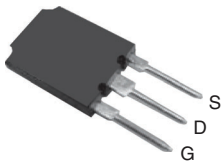
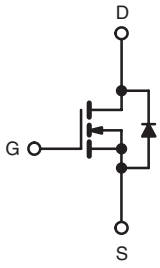
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	600	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.110
Q_g (Max.) (nC)	330	
Q_{gs} (nC)	84	
Q_{gd} (nC)	150	
Configuration	Single	





N-Channel MOSFET

FEATURES

- Low Gate Charge Q_g Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dV/dt Capability
- Lead (Pb)-free Available

Available

RoHS* COMPLIANT

APPLICATIONS

- Hard Switching Primary or PFC Switch
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Motor Drive

ORDERING INFORMATION	
Package	Super-247™
Lead (Pb)-free	IRFPS40N60KPbF
	SiHFPS40N60K-E3
SnPb	IRFPS40N60K
	SiHFPS40N60K

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	I_D	40	A
		T_C = 100 °C		24	
Pulsed Drain Current[a]			I_{DM}	160	
Linear Derating Factor				4.5	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	600	mJ
Repetitive Avalanche Current[a]			I_{AR}	40	A
Repetitive Avalanche Energy[a]			E_{AR}	57	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	570	W
Peak Diode Recovery dV/dt[c]			dV/dt	7.5	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]	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Starting T_J = 25 °C, L = 0.84 mH, R_G = 25 Ω, I_{AS} = 38 A, dV/dt = 5.5 V/ns (see fig. 12a).
c. $I_{SD} \leq$ 38 A, dI/dt ≤ 150 A/µs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 150 °C.
d. 1.6 mm from case.

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

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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}	-	0.22	

SPECIFICATIONS T_J = 25 °C, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA		-	0.63	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V		-	-	50	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 24 A[b]	-	0.110	0.130	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 24 A[b]		21	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	7970	-	pF
Output Capacitance	C_{oss}			-	750	-	
Reverse Transfer Capacitance	C_{rss}			-	75	-	
Output Capacitance	C_{oss}	V_{GS} = 0 V	V_{DS} = 1.0 V , f = 1.0 MHz	-	9440	-	
			V_{DS} = 480 V , f = 1.0 MHz	-	200	-	
Effective Output Capacitance	C_{oss} eff.		V_{DS} = 0 V to 480 V[c]	-	260	-	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 38 A, V_{DS} = 480 V, see fig. 6 and 13[b]	-	-	330	nC
Gate-Source Charge	Q_{gs}			-	-	84	
Gate-Drain Charge	Q_{gd}			-	-	150	
Turn-On Delay Time	$t_{d(on)}$		V_{DD} = 300 V, I_D = 38 A, R_G = 4.3 Ω, see fig. 10[b]	-	47	-	ns
Rise Time	t_r			-	110	-	
Turn-Off Delay Time	$t_{d(off)}$			-	97	-	
Fall Time	t_f			-	60	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	40	A
Pulsed Diode Forward Current[a]	I_{SM}			-	-	160	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 38 A, V_{GS} = 0 V[b]		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C	I_F = 38 A, dI/dt = 100 A/µs	-	630	950	ns
		T_J = 125 °C		-	730	1090	
Body Diode Reverse Recovery Charge	Q_{rr}	T_J = 25 °C		-	14	20	µC
		T_J = 125 °C		-	17	25	
Body Diode Recovery Current	I_{RRM}	T_J = 25 °C		-	39	58	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 ≤ 300 µs; duty cycle ≤ 2 %.

c. C_{oss} 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}.

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TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

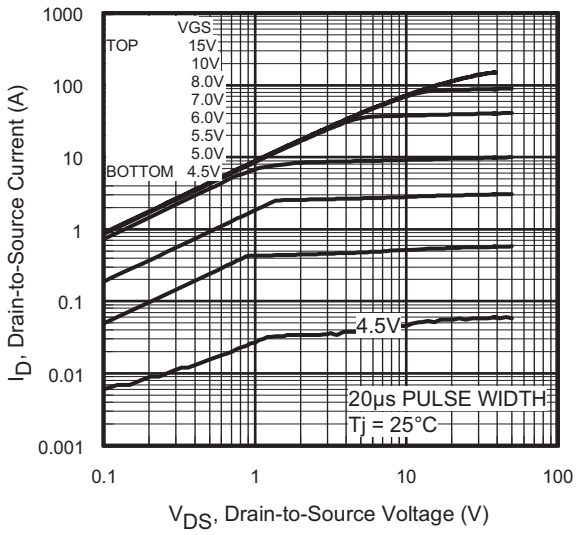

Fig. 1 - Typical Output Characteristics

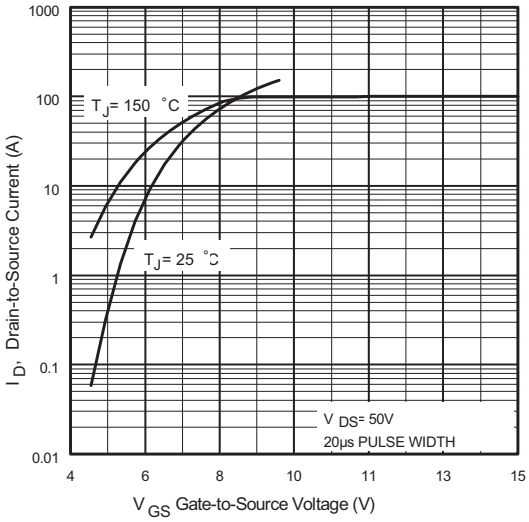

Fig. 3 - Typical Transfer Characteristics

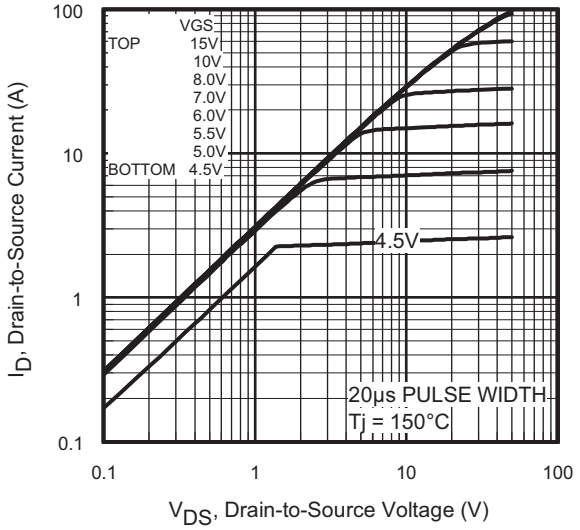

Fig. 2 - Typical Output Characteristics

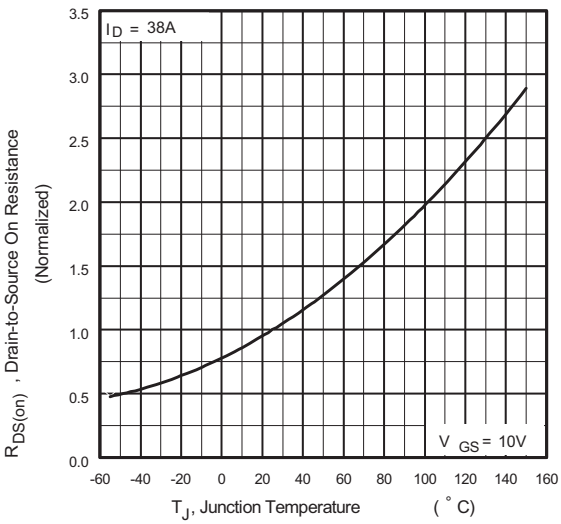

Fig. 4 - Normalized On-Resistance vs. Temperature

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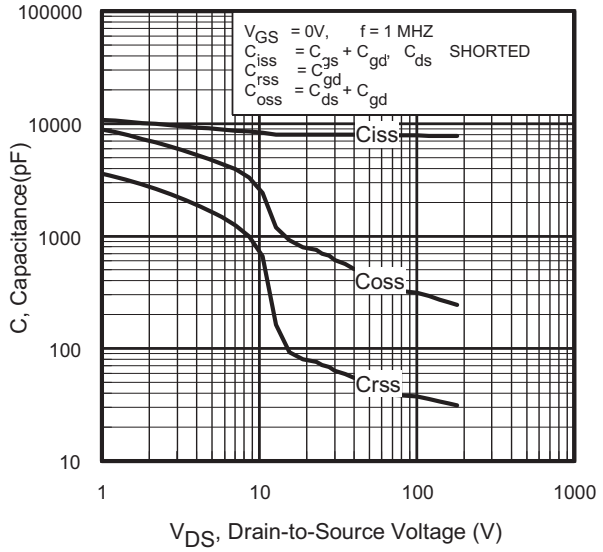

Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

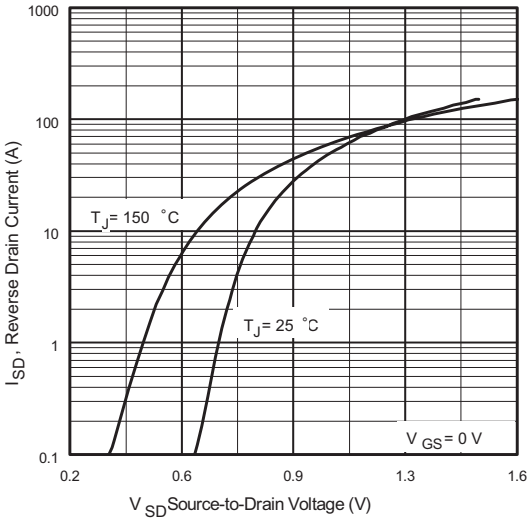

Fig. 7 - Typical Source-Drain Diode Forward Voltage

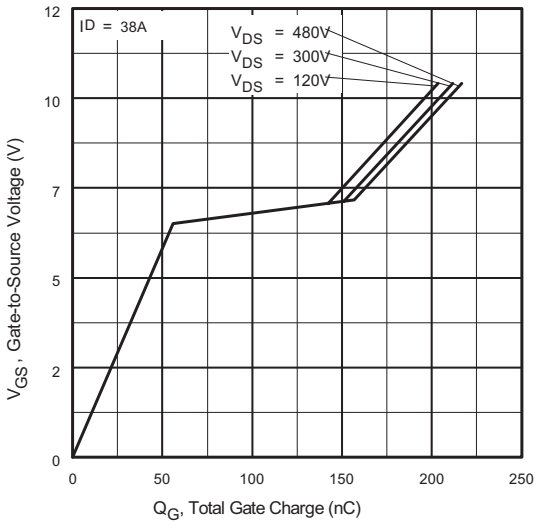

Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

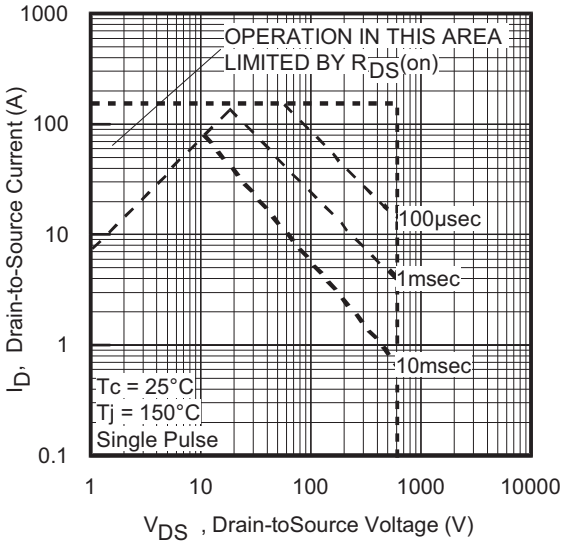

Fig. 8 - Maximum Safe Operating Area

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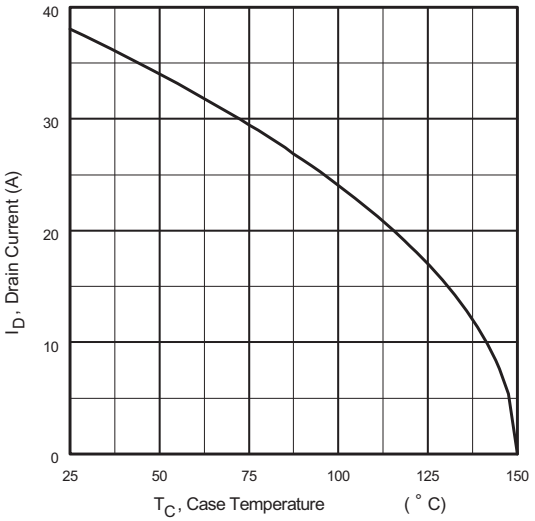

Fig. 9 - Maximum Drain Current vs. Case Temperature

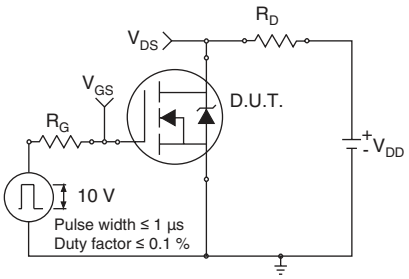

Fig. 10a - Switching Time Test Circuit

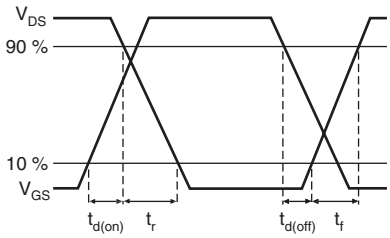

Fig. 10b - Switching Time Waveforms

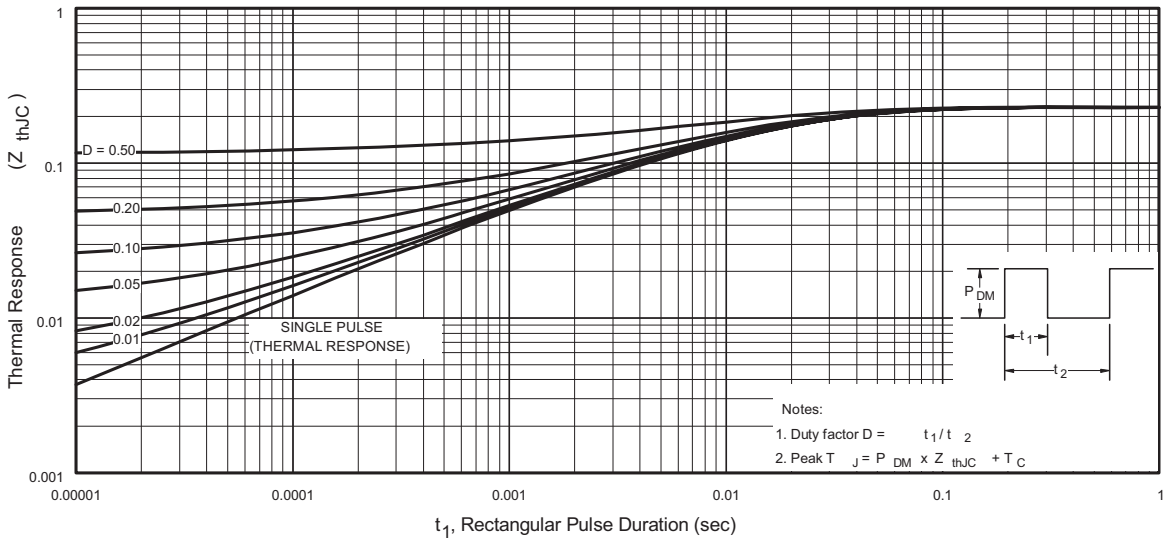

Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

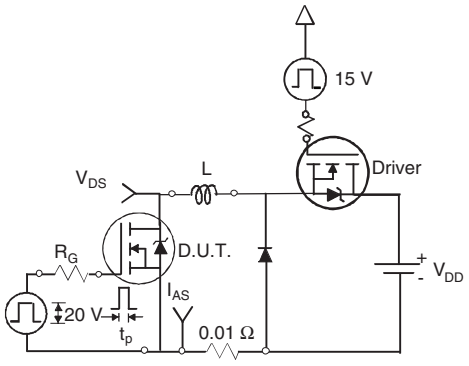

Fig. 12a - Unclamped Inductive Test Circuit

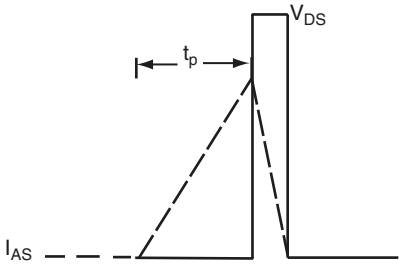

Fig. 12b - Unclamped Inductive Waveforms

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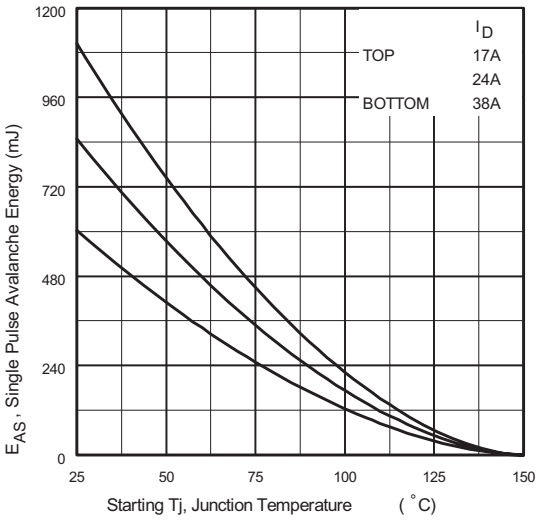

