MEG-Array Connector System

Grace S. Showers – Product Manager

October 5, 2005

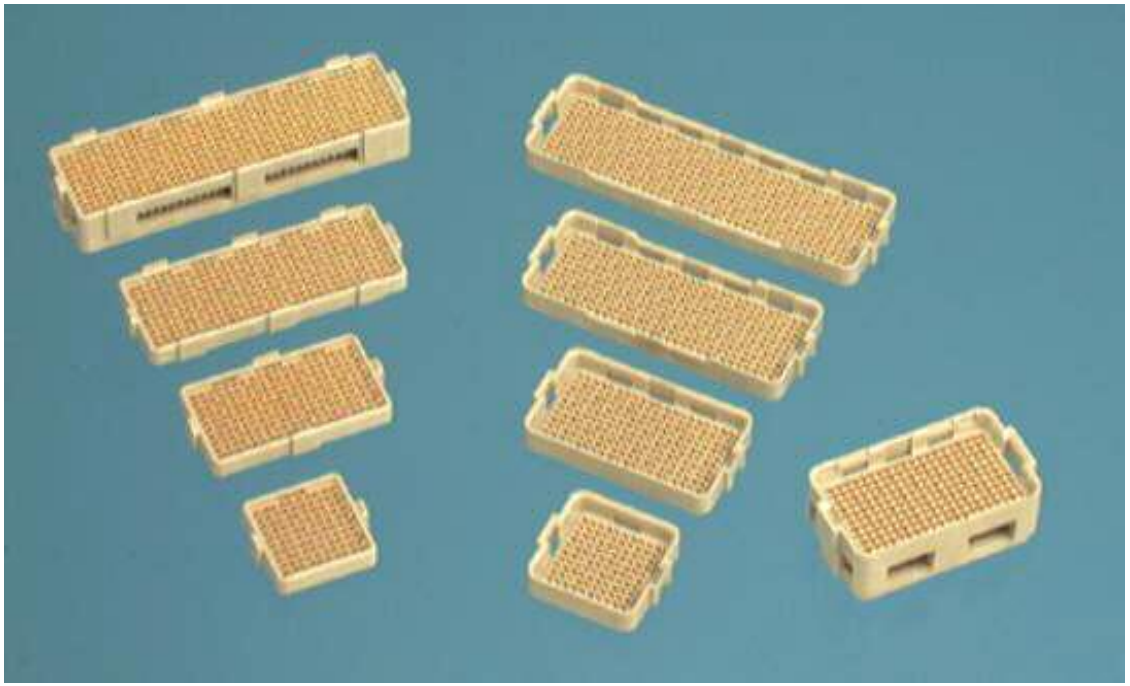
FCI

MEG-Array® Connector System

- High-Density, High-Speed Mezzanine Applications
- Ball Grid Array (BGA) Attachment
- 1.27mm X 1.27mm Array Grid Pitch
- 81, 100, 200, 240, 300, 400 & 528 Positions
- Stack Heights of 4mm To 14mm

MEG-Array® Connector System

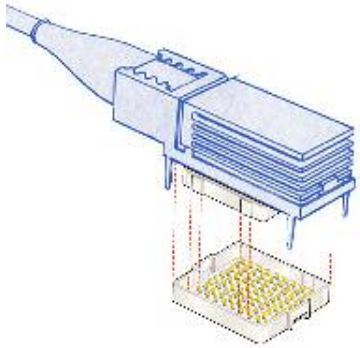
- **Bandwidth Of 5Ghz (10Gb/s) for Differential Pairs**
- **Demonstrated Solder Joint Reliability Of Greater Than 22 Year (IPC-SM-785)**
- **Meets Telcordia GR-1217-CORE**

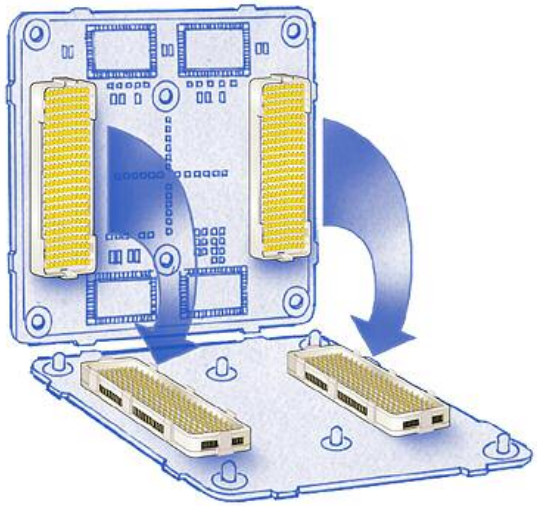


Continued MEG-Array® Offering

Total Mated Height							
Size	Type	4.0mm	6.0mm	8.0mm	10.0mm	12.0mm	14.0mm
81 position 9X9	Plug	55714					
	Receptacle	55715					
100 position 10x10	Plug	84512					
	Receptacle	84513					
200 position 10x20	Plug	84516	84516	84516	84530	84530	84530
	Receptacle	84517	55724	84535	84517	55724	84535
300 position 10x30	Plug	84500	84500	84500	84578	84578	84578
	Receptacle	84501	84502 for 5.5mm BTB	84553	84501	84502 for 11.5mm BTB	84553
400 position 10x40	Plug	84740	84740	84740	84520	84520	84520
	Receptacle	74221	74388	74390	74221	74388	74390
240 position 8x30	Plug	74213	74213				
	Receptacle	74217	55755				
528 position 12x44	Plug		10022671				
	Receptacle		10026846				

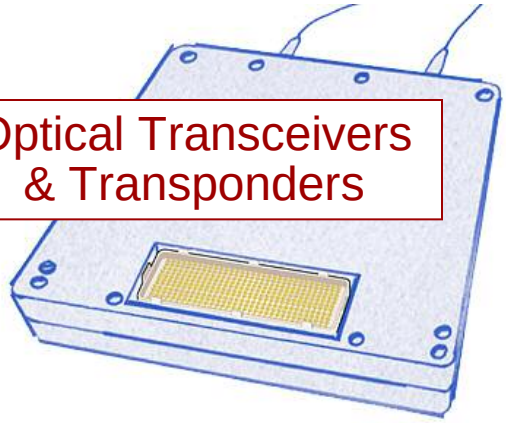
Typical Connector Applications



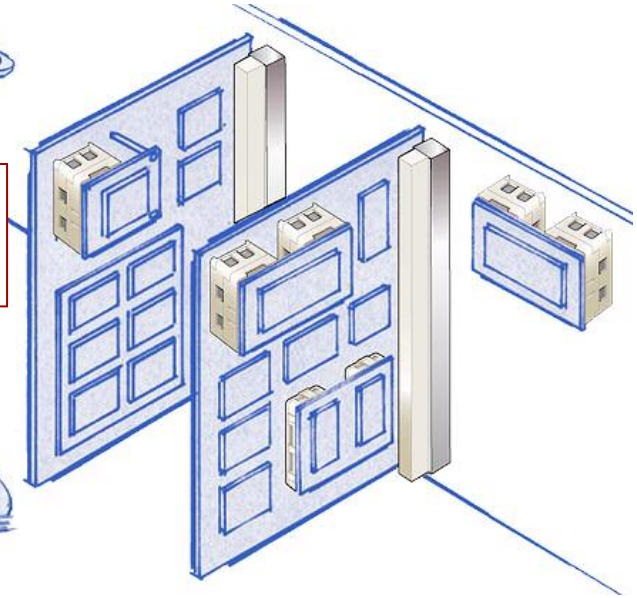


Flexible Circuits

Optical Transceivers & Transponders



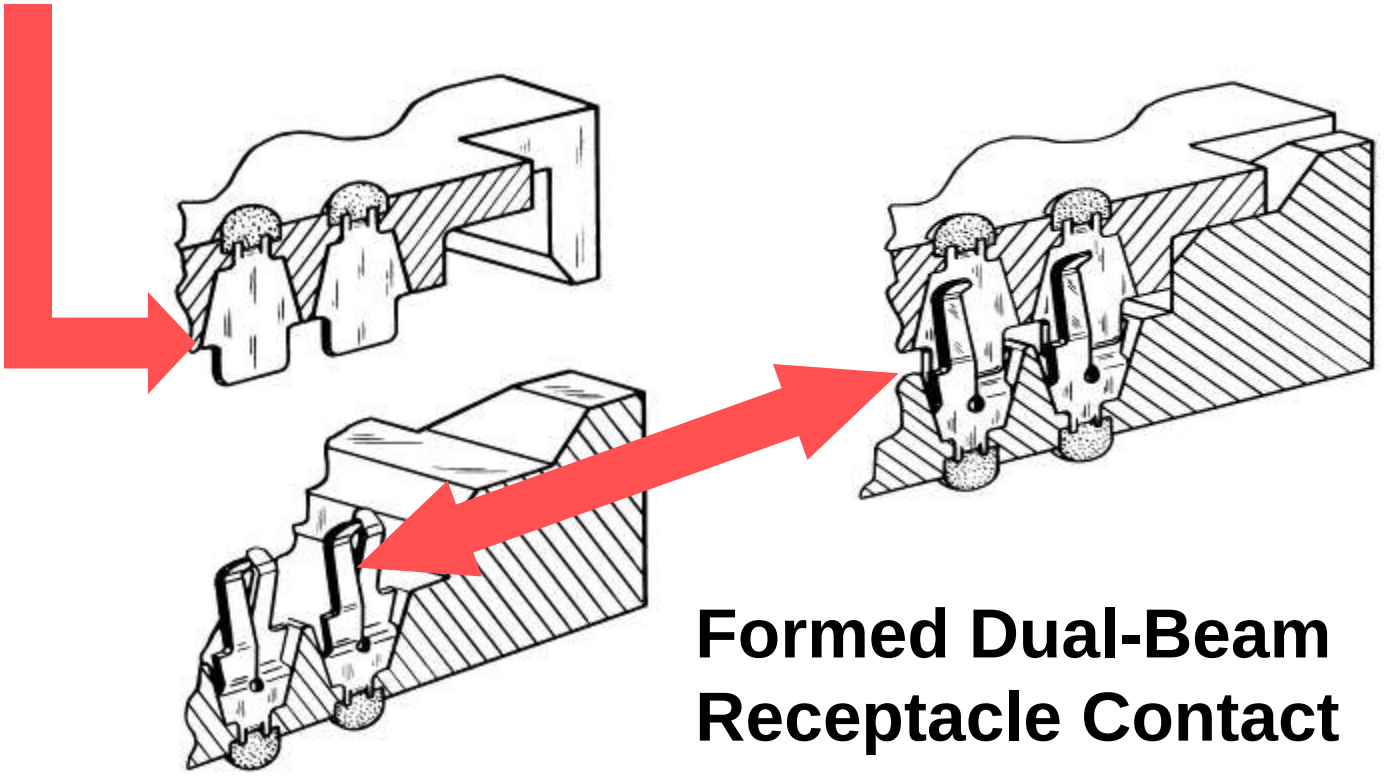
Mezzanine Board Stacking



MEG-Array® Connector System

- **Reliable, Redundant Contact Structure**

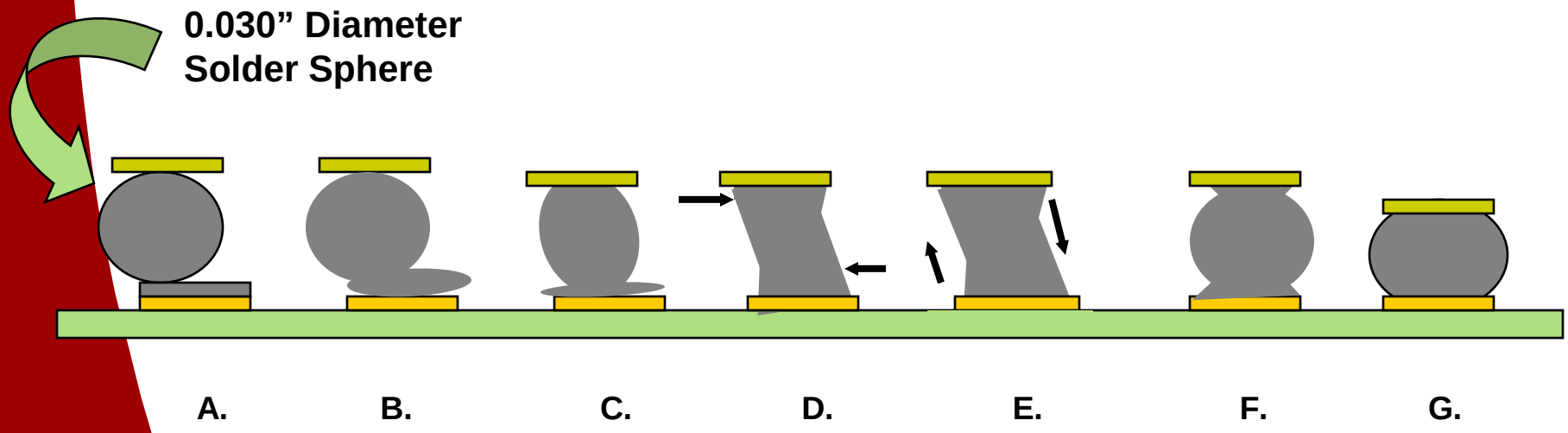
Smooth Coined Contact Surfaces On Plug Blade



