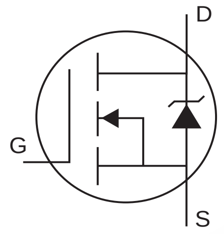
International
IOR Rectifier

PD -91805

IRL1104

HEXFET® Power MOSFET

- Logic-Level Gate Drive
- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



V_{DSS} = 40V

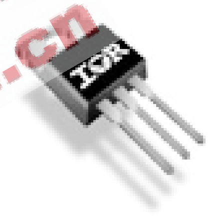
$R_{DS(on)}$ = 0.008Ω

I_D = 104A⑤

Description

Fifth Generation HEXFET® power MOSFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible 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 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	104⑤	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	74	
I_{DM}	Pulsed Drain Current①	416	
P_D @T_C = 25°C	Power Dissipation	167	W
	Linear Derating Factor	1.1	W/°C
V_{GS}	Gate-to-Source Voltage	±16	V
E_{AS}	Single Pulse Avalanche Energy ②	340	mJ
I_{AR}	Avalanche Current①	62	A
E_{AR}	Repetitive Avalanche Energy①	17	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	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	——	0.9	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	——	0.50	——	
$R_{\theta JA}$	Junction-to-Ambient	——	——	62	

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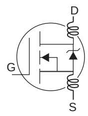
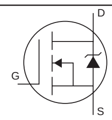
Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.04	——	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resis-	——	——	0.008	Ω	V_{GS} = 10V, I_D = 62A ④
		——	——	0.012		V_{GS} = 4.5V, I_D = 52A ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	——	——	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	53	——	——	S	V_{DS} = 25V, I_D = 62A
I_{DSS}	Drain-to-Source Leakage Current	——	——	25	µA	V_{DS} = 40V, V_{GS} = 0V
		——	——	250		V_{DS} = 32V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 16V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -16V
Q_g	Total Gate Charge	——	——	68	nC	I_D = 62A
Q_{gs}	Gate-to-Source Charge	——	——	24		V_{DS} = 32V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	——	33		V_{GS} = 4.5V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	——	18	——	ns	V_{DD} = 20V
t_r	Rise Time	——	257	——		I_D = 62A
$t_{d(off)}$	Turn-Off Delay Time	——	32	——		R_G = 3.6Ω, V_{GS} = 4.5V
t_f	Fall Time	——	64	——		R_D = 0.4Ω, See Fig. 10 ④
L_D	Internal Drain Inductance	——	4.5	——	nH	Between lead, 6mm (0.25in.)
L_S	Internal Source Inductance	——	7.5	——		from package and center of die contact 
C_{iss}	Input Capacitance	——	3445	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	1065	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	270	——		f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	104⑤	A	MOSFET symbol showing the
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	416		integral reverse p-n junction diode. 
V_{SD}	Diode Forward Voltage	——	——	1.3	V	T_J = 25°C, I_S = 62A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	84	126	ns	T_J = 25°C, I_F = 62A
Q_{rr}	Reverse Recovery Charge	——	223	335	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 V_{DD} = 15V, starting T_J = 25°C, L = 0.18mH R_G = 25Ω, I_{AS} =62A. (See Figure 12)

③ $I_{SD} \leq$ 62A, di/dt $\leq$ 217A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C

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

⑤ Calculated continuous current based on maximum allowable junction temperature;for recommended current-handling of the package refer to Design Tip # 93-4

