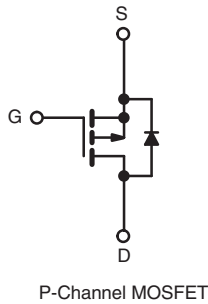
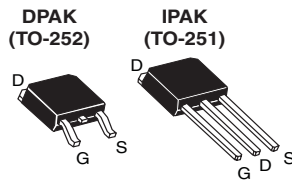


Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	- 50
$R_{DS(on)}$ (Ω)	$V_{GS} = - 10$ V 0.28
Q_g (Max.) (nC)	14
Q_{gs} (nC)	6.5
Q_{gd} (nC)	6.5
Configuration	Single



FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Surface Mountable (Order As IRFR9020, SiHFR9020)
- Straight Lead Option (Order As IRFU9020, SiHFU9020)
- Repetitive Avalanche Ratings
- Dynamic dV/dt Rating
- Simple Drive Requirements
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



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 IRFR9020, SiHFR9020 is provided on 16mm tape. The straight lead option IRFU9020, SiHFU9020 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-to-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 and Halogen-free	SiHFR9020-GE3	SiHFR9020TR-GE3 ^a	SiHFR9020TRL-GE3 ^a	SiHFU9020-GE3
Lead (Pb)-free	IRFR9020PbF	IRFR9020TRPbF ^a	IRFR9020TRLPbF ^a	IRFU9020PbF
	SiHFR9020-E3	SiHFR9020T-E3 ^a	SiHFR9020TL-E3 ^a	SiHFU9020-E3
SnPb	IRFR9020	IRFR9020TR ^a	IRFR9020TRL ^a	IRFU9020
	SiHFR9020	SiHFR9020T ^a	SiHFR9020TL ^a	SiHFU9020

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted					
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	- 50	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current	V_{GS} at - 10 V	$T_C = 25$ °C	I_D	- 9.9	A
		$T_C = 100$ °C		- 6.3	
Pulsed Drain Current ^a			I_{DM}	- 40	
Linear Derating Factor				0.33	W/°C

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


ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted			
PARAMETER	SYMBOL	LIMIT	UNIT
Single Pulse Avalanche Energy ^b	E_{AS}	250	mJ
Repetitive Avalanche Current ^a	I_{AR}	- 9.9	A
Repetitive Avalanche Energy ^a	E_{AR}	4.2	mJ
Maximum Power Dissipation	P_D	42	W
Peak Diode Recovery dV/dt^c	dV/dt	5.8	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	°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	°C/W
Case-to-Sink	R_{thCS}	-	1.7	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	3.0	

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}	$V_{GS} = 0\text{ V}$, $I_D = - 250\text{ }\mu\text{A}$		- 50	-	-	V
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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 500	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = \text{max. rating}$, $V_{GS} = 0\text{ V}$		-	-	250	μA
		$V_{DS} = 0.8 \times \text{max. rating}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$		-	-	1000	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = - 10\text{ V}$	$I_D = 5.7\text{ A}^b$	-	0.20	0.28	Ω
Forward Transconductance	g_{fs}	$V_{DS} \leq - 50\text{ V}$, $I_{DS} = - 5.7\text{ A}$		2.3	3.5	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = - 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 9		-	490	-	pF
Output Capacitance	C_{oss}			-	320	-	
Reverse Transfer Capacitance	C_{rss}			-	70	-	
Total Gate Charge	Q_g	$V_{GS} = - 10\text{ V}$	$I_D = - 9.7\text{ A}$, $V_{DS} = 0.8 \times \text{max. rating}$, 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	$t_{d(on)}$	$V_{DD} = - 25\text{ V}$, $I_D = - 9.7\text{ A}$, $R_g = 18\text{ }\Omega$, $R_D = 2.4\text{ }\Omega$, 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	-	

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 $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25°C , unless otherwise noted