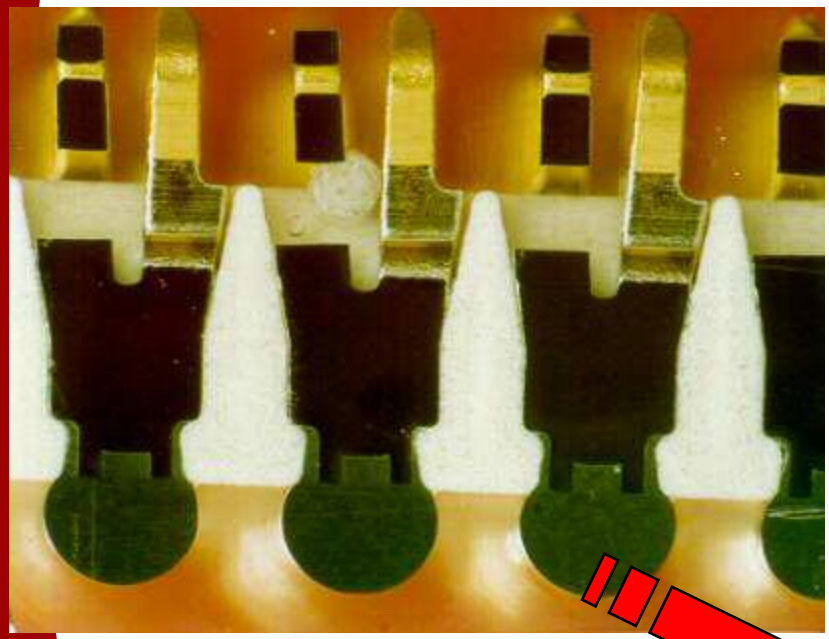
Formed Dual-Beam Receptacle Contact

Self-Centering in X and Y Directions

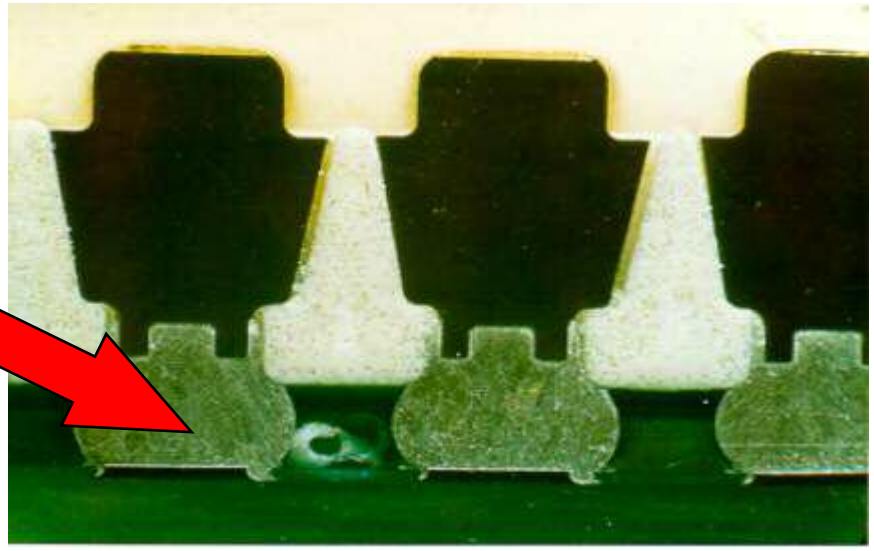
- **Surface Tension Promotes Self-Centering Of The Connector During Re-flow With A Placement Of Only 50% Of The Solder Sphere On The Pad**
- **Compensates For Placement Error**



Self-Leveling in Z Direction



- Solder Spheres Collapse Upon Reflow For Vertical Self-Leveling
- Compensates For Warpage Or Mis-match



Cross section prior to soldering

Cross section after soldering

FCI's BGA Reliability

- **FCI 100% Verifies BGA Coplanarity Of Every MEG-Array Connector**
- **Solder Joint Reliability – FCI's BGA Solder Joint Reliability On The MEG-Array Product In Accordance With IPC-SM-785 Is In Excess Of 22 Years Life**
- **Additional Reliability Testing At The PCB Interface**
  - **Passed 1000 Thermal Cycles -40C To +85C**
  - **Passed 1000 Thermal Cycles -25C To +100C**

Testing Conducted At An Outside Lab

Meg-Array® System Advantages

- *In-Process Inspection & Quality Controls*
  - *Vision Systems*
    - *Verification Of Terminal And BGA Presence*
  - *RVSI*
    - *100% Laser Inspection – Coplanarity*
  - *Acuity*
    - *Verification Of Terminal Placement*

Meg-Array® Connector Signal Integrity Testing

FCI

MEG-Array® High-Speed Performance Summary Table

Stack Height	Differential Impedance Tr = 100ps	Differential*** Insertion Loss	10 Gb/s** Eye	Propagation Delay	Multiactive NEXT Tr = 100ps	Differential Pairs per Linear Inch
4mm	91.0 / 100.0	5.32 GHz	Pass	24.21ps	<1%	39
10mm	100.0 / 104.0	5.30 GHz	Pass	54.33ps	<1%	39
14mm	100.0 / 112.0	5.65 GHz	Pass	70.50ps	<1%	39

- **Notes:**

****The acceptance criteria for Eye Patterns are a mask height of 25% and a mask width of 40%.**

*****Denotes Bandwidth. Frequency at which Insertion Loss reaches 3 dB.**

Rise time (T_r) is specified from 10% to 90% of the signal amplitude.

