



September, 2013
SJ-FET

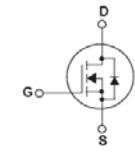
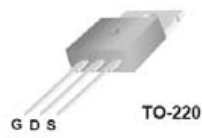
TSP12N60MS / TSF12N60MS 600V N-Channel MOSFET

Description

SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

Features

- 650V @T_J = 150 °C
- Typ. R_{DS(on)} = 0.4Ω
- Ultra Low Gate Charge (typ. Q_g = 30nC)
- 100% avalanche tested



Absolute Maximum Ratings

Symbol	Parameter	TSP12N60MS	TSF12N60MS	Unit
V _{DSS}	Drain-Source Voltage	600		V
I _D	Drain Current -Continuous (TC = 25°C)	12	12*	A
	-Continuous (TC = 100°C)	8.5	8.5*	
I _{DM}	Drain Current - Pulsed (Note 1)	40	40*	A
V _{GSS}	Gate-Source voltage	±30		V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	120		mJ
I _{AR}	Avalanche Current (Note 1)	2		A
E _{AR}	Repetitive Avalanche Energy (Note 1)	60		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P _D	Power Dissipation (TC = 25°C) -Derate above 25°C	205	35	W
		1.67	0.3	
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150		°C
T _L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		°C

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	TSP12N60MS	TSF12N60MS	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case	0.6	6	°C/W
R _{θCS}	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62	62	°C/W

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Electrical Characteristics TC = 25°C unless otherwise noted

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	600	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150°C	--	650	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.6	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600V, V _{GS} = 0V V _{DS} = 480V, T _C = 125°C	--	--	1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.5	--	4.5	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 5A	--	0.4	0.43	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 5A (Note 4)	--	16	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	600	800	pF
C _{oss}	Output Capacitance		--	120	200	pF
C _{rss}	Reverse Transfer Capacitance		--	55	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 400V, I _D = 5A R _G = 20Ω (Note 4, 5)	--	25	--	ns
t _r	Turn-On Rise Time		--	55	--	ns
t _{d(off)}	Turn-Off Delay Time		--	70	--	ns
t _f	Turn-Off Fall Time		--	40	--	ns
Q _g	Total Gate Charge		V _{DS} = 480V, I _D = 10A V _{GS} = 10V (Note 4, 5)	--	35	45
Q _{gs}	Gate-Source Charge	--		5	--	nC
Q _{gd}	Gate-Drain Charge	--		18	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	40	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 12A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 12A dI _F /dt = 100A/μs	--	240	--	ns
Q _{rr}	Reverse Recovery Charge	(Note 4)	--	3.1	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=60mH, I_{AS}=2A, V_{DD}=150V, Starting T_J=25 °C
3. I_{SD}≤12A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25 °C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

