PTW69N30

300V N-Channel MOSFET

BV$_{DSS}$	R$_{DS(ON),typ.}$	I$_D$
300V	35mΩ	69A

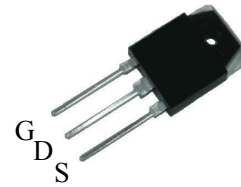### General Features

➤ Advanced Planar Process
➤ R$_{DS(ON),typ.}$=35 mΩ@V$_{GS}$=10V
➤ Low Gate Charge Minimize Switching Loss
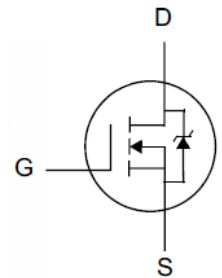➤ Rugged Poly silicon Gate Structure

Applications

➤ BLDC Motor Driver
➤ Electric Welder
➤ High Efficiency SMPS

TO-3P

Package Not to Scale

Ordering Information

Part Number	Package	Brand
PTW69N30	TO-3P	*i*

Absolute Maximum Ratings

T$_C$=25℃ unless otherwise specified

Symbol	Parameter	PTW69N30	Unit
V$_{DSS}$	Drain-to-Source Voltage	300	V
V$_{GSS}$	Gate-to-Source Voltage	±30	
I$_D$	Continuous Drain Current	69	A
	Continuous Drain Current @ Tc=100℃	42	
I$_{DM}$	Pulsed Drain Current at V$_{GS}$=10V[2,4]	276	
E$_{AS}$	Single Pulse Avalanche Energy	5000	mJ
dv/dt	Peak Diode Recovery dv/dt[3]	5.0	V/ns
P$_D$	Power Dissipation	520	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	PTW69N30	Unit
R$_{θJC}$	Thermal Resistance, Junction-to-Case	0.24	℃/W
R$_{θJA}$	Thermal Resistance, Junction-to-Ambient	50	

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	300	--	--	V	V_{GS}=0V, I_D=250uA
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	uA	V_{DS}=300V, V_{GS}=0V
		--	--	125		V_{DS}=240V, 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	--	35	49	mΩ	V_{GS}=10V, I_D=35A
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=V_{GS}, I_D=250uA
g_{FS}	Forward Transconductance	--	55	--	S	V_{DS} =15V, I_D=30A

Dynamic Characteristics   Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance	--	7200	--	pF	V_{GS}=0V, V_{DS}=25V, f=1.0MHz
C_{rss}	Reverse Transfer Capacitance	--	130	--		
C_{oss}	Output Capacitance	--	850	--		
Q_g	Total Gate Charge	--	150	--	nC	V_{DD}=150V, I_D=69A, V_{GS}=0 to 10V
Q_{gs}	Gate-to-Source Charge	--	38	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	60	--		

Resistive Switching Characteristics   Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	55	--	nS	V_{DD}=150V, I_D=35A, V_{GS}= 10V R_G=10Ω
t_{rise}	Rise Time	--	120	--		
$t_{d(OFF)}$	Turn-Off Delay Time	--	160	--		
t_{fall}	Fall Time	--	70	--		

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]	--	--	69	A	Integral PN-diode in MOSFET
I_{SM}	Pulsed Source Current[2]	--	--	276		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	$I_S=69A$, $V_{GS}=0V$
trr	Reverse recovery time	--	500	--	ns	$V_{GS}=0V$,$I_F=69A$, $di_F/dt=100A/μs$
Qrr	Reverse recovery charge	--	4.5	--	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%.

Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance
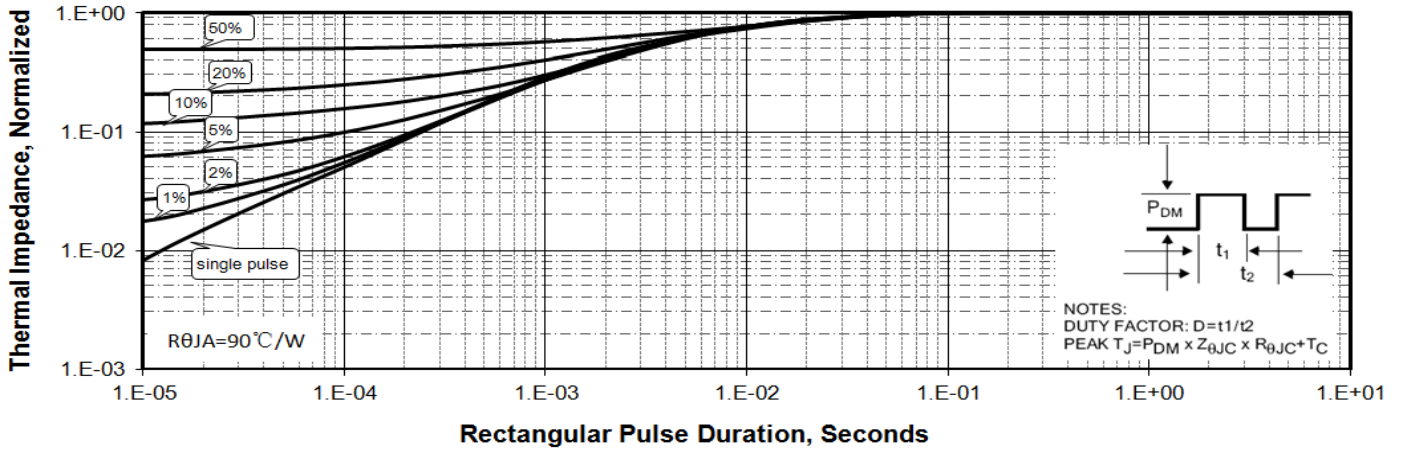
Figure 2 . Max. Power Dissipation vs Case Temperature
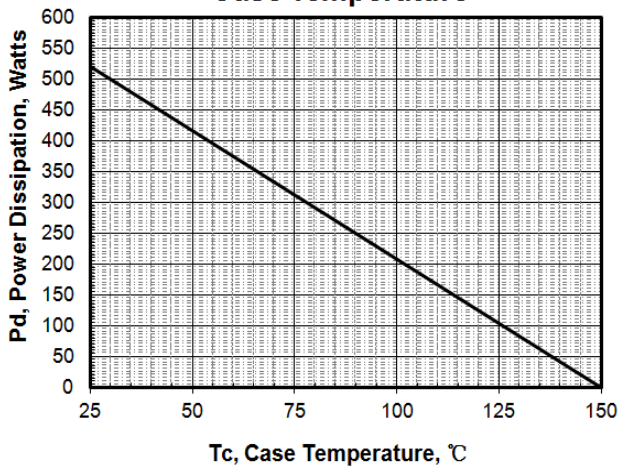
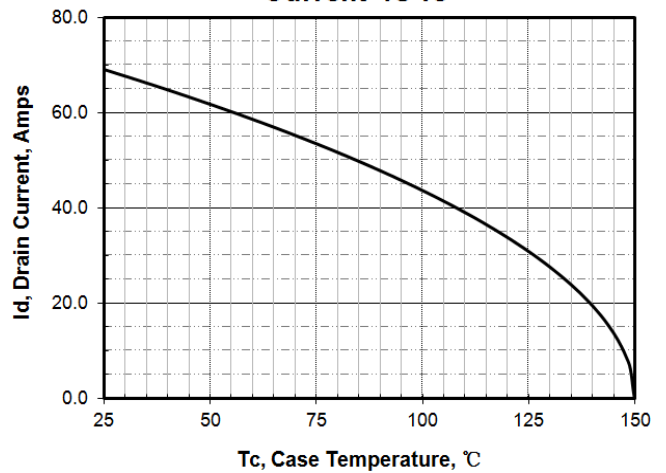### Figure 3 .Maximum Continuous Drain Current vs Tc
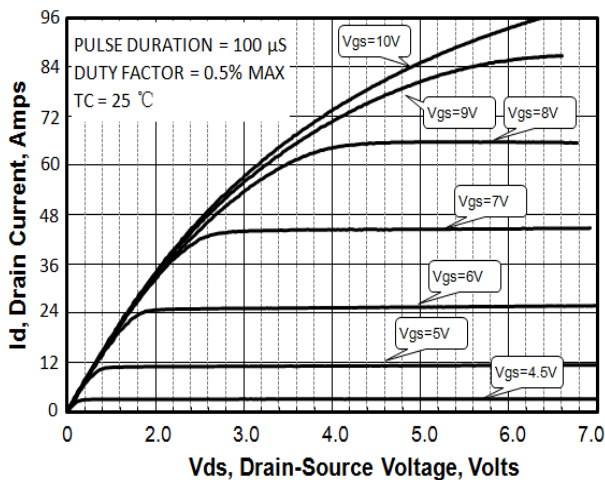

