

# TSM250N02CX

## 20V N-Channel Power MOSFET

SOT-23



### Pin Definition:

1. Gate
2. Source
3. Drain

### Note:

MSL 1 (Moisture Sensitivity Level)  
per J-STD-020

### Key Parameter Performance

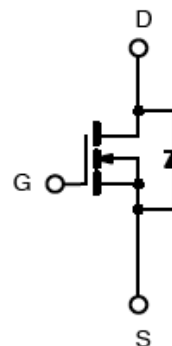
Parameter	Value	Unit
$V_{DS}$	20	V
$R_{DS(on)}$ (max)	$V_{GS} = 4.5V$	25
	$V_{GS} = 2.5V$	35
	$V_{GS} = 1.8V$	55
$Q_g$	7.7	nC

### Ordering Information

Ordering code	Package	Packing
TSM250N02CX RFG	SOT-23	3kpcs / 7" Reel

- Note: Halogen-free according to IEC 61249-2-21 definition

### Block Diagram



N-Channel MOSFET

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Continuous Drain Current	$I_D$	$T_C = 25^\circ C$	5.8
		$T_C = 100^\circ C$	3.7
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	23.2	A
Power Dissipation @ $T_C = 25^\circ C$	$P_D$	1.56	W
Operating Junction Temperature	$T_J$	150	$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ C$

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	80	$^\circ C/W$

### Electrical Specifications ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

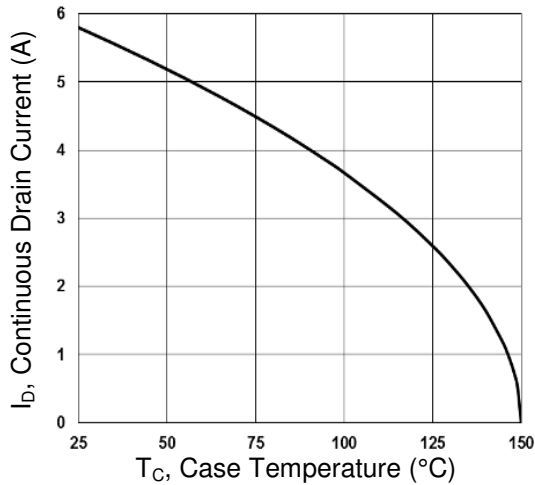
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	20	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 4.5\text{V}, I_D = 4\text{A}$	$R_{DS(on)}$	--	20	25	m $\Omega$
	$V_{GS} = 2.5\text{V}, I_D = 3\text{A}$		--	27	35	
	$V_{GS} = 1.8\text{V}, I_D = 2\text{A}$		--	39	55	
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	0.4	0.6	0.8	V
Zero Gate Voltage Drain Current	$V_{DS} = 16\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
	$V_{DS} = 16\text{V}, T_J = 85^\circ\text{C}$		--	--	10	
Gate Body Leakage	$V_{GS} = \pm 10\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance <sup>(Note 2)</sup>	$V_{DS} = 10\text{V}, I_S = 3\text{A}$	$g_{fs}$	--	6.5	--	S
<b>Dynamic</b>						
Total Gate Charge <sup>(Note 2,3)</sup>	$V_{DS} = 10\text{V}, I_D = 4\text{A},$ $V_{GS} = 4.5\text{V}$	$Q_g$	--	7.7	--	nC
Gate-Source Charge <sup>(Note 2,3)</sup>		$Q_{gs}$	--	0.9	--	
Gate-Drain Charge <sup>(Note 2,3)</sup>		$Q_{gd}$	--	2.4	--	
Input Capacitance	$V_{DS} = 10\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	$C_{iss}$	--	535	--	pF
Output Capacitance		$C_{oss}$	--	60	--	
Reverse Transfer Capacitance		$C_{rss}$	--	34	--	
<b>Switching</b>						
Turn-On Delay Time <sup>(Note 2,3)</sup>	$V_{DD} = 10\text{V}, I_D = 1\text{A},$ $V_{GS} = 4.5\text{V}, R_G = 25\Omega$	$t_{d(on)}$	--	4.1	--	ns
Turn-On Rise Time <sup>(Note 2,3)</sup>		$t_r$	--	11.6	--	
Turn-Off Delay Time <sup>(Note 2,3)</sup>		$t_{d(off)}$	--	23.9	--	
Turn-Off Fall Time <sup>(Note 2,3)</sup>		$t_f$	--	7.6	--	
<b>Source-Drain Diode Ratings and Characteristic</b>						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	$I_S$	--	--	5.8	A
Maximum Pulse Drain-Source Diode Forward Current		$I_{SM}$	--	--	23.2	A
Diode-Source Forward Voltage	$V_{GS} = 0\text{V}, I_S = 1\text{A}$	$V_{SD}$	--	--	1	V

