500V N-Channel MOSFET

Lead Free Package and Finish

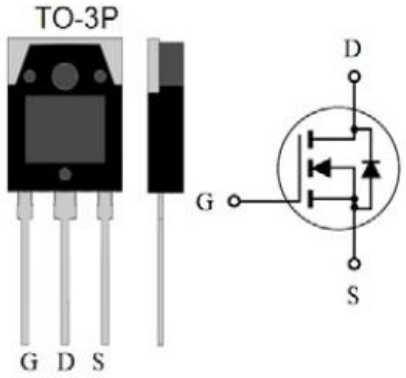
BV_{DSS}	$R_{DS(ON),typ.}$	I_D
500V	85mΩ	46A

General Features

- Advanced Planar Process
- $R_{DS(ON),typ.}$=85 mΩ@V_{GS}=10V
- Low Gate Charge Minimize Switching Loss
- Rugged Poly silicon Gate Structure

Applications

- BLDC Motor Driver
- Electric Welder
- High Efficiency SMPS



Ordering Information

Part Number	Package	Brand
PTW40N50	TO-3P	

Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter	PTW40N50	Unit
V_{DSS}	Drain-to-Source Voltage	500	V
V_{GSS}	Gate-to-Source Voltage	±30	
I_D	Continuous Drain Current	46	A
	Continuous Drain Current @ Tc=100℃	30	
I_{DM}	Pulsed Drain Current at V_{GS}=10V[2,4]	180	
E_{AS}	Single Pulse Avalanche Energy	5000	mJ
dv/dt	Peak Diode Recovery dv/dt[3]	5.0	V/ns
P_D	Power Dissipation	540	W
	Derating Factor above 25℃	4.32	W/℃
T_L T_{PAK}	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260	℃
T_J& T_{STG}	Operating and Storage Temperature Range	-55 to 150	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	PTW40N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.23	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	50	

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Electrical Characteristics

OFF Characteristics

T_J =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	500	--	--	V	V_{GS}=0V, I_D=250uA
I_{DSS}	Drain-to-Source Leakage Current	--	--	5	uA	V_{DS}=500V, V_{GS}=0V
		--	--	500		V_{DS}=400V, V_{GS}=0V, T_J =125℃
I_{GSS}	Gate-to-Source Leakage Current	--	--	+100	nA	V_{GS}=+30V, V_{DS}=0V
		--	--	-100		V_{GS}=-30V, V_{DS}=0V

ON Characteristics

T_J =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	85	100	mΩ	V_{GS}=10V, I_D=23A
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=V_{GS}, I_D=250uA
g_{FS}	Forward Transconductance	--	32	--	S	V_{DS} =25V, I_D=23A

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	1.0	--	nF	V_{GS}=0V, V_{DS}=25V, f=1.0MH_Z
C_{rss}	Reverse Transfer Capacitance	--	0.1	--		
C_{oss}	Output Capacitance	--	0.7	--		
Q_g	Total Gate Charge	--	138	--	nC	V_{DD}=250V, I_D=23A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	38	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	27	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	25	--	nS	V_{DD}=250V, I_D=23A, V_{GS}= 10V R_G=10Ω
t_{rise}	Rise Time	--	39	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	100	--		
t_{fall}	Fall Time	--	36	--		

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Source-Drain Body Diode Characteristics

T_J=25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current[2]	--	--	46	A	Integral PN-diode in MOSFET
I_{SM}	Pulsed Source Current[2]	--	--	180		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	I_S=46A, V_{GS}=0V
trr	Reverse recovery time	--	730	--	ns	V_{GS}=0V ,I_F=46A, di_F/dt=100A/μs
Qrr	Reverse recovery charge	--	3.0	--	uC	

Note:

[1] T_J=+25℃ to +150℃ .
[2] Silicon limited current only.
[3] Package limited current.
[4] Repetitive rating; pulse width limited by maximum junction temperature.
[5] Pulse width≤380μs; duty cycle≤2%.

