

# Advanced Interconnect Technology for Rugged Embedded Computing

## Aerospace Defense & Marine Development Engineering

Matt McAlonis- Development Engineering Manager  
January 22, 2013

**EVERY CONNECTION COUNTS**



# Embedded Tech Trends: Contents

- TE Connectivity- A Brief Introduction
  - A World Leader Enabling Connectivity
- Trends in high speed ruggedized board-to-board connectors
  - “S.W.A.P.” (Size, Weight, & Power)
  - “C.O.T.S” (Commercial Off the Shelf / Standards)
  - “High-Speed” Migration / Footprint layouts
  - Increasing Reliability- Making all this work in deployment
- VITA 46 & VPX- Strengthening the Foundation
  - VPX “Torture test”
  - 10,000 cycle mating/unmating test
  - VPX derivatives- Architecturally compatible and new alternatives



# TE Connectivity: A World Leader Enabling Connectivity

## Serving Large Attractive Markets

### Consumer

### Industrial and Infrastructure



Transportation



Consumer Products



Communications



SubCom



Energy



Industrial Equipment



Aerospace & Defense



Medical

## With a Wealth of Technology Platforms



Connectors



Fiber Optics



Touch Systems



Circuit Protection



Sealing & Protection



Wireless



Precision Wire & Cable

## And Extensive Global Resources

**7,000 Engineers**  
Close to Our Customers

**5,000 Salespeople**  
Advising Our Customers

**150 Countries**  
Served

**~90**  
**Manufacturing Sites**  
Serving Every Region

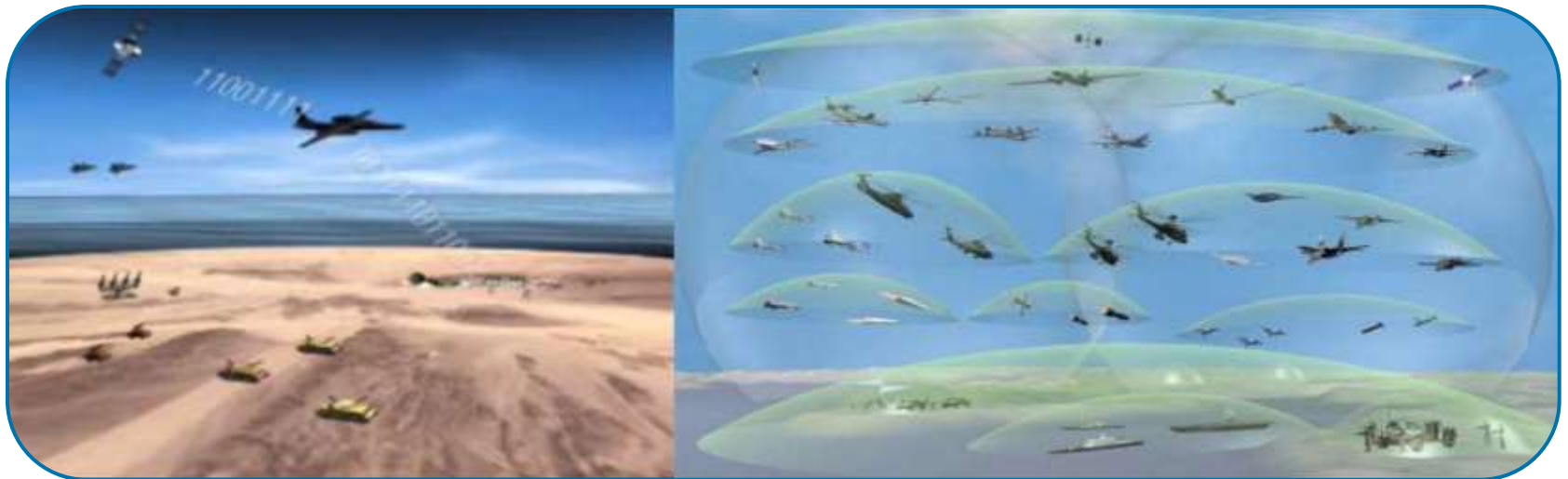
# Industry Need: Rugged and Portable performance



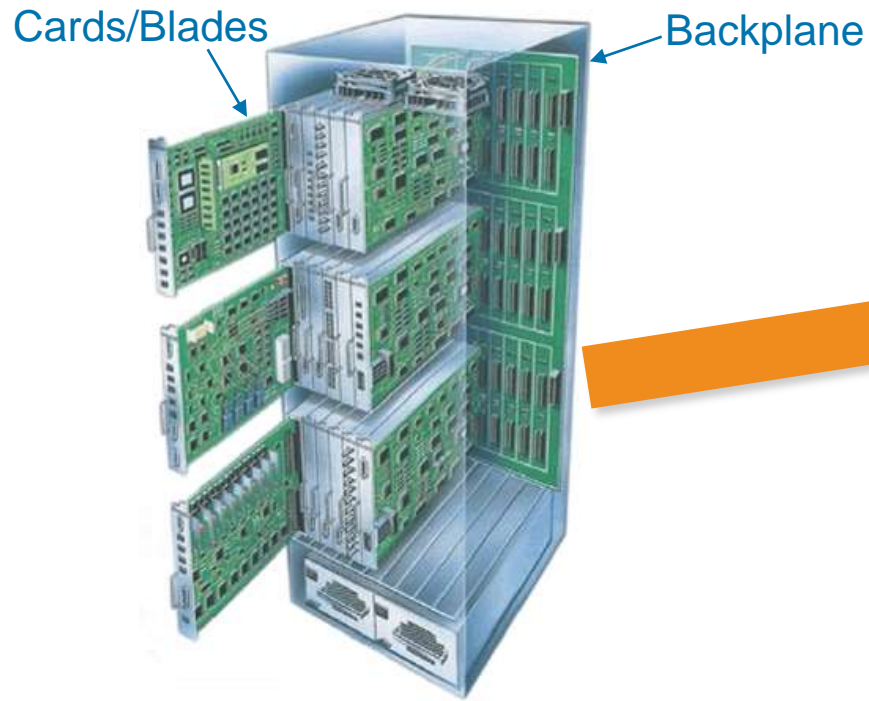
High speed connectors are required to work in these rugged environments

# Industry Need: Real-time processing of data

- Sensors collect increasingly high amounts of raw data.
  - Video
  - Radar
  - Infrared
- Ability to process high volume of data in “real-time” is critical.
  - Providing safety and knowledge through “instant” communication
- “Embedded Computing”



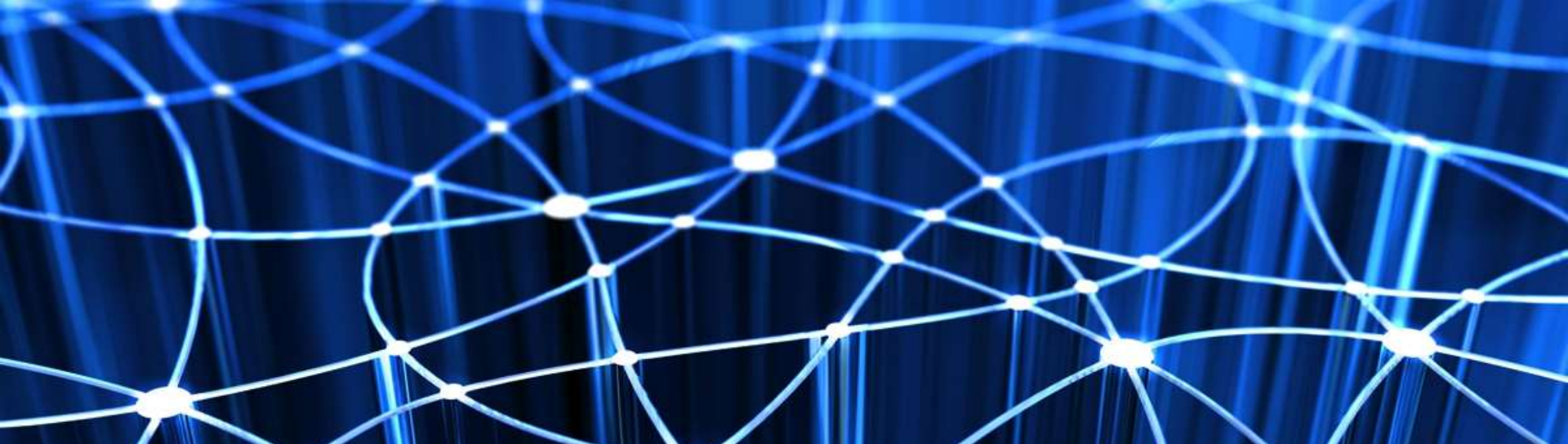
# Typical “High Speed” System



Rugged system  
-Optimum “SWAP”



