

# FM809/810

## 3-Pin $\mu$ C Supervisor Circuits

### General Description

The FM809/810 are supervisor circuits that monitor power supply or other system voltages and issue reset pulse whenever the voltage being monitored is out of tolerance. Once asserted, the reset pulse is guaranteed to be valid for a minimum of 140ms (256ms typical). FM809xx offers active low push-pull type of reset while FM810xx offers active high push-pull type. Several threshold voltages are offered to accommodate 5.0V, 3.3V, 3.0V and 2.7V system voltages.

The low supply current (typically 2  $\mu$ A) recommends FM809/810 devices for portable designs or wherever power saving is primary.

These devices are offered in space saving 3-pin SOT23 and SC70 packages.

### Features

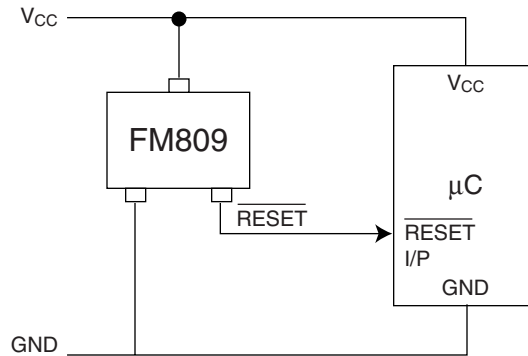
- $V_{TH}$  voltages of 4.63V, 4.38V, 4.00V, 3.08V, 2.93V and 2.63V
- $\overline{RESET}$  (FM809) or RESET (FM810) output

- 140ms power-on RESET delay (minimum)
- $\overline{RESET}$  operation guaranteed to 1.0V
- Supply current only 2 $\mu$ A
- No external components
- Operating Range
  - -40°C to +105°C (SOT23)
  - -40°C to +85°C (SC70)
- SOT23-3 and SC70-3 packages

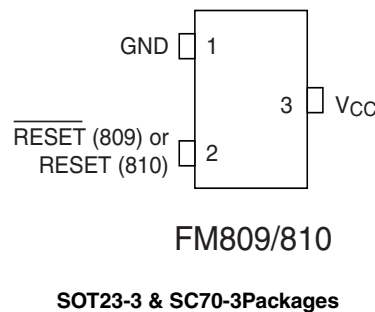
### Applications

- Microcontrollers and Microprocessors
- Appliances
- Power-Supply Monitoring
- Portable Equipment
- Automotive Systems

### Typical Operating Circuit



### Connection Diagram



## Absolute Maximum Ratings

|  |                              |  |   |
|--|------------------------------|--|---|
| Voltage on any terminal relative to GND          |                              | ESD Rating   |   |
| $V_{CC}$   | -0.3V to +6.0V               | Human Body Model   | $\geq 2$ KV                                   |
| RESET, $\overline{\text{RESET}}$                 | -0.3V to ( $V_{CC} + 0.3$ )V | Machine Model  | $\geq 200$ KV                                 |
| Input Current                                    | 20mA                         | Rate of Rise of $V_{CC}$   | 100V/ $\mu$ s                                 |
| Output Current: RESET, $\overline{\text{RESET}}$ | 20mA                         | Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )         |   |
|  |                              | SOT23-3 (derate 4mW/ $^\circ\text{C}$ above +70 $^\circ\text{C}$ ) | 320mW   |
|  |                              | Operating Temperature Range  | -40 $^\circ\text{C}$ to +105 $^\circ\text{C}$ |
|  |                              | Storage Temperature Range  | -65 $^\circ\text{C}$ to +150 $^\circ\text{C}$ |
|  |                              | Lead Temperature (soldering, 10s)                                  | +300 $^\circ\text{C}$                         |

These are stress ratings only, and functional operation is not implied for these levels or beyond. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

## Electrical Characteristics SOT23 Package ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

$V_{CC}$  = full range, as noted under conditions. See Note 1.

| Parameter                                       | Symbol   | Conditions   | Min  | Typ (Note 3) | Max  | Units                 |   |
|---|----------|--|--|--------------|------|-----------------------|---|
| Operating Voltage                               | $V_{CC}$ | $T_A = 0^\circ\text{C}$ to +70 $^\circ\text{C}$                                    | 1.0  |              | 5.5  | V                     |   |
|   |          | $T_A = -40^\circ\text{C}$ to 105 $^\circ\text{C}$                                  | 1.1  |              | 5.5  |                       |   |
| Supply Current                                  | $I_{CC}$ | $T_A = -40^\circ\text{C}$ to 105 $^\circ\text{C}$ , $V_{CC} < 5.5$ V<br>FM809J/L/M |  | 5            | 10   | $\mu$ A               |   |
|   |          | $T_A = -40^\circ\text{C}$ to 105 $^\circ\text{C}$ , $V_{CC} < 3.6$ V<br>FM809R/S/T |  | 2            | 6    |                       |   |
| Reset Threshold                                 | $V_{TH}$ | FM8xxL   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 4.40         | 4.63 | 4.86                  | V |
|   |          | FM8xxM   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 4.18         | 4.38 | 4.52                  |   |
|   |          | FM8xxJ   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 3.90         | 4.00 | 4.18                  |   |
|   |          | FM8xxT   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 2.97         | 3.08 | 3.19                  |   |
|   |          | FM8xxS   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 2.79         | 2.93 | 3.00                  |   |
|   |          | FM8xxR   | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$ | 2.49         | 2.63 | 2.70                  |   |
| Reset Threshold Tempco                          |          |  |  | 30           |      | ppm/ $^\circ\text{C}$ |   |
| $V_{CC}$ to Reset Delay (Note 2)                |          | $V_{CC} = V_{TH}$ to ( $V_{TH} - 100$ mV)  |  | 10           | 15   | $\mu$ s               |   |
| Reset Active Timeout Period                     |          | $T_A = -40^\circ\text{C}$ to +105 $^\circ\text{C}$                                 | 140  | 256          | 560  | ms                    |   |
| FM809 Output Low ( $\overline{\text{RESET}}$ )  | $V_{OL}$ | $V_{CC} = V_{TH}(\text{min})$ , $I_{SINK} = 1.2$ mA,<br>FM809R/S/T                 |  |              | 0.3  | V                     |   |
|   |          | $V_{CC} = V_{TH}(\text{min})$ , $I_{SINK} = 3.2$ mA,<br>FM809J/L/M                 |  |              | 0.4  |                       |   |
|   |          | $V_{CC} < 1.0$ V, $I_{SINK} = 50$ $\mu$ A  |  |              | 0.3  |                       |   |
| FM809 Output High ( $\overline{\text{RESET}}$ ) | $V_{OH}$ | $V_{CC} > V_{TH}(\text{max})$ , $I_{SOURCE} = 500$ $\mu$ A (R/S/T)                 | 0.8 $V_{CC}$                                       |              |      | V                     |   |
|   |          | $V_{CC} > V_{TH}(\text{max})$ , $I_{SOURCE} = 800$ $\mu$ A (J/M/L)                 | $V_{CC} - 1.5$ V                                   |              |      |                       |   |
| FM810 Output Low ( $\overline{\text{RESET}}$ )  | $V_{OL}$ | $V_{CC} = V_{TH}(\text{max})$ , $I_{SINK} = 1.2$ mA,<br>FM810R/S/T                 |  |              | 0.3  | V                     |   |
|   |          | $V_{CC} = V_{TH}(\text{max})$ , $I_{SINK} = 3.2$ mA,<br>FM810J/L/M                 |  |              | 0.4  |                       |   |
| FM810 Output High ( $\overline{\text{RESET}}$ ) | $V_{OH}$ | $1.8\text{V} < V_{CC} < V_{TH}(\text{min})$ , $I_{SOURCE} = 150$ $\mu$ A           | 0.8 $V_{CC}$                                       |              |      | V                     |   |

**Note 1:** Testing in production is 25 $^\circ\text{C}$  only.  $V_{CC} = 5$ V for FM8xxL/M/J,  $V_{CC} = 3.3$ V for FM8xxT/S and  $V_{CC} = 3$ V for FM8xxR. Limits over temperature are guaranteed by design.

**Note 2:**  $\overline{\text{RESET}}$  output is for FM809. RESET output is for FM810.

**Note 3:** Typical values are at 25 $^\circ\text{C}$ .

**Note 4:** Recommended minimum slew rate for the  $V_{CC}$  rampup is 200mV/sec in the 0 to 2V range for the device to function properly.

## Absolute Maximum Ratings

|  |                              |  |                 |
|--|------------------------------|--|-----------------|
| Voltage on any terminal relative to GND          |                              | ESD Rating   |                 |
| $V_{CC}$   | -0.3V to +6.0V               | Human Body model   | 1.5KV           |
| RESET, $\overline{\text{RESET}}$                 | -0.3V to ( $V_{CC} + 0.3V$ ) | Machine model  | $\geq 200KV$    |
| Input Current                                    | 20mA                         | Rate of Rise of $V_{CC}$                                   | 100V/ $\mu$ s   |
| Output Current: RESET, $\overline{\text{RESET}}$ | 20mA                         | Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ ) |                 |
|  |                              | SC70-3   | 174mW           |
|  |                              | Operating Temperature Range                                | -40°C to +85°C  |
|  |                              | Storage Temperature Range                                  | -65°C to +150°C |
|  |                              | Lead Temperature (soldering, 10s)                          | +300°C          |

These are stress ratings only, and functional operation is not implied for these levels or beyond. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

## Electrical Characteristics SC70 Package ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

$V_{CC}$  = full range, as noted under conditions. See Note 1.

| Parameter                        | Symbol   | Conditions   | Min             | Typ (Note 3) | Max  | Units                 |
|----------------------------------|----------|--|-----------------|--------------|------|-----------------------|
| Operating Voltage                | $V_{CC}$ | $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$                               | 1.4             |              | 5.5  | V                     |
|                                  |          | $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$                              | 1.6             |              | 5.5  |                       |
| Supply Current                   | $I_{CC}$ | $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ , $V_{CC} < 5.5V$ FM809J/L/M |                 | 9            | 15   | $\mu\text{A}$         |
|                                  |          | $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ , $V_{CC} < 3.6V$ FM809R/S/T |                 | 6            | 10   |                       |
| Reset Threshold                  | $V_{TH}$ | FM8xxL $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 4.40            | 4.63         | 4.86 | V                     |
|                                  |          | FM8xxM $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 4.18            | 4.38         | 4.52 |                       |
|                                  |          | FM8xxJ $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 3.90            | 4.00         | 4.18 |                       |
|                                  |          | FM8xxT $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 2.97            | 3.08         | 3.19 |                       |
|                                  |          | FM8xxS $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 2.79            | 2.93         | 3.00 |                       |
|                                  |          | FM8xxR $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                      | 2.49            | 2.63         | 2.70 |                       |
| Reset Threshold Tempco           |          |  |                 | 30           |      | ppm/ $^\circ\text{C}$ |
| $V_{CC}$ to Reset Delay (Note 2) |          | $V_{CC} = V_{TH}$ to ( $V_{TH} - 100\text{mV}$ )                             |                 | 10           | 15   | $\mu\text{s}$         |
| Reset Active Timeout Period      |          | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$                             | 100             | 256          | 560  | ms                    |
| FM809 Output Low (RESET)         | $V_{OL}$ | $V_{CC} = V_{TH}(\text{min})$ , $I_{SINK} = 1.2\text{mA}$ , FM809R/S/T       |                 |              | 0.35 | V                     |
|                                  |          | $V_{CC} = V_{TH}(\text{min})$ , $I_{SINK} = 3.2\text{mA}$ , FM809J/L/M       |                 |              | 0.4  |                       |
|                                  |          | $V_{CC} < 1.0V$ , $I_{SINK} = 50\mu\text{A}$                                 |                 |              | 0.3  |                       |
| FM809 Output High (RESET)        | $V_{OH}$ | $V_{CC} > V_{TH}(\text{max})$ , $I_{SOURCE} = 500\mu\text{A}$ (R/S/T)        | $0.8V_{CC}$     |              |      | V                     |
|                                  |          | $V_{CC} > V_{TH}(\text{max})$ , $I_{SOURCE} = 800\mu\text{A}$ (J/M/L)        | $V_{CC} - 1.5V$ |              |      |                       |
| FM810 Output Low (RESET)         | $V_{OL}$ | $V_{CC} = V_{TH}(\text{max})$ , $I_{SINK} = 1.2\text{mA}$ , FM810R/S/T       |                 |              | 0.35 | V                     |
|                                  |          | $V_{CC} = V_{TH}(\text{max})$ , $I_{SINK} = 3.2\text{mA}$ , FM810J/L/M       |                 |              | 0.4  |                       |
| FM810 Output High (RESET)        | $V_{OH}$ | $1.8V < V_{CC} < V_{TH}(\text{min})$ , $I_{SOURCE} = 150\mu\text{A}$         | $0.8V_{CC}$     |              |      | V                     |

**Note 1:** Testing in production is  $25^\circ\text{C}$  only.  $V_{CC} = 5V$  for FM8xxL/M/J,  $V_{CC} = 3.3V$  for FM8xxT/S and  $V_{CC} = 3V$  for FM8xxR. Limits over temperature are guaranteed by design.

**Note 2:** RESET output is for FM809.  $\overline{\text{RESET}}$  output is for FM810.

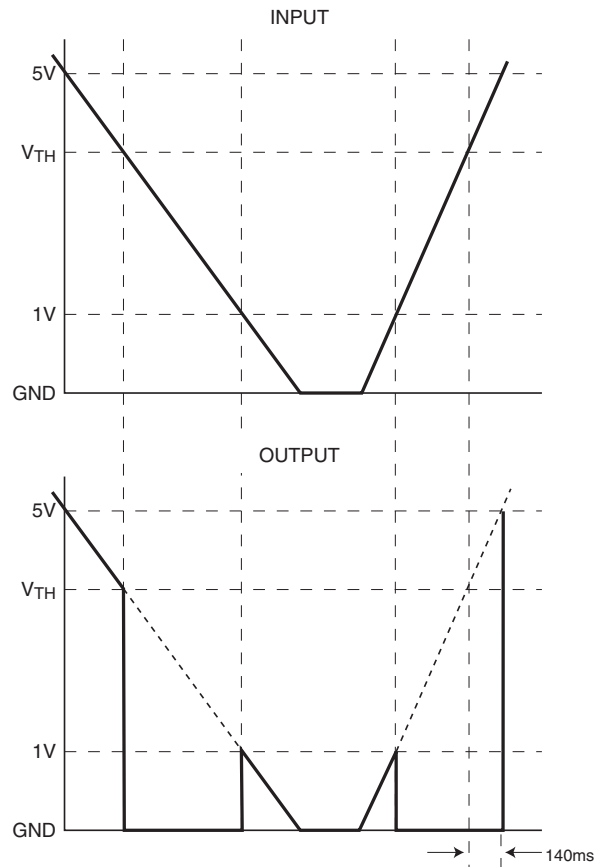
**Note 3:** Typical values are at  $25^\circ\text{C}$ .

## Pin Descriptions

| Pin Number | Name     | Function   |
|------------|----------|--|
| 1          | GND      | GROUND   |
| 2          | RESET*   | RESET (RESET) remains LOW (HIGH) while $V_{CC}$ is below $V_{TH}$ , and for at least 140ms after $V_{CC}$ rises above $V_{TH}$ . |
| 3          | $V_{CC}$ |  |

\* with overbar, FM809 (RESET); without, FM810 (RESET).

## Circuit Timing (e.g.: FM809)



When operating properly with 5V in (for example),  $V_{OUT}$  will also be about 5V. When  $V_{IN}$  starts to fall,  $V_{OUT}$  will follow it down as shown. When  $V_{IN}$  drops below  $V_{TH}$ ,  $V_{OUT}$  drops to ground ("issues a RESET") and stays there unless  $V_{IN}$  also falls below its minimum operating voltage, approx. 1V. At this point, the supervisor loses control, and its output may rise, only to again follow  $V_{IN}$  down to the ground.

When  $V_{IN}$  begins to rise,  $V_{OUT}$  follows it until 1.0V or so is reached, whereupon the device regains control,  $V_{OUT}$  is pulled to ground, etc. When  $V_{IN}$  rises above  $V_{TH}$ ,  $V_{OUT}$  comes out of RESET 140 ms later.

If it is required that a lower value than  $GND + 1.0V$  is needed on RESET signal during  $V_{CC} \leq 1V$ , a 100K resistor may be used on the device output (to GND for the FM809, to  $V_{CC}$  for the FM810).

### Ordering Information (FM809)

| Part Number | Top Marking | RESET Threshold (V) | Output Type           | Package Type | Packing Method    |
|-------------|-------------|---------------------|-----------------------|--------------|-------------------|
| FM809LS3X   | 09L         | 4.63                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809MS3X   | 09M         | 4.38                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809JS3X   | 09J         | 4.00                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809TS3X   | 09T         | 3.08                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809SS3X   | 09S         | 2.93                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809RS3X   | 09R         | 2.63                | Push-Pull, active LOW | 3-Pin, SOT23 | 3000 units in T&R |
| FM809LP3X   | VLY         | 4.63                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |
| FM809MP3X   | VMY         | 4.38                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |
| FM809JP3X   | VJY         | 4.00                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |
| FM809TP3X   | VTY         | 3.08                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |
| FM809SP3X   | VSY         | 2.93                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |
| FM809RP3X   | VRY         | 2.63                | Push-Pull, active LOW | 3-Pin, SC70  | 3000 units in T&R |

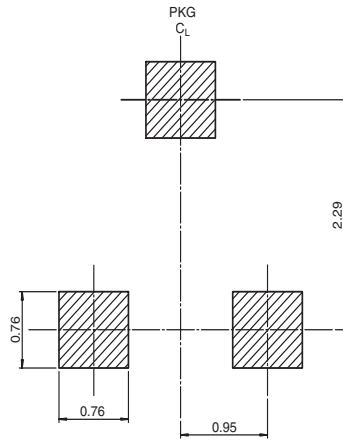
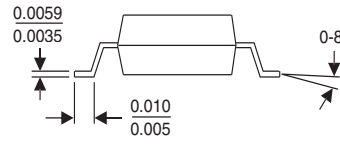
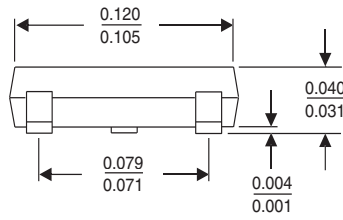
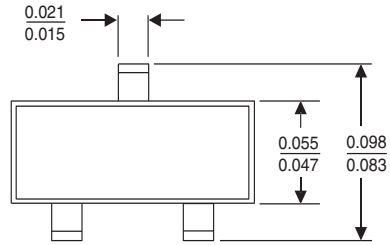
**Note 4:** Devices listed above feature 250ms typical Reset Pulse width. Consult Fairchild sales for other reset pulse width options.

## Ordering Information (FM810)

| Part Number | Top Marking | RESET Threshold (V) | Output Type            | Package Type | Packing Method    |
|-------------|-------------|---------------------|------------------------|--------------|-------------------|
| FM810LS3X   | 10L         | 4.63                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810MS3X   | 10M         | 4.38                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810JS3X   | 10J         | 4.00                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810TS3X   | 10T         | 3.08                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810SS3X   | 10S         | 2.93                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810RS3X   | 10R         | 2.63                | Push-Pull, active HIGH | 3-Pin, SOT23 | 3000 units in T&R |
| FM810LP3X   | ZLY         | 4.63                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |
| FM810MP3X   | ZMY         | 4.38                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |
| FM810JP3X   | ZJY         | 4.00                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |
| FM810TP3X   | ZTY         | 3.08                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |
| FM810SP3X   | ZSY         | 2.93                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |
| FM810RP3X   | ZRY         | 2.63                | Push-Pull, active HIGH | 3-Pin, SC70  | 3000 units in T&R |

**Note 5:** Devices listed above feature 250ms typical Reset Pulse width. Consult Fairchild sales for other reset pulse width options.

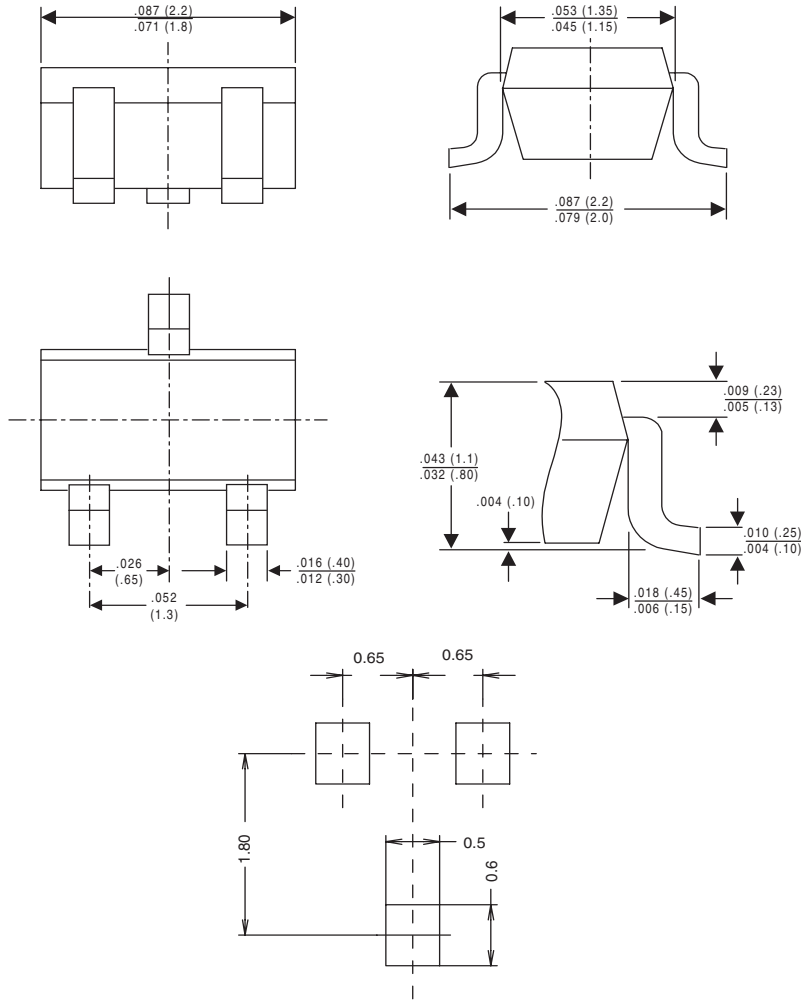
**Physical Dimensions** inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION

**SOT-23 Package Dimensions**  
**FS Pkg Code AU**

**Physical Dimensions** inches (millimeters) unless otherwise noted



**Land Pattern Recommendation**

**SC70 Package Dimensions**

**Life Support Policy**

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