

# TSM5NS50

## 500V N-Channel Power MOSFET

**TO-252**

**Pin Definition:**

1. Gate
2. Drain
3. Source

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
500	0.8 @ $V_{GS} = 10V$	4

**Features**

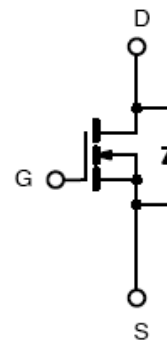
- Low  $R_{DS(on)}$
- Low Gate Charge
- Unclamped Inductive Switching (UIS) Rated

**Application**

- Load Switch
- Ballast
- Lighting

**Ordering Information**

Part No.	Package	Packing
TSM5NS50CP RO	TO-252	T&R

**Block Diagram**


N-Channel MOSFET

**Absolute Maximum Rating ( $T_a = 25^\circ\text{C}$  unless otherwise noted)**

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	4.4	A
Pulsed Drain Current	$I_{DM}$	20	A
Repetitive Avalanche Current	$I_{AR}$	5	A
Energy Avalanche	EAS	150	mJ
Maximum Power Dissipation	$P_D$	70	W
Operating Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**Thermal Performance**

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R_{\theta JC}$	1.78	$^\circ\text{C/W}$
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	62	$^\circ\text{C/W}$

Notes:

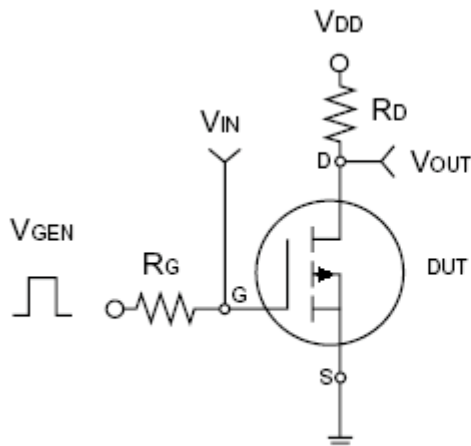
- a. When mounted on 1 inch square 2oz copper clad FR-4

### Electrical Specifications

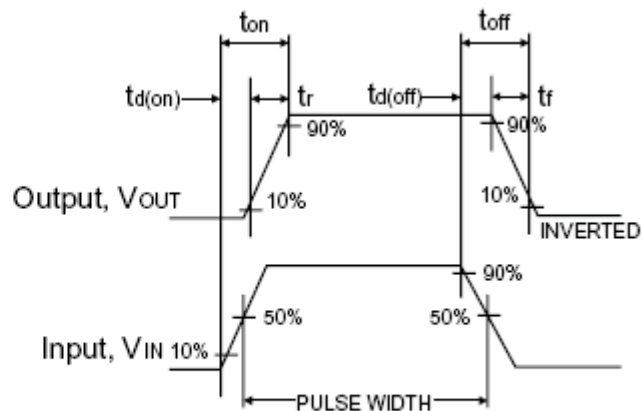
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	500	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2	--	4	V
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = 500V, V_{GS} = 0V$	$I_{DSS}$	--	--	1.0	$\mu A$
Drain-Source On-State Resistance <sup>a</sup>	$V_{GS} = 10V, I_D = 4.0A$	$R_{DS(ON)}$	--	0.7	0.8	$\Omega$
Diode Forward Voltage	$I_S = 4.4A, V_{GS} = 0V$	$V_{SD}$	--	1.0	1.5	V
<b>Dynamic <sup>b</sup></b>						
Total Gate Charge	$V_{DS} = 520V, I_D = 4.4A, V_{GS} = 10V$	$Q_g$	--	13	--	nC
Gate-Source Charge		$Q_{gs}$	--	3	--	
Gate-Drain Charge		$Q_{gd}$	--	6	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	$C_{iss}$	--	400	--	pF
Output Capacitance		$C_{oss}$	--	120	--	
Reverse Transfer Capacitance		$C_{rss}$	--	40	--	
<b>Switching <sup>c</sup></b>						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 4.4A, V_{DS} = 350V, R_G = 25\Omega$	$t_{d(on)}$	--	6	--	nS
Turn-On Rise Time		$t_r$	--	3	--	
Turn-Off Delay Time		$t_{d(off)}$	--	50	--	
Turn-Off Fall Time		$t_f$	--	10	--	
Source-to-Drain Reverse Recovery Time	$I_S = 4.4A, di/dt = 100A/\mu S$	$t_r$	--	250	00	nS

Notes:

- a. Pulse test: pulse width  $\leq 300\mu S$ , duty cycle  $\leq 2\%$
- b. For design reference only, not subject to production testing.
- c. Switching time is essentially independent of operating temperature.



