

International
IR Rectifier

SMPS MOSFET

PD - 91815C
IRFB9N65A

HEXFET® Power MOSFET

Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching

V _{DSS}	R _{DS(on)} max	I _D
650V	0.93Ω	8.5A

Benefits

- Low Gate Charge Q_g results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current



Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V	8.5	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V	5.4	
I _{DM}	Pulsed Drain Current ①②	21	
P _D @ T _C = 25°C	Power Dissipation	167	W
	Linear Derating Factor	1.3	W/°C
V _{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③④	2.8	V/ns
T _J	Operating Junction and	-55 to + 150	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Typical SMPS Topologies

- Single Transistor Flyback
- Single Transistor Forward

Notes ① through ⑤ are on page 8
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Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	650	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.67	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⓐ
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.93	Ω	$V_{GS} = 10V, I_D = 5.1\text{A}$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 650V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 520V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	3.9	—	—	S	$V_{DS} = 50V, I_D = 3.1\text{A}$ ⓐ
Q_g	Total Gate Charge	—	—	48	nC	$I_D = 5.2\text{A}$
Q_{gs}	Gate-to-Source Charge	—	—	12		$V_{DS} = 400V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	19		$V_{GS} = 10V, \text{See Fig. 6 and 13}$ ④ⓐ
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = 325V$
t_r	Rise Time	—	20	—		$I_D = 5.2\text{A}$
$t_{d(off)}$	Turn-Off Delay Time	—	34	—		$R_G = 9.1\Omega$
t_f	Fall Time	—	18	—		$R_D = 62\Omega, \text{See Fig. 10}$ ④ⓐ
C_{iss}	Input Capacitance	—	1417	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	177	—		$V_{DS} = 25V$
C_{riss}	Reverse Transfer Capacitance	—	7.0	—		$f = 1.0\text{MHz}, \text{See Fig. 5}$ ⓐ
C_{oss}	Output Capacitance	—	1912	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	48	—		$V_{GS} = 0V, V_{DS} = 520V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	84	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 520V$ ⑤ⓐ

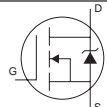
Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energyⓐ	—	325	mJ
I_{AR}	Avalanche Current①	—	5.2	A
E_{AR}	Repetitive Avalanche Energy①	—	16	mJ

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	

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	5.2	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	21		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 5.2\text{A}, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	493	739	ns	$T_J = 25^\circ\text{C}, I_F = 5.2\text{A}$
Q_{rr}	Reverse Recovery Charge	—	2.1	3.2	μC	$di/dt = 100\text{A}/\mu s$ ④ⓐ
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

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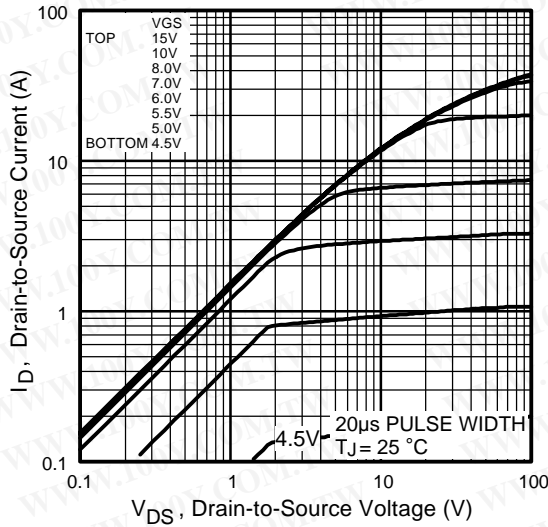


Fig 1. Typical Output Characteristics

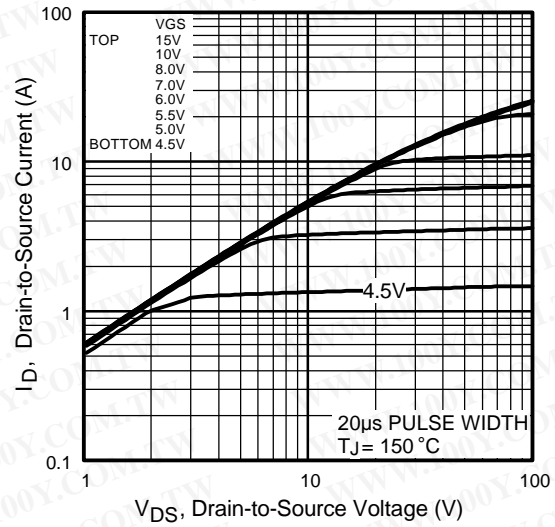


Fig 2. Typical Output Characteristics

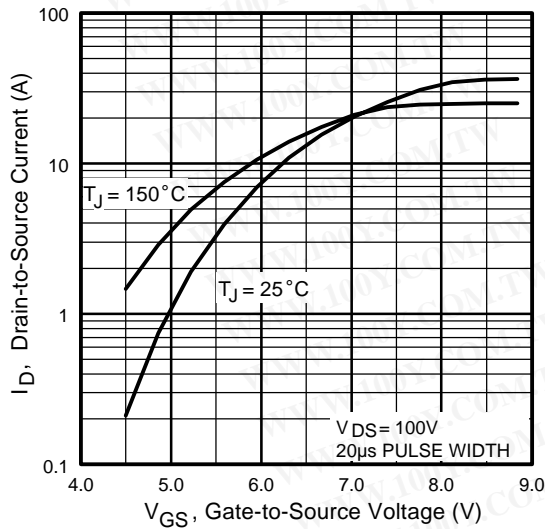


Fig 3. Typical Transfer Characteristics

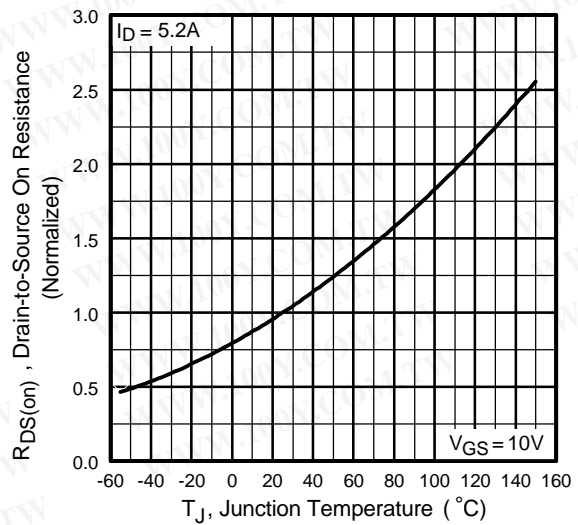


Fig 4. Normalized On-Resistance Vs. Temperature

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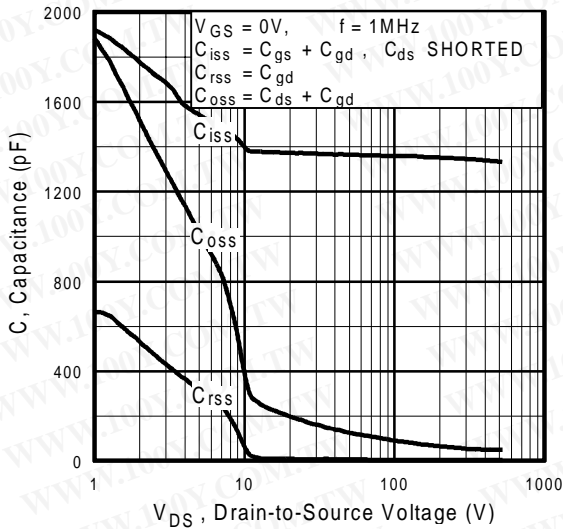


