

3-Pin Reset Monitors for 3.3V Systems

Features

- Precision V_{CC} Monitor for 3.3V Systems
- 100msec Minimum $\overline{\text{RESET}}$, RESET Output Duration
- Output Valid to $V_{CC} = 1.2\text{V}$
- V_{CC} Transient Immunity
- Small 3-Pin SOT-23B Package
- No External Components

Applications

- Computers
- Embedded Systems
- Battery Powered Equipment
- Critical μP Power Supply Monitoring

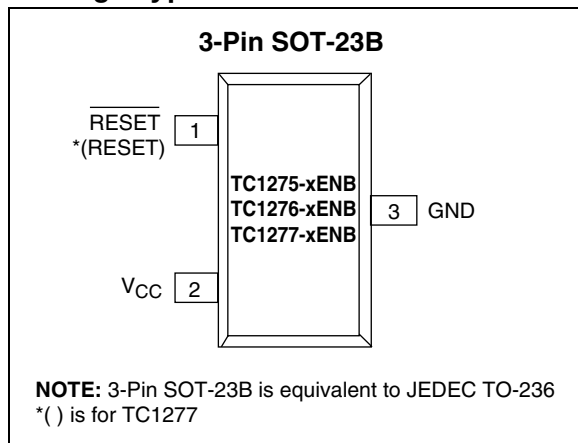
Device Selection Table

Part Number	Order	Package	Temp. Range
TC1275-xENB	Complimentary	3-Pin SOT-23B	-40°C to +85°C
TC1276-xENB	Open Drain	3-Pin SOT-23B	-40°C to +85°C
TC1277-xENB	Complimentary	3-Pin SOT-23B	-40°C to +85°C

NOTE: "x" denotes a suffix for V_{CC} threshold (see table below).

Suffix	Reset V_{CC} Threshold (V)
5	3.06
10	2.88
20	2.55

Package Type



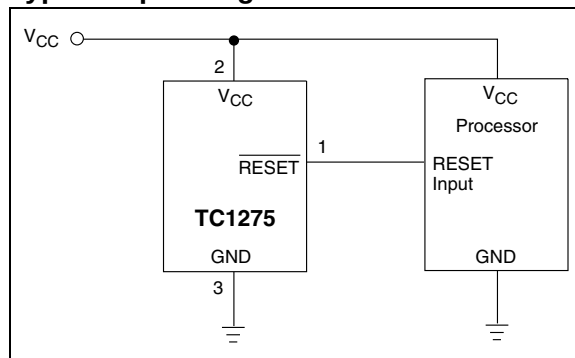
General Description

The TC1275/TC1276/TC1277 are cost-effective system supervisor circuits designed to monitor V_{CC} in digital systems and provide a reset signal to the host processor when necessary. No external components are required.

The reset output is driven active within 20 μsec of V_{CC} falling through the reset voltage threshold. RESET is maintained active for a minimum of 100msec after V_{CC} rises above the reset threshold. The TC1277 has an active-high RESET output while the TC1275 and TC1276 have an active-low RESET output. TC1275 and TC1277 each have a complimentary output while the TC1276 has an open drain output. The output of the TC1275 and TC1276 is valid down to $V_{CC} = 1.2\text{V}$. The TC1277 is valid down to $V_{CC} = 1.8\text{V}$. All three devices are available in a 3-Pin SOT-23B package.

The TC1275/TC1276/TC1277 devices are optimized to reject fast transient glitches on the V_{CC} line.

Typical Operating Circuit



TC1275/TC1276/TC1277

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings*

Supply Voltage (V_{CC} to GND) +6.0V
 $\overline{\text{RESET}}$, RESET -0.3V to (V_{CC} + 0.3V)
 Input Current, V_{CC} 20mA
 Output Current, $\overline{\text{RESET}}$, RESET 20mA
 Power Dissipation ($T_A \leq 70^\circ\text{C}$)
 3-Pin SOT-23B (derate 4mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$)
 230mW
 Operating Temperature Range -40°C to $+85^\circ\text{C}$
 Storage Temperature Range -65°C to $+150^\circ\text{C}$

*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.

TC1275/TC1276/TC1277 ELECTRICAL SPECIFICATIONS

Recommended DC Operating Conditions: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$.							
Symbol	Parameter	Min	Typ	Max	Units	Device	Test Conditions
V_{CC}	Supply Voltage	1.2 1.8	— —	5.5 5.5	V	TC1275, TC1276 TC1277	Note 1
DC Electrical Characteristics: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$.							
Symbol	Parameter	Min	Typ	Max	Units		Test Conditions
V_{OH}	Output Voltage @ 0-500 μA	$V_{CC} - 0.5\text{V}$	$V_{CC} - 0.1\text{V}$	—	V	TC1275, TC1277	Note 1
I_{OH}	Output Current @ 2.4 Volts $V_{CC} = 5\text{V}$ $V_{CC} = 2.7\text{V}$	— —	13 1.3	— —	mA	TC1275 TC1277	Note 2
I_{OL}	Output Current @ 0.4 Volts	+10	30	—	mA		Note 2, Note 5
I_{CC}	Operating Current $V_{CC} < 5.5\text{V}$ $V_{CCTP} < V_{CC} < 5.5\text{V}$ $V_{CC} < V_{CCTP}$	— — —	20 20 350	35 35 700	μA	TC1275, TC1277 TC1276 TC1276	Note 3 Note 3 Note 3
V_{CCTP-5}	V_{CC} Trip Point (TC1275/6/7-5)	2.98	3.06	3.15	V		Note 1
$V_{CCTP-10}$	V_{CC} Trip Point (TC1275/6/7-10)	2.80	2.88	2.97	V		Note 1
$V_{CCTP-20}$	V_{CC} Trip Point (TC1275/6/7-20)	2.47	2.55	2.64	V		Note 1
C_{OUT}	Output Capacitance	—	9	—	pF		
R_P	Internal Pull-Up Resistor	3.0	6.0	9.0	k Ω	TC1276	
AC Electrical Characteristics: $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$.							
Symbol	Parameter	Min	Typ	Max	Units		Test Conditions
t_{RST}	RESET Active Time	100	200	300	msec		
t_{RPD1}	V_{CC} Detect to $\overline{\text{RESET}}$	—	20	50	μsec	TC1275, TC1276	$V_{CC(LOW)} = 1\text{V}$, Figure 3-2
t_{RPD2}	V_{CC} Detect to RESET	—	20	50	μsec	TC1277	$V_{CC(LOW)} = 1\text{V}$, Figure 3-4
t_F	V_{CC} Slew Rate ($V_{CCTP(MAX)}$ to $V_{CCTP(MIN)}$)	300	—	—	μsec		Figure 3-2, Figure 3-4
t_R	V_{CC} Slew Rate ($V_{CCTP(MIN)}$ to $V_{CCTP(MAX)}$)	0	—	—	nsec		Figure 3-1, Figure 3-3
t_{RPU1}	V_{CC} Detect to $\overline{\text{RESET}}$	100	200	300	msec	TC1275, TC1276	Note 4, Figure 3-1
t_{RPU2}	V_{CC} Detect to RESET	100	200	300	msec	TC1277	Note 4, Figure 3-3

- Note** 1: All voltages referenced to ground.
 2: Measured with $V_{CC} \geq 2.7$ volts.
 3: Measured with RESET output open for TC1275/TC1276; measured with RESET output open for TC1277.
 4: $t_R = 5\mu\text{sec}$.
 5: A 1k Ω external resistor may be required in some applications for proper operation of the microprocessor reset control circuit when using the TC1276.

TC1275/TC1276/TC1277

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-23B)	Symbol	Description
1	$\overline{\text{RESET}}$ (TC1275/ TC1276)	$\overline{\text{RESET}}$ output remains low while V_{CC} is below the reset voltage threshold, and for 200msec (100msec min.) after V_{CC} rises above reset threshold. The output stage of the TC1275 is complimentary. The output stage of the TC1276 is open drain.
1	RESET (TC1277)	RESET output remains high while V_{CC} is below the reset voltage threshold, and for 200msec (100msec min.) after V_{CC} rises above reset threshold. The output stage of the TC1277 is complimentary.
2	V_{CC}	Supply voltage (1.2V to 5.5V TC1275 and TC1276, 1.8V to 5.5V TC1277).
3	GND	Ground.

TC1275/TC1276/TC1277

3.0 APPLICATIONS INFORMATION

3.1 Operation – Power Monitor

The TC1275/TC1276/TC1277 provide the function of detecting out-of-tolerance power supply conditions and warning a processor-based system of impending power failure. When V_{CC} is detected as out-of-tolerance, the RESET signal is asserted. On power-up, RESET is kept active for approximately 200msec after the power supply has reached the selected tolerance. This allows the power supply and microprocessor to stabilize before RESET is released.

FIGURE 3-1: Timing Diagram – Power Up (TC1275/TC1276)

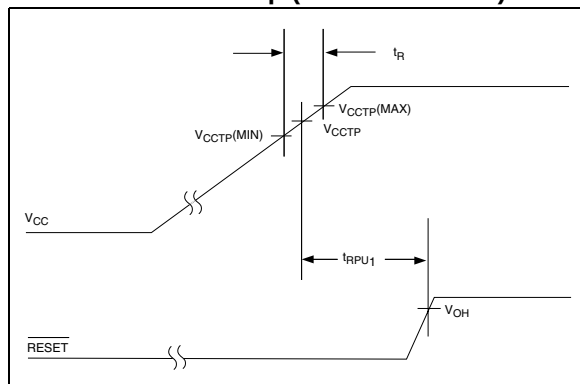


FIGURE 3-2: Timing Diagram – Power Down (TC1275/TC1276)

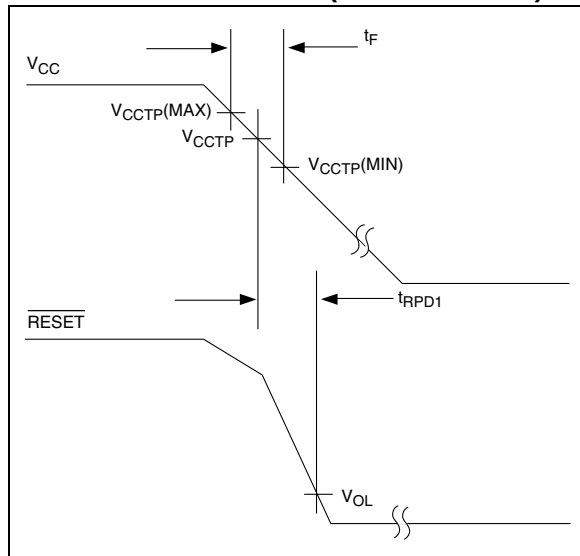


FIGURE 3-3: Timing Diagram – Power Up (TC1277)

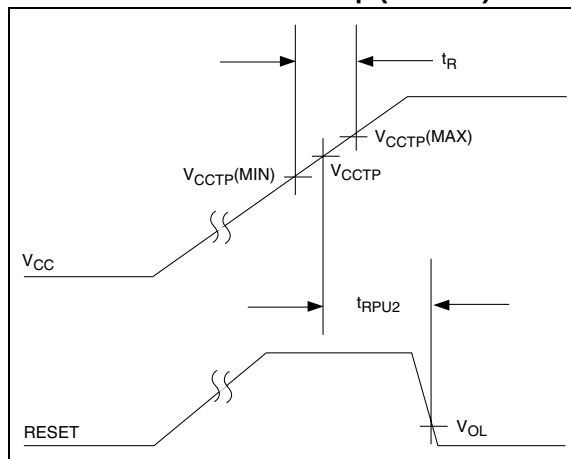
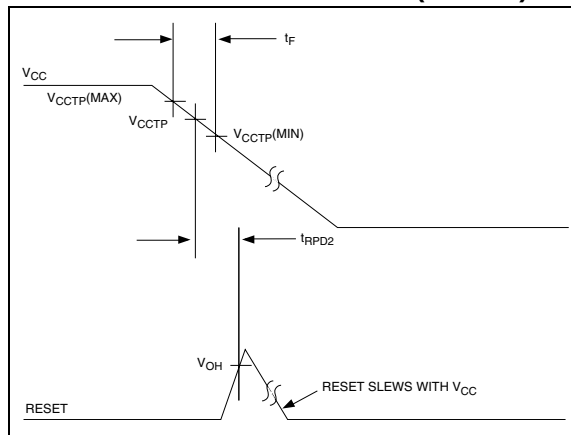


FIGURE 3-4: Timing Diagram – Power Down (TC1277)



3.2 V_{CC} Transient Rejection

The TC1275/TC1276/TC1277 provides accurate V_{CC} monitoring and reset timing during power-up, power-down, and brownout/sag conditions, and rejects negative-going transients (glitches) on the power supply line. Figure 3-5 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive that lays **under** the curve will **not** generate a reset signal. Combinations above the curve are detected as a brownout or power-down. Transient immunity can be improved by adding a capacitor in close proximity to the V_{CC} pin of the TC1275/TC1276/TC1277.

3.3 RESET Signal Integrity During Power-Down

The TC1275 $\overline{\text{RESET}}$ output is valid to $V_{CC} = 1.2V$. Below this voltage the output becomes an "open circuit" and does not sink current. This means CMOS logic inputs to the μP will be floating at an undetermined voltage. Most digital systems are completely shut down well above this voltage. However, in situations where $\overline{\text{RESET}}$ must be maintained valid to $V_{CC} = 0V$, a pull-down resistor must be connected from $\overline{\text{RESET}}$ to ground to discharge stray capacitances and hold the output low (Figure 3-6). This resistor value, though not critical, should be chosen such that it does not appreciably load $\overline{\text{RESET}}$ under normal operation (100k Ω will be suitable for most applications). Similarly, a pull-up resistor to V_{CC} is required for the TC1277 to ensure a valid high $\overline{\text{RESET}}$ for V_{CC} below 1.8V.

FIGURE 3-5: MAXIMUM TRANSIENT DURATION VS. OVERDRIVE FOR GLITCH REJECTION AT 25°C

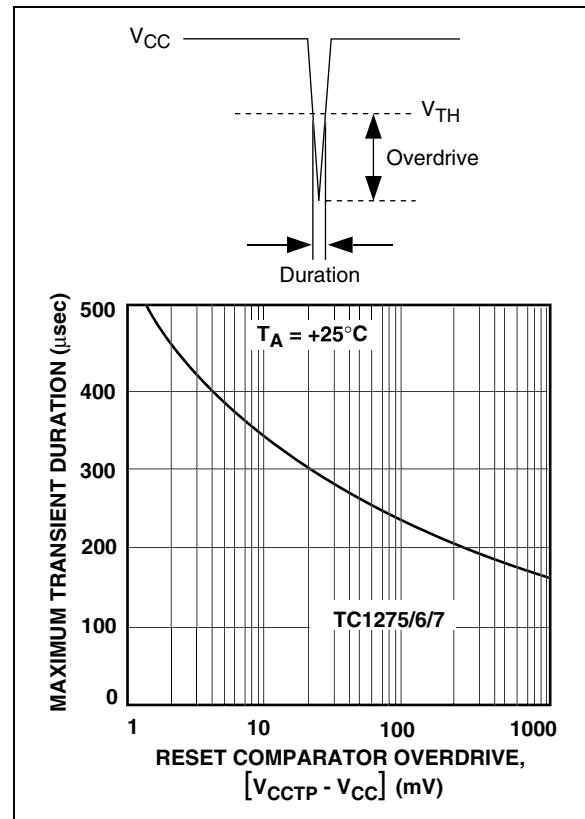
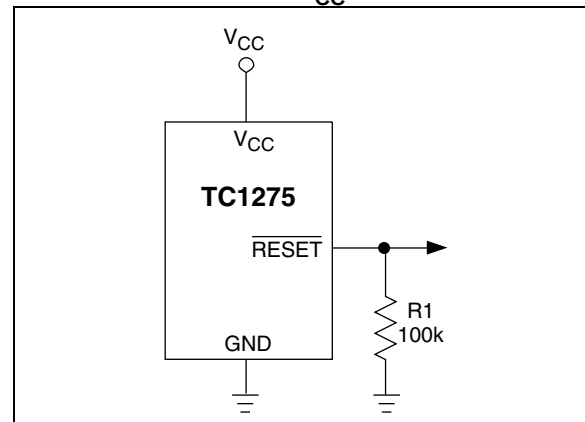


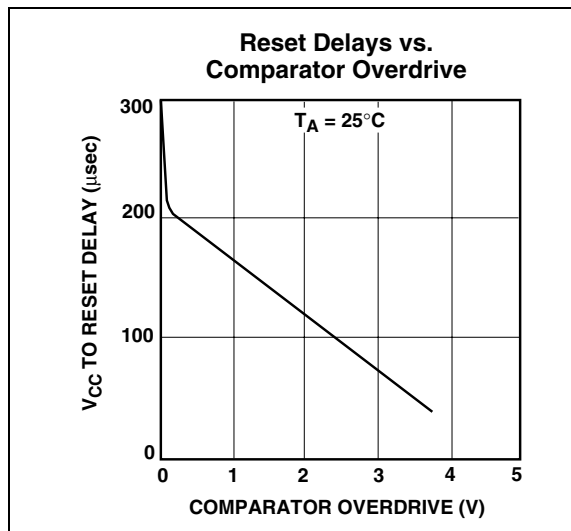
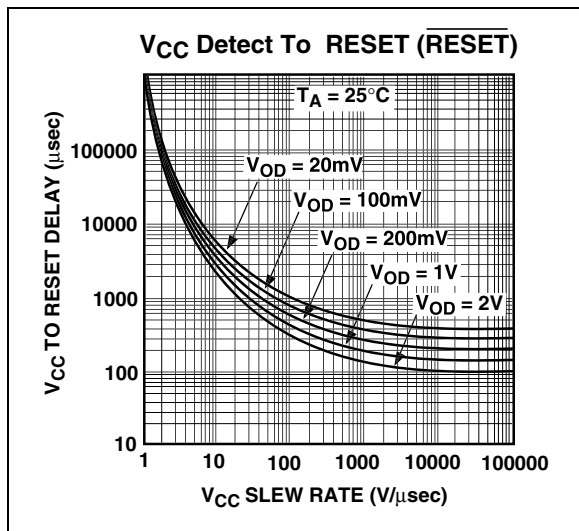
FIGURE 3-6: ENSURING $\overline{\text{RESET}}$ VALID TO $V_{CC} = 0V$



TC1275/TC1276/TC1277

4.0 TYPICAL CHARACTERISTICS

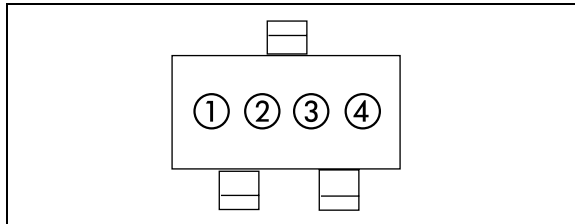
Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside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



TC1275/TC1276/TC1277

5.0 PACKAGING INFORMATION

5.1 Package Marking Information



① & ② = part number code + temperature range and voltage

TC1275 (V)	Code
2.55	DA
2.88	DB
3.06	DC

TC1276 (V)	Code
2.55	EA
2.88	EB
3.06	EC
TC1277 (V)	Code
2.55	FA
2.88	FB
3.06	FC

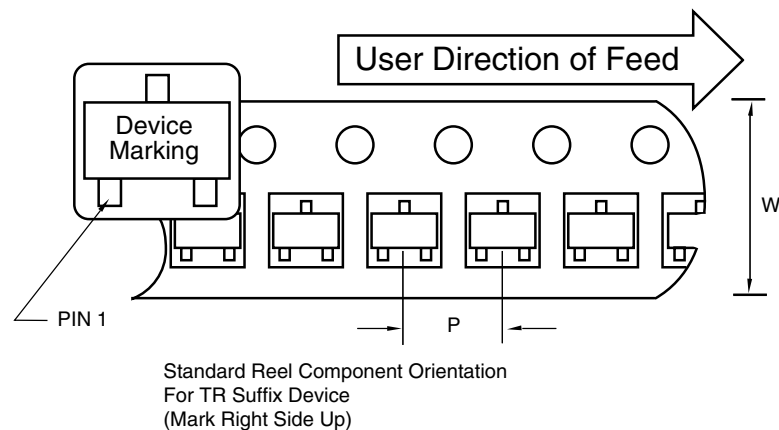
ex: 1275-20 = ⒹⒶ⓪⓪

③ represents year and quarter code

④ represents production lot ID code

5.2 Taping Form

Component Taping Orientation for 3-Pin SOT-23B (JEDEC TO-236) Devices



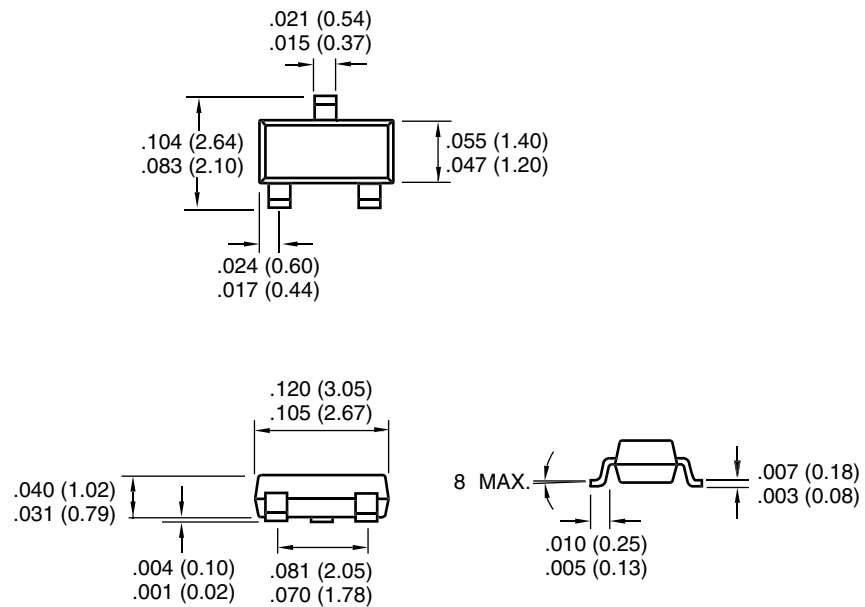
Carrier Tape, Number of Components Per Reel and Reel Size

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

TC1275/TC1276/TC1277

5.3 Package Dimensions

3-Pin SOT-23B



Dimensions: inches (mm)

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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:

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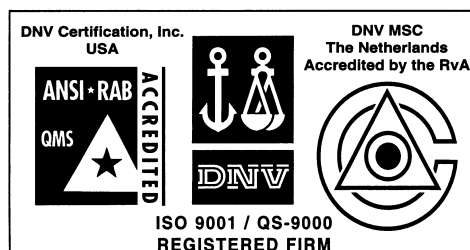
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Irvine, CA 92612
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New York

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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: 86-28-86766200 Fax: 86-28-86766599

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
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China - Hong Kong SAR

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

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Microchip Technology Japan K.K.
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Korea

Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
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Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
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Singapore, 188980
Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan

Microchip Technology Taiwan
11F-3, No. 207
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EUROPE

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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
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United Kingdom

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