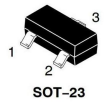
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# Si2304BDS-T1-GE3
# N-Channel 30 V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) | $Q_g$ (Typ.) |
| 30 | 0.070 at $V_{GS}$ = 10 V | 3.2 | 2.6 |
| | 0.105 at $V_{GS}$ = 4.5 V | 2.6 | |

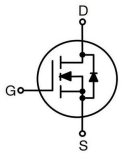
## FEATURES

- **Halogen-free According to Definition**
- TrenchFET® Power MOSFET
- 100 % $R_g$ Tested
- Compliant to RoHS




SOT–23

1 – Gate
2 – Source
3 – Drain




* Marking Code

**Ordering Information:** Si2304BDS-T1-E3 (Lead (Pb)-free)
Si2304BDS-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 | | $V_{DS}$ | 30 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | | |
| Continuous Drain Current ($T_J$ = 150 °C)[a, b] | $T_A$ = 25 °C | $I_D$ | 3.2 | 2.6 | A |
| | $T_A$ = 70 °C | | 2.5 | 2.1 | |
| Pulsed Drain Current | | $I_{DM}$ | 10 | | |
| Continuous Source Current (Diode Conduction)[a, b] | | $I_S$ | 0.9 | 0.62 | |
| Maximum Power Dissipation[a, b] | $T_A$ = 25 °C | $P_D$ | 1.08 | 0.75 | W |
| | $T_A$ = 70 °C | | 0.69 | 0.48 | |
| 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[a] | t ≤ 5 s | $R_{thJA}$ | 90 | 115 | °C/W |
| | Steady State | | 130 | 166 | |
| Maximum Junction-to-Foot (Drain) | Steady State | $R_{thJF}$ | 60 | 75 | |

Notes:
a. Surface mounted on FR4 board, t ≤ 5 s.
b. Pulse width limited by maximum junction temperature.
c. Surface mounted on FR4 board.

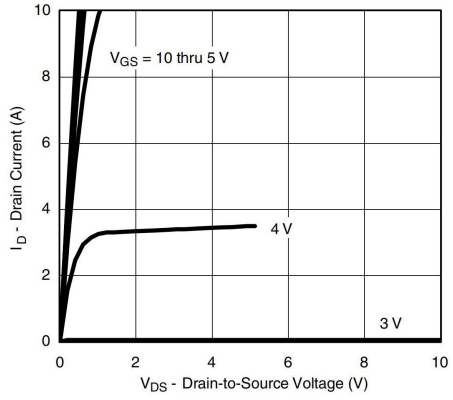
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| **SPECIFICATIONS** ($T_A$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Limits** | | | **Unit** |
| | | | **Min.** | **Typ.** | **Max.** | |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 30 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1.5 | | 3 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V | | | 0.5 | µA |
| | | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | | | 10 | |
| | | $V_{DS}$ = 30 V, $V_{GS}$ = 1 V, $T_J$ = 25 °C | | | 1 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS} \geq$ 4.5 V, $V_{GS}$ = 10 V | 6 | | | A |
| Drain-Source On-Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 2.5 A | | 0.055 | 0.070 | Ω |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 2 A | | 0.080 | 0.105 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 4.5 V, $I_D$ = 2.5 A | | 6 | | S |
| Diode Forward Voltage | $V_{SD}$ | $I_S$ = 1.25 A, $V_{GS}$ = 0 V | | 0.8 | 1.2 | V |
| **Dynamic** | | | | | | |
| Gate Charge | $Q_g$ | $V_{DS}$ = 15 V, $V_{GS}$ = 5 V, $I_D$ = 2.5 A | | 2.6 | 4 | nC |
| Total Gate Charge | $Q_{gt}$ | $V_{DS}$ = 15 V, $V_{GS}$ = 10 V, $I_D$ = 2.5 A | | 4.6 | 7 | |
| Gate-Source Charge | $Q_{gs}$ | | | 0.8 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 1.15 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | 0.6 | 3 | 6 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1 MHz | | 225 | | pF |
| Output Capacitance | $C_{oss}$ | | | 50 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 28 | | |
| **Switching** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 15 V, $R_L$ = 15 Ω<br>$I_D \cong$ 1 A, $V_{GEN}$ = 10 V, $R_g$ = 6 Ω | | 7.5 | 12 | ns |
| Rise Time | $t_r$ | | | 12.5 | 20 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 19 | 30 | |
| Fall Time | $t_f$ | | | 15 | 25 | |

