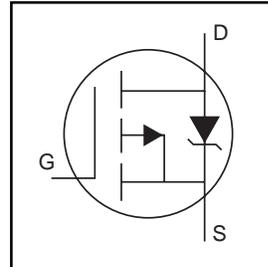


- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- P-Channel
- Fast Switching
- Fully Avalanche Rated

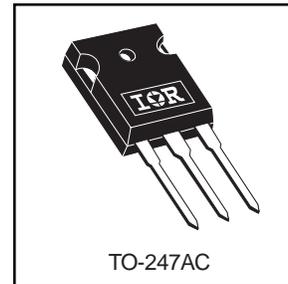


$V_{DSS} = -100V$
$R_{DS(on)} = 0.117\Omega$
$I_D = -23A$

### 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-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole.



### Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-23	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$	-16	
$I_{DM}$	Pulsed Drain Current ①⑤	-76	
$P_D @ T_C = 25^\circ C$	Power Dissipation	140	W
	Linear Derating Factor	0.91	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy②⑤	430	mJ
$I_{AR}$	Avalanche Current①	-11	A
$E_{AR}$	Repetitive Avalanche Energy①	14	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	-5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

### Thermal Resistance

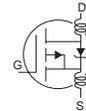
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.1	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	40	

# IRFP9140N

International  
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
	$V_{(BR)DSS}$	-100	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
	$\Delta V_{(BR)DSS}/\Delta T_J$	—	-0.11	—	V/°C	Reference to $25^\circ\text{C}, I_D = -1\text{mA}$ ⑤
	$R_{DS(on)}$	—	—	0.117	$\Omega$	$V_{GS} = -10V, I_D = -13A$ ④
	$V_{GS(th)}$	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
	$g_{fs}$	5.3	—	—	S	$V_{DS} = -50V, I_D = 11A$ ⑤
	$I_{DSS}$	—	—	-25	$\mu A$	$V_{DS} = -100V, V_{GS} = 0V$
		—	—	-250	$\mu A$	$V_{DS} = -80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
	$I_{GSS}$	—	—	100	nA	$V_{GS} = 20V$
		—	—	-100	nA	$V_{GS} = -20V$
	$Q_g$	—	—	97	nC	$I_D = -11A$
	$Q_{gs}$	—	—	15	nC	$V_{DS} = -80V$
	$Q_{gd}$	—	—	51	nC	$V_{GS} = -10V$ , See Fig. 6 and 13 ④⑤
	$t_{d(on)}$	—	15	—	ns	$V_{DD} = -50V$ $I_D = -11A$ $R_G = 5.1\Omega$ $R_D = 4.2\Omega$ , See Fig. 10 ④⑤
	$t_r$	—	67	—		
	$t_{d(off)}$	—	51	—		
	$t_f$	—	51	—		
	$L_D$	—	5.0	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
	$L_S$	—	13	—		
	$C_{iss}$	—	1300	—	pF	$V_{GS} = 0V$ $V_{DS} = -25V$ $f = 1.0\text{MHz}$ , See Fig. 5 ⑤
	$C_{oss}$	—	400	—		
	$C_{rss}$	—	240	—		

