

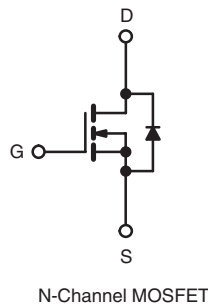
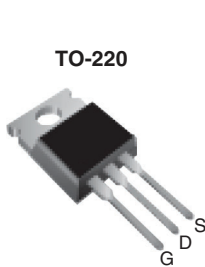


**THE DATASHEET OF
IRFB16N60LPBF**



Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.385
Q_g (Max.) (nC)	100	
Q_{gs} (nC)	30	
Q_{gd} (nC)	46	
Configuration	Single	



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 Available



RoHS*
COMPLIANT

APPLICATIONS

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

ORDERING INFORMATION	
Package	TO-220
Lead (Pb)-free	IRFB16N60LPbF
	SiHFB16N60L-E3
SnPb	IRFB16N60L
	SiHFB16N60L


ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	600	V	
Gate-Source Voltage	V_{GS}	± 30		
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25$ °C	16	A
		$T_C = 100$ °C	10	
Pulsed Drain Current ^a	I_{DM}	60		
Linear Derating Factor		2.5	W/°C	
Single Pulse Avalanche Energy ^b	E_{AS}	310	mJ	
Avalanche Current ^a	I_{AR}	16	A	
Repetitive Avalanche Energy ^a	E_{AR}	31	mJ	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	310	W
Peak Diode Recovery dV/dt^c	dV/dt	11	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. 12).
- Starting $T_J = 25$ °C, $L = 2.5$ mH, $R_G = 25$ Ω , $I_{AS} = 16$ A (see fig. 14a).
- $I_{SD} \leq 16$ A, $dI/dt \leq 650$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °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
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.4	

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.39	-	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}	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	50	μA
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	2.0	mA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 9.0\text{ A}^b$	-	0.385	0.460	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 9.0\text{ A}$		8.3	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$, see fig. 5		-	2720	-	pF
Output Capacitance	C_{oss}			-	26	-	
Reverse Transfer Capacitance	C_{riss}			-	20	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 0\text{ V to } 480\text{ V}^c$	-	120	-	pF
Effective Output Capacitance (Energy Related)	$C_{oss\text{ eff. (ER)}}$			-	100	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 16\text{ A}, V_{DS} = 480\text{ V},$ see fig. 7 and 15 ^b	-	-	100	nC
Gate-Source Charge	Q_{gs}			-	-	30	
Gate-Drain Charge	Q_{gd}			-	-	46	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}$	$V_{DD} = 300\text{ V}, I_D = 16\text{ A},$ $R_G = 1.8\text{ }\Omega,$ see fig. 11a and 11b ^b	-	20	-	ns
Rise Time	t_r			-	44	-	
Turn-Off Delay Time	$t_{d(off)}$			-	28	-	
Fall Time	t_f			-	5.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	16	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	60	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 16\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 16\text{ A},$ $T_J = 125\text{ }^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	130	200	ns
Body Diode Reverse Recovery Time				-	240	360	
Body Diode Reverse Recovery Charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_S = 16\text{ A},$ $T_J = 125\text{ }^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	450	670	nC
Body Diode Reverse Recovery Charge				-	1080	1620	
Body Diode Reverse Recovery Current	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$		-	5.8	8.7	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. 12).
- 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