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Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

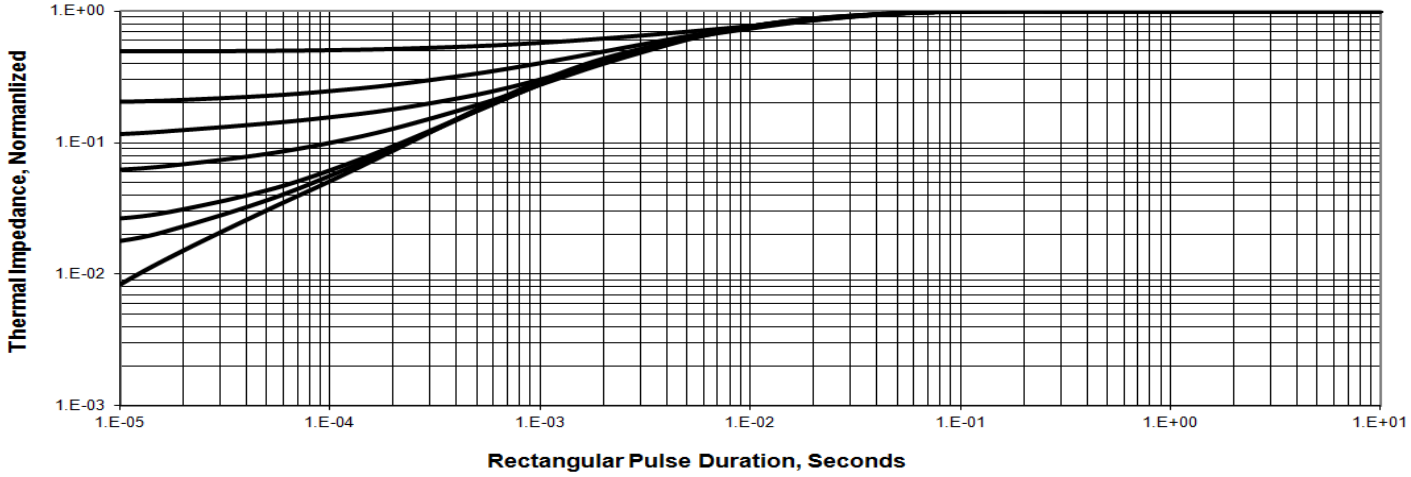


Figure 2 . Max. Power Dissipation vs Case Temperature

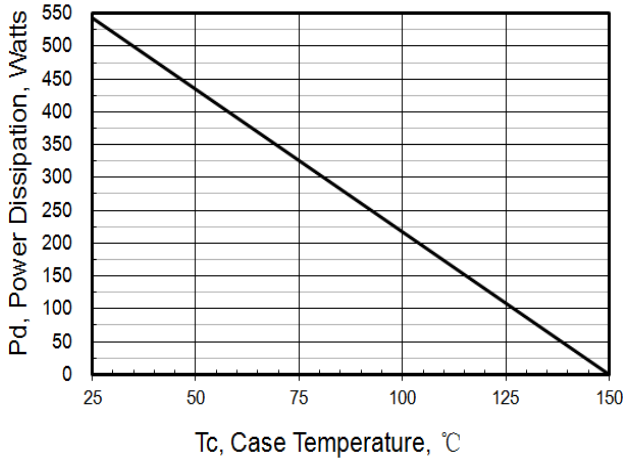


Figure 3 .Maximum Continuous Drain Current vs Tc

