

Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	300	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.45
Q_g (Max.) (nC)	33	
Q_{gs} (nC)	6.9	
Q_{gd} (nC)	12	
Configuration	Single	

FEATURES

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available

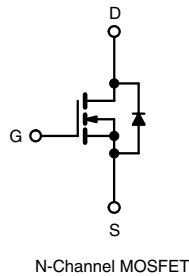
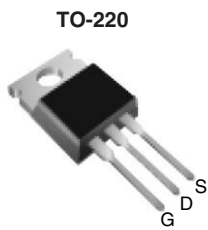


Available
RoHS*
COMPLIANT

DESCRIPTION

Third Generation Power MOSFETs from Vishay provides the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness.

The TO-220 package is universally preferred for all commercial-industrial applications at lower dissipation levels to approximately 50 watts. 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	IRFB9N30APbF SiHFB9N30A-E3
SnPb	IRFB9N30A SiHFB9N30A

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted					
PARAMETER		SYMBOL	LIMIT	UNIT	
Gate-Source Voltage		V_{GS}	± 30	V	
Continuous Drain Current	V_{GS} at 10 V	I_D	$T_C = 25\text{ }^\circ\text{C}$	9.3	A
			$T_C = 100\text{ }^\circ\text{C}$	5.9	
Pulsed Drain Current ^a		I_{DM}	37		
Linear Derating Factor			0.77	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy ^b		E_{AS}	160	mJ	
Repetitive Avalanche Current ^a		I_{AR}	9.3	A	
Repetitive Avalanche Energy ^a		E_{AR}	9.6	mJ	
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	96	W	
Peak Diode Recovery dV/dt^c		dV/dt	4.6	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	

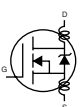
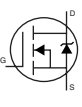
Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 3.7\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = 9.3\text{ A}$ (see fig. 12).
- $I_{SD} \leq 9.3\text{ A}$, $dI/dt \leq 270\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 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}	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	1.3	

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	300	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$	-	0.38	-	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}	$V_{GS} = \pm 30$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 300\text{ V}, V_{GS} = 0\text{ V}$	-	-	25	μA
		$V_{DS} = 240\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5.5\text{ A}^b$	-	-	0.45	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 5.6\text{ A}^b$	6.6	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$ $V_{DS} = 1.0\text{ V}$ $V_{DS} = 240\text{ V}$ $V_{DS} = 0\text{ V to } 240\text{ V}^c$ $V_{DS} = 25\text{ V}$ $f = 1.0\text{ MHz, see fig. 5}$	-	920	-	pF
	C_{oss}		-	1200	-	
	$C_{oss\text{ eff.}}$		-	102	-	
Output Capacitance	C_{oss}		-	160	-	
Reverse Transfer Capacitance	C_{rss}		-	8.7	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}, I_D = 9.3\text{ A}, V_{DS} = 240\text{ V},$ see fig. 6 and 13 ^b	-	-	33	nC
Gate-Source Charge	Q_{gs}		-	-	6.9	
Gate-Drain Charge	Q_{gd}		-	-	12	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 150\text{ V}, I_D = 9.3\text{ A}$ $R_G = 12\text{ }\Omega, R_D = 16\text{ }\Omega, \text{ see fig. 10}^b$	-	10	-	ns
Rise Time	t_r		-	25	-	
Turn-Off Delay Time	$t_{d(off)}$		-	35	-	
Fall Time	t_f		-	29	-	
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 	-	-	9.3	A
Pulsed Diode Forward Current ^a	I_{SM}		-	-	37	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 9.3\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 9.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	280	420	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.5	2.3	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 $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

