



TSK60N50MSD

500V N-Channel Fast Recovery MOSFET

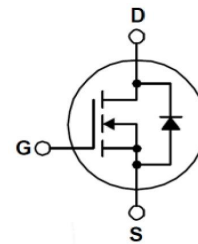
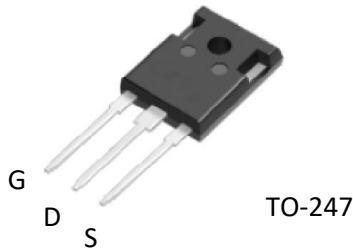
General Description

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.

Features

60A, 500V, Max. $R_{DS(on)} = 0.122\Omega$
@ $V_{GS} = 10V$

- ◆ Drain-Source breakdown voltage: $BVDSS = 500V$ (Min.)
- ◆ Low drain-source On resistance: $R_{DS(on)} = 122m\Omega$ (Max.)
- ◆ 100% avalanche tested
- ◆ RoHS compliant device



Absolute Maximum Ratings $T_C = 25^\circ C$ 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 *	$T_C = 25^\circ C$	60	A
		$T_C = 100^\circ C$	40	A
I_{DM}	Pulsed Drain Current *		240	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	2312	mJ
I_{AR}	Repetitive avalanche current	(Note 2)	68	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	100	mJ
P_D	Power Dissipation ($T_C = 25^\circ C$)		1000	W
T_J	Junction temperature		150	$^\circ C$
T_{stg}	Storage temperature range		-55~150	$^\circ C$

* Limited only maximum junction temperature

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.125	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ C/W$

Electrical Characteristics $T_c=25\text{ }^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$, $I_D = 30\text{ A}$	--	0.095	0.122	Ω
R_g	Internal gate resistance	Open drain, $f=1\text{ MHz}$	--	0.8	--	Ω

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	500	--	--	V
I_{DSS}	Drain-source cut-off current	$V_{DS}=500\text{ V}$, $V_{GS} = 0\text{ V}$	--	--	25	μA
		$V_{DS}=500\text{ V}$, $T_c=125\text{ }^{\circ}\text{C}$	--	--	100	μA
I_{GSS}	Gate leakage current	$V_{DS}=0\text{ V}$, $V_{GS}=\pm 20\text{ V}$	--	--	± 250	Na

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$	--	9533	--	pF
C_{oss}	Output Capacitance		--	735	--	pF
C_{rss}	Reverse Transfer Capacitance		--	71	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Time (Note 3,4)	$V_{DD}=250\text{ V}$, $I_D = 60\text{ A}$, $R_G = 25\text{ }\Omega$	--	102	--	ns
t_r	Turn-On Rise Time (Note 3,4)		--	58	--	ns
$t_{d(off)}$	Turn-Off Delay Time (Note 4,5)		--	475	--	ns
t_f	Turn-Off Fall Time (Note 3,4)		--	77	--	ns
Q_g	Total Gate Charge (Note 3,4)	$V_{DS}=400\text{ V}$, $I_D = 60\text{ A}$, $V_{GS} = 10\text{ V}$	--	193	--	nC
Q_{gs}	Gate-Source Charge (Note 3,4)		--	43	--	nC
Q_{gd}	Gate-Drain Charge (Note 3,4)		--	63	--	nC

Source-Drain Diode Maximum Ratings and Characteristics

I_S	Continuous Source-Drain Diode Forward Current		--	--	60	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	240	
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 60\text{ A}$, $V_{GS} = 0\text{ V}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$I_S = 50\text{ A}$, $V_{GS} = 0\text{ V}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 3, 4)	--	381	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.27	--	μC

NOTES:

1. Repeated rating: Pulse width limited by safe operating area
2. $L=1\text{ mH}$, $I_{AS}=68\text{ A}$, $V_{DD}=50\text{ V}$, $R_G=25\text{ }\Omega$, Starting $T_J=25\text{ }^{\circ}\text{C}$
3. Pulse test: Pulse width $\leq 300\text{ }\mu\text{s}$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature typical characteristics

