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FAIRCHILD

SEMICONDUCTOR®

FM809/810
3-Pin µC 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 µA) 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 2µA
- No external components
- Operating Range
  — -40°C to +105°C (SOT23)
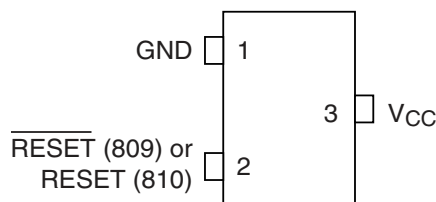 — -40°C to +85°C (SC70)
- SOT23-3 and SC70-3 packages

Applications

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

Typical Operating Circuit
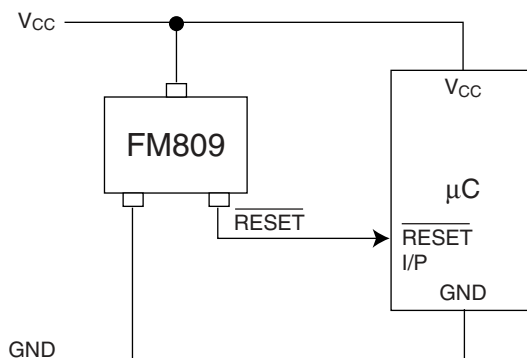
Connection Diagram

FM809/810
SOT23-3 & SC70-3Packages

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Absolute Maximum Ratings

Voltage on any terminal relative to GND

V_{CC}	-0.3V to +6.0V
RESET, $\overline{RESET}$	-0.3V to (V_{CC} + 0.3V)

Input Current   20mA

Output Current: RESET, $\overline{RESET}$ 20mA

Rate of Rise of V_{CC} 100V/µs

Continuous Power Dissipation (T_A = +70°C)
     SOT23-3 (derate 4mW/°C above +70°C)   320mW

Operating Temperature Range   -40°C to +105°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 SOT23 Package (T_A = 25°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°C to +70°C		1.0		5.5	V
		T_A = -40°C to 105°C		1.1		5.5	
Supply Current	I_{CC}	T_A = -40°C to 105°C, V_{CC} < 5.5V FM809J/L/M			5	10	µA
		T_A = -40°C to 105°C, V_{CC} < 3.6V FM809R/S/T			2	6	
Reset Threshold	V_{TH}	FM8xxL	T_A = -40°C to +105°C	4.40	4.63	4.86	V
		FM8xxM	T_A = -40°C to +105°C	4.18	4.38	4.52	
		FM8xxJ	T_A = -40°C to +105°C	3.90	4.00	4.18	
		FM8xxT	T_A = -40°C to +105°C	2.97	3.08	3.19	
		FM8xxS	T_A = -40°C to +105°C	2.79	2.93	3.00	
		FM8xxR	T_A = -40°C to +105°C	2.49	2.63	2.70	
Reset Threshold Tempco					30		ppm/°C
V_{CC} to Reset Delay (Note 2)		V_{CC} = V_{TH} to (V_{TH} - 100mV)			10		µs
Reset Active Timout Period		T_A = -40°C to +105°C		140	256	560	ms
FM809 Output Low ($\overline{RESET}$)	V_{OL}	V_{CC} = V_{TH}(min), I_{SINK} = 1.2mA, FM809R/S/T				0.3	V
		V_{CC} = V_{TH}(min), I_{SINK} = 3.2mA, FM809J/L/M				0.4	
		V_{CC} = < 1.0V, I_{SINK} = 50µA				0.3	
FM809 Output High ($\overline{RESET}$)	V_{OH}	V_{CC} > V_{TH}(max), I_{SOURCE} = 500µA (R/S/T)		0.8V_{CC}			V
		V_{CC} > V_{TH}(max), I_{SOURCE} = 800µA		V_{CC} - 1.5V			
FM810 Output Low (RESET)	V_{OL}	(J/M/L) V_{CC} = V_{TH}(max), I_{SINK} = 1.2mA, FM810R/S/T				0.3	V
		V_{CC} = V_{TH}(max), I_{SINK} = 3.2mA, FM810J/L/M				0.4	
FM810 Output High (RESET)	V_{OH}	1.8V < V_{CC} < V_{TH}(min), I_{SOURCE} = 150µA		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: $\overline{RESET}$ output is for FM809. RESET output is for FM810.

Note 3: Typical values are at 25°C.

Absolute Maximum Ratings

Voltage on any terminal relative to GND
$\quad$V$_{CC}$ $\qquad$ -0.3V to +6.0V
$\quad$RESET, $\overline{\text{RESET}}$ $\qquad$ -0.3V to (V$_{CC}$ + 0.3V)

Input Current $\qquad$ 20mA

Output Current: RESET, $\overline{\text{RESET}}$ $\qquad$ 20mA

Rate of Rise of V$_{CC}$ $\qquad$ 100V/μs

Continuous Power Dissipation (T$_A$ = +70°C)
$\quad$SC70-3 $\qquad$ 174mW

Operating Temperature Range $\qquad$ -40°C to +85°C

Storage Temperature Range $\qquad$ -65°C to +150°C

Lead Temperature (soldering, 10s) $\qquad$ +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°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°C to +70°C		1.4		5.5	V
		T$_A$ = -40°C to 85°C		1.6		5.5	
Supply Current	I$_{CC}$	T$_A$ = -40°C to 85°C, V$_{CC}$ < 5.5V FM809J/L/M			9	15	μA
		T$_A$ = -40°C to 85°C, V$_{CC}$ < 3.6V FM809R/S/T			6	10	
Reset Threshold	V$_{TH}$	FM8xxL	T$_A$ = -40°C to +85°C	4.50	4.63	4.75	V
		FM8xxM	T$_A$ = -40°C to +85°C	4.25	4.38	4.50	
		FM8xxJ	T$_A$ = -40°C to +85°C	3.89	4.00	4.10	
		FM8xxT	T$_A$ = -40°C to +85°C	3.00	3.08	3.15	
		FM8xxS	T$_A$ = -40°C to +85°C	2.85	2.93	3.00	
		FM8xxR	T$_A$ = -40°C to +85°C	2.55	2.63	2.70	
Reset Threshold Tempco					30		ppm/°C
V$_{CC}$ to Reset Delay (Note 2)		V$_{CC}$ = V$_{TH}$ to (V$_{TH}$ - 100mV)			10		μs
Reset Active Timout Period		T$_A$ = -40°C to +85°C		140	256	560	ms
FM809 Output Low ($\overline{\text{RESET}}$)	V$_{OL}$	V$_{CC}$ = V$_{TH}$(min), I$_{SINK}$ = 1.2mA, FM809R/S/T				0.3	V
		V$_{CC}$ = V$_{TH}$(min), I$_{SINK}$ = 3.2mA, FM809J/L/M				0.4	
		V$_{CC}$ = < 1.0V, I$_{SINK}$ = 50μA				0.3	
FM809 Output High ($\overline{\text{RESET}}$)	V$_{OH}$	V$_{CC}$ > V$_{TH}$(max), I$_{SOURCE}$ = 500μA (R/S/T)		0.8V$_{CC}$			V
		V$_{CC}$ > V$_{TH}$(max), I$_{SOURCE}$ = 800μA		V$_{CC}$ - 1.5V			
FM810 Output Low (RESET)	V$_{OL}$	(J/M/L) V$_{CC}$ = V$_{TH}$(max), I$_{SINK}$ = 1.2mA, FM810R/S/T				0.3	V
		V$_{CC}$ = V$_{TH}$(max), I$_{SINK}$ = 3.2mA, FM810J/L/M				0.4	
FM810 Output High (RESET)	V$_{OH}$	1.8V < V$_{CC}$ < V$_{TH}$(min), I$_{SOURCE}$ = 150μA		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.
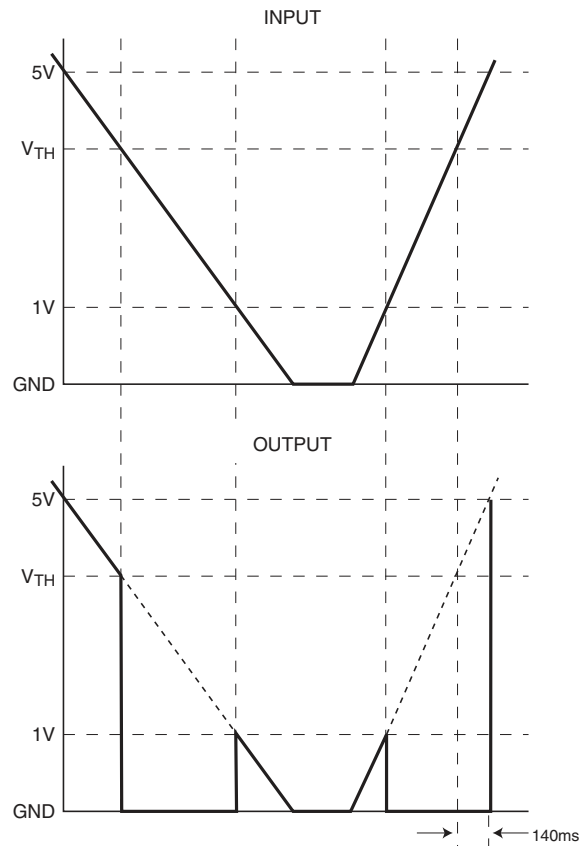**Note 2:** $\overline{\text{RESET}}$ output is for FM809. RESET output is for FM810.
Note 3: Typical values are at 25°C.

Pin Descriptions

Pin Number	Name	Function
1	GND	GROUND
2	$\overline{\text{RESET}}$*	$\overline{\text{RESET}}$ (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 ($\overline{\text{RESET}}$); 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).

FM809/810 Rev. D

Ordering Information (FM809)

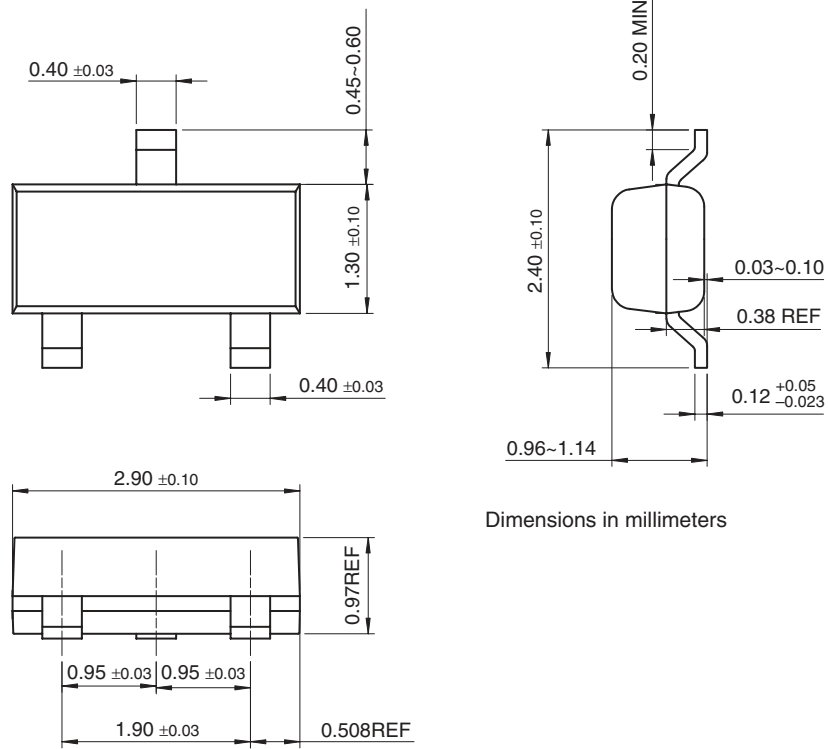| Part Number	Top Marking	RESET Threshold (V)	Output Type	Package Type	Packing Method
FM809LS3	09L	4.63	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809MS3	09M	4.38	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809JS3	09J	4.00	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809TS3	09T	3.08	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809SS3	09S	2.93	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809RS3	09R	2.63	Push-Pull, active LOW	3-Pin, SOT23	3000 units in T&R
FM809LP3	VLY	4.63	Push-Pull, active LOW	3-Pin, SC70	3000 units in T&R
FM809MP3	VMY	4.38	Push-Pull, active LOW	3-Pin, SC70	3000 units in T&R
FM809JP3	VJY	4.00	Push-Pull, active LOW	3-Pin, SC70	3000 units in T&R
FM809TP3	VTY	3.08	Push-Pull, active LOW	3-Pin, SC70	3000 units in T&R
FM809SP3	VSY	2.93	Push-Pull, active LOW	3-Pin, SC70	3000 units in T&R
FM809RP3	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.

