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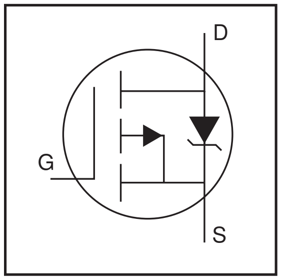
International
IOR Rectifier

IRL5602S

HEXFET® Power MOSFET

- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- P-Channel
- Fast Switching
- Fully Avalanche Rated



V_{DSS} = -20V

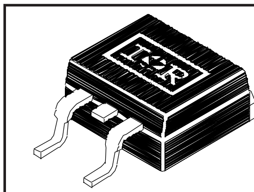
$R_{DS(on)}$ = 0.042Ω

I_D = -24A

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^2Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D^2Pak is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application.



D^2Pak

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ -4.5V	-24	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ -4.5V	-17	
I_{DM}	Pulsed Drain Current ①	-96	
P_D @T_C = 25°C	Power Dissipation	75	W
	Linear Derating Factor	0.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 8.0	V
E_{AS}	Single Pulse Avalanche Energy②	290	mJ
I_{AR}	Avalanche Current①	-12	A
E_{AR}	Repetitive Avalanche Energy①	7.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-0.81	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

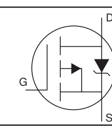
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	2.0	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted,steady-state)**	——	40	

5/11/99

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-20	——	——	V	V_{GS} = 0V, I_D = -250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	-0.013	——	V/°C	Reference to 25°C, I_D = -1mA⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.042	Ω	V_{GS} = -4.5V, I_D = -12A ④
		——	——	0.062		V_{GS} = -2.7V, I_D = -10A ④
		——	——	0.075		V_{GS} = -2.5V, I_D = -10A ④
$V_{GS(th)}$	Gate Threshold Voltage	-0.7	——	-1.0	V	V_{DS} = V_{GS}, I_D = -250μA
g_{fs}	Forward Transconductance	12	——	——	S	V_{DS} = -15V, I_D = -12A⑤
I_{DSS}	Drain-to-Source Leakage Current	——	——	-25	μA	V_{DS} = -20V, V_{GS} = 0V
		——	——	-250		V_{DS} = -16V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	500	nA	V_{GS} = -8.0V
	Gate-to-Source Reverse Leakage	——	——	-500		V_{GS} = 8.0V
Q_g	Total Gate Charge	——	——	44	nC	I_D = -12A
Q_{gs}	Gate-to-Source Charge	——	——	8.7		V_{DS} = -16V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	19		V_{GS} = -4.5V, See Fig. 6 and 13 ④⑤
$t_{d(on)}$	Turn-On Delay Time	——	9.7	——	ns	V_{DD} = -10 V
t_r	Rise Time	——	73	——		I_D = -12A
$t_{d(off)}$	Turn-Off Delay Time	——	53	——		R_G = 6.0Ω, V_{GS} = 4.5V
t_f	Fall Time	——	84	——		R_D = 0.8Ω, See Fig. 10④⑤
L_S	Internal Source Inductance	——	7.5	——	nH	Between lead, and center of die contact
C_{iss}	Input Capacitance	——	1460	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	790	——		V_{DS} = -15V
C_{rss}	Reverse Transfer Capacitance	——	370	——		ƒ = 1.0MHz, See Fig. 5⑤

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-24	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	-96		
V_{SD}	Diode Forward Voltage	——	——	-1.4	V	T_J = 25°C, I_S = -12A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	58	88	ns	T_J = 25°C, I_F = -12A
Q_{rr}	Reverse RecoveryCharge	——	54	81	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 = 3.0mH R_G = 25Ω, I_{AS} = -14A. (See Figure 12)

③ I_{SD} ≤ -12A, di/dt ≤ 120A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C

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

** When mounted on FR-4 board using minimum recommended footprint.
For recommended footprint and soldering techniques refer to application note #AN-994.

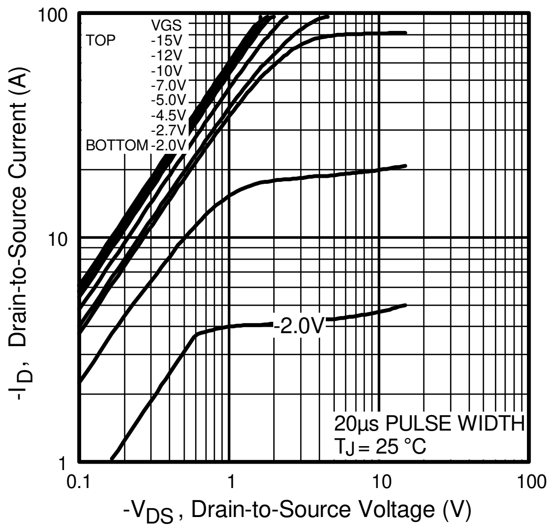


Fig 1. Typical Output Characteristics

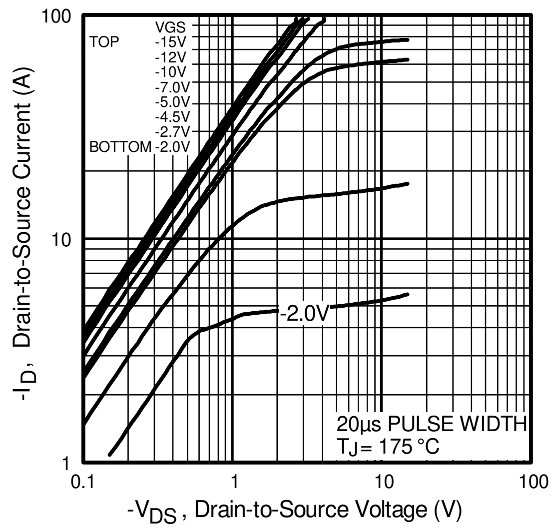


Fig 2. Typical Output Characteristics

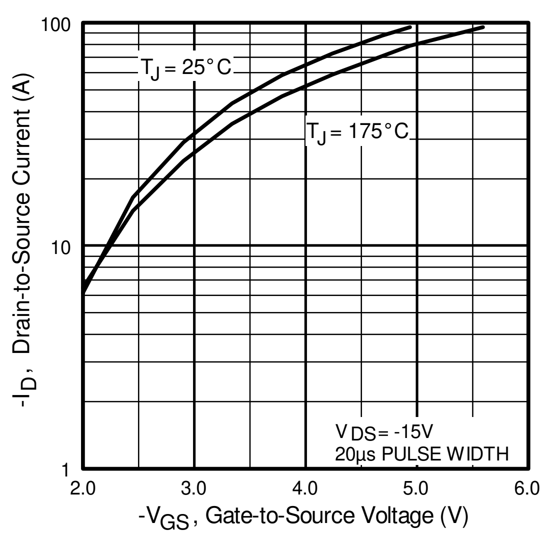


Fig 3. Typical Transfer Characteristics

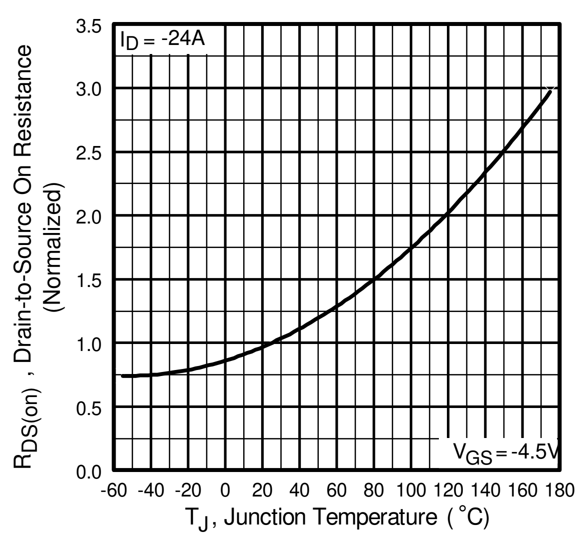


Fig 4. Normalized On-Resistance Vs. Temperature

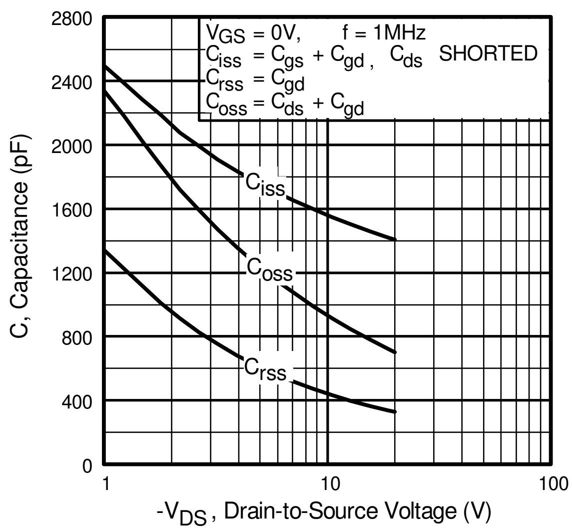


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

