



## LM809/LM810 3-Pin Microprocessor Reset Circuits

### 1 Features

- Precision Monitoring of Supply Voltages
  - Available Threshold Options:  
2.63 V, 2.93 V, 3.08 V, 4.38 V, 4.63 V
- Superior Upgrade to MAX809 and MAX810
- Fully Specified Over Temperature
- 140-ms Minimum Power-On Reset Pulse Width, 240-ms Typical
  - Active-Low  $\overline{\text{RESET}}$  Output (LM809)
  - Active-High RESET Output (LM810)
- Ensured RESET Output Valid for  $V_{CC} \geq 1 \text{ V}$
- Low Supply Current, 15- $\mu\text{A}$  Typical
- Power Supply Transient Immunity

### 2 Applications

- Factory Automation
- Building Automation
- Programmable Logic Control
- Renewable Energy
- Microprocessor Systems
- Computers
- Controllers
- Intelligent Instruments
- Portable/Battery-Powered Equipment
- Automotive

### 3 Description

The LM809 and LM810 microprocessors 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 and LM810 are 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 240 ms 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 5-V, 3.3-V, and 3-V supply voltages.

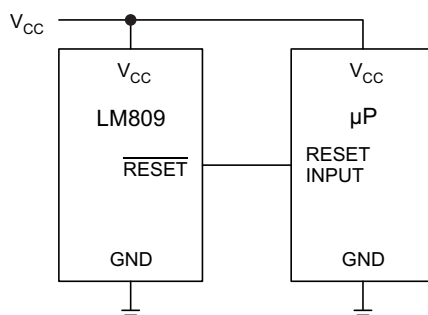
With a low supply current of only 15  $\mu\text{A}$ , the LM809 and LM810 are ideal for use in portable equipment.

#### Device Information<sup>(1)</sup>

| PART NUMBER  | PACKAGE    | BODY SIZE (NOM)   |
|--------------|------------|-------------------|
| LM809, LM810 | SOT-23 (3) | 2.92 mm × 1.30 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

#### Typical Application for Microprocessor Reset Circuit



## Table of Contents

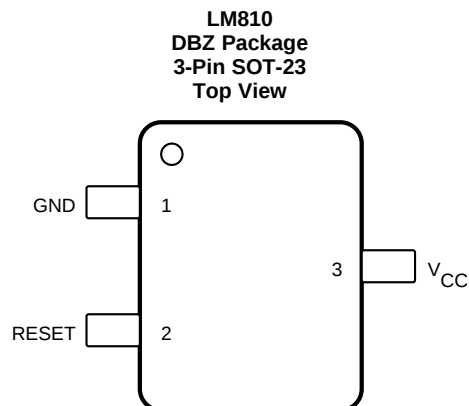
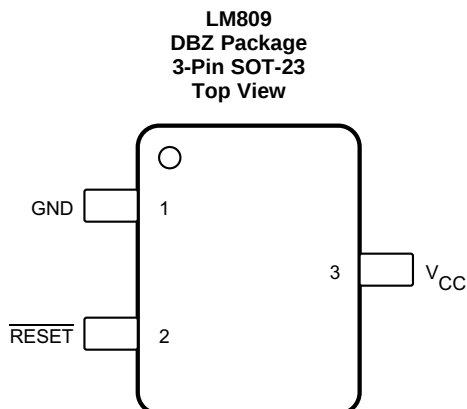
|                                                |          |                                                  |           |
|------------------------------------------------|----------|--------------------------------------------------|-----------|
| <b>1 Features</b> .....                        | <b>1</b> | 7.4 Device Functional Modes.....                 | <b>9</b>  |
| <b>2 Applications</b> .....                    | <b>1</b> | <b>8 Application and Implementation</b> .....    | <b>10</b> |
| <b>3 Description</b> .....                     | <b>1</b> | 8.1 Application Information.....                 | <b>10</b> |
| <b>4 Revision History</b> .....                | <b>2</b> | 8.2 Typical Application .....                    | <b>10</b> |
| <b>5 Pin Configuration and Functions</b> ..... | <b>3</b> | <b>9 Power Supply Recommendations</b> .....      | <b>11</b> |
| <b>6 Specifications</b> .....                  | <b>4</b> | <b>10 Layout</b> .....                           | <b>11</b> |
| 6.1 Absolute Maximum Ratings .....             | 4        | 10.1 Layout Guidelines .....                     | 11        |
| 6.2 ESD Ratings.....                           | 4        | 10.2 Layout Example .....                        | 11        |
| 6.3 Recommended Operating Conditions.....      | 4        | <b>11 Device and Documentation Support</b> ..... | <b>12</b> |
| 6.4 Thermal Information .....                  | 4        | 11.1 Related Links .....                         | 12        |
| 6.5 Electrical Characteristics.....            | 5        | 11.2 Community Resources.....                    | 12        |
| 6.6 Typical Characteristics .....              | 6        | 11.3 Trademarks .....                            | 12        |
| <b>7 Detailed Description</b> .....            | <b>7</b> | 11.4 Electrostatic Discharge Caution.....        | 12        |
| 7.1 Overview .....                             | 7        | 11.5 Glossary .....                              | 12        |
| 7.2 Functional Block Diagram .....             | 7        | <b>12 Mechanical, Packaging, and Orderable</b>   |           |
| 7.3 Feature Description.....                   | 7        | <b>Information</b> .....                         | <b>12</b> |

## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision D (May 2013) to Revision E                                                                                                                                                                                                                                                                                                     | Page     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| • Removed the SON package.....                                                                                                                                                                                                                                                                                                                       | <b>1</b> |
| • Added <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. .... | <b>1</b> |

## 5 Pin Configuration and Functions



### Pin Functions

| PIN                       |       |       | I/O | DESCRIPTION                                                                                                                                                                        |
|---------------------------|-------|-------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                      | NO.   |       |     |                                                                                                                                                                                    |
|                           | LM809 | LM810 |     |                                                                                                                                                                                    |
| $\overline{\text{RESET}}$ | 2     | —     | O   | Active-low output. $\overline{\text{RESET}}$ remains low while $V_{\text{CC}}$ is below the reset threshold, and for 240 ms after $V_{\text{CC}}$ rises above the reset threshold. |
| RESET                     | —     | 2     | O   | Active-high output. RESET remains high while $V_{\text{CC}}$ is below the reset threshold, and for 240 ms after $V_{\text{CC}}$ rises above the reset threshold.                   |
| $V_{\text{CC}}$           | 3     | 3     | I   | Supply voltage                                                                                                                                                                     |
| GND                       | 1     | 1     | —   | Ground reference                                                                                                                                                                   |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

see <sup>(1)(2)</sup>

|                                                   |                                  | MIN  | MAX            | UNIT       |
|---------------------------------------------------|----------------------------------|------|----------------|------------|
| Input supply voltage                              | $V_{CC}$                         | −0.3 | 6              | V          |
| Output voltage                                    | RESET, $\overline{\text{RESET}}$ | −0.3 | $V_{CC} + 0.3$ | V          |
| Input current                                     | $V_{CC}$                         |      | 20             | mA         |
| Output current                                    | RESET, $\overline{\text{RESET}}$ |      | 20             | mA         |
| Rate of rise                                      | $V_{CC}$                         |      | 100            | V/ $\mu$ s |
| Continuous power dissipation                      |                                  |      | 320            | mW         |
| Lead temperature (soldering, 10 s)                |                                  |      | 300            | °C         |
| Ambient temperature range, $T_A$                  |                                  | −40  | 105            | °C         |
| Maximum junction temperature, $T_{J(\text{MAX})}$ |                                  |      | 125            | °C         |
| Storage temperature, $T_{\text{stg}}$             |                                  | −65  | 160            | °C         |

- Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.

### 6.2 ESD Ratings

|                                          |                                                                                | VALUE | UNIT |
|------------------------------------------|--------------------------------------------------------------------------------|-------|------|
| $V_{\text{ESD}}$ Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±2000 | V    |
|                                          | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±200  |      |

- JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible with the necessary precautions. Pins listed as ±2000 V may actually have higher performance.
- JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible with the necessary precautions. Pins listed as ±200 V may actually have higher performance.

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

|                              |                                                           |                                                 | MIN | NOM | MAX | UNIT          |
|------------------------------|-----------------------------------------------------------|-------------------------------------------------|-----|-----|-----|---------------|
| $V_{CC}$ Input voltage 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      | $V_{CC} < 5.5\text{ V,}$<br>LM8xx: 4.63, 4.38, 4.00       | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  |     | 18  | 60  | $\mu\text{A}$ |
|                              |                                                           | $T_A = 85^\circ\text{C to } 105^\circ\text{C}$  |     |     | 100 |               |
|                              | $V_{CC} < 3.6\text{ V,}$<br>LM8xx: 3.08, 2.93, 2.63, 2.45 | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  |     | 15  | 50  |               |
|                              |                                                           | $T_A = 85^\circ\text{C to } 105^\circ\text{C}$  |     |     | 100 |               |

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | LM809, LM810 | UNIT |
|-------------------------------|----------------------------------------------|--------------|------|
|                               |                                              | DBZ (SOT-23) |      |
|                               |                                              | 3 PINS       |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 252.0        | °C/W |
| $R_{\theta JC(\text{top})}$   | Junction-to-case (top) thermal resistance    | 113.3        | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 53.5         | °C/W |
| $\Psi_{JT}$                   | Junction-to-top characterization parameter   | 9.9          | °C/W |
| $\Psi_{JB}$                   | Junction-to-board characterization parameter | 52.6         | °C/W |
| $R_{\theta JC(\text{bot})}$   | Junction-to-case (bottom) thermal resistance | —            | °C/W |

- For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics

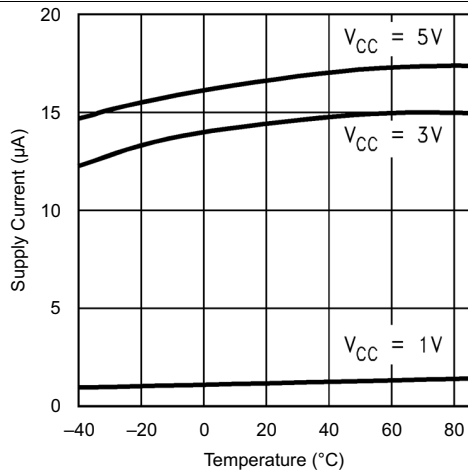
$V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A$  =  $25^{\circ}\text{C}$ ,  $V_{CC}$  = 5 V for 4.63, 4.38, and 4.00 versions,  $V_{CC}$  = 3.3 V for 3.08 and 2.93 versions, and  $V_{CC}$  = 3 V for 2.63 and 2.45 version<sup>(1)</sup>.

