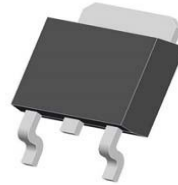


- Surface Mount (IRFR2405)
- Straight Lead (IRFU2405)
- Advanced Process Technology
- Dynamic dv/dt Rating
- Fast Switching
- Fully Avalanche Rated

D-Pak
IRFR2405

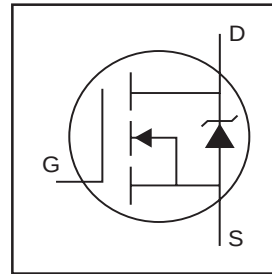


I-Pak
IRFU2405



Description

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.



$$V_{DS} = 55V$$

$$R_{DS(on)} = 0.016\Omega$$

$$I_D = 56A^{\circ}$$

Absolute Maximum Ratings

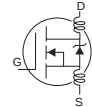
	Parameter	Max.	Units
I_D @ $T_C = 25^{\circ}C$	Continuous Drain Current, V_{GS} @ 10V	56 [Ⓐ]	A
I_D @ $T_C = 100^{\circ}C$	Continuous Drain Current, V_{GS} @ 10V	40 [Ⓐ]	
I_{DM}	Pulsed Drain Current ^①	220	
P_D @ $T_C = 25^{\circ}C$	Power Dissipation	110	W
	Linear Derating Factor	0.71	W/ $^{\circ}C$
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ^②	130	mJ
I_{AR}	Avalanche Current ^①	34	A
E_{AR}	Repetitive Avalanche Energy ^①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ^③	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	$^{\circ}C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.4	$^{\circ}C/W$
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)*	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.052	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.0118	0.016	Ω	$V_{GS} = 10V, I_D = 34A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g_{fs}	Forward Transconductance	30	—	—	S	$V_{DS} = 25V, I_D = 34A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	70	110	nC	$I_D = 34A$
Q_{gs}	Gate-to-Source Charge	—	16	23		$V_{DS} = 44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	19	29		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	15	—	ns	$V_{DD} = 28V$
t_r	Rise Time	—	130	—		$I_D = 34A$
$t_{d(off)}$	Turn-Off Delay Time	—	55	—		$R_G = 6.8\Omega$
t_f	Fall Time	—	78	—		$V_{GS} = 10V$ ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	2430	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	470	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	100	—		$f = 1.0MHz$, See Fig. 5
C_{oss}	Output Capacitance	—	2040	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	350	—		$V_{GS} = 0V, V_{DS} = 44V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance ⑤	—	350	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 44V$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	56	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	220		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 34A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	62	93	ns	$T_J = 25^\circ\text{C}, I_F = 34A$
Q_{rr}	Reverse Recovery Charge	—	170	260	nC	$di/dt = 100A/\mu s$ 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.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.22mH$
 $R_G = 25\Omega$, $I_{AS} = 34A$.
- ③ $I_{SD} \leq 34A$, $di/dt \leq 190A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- ⑤ $C_{oss \text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A

