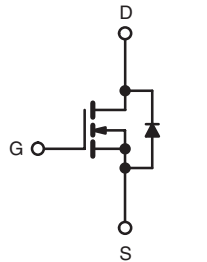
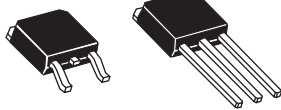




### Power MOSFET

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	200
R <sub>DS(on)</sub> (Ω)	V <sub>GS</sub> = 10 V 0.80
Q <sub>g</sub> (Max.) (nC)	14
Q <sub>gs</sub> (nC)	3.0
Q <sub>gd</sub> (nC)	7.9
Configuration	Single

**DKPAK (TO-252)**      **IPAK (TO-251)**



N-Channel MOSFET

#### FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR220/SiHFR220)
- Straight Lead (IRFU220/SiHFU220)
- Available in Tape and Reel
- 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 DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU/SiHFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 W are possible in typical surface mount applications.

ORDERING INFORMATION					
Package	DKPAK (TO-252)	DKPAK (TO-252)	DKPAK (TO-252)	DKPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRFR220PbF	IRFR220TRLPbF <sup>a</sup>	IRFR220TRPbF <sup>a</sup>	IRFR220TRRPbF <sup>a</sup>	IRFU220PbF
	SiHFR220-E3	SiHFR220TL-E3 <sup>a</sup>	SiHFR220T-E3 <sup>a</sup>	SiHFR220TR-E3 <sup>a</sup>	SiHFU220-E3
SnPb	IRFR220	IRFR220TRL <sup>a</sup>	IRFR220TR <sup>a</sup>	IRFR220TRR <sup>a</sup>	IRFU220
	SiHFR220	SiHFR220TL <sup>a</sup>	SiHFR220T <sup>a</sup>	SiHFR220TR <sup>a</sup>	SiHFU220

#### Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS T <sub>C</sub> = 25 °C, unless otherwise noted				
PARAMETER	SYMBOL		LIMIT	UNIT
Drain-Source Voltage	V <sub>DS</sub>		200	V
Gate-Source Voltage	V <sub>GS</sub>		± 20	
Continuous Drain Current	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	4.8	A
		T <sub>C</sub> = 100 °C	3.0	
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>		19	W/°C
Linear Derating Factor			0.33	
Linear Derating Factor (PCB Mount) <sup>e</sup>			0.020	
Single Pulse Avalanche Energy <sup>b</sup>	E <sub>AS</sub>		230	mJ
Repetitive Avalanche Current <sup>a</sup>	I <sub>AR</sub>		4.8	A
Repetitive Avalanche Energy <sup>a</sup>	E <sub>AR</sub>		4.2	mJ
Maximum Power Dissipation	T <sub>C</sub> = 25 °C		42	W
Maximum Power Dissipation (PCB Mount) <sup>e</sup>	T <sub>A</sub> = 25 °C		2.5	
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt		5.0	V/ns
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>		- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s		260 <sup>d</sup>	



#### Notes

- b. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- c. V<sub>DD</sub> = 50 V, starting T<sub>J</sub> = 25 °C, L = 14 mH, R<sub>G</sub> = 25 Ω, I<sub>AS</sub> = 4.8 A (see fig. 12).
- d. I<sub>SD</sub> ≤ 5.2 A, di/dt ≤ 95 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 150 °C.
- e. 1.6 mm from case.
- f. When mounted on 1" square PCB (FR-4 or G-10 material).

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	-	110	°C/W
Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup>	$R_{thJA}$	-	-	50	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	-	3.0	

### 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
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		200	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.29	-	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	$I_{DSS}$	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	$\mu\text{A}$
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 2.9\text{ A}^b$	-	-	0.80	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}, I_D = 2.9\text{ A}^b$		1.7	-	-	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		-	260	-	pF
Output Capacitance	$C_{oss}$			-	100	-	
Reverse Transfer Capacitance	$C_{rss}$			-	30	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 4.8\text{ A}, V_{DS} = 160\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	14	nC
Gate-Source Charge	$Q_{gs}$			-	-	3.0	
Gate-Drain Charge	$Q_{gd}$			-	-	7.9	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 4.8\text{ A}, R_G = 18\text{ }\Omega, R_D = 20\text{ }\Omega$ , see fig. 10 <sup>b</sup>		-	7.2	-	ns
Rise Time	$t_r$			-	22	-	
Turn-Off Delay Time	$t_{d(off)}$			-	19	-	
Fall Time	$t_f$			-	13	-	
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 		-	-	4.8	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$			-	-	19	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 4.8\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.8	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = 4.8\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	150	300	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	0.91	1.8	$\mu\text{C}$
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  $\leq 2\%$ .



