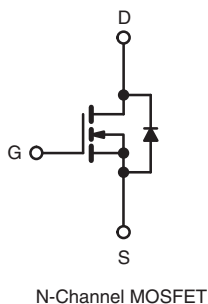
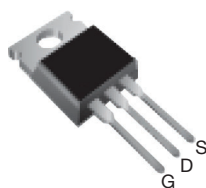


## Power MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	60	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$	0.028
$Q_g$ (Max.) (nC)	67	
$Q_{gs}$ (nC)	18	
$Q_{gd}$ (nC)	25	
Configuration	Single	

**TO-220AB**


### FEATURES

- Dynamic  $dV/dt$  Rating
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT

### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220AB package is universally preferred for commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

### ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	IRFZ44PbF
	SiHFZ44-E3
SnPb	IRFZ44
	SiHFZ44

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ °C}$ , unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current <sup>a</sup>	$I_D$	50	A
Continuous Drain Current		36	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	200	
Linear Derating Factor		1.0	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	100	mJ
Maximum Power Dissipation	$P_D$	150	W
Peak Diode Recovery $dV/dt$ <sup>c</sup>	$dV/dt$	4.5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature) <sup>d</sup>	for 10 s	300	
Mounting Torque	6-32 or M3 screw	10	lbf · in
		1.1	N · m

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25\text{ V}$ , starting  $T_J = 25\text{ °C}$ ,  $L = 44\text{ }\mu\text{H}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 51\text{ A}$  (see fig. 12).
- $I_{SD} \leq 51\text{ A}$ ,  $dI/dt \leq 250\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175\text{ °C}$ .
- 1.6 mm from case.
- Current limited by the package, (die current = 51 A).

\* Pb containing terminations are not RoHS compliant, exemptions may apply

**THERMAL RESISTANCE RATINGS**

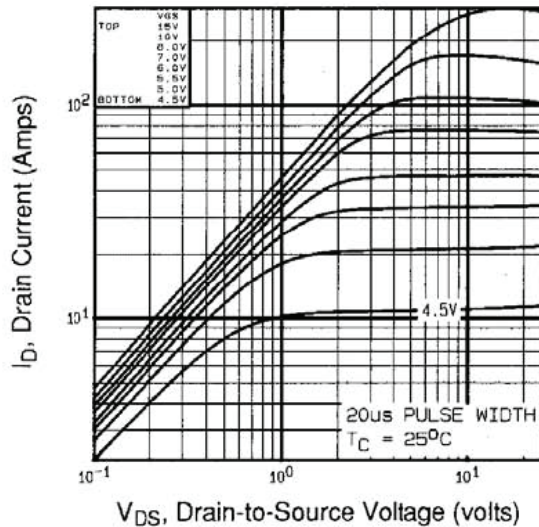
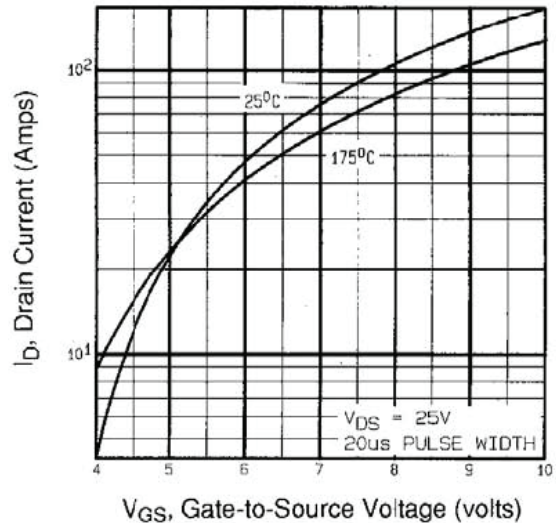
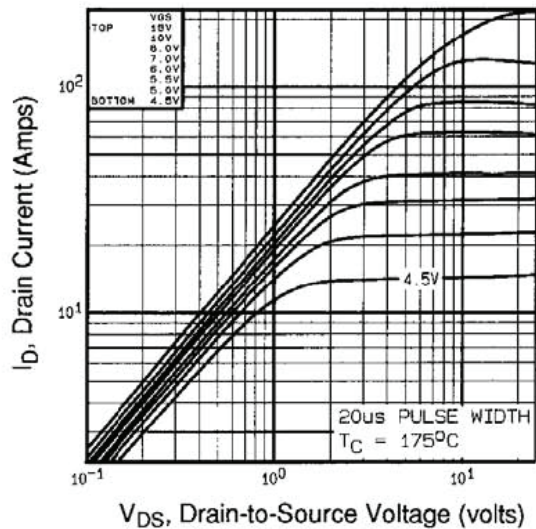
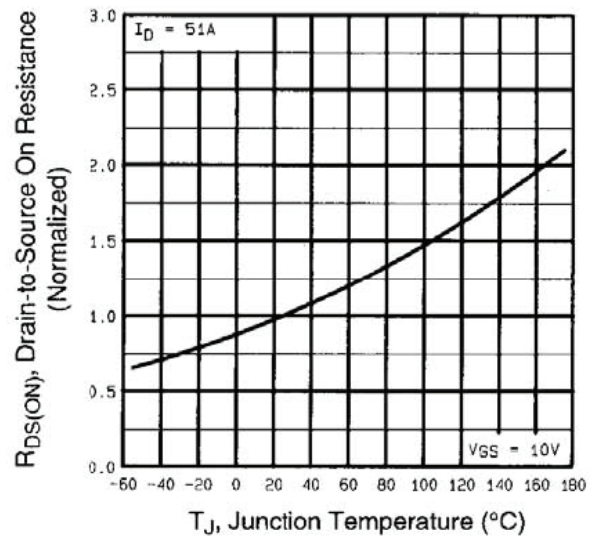
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	$R_{thCS}$	0.50	-	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	1.0	