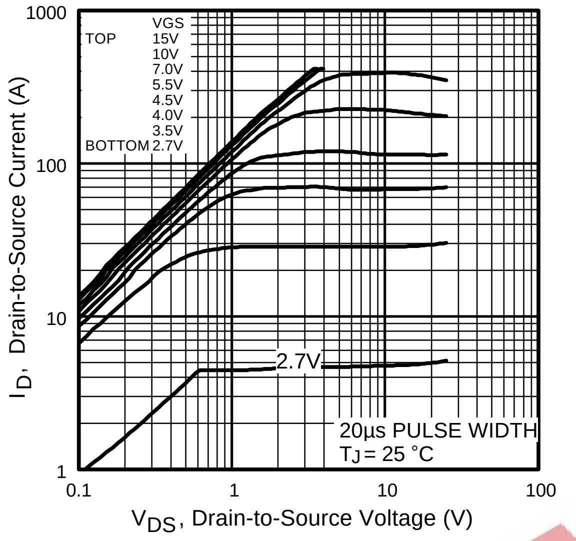


Fig 1. Typical Output Characteristics

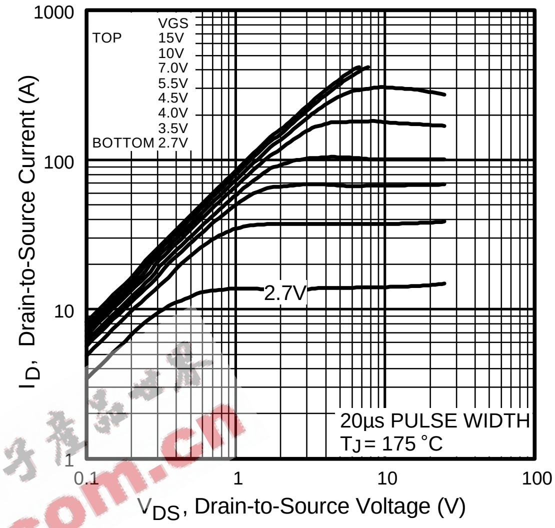


Fig 2. Typical Output Characteristics

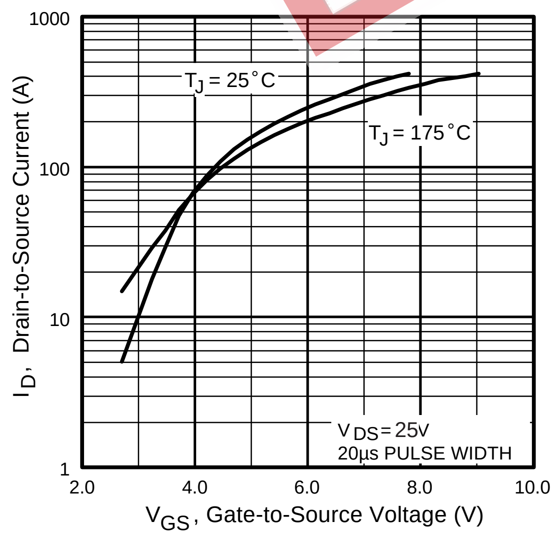


Fig 3. Typical Transfer Characteristics

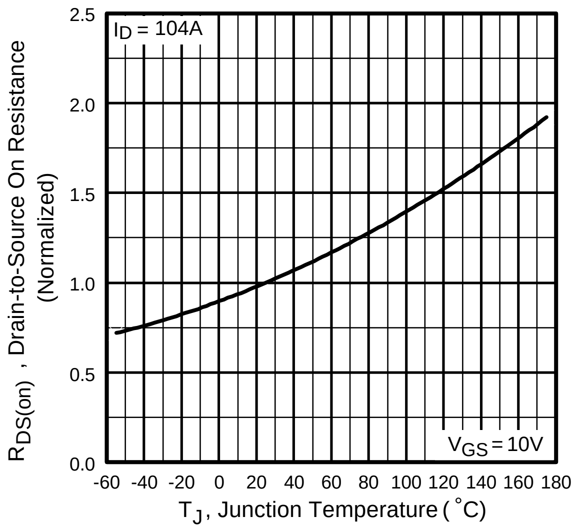


Fig 4. Normalized On-Resistance Vs. Temperature

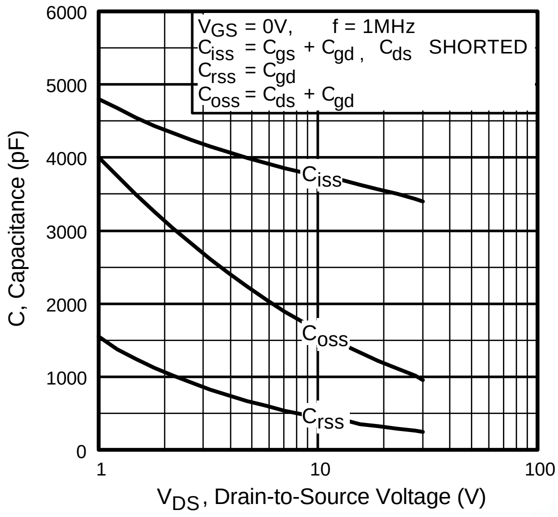


