TCM809/TCM810

3-Pin Microcontroller Reset Monitors

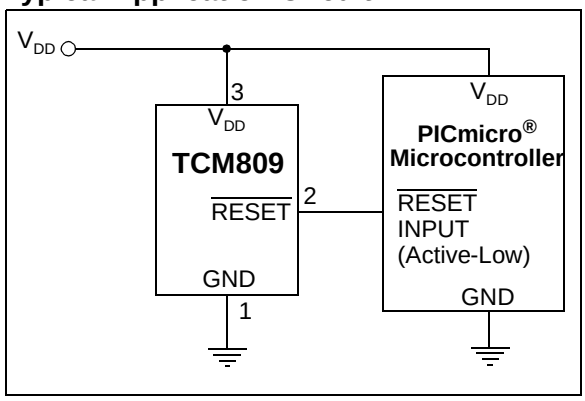
Features

- 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 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

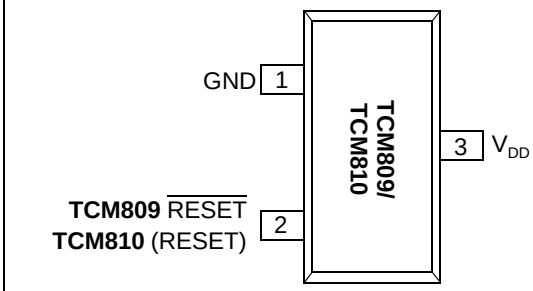
The TCM809 and TCM810 are cost-effective system supervisor circuits designed to monitor V_{DD} in digital systems and provide a reset signal to the host processor, when necessary. No external components are required.

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 $\overline{\text{RESET}}$ 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 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

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.

PIN FUNCTION TABLE

NAME	FUNCTION
GND	Ground.
$\overline{RESET}$ (**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	—	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	

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**.

ELECTRICAL CHARACTERISTICS (CONTINUED)

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
$\overline{\text{RESET}}$ 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
$\overline{\text{RESET}}$ 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: $\overline{\text{RESET}}$ 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.

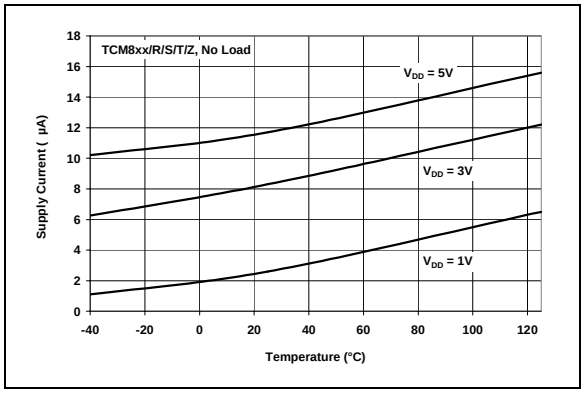


FIGURE 2-1: *Supply Current vs. Temperature.*

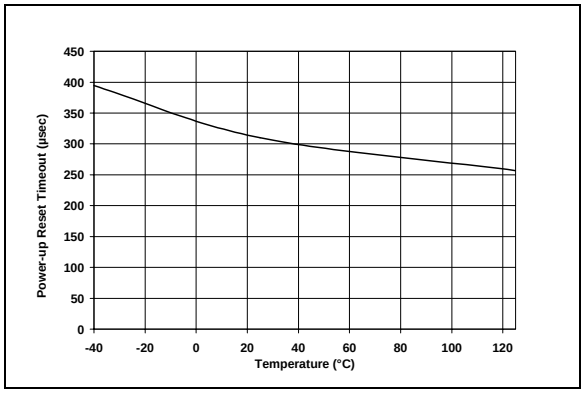


FIGURE 2-3: *Power-up Reset Time Out vs. Temperature.*

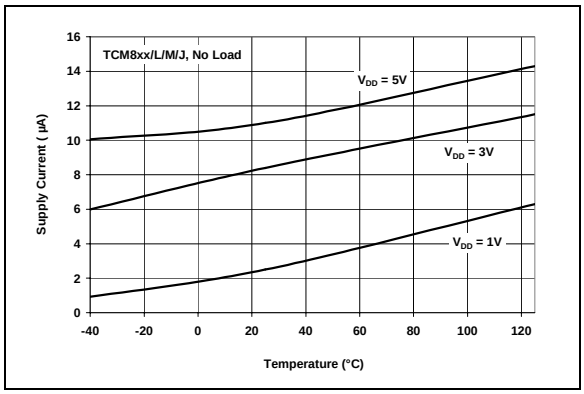


FIGURE 2-2: *Supply Current vs. Temperature.*

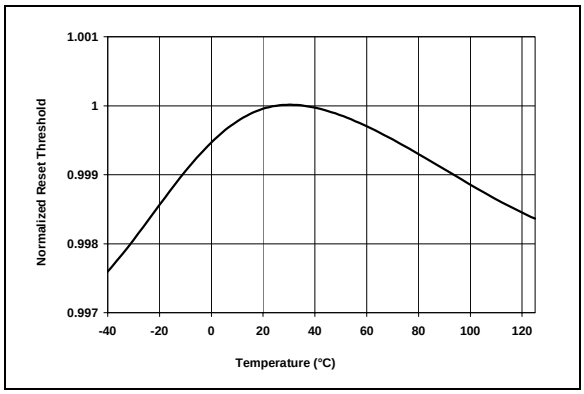


FIGURE 2-4: *Normalized Reset Threshold vs. Temperature.*

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.

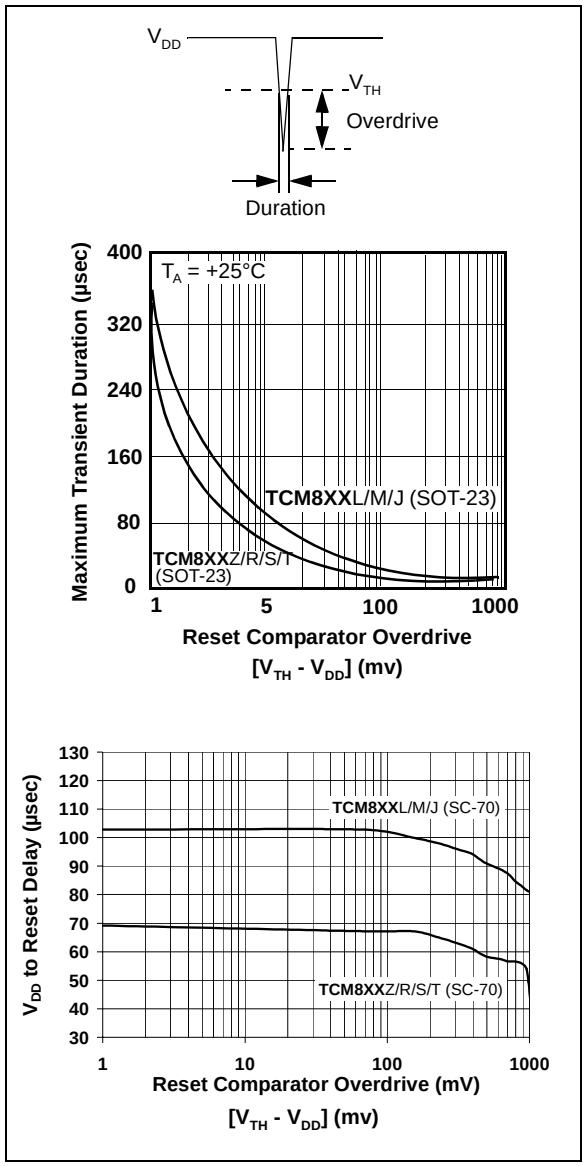


FIGURE 3-1: *Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.*

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.

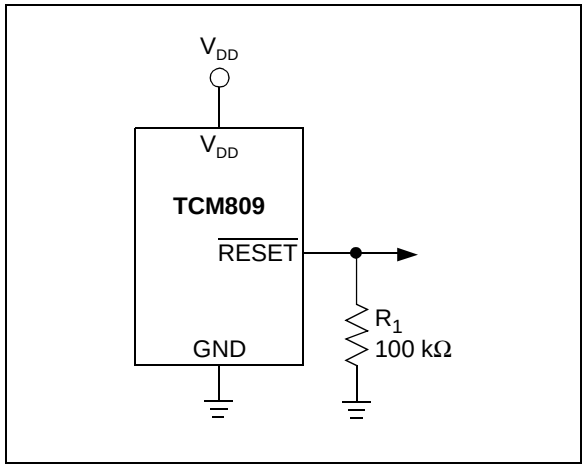


FIGURE 3-2: *The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM809 ensures that the $\overline{\text{RESET}}$ output is valid to V_{DD} = 0V.*

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 kΩ 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.

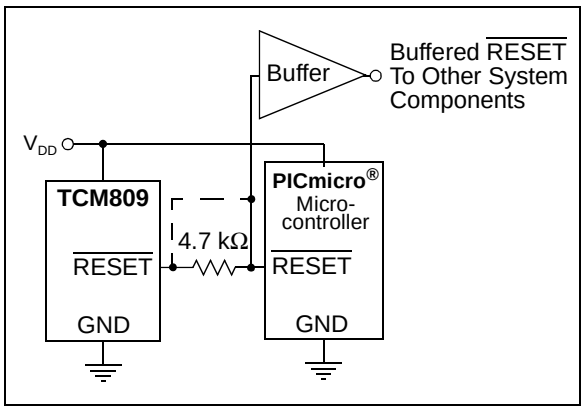
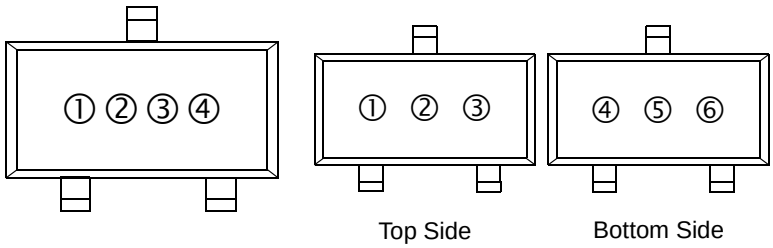


FIGURE 3-3: *Interfacing the TCM809 to a Bidirectional RESET I/O.*

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

3-Pin SOT-23B **3-Pin SC-70**



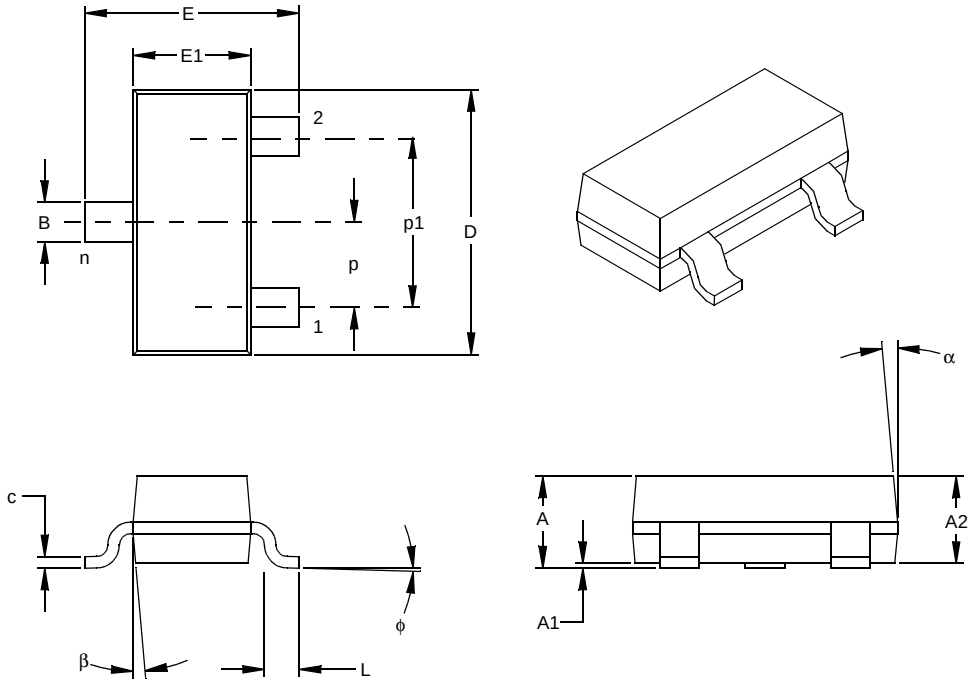
Part Number	SOT-23/SC-70
TCM809LENB	J1
TCM809MENB	J2
TCM809TENB	J3
TCM809SENB	J4
TCM809RENB	J5
TCM809JENB	J6
TCM809ZENB	J7
TCM809LVNB/TCM809LVLB	JZ
TCM809MVNB/TCM809MVLB	JY
TCM809TVNB/TCM809TVLB	JX
TCM809SVNB/TCM809SVLB	JV
TCM809RVNB/TCM809RVLB	JU
TCM809JVNB/TCM809JVLB	JT
TCM809ZVNB/TCM809ZVLB	JS (SC-70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

Part Number	SOT-23/SC-70
TCM810LENB	K1
TCM810MENB	K2
TCM810TENB	K3
TCM810SENB	K4
TCM810RENB	K5
TCM810ZENB	K6
TCM810LVNB/**TCM810**LVLB	KZ
TCM810MVNB/**TCM810**MVLB	KY
TCM810TVNB/**TCM810**TVLB	KX
TCM810SVNB/**TCM810**SVLB	KV
TCM810RVNB/**TCM810**RVLB	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.

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

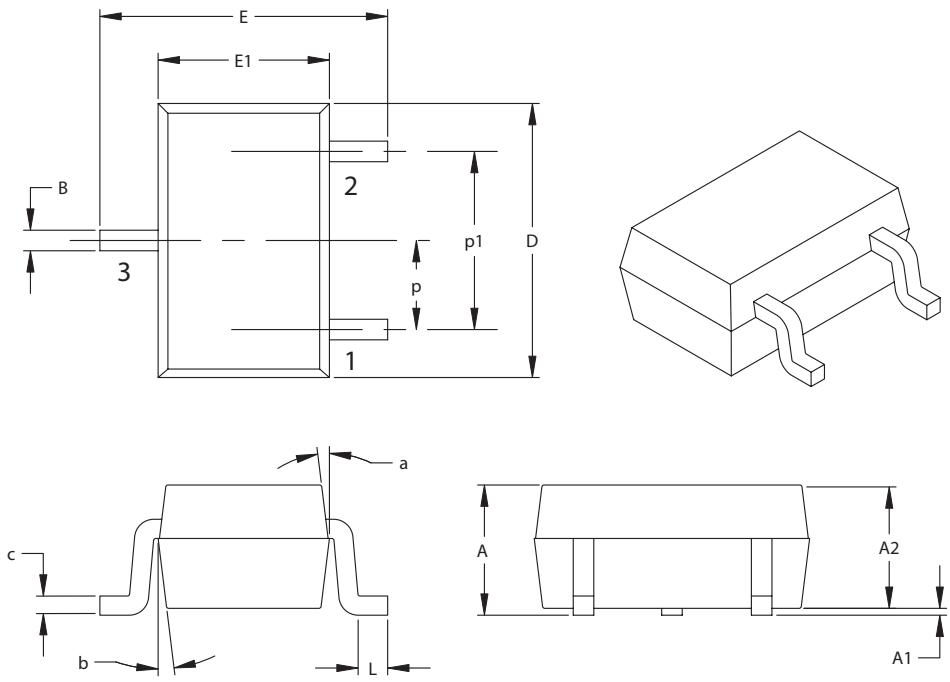


Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.038			0.96	
Outside lead pitch (basic)	p1		.076			1.92	
Overall Height	A	.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2	.035	.037	.040	0.88	0.95	1.02
Standoff §	A1	.000	.002	.004	0.01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



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

4.2 Product Tape and Reel Specifications

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

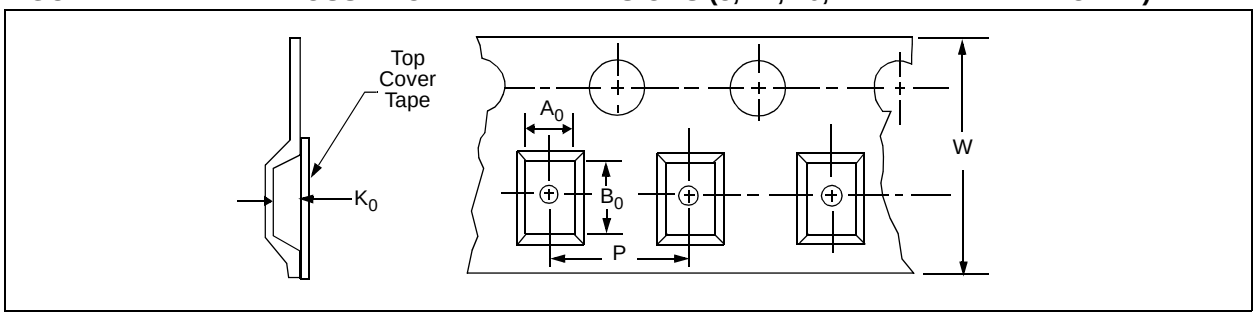
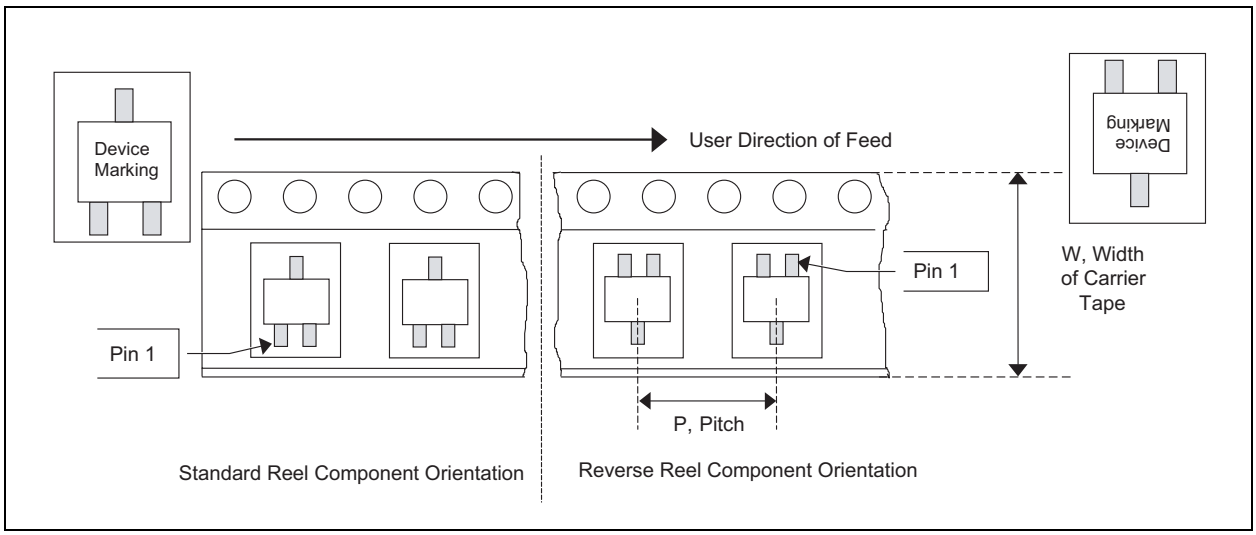


TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS

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.

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:

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)

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

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