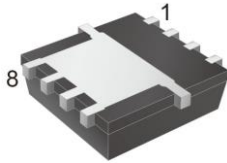


# TSM230N06PQ56

## 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**

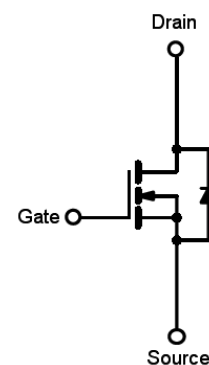
Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	23
	$V_{GS} = 4.5V$	28
$Q_g$	28	nC

**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** ( $T_c = 25^\circ C$  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	$I_D$	$T_c = 25^\circ C$	44
		$T_c = 100^\circ C$	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 @ $T_c = 25^\circ C$	$P_D$	83	W
Operating Junction Temperature	$T_J$	-55 to +150	$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ C$

**Thermal Performance**

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

### Electrical Specifications (T<sub>C</sub> = 25°C unless otherwise noted)

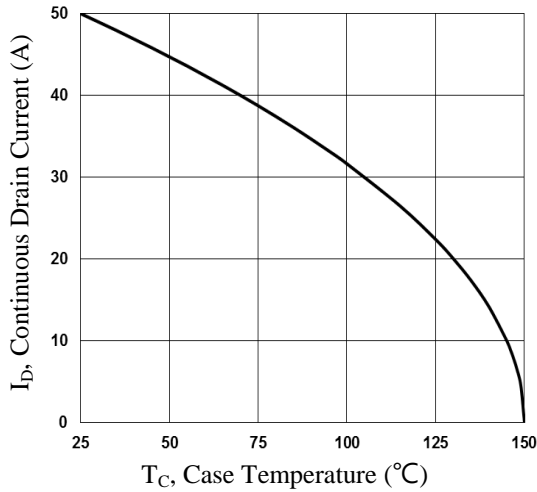
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	BV <sub>DSS</sub>	60	--	--	V
Drain-Source On-State Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A	R <sub>DS(on)</sub>	--	20	23	mΩ
	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A		--	23	28	
Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	V <sub>GS(TH)</sub>	1.2	1.8	2.5	V
Zero Gate Voltage Drain Current	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V	I <sub>DSS</sub>	--	--	1	μA
	V <sub>DS</sub> = 48V, T <sub>J</sub> = 125°C		--	--	10	
Gate Body Leakage	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V	I <sub>GSS</sub>	--	--	±100	nA
Forward Transconductance <sup>(Note 3)</sup>	V <sub>DS</sub> = 10V, I <sub>D</sub> = 10A	g <sub>fs</sub>	--	9	--	S
<b>Dynamic</b>						
Total Gate Charge <sup>(Note 3,4)</sup>	V <sub>DS</sub> = 30V, I <sub>D</sub> = 15A, V <sub>GS</sub> = 10V	Q <sub>g</sub>	--	28	--	nC
Gate-Source Charge <sup>(Note 3,4)</sup>		Q <sub>gs</sub>	--	3.5	--	
Gate-Drain Charge <sup>(Note 3,4)</sup>		Q <sub>gd</sub>	--	6.5	--	
Input Capacitance	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1.0MHz	C <sub>iss</sub>	--	1680	--	pF
Output Capacitance		C <sub>oss</sub>	--	115	--	
Reverse Transfer Capacitance		C <sub>rss</sub>	--	85	--	
<b>Switching</b>						
Turn-On Delay Time <sup>(Note 3,4)</sup>	V <sub>DD</sub> = 30V, I <sub>D</sub> = 1A, V <sub>GS</sub> = 10V, R <sub>G</sub> = 6Ω	t <sub>d(on)</sub>	--	7.2	--	ns
Turn-On Rise Time <sup>(Note 3,4)</sup>		t <sub>r</sub>	--	38	--	
Turn-Off Delay Time <sup>(Note 3,4)</sup>		t <sub>d(off)</sub>	--	34	--	
Turn-Off Fall Time <sup>(Note 3,4)</sup>		t <sub>f</sub>	--	8.2	--	
<b>Source-Drain Diode Ratings and Characteristic</b>						
Maximum Continuous Drain-Source Diode Forward Current	Integral reverse diode in the MOSFET	I <sub>S</sub>	--	--	44	A
Maximum Pulse Drain-Source Diode Forward Current		I <sub>SM</sub>	--	--	176	A
Diode-Source Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A	V <sub>SD</sub>	--	--	1	V
Reverse Recovery Time <sup>(Note 3)</sup>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A	t <sub>rr</sub>	--	19.6	--	ns
Reverse Recovery Charge <sup>(Note 3)</sup>	di <sub>F</sub> /dt = 100A/μs	Q <sub>rr</sub>	--	14.2	--	nC

