

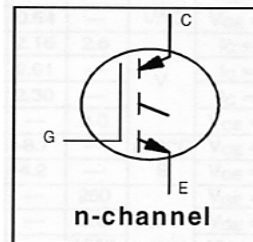
IRG4RC10UPbF

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

Features

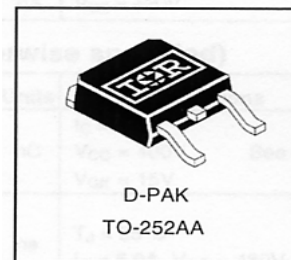
- UltraFast: Optimized for high operating frequencies (8-40 kHz in hard switching, >200 kHz in resonant mode)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than previous generation
- Industry standard TO-252AA package
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 2.15V$
@ $V_{GE} = 15V, I_C = 5.0A$

Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	8.5	A
$I_C @ T_C = 100^\circ C$	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
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	38	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	15	
T_J	Operating Junction and	-55 to +150	$^\circ C$
T_{STG}	Storage Temperature Range		
	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	$^\circ C/W$
$R_{\theta JA}$	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 @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	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	—		$I_C = 5.0A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	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	—	-8.7	—	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
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		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	1000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
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)	—	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	$T_J = 25^\circ\text{C}$ $I_C = 5.0A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 100\Omega$ Energy losses include "tail"
t_r	Rise Time	—	11	—		
$t_{d(off)}$	Turn-Off Delay Time	—	116	240		
t_f	Fall Time	—	81	180	mJ	See Fig. 9, 10, 14
E_{on}	Turn-On Switching Loss	—	0.08	—		
E_{off}	Turn-Off Switching Loss	—	0.16	—		
E_{ts}	Total Switching Loss	—	0.24	0.36	ns	$T_J = 150^\circ\text{C}$, $I_C = 5.0A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 100\Omega$ Energy losses include "tail"
$t_{d(on)}$	Turn-On Delay Time	—	18	—		
t_r	Rise Time	—	14	—		
$t_{d(off)}$	Turn-Off Delay Time	—	180	—	mJ	See Fig. 11, 14
t_f	Fall Time	—	150	—		
E_{ts}	Total Switching Loss	—	0.36	—		
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	270	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 7 $f = 1.0MHz$
C_{oes}	Output Capacitance	—	21	—		
C_{res}	Reverse Transfer Capacitance	—	3.5	—		

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 100\Omega$, (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.

