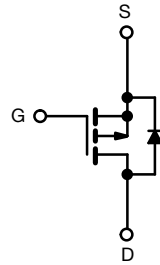


Power MOSFET



P-Channel MOSFET

FEATURES

- For automatic insertion
- Compact, end stackable
- Fast switching
- Low drive current
- Easy paralleled
- Excellent temperature stability
- P-channel versatility
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{DS} (V)	- 50	
$R_{DS(on)}$ (Ω)	$V_{GS} = -10$ V	0.50
Q_g (Max.) (nC)	11	
Q_{gs} (nC)	3.8	
Q_{gd} (nC)	4.1	
Configuration	Single	

DESCRIPTION

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

The p-channel HVMDIPs are designed for application which require the convenience of reverse polarity operation. They retain all of the features of the more common n-channel HVMDIPs such as voltage control, very fast switching, ease of paralleling, and excellent temperature stability.

P-channels HVMDIPs are intended for use in power stages where complementary symmetry with n-channel devices offers circuit simplification. They are also very useful in drive stages because of the circuit versatility offered by the reverse polarity connection. Applications include motor control, audio amplifiers, switched mode converters, control circuits and pulse amplifiers.

ORDERING INFORMATION

Package	HVMDIP
Lead (Pb)-free	IRFD9010PbF

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

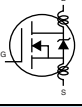

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	- 50	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current	V_{GS} at -10 V	$T_C = 25^\circ\text{C}$	- 1.1
		$T_C = 100^\circ\text{C}$	- 0.68
Pulsed drain current ^a	I_{DM}	- 8.8	A
Linear derating factor		0.01	W/ $^\circ\text{C}$
Inductive current, clamped	$L = 100 \mu\text{H}$ see fig. 14	I_{LM}	- 8.8
Inductive current, unclamped (avalanche current)	see fig. 15	I_L	- 1.5
Maximum power dissipation	$T_C = 25^\circ\text{C}$	P_D	1
Operating junction and storage temperature range		T_J, T_{stg}	- 55 to + 150
Soldering recommendations (peak temperature)	For 10 s		300 ^d

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = -25$ V, starting $T_J = 25^\circ\text{C}$, $L = 52$ mH, $R_g = 25 \Omega$, $I_{AS} = -2.0$ A (see fig. 12)
- $I_{SD} \leq -4.0$ A, $dI/dt \leq 75$ A/ μs , $V_{DD} \leq V_{DS}$, $T_J \leq 175^\circ\text{C}$
- 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}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$		- 50	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$		-	- 0.091	-	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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 500	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -50\text{ V}, V_{GS} = 0\text{ V}$		-	-	- 250	μA
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	- 1000	
On-State Drain Current	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ max.	- 1.1	-	-	A
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -0.58\text{ A}^b$	-	0.35	0.50	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -20\text{ V}, I_D = -2.4\text{ A}$		1.7	2.5	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	240	-	μF
Output Capacitance	C_{oss}			-	160	-	
Reverse Transfer Capacitance	C_{rss}			-	30	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$	$I_D = -4.7\text{ A}, V_{DS} = 0.8\text{ V}$ see fig. 6 and 13 ^b	-	7.2	11	nC
Gate-Source Charge	Q_{gs}			-	2.5	3.8	
Gate-Drain Charge	Q_{gd}			-	2.7	4.1	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -25\text{ V}, I_D = -4.7\text{ A}$ $R_g = 24\text{ }\Omega, R_D = 5.6\text{ }\Omega$, see fig. 10 ^b		-	6.1	9.2	ns
Rise Time	t_r			-	47	71	
Turn-Off Delay Time	$t_{d(off)}$			-	13	20	
Fall Time	t_f			-	39	59	
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 		-	-	- 1.1	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	- 8.8	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = -0.7\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	- 5.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = -4.7\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		33	75	160	ns
Body Diode Reverse Recovery Charge	Q_{rr}			0.090	0.22	0.52	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 $\leq 2\text{ }\%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

