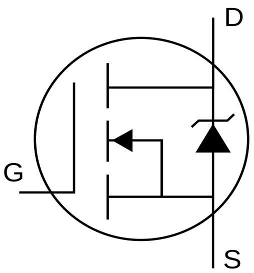
PD - 9.1642A

International Rectifier

IRFR/U3303

HEXFET® Power MOSFET

- Ultra Low On-Resistance
- Surface Mount (IRFR3303)
- Straight Lead (IRFU3033)
- Advanced Process Technology
- Fast Switching
- Fully Avalanche Rated



V_{DSS} = 30V

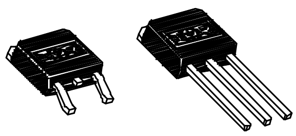
$R_{DS(on)}$ = 0.031Ω

I_D = 33A⑤

Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The D-Pak is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 watts are possible in typical surface mount applications.



D-Pak TO-252AA   I-Pak TO-251AA

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	33⑤	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	21⑤	
I_{DM}	Pulsed Drain Current ①	120	
P_D @T_C = 25°C	Power Dissipation	57	W
	Linear Derating Factor	0.45	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	95	mJ
I_{AR}	Avalanche Current①	18	A
E_{AR}	Repetitive Avalanche Energy①	5.7	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	2.2	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)**	——	50	
$R_{\theta JA}$	Junction-to-Ambient	——	110	

8/25/97

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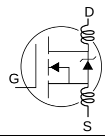
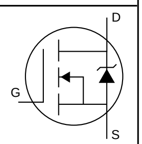
Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.032	——	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.031	Ω	V_{GS} = 10V, I_D = 18A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	——	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	9.3	——	——	S	V_{DS} = 25V, I_D = 18A
I_{DSS}	Drain-to-Source Leakage Current	——	——	25	µA	V_{DS} = 30V, V_{GS} = 0V
		——	——	250		V_{DS} = 24V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -20V
Q_g	Total Gate Charge	——	——	29	nC	I_D = 18A
Q_{gs}	Gate-to-Source Charge	——	——	7.3		V_{DS} = 24V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	13		V_{GS} = 10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	——	11	——	ns	V_{DD} = 15V
t_r	Rise Time	——	99	——		I_D = 18A
$t_{d(off)}$	Turn-Off Delay Time	——	16	——		R_G = 13Ω
t_f	Fall Time	——	28	——		R_D = 0.8Ω, See Fig. 10 ④
L_D	Internal Drain Inductance	——	4.5	——	nH	Between lead, 6mm (0.25in.) from package and center of die contact⑥ 
L_S	Internal Source Inductance	——	7.5	——		
C_{iss}	Input Capacitance	——	750	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	400	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	140	——		f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	33⑤	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	120		
V_{SD}	Diode Forward Voltage	——	——	1.3	V	T_J = 25°C, I_S = 18A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	53	80	ns	T_J = 25°C, I_F = 18A
Q_{rr}	Reverse RecoveryCharge	——	94	140	nC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② Starting T_J = 25°C, L = 590µH R_G = 25Ω, I_{AS} = 18A. (See Figure 12)

③ $I_{SD} \le$ 18A, di/dt $\le$ 140A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 150°C

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ Caculated continuous current based on maximum allowable junction temperature; Package limitation current = 20A.

⑥ This is applied for I-PAK, L_S of D-PAK is measured between lead and center of die contact

