

TSM650P02CX

20V P-Channel Power MOSFET

SOT-23



Pin Definition:

1. Gate
2. Source
3. Drain

Key Parameter Performance

| Parameter | Value | Unit |
|--------------------|------------------|------|
| V_{DS} | -20 | V |
| $R_{DS(on)}$ (max) | $V_{GS} = -4.5V$ | 65 |
| | $V_{GS} = -2.5V$ | 85 |
| | $V_{GS} = -1.8V$ | 130 |
| Q_g | 6.4 | nC |

Features

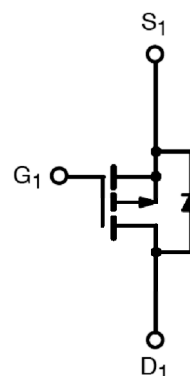
- Fast switching
- Suited for -1.8V gate drive applications
- Halogen-free

Ordering Information

| Part No. | Package | Packing |
|-----------------|---------|---------------|
| TSM650P02CX RFG | SOT-23 | 3kcs / 7+Reel |

Note: %G+denotes for Halogen- and Antimony-free as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

Block Diagram



P-Channel MOSFET

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|--|-----------|---------------------|------------|
| Drain-Source Voltage | V_{DS} | -20 | V |
| Gate-Source Voltage | V_{GS} | ± 10 | V |
| Continuous Drain Current | I_D | $T_C = 25^\circ C$ | -4.1 |
| | | $T_C = 100^\circ C$ | -2.6 |
| Pulsed Drain Current ^(Note 1) | I_{DM} | -16.4 | A |
| Power Dissipation @ $T_C = 25^\circ C$ | P_D | 1.56 | W |
| Operating Junction Temperature | T_J | 150 | $^\circ C$ |
| Storage Temperature Range | T_{STG} | -55 to +150 | $^\circ C$ |

Thermal Performance

| Parameter | Symbol | Limit | Unit |
|--|----------|-------|--------------|
| Thermal Resistance - Junction to Ambient | R_{JA} | 80 | $^\circ C/W$ |

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

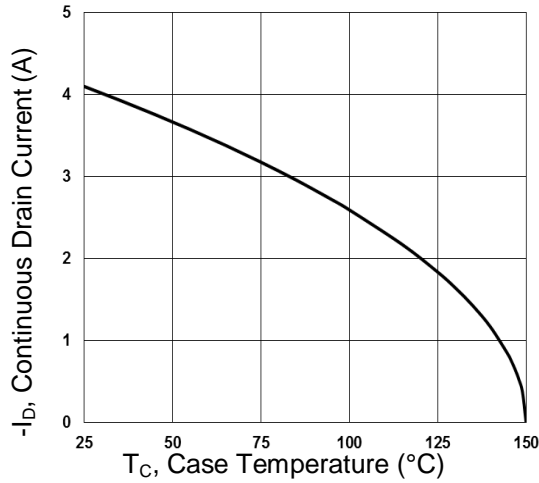
| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|--------------|------|------|-----------|---------|
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = 0V, I_D = -250\mu A$ | BV_{DSS} | -20 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS} = -4.5V, I_D = -3A$ | $R_{DS(on)}$ | -- | 52 | 65 | m |
| | $V_{GS} = -2.5V, I_D = -2A$ | | -- | 73 | 85 | |
| | $V_{GS} = -1.8V, I_D = -1.5A$ | | -- | 105 | 130 | |
| Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = -250\mu A$ | $V_{GS(TH)}$ | -0.4 | -0.6 | -0.8 | V |
| Zero Gate Voltage Drain Current | $V_{DS} = -20V, V_{GS} = 0V$ | I_{DSS} | -- | -- | -1 | μA |
| | $V_{DS} = -16V, T_J = 125^\circ\text{C}$ | | -- | -- | -10 | |
| Gate Body Leakage | $V_{GS} = \pm 10V, V_{DS} = 0V$ | I_{GSS} | -- | -- | ± 100 | nA |
| Forward Transconductance ^(Note 2) | $V_{DS} = -10V, I_D = -3A$ | g_{fs} | -- | 5.5 | -- | S |
| Dynamic | | | | | | |
| Total Gate Charge ^(Note 2,3) | $V_{DS} = -10V, I_D = -3A,$ $V_{GS} = -4.5V$ | Q_g | -- | 6.4 | -- | nC |
| Gate-Source Charge ^(Note 2,3) | | Q_{gs} | -- | 0.9 | -- | |
| Gate-Drain Charge ^(Note 2,3) | | Q_{gd} | -- | 1.6 | -- | |
| Input Capacitance | $V_{DS} = -10V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$ | C_{iss} | -- | 515 | -- | μF |
| Output Capacitance | | C_{oss} | -- | 55 | -- | |
| Reverse Transfer Capacitance | | C_{rss} | -- | 20 | -- | |
| Switching | | | | | | |
| Turn-On Delay Time ^(Note 2,3) | $V_{DD} = -10V, I_D = -1A,$ $V_{GS} = -4.5V, R_{GEN} = 25$ | $t_{d(on)}$ | -- | 5 | -- | ns |
| Turn-On Rise Time ^(Note 2,3) | | t_r | -- | 17.4 | -- | |
| Turn-Off Delay Time ^(Note 2,3) | | $t_{d(off)}$ | -- | 40.7 | -- | |
| Turn-Off Fall Time ^(Note 2,3) | | t_f | -- | 11.4 | -- | |
| 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:

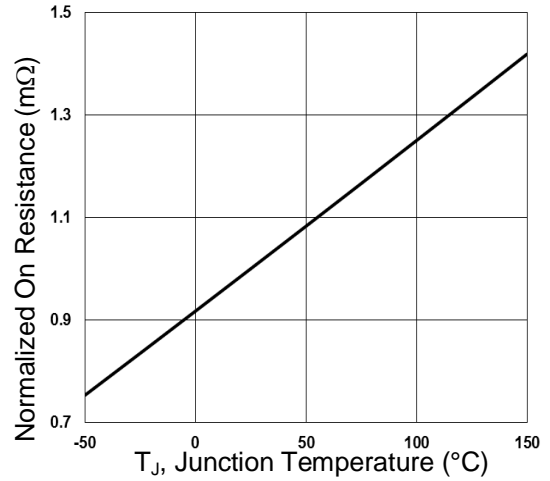
- Pulse width limited by safe operating area
- Pulse test: pulse width $m300\mu s$, duty cycle $m2\%$
- Switching time is essentially independent of operating temperature.

Electrical Characteristics Curve

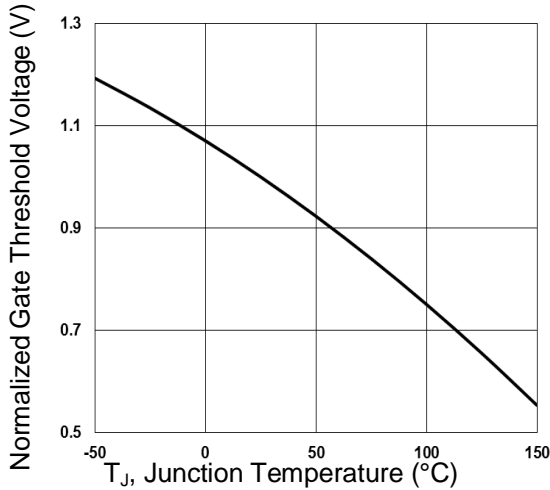
Continuous Drain Current vs. T_C



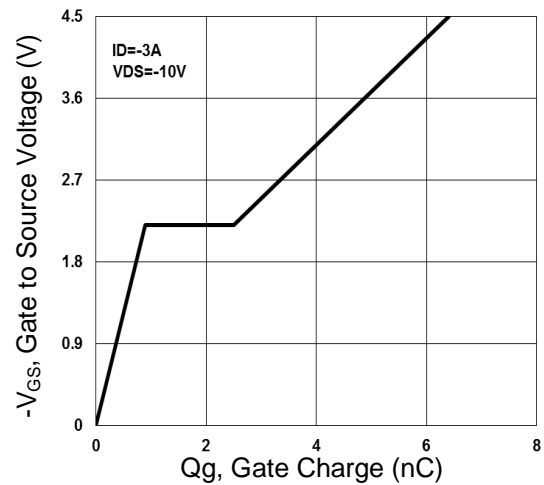
Normalized $R_{DS(on)}$ VS. T_J



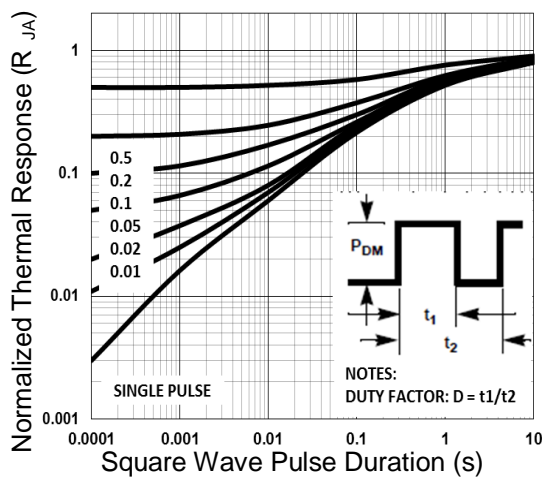
Threshold Voltage vs. Junction Temperature



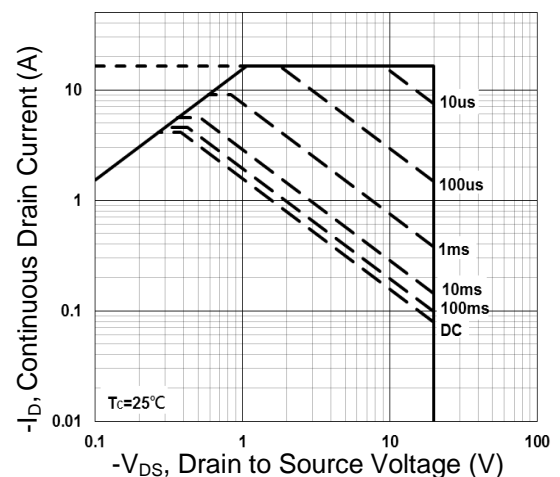
Gate Charge Waveform



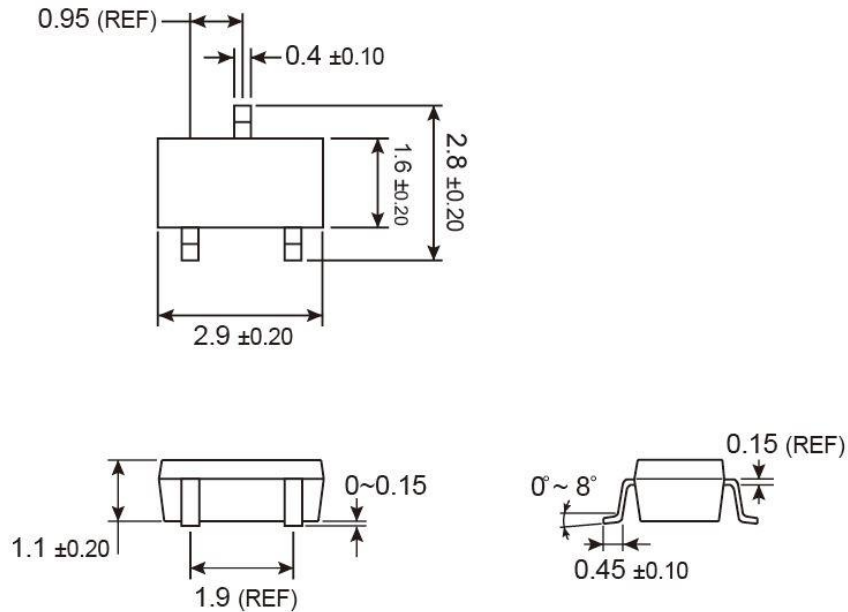
Normalized Thermal Transient Impedance Curve



Maximum Safe Operating Area

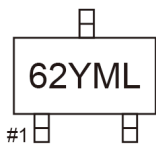


SOT-23 Mechanical Drawing



Unit: Millimeters

Marking Diagram



- 62** = Device Code
- 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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