**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		60	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.060	-	V/°C
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V		-	-	25	μA
		V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	250	
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 31 A <sup>b</sup>	-	-	0.028	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 25 V, I <sub>D</sub> = 31 A		15	-	-	S
Dynamic							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1.0 MHz, see fig. 5		-	1900	-	pF
Output Capacitance	C <sub>oss</sub>			-	920	-	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	170	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 51 A, V <sub>DS</sub> = 48 V, see fig. 6 and 13 <sup>b</sup>	-	-	67	nC
Gate-Source Charge	Q <sub>gs</sub>			-	-	18	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	25	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 51 A, R <sub>g</sub> = 9.1 Ω, R <sub>D</sub> = 0.55 Ω, see fig. 10 <sup>b</sup>		-	14	-	ns
Rise Time	t <sub>r</sub>			-	110	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	45	-	
Fall Time	t <sub>f</sub>			-	92	-	
Internal Drain Inductance	L <sub>D</sub>	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	nH
Internal Source Inductance	L <sub>S</sub>			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	50	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	200	
Body Diode Voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 51 A, V <sub>GS</sub> = 0 V <sup>b</sup>		-	-	2.5	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = 51 A, dI/dt = 100 A/μs		-	120	180	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	0.53	0.80	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )					

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Fig. 1 Typical Output Characteristics,  $T_C = 25^\circ\text{C}$** 

