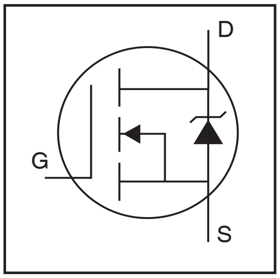
PD - 94954D

International
IOR Rectifier

IRF3710PbF

HEXFET® Power MOSFET

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



V_{DSS} = 100V

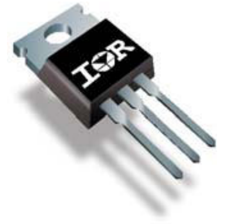
$R_{DS(on)}$ = 23mΩ

I_D = 57A

Description

Advanced HEXFET® Power MOSFETs 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.


TO-220AB

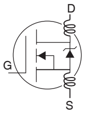
Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	57	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	40	
I_{DM}	Pulsed Drain Current ①	180	
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
I_{AR}	Avalanche Current①	28	A
E_{AR}	Repetitive Avalanche Energy①	20	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.8	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 srew	10 lbf•in (1.1N•m)	

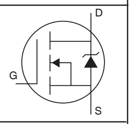
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.75	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	——	
$R_{\theta JA}$	Junction-to-Ambient	——	62	

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	$V_{GS} = 0V$, $I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.13	–––	V/°C	Reference to 25°C, $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	–––	23	mΩ	$V_{GS} = 10V$, $I_D = 28A$ 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	32	–––	–––	S	$V_{DS} = 25V$, $I_D = 28A$④
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	–––	–––	130	nC	$I_D = 28A$
Q_{gs}	Gate-to-Source Charge	–––	–––	26		$V_{DS} = 80V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	–––	43		$V_{GS} = 10V$, See Fig. 6 and 13
$t_{d(on)}$	Turn-On Delay Time	–––	12	–––	ns	$V_{DD} = 50V$
t_r	Rise Time	–––	58	–––		$I_D = 28A$
$t_{d(off)}$	Turn-Off Delay Time	–––	45	–––		$R_G = 2.5\Omega$
t_f	Fall Time	–––	47	–––		$V_{GS} = 10V$, 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	–––	3130	–––	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	–––	410	–––		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	–––	72	–––		ƒ = 1.0MHz, See Fig. 5
E_{AS}	Single Pulse Avalanche Energy②	–––	1060⑤	280⑥	mJ	$I_{AS} = 28A$, $L = 0.70mH$

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	–––	–––	57	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)①	–––	–––	230		
V_{SD}	Diode Forward Voltage	–––	–––	1.2	V	$T_J = 25°C$, $I_S = 28A$, $V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	–––	140	220	ns	$T_J = 25°C$, $I_F = 28A$
Q_{rr}	Reverse Recovery Charge	–––	670	1010	nC	di/dt = 100A/μs 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 $T_J = 25°C$, $L = 0.70mH$ $R_G = 25\Omega$, $I_{AS} = 28A$, V_{GS}=10V (See Figure 12)

③ $I_{SD} \leq 28A$, di/dt ≤ 380A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175°C$

④ Pulse width ≤ 400μs; duty cycle ≤ 2%.

⑤ This is a typical value at device destruction and represents operation outside rated limits.

⑥ This is a calculated value limited to $T_J = 175°C$.