#### Note:

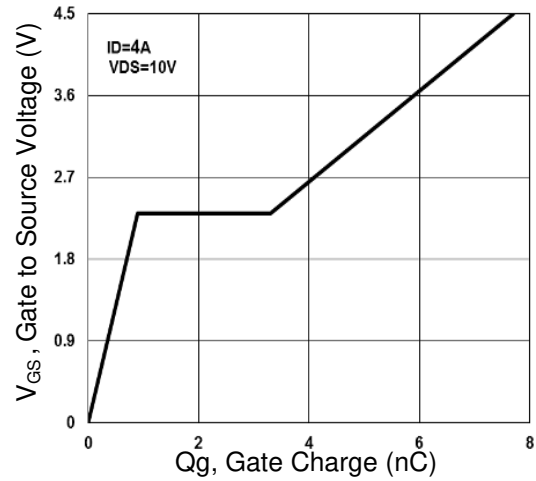
1. Pulse width limited by safe operating area
2. Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$
3. Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curve

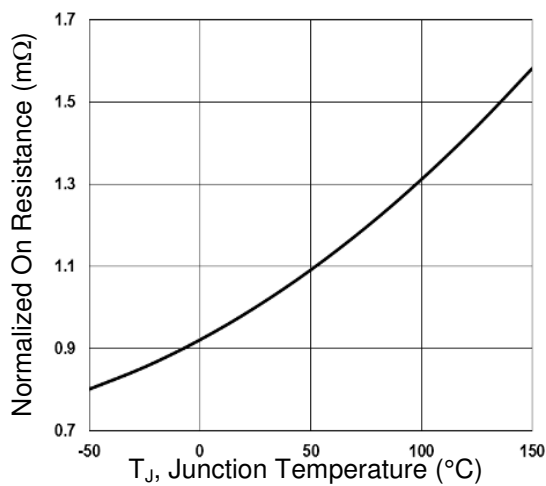
**Continuous Drain Current vs.  $T_C$**



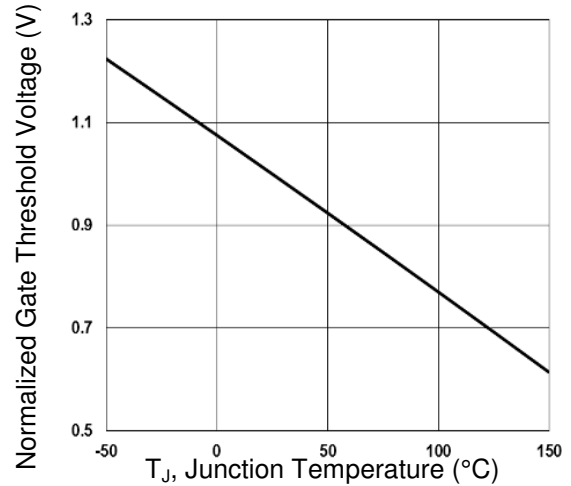
**Gate Charge**



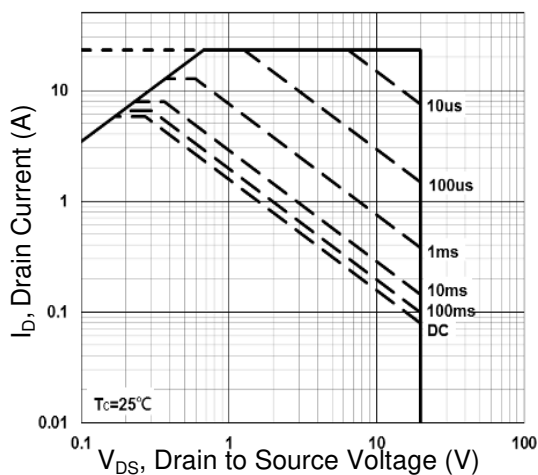
**On-Resistance vs. Junction Temperature**



