

3-Pin Microcontroller Reset Monitors

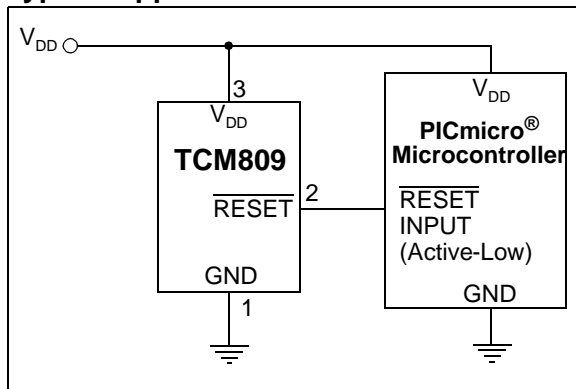
Features

- Precision V_{DD} Monitor for 2.5V, 3.0V, 3.3V, 5.0V Nominal System Voltage Supplies
- 140 msec Minimum RESET Time Out Period
- 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:
 - 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



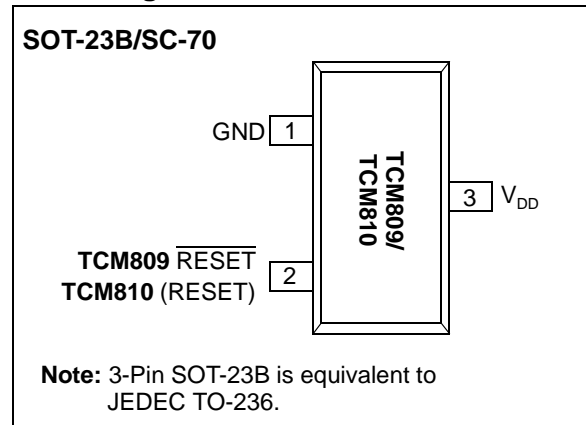
General Description

The TCM809 and TCM810 are cost-effective system supervisor circuits designed to monitor V_{DD} in digital systems 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 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 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 is 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



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/ μ sec
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.
$\overline{\text{RESET}}$ (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 $T_A = +25^\circ\text{C}$, $V_{DD} = 5\text{V}$ 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
V_{DD} Range		1.0	—	5.5	V	$T_A = 0^\circ\text{C}$ to +70°C
		1.2	—	5.5		$T_A = -40^\circ\text{C}$ to +125°C
Supply Current	I_{CC}	—	12	30	μA	TCM8xxL/M/J: $V_{DD} < 5.5\text{V}$
		—	9	25		TCM8xxR/S/T/Z: $V_{DD} < 3.6\text{V}$
Reset Threshold (Note 2)	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°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°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°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°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°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°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°C
Reset Threshold Tempco		—	30	—	ppm/ $^\circ\text{C}$	
V_{DD} to Reset Delay,		—	65	—	μsec	$V_{DD} = V_{TH}$ to ($V_{TH} - 100\text{ mV}$) (Note 2)
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: RESET output for TCM809, RESET output for 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 (**Note 1**).

Parameter	Sym	Min	Typ	Max	Units	Test Conditions
RESET Output Voltage Low (TCM809)	V_{OL}	— — —	— — —	0.3 0.4 0.3	V	TCM809 R/S/T/Z: $V_{DD} = V_{TH \text{ min}}$, $I_{SINK} = 1.2 \text{ mA}$ TCM809 L/M/J: $V_{DD} = V_{TH \text{ min}}$, $I_{SINK} = 3.2 \text{ mA}$ $V_{DD} > 1.0\text{V}$, $I_{SINK} = 50 \mu\text{A}$
RESET Output Voltage High (TCM809)	V_{OH}	$0.8 V_{DD}$ $V_{DD} - 1.5$	— —	— —	V	TCM809 R/S/T/Z: $V_{DD} > V_{TH \text{ max}}$, $I_{SOURCE} = 500 \mu\text{A}$ TCM809 L/M/J: $V_{DD} > V_{TH \text{ max}}$, $I_{SOURCE} = 800 \mu\text{A}$
RESET Output Voltage Low (TCM810)	V_{OL}	— —	— —	0.3 0.4	V	TCM810 R/S/T/Z: $V_{DD} = V_{TH \text{ max}}$, $I_{SINK} = 1.2 \text{ mA}$ TCM810 L/M: $V_{DD} = V_{TH \text{ max}}$, $I_{SINK} = 3.2 \text{ mA}$
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 $T_A = +25^\circ\text{C}$, 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.