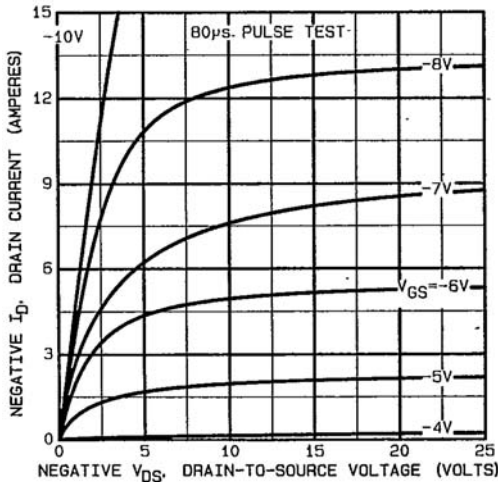


Fig. 1 - Typical Output Characteristics

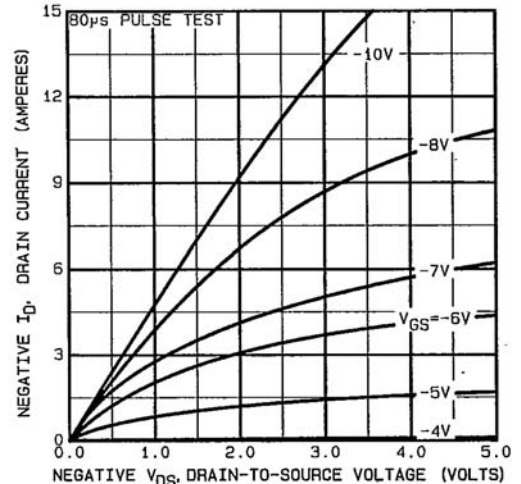


Fig. 3 - Typical Saturation Characteristics

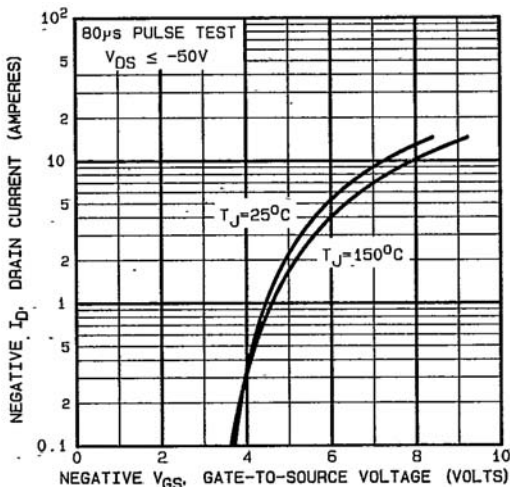


Fig. 2 - Typical Transfer Characteristics

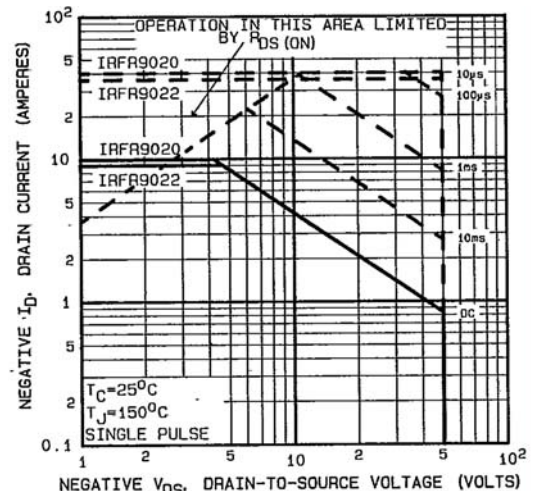


Fig. 4 - Maximum Safe Operating Area

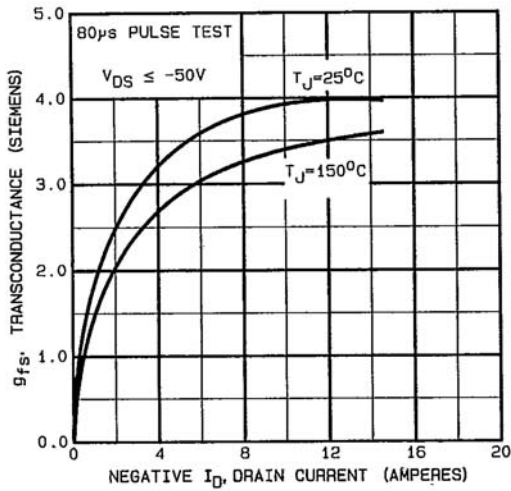


Fig. 5 - Typical Transconductance vs. Drain Current

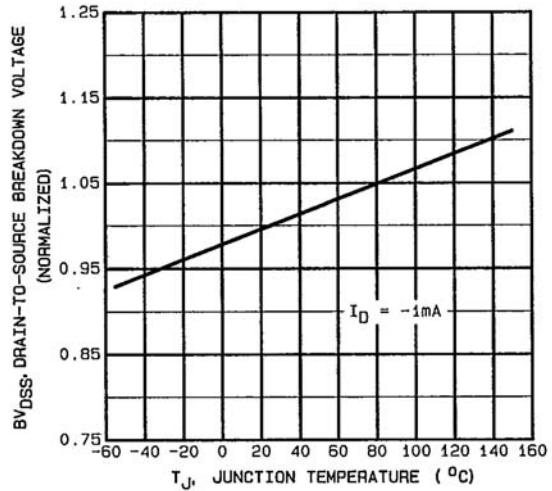


Fig. 7 - Breakdown Voltage vs. Temperature

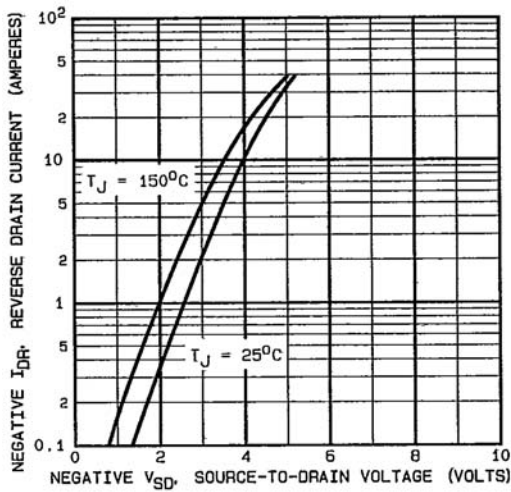


Fig. 6 - Typical Source-Drain Diode Forward Voltage

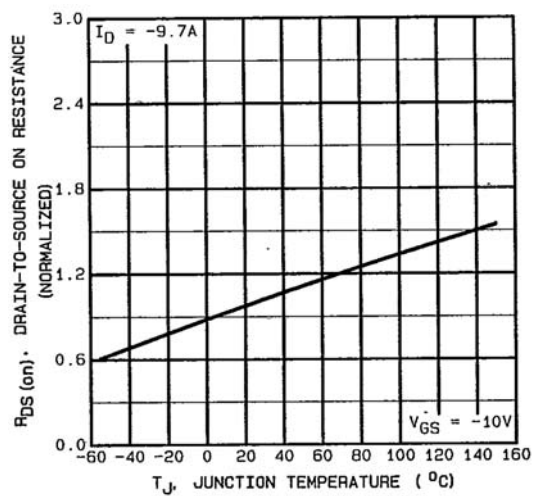


Fig. 8 - Normalized On-Resistance vs. Temperature

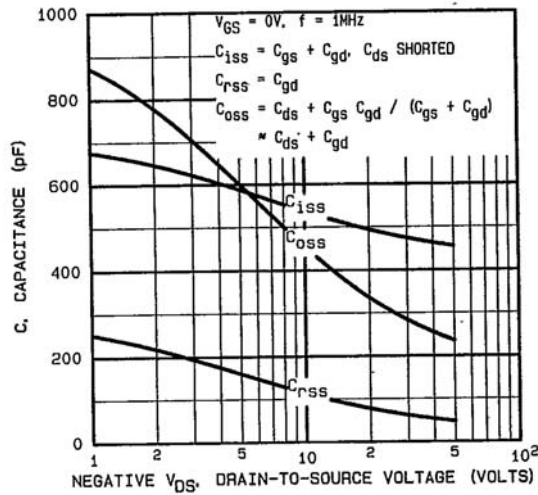


