

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

## PRODUCT SUMMARY

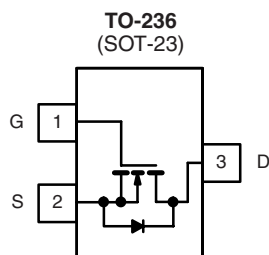
| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) | $Q_g$ (Typ.) |
|--------------|---------------------------|-----------|--------------|
| 20           | 0.057 at $V_{GS} = 4.5$ V | 2.9       | 3.5          |
|              | 0.075 at $V_{GS} = 2.5$ V | 2.6       |              |

## FEATURES

- Halogen-free Option Available
- TrenchFET® Power MOSFET

## APPLICATIONS

- Load Switching for Portable Devices
- DC/DC Converter


**RoHS**  
COMPLIANT


Top View

Si2302CDS (N2)\*

\* Marking Code

Ordering Information: Si2302CDS-T1-E3 (Lead (Pb)-free)  
Si2302CDS-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>a</sup>   | $I_D$          | 2.9         | 2.6          | A    |
|                                                           |                | 2.3         | 2.1          |      |
| Pulsed Drain Current <sup>b</sup>                         | $I_{DM}$       | 10          |              |      |
| Continuous Source Current (Diode Conduction) <sup>a</sup> | $I_S$          | 0.72        | 0.6          |      |
| Power Dissipation <sup>a</sup>                            | $P_D$          | 0.86        | 0.71         | W    |
|                                                           |                | 0.55        | 0.46         |      |
| 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>a</sup> | $R_{thJA}$ | 120     | 145     | °C/W |
|                                          |            | 140     | 175     |      |
| Maximum Junction-to-Foot                 | $R_{thJF}$ | 62      | 78      |      |

Notes:

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

b. Pulse width limited by maximum junction temperature.

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

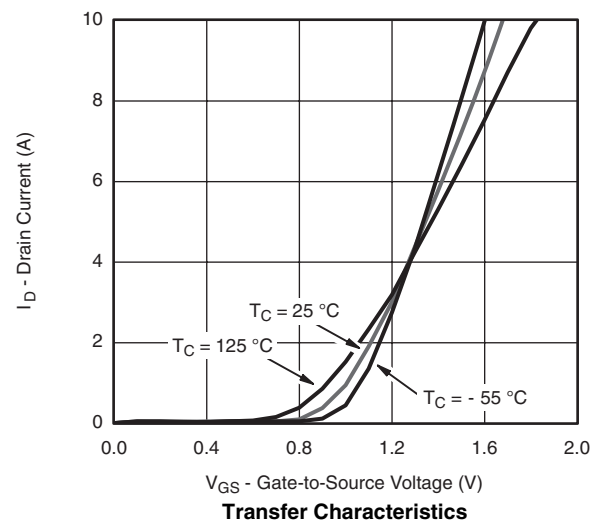
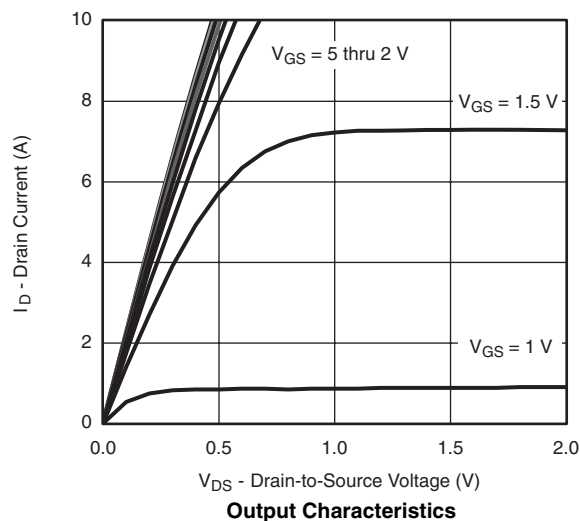
| Parameter                               | Symbol       | Test Conditions                                                                                                             | Limits |       |           | Unit          |
|-----------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------|--------|-------|-----------|---------------|
|                                         |              |                                                                                                                             | 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                  | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                             | 0.40   |       | 0.85      |               |
| 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         | $\mu\text{A}$ |
|                                         |              | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^{\circ}\text{C}$                                               |        |       | 75        |               |
| On-State Drain Current <sup>a</sup>     | $I_{D(on)}$  | $V_{DS} \geq 10\text{ V}, V_{GS} = 4.5\text{ V}$                                                                            | 6      |       |           | A             |
| Drain-Source On-Resistance <sup>a</sup> | $R_{DS(on)}$ | $V_{GS} = 4.5\text{ V}, I_D = 3.6\text{ A}$                                                                                 |        | 0.045 | 0.057     | $\Omega$      |
|                                         |              | $V_{GS} = 2.5\text{ V}, I_D = 3.1\text{ A}$                                                                                 |        | 0.056 | 0.075     |               |
| Forward Transconductance <sup>a</sup>   | $g_{fs}$     | $V_{DS} = 5\text{ V}, I_D = 3.6\text{ A}$                                                                                   |        | 13    |           | S             |
| Diode Forward Voltage                   | $V_{SD}$     | $I_S = 0.95\text{ A}, V_{GS} = 0\text{ V}$                                                                                  |        | 0.7   | 1.2       | V             |
| Dynamic <sup>b</sup>                    |              |                                                                                                                             |        |       |           |               |
| Total Gate Charge                       | $Q_g$        | $V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 3.6\text{ A}$                                                           |        | 3.5   | 5.5       | nC            |
| Gate-Source Charge                      | $Q_{gs}$     |                                                                                                                             |        | 0.6   |           |               |
| Gate-Drain Charge                       | $Q_{gd}$     |                                                                                                                             |        | 0.45  |           |               |
| Gate Resistance                         | $R_g$        | $f = 1.0\text{ MHz}$                                                                                                        | 2.0    | 4.0   | 8.0       | $\Omega$      |
| Switching                               |              |                                                                                                                             |        |       |           |               |
| Turn-On Delay Time                      | $t_{d(on)}$  | $V_{DD} = 10\text{ V}, R_L = 2.78\text{ }\Omega$<br>$I_D \cong 3.6\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ |        | 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      | $t_{rr}$     | $I_F = 3.6\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$                                                                      |        | 8.5   | 15        | nC            |
| Body Diode Reverse Recovery Charge      | $Q_{rr}$     |                                                                                                                             |        | 2.0   | 4.0       |               |

## Notes:

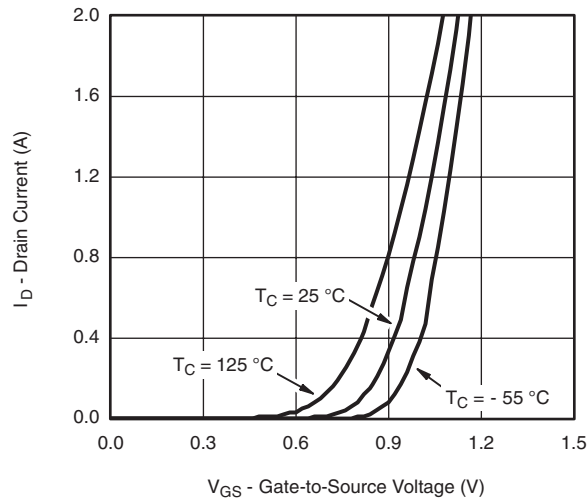
a. Pulse test: Pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

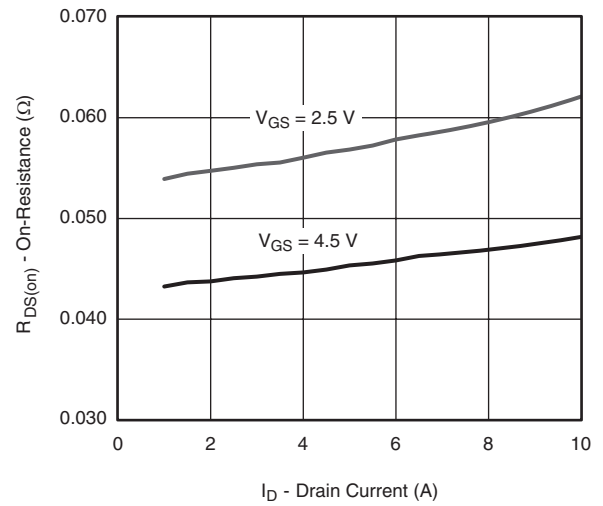
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS**  $25^\circ\text{C}$ , unless otherwise noted

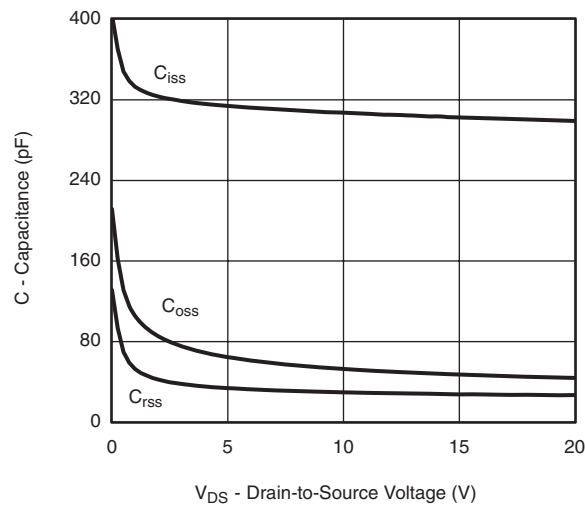
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



