



Power MOSFET

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

FEATURES

- Advanced Process Technology
- Surface Mount (IRF9Z14S/SiHF9Z14S)
- Low-Profile Through-Hole (IRF9Z14L/SiHF9Z14L)
- 175 °C Operating Temperature
- Fast Switching
- P-Channel
- Fully Avalanche Rated
- Lead (Pb)-free Available



Available

RoHS*
COMPLIANT

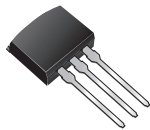
DESCRIPTION

Third generation Power MOSFETs from Vishay utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

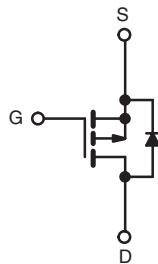
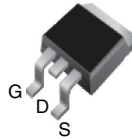
The D²PAK is a surface mount power package capable of accommodating die size up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²PAK is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface mount application.

The through-hole version (IRF9Z14L/SiHF9Z14L) is available for low-profile applications.

I²PAK (TO-262)



D²PAK (TO-263)



P-Channel MOSFET

ORDERING INFORMATION

Package	D ² PAK (TO-263)	D ² PAK (TO-263)	I ² PAK (TO-262)
Lead (Pb)-free	IRF9Z14SPbF SiHF9Z14S-E3	IRF9Z14STRLPbF ^a SiHF9Z14STL-E3 ^a	IRF9Z14LPbF SiHF9Z14L-E3
SnPb	IRF9Z14S SiHF9Z14S	IRF9Z14STRL ^a SiHF9Z14STL ^a	- -

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	- 60	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ^e	V_{GS} at - 10 V	$T_C = 25$ °C	- 6.7
		$T_C = 100$ °C	- 4.7
Pulsed Drain Current ^{a, e}	I_{DM}	- 27	A
Linear Derating Factor		0.29	W/°C
Single Pulse Avalanche Energy ^{b, e}	E_{AS}	140	mJ
Avalanche Current ^a	I_{AR}	- 6.7	A
Repetitive Avalanche Energy ^a	E_{AR}	4.3	mJ
Maximum Power Dissipation	P_D	$T_C = 25$ °C	3.7
		$T_A = 25$ °C	43

* Pb containing terminations are not RoHS compliant, exemptions may apply

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Peak Diode Recovery $dV/dt^c, e$	dV/dt	- 4.5	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 175	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d	


Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. $V_{DD} = - 25\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 3.6\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = - 6.7\text{ A}$ (see fig. 12).
- c. $I_{SD} \leq - 6.7\text{ A}$, $dI/dt \leq 90\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 175\text{ }^\circ\text{C}$.
- d. 1.6 mm from case.
- e. Uses IRF9Z14/SiHF9Z14 data and test conditions.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mounted, steady-state) ^a	R_{thJA}	-	40	$^\circ\text{C}/\text{W}$
Maximum Junction-to-Case (Drain)	R_{thJC}	-	3.5	

Note

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

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}	$V_{GS} = 0\text{ V}$, $I_D = - 250\text{ }\mu\text{A}$	- 60	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = - 1\text{ mA}^c$	-	- 0.06	-	$\text{V}/^\circ\text{C}$
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}	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = - 60\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	- 100	μA
		$V_{DS} = - 48\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	-	- 500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = - 10\text{ V}$, $I_D = - 4.0\text{ A}^b$	-	-	0.5	Ω
Forward Transconductance	g_{fs}	$V_{DS} = - 25\text{ V}$, $I_D = - 4.0\text{ A}^c$	1.4	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = - 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5 ^c	-	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 ^{b, c}	-	-	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 ^b	-	11	-	ns
Rise Time	t_r		-	63	-	
Turn-Off Delay Time	$t_{d(off)}$		-	10	-	
Fall Time	t_f		-	31	-	
Internal Source Inductance	L_S	Between lead, and center of die contact	-	7.5	-	nH
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	- 6.7	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	- 27	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = - 6.7\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	- 5.5	V



SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain-Source Body Diode Characteristics						
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25^\circ\text{C}$, $I_F = -6.7\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^{b,c}$	-	80	160	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	96	190	nC
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 $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\%$.
- c. Uses IRF9Z14/SiHF9Z14 data and test conditions.