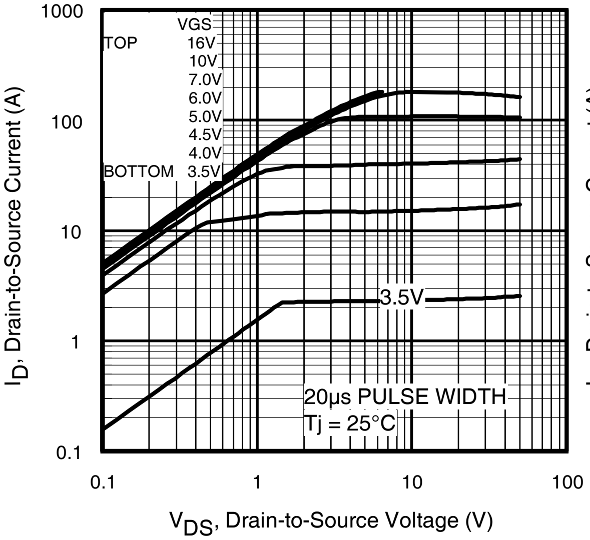


Fig 1. Typical Output Characteristics

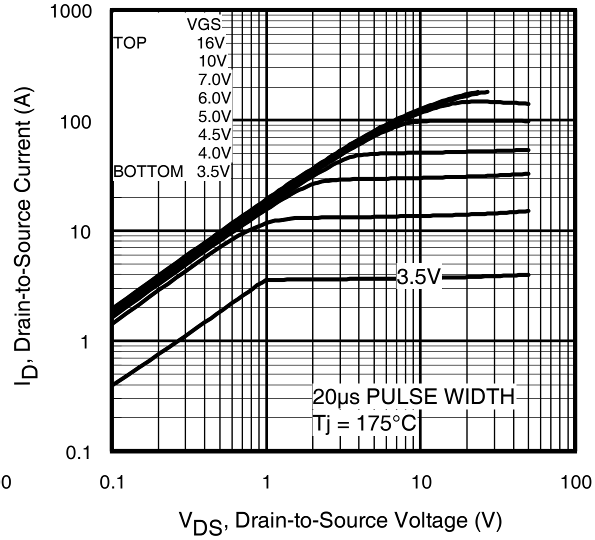


Fig 2. Typical Output Characteristics

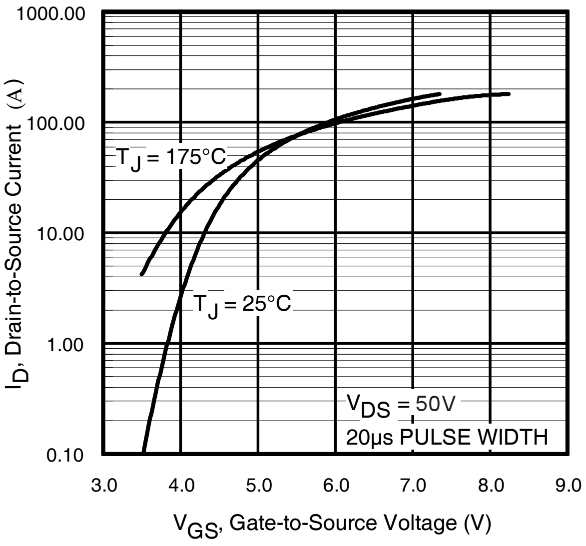


Fig 3. Typical Transfer Characteristics

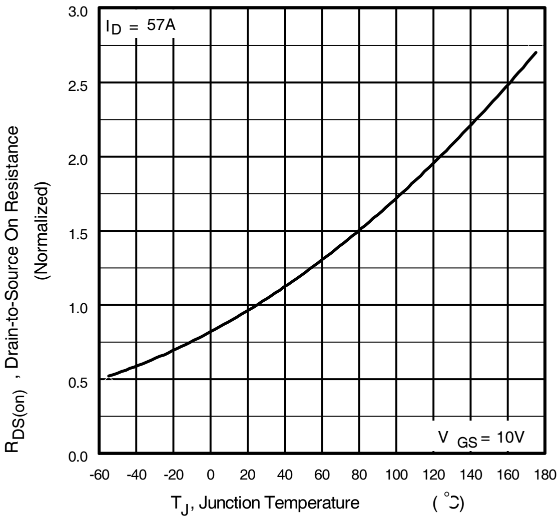


Fig 4. Normalized On-Resistance
Vs. Temperature

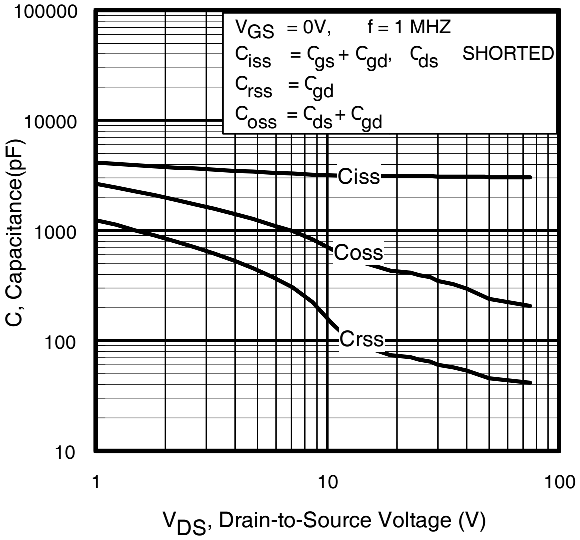


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

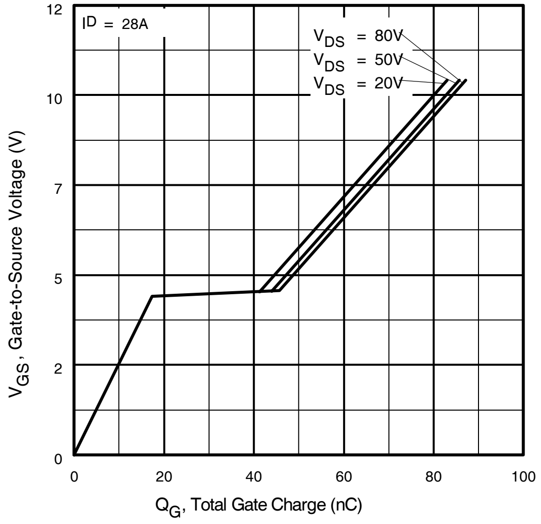


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

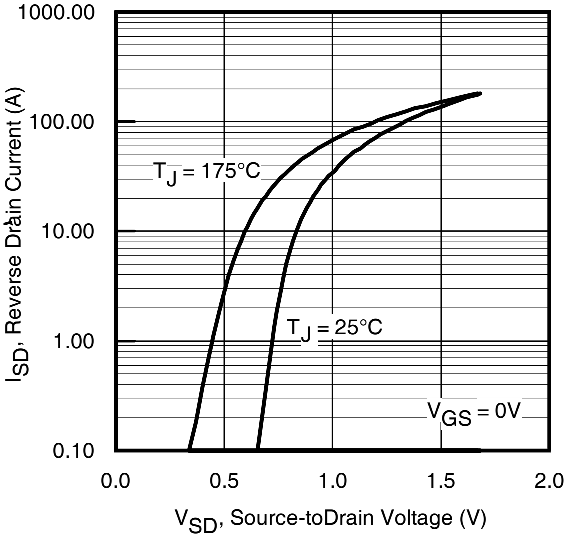


