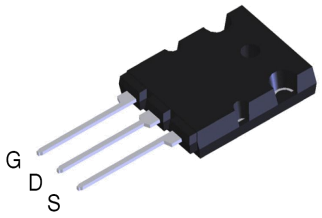
500V N-Channel MOSFET

Lead Free Package and Finish

BV_{DSS}	$R_{DS(ON),typ.}$	I_D
500V	47mΩ	94A

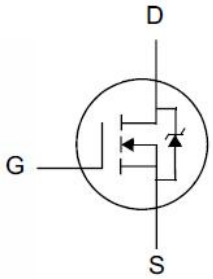
General Features

- Proprietary New Planar Technology
- $R_{DS(ON),typ.}$=47 mΩ@V_{GS}=10V
- Low Gate Charge Minimize Switching Loss
- Fast Intrinsic Diode,Fast Recovery Body Diode



TO-264

Package Not to Scale



Applications

- Uninterruptible Power Supply
- AC−DC Power Supply
- SMPS

Ordering Information

Part Number	Package	Brand
PTK94N50FD	TO-264	

Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter	PTK94N50FD	Unit
V_{DSS}	Drain-to-Source Voltage[1]	500	V
V_{GSS}	Gate-to-Source Voltage	±30	
I_D	Continuous Drain Current	94	A
$I_{D\ @\ Tc\ =100℃}$	Continuous Drain Current @ Tc=100℃	65	
I_{DM}	Pulsed Drain Current at V_{GS}=10V[2]	376	
E_{AS}	Single Pulse Avalanche Energy	6000	mJ
E_{AR}	Avalanche Energy ,Repetitive	500	
dv/dt	Peak Diode Recovery dv/dt[3]	30	V/ns
P_D	Power Dissipation	1300	W
	Derating Factor above 25℃	12	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	PTK94N50FD	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.096	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	30	

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	--	--	10	uA	V_{DS}=500V, V_{GS}=0V
		--	--	1000		V_{DS}=400V, V_{GS}=0V, T_J =125℃
I_{GSS}	Gate-to-Source Leakage Current	--	--	+200	nA	V_{GS}=+30V, V_{DS}=0V
		--	--	-200		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[4]	--	47	65	mΩ	V_{GS}=10V, I_D=20A
$V_{GS(TH)}$	Gate Threshold Voltage	3.0	--	5.0	V	V_{DS}=V_{GS}, I_D=250uA
gfs	Forward Transconductance[4]	--	75	--	S	V_{DS}=20V,I_D=26A

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	13420	--	pF	V_{GS}=0V, V_{DS}=25V, f=1.0MHz
C_{rss}	Reverse Transfer Capacitance	--	58	--		
C_{oss}	Output Capacitance	--	1250	--		
Q_g	Total Gate Charge	--	225	--	nC	V_{DD}=250V, I_D=47A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	65	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	58	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	36	--	nS	V_{DD}=250V, I_D=47A, V_{GS}= 10V R_G=1.0Ω
t_{rise}	Rise Time	--	15	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	75	--		
t_{fall}	Fall Time	--	15	--		

Source-Drain Body Diode Characteristics

T_J=25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current[4]	--	--	96	A	Integral PN-diode in MOSFET
I_{SM}	Pulsed Source Current[4]	--	--	376		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	I_S=94A, V_{GS}=0V
trr	Reverse recovery time	--	135	200	ns	V_{GS}=0V ,I_F=47A, di_F/dt=100A/μs
Qrr	Reverse recovery charge	--	1.3	--	uC	

Note:

[1] T_J=+25℃ to +150℃
[2] Repetitive rating; pulse width limited by maximum junction temperature.
[3] I_{SD}= 47A di/dt < 100 A/μs, V_{DD} < BV_{DSS}, T_J=+150℃.
[4] Pulse width≤380μs; duty cycle≤2%.

