

Power MOSFET

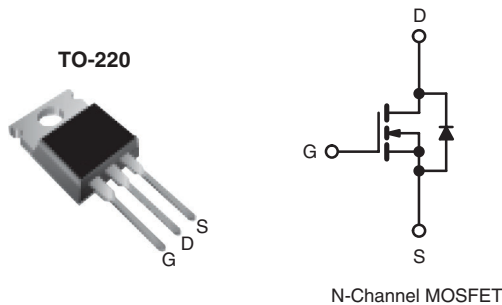
PRODUCT SUMMARY		
V_{DS} (V)	50	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.024
Q_g (Max.) (nC)	66	
Q_{gs} (nC)	21	
Q_{gd} (nC)	25	
Configuration	Single	

FEATURES

- Dynamic dV/dt Rating
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available



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-220 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-220 contribute to its wide acceptance throughout the industry.

ORDERING INFORMATION	
Package	TO-220
Lead (Pb)-free	IRFZ46PbF
	SiHFZ46-E3
SnPb	IRFZ46
	SiHFZ46

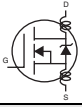

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	50	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ^e	V_{GS} at 10 V	$T_C = 25$ °C	A
Continuous Drain Current		$T_C = 100$ °C	
Pulsed Drain Current ^a	I_{DM}	220	
Linear Derating Factor		1.0	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	100	mJ
Maximum Power Dissipation	$T_C = 25$ °C	P_D	W
Peak Diode Recovery dV/dt^c		dV/dt	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature) ^d	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).
- $V_{DD} = 25$ V, starting $T_J = 25$ °C, $L = 34$ μ H, $R_G = 25$ Ω , $I_{AS} = 54$ A (see fig. 12).
- $I_{SD} \leq 54$ A, $dI/dt \leq 250$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 175$ °C.
- 1.6 mm from case
- Current limited by the package, (die current = 54 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 $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	50	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$	-	0.057	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 32\text{ A}^b$	-	-	0.024	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 25\text{ V}, I_D = 32\text{ A}^b$	27	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5	-	1800	-	pF
Output Capacitance	C_{oss}		-	960	-	
Reverse Transfer Capacitance	C_{rss}		-	160	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}, I_D = 54\text{ A}, V_{DS} = 48\text{ V}$, see fig. 6 and 13 ^b	-	-	66	nC
Gate-Source Charge	Q_{gs}		-	-	21	
Gate-Drain Charge	Q_{gd}		-	-	25	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 28\text{ V}, I_D = 54\text{ A}, R_G = 9.1\text{ }\Omega, R_D = 0.49\text{ }\Omega$, see fig. 10 ^b	-	12	-	ns
Rise Time	t_r		-	120	-	
Turn-Off Delay Time	$t_{d(off)}$		-	42	-	
Fall Time	t_f		-	95	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 	-	4.5	-	nH
Internal Source Inductance	L_S		-	7.5	-	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	50 ^c	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	220	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 54\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	2.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 54\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	66	99	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	0.17	0.31	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

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 $\leq 2\%$.
- c. Current limited by the package, (die current = 54 A).

