

International IR Rectifier

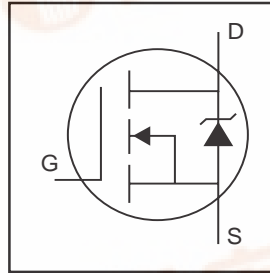
PD - 9.1497A

IRLI540N

PRELIMINARY

HEXFET® Power MOSFET

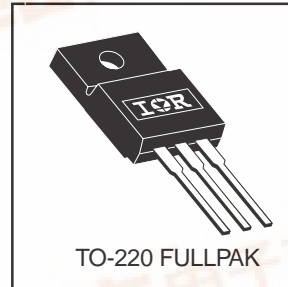
- Logic-Level Gate Drive
- Advanced Process Technology
- Isolated Package
- High Voltage Isolation = 2.5KVRMS ⑤
- Sink to Lead Creepage Dist. = 4.8mm
- Fully Avalanche Rated



V_{DS}	100V
$R_{DS(on)}$	0.044Ω
I_D	23A

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} @ 10V	23	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	16	
I_{DM}	Pulsed Drain Current ①⑥	120	
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	± 16	V
E_{AS}	Single Pulse Avalanche Energy②⑥	310	mJ
I_{AR}	Avalanche Current①⑥	18	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	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	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	



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	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.044	Ω	$V_{GS} = 10V, I_D = 12A$ ④
		—	—	0.053		$V_{GS} = 5.0V, I_D = 12A$ ④
		—	—	0.063		$V_{GS} = 4.0V, I_D = 10A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	14	—	—	S	$V_{DS} = 25V, I_D = 18A$ ⑥
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 16V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -16V$
Q_g	Total Gate Charge	—	—	74	nC	$I_D = 18A$ $V_{DS} = 80V$ $V_{GS} = 5.0V$, See Fig. 6 and 13 ④⑥
Q_{gs}	Gate-to-Source Charge	—	—	9.4		
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	38		
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	$V_{DD} = 50V$ $I_D = 18A$ $R_G = 5.0\Omega, V_{GS} = 5.0V$ $R_D = 2.7\Omega$, See Fig. 10 ④⑥
t_r	Rise Time	—	81	—		
$t_{d(off)}$	Turn-Off Delay Time	—	39	—		
t_f	Fall Time	—	62	—		
L_D	Internal Drain Inductance	—	4.5	—		
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	1800	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$, See Fig. 5⑥
C_{oss}	Output Capacitance	—	350	—		
C_{riss}	Reverse Transfer Capacitance	—	170	—		
C	Drain to Sink Capacitance	—	12	—		

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	23	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①⑥	—	—	120		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 18A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	190	290	ns	$T_J = 25^\circ\text{C}, I_F = 18A$
Q_{rr}	Reverse Recovery Charge	—	1.1	1.7	μC	$di/dt = 100A/\mu s$ 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 $T_J = 25^\circ\text{C}$, $L = 1.9\text{mH}$
 $R_G = 25\Omega, I_{AS} = 18A$. (See Figure 12)
 ③ $I_{SD} \leq 18A, di/dt \leq 180A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.⑤ $t = 60s, f = 60\text{Hz}$

