# Truesemi®

TSP32N20M
200V 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

•32A,200V,Max.RDS(on)=0.086Ω @ VGS =10V
•Low gate charge: Qg=46nC (Typ.)
• Low reverse transfer capacitance: Crss=36pF (Typ.)
• Lower EMI noise
•RoHS compliant device
•100% avalanche tested

TO-220

G D S

Absolute Maximum Ratings Tc=25℃ unless otherwise specified

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		200	V
V_{GS}	Gate-Source Voltage		± 30	V
I_D	Drain Current	Tc = 25℃	32	A
		Tc = 100℃	20	A
I_{DM}	Pulsed Drain Current (Note 1)		128	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		512	mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)		4.8	mJ
I_{AR}	Repetitive Avalanche current (Note 1)		32	A
P_D	Power Dissipation (Tc = 25℃)		48	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{θJC}$	Thermal Resistance,Junction-to-Case	--	2.60	℃/W
$R_{θJA}$	Thermal Resistance,Junction-to-Ambient	--	62.5	℃/W

Electrical Characteristics T_C=25 ℃ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250 uA	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 16 A	--	0.070	0.086	Ω
g_{fs}	Forward transfer conductance	V_{DS} = 10V, I_D = 16A (Note3)	--	3	--	S

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	200	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 200 V, T_C = 125℃	--	--	100	uA
I_{GSSF}	Gate-Body Leakage Current,Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current,Reverse	V_{GS} =- 30 V, V_{DS} = 0 V	--	--	-100	nA

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2200	--	pF
C_{oss}	Output Capacitance		--	288	--	pF
C_{rss}	Reverse Transfer Capacitance		--	36	--	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Time	V_{DS} = 100 V, I_D = 16 A, R_G = 25 Ω (Note 3,4)	--	33	--	ns
t_r	Turn-On Rise Time		--	24	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	121	--	ns
t_f	Turn-Off Fall Time		--	27	--	ns
Q_g	Total Gate Charge	V_{DS} = 160 V, I_D =32A, V_{GS} = 10 V (Note 3,4)	--	46	--	nC
Q_{gs}	Gate-Source Charge		--	12	--	nC
Q_{gd}	Gate-Drain Charge		--	17	--	nC

Source-Drain Diode Maximum Ratings and Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Continuous Source-Drain Diode Forward Current		--	--	32	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	128	
V_{SD}	Source-Drain Diode Forward Voltage	I_{SD} =32A, V_{GS} = 0 V	--	--	1.4	V
t_{rr}	Reverse Recovery Time	I_{SD} = 32A, V_{GS} = 0 V di_F/dt = 100 A/µs (Note 3,4)	--	200	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.4	--	uC

NOTES:

1. Repeated rating: Pulse width limited by safe operating area

2.L=1mH, IAS=32A, VDD=50V, RG=25 , Starting TJ=25 C

3. Pulse test: Pulse width≤300us, Duty cycle≤2%

4. Essentially independent of operating temperature typical characteristics

Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

※ Note :
1. T_C = 25℃
2. 250us Pulse Test
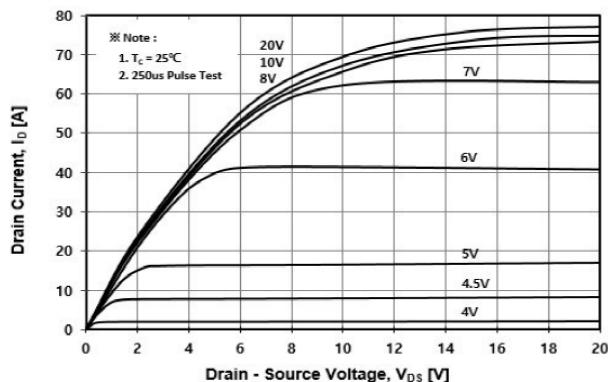
Fig. 2 Typical Transfer Characteristics

※ Note :
1. V_{DS} = 10V
2. 250us Pulse Test
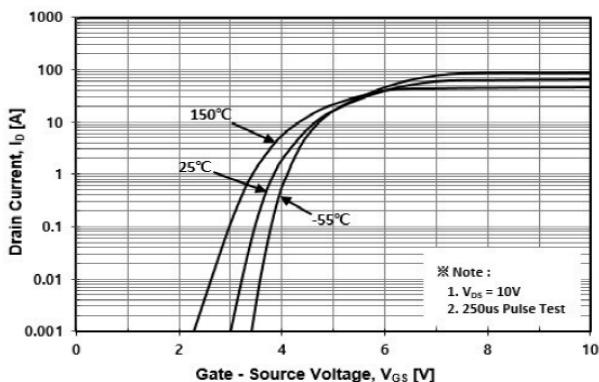
Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

※ Note :
1. T_J = 25℃
2. V_{GS} = 10V
3. 250us Pulse Test
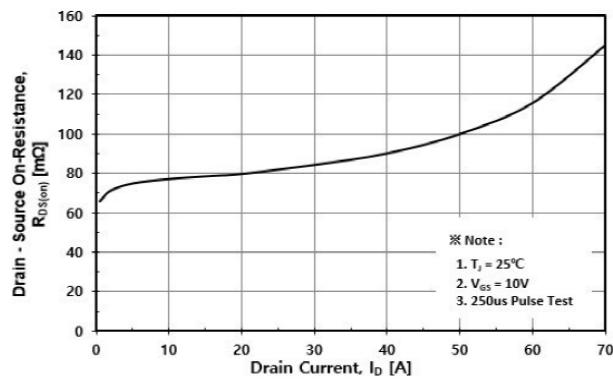
Fig. 4 Body Diode Forward Voltage Variation with Source Current

※ Note :
1. V_{GS} = 0V
2. 250us Pulse Test
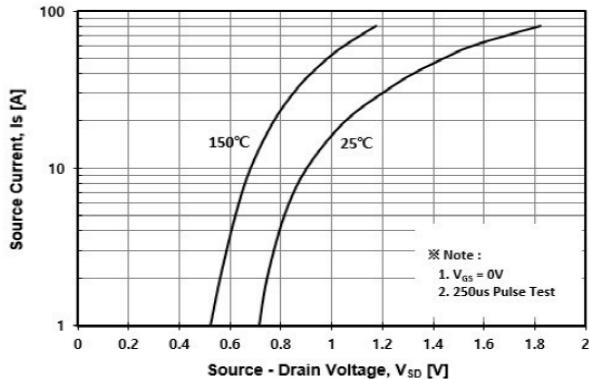
Fig. 5 Typical Capacitance Characteristics

※ Note :
1. V_{GS} = 0V
2. f = 1MHz
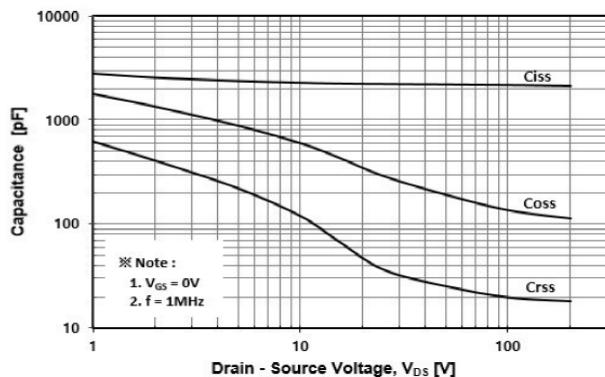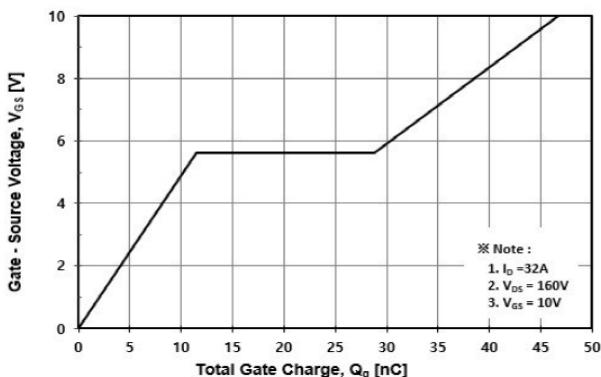
Fig. 6 Typical Total Gate Charge Characteristics

※ Note :
1. I_D =32A
2. V_{DS} = 160V
3. V_{GS} = 10V

Typical Electrical Characteristics Curves

Fig. 7 Breakdown Voltage Variation vs. Temperature

※ Note :
1. V_{GS} = 0V
2. I_{DS} = 250uA
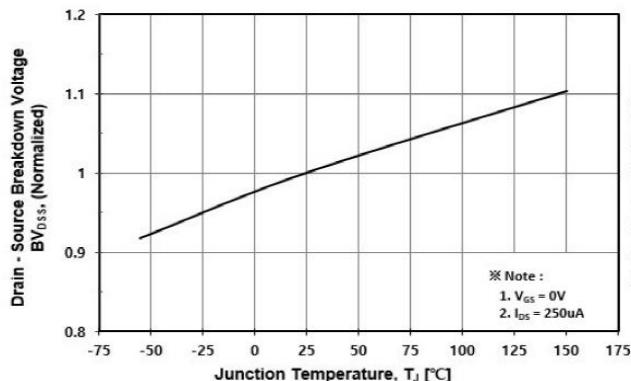
Fig. 8 On-Resistance Variation vs. Temperature

※ Note :
1. V_{GS} = 10V
2. I_D = 16A
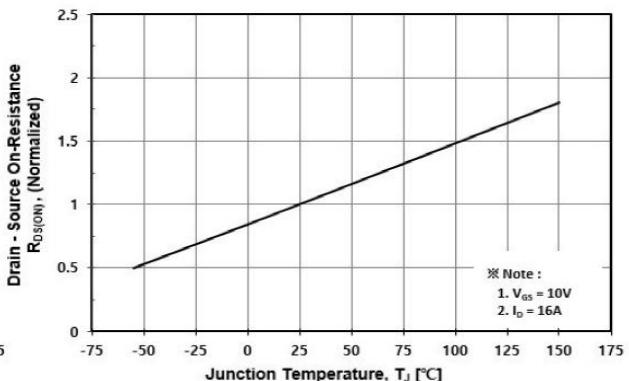
Fig. 9 Maximum Drain Current vs. Case Temperature
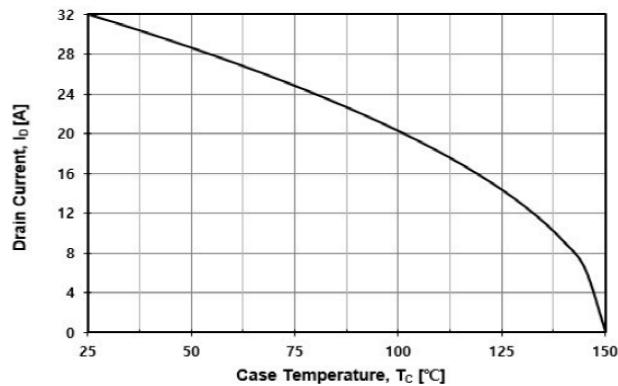
Fig. 10 Maximum Safe Operating Area

Operation in This Area is Limited by $R_{DS(on)}$

※ Note :
1. T_C = 25℃
2. T_J = 150℃
3. Single Pulse
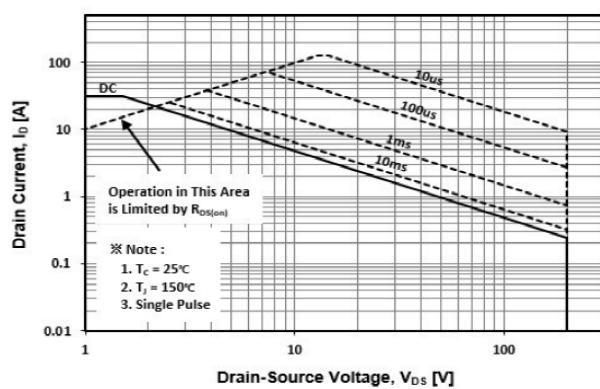
Fig. 11 Transient Thermal Impedance

