

3-Pin Microcontroller Reset Monitors

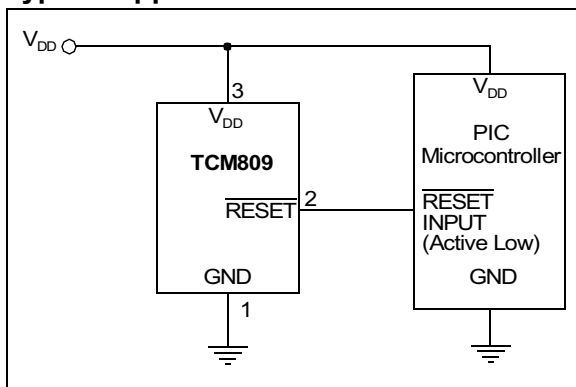
Features

- Precision V_{DD} Monitor for 2.5V, 3.0V, 3.3V, 5.0V Nominal System Voltage Supplies
- 140 msec Minimum RESET Timeout Period
- 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 (E): -40°C to +85°C
 - Industrial (V): -40°C to +125°C

Applications

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

Typical Application Circuit



General Description

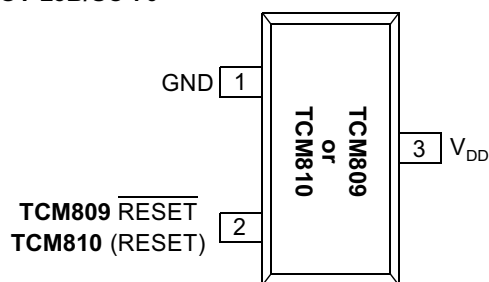
The TCM809 and TCM810 are cost effective system supervisor circuits designed to monitor V_{DD} in digital systems and provide a reset signal to the host processor when necessary. No external components are required.

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 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

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, $\overline{\text{RESET}}$, RESET20 mA
dV/dt (V_{DD})..... 100V/ μsec
Operating Temperature Range..... - 40°C to +125°C
Power Dissipation ($T_A = 70^\circ\text{C}$):
3-Pin SOT-23B (derate 4 mW/ $^\circ\text{C}$ above +70°C).....320 mW
3-Pin SC-70 (derate 2.17 mW/ $^\circ\text{C}$ 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
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 (Note 1).						
Parameter	Sym	Min	Typ	Max	Units	Test Conditions
V_{DD} Range		1.0 1.2	— —	5.5 5.5	V	$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
Supply Current (SOT-23)	I_{CC}	— —	24 17	60 50	μA	TCM8xxL/M/J: $V_{DD} < 5.5V$ 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: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		4.31 4.25	4.38 —	4.45 4.50		TCM8xxM: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		3.93 3.89	4.00 —	4.06 4.10		TCM809J: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		3.04 3.00	3.08 —	3.11 3.15		TCM8xxT: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.89 2.85	2.93 —	2.96 3.00		TCM8xxS: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.59 2.55	2.63 —	2.66 2.70		TCM8xxR: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
		2.28 2.25	2.32 —	2.35 2.38		TCM8xxZ: $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$
Reset Threshold Tempco		—	30	—	ppm/ $^\circ\text{C}$	
V_{DD} to Reset Delay, SOT-23		—	20	—	μsec	$V_{DD} = V_{TH}$ to ($V_{TH} - 100\text{ mV}$) (Note 2)
V_{DD} to Reset Delay, SC-70		—	65	—	μsec	$V_{DD} = V_{TH}$ to ($V_{TH} - 100\text{ mV}$) (Note 2)
Reset Active Time-out Period, SOT-23		140	240	560	msec	
Reset Active Time-out Period, SC-70		140	320	560	msec	
RESET Output Voltage Low (TCM809)	V_{OL}	— — —	— — —	0.3 0.4 0.3	V	TCM809R/S/T/Z: $V_{DD} = V_{TH}\text{ min.}$, $I_{SINK} = 1.2\text{ mA}$ TCM809L/M/J: $V_{DD} = V_{TH}\text{ min.}$, $I_{SINK} = 3.2\text{ mA}$ $V_{DD} > 1.0V$, $I_{SINK} = 50\text{ }\mu\text{A}$
RESET Output Voltage High (TCM809)	V_{OH}	0.8 V_{DD} $V_{DD} - 1.5$	— —	— —	V	TCM809R/S/T/Z: $V_{DD} > V_{TH}\text{ max.}$, $I_{SOURCE} = 500\text{ }\mu\text{A}$ TCM809L/M/J: $V_{DD} > V_{TH}\text{ max.}$, $I_{SOURCE} = 800\text{ }\mu\text{A}$