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

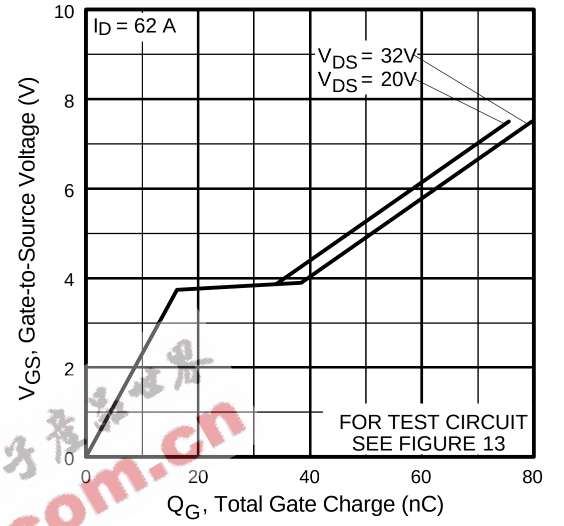


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

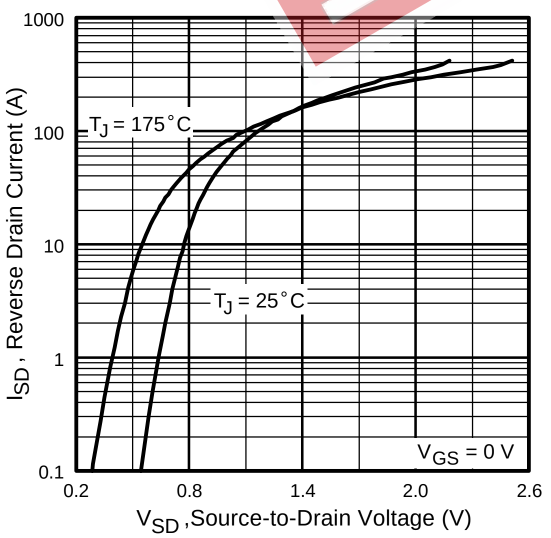


Fig 7. Typical Source-Drain Diode Forward Voltage

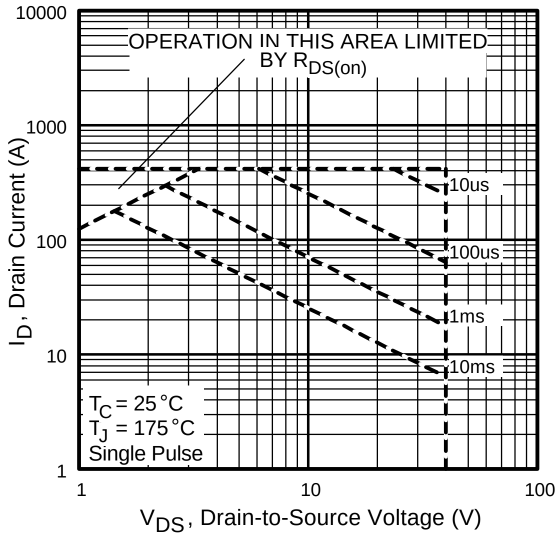


Fig 8. Maximum Safe Operating Area

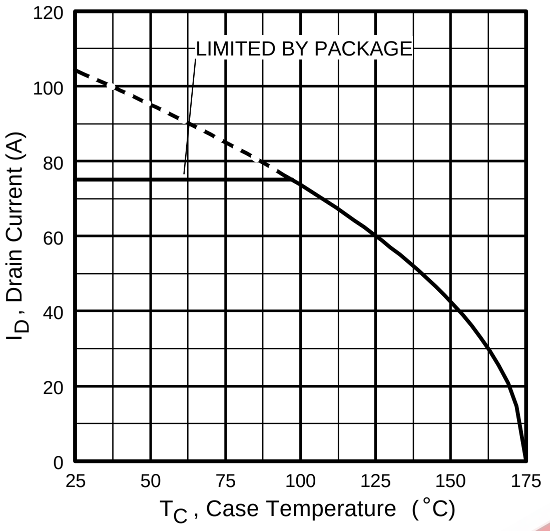


