



# IRFL9014, SiHFL9014

Vishay Siliconix

## Power MOSFET

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

### FEATURES

- Surface Mount
- Available in Tape and Reel
- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- P-Channel
- Fast Switching
- Ease of Paralleling
- Lead (Pb)-free Available

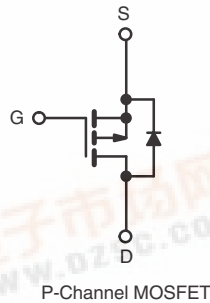


Available  
**RoHS\***  
COMPLIANT

### 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 SOT-223 package is designed for surface-mounting using vapor phase, infrared, or wave soldering techniques. Its unique package design allows for easy automatic pick-and-place as with other SOT or SOIC packages but has the added advantage of improved thermal performance due to an enlarged tab for heatsinking. Power dissipation of greater than 1.25 W is possible in a typical surface mount application.



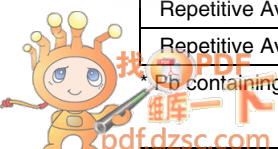
ORDERING INFORMATION		
Package	SOT-223	SOT-223
Lead (Pb)-free	IRFL9014PbF	IRFL9014TRPbF <sup>a</sup>
	SiHFL9014-E3	SiHFL9014T-E3 <sup>a</sup>
SnPb	IRFL9014	IRFL9014TR <sup>a</sup>
	SiHFL9014	SiHFL9014T <sup>a</sup>

**Note**

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$ , unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	- 60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$V_{GS}$ at - 10 V	$T_C = 25^\circ\text{C}$	- 1.8
		$T_C = 100^\circ\text{C}$	- 1.1
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	- 14	A
Linear Derating Factor		0.025	
Linear Derating Factor (PCB Mount) <sup>e</sup>		0.017	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	140	mJ
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	- 1.8	A
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	0.31	mJ

<sup>a</sup> Pb containing terminations are not RoHS compliant, exemptions may apply



# IRFL9014, SiHFL9014

Vishay Siliconix



<b>ABSOLUTE MAXIMUM RATINGS</b> $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted				
PARAMETER		SYMBOL	LIMIT	UNIT
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	$P_D$	3.1	W
Maximum Power Dissipation (PCB Mount) <sup>e</sup>	$T_A = 25\text{ }^\circ\text{C}$		2.0	
Peak Diode Recovery $dV/dt^c$		$dV/dt$	- 4.5	V/ns
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s		300 <sup>d</sup>	


### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = - 25\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 50\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = - 1.8\text{ A}$  (see fig. 12).
- $I_{SD} \leq - 6.7\text{ A}$ ,  $dI/dt \leq 90\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).


<b>THERMAL RESISTANCE RATINGS</b>				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup>	$R_{thJA}$	-	60	$^\circ\text{C}/\text{W}$
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	40	

### Note

- When mounted on 1" square PCB (FR-4 or G-10 material).

<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	- 60	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$	-	- 0.059	-	$\text{V}/^\circ\text{C}$
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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = - 60\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	- 100	$\mu\text{A}$
		$V_{DS} = - 48\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	- 500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = - 10\text{ V}$ , $I_D = 1.1\text{ A}^b$	-	-	0.50	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = - 25\text{ V}$ , $I_D = 1.1\text{ A}^b$	1.3	-	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1.0\text{ MHz}$ , see fig. 5	-	270	-	pF
Output Capacitance	$C_{oss}$		-	170	-	
Reverse Transfer Capacitance	$C_{rss}$		-	31	-	
Total Gate Charge	$Q_g$	$V_{GS} = - 10\text{ V}$ , $I_D = - 6.7\text{ A}$ , $V_{DS} = - 48\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	12	nC
Gate-Source Charge	$Q_{gs}$		-	-	3.8	
Gate-Drain Charge	$Q_{gd}$		-	-	5.1	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = - 30\text{ V}$ , $I_D = - 6.7\text{ A}$ , $R_G = 24\text{ }\Omega$ , $R_D = 4.0\text{ }\Omega$ , see fig. 10 <sup>b</sup>	-	11	-	ns
Rise Time	$t_r$		-	63	-	
Turn-Off Delay Time	$t_{d(off)}$		-	9.6	-	
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	-	



SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	- 1.8	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	- 14	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = -1.8\text{ A}$ , $V_{GS} = 0\text{ V}^b$	-	-	- 5.5	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = -6.7\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	80	160	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	0.096	0.19	$\mu\text{C}$
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  $25\text{ }^\circ\text{C}$ , unless otherwise noted**

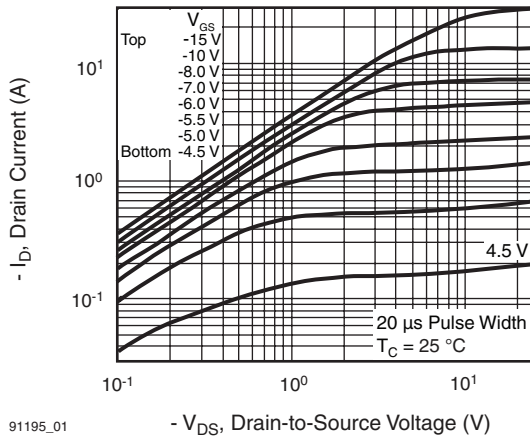


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$

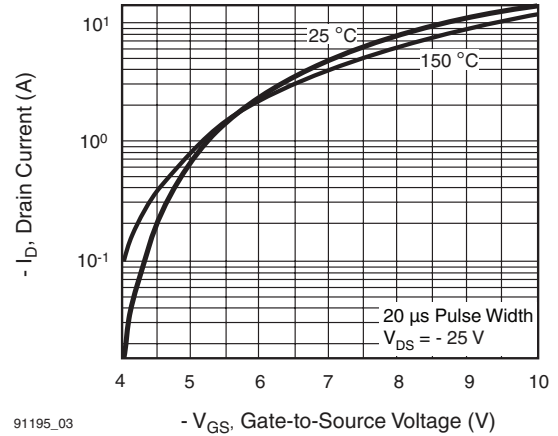


Fig. 3 - Typical Transfer Characteristics

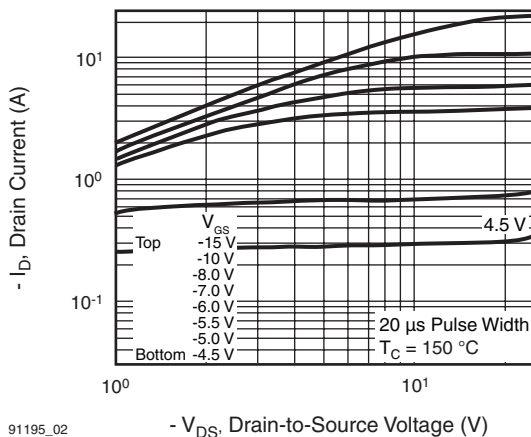


Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$

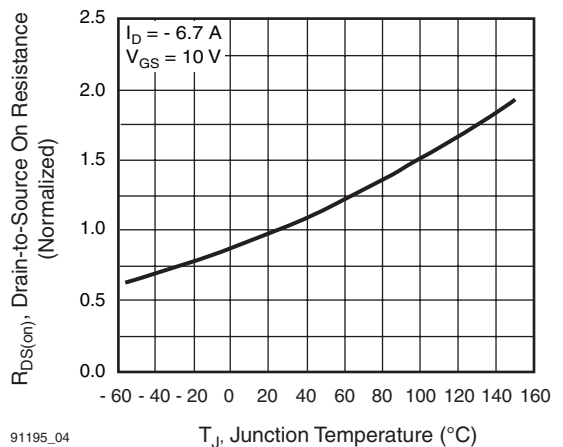
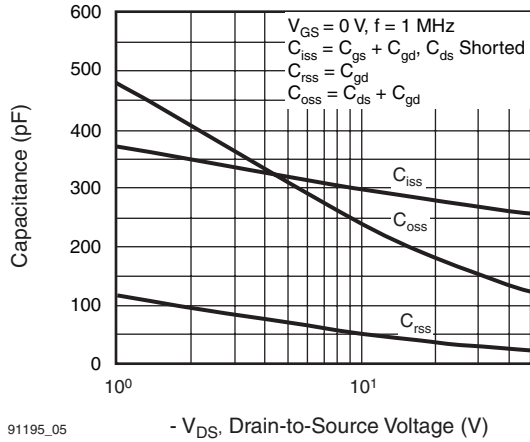
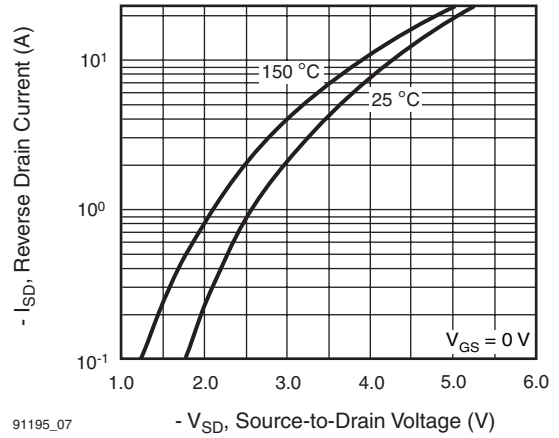


Fig. 4 - Normalized On-Resistance vs. Temperature



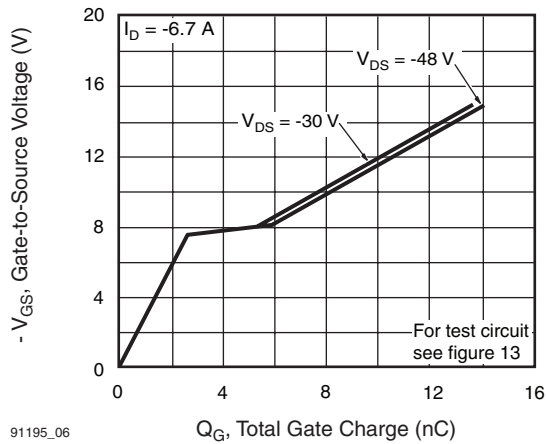
91195\_05

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



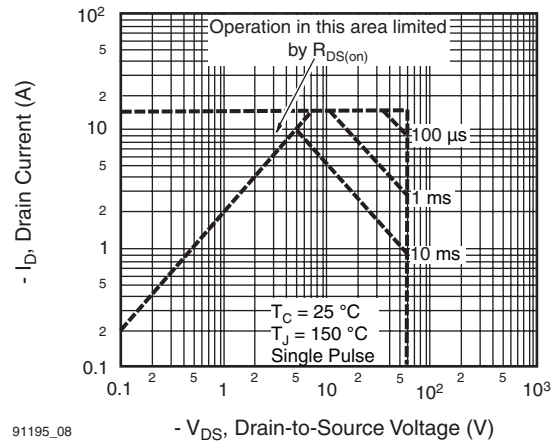
91195\_07

**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



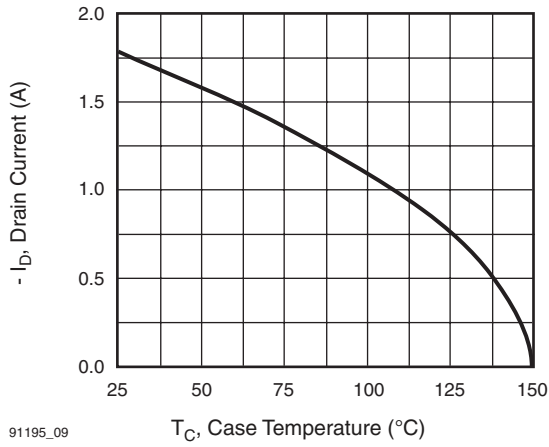
91195\_06

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



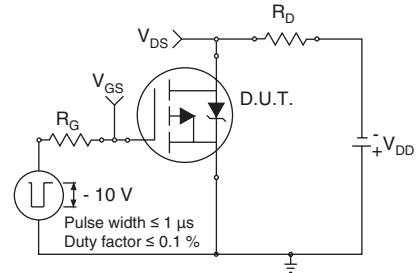
91195\_08

**Fig. 8 - Maximum Safe Operating Area**

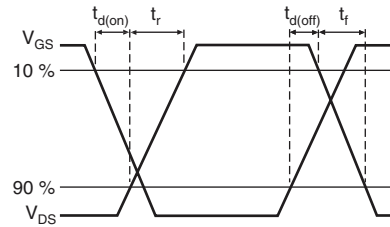


91195\_09

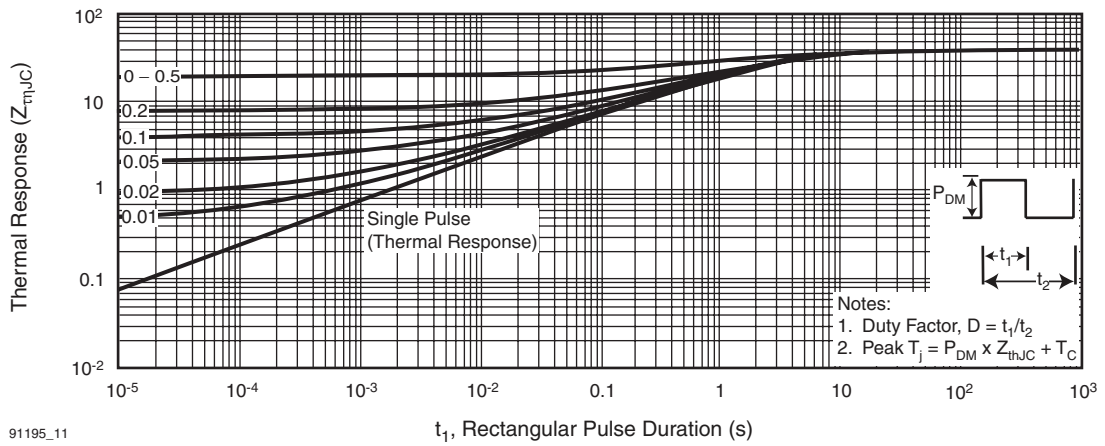
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



