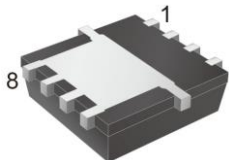


# TSM230N06PQ56

## 60V N-Channel Power MOSFET

### PDFN56



### Pin Definition:

- |           |          |
|-----------|----------|
| 1. Source | 8. Drain |
| 2. Source | 7. Drain |
| 3. Source | 6. Drain |
| 4. Gate   | 5. Drain |

### Note:

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

### Key Parameter Performance

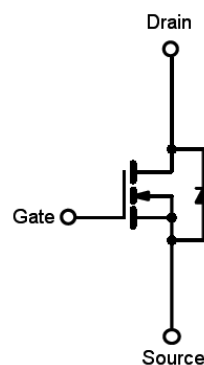
Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	23
	$V_{GS} = 4.5V$	28
$Q_g$	28	nC

### Ordering Information

Part No.	Package	Packing
TSM230N06PQ56 RLG	PDFN56	2.5kpcs / 13" Reel

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

### Block Diagram



N-Channel MOSFET

### Absolute Maximum Ratings ( $T_c = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_c = 25^\circ\text{C}$	44
		$T_c = 100^\circ\text{C}$	28
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	176	A
Single Pulse Avalanche Energy <sup>(Note 2)</sup>	$E_{AS}$	42	mJ
Power Dissipation @ $T_c = 25^\circ\text{C}$	$P_D$	83	W
Operating Junction Temperature	$T_J$	-55 to +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ\text{C}$

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R_{\theta JC}$	1.5	$^\circ\text{C}/\text{W}$
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	62	

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

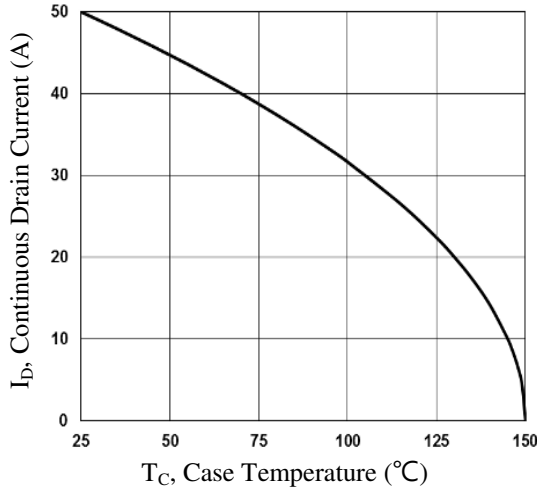
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	60	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 20A$	$R_{DS(on)}$	--	20	23	m $\Omega$
	$V_{GS} = 4.5V, I_D = 12A$		--	23	28	
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	1.2	1.8	2.5	V
Zero Gate Voltage Drain Current	$V_{DS} = 60V, V_{GS} = 0V$	$I_{DSS}$	--	--	1	$\mu A$
	$V_{DS} = 48V, T_J = 125^\circ\text{C}$		--	--	10	
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance <sup>(Note 3)</sup>	$V_{DS} = 10V, I_D = 10A$	$g_{fs}$	--	9	--	S
<b>Dynamic</b>						
Total Gate Charge <sup>(Note 3,4)</sup>	$V_{DS} = 30V, I_D = 15A,$ $V_{GS} = 10V$	$Q_g$	--	28	--	nC
Gate-Source Charge <sup>(Note 3,4)</sup>		$Q_{GS}$	--	3.5	--	
Gate-Drain Charge <sup>(Note 3,4)</sup>		$Q_{GD}$	--	6.5	--	
Input Capacitance	$V_{DS} = 20V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$	$C_{iss}$	--	1680	--	pF
Output Capacitance		$C_{oss}$	--	115	--	
Reverse Transfer Capacitance		$C_{rss}$	--	85	--	
<b>Switching</b>						
Turn-On Delay Time <sup>(Note 3,4)</sup>	$V_{DD} = 30V, I_D = 1A,$ $V_{GS} = 10V, R_G = 6\Omega$	$t_{d(on)}$	--	7.2	--	ns
Turn-On Rise Time <sup>(Note 3,4)</sup>		$t_r$	--	38	--	
Turn-Off Delay Time <sup>(Note 3,4)</sup>		$t_{d(off)}$	--	34	--	
Turn-Off Fall Time <sup>(Note 3,4)</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	$I_S$	--	--	44	A
Maximum Pulse Drain-Source Diode Forward Current		$I_{SM}$	--	--	176	A
Diode-Source Forward Voltage	$V_{GS} = 0V, I_S = 1A$	$V_{SD}$	--	--	1	V
Reverse Recovery Time <sup>(Note 3)</sup>	$V_{GS} = 0V, I_S = 1A$	$t_{rr}$	--	19.6	--	ns
Reverse Recovery Charge <sup>(Note 3)</sup>	$di_F/dt = 100A/\mu s$	$Q_{rr}$	--	14.2	--	nC

