



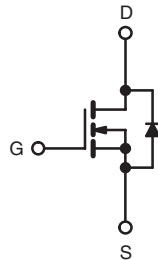
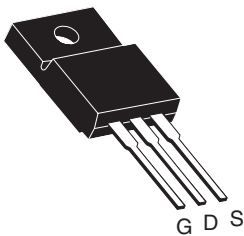
THE DATASHEET OF IRFIB5N50LPBF



Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.67
Q_g (Max.) (nC)	45	
Q_{gs} (nC)	13	
Q_{gd} (nC)	23	
Configuration	Single	

TO-220 FULLPAK



N-Channel MOSFET

FEATURES

- Super Fast Body Diode Eliminates the Need for External Diodes in ZVS Applications
- Lower Gate Charge Results in Simpler Drive Requirements
- Enhanced dV/dt Capabilities Offer Improved Ruggedness
- Higher Gate Voltage Threshold Offers Improved Noise Immunity
- Lead (Pb)-free



APPLICATIONS

- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control Applications


ORDERING INFORMATION	
Package	TO-220 FULLPAK
Lead (Pb)-free	IRFIB5N50LPbF SiHFIB5N50L-E3

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	500	V	
Gate-Source Voltage	V_{GS}	± 30		
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25$ °C	4.7	A
		$T_C = 100$ °C	3.0	
Pulsed Drain Current ^a	I_{DM}	16		
Linear Derating Factor		0.33	W/°C	
Single Pulse Avalanche Energy ^b	E_{AS}	140	mJ	
Avalanche Current ^a	I_{AR}	4.0	A	
Repetitive Avalanche Energy ^a	E_{AR}	3.0	mJ	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	42	W
Peak Diode Recovery dV/dt^c		dV/dt	19	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
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 $T_J = 25$ °C, $L = 18$ mH, $R_G = 25$ Ω , $I_{AS} = 4.0$ A, $dV/dt = 19$ V/ns, (see fig. 17).
- $I_{SD} \leq 4.0$ A, $dI/dt \leq 421$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
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}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	500	-	-	V	
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$	-	0.43	-	V/°C	
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3.0	-	5.0	V	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	50	μA	
		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	-	2.0	mA	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 2.4\text{ A}^b$	-	0.67	0.80	Ω	
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 2.4\text{ A}$	2.8	-	-	S	
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5	-	1000	-	pF	
Output Capacitance	C_{oss}		-	110	-		
Reverse Transfer Capacitance	C_{rss}		-	12	-		
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 1.0\text{ V}$, $f = 1.0\text{ MHz}$	-	1360	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$		$V_{DS} = 400\text{ V}$, $f = 1.0\text{ MHz}$	-	31	-	
Effective Output Capacitance (Energy Related)	$C_{oss\text{ eff. (ER)}}$	$V_{DS} = 0\text{ V to } 400\text{ V}^c$	-	75	-		
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 4.0\text{ A}$, $V_{DS} = 400\text{ V}$, see fig. 7 and 16 ^b	-	-	45	nC
Gate-Source Charge	Q_{gs}			-	-	13	
Gate-Drain Charge	Q_{gd}			-	-	23	
Internal Gate Resistance	R_G	$f = 1\text{ MHz}$, open drain		-	2.0	-	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 250\text{ V}$, $I_D = 4.0\text{ A}$, $R_G = 9.0\text{ }\Omega$, $V_{GS} = 10\text{ V}$, see fig. 11a and 11b ^b	-	13	-	ns	
Rise Time	t_r		-	17	-		
Turn-Off Delay Time	$t_{d(off)}$		-	26	-		
Fall Time	t_f		-	10	-		
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	4.7	A	
Pulsed Diode Forward Current ^a	I_{SM}		-	-	16		
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 4.0\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	1.5	V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 4.0\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	73	110	ns	
			-	99	150		
Body Diode Reverse Recovery Charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 4.0\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	200	310	nC	
			-	360	540		
Drain-Source Body Diode Characteristics							
Body Diode Reverse Recovery Current	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$	-	6.7	10	A	
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_{DS} .
 $C_{oss\text{ eff. (ER)}}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 to 80 % V_{DS} .

