

Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	- 200	
$R_{DS(on)}$ (Ω)	$V_{GS} = -10$ V	3.0
Q_g (Max.) (nC)	11	
Q_{gs} (nC)	7.0	
Q_{gd} (nC)	4.0	
Configuration	Single	

FEATURES

- Dynamic dV/dt Rating
- P-Channel
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available

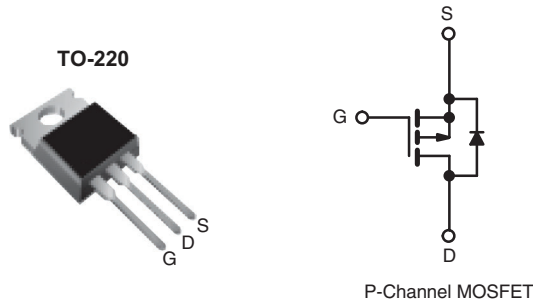


Available
RoHS*
COMPLIANT

DESCRIPTION

The Power MOSFETs technology is the key to Vishay's advanced line of Power MOSFET transistors. The efficient geometry and unique processing of the Power MOSFETs design achieve very low on-state resistance combined with high transconductance and extreme device ruggedness.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.



ORDERING INFORMATION

Package	TO-220
Lead (Pb)-free	IRF9610PbF SiHF9610-E3
SnPb	IRF9610 SiHF9610

ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$, 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	$T_C = 25$	- 1.8	A
		$T_C = 100$	- 1.0	
Pulsed Drain Current ^a	I_{DM}	- 7.0		
Linear Derating Factor		0.16	W/ $^\circ\text{C}$	
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	20	W
Inductive Current, Clamp	I_{LM}	- 7.0	A	
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	$^\circ\text{C}$	
Soldering Recommendations (Peak Temperature)	for 10 s	300 ^d		
Mounting Torque	6-32 or M3 screw	10		lbf · in
		1.1	N · m	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 5).
- Not applicable.
- $I_{SD} \leq -1.8$ A, $dI/dt \leq 70$ A/ μs , $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.
- 1.6 mm from case.

