

## P-Channel Power MOSFET

-20V, -2.8A, 130mΩ

### Features

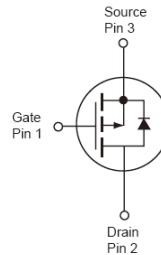
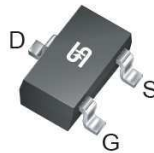
- Advance Trench Process Technology
- High Density Cell Design for Ultra Low On-resistance

### Application

- Telecom power
- Consumer Electronics

#### KEY PERFORMANCE PARAMETERS

| PARAMETER          | VALUE            | UNIT |
|--------------------|------------------|------|
| $V_{DS}$           | -20              | V    |
| $R_{DS(on)}$ (max) | $V_{GS} = -4.5V$ | 130  |
|                    | $V_{GS} = -2.5V$ | 190  |
| $Q_g$              | 7.2              | nC   |


**SOT-23**

**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| PARAMETER                                             | SYMBOL         | LIMIT                     | UNIT             |
|-------------------------------------------------------|----------------|---------------------------|------------------|
| Drain-Source Voltage                                  | $V_{DS}$       | -20                       | V                |
| Gate-Source Voltage                                   | $V_{GS}$       | $\pm 12$                  | V                |
| Continuous Drain Current (Note 1)                     | $I_D$          | $T_C = 25^\circ\text{C}$  | A                |
|                                                       |                | $T_C = 100^\circ\text{C}$ |                  |
| Pulsed Drain Current (Note 2)                         | $I_{DM}$       | -10                       | A                |
| Continuous Source Current (Diode Conduction) (Note 3) | $I_S$          | -1                        | A                |
| Total Power Dissipation                               | $P_{DTOT}$     | $T_A = 25^\circ\text{C}$  | W                |
|                                                       |                | $T_A = 70^\circ\text{C}$  |                  |
| Operating Junction and Storage Temperature Range      | $T_J, T_{STG}$ | - 55 to +150              | $^\circ\text{C}$ |

#### THERMAL PERFORMANCE

| PARAMETER                                            | SYMBOL          | LIMIT | UNIT               |
|------------------------------------------------------|-----------------|-------|--------------------|
| Junction to Ambient Thermal Resistance (PCB mounted) | $R_{\theta JA}$ | 175   | $^\circ\text{C/W}$ |

**Notes:**  $R_{\theta JA}$  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.  $R_{\theta JA}$  shown below for single device operation on FR-4 PCB in still air.

