TCM809/TCM810

3-Pin Microcontroller Reset Monitors

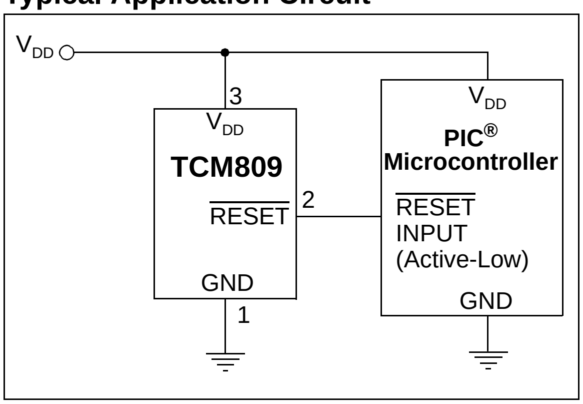
Features

- 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

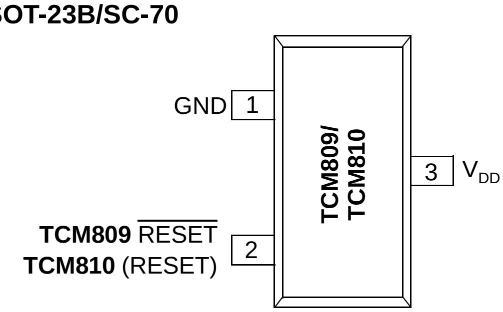
The TCM809 and TCM810 are cost-effective system supervisor circuits designed to monitor V_{DD} in digital systems; providing a reset signal to the host processor, when necessary. No external components are required.

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.

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**.

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.

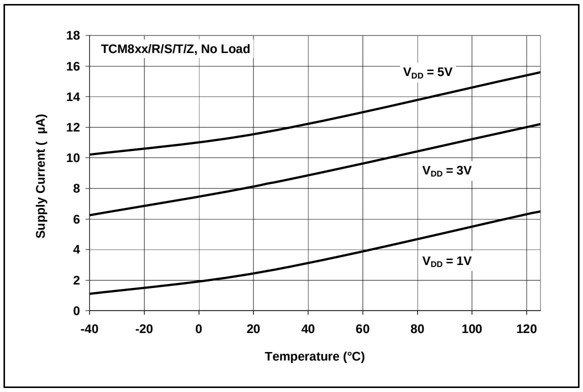


FIGURE 2-1: *Supply Current vs. Temperature.*

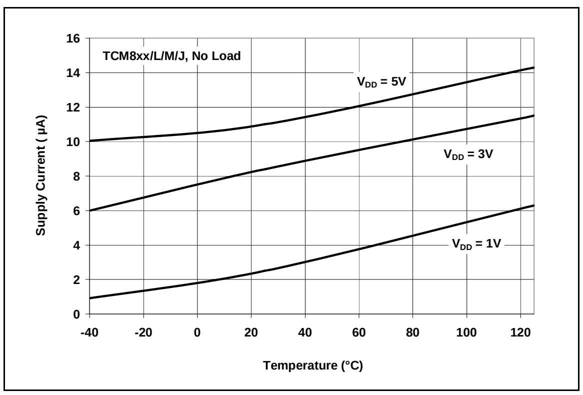


FIGURE 2-2: *Supply Current vs. Temperature.*

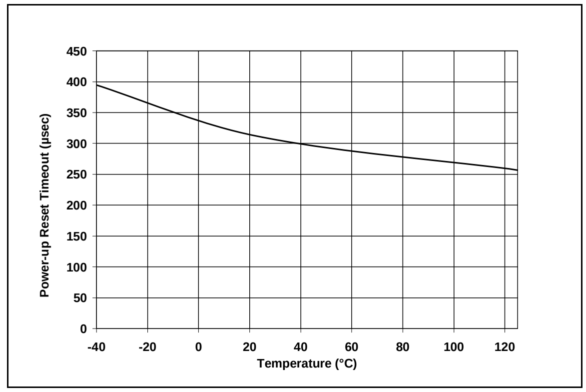


FIGURE 2-3: *Power-up Reset Time Out vs. Temperature.*

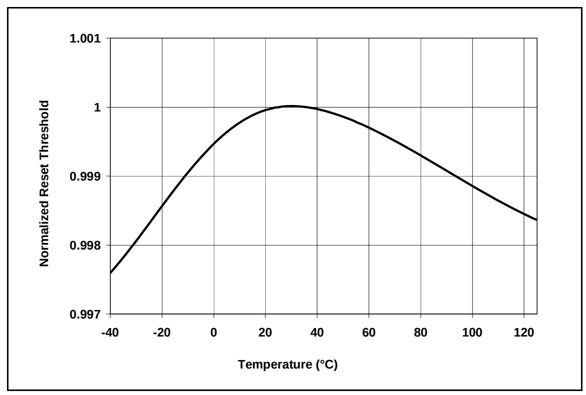


FIGURE 2-4: *Normalized Reset Threshold vs. Temperature.*

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

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.

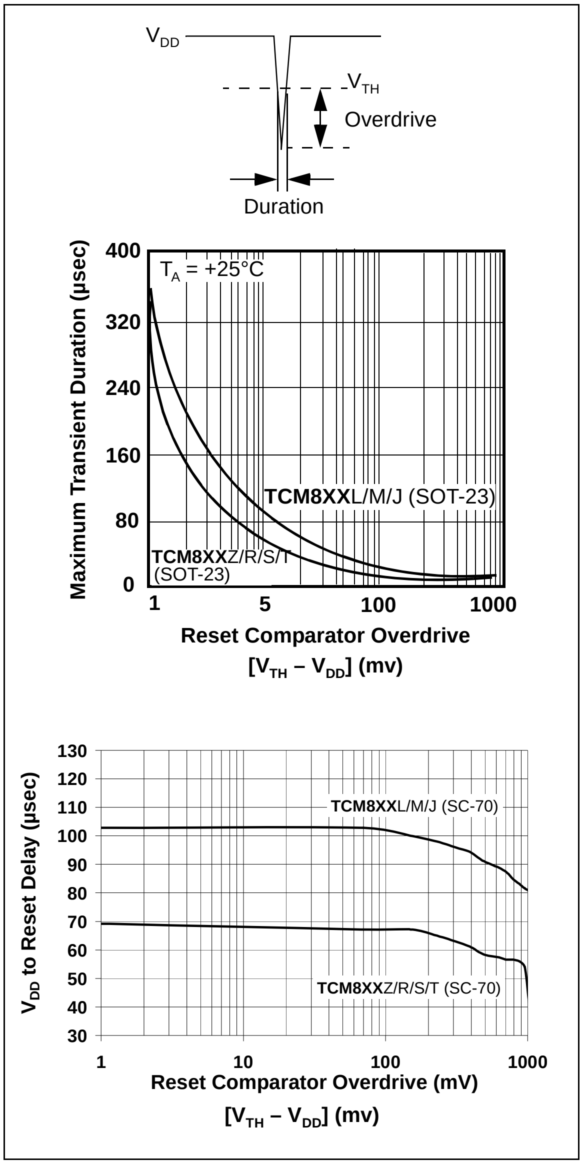


FIGURE 4-1: *Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.*

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.

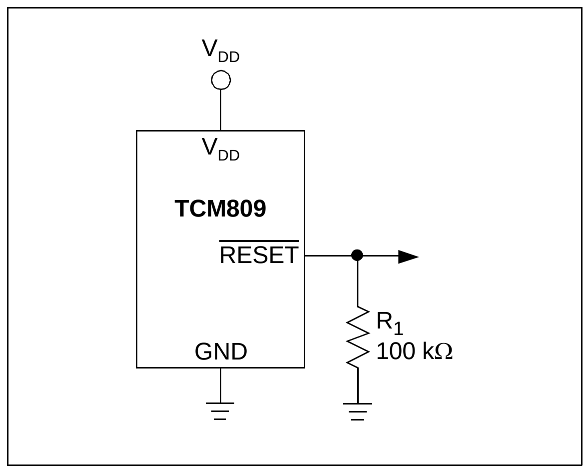


FIGURE 4-2: *The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to V_{DD} = 0V.*

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.

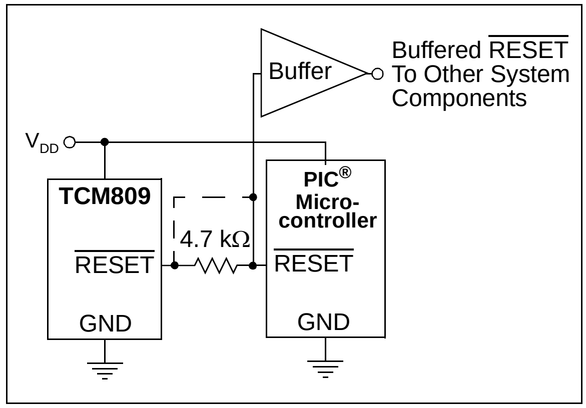
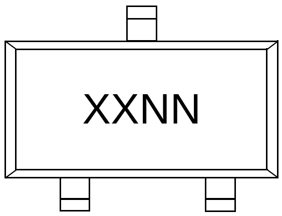


FIGURE 4-3: *Interfacing the TCM809 to a Bidirectional RESET I/O.*

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

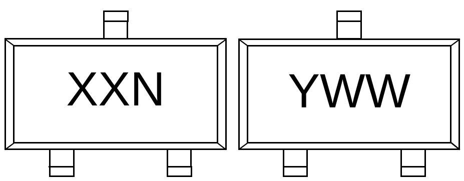
3-Pin SOT-23B



Example:

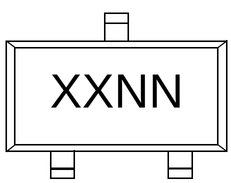
Customer Specific Information Codes for:			
Part Number		**TCM8xx =** **TCM809**	**TCM810**
TCM8xxL	ENB	J1	K1
	VNB	JZ	KZ
TCM8xxM	ENB	J2	K2
	VNB	JY	KY
TCM8xxT	ENB	J3	K3
	VNB	JX	KX
TCM8xxS	ENB	J4	K4
	VNB	JV	KV
TCM8xxR	ENB	J5	K5
	VNB	JU	KU
TCM8xxJ	ENB	J6	—
	VNB	JT	KS
TCM8xxZ	ENB	J7	K6

3-Pin SC-70



Top Side Bottom Side

OR



Example:

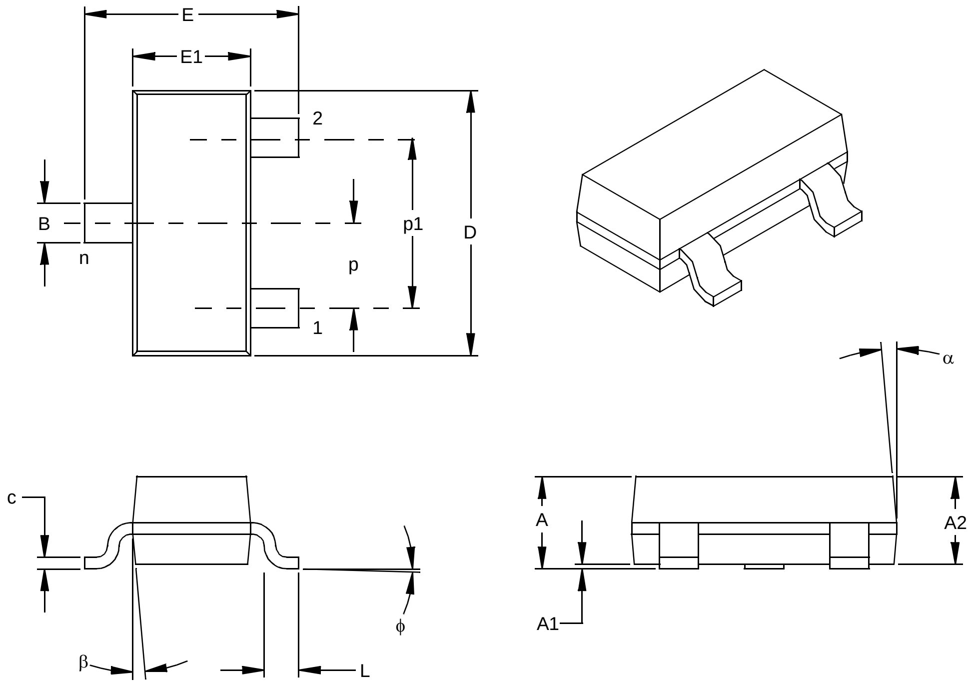
Customer Specific Information Codes for:			
Part Number		**TCM8xx =** **TCM809**	**TCM810**
TCM8xxL	ELB	J1	—
	VLB	JZ	KZ
TCM8xxM	ELB	J2	—
	VLB	JY	KY
TCM8xxT	ELB	J3	—
	VLB	JX	KX
TCM8xxS	ELB	J4	—
	VLB	JV	KV
TCM8xxR	ELB	J5	—
	VLB	JU	KU
TCM8xxJ	ELB	J6	—
	VLB	JT	KS
TCM8xxZ	ELB	J7	—
	VLB	JS	KT

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)

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



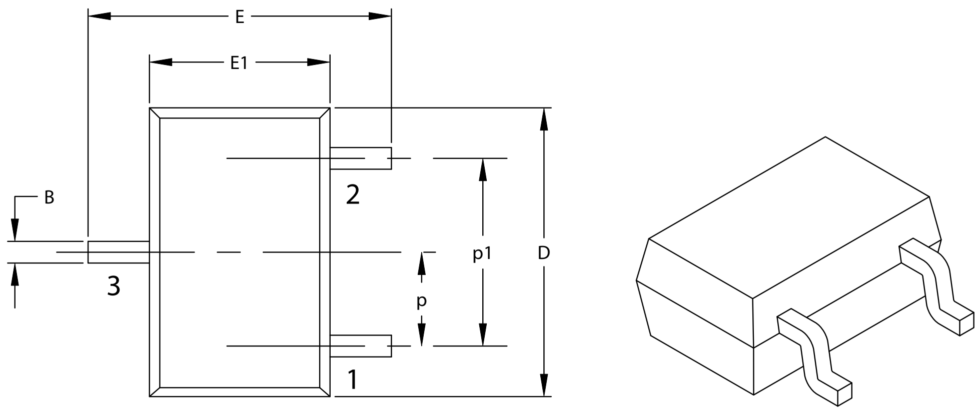
Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.038			0.96	
Outside lead pitch (basic)	p1		.076			1.92	
Overall Height	A	.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2	.035	.037	.040	0.88	0.95	1.02
Standoff §	A1	.000	.002	.004	0.01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

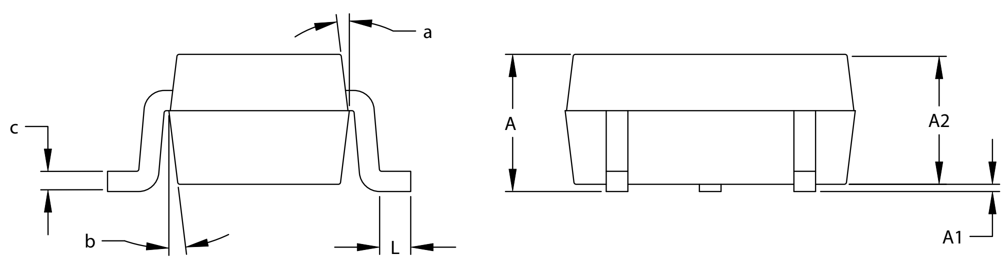
* Controlling Parameter
§ Significant Characteristic

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)

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging





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)

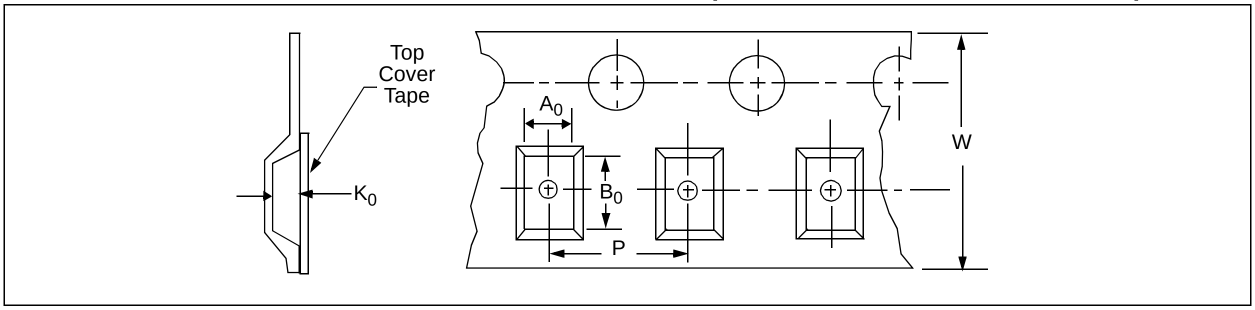
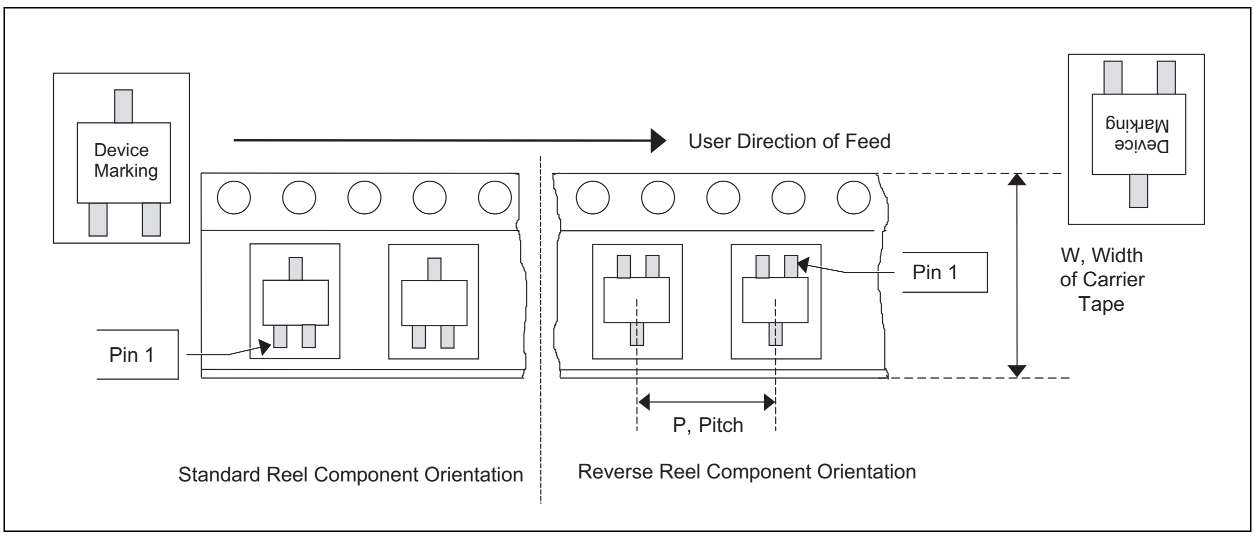


TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS

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



APPENDIX A: REVISION HISTORY

Revision E (December 2012)

- Added a note to each package outline drawing.

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:

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.

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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2. 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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