



IRFR9022, IRFU9022, SiHFR9022, SiHFU9022

Vishay Siliconix

Power MOSFET

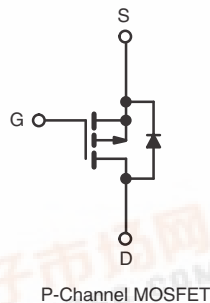
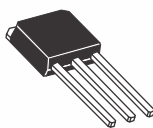
PRODUCT SUMMARY

V_{DS} (V)	- 50	
$R_{DS(on)}$ (Ω)	$V_{GS} = - 10$ V	0.33
Q_g (Max.) (nC)	14	
Q_{gs} (nC)	6.5	
Q_{gd} (nC)	6.5	
Configuration	Single	

DPAK
(TO-252)



IPAK
(TO-251)



FEATURES

- Surface Mountable (Order as IRFR9022/SiHFR9022)
- Straight Lead Option (Order as IRFU9022/SiHFU9022)
- Repetitive Avalanche Ratings
- Dynamic dV/dt Rating
- Simple Drive Requirements
- Ease of Paralleling
- Lead (Pb)-free Available



RoHS*
COMPLIANT

DESCRIPTION

The Power MOSFET technology is the key to Vishay's advanced line of Power MOSFET transistors. The efficient geometry and unique processing of this latest "State of the Art" design achieves: very low on-state resistance combined with high transconductance; superior reverse energy and diode recovery dV/dt .

The Power MOSFET transistors also feature all of the well established advantages of MOSFET'S such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

Surface mount packages enhance circuit performance by reducing stray inductances and capacitance. The TO-252 surface mount package brings the advantages of Power MOSFET's to high volume applications where PC Board surface mounting is desirable. The surface mount option IRFR9022/SiHFR9022 is provided on 16mm tape. The straight lead option IRFR9022/SiHFR9022 of the device is called the IPAK (TO-251).

They are well suited for applications where limited heat dissipation is required such as, computers and peripherals, telecommunication equipment, DC/DC converters, and a wide range of consumer products.

ORDERING INFORMATION

Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free	IRFR9022PbF	IRFR9022TRPbF ^a	IRFR9022TRLPbF ^a	IRFU9022PbF
	SiHFR9022-E3	SiHFR9022T-E3 ^a	SiHFR9022TL-E3 ^a	SiHFU9022-E3
SnPb	IRFR9022	IRFR9022TR ^a	IRFR9022TRL ^a	IRFU9022
	SiHFR9022	SiHFR9022T ^a	SiHFR9022TL ^a	SiHFU9022

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}	- 50	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Drain Current ^a	I_{DM}	- 36	
Linear Derating Factor		0.33	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	440	mJ
Repetitive Avalanche Current ^a	I_{AR}	- 9.9	A
Repetitive Avalanche Energy ^a	E_{AR}	4.2	mJ

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

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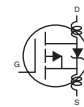
ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^{\circ}\text{C}$, unless otherwise noted				
PARAMETER		SYMBOL	LIMIT	UNIT
Maximum Power Dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	P_D	42	W
Peak Diode Recovery dV/dt		dV/dt	5.8	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 150	$^{\circ}\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s		300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 14).
- $V_{DD} = -25\text{ V}$, Starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 5.1\text{ mH}$, $R_G = 25\text{ }\Omega$, Peak $I_L = -9.9\text{ A}$
- $I_{SD} \leq -9.9\text{ A}$, $dI/dt \leq -120\text{ A}/\mu\text{s}$, $V_{DD} \leq 40\text{ V}$, $T_J \leq 150\text{ }^{\circ}\text{C}$.
- 0.063" (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	$^{\circ}\text{C}/\text{W}$
Case-to-Sink	R_{thCS}	-	1.7	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	3.0	


