

IRF520N

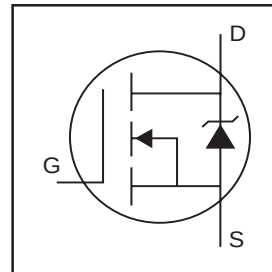
HEXFET® Power MOSFET

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

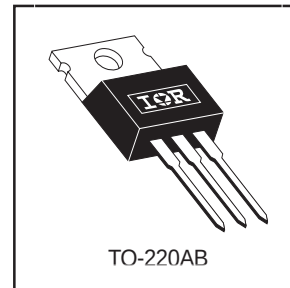
Description

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.



$V_{DS} = 100V$
$R_{DS(on)} = 0.20\Omega$
$I_D = 9.7A$



Absolute Maximum Ratings

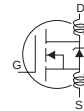
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	9.7	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	6.8	
I_{DM}	Pulsed Drain Current ①	38	
$P_D @ T_C = 25^\circ C$	Power Dissipation	48	W
	Linear Derating Factor	0.32	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	91	mJ
I_{AR}	Avalanche Current①	5.7	A
E_{AR}	Repetitive Avalanche Energy①	4.8	mJ
dv/dt	Peak Diode Recovery dv/dt ③	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	—	3.1	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (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	—	0.11	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.20	Ω	$V_{GS} = 10V, I_D = 5.7A$ 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	2.7	—	—	S	$V_{DS} = 50V, I_D = 5.7A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	25	nC	$I_D = 5.7A$
Q_{gs}	Gate-to-Source Charge	—	—	4.8		$V_{DS} = 80V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	11		$V_{GS} = 10V$, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	4.5	—	ns	$V_{DD} = 50V$
t_r	Rise Time	—	23	—		$I_D = 5.7A$
$t_{d(off)}$	Turn-Off Delay Time	—	32	—		$R_G = 22\Omega$
t_f	Fall Time	—	23	—		$R_D = 8.6\Omega$, 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	—	330	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	92	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	54	—		$f = 1.0MHz$, See Fig. 5



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	9.7	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	38		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 5.7A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	99	150	ns	$T_J = 25^\circ\text{C}, I_F = 5.7A$
Q_{rr}	Reverse Recovery Charge	—	390	580	nC	$di/dt = 100A/\mu s$ ④

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② $V_{DD} = 25V$, starting $T_J = 25^\circ\text{C}$, $L = 4.7mH$
 $R_G = 25\Omega$, $I_{AS} = 5.7A$. (See Figure 12)

③ $I_{SD} \leq 5.7A$, $di/dt \leq 240A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

