VISHAY IRFD9014 Siliconix Power MOSFET Owner's Manual

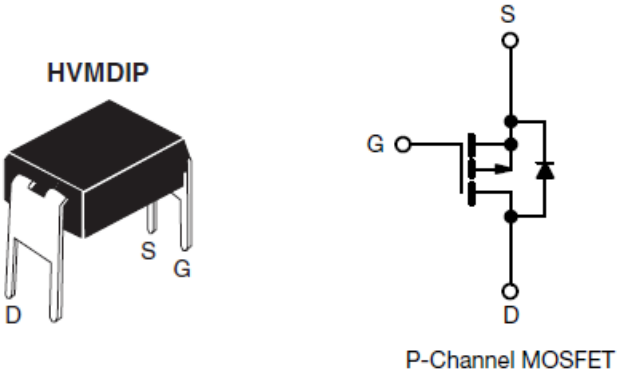
Contents

VISHAY IRFD9014 Siliconix Power MOSFET

Specifications

- Brand: Vishay Siliconix
- Product Name: IRFD9014
- Type: Power MOSFET
- Package Type: HVMDIP
- Channel Type: P-Channel
- Drain-Source Voltage (VDS): -60V
- On-Resistance (RDS(on)): 3.8 Ohms
- Total Gate Charge (Qg): 5.1 nC (Max.)
- Gate-Source Charge (Qgs): 0.50 nC
- Gate-Drain Charge (Qgd): 12 nC

Product Usage Instructions



PRODUCT SUMMARY		
V_{DS} (V)	-60	
RDS(on) (W)	V_{GS} = -10 V	0.50
Q_g (Max.) (nC)	12	
Q_{gs} (nC)	3.8	
Q_{gd} (nC)	5.1	
Configuration	Single	

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic Insertion
- End stackable
- P-channel
- 175 °C operating temperature
- Fast switching
- Material categorization: for definitions of compliance please see **www.vishay.com/doc?99912**

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

ORDERING INFORMATION	
Package	HVMDIP
Lead (Pb)-free	IRFD9014PbF

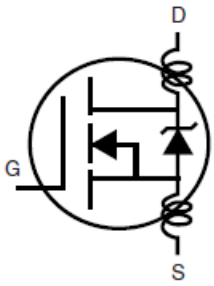
ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-source voltage			VDS	-60	V
Gate-source voltage			VGS	± 20	
Continuous drain current	V_{GS} at 10 V	T_A = 25 °C	I_D	-1.1	A
		T_A = 100 °C		-0.80	
Pulsed drain current a			IDM	-8.8	
Linear derating factor				0.0083	W/°C
Single pulse avalanche energy b			EAS	140	mJ
Repetitive avalanche current a			IAR	-1.1	A
Repetitive avalanche energy a			EAR	0.13	mJ
Maximum power dissipation	T_A = 25 °C		P_D	1.3	W
Peak diode recovery dV/dt c			dV/dt	-4.5	V/ns
Operating junction and storage temperature range			TJ, Tstg	-55 to +175	°C
Soldering recommendations (peak temperature)	For 10 s			300d	

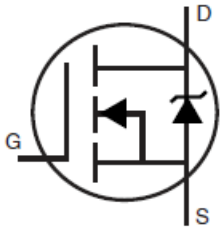
Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- b. VDD = -25 V, starting TJ = 25 °C, L = 33 mH, Rg = 25 Ω, IAS = -2.2 A (see fig. 12)
- c. ISD ≤ -6.7 A, dI/dt ≤ 90 A/µs, VDD ≤ VDS, TJ ≤ 175 °C
- d. 1.6 mm from case

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	RthJA	–	120	°C/W

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	VDS	V_{GS} = 0 V, I_D = -250 µA	-60	–	–	V
V_{DS} Temperature Coefficient	DV_{DS}/T_J	Reference to 25 °C, I_D = -1 mA	–	-0.060	–	V/°C

