TCM809/TCM810

3-Pin Microcontroller Reset Monitors

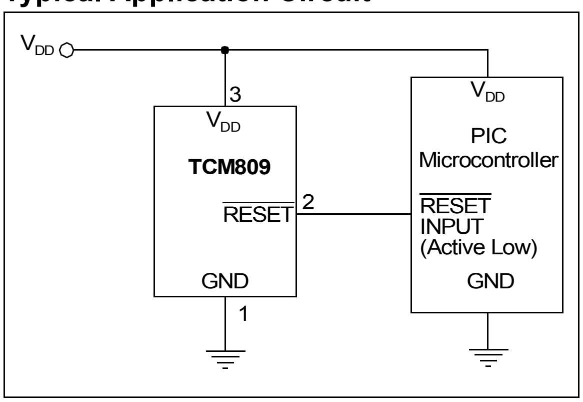
Features

- Precision V_{DD} Monitor for 2.5V, 3.0V, 3.3V, 5.0V Nominal System Voltage Supplies
- 140 msec Minimum RESET Timeout 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 Range:
  - Commercial, SC-70(E): -40°C to +85°C
  - Industrial, 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

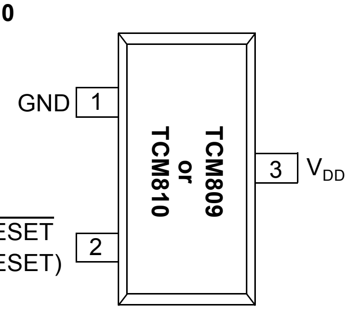
The TCM809 and TCM810 are cost effective system supervisor circuits designed to monitor V_{DD} in digital systems and provide a reset signal to the host processor when necessary. No external components are required.

The RESET output is typically driven active within 20 µsec (SOT-23) or 65 µsec (SC-70) 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 SOT-23B and SC-70 packages.

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

Pin Configurations

SOT-23B/SC-70



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

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/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.

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°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 1.2	— —	5.5 5.5	V	T_A = 0°C to +70°C T_A = – 40°C to +125°C
Supply Current (SOT-23)	I_{CC}	— —	24 17	60 50	µA	TCM8xxL/M: V_{DD} < 5.5V TCM8xxR/S/T/Z: V_{DD} < 3.6V
Supply Current (SC-70)	I_{CC}	— —	12 9	30 25	µA	TCM8xxL/M/J: V_{DD} < 5.5V TCM8xxR/S/T/Z: V_{DD} < 3.6V
Reset Threshold **(Note 2)**	V_{TH}	4.56 4.50	4.63 —	4.70 4.75	V	TCM8xxL: T_A = +25°C T_A = – 40°C to +125°C
		4.31 4.25	4.38 —	4.45 4.50		TCM8xxM: T_A = +25°C T_A = – 40°C to +125°C
		3.93 3.89	4.00 —	4.06 4.10		TCM809J: T_A = +25°C T_A = – 40°C to +125°C
		3.04 3.00	3.08 —	3.11 3.15		TCM8xxT: T_A = +25°C T_A = – 40°C to +125°C
		2.89 2.85	2.93 —	2.96 3.00		TCM8xxS: T_A = +25°C T_A = – 40°C to +125°C
		2.59 2.55	2.63 —	2.66 2.70		TCM8xxR: T_A = +25°C T_A = – 40°C to +125°C
		2.28 2.25	2.32 —	2.35 2.38		TCM8xxZ: T_A = +25°C T_A = – 40°C to +125°C
Reset Threshold Tempco		—	30	—	ppm/°C	
V_{DD} to Reset Delay, SOT-23		—	20	—	µsec	V_{DD} = V_{TH} to (V_{TH} – 100 mV) **(Note 2)**
V_{DD} to Reset Delay, SC-70		—	65	—	µsec	V_{DD} = V_{TH} to (V_{TH} – 100 mV) **(Note 2)**
Reset Active Time-out Period, SOT-23		140	240	560	msec	
Reset Active Time-out Period, SC-70		140	320	560	msec	
$\overline{\text{RESET}}$ Output Voltage Low (TCM809)	V_{OL}	— — —	— — —	0.3 0.4 0.3	V	TCM809R/S/T/Z: V_{DD} = V_{TH} min, I_{SINK} = 1.2 mA TCM809L/M/J: V_{DD} = V_{TH} min, I_{SINK} = 3.2 mA V_{DD} > 1.0V, I_{SINK} = 50 µA
$\overline{\text{RESET}}$ Output Voltage High (TCM809)	V_{OH}	0.8 V_{DD} V_{DD} – 1.5	— —	— —	V	TCM809R/S/T/Z: V_{DD} > V_{TH} max, I_{SOURCE} = 500 µA TCM809L/M/J: V_{DD} > V_{TH} max, I_{SOURCE} = 800 µA