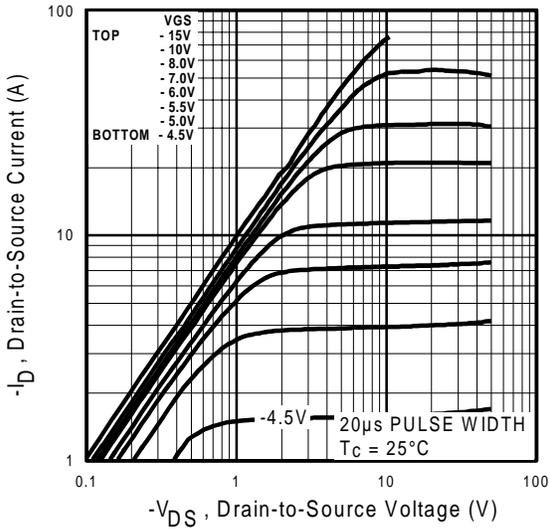


## Source-Drain Ratings and Characteristics

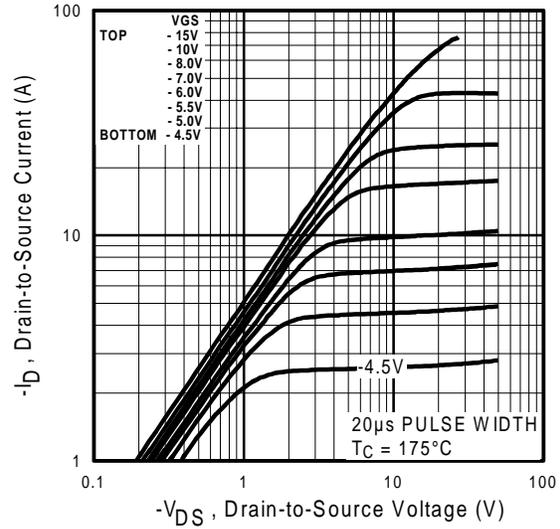
	Parameter	Min.	Typ.	Max.	Units	Conditions
	$I_S$	—	—	-23	A	MOSFET symbol showing the integral reverse p-n junction diode.
	$I_{SM}$	—	—	-76		
	$V_{SD}$	—	—	-1.3	V	$T_J = 25^\circ\text{C}, I_S = -13A, V_{GS} = 0V$ ④
	$t_{rr}$	—	150	220	ns	$T_J = 25^\circ\text{C}, I_F = -11A$
	$Q_{rr}$	—	830	1200	$\mu C$	$di/dt = -100A/\mu s$ ④
	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

### Notes:

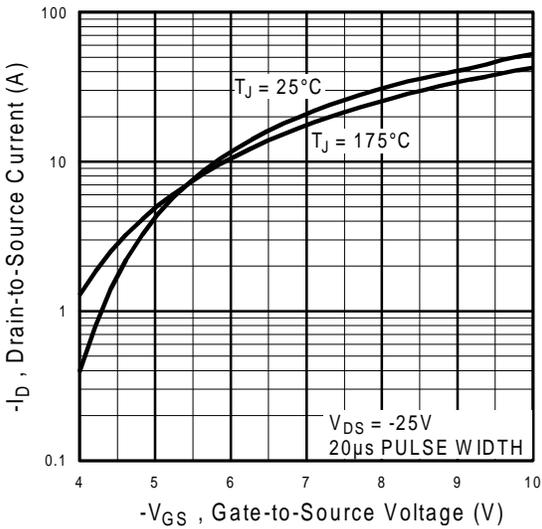
- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}, L = 7.1\text{mH}$   
 $R_G = 25\Omega, I_{AS} = -11A$ . (See Figure 12)
- ③  $I_{SD} \leq -11A, di/dt \leq -470A/\mu s, V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 175^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ Uses IRF9540N data and test conditions



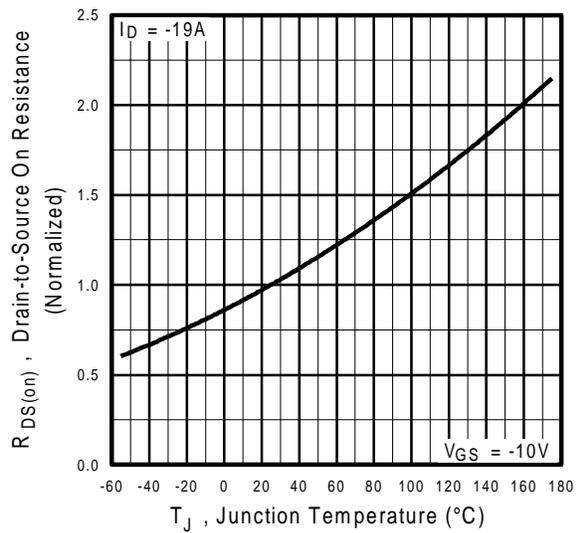
**Fig 1.** Typical Output Characteristics



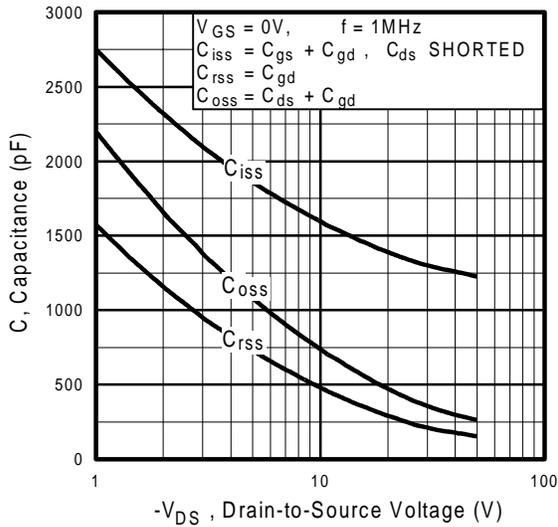
**Fig 2.** Typical Output Characteristics



