

LM809/LM810

3-Pin Microprocessor Reset Circuits

General Description

The LM809/810 microprocessor supervisory circuits can be used to monitor the power supplies in microprocessor and digital systems. They provide a reset to the microprocessor during power-up, power-down and brown-out conditions.

The function of the LM809/810 is to monitor the V_{CC} supply voltage, and assert a reset signal whenever this voltage declines below the factory-programmed reset threshold. The reset signal remains asserted for 240ms after V_{CC} rises above the threshold. The LM809 has an active-low $\overline{\text{RESET}}$ output, while the LM810 has an active-high RESET output.

Seven standard reset voltage options are available, suitable for monitoring 5V, 3.3V, and 3V supply voltages.

With a low supply current of only 15 μA , the LM809/810 are ideal for use in portable equipment. The LM809/LM810 are available in the 3-pin SOT23 package and in the 6-Lead LLP package.

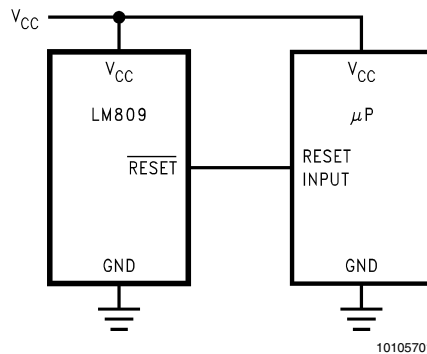
Features

- Precise monitoring of 3V, 3.3V, and 5V supply voltages
- Superior upgrade to MAX809/810
- Fully specified over temperature
- 140ms min. Power-On Reset pulse width, 240ms typical
 - Active-low $\overline{\text{RESET}}$ Output (LM809)
 - Active-high RESET Output (LM810)
- Guaranteed RESET Output valid for $V_{CC} \geq 1\text{V}$
- Low Supply Current, 15 μA typ.
- Power supply transient immunity

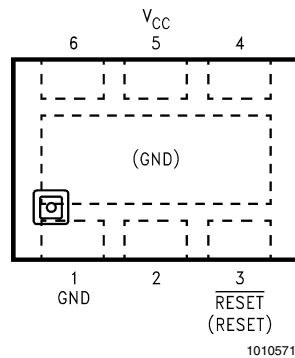
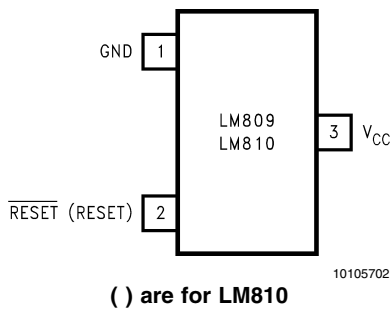
Applications

- Microprocessor Systems
- Computers
- Controllers
- Intelligent Instruments
- Portable/Battery-Powered Equipment
- Automotive

Typical Application Circuit



Connection Diagrams



Ordering Information

| Reset Threshold (V) | LM809 Supplied as 1000 units, tape & reel | LM809 Supplied as 3000 units, tape & reel | Package Top Mark | Package Type | NSC Package |
|---------------------|---|---|------------------|--------------|-------------|
| 4.63 | LM809M3-4.63 | LM809M3X-4.63 | S8B | SOT23-3 | M03B |
| 4.38 | LM809M3-4.38 | LM809M3X-4.38 | S7B | | |
| 4.00 | LM809M3-4.00 | LM809M3X-4.00 | S6B | | |
| 3.08 | LM809M3-3.08 | LM809M3X-3.08 | S5B | | |
| 2.93 | LM809M3-2.93 | LM809M3X-2.93 | S4B | | |
| 2.63 | LM809M3-2.63 | LM809M3X-2.63 | S3B | | |
| 2.45 | LM809M3-2.45 | LM809M3X-2.45 | SFB | | |
| Reset Threshold (V) | LM810 Supplied as 1000 units, tape & reel | LM810 Supplied as 3000 units, tape & reel | Package Top Mark | Package Type | NSC Package |
| 4.63 | LM810M3-4.63 | LM810M3X-4.63 | SEB | SOT23-3 | M03B |
| 4.38 | LM810M3-4.38 | LM810M3X-4.38 | SDB | | |
| 4.00 | LM810M3-4.00 | LM810M3X-4.00 | SCB | | |
| 3.08 | LM810M3-3.08 | LM810M3X-3.08 | SBB | | |
| 2.93 | LM810M3-2.93 | LM810M3X-2.93 | SAB | | |
| 2.63 | LM810M3-2.63 | LM810M3X-2.63 | S9B | | |
| Reset Threshold (V) | LM809 Supplied as 1000 units, tape & reel | LM809 Supplied as 4500 units, tape & reel | Package Top Mark | Package Type | NSC Package |
| 2.63 | LM809LD-2.63 | LM809LDX-2.63 | S13 | LLP-6 | LDB06A |

