Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

# N-Channel Power MOSFET

20V, 3.9A, 65mΩ

## FEATURES

- Low $R_{DS(ON)}$ to minimize conductive losses
- Low gate charge for fast power switching
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

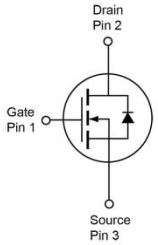
| KEY PERFORMANCE PARAMETERS | | | |
|---|---|---|---|
| **PARAMETER** | | **VALUE** | **UNIT** |
| $V_{DS}$ | | 20 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ = 4.5V | 65 | mΩ |
| | $V_{GS}$ = 2.5V | 95 | |
| $Q_g$ | | 7.8 | nC |

## APPLICATIONS

- Load switch
- Backlights

Pb-Free RoHS COMPLIANT HALOGEN FREE

**SOT-23**


**Note:** MSL 3 (Moisture Sensitivity Level) per J-STD-020

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C unless otherwise noted) | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **LIMIT** | **UNIT** |
| Drain-Source Voltage | | $V_{DS}$ | 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±8 | V |
| Continuous Drain Current (Note 1) | $T_C$ = 25°C | $I_D$ | 3.9 | A |
| | $T_A$ = 25°C | | 3.2 | |
| Pulsed Drain Current | | $I_{DM}$ | 15.6 | A |
| Total Power Dissipation | $T_C$ = 25°C | $P_D$ | 1.5 | W |
| | $T_C$ = 125°C | | 0.3 | |
| Total Power Dissipation | $T_A$ = 25°C | $P_D$ | 1 | W |
| | $T_A$ = 125°C | | 0.2 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | - 55 to +150 | °C |

| THERMAL PERFORMANCE | | | |
|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **LIMIT** | **UNIT** |
| Junction to Case Thermal Resistance | $R_{\Theta JC}$ | 84 | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\Theta JA}$ | 124 | °C/W |

**Thermal Performance Note:** $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\Theta JA}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design.

| ELECTRICAL SPECIFICATIONS ($T_A$ = 25°C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **SYMBOL** | **MIN** | **TYP** | **MAX** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | $BV_{DSS}$ | 20 | -- | -- | V |
| Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | $V_{GS(TH)}$ | 0.65 | 0.9 | 1.2 | V |
| Gate-Source Leakage Current | $V_{GS}$ = ±8V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Drain-Source Leakage Current | $V_{GS}$ = 0V, $V_{DS}$ = 20V | $I_{DSS}$ | -- | -- | 1 | μA |
| | $V_{GS}$ = 0V, $V_{DS}$ = 20V<br>$T_J$ = 125°C | | -- | -- | 100 | |
| Drain-Source On-State Resistance (Note 2) | $V_{GS}$ = 4.5V, $I_D$ = 3.2A | $R_{DS(on)}$ | -- | 34 | 65 | mΩ |
| | $V_{GS}$ = 2.5V, $I_D$ = 3.2A | | -- | 45 | 95 | |
| Forward Transconductance (Note 2) | $V_{DS}$ = 5V, $I_D$ = 3.2A | $g_{fs}$ | -- | 19 | -- | S |
| **Dynamic** (Note 3) | | | | | | |
| Total Gate Charge | $V_{GS}$ = 4.5V, $V_{DS}$ = 10V, $I_D$ = 3.2A | $Q_g$ | -- | 7.8 | -- | nC |
| Total Gate Charge | $V_{GS}$ = 2.5V, $V_{DS}$ = 10V, $I_D$ = 3.2A | $Q_g$ | -- | 5 | -- | |
| Gate-Source Charge | | $Q_{gs}$ | -- | 1 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 2.5 | -- | |
| Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 10V<br>f = 1.0MHz | $C_{iss}$ | -- | 587 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 94 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 64 | -- | |
| Gate Resistance | f = 1.0MHz, open drain | $R_g$ | -- | 1.6 | -- | Ω |
| **Switching** (Note 3) | | | | | | |
| Turn-On Delay Time | $V_{GS}$ = 4.5V, $V_{DS}$ = 10V, $I_D$ = 3.2A, $R_G$ = 2Ω, | $t_{d(on)}$ | -- | 5.4 | -- | ns |
| Turn-On Rise Time | | $t_r$ | -- | 26.4 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 16.4 | -- | |
| Turn-Off Fall Time | | $t_f$ | -- | 15.8 | -- | |
| **Source-Drain Diode** | | | | | | |
| Forward Voltage (Note 2) | $V_{GS}$ = 0V, $I_S$ = 3.2A | $V_{SD}$ | -- | -- | 1.2 | V |
| Reverse Recovery Time | $I_S$ = 3.2A , dI/dt = 100A/μs | $t_{rr}$ | -- | 19 | -- | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | -- | 8 | -- | nC |

