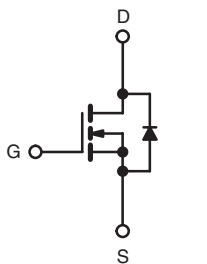




Power MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	600	
R <sub>DS(on)</sub> (Ω)	V <sub>GS</sub> = 10 V	0.175
Q <sub>g</sub> (Max.) (nC)	220	
Q <sub>gs</sub> (nC)	67	
Q <sub>gd</sub> (nC)	96	
Configuration	Single	



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
- Enhances dV/dt Capabilities Offer Improved Ruggedness
- Higher Gate Voltage Threshold Offer 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	SUPER-247™
Lead (Pb)-free	IRFPS29N60LPbF SiHFPS29N60L-E3
SnPb	IRFPS29N60L SiHFPS29N60L

ABSOLUTE MAXIMUM RATINGS T <sub>C</sub> = 25 °C, unless otherwise noted					
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V <sub>DS</sub>	600	V
Gate-Source Voltage			V <sub>GS</sub>	± 30	
Continuous Drain Current	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	I <sub>D</sub>	29	A
		T <sub>C</sub> = 100 °C		18	
Pulsed Drain Current <sup>a</sup>			I <sub>DM</sub>	110	
Linear Derating Factor				3.8	W/°C
Single Pulse Avalanche Energy <sup>b</sup>			E <sub>AS</sub>	570	mJ
Repetitive Avalanche Current <sup>a</sup>			I <sub>AR</sub>	29	A
Repetitive Avalanche Energy <sup>a</sup>			E <sub>AR</sub>	48	mJ
Maximum Power Dissipation	T <sub>C</sub> = 25 °C		P <sub>D</sub>	480	W
Peak Diode Recovery dV/dt <sup>c</sup>			dV/dt	15	V/ns
Operating Junction and Storage Temperature Range			T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 150	°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).
- Starting T<sub>J</sub> = 25 °C, L = 1.5 mH, R<sub>G</sub> = 25 Ω, I<sub>AS</sub> = 29 A (see fig.12a).
- I<sub>SD</sub> ≤ 29 A, dI/dt ≤ 830 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 150 °C.
- 1.6 mm from case.

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

# IRFPS29N60L, SiHFPS29N60L




Vishay Siliconix

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient <sup>a</sup>	$R_{thJA}$	-	40	°C/W
Case-to-Sink, Flat, Greased Surface	$R_{thCS}$	0.24	-	
Maximum Junction-to-Case (Drain) <sup>a</sup>	$R_{thJC}$	-	0.26	

**Note**

a.  $R_{th}$  is measured at  $T_J$  approximately 90 °C.