Commercial system designed  
for “office” environment

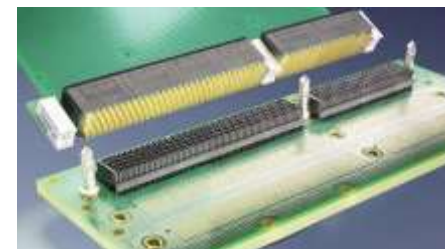


# VITA 46 & VPX- Strengthening the Foundation

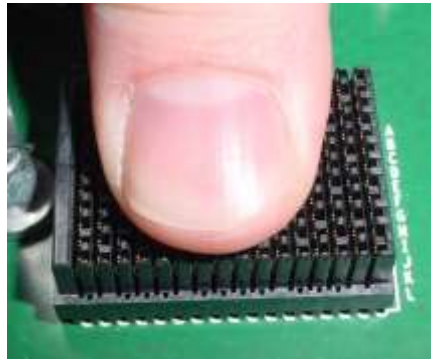
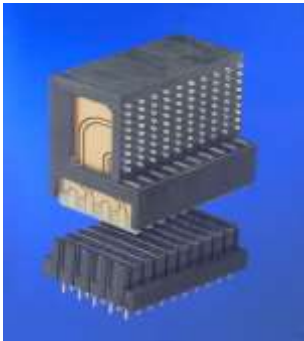
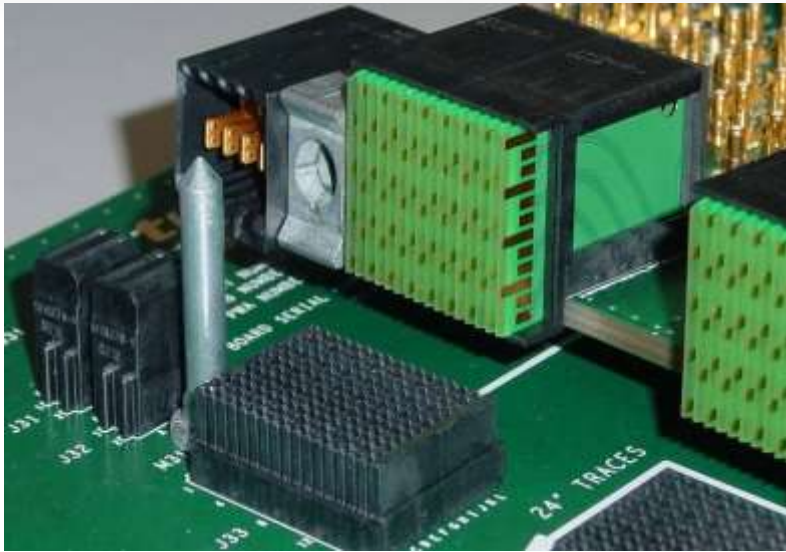
Aerospace Defense & Marine Development Engineering

January 22, 2013

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# MULTIGIG RT Family- Product Overview



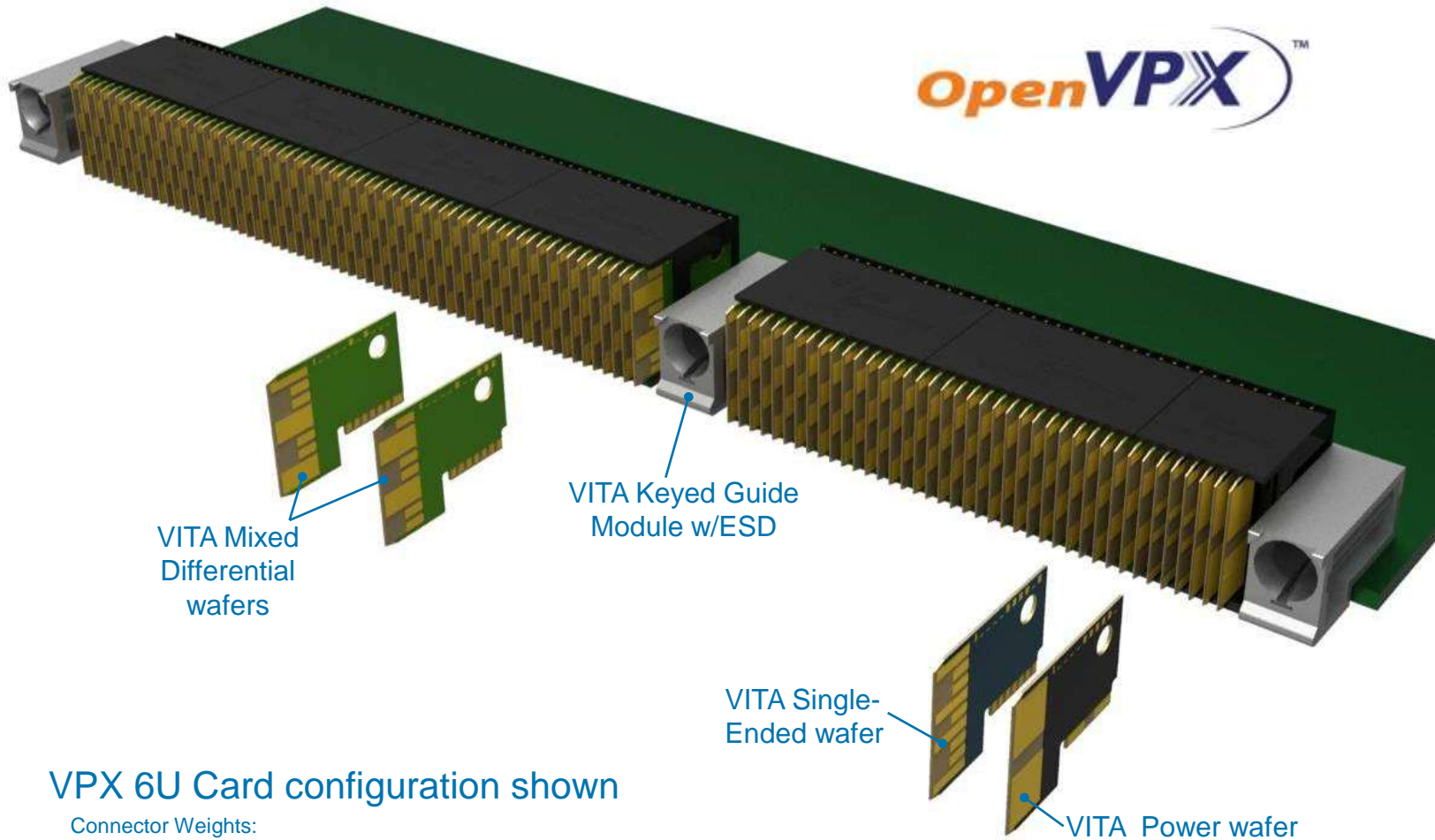
- **Pin-less** backplane connector family
- Data rates up to 12.5 Gbps
- Modular connector system
- Available in two versions fitting 0.8" (20.3 mm) and 1.0" (25.4 mm) card slot pitches
- Density up to 140 signals per inch (55 signals per cm)
- Connector system specified in VME standards: VITA 41 and VITA 46
- Daughtercard connector utilizes PCB wafer construction, which allows **extreme flexibility** with **customized wafer loading patterns**
- Future plans include components, active and passive, within the daughtercard connector
- Website: <http://www.multigigrt.com>



# Typical MULTIGIG RT Implementation

The lightest weight  
VPX connector  
solution!

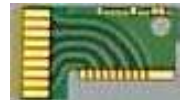
Wafers can be loaded in custom loading patterns to match the application



Example wafer options include:



Differential wafer



Open pinfield (OPF) wafer



Single-ended wafer



Custom wafer

## VPX 6U Card configuration shown

Connector Weights:  
Fully populated 6U card ~90 grams / Backplane ~60 grams (~150 grams/slot)

# Strengthening the VPX Foundation: MULTIGIG RT 2-R

- [www.TheFutureUnleashed.com](http://www.TheFutureUnleashed.com) announces MULTIGIG RT 2-R!

