AMPHENOL TCS

TB-2313

Lynx

DFM and SMT Assembly Guideline

Revision “D“

Specification Revision Status

Revision	SCR No.	Description	Initial	Date
“A“	S3945	Initial Release	AP	10-08-15
“B”	S4084	Updated Reflow Process	AP	11-12-15
“C”	S4510	Updated PCB Pad Layout	AP	04-19-16
“D”	S5138	Updated Section 3.7	AP	09-15-16

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1.1 DFM Guideline Introduction

This document is intended to provide design criteria and process information that will promote automation, cost and cycle time reduction, and help to produce designs that will yield high quality for the solder attach of Lynx connectors. The Lynx connector will be used in many assembly processes, and because all processes are different, this document provides a starting point, or "baseline" criteria for application process development. **This document is not intended to be the final process definition, nor is it intended to constrain designs.** If customers cannot meet/follow all of the recommendations, they should contact Amphenol TCS to discuss the best alternatives.

1.2 Scope

This document has been prepared to communicate the application guidelines for the Lynx Surface Mount Connector. It provides Printed Circuit Board (PCB) footprint and layout criteria, and "starting-point" process recommendations for SMT assembly. Updates and revisions will be issued on a continuous basis to expand the guidelines, address changes in technology and manufacturing capabilities, and cover modifications and/or additions to current criteria.

1.3 Purpose

DFM is the sharing of manufacturing guidelines developed from industry standards and the knowledge gained from design and production. Applying these guidelines concurrently, in new product development with the design and application of Amphenol's Lynx connector, can positively impact cost, time to market, and quality of the end product.

1.4 Reference Documents

Located at: http://www.amphenol-tcs.com/lynx

- **1.4.1** General Product Spec
- **1.4.2** Plug Assembly Drawing
- **1.4.3** Receptacle Assembly Drawing
- **1.4.4** Lynx Data Sheet

1.5 Levels of Requirement

For each requirement, an impact and benefit statement is included to quantify the requirement. Some requirements are stated as being recommended or preferred per the following:

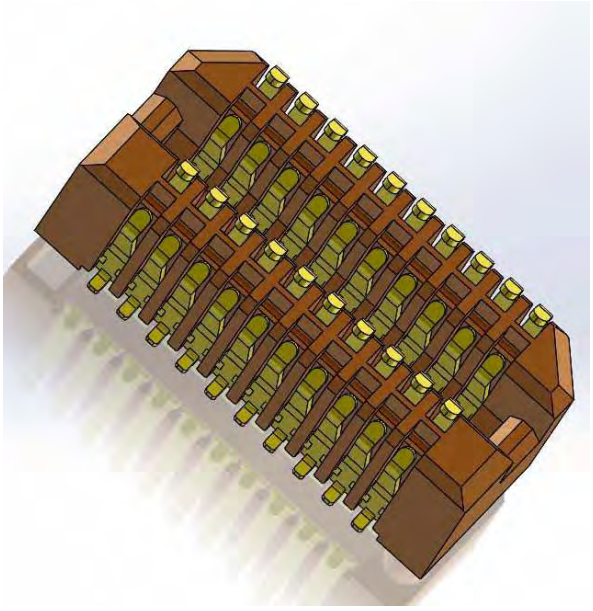
Recommended: The minimum processing requirement – a deviation **will** most likely impact manufacturability and cost.

Preferred: Should be done when possible – a deviation **could** impact manufacturability and cost.

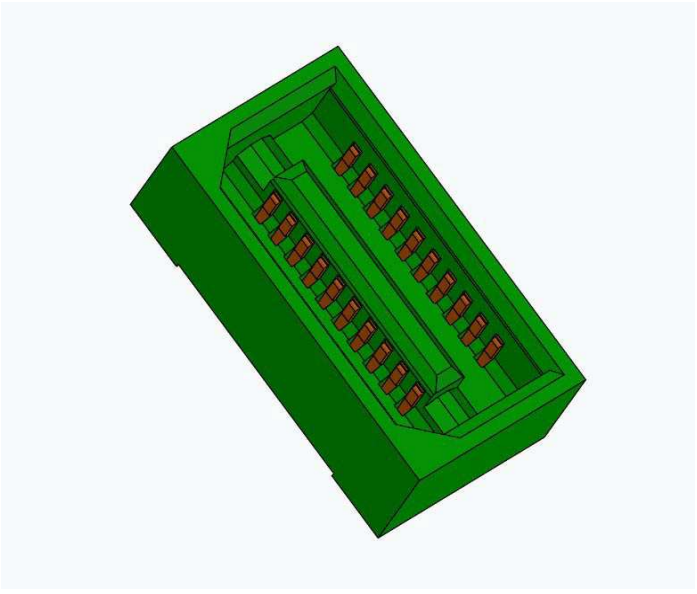
2.1 Design Introduction – Lynx Connector

The Lynx connector is organized as a four row mezzanine connector which accommodates 10 to 60 positions by four rows. The lynx configuration offers a keying feature to prevent incorrect matingorientation and offset PCB posts which prevent incorrect installation on the board. The connector is completely SMT attach, utilizing a gull wing pin-in-paste for termination to the board, and is readily applied using standardSMT processes.

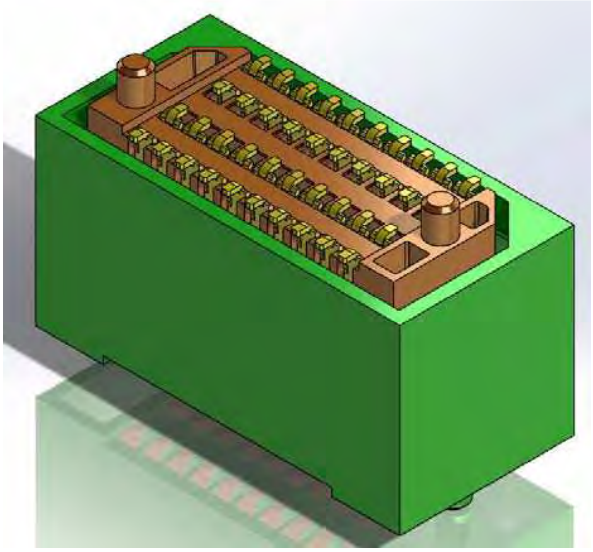
Lynx Receptacle

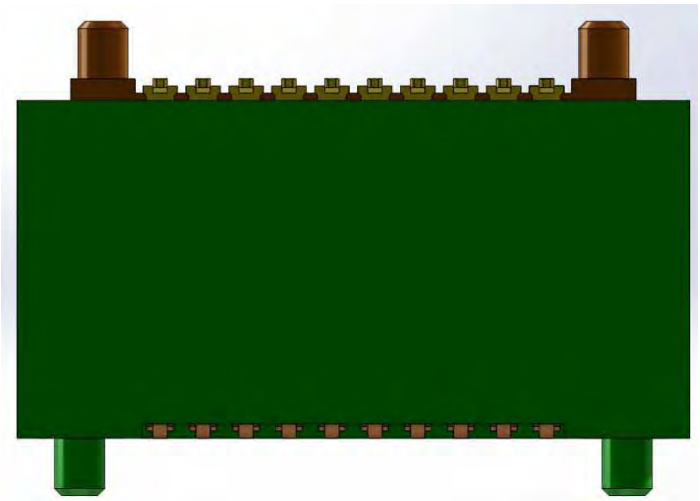


Lynx Plug

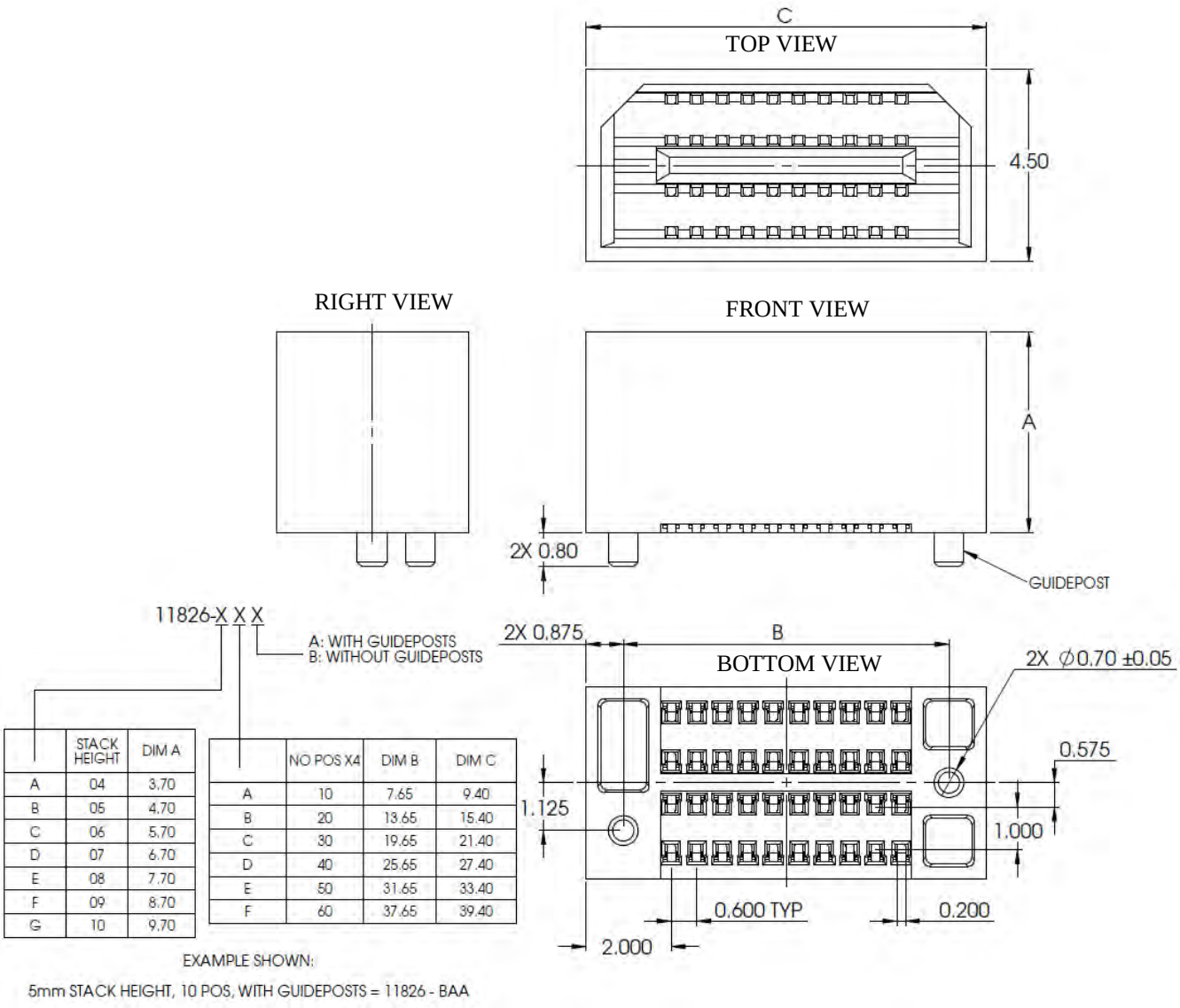


Lynx Mated





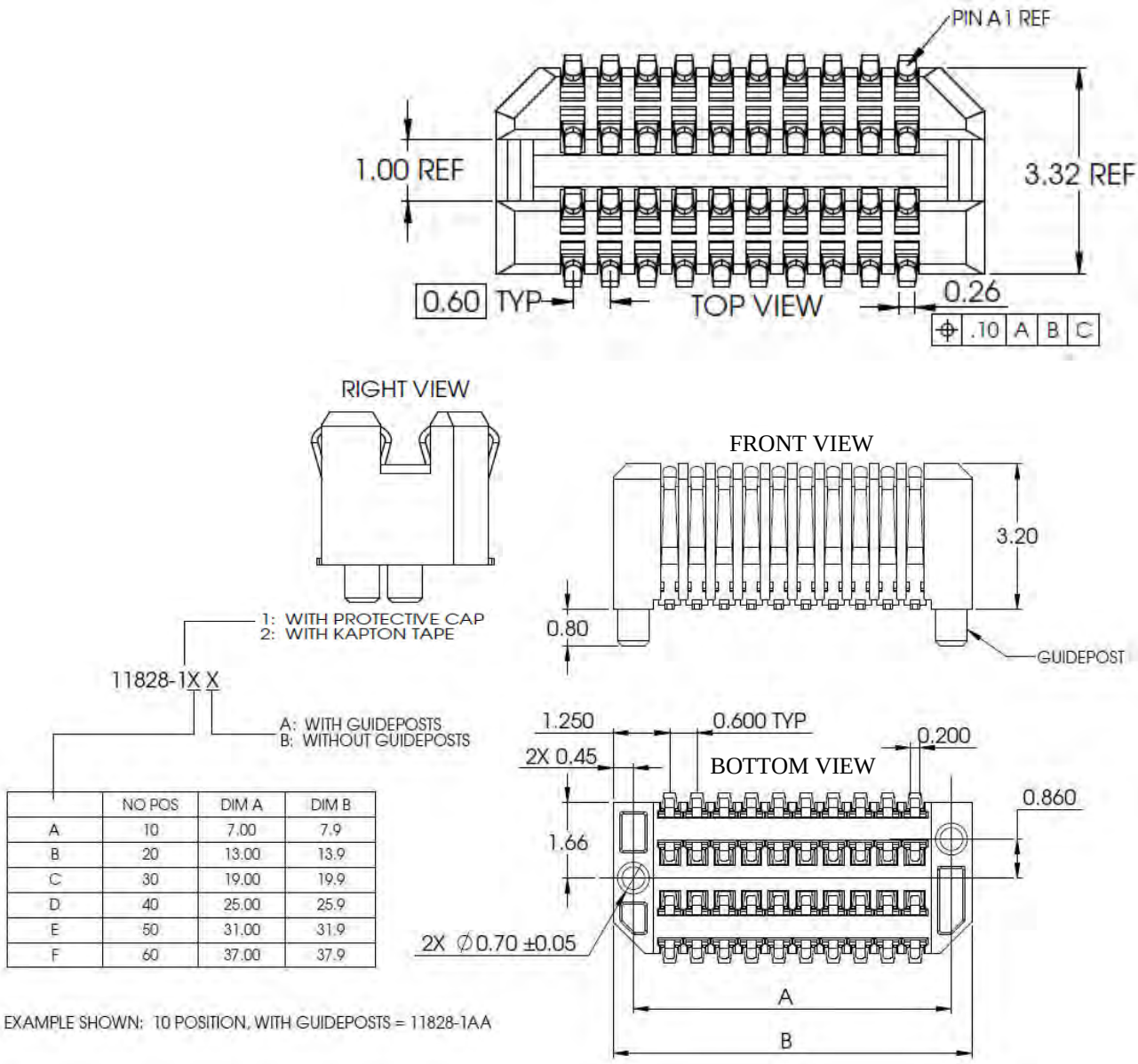
2.2 Part Numbering Matrix: Lynx Plug



	STACK HEIGHT	DIM A
A	04	3.70
B	05	4.70
C	06	5.70
D	07	6.70
E	08	7.70
F	09	8.70
G	10	9.70

	NO POS X4	DIM B	DIM C
A	10	7.65	9.40
B	20	13.65	15.40
C	30	19.65	21.40
D	40	25.65	27.40
E	50	31.65	33.40
F	60	37.65	39.40

2.3 Part Numbering Matrix: Lynx Receptacle



	NO POS	DIM A	DIM B
A	10	7.00	7.9
B	20	13.00	13.9
C	30	19.00	19.9
D	40	25.00	25.9
E	50	31.00	31.9
F	60	37.00	37.9

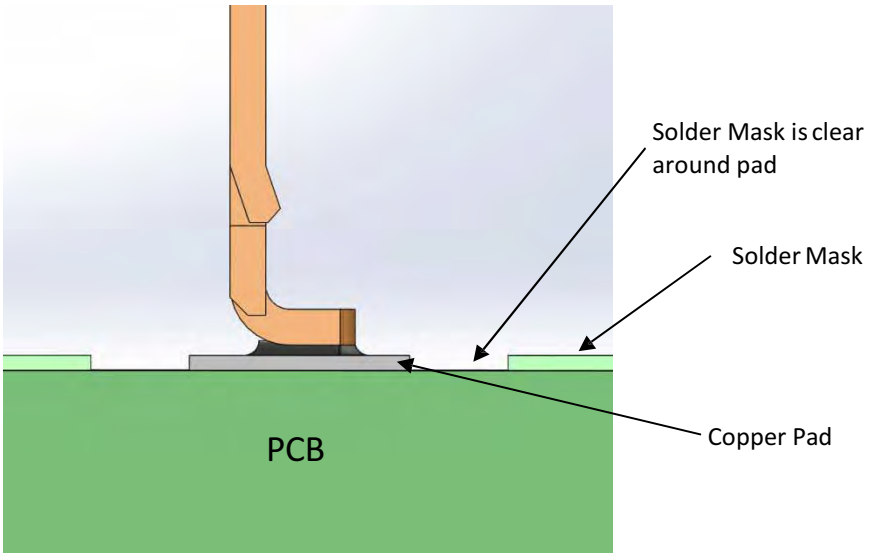
EXAMPLE SHOWN: 10 POSITION, WITH GUIDEPOSTS = 11828-1AA

3.1 Design Requirements

3.2 Lynx Solder Joint Definition – Reliability Factors

The recommendations made below have a direct impact on the reliability of the connector solder joint, and play an important role in facilitating the connectors' ability to self-center and achieve the best possible location tolerances.

Requirements	DFM Impact/Benefit
• Recommend using a "Copper Defined" landing pad as opposed to a "Solder-Mask Defined" pad.	• "Copper defined" better insures a round, accurately located pad – critical to part location tolerance. • "Copper defined" pad produces a more reliable solder joint – allowing solder to wrap around the pad edge.
• Pad Size = 0.740mm x 0.370mm	• Smaller pad will result in decreased wetting area, based on solder volume – increasing the risk of solder fracture. • Larger pads will increase the risk of shorting.
• Solder mask should be clear around pad	• In-accurate registration will result in solder mask encroaching onto copper pad.



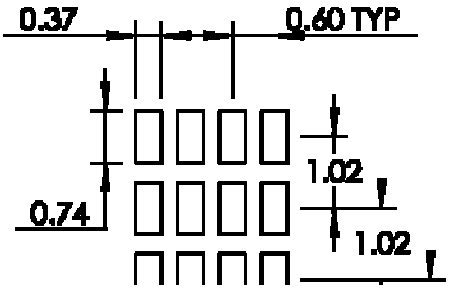
Copper defined pad yields highest quality solder joint compared to solder mask defined
- Does not inhibit connector ability to self center
- Solder creates proper meniscus to promote maximum strength and proper wetting

3.3 Landing Pad Footprint

Refer to Figure 3.2.1 for overall landing pad layout. Via in pad or offset will be application dependant. The exact design will depend on several factors including design goals, route-ability, customer specific design for manufacturability (DFM) guidelines, and PCB fabricator capabilities. The diagram below offers a starting point, with the critical parameters in bold.

Requirements	DFM Impact/Benefit/Alternatives
• Amphenol TCS recommends a 0.740mm x 0.370mm "Copper Defined" landing pad over a "Solder-Mask Defined" pad.	• See previous section for impact
• Minimum .13mm (.005") Solder Mask Dam between pad and via.	• Prevents solder from wicking away from pad and into via, causing insufficient solder joints.
• It's preferred to mask the vias if design allows, or if a .13mm min dam can't be held.	• Via drill sizes can be changed based on PCB fabricators board thickness aspect ratio, but must insure a minimum solder mask dam.

PCB PAD LAYOUT WITHOUT GUIDE PINS



PCB PAD LAYOUT WITH GUIDE PINS

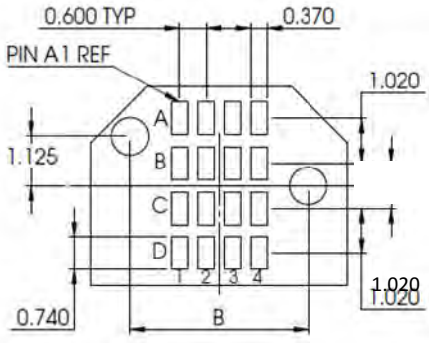


Figure 3.2.1 Lynx Detailed Board Layout (General Requirements, Refer to Customer Drawing for specific dimensions)

3.4 PCB General Requirements

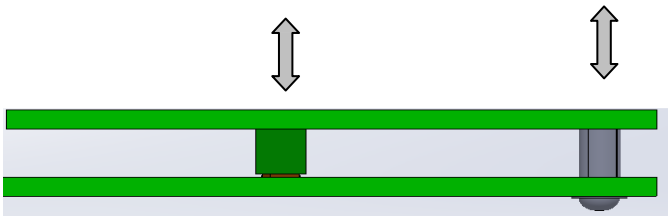
Requirements	DFM Impact/Benefit
• Maximum recommended board warp – 7 mils/inch*. (Sufficient for surface finishes that have less than .001" thickness variation such as OSP, ENIG, Immersion Tin and Silver.)	• Minimizes the risk of opens
• The Pin 1 locating chamfer is shown on layout. Part should be oriented to align to the chamfer.	• Ensures correct board alignment

***Note: The recommended board warp is also based on the assembly process stencil thickness used.**

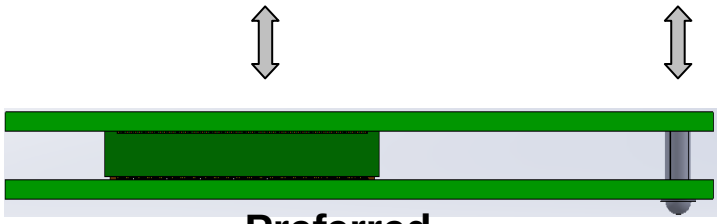
3.5 Preferred Mating/Un-Mating and Allowable Mate Angles

Requirements	DFM Impact/Benefit
• Layout should include a slightly larger silkscreen outline of the component housing.	• Silkscreen is visible after connector placement, and allows for "first-piece" visual inspection of polarity/orientation.
• When mating/un-mating card where yourotate on connector width – max angle is 2 degrees	• Prevents connector damage
• When mating/un-mating card where yourotate on connector length – max angle is 2 degrees	• Prevents connector damage

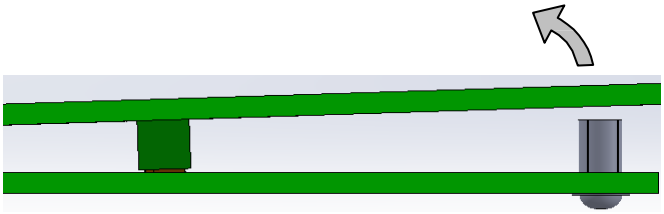
Mating and Un-mating:



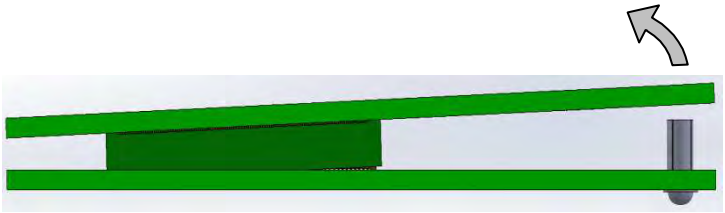
Preferred



Preferred



Acceptable



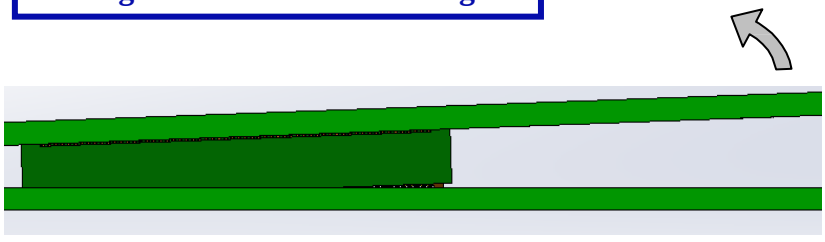
Not Recommended

Mating and Un-mating:

1. Rotating on connector width

Angle Between PCB 2.00 Deg

2. Rotating on connector length



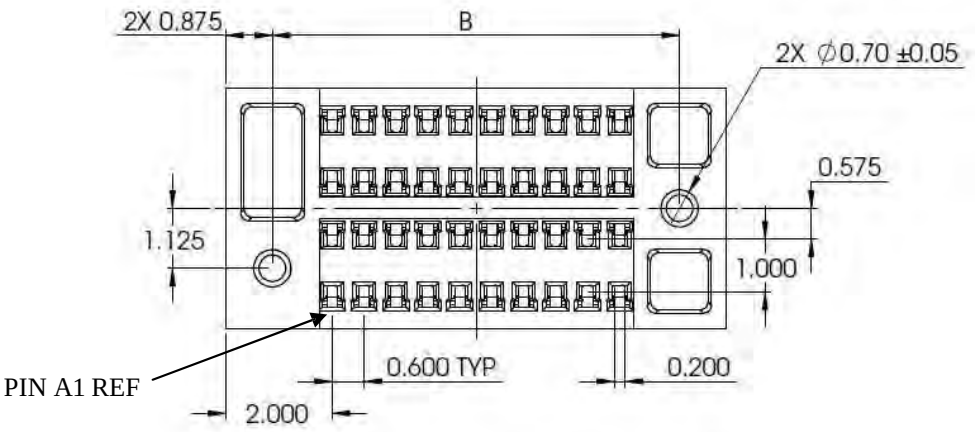
Angle Between PCB 2.00 Deg

3.6 Lynx Polarizing Features

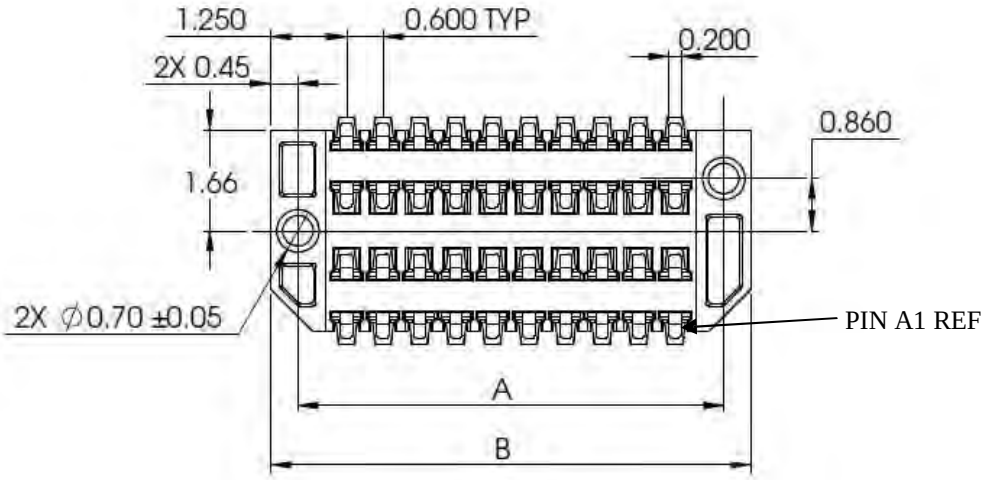
Requirements	DFM Impact/Benefit
• PCB should be designed using the guidepostoffset shown below	• Prevents incorrect mating and damage tothe connector
• Maximum mis-alignment in X direction is0.03mm max. Maximum mis-alignment in the Y direction is 0.03mm max. (See below)	• Prevents damage to the connector
• Blind mates should include standoffs or mechanical alignment hardware to assist.(See section 3.7 for details)	• Completes gross alignment allowing connector housing to begin next level of align andprevents stubbing of contacts.

Polarizing Features

BOTTOM VIEW PLUG



BOTTOM VIEW RECEPTACLE



3.7 Mechanical Requirements

The Lynx connector should NOT be used as the primary mechanical structure when used within interposer board connecting two boards within a system. Board assembly weight and shock and vibration forces should be supported by other mechanical means such as standoffs. The following describes minimum requirements for mechanical packaging.

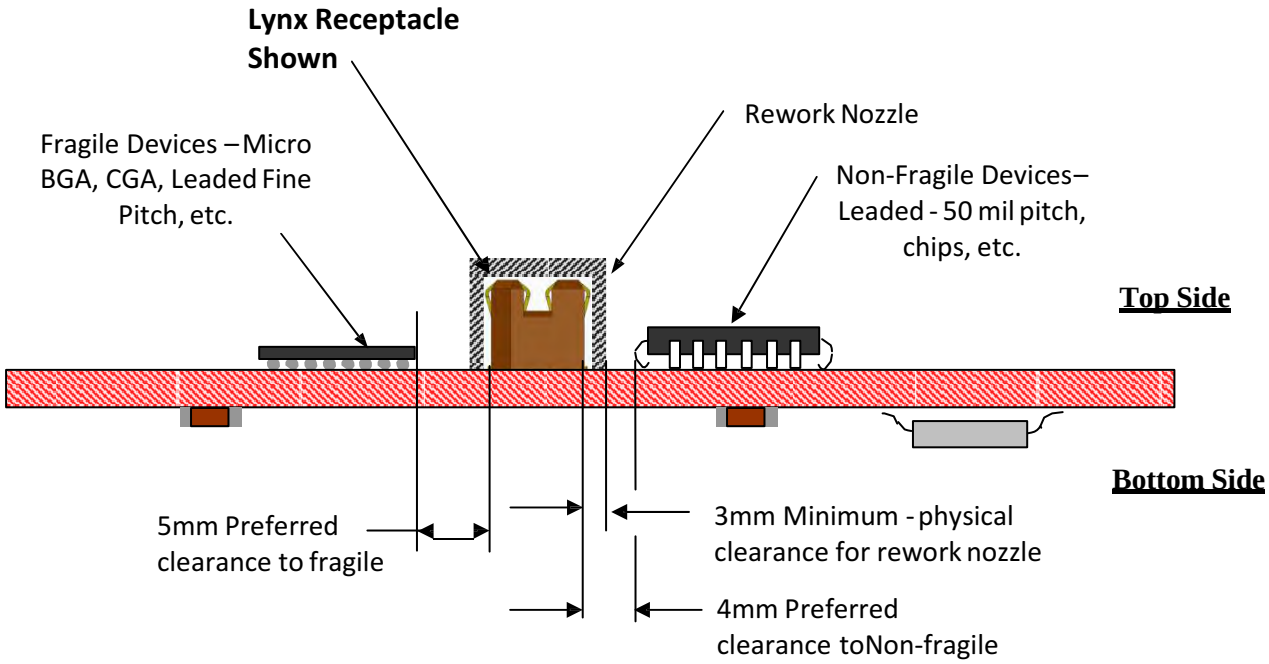
Requirements	DFM Impact/Benefit
• Provide sufficient hold down forces to retain mated cards.	• Insure connectors stay mated during shipment and vibration.
• Alignment Pins are required for multi-connector application. • Should be placed outside the connector keep-out zones.	• Provides guidance for blind mating.
• Standoffs are required for all applications.	• Maintain minimum wipe regardless of shock, vibration and board warp tolerances. • Support the mated boards and protect the BGA solder joints. • Minimizes mechanical stresses on the solder joints
• Stand-off lengths are shown below	• Matrix provides the correct stand-off length to minimize board or connector stresses.
• Stand-offs should be placed outside the connector keep-out zones.	• Allows for connector rework without having to remove stand-offs
• Number of stand-offs and pattern of placement should prevent all mechanical stresses to the solder joint.	• Insures no solder joint failures due to shock and vibration.

Mated Stack Height (mm)	Standoff Height (mm)
4.0	4.0+0.15/-0.0
5.0	5.0+0.15/-0.0
6.0	6.0+0.15/-0.0
7.0	7.0+0.15/-0.0
8.0	8.0+0.15/-0.0
9.0	9.0+0.15/-0.0
10.0	10.0 +0.15/-0.0

3.8 Keep-out Zone and Clearances

The Lynx connector keep-out zone is required for re-work capability. This allows clearance around the connector housing for rework tooling and nozzles.

Requirements	DFM Impact/Benefit
• The recommended minimum clearance required is 3mm – preferred clearance is 4mm to non-fragile adjacent components.	• Rework nozzle - physical clearance
• It's preferred to have 5mm clearance to adjacent devices that are very fine pitch with small thermal mass, and could re-reflow – this is dependent on board thickness, copper weight and connector height	• Prevents re-reflow of adjacent device, which could cause shorts/defects on that device.



4.0 Connector Handling

The Lynx connector leads are robust and not easily susceptible to damage. Standard SMT device care should be taken when handling the connectors through the process.

Outer box and foam packaging can be removed in the stockroom prior to transferring the parts to the SMT area.

Lynx connector materials are NOT moisture sensitive per J-STD-020. This standard does not apply to connectors.

Requirements	DFM Impact/Benefit
• Connectors should be kept in the Tape & Reel or tube for transfer and storage in the SMT process.	• Protects the connector lead frame until it can be loaded into the placement machine
• Storage conditions should be ≤ 30°C and 60% Relative Humidity.	• Insure connector meets standard shelf life durations without impact to solderability. • Reel and parts should be packed in vapor barrier bags with desiccant if storage environment exceeds the requirements defined.

5.0 Solder Paste Process

Requirements	DFM Impact/Benefit
• Liquid Photo-Imageable (LPI) soldermask over bare copper is preferred.	• Most common – provides best adhesion for solder mask - preventing peeling and flakingof mask during assembly processes.
• Recommended stencil thickness 5-6mils (0.127 - 0.152mm)	• Minimizes the risk of opens
• Recommended aperture is reduced by 2 mils (0.05mm)	• Minimizes the risk of solder bridging

Board Warp Matrix - The following matrix defines the board warp spec required for each of the listed variables – Stencil Thickness and Pad Finish Co-planarity

		Pad Finish Co-planarity	
		<.001"	<.002"
Stencil Thickness and Paste Process Variation	5 mil +2/-0 mil	.007"	.005"
	5 mil +2/-.5 mil	.005"	Not Recommended
	6 mil +2/-0 mils	.007"	.007"
	6 mil +2/-.5 mil	.007"	.005"

6.1 Placement Process

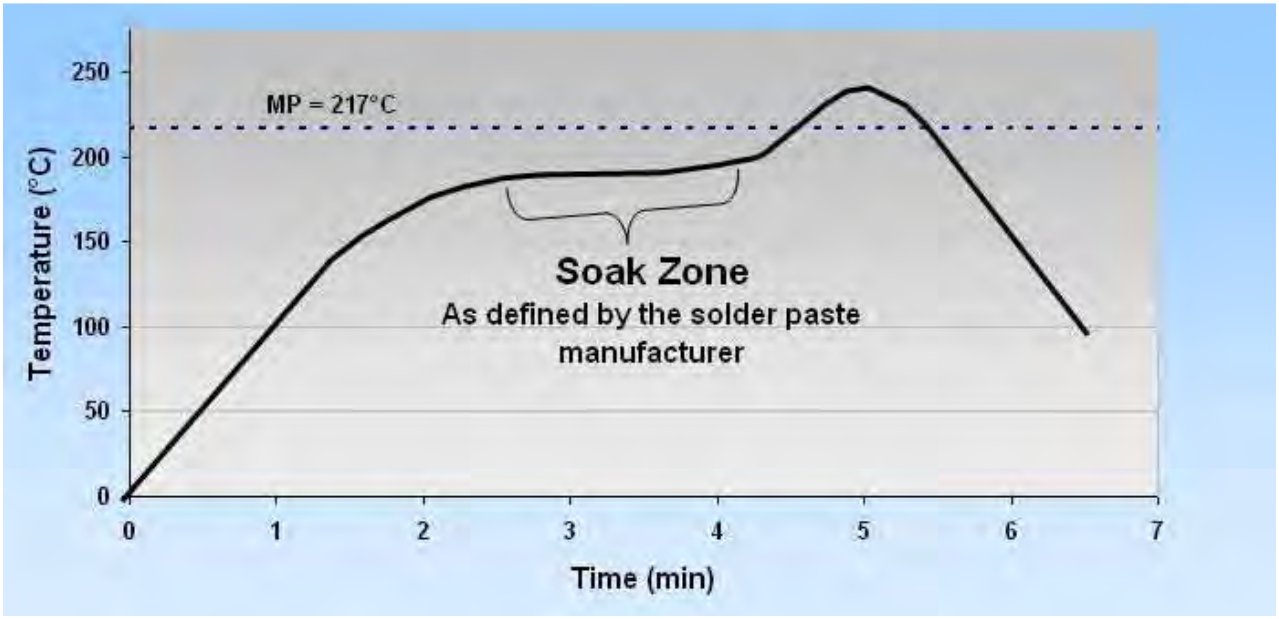
Requirements	DFM Impact/Benefit
• Connector should be **pre-oriented** for machine vision system alignment.	• Prevents nozzle slip/skew, between camera and placement, due to connector weight.
• Full circular side lighting is preferred	• Ability to most accurately find the ball, without background lighting issues.
• Nozzle selection should be based on connector weight Note: Refer to Placement equipment specs to verify capability	• Heavier connectors require larger bore nozzles to allow for sufficient vacuum and pick-up forceand prevent part slip or skew.
• Placement location/centroid of the part should be based on the contact tails.	• Minimizes the percentage of contact tail that is off-pad.

6.2 Placement Process – Feeders

Requirements	DFM Impact/Benefit
• Connectors are shipped in tubes or Tape & Reel and are equipped with a cap that provides a flat vacuum surface – see below.	• Meets the requirements of industry standard placement equipment
• The Pickup TAP can be removed by hand after reflow	• See reflow process section for more info

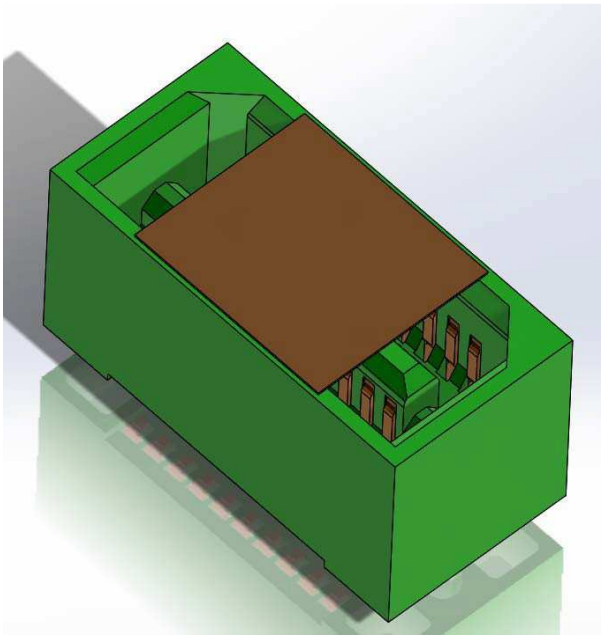
6.3 Reflow Process – Reflow Profile Recommendations

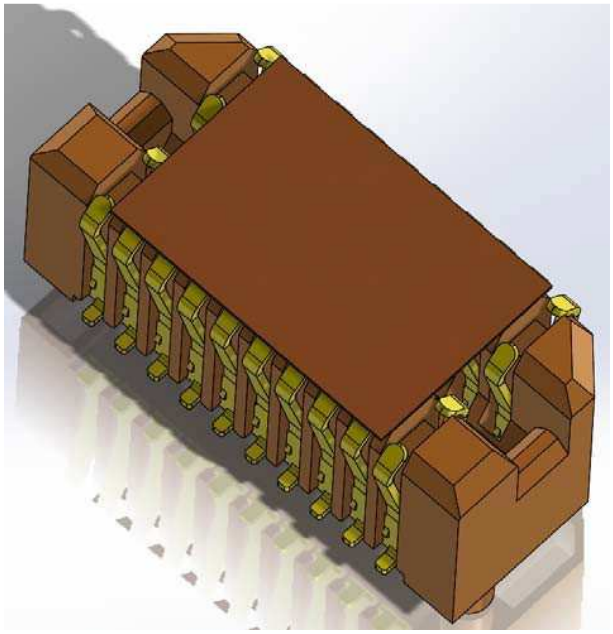
Requirements	DFM Impact/Benefit
• Set process to the solder paste supplier's recommended profile.	• This varies by supplier and specific flux chemistry
• Recommend only maximum of 2 Reflow Cycles	• Minimizes the solder wicking
• Recommend using a Soak Profile over a straight ramp to peak. The soak time and temperature is defined by the paste manufacturer based on optimal flux chemistry activation temperatures.	• Minimizes void formation and risk of pillow head defects • Minimizes delta T's across thermally heavier parts



6.4 Reflow Process – Vacuum Cap Removal

Requirements	DFM Impact/Benefit
• Post reflow Pickup TAP removal	• Pickup TAP can be removed after reflow/inspection. (Note: A new Pickup TAP is required for connector rework)





7.0 Double Sided Reflow Process

Requirements	DFM Impact/Benefit
• Lynx is compatible with double-sidedreflow soldering. • ATCS recommends a secondary methodof retention (such as peel-able soldermask) when running Lynx connectors upside down in the reflow process.	• Prevents connectors falling off the board.
• Before applying the secondary retentionand running connectors upside down in reflow-inspect the connector to insure thecontacts have reflowed and the housing is seatedto the board surface – see Reflow Process section for more info.	• Improperly reflowed connectors and possible cold and/or insufficient solder joints will result in problems with the secondary method of attachment
• Remove the Pickup TAP after the 1st reflow cycle.	• Reduces the weight of the connector and the risk of the connector dropping off the board.
• One method is to apply RTV or peel-able solder mask to the base of the housing AFTER the 1st reflow cycle	• Holds connector on the board • Should be tested and verified in thecustomer's specific process
• The method of retention and material usedis the decision of the customer. ATCS can provide input and technicalsupport during the developmentphases.	• Each customer will have different process and design restrictions or requirements for their specific application.

8.0 Rework Process

Requirements	DFM Impact/Benefit
• Use specialized rework equipment for connector removal and replacement, and should include thermal profiling and temperature measurement capability.	• Achieves reflow at point of removal without excessive heat to the connector and PCB, or insufficient heat causing lifted pads.
• Follow reflow profiling guidelines in section 8 and make sure to include a thermocouple on **top of the connector housing** during reflow profiling – It is preferred to keep the plastic below 260°C with a max allowable temperature of 280°C.	• Insures against plastic over-heating and damage. (See reflow section for more detail.)
• Automated placement capability is preferred – including vacuum pick-up and placement.	• This will provide consistent placements.
• Hand/Manual placement is not recommended.	• Manual placement is inconsistent
• Follow normal rework processes for PCB site cleaning and prep, and reflow profile development.	• Improves rework yield and insures reliable solder joints
• "Flux-only" processing is not recommended.	• Inconsistent amount of metal left on pad during site prep, resulting in excessive pad co-planarity variation – increased risk of solder opens.
• Paste deposition is recommended using either an automated dispensing system or manual micro stencils – resulting in a 6 mil tall deposit.	• Prevents opens/shorts with high reliability solder joints.

Addendum A

Lynx Connector Weights

Type	Part Number	Description	Design Height (mm)	# of Contacts	Weight w/Cap (grams)	Weight per Contact (grams/contacts)
Plug (0.6mm)	11826-BAA	Plug, 5mm, Pb-Free	4.7	40	**0.181**	**0.0045**
	11826-BCA	Plug, 5mm, Pb-Free	4.7	120	**0.544**	**0.0045**
	11826-BFA	Plug, 5mm, Pb-Free	4.7	240	**0.907**	**0.0038**
Receptacle (0.6mm)	11828-1AA	Receptacle, 5mm, Pb-Free	3.2	40	**0.091**	**0.0023**
	11828-1CA	Receptacle, 5mm, Pb-Free	3.2	120	**0.363**	**0.0030**
	11828-1FA	Receptacle, 5mm, Pb-Free	3.2	240	**0.635**	**0.0026**

Note: Cap refers to vacuum pick-up cap1

Addendum B: DFM and Assembly Readiness Check Sheet

Item	Sect	Check	Change/Comments	Who	Status
PCB Design	3.1 to 3.4	• Copper defined .60mm (024") pad – clear of solder mask • Minimum .22mm (.005") Solder Mask dam to Via, or via masking • Specify board warp spec per process variables • Multi connector orientation is the same • Long side of connector is parallel across the larger spans • Layout includes slightly oversized silkscreen outline of connector.			
Mech. Req'ments	3.5-3.7	• Stand-offs or mechanical spacers are required to secure the mated distance.			
Handling	4.0	• Removal/replacement from tape & reel or tube is not recommended – minimize manual handling • Handling process should include re-packaging and handling pre-cautions.			
Solder Paste	5.0	• Stencil thickness is 5-6 mil. • Stencil aperture should be reduced by 2mils.			
Placement	6.0-6.1	• Set-up should full lighting, and pre-orient align. • Custom programming and nozzles may be required.			
Reflow	6.2-6.3	• Follow solder paste manufacturer's recommended profile. • Recommend using a soak profile in reflow.			
		• Follow recommended process for vacuum cap removal.			
Double Sided Reflow	7.0	• Connectors that exceed the weight limits may require post-reflow retention such as RTV or peel-able solder mask.			
Rework	8.0	• Automated placement capability preferred • Manual placement not recommended • Paste deposition should be 5-6 mils high • "Flux-only" processing not recommended			