

1.5A Dual High-Speed Power MOSFET Drivers

Features

- High-Speed Switching ($C_L = 1000\text{pF}$): 30nsec
- High Peak Output Current: 1.5A
- High Output Voltage Swing
 - $V_{DD} - 25\text{mV}$
 - $GND + 25\text{mV}$
- Low Input Current (Logic "0" or "1"): $1\mu\text{A}$
- TTL/CMOS Input Compatible
- Available in Inverting and Noninverting Configurations
- Wide Operating Supply Voltage
 - 4.5V to 18V
- Current Consumption
 - Inputs Low – 0.4mA
 - Inputs High – 8mA
- Single Supply Operation
- Low Output Impedance: 6Ω
- Pinout Equivalent of DS0026 and MMH0026
- Latch-Up Resistant: Withstands $> 500\text{mA}$ Reverse Current
- ESD Protected: 2kV

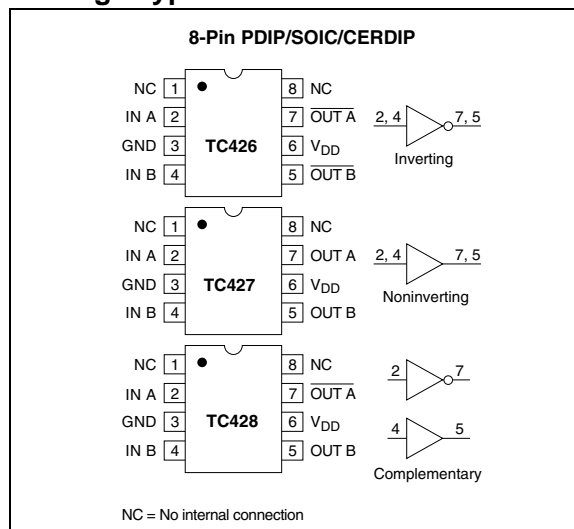
Applications

- Switch Mode Power Supplies
- Pulse Transformer Drive
- Clock Line Driver
- Coax Cable Driver

Device Selection Table

Part Number	Package	Configuration	Temp. Range
TC426COA	8-Pin SOIC	Inverting	0°C to $+70^\circ\text{C}$
TC426CPA	8-Pin PDIP	Inverting	0°C to $+70^\circ\text{C}$
TC426EOA	8-Pin SOIC	Inverting	-40°C to $+85^\circ\text{C}$
TC426EPA	8-Pin PDIP	Inverting	-40°C to $+85^\circ\text{C}$
TC426IJA	8-Pin CERDIP	Inverting	-25°C to $+85^\circ\text{C}$
TC426MJA	8-Pin CERDIP	Inverting	-55°C to $+125^\circ\text{C}$
TC427COA	8-Pin SOIC	Noninverting	0°C to $+70^\circ\text{C}$
TC427CPA	8-Pin PDIP	Noninverting	0°C to $+70^\circ\text{C}$
TC427EOA	8-Pin SOIC	Noninverting	-40°C to $+85^\circ\text{C}$
TC427EPA	8-Pin PDIP	Noninverting	-40°C to $+85^\circ\text{C}$
TC427IJA	8-Pin CERDIP	Noninverting	-25°C to $+85^\circ\text{C}$
TC427MJA	8-Pin CERDIP	Noninverting	-55°C to $+125^\circ\text{C}$
TC428COA	8-Pin SOIC	Complementary	0°C to $+70^\circ\text{C}$
TC428CPA	8-Pin PDIP	Complementary	0°C to $+70^\circ\text{C}$
TC428EOA	8-Pin SOIC	Complementary	-40°C to $+85^\circ\text{C}$
TC428EPA	8-Pin PDIP	Complementary	-40°C to $+85^\circ\text{C}$
TC428IJA	8-Pin CERDIP	Complementary	-25°C to $+85^\circ\text{C}$
TC428MJA	8-Pin CERDIP	Complementary	-55°C to $+125^\circ\text{C}$

Package Type



General Description

The TC426/TC427/TC428 are dual CMOS high-speed drivers. A TTL/CMOS input voltage level is translated into a rail-to-rail output voltage level swing. The CMOS output is within 25mV of ground or positive supply.

The low impedance, high-current driver outputs swing a 1000pF load 18V in 30nsec. The unique current and voltage drive qualities make the TC426/TC427/TC428 ideal power MOSFET drivers, line drivers, and DC-to-DC converter building blocks.

Input logic signals may equal the power supply voltage. Input current is a low $1\mu\text{A}$, making direct interface to CMOS/bipolar switch-mode power supply control ICs possible, as well as open-collector analog comparators.