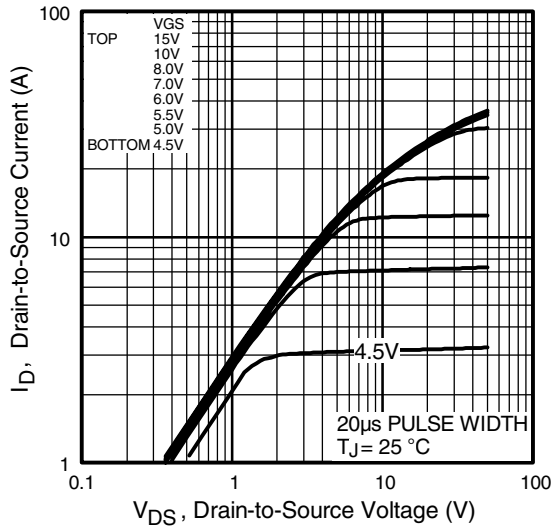


Fig. 1 - Typical Output Characteristics

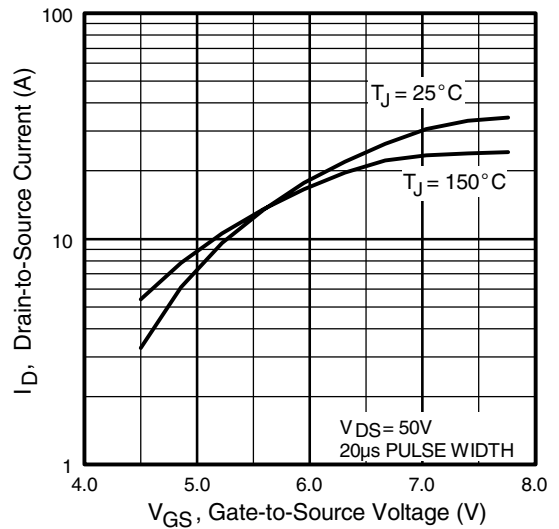


Fig. 3 - Typical Transfer Characteristics

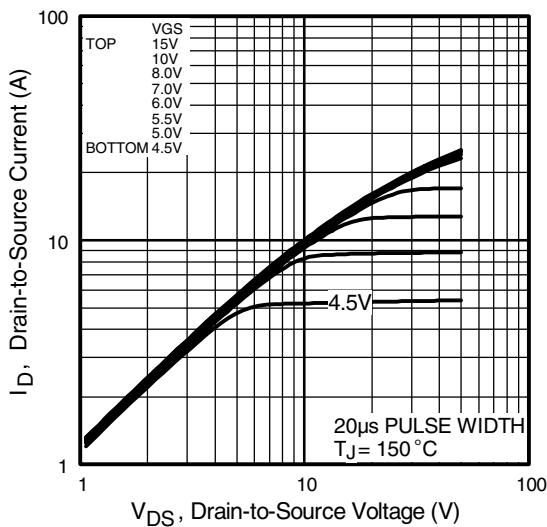


Fig. 2 - Typical Output Characteristics

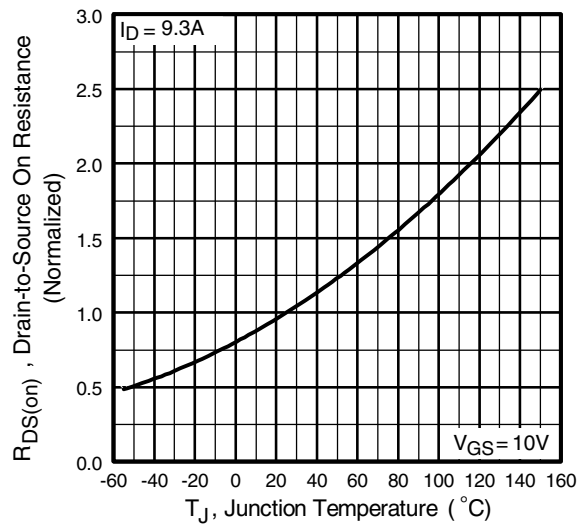


Fig. 4 - Normalized On-Resistance vs. Temperature

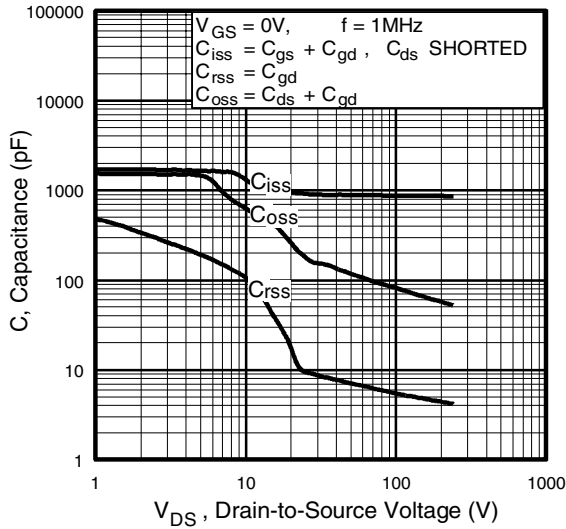


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

