

Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	400	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.30
Q_g (Max.) (nC)	150	
Q_{gs} (nC)	23	
Q_{gd} (nC)	80	
Configuration	Single	

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available

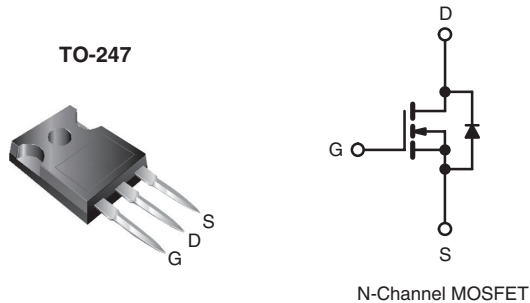


Available
RoHS*
COMPLIANT

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 distance between pins to meet the requirements of most safety specifications.



ORDERING INFORMATION	
Package	TO-247
Lead (Pb)-free	IRFP350PbF SiHFP350-E3
SnPb	IRFP350 SiHFP350

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	400	V	
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25$ °C	16	A
		$T_C = 100$ °C	10	
Pulsed Drain Current ^a	I_{DM}	64		
Linear Derating Factor		1.5	W/°C	
Single Pulse Avalanche Energy ^b	E_{AS}	390	mJ	
Repetitive Avalanche Current ^a	I_{AR}	16	A	
Repetitive Avalanche Energy ^a	E_{AR}	19	mJ	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	190	W
Peak Diode Recovery dV/dt^c		dV/dt	4.0	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).
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 2.7$ mH, $R_G = 25$ Ω , $I_{AS} = 16$ A (see fig. 12).
- $I_{SD} \leq 16$ A, $dI/dt \leq 200$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °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}	-	0.65	

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	400	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$	-	0.51	-	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}	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 320\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 9.6\text{ A}^b$	-	-	0.30	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 9.6\text{ A}^b$	10	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$, see fig. 5	-	2600	-	pF
Output Capacitance	C_{oss}		-	660	-	
Reverse Transfer Capacitance	C_{riss}		-	250	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V},$ $I_D = 16\text{ A}, V_{DS} = 320\text{ V},$ see fig. 6 and 13 ^b	-	-	150	nC
Gate-Source Charge	Q_{gs}		-	-	23	
Gate-Drain Charge	Q_{gd}		-	-	80	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 200\text{ V}, I_D = 16\text{ A},$ $R_G = 6.2\text{ }\Omega, R_D = 12\text{ }\Omega$ see fig. 10 ^b	-	16	-	ns
Rise Time	t_r		-	49	-	
Turn-Off Delay Time	$t_{d(off)}$		-	87	-	
Fall Time	t_f		-	47	-	
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 	-	-	16	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	64	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 16\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.6	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 16\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	380	570	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	4.7	7.1	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

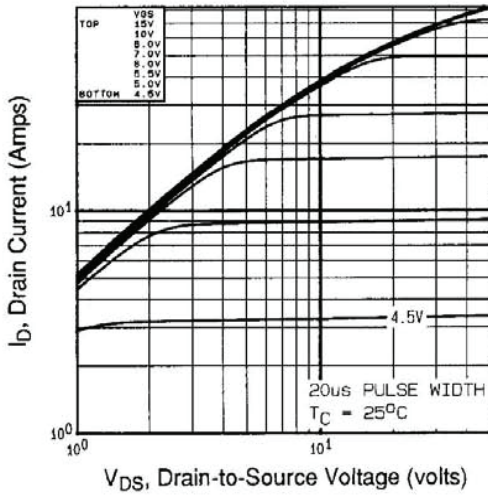


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

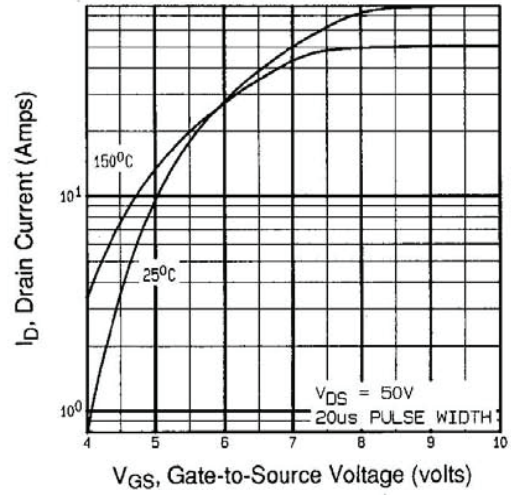


Fig. 3 - Typical Transfer Characteristics

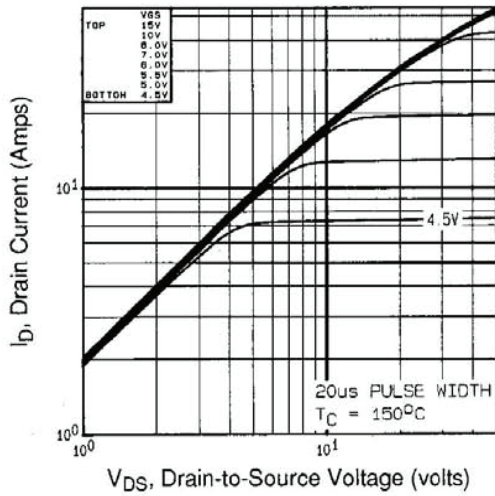


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

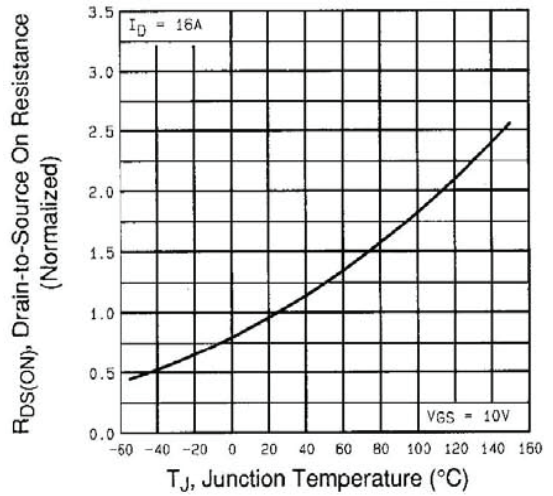


Fig. 4 - Normalized On-Resistance vs. Temperature

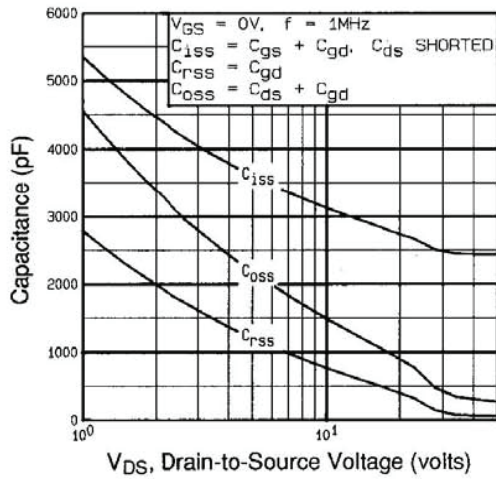


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

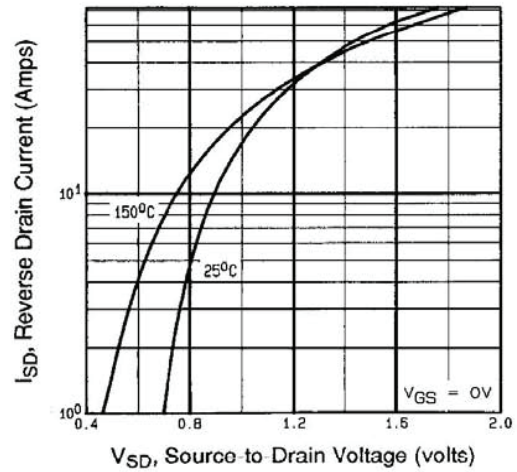


Fig. 7 - Typical Source-Drain Diode Forward Voltage

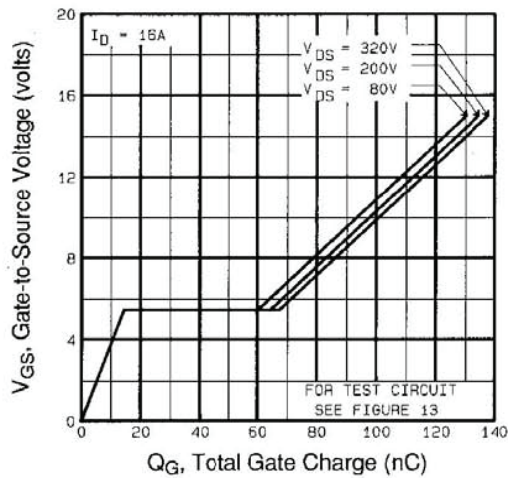


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

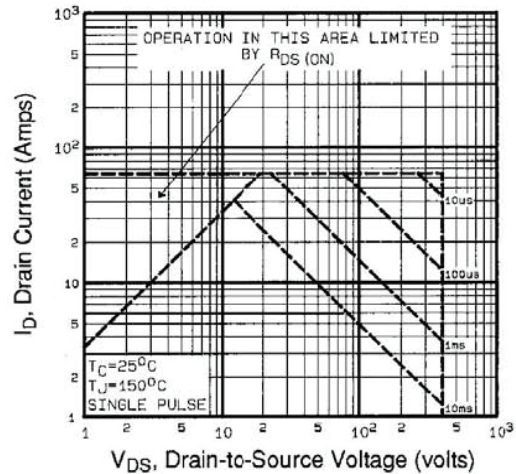


Fig. 8 - Maximum Safe Operating Area

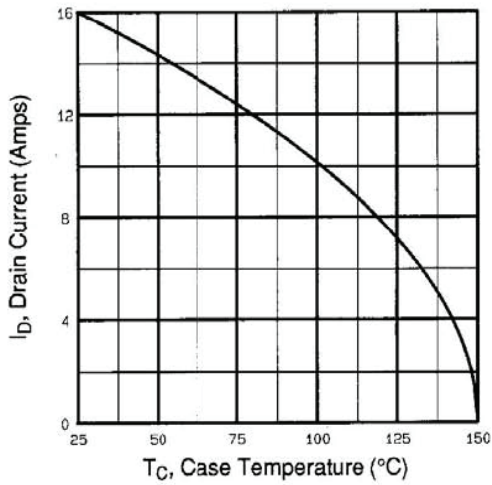


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit

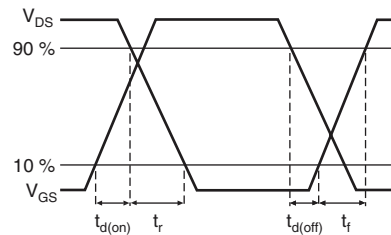


Fig. 10b - Switching Time Waveforms

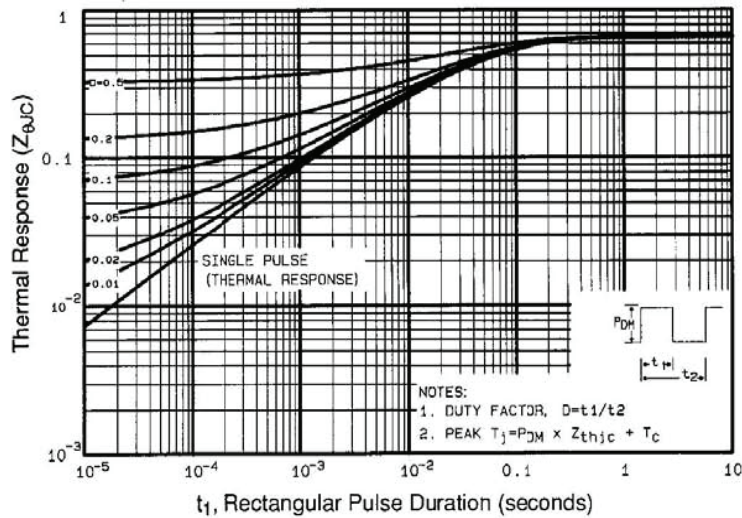


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

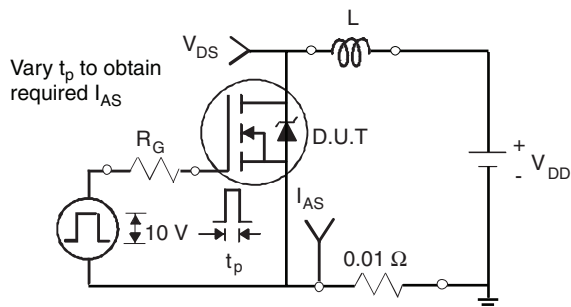


