

## BSO052N03S-VB Datasheet

# N-Channel 30-V (D-S) MOSFET

| PRODUCT SUMMARY     |                                  |                                 |                       |  |  |  |
|---------------------|----------------------------------|---------------------------------|-----------------------|--|--|--|
| V <sub>DS</sub> (V) | $R_{DS(on)}(\Omega)$             | I <sub>D</sub> (A) <sup>a</sup> | Q <sub>g</sub> (Typ.) |  |  |  |
| 30                  | 0.008 at V <sub>GS</sub> = 10 V  | 13                              | 6.1 nC                |  |  |  |
|                     | 0.011 at V <sub>GS</sub> = 4.5 V | 11                              | 0.1110                |  |  |  |

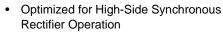
**SO-8** 

Top View

D D

#### **FEATURES**

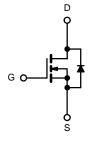
- · Halogen-free
- TrenchFET® Power MOSFET



- 100 % R<sub>g</sub> Tested
- 100 % UIS Tested

#### **APPLICATIONS**

- Notebook CPU Core
  - High-Side Switch



N-Channel MOSFET

| <b>ABSOLUTE MAXIMUM RATINGS</b>                     | <b>S</b> T <sub>A</sub> = 25 °C, unles | s otherwise note | ed                  |      |  |
|---|--|------------------|---------------------|------|--|
| Parameter   |  | Symbol           | Limit               | Unit |  |
| Drain-Source Voltage                                | V <sub>DS</sub>                        | 30               | V                   |      |  |
| Gate-Source Voltage                                 |  | $V_{GS}$         | ± 20                | ¬    |  |
|   | T <sub>C</sub> = 25 °C                 |                  | 13                  |      |  |
| Continuous Drain Current (T <sub>.1</sub> = 150 °C) | T <sub>C</sub> = 70 °C                 |                  | 10                  |      |  |
| Continuous Diairi Current (1) = 150 °C)             | T <sub>A</sub> = 25 °C                 | I <sub>D</sub>   | 9 <sup>b, c</sup>   |      |  |
|   | T <sub>A</sub> = 70 °C                 |                  | 7 <sup>b, c</sup>   | _    |  |
| Pulsed Drain Current                                | I <sub>DM</sub>                        | 45               | A                   |      |  |
| Continuous Course Desir Diede Current               | T <sub>C</sub> = 25 °C                 |                  | 3.7                 |      |  |
| Continuous Source-Drain Diode Current               | T <sub>A</sub> = 25 °C                 | I <sub>S</sub>   | 2.0 <sup>b, c</sup> |      |  |
| Single Pulse Avalanche Current                      | L = 0.1 mH                             | I <sub>AS</sub>  | 20                  |      |  |
| Avalanche Energy                                    | L = 0.1 MH                             | E <sub>AS</sub>  | 21                  | mJ   |  |
|   | T <sub>C</sub> = 25 °C                 |                  | 4.1                 |      |  |
| Maximum Davier Disable stice                        | T <sub>C</sub> = 70 °C                 | ь                | 2.5                 | \^/  |  |
| Maximum Power Dissipation                           | T <sub>A</sub> = 25 °C                 | P <sub>D</sub>   | 2,2 <sup>b, c</sup> | W    |  |
|   | T <sub>A</sub> = 70 °C                 |                  | 1.3 <sup>b, c</sup> |      |  |
| Operating Junction and Storage Temperature Ra       | T <sub>J</sub> , T <sub>stg</sub>      | - 55 to 150      | °C                  |      |  |

| THERMAL RESISTANCE RATINGS                  |              |            |         |         |      |  |
|---|--------------|------------|---------|---------|------|--|
| Parameter                                   |              | Symbol     | Typical | Maximum | Unit |  |
| Maximum Junction-to-Ambient <sup>b, d</sup> | t ≤ 10 s     | $R_{thJA}$ | 39      | 55      | °C/W |  |
| Maximum Junction-to-Foot (Drain)            | Steady State | $R_{thJF}$ | 25      | 29      | C/VV |  |

#### Notes:

- a. Base on  $T_C = 25$  °C.
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 10 s.
- d. Maximum under Steady State conditions is 85 °C/W.



