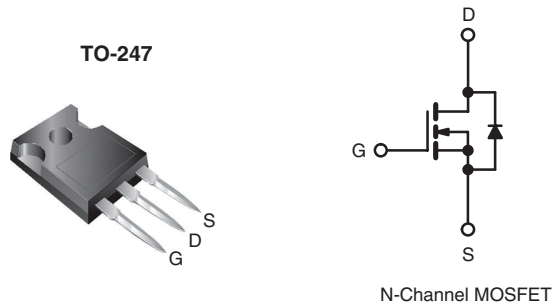


## Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	400
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$   0.20
$Q_g$ (Max.) (nC)	210
$Q_{gs}$ (nC)	30
$Q_{gd}$ (nC)	110
Configuration	Single



### FEATURES

- Dynamic  $dV/dt$  Rated
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- 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 TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.

ORDERING INFORMATION	
Package	TO-247
Lead (Pb)-free	IRFP360PbF SiHFP360-E3
SnPb	IRFP360 SiHFP360

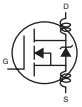

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted					
PARAMETER		SYMBOL	LIMIT	UNIT	
Drain-Source Voltage		$V_{DS}$	400	V	
Gate-Source Voltage		$V_{GS}$	$\pm 20$		
Continuous Drain Current	$V_{GS}$ at 10 V	$I_D$	$T_C = 25\text{ }^\circ\text{C}$	23	A
			$T_C = 100\text{ }^\circ\text{C}$	14	
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	92		
Linear Derating Factor			2.2	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy <sup>b</sup>		$E_{AS}$	1200	mJ	
Repetitive Avalanche Current <sup>a</sup>		$I_{AR}$	23	A	
Repetitive Avalanche Energy <sup>a</sup>		$E_{AR}$	28	mJ	
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	$P_D$	280	W	
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		300 <sup>d</sup>		
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. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 4.0\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 23\text{ A}$  (see fig. 12).
- $I_{SD} \leq 23\text{ A}$ ,  $dI/dt \leq 170\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 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	$R_{thJA}$	-	40	°C/W
Case-to-Sink, Flat, Greased Surface	$R_{thCS}$	0.24	-	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.45	

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
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 $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$	-	0.56	-	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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	25	$\mu\text{A}$
		$V_{DS} = 320\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ $I_D = 14\text{ A}^b$	-	-	0.20	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}$ , $I_D = 14\text{ A}^b$	14	-	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1.0\text{ MHz}$ , see fig. 5	-	4500	-	pF
Output Capacitance	$C_{oss}$		-	1100	-	
Reverse Transfer Capacitance	$C_{rss}$		-	490	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$ $I_D = 23\text{ A}$ , $V_{DS} = 320\text{ V}$ , see fig. 6 and 13 <sup>b</sup>	-	-	210	nC
Gate-Source Charge	$Q_{gs}$		-	-	30	
Gate-Drain Charge	$Q_{gd}$		-	-	110	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 200\text{ V}$ , $I_D = 23\text{ A}$ , $R_G = 4.3\text{ }\Omega$ , $R_D = 8.3\text{ }\Omega$ , see fig. 10 <sup>b</sup>	-	18	-	ns
Rise Time	$t_r$		-	79	-	
Turn-Off Delay Time	$t_{d(off)}$		-	100	-	
Fall Time	$t_f$		-	67	-	
Internal Drain Inductance	$L_D$	Between lead, 6 mm (0.25") from package and center of die contact 	-	5.0	-	nH
Internal Source Inductance	$L_S$		-	13	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	23	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	92	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = 23\text{ A}$ , $V_{GS} = 0\text{ V}^b$	-	-	1.8	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = 23\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	420	630	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	5.6	8.4	$\mu\text{C}$
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  $\leq 2\%$ .

