

International **IR** Rectifier

PD - 91280D

IRF4905

HEXFET® Power MOSFET

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

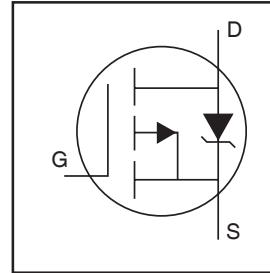
Description

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.

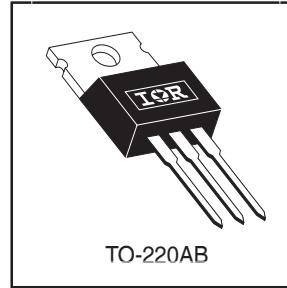
The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ -10V	-74	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ -10V	-52	
I _{DM}	Pulsed Drain Current ①	-260	
P _D @ T _C = 25°C	Power Dissipation	200	W
	Linear Derating Factor	1.3	W/C
V _{GS}	Gate-to-Source Voltage	± 20	V
E _{AS}	Single Pulse Avalanche Energy ②	930	mJ
I _{AR}	Avalanche Current ①	-38	A
E _{AR}	Repetitive Avalanche Energy ①	20	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-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	300 (1.6mm from case)	
		10 lbf·in (1.1N·m)	



V_{DSS} = -55V
R_{DS(on)} = 0.02Ω
I_D = -74A



Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case	---	0.75	°C/W
R _{θCS}	Case-to-Sink, Flat, Greased Surface	0.50	---	
R _{θJA}	Junction-to-Ambient	---	62	

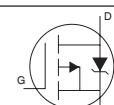
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Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	-55	---	---	V	$V_{GS} = 0V, I_D = -250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}/\Delta T_J}$	Breakdown Voltage Temp. Coefficient	---	-0.05	---	V°C	Reference to $25^\circ\text{C}, I_D = -1\text{mA}$
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	---	---	0.02	Ω	$V_{GS} = -10V, I_D = -38A$ ④
$V_{GS(\text{th})}$	Gate Threshold Voltage	-2.0	---	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
g_{fs}	Forward Transconductance	21	---	---	S	$V_{DS} = -25V, I_D = -38A$
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	---	---	180	nC	$I_D = -38A$
Q_{gs}	Gate-to-Source Charge	---	---	32		$V_{DS} = -44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	---	---	86		$V_{GS} = -10V$, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	---	18	---	ns	$V_{DD} = -28V$
t_r	Rise Time	---	99	---		$I_D = -38A$
$t_{d(off)}$	Turn-Off Delay Time	---	61	---		$R_G = 2.5\Omega$
t_f	Fall Time	---	96	---		$R_D = 0.72\Omega$, See Fig. 10 ④
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	---	3400	---	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	---	1400	---		$V_{DS} = -25V$
C_{rss}	Reverse Transfer Capacitance	---	640	---		$f = 1.0\text{MHz}$, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	---	---	-74	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	---	---	-260		
V_{SD}	Diode Forward Voltage	---	---	-1.6	V	$T_J = 25^\circ\text{C}, I_S = -38A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	---	89	130	ns	$T_J = 25^\circ\text{C}, I_F = -38A$
Q_{rr}	Reverse Recovery Charge	---	230	350	nC	$di/dt = -100\text{A}/\mu\text{s}$ ④
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 $T_J = 25^\circ\text{C}$, $L = 1.3\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = -38A$. (See Figure 12)
- ③ $I_{SD} \leq -38A$, $di/dt \leq -270\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(\text{BR})\text{DSS}}$,
 $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.