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

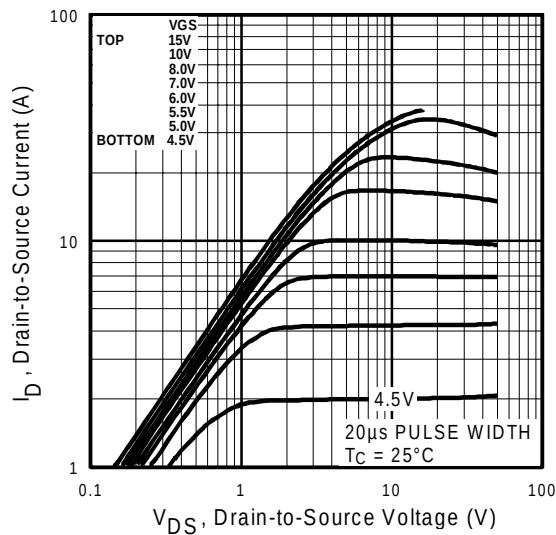


Fig 1. Typical Output Characteristics

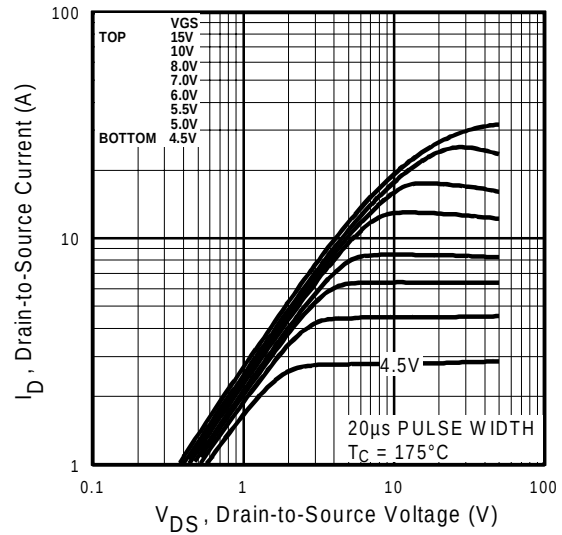


Fig 2. Typical Output Characteristics

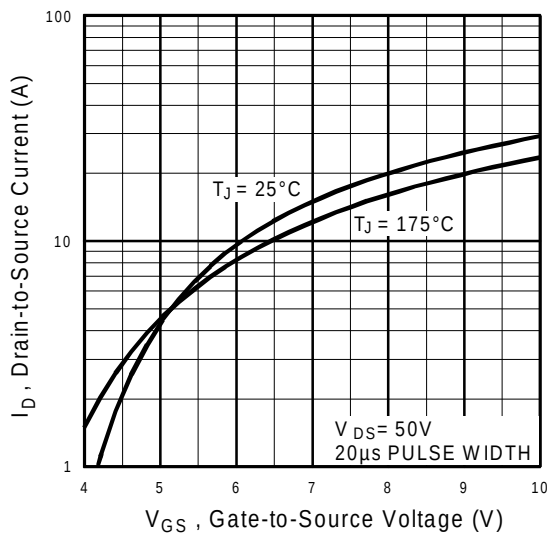


Fig 3. Typical Transfer Characteristics

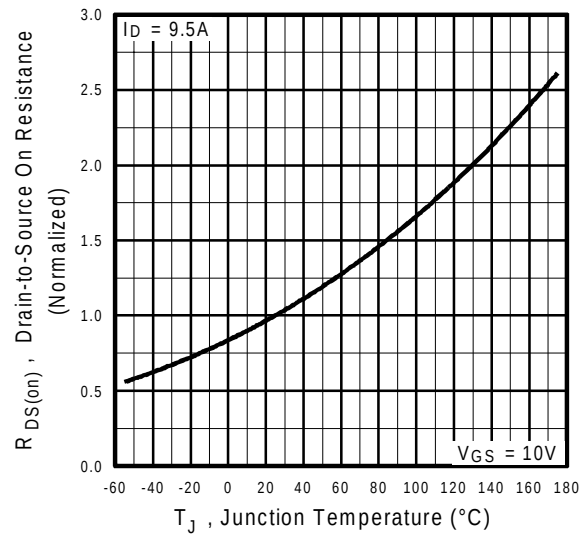


Fig 4. Normalized On-Resistance Vs. Temperature

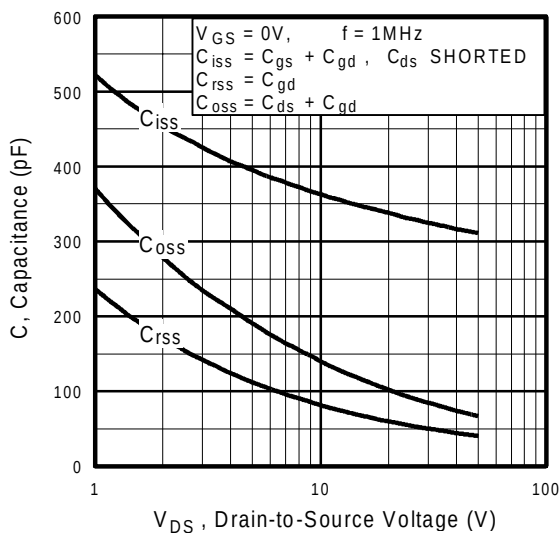


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

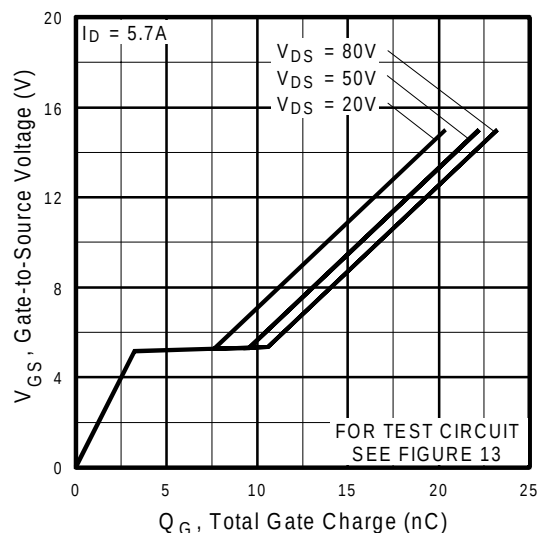


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

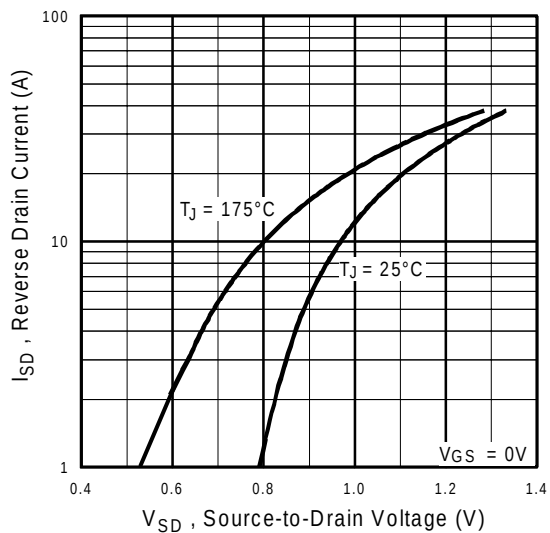


Fig 7. Typical Source-Drain Diode Forward Voltage

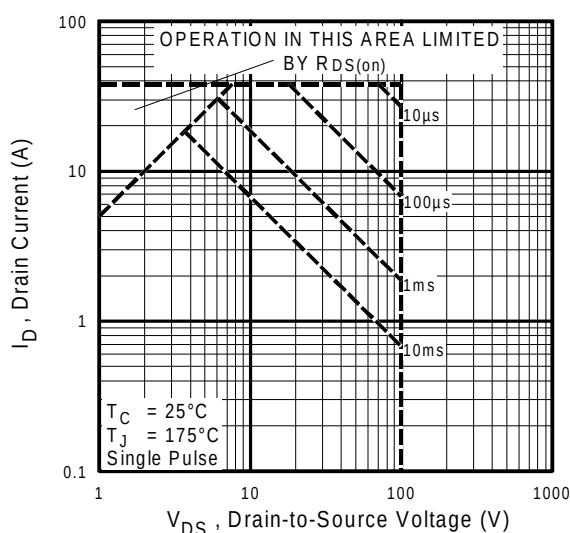


Fig 8. Maximum Safe Operating Area

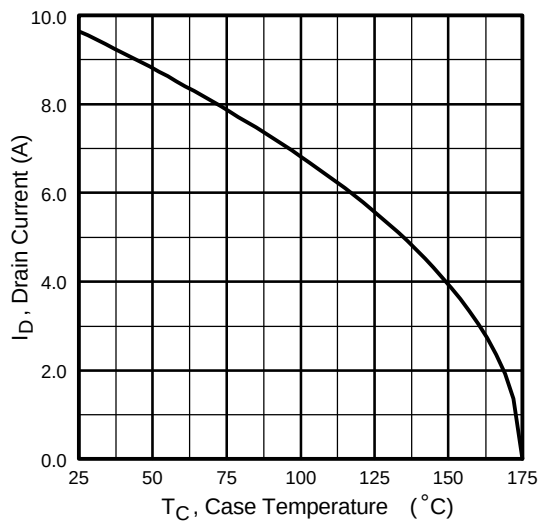


Fig 9. Maximum Drain Current Vs. Case Temperature

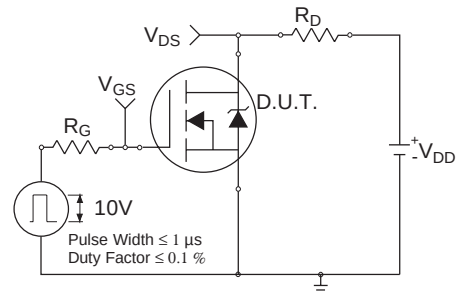


Fig 10a. Switching Time Test Circuit

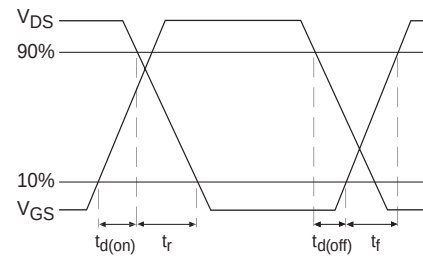


Fig 10b. Switching Time Waveforms

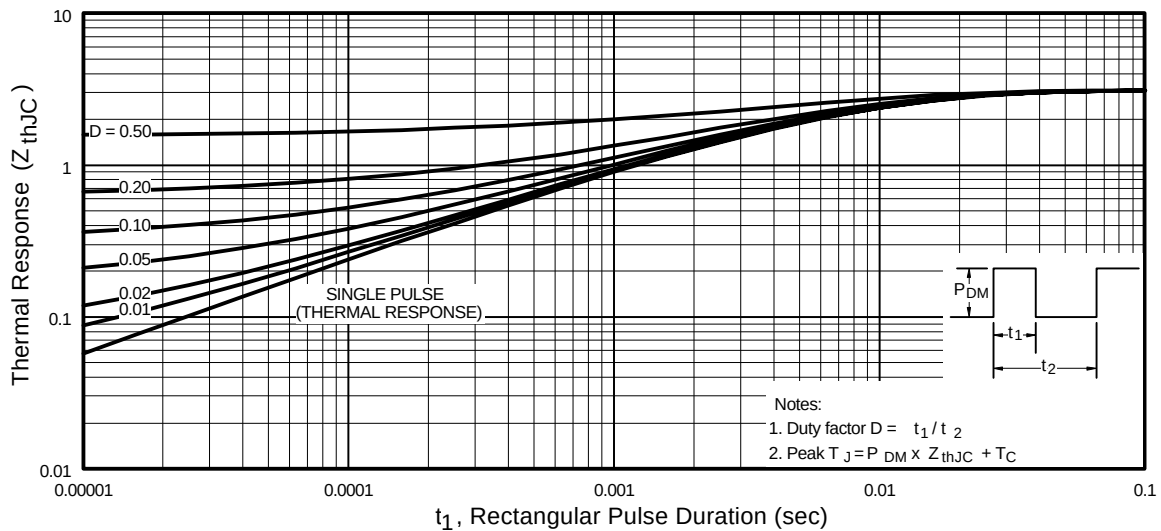


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

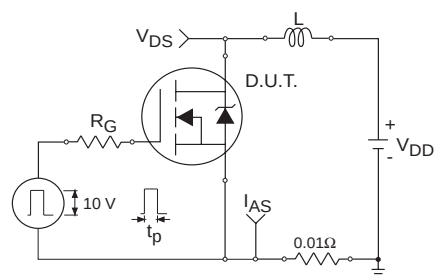


Fig 12a. Unclamped Inductive Test Circuit

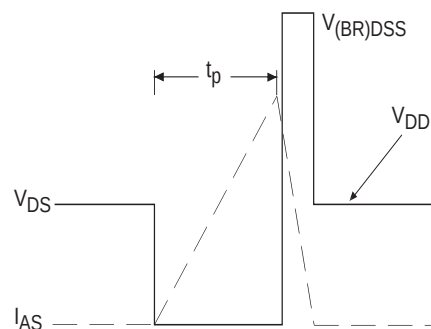


Fig 12b. Unclamped Inductive Waveforms

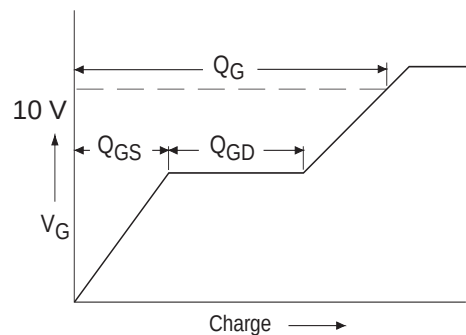


Fig 13a. Basic Gate Charge Waveform

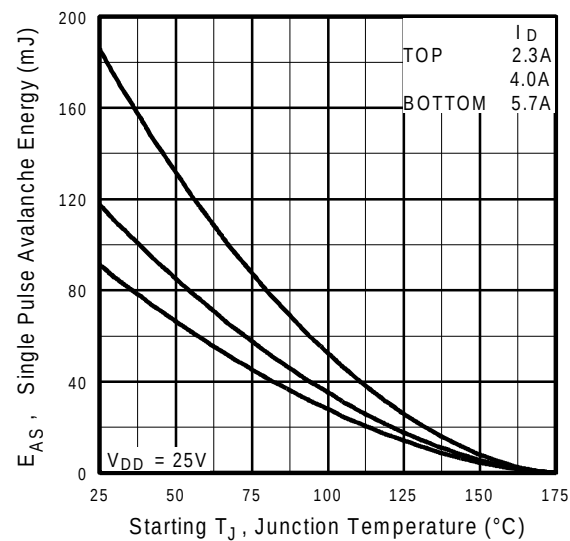


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

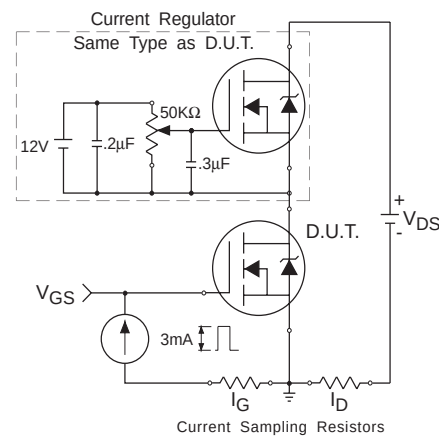


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

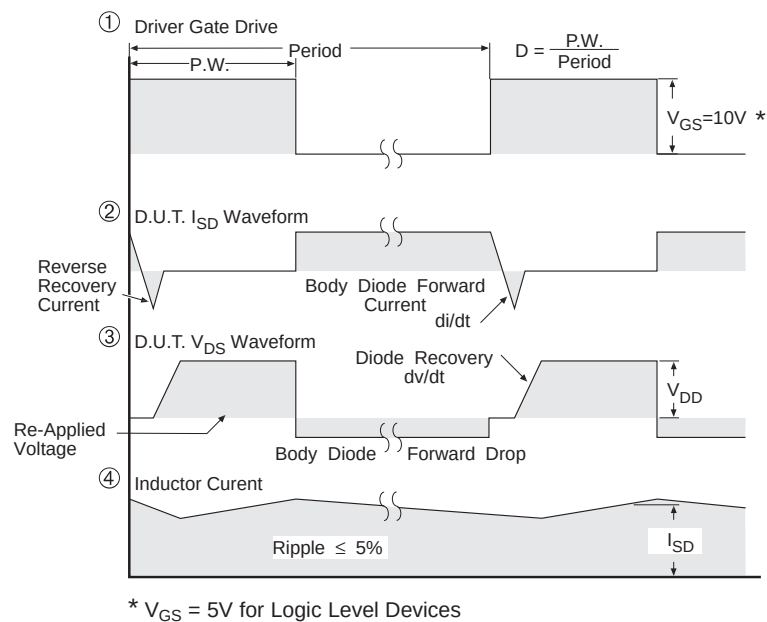
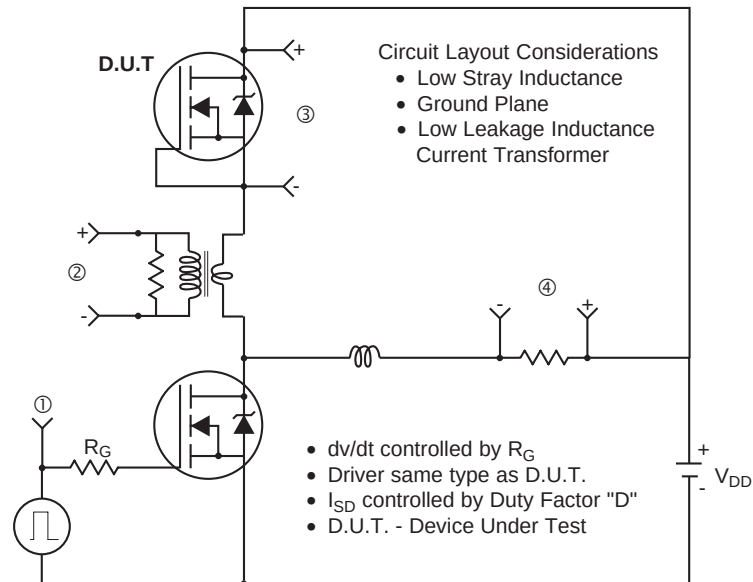


Fig 14. For N-Channel HEXFETS

International
IOR Rectifier

TO-220AB Outline

The technical drawing consists of two views: a front view on the left and a side view on the right.

Front View Dimensions:

- Total width: 10.54 (.415)
- Top hole diameter: Ø 3.78 (.149) / 3.54 (.139)
- Distance from top edge to center of top hole: 2.87 (.113) / 2.62 (.103)
- Distance from top hole center to start of lead area: 10.29 (.405)
- Lead length: 6.47 (.255) / 6.10 (.240)
- Lead thickness: 1.15 (.045) MIN
- Lead pitch: 1.40 (.055) / 1.15 (.045)
- Lead count: 3X
- Bottom hole diameter: Ø 0.93 (.037) / 0.69 (.027)
- Bottom hole position: 0.36 (.014) (M) B A (M)
- Overall height: 15.24 (.600) / 14.84 (.584)
- Internal feature height: 14.09 (.555) / 13.47 (.530)
- Internal feature width: 4.06 (.160) / 3.55 (.140)
- Base width: 2.54 (.100)
- Base thickness: 2X

Side View Dimensions:

- Top flange width: 4.69 (.185) / 4.20 (.165)
- Flange thickness: 1.32 (.052) / 1.22 (.048)
- Lead length: 2.92 (.115) / 2.64 (.104)
- Lead thickness: 0.55 (.022) / 0.46 (.018)
- Lead count: 3X

LEAD ASSIGNMENTS

- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE
- 4 - DRAIN

NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220-AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB

Diagram illustrating the markings on an IRF1010 MOSFET package:

- INTERNATIONAL RECTIFIER LOGO**: Points to the "IR" logo on the package.
- PART NUMBER**: Points to the "IRF1010" marking.
- DATE CODE (YYWW)**: Points to the "9246" marking. Below this, it specifies:
 - YY = YEAR
 - WW = WEEK
- ASSEMBLY LOT CODE**: Points to the "9B 1M" marking.

International
IOR Rectifier

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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-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086
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<http://www.irf.com/> *Data and specifications subject to change without notice.* **5/98**

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