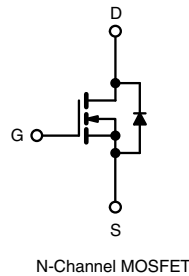
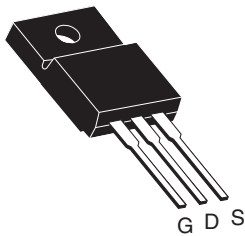


## Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	60	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10$ V	0.20
$Q_g$ (Max.) (nC)	11	
$Q_{gs}$ (nC)	3.1	
$Q_{gd}$ (nC)	5.8	
Configuration	Single	

**TO-220 FULLPAK**

**FEATURES**

- Isolated Package
- High Voltage Isolation = 2.5 kV<sub>RMS</sub> (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- 175 °C Operating Temperature
- Dynamic dv/dt Rating
- Low Thermal Resistance
- Compliant to RoHS Directive 2002/95/EC


**DESCRIPTION**

Third generation Power MOSFETs from Vishay provides the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness.

The TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The molding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The FULLPAK is mounted to a heatsink using a single clip or by a single screw fixing.

**ORDERING INFORMATION**

Package	TO-220 FULLPAK
Lead (Pb)-free	IRFIZ14GPbF
	SiHFIZ14G-E3
SnPb	IRFIZ14G
	SiHFIZ14G

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	$V_{GS}$ at 10 V $T_C = 25$ °C	8.0
		$T_C = 100$ °C	5.7
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	32	A
Linear Derating Factor		0.18	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	47	mJ
Maximum Power Dissipation	$P_D$	27	W
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	4.5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature)	for 10 s	300 <sup>d</sup>	
Mounting Torque	6-32 or M3 screw	10	
		1.1	

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25$  V, starting  $T_J = 25$  °C, L = 1.47 mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 8.0$  A (see fig. 12).
- $I_{SD} \leq 10$  A,  $dI/dt \leq 90$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.

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

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	65	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	5.5	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , 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 $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$	-	0.63	-	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	$I_{GSS}$	$V_{GS} = \pm 20$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	25	$\mu\text{A}$
		$V_{DS} = 48\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 4.8\text{ A}^b$	-	-	0.20	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 25\text{ V}$ , $I_D = 4.8\text{ A}^b$	2.2	-	-	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	-	300	-	pF
Output Capacitance	$C_{oss}$		-	160	-	
Reverse Transfer Capacitance	$C_{rss}$		-	29	-	
Drain to Sink Capacitance	$C$		-	12	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$ , $I_D = 10\text{ A}$ , $V_{DS} = 48\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	11	nC
Gate-Source Charge	$Q_{gs}$		-	-	3.1	
Gate-Drain Charge	$Q_{gd}$		-	-	5.8	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}$ , $I_D = 10\text{ A}$ $R_g = 24\text{ }\Omega$ , $R_D = 2.7\text{ }\Omega$ , see fig. 10 <sup>b</sup>	-	10	-	ns
Rise Time	$t_r$		-	50	-	
Turn-Off Delay Time	$t_{d(off)}$		-	13	-	
Fall Time	$t_f$		-	19	-	
Internal Drain Inductance	$L_D$	Between lead, 6 mm (0.25") from package and center of die contact	-	4.5	-	nH
Internal Source Inductance	$L_S$		-	7.5	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode	-	-	8.0	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	32	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = 8.0\text{ A}$ , $V_{GS} = 0\text{ V}^b$	-	-	1.6	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = 10\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}^b$	-	70	140	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	0.20	0.40	$\mu\text{C}$
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 °C, unless otherwise noted)