⑥ Uses IRL540N data and test conditions

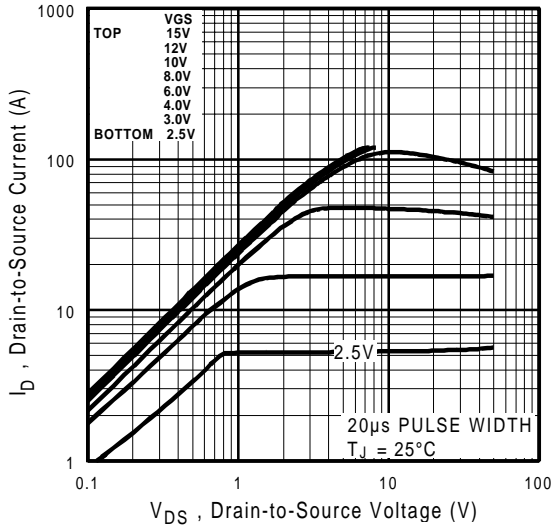


Fig 1. Typical Output Characteristics

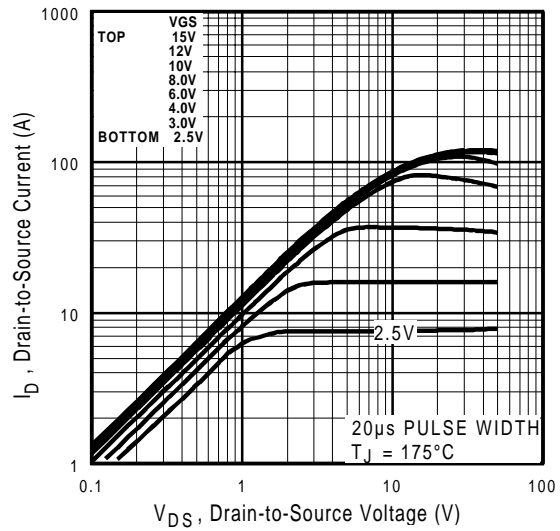


Fig 2. Typical Output Characteristics

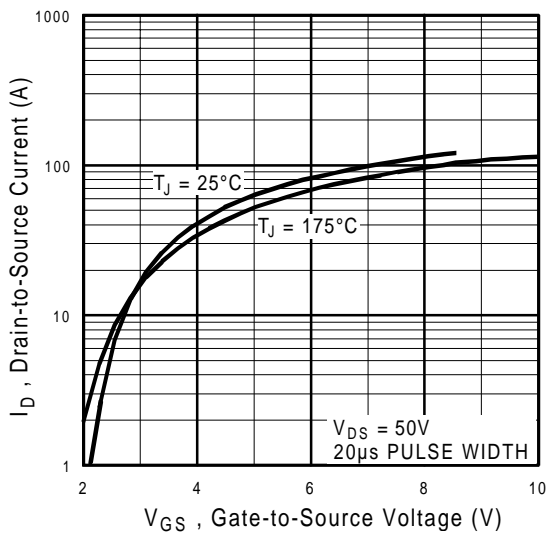


Fig 3. Typical Transfer Characteristics

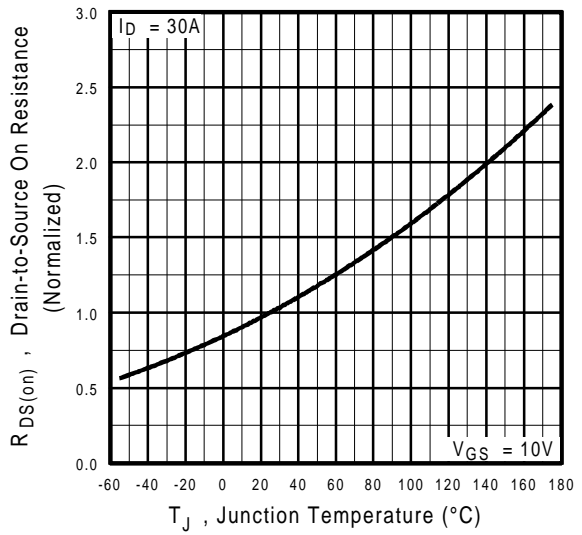


Fig 4. Normalized On-Resistance Vs. Temperature

