



# ATmega48A/PA/88A/PA/ 168A/PA/328/P

---

## Silicon Errata and Data Sheet Clarifications

---

### Introduction

---

The ATmega48A/PA/88A/PA/168A/PA/328/P devices you have received conform functionally to the current device data sheet ([www.microchip.com/DS40002061](http://www.microchip.com/DS40002061)), except for the anomalies described in this document. The erratas described in this document will likely be addressed in future revisions of the ATmega48A/PA/88A/PA/168A/PA/328/P devices.

**Note:**

- This document summarizes all the silicon errata issues from all revisions of silicon, previous as well as current.

### 1. Silicon Issue Summary

#### Legend

- Erratum is not applicable.
- X Erratum is applicable.

Peripheral	Short Description	Valid for Silicon Revision								
		ATmega48A/PA		ATmega88A/PA		ATmega168A/PA		ATmega328/P		
		Rev. D (1)	Rev. E	Rev. F (1)	Rev. G	Rev. E (1)	Rev. L	Rev. A	Rev. B	Rev. D
System Clock and Clock Options	<a href="#">2.2.1. Unstable 32 kHz Oscillator</a>	-	-	-	-	-	-	X	X	-
TWI	<a href="#">2.3.1. TWI Data Setup Time Can Be Too Short</a>	X	X	X	X	X	X	-	-	X
Analog Comparator	<a href="#">2.4.1. Analog MUX Can Be Turned Off When Setting the ACME Bit</a>	X	X	X	X	X	X	X	X	X

#### Note:

1. This revision is the initial release of the silicon.

The following silicon revisions were never released to production:

- ATmega168A/PA
  - Rev. F-K
- ATmega328/P
  - Rev. C

## 2. Silicon Errata Issues

### 2.1 Errata Details

- Erratum is not applicable.
- X Erratum is applicable.

### 2.2 System Clock and Clock Options

#### 2.2.1 Unstable 32 kHz Oscillator

The 32 kHz oscillator does not work as a system clock and if it used as an asynchronous timer, it is inaccurate.

##### Work around

None.

##### Affected Silicon Revisions

ATmega48A/PA		
Rev. D	Rev. E	
-	-	
ATmega88A/PA		
Rev. F	Rev. G	
-	-	
ATmega168A/PA		
Rev. E	Rev. L	
-	-	
ATmega328/P		
Rev. A	Rev. B	Rev. D
X	X	-

### 2.3 TWI - Two-Wire Interface

#### 2.3.1 TWI Data Setup Time Can Be Too Short

When running the device as a TWI slave with a system clock above 2 MHz, the data setup time for the first bit after ACK may, in some cases, be too short. This may cause a false start or stop condition on the TWI line.

##### Work around

Insert a delay between setting TWDR and TWCR.

### Affected Silicon Revisions

ATmega48A/PA		
Rev. D	Rev. E	
X	X	
ATmega88A/PA		
Rev. F	Rev. G	
X	X	
ATmega168A/PA		
Rev. E	Rev. L	
X	X	
ATmega328/P		
Rev. A	Rev. B	Rev. D
-	-	X

## 2.4 AC - Analog Comparator

### 2.4.1 Analog MUX Can Be Turned Off When Setting the ACME Bit

If the ACME (Analog Comparator Multiplexer Enabled) bit in ADCSRB is set while MUX3 in ADMUX is '1' (ADMUX[3:0]=1xxx), all MUXs are turned off until the ACME bit is cleared.

#### Work around

Clear the MUX3 bit before setting the ACME bit.

### Affected Silicon Revisions

ATmega48A/PA		
Rev. D		Rev. E
X		X
ATmega88A/PA		
Rev. F		Rev. G
X		X
ATmega168A/PA		
Rev. E		Rev. L
X		X
ATmega328/P		
Rev. A	Rev. B	Rev. D
X	X	X

### 3. Data Sheet Clarifications

The following typographic corrections and clarifications are to be noted for the latest version of the device data sheet ([www.microchip.com/DS40002061](http://www.microchip.com/DS40002061)).

**Note:** Corrections are shown in **bold**. Where possible, the original bold text formatting has been removed for clarity.

#### 3.1 Ordering Information

A clarification has been made to tables titled 'Package Type' for all devices documented in the data sheet:

- A note to the 32M1-A row was added informing that the package type can be delivered in two different styles

Package Type	
32A	32-lead, (1.0 mm) Plastic Thin Quad Flat Package (TQFP)
28M1	28-pad, 4 x 4 x 1.0 body, Lead Pitch 0.45 mm Very Thin Plastic Quad Flat No-Lead (VQFN)
32M1-A <sup>(1)</sup>	32-pad, 5 x 5 x 1.0 body, Lead Pitch 0.50 mm Thin Plastic Quad Flat No-Lead (VQFN)
28P3	28-lead, 0.300" Wide, Skinny Plastic Dual Inline Package (SPDIP)

1. **This package type can be delivered with two different styles with reference numbers 'C04-21400' (punched) and 'C04-21395' (sawn) as shown in section 3.2.1 - 32M1-A. For PCB layouts, it is recommended to take both *recommended land patterns* into consideration.**

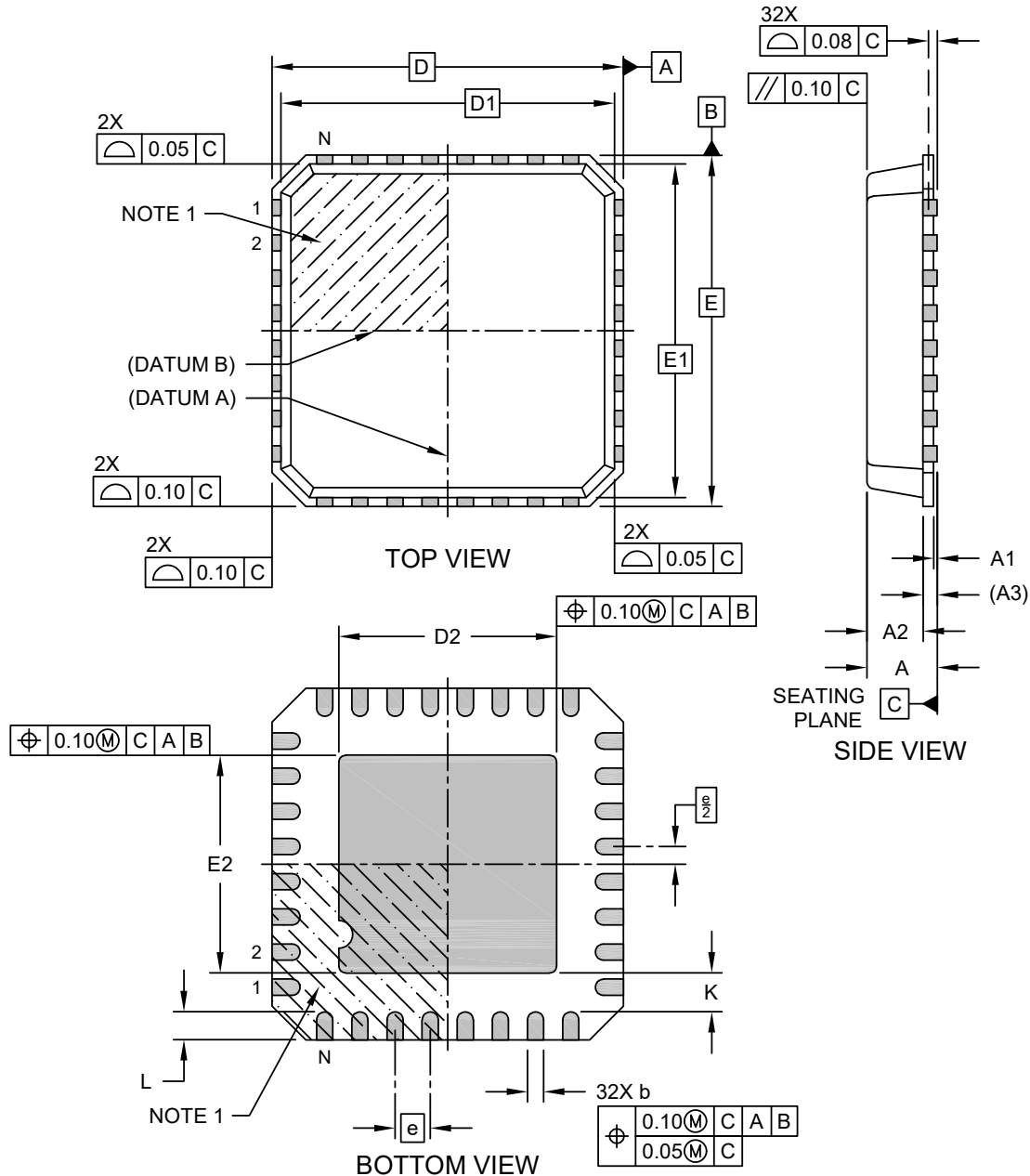
#### 3.2 Package Information

A clarification about the other package style available for package type 32M1-A has been added to the 32M1-A section.

### 3.2.1 32M1-A

#### 32-Lead Thin Plastic Quad Flat, No Lead Package (S4B) - 5x5 mm Body [VQFN] Punch Singulated; 3.10x3.10 mm Exposed Pad

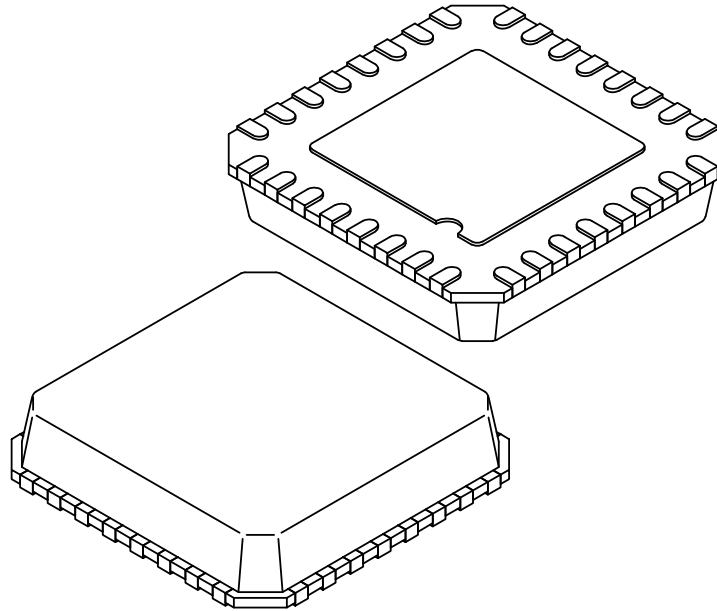
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-21400 Rev B Sheet 1 of 2

### 32-Lead Thin Plastic Quad Flat, No Lead Package (S4B) - 5x5 mm Body [VQFN] Punch Singulated; 3.10x3.10 mm Exposed Pad

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	32		
Pitch	e	0.50 BSC		
Overall Height	A	0.80	0.85	1.00
Standoff	A1	0.00	0.02	0.05
Mold Cap Thickness	A2	-	0.65	0.70
Terminal Thickness	A3	0.20 REF		
Overall Length	D	5.00 BSC		
Mold Cap Length	D1	4.75 BSC		
Exposed Pad Length	D2	2.95	3.10	3.25
Overall Width	E	5.00 BSC		
Mold Cap Width	E1	4.75 BSC		
Exposed Pad Width	E2	2.95	3.10	3.25
Terminal Width	b	0.18	0.23	0.30
Terminal Length	L	0.30	0.40	0.50
Terminal-to-Exposed-Pad	K	0.20	-	-

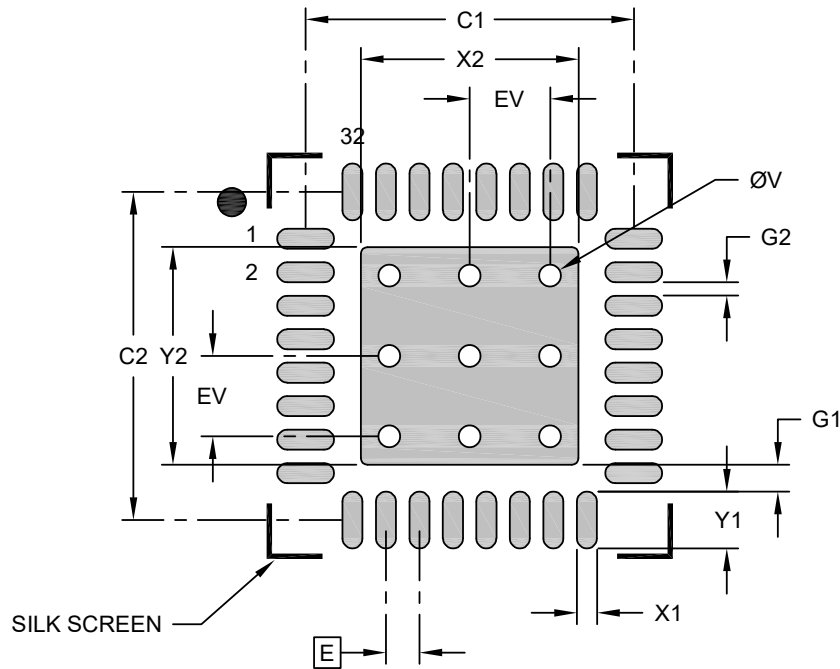
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is punch singulated
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-21400 Rev B Sheet 2 of 2

### 32-Lead Thin Plastic Quad Flat, No Lead Package (S4B) - 5x5 mm Body [VQFN] Punch Singulated; 3.10x3.10 mm Exposed Pad

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



#### RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Optional Center Pad Width	X2			3.25
Optional Center Pad Length	Y2			3.25
Contact Pad Spacing	C1		4.90	
Contact Pad Spacing	C2		4.90	
Contact Pad Width (X32)	X1			0.30
Contact Pad Length (X32)	Y1			0.85
Contact Pad to Center Pad (X32)	G1	0.40		
Contact Pad to Contact Pad (X28)	G2	0.20		
Thermal Via Diameter	V		0.33	
Thermal Via Pitch	EV		1.20	

**Notes:**

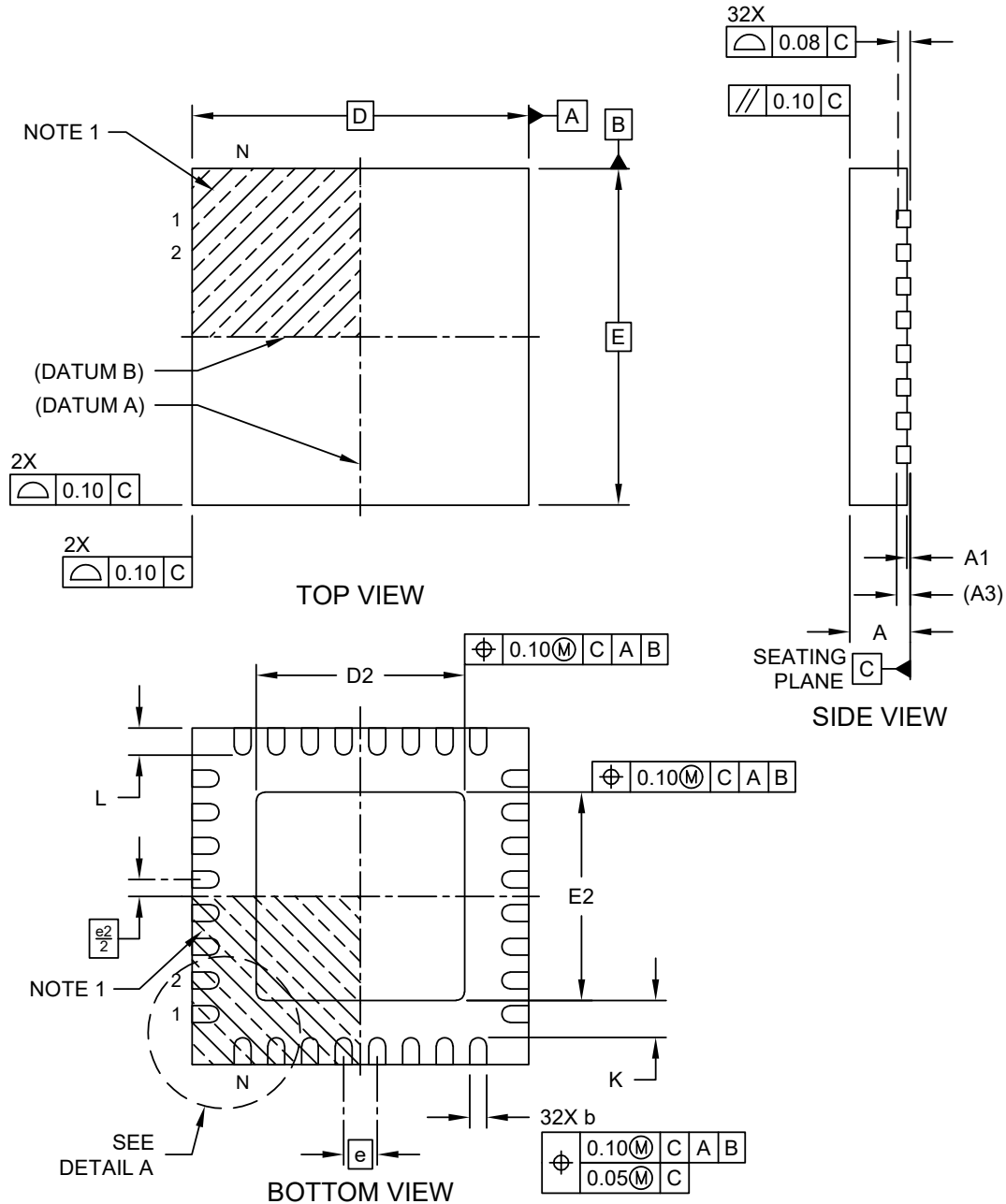
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-23400 Rev B



### 32-Lead Very Thin Plastic Quad Flat, No Lead Package (UBB) - 5x5x0.9 mm Body [VQFN] With 3.1x3.1 mm Exposed Pad; Atmel Legacy Global Package Code ZMF

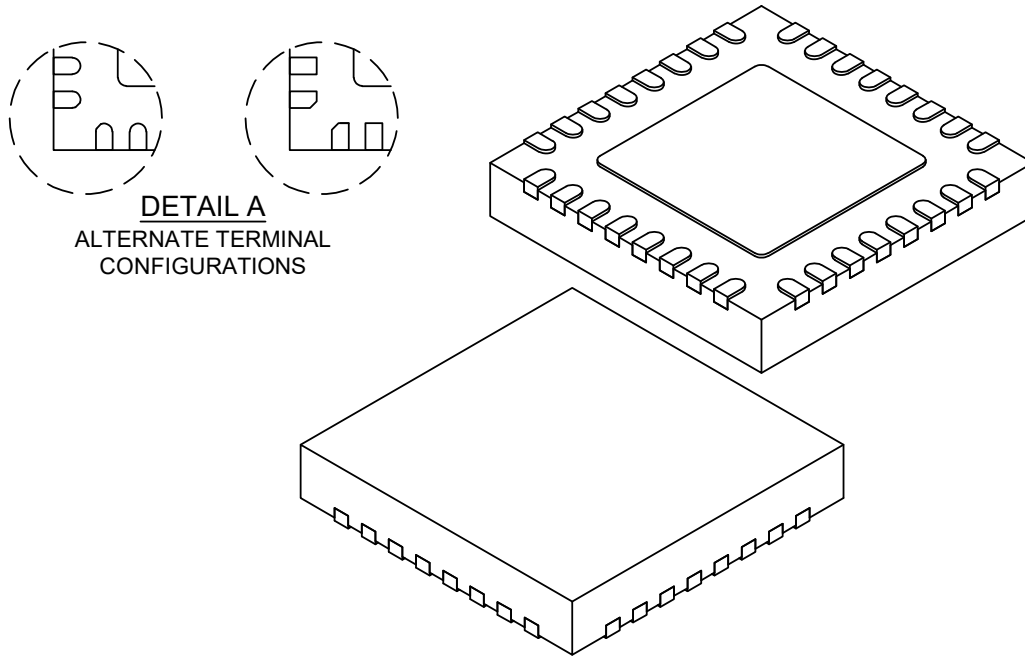
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-21395-UBB Rev C Sheet 1 of 2

### 32-Lead Very Thin Plastic Quad Flat, No Lead Package (UBB) - 5x5x0.9 mm Body [VQFN] With 3.1x3.1 mm Exposed Pad; Atmel Legacy Global Package Code ZMF

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Terminals	N	32		
Pitch	e	0.50 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.203 REF		
Overall Length	D	5.00 BSC		
Exposed Pad Length	D2	3.00	3.10	3.20
Overall Width	E	5.00 BSC		
Exposed Pad Width	E2	3.00	3.10	3.20
Terminal Width	b	0.18	0.25	0.30
Terminal Length	L	0.30	0.40	0.50
Terminal-to-Exposed-Pad	K	0.20	-	-

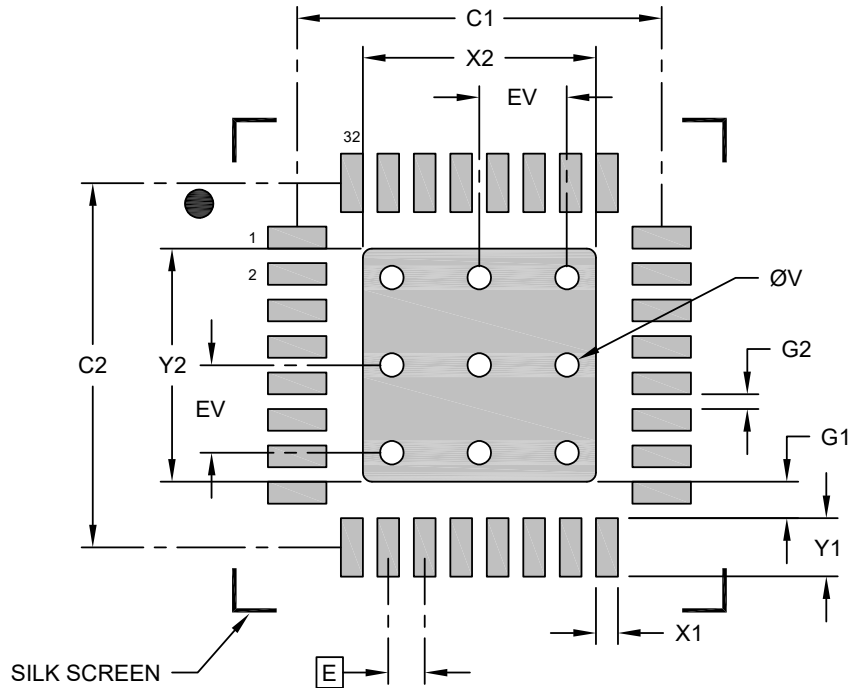
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-21395-UBB Rev C Sheet 2 of 2

### 32-Lead Very Thin Plastic Quad Flat, No Lead Package (UBB) - 5x5x0.9 mm Body [VQFN] With 3.1x3.1 mm Exposed Pad; Atmel Legacy Global Package Code ZMF

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



#### RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Center Pad Width	X2			3.20
Center Pad Length	Y2			3.20
Contact Pad Spacing	C1		5.00	
Contact Pad Spacing	C2		5.00	
Contact Pad Width (X32)	X1			0.30
Contact Pad Length (X32)	Y1			0.80
Contact Pad to Center Pad (X32)	G1	0.20		
Contact Pad to Contact Pad (X28)	G2	0.20		
Thermal Via Diameter	V		0.33	
Thermal Via Pitch	EV		1.20	

#### Notes:

1. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-23395-UBB Rev C

## 4. Document Revision History

**Note:** The data sheet clarification document revision is independent of the die revision and the device variant (last letter of the ordering number).

### 4.1 Revision History

Doc Rev.	Date	Comments
B	11/2021	Added data sheet clarifications: <ul style="list-style-type: none"><li>• <a href="#">Ordering Information</a></li><li>• <a href="#">Package Information</a></li></ul>
A	09/2020	Initial document release. <ul style="list-style-type: none"><li>• Content moved from the data sheet and restructured to the new document template</li><li>• Updated the die revision list to reflect die revisions in production</li></ul>

## The Microchip Website

---

Microchip provides online support via our website at [www.microchip.com/](http://www.microchip.com/). This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

## Product Change Notification Service

---

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to [www.microchip.com/pcn](http://www.microchip.com/pcn) and follow the registration instructions.

## Customer Support

---

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: [www.microchip.com/support](http://www.microchip.com/support)

## Microchip Devices Code Protection Feature

---

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.

## Legal Notice

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.

## 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, TempTrackr, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

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, Vite, 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, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, INICnet, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, 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, SAM-ICE, Serial Quad I/O, SMART-I.S., SQL, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, 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, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-8874-3

## Quality Management System

---

For information regarding Microchip's Quality Management Systems, please visit [www.microchip.com/quality](http://www.microchip.com/quality).

## Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
<b>Corporate Office</b> 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: <a href="http://www.microchip.com/support">www.microchip.com/support</a> Web Address: <a href="http://www.microchip.com">www.microchip.com</a>	<b>Australia - Sydney</b> Tel: 61-2-9868-6733 <b>China - Beijing</b> Tel: 86-10-8569-7000 <b>China - Chengdu</b> Tel: 86-28-8665-5511 <b>China - Chongqing</b> Tel: 86-23-8980-9588 <b>China - Dongguan</b> Tel: 86-769-8702-9880 <b>China - Guangzhou</b> Tel: 86-20-8755-8029 <b>China - Hangzhou</b> Tel: 86-571-8792-8115 <b>China - Hong Kong SAR</b> Tel: 852-2943-5100 <b>China - Nanjing</b> Tel: 86-25-8473-2460 <b>China - Qingdao</b> Tel: 86-532-8502-7355 <b>China - Shanghai</b> Tel: 86-21-3326-8000 <b>China - Shenyang</b> Tel: 86-24-2334-2829 <b>China - Shenzhen</b> Tel: 86-755-8864-2200 <b>China - Suzhou</b> Tel: 86-186-6233-1526 <b>China - Wuhan</b> Tel: 86-27-5980-5300 <b>China - Xian</b> Tel: 86-29-8833-7252 <b>China - Xiamen</b> Tel: 86-592-2388138 <b>China - Zhuhai</b> Tel: 86-756-3210040	<b>India - Bangalore</b> Tel: 91-80-3090-4444 <b>India - New Delhi</b> Tel: 91-11-4160-8631 <b>India - Pune</b> Tel: 91-20-4121-0141 <b>Japan - Osaka</b> Tel: 81-6-6152-7160 <b>Japan - Tokyo</b> Tel: 81-3-6880-3770 <b>Korea - Daegu</b> Tel: 82-53-744-4301 <b>Korea - Seoul</b> Tel: 82-2-554-7200 <b>Malaysia - Kuala Lumpur</b> Tel: 60-3-7651-7906 <b>Malaysia - Penang</b> Tel: 60-4-227-8870 <b>Philippines - Manila</b> Tel: 63-2-634-9065 <b>Singapore</b> Tel: 65-6334-8870 <b>Taiwan - Hsin Chu</b> Tel: 886-3-577-8366 <b>Taiwan - Kaohsiung</b> Tel: 886-7-213-7830 <b>Taiwan - Taipei</b> Tel: 886-2-2508-8600 <b>Thailand - Bangkok</b> Tel: 66-2-694-1351 <b>Vietnam - Ho Chi Minh</b> Tel: 84-28-5448-2100	<b>Austria - Wels</b> Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 <b>Denmark - Copenhagen</b> Tel: 45-4485-5910 Fax: 45-4485-2829 <b>Finland - Espoo</b> Tel: 358-9-4520-820 <b>France - Paris</b> Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 <b>Germany - Garching</b> Tel: 49-8931-9700 <b>Germany - Haan</b> Tel: 49-2129-3766400 <b>Germany - Heilbronn</b> Tel: 49-7131-72400 <b>Germany - Karlsruhe</b> Tel: 49-721-625370 <b>Germany - Munich</b> Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 <b>Germany - Rosenheim</b> Tel: 49-8031-354-560 <b>Israel - Ra'anana</b> Tel: 972-9-744-7705 <b>Italy - Milan</b> Tel: 39-0331-742611 Fax: 39-0331-466781 <b>Italy - Padova</b> Tel: 39-049-7625286 <b>Netherlands - Drunen</b> Tel: 31-416-690399 Fax: 31-416-690340 <b>Norway - Trondheim</b> Tel: 47-72884388 <b>Poland - Warsaw</b> Tel: 48-22-3325737 <b>Romania - Bucharest</b> Tel: 40-21-407-87-50 <b>Spain - Madrid</b> Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 <b>Sweden - Gothenberg</b> Tel: 46-31-704-60-40 <b>Sweden - Stockholm</b> Tel: 46-8-5090-4654 <b>UK - Wokingham</b> Tel: 44-118-921-5800 Fax: 44-118-921-5820