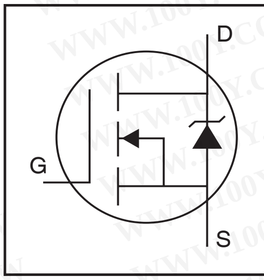
PD - 94873

International
IOR Rectifier

IRFI1310NPbF

HEXFET® Power MOSFET

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



V_{DSS} = 100V

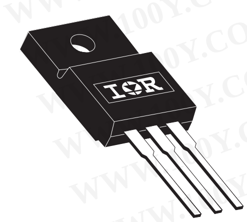
$R_{DS(on)}$ = 0.036Ω

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 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.



TO-220 FULLPAK

Absolute Maximum Ratings

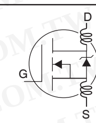
	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	24	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	17	
I_{DM}	Pulsed Drain Current ①⑥	140	
P_D @T_C = 25°C	Power Dissipation	56	W
	Linear Derating Factor	0.37	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑥	420	mJ
I_{AR}	Avalanche Current①⑥	22	A
E_{AR}	Repetitive Avalanche Energy①	5.6	mJ
d_v/d_t	Peak Diode Recovery dv/dt③⑥	5.0	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)	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

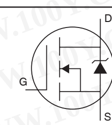
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	–––	2.7	°C/W
$R_{\theta JA}$	Junction-to-Ambient	–––	65	

12/9/03

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
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.11	–––	V/°C	Reference to 25°C, I_D = 1mA⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	–––	0.036	Ω	V_{GS} = 10V, I_D = 13A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	–––	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	14	–––	–––	S	V_{DS} = 25V, I_D = 22A⑥
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°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	–––	–––	120	nC	I_D = 22A
Q_{gs}	Gate-to-Source Charge	–––	–––	15		V_{DS} = 80V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	–––	58		V_{GS} = 10V, See Fig. 6 and 13 ④⑥
$t_{d(on)}$	Turn-On Delay Time	–––	11	–––	ns	V_{DD} = 50V
t_r	Rise Time	–––	56	–––		I_D = 22A
$t_{d(off)}$	Turn-Off Delay Time	–––	45	–––		R_G = 3.6Ω
t_f	Fall Time	–––	40	–––		R_D = 2.9Ω, 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	–––	1900	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	450	–––		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	–––	230	–––		ƒ = 1.0MHz, See Fig. 5⑥
C	Drain to Sink Capacitance	–––	12	–––		ƒ = 1.0MHz

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) ①⑥	–––	–––	140		
V_{SD}	Diode Forward Voltage	–––	–––	1.3	V	T_J = 25°C, I_S = 13A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	–––	180	270	ns	T_J = 25°C, I_F = 22A
Q_{rr}	Reverse RecoveryCharge	–––	1.2	1.8	µC	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 = 1.0mH R_G = 25Ω, I_{AS} = 22A. (See Figure 12)

③ I_{SD} ≤ 22A, di/dt ≤ 180A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C

