



IRFR310, IRFU310, SiHFR310, SiHFU310

Vishay Siliconix

Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	400
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$ 3.6
Q_g (Max.) (nC)	12
Q_{gs} (nC)	1.9
Q_{gd} (nC)	6.5
Configuration	Single

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR310/SiHFR310)
- Straight Lead (IRFU310/SiHFU310)
- Available in Tape and Reel
- Fast Switching
- Fully Avalanche Rated
- Lead (Pb)-free Available



Available
RoHS*
COMPLIANT

DESCRIPTION

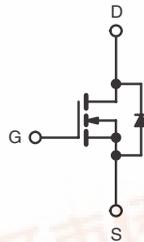
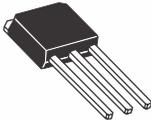
Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

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.

DPAK
(TO-252)



IPAK
(TO-251)



N-Channel MOSFET

ORDERING INFORMATION

Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRFR310PbF	IRFR310TRLPbF ^a	IRFR310TRPbF ^a	IRFR310TRRPbF ^a	IRFU310PbF
	SiHFR310-E3	SiHFR310TL-E3 ^a	SiHFR310T-E3 ^a	SiHFR310TR-E3 ^a	SiHFU310-E3
SnPb	IRFR310	IRFR310TRL ^a	IRFR310TR ^a	-	IRFU310
	SiHFR310	SiHFR310TL ^a	SiHFR310T ^a	-	SiHFU310

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}	400	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25^\circ\text{C}$	1.7
		$T_C = 100^\circ\text{C}$	1.1
Pulsed Drain Current ^a	I_{DM}	6.0	A
Linear Derating Factor		0.20	W/ $^\circ\text{C}$
Linear Derating Factor (PCB Mount) ^e		0.020	
Single Pulse Avalanche Energy ^b	E_{AS}	86	mJ
Repetitive Avalanche Current ^a	I_{AR}	1.7	A
Repetitive Avalanche Energy ^a	E_{AR}	2.5	mJ
Maximum Power Dissipation	P_D	$T_C = 25^\circ\text{C}$	25
Maximum Power Dissipation (PCB Mount) ^e		$T_A = 25^\circ\text{C}$	2.5
Peak Diode Recovery dV/dt ^c	dV/dt	4.0	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	260 ^d	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. $V_{DD} = 50\text{ V}$, starting $T_J = 25^\circ\text{C}$, $L = 52\text{ mH}$, $R_G = 25\ \Omega$, $I_{AS} = 1.7\text{ A}$ (see fig. 12).

c. $I_{SD} \leq 1.7\text{ A}$, $dI/dt \leq 40\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.

d. 1.6 mm from case.

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

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

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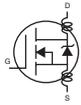
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THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mounted, steady-state) ^a	R_{thJA}	-	50	°C/W
Maximum Junction-to-Ambient	R_{thJA}	-	110	
Maximum Junction-to-Case	R_{thJC}	-	5.0	

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	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		400	-	- V	
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.47	- $^\circ\text{C}^{-1}$	
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}	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100\text{ nA}$	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$		-	-	25 μA	
		$V_{DS} = 320\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250 μA	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.0\text{ A}^b$	-	-	3.6 Ω	
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 1.0\text{ A}^b$		0.97	-	- 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		-	170	-	
Output Capacitance	C_{oss}			-	34	-	pF
Reverse Transfer Capacitance	C_{rss}			-	6.3	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 2.0\text{ A}, V_{DS} = 320\text{ V}$, see fig. 6 and 13 ^{b, c}	-	-	12	
Gate-Source Charge	Q_{gs}			-	-	1.9	nC
Gate-Drain Charge	Q_{gd}			-	-	6.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 200\text{ V}, I_D = 2.0\text{ A}, R_G = 24\text{ }\Omega, R_D = 95\text{ }\Omega$, see fig. 10 ^{b, c}		-	7.9	-	
Rise Time	t_r			-	9.9	-	ns
Turn-Off Delay Time	$t_{d(off)}$			-	21	-	
Fall Time	t_f			-	11	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 		-	4.5	-	
Internal Source Inductance	L_S			-	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 		-	-	1.7	
Pulsed Diode Forward Current ^a	I_{SM}			-	-	6.0	A
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 1.7\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.6 V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 2.0\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	240	540 ns	
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.85	1.6 μC	
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 $\leq 2\%$.