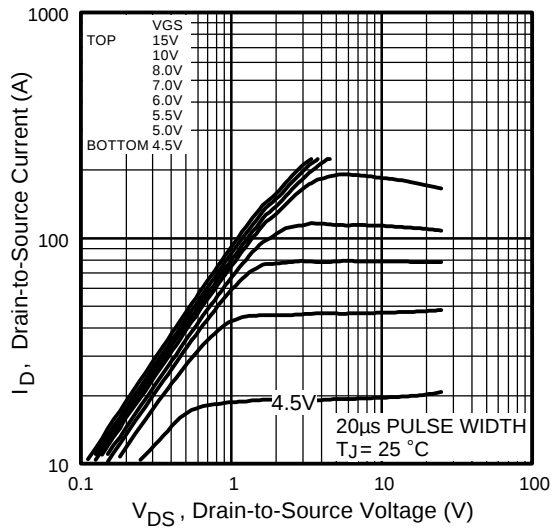


Fig 1. Typical Output Characteristics

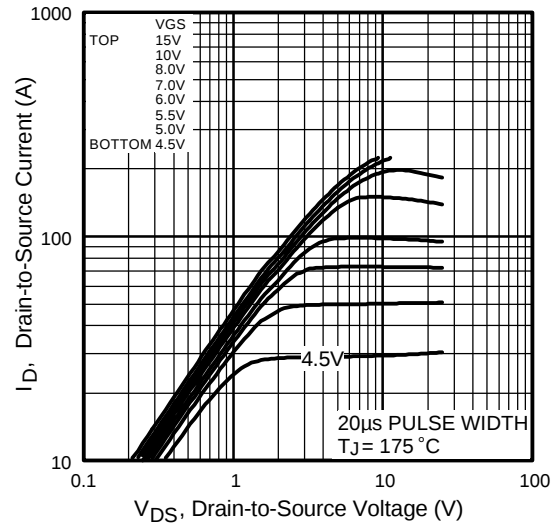


Fig 2. Typical Output Characteristics

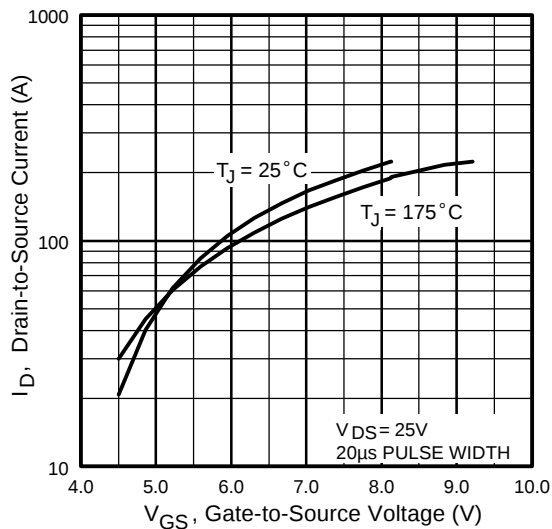


Fig 3. Typical Transfer Characteristics

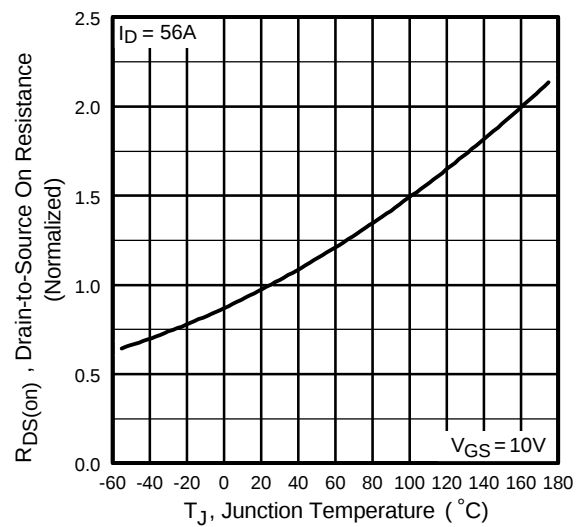


Fig 4. Normalized On-Resistance Vs. Temperature

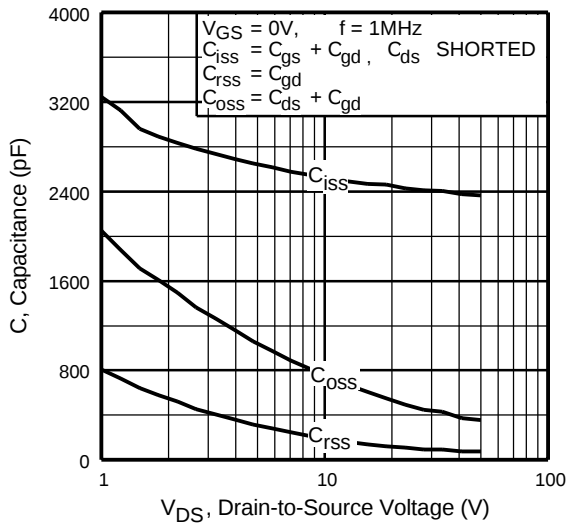