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

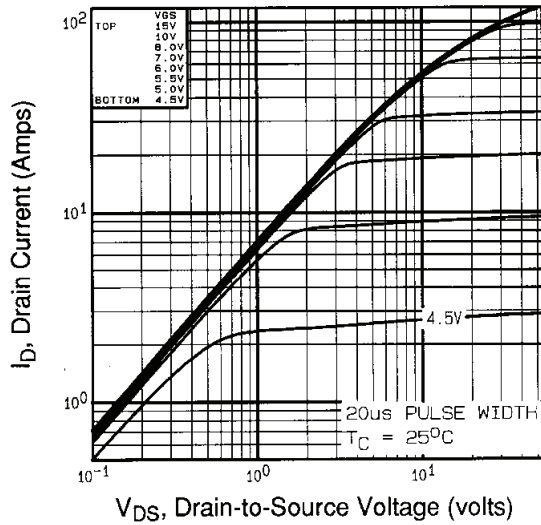


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

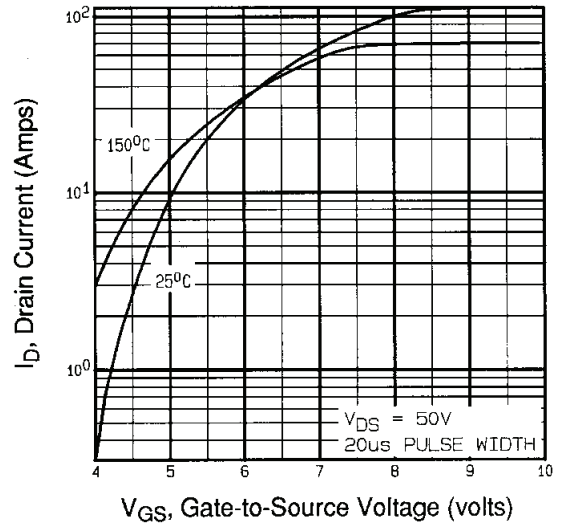


Fig. 3 - Typical Transfer Characteristics

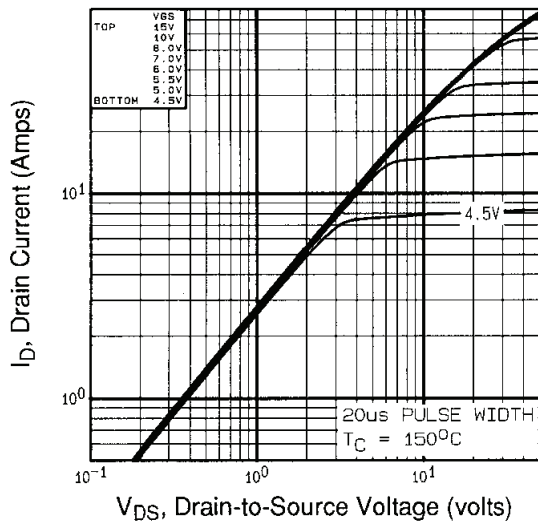


Fig. 2 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$

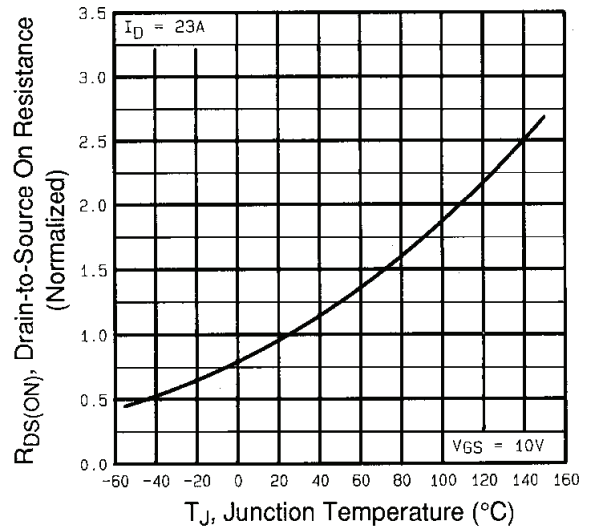


Fig. 4 - Normalized On-Resistance vs. Temperature

