Features:
- Highly Accurate: ±2%
- Low-Power Consumption: 1.0μA, 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

General Description:
The TC53 is a low-power voltage detector. Typical supply current consumption is only 1μA at an input voltage of 2V. The voltage detection threshold setting is factory-programmed and ensured to ±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.

Device Selection Table

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Temp. Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC53-xxxxxxxxxx</td>
<td>5-Pin SOT-23A</td>
<td>-40°C to +85°C</td>
</tr>
</tbody>
</table>

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

Package Type

![Functional Block Diagram]

1) CMOS Output

2) N-Channel Open Drain Output

Not recommended for new designs – Please use MCP111/2
1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Input Voltage ........................................................+12V
Output Current ...................................................50 mA
Output Voltage.......................VIN + 0.3V to VSS – 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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_DV</td>
<td>Detect Voltage</td>
<td>V_T x 0.98</td>
<td>V_T ±0.5%</td>
<td>V_T x 1.02</td>
<td>V</td>
<td>Note 3</td>
</tr>
<tr>
<td>V_HYS</td>
<td>Hysteresis Range</td>
<td>V_DV x 0.02</td>
<td>V_DV x 0.05</td>
<td>V_DV x 0.08</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I_SS</td>
<td>Supply Current</td>
<td>—</td>
<td>0.9</td>
<td>2.6</td>
<td>μA</td>
<td>VIN = 1.5V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>1.0</td>
<td>3.0</td>
<td></td>
<td>VIN = 2.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>1.3</td>
<td>3.4</td>
<td></td>
<td>VIN = 3.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>1.6</td>
<td>3.8</td>
<td></td>
<td>VIN = 4.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>2.0</td>
<td>4.2</td>
<td></td>
<td>VIN = 5.0V</td>
</tr>
<tr>
<td>V_IN</td>
<td>Operating Voltage</td>
<td>1.5</td>
<td>—</td>
<td>10.0</td>
<td>V</td>
<td>V_DV = 2.1 to 6.0V</td>
</tr>
<tr>
<td>I_OUT</td>
<td>Output Current</td>
<td>—</td>
<td>2.2</td>
<td>—</td>
<td>mA</td>
<td>N-ch; V_DS = 0.5V, VIN = 1.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>7.7</td>
<td>—</td>
<td></td>
<td>VIN = 2.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>10.1</td>
<td>—</td>
<td></td>
<td>VIN = 3.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>11.5</td>
<td>—</td>
<td></td>
<td>VIN = 4.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>13.0</td>
<td>—</td>
<td></td>
<td>VIN = 5.0V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>-10.0</td>
<td>—</td>
<td></td>
<td>P-ch; V_DS = 2.1V, VIN = 8.0V (CMOS Output)</td>
</tr>
<tr>
<td>ΔV_DV/ (ΔT_OPR V_DV)</td>
<td>Temperature Characteristics</td>
<td>—</td>
<td>±100</td>
<td>—</td>
<td>ppm/°C</td>
<td></td>
</tr>
<tr>
<td>I_DLY</td>
<td>Delay Time (V_DR → V_OUT Inversion)</td>
<td>—</td>
<td>—</td>
<td>0.2</td>
<td>ms</td>
<td></td>
</tr>
</tbody>
</table>

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_DV.

Note 2: The power consumption during power-start to output being stable (release operation) is 2μA 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

<table>
<thead>
<tr>
<th>Pin No. (5-Pin SOT-23A)</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VOUT1</td>
<td>Output</td>
</tr>
<tr>
<td>2</td>
<td>VIN</td>
<td>Supply voltage input.</td>
</tr>
<tr>
<td>3</td>
<td>VSS</td>
<td>Ground terminal.</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>Not connected.</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>Not connected.</td>
</tr>
</tbody>
</table>

3.0 DETAILED DESCRIPTION

FIGURE 3-1: TIMING DIAGRAM

Input Voltage (VIN)
Detect Release Voltage (VDR)
Detect Voltage (VDF)
Minimum Operating Voltage (VMIN)
Ground Voltage (VSS)
Output Voltage (VOUT)
Ground Voltage (VSS)
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

Legend:

- **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
- **63** Pb-free JEDEC designator for Matte Tin (Sn)
- ***\** This package is Pb-free. The Pb-free JEDEC designator \( \text{63} \) can be found on the outer packaging for this package.

Example:

5-Lead SOT-23A

Legend:

- **XXNN** Example: L852

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.
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Output</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CMOS</td>
<td>0.0</td>
</tr>
<tr>
<td>B</td>
<td>CMOS</td>
<td>1.1</td>
</tr>
<tr>
<td>C</td>
<td>CMOS</td>
<td>2.2</td>
</tr>
<tr>
<td>D</td>
<td>CMOS</td>
<td>3.3</td>
</tr>
<tr>
<td>E</td>
<td>CMOS</td>
<td>4.4</td>
</tr>
<tr>
<td>F</td>
<td>CMOS</td>
<td>5.5</td>
</tr>
<tr>
<td>H</td>
<td>CMOS</td>
<td>6.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Output</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Nch</td>
<td>0.0</td>
</tr>
<tr>
<td>L</td>
<td>Nch</td>
<td>1.1</td>
</tr>
<tr>
<td>M</td>
<td>Nch</td>
<td>2.2</td>
</tr>
<tr>
<td>N</td>
<td>Nch</td>
<td>3.3</td>
</tr>
<tr>
<td>P</td>
<td>Nch</td>
<td>4.4</td>
</tr>
<tr>
<td>R</td>
<td>Nch</td>
<td>5.5</td>
</tr>
<tr>
<td>S</td>
<td>Nch</td>
<td>6.6</td>
</tr>
</tbody>
</table>

1. Represents output configuration and first integer of voltage
2. Represents first decimal of output voltage
3. Represents delay function and delay time
   3 = no delay function
4. Represents assembly lot code

**Symbol Output Voltage**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.0</td>
</tr>
<tr>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>2</td>
<td>.2</td>
</tr>
<tr>
<td>3</td>
<td>.3</td>
</tr>
<tr>
<td>4</td>
<td>.4</td>
</tr>
<tr>
<td>5</td>
<td>.5</td>
</tr>
<tr>
<td>6</td>
<td>.6</td>
</tr>
<tr>
<td>7</td>
<td>.7</td>
</tr>
<tr>
<td>8</td>
<td>.8</td>
</tr>
<tr>
<td>9</td>
<td>.9</td>
</tr>
</tbody>
</table>
5-Lead Plastic Small Outline Transistor (CT) [SOT-23]

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>MIN</td>
</tr>
<tr>
<td>Number of Pins</td>
<td>N</td>
</tr>
<tr>
<td>Lead Pitch</td>
<td>e</td>
</tr>
<tr>
<td>Outside Lead Pitch</td>
<td>e1</td>
</tr>
<tr>
<td>Overall Height</td>
<td>A</td>
</tr>
<tr>
<td>Molded Package Thickness</td>
<td>A2</td>
</tr>
<tr>
<td>Standoff</td>
<td>A1</td>
</tr>
<tr>
<td>Overall Width</td>
<td>E</td>
</tr>
<tr>
<td>Molded Package Width</td>
<td>E1</td>
</tr>
<tr>
<td>Overall Length</td>
<td>D</td>
</tr>
<tr>
<td>Foot Length</td>
<td>L</td>
</tr>
<tr>
<td>Footprint</td>
<td>L1</td>
</tr>
<tr>
<td>Foot Angle</td>
<td>φ</td>
</tr>
<tr>
<td>Lead Thickness</td>
<td>c</td>
</tr>
<tr>
<td>Lead Width</td>
<td>b</td>
</tr>
</tbody>
</table>

Notes:
1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
TC53

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

RECOMMENDED LAND PATTERN

<table>
<thead>
<tr>
<th>Units</th>
<th>Dimension Limits</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN</td>
<td>NOM</td>
</tr>
<tr>
<td>Contact Pitch</td>
<td>E</td>
<td>0.95 BSC</td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C</td>
<td>2.80</td>
</tr>
<tr>
<td>Contact Pad Width (X5)</td>
<td>X</td>
<td>0.60</td>
</tr>
<tr>
<td>Contact Pad Length (X5)</td>
<td>Y</td>
<td>1.10</td>
</tr>
<tr>
<td>Distance Between Pads</td>
<td>G</td>
<td>1.70</td>
</tr>
<tr>
<td>Distance Between Pads</td>
<td>GX</td>
<td>0.35</td>
</tr>
<tr>
<td>Overall Width</td>
<td>Z</td>
<td>3.90</td>
</tr>
</tbody>
</table>

Notes:
1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2091A
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.
PRODUCT IDENTIFICATION SYSTEM

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

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>X</th>
<th>XX</th>
<th>XX</th>
<th>XX</th>
<th>XX</th>
<th>XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configuration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Device:** TC53: Low-power voltage detector

**Output Configuration:**
- N = NMOS
- C = CMOS

**Detected Voltage:**
- 22 = 2.2V
- 27 = 2.7V
- 29 = 2.9V

**Tolerance:** 02 = ±2%

**Temperature Range:** E = -40°C to +125°C (Extended)

**Package:** CT: 5-Pin SOT-23A Package

**Taping Direction:** TR: Standard Taping

**Examples:**

a) TC53C2202ECTTR: CMOS, 2.2V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Taping.

b) TC53N2702ECTTR: NMOS, 2.7V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Taping.

c) TC53N2902ECTTR: NMOS, 2.9V, ±2% tolerance, Extended Temperature, 5LD SOT-23A, Standard Taping.
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  Fax: 65-6334-8850
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  Fax: 39-0331-466781
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  Fax: 31-416-690340
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  Fax: 34-91-708-08-91
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  Tel: 44-118-921-5869  
  Fax: 44-118-921-5820
- **Thailand - Bangkok**  
  Tel: 66-2-694-1351  
  Fax: 66-2-694-1350

08/02/11