

## General Description

The AAT3520 series of PowerManager products is part of AnalogicTech's Total Power Management IC™ (TPMIC™) product family. These microprocessor reset circuits are ideal for monitoring voltage supplies in portable systems, where extended battery life is critical. They provide a low-cost, reliable solution by eliminating the need for external components. The AAT3520 series operates by monitoring the system power supply voltage. When the input voltage drops below a fixed threshold, the device asserts a reset signal for a fixed time period after  $V_{CC}$  has risen back above the fixed threshold; 30ms and 150ms minimum periods are available. The AAT3520 product series is guaranteed to operate down to 1.2V and is designed to ignore fast line transients appearing on  $V_{CC}$ . The AAT3520 series is available with three output stage versions: AAT3520 push-pull active high output; AAT3522 push-pull active low output; and AAT3524 open drain active low output. The quiescent supply current is extremely low, typically 1 $\mu$ A, making it ideal for portable battery-operated equipment.

The AAT3520/2/4 are available in a Pb-free, 3-pin SOT23 package and are specified over the -40°C to +85°C operating temperature range.

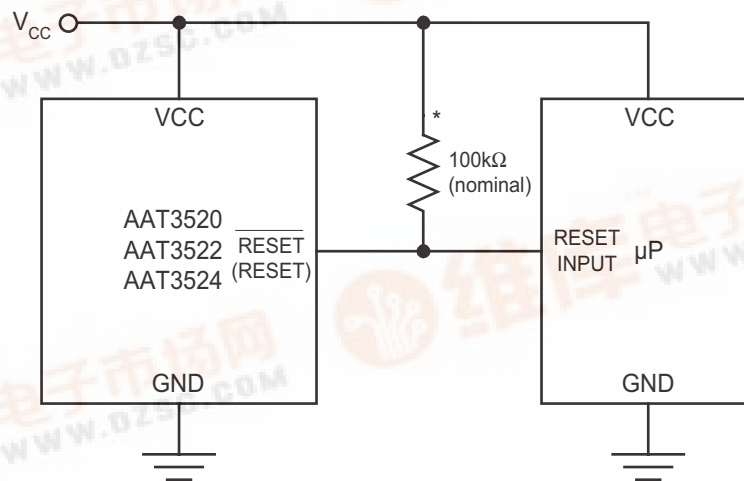
## Features

- Input Voltage Range: 1.2V to 5.5V
- Operation Down to 1.2V
- Extremely Low Quiescent Current: <2 $\mu$ A
- High Accuracy Detection Threshold:  $\pm 1.5\%$
- Monitor Power Supply Voltages
- Fixed Thresholds from 2.2V to 4.6V
- Reset Pulse Width Options
  - Minimum 30ms or 150ms
  - Fast Propagation Delay <20 $\mu$ s
- Available Output Configurations:
  - Open-Drain Output
  - CMOS Active High Output
  - CMOS Active Low Output
- Temperature Range: -40°C to +85°C
- 3-Pin SOT23 Package
- 4kV ESD Rating

## Applications

- Cell Phones
- Embedded Systems
- Intelligent Instruments
- Notebook Computers
- Portable Electronics

## Typical Application



\*AAT3524 Only

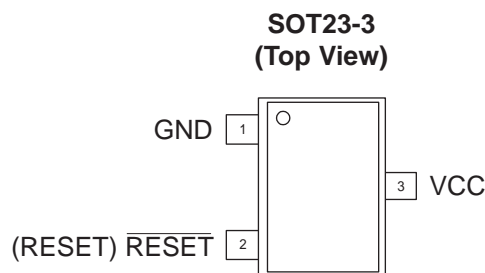
## Pin Descriptions

| Pin # | Symbol                   | Function  |
|-------|--------------------------|---|
| 1     | GND                      | Ground connection.  |
| 2     | RESET (AAT3520)          | RESET output remains high while $V_{CC}$ is below the reset threshold and remains so for a fixed time period after $V_{CC}$ raises above the reset threshold. |
|       | RESET (AAT3522, AAT3524) | RESET output remains low while $V_{CC}$ is below the reset threshold and remains so for a fixed time period after $V_{CC}$ raises above the reset threshold.  |
| 3     | VCC                      | Supply voltage (+1.2V to +5.5V). Due to extremely low operating current, place a 10nF capacitor between VCC and GND.  |

