# TCM809/TCM810

## 3-Pin Microcontroller Reset Monitors

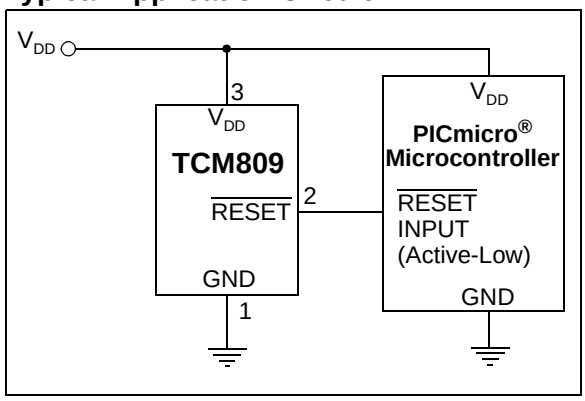
### Features

- Precision $V_{DD}$ Monitor for 2.5V, 3.0V, 3.3V, 5.0V Nominal System Voltage Supplies
- 140 msec Minimum RESET Time-Out Period
- $\overline{\text{RESET}}$ Output to $V_{DD}$ = 1.0V (**TCM809**)
- Low Supply Current, 9 µA (typ.)
- $V_{DD}$ Transient Immunity
- Small 3-Pin SC-70 and SOT-23B Packages
- No External Components
- Push-Pull RESET Output
- Temperature Ranges:
  - Industrial: SC-70 (E): -40°C to +85°C
  - Extended: SOT-23, SC-70 (V): -40°C to +125°C

### Applications

- Computers
- Embedded Systems
- Battery-powered Equipment
- Critical Microcontroller Power Supply Monitoring
- Automotive

### Typical Application Circuit




### General Description

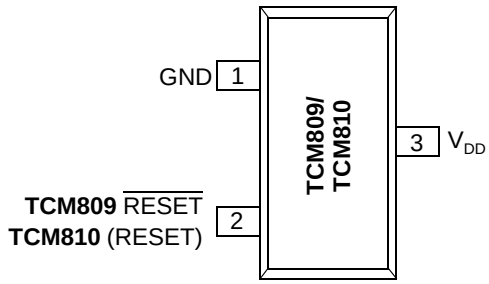
The TCM809 and TCM810 are cost-effective system supervisor circuits designed to monitor $V_{DD}$ in digital systems; providing a reset signal to the host processor, when necessary. No external components are required.

The RESET output is typically driven active within 65 µsec of $V_{DD}$ falling through the reset voltage threshold. RESET is maintained active for a minimum of 140 msec after $V_{DD}$ rises above the reset threshold. The TCM810 has an active-high RESET output, while the TCM809 has an active-low $\overline{\text{RESET}}$ output. The output of the TCM809/TCM810 is valid down to $V_{DD}$ = 1V. Both devices are available in 3-Pin SC-70 and SOT-23B packages.

The TCM809/TCM810 are optimized to reject fast transient glitches on the $V_{DD}$ line. A low supply current of 9 µA (typ., $V_{DD}$ = 3.3V) make these devices suitable for battery-powered applications.

### Pin Configurations

**SOT-23B/SC-70**




**Note:** 3-Pin SOT-23B is equivalent to JEDEC TO-236.

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## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

Supply Voltage ($V_{DD}$ to GND) ..... 6.0V
$\overline{RESET}$, RESET ..... -0.3V to ($V_{DD}$ +0.3V)
Input Current, $V_{DD}$ ..... 20 mA
Output Current, $\overline{RESET}$, RESET ..... 20 mA
dV/dt ($V_{DD}$) ..... 100V/µsec
Operating Temperature Range ..... -40°C to +125°C
Power Dissipation ($T_A$ = 70°C):
3-Pin SOT-23B (derate 4 mW/°C above +70°C) ..... 320 mW
3-Pin SC-70 (derate 2.17 mW/°C above +70°C) ..... 174 mW
Storage Temperature Range ..... -65°C to +150°C
Maximum Junction Temperature, $T_J$ ..... 150°C

† **Notice:** Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

$V_{DD}$ = Full Range, $T_A$ = Operating Temperature Range, unless otherwise noted. Typical values are at $T_A$ = +25°C, $V_{DD}$ = 5V for L/M/J, 3.3V for T/S, 3.0V for R and 2.5V for Z **(Note 1)**.