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

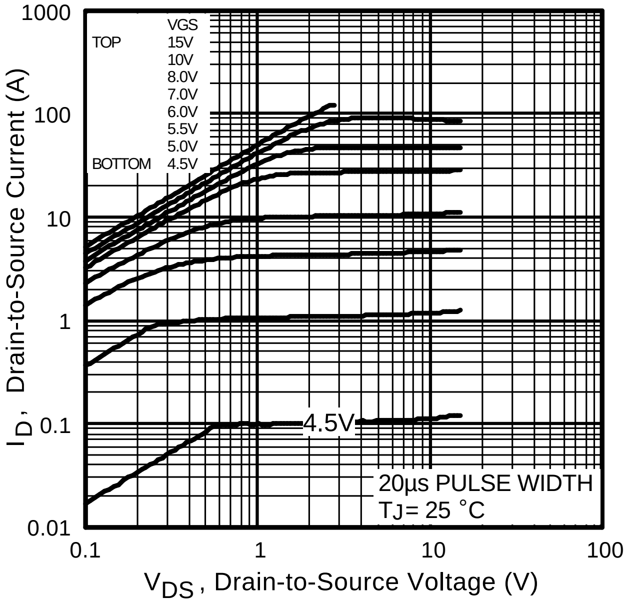


Fig 1. Typical Output Characteristics

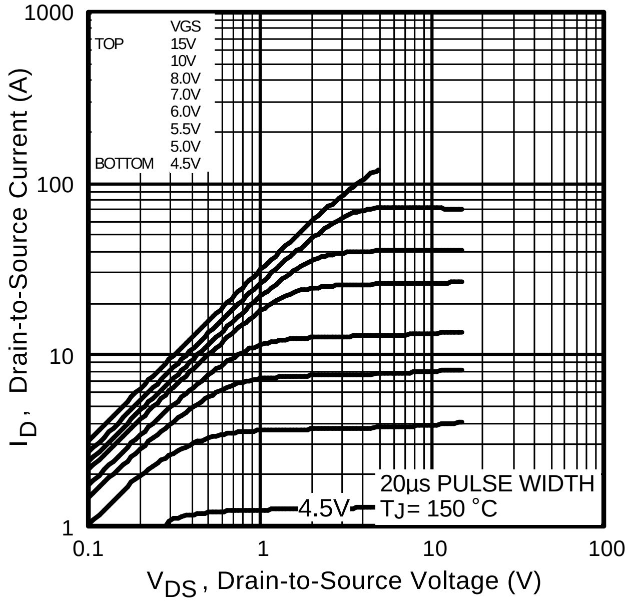


Fig 2. Typical Output Characteristics

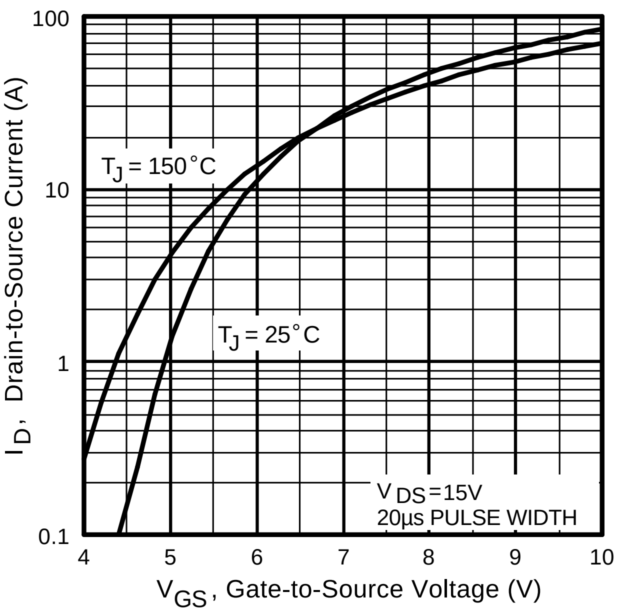


Fig 3. Typical Transfer Characteristics