Figure 4. Output Characteristics

Figure 5. Rdson vs Gate Voltage
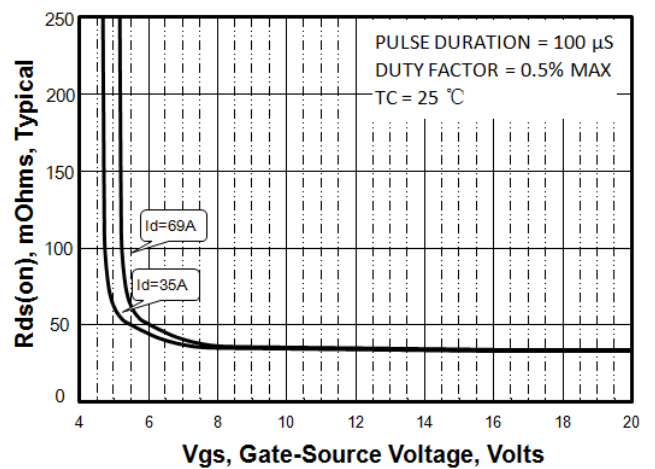
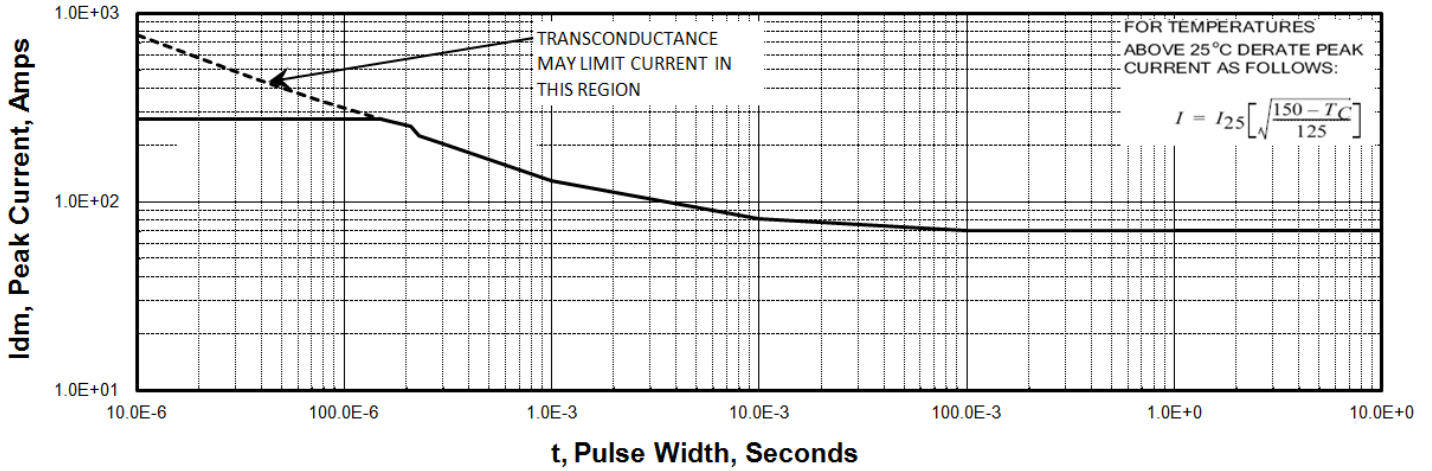## Typical Characteristics(Cont.)

Figure 6. Peak Current Capability

TRANSCONDUCTANCE MAY LIMIT CURRENT IN THIS REGION

FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25}\left[\sqrt{\frac{150 - TC}{125}}\right]$$

Idm, Peak Current, Amps

t, Pulse Width, Seconds

Figure 7. Transfer Characteristics

PULSE DURATION = 10 μS
DUTY FACTOR = 0.5% MAX
V_{DS}=15V

-55°C
+25°C
+175°C

Id, Drain to Source Current, Amps

Vgs, Gate to Source Voltage, Volts
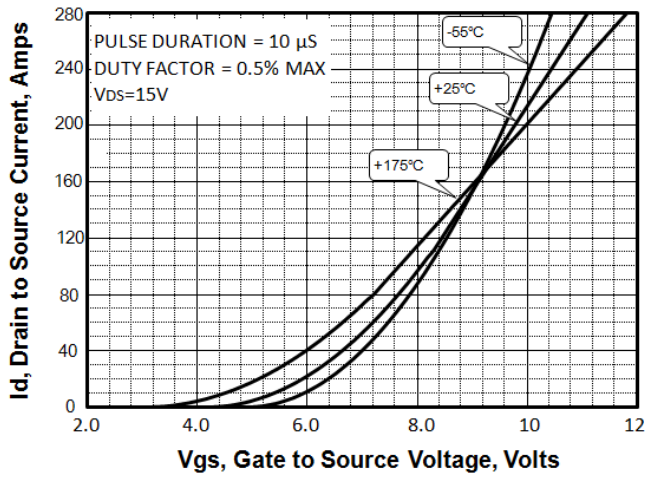
Figure 8. Unclamped Inductive Switching Capability

STARTING T_J = 25°C
STARTING T_J = 150°C

Id, Drain Current, Amps

If R= 0: tAV= (L×IAS)/(1.3BVDSS-VDD)
If R 0: tAV= (L/R) ln[IAS×R)/(1.3BVDSS-VDD)+1]
R equals total Series resistance of Drain circuit

tav, Time in Avalanche, Seconds
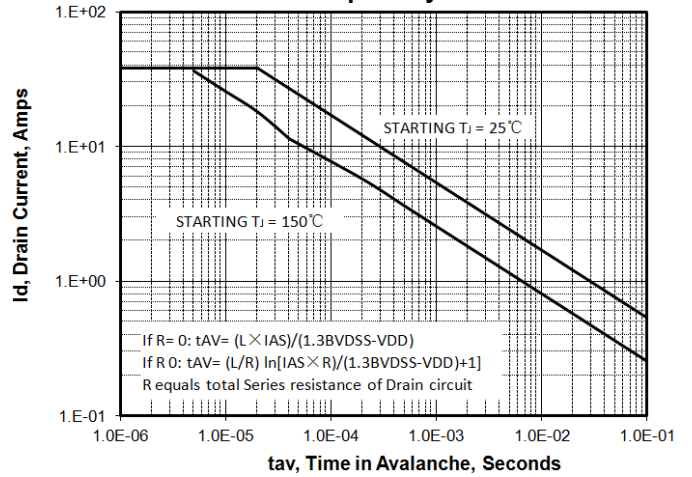
Figure 9. Drain to Source ON Resistance vs Drain Current

PULSE DURATION = 10 μS
DUTY FACTOR = 0.5% MAX
TC = 25 °C

V_{GS} = 10V

Rds(on), mOhms

Id, Drain Current, Amps
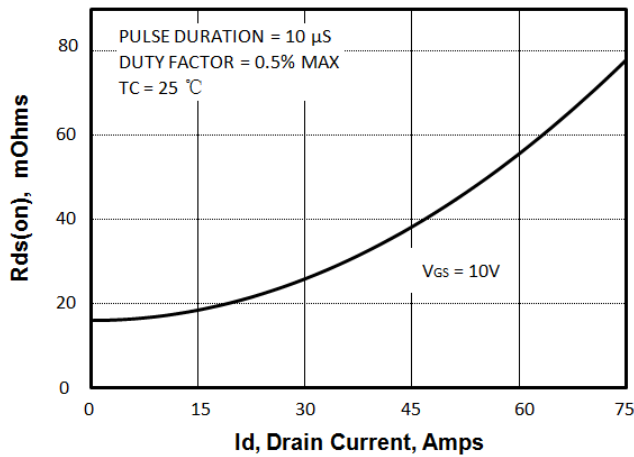
Figure 10. Rdson vs Junction Temperature

PULSE DURATION = 10 μS
DUTY FACTOR = 0.5% MAX
V_{GS} = 10V, I_D = 30A

Rds(on), Drain to Source ON Resistance, Normalized

Tj, Junction Temperature, °C
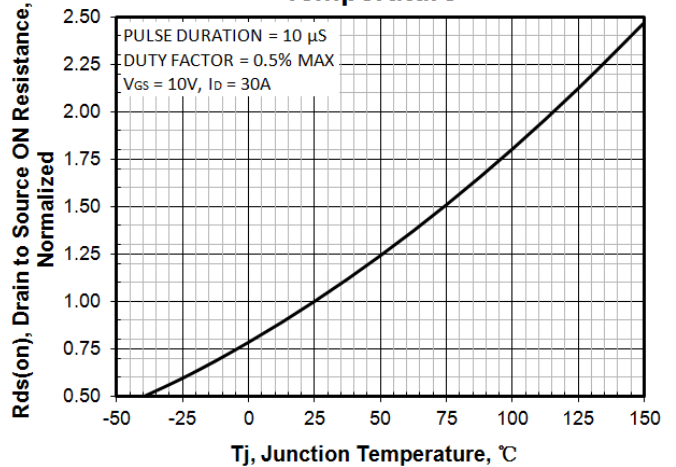
Typical Characteristics(Cont.)

Figure 11.Breakdown Voltage vs Temperature

$V_{GS} = 0V$
$I_D = 250 \mu A$

Bvdss, Drain to Source Breakdown Voltage, Normalized

Tj, Junction Temperature, ℃
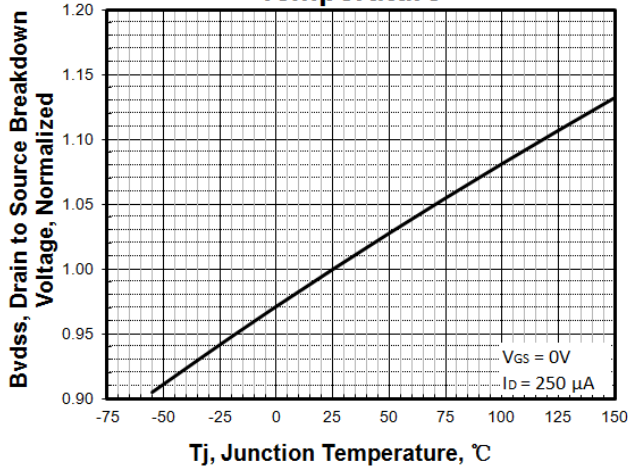
Figure 12.Threshold Voltage vs Temperature

$V_{GS} = V_{DS}$
$I_D = 250 \mu A$

Vgs(th), Normalized

Tj, Junction Temperature, ℃
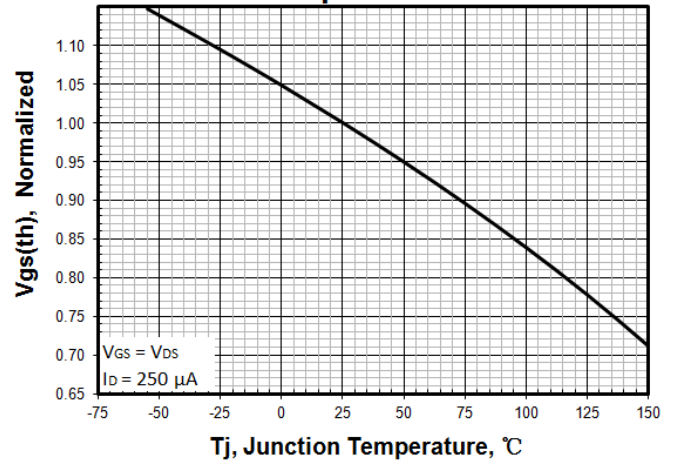
Figure 13 . Maximum Safe Operating Area

10us
100us
1ms
10ms
DC

OPERATION IN THIS AREA MAY BE LIMITED BY RDS(ON)
TJ = MAX RATED
TC = 25℃

Id, Drain Current, Amps

Vds, Drain Source Voltage, Volts
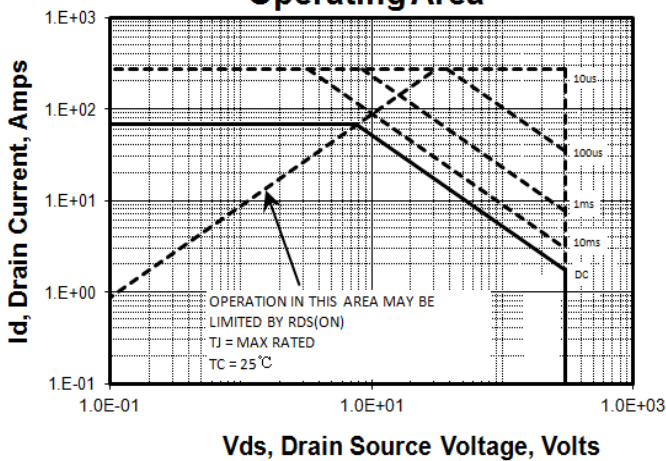
Figure 14. Capacitance vs Vds

$V_{GS} = 0V$, $f = 1MHz$,
$Ciss = Cgs + Cgd$,
$Coss\ Cds + Cgd$,
$Crss = Cgd$

Ciss
Coss
Crss

Capacitance, pF

Vds, Drain to Source Voltage, Volts
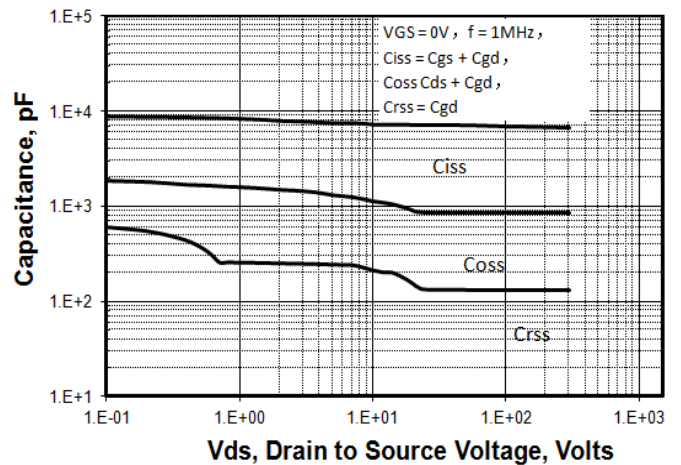
Figure 15 . Typical Gate Charge

$V_{DD}=150V, I_D=69A$

Vgs, gate to source voltage (v)

Qg, Total gate charge (nC)
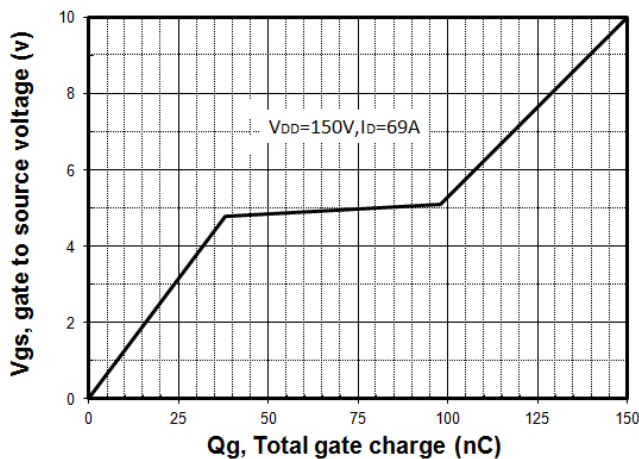
Figure 16.Body Diode Transfer Characteristics

125℃
25℃

Isd, Reverse Drain Current, Amps

Vsd, Source-Drain Voltage, Volts
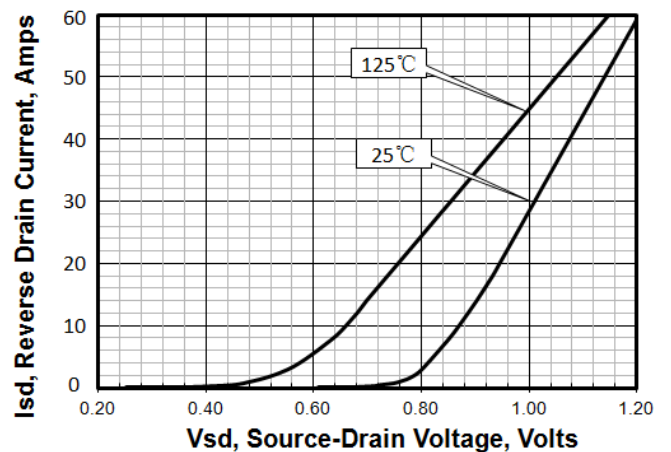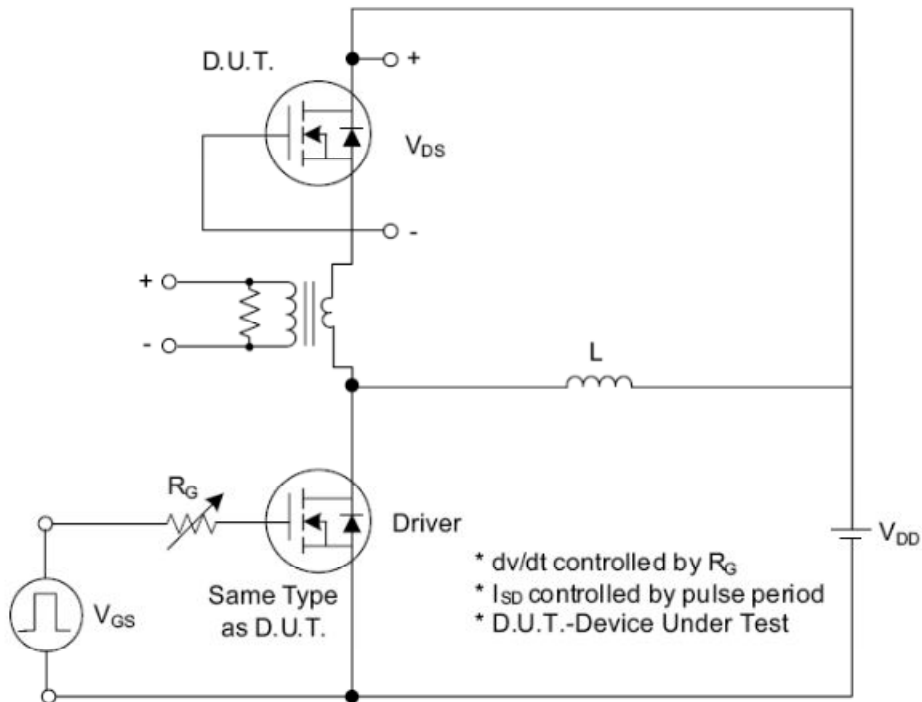
Test Circuits and Waveforms

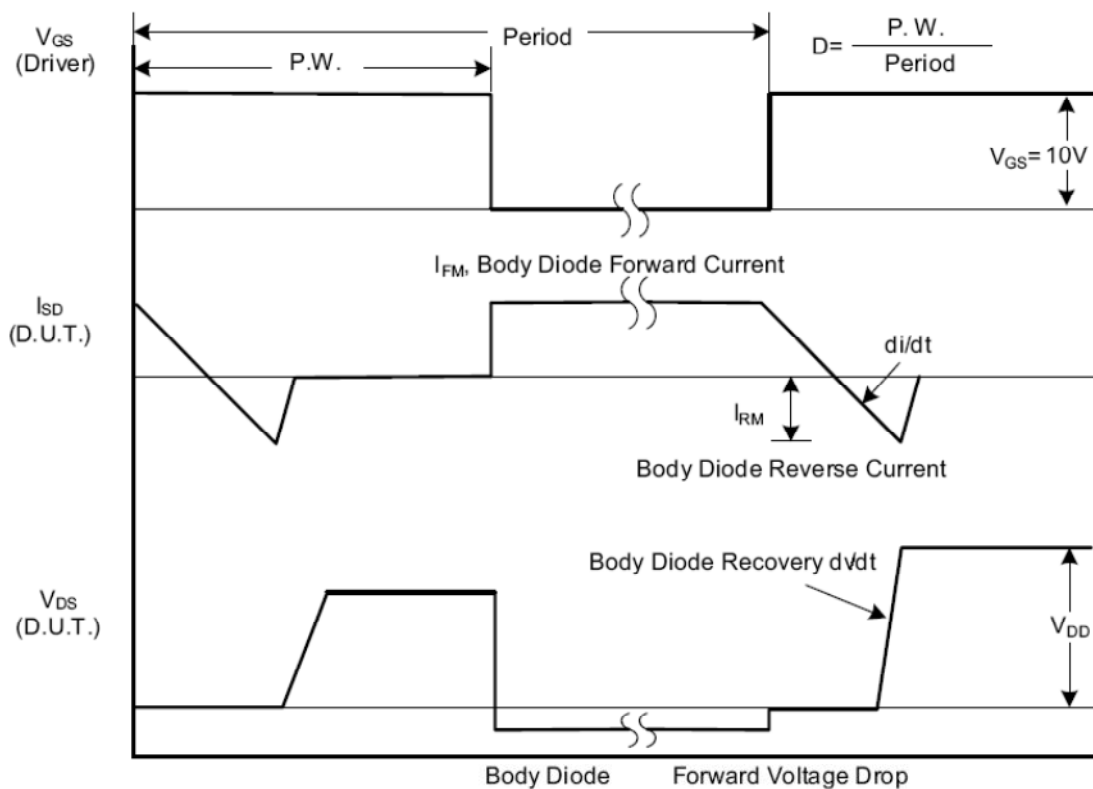Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

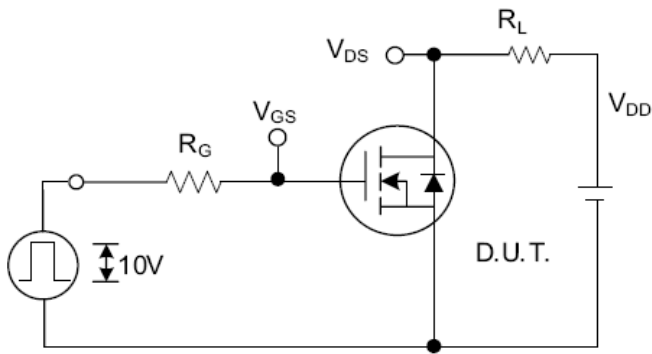Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

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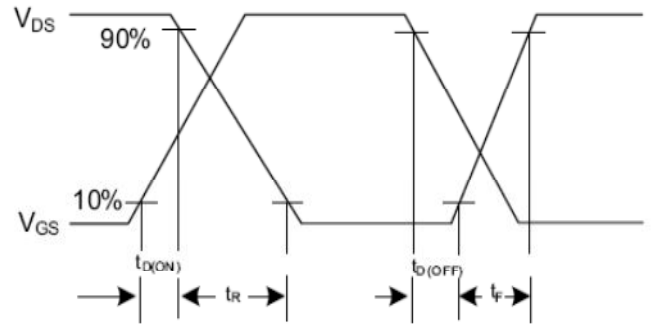# Test Circuits and Waveforms (Cont.)

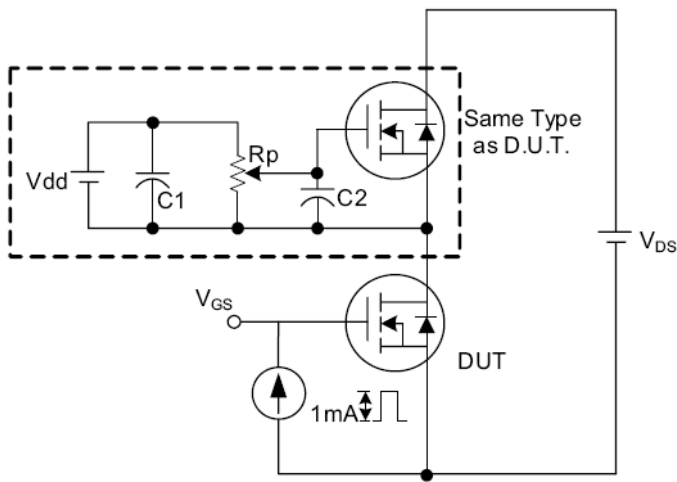Fig. 2.1 Switching Test Circuit

Fig. 2.2 Switching Waveforms

Fig. 3 . 1 Gate Charge Test Circuit

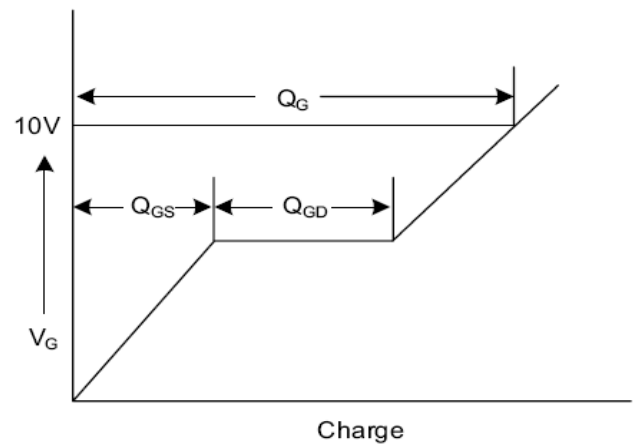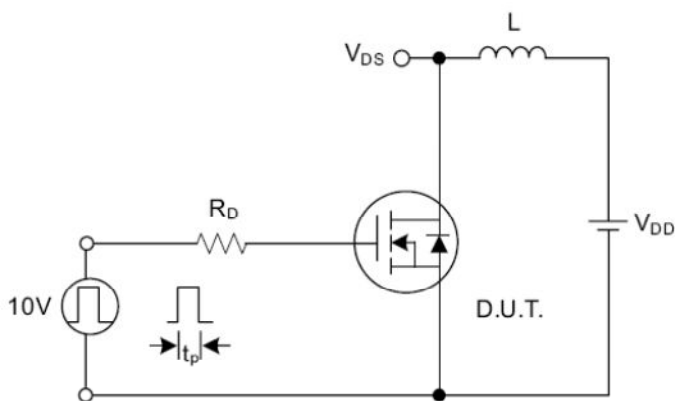Fig. 3 . 2 Gate Charge Waveform

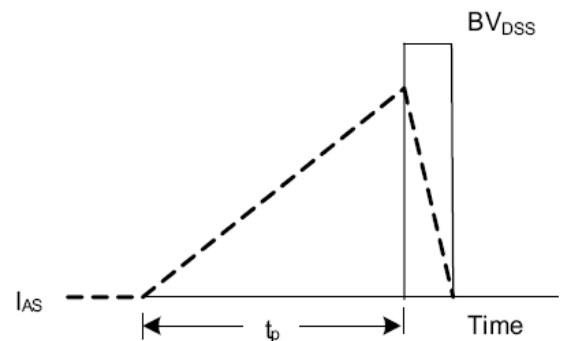Fig. 4.1 Unclamped Inductive Switching Test Circuit

Fig. 4.2 Unclamped Inductive Switching Waveforms

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