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TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

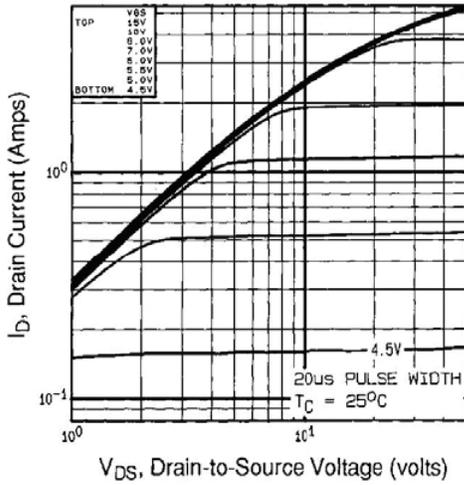


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

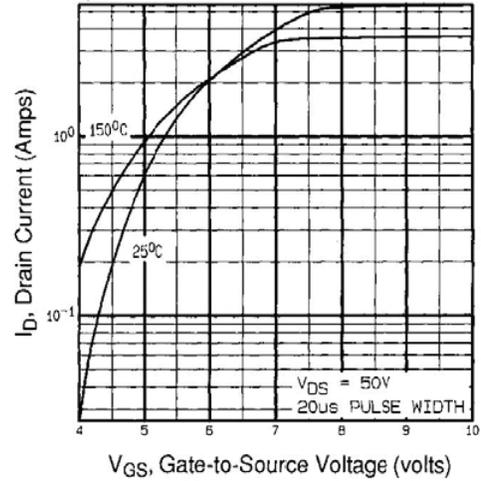


Fig. 3 - Typical Transfer Characteristics

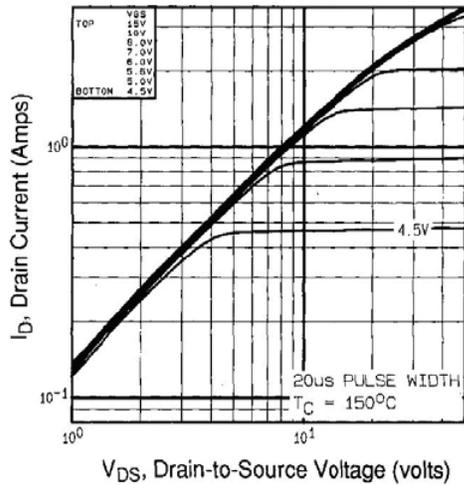


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

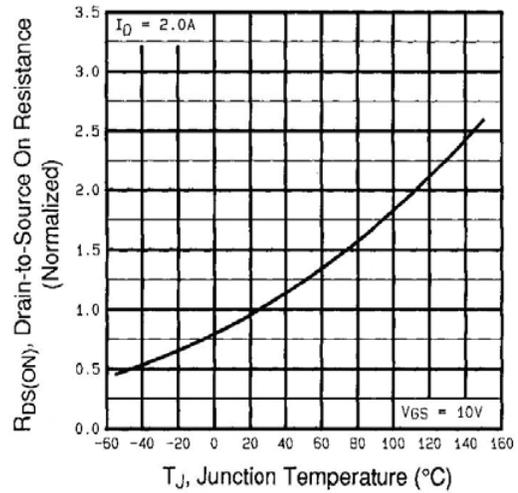


Fig. 4 - Normalized On-Resistance vs. Temperature

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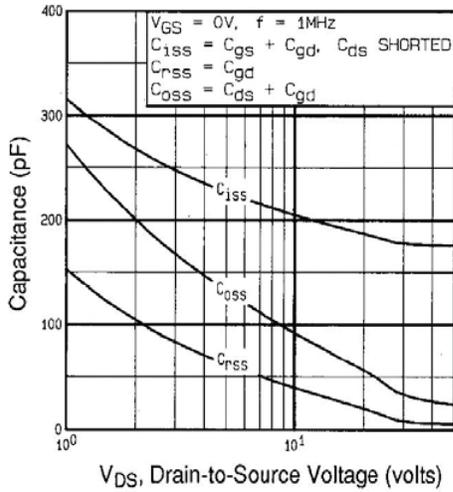