**Fig. 3 Typical Transfer Characteristics**

**Fig. 2 Typical Output Characteristics,  $T_C = 175^\circ\text{C}$** 

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

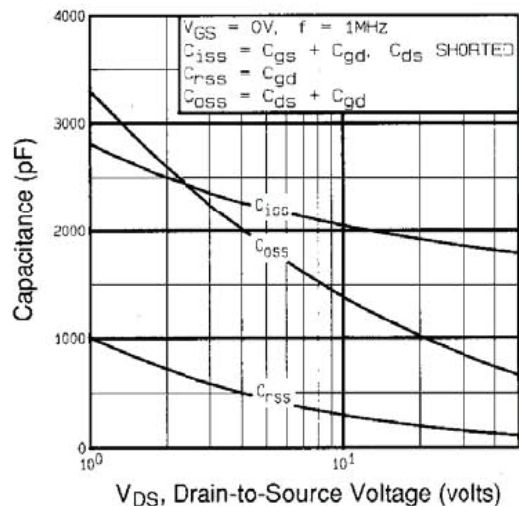


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

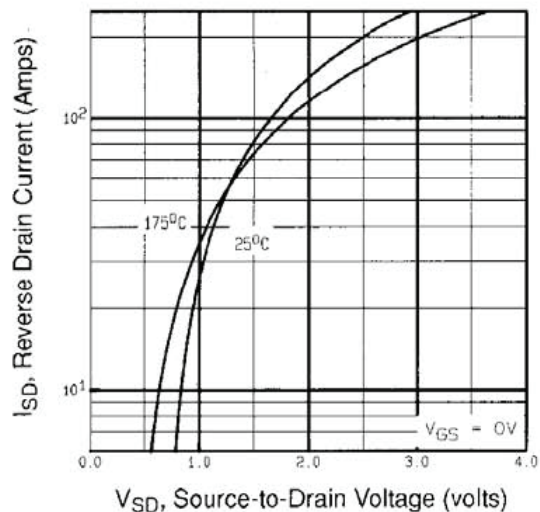


Fig. 7 - Typical Source-Drain Diode Forward Voltage

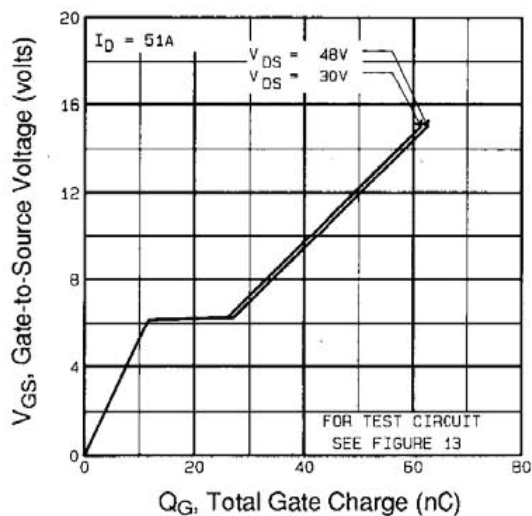


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