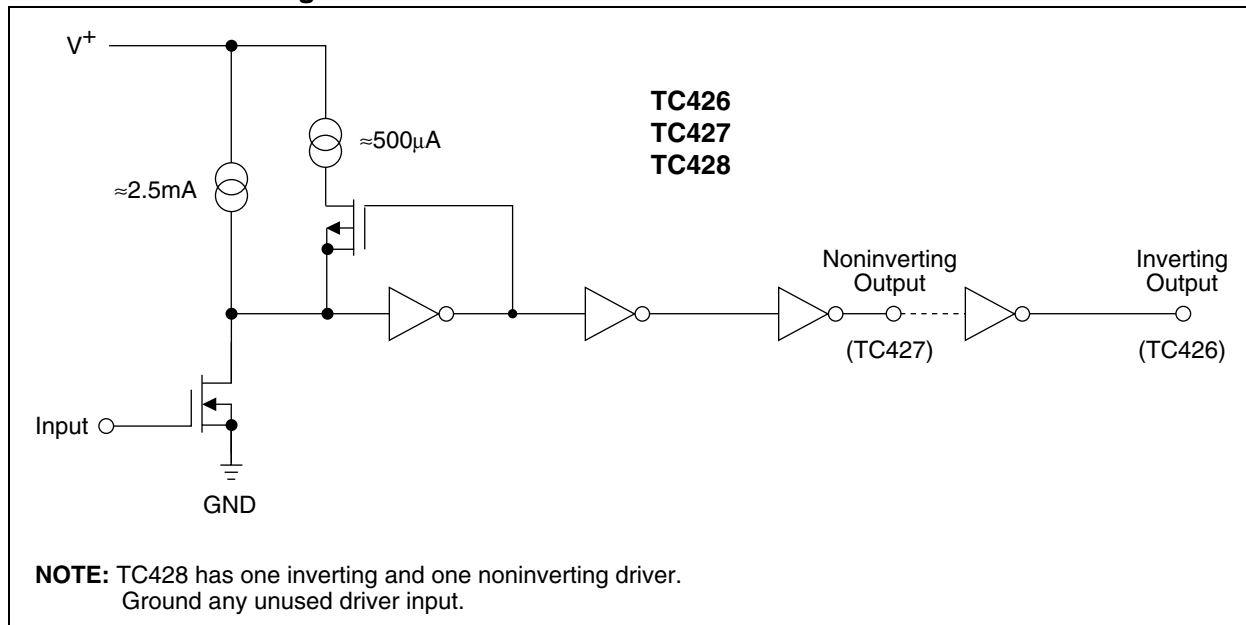
Quiescent power supply current is 8mA maximum. The TC426 requires 1/5 the current of the pin-compatible bipolar DS0026 device. This is important in DC-to-DC converter applications with power efficiency constraints and high-frequency switch-mode power supply applications. Quiescent current is typically 6mA when driving a 1000pF load 18V at 100kHz.

The inverting TC426 driver is pin-compatible with the bipolar DS0026 and MMH0026 devices. The TC427 is noninverting; the TC428 contains an inverting and non-inverting driver.

Other pin compatible driver families are the TC1426/TC1427/TC1428, TC4426/TC4427/TC4428 and TC4426A/TC4427A/TC4428A.

TC426/TC427/TC428

Functional Block Diagram



TC426/TC427/TC428

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings*

Supply Voltage.....	+20V
Input Voltage, Any Terminal	$V_{DD} + 0.3V$ to $GND - 0.3V$
Power Dissipation ($T_A \leq 70^\circ C$)	
PDIP.....	730mW
CERDIP.....	800mW
SOIC.....	470mW
Derating Factor	
PDIP.....	8mW/ $^\circ C$
CERDIP.....	6.4mW/ $^\circ C$
SOIC.....	4mW/ $^\circ C$
Operating Temperature Range	
C Version.....	$0^\circ C$ to $+70^\circ C$
I Version.....	$-25^\circ C$ to $+85^\circ C$
E Version.....	$-40^\circ C$ to $+85^\circ C$
M Version.....	$-55^\circ C$ to $+125^\circ C$
Storage Temperature Range.....	$-65^\circ C$ to $+150^\circ C$

*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.

TC426/TC427/TC428 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: $T_A = +25^\circ C$ with $4.5V \leq V_{DD} \leq 18V$, unless otherwise noted.						
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
Input						
V_{IH}	Logic 1, High Input Voltage	2.4	—	—	V	
V_{IL}	Logic 0, Low Input Voltage	—	—	0.8	V	
I_{IN}	Input Current	-1	—	1	μA	$0V \leq V_{IN} \leq V_{DD}$
Output						
V_{OH}	High Output Voltage	$V_{DD} - 0.025$	—	—	V	
V_{OL}	Low Output Voltage	—	—	0.025	V	
R_{OH}	High Output Resistance	—	10	15	Ω	$I_{OUT} = 10mA, V_{DD} = 18V$
R_{OL}	Low Output Resistance	—	6	10	Ω	$I_{OUT} = 10mA, V_{DD} = 18V$
I_{PK}	Peak Output Current	—	1.5	—	A	
Switching Time (Note 1)						
t_R	Rise Time	—	—	30	nsec	Figure 3-1, Figure 3-2
t_F	Fall Time	—	—	30	nsec	Figure 3-1, Figure 3-2
t_{D1}	Delay Time	—	—	50	nsec	Figure 3-1, Figure 3-2
t_{D2}	Delay Time	—	—	75	nsec	Figure 3-1, Figure 3-2
Power Supply						
I_S	Power Supply Current	—	—	8	mA	$V_{IN} = 3V$ (Both Inputs)
		—	—	0.4		$V_{IN} = 0V$ (Both Inputs)

Note 1: Switching times ensured by design.