Note 1: Production testing done at T_A = +25°C, over temperature limits ensured by QC screen.
2: RESET Output for TCM809, RESET Output for TCM810.

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
RESET Output Voltage Low (TCM810)	V_{OL}	— —	— —	0.3 0.4	V	TCM810R/S/T/Z: $V_{DD} = V_{TH}$ max, I_{SINK} = 1.2 mA TCM810L/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, over temperature limits ensured by QC screen.
2: $\overline{\text{RESET}}$ Output for TCM809, RESET Output for TCM810.

2.0 APPLICATIONS INFORMATION

2.1 VDD Transient Rejection

The TCM809/TCM810 provides accurate V_{DD} monitoring and reset timing during power-up, power-down, and brownout/sag conditions. These devices also reject negative-going transients (glitches) on the power supply line. Figure 2-1 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive which lies under the curve will not generate a reset signal.

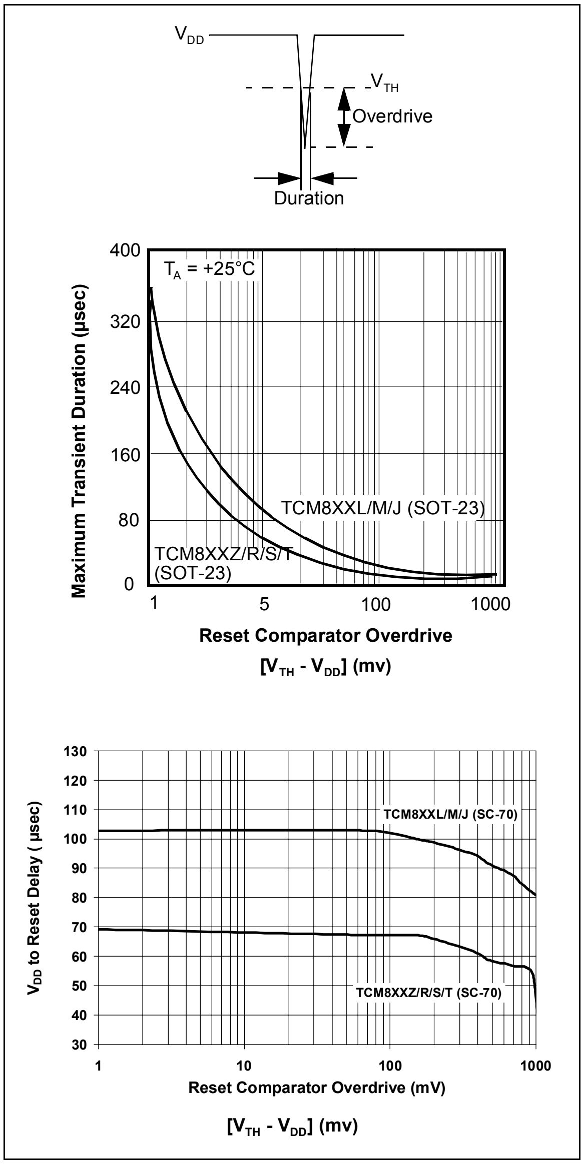


FIGURE 2-1: *Maximum Transient Duration vs. Overdrive for Glitch Rejection at 25°C.*

Combinations above the curve are detected as a brownout 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.

2.2 $\overline{\text{RESET}}$ 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 shutdown 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 2-2). 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 RESET for V_{DD} below 1.0V.

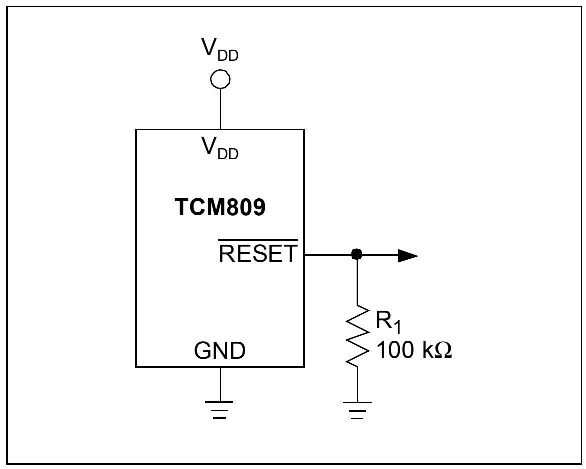


FIGURE 2-2: *The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to V_{DD} = 0V.*

2.3 Controllers and Processors With Bidirectional I/O Pins

Some microcontrollers have bi-directional 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 2-3). If there are other components in the system which 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.

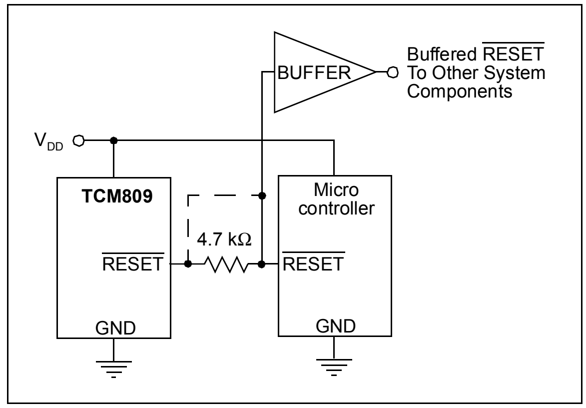


FIGURE 2-3: *Interfacing the TCM809 to a Bidirectional RESET I/O.*

3.0 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.

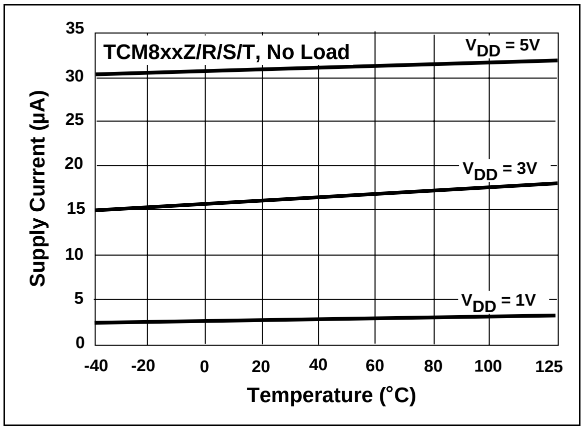


FIGURE 3-1: *Supply Current vs. Temperature, SOT-23.*

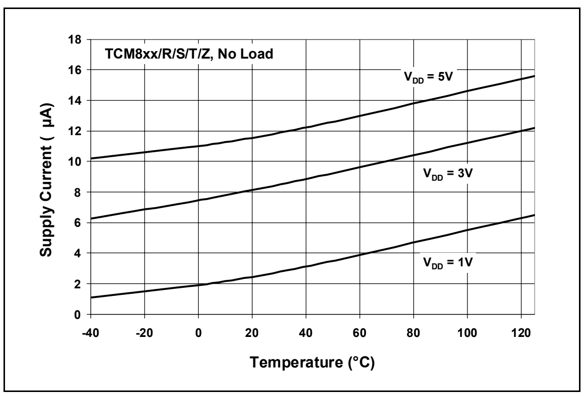


FIGURE 3-2: *Supply Current vs. Temperature, SC-70.*

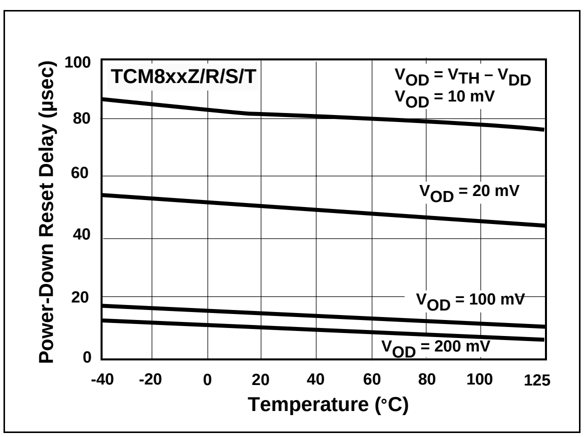


FIGURE 3-3: *Power-Down Reset Delay vs. Temperature, SOT-23.*

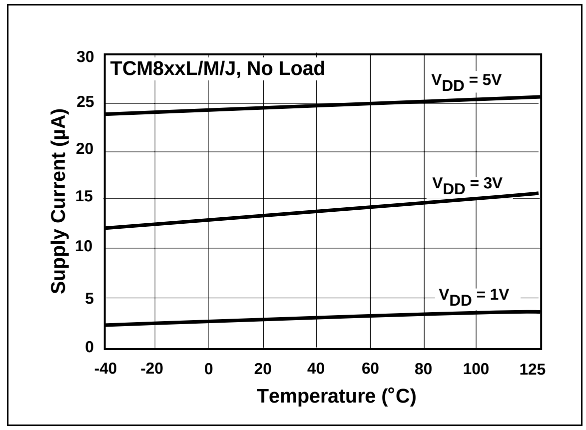


FIGURE 3-4: *Supply Current vs. Temperature, SOT-23.*

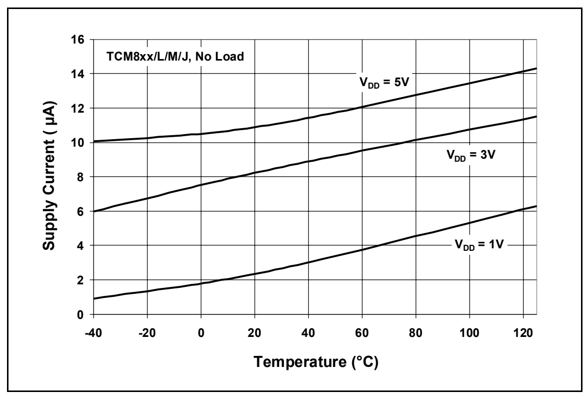


FIGURE 3-5: *Supply Current vs. Temperature, SC-70.*

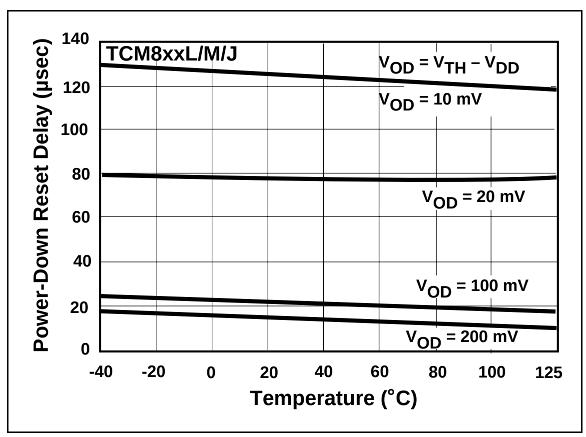


FIGURE 3-6: *Power-Down Reset Delay vs. Temperature, SOT-23.*

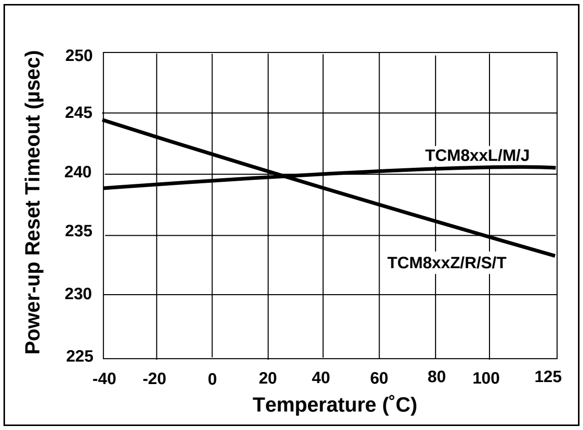


FIGURE 3-7: *Power-Up Reset Time-out vs. Temperature, SOT-23.*

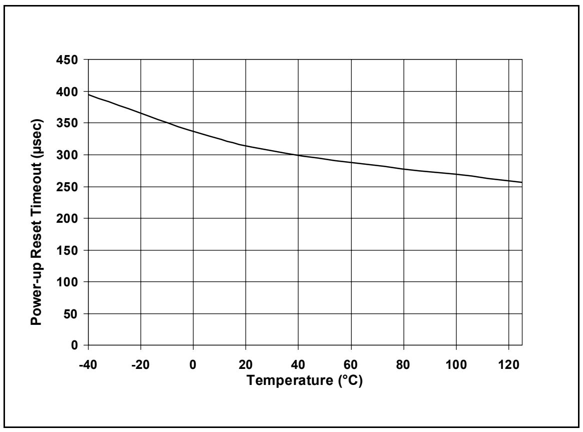


FIGURE 3-8: *Power-up Reset Time-out vs. Temperature, SC-70.*

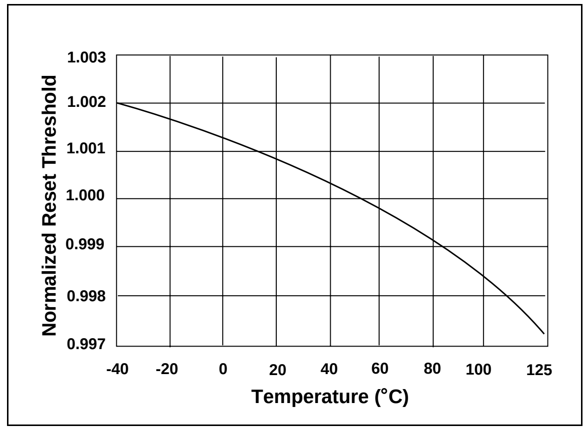


FIGURE 3-9: *Normalized Reset Threshold vs. Temperature, SOT-23.*

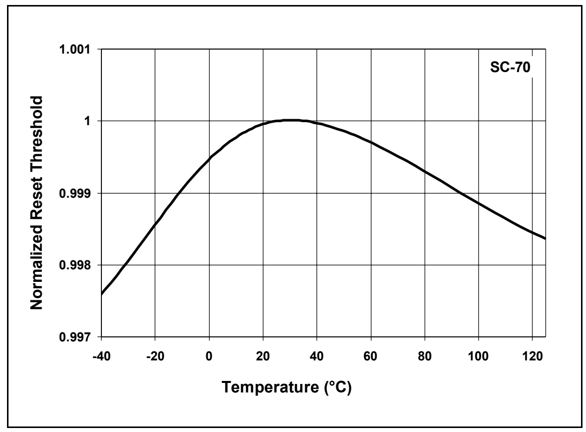
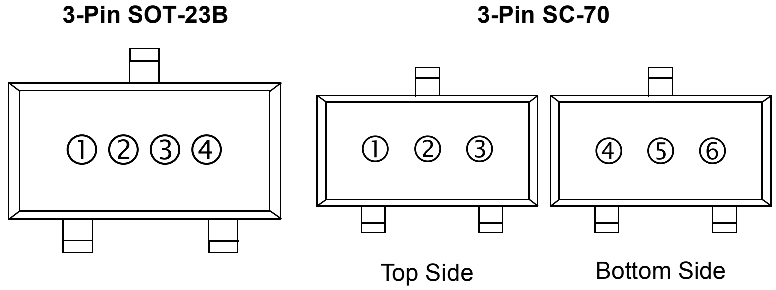


FIGURE 3-10: *Normalized Reset Threshold vs. Temperature, SC-70.*

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)