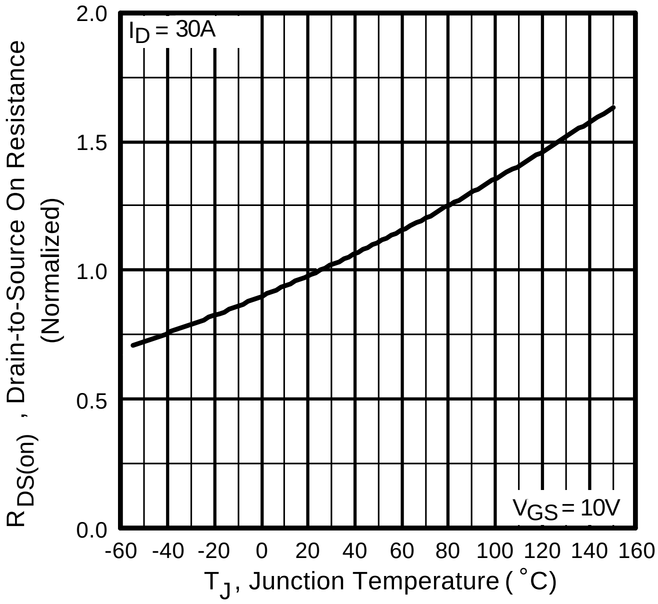


Fig 4. Normalized On-Resistance
Vs. Temperature

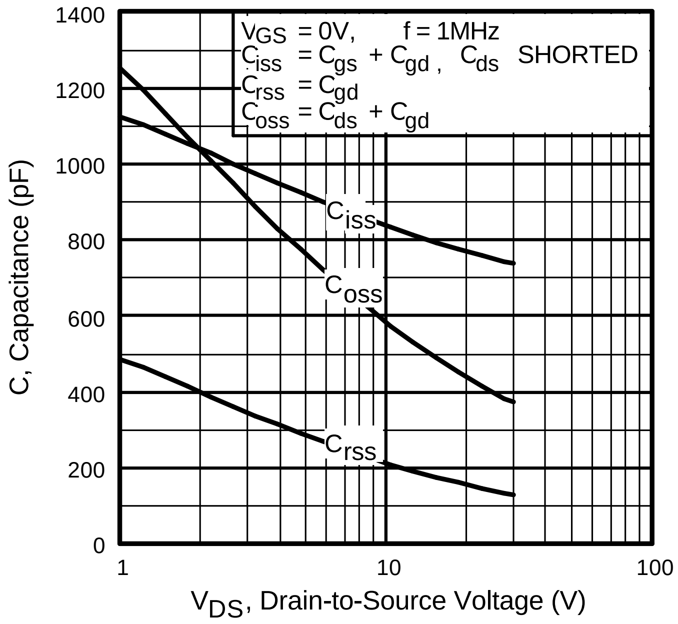


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

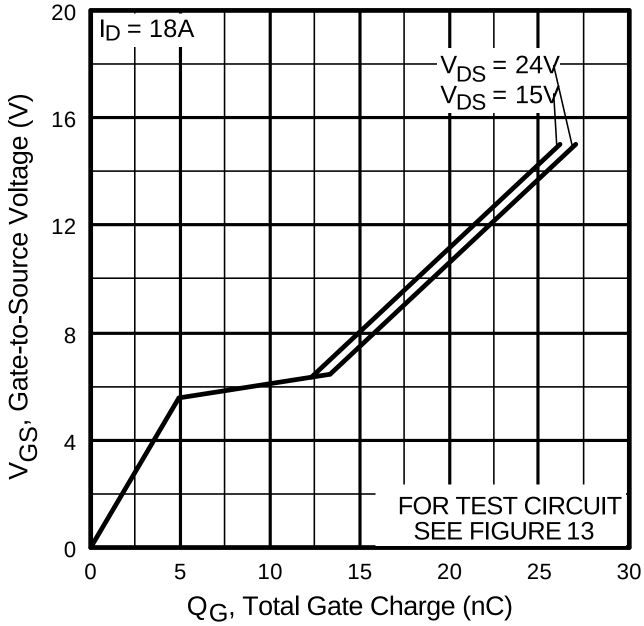


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

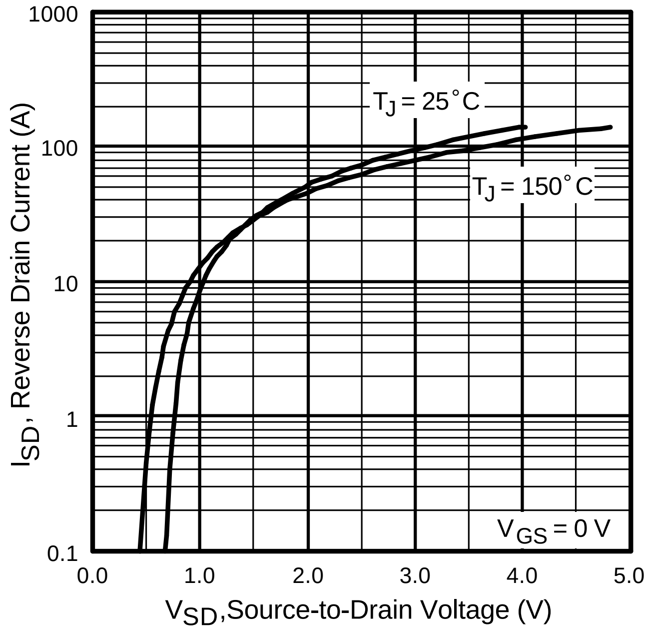