TC426/TC427/TC428

TC426/TC427/TC428 ELECTRICAL SPECIFICATIONS (CONTINUED)

Electrical Characteristics: Over operating temperature range with $4.5V \leq V_{DD} \leq 18V$, unless otherwise noted.						
Input						
V_{IH}	Logic 1, High Input Voltage	2.4	—	—	V	
V_{IL}	Logic 0, Low Input Voltage	—	—	0.8	V	
I_{IN}	Input Current	-10	—	10	μA	$0V \leq V_{IN} \leq V_{DD}$
Output						
V_{OH}	High Output Voltage	$V_{DD} - 0.025$	—	—	V	
V_{OL}	Low Output Voltage	—	—	0.025	V	
R_{OH}	High Output Resistance	—	13	20	Ω	$I_{OUT} = 10mA, V_{DD} = 18V$
R_{OL}	Low Output Resistance	—	8	15	Ω	$I_{OUT} = 10mA, V_{DD} = 18V$
Switching Time (Note 1)						
t_R	Rise Time	—	—	60	nsec	Figure 3-1, Figure 3-2
t_F	Fall Time	—	—	60	nsec	Figure 3-1, Figure 3-2
t_{D1}	Delay Time	—	—	75	nsec	Figure 3-1, Figure 3-2
t_{D2}	Delay Time	—	—	120	nsec	Figure 3-1, Figure 3-2
Power Supply						
I_S	Power Supply Current	—	—	12	mA	$V_{IN} = 3V$ (Both Inputs)
		—	—	0.6		$V_{IN} = 0V$ (Both Inputs)

Note 1: Switching times ensured by design.

2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

TABLE 2-1: PIN FUNCTION TABLE

Pin No. (8-Pin PDIP, SOIC, CERDIP)	Symbol	Description
1	NC	No Internal Connection.
2	IN A	Control Input A, TTL/CMOS compatible logic input.
3	GND	Ground.
4	IN B	Control Input B, TTL/CMOS compatible logic input.
5	OUT B	CMOS totem-pole output.
6	V _{DD}	Supply input, 4.5V to 18V.
7	OUT A	CMOS totem-pole output.
8	NC	No internal Connection.

TC426/TC427/TC428

3.0 APPLICATIONS INFORMATION

3.1 Supply Bypassing

Charging and discharging large capacitive loads quickly requires large currents. For example, charging a 1000pF load to 18V in 25nsec requires an 0.72A current from the device power supply.

To ensure low supply impedance over a wide frequency range, a parallel capacitor combination is recommended for supply bypassing. Low-inductance ceramic disk capacitors with short lead lengths (< 0.5 in.) should be used. A 1μF film capacitor in parallel with one or two 0.1μF ceramic disk capacitors normally provides adequate bypassing.

3.2 Grounding

The TC426 and TC428 contain inverting drivers. Ground potential drops developed in common ground impedances from input to output will appear as negative feedback and degrade switching speed characteristics.

Individual ground returns for the input and output circuits or a ground plane should be used.

3.3 Input Stage

The input voltage level changes the no-load or quiescent supply current. The N-channel MOSFET input stage transistor drives a 2.5mA current source load. With a logic "1" input, the maximum quiescent supply current is 8mA. Logic "0" input level signals reduce quiescent current to 0.4mA maximum. Minimum power dissipation occurs for logic "0" inputs for the TC426/TC427/TC428. **Unused driver inputs must be connected to V_{DD} or GND.**

The drivers are designed with 100mV of hysteresis. This provides clean transitions and minimizes output stage current spiking when changing states. Input voltage thresholds are approximately 1.5V, making the device TTL compatible over the 4.5V to 18V supply operating range. Input current is less than 1μA over this range.

The TC426/TC427/TC428 may be directly driven by the TL494, SG1526/1527, SG1524, SE5560, and similar switch-mode power supply integrated circuits.

3.4 Power Dissipation

The supply current vs frequency and supply current vs capacitive load characteristic curves will aid in determining power dissipation calculations.

The TC426/TC427/TC428 CMOS drivers have greatly reduced quiescent DC power consumption. Maximum quiescent current is 8mA compared to the DS0026 40mA specification. For a 15V supply, power dissipation is typically 40mW.

Two other power dissipation components are:

- Output stage AC and DC load power.
- Transition state power.

Output stage power is:

$$P_o = P_{DC} + P_{AC} \\ = V_o (I_{DC}) + f C_L V_S^2$$

Where:

- V_o = DC output voltage
- I_{DC} = DC output load current
- f = Switching frequency
- V_s = Supply voltage

In power MOSFET drive applications the P_{DC} term is negligible. MOSFET power transistors are high impedance, capacitive input devices. In applications where resistive loads or relays are driven, the P_{DC} component will normally dominate.

The magnitude of P_{AC} is readily estimated for several cases:

- | | |
|----------------------------|----------------------------|
| A. | B. |
| 1. f = 200kHz | 1. f = 200kHz |
| 2. C _L = 1000pf | 2. C _L = 1000pf |
| 3. V _s = 18V | 3. V _s = 15V |
| 4. P _{AC} = 65mW | 4. P _{AC} = 45mW |

During output level state changes, a current surge will flow through the series connected N and P channel output MOSFETS as one device is turning "ON" while the other is turning "OFF". The current spike flows only during output transitions. The input levels should not be maintained between the logic "0" and logic "1" levels. **Unused driver inputs must be tied to ground and not be allowed to float.** Average power dissipation will be reduced by minimizing input rise times. As shown in the characteristic curves, average supply current is frequency dependent.

TC426/TC427/TC428

FIGURE 3-1: INVERTING DRIVER SWITCHING TIME TEST CIRCUIT

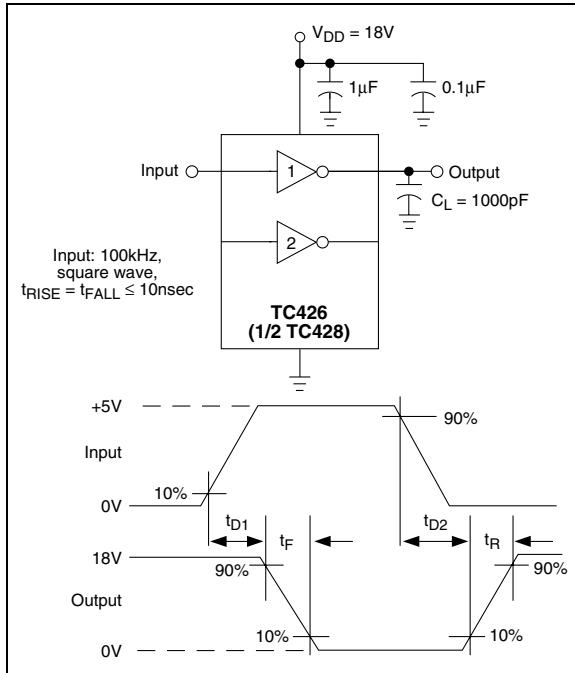


FIGURE 3-2: NONINVERTING DRIVER SWITCHING TIME TEST CIRCUIT

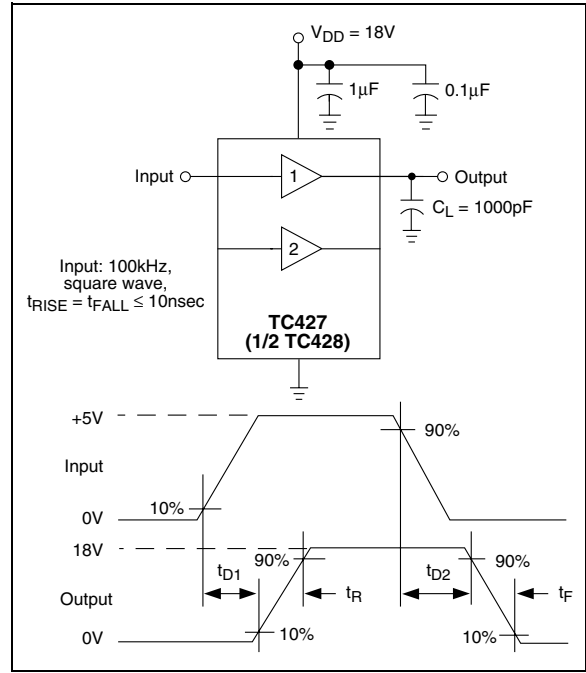


FIGURE 3-3: VOLTAGE DOUBLER

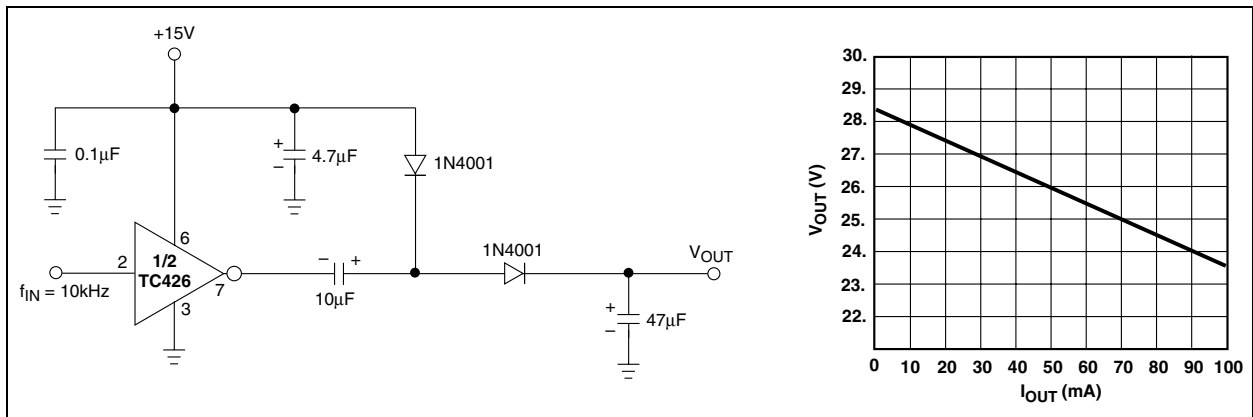
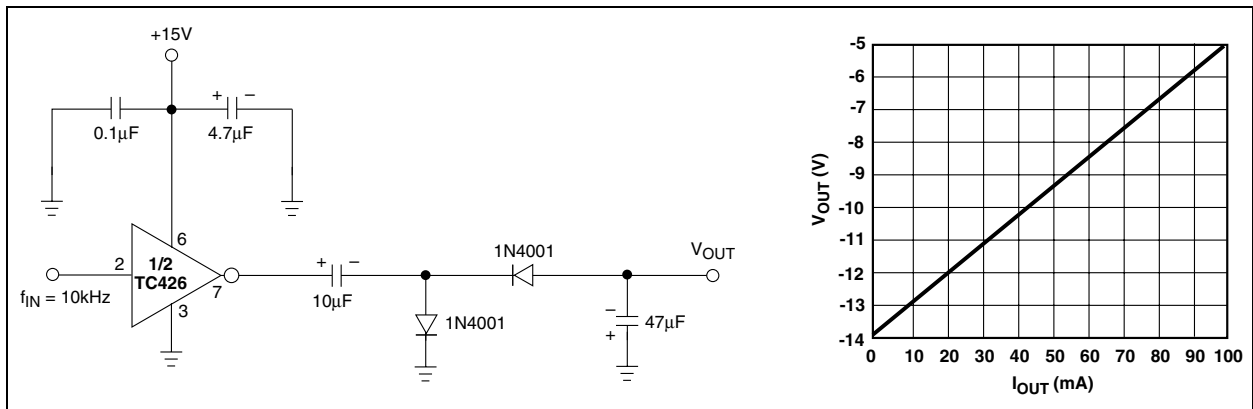


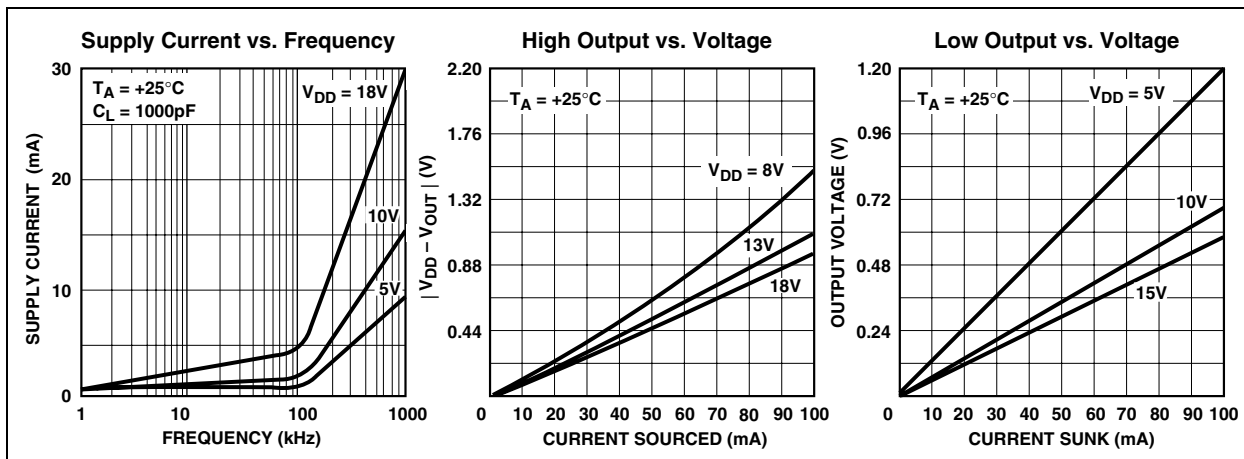
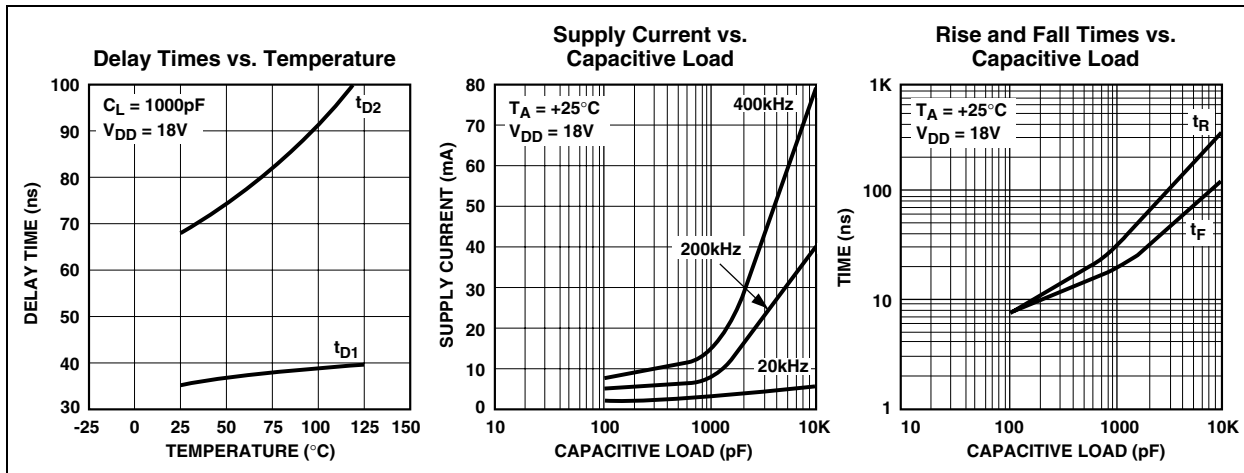
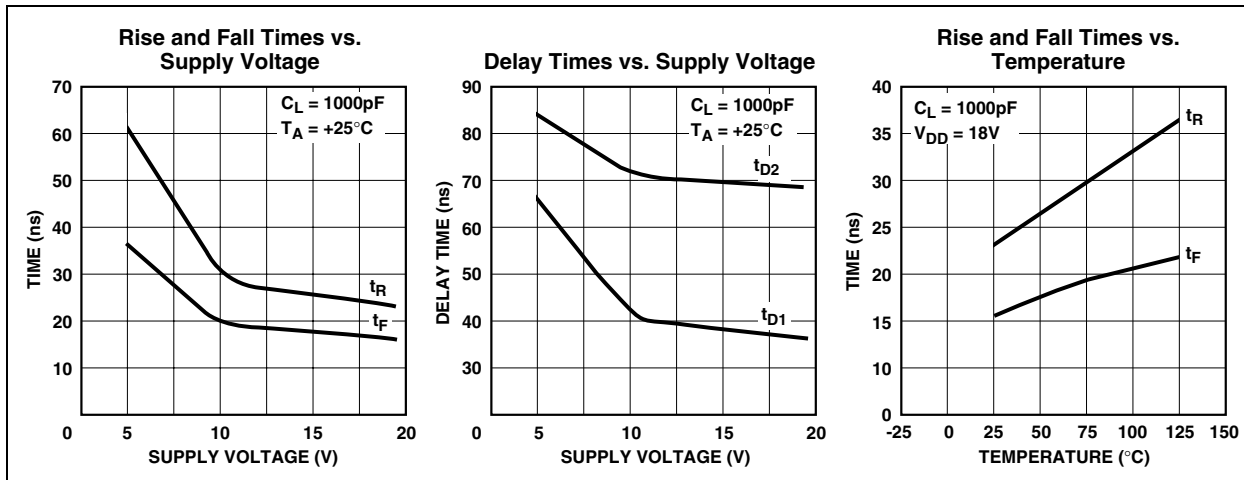
FIGURE 3-4: VOLTAGE INVERTER



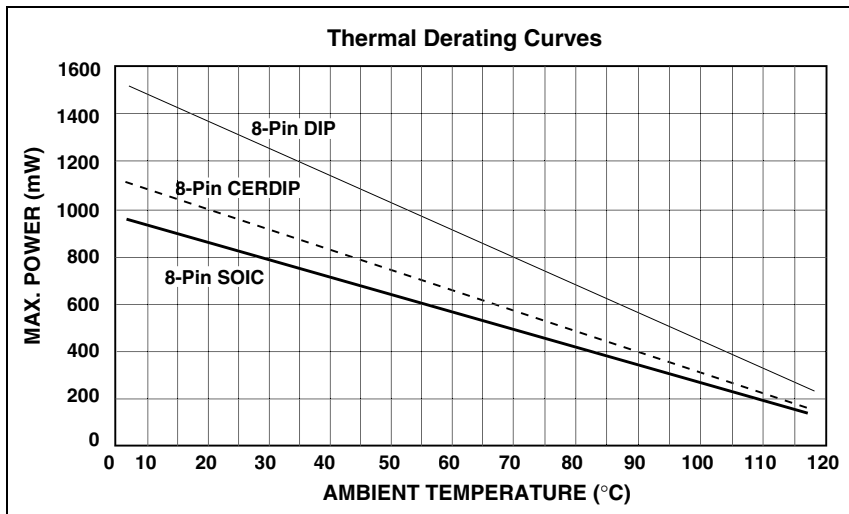
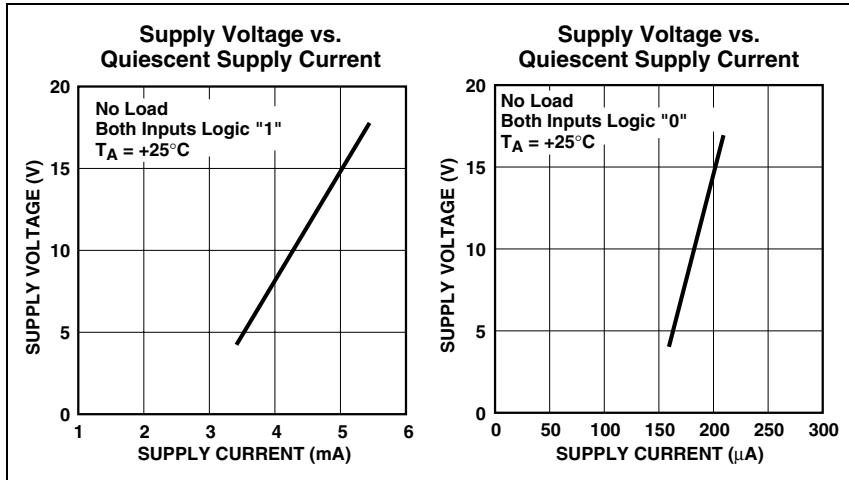
TC426/TC427/TC428

4.0 TYPICAL CHARACTERISTICS

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.



TYPICAL CHARACTERISTICS (CONTINUED)



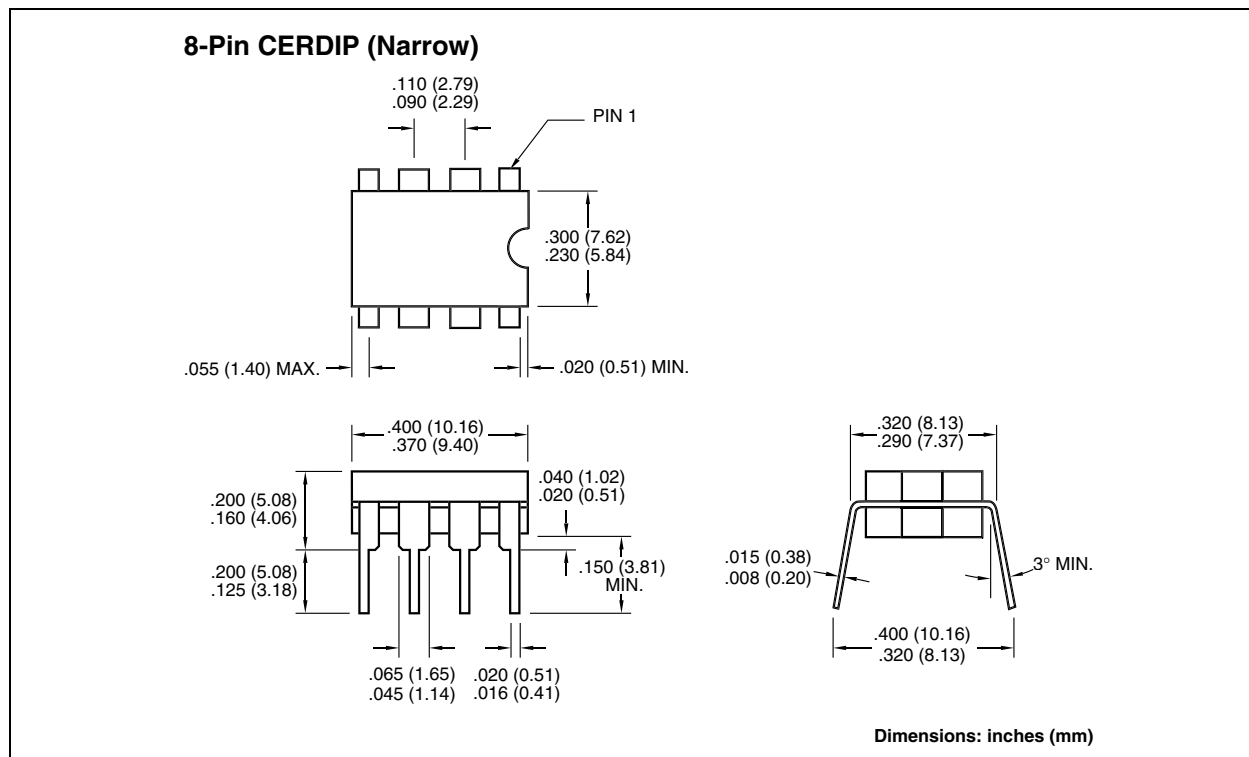
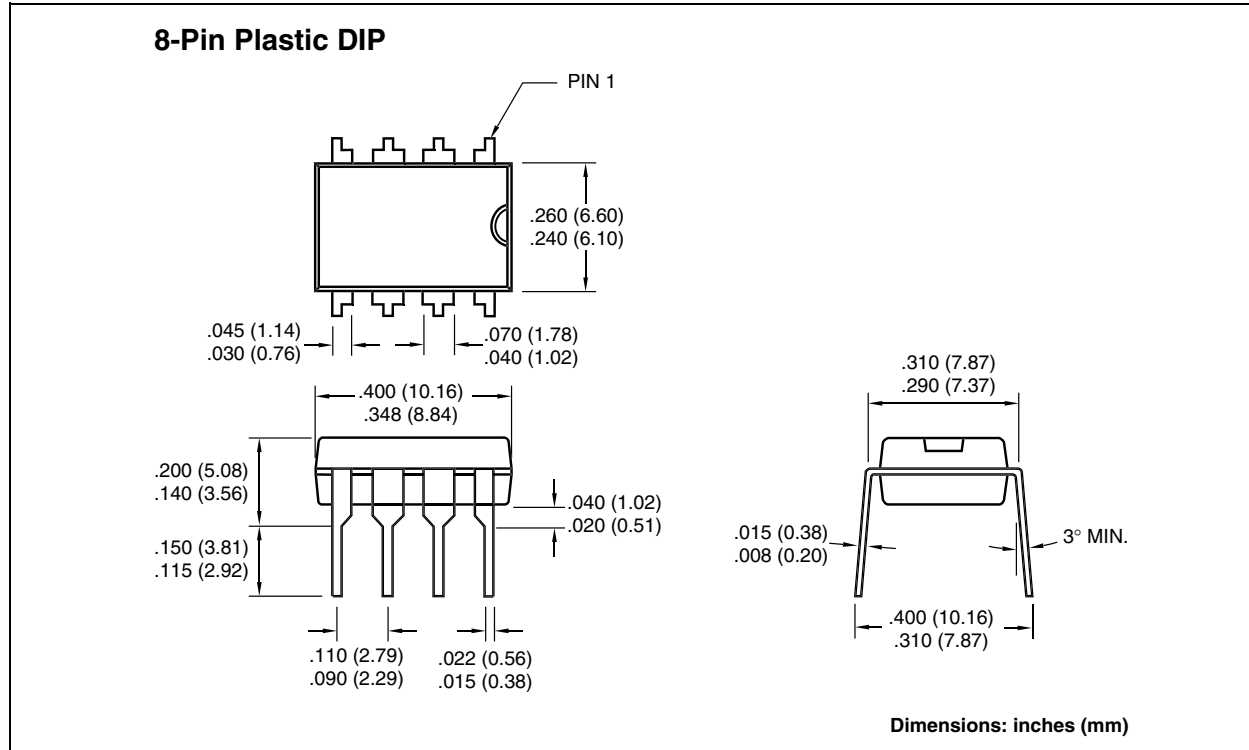
TC426/TC427/TC428

5.0 PACKAGING INFORMATION

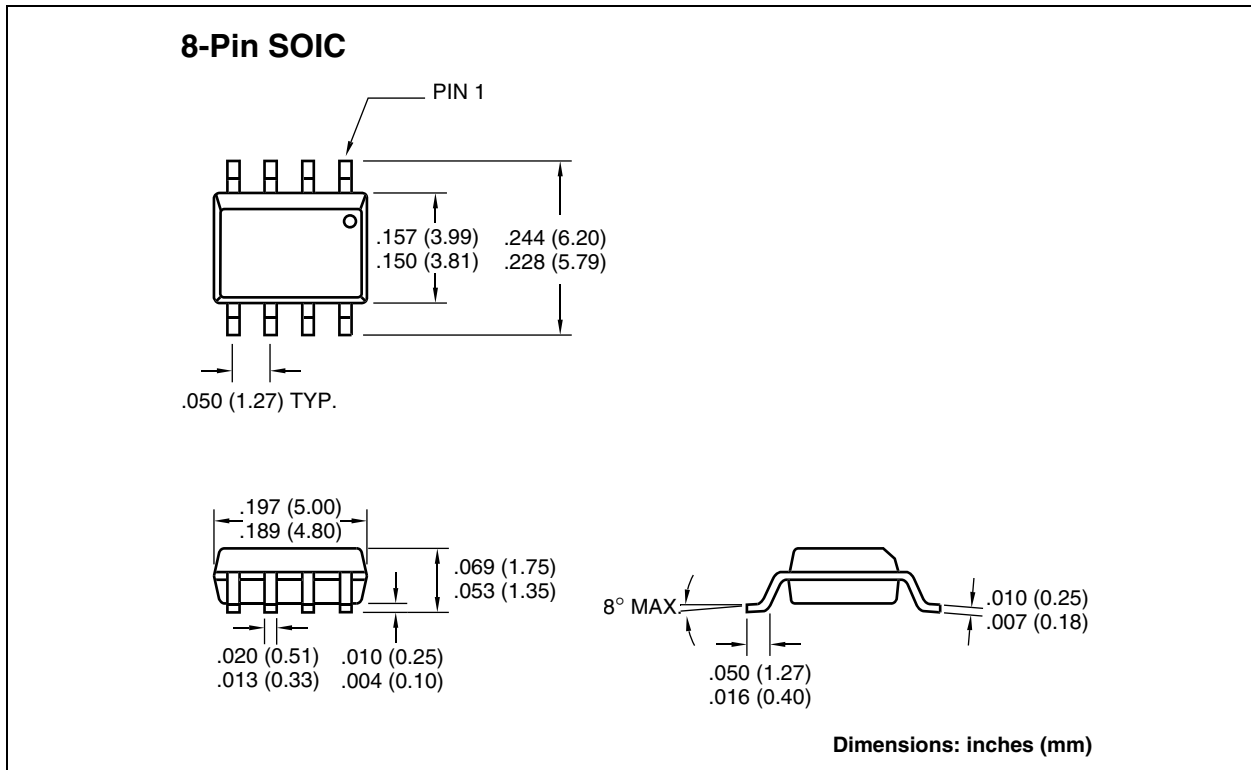
5.1 Package Marking Information

Package marking data not available at this time.

5.2 Package Dimensions



Package Dimensions (Continued)



TC426/TC427/TC428

NOTES:

Sales and Support

Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site (www.microchip.com)

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

New Customer Notification System

Register on our web site (www.microchip.com/cn) to receive the most current information on our products.

TC426/TC427/TC428

NOTES:

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, under any intellectual property rights.

Trademarks


The Microchip name and logo, the Microchip logo, FilterLab, KEELOQ, microID, MPLAB, PIC, PICmicro, PICMASTER, PICSTART, PRO MATE, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

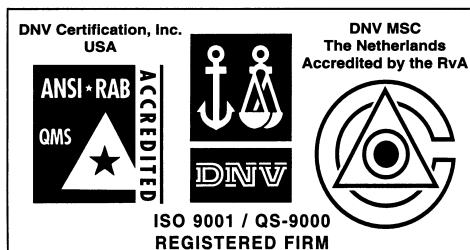
dsPIC, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, microPort, Migratable Memory, MPASM, MPLIB, MPLINK, MPSIM, MXDEV, PICC, PICDEM, PICDEM.net, rfPIC, Select Mode and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A.

Serialized Quick Turn Programming (SQTP) is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2002, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.



Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999 and Mountain View, California in March 2002. The Company's quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, non-volatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001 certified.



MICROCHIP

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

Boston

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

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

Detroit

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

Kokomo

2767 S. Albright Road
Kokomo, Indiana 46902
Tel: 765-864-8360 Fax: 765-864-8387

Los Angeles

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

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

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

China - Beijing

Microchip Technology Consulting (Shanghai)
Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu

Microchip Technology Consulting (Shanghai)
Co., Ltd., Chengdu Liaison Office
Rm. 2401, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-6766200 Fax: 86-28-6766599

China - Fuzhou

Microchip Technology Consulting (Shanghai)
Co., Ltd., Fuzhou Liaison Office
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

China - Shanghai

Microchip Technology Consulting (Shanghai)
Co., Ltd.
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

China - Shenzhen

Microchip Technology Consulting (Shanghai)
Co., Ltd., Shenzhen Liaison Office
Rm. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

Hong Kong

Microchip Technology Hongkong Ltd.
Unit 901-6, 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'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan

Microchip Technology Japan K.K.
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 135-882
Tel: 82-2-554-7200 Fax: 82-2-558-5934

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-6334-8870 Fax: 65-6334-8850

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

Denmark

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

France

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

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

Italy

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

03/01/02