| Parameter | Sym | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{DD}$ Range | | 1.0 | — | 5.5 | V | $T_A$ = 0°C to +70°C |
| | | 1.2 | — | 5.5 | | $T_A$ = – 40°C to +125°C |
| Supply Current | $I_{CC}$ | — | 12 | 30 | µA | **TCM8xx**L/M/J: $V_{DD}$ < 5.5V |
| | | — | 9 | 25 | | **TCM8xx**R/S/T/Z: $V_{DD}$ < 3.6V |
| Reset Threshold **(Note 2)** | $V_{TH}$ | 4.56 | 4.63 | 4.70 | V | **TCM8xx**L: $T_A$ = +25°C |
| | | 4.50 | — | 4.75 | | $T_A$ = – 40°C to +125°C |
| | | 4.31 | 4.38 | 4.45 | V | **TCM8xx**M: $T_A$ = +25°C |
| | | 4.25 | — | 4.50 | V | $T_A$ = – 40°C to +125°C |
| | | 3.93 | 4.00 | 4.06 | V | **TCM809**J: $T_A$ = +25°C |
| | | 3.89 | — | 4.10 | V | $T_A$ = – 40°C to +125°C |
| | | 3.04 | 3.08 | 3.11 | V | **TCM8xx**T: $T_A$ = +25°C |
| | | 3.00 | — | 3.15 | V | $T_A$ = – 40°C to +125°C |
| | | 2.89 | 2.93 | 2.96 | V | **TCM8xx**S: $T_A$ = +25°C |
| | | 2.85 | — | 3.00 | V | $T_A$ = – 40°C to +125°C |
| | | 2.59 | 2.63 | 2.66 | V | **TCM8xx**R: $T_A$ = +25°C |
| | | 2.55 | — | 2.70 | V | $T_A$ = – 40°C to +125°C |
| | | 2.28 | 2.32 | 2.35 | V | **TCM8xx**Z: $T_A$ = +25°C |
| | | 2.25 | — | 2.38 | V | $T_A$ = – 40°C to +125°C |
| Reset Threshold Tempco | | — | 30 | — | ppm/°C | |
| $V_{DD}$ to Reset Delay, | | — | 65 | — | µsec | $V_{DD}$ = $V_{TH}$ to ($V_{TH}$ – 100 mV) **(Note 2)** |
| Reset Active Time Out Period | | 140 | 320 | 560 | msec | |
| $\overline{RESET}$ Output Voltage Low (**TCM809**) | $V_{OL}$ | — | — | 0.3 | V | **TCM809**R/S/T/Z: $V_{DD}$ = $V_{TH}$ min, $I_{SINK}$ = 1.2 mA |
| | | — | — | 0.4 | | **TCM809**L/M/J: $V_{DD}$ = $V_{TH}$ min, $I_{SINK}$ = 3.2 mA |
| | | — | — | 0.3 | | $V_{DD}$ > 1.0V, $I_{SINK}$ = 50 µA |
| $\overline{RESET}$ Output Voltage High (**TCM809**) | $V_{OH}$ | 0.8 $V_{DD}$ | — | — | V | **TCM809**R/S/T/Z: $V_{DD}$ > $V_{TH}$ max, $I_{SOURCE}$ = 500 µA |
| | | $V_{DD}$ – 1.5 | — | — | | **TCM809**L/M/J: $V_{DD}$ > $V_{TH}$ max, $I_{SOURCE}$ = 800 µA |
| RESET Output Voltage Low (**TCM810**) | $V_{OL}$ | — | — | 0.3 | V | **TCM810**R/S/T/Z:$V_{DD}$ = $V_{TH}$ max, $I_{SINK}$ = 1.2 mA |
| | | — | — | 0.4 | | **TCM810**L/M: $V_{DD}$ = $V_{TH}$ max, $I_{SINK}$ = 3.2 mA |
| RESET Output Voltage High (**TCM810**) | $V_{OH}$ | 0.8 $V_{DD}$ | — | — | V | 1.8 < $V_{DD}$ < $V_{TH}$ min, $I_{SOURCE}$ = 150 µA |

**Note 1:** Production testing done at $T_A$ = +25°C, overtemperature limits ensured by QC screen.
**2:** $\overline{RESET}$ output for **TCM809**, RESET output for **TCM810**.


