

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

| PRODUCT SUMMARY     |                                  |                                    |                       |
|---------------------|----------------------------------|------------------------------------|-----------------------|
| V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)          | I <sub>D</sub> (A) <sup>a, e</sup> | Q <sub>g</sub> (Typ.) |
| 20                  | 0.044 at V <sub>GS</sub> = 4.5 V | 4.5                                | 6.8 nC                |
|                     | 0.050 at V <sub>GS</sub> = 2.5 V | 4.2                                |                       |
|                     | 0.056 at V <sub>GS</sub> = 1.8 V | 4.0                                |                       |
|                     | 0.070 at V <sub>GS</sub> = 1.5 V | 1.5                                |                       |

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- Compliant to RoHS Directive 2002/95/EC

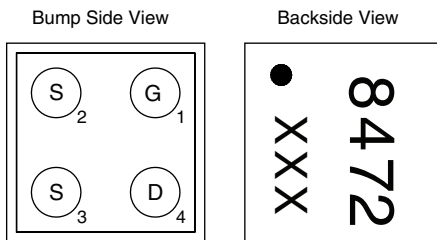


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

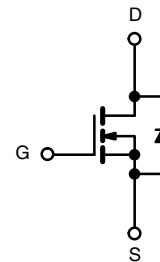
### APPLICATIONS

- Baseband Switch
- DC/DC Conversion
  - Boost Converters
- Smart Phones, Portable Media Players

### MICRO FOOT



**Device Marking:** 8472  
xxx = Date/Lot Traceability Code



N-Channel MOSFET

**Ordering Information:** Si8472DB-T2-E1 (Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted) |                                   |                        |                   |   |
|---|-----------------------------------|------------------------|-------------------|---|
| Parameter   | Symbol                            | Limit                  | Unit              |   |
| Drain-Source Voltage  | V <sub>DS</sub>                   | 20                     | V                 |   |
| Gate-Source Voltage   | V <sub>GS</sub>                   | ± 8                    |                   |   |
| Continuous Drain Current (T <sub>J</sub> = 150 °C)                        | I <sub>D</sub>                    | T <sub>A</sub> = 25 °C | 4.5 <sup>a</sup>  | A |
|   |                                   | T <sub>A</sub> = 70 °C | 3.6 <sup>a</sup>  |   |
|   |                                   | T <sub>A</sub> = 25 °C | 3.3 <sup>b</sup>  |   |
|   |                                   | T <sub>A</sub> = 70 °C | 2.6 <sup>b</sup>  |   |
| Pulsed Drain Current (t = 300 μs)   | I <sub>DM</sub>                   | 20                     |                   |   |
| Continuous Source-Drain Diode Current                                     | I <sub>S</sub>                    | T <sub>C</sub> = 25 °C | 1.5 <sup>a</sup>  |   |
|   |                                   | T <sub>A</sub> = 25 °C | 0.65 <sup>b</sup> |   |
| Maximum Power Dissipation   | P <sub>D</sub>                    | T <sub>A</sub> = 25 °C | 1.8 <sup>a</sup>  | W |
|   |                                   | T <sub>A</sub> = 70 °C | 1.1 <sup>a</sup>  |   |
|   |                                   | T <sub>A</sub> = 25 °C | 0.78 <sup>b</sup> |   |
|   |                                   | T <sub>A</sub> = 70 °C | 0.5 <sup>b</sup>  |   |
| Operating Junction and Storage Temperature Range                          | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150            |                   |   |
| Package Reflow Conditions <sup>c</sup>                                    | VPR                               | 260                    | °C                |   |
|   | IR/Convection                     | 260                    |                   |   |

**Notes:**

- Surface mounted on 1" x 1" FR4 board with full copper, t = 10 s.
- Surface mounted on 1" x 1" FR4 board with minimum copper, t = 10 s.
- Refer to IPC/JEDEC (J-STD-020C), no manual or hand soldering.
- In this document, any reference to case represents the body of the MICRO FOOT device and foot is the bump.
- Based on T<sub>A</sub> = 25 °C.

**THERMAL RESISTANCE RATINGS**

| Parameter                                   |                    | Symbol     | Typical | Maximum | Unit |
|---|--------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a, b</sup> | $t = 10 \text{ s}$ | $R_{thJA}$ | 55      | 70      | °C/W |
| Maximum Junction-to-Ambient <sup>c, d</sup> | $t = 10 \text{ s}$ |            | 125     | 160     |      |

## Notes:

- a. Surface mounted on 1" x 1" FR4 board with full copper.  
b. Maximum under steady state conditions is 100 °C/W.  
c. Surface mounted on 1" x 1" FR4 board with minimum copper.  
d. Maximum under steady state conditions is 190 °C/W.

**SPECIFICATIONS** ( $T_J = 25 \text{ °C}$ , unless otherwise noted)

| Parameter                                     | Symbol                  | Test Conditions   | Min. | Typ.  | Max.      | Unit          |
|---|-------------------------|---|------|-------|-----------|---------------|
| <b>Static</b>                                 |                         |   |      |       |           |               |
| Drain-Source Breakdown Voltage                | $V_{DS}$                | $V_{GS} = 0 \text{ V}, I_D = 250 \text{ } \mu\text{A}$  | 20   |       |           | V             |
| $V_{DS}$ Temperature Coefficient              | $\Delta V_{DS}/T_J$     | $I_D = 250 \text{ } \mu\text{A}$  |      | 16    |           | mV/°C         |
| $V_{GS(th)}$ Temperature Coefficient          | $\Delta V_{GS(th)}/T_J$ |   | -2.6 |       |           |               |
| Gate-Source Threshold Voltage                 | $V_{GS(th)}$            | $V_{DS} = V_{GS}, I_D = 250 \text{ } \mu\text{A}$   | 0.4  |       | 0.9       | V             |
| Gate-Source 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         | $\mu\text{A}$ |
|   |                         | $V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 70 \text{ °C}$  |      |       | 10        |               |
| On-State Drain Current <sup>a</sup>           | $I_{D(on)}$             | $V_{DS} \leq -5 \text{ V}, V_{GS} = 4.5 \text{ V}$  | 10   |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup> | $R_{DS(on)}$            | $V_{GS} = 4.5 \text{ V}, I_D = 1.5 \text{ A}$   |      | 0.036 | 0.044     | $\Omega$      |
|   |                         | $V_{GS} = 2.5 \text{ V}, I_D = 1 \text{ A}$   |      | 0.041 | 0.050     |               |
|   |                         | $V_{GS} = 1.8 \text{ V}, I_D = 1 \text{ A}$   |      | 0.046 | 0.056     |               |
|   |                         | $V_{GS} = 1.5 \text{ V}, I_D = 0.5 \text{ A}$   |      | 0.050 | 0.070     |               |
| Forward Transconductance <sup>a</sup>         | $g_{fs}$                | $V_{DS} = 10 \text{ V}, I_D = 1.5 \text{ A}$  |      | 16    |           | S             |
| <b>Dynamic<sup>b</sup></b>                    |                         |   |      |       |           |               |
| Input Capacitance                             | $C_{iss}$               | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$  |      | 630   |           | pF            |
| Output Capacitance                            | $C_{oss}$               |   | 105  |       |           |               |
| Reverse Transfer Capacitance                  | $C_{rss}$               |   | 42   |       |           |               |
| Total Gate Charge                             | $Q_g$                   | $V_{DS} = 10 \text{ V}, V_{GS} = 8 \text{ V}, I_D = 1.5 \text{ A}$  |      | 12    | 18        | nC            |
|   |                         | $V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 1.5 \text{ A}$  |      | 6.8   | 11        |               |
| $Q_{gs}$                                      | 0.8                     |   |      |       |           |               |
| $Q_{gd}$                                      | 1.1                     |   |      |       |           |               |
| Gate Resistance                               | $R_g$                   | $V_{GS} = 0.1 \text{ V}, f = 1 \text{ MHz}$   |      | 5.3   |           | $\Omega$      |
| Turn-On Delay Time                            | $t_{d(on)}$             | $V_{DD} = -10 \text{ V}, R_L = 6.7 \text{ } \Omega$<br>$I_D \cong 1.5 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \text{ } \Omega$ |      | 7     | 15        | ns            |
| Rise Time                                     | $t_r$                   |   | 15   | 30    |           |               |
| Turn-Off Delay Time                           | $t_{d(off)}$            |   | 30   | 60    |           |               |
| Fall Time                                     | $t_f$                   |   | 10   | 20    |           |               |
| Turn-On Delay Time                            | $t_{d(on)}$             | $V_{DD} = -10 \text{ V}, R_L = 6.7 \text{ } \Omega$<br>$I_D \cong -1.5 \text{ A}, V_{GEN} = -8 \text{ V}, R_g = 1 \text{ } \Omega$  |      | 5     | 10        |               |
| Rise Time                                     | $t_r$                   |   | 15   | 30    |           |               |
| Turn-Off Delay Time                           | $t_{d(off)}$            |   | 30   | 60    |           |               |
| Fall Time                                     | $t_f$                   |   | 10   | 20    |           |               |



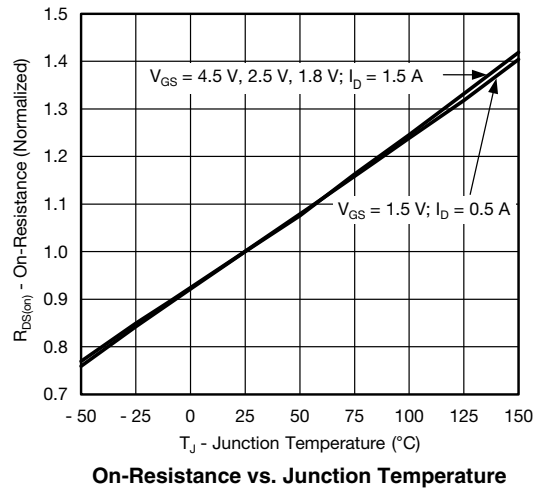
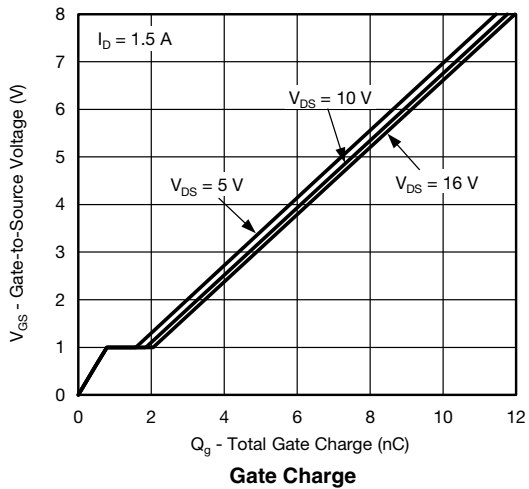
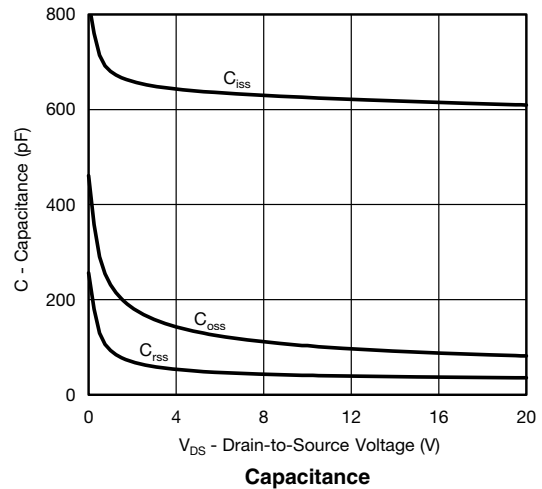
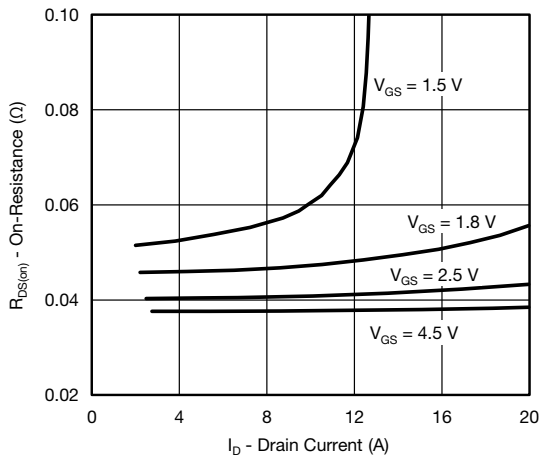
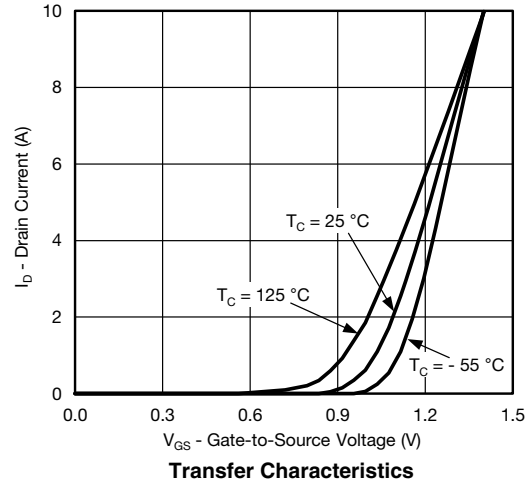
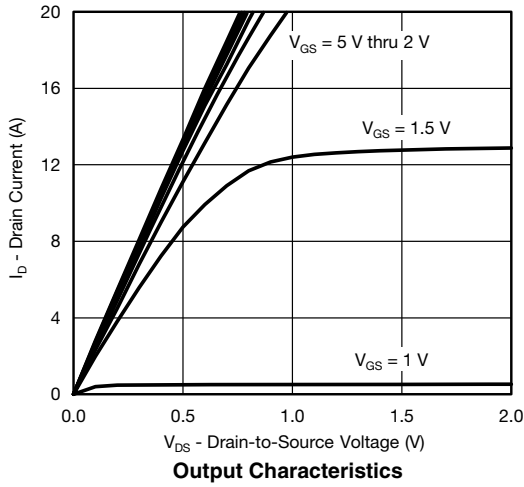
| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |          |  |      |      |      |      |
|---|----------|--|------|------|------|------|
| Parameter   | Symbol   | Test Conditions  | Min. | Typ. | Max. | Unit |
| <b>Drain-Source Body Diode Characteristics</b>                              |          |  |      |      |      |      |
| Continuous Source-Drain Diode Current                                       | $I_S$    | $T_A = 25\text{ }^\circ\text{C}$   |      |      | 1.5  | A    |
| Pulse Diode Forward Current   | $I_{SM}$ |  |      |      | 20   |      |
| Body Diode Voltage  | $V_{SD}$ | $I_S = 1.5\text{ A}, V_{GS} = 0$   |      | 0.7  | 1.2  | V    |
| Body Diode Reverse Recovery Time  | $t_{rr}$ | $I_F = 1.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ |      | 15   | 30   | ns   |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$ |  |      | 6    | 15   | nC   |
| Reverse Recovery Fall Time  | $t_a$    |  |      | 7    |      | ns   |
| Reverse Recovery Rise Time  | $t_b$    |  |      | 8    |      |      |

Notes:

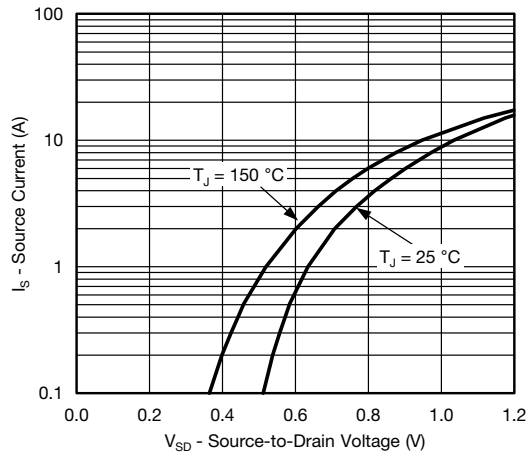
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

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.

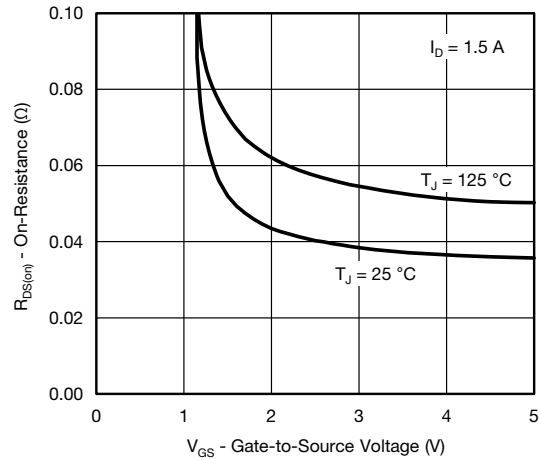
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



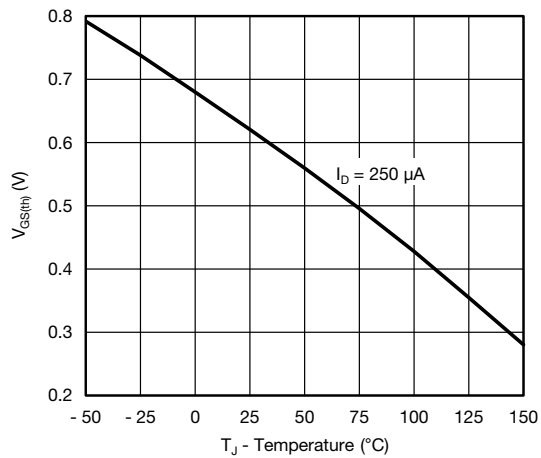
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



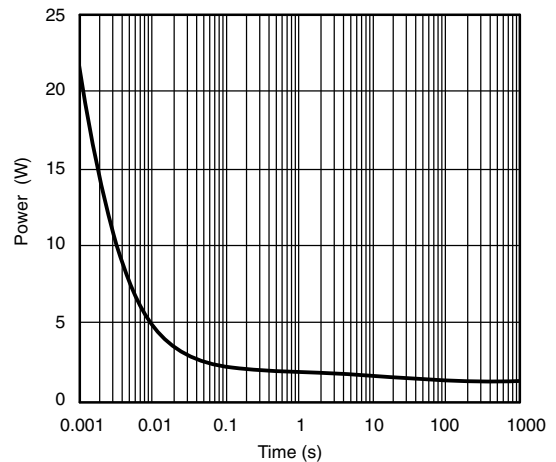
**Source-Drain Diode Forward Voltage**



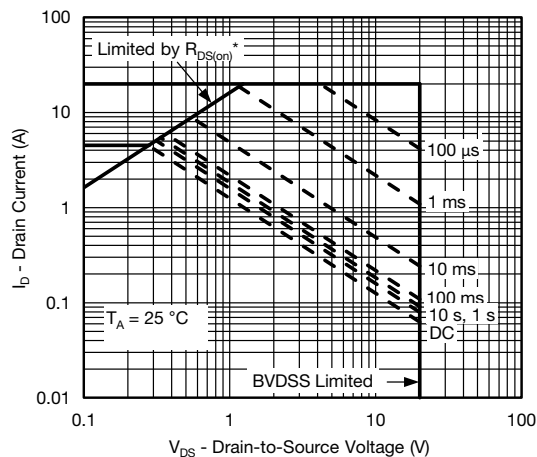
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

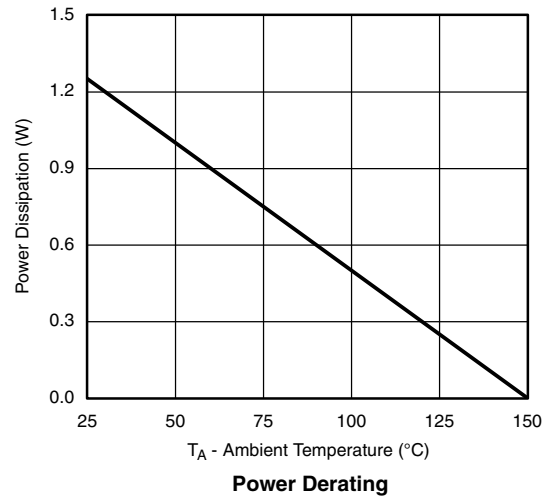
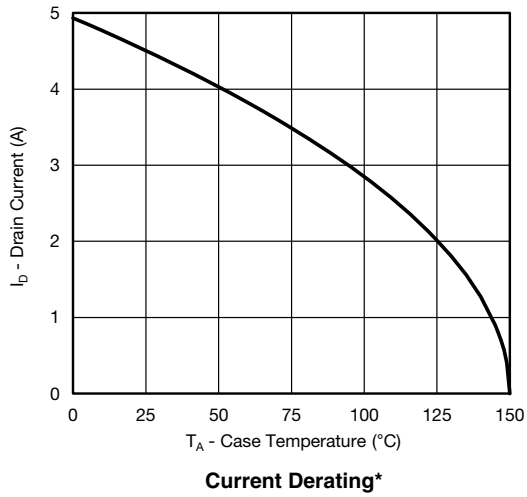


**Single Pulse Power, Junction-to-Ambient**



**Safe Operating Area, Junction-to-Ambient**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

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

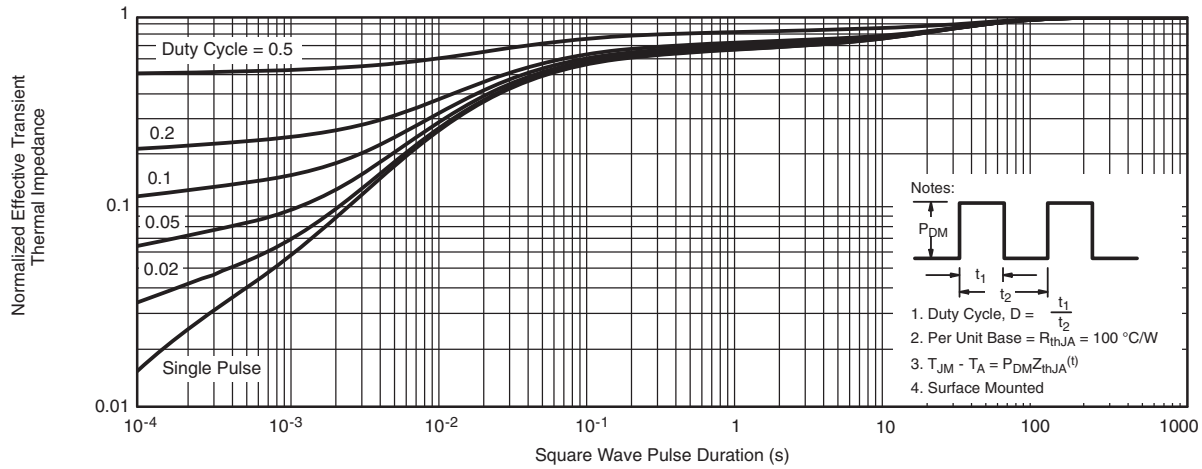


Note:

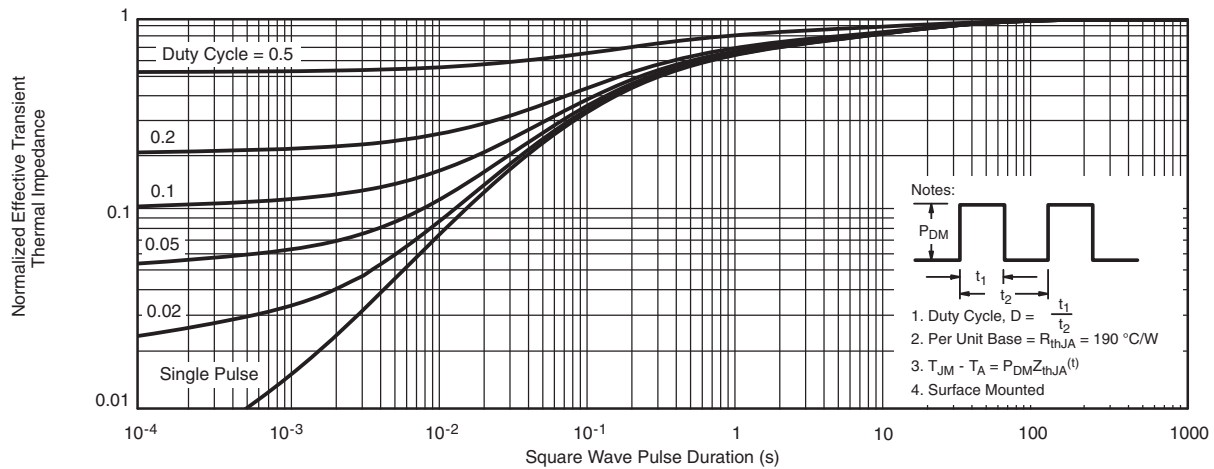
When Mounted on 1" x 1" FR4 with Full Copper.

\* 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.

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



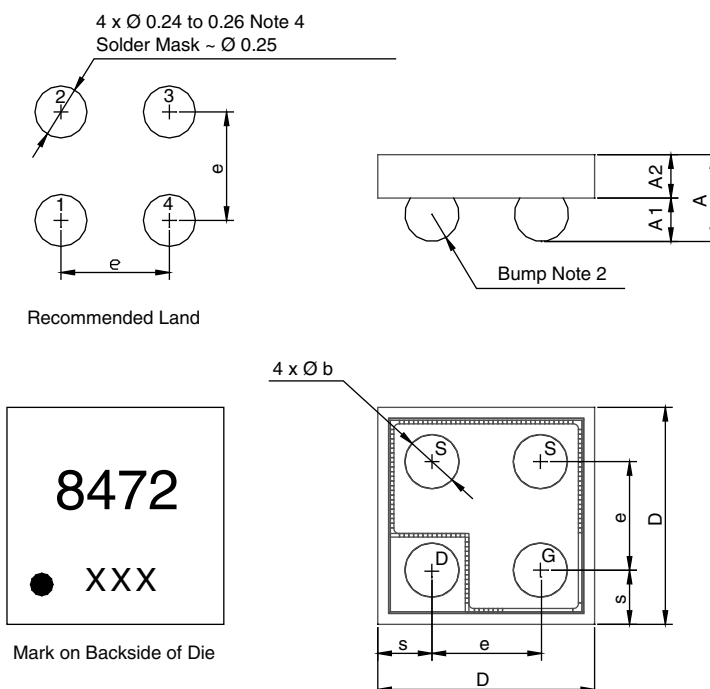
**Normalized Thermal Transient Impedance, Junction-to-Ambient (1" x 1" FR4 Board with Full Copper)**



**Normalized Thermal Transient Impedance, Junction-to-Ambient (1" x 1" FR4 Board with Minimum Copper)**

## PACKAGE OUTLINE

### MICRO FOOT 1 mm x 1 mm: 4-BUMP (2 x 2, 0.5 mm PITCH)



Notes (Unless otherwise specified):

1. All dimensions are in millimeters.
2. Four (4) solder bumps are lead (Pb)-free 95.5Sn/3.8Ag/0.7Cu with diameter  $\varnothing$  0.30 mm to 0.32 mm.
3. Backside surface is coated with a Ti/Ni/Ag layer.
4. Non-solder mask defined copper landing pad.
5. • is location of pin 1.

| Dim.           | Millimeters <sup>a</sup> |       |       | Inches |        |        |
|----------------|--------------------------|-------|-------|--------|--------|--------|
|                | Min.                     | Nom.  | Max.  | Min.   | Nom.   | Max.   |
| A              | 0.462                    | 0.505 | 0.548 | 0.0181 | 0.0198 | 0.0215 |
| A <sub>1</sub> | 0.220                    | 0.250 | 0.280 | 0.0086 | 0.0098 | 0.0110 |
| A <sub>2</sub> | 0.242                    | 0.255 | 0.268 | 0.0095 | 0.0100 | 0.0105 |
| b              | 0.300                    | 0.310 | 0.320 | 0.0118 | 0.0122 | 0.0126 |
| e              | 0.500                    |       |       | 0.0197 |        |        |
| s              | 0.230                    | 0.250 | 0.270 | 0.0090 | 0.0098 | 0.0106 |
| D              | 0.920                    | 0.960 | 1.000 | 0.0362 | 0.0378 | 0.0394 |

Notes:

- a. Use millimeters as the primary measurement.

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