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

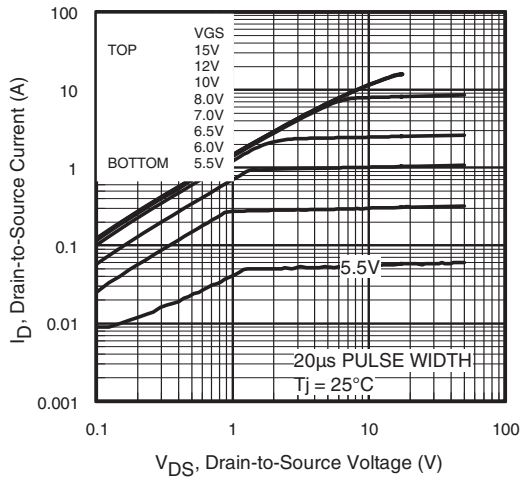


Fig. 1 - Typical Output Characteristics

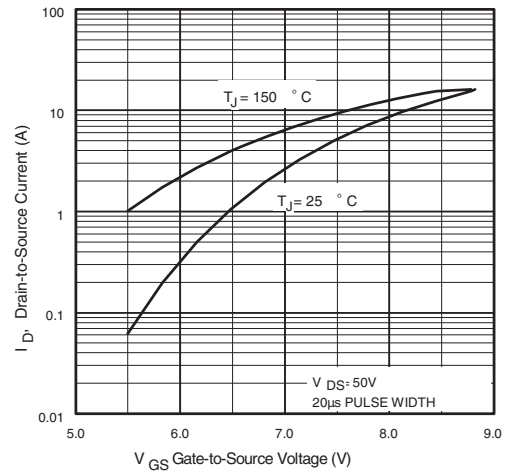


Fig. 3 - Typical Transfer Characteristics

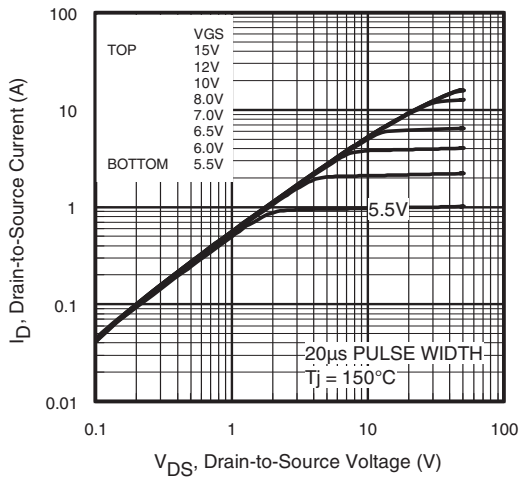


Fig. 2 - Typical Output Characteristics

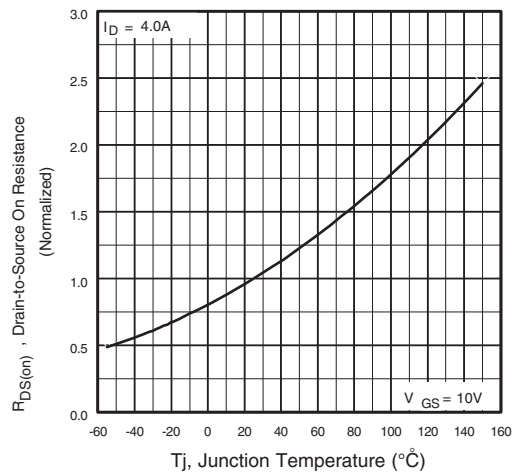


Fig. 4 - Normalized On-Resistance vs. Temperature