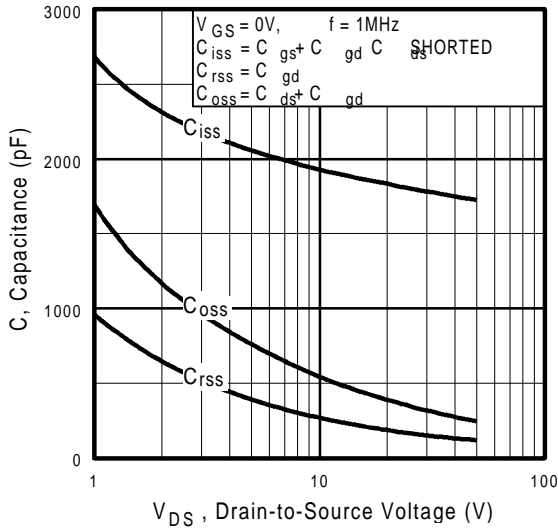


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

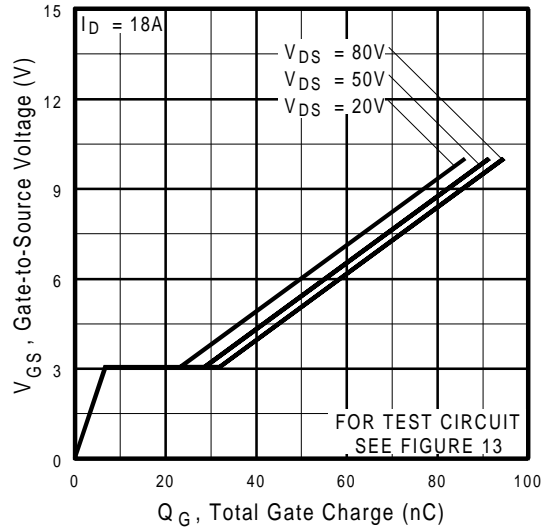


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

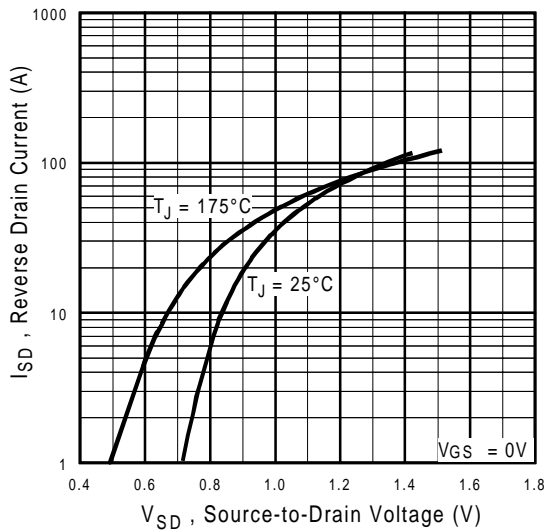


Fig 7. Typical Source-Drain Diode Forward Voltage

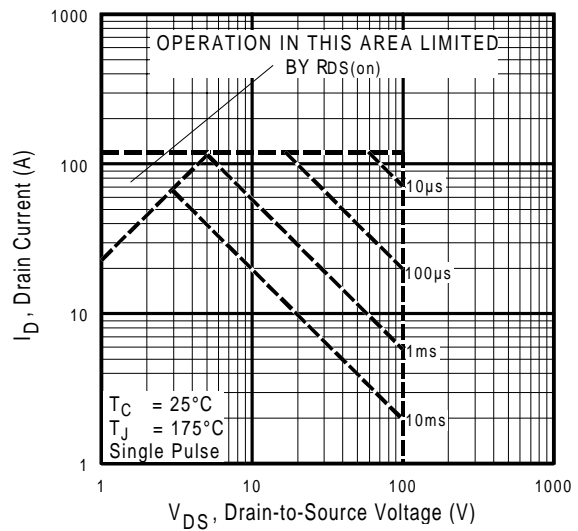


Fig 8. Maximum Safe Operating Area

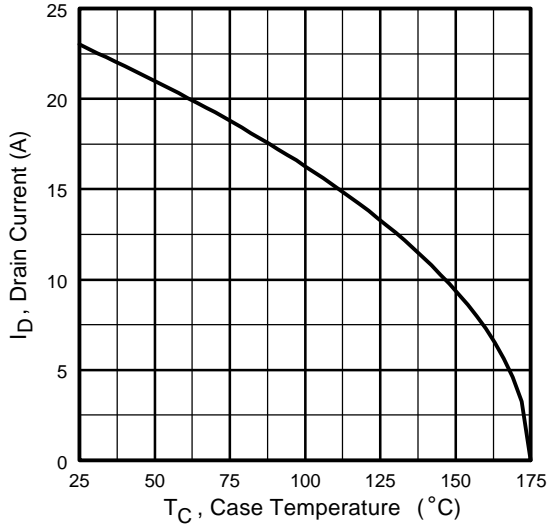


