

## Voltage Detector

### Features

- Precise Detection Thresholds: Standard  $\pm 2.0\%$ , Custom  $\pm 1.0\%$
- Small Packages: 3-Pin SOT-23A, 3-Pin SOT-89, 5-Pin SOT-23A (7.7V only)
- Low Current Drain: Typ.  $1\mu\text{A}$
- Wide Detection Range: 1.1V to 6.0V and 7.7V
- Wide Operating Voltage Range: 0.7V to 10V

### Applications

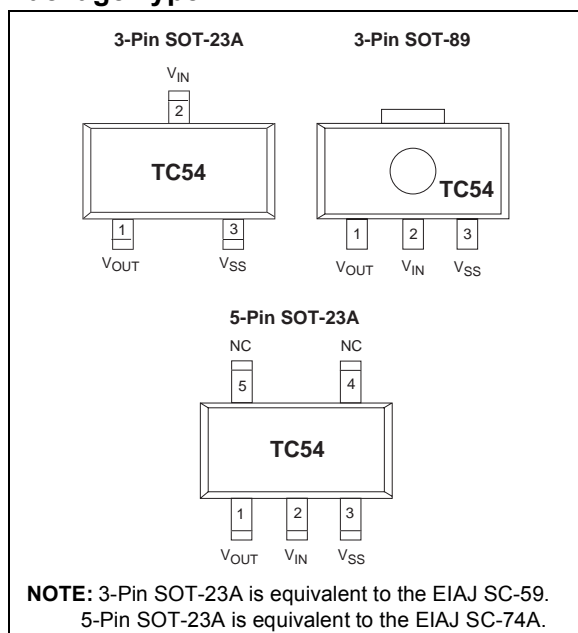
- Battery Voltage Monitoring
- Microprocessor Reset
- System Brown-out Protection
- Switching Circuit in Battery Backup
- Level Discriminator

### Device Selection Table

Part Number	Package	Temp. Range
TC54-xxxxxxxxxx	3-Pin SOT-23A	-40°C to +85°C
TC54-xxxxxxxxxx	3-Pin SOT-89	-40°C to +85°C
TC54-xxxxxxxxxx	5-Pin SOT-23A	-40°C to +85°C

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

### Package Type



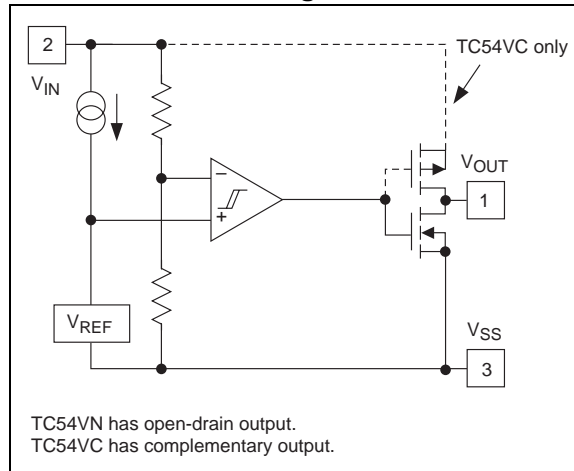
### General Description

The TC54 Series are CMOS voltage detectors, suited especially for battery-powered applications because of their extremely low  $1\mu\text{A}$  operating current and small surface-mount packaging. Each part is laser trimmed to the desired threshold voltage which can be specified from 1.1V to 6.0V and 7.7V, for a 2% and 1.5V to 6.0V for a 1% tolerance.

The device includes a comparator, low-current high-precision reference, laser-trimmed divider, hysteresis circuit and output driver. The TC54 is available with either an open-drain or complementary output stage.

In operation, the TC54's output (V<sub>OUT</sub>) remains in the logic HIGH state as long as V<sub>IN</sub> is greater than the specified threshold voltage (V<sub>DET</sub>-). When V<sub>IN</sub> falls below V<sub>DET</sub>- the output is driven to a logic LOW. V<sub>OUT</sub> remains LOW until V<sub>IN</sub> rises above V<sub>DET</sub>- by an amount V<sub>HYST</sub>, whereupon it resets to a logic HIGH.

### Functional Block Diagram



# TC54

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Input Voltage .....	+12V
Output Current .....	50mA
Output Voltage: CMOS.....	(V <sub>SS</sub> - 0.3V) to (V <sub>IN</sub> + 0.3V)
Open Drain.....	(V <sub>SS</sub> - 0.3V) to 12V
Power Dissipation (T <sub>A</sub> ≤ 70°C):	
3-Pin SOT-23A.....	240mW
3-Pin SOT-89 .....	400mW
5-Pin SOT-23A.....	240mW
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.

### TC54 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: T <sub>A</sub> = 25°C, unless otherwise specified.						
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
V <sub>IN</sub>	Operating Voltage	0.7	—	10.0	V	(V <sub>DET-</sub> ) = 0.8 to 6.0V
I <sub>SS</sub>	Quiescent Current	—	1.0 1.3 1.6 2.0	3.0 3.4 3.8 4.2	μA	V <sub>IN</sub> = 2.1V V <sub>IN</sub> = 3.0V V <sub>IN</sub> = 4.0V V <sub>IN</sub> = 5.0V
V <sub>DET-</sub>	Threshold Voltage	V <sub>DET-</sub> × 0.98	—	V <sub>DET-</sub> × 1.02	V	
V <sub>HYST</sub>	Hysteresis Voltage	V <sub>DET-</sub> × 0.02	V <sub>DET-</sub> × 0.05	V <sub>DET-</sub> × 0.08	V	
I <sub>OUT</sub>	Output Current	—	7.7 10.1 11.5 13.0 — -10.0	—	mA	V <sub>OL</sub> = 0.5V, V <sub>IN</sub> = 2.1V V <sub>IN</sub> = 3.0V V <sub>IN</sub> = 4.0V V <sub>IN</sub> = 5.0V TC54VC Only; V <sub>OH</sub> = V <sub>IN</sub> - 2.1V, V <sub>IN</sub> = 8.0V
T <sub>C</sub> (V <sub>DET-</sub> )	Tempco of (V <sub>DET-</sub> )	—	±100	—	ppm/°C	-40°C ≤ T <sub>A</sub> ≤ 85°C

## 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-23A) (3-Pin SOT-89)	Symbol	Description
1	$V_{OUT}$	Digital output. This output goes low when $V_{IN}$ drops below $V_{DET-}$ and returns high when $V_{IN}$ rises above $V_{DET-} + V_{HYST}$ . (See Figure 3-1, Timing Diagram.)
2	$V_{IN}$	Analog input. This pin is both the power supply input and the voltage to be monitored.
3	$V_{SS}$	Ground terminal.

Pin No. (5-Pin SOT-23A)	Symbol	Description
1	$V_{OUT}$	Digital output. This output goes low when $V_{IN}$ drops below $V_{DET-}$ and returns high when $V_{IN}$ rises above $V_{DET-} + V_{HYST}$ . (See Figure 3-1, Timing Diagram.)
2	$V_{IN}$	Analog input. This pin is both the power supply input and the voltage to be monitored.
3	$V_{SS}$	Ground terminal.
4	NC	Not connected.
5	NC	Not connected.

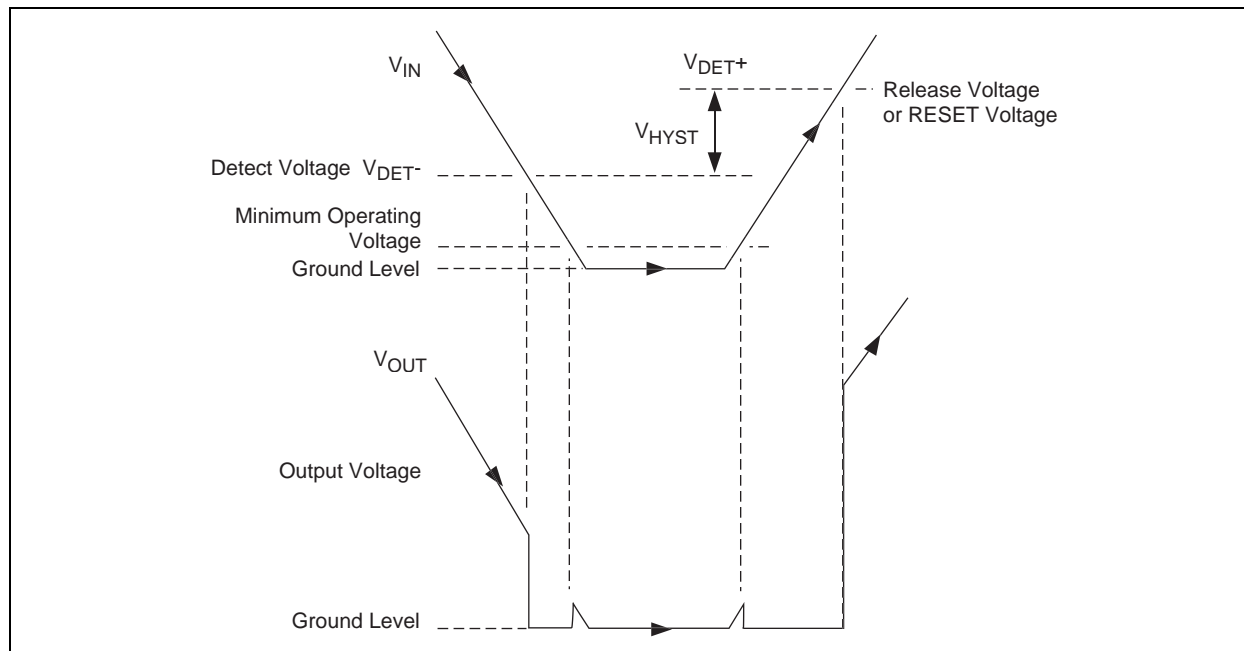
# TC54

## 3.0 DETAILED DESCRIPTION

In normal steady-state operation, when  $V_{IN} > V_{DET-}$ , the output will be at a logic high, see Figure 3-1. In the case of the TC54V, this is an open-drain condition. If and when the input falls below  $V_{DET-}$ , the output will pull down (Logic 0) to  $V_{SS}$ . Generally,  $V_{OUT}$  can pull down to within 0.5V of  $V_{SS}$  at rated output current and input voltage. (See Section 1.0, Electrical Characteristics).

The output,  $V_{OUT}$ , will stay valid until the input voltage falls below the minimum operating voltage,  $V_{INMIN}$ , of 0.7V. Below this minimum operating voltage, the output is undefined. During power-up or anytime  $V_{IN}$  has fallen below  $V_{INMIN}$ ,  $V_{OUT}$  will remain undefined until  $V_{IN}$  rises above  $V_{INMIN}$ , at which time the output will become valid.  $V_{OUT}$  will be in its active low state while  $V_{INMIN} < V_{IN} < V_{DET+}$ . ( $V_{DET+} = V_{DET-} + V_{HYST}$ ). If and when the input rises above  $V_{DET+}$ , the output will assume its inactive state. (High for TC54VC, open-drain for TC54VN).

FIGURE 3-1: TIMING DIAGRAM

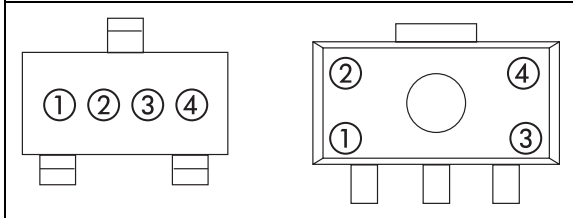


## 4.0 APPLICATIONS INFORMATION

Refer to Microchip Technology Application Note #779, *Using the TC54 Voltage Detector*.

## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information



① represents output configuration (CMOS or Nch) and first integer of voltage

Ex: CMOS 3.x = ① ○ ○ ○

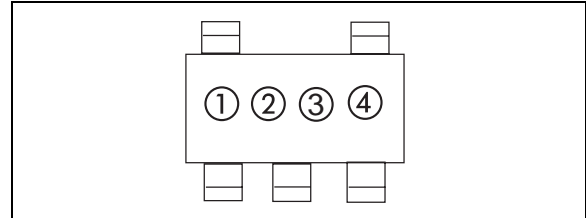
Symbol	Output	Voltage
B	CMOS	1.
C	CMOS	2.
D	CMOS	3.
E	CMOS	4.
F	CMOS	5.
H	CMOS	6.

Symbol	Output	Voltage
L	Nch	1.
M	Nch	2.
N	Nch	3.
P	Nch	4.
R	Nch	5.
S	Nch	6.
T	Nch	7.

② represents first decimal of output voltage (0-9)

Ex: CMOS 3.x = ① ④ ○ ○

③ & ④ represents assembly lot code



① represents output configuration and first integer of voltage

Symbol	Output	Voltage
T	Nch	7.

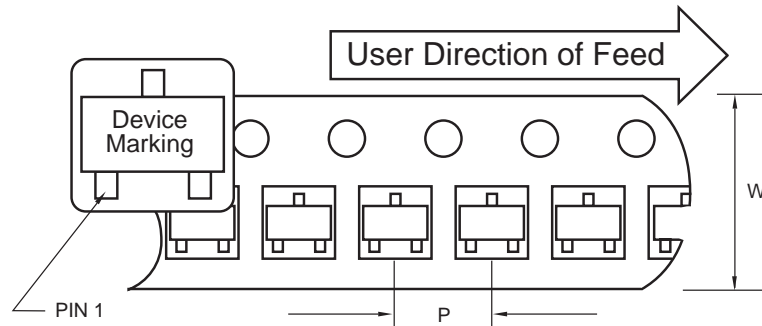
② represents first decimal of output voltage

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

③ & ④ represents assembly lot code

## 5.2 Taping Form

### Component Taping Orientation for 3-Pin SOT-23A (EIAJ SC-59) Devices

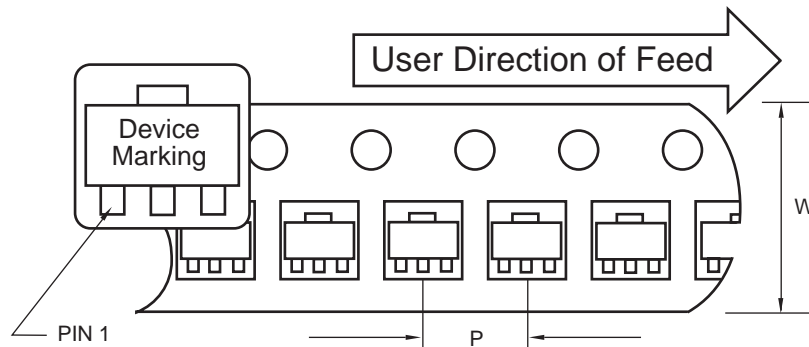


Standard Reel Component Orientation  
for TR Suffix Device  
(Mark Right Side Up)

**Carrier Tape, Number of Components Per Reel and Reel Size**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin SOT-23A	8 mm	4 mm	3000	7 in

### Component Taping Orientation for 3-Pin SOT-89 Devices

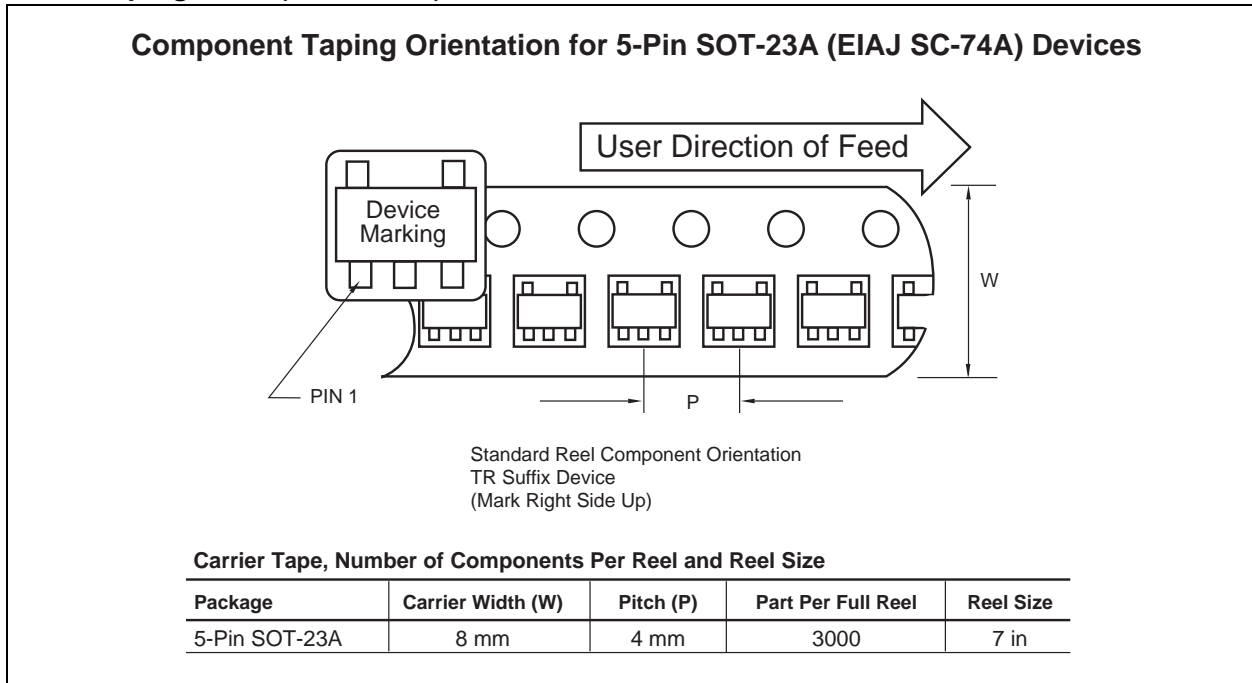


Standard Reel Component Orientation  
for TR Suffix Device  
(Mark Right Side Up)

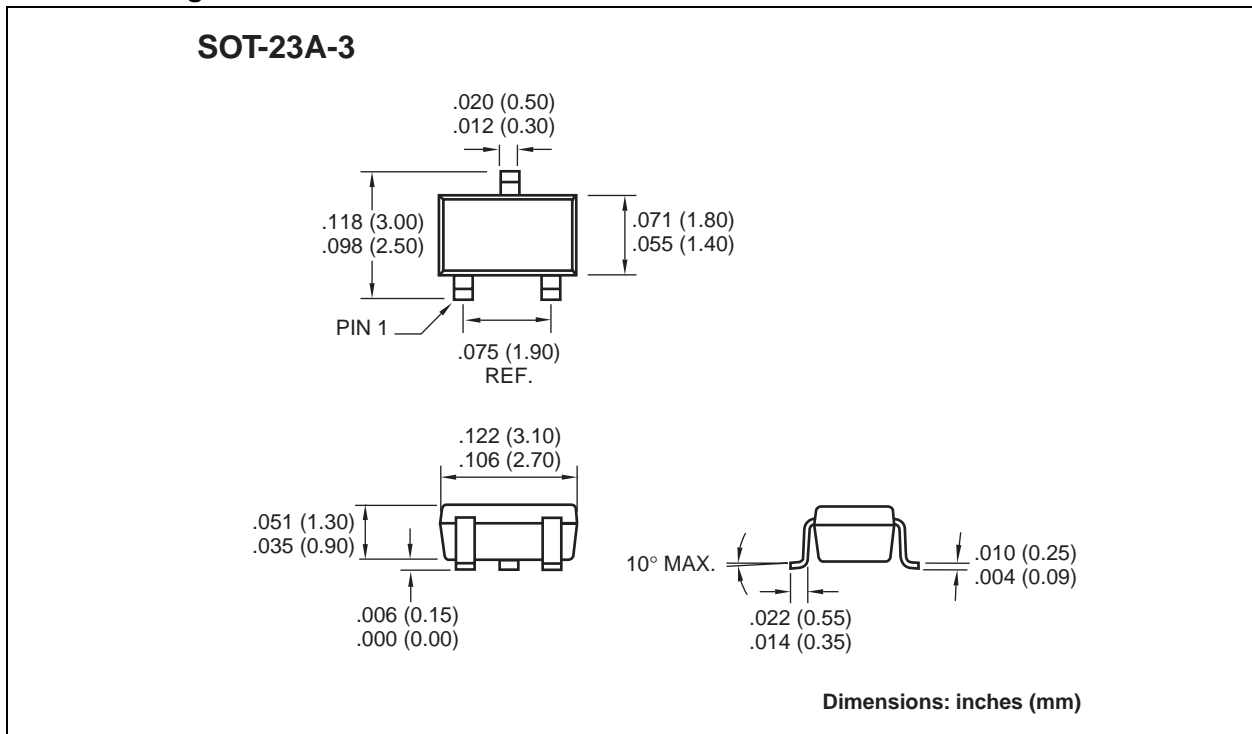
**Carrier Tape, Reel Size, and Number of Components Per Reel**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin SOT-89	12 mm	8 mm	1000	7 in

## 5.2 Taping Form (Continued)

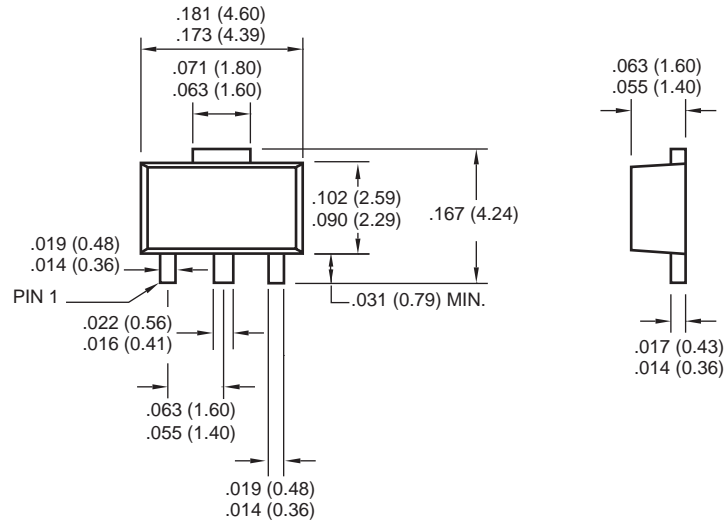


## 5.3 Package Dimensions



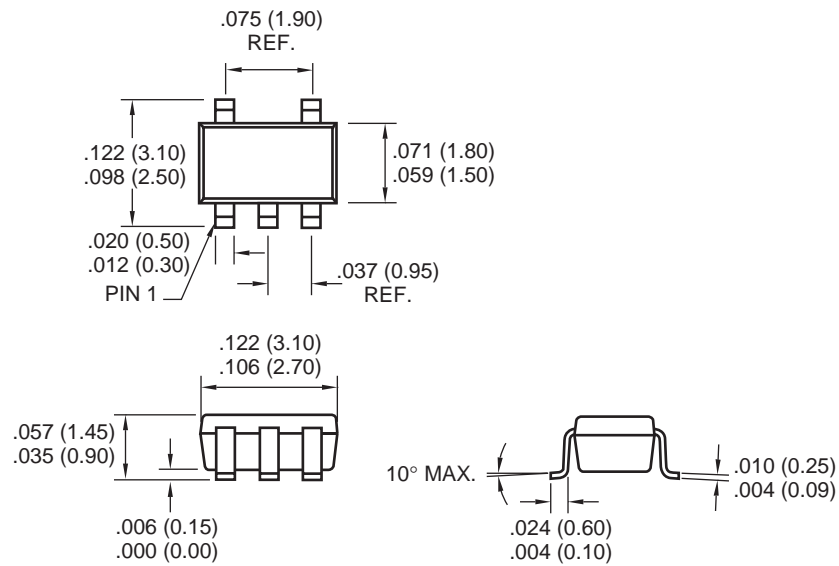
## 5.3 Package Dimensions (Continued)

### SOT-89-3



Dimensions: inches (mm)

### SOT-23A-5



Dimensions: inches (mm)



## PRODUCT IDENTIFICATION SYSTEM

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

PART CODE	TC54V	X	XX	X	X	X	XX	XXX
<b>Output Configuration:</b>								
N = Nch Open Drain								
C = CMOS Output								
<b>Detected Voltage:</b>								
Ex: 15 = 1.5V; 60 = 6.0V								
Ex: 11 = 1.1V; 60 = 6.0V								
<b>Extra Feature Code:</b>								
Fixed: 0								
<b>Tolerance:</b>								
1 = ±1% (custom)								
2 = ±2% (standard)								
<b>Temperature:</b>								
E: -40°C to +85°C								
<b>Package Type and Pin Count:</b>								
CB: 3-Pin SOT-23A (equivalent to EIAJ SC-59)								
MB: 3-Pin SOT-89								
CT: 5-Pin SOT-23A (equivalent to EIAJ SC-74A)								
<b>Taping Direction:</b>								
TR: Standard Taping								

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# TC54

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