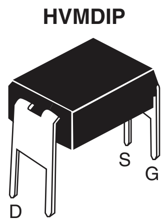
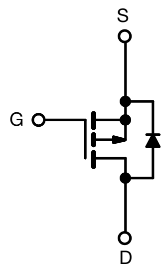
Power MOSFET





P-Channel MOSFET

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	

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

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 °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 °C	I_D	- 1.1	A
		T_C = 100 °C		- 0.68	
Pulsed drain current[a]			I_{DM}	- 8.8	
Linear derating factor				0.01	W/°C
Inductive current, clamped	L = 100 μH see fig. 14		I_{LM}	- 8.8	A
Inductive current, unclamped (avalanche current)	see fig. 15		I_L	- 1.5	
Maximum power dissipation	T_C = 25 °C		P_D	1	W
Operating junction and storage temperature range			T_J, T_{stg}	- 55 to + 150	°C
Soldering recommendations (peak temperature)	For 10 s			300[d]	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. V_{DD} = - 25 V, starting T_J = 25 °C, L = 52 mH, R_g = 25 Ω, I_{AS} = - 2.0 A (see fig. 12)

c. I_{SD} ≤ - 4.0 A, dI/dt ≤ 75 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 175 °C

d. 1.6 mm from case

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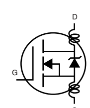
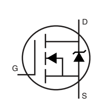
THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	-	120	°C/W

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = - 250 μA		- 50	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = - 1 mA		-	- 0.091	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = - 250 μA		- 2.0	-	- 4.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V		-	-	± 500	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = - 50 V, V_{GS} = 0 V		-	-	- 250	μA
		V_{DS} = - 40 V, V_{GS} = 0 V, T_J = 125 °C		-	-	- 1000	
On-State Drain Current	$I_{D(on)}$	V_{GS} = 10 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 V	I_D = - 0.58 A[b]	-	0.35	0.50	Ω
Forward Transconductance	g_{fs}	V_{DS} = - 20 V, I_D = - 2.4 A		1.7	2.5	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = - 25 V, f = 1.0 MHz, see fig. 5		-	240	-	pF
Output Capacitance	C_{oss}			-	160	-	
Reverse Transfer Capacitance	C_{rss}			-	30	-	
Total Gate Charge	Q_g	V_{GS} = - 10 V	I_D = - 4.7 A, V_{DS} = 0.8 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 V, I_D = - 4.7 A R_g = 24 Ω, R_D = 5.6 Ω, 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 °C, I_S = - 0.7 A, V_{GS} = 0 V[b]		-	-	- 5.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = - 4.7 A, dI/dt = 100 A/μs[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 ≤ 300 μs; duty cycle ≤ 2 %

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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