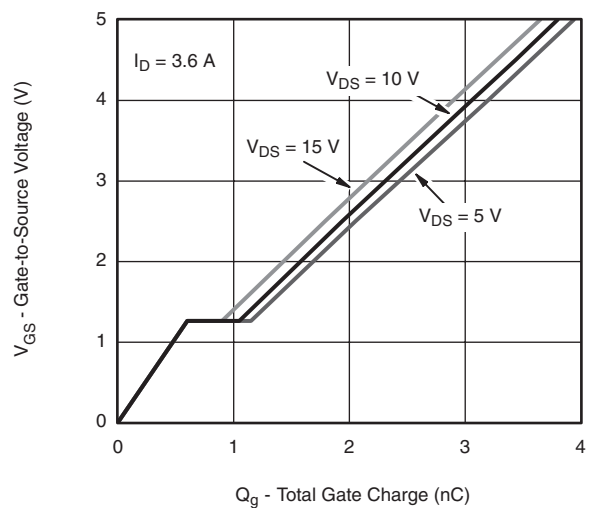
Transfer Characteristics



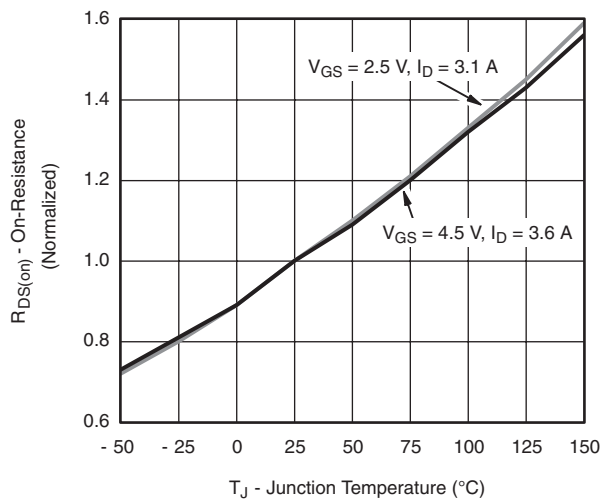
On-Resistance vs. Drain Current



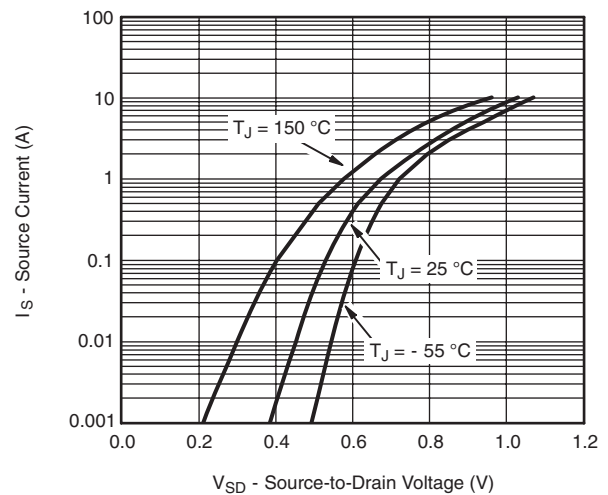
Capacitance



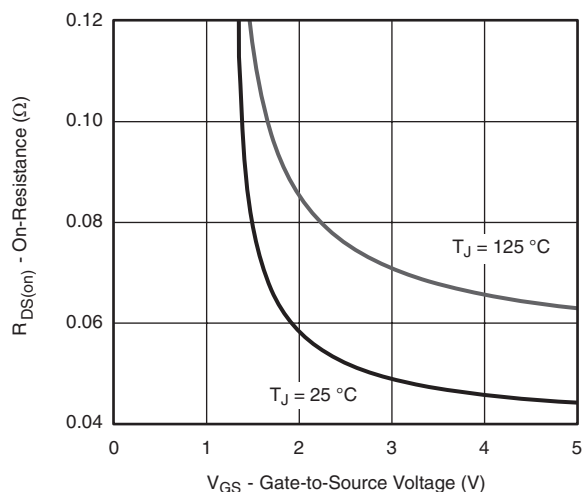
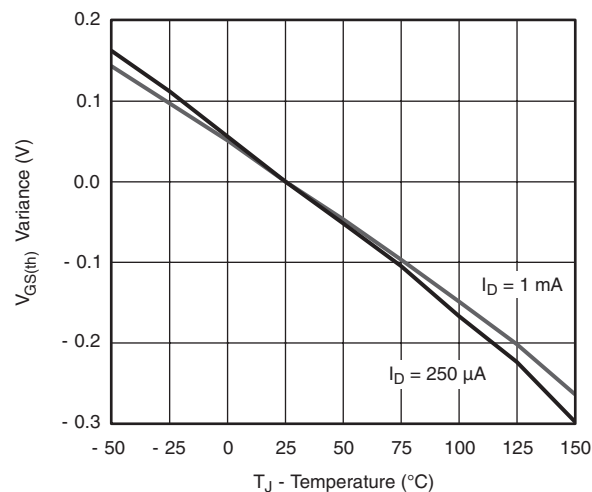
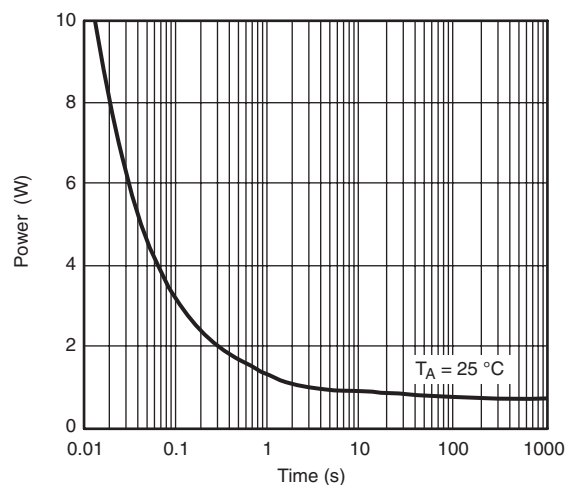
