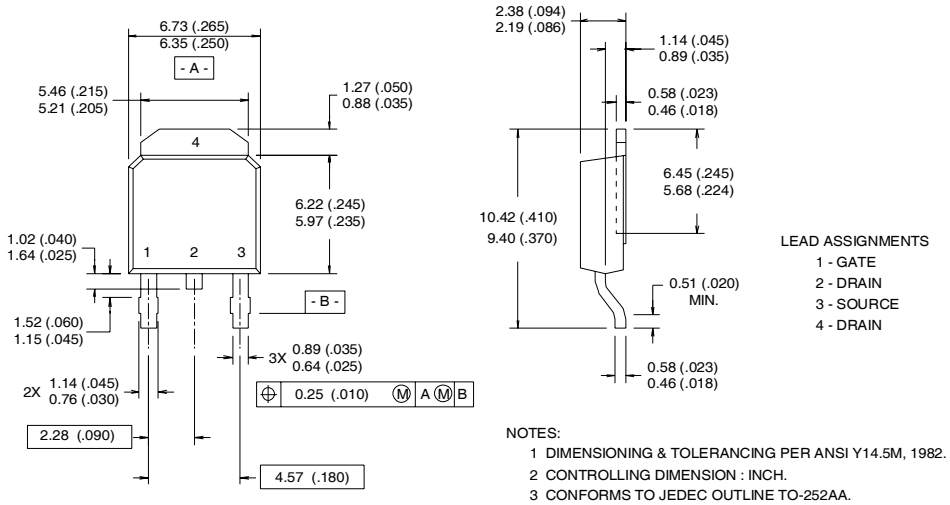


Fig. 14b - Switching Loss Waveforms

D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)

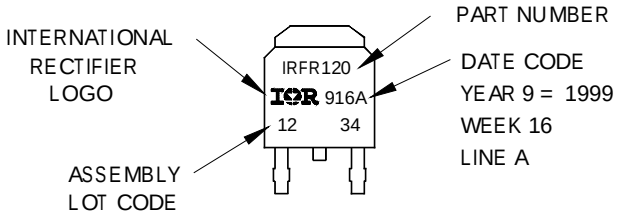


NOTES:
1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 CONFORMS TO JEDEC OUTLINE TO-252AA.
4 DIMENSIONS SHOWN ARE BEFORE SOLDER DIP, SOLDER DIP MAX. +0.16 (.006).

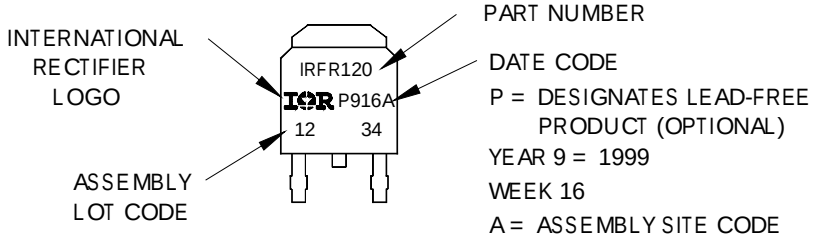
D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 1999
IN THE ASSEMBLY LINE "A"

Note: "P" in assembly line position indicates "Lead-Free"

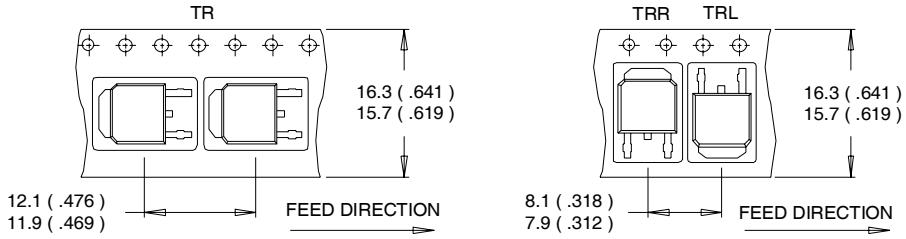


OR

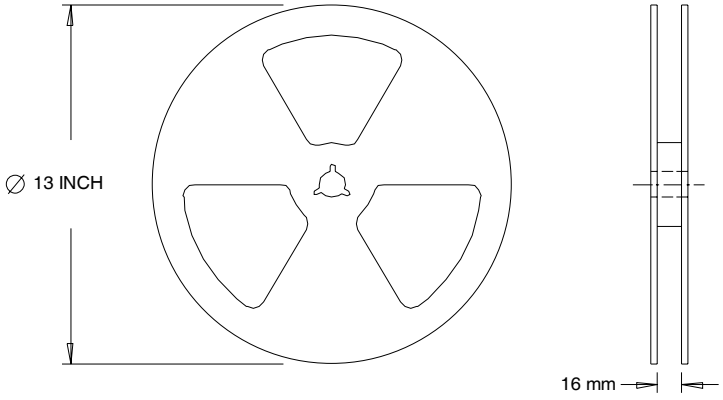


D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



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.

Data and specifications subject to change without notice.
This product has been designed and qualified for the industrial market.
Qualification Standards can be found on IR"s Web site.

International
IOR Rectifier

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

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