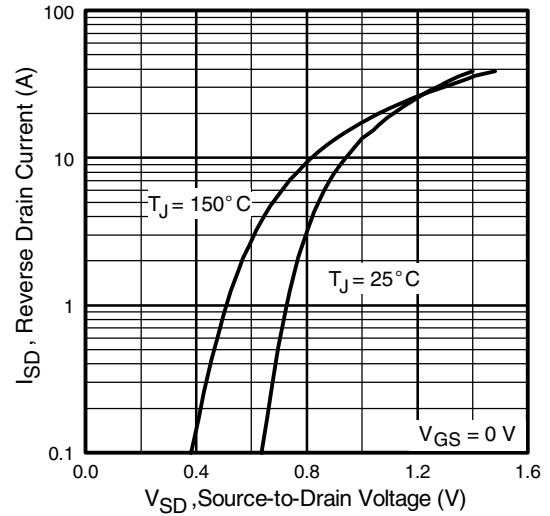


Fig. 7 - Typical Source-Drain Diode Forward Voltage

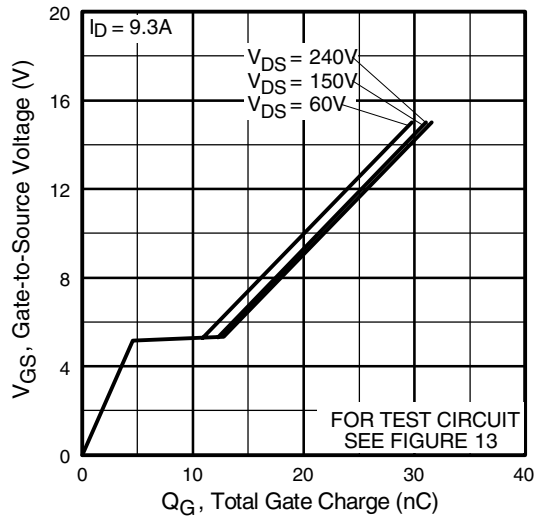


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

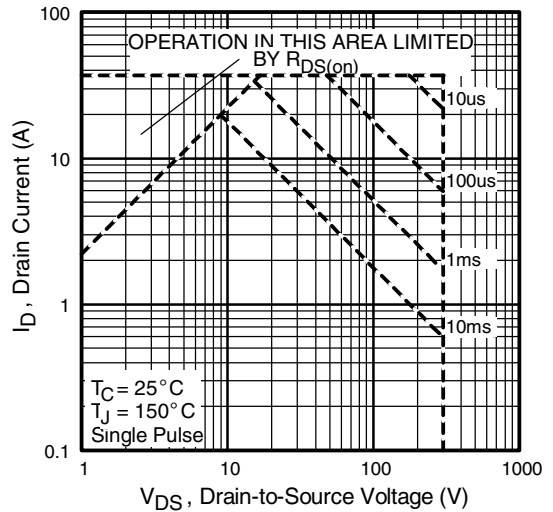


Fig. 8 - Maximum Safe Operating Area

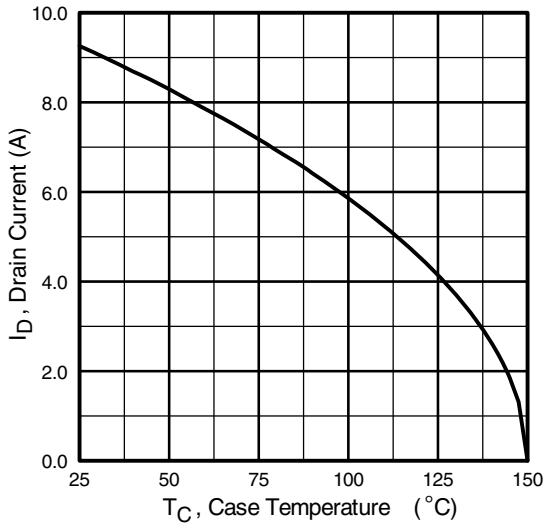


Fig. 9 - Maximum Drain Current vs. Case Temperature

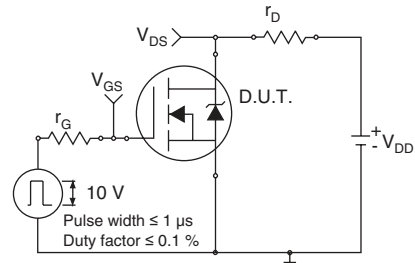


Fig. 10a - Switching Time Test Circuit

