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

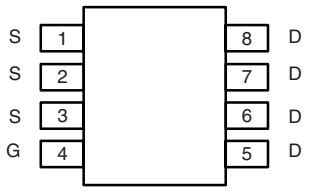
| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) |
| - 20 | 0.040 at $V_{GS}$ = - 4.5 V | - 6.2 |
| | 0.060 at $V_{GS}$ = - 2.7 V | - 5.0 |

## FEATURES

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

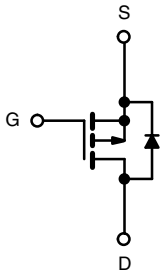
Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

**SO-8**




Top View

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




P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_A$ = 25 °C, unless otherwise noted | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **10 s** | **Steady State** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | - 20 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 12 | | |
| Continuous Drain Current ($T_J$ = 150 °C)[a] | $T_A$ = 25 °C | $I_D$ | - 6.2 | - 4.5 | A |
| | $T_A$ = 70 °C | | - 5.0 | - 3.5 | |
| Pulsed Drain Current | | $I_{DM}$ | - 20 | | |
| Continuous Source Current (Diode Conduction)[a] | | $I_S$ | - 2.3 | - 1.2 | |
| Maximum Power Dissipation[a] | $T_A$ = 25 °C | $P_D$ | 2.5 | 1.3 | W |
| | $T_A$ = 70 °C | | 1.6 | 0.8 | |
| 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 ≤ 10 s | $R_{thJA}$ | 45 | 50 | °C/W |
| | Steady State | | 80 | 95 | |
| Maximum Junction-to-Foot (Drain) | Steady State | $R_{thJF}$ | 20 | 24 | |

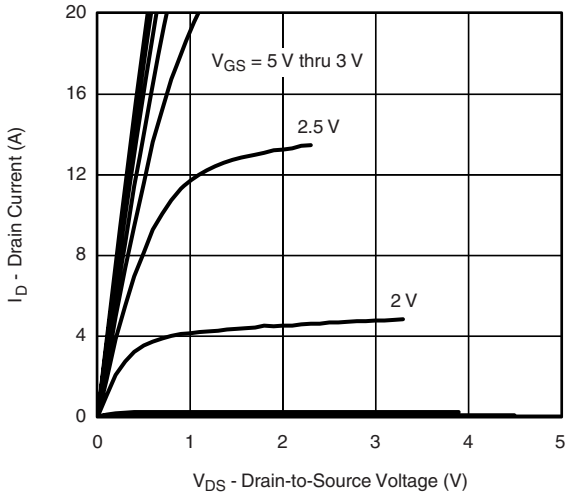
Notes:
a. Surface Mounted on FR4 board, t ≤ 10 s.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.[a]** | **Max.** | **Unit** |
| **Static** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D$ = - 250 µA | - 0.6 | | - 1.5 | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 12 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V | | | - 1 | µA |
| | | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V, $T_J$ = 70 °C | | | - 10 | |
| On-State Drain Current[b] | $I_{D(on)}$ | $V_{DS} \leq$ - 5 V, $V_{GS}$ = - 4.5 V | - 20 | | | A |
| | | $V_{DS} \leq$ - 5 V, $V_{GS}$ = - 2.7 V | - 5 | | | |
| Drain-Source On-State Resistance[b] | $R_{DS(on)}$ | $V_{GS}$ = - 4.5 V, $I_D$ = - 6.2 A | | 0.030 | 0.040 | Ω |
| | | $V_{GS}$ = - 2.7 V, $I_D$ = - 5.0 A | | 0.050 | 0.060 | |
| Forward Transconductance[b] | $g_{fs}$ | $V_{DS}$ = - 9 V, $I_D$ = - 6.2 A | | 15 | | S |
| Diode Forward Voltage[b] | $V_{SD}$ | $I_S$ = - 2.6 A, $V_{GS}$ = 0 V | | - 0.76 | - 1.1 | V |
| **Dynamic[a]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = - 6 V, $V_{GS}$ = - 4.5 V, $I_D$ = - 6.2 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 | | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 6 V, $R_L$ = 6 Ω<br>$I_D \cong$ - 1 A, $V_{GEN}$ = - 4.5 V, $R_g$ = 6 Ω | | 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 A, dI/dt = 100 A/µs | | 35 | 55 | |

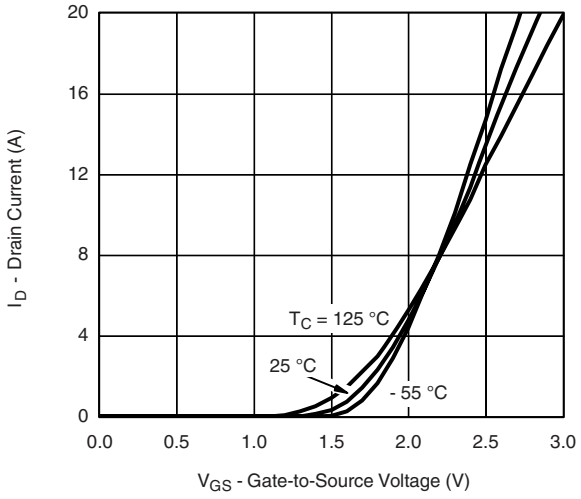
Notes:
a. For design aid only; not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

*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

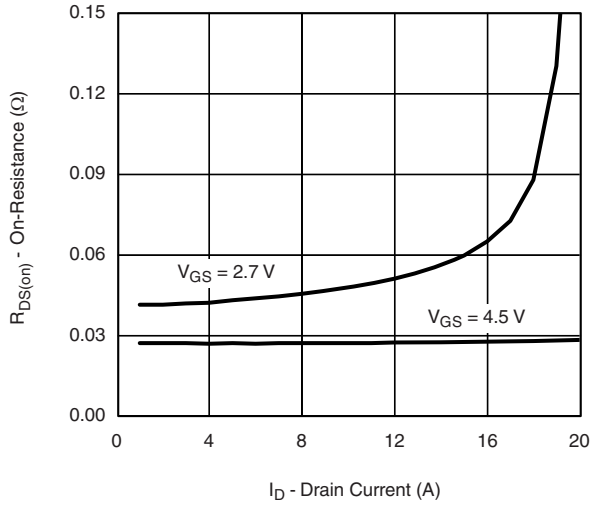



**Output Characteristics**

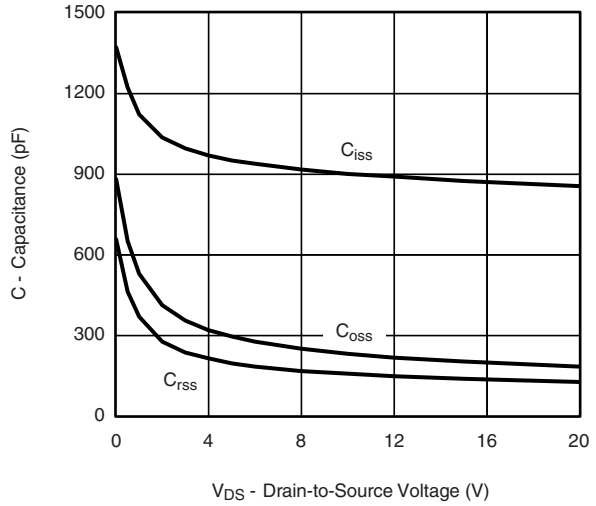



**Transfer Characteristics**

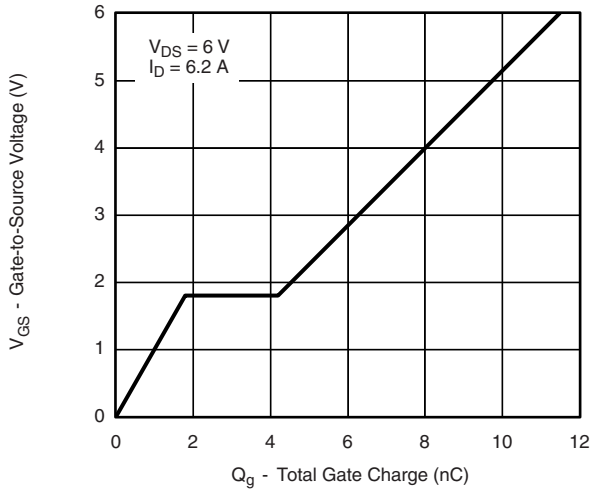
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



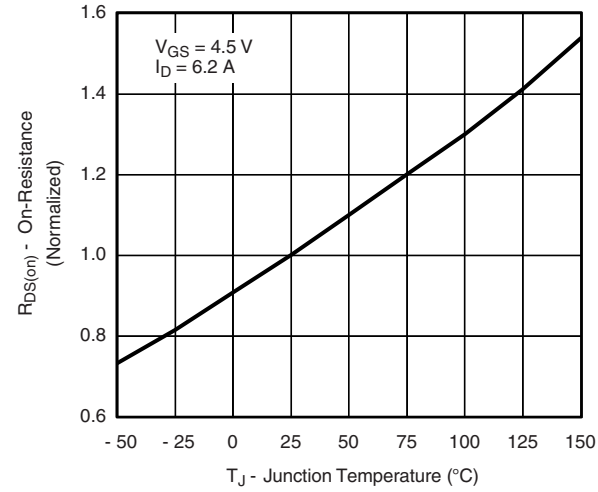

**On-Resistance vs. Drain Current**



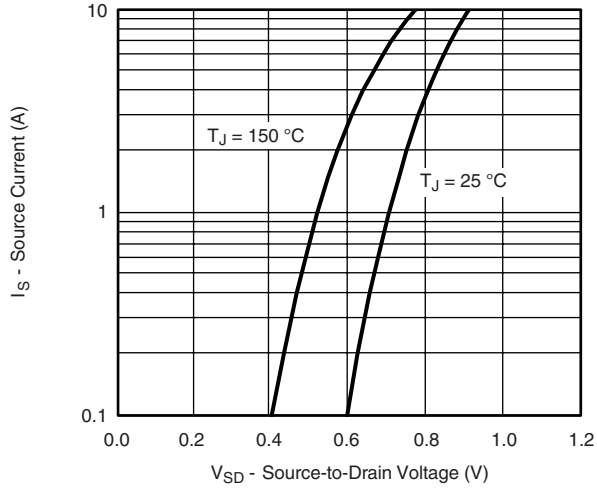

**Capacitance**



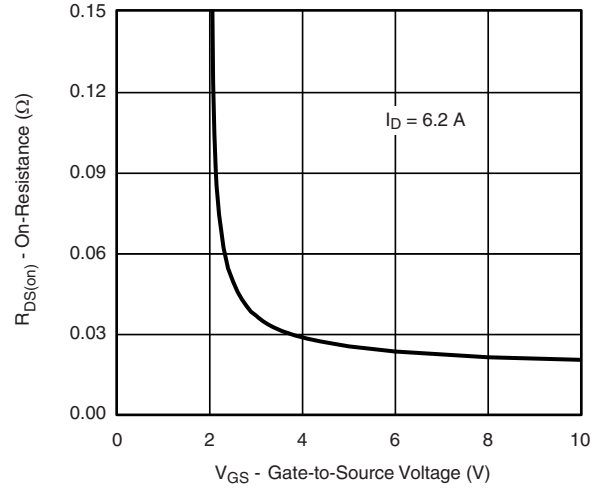

**Gate Charge**




**On-Resistance vs. Junction Temperature**

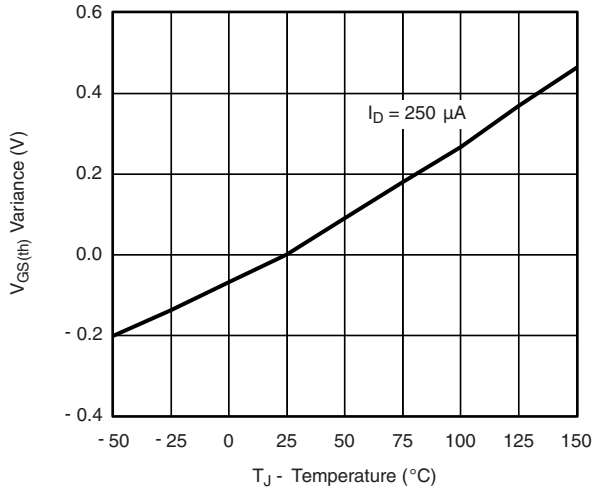



**Source-Drain Diode Forward Voltage**

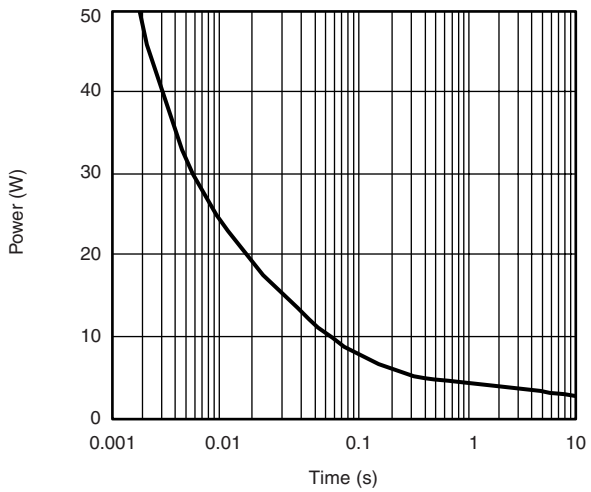



**On-Resistance vs. Gate-to-Source Voltage**

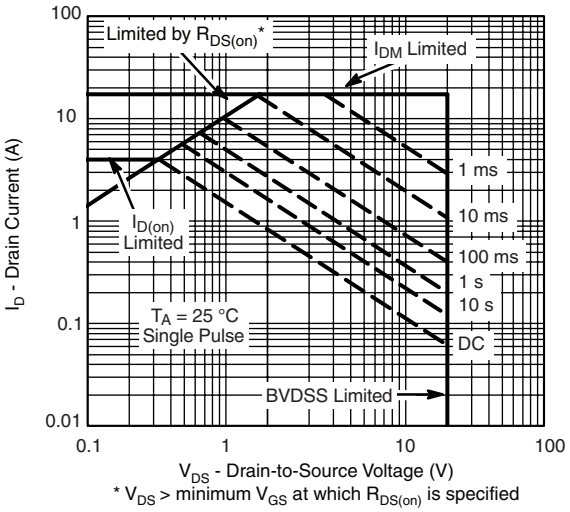
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



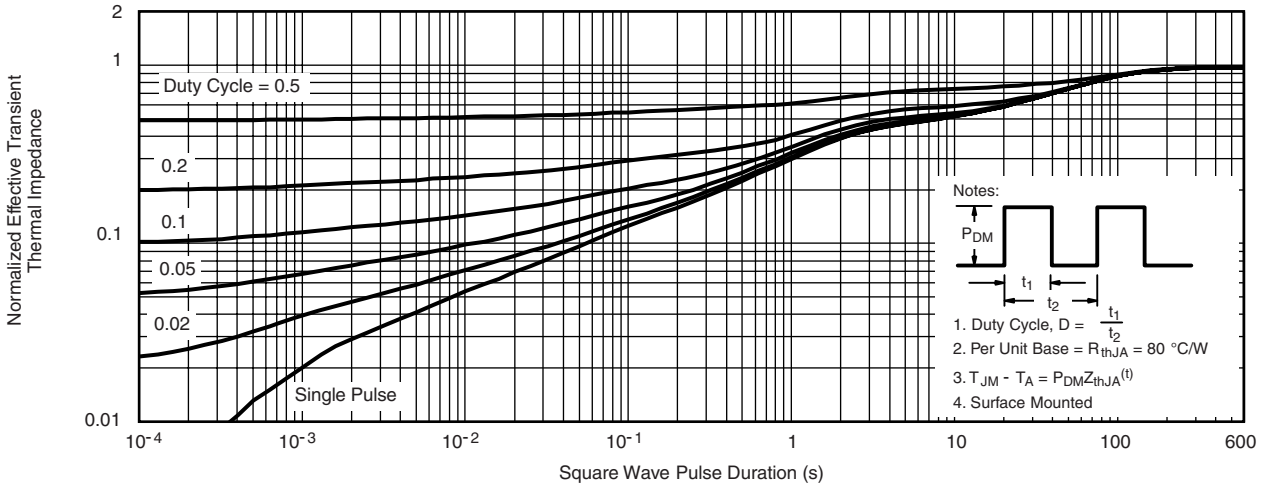

**Threshold Voltage**




**Single Pulse Power**

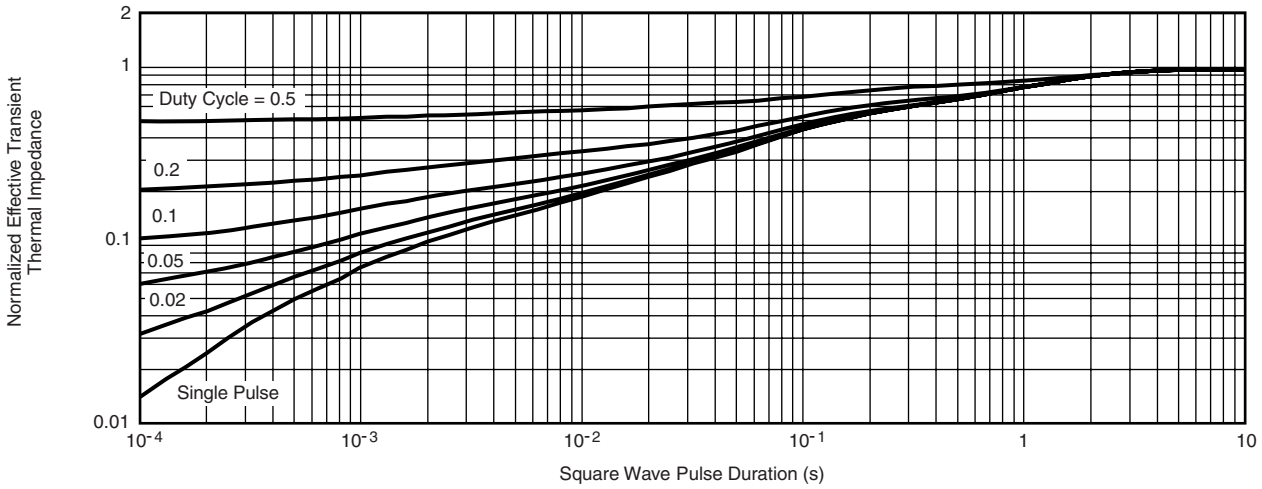



**Safe Operating Area**




**Normalized Thermal Transient Impedance, Junction-to-Ambient**

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




**Normalized Thermal Transient Impedance, Junction-to-Foot**

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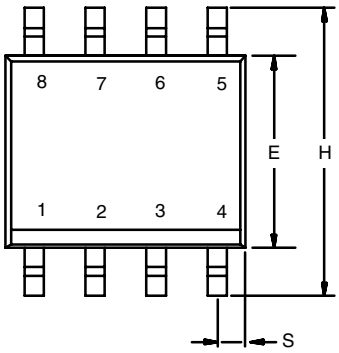
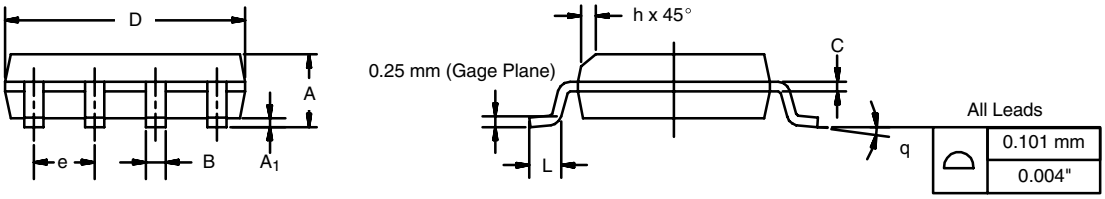
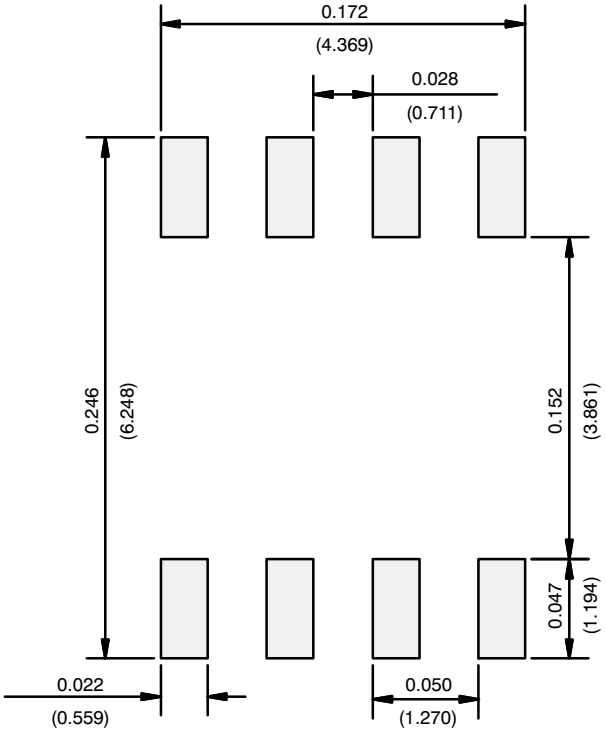
**SOIC (NARROW): 8-LEAD**
JEDEC Part Number: MS-012




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| $A_1$ | 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<br>DWG: 5498 | | | | |

**RECOMMENDED MINIMUM PADS FOR SO-8**




Recommended Minimum Pads
Dimensions in Inches/(mm)

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