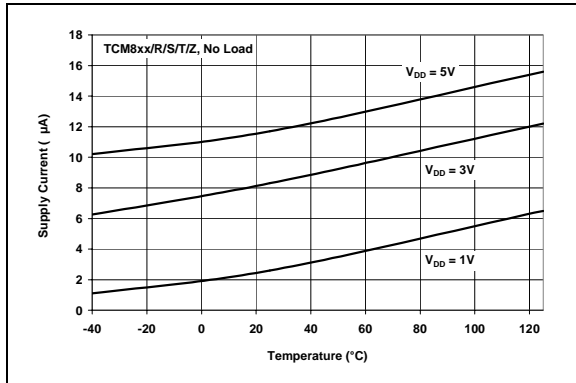


FIGURE 2-1: Supply Current vs. Temperature.

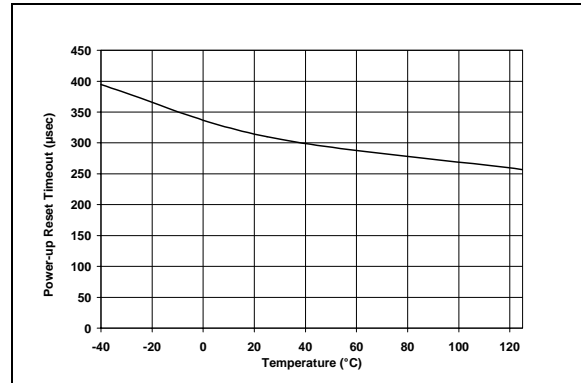


FIGURE 2-3: Power-up Reset Time Out vs. Temperature.

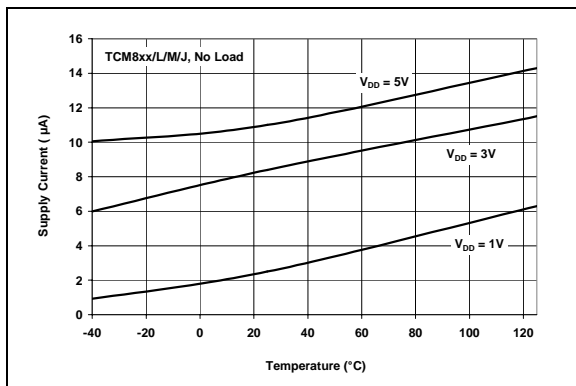


FIGURE 2-2: Supply Current vs. Temperature.

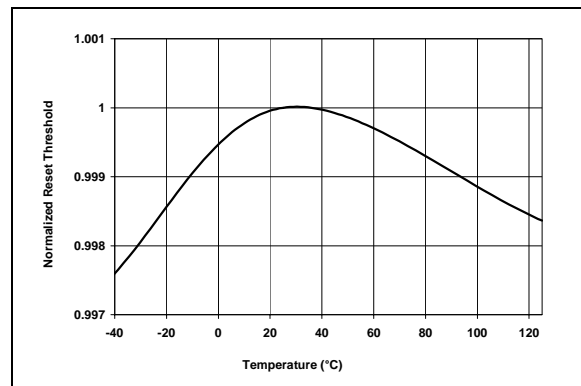


FIGURE 2-4: Normalized Reset Threshold vs. Temperature.

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.