MEG-Array® Eye Patterns

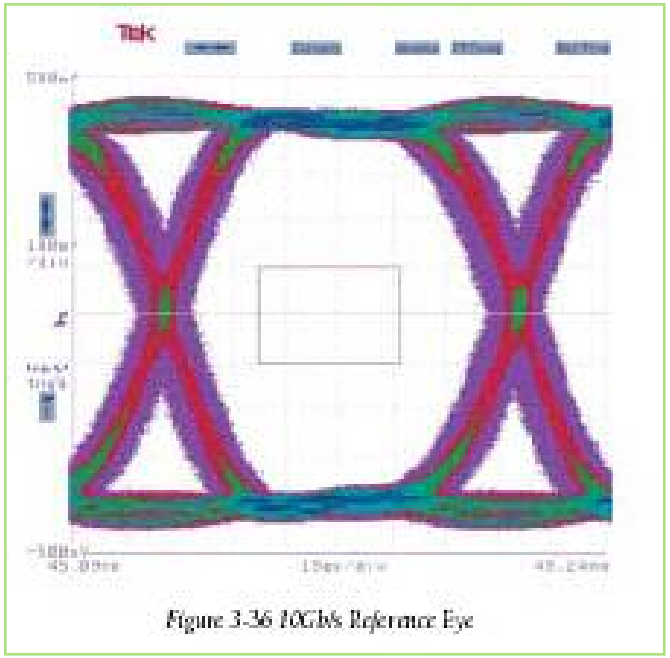


Figure 3-36 10Gb/s Reference Eye

10Gb/s Reference Eye

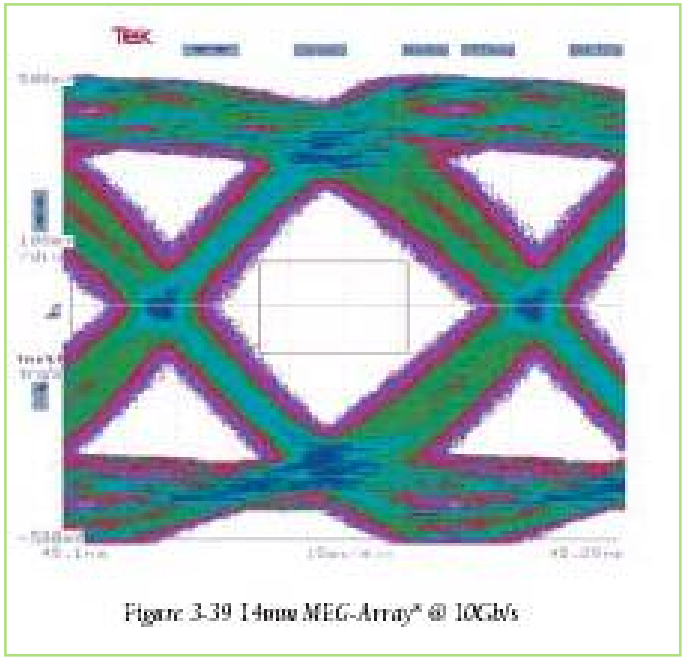


Figure 3-39 14mm MEG-Array® @ 10Gb/s

14mm Stack @ 10Gb/s

Mask Amplitude Was 25% (200 mVp-p) Of The Input Signal And The Mask Width Was Set To 40% (40 ps) Of The Input Signal.

Meg-Array® System Advantages

- *Mass Production Capability*
  - *Released For Mass Production In 1996*
  - *9+ Years Of Volume Production*
  - *Over 38 Million Connectors Shipped*
    - *Approximately 9 Billion+ BGA Contacts Shipped*
  - *Proven/Patented BGA Design*

Product Support

Product Datasheet	950554-007
Application Specification	GS-20-033
Product Specification	GS-12-100
High-Speed Performance Data	950554-008
Test Reports	
SPICE Files	
3D Models – ProE & IGES	

All Of The Above Information Is Located At:

www.fciconnect.com

Under Literature, New Product Documentation, High Speed, Mezzanine

GIG-Array®

MEZZANINE CONNECTOR SYSTEM

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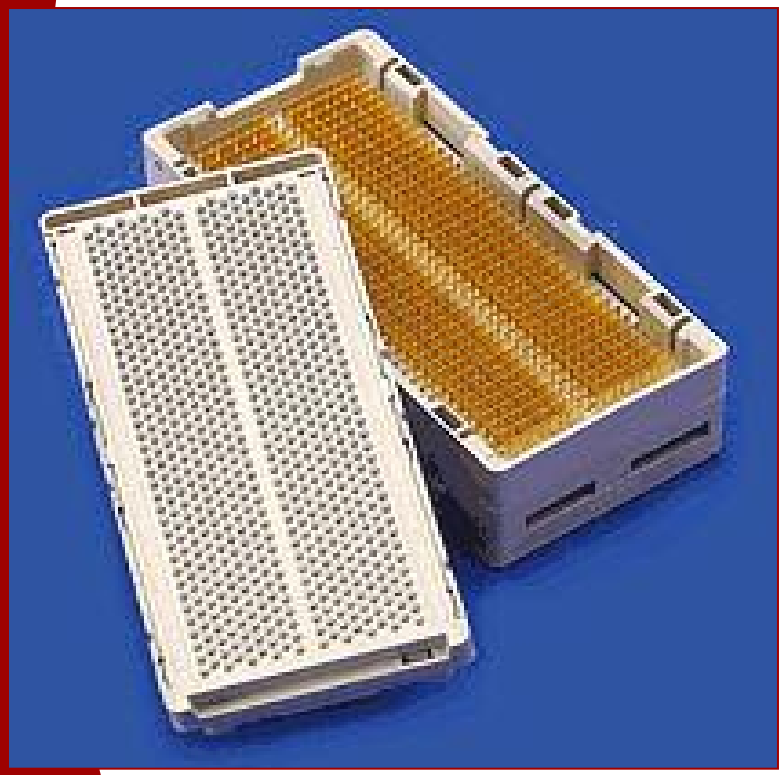
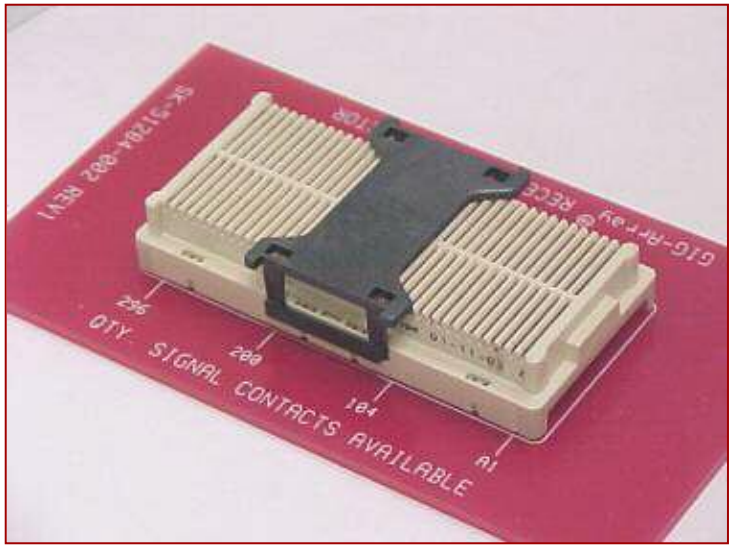
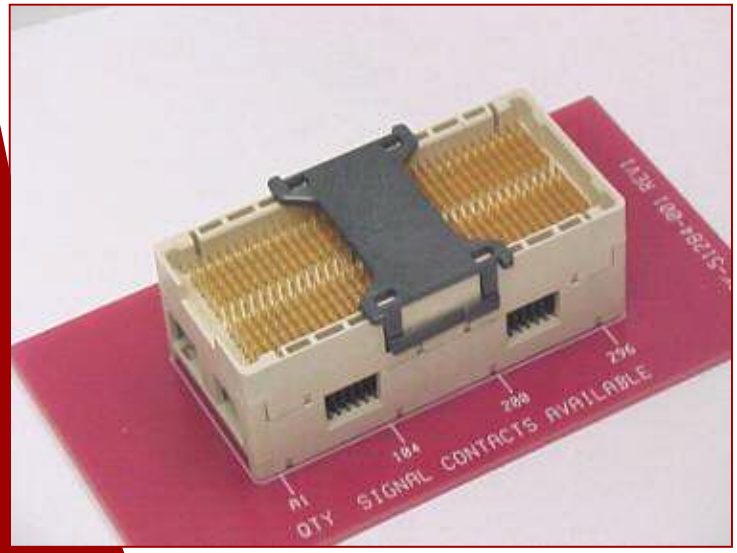
GIG-Array® Connector Features & Benefits



- Optimized Design For High-Density, High-Speed Mezzanine Applications
- Ball Grid Array (BGA) Termination For Process Friendly Attachment
- 1mm X 0.65mm BGA Grid Optimizes Routing And Electrical Performance
- 200 and 296 Positions
- Stack Heights Of 15mm To 35mm

GIG-Array® Connector Features & Benefits





- **100 Ohm Differential Pair Matched Impedance Assures Consistent High Speed Performance**
- **10 Gb/s Differential Pair Performance Supports High Speed Data Rates**
- **Near End Crosstalk (NEXT) Of Less Than 3% Preserves Signal Integrity**
- **Dual-Beam Receptacle Provides Two Points Of Contact On The Signal Contacts Increasing Product Reliability**
- **Polarized Design Assures Proper Mating Of The Connector**

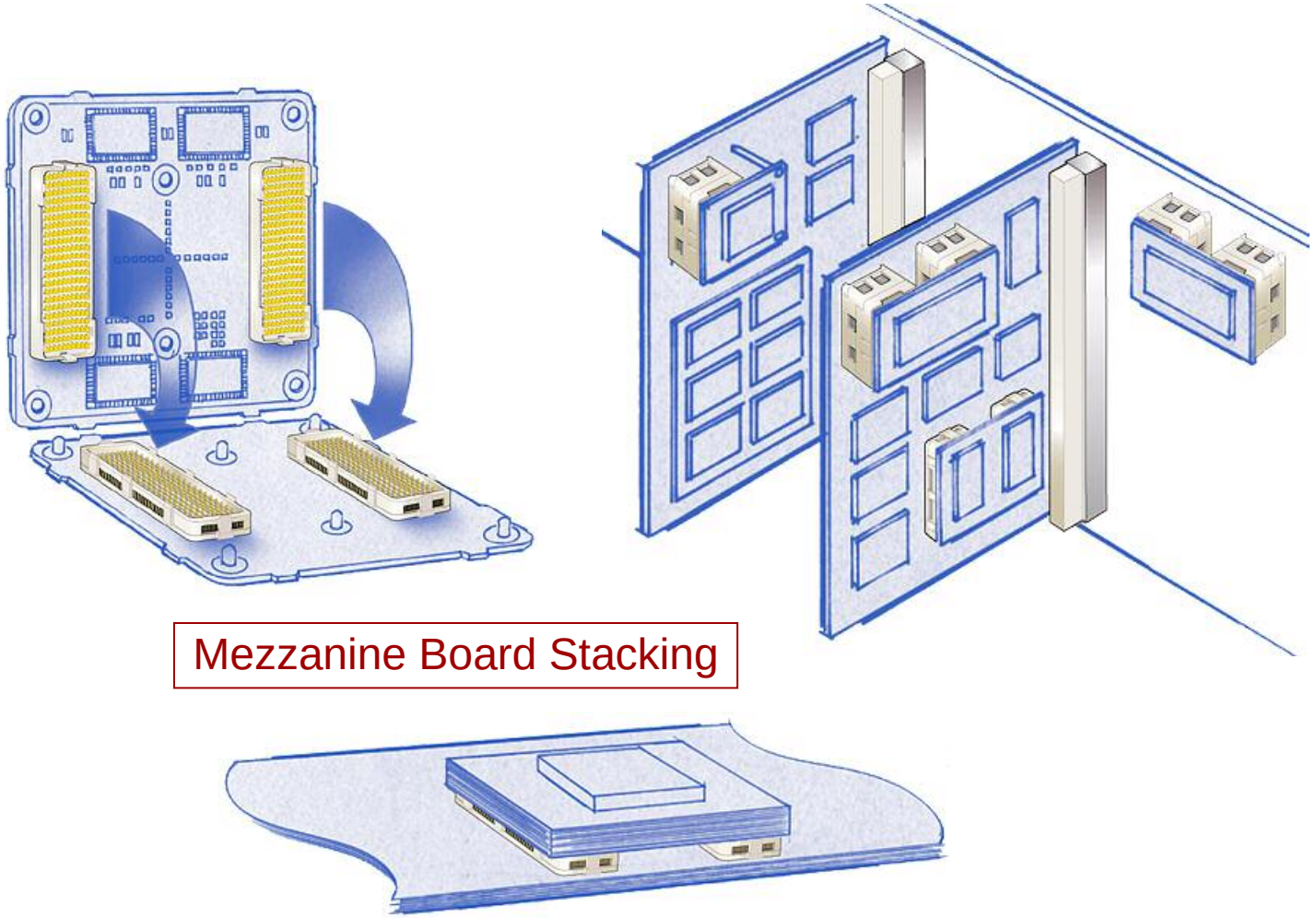
GIG-Array® Capabilities

200 and 296 Signal Positions

RECEPTACLE HEIGHT (P/N)	PLUG HEIGHT (Part Number)				
	10mm	12mm	13mm	15mm	20mm
5mm	15mm	17mm	18mm	20mm	25mm
15mm	25mm	27mm	28mm	30mm	35mm

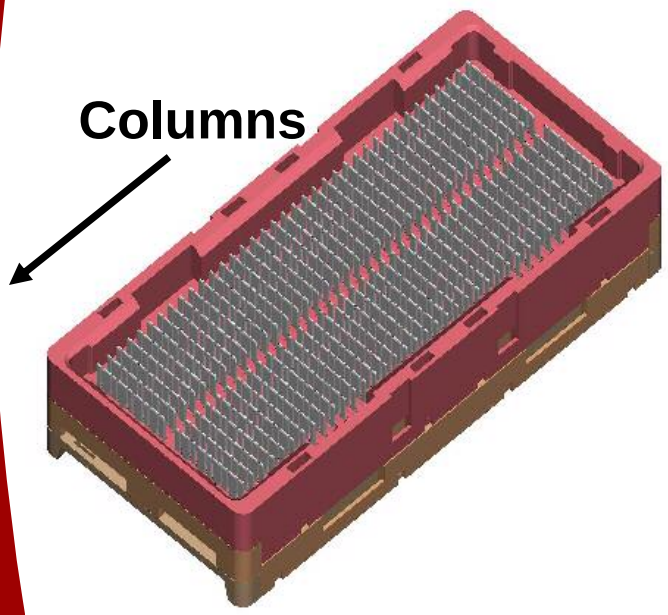
Total Board-To-Board Mated Height in Black
All Dimensions In mm

Typical Connector Applications



Mezzanine Board Stacking

GIG-Array® Connector Plug



Plug Pin Configuration

G	S	G	S	G	S	G	S	G		G	S	G	S	G	S	G	S	G	
G	S	G	S	G	S	G	S	G		G	S	G	S	G	S	G	S	G	
G	S	G	S	G	S	G	S	G		G	S	G	S	G	S	G	S	G	
G	S	G	S	G	S	G	S	G		G	S	G	S	G	S	G	S	G	
G	S	G	S	G	S	G	S	G		G	S	G	S	G	S	G	S	G	

Columns

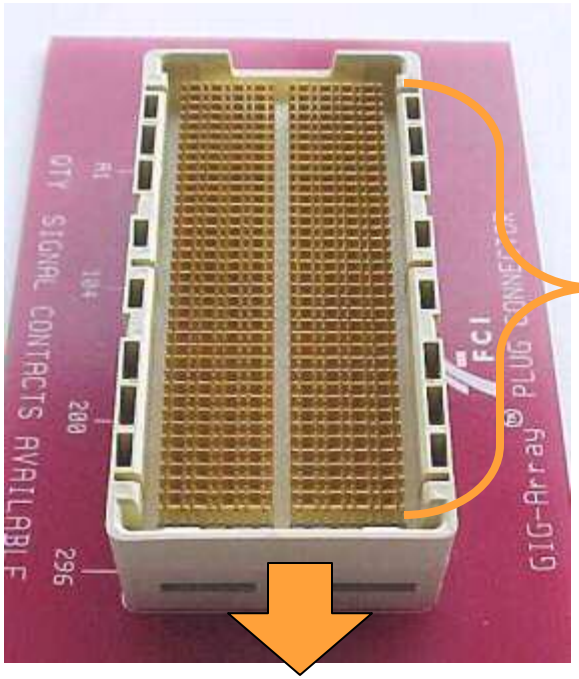
G = Ground

S = Signal

The 296 Position Connector Contains 37 Columns With 8 Usable Signals In A Row

The 200 Position Connector Contains 25 Columns

Integrate Power With The GIG-Array® Connector



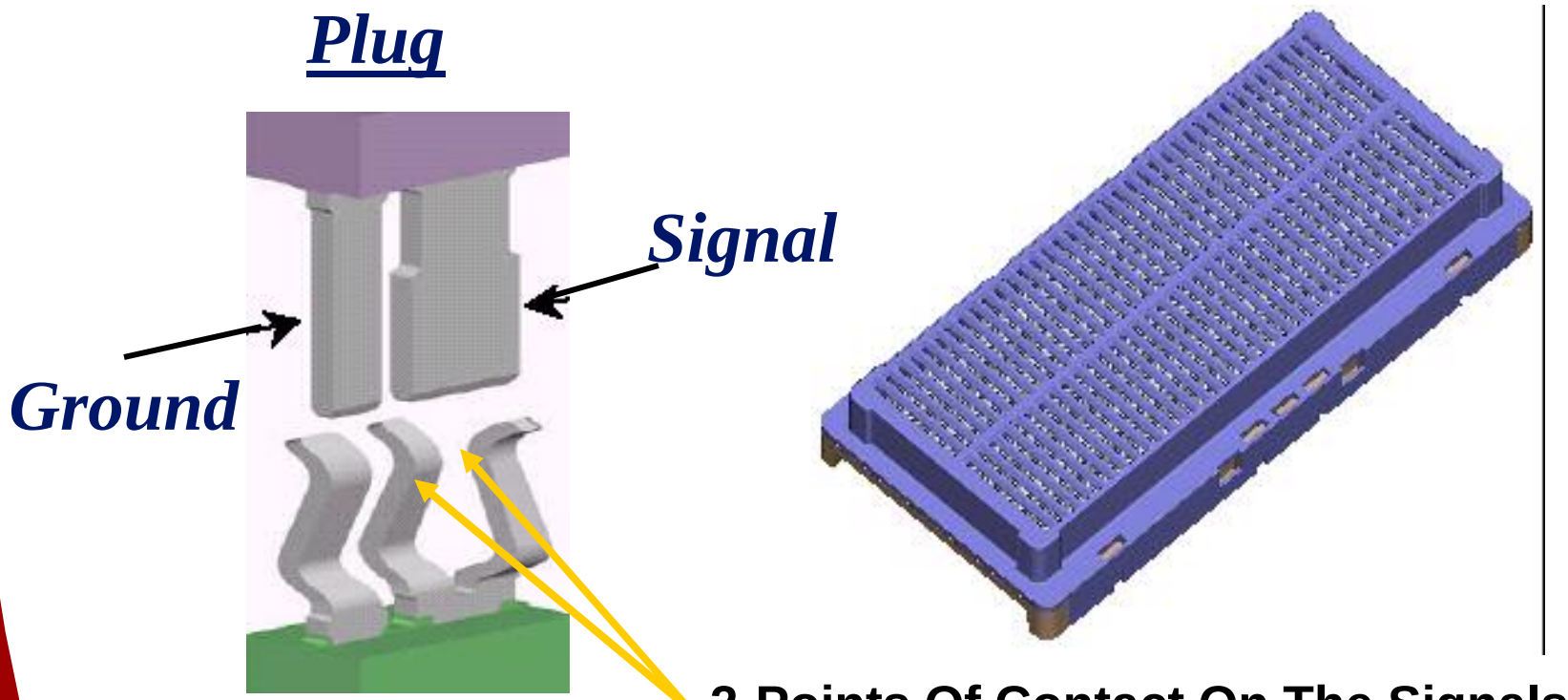
The 296 Position GIG-Array™ Contains 37 Individual Wafers

Each Wafer Contains 10 Ground Pins and 8 Signal Pins

Designers Can Choose To Run 18 Amps (Derated) Through Just One Wafer Using The Other 36 Wafers For High Speed Requirements