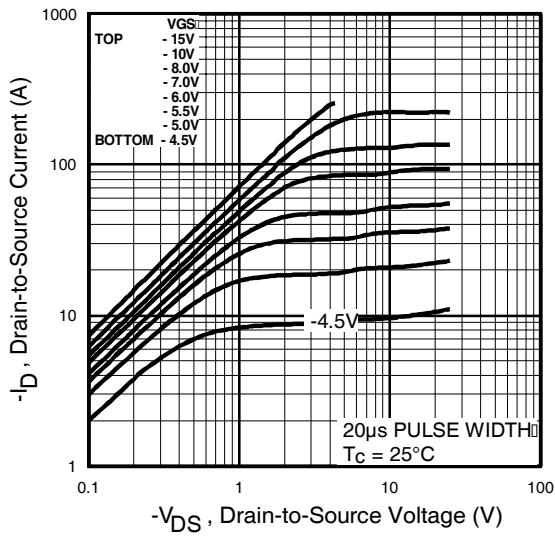


Fig 1. Typical Output Characteristics

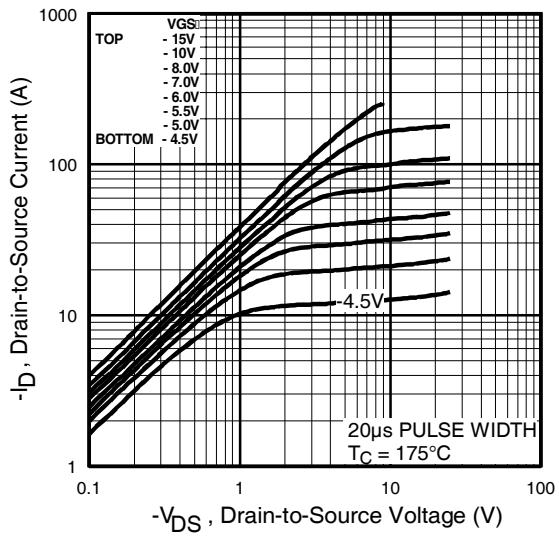


Fig 2. Typical Output Characteristics

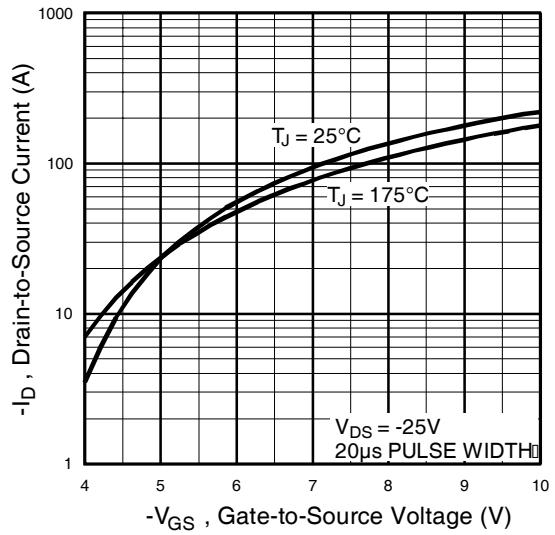


Fig 3. Typical Transfer Characteristics

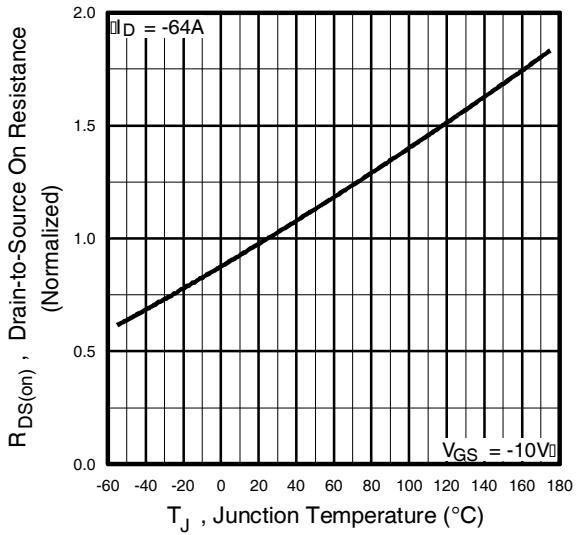


Fig 4. Normalized On-Resistance
Vs. Temperature

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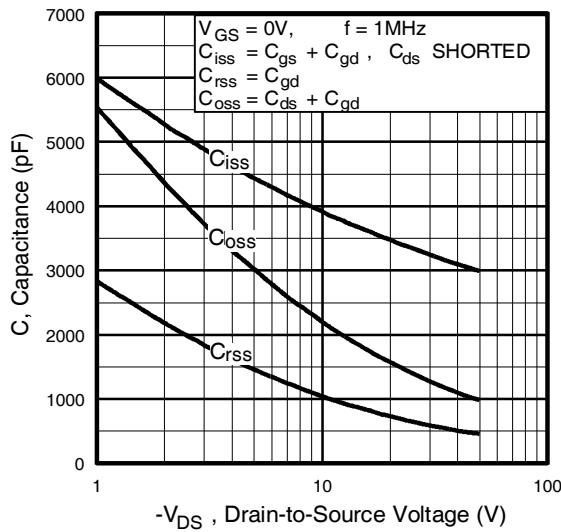