Typical Characteristics

Fig. 1. Output Characteristics @ T_J = 25°C

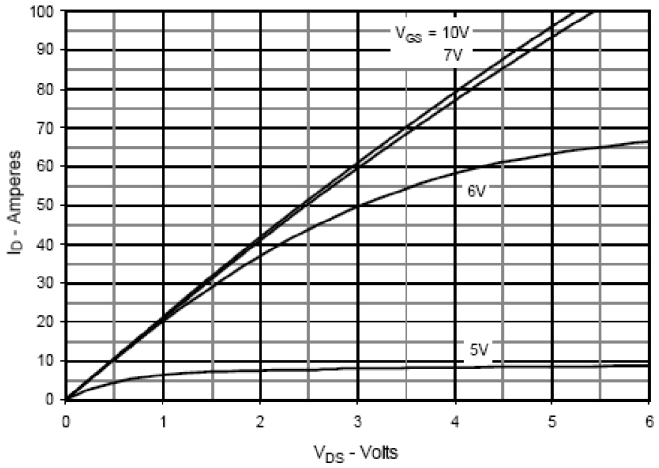


Fig. 2. Extended Output Characteristics @ T_J = 25°C

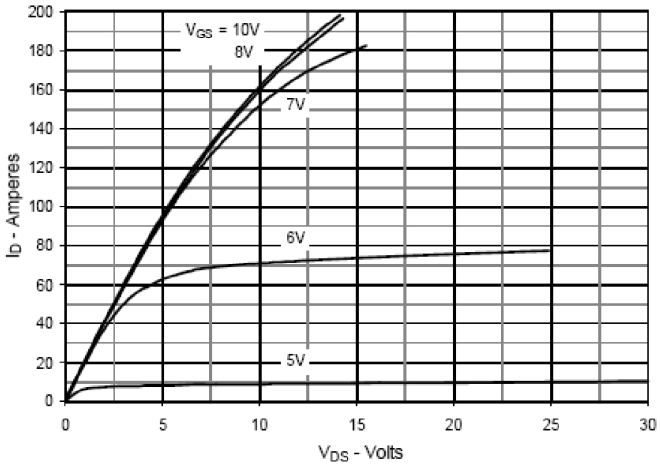


Fig. 3. Output Characteristics @ T_J = 125°C

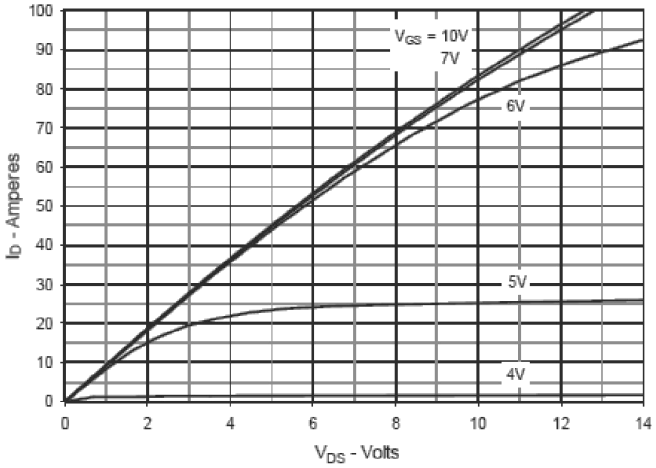