Fig 7. Typical Source-Drain Diode Forward Voltage

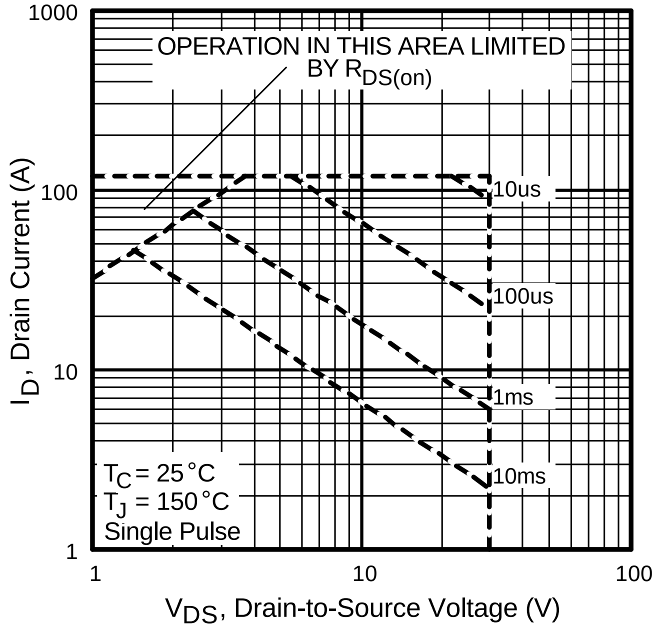


Fig 8. Maximum Safe Operating Area

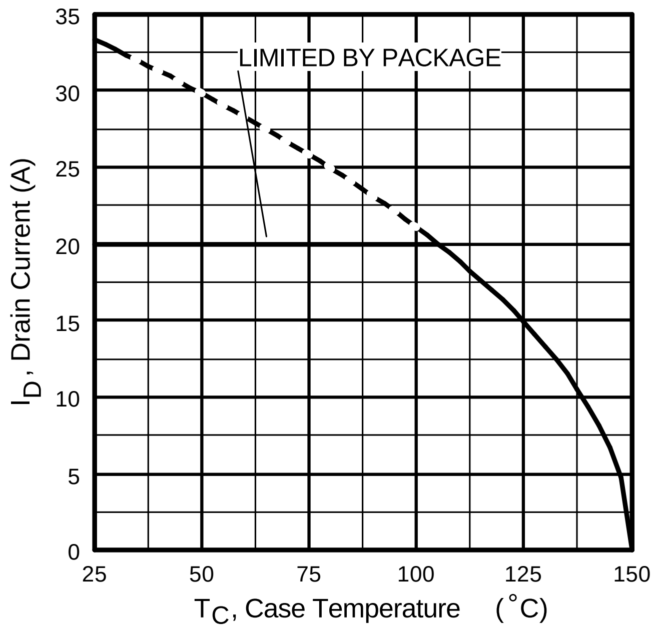


Fig 9. Maximum Drain Current Vs. Case Temperature

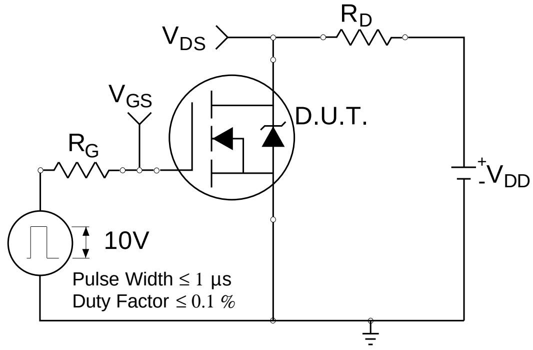


Fig 10a. Switching Time Test Circuit