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## 2.0 TYPICAL PERFORMANCE CHARACTERISTICS

**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

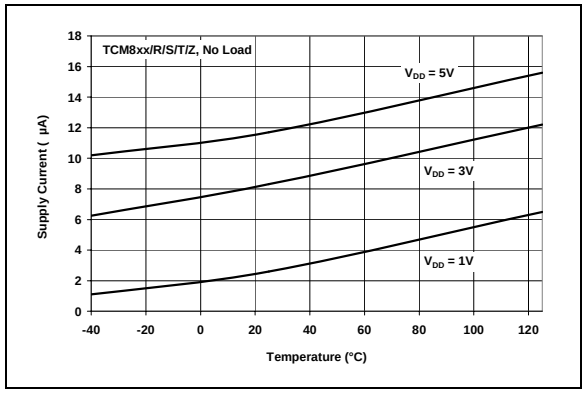



***FIGURE 2-1:*** *Supply Current vs. Temperature.*

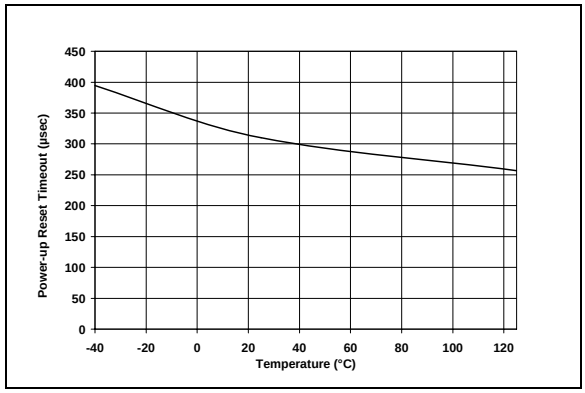



***FIGURE 2-3:*** *Power-up Reset Time Out vs. Temperature.*

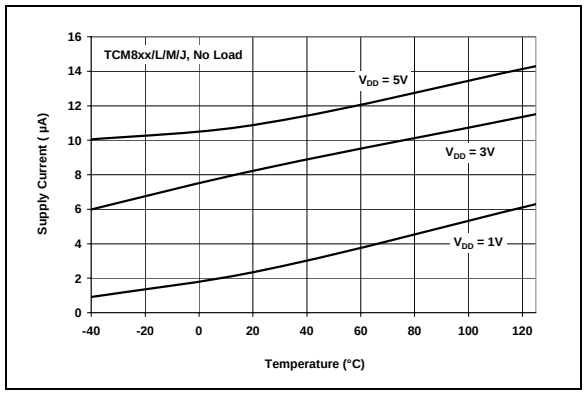



***FIGURE 2-2:*** *Supply Current vs. Temperature.*

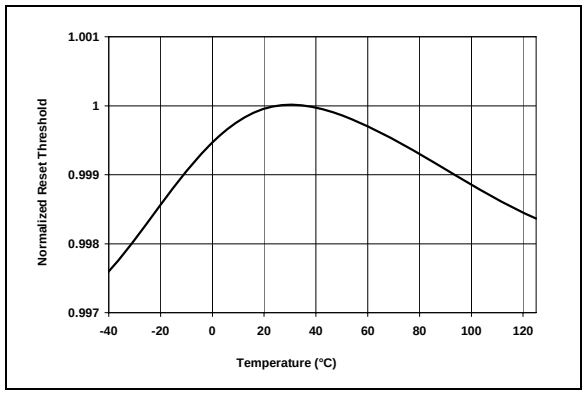



***FIGURE 2-4:*** *Normalized Reset Threshold vs. Temperature.*

## 3.0 PIN DESCRIPTIONS

The descriptions of the pins are given in Table 3-1.

**TABLE 3-1: PIN FUNCTION TABLE**

| NAME | FUNCTION |
|---|---|
| GND | Ground |
| $\overline{\text{RESET}}$ (**TCM809**) | $\overline{\text{RESET}}$ push-pull output |
| RESET (**TCM810**) | RESET push-pull output |
| $V_{DD}$ | Supply voltage (+2.5V, +3.0V, +3.3V, +5.0V). |

### 3.1 Ground (GND)

Ground terminal.

### 3.2 $\overline{\text{RESET}}$ Output (TCM809)

The $\overline{\text{RESET}}$ push-pull output remains low while $V_{DD}$ is below the reset voltage threshold, and for 240 msec (140 msec min.) after $V_{DD}$ rises above reset threshold.

### 3.3 RESET Output (TCM810)

The RESET push-pull output remains high while $V_{DD}$ is below the reset voltage threshold, and for 240 msec (140 msec min.) after $V_{DD}$ rises above reset threshold.

### 3.4 Supply Voltage ($V_{DD}$)

$V_{DD}$: +2.5V, +3.0V, +3.3V and +5.0V


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## 4.0 APPLICATIONS INFORMATION

### 4.1 $V_{DD}$ Transient Rejection

The TCM809/TCM810 provides accurate $V_{DD}$ monitoring and reset timing during power-up, power-down and brown-out/sag conditions. These devices also reject negative-going transients (glitches) on the power supply line. Figure 4-1 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive that lies under the curve will not generate a reset signal.