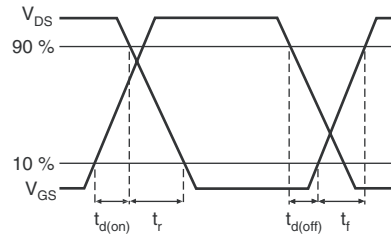


Fig. 10b - Switching Time Waveforms

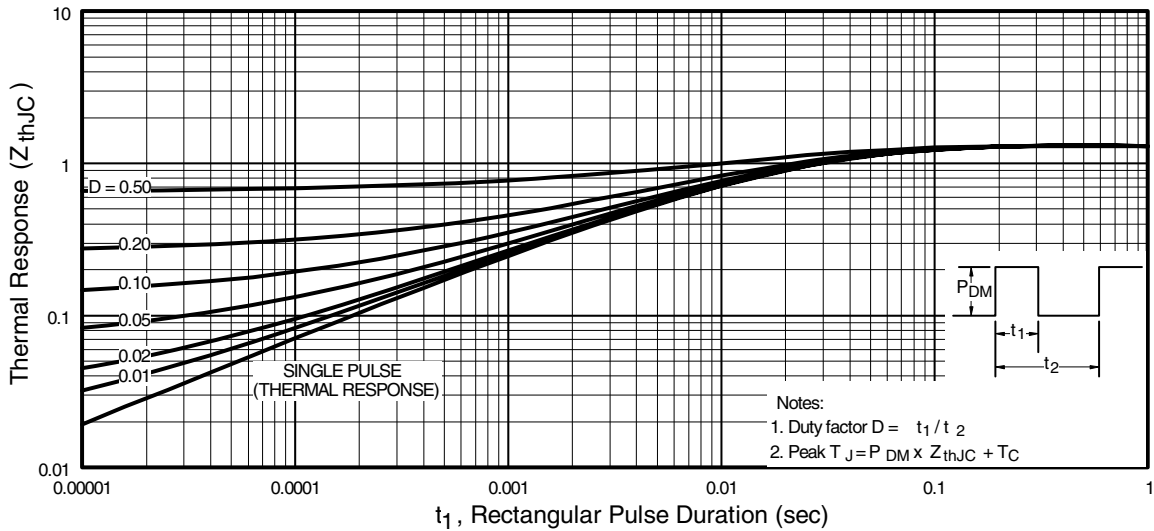


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

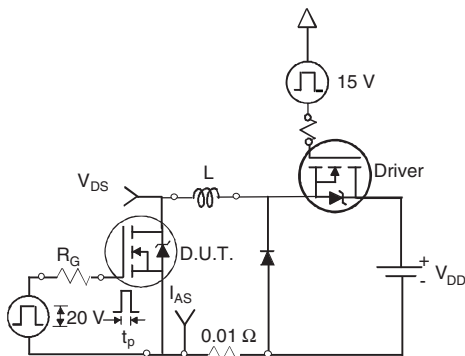


Fig. 12a - Unclamped Inductive Test Circuit

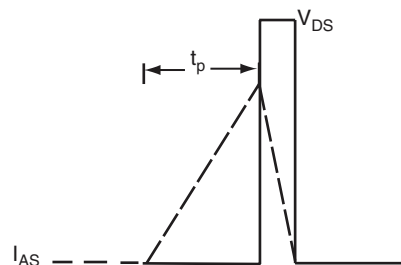


Fig. 12b - Unclamped Inductive Waveforms

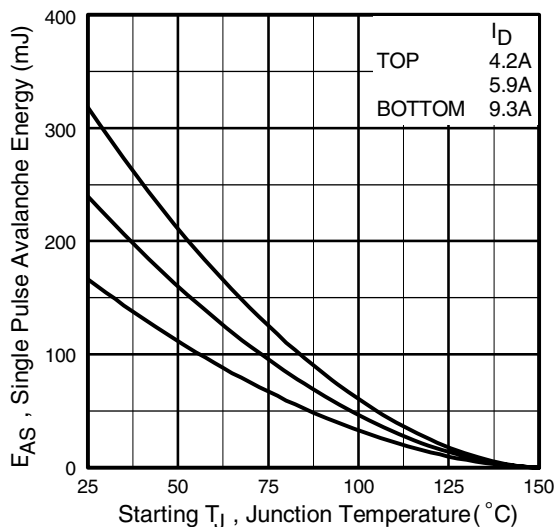


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