#### Note:

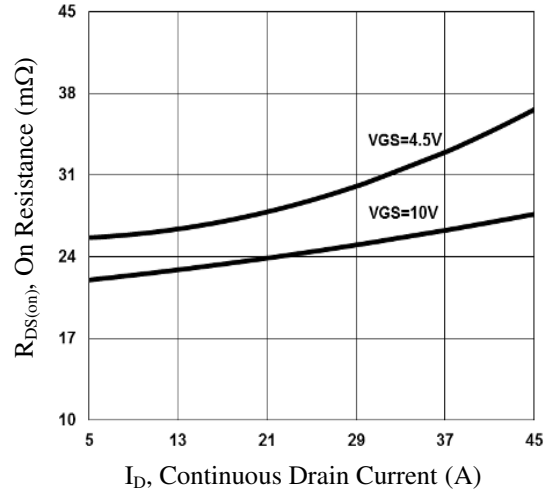
- Pulse width limited by safe operating area
- $L = 0.1\text{mH}, I_{AS} = 29A, V_{DD} = 25V, R_G = 25\Omega,$  Starting  $T_J = 25^\circ\text{C}$
- Pulse test: pulse width  $\leq 300\mu s,$  duty cycle  $\leq 2\%$
- Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curve

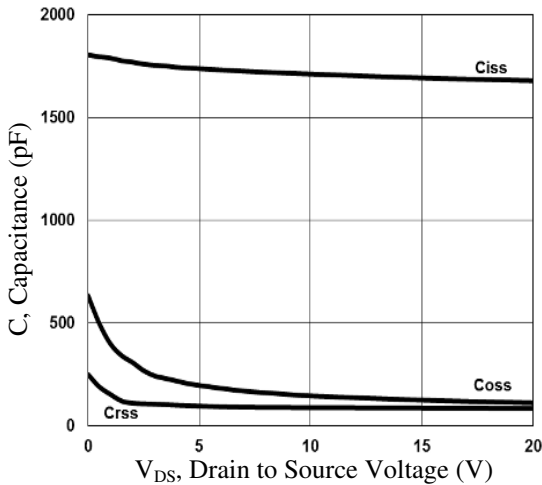
**Continuous Drain Current vs.  $T_C$**



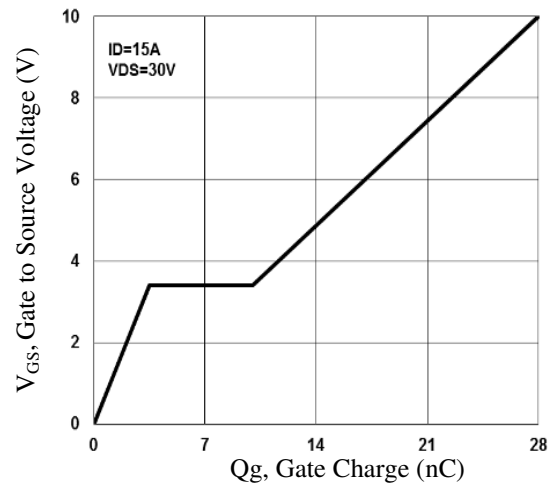
**$R_{DS(on)}$  vs. Continuous Drain Current**