- Quad-redundant Contact System
- VITA 72 vibration-proven
- Tested to 10,000 mating cycles
- The lightest VPX solution
- Compliant to VITA 46
- Fully VITA 46 intermateable



The screenshot shows the TE Connectivity website's product page for the MULTIGIG RT 2-R Connector. The page features the TE Connectivity logo at the top left, a navigation menu with links for Products, Industries, Resources, About TE, My Account, Innovation, and Support Center, and a search bar. The main heading is "MULTIGIG RT 2-R Connector". Below the heading is a carousel of product images, including the MULTIGIG RT 2-R Connector, Fortis 2d Connector, CoeLok FAS-T Connector, and Muzalok Connector. The main content area includes a detailed description of the connector, highlighting its ruggedized and lightweight design for embedded computing applications. It mentions compliance with VITA 46 and VITA 48 standards, and lists key features such as support for high-speed protocols, a quad-redundant contact system, machined guide/keying hardware, light weight PCB wafer construction, associated products, and related resources. A large image of the connector system is shown on the right side of the page.

**MULTIGIG RT 2-R Connector**

Ruggedized and Lightweight for Rugged Embedded Computing Applications.

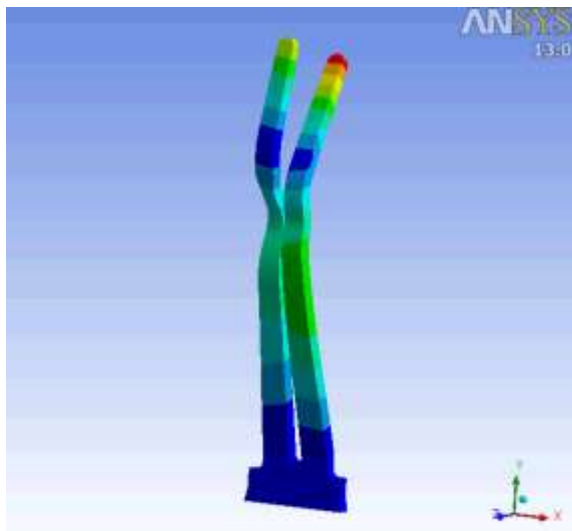
TE's MULTIGIG RT 2-R ruggedized, light weight, high speed board-to-board interconnect is compliant to VITA 48 standard.

This connector system features the modularity and flexibility of the MULTIGIG RT 2 connector, with a new quad-redundant contact structure designed for high vibration levels.

Register here with the TE website to order samples from the product menu page.

- Compliant to VITA 46
- Supports High Speed Protocols
- Quad-redundant Contact System
- Machined Guide / Keying Hardware
- Light Weight PCB Wafer Construction
- Associated Products
- Related Resources

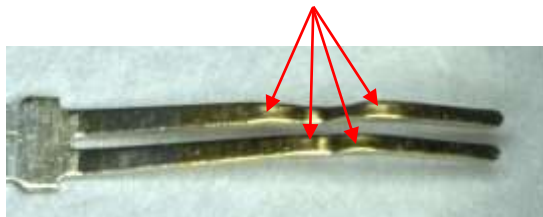
# MULTIGIG RT 2-R Enhanced contact design



RT 2-R Beams have dissimilar frequency modes in vibration

## MULTIGIG RT 2-R

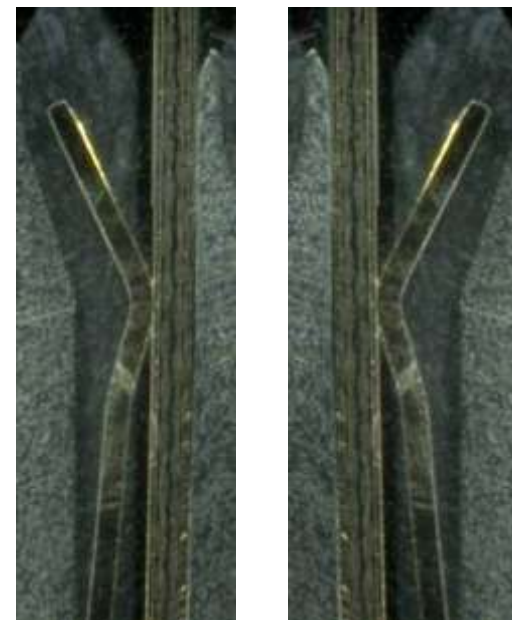
4 Contact Points



RT 2-R Cross section

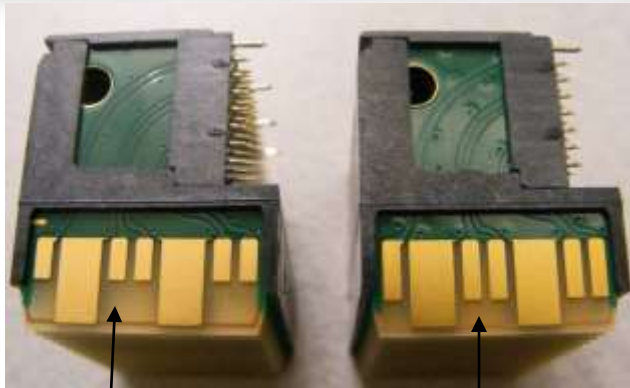
## MULTIGIG RT 2

2 Contact Points



RT 2 Cross section

# MULTIGIG RT 2-R Daughter card enhancement (Extended Pads)



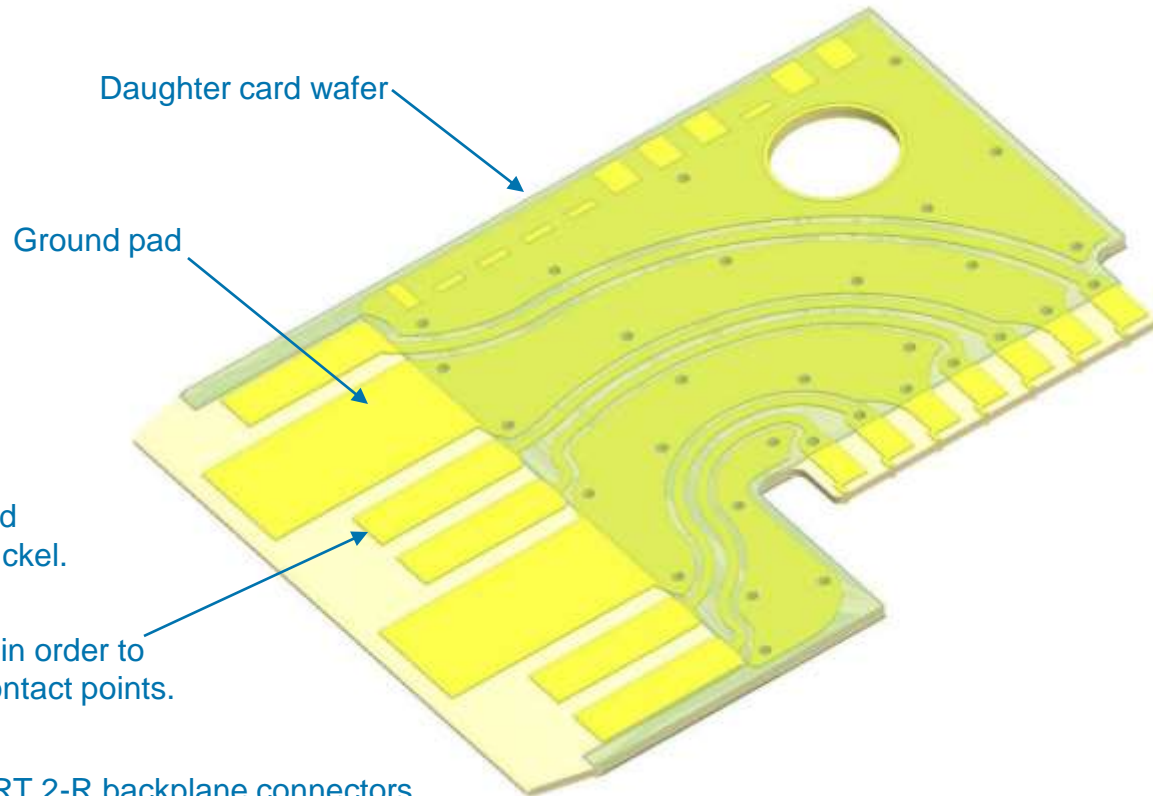
RT 2

RT 2-R  
(Extended pads)

All MULTIGIG RT 2 and RT 2-R VPX daughter card modules are plated with .000050" min gold over nickel.