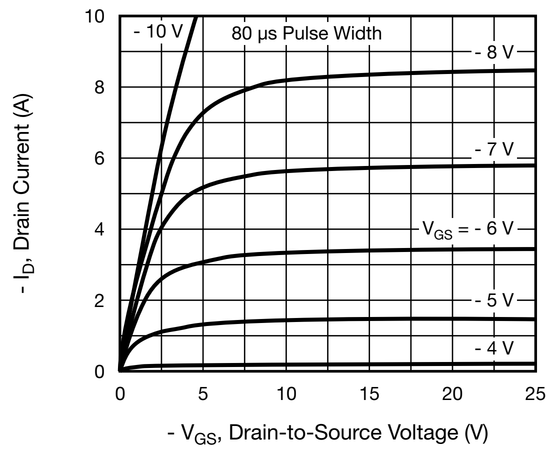

Fig. 1 - Typical Output Characteristics

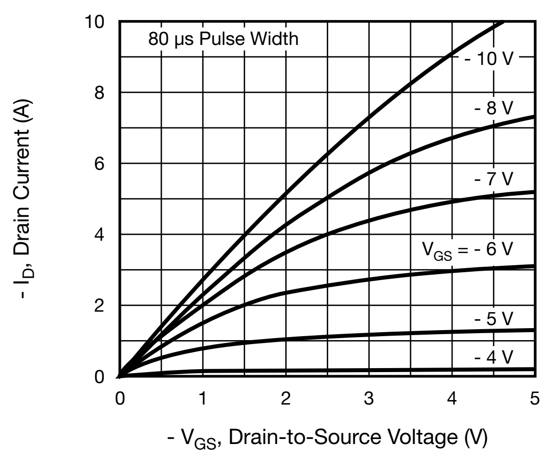

Fig. 2 - Typical Output Characteristics

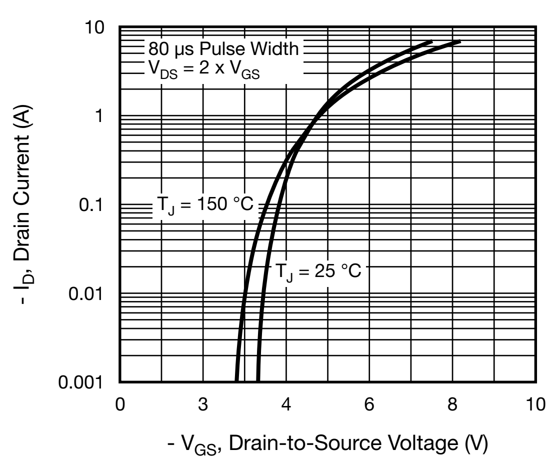

Fig. 3 - Typical Transfer Characteristics

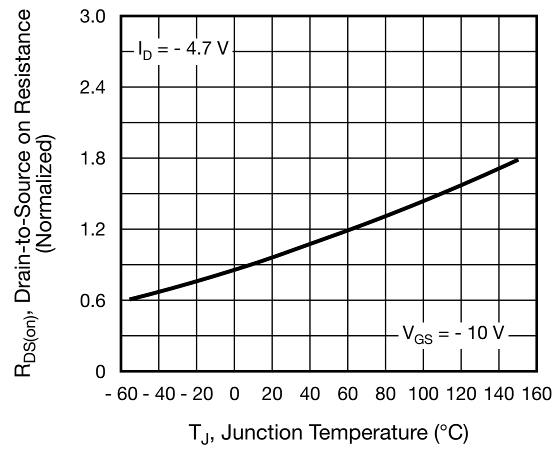

Fig. 4 - Normalized On-Resistance vs. Temperature

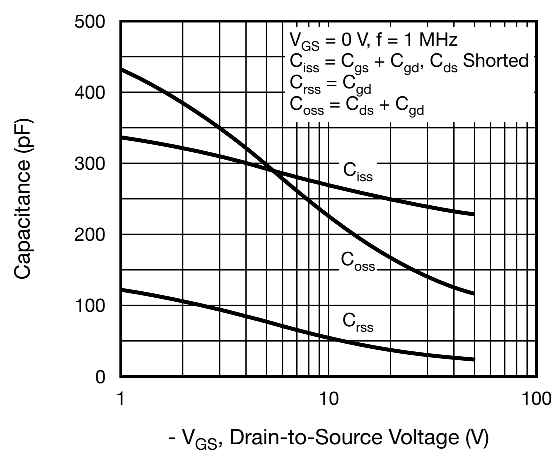

Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

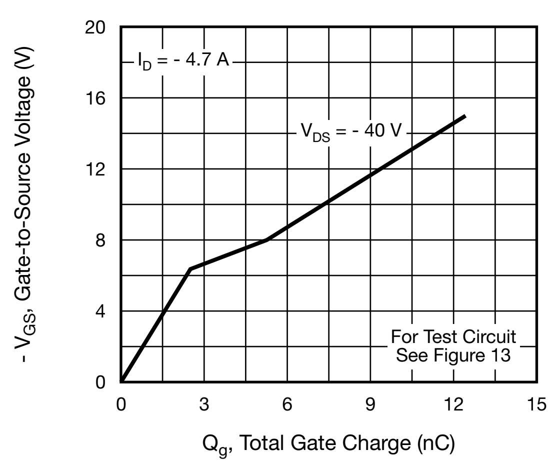

Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

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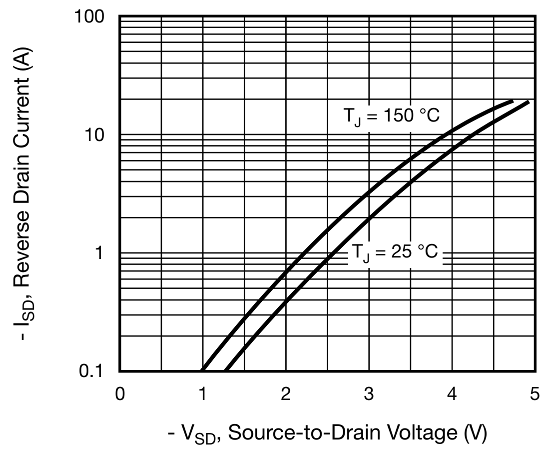

