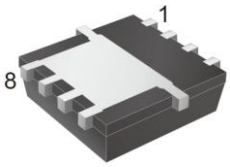
# TSM230N06PQ56

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

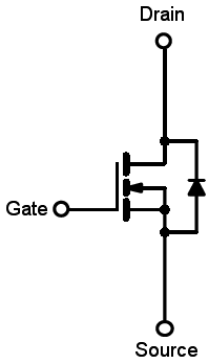
| Parameter | | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | | 60 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ = 10V | 23 | mΩ |
| | $V_{GS}$ = 4.5V | 28 | |
| $Q_g$ | | 28 | nC |

## 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 (Tc = 25℃ unless otherwise noted)

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | Tc = 25℃ | $I_D$ | 44 | A |
| | Tc = 100℃ | | 28 | A |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | 176 | A |
| Single Pulse Avalanche Energy (Note 2) | | $E_{AS}$ | 42 | mJ |
| Power Dissipation @ $T_C$ = 25℃ | | $P_D$ | 83 | W |
| Operating Junction Temperature | | $T_J$ | -55 to +150 | ℃ |
| Storage Temperature Range | | $T_{STG}$ | -55 to +150 | ℃ |

## Thermal Performance

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Thermal Resistance - Junction to Case | $R_{\Theta JC}$ | 1.5 | ℃/W |
| Thermal Resistance - Junction to Ambient | $R_{\Theta JA}$ | 62 | |

# TSM230N06PQ56

60V N-Channel Power MOSFET

## Electrical Specifications ($T_C$ = 25℃ unless otherwise noted)

| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | $BV_{DSS}$ | 60 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS}$ = 10V, $I_D$ = 20A | $R_{DS(on)}$ | -- | 20 | 23 | mΩ |
| | $V_{GS}$ = 4.5V, $I_D$ = 12A | | -- | 23 | 28 | |
| Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | $V_{GS(TH)}$ | 1.2 | 1.8 | 2.5 | V |
| Zero Gate Voltage Drain Current | $V_{DS}$ = 60V, $V_{GS}$ = 0V | $I_{DSS}$ | -- | -- | 1 | μA |
| | $V_{DS}$ = 48V, $T_J$ = 125℃ | | -- | -- | 10 | |
| Gate Body Leakage | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Forward Transconductance (Note 3) | $V_{DS}$ = 10V, $I_D$ = 10A | $g_{fs}$ | -- | 9 | -- | S |
| **Dynamic** | | | | | | |
| Total Gate Charge (Note 3,4) | $V_{DS}$ = 30V, $I_D$ = 15A, $V_{GS}$ = 10V | $Q_g$ | -- | 28 | -- | nC |
| Gate-Source Charge (Note 3,4) | | $Q_{gs}$ | -- | 3.5 | -- | |
| Gate-Drain Charge (Note 3,4) | | $Q_{gd}$ | -- | 6.5 | -- | |
| Input Capacitance | $V_{DS}$ = 20V, $V_{GS}$ = 0V, f = 1.0MHz | $C_{iss}$ | -- | 1680 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 115 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 85 | -- | |
| **Switching** | | | | | | |
| Turn-On Delay Time (Note 3,4) | $V_{DD}$ = 30V, $I_D$ = 1A, $V_{GS}$ = 10V, $R_G$ =6Ω | $t_{d(on)}$ | -- | 7.2 | -- | ns |
| Turn-On Rise Time (Note 3,4) | | $t_r$ | -- | 38 | -- | |
| Turn-Off Delay Time (Note 3,4) | | $t_{d(off)}$ | -- | 34 | -- | |
| Turn-Off Fall Time (Note 3,4) | | $t_f$ | -- | 8.2 | -- | |
| **Source-Drain Diode Ratings and Characteristic** | | | | | | |
| 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 (Note 3) | $V_{GS}$ = 0V, $I_S$ = 1A, $dI_F/dt$ = 100A/μs | $t_{rr}$ | -- | 19.6 | -- | ns |
| Reverse Recovery Charge (Note 3) | | $Q_{rr}$ | -- | 14.2 | -- | nC |

**Note:**

1. Pulse width limited by safe operating area
2. L = 0.1mH, $I_{AS}$ = 29A, $V_{DD}$ = 25V, $R_G$ = 25Ω, Starting $T_J$ = 25℃
3. Pulse test: pulse width ≤ 300μs, duty cycle ≤ 2%
4. Switching time is essentially independent of operating temperature.