Note 1: Production testing done at $T_A = +25^\circ\text{C}$, over temperature limits ensured by QC screen.
Note 2: RESET Output for TCM809, RESET Output for TCM810.

TCM809/TCM810

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 (**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: $V_{DD} = V_{TH} \text{ max}$, $I_{SINK} = 1.2 \text{ mA}$ TCM810L/M/J: $V_{DD} = V_{TH} \text{ max}$, $I_{SINK} = 3.2 \text{ mA}$
RESET Output Voltage High (TCM810)	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 $T_A = +25^\circ\text{C}$, over temperature limits ensured by QC screen.
2: RESET Output for TCM809, RESET Output for TCM810.

TCM809/TCM810

2.0 APPLICATIONS INFORMATION

2.1 V_{DD} 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.

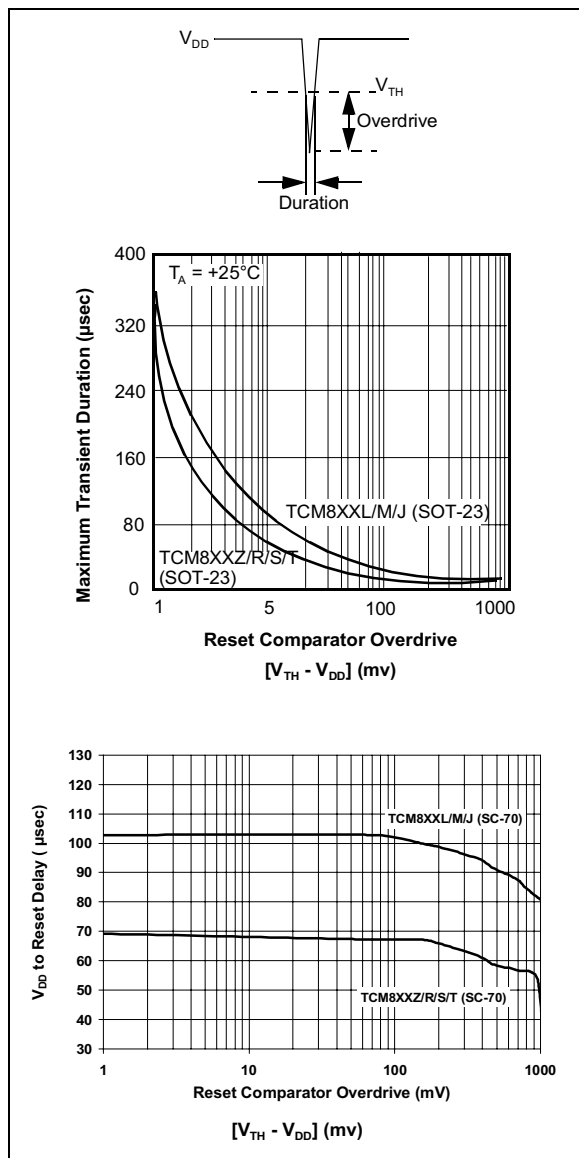


FIGURE 2-1: Maximum Transient Duration vs. Overdrive for Glitch Rejection at 25°C.

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 $V_{DD} = 1.0\text{V}$. 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 shutdown 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 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 $\overline{\text{RESET}}$ for V_{DD} below 1.0V.