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

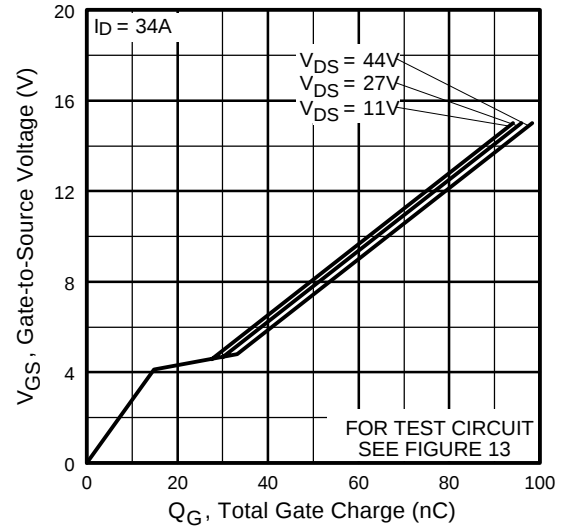


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

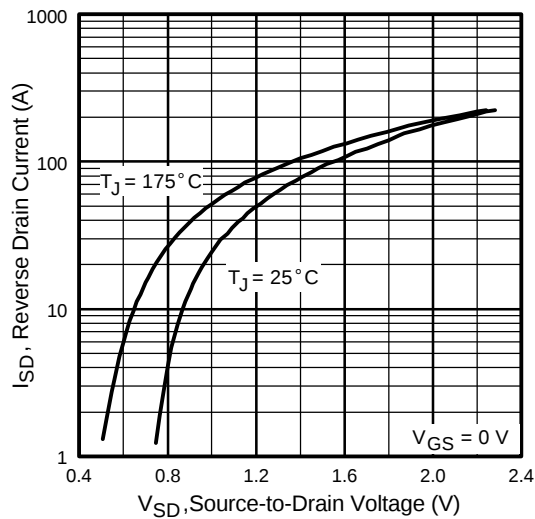


Fig 7. Typical Source-Drain Diode Forward Voltage

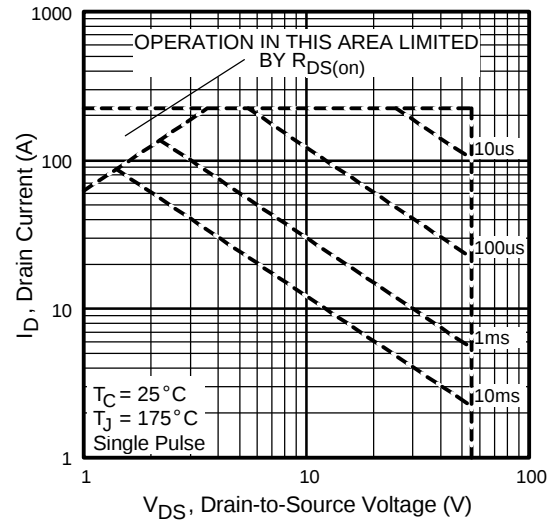


Fig 8. Maximum Safe Operating Area

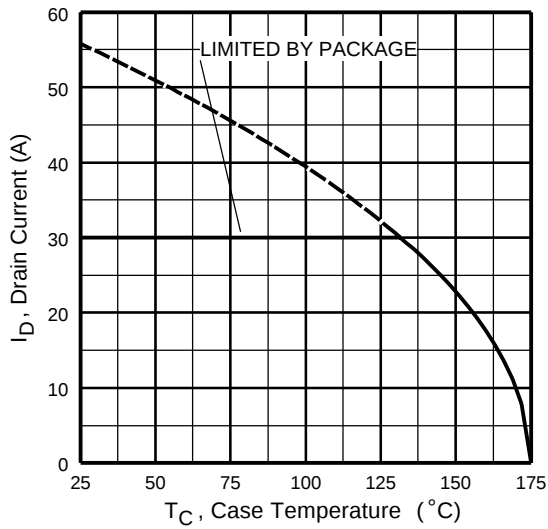


