



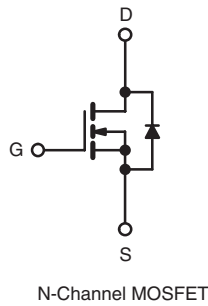
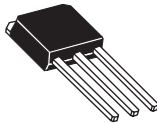
Power MOSFET

PRODUCT SUMMARY	
V _{DS} (V)	200
R _{DS(on)} (Ω)	V _{GS} = 10 V 1.5
Q _g (Max.) (nC)	8.2
Q _{gs} (nC)	1.8
Q _{gd} (nC)	4.5
Configuration	Single

DPAK
(TO-252)



IPAK
(TO-251)



FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR210/SiHFR210)
- Straight Lead (IRFU210/SiHFU210)
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling
- Lead (Pb)-free Available



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	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRFR210PbF	IRFR210TRLpbf ^a	IRFR210TRPbF ^a	-	IRFU210PbF
	SiHFR210-E3	SiHFR210TL-E3 ^a	SiHFR210T-E3 ^a	-	SiHFU210-E3
SnPb	IRFR210	IRFR210TRL ^a	IRFR210TR ^a	IRFR210TRR ^a	IRFU210
	SiHFR210	SiHFR210TL ^a	SiHFR210T ^a	SiHFR210TR ^a	SiHFU210

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS T _C = 25 °C, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V _{DS}	200	V
Gate-Source Voltage	V _{GS}	± 20	
Continuous Drain Current	V _{GS} at 10 V	T _C = 25 °C	A
		T _C = 100 °C	
Pulsed Drain Current ^a	I _{DM}	10	
Linear Derating Factor		0.20	W/°C
Linear Derating Factor (PCB Mount) ^e		0.020	
Single Pulse Avalanche Energy ^b	E _{AS}	130	mJ
Avalanche Current ^a	I _{AR}	2.7	A
Repetitive Avalanche Energy ^a	E _{AR}	2.5	mJ
Maximum Power Dissipation	P _D	T _C = 25 °C	W
Maximum Power Dissipation (PCB Mount) ^e		T _A = 25 °C	
Peak Diode Recovery dV/dt ^c	dV/dt	5.0	V/ns
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s	260 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V_{DD} = 50 V, starting T_J = 25 °C, L = 28 mH, R_G = 25 Ω, I_{AS} = 2.6 A (see fig. 12).
- I_{SD} ≤ 2.6 A, di/dt ≤ 70 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
- 1.6 mm from case.
- 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) ^a	R_{thJA}	-	-	50	
Maximum Junction-to-Case (Drain)	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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.30	-	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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	μA
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.6\text{ A}^b$	-	-	1.5	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 1.6\text{ A}^b$		0.80	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	140	-	pF
Output Capacitance	C_{oss}			-	53	-	
Reverse Transfer Capacitance	C_{rss}			-	15	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 3.3\text{ A}, V_{DS} = 160\text{ V}$, see fig. 6 and 13 ^b	-	-	8.2	nC
Gate-Source Charge	Q_{gs}			-	-	1.8	
Gate-Drain Charge	Q_{gd}			-	-	4.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 3.3\text{ A}, R_G = 24\text{ }\Omega, R_D = 30\text{ }\Omega$, see fig. 10 ^b		-	8.2	-	ns
Rise Time	t_r			-	17	-	
Turn-Off Delay Time	$t_{d(off)}$			-	14	-	
Fall Time	t_f			-	8.9	-	
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	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	2.6	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	10	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 2.6\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	2.0	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 3.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	150	310	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.60	1.4	μC
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 $\leq 2\%$.