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

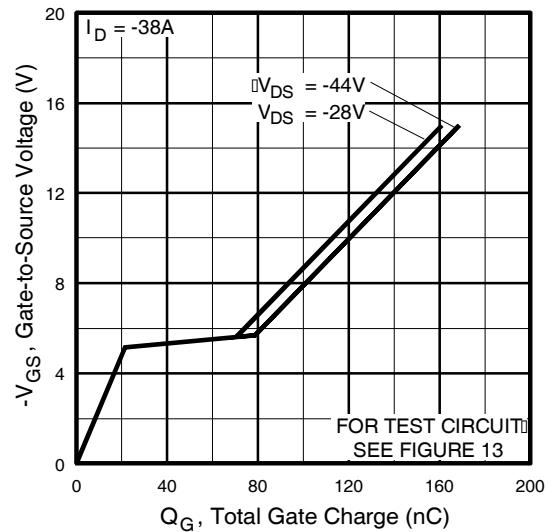


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

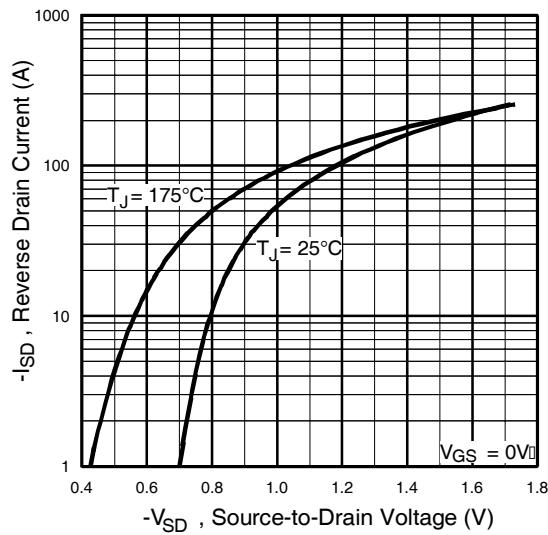


Fig 7. Typical Source-Drain Diode
Forward Voltage

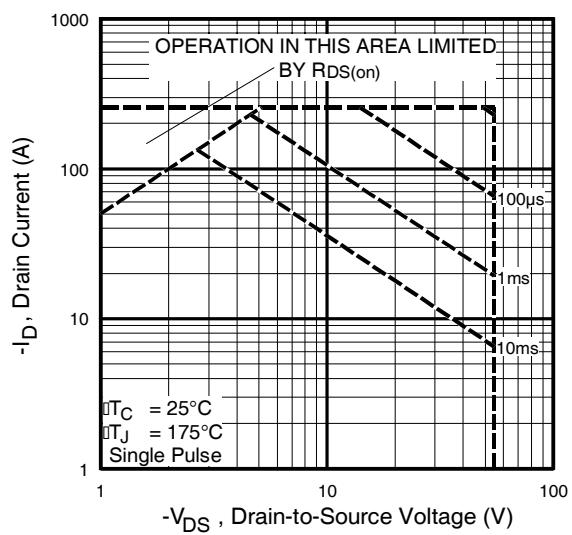


Fig 8. Maximum Safe Operating Area

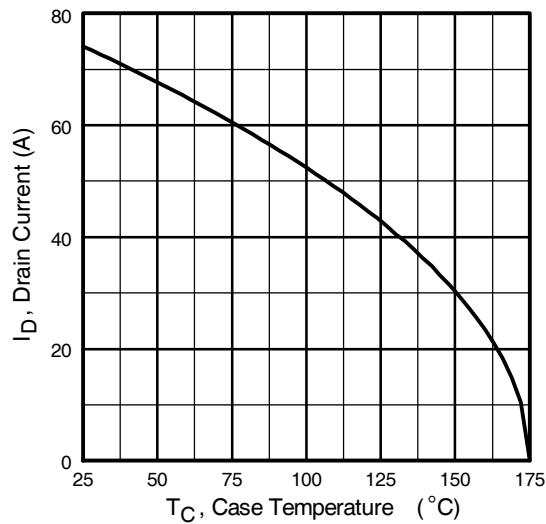