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

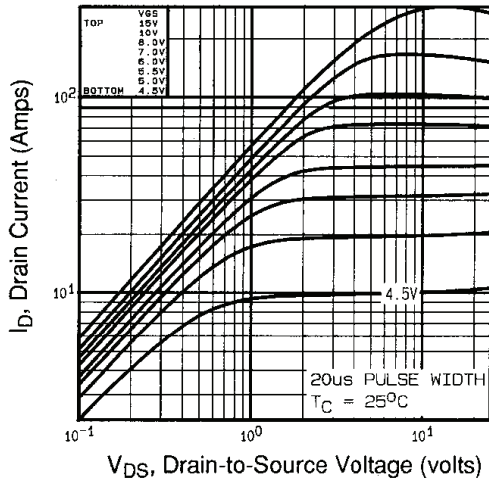


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

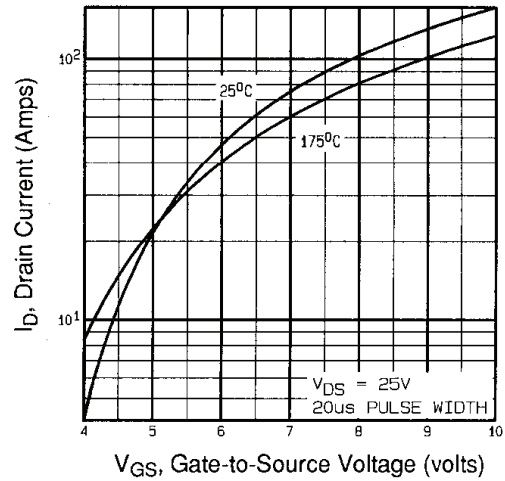


Fig. 3 - Typical Transfer Characteristics

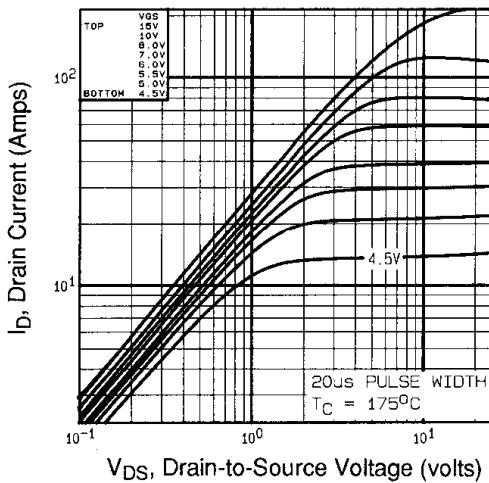


Fig. 2 - Typical Output Characteristics, $T_C = 175\text{ }^\circ\text{C}$

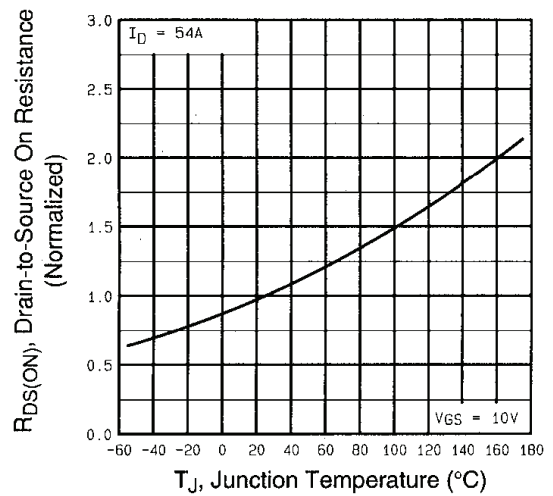


Fig. 4 - Normalized On-Resistance vs. Temperature