Custom voltages and improved accuracies are available, subject to minimum orders. Contact your local National Semiconductor Sales Office for information.

Pin Descriptions

| PIN | | NAME | FUNCTION |
|-------|--------|---------------|---|
| (LLP) | SOT-23 | | |
| 1 | 1 | GND | Ground reference |
| 3 | 2 | RESET (LM809) | Active-low output. RESET remains low while V_{CC} is below the reset threshold, and for 240ms after V_{CC} rises above the reset threshold. |
| | | RESET (LM810) | Active-high output. RESET remains high while V_{CC} is below the reset threshold, and for 240ms after V_{CC} rises above the reset threshold. |
| 5 | 3 | V_{CC} | Supply Voltage (+5V, +3.3V, or +3.0V) |

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

| | |
|--|------------------------------|
| V_{CC} | -0.3V to 6.0V |
| RESET, $\overline{\text{RESET}}$ | -0.3V to ($V_{CC} + 0.3V$) |
| Input Current, V_{CC} Pin | 20mA |
| Output Current, RESET, $\overline{\text{RESET}}$ Pin | 20mA |
| Rate of Rise, V_{CC} | 100V/ μ s |
| ESD Rating (Note 2) | 2kV |

Continuous Power Dissipation

(Note 4)

320mW

 θ_{JA} :

LLP-6

152°C/W

SOT23-3

326°C/W

Ambient Temperature Range

-40°C to +105°C

Maximum Junction Temperature

125°C

Storage Temperature Range

-65°C to +160°C

Lead Temperature (soldering,

10sec)

+300°C

Electrical Characteristics

V_{CC} = full range, T_A = -40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = 5V for 4.63/4.38/4.00 versions, V_{CC} = 3.3V for 3.08/2.93 versions, and V_{CC} = 3V for 2.63/2.45 version (Note 3).

| Symbol | Parameter | Conditions | Min | Typ | Max | Units | | | |
|--|--------------------------|--|--|--|------|-------|---------|-----|-----------------------|
| | V_{CC} Range | $T_A = 0^\circ\text{C to } +70^\circ\text{C}$ | 1.0 | | 5.5 | V | | | |
| | | $T_A = -40^\circ\text{C to } +105^\circ\text{C}$ | 1.2 | | 5.5 | | | | |
| I_{CC} | Supply Current | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | $V_{CC} < 5.5V$, LM8_ _ -4.63/4.38/4.00 | | 18 | 60 | μ A | | |
| | | | $V_{CC} < 3.6V$, LM8_ _ -3.08/2.93/2.63/2.45 | | 15 | 50 | | | |
| | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | $V_{CC} < 5.5V$, LM8_ _ -4.63/4.38/4.00 | | | 100 | | | |
| | | | $V_{CC} < 3.6V$, LM8_ _ -3.08/2.93/2.63/2.45 | | | 100 | | | |
| V_{TH} | Reset Threshold (Note 5) | LM8_ _ -4.63 | $T_A = +25^\circ\text{C}$ | 4.56 | 4.63 | 4.70 | V | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 4.50 | | 4.75 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 4.40 | | 4.86 | | | |
| | | LM8_ _ -4.38 | $T_A = +25^\circ\text{C}$ | 4.31 | 4.38 | 4.45 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 4.25 | | 4.50 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 4.16 | | 4.56 | | | |
| | | LM8_ _ -4.00 | $T_A = +25^\circ\text{C}$ | 3.93 | 4.00 | 4.06 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 3.89 | | 4.10 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 3.80 | | 4.20 | | | |
| | | LM8_ _ -3.08 | $T_A = +25^\circ\text{C}$ | 3.04 | 3.08 | 3.11 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 3.00 | | 3.15 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 2.92 | | 3.23 | | | |
| | | LM8_ _ -2.93 | $T_A = +25^\circ\text{C}$ | 2.89 | 2.93 | 2.96 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 2.85 | | 3.00 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 2.78 | | 3.08 | | | |
| | | LM8_ _ -2.63 | $T_A = +25^\circ\text{C}$ | 2.59 | 2.63 | 2.66 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 2.55 | | 2.70 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 2.50 | | 2.76 | | | |
| | | LM8_ _ -2.45 | $T_A = +25^\circ\text{C}$ | 2.41 | 2.45 | 2.49 | | | |
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 2.38 | | 2.52 | | | |
| | | | $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 2.33 | | 2.57 | | | |
| | | | Reset Threshold Temperature Coefficient | | | 30 | | | ppm/ $^\circ\text{C}$ |
| | | | V_{CC} to Reset Delay (Note 5) | $V_{CC} = V_{TH}$ to ($V_{TH} - 100\text{mV}$) | | 20 | | | μ s |
| | | | Reset Active Timeout Period | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 140 | 240 | | 560 | ms |
| $T_A = +85^\circ\text{C to } +105^\circ\text{C}$ | 100 | | | | 840 | | | | |