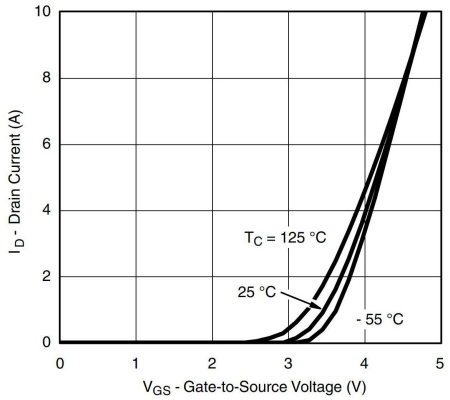
Notes:
a. Pulse test: PW ≤ 300 µs, duty cycle ≤ 2 %.

*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)



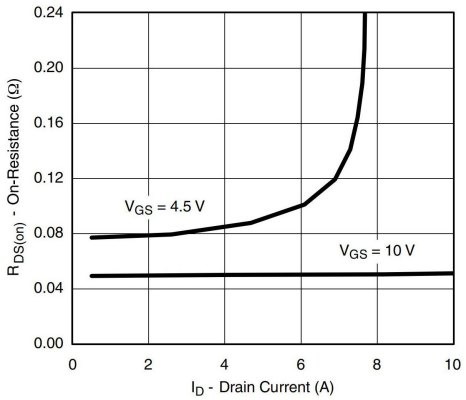

**Output Characteristics**



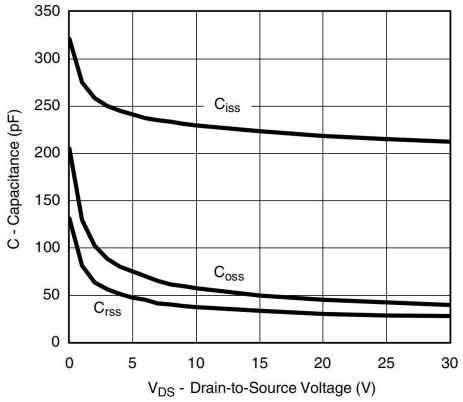

**Transfer Characteristics**

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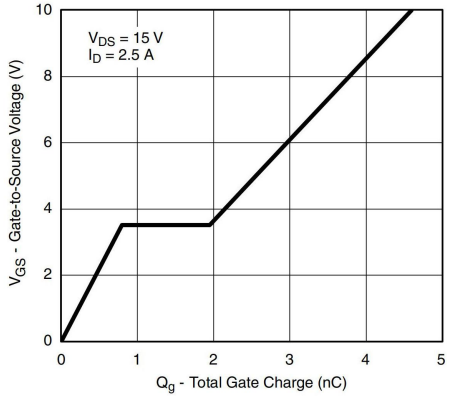
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