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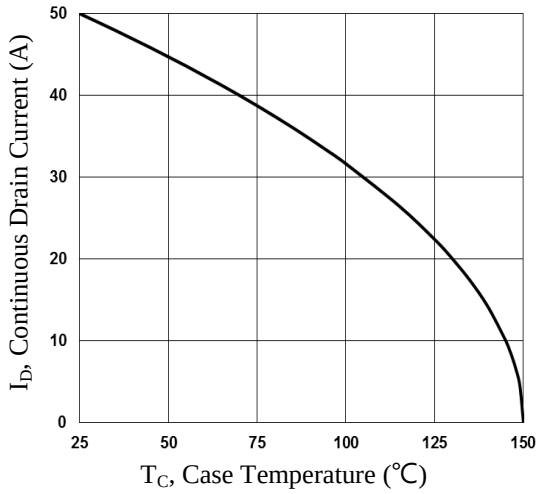
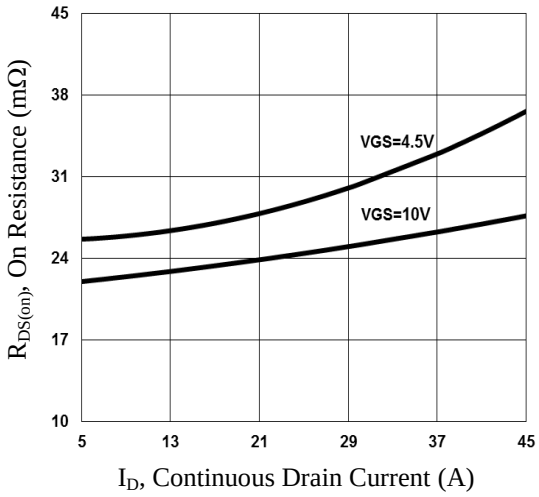
## Electrical Characteristics Curve