Fig. 4. $R_{DS(on)}$ Normalized to I_D = 47A Value vs. Junction Temperature

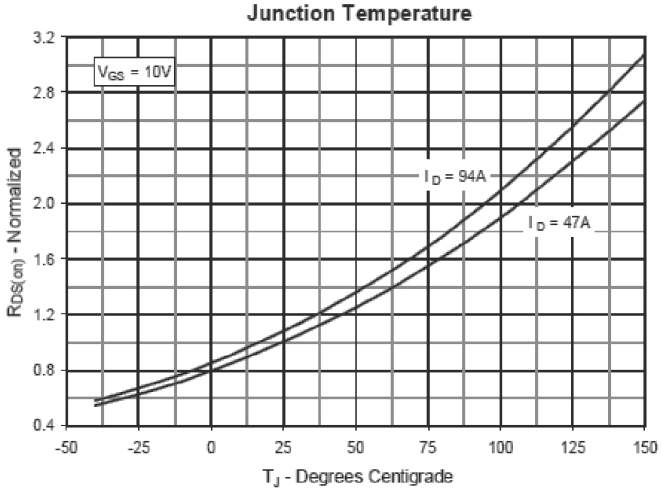


Fig. 5. $R_{DS(on)}$ Normalized to I_D = 47A Value vs. Drain Current

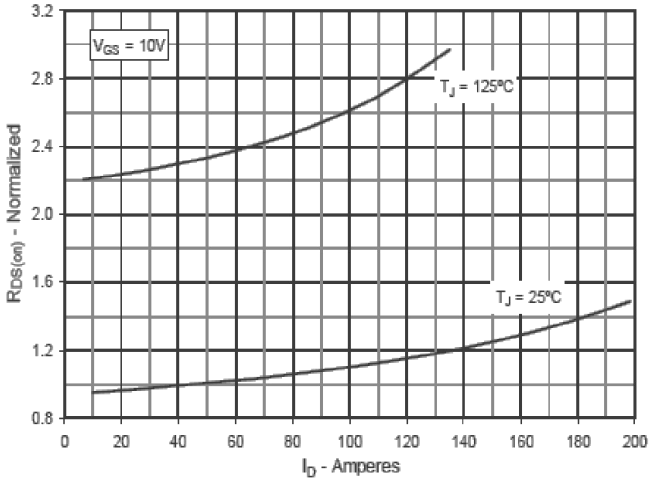
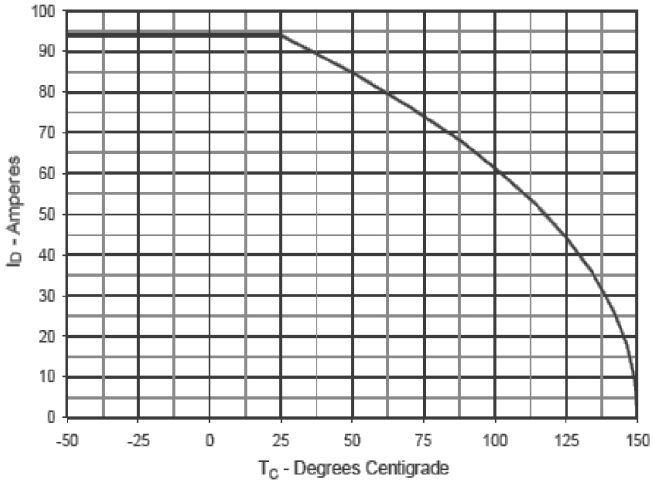


Fig. 6. Maximum Drain Current vs. Case Temperature



Typical Characteristics(Cont.)

Fig. 7. Input Admittance

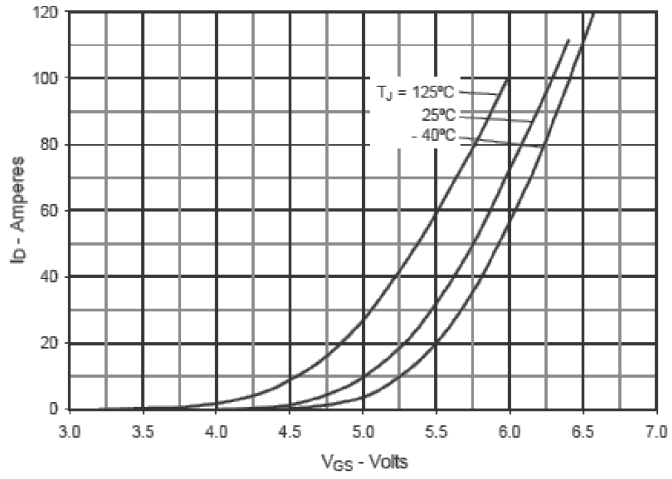


Fig. 8. Transconductance

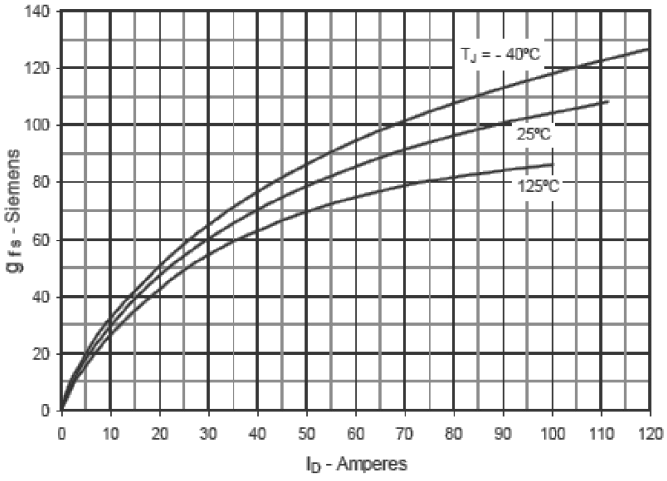


Fig. 9. Forward Voltage Drop of Intrinsic Diode

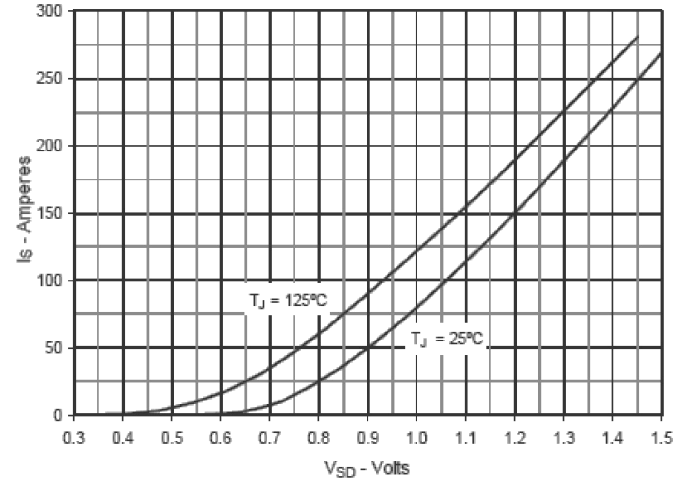


Fig. 10. Gate Charge

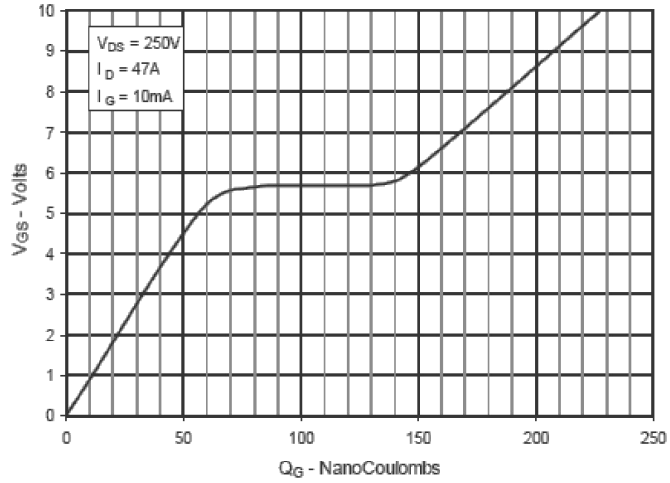


Fig. 11. Capacitance

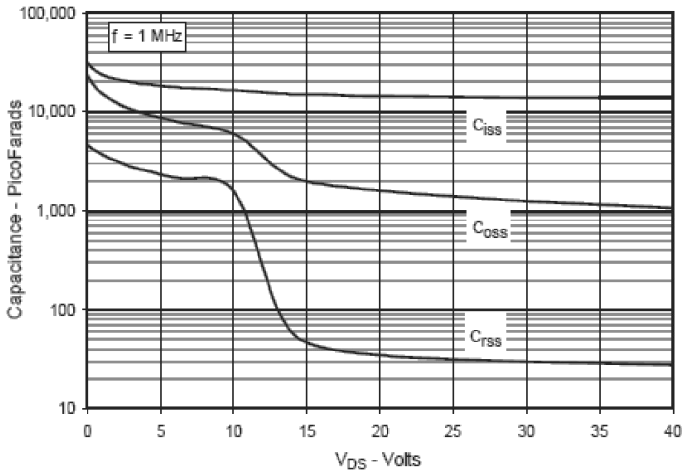
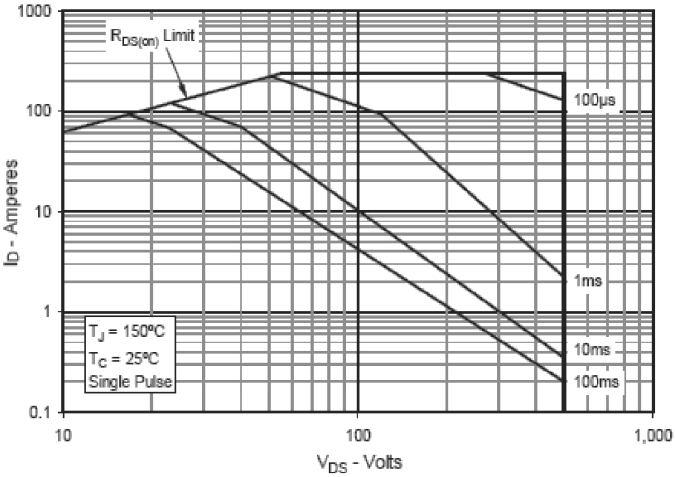
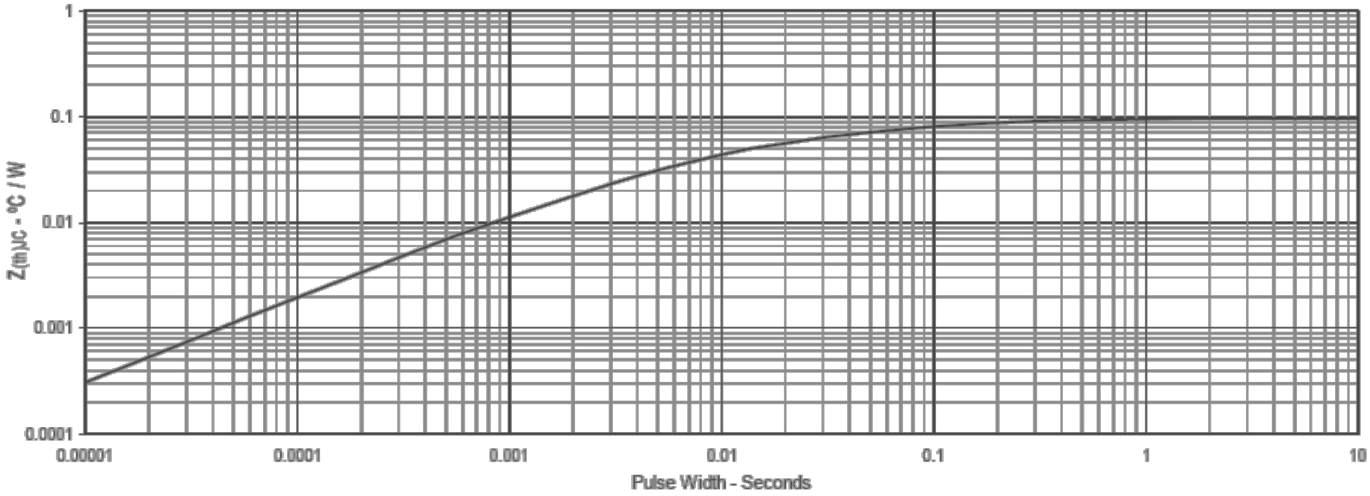


Fig. 12. Forward-Bias Safe Operating Area



Typical Characteristics(Cont.)

Fig. 13. Maximum Transient Thermal Impedance



Test Circuits and Waveforms

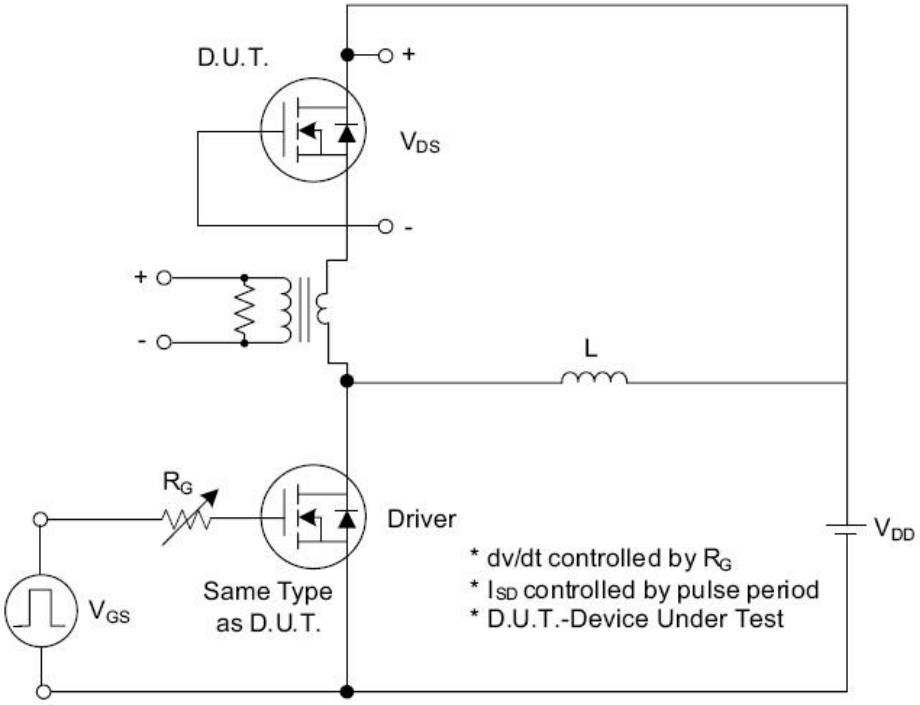


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

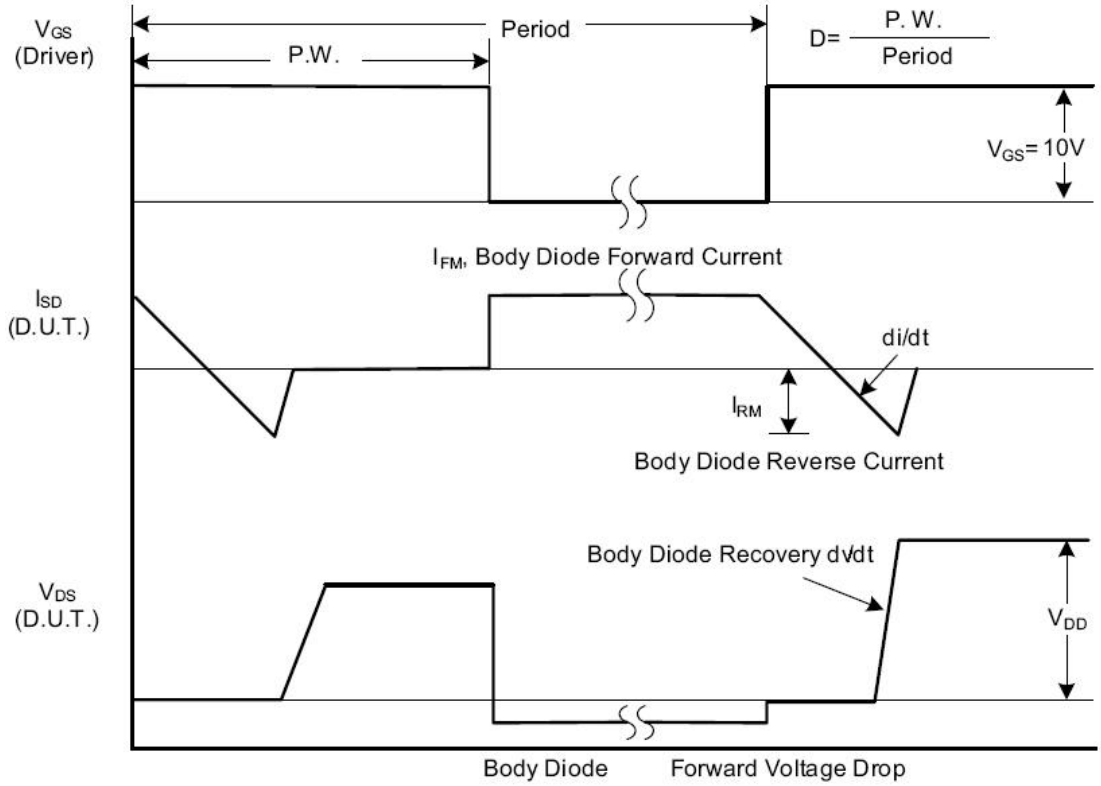


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms (Cont.)