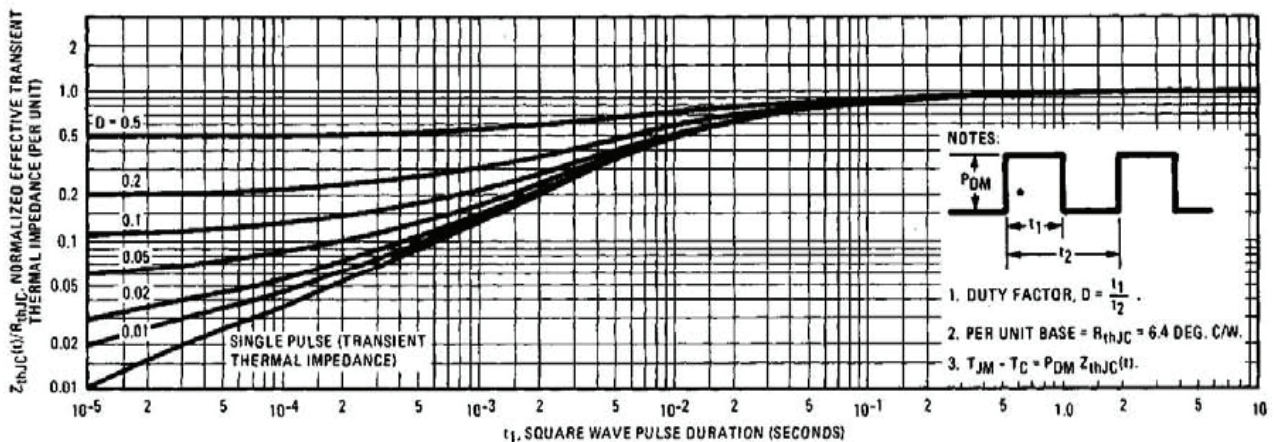
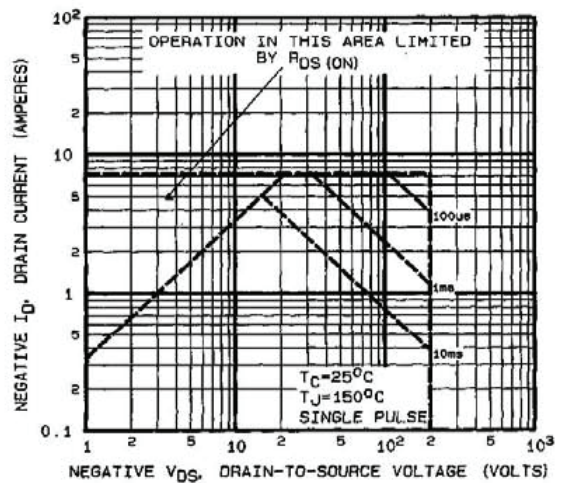
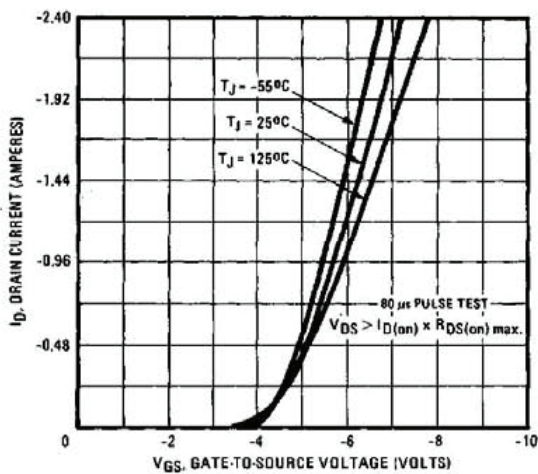
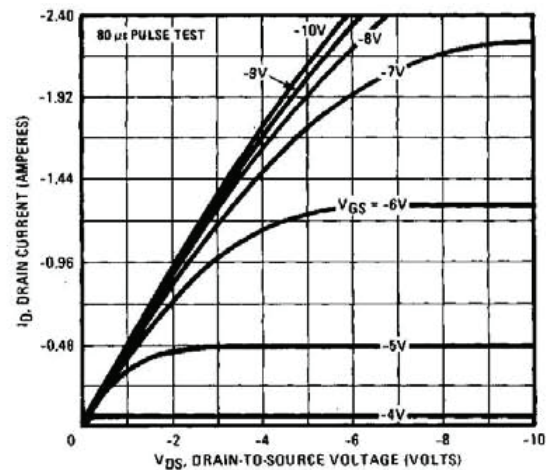
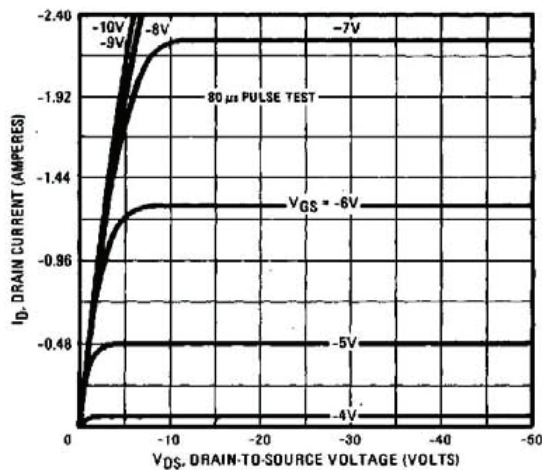
* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	6.4	

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 $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$	-	-0.23	-	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}	$V_{DS} = -200\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	-100	μA
		$V_{DS} = -160\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$, $I_D = -0.90\text{ A}^b$	-	-	3.0	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -50\text{ V}$, $I_D = -0.90\text{ A}^b$	0.90	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 10	-	170	-	pF
Output Capacitance	C_{oss}		-	50	-	
Reverse Transfer Capacitance	C_{rss}		-	15	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$, $I_D = -3.5\text{ A}$, $V_{DS} = -160\text{ V}$, see fig. 11 and 18 ^b	-	-	11	nC
Gate-Source Charge	Q_{gs}		-	-	7.0	
Gate-Drain Charge	Q_{gd}		-	-	4.0	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -100\text{ V}$, $I_D = -0.90\text{ A}$, $R_G = 50\text{ }\Omega$, $R_D = 11\text{ }\Omega$, see fig. 17 ^b	-	8.0	-	ns
Rise Time	t_r		-	15	-	
Turn-Off Delay Time	$t_{d(off)}$		-	10	-	
Fall Time	t_f		-	8.0	-	
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 	-	-	-1.8	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	-7.0	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = -1.8\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	-5.8	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = -1.8\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	240	360	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.7	2.6	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 5).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


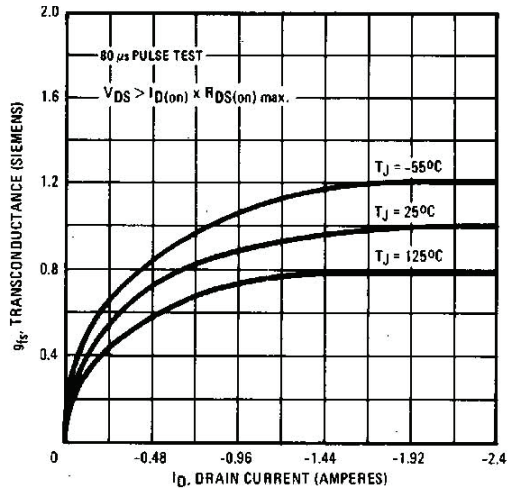


Fig. 6 - Typical Transconductance vs. Drain Current

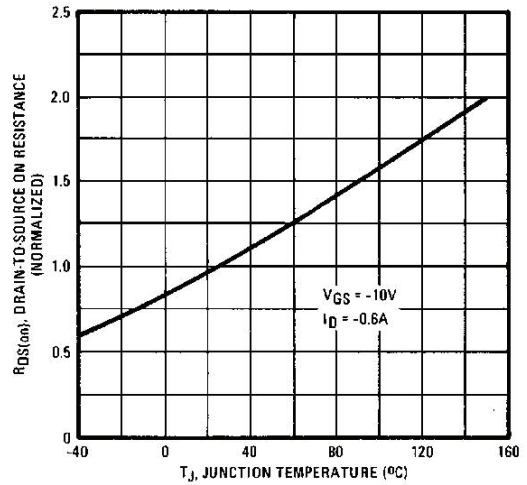


Fig. 9 - Normalized On-Resistance vs. Temperature

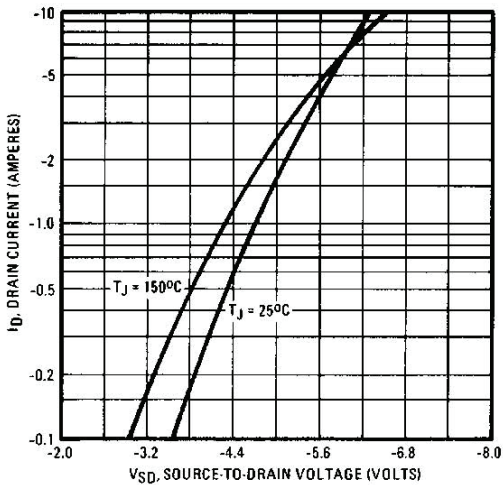


Fig. 7 - Typical Source-Drain Diode Forward Voltage

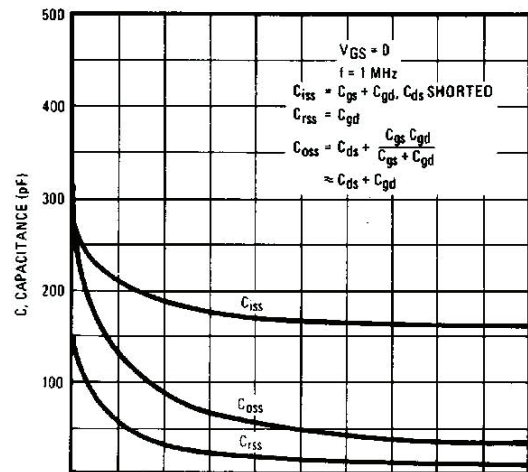


Fig. 10 - Typical Capacitance vs. Drain-to-Source Voltage

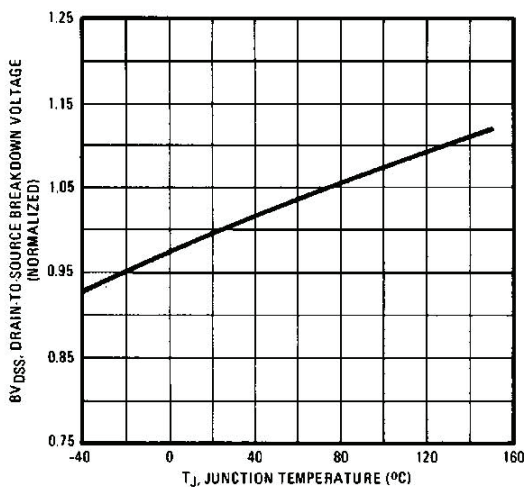


Fig. 8 - Breakdown Voltage vs. Temperature

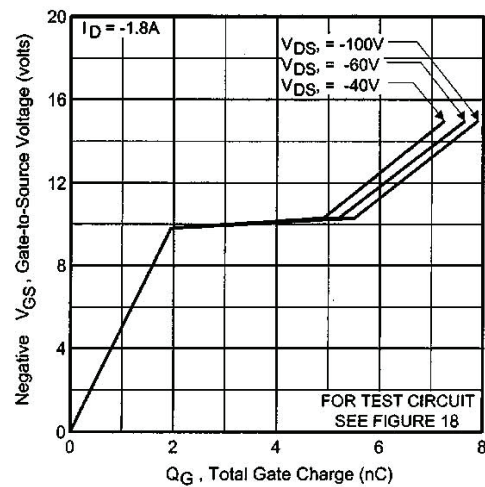
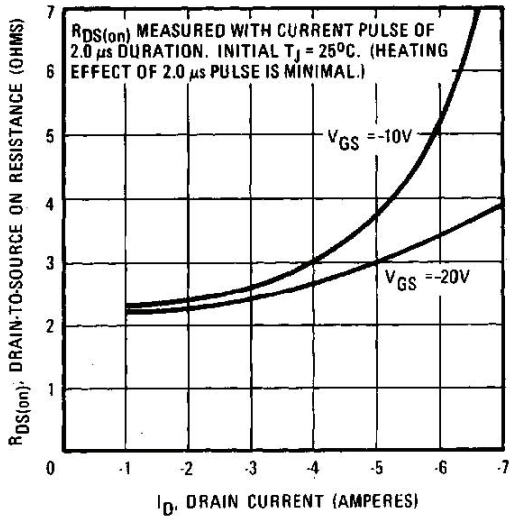
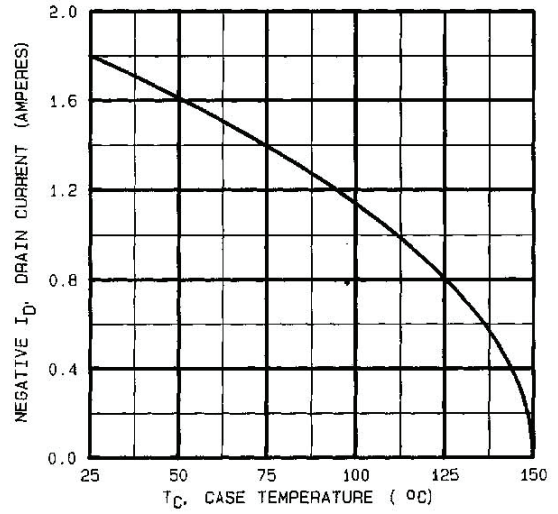
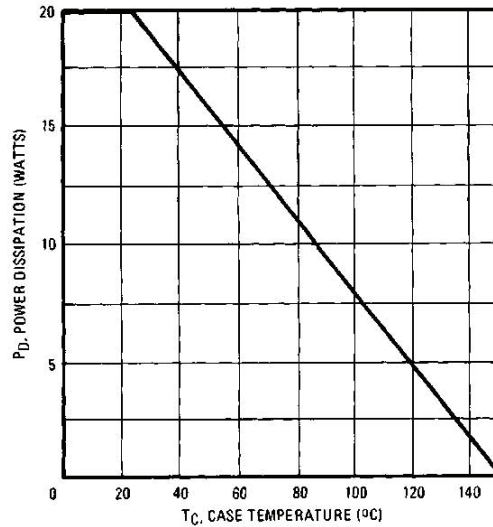
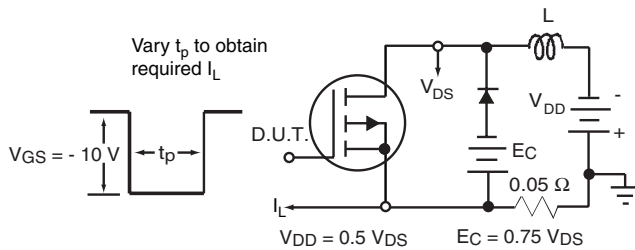
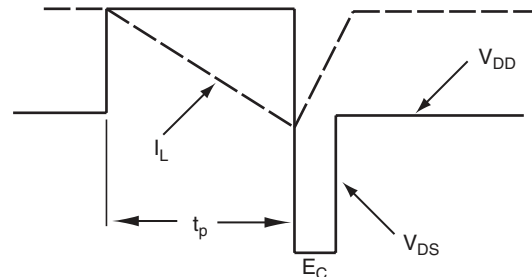


