

FM809/810

3-Pin μ 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 μ 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

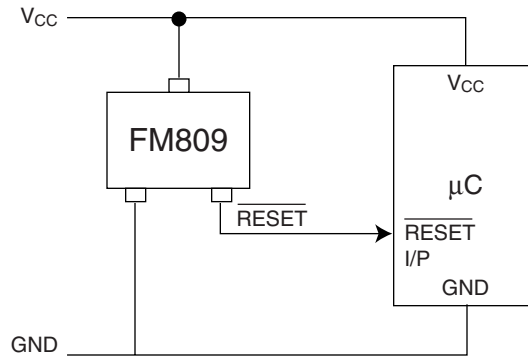
- V_{TH} voltages of 4.63V, 4.38V, 4.00V, 3.08V, 2.93V and 2.63V
- \overline{RESET} (FM809) or RESET (FM810) output

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

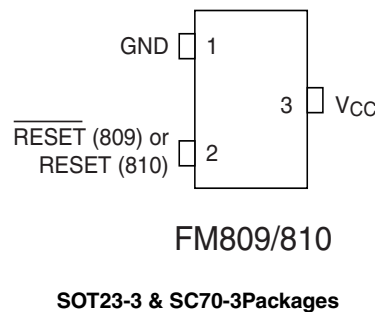
Applications

- 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 | ≥ 2 KV |
| RESET, $\overline{\text{RESET}}$ | -0.3V to ($V_{CC} + 0.3$ V) | Machine Model | ≥ 200 KV |
| Input Current | 20mA | Rate of Rise of V_{CC} | 100V/ μ 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 FM809J/L/M | | 5 | 10 | μ A | |
| | | $T_A = -40^\circ\text{C}$ to 105 $^\circ\text{C}$, $V_{CC} < 3.6$ V 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 | μ 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, FM809R/S/T | | | 0.3 | V | |
| | | $V_{CC} = V_{TH}(\text{min})$, $I_{SINK} = 3.2$ mA, FM809J/L/M | | | 0.4 | | |
| | | $V_{CC} < 1.0$ V, $I_{SINK} = 50$ μ A | | | 0.3 | | |
| FM809 Output High ($\overline{\text{RESET}}$) | V_{OH} | $V_{CC} > V_{TH}(\text{max})$, $I_{SOURCE} = 500$ μ A (R/S/T) | 0.8 V_{CC} | | | V | |
| | | $V_{CC} > V_{TH}(\text{max})$, $I_{SOURCE} = 800$ μ 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, FM810R/S/T | | | 0.3 | V | |
| | | $V_{CC} = V_{TH}(\text{max})$, $I_{SINK} = 3.2$ mA, FM810J/L/M | | | 0.4 | | |
| FM810 Output High ($\overline{\text{RESET}}$) | V_{OH} | $1.8\text{V} < V_{CC} < V_{TH}(\text{min})$, $I_{SOURCE} = 150$ μ 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/ μ 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°C | 1.6 | | 5.5 | |
| Supply Current | I_{CC} | $T_A = -40^\circ\text{C}$ to 85°C , $V_{CC} < 5.5V$ FM809J/L/M | | 9 | 15 | μA |
| | | $T_A = -40^\circ\text{C}$ to 85°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 | μs |
| 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°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.

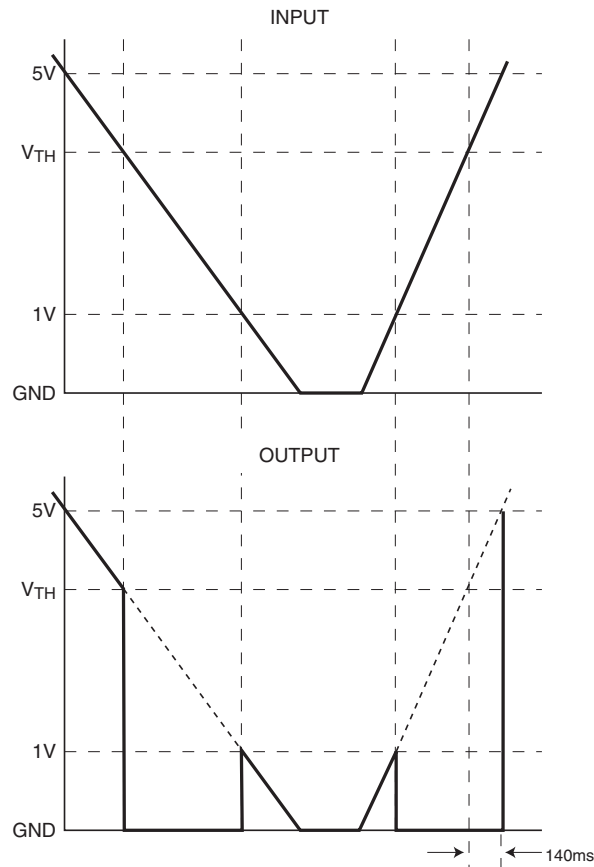
Note 3: Typical values are at 25°C .

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 |

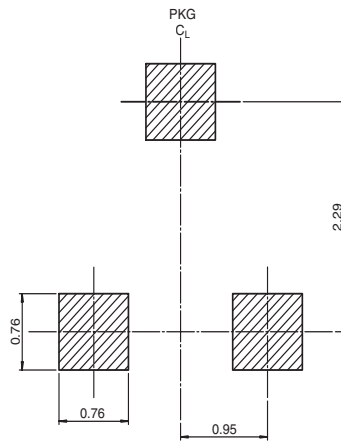
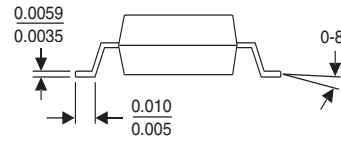
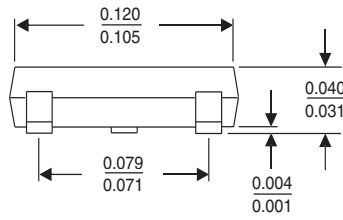
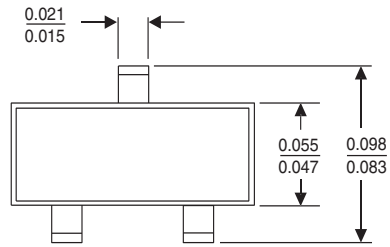
Note 4: Devices listed above feature 250ms typical Reset Pulse width. Consult Fairchild sales for other reset pulse width options.

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.

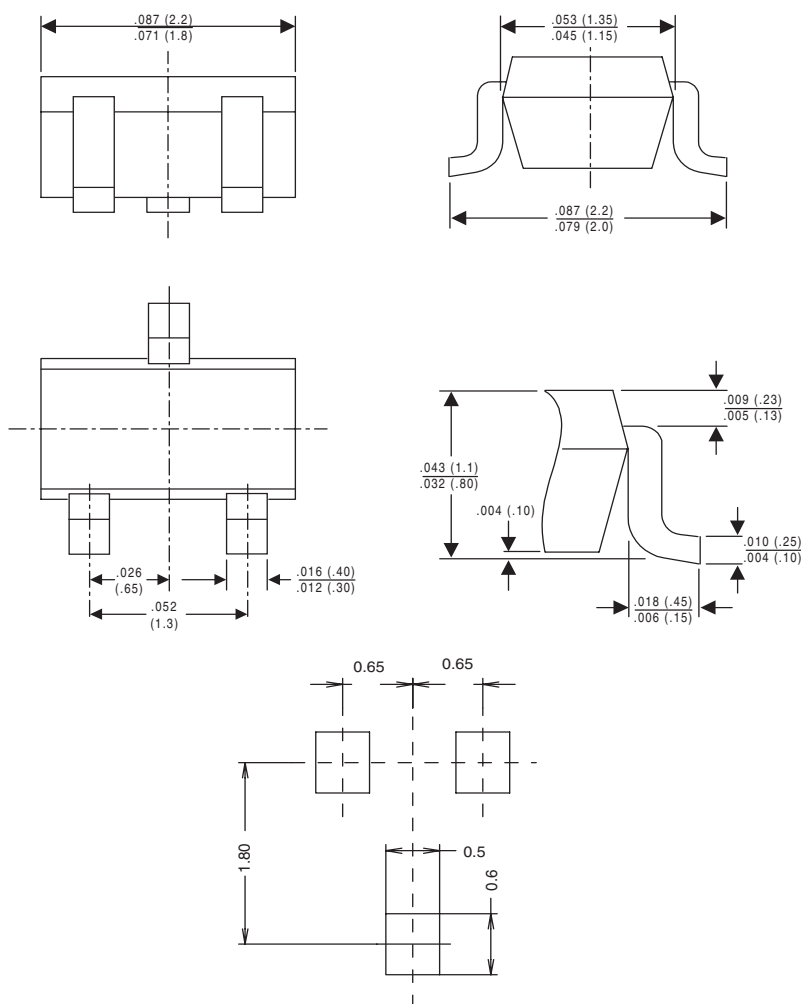
Physical Dimensions inches (millimeters) unless otherwise noted



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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