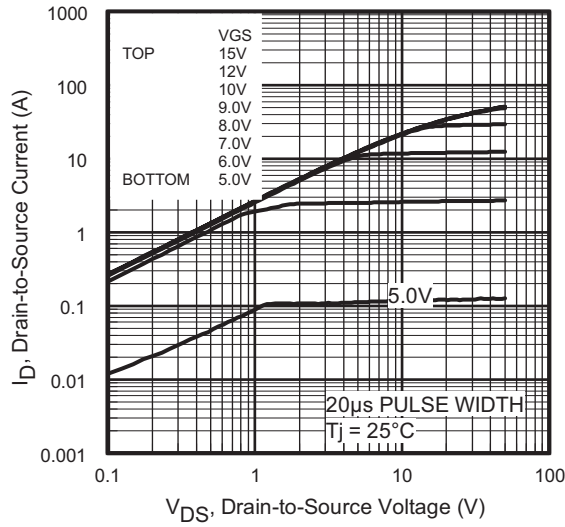


Fig. 1 - Typical Output Characteristics

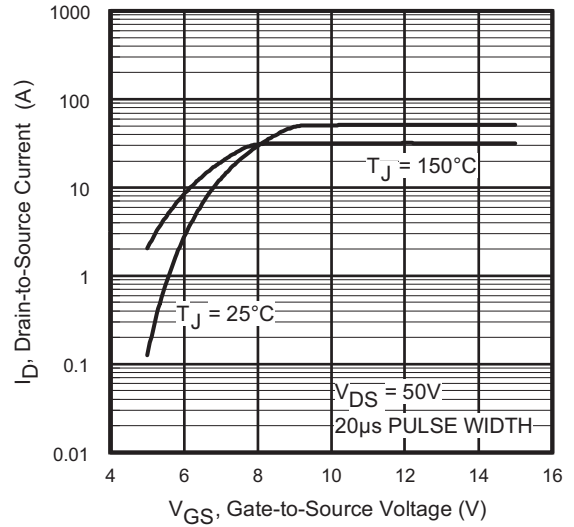


Fig. 3 - Typical Transfer Characteristics

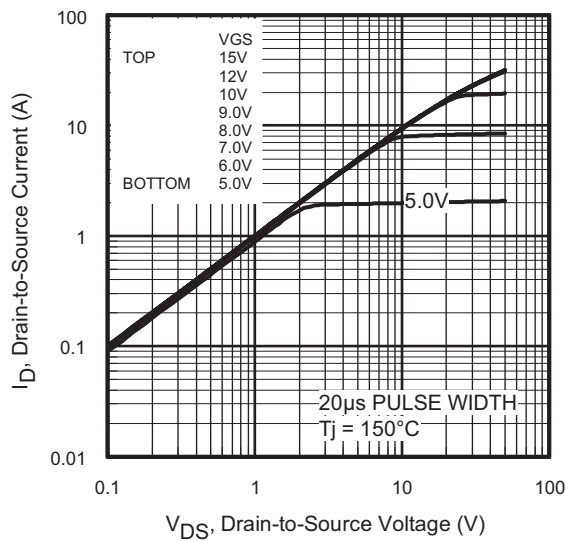


Fig. 2 - Typical Output Characteristics

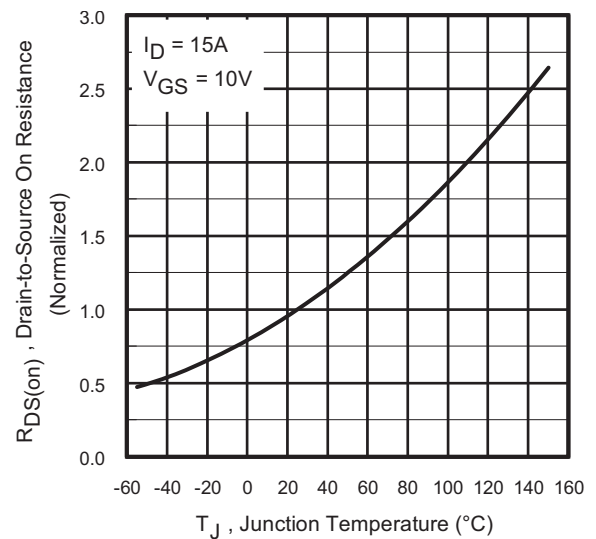


Fig. 4 - Normalized On-Resistance vs. Temperature

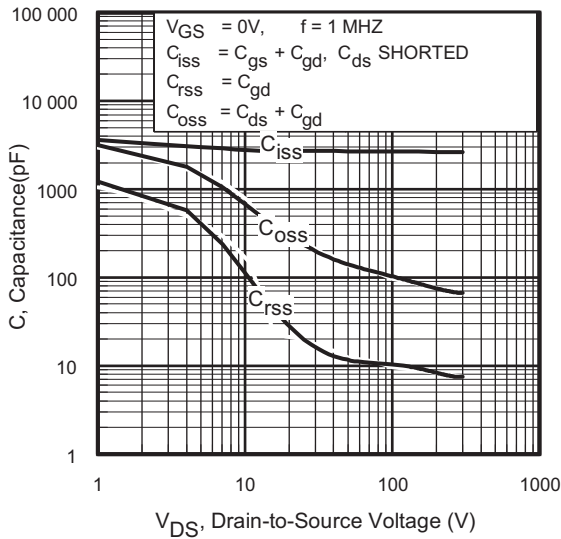


