

IRFI9Z34N

HEXFET® Power MOSFET

- Advanced Process Technology
- Isolated Package
- High Voltage Isolation = 2.5KVRMS 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.

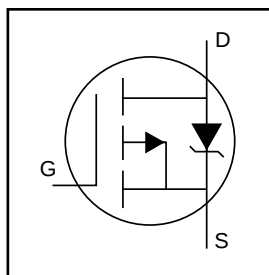
The TO-220 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica 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

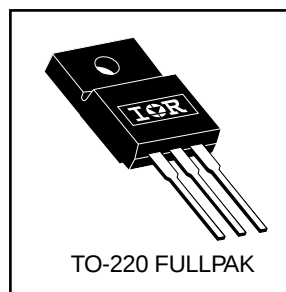
	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ -10V	-14	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ -10V	-10	
I_{DM}	Pulsed Drain Current ① ⑥	- 68	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	37	W
	Linear Derating Factor	0.24	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy② ⑥	180	mJ
I_{AR}	Avalanche Current① ⑥	-10	A
E_{AR}	Repetitive Avalanche Energy①	3.7	mJ
dv/dt	Peak Diode Recovery dv/dt ③ ⑥	-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	—	4.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient	—	65	

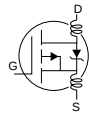


$V_{DSS} = -55V$
$R_{DS(on)} = 0.10\Omega$
$I_D = -14A$

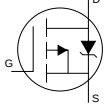


Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	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	—	-0.05	—	V/°C	Reference to 25°C , $I_D = -1mA$ ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.10	Ω	$V_{GS} = -10V, I_D = -7.8A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
g_{fs}	Forward Transconductance	4.2	—	—	S	$V_{DS} = 25V, I_D = -10A$ ⑥
I_{DSS}	Drain-to-Source Leakage Current	—	—	-25	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	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	—	35	nC	$I_D = -10A$
Q_{gs}	Gate-to-Source Charge	—	—	7.9		$V_{DS} = -44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	16		$V_{GS} = -10V$, See Fig. 6 and 13 ④⑥
$t_{d(on)}$	Turn-On Delay Time	—	13	—	ns	$V_{DD} = -28V$
t_r	Rise Time	—	55	—		$I_D = -10A$
$t_{d(off)}$	Turn-Off Delay Time	—	30	—		$R_G = 13\Omega$
t_f	Fall Time	—	41	—		$R_D = 2.6\Omega$, See Fig. 10 ④⑥
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	—	620	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	280	—		$V_{DS} = -25V$
C_{rss}	Reverse Transfer Capacitance	—	140	—		$f = 1.0MHz$, See Fig. 5⑥



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-14	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①⑥	—	—	-68		
V_{SD}	Diode Forward Voltage	—	—	-1.3	V	$T_J = 25^\circ\text{C}, I_S = -7.8A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	54	82	ns	$T_J = 25^\circ\text{C}, I_F = -10A$
Q_{rr}	Reverse Recovery Charge	—	110	160	nC	$di/dt = -100A/\mu s$ 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 $T_J = 25^\circ\text{C}$, $L = 3.6mH$
 $R_G = 25\Omega$, $I_{AS} = -10A$. (See Figure 12)

③ $I_{SD} \leq -10A$, $di/dt \leq -290A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ $t = 60s$, $f = 60Hz$