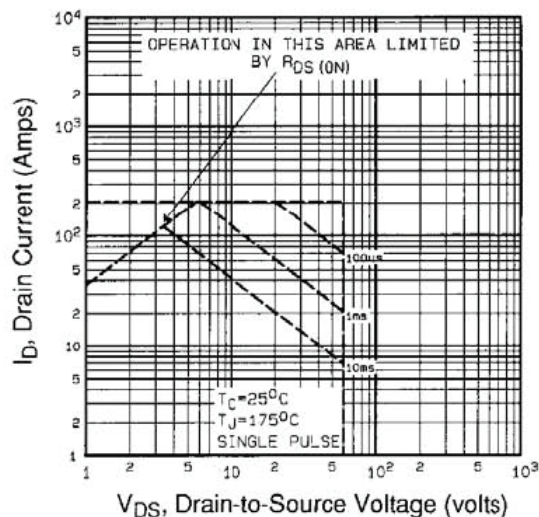


Fig. 8 - Maximum Safe Operating Area

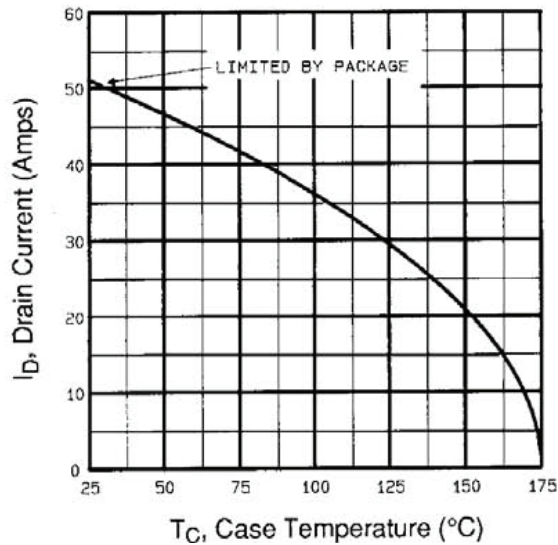


Fig. 9 - Maximum Drain Current vs. Case Temperature

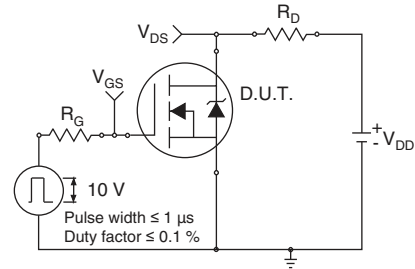


Fig. 10a - Switching Time Test Circuit

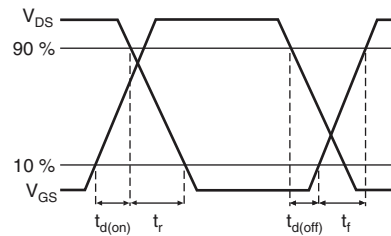


Fig. 10b - Switching Time Waveforms

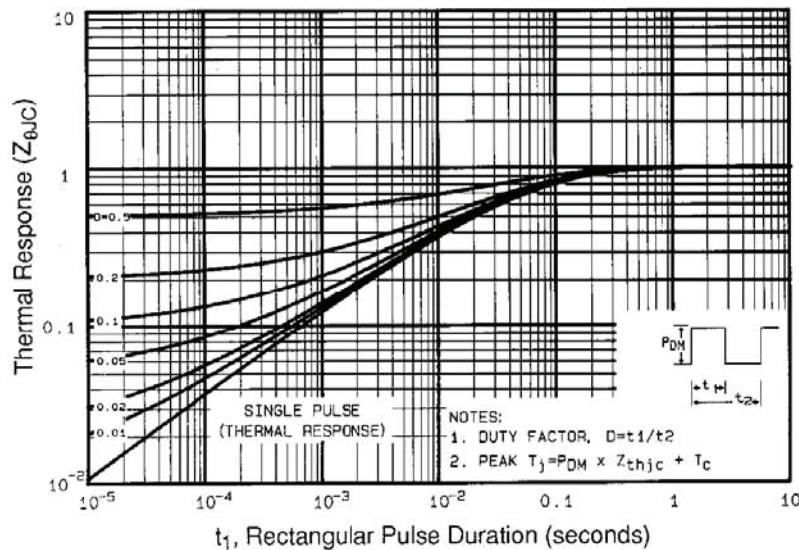


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