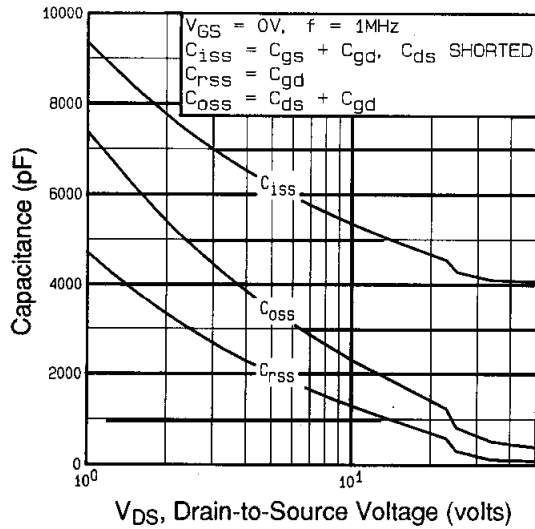


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

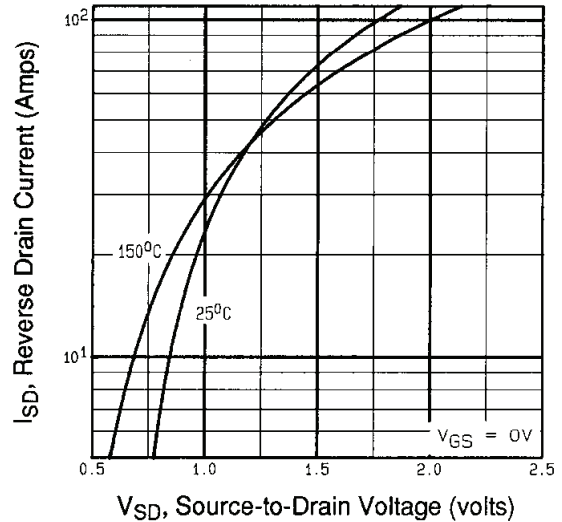


Fig. 7 - Typical Source-Drain Diode Forward Voltage

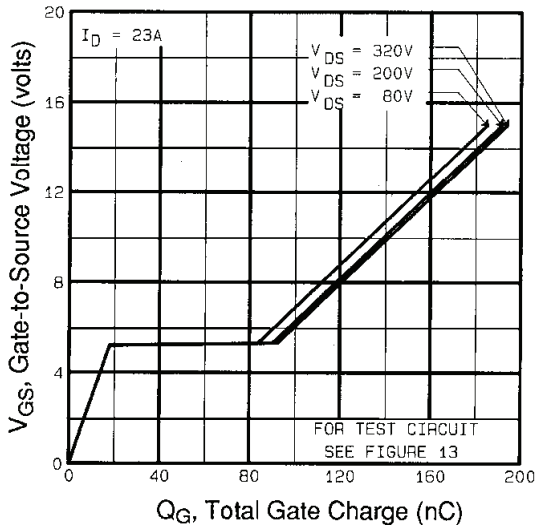


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

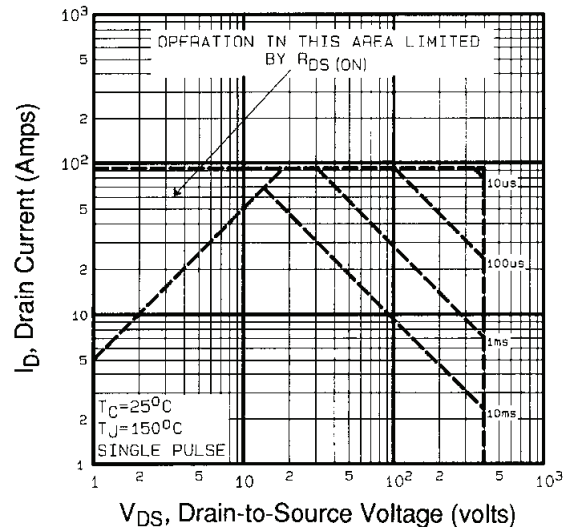


Fig. 8 - Maximum Safe Operating Area

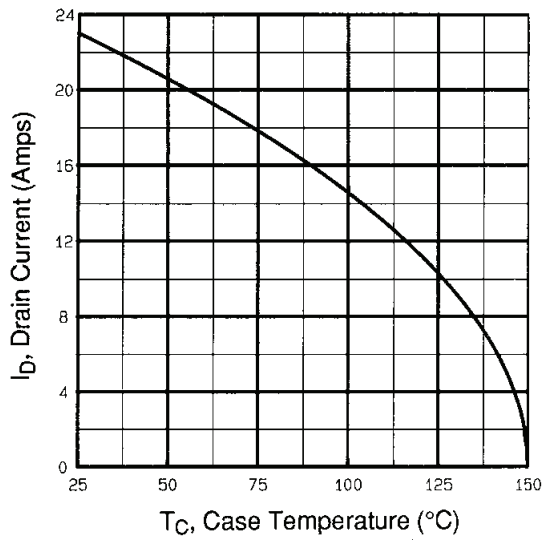