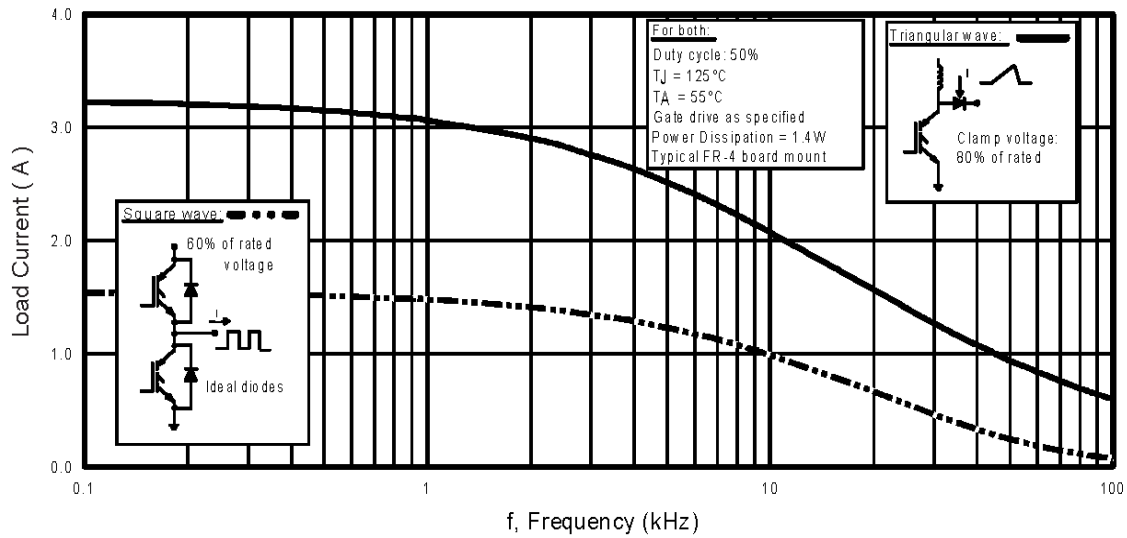


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

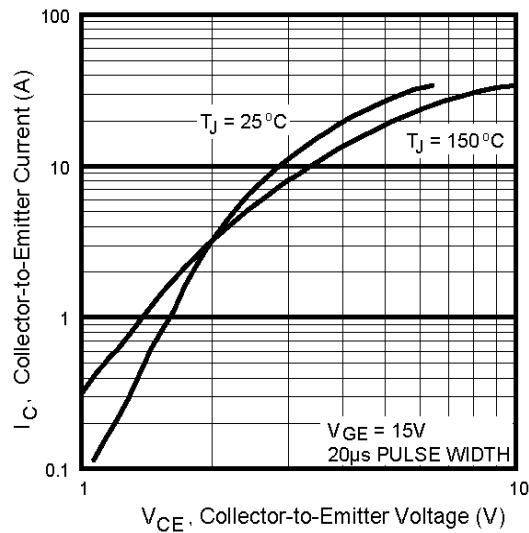


Fig. 2 - Typical Output Characteristics

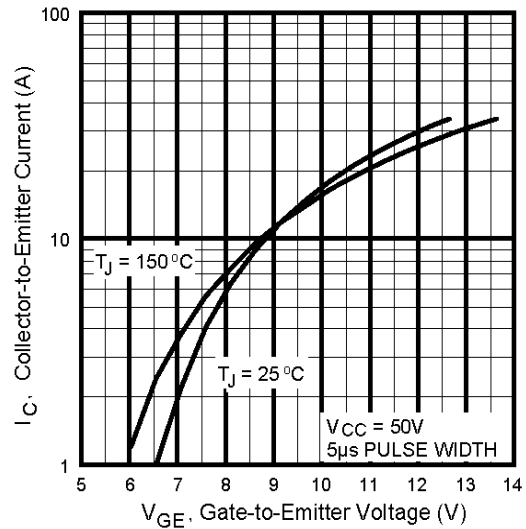


Fig. 3 - Typical Transfer Characteristics

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International
IR Rectifier

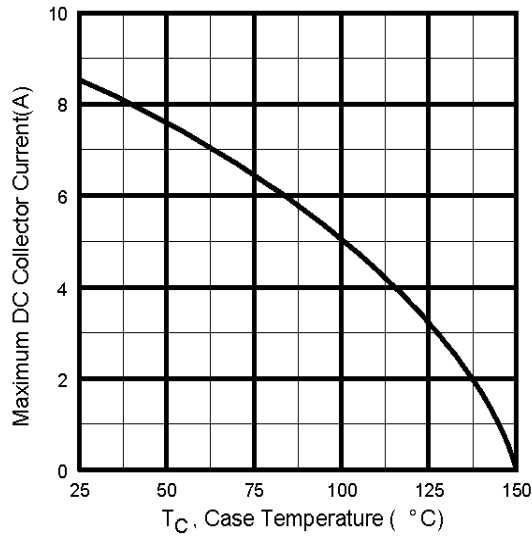