## KERSEMI

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

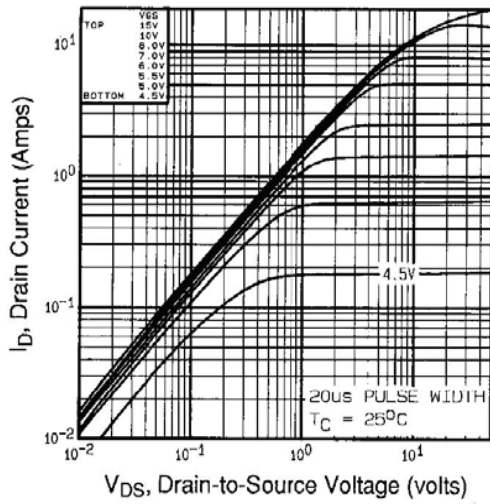


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

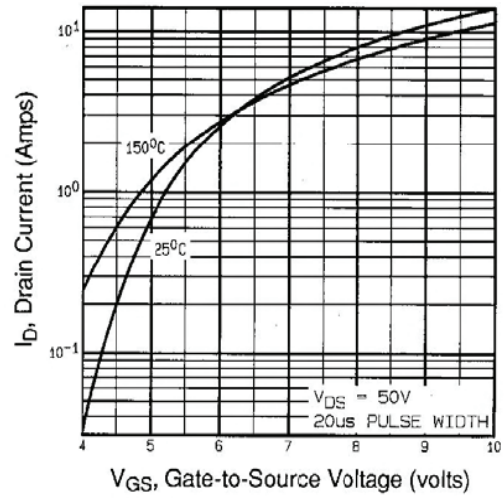


Fig. 3 - Typical Transfer Characteristics

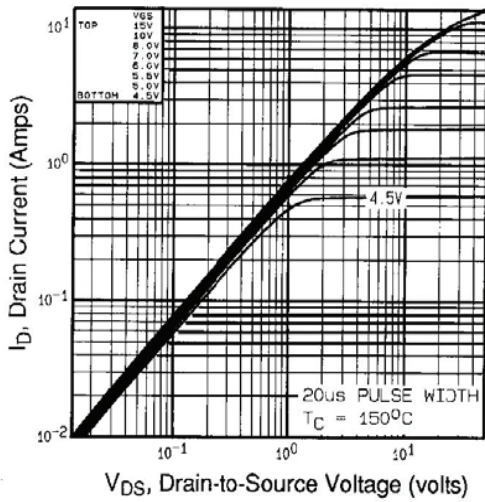


Fig. 2 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$

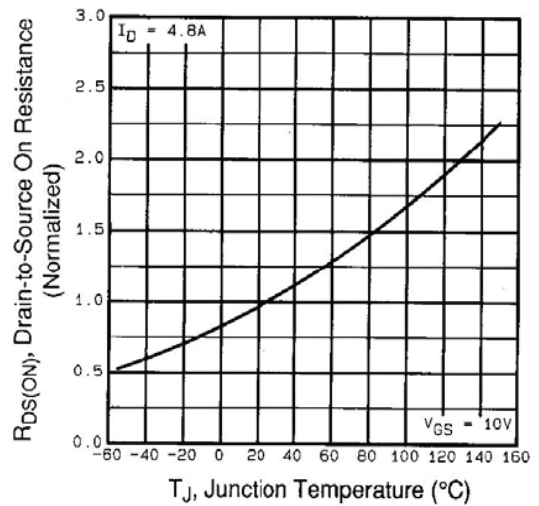


Fig. 4 - Normalized On-Resistance vs. Temperature

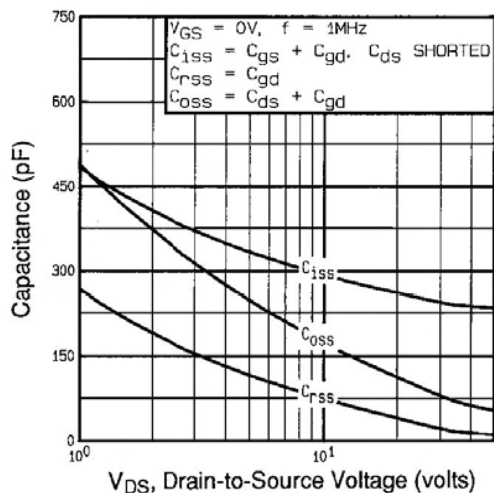