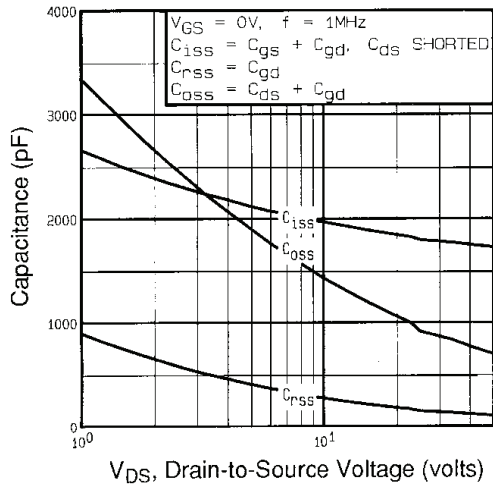


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

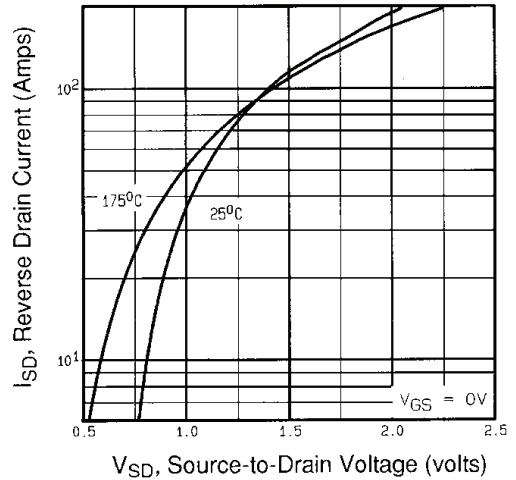


Fig. 7 - Typical Source-Drain Diode Forward Voltage

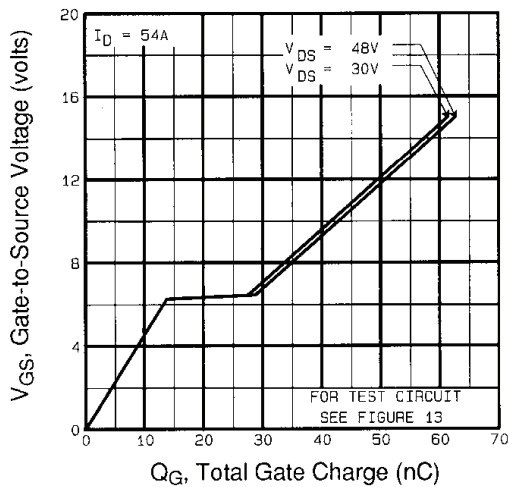


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

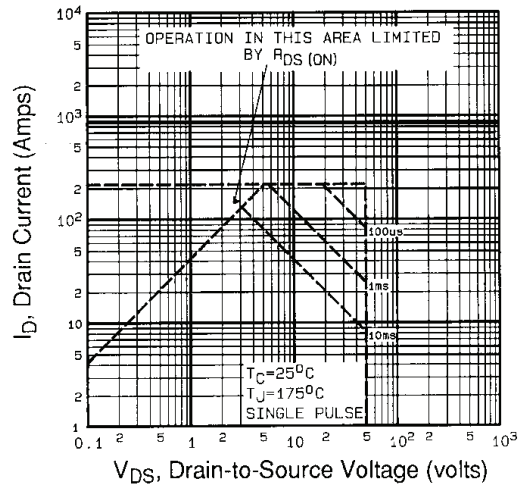


Fig. 8 - Maximum Safe Operating Area

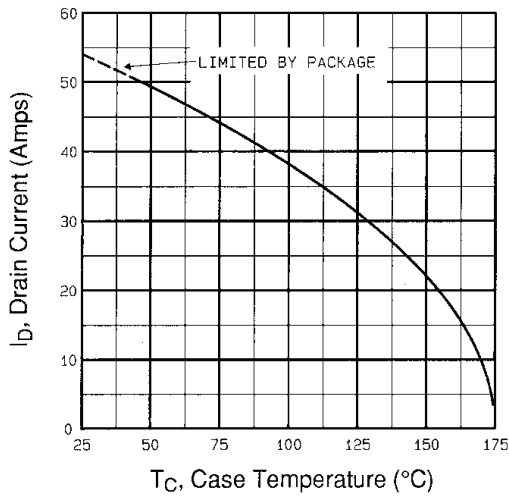