RT 2-R Signal pads have been extended 1.20mm in order to maintain at least 2mm of contact wipe with all 4 contact points.

RT 2 daughter card connectors can be used with RT 2-R backplane connectors and maintain 4 point redundancy if connectors are within 0.5 mm of being fully mated in application.



MULTIGIG RT 2 and RT 2-R can be mated to each other

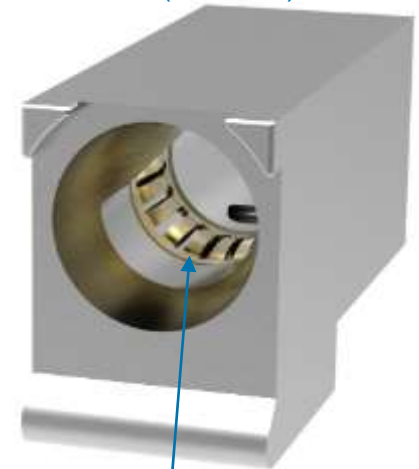
# MULTIGIG RT “Ruggedized” Guide Hardware

- Machined MULTIGIG RT Guide / Keying Hardware
- Available hardware option for VITA 46 and other MULTIGIG RT footprints:

- **Stainless Steel Guide Pin:**



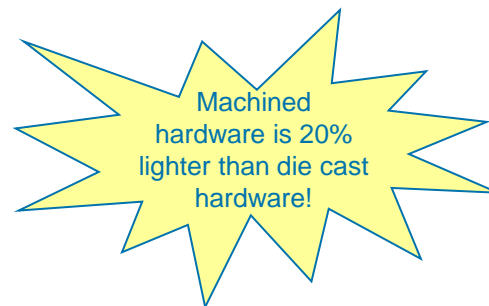
2000677-X  
(No ESD)



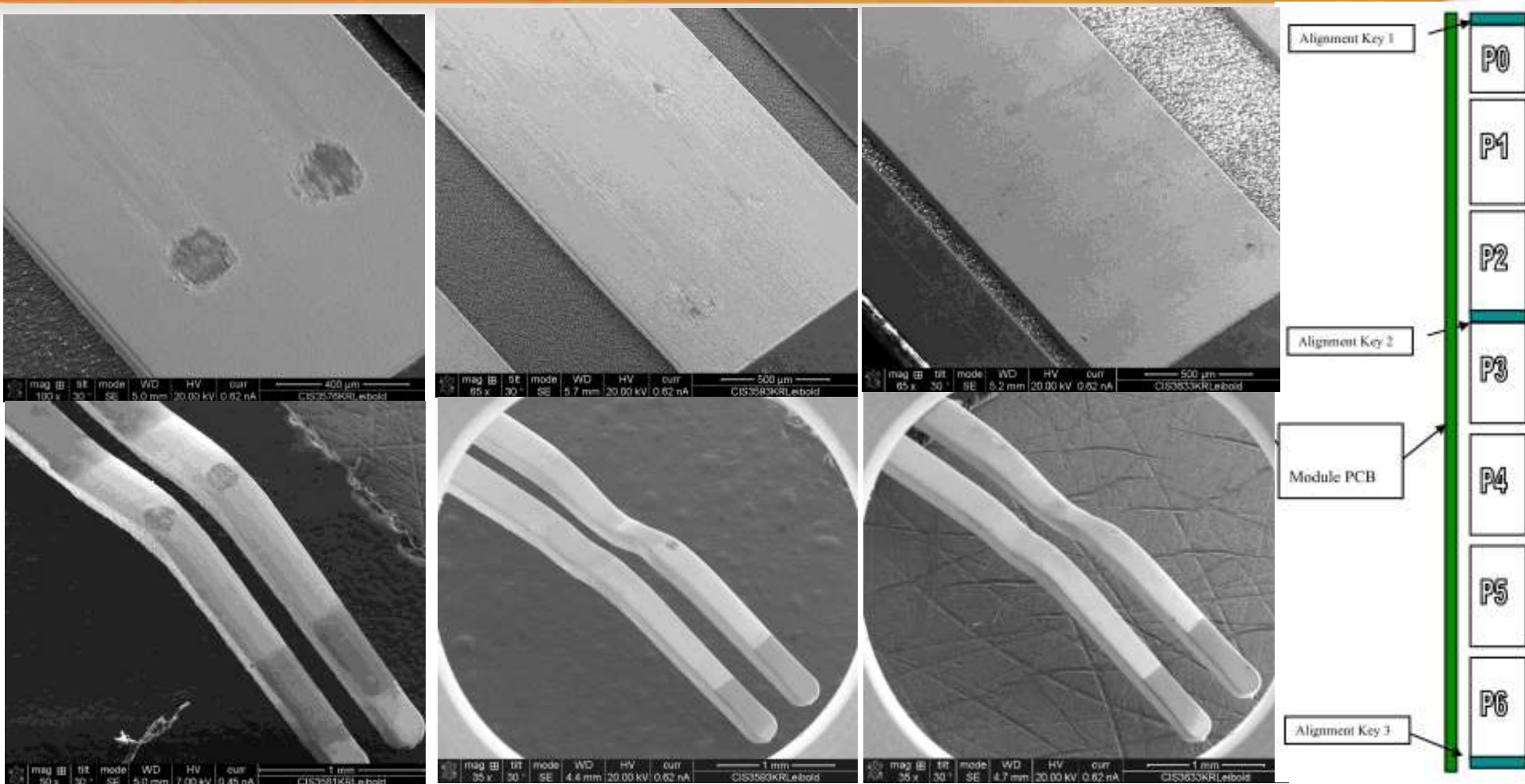
Guide Module Assembly  
Shown w/ optional ESD spring  
(2000713-X)

- **Aluminum (6061) Guide Socket (9.0 mm wide):**

- Ni plated
- With optional ESD contact



# VITA 72 (led by Mercury Systems) "Torture Test" L3+3dB (16.49g rms) 12 hrs Comparison between highest wear locations from each test sample

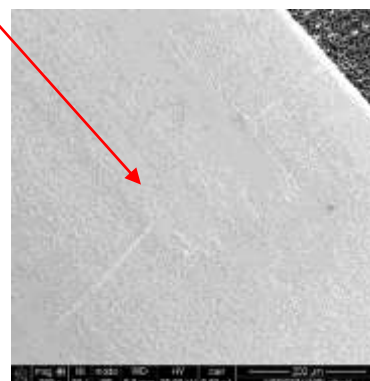
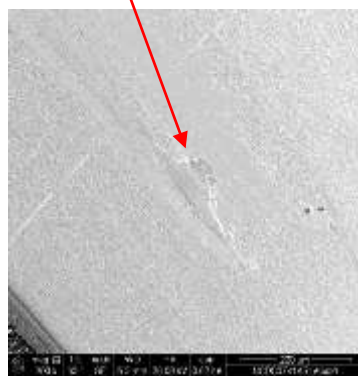
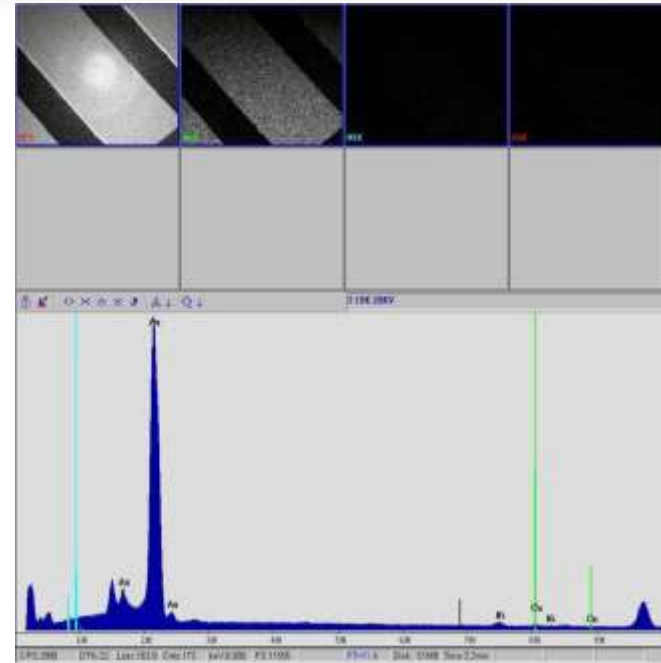
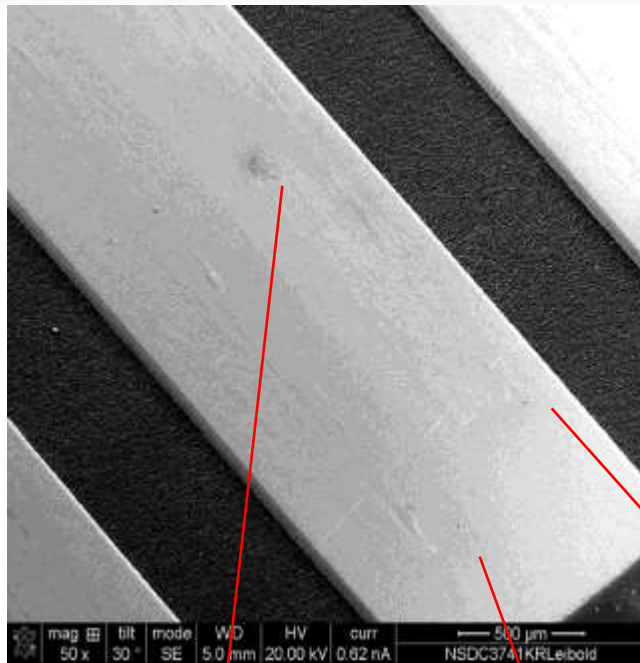


Standard Contact with Standard Guide Hardware Location P2-15

RT 2-R (4-pt) Contact w/ Standard Guide Hardware Location P2-12

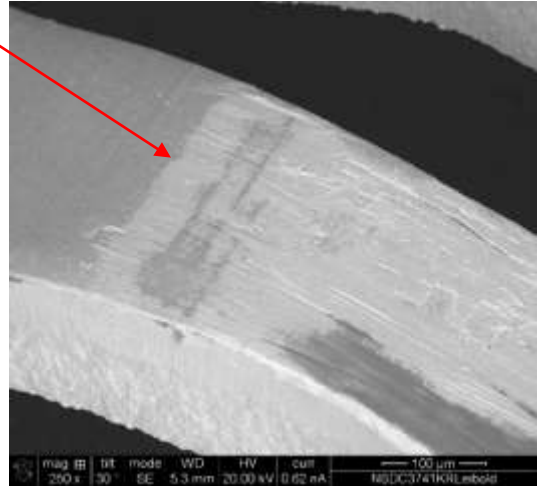
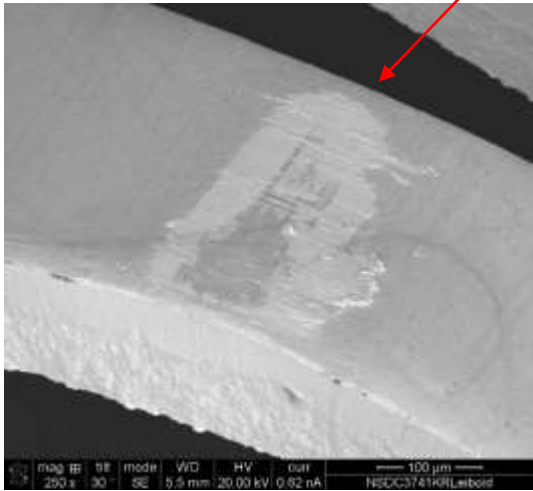
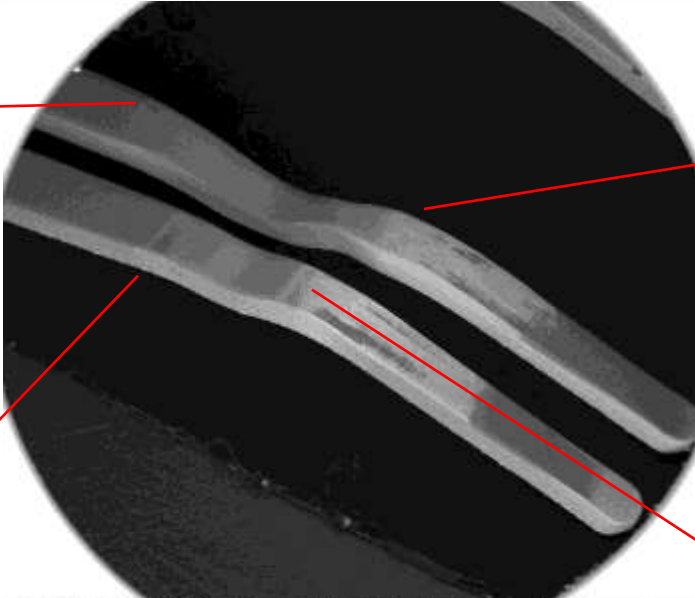
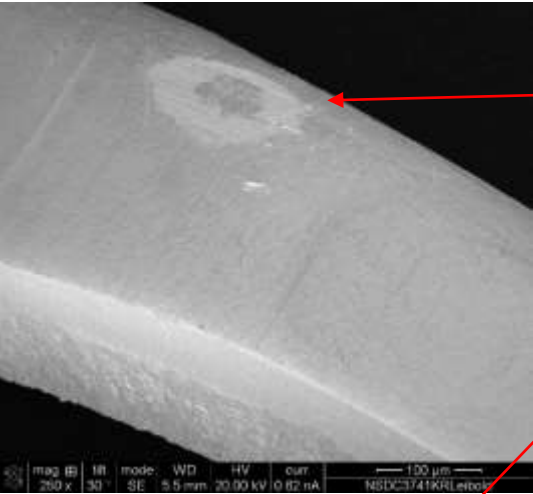
RT 2-R (4-pt) Contact w/ Rugged Guide Hardware Location P4-1

# 10,000 Mating/unmating cycles RT 2-R Daughter Card Wafer



- No exposed Ni.

# 10,000 Mating/Unmating cycles RT 2-R Backplane Contact



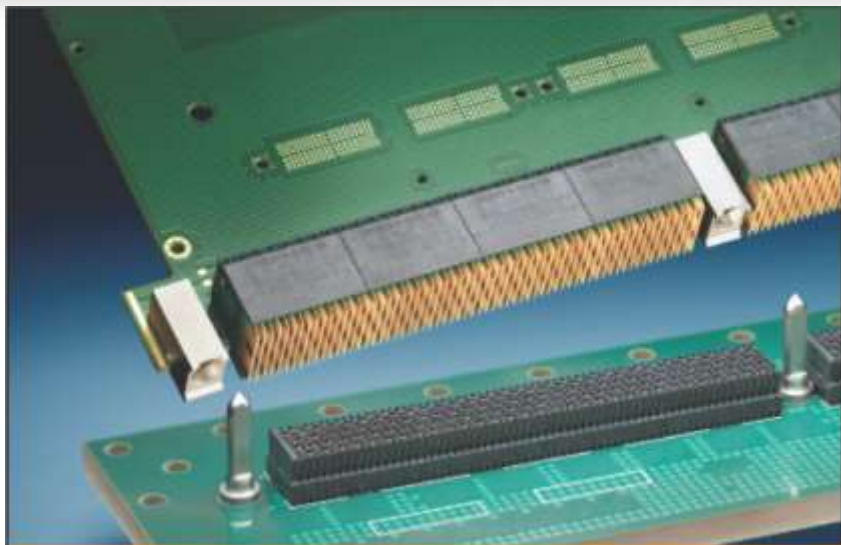
Contact  $\Delta R$  after 10,000 mating/unmating cycles\*

	Signal (72 data pts)	Ground (16 data pts)
Min	-4.24	-1.05
Avg	-0.08	-0.70
Max	0.88	-0.38
Std Dev	0.78	0.20

\*5 mΩ max  $\Delta R$  limit

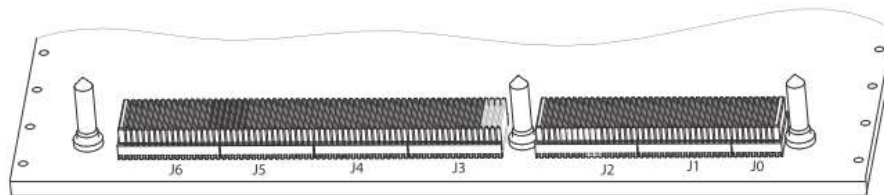
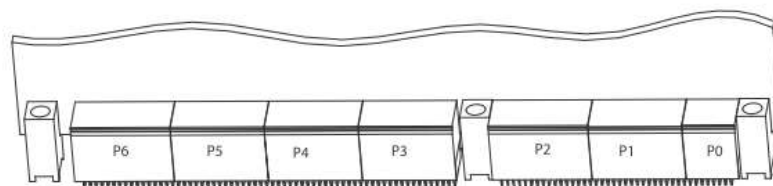


# MULTIGIG RT 2-R VPX Part Numbers



**MULTIGIG RT 2-R  
Connectors**

## PART CONFIGURATIONS



Introducing  
**MULTIGIG RT 2-R**  
Ruggedized Connectors  
for VPX Applications



### DAUGHTERCARD

Module Position	Part No.	
	MULTIGIG RT 2 Connectors	Ruggedized MULTIGIG RT 2-R (Extended Pad Wafers)
PO	1410189-3	2102772-1
P1, P2, P3, P4, P5, P6	Differential	1410187-3
	Single-Ended	1410190-3
Keying Guide Modules	1-1469492-X	2000713-X
	Standard (Zinc Die Cast) Guide Socket	Machined 6061 Aluminum Guide Socket, w/ESD Contact

See TE drawings for guide module and pin options.

### BACKPLANE

Module Position	Part No.	
	MULTIGIG RT 2 Connectors	Ruggedized MULTIGIG RT 2-R (Quad Redundant Contacts)
J0	1410186-1	2102735-1
J1, J3, J4, J5	1410140-1	2102736-1
J2, J6	1410142-1	2102737-1
Keying Guide Pin	1-1469491-X	2000676-X
	Standard (Zinc Die Cast) Guide Pin	Stainless Steel Guide Pin

See TE drawings for guide module and pin options.



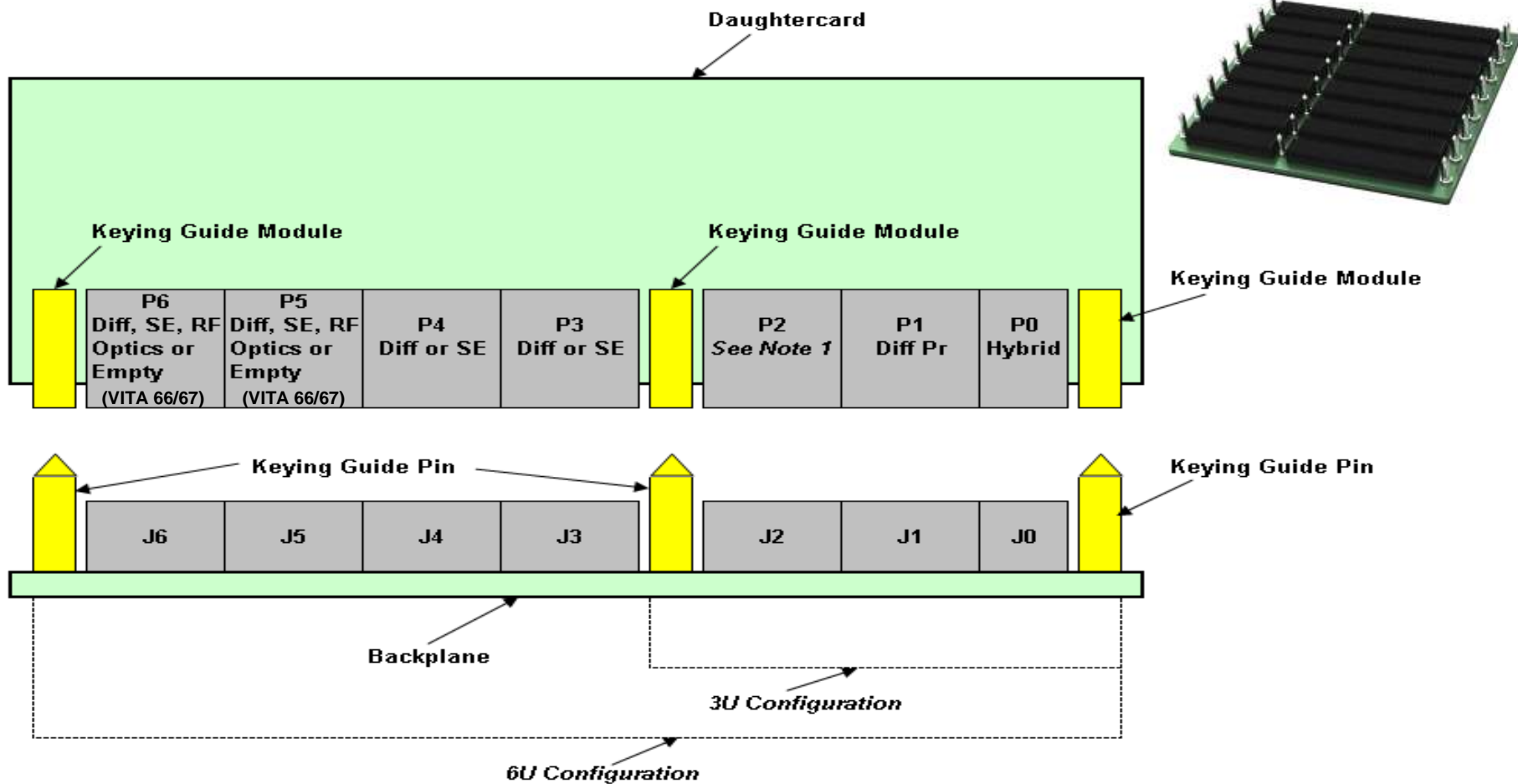
# MULTIGIG RT2 and RT 2-R

## Support Documentation

Literature Number	Description
108-2072	MULTIGIG RT Product Specification
114-13056	MULTIGIG RT Application Specification
501-544	MULTIGIG RT Qualification Test Report
22GC009-1	MULTIGIG RT 2 Connector Routing
25GC001	MULTIGIG RT 2 VITA 46 SI Report
408-10127	MULTIGIG Extraction Tool Instruction Sheet
204690	VITA 46 Contech Research Connector Module Qualification Test Report



# VITA 46 Board – Module Layout



**Note 1:** 6U: Diff or SE / 3U: Diff, SE, RF, Optics or Empty (VITA 66/67)

# TE “VITA 66–Style” Fiber-Optic Connectors

## VITA 66.1:

- Extreme density: up to 48 fiber paths
- Drawings, models & samples available
- TE qualification testing completed end of year 2012



## VITA 66.2:

- Provides excellent SM performance
- Enables single-fiber reparability
- Expected attenuation: 0.5 dB Max
- Temp range: -55° C to +100° C



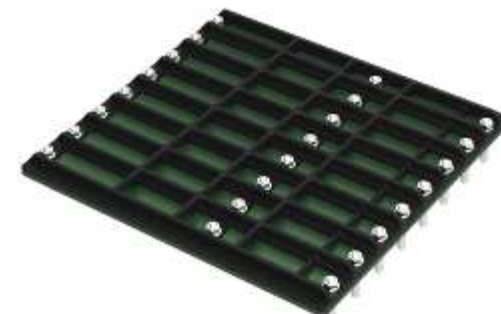
## VITA 66.3:

- Non-contacting optical interface:
  - Frequent mating / unmating (3K cycles)
  - For high-vibration environments
- Preliminary drawings are available

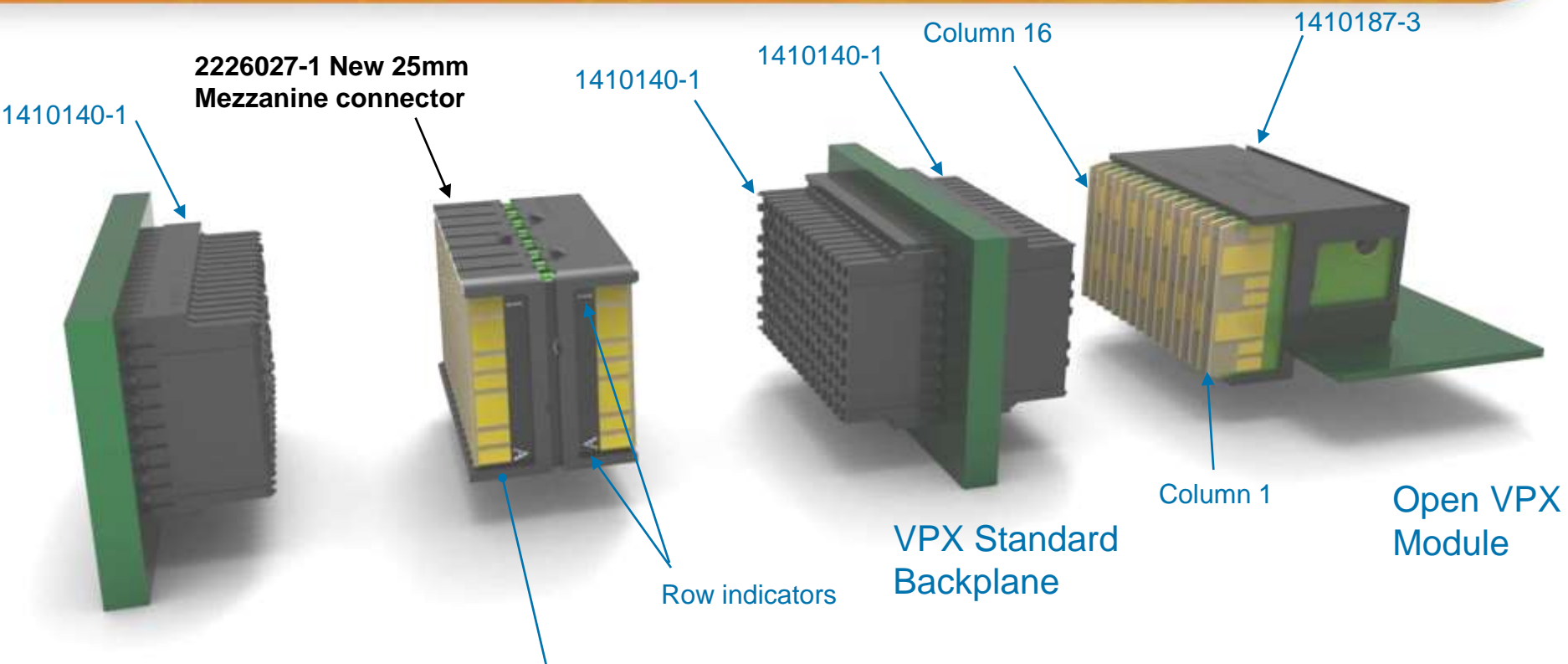


# VPX Accessories

- Composite Backplane support frame
  - High, Medium & Low volume / low cost manufacturing capability
  - Integrated assemblies
  - Unique molding process
    - Reduction in wall thickness vs. overall size
  - Integrated antenna manufacturing
  - Secondary processing & subassembly capability
  - Rapid prototyping

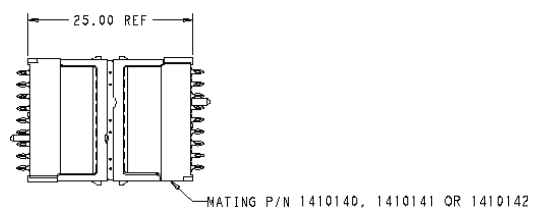


# Application view of VITA 46 25mm Stacking Connector (Samples available)



VPX Functional Backplane

Note: Interposer wafer design is not symmetric and only the orientation as shown will function properly as intended by the VPX pin assignment definition



# Application view of VITA 46 16mm Stacking Connector (concept)

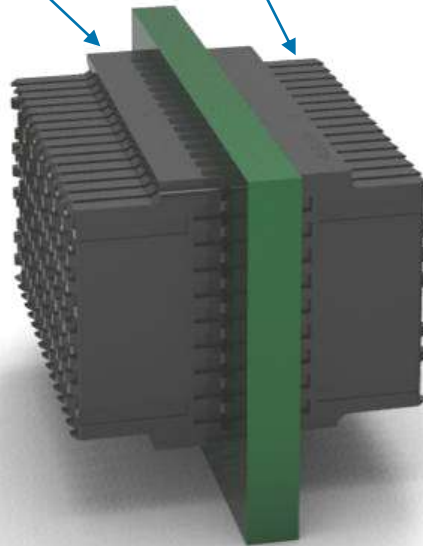
2226000-1 New 16mm Mezzanine connector



VPX Functional Backplane

1410140-1

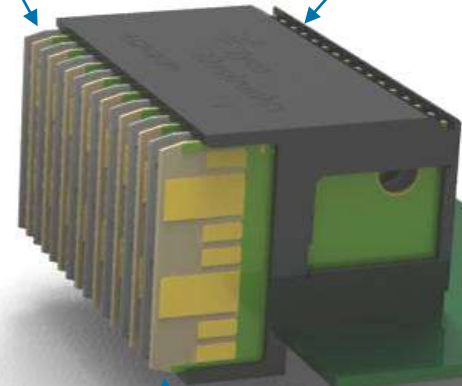
1410140-1



VPX Standard Backplane

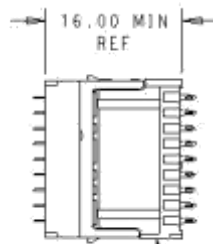
Column 16

1410187-3



Column 1

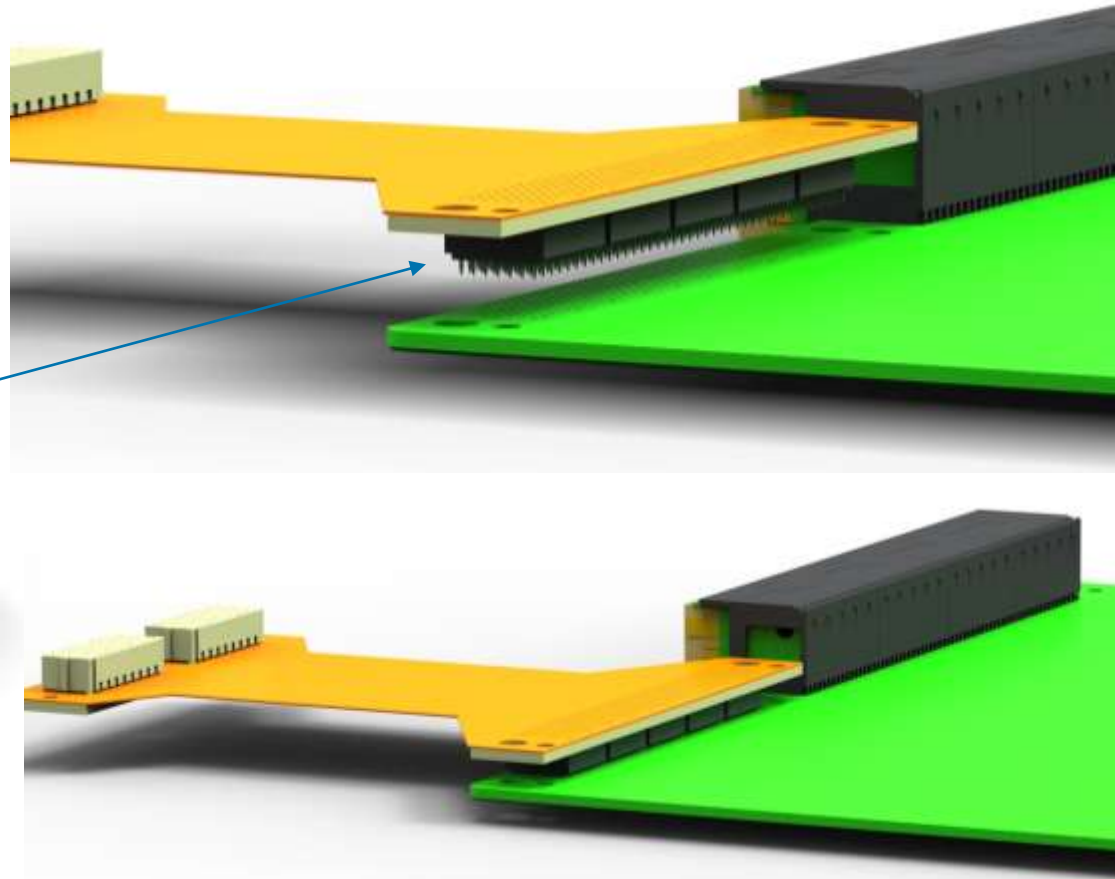
Open VPX Module



MATING P/N 1410140, 1410141 OR 1410142

# VPX Stacking Connector- Rigid Flex example

- VITA 46 Daughtercard footprint compatible
- Enables new system architectures and packaging possibilities!
- Design reuse for rapid development
- Designed with SWAP-C in mind







# MULTIGIG RT

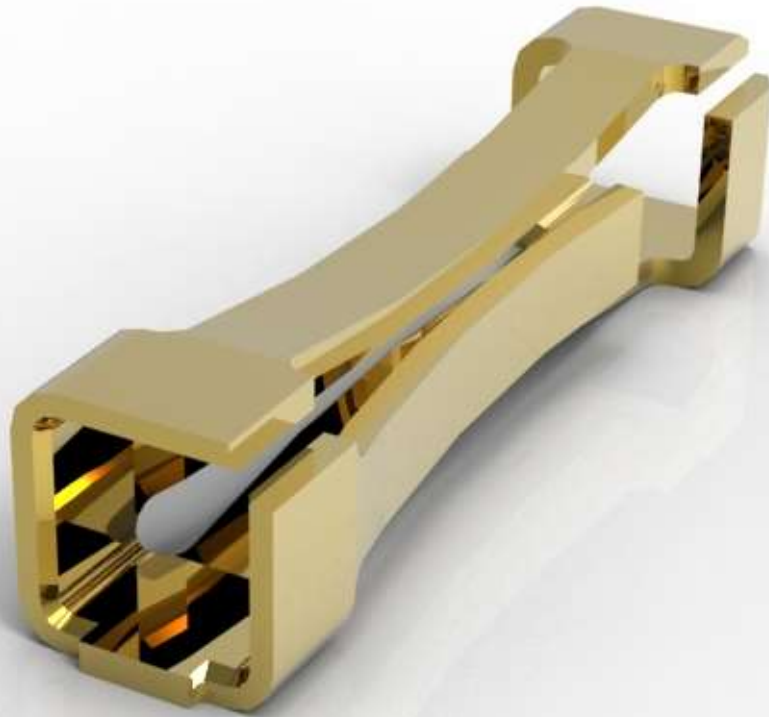
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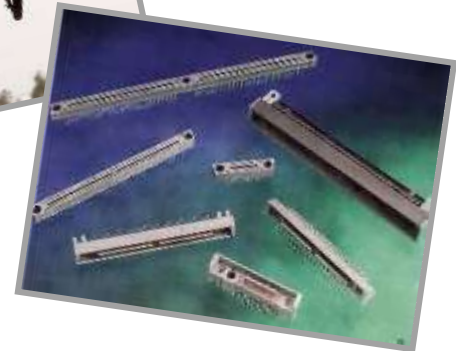


# TE MIL-Spec Mini-Box PCB Connectors (MIL-DTL-55302)

- Industry-proven in high reliability applications.



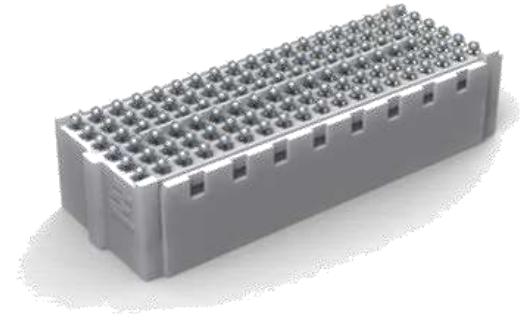
Four-Beam Box Contact



# Mezalok Stacking Connector

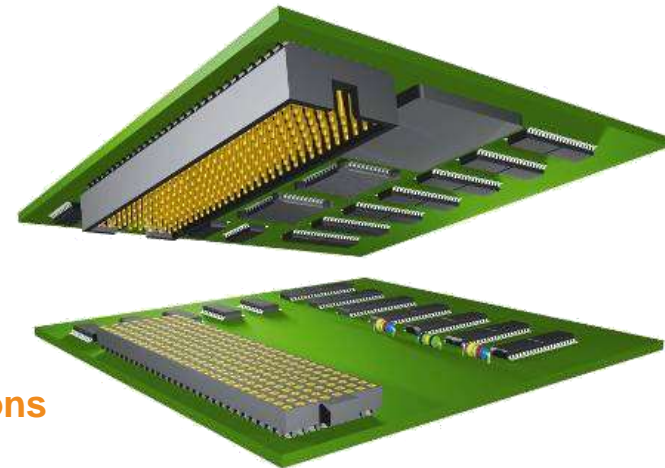
## VITA 61 “XMC 2.0”

Based on VITA 42 XMC (114 pos Samtec SamArray®)



### A High Reliability alternative:

- Backwards compatible with XMC pcb footprint
- Based on MIL-55302 Mini box contact interface
- Accommodates 10mm, 12mm, 15mm and 18mm stack heights
- Solder ball SMT attach in SnPb and RoHS options
- 114 (6 X 19) positions, 60 (6 X 10) positions, and **320 (8 x 40) positions**
- Non-Intermateable with V42 XMC modules
- Protected “stub-proof” socket contacts w/superior wipe & signal integrity
- Exceptional solder joint reliability (2000 cycles thermal shock -55 to 125C)



Samtec SamArray®

# Fortis Zd

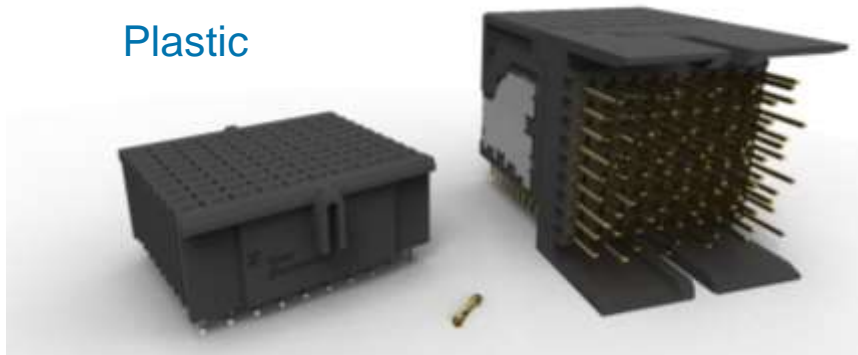
## Advanced High Speed Ruggedized

All shells are fully  
intermateable and  
backwards compatible!!

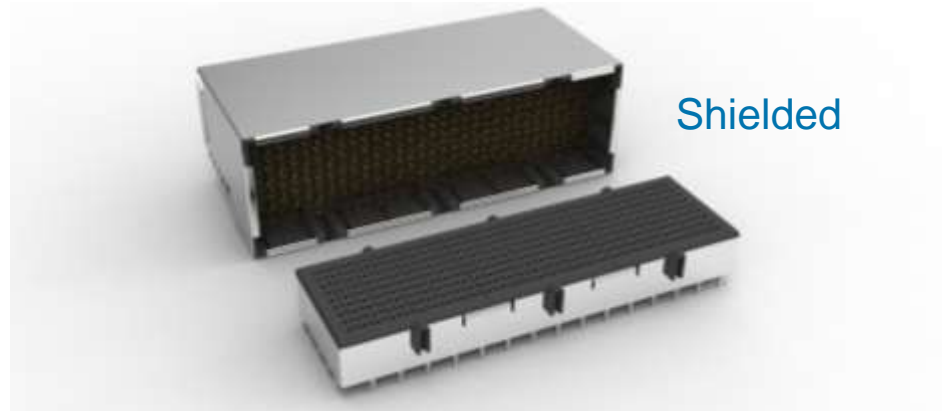
### Fortis Zd Connector System

- Available in (2-pair & 3-pair modules)

Plastic



Shielded



Machined Shell



### Next Generation Backplane connector:

- Utilizes MIL-55302 Mini box contact interface
- Accommodates existing VPX hardware architecture
- Based on Z-PACK TinMan high speed footprint
- Available in 2 & 3 differential pairs per column
- Modular and expandable, based on 10 & 20 column modules
- Provides unprecedented combination of **functional density**, robustness, and SI performance (6U 900 contacts vs 728 VPX)

# Summary

- TE Connectivity- A World Leader Enabling Connectivity
- Ruggedized board-to-board connectors address industry trends
  - “S.W.A.P.” (Size, Weight, & Power)
  - “C.O.T.S” (Commercial Off the Shelf / Standards)
  - “High-Speed” Migration / Footprint layouts
  - Increasing Reliability- Making all this work in deployment
- VITA 46 & VPX- A stronger foundation with fresh possibilities

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