

VOLTAGE DETECTOR

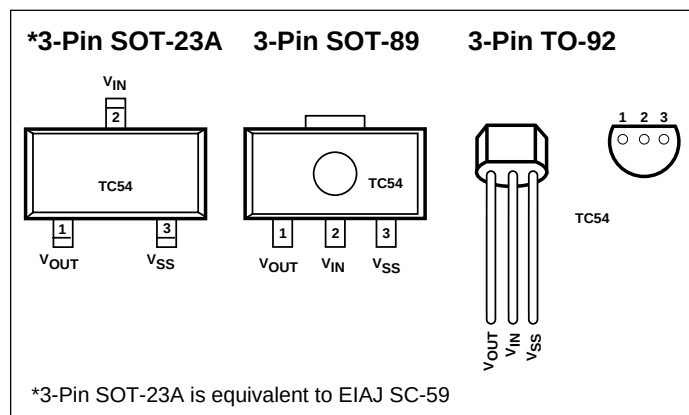
FEATURES

- Precise Detection Thresholds Standard $\pm 2.0\%$
Custom $\pm 1.0\%$
- Small Packages3-Pin SOT-23A, 3-Pin SOT-89, 3-Pin TO-92
- Low Current Drain Typ. $1\mu\text{A}$
- Wide Detection Range 1.1V to 6.0V
- Wide Operating Voltage Range 0.7V to 10V

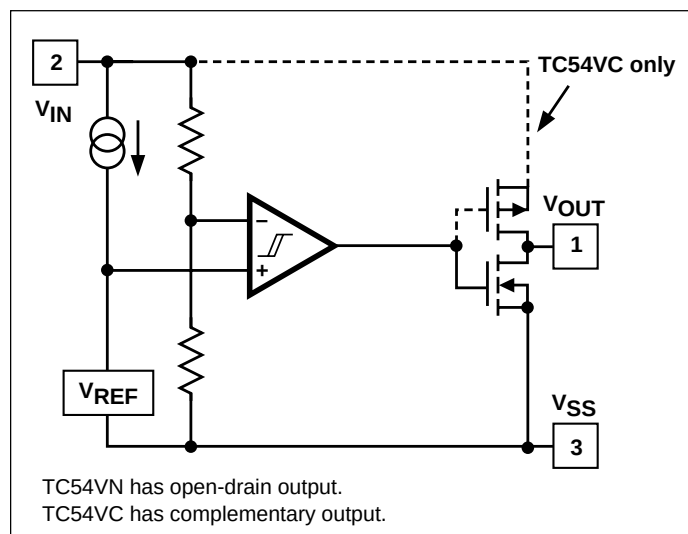
APPLICATIONS

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

PIN CONFIGURATIONS



FUNCTIONAL BLOCK DIAGRAM



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, in 0.1V steps 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_{OUT}) remains in the logic HIGH state as long as V_{IN} is greater than the specified threshold voltage (V_{DET}). When V_{IN} falls below V_{DET} , the output is driven to a logic LOW. V_{OUT} remains LOW until V_{IN} rises above V_{DET} by an amount V_{HYST} , whereupon it resets to a logic HIGH.

ORDERING INFORMATION

PART CODE TC54 V X XX X X X XX XXX

Output form:

N = Nch Open Drain
C = CMOS Output

Detected Voltage:

Ex: 15 = 1.5V; 60 = 6.0V 1.0% Tol.
Ex: 11 = 1.1V; 60 = 6.0V 2.0% Tol.

Extra Feature Code: Fixed: 0

Tolerance:

1 = 1.0% (custom)
2 = 2.0% (standard)

Temperature: E: -40°C to $+85^{\circ}\text{C}$

Package Type and Pin Count:

CB: 3-Pin SOT-23A*, MB: 3-Pin SOT-89,
ZB: 3-Pin TO-92

Taping Direction:

TR: Standard Taping
RT: Reverse Taping
No Suffix: TO-92 Bulk

* 3-Pin SOT-23A is equivalent to EIAJ SC-59.