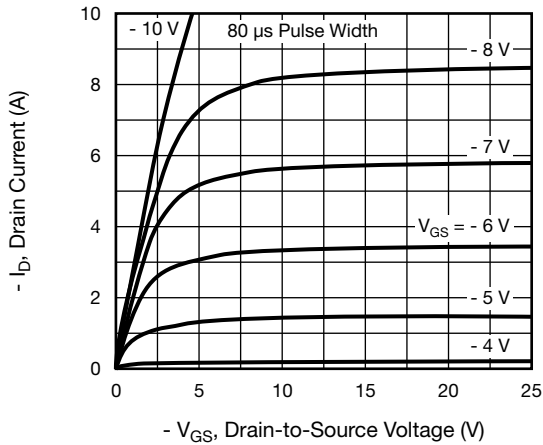


Fig. 1 - Typical Output Characteristics

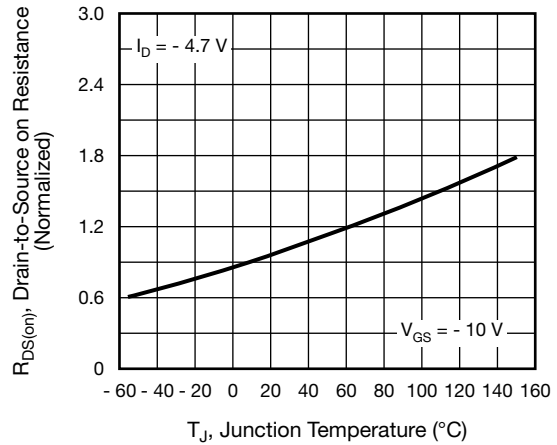


Fig. 4 - Normalized On-Resistance vs. Temperature

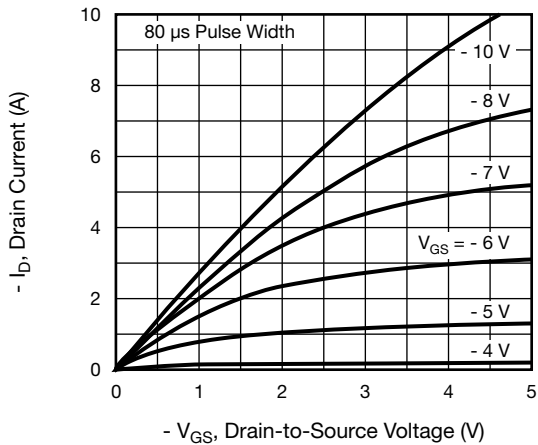


Fig. 2 - Typical Output Characteristics

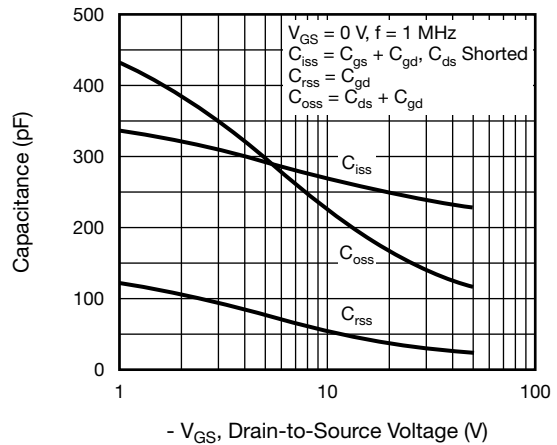


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

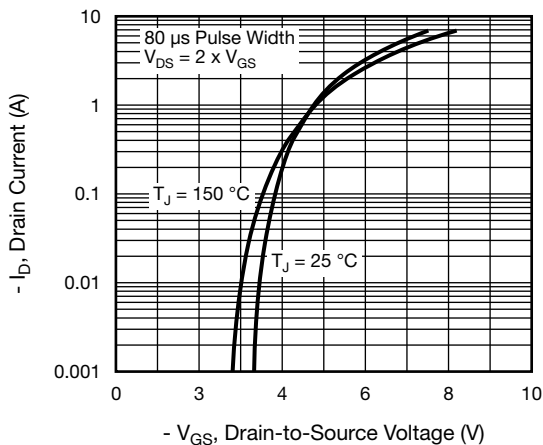


Fig. 3 - Typical Transfer Characteristics

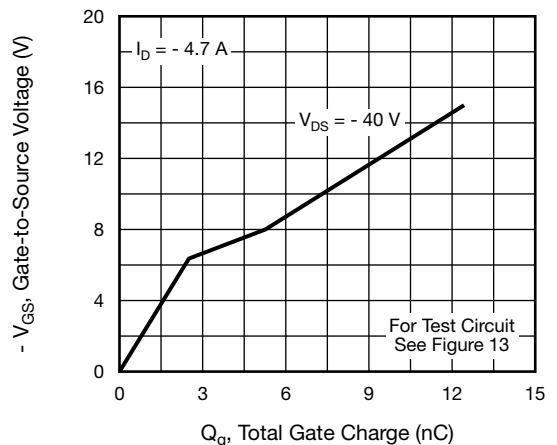


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

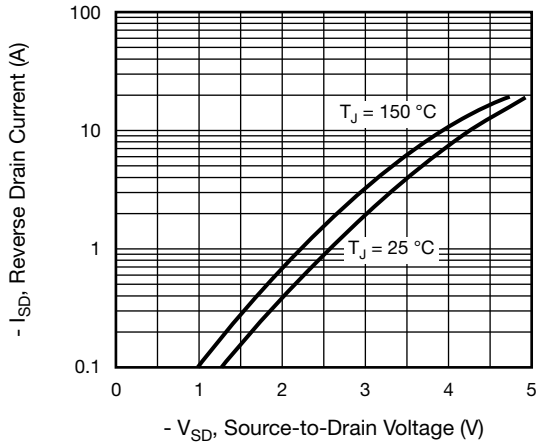


Fig. 7 - Typical Source-Drain Diode Forward Voltage

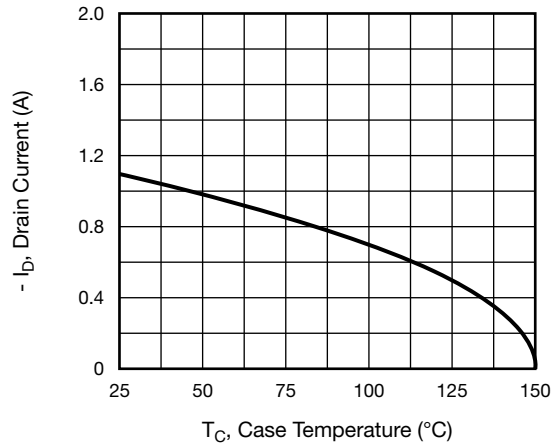


Fig. 9 - Maximum Drain Current vs. Case Temperature

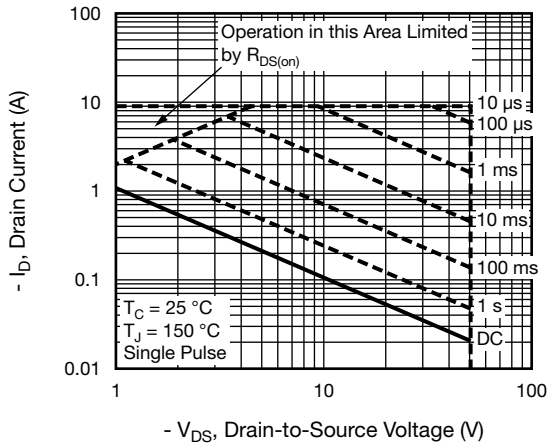