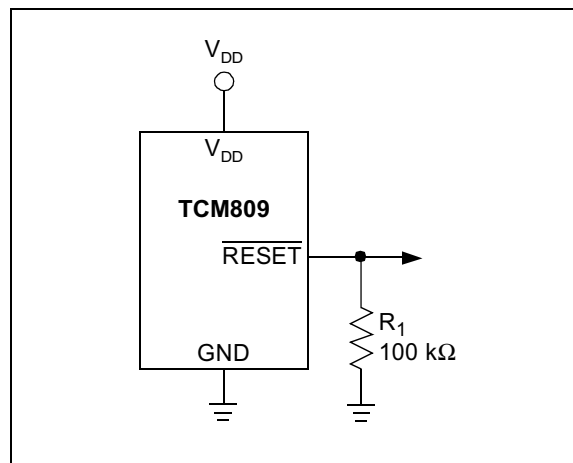


FIGURE 2-2: The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to $V_{DD} = 0\text{V}$.

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 k Ω 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.

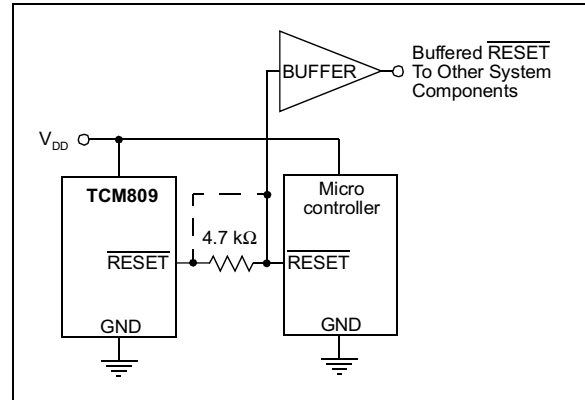


FIGURE 2-3: Interfacing the TCM809 to a Bidirectional RESET I/O.

TCM809/TCM810

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.

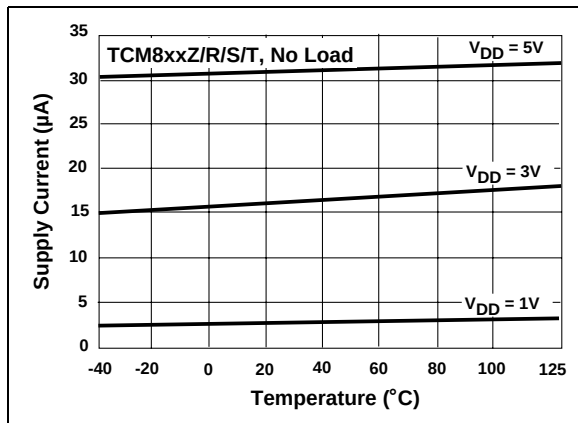


FIGURE 3-1: Supply Current vs. Temperature, SOT-23.

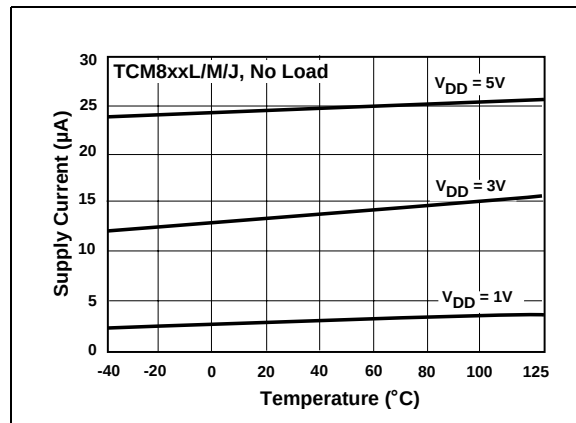


FIGURE 3-4: Supply Current vs. Temperature, SOT-23.