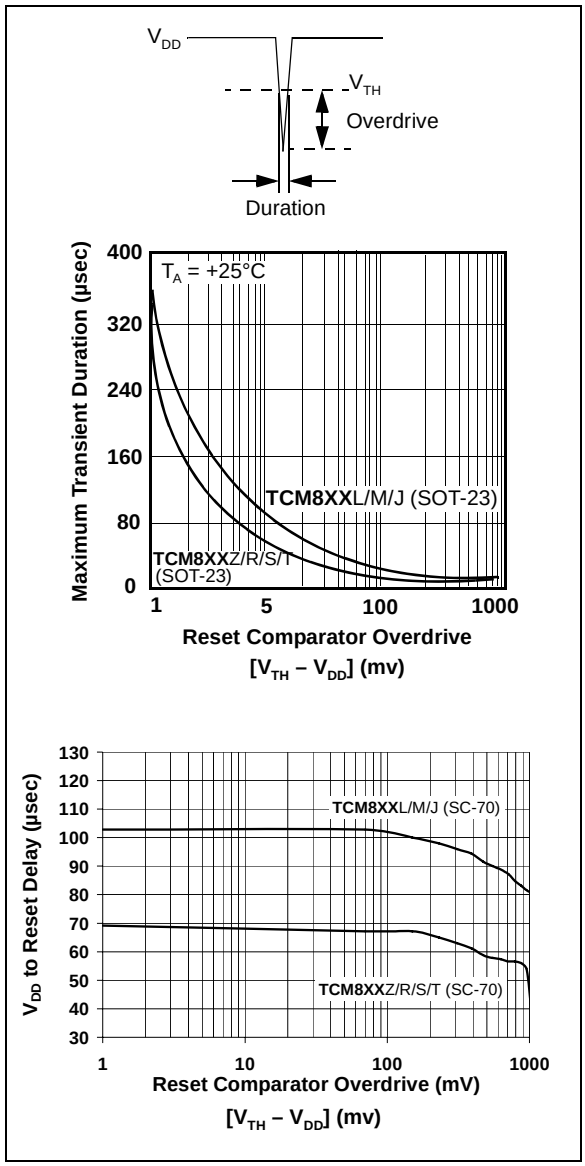



***FIGURE 4-1:*** *Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.*

Combinations above the curve are detected as a brown-out or power-down condition. Transient immunity can be improved by adding a capacitor in close proximity to the $V_{DD}$ pin of the TCM809/TCM810.

### 4.2 $\overline{\text{RESET}}$ Signal Integrity During Power-Down

The TCM809 $\overline{\text{RESET}}$ output is valid to $V_{DD}$ = 1.0V. Below this voltage the output becomes an "open circuit" and does not sink current. This means CMOS logic inputs to the microcontroller will be floating at an undetermined voltage. Most digital systems are completely shut down well above this voltage. However, in situations where $\overline{\text{RESET}}$ must be maintained valid to $V_{DD}$ = 0V, a pull-down resistor must be connected from $\overline{\text{RESET}}$ to ground to discharge stray capacitances and hold the output low (Figure 4-2). This resistor value, though not critical, should be chosen such that it does not appreciably load $\overline{\text{RESET}}$ under normal operation (100 kΩ will be suitable for most applications). Similarly, a pull-up resistor to $V_{DD}$ is required for the TCM810 to ensure a valid high $\overline{\text{RESET}}$ for $V_{DD}$ below 1.0V.

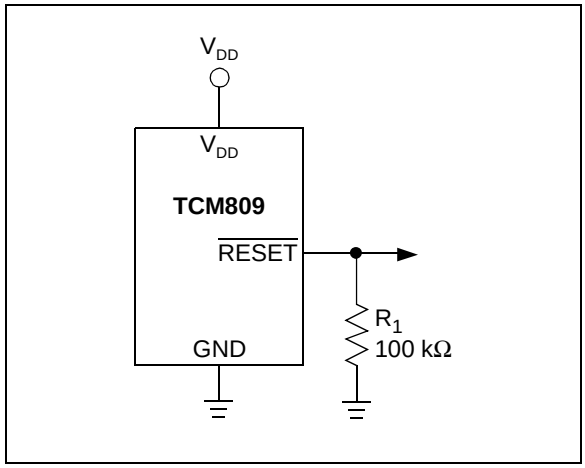



***FIGURE 4-2:*** *The addition of $R_1$ at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to $V_{DD}$ = 0V.*

### 4.3 Controllers and Processors With Bidirectional I/O Pins

Some microcontrollers have bidirectional reset pins. Depending on the current drive capability of the controller pin, an indeterminate logic level may result if there is a logic conflict. This can be avoided by adding a 4.7 kΩ resistor in series with the output of the TCM809/TCM810 (Figure 4-3). If there are other components in the system that require a reset signal, they should be buffered so as not to load the reset line. If the other components are required to follow the reset I/O of the microcontroller, the buffer should be connected as shown with the solid line.