SPECIFICATIONS T _J = 25 °C, unless otherwise noted							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = - 250 μA		- 50	-	-	V
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA		- 2.0	-	- 4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 500	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = max. rating, V _{GS} = 0 V		-	-	250	μA
		V _{DS} = 0.8 x max. rating, V _{GS} = 0 V, T _J = 125 °C		-	-	1000	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = - 10 V	I _D = 5.7 A ^b	-	0.28	0.33	Ω
Forward Transconductance	g _{fs}	V _{DS} ≤ - 50 V, I _{DS} = - 5.7 A		2.3	3.5	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = - 25 V, f = 1.0 MHz, see fig. 9		-	490	-	pF
Output Capacitance	C _{oss}			-	320	-	
Reverse Transfer Capacitance	C _{rss}			-	70	-	
Total Gate Charge	Q _g	V _{GS} = - 10 V	I _D = - 9.7 A, V _{DS} = 0.8 x max. rating, see fig. 16 (Independent operating temperature)	-	9.4	14	nC
Gate-Source Charge	Q _{gs}			-	4.3	6.5	
Gate-Drain Charge	Q _{gd}			-	4.3	6.5	
Turn-On Delay Time	t _{d(on)}	V _{DD} = - 25 V, I _D = - 9.7 A, R _G = 18 Ω, R _D = 2.4 Ω, see fig. 15 (Independent operating temperature)		-	8.2	12	ns
Rise Time	t _r			-	57	66	
Turn-Off Delay Time	t _{d(off)}			-	12	18	
Fall Time	t _f			-	25	38	
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	-	





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SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	- 9.9	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	- 40	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}$, $I_S = -9.9\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	- 6.3	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25^\circ\text{C}$, $I_F = -9.7\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	56	110	280	ns
Body Diode Reverse Recovery Charge	Q_{rr}		0.17	0.34	0.85	nC
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. 14).
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25°C , unless otherwise noted