Fig. 4 - Maximum Collector Current vs. Case Temperature

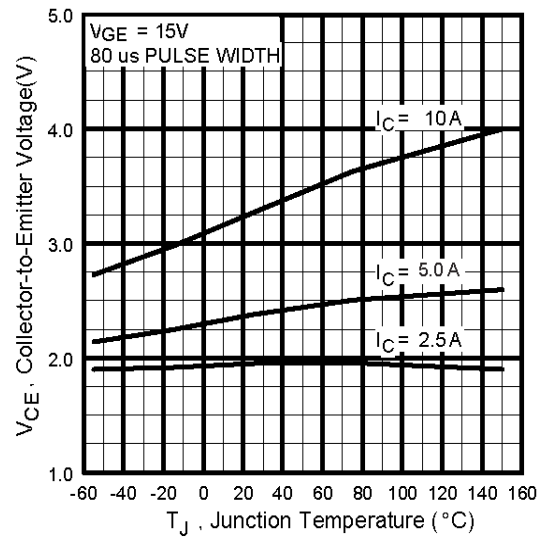


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

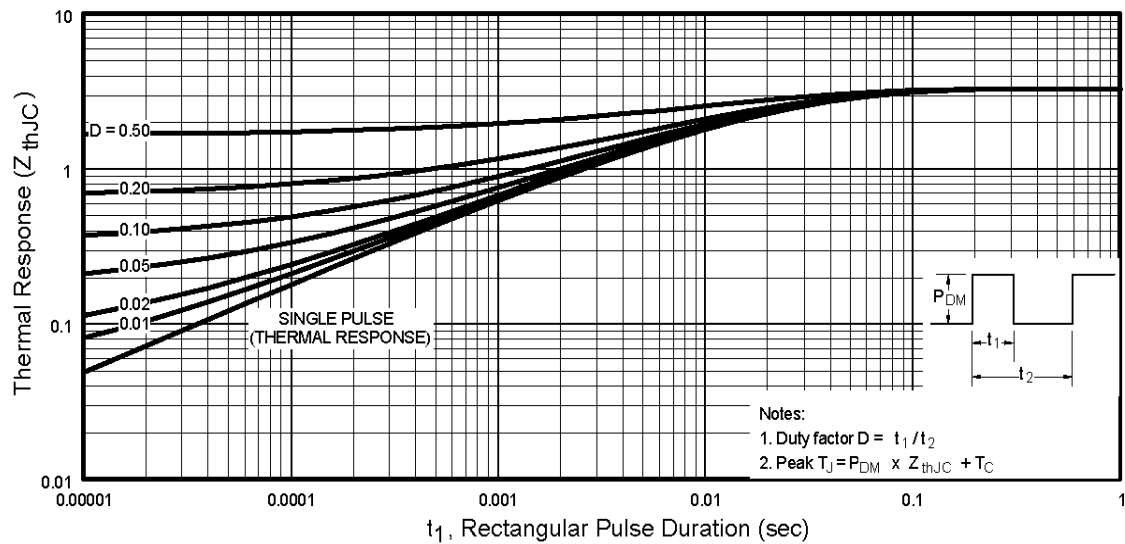


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

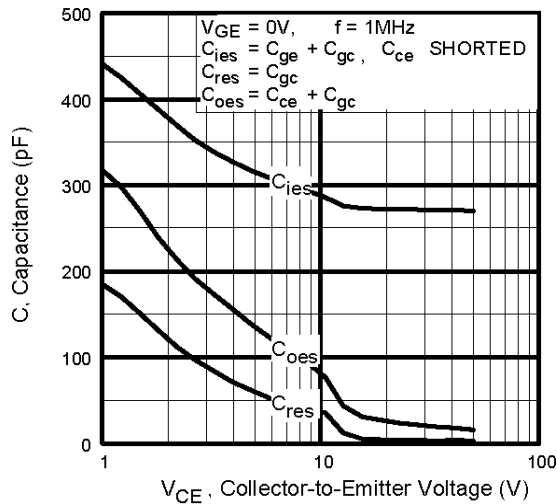


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