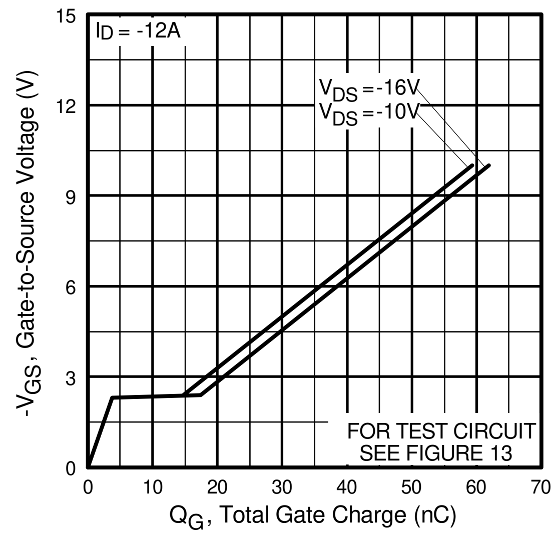


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

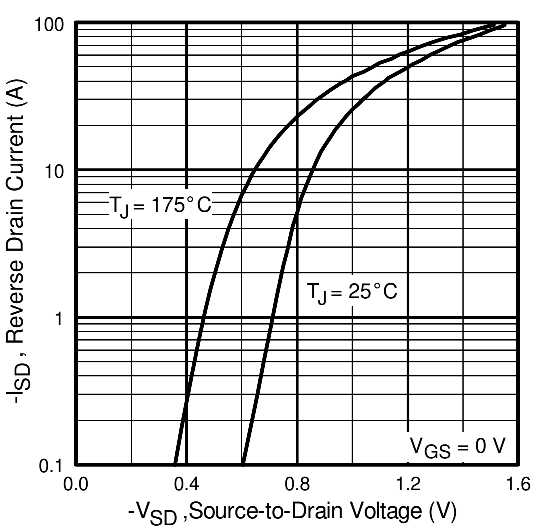


Fig 7. Typical Source-Drain Diode Forward Voltage

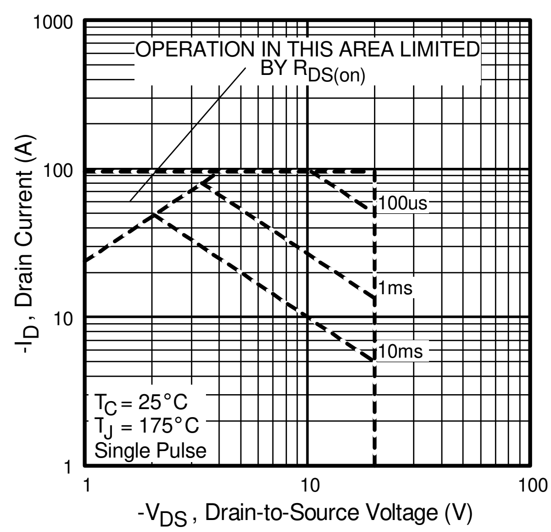


Fig 8. Maximum Safe Operating Area

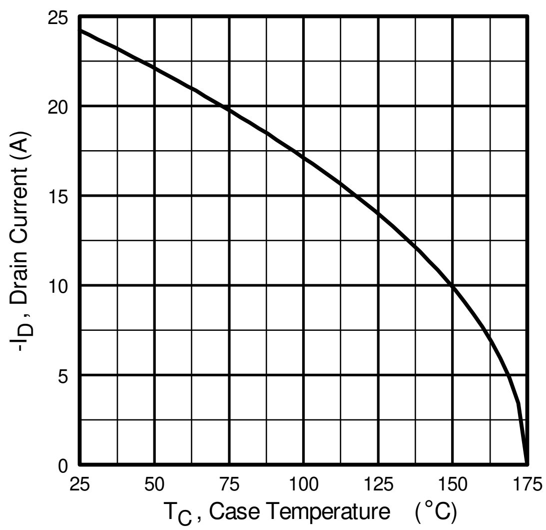
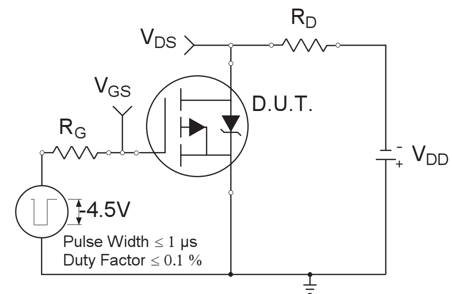
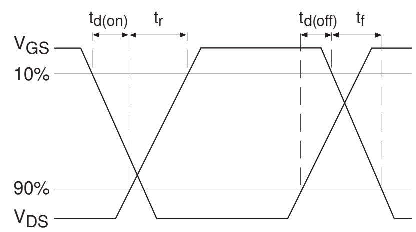