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

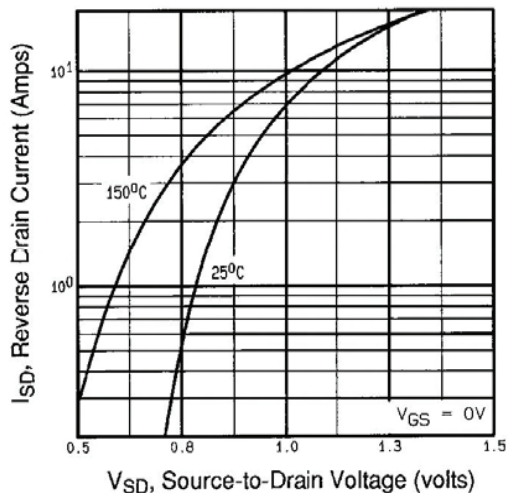


Fig. 7 - Typical Source-Drain Diode Forward Voltage

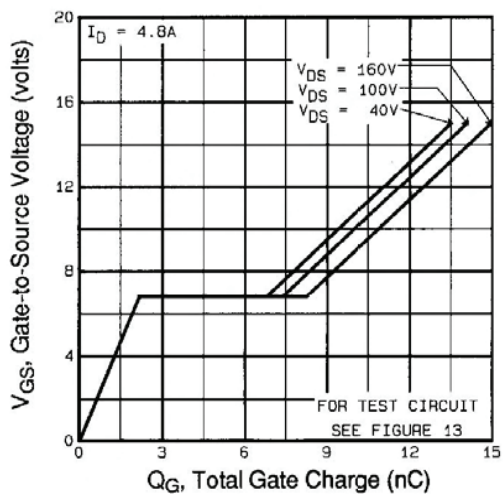


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

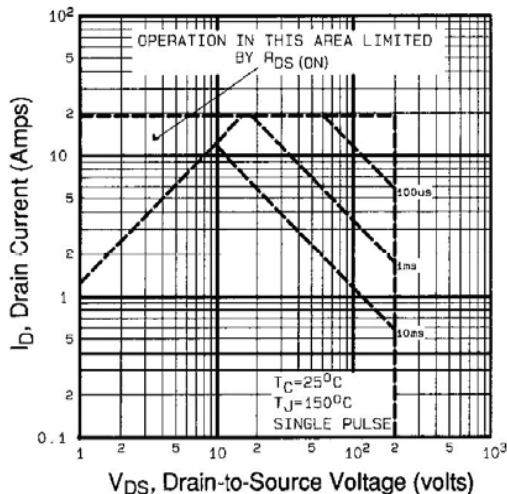


Fig. 8 - Maximum Safe Operating Area



KERSEMI

# IRFR220, IRFU220, SiHFR220, SiHFU220

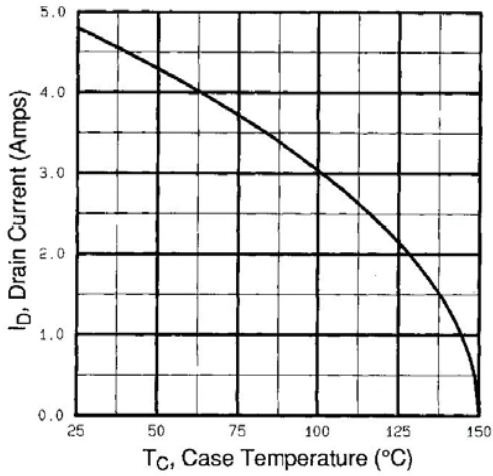


Fig. 9 - Maximum Drain Current vs. Case Temperature