Gate-Source Threshold Voltage	VGS(th)	V_{DS} = V_{GS}, I_D = -250 µA	-2.0	–	-4.0	V
Gate-Source Leakage	IGSS	V_{GS} = ± 20 V	–	–	± 100	nA
Zero Gate Voltage Drain Current	IDSS	V_{DS} = -60 V, V_{GS} = 0 V	–	–	-100	µA
		V_{DS} = -48 V, V_{GS} = 0 V, T_J = 150 °C	–	–	-500	
Drain-Source On-State Resistance	RDS(on)	V_{GS} = -10 V, I_D = -0.66 Ab	–	–	0.50	W
Forward Transconductance	gfs	V_{DS} = -25 V, I_D = -0.66 Ab	0.70	–	–	S
Dynamic						
Input Capacitance	Ciss	V_{GS} = 0 V, V_{DS} = -25 V,f = 1.0 MHz, see fig. 5	–	270	–	pF
Output Capacitance	Coss		–	170	–	
Reverse Transfer Capacitance	Crss		–	31	–	
Total Gate Charge	Q_g	V_{GS} = -10 V, I_D = -6.7 A, V_{DS} = -48 V,see fig. 6 and 13b	–	–	12	nC
Gate-Source Charge	Qgs		–	–	3.8	
Gate-Drain Charge	Qgd		–	–	5.1	
Turn-On Delay Time	td(on)	V_{DD} = -30 V, I_D = -6.7 A,R_g = 24 W, R_D = 4.0 W, see fig. 10b	–	11	–	ns
Rise Time	t_r		–	63	–	
Turn-Off Delay Time	td(off)		–	10	–	
Fall Time	t_f		–	31	–	
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	ISM		–	–	-8.8	
Body Diode Voltage	VSD	T_J = 25 °C, I_S = -1.1 A, V_{GS} = 0 V b	–	–	-5.5	V
Body Diode Reverse Recovery Time	trr	T_J = 25 °C, I_F = -6.7 A, dI/dt = 100 A/µsb	–	80	160	ns
Body Diode Reverse Recovery Charge	Qrr		–	0.096	0.19	µC
Forward Turn-On Time	ton	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 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

