

15 x 15 mm PBGA Daisy-Chain Application Report

by

Elisa Huang
with Debbie Hagen and Andrew Mawer

*This application report describes the 15 x 15 mm PBGA
daisy-chain package and its use in developing PBGA
surface-mount techniques.*

Motorola, Incorporated
Semiconductor Products Sector
6501 William Cannon Drive West
Austin TX 78735-8598



Order this document by number APR42/D.
(Revision 0, April 1998)


MOTOROLA INC., 1998

OnCE and Mfax are trademarks of Motorola, Inc.



MOTOROLA

This document contains information on a new product. Specifications and information herein are subject to change without notice.

Motorola reserves the right to make changes without further notice to any products herein to improve reliability, function, or design. Motorola does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

1 GENERAL INFORMATION

Glob-top plastic ball grid array (PBGA) mechanical sample packages are available from Motorola for use in surface mount assembly process development. They are physically similar to the devices they represent, being manufactured to the same general material and physical specifications. Features of the sample packages include the following:

- Supported devices include die size from 7.874 mm² ~ 15.748 mm² (200 ~ 400 mils²)
- Package is low in cost
- Physically similar to the devices represented
- 14 x 14 ball grid array, with full complement of 196 solder balls
- Adjacent pairs of solder balls are linked in the substrate for solder joint electrical quality test with complementary circuit board
- May be used in surface mount process development, equipment evaluation, and board-level solder joint electrical and mechanical evaluation.

Although the sample packages are similar to the devices represented, there are several differences that should not be significant in this application.

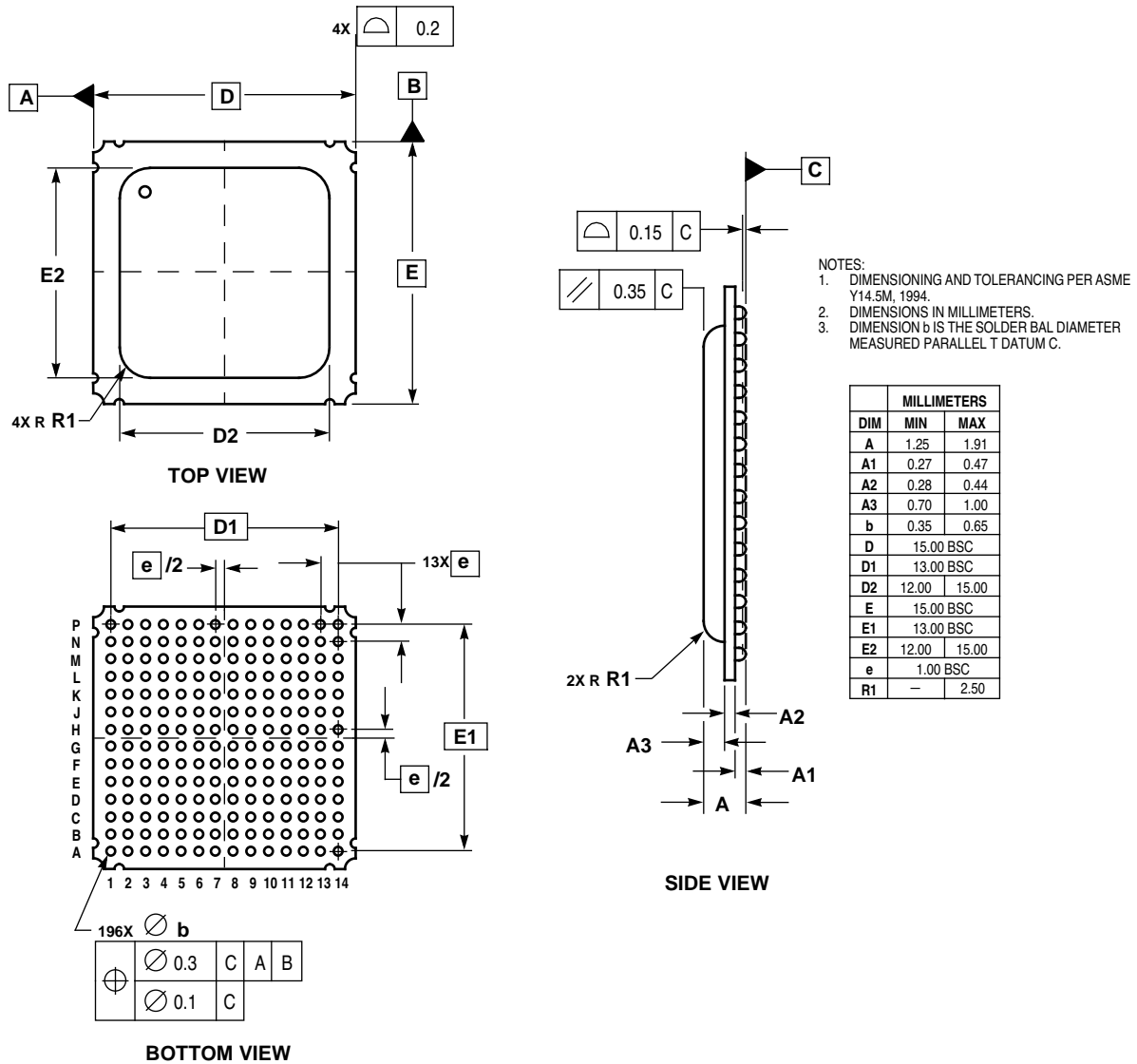
- Live die is not typically used in the sample packages.
- The number of layers in the substrate may differ from the actual package.
- Power and ground planes may not be present in sample packages.

2 PACKAGE DESCRIPTION

The three configurations covered in this application report are the three die sizes in the 15 x 15 mm body, 196-ball PBGA packages. **Table 2-1** lists the Motorola part numbers and case outline numbers for these package types, with the main package parameters. The case outline drawings are shown in **Figure 2-1**.

Table 2-1 15 x 15 mm PBGA Daisy-Chain Package Configuration

Motorola Part Number	Case Number	Body Size (mm)	Die Size (mils)	Ball Array	Ball Count
XC68338GC00	128-01	15 x 15	~(200 mil) 7.874 mm	14 x 14	196
XC56303GC00	128-01	15 x 15	~(250 mil) 9.842 mm	14 x 14	196
XC56307GC00	128-01	15 x 15	~(400 mil) 15.748 mm	14 x 14	196



CASE 1128-01
ISSUE B

DATE 11/22/96

AA1598

Figure 2-1 15 x 15 mm PBGA Case Outline Drawing

Figure 2-2 shows the Motorola-recommended solder-pad geometry for PBGA for etch-defined or non-solder-mask-defined (NSMD) and solder-mask-defined (SMD) configurations. The 196PBGA package has SMD joints with a nominal 0.508 mm solder-mask diameter. For adequate solder-joint reliability, it is critical to maintain the solder-pad diameter on the motherboard within the range specified. The motherboard solder pad is specified at 0.479 mm diameter to accommodate an interstitial via pad diameter of 0.635 mm between four solder pads. The via and via pad diameters as well as solder mask clearance around the via pads can be adjusted as necessary to meet individual design rules and PCB fabricator capabilities. Solder-mask clearance around the non-solder-mask-defined solder pad should be specified so that it does not encroach on the pad in the printed circuit board fabricator's worst-case solder-mask-to-artwork registration tolerance. The solderable surface may be produced with a hot air solder leveled (HASL) process, an organic solderability protective coating, or other surface finish as required.

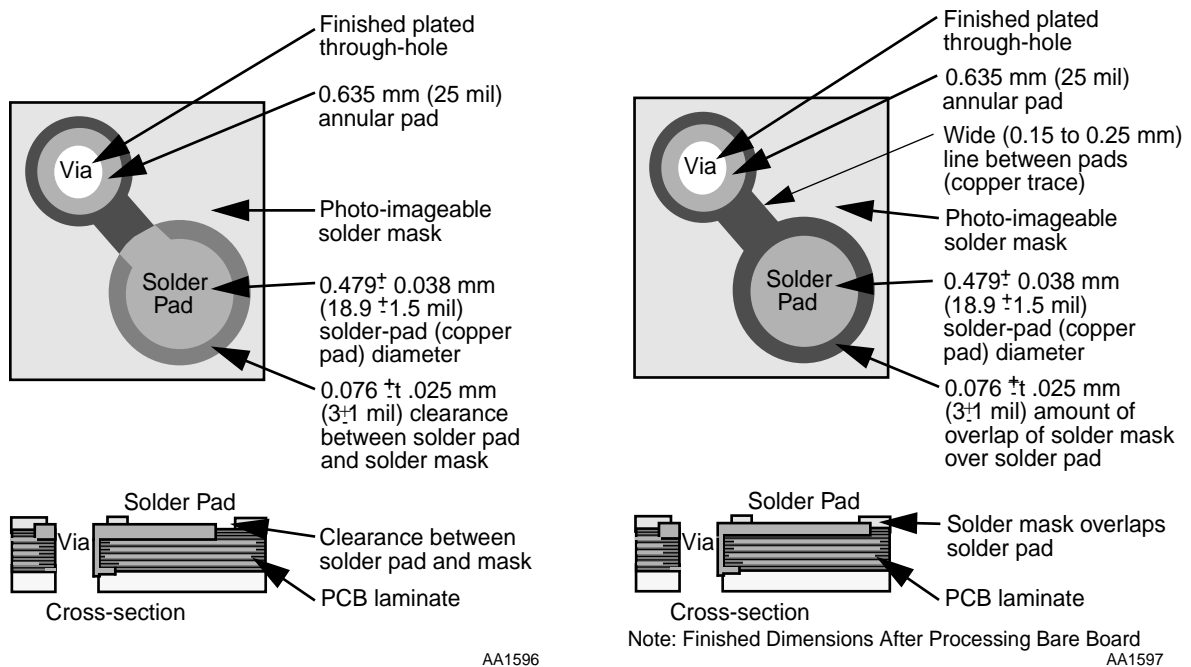
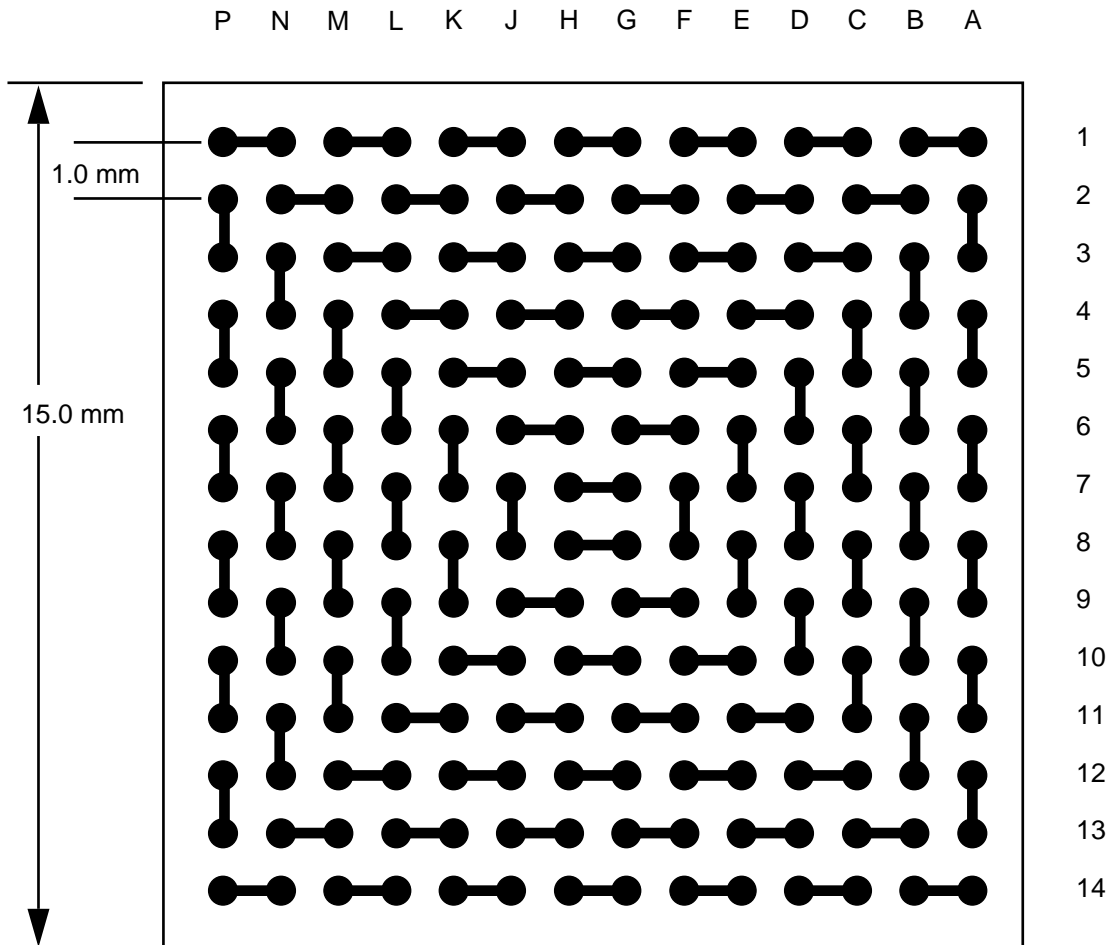


Figure 2-2 Motorola-Recommended Solder-Pad Geometry for 1 mm Pitch 196PBGA

3 PBGA DAISY-CHAIN SUBSTRATE ROUTING

Figure 3-1 shows a schematic of the daisy-chain routing for the 196PBGA package. This figure provides the layout as viewed through the top of the package. Note that the daisy-chain routing traces may not be visible on the actual packages, as they may be obscured by solder-mask material. This schematic may be used to design matching test boards to complement the package routing.



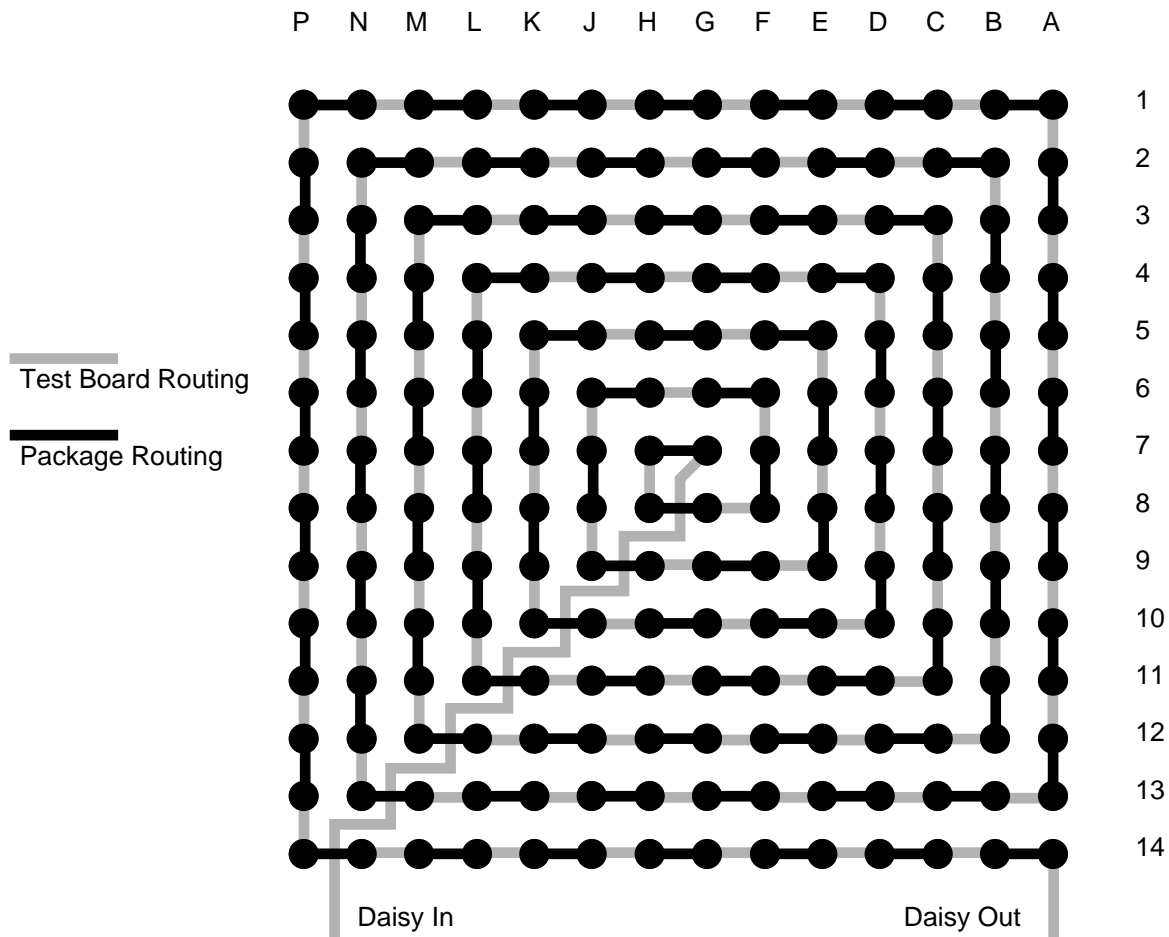
- Note:
1. Package solder pad is 0.508 mm in diameter, and is solder mask defined.
 2. Solder ball is 0.508 mm in diameter.
 3. Viewed through top of package

AA1599

Figure 3-1 Motorola 1.0 mm-Pitch 196 Pin PBGA Daisy-Chain Package

4 MOTHERBOARD ROUTING

A daisy chain is formed by connecting solder pads on the motherboard to complement those on the package, resulting in a continuous net or nets containing most or all of the PBGA solder joints. One net can be configured to encompass all the joints on the package, or one package can be broken into several nets. An example of connecting the package into one net in accelerated thermal cycling is shown in **Figure 4-1**.




- Note:
1. Package solder pad is 0.508 mm in diameter and is solder mask defined.
 2. Solder ball is 0.508 mm in diameter.
 3. Note correct alignment of PBGA package. Continuous circuit will not be achieved if package is rotated. Viewed through top of package.

AA1600

Figure 4-1 PBGA Daisy-Chain Package on Daisy-Chain Circuit Board

OnCE and Mfax are registered trademarks of Motorola, Inc.

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA/Europe/Locations Not Listed:

Motorola Literature Distribution
P.O. Box 5405
Denver, Colorado 80217
1 (800) 441-2447
1 (303) 675-2140

Asia/Pacific:

Motorola Semiconductors H.K. Ltd.
8B Tai Ping Industrial Park
51 Ting Kok Road
Tai Po, N.T., Hong Kong
852-26629298

Japan:

Nippon Motorola Ltd
SPD, Strategic Planning Office
4-32-1, Nishi-Gotanda
Shinagawa-ku, Tokyo 141, Japan
81-3-5487-8488

Motorola Fax Back System (Mfax™):

TOUCHTONE (602) 244-6609
1 (800) 774-1848
RMFAX0@email.sps.mot.com
<http://www.motorola.com/mfax>

Technical Resource Center:

1 (800) 521-6274

DSP Helpline

dsphelp@dsp.sps.mot.com

Internet:

<http://www.motorola-dsp.com/>



MOTOROLA