| PARAMETER                                     |                                               | TEST CONDITIONS                                                                                      |                                | MIN  | TYP  | MAX                   | UNIT |
|-----------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------|------|------|-----------------------|------|
| V <sub>TH</sub>                               | Reset Threshold <sup>(2)</sup>                | LM8xx: 4.63 V                                                                                        | T <sub>A</sub> = 25°C          | 4.56 | 4.63 | 4.70                  | V    |
|                                               |                                               |                                                                                                      | T <sub>A</sub> = −40°C to 85°C | 4.50 |      | 4.75                  |      |
|                                               |                                               |                                                                                                      | T <sub>A</sub> = 85°C to 105°C | 4.40 |      | 4.86                  |      |
|                                               | LM8xx: 4.38 V                                 | T <sub>A</sub> = 25°C                                                                                | 4.31                           | 4.38 | 4.45 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 4.25                           |      | 4.50 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 4.16                           |      | 4.56 |                       |      |
|                                               | LM8xx: 4.00 V                                 | T <sub>A</sub> = 25°C                                                                                | 3.93                           | 4.00 | 4.06 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 3.89                           |      | 4.10 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 3.80                           |      | 4.20 |                       |      |
|                                               | LM8xx: 3.08 V                                 | T <sub>A</sub> = 25°C                                                                                | 3.04                           | 3.08 | 3.11 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 3.00                           |      | 3.15 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 2.92                           |      | 3.23 |                       |      |
|                                               | LM8xx: 2.93 V                                 | T <sub>A</sub> = 25°C                                                                                | 2.89                           | 2.93 | 2.96 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 2.85                           |      | 3.00 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 2.78                           |      | 3.08 |                       |      |
|                                               | LM8xx: 2.63 V                                 | T <sub>A</sub> = 25°C                                                                                | 2.59                           | 2.63 | 2.66 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 2.55                           |      | 2.70 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 2.50                           |      | 2.76 |                       |      |
|                                               | LM8xx: 2.45 V                                 | T <sub>A</sub> = 25°C                                                                                | 2.41                           | 2.45 | 2.49 |                       |      |
|                                               |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       | 2.38                           |      | 2.52 |                       |      |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       | 2.33                           |      | 2.57 |                       |      |
| Reset Threshold Temperature Coefficient       |                                               |                                                                                                      |                                | 30   |      | ppm/°C                |      |
| V <sub>CC</sub> to Reset Delay <sup>(2)</sup> |                                               | V <sub>CC</sub> = V <sub>TH</sub> to (V <sub>TH</sub> − 100 mV)                                      |                                | 20   |      | μs                    |      |
| Reset Active Timeout Period                   |                                               | T <sub>A</sub> = −40°C to 85°C                                                                       |                                | 140  | 240  | 560                   | ms   |
|                                               |                                               | T <sub>A</sub> = 85°C to 105°C                                                                       |                                | 100  |      | 840                   |      |
| V <sub>OL</sub>                               | RESE <sub>T</sub> Output Voltage Low (LM809)  | V <sub>CC</sub> = V <sub>TH(min)</sub> , I <sub>SINK</sub> = 1.2 mA, LM809: 2.45, 2.63, 2.93, 3.08   |                                |      |      | 0.3                   | V    |
|                                               |                                               | V <sub>CC</sub> = V <sub>TH(min)</sub> , I <sub>SINK</sub> = 3.2 mA, LM809: 4.63, 4.38, 4.00         |                                |      |      | 0.4                   |      |
|                                               |                                               | V <sub>CC</sub> > 1 V, I <sub>SINK</sub> = 50 μA                                                     |                                |      |      | 0.3                   |      |
|                                               | RESET Output Voltage Low (LM810)              | V <sub>CC</sub> = V <sub>TH(max)</sub> , I <sub>SINK</sub> = 1.2 mA, LM810: 2.63, 2.93, 3.08         |                                |      |      | 0.3                   |      |
|                                               |                                               | V <sub>CC</sub> = V <sub>TH(max)</sub> , I <sub>SINK</sub> = 3.2 mA, LM810: 4.63, 4.38, 4.00         |                                |      |      | 0.4                   |      |
| V <sub>OH</sub>                               | RESE <sub>T</sub> Output Voltage High (LM809) | V <sub>CC</sub> > V <sub>TH(max)</sub> , I <sub>SOURCE</sub> = 500 μA, LM809: 2.45, 2.63, 2.93, 3.08 |                                |      |      | 0.8 × V <sub>CC</sub> | V    |
|                                               |                                               | V <sub>CC</sub> > V <sub>TH(max)</sub> , I <sub>SOURCE</sub> = 800 μA, LM809: 4.63, 4.38, 4.00       |                                |      |      | V <sub>CC</sub> − 1.5 |      |
|                                               | RESET Output Voltage High (LM810)             | 1.8 V < V <sub>CC</sub> < V <sub>TH(min)</sub> , I <sub>SOURCE</sub> = 150 μA                        |                                |      |      | 0.8 × V <sub>CC</sub> |      |
|                                               |                                               |                                                                                                      |                                |      |      |                       |      |

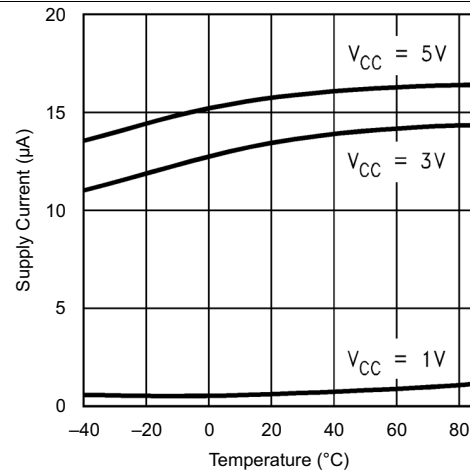
(1) Production testing done at  $T_A$  =  $25^{\circ}\text{C}$ , over temperature limits specified by design only.

