

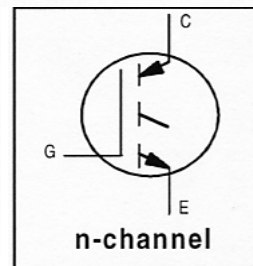
IRG4RC10SPbF

INSULATED GATE BIPOLAR TRANSISTOR

Standard Speed IGBT

Features

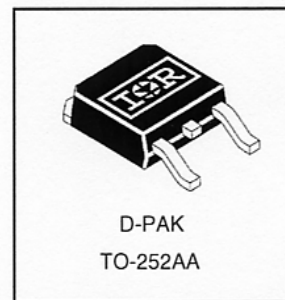
- Extremely low voltage drop; 1.0V typical at 2A, 100°C
- Standard: Optimized for minimum saturation voltage and low operating frequencies (< 1kHz)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than previous generation
- Industry standard TO-252AA package
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.10V$
@ $V_{GE} = 15V, I_C = 2.0A$

Benefits

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



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	14	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	8.0	
I_{CM}	Pulsed Collector Current ①	18	
I_{LM}	Clamped Inductive Load Current ②	18	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	110	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	38	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	15	
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	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

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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
ΔV _{(BR)CES/ΔT_J}	Temperature Coeff. of Breakdown Voltage	—	0.64	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(ON)}	Collector-to-Emitter Saturation Voltage	—	1.58	1.7	V	I _C = 8.0A V _{GE} = 15V
		—	2.05	—		I _C = 14A See Fig.2, 5
		—	1.68	—		I _C = 8.0A, T _J = 150°C
V _{GE(th)}	Gate Threshold Voltage	3.0	—	6.0		V _{CE} = V _{GE} , I _C = 250μA
ΔV _{GE(th)/ΔT_J}	Temperature Coeff. of Threshold Voltage	—	-9.5	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ⑤	3.7	5.5	—	S	V _{CE} = 100V, I _C = 8.0A
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 = 8.0A
Q _{ge}	Gate - Emitter Charge (turn-on)	—	2.4	3.6		V _{CC} = 400V See Fig. 8
Q _{gc}	Gate - Collector Charge (turn-on)	—	6.5	9.8		V _{GE} = 15V
t _{d(on)}	Turn-On Delay Time	—	25	—	ns	T _J = 25°C
t _r	Rise Time	—	28	—		I _C = 8.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	630	950		V _{GE} = 15V, R _G = 100Ω
t _f	Fall Time	—	710	1100		Energy losses include "tail"
E _{on}	Turn-On Switching Loss	—	0.14	—	mJ	See Fig. 9, 10, 14
E _{off}	Turn-Off Switching Loss	—	2.58	—		
E _{ts}	Total Switching Loss	—	2.72	4.3		
t _{d(on)}	Turn-On Delay Time	—	24	—	ns	T _J = 150°C,
t _r	Rise Time	—	31	—		I _C = 8.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	810	—		V _{GE} = 15V, R _G = 100Ω
t _f	Fall Time	—	1300	—		Energy losses include "tail"
E _{ts}	Total Switching Loss	—	3.94	—	mJ	See Fig. 11, 14
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	280	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	30	—		V _{CC} = 30V See Fig. 7
C _{res}	Reverse Transfer Capacitance	—	4.0	—		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 = 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.

