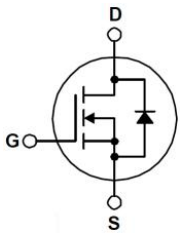
TSF20N50MR
500V N-Channel MOSFET

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

- 20A,500V,Max.$R_{DS(on)}$=0.30 Ω @ V_{GS}=10V
- Low gate charge(typical 45nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		500	V
V_{GS}	Gate-Source Voltage		± 30	V
I_D	Drain Current	T_C = 25℃	20*	A
		T_C = 100℃	10.8*	A
I_{DM}	Pulsed Drain Current	(Note 1)	80*	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	945	mJ
E_{AR}	Repetitive Avalanche Energy	(Note 1)	23.5	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25℃)		38.5	W
	-Derate above 25℃		0.3	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	℃

* Drain current limited by maximum junction temperature.

Thermal Resistance Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	3.3	℃/W
$R_{\theta CS}$	Thermal Resistance,Case-to-Sink Typ.	--	℃/W
$R_{\theta JA}$	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						
V_{GS}	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 = 10.0A	--	0.246	0.30	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20V, I_D = 10.0A	--	25	--	S
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	500	--	--	V
△BVDSS / △TJ	Breakdown Voltage Temperature Coefficient	ID = 250 uA, Referenced to 25 ℃	--	0.5	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 400 V, T_C = 125℃	--	--	10	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						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	3700	--	pF
C_{oss}	Output Capacitance		--	250	--	pF
C_{rss}	Reverse Transfer Capacitance		--	34	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	V_{DS} = 250 V, I_D = 20.0A, R_G = 25 Ω (Note 4)	--	60	--	ns
t_r	Turn-On Rise Time		--	160	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	84	--	ns
t_f	Turn-Off Fall Time		--	84	--	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 20.0A, V_{GS} = 10 V (Note 4)	--	42	--	nC
Q_{gs}	Gate-Source Charge		--	12	--	nC
Q_{gd}	Gate-Drain Charge		--	18	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	20	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	72	
V_{SD}	Source-Drain Diode Forward Voltage	I_S = 20.0A, V_{GS} = 0 V	--	--	1.4	V
t_{rr}	Reverse Recovery Time	I_S =20.0A, V_{GS} = 0 V, di_F/dt = 100 A/μs	--	500	--	ns
Q_{rr}	Reverse Recovery Charge		--	5.4	--	uC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=5.2mH, I_{AS}=18.0A, V_{DD}=50V, R_G=25 Ω,Starting TJ=25 ℃
3. I_{SD}≤18.0A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

