# TSM650P03CX

30V P-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 |
|---|---|---|---|
| $V_{DS}$ | | -30 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ =- 10V | 65 | mΩ |
| | $V_{GS}$ = -4.5V | 75 | |
| | $V_{GS}$ = -2.5V | 100 | |
| $Q_g$ | | 8 | nC |

## Features

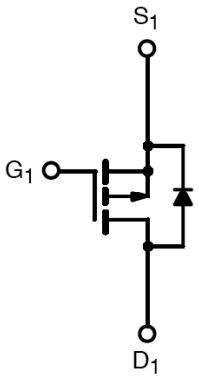
- Fast Switching
- Suited for -2.5V Gate Drive Applications
- Halogen-free

## Ordering Information

| Ordering code | Package | Packing |
|---|---|---|
| TSM650P03CX RFG | SOT-23 | 3kcs / 7” Reel |

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

## Block Diagram




P-Channel MOSFET

## Absolute Maximum Ratings ($T_C$ = 25°C unless otherwise noted)

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current | $T_C$ = 25°C | $I_D$ | -4.1 | A |
| | $T_C$ = 100°C | | -2.6 | A |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | -16.4 | A |
| Power Dissipation @ $T_C$ = 25℃ | | $P_D$ | 1.56 | 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 Ambient | $R_{\Theta JA}$ | 80 | °C/W |

Pb-Free RoHS COMPLIANT

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

| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = -250μA | $BV_{DSS}$ | -30 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS}$ = -10V, $I_D$ = -4A | $R_{DS(on)}$ | -- | 55 | 65 | mΩ |
| | $V_{GS}$ = -4.5V, $I_D$ = -3A | | -- | 65 | 75 | |
| | $V_{GS}$ = -2.5V, $I_D$ = -2A | | -- | 85 | 100 | |
| Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA | $V_{GS(TH)}$ | -0.4 | -0.7 | -0.9 | V |
| Zero Gate Voltage Drain Current | $V_{DS}$ = -30V, $V_{GS}$ = 0V | $I_{DSS}$ | -- | -- | -1 | μA |
| | $V_{DS}$ = -24V, $T_J$ = 125°C | | -- | -- | -10 | |
| Gate Body Leakage | $V_{GS}$ = ±12V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Forward Transconductance (Note 2) | $V_{DS}$ = -10V, $I_D$ = -3A | $g_{fs}$ | -- | 5.4 | -- | S |
| **Dynamic** | | | | | | |
| Total Gate Charge (Note 2,3) | $V_{DS}$ = -15V, $I_D$ = -4A, $V_{GS}$ = -4.5V | $Q_g$ | -- | 8 | -- | nC |
| Gate-Source Charge (Note 2,3) | | $Q_{gs}$ | -- | 1.9 | -- | |
| Gate-Drain Charge (Note 2,3) | | $Q_{gd}$ | -- | 1.4 | -- | |
| Input Capacitance | $V_{DS}$ = -15V, $V_{GS}$ = 0V, f = 1.0MHz | $C_{iss}$ | -- | 810 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 85 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 50 | -- | |
| **Switching** | | | | | | |
| Turn-On Delay Time (Note 2,3) | $V_{DD}$ = -15V, $I_D$ = -1A, $V_{GS}$ = -10V, $R_{GEN}$ = 6Ω | $t_{d(on)}$ | -- | 5.4 | -- | ns |
| Turn-On Rise Time (Note 2,3) | | $t_r$ | -- | 19.4 | -- | |
| Turn-Off Delay Time (Note 2,3) | | $t_{d(off)}$ | -- | 45.9 | -- | |
| Turn-Off Fall Time (Note 2,3) | | $t_f$ | -- | 12.4 | -- | |
| **Source-Drain Diode Ratings and Characteristic** | | | | | | |
| Maximum Continuous Drain-Source Diode Forward Current | Integral reverse diode in the MOSFET | $I_S$ | -- | -- | -4.1 | A |
| Maximum Pulse Drain-Source Diode Forward Current | | $I_{SM}$ | -- | -- | -16.4 | A |
| Diode-Source Forward Voltage | $V_{GS}$ = 0V, $I_S$ = -1A | $V_{SD}$ | -- | -- | -1 | V |