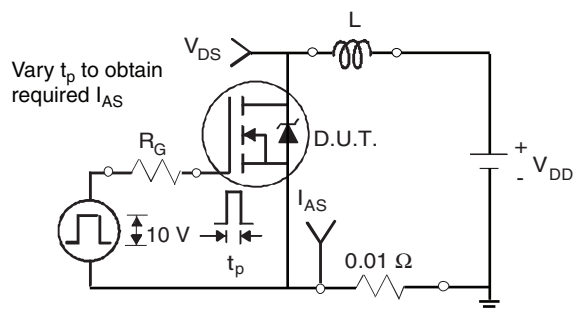


Fig. 12a - Unclamped Inductive Test Circuit

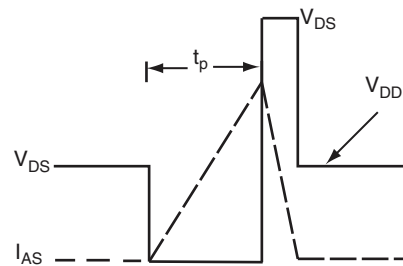


Fig. 12b - Unclamped Inductive Waveforms



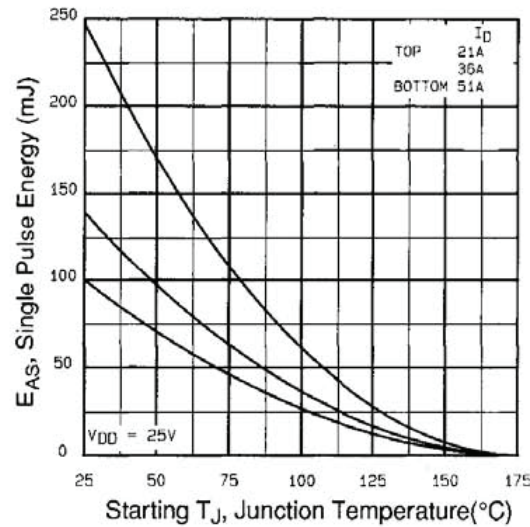


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

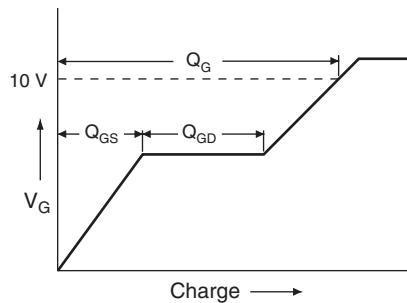


Fig. 13a - Basic Gate Charge Waveform

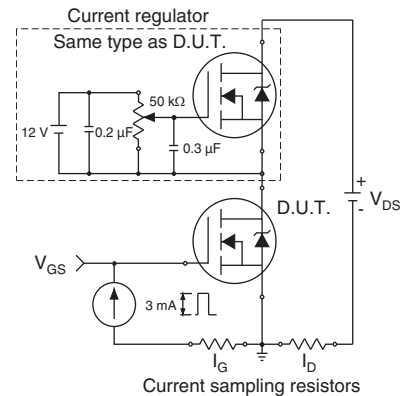
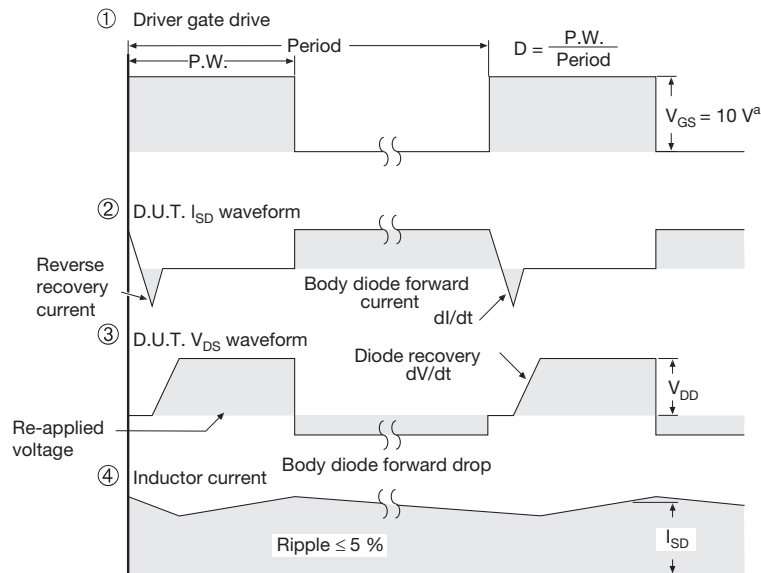
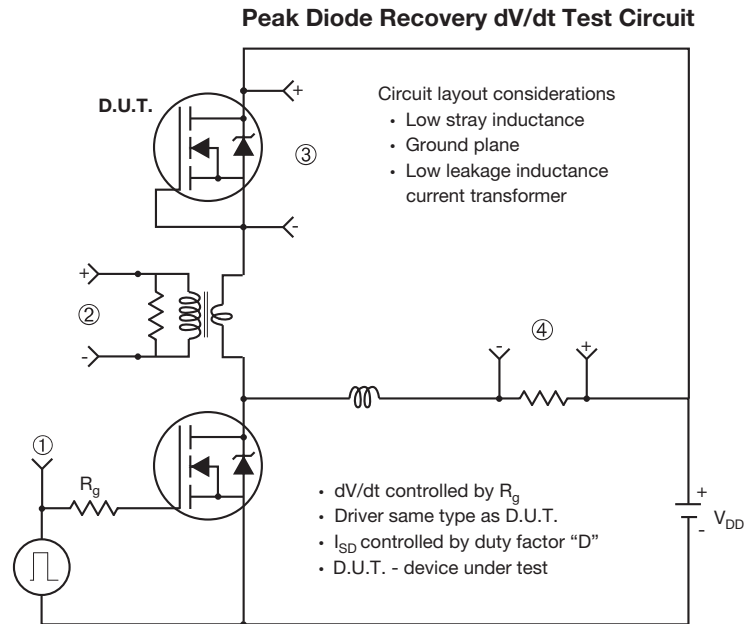