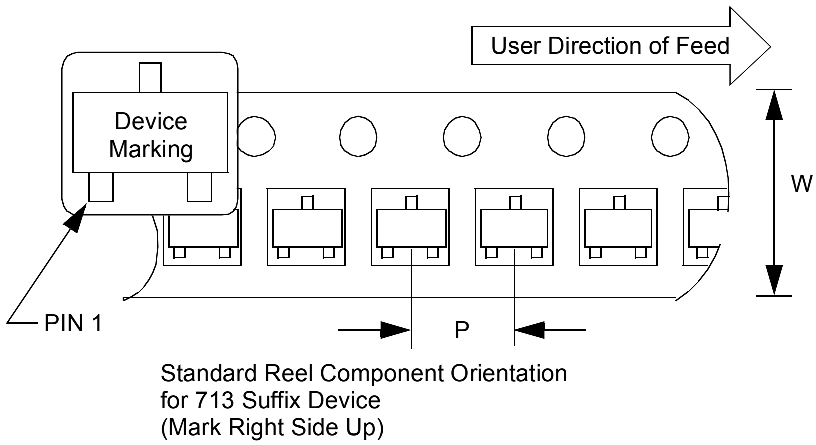
Part Number	SOT-23/SC-70
TCM810LENB	K1
TCM810MENB	K2
TCM810TENB	K3
TCM810SENB	K4
TCM810RENB	K5
TCM810ZENB	K6
TCM810LVNB/TCM810LVLB	KZ
TCM810MVNB/TCM810MVLB	KY
TCM810TVNB/TCM810TVLB	KX
TCM810SVNB/TCM810SVLB	KV
TCM810RVNB/TCM810RVLB	KU
TCM810ZVNB/TCM810ZVLB	KT (SC-70 package only)

Legend:
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.

4.2 Taping Form

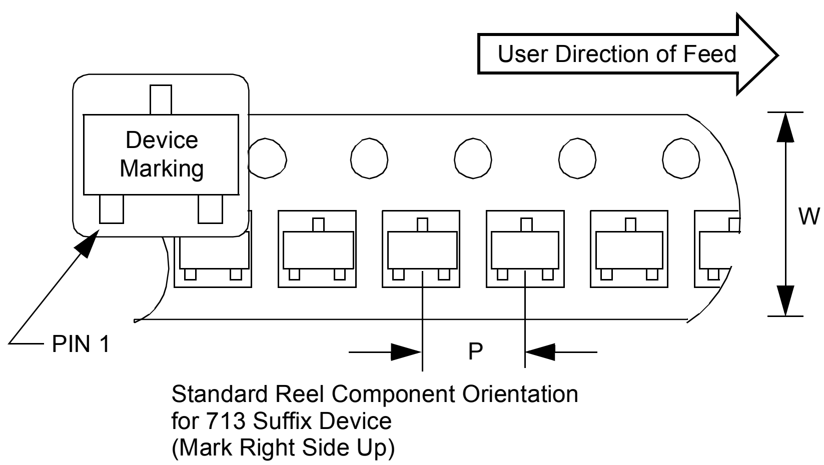
Component Taping Orientation for 3-Pin SOT-23 (JEDEC TO-236) Devices



Carrier Tape, Number of Components Per Reel and Reel Size:

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin SOT-23B	8 mm	4 mm	3000	7 in.