Fig 9. Maximum Drain Current Vs. Case Temperature

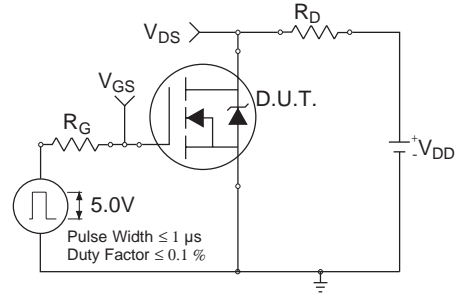


Fig 10a. Switching Time Test Circuit

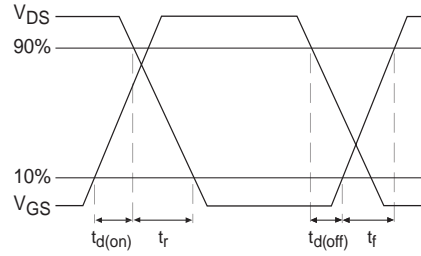


Fig 10b. Switching Time Waveforms

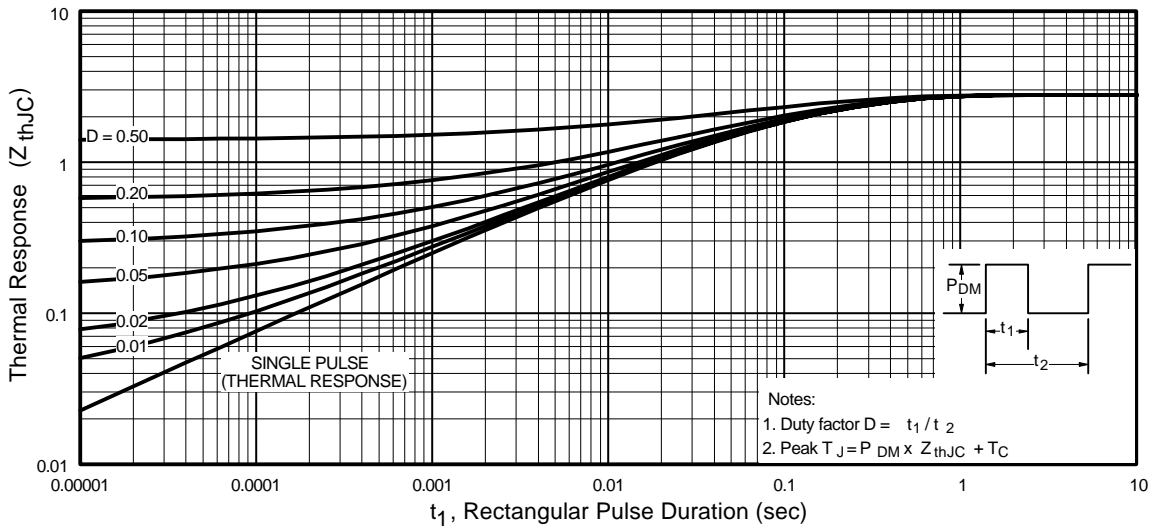


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

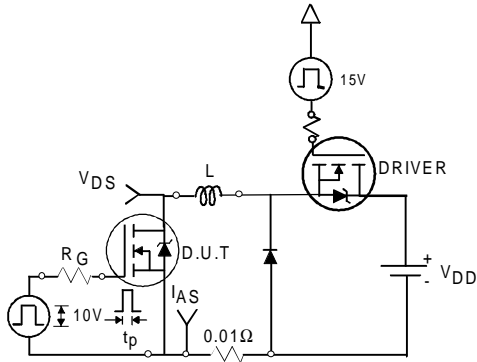


Fig 12a. Unclamped Inductive Test Circuit