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

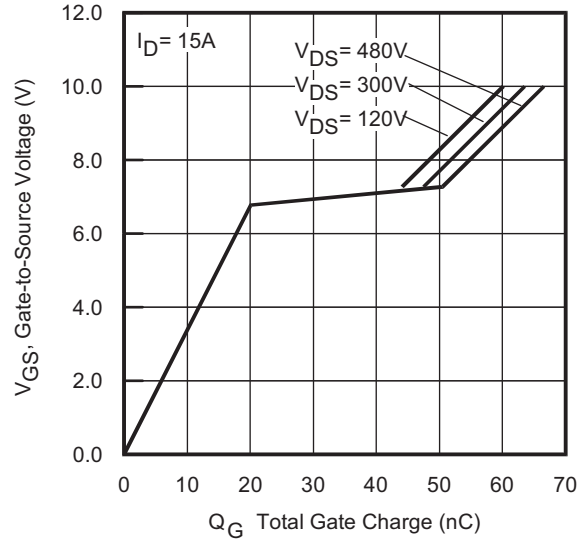


Fig. 7 - Typical Source-Drain Diode Forward Voltage

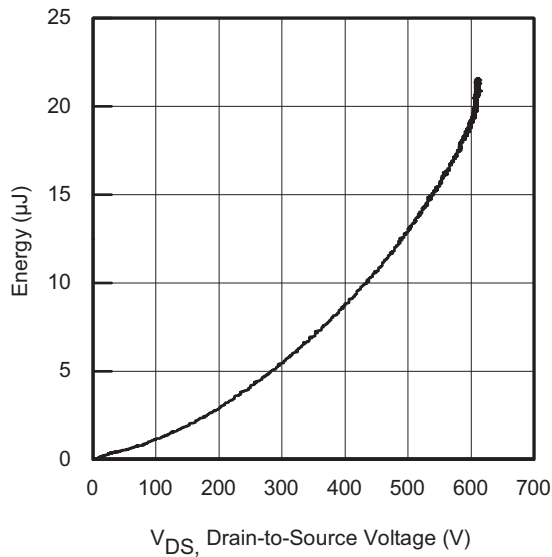


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

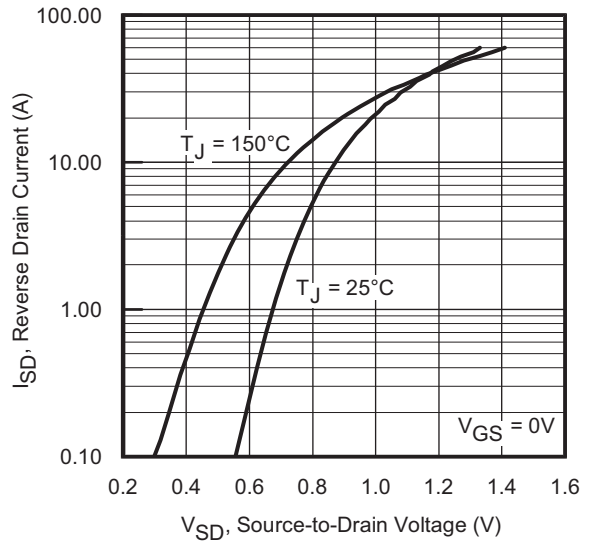


Fig. 8 - Maximum Safe Operating Area

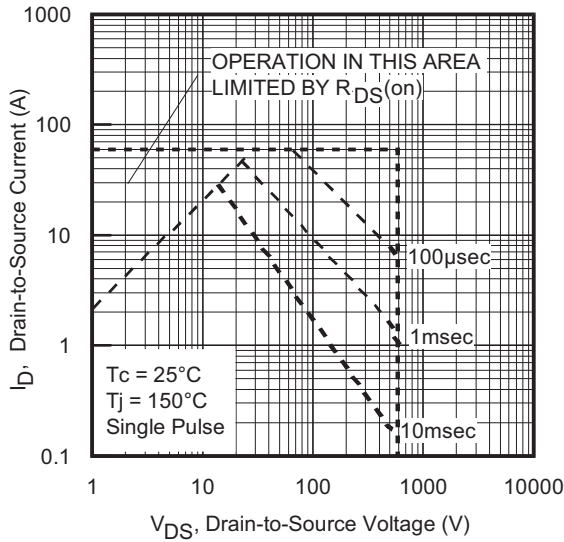


