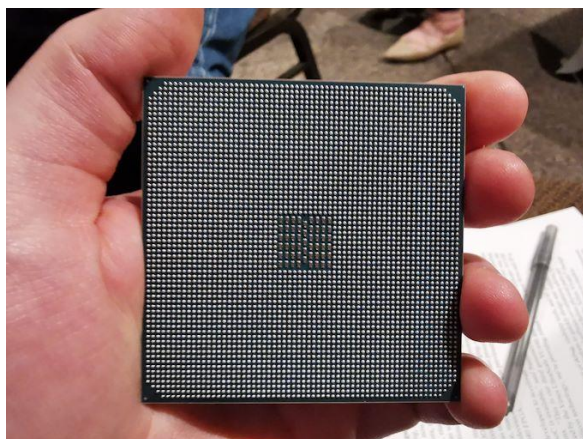
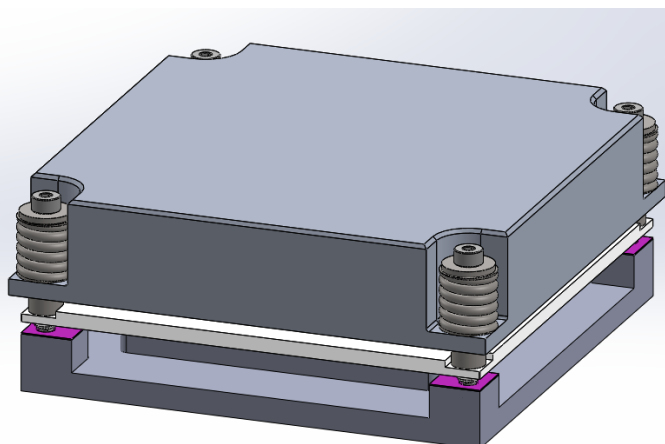


XILINX and other XAMPLES

Very large BGAs pose some real challenges for test and OEM sockets. Thousands of reliable contacts need to be made. Thermal management is always a concern. And the costs can be higher than desired.



A very large BGA



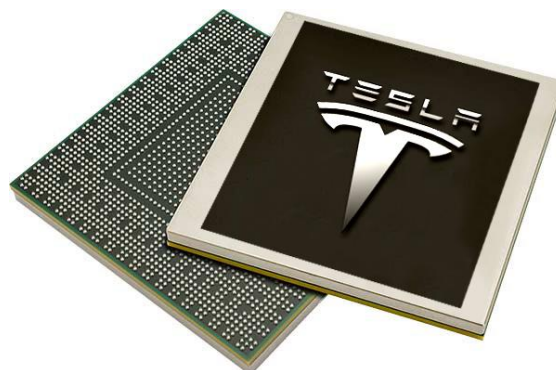
A Paricon BGA socket for OEMs

Xilinx and others

One of the best known IC suppliers using very large BGAs is Xilinx. Their packages can have 2,000+ solder balls on a 1mm pitch. Their devices, called FPGAs (field programmable gate arrays) and SoCs (systems on a chip), join other IC manufacturers who offer large MPUs or AI processors.



Xilinx FPGA



Tesla processor

Why is a socket needed ?

IC packages like this are good candidates for a socket because:

The devices are expensive

A socket allows for the orderly assembly of functional products, without committing the expensive IC into the finished goods inventory until needed for shipments.

The devices are programmable

Devices can be programmed on separate and specialized equipment, and then mounted onto the functional PCBs when ready. Or, the devices can be removed from the PCB for programming updates as needed.

Why is a Paricon socket a good choice for a large BGA ?

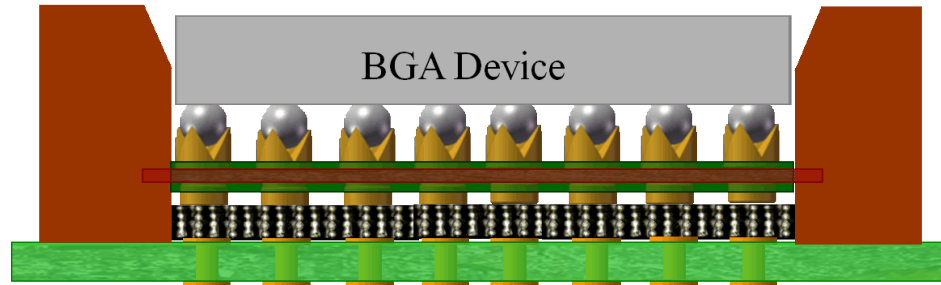
Large-BGA elastomer membrane sockets are much less costly than large-BGA sockets made with conventional contact mechanisms.



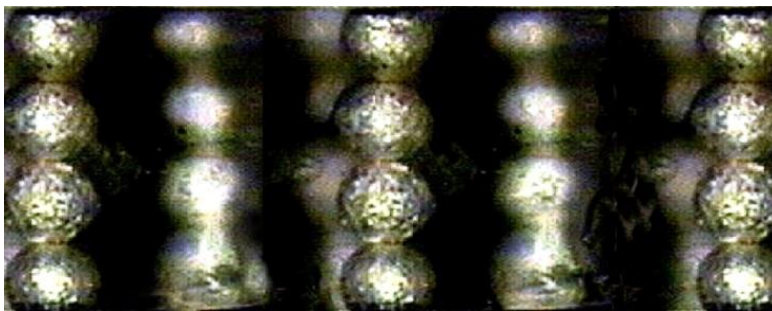
The PariProbe® 4-point metal contact engages each ball securely and is tolerant of variations in the solder ball positions. Each metal contact that engages a solder ball has a degree of independent motion that does not hinder the low CRES elastomer contact mechanism.