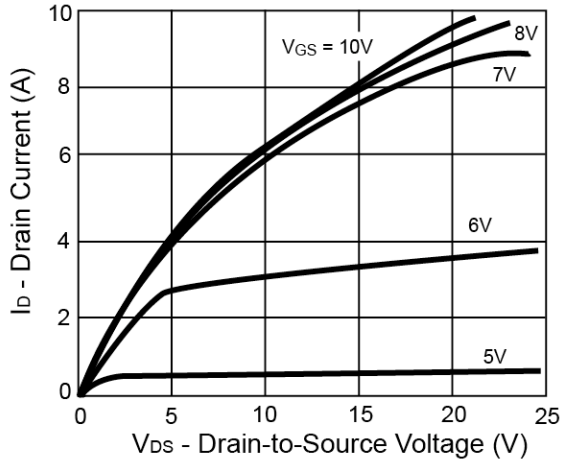
Switching Test Circuit



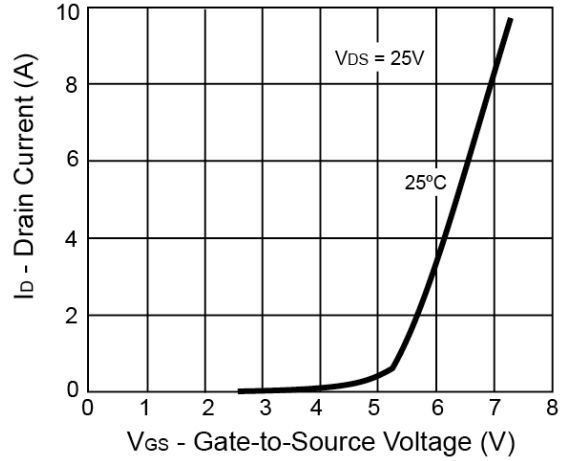
Switchin Waveforms

**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

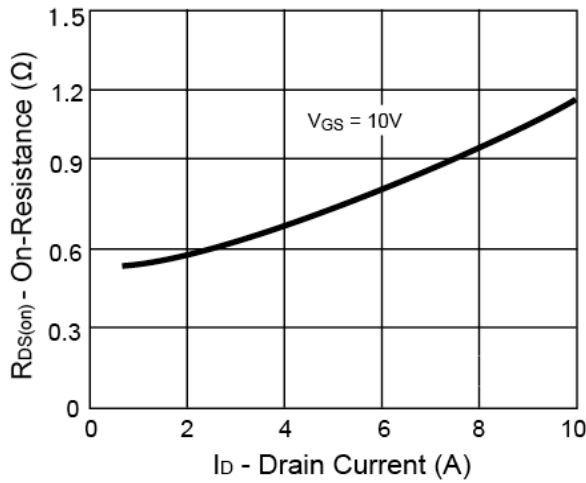
**Output Characteristics**



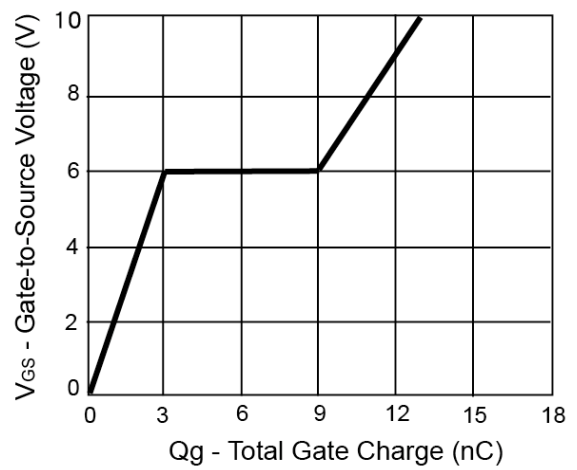
**Transfer Characteristics**



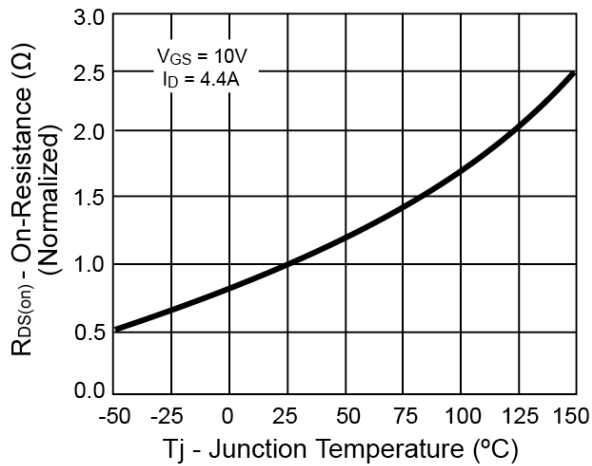
**On-Resistance vs. Drain Current**



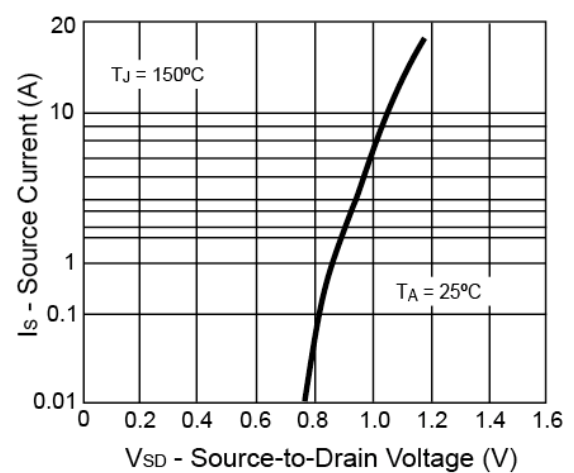
**Gate Charge**



**On-Resistance vs. Junction Temperature**

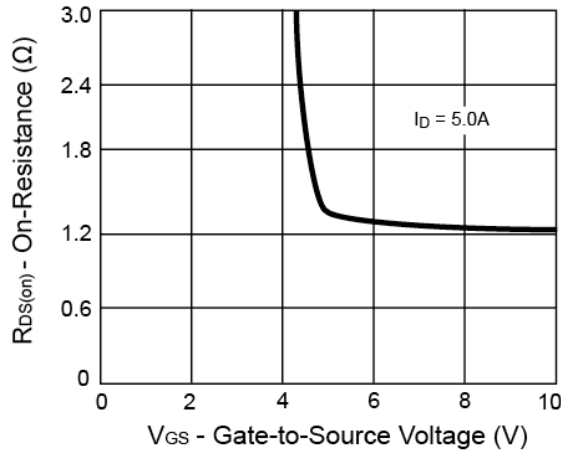


**Source-Drain Diode Forward Voltage**

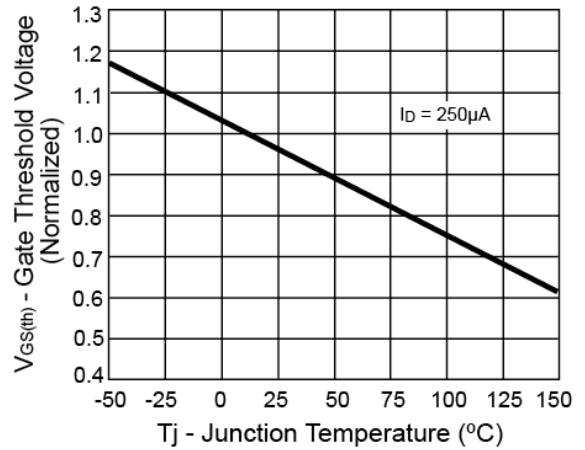


**Electrical Characteristics Curve** (Ta = 25 °C, unless otherwise noted)

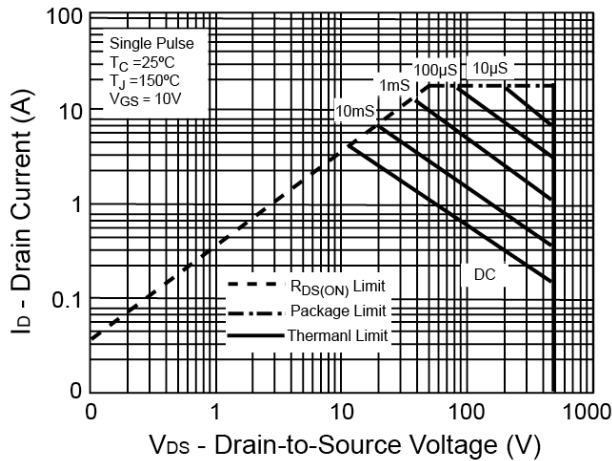
**On-Resistance vs. Gate-Source Voltage**



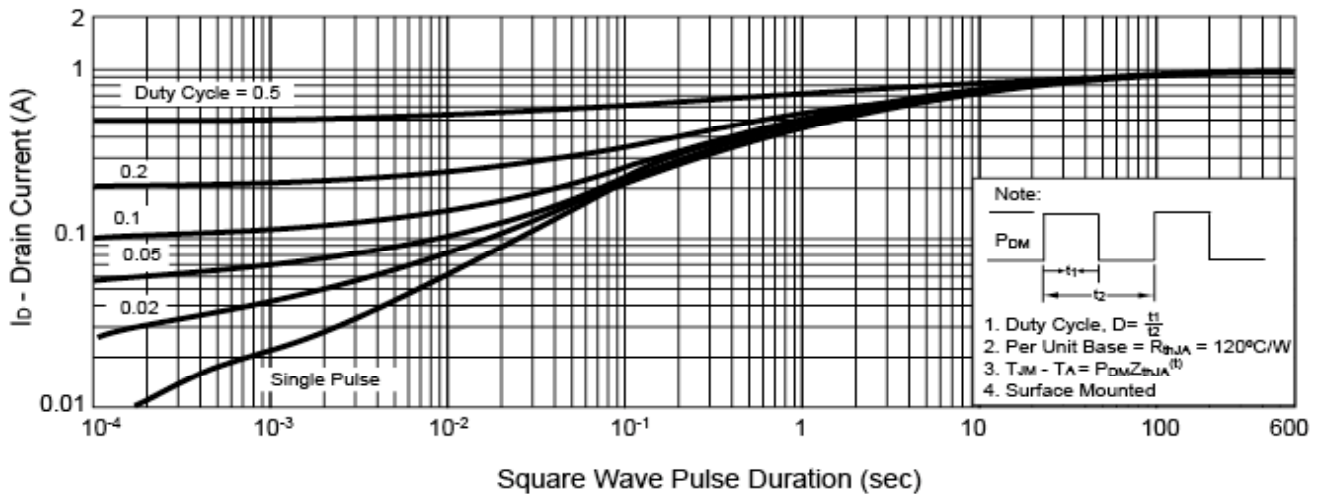
**Threshold Voltage**



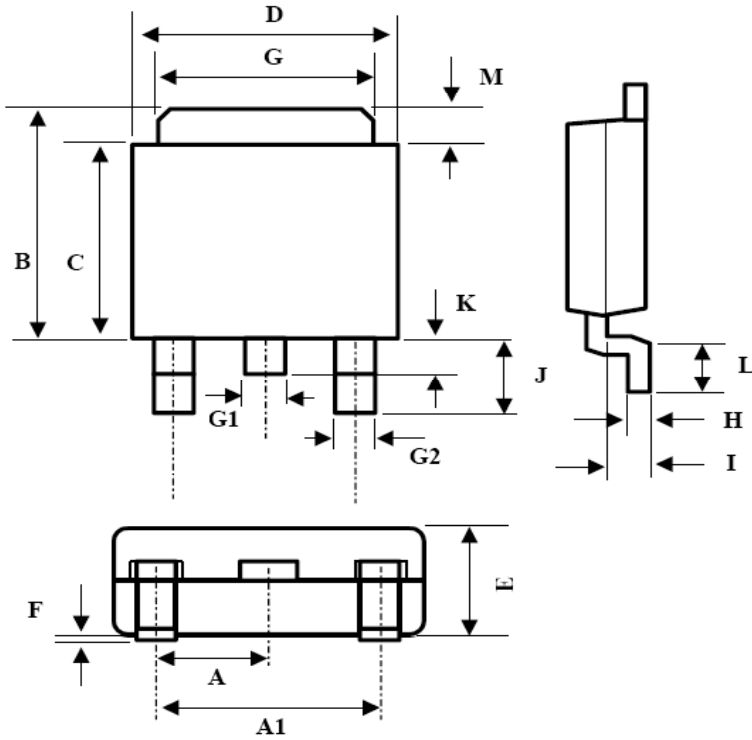
**Maximum Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**SOT-252 Mechanical Drawing**



DIM	TO-252 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.3BSC		0.09BSC	
A1	4.6BSC		0.18BSC	
B	6.80	7.20	0.268	0.283
C	5.40	5.60	0.213	0.220
D	6.40	6.65	0.252	0.262
E	2.20	2.40	0.087	0.094
F	0.00	0.20	0.000	0.008
G	5.20	5.40	0.205	0.213
G1	0.75	0.85	0.030	0.033
G2	0.55	0.65	0.022	0.026
H	0.35	0.65	0.014	0.026
I	0.90	1.50	0.035	0.059
J	2.20	2.80	0.087	0.110
K	0.50	1.10	0.020	0.043
L	0.90	1.50	0.035	0.059
M	1.30	1.70	0.051	0.67

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