

## DMN2050L-7-VB Datasheet N-Channel 20 V (D-S) MOSFET

| PRODUCT SUMMARY     |                                  |                                 |                       |  |  |  |
|---------------------|----------------------------------|---------------------------------|-----------------------|--|--|--|
| V <sub>DS</sub> (V) | $R_{DS(on)}\left(\Omega\right)$  | I <sub>D</sub> (A) <sup>e</sup> | Q <sub>g</sub> (Typ.) |  |  |  |
|                     | 0.022 at V <sub>GS</sub> = 4.5 V | 6 <sup>a</sup>                  |                       |  |  |  |
| 20                  | 0.028 at V <sub>GS</sub> = 2.5 V | 6 <sup>a</sup>                  | 8.8 nC                |  |  |  |
|                     | 0.039 at V <sub>GS</sub> = 1.8 V | 5.6                             |                       |  |  |  |

#### **FEATURES**

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC

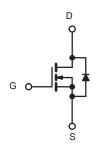


ROHS COMPLIANT HALOGEN FREE

#### **APPLICATIONS**

- DC/DC Converters
- Load Switch for Portable Applications





N-Channel MOSFET

| ABSOLUTE MAXIMUM RATIN                             | IGS 1A - 25 C,         |                                   |                      | 1114     |  |
|--|------------------------|-----------------------------------|----------------------|----------|--|
| Parameter  |                        | Symbol                            | Limit                | Unit     |  |
| Drain-Source Voltage                               |                        | $V_{DS}$                          | 20                   | V        |  |
| Gate-Source Voltage                                |                        | $V_{GS}$                          | ± 12                 | v        |  |
|  | T <sub>C</sub> = 25 °C |                                   | 6 <sup>a</sup>       |          |  |
| Continuous Drain Current (T = 150 °C)              | T <sub>C</sub> = 70 °C | I <sub>D</sub>                    | 5.1                  |          |  |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) | T <sub>A</sub> = 25 °C |                                   | 5 <sup>b, c</sup>    |          |  |
|  | T <sub>A</sub> = 70 °C |                                   | 4 <sup>b, c</sup>    | Α        |  |
| Pulsed Drain Current                               |                        | I <sub>DM</sub>                   | 20                   |          |  |
| Continuous Source-Drain Diode Current              | T <sub>C</sub> = 25 °C |                                   | 1.75                 |          |  |
| Continuous Source-Drain Diode Current              | T <sub>A</sub> = 25 °C | - I <sub>S</sub>                  | 1.04 <sup>b, c</sup> |          |  |
|  | T <sub>C</sub> = 25 °C |                                   | 2.1                  |          |  |
| Maximum Power Dissipation                          | T <sub>C</sub> = 70 °C | ] ,                               | 1.3                  | $\Box$ w |  |
| Maximum Fower Dissipation                          | T <sub>A</sub> = 25 °C | P <sub>D</sub>                    | 1.25 <sup>b, c</sup> | VV       |  |
|  | T <sub>A</sub> = 70 °C |                                   | 0.8 <sup>b, c</sup>  |          |  |
| Operating Junction and Storage Temperature Range   |                        | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150          | °C       |  |
| Soldering Recommendations (Peak Tempera            | ature)                 |                                   | 260                  |          |  |

| THERMAL RESISTANCE RATINGS                  |              |                   |         |         |      |  |  |
|---|--------------|-------------------|---------|---------|------|--|--|
| Parameter                                   |              | Symbol            | Typical | Maximum | Unit |  |  |
| Maximum Junction-to-Ambient <sup>b, d</sup> | t ≤ 5 s      | R <sub>thJA</sub> | 80      | 100     | °C/W |  |  |
| Maximum Junction-to-Foot (Drain)            | Steady State | R <sub>thJF</sub> | 40      | 60      | C/VV |  |  |

#### Notes:

- a. Package limited
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 125  $^{\circ}\text{C/W}.$
- e. Based on  $T_C$  = 25 °C.

