

# TSM230N06CP

## 60V N-Channel Power MOSFET



**Pin Definition:**  
 1. Gate  
 2. Drain  
 3. Source

### Key Parameter Performance

Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	23
	$V_{GS} = 4.5V$	28
$Q_g$	28	nC

### Features

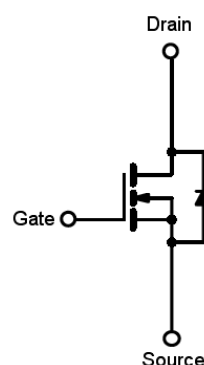
- 100% avalanche tested
- Fast Switching

### Ordering Information

Ordering code	Package	Packing
TSM230N06CP ROG	TO-252	2.5kpcs / 13" Reel

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

### Block Diagram



N-Channel MOSFET

### Absolute Maximum Ratings (T<sub>c</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	±20	V
Continuous Drain Current <sup>(Note 1)</sup>	$I_D$	T <sub>c</sub> = 25°C	50*
		T <sub>c</sub> = 100°C	32*
Pulsed Drain Current <sup>(Note 2)</sup>	$I_{DM}$	200	A
Single Pulse Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	42	mJ
Power Dissipation @ T <sub>c</sub> = 25°C	$P_D$	53	W
Operating Junction Temperature	$T_J$	150	°C
Storage Temperature Range	$T_{STG}$	-55 to +150	°C

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R_{\theta JC}$	2	°C/W
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	62	

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

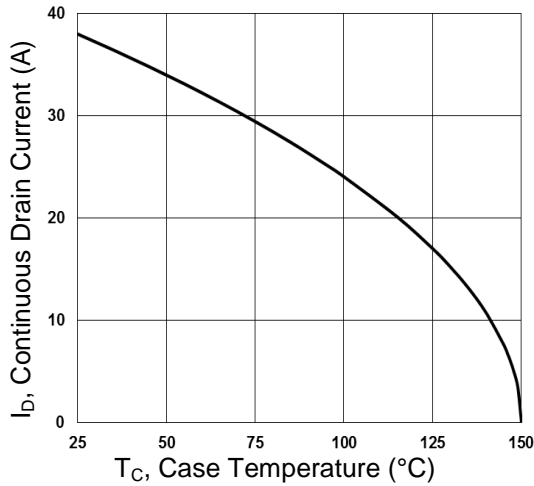
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	60	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 20\text{A}$	$R_{DS(ON)}$	--	20	23	m $\Omega$
	$V_{GS} = 4.5\text{V}, I_D = 12\text{A}$		--	23	28	
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	1.2	1.8	2.5	V
Zero Gate Voltage Drain Current	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
	$V_{DS} = 48\text{V}, T_J = 125^\circ\text{C}$		--	--	10	
Gate Body Leakage	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance <sup>(Note 4)</sup>	$V_{DS} = 10\text{V}, I_D = 10\text{A}$	$g_{fs}$	--	9	--	S
<b>Dynamic</b>						
Total Gate Charge <sup>(Note 4,5)</sup>	$V_{DS} = 30\text{V}, I_D = 15\text{A},$ $V_{GS} = 10\text{V}$	$Q_g$	--	28	--	nC
Gate-Source Charge <sup>(Note 4,5)</sup>		$Q_{gs}$	--	3.5	--	
Gate-Drain Charge <sup>(Note 4,5)</sup>		$Q_{gd}$	--	6.5	--	
Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	$C_{iss}$	--	1680	--	pF
Output Capacitance		$C_{oss}$	--	115	--	
Reverse Transfer Capacitance		$C_{rss}$	--	85	--	
<b>Switching</b>						
Turn-On Delay Time <sup>(Note 4,5)</sup>	$V_{DD} = 30\text{V}, I_D = 1\text{A},$ $V_{GS} = 10\text{V}, R_G = 6\Omega$	$t_{d(on)}$	--	7.2	--	ns
Turn-On Rise Time <sup>(Note 4,5)</sup>		$t_r$	--	38	--	
Turn-Off Delay Time <sup>(Note 4,5)</sup>		$t_{d(off)}$	--	34	--	
Turn-Off Fall Time <sup>(Note 4,5)</sup>		$t_f$	--	8.2	--	
<b>Source-Drain Diode Ratings and Characteristic</b>						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	$I_S$	--	--	50	A
Maximum Pulse Drain-Source Diode Forward Current		$I_{SM}$	--	--	200	A
Diode-Source Forward Voltage	$V_{GS} = 0\text{V}, I_S = 1\text{A}$	$V_{SD}$	--	--	1	V
Reverse Recovery Time <sup>(Note 4)</sup>	$V_{GS} = 0\text{V}, I_S = 1\text{A}$ $dI_F/dt = 100\text{A}/\mu\text{s}$	$t_{rr}$	--	19.6	--	ns
Reverse Recovery Charge <sup>(Note 4)</sup>		$Q_{rr}$	--	14.2	--	nC

