

## Voltage Detector

### Features:

- Highly Accurate:  $\pm 2\%$
- Low-Power Consumption:  $1.0\mu\text{A}$ , Typ.
- Detect Voltage Range: 1.6V to 6.0V and 7.7V
- Operating Voltage: 1.5V to 10.0V
- Output Configuration: Open-Drain or CMOS
- Space-Saving 5-Pin SOT-23A Package

### Typical Applications:

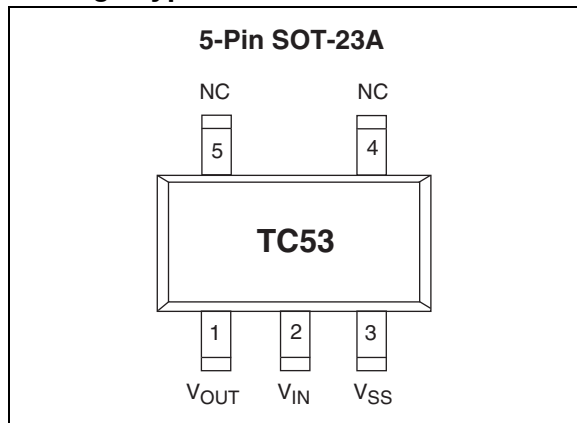
- Microprocessor Reset Circuits
- Battery Life Monitors and Recharge Voltage Monitors
- Memory Battery Backup Circuitry
- Power-On Reset Circuits
- Power Failure Detection
- Delay Circuitry

### Device Selection Table

| Part Number    | Package       | Temp. Range    |
|----------------|---------------|----------------|
| TC53-xxxxxxxxx | 5-Pin SOT-23A | -40°C to +85°C |

Other output voltages are available. Please contact Microchip Technology Inc. for details.

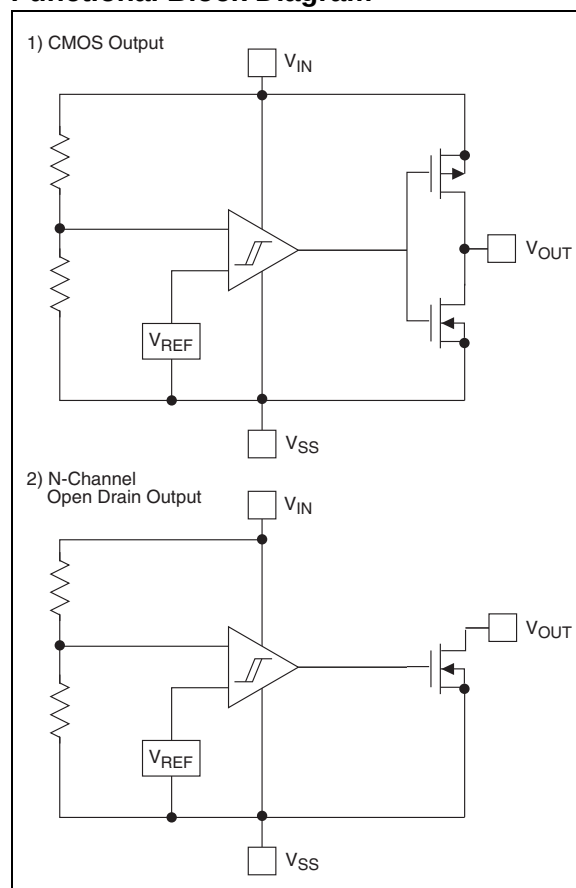
### Package Type



### General Description:

The TC53 is a low-power voltage detector. Typical supply current consumption is only  $1\mu\text{A}$  at an input voltage of 2V. The voltage detection threshold setting is factory-programmed and ensured to  $\pm 2\%$  accuracy. Threshold settings are available over a range of 1.6V to 6.0V. The TC53 has both complementary (CMOS) and open drain (NMOS) output configuration options. TC53 is the ideal voltage detector for precision applications in which small size, low installed cost, high accuracy and low supply current consumption are critical.

### Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

|                                  |                                    |
|----------------------------------|------------------------------------|
| Input Voltage .....              | +12V                               |
| Output Current .....             | 50 mA                              |
| Output Voltage.....              | $V_{IN} + 0.3V$ to $V_{SS} - 0.3V$ |
| Power Dissipation                |                                    |
| 5-Pin SOT-23A .....              | 240 mW                             |
| Operating Temperature Range..... | -40°C to +85°C                     |
| Storage Temperature Range .....  | -40°C to +125°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.

### TC53 ELECTRICAL SPECIFICATIONS

| Electrical Characteristics: $T_A = 25^\circ\text{C}$ , unless otherwise specified.<br><a href="#">Note 1</a> , <a href="#">Note 2</a> . |                                                         |                      |                      |                      |               |                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------|----------------------|----------------------|---------------|---------------------------------------------------------------------------------------------------------------------|
| Symbol                                                                                                                                  | Parameter                                               | Min                  | Typ                  | Max                  | Units         | Test Conditions                                                                                                     |
| $V_{DF}$                                                                                                                                | Detect Voltage                                          | $V_T \times 0.98$    | $V_T \pm 0.5\%$      | $V_T \times 1.02$    | V             | <a href="#">Note 3</a>                                                                                              |
| $V_{HYS}$                                                                                                                               | Hysteresis Range                                        | $V_{DF} \times 0.02$ | $V_{DF} \times 0.05$ | $V_{DF} \times 0.08$ | V             |                                                                                                                     |
| $I_{SS}$                                                                                                                                | Supply Current                                          | —                    | 0.9                  | 2.6                  | $\mu\text{A}$ | $V_{IN} = 1.5V$<br>$V_{IN} = 2.0V$<br>$V_{IN} = 3.0V$<br>$V_{IN} = 4.0V$<br>$V_{IN} = 5.0V$                         |
| $V_{IN}$                                                                                                                                | Operating Voltage                                       | 1.5                  | —                    | 10.0                 | V             | $V_{DF} = 2.1$ to $6.0V$                                                                                            |
| $I_{OUT}$                                                                                                                               | Output Current                                          | —                    | 2.2                  | —                    | mA            | N-ch; $V_{DS} = 0.5V$ , $V_{IN} = 1.0V$<br>$V_{IN} = 2.0V$<br>$V_{IN} = 3.0V$<br>$V_{IN} = 4.0V$<br>$V_{IN} = 5.0V$ |
|                                                                                                                                         |                                                         | —                    | 7.7                  | —                    |               |                                                                                                                     |
|                                                                                                                                         |                                                         | —                    | 10.1                 | —                    |               |                                                                                                                     |
|                                                                                                                                         |                                                         | —                    | 11.5                 | —                    |               |                                                                                                                     |
|                                                                                                                                         |                                                         | —                    | 13.0                 | —                    |               |                                                                                                                     |
|                                                                                                                                         |                                                         | —                    | -10.0                | —                    |               | P-ch; $V_{DS} = 2.1V$ , $V_{IN} = 8.0V$<br>(CMOS Output)                                                            |
| $\Delta V_{DF}/(\Delta T_{OPR} V_{DF})$                                                                                                 | Temperature Characteristics                             | —                    | $\pm 100$            | —                    | ppm/°C        |                                                                                                                     |
| $t_{DLY}$                                                                                                                               | Delay Time<br>( $V_{DR} \rightarrow V_{OUT}$ Inversion) | —                    | —                    | 0.2                  | ms            |                                                                                                                     |

- Note 1:** An additional resistor between the  $V_{IN}$  pin and the supply voltage may alter the electrical characteristics due to the increasing values of  $V_{DR}$ .
- Note 2:** The power consumption during power-start to output being stable (release operation) is  $2\mu\text{A}$  greater than it is after that period (completion of release operation) because of rush current in the delay circuit.
- Note 3:**  $V_T$  is the factory-programmed voltage detection threshold.

## 2.0 PIN DESCRIPTIONS

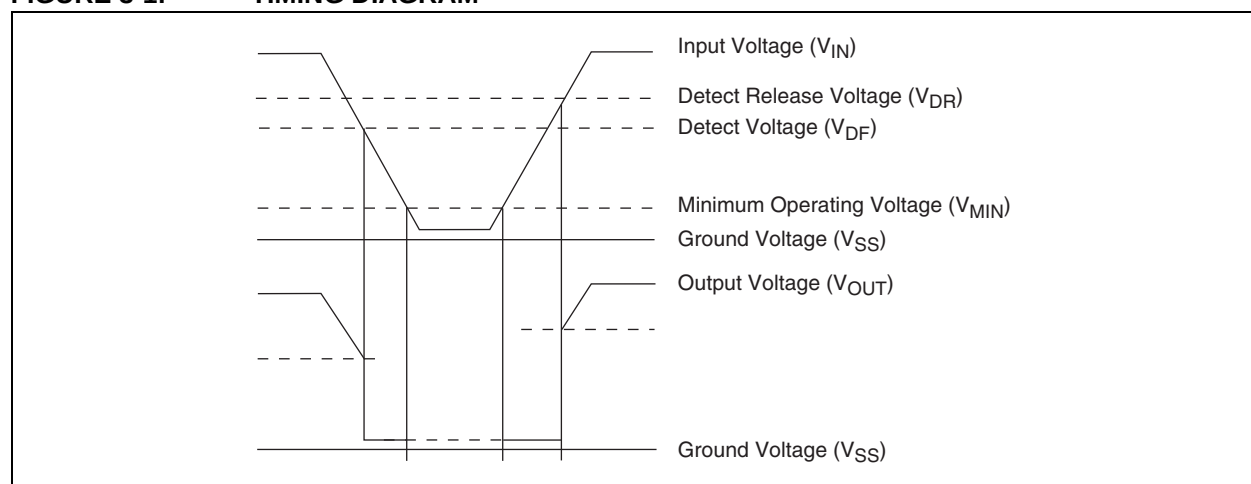
The descriptions of the pins are listed in [Table 2-1](#).

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

| Pin No.<br>(5-Pin SOT-23A) | Symbol     | Description           |
|----------------------------|------------|-----------------------|
| 1                          | $V_{OUT1}$ | Output.               |
| 2                          | $V_{IN}$   | Supply voltage input. |
| 3                          | $V_{SS}$   | Ground terminal.      |
| 4                          | NC         | Not connected.        |
| 5                          | NC         | Not connected.        |

## 3.0 DETAILED DESCRIPTION

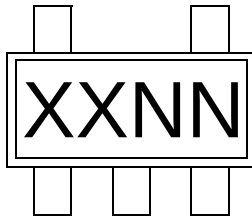
**FIGURE 3-1: TIMING DIAGRAM**



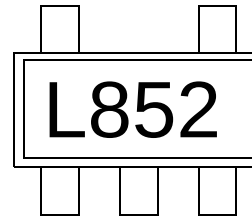
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

5-Lead SOT-23A

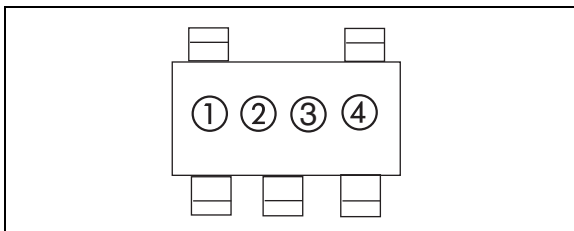


Example



|                |        |                                                                                                                  |
|----------------|--------|------------------------------------------------------------------------------------------------------------------|
| <b>Legend:</b> | XX...X | Customer-specific information                                                                                    |
|                | Y      | Year code (last digit of calendar year)                                                                          |
|                | YY     | Year code (last 2 digits of calendar year)                                                                       |
|                | WW     | Week code (week of January 1 is week '01')                                                                       |
|                | NNN    | Alphanumeric traceability code                                                                                   |
|                | (e3)   | Pb-free JEDEC designator for Matte Tin (Sn)                                                                      |
|                | *      | This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package. |

**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.



① represents output configuration and first integer of voltage

| Symbol | Output | Voltage |
|--------|--------|---------|
| A      | CMOS   | 0.      |
| B      | CMOS   | 1.      |
| C      | CMOS   | 2.      |
| D      | CMOS   | 3.      |
| E      | CMOS   | 4.      |
| F      | CMOS   | 5.      |
| H      | CMOS   | 6.      |

| Symbol | Output | Voltage |
|--------|--------|---------|
| K      | Nch    | 0.      |
| L      | Nch    | 1.      |
| M      | Nch    | 2.      |
| N      | Nch    | 3.      |
| P      | Nch    | 4.      |
| R      | Nch    | 5.      |
| S      | Nch    | 6.      |

② represents first decimal of output voltage

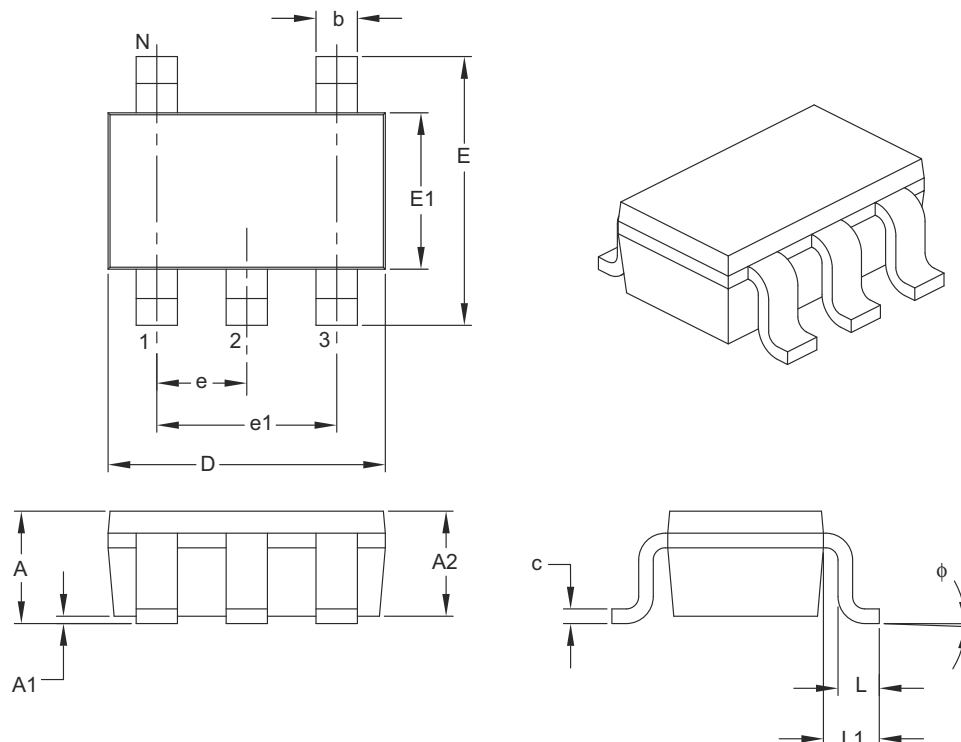
| Symbol | Voltage |
|--------|---------|
| 0      | .0      |
| 1      | .1      |
| 2      | .2      |
| 3      | .3      |
| 4      | .4      |
| 5      | .5      |
| 6      | .6      |
| 7      | .7      |
| 8      | .8      |
| 9      | .9      |

③ represents delay function and delay time  
3 = no delay function

④ represents assembly lot code

## 5-Lead Plastic Small Outline Transistor (CT) [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     | 5           |     |      |
| Lead Pitch               | e     | 0.95 BSC    |     |      |
| Outside Lead Pitch       | e1    | 1.90 BSC    |     |      |
| Overall Height           | A     | 0.90        | —   | 1.45 |
| Molded Package Thickness | A2    | 0.89        | —   | 1.30 |
| Standoff                 | A1    | 0.00        | —   | 0.15 |
| Overall Width            | E     | 2.20        | —   | 3.20 |
| Molded Package Width     | E1    | 1.30        | —   | 1.80 |
| Overall Length           | D     | 2.70        | —   | 3.10 |
| Foot Length              | L     | 0.10        | —   | 0.60 |
| Footprint                | L1    | 0.35        | —   | 0.80 |
| Foot Angle               | φ     | 0°          | —   | 30°  |
| Lead Thickness           | c     | 0.08        | —   | 0.26 |
| Lead Width               | b     | 0.20        | —   | 0.51 |

**Notes:**

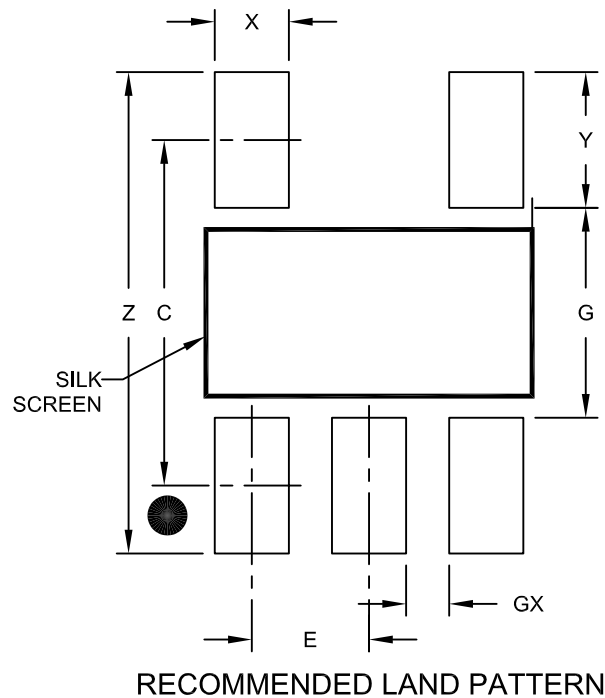
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.

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

Microchip Technology Drawing C04-091B

## 5-Lead Plastic Small Outline Transistor (CT) [SOT-23]

**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  |
| Contact Pitch           | E  | 0.95 BSC    |      |      |
| Contact Pad Spacing     | C  |             | 2.80 |      |
| Contact Pad Width (X5)  | X  |             |      | 0.60 |
| Contact Pad Length (X5) | Y  |             |      | 1.10 |
| Distance Between Pads   | G  | 1.70        |      |      |
| Distance Between Pads   | GX | 0.35        |      |      |
| Overall Width           | Z  |             |      | 3.90 |

### Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2091A

NOTES:



## **APPENDIX A: REVISION HISTORY**

### **Revision D (August 2011)**

- Changed status from active to end-of-life (EOL)

### **Revision C (July 2002)**

- Undocumented changes

### **Revision B (May 2002)**

- Undocumented changes

### **Revision A (March 2001)**

- 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.

| <u>PART NO.</u>                                                                                                                                                                                                                                                                                                                                          | <u>X</u>             | <u>XX</u>        | <u>XX</u> | <u>XX</u>         | <u>XX</u> | <u>XX</u>         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|-----------|-------------------|-----------|-------------------|
| Device                                                                                                                                                                                                                                                                                                                                                   | Output Configuration | Detected Voltage | Tolerance | Temperature Range | Package   | Tapping Direction |
| <div><div>Device:TC53:Low-power voltage detector</div><div>Output Configuration:N = NMOSC = CMOS</div><div>Detected Voltage:22 = 2.2V27 = 2.7V29 = 2.9V</div><div>Tolerance:02 = ±2%</div><div>Temperature Range:E = -40°C to+125°C(Extended)</div><div>Package:CT:5-Pin SOT-23A Package</div><div>Taping Direction:TR:Standard Taping</div></div>       |                      |                  |           |                   |           |                   |
| <div>Examples:</div> <div>a)TC53C2202ECTTR:CMOS, 2.2V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Tapping.</div> <div>b)TC53N2702ECTTR:NMOS, 2.7V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Tapping.</div> <div>c)TC53N2902ECTTR:NMOS, 2.9V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Tapping.</div> |                      |                  |           |                   |           |                   |

NOTES:

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9