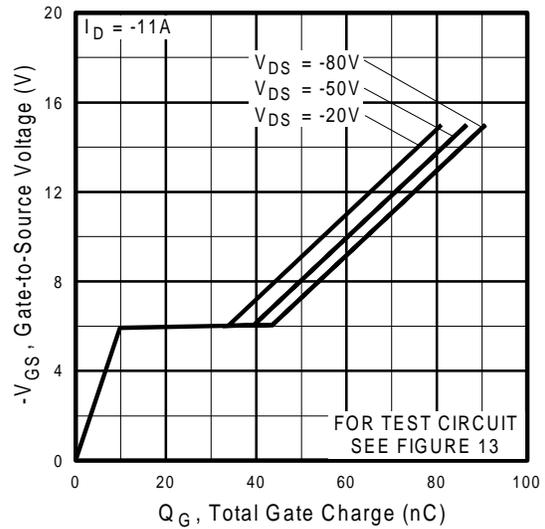
**Fig 3.** Typical Transfer Characteristics



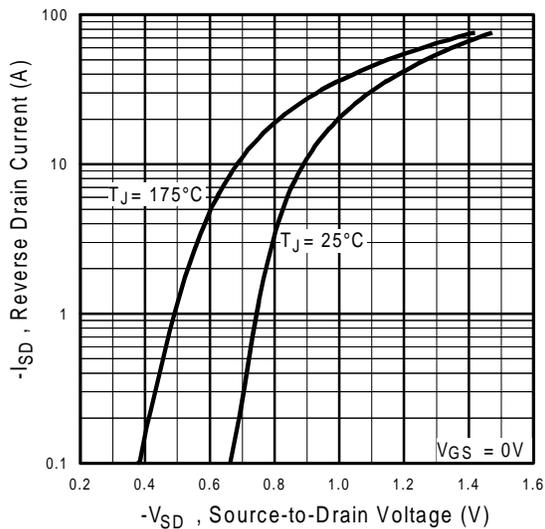
**Fig 4.** Normalized On-Resistance Vs. Temperature



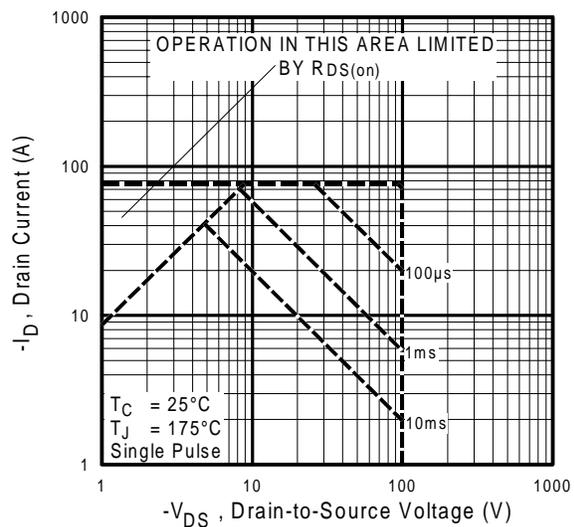
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



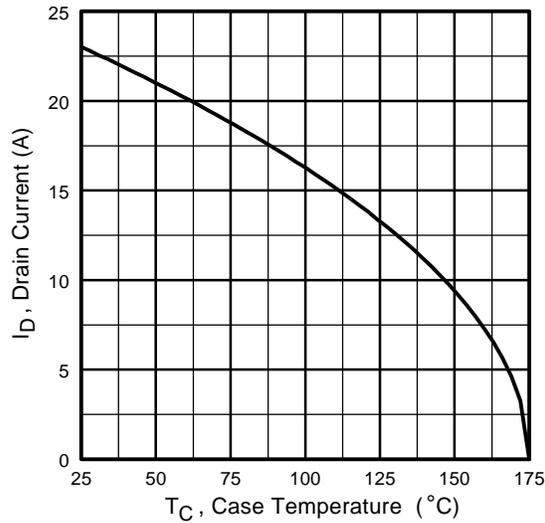
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



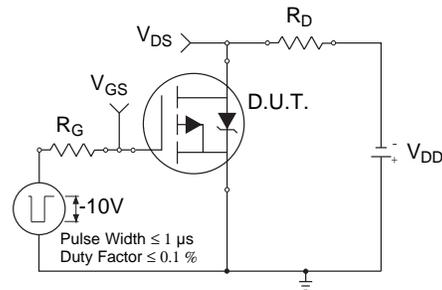
**Fig 7.** Typical Source-Drain Diode Forward Voltage