⑥ Uses IRF9Z34N data and test conditions

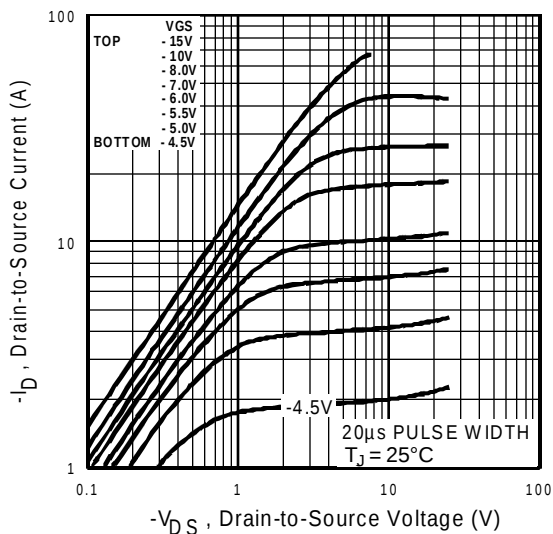


Fig 1. Typical Output Characteristics

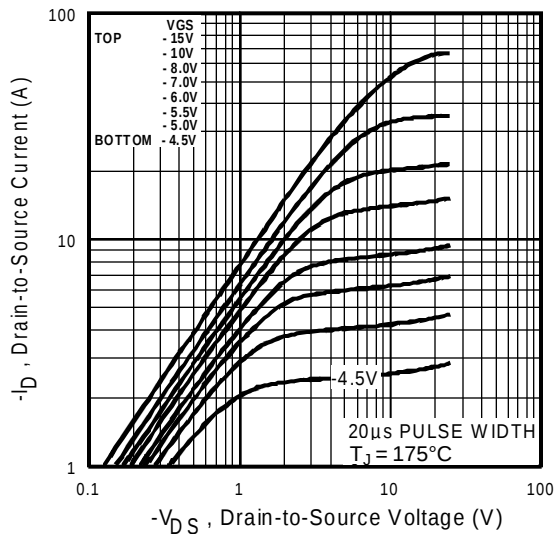


Fig 2. Typical Output Characteristics

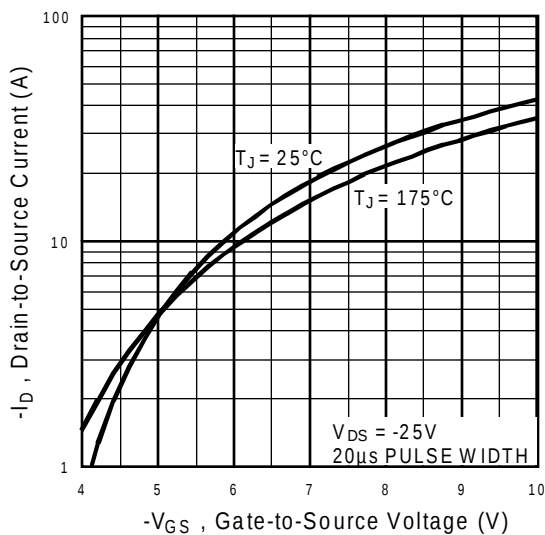


Fig 3. Typical Transfer Characteristics

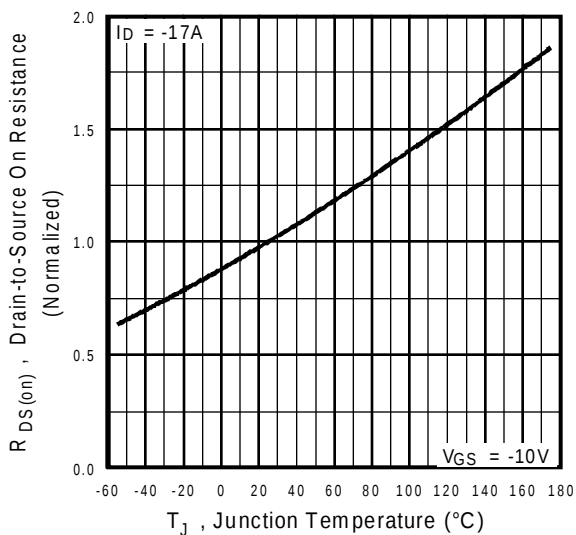


Fig 4. Normalized On-Resistance Vs. Temperature