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

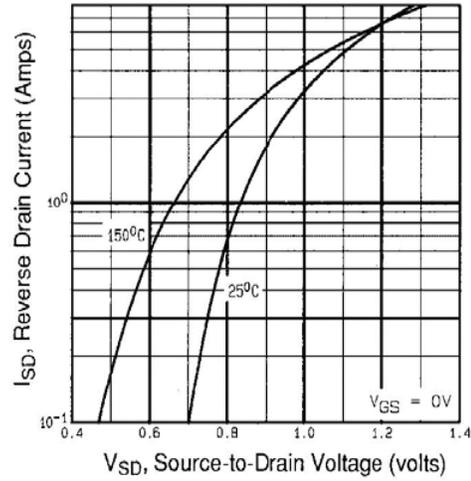


Fig. 7 - Typical Source-Drain Diode Forward Voltage

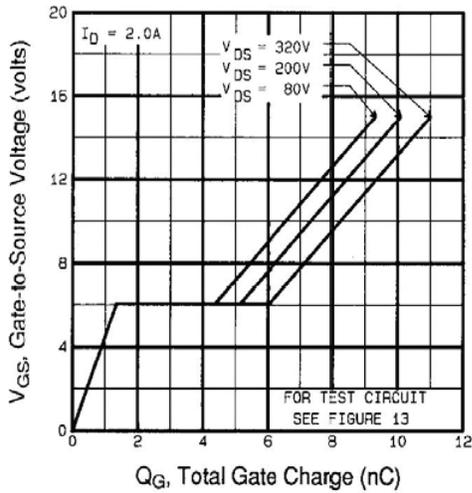


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

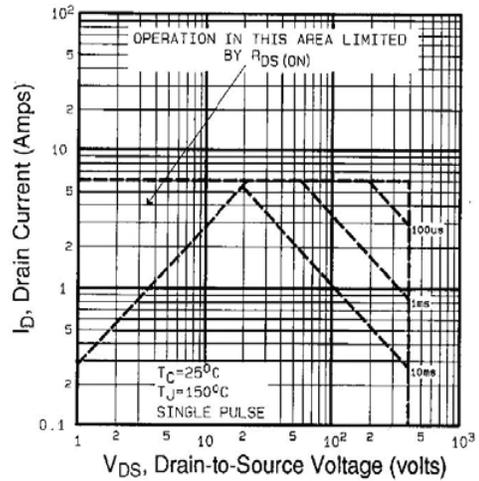


Fig. 8 - Maximum Safe Operating Area



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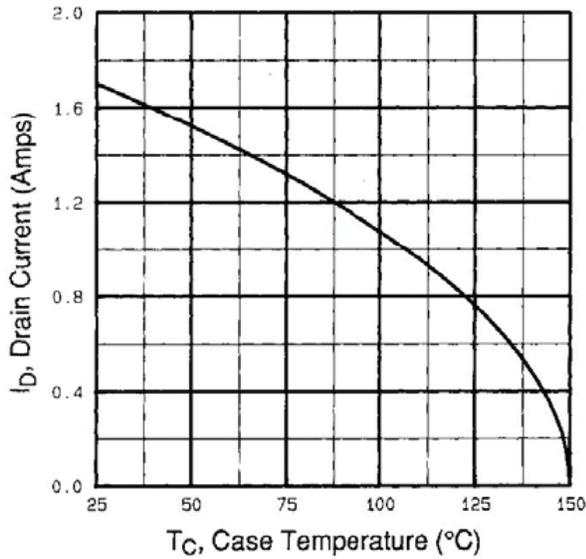