**Notes:**

1. Silicon limited current only.
2. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
3. Switching time is essentially independent of operating temperature.

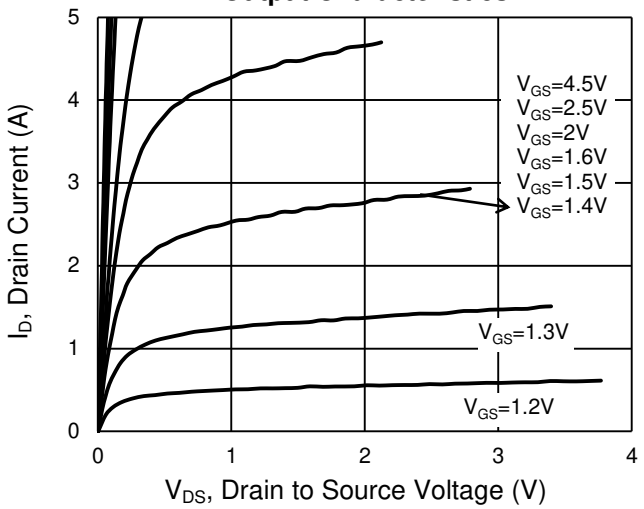
## ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSM2302CX RFG | SOT-23 | 3,000pcs / 7” Reel |

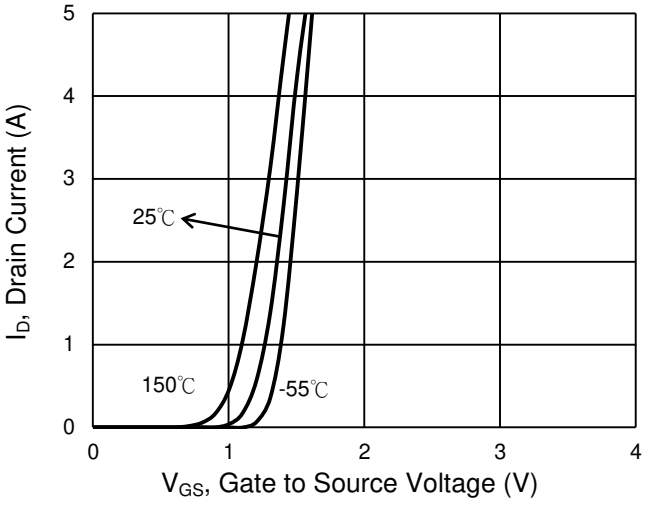
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