Fig. 9 - Maximum Drain Current vs. Case Temperature

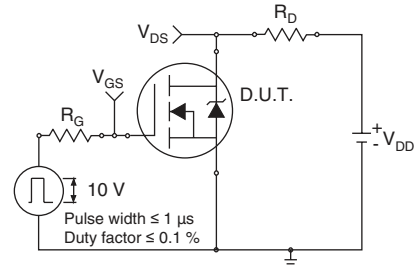


Fig. 10a - Switching Time Test Circuit

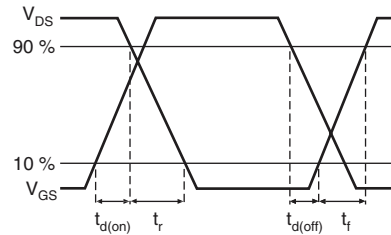


Fig. 10b - Switching Time Waveforms

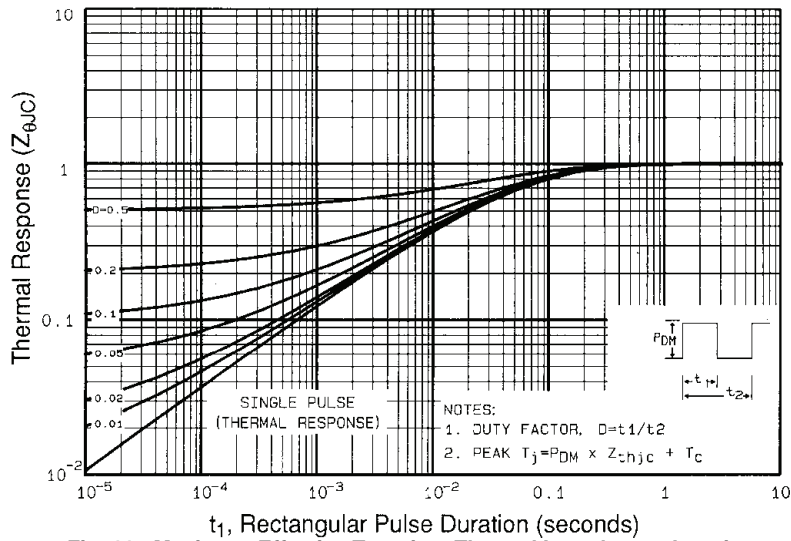


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

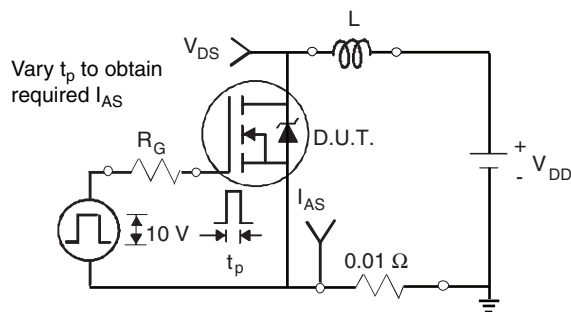


Fig. 12a - Unclamped Inductive Test Circuit

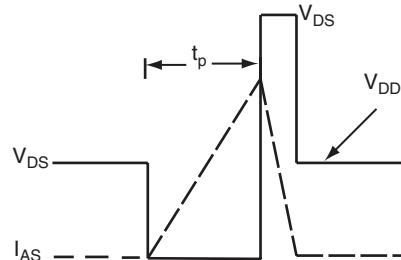


