

# TC1275/TC1276/TC1277

## 3-Pin Reset Monitors for 3.3V Systems

### Features

- Precision  $V_{CC}$  Monitor for 3.3V Systems
- 100 ms Minimum  $\overline{\text{RESET}}$ , RESET Output Duration
- Output Valid to  $V_{CC} = 1.2\text{V}$
- $V_{CC}$  Transient Immunity
- Small 3-Pin SOT-23 Package
- No External Components

### Applications

- Computers
- Embedded Systems
- Battery Powered Equipment
- Critical  $\mu\text{P}$  Power Supply Monitoring

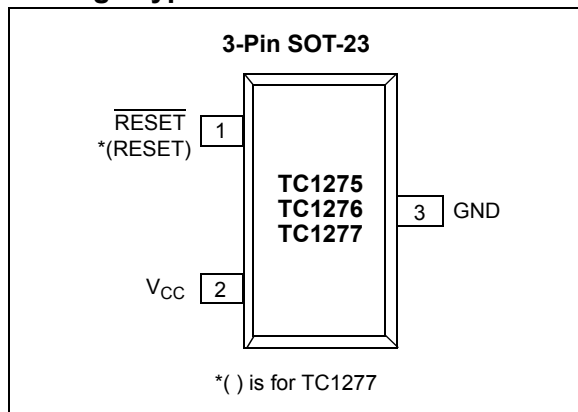
### Device Selection Table

Part Number	Order	Package	Temp. Range
TC1275-xENB	Complimentary	3-Pin SOT-23	-40°C to +85°C
TC1276-xENB	Open-Drain	3-Pin SOT-23	-40°C to +85°C
TC1277-xENB	Complimentary	3-Pin SOT-23	-40°C to +85°C

NOTE: "x" denotes a suffix for  $V_{CC}$  threshold (see table below).

Suffix	Reset $V_{CC}$ Threshold (V)
5	3.06
10	2.88
20	2.55

### Package Type



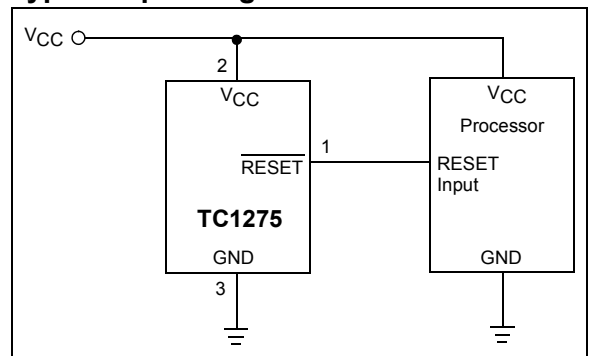
### General Description

The TC1275/TC1276/TC1277 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. No external components are required.

The reset output is driven active within 20  $\mu\text{s}$  of  $V_{CC}$  falling through the reset voltage threshold. RESET is maintained active for a minimum of 100 ms after  $V_{CC}$  rises above the reset threshold. The TC1277 has an active-high RESET output while the TC1275 and TC1276 have an active-low  $\overline{\text{RESET}}$  output. TC1275 and TC1277 each have a complimentary output while the TC1276 has an open drain output. The output of the TC1275 and TC1276 is valid down to  $V_{CC} = 1.2\text{V}$ . The TC1277 is valid down to  $V_{CC} = 1.8\text{V}$ . All three devices are available in a 3-Pin SOT-23 package.

The TC1275/TC1276/TC1277 devices are optimized to reject fast transient glitches on the  $V_{CC}$  line.

### Typical Operating Circuit



# TC1275/TC1276/TC1277

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Supply Voltage ( $V_{CC}$ to GND) .....	+6.0V
$\overline{\text{RESET}}$ , RESET .....	-0.3V to ( $V_{CC} + 0.3V$ )
Input Current, $V_{CC}$ .....	20 mA
Output Current, $\overline{\text{RESET}}$ , RESET .....	20 mA
Power Dissipation ( $T_A \leq 70^\circ\text{C}$ )	
3-Pin SOT-23 (derate 4 mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$ )	
.....	230 mW
Operating Temperature Range.....	$-40^\circ\text{C}$ to $+85^\circ\text{C}$
Storage Temperature Range .....	$-65^\circ\text{C}$ to $+150^\circ\text{C}$

\*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.

### TC1275/TC1276/TC1277 ELECTRICAL SPECIFICATIONS

Recommended DC Operating Conditions: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$ .							
Symbol	Parameter	Min	Typ	Max	Units	Device	Test Conditions
$V_{CC}$	Supply Voltage	1.2 1.8	— —	5.5 5.5	V	TC1275, TC1276 TC1277	Note 1
DC Electrical Characteristics: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$ .							
Symbol	Parameter	Min	Typ	Max	Units	Device	Test Conditions
$V_{OH}$	Output Voltage @ 0-500 $\mu\text{A}$	$V_{CC} - 0.5V$	$V_{CC} - 0.1V$	—	V	TC1275, TC1277	Note 1
$I_{OH}$	Output Current @ 2.4 Volts	—	13	—	mA	TC1275	Note 2
	$V_{CC} = 5V$	—	1.3	—		TC1277	
	$V_{CC} = 2.7V$	—	—	—			
$I_{OL}$	Output Current @ 0.4 Volts	+10	30	—	mA		Note 2, Note 5
$I_{CC}$	Operating Current	—	20	35	$\mu\text{A}$	TC1275, TC1277	Note 3
	$V_{CC} < 5.5V$	—	20	35		TC1276	Note 3
	$V_{CCTP} < V_{CC} < 5.5V$	—	350	700		TC1276	Note 3
$V_{CCTP-5}$	$V_{CC}$ Trip Point (TC1275/6/7-5)	2.98	3.06	3.15	V		Note 1
$V_{CCTP-10}$	$V_{CC}$ Trip Point (TC1275/6/7-10)	2.80	2.88	2.97	V		Note 1
$V_{CCTP-20}$	$V_{CC}$ Trip Point (TC1275/6/7-20)	2.47	2.55	2.64	V		Note 1
$C_{OUT}$	Output Capacitance	—	9	—	pF		
$R_P$	Internal Pull-Up Resistor	3.0	6.0	9.0	k $\Omega$	TC1276	
AC Electrical Characteristics: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$ .							
Symbol	Parameter	Min	Typ	Max	Units	Device	Test Conditions
$t_{RST}$	RESET Active Time	100	200	300	ms		
$t_{RPD1}$	$V_{CC}$ Detect to RESET	—	20	50	$\mu\text{s}$	TC1275, TC1276	$V_{CC(Low)} = 1V$ , Figure 3-2
$t_{RPD2}$	$V_{CC}$ Detect to RESET	—	20	50	$\mu\text{s}$	TC1277	$V_{CC(Low)} = 1V$ , Figure 3-4
$t_F$	$V_{CC}$ Slew Rate ( $V_{CCTP(MAX)}$ to $V_{CCTP(MIN)}$ )	300	—	—	$\mu\text{s}$		Figure 3-2, Figure 3-4
$t_R$	$V_{CC}$ Slew Rate ( $V_{CCTP(MIN)}$ to $V_{CCTP(MAX)}$ )	0	—	—	ns		Figure 3-1, Figure 3-3
$t_{RPU1}$	$V_{CC}$ Detect to RESET	100	200	300	ms	TC1275, TC1276	Note 4, Figure 3-1
$t_{RPU2}$	$V_{CC}$ Detect to RESET	100	200	300	ms	TC1277	Note 4, Figure 3-3

- Note**
- 1: All voltages referenced to ground.
  - 2: Measured with  $V_{CC} \geq 2.7$  volts.
  - 3: Measured with RESET output open for TC1275/TC1276; measured with RESET output open for TC1277.
  - 4:  $t_R = 5 \mu\text{s}$ .
  - 5: A 1 k $\Omega$  external resistor may be required in some applications for proper operation of the microprocessor reset control circuit when using the TC1276.

# TC1275/TC1276/TC1277

## 2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

**TABLE 2-1: PIN FUNCTION TABLE**

Pin No. (3-Pin SOT-23)	Symbol	Description
1	$\overline{\text{RESET}}$ (TC1275/ TC1276)	RESET output remains low while $V_{CC}$ is below the reset voltage threshold, and for 200 ms (100 ms minimum) after $V_{CC}$ rises above reset threshold. The output stage of the TC1275 is complimentary. The output stage of the TC1276 is open-drain.
1	RESET (TC1277)	RESET output remains high while $V_{CC}$ is below the reset voltage threshold, and for 200 ms (100 ms minimum) after $V_{CC}$ rises above reset threshold. The output stage of the TC1277 is complimentary.
2	$V_{CC}$	Supply voltage (1.2V to 5.5V TC1275 and TC1276, 1.8V to 5.5V TC1277).
3	GND	Ground.

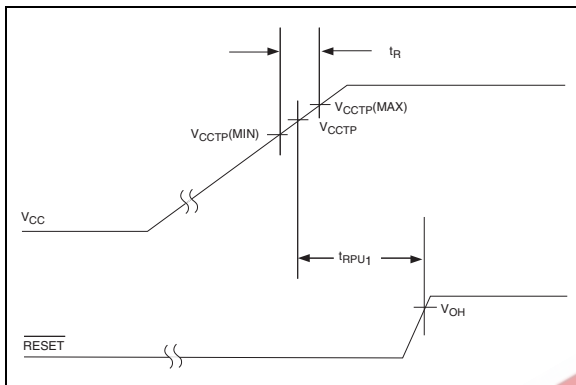
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# TC1275/TC1276/TC1277

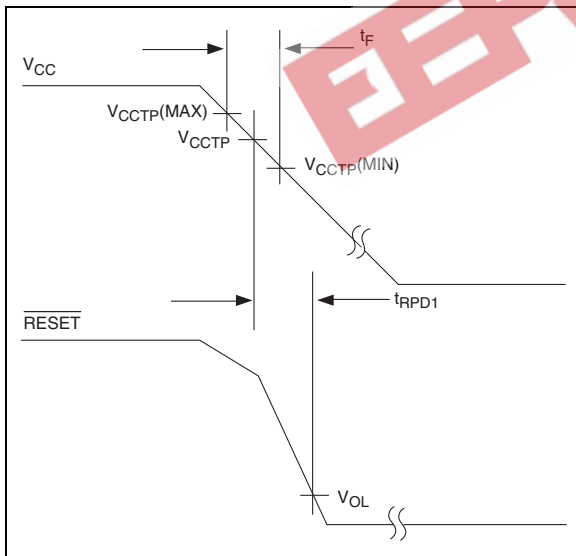
## 3.0 APPLICATIONS INFORMATION

### 3.1 Operation – Power Monitor

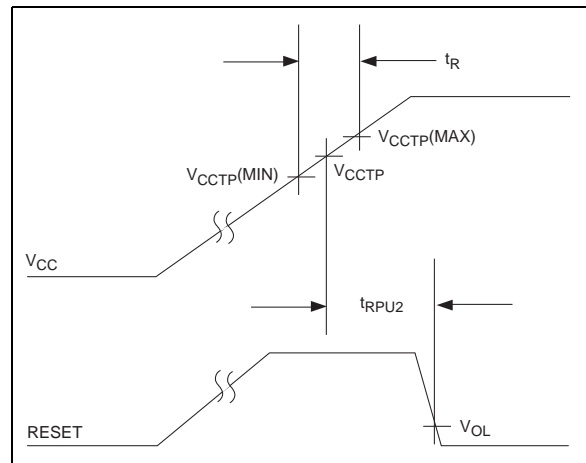
The TC1275/TC1276/TC1277 provide the function of detecting out-of-tolerance power supply conditions and warning a processor-based system of impending power failure. When  $V_{CC}$  is detected as out-of-tolerance, the RESET signal is asserted. On power-up, RESET is kept active for approximately 200 ms after the power supply has reached the selected tolerance. This allows the power supply and microprocessor to stabilize before RESET is released.



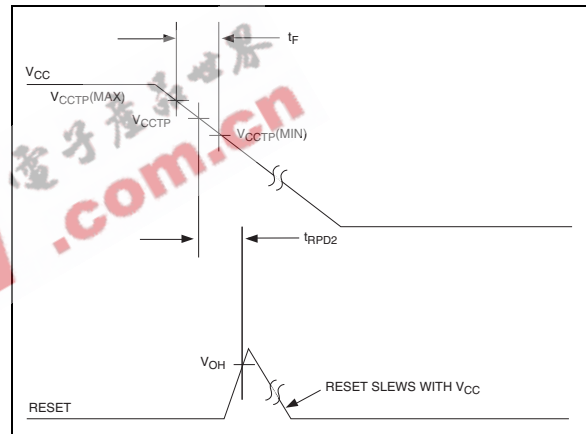
**FIGURE 3-1:** Timing Diagram – Power Up (TC1275/TC1276).



**FIGURE 3-2:** Timing Diagram – Power Down (TC1275/TC1276).



**FIGURE 3-3:** Timing Diagram – Power Up (TC1277).



**FIGURE 3-4:** Timing Diagram – Power Down (TC1277).

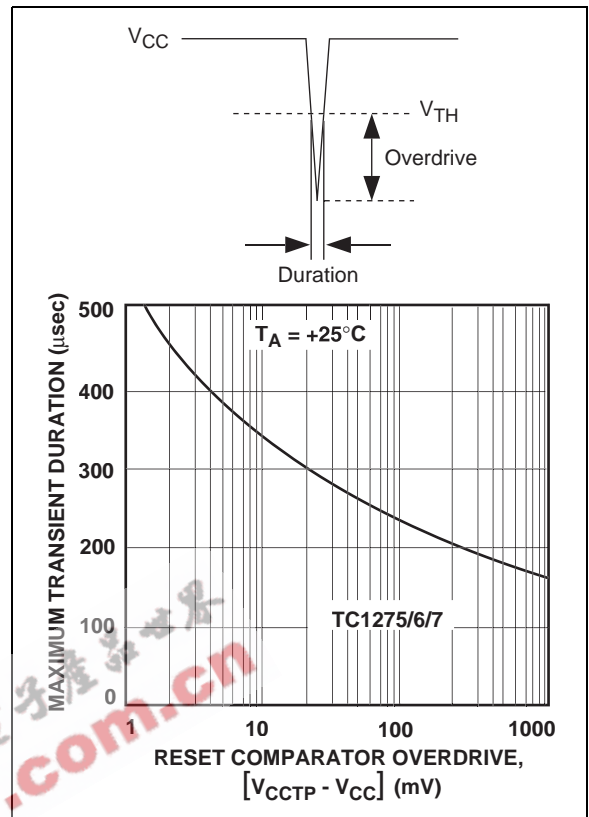
# TC1275/TC1276/TC1277

## 3.2 $V_{CC}$ Transient Rejection

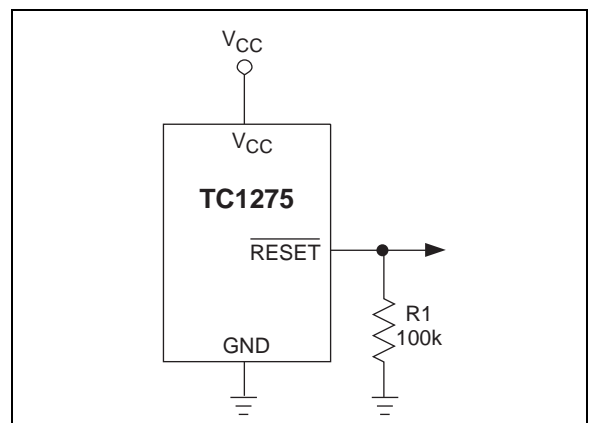
The TC1275/TC1276/TC1277 provides accurate  $V_{CC}$  monitoring and reset timing during power-up, power-down, and brownout/sag conditions, and rejects negative-going transients (glitches) on the power supply line. Figure 3-5 shows the maximum transient duration vs. maximum negative excursion (overdrive) 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 brownout or power-down. Transient immunity can be improved by adding a capacitor in close proximity to the  $V_{CC}$  pin of the TC1275/TC1276/TC1277.

## 3.3 $\overline{\text{RESET}}$ Signal Integrity During Power-Down

The TC1275  $\overline{\text{RESET}}$  output is valid to  $V_{CC} = 1.2V$ . Below this voltage the output becomes an "open circuit" and does not sink current. This means CMOS logic inputs to the  $\mu P$  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 3-6). This resistor value, though not critical, should be chosen such that it does not appreciably load  $\overline{\text{RESET}}$  under normal operation (100 k $\Omega$  will be suitable for most applications). Similarly, a pull-up resistor to  $V_{CC}$  is required for the TC1277 to ensure a valid high  $\overline{\text{RESET}}$  for  $V_{CC}$  below 1.8V.



**FIGURE 3-5:** Maximum Transient Duration Vs. Overdrive For Glitch Rejection At +25°C.

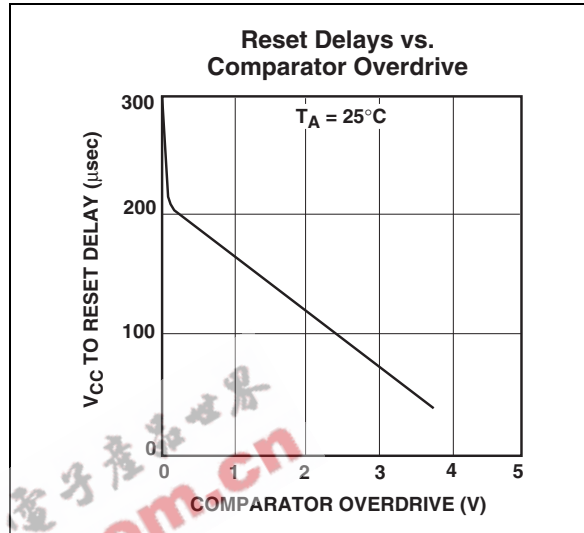
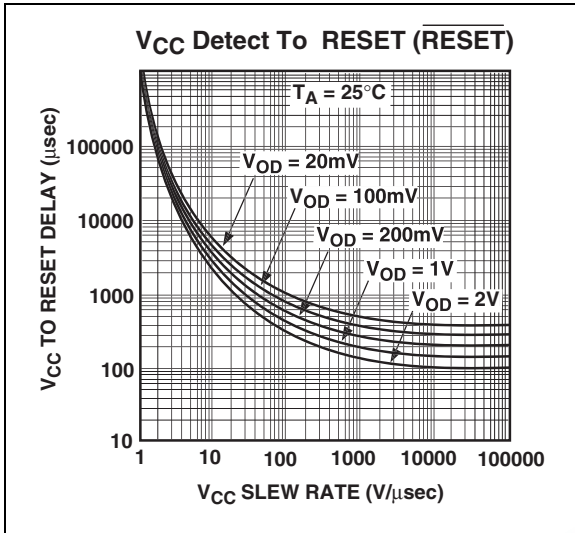


**FIGURE 3-6:** ENSURING  $\overline{\text{RESET}}$  VALID TO  $V_{CC} = 0V$ .

# TC1275/TC1276/TC1277

## 4.0 TYPICAL CHARACTERISTICS

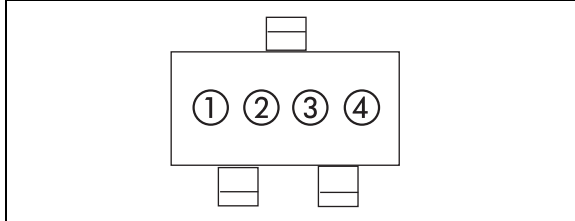
**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be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



# TC1275/TC1276/TC1277

## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information



① & ② = part number code + temperature range and voltage

TC1275 (V)	Code
2.55	DA
2.88	DB
3.06	DC

TC1276 (V)	Code
2.55	EA
2.88	EB
3.06	EC

TC1277 (V)	Code
2.55	FA
2.88	FB
3.06	FC

ex: 1275-20 = ①A○○

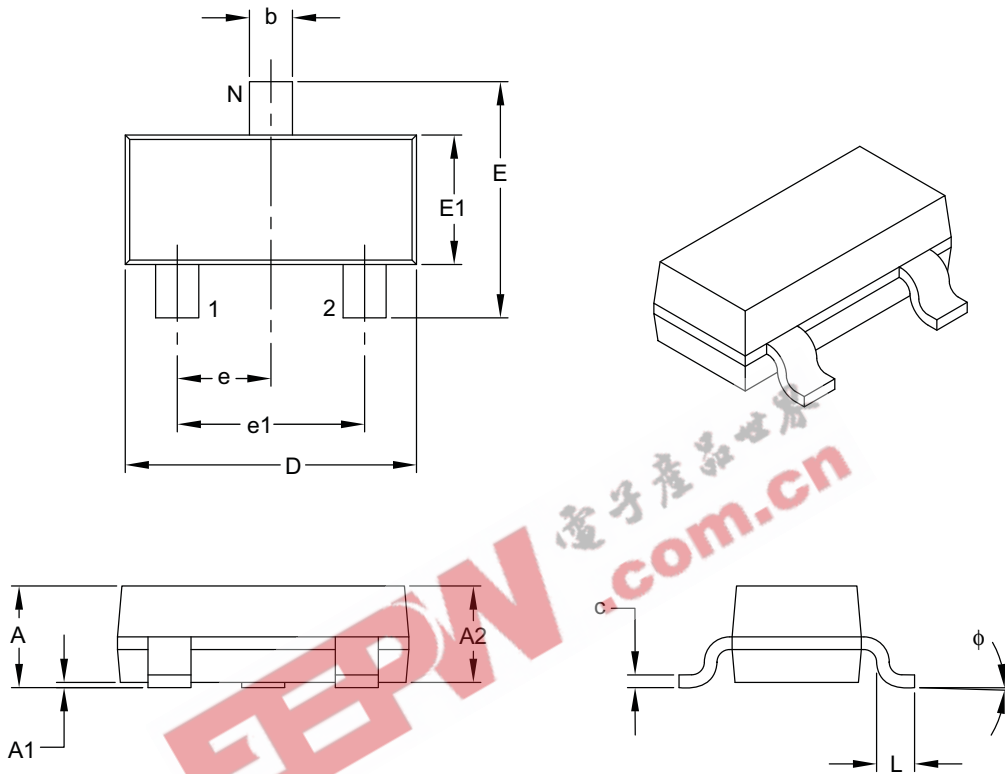
③ represents year and quarter code

④ represents production lot ID code

# TC1275/TC1276/TC1277

## 3-Lead Plastic Small Outline Transistor (TT or NB) [SOT-23]

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	3		
Lead Pitch	e	0.95 BSC		
Outside Lead Pitch	e1	1.90 BSC		
Overall Height	A	0.89	–	1.12
Molded Package Thickness	A2	0.79	0.95	1.02
Standoff	A1	0.01	–	0.10
Overall Width	E	2.10	–	2.64
Molded Package Width	E1	1.16	1.30	1.40
Overall Length	D	2.67	2.90	3.05
Foot Length	L	0.13	0.50	0.60
Foot Angle	$\phi$	0°	–	10°
Lead Thickness	c	0.08	–	0.20
Lead Width	b	0.30	–	0.54

**Notes:**

- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-104B



# TC1275/TC1276/TC1277

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>PART NO.</u>	<u>XX</u>	<u>X</u>	<u>/XX</u>
Device	Reset $V_{CC}$ Threshold	Temperature Range	Package
Device:	TC1275: 3-Pin Reset Monitor - Complementary TC1276: 3-Pin Reset Monitor - Open-Drain TC1277: 3-Pin Reset Monitor - Complementary		
Reset $V_{CC}$ Threshold Voltage	5 = 3.06V 10 = 2.88V 15 = 2.55V		
Temperature Range:	E = -40°C to +85°C		
Package:	NB = Plastic Small Outline Transistor (SOT-23), 3-lead		
<b>Examples:</b>			
a)	TC1275-10ENBTR:	2.88V Reset Monitor	
b)	TC1275-15ENBTR:	2.55V Reset Monitor	
c)	TC1275-5ENBTR:	3.06V Reset Monitor	
a)	TC1276-10ENBTR:	2.88V Reset Monitor	
b)	TC1276-15ENBTR:	2.55V Reset Monitor	
c)	TC1276-5ENBTR:	3.06V Reset Monitor	
a)	TC1277-10ENBTR:	2.88V Reset Monitor	
b)	TC1277-15ENBTR:	2.55V Reset Monitor	
c)	TC1277-5ENBTR:	3.06V Reset Monitor	

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Fax: 34-91-708-08-91

**UK - Wokingham**  
Tel: 44-118-921-5869  
Fax: 44-118-921-5820