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

⑤ t=60s, ƒ=60Hz

⑥ Uses IRF1310N data and test conditions

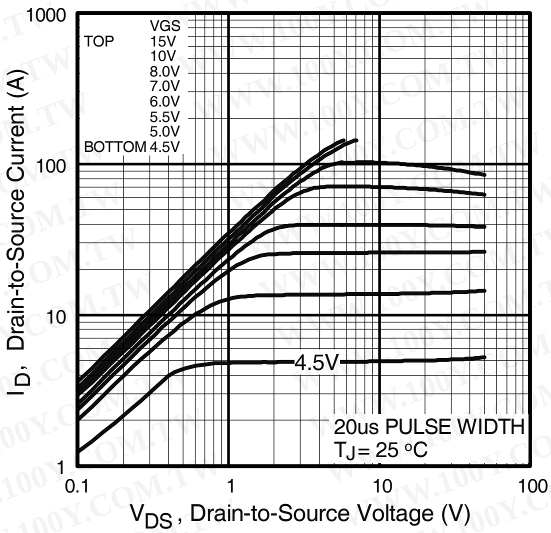


Fig 1. Typical Output Characteristics

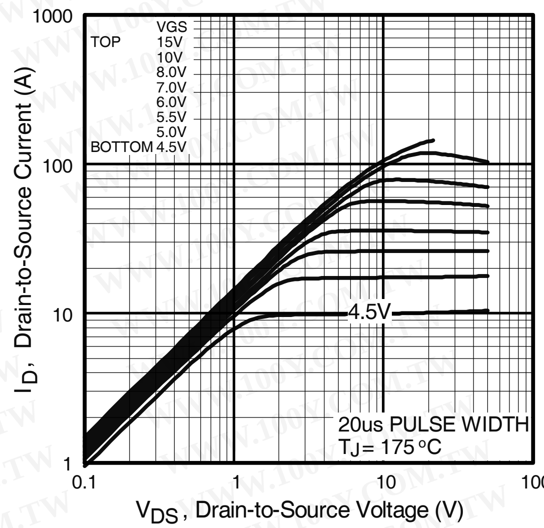


Fig 2. Typical Output Characteristics

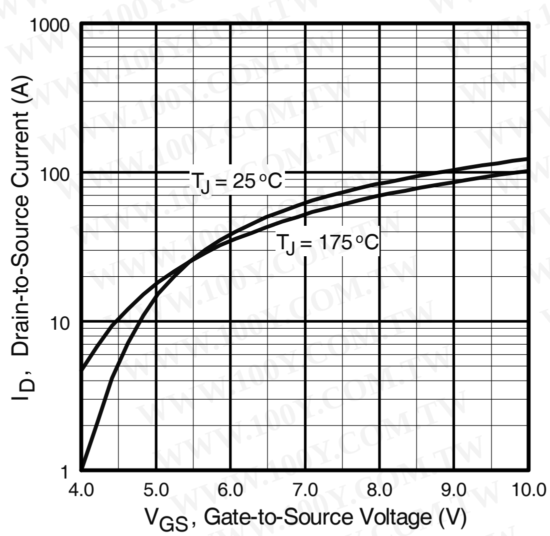


Fig 3. Typical Transfer Characteristics

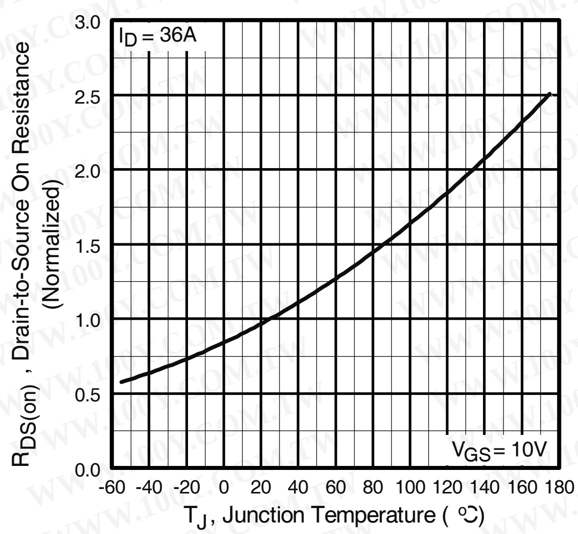