Fig 9. Maximum Drain Current Vs. Case Temperature



Fig 10a. Switching Time Test Circuit

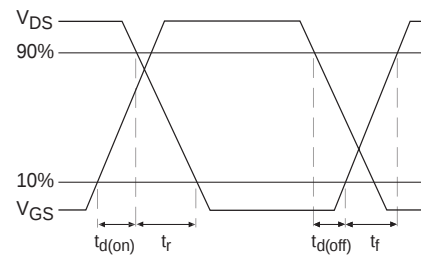


Fig 10b. Switching Time Waveforms

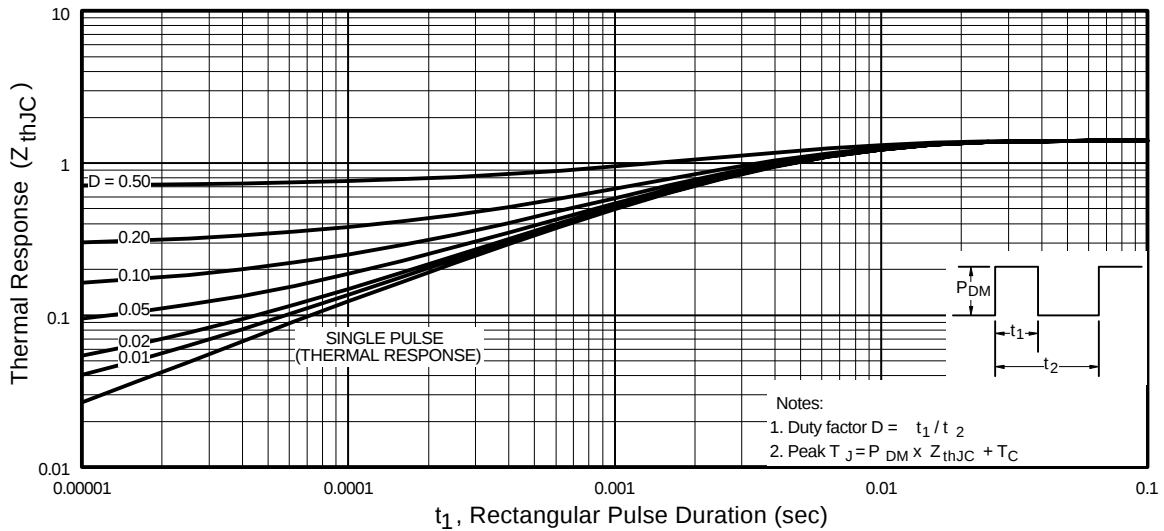


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

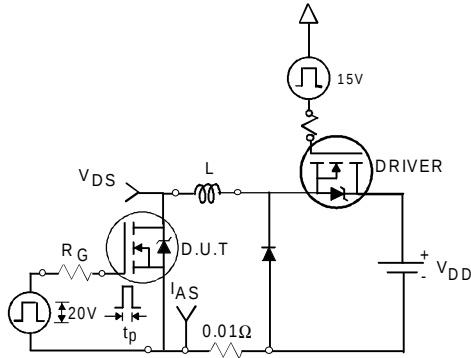


Fig 12a. Unclamped Inductive Test Circuit

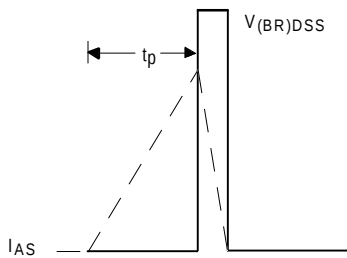


Fig 12b. Unclamped Inductive Waveforms

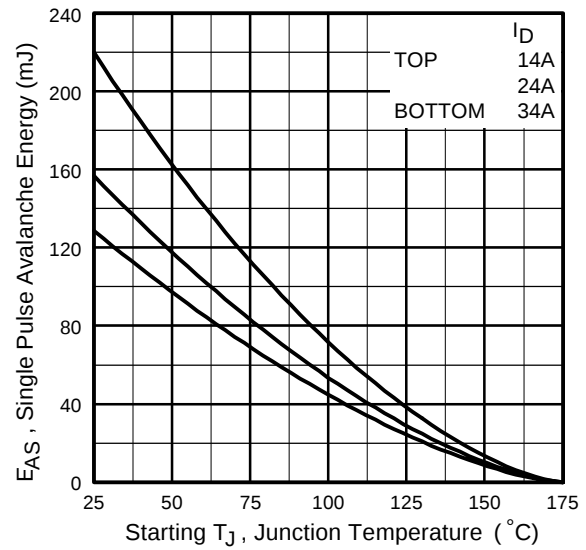


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

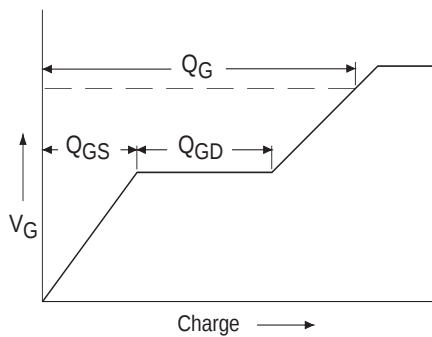


Fig 13a. Basic Gate Charge Waveform

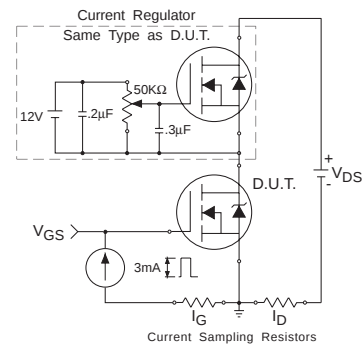
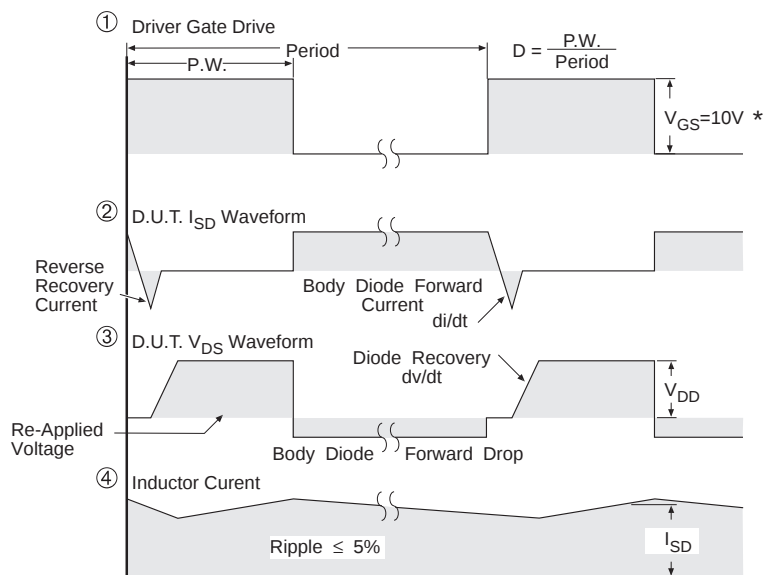
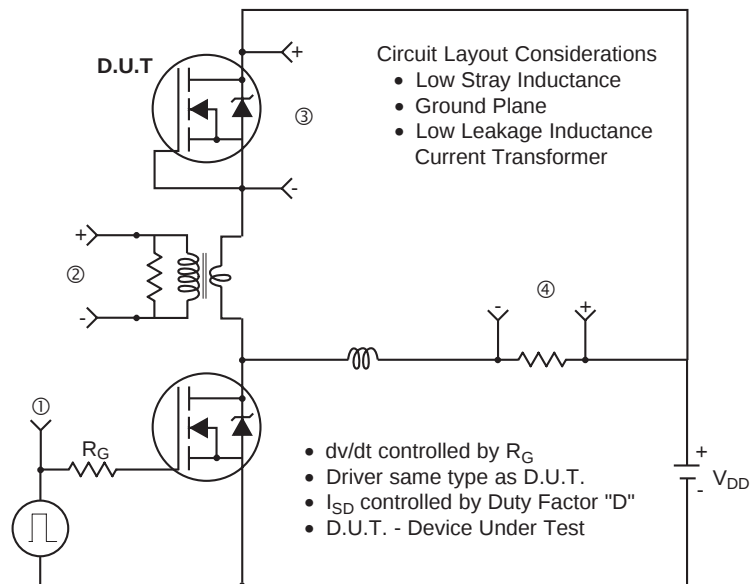


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

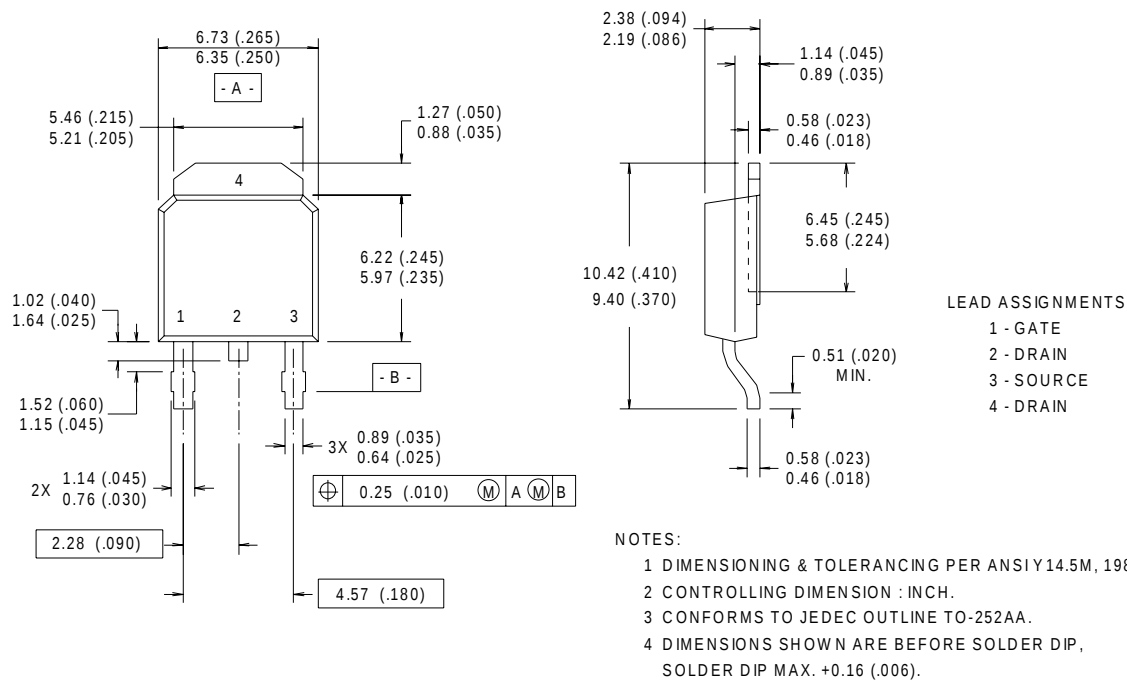


* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFET[®] Power MOSFETs

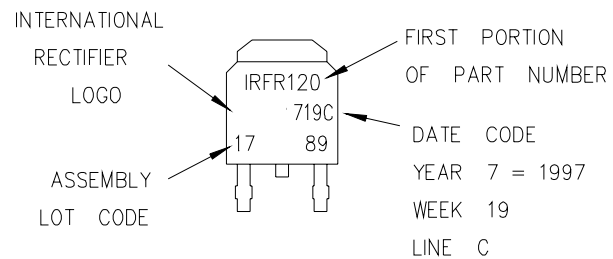
D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