Fig. 9 - Maximum Safe Operating Area

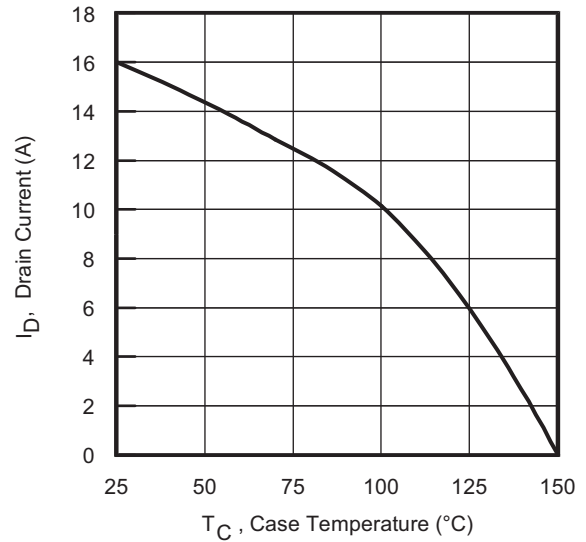


Fig. 10 - Maximum Drain Current vs. Case Temperature

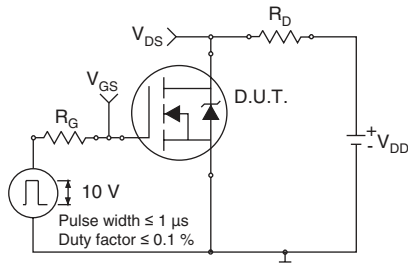


Fig. 11a - Switching Time Test Circuit

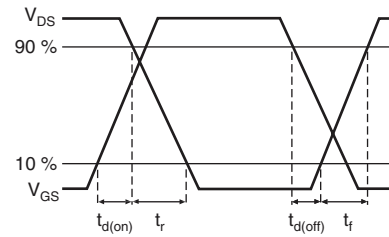


Fig. 11b - Switching Time Waveforms

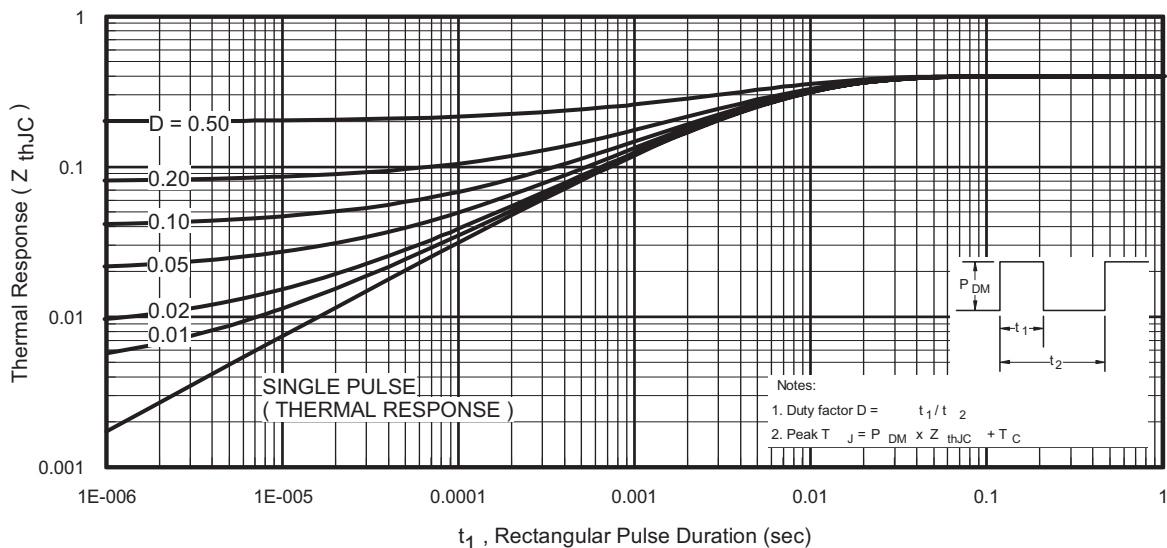