Fig 9. Maximum Drain Current Vs.
Case Temperature

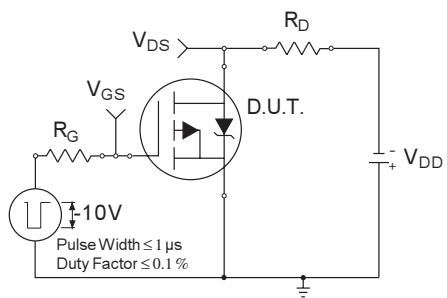


Fig 10a. Switching Time Test Circuit

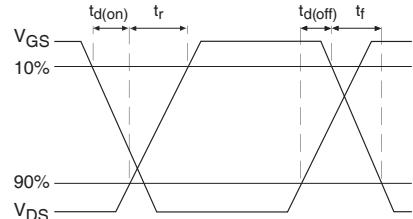


Fig 10b. Switching Time Waveforms

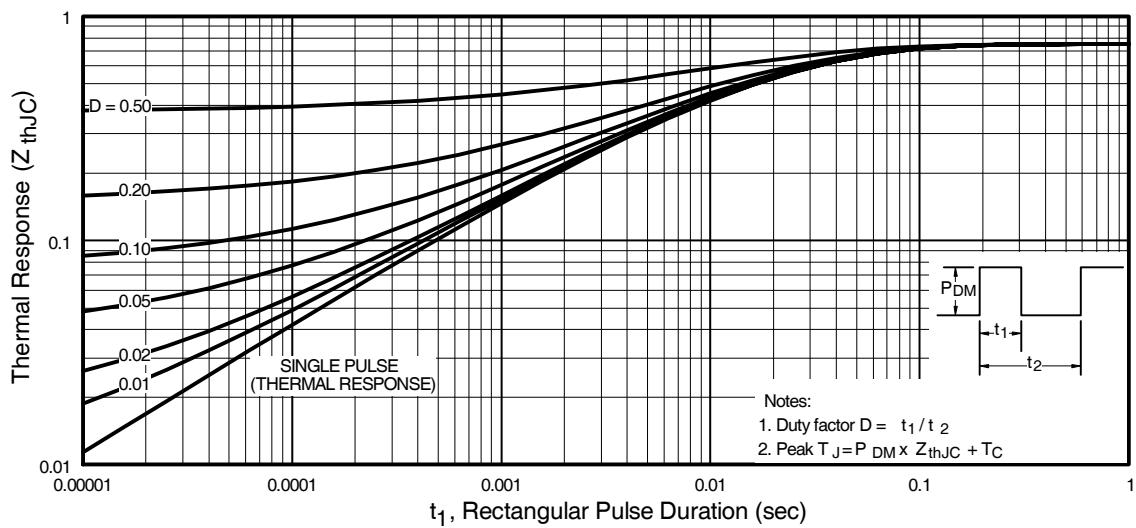


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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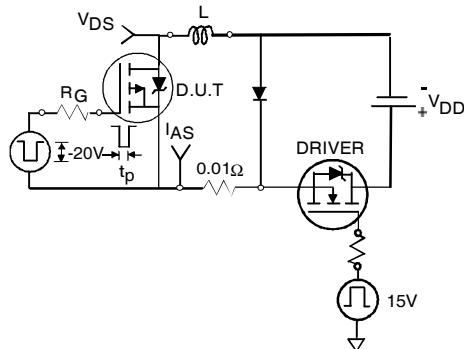


Fig 12a. Unclamped Inductive Test Circuit

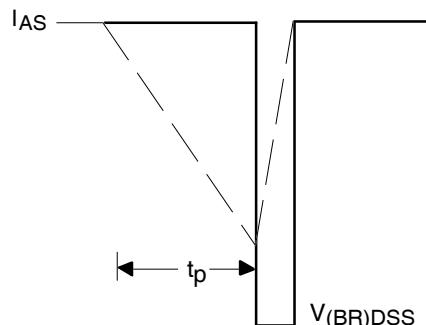


Fig 12b. Unclamped Inductive Waveforms

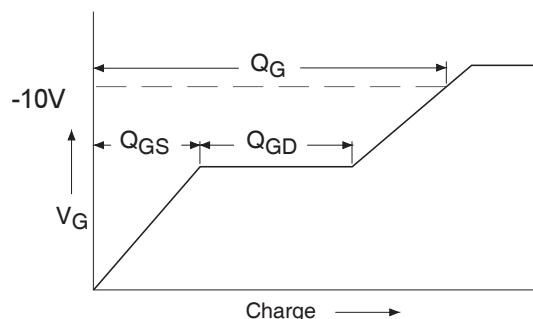


Fig 13a. Basic Gate Charge Waveform

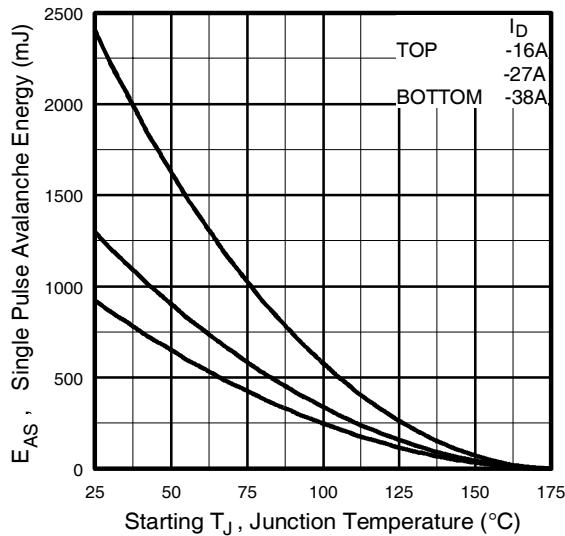


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

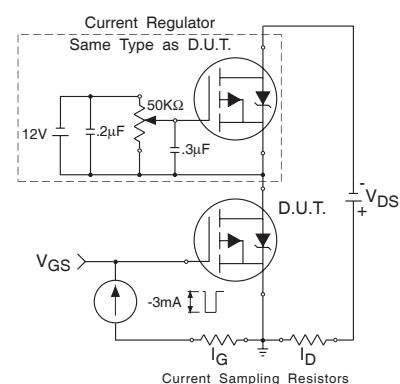
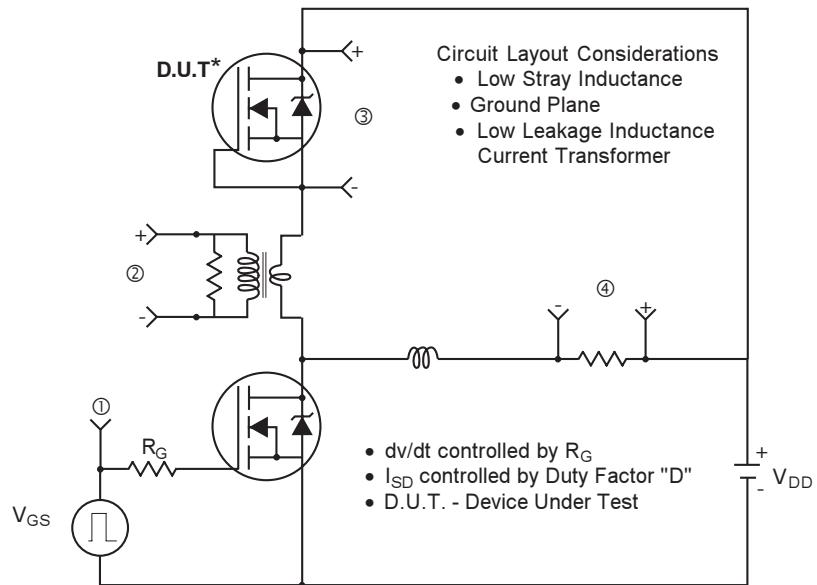
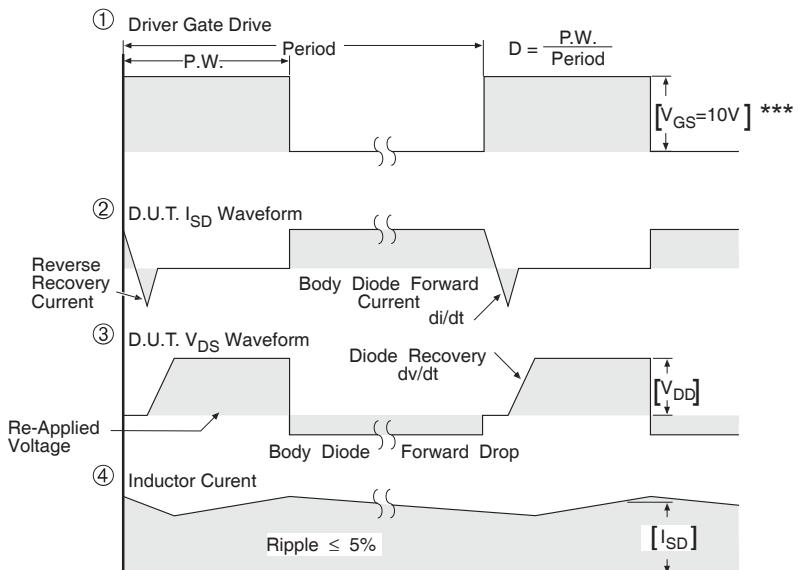