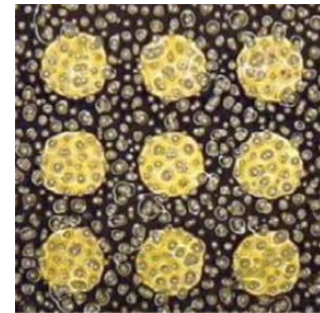
4-point crown
metal contact



A cross section of a PariPoser socket showing the position of the elastomer, the PCB pads, the solder balls, and the floating metal contacts



A cross section of the elastomer showing the conductive particle columns dispersed throughout the entire sheet

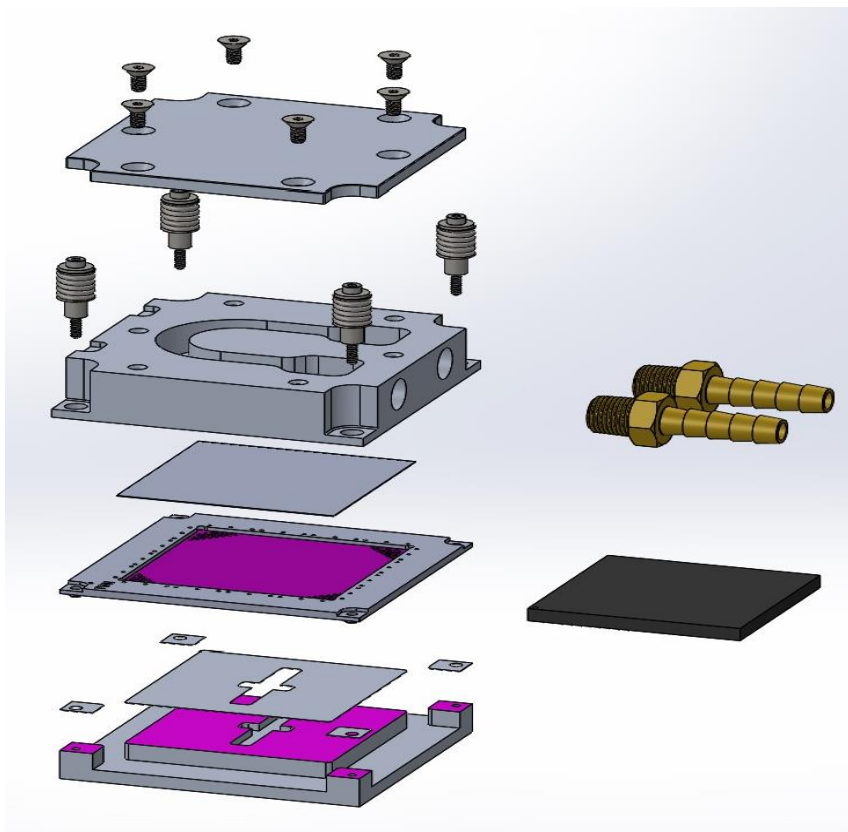


Top-down view showing
redundant columns per pad

PariProbe® BeCu precision-machined contacts can be shaped to match the sizes and materials used in the solder balls. Typically, the PariProbe® contacts are then plated with PdCo to minimize solder contamination problems.



PdCo plated probes engaging a row of solder balls



Paricon BGA sockets can be customized. Shown below is a BGA socket with an integral water cooling head.

What kind of performance should I expect ?

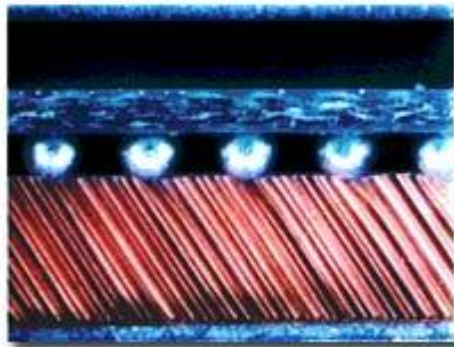
Contact pitch	1 mm
Length of PariProbe®	1mm
Diameter of PariProbe®	0.6mm
Thickness of elastomer	0.25mm
Travel/probe when engaged	0.08 mm - 0.1mm
Normal Force	30-40 grams per contact position
DC resistance	< 30 mΩ
Self inductance	0.3 nH
Current Rating	> 5 A per contact

Bandwidth @ -1dB	40 GHz
Temp. Rating	-50 °C to 150 °C
Durability	500K+ cycles

What's different about a Paricon elastomeric BGA socket ?

Paricon elastomeric BGA sockets use an elastomer with uniformly distributed conductive columns and floating metal contacts held in position with a Kapton carrier. The elastomer metal content is low (10%).

Some elastomer sockets have enameled wires encased in a silicone sheet. The bare-metal ends of the wires make the contact to the PCB pads and the solder balls.

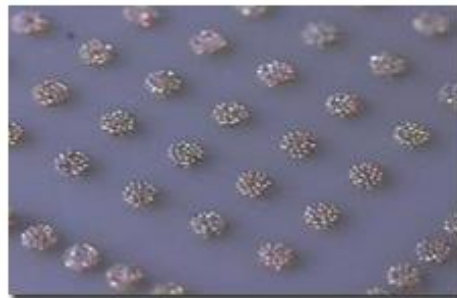


Wires encased in a silicone sheet

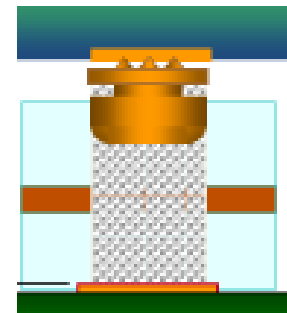
Some elastomer sockets use high-metal-content plugs that are positioned at the locations of the solder balls, and then held in that position by a carrier membrane or overmolded with silicone.