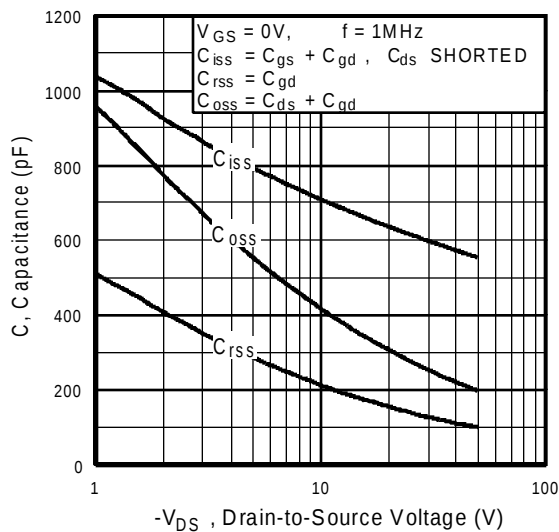


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

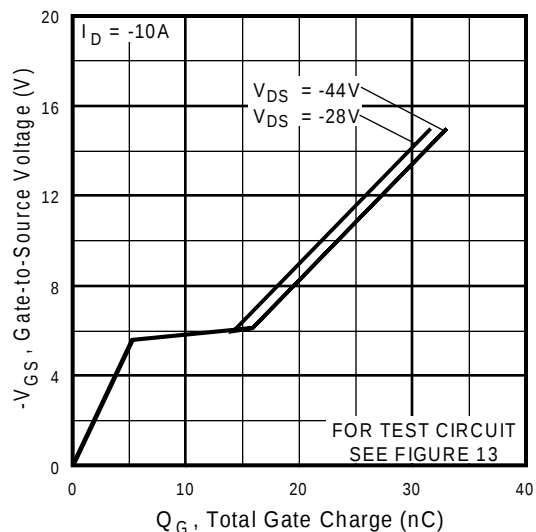


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

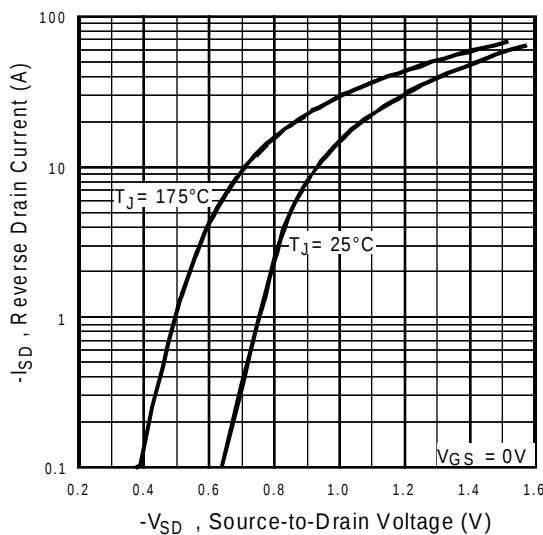


Fig 7. Typical Source-Drain Diode Forward Voltage

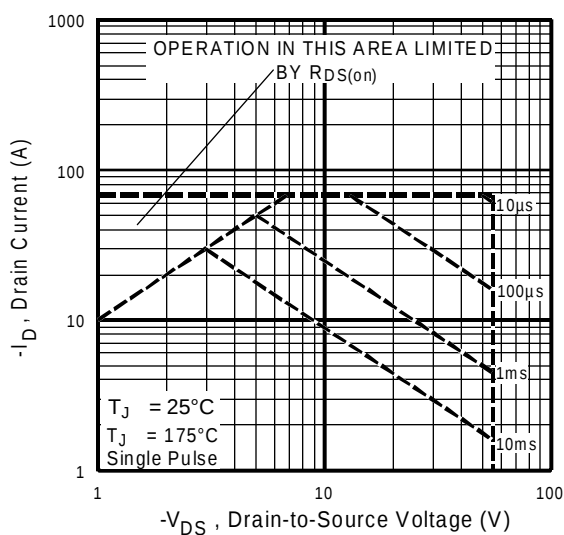


Fig 8. Maximum Safe Operating Area

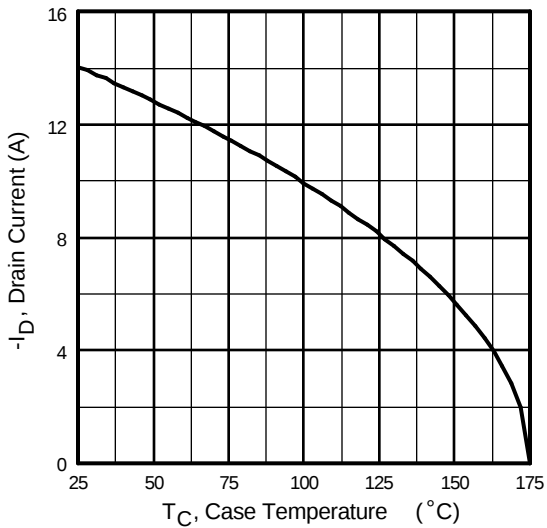