Fig. 8 - Maximum Safe Operating Area

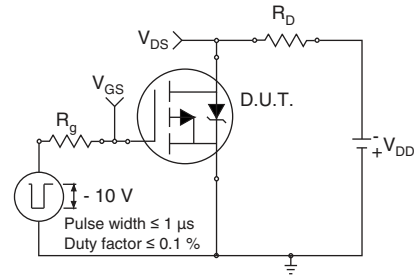


Fig. 10a - Switching Time Test Circuit

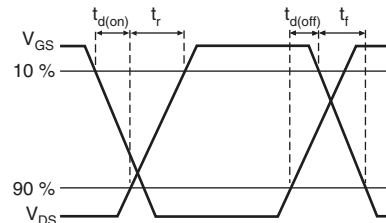


Fig. 10b - Switching Time Waveforms

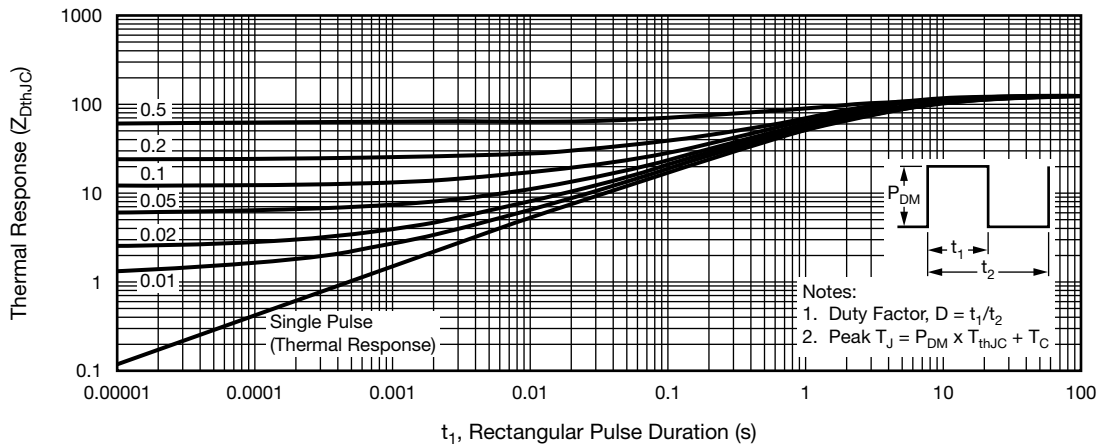


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

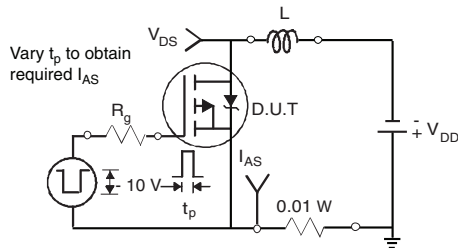


Fig. 12a - Unclamped Inductive Test Circuit