Electrical Characteristics (Continued)

V_{CC} = full range, T_A = -40°C to $+105^{\circ}\text{C}$, unless otherwise noted. Typical values are at T_A = $+25^{\circ}\text{C}$, V_{CC} = 5V for 4.63/4.38/4.00 versions, V_{CC} = 3.3V for 3.08/2.93 versions, and V_{CC} = 3V for 2.63/2.45 version (Note 3).

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|----------|---|--|--------------|-----|-----|-------|
| V_{OL} | $\overline{\text{RESET}}$ Output Voltage Low (LM809) | $V_{CC} = V_{TH} \text{ min}$, $I_{SINK} = 1.2\text{mA}$, LM809-2.45/2.63/2.93/3.08 | | | 0.3 | V |
| | | $V_{CC} = V_{TH} \text{ min}$, $I_{SINK} = 3.2\text{mA}$, LM809-4.63/4.38/4.00 | | | 0.4 | |
| | | $V_{CC} > 1.0\text{V}$, $I_{SINK} = 50\mu\text{A}$ | | | 0.3 | |
| V_{OH} | $\overline{\text{RESET}}$ Output Voltage High (LM809) | $V_{CC} > V_{TH} \text{ max}$, $I_{SOURCE} = 500\mu\text{A}$, LM809-2.45/2.63/2.93/3.08 | $0.8V_{CC}$ | | | V |
| | | $V_{CC} > V_{TH} \text{ max}$, $I_{SOURCE} = 800\mu\text{A}$, LM809-4.63/4.38/4.00 | $V_{CC}-1.5$ | | | |
| V_{OL} | RESET Output Voltage Low (LM810) | $V_{CC} = V_{TH} \text{ max}$, $I_{SINK} = 1.2\text{mA}$, LM810-2.63/2.93/3.08 | | | 0.3 | V |
| | | $V_{CC} = V_{TH} \text{ max}$, $I_{SINK} = 3.2\text{mA}$, LM810-4.63/4.38/4.00 | | | 0.4 | |
| V_{OH} | RESET Output Voltage High (LM810) | $1.8\text{V} < V_{CC} < V_{TH} \text{ min}$, $I_{SOURCE} = 150\mu\text{A}$ | $0.8V_{CC}$ | | | V |

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Ratings are conditions under which the device operates correctly. Operating ratings do not imply guaranteed performance limits. For guaranteed performance limits and associated test conditions, see the Electrical Characteristics.