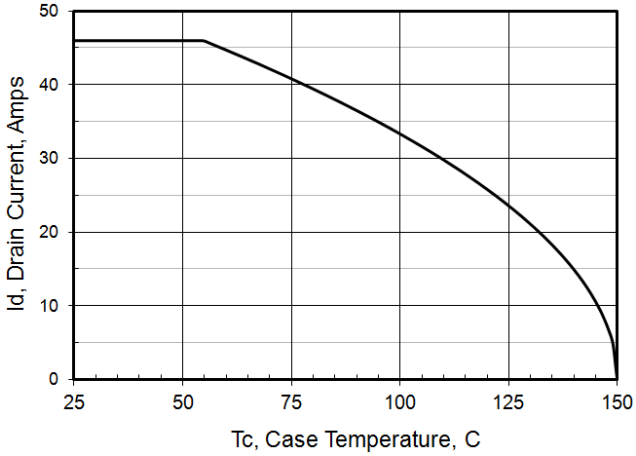


Figure 4. Typical Output Characteristics

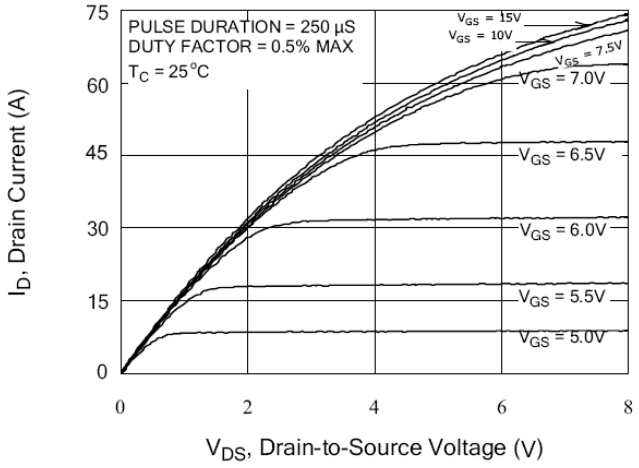
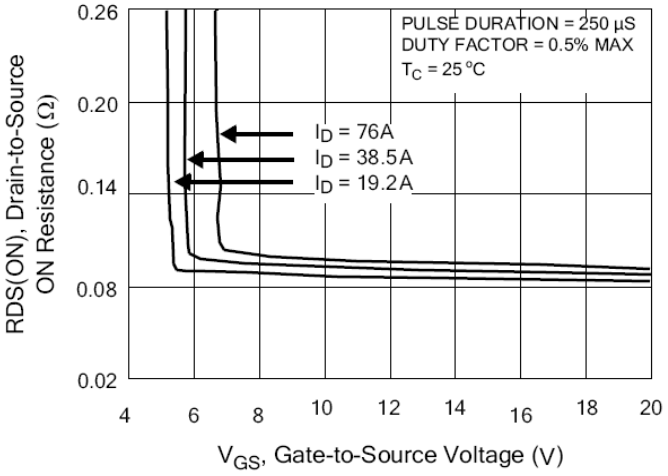


Figure5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



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Typical Characteristics(Cont.)

Figure 6. Peak Current Capability

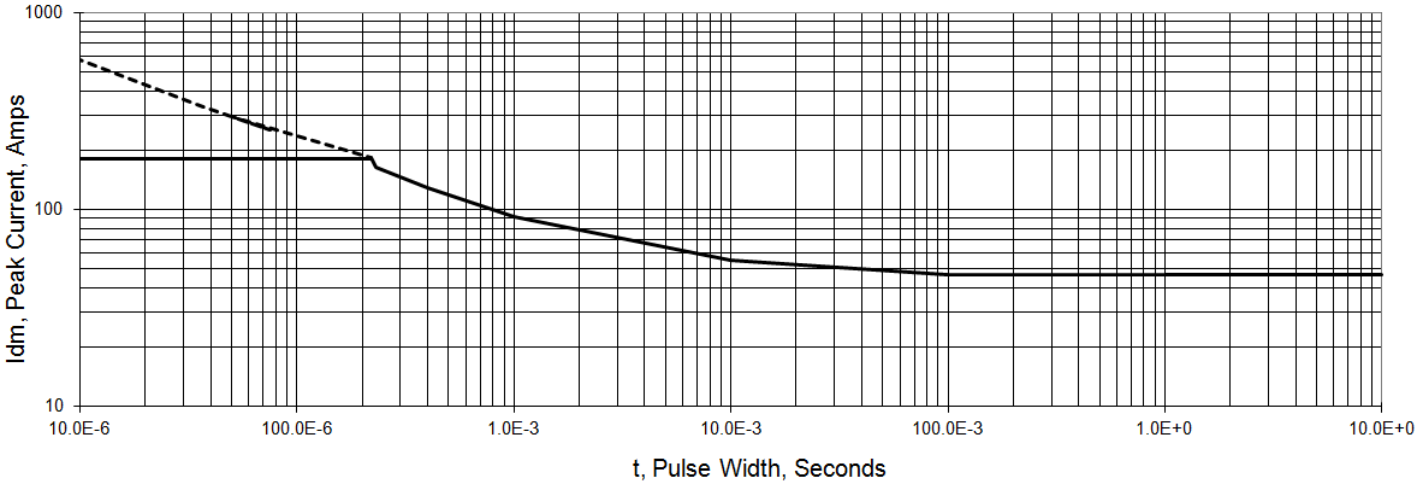


Figure 7. Typical Transfer Characteristics

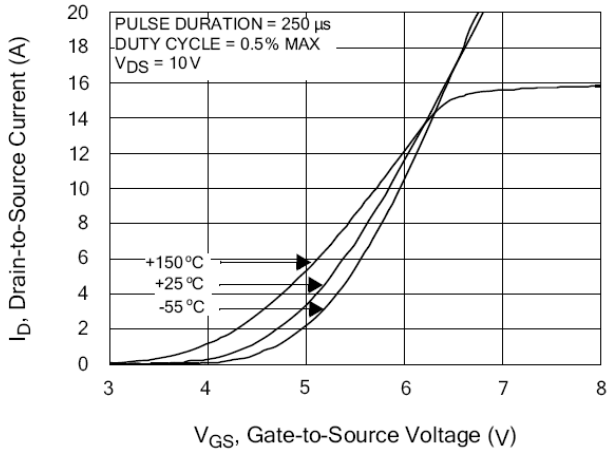


Figure8. Unclamped Inductive Switching Capability

