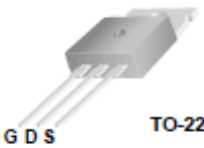
TSP5N65M/TSF5N65M
650V N-Channel MOSFET

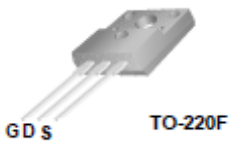
General Description

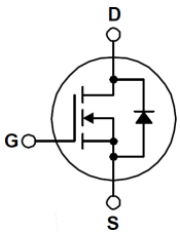
This Power MOSFET is produced using Truesemi's advanced planar stripe DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

Features

- 4.5A,650V,Max.$R_{DS(on)}$=3.0 Ω @ V_{GS} =10V
- Low gate charge(typical 16nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability







Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter		TSP5N65M	TSF5N65M	Units
V_{DSS}	Drain-Source Voltage		650		V
V_{GS}	Gate-Source Voltage		±30		V
I_D	Drain Current	T_C = 25℃	4.5	4.5*	A
		T_C = 100℃	2.7	2.7*	A
I_{DM}	Pulsed Drain Current	(Note 1)	18	18*	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	180		mJ
E_{AR}	Repetitive Avalanche Energy	(Note 1)	10.4		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25℃)		104	34	W
	-Derate above 25℃		0.83	0.27	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	TSP5N65M	TSF5N65M	Units
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	1.2	3.65	℃/W
$R_{\theta CS}$	Thermal Resistance,Case-to-Sink Typ.	0.5	--	℃/W
$R_{\theta JA}$	Thermal Resistance,Junction-to-Ambient	62.5	62.5	℃/W

Electrical Characteristics T_C=25 ℃ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
$V_{GS(th)}$	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 = 2.25A	--	2.5	3.0	Ω
g_{FS}	Forward Transconductance	V_{DS}=20V,I_D=2.25A	--	4.5	--	S
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	650	--	--	V
△BVDSS / △TJ	Breakdown Voltage Temperature Coefficient	ID = 250 uA, Referenced to 25℃	--	0.6	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 520 V, T_J = 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	--	720	--	pF
C_{oss}	Output Capacitance		--	55	--	pF
C_{rss}	Reverse Transfer Capacitance		--	7	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	V_{DS} = 325V, I_D = 4.5A, R_G = 25 Ω (Note 4,5)	--	10	--	ns
t_r	Turn-On Rise Time		--	40	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	40	--	ns
t_f	Turn-Off Fall Time		--	50	--	ns
Q_g	Total Gate Charge	V_{DS} = 520 V, I_D = 4.5A, V_{GS} = 10 V (Note 4,5)	--	16	--	nC
Q_{gs}	Gate-Source Charge		--	2.5	--	nC
Q_{gd}	Gate-Drain Charge		--	6.5	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	4.5	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	18.0	
V_{SD}	Source-Drain Diode Forward Voltage	I_S = 4.5 A, V_{GS} = 0 V	--	--	1.4	V
t_{rr}	Reverse Recovery Time	I_S =4.5A, V_{GS} = 0 V di_F/dt = 100 A/μs (Note 4)	--	300	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.0	--	uC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=17mH, I_{AS}=4.5A, V_{DD}=50V, R_G=25 Ω,Starting TJ=25 ℃
3. I_{SD}≤4.5A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