Fig. 9 - Maximum Drain Current vs. Case Temperature

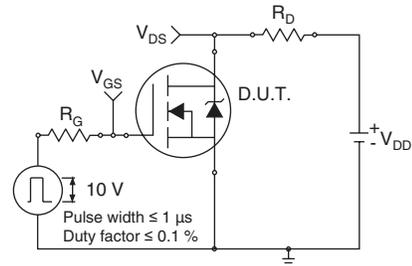


Fig. 10a - Switching Time Test Circuit

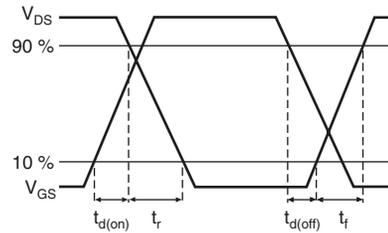


Fig. 10b - Switching Time Waveforms

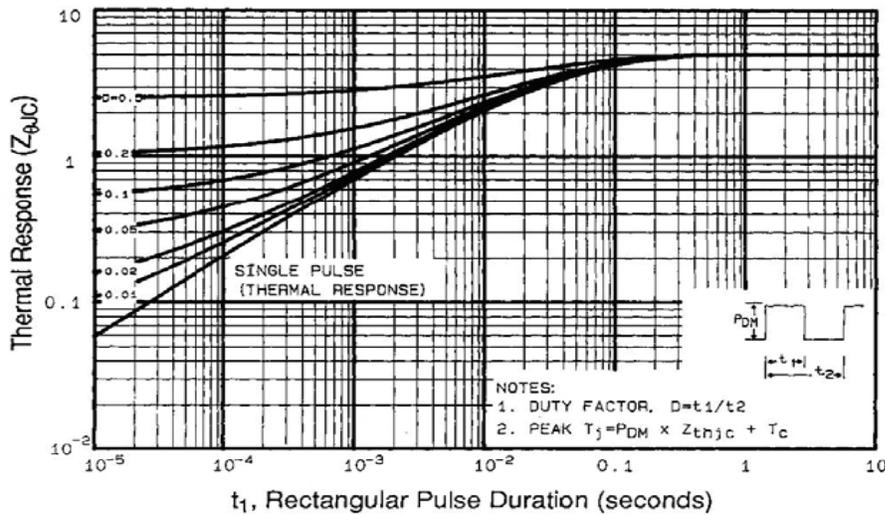


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

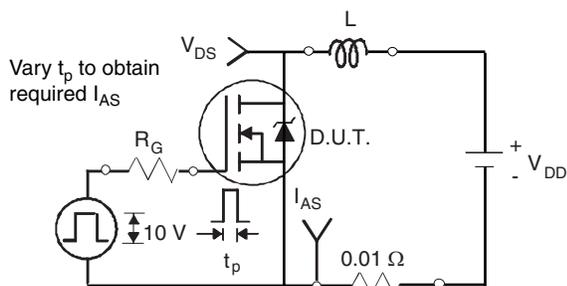


Fig. 12a - Unclamped Inductive Test Circuit

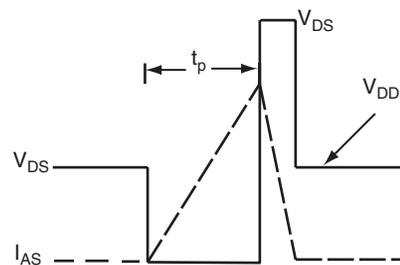


