

# IRFBA22N50A

HEXFET® Power MOSFET

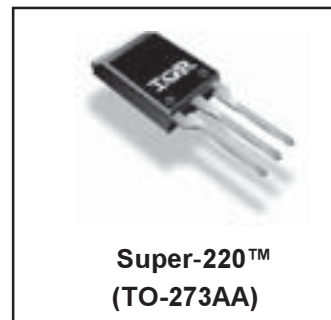
## Applications

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

$V_{DSS}$	$R_{DS(on) \max}$	$I_D$
500V	0.23Ω	24A

## 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
- Effective  $C_{oss}$  Specified (See AN1001)



## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	24	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	15	
$I_{DM}$	Pulsed Drain Current ①	96	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	340	W
	Linear Derating Factor	2.7	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 30	V
$dv/dt$	Peak Diode Recovery $dv/dt$ ③	3.4	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 )	
	Recommended clip force	20	N

## Applicable Off Line SMPS Topologies:

- Full Bridge Converters
- Power Factor Correction Boost

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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	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.23	$\Omega$	$V_{GS} = 10V, I_D = 13.8A$ 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	$\mu A$	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	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	12	—	—	S	$V_{DS} = 50V, I_D = 13.8A$
$Q_g$	Total Gate Charge	—	—	115	nC	$I_D = 23A$
$Q_{gs}$	Gate-to-Source Charge	—	—	30		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	50		$V_{GS} = 10V$ , See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	20	—		$V_{DD} = 250V$
$t_r$	Rise Time	—	66	—	ns	$I_D = 23A$
$t_{d(off)}$	Turn-Off Delay Time	—	46	—		$R_G = 4.3\Omega$
$t_f$	Fall Time	—	44	—		$R_D = 10.6\Omega$ , See Fig. 10 ④
$C_{iss}$	Input Capacitance	—	3400	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	500	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	17	—		$f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	4900	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	130	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$
$C_{oss\text{ eff.}}$	Effective Output Capacitance	—	150	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤

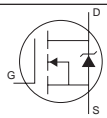
## Avalanche Characteristics

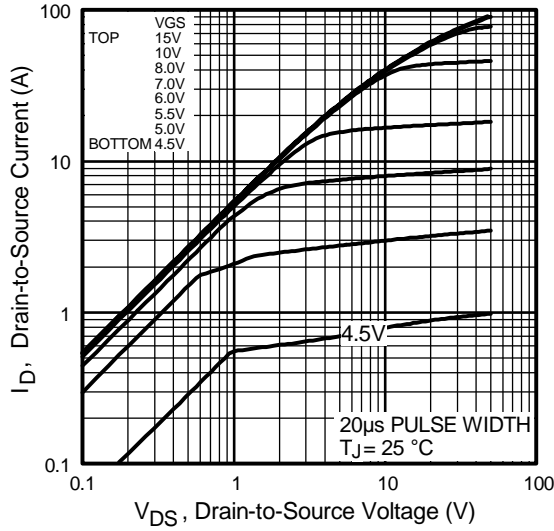
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	1200	mJ
$I_{AR}$	Avalanche Current ③	—	24	A
$E_{AR}$	Repetitive Avalanche Energy ④	—	34	mJ

## Thermal Resistance

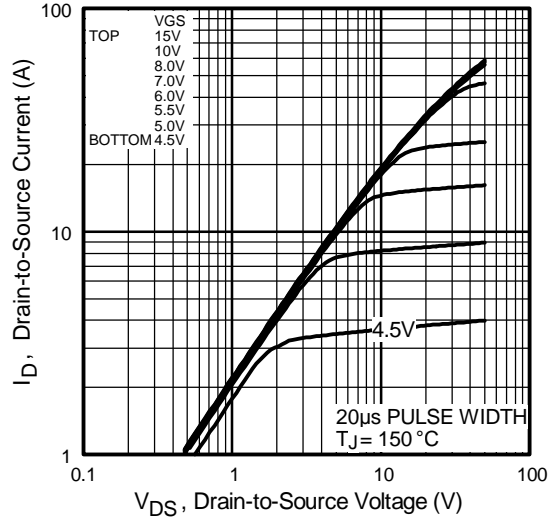
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.37	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	58	

## Diode Characteristics

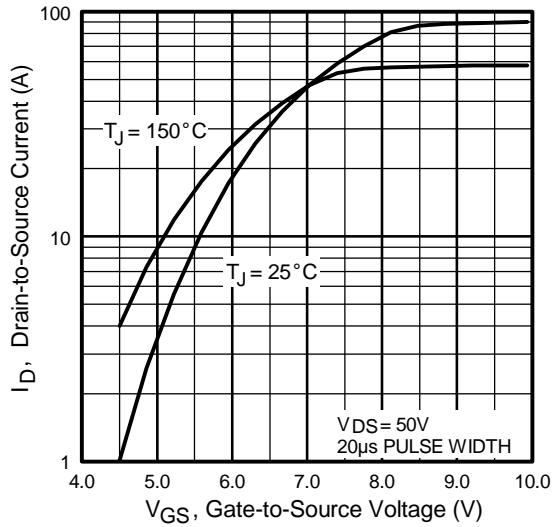
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	23	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	92		
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 23A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	500	750	ns	$T_J = 25^\circ\text{C}, I_F = 23A$
$Q_{rr}$	Reverse Recovery Charge	—	6.4	9.6	$\mu\text{C}$	$di/dt = 100A/\mu\text{s}$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				



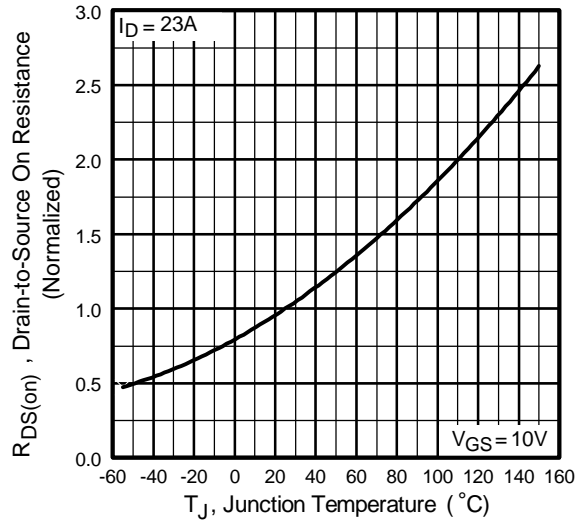
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