(2) RESE $\overline{T}$  Output for LM809, RESET output for LM810.

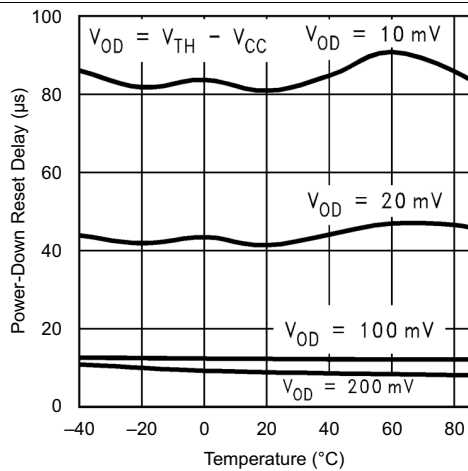
## 6.6 Typical Characteristics



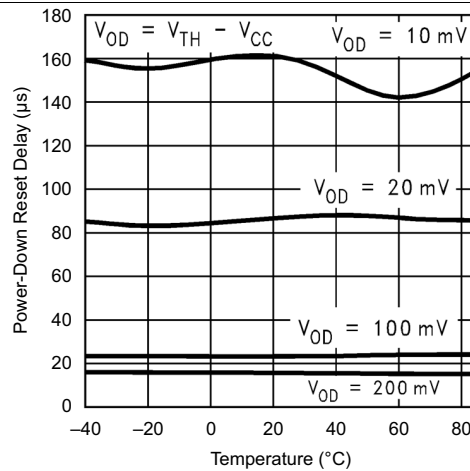
**Figure 1. Supply Current vs Temperature (No Load, LM8xx: 2.63, 2.93, 3.08)**



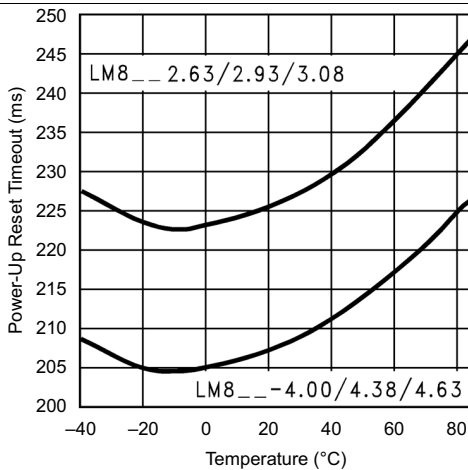
**Figure 2. Supply Current vs Temperature (No Load, LM8xx: 4.63, 4.38)**



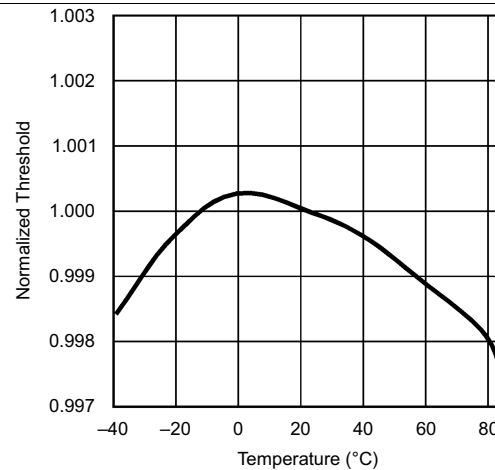
**Figure 3. Power-Down Reset Delay vs Temp (LM8xx: 2.63, 2.93, 3.08)**



**Figure 4. Power-Down Reset Delay vs Temperature (LM8xx: 4.63, 4.38)**



**Figure 5. Power-Up Reset Timeout vs Temperature**



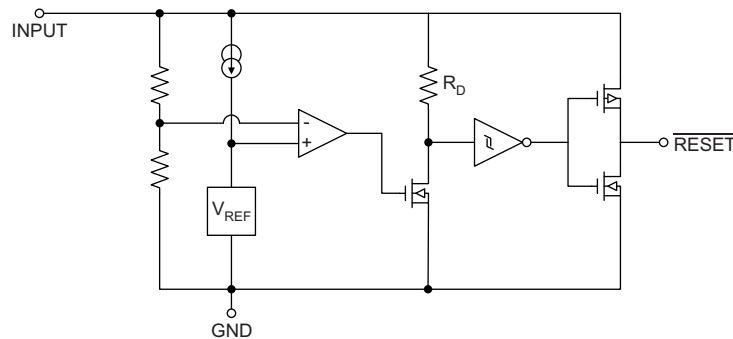
**Figure 6. Normalized Reset Threshold vs Temperature**