Fig 9. Maximum Drain Current Vs. Case Temperature

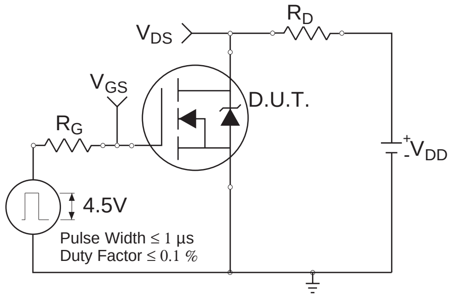


Fig 10a. Switching Time Test Circuit

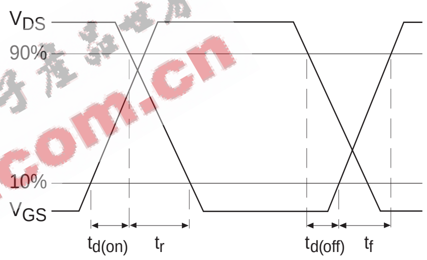


Fig 10b. Switching Time Waveforms

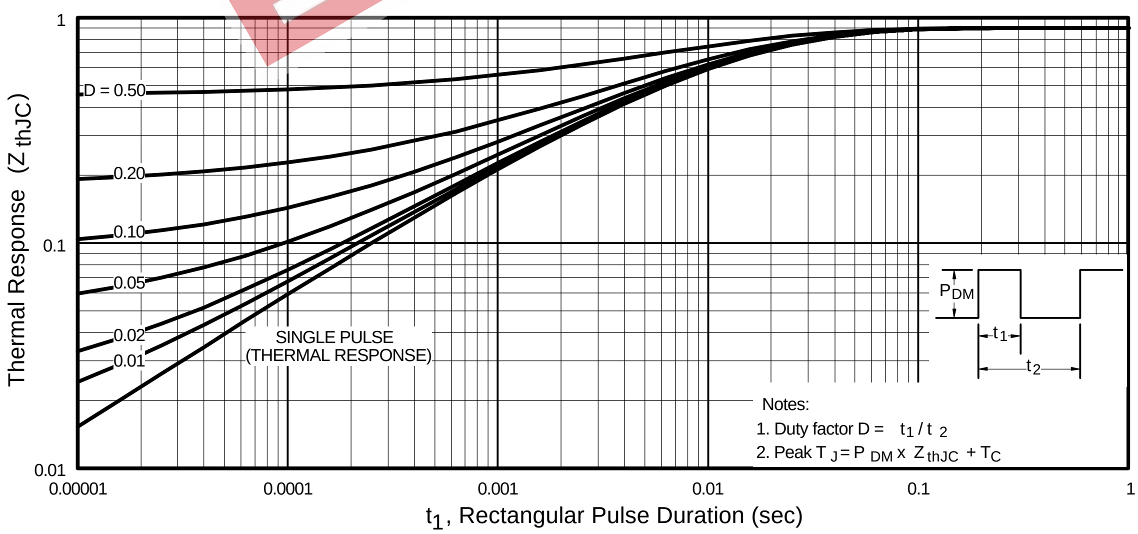


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

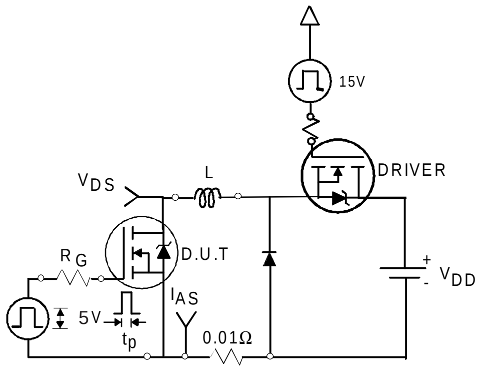