TYPICAL CHARACTERISTICS 25°C , unless otherwise noted

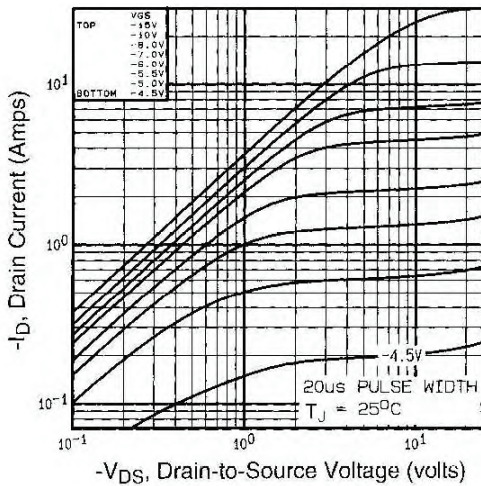


Fig. 1 - Typical Output Characteristics

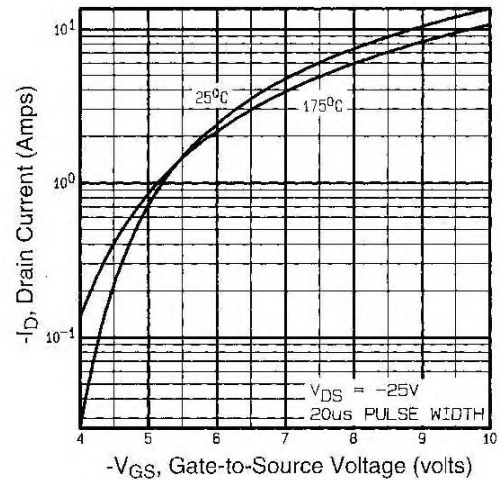


Fig. 3 - Typical Transfer Characteristics

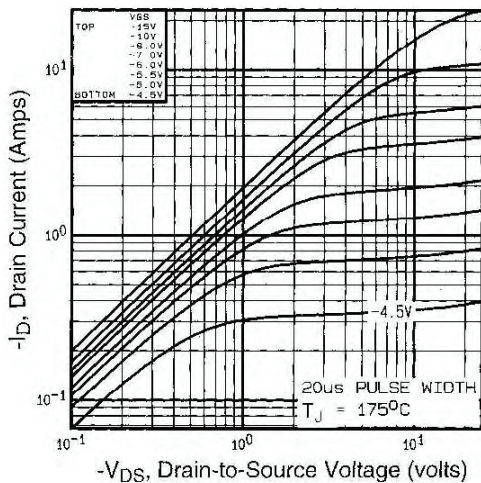


Fig. 2 - Typical Output Characteristics

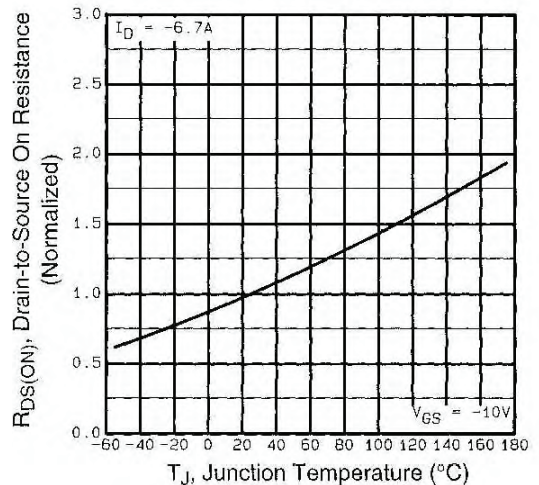


Fig. 4 - Normalized On-Resistance vs. Temperature

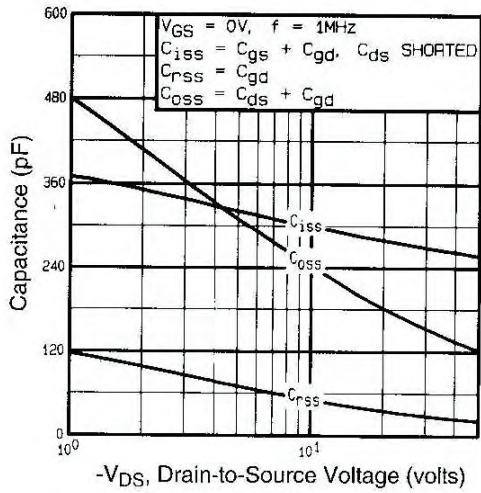


