TC1270/TC1271

4-Pin Reset Monitors

Features:

- Precision V_{CC} Monitor for 1.8V, 2.7V, 3.0V, 3.3V and 5.0V Nominal Supplies
- Manual Reset Input
- 140 ms Minimum $\overline{\text{RESET}}$, Reset Output Duration
- $\overline{\text{RESET}}$ Output Valid to V_{CC} = 1.0V (TC1270)
- Low 7 µA Supply Current
- V_{CC} Transient Immunity
- Small 4-Pin SOT-143 Package
- No External Components
- Replacement for MAX811/812 and Offers a Lower Threshold Voltage Option

Applications:

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

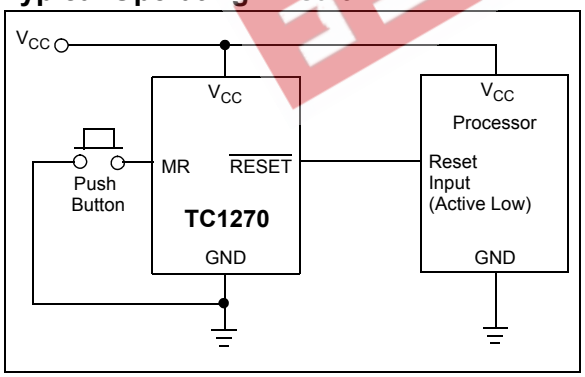
General Description

The TC1270 and TC1271 are cost-effective system supervisor circuits designed to monitor V_{CC} in digital systems and provide a reset signal to the host processor 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.

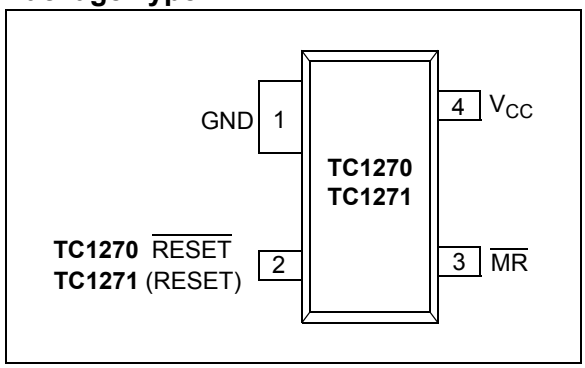
The reset output is driven active within 20 µs (4 µs for F version) of V_{CC} falling through the reset voltage threshold. Reset is maintained active for a minimum of 140 ms after V_{CC} rises above the reset threshold. The TC1271 has an active-high $\overline{\text{RESET}}$ output while the TC1270 has an active-low $\overline{\text{RESET}}$ output. The output of the TC1270 is valid down to V_{CC} = 1V. Both devices are available in a 4-Pin SOT-143 package.

The TC1270/TC1271 devices are optimized to reject fast transient glitches on the V_{CC} line. Low supply current of 7 µA (V_{CC} = 3.3V) makes these devices suitable for battery powered applications.

Typical Operating Circuit



Package Type



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Supply Voltage (V_{CC} to GND) .....+6.0V
$\overline{RESET}$, Reset ..... -0.3V to (V_{CC} + 0.3V)
Input Current, V_{CC}.....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

† Stresses above 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 above those indicated in the operation sections of the specifications is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

ELECTRICAL SPECIFICATIONS

Electrical Characteristics: V_{CC} = 5V for L/M versions, V_{CC} = 3.3V for T/S versions, V_{CC} = 3V for R version, V_{CC} = 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)**.