Discrete contacts offer more flexibility in handling Power or Low-Speed signals

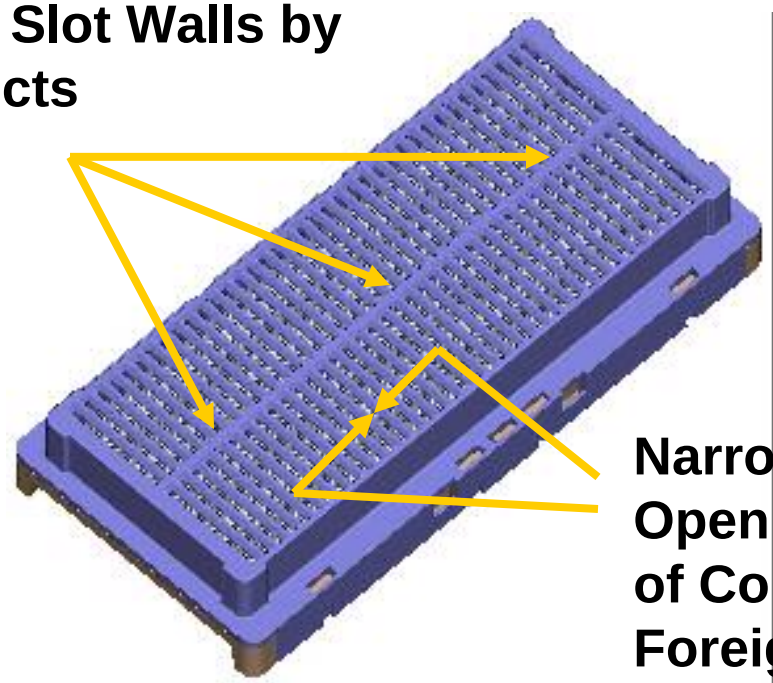
GIG-Array® Connector Receptacle



2-Points Of Contact On The Signals Increase Reliability Of The End Application

GIG-Array® Connector Receptacle

Center-Wall to Reduce Deflection of Slot Walls by Foreign Objects

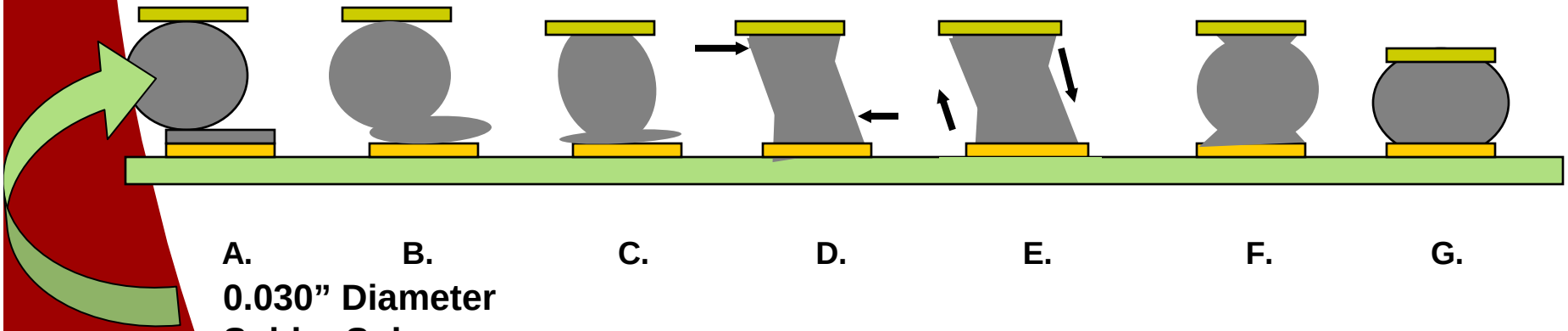


Narrower Receptacle Slot Openings Also Reduce Risk of Contact Damage from Foreign Objects

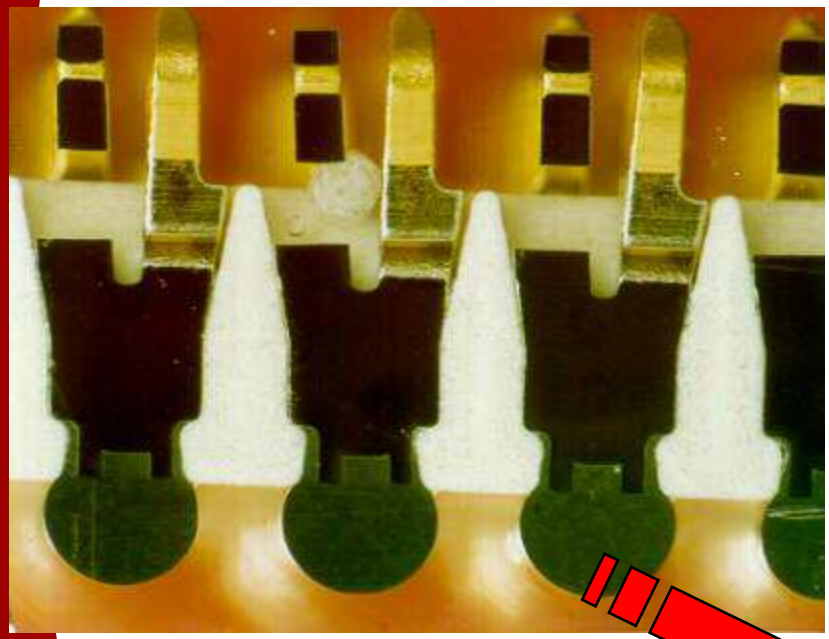
Receptacle

BGA Self-Centering in X and Y Directions & Self-Leveling in Z Direction

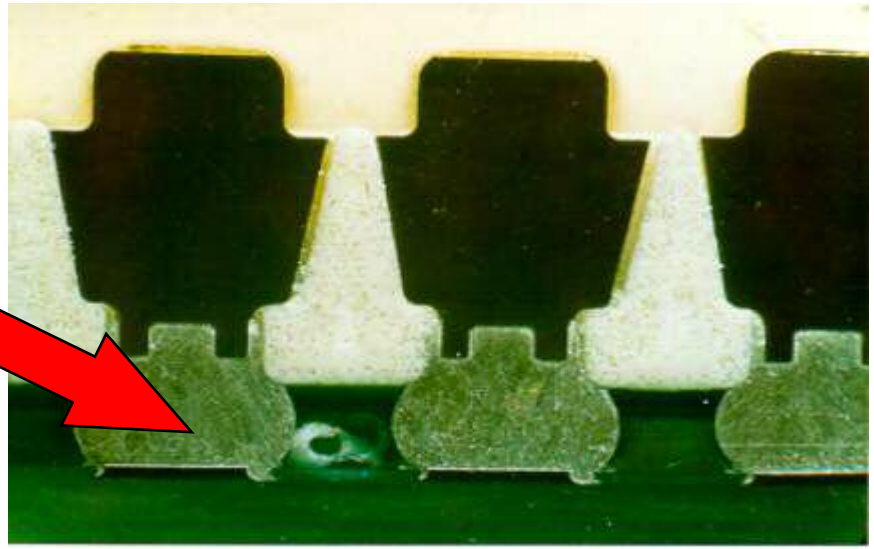
- **Surface Tension Promotes Self-Centering Of The Connector Connector During Re-flow With A Placement Of Only 50% Of The Solder Sphere On The Pad**
  - ✓ **Compensates For Placement Error**
- **Solder Spheres Collapse Upon Reflow For Vertical Self-Leveling**
  - ✓ **Compensates For PCB Warpage**