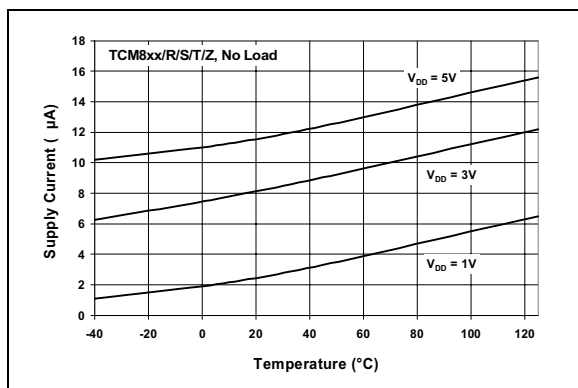


FIGURE 3-2: Supply Current vs. Temperature, SC-70.

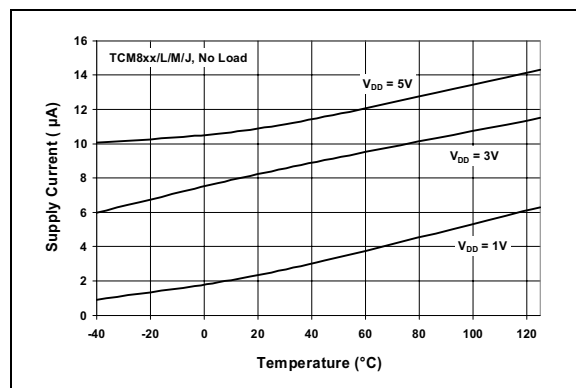


FIGURE 3-5: Supply Current vs. Temperature, SC-70.

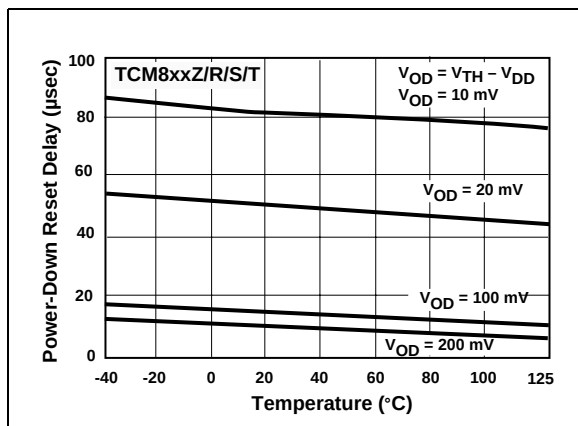


FIGURE 3-3: Power-Down Reset Delay vs. Temperature, SOT-23.

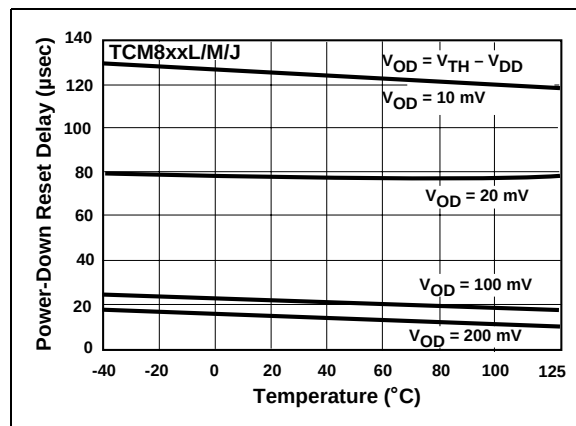


FIGURE 3-6: Power-Down Reset Delay vs. Temperature, SOT-23.

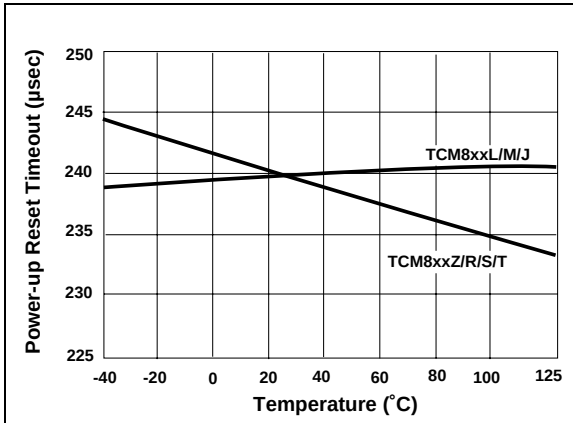


FIGURE 3-7: Power-Up Reset Time-out vs. Temperature, SOT-23.

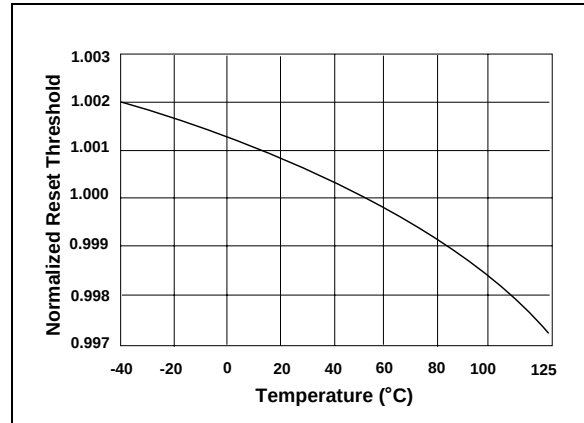


FIGURE 3-9: Normalized Reset Threshold vs. Temperature, SOT-23.

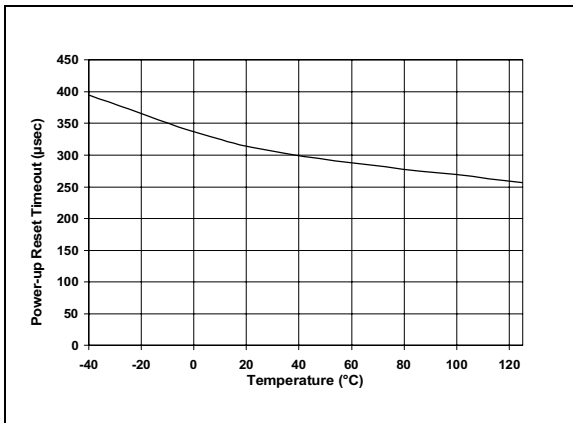


FIGURE 3-8: Power-up Reset Time-out vs. Temperature, SC-70.

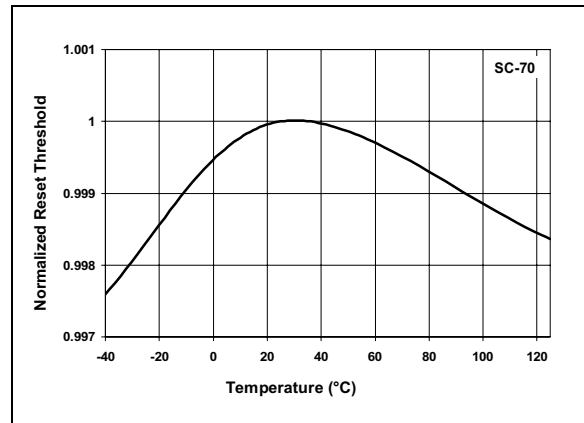


FIGURE 3-10: Normalized Reset Threshold vs. Temperature, SC-70.

TCM809/TCM810

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

3-Pin SOT-23B

①

②

③

④

3-Pin SC-70

①

②

③

④

⑤

⑥

Top Side

Bottom Side

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

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

Legend:

1

2

3

4

5

6

Part Number + temperature range and voltage (two-digit code)

Part Number + temperature range and voltage (two-digit code)

Lot ID number

Year and work week

Year and work week

Year and work week

Note:

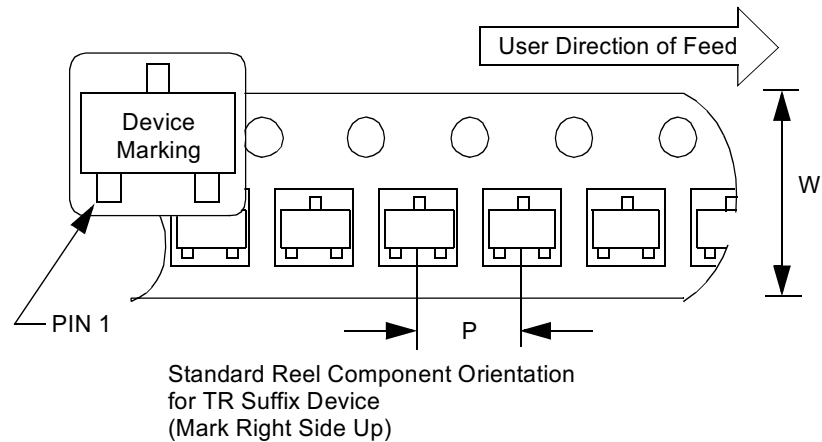
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4.2 Taping Form

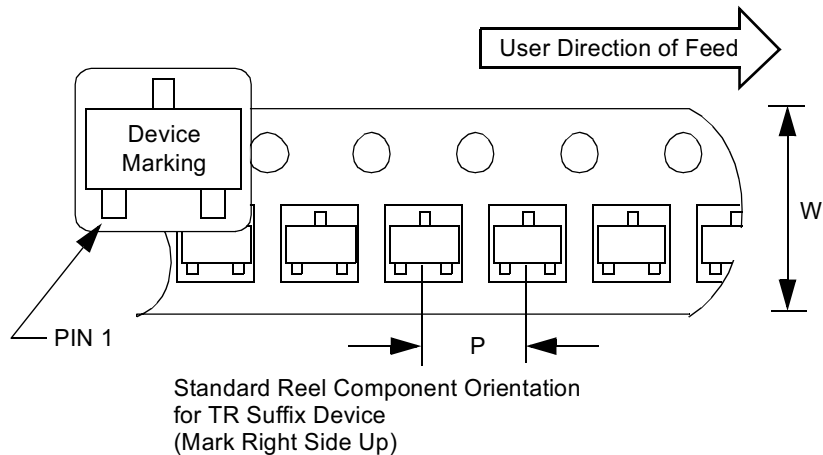
Component Taping Orientation for 3-Pin SOT-23 (JEDEC TO-236) Devices



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



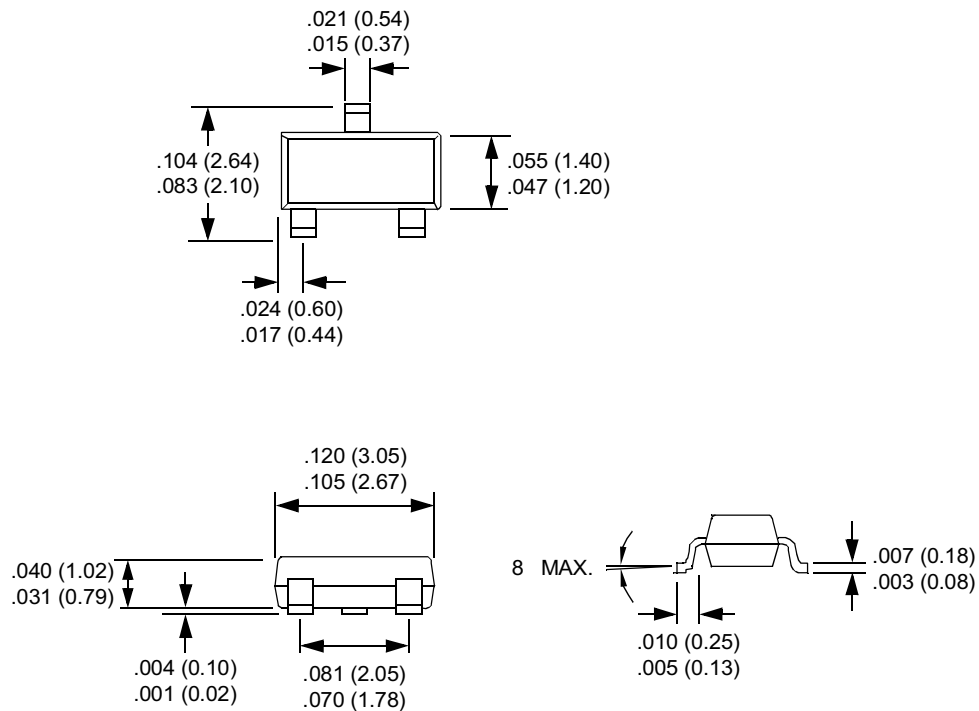
Carrier Tape, Number of Components Per Reel and Reel Size:

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

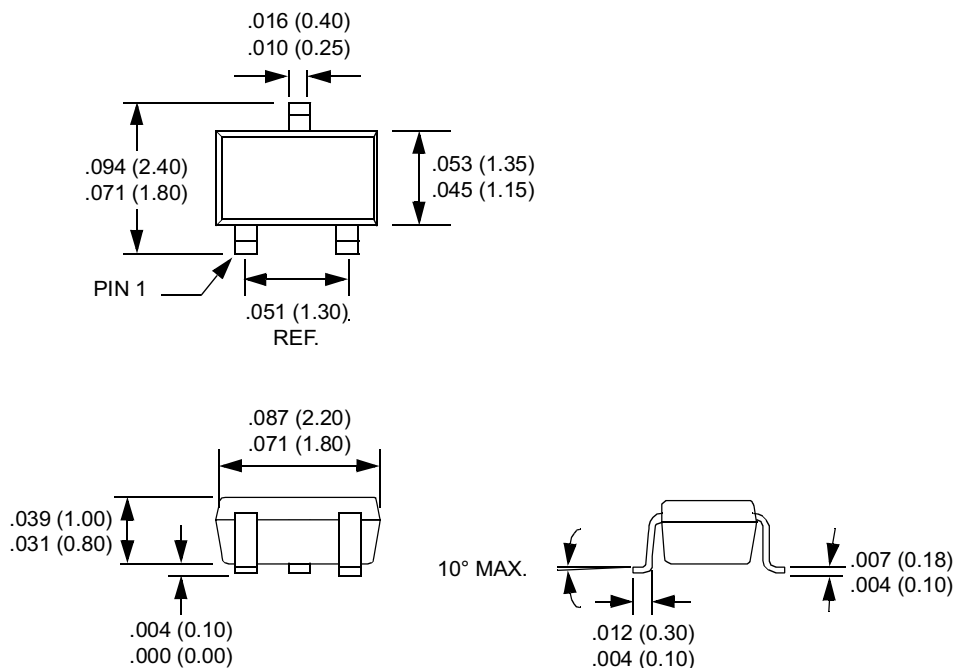
TCM809/TCM810

4.3 Packaging Information

3-Pin SOT-23B



3-Pin SC-70



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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.

<u>PART NO.</u>	<u>X</u>	<u>X</u>
Device	V _{DD} Reset Threshold	Temperature Range
Device:	TCM809: Microcontroller with active-low <u>RESET</u> output TCM809TR: Microcontroller with active-low RESET output (Tape and Reel) TCM810: Microcontroller with active-high RESET output TCM810TR: Microcontroller with active-high RESET output (Tape and Reel)	
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:	NB = SOT-23B, 3-pin LB = SC-70, 3-pin	

Examples:

- TCM809LENB: SOT-23B, 3-Pin Microcontroller Reset Monitor, 4.63V Reset Threshold, Temperature of -40°C to +85°C.
- TCM810ZVLB: SC-70, 3-Pin Microcontroller Reset Monitor, 2.32V Reset Threshold, Temperature of -40°C to +125°C.

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TCM809/TCM810

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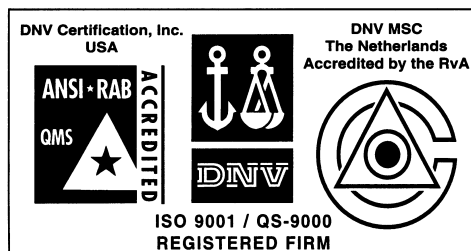
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