## 7 Detailed Description

### 7.1 Overview

The LM809 and LM810 microprocessor supervisory circuits provide a simple solution to monitor the power supplies in microprocessor and digital systems and provide a reset during power-up, power-down, and brown-out conditions. The reset signal is controlled by the factory-programmed reset threshold on the  $V_{CC}$  supply voltage pin. When the voltage declines below the reset threshold, the reset signal is asserted and remains asserted for 240 ms 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. The available threshold options are 2.63 V, 2.93 V, 3.08 V, 4.38 V, and 4.63 V to provide precision monitoring of supply voltages.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Benefits of Precision Reset Thresholds

A microprocessor supply supervisor must provide a reset output within a predictable range of the supply voltage. A common threshold range is between 5% and 10% below the nominal supply voltage. The 4.63-V and 3.08-V options of the LM809 and LM810 use highly accurate circuitry to ensure that the reset threshold occurs only within this range (for 5-V and 3.3-V supplies). The other voltage options have the same tight tolerance to ensure a reset signal for other narrow monitor ranges. See [Table 1](#) for examples of how the standard reset thresholds apply to 3-V, 3.3-V, and 5-V nominal supply voltages.

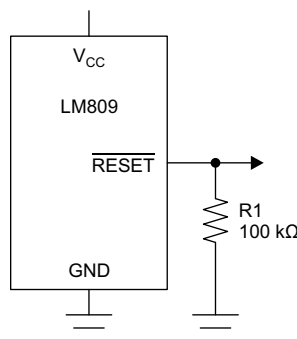
**Table 1. Reset Thresholds Related to Common Supply Voltages**

| Reset Threshold | 3 V      | 3.3 V    | 5 V      |
|-----------------|----------|----------|----------|
| 4.63 ± 3%       |          |          | 90 – 95% |
| 4.38 ± 3%       |          |          | 85 – 90% |
| 4.00 ± 3%       |          |          | 78 – 82% |
| 3.08 ± 3%       |          | 90 – 95% |          |
| 2.93 ± 3%       |          | 86 – 90% |          |
| 2.63 ± 3%       | 85 – 90% | 77 – 81% |          |
| 2.45 ± 3%       | 79 – 84% | 72 – 76% |          |

### 7.3.1.1 Ensuring a Valid Reset Output Down to $V_{CC} = 0\text{ V}$

When  $V_{CC}$  falls below  $1\text{ V}$ , the LM809  $\overline{\text{RESET}}$  output no longer sinks current. A high-impedance CMOS logic input connected to  $\overline{\text{RESET}}$  can therefore drift to undetermined voltages. To prevent this situation, a  $100\text{-k}\Omega$  resistor should be connected from the  $\overline{\text{RESET}}$  output to ground, as shown in Figure 7.

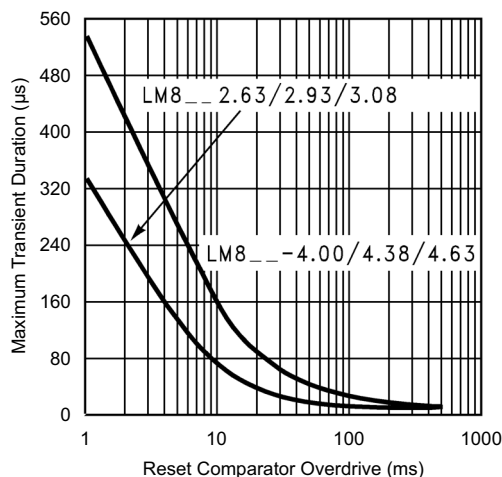
A  $100\text{-k}\Omega$  pullup resistor to  $V_{CC}$  is also recommended for the LM810, if  $\overline{\text{RESET}}$  is required to remain valid for  $V_{CC} < 1\text{ V}$ .



**Figure 7.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**

### 7.3.1.2 Negative-Going $V_{CC}$ Transients

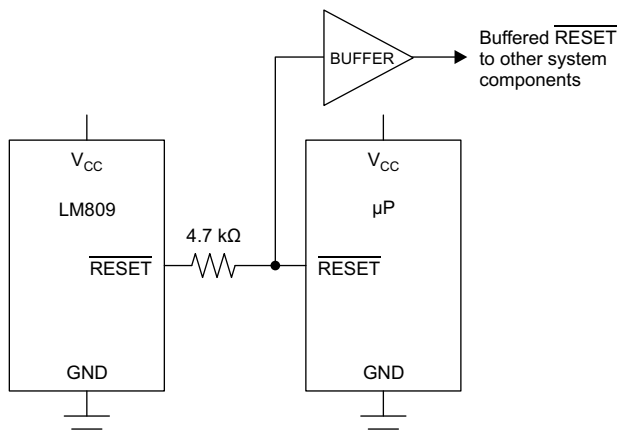
The LM809 and LM810 are relatively immune to short negative-going transients or glitches on  $V_{CC}$ . Figure 8 shows the maximum pulse width a negative-going  $V_{CC}$  transient can have without causing a reset pulse. In general, as the magnitude of the transient increases, going further below the threshold, the maximum allowable pulse width decreases. Typically, for the  $4.63\text{-V}$  and  $4.38\text{-V}$  version of the LM809 or LM810, a  $V_{CC}$  transient that goes  $100\text{ mV}$  below the reset threshold and lasts  $20\text{ }\mu\text{s}$  or less will not cause a reset pulse. A  $0.1\text{-}\mu\text{F}$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin will provide additional transient rejection.