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

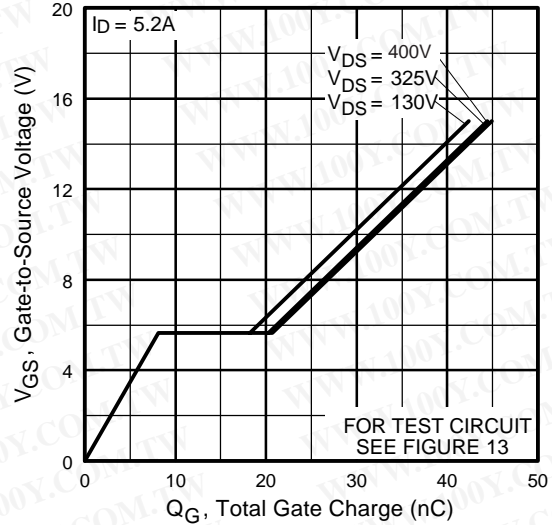


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

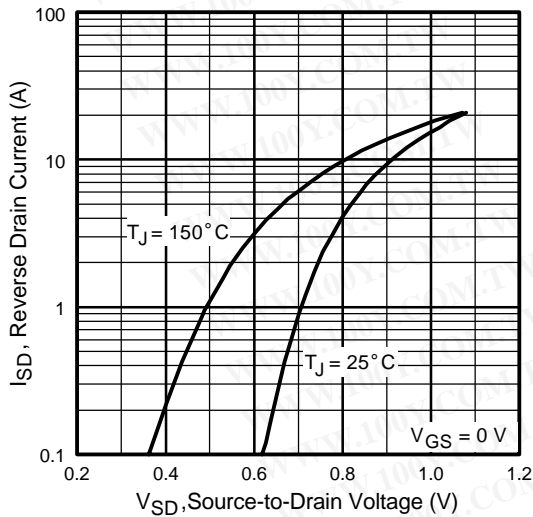


Fig 7. Typical Source-Drain Diode Forward Voltage

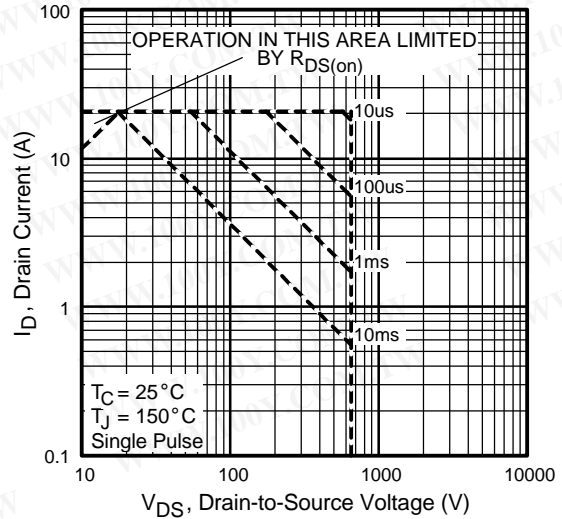


Fig 8. Maximum Safe Operating Area

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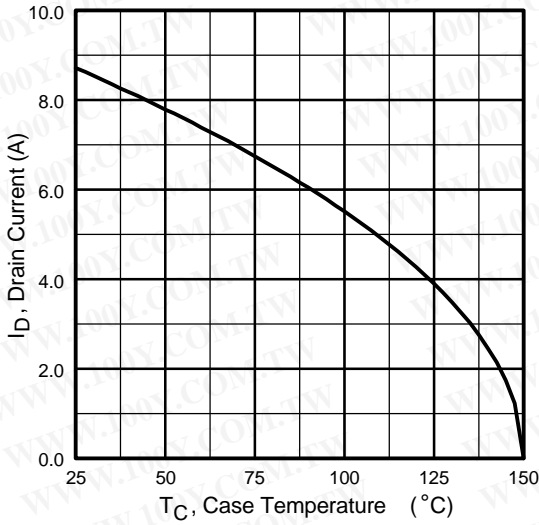