Fig 4. Normalized On-Resistance Vs. Temperature

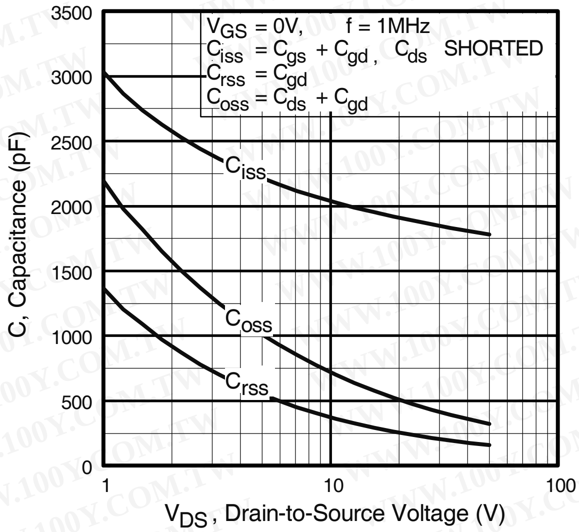


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

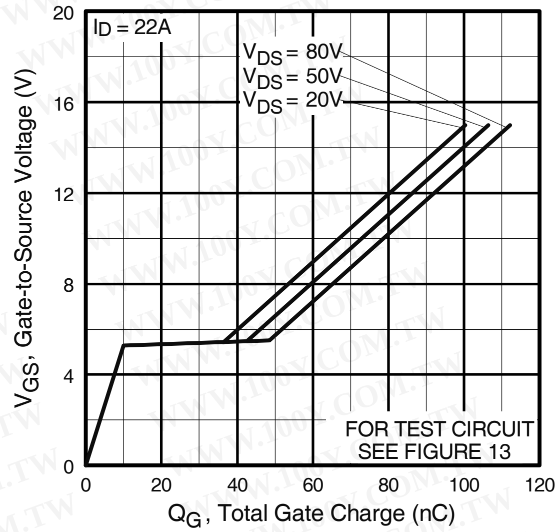


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

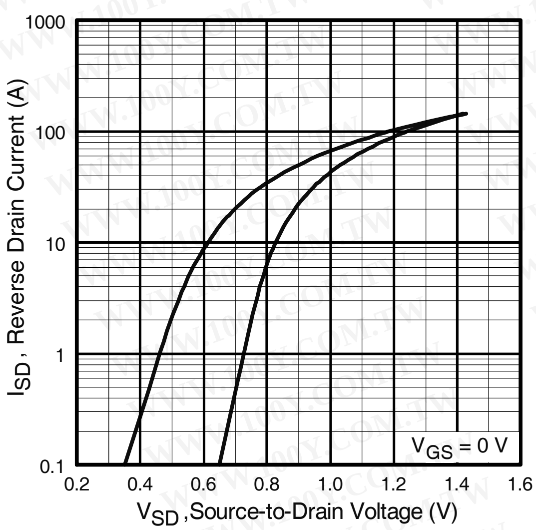


Fig 7. Typical Source-Drain Diode Forward Voltage

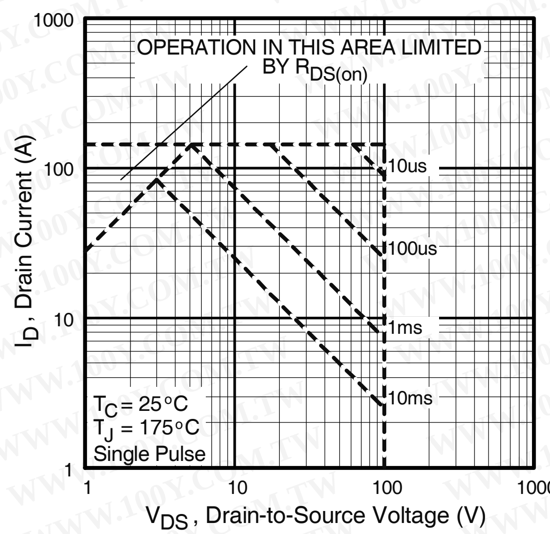


Fig 8. Maximum Safe Operating Area