#### Note:

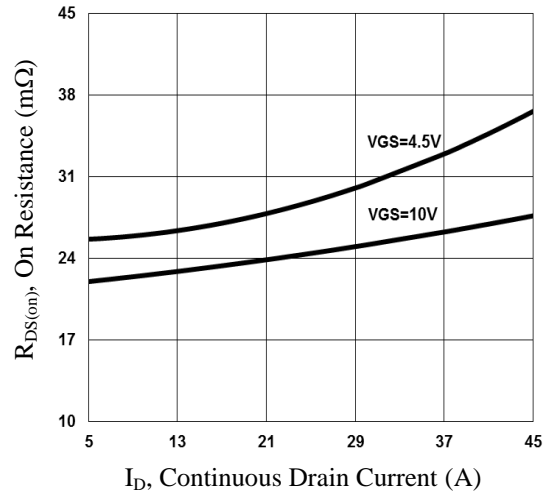
1. Pulse width limited by safe operating area
2. L = 0.1mH, I<sub>AS</sub> = 29A, V<sub>DD</sub> = 25V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. Pulse test: pulse width ≤ 300μs, duty cycle ≤ 2%
4. Switching time is essentially independent of operating temperature.

### Electrical Characteristics Curve

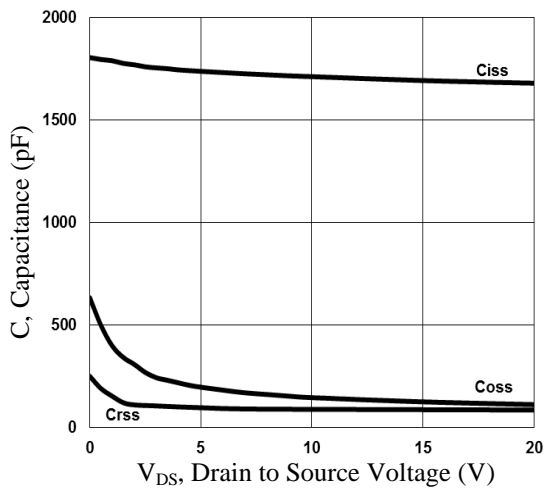
**Continuous Drain Current vs.  $T_C$**



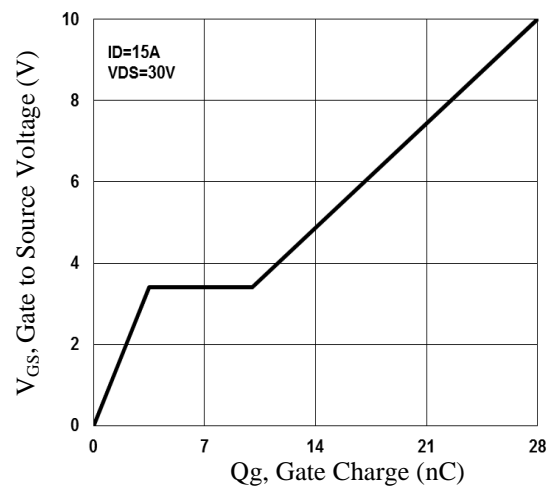
**$R_{DS(on)}$  vs. Continuous Drain Current**



