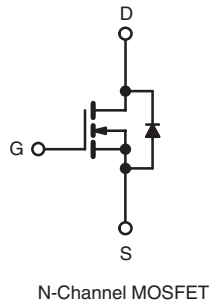
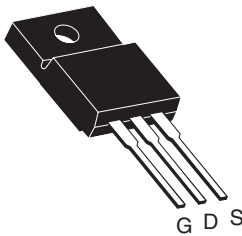


## Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	500
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$ 3.0
$Q_g$ (Max.) (nC)	24
$Q_{gs}$ (nC)	3.3
$Q_{gd}$ (nC)	13
Configuration	Single

**TO-220 FULLPAK**

**FEATURES**

- Isolated Package
- High Voltage Isolation = 2.5 kV<sub>RMS</sub> ( $t = 60\text{ s}$ ,  $f = 60\text{ Hz}$ )
- Sink to Lead Creepage Distance = 4.8 mm
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free 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 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. The 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	IRFI820GPbF
	SiHFI820G-E3
SnPb	IRFI820G
	SiHFI820G

**ABSOLUTE MAXIMUM RATINGS**  $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted

PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	$V_{DS}$	500	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current	$V_{GS}$ at 10 V	$T_C = 25\text{ }^\circ\text{C}$	A	
		$T_C = 100\text{ }^\circ\text{C}$		
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	8.4		
Linear Derating Factor		0.24	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	110	mJ	
Repetitive Avalanche Current <sup>a</sup>	$I_{AR}$	2.1	A	
Repetitive Avalanche Energy <sup>a</sup>	$E_{AR}$	3.0	mJ	
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	$P_D$	30	W
Peak Diode Recovery dV/dt <sup>c</sup>		dV/dt	3.5	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>		
Mounting Torque	6-32 or M3 screw		10	lbf · in
			1.1	N · m

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 44\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 2.1\text{ A}$  (see fig. 12).
- $I_{SD} \leq 2.1\text{ A}$ ,  $dI/dt \leq 50\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.

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

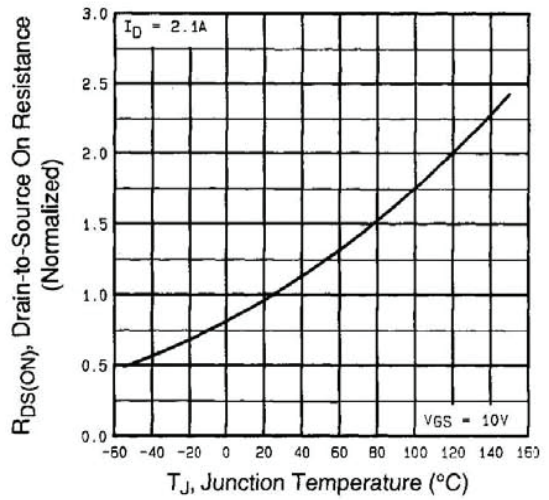
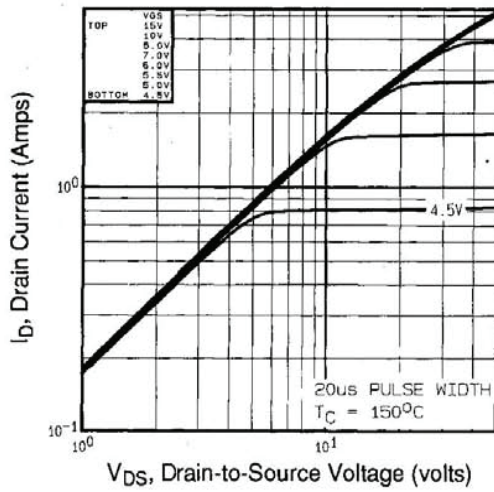
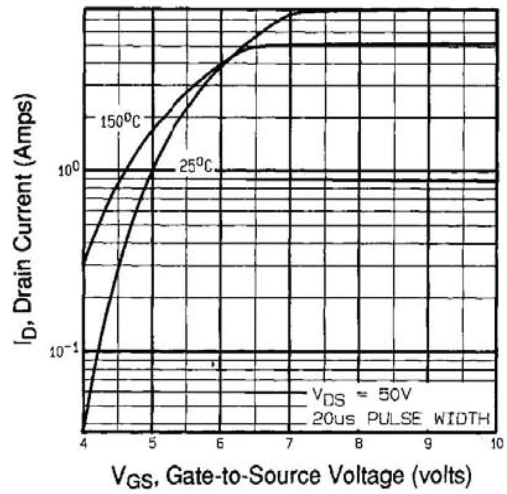
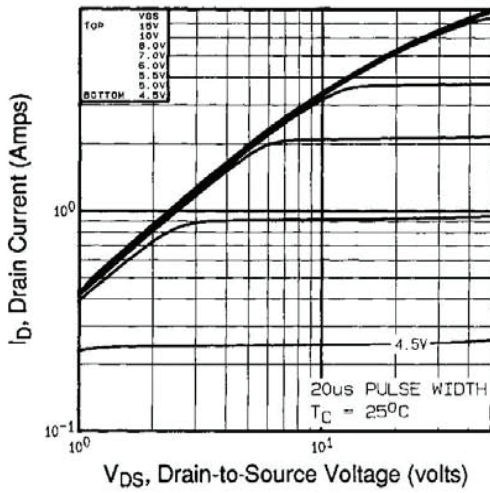
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	65	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	4.1	

