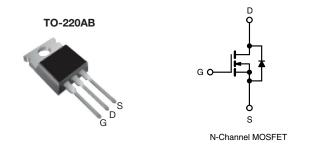


## **Power MOSFET**

PRODUCT SUMMARY				
V <sub>DS</sub> (V)	60			
$R_{DS(on)}\left(\Omega\right)$	V <sub>GS</sub> = 10 V	0.20		
Q <sub>g</sub> (Max.) (nC)	11			
Q <sub>gs</sub> (nC)	3.1			
Q <sub>gd</sub> (nC)	5.8			
Configuration	Single			



### **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'

### **DESCRIPTION**

Third Generation Power MOSFETs from Vishay provides 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 all 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	
Load (Dla) fine	IRFZ10PbF	
Lead (Pb)-free	SiHFZ10-E3	
C-Db	IRFZ10	
SnPb	SiHFZ10	

ABSOLUTE MAXIMUM RATINGS (TC	= 25 °C, unl	ess otherwis	se noted)			
PARAMETER			SYMBOL	LIMIT	UNIT	
Drain-Source Voltage			$V_{DS}$	60	V	
Gate-Source Voltage			$V_{GS}$	± 20	1 V	
Continuous Drain Current	V -140V	T <sub>C</sub> = 25 °C	- I <sub>D</sub>	10		
	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 100 °C		7.2	Α	
Pulsed Drain Current <sup>a</sup>			I <sub>DM</sub>	40		
Linear Derating Factor				0.29	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>			E <sub>AS</sub>	47	mJ	
Maximum Power Dissipation	T <sub>C</sub> =	25 °C	$P_{D}$	43	W	
Peak Diode Recovery dV/dtc			dV/dt	4.5	V/ns	
Operating Junction and Storage Temperature Range			T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 175	00	
Soldering Recommendations (Peak Temperature)	for 10 s			300 <sup>d</sup>	- °C	
Mounting Torque	6-32 or M3 screw			10	lbf ⋅ in	
				1.1	N⋅m	

#### Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b.  $V_{DD}$  = 25 V, starting  $T_J$  = 25 °C, L = 1.8 mH,  $R_g$  = 25  $\Omega$ ,  $I_{AS}$  = 7.2 A (see fig. 12).
- c.  $I_{SD} \le 10$  A,  $dI/dt \le 90$  A/ $\mu$ s,  $V_{DD} \le V_{DS}$ ,  $T_J \le 175$  °C.
- d. 1.6 mm from case.

<sup>\*</sup> Pb containing terminations are not RoHS compliant, exemptions may apply



THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R <sub>thJA</sub>	-	62	
Case-to-Sink, Flat, Greased Surface	R <sub>thCS</sub>	0.50	-	°C/W
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	-	3.5	

PARAMETER	SYMBOL	TEST (	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0$	) V, I <sub>D</sub> = 250 μA	60	-	-	V
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	Reference	Reference to 25 °C, I <sub>D</sub> = 1 mA		0.063	-	V/°C
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V$	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$		-	4.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V		ı	-	25	μΑ
Zero date voltage Drain Guirent	DSS	$V_{DS} = 48 \text{ V}, \text{ V}$	$t_{GS} = 0 \text{ V}, T_{J} = 150 ^{\circ}\text{C}$	ı	-	250	μΑ
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	$V_{GS} = 10 \text{ V}$	$I_D = 6.0 \text{ A}^b$	ı	-	0.20	Ω
Forward Transconductance	9 <sub>fs</sub>	V <sub>DS</sub> = 25 V, I <sub>D</sub> = 6.0 A <sup>b</sup>		2.4	-	-	S
Dynamic							
Input Capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$ $V_{DS} = 25 \text{ V}$ $f = 1.0 \text{ MHz}, \text{ see fig. 5}$		1	300	-	pF
Output Capacitance	C <sub>oss</sub>			ı	160	-	
Reverse Transfer Capacitance	$C_{rss}$			ı	29	-	
Total Gate Charge	$Q_g$		$V_{GS} = 10 \text{ V}$ $I_D = 10 \text{ A}, V_{DS} = 48 \text{ V}, - \text{see fig. 6 and } 13^{\text{b}}$	i	-	11	nC
Gate-Source Charge	$Q_{gs}$	V <sub>GS</sub> = 10 V		-	-	3.1	
Gate-Drain Charge	Q <sub>gd</sub>			-	-	5.8	
Turn-On Delay Time	t <sub>d(on)</sub>	$V_{DD}=30~\text{V},~\text{I}_D=10~\text{A}$ $R_g=24~\Omega,~\text{R}_D=2.7~\Omega,~\text{see fig.}~10^b$		1	10	-	ns
Rise Time	t <sub>r</sub>			-	50	-	
Turn-Off Delay Time	t <sub>d(off)</sub>			-	13	-	
Fall Time	t <sub>f</sub>			-	19	-	
Internal Drain Inductance	L <sub>D</sub>	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	
Internal Source Inductance	L <sub>S</sub>			-	7.5	-	- nH
Drain-Source Body Diode Characteristic	s				•	•	
Continuous Source-Drain Diode Current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	10	A
Pulsed Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			-	-	40	
Body Diode Voltage	$V_{SD}$	$T_J = 25  ^{\circ}\text{C},  I_S = 10  \text{A},  V_{GS} = 0  \text{V}^{\text{b}}$		ı	-	1.6	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	- T <sub>J</sub> = 25 °C, I <sub>F</sub> = 10 A, di/dt = 100 A/μs <sup>b</sup>		ı	70	140	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			-	0.20	0.40	μC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-	on is do	minated b	ov Ls and	L <sub>D</sub> )	