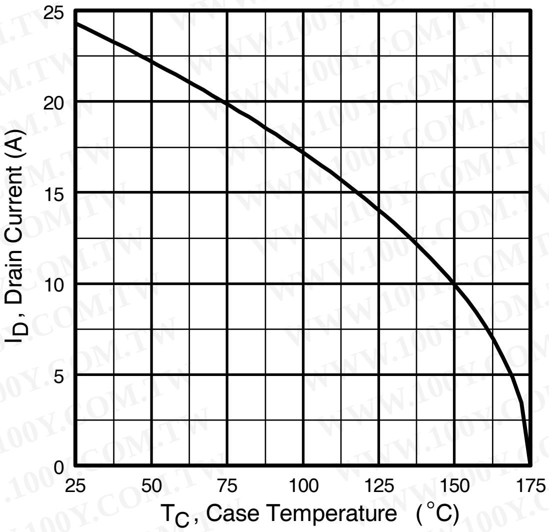


Fig 9. Maximum Drain Current Vs. Case Temperature

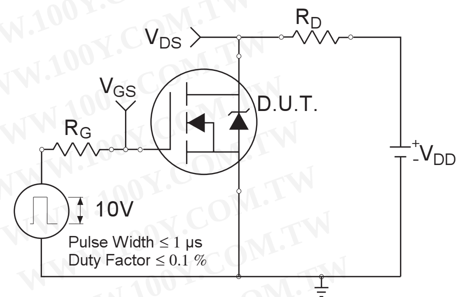


Fig 10a. Switching Time Test Circuit

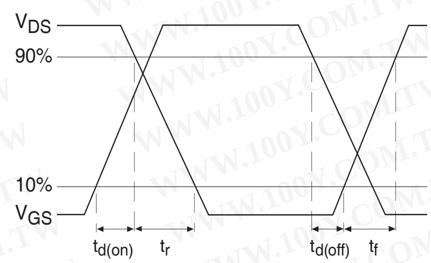


Fig 10b. Switching Time Waveforms

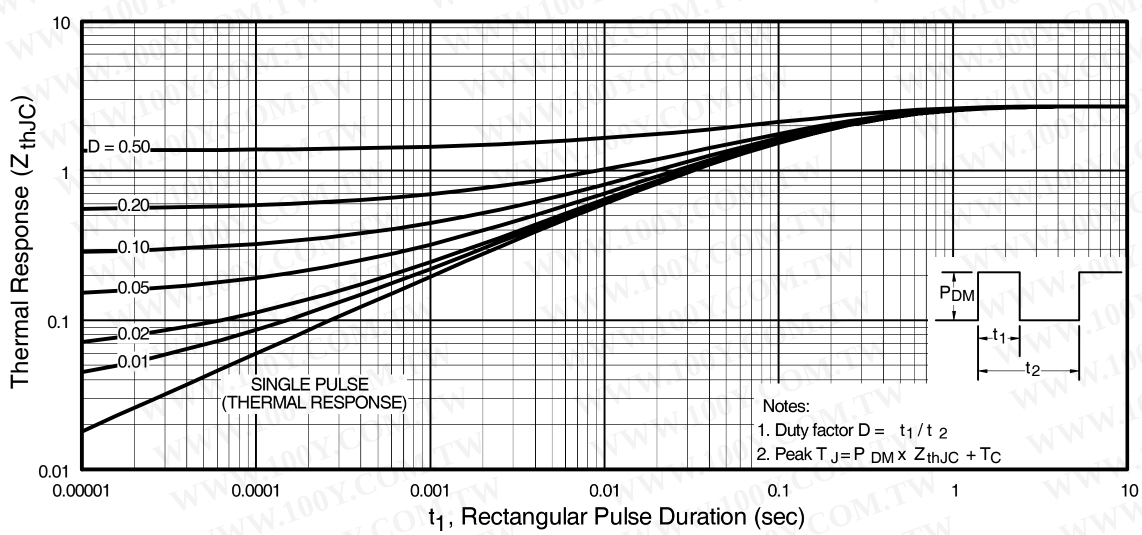


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

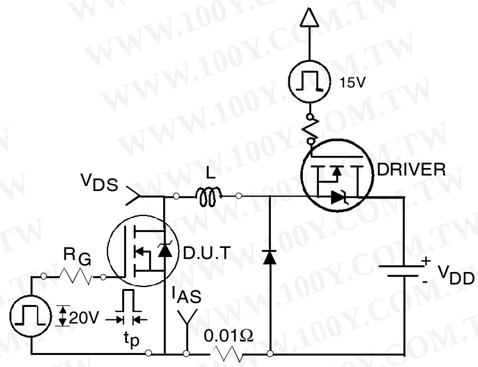


