



Assembly Notes for LGA, BGA and CSP Loranger Sockets

Thank you for choosing Loranger sockets. The basic premise for utilizing the Loranger sockets for LGA, BGA and CSP packages is that the assemblies must be designed to maintain parallelism and registration at all times. Lack of parallelism creates a bending action on the socket, which translates into a tension stress being applied to the DUT package. Likewise, misregistration misses the target connection, and therefore cannot be tolerated. Also, basic cleaning and handling procedures are to be followed during assembly and use. Thus, the following design rules must be applied rigorously. Please feel free to contact your sales representative with any questions. A list of company sales contacts is available at www.loranger.com, or please feel free to contact the Loranger USA East Coast office at (814) 723- 2250, or the USA West Coast office at (408) 727-4234.

Recommended Values for Loranger (BGA, LGA and μBGA), Compression Mount, Socket Routing Notes

LORANGER SOCKET LAND PATTERN DESIGN AND ROUTING CRITERIA (REFERENCE DIAGRAMS BELOW)		Loranger Socket Pitch Range							
		0.40mm (0.0157")	0.50mm (0.0197")	0.60mm (0.0236")	0.65mm (0.0256")	0.75mm (0.0295")	0.80mm (0.0315")	1.00mm (0.0394")	1.27mm (0.0500")
P_{top}	Top Side Square Conductor Pad Width	0.305mm (0.012")	0.356mm (0.014")	0.457mm (0.018")	0.508mm (0.020")	0.559mm (0.022")	0.610mm (0.024")	0.813mm (0.032")	0.889mm (0.035")
T	Escaped Trace Width	Trace width is determined by design layout and current carrying requirements							
P1_{mid}	Internal Round Pad Diameter for Single Snake Routing	0.305mm (0.012")	0.356mm (0.014")	0.457mm (0.018")	0.508mm (0.020")	0.508mm (0.020")	0.508mm (0.020")	0.813mm (0.032")	0.889mm (0.035")
P2_{mid}	Internal Round Pad Diameter for Double Snake Routing	NA	NA	NA	NA	NA	NA	0.610mm (0.024")	0.660mm (0.026")
T1_{mid}	Internal Array Trace Width for Single Snake Routing	0.076mm (0.003")	Refer to Note2						
T2_{mid}	Internal Array Trace Width for Double Snake Routing	NA	NA	NA	NA	NA	NA	Refer to Note2	
P_{bot}	Bottom Side Round Pad Diameter	0.305mm (0.012")	0.356mm (0.014")	0.457mm (0.018")	0.508mm (0.020")	0.432mm (0.017")	0.432mm (0.017")	0.610mm (0.024")	0.660mm (0.026")
T1_{bot}	Bottom Side Array Trace Width	NA	NA	NA	NA	0.102mm (0.004")	0.102mm (0.004")	0.127mm (0.005")	0.2mm (0.008")

<u>Top Layer (Layer 1)</u>	<u>Layer 2 thru Layer n-1: SS</u> Single Snake Routing	<u>Layer 2 thru Layer n-1: DS</u> Double Snake Routing (1mm min.)	<u>Bottom Layer (Layer n)</u>

Every PTH requires a pad on the bottom layer for proper plating.

Note1: This chart was developed as a guideline for routing Loranger compression mount sockets. Always reference the Loranger Socket Land Pattern found on page 2 of 2 of the Loranger socket catalog drawing as it takes precedence over these guidelines.

Note2: Refer to the "P.C. Land Pattern" section on page 2 of 2 of the Loranger socket drawing for the maximum finished via hole diameter labeled "V" above. For calculating T1_{mid} and T2_{mid} subtract the calculated drilled hole size (V(in.) + 0.002") from the socket pitch and divide by 3 or 5; refer to the following formulas:

SINGLE SNAKE ROUTING (in.): $T1_{mid} = (\text{SOCKET PITCH (in.)} - (V \text{ (in.)} + 0.002")) \div 3$; where V(in.) + 0.002" is the calculated drill size to be used.

DOUBLE SNAKE ROUTING (in.): $T2_{mid} = (\text{SOCKET PITCH (in.)} - (V \text{ (in.)} + 0.002")) \div 5$; where V(in.) + 0.002" is the calculated drill size to be used.

Note3: Teardropping of all pads with a connected trace is recommended.

MANUFACTURING PROCEDURE: PCB Registration Inspection Procedure		OPERATION NO.: 9400 - 0100
EQUIPMENT/MATERIALS: Alignment gauge Microscope PC board	SPEC. NO.:	
	ASSEMBLY P/N: All LGA & BGA Sockets	
	CUSTOMER P/N: N/A	
	EFFECTIVE DATE: 7-Oct-02	
	SUPERSEDES: N/A	
DEPARTMENT NO.: 240		

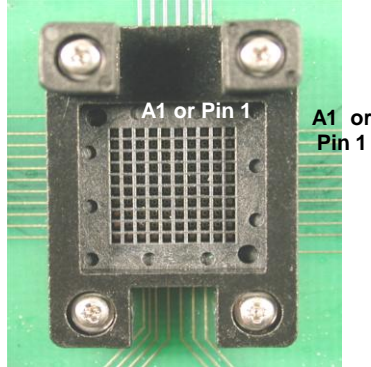


FIGURE 1 - Check & adjust the alignment gauge for proper positioning on the PC board.

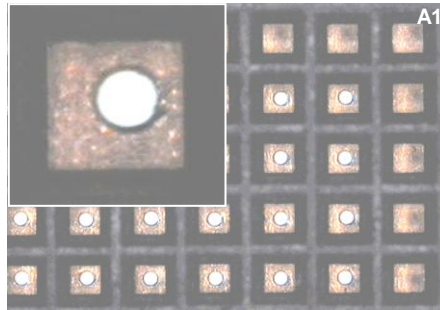


FIGURE 2A - Alignment gauge aligned properly with PCB conductor pads (PCB conductor pads centered in gauge holes).

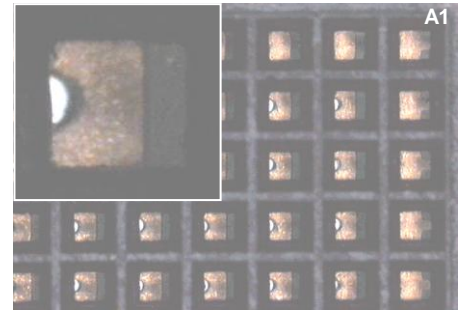


FIGURE 2B - Alignment gauge shifted to right or PCB conductor pads shifted to left (PCB conductor pads off-center in gauge holes).

STEP NO.	DESCRIPTION
1.0	<p>Before mounting any sockets to a PC board, the registration of the PC board conductor pads to the socket contacts must be checked. This alignment can only be checked using an alignment gauge, as outlined in the Steps below.</p> <p>Position the PC board to be checked underneath a microscope or similar magnified viewing area.</p> <p>NOTE: Make certain that the board is elevated/raised off of the work surface to allow the alignment gauge to fully seat (screws do not hit the work surface).</p>
2.0	<p>Properly orient the alignment gauge on the PC board so that position "A1 or Pin 1" of the alignment gauge aligns with position "A1 or Pin 1" on the PC board and insert the alignment gauge into the PC bd, FIGURE 1.</p> <p>NOTE: Position "A1 or Pin 1" in FIGURE 1, above, is for reference only. Please refer to the LIC catalog drawing for the particular socket that you may be using for the correct location of position "A1 or Pin 1", as position "A1 or Pin 1" varies from socket to socket.</p>
3.0	<p>While viewing through the microscope, check the position of the alignment gauge holes with the position of the PC board conductor pads.</p> <p>NOTE: Although the PC board holes for the socket mounting screws and/or plastic alignment posts are designed for a tight fit, the alignment gauge may still move around on the board in some instances. If this is the case, move the alignment gauge towards position "A1" and compare the alignment with FIGURE 2A and FIGURE 2B.</p>

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	ASSEMBLY P/N: All LGA & BGA Sockets	
	CUSTOMER P/N: N/A	
	EFFECTIVE DATE: 7-Oct-02	
	SUPERSEDES: N/A	
DEPARTMENT NO.: 240		

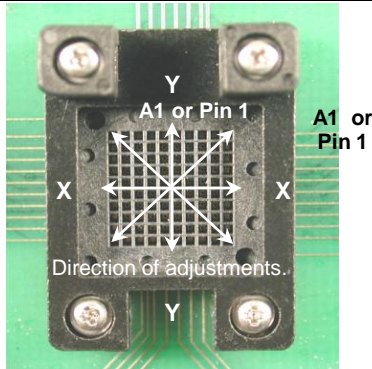


FIGURE 3 - Adjust the alignment gauge on the PC board until the best position is determined.

STEP NO.	DESCRIPTION
4.0	If the alignment gauge holes align with the PC board conductor pads, FIGURE 2A, then note this position and skip to Step #7.0.
5.0	If the alignment gauge holes <u>DO NOT</u> align with the PC board conductor pads, FIGURE 2B, then continue with Step #6.0.
6.0	Move the alignment gauge around on the PC board, from corner to corner and in the X and Y axes, FIGURE 3, until the best alignment is determined (closest to FIGURE 2A) and note that position with reference to position "A1 or Pin 1". NOTE: Please refer to the LIC catalog drawing for the particular socket that you may be using for the correct location of position "A1 or Pin 1", as position "A1 or Pin 1" varies from socket to socket.
7.0	Once the "Best" position has been determined, mount all of the sockets to the PC board, by first positioning and holding them in the proper location, as determined from Steps #4.0 or #6.0, and then tightening them down according to the included "Socket Mounting Instructions". NOTE: Every PC board should be checked in this manner, as well as checking several positions within each board, to make certain of uniformity. Failure to do so may result in inconsistent test results. This "best" position is people dependent, which is why LIC PC board design rules should be followed to make the landing pad on the PC board as large as feasible (along with all of the other design rules), to avoid mis-alignment.

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TABLE OF CONTENTS:

PAGE 1:	CLEANING AND HANDLING PROCEDURES
PAGE 2:	PRINTED CIRCUIT BOARD DESIGN GUIDELINES
PAGE 3:	LORANGER PCB FOOTPRINT REVIEW SERVICE
PAGE 4:	SOCKET MOUNTING INSTRUCTIONS
PAGE 6:	SOCKET ASSEMBLY KIT AND TORQUE WRENCH SPECIFICATIONS

CLEANING AND HANDLING PROCEDURES FOR LGA, BGA & CSP SOCKETS & BOARDS:

The basic premise for effectively handling all LGA, BGA or CSP sockets is that these sockets must be kept from all debris, dust, packaging particulate, hand creams, oils, perspiration and foreign matter that could lodge between the contacts in the socket. The connection to the DUT package I/O points and the connection points to the P.C. board input/output locations must also be clean. In this spirit, the sockets and P.C. boards must follow the handling methodology and cleaning techniques in the outline below.

1. Rubber Gloves or Finger Cots
People who handle the sockets and P.C. boards shall wear lint-free, rubber, surgical grade gloves or finger cots to handle the parts at all times to avoid transferring foreign elements to the sockets.
2. Clean, Clear Plastic Bags
Unused parts, sockets in process and finished assemblies shall be stored in clean plastic bags.
3. Ultrasonic Cleaning of Subassembly Components
All components shall be ultrasonically cleaned in a degreasing solvent before handling with rubber gloves for processing.
4. Visual Inspection
Before storage is complete, the assemblies shall be 100% visually inspected to check for debris and foreign matter. If any debris is found under a 10X magnification, the assembly shall be recycled again until no further foreign matter is found.
5. Verification of Conductor Path Plating Thickness
Audit the board certifications or measure the conductor paths (NOT the edgifiers) to determine that 40 micro inches minimum of gold to 50 micro inches of gold over 50 micro inches minimum of nickel exist.

Assembly Notes for LGA, BGA and CSP Loranger Sockets

PRINTED CIRCUIT BOARD DESIGN GUIDELINES:

1. Routing Guidelines

Please refer to the attached document: Design Guidelines for Routing X.XX mm Pitch Sockets. This document describes the routing procedures for the printed circuit board footprint of the Loranger socket. Additional notes follow below.

2. Recommended pad shapes, sizes and locations

LIC socket catalog drawings always show the "P.C. LAND PATTERN". This land pattern drawing shows all the dimensions and tolerances required for the pads and plated thru holes for each socket. Adhering to this drawing exactly is of paramount importance to ensure optimum socket reliability. Some of the very important aspects of the drawings are expanded upon below.

3. Level Top-Side Pads

On the top side of the P.C. board (socket side), the contact pads under the socket and the standoff pads around the 4 mounting holes shall be at the same level, i.e. generated with the same metallurgy and void of solder mask or other coatings.

4. Level Bottom-Side Pads

On the bottom of the board, there shall be pads around the four mounting holes (similar to the top). These pads are to be identical in height to the make up of the construction of the underside area (bottom) of the board. (e.g. Assuming conductor path and solder mask on the bottom of the board, the 4 pads shall also have the same conductor path and solder mask.) Recently, LIC PCB designers have been using a top and bottom solder mask free zone on the entire footprint area, out to and including the socket and back-up plate largest dimensions.

5. Plating Requirements

The required plating specification for the conductor paths (not the edgifiers) is to have 40 to 50 microinches of electroplated gold over 50 microinches of electroplated Nickel min. This is mandatory. If the sockets are to be soldered or attached with conductive epoxy, then other types of plating are acceptable at the sacrifice of easy replacement.

6. Drilling Requirements

The non-plated thru holes for the four mounting screws must be drilled 0.001" over the maximum thread size of the screw and held to a plus or minus tolerance of 0.001" with a true position of 0.004". The 0.001" tolerance needs to be explicitly stated on any fabrication drawing to ensure the hole is within spec. The conductor pad via holes are usually specified as a maximum value, and is dependent on the socket pitch. For example, 0.8 mm pitch sockets require 0.009" max. diameter via holes. Loranger would specify this on a fabrication drawing as: *0.009" +0.000" / -0.009" (may be plated closed)*. Please refer to the "P.C. Land Pattern" of the socket drawing for the maximum allowable via hole size, which is dependent on the pitch of the socket.

7. Top Solder Mask Note (if solder mask is being used):

LIC Engineering recommends a solder mask free polygon to be placed over the entire footprint area on the topside to ensure no solder mask contamination on the topside conductor pads.

8. Bottom Solder Mask Note (if solder mask is being used):

If a back-up plate is used, LIC engineering recommends a solder mask free polygon should be placed over the entire footprint area on the bottom side (extending to the edges of the back-up plate). This ensures that when the back-up plate is tightened to the board there is no uneven surface on the bottom of the board that will cause it to bow.

Continued...

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9. Guide Pin Locator Holes (2x)

Many of the sockets have plastic molded guide pins protruding from the bottom of the plastic body. These holes are critical to the proper location of the assembled socket on a PCB and therefore must be accurately placed to guarantee correct socket to board registration.

LORANGER PCB FOOTPRINT REVIEW SERVICE:

Loranger offers a PCB footprint review at no cost for footprint accuracy compared to LIC recommended footprint, which can be found on the Loranger socket drawing. Below is a list of the dimensions that we will compare the required Loranger International specifications to the information given to LIC Engineering in the gerber files you would send us.

PAD DEFINITIONS:	Top Side Conductor Pad & Solder mask Top Side Mounting Pad & Solder mask Bottom Side Mounting Pad & Solder mask
HOLE INFORMATION:	Mounting Hole & Alignment Hole Conductor Pad Via Hole Conductor Pad Via Hole Position
PLATING:	Board Conductor Path Plating
DIMENSIONS:	Mounting Hole Dimension (Long & Short Axis) Mounting Hole to Conductor Pad (Long & Short Axis) Overall Array Dimension

Below is a list of files that Loranger will need to complete the Footprint Review:

1. Top side Gerber file
2. Top-solder mask Gerber file
3. Bottom side Gerber file
4. Bottom-solder mask Gerber file
5. Fabrication Drawing Gerber file with drilling and plating information and tolerancing.

****All gerber files should be RS-274-X embedded apertures if possible. If it is not possible, please provide the aperture list****

- LIC PCBDD will verify that all design information in the gerber files matches the recommended "PC Land Pattern" which is located on page 2 of 2 on each of our socket catalog drawings.
- Snaking-thru conductor pads on the top layer is NOT recommended because of the increased chance of a contact shorting to a trace.
- We will check your conductor path plating on the fabrication drawing gerber files, and we remind you that our BGA, LGA & CSP sockets require conductor pads, which must be 40 to 50 micro-inches of electroplated Gold over 50 micro-inches minimum of electroplated Nickel.

SOCKET MOUNTING INSTRUCTIONS:

Assembly Notes for LGA, BGA and CSP Loranger Sockets

LGA/BGA/CSP Direct Socket and P.C. Board Assembly Procedure

- 1.0 Prior to assembling the socket(s) onto the printed circuit board, please complete the Loranger PCB Registration Inspection Procedure included with this document. A Loranger alignment gauge is supplied with the socket order for this purpose.
- 2.0 After completing the Loranger PCB Registration Inspection Procedure, remove four (4) nuts, four (4) lock washers, an insulator and a metal support plate, or a plastic shipping protector and four (4) flat washers, from the bottom of the socket(s). DO NOT turn the head of the screw! Only turn the nut, as the internal threadlocker is sufficient to keep the screw from moving.

NOTES: Keep from touching the exposed contact springs to prevent damaging them.

Contacts must be free floating when the socket is mounted. This means no DUT packages can be in the sockets when mounting BGA, CSP or LGA sockets. Also the area that the socket is mounted on and the DUT packages must be seated on a level plane (free of debris, oils, and other contamination).

- 3.0 Referencing the locating guides for pin "A1" and/or the assembly print, properly orient the socket on the topside of the PC board.
- 4.0 Carefully insert the socket screw threads through the mounting holes in the PC board until the socket is fully seated. Some sockets have the additional molded, plastic guide pins protruding from the body to fine adjust in the last 0.060" of loading also.

NOTE: LIC provides 4 mount screws that are long enough to mount to 0.059" nominal thick P.C. board, and laminate up to 0.093" thick. Included with the screws are spring washers that even out the mounting torque. If other board thicknesses are to be utilized, LIC will provide a different screw length to meet the requirements under a special order.

- 5.0 Position the socket as determined from the Loranger PCB Registration Inspection Procedure (noted in step 1.0 above). Holding the socket in place, turn the assembly over to expose the bottom side of the PC board.
- 6.0 If an insulator is present, carefully place the insulator over the four (4) screws and slide the insulator down until it touches the PC board, if provided with the socket.

NOTE: Skip this step if only a plastic shipping plate is provided. (The plastic shipping plates are for contact protection only and are to be discarded. NEVER mount the plastic shipping plates on the P.C. board.)

- 7.0 If a metal support plate is present, carefully place the support plate over the four (4) screws, positioning the side labeled with a "B" away from the insulator and PC board, and slide the support plate down until it touches the insulator, if provided with the socket. (See Figure below.) [The "B" is now visible from the bottom of the board.]

If NO letter "B" on support plate, then place plate on four (4) screws with the two (2) alignment holes on plate matching two (2) holes on insulator and the two (2) alignment posts on bottom side of socket.

NOTE: Skip this step if only a plastic shipping plate is provided. (The plastic shipping plates are for contact protection only and are to be discarded. NEVER mount the plastic shipping plates on the P.C. board.) Continued...

Assembly Notes for LGA, BGA and CSP Loranger Sockets

SOCKET MOUNTING INSTRUCTIONS CONTINUED:

- 8.0 If a plastic shipping plate is present, place one (1) flat washer over each of the four (4) screws.

NOTE: Skip this step if a metal support plate is provided.

- 9.0 Place one (1) lock washer over each of the four (4) screws.
- 10.0 Place one (1) nut over each of the four (4) screws and hand tighten by turning the nuts only. (DO NOT torque the screw head.)
- 11.0 Insert and hold a Phillips screwdriver in each screw head and, using a torque driver, tighten all four (4) nuts, as illustrated in the diagram below. This will prevent damage to the cured internal threadlocker during the socket mounting process. The maximum torque setting for a #4-40 screw and for a #2-56 screw is 2.5 in.-lbs. [40.0 in.-ozs.], and the maximum torque setting for a #0-80 screw is 1.5 in.-lbs. [25.0 in.-ozs.]. Please reference the LIC socket catalog drawing, available from your sales representative, for the proper torque value for a given socket.

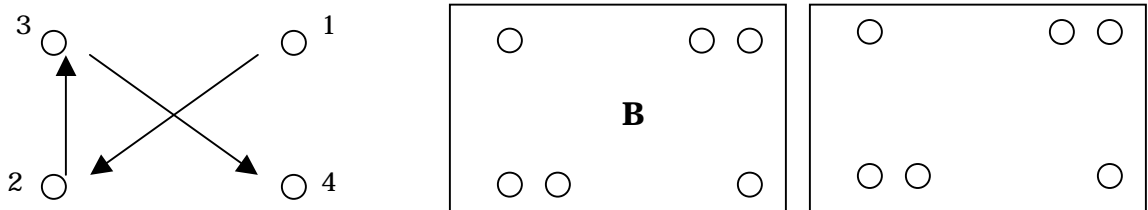


Figure - Support Plates "B" and NO "B"

Diagram - Torque pattern for the LGA/BGA/CSP sockets.

- 12.0 Add Loctite #294, ND Industries #150012 or equivalent, to all externally torqued hex nuts in the thread area only, immediately adjacent to the nut.

NOTE: This is to avoid any loosening of the screws under burn-in conditions over time. Loose screws lessen the spring force at the socket/ P.C. board surface mount interface and create intermittent contact. Threadlocker stops the loosening of screws and the recommended #294 or #150012 Threadlocker does the job while still enabling repair and removal if necessary.

- 13.0 Repeat steps #1.0 - #12.0 for all remaining socket and PC board assemblies.
- 14.0 Test After Assembly - Socket electrical tests must be conducted with a properly designed probe that simulates the DUT package. Damage from individual digital volt meter (DVM) probes can occur with scrubbing pressure across the individual hardened contacts, due to the lever arm of the DVM probe against the miniature contacts. In addition, a full contact probe should be raised and lowered once clamped to a vertical slide, so as to not apply a cantilever load to the contacts from a cocked probe insertion. Also, lightly tap the socket to settle the contacts before inserting the probe.

NOTE: For LGA packages, the DUT on the floating plate must be pushed toward the datum corner before closing the cover and latching, whereas BGA packages will self center by loading and moving slightly to allow the balls to self seat in the array of holes in the socket.

Assembly Notes for LGA, BGA and CSP Loranger Sockets

LORANGER SOCKET ASSEMBLY KITS:

Variable torque wrench kit (20 – 120 in-oz).

Kit consists of:

- 1 – Torque wrench LIC # 0690000
- 1 – Socket adaptor LIC # 0690001
- 1 – 5/32” 6 point socket LIC # 0690002
- 1 – 3/16” 6 point socket LIC # 0690003
- 1- Bottle of Threadlocker
- 1 – Set of application needles

Fixed value torque wrench kit.

Kit consists of:

- 1- Standard fixed value torque wrench LIC # 069000.40
- 1- Socket adaptor LIC # 0690001
- 1- 3/16 “ socket LIC # 0690003
- 1- Bottle of Threadlocker
- 1 – Set of application needles

Please contact your Loranger salesperson for pricing details for Socket Assembly Kits.

TORQUE WRENCH SPECIFICATIONS:

SUPPLIER: Mountz
1080 North 11th St.
San Jose, CA 91552
(408) 292-2214

VARIABLE SETTING TORQUE WRENCH:

Model #: MT120AFH (Female Hex Drive)
Item #: 02-0374
Torque Range: 20-120 in.-ozs (1.25 – 7.5 in-lbs) Externally Adjustable

FIXED SETTING TORQUE WRENCH:

Model #: Standard (Female Hex Drive)
Item #: 02-0079
Torque Range: 8.0 in-ozs – 36 in-lbs. (Internally Adjustable)

NOTES:

1. Tools require the purchase of a 2” long, ¼ “ hex socket extension and a ¼”, 6 point socket for torquing the #4-40 hex nuts, a 3/16”, 6-point socket for torquing the #2-56 hex nuts, or a 5/32”, 6-point socket for torquing the #0-80 hex nuts, since the above tools do not come as standard and are considered “special ordered” as accessories.
2. The fixed tools must be ordered to the required torque setting (#4-40 screws and #2-56 screws = 40.0 in-ozs max and the #0-80 screws = 25.0 in-ozs max).