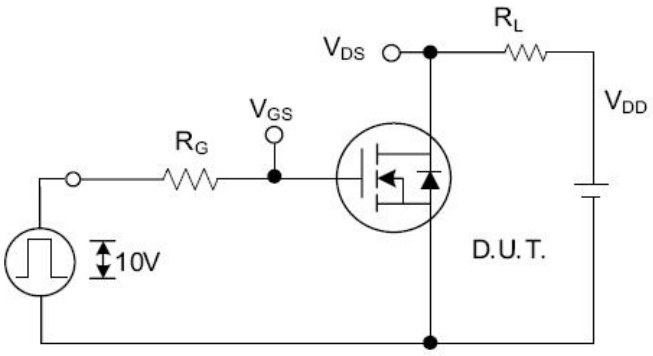


Fig. 2.1 Switching Test Circuit

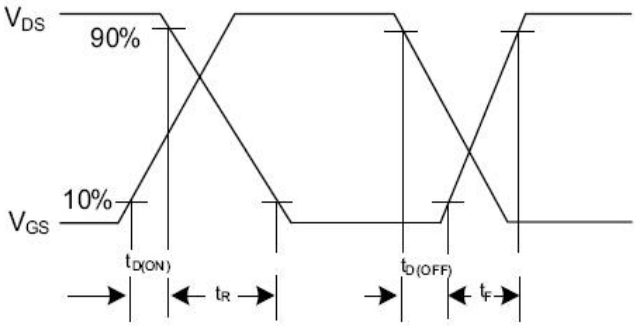


Fig. 2.2 Switching Waveforms

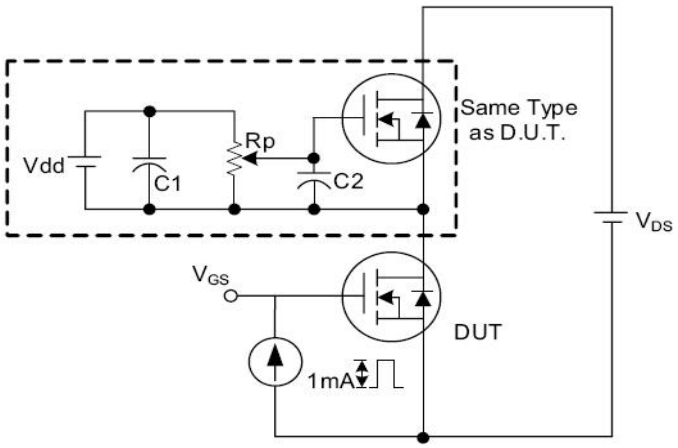


Fig. 3 . 1 Gate Charge Test Circuit

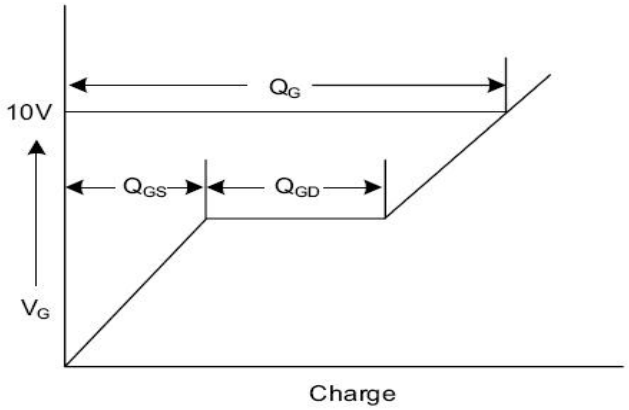


Fig. 3 . 2 Gate Charge Waveform

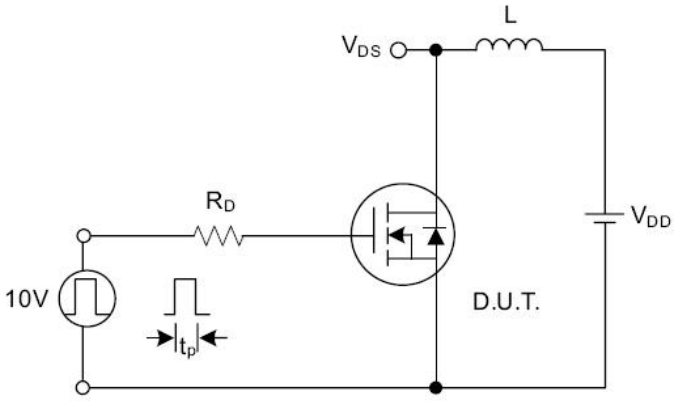


Fig. 4.1 Unclamped Inductive Switching Test Circuit

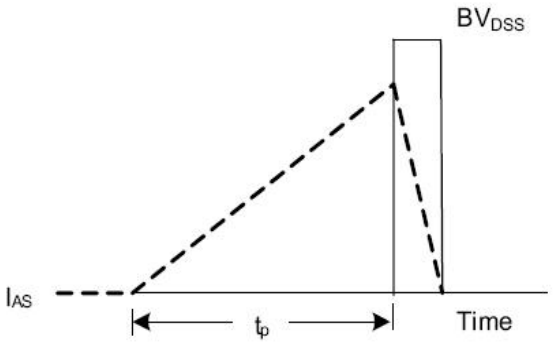


Fig. 4.2 Unclamped Inductive Switching Waveforms

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