

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

### PRODUCT SUMMARY

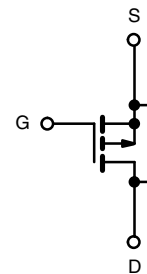
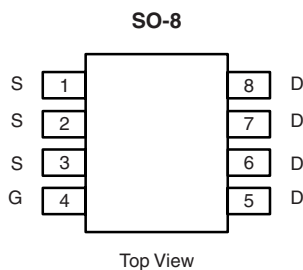
| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) |
|--------------|-----------------------------|-----------|
| - 20         | 0.040 at $V_{GS} = - 4.5$ V | - 6.2     |
|              | 0.060 at $V_{GS} = - 2.7$ V | - 5.0     |

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Compliant to RoHS Directive 2002/95/EC



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



P-Channel MOSFET

**Ordering Information:** Si9433BDY-T1-E3 (Lead (Pb)-free)  
Si9433BDY-T1-GE3 (Lead (Pb)-free and Halogen-free)

### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

| ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted |                        |                                   |             |              |      |
|-------------------------------------------------------------------------|------------------------|-----------------------------------|-------------|--------------|------|
| Parameter                                                               |                        | Symbol                            | 10 s        | Steady State | Unit |
| Drain-Source Voltage                                                    |                        | V <sub>DS</sub>                   | - 20        |              | V    |
| Gate-Source Voltage                                                     |                        | V <sub>GS</sub>                   | ± 12        |              |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>         | T <sub>A</sub> = 25 °C | I <sub>D</sub>                    | - 6.2       | - 4.5        | A    |
|                                                                         | T <sub>A</sub> = 70 °C |                                   | - 5.0       | - 3.5        |      |
| Pulsed Drain Current                                                    |                        | I <sub>DM</sub>                   | - 20        |              |      |
| Continuous Source Current (Diode Conduction) <sup>a</sup>               |                        | I <sub>S</sub>                    | - 2.3       | - 1.2        |      |
| Maximum Power Dissipation <sup>a</sup>                                  | T <sub>A</sub> = 25 °C | P <sub>D</sub>                    | 2.5         | 1.3          | W    |
|                                                                         | T <sub>A</sub> = 70 °C |                                   | 1.6         | 0.8          |      |
| Operating Junction and Storage Temperature Range                        |                        | 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>a</sup> | $R_{thJA}$ | 45      | 50      | °C/W |
|                                          |            | 80      | 95      |      |
| Maximum Junction-to-Foot (Drain)         | $R_{thJF}$ | 20      | 24      |      |

Notes:

a. Surface Mounted on FR4 board,  $t \leq 10$  s.

| <b>SPECIFICATIONS</b> $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted |              |                                                                                                                                    |      |                   |           |               |
|-----------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------|------|-------------------|-----------|---------------|
| Parameter                                                                         | Symbol       | Test Conditions                                                                                                                    | Min. | Typ. <sup>a</sup> | Max.      | Unit          |
| <b>Static</b>                                                                     |              |                                                                                                                                    |      |                   |           |               |
| Gate Threshold Voltage                                                            | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                | -0.6 |                   | -1.5      | V             |
| Gate-Body Leakage                                                                 | $I_{GSS}$    | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 12\text{ V}$                                                                                 |      |                   | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                   | $I_{DSS}$    | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                    |      |                   | -1        | $\mu\text{A}$ |
|                                                                                   |              | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 70\text{ }^{\circ}\text{C}$                                               |      |                   | -10       |               |
| On-State Drain Current <sup>b</sup>                                               | $I_{D(on)}$  | $V_{DS} \leq -5\text{ V}$ , $V_{GS} = -4.5\text{ V}$                                                                               | -20  |                   |           | A             |
|                                                                                   |              | $V_{DS} \leq -5\text{ V}$ , $V_{GS} = -2.7\text{ V}$                                                                               | -5   |                   |           |               |
| Drain-Source On-State Resistance <sup>b</sup>                                     | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}$ , $I_D = -6.2\text{ A}$                                                                                   |      | 0.030             | 0.040     | $\Omega$      |
|                                                                                   |              | $V_{GS} = -2.7\text{ V}$ , $I_D = -5.0\text{ A}$                                                                                   |      | 0.050             | 0.060     |               |
| Forward Transconductance <sup>b</sup>                                             | $g_{fs}$     | $V_{DS} = -9\text{ V}$ , $I_D = -6.2\text{ A}$                                                                                     |      | 15                |           | S             |
| Diode Forward Voltage <sup>b</sup>                                                | $V_{SD}$     | $I_S = -2.6\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                      |      | -0.76             | -1.1      | V             |
| <b>Dynamic<sup>a</sup></b>                                                        |              |                                                                                                                                    |      |                   |           |               |
| Total Gate Charge                                                                 | $Q_g$        | $V_{DS} = -6\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -6.2\text{ A}$                                                          |      | 8.8               | 14        | nC            |
| Gate-Source Charge                                                                | $Q_{gs}$     |                                                                                                                                    |      | 1.8               |           |               |
| Gate-Drain Charge                                                                 | $Q_{gd}$     |                                                                                                                                    |      | 2.4               |           |               |
| Gate Resistance                                                                   | $R_g$        |                                                                                                                                    |      | 8.5               |           | $\Omega$      |
| Turn-On Delay Time                                                                | $t_{d(on)}$  | $V_{DD} = -6\text{ V}$ , $R_L = 6\text{ }\Omega$<br>$I_D \equiv -1\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 6\text{ }\Omega$ |      | 40                | 60        | ns            |
| Rise Time                                                                         | $t_r$        |                                                                                                                                    |      | 55                | 85        |               |
| Turn-Off Delay Time                                                               | $t_{d(off)}$ |                                                                                                                                    |      | 65                | 100       |               |
| Fall Time                                                                         | $t_f$        |                                                                                                                                    |      | 30                | 45        |               |
| Source-Drain Reverse Recovery Time                                                | $t_{rr}$     | $I_F = -2.3\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$                                                                         |      | 35                | 55        |               |

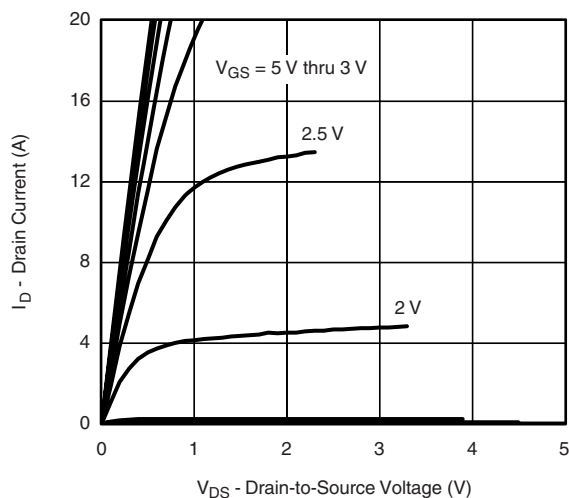
Notes:

a. For design aid only; not subject to production testing.

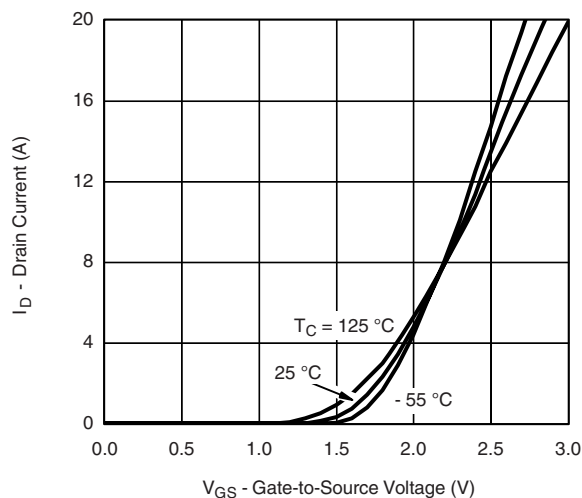
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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

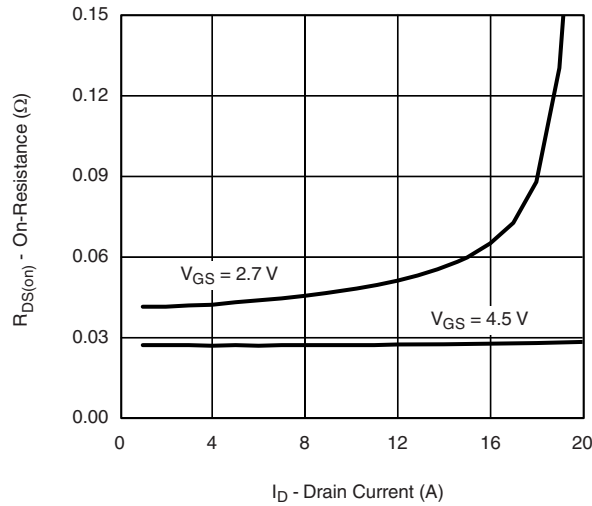


Output Characteristics

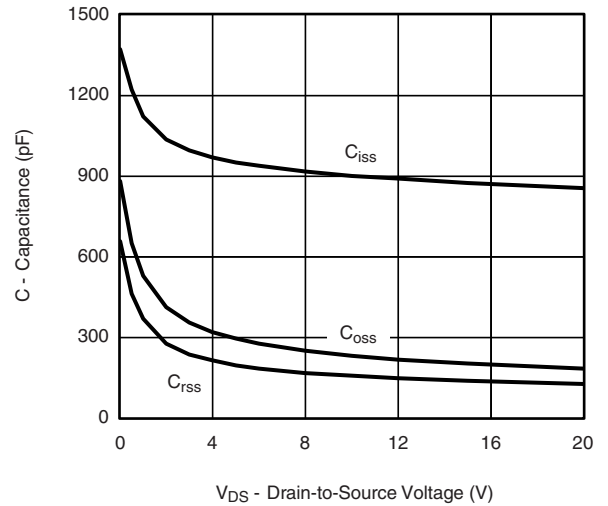


Transfer Characteristics

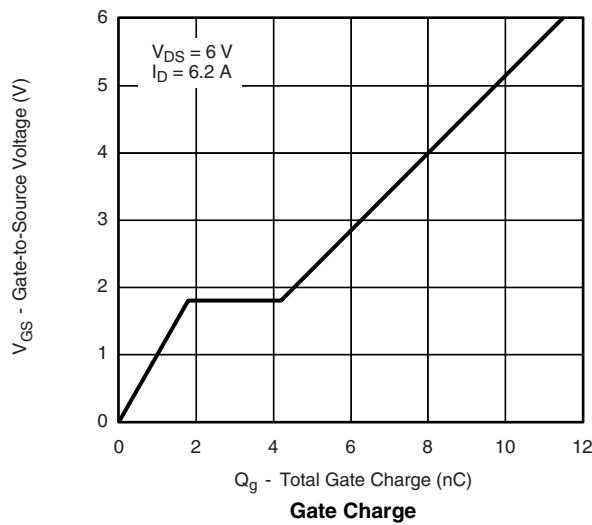
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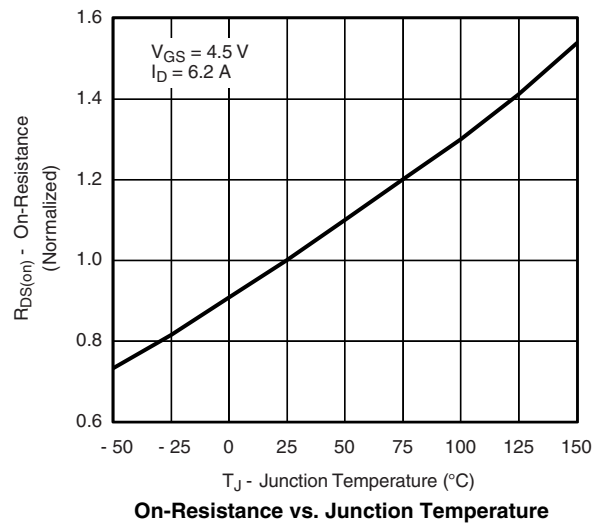
On-Resistance vs. Drain Current



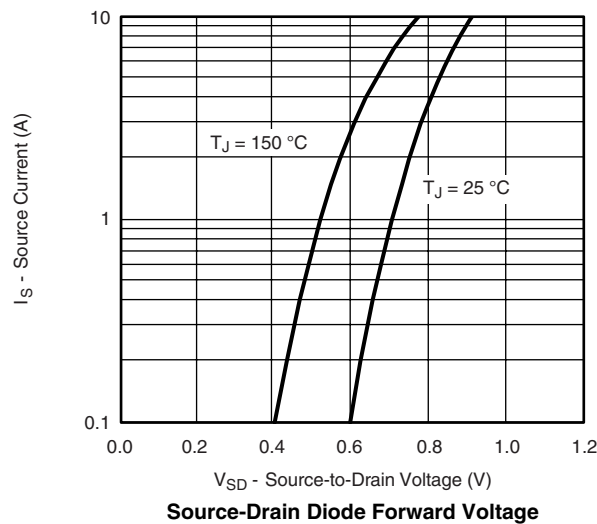
Capacitance



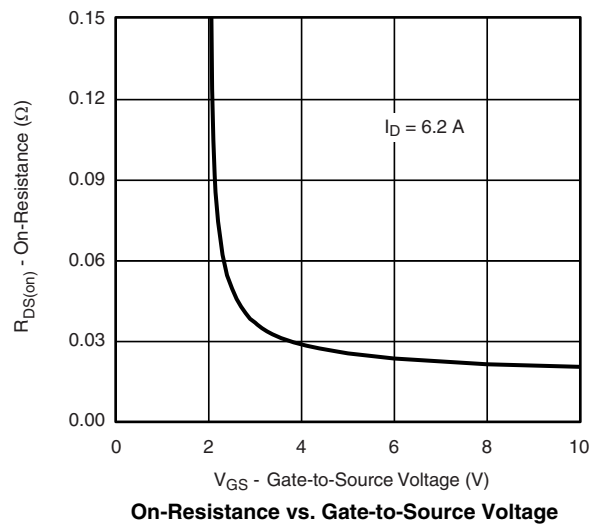
Gate Charge



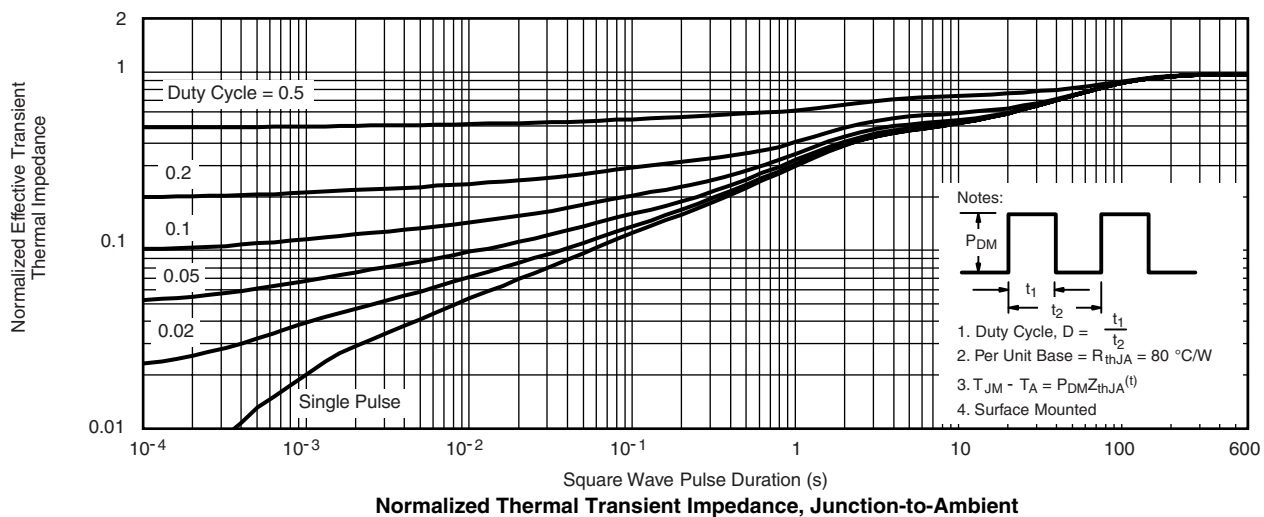
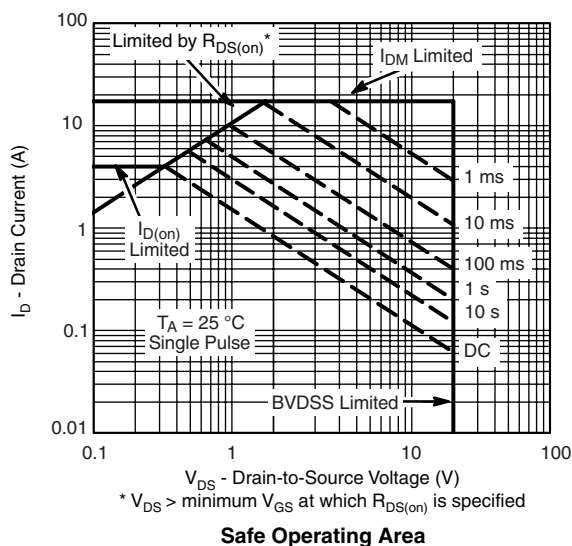
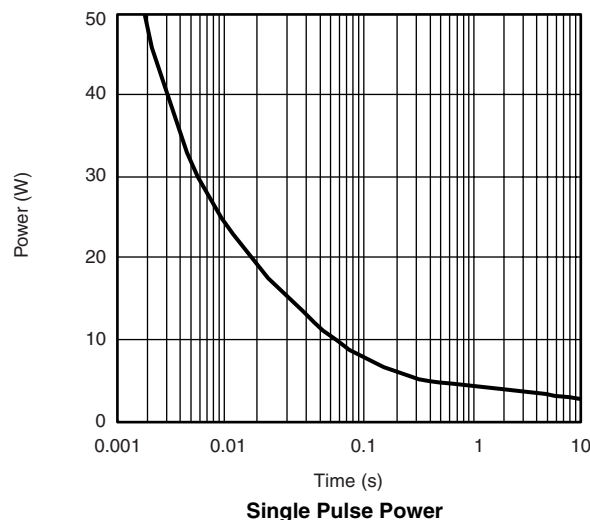
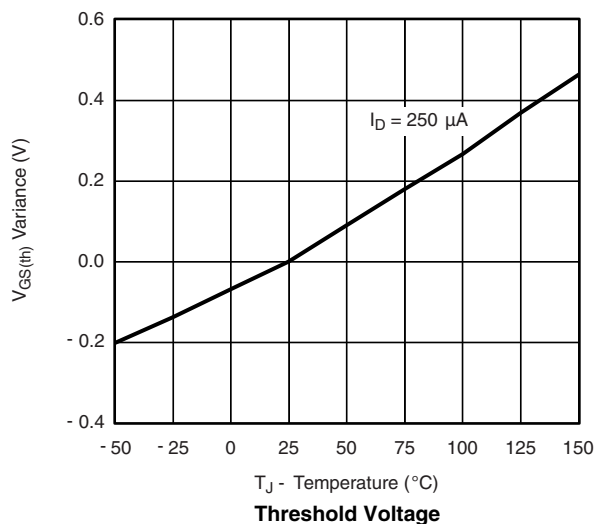
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

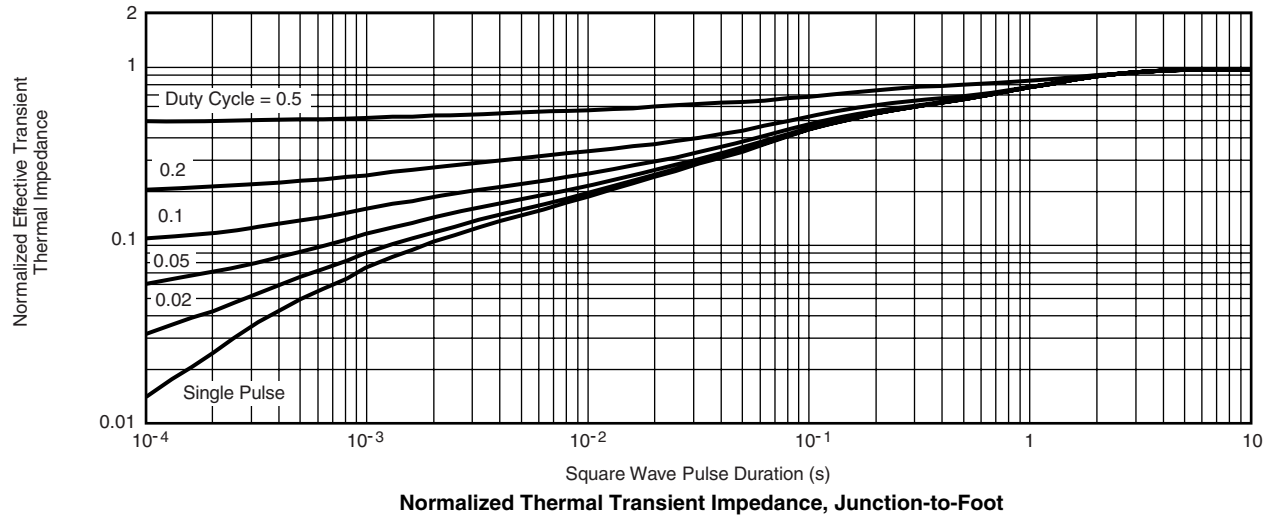


On-Resistance vs. Gate-to-Source Voltage

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



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## SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



| DIM                            | MILLIMETERS |      | INCHES    |       |
|--------------------------------|-------------|------|-----------|-------|
|                                | Min         | Max  | Min       | Max   |
| A                              | 1.35        | 1.75 | 0.053     | 0.069 |
| A <sub>1</sub>                 | 0.10        | 0.20 | 0.004     | 0.008 |
| B                              | 0.35        | 0.51 | 0.014     | 0.020 |
| C                              | 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 |
| e                              | 1.27 BSC    |      | 0.050 BSC |       |
| H                              | 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 |
| 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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