Fig 12a. Unclamped Inductive Test Circuit

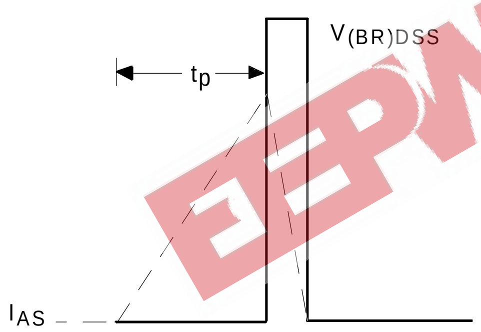


Fig 12b. Unclamped Inductive Waveforms

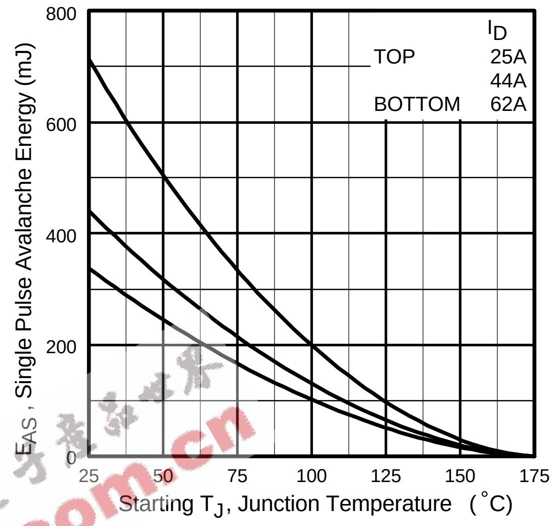


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

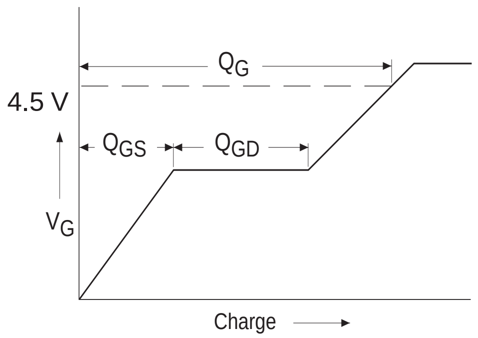


Fig 13a. Basic Gate Charge Waveform

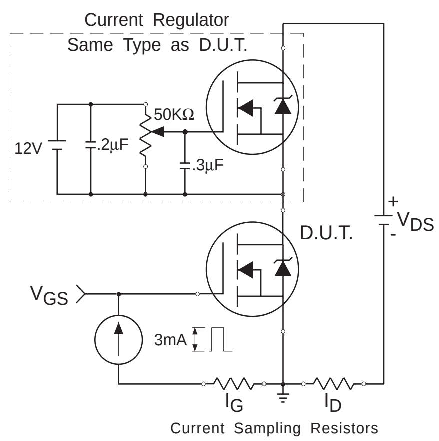
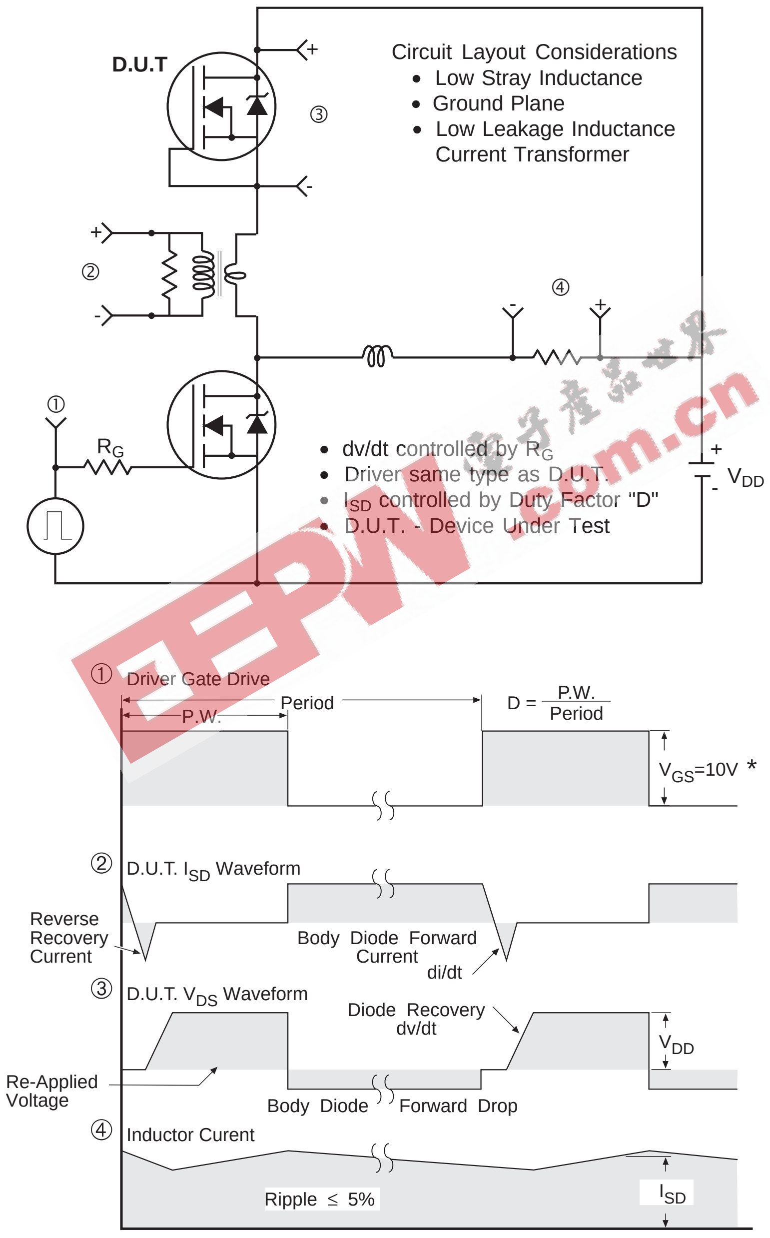