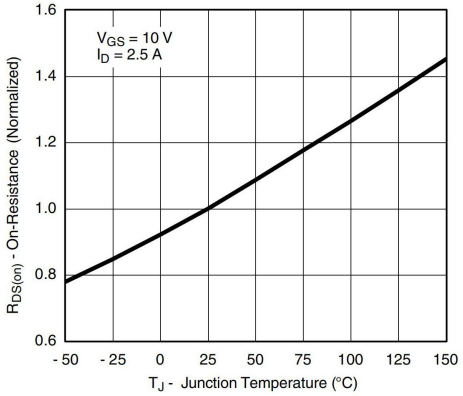

**On-Resistance vs. Drain Current**



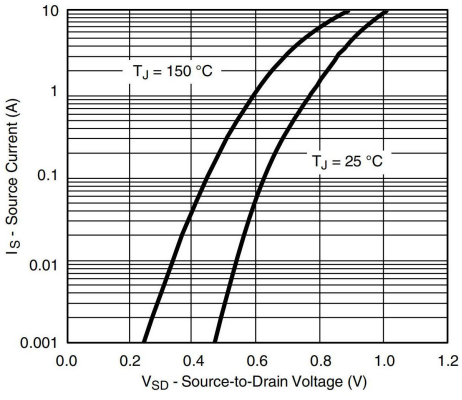

**Capacitance**



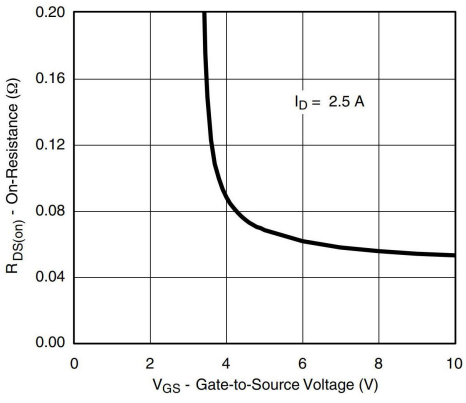

**Gate Charge**




**On-Resistance vs. Junction Temperature**



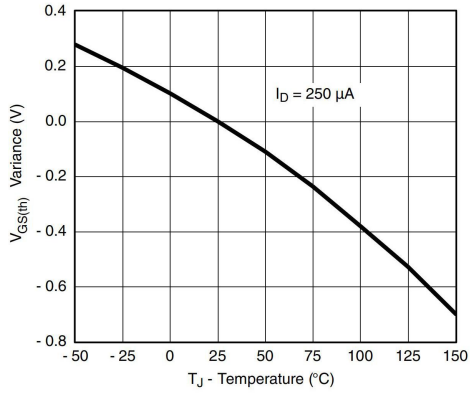

**Source-Drain Diode Forward Voltage**



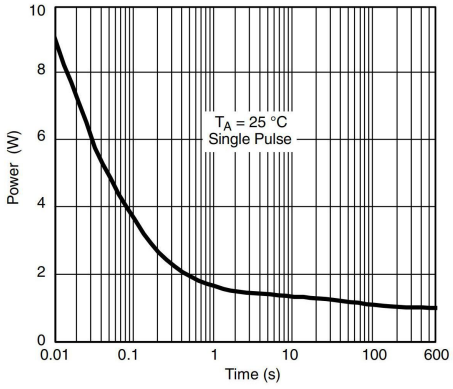

**On-Resistance vs. Gate-to-Source Voltage**

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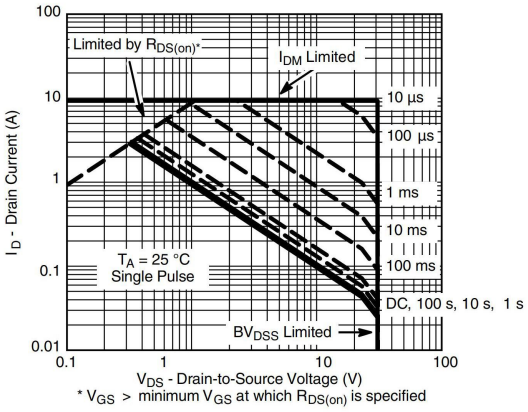
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



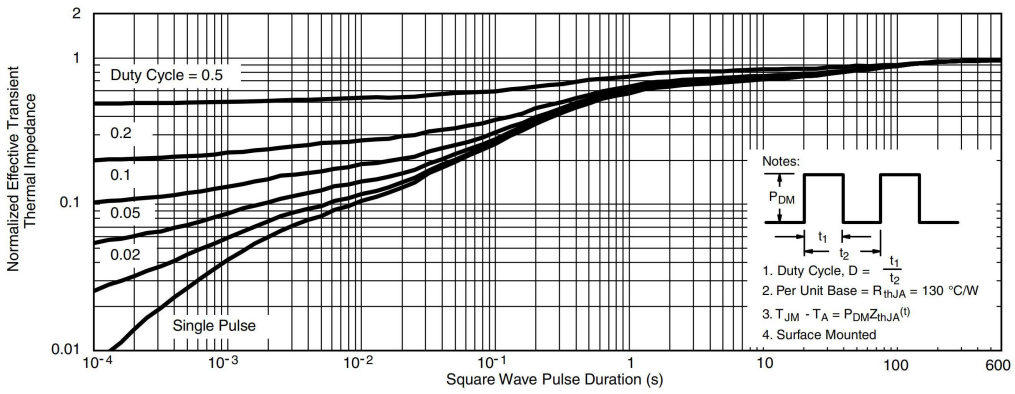

**Threshold Voltage**




**Single Pulse Power**




**Safe Operating Area**

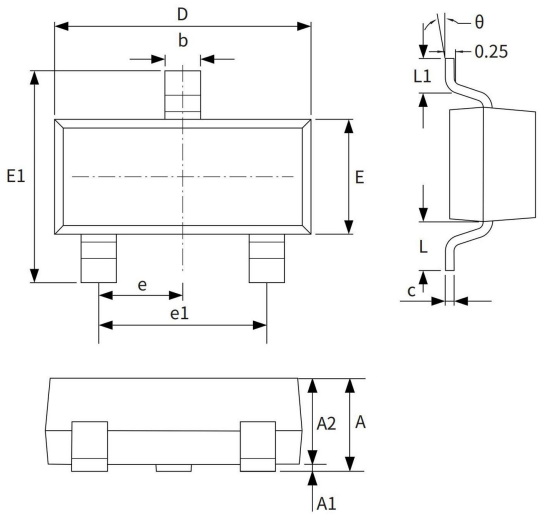


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## Ordering Information

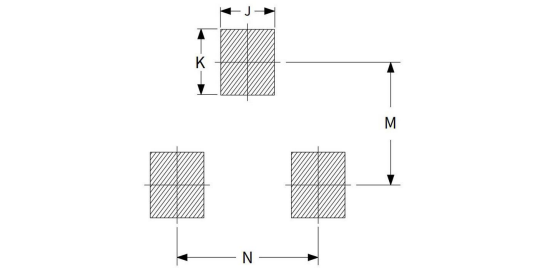
| PACKAGE | PACKAGE CODE | UNIT WEIGHT(g) | REEL(pcs) | BOX(pcs) | CARTON(pcs) | DELIVERY MODE |
|---|---|---|---|---|---|---|
| SOT-23 | R1 | 0.008 | 3000 | 30000 | 240000 | 7'' |

## Package Outline Dimensions (SOT-23)




| Symbol | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 0.90 | 1.15 | 0.035 | 0.045 |
| A1 | - | 0.10 | - | 0.004 |
| A2 | 0.90 | 1.05 | 0.035 | 0.041 |
| b | 0.30 | 0.50 | 0.012 | 0.020 |
| c | 0.10 | 0.20 | 0.004 | 0.008 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 1.20 | 1.40 | 0.047 | 0.055 |
| E1 | 2.25 | 2.55 | 0.089 | 0.100 |
| e | 0.950TYP | | 0.037TYP | |
| e1 | 1.80 | 2.00 | 0.071 | 0.079 |
| L | 0.550REF | | 0.022REF | |
| L1 | 0.30 | 0.50 | 0.012 | 0.020 |
| θ | - | 8° | - | 8° |

## Suggested Pad Layout




| Symbol | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| J | 0.75 | 0.85 | 0.030 | 0.033 |
| K | 0.85 | 0.95 | 0.033 | 0.037 |
| M | 1.95 | 2.05 | 0.077 | 0.081 |
| N | 1.85 | 1.95 | 0.073 | 0.077 |