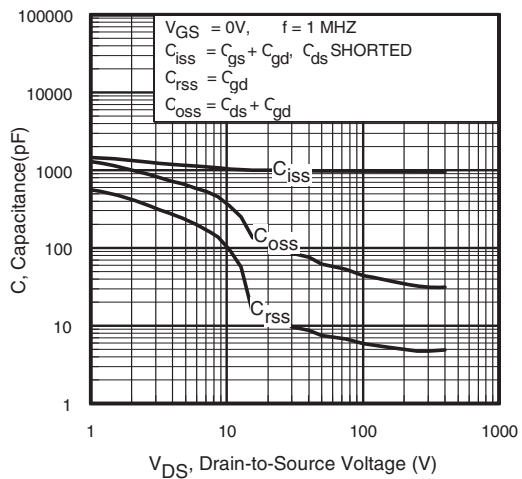


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

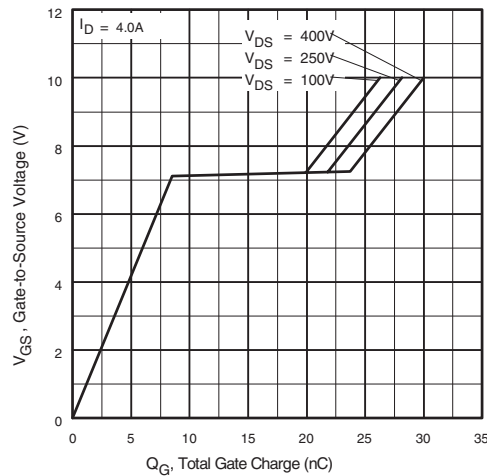


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

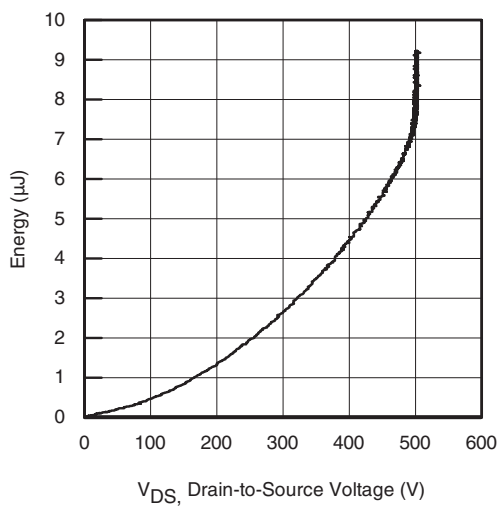


Fig. 6 - Typical Output Capacitance Stored Energy vs. V_{DS}

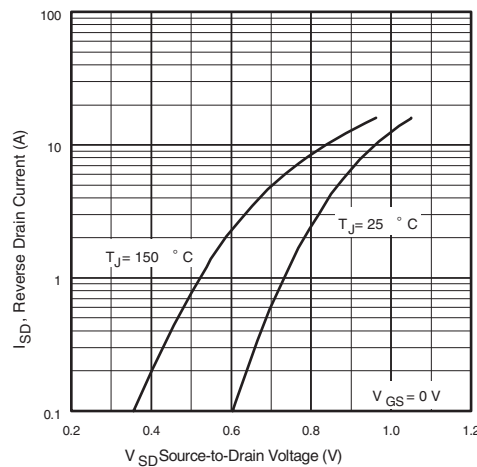


Fig. 8 - Typical Source-Drain Diode Forward Voltage

