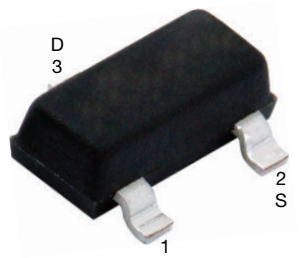
# N-Channel 20 V (D-S) MOSFET

**SOT-23 (TO-236)**




Top View

**Marking code:** O2

## FEATURES

- TrenchFET® power MOSFET
- 100 % $R_g$ tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

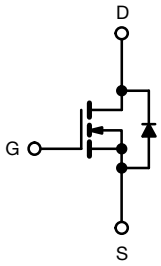
Pb-free

RoHS COMPLIANT

HALOGEN FREE

## APPLICATIONS

- Load switching for portable devices
- DC/DC converter




N-Channel MOSFET

| PRODUCT SUMMARY | |
|---|---|
| $V_{DS}$ (V) | 20 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS}$ = 4.5 V | 0.057 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS}$ = 2.5 V | 0.075 |
| $Q_g$ typ. (nC) | 3.5 |
| $I_D$ (A) | 2.9 |
| Configuration | Single |

| ORDERING INFORMATION | |
|---|---|
| Package | SOT-23 |
| Lead (Pb)-free and halogen-free | Si2302DDS-T1-GE3 |

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

| PARAMETER | | SYMBOL | 5 s | STEADY STATE | UNIT |
|---|---|---|---|---|---|
| Drain-source voltage | | $V_{DS}$ | 20 | 20 | V |
| Gate-source voltage | | $V_{GS}$ | ± 8 | ± 8 | |
| Continuous drain current ($T_J$ = 150 °C) [a] | $T_A$ = 25 °C | $I_D$ | 2.9 | 2.6 | A |
| | $T_A$ = 70 °C | | 2.3 | 2.1 | |
| Pulsed drain current (t = 300 µs) [b] | | $I_{DM}$ | 10 | 10 | |
| Continuous source current (diode conduction) [a] | | $I_S$ | 0.72 | 0.6 | |
| Power dissipation [a] | $T_A$ = 25 °C | $P_D$ | 0.86 | 0.71 | W |
| | $T_A$ = 70 °C | | 0.55 | 0.46 | |
| Operating junction and storage temperature range | | $T_J$, $T_{stg}$ | -55 to +150 | -55 to +150 | °C |

**THERMAL RESISTANCE RATINGS**

| PARAMETER | | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|---|---|---|---|---|---|
| Maximum junction-to-ambient [a] | t ≤ 5 s | $R_{thJA}$ | 120 | 145 | °C/W |
| | Steady state | | 140 | 175 | |
| Maximum junction-to-foot | Steady state | $R_{thJF}$ | 62 | 78 | |

**Notes**

a. Surface mounted on 1" x 1" FR4 board

b. Pulse width limited by maximum junction temperature

| **SPECIFICATIONS** ($T_A$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-source breakdown voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 20 | - | - | V |
| Gate-threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 0.40 | - | 0.85 | |
| Gate-body leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 8 V | - | - | ± 100 | nA |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | - | - | 1 | µA |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, $T_J$ = 70 °C | - | - | 75 | |
| On-state drain current [a] | $I_{D(on)}$ | $V_{DS}$ ≥ 10 V, $V_{GS}$ = 4.5 V | 6 | - | - | A |
| Drain-source on-resistance [a] | $R_{DS(on)}$ | $V_{GS}$ = 4.5 V, $I_D$ = 3.6 A | - | 0.045 | 0.057 | Ω |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 3.1 A | - | 0.056 | 0.075 | |
| Forward transconductance [a] | $g_{fs}$ | $V_{DS}$ = 5 V, $I_D$ = 3.6 A | - | 13 | - | S |
| Diode forward voltage | $V_{SD}$ | $I_S$ = 0.95 A, $V_{GS}$ = 0 V | - | 0.7 | 1.2 | V |
| **Dynamic [b]** | | | | | | |
| Total gate charge | $Q_g$ | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_D$ = 3.6 A | - | 3.5 | 5.5 | nC |
| Gate-source charge | $Q_{gs}$ | | - | 0.6 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 0.45 | - | |
| Gate resistance | $R_g$ | f = 1 MHz | 2 | 4 | 8 | Ω |
| **Switching** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 10 V, $R_L$ = 2.78 Ω, $I_D$ ≅ 3.6 A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 Ω | - | 8 | 15 | ns |
| Rise time | $t_r$ | | - | 7 | 15 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 30 | 45 | |
| Fall time | $t_f$ | | - | 7 | 15 | |
| Source-drain reverse recovery time | $t_{rr}$ | $I_F$ = 3.6 A, di/dt = 100 A/µs | - | 8.5 | 15 | |
| Body diode reverse recovery charge | $Q_{rr}$ | | - | 2 | 4 | nC |

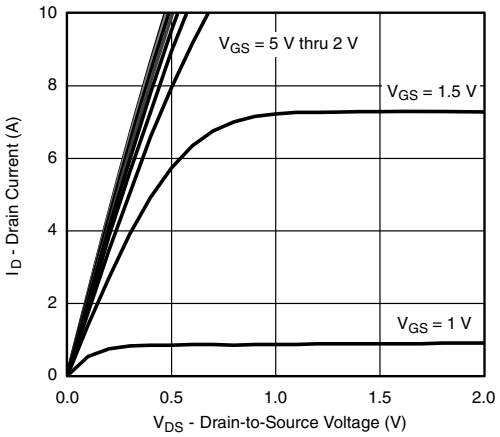
**Notes**

a. Pulse test: Pulse width ≤ 300 µs, duty cycle ≤ 2 %

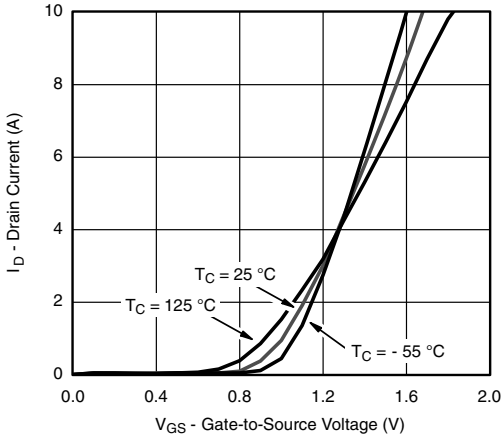
b. Guaranteed by design, not subject to production testing

*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.*

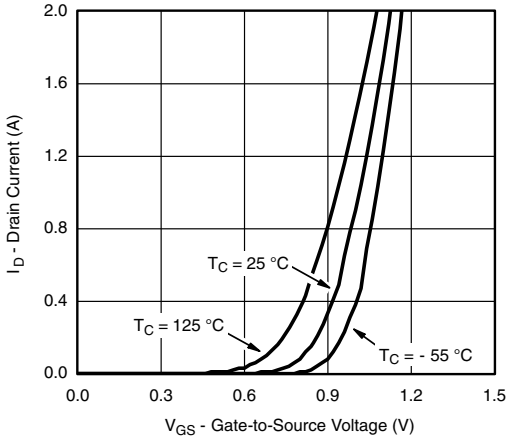
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



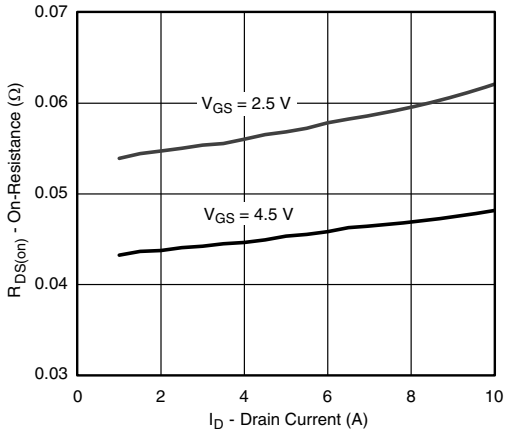

**Output Characteristics**



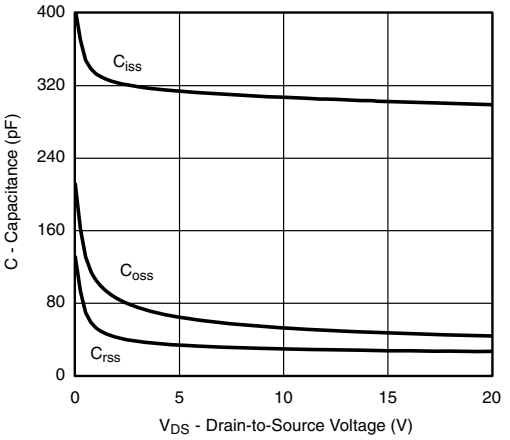

**Transfer Characteristics**



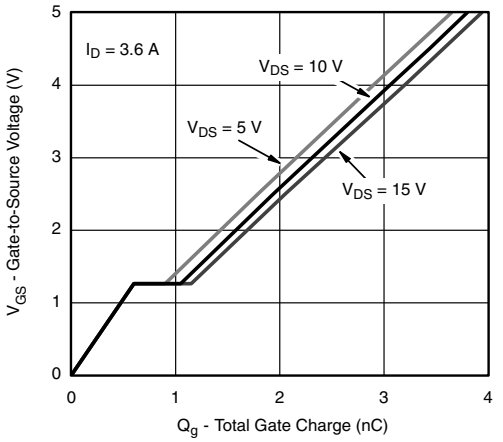

**Transfer Characteristics**




**On-Resistance vs. Drain Current**

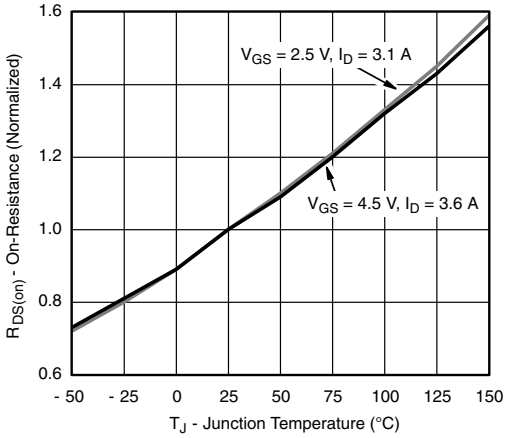



**Capacitance**

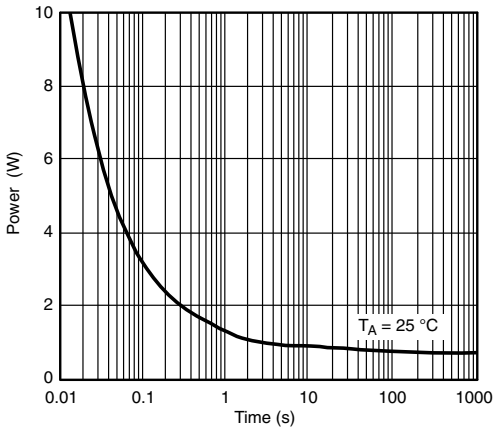



**Gate Charge**

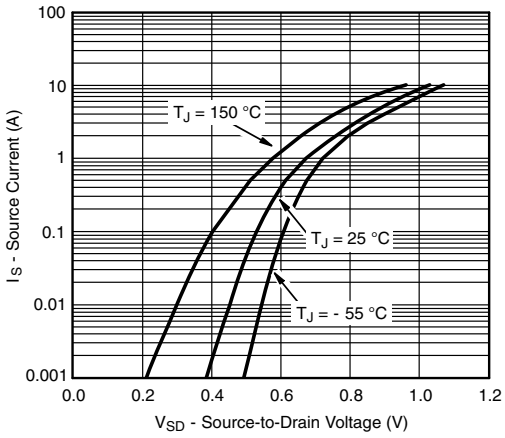
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



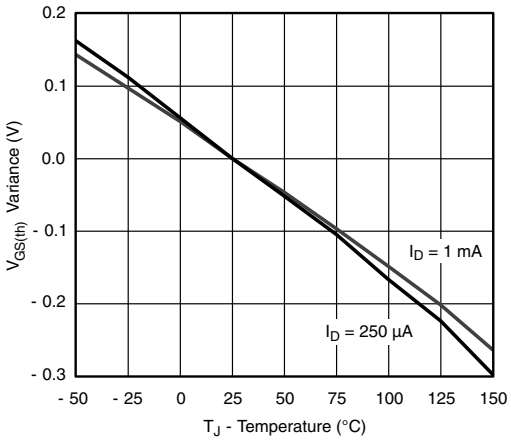

**On-Resistance vs. Junction Temperature**



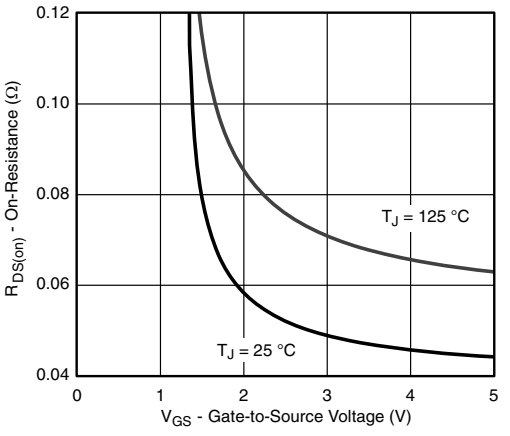

**Single Pulse Power**



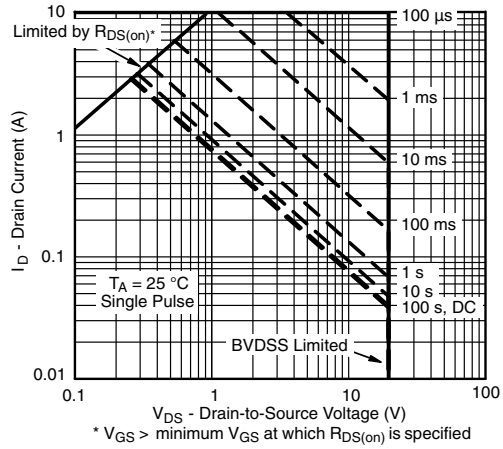

**Source-Drain Diode Forward Voltage**




**Threshold Voltage**

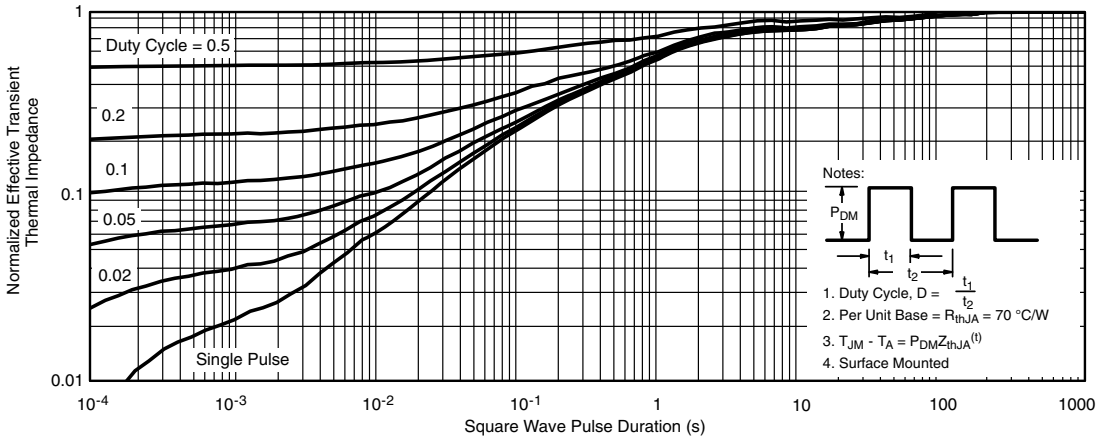



**On-Resistance vs. Gate-to-Source Voltage**




**Safe Operating Area, Junction-to-Ambient**

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




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

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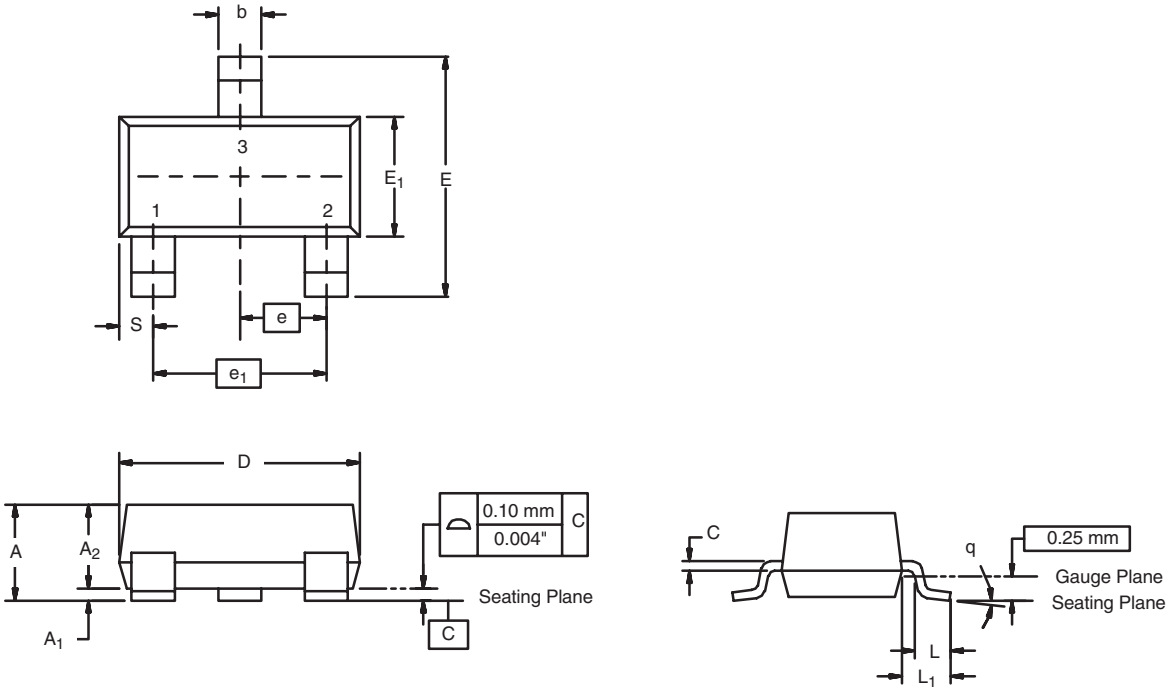
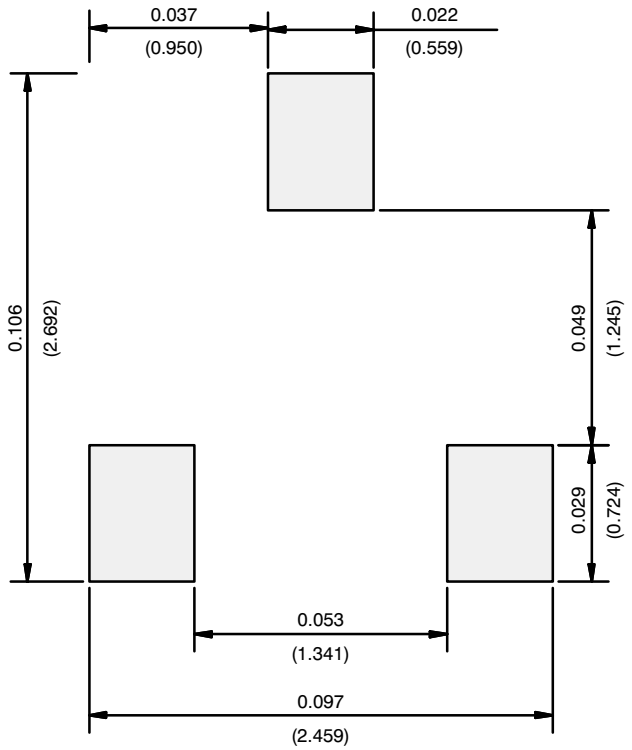
## SOT-23 (TO-236): 3-LEAD




| Dim | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| $A_1$ | 0.01 | 0.10 | 0.0004 | 0.004 |
| $A_2$ | 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 |
| $E_1$ | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 0.95 BSC | | 0.0374 Ref | |
| $e_1$ | 1.90 BSC | | 0.0748 Ref | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| $L_1$ | 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<br>DWG: 5479 | | | | |

## RECOMMENDED MINIMUM PADS FOR SOT-23




Recommended Minimum Pads
Dimensions in Inches/(mm)

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