### **Notes**

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



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

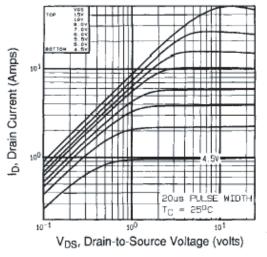


Fig. 1 - Typical Output Characteristics, T<sub>C</sub> = 25 °C

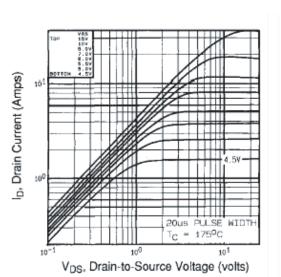


Fig. 2 - Typical Output Characteristics, T<sub>C</sub> = 175 °C

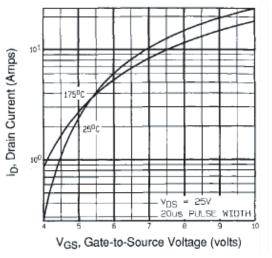


Fig. 3 - Typical Transfer Characteristics

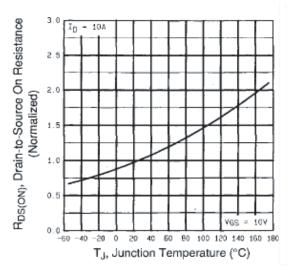


Fig. 4 - Normalized On-Resistance vs. Temperature



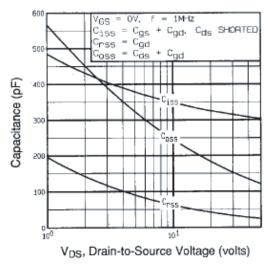


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

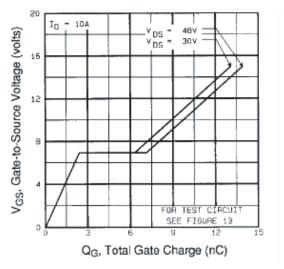


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

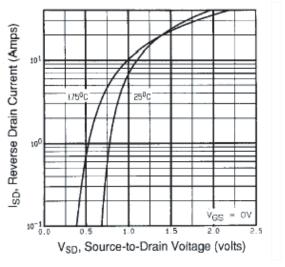


Fig. 7 - Typical Source-Drain Diode Forward Voltage

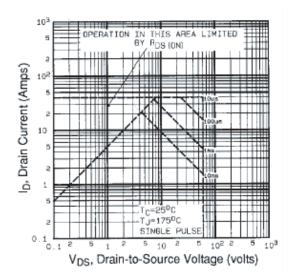


Fig. 8 - Maximum Safe Operating Area





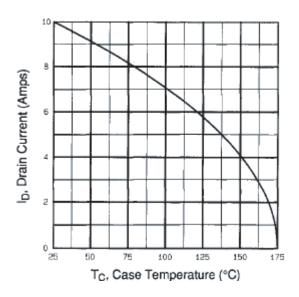


Fig. 9 - Maximum Drain Current vs. Case Temperature

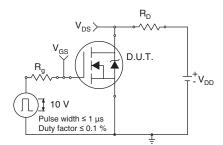


Fig. 10a - Switching Time Test Circuit

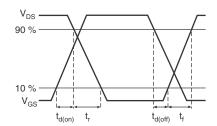


Fig. 10b - Switching Time Waveforms

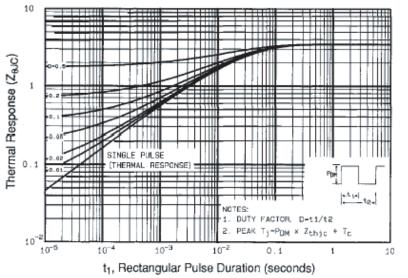


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



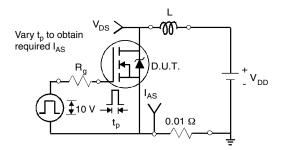


Fig. 12a - Unclamped Inductive Test Circuit

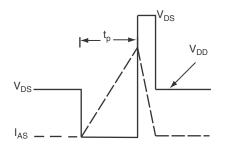


Fig. 12b - Unclamped Inductive Waveforms

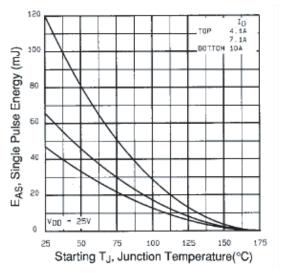


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

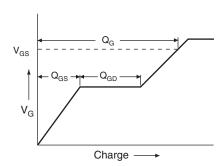


Fig. 13a - Basic Gate Charge Waveform

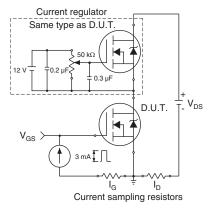
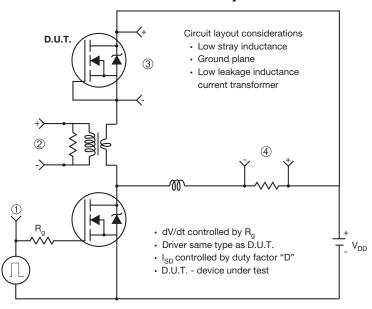


Fig. 13b - Gate Charge Test Circuit





### Peak Diode Recovery dV/dt Test Circuit



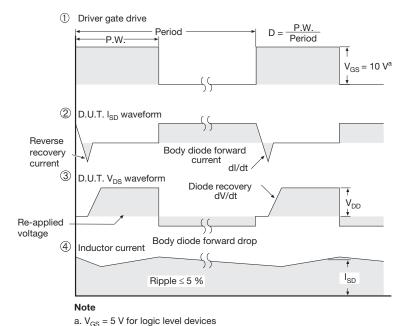


Fig. 14 - For N-Channel

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Revision: 02-Oct-12 Document Number: 91000