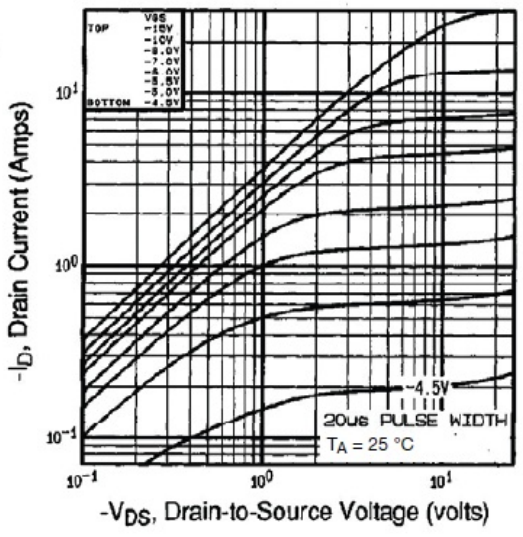


Fig. 1 - Typical Output Characteristics, T_A = 25 °C

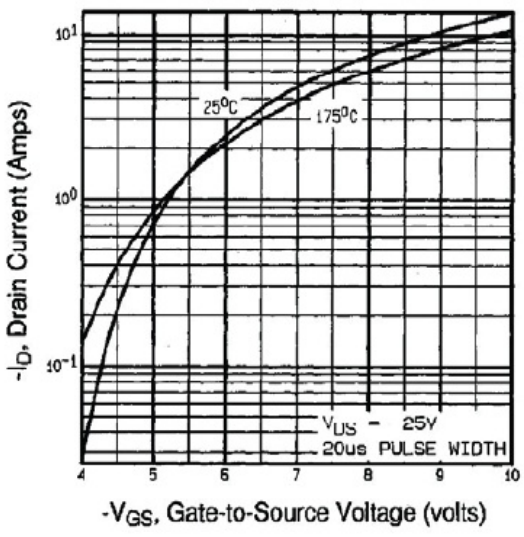


Fig. 2 - Typical Transfer Characteristics

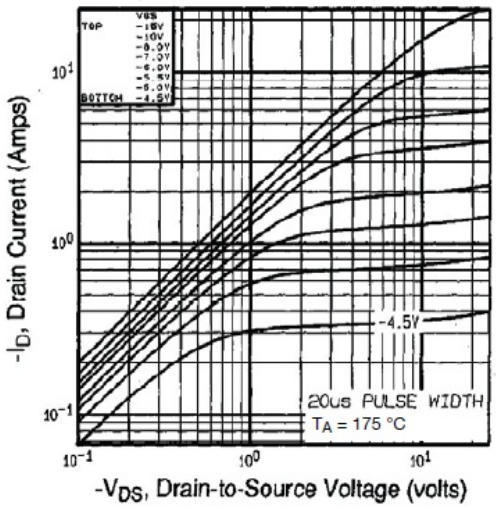


Fig. 1 - Typical Output Characteristics, T_A = 175 °C

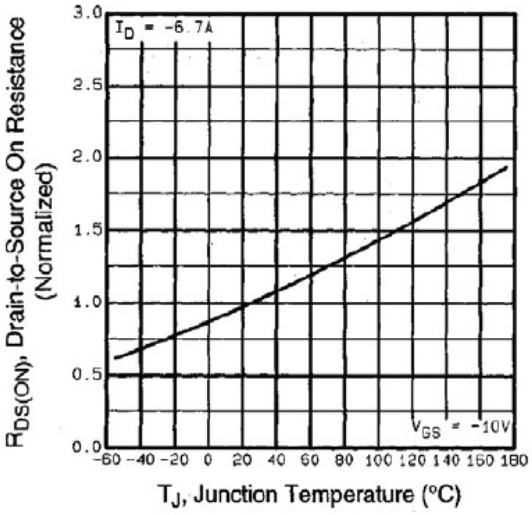


Fig. 3 - Normalized On-Resistance vs. Temperature