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

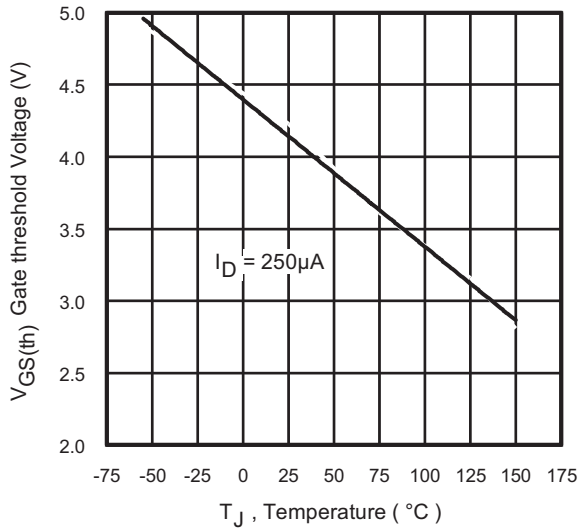


Fig. 13 - Threshold Voltage vs. Temperature

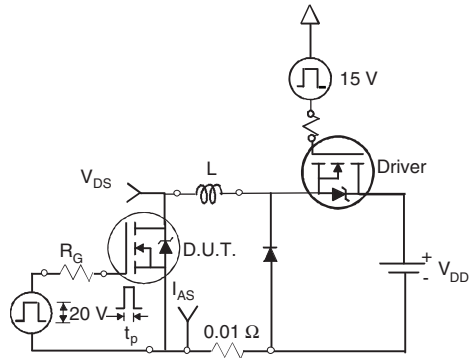


Fig. 14b - Unclamped Inductive Test Circuit

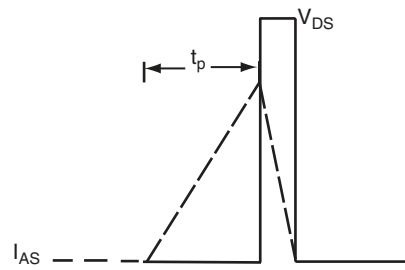


Fig. 14c - Unclamped Inductive Waveforms

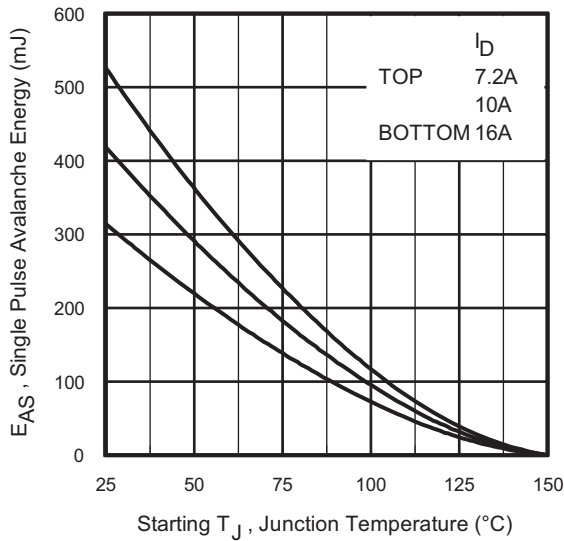


Fig. 14a - Maximum Avalanche Energy vs. Drain Current