**Figure 8. Maximum Transient Duration without Causing a Reset Pulse vs Reset Comparator Overdrive**

### 7.3.1.3 Interfacing to $\mu$ Ps with Bidirectional Reset Pins

Microprocessors with bidirectional reset pins, such as the Motorola 68HC11 series, can be connected to the LM809 RESET output. To ensure a correct output on the LM809 even when the microprocessor reset pin is in the opposite state, connect a 4.7-k $\Omega$  resistor between the LM809 RESET output and the  $\mu$ P reset pin, as shown in Figure 9. Buffer the LM809 RESET output to other system components.



**Figure 9. Interfacing to Microprocessors with Bidirectional Reset I/O**

## 7.4 Device Functional Modes

### 7.4.1 V<sub>CC</sub> Supply Voltage Low

When V<sub>CC</sub> supply voltage declines below the reset threshold, the RESET output is asserted. For LM809, the active-low RESET output is low. For LM810, the active-high RESET output is high.

### 7.4.2 V<sub>CC</sub> Supply Voltage High

When the V<sub>CC</sub> supply voltage rises above the reset threshold, the RESET output resets after 240 ms. For LM809, the active-low RESET output rises high. For LM810, the active-high RESET output drops low.

## 8 Application and Implementation

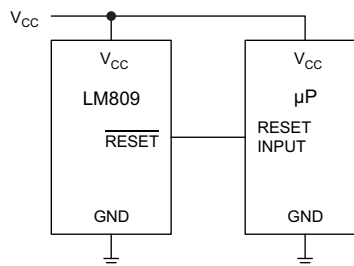
### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 8.1 Application Information

The LM809 and LM810 are a supervisor circuit for microprocessor and digital systems. With a low supply current of only 15  $\mu\text{A}$ , the LM809 and LM810 are ideal for use in portable equipment.

### 8.2 Typical Application



**Figure 10. Microprocessor  $\overline{\text{RESET}}$  Circuit**

#### 8.2.1 Design Requirements

For this design example, use the parameters listed in [Table 2](#) as the input parameters.

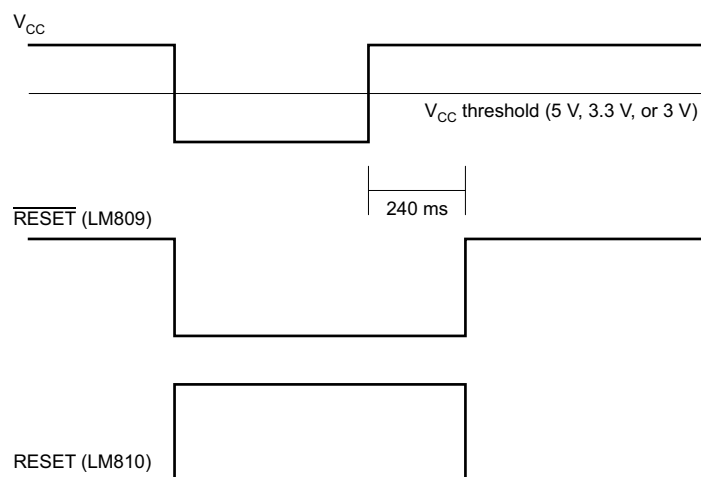
**Table 2. Design Parameters**

| DESIGN PARAMETER            | EXAMPLE VALUE |
|-----------------------------|---------------|
| Input supply voltage range  | 1 V to 5.5 V  |
| Reset output voltage (high) | Input supply  |
| Reset output voltage (low)  | 0 V           |

#### 8.2.2 Detailed Design Procedure

For the typical application circuit, all that is required is the LM809 or LM810 IC, but TI recommends an input capacitor to help with input voltage transients. A typical input capacitor value is 0.1  $\mu\text{F}$  and must be rated for the highest expected input voltage.

### 8.2.3 Application Curve



**Figure 11. Reset Active Timeout**

## 9 Power Supply Recommendations

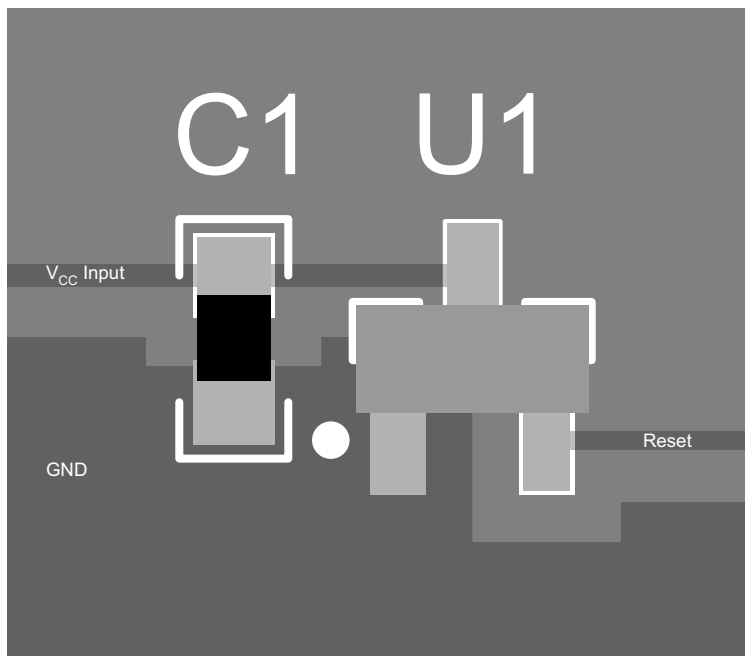
The input of the LM809 is designed to handle up to the supply voltage absolute maximum rating of 6.5 V. If the input supply is susceptible to any large transients above the maximum rating, then extra precautions should be taken. An input capacitor is recommended to avoid false reset output triggers due to noise.