Fig 9. Maximum Drain Current Vs. Case Temperature

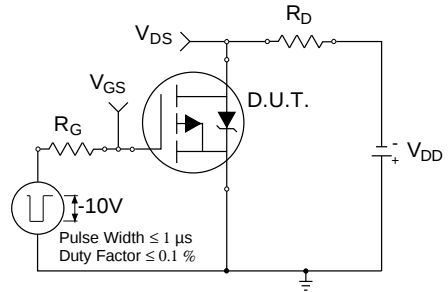


Fig 10a. Switching Time Test Circuit

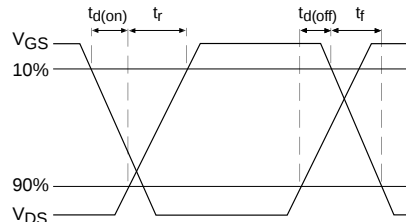


Fig 10b. Switching Time Waveforms

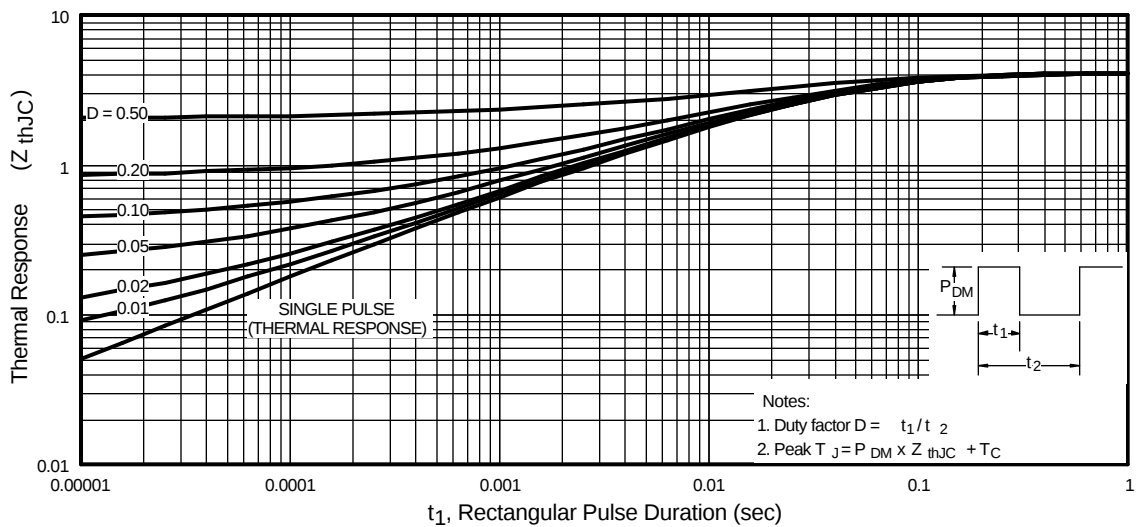
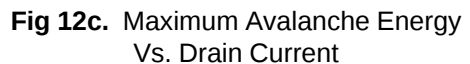
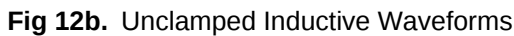
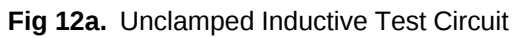