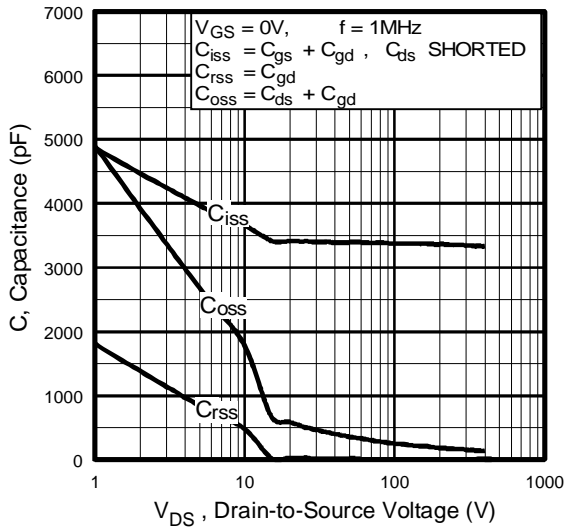


**Fig 3.** Typical Transfer Characteristics

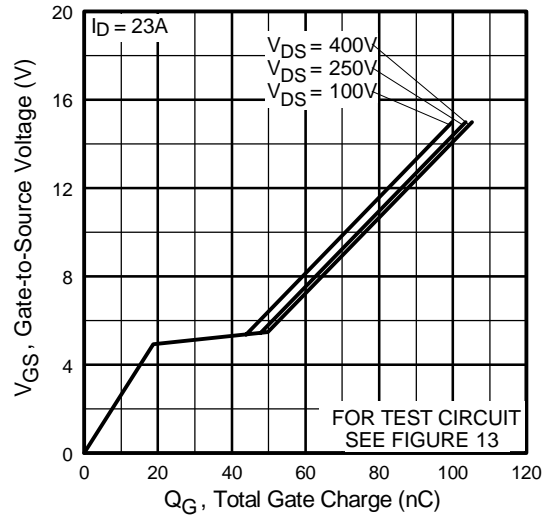


**Fig 4.** Normalized On-Resistance Vs. Temperature

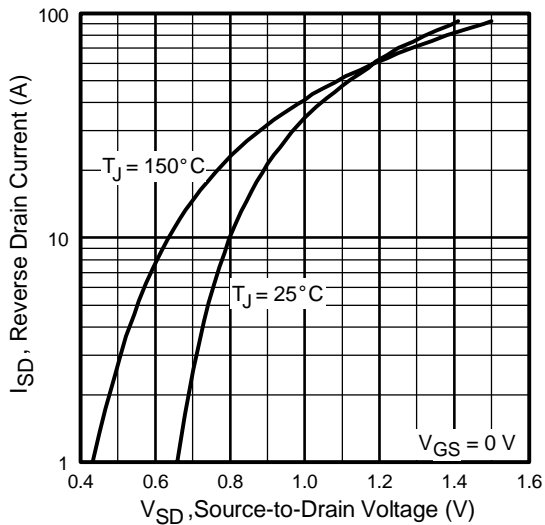
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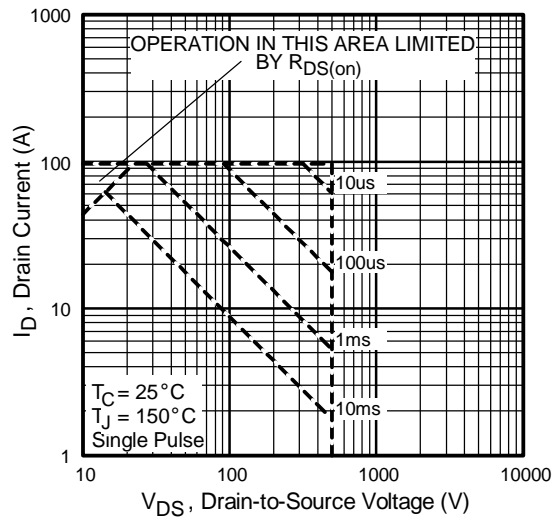
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



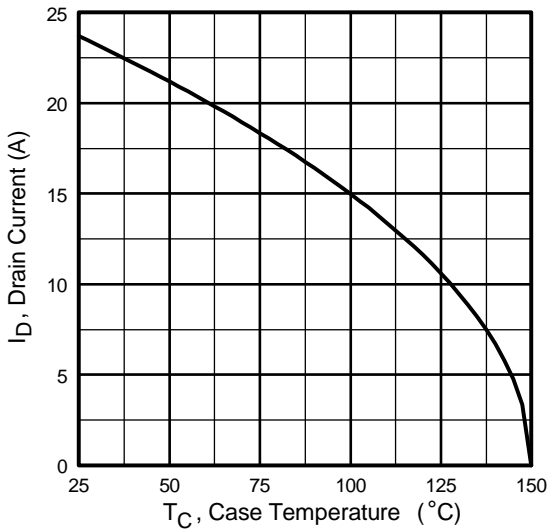
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