Typical Characteristics Curve

Fig. 1 Typical Output Characteristics

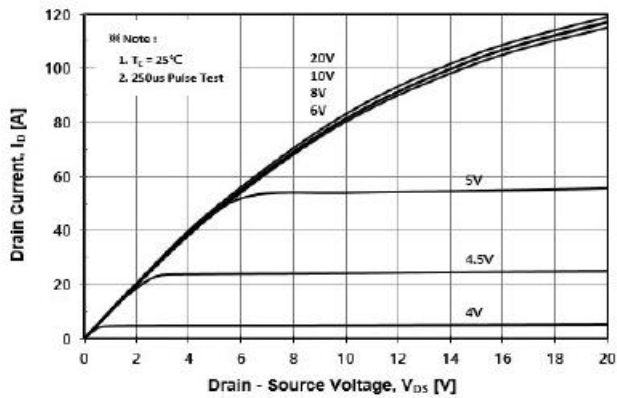


Fig. 2 Typical Transfer Characteristics

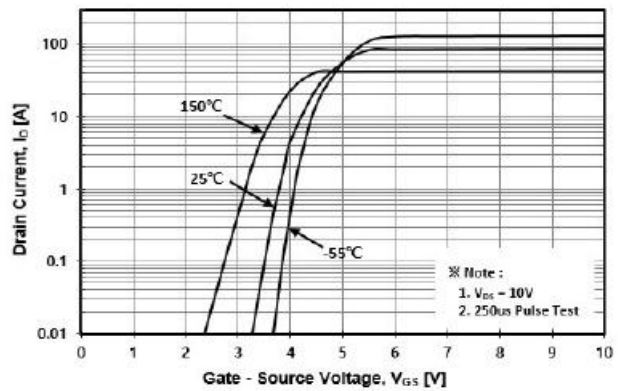


Fig. 3 On-Resistance Variation with Drain Current and Gate Voltage

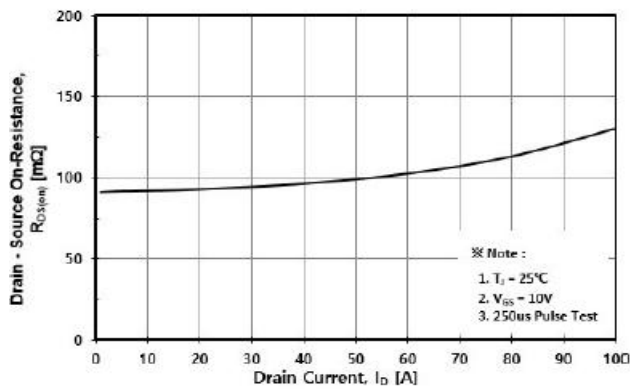


Fig. 4 Body Diode Forward Voltage Variation with Source Current

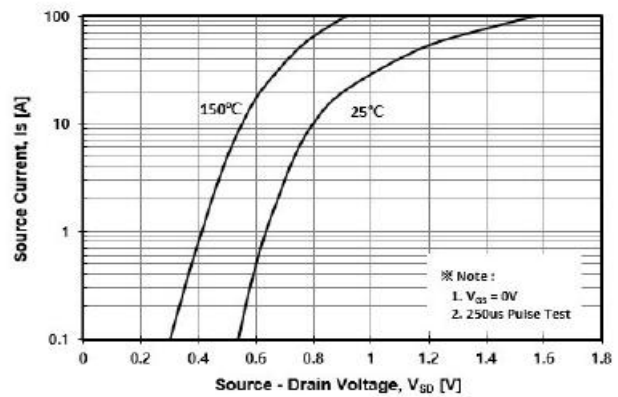


Fig. 5 Typical Capacitance Characteristics

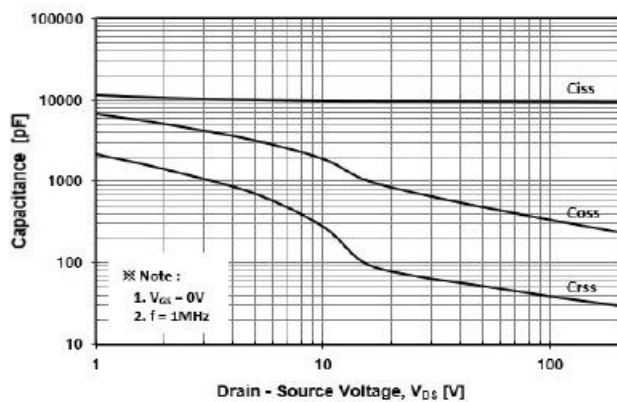
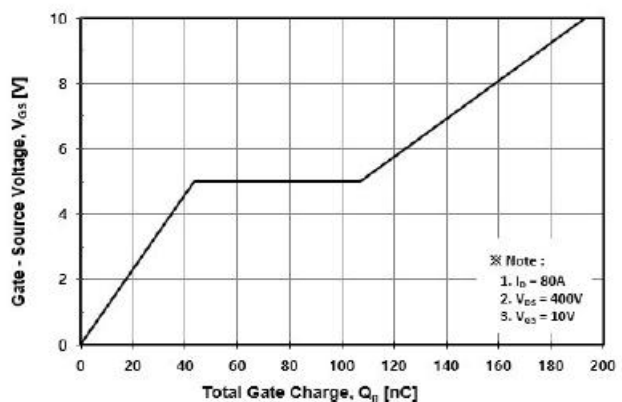


Fig. 6 Typical Total Gate Charge Characteristics



Typical Characteristics Curve (Continue)

Fig. 7 Breakdown Voltage Variation vs. Temperature

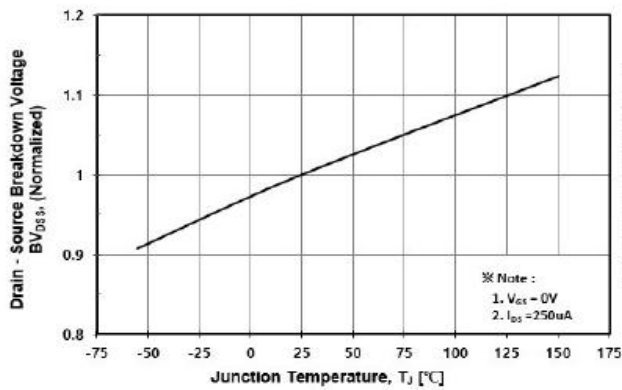


Fig. 8 On-Resistance Variation vs. Temperature

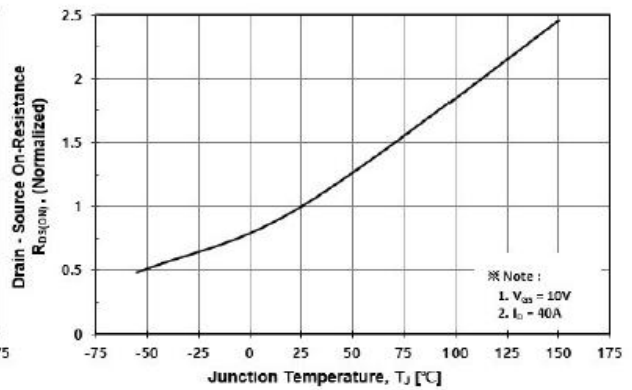


Fig. 9 Maximum Drain Current vs. Case Temperature

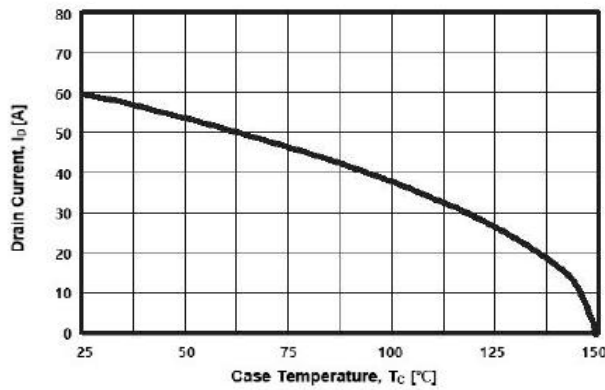


Fig. 10 Maximum Safe Operating Area

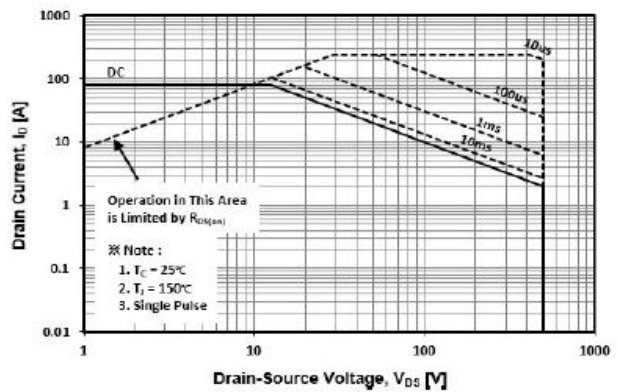


Fig. 11 Transient Thermal Impedance

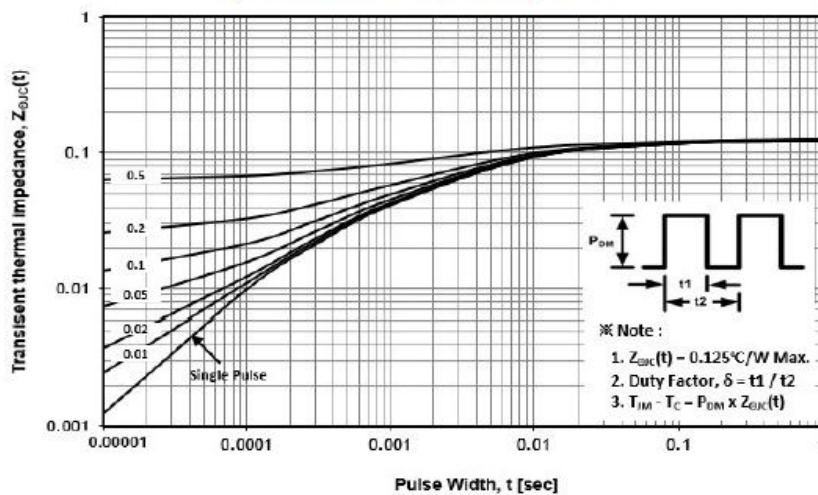


Fig. 12 Gate Charge Test Circuit & Waveform

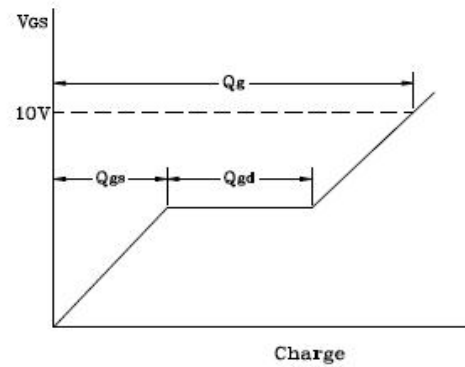
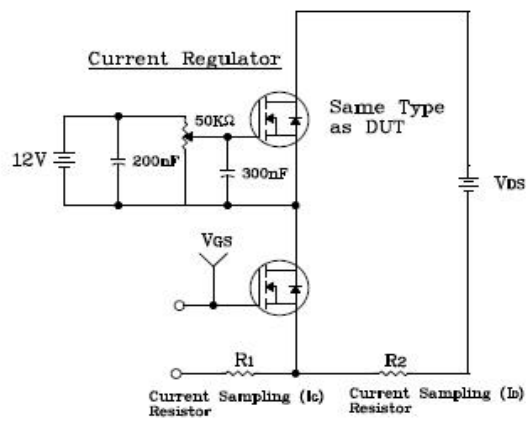


Fig. 13 Resistive Switching Test Circuit & Waveform

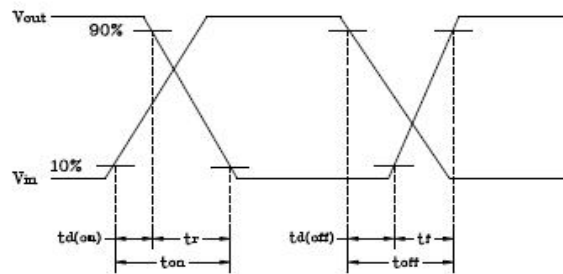
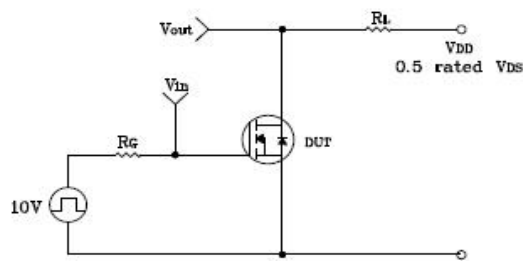


Fig. 14 E_{AS} Test Circuit & Waveform

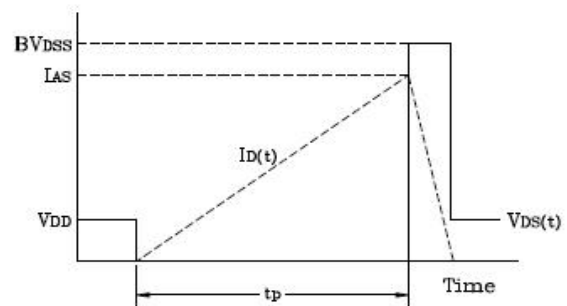
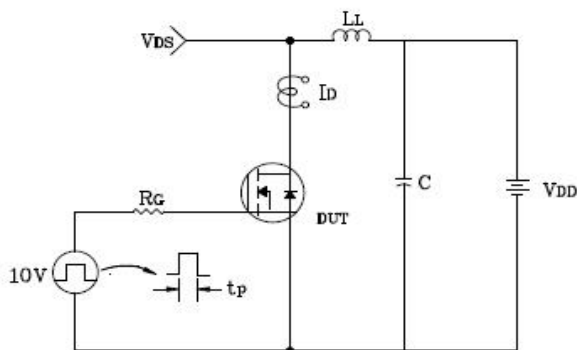


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform