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

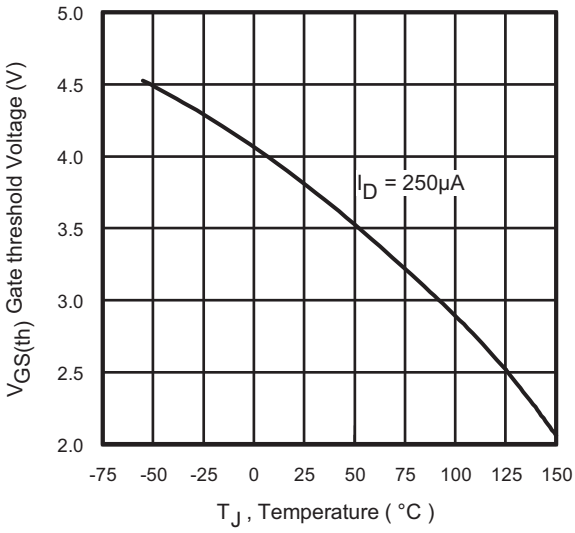

Fig. 12d - Threshold Voltage vs. Temperature

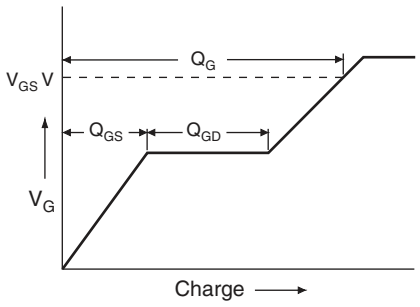

Fig. 13a - Basic Gate Charge Waveform

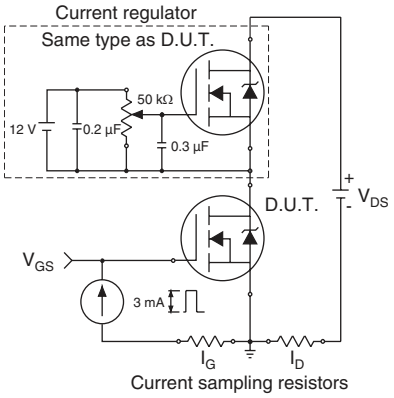

Fig. 13b - Gate Charge Test Circuit

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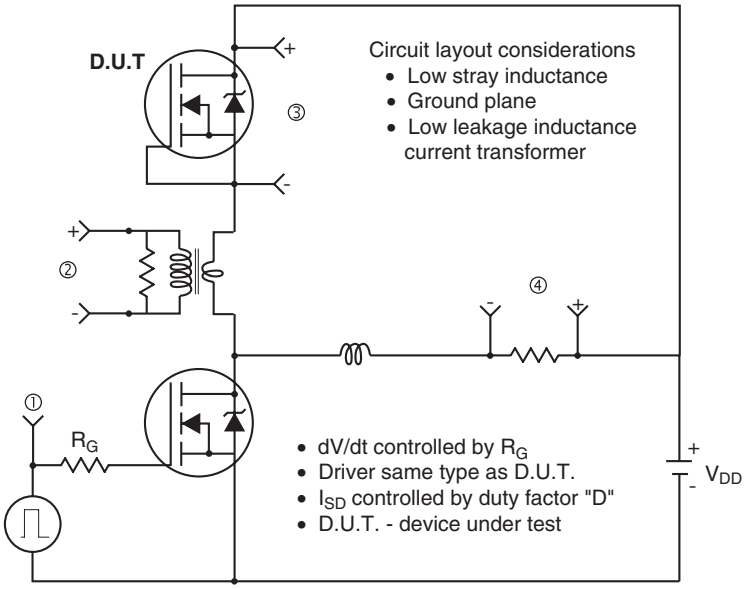
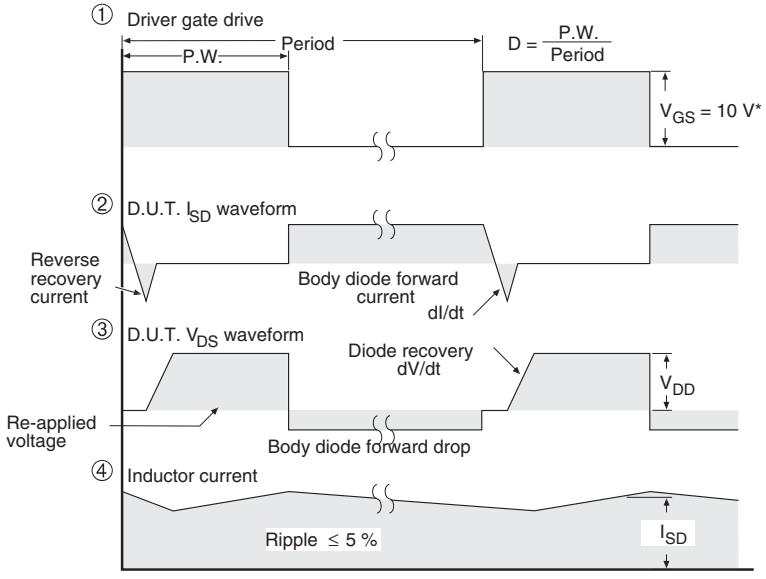
Peak Diode Recovery dV/dt Test Circuit





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

Fig. 14 - For N-Channel

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