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
V_{CC}	V_{CC} Range	1.2	—	5.5	V	
I_{CC}	Supply Current	—	7	15	µA	$V_{CC} > V_{TH}$, for L/M/R/S/T/F
		—	10	15	µA	$V_{CC} < V_{TH}$, for L/M/R/S/T
		—	6	12	µA	$V_{CC} < V_{TH}$, for F
V_{TH}	Reset Threshold	4.54 4.50	4.63 —	4.72 4.75	V V	TC127_L; T_A = +25°C T_A = -40°C to +85°C
		4.30 4.25	4.38 —	4.46 4.50	V V	TC127_M; T_A = +25°C T_A = -40°C to +85°C
		3.03 3.00	3.08 —	3.14 3.15	V V	TC127_T; T_A = +25°C T_A = -40°C to +85°C
		2.88 2.85	2.93 —	2.98 3.00	V V	TC127_S; T_A = +25°C T_A = -40°C to +85°C
		2.58 2.55	2.63 —	2.68 2.70	V V	TC127_R; T_A = +25°C T_A = -40°C to +85°C
		1.71 1.70	1.75 —	1.79 1.80	V V	TC127_F; T_A = +25°C T_A = -40°C to +85°C
	Reset Threshold Tempco	—	30	—	ppm/°C	
	V_{CC} to Reset Delay	— —	20 5	— —	µs	V_{CC} = V_{TH} to V_{TH} – 125 mV; L/M/R/S/T/F
t_{RP}	Reset Active Time-out Period	140	280	560	ms	V_{CC} = $V_{TH(MAX)}$
t_{MR}	$\overline{MR}$ Minimum Pulse Width	10	—	—	µs	
	$\overline{MR}$ Glitch Immunity	—	0.1	—	µs	
t_{MD}	$\overline{MR}$ to Reset Propagation Delay	—	0.5	—	µs	
V_{IH}	$\overline{MR}$ Input Threshold	2.3	—	—	V	$V_{CC} > V_{TH(MAX)}$, TC127_L/M
		0.7 V_{CC}	—	—	V	$V_{CC} > V_{TH(MAX)}$, TC127_R/S/T/F
V_{IL}		—	—	0.8	V	$V_{CC} > V_{TH(MAX)}$, TC127_L/M
		—	—	0.15 V_{CC}	V	$V_{CC} > V_{TH(MAX)}$, TC127_R/S/T/F
	$\overline{MR}$ Pull-up Resistance	10	20	40	kΩ	
V_{OH}	Reset Output Voltage High (TC1271)	0.8 V_{CC}	—	—	V	I_{SOURCE} = 150 µA; $V_{CC} \leq V_{TH(MIN)}$

Note 1: Production testing done at T_A = +25°C, over temperature limits ensured by design.
2: $\overline{RESET}$ output for TC1270, Reset output for TC1271.

ELECTRICAL SPECIFICATIONS (CONTINUED)

Electrical Characteristics: V_{CC} = 5V for L/M versions, V_{CC} = 3.3V for T/S versions, V_{CC} = 3V for R version, V_{CC} = 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)**.

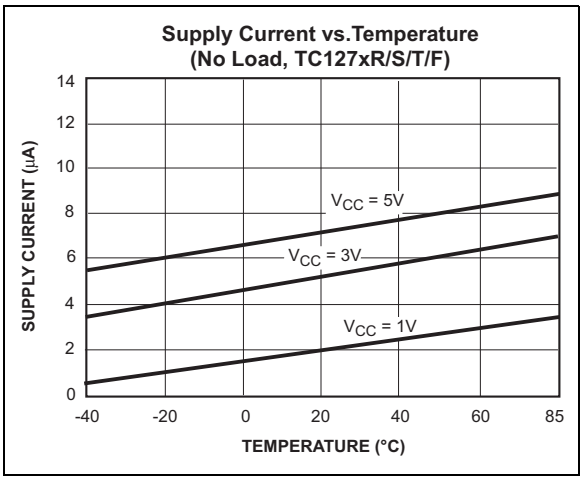
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
V_{OL}	Reset Output Voltage Low (TC1271)	—	—	0.2	V	TC1271F only, I_{SINK} = 500 µA, $V_{CC} = V_{TH(MAX)}$
		—	—	0.3	V	TC1271R/S/T only, I_{SINK} = 1.2 mA, $V_{CC} = V_{TH(MAX)}$
		—	—	0.4	V	TC1271L/M only, I_{SINK} = 3.2 mA, $V_{CC} = V_{TH(MAX)}$
V_{OL}	$\overline{\text{RESET}}$ Output Voltage Low (TC1270)	—	—	0.3	V	TC1270R/S/T only, I_{SINK} = 1.2 mA, $V_{CC} = V_{TH(MIN)}$ TC1270F only: I_{SINK} = 500 µA, $V_{CC} = V_{TH(MIN)}$
		— —	— —	0.4 TBD	V V	TC1270L/M only, I_{SINK} = 3.2 mA, $V_{CC} = V_{TH(MIN)}$ I_{SINK} = 50 µA, V_{CC} > 1.0V
V_{OH}	$\overline{\text{RESET}}$ Output Voltage High (TC1270)	V_{CC} – 1.5	—	—	V	TC1270L/M only, I_{SOURCE} = 800 µA, $V_{CC} = V_{TH(MAX)}$
		0.8 V_{CC}	—	—	V	TC1270R/S/T/F only, I_{SOURCE} = 500 µA, $V_{CC} = V_{TH(MAX)}$

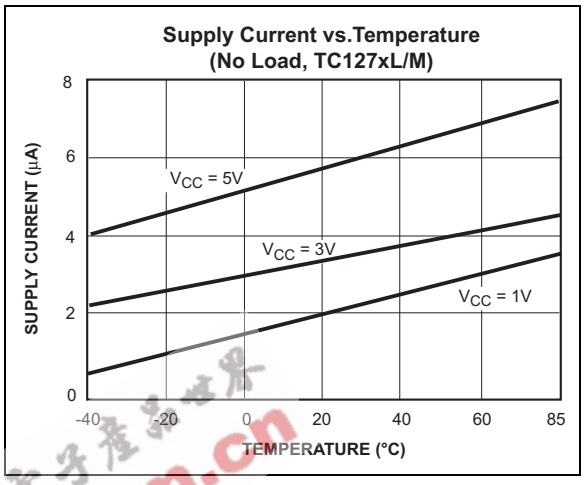
Note 1: Production testing done at T_A = +25°C, over temperature limits ensured by design.

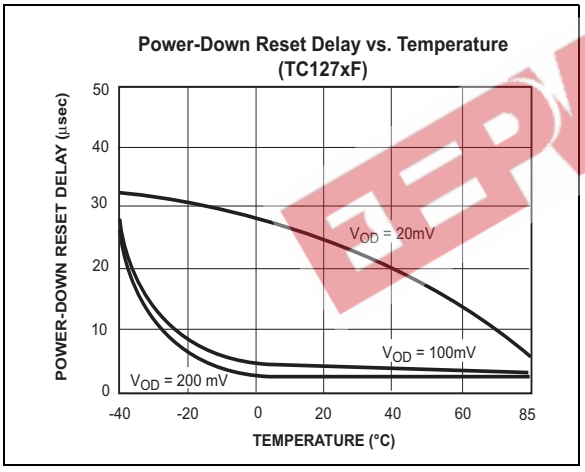
2: $\overline{\text{RESET}}$ output for TC1270, Reset output for TC1271.

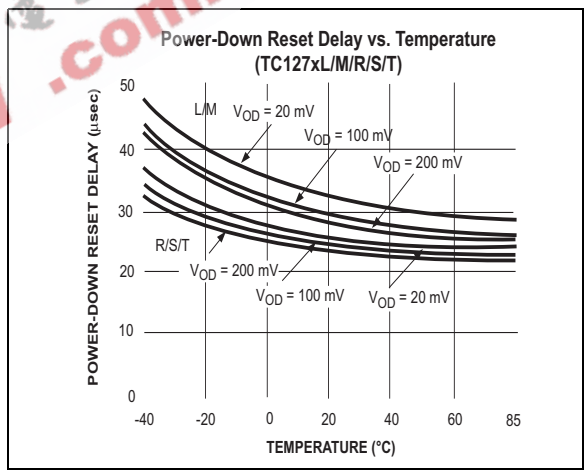
2.0 TYPICAL CHARACTERISTICS

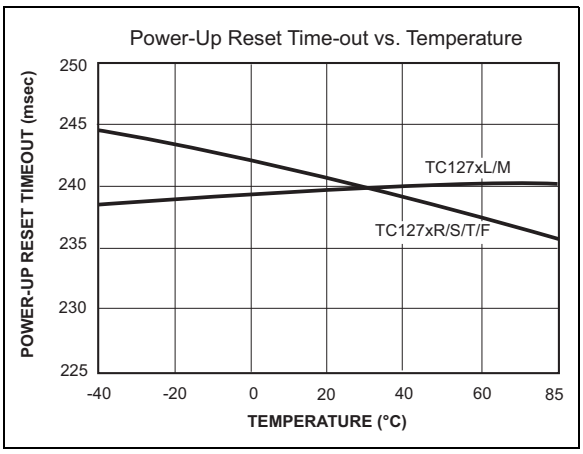
Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