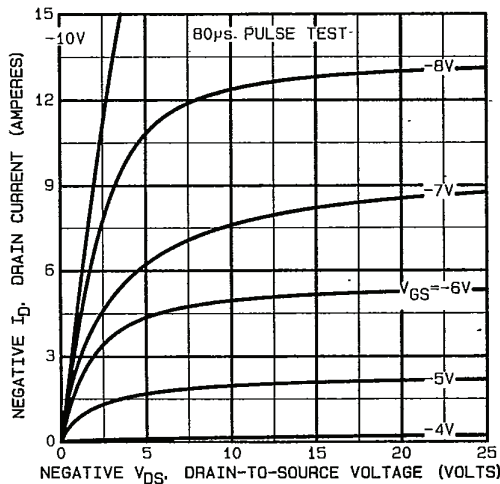


Fig. 1 - Typical Output Characteristics

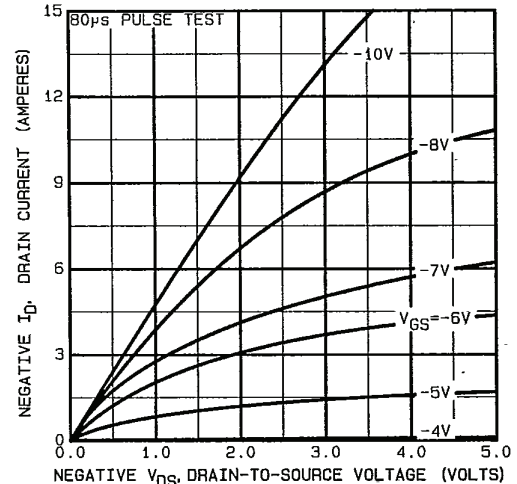


Fig. 3 - Typical Saturation Characteristics

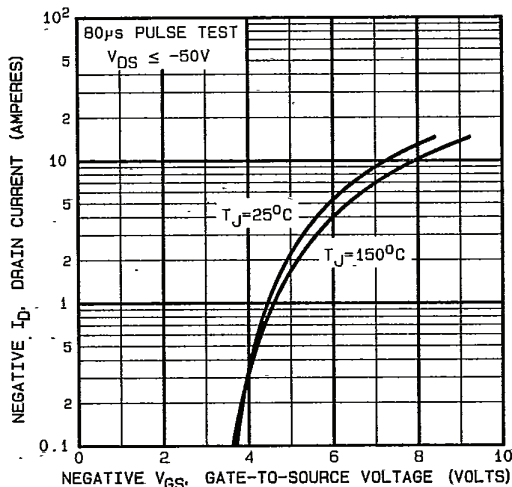


Fig. 2 - Typical Transfer Characteristics

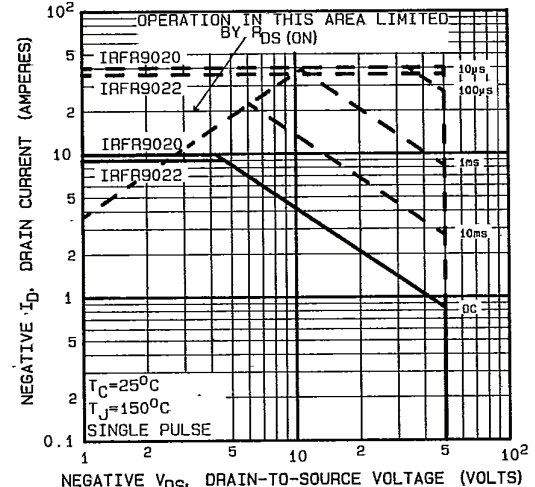


Fig. 4 - Maximum Safe Operating Area

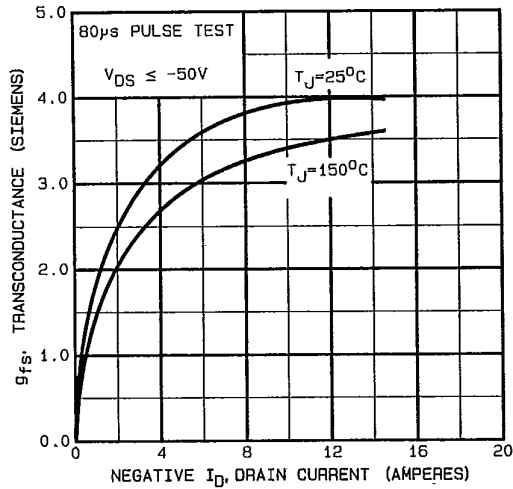


Fig. 5 - Typical Transconductance vs. Drain Current

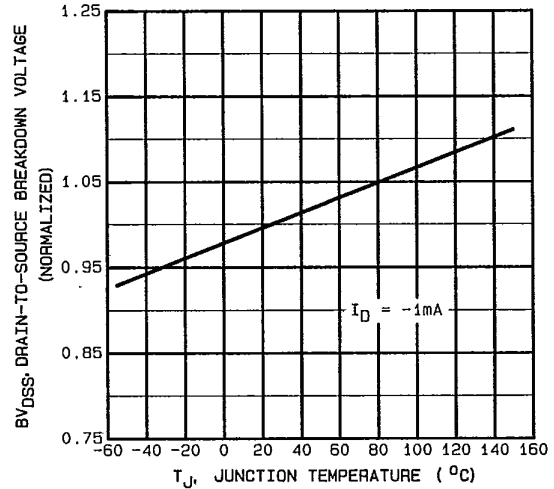


Fig. 7 - Breakdown Voltage vs. Temperature

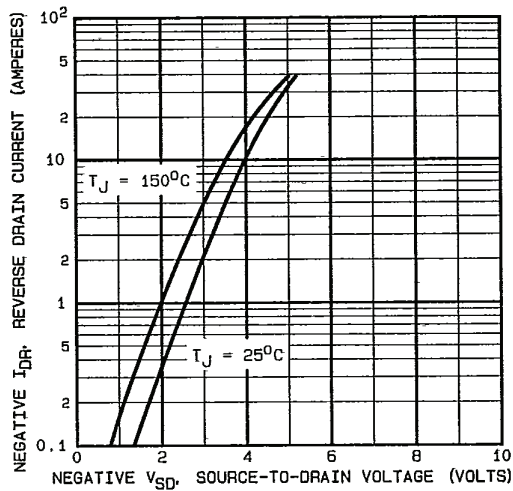


Fig. 6 - Typical Source-Drain Diode Forward Voltage

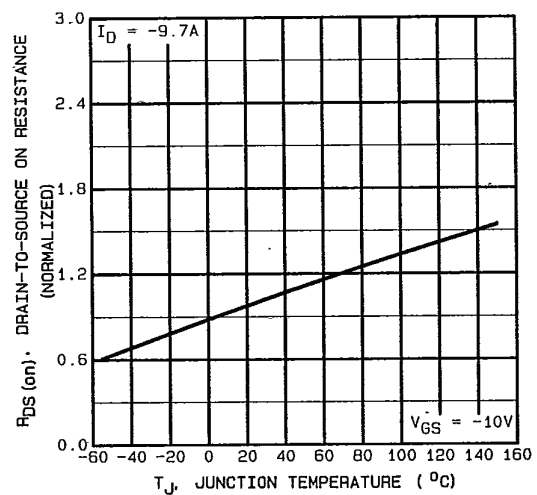


Fig. 8 - Normalized On-Resistance vs. Temperature

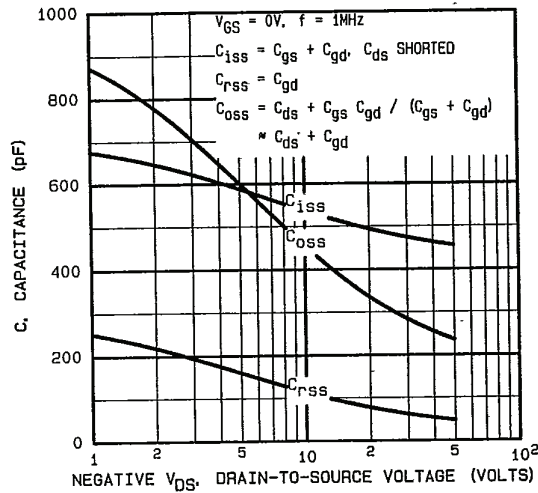


Fig. 9 - Typical Capacitance vs. Drain-to-Source Voltage

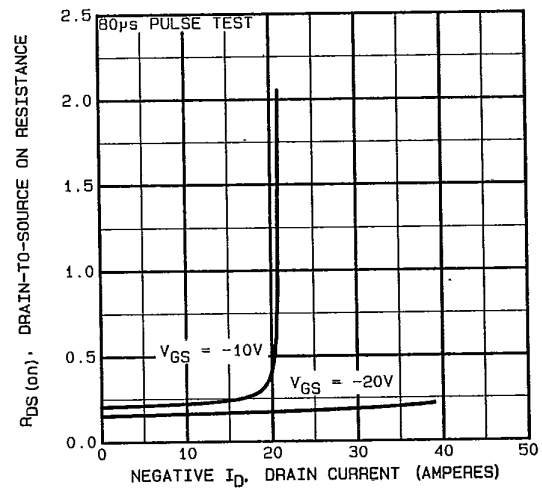


Fig. 11 - Typical On-Resistance vs. Drain Current

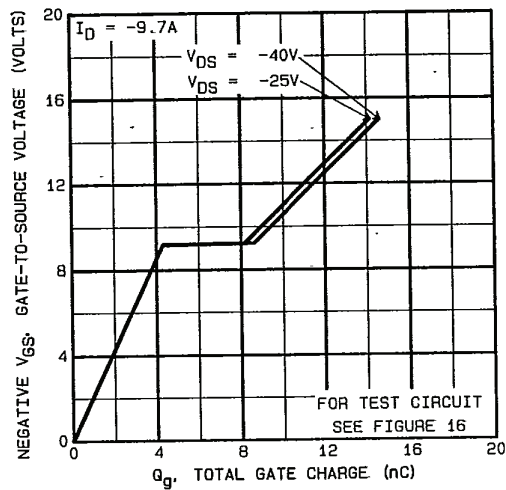


Fig. 10 - Typical Gate Charge vs. Gate-to-Source Voltage

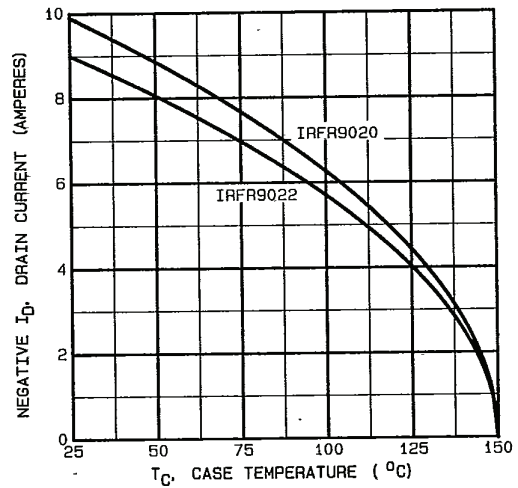


Fig. 12 - Maximum Drain Current vs. Case Temperature

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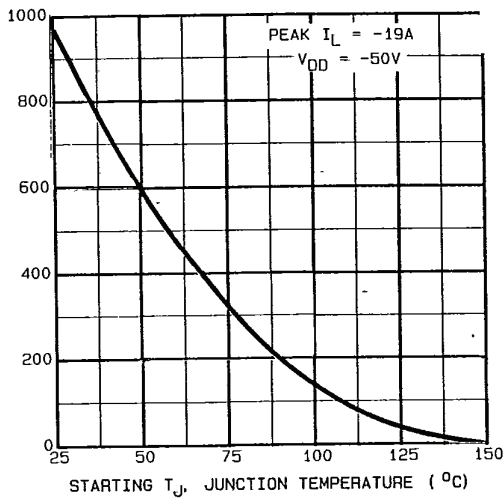