Fig 9. Maximum Drain Current Vs. Case Temperature





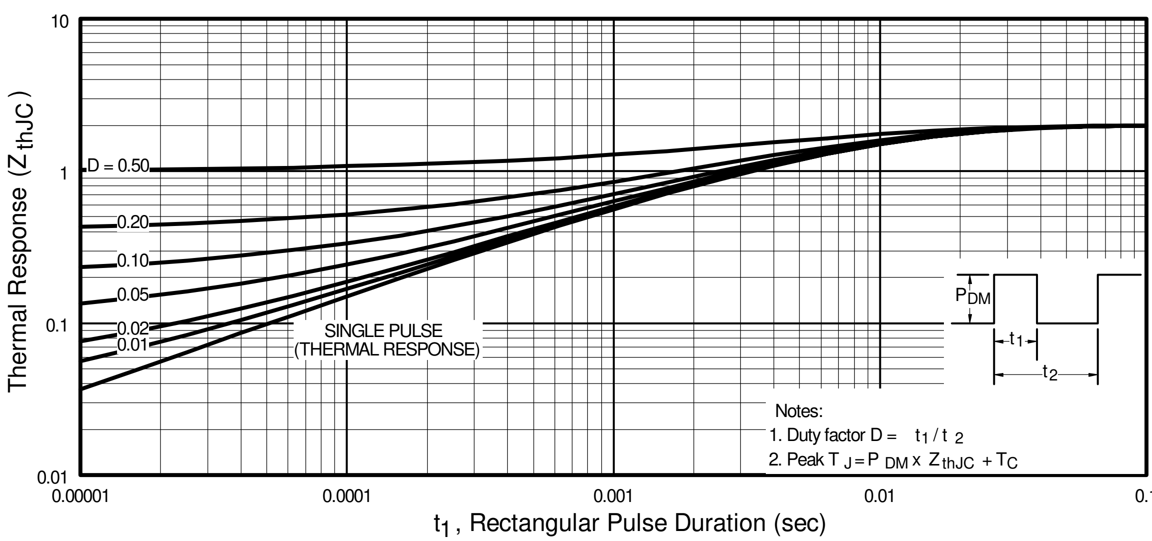


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

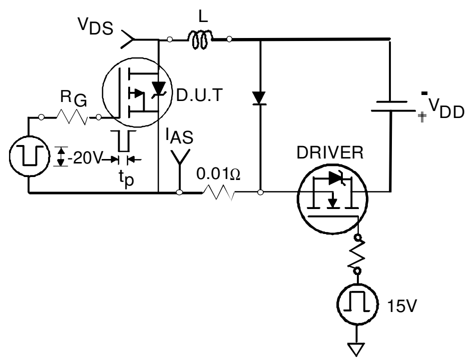


Fig 12a. Unclamped Inductive Test Circuit

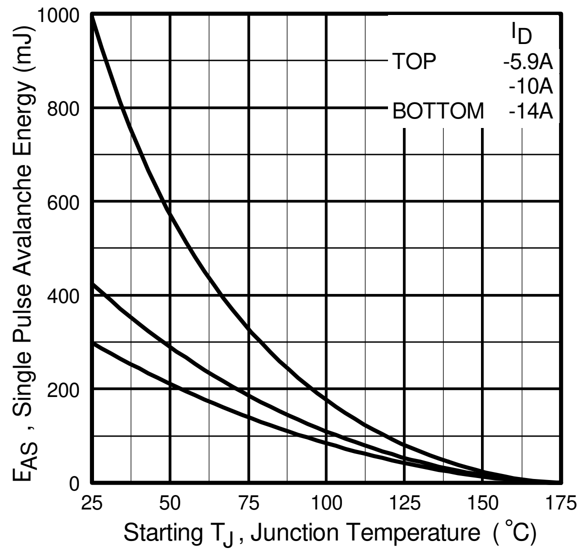


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