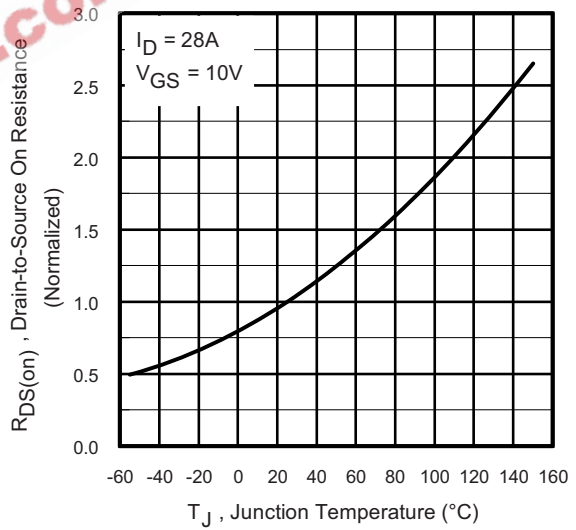
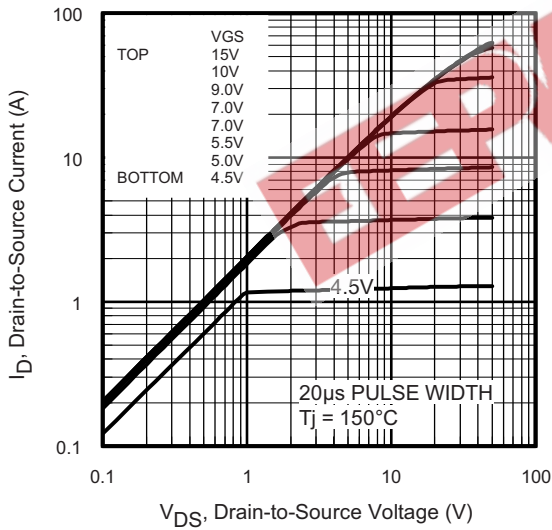
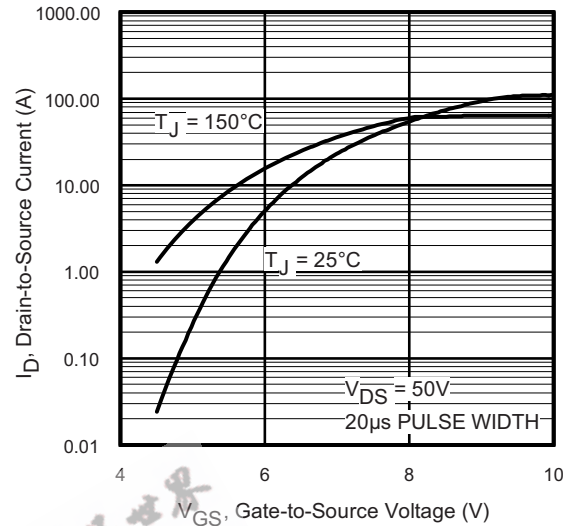
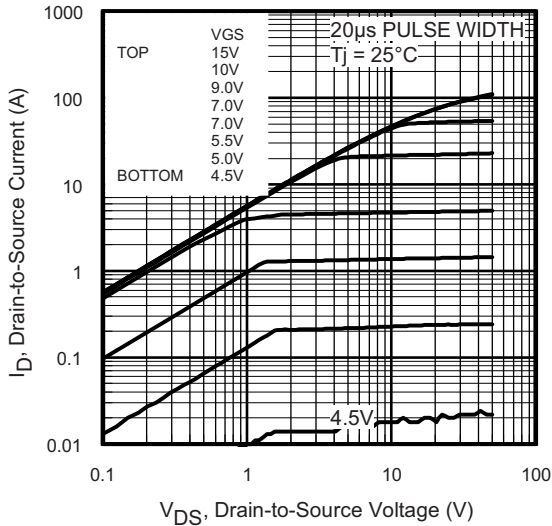
SPECIFICATIONS $T_J = 25\text{ °C}$ , unless otherwise noted						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	600	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1\text{ mA}$	-	0.53	-	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	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	50	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$	-	-	2.0	mA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 17\text{ A}^b$	-	0.175	0.21	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}, I_D = 17\text{ A}^b$	15	-	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}, \text{ see fig. 5}^b$	-	6160	-	pF
Output Capacitance	$C_{oss}$		-	530	-	
Reverse Transfer Capacitance	$C_{rss}$		-	44	-	
Effective Output Capacitance	$C_{oss\text{ eff.}}$		-	250	-	
Effective Output Capacitance (Energy Related)	$C_{oss\text{ eff. (ER)}}$		$V_{DS} = 0\text{ V to } 480\text{ V}^c$	-	190	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}, I_D = 29\text{ A}, V_{DS} = 480\text{ V}, \text{ see fig. 7 and 15}^b$	-	-	220	nC
Gate-Source Charge	$Q_{gs}$		-	-	67	
Gate-Drain Charge	$Q_{gd}$		-	-	96	
Internal Gate Resistance	$R_G$	$f = 1\text{ MHz}, \text{ open drain}$	-	0.86	-	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 300\text{ V}, I_D = 29\text{ A}, R_G = 4.3\text{ }\Omega, V_{GS} = 10\text{ V}, \text{ see fig. 11a and 11b}^b$	-	34	-	ns
Rise Time	$t_r$		-	100	-	
Turn-Off Delay Time	$t_{d(off)}$		-	66	-	
Fall Time	$t_f$		-	54	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	29	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$		-	-	110	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ °C}, I_S = 29\text{ A}, V_{GS} = 0\text{ V}^b$	-	-	1.5	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ °C}, I_F = 29\text{ A}, T_J = 125\text{ °C}, di/dt = 100\text{ A}/\mu\text{s}^b$	-	130	190	ns
			-	240	360	
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	630	950	$\mu\text{C}$
			-	1820	2720	
Body Diode Recovery Current	$I_{RRM}$	$T_J = 25\text{ °C}$	-	9.4	14	A
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  $\leq 2\%$ .
- c.  $C_{oss\text{ eff.}}$  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