Fig 9. Maximum Drain Current Vs. Case Temperature

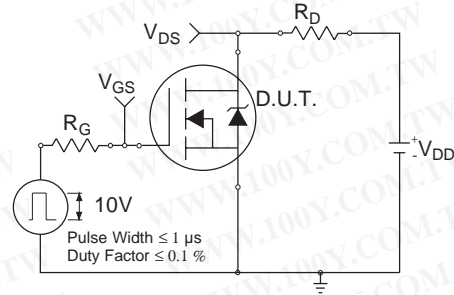


Fig 10a. Switching Time Test Circuit

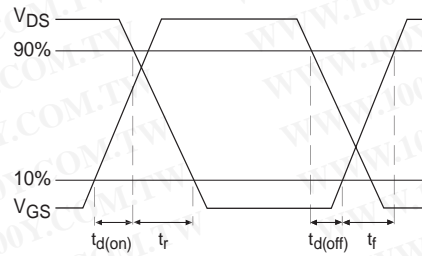


Fig 10b. Switching Time Waveforms

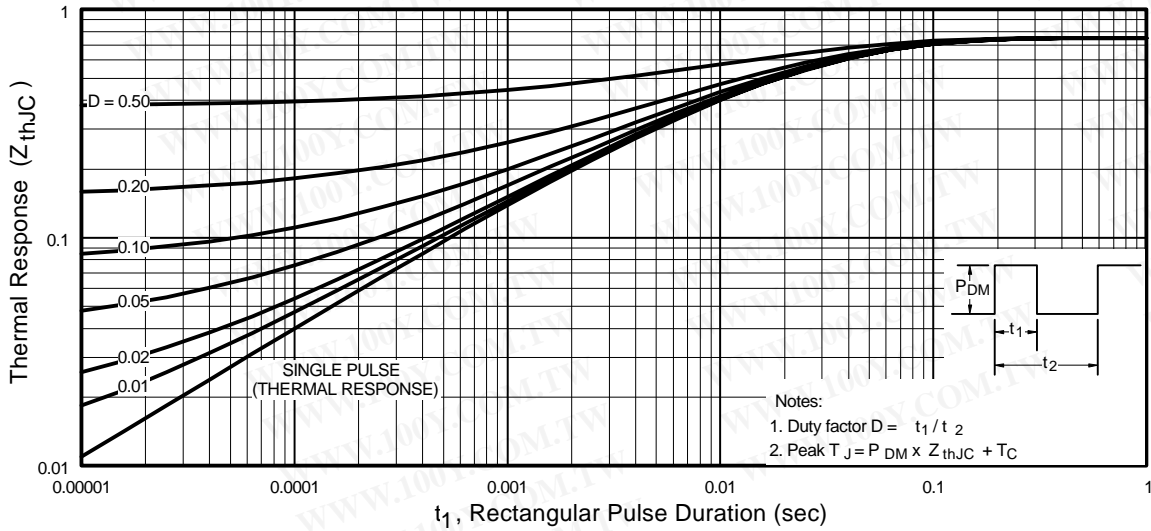


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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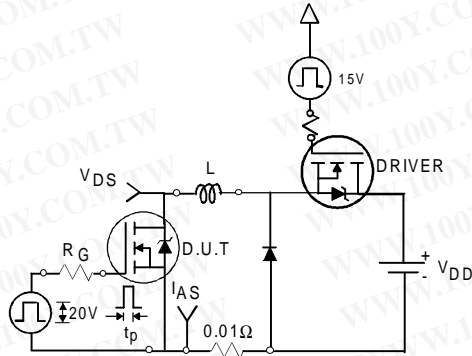