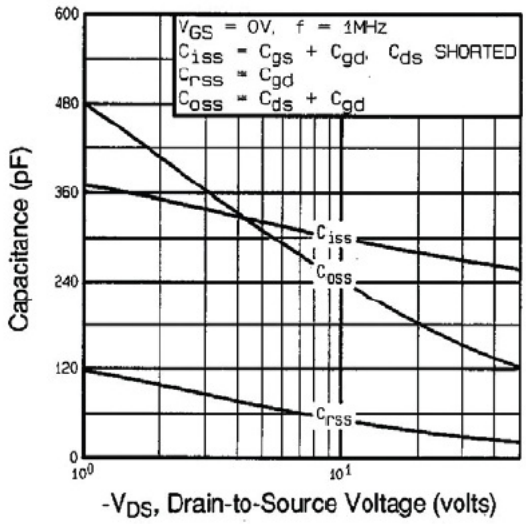


Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage

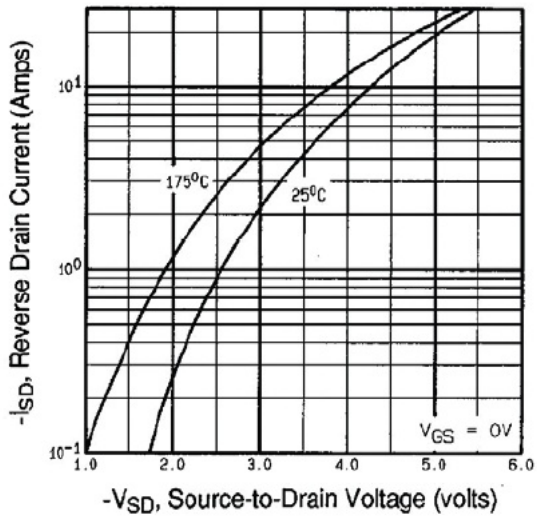


Fig. 6 - Typical Source-Drain Diode Forward Voltage

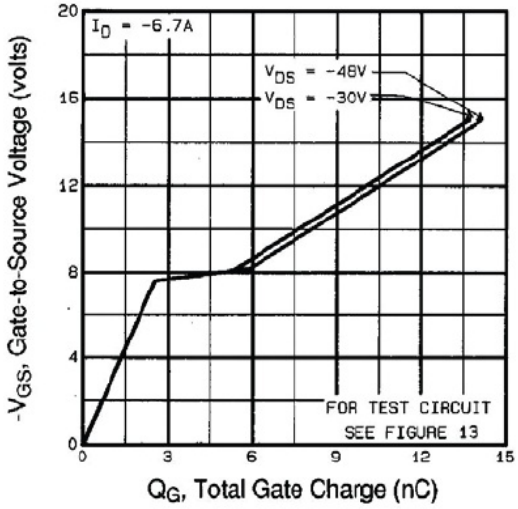


Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage

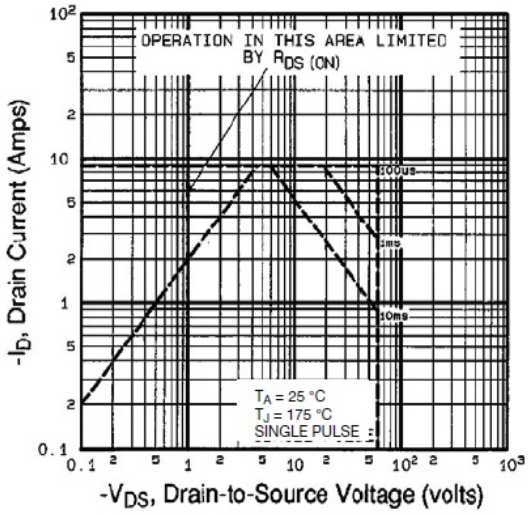


Fig. 7 - Maximum Safe Operating Area

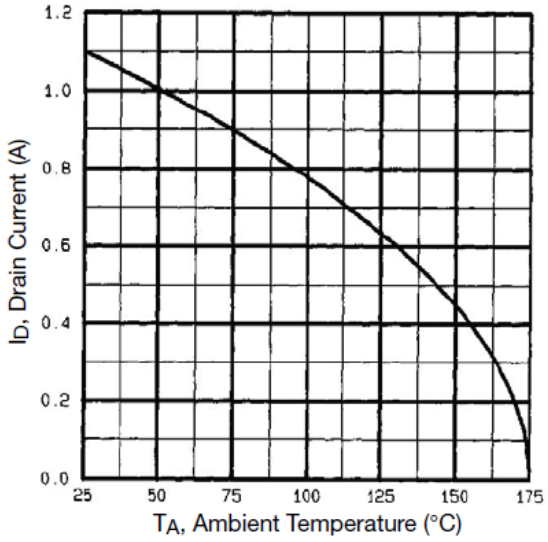


Fig. 8 - Maximum Drain Current vs. Ambient Temperature

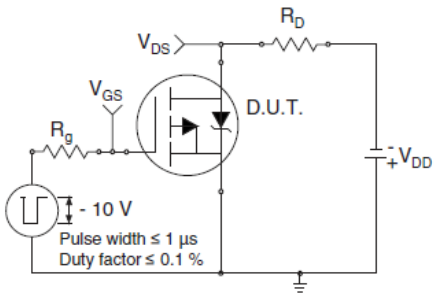


Fig. 10a - Switching Time Test Circuit

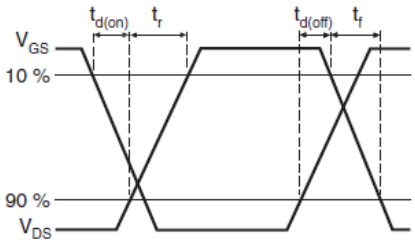


Fig. 10b - Switching Time Waveforms

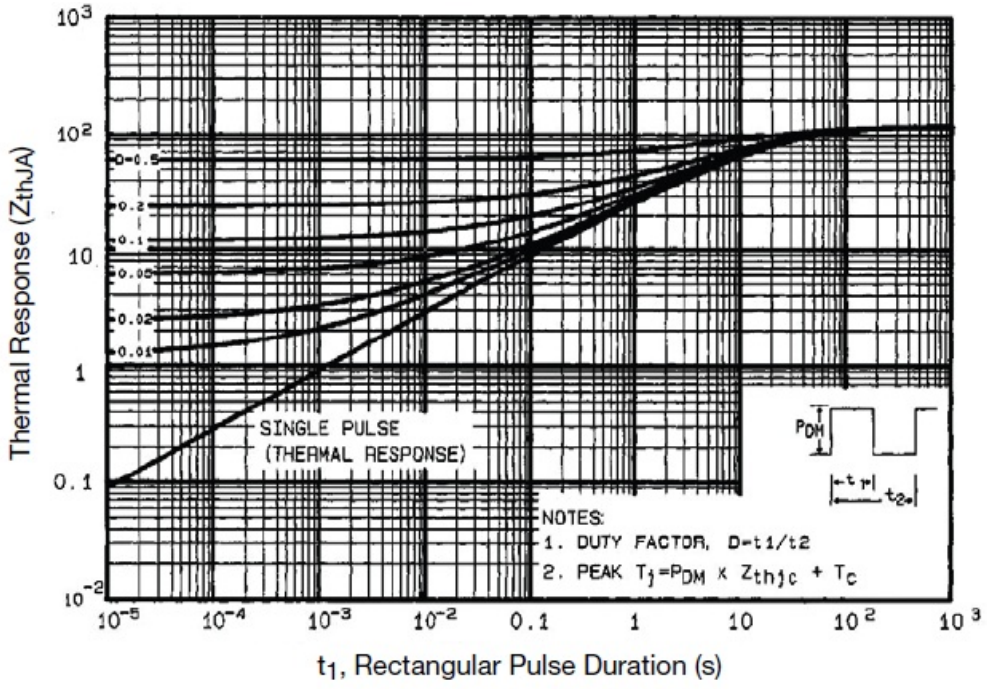


Fig. 9 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

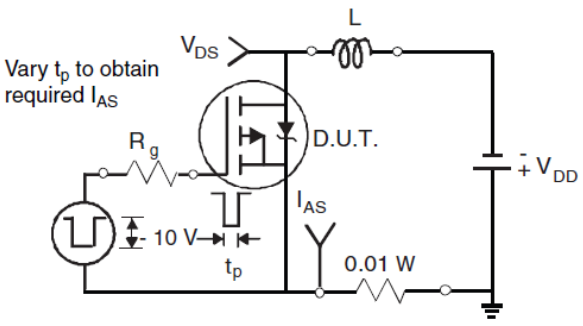


Fig. 12a - Unclamped Inductive Test Circuit

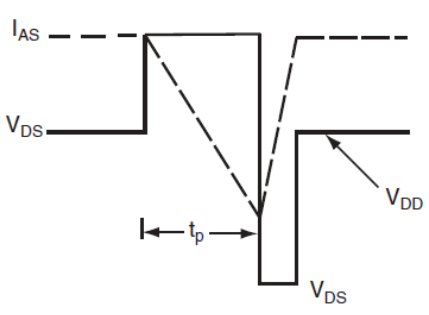


Fig. 12b - Unclamped Inductive Waveforms

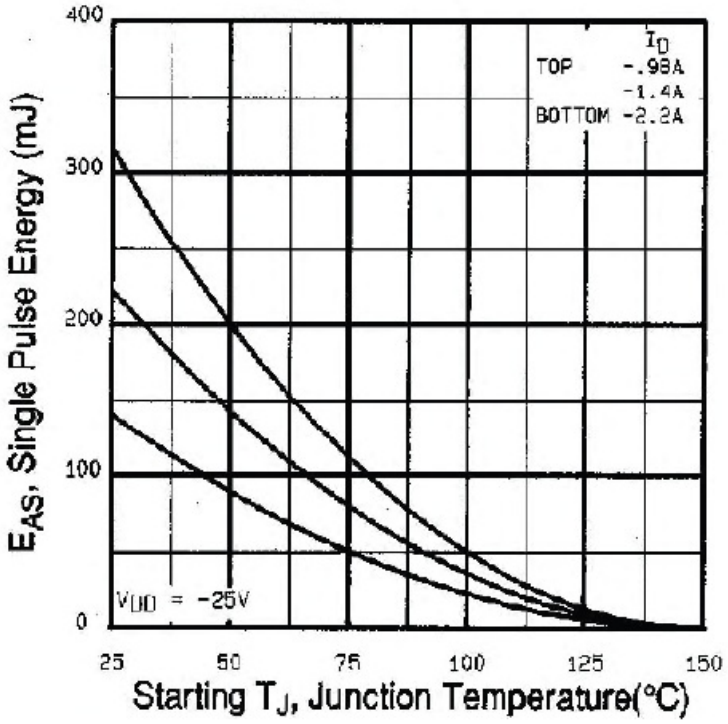


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

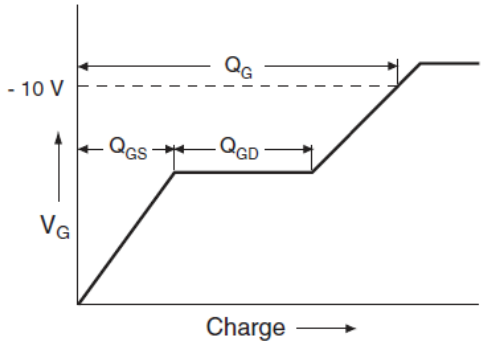


Fig. 13a - Basic Gate Charge Waveform

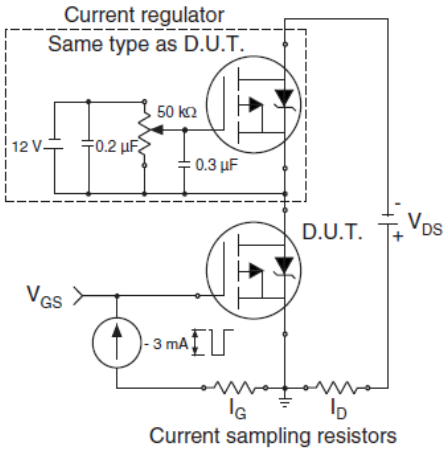
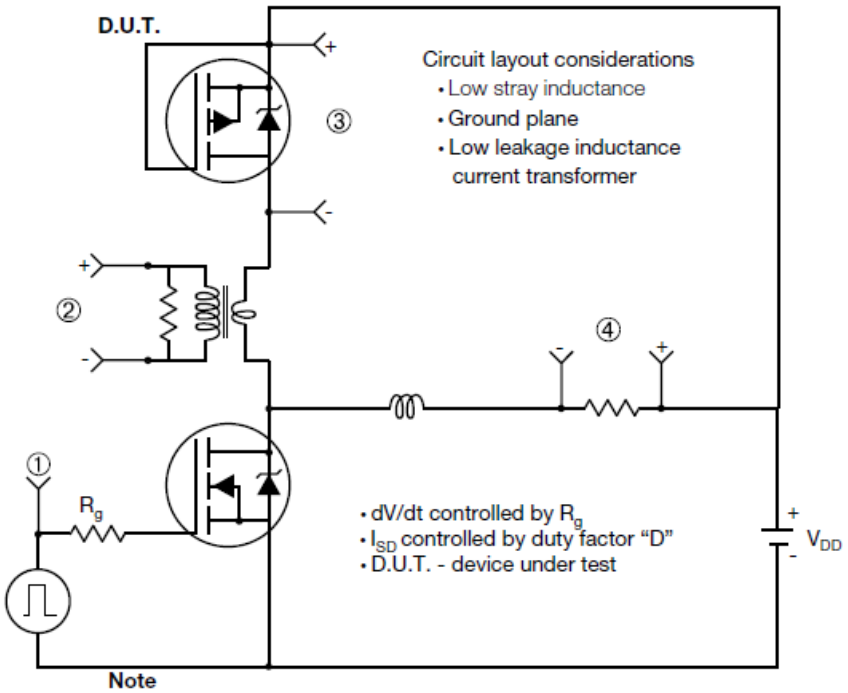