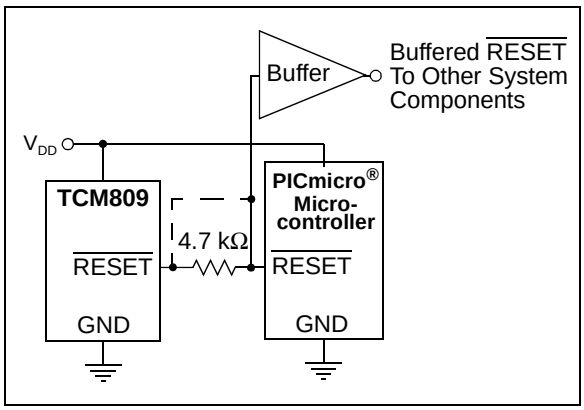


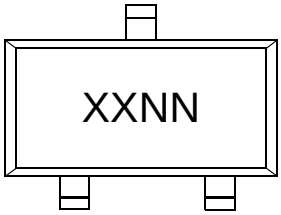

***FIGURE 4-3:*** *Interfacing the TCM809 to a Bidirectional RESET I/O.*


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## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

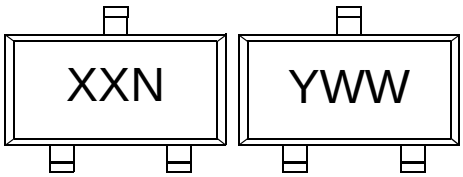
**3-Pin SOT-23B**



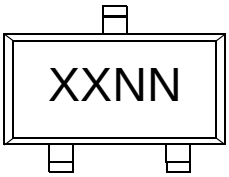

**Example:**

| Customer Specific Information Codes for: | | | |
|---|---|---|---|
| | | TCM8xx = | |
| Part Number | | TCM809 | TCM810 |
| TCM8xxL | ENB | J1 | K1 |
| | VNB | JZ | KZ |
| TCM8xxM | ENB | J2 | K2 |
| | VNB | JY | KY |
| TCM8xxT | ENB | J3 | K3 |
| | VNB | JX | KX |
| TCM8xxS | ENB | J4 | K4 |
| | VNB | JV | KV |
| TCM8xxR | ENB | J5 | K5 |
| | VNB | JU | KU |
| TCM8xxJ | ENB | J6 | — |
| | VNB | JT | KS |
| TCM8xxZ | ENB | J7 | K6 |