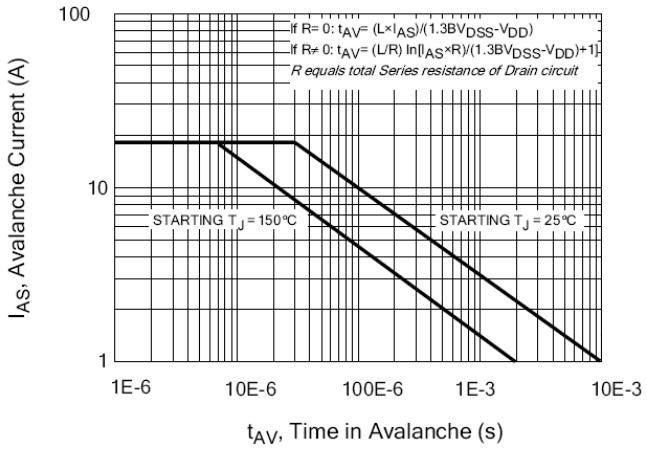


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

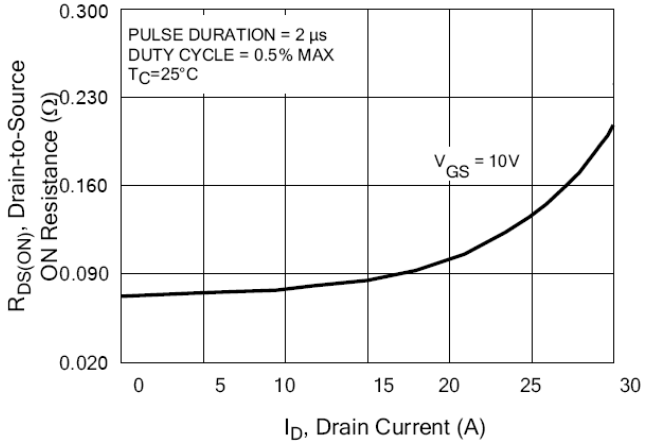
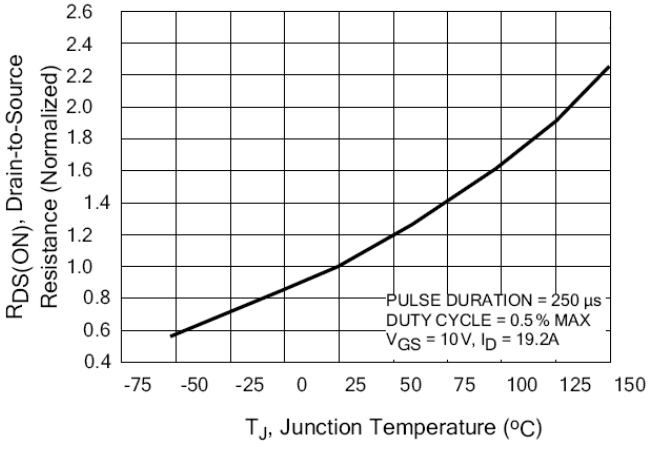


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature



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Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

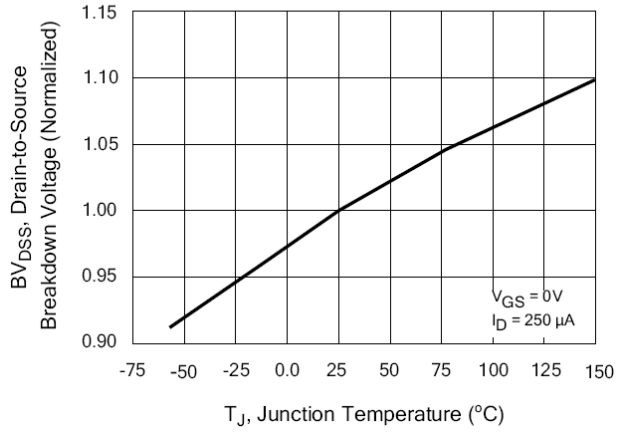


Figure 12. Typical Threshold Voltage vs Junction Temperature

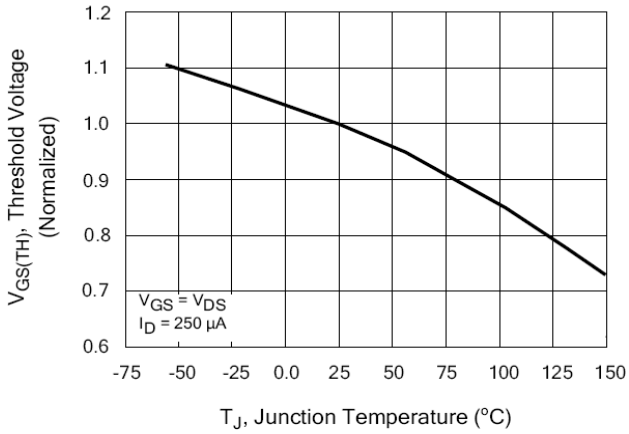


Figure 13. Maximum Forward Bias Safe Operating Area

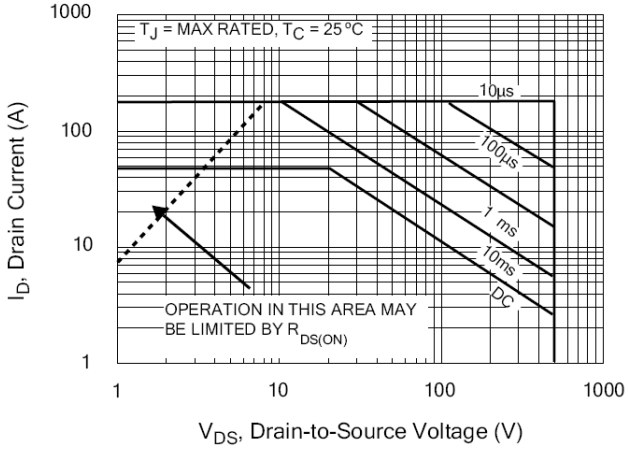


Figure 14. Typical Capacitance vs Drain-to-Source Voltage

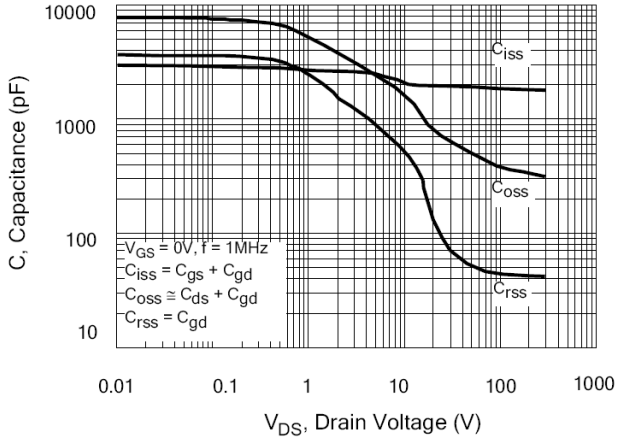


Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

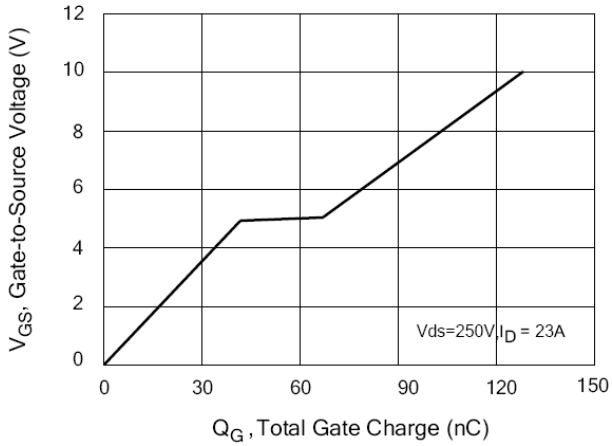
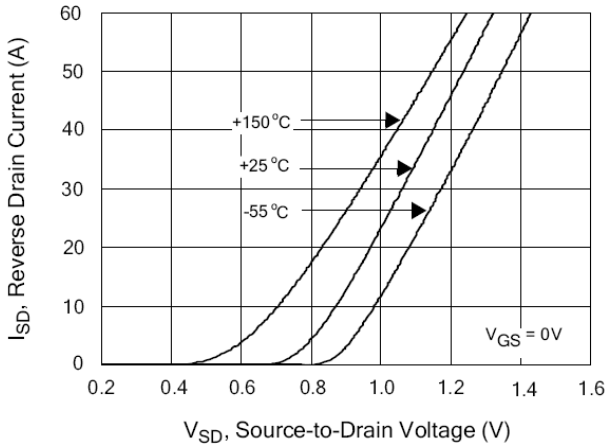


Figure 16. Typical Body Diode Transfer Characteristics



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Test Circuits and Waveforms

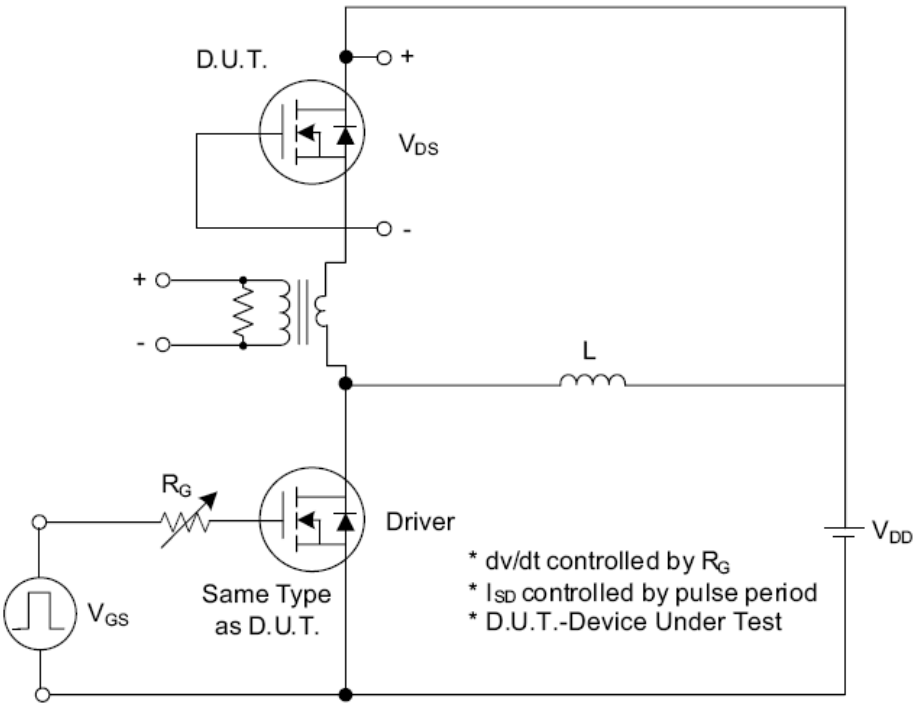

Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

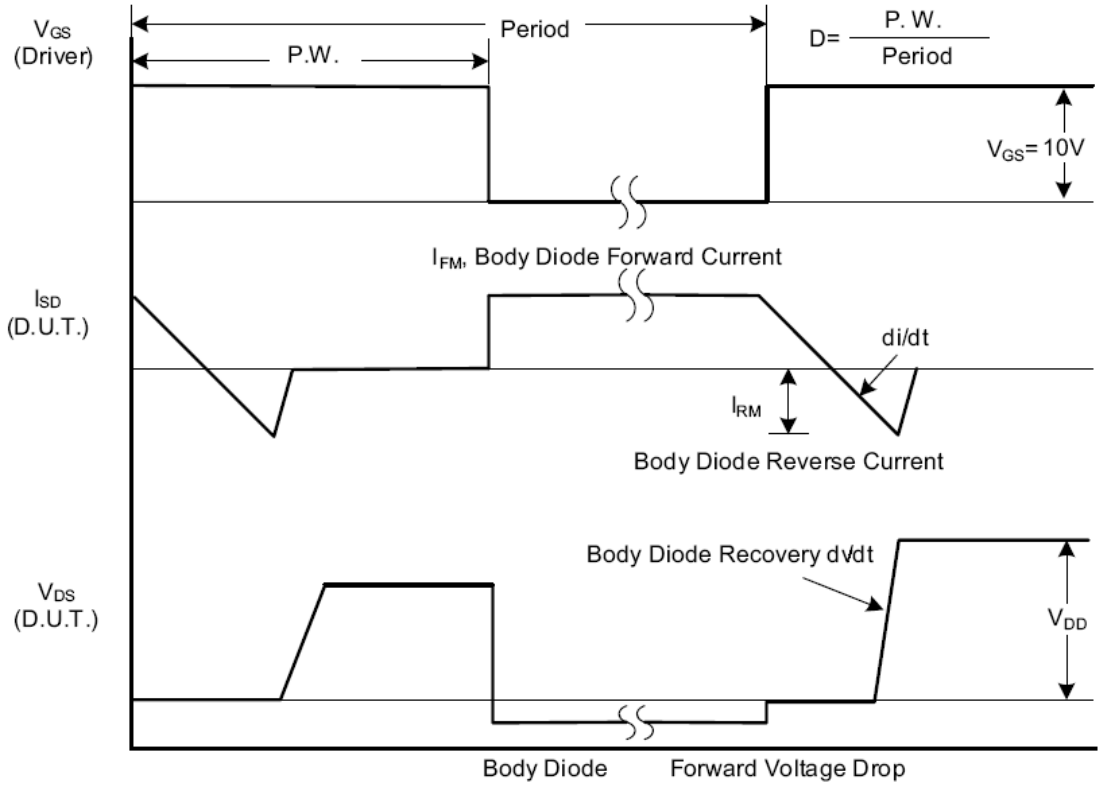

Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

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Test Circuits and Waveforms (Cont.)