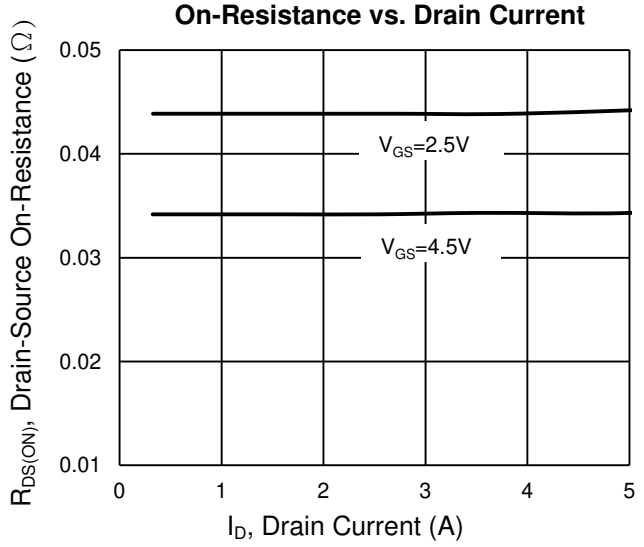
**Output Characteristics**



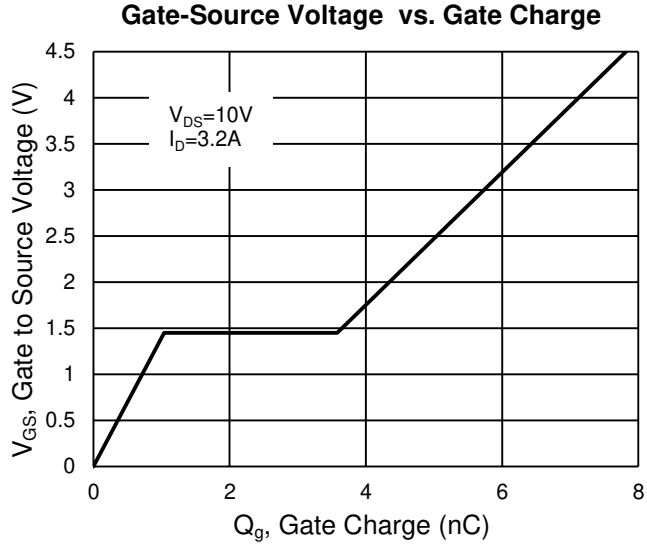

**Transfer Characteristics**



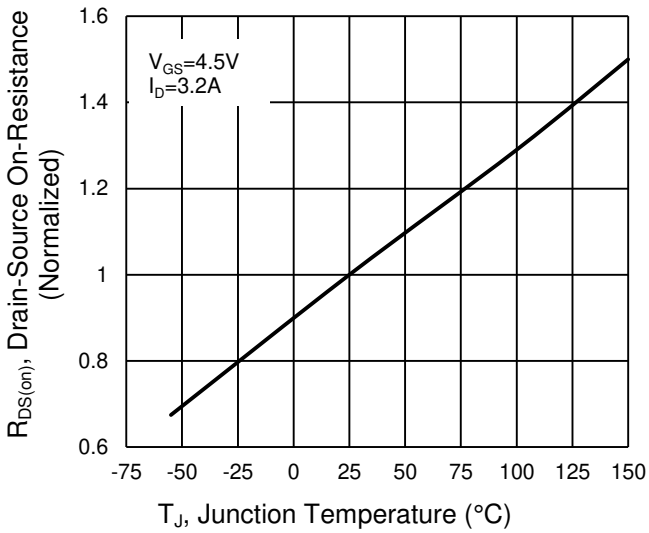

**On-Resistance vs. Drain Current**



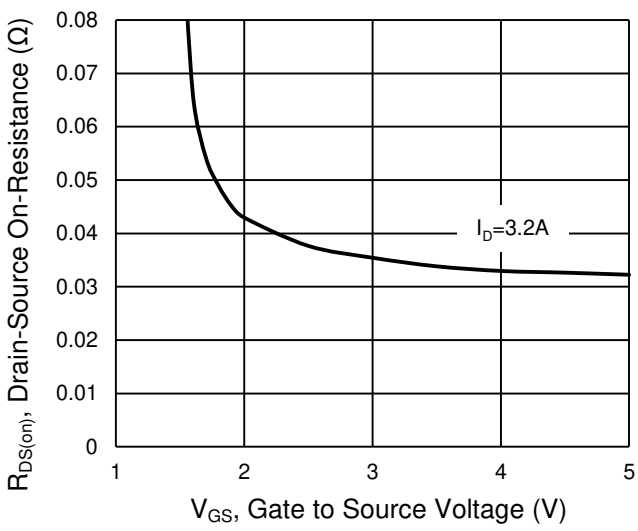

**Gate-Source Voltage vs. Gate Charge**




**On-Resistance vs. Junction Temperature**



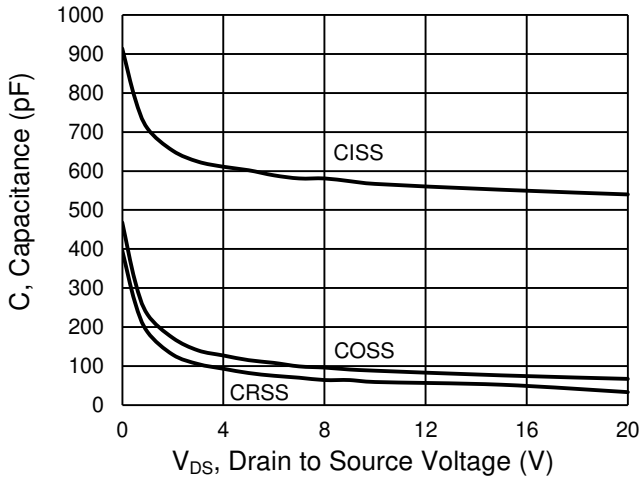

**On-Resistance vs. Gate-Source Voltage**



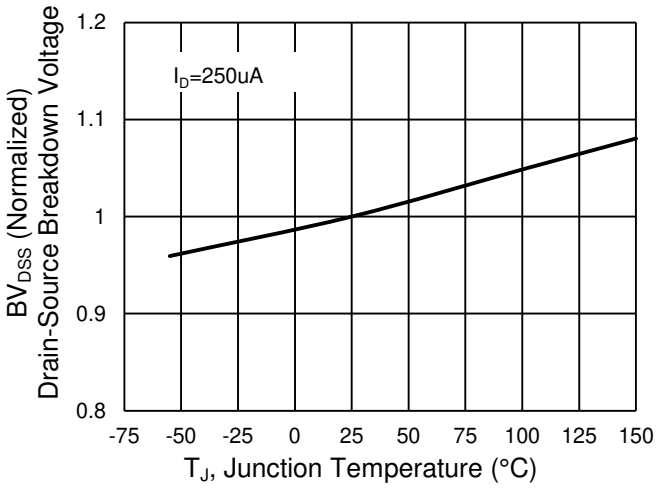
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

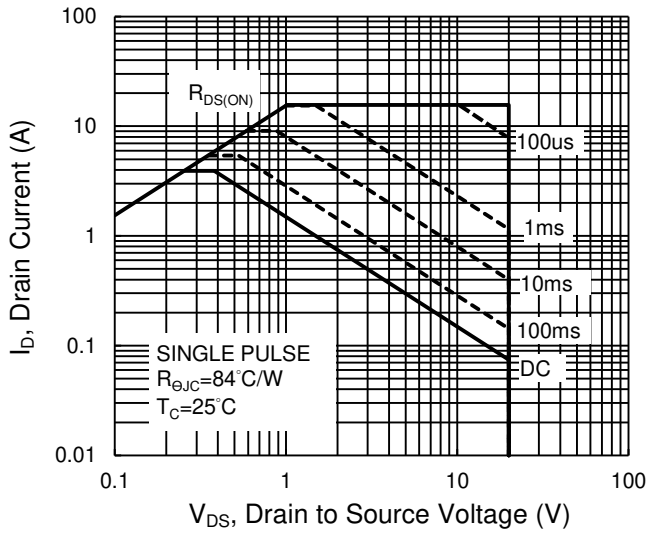
**Capacitance vs. Drain-Source Voltage**