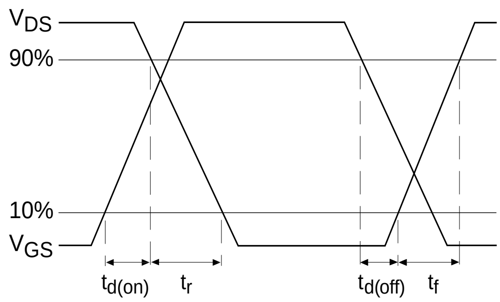


Fig 10b. Switching Time Waveforms

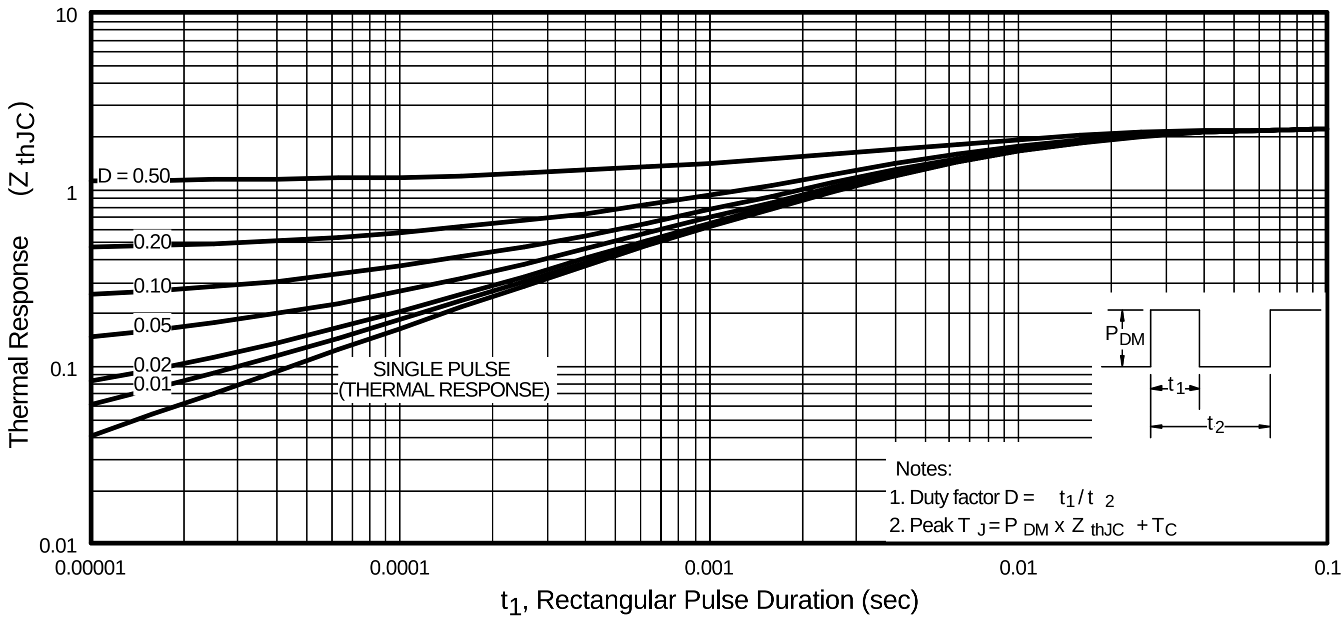


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

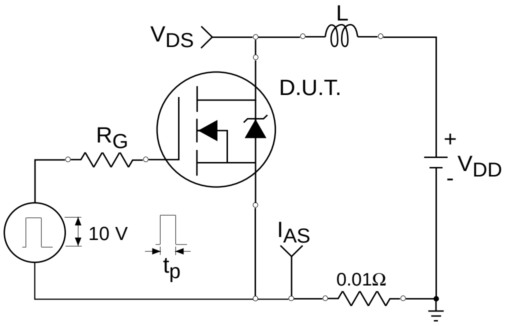


Fig 12a. Unclamped Inductive Test Circuit

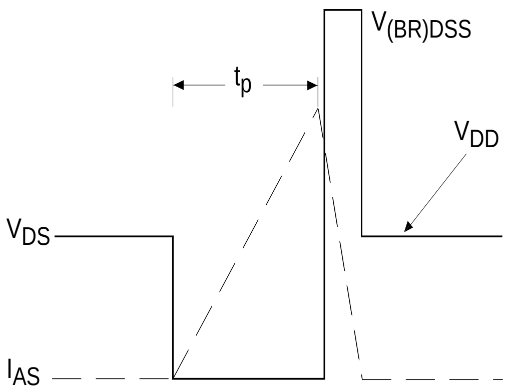


Fig 12b. Unclamped Inductive Waveforms

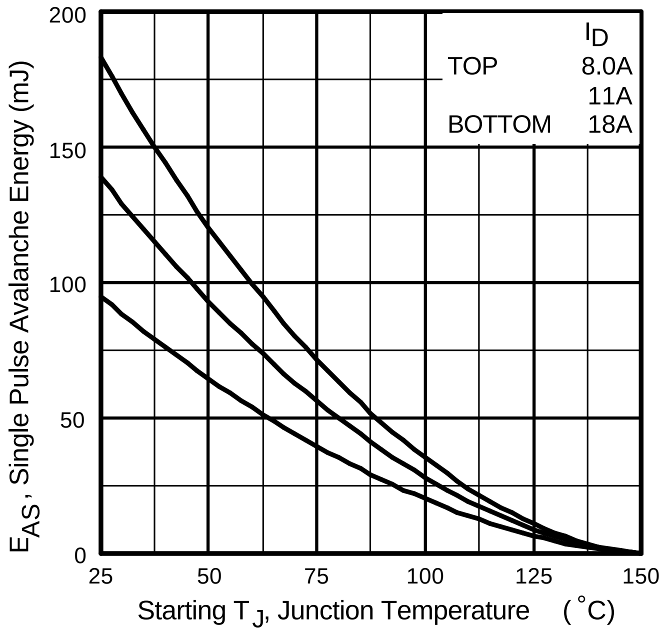


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

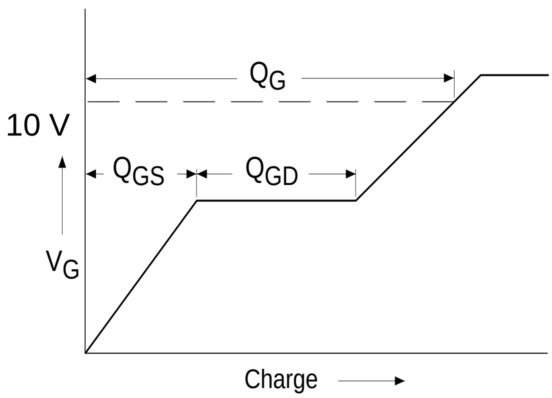


Fig 13a. Basic Gate Charge Waveform

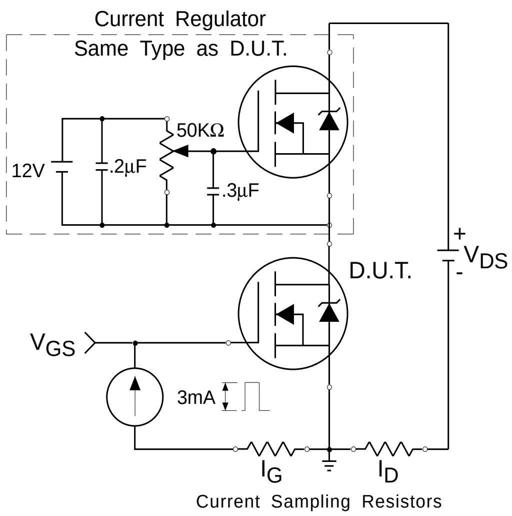
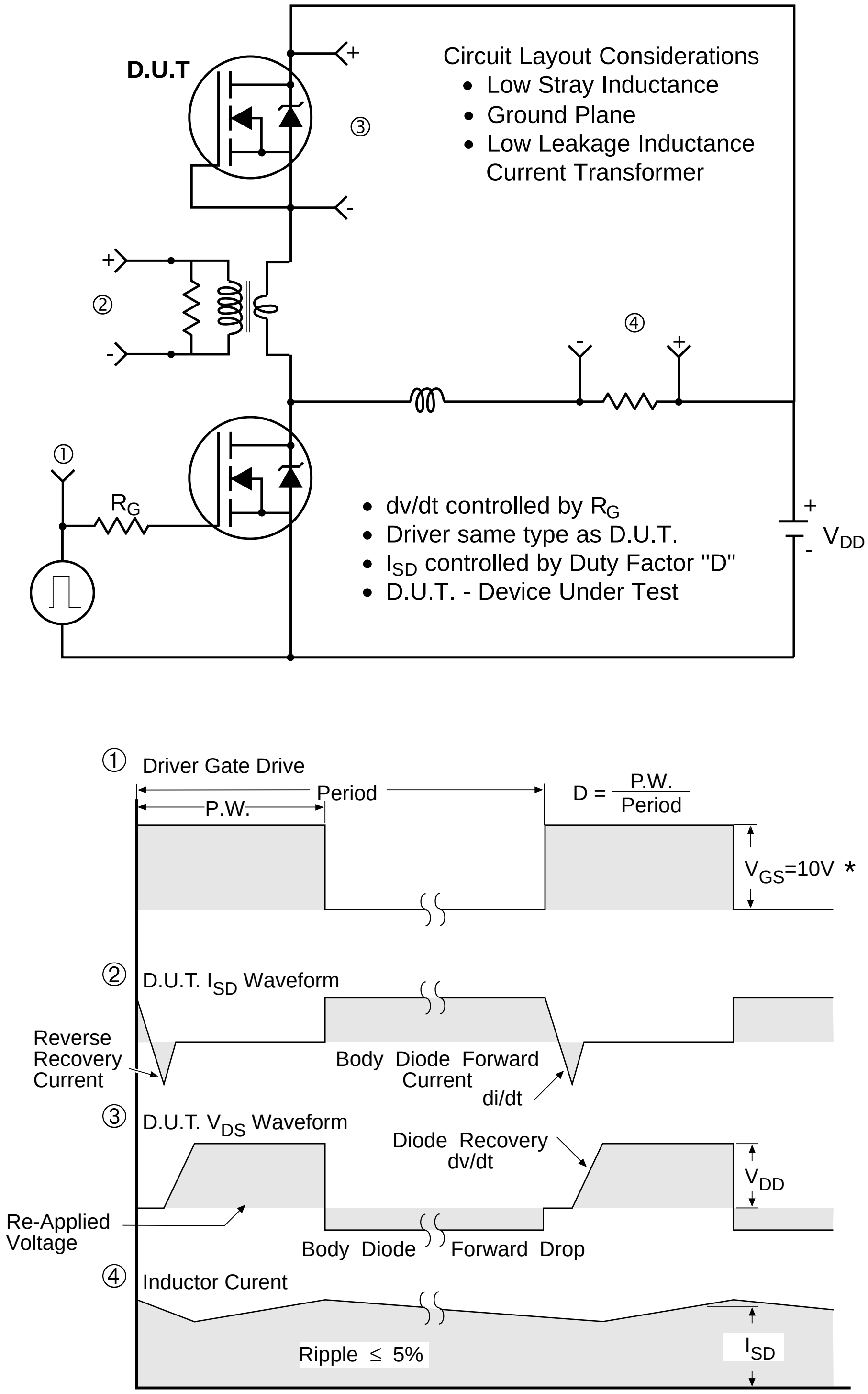


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

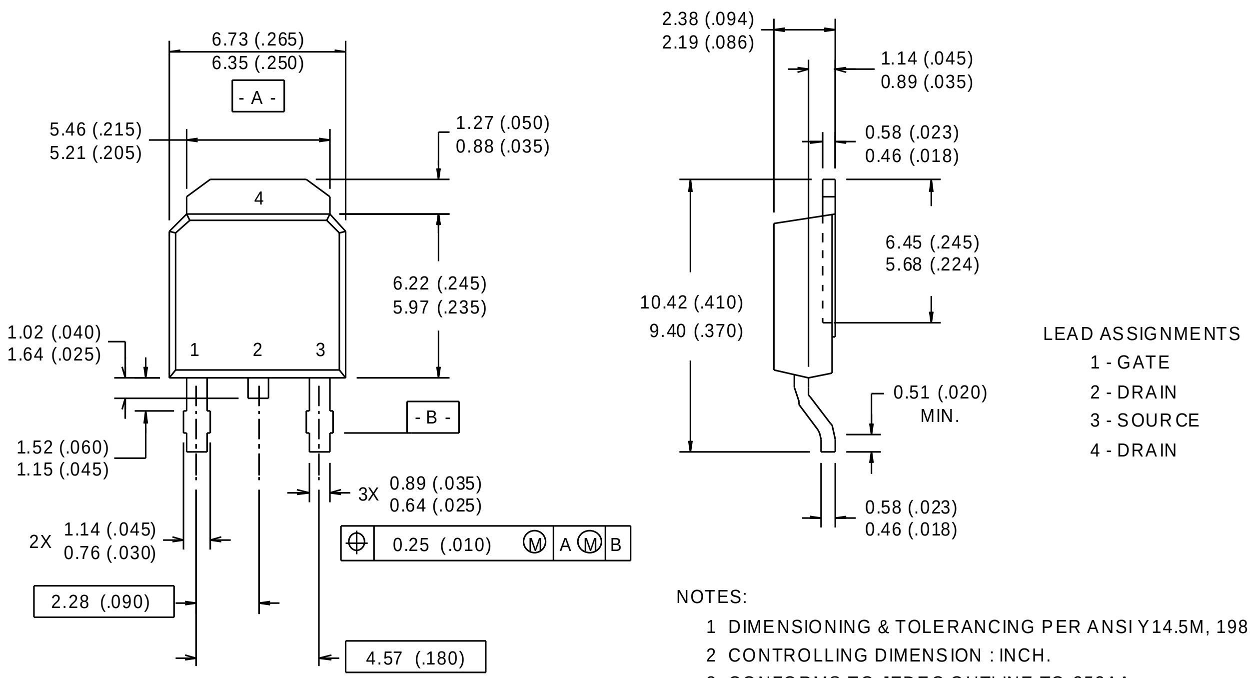


* V_{GS} = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFETS

Package Outline

TO-252AA Outline
Dimensions are shown in millimeters (inches)

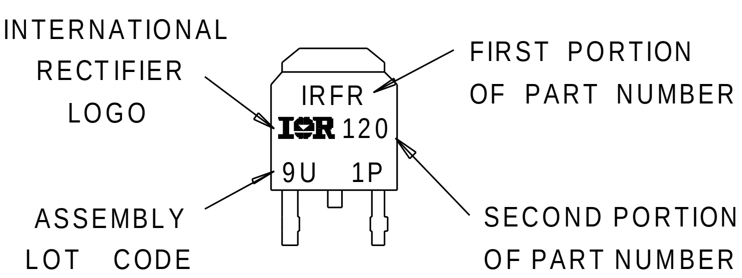


NOTES:
1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 CONFORMS TO JEDEC OUTLINE TO-252AA.
4 DIMENSIONS SHOWN ARE BEFORE SOLDER DIP, SOLDER DIP MAX. +0.16 (.006).

Part Marking Information

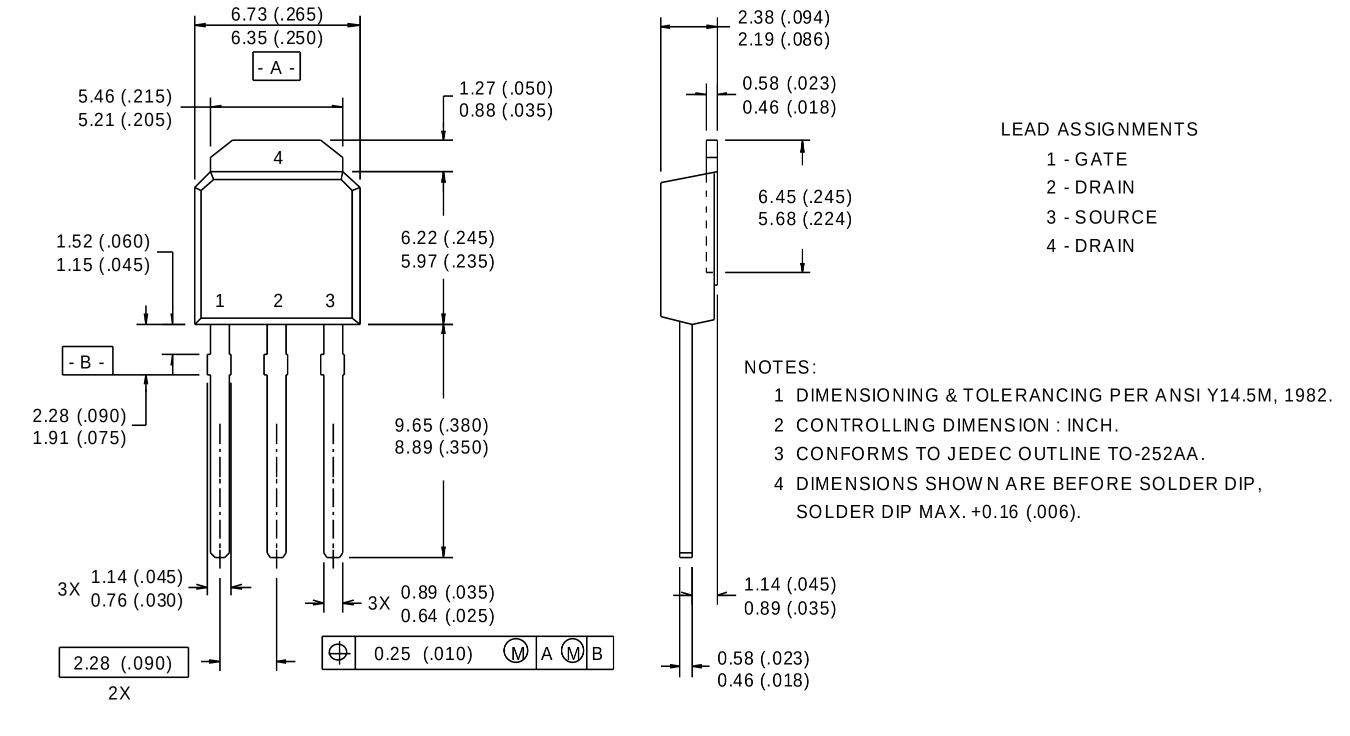
TO-252AA (D-Pak)