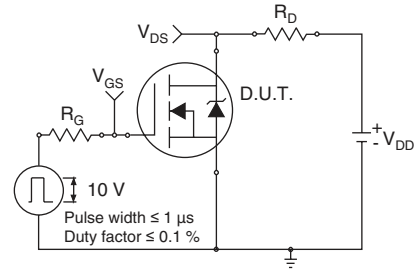


Fig. 10a - Switching Time Test Circuit

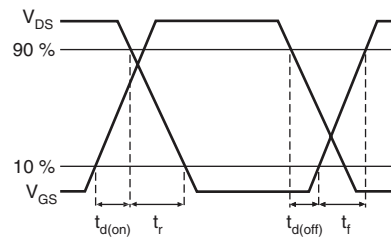


Fig. 10b - Switching Time Waveforms

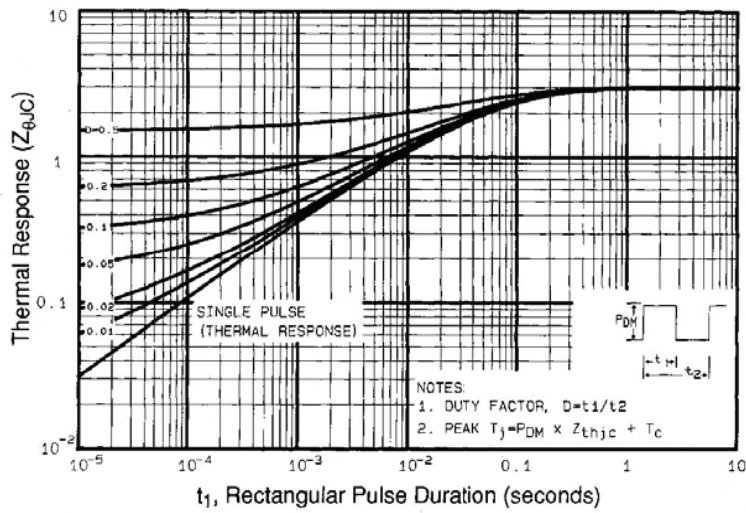


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

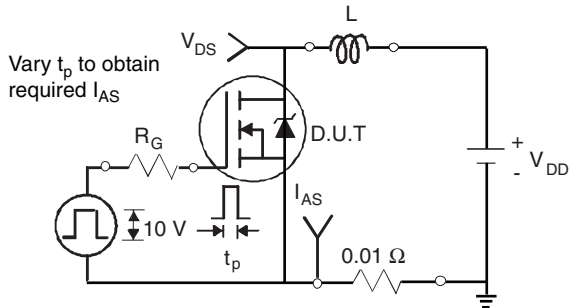


Fig. 12a - Unclamped Inductive Test Circuit

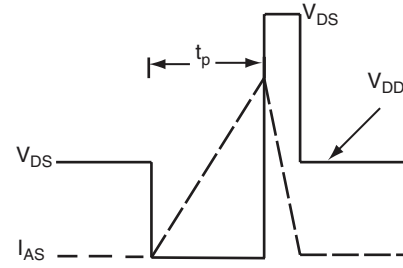


Fig. 12b - Unclamped Inductive Waveforms

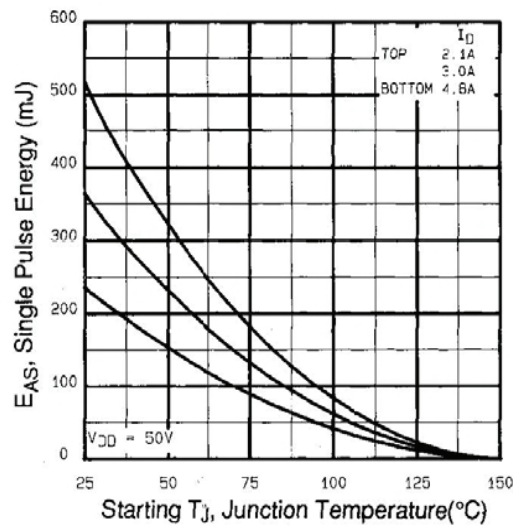