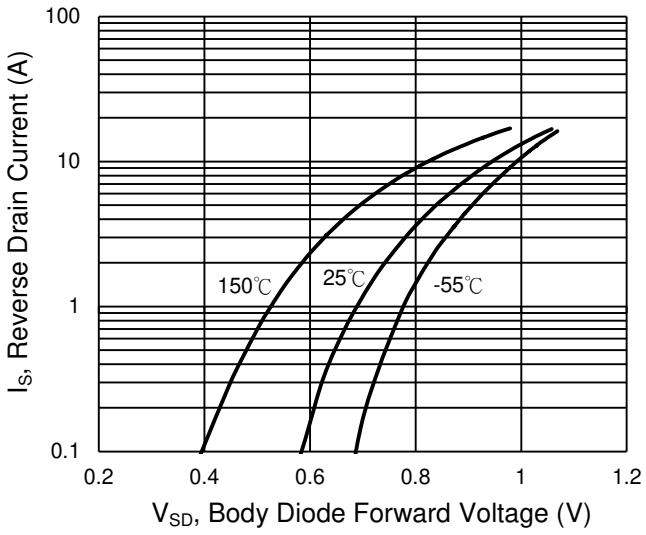

**$BV_{DSS}$ vs. Junction Temperature**



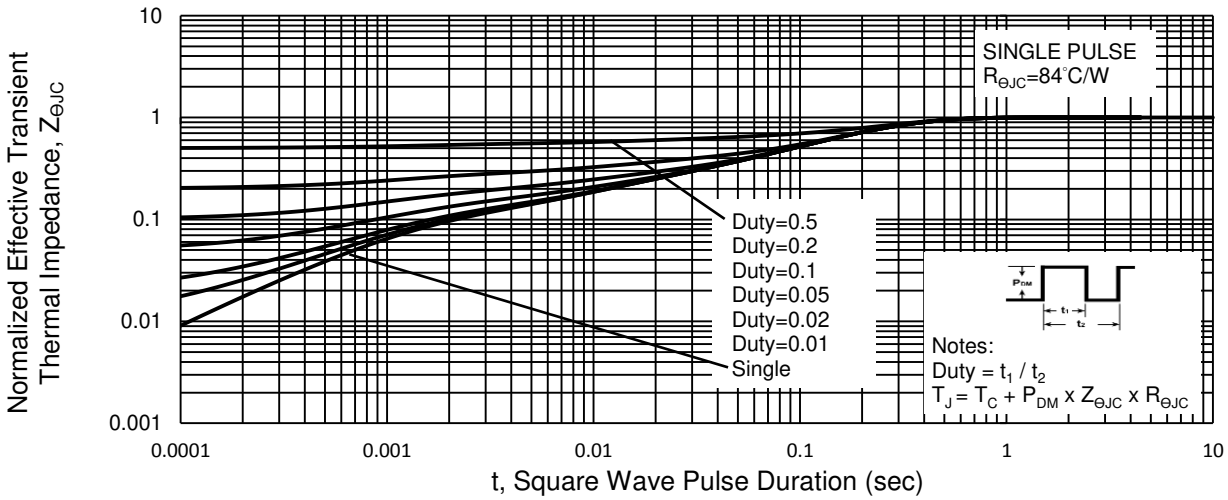

**Maximum Safe Operating Area, Junction-to-Case**




**Source-Drain Diode Forward Current vs. Voltage**

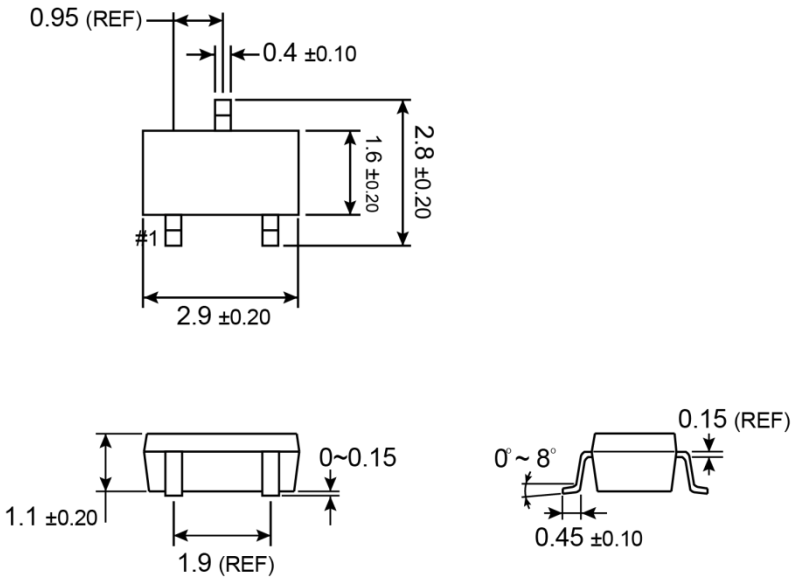



**Normalized Thermal Transient Impedance, Junction-to-Case**

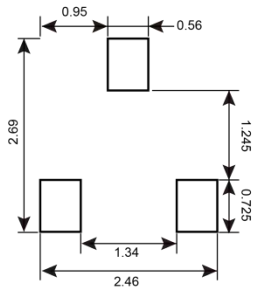


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**SOT-23**




## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## MARKING DIAGRAM


**2** = Device Code
**Y** = Year Code
**M** = Month Code

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **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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