#### Note:

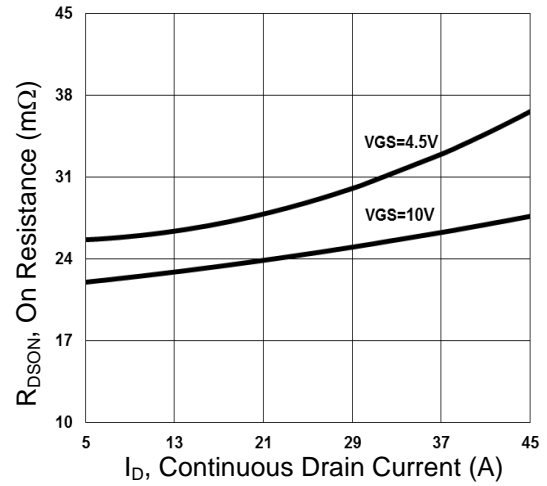
- Limited by maximum junction temperature
- Pulse width limited by safe operating area
- $L = 0.1\text{mH}, I_{AS} = 29\text{A}, V_{DD} = 25\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$
- Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curve

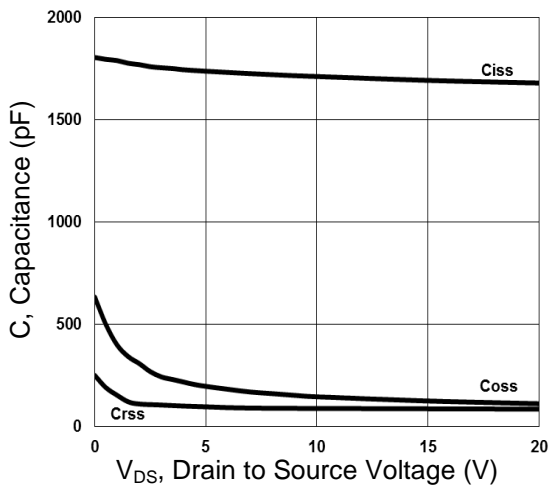
**Continuous Drain Current vs.  $T_C$**



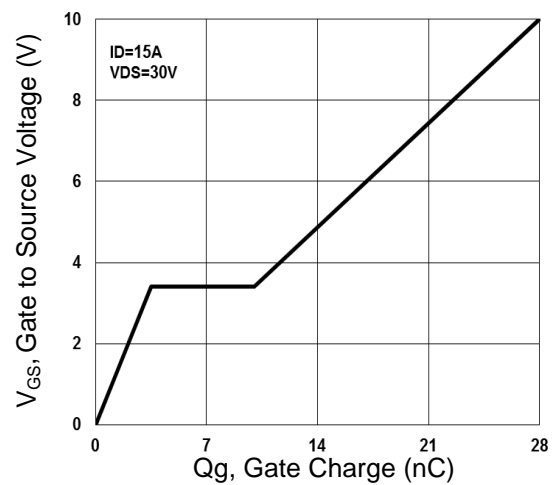
**$R_{DS(on)}$  vs. Continuous Drain Current**