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TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

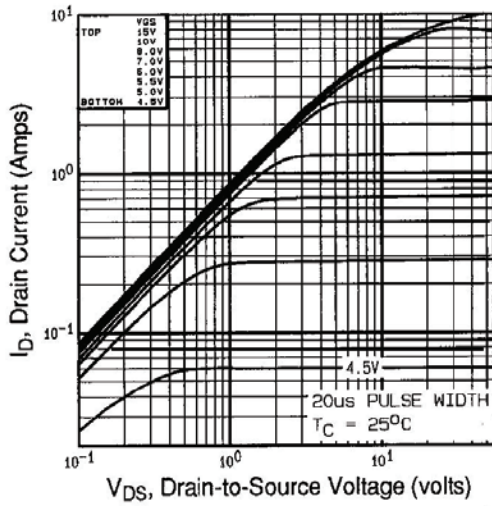


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

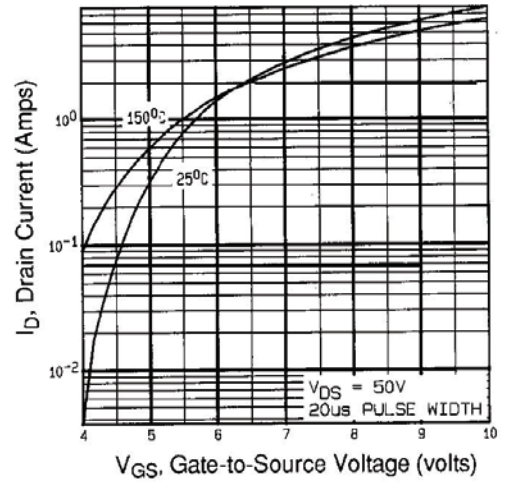


Fig. 3 - Typical Transfer Characteristics

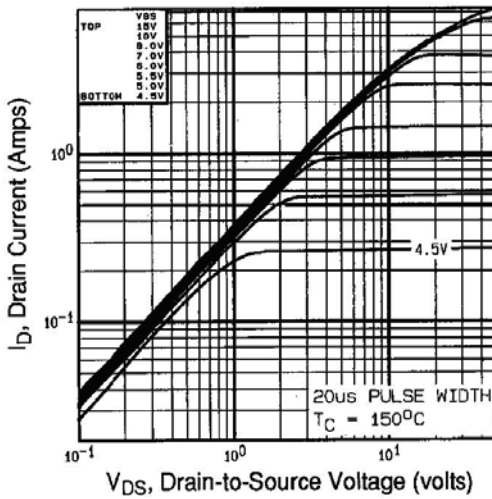


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

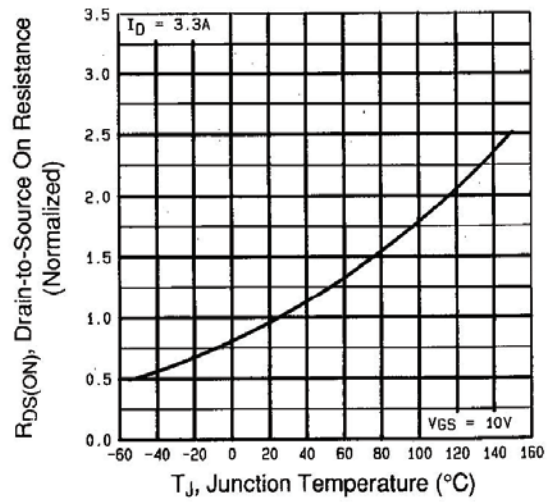


Fig. 4 - Normalized On-Resistance vs. Temperature