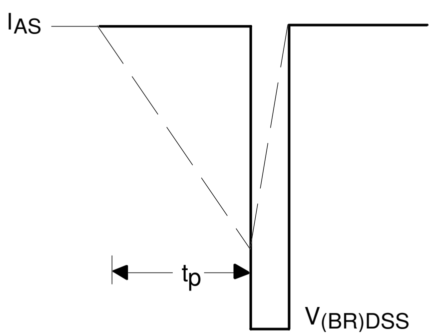


Fig 12b. Unclamped Inductive Waveforms

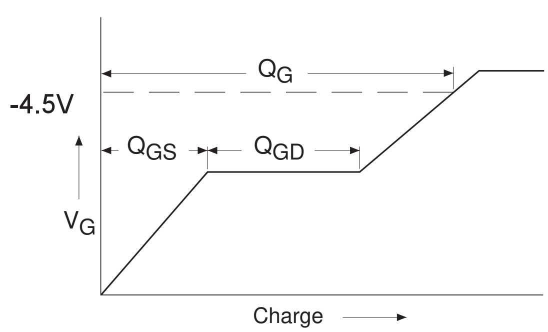


Fig 13a. Basic Gate Charge Waveform

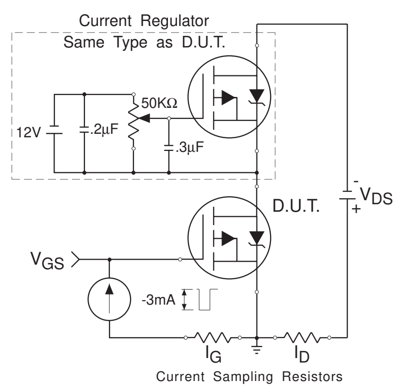
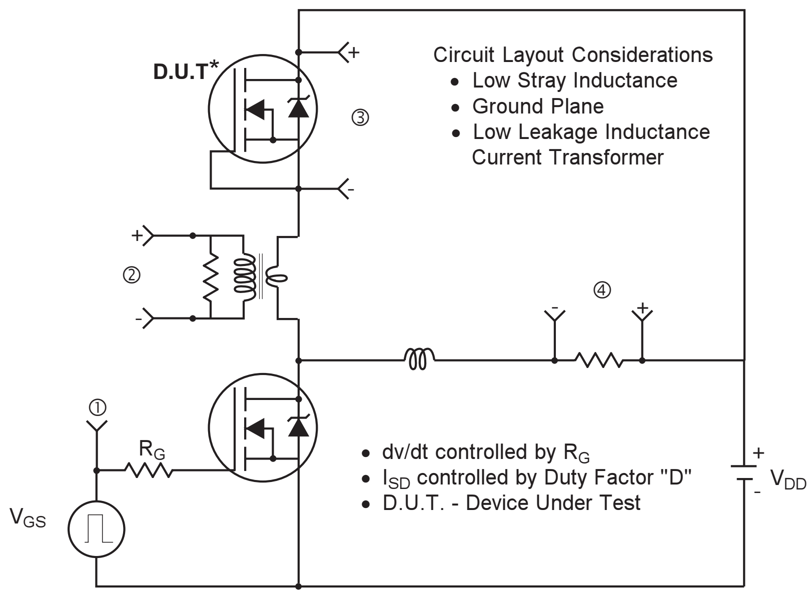
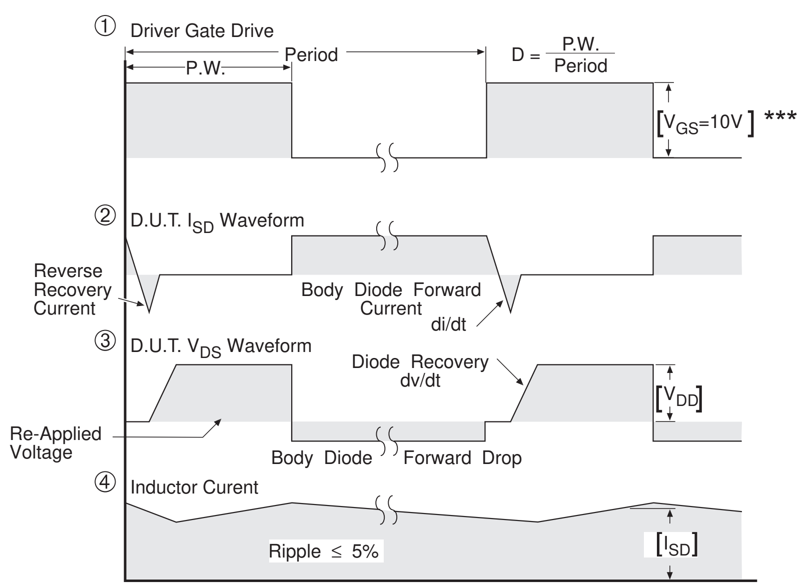