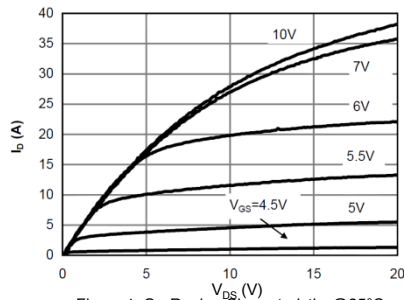


Figure 1: On-Region Characteristics@25°C

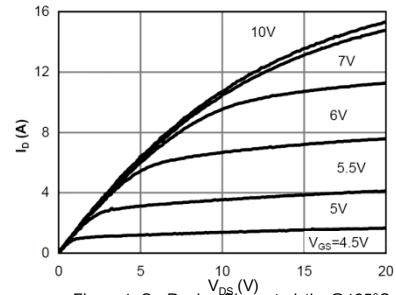


Figure 1: On-Region Characteristics@125°C

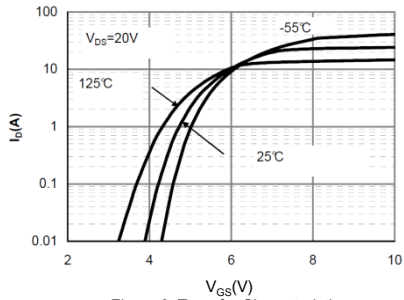


Figure 3: Transfer Characteristics

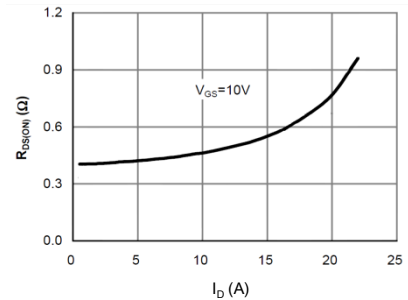


Figure 4: On-Resistance vs. Drain Current and Gate Voltage

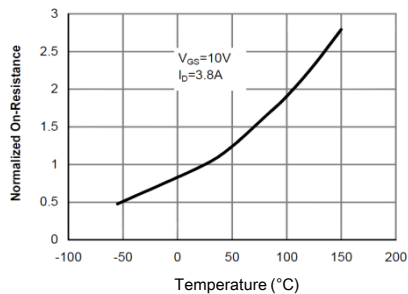


Figure 5: On-Resistance vs. Junction Temperature

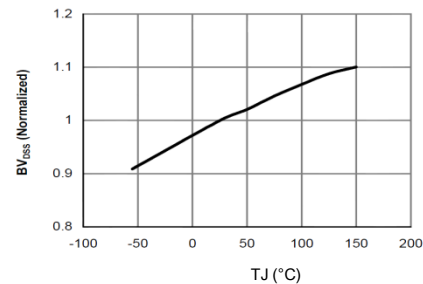


Figure 6: Break Down vs. Junction Temperature