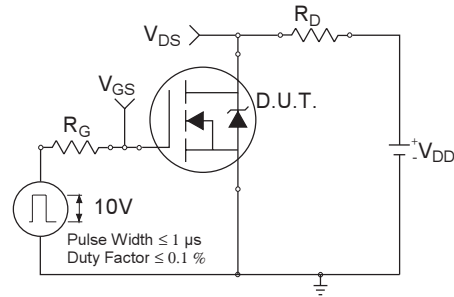
**Fig 7.** Typical Source-Drain Diode Forward Voltage



**Fig 8.** Maximum Safe Operating Area



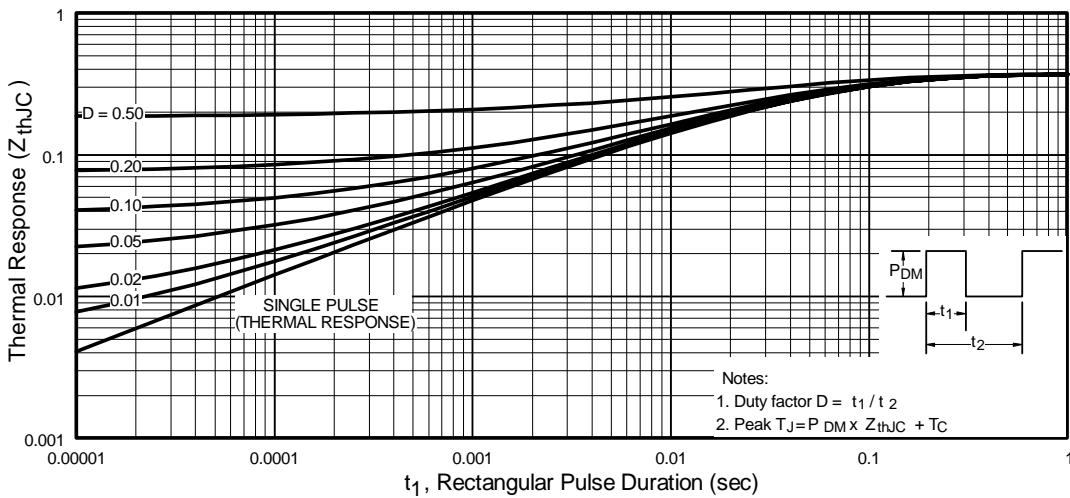
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit



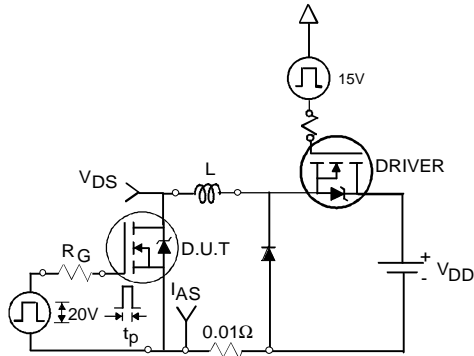
**Fig 10b.** Switching Time Waveforms



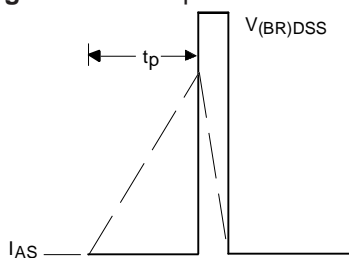
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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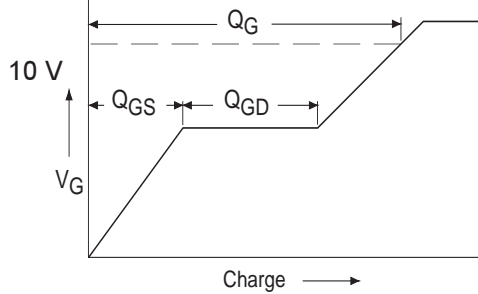
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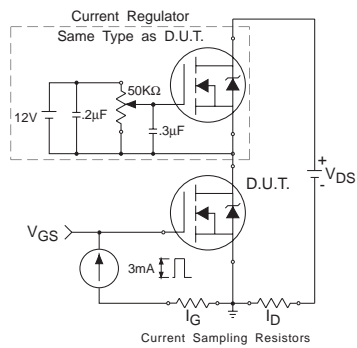
**Fig 12a.** Unclamped Inductive Test Circuit