Fig. 13b - Gate Charge Test



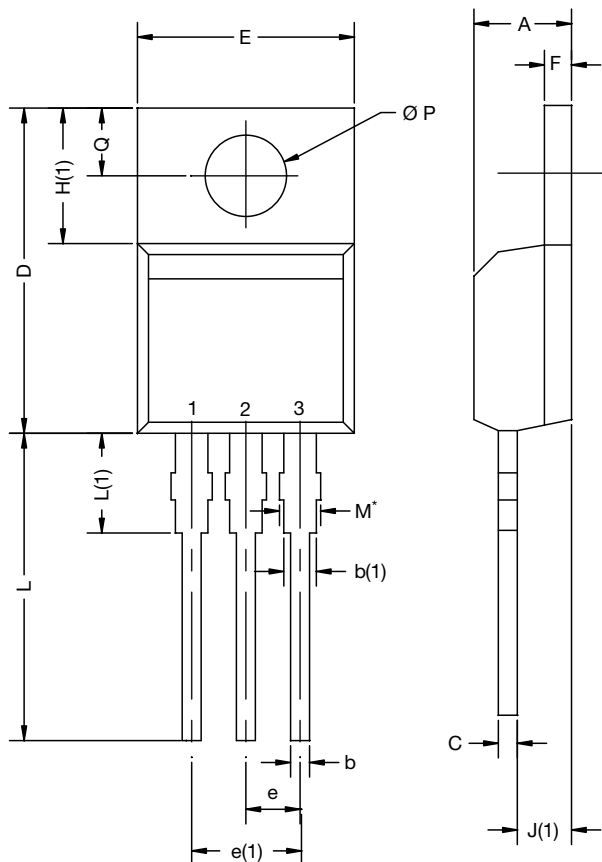
**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 14 - For N-Channel**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?91291](http://www.vishay.com/ppg?91291).

## TO-220-1



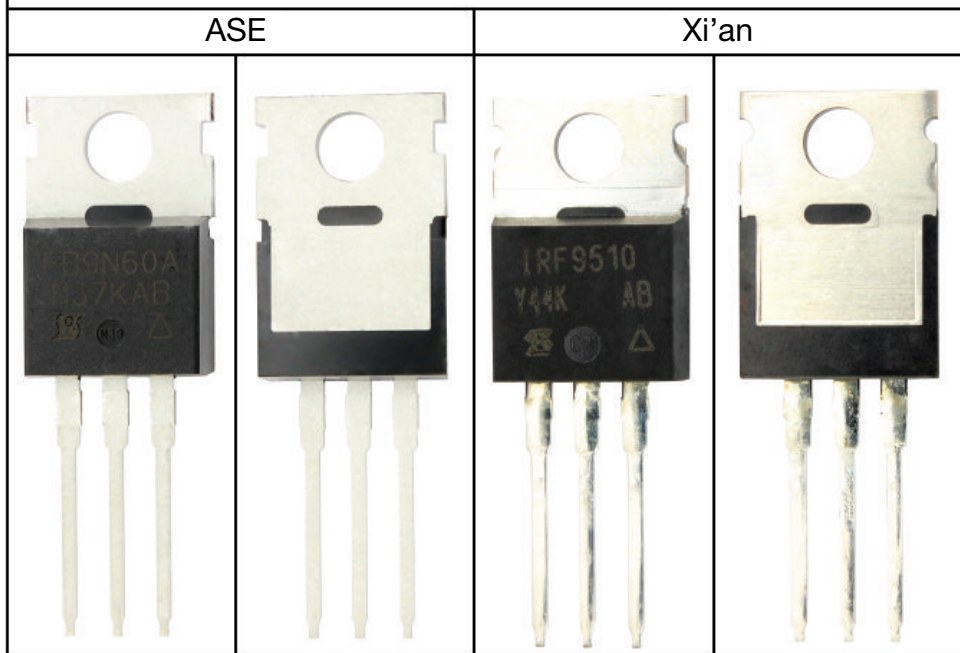
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	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
Ø P	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: X15-0364-Rev. C, 14-Dec-15  
DWG: 6031

### Note

- M\* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM

## Package Picture







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