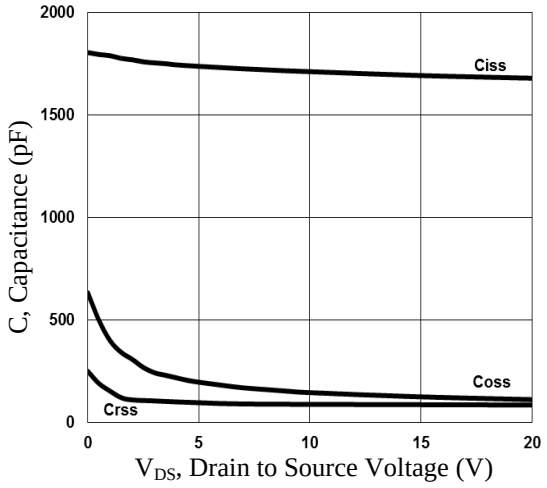
### Continuous Drain Current vs. $T_C$



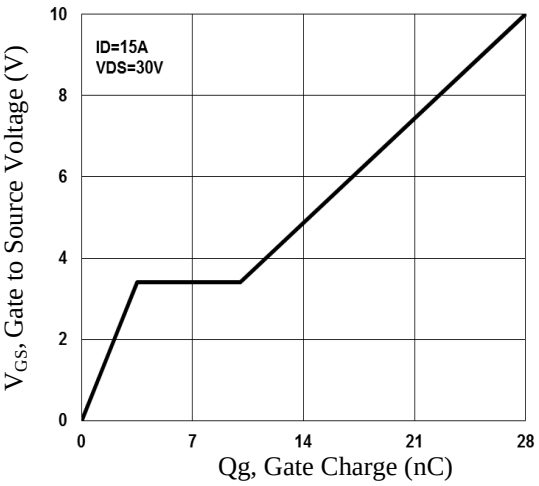

### $R_{DS(on)}$ vs. Continuous Drain Current



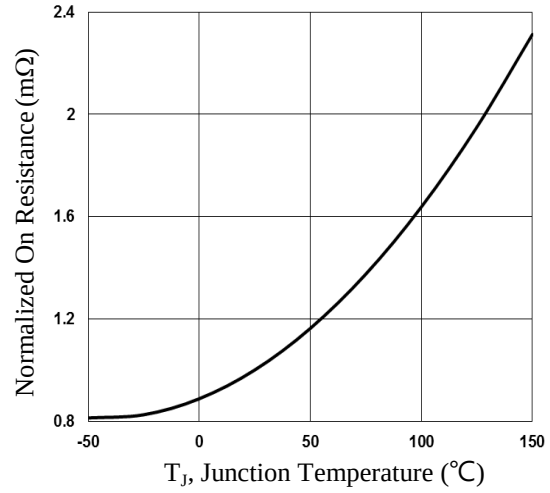

### Capacitance



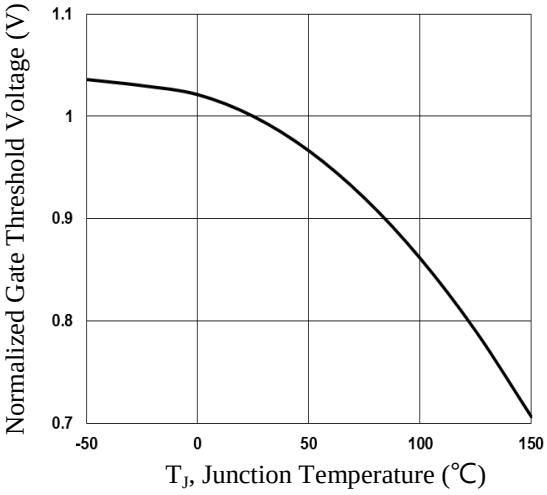

### Gate Charge




### On-Resistance vs. Junction Temperature




### Threshold Voltage vs. Junction Temperature



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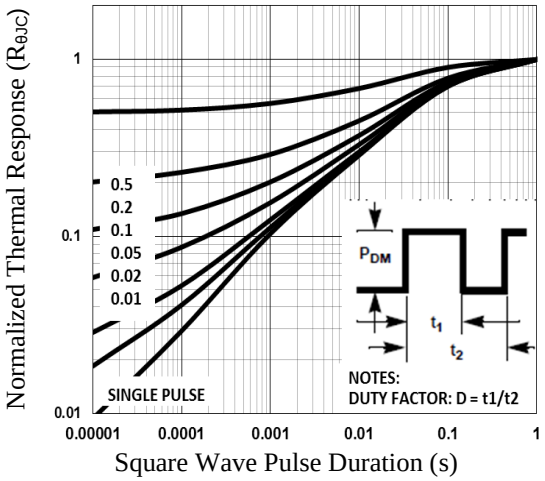
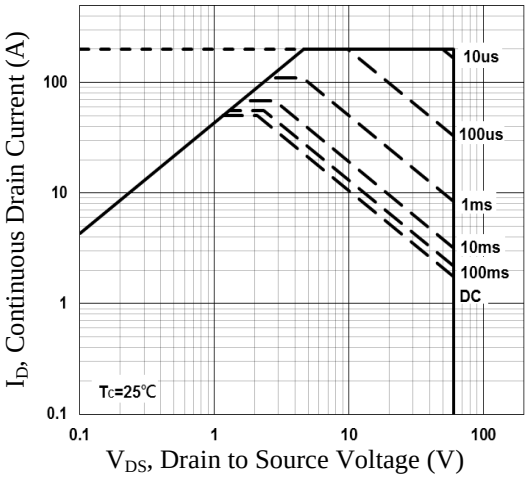
## Electrical Characteristics Curve

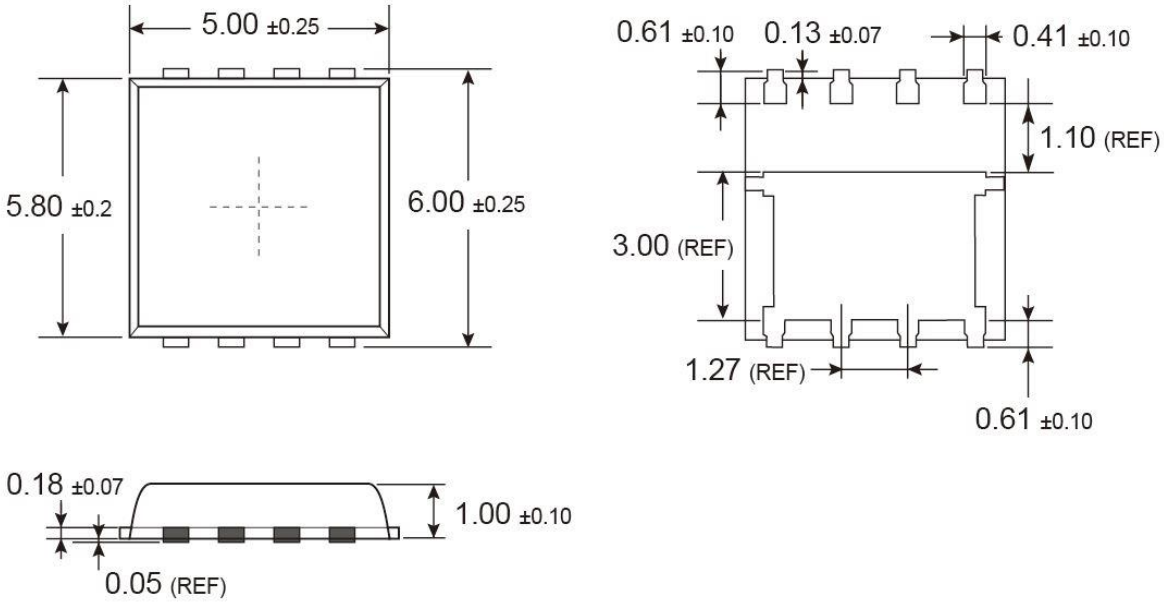
### Normalized Thermal Transient Impedance Curve




### Maximum Safe Operating Area

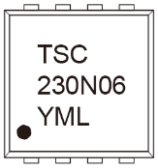


## PDFN56 Mechanical Drawing




Unit: Millimeters

## Marking Diagram

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

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