

## P-Channel 2.5 V (G-S) MOSFET

### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) <sup>b</sup> |
|--------------|-----------------------------|------------------------|
| - 20         | 0.100 at $V_{GS} = - 4.5$ V | - 2.4                  |
|              | 0.150 at $V_{GS} = - 2.5$ V | - 2.0                  |

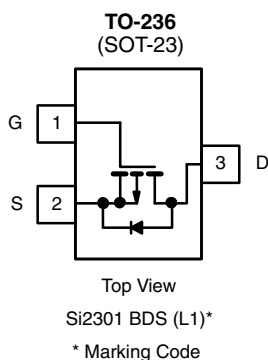
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT

HALOGEN  
**FREE**  
Available



**Ordering Information:** Si2301BDS-T1-E3 (Lead (Pb)-free)  
Si2301BDS-T1-GE3 (Lead (Pb)-free and Halogen-free)

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

| Parameter                                                 | Symbol         | 5 s         | Steady State | Unit |
|-----------------------------------------------------------|----------------|-------------|--------------|------|
| Drain-Source Voltage                                      | $V_{DS}$       | - 20        |              | V    |
| Gate-Source Voltage                                       | $V_{GS}$       | $\pm 8$     |              |      |
| Continuous Drain Current ( $T_J = 150$ °C) <sup>b</sup>   | $I_D$          | - 2.4       | - 2.2        | A    |
|                                                           |                | - 1.9       | - 1.8        |      |
| Pulsed Drain Current <sup>a</sup>                         | $I_{DM}$       | - 10        |              |      |
| Continuous Source Current (Diode Conduction) <sup>b</sup> | $I_S$          | - 0.72      | - 0.6        |      |
| Power Dissipation <sup>b</sup>                            | $P_D$          | 0.9         | 0.7          | W    |
|                                                           |                | 0.57        | 0.45         |      |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$ | - 55 to 150 |              | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                | Symbol     | Typical | Maximum | Unit |
|------------------------------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>b</sup> | $R_{thJA}$ | 120     | 145     | °C/W |
| Maximum Junction-to-Ambient <sup>c</sup> |            | 140     | 175     |      |

Notes:

- a. Pulse width limited by maximum junction temperature.  
b. Surface mounted on FR4 board,  $t \leq 5$  s.  
c. Surface mounted on FR4 board.

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

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

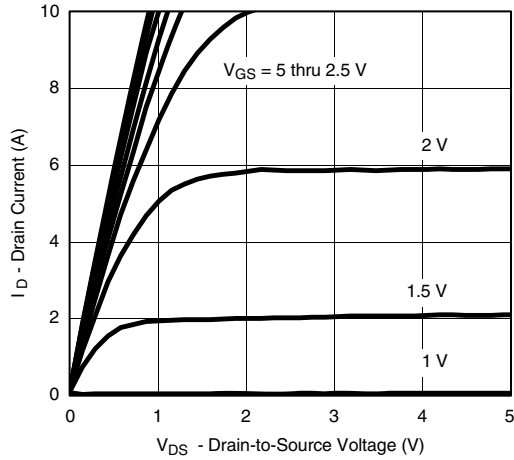
| Parameter                                     | Symbol       | Test Conditions                                                                                                                    | Limits |        |           | Unit          |
|-----------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-----------|---------------|
|                                               |              |                                                                                                                                    | Min.   | Typ.   | Max.      |               |
| Static                                        |              |                                                                                                                                    |        |        |           |               |
| Drain-Source Breakdown Voltage                | $V_{DS}$     | $V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$                                                                            | - 20   |        |           | V             |
| Gate Threshold Voltage                        | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                | - 0.45 |        | - 0.95    |               |
| Gate-Body Leakage                             | $I_{GSS}$    | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 8\text{ V}$                                                                                  |        |        | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current               | $I_{DSS}$    | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                    |        |        | - 1       | $\mu\text{A}$ |
|                                               |              | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$                                               |        |        | - 10      |               |
| On-State Drain Current <sup>a</sup>           | $I_{D(on)}$  | $V_{DS} \leq -5\text{ V}$ , $V_{GS} = -4.5\text{ V}$                                                                               | - 6    |        |           | A             |
|                                               |              | $V_{DS} \leq -5\text{ V}$ , $V_{GS} = -2.5\text{ V}$                                                                               | - 3    |        |           |               |
| Drain-Source On-State Resistance <sup>a</sup> | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}$ , $I_D = -2.8\text{ A}$                                                                                   |        | 0.080  | 0.100     | $\Omega$      |
|                                               |              | $V_{GS} = -2.5\text{ V}$ , $I_D = -2\text{ A}$                                                                                     |        | 0.110  | 0.150     |               |
| Forward Transconductance <sup>a</sup>         | $g_{fs}$     | $V_{DS} = -5\text{ V}$ , $I_D = -2.8\text{ A}$                                                                                     |        | 6.5    |           | S             |
| Diode Forward Voltage                         | $V_{SD}$     | $I_S = -0.75\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                     |        | - 0.80 | - 1.2     | V             |
| Dynamic <sup>b</sup>                          |              |                                                                                                                                    |        |        |           |               |
| Total Gate Charge                             | $Q_g$        | $V_{DS} = -6\text{ V}$ , $V_{GS} = -4.5\text{ V}$<br>$I_D \cong -2.8\text{ A}$                                                     |        | 4.5    | 10        | nC            |
| Gate-Source Charge                            | $Q_{gs}$     |                                                                                                                                    |        | 0.7    |           |               |
| Gate-Drain Charge                             | $Q_{gd}$     |                                                                                                                                    |        | 1.1    |           |               |
| Gate Resistance                               | $R_g$        | $f = 1\text{ MHz}$                                                                                                                 | 2      | 8      | 16        | $\Omega$      |
| Input Capacitance                             | $C_{iss}$    | $V_{DS} = -6\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                |        | 375    |           | pF            |
| Output Capacitance                            | $C_{oss}$    |                                                                                                                                    |        | 95     |           |               |
| Reverse Transfer Capacitance                  | $C_{rss}$    |                                                                                                                                    |        | 65     |           |               |
| Switching <sup>c</sup>                        |              |                                                                                                                                    |        |        |           |               |
| Turn-On Time                                  | $t_{d(on)}$  | $V_{DD} = -6\text{ V}$ , $R_L = 6\text{ }\Omega$<br>$I_D \cong -1\text{ A}$ , $V_{GEN} = -4.5\text{ V}$<br>$R_g = 6\text{ }\Omega$ |        | 20     | 30        | ns            |
|                                               | $t_r$        |                                                                                                                                    |        | 40     | 60        |               |
| Turn-Off Time                                 | $t_{d(off)}$ |                                                                                                                                    |        | 30     | 45        |               |
|                                               | $t_f$        |                                                                                                                                    |        | 20     | 30        |               |

## Notes:

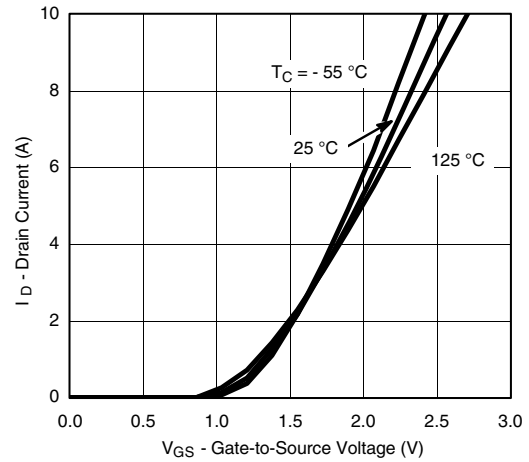
- a. Pulse test: pulse width  $\leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .  
b. For DESIGN AID ONLY, not subject to production testing.  
c. Switching time is essentially independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

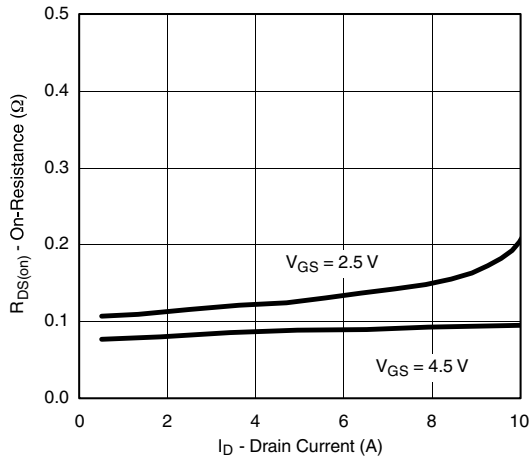
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



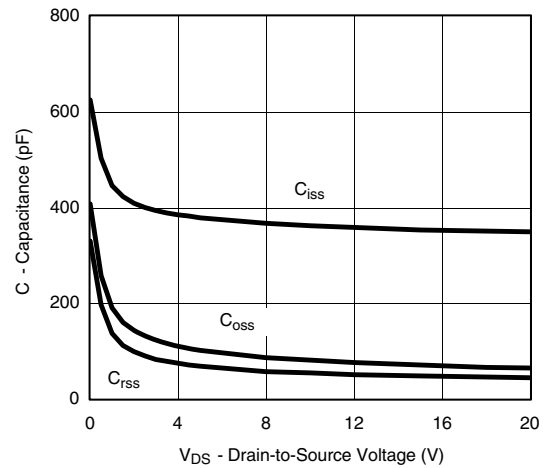
Output Characteristics



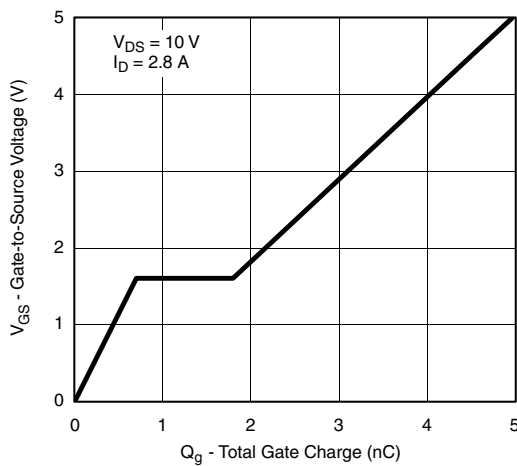
Transfer Characteristics



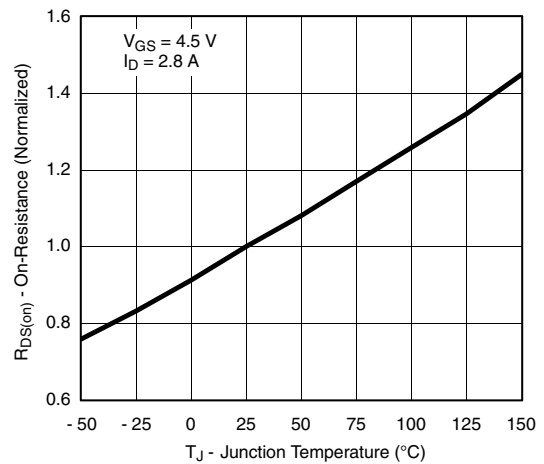
On-Resistance vs. Drain Current



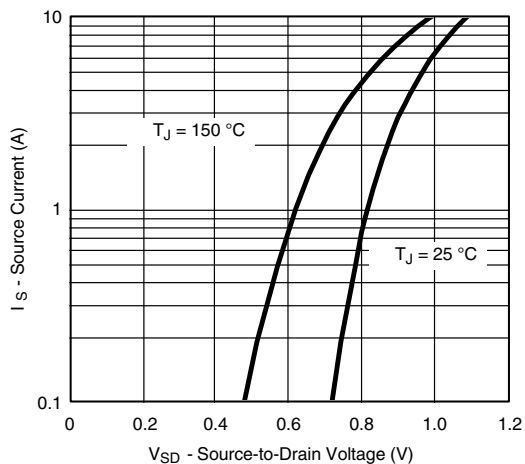
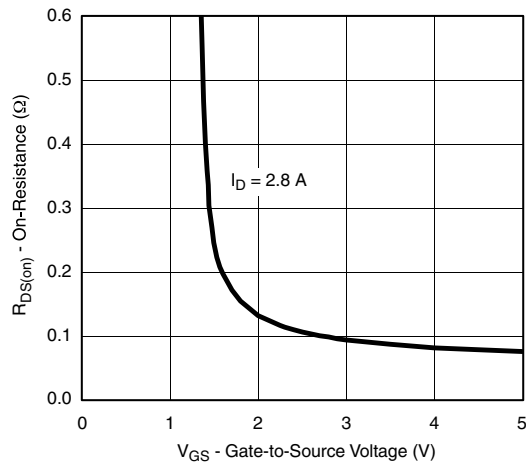
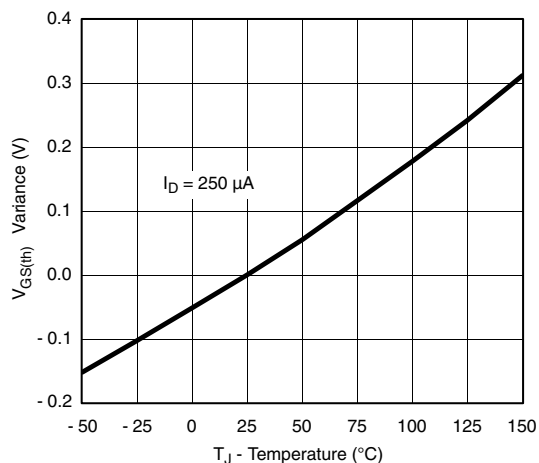
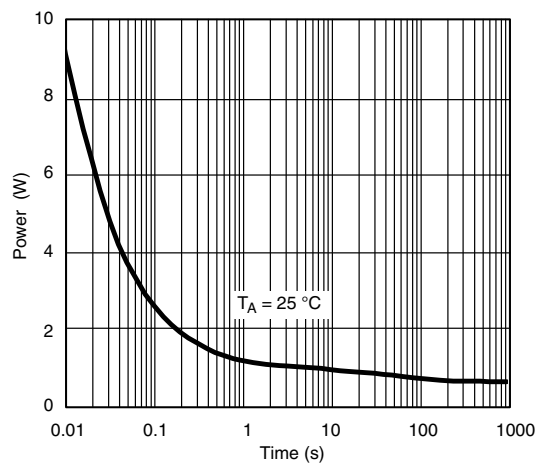
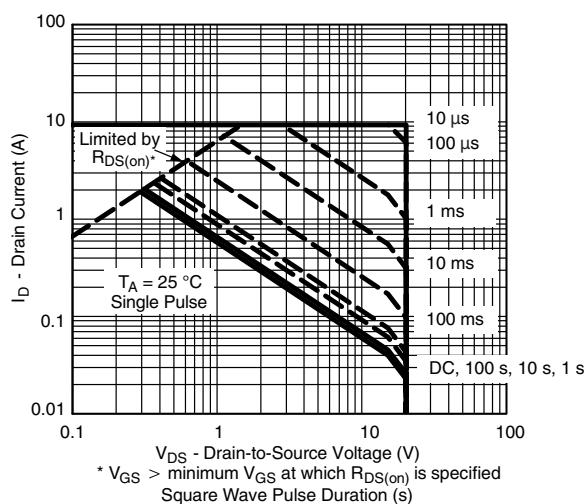
Capacitance



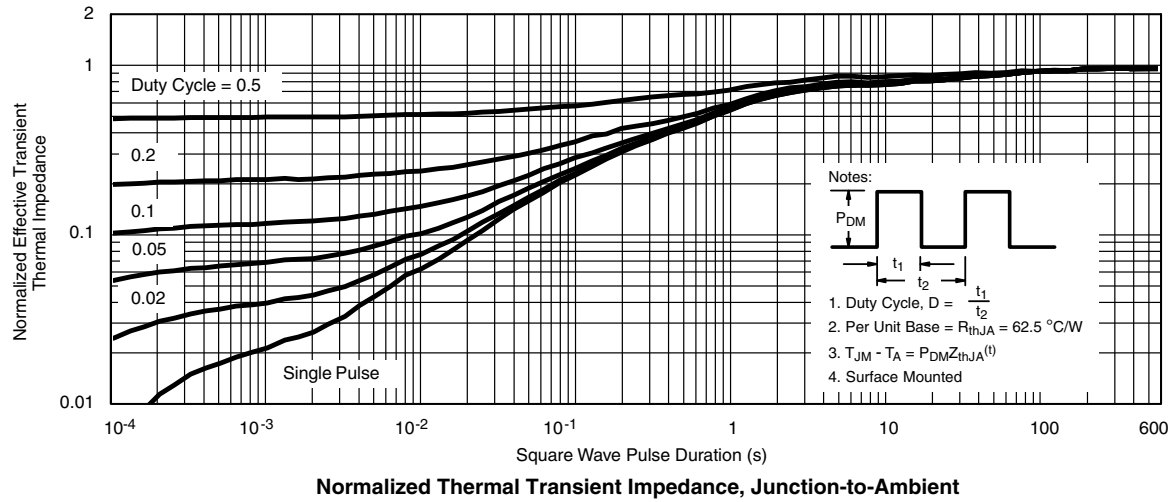
Gate Charge



On-Resistance vs. Junction Temperature

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power****Safe Operating Area**

## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?72066](http://www.vishay.com/ppg?72066).

## SOT-23 (TO-236): 3-LEAD



| Dim                            | MILLIMETERS |      | INCHES     |       |
|--------------------------------|-------------|------|------------|-------|
|                                | Min         | Max  | Min        | Max   |
| A                              | 0.89        | 1.12 | 0.035      | 0.044 |
| A <sub>1</sub>                 | 0.01        | 0.10 | 0.0004     | 0.004 |
| A <sub>2</sub>                 | 0.88        | 1.02 | 0.0346     | 0.040 |
| b                              | 0.35        | 0.50 | 0.014      | 0.020 |
| c                              | 0.085       | 0.18 | 0.003      | 0.007 |
| D                              | 2.80        | 3.04 | 0.110      | 0.120 |
| E                              | 2.10        | 2.64 | 0.083      | 0.104 |
| E <sub>1</sub>                 | 1.20        | 1.40 | 0.047      | 0.055 |
| e                              | 0.95 BSC    |      | 0.0374 Ref |       |
| e <sub>1</sub>                 | 1.90 BSC    |      | 0.0748 Ref |       |
| L                              | 0.40        | 0.60 | 0.016      | 0.024 |
| L <sub>1</sub>                 | 0.64 Ref    |      | 0.025 Ref  |       |
| S                              | 0.50 Ref    |      | 0.020 Ref  |       |
| q                              | 3°          | 8°   | 3°         | 8°    |
| ECN: S-03946-Rev. K, 09-Jul-01 |             |      |            |       |
| DWG: 5479                      |             |      |            |       |

## RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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