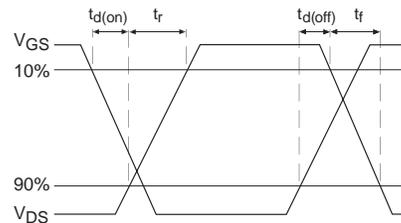
**Fig 8.** Maximum Safe Operating Area



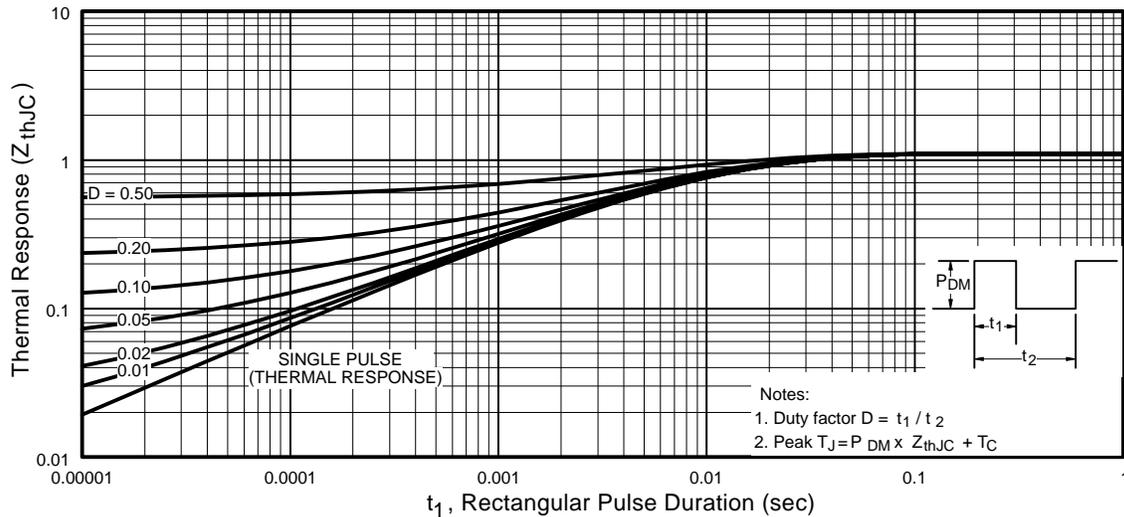
**Fig 9.** Maximum Drain Current Vs. Case Temperature



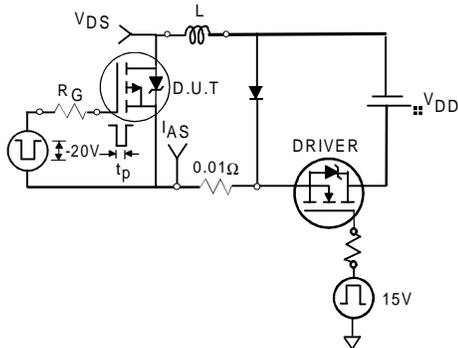
**Fig 10a.** Switching Time Test Circuit



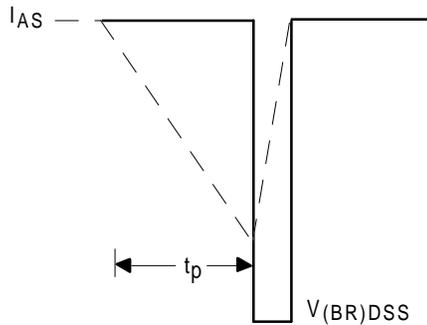
**Fig 10b.** Switching Time Waveforms



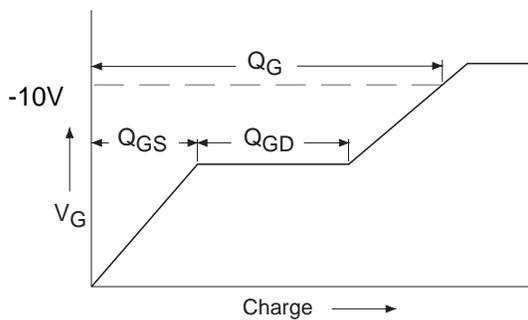
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



