# P-Channel 40-V (D-S) MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A)[b] |
| - 40 | 0.082 at $V_{GS}$ = - 10 V | - 3.0 |
| | 0.130 at $V_{GS}$ = - 4.5 V | - 2.4 |

## FEATURES

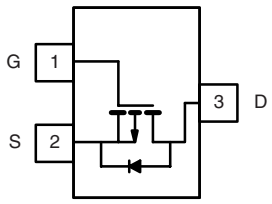
- **Halogen-free According to IEC 61249-2-21 Available**
- TrenchFET® Power MOSFET

## APPLICATIONS

- Load Switch

Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

**TO-236**
(SOT-23)




Top View
Si2319DS (C9)*
*Marking Code

**Ordering Information:** Si2319DS-T1-E3 (Lead (Pb)-free)
Si2319DS-T1-GE3 (Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS $T_A$ = 25 °C, unless otherwise noted | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **5 s** | **Steady State** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | - 40 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | | |
| Continuous Drain Current ($T_J$ = 150 °C)[b] | $T_A$ = 25 °C | $I_D$ | - 3.0 | - 2.3 | A |
| | $T_A$ = 70 °C | | - 2.4 | - 1.85 | |
| Pulsed Drain Current[a] | | $I_{DM}$ | - 12 | | |
| Continuous Source Current (Diode Conduction)[b] | | $I_S$ | - 1.0 | - 0.62 | |
| Power Dissipation[b] | $T_A$ = 25 °C | $P_D$ | 1.25 | 0.75 | W |
| | $T_A$ = 70 °C | | 0.8 | 0.48 | |
| 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[b] | $R_{thJA}$ | 75 | 100 | °C/W |
| Maximum Junction-to-Ambient[c] | | 120 | 166 | |
| Maximum Junction-to-Foot (Drain) | $R_{thJF}$ | 40 | 50 | |

Notes:
a. Pulse width limited by maximum junction temperature.
b. Surface mounted on FR4 board, t ≤ 5 s.
c. Surface Mounted on FR4 board.

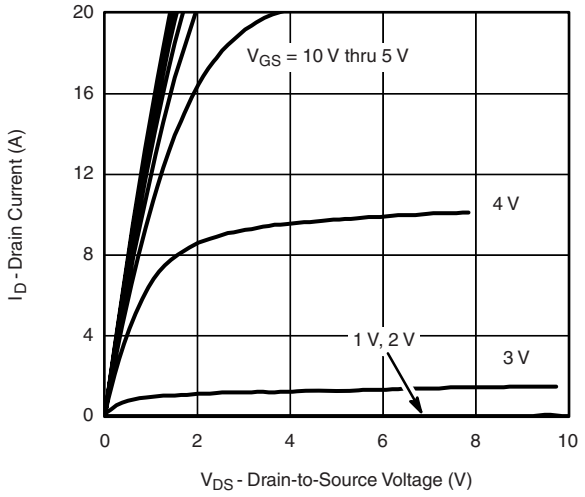
For Spice model information via the worldwide web: www.vishay.com/www/product/spice.htm.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Limits** | | | **Unit** |
| | | | **Min.** | **Typ.** | **Max.** | |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = - 250 µA | - 40 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = - 250 µA | - 1 | | - 3.0 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = - 40 V, $V_{GS}$ = 0 V | | | - 1 | µA |
| | | $V_{DS}$ = - 40 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | | | - 10 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS} \leq$ - 5 V, $V_{GS}$ = - 10 V | - 6 | | | A |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = - 10 V, $I_D$ = - 3.0 A | | 0.065 | 0.082 | Ω |
| | | $V_{GS}$ = - 4.5 V, $I_D$ = - 2.4 A | | 0.100 | 0.130 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = - 5 V, $I_D$ = - 3.0 A | | 7.0 | | S |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = - 1.25 A, $V_{GS}$ = 0 V | | - 0.8 | - 1.2 | V |
| **Dynamic[b]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = - 20 V, $V_{GS}$ = - 10 V<br>$I_D \cong$ - 3 A | | 11.3 | 17 | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 1.7 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 3.3 | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V, f = 1 MHz | | 470 | | pF |
| Output Capacitance | $C_{oss}$ | | | 85 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 65 | | |
| **Switching[c]** | | | | | | |
| Turn-On Time | $t_{d(on)}$ | $V_{DD}$ = - 20 V, $R_L$ = 20 Ω<br>$I_D \cong$ - 1.0 A, $V_{GEN}$ = - 4.5 V<br>$R_g$ = 6 Ω | | 7 | 15 | ns |
| | $t_r$ | | | 15 | 25 | |
| Turn-Off Time | $t_{d(off)}$ | | | 25 | 40 | |
| | $t_f$ | | | 25 | 40 | |

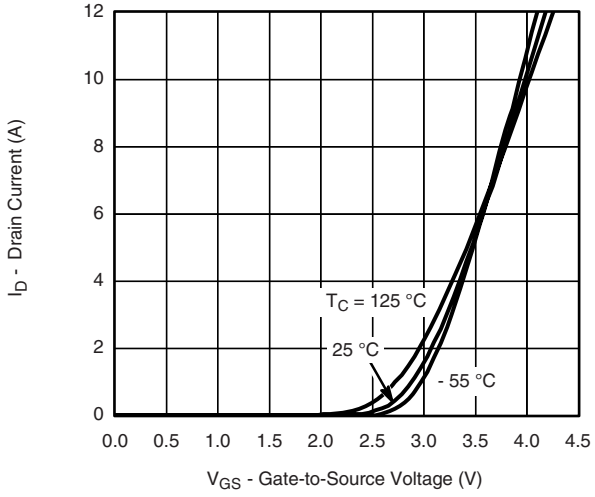
Notes:
a. Pulse test: PW ≤ 300 µs duty cycle ≤ 2 %.
b. For design aid only, not subject to production testing.
c. Switching time is essentially independent of operating temperature.

*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.*

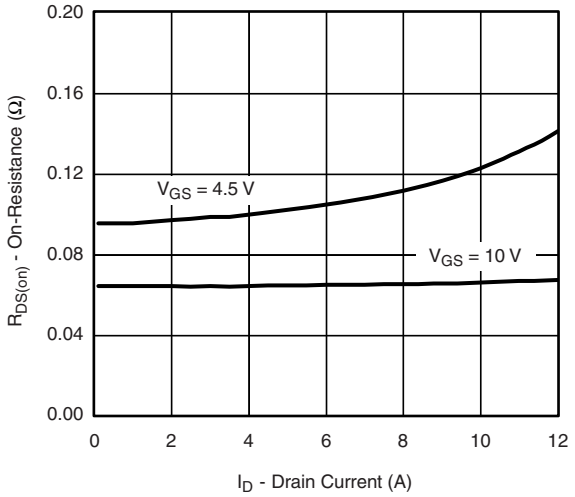
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



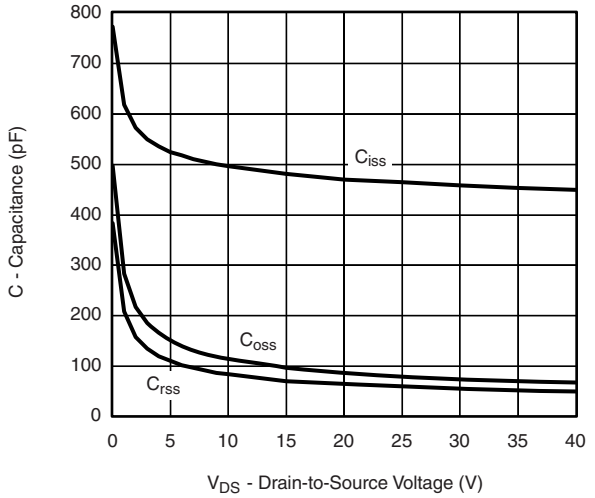

**Output Characteristics**



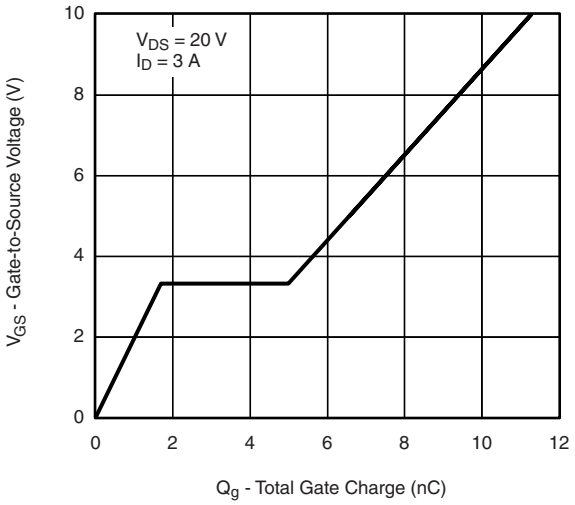

**Transfer Characteristics**



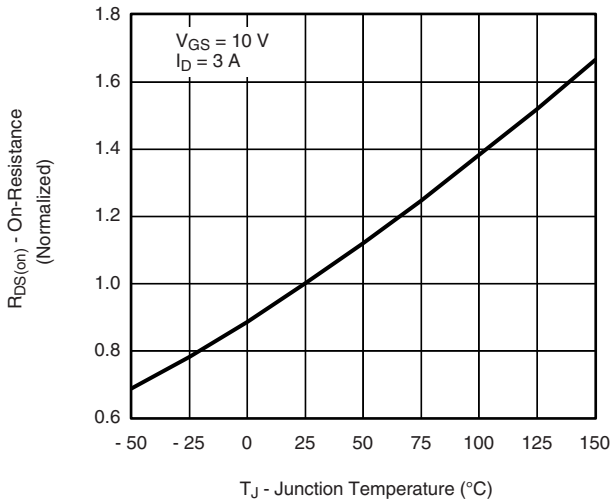

**On-Resistance vs. Drain Current**




**Capacitance**

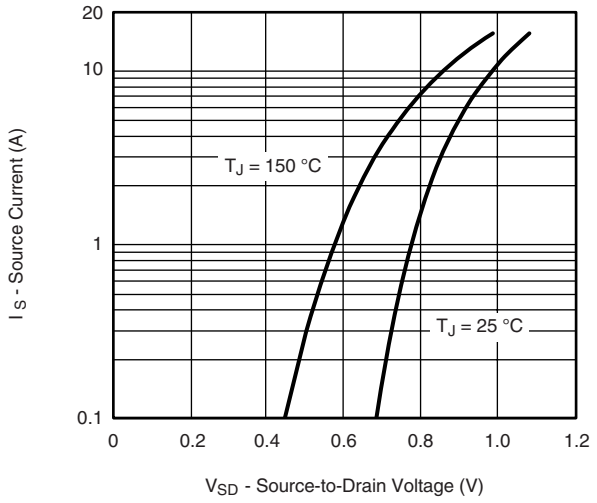



**Gate Charge**

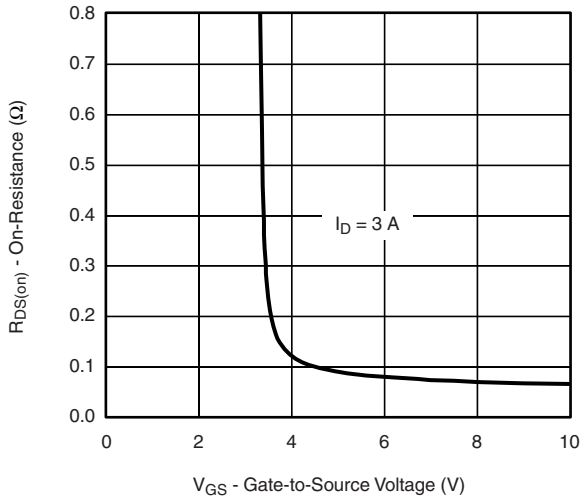



**On-Resistance vs. Junction Temperature**

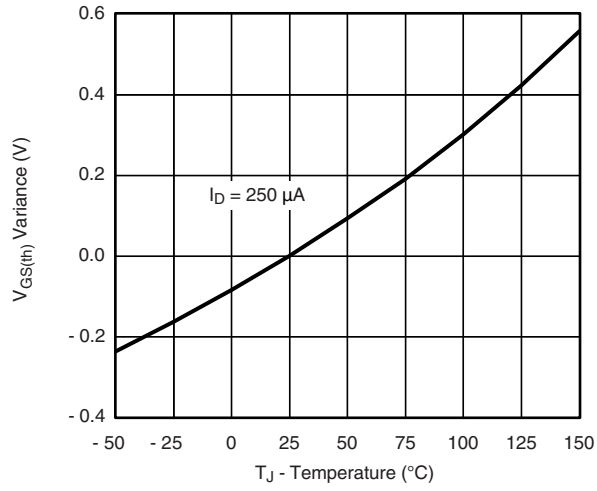
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



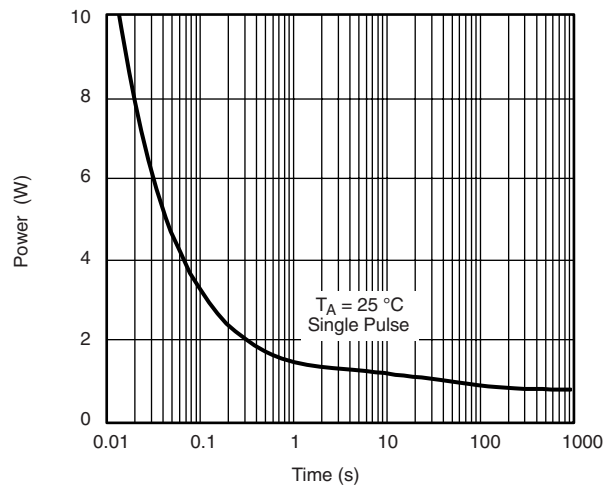

**Source-Drain Diode Forward Voltage**



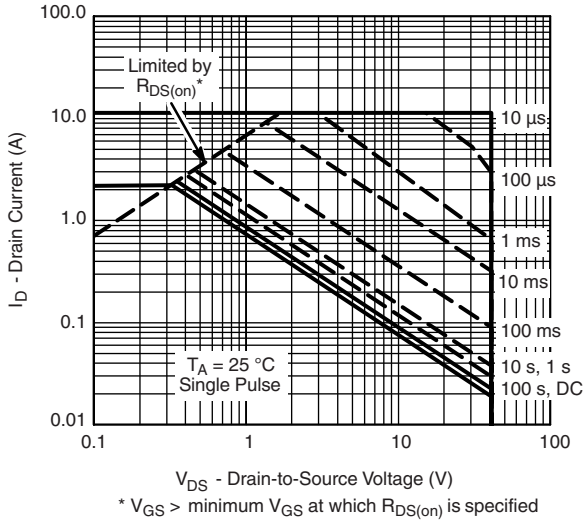

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**



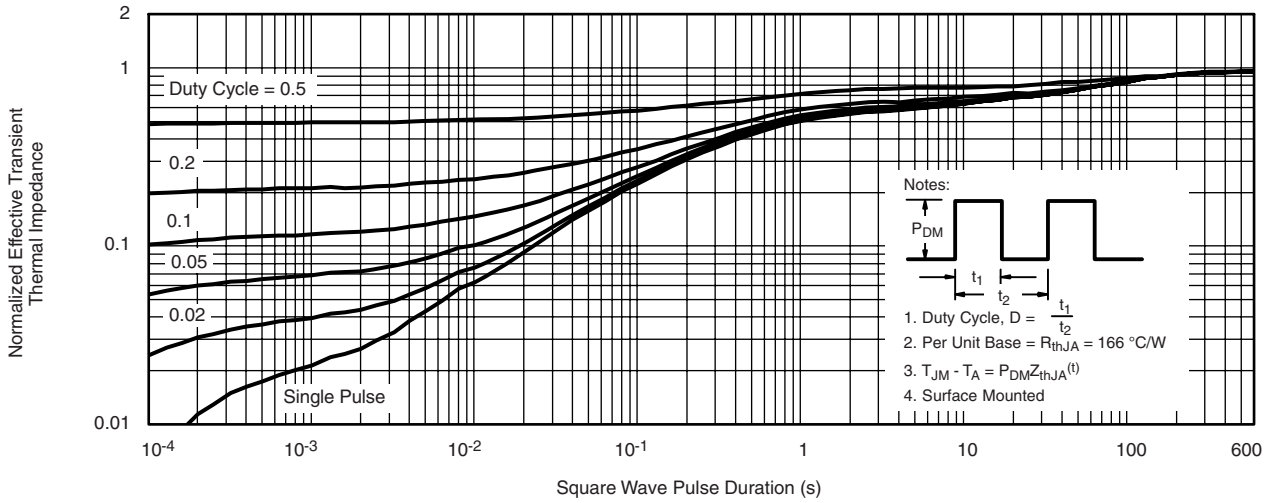

**Single Pulse Power**




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

**Safe Operating Area, Junction-to-Case**

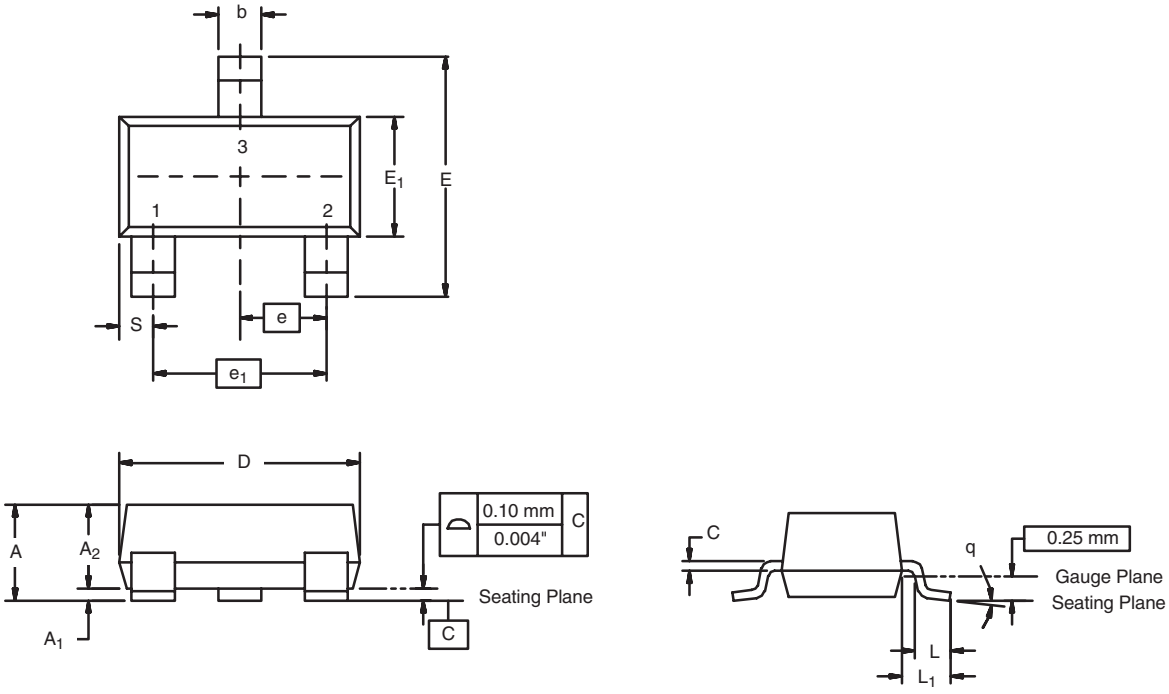
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted




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

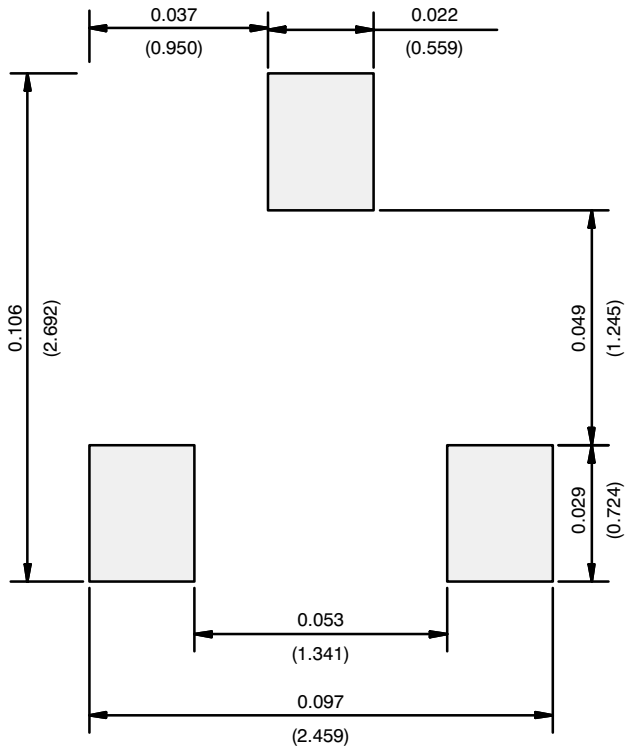
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## SOT-23 (TO-236): 3-LEAD




| Dim | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| $A_1$ | 0.01 | 0.10 | 0.0004 | 0.004 |
| $A_2$ | 0.88 | 1.02 | 0.0346 | 0.040 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 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 |
| $E_1$ | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 0.95 BSC | | 0.0374 Ref | |
| $e_1$ | 1.90 BSC | | 0.0748 Ref | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| $L_1$ | 0.64 Ref | | 0.025 Ref | |
| S | 0.50 Ref | | 0.020 Ref | |
| q | 3° | 8° | 3° | 8° |
| ECN: S-03946-Rev. K, 09-Jul-01<br>DWG: 5479 | | | | |

## RECOMMENDED MINIMUM PADS FOR SOT-23




Recommended Minimum Pads
Dimensions in Inches/(mm)

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APPLICATION NOTE

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