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

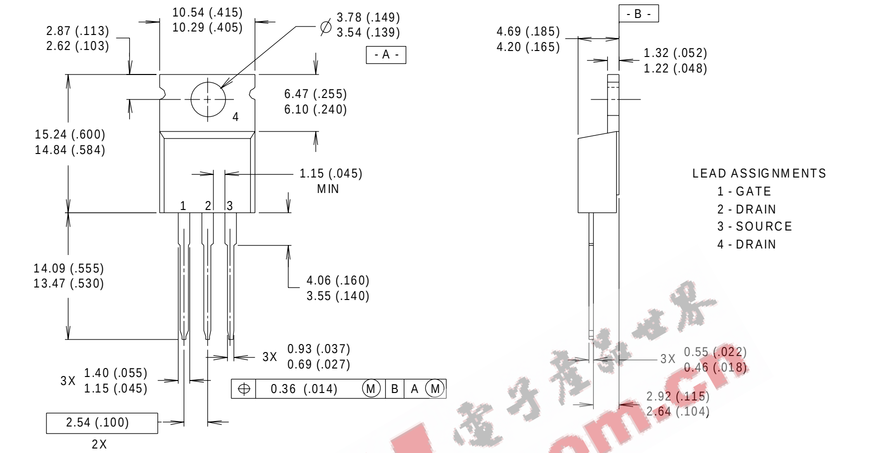


* V_{GS} = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFET® power MOSFETs

TO-220AB Package Details

Dimensions are shown in millimeters (inches)

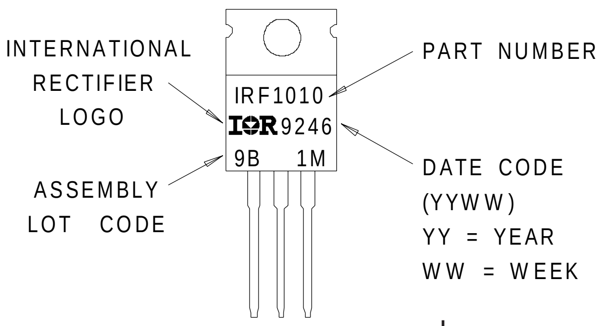


NOTES:

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

TO-220AB Part Marking

EXAMPLE : THIS IS AN IRF1010
WITH ASSEMBLY
LOT CODE 9B1M



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