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



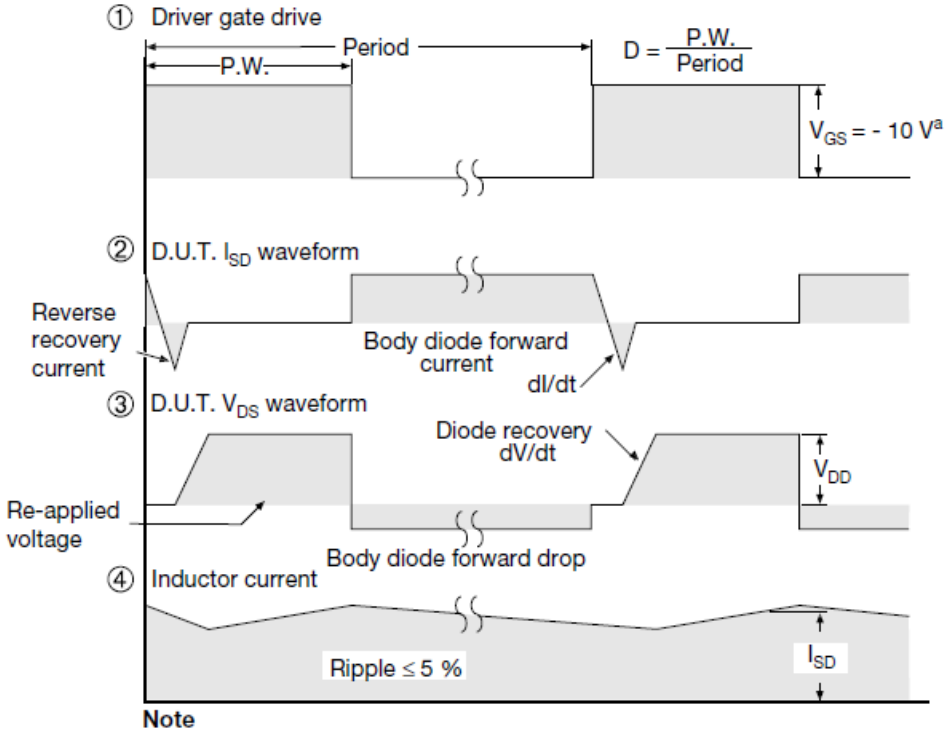
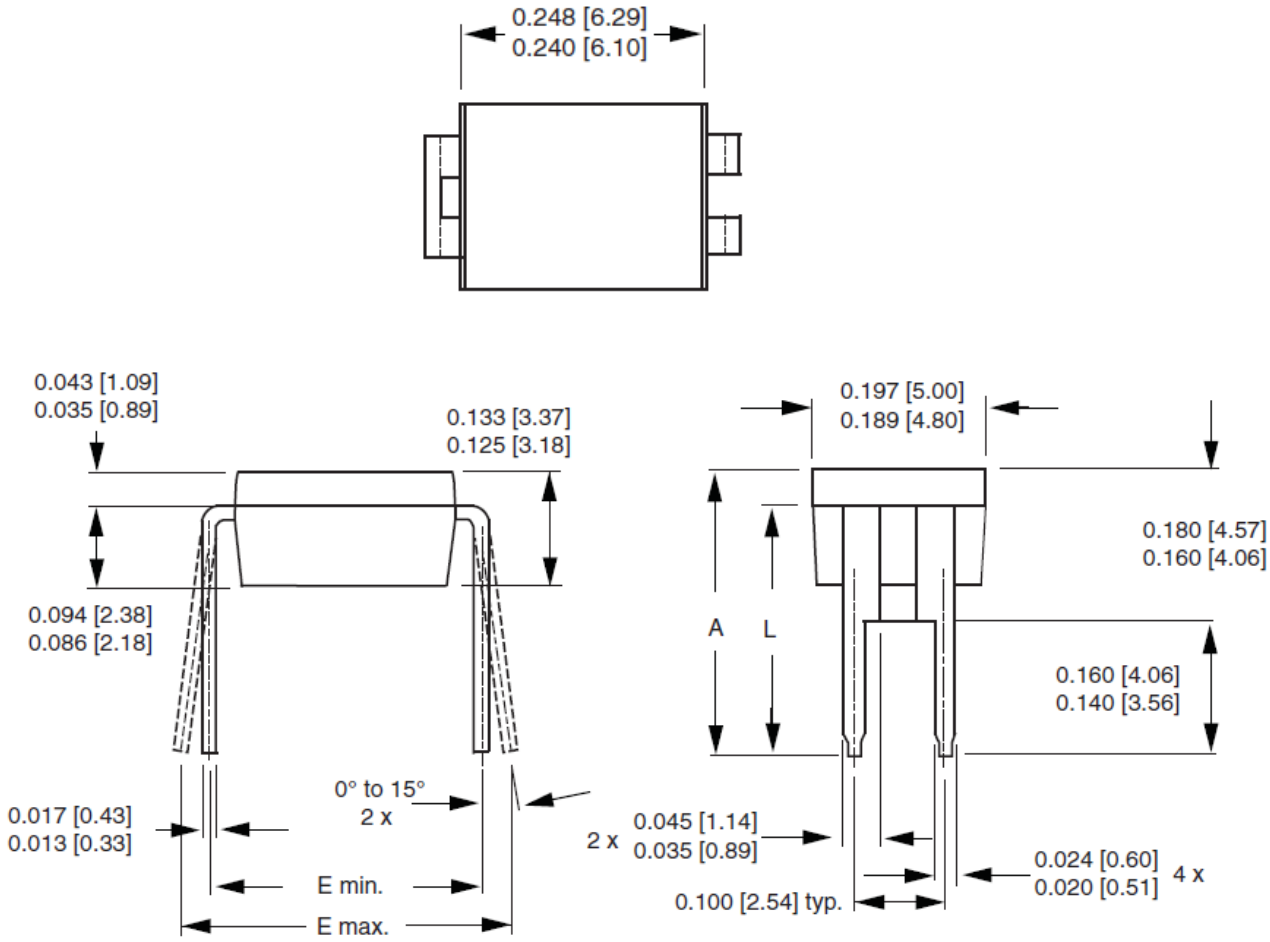


