

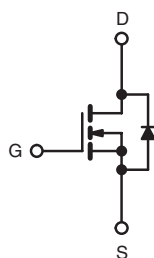
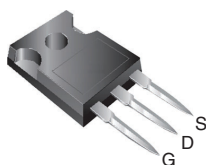


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.85
Q_g (Max.) (nC)	63	
Q_{gs} (nC)	11	
Q_{gd} (nC)	30	
Configuration	Single	

TO-247



N-Channel MOSFET

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- 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-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole. It also provides greater creepage distances between pins to meet the requirements of most safety specifications.

ORDERING INFORMATION

Package	TO-247
Lead (Pb)-free	IRFP440PbF
	SiHFP440-E3
SnPb	IRFP440
	SiHFP440

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^{\circ}\text{C}$, unless otherwise noted

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	500	V
Gate-Source Voltage			V _{GS}	± 20	
Continuous Drain Current	V _{GS} at 10 V	T _C = 25 °C	I _D	8.8	A
		T _C = 100 °C		5.6	
Pulsed Drain Current ^a			I _{DM}	35	
Linear Derating Factor				1.2	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	480	mJ
Repetitive Avalanche Current ^a			I _{AR}	8.8	A
Repetitive Avalanche Energy ^a			E _{AR}	15	mJ
Maximum Power Dissipation	T _C = 25 °C		P _D	150	W
Peak Diode Recovery dV/dt ^c			dV/dt	3.5	V/ns
Operating Junction and Storage Temperature Range			T _J , T _{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)		for 10 s		300 ^d	
Mounting Torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

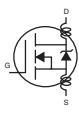
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 11\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = 8.8\text{ A}$ (see fig. 12).
- $I_{SD} \leq 8.8\text{ A}$, $dI/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^{\circ}\text{C}$.
- 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.24	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.83	

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$		500	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.78	-	V/ $^\circ\text{C}$
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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$		-	-	25	μA
		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 5.3\text{ A}^b$	-	-	0.85	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 5.3\text{ A}^b$		5.3	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5		-	1300	-	pF
Output Capacitance	C_{oss}			-	310	-	
Reverse Transfer Capacitance	C_{rss}			-	120	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 8.0\text{ A}$, $V_{DS} = 400\text{ V}$ see fig. 6 and 13 ^b	-	-	63	nC
Gate-Source Charge	Q_{gs}			-	-	11	
Gate-Drain Charge	Q_{gd}			-	-	30	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}$, $I_D = 8.0\text{ A}$, $R_G = 9.1\text{ }\Omega$, $R_D = 31\text{ }\Omega$, see fig. 10 ^b		-	14	-	ns
Rise Time	t_r			-	23	-	
Turn-Off Delay Time	$t_{d(off)}$			-	49	-	
Fall Time	t_f			-	20	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 		-	5.0	-	nH
Internal Source Inductance	L_S			-	13	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	8.8	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	35	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 8.8\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	-	2.0	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 8.0\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$		-	460	970	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	3.5	7.6	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 $\leq 2\%$.