Fig. 9 - Maximum Drain Current vs. Case Temperature

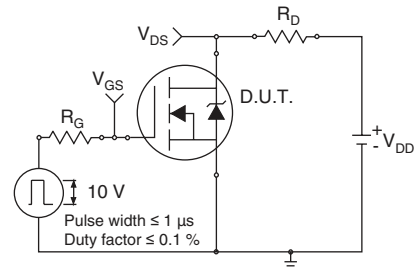


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

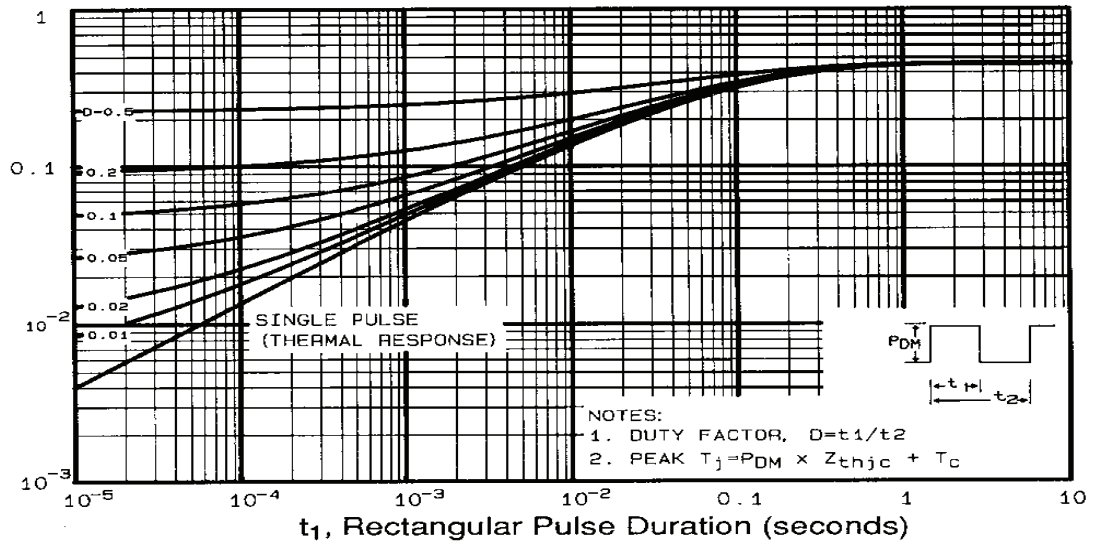


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

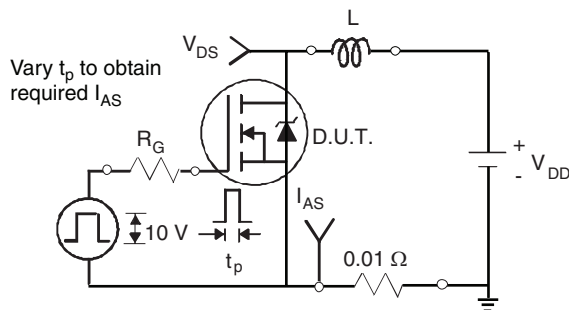


Fig. 12a - Unclamped Inductive Test Circuit

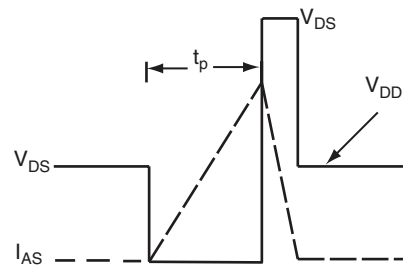


Fig. 12b - Unclamped Inductive Waveforms

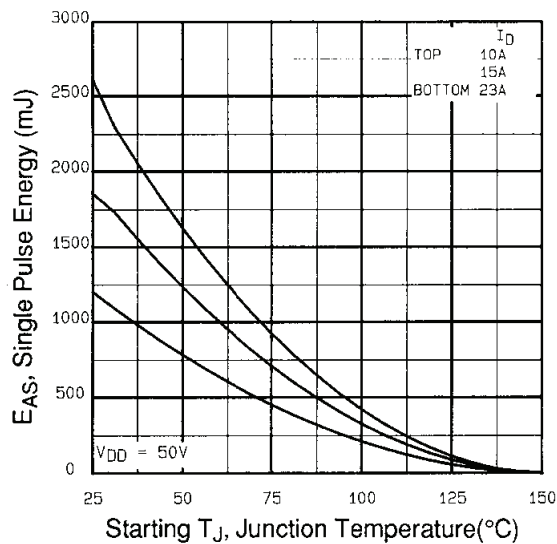