FM809/810 Rev. D

Ordering Information (FM810)

Part Number	Top Marking	RESET Threshold (V)	Output Type	Package Type	Packing Method
FM810LS3	10L	4.63	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810MS3	10M	4.38	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810JS3	10J	4.00	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810TS3	10T	3.08	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810SS3	10S	2.93	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810RS3	10R	2.63	Push-Pull, active HIGH	3-Pin, SOT23	3000 units in T&R
FM810LP3	ZLY	4.63	Push-Pull, active HIGH	3-Pin, SC70	3000 units in T&R
FM810MP3	ZMY	4.38	Push-Pull, active HIGH	3-Pin, SC70	3000 units in T&R
FM810JP3	ZJY	4.00	Push-Pull, active HIGH	3-Pin, SC70	3000 units in T&R
FM810TP3	ZTY	3.08	Push-Pull, active HIGH	3-Pin, SC70	3000 units in T&R
FM810SP3	ZSY	2.93	Push-Pull, active HIGH	3-Pin, SC70	3000 units in T&R
FM810RP3	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.
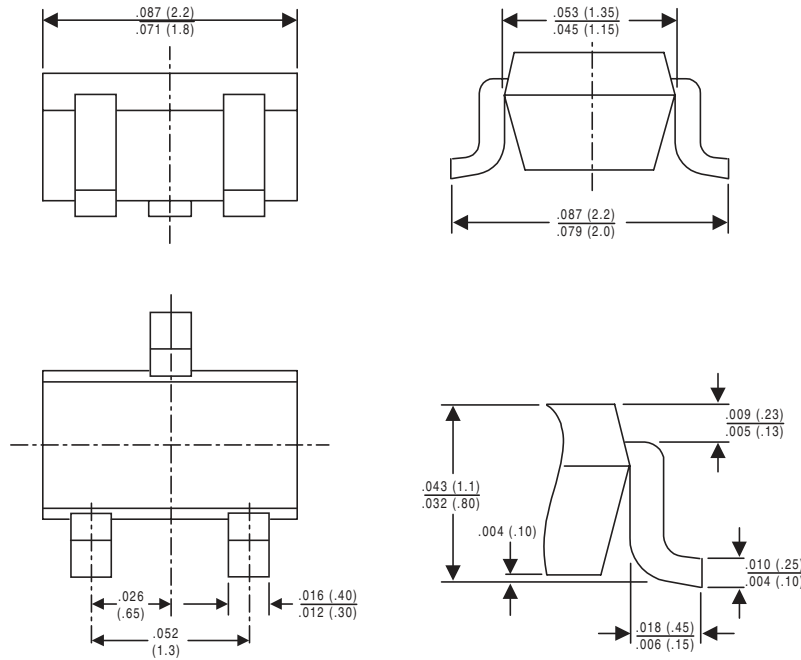
Physical Dimensions inches (millimeters) unless otherwise noted

0.40 ±0.03

0.45~0.60

1.30 ±0.10

0.40 ±0.03

0.20 MIN

2.40 ±0.10

0.03~0.10

0.38 REF

0.12 $^{+0.05}_{-0.023}$

0.96~1.14

Dimensions in millimeters

2.90 ±0.10

0.97REF

0.95 ±0.03 0.95 ±0.03

1.90 ±0.03

0.508REF

SOT-23 Package Dimensions
FS Pkg Code AU

FM809/810 Rev. D

Physical Dimensions inches (millimeters) unless otherwise noted

.087 (2.2)
.071 (1.8)

.053 (1.35)
.045 (1.15)

.087 (2.2)
.079 (2.0)

.009 (.23)
.005 (.13)

.043 (1.1)
.032 (.80)

.004 (.10)

.010 (.25)
.004 (.10)

.026 (.65)

.016 (.40)
.012 (.30)

.052 (1.3)

.018 (.45)
.006 (.15)

SC70 Package Dimensions

Life Support Policy

Fairchild's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President of Fairchild Semiconductor Corporation. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

FM809/810 Rev. D