Component Taping Orientation for 3-Pin SC-70 (EIAJ) Devices

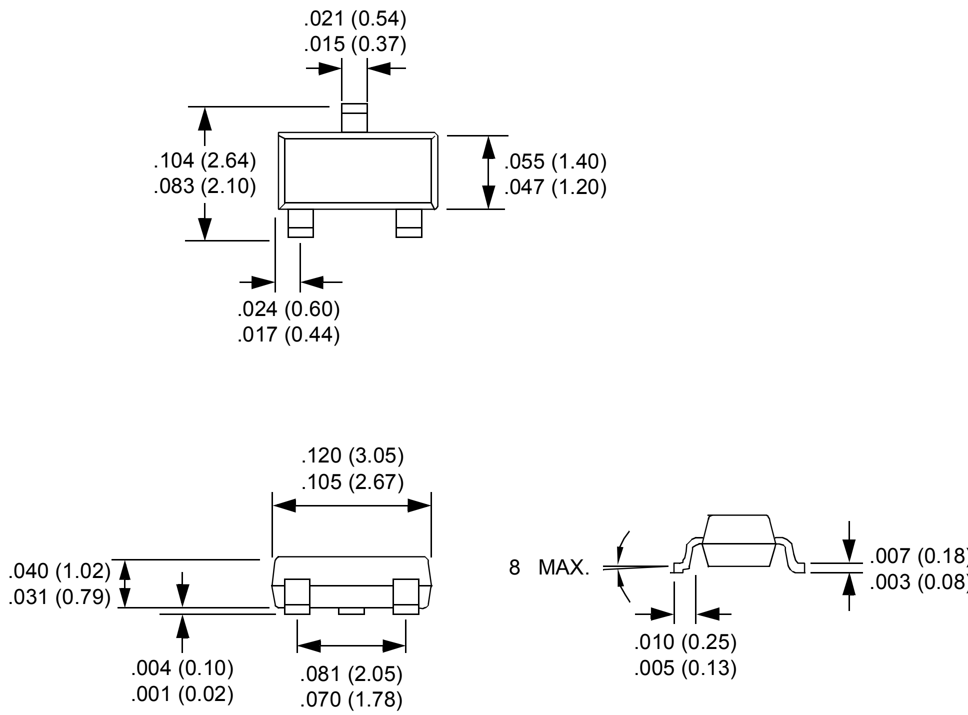


Carrier Tape, Number of Components Per Reel and Reel Size:

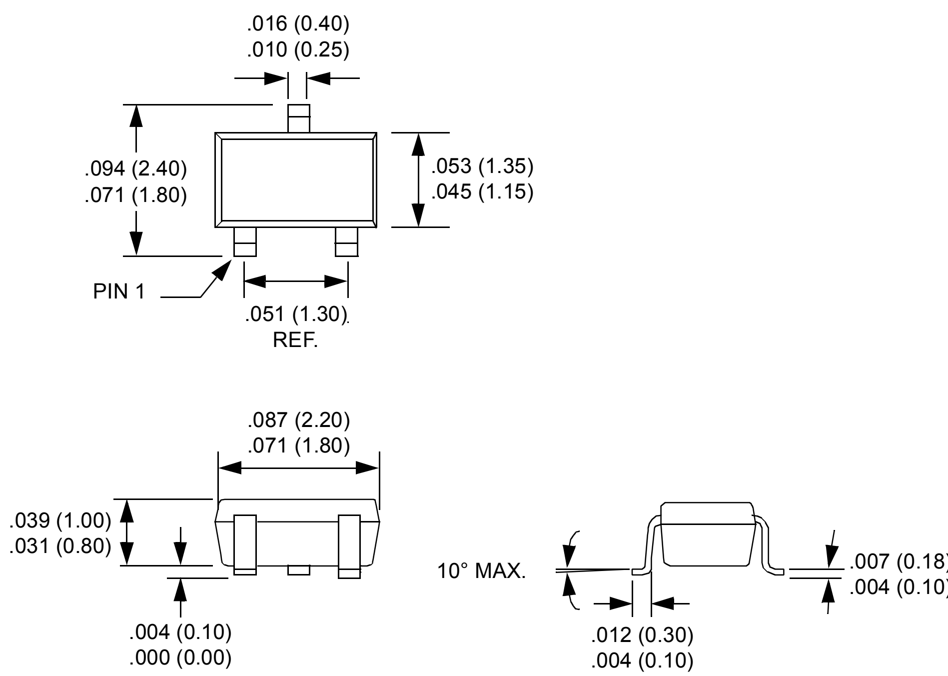
Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin SC-70	8 mm	4 mm	3000	7 in.

4.3 Packaging Information

3-Pin SOT-23B



3-Pin SC-70



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Device: **TCM809/TCM810** Literature Number: **DS21661B**

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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 2.63V 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 2.63V Reset Monitor, -40°C to +125°C, Tape and Reel.

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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

New York
150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-273-5305 Fax: 631-273-5335

San Jose
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

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

ASIA/PACIFIC

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

China - Beijing
Microchip Technology Consulting (Shanghai) Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu
Microchip Technology Consulting (Shanghai) Co., Ltd., Chengdu Liaison Office
Rm. 2401, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-6766200 Fax: 86-28-6766599

China - Fuzhou
Microchip Technology Consulting (Shanghai) Co., Ltd., Fuzhou Liaison Office
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

China - Shanghai
Microchip Technology Consulting (Shanghai) Co., Ltd.
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
Microchip Technology Consulting (Shanghai) Co., Ltd., Shenzhen Liaison Office
Rm. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

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

India
Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

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

Singapore
Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

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

EUROPE

Denmark
Microchip Technology Nordic ApS
Regus Business Centre
Lautrup hoj 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

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

Germany
Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Italy
Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom
Arizona Microchip Technology Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

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