



# TCM809/TCM810

## 3-Pin Microcontroller Reset Monitors

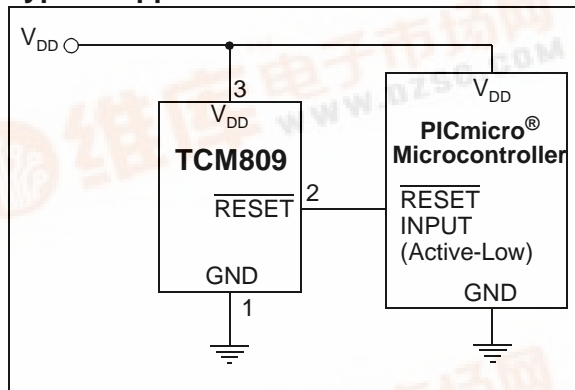
### Features

- 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  $V_{DD} = 1.0\text{V}$  (TCM809)
- Low Supply Current, 9  $\mu\text{A}$  (typ.)
- $V_{DD}$  Transient Immunity
- Small 3-Pin SC-70 and SOT-23B Packages
- No External Components
- Push-Pull RESET Output
- Temperature Range:
  - Industrial, SC-70 (E):  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
  - Extended, SOT-23, SC-70 (V):  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

### Applications

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

### Typical Application Circuit



### General Description

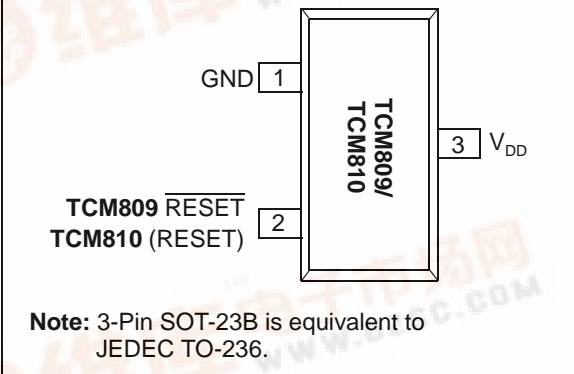
The TCM809 and TCM810 are cost-effective system supervisor circuits designed to monitor  $V_{DD}$  in digital systems and provide a reset signal to the host processor, when necessary. No external components are required.

The RESET output is typically driven active within 65  $\mu\text{s}$  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 RESET output. The output of the TCM809/TCM810 is valid down to  $V_{DD} = 1\text{V}$ . Both devices are available in 3-Pin SC-70 and SOT-23B packages.

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

### Pin Configurations

#### SOT-23B/SC-70



# TCM809/TCM810

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

Supply Voltage ( $V_{DD}$  to GND) .....6.0V  
 $\overline{\text{RESET}}$ , RESET ..... - 0.3V to ( $V_{DD} + 0.3V$ )  
Input Current,  $V_{DD}$ .....20 mA  
Output Current,  $\overline{\text{RESET}}$ , RESET .....20 mA  
 $dV/dt$  ( $V_{DD}$ ) ..... 100V/ $\mu\text{sec}$   
Operating Temperature Range..... - 40°C to +125°C  
Power Dissipation ( $T_A = 70^\circ\text{C}$ ):  
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.

## PIN FUNCTION TABLE

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

## ELECTRICAL CHARACTERISTICS

$V_{DD}$ = Full Range, $T_A$ = Operating Temperature Range, unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$ , $V_{DD} = 5V$ for L/M/J, 3.3V for T/S, 3.0V for R and 2.5V for Z ( <b>Note 1</b> ).						
Parameter	Sym	Min	Typ	Max	Units	Test Conditions
$V_{DD}$ Range		1.0	—	5.5	V	$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$
		1.2	—	5.5		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
Supply Current	$I_{CC}$	—	12	30	$\mu\text{A}$	TCM8xxL/M/J: $V_{DD} < 5.5V$
		—	9	25		TCM8xxR/S/T/Z: $V_{DD} < 3.6V$
Reset Threshold ( <b>Note 2</b> )	$V_{TH}$	4.56	4.63	4.70	V	TCM8xxL: $T_A = +25^\circ\text{C}$
		4.50	—	4.75		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		4.31	4.38	4.45	V	TCM8xxM: $T_A = +25^\circ\text{C}$
		4.25	—	4.50	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		3.93	4.00	4.06	V	TCM809J: $T_A = +25^\circ\text{C}$
		3.89	—	4.10	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		3.04	3.08	3.11	V	TCM8xxT: $T_A = +25^\circ\text{C}$
		3.00	—	3.15	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.89	2.93	2.96	V	TCM8xxS: $T_A = +25^\circ\text{C}$
		2.85	—	3.00	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.59	2.63	2.66	V	TCM8xxR: $T_A = +25^\circ\text{C}$
		2.55	—	2.70	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.28	2.32	2.35	V	TCM8xxZ: $T_A = +25^\circ\text{C}$
		2.25	—	2.38	V	$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
Reset Threshold Tempco		—	30	—	ppm/°C	
$V_{DD}$ to Reset Delay,		—	65	—	$\mu\text{sec}$	$V_{DD} = V_{TH}$ to ( $V_{TH} - 100\text{ mV}$ ) ( <b>Note 2</b> )
Reset Active Time Out Period		140	320	560	msec	

**Note 1:** Production testing done at  $T_A = +25^\circ\text{C}$ , overtemperature limits ensured by QC screen.

**Note 2:**  $\overline{\text{RESET}}$  output for TCM809, RESET output for TCM810.

# TCM809/TCM810

## ELECTRICAL CHARACTERISTICS (CONTINUED)

$V_{DD}$ = Full Range, $T_A$ = Operating Temperature Range, unless otherwise noted. Typical values are at $T_A = +25^{\circ}\text{C}$ , $V_{DD} = 5\text{V}$ for L/M/J, 3.3V for T/S, 3.0V for R and 2.5V for Z ( <b>Note 1</b> ).						
Parameter	Sym	Min	Typ	Max	Units	Test Conditions
RESET Output Voltage Low ( <b>TCM809</b> )	$V_{OL}$	— — —	— — —	0.3 0.4 0.3	V	<b>TCM809R/S/T/Z:</b> $V_{DD} = V_{TH \text{ min}}, I_{SINK} = 1.2 \text{ mA}$ <b>TCM809L/M/J:</b> $V_{DD} = V_{TH \text{ min}}, I_{SINK} = 3.2 \text{ mA}$ $V_{DD} > 1.0\text{V}, I_{SINK} = 50 \mu\text{A}$
RESET Output Voltage High ( <b>TCM809</b> )	$V_{OH}$	$0.8 V_{DD}$ $V_{DD} - 1.5$	— —	— —	V	<b>TCM809R/S/T/Z:</b> $V_{DD} > V_{TH \text{ max}}, I_{SOURCE} = 500 \mu\text{A}$ <b>TCM809L/M/J:</b> $V_{DD} > V_{TH \text{ max}}, I_{SOURCE} = 800 \mu\text{A}$
RESET Output Voltage Low ( <b>TCM810</b> )	$V_{OL}$	— —	— —	0.3 0.4	V	<b>TCM810R/S/T/Z:</b> $V_{DD} = V_{TH \text{ max}}, I_{SINK} = 1.2 \text{ mA}$ <b>TCM810L/M:</b> $V_{DD} = V_{TH \text{ max}}, I_{SINK} = 3.2 \text{ mA}$
RESET Output Voltage High ( <b>TCM810</b> )	$V_{OH}$	$0.8 V_{DD}$	—	—	V	$1.8 < V_{DD} < V_{TH \text{ min}}, I_{SOURCE} = 150 \mu\text{A}$

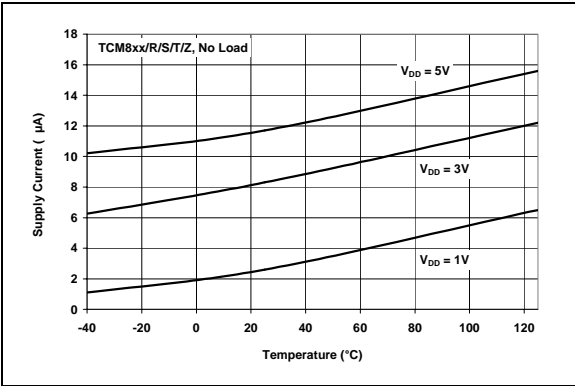
**Note 1:** Production testing done at  $T_A = +25^{\circ}\text{C}$ , overtemperature limits ensured by QC screen.

**Note 2:** RESET output for **TCM809**, RESET output for **TCM810**.

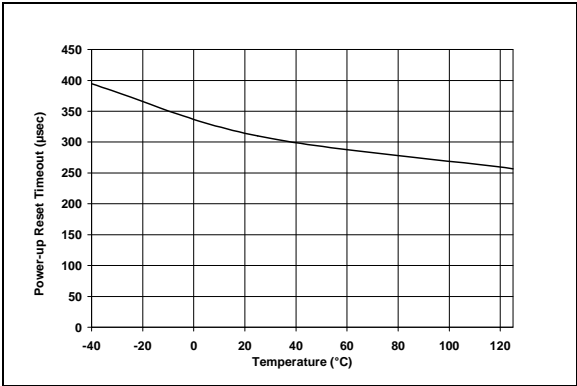
# TCM809/TCM810

## 2.0 TYPICAL PERFORMANCE CHARACTERISTICS

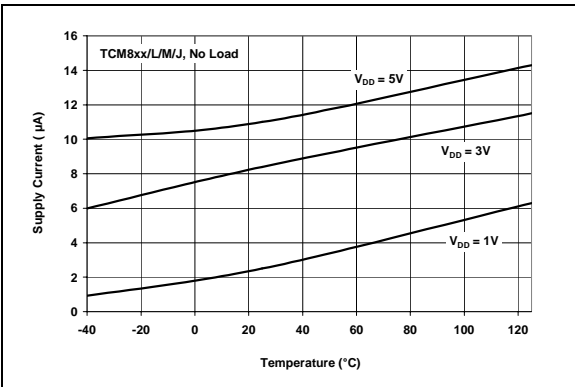
**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be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



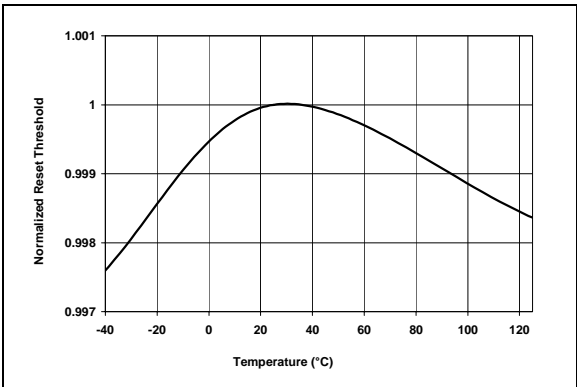
**FIGURE 2-1:** Supply Current vs. Temperature.



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



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



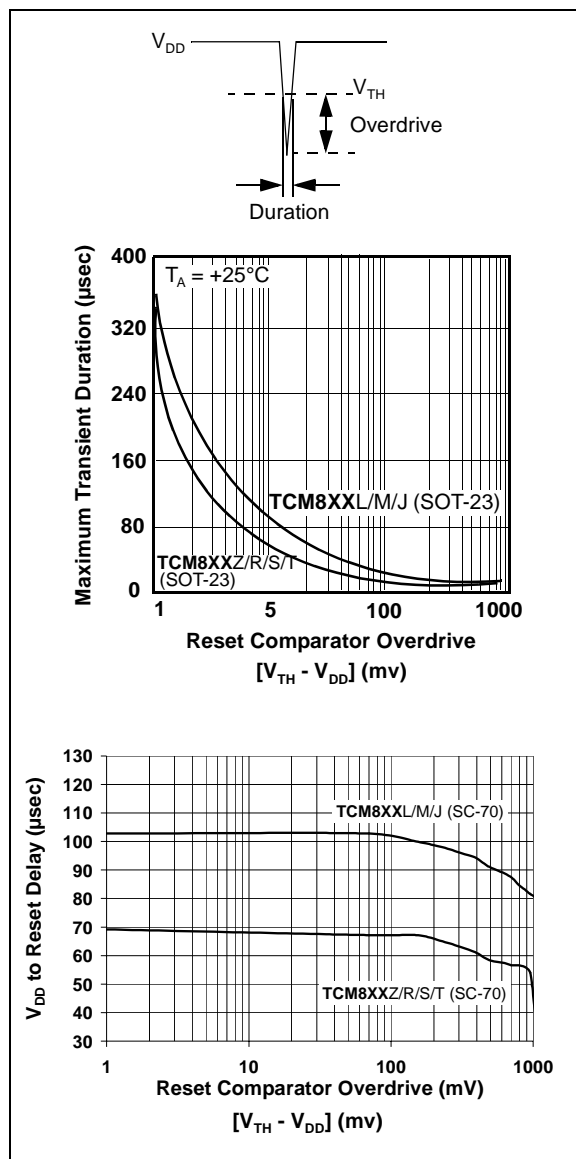
**FIGURE 2-4:** Normalized Reset Threshold vs. Temperature.

# TCM809/TCM810

## 3.0 APPLICATIONS INFORMATION

### 3.1 $V_{DD}$ 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 3-1 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.

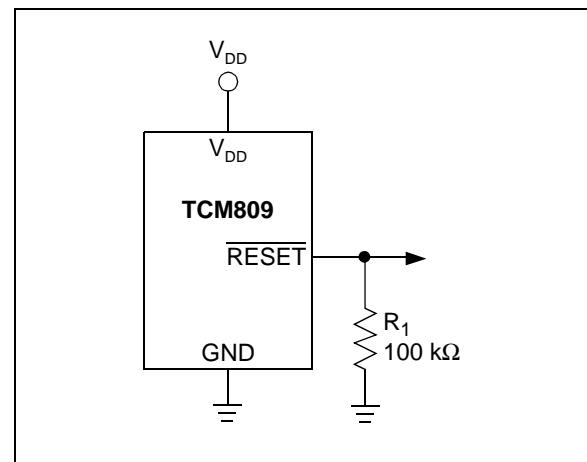


**FIGURE 3-1:** Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.

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.

### 3.2 $\overline{\text{RESET}}$ Signal Integrity During Power-Down

The TCM809  $\overline{\text{RESET}}$  output is valid to  $V_{DD} = 1.0\text{V}$ . 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  $V_{DD} = 0\text{V}$ , a pull-down resistor must be connected from  $\overline{\text{RESET}}$  to ground to discharge stray capacitances and hold the output low (Figure 3-2). This resistor value, though not critical, should be chosen such that it does not appreciably load  $\overline{\text{RESET}}$  under normal operation (100 k $\Omega$  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.

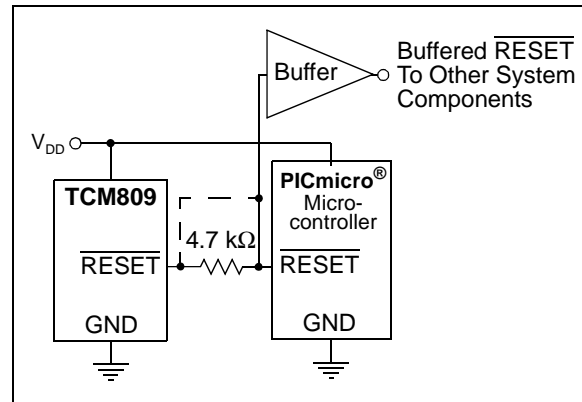


**FIGURE 3-2:** The addition of  $R_1$  at the  $\overline{\text{RESET}}$  output of the TCM809 ensures that the  $\overline{\text{RESET}}$  output is valid to  $V_{DD} = 0\text{V}$ .

# TCM809/TCM810

## 3.3 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 k $\Omega$  resistor in series with the output of the TCM809/TCM810 (Figure 3-3). 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.

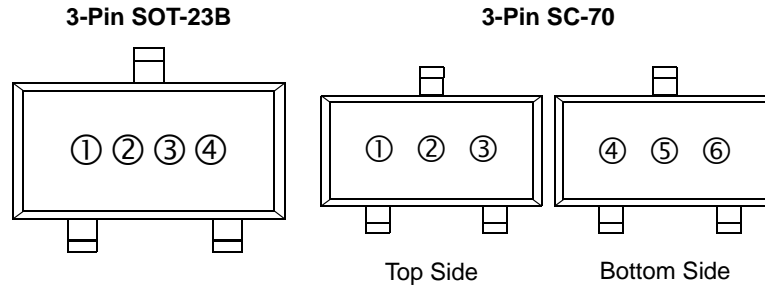


**FIGURE 3-3:** Interfacing the TCM809 to a Bidirectional RESET I/O.

# TCM809/TCM810

## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information



Part Number	SOT-23/SC-70
TCM809LENB	J1
TCM809MENB	J2
TCM809TENB	J3
TCM809SENB	J4
TCM809RENB	J5
TCM809JENB	J6
TCM809ZENB	J7
TCM809LVNB/TCM809LVLB	JZ
TCM809MVNB/TCM809MVLB	JY
TCM809TVNB/TCM809TVLB	JX
TCM809SVNB/TCM809SVLB	JV
TCM809RVNB/TCM809RVLB	JU
TCM809JVNB/TCM809JVLB	JT
TCM809ZVNB/TCM809ZVLB	JS (SC-70 package only)

