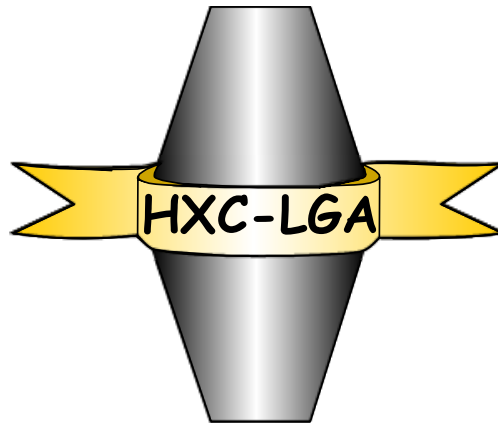


REV. O	RELEASED EC# 0S1G-0411-04 APP'D: DES 9-1-04	REV. A	RELEASED EC# 0S1G-0431-04 APP'D: DES 10-24-04	REV. B	RELEASED EC-09-004313 LS APP'D: WA 3-23-09
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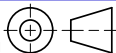
LGA Application Guide

Recommended information for LGA socketing applications.

If design requirements vary then contact

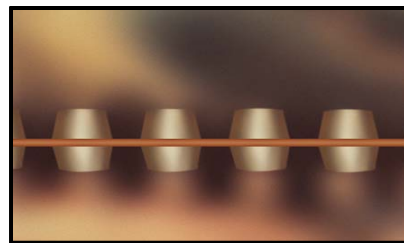
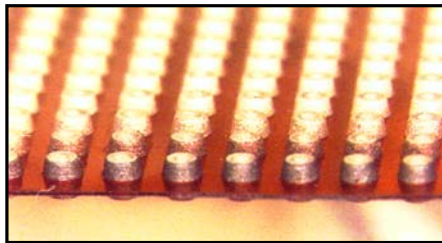
Tyco Electronics Engineering

CUSTOMER DRAWING
SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

 Tyco Electronics Norwood, Massachusetts. 02062			CONFIDENTIAL PROPERTY OF TYCO ELECTRONICS. NOT TO BE DISCLOSED TO OTHERS. REPRODUCED OR USED FOR ANY PURPOSES EXCEPT AS AUTHORIZED IN WRITING BY AN AUTHORIZED OFFICIAL OF TYCO ELECTRONICS. MUST BE RETURNED TO TYCO ELECTRONICS ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSES FOR WHICH LENT.		TITLE: CUSTOMER DRAWING	
DRAWN BY: D.SYLVA		DATE: 3-15-04			LGA SOCKET APPLICATION GUIDE	
ENGINEER: D.SYLVA		DATE: 3-15-04		TEL: (781) 278-5200 FAX: (781) 278-5355		TE PART NO.:
FILENAME C-1640904	PROJECT	SYSTEM	WEB SITE: http://www.tycoelectronics.com		DIMENSIONS ARE IN: SCALE: NONE	SHEET 1 of 9
			THIRD ANGLE PROJECTION		SIZE A	DWG.NO.: C-1640904
					REV. B	

What is HXC-LGA?

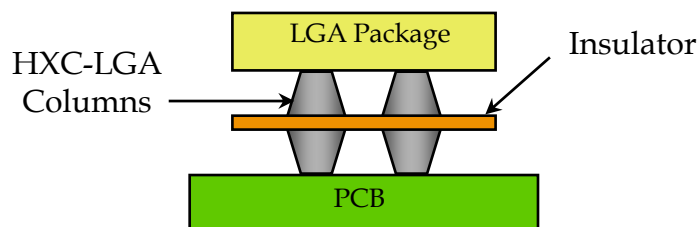
HXC-LGA is a material system designed to address high density socket and connector requirements. The patented HXC-LGA (High Cross Link Column) material system provides a highly conductive interconnect. This proprietary material consists of a high temperature polymer compound that has been embedded with metalized particles which is molded into conductive micro-columns. HXC-LGA has been designed to meet the board connection requirements of microprocessors and ASICs used in high-end servers, workstations, desktop PCs, and mobile PC applications. 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

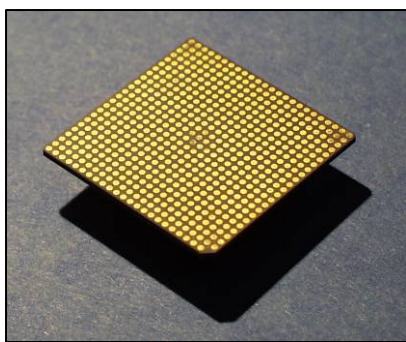
How HXC-LGA Works:

The HXC-LGA 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 parallel surfaces are compressed, the metallized particles encapsulated within the columns link together, thus providing the conductive path.



Why Choose LGA Packaging?

- Socketing of Microprocessor Model
 - Maximum Flexibility of Motherboard Inventory to Meet Market Demands
 - “Make-to-Order” Model Achievable
- Motherboard Build Cycle
 - Quick Diagnosis (FCT, ICT)
 - Inexpensive Replace and Repair Now Possible
- Package Cost
 - Smaller Package (High Density)
 - No Ball or Pin Attach
- Field Upgradability
 - Solderless socket allows easy field CPU repair or replacement
- Tariffs
 - Moving Motherboards with Lower Tariff Restrictions Now an Option
- Very Low Profile
 - Less than 1mm
- High Speed
 - Short Signal Path Permits greater than 10 GHz Processing Speeds
- Power
 - Short Signal Path Minimizes Voltage Drop from Package to Motherboard



Package Considerations:

HXC-LGA sockets are designed to work with both Ceramic (CLGA) and Organic (OLGA) microprocessor and ASIC packages.

LGA Design Guidelines

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 or for any combination of pitch.

Package Pad Diameter:

Pitch mm [in]	Effective Pad Dia. +0,05mm [.002in]
0,40 [.016]	0,20 [.008]
0,50 [.020]	0,20 [.008]
0,80 [.031]	0,30 [.012]
1,00 [.039]	0,71 [.028]
1,27 [.050]	0,79 [.031]

Package Pad Positioning:

Pitch mm [in]	Pad to Pad T.P. @ MMC	Pad Array T.P. @ MMC
0,40 [.016]	Ø 0,05 [.002]	Ø 0,10 [.004]
0,50 [.020]	Ø 0,05 [.002]	Ø 0,10 [.004]
0,80 [.031]	Ø 0,05 [.002]	Ø 0,10 [.004]
1,00 [.039]	Ø 0,08 [.003]	Ø 0,13 [.005]
1,27 [.050]	Ø 0,08 [.003]	Ø 0,13 [.005]

Package Flatness:

Organic LGA 0,10mm [.004in]

Ceramic LGA 0,08mm [.003in]

Package Sizing vs. Array Size:

Center Line of last Pad to edge of package 2,00 mm [.079in] recommended. Please notify Tyco Electronics/HXC-LGA Engineering if less.

Package Pad Plating:

Flash gold, 10 µ inches minimum over Nickel, 150 µ inches. 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 plating processes can also be used.

PC Board Design Guidelines

Board Design Considerations:

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

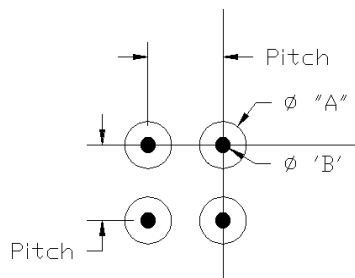
Careful consideration with respect to the layout of the board should be taken, as most HXC-LGA applications will require 4 thru-holes for compression hardware and 2 thru-holes for alignment pins.

Board Design:

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

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

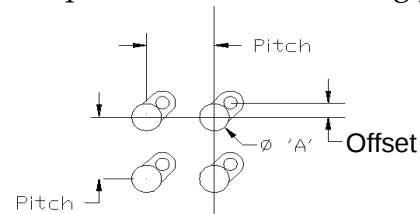
Pitch mm [in]	Pad Diameter "A" +0,03 [.001] mm [in]	Max Via Dia. "B" After Plating mm [in]	Pad to Pad T.P. @ MMC
0,40 [.016]	0,23 [.009]	Filled	0,10 [.004]
0,50 [.020]	0,28 [.011]	Filled	0,10 [.004]
0,80 [.031]	0,46 [.018]	0,20 [.008]	0,10 [.004]
1,00 [.039]	0,69 [.027]	0,20 [.008]	0,10 [.004]
1,27 [.050]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



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. Solder resist of $> 0,025\text{mm}$ [.001in] thickness can be used to define PCB pad. If this is the case, notify Tyco Engineering.

Resist Thickness:

Flush or below the pad surfaces, except when defining pad diameters.

Resist Clearance:

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

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:

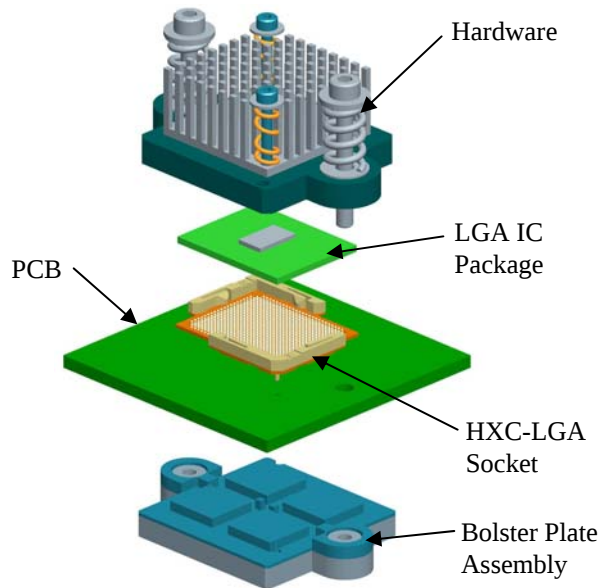
Ideally, mounting holes should be placed close to the array (ie. Socket Corners) to minimize board bow. Standard hole Ø is 3,18mm [.125in], but this can vary depending on design.

PWB Pad Plating:

Flash gold, 10 µ inches minimum over Nickel 150 µ inches. 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-LGA Socket and Hardware for test system

HXC-LGA 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]	0,43 [.017]
1,27 [.050]	0,43 [.017]

HXC-LGA Column Location:

Pitch mm [in]	TP 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-LGA Column Loading:

Each HXC-LGA column varies according to pitch. See table for nominal loading for maximum performance and reliability. Though HXC-LGA 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-LGA columns.

PWB Real-Estate Requirements:

Typical framed socket design requires a clearance zone of 6,80 mm [.268in] larger than the package size. For example; a 42.5 mm [1.673in] sq. package would typically require sq. clearance zone of 49,30 mm [1.94in].

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

Consult factory for other options.

Bolster Plate & Hardware Design

Bolster Plate:

The HXC-LGA 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 OLGA and 0,08mm[.003in] for CLGA.

To insure an even distribution of loading over the HXC-LGA 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) force', as opposed to 'fixed deflection'. It is recommended that the hardware be located uniformly with respect to the HXC-LGA column array.

The spring deflection should be controlled by mechanical features 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-LGA 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-LGA columns.** All products are individually packaged. Keep HXC-LGA sockets/connectors covered and in packaging until ready for use. Do not attempt to clean the HXC-LGA 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 PCB 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.

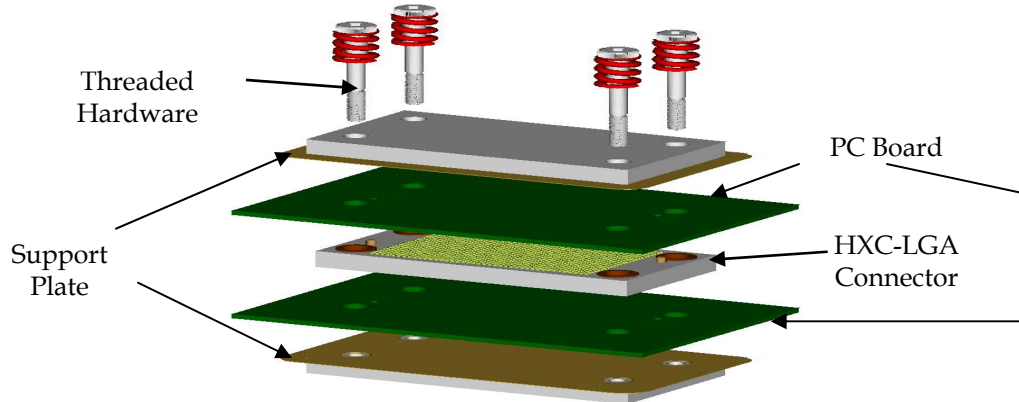
Board Rework:

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

Removal:

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

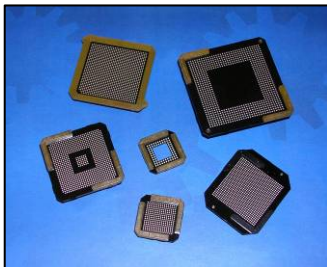
Board to Board Connector Design Considerations



Many of the considerations for Board to Board Stacking connectors are the same as previously stated in PCB guidelines and socket considerations.

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

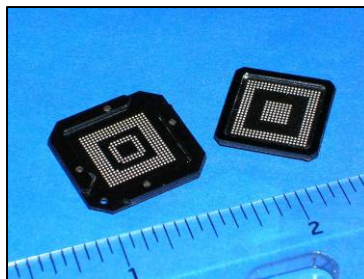
Ask us about these other products from Tyco Electronics/HXC-LGA or visit our website at <http://www.tycoelectronics.com/> for more information.



BGA Sockets



Flex to Board Connectors



0,50 mm Pitch BGA Sockets