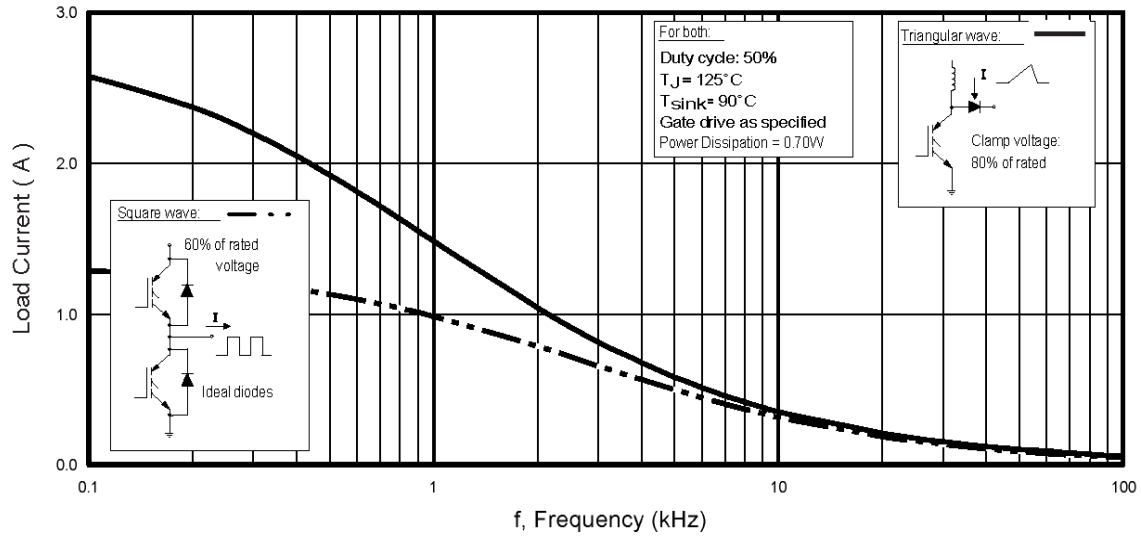


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

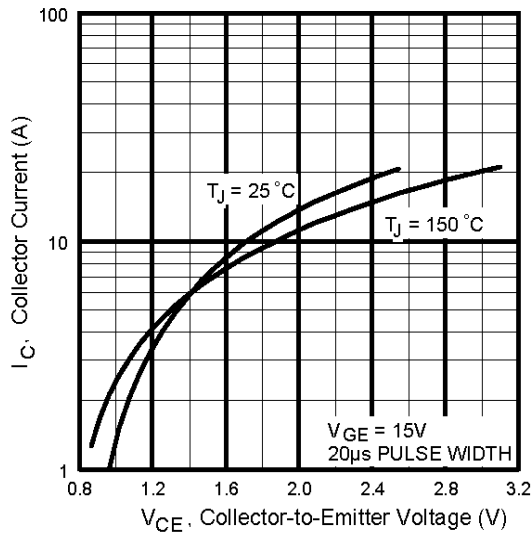


Fig. 2 - Typical Output Characteristics

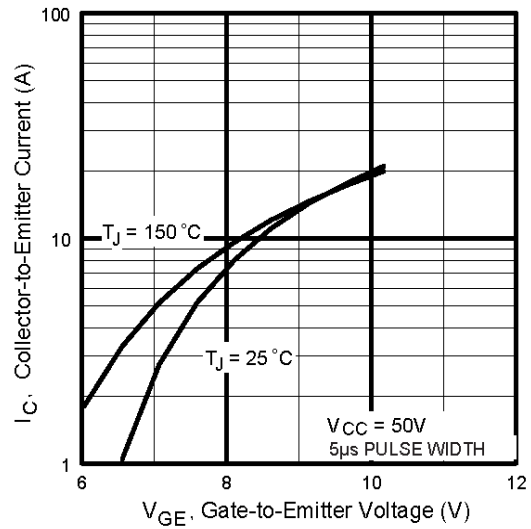


Fig. 3 - Typical Transfer Characteristics

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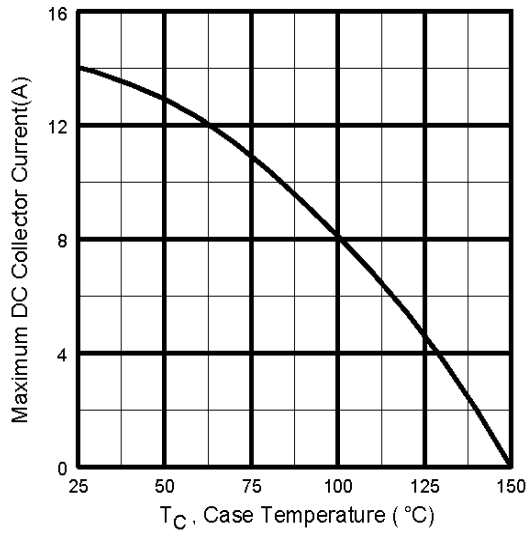


