VT-827

Voltage Controlled, Temperature Compensated Crystal Oscillator

Features

- Clipped Sine Wave or CMOS Output
- 8.000 MHz to 40.000 MHz Output
- ±2.5 ppm Temperature Stabilty
- Optional Frequency Tuning
- Fundamental Crystal Design
- Gold over Nickel Contact Pads
- Hermetically Sealed Ceramic 3.2 mm x 2.5 mm SMD Package
- Product is Compliant to RoHS Directive and Fully Compatible with Lead-Free Assembly

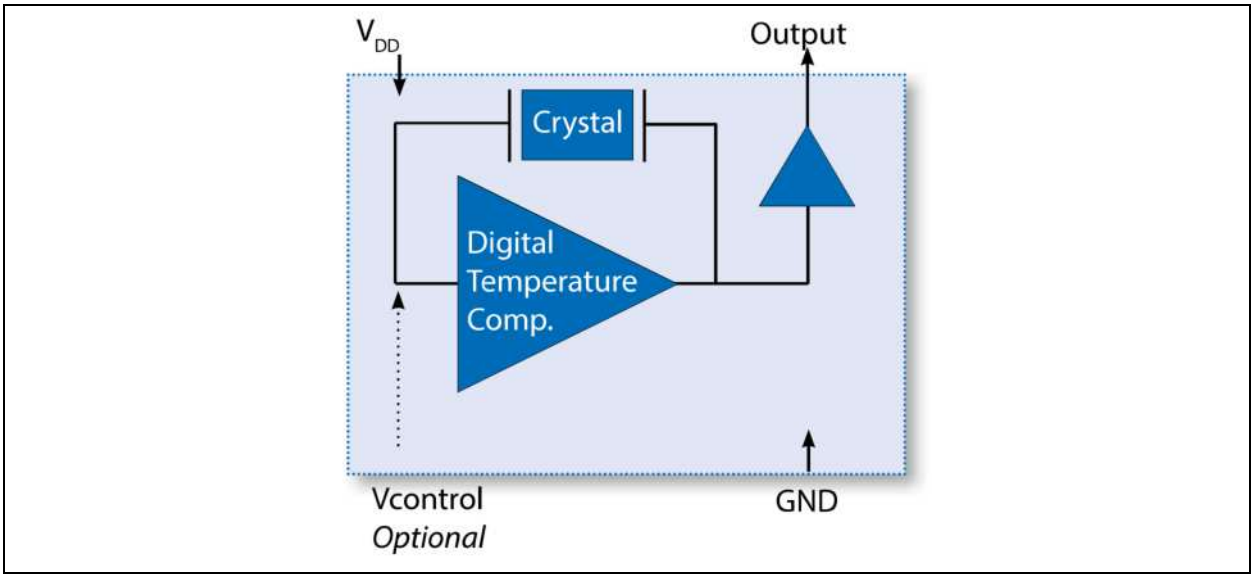
Applications

- Femto Cells
- Base Stations
- IP Networking
- Point-to-Point Radio
- Manpack Radio
- Test and Measurement

General Description

Microchip's VT-827 temperature compensated crystal oscillator (TCXO) is a quartz stabilized, clipped sine wave or CMOS output, digital temperature compensated oscillator that operates off a 2.5V, 3.0V, or 3.3V supply in a hermetically sealed 3.2 mm x 2.5 mm package

Block Diagram



© 2021 Microchip Technology Inc.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{DD}) ..... –0.3V to +4.0V
Control Voltage (V_C) ..... –0.3V to V_{DD} + 0.3V
ESD Rating, Human Body Model (Note 1) 600V
ESD Rating, Charged Device Model (Note 1) ..... 3 kV
Storage Temperature (T_S) ..... –55°C to +120°C

† Notice: Stresses in excess of the Absolute Maximum Ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in excess of conditions represented in the operational sections of this data sheet. Exposure to Absolute Maximum Ratings for extended periods may adversely affect device reliability.

Note 1: Although ESD protection circuitry has been designed into the VT-827, proper precautions should be taken when handling and mounting. Microchip employs a Human Body Model (HBM) and a Charged Device Model (CDM) for ESD susceptibility testing and design protection evaluation. ESD thresholds are dependent on the circuit parameters used to define the model. Although no industry standard has been adopted for the CDM, a standard resistance of 1.5 kΩ and capacitance of 100 pF is widely used and therefore can be used for comparison purposes.

ELECTRICAL CHARACTERISTICS, CMOS OUTPUT

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Frequency (Note 1)	f_O	8	—	40	MHz	Ordering Option
Supply Voltage (Note 2)	V_{DD}	—	2.5	—	V	Ordering Option
		—	3.0	—		
		—	3.3	—		
Supply Current	I_{DD}	—	—	6.0	mA	—
Operating Temperature	T_{OP}	–30	—	+85	°C	Ordering Option
		–40	—	+85		
Stability over Operating Temperature	—	—	—	±1.0	ppm	Ordering Option
		—	—	±1.5		
		—	—	±2.0		
		—	—	±2.5		
Initial Accuracy (Note 3)	—	—	—	±1.5	ppm	“No Adjust” option
Power Supply Stability, ±5% change	—	—	—	±0.3	ppm	—
Load Stability, ±5% change	—	—	—	±0.3	ppm	—
Aging	—	—	—	±1.0	ppm	1st year
Pull Range	PR	±5	—	—	ppm	Ordering Option
		±10	—	—		
		±12	—	—		
Control Voltage to Reach Pull Range	—	0.5	—	2.5	V	—
Control Voltage Impedance	—	100	—	—	kΩ	—

Note 1: The output is DC-coupled.
2: The VT-827 power supply pin should be filtered. For example, a 10 µF, 0.1 µF, and 0.01 µF.
3: After two IR reflows and 24 hours.
4: Measured at 10% and 90% of waveform.

© 2021 Microchip Technology Inc.

ELECTRICAL CHARACTERISTICS, CMOS OUTPUT (CONTINUED)

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions
Gain Slope	—	Positive			—	—
Output Level	V_{OH}	0.8 x V_{DD}	—	—	V	—
	V_{OL}	—	—	0.5	V	
Rise and Fall Time (Note 4)	t_r/t_f	—	—	10	ns	—
Duty Cycle	—	40	—	60	%	—
Output Load	—	—	15	—	pF	—
Phase Noise, 10 Hz	$Ø_N$	—	–80	—	dBc/Hz	30.000 MHz
Phase Noise, 100 Hz		—	–110	—		
Phase Noise, 1 kHz		—	–130	—		
Phase Noise, 10 kHz		—	–140	—		
Phase Noise, 100 kHz		—	–140	—		
Phase Noise, 1 MHz		—	–145	—		
Start Up Time	t_{SU}	—	—	2	ms	—

Note 1: The output is DC-coupled.

2: The VT-827 power supply pin should be filtered. For example, a 10 µF, 0.1 µF, and 0.01 µF.

3: After two IR reflows and 24 hours.

4: Measured at 10% and 90% of waveform.

© 2021 Microchip Technology Inc.

ELECTRICAL CHARACTERISTICS, CLIPPED SINE WAVE OUTPUT

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Frequency (Note 1)	f_O	8	—	40	MHz	Ordering Option
Supply Voltage (Note 2)	V_{DD}	—	2.5	—	V	Ordering Option
		—	3.0	—		
		—	3.3	—		
Supply Current	I_{DD}	—	—	2.0	mA	—
Operating Temperature	T_{OP}	–30	—	+85	°C	Ordering Option
		–40	—	+85		
Stability over Operating Temperature	—	—	—	±1.0	ppm	Ordering Option
		—	—	±1.5		
		—	—	±2.0		
		—	—	±2.5		
Initial Accuracy (Note 3)	—	—	—	±1.5	ppm	“No Adjust” option
Power Supply Stability, ±5% change	—	—	—	±0.3	ppm	—
Load Stability, ±5% change	—	—	—	±0.3	ppm	—
Aging	—	—	—	±1.0	ppm	1st year
Pull Range	PR	±5	—	—	ppm	Ordering Option
		±10	—	—		
		±12	—	—		
Control Voltage to Reach Pull Range	—	0.5	—	2.5	V	—
Control Voltage Impedance	—	100	—	—	kΩ	—
Gain Slope	—	Positive			—	—
Output Level	V_{OP-P}	0.8	—	—	V	—
Output Load	—	—	10K || 10	—	pF	—
Phase Noise, 10 Hz	$Ø_N$	—	–93	—	dBc/Hz	24.000 MHz
Phase Noise, 100 Hz		—	–120	—		
Phase Noise, 1 kHz		—	–138	—		
Phase Noise, 10 kHz		—	–145	—		
Phase Noise, 100 kHz		—	–148	—		
Phase Noise, 1 MHz		—	–153	—		
Start Up Time	t_{SU}	—	—	2	ms	—

Note 1: The output is DC-coupled.

2: The VT-827 power supply should be filtered. For example, a 10 µF, 0.1 µF, and 0.01 µF capacitor.

3: After two IR reflows and 24 hours.

© 2021 Microchip Technology Inc.

2.0 PIN DESCRIPTIONS

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

TABLE 2-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	NC or V_C	No connection or TCXO control voltage. See Note 1.
2	GND	Ground.
3	OUT	Output.
4	V_{DD}	Supply voltage.

Note 1: Pin 1 should not be left floating on the optional VCXO device. Pin 1 can be left open or set to GND on the non-VCXO option.

VCXO FUNCTION

The VT-827 is supplied with a VCXO function for applications where it will be used in a PLL or if the output frequency needs fine tuning or calibration adjustments. This is a high impedance input, 100 kΩ, and can be driven with an Op Amp or terminated with adjustable resistors. Pin 1 should not be left floating on the VCXO optional device. Pin 1 can be left open or set to GND on the non-VCXO option.

© 2021 Microchip Technology Inc.

3.0 RELIABILITY

Microchip qualification will include aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VT-827 family is capable of meeting the following qualification tests.

TABLE 3-1: ENVIRONMENTAL COMPLIANCE

Parameter	Conditions
Mechanical Shock	MIL-STD-883, Method 2002 (1500G, 0.5 ms)
Mechanical Vibration	MIL-STD-883, Method 2007 (20G peak acceleration)
Temperature Cycle	MIL-STD-883, Method 1010 (–55°C to +85°C)
Solderability	MIL-STD-883, Method 2003 (Lead-free solder)
Gross and Fine Leak	MIL-STD-883, Method 1014
Resistance to Solvents	MIL-STD-883, Method 2015 (IPA solvent)
Moisture Sensitivity Level	MSL 1
Contact Pads	Gold (0.3 µm min., 1.0 µm max.) over Nickel

4.0 IR REFLOW

Devices are built using lead-free epoxy and can be subjected to standard lead-free IR reflow conditions shown in Table 4-1. Contact pads are gold over nickel and lower maximum temperatures can also be used, such as 220°C.

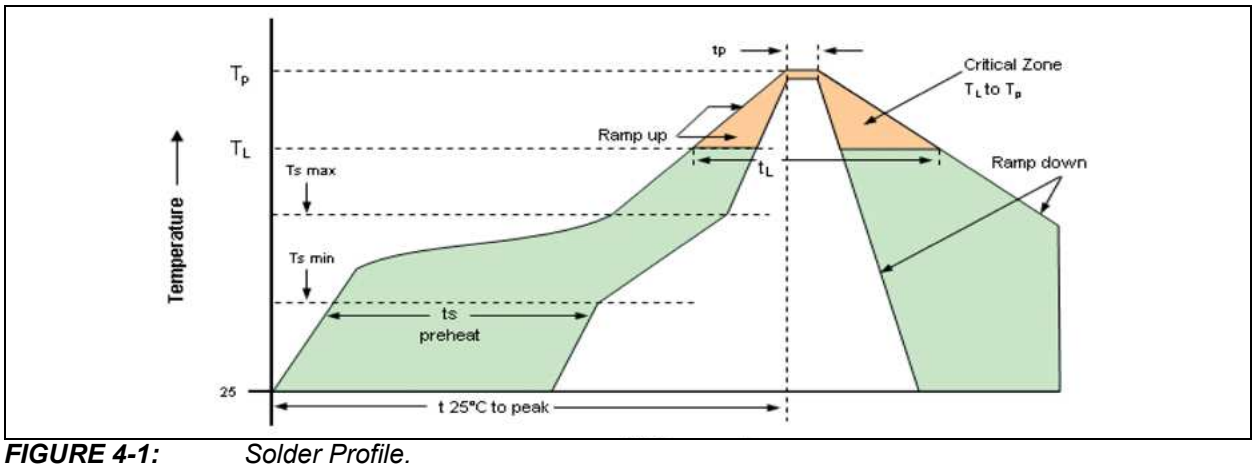


FIGURE 4-1: *Solder Profile.*

TABLE 4-1: REFLOW PROFILE

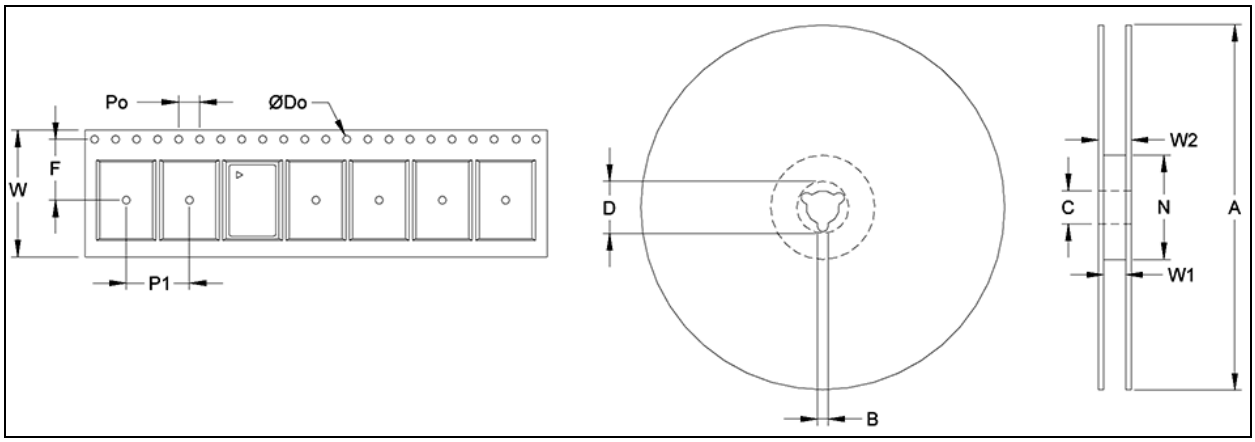
Parameter	Symbol	Value
Pre-Heat Time	t_S	200 seconds maximum
—	$T_{S(MIN)}$	150°C
—	$T_{S(MAX)}$	200°C
Ramp Up	R_{UP}	3°C/sec. maximum
Time above 217°C	t_L	150 seconds maximum
Time to Peak Temperature	T_{AMB-P}	480 seconds maximum
Time at 260°C	t_P	30 seconds maximum
Time at 240°C	t_{P2}	60 seconds maximum
Ramp Down	R_{DN}	6°C/sec. maximum

© 2021 Microchip Technology Inc.

5.0 TAPE AND REEL

TABLE 5-1: TAPE AND REEL DIMENSIONS

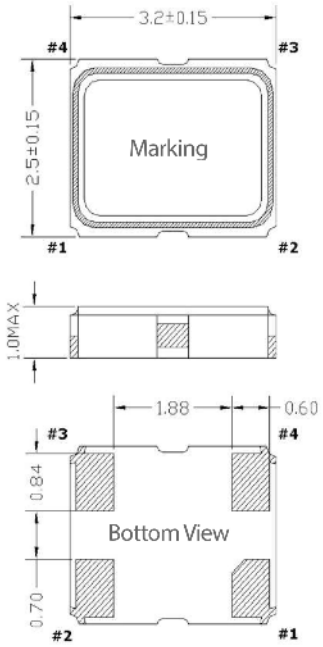
Tape Dimensions (mm)						Reel Dimensions (mm)							
Dimension	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	# per Reel
Tolerance	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Max	
VT-827	8	3.5	1.5	4	4	178	2	13	21	60	10	14	1000



6.0 PACKAGING INFORMATION

4-Lead 3.2 mm x 2.5 mm VDFN Package Outline and Recommended Land Pattern

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Marking
VFFMFFF
.YYWW KH
where
V = Vectron
FFMFFF = Frequency, eg 25M000 = 25.000MHz
YY= Year, MM= Month, KH = Manufacturing location

Dimensions in mm

© 2021 Microchip Technology Inc.

APPENDIX A: REVISION HISTORY

Revision A (April 2021)

- Converted Vectron document VT-827 to Microchip data sheet template DS20006523A.
- Minor grammatical text changes throughout.

NOTES:

© 2021 Microchip Technology Inc.

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

Device	-X	X	X	-XXX	X	-XXXXXXXXXX	XX
Part No.	Power Supply	Output	Temp. Range	Stability	Tuning	Frequency	Packaging

Device:	VT-827:	Voltage Controlled, Temperature Compensated Crystal Oscillator in 4-Lead 3.2 mm x 2.5 mm VDFN
Power Supply:	E = 3.3VDC ±5% F = 3.0VDC ±5% H = 2.5VDC ±5%	
Output:	A = CMOS F = Clipped Sine Wave	
Temperature Range:	E = –40°C to +85°C H = –30°C to +85°C	
Stability:	106 = ±1.0 ppm 156 = ±1.5 ppm 206 = ±2.0 ppm 256 = ±2.5 ppm	
Tuning:	0 = Fixed, No Tuning A = ±5 ppm C = ±10 ppm D = ±12 ppm	
Frequency:	xxMxxxxxxx=Frequency in MHz	
Packaging:	TR = 1,000/Reel <blank>= Cut Tape/ non-TR quantities	

Examples:

a) VT-827-EAH-106C-14M7456000TR:
VT-827, 3.3VDC, CMOS Output, –30°C to +85°C Temp Range, ±1.0 ppm Stability, ±10 ppm Tuning, 14.7456 MHz, 1000/Reel

b) VT-827-HFH-256A-38M4000000TR:
VT-827, 2.5VDC, Clipped Sine Wave Output, –30°C to +85°C Temp Range, ±2.5 ppm Stability, ±5 ppm Tuning, 38.400 MHz, 1000/Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

Note: Not all combinations of options are available. ±2.5 ppm stability over the –30°C to +85°C range is the standard best option. Check with the factory on combination and frequency.

TABLE 1: STANDARD FREQUENCIES

8.000 MHz	10.000 MHz	12.000 MHz	12.800 MHz	13.000 MHz	14.400 MHz
14.7456 MHz	16.000 MHz	16.384 MHz	18.432 MHz	19.200 MHz	19.53125 MHz
20.000 MHz	22.5792 MHz	24.000 MHz	25.000 MHz	26.000 MHz	27.000 MHz
30.000 MHz	30.720 MHz	31.250 MHz	32.000 MHz	33.1776 MHz	36.000 MHz
38.400 MHz	40.000 MHz	—	—	—	—

NOTES:

© 2021 Microchip Technology Inc.

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable." Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication is provided for the sole purpose of designing with and using Microchip products. Information regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SMART-I.S., storClad, SQI, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

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

© 2021, Microchip Technology Incorporated, All Rights Reserved.

ISBN: 978-1-5224-8185-0

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:
http://www.microchip.com/support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880- 3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

© 2021 Microchip Technology Inc.