Fig 12a. Unclamped Inductive Test Circuit

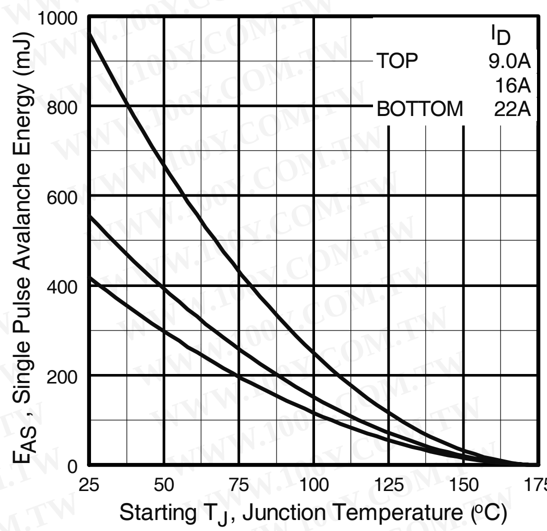


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

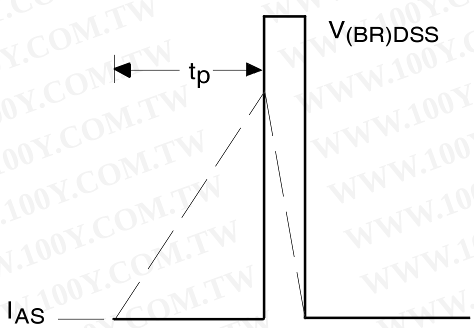


Fig 12b. Unclamped Inductive Waveforms

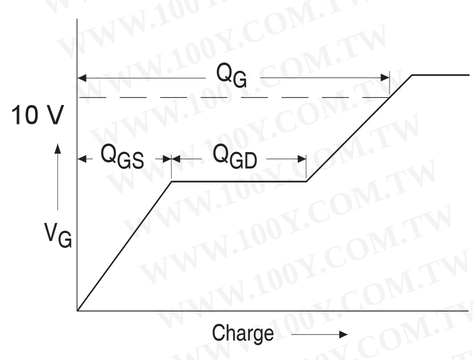


Fig 13a. Basic Gate Charge Waveform

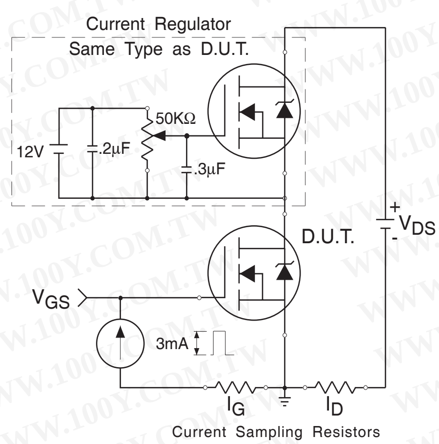
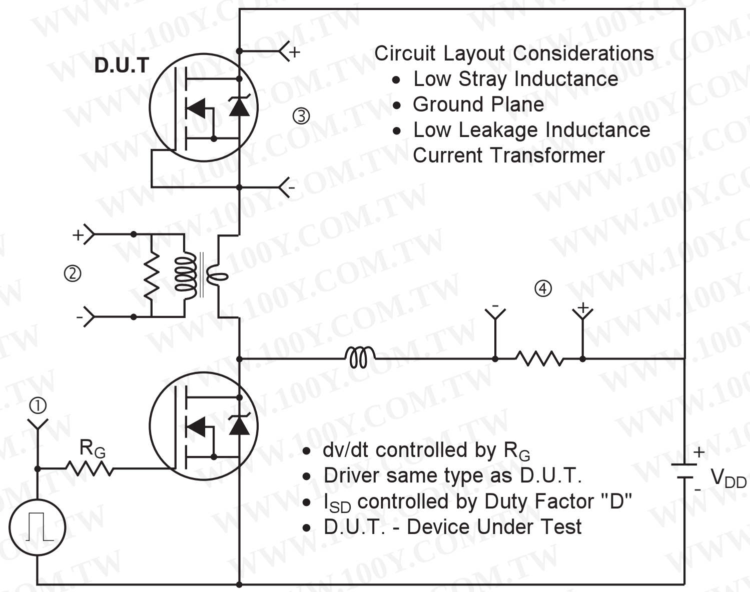
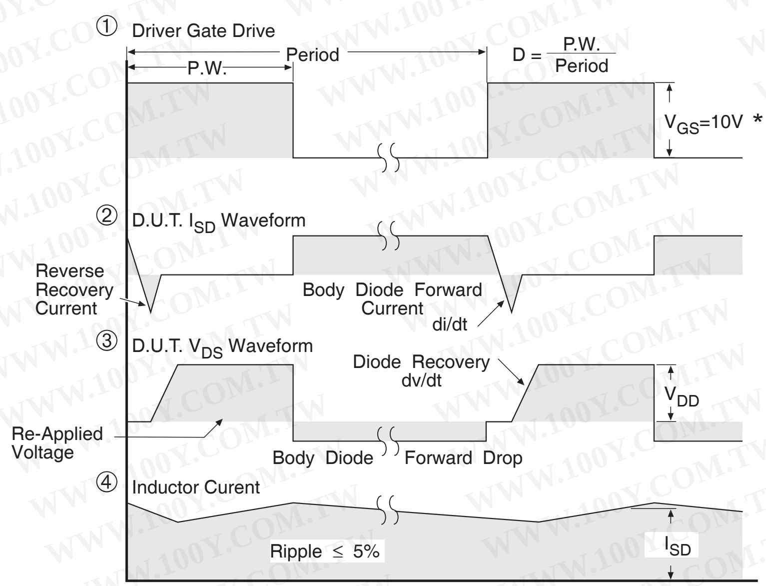