Fig. 12b - Unclamped Inductive Waveforms

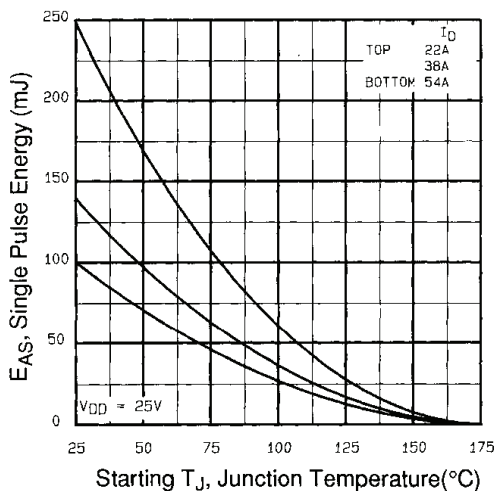


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

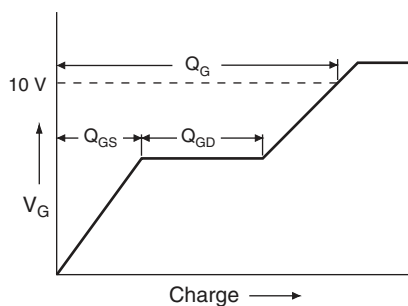


Fig. 13a - Basic Gate Charge Waveform

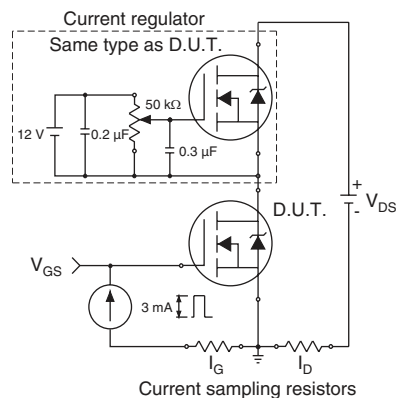
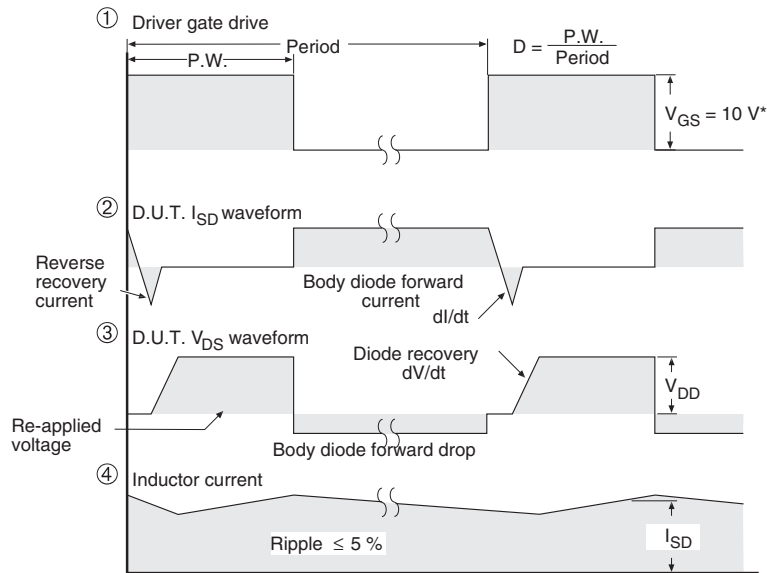
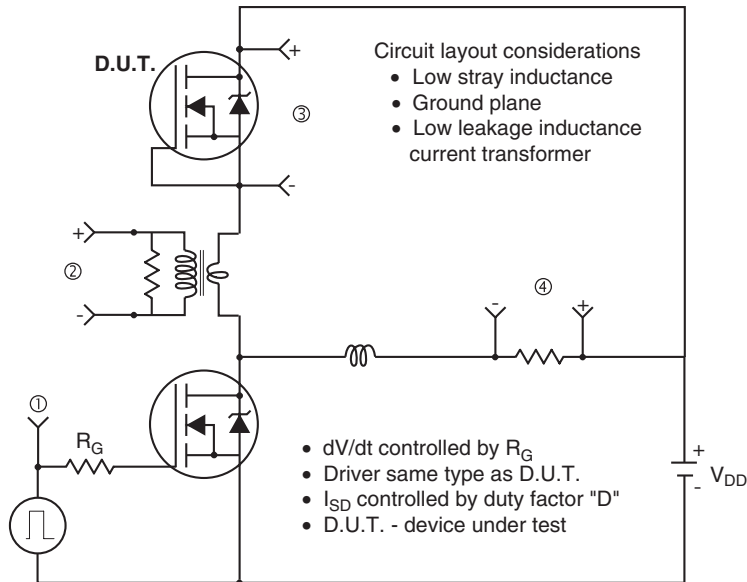


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel

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