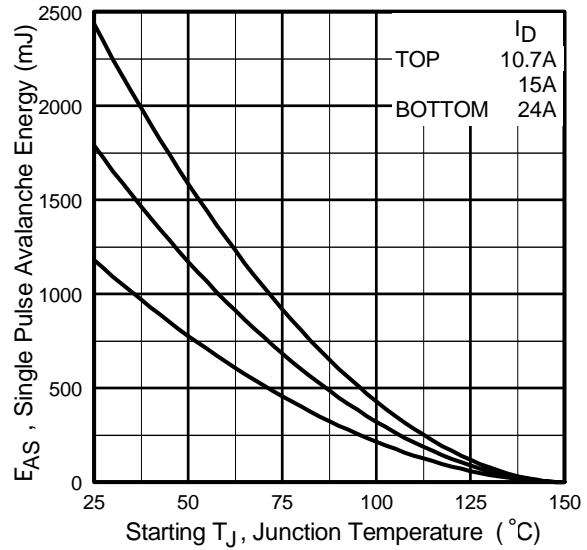
**Fig 12b.** Unclamped Inductive Waveforms



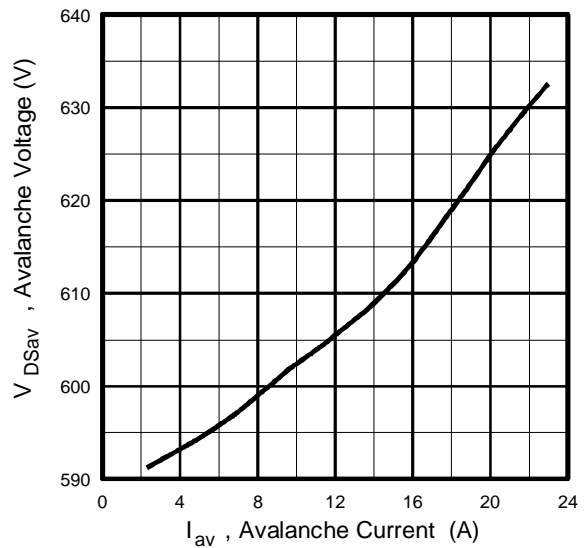
**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit

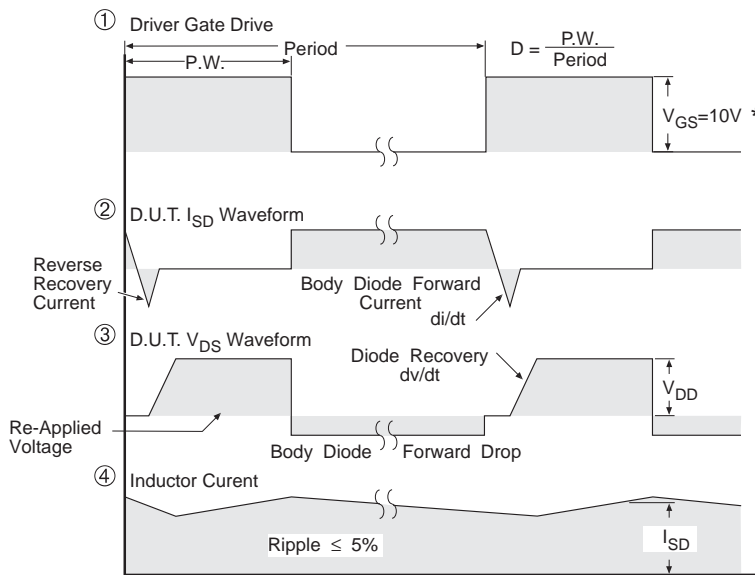
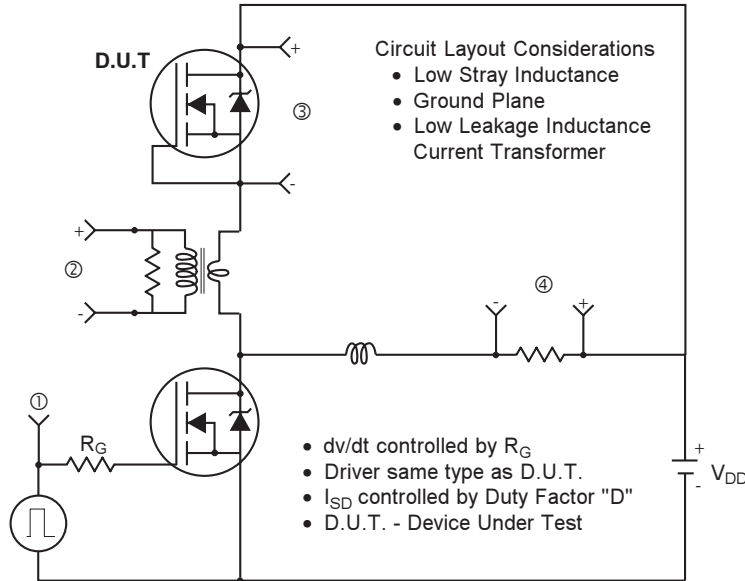


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

## Peak Diode Recovery dv/dt Test Circuit



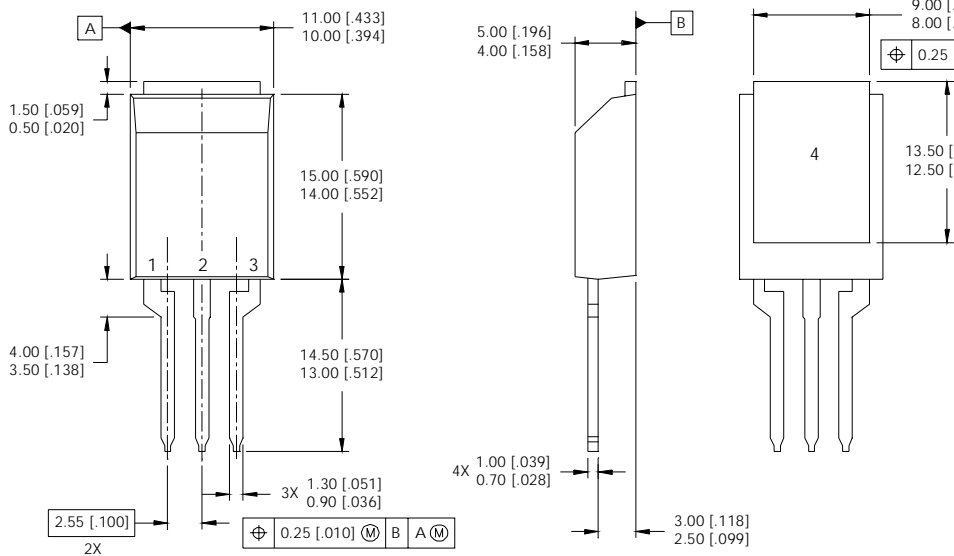
\*  $V_{GS} = 5V$  for Logic Level Devices

**Fig 14.** For N-Channel HEXFET® Power MOSFET

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## Super-220™ ( TO-273AA ) Package Outline



### NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.

### LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3.4\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 24\text{A}$ . (See Figure 12)
- ③  $I_{SD} \leq 23\text{A}$ ,  $di/dt \leq 123\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{OSS}$  eff. is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$

Super-220™ not recommended for surface mount application

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.

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