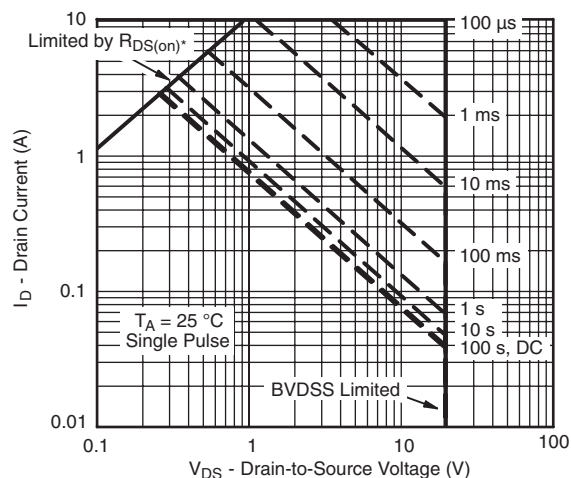
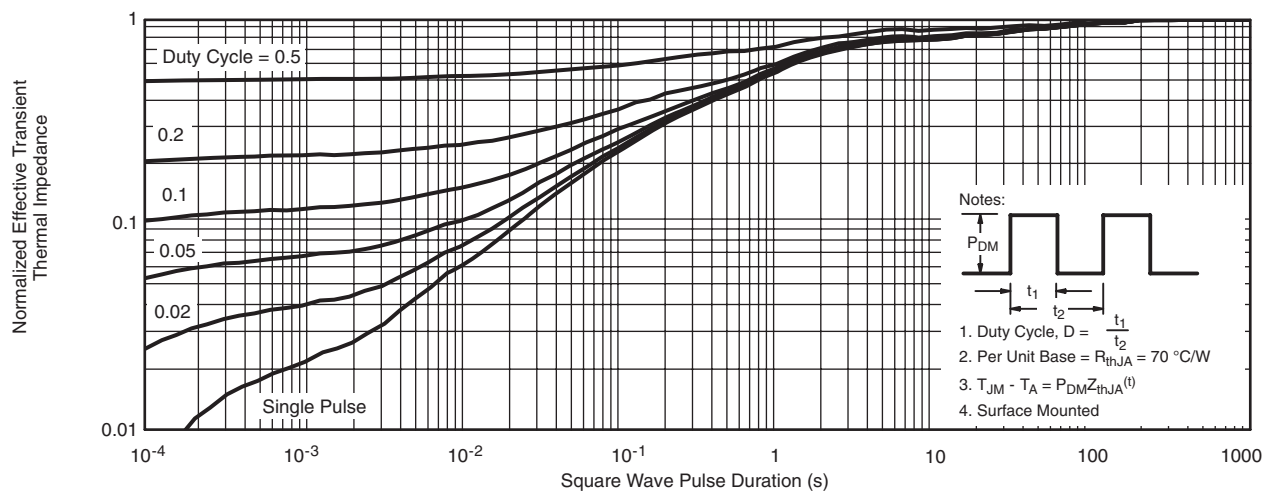
Gate Charge



On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power**\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified**Safe Operating Area, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Ambient**

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