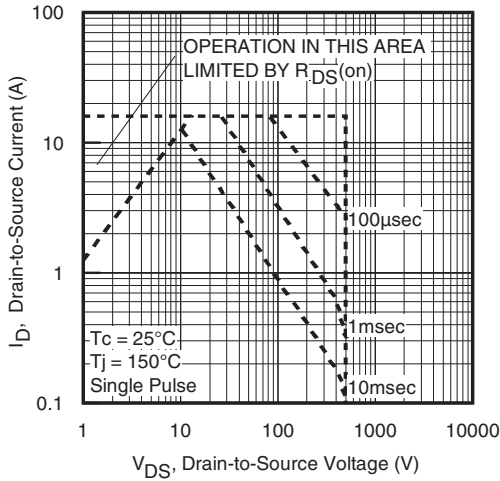


Fig. 9 - Maximum Safe Operating Area

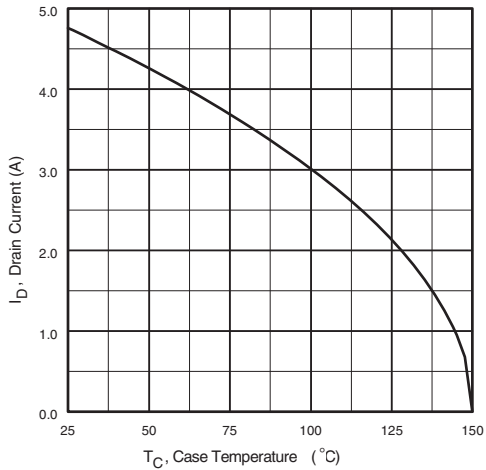


Fig. 10 - Maximum Drain Current vs. Case Temperature

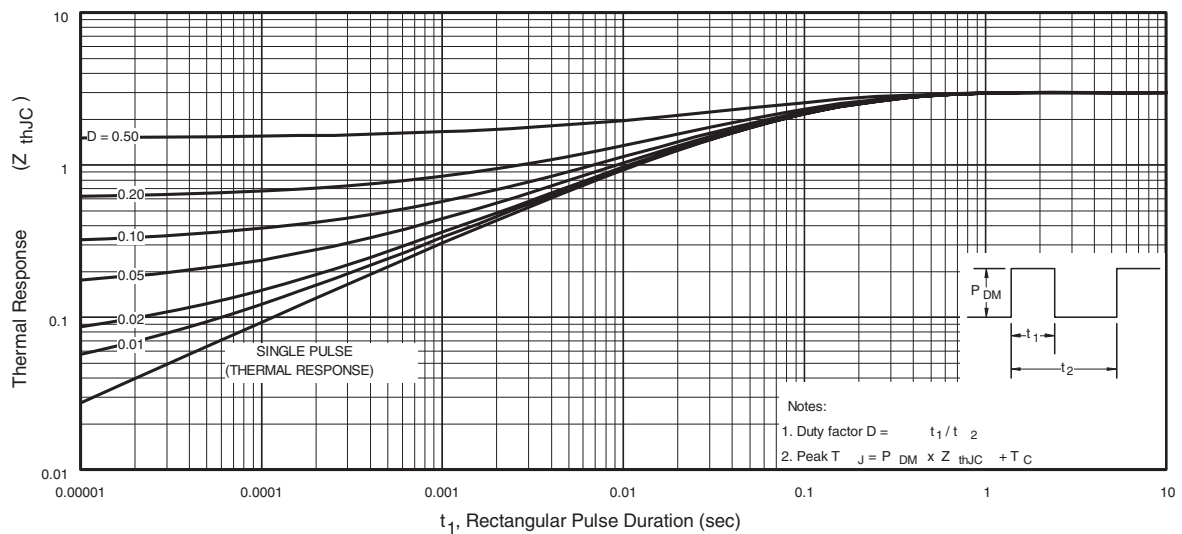


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

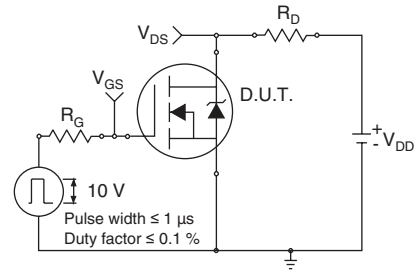


Fig. 11a - Switching Time Test Circuit

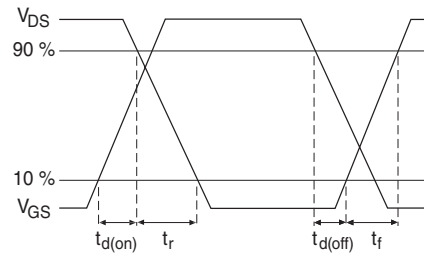


Fig. 11b - Switching Time Waveforms

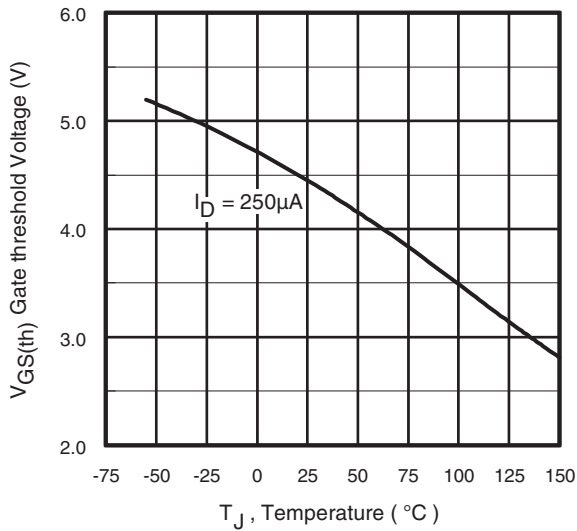


Fig. 13 - Threshold Voltage vs. Temperature

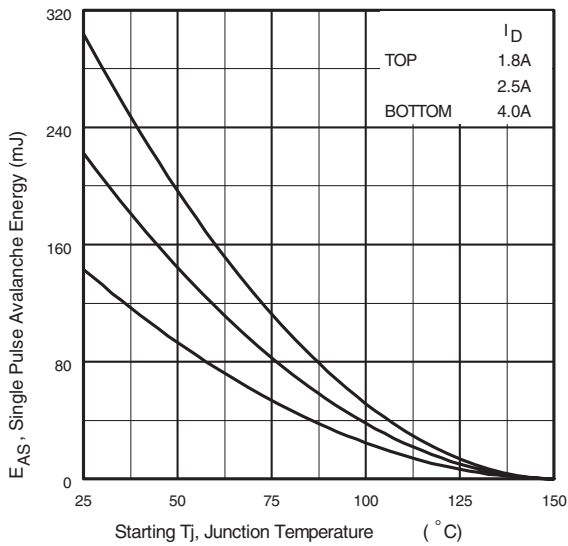


Fig. 14 - Maximum Avalanche Energy vs. Drain Current

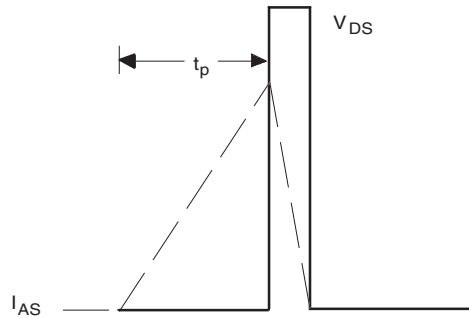


Fig. 15b - Unclamped Inductive Waveforms

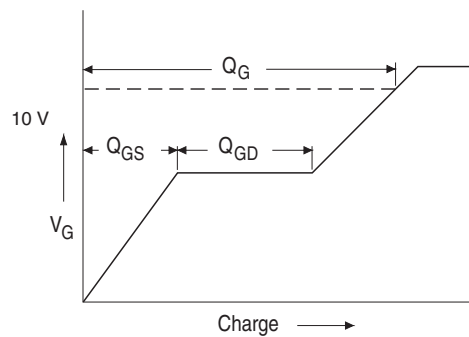