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

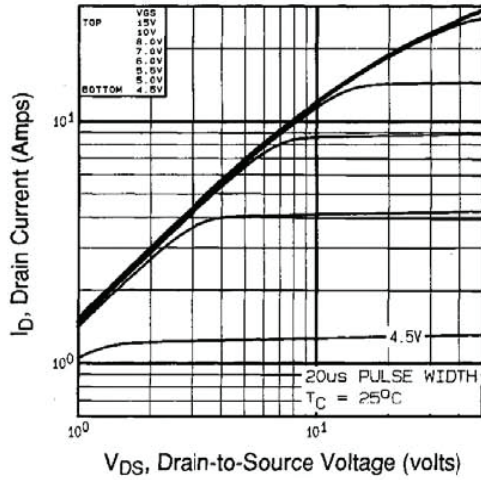


Fig. 1 - Typical Output Characteristics, $T_C = 25^\circ\text{C}$

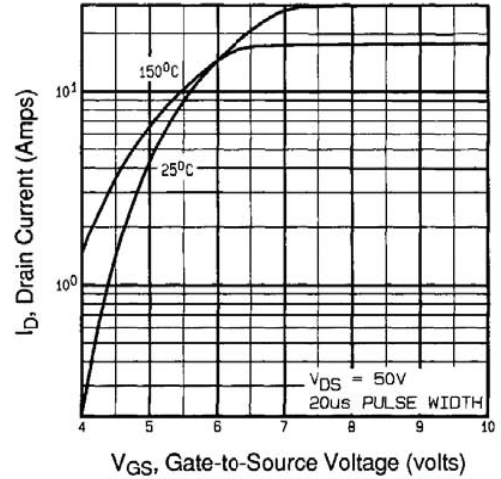


Fig. 3 - Typical Transfer Characteristics

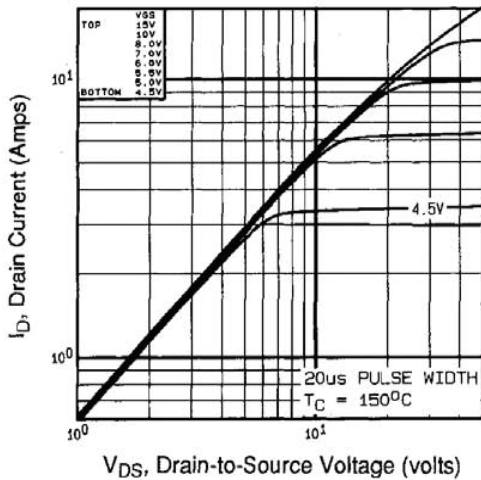


Fig. 2 - Typical Output Characteristics, $T_C = 150^\circ\text{C}$

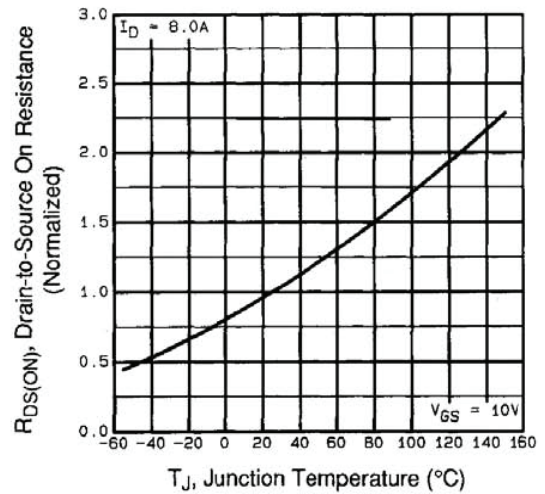


Fig. 4 - Normalized On-Resistance vs. Temperature

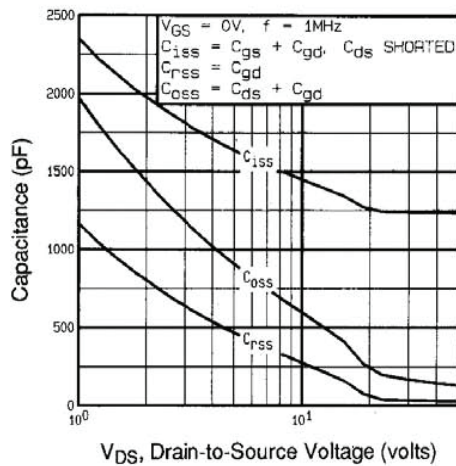


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

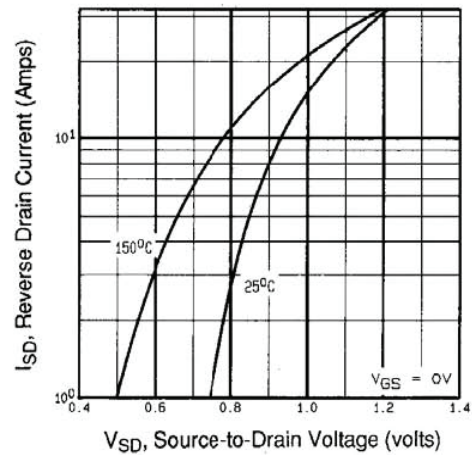