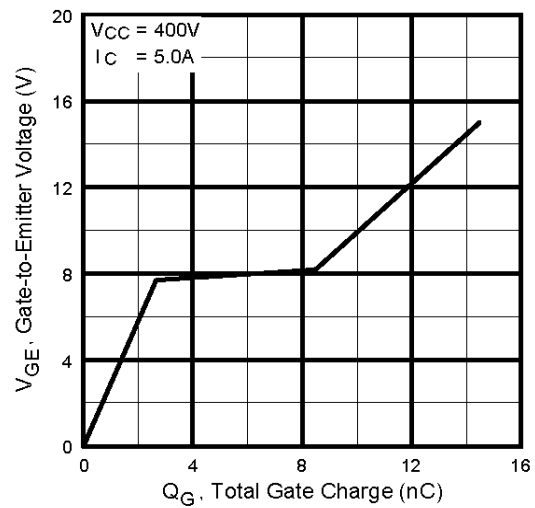


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

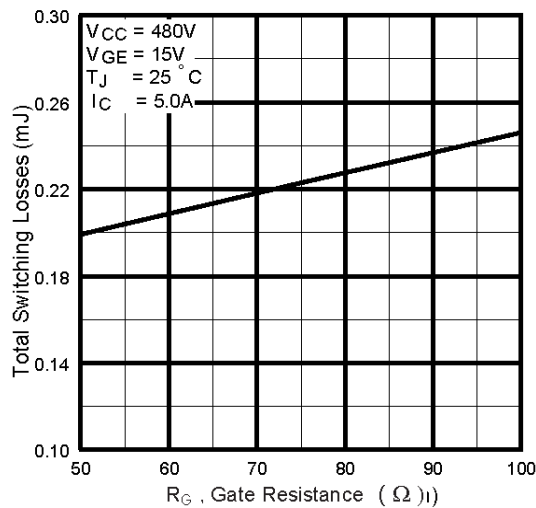


Fig. 9 - Typical Switching Losses vs. Gate Resistance

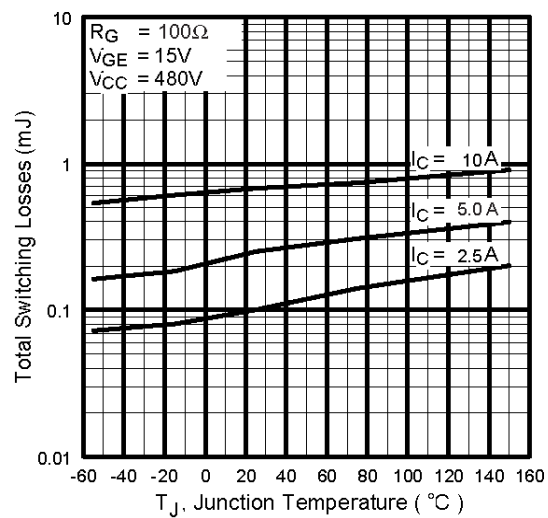


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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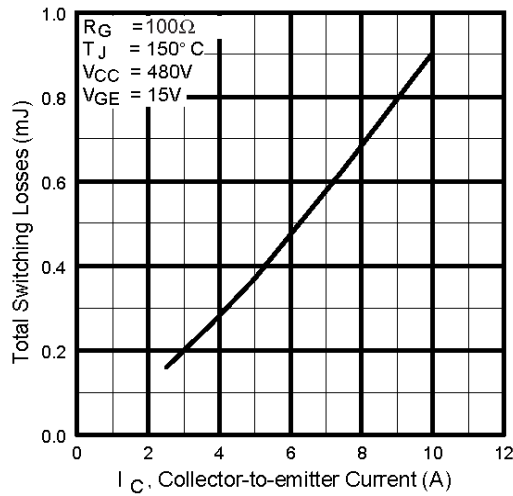