Fig. 9 - Typical Capacitance vs. Drain-to-Source Voltage

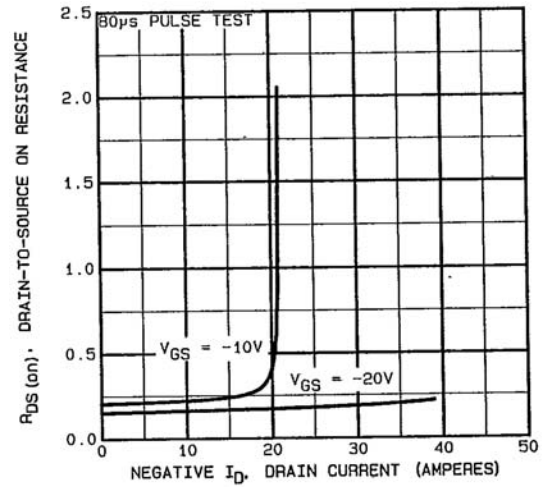


Fig. 11 - Typical On-Resistance vs. Drain Current

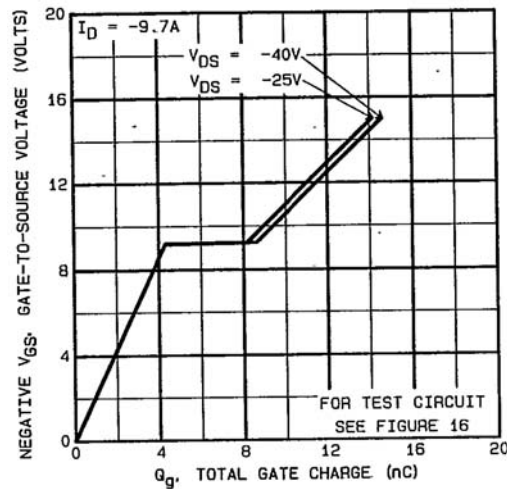


Fig. 10 - Typical Gate Charge vs. Gate-to-Source Voltage

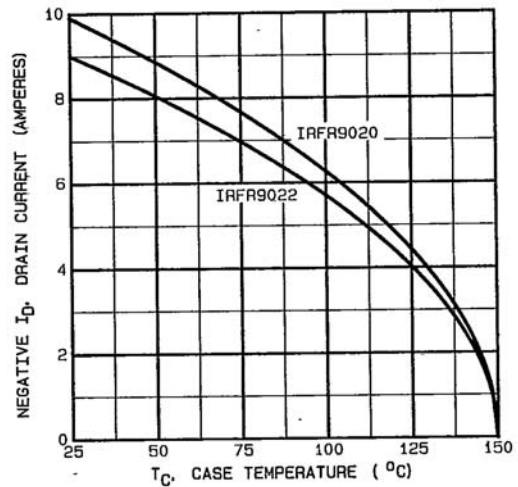


Fig. 12 - Maximum Drain Current vs. Case Temperature

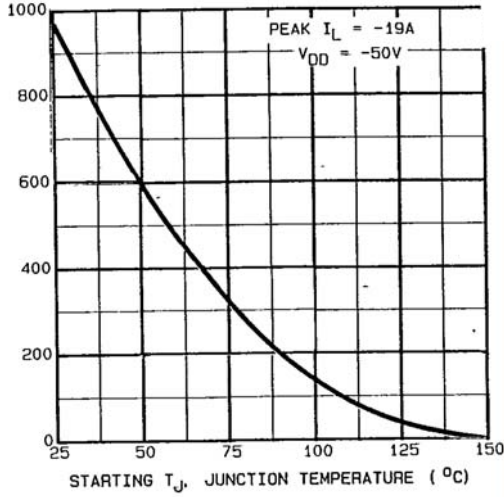