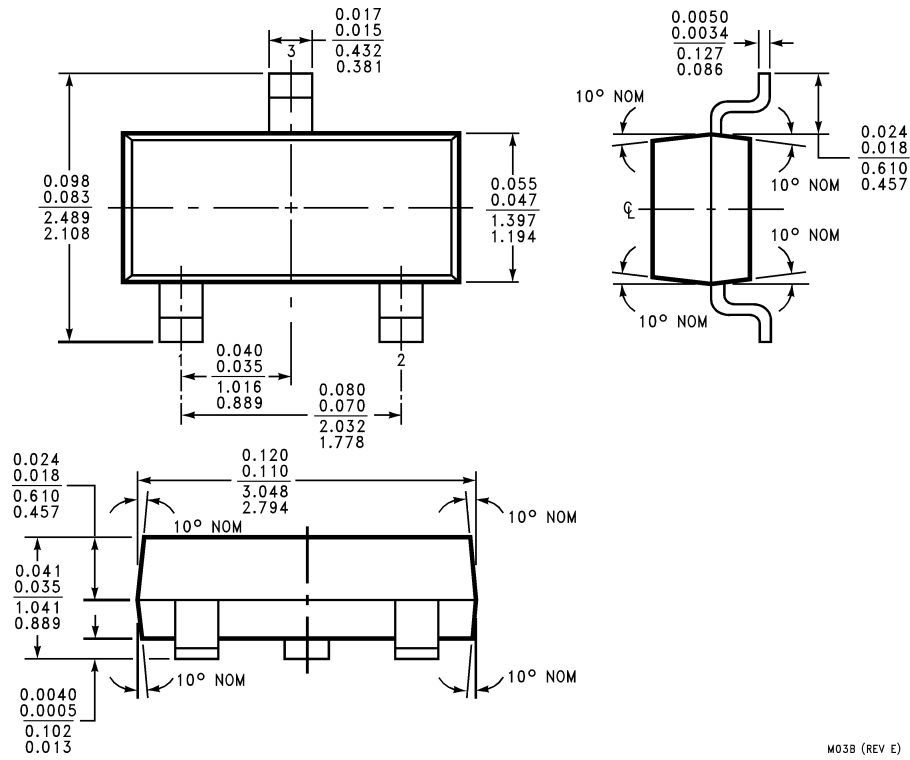
Note 2: The human body model is a 100pF capacitor discharged through a 1.5k Ω resistor into each pin.

Note 3: Production testing done at $T_A = +25^{\circ}\text{C}$, over temperature limits guaranteed by design only.

Note 4: At elevated temperatures, devices must be derated based on package thermal resistance. The device in the SOT23-3 package must be derated at 4mW/ $^{\circ}\text{C}$ at ambient temperatures above 70 $^{\circ}\text{C}$. The device has internal thermal protection.

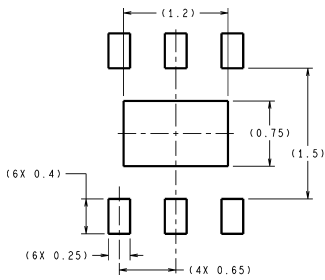
Note 5: $\overline{\text{RESET}}$ Output for LM809, RESET output for LM810.

Physical Dimensions inches (millimeters) unless otherwise noted



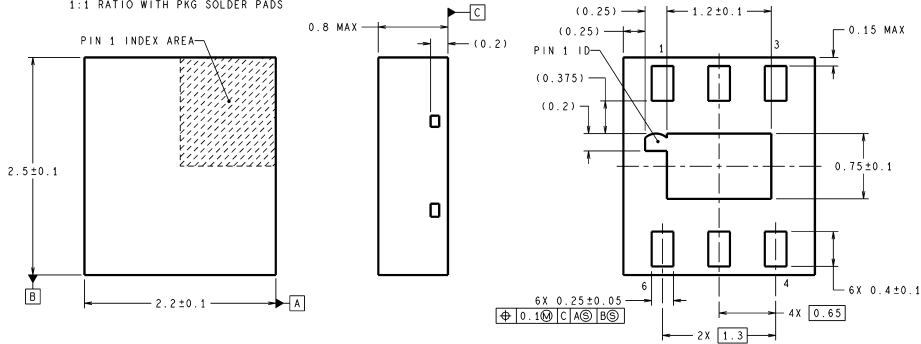
M03B (REV E)

3-Lead SOT23-3
For Ordering, refer to Ordering Information table
NS Package Number M03B



DIMENSIONS ARE IN MILLIMETERS

RECOMMENDED LAND PATTERN
 1:1 RATIO WITH PKG SOLDER PADS



LDB06A (Rev A)

6-Lead LLP (NLDBB006)
For Ordering, refer to Ordering Information table
NS Package Number LDB06A