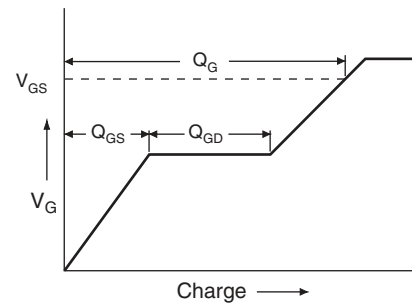


Fig. 15a - Basic Gate Charge Waveform

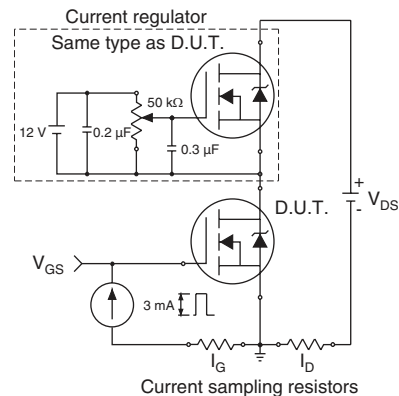


Fig. 15b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

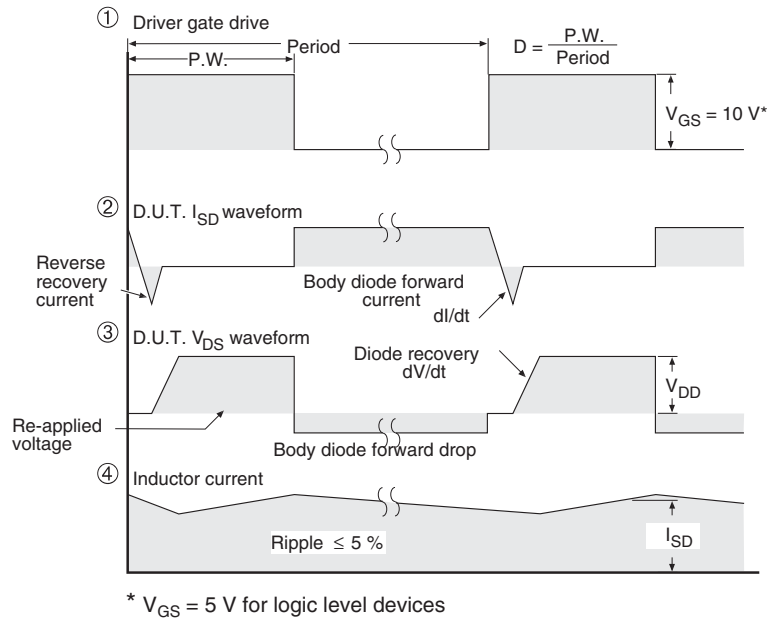
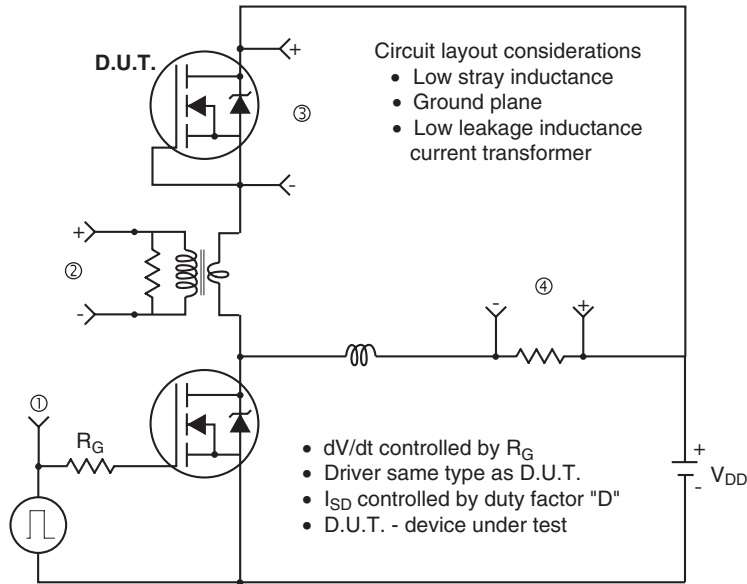


Fig. 16 - For N-Channel

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