**ELECTRICAL SPECIFICATIONS** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

| PARAMETER                              | CONDITIONS                                                                                      | SYMBOL              | MIN  | TYP  | MAX  | UNIT |
|----------------------------------------|-------------------------------------------------------------------------------------------------|---------------------|------|------|------|------|
| Static <sup>(Note 4)</sup>             |                                                                                                 |                     |      |      |      |      |
| Drain-Source Breakdown Voltage         | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                    | BV <sub>DSS</sub>   | -20  | --   | --   | V    |
| Gate Threshold Voltage                 | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                      | V <sub>GS(th)</sub> | -0.6 | -0.7 | -1   | V    |
| Gate Body Leakage                      | V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V                                                    | I <sub>GSS</sub>    | --   | --   | ±100 | nA   |
| Zero Gate Voltage Drain Current        | V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V                                                    | I <sub>DSS</sub>    | --   | --   | 1.0  | μA   |
| Drain-Source On-State Resistance       | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -2.8A                                                 | R <sub>DS(on)</sub> | --   | 90   | 130  | mΩ   |
|                                        | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2.0A                                                 |                     | --   | 120  | 190  |      |
| Dynamic <sup>(Note 5)</sup>            |                                                                                                 |                     |      |      |      |      |
| Gate Resistance                        | V <sub>GS</sub> = V <sub>DS</sub> =0V, f=1MHz                                                   | R <sub>g</sub>      | --   | 7.5  | --   | Ω    |
| Total Gate Charge                      | V <sub>DS</sub> = -6V, I <sub>D</sub> = -2.8A,<br>V <sub>GS</sub> = -4.5V                       | Q <sub>g</sub>      | --   | 7.2  | --   | nC   |
| Gate-Source Charge                     |                                                                                                 | Q <sub>gs</sub>     | --   | 2.2  | --   |      |
| Gate-Drain Charge                      |                                                                                                 | Q <sub>gd</sub>     | --   | 1.2  | --   |      |
| Input Capacitance                      | V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                     | C <sub>iss</sub>    | --   | 480  | --   | pF   |
| Output Capacitance                     |                                                                                                 | C <sub>oss</sub>    | --   | 460  | --   |      |
| Reverse Transfer Capacitance           |                                                                                                 | C <sub>rss</sub>    | --   | 10   | --   |      |
| Switching <sup>(Note 6)</sup>          |                                                                                                 |                     |      |      |      |      |
| Turn-On Delay Time                     | V <sub>DD</sub> = -6V, R <sub>L</sub> = 6Ω,<br>V <sub>GEN</sub> = -4.5V,<br>R <sub>G</sub> = 6Ω | t <sub>d(on)</sub>  | --   | 38   | --   | ns   |
| Turn-On Rise Time                      |                                                                                                 | t <sub>r</sub>      | --   | 25   | --   |      |
| Turn-Off Delay Time                    |                                                                                                 | t <sub>d(off)</sub> | --   | 43   | --   |      |
| Turn-Off Fall Time                     |                                                                                                 | t <sub>f</sub>      | --   | 5    | --   |      |
| Source-Drain Diode <sup>(Note 4)</sup> |                                                                                                 |                     |      |      |      |      |
| Forward On Voltage                     | I <sub>S</sub> = -1A, V <sub>GS</sub> = 0V                                                      | V <sub>SD</sub>     | --   | -0.7 | -1.3 | V    |

**Notes:**

- Current limited by package.
- Pulse width limited by the maximum junction temperature.
- Surface Mounted on a 1 in<sup>2</sup> pad of 2oz Cu,  $t \leq 10$  sec.
- Pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$ .
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

**ORDERING INFORMATION**

| <b>PART NO.</b> | <b>PACKAGE</b> | <b>PACKING</b>      |
|-----------------|----------------|---------------------|
| TSM2301ACX RFG  | SOT-23         | 3,000 pcs / 7" Reel |

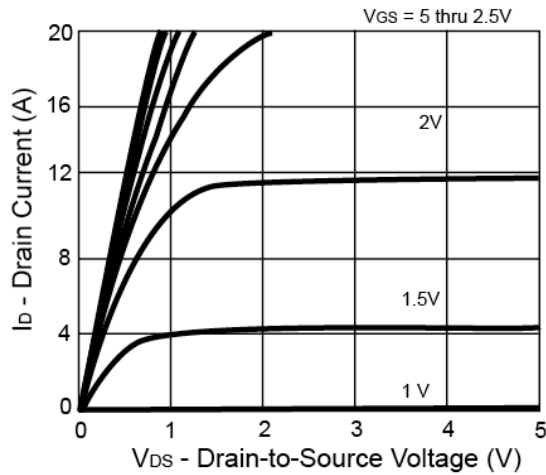
**Note:**

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

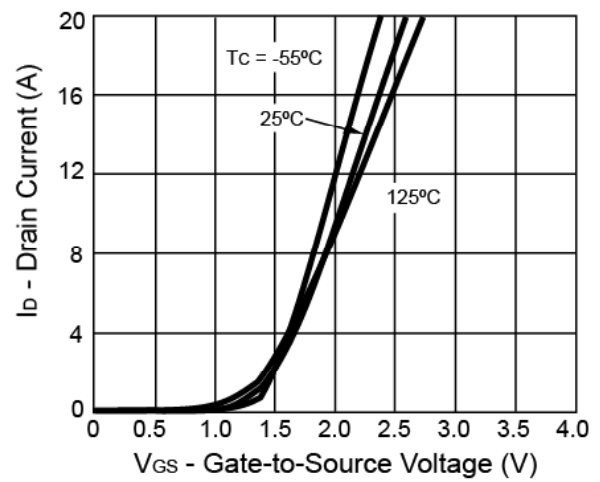
## CHARACTERISTICS CURVES

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

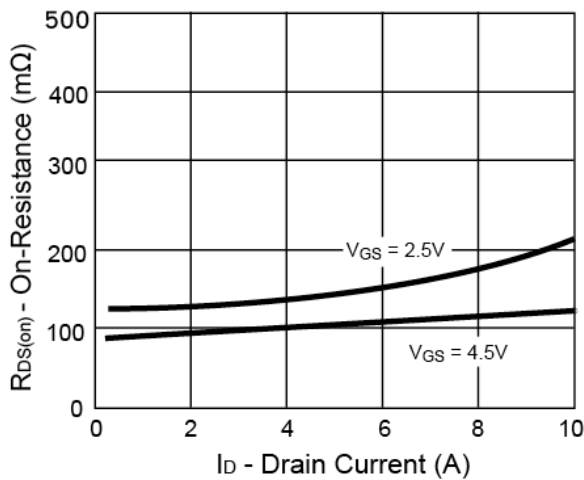
**Output Characteristics**



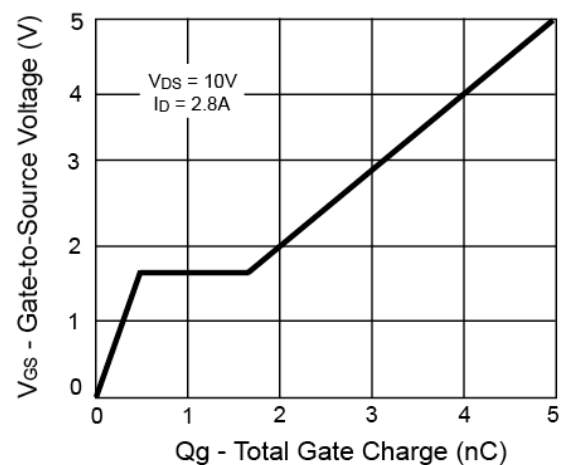
**Transfer Characteristics**



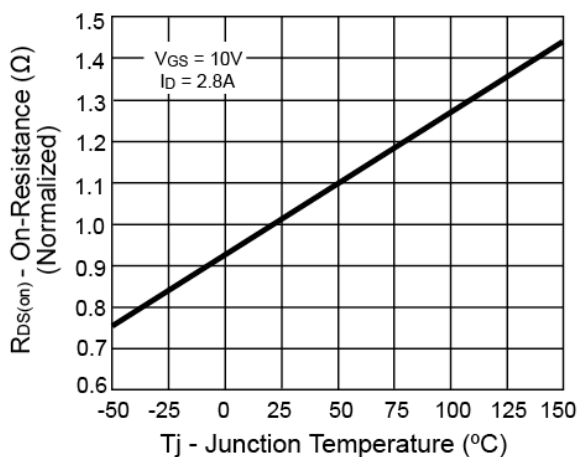
