

TS4N60

600V N-Channel Mosfet

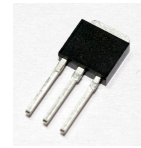
features

- ◆ 4.0A,600V, $R_{DS(on)}=1.8\Omega$ (typical)@ $V_{GS}=10V$
- ◆ Low gate charge(typical 18nc)
- ◆ Low Crss (typical 15pF)
- ◆ Fast switching
- ◆ 100%avalanche tested
- ◆ Improved dv/dt capability

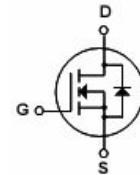
General Description

- ◆ Package:TO-251
- ◆ This advanced technology has been especially tailored to Minimize on-state resistance, provide superior switching Performance, and withstand high energy pulse in the
- ◆ Avalanche and commutation mode. These devices are well Suited for high efficiency switch mode power supply.

DRAWING



G D S



Absolute Maximum Ratings

Symbol	Parameter	Spec	Units
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current -Continuous($T_c=25^\circ C$)	4	A
	-Continuous($T_c=100^\circ C$)	2.9	A
I_{DM}	Drain Current -Pulsed (* 1)	16	A
V_{GSS}	Gate-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (* 2)	200	mJ
I_{AR}	Avalanche Current (* 1)	4	A
E_{AR}	Repetitive Avalanche Energy (* 1)	20	mJ
dv/dt	Peak Diode Recovery dv/dt (* 3)	4.5	V/ns
P_D	Power Dissipation ($TC=25^\circ C$)	75	W
	-Derate above $25^\circ C$	0.6	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum lead temperature for soldering purpose 1/8" from case for 5 seconds	300	$^\circ C$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	—	1.67	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	—	62.5	$^\circ C/W$

Electrical Characteristics(Tc=25℃ unless otherwise noted)
Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _b =250uA	600	—	—	V
BV _{DSS} /T _J	Breakdown Voltage Temperature Coefficient	ID=250uA, Referenced to 25℃	—	0.67	—	V/℃
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =600V, V _{GS} =0V	—	—	1	uA
		V _{DS} =480V, Tc=125℃	—	—	100	uA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{gs} =20V, V _{ds} =0V	—	—	10	uA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{gs} =-20V, V _{ds} =0V	—	—	-10	uA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V _{GSTH}	Gate Threshold Voltage	V _{DS} =V _{GS} , ID=250uA	2	3.2	4	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, ID=2.0 A	—	1.8	2.3	Ω
G _{fs}	Forward Transconductance	V _{DS} =15V, ID=2.0A	—	5.0	—	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C _{iss}	Input Capacitance	V _{DS} =25V, V _{GS} =0V, f=1.0MHz	—	470	—	pF
C _{oss}	Output Capacitance		—	58	—	pF
C _{rss}	Reverse Transfer Capacitance		—	15	—	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t _{don}	Turn-On Delay Time	V _{DD} =250V I _D =4.0A R _G =25Ω	—	12	—	ns
t _r	Turn-On Rise Time		—	46	—	ns
t _{doff}	Turn-Off Delay Time		—	50	—	ns
t _f	Turn-Off Fall Time		—	48	—	ns
Q _g	Total Gate Charge	V _{DS} =400V	—	18	28	nc
Q _{gs}	Gate-Source Charge	I _D =4.0A	—	3.2	—	nc
Q _{gd}	Gate-Drain Charge	V _{GS} =10V	—	10	—	nc

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I _s	Maximum Continuous Drain-source diode forward current		—	—	4	A
I _{sm}	Maximum pulsed drain-source diode forward current		—	—	16	A
V _{sd}	Drain-source diode forward Voltage	V _{GS} =0V, I _S =4.0A	—	—	1.5	V
T _{rr}	Reverse Recovery Time	V _{GS} =0V, I _S =4.0A	—	270	—	ns
Q _{rr}	Reverse Recovery charge	diff/dt=100A/us	—	1.9	—	uc

Notes:

*1: Repetitive rating; pulse width limited by maximum junction temperature

*2: L=10.0mH, I_D=4A, Start T_J=25℃

*3: I_{SD}=4A, di/dt ≤100A/us, V_{DD} ≤BV_{DS}, Start T_J=25℃

Typical Characteristics

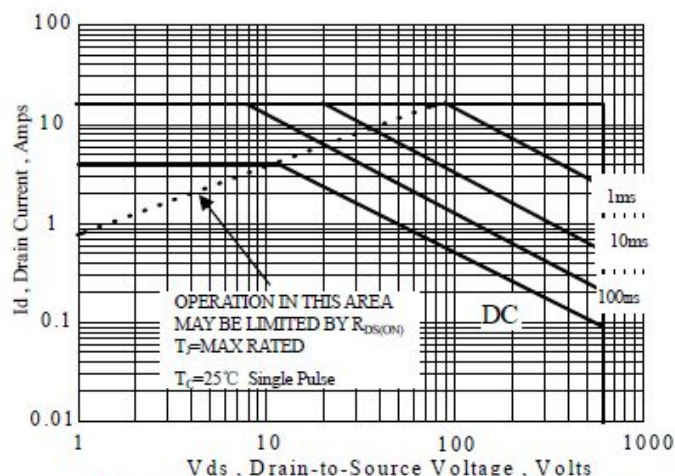


Figure 1 Maximum Forward Bias Safe Operating Area

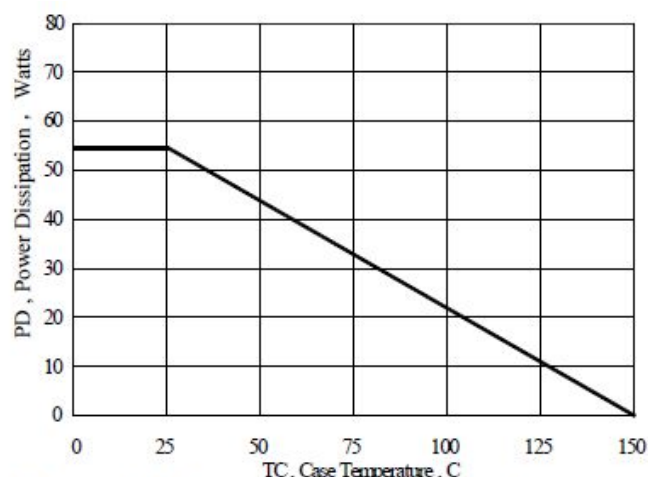


Figure 2 Maximum Power Dissipation vs Case Temperature

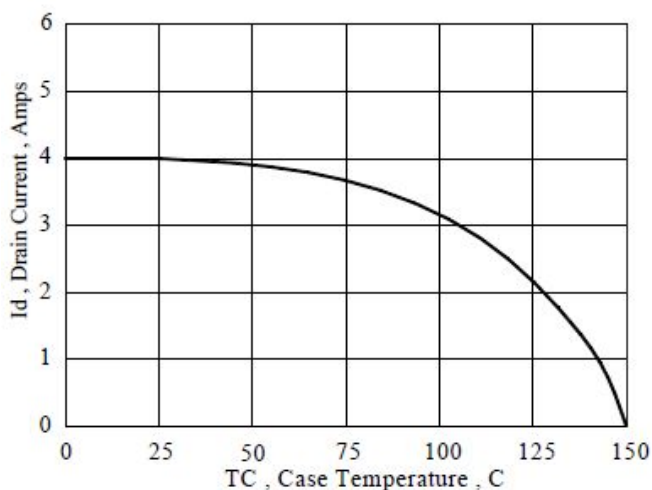


Figure 3 Maximum Continuous Drain Current vs Case Temperature

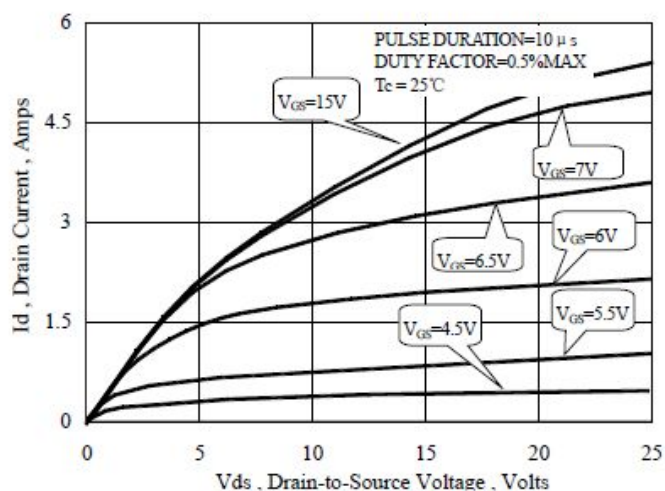


Figure 4 Typical Output Characteristics

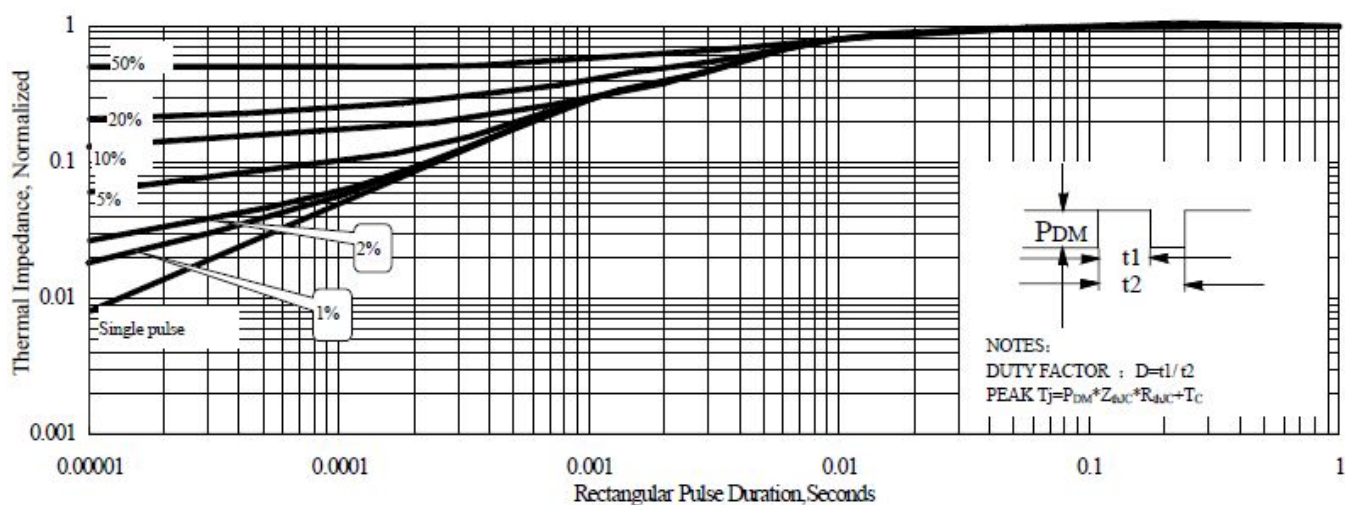


Figure 5 Maximum Effective Thermal Impedance, Junction to Case

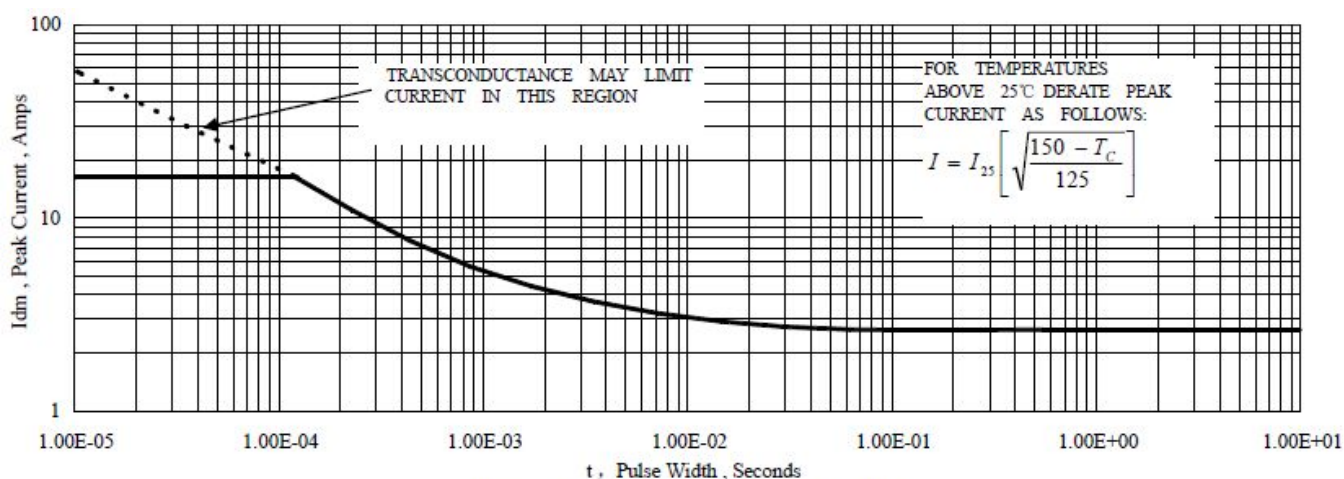


Figure 6 Maximum Peak Current Capability

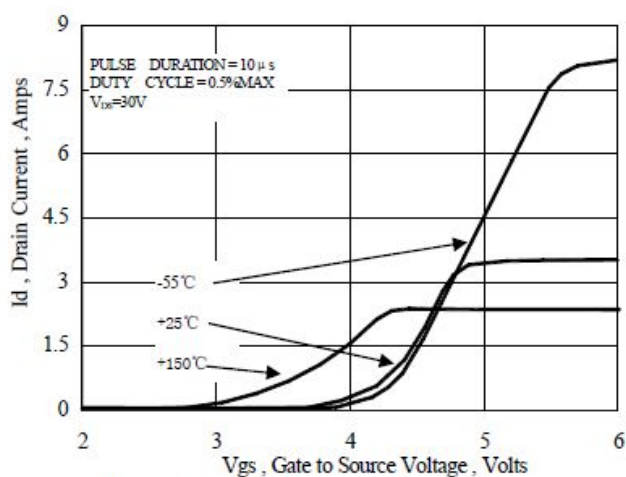


Figure 7 Typical Transfer Characteristics

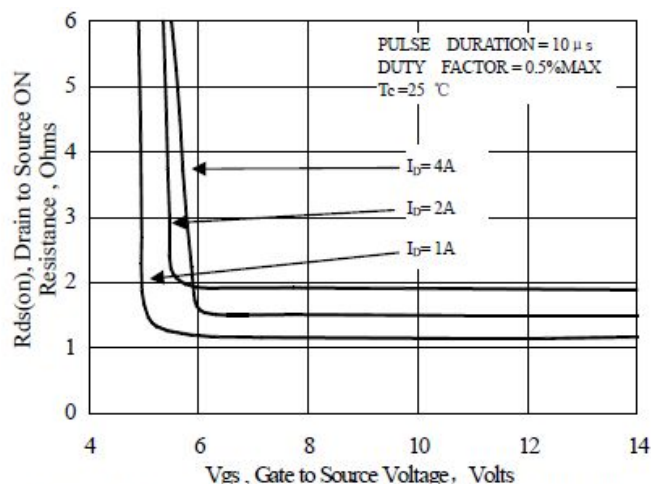


Figure 8 Typical Drain to Source ON Resistance vs. Gate Voltage and Drain Current

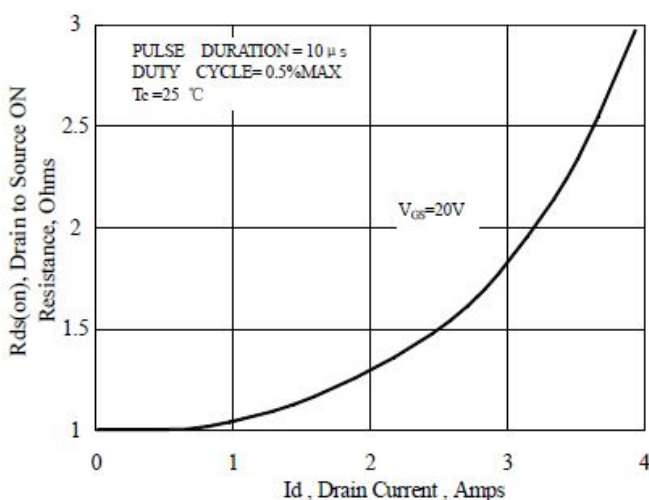


Figure 9 Typical Drain to Source ON Resistance vs. Drain Current

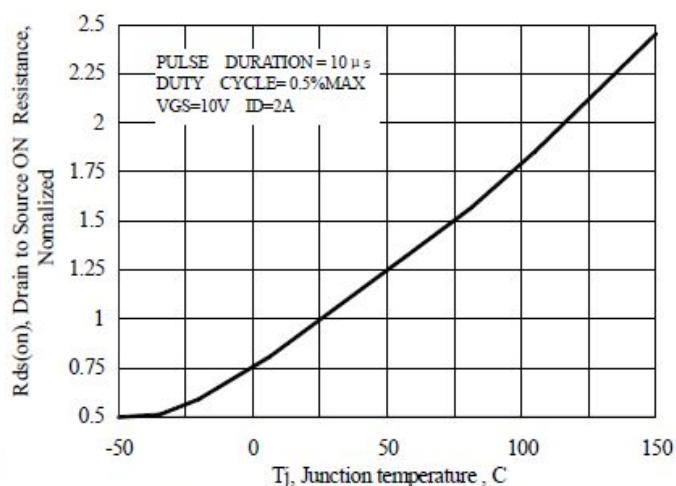


Figure 10 Typical Drain to Source on Resistance vs. Junction Temperature

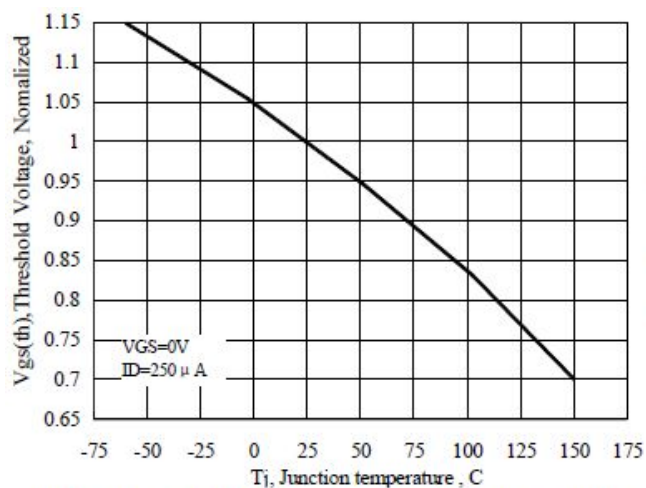


Figure 11 Typical Threshold Voltage vs Junction Temperature

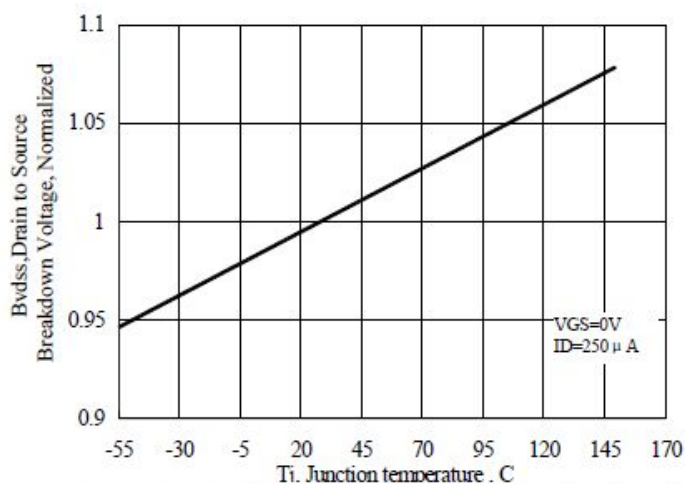


Figure 12 Typical Breakdown Voltage vs Junction Temperature

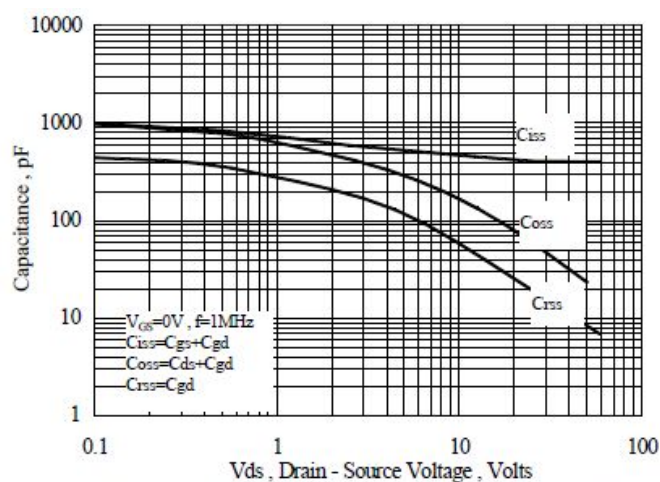


Figure 13 Typical Capacitance vs Drain to Source Voltage

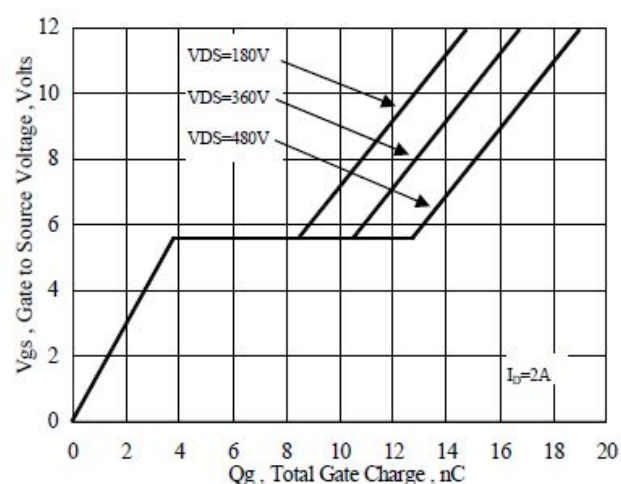


Figure 14 Typical Gate Charge vs Gate to Source Voltage

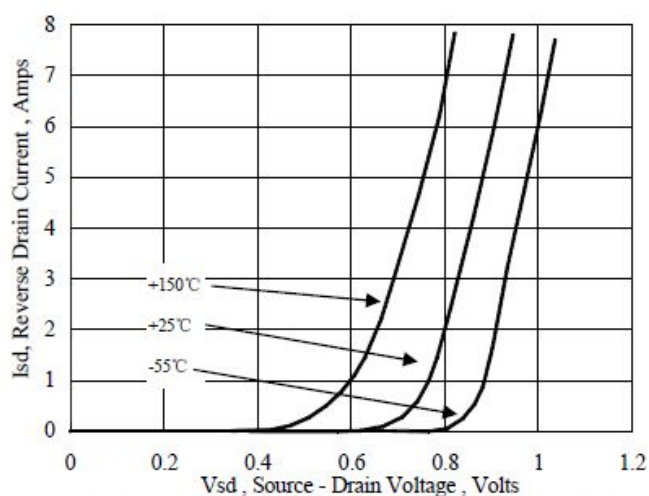


Figure 15 Typical Body Diode Transfer Characteristics

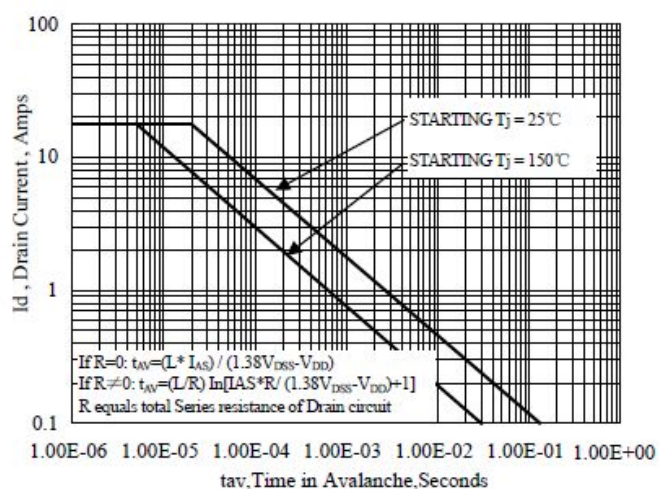
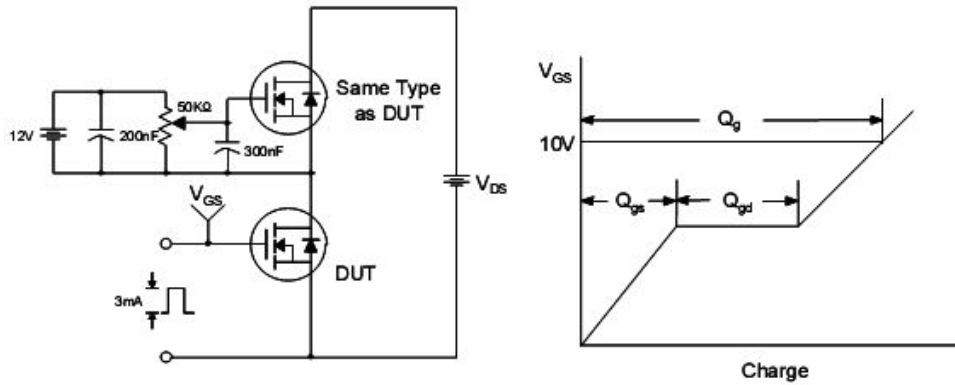


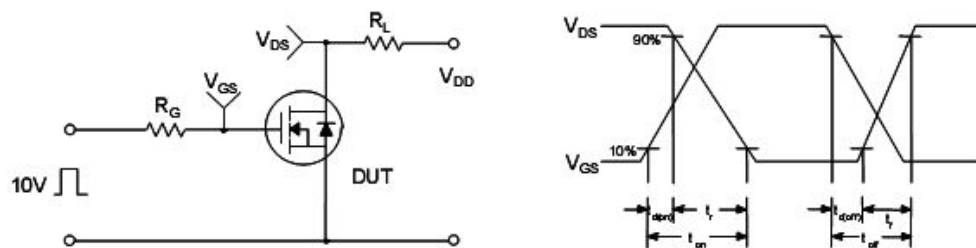
Figure 16 Unclamped Inductive Switching Capability

Test circuits and waveforms

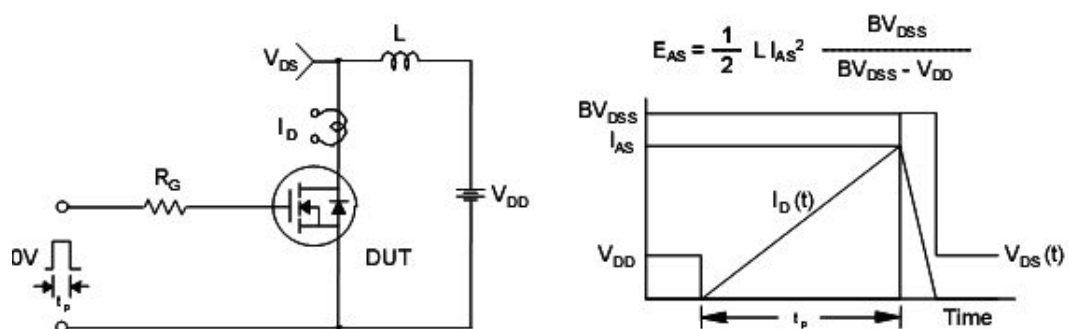
Gate Charge Test Circuit & Waveform



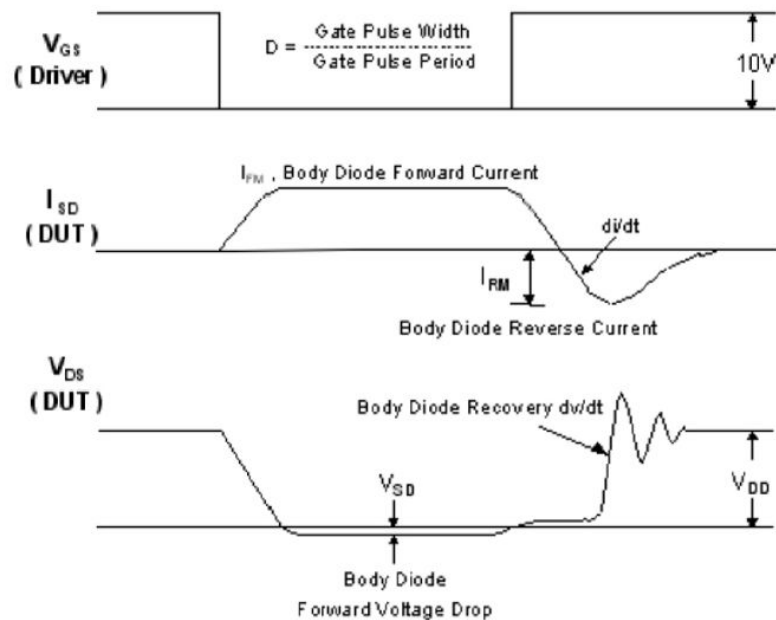
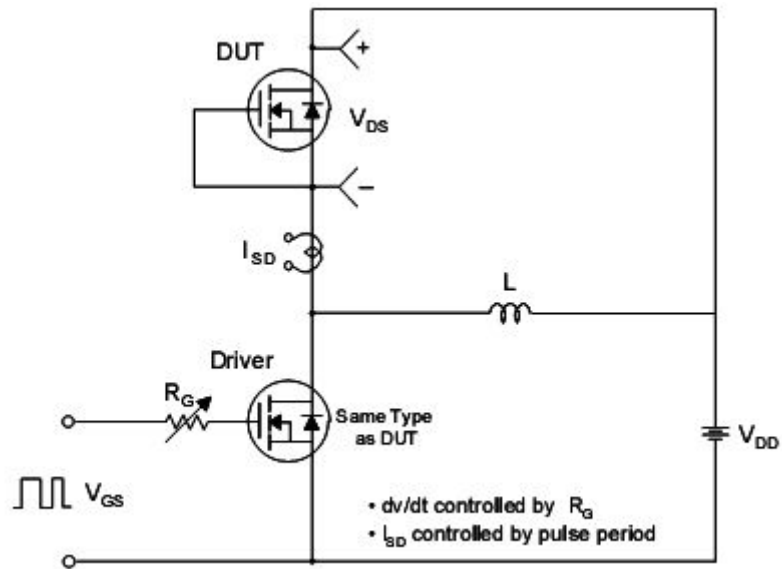
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Circuit & Waveforms



Mechanical Dimensions