High metal content conductive plugs overmolded with silicone



Conductive plugs inserted in a carrier



Conductive plugs with a metal tip

What's the same about all elastomeric BGA sockets ?

All elastomer contacts compress about the same ($< 30\%$ of the contact length) at the contact locations.

All silicone sheets or plugs have to allow for a “squeeze relief” zone. The silicone doesn't really compress – it just changes shape.

Silicone has a high TCE, so lateral and vertical expansion needs to be taken into consideration.

Each contact needs a normal force of 30-40 grams. When there are a lot of contacts, the overall force per socket gets quite high. Usually, a stiffener plate under the PCB is needed.

What do I need to consider to get started ?

The IC manufacturer's data sheet ?

Are there any special considerations ?

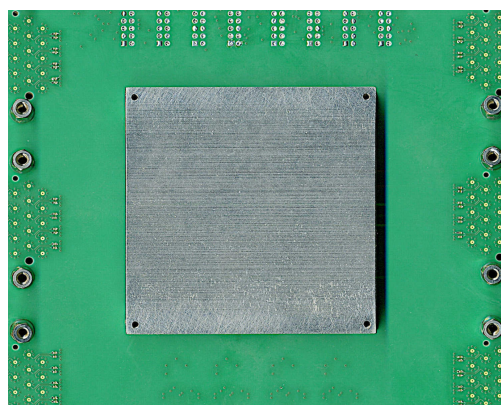
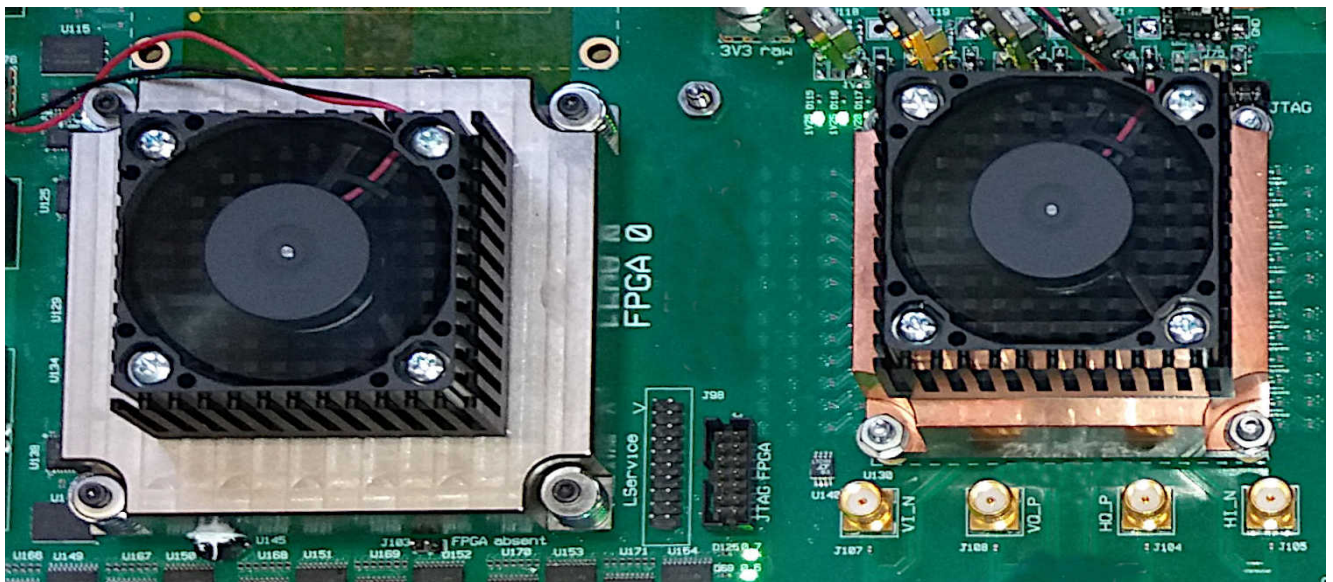
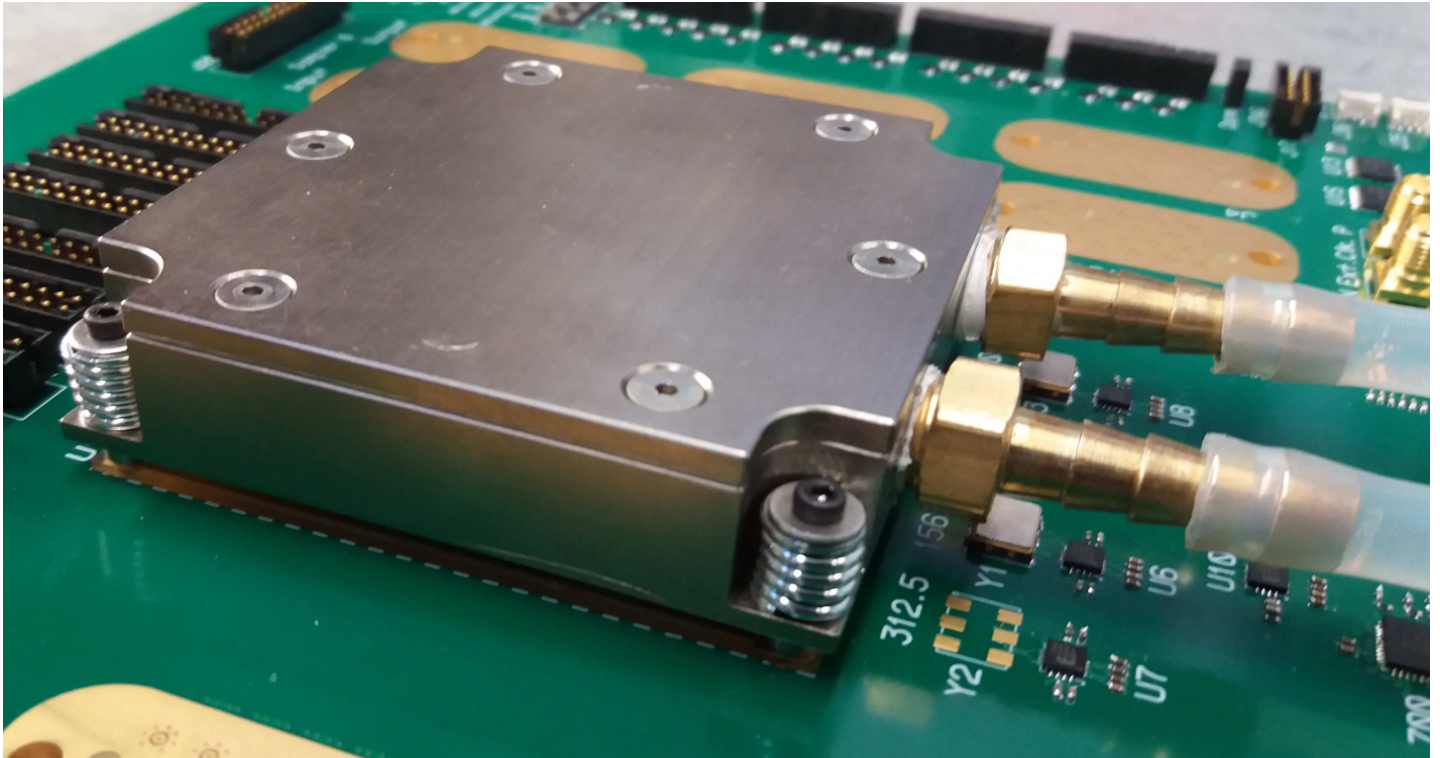
What's the size and shape of the PCB contact pads ?

Is there solder mask on the DUT board ?

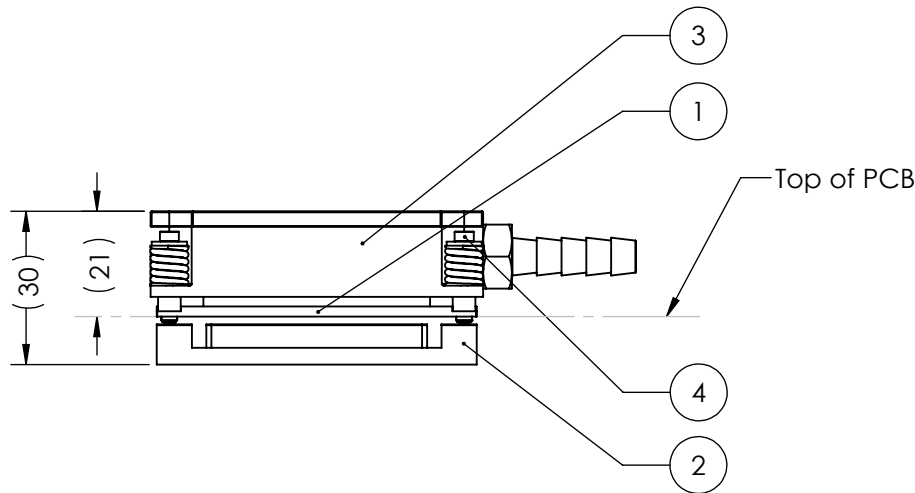
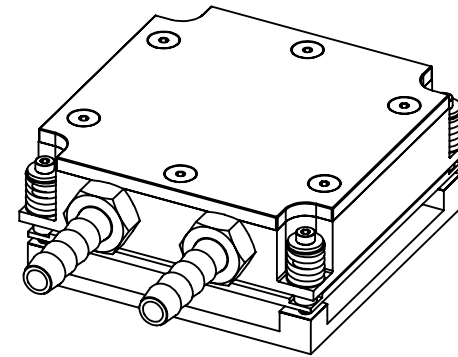
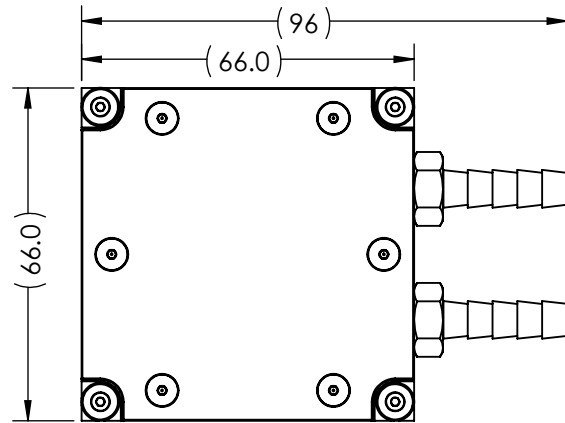
various F18 sockets from Paricon
continuous operation over 2+ years

DUTs are NON-soldered

~100W dissipated power on 2000BGA FPGA



REVISION			
REV.	DESCRIPTION	DATE	APPROVED



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
-	F18-BAD-0119.E-00	F18 Socket Assembly	
1	F18-BAD-0119.E-01	F18 Contactor Assembly, 45x45_1924 BGA Device, 1.0mm Pitch	1
2	F18-BAD-0119.E-05	F18 Support Plate Assembly, 45x45_1924 BGA Device, 1.0mm Pitch	1
3	F18-BAD-0119.E-07	F18 Load Plate Assembly, 45x45_1924 BGA Device, 1.0mm Pitch, Liquid Cooled	1
4	F18-BAD-0119.E-17	F18 Loading Hardware Assembly	1 (Set)
-	F18-BAD-0119.E-16	F18 Load Plate, 45x45_1924 BGA Device, 1.0mm Pitch	
-	F18-BAD-0119.E-56	Thermal Interface Material, 46x46x0.2mm	

Notes:

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

MATERIAL:	NAME	DATE
DRAWN BY:	LRF	4/3/2019
FINISH:	CHECKED BY:	ES
	COMMENTS:	4/5/2019
TOLERANCES UNLESS OTHER SPECIFIED: DECIMALS ANGLES X. ± 1.0 ± 1° X.X ± 0.25 X.XX ± 0.10 X.XXX ± 0.025		

DWG.# / PART.# OR ASSY.#
 F18-BAD-0119.E-00 / F18-BAD-0119.E-00
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TITLE:
 F18 Socket Assembly
 45x45_1924 BGA Device, 1.0mm Pitch

SIZE	PART#	REV
A	F18-BAD-0119.E-00	A
SCALE: 2:3	UNITS: MM	THIRD ANGLE PROJECTION
SHEET 1 OF 7		

INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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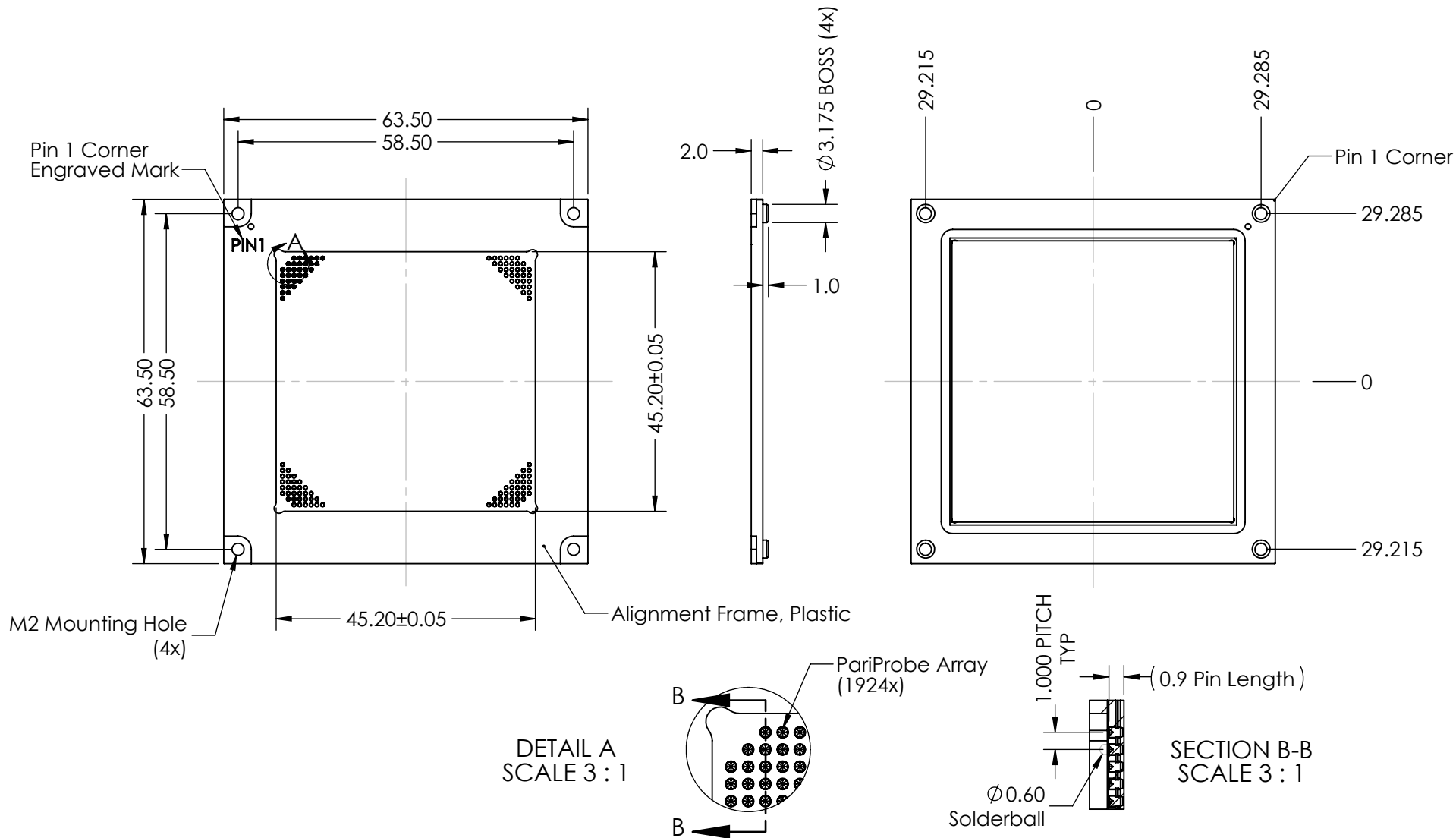
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Notes:

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

MATERIAL:		NAME	DATE
FINISH:		DRAWN BY:	LRF 4/3/2019
		CHECKED BY:	ES 4/5/2019
		COMMENTS:	
TOLERANCES UNLESS OTHER SPECIFIED: DECIMALS ANGLES X. ± 1.0 ± 1° X.X ± 0.25 X.XX ± 0.10 X.XXX ± 0.025			
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TITLE:
F18 Contactor Assembly
45x45_1924 BGA Device, 1.0mm Pitch

SIZE	PART#	REV
A	F18-BAD-0119.E-01	A
SCALE: 1:1	UNITS: MM	THIRD ANGLE PROJECTION
SHEET 2 OF 7		

INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

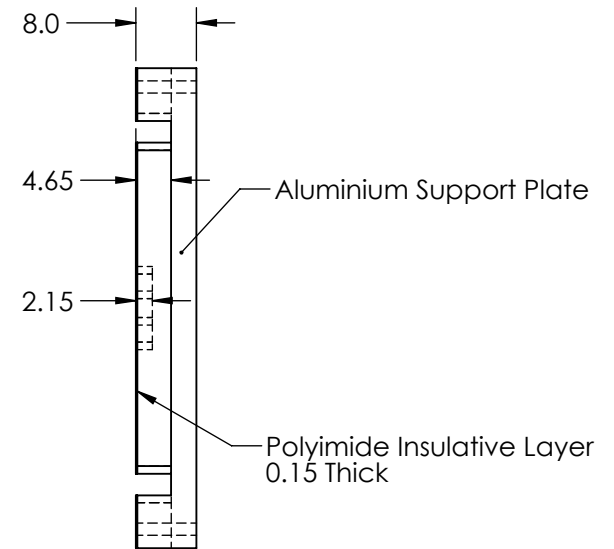
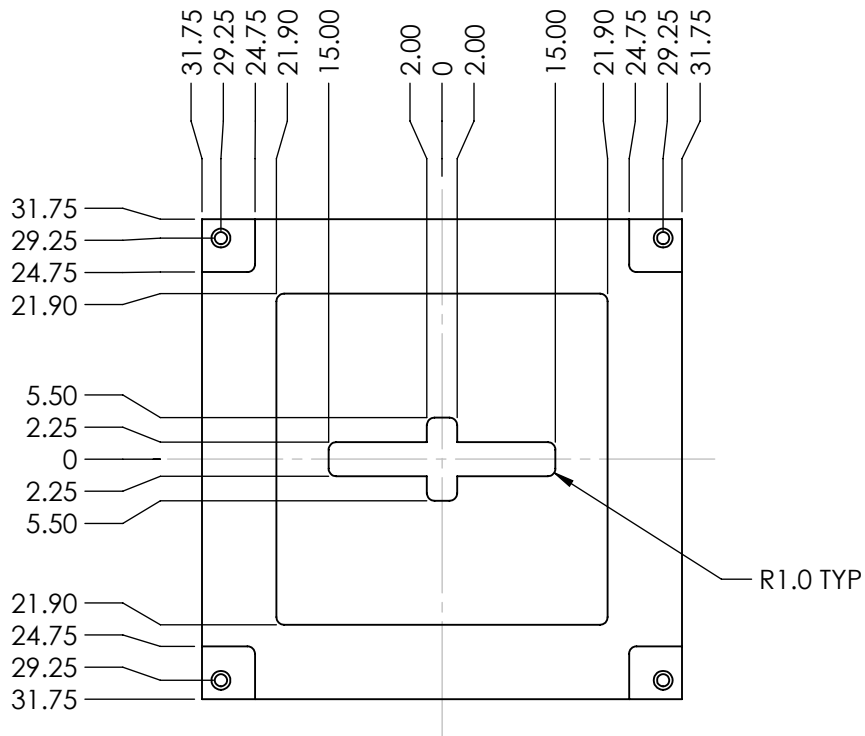
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Notes:

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

MATERIAL:		NAME	DATE	
		DRAWN BY:	LRF	
FINISH:		CHECKED BY:	ES	
	COMMENTS:			
TOLERANCES UNLESS OTHER SPECIFIED:				
<u>DECIMALS</u>		<u>ANGLES</u>		
X. ± 1.0		± 1°		
X.X ± 0.25				
X.XX ± 0.10				
X.XXX ± 0.025				
DWG.# / PART.# OR ASSY.#				
F18-BAD-0119.E-00 / F18-BAD-0119.E-05				
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SIZE	PART#	REV		
A	F18-BAD-0119.E-05	A		
SCALE: 1:1	UNITS: MM	THIRD ANGLE PROJECTION	SHEET 3 OF 7	

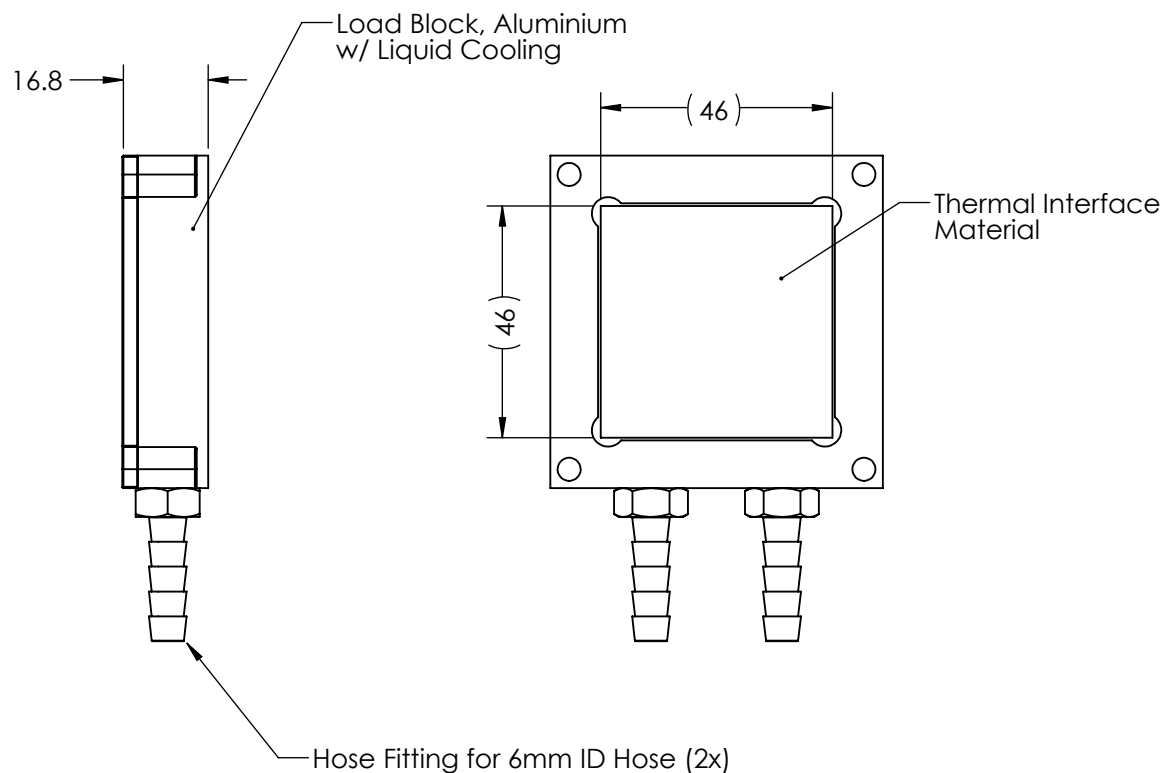
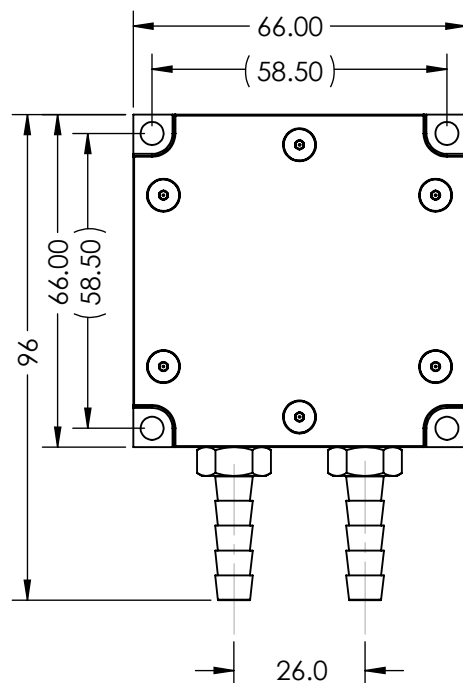
INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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**Notes:**

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

MATERIAL:		NAME	DATE				
	DRAWN BY:	LRF	4/3/2019				
FINISH:	CHECKED BY:	ES	4/5/2019				
COMMENTS:							
TOLERANCES UNLESS OTHER SPECIFIED: <u>DECIMALS</u> <u>ANGLES</u>				TITLE: F18 Load Plate Assembly 45x45_1924 BGA Device, 1.0mm Pitch			
X. ± 1.0 ± 1°							
X.X ± 0.25							
X.XX ± 0.10							
X.XXX ± 0.025							
DWG.# / PART.# OR ASSY.# F18-BAD-0119.E-00 / F18-BAD-0119.E-07				SIZE	PART#	REV	
PROPRIETARY AND CONFIDENTIAL				A	F18-BAD-0119.E-07	A	
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INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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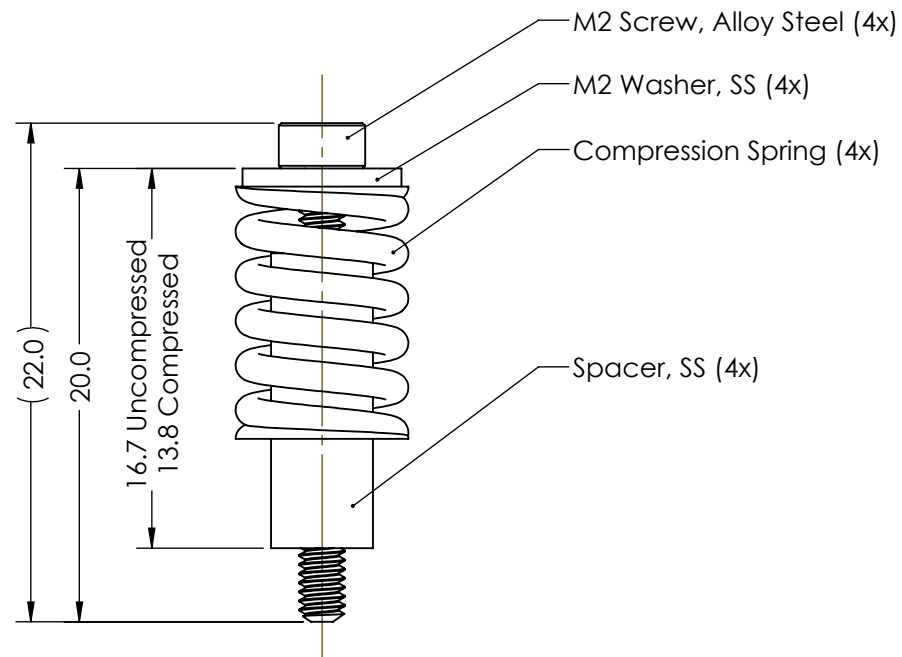
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Notes:

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

- A Nominal Load Per Screw: 10.9 kg [24 lbs]
 Nominal Load on Socket Assembly: 43.6 kg [96 lbs]

MATERIAL:	NAME	DATE
FINISH:	DRAWN BY: LRF	4/3/2019
	CHECKED BY: ES	4/5/2019
COMMENTS:		
TOLERANCES UNLESS OTHER SPECIFIED: DECIMALS ANGLES X. ± 1.0 ± 1° X.X ± 0.25 X.XX ± 0.10 X.XXX ± 0.025		

DWG.# / PART.# OR ASSY.#
 F18-BAD-0119.E-00 / F18-BAD-0119.E-17

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TITLE: F18 Loading Hardware Assembly

SIZE	PART#	REV
A	F18-BAD-0119.E-17	A
SCALE: 3:1	UNITS: MM	THIRD ANGLE PROJECTION
SHEET 5 OF 7		

INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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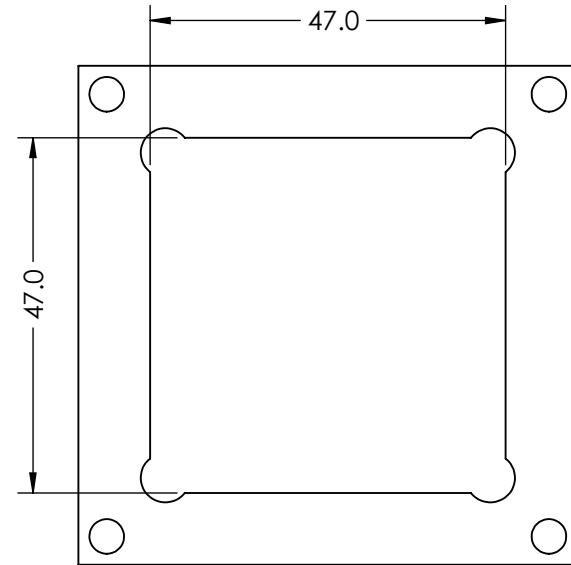
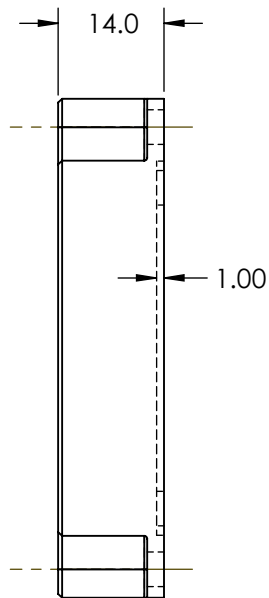
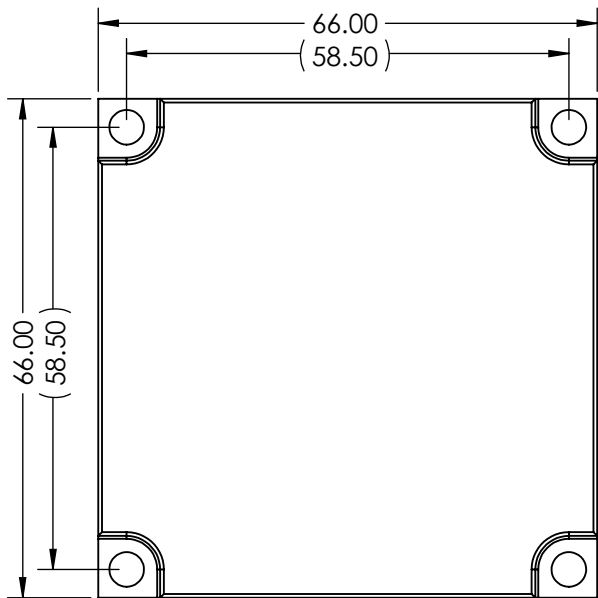
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Notes:

Socket Assembly for Device: KU115FLVF1924, 45x45_1924 BGA

A Optional Item: Not part of standard socket

MATERIAL: Ni Plated Al	DRAWN BY: LRF	NAME LRF	DATE 4/3/2019
FINISH:	CHECKED BY: ES	DATE 4/5/2019	
COMMENTS:			
TOLERANCES UNLESS OTHER SPECIFIED: DECIMALS ANGLES			
X. ± 1.0 ± 1°			
X.X ± 0.25			
X.XX ± 0.10			
X.XXX ± 0.025			

DWG.# / PART.# OR ASSY.#
F18-BAD-0119.E-00 / F18-BAD-0119.E-16

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TITLE:
F18 Load Plate
45x45_1924 BGA Device, 1.0mm Pitch

SIZE A	PART# F18-BAD-0119.E-16	REV A
SCALE: 1:1	UNITS: MM	THIRD ANGLE PROJECTION
SHEET 6 OF 7		

INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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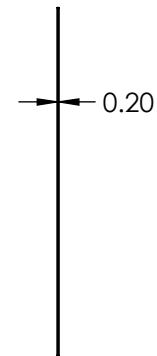
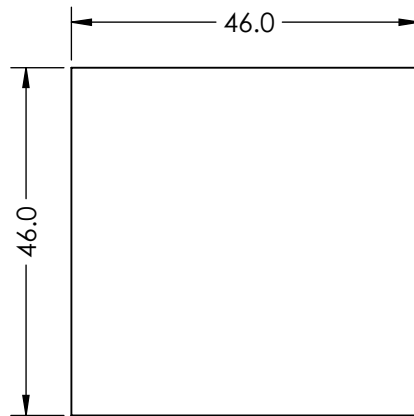
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Notes:

Optional Item: Not part of standard socket

MATERIAL: Indium Silver Alloy	DRAWN BY: LRF	NAME LRF	DATE 4/3/2019
FINISH:	CHECKED BY: ES	DATE 4/5/2019	COMMENTS:
TOLERANCES UNLESS OTHER SPECIFIED: DECIMALS ANGLES X. ± 1.0 ± 1° X.X ± 0.25 X.XX ± 0.10 X.XXX ± 0.025			
DWG.# / PART.# OR ASSY.# F18-BAD-0119.E-00 / F18-BAD-0119.E-56			
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TITLE:
Thermal Interface Material
46x46x0.2mm

SIZE A	PART# F18-BAD-0119.E-56	REV A
SCALE: 1:1	UNITS: MM	THIRD ANGLE PROJECTION
SHEET 7 OF 7		

INTERPRET THIS DRAWING IN ACCORDANCE WITH ASME Y14.5-2009

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