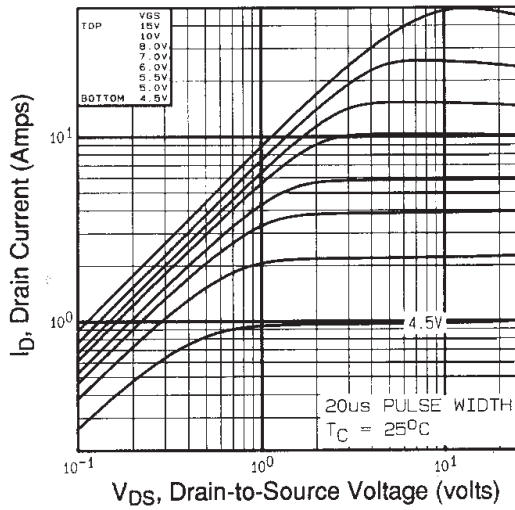


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$

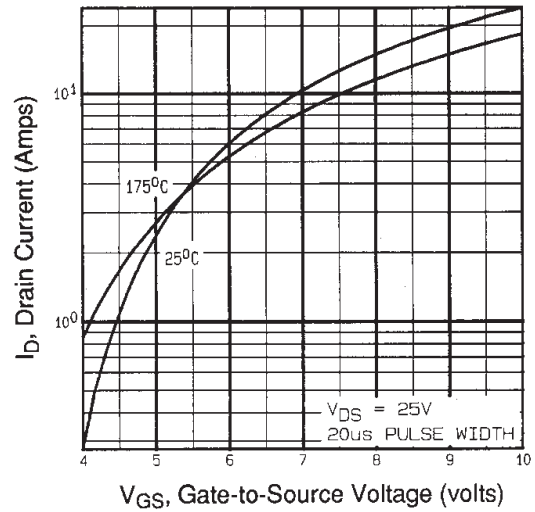


Fig. 3 - Typical Transfer Characteristics

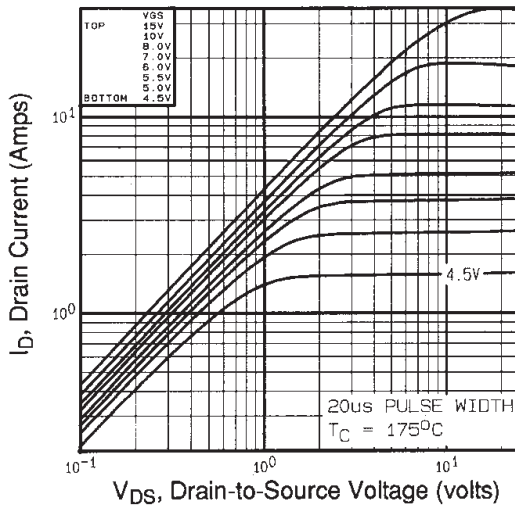


Fig. 2 - Typical Output Characteristics,  $T_C = 175\text{ }^\circ\text{C}$

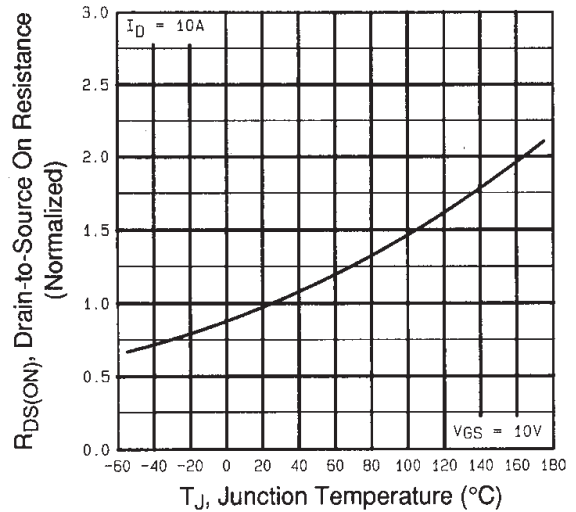


Fig. 4 - Normalized On-Resistance vs. Temperature

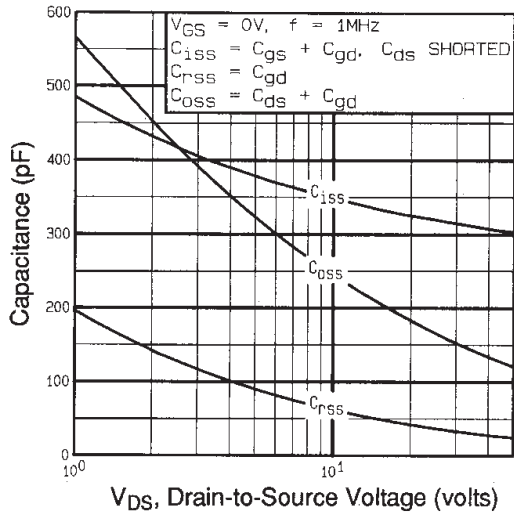


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

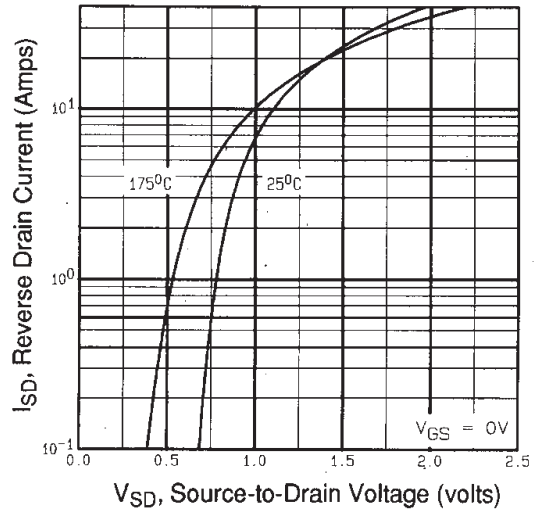


Fig. 7 - Typical Source-Drain Diode Forward Voltage

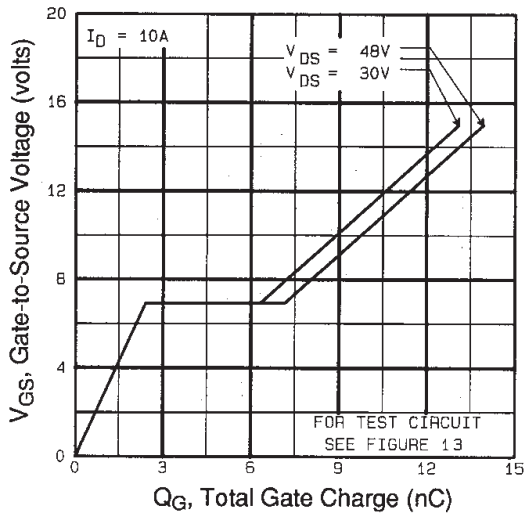


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

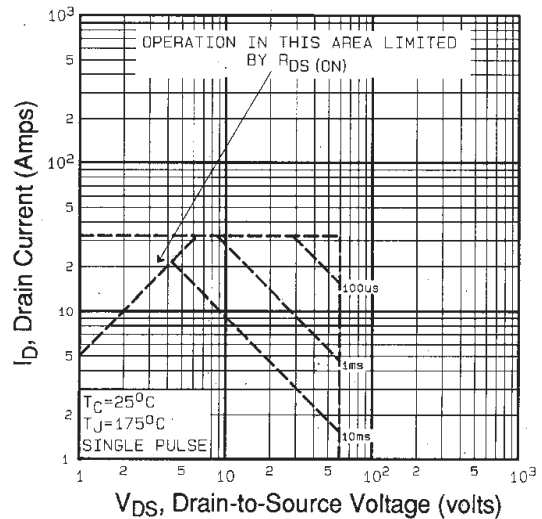
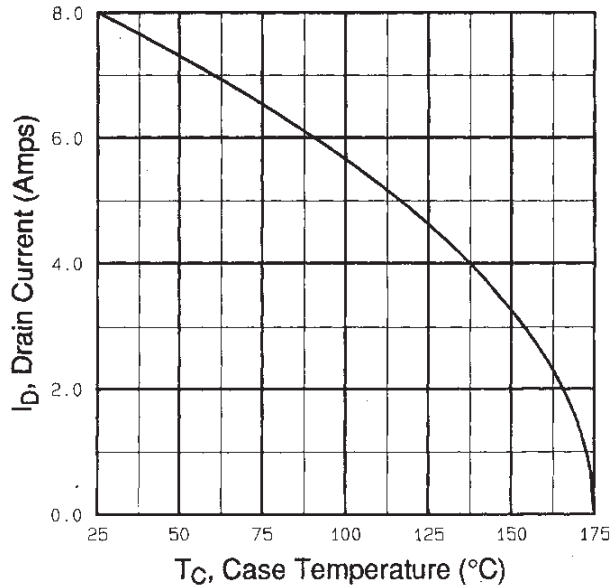
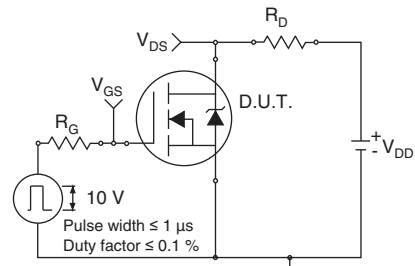


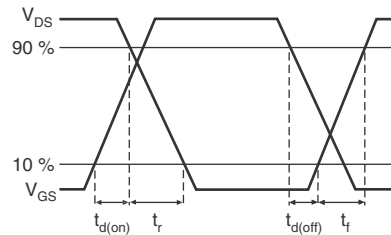
Fig. 8 - Maximum Safe Operating Area



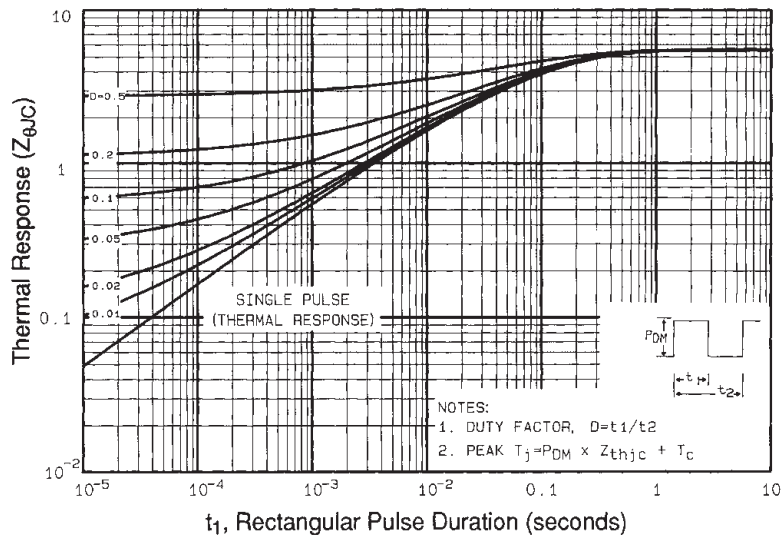
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



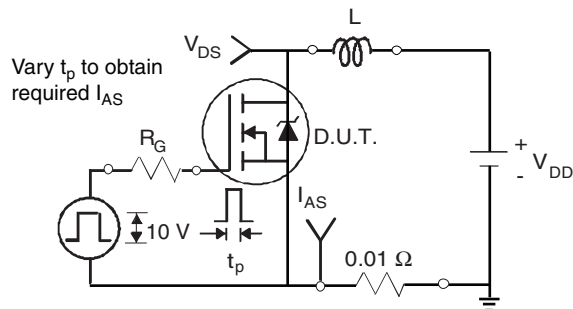
**Fig. 10a - Switching Time Test Circuit**



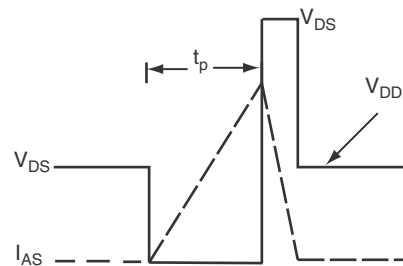
**Fig. 10b - Switching Time Waveforms**



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



**Fig. 12a - Unclamped Inductive Test Circuit**



**Fig. 12b - Unclamped Inductive Waveforms**

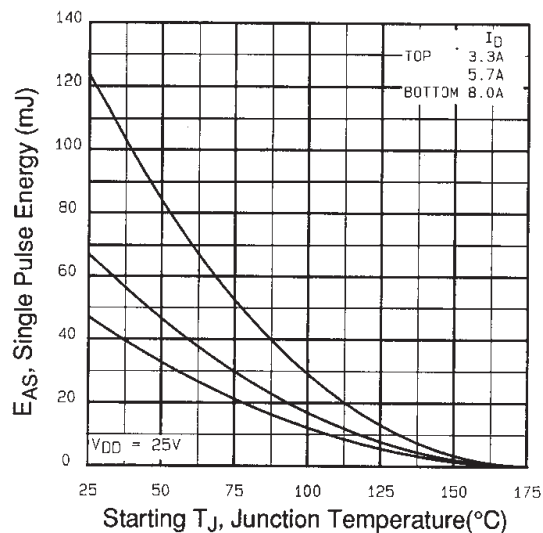


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

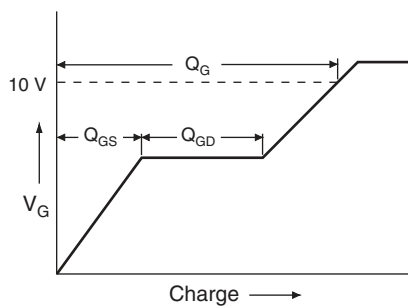


Fig. 13a - Basic Gate Charge Waveform

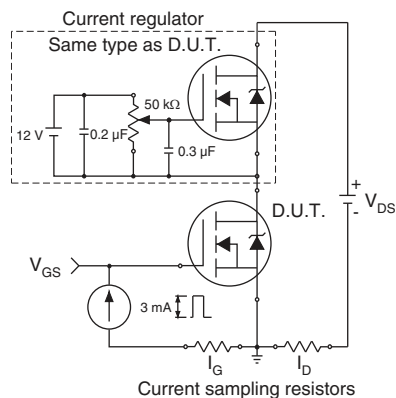
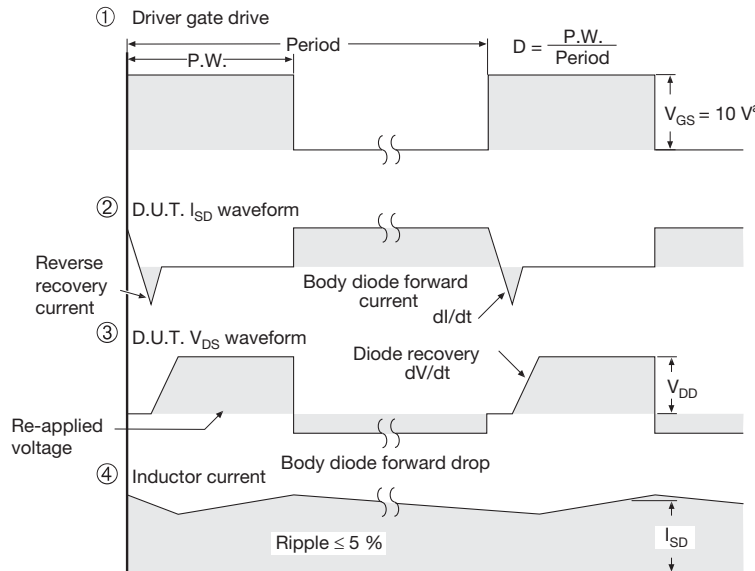
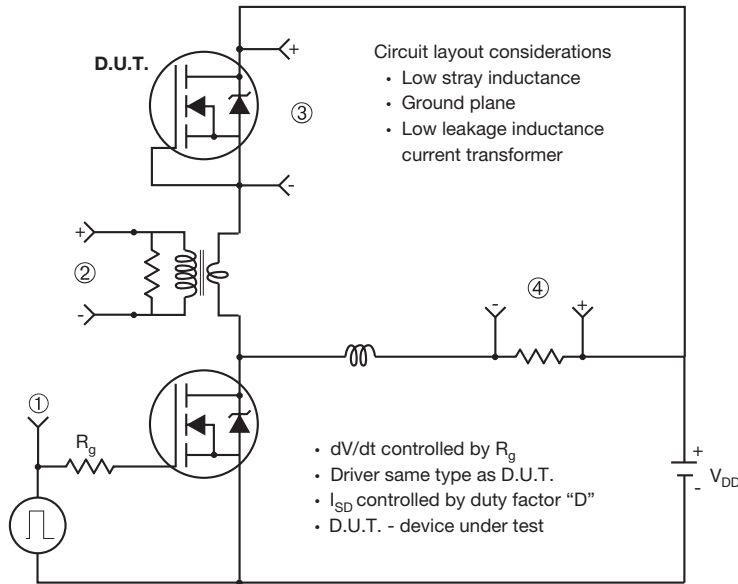


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 14 - For N-Channel**

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