Fig. 13a - Maximum Avalanche vs. Starting Junction Temperature

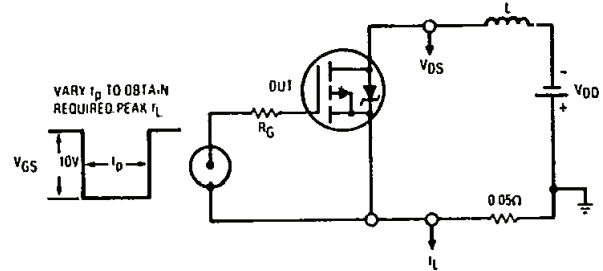


Fig. 13b - Unclamped Inductive Test Circuit

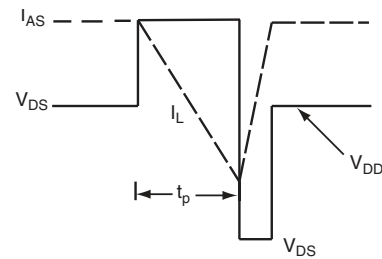


Fig. 13c - Unclamped Inductive Waveforms

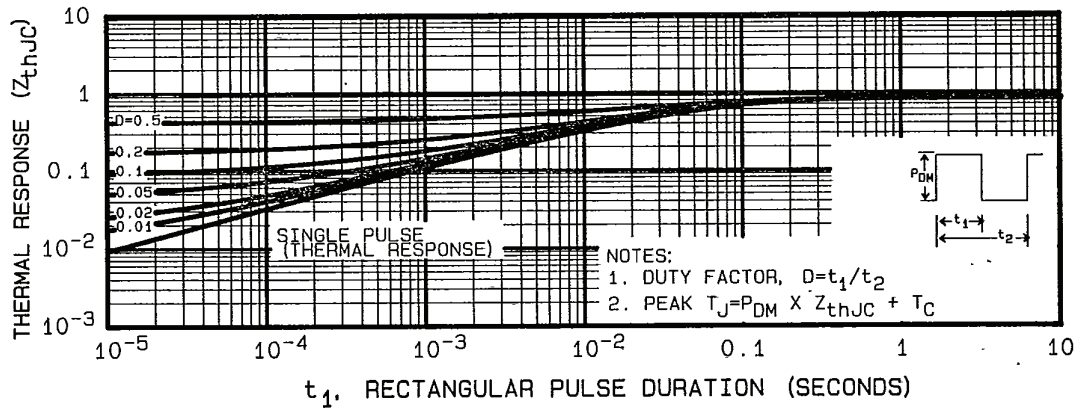


Fig. 14 - Maximum Effective Transient Thermal Impedance, Junction-to-Case vs. Pulse Duration



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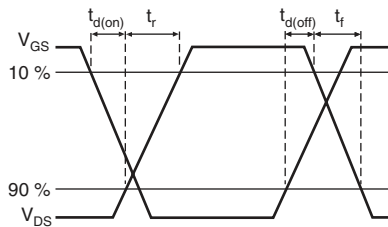


Fig. 15a - Switching Time Waveforms

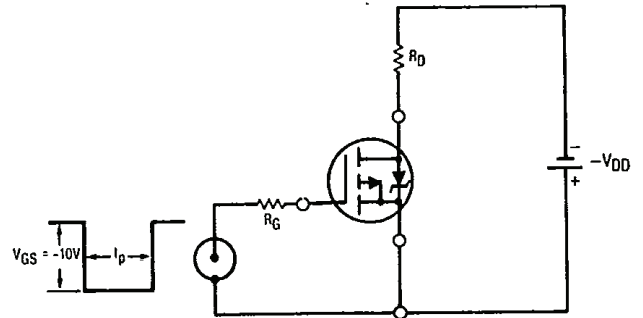


Fig. 15b - Switching Time Test Circuit

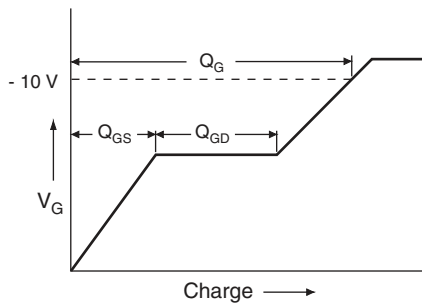


Fig. 16a - Basic Gate Charge Waveform

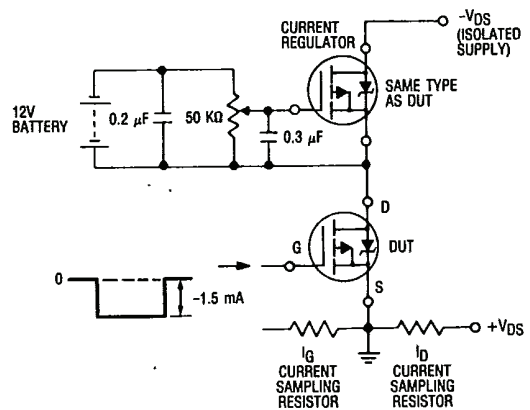


Fig. 16b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

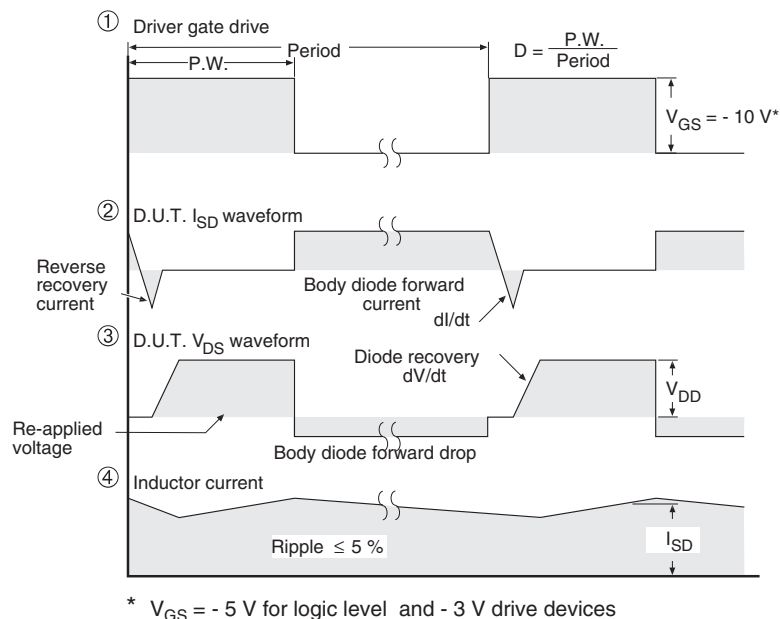
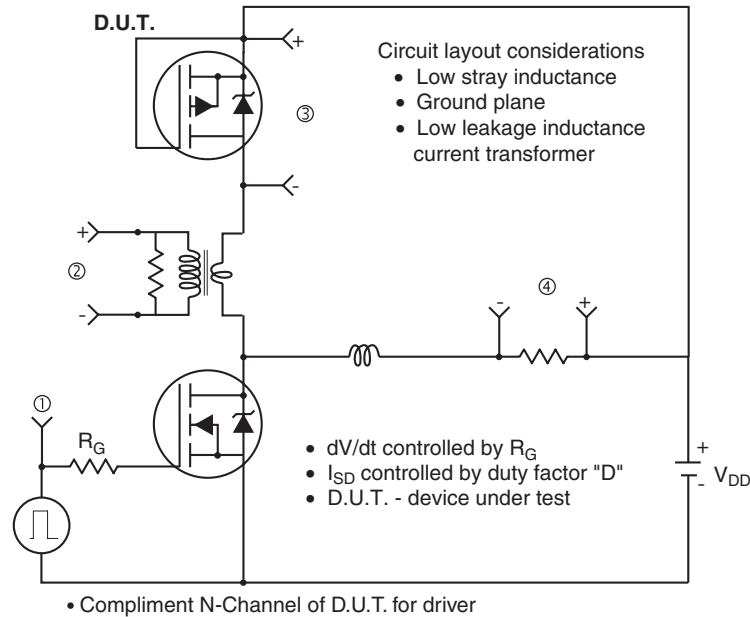


Fig. 17 - For P-Channel



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