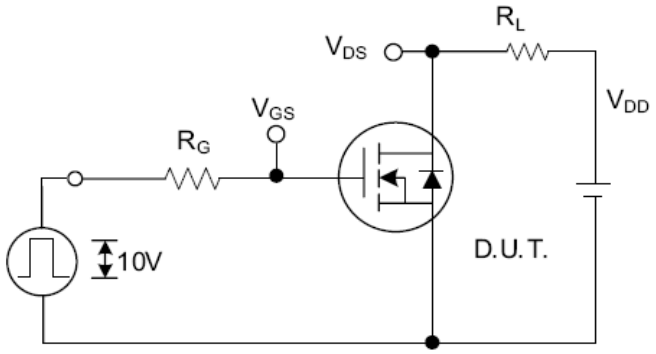

Fig. 2.1 Switching Test Circuit

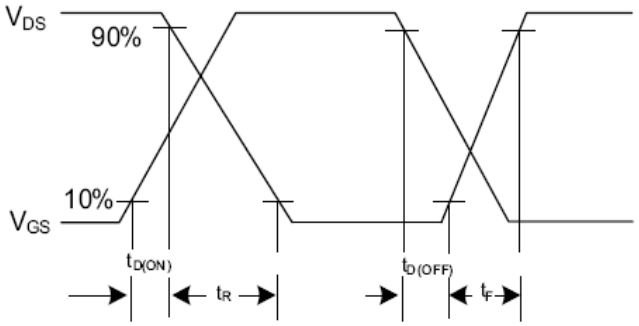

Fig. 2.2 Switching Waveforms

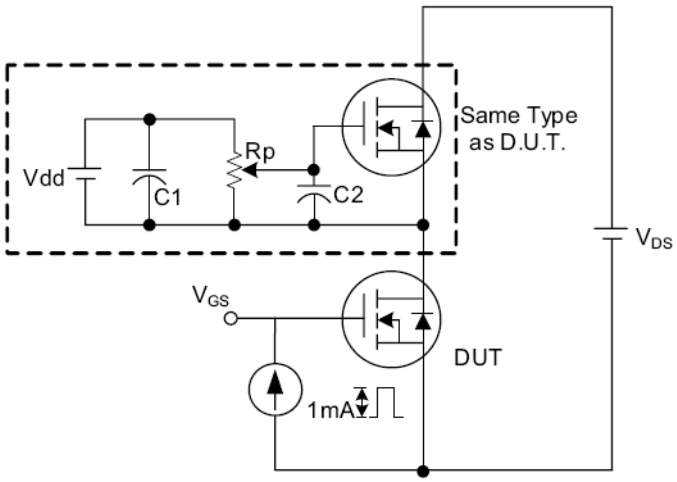

Fig. 3 . 1 Gate Charge Test Circuit

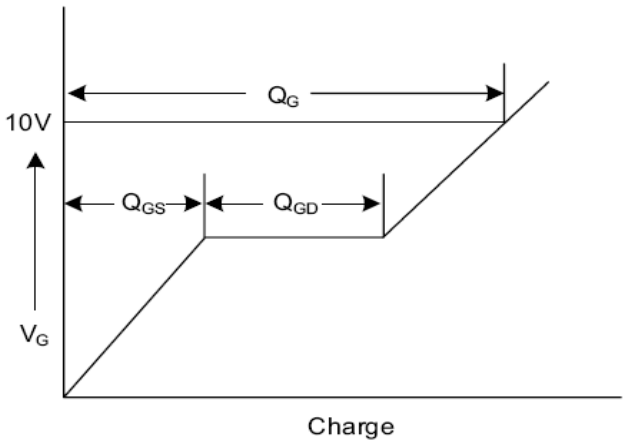

Fig. 3 . 2 Gate Charge Waveform

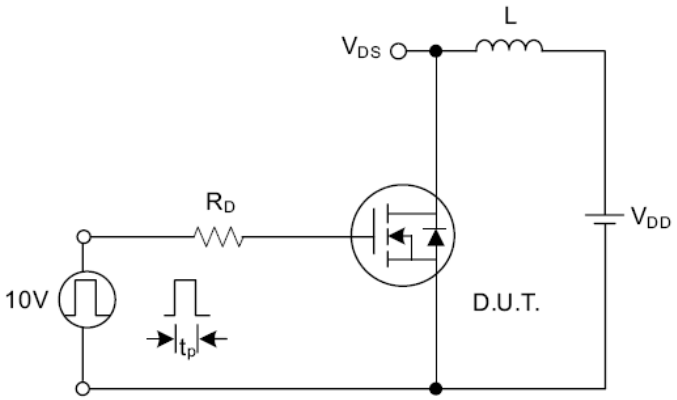

Fig. 4.1 Unclamped Inductive Switching Test Circuit

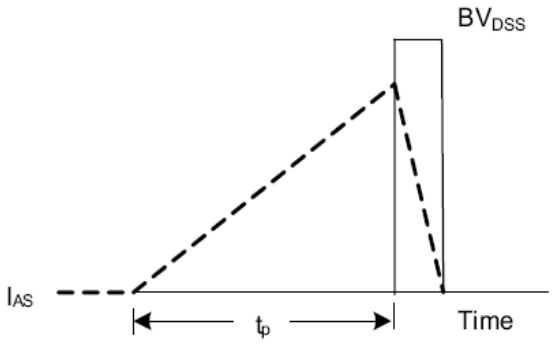

Fig. 4.2 Unclamped Inductive Switching Waveforms

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   b. support or sustain life,
   c. whose failure to perform when properly used in accordance with instructions for used provided in the labeling, can be reasonably expected to result in significant injury to the user.
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