Self-Leveling in Z Direction



- Solder Spheres Collapse Upon Reflow For Vertical Self-Leveling
- Compensates For Warpage Or Mis-match



Cross section prior to soldering

Cross section after soldering

FCI's BGA Reliability

- ☆ **GIG-Array® Connectors Utilize The Exact Same BGA Sphere, Design, And Process As MEG-Array Connectors**
- ☆ **FCI 100% Verifies BGA Coplanarity Of Every GIG-Array Connector**
- **Solder Joint Reliability – FCI's BGA Solder Joint Reliability Is In Accordance With IPC-SM-785 Is In Excess Of 22 Years Life**
- **GIG-Array Connectors Passed 2670 Thermal Cycles 0 C to +100 C per IPC-SM-785**

GIG-Array® Connector Signal Integrity Testing

GIG-Array® High-Speed Performance

Stack Height	Differential Impedance Tr = 100ps	Differential*** Insertion Loss	10 Gb/s** Eye	Propagation Delay	Multiactive NEXT Tr = 100ps	Differential Pairs per Linear Inch
15mm	96.48 / 99.74	6.85 GHz	Pass	53.23ps	1.24%	51*
20mm	93.5 / 102.6	5.12 GHz	Pass	87.57ps	1.13%	51*
25mm	93.0 / 107.4	4.25 GHz	Pass	108.19ps	1.14%	51*
30mm	96.50 / 108.32	6.50 GHz	Pass	117.52ps	1.25%	51*
35mm	96.51 / 108.91	6.05 GHz	Pass	132.45ps	1.25%	51*

- **Notes:**

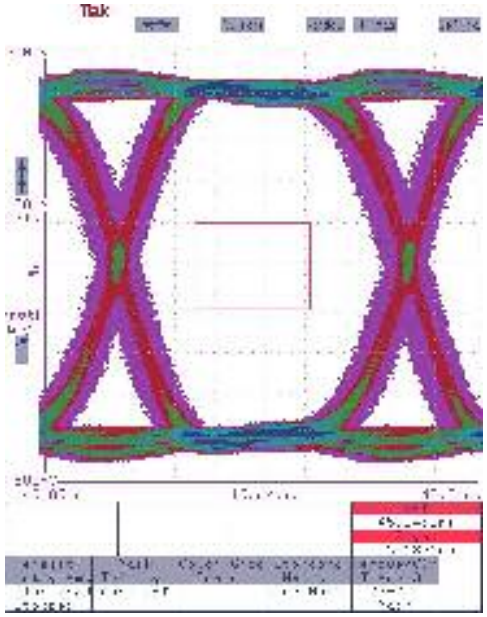
  ***The acceptance criteria for Eye Patterns are a mask height of 25% and a mask width of 40%.**

  ****Denotes Bandwidth. Frequency at which Insertion Loss reaches 3 dB.**

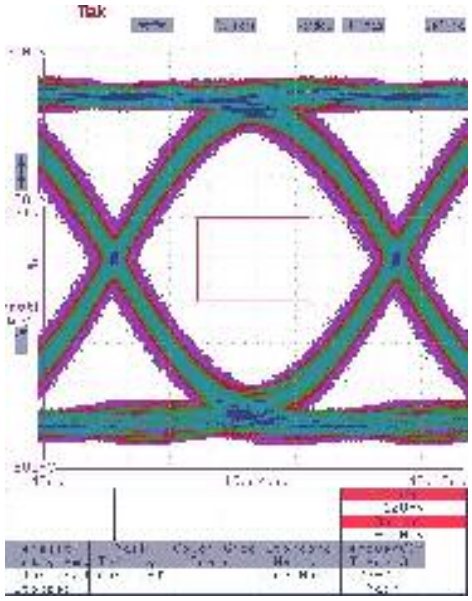
  Rise time (T_r) is specified from 10% to 90% of the signal amplitude.

GIG-Array® 10Gb/s Eye Patterns

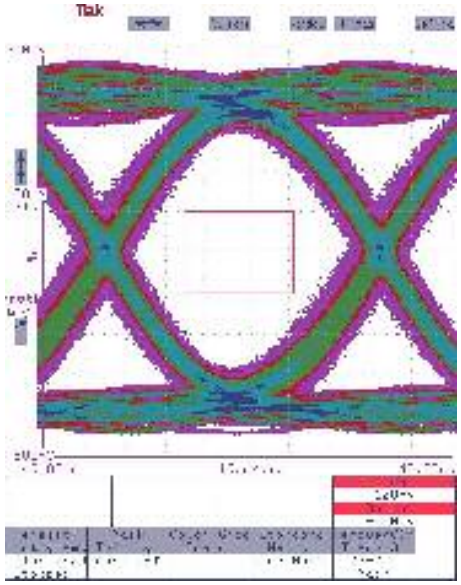
10 Gb/s Reference Eye Pattern



20 mm GIG-Array Differential Eye Pattern



25 mm GIG-Array Differential Eye Pattern



Mask Amplitude Was 25% (200 mVp-p) Of The Input Signal And The Mask Width Was Set To 40% (40 ps) Of The Input Signal.

Summary – GIG-Array® Advantages

- Provides 10Gb/s Electrical Performance
- FCI Is Recognized As The BGA Expert… Shipping over 9 Billion BGA Contacts
- Provide 2-Points Of Contact for Reliability
- Receptacles Features a Narrower Receptacle Slot Openings To Reduce Risk of Contact Damage from Foreign Objects
- Individual Contacts Provide More Flexibility In Handling Power Or Low-Speed Signals Than A One-Piece Ground Shield
- Certified Second Source (Tyco)
  - Intermateable and Interchaneable
- FCI Worked With Solectron & Universal In Developing The GIG-Array Application Specification Assuring Stable Process Capability During Product Application

Product Support

Product Datasheet	950554-007
Application Specification	GS-20-033
Product Specification	GS-12-100
High-Speed Performance Data	950554-008
Sample Kit	950558-037
Test Reports	
SPICE Files	
3D Models – ProE & IGES	

All Of The Above Information Is Located At:

www.fciconnect.com

Under Literature, New Product Documentation, High Speed Mezzanine

Thank You