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity of D.U.T for P-Channel



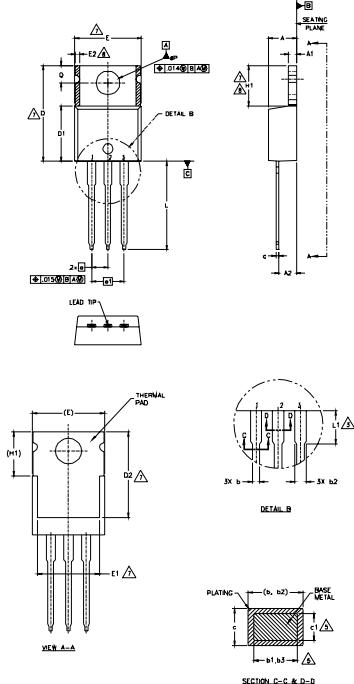
*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 14. For P-Channel HEXFETS

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TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DIMENSIONS b1, b3 & c1 APPLY TO BASE METAL ONLY.
- CONTROLLING DIMENSION : INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E, H1, D2 & E1
- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRRREGULARITIES ARE ALLOWED.
- OUTLINE CONFORMS TO JEDEC TO-220 EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	3.56	4.83	.140	.190		
A1	0.51	1.40	.020	.055		
A2	2.03	2.92	.080	.115		
b	0.38	1.01	.015	.040		
b1	0.38	0.97	.015	.038	5	
b2	1.14	1.78	.045	.070		
b3	1.14	1.73	.045	.068	5	
c	0.36	0.61	.014	.024		
c1	0.36	0.56	.014	.022	5	
D	14.22	16.51	.560	.650	4	
D1	8.38	9.02	.330	.355		
D2	11.68	12.88	.460	.507	7	
E	9.65	10.67	.380	.420	4,7	
E1	6.86	8.89	.270	.350	7	
E2	-	0.76	-	.030	8	
e	2.54 BSC 5.08 BSC		.100 BSC .200 BSC			
e1					7,8	
H1	5.84	6.86	.230	.270		
L	12.70	14.73	.500	.580		
L1	-	6.35	-	.250	3	
gP	3.54	4.08	.139	.161		
Q	2.54	3.42	.100	.135		

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LEAD ASSIGNMENTS

HEXFET
1 - GATE
2 - DRAIN
3 - SOURCE

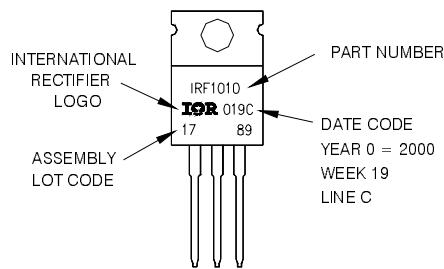
IRFET, Cap Pack
1 - GATE
2 - COLLECTOR
3 - Emitter

DIODES
1 - ANODE
2 - CATHODE
3 - ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE 'C'

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



TO-220AB packages are not recommended for Surface Mount Application.

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

Data and specifications subject to change without notice.
Qualification Standards can be found on IR's Web site.

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