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



Circuit Layout Considerations

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance Current Transformer

Parameters:

- dv/dt controlled by R_G
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test

① Driver Gate Drive

P.W. Period

$D = \frac{P.W.}{Period}$

$V_{GS} = 10V$ ***

② D.U.T. I_{SD} Waveform

Reverse Recovery Current

Body Diode Forward Current

di/dt

③ D.U.T. V_{DS} Waveform

Diode Recovery dv/dt

V_{DD}

Re-Applied Voltage

Body Diode Forward Drop

④ Inductor Current

Ripple $\leq 5\%$

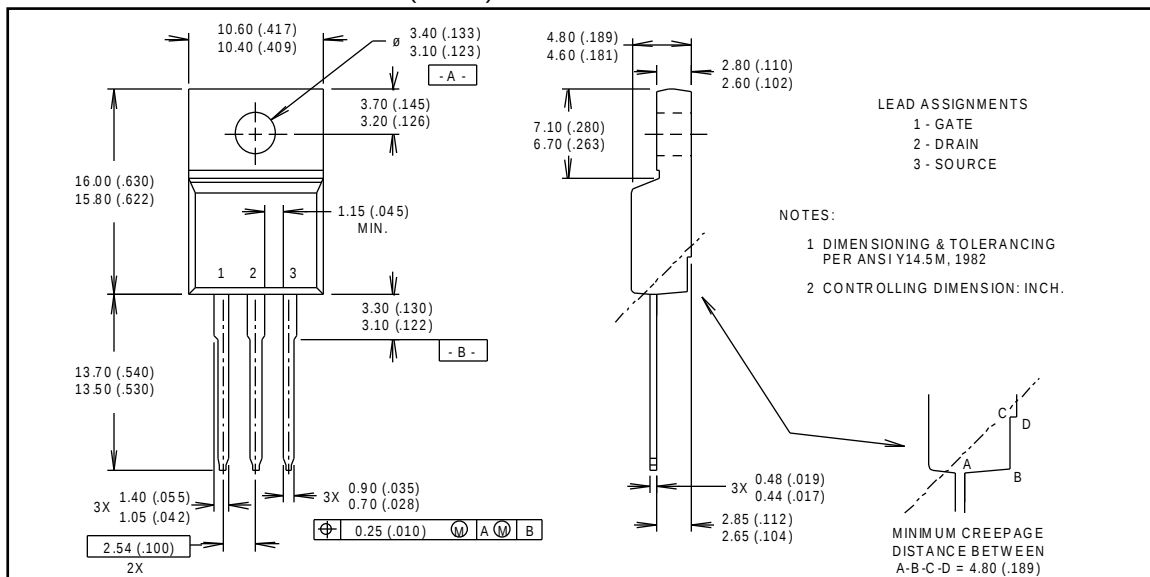
I_{SD}

Fig 14. For P-Channel HEXFETS

Package Outline

TO-220 Fullpak Outline

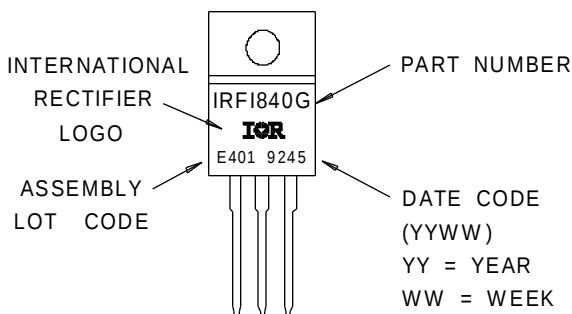
Dimensions are shown in millimeters (inches)



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: 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-Ki, Tokyo Japan 171 Tel: 81 3 3983 0086

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