Fig. 11 - Typical Gate Charge vs. Gate-to-Source Voltage


Fig. 12 - Typical On-Resistance vs. Drain Current

Fig. 13 - Maximum Drain Current vs. Case Temperature

Fig. 14 - Power vs. Temperature Derating Curve

Fig. 15 - Clamped Inductive Test Circuit

Fig. 16 - Clamped Inductive Waveforms

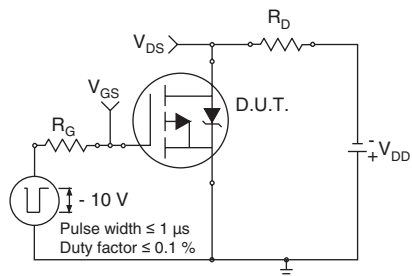


Fig. 17a - Switching Time Test Circuit

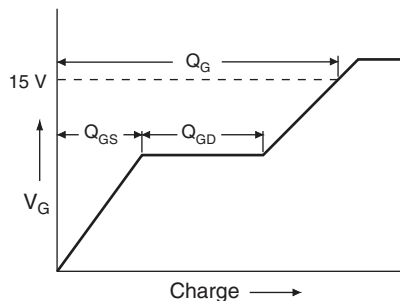


Fig. 18a - Basic Gate Charge Waveform

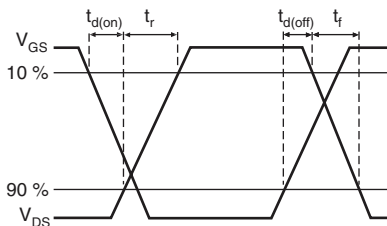


Fig. 17b - Switching Time Waveforms

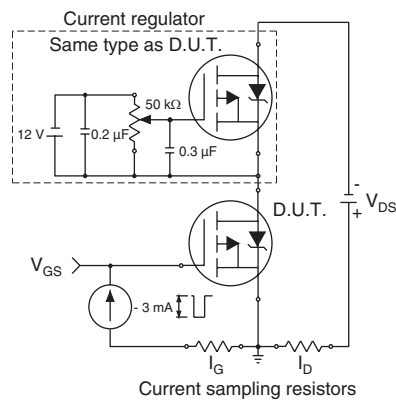
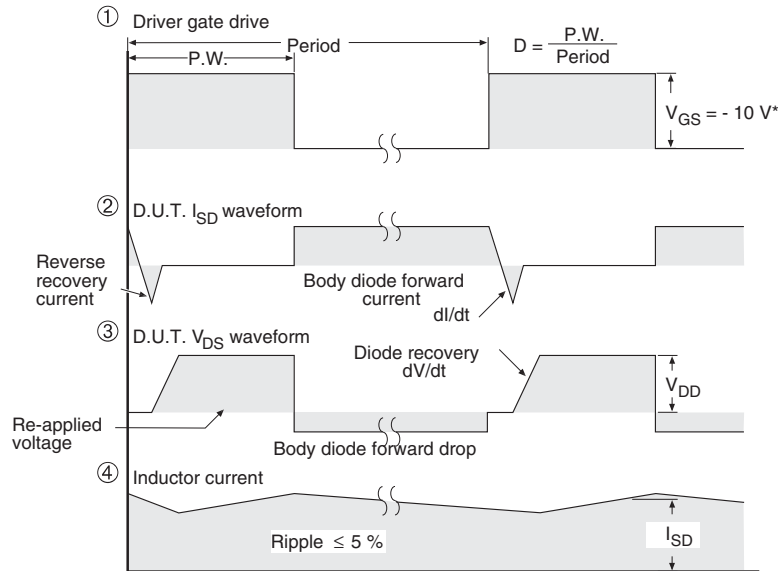
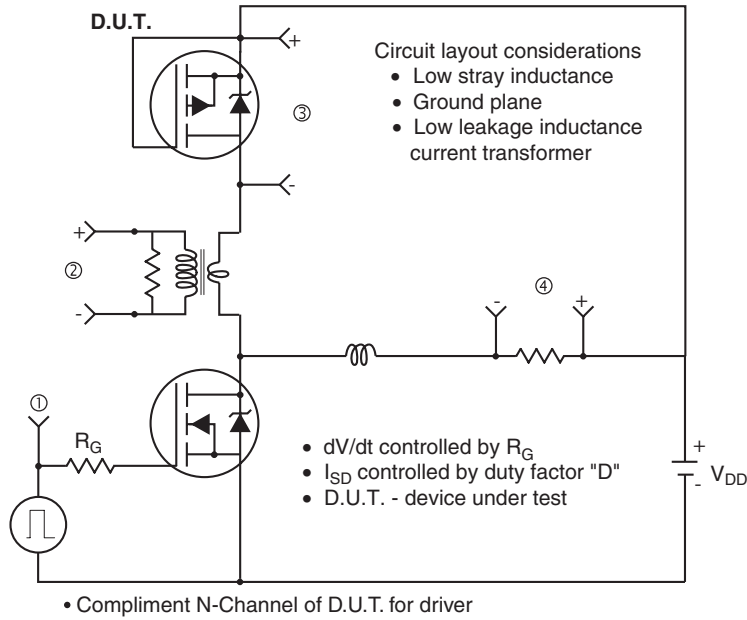


Fig. 18b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit


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

Fig. 19 - For P-Channel

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