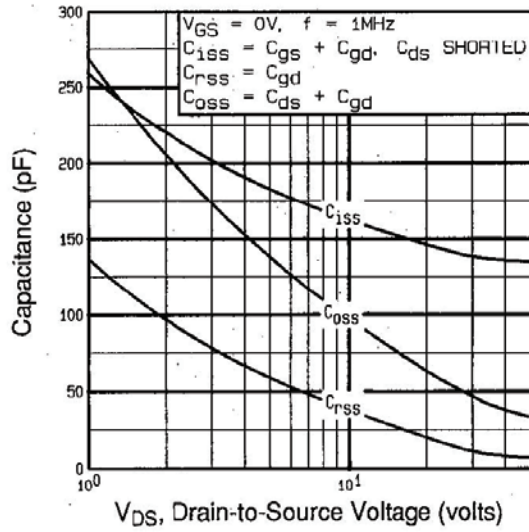


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

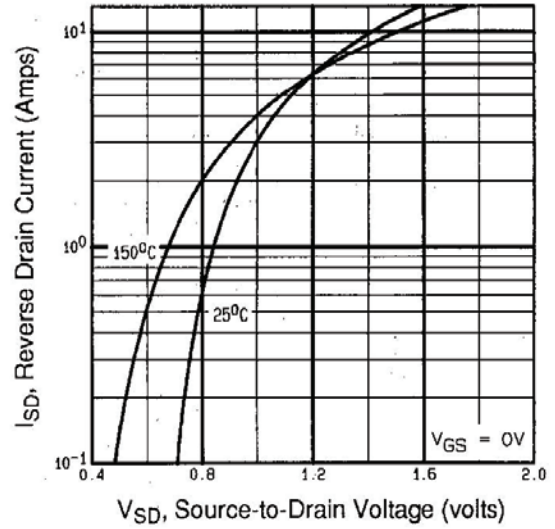


Fig. 7 - Typical Source-Drain Diode Forward Voltage

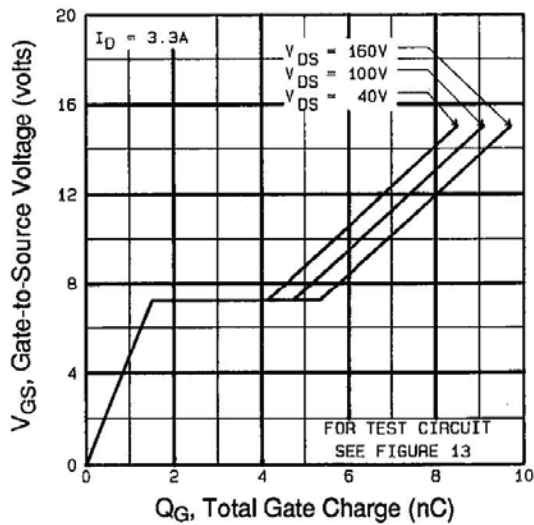


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

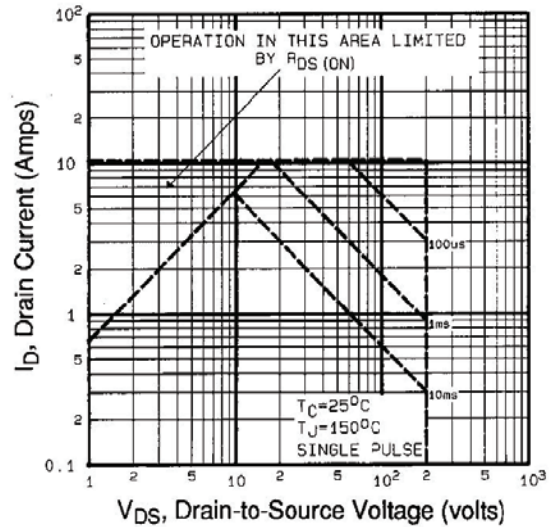


Fig. 8 - Maximum Safe Operating Area



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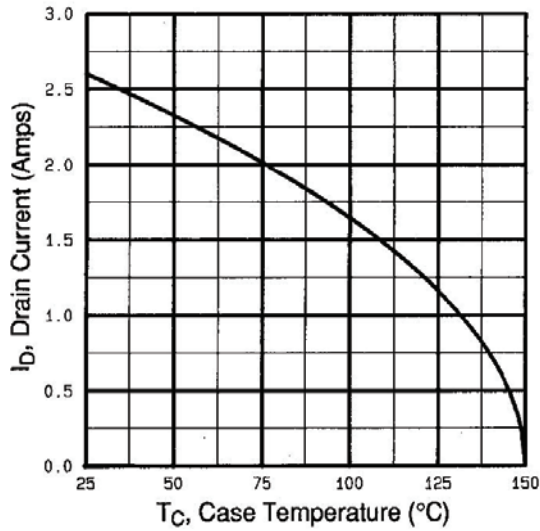