Fig. 12a - Unclamped Inductive Test Circuit

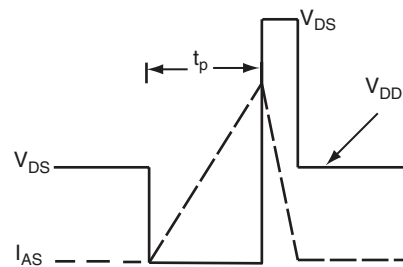


Fig. 12b - Unclamped Inductive Waveforms

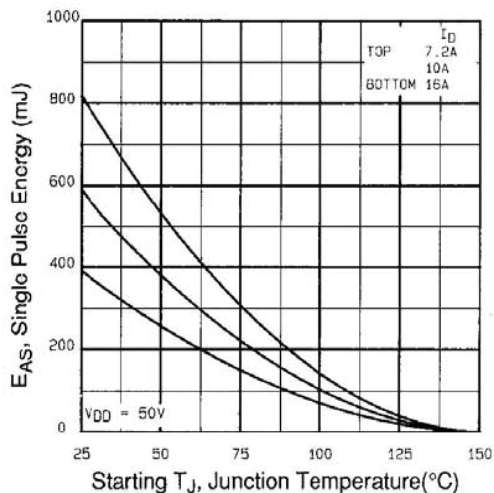


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

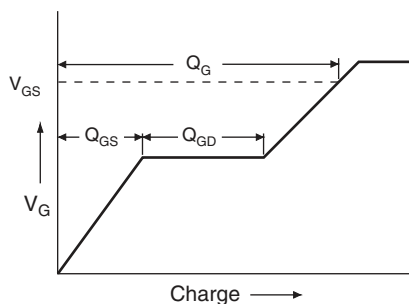


Fig. 13a - Basic Gate Charge Waveform

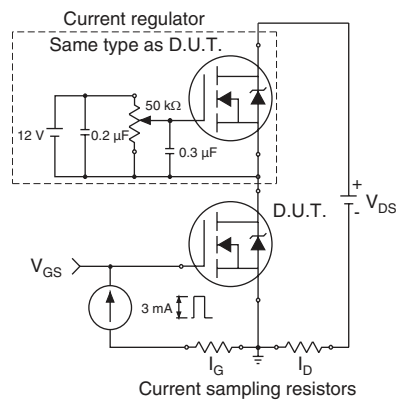
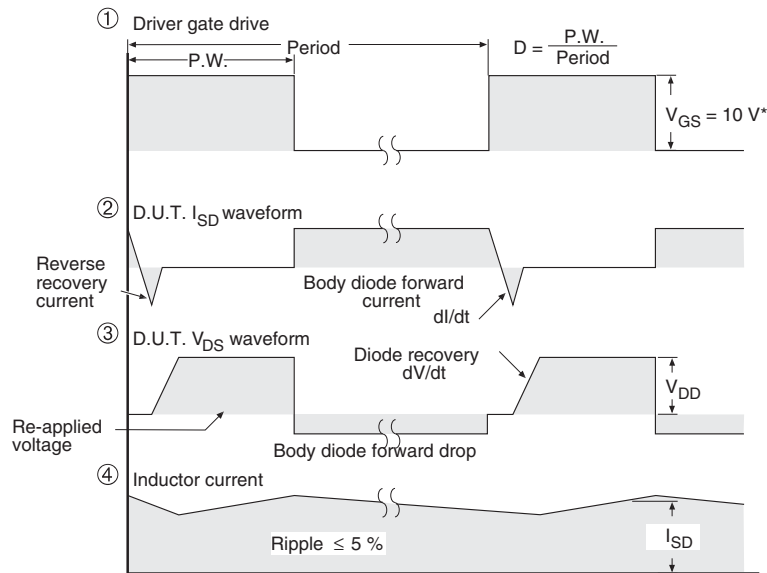
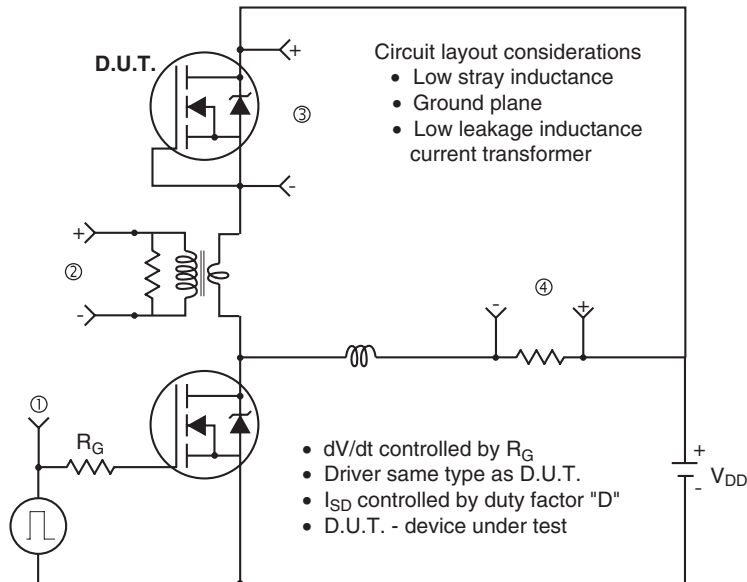


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel

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