Fig 12a. Unclamped Inductive Test Circuit

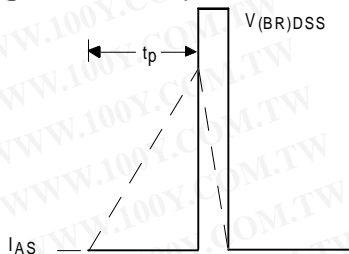


Fig 12b. Unclamped Inductive Waveforms

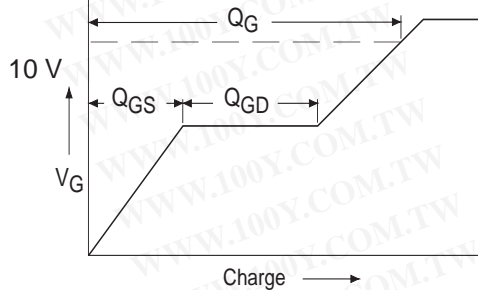


Fig 13a. Basic Gate Charge Waveform

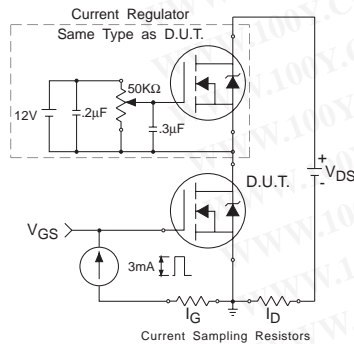


Fig 13b. Gate Charge Test Circuit

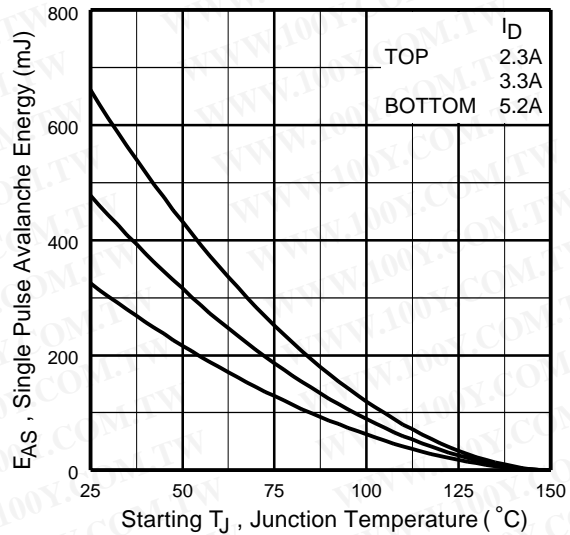


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

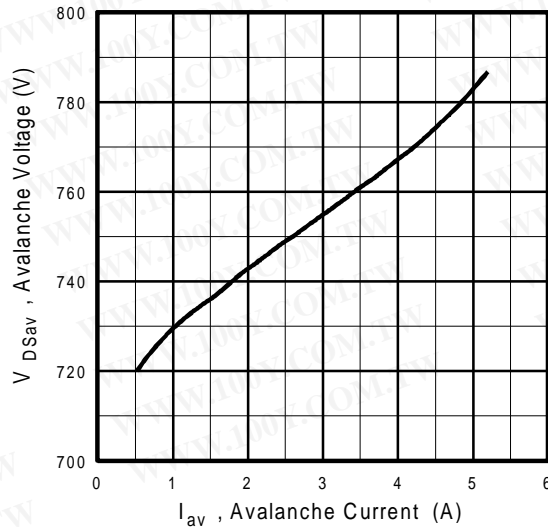
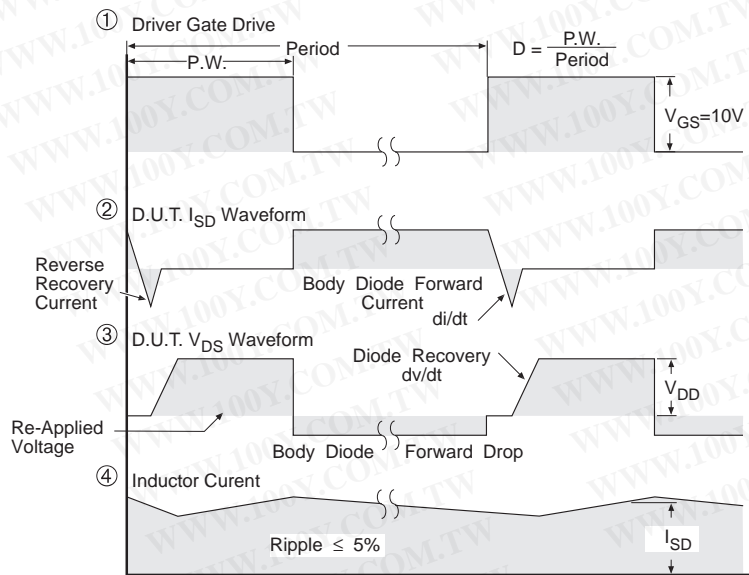
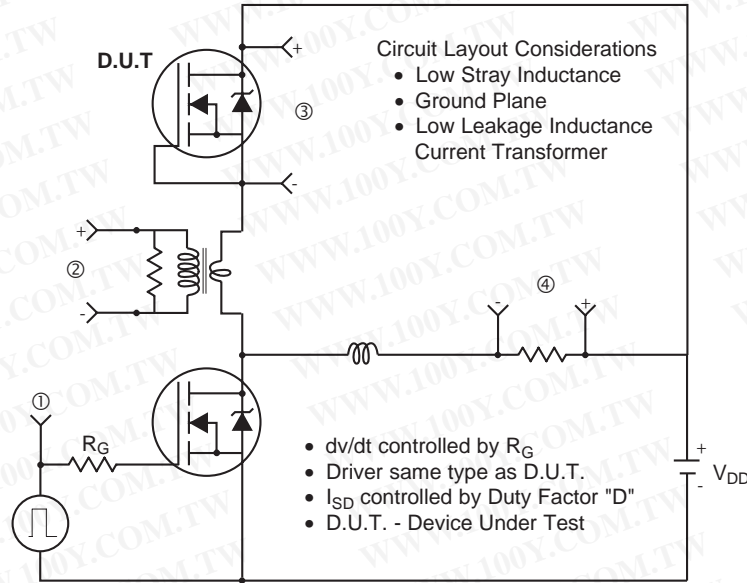


Fig 12d. Typical Drain-to-Source Voltage Vs. Avalanche Current

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Peak Diode Recovery dv/dt Test Circuit



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

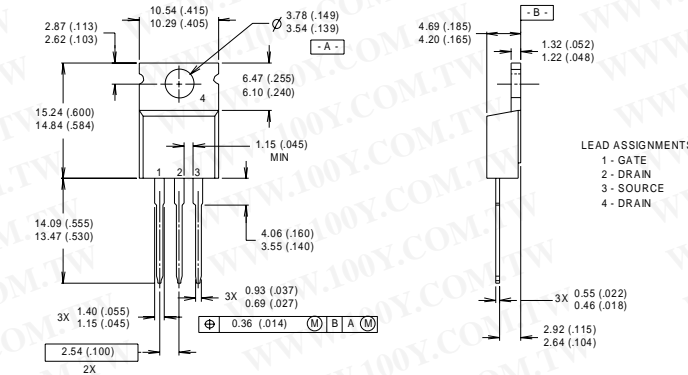
Fig 14. For N-Channel HEXFET® Power MOSFETs

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TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

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- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSII 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 Information

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

