

## Power MOSFET



N-Channel MOSFET

### FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

Marking code: FD

| PRODUCT SUMMARY           |                            |
|---------------------------|----------------------------|
| $V_{DS}$ (V)              | 250                        |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ 2.0 |
| $Q_g$ (Max.) (nC)         | 8.2                        |
| $Q_{gs}$ (nC)             | 1.8                        |
| $Q_{gd}$ (nC)             | 4.5                        |
| Configuration             | Single                     |

### DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-223 package is designed for surface-mounting using vapor phase, infrared, or wave soldering techniques. Its unique package design allows for easy automatic pick-and-place as with other SOT or SOIC packages but has the added advantage of improved thermal performance due to an enlarged tab for heatsinking. Power dissipation of greater than 1.25 W is possible in a typical surface mount application.

| ORDERING INFORMATION            |                                  |
|---------------------------------|----------------------------------|
| Package                         | SOT-223                          |
| Lead (Pb)-free and halogen-free | SiHFL214TR-GE3 <sup>a</sup>      |
|                                 | IRFL214TRPbF-BE3 <sup>a, b</sup> |
| Lead (Pb)-free                  | IRFL214TRPbF <sup>a</sup>        |

### Notes

- See device orientation
- “-BE3” denotes alternate manufacturing location

| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                                  |                                   |             |                     |
|---|----------------------------------|-----------------------------------|-------------|---------------------|
| PARAMETER   | SYMBOL                           |                                   | LIMIT       | UNIT                |
| Drain-source voltage  | $V_{DS}$                         |                                   | 250         | V                   |
| Gate-source voltage   | $V_{GS}$                         |                                   | $\pm 20$    |                     |
| Continuous drain current  | $V_{GS}$ at 10 V                 | $T_C = 25\text{ }^\circ\text{C}$  | 0.79        | A                   |
|   |                                  | $T_C = 100\text{ }^\circ\text{C}$ | 0.50        |                     |
| Pulsed drain current <sup>a</sup>   | $I_{DM}$                         |                                   | 6.3         | W/ $^\circ\text{C}$ |
| Linear derating factor  |                                  |                                   | 0.025       |                     |
| Linear derating factor (PCB mount) <sup>e</sup>                                       |                                  |                                   | 0.017       |                     |
| Single pulse avalanche energy <sup>b</sup>  | $E_{AS}$                         |                                   | 50          | mJ                  |
| Avalanche current <sup>a</sup>  | $I_{AR}$                         |                                   | 0.79        | A                   |
| Repetitive avalanche energy <sup>a</sup>  | $E_{AR}$                         |                                   | 0.31        | mJ                  |
| Maximum power dissipation   | $T_C = 25\text{ }^\circ\text{C}$ |                                   | 3.1         | W                   |
|   | $T_A = 25\text{ }^\circ\text{C}$ |                                   | 2.0         |                     |
| Peak diode recovery dv/dt <sup>c</sup>  | dV/dt                            |                                   | 4.8         | V/ns                |
| Operating junction and storage temperature range                                      | $T_J, T_{stg}$                   |                                   | -55 to +150 | $^\circ\text{C}$    |
| Soldering recommendations (peak temperature) <sup>d</sup>                             | For 10 s                         |                                   | 300         |                     |

### Notes



- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 128\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 0.79\text{ A}$  (see fig. 12)
- $I_{SD} \leq 2.7\text{ A}$ ,  $dI/dt \leq 65\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case
- When mounted on 1" square PCB (FR-4 or G-10 material)



| THERMAL RESISTANCE RATINGS                           |                   |      |      |      |      |
|--|-------------------|------|------|------|------|
| PARAMETER  | SYMBOL            | MIN. | TYP. | MAX. | UNIT |
| Maximum junction-to-ambient (PCB mount) <sup>a</sup> | R <sub>thJA</sub> | -    | -    | 60   | °C/W |
| Maximum junction-to-case (drain)                     | R <sub>thJC</sub> | -    | -    | 40   |      |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material)

| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                  |  |  |      |      |       |      |
|---|----------------------------------|--|--|------|------|-------|------|
| PARAMETER   | SYMBOL                           | TEST CONDITIONS  |  | MIN. | TYP. | MAX.  | UNIT |
| <b>Static</b>   |                                  |  |  |      |      |       |      |
| Drain-source breakdown voltage                                  | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   |  | 250  | -    | -     | V    |
| V <sub>DS</sub> temperature coefficient                         | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA  |  | -    | 0.39 | -     | V/°C |
| Gate-source threshold voltage                                   | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA  |  | 2.0  | -    | 4.0   | V    |
| Gate-source leakage   | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V   |  | -    | -    | ± 100 | nA   |
| Zero gate voltage drain current                                 | I <sub>DSS</sub>                 | V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V   |  | -    | -    | 25    | μA   |
|   |                                  | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C  |  | -    | -    | 250   |      |
| Drain-source on-state resistance                                | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V   | I <sub>D</sub> = 0.47 A <sup>b</sup>   | -    | -    | 2.0   | Ω    |
| Forward transconductance  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 0.47 A  |  | 0.50 | -    | -     | S    |
| <b>Dynamic</b>  |                                  |  |  |      |      |       |      |
| Input capacitance   | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5   |  | -    | 140  | -     | pF   |
| Output capacitance  | C <sub>oss</sub>                 |  |  | -    | 42   | -     |      |
| Reverse transfer capacitance                                    | C <sub>rss</sub>                 |  |  | -    | 9.6  | -     |      |
| Total gate charge   | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V   | I <sub>D</sub> = 2.7 A, V <sub>DS</sub> = 200 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 8.2   | nC   |
| Gate-source charge  | Q <sub>gs</sub>                  |  |  | -    | -    | 1.8   |      |
| Gate-drain charge   | Q <sub>gd</sub>                  |  |  | -    | -    | 4.5   |      |
| Turn-on delay time  | t <sub>d(on)</sub>               | V <sub>DD</sub> = 125 V, I <sub>D</sub> = 2.7 A,<br>R <sub>g</sub> = 24 Ω, R <sub>D</sub> = 45 Ω, see fig. 10 <sup>b</sup>                                       |  | -    | 7.0  | -     | ns   |
| Rise time   | t <sub>r</sub>                   |  |  | -    | 7.6  | -     |      |
| Turn-off delay time   | t <sub>d(off)</sub>              |  |  | -    | 16   | -     |      |
| Fall time   | t <sub>f</sub>                   |  |  | -    | 7.0  | -     |      |
| Internal drain inductance                                       | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  |  | -    | 4.0  | -     | nH   |
| Internal source inductance                                      | L <sub>S</sub>                   |  |  | -    | 6.0  | -     |      |
| <b>Drain-Source Body Diode Characteristics</b>                  |                                  |  |  |      |      |       |      |
| Continuous source-drain diode current                           | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode    |  | -    | -    | 0.79  | A    |
| Pulsed diode forward current <sup>a</sup>                       | I <sub>SM</sub>                  |  |  | -    | -    | 6.3   |      |
| Body diode voltage  | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 0.79 A, V <sub>GS</sub> = 0 V <sup>b</sup>  |  | -    | -    | 2.0   | V    |
| Body diode reverse recovery time                                | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 2.7 A, dI/dt = 100 A/μs <sup>b</sup>  |  | -    | 190  | 390   | ns   |
| Body diode reverse recovery charge                              | Q <sub>rr</sub>                  |  |  | -    | 0.64 | 1.3   | μC   |
| Forward turn-on time  | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )  |  |      |      |       |      |

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %

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

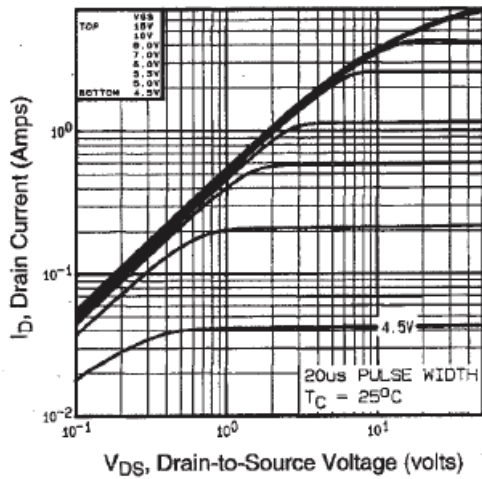


Fig. 1 - Typical Output Characteristics

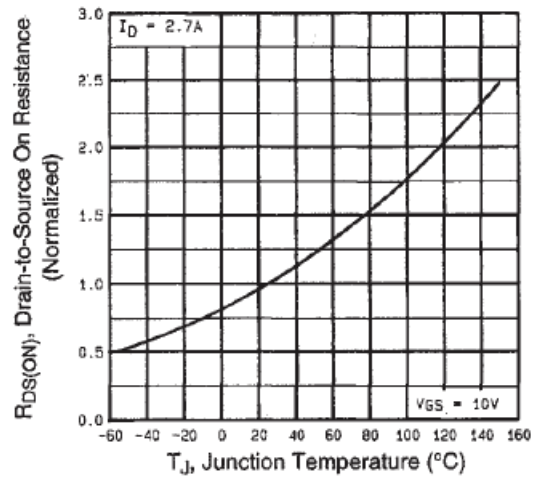


Fig. 4 - Normalized On-Resistance vs. Temperature

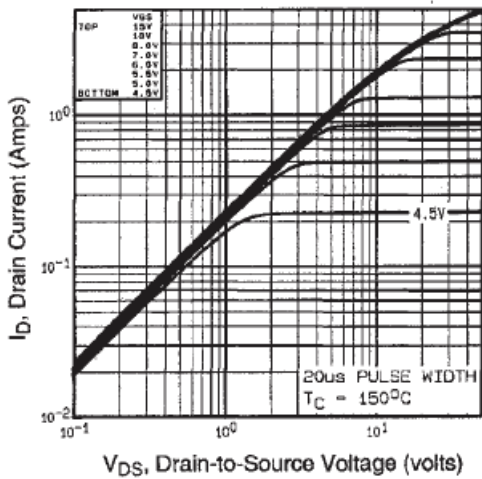


Fig. 2 - Typical Output Characteristics

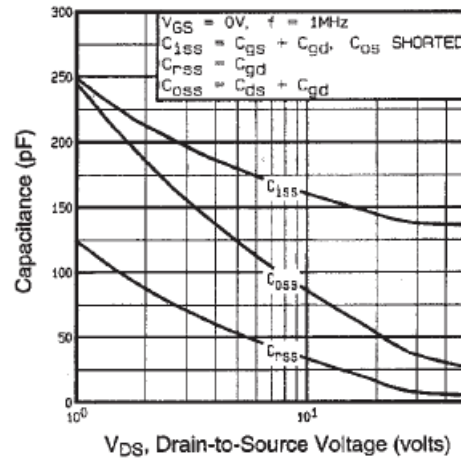


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

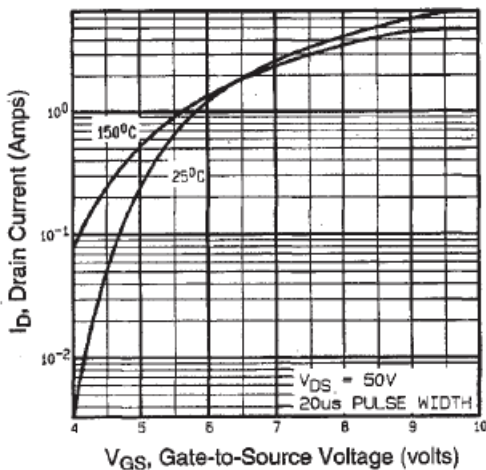


Fig. 3 - Typical Transfer Characteristics

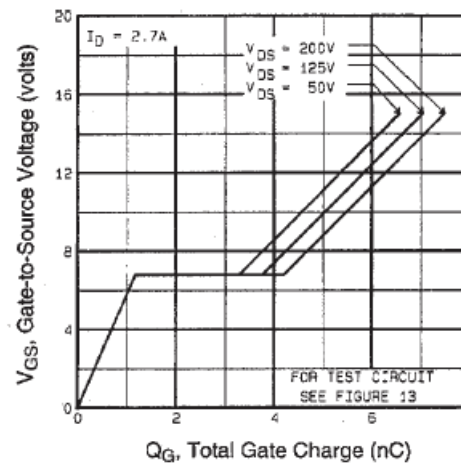


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

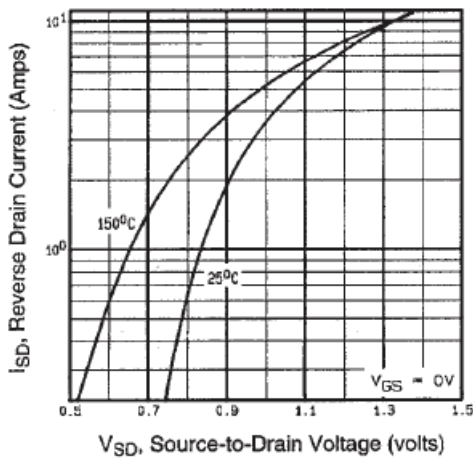


Fig. 7 - Typical Source-Drain Diode Forward Voltage

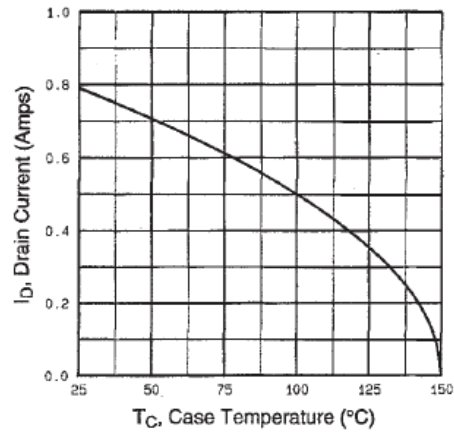


Fig. 9 - Maximum Drain Current vs. Case Temperature

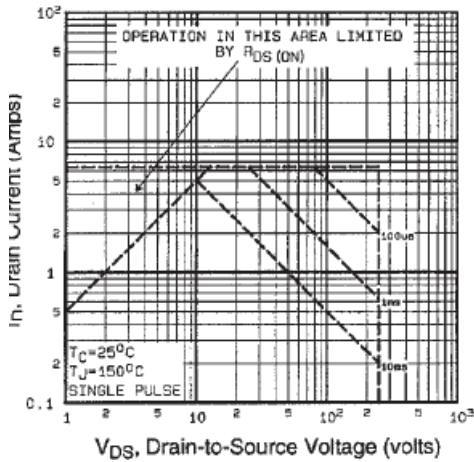


Fig. 8 - Maximum Safe Operating Area

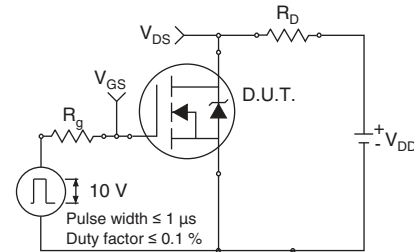


Fig. 10a - Switching Time Test Circuit

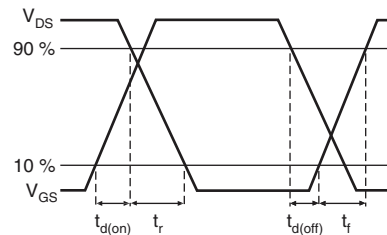


Fig. 10b - Switching Time Waveforms

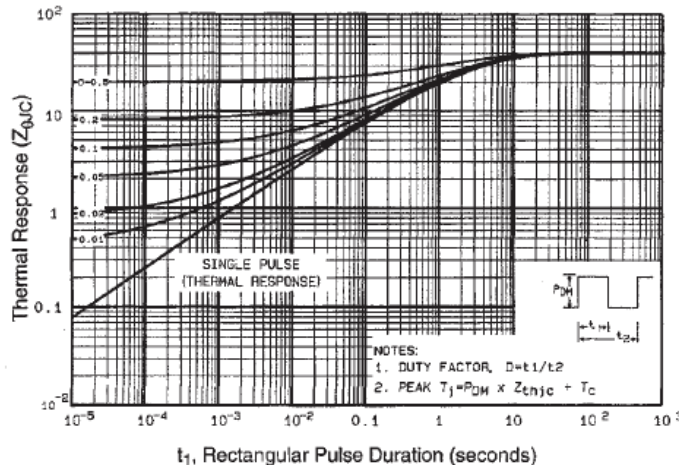


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

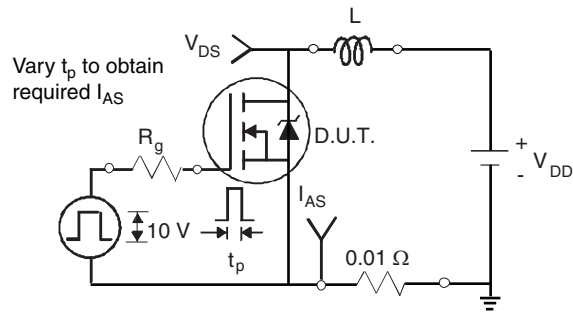


Fig. 12a - Unclamped Inductive Test Circuit

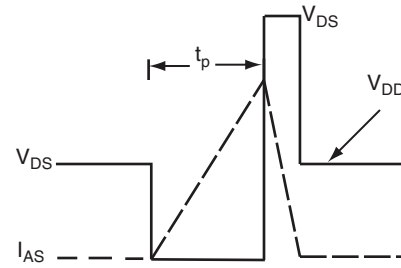


Fig. 12b - Unclamped Inductive Waveforms

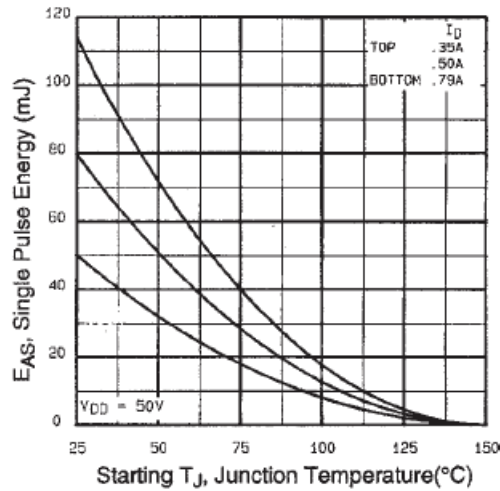


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

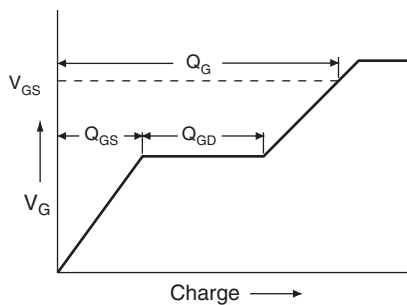


Fig. 13a - Basic Gate Charge Waveform

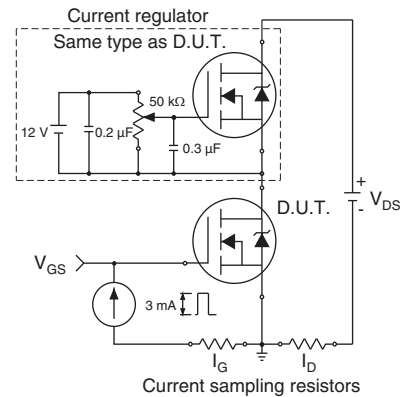
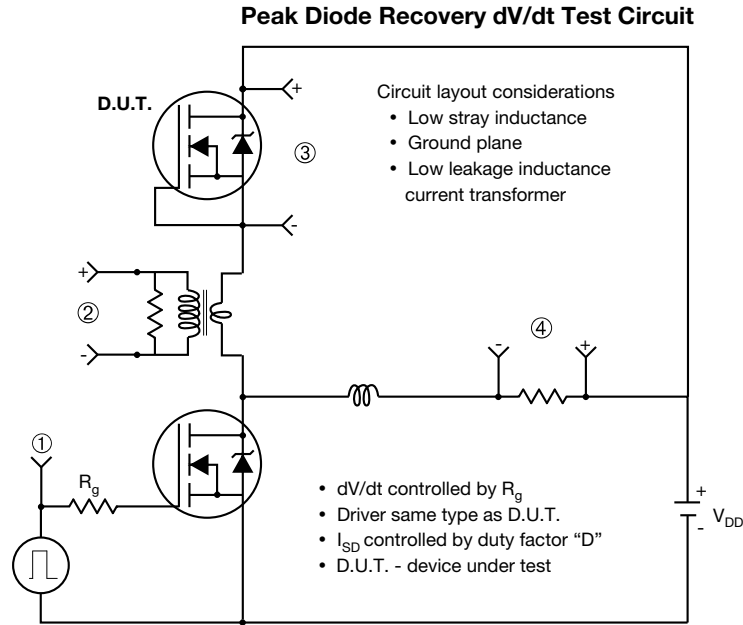


Fig. 13b - Gate Charge Test Circuit



**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig.14 - For N-Channel**

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## 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 |       |
| $\theta$ | -           | 10'  | -          | 10'   |

ECN: S-82109-Rev. A, 15-Sep-08  
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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