※ Note :
1. $Z_{\theta JC}(t)$ = 2.6℃/W Max.
2. Duty Factor, δ = t1 / t2
3. $T_{JM} - T_C = P_{DM} \times Z_{\theta JC}(t)$
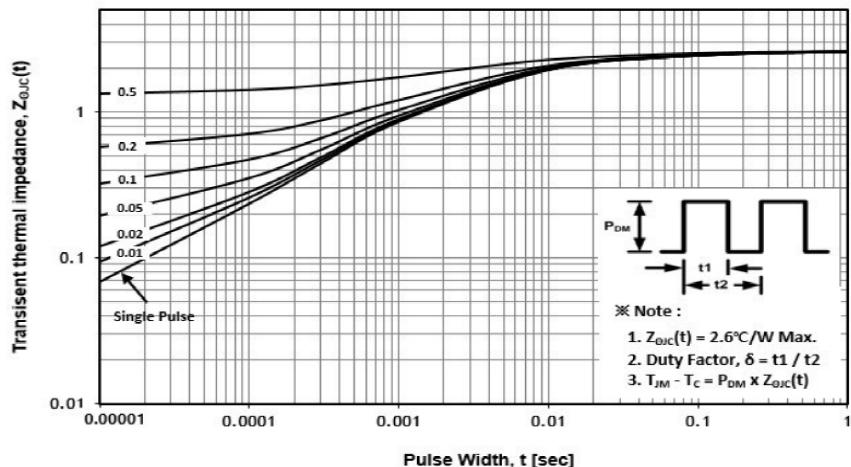
Fig. 12 Gate Charge Test Circuit & Waveform
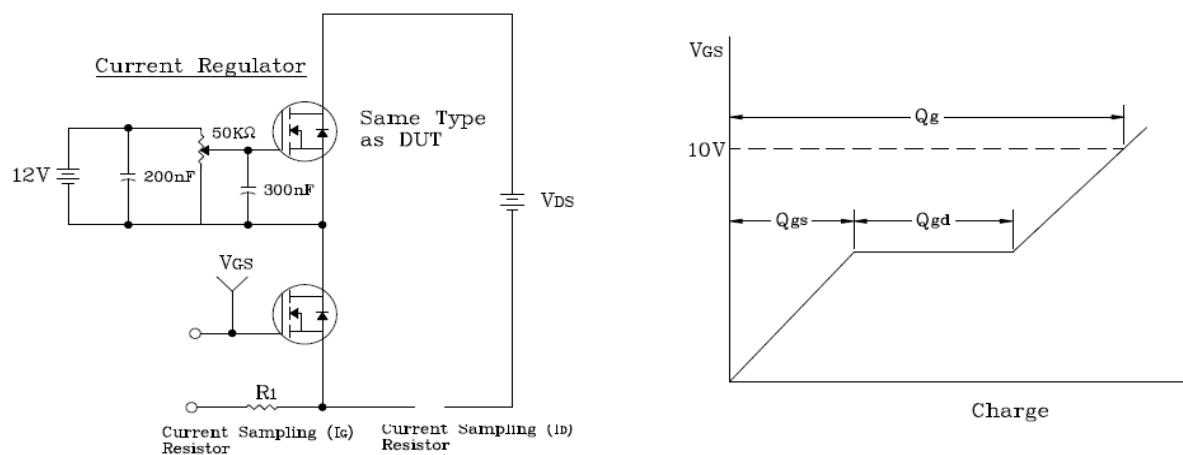
## Fig. 13 Resistive Switching Test Circuit & Waveform
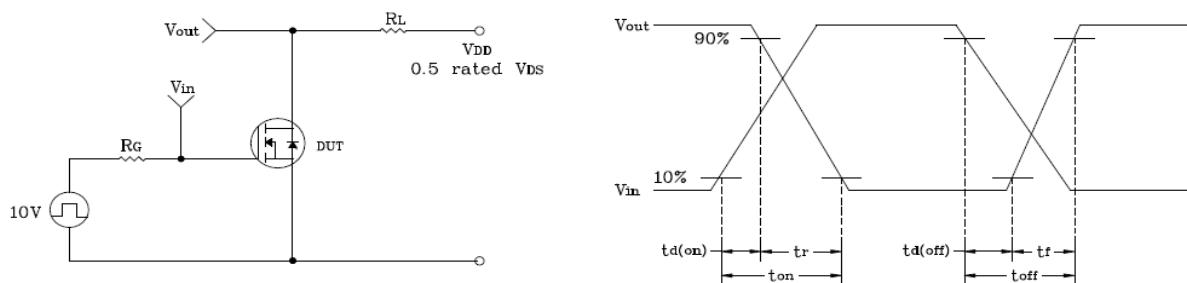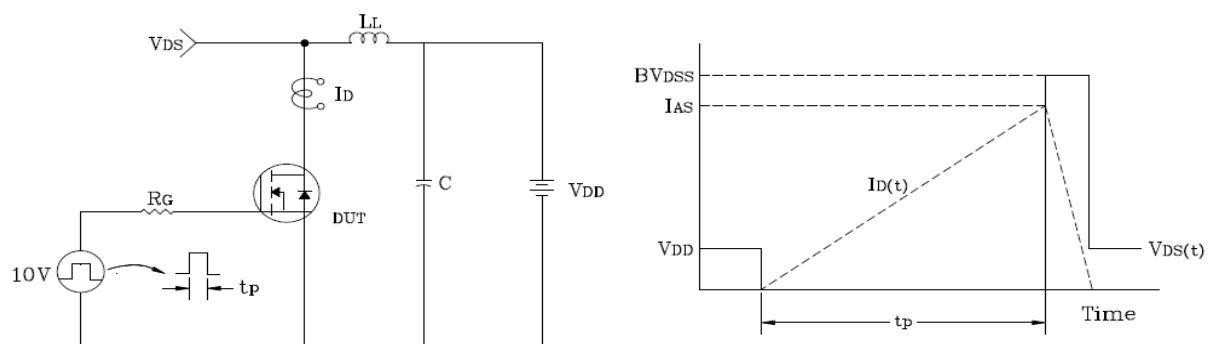

Fig. 14 E$_{AS}$ Test Circuit & Waveform

Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

VGS (Driver) — 10V

Is (DUT) — I$_{FM}$, Body Diode Forward Current — di/dt — Irr — Body Diode Reverse Current

VDS (DUT) — V$_F$ — VDD — Body Diode Forwad Voltage Drop