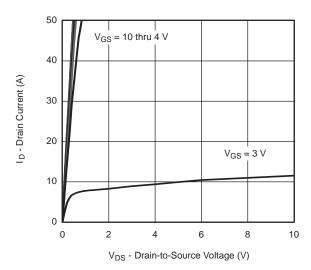
| Parameter                                     | Symbol                    | Test Conditions   | Min. | Тур.  | Max.     | Unit  |  |
|---|---------------------------|---|------|-------|----------|-------|--|
| Static  |                           |   |      |       |          |       |  |
| Drain-Source Breakdown Voltage                | V <sub>DS</sub>           | $V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$                         | 30   |       |          | V     |  |
| V <sub>DS</sub> Temperature Coefficient       | $\Delta V_{DS}/T_{J}$     | J 250A  |      | 26    |          | mV/°C |  |
| V <sub>GS(th)</sub> Temperature Coefficient   | $\Delta V_{GS(th)}/T_{J}$ | I <sub>D</sub> = 250 μA   |      | - 6   |          |       |  |
| Gate-Source Threshold Voltage                 | V <sub>GS(th)</sub>       | $V_{DS} = V_{GS}, I_{D} = 250 \mu A$                                  | 1.0  |       | 3.0      | V     |  |
| Gate-Source Leakage                           | I <sub>GSS</sub>          | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$                     |      |       | ± 100    | nA    |  |
| Zana Oata Valla na Busin Oanna d              |                           | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$                         |      |       | 1        | μΑ    |  |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>          | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 \text{ °C}$  |      |       | 10       |       |  |
| On-State Drain Current <sup>a</sup>           | I <sub>D(on)</sub>        | $V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$                       | 20   |       |          | Α     |  |
|   |                           | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A                         |      | 0.008 |          | _     |  |
| Drain-Source On-State Resistance <sup>a</sup> | R <sub>DS(on)</sub>       | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9 A                         |      | 0.011 |          | Ω     |  |
| Forward Transconductance <sup>a</sup>         | 9 <sub>fs</sub>           | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 10 A                         |      | 50    |          | S     |  |
| Dynamic <sup>b</sup>                          | <u> </u>                  |   |      |       |          |       |  |
| Input Capacitance                             | C <sub>iss</sub>          |   |      | 800   |          | pF    |  |
| Output Capacitance                            | C <sub>oss</sub>          | $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$      |      | 165   |          |       |  |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>          |   |      | 73    |          |       |  |
| T. 10 . 0                                     | Qg                        | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A |      | 15    | 23       | 1     |  |
| Total Gate Charge                             |                           |   |      | 6.8   | 10.2     | nC    |  |
| Gate-Source Charge                            | $Q_{gs}$                  | $V_{DS} = 15 \text{ V}, V_{GS} = 5 \text{ V}, I_{D} = 10 \text{ A}$   |      | 2.5   |          |       |  |
| Gate-Drain Charge                             | $Q_{gd}$                  |   |      | 2.3   |          |       |  |
| Gate Resistance                               | $R_g$                     | f = 1 MHz   | 0.36 | 1.8   | 3.6      | Ω     |  |
| Turn-On Delay Time                            | t <sub>d(on)</sub>        |   |      | 16    | 23       |       |  |
| Rise Time                                     | t <sub>r</sub>            | $V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$                                 |      | 12    | 16       | 1     |  |
| Turn-Off Delay Time                           | t <sub>d(off)</sub>       | $I_D \cong 9 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$      |      | 16    | 22       | 1     |  |
| Fall Time                                     | t <sub>f</sub>            |   |      | 10    | 18       | 1     |  |
| Turn-On Delay Time                            | t <sub>d(on)</sub>        |   |      | 8     | 16       | ns    |  |
| Rise Time                                     | t <sub>r</sub>            | $V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$                                 |      | 10    | 20       |       |  |
| Turn-Off Delay Time                           | t <sub>d(off)</sub>       | $I_D \cong 9 \text{ A}, \ V_{GEN} = 10 \text{ V}, \ R_g = 1 \ \Omega$ |      | 16    | 22       |       |  |
| Fall Time                                     | t <sub>f</sub>            |   |      | 8     | 15       |       |  |
| <b>Drain-Source Body Diode Characterist</b>   | ics                       |   |      | 1     | <b>'</b> |       |  |
| Continuous Source-Drain Diode Current         | IS                        | T <sub>C</sub> = 25 °C  |      |       | 10       |       |  |
| Pulse Diode Forward Current <sup>a</sup>      | I <sub>SM</sub>           |   |      |       | 50       | _ A   |  |
| Body Diode Voltage                            | $V_{SD}$                  | I <sub>S</sub> = 9 A  |      | 0.8   | 1.2      | V     |  |
| Body Diode Reverse Recovery Time              | t <sub>rr</sub>           |   |      | 15    | 30       | ns    |  |
| Body Diode Reverse Recovery Charge            | Q <sub>rr</sub>           | I <sub>F</sub> = 9 A, dl/dt = 100 A/μs, T <sub>J</sub> = 25 °C        |      | 6     | 12       | nC    |  |
| Reverse Recovery Fall Time                    | t <sub>a</sub>            |   |      | 8     |          |       |  |
| Reverse Recovery Rise Time                    | t <sub>b</sub>            |   |      |       |          | ns    |  |

#### Notes:

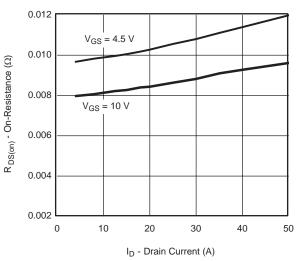
- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%.$
- b. Guaranteed by design, not subject to production testing.

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.

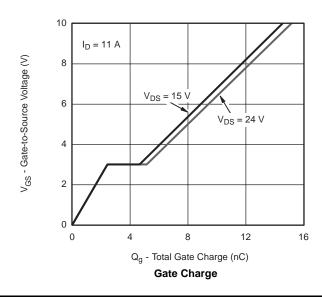




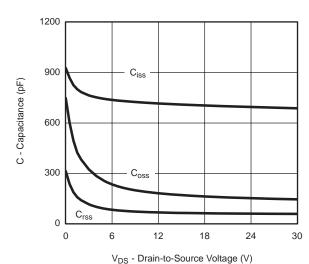




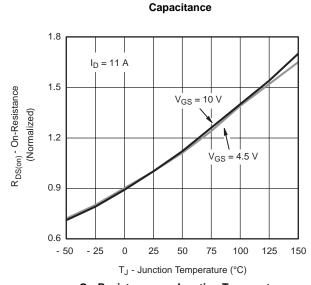
On-Resistance vs. Drain Current and Gate Voltage



V<sub>GS</sub> - Gate-to-Source Voltage (V) **Transfer Characteristics** 

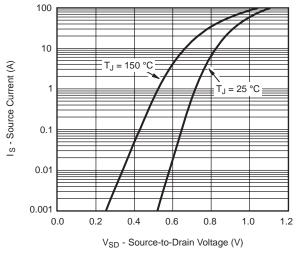


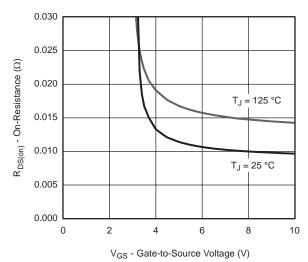
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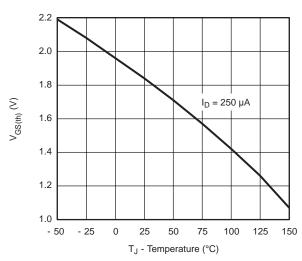
On-Resistance vs. Junction Temperature