Fig. 16a - Basic Gate Charge Waveform

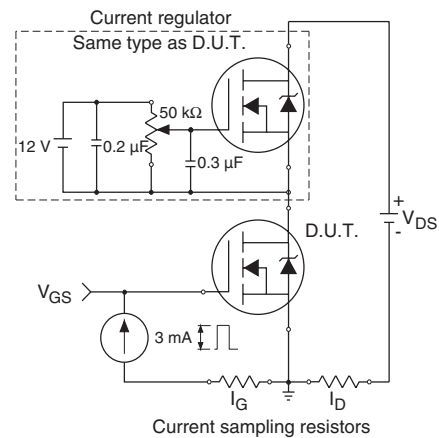


Fig. 16b - Gate Charge Test Circuit

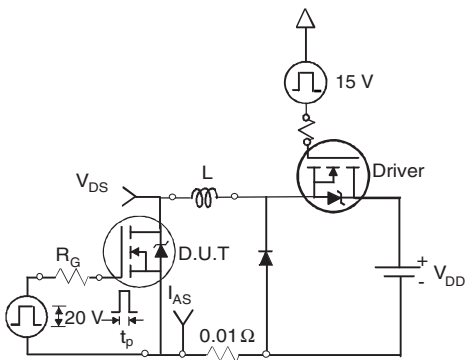


Fig. 15a - Unclamped Inductive Test Circuit

Peak Diode Recovery dV/dt Test Circuit

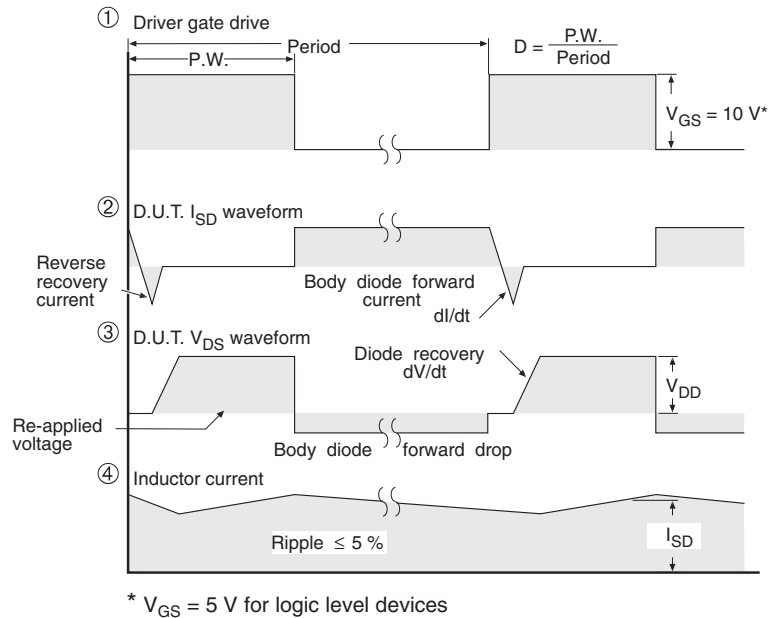
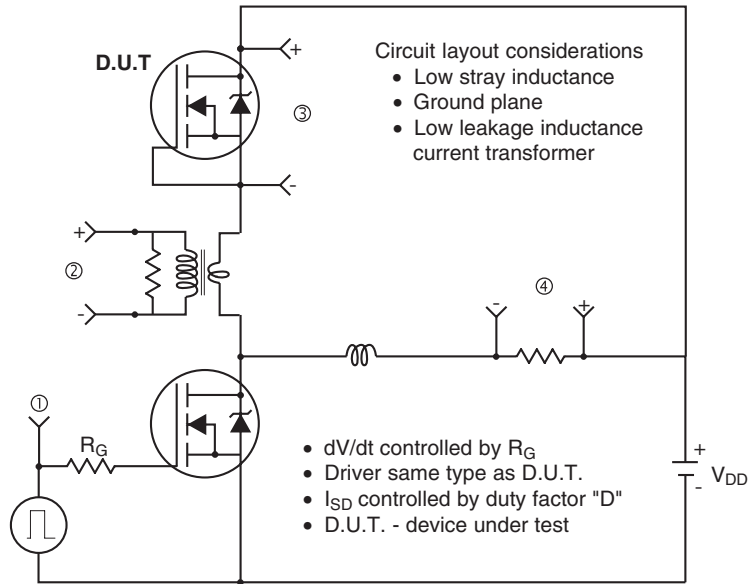


Fig. 17 - For N-Channel

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