

Power MOSFET



P-Channel MOSFET

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic insertion
- End stackable
- P-channel
- Fast switching
- Ease of paralleling
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{DS} (V)	-200	
$R_{DS(on)}$ (Ω)	$V_{GS} = -10$ V	3.0
Q_g (Max.) (nC)	8.9	
Q_{gs} (nC)	2.1	
Q_{gd} (nC)	3.9	
Configuration	Single	

DESCRIPTION

The power MOSFETs technology is the key to Vishay advanced line of power MOSFET transistors. The efficient geometry and unique processing of the power MOSFETs design achieve very low on-state resistance combined with high transconductance and extreme device ruggedness.

The 4 pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1" pin centers. The dual drain serves as a thermal link to the mounting surface for power dissipation levels up to 1 W.

ORDERING INFORMATION

Package	HVMDIP
Lead (Pb)-free	IRFD9210PbF

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	-200	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current	I_D	$T_A = 25$ °C	-0.40
		$T_A = 100$ °C	-0.25
Pulsed drain current ^a	I_{DM}	-3.2	A
Linear derating factor		0.0083	W/°C
Single pulse avalanche energy ^b	E_{AS}	210	mJ
Repetitive avalanche current ^a	I_{AR}	-0.40	A
Repetitive avalanche energy ^a	E_{AR}	0.10	mJ
Maximum power dissipation	P_D	1.0	W
Peak diode recovery dv/dt ^c	dV/dt	-5.0	V/ns
Operating junction and storage temperature range	T_J, T_{stg}	-55 to + 150	°C
Soldering rRecommendations (peak temperature) ^d	For 10 s	300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = -50$ V, starting $T_J = 25$ °C, $L = 123$ mH, $R_g = 25$ Ω , $I_{AS} = -1.6$ A (see fig. 12)
- $I_{SD} \leq -2.3$ A, $dI/dt \leq 70$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C
- 1.6 mm from case

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	120	°C/W

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}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$		-200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$		-	-0.23	-	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}	$V_{DS} = -200\text{ V}, V_{GS} = 0\text{ V}$		-	-	-100	μA
		$V_{DS} = -160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -0.24\text{ A}^b$	-	-	3.0	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -50\text{ V}, I_D = -0.24\text{ A}$		0.27	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = -25\text{ V},$ $f = 1.0\text{ MHz},$ see fig. 5		-	170	-	pF
Output Capacitance	C_{oss}			-	54	-	
Reverse Transfer Capacitance	C_{rss}			-	16	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$	$I_D = -1.3\text{ A}, V_{DS} = -160\text{ V}$ see fig. 6 and 13 ^b	-	-	8.9	nC
Gate-Source Charge	Q_{gs}			-	-	2.1	
Gate-Drain Charge	Q_{gd}			-	-	3.9	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -100\text{ V}, I_D = -2.3\text{ A}$ $R_g = 24\text{ }\Omega, R_D = 41\text{ }\Omega,$ see fig. 10 ^b		-	8.0	-	ns
Rise Time	t_r			-	12	-	
Turn-Off Delay Time	$t_{d(off)}$			-	11	-	
Fall Time	t_f			-	13	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact		-	4.0	-	nH
Internal Source Inductance	L_S			-	6.0	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	-0.40	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	-3.2	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = -0.40\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	-5.8	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = -2.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	110	220	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.56	1.1	μC

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)