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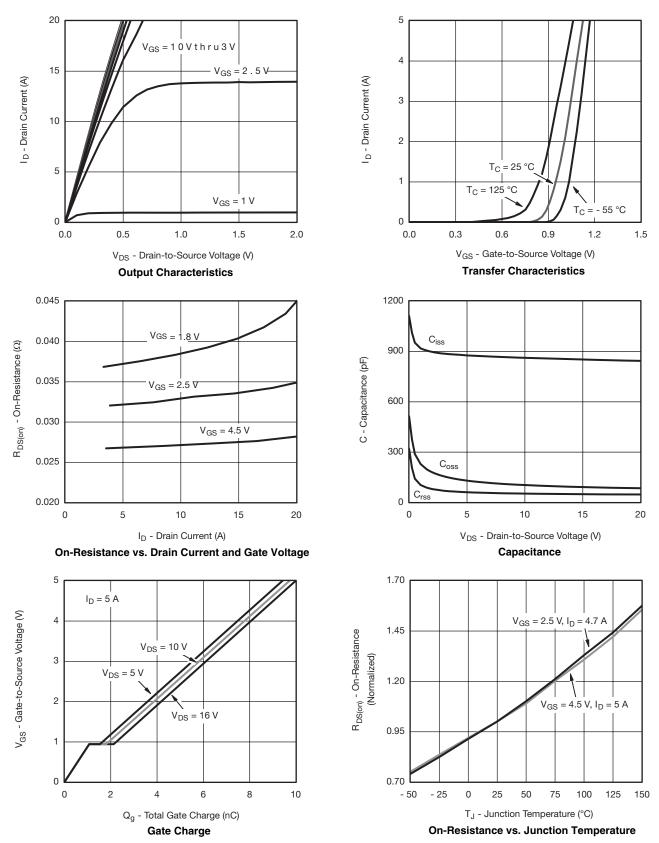
| Parameter   | Symbol                  | Test Conditions   | Min.     | Тур.  | Max.  | Unit  |
|---|-------------------------|---|----------|-------|-------|-------|
| Static  |                         |   | l .      |       |       |       |
| Drain-Source Breakdown Voltage                        | V <sub>DS</sub>         | $V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$   | 20       |       |       | V     |
| V <sub>DS</sub> Temperature Coefficient               | $\Delta V_{DS}/T_{J}$   | ΔVpe/T <sub>1</sub>   |          | 25    |       | mV/°C |
| V <sub>GS(th)</sub> Temperature Coefficient           | $\Delta V_{GS(th)}/T_J$ | I <sub>D</sub> = 250 μA   |          | - 2.6 |       | mV/°C |
| Gate-Source Threshold Voltage                         | V <sub>GS(th)</sub>     | $V_{DS} = V_{GS}$ , $I_D = 250 \mu A$   | 0.45     |       | 1.0   | V     |
| Gate-Source Leakage                                   | I <sub>GSS</sub>        | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$  |          |       | ± 100 | nA    |
|   |                         | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V   |          |       | 1     | μА    |
| Zero Gate Voltage Drain Current                       | IDSS                    | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °C                     |          |       | 10    |       |
| On-State Drain Current <sup>a</sup>                   | I <sub>D(on)</sub>      | $V_{DS} \le 5 \text{ V}, V_{GS} = 4.5 \text{ V}$  | 20       |       |       | Α     |
|   | , ,                     | $V_{GS} = 4.5 \text{ V}, I_D = 5.0 \text{ A}$   |          | 0.022 |       | Ω     |
| Drain-Source On-State Resistance <sup>a</sup>         | R <sub>DS(on)</sub>     | $V_{GS} = 2.5 \text{ V}, I_D = 4.7 \text{ A}$   |          | 0.028 |       |       |
|   |                         | $V_{GS} = 1.8 \text{ V}, I_D = 4.3 \text{ A}$   |          | 0.039 |       |       |
| Forward Transconductance <sup>a</sup> 9 <sub>fs</sub> |                         | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5.0 A  |          | 24    |       | S     |
| Dynamic <sup>b</sup>                                  |                         |   |          | L     |       |       |
| Input Capacitance                                     | C <sub>iss</sub>        |   |          | 865   |       | pF    |
| Output Capacitance                                    | C <sub>oss</sub>        | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                          |          | 105   |       |       |
| Reverse Transfer Capacitance                          | C <sub>rss</sub>        | 20  |          | 55    |       |       |
| ·   |                         | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 5.0 A                     |          | 12    | 18    |       |
| Total Gate Charge                                     | Q <sub>g</sub>          |   |          | 8.8   | 14    | nC    |
| Gate-Source Charge                                    | Q <sub>gs</sub>         | $V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 5.0 \text{ A}$                    |          | 1.1   |       |       |
| Gate-Drain Charge                                     | Q <sub>gd</sub>         | 20 00   |          | 0.7   |       |       |
| Gate Resistance                                       | R <sub>g</sub>          | f = 1 MHz   | 0.5      | 2.4   | 4.8   | Ω     |
| Turn-On Delay Time                                    | t <sub>d(on)</sub>      |   |          | 8     | 16    |       |
| Rise Time   | t <sub>r</sub>          | $V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$   |          | 17    | 26    | 1     |
| Turn-Off Delay Time                                   | t <sub>d(off)</sub>     | $I_D\cong 4$ A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 $\Omega$                                     |          | 31    | 47    | 1     |
| Fall Time   | t <sub>f</sub>          |   |          | 8     | 16    | ns    |
| Turn-On Delay Time                                    | t <sub>d(on)</sub>      |   |          | 5     | 10    | 115   |
| Rise Time   | t <sub>r</sub>          | $V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$   |          | 13    | 20    |       |
| Turn-Off Delay Time                                   | t <sub>d(off)</sub>     | $I_D\cong 4$ A, $V_{GEN}=5$ V, $R_g=1$ $\Omega$   |          | 21    | 32    |       |
| Fall Time   | t <sub>f</sub>          |   |          | 6     | 12    |       |
| <b>Drain-Source Body Diode Characteristic</b>         | s                       |   | <u> </u> | I.    |       |       |
| Continuous Source-Drain Diode Current                 | Is                      | T <sub>C</sub> = 25 °C  |          |       | 1.75  |       |
| Pulse Diode Forward Current                           | I <sub>SM</sub>         |   |          |       | 20    | A     |
| Body Diode Voltage                                    | V <sub>SD</sub>         | I <sub>S</sub> = 4 A, V <sub>GS</sub> = 0 V   |          | 0.75  | 1.2   | V     |
| Body Diode Reverse Recovery Time                      | t <sub>rr</sub>         |   |          | 12    | 20    | ns    |
| Body Diode Reverse Recovery Charge                    | Q <sub>rr</sub>         | 1 4 4 4U/4 400 A/ T 07 00   |          | 5     | 10    | nC    |
| Reverse Recovery Fall Time                            | t <sub>a</sub>          | $I_F = 4 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$ |          | 7     |       |       |
| Reverse Recovery Rise Time                            | t <sub>b</sub>          |   |          | 5     |       | ns    |

#### Notes:

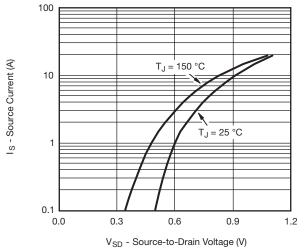
- a. Pulse test; pulse width  $\leq$  300  $\mu s,$  duty cycle  $\leq$  2 % b. Guaranteed by design, not subject to production testing.

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.

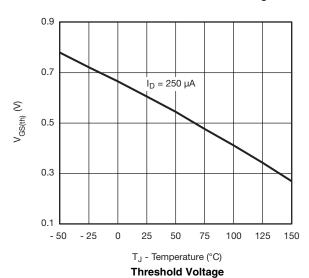








Source-Drain Diode Forward Voltage

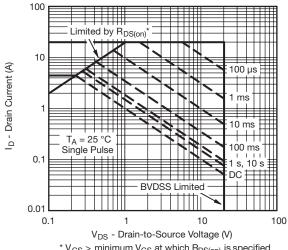


0.06  $I_D = 5 A$ R<sub>DS(on)</sub> - On-Resistance (Ω) 0.05 0.04 T<sub>J</sub> = 125 °C 0.03  $T_J = 25$  °C 0.02 0 4 6 V<sub>GS</sub> - Gate-to-Source Voltage (V)

On-Resistance vs. Gate-to-Source Voltage



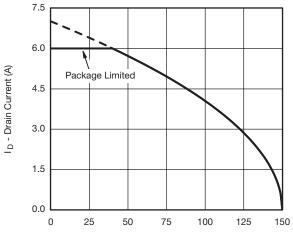
Single Pulse Power (Junction-to-Ambient)



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

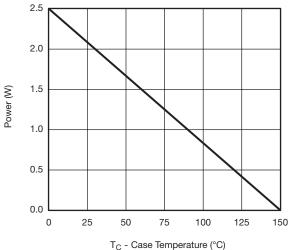
Safe Operating Area, Junction-to-Ambient





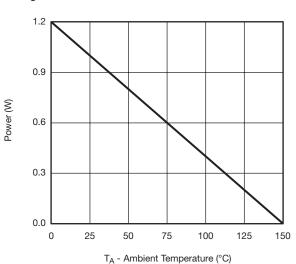
T<sub>C</sub> - Case Temperature (°C)

#### **Current Derating\***



Power Derating, Junction-to-Foot

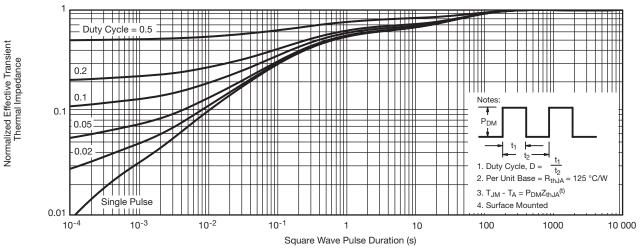




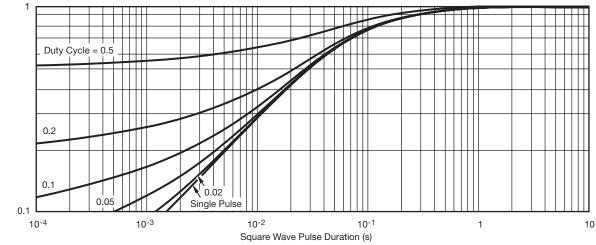
Power Derating, Junction-to-Ambient

<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.







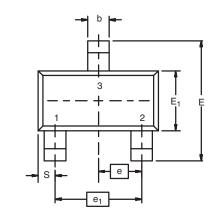


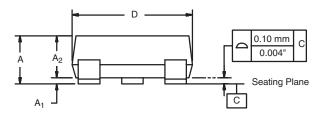
Normalized Thermal Transient Impedance, Junction-to-Foot

Normalized Effective Transient Thermal Impedance



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







| Dim                      | MILLIN   | IETERS | INCHES     |            |  |  |
|--------------------------|----------|--------|------------|------------|--|--|
|                          | Min      | Max    | Min        | Max        |  |  |
| Α                        | 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      |  |  |
| С                        | 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      |  |  |
| е                        | 0.95 BSC |        | 0.0374 Ref |            |  |  |
| e <sub>1</sub>           | 1.90 BSC |        | 0.074      | 0.0748 Ref |  |  |
| L                        | 0.40     | 0.60   | 0.016      | 0.024      |  |  |
| L <sub>1</sub>           | 0.64 Ref |        | 0.025      | i 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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