91195\_11

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

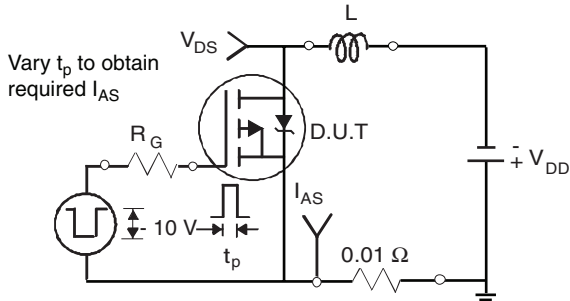


Fig. 12a - Unclamped Inductive Test Circuit

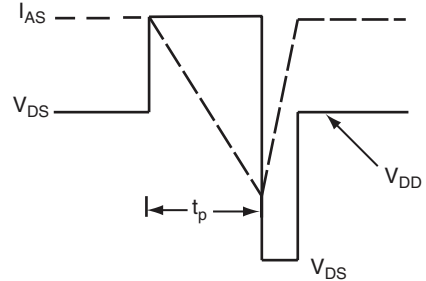


Fig. 12b - Unclamped Inductive Waveforms

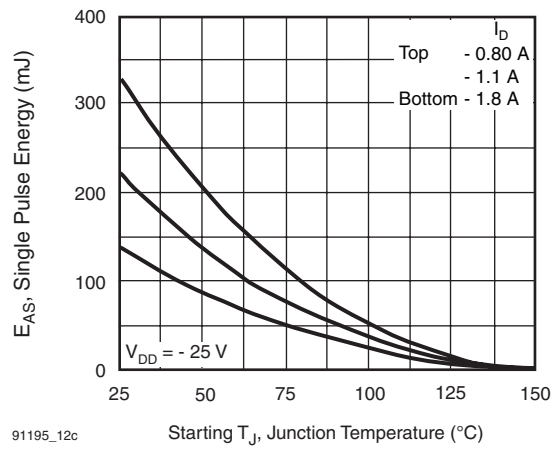


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

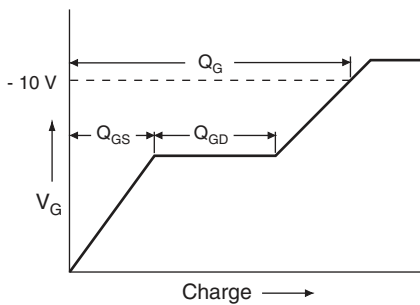