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

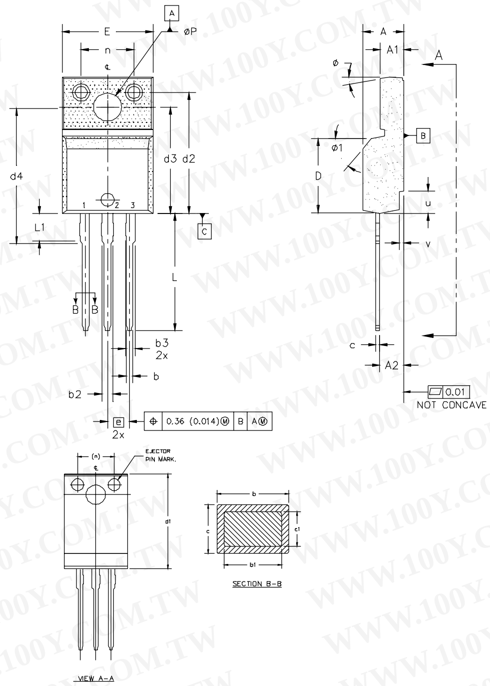




* V_{GS} = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFETS

TO-220 Full-Pak Package Outline



NOTES:
1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.0 DIMENSION b1 APPLY TO BASE METAL ONLY.
6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
7.0 CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	0.180	0.190	
A1	2.57	2.83	0.101	0.114	
A2	2.51	2.85	0.099	0.112	
b	0.622	0.89	0.024	0.035	
b1	0.622	0.838	0.024	0.033	5
b2	1.229	1.400	0.048	0.055	
b3	1.229	1.400	0.048	0.055	
c	0.440	0.629	0.017	0.025	
c1	0.440	0.584	0.017	0.023	
D	8.65	9.80	0.341	0.386	4
d1	15.80	16.12	0.622	0.635	
d2	13.97	14.22	0.550	0.560	
d3	12.30	12.92	0.484	0.509	
d4	8.64	9.91	0.340	0.390	
E	10.36	10.63	0.408	0.419	4
e	2.54 BSC		0.100 BSC		
L	13.20	13.73	0.520	0.541	
L1	3.10	3.50	0.122	0.138	3
n	6.05	6.15	0.238	0.242	
øP	3.05	3.45	0.120	0.136	
u	2.40	2.50	0.094	0.098	6
v	0.40	0.50	0.016	0.020	6
ø	3°	7°	3°	7°	
ø1		45°		45°	

LEAD ASSIGNMENTS

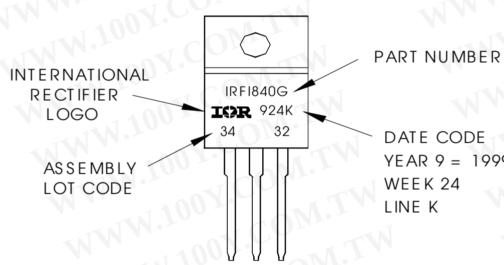
HEXFET
1.- GATE
2.- DRAIN
3.- SOURCE

IGBTs, CoPACK
1.- GATE
2.- COLLECTOR
3.- EMITTER

TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"

Note: "P" in assembly line position indicates "Lead-Free"



Data and specifications subject to change without notice.

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