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

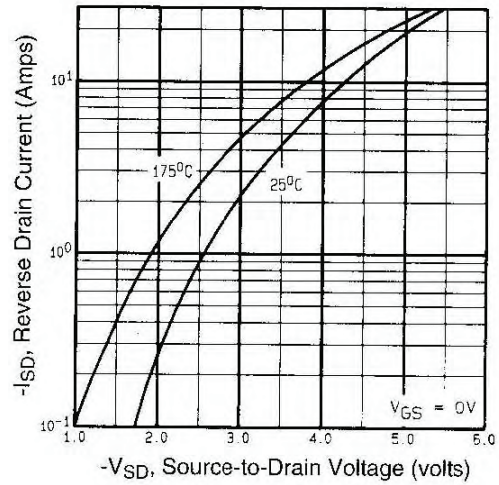


Fig. 7 - Typical Source-Drain Diode Forward Voltage

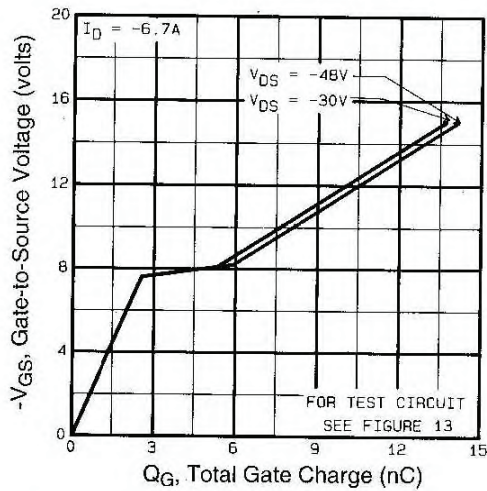


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

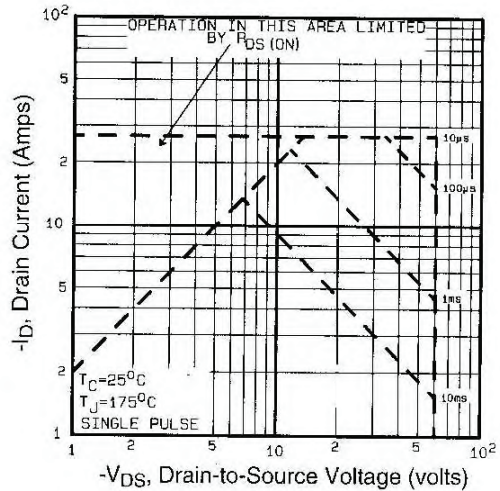


Fig. 8 - Maximum Safe Operating Area

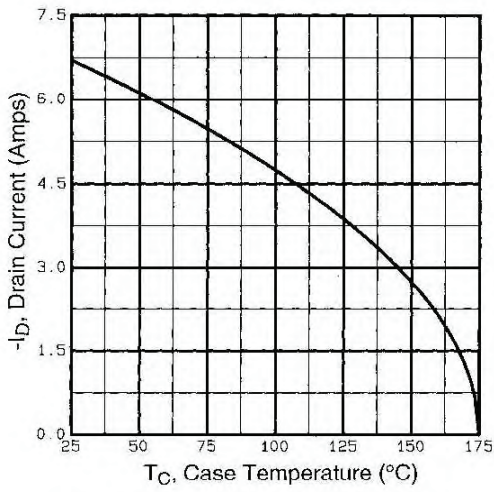


Fig. 9 - Maximum Drain Current vs. Case Temperature

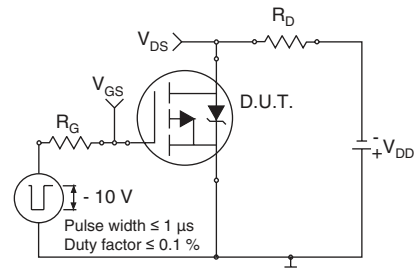


Fig. 10a - Switching Time Test Circuit

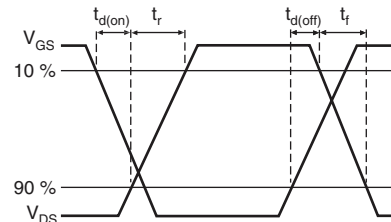


Fig. 10b - Switching Time Waveforms

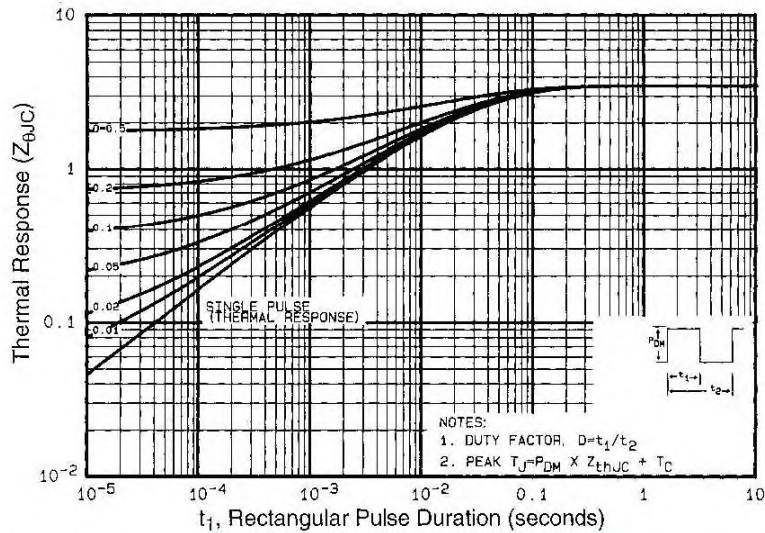


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

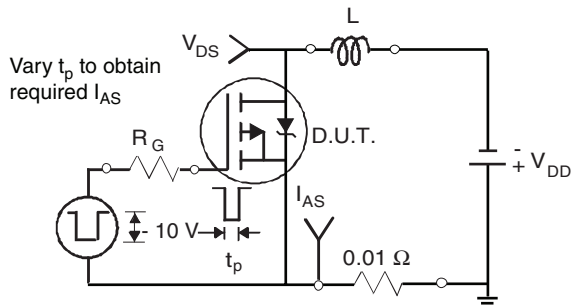


Fig. 12a - Unclamped Inductive Test Circuit

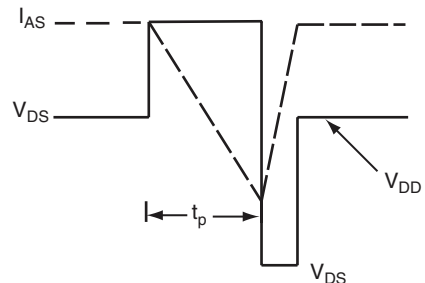


Fig. 12b - Unclamped Inductive Waveforms

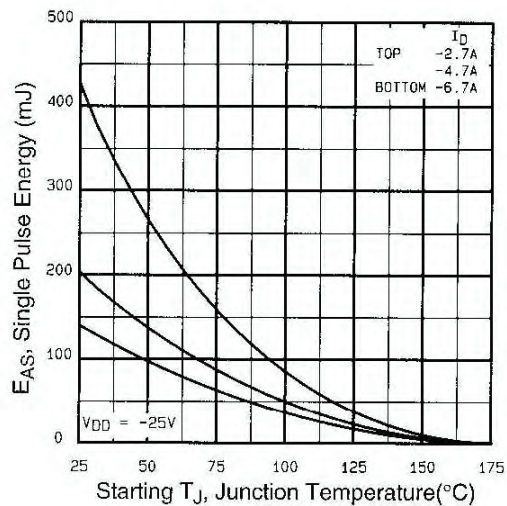


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

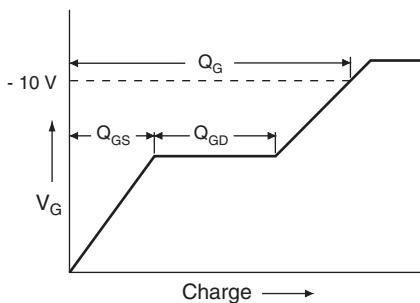


Fig. 13a - Basic Gate Charge Waveform

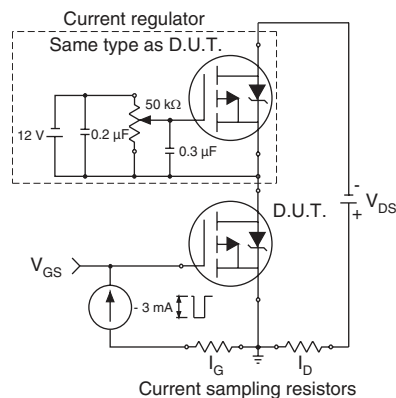
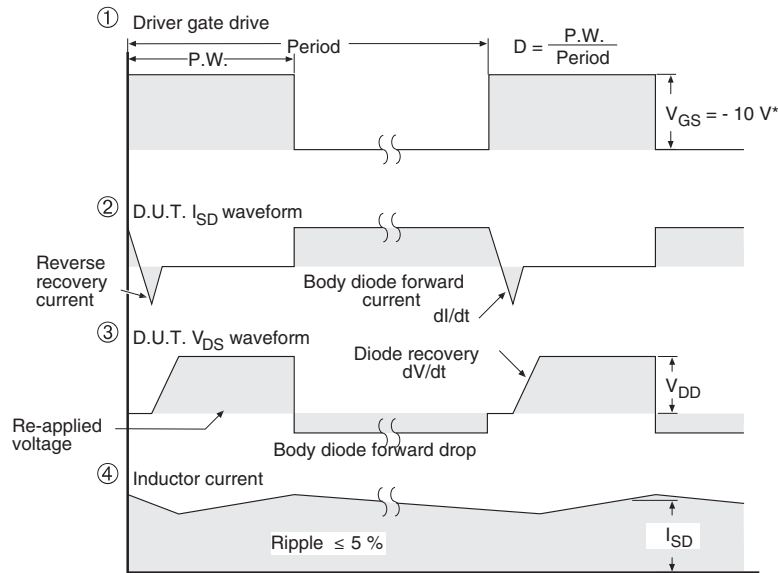
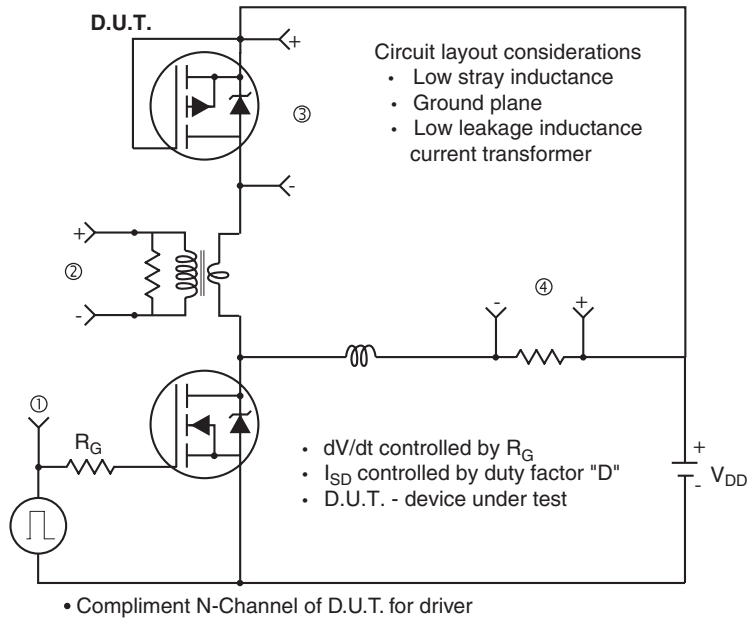


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For P-Channel

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