Fig. 13a - Maximum Avalanche vs. Starting Junction Temperature

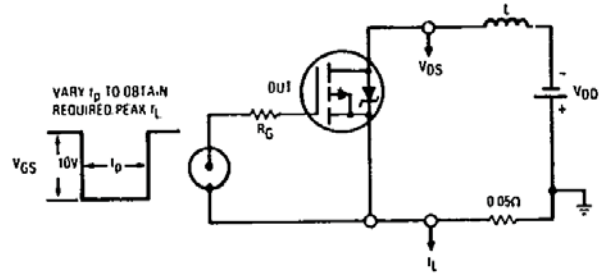


Fig. 13b - Unclamped Inductive Test Circuit

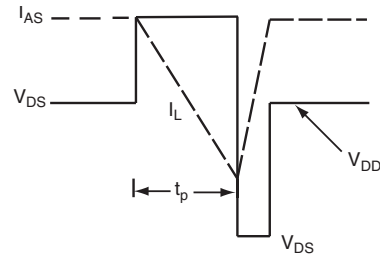


Fig. 13c - Unclamped Inductive Waveforms

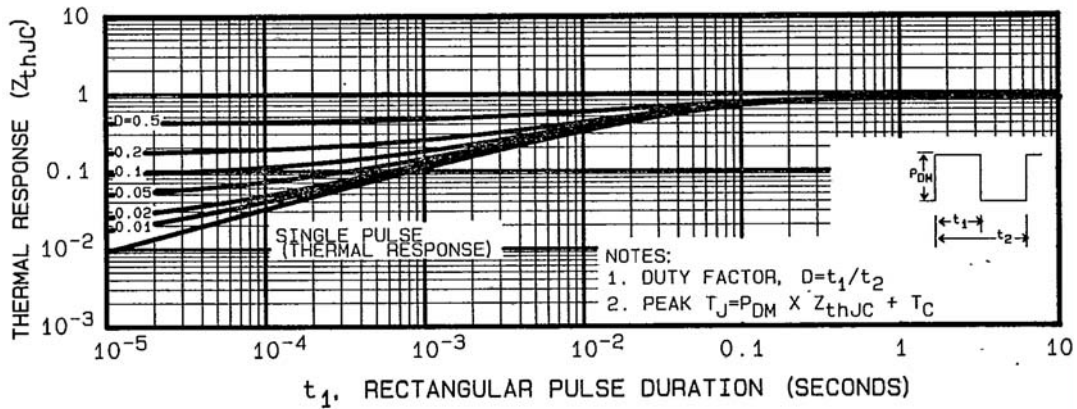


Fig. 14 - Maximum Effective Transient Thermal Impedance, Junction-to-Case vs. Pulse Duration

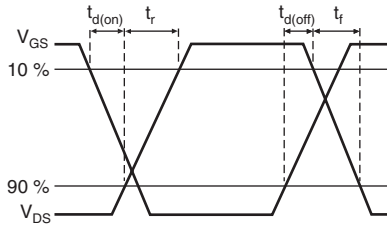


Fig. 15a - Switching Time Waveforms

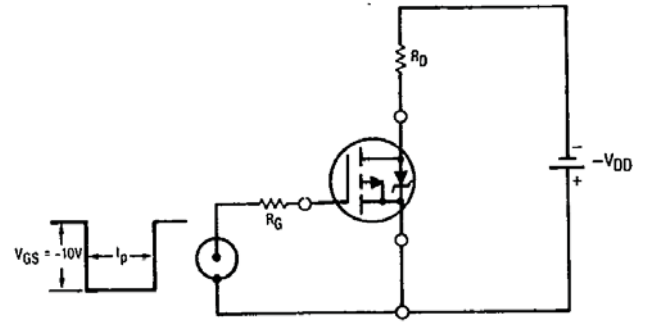


Fig. 15b - Switching Time Test Circuit

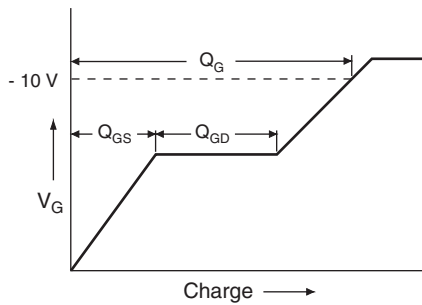


Fig. 16a - Basic Gate Charge Waveform

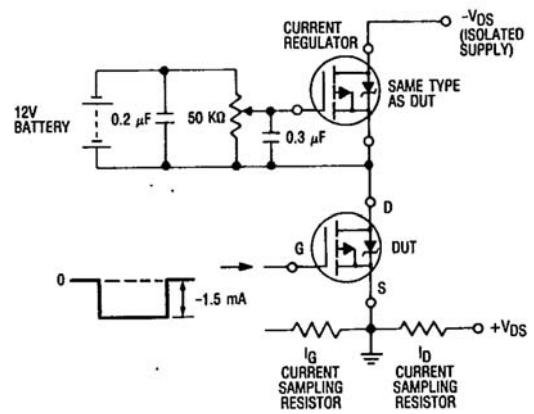
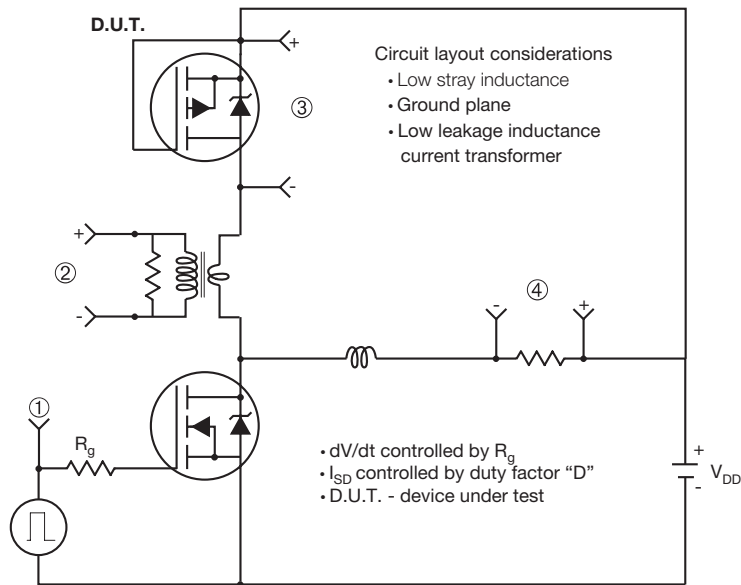
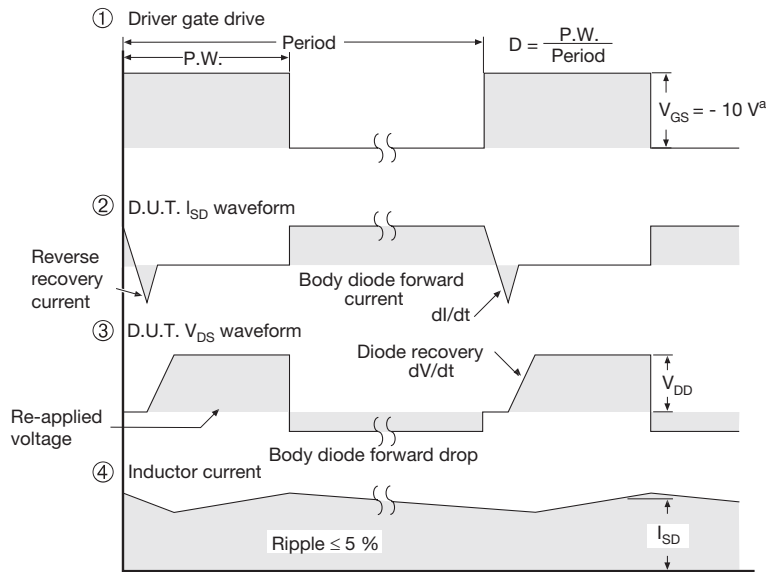


Fig. 16b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
• Compliment N-Channel of D.U.T. for driver



Note
a. $V_{GS} = -5\text{ V}$ for logic level and -3 V drive devices

Fig. 17 - For P-Channel

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