Fig. 4 - Maximum Collector Current vs. Case Temperature

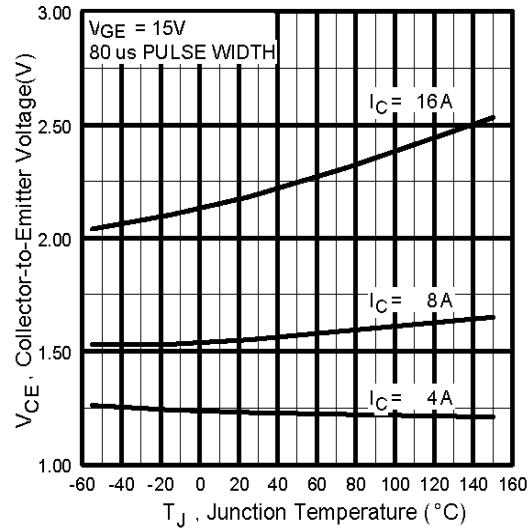


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

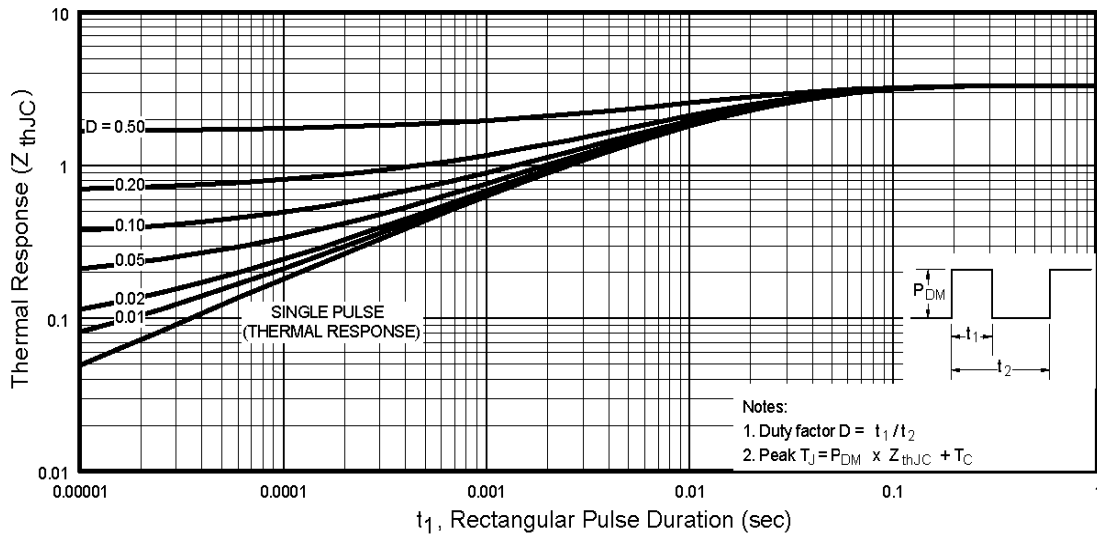


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

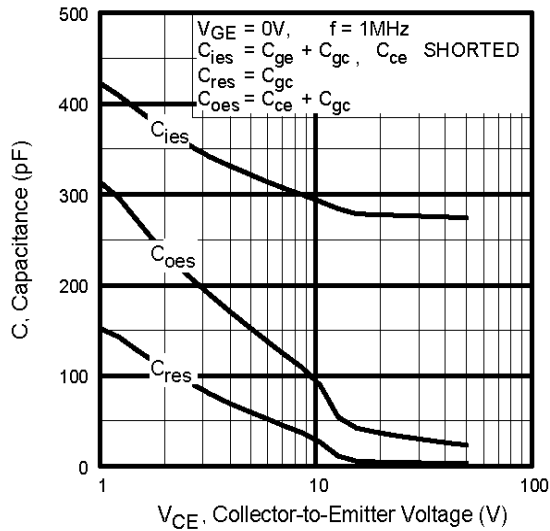


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

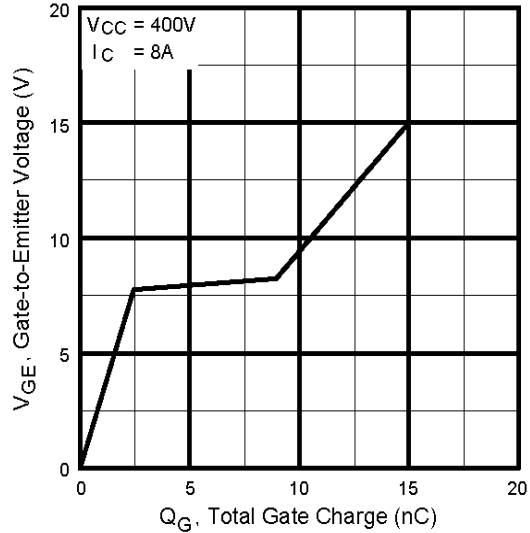


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

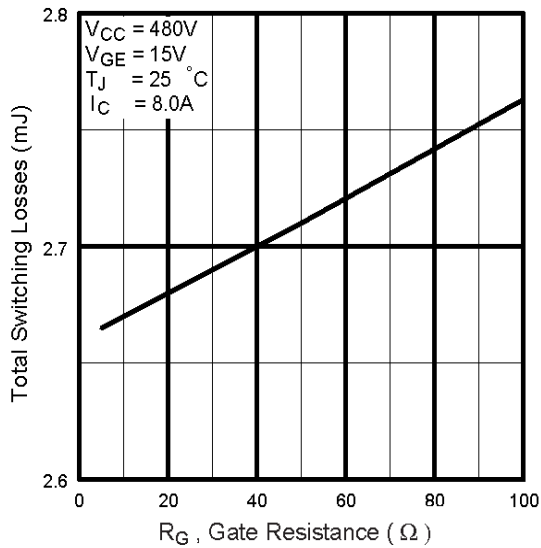


Fig. 9 - Typical Switching Losses vs. Gate Resistance

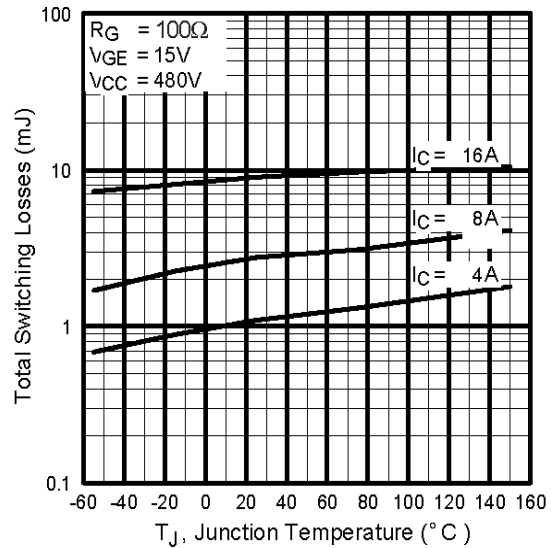


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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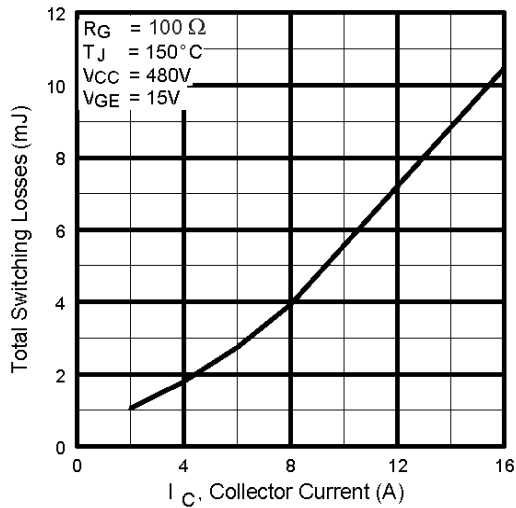


Fig. 11 - Typical Switching Losses vs. Collector Current

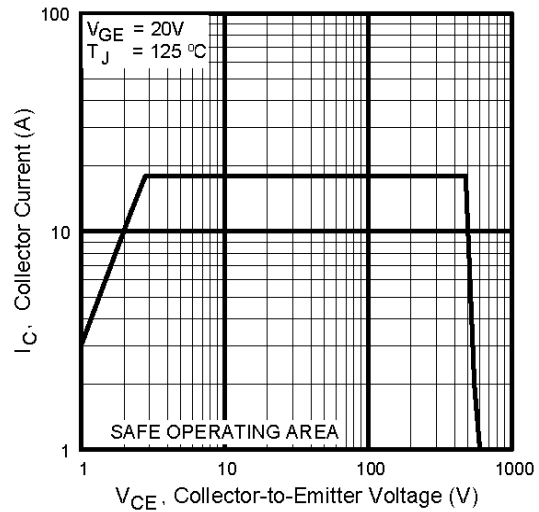
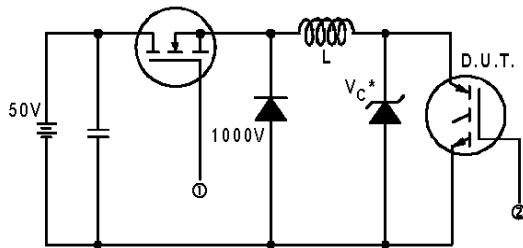


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; $V_C = 80\%$ of $V_{ce(max)}$
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated I_d .

Fig. 13a - Clamped Inductive Load Test Circuit

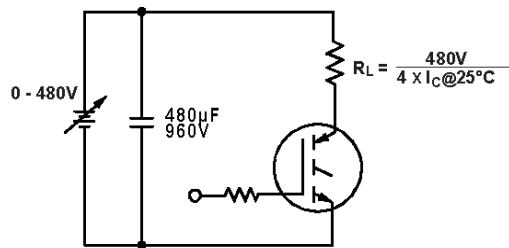


Fig. 13b - Pulsed Collector Current Test Circuit

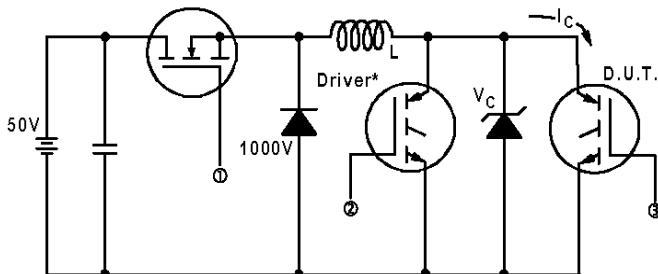


Fig. 14a - Switching Loss Test Circuit

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

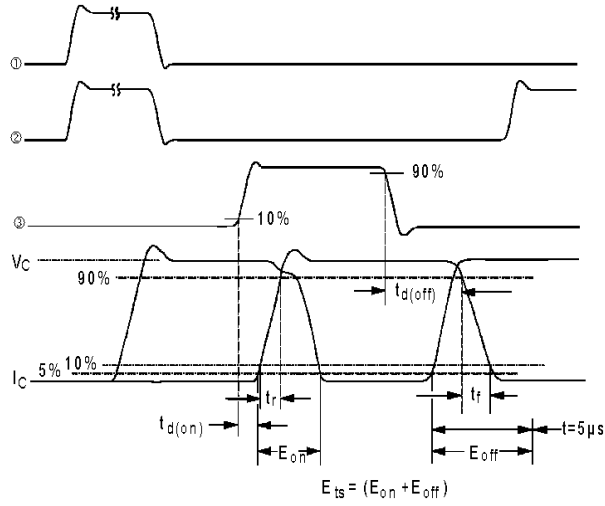


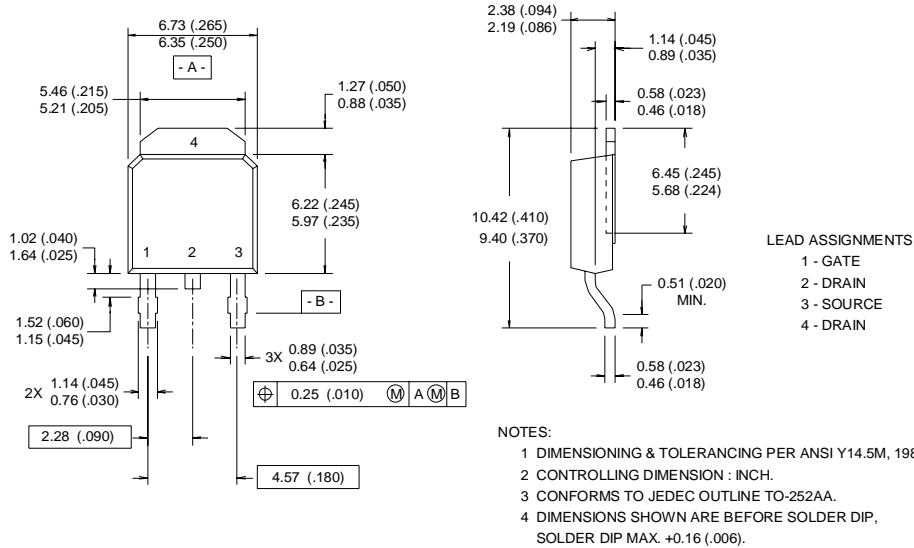
Fig. 14b - Switching Loss Waveforms

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D-Pak (TO-252AA) Package Outline

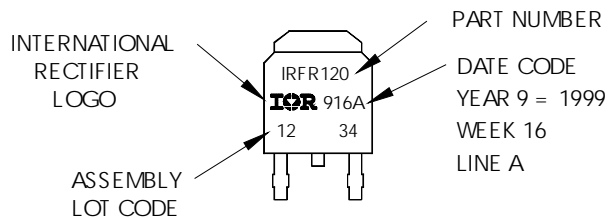
Dimensions are shown in millimeters (inches)



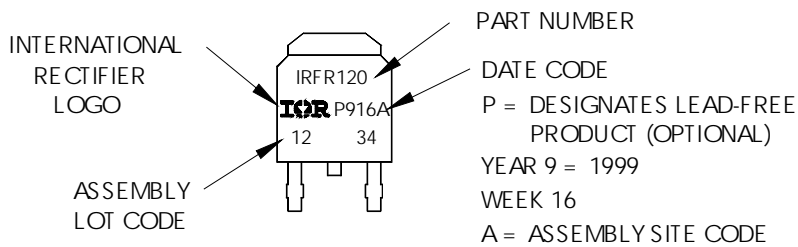
D-Pak (TO-252AA) Part Marking Information

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"

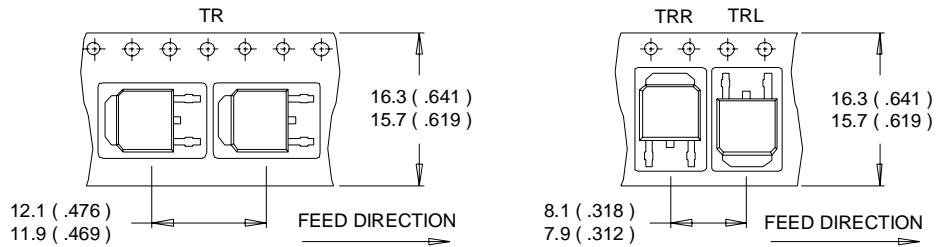


OR



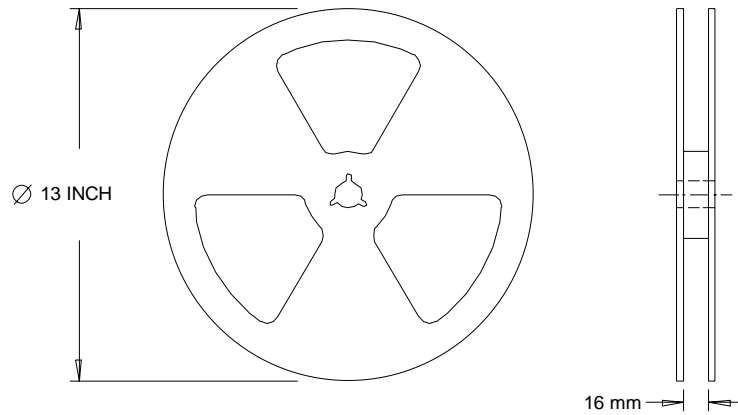
D-Pak (TO-252AA) Tape & Reel Information

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.