## Part Number Descriptions

| Part Number | Part Description                              |
|-------------|---|
| AAT3520     | Reset Output Push Pull Active High with Delay |
| AAT3522     | Reset Output Push Pull Active Low with Delay  |
| AAT3524     | Reset Output Open Drain Active Low with Delay |

## Pin Configuration



## Absolute Maximum Ratings<sup>1</sup>

T<sub>A</sub> = 25°C, unless otherwise noted.

| Symbol                           | Description                                      | Value                         | Units |
|----------------------------------|--|-------------------------------|-------|
| V <sub>CC</sub>                  | V <sub>CC</sub> to GND                           | -0.3 to 5.5                   | V     |
| V <sub>RESET</sub>               | RESET to GND (Push-Pull Output)                  | -0.3 to V <sub>CC</sub> + 0.3 | V     |
|                                  | RESET to GND (Open Drain Output)                 | -0.3 to 5.5                   |       |
| I <sub>MAX</sub>                 | Maximum Continuous Input Current                 | 20                            | mA    |
| I <sub>RESET</sub>               | RESET/RESET Current                              | 20                            | mA    |
| dV <sub>CC</sub> /d <sub>t</sub> | Rate of Rise of V <sub>CC</sub>                  | 100                           | V/μs  |
| T <sub>J</sub>                   | Operating Junction Temperature Range             | -40 to 150                    | °C    |
| T <sub>LEAD</sub>                | Maximum Soldering Temperature (at Leads) for 10s | 300                           | °C    |

## Thermal Information<sup>2</sup>

| Symbol          | Description                | Value | Units |
|-----------------|----------------------------|-------|-------|
| Θ <sub>JA</sub> | Maximum Thermal Resistance | 200   | °C/W  |
| P <sub>D</sub>  | Maximum Power Dissipation  | 320   | mW    |

1. Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum Rating should be applied at any one time.
2. Mounted on an FR4 board.

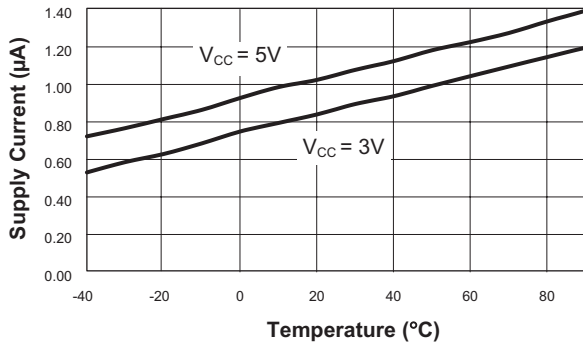
## Electrical Characteristics

$V_{IN} = 5V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted. Typical values are at  $T_A = 25^{\circ}C$ ;  $V_{CC} = 5V$  for 4.63/4.38V versions;  $V_{CC} = 3.3V$  for 3.08/2.93V versions;  $V_{CC} = 3.0V$  for 2.63V version;  $V_{CC} = 2.5V$  for 2.32/2.2V versions.

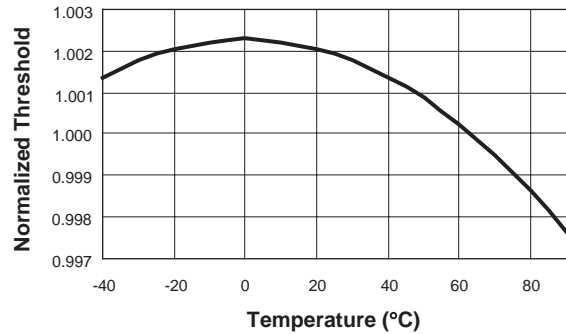
| Symbol                    | Description                                  | Conditions  | Min              | Typ      | Max              | Units            |
|---------------------------|--|---|------------------|----------|------------------|------------------|
| $V_{CC}$                  | Operation Voltage                            | $T_A = 0^{\circ}C$ to $+70^{\circ}C$  | 1.0              |          | 5.5              | V                |
|                           |  | $T_A = -40^{\circ}C$ to $+85^{\circ}C$  | 1.2              |          | 5.5              |                  |
| $I_Q$                     | Quiescent Current                            | $V_{CC} = 5.5V$   |                  | 1.05     | 3                | $\mu A$          |
|                           |  | $V_{CC} = 3V$   |                  | 0.85     | 2                |                  |
| $V_{TH}$                  | RESET Threshold (Table 1)                    | $T_A = 25^{\circ}C$   | $V_{TH} - 1.5\%$ | $V_{TH}$ | $V_{TH} + 1.5\%$ | V                |
|                           |  | $T_A = -40^{\circ}C$ to $+85^{\circ}C$  | $V_{TH} - 2.5\%$ | $V_{TH}$ | $V_{TH} + 2.5\%$ |                  |
| $\Delta V_{TH}/^{\circ}C$ | RESET Threshold Temperature Coefficient      |   |                  | 40       |                  | ppm/ $^{\circ}C$ |
| $t_P$                     | RESET Propagation Delay                      | $V_{CC} = V_{TH}$ to $(V_{TH} - 100mV)$   |                  | 15       |                  | $\mu s$          |
| $t_{RDY}$                 | RESET Active Timeout Period                  | -50 Option  | 30               | 50       | 100              | ms               |
|                           |  | -200 Option   | 150              | 250      | 400              |                  |
| $V_{OL}$                  | RESET Low Output Voltage<br>AAT3522, AAT3524 | $I_{SINK} = 1.2mA$ , $V_{CC} = V_{TH(min)}$ ,<br>$V_{TH} \leq 3.08V$ , RESET Asserted     |                  |          | 0.3              | V                |
|                           |  | $I_{SINK} = 3.2mA$ , $V_{CC} = V_{TH(min)}$ ,<br>$V_{TH} > 3.08V$ , RESET Asserted        |                  |          | 0.4              |                  |
| $V_{OH}$                  | RESET High Output Voltage<br>AAT3522         | $I_{SOURCE} = 800\mu A$ , $V_{TH} > 3.08V$ ,<br>$V_{CC} > V_{TH(max)}$                    | $V_{CC} - 1.5$   |          |                  | V                |
|                           |  | $I_{SOURCE} = 500\mu A$ , $V_{TH} \leq 3.08V$ ,<br>$V_{CC} > V_{TH(max)}$                 | $0.8 V_{CC}$     |          |                  |                  |
| $V_{OL}$                  | RESET Low Output Voltage<br>AAT3520          | $I_{SINK} = 1.2mA$ , $V_{CC} > V_{TH(max)}$ ,<br>$V_{TH} \leq 3.08V$ , RESET Not Asserted |                  |          | 0.3              | V                |
|                           |  | $I_{SINK} = 3.2mA$ , $V_{CC} > V_{TH(max)}$ ,<br>$V_{TH} > 3.08V$ , RESET Not Asserted    |                  |          | 0.4              |                  |
| $V_{OH}$                  | RESET High Output Voltage<br>AAT3520         | $I_{SOURCE} = 500\mu A$ , $V_{CC} > 2.1V$ ,<br>RESET Asserted                             | $0.8V_{CC}$      |          |                  | V                |
|                           |  | $I_{SOURCE} = 50\mu A$ , $V_{CC} > 1.2V$ ,<br>RESET Asserted                              | $0.8V_{CC}$      |          |                  |                  |
| $I_{DOFF}$                | RESET Leakage Current<br>AAT3524             | $V_{CC} > V_{TH}$   |                  |          | 1                | $\mu A$          |

## Typical Characteristics

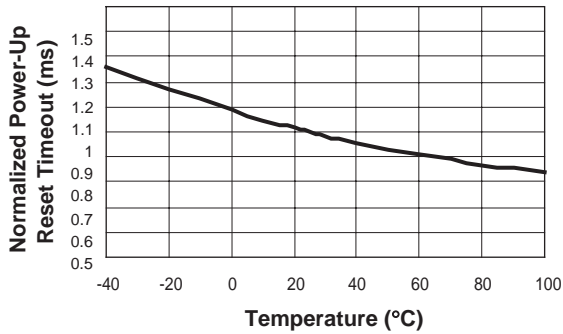
Supply Current vs. Temperature



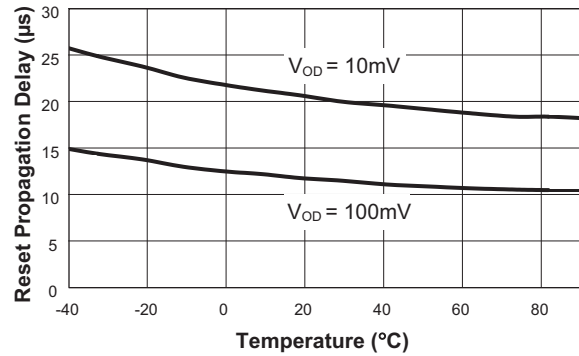
Normalized Reset Threshold vs. Temperature



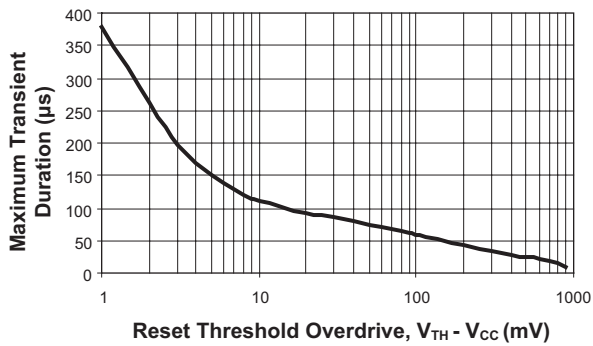
Normalized Power-Up Reset Timeout vs. Temperature



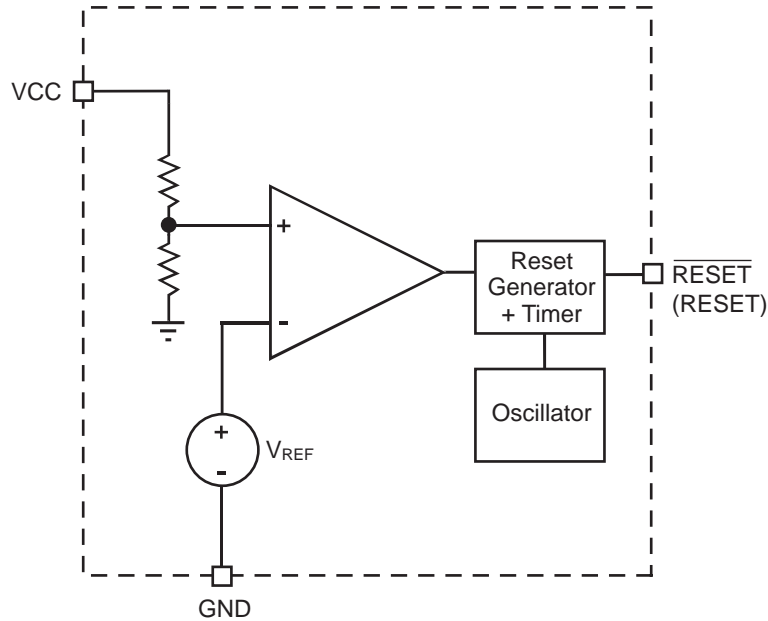
Power-Down Reset Propagation Delay vs. Temperature



Maximum Transient Duration vs. Reset Threshold Overdrive



## Functional Block Diagram



## Functional Description

### General

During start-up, the reset pin on a microprocessor ensures that it is fully reset and starts up in a known condition. The AAT3520 series of microprocessor reset devices monitor the supply voltage to a microprocessor and assert a reset signal whenever the

$V_{CC}$  voltage falls below a factory-programmed threshold. This threshold is accurate within  $\pm 1.5\%$  at  $25^{\circ}\text{C}$  and within  $\pm 2.5\%$  over the entire operating temperature range. The reset signal remains asserted for a fixed time period ( $t_{RDY}$ ) after  $V_{CC}$  has risen above the threshold, as shown in Figure 1. See Ordering Information for available RESET active timeout periods

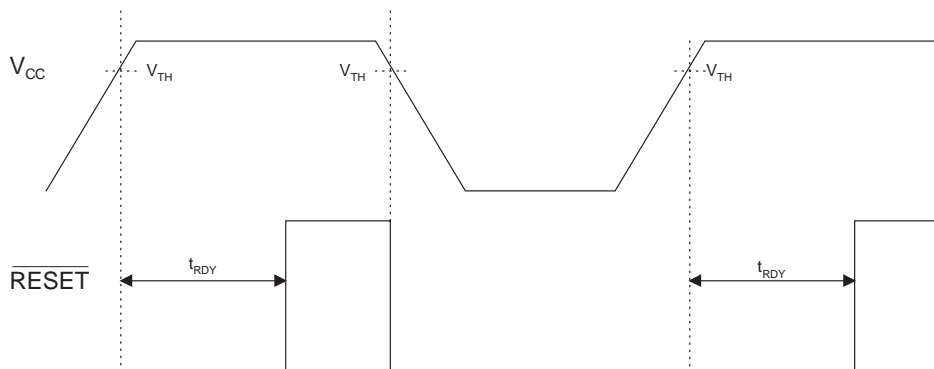


Figure 1: Reset Timing Diagram (AAT3522, AAT3524).

## Applications Information

### Reset Output Options

The AAT3524 has an active low open drain output and the AAT3520/2 have a push-pull output. The AAT3524 may be used in multiple voltage systems with an external pull-up resistor. This allows the AAT3524 to interface to microprocessors with higher supply voltages up to 5.5V (Figure 3). In the event of a power down or brown-out condition, the reset signal remains valid until the  $V_{CC}$  drops below 1.2V. To ensure validity down to ground, an external 100kΩ resistor should be connected between the RESET output and GND.

### Supply Voltage Transient Behavior

In some cases, fast negative transients of short duration can appear on the  $V_{CC}$  power supply. The AAT3520 series devices provide some immunity to line transients which can generate invalid reset pulses. Figure 1 shows typical behavior to short duration pulses versus RESET comparator overdrive. As shown in the Maximum Transient Duration vs. Reset Threshold Overdrive graph, when the transient voltage becomes larger, the time allowed before asserting a reset becomes shorter (i.e., typically a transient of 100mV below the reset threshold would have to present for more than 50μs to cause a reset). Immunity can be increased by the addition of a small bypass capacitor of 0.1μF connected as closely to the  $V_{CC}$  pin as possible.

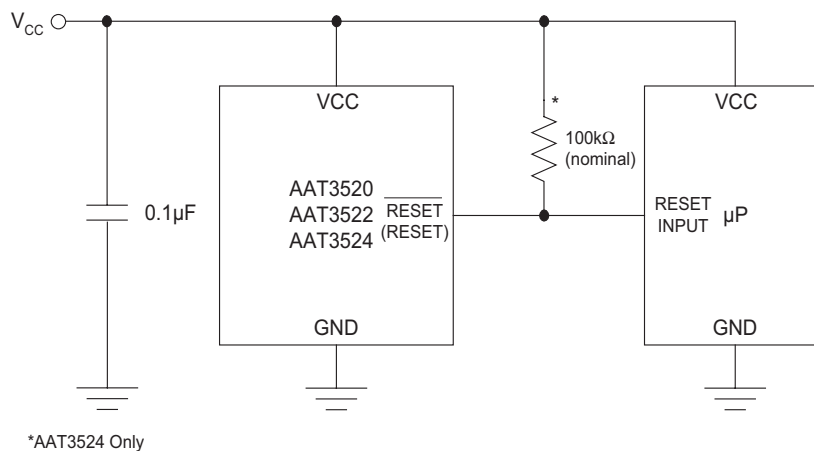


Figure 2: Using Recommended Bypass Capacitor.

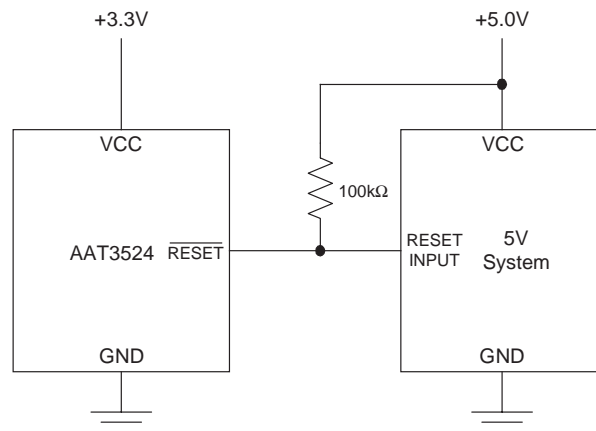


Figure 3: Using AAT3524 Open Drain Output with Multiple Supplies.

**Factory Trimmed Reset Thresholds<sup>1</sup> and Ordering Information**

| Ordering Part Number <sup>2</sup>  | Marking <sup>3</sup>                      | Minimum Reset Active (ms)     | Reset Threshold Voltage, V <sub>TH</sub> (V) |       |       |                                 |       |
|--|---|-------------------------------|--|-------|-------|---------------------------------|-------|
|  |   |                               | T <sub>A</sub> = 25°C                        |       |       | T <sub>A</sub> = -40°C to +85°C |       |
|  |   |                               | Min  | Typ   | Max   | Min                             | Max   |
| <b>AAT3522IGY-2.20-200-T1</b>  | DBXYY                                     | 150                           | 2.167  | 2.200 | 2.233 | 2.145                           | 2.255 |
| AAT3520IGY-2.32-200-T1<br><b>AAT3522IGY-2.32-200-T1</b><br>AAT3524IGY-2.32-200-T1  | DTXYY                                     | 150<br>150<br>150             | 2.285  | 2.320 | 2.355 | 2.262                           | 2.378 |
| <b>AAT3522IGY-2.45-200-T1</b>  | DXXYY                                     | 150                           | 2.413  | 2.450 | 2.487 | 2.389                           | 2.511 |
| <b>AAT3520IGY-2.63-200-T1</b><br><b>AAT3522IGY-2.63-200-T1</b><br>AAT3524IGY-2.63-200-T1   | GNXYY<br>CAXYY<br>CWXYY                   | 150<br>150<br>150             | 2.591  | 2.630 | 2.669 | 2.564                           | 2.696 |
| <b>AAT3520IGY-2.93-200-T1</b><br><b>AAT3522IGY-2.93-50-T1</b><br><b>AAT3522IGY-2.93-200-T1</b><br>AAT3524IGY-2.93-200-T1                                 | CZXYY<br>FVXYY<br>CCXYY<br>FPXYY          | 150<br>30<br>150<br>150       | 2.886  | 2.930 | 2.974 | 2.857                           | 3.003 |
| <b>AAT3520IGY-3.08-50-T1</b><br><b>AAT3520IGY-3.08-200-T1</b><br><b>AAT3522IGY-3.08-50-T1</b><br><b>AAT3522IGY-3.08-200-T1</b><br>AAT3524IGY-3.08-200-T1 | EFXYY<br>CNXYY<br>CYXYY<br>CBXYY<br>BGXYY | 30<br>150<br>30<br>150<br>150 | 3.034  | 3.080 | 3.126 | 3.003                           | 3.157 |
| AAT3520IGY-4.38-200-T1<br><b>AAT3522IGY-4.38-200-T1</b><br>AAT3524IGY-4.38-200-T1  | FUXYY<br>IVXYY                            | 150<br>150<br>150             | 4.314  | 4.380 | 4.446 | 4.271                           | 4.490 |
| <b>AAT3520IGY-4.63-200-T1</b><br><b>AAT3522IGY-4.63-200-T1</b><br>AAT3524IGY-4.63-200-T1   | HKXYY<br>DAXYY<br>DUXYY                   | 150<br>150<br>150             | 4.561  | 4.630 | 4.699 | 4.514                           | 4.746 |



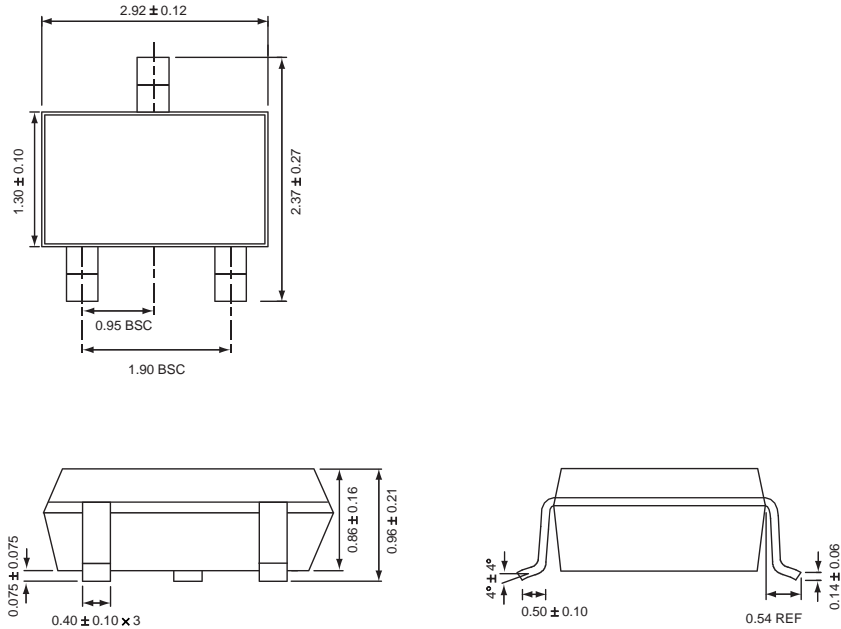
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1. Contact Local Sales Office for custom trimmed options.
2. Sample stock is generally held on part numbers listed in **BOLD**.
3. XYY = assembly and date code.



**Package Information**

**SOT23-3**



All dimensions in millimeters.

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