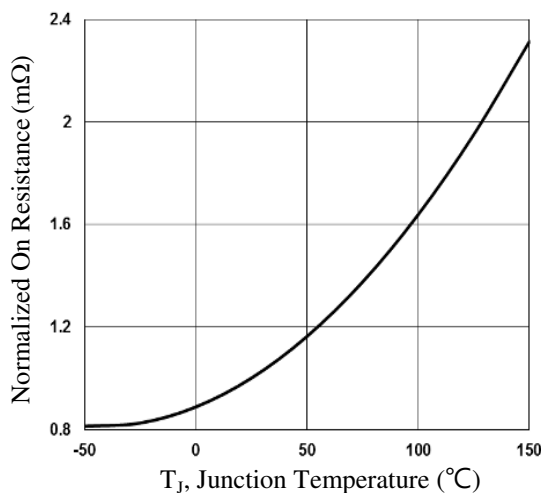
**Capacitance**



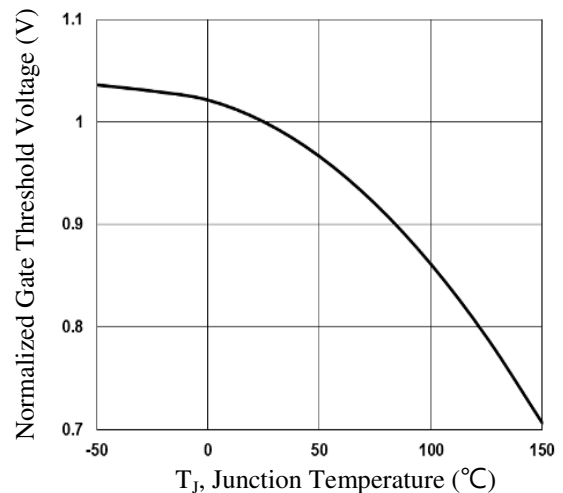
**Gate Charge**



**On-Resistance vs. Junction Temperature**

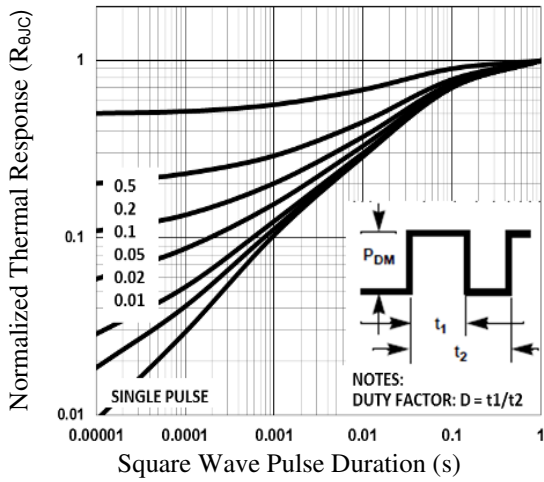


**Threshold Voltage vs. Junction Temperature**

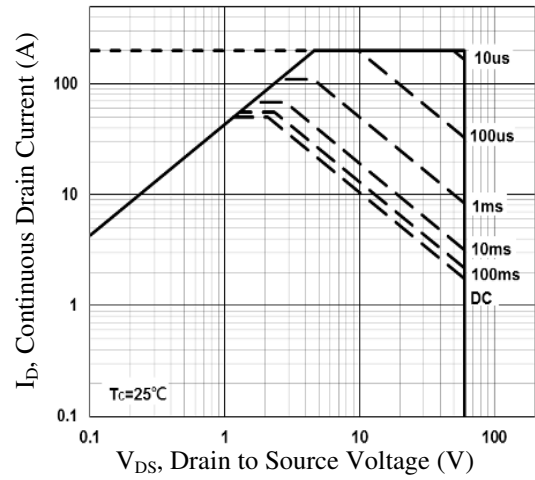


### Electrical Characteristics Curve

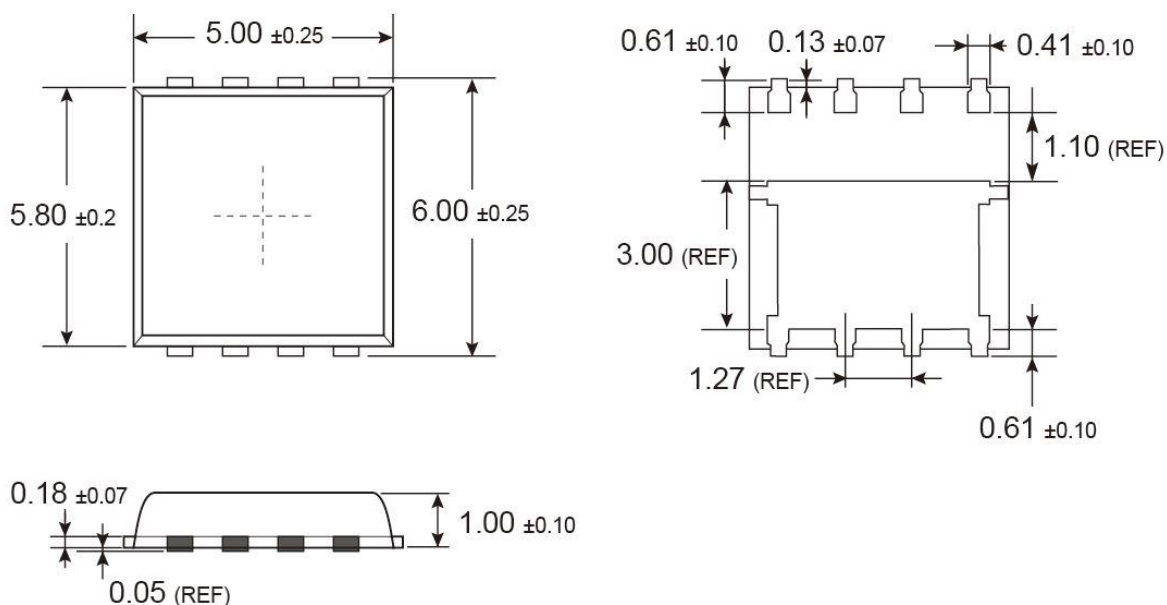
**Normalized Thermal Transient Impedance Curve**



**Maximum Safe Operating Area**

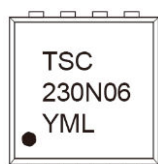


### PDFN56 Mechanical Drawing



Unit: Millimeters

### Marking Diagram



- 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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