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



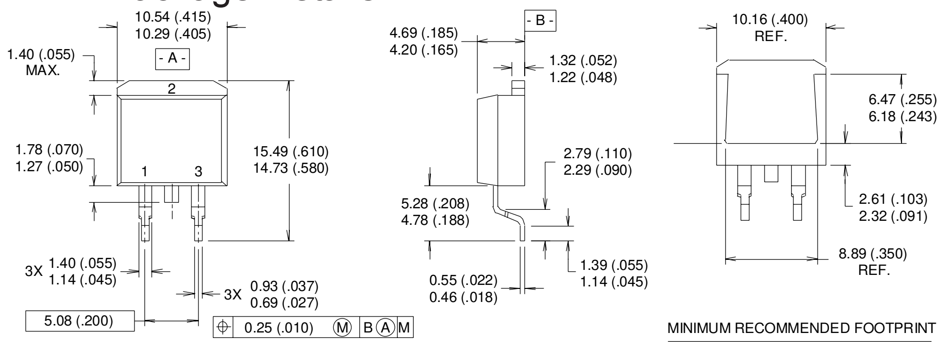
* Reverse Polarity of D.U.T for P-Channel



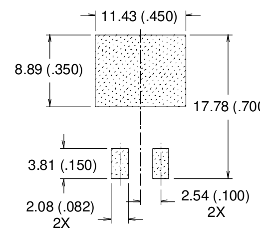
*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 14. For P-Channel HEXFETS

TO-263AB Package Details



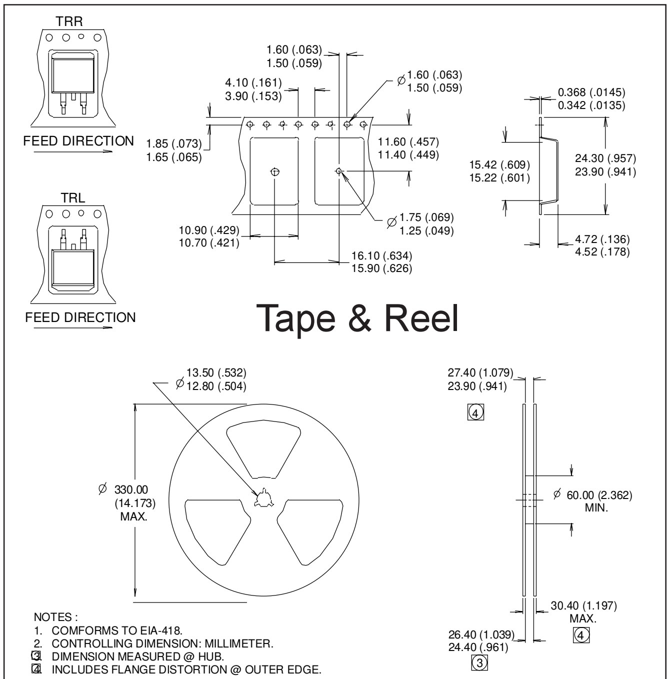
MINIMUM RECOMMENDED FOOTPRINT



NOTES:
1. DIMENSIONS AFTER SOLDER DIP.
2. DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIMENSION : INCH.
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

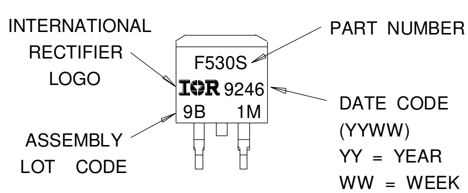
LEAD ASSIGNMENTS
1 - GATE
2 - DRAIN
3 - SOURCE

Tape & Reel



Part Marking

(This is an IRF530S with assembly lot code 9B1M)



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http://www.irf.com/   *Data and specifications subject to change without notice. 5/99*

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