**On-Resistance vs. Drain Current**



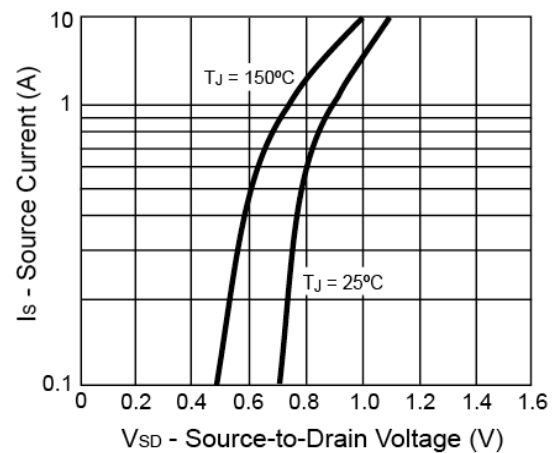
**Gate Charge**



**On-Resistance vs. Junction Temperature**



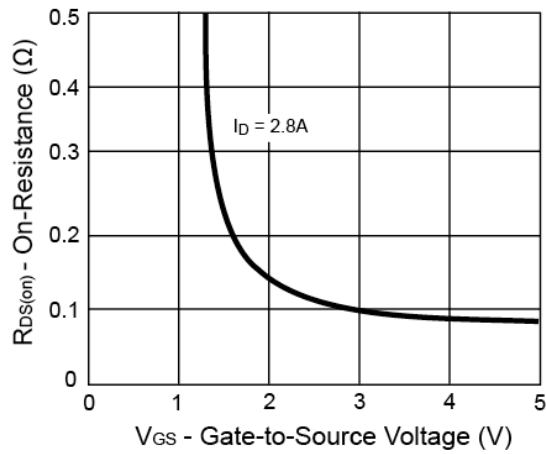
**Source-Drain Diode Forward Voltage**



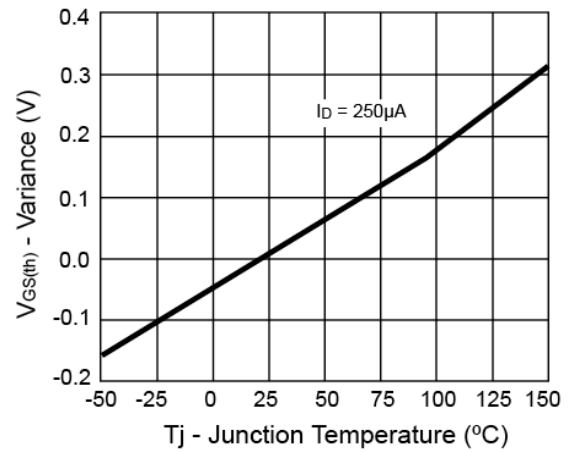
## Electrical Characteristics Curve

(T<sub>c</sub> = 25°C, unless otherwise noted)

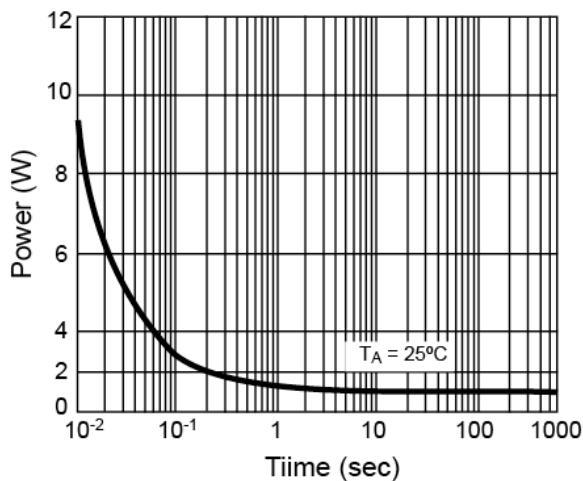
**On-Resistance vs. Gate-Source Voltage**



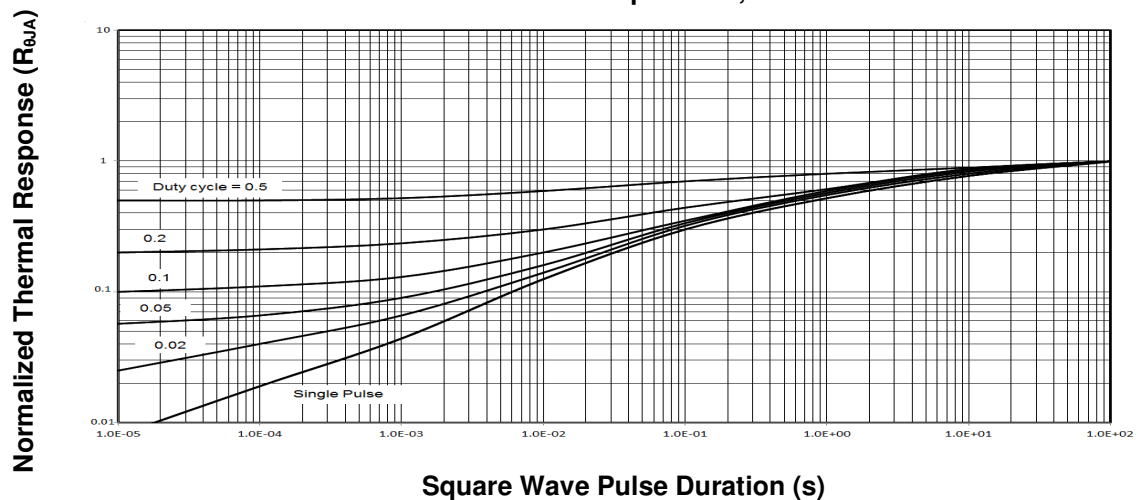
**Threshold Voltage**



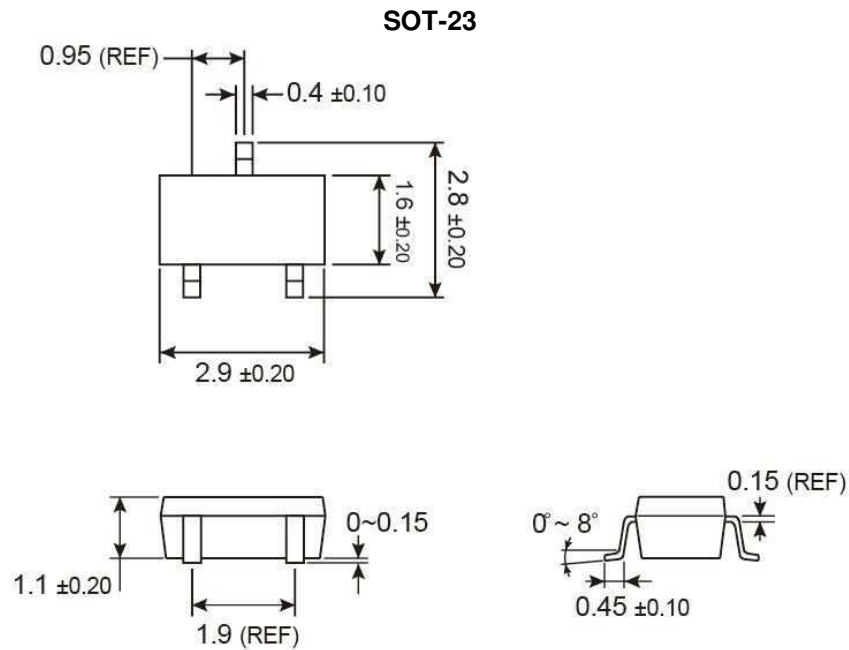
**Single Pulse Power**



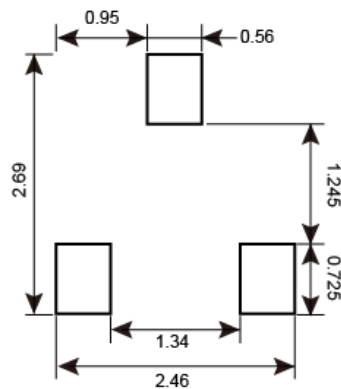
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



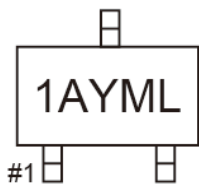
**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)



**SUGGESTED PAD LAYOUT** (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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