**3-Pin SC-70**




**OR**



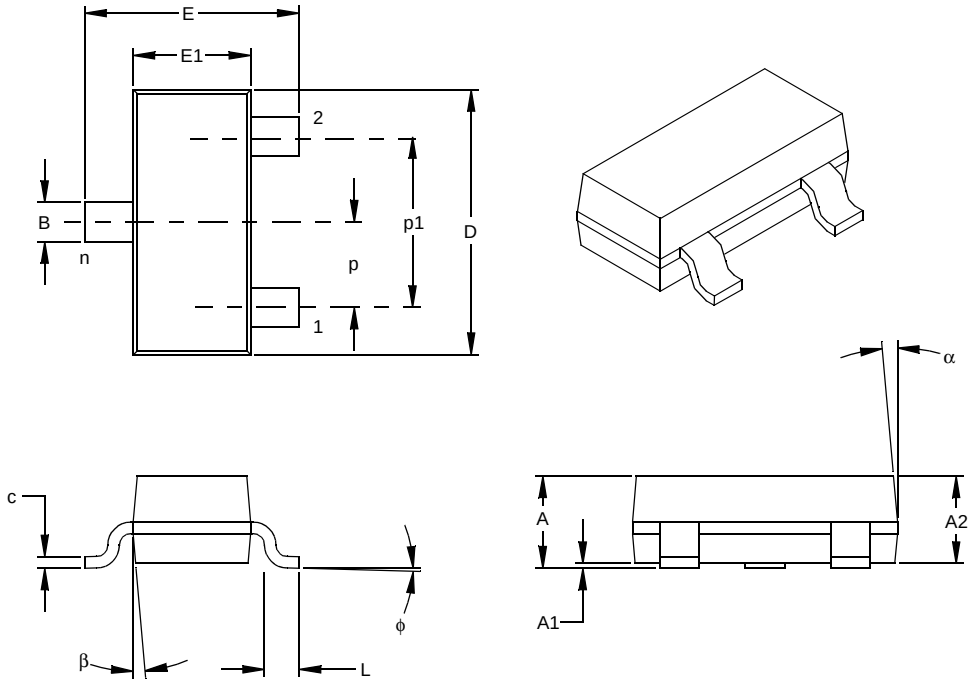

**Example:**

| Customer Specific Information Codes for: | | | |
|---|---|---|---|
| | | TCM8xx = | |
| Part Number | | TCM809 | TCM810 |
| TCM8xxL | ELB | J1 | — |
| | VLB | JZ | KZ |
| TCM8xxM | ELB | J2 | — |
| | VLB | JY | KY |
| TCM8xxT | ELB | J3 | — |
| | VLB | JX | KX |
| TCM8xxS | ELB | J4 | — |
| | VLB | JV | KV |
| TCM8xxR | ELB | J5 | — |
| | VLB | JU | KU |
| TCM8xxJ | ELB | J6 | — |
| | VLB | JT | KS |
| TCM8xxZ | ELB | J7 | — |
| | VLB | JS | KT |

| | | |
|---|---|---|
| **Legend:** | XX...X | Customer-specific information* |
| | Y | Year code (last digit of calendar year) |
| | YY | Year code (last 2 digits of calendar year) |
| | WW | Week code (week of January 1 is week '01') |
| | NNN | Alphanumeric traceability code |
| | (e3) | Pb-free JEDEC designator for Matte Tin (Sn) |
| | * | This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package. |