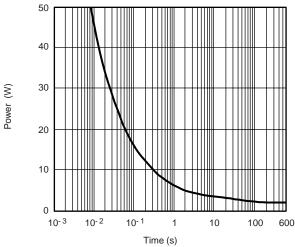




#### Source-Drain Diode Forward Voltage

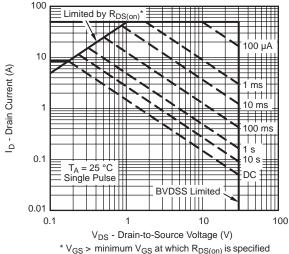


On-Resistance vs. Gate-to-Source Voltage



**Threshold Voltage** 

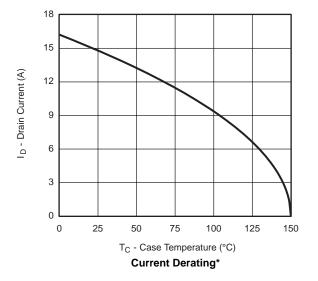
Single Pulse Power, Junction-to-Ambient

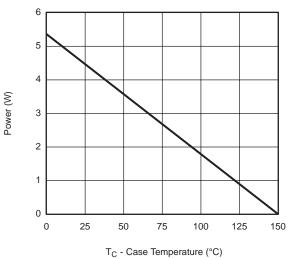


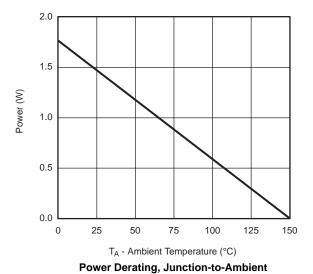
\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Ambient





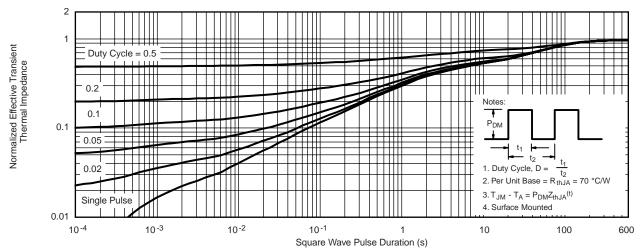




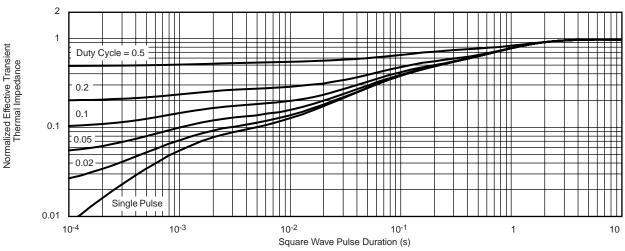
Power Derating, Junction-to-Foot

<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.





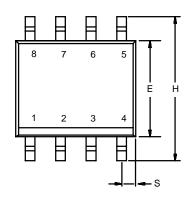
Normalized Thermal Transient Impedance, Junction-to-Ambient

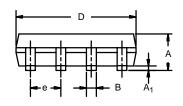


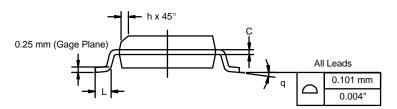
Normalized Thermal Transient Impedance, Junction-to-Foot



## SOIC (NARROW): 8-LEAD







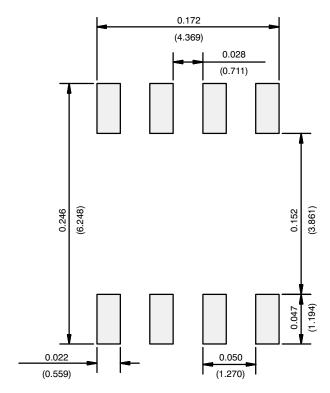
|                              | MILLIMETERS |      | INC       | HES   |  |  |
|------------------------------|-------------|------|-----------|-------|--|--|
| DIM                          | Min         | Max  | Min       | Max   |  |  |
| Α                            | 1.35        | 1.75 | 0.053     | 0.069 |  |  |
| A <sub>1</sub>               | 0.10        | 0.20 | 0.004     | 0.008 |  |  |
| В                            | 0.35        | 0.51 | 0.014     | 0.020 |  |  |
| С                            | 0.19        | 0.25 | 0.0075    | 0.010 |  |  |
| D                            | 4.80        | 5.00 | 0.189     | 0.196 |  |  |
| E                            | 3.80        | 4.00 | 0.150     | 0.157 |  |  |
| е                            | 1.27 BSC    |      | 0.050 BSC |       |  |  |
| Н                            | 5.80        | 6.20 | 0.228     | 0.244 |  |  |
| h                            | 0.25        | 0.50 | 0.010     | 0.020 |  |  |
| L                            | 0.50        | 0.93 | 0.020     | 0.037 |  |  |
| q                            | 0°          | 8°   | 0°        | 8°    |  |  |
| S                            | 0.44        | 0.64 | 0.018     | 0.026 |  |  |
| FCN: C-06527-Rev   11-Sen-06 |             |      |           |       |  |  |

ECN: C-06527-Rev. I, 11-Sep-06

DWG: 5498



#### **RECOMMENDED MINIMUM PADS FOR SO-8**



Recommended Minimum Pads Dimensions in Inches/(mm)



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