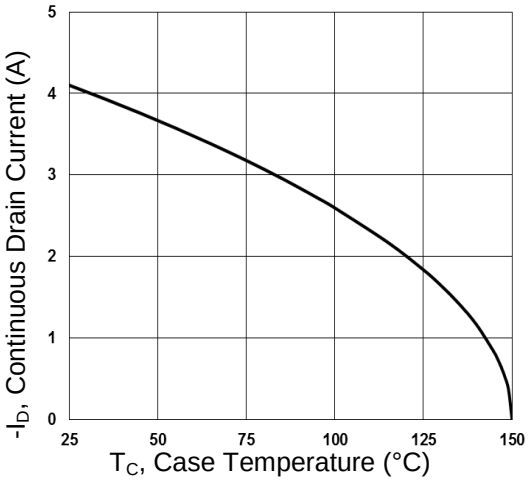
**Note:**

1. Pulse width limited by safe operating area
2. Pulse test: pulse width ≤ 300μs, duty cycle ≤ 2%
3. Switching time is essentially independent of operating temperature.

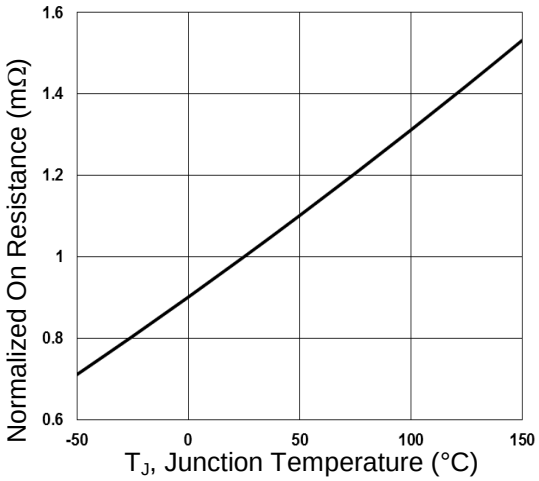
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## Electrical Characteristics Curve