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	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$		500	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.59	-	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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 500\text{ V}$ , $V_{GS} = 0\text{ V}$		-	-	25	$\mu\text{A}$
		$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.3\text{ A}^b$	-	-	3.0	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}$ , $I_D = 1.3\text{ A}^b$		1.5	-	-	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		-	360	-	pF
Output Capacitance	$C_{oss}$			-	92	-	
Reverse Transfer Capacitance	$C_{rss}$			-	37	-	
Drain to Sink Capacitance	$C$	$f = 1.0\text{ MHz}$		-	12	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 2.1\text{ A}$ , $V_{DS} = 400\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	24	nC
Gate-Source Charge	$Q_{gs}$			-	-	3.3	
Gate-Drain Charge	$Q_{gd}$			-	-	13	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}$ , $I_D = 2.1\text{ A}$ , $R_G = 18\text{ }\Omega$ , $R_D = 120\text{ }\Omega$ , see fig. 10 <sup>b</sup>		-	8.0	-	ns
Rise Time	$t_r$			-	8.6	-	
Turn-Off Delay Time	$t_{d(off)}$			-	33	-	
Fall Time	$t_f$			-	16	-	
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		-	-	2.1	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$			-	-	8.0	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = 2.1\text{ A}$ , $V_{GS} = 0\text{ V}^b$		-	-	1.6	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = 2.1\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}^b$		-	260	520	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	0.70	1.4	$\mu\text{C}$
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )					