Figure 1. On-Region Characteristics

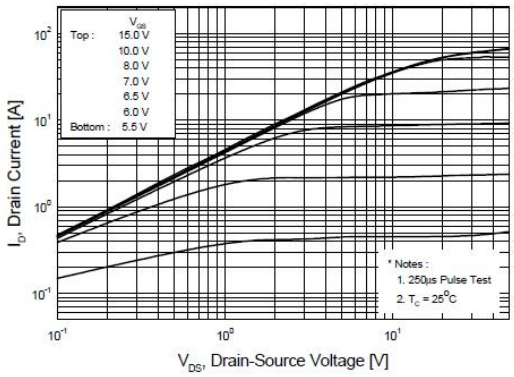


Figure 2. Transfer Characteristics

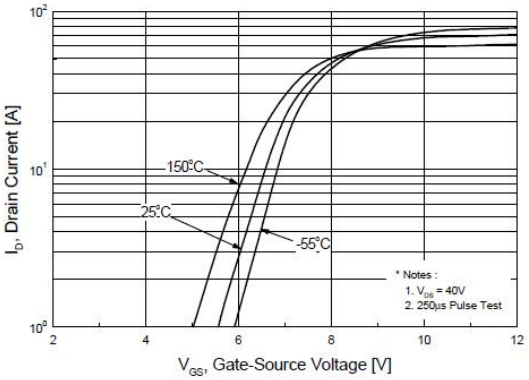


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

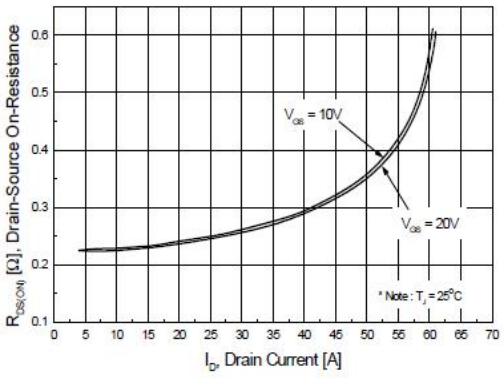


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

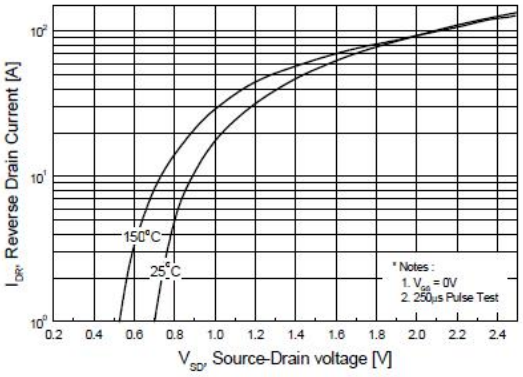


Figure 5. Capacitance Characteristics

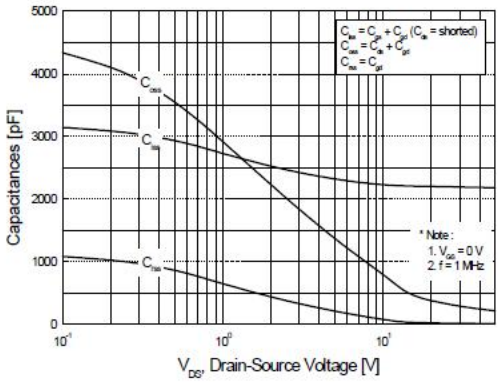
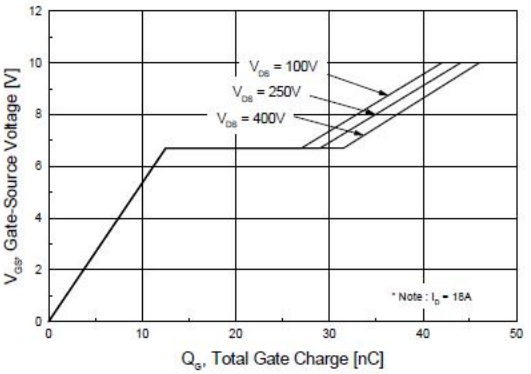