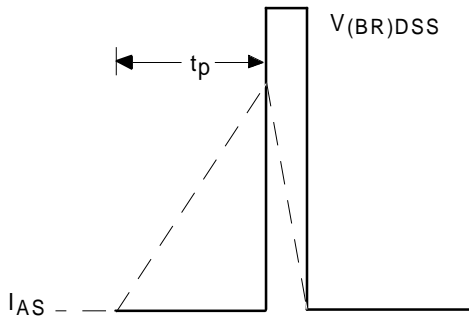


Fig 12b. Unclamped Inductive Waveforms

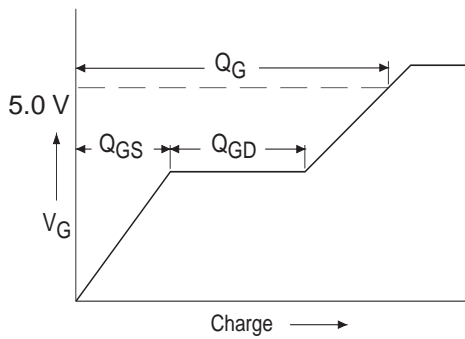


Fig 13a. Basic Gate Charge Waveform

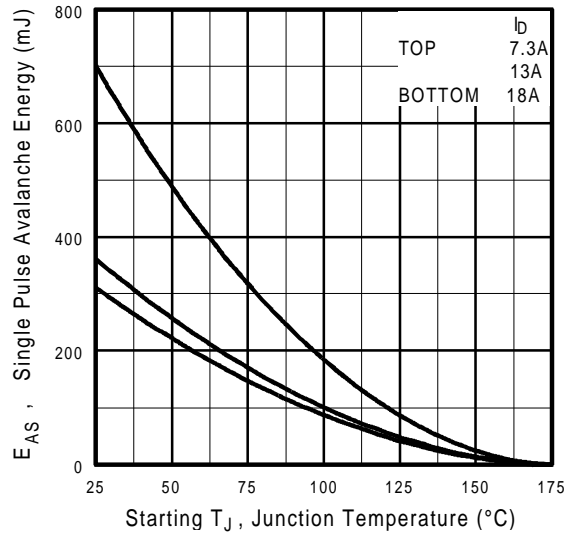


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

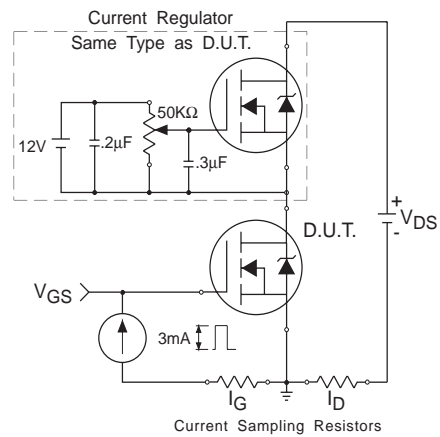
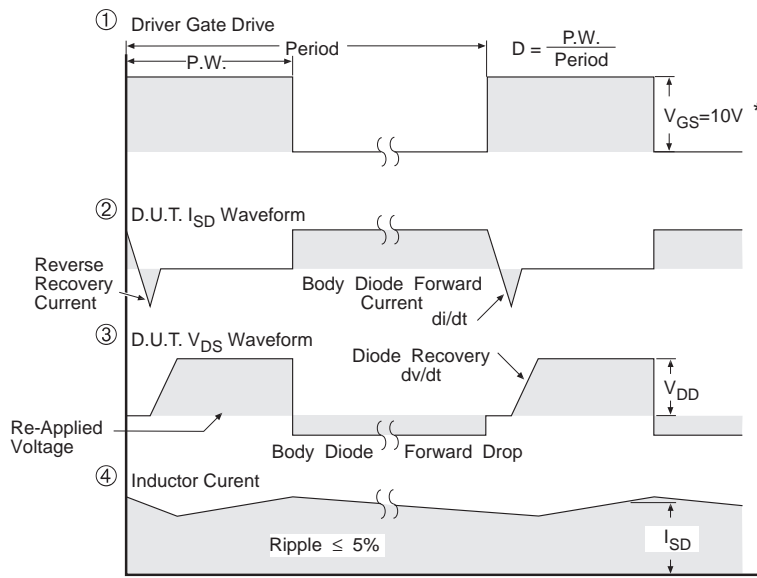
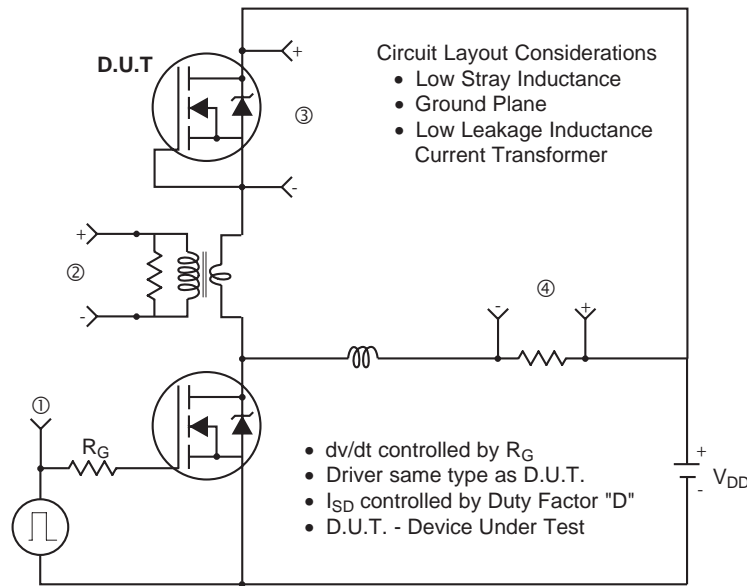


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

Fig 14. For N-Channel HEXFETS

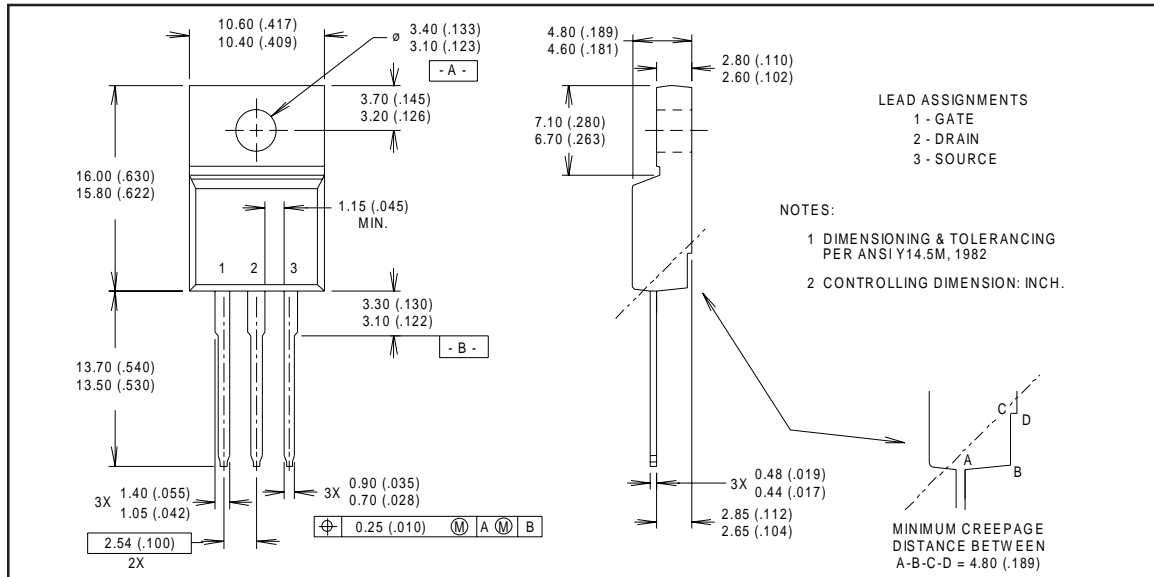
IRLI540N

International
IR Rectifier

Package Outline

TO-220 Fullpak Outline

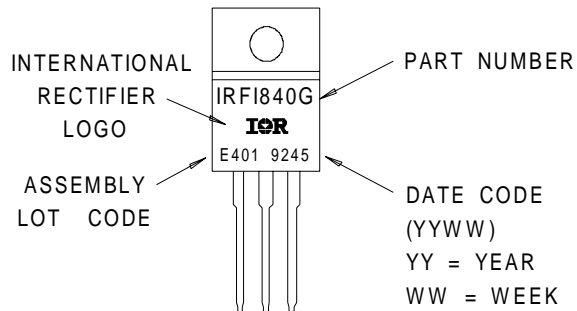
Dimensions are shown in millimeters (inches)



Part Marking Information

TO-220 Fullpak

EXAMPLE : THIS IS AN IRFI840G
 WITH ASSEMBLY
 LOT CODE E401



International
IR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331

EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T 3Z2, Tel: (905) 453 2200

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: 171 (K&H Bldg.) 30-4 Nishi-ikebukuro 3-chome, Toshima-ku, Tokyo Japan Tel: 81 33 983 0086

IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 16907 Tel: 65 221 8371

Data and specifications subject to change without notice.