TC54 Series

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage V_{IN}	12V
Output Voltage: CMOS	$(V_{SS} - 0.3)$ to $(V_{IN} + 0.3)$
Open Drain	$(V_{SS} - 0.3)$ to 12V
Output Current	50mA
Power Dissipation: ($T_A \leq 70^\circ\text{C}$)	
3-Pin SOT-23A	240mW
3-Pin SOT-89	400mW
3-Pin TO-92	440mW
Operating Temperature	-40°C to $+85^\circ\text{C}$
Storage Temperature	-65°C to $+150^\circ\text{C}$
Soldering Temperature (10 sec)	300°C

* Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. 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 operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

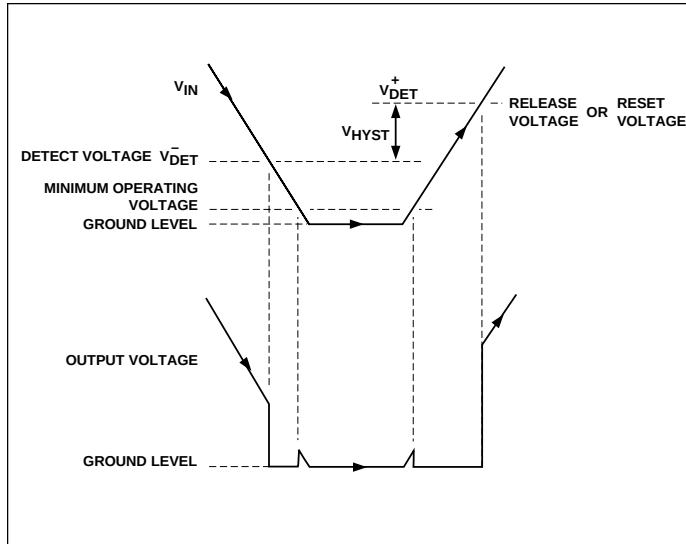
ELECTRICAL CHARACTERISTICS: $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Voltage	$V_{DET} = 0.8$ to 6.0V	0.7		10.0	V
I_{SS}	Quiescent Current	$V_{IN} = 2.1\text{V}$ 3.0V 4.0V 5.0V	—	1.0 1.3 1.6 2.0	3.0 3.4 3.8 4.2	μA
V_{DET}	Threshold Voltage		(V_{DET}) $\times 0.98$	—	(V_{DET}) $\times 1.02$	V
V_{HYST}	Hysteresis Range		(V_{DET}) $\times 0.02$	(V_{DET}) $\times 0.05$	(V_{DET}) $\times 0.08$	V
I_{OUT}	Output Current	$V_{OL} = 0.5\text{V}$ TC54VC Only: $V_{OH} = V_{IN} - 2.1\text{V}$	$V_{IN} = 2.1\text{V}$ 3.0V 4.0V 5.0V $V_{IN} = 8.0\text{V}$	— 7.7 10.1 11.5 13.0 — 10.0	—	mA
$T_C (V_{DET})$	Tempco of (V_{DET})	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	—	± 100		ppm/ $^\circ\text{C}$

PIN DESCRIPTION

Pin No.	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 timing chart).
2	V_{IN}	Analog input. This pin is both the power supply input and the voltage to be monitored.
3	V_{SS}	Ground terminal.

TIMING CHART



DESCRIPTION OF OPERATION

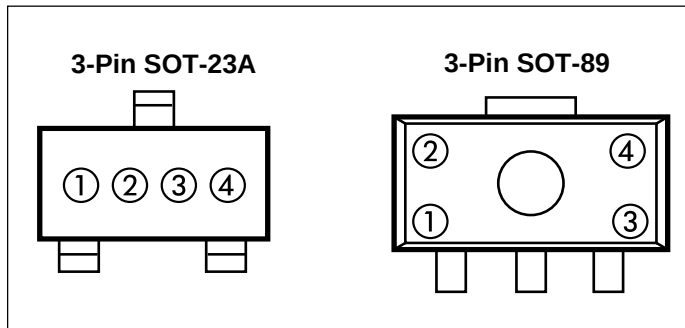
Refer to the Timing Chart below. In normal steady-state operation, when $V_{IN} > V_{DET}^+$, the output will be at a logic high. In the case of the TC54V, this is an open-drain condition. If and when the input falls below V_{DET}^- , the output will pull down (Logic 0) to V_{SS} . Generally, V_{OUT}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

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

APPLICATIONS

Refer to TelCom Semiconductor Application Note #2, *Using the TC54 Voltage Detector*.

MARKING



① = output (Nch or CMOS) plus first voltage digit

	1	2	3	4	5	6
Nch	L	M	N	P	R	S
CMOS	B	C	D	E	F	H

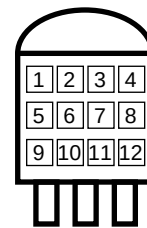
ex: CMOS 3.x = D○○○

② = first voltage decimal (0-9)

ex: CMOS 3.4 = D④○○

③ & ④ = assembly lot number

3-Pin TO-92



①, ② & ③ = 54x (fixed)

④ = output (C = CMOS, N = Nch)

⑤ = first voltage digit (2-6)

⑥ = first voltage decimal (0-9)

⑦ = extra feature code : fixed : 0

⑧ = detecting accuracy

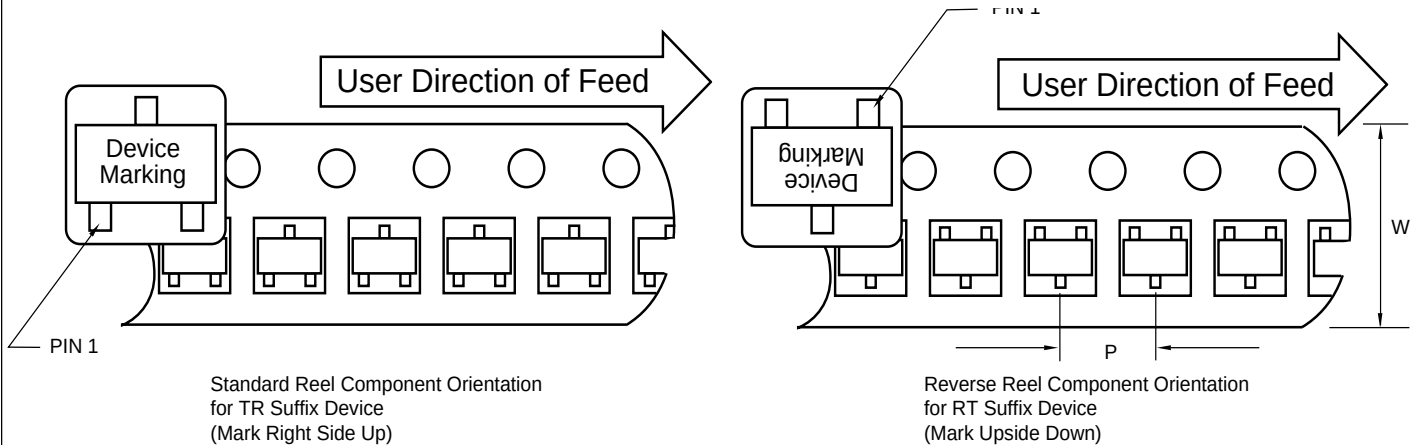
1 = $\pm 1.0\%$ (custom), 2 = $\pm 2.0\%$ (standard)

⑨, ⑩, ⑪ & ⑫ = assembly lot number

TC54 Series

TAPING FORMS

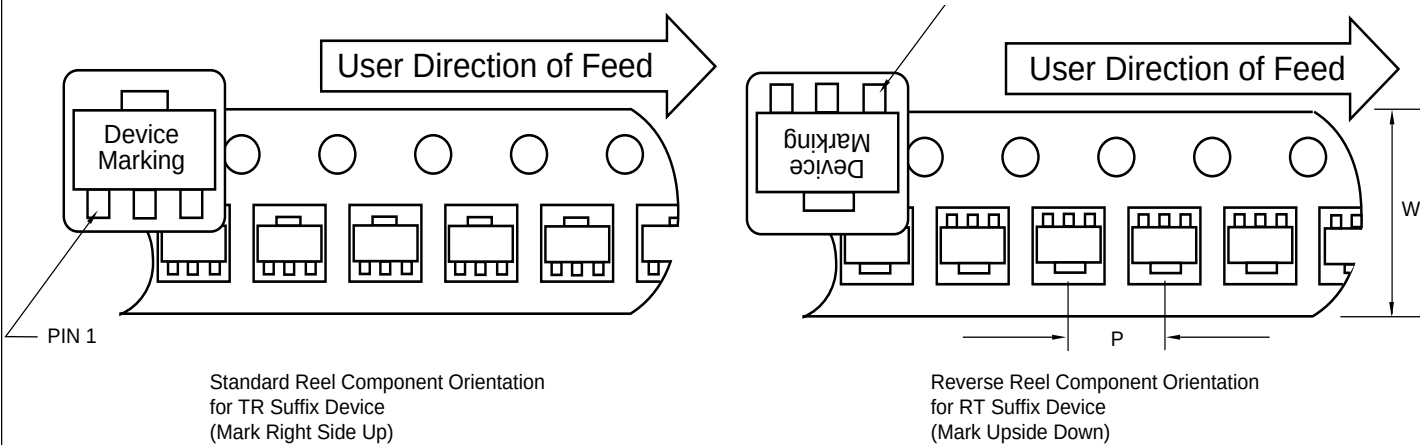
Component Taping Orientation for 3-Pin SOT-23A(EIAJ SC-59) Devices



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

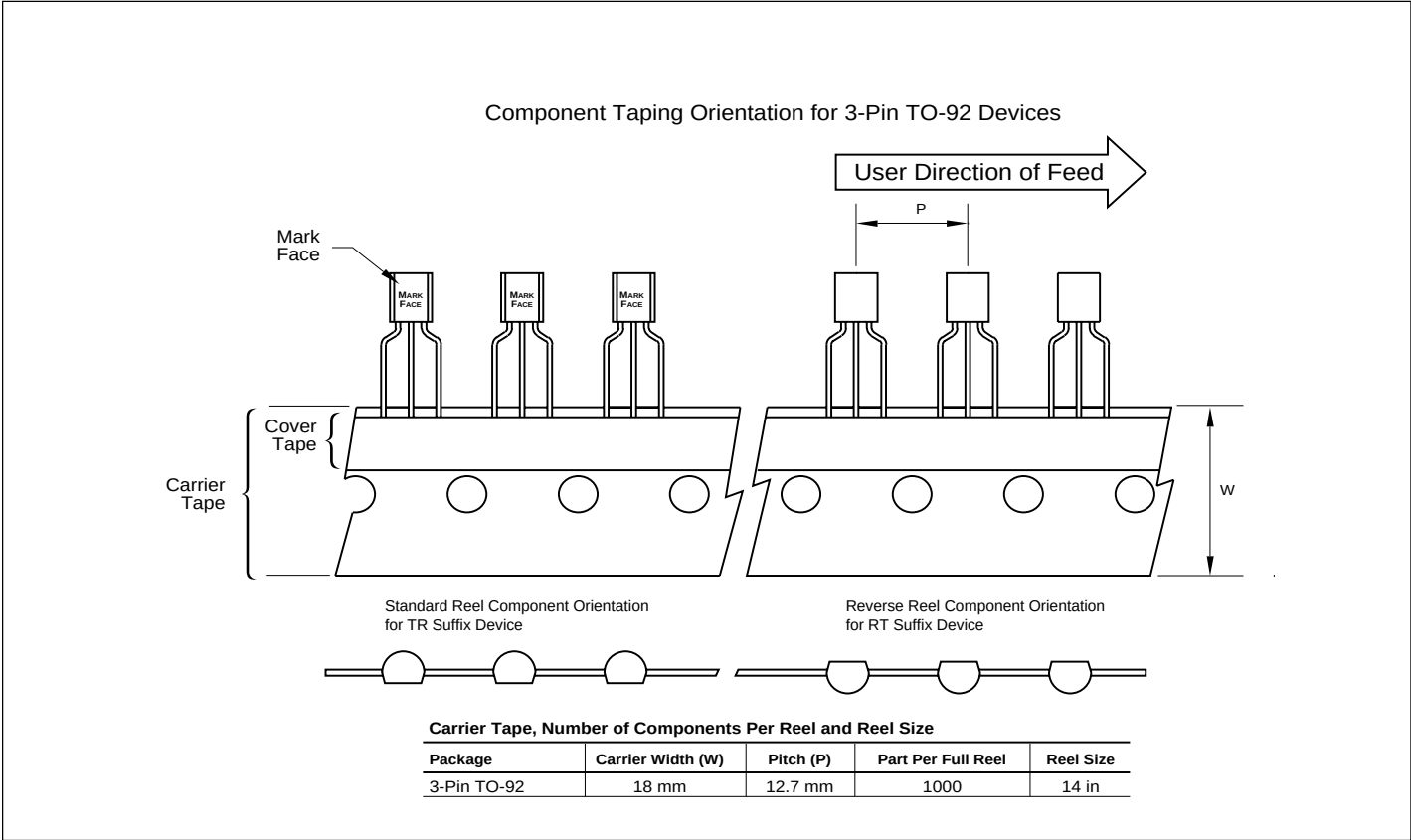
Component Taping Orientation for 3-Pin SOT-89



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

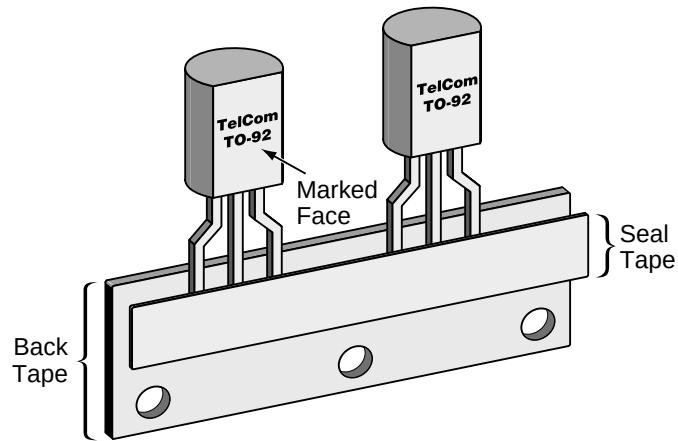
TAPING FORMS (Cont.)



TC54 Series

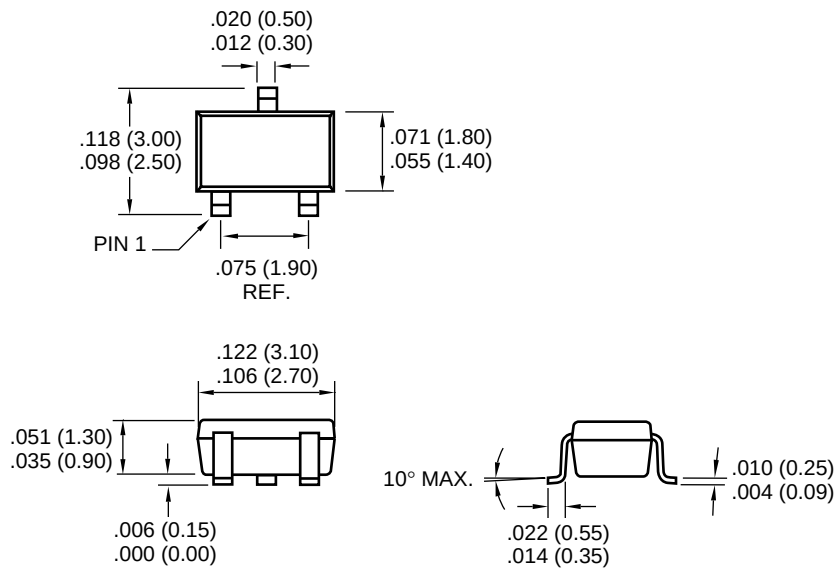
TAPING FORMS (Cont.)

Component Taping Orientation for 3-Pin TO-92 (Cont.)



PACKAGE DIMENSIONS

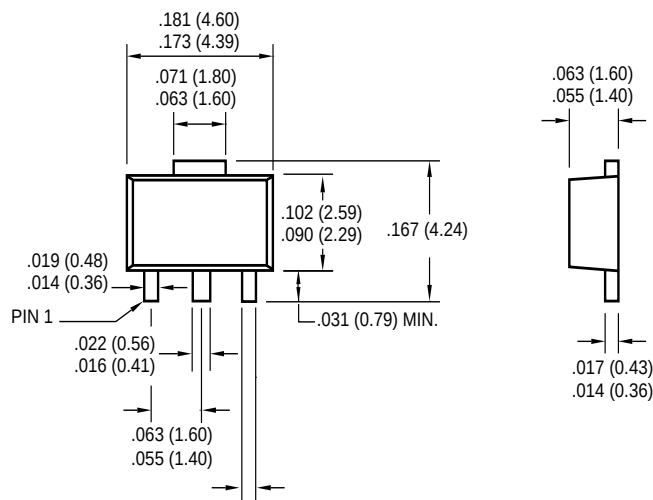
3-Pin SOT-23A (EIAJ SC-59)



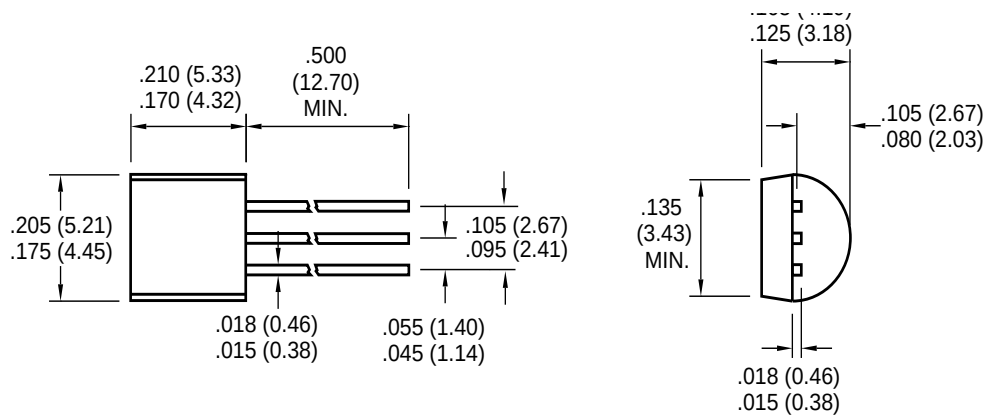
Dimensions: inches (mm)

PACKAGE DIMENSIONS (Cont.)

3-Pin SOT-89



3-Pin TO-92



Dimensions: inches (mm)



WORLDWIDE SALES AND SERVICE

AMERICAS

Corporate Office

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200 Fax: 480-792-7277
Technical Support: 480-792-7627
Web Address: <http://www.microchip.com>

Rocky Mountain

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7966 Fax: 480-792-7456

Atlanta

500 Sugar Mill Road, Suite 200B
Atlanta, GA 30350
Tel: 770-640-0034 Fax: 770-640-0307

Austin

Analog Product Sales
8303 MoPac Expressway North
Suite A-201
Austin, TX 78759
Tel: 512-345-2030 Fax: 512-345-6085

Boston

2 Lan Drive, Suite 120
Westford, MA 01886
Tel: 978-692-3848 Fax: 978-692-3821

Boston

Analog Product Sales
Unit A-8-1 Millbrook Tarry Condominium
97 Lowell Road
Concord, MA 01742
Tel: 978-371-6400 Fax: 978-371-0050

Chicago

333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 630-285-0071 Fax: 630-285-0075

Dallas

4570 Westgrove Drive, Suite 160
Addison, TX 75001
Tel: 972-818-7423 Fax: 972-818-2924

Dayton

Two Prestige Place, Suite 130
Miamisburg, OH 45342
Tel: 937-291-1654 Fax: 937-291-9175

Detroit

Tri-Atria Office Building
32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250 Fax: 248-538-2260

Los Angeles

18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

Mountain View

Analog Product Sales
1300 Terra Bella Avenue
Mountain View, CA 94043-1836
Tel: 650-968-9241 Fax: 650-967-1590

New York

150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-273-5305 Fax: 631-273-5335

San Jose

Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto

6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

China - Beijing

Microchip Technology Beijing Office
Unit 915
New China Hong Kong Manhattan Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Shanghai

Microchip Technology Shanghai Office
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

Hong Kong

Microchip Asia Pacific
RM 2101, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

India

Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaughnessy Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan

Microchip Technology Intl. Inc.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

Korea

Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea
Tel: 82-2-554-7200 Fax: 82-2-558-5934

ASIA/PACIFIC (continued)

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

Taiwan

Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Australia

Microchip Technology Australia Pty Ltd
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

Denmark

Microchip Technology Denmark ApS
Regus Business Centre
Lautrup hof 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

France

Arizona Microchip Technology SARL
Parc d'Activite du Moulin de Massy
43 Rue du Saule Trappu
Batiment A - 1er Etage
91300 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany

Arizona Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Germany

Analog Product Sales
Lochhamer Strasse 13
D-82152 Martinsried, Germany
Tel: 49-89-895650-0 Fax: 49-89-895650-22

Italy

Arizona Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom

Arizona Microchip Technology Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

All rights reserved. © 2001 Microchip Technology Incorporated. Printed in the USA. 1/01



Printed on recycled paper.

01/09/01

Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. No representation or warranty is given and no liability is assumed by Microchip Technology Incorporated with respect to the accuracy or use of such information, or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Microchip's products as critical components in life support systems is not authorized except with express written approval by Microchip. No licenses are conveyed, implicitly or otherwise, except as maybe explicitly expressed herein, under any intellectual property rights. The Microchip logo and name are registered trademarks of Microchip Technology Inc. in the U.S.A. and other countries. All rights reserved. All other trademarks mentioned herein are the property of their respective companies.