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

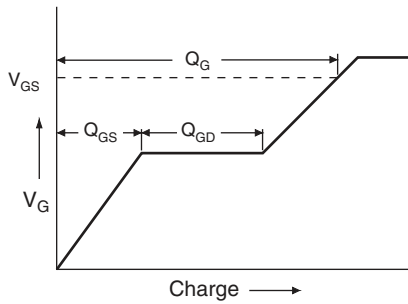


Fig. 13a - Basic Gate Charge Waveform

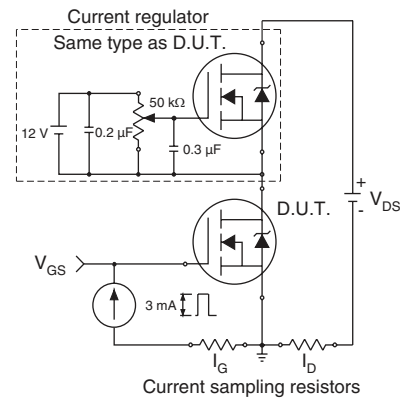
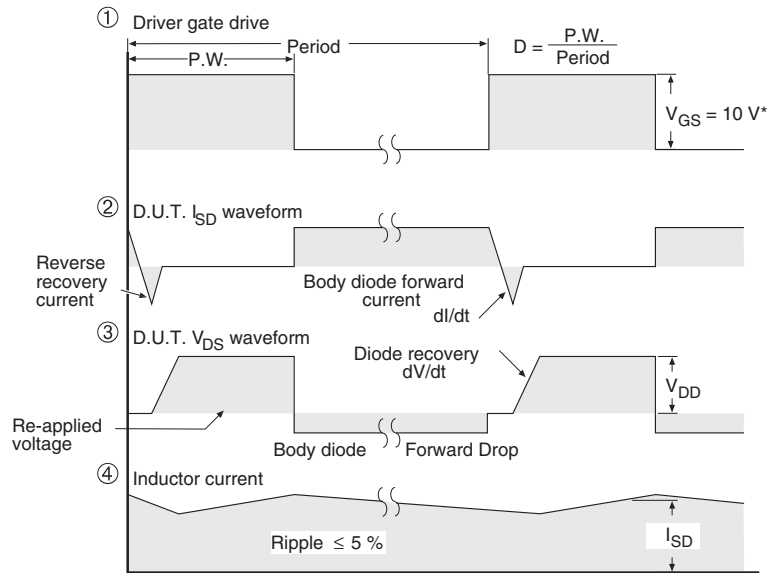
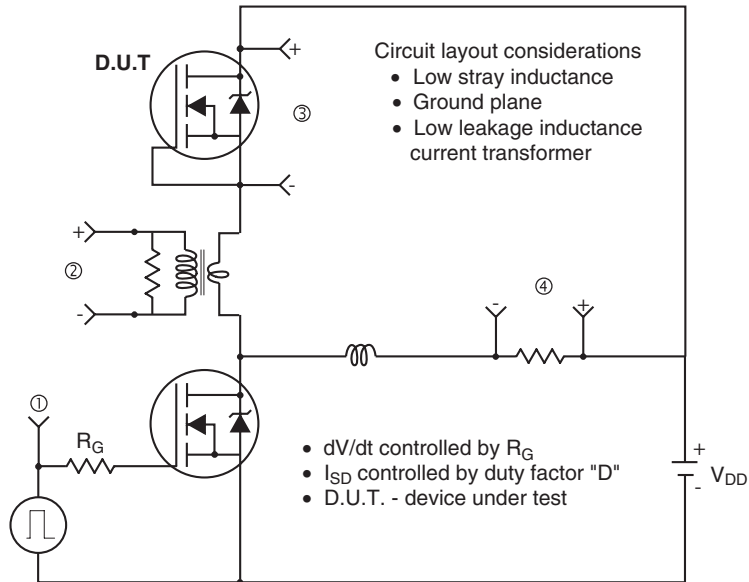


Fig. 13b - Gate Charge Test Circuit

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



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

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