Typical Performance Characteristics

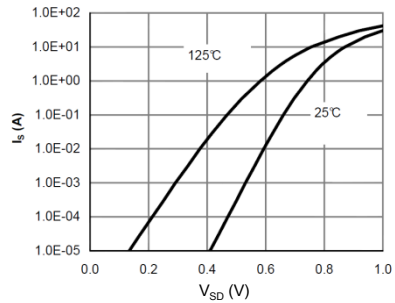


Figure 7: Body-Diode Characteristics

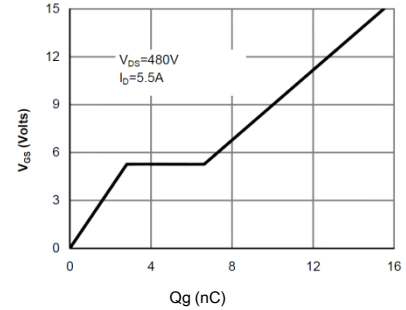


Figure 8: Gate-Charge Characteristics

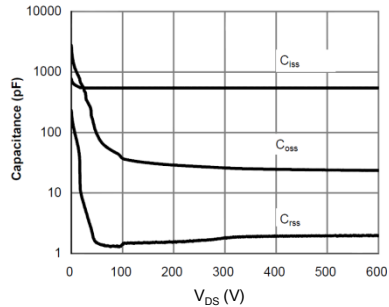


Figure 9: Capacitance Characteristics

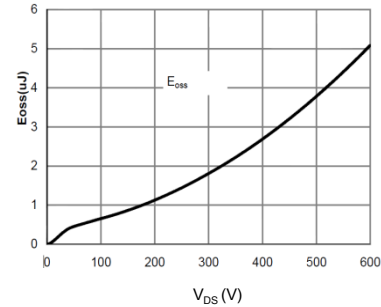


Figure 10: C_{OSS} stored Energy

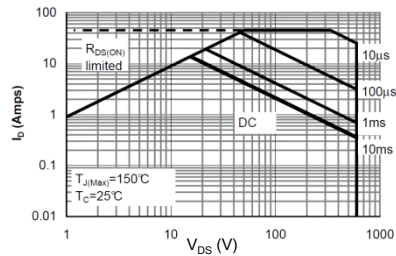


Figure 11: Maximum Forward Biased Safe Operating Area

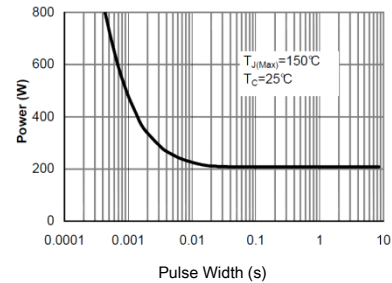


Figure 12: Single Pulse Power Rating Junction-to-Case