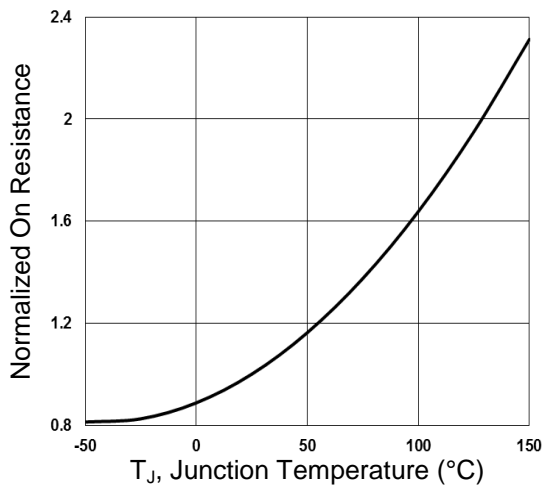
**Capacitance**



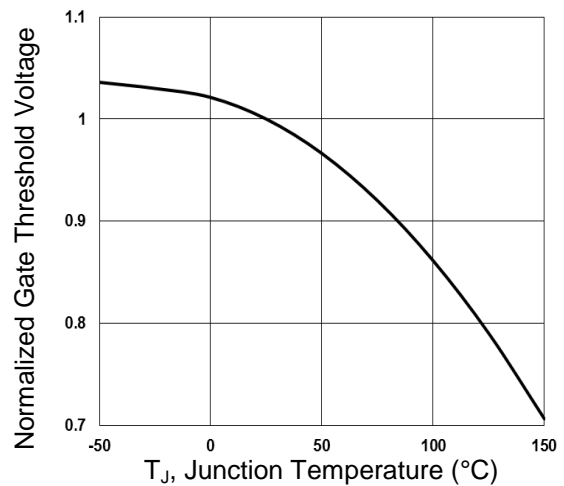
**Gate Charge**



**On-Resistance vs. Junction Temperature**

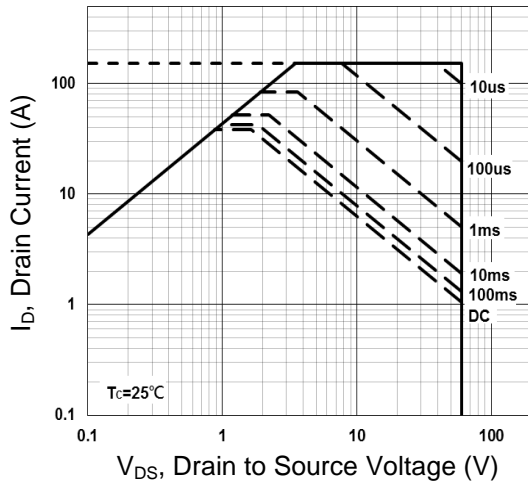


**Threshold Voltage vs. Junction Temperature**

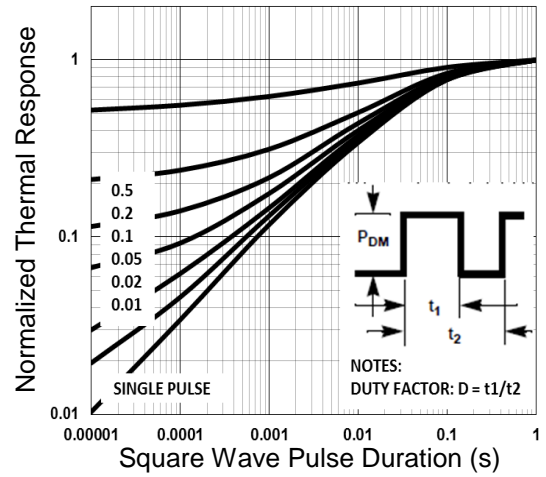


### Electrical Characteristics Curve

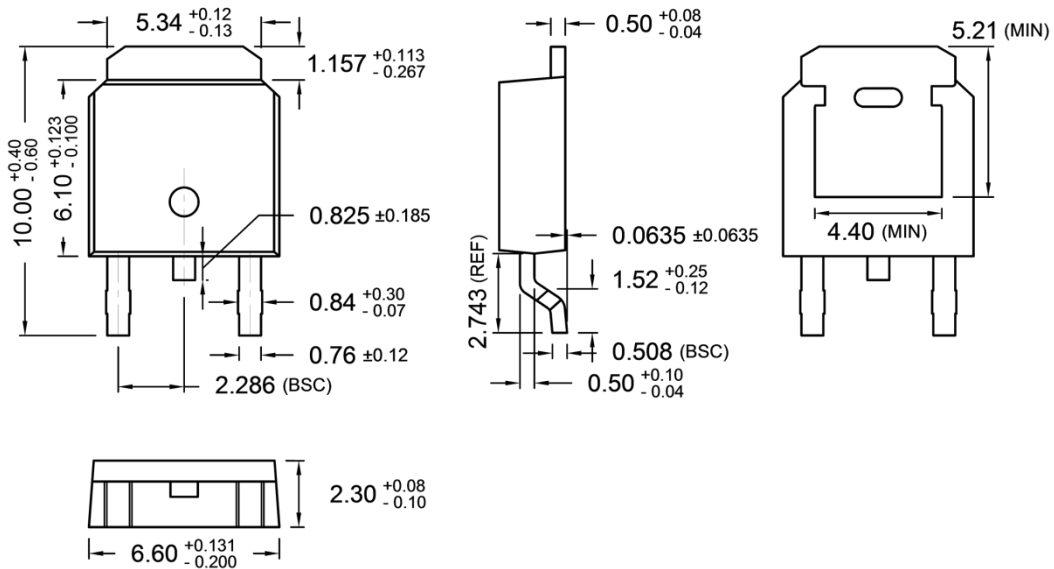
**Maximum Safe Operating Area**



**Normalized Thermal Transient Impedance**

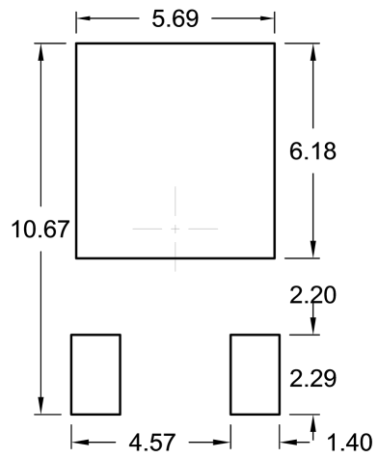


### TO-252 Mechanical Drawing

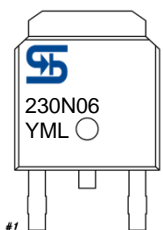


Unit: Millimeters

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



### **Marking Diagram**



- Y** = Year Code
- M** = Month Code
- 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 (1~9, A~Z)

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