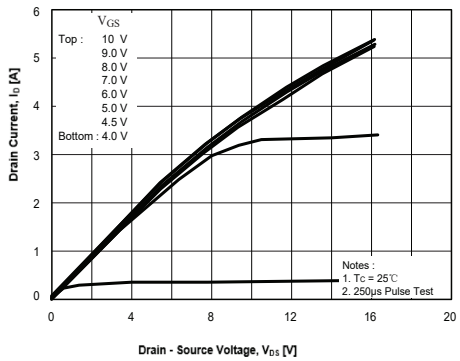


Figure 1. On-Region Characteristics

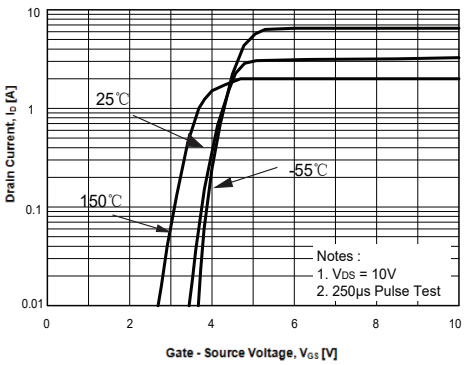


Figure 2. Transfer Characteristics

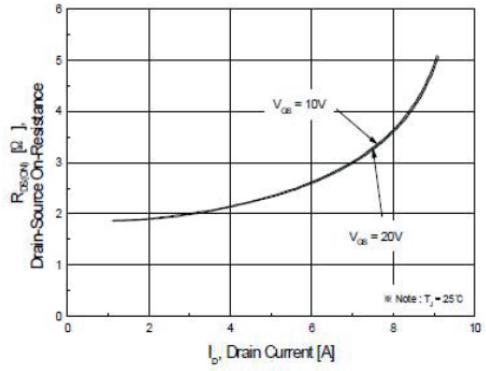


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

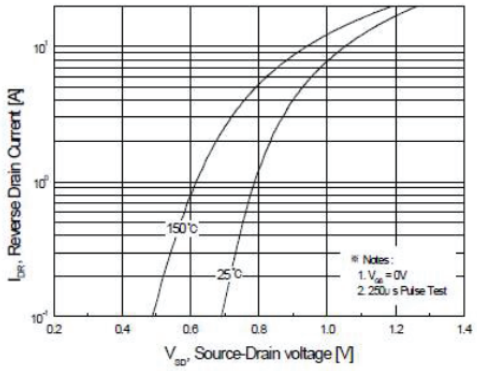


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

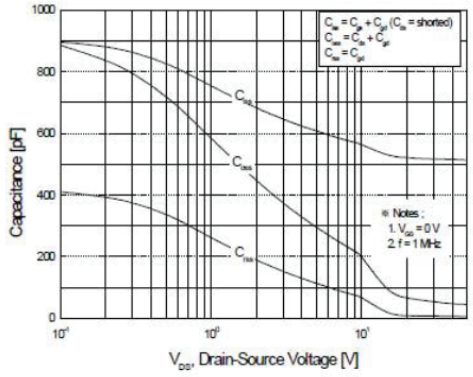


Figure 5. Capacitance Characteristics

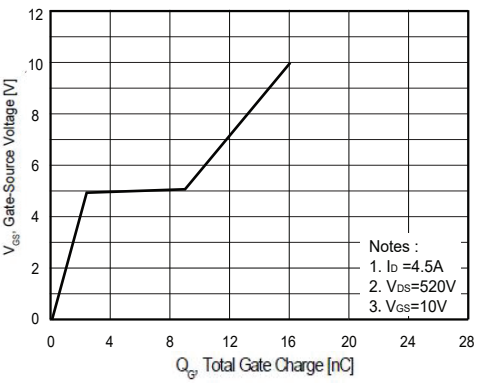


Figure 6. Gate Charge Characteristics