Fig. 7 - Typical Source-Drain Diode Forward Voltage

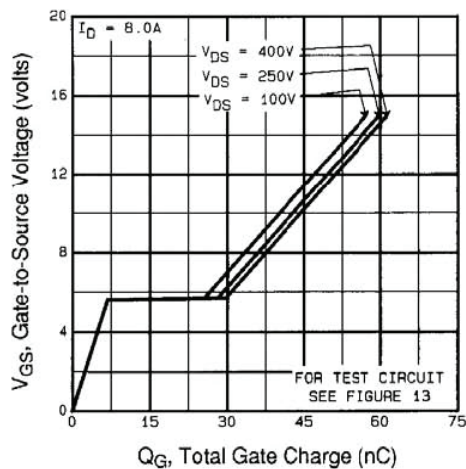


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

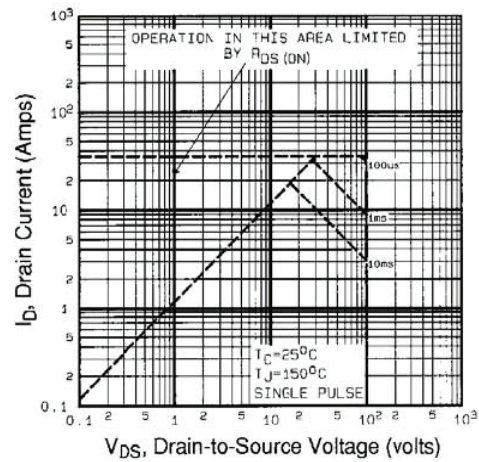


Fig. 8 - Maximum Safe Operating Area

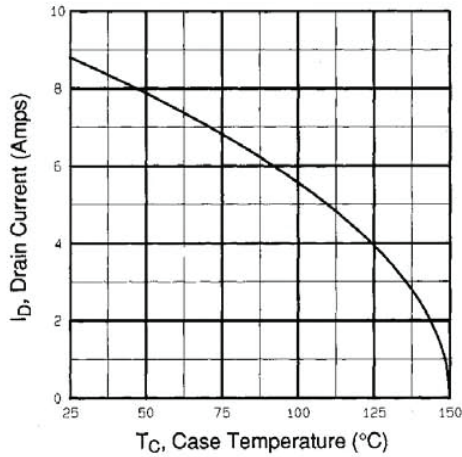


Fig. 9 - Maximum Drain Current vs. Case Temperature

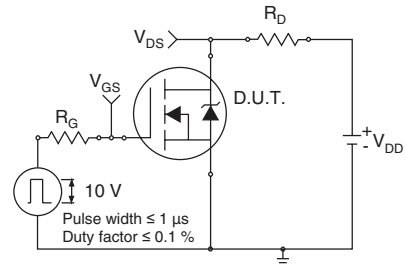


Fig. 10a - Switching Time Test Circuit

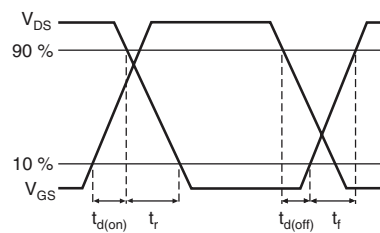


Fig. 10b - Switching Time Waveforms

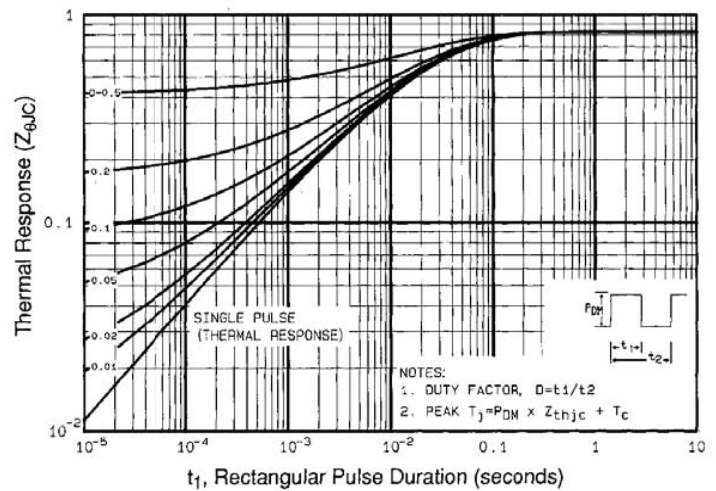


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

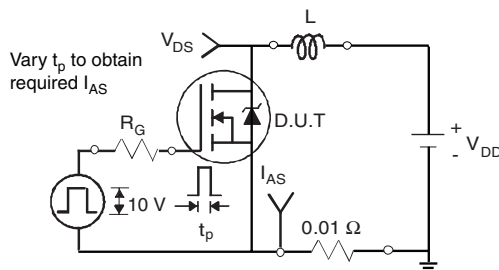


Fig. 12a - Unclamped Inductive Test Circuit

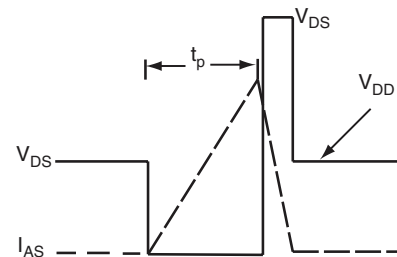


Fig. 12b - Unclamped Inductive Waveforms

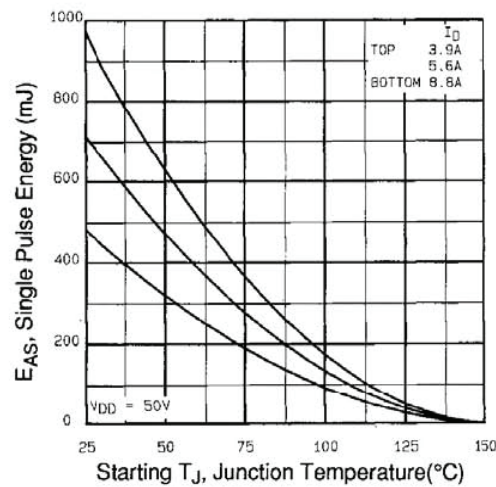


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

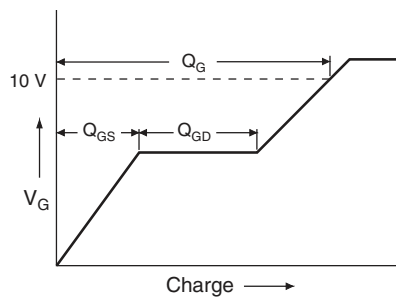


Fig. 13a - Basic Gate Charge Waveform

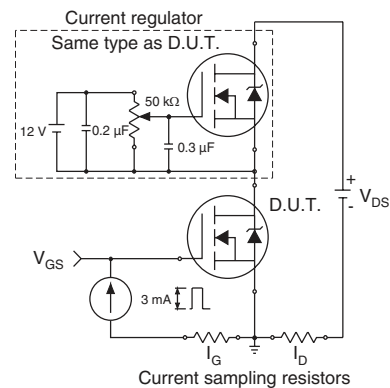


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

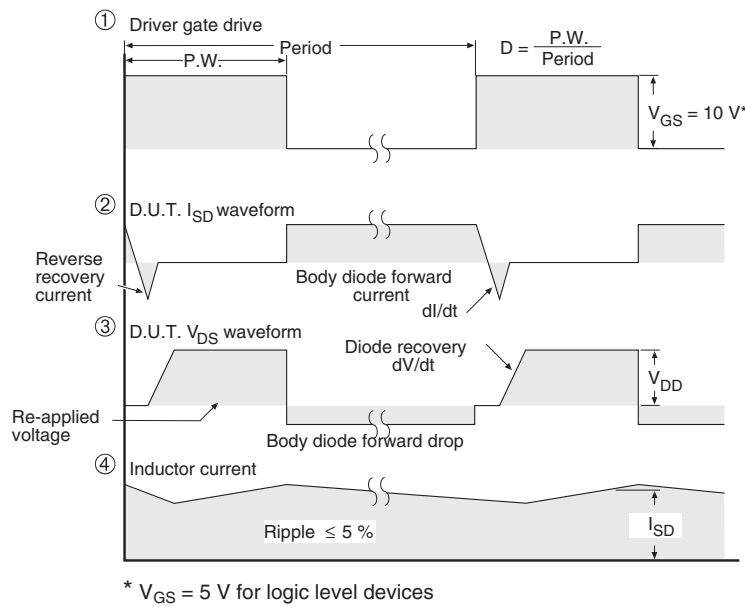
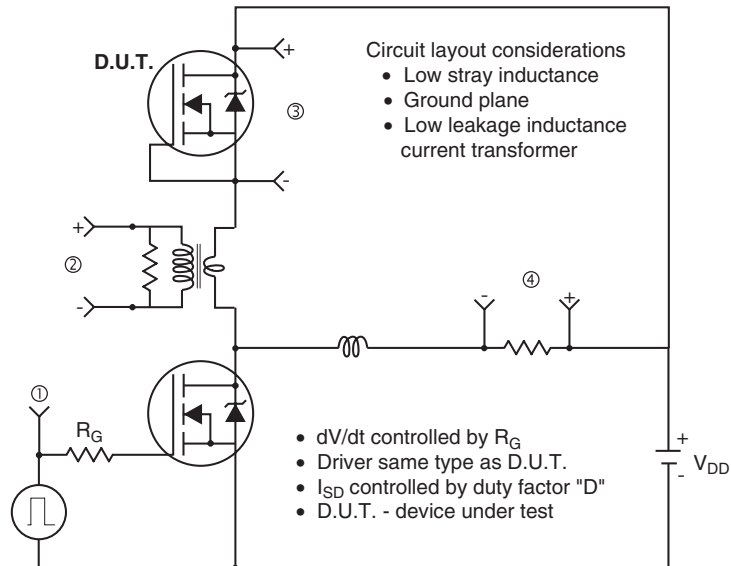


Fig.14 - For N-Channel

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