Fig. 7 - Typical Source-Drain Diode Forward Voltage

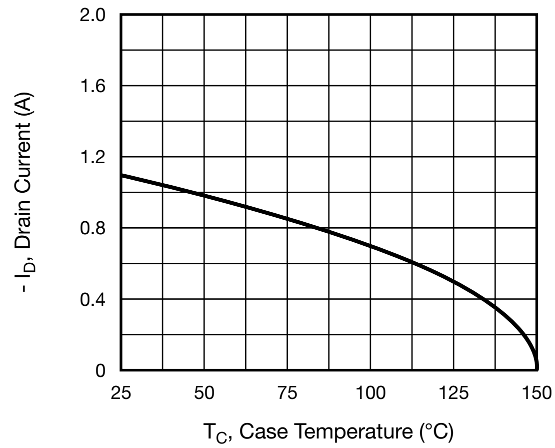

Fig. 9 - Maximum Drain Current vs. Case Temperature

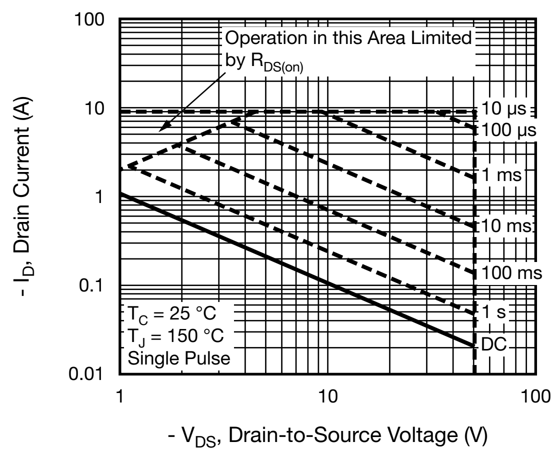

Fig. 8 - Maximum Safe Operating Area

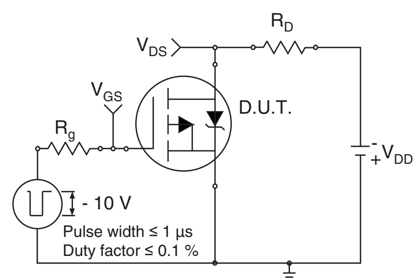

Fig. 10a - Switching Time Test Circuit

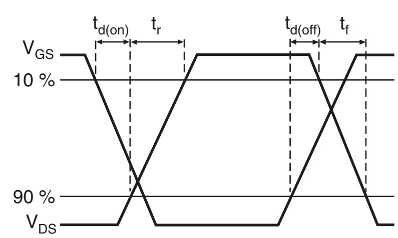

Fig. 10b - Switching Time Waveforms

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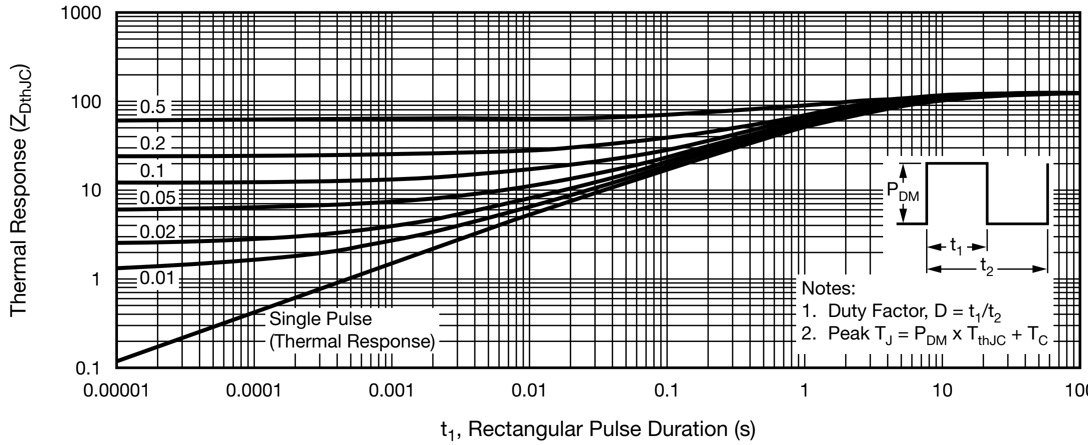

Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

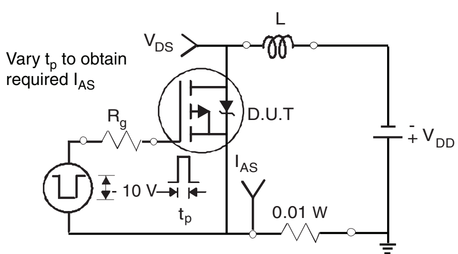

Fig. 12a - Unclamped Inductive Test Circuit

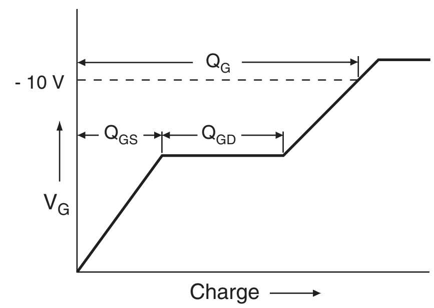

Fig. 13a - Basic Gate Charge Waveform

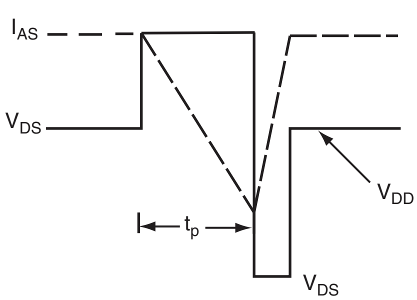

Fig. 12b - Unclamped Inductive Waveforms

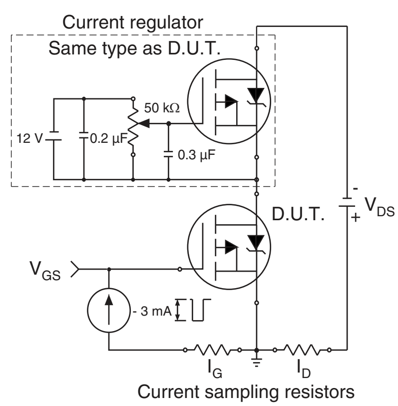

Fig. 13b - Gate Charge Test Circuit

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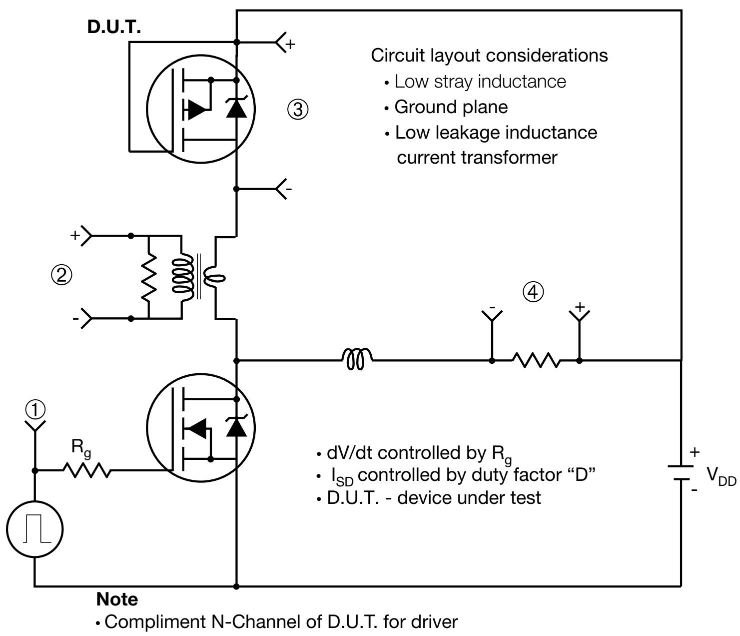
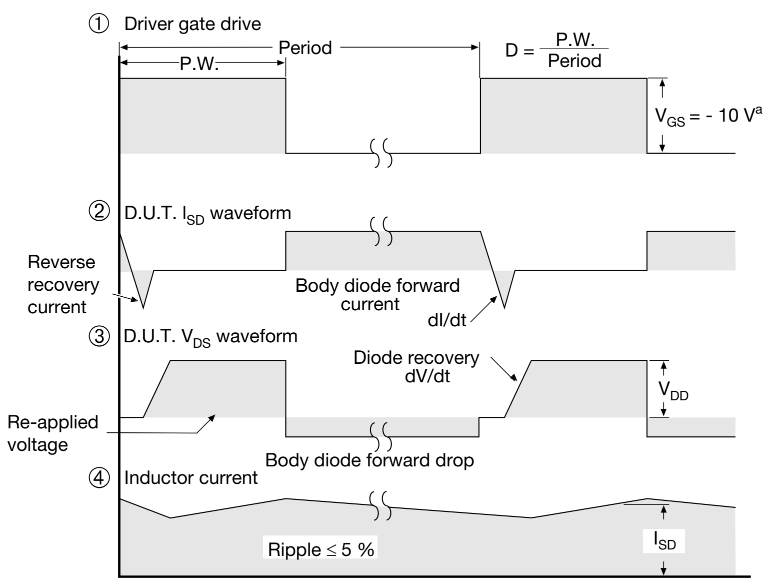
Peak Diode Recovery dV/dt Test Circuit





Note

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

Fig. 14 - For P-Channel

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