

## N-Channel 60-V (D-S) MOSFET

### PRODUCT SUMMARY

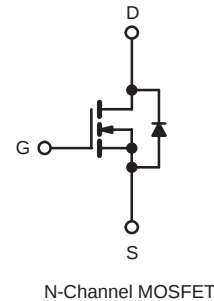
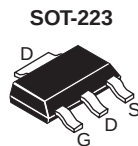
| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
|--------------|---------------------------|-----------|
| 60           | 0.029 at $V_{GS} = 10$ V  | 7.0       |
|              | 0.033 at $V_{GS} = 4.5$ V | 5.6       |

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFETs
- 175 °C Maximum Junction Temperature
- Compliant to RoHS Directive 2002/95/EC



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



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

| Parameter                                               | Symbol         | 10 s        | Steady State | Unit |
|---------------------------------------------------------|----------------|-------------|--------------|------|
| Drain-Source Voltage                                    | $V_{DS}$       | 60          |              | V    |
| Gate-Source Voltage                                     | $V_{GS}$       | $\pm 20$    |              |      |
| Continuous Drain Current ( $T_J = 175$ °C) <sup>a</sup> | $I_D$          | 7.0         | 6.0          | A    |
|                                                         |                | 6.1         | 5.0          |      |
| Pulsed Drain Current                                    | $I_{DM}$       | 40          |              |      |
| Avalanche Current                                       | $I_{AS}$       | 15          |              |      |
| Single Pulse Avalanche Energy                           | $E_{AS}$       | 11          |              | mJ   |
| Maximum Power Dissipation <sup>a</sup>                  | $P_D$          | 3.3         | 1.7          | W    |
|                                                         |                | 2.3         | 1.2          |      |
| Operating Junction and Storage Temperature Range        | $T_J, T_{stg}$ | - 55 to 175 |              | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                | Symbol     | Typical | Maximum | Unit |
|------------------------------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a</sup> | $R_{thJA}$ | 36      | 45      | °C/W |
|                                          |            | 75      | 90      |      |
| Maximum Junction-to-Foot (Drain)         | $R_{thJF}$ | 17      | 20      |      |

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

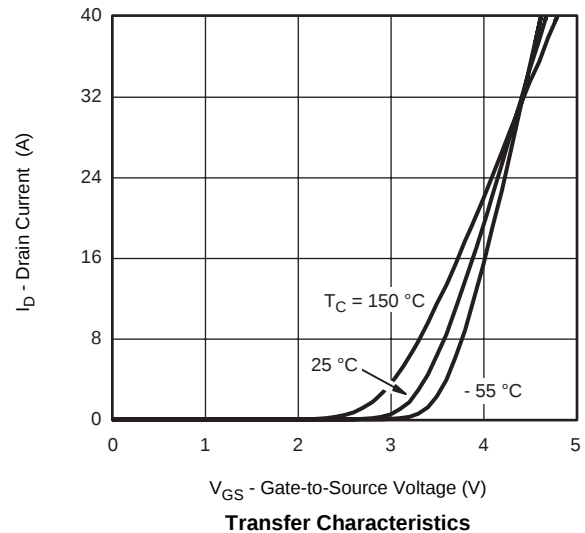
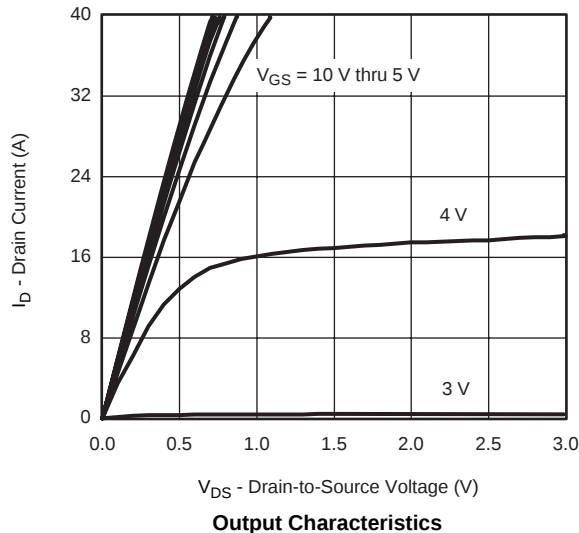
| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted |              |                                                                                                                                 |      |       |           |               |
|----------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| Parameter                                                                  | Symbol       | Test Conditions                                                                                                                 | Min. | Typ.  | Max.      | Unit          |
| Static                                                                     |              |                                                                                                                                 |      |       |           |               |
| Drain-Source Breakdown Voltage                                             | $V_{DS}$     | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                          | 60   |       |           | V             |
| Gate Threshold Voltage                                                     | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                              | 1    |       | 3         | V             |
| Gate-Body Leakage                                                          | $I_{GSS}$    | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$                                                                              |      |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                            | $I_{DSS}$    | $V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                  |      |       | 1         | $\mu\text{A}$ |
|                                                                            |              | $V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$                                             |      |       | 20        |               |
| On-State Drain Current <sup>a</sup>                                        | $I_{D(on)}$  | $V_{DS} \geq 5\text{ V}$ , $V_{GS} = 10\text{ V}$                                                                               | 40   |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                              | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ , $I_D = 6.0\text{ A}$                                                                                   |      | 0.028 |           | $\Omega$      |
|                                                                            |              | $V_{GS} = 10\text{ V}$ , $I_D = 6.0\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                             |      | 0.032 |           |               |
|                                                                            |              | $V_{GS} = 10\text{ V}$ , $I_D = 6.0\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$                                             |      | 0.040 |           |               |
|                                                                            |              | $V_{GS} = 4.5\text{ V}$ , $I_D = 5.1\text{ A}$                                                                                  |      | 0.033 |           |               |
| Forward Transconductance <sup>a</sup>                                      | $g_{fs}$     | $V_{DS} = 15\text{ V}$ , $I_D = 6.0\text{ A}$                                                                                   |      | 25    |           | S             |
| Diode Forward Voltage <sup>a</sup>                                         | $V_{SD}$     | $I_S = 1.7\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                    |      | 0.8   | 1.2       | V             |
| Dynamic <sup>b</sup>                                                       |              |                                                                                                                                 |      |       |           |               |
| Total Gate Charge                                                          | $Q_g$        | $V_{DS} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 6.0\text{ A}$                                                          |      | 18    | 27        | nC            |
| Gate-Source Charge                                                         | $Q_{gs}$     |                                                                                                                                 |      | 3.4   |           |               |
| Gate-Drain Charge                                                          | $Q_{gd}$     |                                                                                                                                 |      | 5.3   |           |               |
| Gate Resistance                                                            | $R_g$        | $V_{GS} = 0.1\text{ V}$ , $f = 5\text{ MHz}$                                                                                    | 0.5  | 1.4   | 2.4       | $\Omega$      |
| Turn-On Delay Time                                                         | $t_{d(on)}$  | $V_{DD} = 30\text{ V}$ , $R_L = 30\text{ }\Omega$<br>$I_D \cong 1\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 6\text{ }\Omega$ |      | 10    | 20        | ns            |
| Rise Time                                                                  | $t_r$        |                                                                                                                                 |      | 10    | 20        |               |
| Turn-Off Delay Time                                                        | $t_{d(off)}$ |                                                                                                                                 |      | 25    | 50        |               |
| Fall Time                                                                  | $t_f$        |                                                                                                                                 |      | 12    | 24        |               |
| Source-Drain Reverse Recovery Time                                         | $t_{rr}$     | $I_F = 1.7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$                                                                       |      | 50    | 80        |               |

Notes:

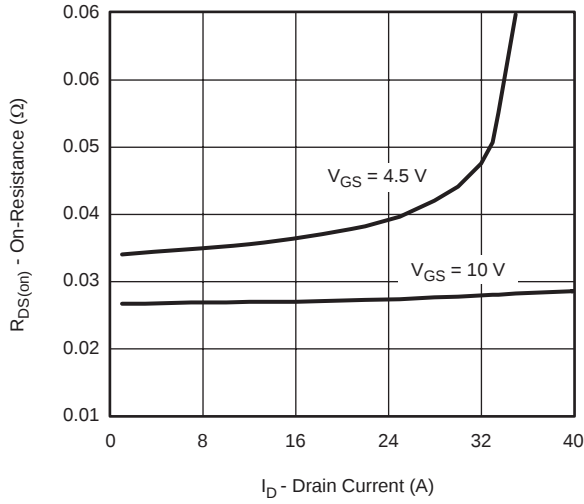
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

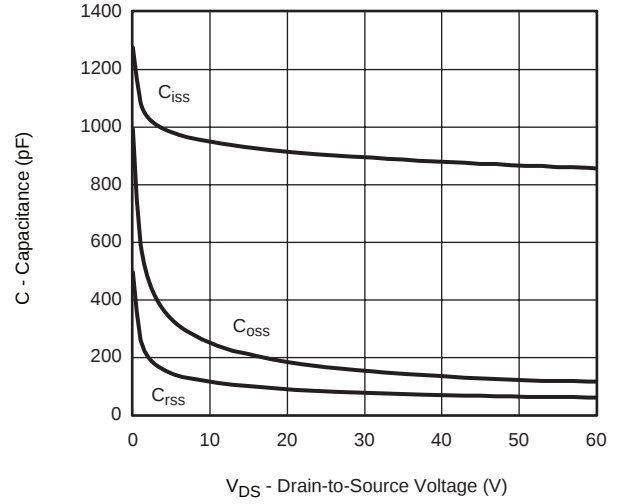
## TYPICAL CHARACTERISTICS $25\text{ }^{\circ}\text{C}$ , unless otherwise noted



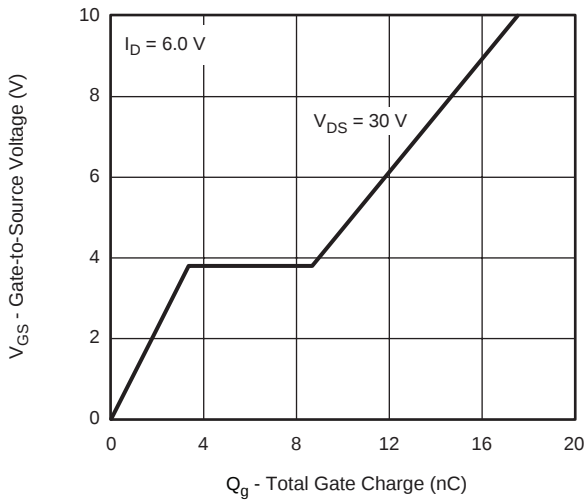
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



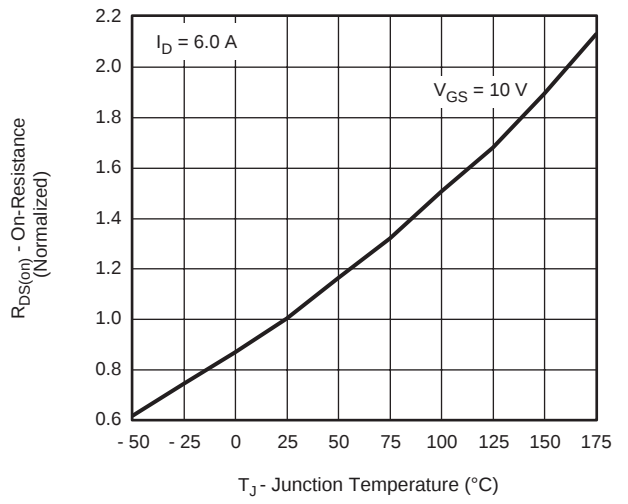
On-Resistance vs. Drain Current



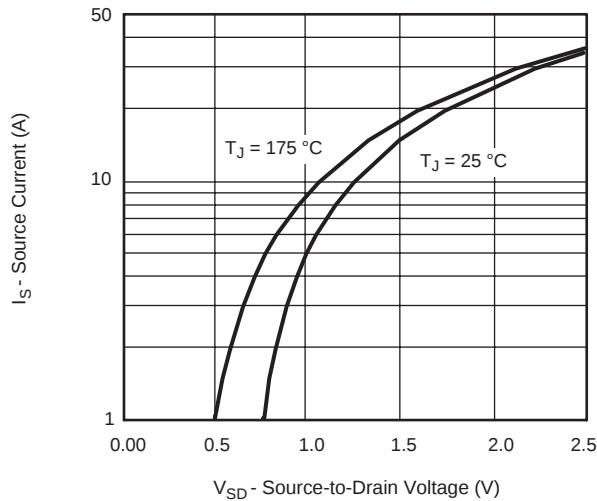
Capacitance



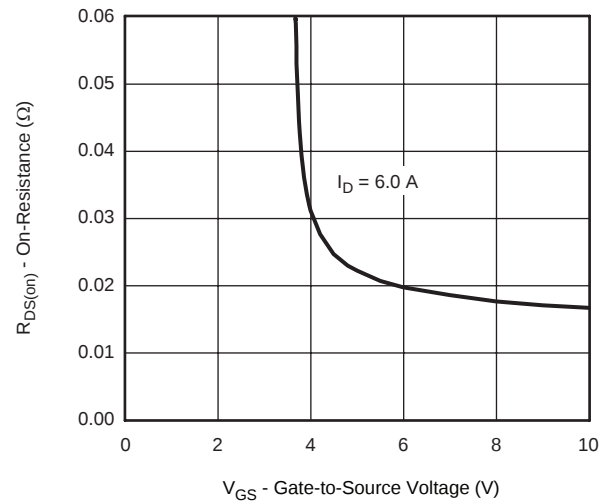
Gate Charge



On-Resistance vs. Junction Temperature

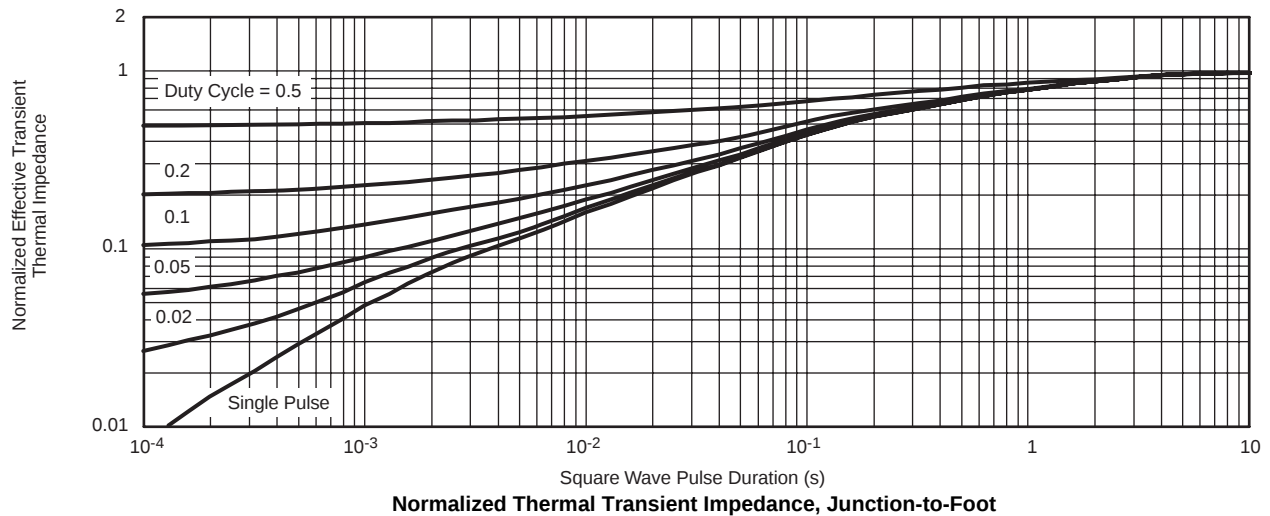
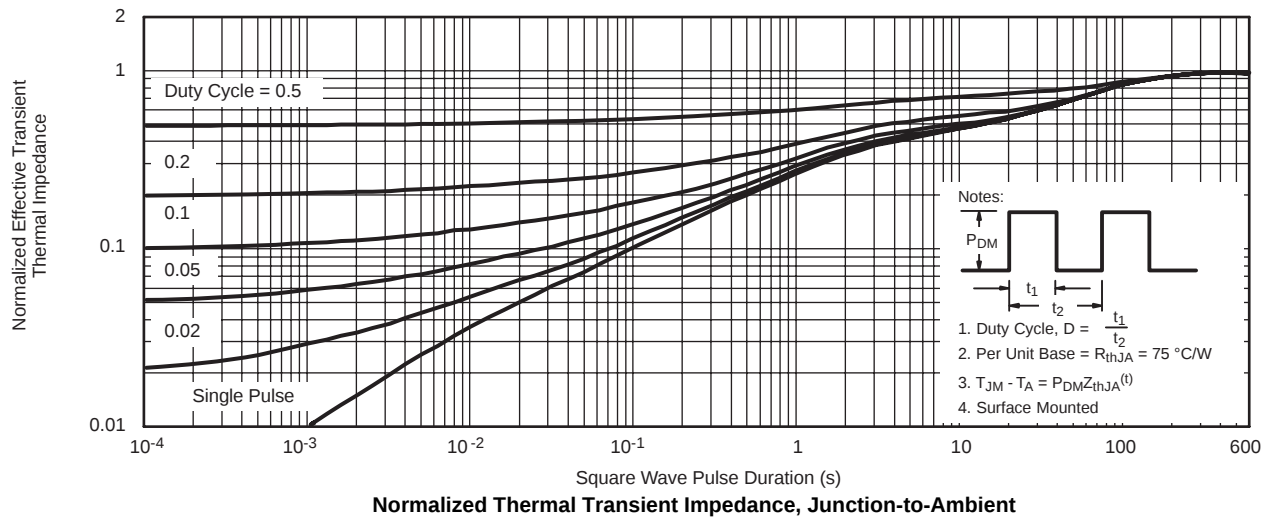
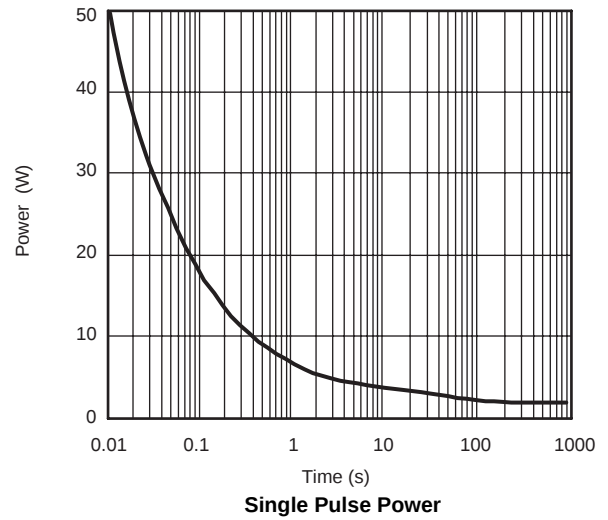
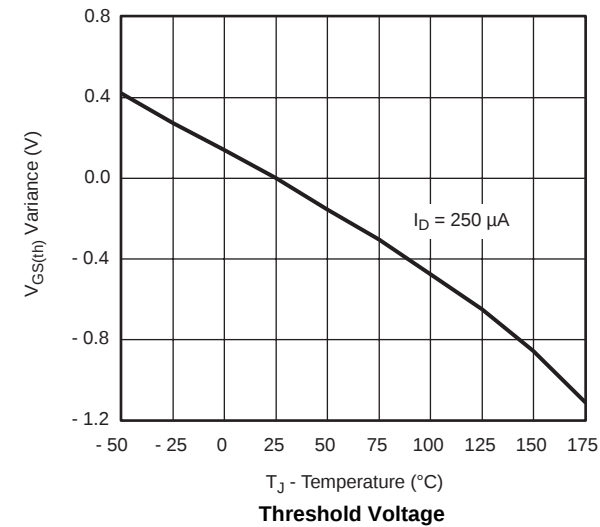


Source-Drain Diode Forward Voltage

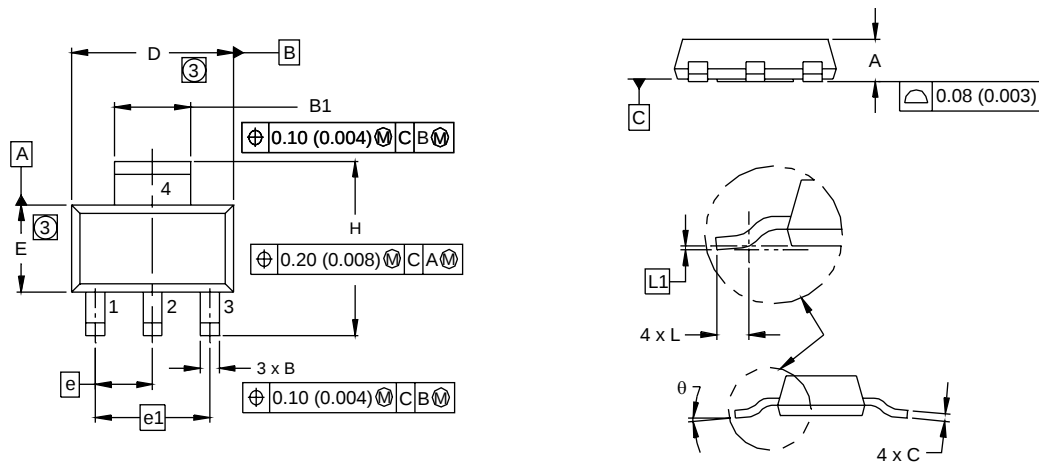


On-Resistance vs. Gate-to-Source Voltage

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



**SOT-223 (HIGH VOLTAGE)**



| DIM.                                        | MILLIMETERS |      | INCHES     |       |
|---------------------------------------------|-------------|------|------------|-------|
|                                             | MIN.        | MAX. | MIN.       | MAX.  |
| A                                           | 1.55        | 1.80 | 0.061      | 0.071 |
| B                                           | 0.65        | 0.85 | 0.026      | 0.033 |
| B1                                          | 2.95        | 3.15 | 0.116      | 0.124 |
| C                                           | 0.25        | 0.35 | 0.010      | 0.014 |
| D                                           | 6.30        | 6.70 | 0.248      | 0.264 |
| E                                           | 3.30        | 3.70 | 0.130      | 0.146 |
| e                                           | 2.30 BSC    |      | 0.0905 BSC |       |
| e1                                          | 4.60 BSC    |      | 0.181 BSC  |       |
| H                                           | 6.71        | 7.29 | 0.264      | 0.287 |
| L                                           | 0.91        | -    | 0.036      | -     |
| L1                                          | 0.061 BSC   |      | 0.0024 BSC |       |
| θ                                           | -           | 10°  | -          | 10°   |
| ECN: S-82109-Rev. A, 15-Sep-08<br>DWG: 5969 |             |      |            |       |

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension do not include mold flash.
4. Outline conforms to JEDEC outline TO-261AA.

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