

IRFI9540N

HEXFET® Power MOSFET

- Advanced Process Technology
- Isolated Package
- High Voltage Isolation = 2.5KV RMS ⑤
- Sink to Lead Creepage Dist. = 4.8mm
- P-Channel
- Fully Avalanche Rated

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.

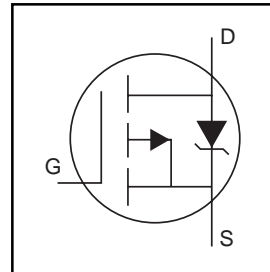
The TO-220 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The Fullpak is mounted to a heatsink using a single clip or by a single screw fixing.

Absolute Maximum Ratings

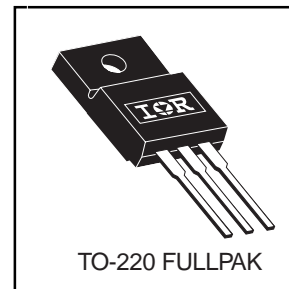
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-15	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-10	
I_{DM}	Pulsed Drain Current ①⑥	-76	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	54	W
	Linear Derating Factor	0.36	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑥	430	mJ
I_{AR}	Avalanche Current①⑥	-11	A
E_{AR}	Repetitive Avalanche Energy①	5.4	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑥	-5.0	V/ns
T_J	Operating Junction and Storage Temperature Range	-55 to +175	°C
T_{STG}			
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.8	°C/W
$R_{\theta JA}$	Junction-to-Ambient	—	65	

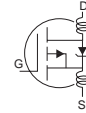


$V_{DSS} = -100\text{V}$
$R_{DS(on)} = 0.117\Omega$
$I_D = -15\text{A}$



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

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	-100	—	—	V	V _{GS} = 0V, I _D = -250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	-0.11	—	V/°C	Reference to 25°C, I _D = -1mA ^⑥
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	—	0.117	Ω	V _{GS} = -10V, I _D = -7.8A ^④
V _{GS(th)}	Gate Threshold Voltage	-2.0	—	-4.0	V	V _{DS} = V _{GS} , I _D = -250μA
g _{fs}	Forward Transconductance	5.3	—	—	S	V _{DS} = -50V, I _D = -11A ^⑥
I _{DSS}	Drain-to-Source Leakage Current	—	—	-25	μA	V _{DS} = -100V, V _{GS} = 0V
		—	—	-250	μA	V _{DS} = -80V, 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	nA	V _{GS} = -20V
Q _g	Total Gate Charge	—	—	97	nC	I _D = -11A
Q _{gs}	Gate-to-Source Charge	—	—	15	nC	V _{DS} = -80V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	—	51	nC	V _{GS} = -10V, See Fig. 6 and 13 ^{④⑥}
t _{d(on)}	Turn-On Delay Time	—	15	—	ns	V _{DD} = -50V I _D = -11A R _G = 5.1Ω R _D = 4.2Ω, See Fig. 10 ^{④⑥}
t _r	Rise Time	—	67	—		
t _{d(off)}	Turn-Off Delay Time	—	51	—		
t _f	Fall Time	—	51	—		
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	—	1300	—	pF	V _{GS} = 0V V _{DS} = -25V f = 1.0MHz, See Fig. 5 ^⑥
C _{oss}	Output Capacitance	—	400	—		
C _{rss}	Reverse Transfer Capacitance	—	240	—		
C	Drain to Sink Capacitance	—	12	—		



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	-15	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ^{①⑥}	—	—	-76		
V _{SD}	Diode Forward Voltage	—	—	-1.6	V	T _J = 25°C, I _S = -7.8A, V _{GS} = 0V ^④
t _{rr}	Reverse Recovery Time	—	150	220	ns	T _J = 25°C, I _F = -11A
Q _{rr}	Reverse Recovery Charge	—	830	1200	nC	di/dt = -100A/μs ^{④⑥}
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 = 7.1mH
R_G = 25Ω, I_{AS} = -11A. (See Figure 12)
- ③ I_{SD} ≤ -11A, di/dt ≤ -470A/μs, V_{DD} ≤ V_{(BR)DSS},
T_J ≤ 175°C
- ④ Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ⑤ t = 60s, f = 60Hz
- ⑥ Uses IRF9540N data and test conditions

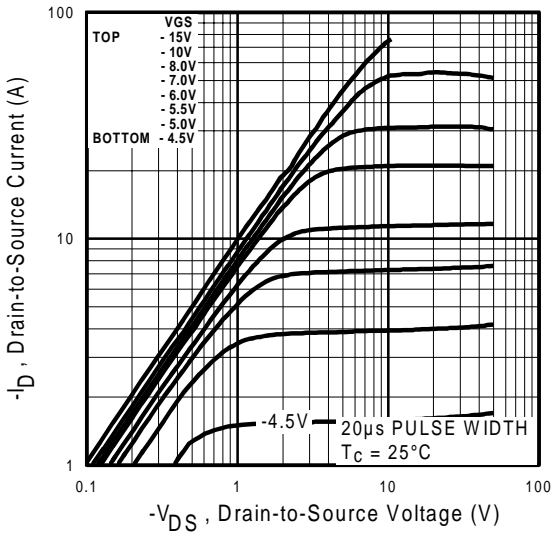


Fig 1. Typical Output Characteristics

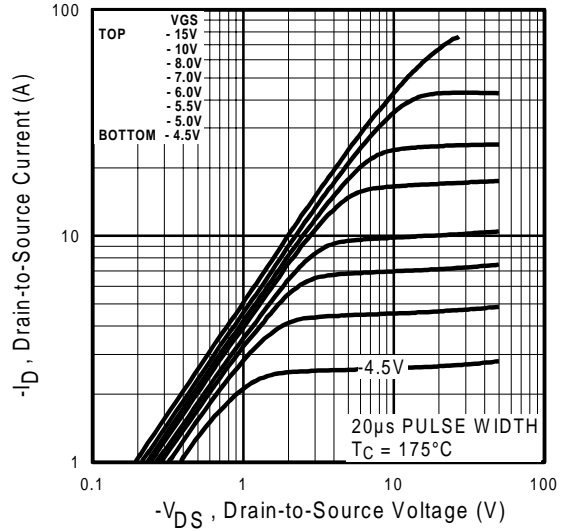


Fig 2. Typical Output Characteristics

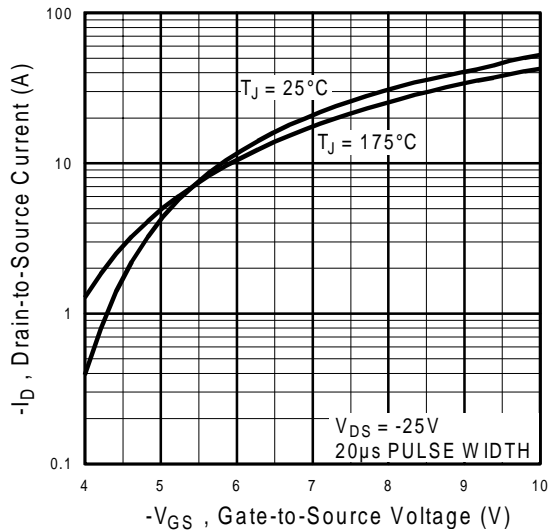


Fig 3. Typical Transfer Characteristics

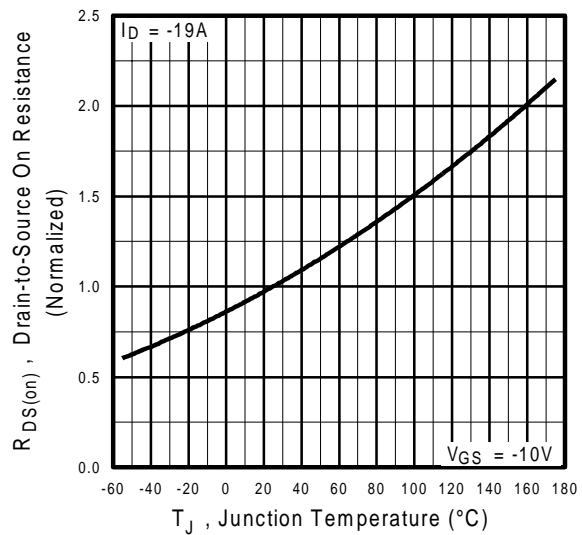


Fig 4. Normalized On-Resistance Vs. Temperature

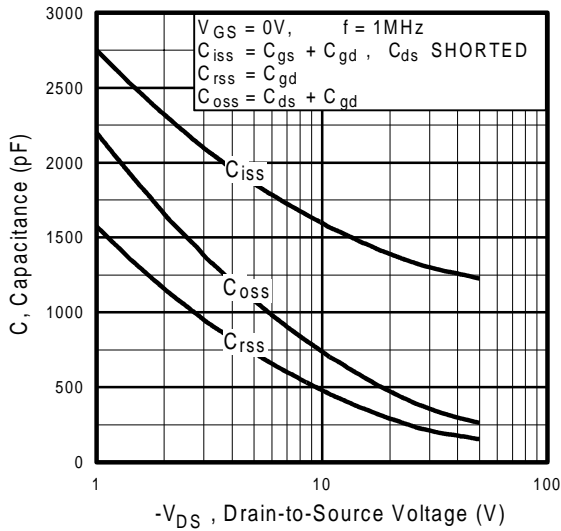