Fig. 12b - Unclamped Inductive Waveforms

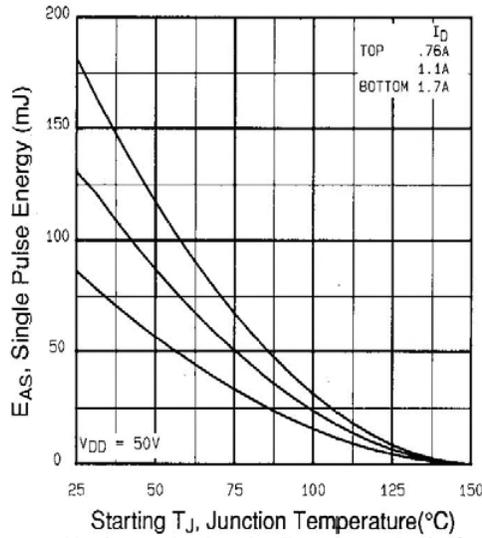


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

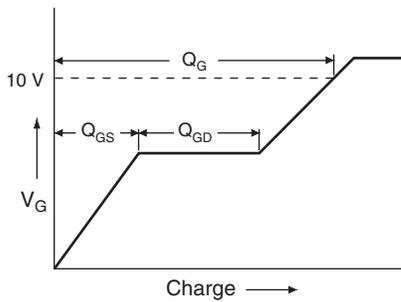


Fig. 13a - Basic Gate Charge Waveform

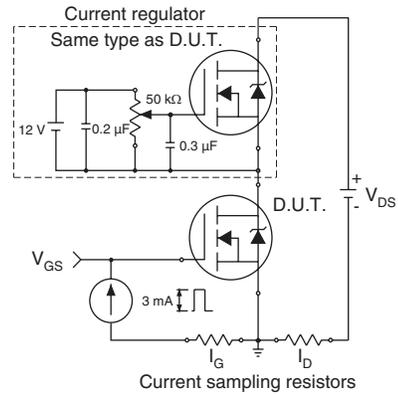
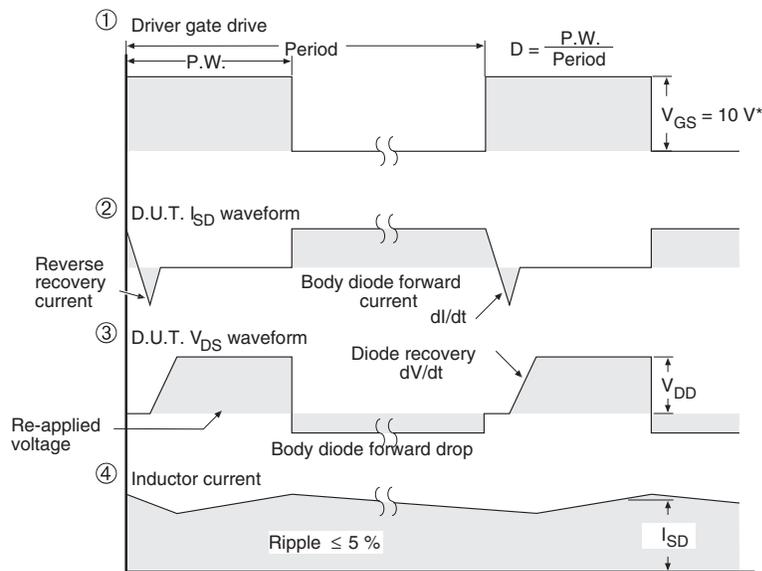
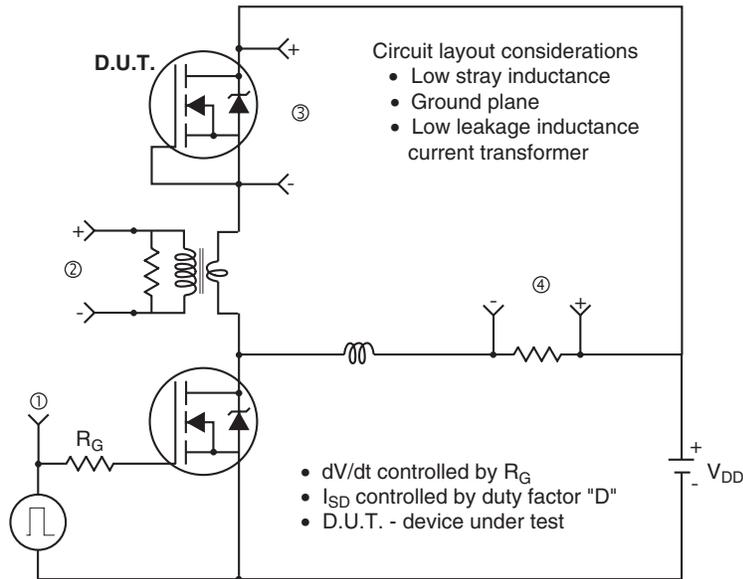


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel



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