Fig. 9 - Maximum Drain Current vs. Case Temperature

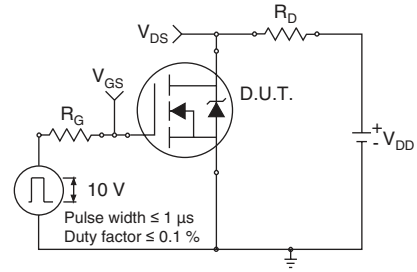


Fig. 10a - Switching Time Test Circuit

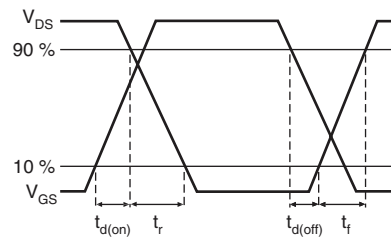


Fig. 10b - Switching Time Waveforms

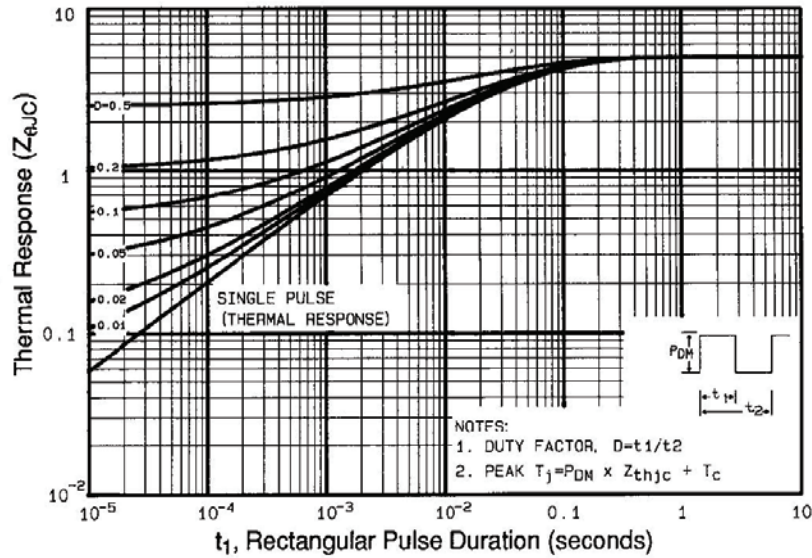


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

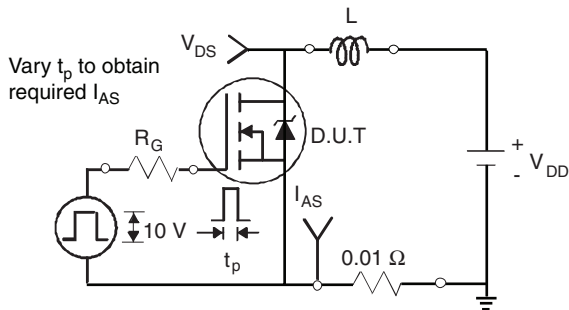


Fig. 12a - Unclamped Inductive Test Circuit

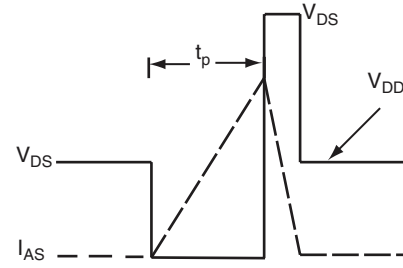


Fig. 12b - Unclamped Inductive Waveforms