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

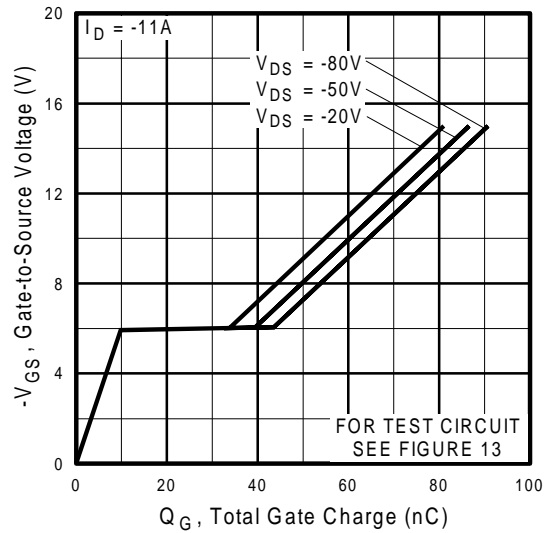


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

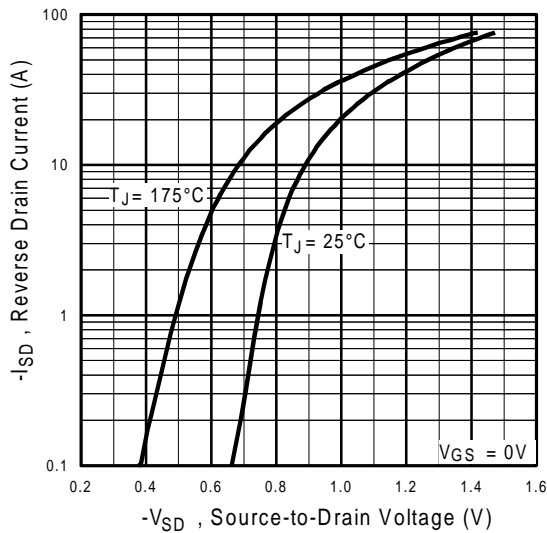


Fig 7. Typical Source-Drain Diode Forward Voltage

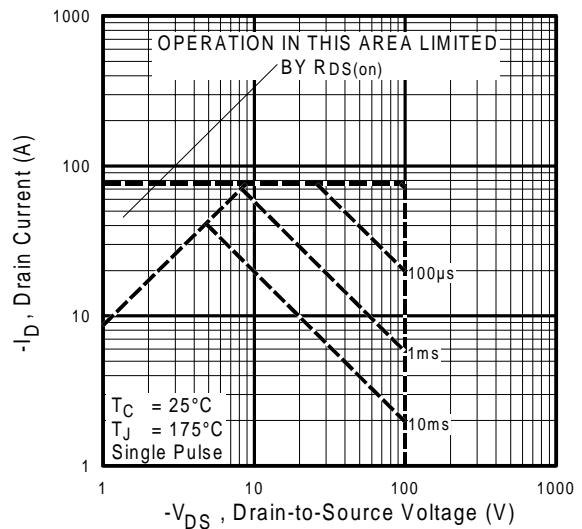


Fig 8. Maximum Safe Operating Area

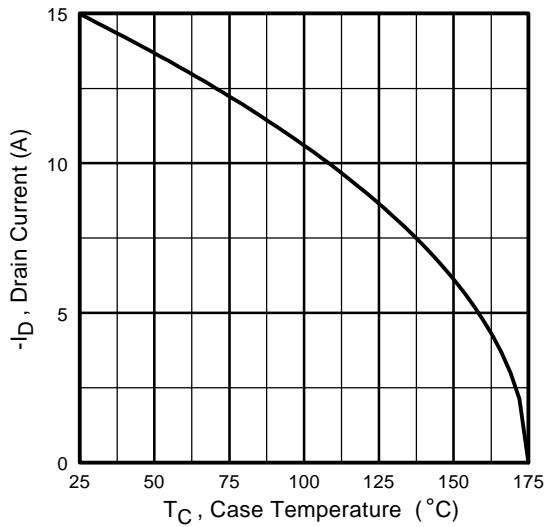


Fig 9. Maximum Drain Current Vs. Case Temperature

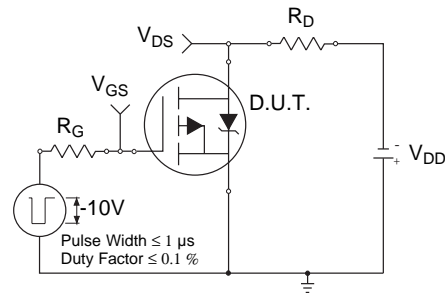


Fig 10a. Switching Time Test Circuit

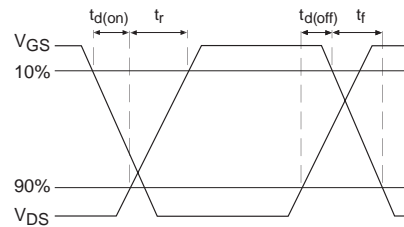


Fig 10b. Switching Time Waveforms

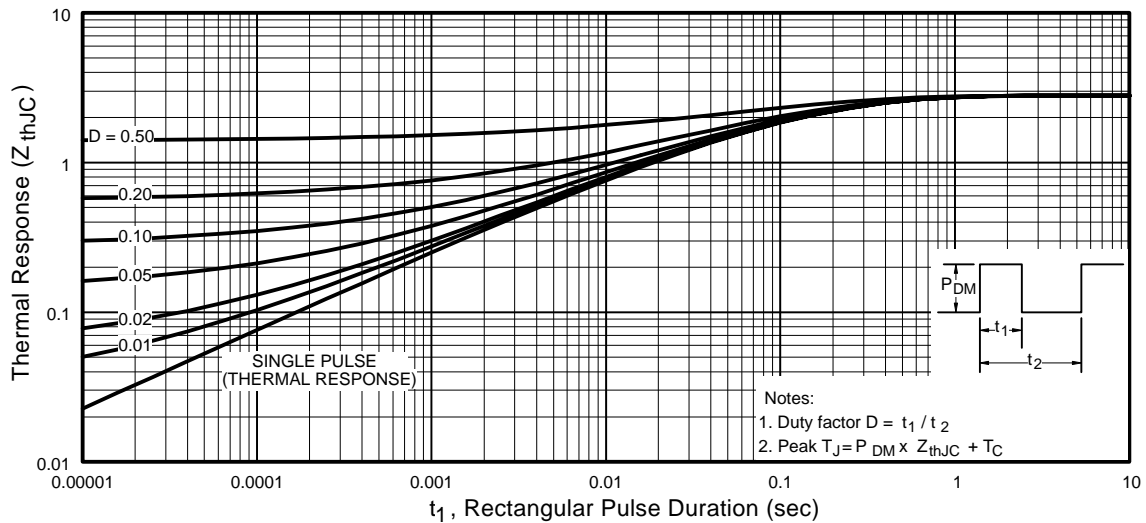


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

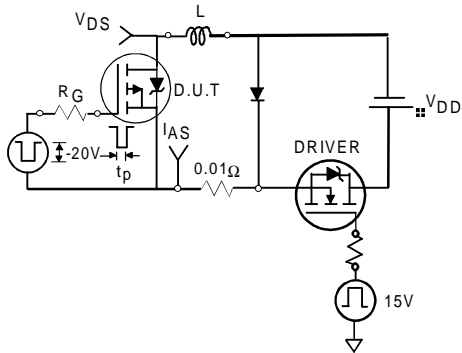


Fig 12a. Unclamped Inductive Test Circuit

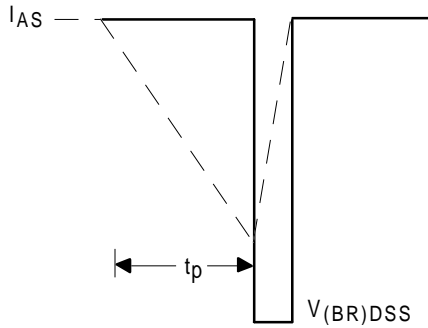


Fig 12b. Unclamped Inductive Waveforms

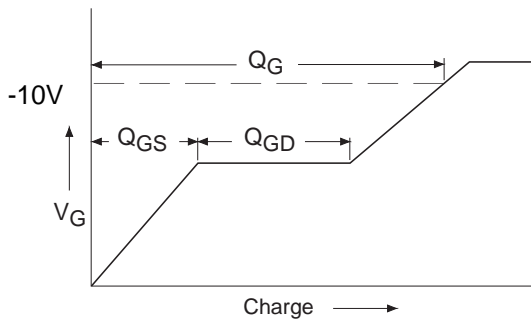


Fig 13a. Basic Gate Charge Waveform

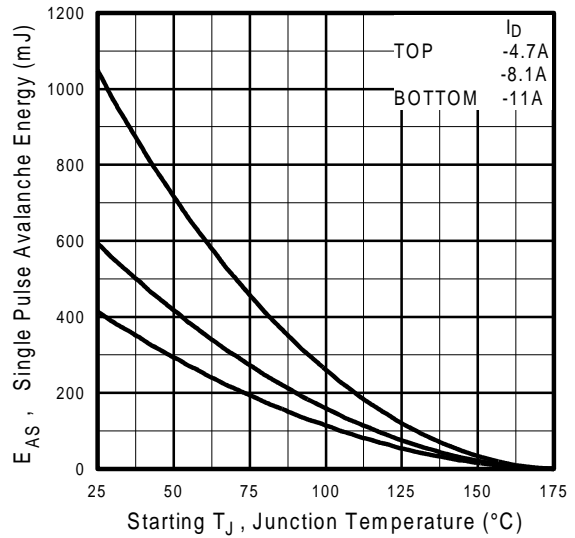


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

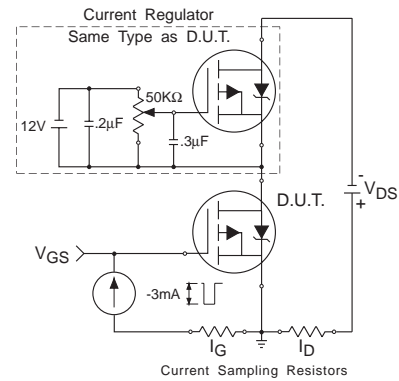
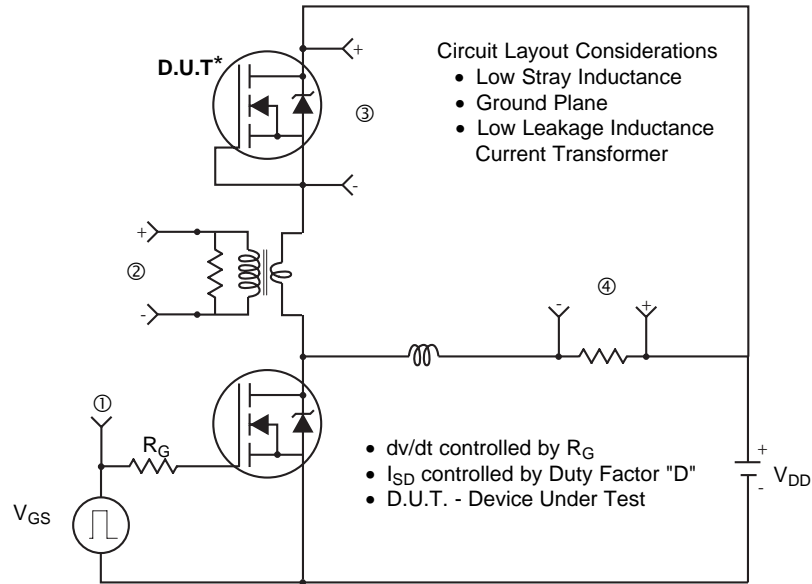
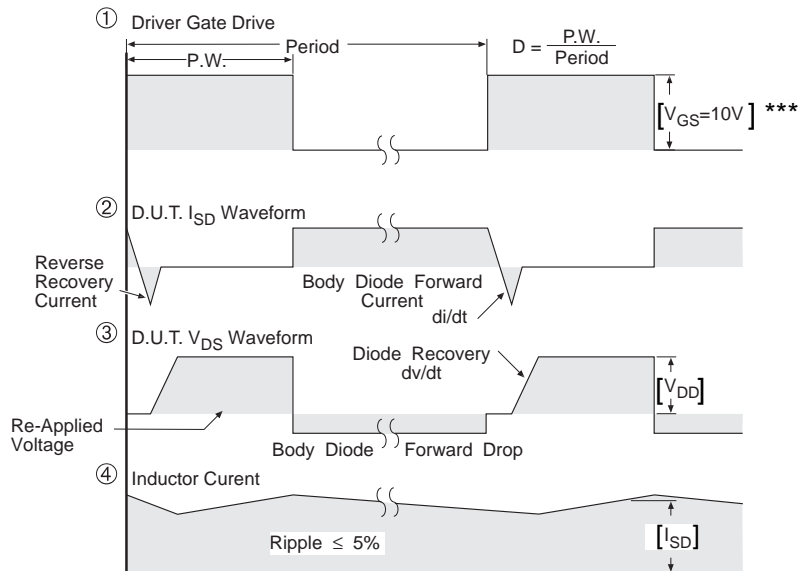


Fig 13b. Gate Charge Test Circuit

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

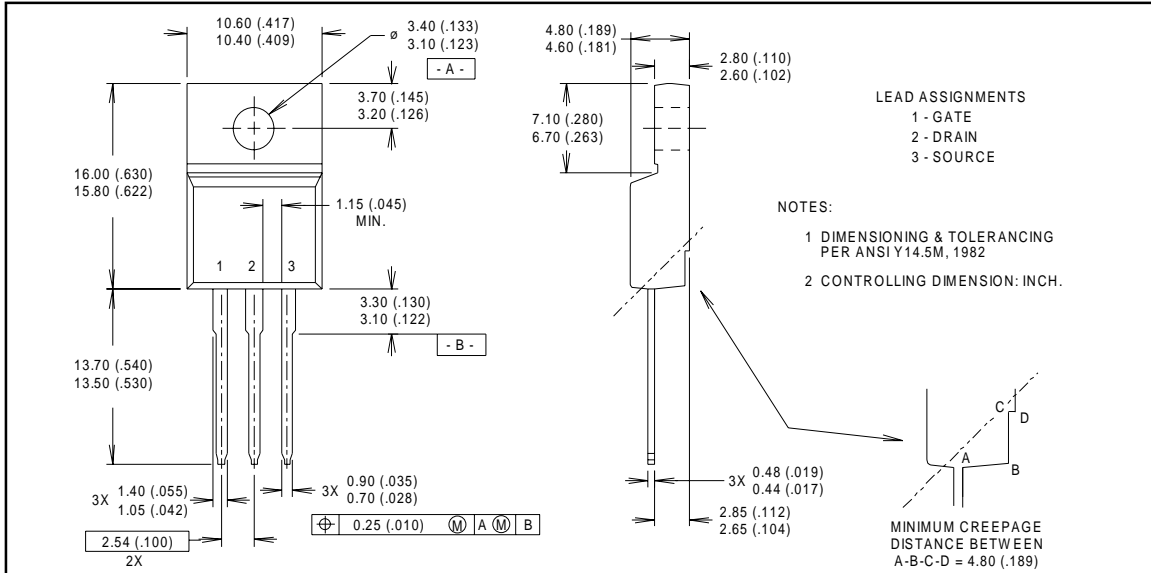
IRFI9540N

International
IR Rectifier

Package Outline

TO-220 Fullpak Outline

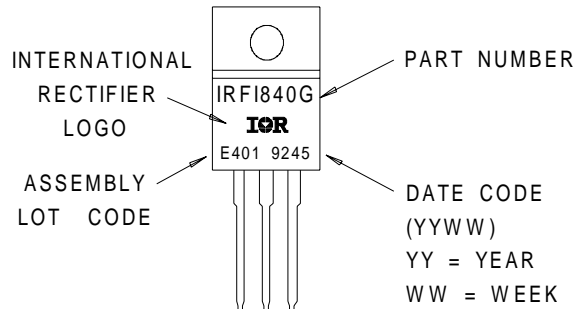
Dimensions are shown in millimeters (inches)



Part Marking Information

TO-220 Fullpak

EXAMPLE : THIS IS AN IRFI840G
 WITH ASSEMBLY
 LOT CODE E401



International
IR Rectifier

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EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020
IR CANADA: 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 2Z8, Tel: (905) 475 1897
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
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
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<http://www.irf.com/> Data and specifications subject to change without notice. 3/98

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