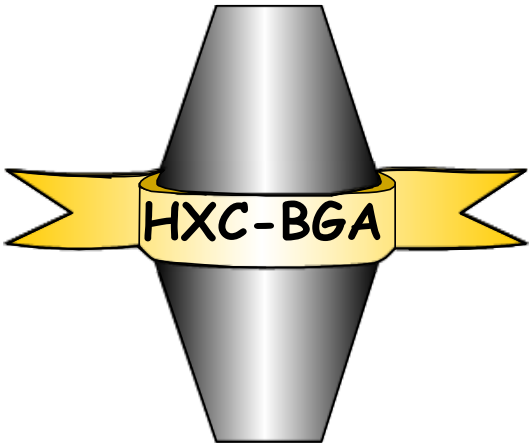
REV.		REV.		REV.	
O	RELEASED EC# 0S1G-0411-04 APP'D: DES 9-1-04	A	RELEASED EC# 0S1G-0411-04 APP'D: DES 10-12-04	B	RELEASED ERN# 111098 LS APP'D: SBW 11-7-05
C	RELEASED ECO-09-004313 LS APP'D: WA 2-25-09				



BGA Application Guide

Recommended information for BGA socketing applications.

If design requirements vary then contact

Tyco Electronics Engineering

CUSTOMER DRAWING

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

Tyco Electronics Norwood, Massachusetts. 02062

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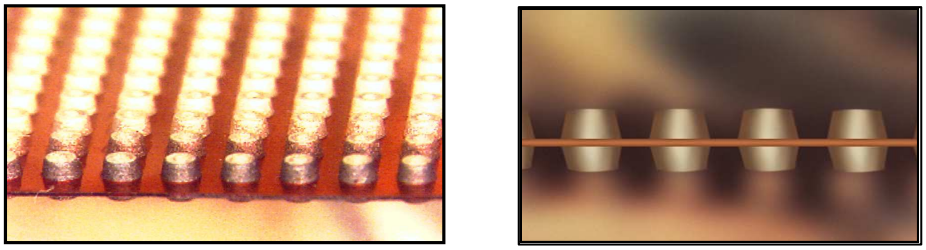
DRAWN BY:	D.SYLVIA
DATE:	3-15-04
ENGINEER:	D.SYLVIA
DATE:	3-15-04
FILENAME	C-1640905
PROJECT	
SYSTEM	.
TITLE:	CUSTOMER DRAWING, BGA SOCKET APPLICATION GUIDE
DIMENSIONS ARE IN:	
SCALE:	NONE
TE PART NO.:	.
SHEET	1 of 9
THIRD ANGLE PROJECTION	
SIZE	A
DWG.NO.:	C-1640905
REV.	C

What is HXC-BGA?

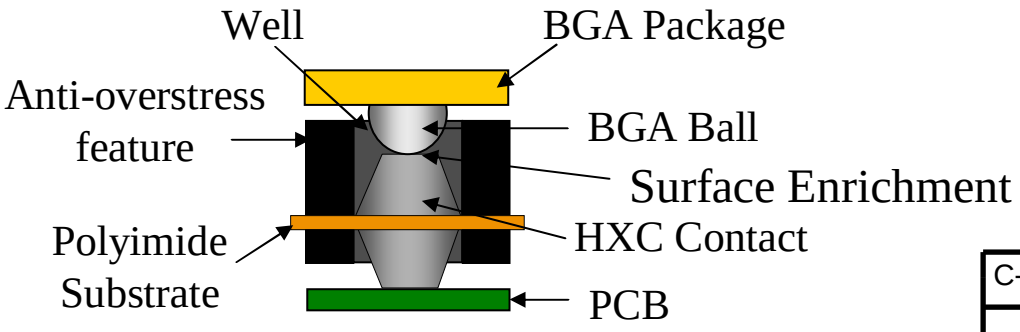
HXC-BGA is a material system designed to address high density socket and connector requirements. The patented HXC-BGA (High Cross Link Column) material system provides a highly conductive interconnect. This proprietary material consists of a high temperature polymer compound that has been embedded with metalized particles. The material is formed into conductive micro-columns. HXC-BGA has been designed to meet the board connection requirements of microprocessors and ASICs used in high-end servers, workstations, desktop PCs, mobile PC, test and bring-up. For other applications see page 9 of this guide or visit us on the web at http://www.tycoelectronics.com/



Actual columns in an array

How HXC-BGA Works:

The HXC-BGA conductive column is molded into an insulator which aligns the columns over the desired I/O field that is to be interconnected. As the two surfaces are compressed, the metallized particles encapsulated within the columns link together, thus providing the conductive path.



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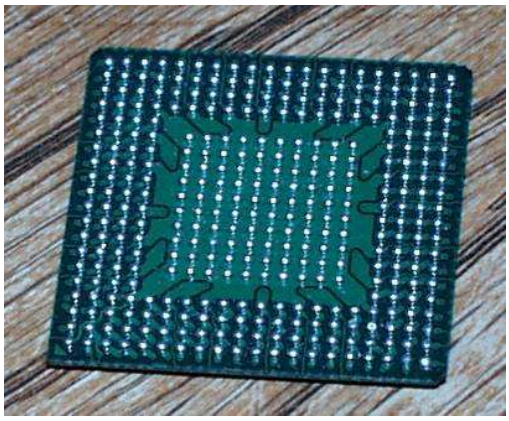
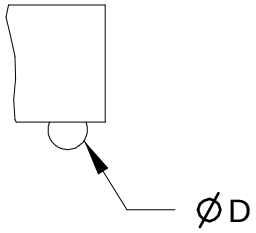
Why Choose HXC–BGA Socket for Test, Bring up or Validation?

- **High I/O (4000+)**
- **Custom Design Available**
- **Short Lead Times**
- **High Density (down to 0,5mm pitch)**
- **Reusable/Replaceable**





BGA Design Guidelines

Package Considerations:

HXC-BGA sockets are designed to work with both Ceramic (CBGA) and Organic (OBGA) microprocessor and ASIC packages.

Package Design:

Design should follow standard industry practices as defined by JEDEC standards, unless otherwise specified.

Package Pad Pitch:

1,27mm [.050in], 1,00mm [.039in], 0,80mm [.031in], 0,50mm [.020in], 0,40mm [.016in]

Contact engineering for pitch <0,80mm

BGA Ball Types:

Eutectic Pb/Sn, Non-eutectic Pb/Sn and Pb free ball acceptable

Package Flatness:

Organic BGA - 0,10mm [.004in]

Ceramic BGA - 0,08mm [.003in]

Package Ball Positioning:

Pitch mm [in]	Ball to Ball T.P. @ MMC	* Ball Dimension D
0,40 [.016]	Ø 0,08 [.003]	Ø 0,20 [.008] - 0,25 [.010]
0,50 [.020]	Ø 0,08 [.003]	Ø 0,25 [.010] - 0,35 [.014]
0,80 [.031]	Ø 0,10 [.004]	Ø 0,40 [.016] - 0,55 [.022]
1,00 [.039]	Ø 0,10 [.004]	Ø 0,55 [.022] - 0,72 [.028]
1,27 [.050]	Ø 0,15 [.006]	Ø 0,60 [.024] - 0,90 [.035]

*** Recommended - Please notify engineering if different**

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PC Board Design Guidelines

Board Design Considerations:

HXC-BGA columns are designed to work with all industry standard board designs and materials (FR-4, Polyimide, Rogers, etc.)

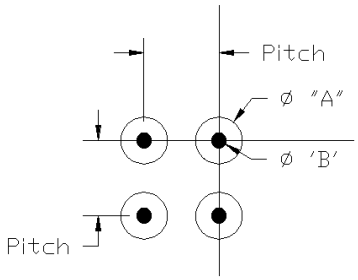
Careful consideration with respect to the layout of the board should be taken, as most HXC-BGA applications will require 4 thru-holes for compression hardware and 2 thru holes for alignment pins.

Board Design:

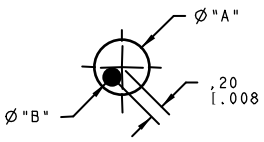
Design should follow standard industry practices as defined by IPC Specification 2221, unless otherwise specified.

Board Pad Diameter (Via-in-Pad Design):

Pitch mm [in]	Pad Diameter "A" +0,03 [.001] mm [in]	Max Via Dia. "B" After Plating mm [in]	Pad to Pad T.P. @ MMC
0,40 [.016]	0,23 [.009]	Filled	0,10 [.004]
0,50 [.020]	0,28 [.011]	Filled	0,10 [.004]
0,80 [.031]	0,46 [.018]	0,20 [.008]	0,10 [.004]
1,00 [.039]	0,69 [.027]	0,20 [.008]	0,10 [.004]
1,27 [.050]	0,79 [.031]	0,25 [.010]	0,13 [.005]



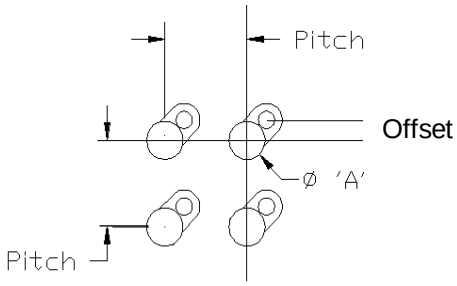
Optional Pad Configuration: Offset Via-in -Pad



Board Pad Diameter (Solid Pad / Offset Via):

Pitch mm [in]	Pad Diameter "A" +0,03 [.001] mm [in]	Offset
0,40 [.016]	not recommended	
* 0,50 [.020]	0,225 [.0089]	0,25 [.010]
0,80 [.031]	0,457 [.0180]	0,25 [.010]
1,00 [.039]	0,635 [.0250]	0,35 [.014]
1,27 [.050]	0,790 [.0311]	0,40 [.016]

***Contact pad to be solder resist defined**
(Via pads to be covered with Solder Mask to prevent contact shorting.)



Solder Resist (Solder Mask):

The use of solder resist coatings shall be in accordance with the requirements of IPC-SM-840. It is recommended that only photo-imageable resists be used as that process yields superior thickness control.

Resist Thickness:

Flush or below the contact pad plane, except when defining pad diameters

Resist Clearance:

0,00 – 0,05 mm [.000 - .002in] typically

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Board Flatness:

Design to industry standards. The Bolster Plate used in the assembly tends to 'flatten' the PWB or at least conform it to the Bolster Plate flatness.

Alignment Hole Tolerancing & Positioning:

Pitch mm [in]	Hole Diameter Tolerance +/- mm [in]	Alignment Hole Location T.P. @ MMC w/ Respect to Pads
0,40 [.016]	0,025 [.0010]	0,10 [.004]
0,50 [.020]	0,025 [.0010]	0,10 [.004]
0,80 [.031]	0,025 [.0010]	0,10 [.004]
1,00 [.039]	0,025 [.0010]	0,10 [.004]
1,27 [.050]	0,025 [.0010]	0,10 [.004]

Socket Hardware Mounting Hole Positioning:

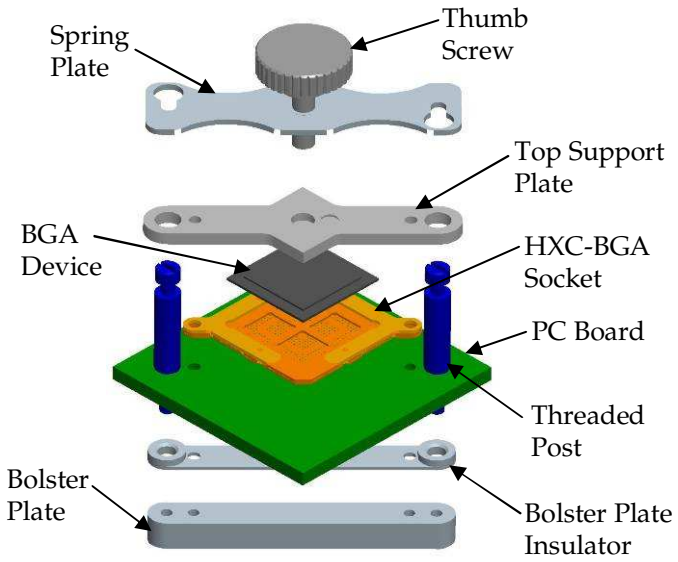
Ideally, mounting holes should be placed close to the array (ie. Socket Corners) to minimize board bow. Standard hole Ø is 3,18mm [.125in], but this can vary depending on design.

PWB Pad Plating:

Flash gold, 10 µ inches minimum over 150 µ inches of Nickel. Gold can be either Hard or Soft as defined by Mil-G-45204 and can not be porous or have exposed Nickel or Copper. Either Electrolytic or Immersion silver process can also be used.

Note: Pad surfaces must be clean and free of contamination, ie. Dust, dirt, oil, flux residue, etc. When boards are reused for multiple mating cycles, the board should be cleaned using IPA and a soft bristle brush and blown dry with pressurized air.

Socket Design Considerations



Typical HXC-BGA Socket and Hardware For test system.

HXC-BGA Column Size:

Pitch mm [in]	Column Diameter (at Mating Face) mm [in] (REF)
0,40 [.016]	0,20 [.008]
0,50 [.020]	0,28 [.011]
0,80 [.031]	0,46 [.018]
1,00 [.039]	0,46 [.018]
1,27 [.050]	0,66 [.026]

HXC-BGA Column Location:

Pitch mm [in]	T.P. of Column to Alignment Pin mm [in]
0,40 [.016]	0,10 [.004]
0,50 [.020]	0,15 [.006]
0,80 [.031]	0,18 [.007]
1,00 [.039]	0,18 [.007]
1,27 [.050]	0,18 [.007]

HXC-BGA Column Loading:

Each HXC-BGA column varies according to pitch. See table for nominal loading for maximum performance and reliability. Though HXC-BGA may work in various mounting configurations, it is recommended that the loading be uniform with respect to the socket.

Typical Column Deflection:

Pitch mm [in]	Deflection Range	Nominal Loading
0,40 [.016]	0,20 [.008]	20 grms
0,50 [.020]	0,20 [.008]	25 grms
0,80 [.031]	0,30 [.012]	45 grms
1,00 [.039]	0,30 [.012]	45 grms
1,27 [.050]	0,30 [.012]	45 grms

The deflection range is limited by hard stops which are designed into every socket. The stops prevent over deflection of the HXC-BGA columns.

PWB Real-Estate Requirements:

Typical framed socket design requires a clearance zone of 6,80mm [.268in] larger than the package size. For example; a 42,5mm [1.673in] sq. package would typically require sq. clearance zone of 49,30mm [1.941in].

Frameless socket can be designed to occupy no more real-estate than the package.

Consult factory for other options.

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Bolster Plate & Hardware Design

Bolster Plate:

The HXC-BGA contact system is solderless, Z-axis connection system and therefore, requires mechanical hardware to create the required compression force and at the same time hold the connector in place.

The mechanical design typically incorporates the Thermal Management Solution (ie. Heat Sink or Heat Spreader Plate) as the device that applies the top load. In applications where no Thermal Management Solution is used, a Top Loading Plate must be used. The top must not have a deflection or bow exceeding 0,05mm [.002in] for OBGA and 0,08mm [.003in] for CBGA.

To insure an even distribution of loading over the HXC-BGA column array, a second hardware device called the Bolster Plate is typically used on the bottom side of the PWB.

Depending on application, the Bolster Plate material can be aluminum or stainless steel. The thickness of the Bolster Plate will vary depending on the load (ie. I/O count x required load per column) the Bolster Plate design, and the material choice of the Bolster Plate. The Plate must be designed to support the required load, ie. under load, the Plate must not have a deflection or bow exceeding 0,03mm (.001in).

An insulating film is placed between the Bolster Plate and the PWB to provide electrical isolation between the Bolster Plate and the PWB.

Bolster Plate Flatness:

Ideally, the design of the Bolster Plate should be as flat as possible. Producing a 'perfectly' flat plate is not always possible.

Probing Plate :

Probing plates that allow for PCB back side probing are available upon request.

Mounting Hardware:

Due to broad range of stack-up tolerances present in a micro-processor – PWB assembly (package & PWB thickness tolerances, as well as, Thermal Interface choice) and the unique nature of 'Elastomeric' contact design, it is recommended that the hardware be of such a design as to provide 'constant (spring) loading', as opposed to 'fixed deflection'. It is recommended that the hardware be located uniformly with respect to the HXC-BGA column array.

The spring deflection should be controlled by mechanical features (ie. stops) within the hardware design, rather than with a torque spec.

A dry lubricant on the threaded hardware is recommended so as to maintain a uniform threading torque, as well as minimizing galling.

Tyco Electronics / HXC-BGA can design and supply the Compression Hardware, Heatsinks and Bolster Plate combination to meet your custom application needs.

Installation:

Handle the sockets/connectors by the frame/housing only. **Do not touch the HXC-BGA columns**. All products are individually packaged. Keep HXC-BGA sockets/connectors covered and in packaging until ready for use. Do not attempt to clean the HXC-BGA columns by mechanical or chemical means. Damage may occur. The sockets should be blown off with de-ionized air to clean.

Board Cleanliness:

Prior to installation, the pads must be clean and dry with no solder flux, solder residue, oils or adhesive film present. If cleaning is required, use a soft bristle brush with IPA to clean the board array.

Board Rework:

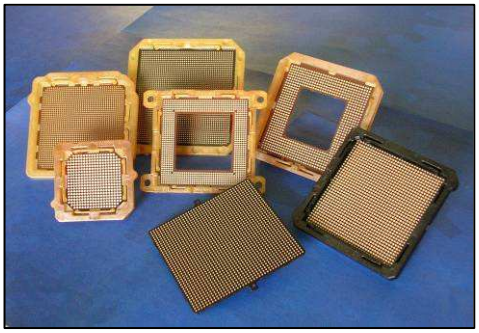
Prior to any board rework involving Heat and/or cleaning removal of the HXC-BGA socket is required. The board must be clean and dry prior to re-installation of existing or new socket.

Removal:

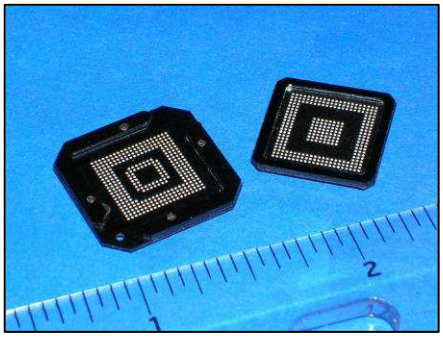
As each HXC-BGA design tends to be customer specific in mounting configuration and mounting hardware, please follow design specific Assembly / Disassembly instructions.

Contact the HXC-BGA group for solutions to meet your requirements.

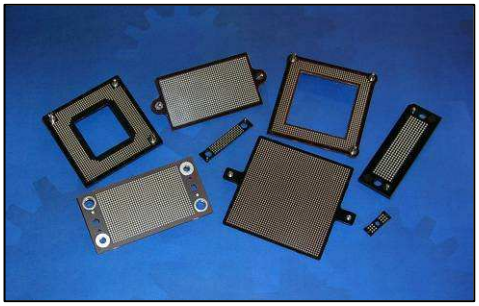
Ask us about these other products from Tyco Electronics/HXC-BGA or visit our website at http://www.tycoelectronics.com/ for more information.



LGA Sockets



0,50 mm Pitch BGA Sockets



Board to Board Connectors

Flex to Board Connectors

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