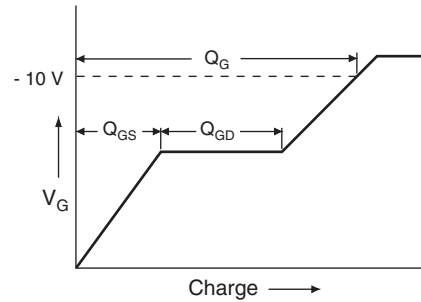


Fig. 13a - Basic Gate Charge Waveform

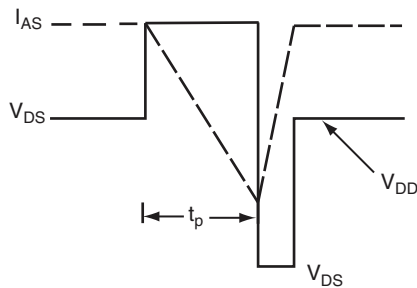


Fig. 12b - Unclamped Inductive Waveforms

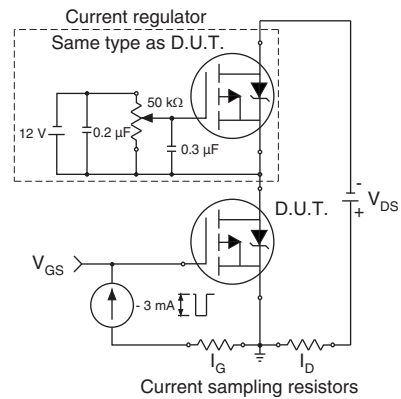


Fig. 13b - Gate Charge Test Circuit

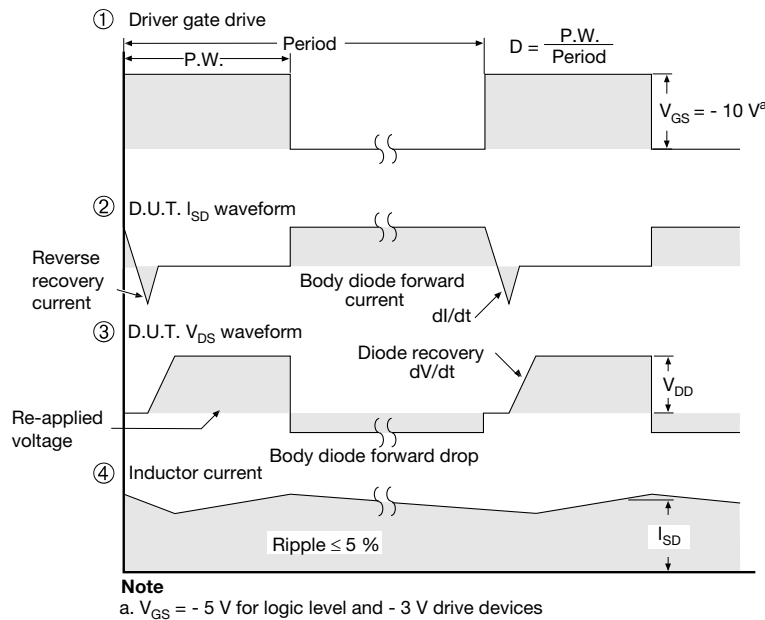
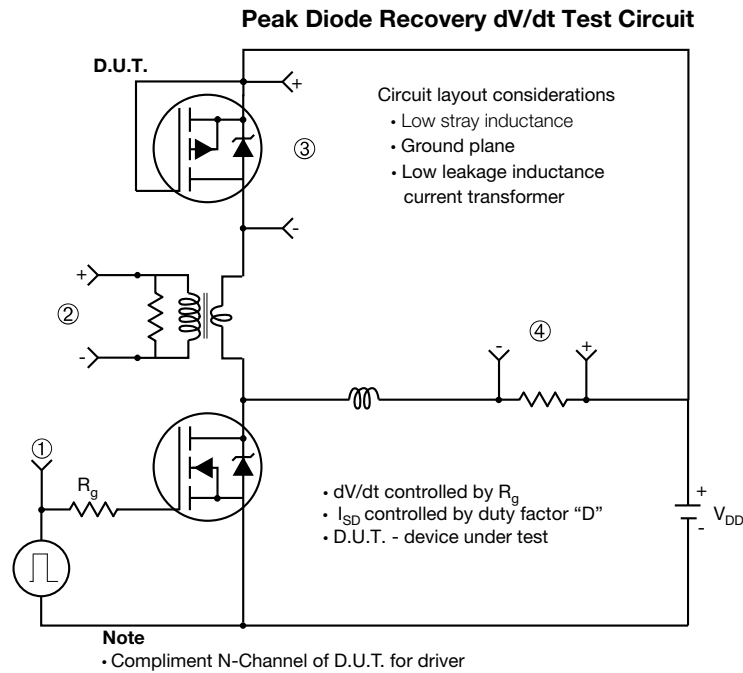


Fig. 14 - For P-Channel

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