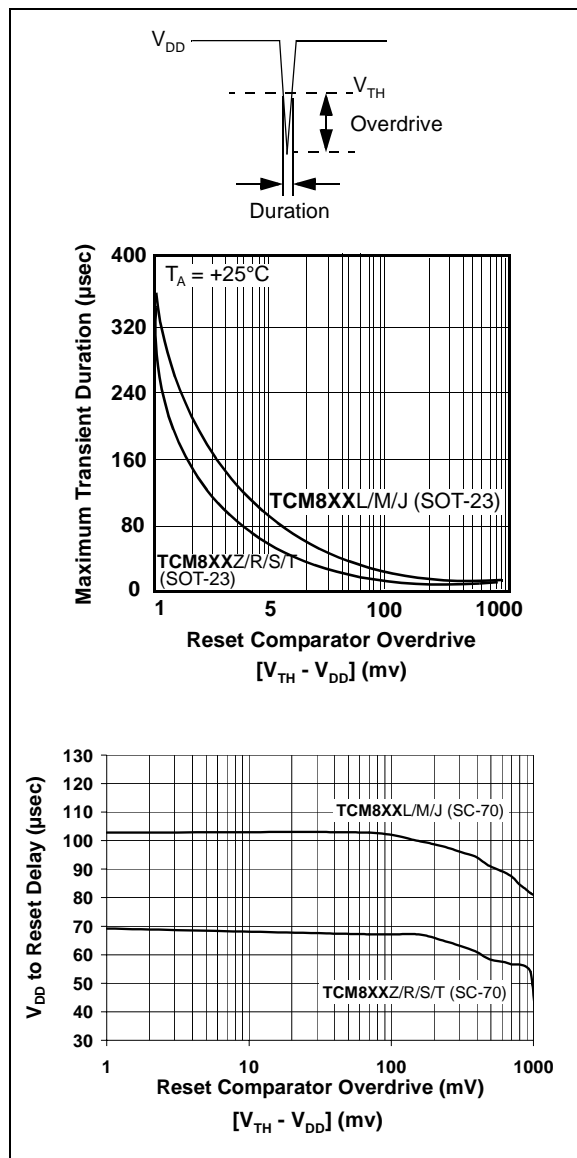


FIGURE 3-1: Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.

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 $V_{DD} = 1.0V$. 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 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 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.

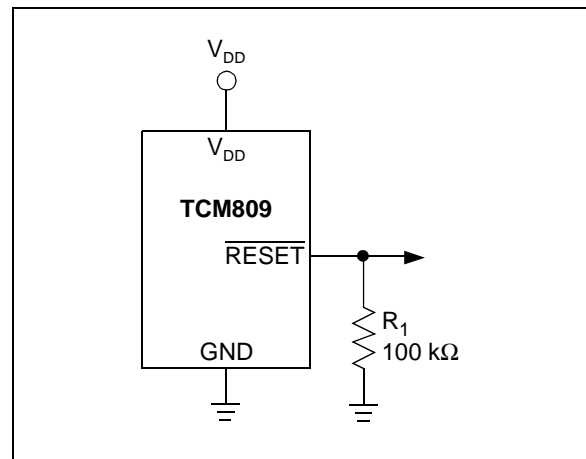


FIGURE 3-2: The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to $V_{DD} = 0V$.

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 Ω 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.

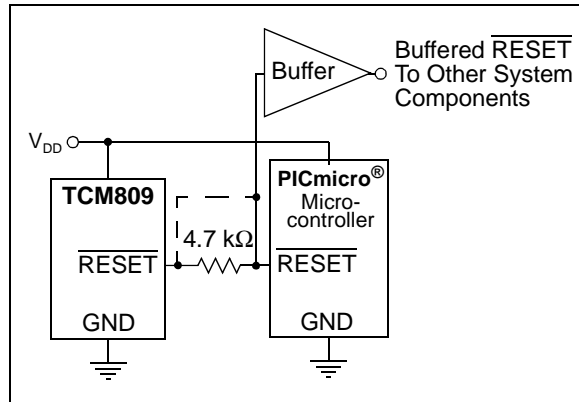
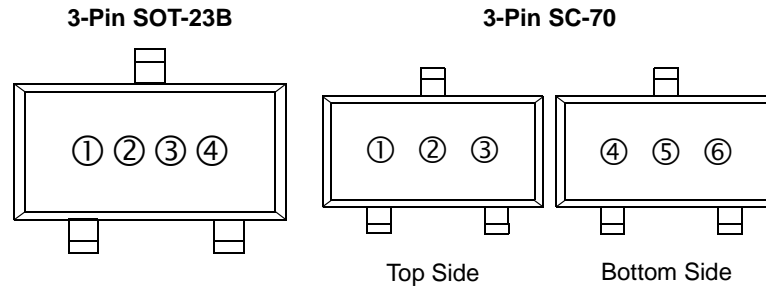


FIGURE 3-3: Interfacing the TCM809 to a Bidirectional RESET I/O.