**Note**: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

## 3-Lead Plastic Small Outline Transistor (NB) (SOT-23)



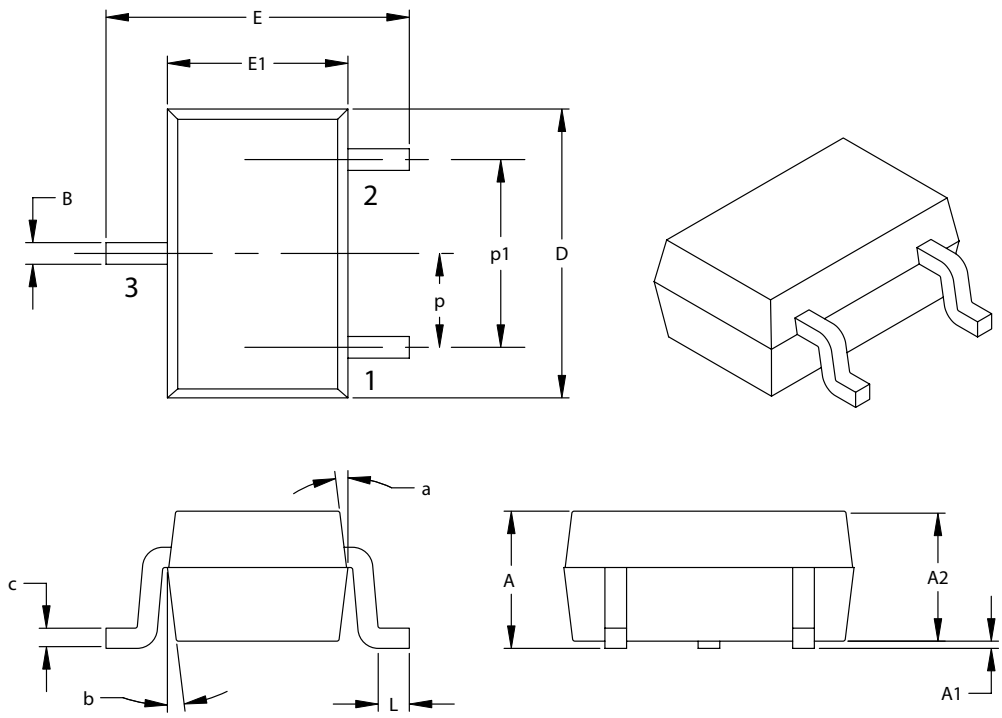

| Units | | INCHES* | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 3 | | | 3 | |
| Pitch | p | | .038 | | | 0.96 | |
| Outside lead pitch (basic) | p1 | | .076 | | | 1.92 | |
| Overall Height | A | .035 | .040 | .044 | 0.89 | 1.01 | 1.12 |
| Molded Package Thickness | A2 | .035 | .037 | .040 | 0.88 | 0.95 | 1.02 |
| Standoff § | A1 | .000 | .002 | .004 | 0.01 | 0.06 | 0.10 |
| Overall Width | E | .083 | .093 | .104 | 2.10 | 2.37 | 2.64 |
| Molded Package Width | E1 | .047 | .051 | .055 | 1.20 | 1.30 | 1.40 |
| Overall Length | D | .110 | .115 | .120 | 2.80 | 2.92 | 3.04 |
| Foot Length | L | .014 | .018 | .022 | 0.35 | 0.45 | 0.55 |
| Foot Angle | ϕ | 0 | 5 | 10 | 0 | 5 | 10 |
| Lead Thickness | c | .004 | .006 | .007 | 0.09 | 0.14 | 0.18 |
| Lead Width | B | .015 | .017 | .020 | 0.37 | 0.44 | 0.51 |
| Mold Draft Angle Top | α | 0 | 5 | 10 | 0 | 5 | 10 |
| Mold Draft Angle Bottom | β | 0 | 5 | 10 | 0 | 5 | 10 |

* Controlling Parameter
§ Significant Characteristic

**Notes:**
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010” (0.254mm) per side.
JEDEC Equivalent: TO-236
Drawing No. C04-104


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## 3-Lead Plastic Small Outline Transistor (LB) (SC-70)




| Units | | INCHES | | MILLIMETERS* | |
|---|---|---|---|---|---|
| Dimension Limits | | MIN | MAX | MIN | MAX |
| Number of Pins | | 3 | | 3 | |
| Pitch | p | .026 BSC. | | 0.65 BSC. | |
| Outside lead pitch (basic) | p1 | .051 BSC. | | 1.30 BSC. | |
| Overall Height | A | .031 | .043 | 0.80 | 1.10 |
| Molded Package Thickness | A2 | .031 | .039 | 0.80 | 1.00 |
| Standoff | A1 | .000 | .0004 | 0.00 | .010 |
| Overall Width | E | .071 | .094 | 1.80 | 2.40 |
| Molded Package Width | E1 | .045 | .053 | 1.15 | 1.35 |
| Overall Length | D | .071 | .089 | 1.80 | 2.25 |
| Foot Length | L | .004 | .016 | 0.10 | 0.41 |
| Lead Thickness | c | .003 | .010 | 0.08 | 0.25 |
| Lead Width | B | .006 | .016 | 0.15 | 0.40 |
| Mold Draft Angle Top | a | 8° | 12° | 8° | 12° |
| Mold Draft Angle Bottom | b | 8° | 12° | 8° | 12° |

*Controlling Parameter

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEITA (EIAJ) Equivalent: SC70

Drawing No. C04-104

## 5.2 Product Tape and Reel Specifications

**FIGURE 5-1: EMBOSSED CARRIER DIMENSIONS (8, 12, 16 AND 24 MM TAPE ONLY)**

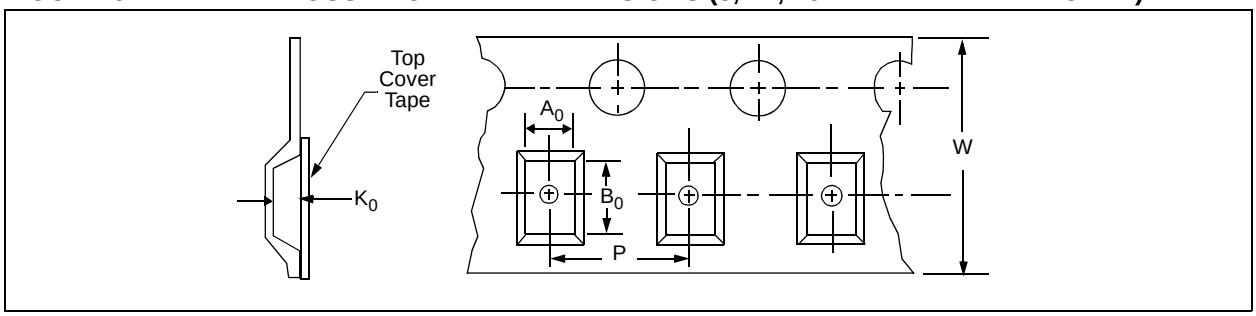
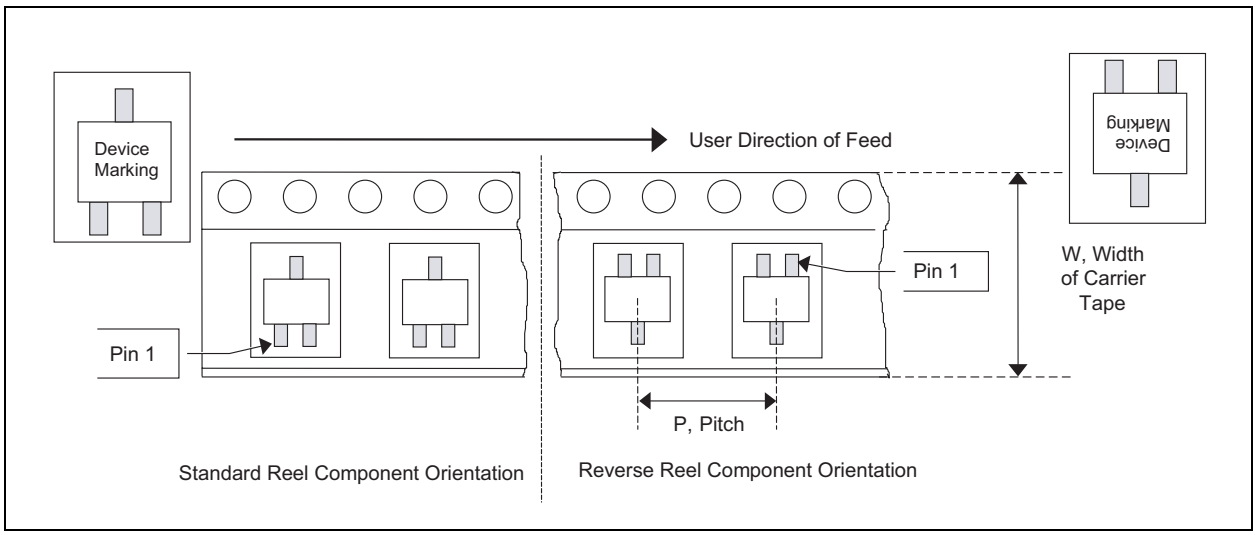



**TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS**

| Case Outline | Package Type | | Carrier Dimensions | | Cavity Dimensions | | | Output Quantity Units | Reel Diameter in mm |
|---|---|---|---|---|---|---|---|---|---|
| | | | W mm | P mm | A0 mm | B0 mm | K0 mm | | |
| NB | SOT-23 | 3L | 8 | 4 | 3.15 | 2.77 | 1.22 | 3000 | 180 |
| LB | SC-70 | 3L | 8 | 4 | 2.4 | 2.4 | 1.19 | 3000 | 180 |

**FIGURE 5-2: 3-LEAD SOT-23/SC70 DEVICE TAPE AND REEL SPECIFICATIONS**





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## APPENDIX A: REVISION HISTORY

### Revision D (March 2005)

- Updated **6.0 "Packaging Information"** to include old and new packaging examples.
- Applied new template and rearranged sections to be consistent with current documentation.

### Revision C (April 2004)

### Revision B (January 2002)

### Revision A (May 2001)

Initial release of data sheet.

**NOTES:**


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## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

| PART NO. | X | X | XXXXX |
|---|---|---|---|
| Device | $V_{DD}$ Reset Threshold | Temperature Range | Package |

| | | |
|---|---|---|
| Device: | TCM809: | Supervisor circuit with active-low $\overline{\text{RESET}}$ output |
| | TCM810: | Supervisor circuit with active-high RESET output |
| $V_{DD}$ Reset Threshold: | L = | 4.63V |
| | M = | 4.38V |
| | J = | 4.00V |
| | T = | 3.08V |
| | S = | 2.93V |
| | R = | 2.63V |
| | Z = | 2.32V |
| Temperature Range: | E = | -40°C to +85°C |
| | V = | -40°C to +125°C |
| Package: | NB713 = | SOT-23B, 3-pin (Tape and Reel) |
| | LB713 = | SC-70, 3-pin (Tape and Reel) |

**Examples:**

| | | |
|---|---|---|
| a) | TCM809LENB713: | SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +85°C, Tape and Reel. |
| b) | TCM809LVLB713: | SC-70-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel. |
| c) | TCM809LVNB713: | SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel. |
| a) | TCM810MENB713: | SOT-23B-3-TR, Microcontroller 4.38V Reset Monitor, -40°C to +85°C, Tape and Reel. |
| b) | TCM810RVLB713: | SOT-23B-3-TR, Microcontroller 2.63V Reset Monitor, -40°C to +125°C, Tape and Reel. |
| c) | TCM810TVLB713: | SC-70-3-TR, Microcontroller 4.38V Reset Monitor, -40°C to +125°C, Tape and Reel. |

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