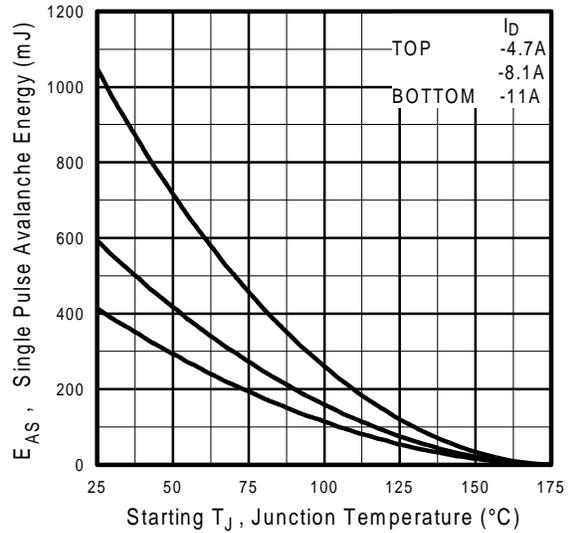
**Fig 12a.** Unclamped Inductive Test Circuit



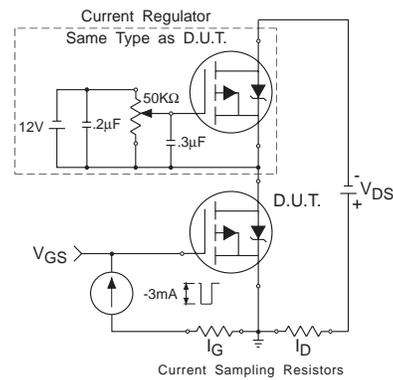
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 13a.** Basic Gate Charge Waveform

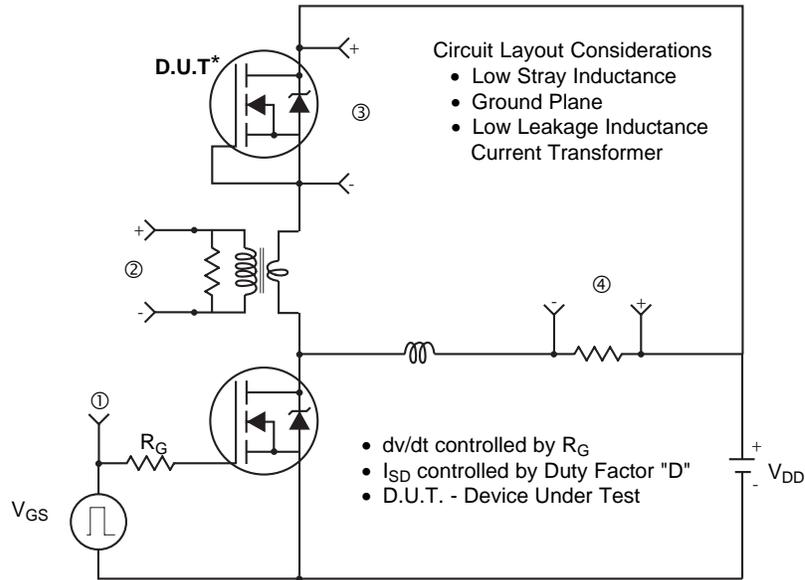


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

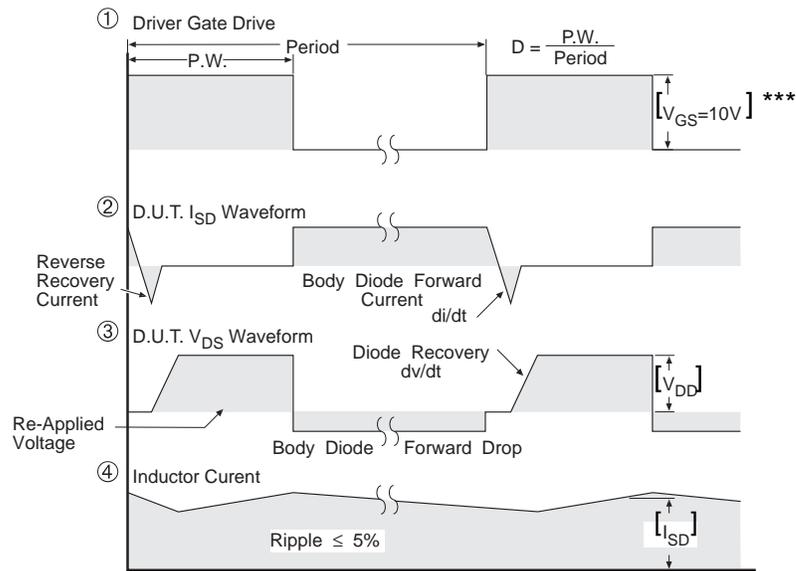


**Fig 13b.** Gate Charge Test Circuit

## 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



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