

# TSF4N90M

## 900V N-Channel MOSFET

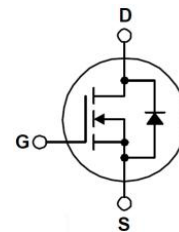
### General Description

This Power MOSFET is produced using Truesemi's advanced planar stripe DMOS technology. 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 switched mode power supplies, active power factor correction based on half bridge topology.



### Features

- Drain-Source breakdown voltage: BVDSS=900V (Min.)
- Low gate charge: Qg=22nC (Typ.)
- Low drain-source On resistance: RDS(on)=4.2Ω (Max.)
- 100% avalanche tested
- RoHS compliant device



### Absolute maximum ratings (T<sub>c</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	V <sub>DSS</sub>	900	V	
Gate-source voltage	V <sub>GSS</sub>	±30	V	
Drain current (DC) *	I <sub>D</sub>	T <sub>c</sub> =25°C	4	A
		T <sub>c</sub> =100°C	2.53	A
Drain current (Pulsed) *	I <sub>DM</sub>	16	A	
Single avalanche current <sup>(Note 2)</sup>	I <sub>AS</sub>	4	A	
Single pulsed avalanche energy <sup>(Note 2)</sup>	E <sub>AS</sub>	84.7	mJ	
Repetitive avalanche current <sup>(Note 1)</sup>	I <sub>AR</sub>	4	A	
Repetitive avalanche energy <sup>(Note 1)</sup>	E <sub>AR</sub>	4	mJ	
Power dissipation	P <sub>D</sub>	40	W	
Junction temperature	T <sub>J</sub>	150	°C	
Storage temperature range	T <sub>stg</sub>	-55-150	°C	

\* Limited only maximum junction temperature

## Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 3.13	°C/W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 62.5	

## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	900	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}$ , $V_{DS}=V_{GS}$	3	4	5	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=900\text{V}$ , $V_{GS}=0\text{V}$	-	-	1	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$	-	-	$\pm 100$	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2\text{A}$	-	3.7	4.2	$\Omega$
Forward transfer conductance (Note 3)	$g_{fs}$	$V_{DS}=10\text{V}$ , $I_D=2\text{A}$	-	4	-	S
Input capacitance	$C_{ISS}$	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ , $f=1.0\text{MHz}$	-	750	-	pF
Output capacitance	$C_{OSS}$		-	62	-	
Reverse transfer capacitance	$C_{RSS}$		-	12	-	
Turn-on delay time (Note 3,4)	$t_{d(on)}$	$V_{DD}=450\text{V}$ , $I_D=4\text{A}$ , $R_G=25\Omega$	-	38	-	ns
Rise time (Note 3,4)	$t_r$		-	60	-	
Turn-off delay time (Note 3,4)	$t_{d(off)}$		-	68	-	
Fall time (Note 3,4)	$t_f$		-	54	-	
Total gate charge (Note 3,4)	$Q_g$	$V_{DS}=720\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=4\text{A}$	-	22	-	nC
Gate-source charge (Note 3,4)	$Q_{gs}$		-	8	-	
Gate-drain charge (Note 3,4)	$Q_{gd}$		-	7	-	

## Source-Drain Diode Ratings and Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	$I_S$	Integral reverse diode in the MOSFET	-	-	4	A
Source current (Pulsed)	$I_{SM}$		-	-	16	A
Forward voltage	$V_{SD}$	$V_{GS}=0\text{V}$ , $I_S=4\text{A}$	-	-	1.4	V
Reverse recovery time (Note 3,4)	$t_{rr}$	$I_S=4\text{A}$ , $V_{GS}=0\text{V}$ $dI_F/dt=100\text{A}/\mu\text{s}$	-	301	-	ns
Reverse recovery charge (Note 3,4)	$Q_{rr}$		-	2.06	-	$\mu\text{C}$

Note:

1. Repeated rating: Pulse width limited by safe operating area
2.  $L=10\text{mH}$ ,  $I_{AS}=4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse test: Pulse width $\leq 300\mu\text{s}$ , Duty cycles $\leq 2\%$
4. Essentially independent of operating temperature typical characteristics

## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

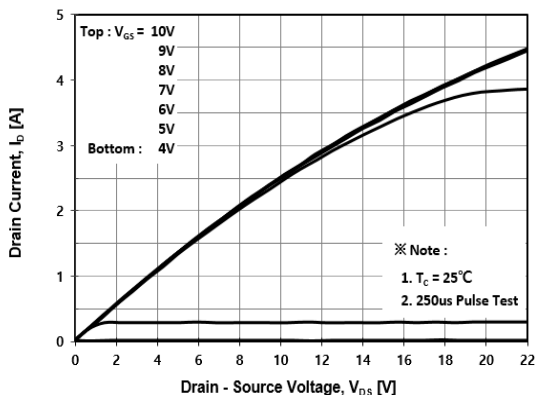


Fig. 2 Typical Transfer Characteristics

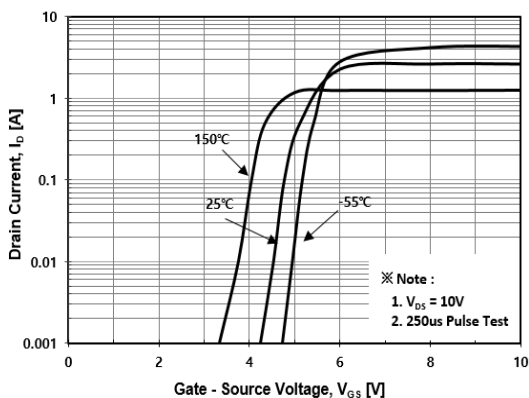


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

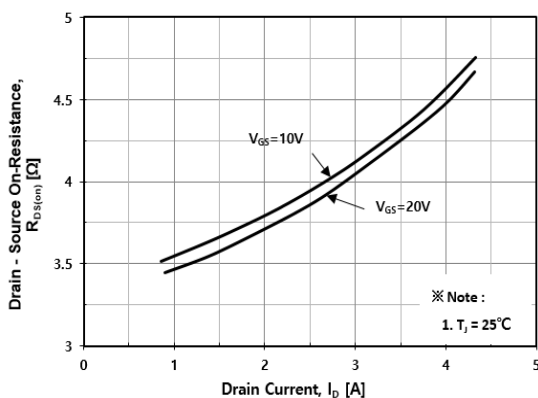


Fig. 4 Body Diode Forward Voltage Variation with Source Current

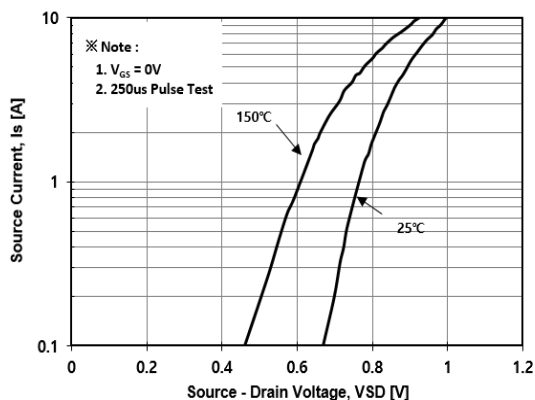


Fig. 5 Typical Capacitance Characteristics

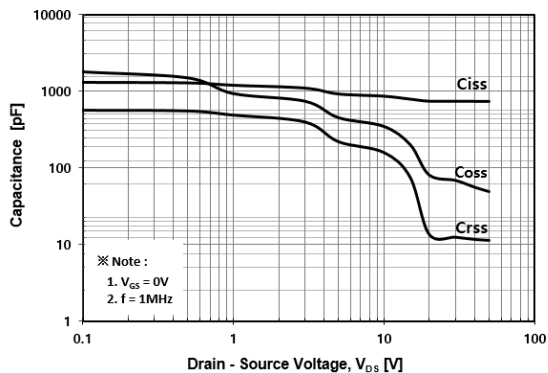
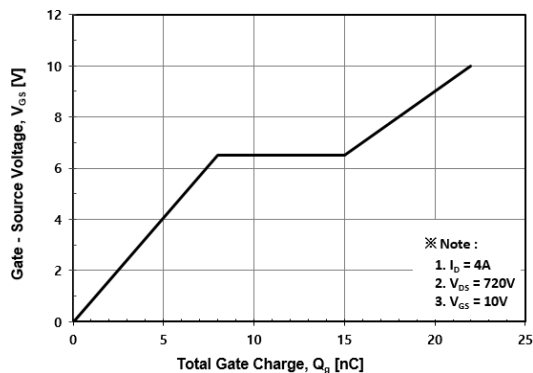


Fig. 6 Typical Total Gate Charge Characteristics



## Electrical Characteristics Curves

Fig. 7 Breakdown Voltage Variation vs. Temperature

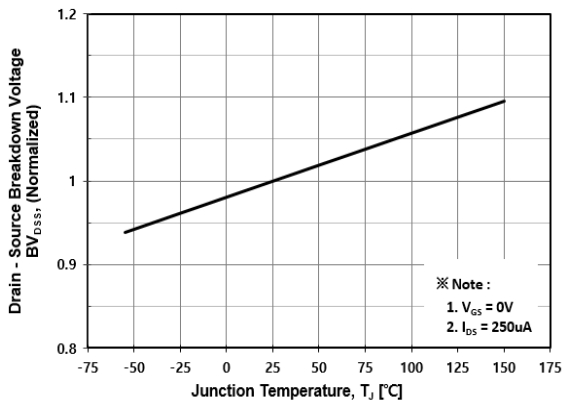


Fig. 8 On-Resistance Variation vs. Temperature

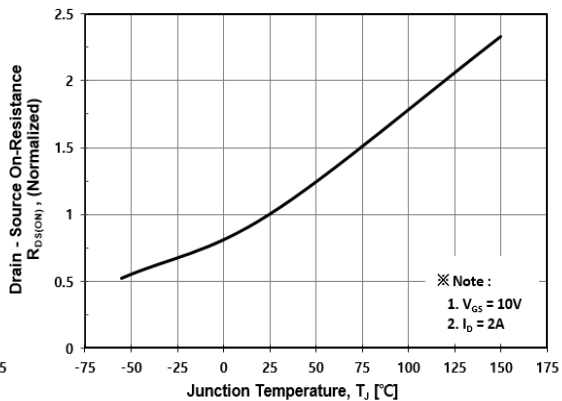


Fig. 9 Maximum Drain Current vs. Case Temperature

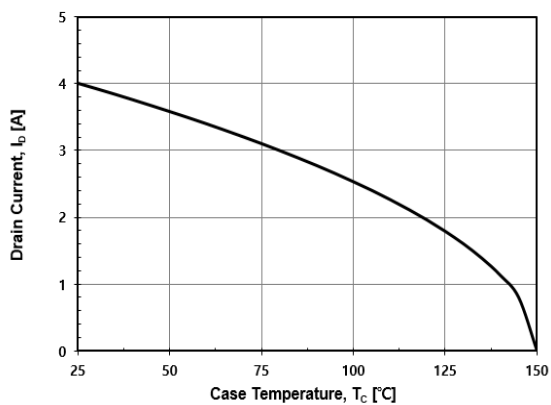


Fig. 10 Maximum Safe Operating Area

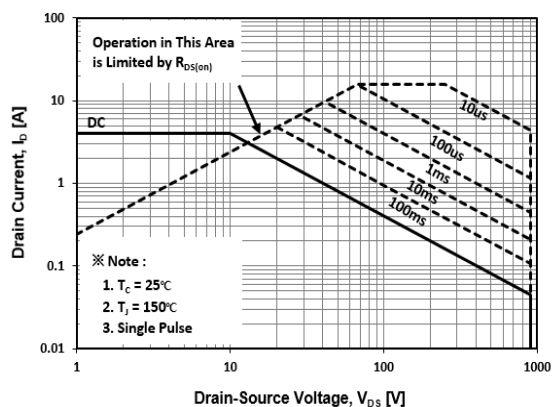


Fig. 11 Transient Thermal Impedance

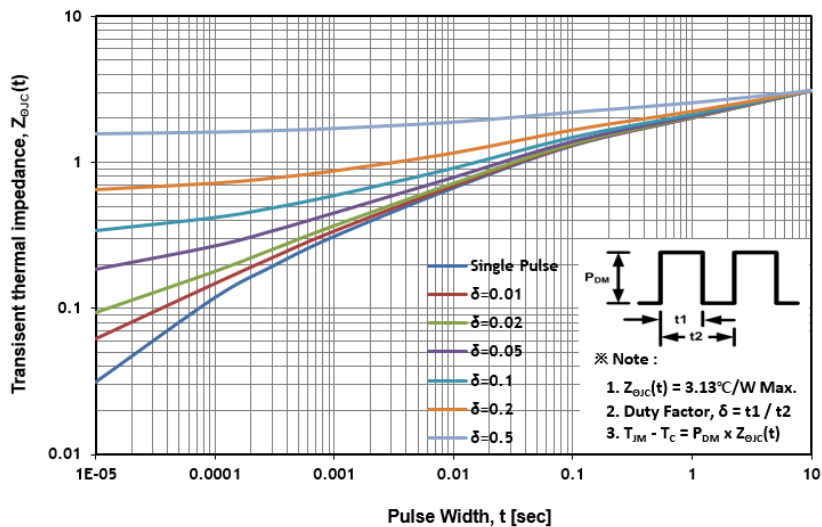


Fig. 12 Gate Charge Test Circuit & Waveform

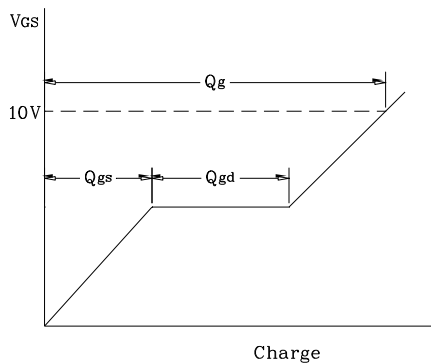
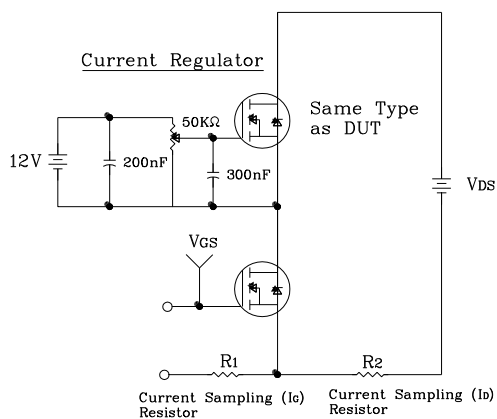


Fig. 13 Resistive Switching Test Circuit & Waveform

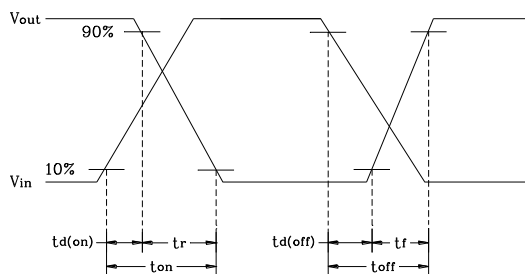
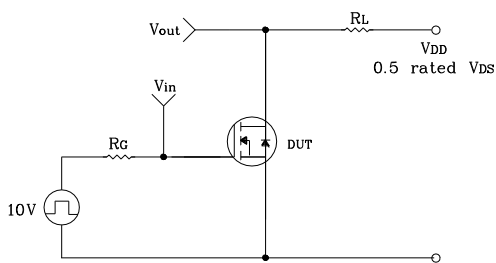


Fig. 14 EAS Test Circuit & Waveform

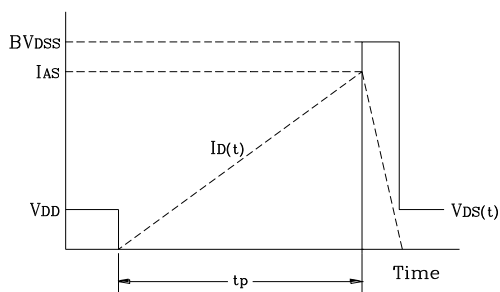
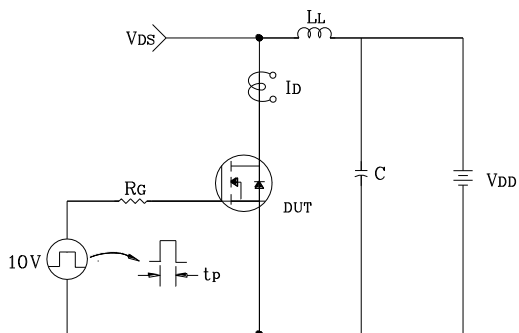
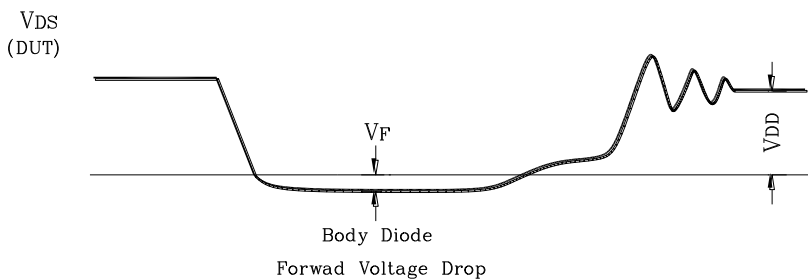
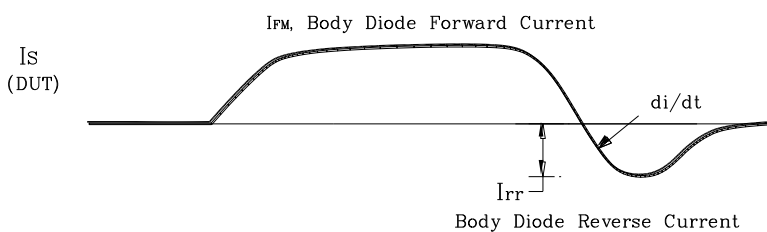
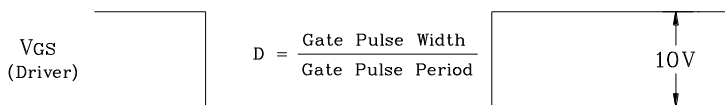
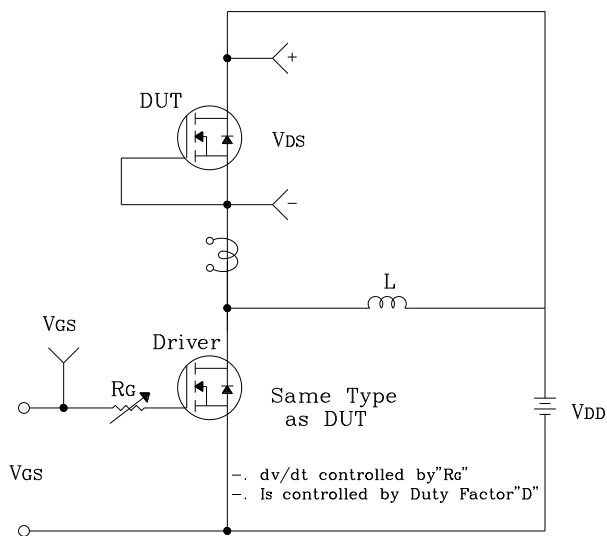


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



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