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



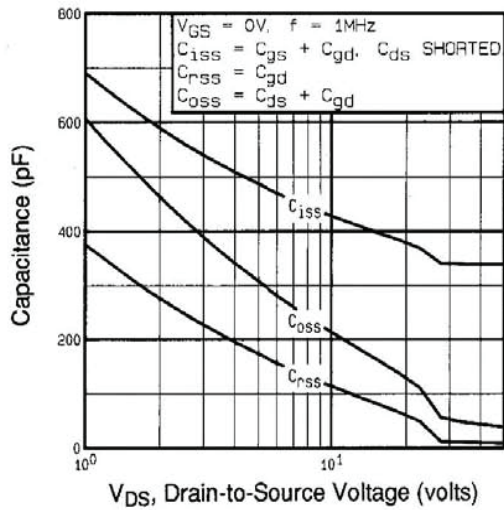


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

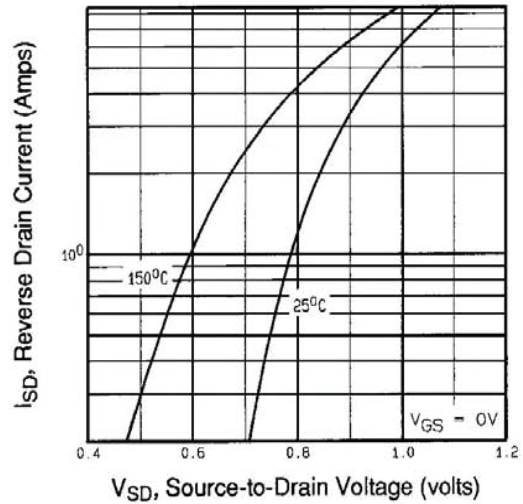


Fig. 7 - Typical Source-Drain Diode Forward Voltage

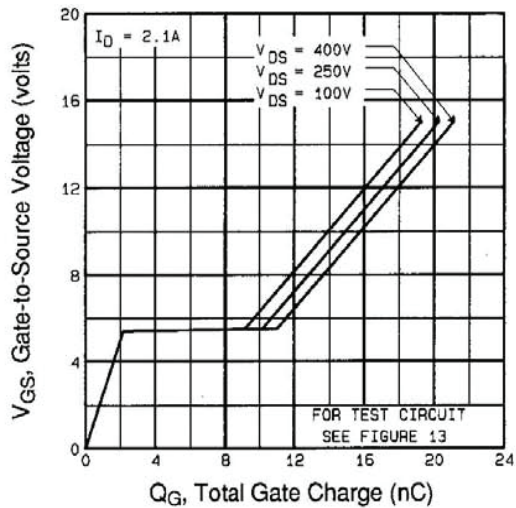


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

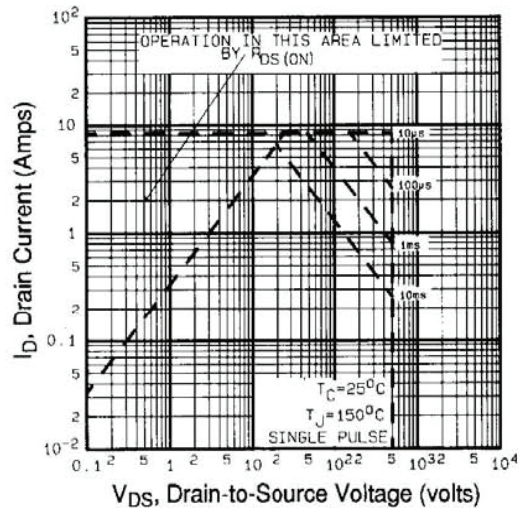


Fig. 8 - Maximum Safe Operating Area

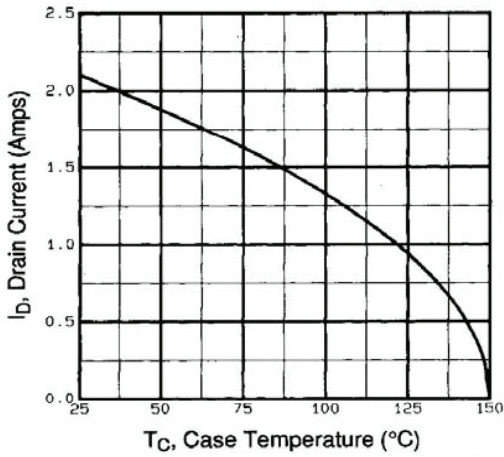


Fig. 9 - Maximum Drain Current vs. Case Temperature

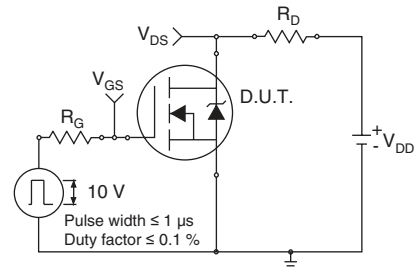


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

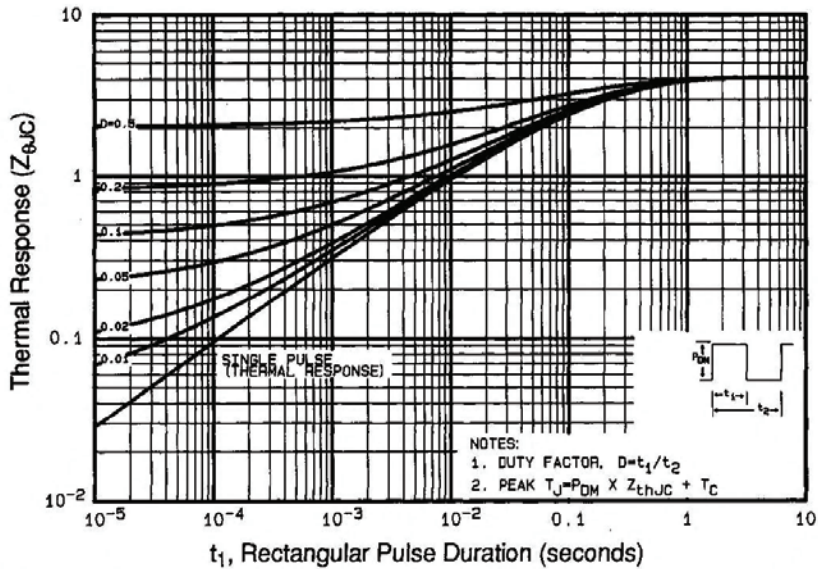


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

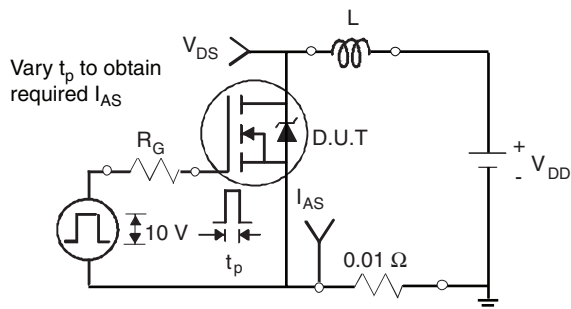


Fig. 12a - Unclamped Inductive Test Circuit

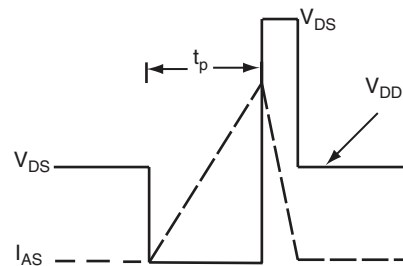


Fig. 12b - Unclamped Inductive Waveforms

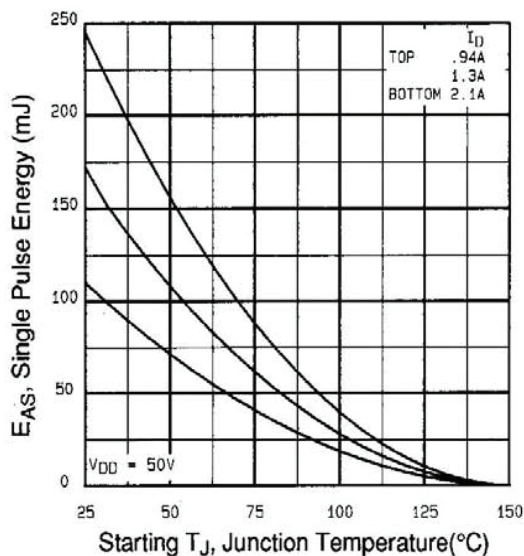