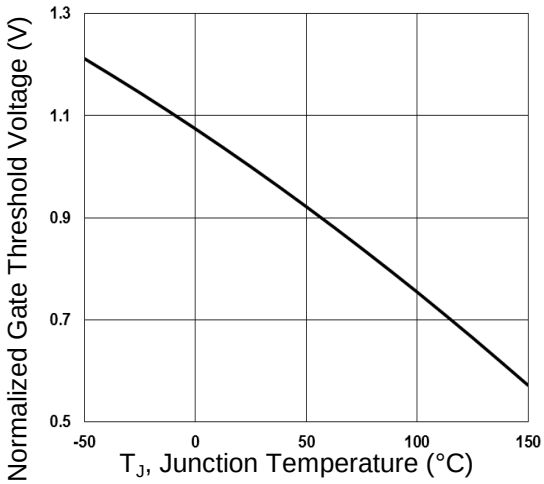
### Continuous Drain Current vs. $T_C$



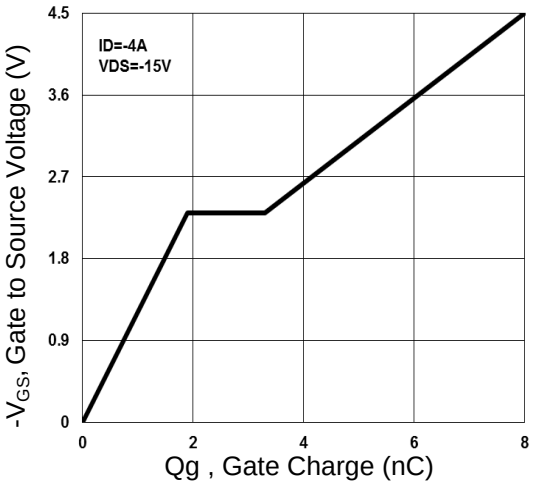

### Normalized $R_{DS}(on)$ vs. $T_J$



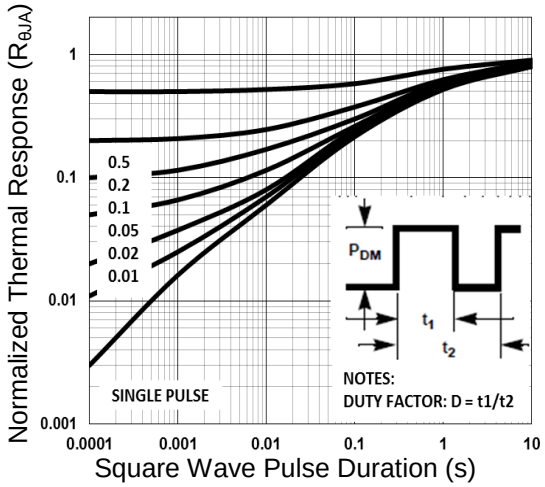

### Threshold Voltage vs. Junction Temperature



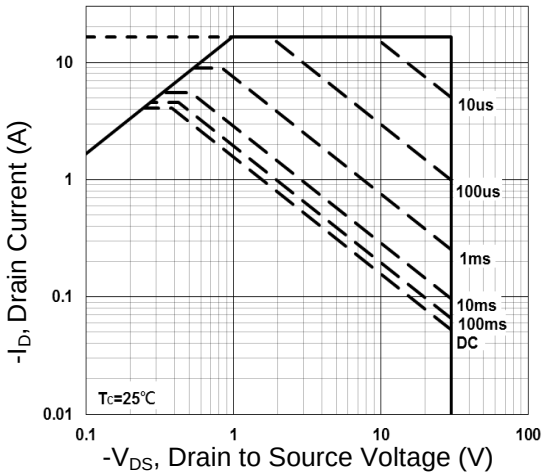

### Gate Charge Waveform



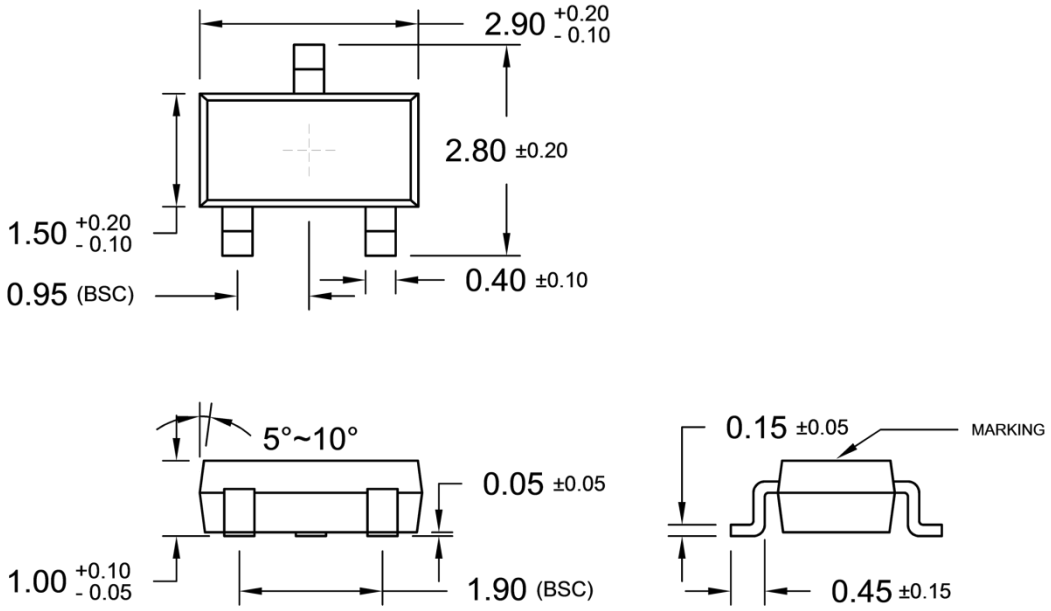

### Normalized Thermal Transient Impedance Curve




### Maximum Safe Operating Area

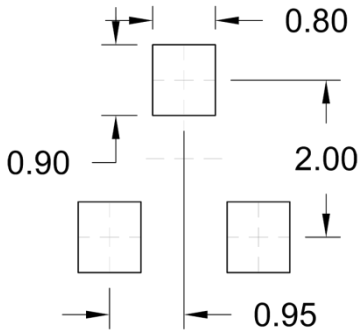


## SOT-23 Mechanical Drawing

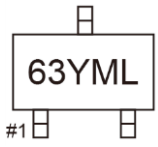



Unit: Millimeters

## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## Marking Diagram




**63** = Device Code
**Y** = Year Code
**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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