TCM811/TCM812

4-Pin Microcontroller Reset Monitors

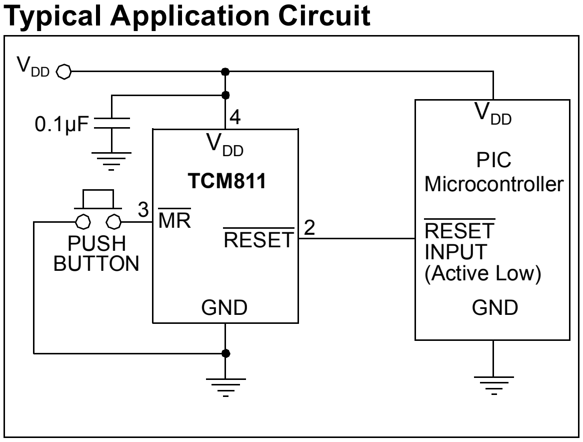
Features

- Precision V_{DD} Monitor for 2.0V, 2.8V, 3.0V, 3.3V, 5.0V Nominal Supplies
- Manual Reset Input
- 140 msec Minimum RESET Output Duration
- $\overline{\text{RESET}}$ Output Valid to V_{DD} = 1.0V (TCM811)
- Low 6 µA (typ.) Supply Current
- V_{DD} Transient Immunity
- Small 4-Pin SOT-143 Package
- No External Components
- Replacement for MAX811/812 and Offers a Lower Threshold Voltage Option
- Push-Pull RESET Output
- Temperature Range:
  - Commercial (C) -40°C to +85°C

Applications

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

Typical Application Circuit



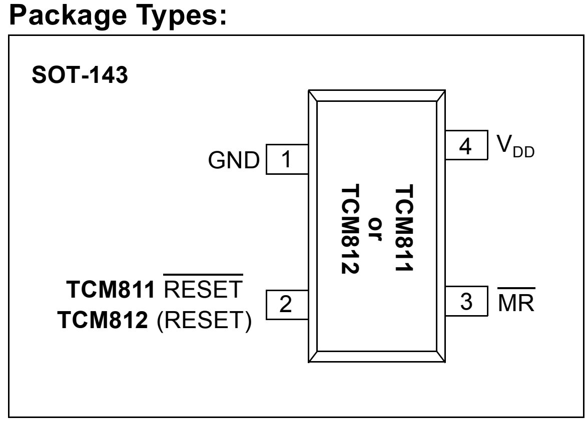
General Description

The TCM811 and TCM812 are cost effective system supervisory circuits designed to monitor V_{DD} in digital systems and provide a reset signal to the host controller when necessary. A manual reset input is provided to override the reset monitor and is suitable for use as a push-button reset. No external components are required.

The reset output is driven active within 20 µsec (5 µsec for F version) 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 TCM812 has an active high RESET output while the TCM811 has an active low RESET output. The output of the TCM811 is valid down to V_{DD} = 1V. Both devices are available in a 4-Pin SOT-143 package, specified with a temperature range of -40°C to +85°C.

The TCM811/TCM812 are optimized to reject fast transient glitches on the V_{DD} line. A low supply current of 6 µA (V_{DD} = 3.3V) makes these devices ideal for battery powered applications.

Package Types:



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

Operating Temperature Range......................– 40°C to +85°C

Storage Temperature Range.......................– 65°C to +150°C

Maximum Junction Temperature, T_S.............................. 150°C

***Notice:** Stresses beyond those listed under “Absolute Maximun Ratings” may cause permanenet damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximun rating conditions for extended periods may affect device reliability.

PIN FUNCTION TABLE

NAME	FUNCTION
GND	Ground
$\overline{RESET}$ (TCM811)	$\overline{RESET}$ push-pull output remains low while V_{DD} is below the reset voltage threshold, and for at least 140 msec (min.) after V_{DD} rises above reset threshold.
RESET (TCM812)	RESET push-pull output remains high while V_{DD} is below the reset voltage threshold, and for at least 140 msec (min.) after V_{DD} rises above reset threshold.
$\overline{MR}$	Manual Reset input generates a reset when $\overline{MR}$ is below $V_{IL.}$
V_{DD}	Supply Voltage

ELECTRICAL CHARACTERISTICS

V_{DD} = 5V for L/M versions, V_{DD} = 3.3V for T/S versions, V_{DD} = 3V for R version, V_{DD} = 2.0V for F version.
T_A = –40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C. (**Note 1**)

Parameters	Sym	Min	Typ	Max	Units	Conditions
V_{DD} Range	V_{DD}	1.0 1.1	— —	5.5 5.5	V	TCM811 TCM812
Supply Current	I_{CC}	— —	6 4.75	15 10	µA	TCM81_L/M, V_{DD} = 5.5V, I_{OUT} = 0 TCM81_R/S/T/F, V_{DD} = 3.6V, I_{OUT} = 0
Reset Threshold	V_{TH}	4.54 4.50	4.63 —	4.72 4.75	V	TCM81_L: T_A = +25°C T_A = –40°C to +85°C
		4.30 4.25	4.38 —	4.46 4.50		TCM81_M: T_A = +25°C T_A = –40°C to +85°C
		3.03 3.00	3.08 —	3.14 3.15		TCM81_T: T_A = +25°C T_A = –40°C to +85°C
		2.88 2.85	2.93 —	2.98 3.00		TCM81_S: T_A = +25°C T_A = –40°C to +85°C
		2.58 2.55	2.63 —	2.68 2.70		TCM81_R: T_A = +25°C T_A = –40°C to +85°C
		1.71 1.70	1.75 —	1.79 1.80		TCM81_F: T_A = +25°C T_A = –40°C to +85°C
Reset Threshold Tempco		—	30	—	ppm/°C	
V_{DD} to Reset Delay		— —	20 5	— —	µsec	V_{DD} = V_{TH} to V_{TH} –125 mV; L, M, R, S, T, F
Reset Active Timeout Period	t_{RP}	140	280	560	msec	V_{DD} = $V_{TH(MAX)}$
$\overline{MR}$ Minimum Pulse Width	t_{MR}	10	—	—	µsec	
$\overline{MR}$ Glitch Immunity		—	100	—	nsec	
$\overline{MR}$ to Reset Propagation Delay	t_{MD}	—	0.5	—	µsec	

Note 1: Production testing done at T_A = +25°C and +85°C, over temperature limits are tested with periodic QA tests in production.

V_{DD} = 5V for L/M versions, V_{DD} = 3.3V for T/S versions, V_{DD} = 3V for R version, V_{DD} = 2.0V for F version. T_A = –40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C. (**Note 1**)						
Parameters	**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
$\overline{\text{MR}}$ Input Threshold	V_{IH} V_{IL}	2.3 —	— —	— 0.8	V	$V_{DD} > V_{TH(MAX)}$, TCM81_L/M
	V_{IH} V_{IL}	0.7 V_{DD} —	— —	— 0.25 V_{DD}	V	$V_{DD} > V_{TH(MAX)}$, TCM81_R/S/T/F
$\overline{\text{MR}}$ Pull-up Resistance		10	20	40	kΩ	
$\overline{\text{RESET}}$ Output Voltage Low (TCM811)	V_{OL}	—	—	0.3	V	TCM811R/S/T only; I_{SINK} = 1.2 mA, $V_{DD} = V_{TH(MIN)}$
		—	—	0.4	V	TCM811F only; I_{SINK} = 500 µA, $V_{DD} = V_{TH(MIN)}$
		—	—	0.3	V	TCM811L/M only; I_{SINK} = 3.2 mA, $V_{DD} = V_{TH(MIN)}$ I_{SINK} = 3.2 mA, $V_{DD} = V_{TH(MIN)}$
$\overline{\text{RESET}}$ Output Voltage High (TCM811)	V_{OH}	0.8 V_{DD}	—	—	V	TCM811R/S/T/F only; I_{SOURCE} = 500 µA, $V_{DD} > V_{TH(MAX)}$
		V_{DD} - 1.5	—	—	V	TCM811L/M only; I_{SOURCE} = 800 µA, $V_{DD} > V_{TH(MAX)}$
RESET Output Voltage Low (TCM812)	V_{OL}	—	—	0.2	V	TCM812F only, I_{SINK} = 500 µA, $V_{DD} = V_{TH(MAX)}$
		—	—	0.3		TCM812R/S/T only, I_{SINK} = 1.2 mA, $V_{DD} = V_{TH(MAX)}$
		—	—	0.4		TCM812L/M only, I_{SINK} = 1.2 mA, $V_{DD} = V_{TH(MAX)}$
RESET Output Voltage High (TCM812)	V_{OH}	0.8 V_{DD}	—	—	V	I_{SOURCE} = 150 µA, $V_{DD} \leq V_{TH(MIN)}$

Note 1: Production testing done at T_A = +25°C and +85°C, over temperature limits are tested with periodic QA tests in production.

2.0 APPLICATIONS INFORMATION

The TCM811/TCM812 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 that is under the curve will not generate a reset signal. Combinations above the curve are detected as a brownout or power-down. Transient immunity can be improved by adding a 0.1 µF capacitor in close proximity to the V_{DD} pin of the TCM811/812.

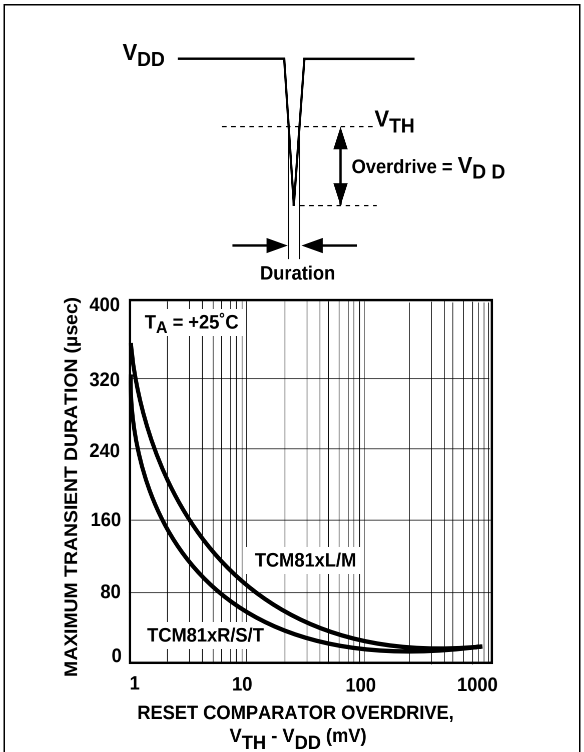


FIGURE 2-1: Maximum Transient Duration vs. Overdrive for Glitch Rejection at 25°C.

2.1 RESET Signal Integrity During Power-Down

The TCM811 $\overline{\text{RESET}}$ push-pull 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 TCM812 to ensure a valid high RESET for V_{DD} below 1.1V.

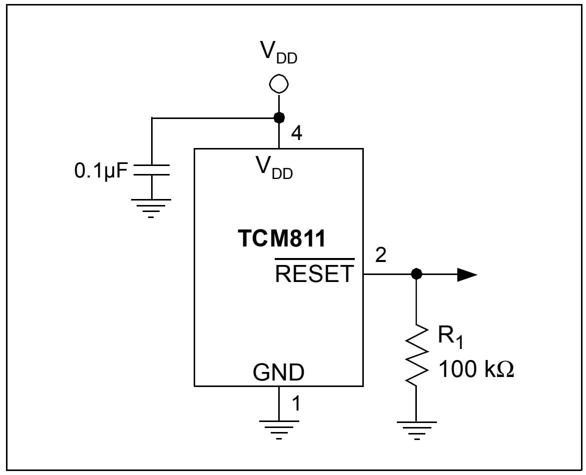


FIGURE 2-2: The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM811 ensures that the $\overline{\text{RESET}}$ output is valid to V_{DD} = 0V.

2.2 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 TCM811/TCM812 (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.

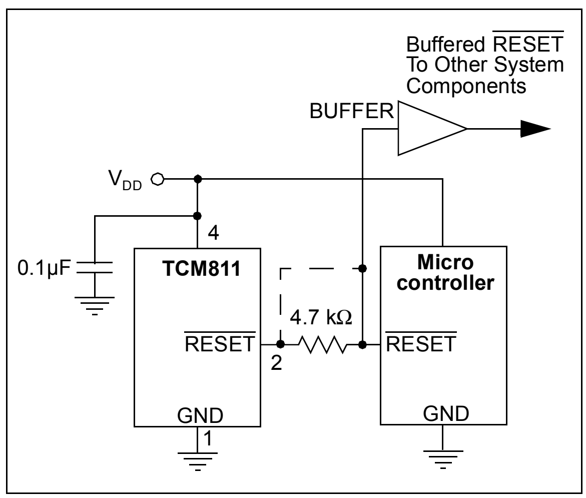


FIGURE 2-3: Interfacing the TCM811 to a Bi-directional Reset I/O.

3.0 TYPICAL PERFORMANCE CHARACTERISTICS

Note: The graphs 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, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

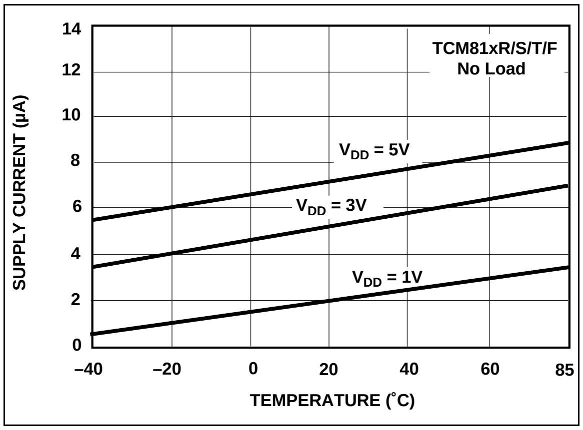


FIGURE 3-1: Supply Current vs. Temperature.

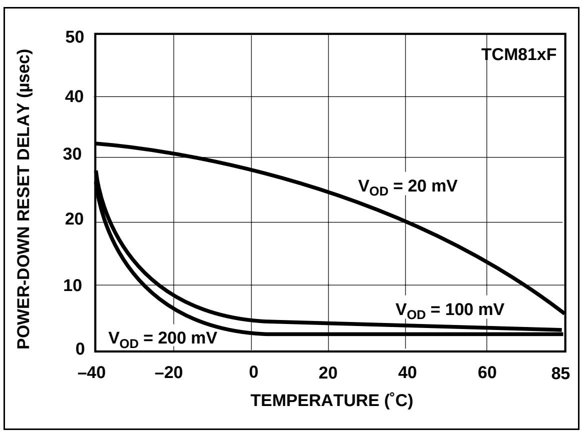


FIGURE 3-2: Power-Down Reset Delay vs. Temperature.

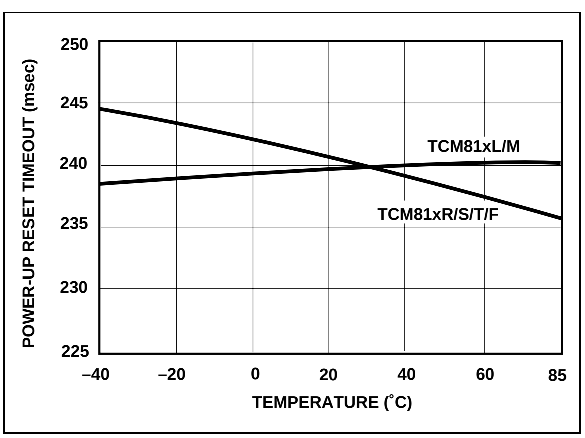


FIGURE 3-3: Power-Up Reset Timeout vs. Temperature.

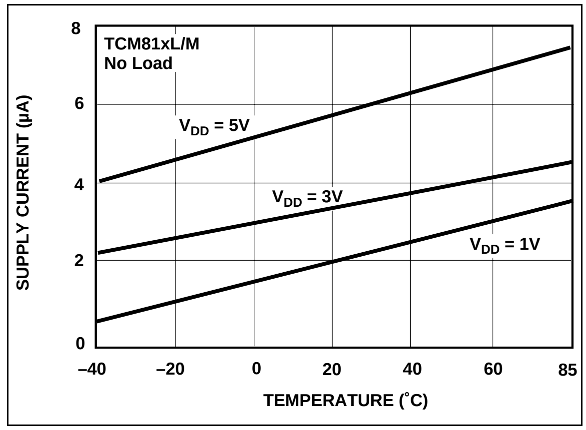


FIGURE 3-4: Supply Current vs. Temperature.

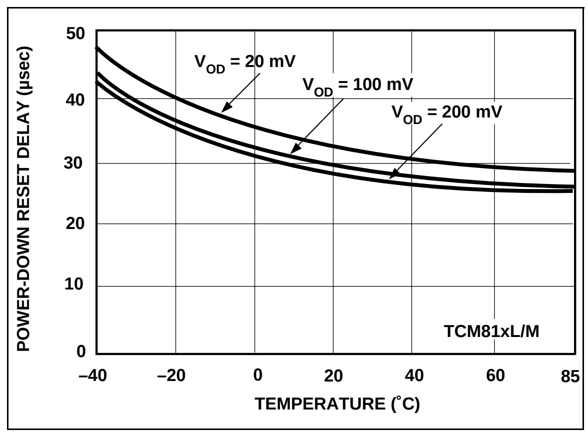


FIGURE 3-5: Power-Down Reset Delay vs. Temperature.

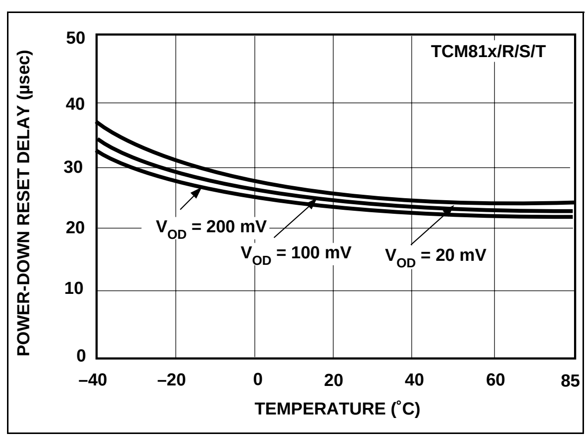


FIGURE 3-6: Power-Down Reset Delay vs. Temperature.

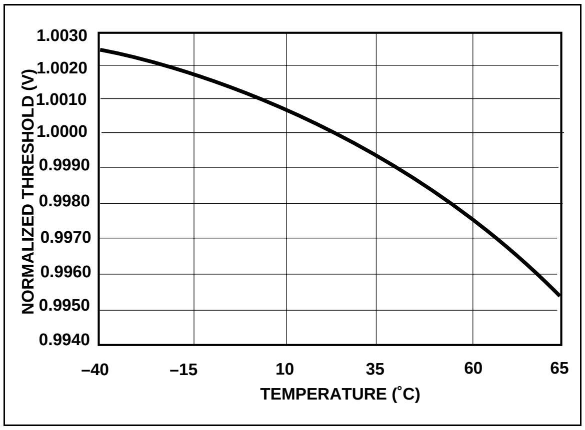
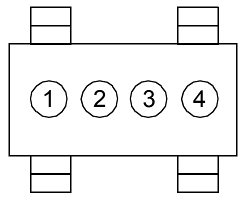


FIGURE 3-7: Normalized Reset Threshold vs. Temperature.

4.0 PACKAGING INFORMATION

4.1 Package Marking Information

4-Pin SOT-143



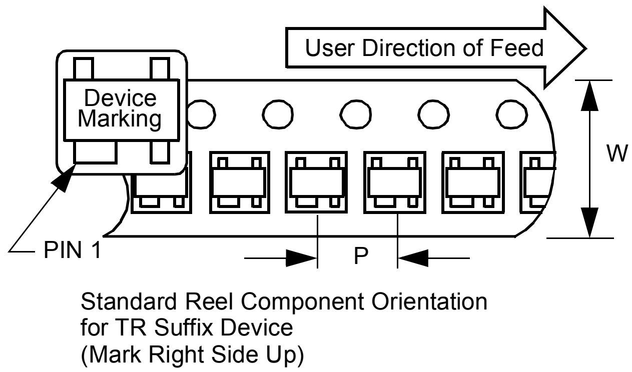
Part Number	(V)	Code
TCM811LERC	4.63	U1
TCM811MERC	4.38	U2
TCM811TERC	3.08	U3
TCM811SERC	2.93	U4
TCM811RERC	2.63	U5
TCM811FERC	1.75	U7
TCM812LERC	4.63	V1
TCM812MERC	4.38	V2
TCM812TERC	3.08	V3
TCM812SERC	2.93	V4
TCM812RERC	2.63	V5
TCM812FERC	1.75	V7

Legend:
1 Part Number + temperature range and voltage (two-digit code)
2 Part Number + temperature range and voltage (two-digit code)
3 Year and two-month period code
4 Lot ID number

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.

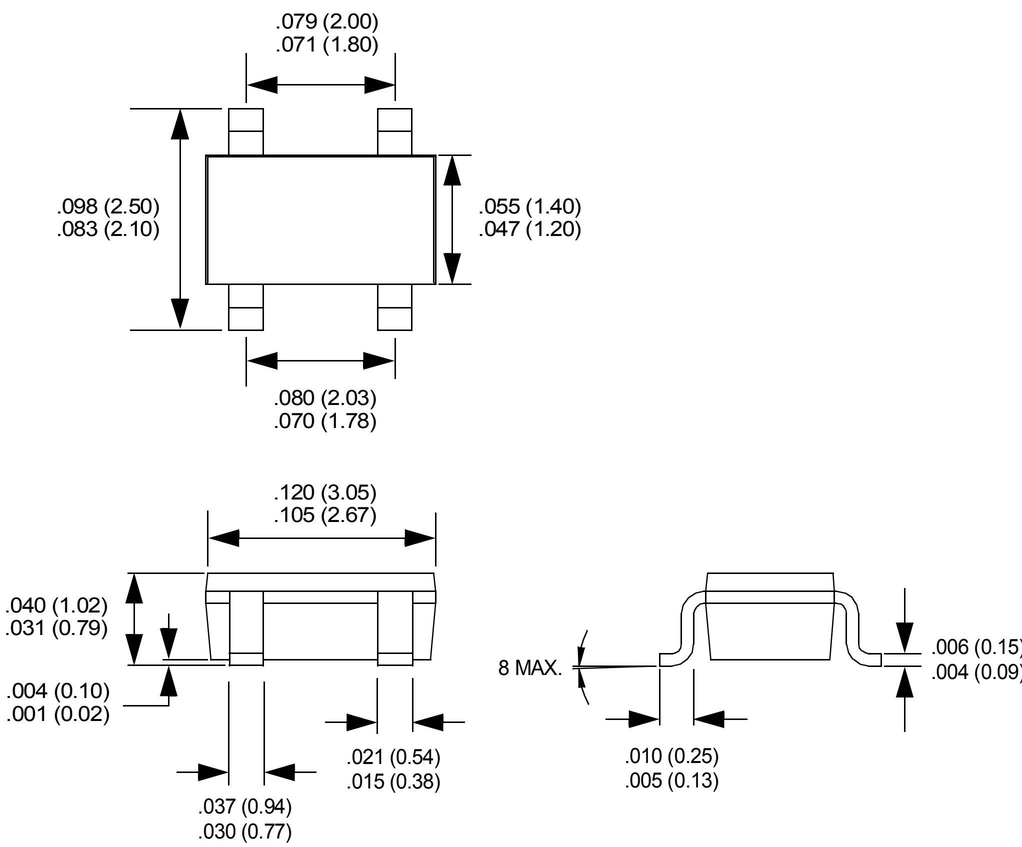
4.2 Package Dimensions

Component Taping Orientation for 4-Pin SOT-143 Devices



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

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
4-Pin SOT-143	8 mm	4 mm	3000	7 in.



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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	XXXX
Device	V_{DD} Reset Threshold	Temperature Range	Package

Device:	TCM811:	Supervisor Circuit with active-low $\overline{\text{RESET}}$ output	
	TCM812:	Supervisor Circuit with active-high RESET output	
V_{DD} Reset Threshold:	L	=	4.63V
	M	=	4.38V
	T	=	3.08V
	S	=	2.93V
	R	=	2.63V
	F	=	1.75V
Temperature Range:	E	=	-40°C to +85°C
Package:	RCTR	=	SOT-143, 4-pin (Tape and Reel)

Examples:

a) TCM811LERCTR: SOT-143, Microcontroller 4.63V Reset Monitor, -40°C to +85°C, Tape and Reel.

b) TCM811MERCTR: SOT-143, Microcontroller 4.38V Reset Monitor, -40°C to +85°C, Tape and Reel.

a) TCM812FERCTR: SOT-143, Microcontroller 1.75V Reset Monitor, -40°C to +85°C, Tape and Reel.

b) TCM812SERCTR: SOT-143, Microcontroller 2.93V Reset Monitor, -40°C to +125°C, Tape and Reel.

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01/18/02