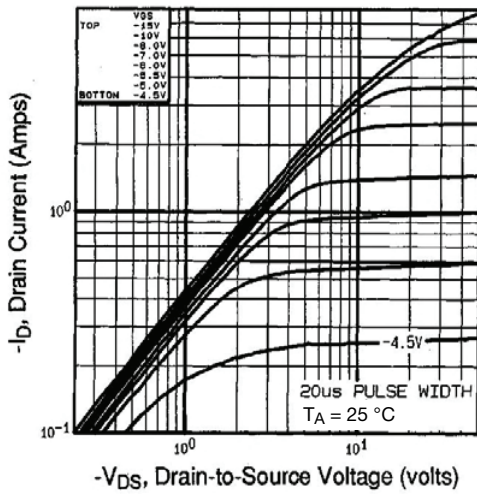


Fig. 1 - Typical Output Characteristics, $T_A = 25\text{ }^\circ\text{C}$

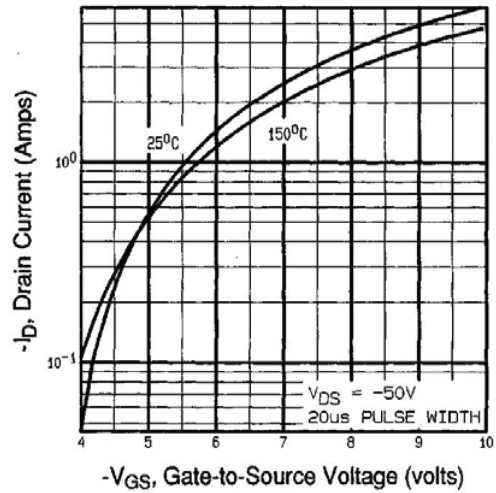


Fig. 3 - Typical Transfer Characteristics

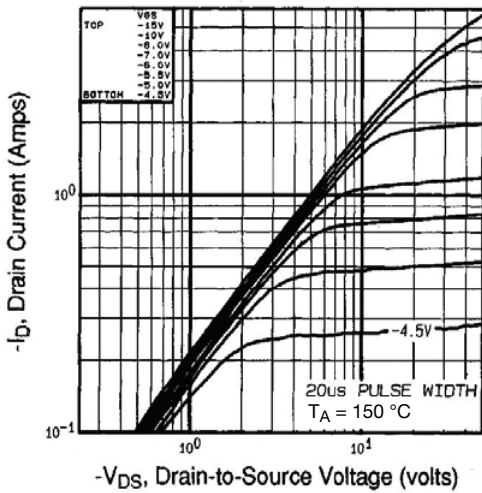


Fig. 2 - Typical Output Characteristics, $T_A = 150\text{ }^\circ\text{C}$

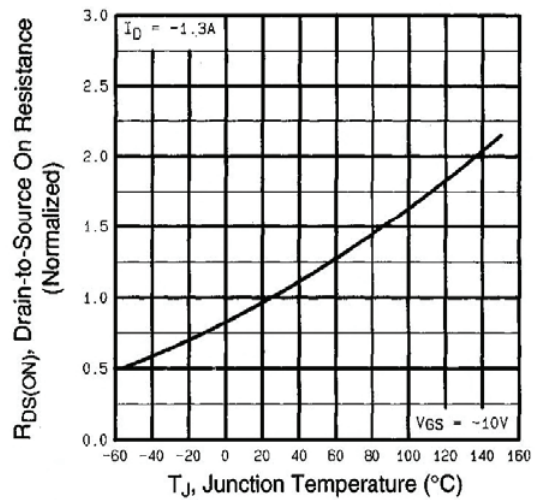


Fig. 4 - Normalized On-Resistance vs. Temperature

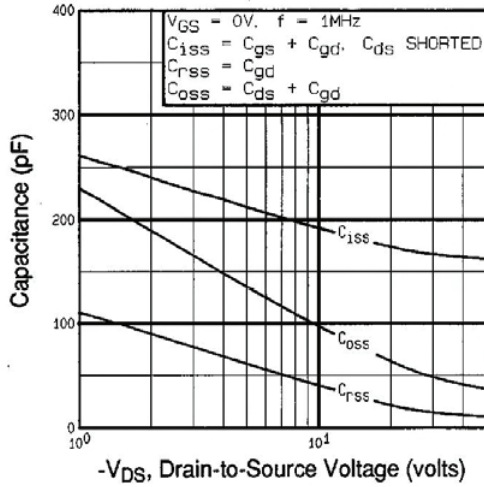


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

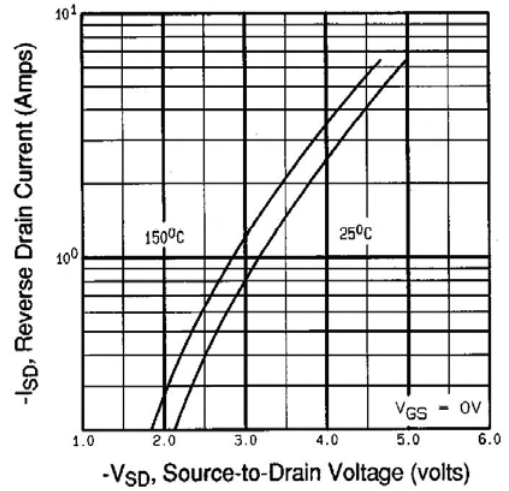


Fig. 7 - Typical Source-Drain Diode Forward Voltage

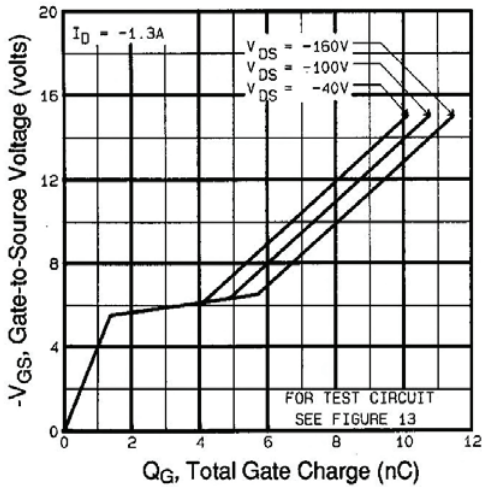


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

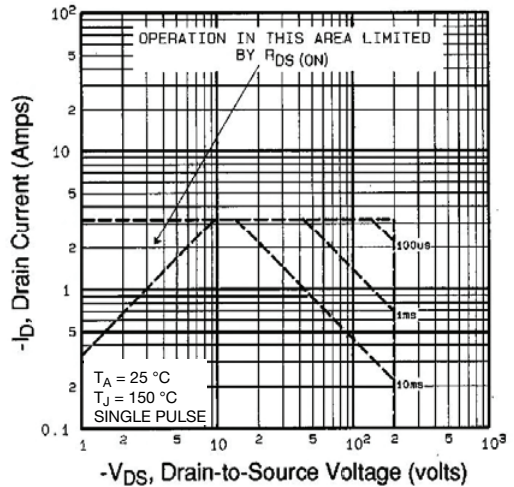


Fig. 8 - Maximum Safe Operating Area

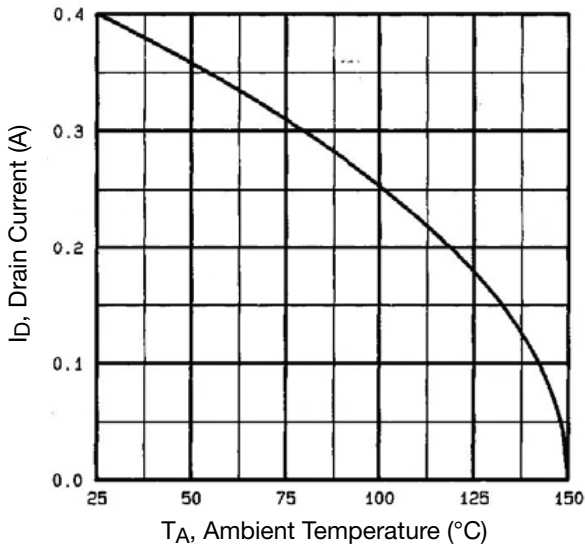


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

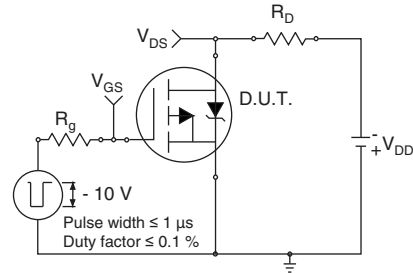


Fig. 10a - Switching Time Test Circuit

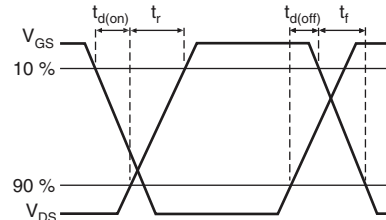


Fig. 10b - Switching Time Waveforms

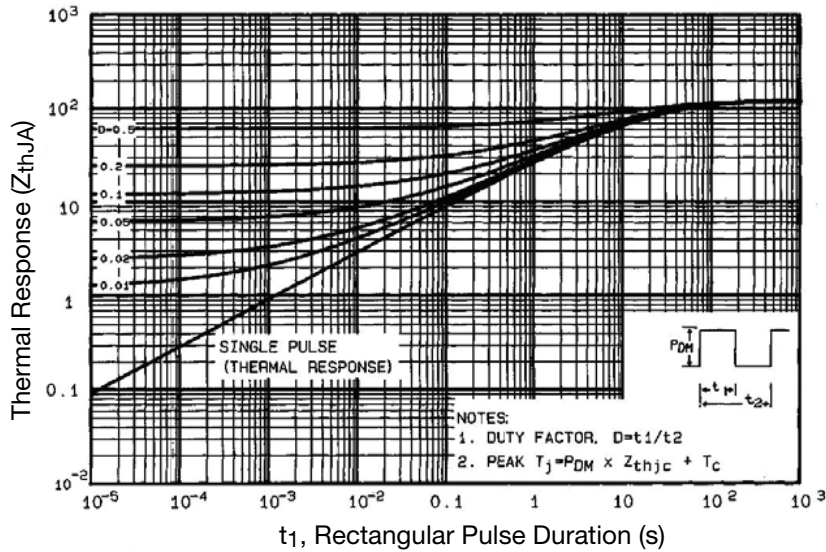


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

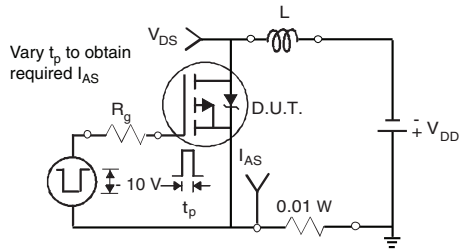


Fig. 12a - Unclamped Inductive Test Circuit

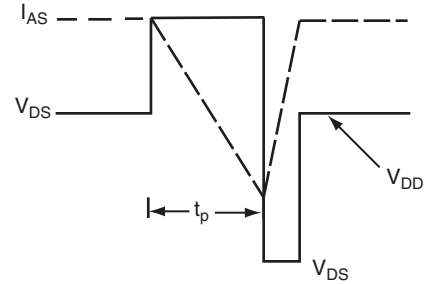


Fig. 12b - Unclamped Inductive Waveforms

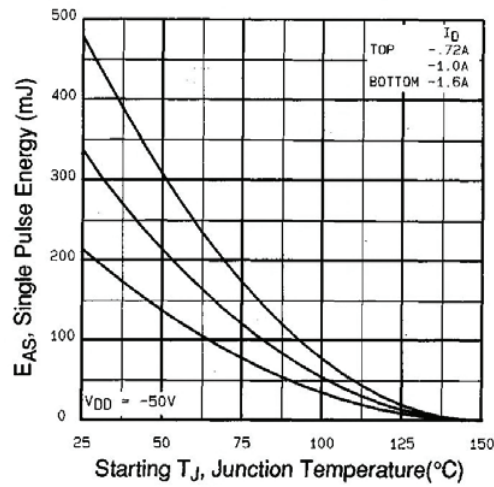


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

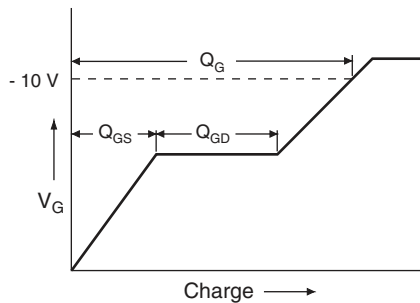


Fig. 13a - Basic Gate Charge Waveform