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

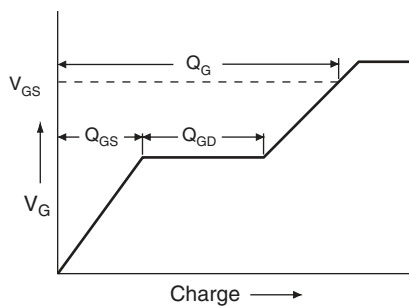


Fig. 13a - Basic Gate Charge Waveform

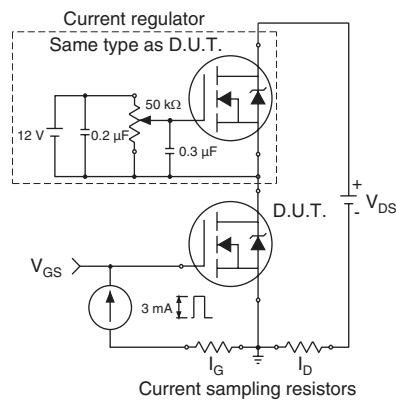


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery $dV/dt$ Test Circuit

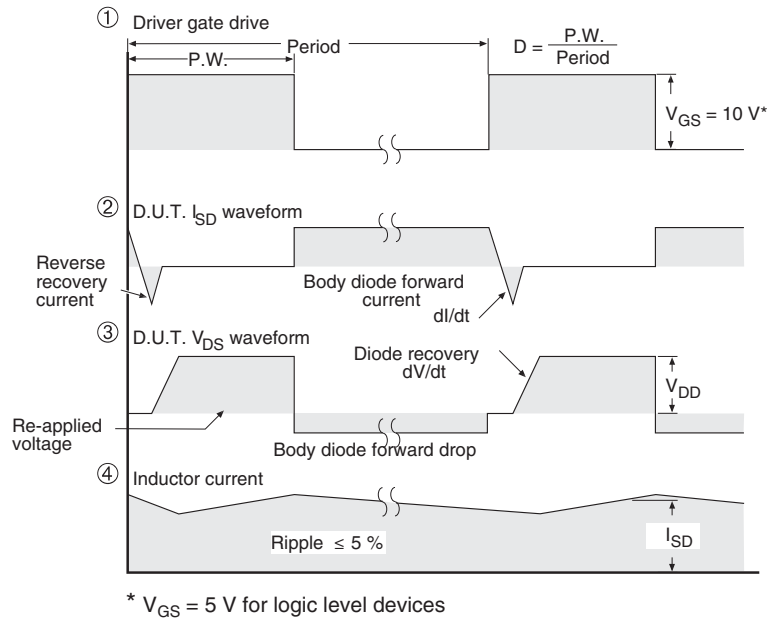
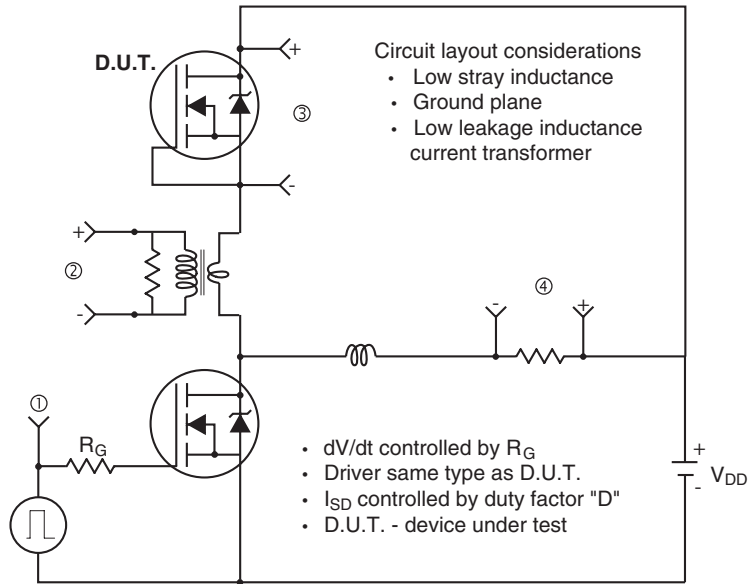


Fig. 14 - For N-Channel

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