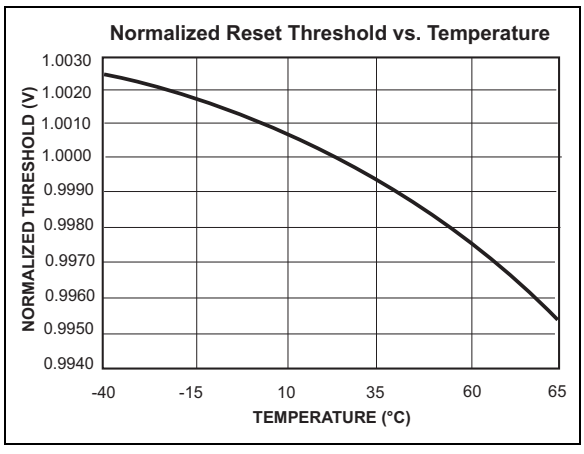












3.0 PIN DESCRIPTIONS

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	$\overline{\text{RESET}}$ (TC1270)	$\overline{\text{RESET}}$ output remains low while V_{CC} is below the Reset voltage threshold, and for at least 140 ms min. after V_{CC} rises above Reset threshold
2	RESET (TC1271)	Reset output remains high while V_{CC} is below the Reset voltage threshold, and for at least 140 ms min. after V_{CC} rises aboev Reset threshold
3	$\overline{\text{MR}}$	Manual Reset input generates a Reset when $\overline{\text{MR}}$ is below V_{IL}
4	V_{CC}	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 ($\overline{\text{RESET}}$) (TC1270)

$\overline{\text{RESET}}$ output remains low while V_{CC} is below the Reset voltage threshold (V_{TRIP}). Once the device voltage (V_{CC}) 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) (TC1271)

RESET output remains high while V_{CC} is below the Reset voltage threshold (V_{TRIP}). Once the device voltage (V_{CC}) 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_{CC})

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

4.0 APPLICATIONS INFORMATION

4.1 V_{CC} Transient Rejection

The TC1270/TC1271 provides accurate V_{CC} monitoring and Reset timing during power-up, power-down, and brownout/sag conditions, and rejects negative-going transients (glitches) on the power supply line. Figure 4-3 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive that lays **under** the curve will **not** generate a Reset signal. Combinations above the curve are detected as a brown-out or power-down. Transient immunity can be improved by adding a capacitor in close proximity to the V_{CC} pin of the TC1270/TC1271.

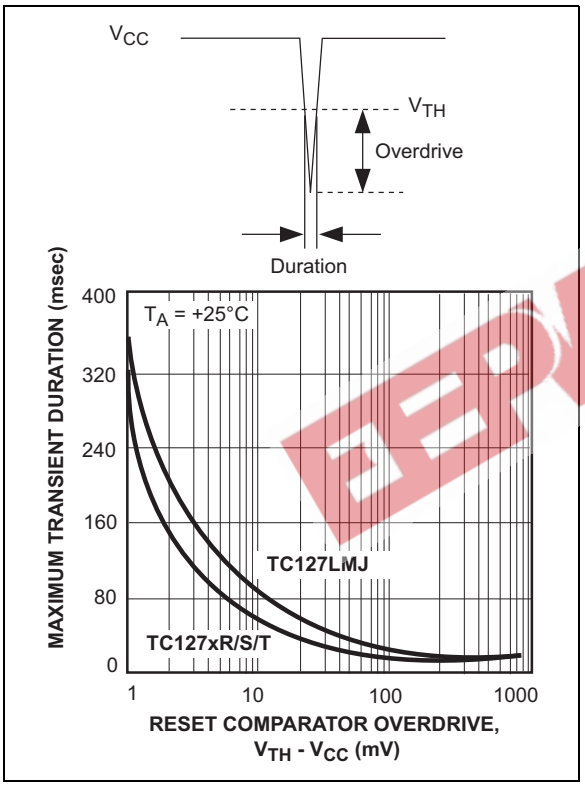


FIGURE 4-1: *Maximum Transient Duration vs. Overdrive for Glitch Rejection at +25°C.*

4.2 Reset Signal Integrity During Power-Down

The TC1270 $\overline{\text{RESET}}$ output is valid to V_{CC} = 1.0V. Below this voltage the output becomes an "open circuit" and does not sink current. This means CMOS logic inputs to the microprocessor 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_{CC} = 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_{CC} is required for the TC1271 to ensure a valid high $\overline{\text{RESET}}$ for V_{CC} below 1.1V.

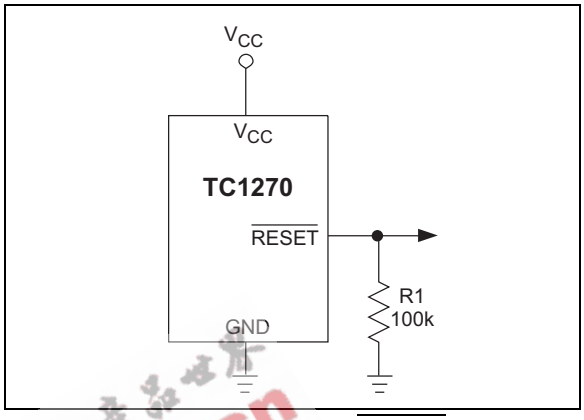


FIGURE 4-2: *Ensuring $\overline{\text{RESET}}$ Valid to V_{CC} = 0V.*

4.3 Processors With Bidirectional I/O Pins

Some microprocessor's (such as Motorola 68HC11) have bidirectional Reset pins. Depending on the current drive capability of the processor 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 TC1270/TC1271 (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 microprocessor, the buffer should be connected as shown with the solid line.

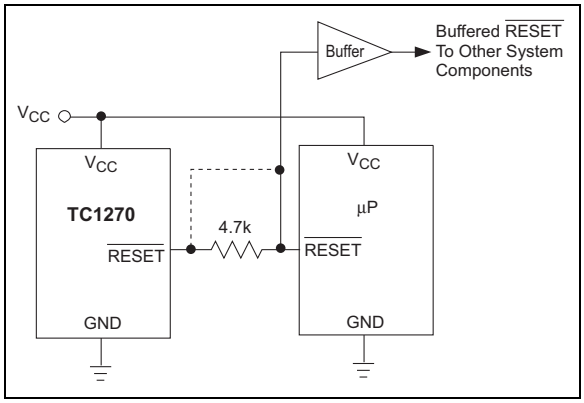
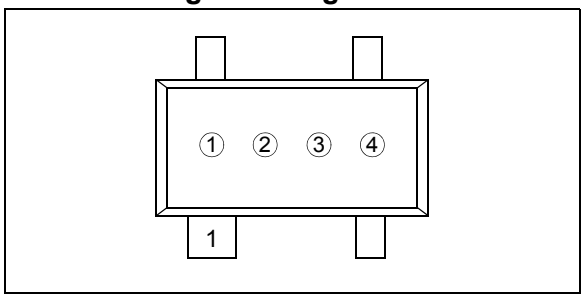


FIGURE 4-3: *Interfacing to Bidirectional Reset I/O.*

5.0 PACKAGING INFORMATION

5.1 Package Marking Information



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

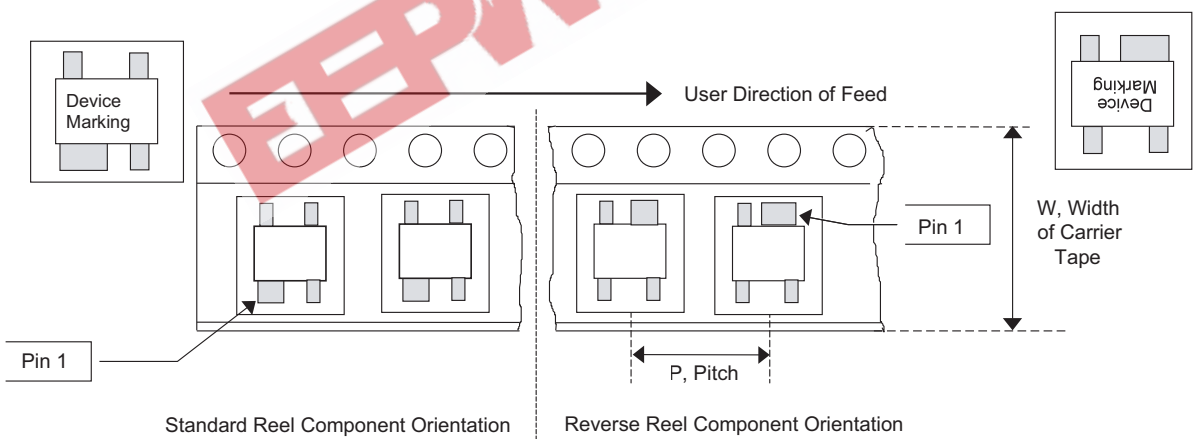
Part Number	(V)	TC1270 Code
TC1270LERCTR	4.63	S1
TC1270MERCTR	4.38	S2
TC1270TERCTR	3.08	S3
TC1270SERCTR	2.93	S4
TC1270RERCTR	2.63	S5
TC1270FERCTR	1.75	S7

Part Number	(V)	TC1271 Code
TC1271LERCTR	4.63	T1
TC1271MERCTR	4.38	T2
TC1271TERCTR	3.08	T3
TC1271SERCTR	2.9	T4
TC1271RERCTR	2.63	T5
TC1271FERCTR	1.75	T7

③ represents year and quarter code

④ represents production lot ID code

5.2 Taping Form

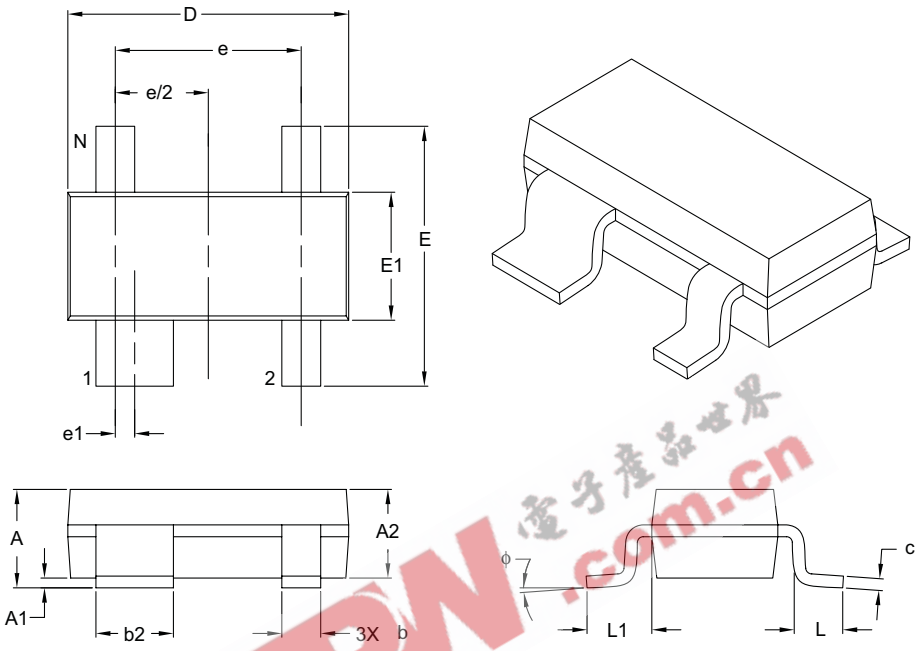


for TR Suffix Device
(Mark Right Side Up)

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

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

APPENDIX A: REVISION HISTORY

Revision D (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 table.

Revision C (June 2006)

- Enhanced SOT-143 Packaging Information.

Revision B (May 2002)

- Undocumented changes.

Revision A (March 2002)

- Original Release of this Document.

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	XX
Device	Threshold Voltage	Temperature Range	Package

Device	TC1270:	4-Pin $\overline{\text{RESET}}$ Monitor
	TC1271:	4-Pin RESET Monitor
Threshold voltage (typical)	L =	4.63
	M =	4.38
	T =	3.08
	S =	2.93
	R =	2.63
	F =	1.75
Temperature Range	E =	-40°C to +85°C
Package	RCTR =	Plastic small outline transistor (RC) SOT-143, 4 lead, (tape and reel).

Examples:

a)	TC1270LERCTR:	4.63V
b)	TC1270MERCTR:	4.38V
c)	TC1270TERCTR:	3.08V
d)	TC1270SERCPBTR:	2.93V
e)	TC1270SERCTR:	2.93V
f)	TC1270RERCTR:	2.63V
g)	TC1270FERCTR:	1.75V

a)	TC1271LERCTR:	4.63V
b)	TC1271MERCTR:	4.38V
c)	TC1271TERCTR:	3.08V
d)	TC1271SERCTR:	2.93V
e)	TC1271RERCTR:	2.63V
f)	TC1271FERCTR:	1.75V

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.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- 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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