Fig 7. Typical Source-Drain Diode Forward Voltage

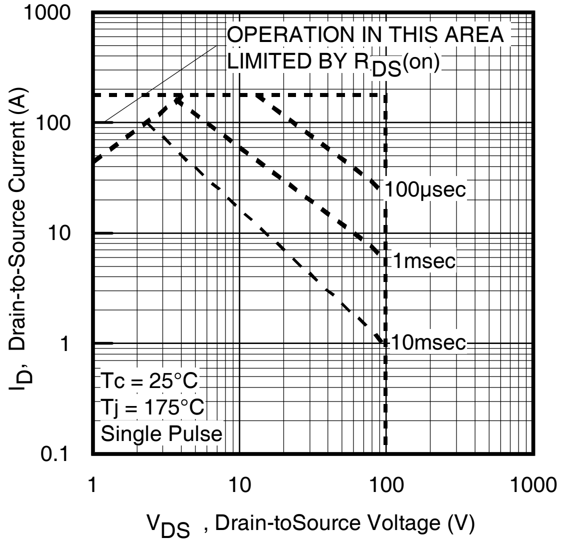


Fig 8. Maximum Safe Operating Area

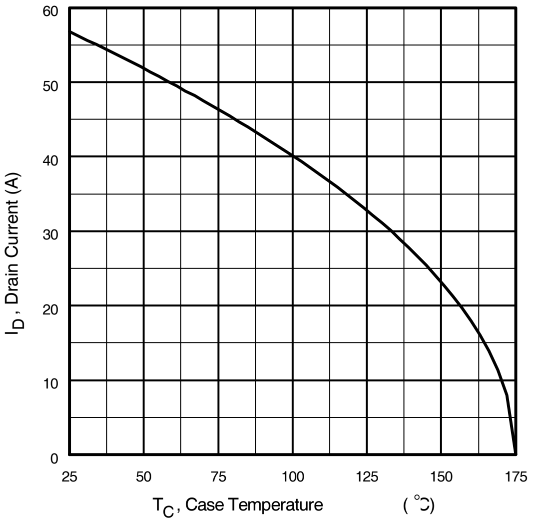


Fig 9. Maximum Drain Current Vs. Case Temperature

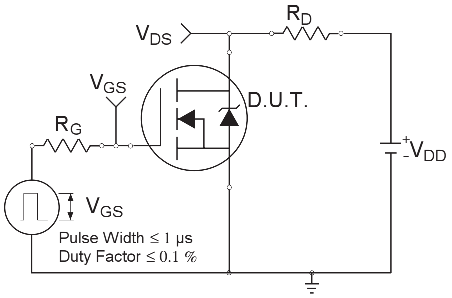


Fig 10a. Switching Time Test Circuit

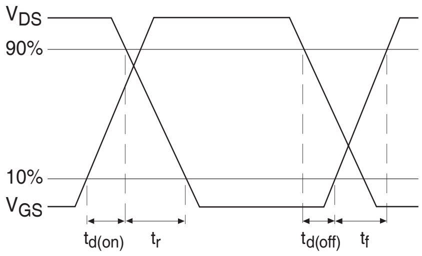


Fig 10b. Switching Time Waveforms

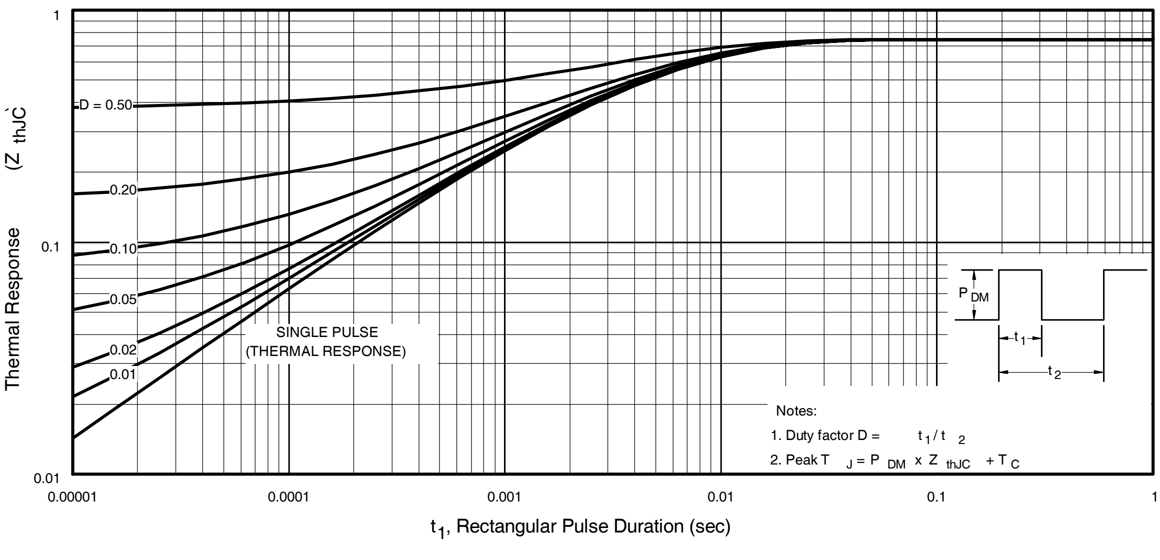


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

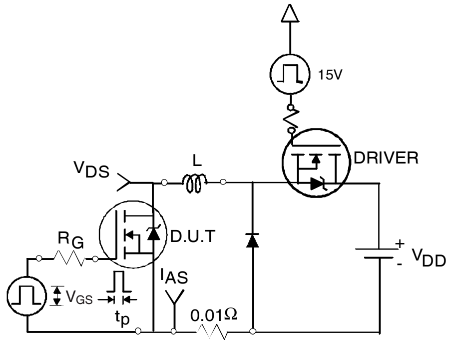


Fig 12a. Unclamped Inductive Test Circuit

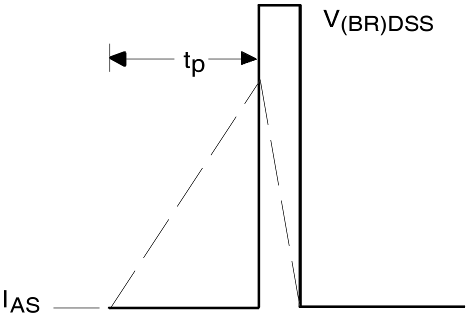


Fig 12b. Unclamped Inductive Waveforms

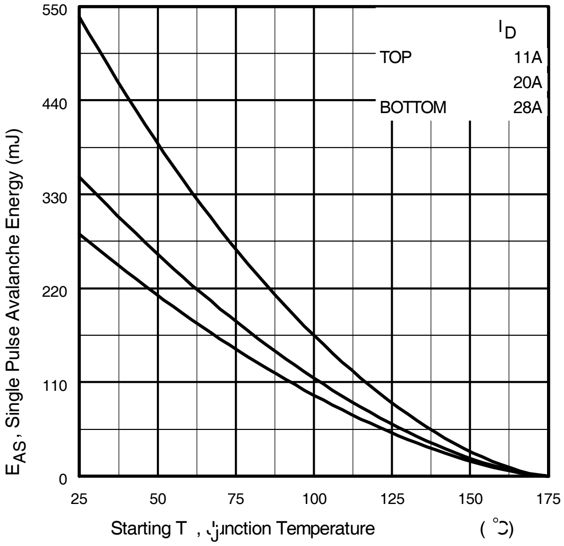


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

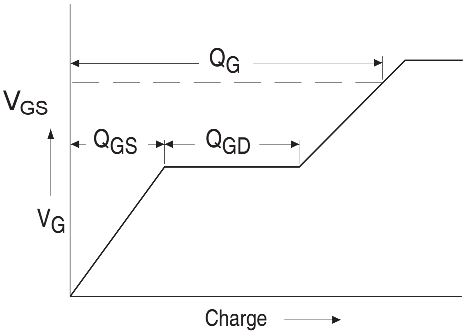


Fig 13a. Basic Gate Charge Waveform

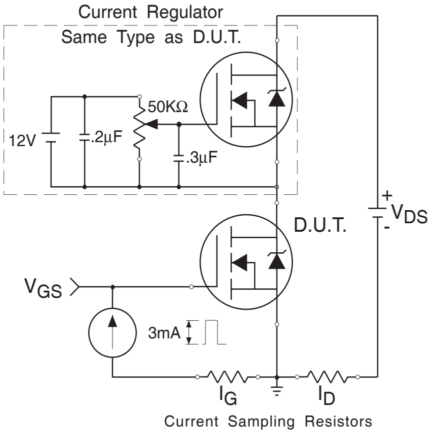
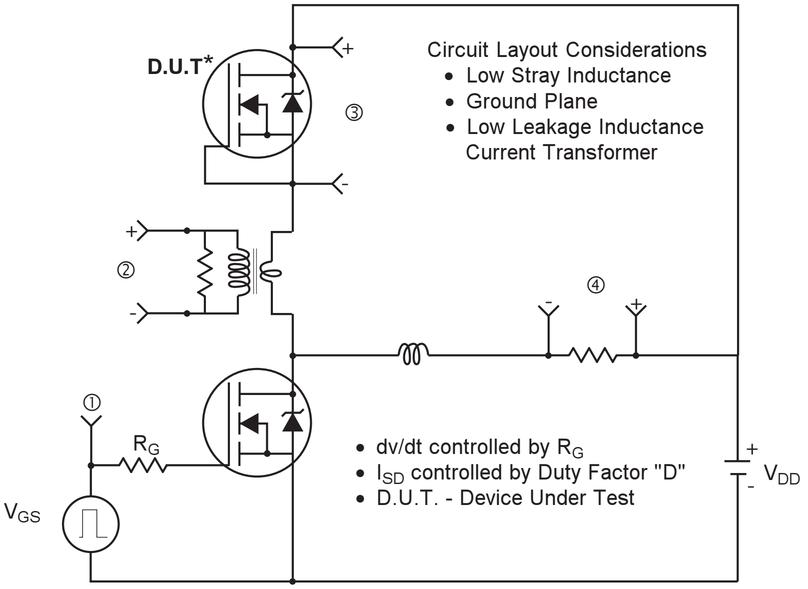
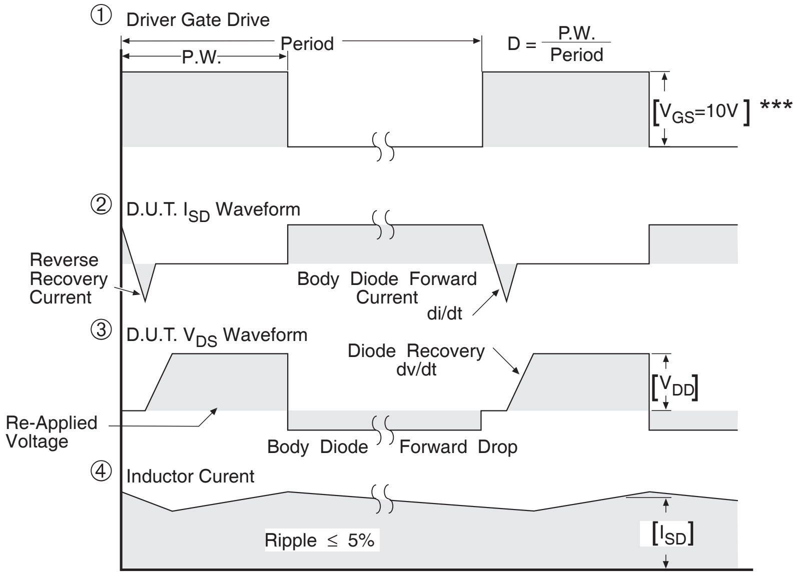


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

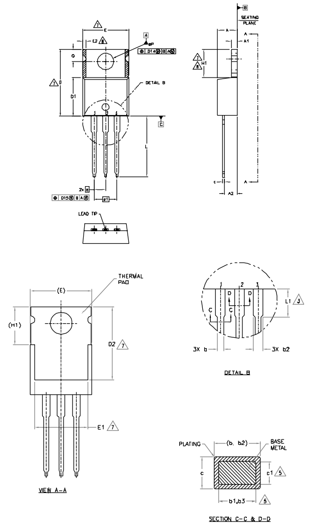


*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 14. For N-channel HEXFET® power MOSFETs

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1 – DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994
2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY
5 - DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.- CONTROLLING DIMENSION : INCHES.
7 – THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8 – DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.- 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		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
ØP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

1.- GATE
2.- COLLECTOR
3.- EMITTER

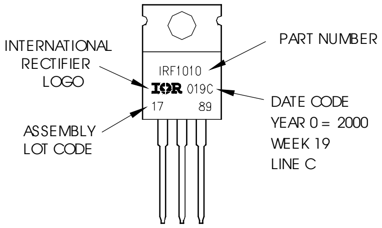
DIODES

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 package is not recommended for Surface Mount Application

Notes:

1. For an Automotive Qualified version of this part please seehttp://www.irf.com/product-info/auto/

2. For the most current drawing please refer to IR website at http://www.irf.com/package/

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.07/2010

AbN
automation

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie") .

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.