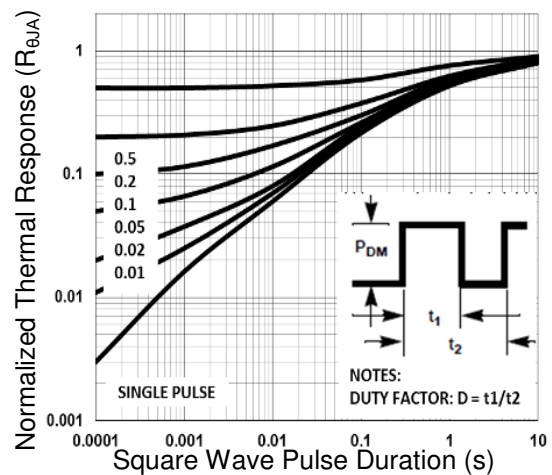
**Threshold Voltage vs. Junction Temperature**



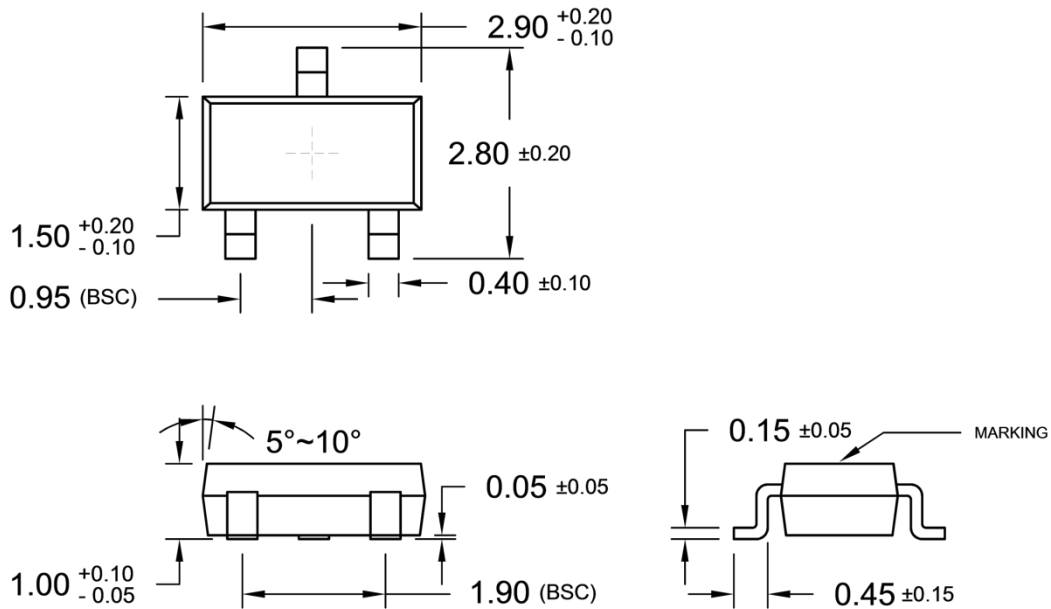
**Maximum Safe Operating Area**



**Normalized Thermal Transient Impedance Curve**

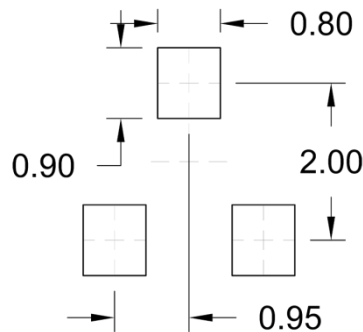


**SOT-23 Mechanical Drawing**

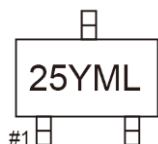


Unit: Millimeters

**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**Marking Diagram**



- 25** = Device Code
- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apr, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
- L** = Lot Code

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