
EIGHTEENTH ANNUAL
BiTS
Burn-in & Test Strategies Workshop
March 5 - 8, 2017
Hilton Phoenix / Mesa Hotel
Mesa, Arizona
Archive – Session 6
© 2017 BiTS Workshop – Image: tonda / iStock

Copyright Notice

Session 6

Jason Mroczkowski

Session Chair

BiTS Workshop 2017 Schedule

Frontier Day

Tuesday March 7 - 1:30 pm

Making Contact

"High Current Final Test Contactor Development"

Thiha Shwe, Hisashi Ata – Texas Instruments

Kenichi Sato – Yokowo

"Customers Are the New Team Member for Board to Board Connectors"

Derek Biggs – Plastronics

"WLCSP Contacting Technologies for 0.2 mm Pitch and Below"

Valts Treibergs - Xcerra Corporation

"Coming to terms with Burn-In sockets"

James Tong - Texas Instruments

BiTS 2017 Burn-in & Test Strategies Workshop

Customers Are the New Team Members for Board to Board Connectors

Derek Biggs
Plastronics Sockets and Connectors

BiTS Burn-in & Test Strategies Workshop™

BiTS Workshop
March 5 - 8, 2017

PLASTRONICS SOCKETS & CONNECTORS

Overview

Plastronics Sockets and Connectors has partnered with an established connector company to develop a low profile connector to be used within a extreme test environment.

This presentation includes the process of understanding the customer needs to develop a testable prototype for future high volume production.

Contents

- The Customer
- H-Pin Board to Board Connectors
- Connecting the Customer
- Design to Prototype
- Assembly
- Results and Data
- Considerations

The Customer

- Who are they?
- How are they a design team member?
- What do they offer as a design team member?

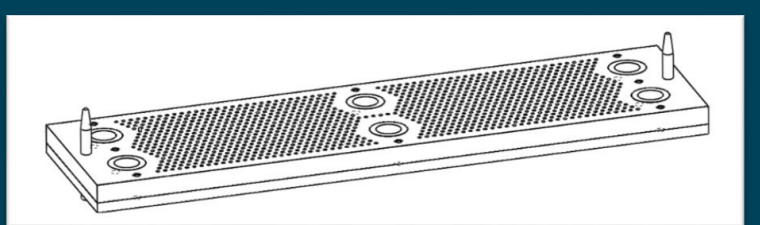
The Customer

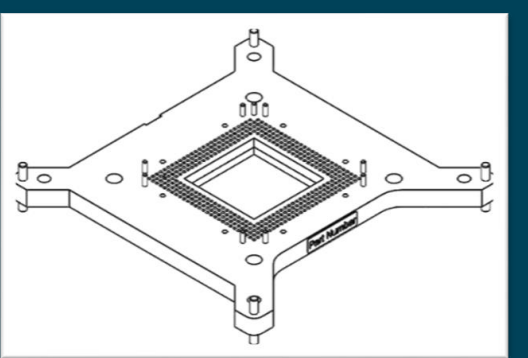
- Why do they need to hire additional engineering?

- When do you need to understand the customer?

H-Pin Board to Board Connectors

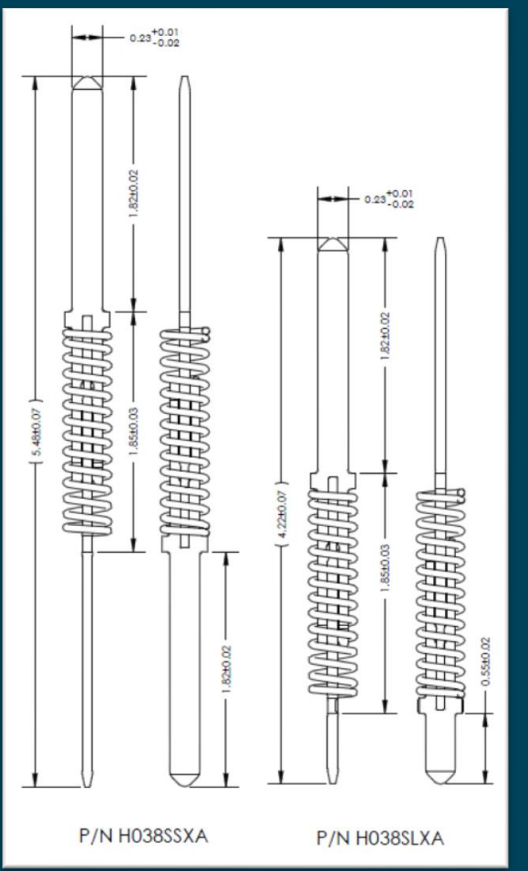
- H-Pin
  - Stamped BeCu w/ Au Plated Pin Probe
  - Stainless Steel w/ Au Plated Spring
    - These are important material features when considering for harsh environments.
- Density
  - 0.35mm or greater available pitch





H-Pin Board to Board Connectors

- Force
  - 5gf to 35gf available contacts
  - Force may be controlled within plastic housing design
  - Variable travel compliancy (0.2mm to 1.0mm)
- Custom Applications
  - Low Profile
  - Custom Tuned Housings for Force Requirements
  - Variable Travel Compliancy
  - Various types of Plastic available



Connecting the Customer

- Why did the customer need us?
  - Limitations within their contact systems prohibited them producing any connector pitch tighter than 1.27mm.
  - They required 0.50mm Pitch
  - Variable contact heights were needed
    - New contact needed to be developed by Engineering
      - H038SS1A

Connecting the Customer

- Project Scope Defined
  - To use customer's design and produce working mechanical prototypes. Prototypes must be able to pass simulated environment lab tests. Reliable contact is the most important factor.

What are the environmental conditions?

Will the H-pin withstand the tests?

Will the contact housing material withstand the tests?

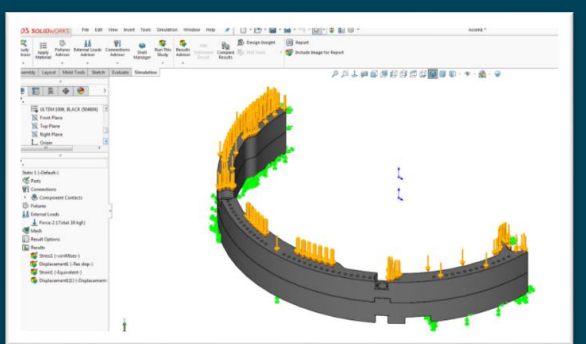
NEED TO SIMULATE IN FEA!

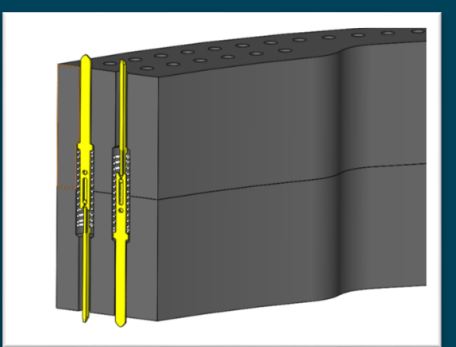
Connecting the Customer

- What are the environmental conditions?
  - Rapid acceleration (5000G to 10000G Force)
  - High Constant Vibration (30sec to 60sec)
  - Automotive Tri-temp Performance (-40℃ to 125℃)
- Will the H-Pin withstand the tests?
  - Reliable contact
  - Signal performance stability
  - Contact resistance performance

Connecting the Customer

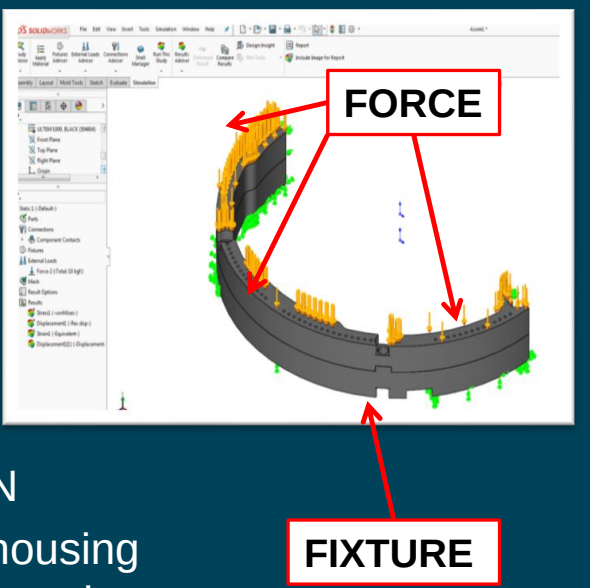
- Will the contact housing material withstand the tests?
  - Initial thought was Ultem1000/2210EPR, our most common material would be acceptable.
  - FEA results showed this material should be acceptable with safety margin.



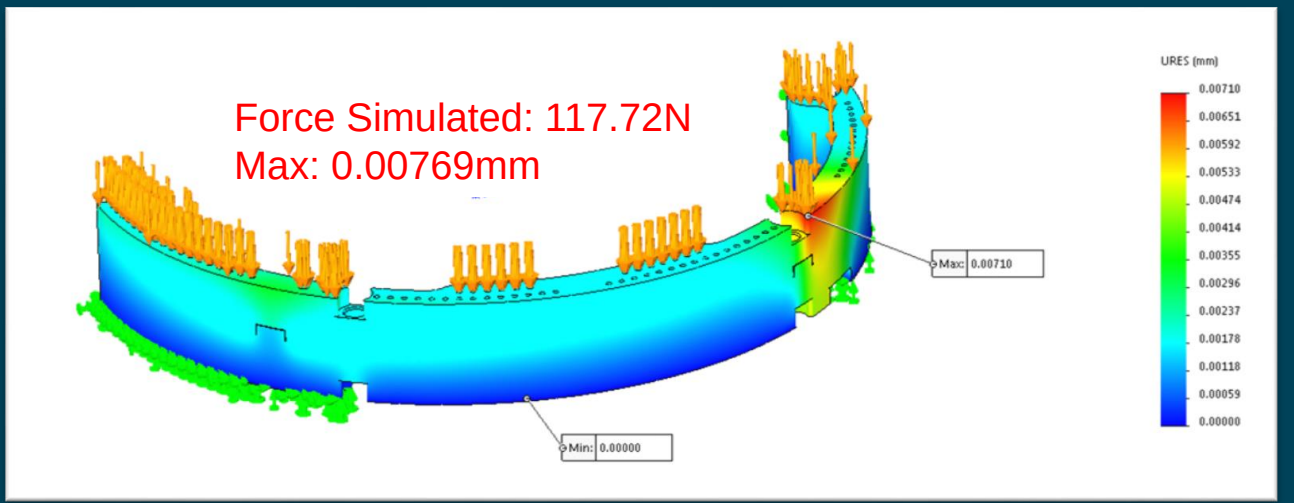


Connecting the Customer

- FEA Assumptions:
- Connectors mass is equal to 1g
  - Each plate models 0.60g = 1.2g Assembly Mass
  - MEASURED MASS
    0.54g + 0.53g = 1.07g
- Figuring Force:
  - G force is a multiple of acceleration
  - 5000G = 49050 m/s/s
  - 10000G = 98100m/s/s
  - F1 = (0.0012kg*49050m/s/s)=58.86N
  - F2 = (0.0012kg*98100m/s/s)=117.72N
- Fixture geometry is based on connector housing assembly, where the connector would be resting on a solid mounting floor.



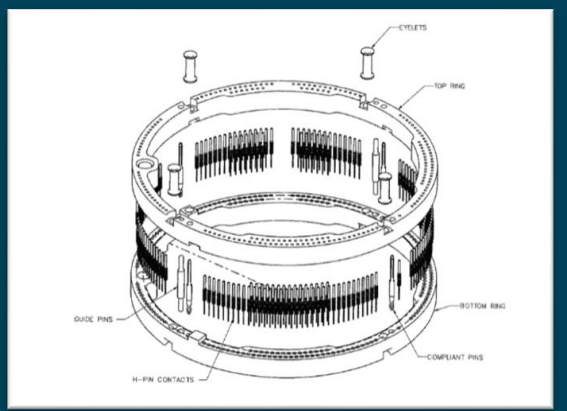
Connecting the Customer

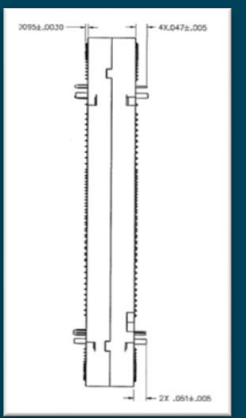


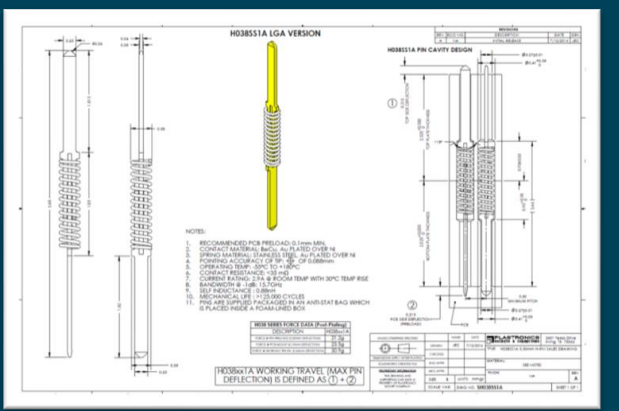
- FEA simulations for Assembly Displacement (mm)
  - 5000G and 10000G were simulated.
  - Dummy block contact housings were tested for immediate verification for material acceptance and passed.

Connecting the Customer

- Customer completed initial design
  - Design based on published Plastronics design guide.
  - Initial assembly was thoroughly documented and resulted in new fixture concepts to improve throughput for future builds.

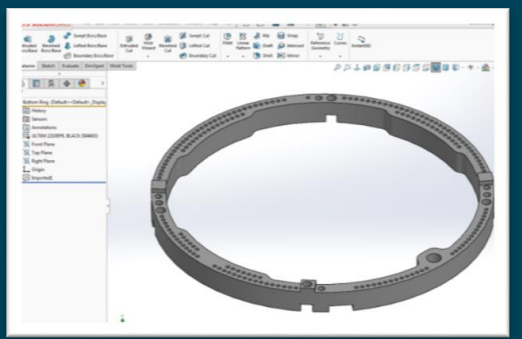


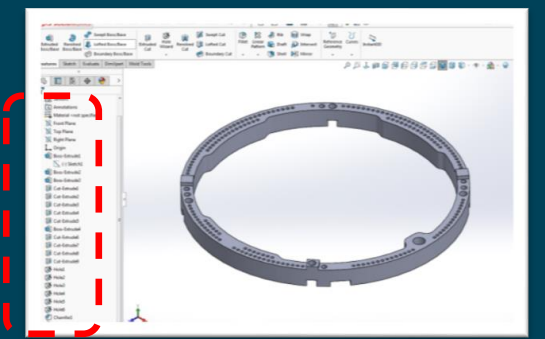




Design to Prototype

- Importing the design
  - ProE to SolidWorks2016 model conversion
  - Ran FeatureWorks to create models

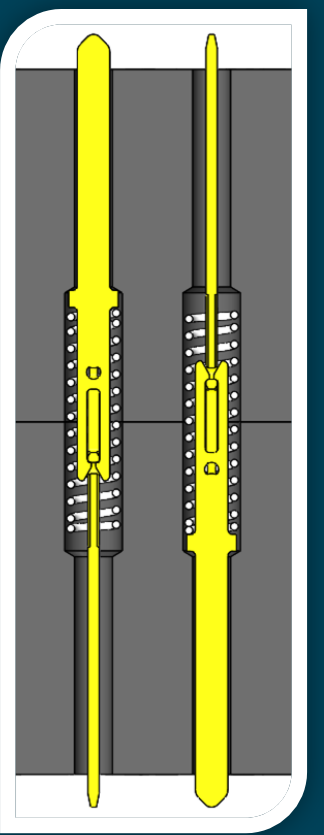




- Reviewing the models
  - Recreated models were compared to each customer produced drawing for feature verification

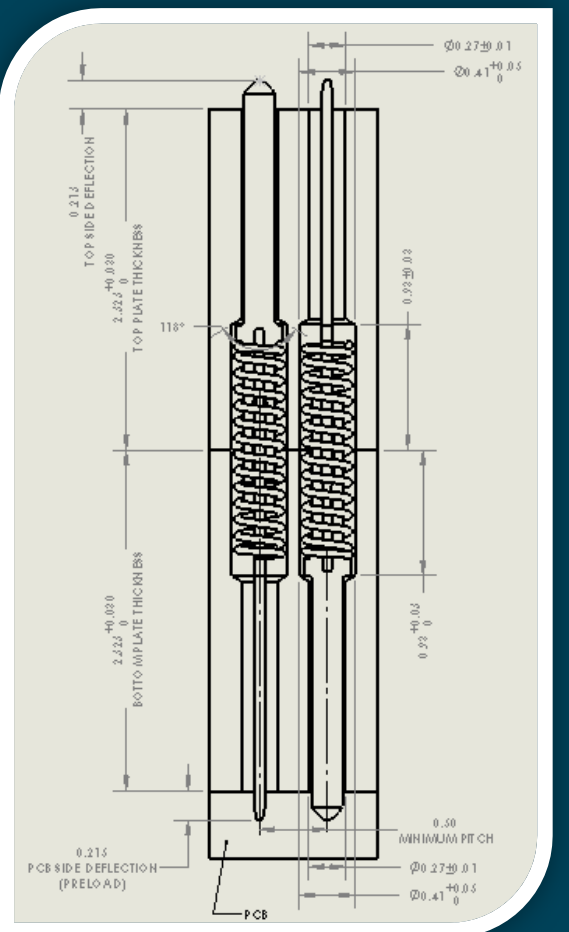
Design to Prototype

- New Contact Housing Design Considerations
  - First time design for H038SS1A
  - 31gf Contact Spring Force
  - Preloading?
  - Floating?
  - Pin tip exposure?
  - Pin tip biasing?
  - Assembly Ease?
  - Safety within the dimensions?



Design to Prototype

- Design Calculations
  - Minimum Contact Travel = 0.34mm
  - Maximum Contact Travel = 0.43mm
  - Pre-load Force in ring connector = 3646.gf (8.03lbf)
  - Min force for full compression mounting = 4971gf (10.95lbf)
  - Max force for full compression mounting = 5532gf (11.75lbf)
  - Designed in Safety: Bilateral Tolerance scheme is to protect contact within housing by never over stroking to mechanical collapsed position.

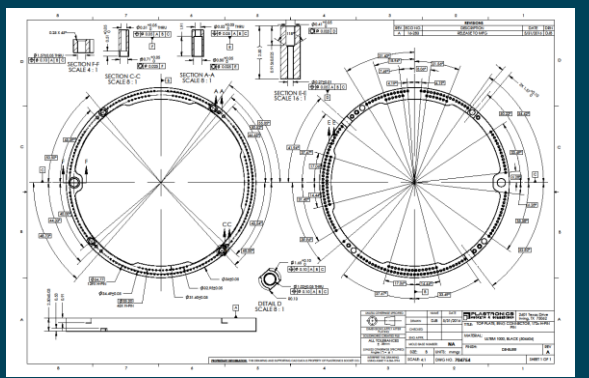


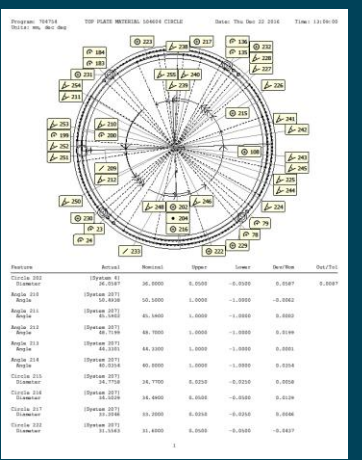
Design to Prototype

- Customer Designed Assembly Fixtures
  - Eyelet Swage Assembly
    - Swage punch
    - Swage press
    - Swage hard stop fixture base
  - Design Difficulties

Assembly

- Incoming Inspection
  - Each part went through full inspection to verify dimensions were within tolerance and documented for history
  - Initial fit check was performed to ensure assembly





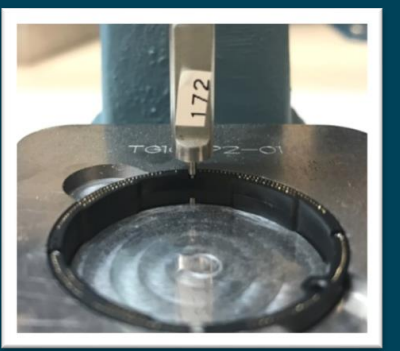
Assembly

H-pin Loading

- Contact loading is known standard.
- Time averages 8 to 10 minutes per part.

Top Ring Assembly

- Average assembly time for floating on the top ring averages 2 to 5 minutes.
- Difficulties?



Eyelet Swage

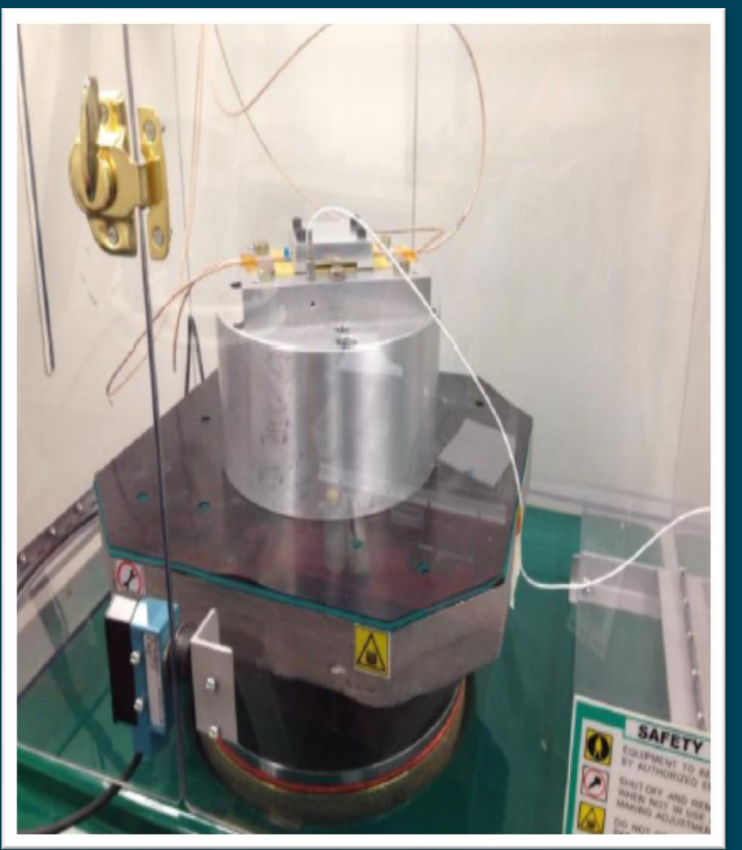
- Average swaging step is 2 minutes
- Manual fixture to part alignment for each eyelet

Assembly

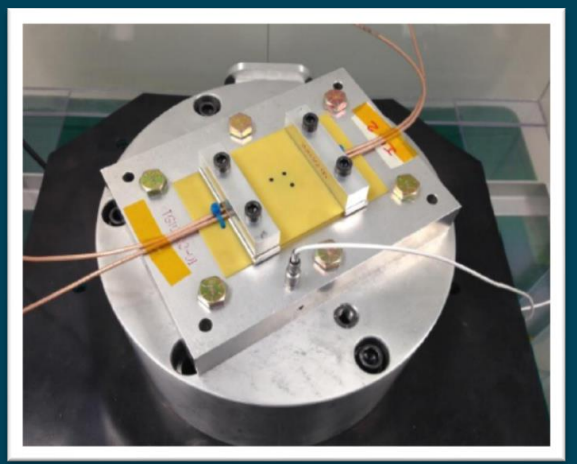
- Final Inspection
  - Each part went through inspection for all critical measurements and functional requirements.
  - Parts were compared to final assembly measurements and were within the specified tolerance ranges.

Data and Results

- Shock Test
  - Goal: 100% contact per connector
  - Tests performed at 24℃
  - Two test set-ups
    - Solid Plate
    - Two-bar

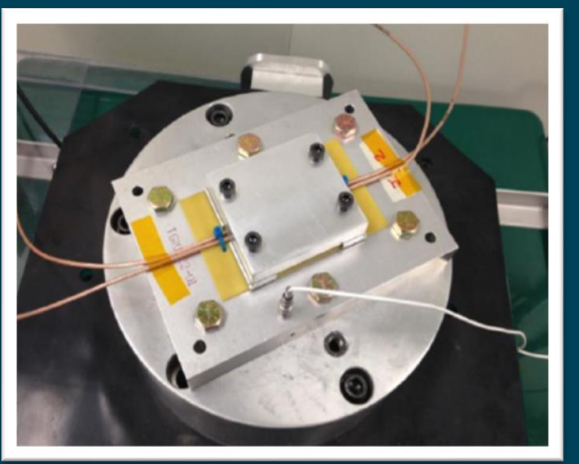


Data and Results



Two Bar

VS.



Single Plate

- Two Bar was evaluated to be a unrealistic mounting procedure for connector assembly based on real world application and would produce inaccurate results
- Single plate gives the impression of a full face mounting in connector assembly

Data and Results

Shock Test					LAB-006342			
Part Number: 25BHS50Y01M - 25 POS - H PIN					Date: 6/18/2014			
	Run #	Height (inches)	Pressure (psi)	I/M # 1	I/M # 2	I/M # 3	I/M # 4	G Level (g)
TEST WITH 2 BARS	1	14	27	Failed	Failed	Failed	Passed	4969
	2	13	27	Failed	Failed	Failed	Failed	5073
	3	10	27	Passed	Passed	Passed	Passed	4145
	4	10	27	Passed	Failed	Passed	Passed	4023
	5	10	27	Passed	Passed	Passed	Passed	4410
	6	11	27	Failed	Failed	Failed	Passed	4438
	7	10	25	Passed	Passed	Passed	Passed	3893
	8	10	27	Passed	Passed	Passed	Passed	4584

Data and Results

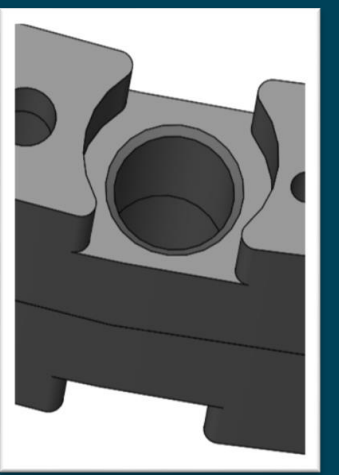
Shock Test					LAB-006342			
Part Number: 25BHS50Y01M - 25 POS - H PIN					Date: 6/18/2014			
	Run #	Height (inches)	Pressure (psi)	I/M # 1	I/M # 2	I/M # 3	I/M # 4	G Level (g)
TEST WITH SOLID PLATE	1	15	27	Failed	Passed	Passed	Passed	5952
	2	15	27	Failed	Passed	Passed	Passed	5909
	3	12	27	Failed	Passed	Passed	Passed	4592
	4	12	25	Passed	Passed	Passed	Passed	4369
	5	12	27	Passed	Passed	Passed	Passed	5129
	6	12	27	Failed	Passed	Passed	Passed	4159
	7	12	27	Passed	Passed	Passed	Passed	4607
	8	13	27	Passed	Passed	Passed	Passed	5049
	9	13	27	Passed	Passed	Passed	Passed	4682
	10	13.5	27	Passed	Passed	Passed	Passed	5079
	11	13.5	27	Passed	Passed	Passed	Passed	5011

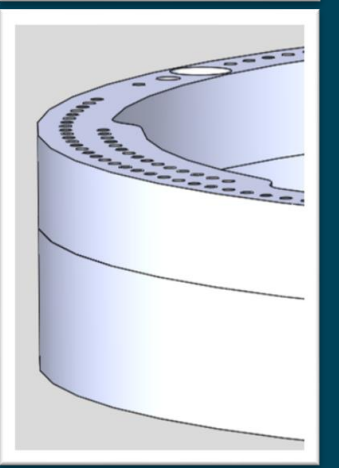
Data and Results

- Design to Prototype Results
  - Design was reviewed and verified
  - Assembly process was tested and proved to need improvement
  - Prototype was assembled and met final inspection verification from both parties
  - Prototype was tested per outline procedure
  - Prototypes passed verification process from end customer

Considerations

- Reduction of unnecessary complex machined features and future molded features.
- Change plate thickness ratio from 50/50 to 60/40.
  - Adds 0.51mm to contact loading plate (bottom ring)
  - Increase contact pointing accuracy for assembly which in return Increases manufacturability for top ring assembly





Conclusion

- Without having the customer as part of the team, this level of success wouldn't be achievable:

Designed, Tested, and Approved