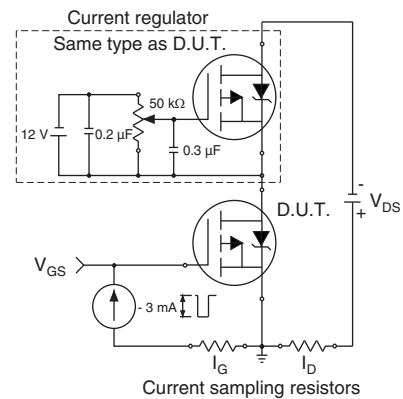
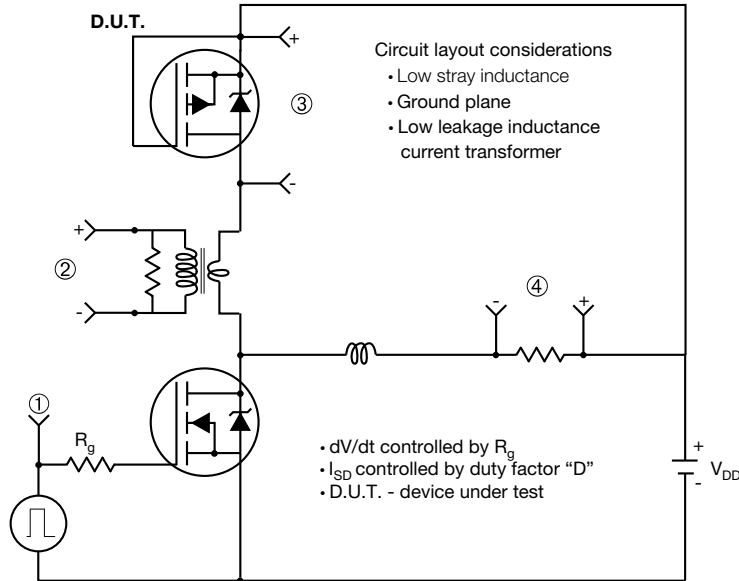


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
• Compliment N-Channel of D.U.T. for driver



Note
a. $V_{GS} = -5\text{ V}$ for logic level and -3 V drive devices

Fig. 14 - For P-Channel

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HVM DIP (High voltage)



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.310	0.330	7.87	8.38
E	0.300	0.425	7.62	10.79
L	0.270	0.290	6.86	7.36

ECN: X10-0386-Rev. B, 06-Sep-10
DWG: 5974

Note

- Package length does not include mold flash, protrusions or gate burrs. Package width does not include interlead flash or protrusions.



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