Typical Characteristics

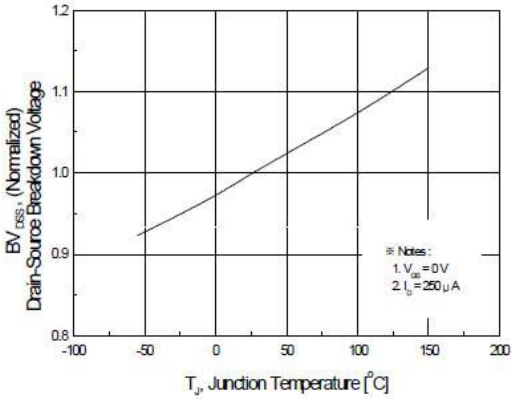


Figure 7. Breakdown Voltage Variation vs Temperature

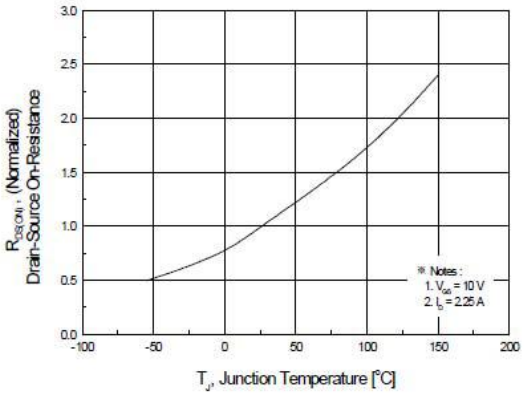


Figure 8. On-Resistance Variation vs Temperature

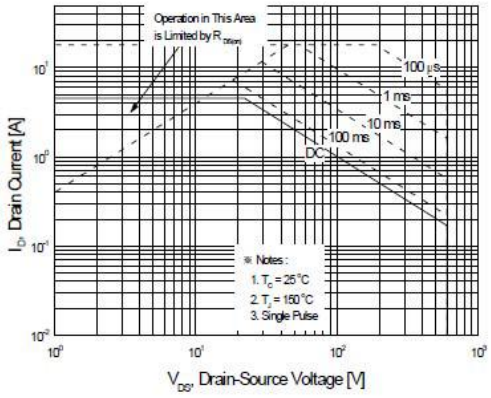


Figure 9-1. Maximum Safe Operating Area for TSP5N65M

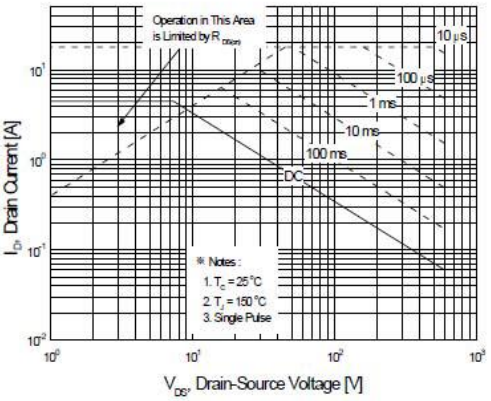


Figure 9-2. Maximum Safe Operating Area for TSP5N65M

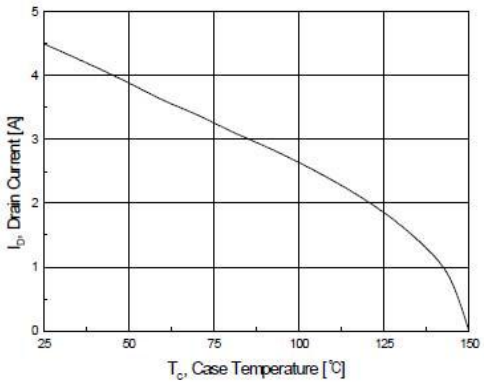


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics

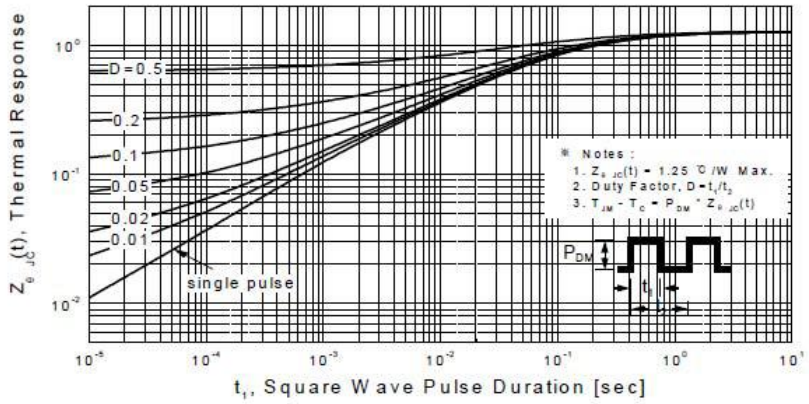


Figure 11-1. Transient Thermal Response Curve for TSP5N65M

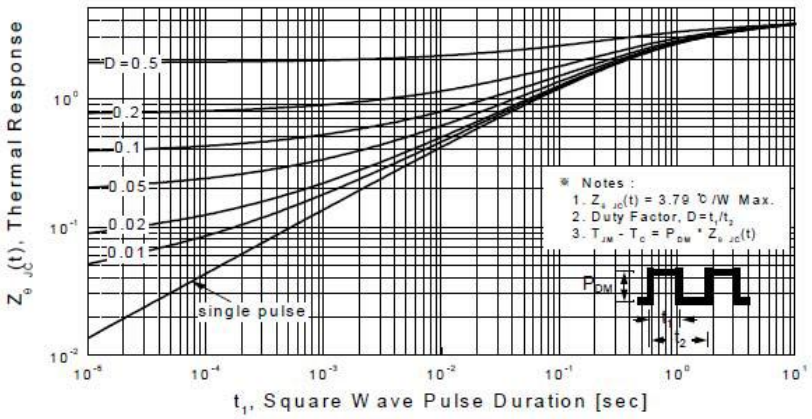


Figure 11-2. Transient Thermal Response Curve for TSP5N65M

Fig 12. Gate Charge Test Circuit & Waveform

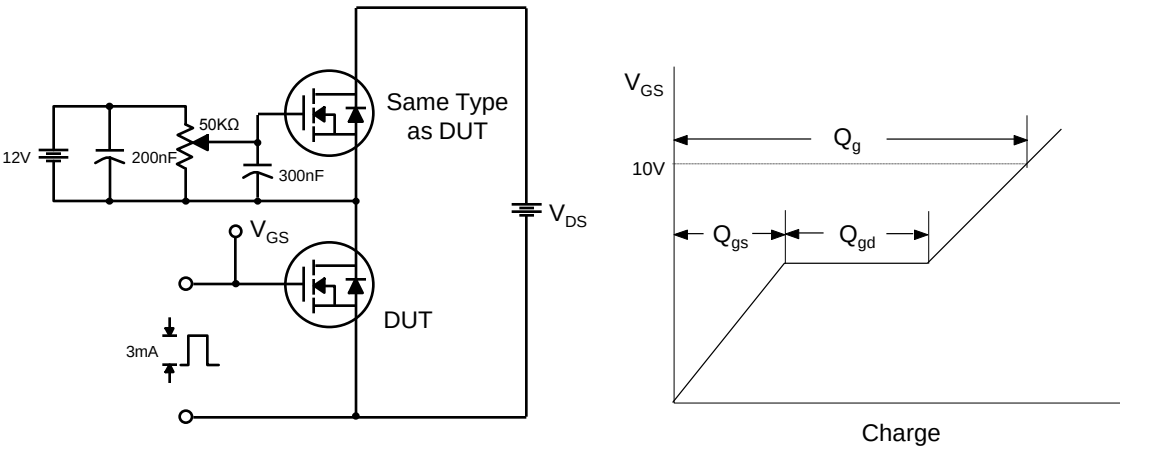


Fig 13. Resistive Switching Test Circuit & Waveforms

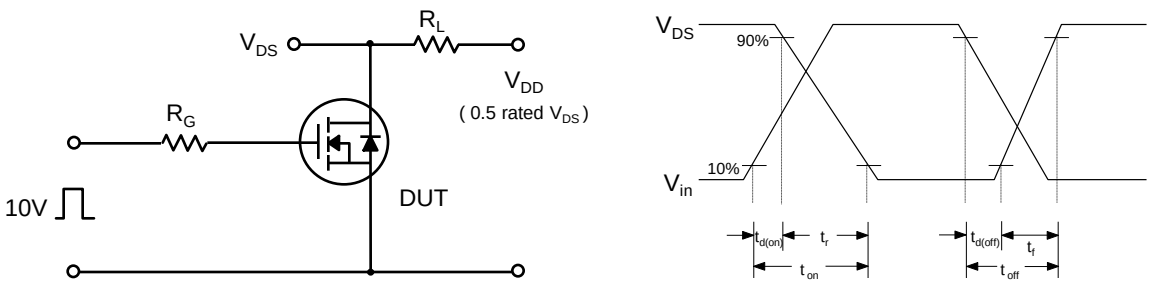


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

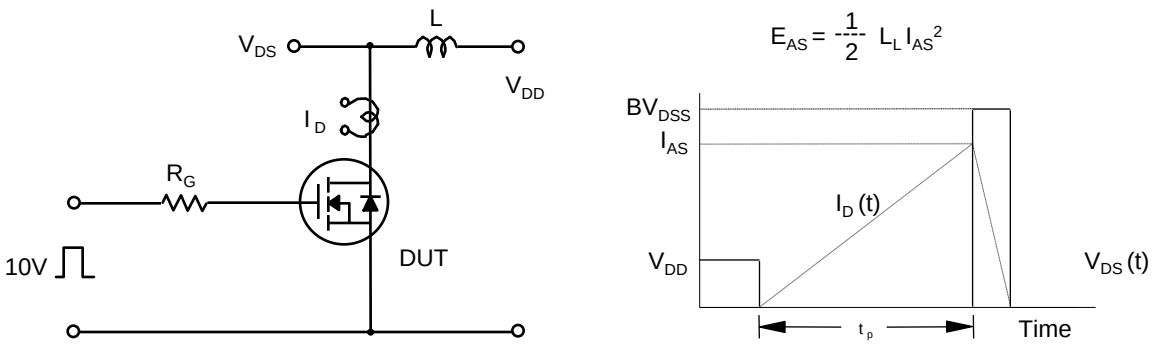


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms