

DUAL RS-232 TRANSMITTER/RECEIVER AND POWER SUPPLY

FEATURES

- Meets All RS-232 Specifications
- Operates From Single 5V Power Supply
- 2 Drivers and 2 Receivers
- On-Board Voltage Quadrupler
- Input Levels $\pm 30V$
- Output Swing With +5V Supply $\pm 9V$
- Low Supply Current 5 mA
- Does not require external $\pm 12V$ supplies

APPLICATIONS

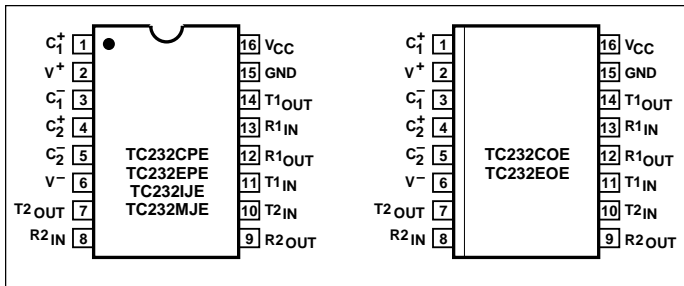
- RS-232C Communication Links
- Modems, peripherals, computers
- Battery-powered systems

GENERAL DESCRIPTION

The TC232 is a dual RS-232 transmitter/receiver that complies with EIA /TIA RS-232E guidelines and is ideal for all RS-232 communication links. This device operates from a 5V power supply and contains two charge pump voltage converters that produce $\pm 10V$ power supplies.

The TC232 has four level translators. Two are RS-232 transmitters that convert TTL/CMOS input levels to 9V RS-232 outputs. The other two translators are RS-232 receivers that convert RS-232 inputs to 5V TTL/CMOS output levels. The receivers have a nominal threshold of 1.3V, a typical hysteresis of 0.5V, and can operate with inputs up to $\pm 30V$.

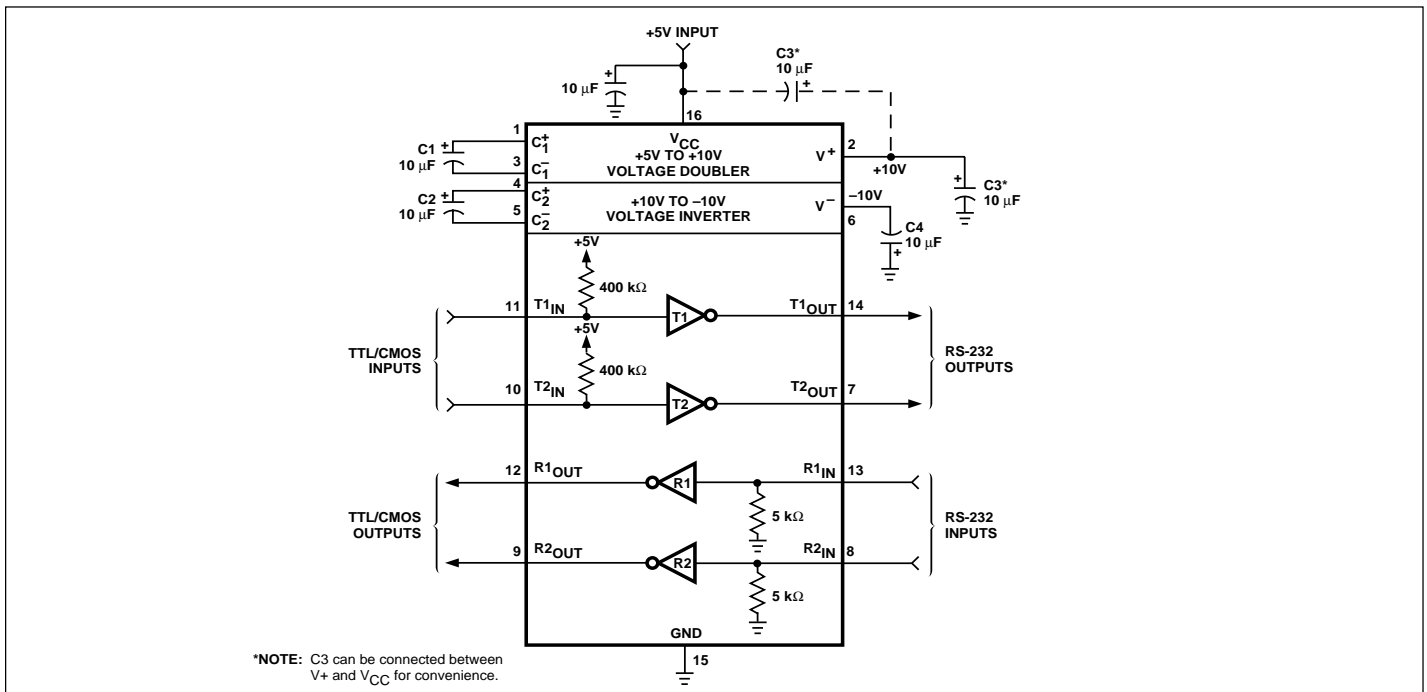
PIN CONFIGURATIONS (DIP and SOIC)



ORDERING INFORMATION

Part No.	Package	Temp. Range
TC232COE	16-Pin SOIC (Wide)	0°C to +70°C
TC232CPE	16-Pin Plastic DIP	0°C to +70°C
TC232EOE	16-Pin SOIC (Wide)	-40°C to +85°C
TC232EPE	16-Pin Plastic DIP	-40°C to +85°C
TC232IJE	16-Pin CerDIP	-25°C to +85°C
TC232MJE	16-Pin CerDIP	-55°C to +125°C

TYPICAL APPLICATION



DUAL RS-232 TRANSMITTER/ RECEIVER AND POWER SUPPLY

TC232

ABSOLUTE MAXIMUM RATINGS*

V_{CC}	+6V
V^+	+12V
V^-	+12V
Input Voltages	
$T1_{IN}, T2_{IN}$	-0.3 to ($V_{CC} + 0.3V$)
$R1_{IN}, R2_{IN}$	$\pm 30V$
Output Voltages	
$T1_{OUT}, T2_{OUT}$	($V^+ + 0.3V$) to ($V^- - 0.3V$)
$R1_{OUT}, R2_{OUT}$	-0.3 to ($V_{CC} + 0.3V$)
Short Circuit Duration	
V^+	30sec
V^-	30sec
$T1_{OUT}, T2_{OUT}$	Continuous
Storage Temperature Range	-65°C to +150°C

Package Power Dissipation ($T_A \leq 70^\circ C$)	
CerDIP	890mW
Derate 9.5 mW/°C Above +70°C	
Plastic DIP	840mW
Derate 7 mW/°C Above +70°C	
Small Outline (SOIC)	760mW
Derate 7 mW/°C Above +70°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 operation sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS: $V_{CC} = 5V \pm 10\%$, $T_A =$ operating temperature range, test circuit unless otherwise noted.

Parameter	Test Conditions	Min	Typ	Max	Unit
Output Voltage Swing	$T1_{OUT}, T2_{OUT}$ Loaded With 3 k Ω to Ground	± 5	± 9	± 10	V
Power Supply Current		—	5	10	mA
Input Logic Threshold Low	$T1_{IN}, T2_{IN}$	—	—	0.8	V
Input Logic Threshold High	$T1_{IN}, T2_{IN}$	2	—	—	V
Logic Pull-Up Current	$T1_{IN}, T2_{IN} = 0V$	—	15	200	μA
RS-232 Input Voltage Operating Range		-30	—	+30	V
RS-232 Input Threshold Low	$V_{CC} = 5V$	0.8	1.2	—	V
RS-232 Input Threshold High	$V_{CC} = 5V$	—	1.7	2.4	V
RS-232 Input Hysteresis		0.2	0.5	1	V
RS-232 Input Resistance	$T_A = +25^\circ C, V_{CC} = 5V$	3	5	7	k Ω
TTL/CMOS Output Voltage Low	$I_{OUT} = 3.2$ mA	—	—	0.4	V
TTL/CMOS Output Voltage High	$I_{OUT} = -1$ mA	3.5	—	—	V
Propagation Delay	RS-232 to TTL or TTL to RS-232	—	0.5	—	μsec
Instantaneous Slew Rate	$C_L = 10$ pF, $R_L = 3$ k Ω to 7 k Ω , $T_A = +25^\circ C$ (Note 1)	—	—	30	V/ μsec
Transition Region Slew Rate	$R_L = 3$ k Ω , $C_L = 2500$ pF Measured From +3V to -3V or -3V to +3V	—	3	—	V/ μsec
Output Resistance	$V_{CC} = V^+ = V^- = 0V, V_{OUT} = \pm 2V$	300	—	—	Ω
RS-232 Output Short-Circuit Current		—	± 10	—	mA

NOTE 1. Sample tested.

DUAL RS-232 TRANSMITTER/ RECEIVER AND POWER SUPPLY

TC232

DETAILED DESCRIPTION

The TC232 contains a +5V to $\pm 10V$ dual charge pump voltage converter, a dual transmitter and a dual receiver.

+5V to $\pm 10V$ Dual Charge Pump Voltage Converter

The TC232 power supply consists of two charge pumps. One uses external capacitor C1 to double the +5V input to +10V, with output impedance of about 200 Ω . The other uses C2 to invert +10V to -10V, with overall output impedance of 450 Ω (including effects of +5V to +10V doubler impedance).

The clock in the doubler circuit will start at $\approx 4.2V$ in the typical part, but external loads may make this point rise to as high as 4.5V with a load of 2 k Ω on each of the two output voltages.

Because of this, use of the doubler and inverter to run additional external circuits should be limited. The maximum current should be no more than 2.5 mA from the +10V and -10V, in order to guarantee start-up of the doubler clock.

The test circuit employs 22 μF capacitors for C1 to C4, but the value is not critical. These capacitors usually are low-cost aluminum or tantalum electrolytic capacitors.

Increasing C1 and C2 to 47 μF lowers the output impedance of the +10V doubler and the -10V inverter by the change in the ESR of the capacitors.

Increasing C3 and C4 lowers ripple on the $\pm 10V$ outputs and 16 kHz ripple on the RS-232 outputs. Where size is critical, the value of C1 to C4 can be lowered to 1 μF . The use of a low ESR capacitor will help lower the output ripple and keep the output impedance of the $\pm 10V$ as low as possible.

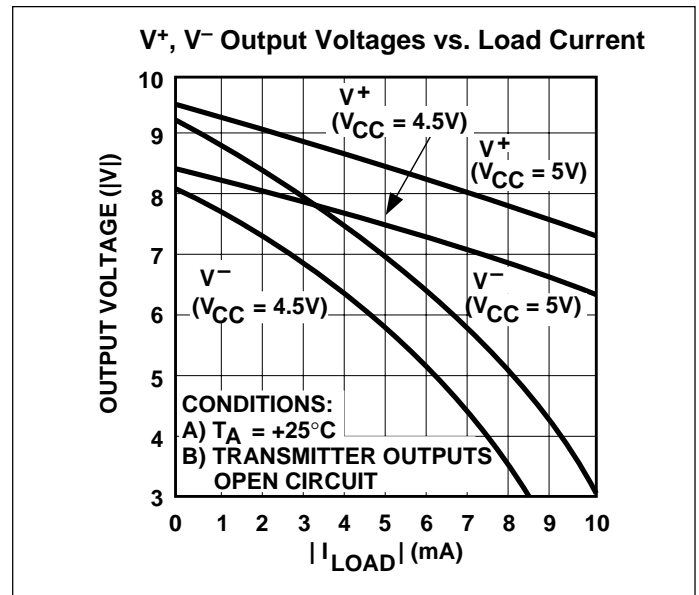
Dual Transmitter

TC232 transmitters are CMOS inverters driven by $\pm 10V$ internally-generated voltages. The input is TTL/CMOS compatible, with a logic threshold of about 26% of V_{CC} (1.3V for 5V V_{CC}). The input of an unused transmitter can be left unconnected, since an internal 400 k Ω pull-up resistor connected between the transmitter input and V_{CC} pulls the input HIGH and forces the unused transmitter output to the LOW state.

With V_{CC} at 5V, the outputs will go from ($V^+ - 0.6V$) to V^- with no load and will swing $\pm 9V$ when loaded with 3 k Ω . The minimum output voltage swing, with V_{CC} at 4.5V and at maximum ambient temperature, is $\pm 5V$. This conforms to RS-232 specifications for "worst-case" conditions.

EIA/TIA RS-232E specs limit the slew rate at output to less than 30V/ μs .

The powered-down output impedance ($V_{CC} = 0V$) is a minimum of 300 Ω with $\pm 2V$ applied to outputs.



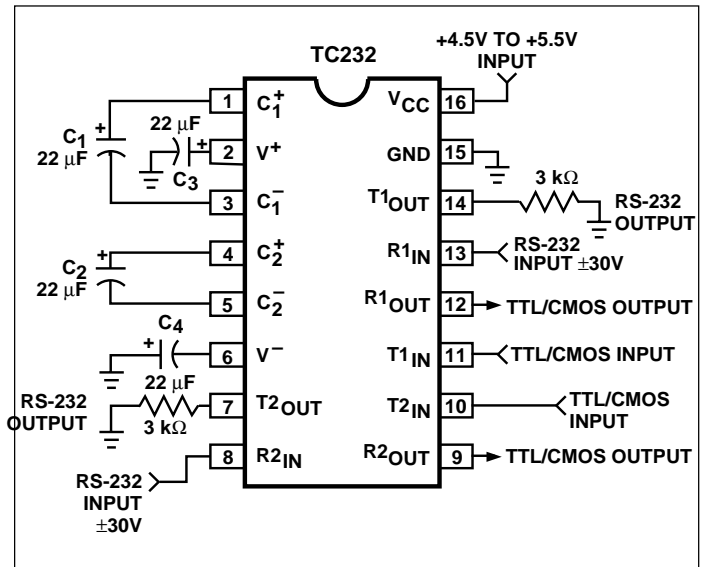
The outputs are protected and can be short-circuited to ground indefinitely.

Dual Receiver

TC232 receivers meet RS-232 input specifications. Input impedance is between 3 k Ω and 7 k Ω . Switching thresholds are within the $\pm 3V$ limits, and the receivers withstand up to $\pm 30V$ inputs. RS-232 and TTL/CMOS input compatible, the receivers have 0.8V V_{IL} and 2.4V V_{IH} with 0.5V hysteresis to reject noise.

The TTL/CMOS compatible receiver output is LOW when an RS-232 input is greater than 2.4V. It is HIGH when an input is floating or between +0.8V and -30V.

TEST CIRCUIT

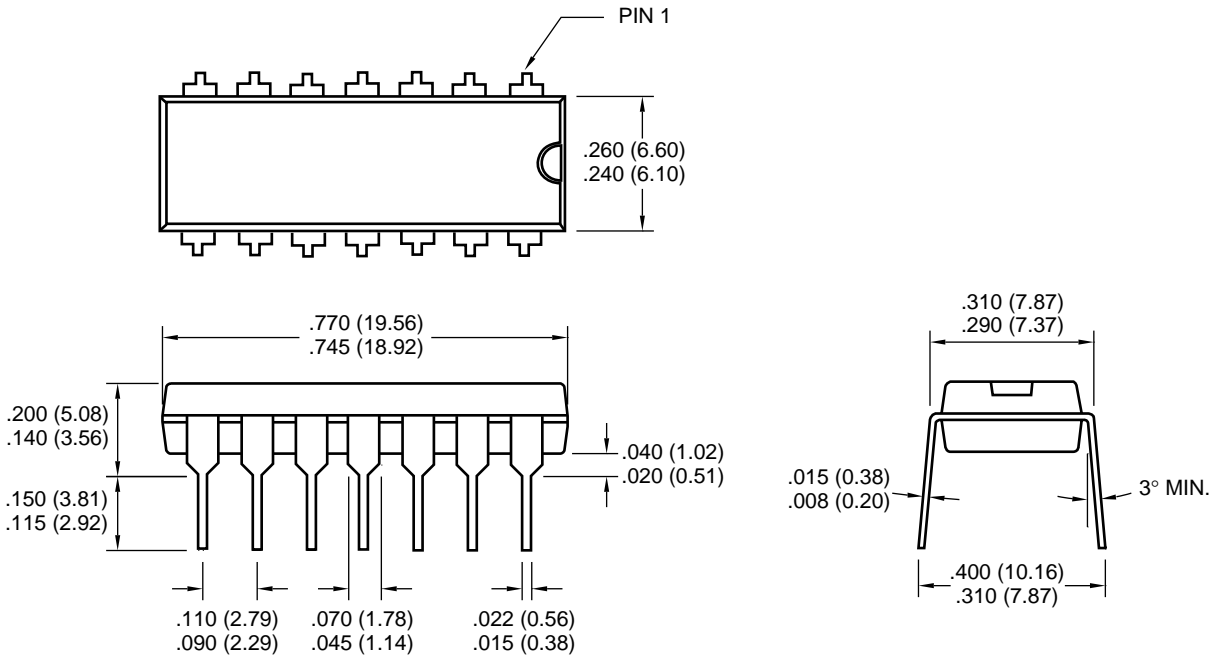


DUAL RS-232 TRANSMITTER/ RECEIVER AND POWER SUPPLY

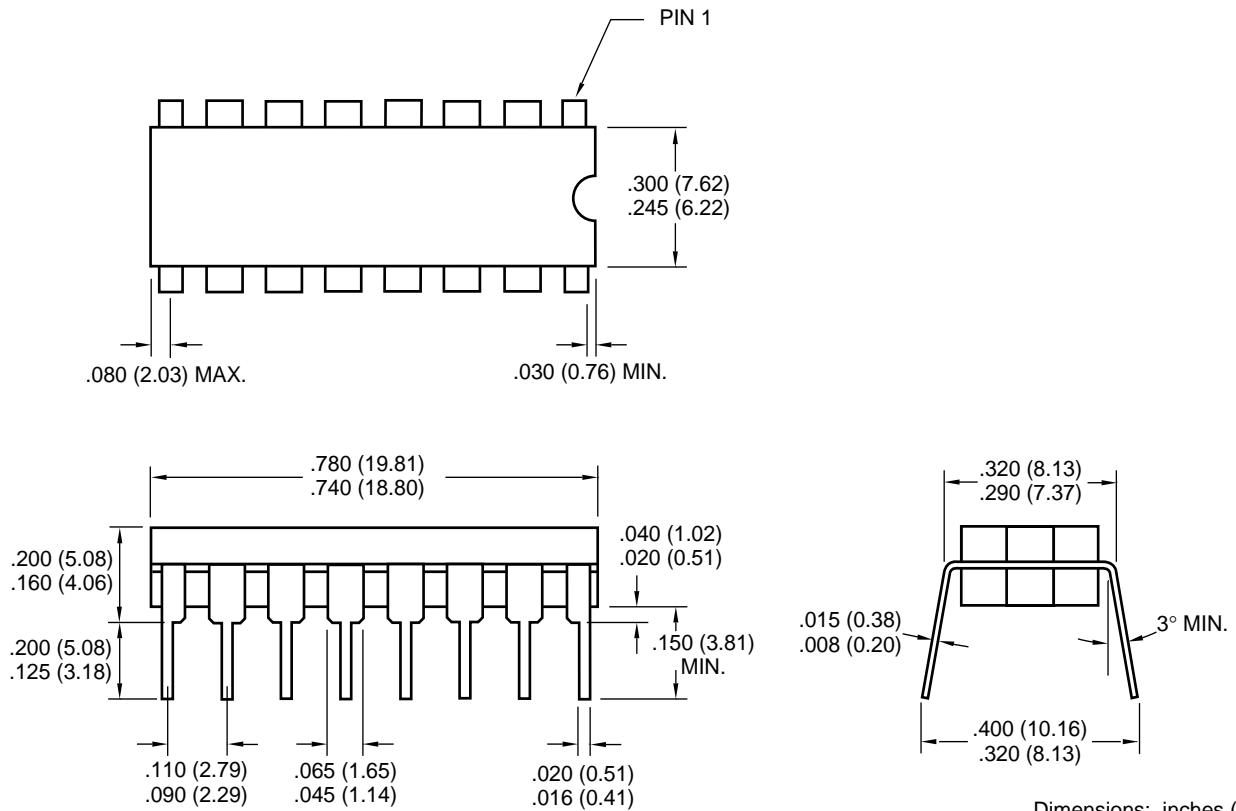
TC232

PACKAGE DIMENSIONS

16-Pin Plastic DIP



16-Pin CerDIP

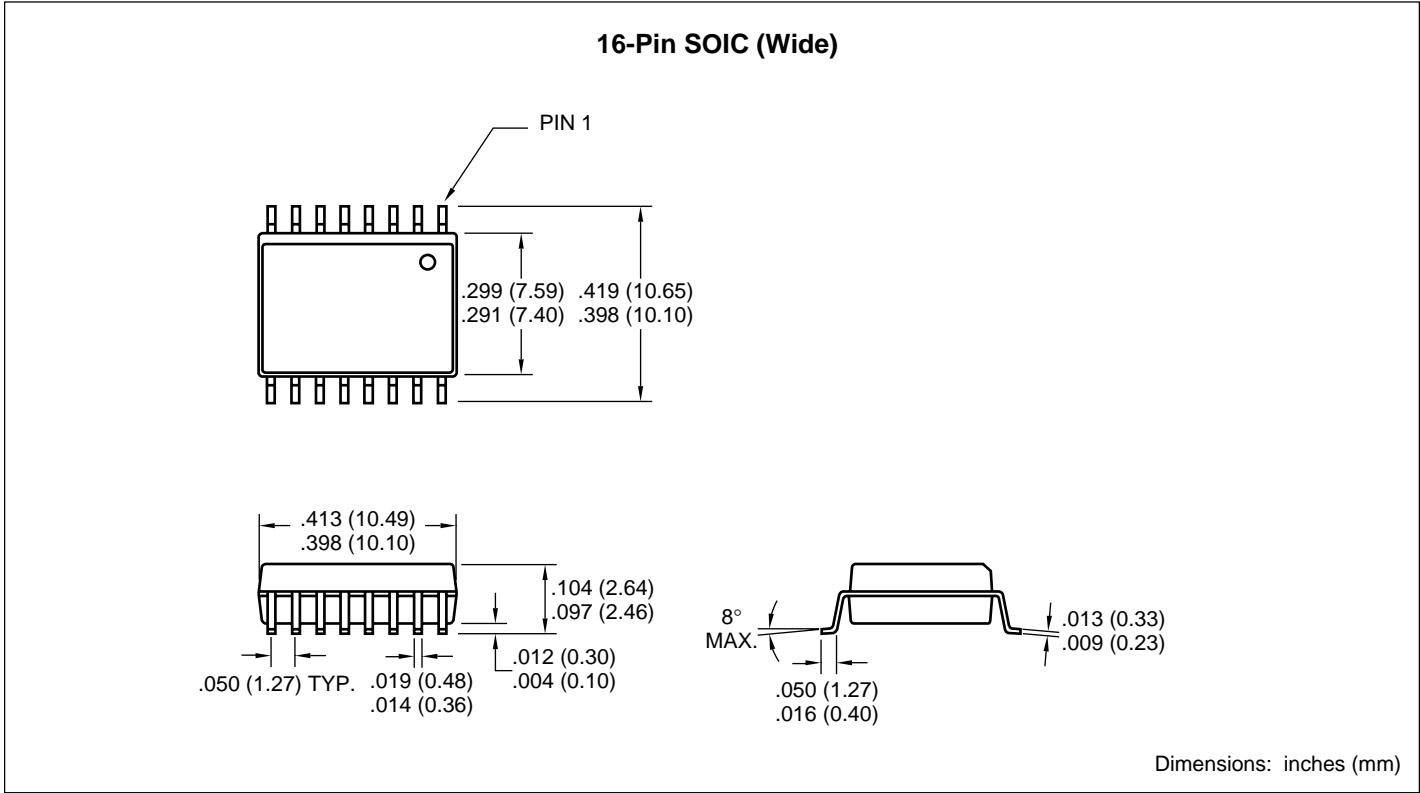


Dimensions: inches (mm)

DUAL RS-232 TRANSMITTER/ RECEIVER AND POWER SUPPLY

TC232

PACKAGE DIMENSIONS (Cont.)





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'Shaughnessey 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 høj 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 Trapu
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
Lochamer 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 Microchips 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.