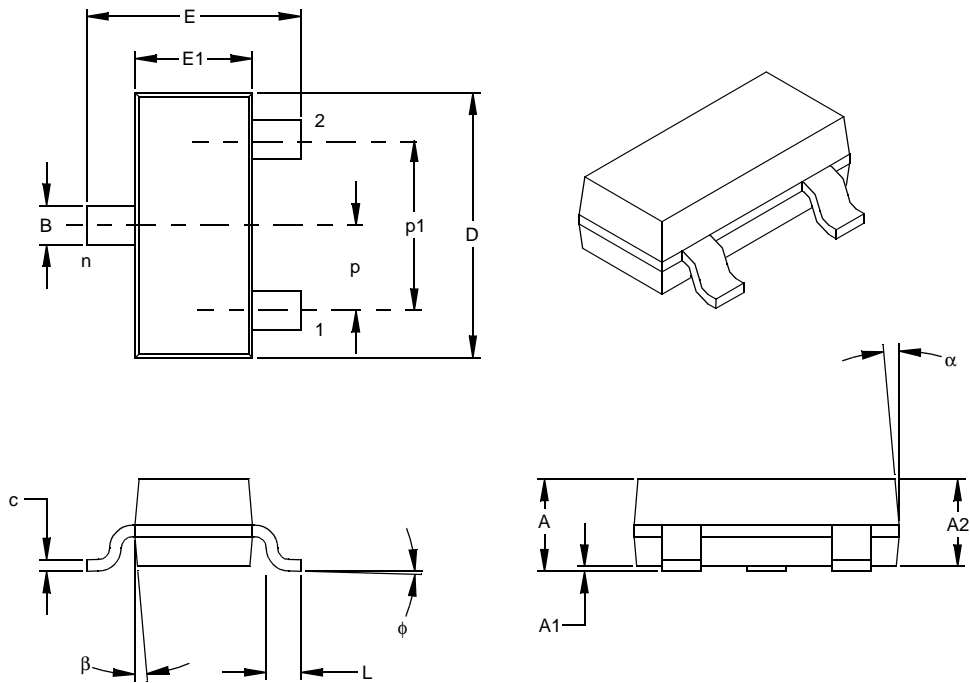
Part Number	SOT-23/SC-70
TCM810LENB	K1
TCM810MENB	K2
TCM810TENB	K3
TCM810SENB	K4
TCM810RENB	K5
TCM810ZENB	K6
TCM810LVNB/TCM810LVLB	KZ
TCM810MVNB/TCM810MVLB	KY
TCM810TVNB/TCM810TVLB	KX
TCM810SVNB/TCM810SVLB	KV
TCM810RVNB/TCM810RVLB	KU

<b>Legend:</b>	1	Part Number + temperature range and voltage (two-digit code)
	2	Part Number + temperature range and voltage (two-digit code)
	3	Lot ID number
	4	Year and work week
	5	Year and work week
	6	Year and work week

**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.

# TCM809/TCM810

## 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

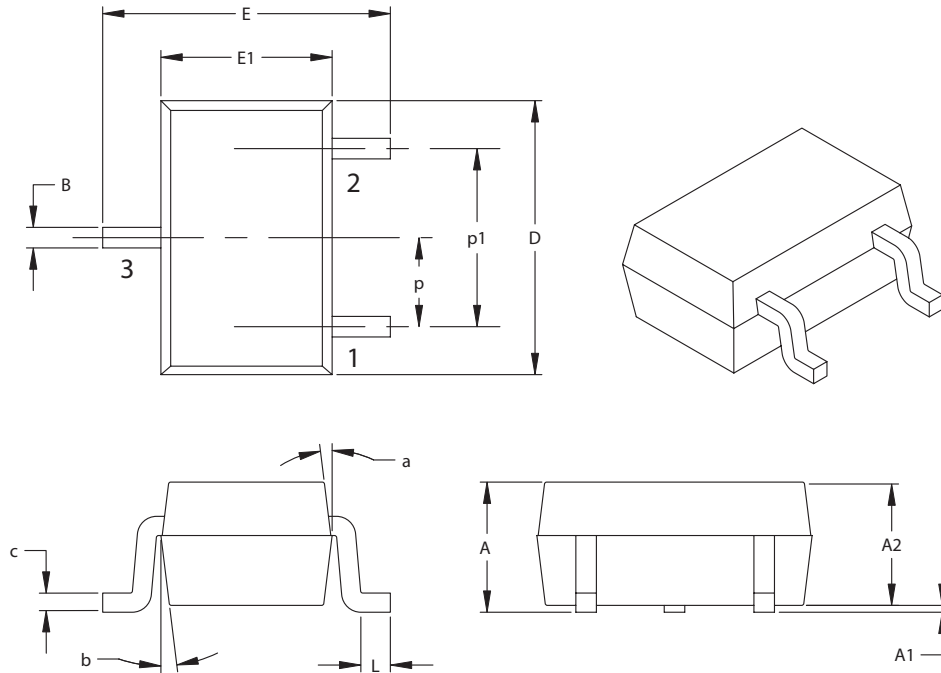
\* Controlling Parameter  
§ Significant Characteristic

**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



# TCM809/TCM810

## 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

# TCM809/TCM810

## 4.2 Product Tape and Reel Specifications

FIGURE 4-1: EMBOSSED CARRIER DIMENSIONS (8, 12, 16, AND 24 MM TAPE ONLY)

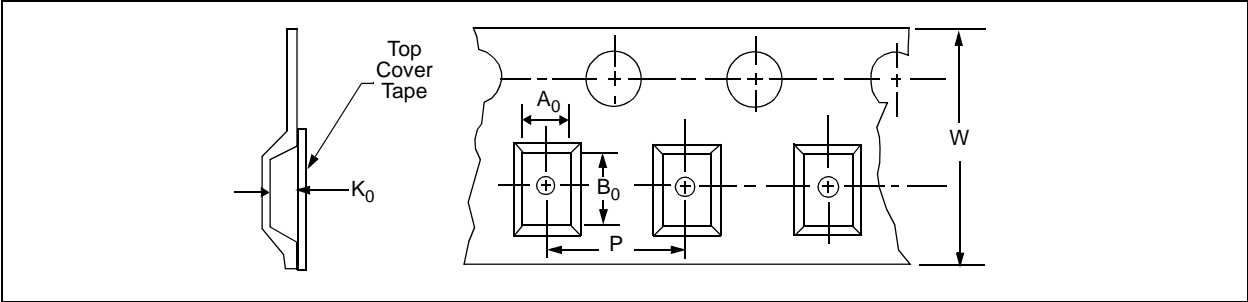
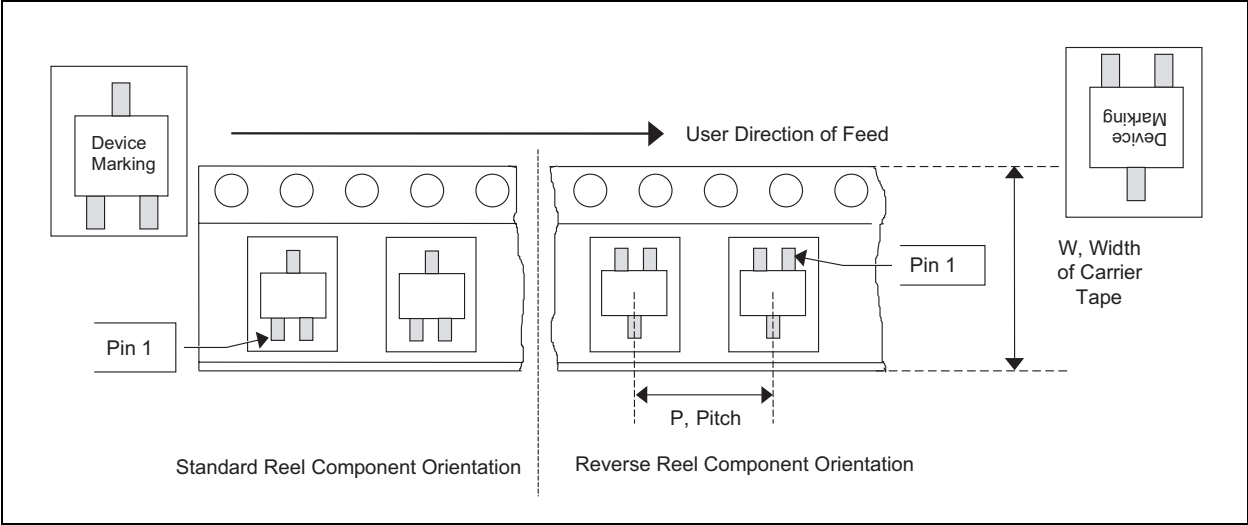


TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS

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 4-2: 3-LEAD SOT-23/SC70 DEVICE TAPE AND REEL SPECIFICATIONS



# TCM809/TCM810

## PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	<u>X</u>	<u>X</u>	<u>XXXXX</u>
Device	V <sub>DD</sub> Reset Threshold	Temperature Range	Package
<div>Device: TCM809: Supervisor circuit with active-low <math>\overline{\text{RESET}}</math> output TCM810: Supervisor circuit with active-high RESET output</div> <div>V<sub>DD</sub> Reset Threshold: L = 4.63V M = 4.38V J = 4.00V T = 3.08V S = 2.93V R = 2.63V Z = 2.32V</div> <div>Temperature Range: E = -40°C to +85°C V = -40°C to +125°C</div> <div>Package: NB713 = SOT-23B, 3-pin (Tape and Reel) LB713 = SC-70, 3-pin (Tape and Reel)</div>			
<b>Examples:</b> <div>a) TCM809LENB713: SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +85°C, Tape and Reel.</div> <div>b) TCM809LVLB713: SC-70-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel.</div> <div>c) TCM809LVNB713: SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel.</div> <div>a) TCM810MENB713: SOT-23B-3-TR, Microcontroller 4.38V Reset Monitor, -40°C to +85°C, Tape and Reel.</div> <div>b) TCM810RVLB713: SOT-23B-3-TR, Microcontroller 2.63V Reset Monitor, -40°C to +125°C, Tape and Reel.</div> <div>c) TCM810TVLB713: SC-70-3-TR, Microcontroller 4.38V Reset Monitor, -40°C to +125°C, Tape and Reel.</div>			

## Sales and Support

### Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site ([www.microchip.com](http://www.microchip.com))

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

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# TCM809/TCM810

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NOTES:

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*Microchip received ISO/TS-16949:2002 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona and Mountain View, California in October 2003. The Company's quality system processes and procedures are for its PICmicro® 8-bit MCUs, KEELoQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.*

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## WORLDWIDE SALES AND SERVICE

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### AMERICAS

#### Corporate Office

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7200  
Fax: 480-792-7277  
Technical Support: 480-792-7627  
Web Address: <http://www.microchip.com>

#### Atlanta

3780 Mansell Road, Suite 130  
Alpharetta, GA 30022  
Tel: 770-640-0034  
Fax: 770-640-0307

#### Boston

2 Lan Drive, Suite 120  
Westford, MA 01886  
Tel: 978-692-3848  
Fax: 978-692-3821

#### Chicago

333 Pierce Road, Suite 180  
Itasca, IL 60143  
Tel: 630-285-0071  
Fax: 630-285-0075

#### Dallas

4570 Westgrove Drive, Suite 160  
Addison, TX 75001  
Tel: 972-818-7423  
Fax: 972-818-2924

#### Detroit

Tri-Atria Office Building  
32255 Northwestern Highway, Suite 190  
Farmington Hills, MI 48334  
Tel: 248-538-2250  
Fax: 248-538-2260

#### Kokomo

2767 S. Albright Road  
Kokomo, IN 46902  
Tel: 765-864-8360  
Fax: 765-864-8387

#### Los Angeles

18201 Von Karman, Suite 1090  
Irvine, CA 92612  
Tel: 949-263-1888  
Fax: 949-263-1338

#### San Jose

1300 Terra Bella Avenue  
Mountain View, CA 94043  
Tel: 650-215-1444  
Fax: 650-961-0286

#### Toronto

6285 Northam Drive, Suite 108  
Mississauga, Ontario L4V 1X5, Canada  
Tel: 905-673-0699  
Fax: 905-673-6509

### ASIA/PACIFIC

#### Australia

Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733  
Fax: 61-2-9868-6755

#### China - Beijing

Unit 706B  
Wan Tai Bei Hai Bldg.  
No. 6 Chaoyangmen Bei Str.  
Beijing, 100027, China  
Tel: 86-10-85282100  
Fax: 86-10-85282104

#### China - Chengdu

Rm. 2401-2402, 24th Floor,  
Ming Xing Financial Tower  
No. 88 TIDU Street  
Chengdu 610016, China  
Tel: 86-28-86766200  
Fax: 86-28-86766599

#### China - Fuzhou

Unit 28F, World Trade Plaza  
No. 71 Wusi Road  
Fuzhou 350001, China  
Tel: 86-591-7503506  
Fax: 86-591-7503521

#### China - Hong Kong SAR

Unit 901-6, Tower 2, Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T., Hong Kong  
Tel: 852-2401-1200  
Fax: 852-2401-3431

#### China - Shanghai

Room 701, Bldg. B  
Far East International Plaza  
No. 317 Xian Xia Road  
Shanghai, 200051  
Tel: 86-21-6275-5700  
Fax: 86-21-6275-5060

#### China - Shenzhen

Rm. 1812, 18/F, Building A, United Plaza  
No. 5022 Binhe Road, Futian District  
Shenzhen 518033, China  
Tel: 86-755-82901380  
Fax: 86-755-8295-1393

#### China - Shunde

Room 401, Hongjian Building, No. 2  
Fengxiangnan Road, Ronggui Town, Shunde  
District, Foshan City, Guangdong 528303, China  
Tel: 86-757-28395507 Fax: 86-757-28395571

#### China - Qingdao

Rm. B505A, Fullhope Plaza,  
No. 12 Hong Kong Central Rd.  
Qingdao 266071, China  
Tel: 86-532-5027355 Fax: 86-532-5027205

#### India

Divyasree Chambers  
1 Floor, Wing A (A3/A4)  
No. 11, O'Shaughnessy Road  
Bangalore, 560 025, India  
Tel: 91-80-22290061 Fax: 91-80-22290062

#### Japan

Benex S-1 6F  
3-18-20, Shinyokohama  
Kohoku-Ku, Yokohama-shi  
Kanagawa, 222-0033, Japan  
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

#### Korea

168-1, Youngbo Bldg. 3 Floor  
Samsung-Dong, Kangnam-Ku  
Seoul, Korea 135-882  
Tel: 82-2-554-7200 Fax: 82-2-558-5932 or  
82-2-558-5934

#### Singapore

200 Middle Road  
#07-02 Prime Centre  
Singapore, 188980  
Tel: 65-6334-8870 Fax: 65-6334-8850

#### Taiwan

Kaohsiung Branch  
30F - 1 No. 8  
Min Chuan 2nd Road  
Kaohsiung 806, Taiwan  
Tel: 886-7-536-4818  
Fax: 886-7-536-4803

#### Taiwan

Taiwan Branch  
11F-3, No. 207  
Tung Hua North Road  
Taipei, 105, Taiwan  
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

### EUROPE

#### Austria

Durisolstrasse 2  
A-4600 Wels  
Austria  
Tel: 43-7242-2244-399  
Fax: 43-7242-2244-393

#### Denmark

Regus Business Centre  
Lautrup høj 1-3  
Ballerup DK-2750 Denmark  
Tel: 45-4420-9895 Fax: 45-4420-9910

#### France

Parc d'Activite du Moulin de Massy  
43 Rue du Saule Trapu  
Batiment A - 1er Etage  
91300 Massy, France  
Tel: 33-1-69-53-63-20  
Fax: 33-1-69-30-90-79

#### Germany

Steinheilstrasse 10  
D-85737 Ismaning, Germany  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

#### Italy

Via Quasimodo, 12  
20025 Legnano (MI)  
Milan, Italy  
Tel: 39-0331-742611  
Fax: 39-0331-466781

#### Netherlands

P. A. De Biesbosch 14  
NL-5152 SC Drunen, Netherlands  
Tel: 31-416-690399  
Fax: 31-416-690340

#### United Kingdom

505 Eskdale Road  
Winnersh Triangle  
Wokingham  
Berkshire, England RG41 5TU  
Tel: 44-118-921-5869  
Fax: 44-118-921-5820