Fig. 10 - For P-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91136.

HVM DIP (High voltage)



	INCHES		MILLIMETERS	
DIM.	**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

1. Package length does not include mold flash, protrusions or gate burrs. Package width does not include inter lead flash or protrusions.

Disclaimer

application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability. Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application.

It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limite d to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience an d for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay o f any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorize d Vishay personnel to obtain written terms and conditions regarding products designed for such applications. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

For technical questions, contact: **hvm@vishay.com**
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT **www.vishay.com/doc?91000**

FAQ

- **What is the maximum Drain-Source Voltage for IRFD9014?**

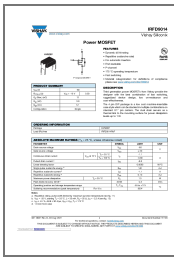
  The maximum Drain-Source Voltage (VDS) for IRFD9014 is -60V.
- **What is the On-Resistance of IRFD9014?**

  The On-Resistance (RDS(on)) of IRFD9014 is 3.8 Ohms.
- **Where can I find detailed features of IRFD9014?**

  You can find detailed features of IRFD9014 at **www.vishay.com/doc?99912**.
- **What is the maximum power dissipation level supported by IRFD9014?**

  The IRFD9014 supports power dissipation levels up to 1W.

Documents / Resources

	**VISHAY IRFD9014 Siliconix Power MOSFET** [pdf] Owner's Manual IRFD9014, IRFD9014 Siliconix Power MOSFET, Siliconix Power MOSFET, Power MOSFET

References

- Vishay Intertechnology: Passives & Discrete Semiconductors
- User Manual