EXAMPLE : THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 9U1P



Package Outline

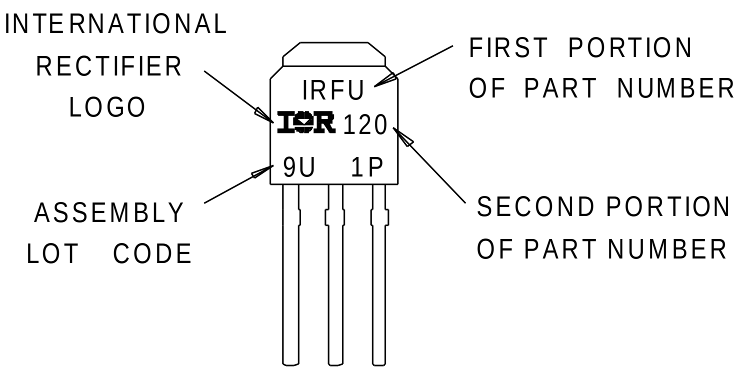
TO-251AA Outline
Dimensions are shown in millimeters (inches)



Part Marking Information

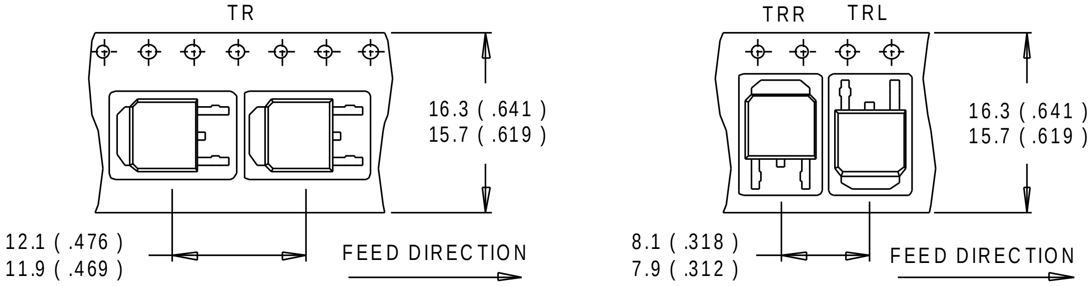
TO-251AA (I-Pak)

EXAMPLE : THIS IS AN IRFU120 WITH ASSEMBLY LOT CODE 9U1P

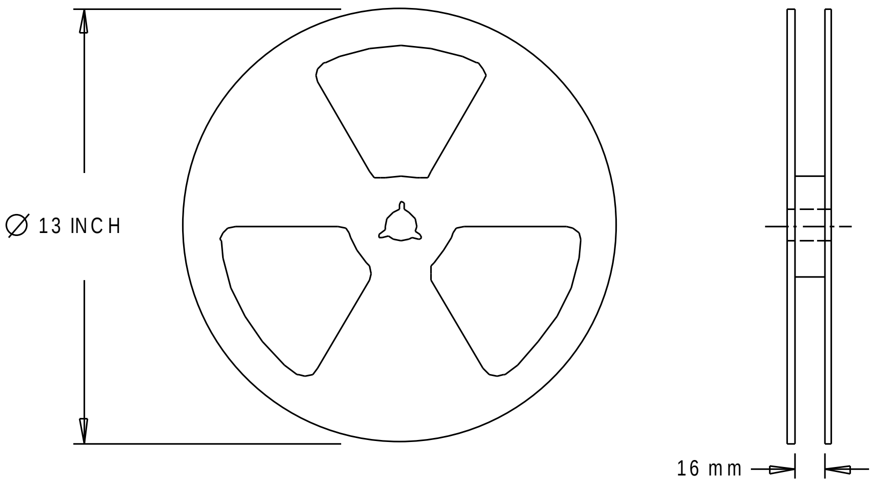


Tape & Reel Information

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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IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 0316 Tel: 65 221 8371

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