

ZRB500

Precision 5V micropower voltage reference

Description

The ZRB500 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRB500 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRB500 is recommended for operation between 50 μ A and 15mA and so is ideally suited to low power and battery powered applications.

Features

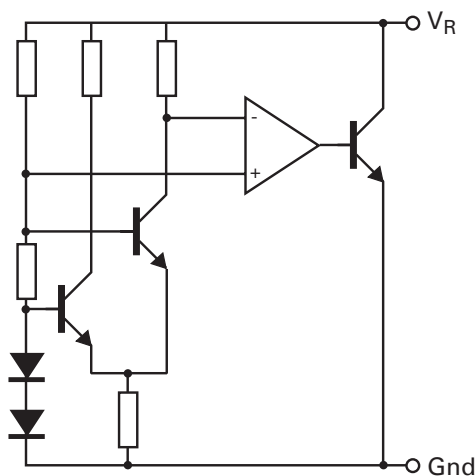
- $\pm 3\%$, 2% and 1% tolerance
- Operating current 50 μ A to 15mA
- Typical T_C 15ppm/ $^{\circ}$ C
- Transient response, stable in less than 10 μ s
- Industrial temperature range
- Small outline SOT23 and TO92 style packages

Excellent performance is maintained to an absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

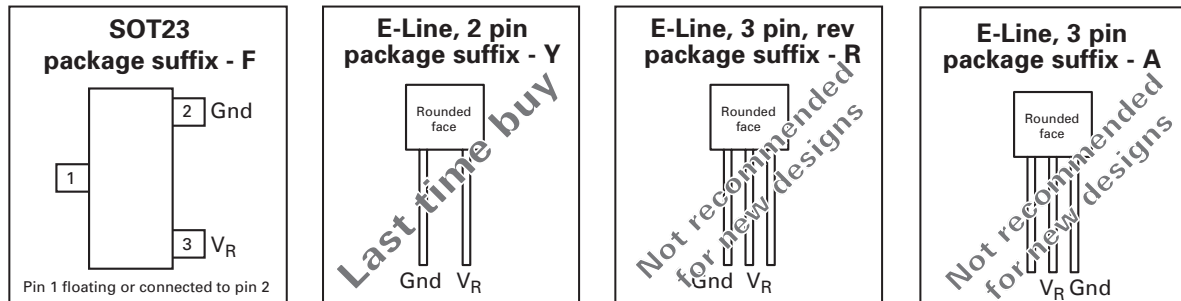
Applications

- Battery powered and portable equipment
- Metering and measurement systems
- Instrumentation
- Test equipment
- Data acquisition systems
- Precision power supplies

Typical application circuit



Connection diagrams



Ordering information

| Order reference | Tol. (%) | Device mark | Status (*) | Reel size (inches) | Quantity per reel | Tape width (mm) |
|-----------------|----------|-------------|------------|--------------------|-------------------|-----------------|
| ZRB500A01 | 1 | ZRB50001 | NRND | Loose | 4,000 | - |
| ZRB500A01STOA | 1 | ZRB50001 | NRND | 12.5 | 2,000 | - |
| ZRB500A01STOB | 1 | ZRB50001 | NRND | 12.5 | 2,000 | - |
| ZRB500A01STZ | 1 | ZRB50001 | NRND | Concertina pack | 2,000 | - |
| ZRB500A02 | 2 | ZRB50002 | NRND | Loose | 4,000 | - |
| ZRB500A02STOA | 2 | ZRB50002 | NRND | 12.5 | 2,000 | - |
| ZRB500A02STOB | 2 | ZRB50002 | NRND | 12.5 | 2,000 | - |
| ZRB500A02STZ | 2 | ZRB50002 | NRND | Concertina pack | 2,000 | - |
| ZRB500A03 | 3 | ZRB50003 | NRND | Loose | 4,000 | - |
| ZRB500A03STOA | 3 | ZRB50003 | NRND | 12.5 | 2,000 | - |
| ZRB500A03STOB | 3 | ZRB50003 | NRND | 12.5 | 2,000 | - |
| ZRB500A03STZ | 3 | ZRB50003 | NRND | Concertina pack | 2,000 | - |
| ZRB500F01TA | 1 | 50I | REL | 7 | 3,000 | 8 |
| ZRB500F01TC | 1 | 50I | REL | 13 | 10,000 | 8 |
| ZRB500F02TA | 2 | 50H | REL | 7 | 3,000 | 8 |
| ZRB500F02TC | 2 | 50H | REL | 13 | 10,000 | 8 |
| ZRB500F03TA | 3 | 50G | REL | 7 | 3,000 | 8 |
| ZRB500F03TC | 3 | 50G | REL | 13 | 10,000 | 8 |
| ZRB500R01 | 1 | ZRB500R1 | NRND | Loose | 4,000 | - |
| ZRB500R01STOA | 1 | ZRB500R1 | NRND | 12.5 | 2,000 | - |
| ZRB500R01STOB | 1 | ZRB500R1 | NRND | 12.5 | 2,000 | - |
| ZRB500R01STZ | 1 | ZRB500R1 | NRND | Concertina pack | 2,000 | - |
| ZRB500R02 | 2 | ZRB500R2 | NRND | Loose | 4,000 | - |
| ZRB500R02STOA | 2 | ZRB500R2 | NRND | 12.5 | 2,000 | - |
| ZRB500R02STOB | 2 | ZRB500R2 | NRND | 12.5 | 2,000 | - |
| ZRB500R02STZ | 2 | ZRB500R2 | NRND | Concertina pack | 2,000 | - |
| ZRB500R03 | 3 | ZRB500R3 | NRND | Loose | 4,000 | - |
| ZRB500R03STOA | 3 | ZRB500R3 | NRND | 12.5 | 2,000 | - |

ZRB500

Ordering information

| Order reference | Tol. (%) | Device mark | Status (*) | Reel size (inches) | Quantity per reel | Tape width (mm) |
|-----------------|----------|-------------|------------|--------------------|-------------------|-----------------|
| ZRB500R03STOB | 3 | ZRB500R3 | NRND | 12.5 | 2,000 | - |
| ZRB500R03STZ | 3 | ZRB500R3 | NRND | Concertina pack | 2,000 | - |
| ZRB500Y01 | 1 | ZRB50001 | LTB | Loose | 4,000 | - |
| ZRB500Y01STOA | 1 | ZRB50001 | LTB | 12.5 | 2,000 | - |
| ZRB500Y01STOB | 1 | ZRB50001 | LTB | 12.5 | 2,000 | - |
| ZRB500Y01STZ | 1 | ZRB50001 | LTB | Concertina pack | 2,000 | - |
| ZRB500Y02 | 1 | ZRB50002 | LTB | Loose | 4,000 | - |
| ZRB500Y02STOA | 2 | ZRB50002 | LTB | 12.5 | 2,000 | - |
| ZRB500Y02STOB | 2 | ZRB50002 | LTB | 12.5 | 2,000 | - |
| ZRB500Y02STZ | 2 | ZRB50002 | LTB | Concertina pack | 2,000 | - |
| ZRB500Y03 | 3 | ZRB50003 | LTB | Loose | 4,000 | - |
| ZRB500Y03STOA | 3 | ZRB50003 | LTB | 12.5 | 2,000 | - |
| ZRB500Y03STOB | 3 | ZRC50003 | LTB | 12.5 | 2,000 | - |
| ZRB500Y03STZ | 3 | ZRC50003 | LTB | Concertina pack | 2,000 | - |

NOTES:

(*) NRND Not recommended for new designs
REL Released
LTB Last time buy

Absolute maximum rating

| | | | |
|-----------------------|------------------------------|--|-------|
| Reverse current | 25mA | Power dissipation ($T_{amb} = 25^{\circ}\text{C}$) | |
| Forward current | 25mA | SOT23 | 330mW |
| Operating temperature | -40 to 85°C | | |
| Storage temperature | -55 to 125°C | | |

Electrical characteristics. Test conditions (unless otherwise stated) $T_{amb} = 25^{\circ}\text{C}$

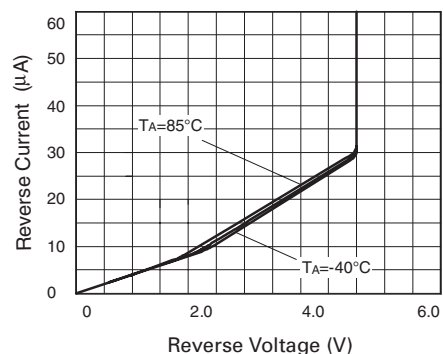
| Symbol | Parameter | Conditions | Limits | | | Tol. (%) | Units |
|-------------|---|---|--------|------|------|----------|-------------------------|
| | | | Min. | Typ. | Max. | | |
| V_R | Reverse breakdown voltage | $I_R = 150\mu\text{A}$ | 4.95 | 5.0 | 5.05 | 1 | V |
| | | | 4.90 | 5.0 | 5.10 | 2 | V |
| | | | 4.85 | 5.0 | 5.15 | 3 | V |
| I_{MIN} | Minimum operating current | | | 30 | 50 | | μA |
| I_R | Recommended operating current | | 0.05 | | 15 | | mA |
| $T_C^{(*)}$ | Average reverse breakdown voltage temperature coefficient | $I_{R(min)}$ to $I_{R(max)}$ | | 15 | 50 | | ppm/ $^{\circ}\text{C}$ |
| $R_S^{(t)}$ | Slope resistance | | | 0.33 | 1.5 | | Ω |
| Z_R | Reverse dynamic impedance | $I_R = 1\text{mA}$ $f = 100\text{Hz}$ $I_{AC} = 0.1I_R$ | | 0.4 | 1 | | Ω |
| E_N | Wideband noise voltage | $I_R = 150\mu\text{A}$ $f = 10\text{Hz}$ to 10kHz | | 105 | | | $\mu\text{V(rms)}$ |

NOTES:

$$(*) T_C = \frac{(V_{R(max)} - V_{R(min)}) \times 1000000}{V_R \times (T_{(max)} - T_{(min)})}$$

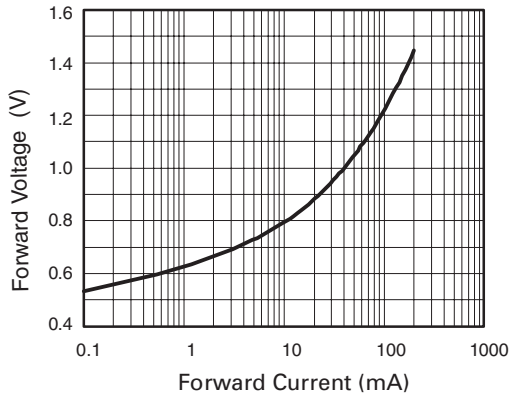
Note: $V_{R(max)} - V_{R(min)}$ is the maximum deviation in reference voltage measured over the full operating temperature range.

$$(t) R_S = \frac{V_R \text{ Change}(I_{R(min)} \text{ to } I_{R(max)})}{I_{R(max)} - I_{R(min)}}$$

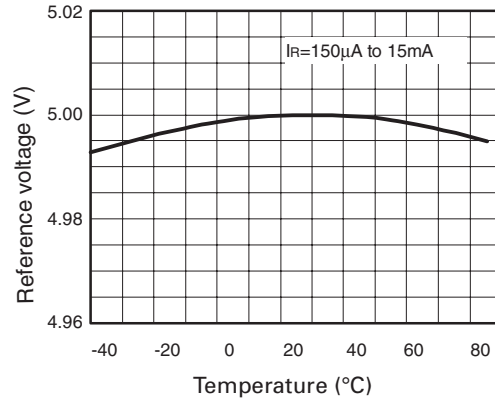


Reverse Characteristics

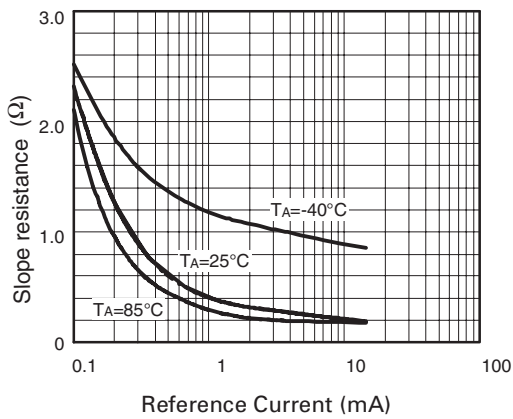
Typical characteristics



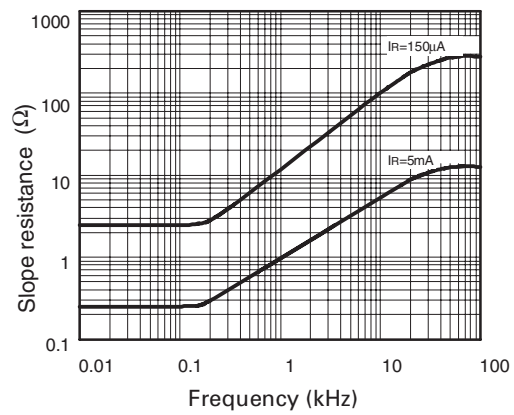
Forward Characteristics



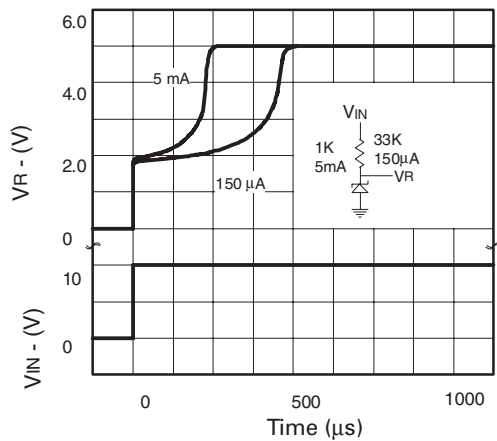
Temperature Drift



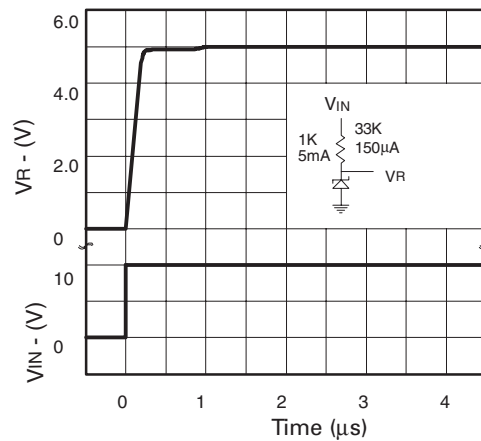
Slope Resistance v Current



Slope Resistance v Frequency

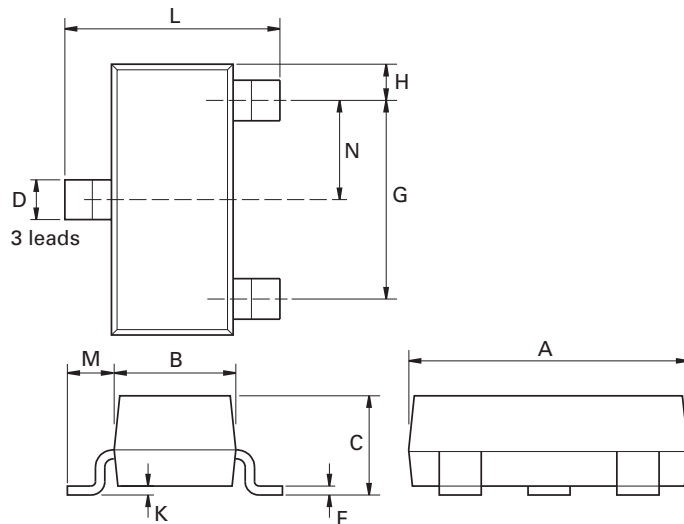


**Transient Response
(Single Pulse)**



**Transient Response
(Repetitive Pulse)**

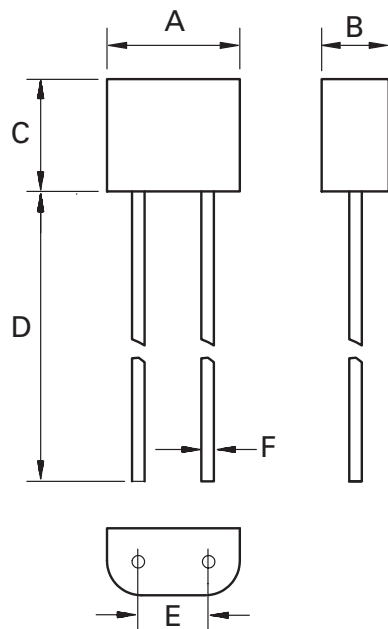
Package outline - SOT23



| Dim. | Millimeters | | Inches | | Dim. | Millimeters | | Inches | |
|------|-------------|------|-----------|--------|------|-------------|------|------------|--------|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Max. | Max. |
| A | 2.67 | 3.05 | 0.105 | 0.120 | H | 0.33 | 0.51 | 0.013 | 0.020 |
| B | 1.20 | 1.40 | 0.047 | 0.055 | K | 0.01 | 0.10 | 0.0004 | 0.004 |
| C | - | 1.10 | - | 0.043 | L | 2.10 | 2.50 | 0.083 | 0.0985 |
| D | 0.37 | 0.53 | 0.015 | 0.021 | M | 0.45 | 0.64 | 0.018 | 0.025 |
| F | 0.085 | 0.15 | 0.0034 | 0.0059 | N | 0.95 NOM | | 0.0375 NOM | |
| G | 1.90 NOM | | 0.075 NOM | | - | - | - | - | - |

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inch

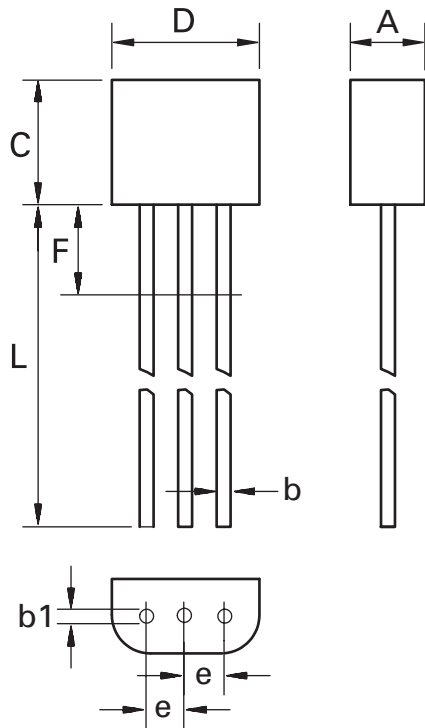
Package outline - E-Line, 2 pin



| DIM | Millimeters | | Inches | |
|-----|-------------|-------|----------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.37 | 4.77 | 0.17 | 0.18 |
| B | 2.16 | 2.41 | 0.085 | 0.095 |
| C | 3.61 | 4.01 | 0.14 | 0.16 |
| D | 13.00 | 13.97 | 0.51 | 0.55 |
| E | 2.54 NOM | | 0.10 NOM | |
| F | 0.37 | 0.495 | 0.015 | 0.019 |

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

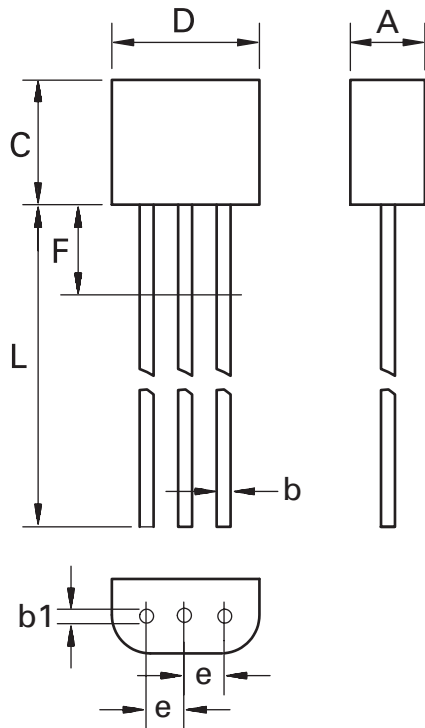
Package outline - E-Line, 3 pin, rev.



| DIM | Millimeters | | Inches | |
|-----|-------------|-------|-----------|--------|
| | Min. | Max. | Min. | Max. |
| A | 2.16 | 2.41 | 0.085 | 0.095 |
| b | 0.41 | 0.495 | 0.016 | 0.0195 |
| b1 | 0.41 | 0.495 | 0.016 | 0.0195 |
| D | 4.37 | 4.77 | 0.172 | 0.188 |
| E | 3.61 | 4.01 | 0.142 | 0.158 |
| e | 1.27 NOM | | 0.050 NOM | |
| F | — | 2.50 | — | 0.098 |
| L | 13.00 | 13.97 | 0.512 | 0.550 |

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

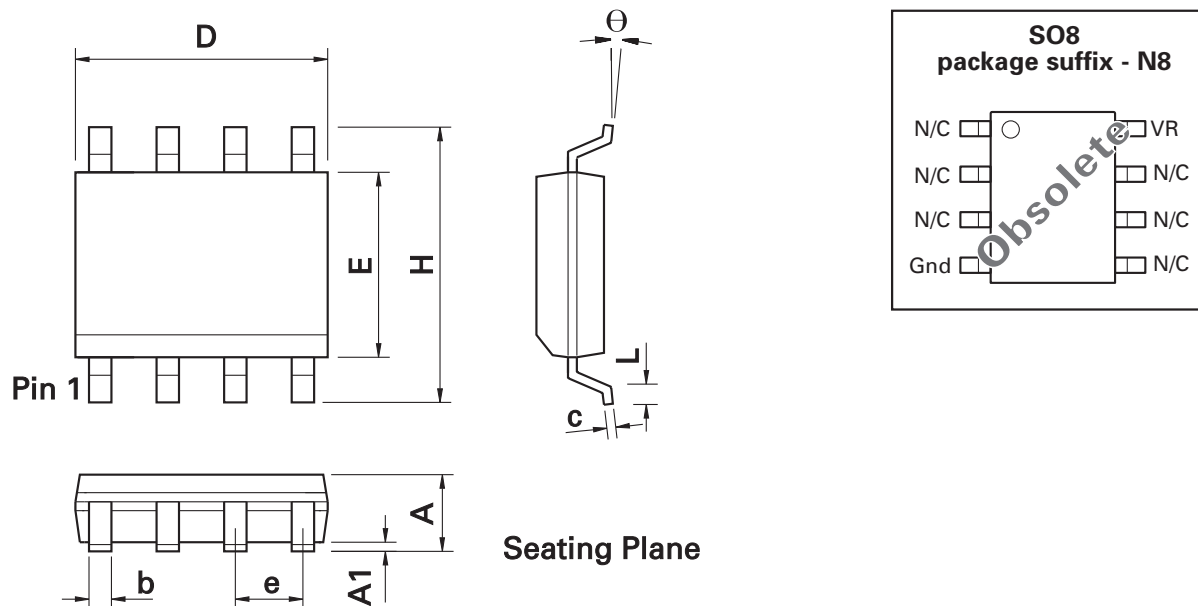
Package outline - E-Line, 3 pin



| DIM | Millimeters | | Inches | |
|-----|-------------|-------|-----------|--------|
| | Min. | Max. | Min. | Max. |
| A | 2.16 | 2.41 | 0.085 | 0.095 |
| b | 0.41 | 0.495 | 0.016 | 0.0195 |
| b1 | 0.41 | 0.495 | 0.016 | 0.0195 |
| D | 4.37 | 4.77 | 0.172 | 0.188 |
| E | 3.61 | 4.01 | 0.142 | 0.158 |
| e | 1.27 NOM | | 0.050 NOM | |
| F | — | 2.50 | — | 0.098 |
| L | 13.00 | 13.97 | 0.512 | 0.550 |

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

Package outline - SO8



| DIM | Inches | | Millimeters | | DIM | Inches | | Millimeters | |
|-----|--------|-------|-------------|------|-----|-----------|-------|-------------|------|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Min. | Max. |
| A | 0.053 | 0.069 | 1.35 | 1.75 | e | 0.050 BSC | | 1.27 BSC | |
| A1 | 0.004 | 0.010 | 0.10 | 0.25 | b | 0.013 | 0.020 | 0.33 | 0.51 |
| D | 0.189 | 0.197 | 4.80 | 5.00 | c | 0.008 | 0.010 | 0.19 | 0.25 |
| H | 0.228 | 0.244 | 5.80 | 6.20 | θ | 0° | 8° | 0° | 8° |
| E | 0.150 | 0.157 | 3.80 | 4.00 | h | 0.010 | 0.020 | 0.25 | 0.50 |
| L | 0.016 | 0.050 | 0.40 | 1.27 | - | - | - | - | - |

Note: Controlling dimensions are in inches. Approximate dimensions are provided in millimeters

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