## 10 Layout

### 10.1 Layout Guidelines

Place the input capacitor as close as possible to the IC.

### 10.2 Layout Example



**Figure 12. Layout Example**

## 11 Device and Documentation Support

### 11.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 3. Related Links**

| PARTS | PRODUCT FOLDER             | SAMPLE & BUY               | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|-------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| LM809 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| LM810 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

### 11.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](#), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 11.3 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 11.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 11.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number              | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|------------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM809M3-2.63/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S3B                 |
| LM809M3-2.63/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S3B                 |
| <a href="#">LM809M3-2.93/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S4B                 |
| LM809M3-2.93/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S4B                 |
| <a href="#">LM809M3-3.08/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S5B                 |
| LM809M3-3.08/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S5B                 |
| <a href="#">LM809M3-4.38/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S7B                 |
| LM809M3-4.38/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S7B                 |
| <a href="#">LM809M3-4.63/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S8B                 |
| LM809M3-4.63/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S8B                 |
| <a href="#">LM809M3X-2.63/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S3B                 |
| LM809M3X-2.63/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S3B                 |
| <a href="#">LM809M3X-2.93/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S4B                 |
| LM809M3X-2.93/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S4B                 |
| <a href="#">LM809M3X-3.08/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S5B                 |
| LM809M3X-3.08/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S5B                 |
| <a href="#">LM809M3X-4.38/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -            | S7B                 |
| LM809M3X-4.38/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S7B                 |
| <a href="#">LM809M3X-4.63/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S8B                 |
| LM809M3X-4.63/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | S8B                 |
| <a href="#">LM810M3-4.63/NOPB</a>  | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | SEB                 |
| LM810M3-4.63/NOPB.A                | Active        | Production           | SOT-23 (DBZ)   3 | 1000   SMALL T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | SEB                 |
| <a href="#">LM810M3X-4.63/NOPB</a> | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | SEB                 |
| LM810M3X-4.63/NOPB.A               | Active        | Production           | SOT-23 (DBZ)   3 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 105   | SEB                 |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM809M3-2.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3-2.93/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3-3.08/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3-4.38/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3-4.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3X-2.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3X-2.93/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3X-3.08/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3X-4.38/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM809M3X-4.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM810M3-4.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |
| LM810M3X-4.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 178.0              | 8.4                | 3.3     | 2.9     | 1.22    | 4.0     | 8.0    | Q3            |