Typical Performance Characteristics

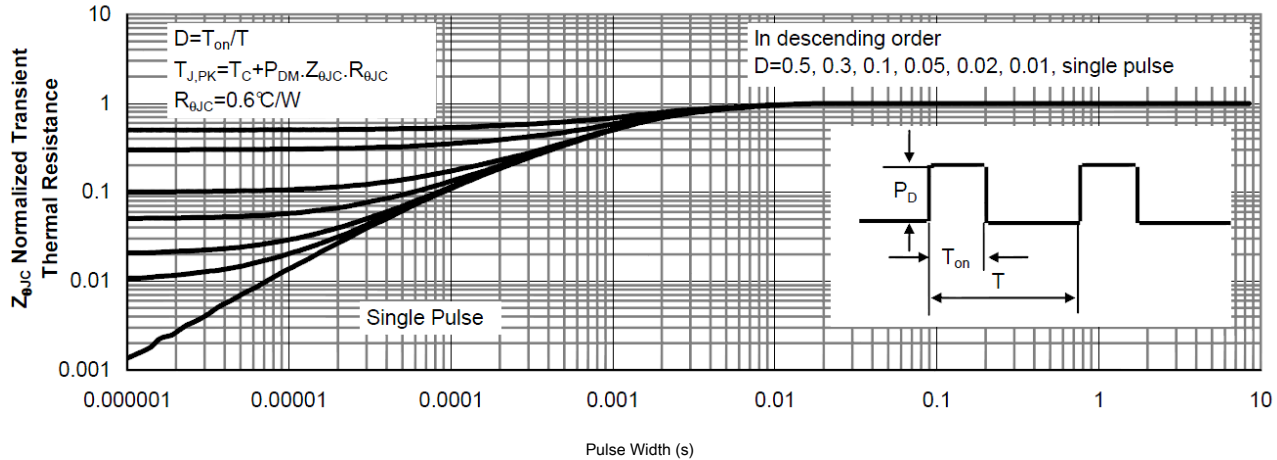


Figure 13: Normalized Maximum Transient Thermal Impedance

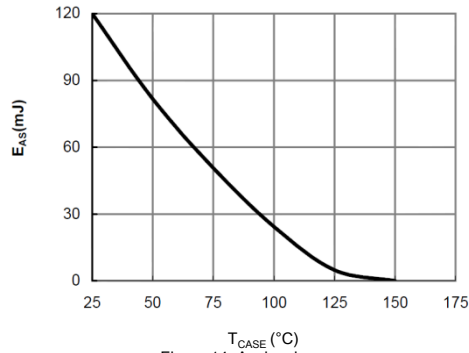


Figure 14: Avalanche energy

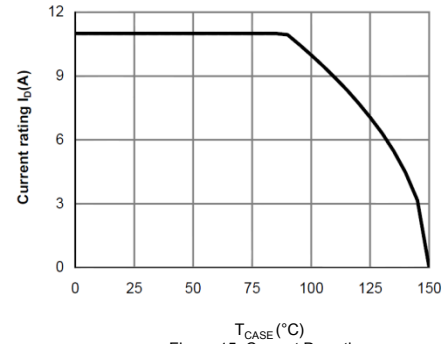


Figure 15: Current De-rating

Typical Performance Characteristics

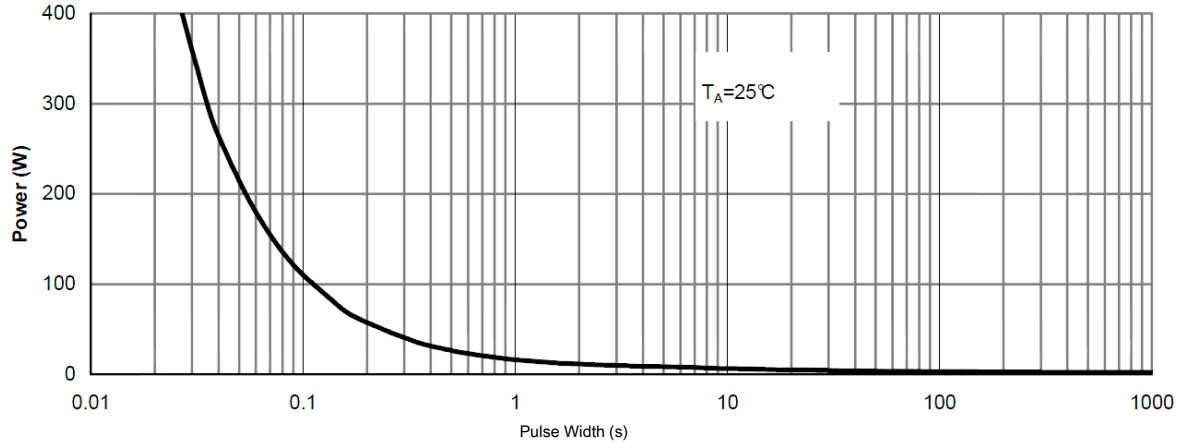


Figure 16: Single Pulse Power Rating Junction-to-Ambient

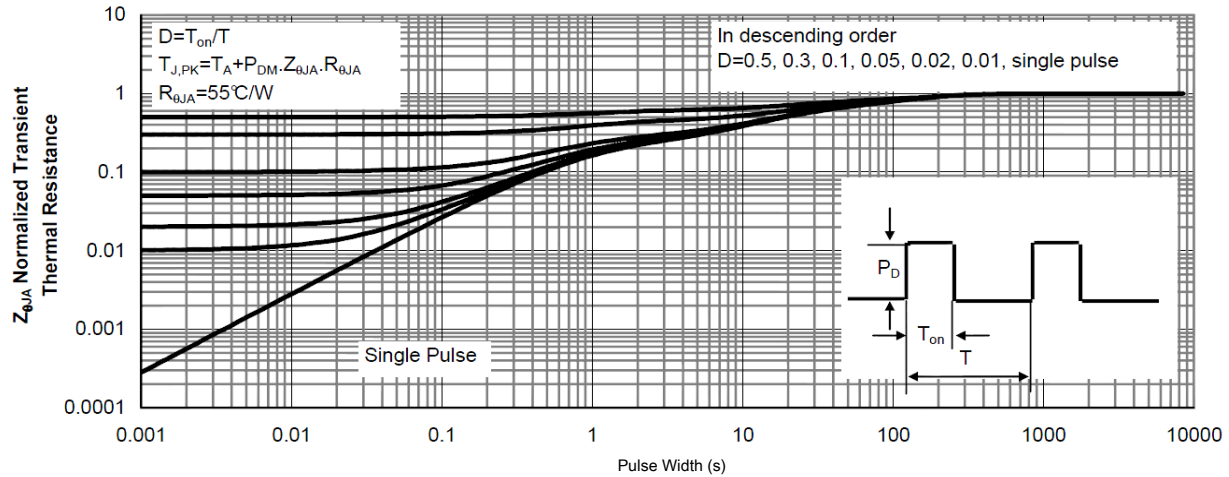


Figure 17: Normalized Maximum Transient Thermal Impedance