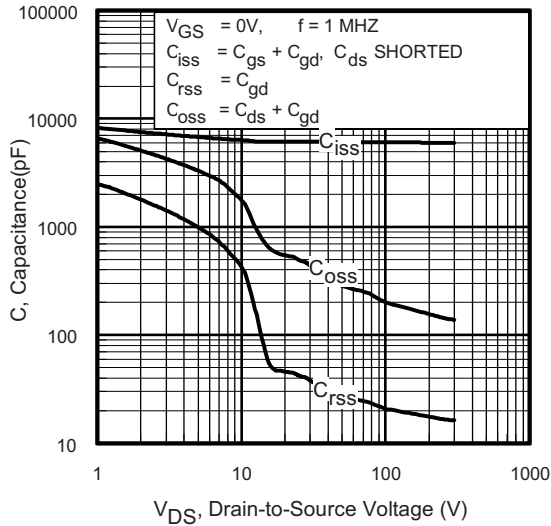


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

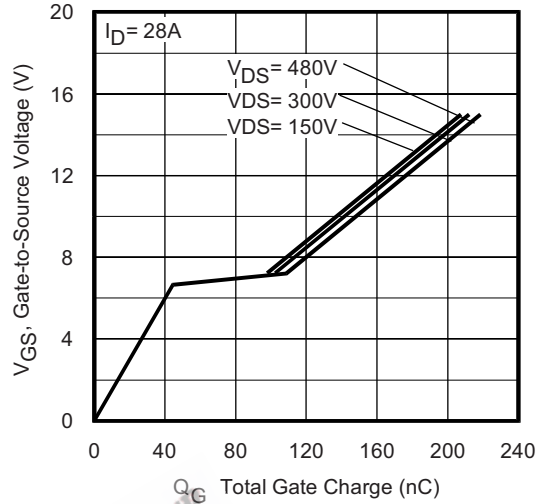


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

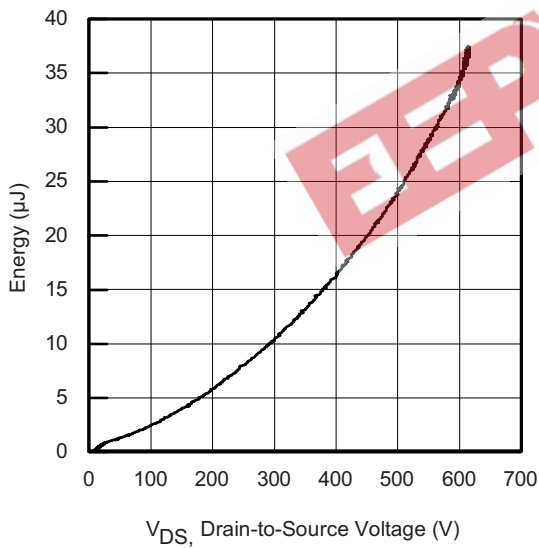


Fig. 6 - Typical Output Capacitance Stored Energy vs.  $V_{DS}$

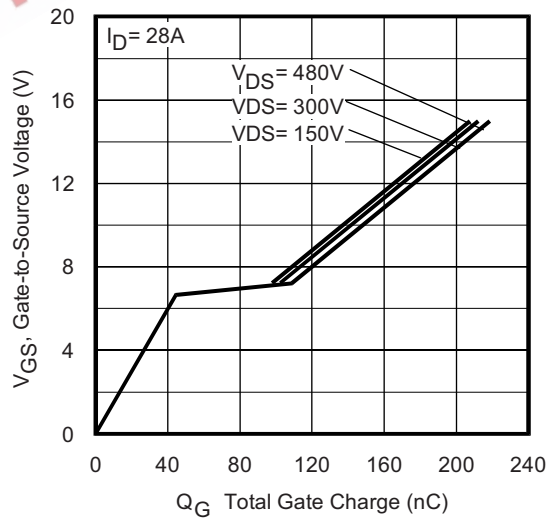


Fig. 8 - Typical Source-Drain Diode Forward Voltage

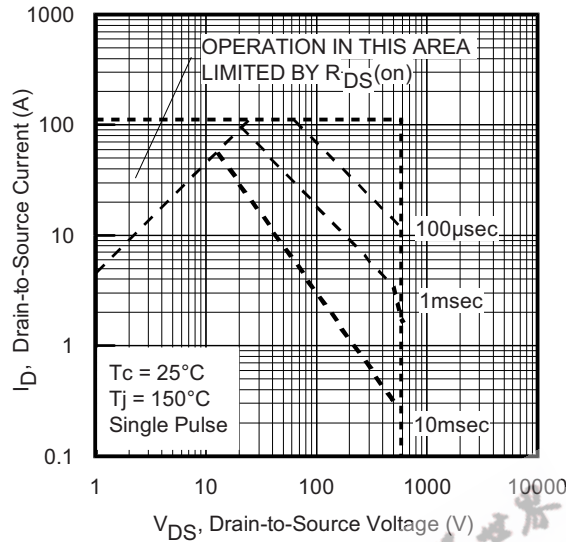


Fig. 9 - Maximum Safe Operating Area

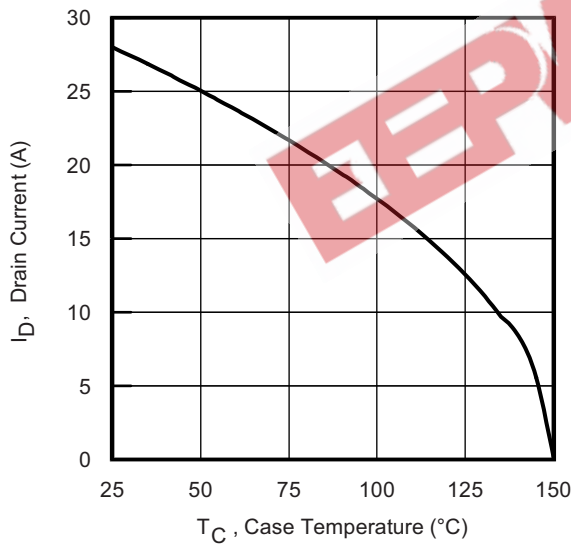


Fig. 10 - Maximum Drain Current vs. Case Temperature

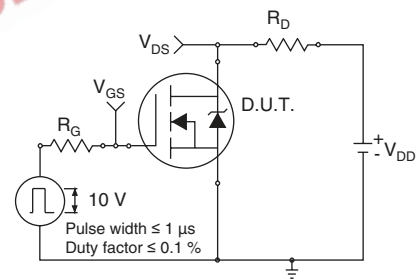


Fig. 11a - Switching Time Test Circuit

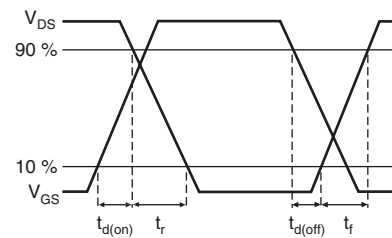


Fig. 11b - Switching Time Waveforms

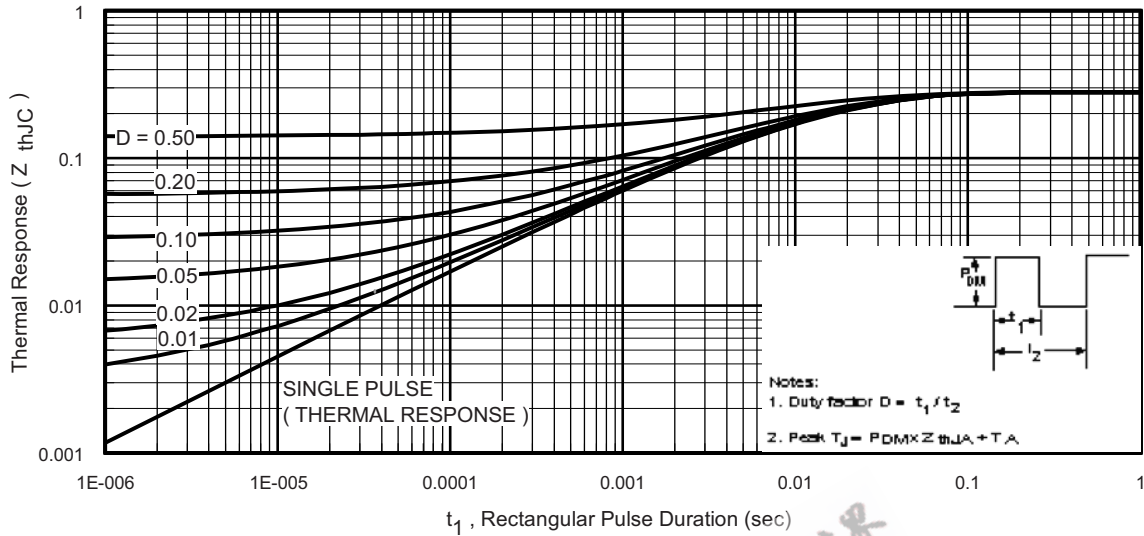


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

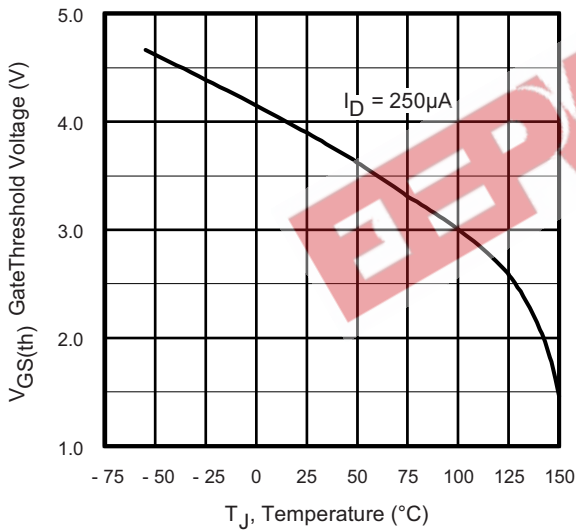


Fig. 13 - Threshold Voltage vs. Temperature

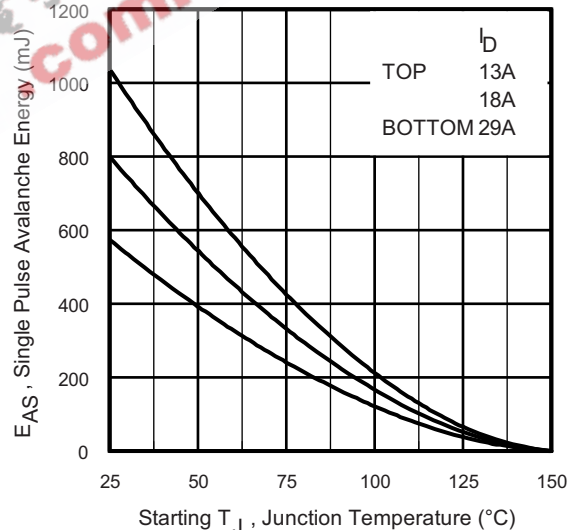


Fig. 14a - Maximum Avalanche Energy vs. Drain Current

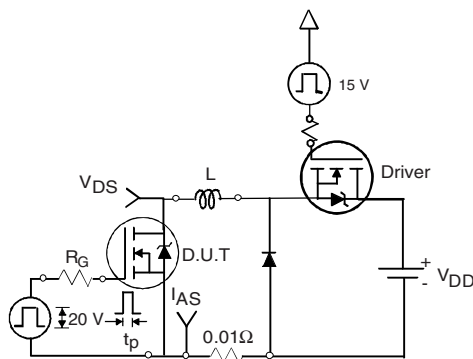
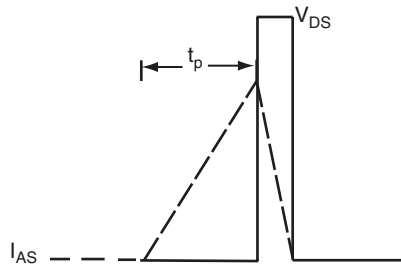
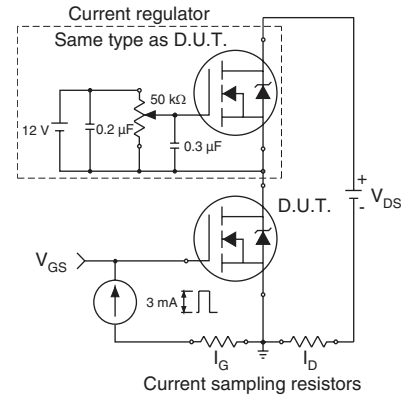


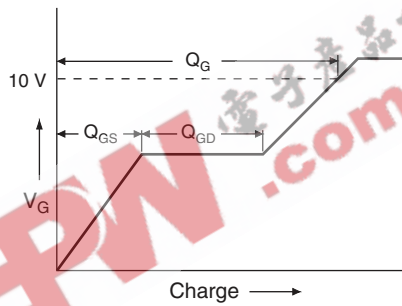
Fig. 14b - Unclamped Inductive Test Circuit



**Fig. 14c - Unclamped Inductive Waveforms**

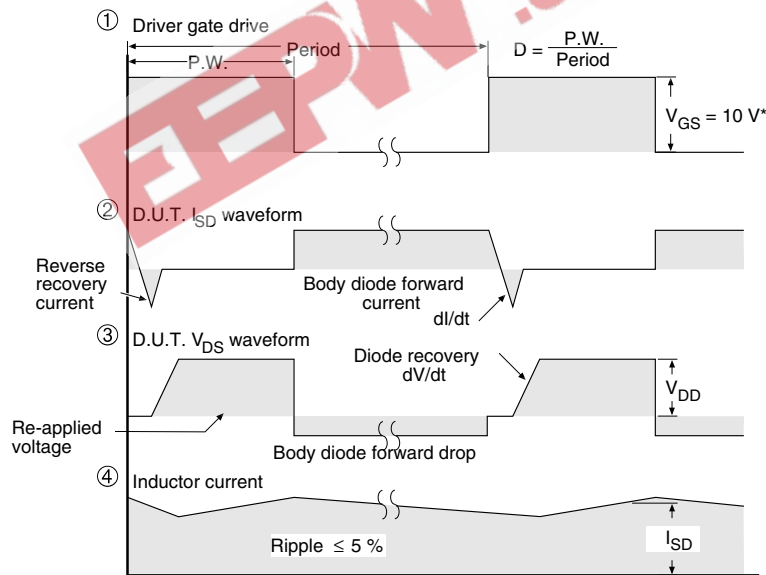
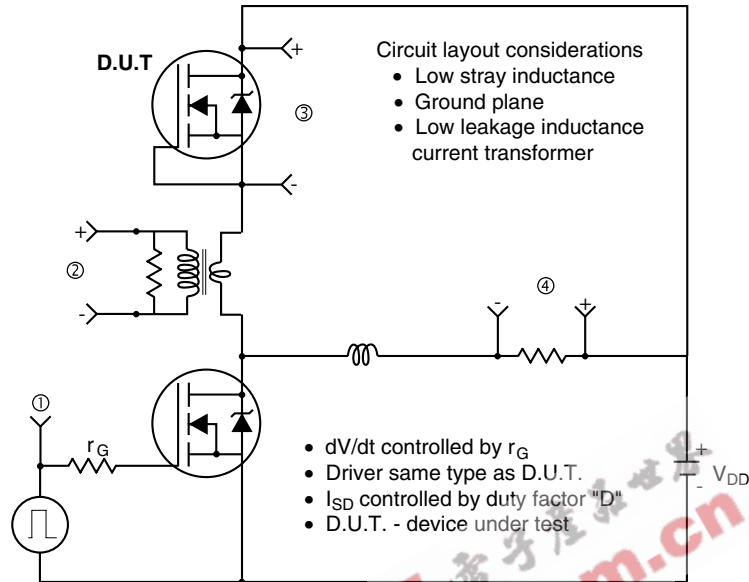


**Fig. 15a - Gate Charge Test Circuit**



**Fig. 15b - Basic Gate Charge Waveform**

## Peak Diode Recovery dV/dt Test Circuit



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

Fig. 16 - For N-Channel

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