Figure 6. Gate Charge Characteristics



Typical Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

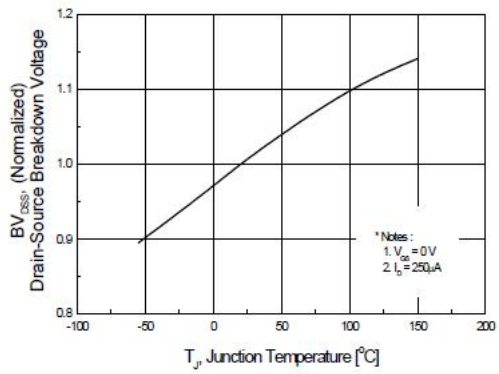


Figure 8. On-Resistance Variation vs. Temperature

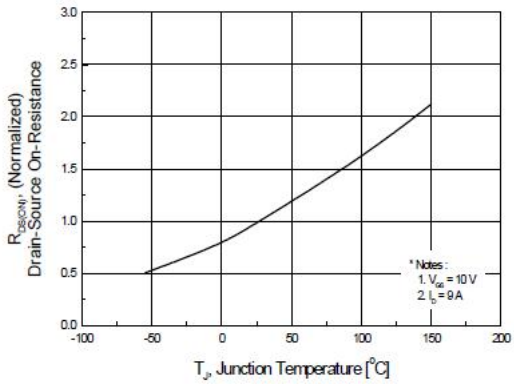


Figure 9.Maximum Safe Operating Area

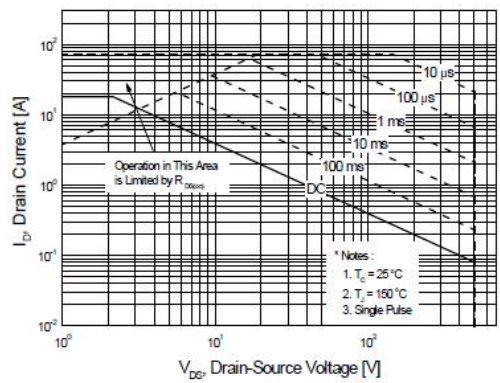


Figure 10.Maximum Drain Current vs. Case Temperature

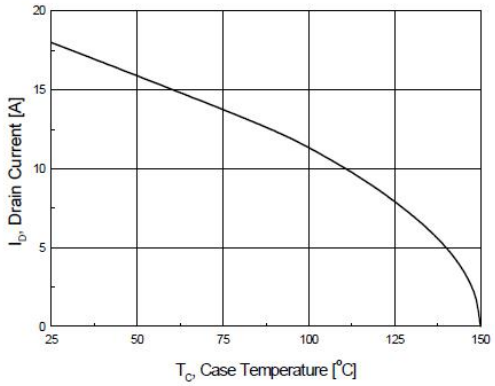


Figure 11.Transient Thermal Response Curve

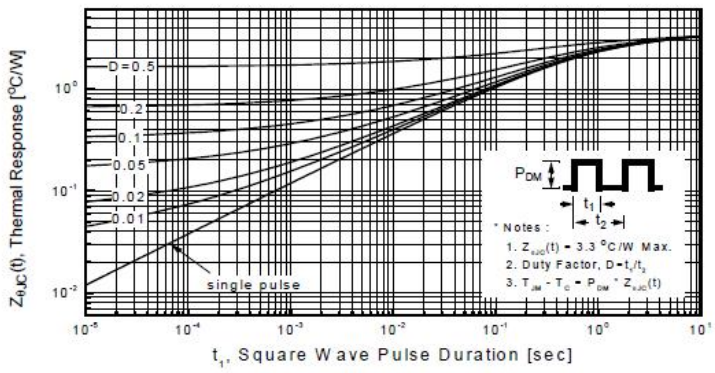
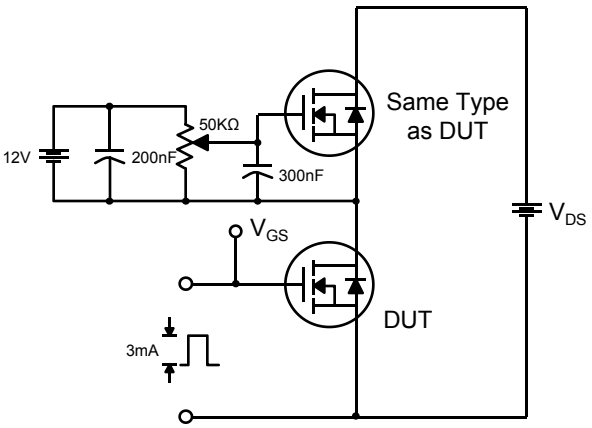


Fig 12. Gate Charge Test Circuit & Waveform



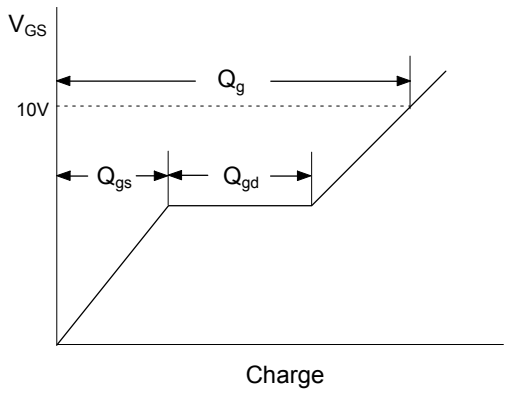
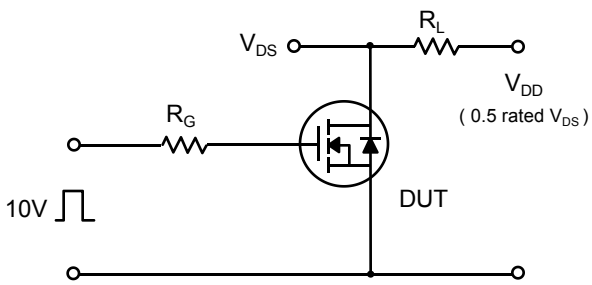


Fig 13. Resistive Switching Test Circuit & Waveforms



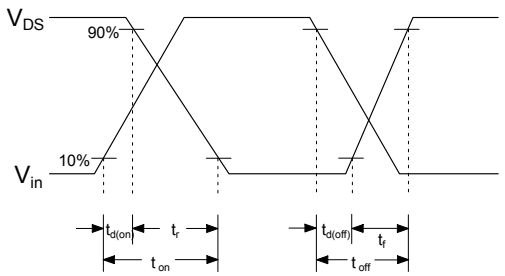
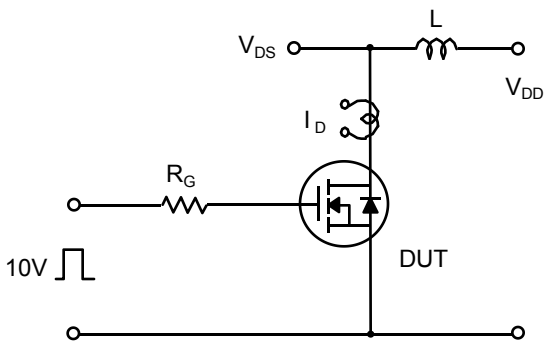


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms



$$E_{AS} = \frac{1}{2} L_L I_{AS}^2$$

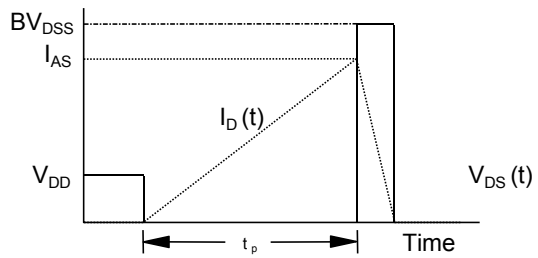


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms