TCM811/TCM812

4-Pin Reset Monitors

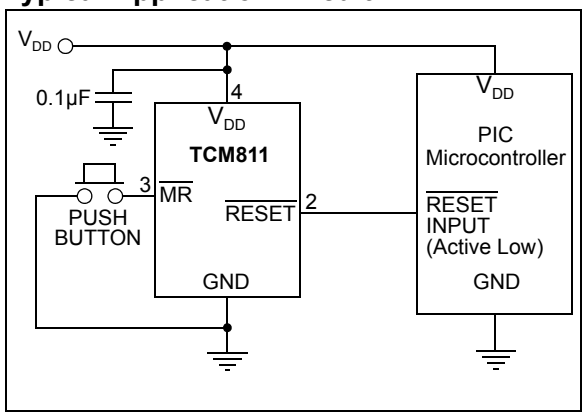
Features

- Precision V_{DD} Monitor for 2.0V, 2.8V, 3.0V, 3.3V, 5.0V Nominal Supplies
- Manual Reset Input
- 140 ms 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



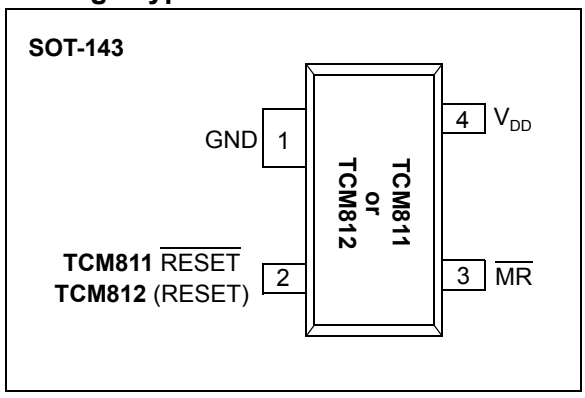
General Description

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 µs (5 µs for F version) of V_{DD} falling through the reset voltage threshold. RESET is maintained active for a minimum of 140 ms after V_{DD} rises above the reset threshold. The TCM812 has an active high RESET output while the TCM811 has an active low $\overline{\text{RESET}}$ 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:



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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 Maximum Ratings" may cause permanent 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 maximum rating conditions for extended periods may affect device reliability.

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. Unless otherwise noted, T_A = –40°C to +85°C. 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	15	µA	TCM81_L/M, V_{DD} = 5.5V, I_{OUT} = 0
		—	4.75	10	µA	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 V	TCM81_L: T_A = +25°C T_A = –40°C to +85°C
		4.30 4.25	4.38 —	4.46 4.50	V V	TCM81_M: T_A = +25°C T_A = –40°C to +85°C
		3.03 3.00	3.08 —	3.14 3.15	V V	TCM81_T: T_A = +25°C T_A = –40°C to +85°C
		2.88 2.85	2.93 —	2.98 3.00	V V	TCM81_S: T_A = +25°C T_A = –40°C to +85°C
		2.58 2.55	2.63 —	2.68 2.70	V V	TCM81_R: T_A = +25°C T_A = –40°C to +85°C
		1.71 1.70	1.75 —	1.79 1.80	V V	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	—	µs	V_{DD} = V_{TH} to V_{TH} –125 mV; TCM81_L/M
		—	5	—	µs	V_{DD} = V_{TH} to V_{TH} –125 mV; TCM81_R/S/T/F
Reset Active Timeout Period	t_{RP}	140	280	560	ms	V_{DD} = $V_{TH(MAX)}$
$\overline{MR}$ Minimum Pulse Width	t_{MR}	10	—	—	µs	
$\overline{MR}$ Glitch Immunity		—	100	—	ns	
$\overline{MR}$ to Reset Propagation Delay	t_{MD}	—	0.5	—	µs	

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

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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. Unless otherwise noted, T_A = –40°C to +85°C. Typical values are at T_A = +25°C. (**Note 1**)

Parameters	Sym	Min	Typ	Max	Units	Conditions
$\overline{MR}$ Input Threshold	V_{IH}	2.3	—	—	V	$V_{DD} > V_{TH(MAX)}$, TCM81_L/M
		0.7 V_{DD}	—	—	V	$V_{DD} > V_{TH(MAX)}$, TCM81_R/S/T/F
	V_{IL}	—	—	0.8	V	$V_{DD} > V_{TH(MAX)}$, TCM81_L/M
		—	—	0.25 V_{DD}	V	$V_{DD} > V_{TH(MAX)}$, TCM81_R/S/T/F
$\overline{MR}$ Pull-up Resistance		10	20	40	kΩ	
$\overline{RESET}$ 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, $V_{DD} = V_{TH(MIN)}$
$\overline{RESET}$ 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	V	TCM812R/S/T only, I_{SINK} = 1.2 mA, $V_{DD} = V_{TH(MAX)}$
		—	—	0.4	V	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, overtemperature limits are tested with periodic QA tests in production.

2.0 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.

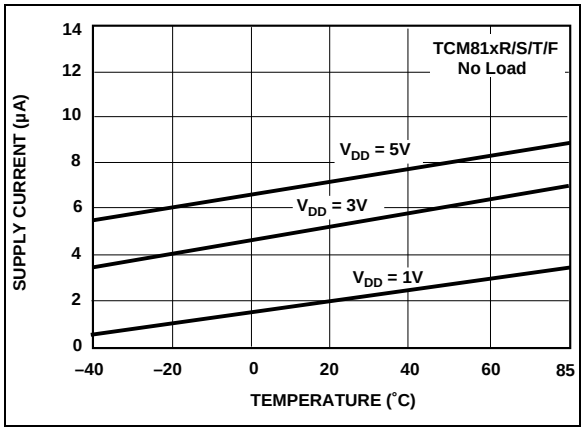

FIGURE 2-1: Supply Current vs. Temperature.

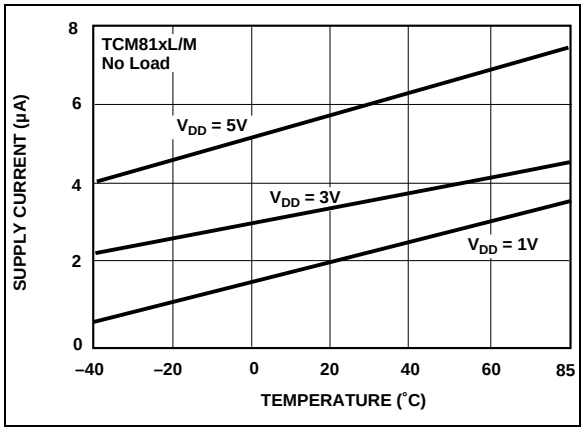

FIGURE 2-4: Supply Current vs. Temperature.

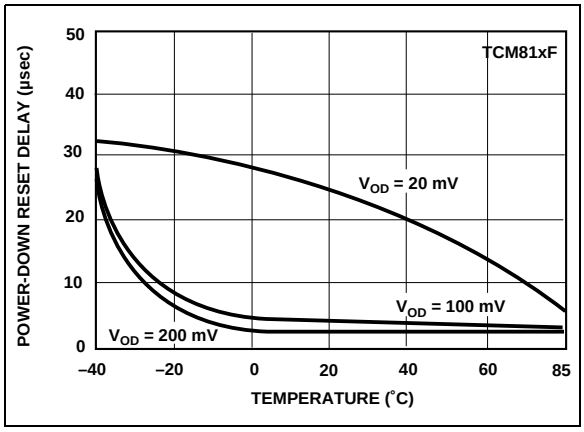

FIGURE 2-2: Power-Down Reset Delay vs. Temperature.

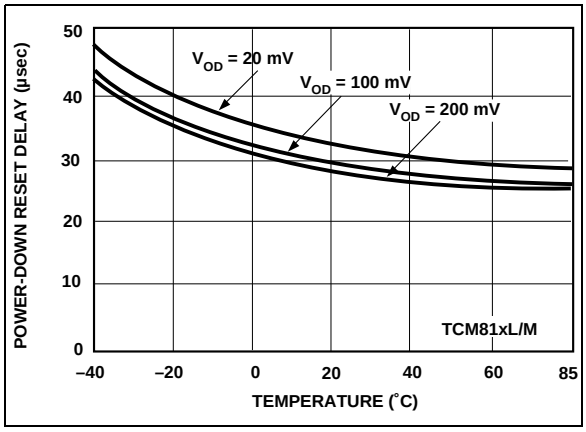

FIGURE 2-5: Power-Down Reset Delay vs. Temperature.

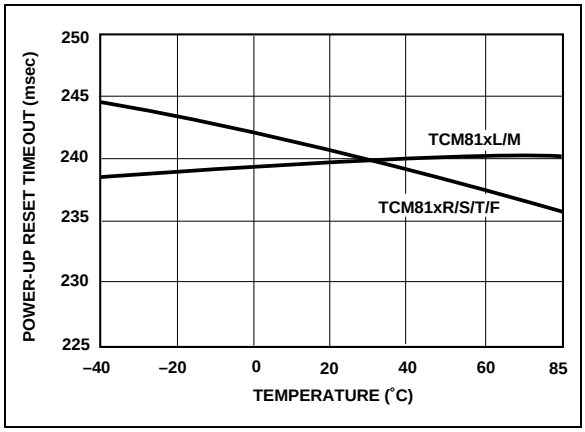

FIGURE 2-3: Power-Up Reset Timeout vs. Temperature.

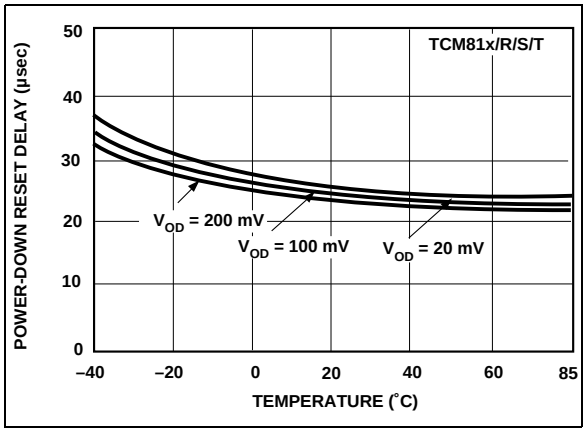

FIGURE 2-6: Power-Down Reset Delay vs. Temperature.

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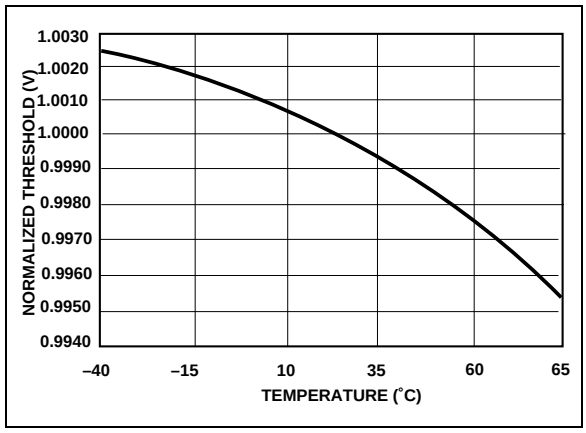

FIGURE 2-7: Normalized Reset Threshold vs. Temperature.

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

Pin No.	Symbol	Description
1	GND	Ground
2	$\overline{\text{RESET}}$ (TCM811)	$\overline{\text{RESET}}$ push-pull output remains low while V_{DD} is below the reset voltage threshold, and for at least 140 ms (min.) after V_{DD} rises above reset threshold
2	RESET (TCM812)	Reset push-pull output remains high while V_{DD} is below the reset voltage threshold, and for at least 140 ms (min.) after V_{DD} rises above reset threshold
3	$\overline{\text{MR}}$	Manual Reset input generates a Reset when $\overline{\text{MR}}$ is below V_{IL}
4	V_{DD}	Supply voltage

3.1 Ground Terminal (GND)

GND provides the negative reference for the analog input voltage. Typically, the circuit ground is used.

3.2 Reset Output ($\overline{\text{RESET}}$) (TCM811)

$\overline{\text{RESET}}$ output remains low while V_{DD} is below the Reset voltage threshold (V_{TRIP}). Once the device voltage (V_{DD}) returns to a high level ($V_{TRIP} + V_{HYS}$), the device will remain in Reset for the Reset delay timer (T_{RST}). After that time expires, the $\overline{\text{RESET}}$ pin will be driven to the high state.

3.3 Reset Output (RESET) (TCM812)

RESET output remains high while V_{DD} is below the Reset voltage threshold (V_{TRIP}). Once the device voltage (V_{DD}) returns to a high level ($V_{TRIP} + V_{HYS}$), the device will remain in Reset for the Reset delay timer (T_{RST}). After that time expires, the RESET pin will be driven to the low state.

3.4 Manual Reset ($\overline{\text{MR}}$)

The Manual Reset ($\overline{\text{MR}}$) input pin allows a push button switch to easily be connected to the system. When the push button is depressed, it forces a system Reset. This pin has circuitry that filters noise that may be present on the MR signal.

The $\overline{\text{MR}}$ pin is active-low and has an internal pull-up resistor.

3.5 Supply Voltage (V_{DD})

V_{DD} can be used for power supply monitoring or a voltage level that requires monitoring.

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4.0 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 4-1 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/TCM812.

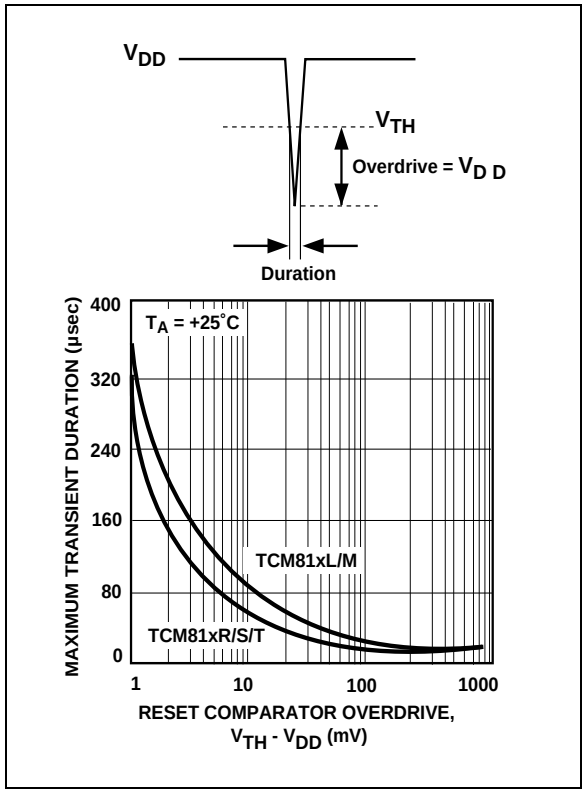


FIGURE 4-1: *Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.*

4.1 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 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 TCM812 to ensure a valid high RESET for V_{DD} below 1.1V.

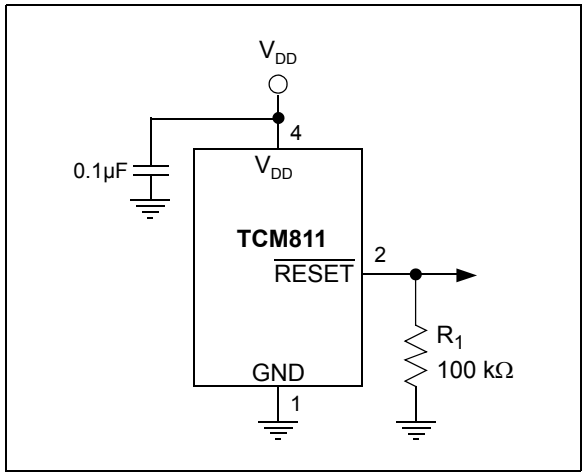


FIGURE 4-2: *The addition of R_1 at the $\overline{\text{RESET}}$ output of the TCM811 ensures that the $\overline{\text{RESET}}$ output is valid to V_{DD} = 0V.*

4.2 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 TCM811/TCM812 (Figure 4-3). 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.

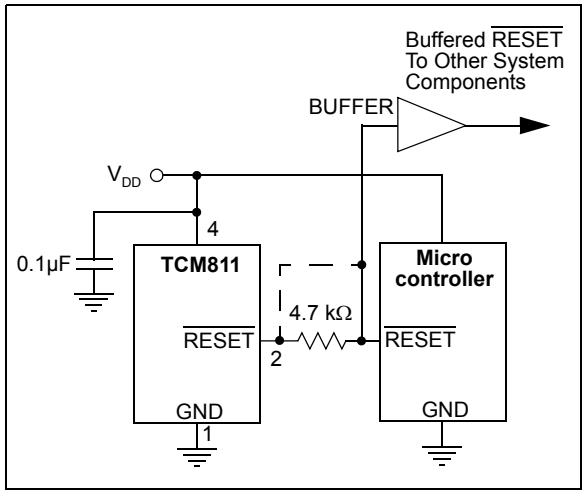
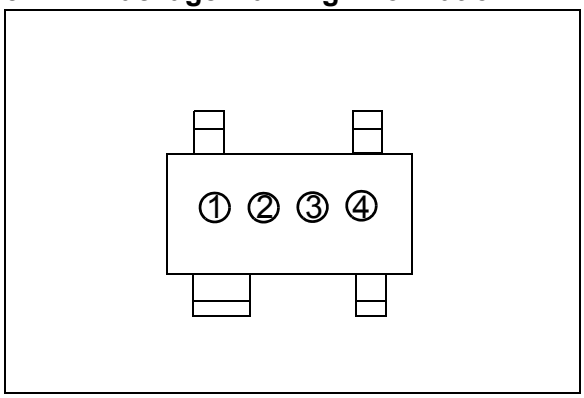


FIGURE 4-3: *Interfacing the TCM811 to a Bidirectional Reset I/O.*

5.0 PACKAGING INFORMATION

5.1 Package Marking Information



① & ② = part number code + reset threshold voltage (two-digit code)

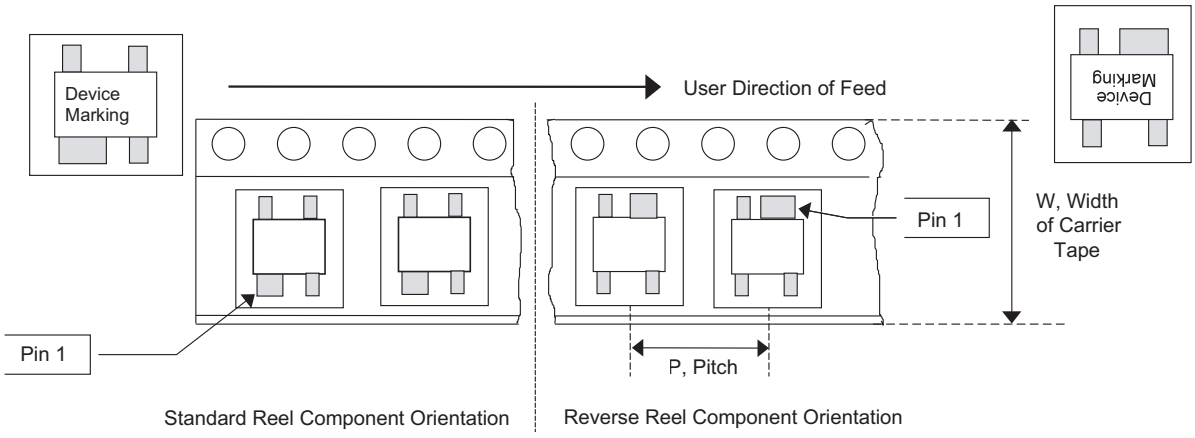
Part Number	(V)	TCM811 Code
TCM811LERCTR	4.63	U1
TCM811MERCTR	4.38	U2
TCM811TERCTR	3.08	U3
TCM811SERCTR	2.93	U4
TCM811RERCTR	2.63	U5
TCM811FERCTR	1.75	U7
Part Number	**(V)**	**TCM812 Code**
TCM812LERCTR	4.63	V1
TCM812MERCTR	4.38	V2
TCM812TERCTR	3.08	V3
TCM812SERCTR	2.93	V4
TCM812RERCTR	2.63	V5
TCM812FERCTR	1.75	V7

③ represents year and two-month period code

④ represents production lot ID code

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.

5.2 Taping Form



for TR Suffix Device
(Mark Right Side Up)

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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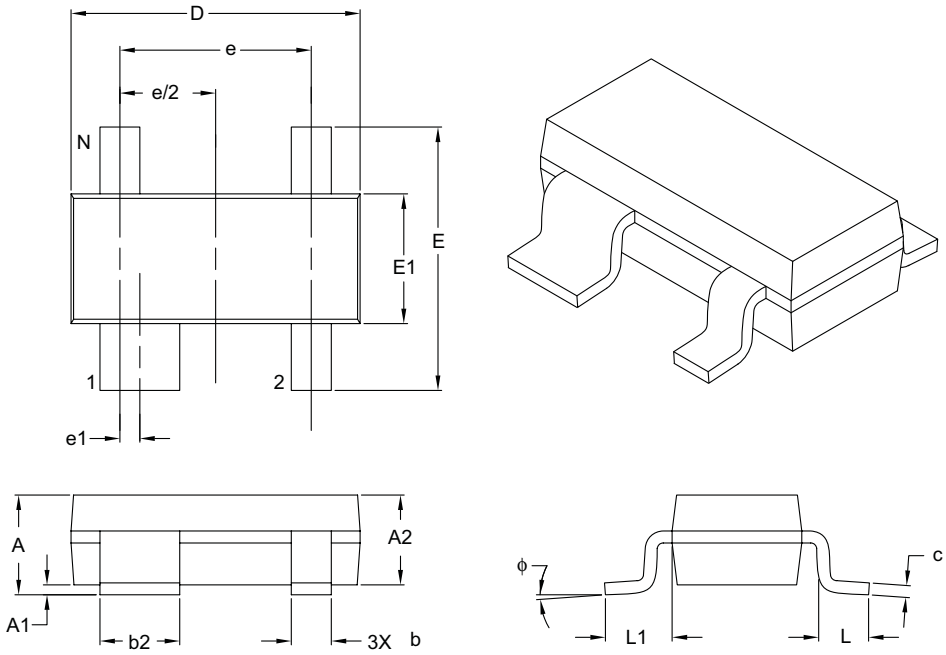
4-Lead Plastic Small Outline Transistor (RC) [SOT-143]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		4	
Pitch	e		1.92 BSC	
Pin1 Offset	e1		0.20 BSC	
Overall Height	A	0.80	–	1.22
Molded Package Thickness	A2	0.75	0.90	1.07
Standoff §	A1	0.01	–	0.15
Overall Width	E	2.10	–	2.64
Molded Package Width	E1	1.20	1.30	1.40
Overall Length	D	2.67	2.90	3.05
Foot Length	L	0.13	0.50	0.60
Footprint	L1		0.54 REF	
Foot Angle	ϕ	0°	–	8°
Lead Thickness	c	0.08	–	0.20
Lead 1 Width	b1	0.76	–	0.94
Leads 2, 3 & 4 Width	b	0.30	–	0.54

Notes:

1. § Significant Characteristic.
1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-031B

NOTES:

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APPENDIX A: REVISION HISTORY

Revision C (February 2007)

- **Section 5.0 "Packaging Information"**: Corrected SOT-143 packaging information.
- **Section 3.0 "Pin Descriptions"**: Added pin descriptions.
- Added disclaimer on package outline drawing.
- Updated package outline drawing.
- **Section 1.0 "Electrical Characteristics"**: Reformatted Electrical Characteristics

Revision B (January 2002)

- Undocumented changes.

Revision A (October 2001)

- Original Release of this Document.

NOTES:

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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: 4-Pin µP Reset Monitor ($\overline{\text{RESET}}$ low) TCM812: 4-Pin µP Reset Monitor (RESET high)
Threshold Voltage: (typical)	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 = Plastic Small Outline Transistor (RC) SOT-143, 4 lead, (tape and reel).

Examples:

a) TCM811LERCTR: 4.63V
b) TCM811MERCTR: 4.38V
c) TCM811TERCTR: 3.08V
d) TCM811SERCTR: 2.93V
e) TCM811RERCTR: 2.63V
f) TCM811FERCTR: 1.75V

a) TCM812LERCTR: 4.63V
b) TCM812MERCTR: 4.38V
c) TCM812TERCTR: 3.08V
d) TCM812SERCTR: 2.93V
e) TCM812RERCTR: 2.63V
f) TCM812FERCTR: 1.75V

NOTES:

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- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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12/08/06

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