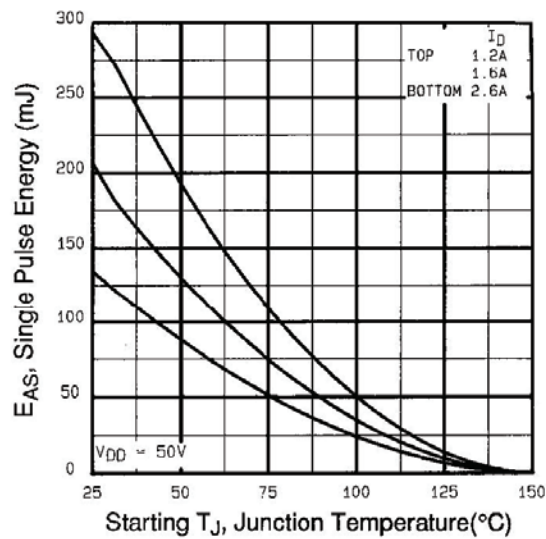


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

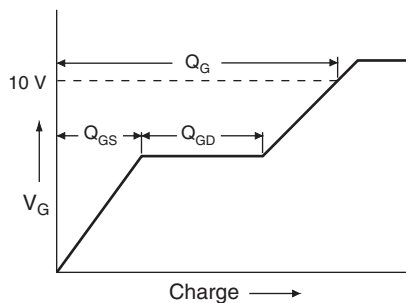


Fig. 13a - Basic Gate Charge Waveform

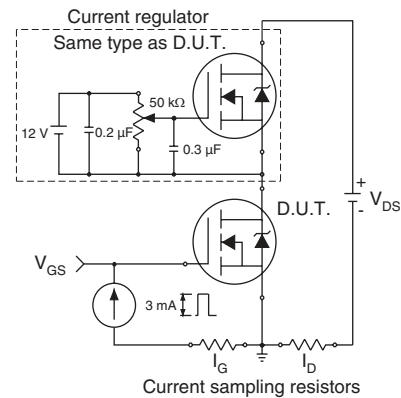


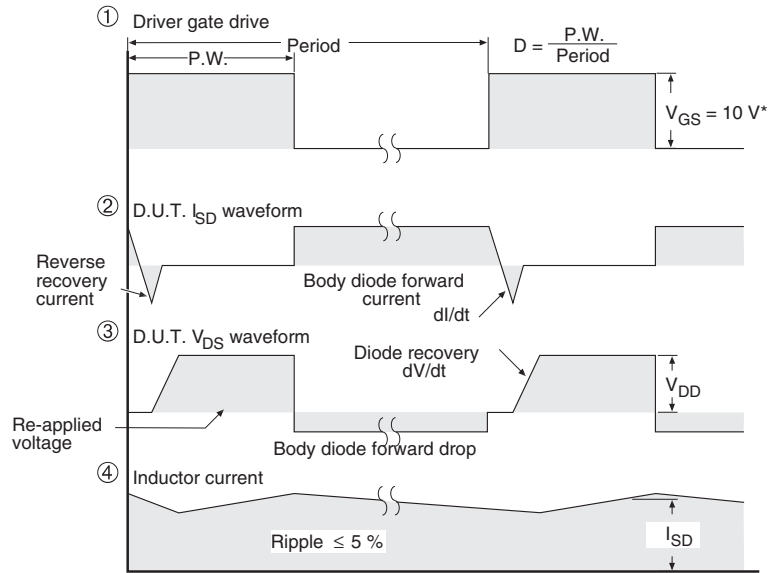
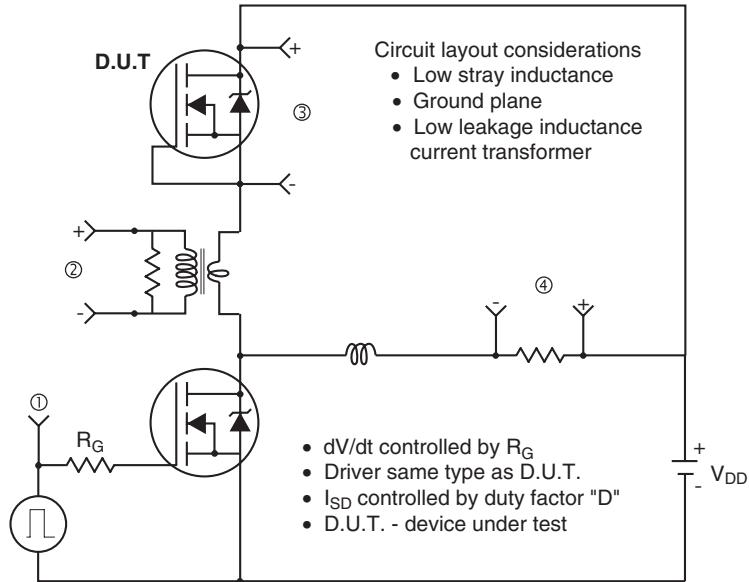
Fig. 13b - Gate Charge Test Circuit



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IRFR210, IRFU210, SiHFR210, SiHFU210

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel