

## 1 Description

The RedRock™ RR122-1B52-511 / 512 is a digital magnetic sensor ideal for use in medical, industrial, automotive, and consumer applications. It is based on patented Tunneling Magnetoresistance (TMR) technology with seamless CMOS integration.

The RR122-1B52-511 / 512 features an operate sensitivity of 30 G (3 mT), with an omnipolar magnetic field response. It offers a wide supply voltage range from 1.7 up to 5.5 V, ideal for applications ranging from small battery-powered electronics to industrial machinery. It has extremely low average current drain (1.2 μA) for an active magnetic sensor with an operating frequency of 250 Hz and high operating temperature ranges from -40°C up to +85°C\*.

\* Alternatively, the above part numbers are available as an RR122-1B53-511 / 512 which features a high operating temperature of +125°C. Contact Coto for details.

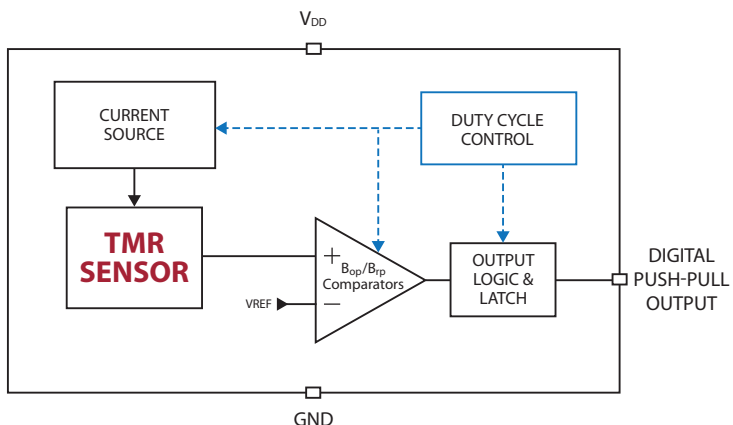
## Device Information

| Part Series    | Package  | Body Size (mm)     |
|----------------|----------|--------------------|
| RR122-1B52-511 | SOT-23-3 | 2.90 x 1.60 x 1.02 |
| RR122-1B52-512 | LGA-4    | 1.45 x 1.45 x 0.44 |

## Device Packages



**Functional Block Diagram for Digital Push-Pull Output**



## 2 Features

- ▶ Operate sensitivity of 30 G
- ▶ Lowest Average Current < 1.2 μA
- ▶ Wide Supply Voltage range of 1.7V – 5.5V
- ▶ Omnipolar Push-Pull Response
- ▶ Operating Frequency of 250 Hz
- ▶ Temperature Rated up to 85°C\*
- ▶ RoHS & REACH Compliant

## 3 Applications

- ▶ Proximity Detection
- ▶ Rotary Sensing
- ▶ Fluid Level Detection
- ▶ Door & Lid Closure Detection
- ▶ Utility Meters
- ▶ Motor Controllers
- ▶ Consumer Electronics

## Device Nomenclature

### Ordering Information

RR122-X X X X-YYY

| Series                            | Package                   |
|-----------------------------------|---------------------------|
| <b>Magnetic Polarity Response</b> | 1: SOT-23-3               |
| 1 = Omnipolar                     | 2: LGA-4                  |
| 2 = Unipolar                      | 5: SOT-23-5               |
| 3 = Bipolar/Latch                 | <b>Output Response</b>    |
| <b>Magnetic Sensitivity (G)</b>   | 1: Active Low             |
| A: Op 9, Rel 5                    | <b>Supply Voltage (V)</b> |
| E: Op 15, Rel 10                  | 5: 1.7 – 5.5              |
| B: Op 30, Rel 20                  | <b>Temp Rating (°C)</b>   |
| F: Op 70, Rel 50                  | 2: -40 – +85              |
| C: Op 10, Rel -10                 | 3: -40 – +125             |
| <b>Clock Frequency (Hz)</b>       |                           |
| 1: 2                              |                           |
| 2: 10                             |                           |
| 3: 20                             |                           |
| 5: 250                            |                           |
| 6: 500                            |                           |
| 7: 2500                           |                           |
| 9: 10000                          |                           |
| U: 100+Turbo (10000)              |                           |

## 4 Specifications

### 4.1 Absolute Environmental Ratings<sup>1,2</sup>

| Parameters   | Units | Min   | Typ | Max  |
|--|-------|-------|-----|------|
| Operating Temperature ( $T_{OP}$ )                     | °C    | -40   |     | +85  |
| Storage Temperature ( $T_{STG}$ )                      | °C    | -65   |     | +150 |
| Junction Temperature ( $T_J$ )                         | °C    |       |     | +150 |
| Soldering Temperature (3 cycles, 1 min.) ( $T_{SOL}$ ) | °C    |       |     | +260 |
| ESD Level Human Body Model per JESD22-A114             | V     | ±4000 |     |      |
| Junction-to-Ambient Thermal Resistance (LGA-4)         | °C/W  |       | 165 |      |
| Junction-to-Ambient Thermal Resistance (SOT-23-3)      | °C/W  |       | 215 |      |
| Magnetic Field Exposure                                | G     |       |     | 500  |

### 4.2 Absolute Electrical Ratings<sup>1,2</sup>

| Parameters                                     | Units | Min  | Typ | Max      |
|--|-------|------|-----|----------|
| Supply Voltage ( $V_{DD}$ )                    | V     | -0.3 |     | +5.5     |
| Push-pull Output (Active Low)( $V_{OUT\_PP}$ ) | V     | -0.3 |     | $V_{DD}$ |
| Input and Output Current ( $I_{IN}/I_{OUT}$ )  | mA    | -10  |     | +10      |

### 4.3 Operating Electrical Characteristics for RR122-1B52-511 / 512<sup>3</sup>

| Parameters   | Units | Min          | Typ  | Max          |
|--|-------|--------------|------|--------------|
| Supply Voltage ( $V_{DD}$ )  | V     | 1.7          |      | 5.5          |
| Power-On Time ( $t_{ON}$ )( $V_{DD} > 90\%$ )                        | μs    |              | 50   | 75           |
| Peak Power-On Current  | mA    |              |      | 1.4          |
| Active Mode Time ( $t_{ACT}$ )                                       | μs    |              | 400  |              |
| Output Voltage (High) ( $V_{OUTH}$ )                                 | V     | 90% $V_{DD}$ |      |              |
| Output Voltage (Low) ( $V_{OUTL}$ )                                  | V     |              |      | 10% $V_{DD}$ |
| Under Voltage Lockout Threshold Rising $V_{DD}$ ( $V_{UVLO-RISE}$ )  | V     |              | 1.6  | 1.65         |
| Under Voltage Lockout Threshold Falling $V_{DD}$ ( $V_{UVLO-FALL}$ ) | V     | 1.40         | 1.55 |              |
| Under Voltage Lockout Hysteresis ( $V_{UV-HYST}$ )                   | mV    |              | 50   |              |
| Average Supply Current @ $V_{DD} = 1.7$ V, $f_s = 250$ Hz            | μA    |              | 1.2  |              |
| Average Supply Current @ $V_{DD} = 3.0$ V, $f_s = 250$ Hz            | μA    |              | 1.3  |              |

#### Notes:

- Exceeding Absolute Ratings may cause permanent damage to the device.
- Unless otherwise specified, all characteristics are measured at 25°C.
- Unless otherwise specified,  $V_{DD} = 1.7$  V to 5.5 V,  $T_A = -40$ °C to +85°C. Typical values are  $V_{DD} = 3.0$  V and  $T_A = +25$ °C.



ESD Note: This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, proper ESD precautions should be taken to avoid performance degradation or loss of functionality. Damage due to inappropriate handling is not covered under warranty.

## 4 Specifications (cont.)

### 4.4 Operating Characteristics for RR122-1B52-511 / 512<sup>1,2</sup>

| Parameters                             | Units   | Min | Typ | Max |
|--|---------|-----|-----|-----|
| Switching Frequency ( $f_{sw}$ )       | Hz      | 165 | 250 | 300 |
| Active Mode Time ( $t_{ACT}$ )         | $\mu s$ |     | 400 |     |
| Idle Mode Time ( $t_{IDLE}$ )          | ms      |     | 4   |     |
| Operate Point ( $B_{OPN}$ )            | G       | 27  | 30  | 38  |
| Operate Point ( $B_{OPS}$ )            | G       | -38 | -30 | -27 |
| Release Point ( $B_{RPN}$ )            | G       | 18  | 20  | 27  |
| Release Point ( $B_{RPS}$ )            | G       | -27 | -20 | -18 |
| Hysteresis ( $B_{HYST}$ ) <sup>4</sup> | G       | 5   | 10  |     |

#### Notes:

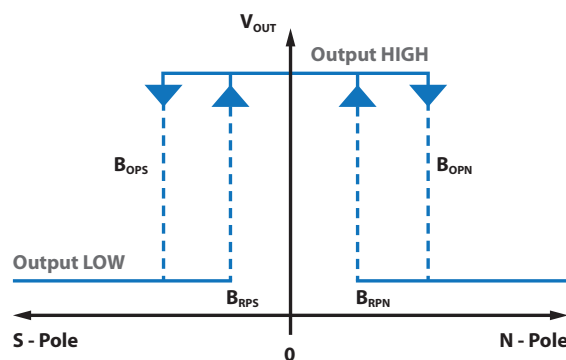
1. Unless otherwise specified,  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $T_A = -40^\circ\text{C to }+85^\circ\text{C}$ . Typical values are  $V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

2. Conditions:  $B_{HYST} = |B_{OP} - B_{RP}|$



ESD Note: This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, proper ESD precautions should be taken to avoid performance degradation or loss of functionality. Damage due to inappropriate handling is not covered under warranty.

## 5 Output Response vs. Magnetic Flux

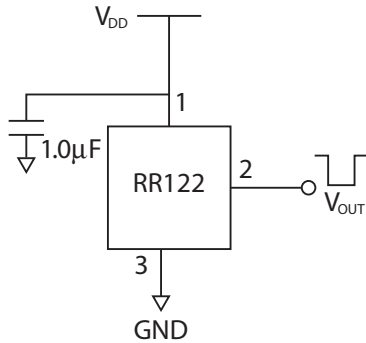


## 6 Application Information

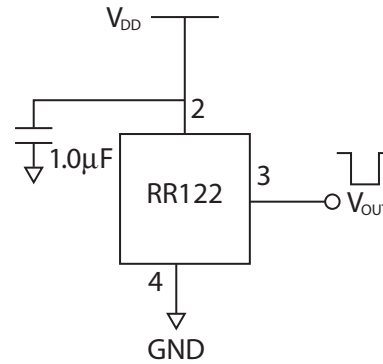
### RR122 Push-Pull Output Application Circuit

The output voltage on the RR122 is active low, meaning that while a sufficiently strong magnetic field is present, the output voltage is low. The output voltage can be connected to a digital I/O pin on a microcontroller. A decoupling capacitor between the supply voltage and ground is required with placement close to the magnetic sensor. A typical capacitor value of 1.0  $\mu$ F will suffice.

#### 6.1 Application Circuit (SOT-23-3)

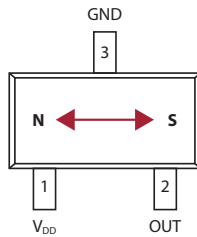


#### 6.2 Application Circuit (LGA-4)

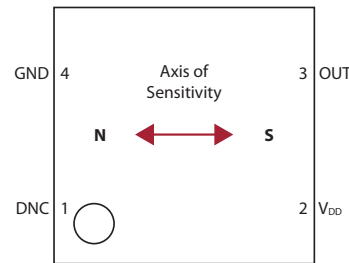


## 7 Axis of Sensitivity

### 7.1 SOT-23-3

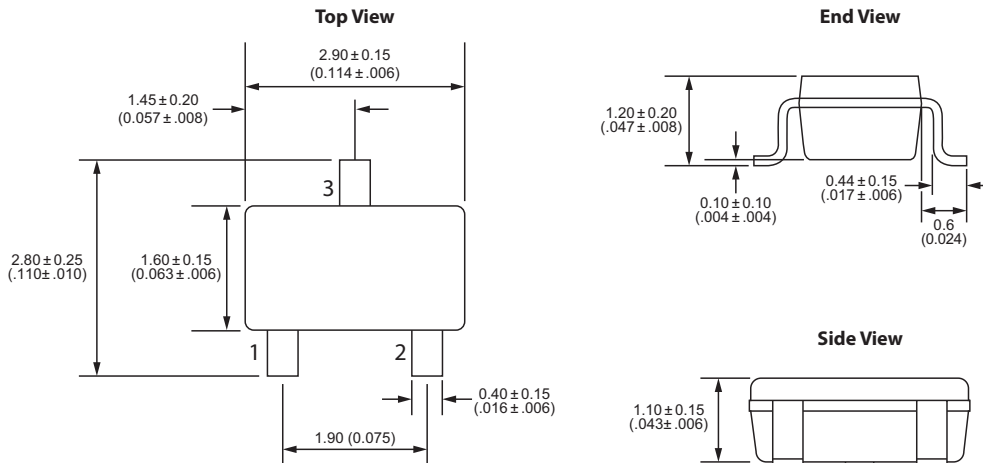


### 7.2 LGA-4



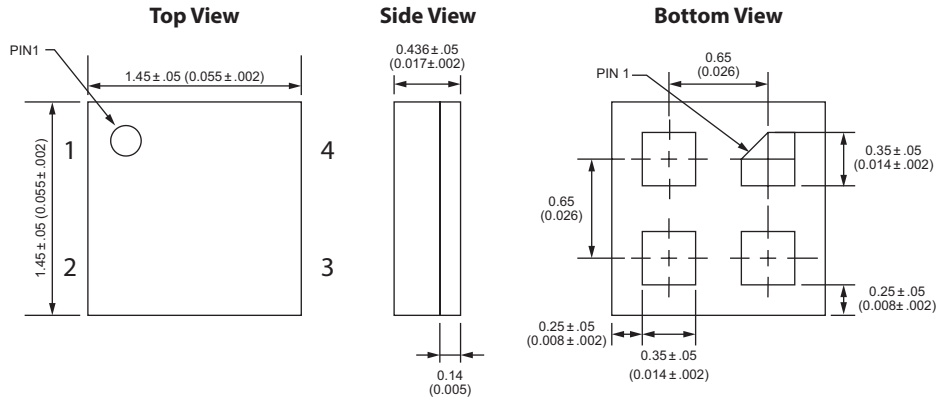
## 8 Dimensions *Millimeters (Inches)*

### 8.1 SOT-23-3 Package



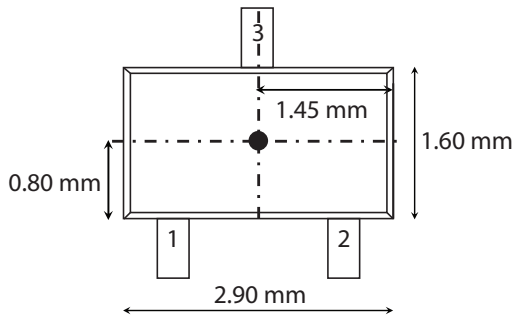
8 Dimensions *Millimeters (Inches)*

8.2 LGA-4 Package

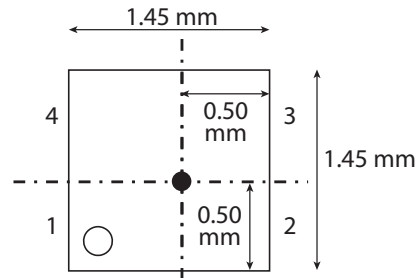


9 TMR Sensor Location

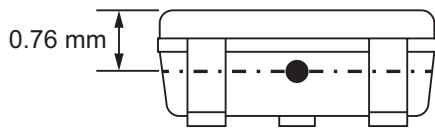
9.1 SOT-23-3 Package



9.2 LGA-4 Package



9.3 SOT Package - Side View



9.4 LGA Package - Side View



10 Output Behavior vs. Magnetic Field Diagrams

Output Behavior vs. Magnetic Field - Omnipolar

| Characteristics | Conditions                         | Output                 |
|-----------------|------------------------------------|------------------------|
| South Pole      | $B < B_{OPS}$<br>$0 > B > B_{RPS}$ | Low (ON)<br>High (OFF) |
| North Pole      | $B > B_{OPN}$<br>$0 < B < B_{RPN}$ | Low (ON)<br>High (OFF) |

## 11 TMR Sensor & Switch Packaging

### 11.1 SOT-23-3 Tape & Reel Packaging

Standard packaging is Tape & Reel containing 3,000 pieces. MSL Rating is 1.

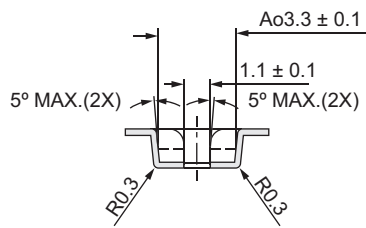
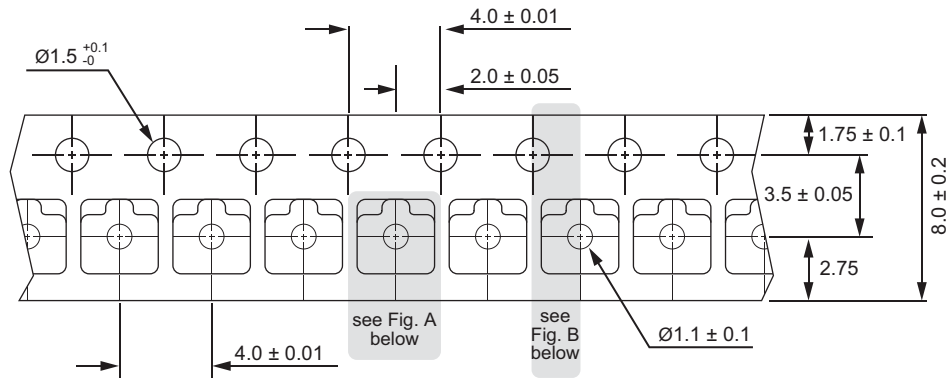


Fig. A

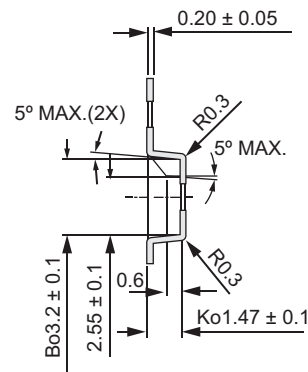
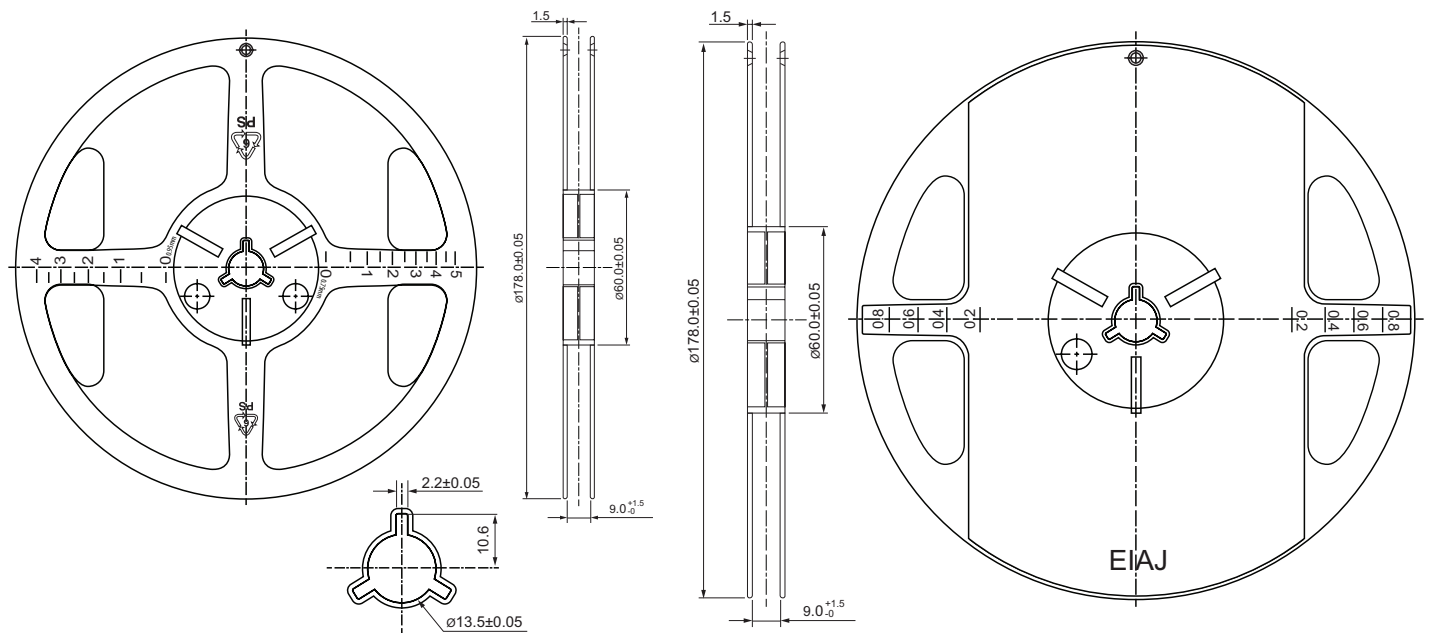


Fig. B





## 11 TMR Sensor & Switch Packaging

### 11.3 RedRock TMR Packaging

#### Box Dimensions – 14x10x6 inches

- Fits 1 to 3 reels = 3000 to 9000 pcs
- Weight for 3000 pcs = 0.90 kilos
- Weight for 9000 pcs = 1.00 kilos

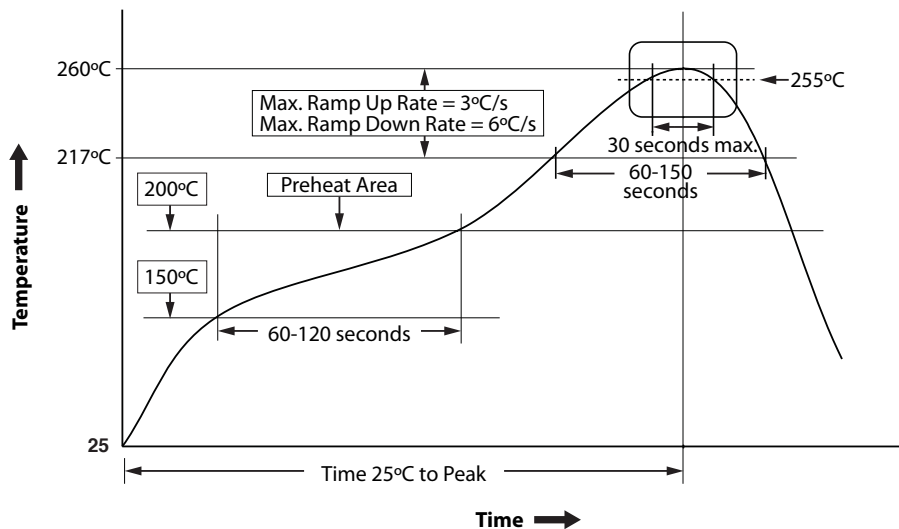
#### Box Dimensions – 18x14x12 inches

- Fits 4 to 24 reels = 12000 to 72000 pcs
- Weight for 12000 pcs = 1.50 kilos
- Weight for 72000 pcs = 4.90 kilos

## 12 Suggested Pb-Free Reflow Profile

### Notes:

1. Fully compatible with standard no-lead solder profile, 260°C for 30 seconds max (3 cycles max).
2. Profile shown as example. Users are advised to develop their own board-level profile.
3. Suggested Pb-free reflow profile derived from IPC/JEDEC J-STD-020E.
4. Temperature tolerance: +0°C, as measured at any point on the package or leads
5. MSL rating of 1 (SOT-23-3 only) compatible with J-STD-020 or equivalent.
6. MSL rating of 3 (LGA-4 and Leaded LGA-4) compatible with J-STD-020 or equivalent.
7. All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow (e.g., live-bug). If parts are reflowed in other than the normal live bug assembly reflow orientation (i.e., dead-bug),  $T_p$  shall be within  $\pm 2^\circ\text{C}$  of the live bug  $T_p$  and still meet the  $T_c$  requirements, otherwise, the profile shall be adjusted to achieve the latter. To accurately measure actual peak package body temperatures, refer to JEP140 for recommended thermocouple use.
8. Reflow profiles in this document are for classification/preconditioning and are not meant to specify board assembly profiles. Actual board assembly profiles should be developed based on specific process needs and board designs and should not exceed the parameters in this table.

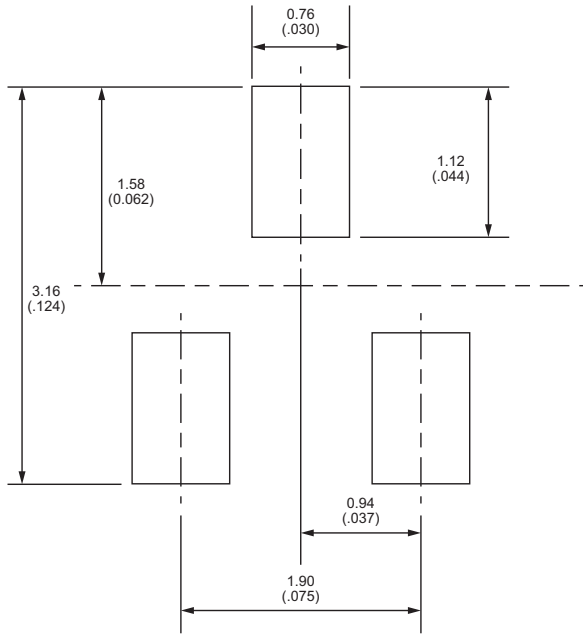




### 13 Suggested Solder Pad Layout

Dimensions in mm (inches)

#### 13.1 SOT-23-3 Solder Pad Layout



#### 13.2 LGA-4 Solder Pad Layout