4.0 PACKAGING INFORMATION

4.1 Package Marking Information



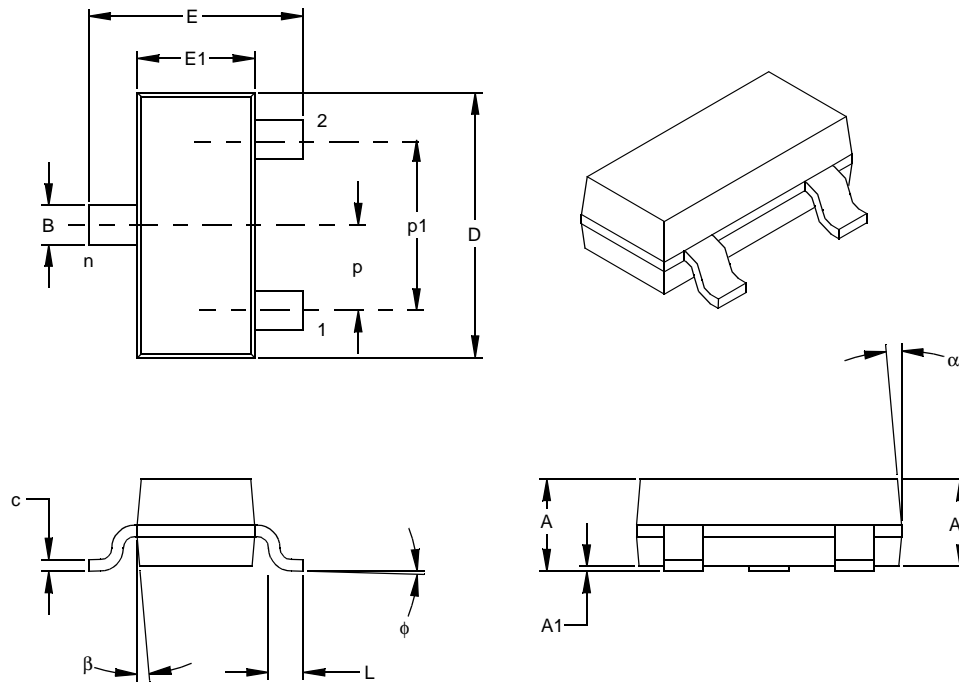
Part Number	SOT-23/SC-70
TCM809LENB	J1
TCM809MENB	J2
TCM809TENB	J3
TCM809SENB	J4
TCM809RENB	J5
TCM809JENB	J6
TCM809ZENB	J7
TCM809LVNB/TCM809LVLB	JZ
TCM809MVNB/TCM809MVLB	JY
TCM809TVNB/TCM809TVLB	JX
TCM809SVNB/TCM809SVLB	JV
TCM809RVNB/TCM809RVLB	JU
TCM809JVNB/TCM809JVLB	JT
TCM809ZVNB/TCM809ZVLB	JS (SC-70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

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.

TCM809/TCM810

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



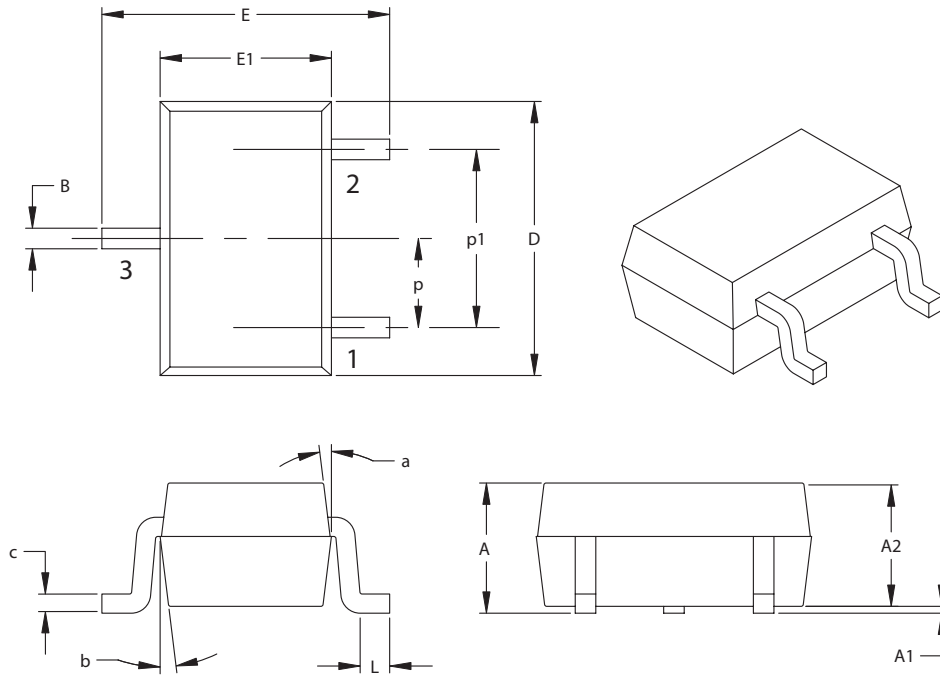
Units		INCHES*			MILLIMETERS		
Dimension	Limits	MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.038			0.96	
Outside lead pitch (basic)	p1		.076			1.92	
Overall Height	A	.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2	.035	.037	.040	0.88	0.95	1.02
Standoff §	A1	.000	.002	.004	0.01	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

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



Dimension Limits	Units	INCHES		MILLIMETERS*	
		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)

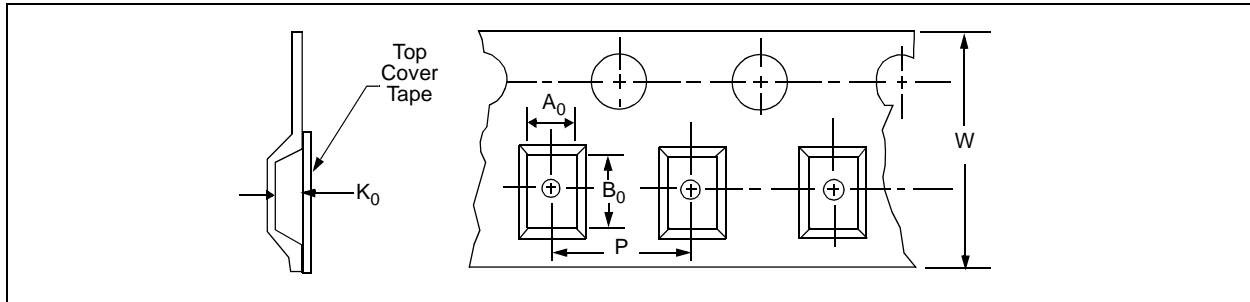
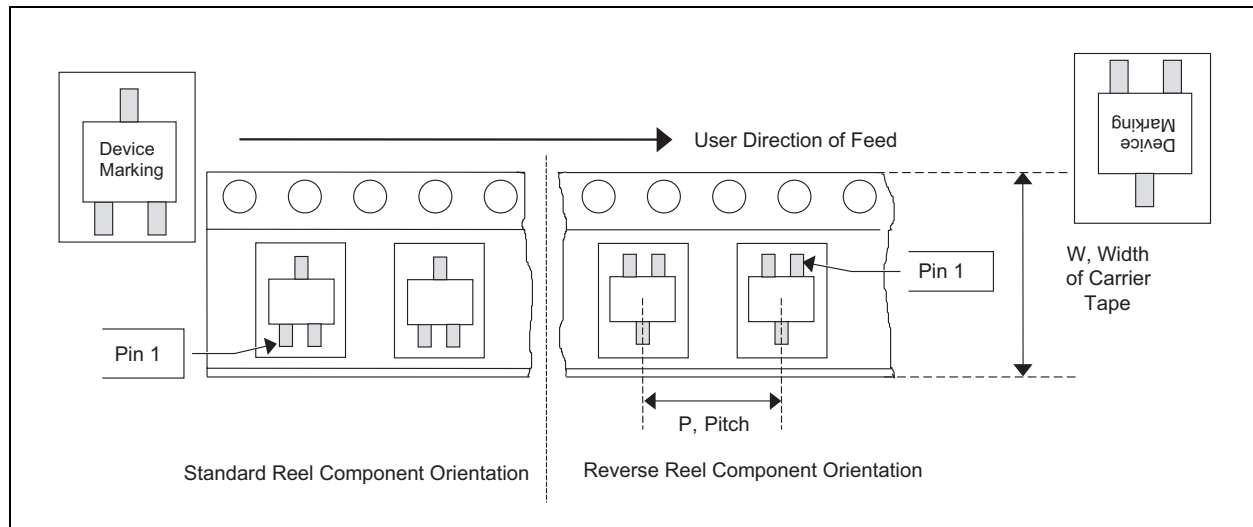


TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS

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



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>	Examples:	
Device	V _{DD} Reset Threshold	Temperature Range	Package		
Device:	TCM809: Supervisor circuit with active-low <u>RESET</u> output TCM810: Supervisor circuit with active-high <u>RESET</u> output			a)	TCM809LENB713: SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +85°C, 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			b)	TCM809LVLB713: SC-70-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel.
Temperature Range:	E = -40°C to +85°C V = -40°C to +125°C			c)	TCM809LVNB713: SOT-23B-3-TR, Microcontroller 4.63V Reset Monitor, -40°C to +125°C, Tape and Reel.
Package:	NB713 = SOT-23B, 3-pin (Tape and Reel) LB713 = SC-70, 3-pin (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.

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:

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3. The Microchip Worldwide Site (www.microchip.com)

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

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TCM809/TCM810

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
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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 - Ier 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

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