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

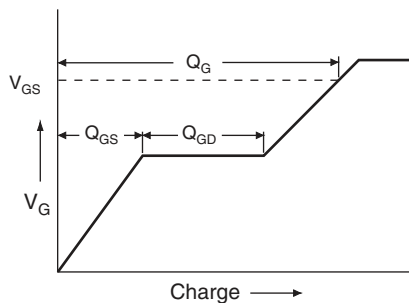


Fig. 13a - Basic Gate Charge Waveform

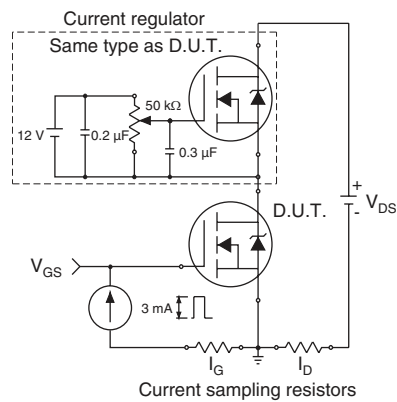
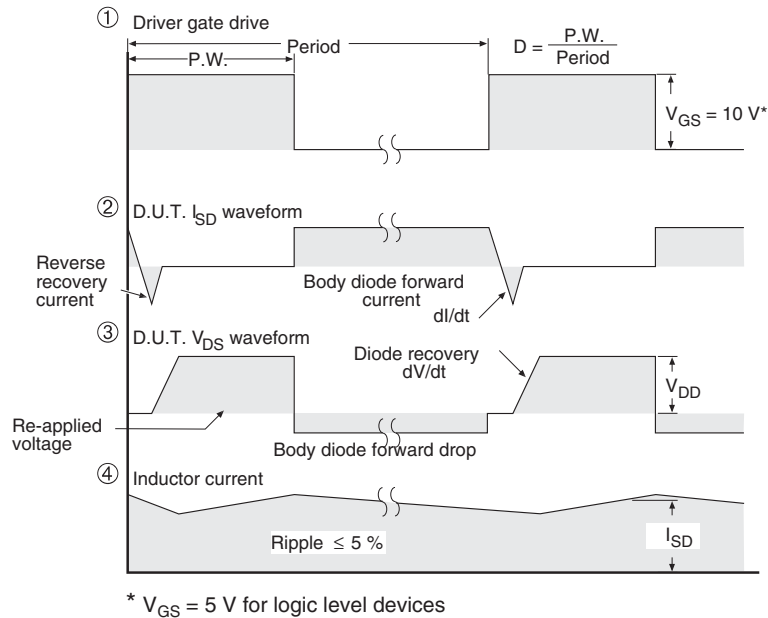
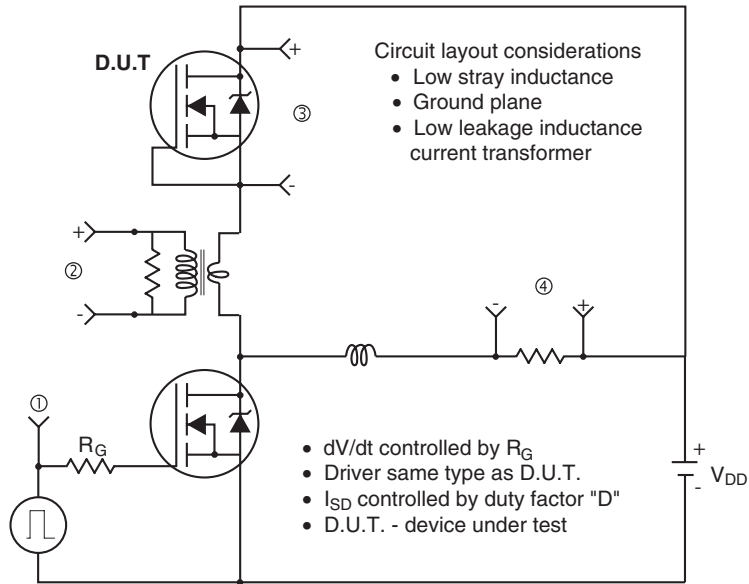


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery $dV/dt$ Test Circuit



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

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