Fig. 13a - Basic Gate Charge Waveform

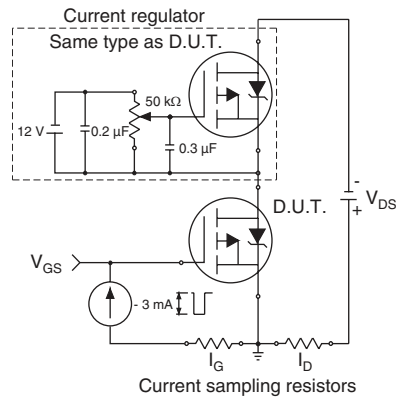
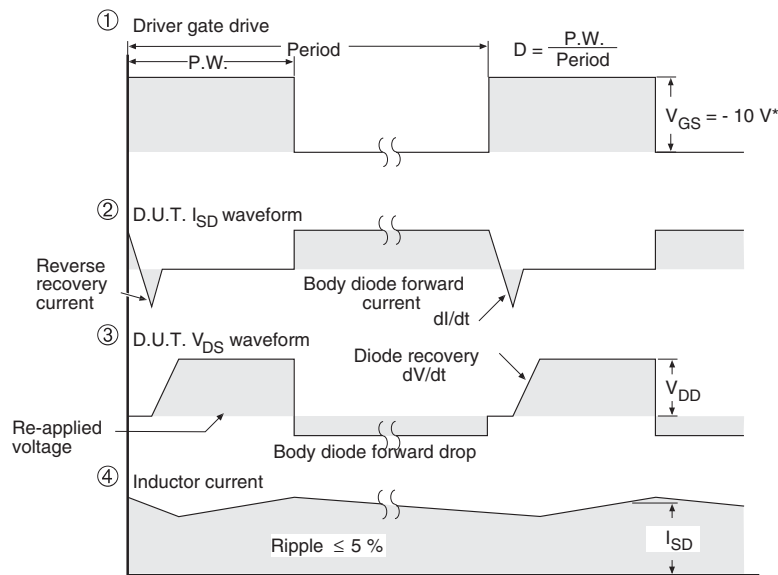
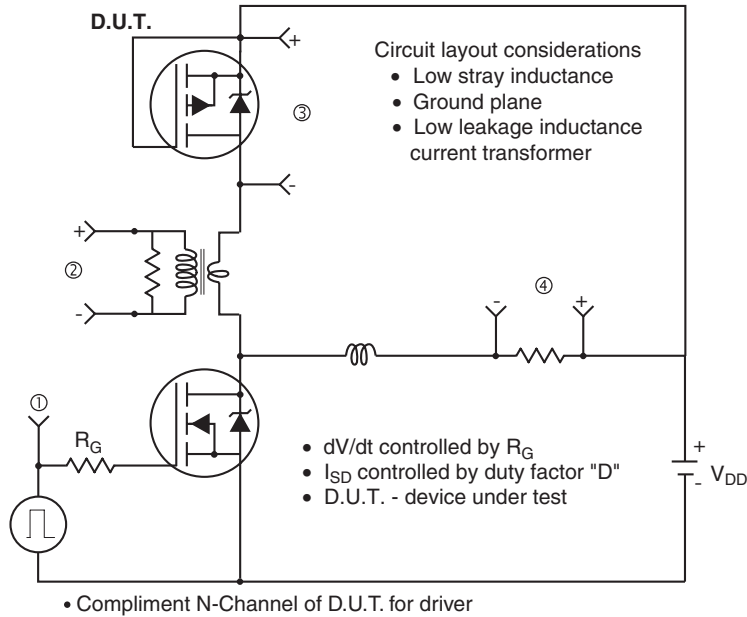


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery dV/dt Test Circuit



\*  $V_{GS} = -5 V$  for logic level and  $-3 V$  drive devices

**Fig.14 - For P-Channel**



### Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.