## TAPE AND REEL BOX DIMENSIONS

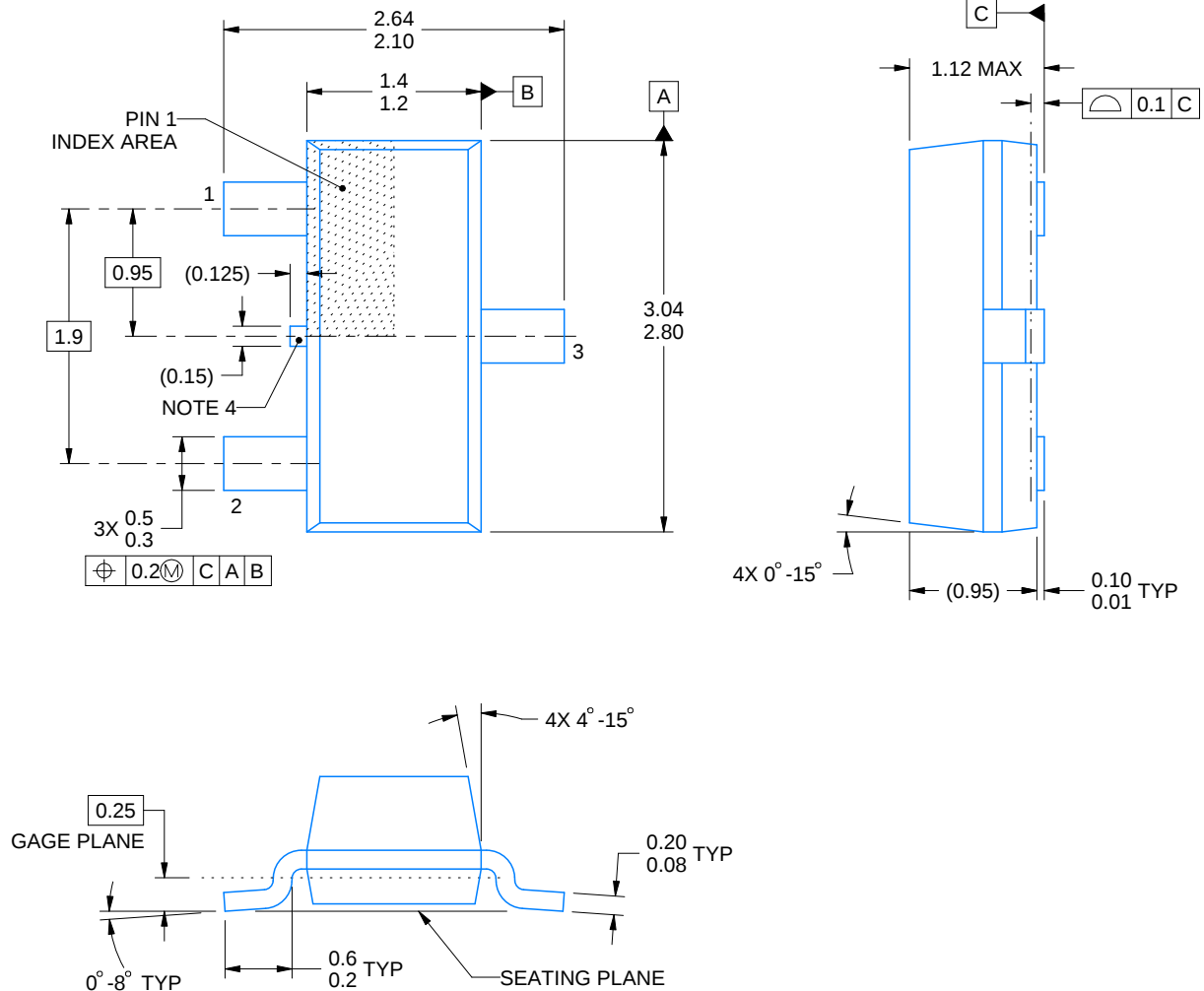


\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM809M3-2.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM809M3-2.93/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM809M3-3.08/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM809M3-4.38/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM809M3-4.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM809M3X-2.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |
| LM809M3X-2.93/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |
| LM809M3X-3.08/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |
| LM809M3X-4.38/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |
| LM809M3X-4.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |
| LM810M3-4.63/NOPB  | SOT-23       | DBZ             | 3    | 1000 | 208.0       | 191.0      | 35.0        |
| LM810M3X-4.63/NOPB | SOT-23       | DBZ             | 3    | 3000 | 208.0       | 191.0      | 35.0        |

**DBZ0003A****PACKAGE OUTLINE****SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



4214838/F 08/2024

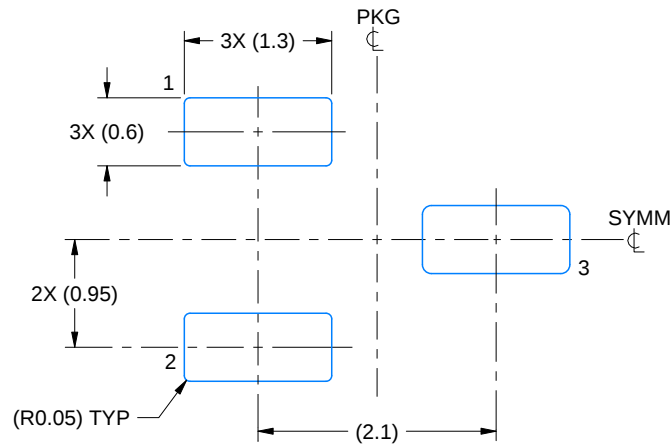
**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side

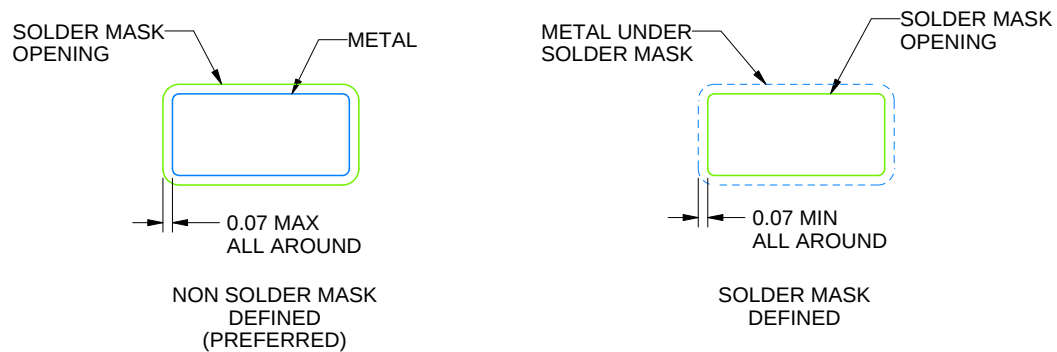
**DBZ0003A**

**SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
SCALE:15X



## SOLDER MASK DETAILS

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NOTES: (continued)

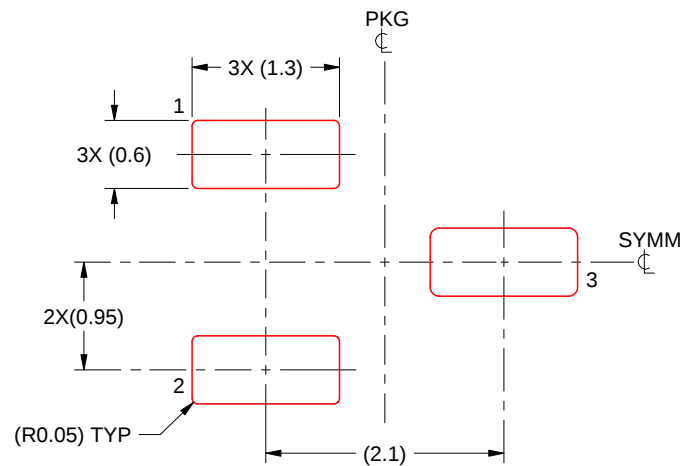
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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