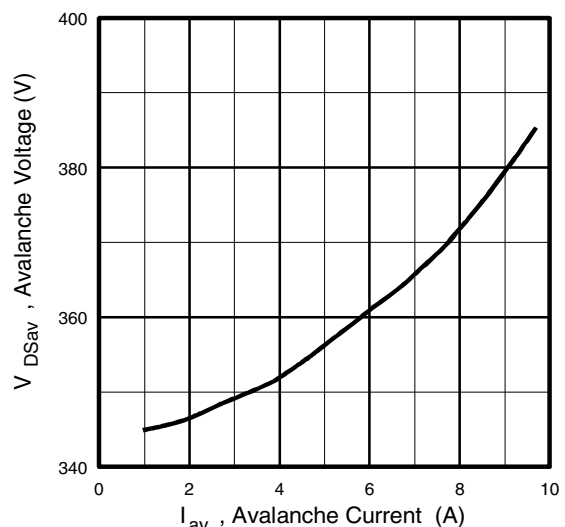


Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

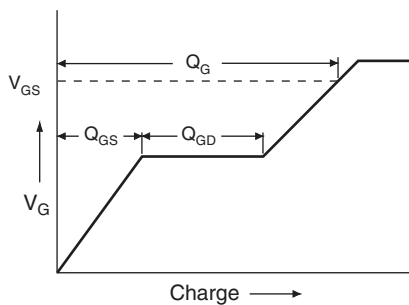


Fig. 13a - Basic Gate Charge Waveform

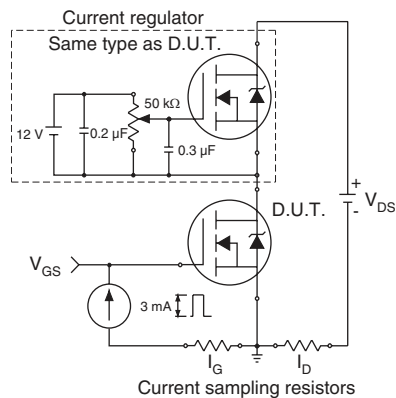
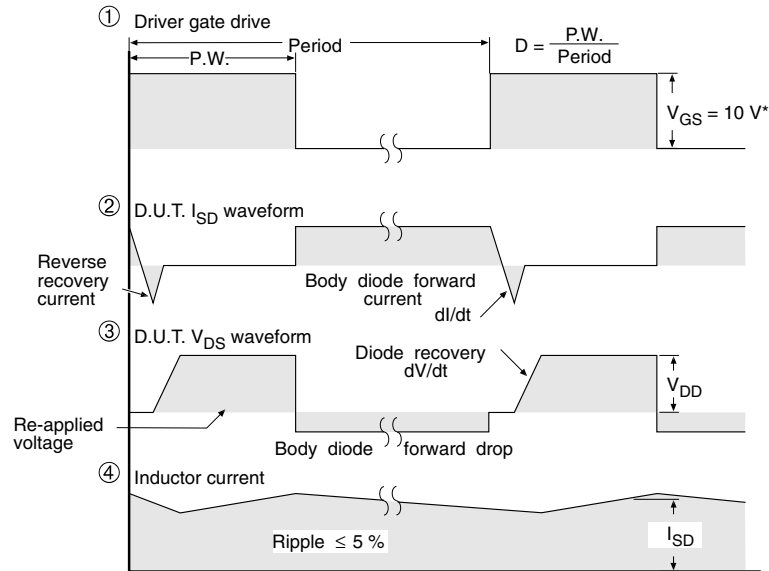
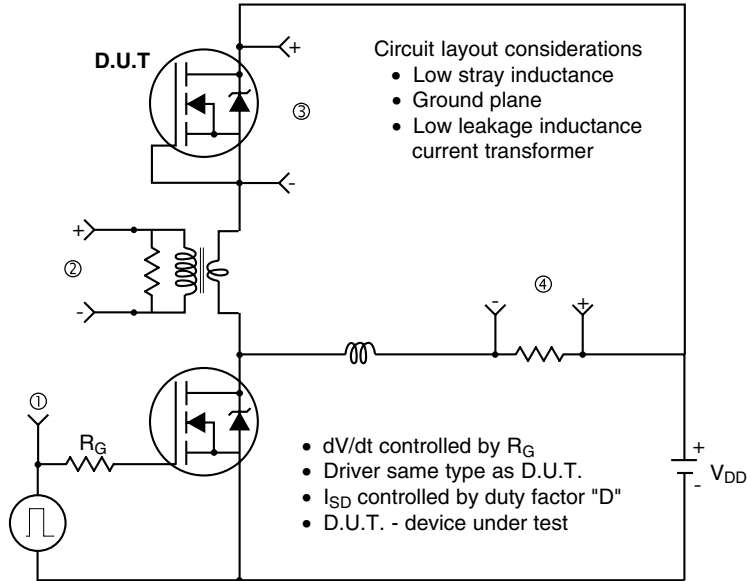


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel

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