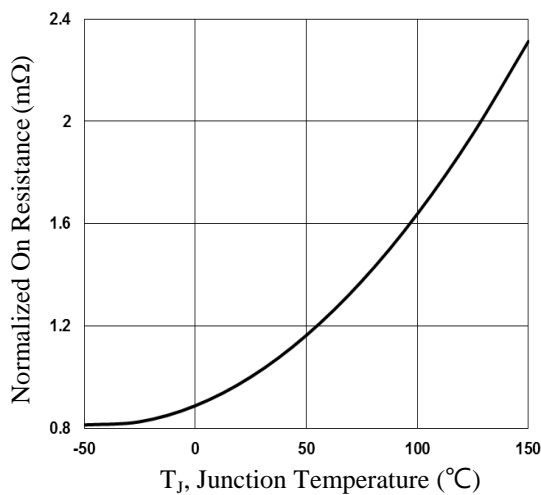
**Capacitance**



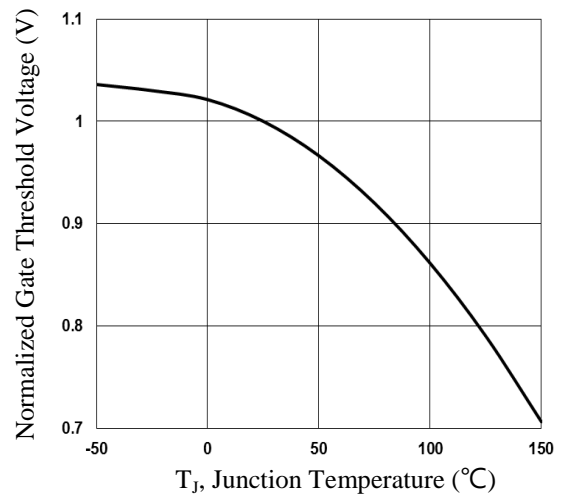
**Gate Charge**



**On-Resistance vs. Junction Temperature**

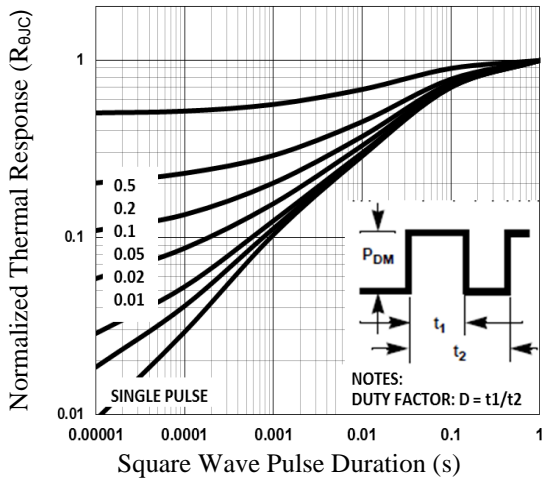


**Threshold Voltage vs. Junction Temperature**

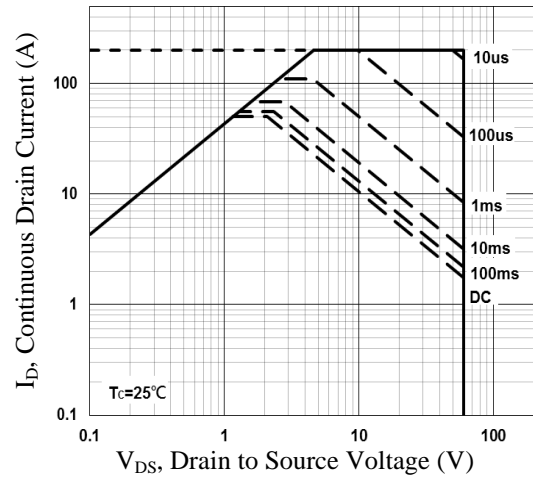


### Electrical Characteristics Curve

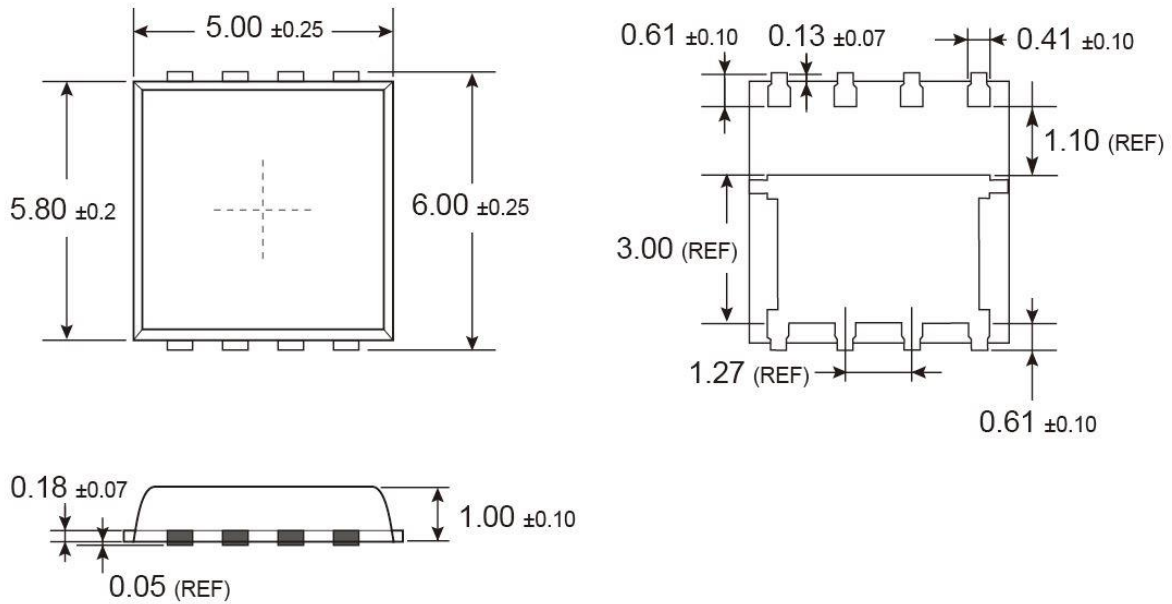
**Normalized Thermal Transient Impedance Curve**



**Maximum Safe Operating Area**

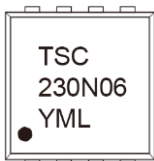


### PDFN56 Mechanical Drawing



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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