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

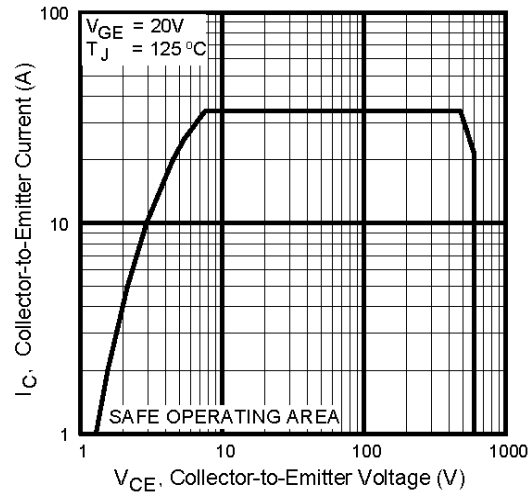


Fig. 12 - Turn-Off SOA

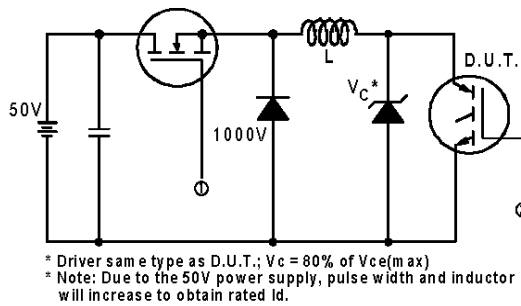


Fig. 13a - Clamped Inductive Load Test Circuit

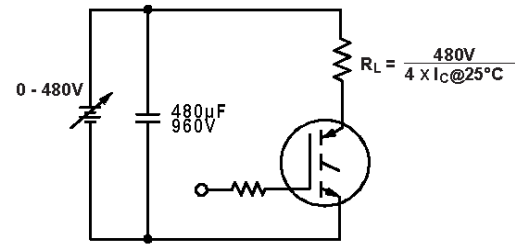


Fig. 13b - Pulsed Collector Current Test Circuit

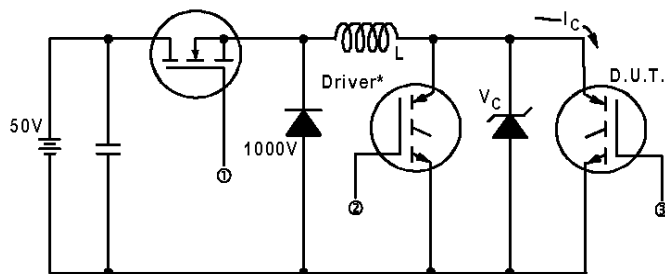


Fig. 14a - Switching Loss Test Circuit

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

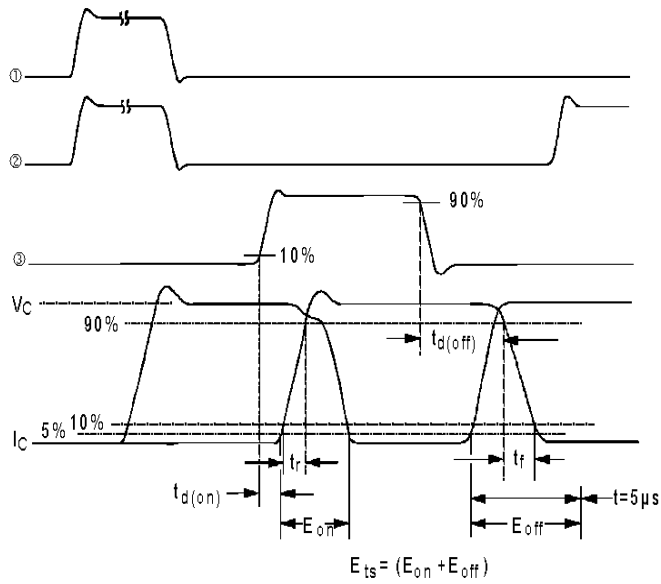


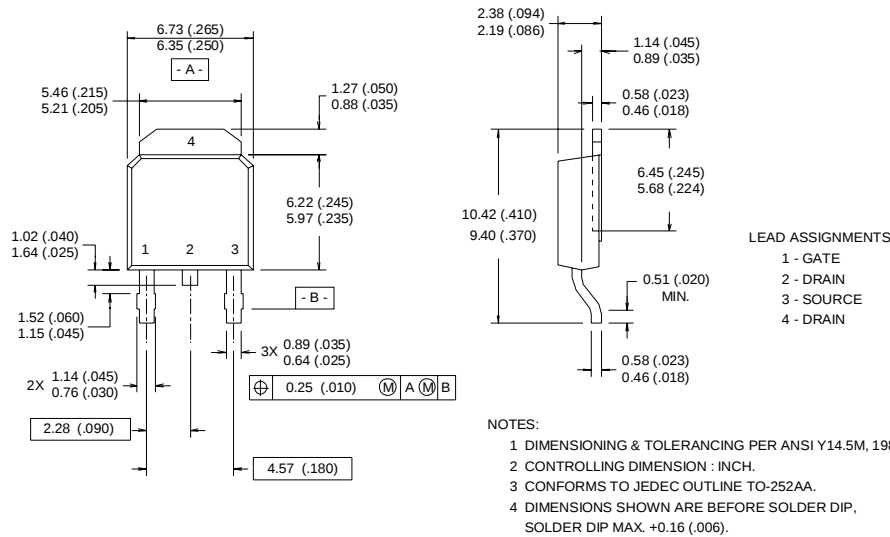
Fig. 14b - Switching Loss
Waveforms

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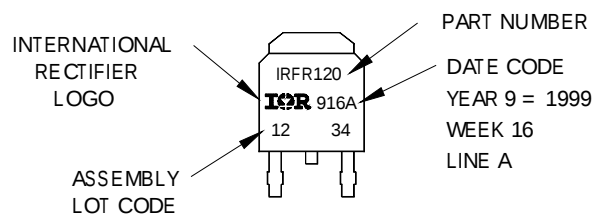
D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)

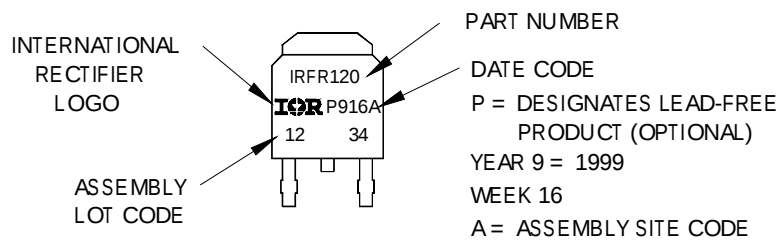


D-Pak (TO-252AA) Part Marking Information

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"

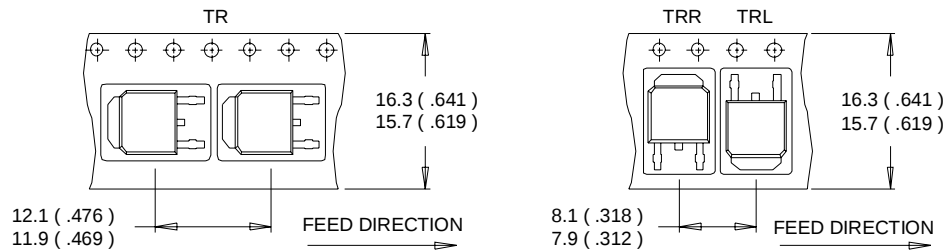


OR



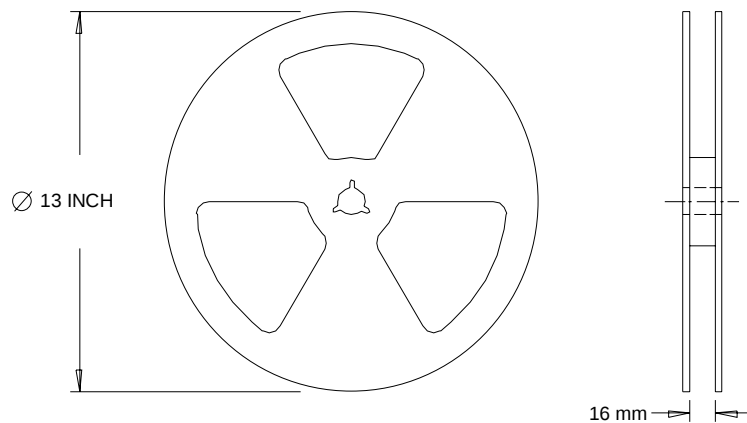
D-Pak (TO-252AA) Tape & Reel Information

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.

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