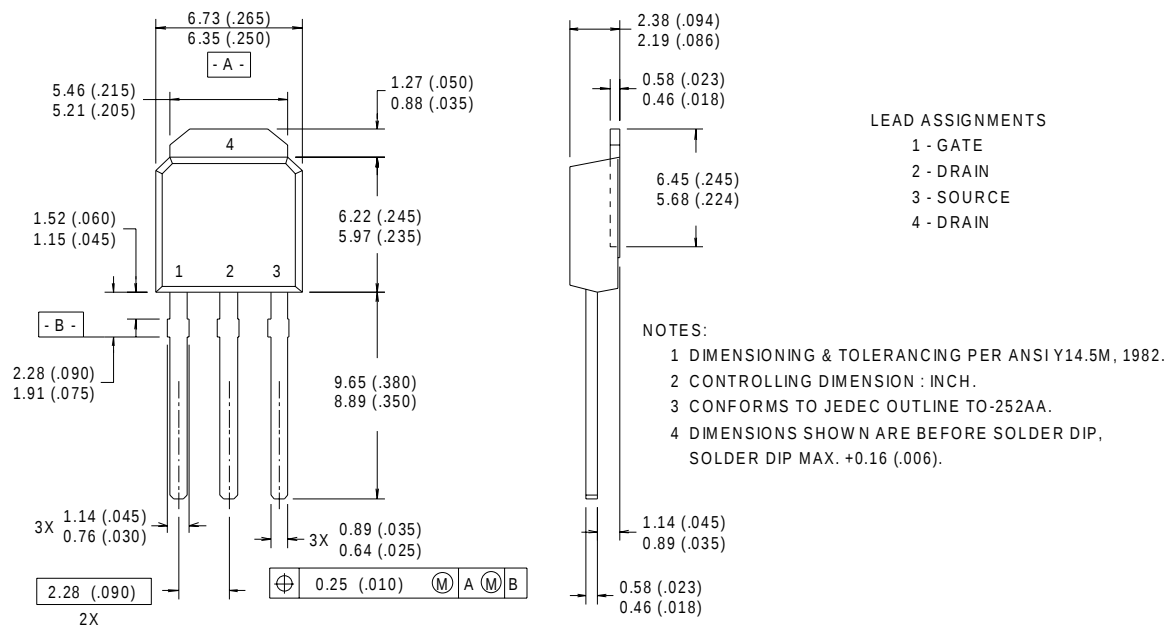
D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"

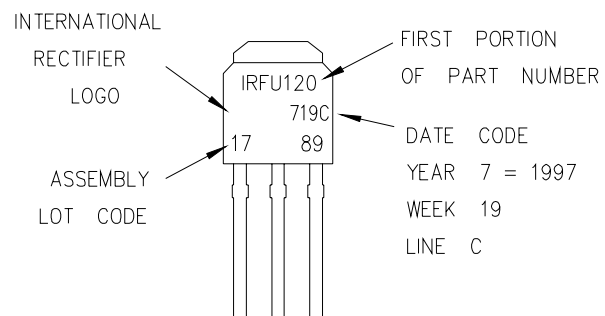




Dimensions are shown in millimeters (inches)

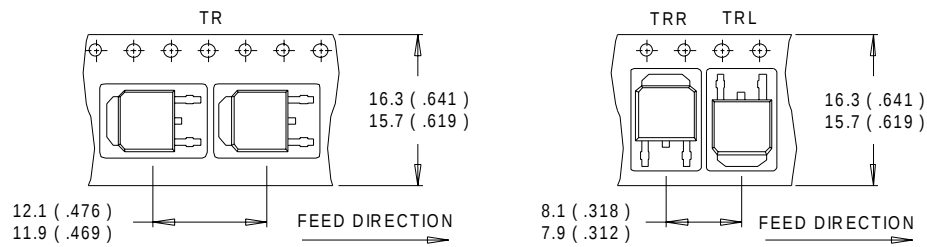


EXAMPLE: THIS IS AN IRFU120
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



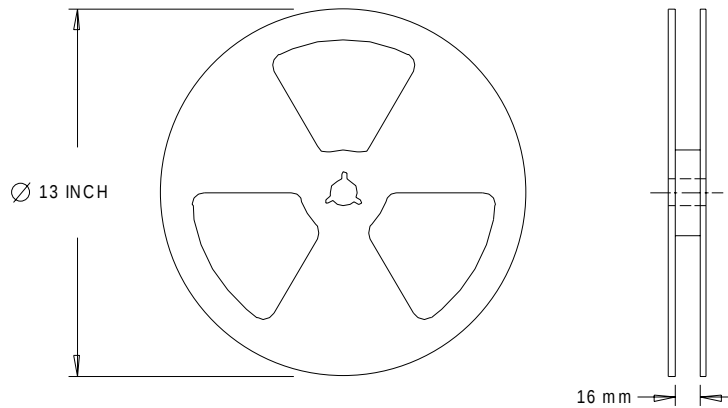
D-Pak (TO-252AA) Tape & Reel Information

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.



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