Advanced Interconnect Technology for Rugged Embedded Computing

Aerospace Defense & Marine Development Engineering

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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
  - Transportation
  - Consumer Products
  - Communications
- Industrial and Infrastructure
  - 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

Commercial system designed for “office” environment

Rugged system - Optimum “SWAP”
VITA 46 & VPX - Strengthening the Foundation

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EVERY CONNECTION COUNTS
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](http://www.multigigrt.com)
Typical MULTIGIG RT Implementation

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 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
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)

Daughter card wafer

Ground pad

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:

  – Aluminum (6061) Guide Socket (9.0 mm wide):
    • Ni plated
    • With optional ESD contact

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

Machined hardware is 20% lighter than die cast hardware!
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 Δ R after 10,000 mating/unmating cycles*

<table>
<thead>
<tr>
<th></th>
<th>Signal (72 data pts)</th>
<th>Ground (16 data pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>-4.24</td>
<td>-1.05</td>
</tr>
<tr>
<td>Avg</td>
<td>-0.08</td>
<td>-0.70</td>
</tr>
<tr>
<td>Max</td>
<td>0.88</td>
<td>-0.38</td>
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<tr>
<td>Std Dev</td>
<td>0.78</td>
<td>0.20</td>
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</tbody>
</table>

*5 mΩ max ΔR limit
MULTIGIG RT 2-R VPX Part Numbers

Introducing MULTIGIG RT 2-R Ruggedized Connectors for VPX Applications

PART CONFIGURATIONS

<table>
<thead>
<tr>
<th>Module Position</th>
<th>MULTIGIG RT 2 Connectors</th>
<th>Ruggedized MULTIGIG RT 2-R (Extended Pad Wells)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>140186-X</td>
<td>2013172-1</td>
</tr>
<tr>
<td>P1, P2, P3, P4, P5, P6</td>
<td>140190-1</td>
<td>201264-0-1</td>
</tr>
</tbody>
</table>

**DAUGHTERCARD**

**BACKPLANE**

See TE drawings for guide module and pin options.

See TE drawings for guide module and pin options.
## MULTIGIG RT2 and RT 2-R Support Documentation

<table>
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<tr>
<th>Literature Number</th>
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<tr>
<td>108-2072</td>
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<td>MULTIGIG Extraction Tool Instruction Sheet</td>
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<tr>
<td>204690</td>
<td>VITA 46 Contech Research Connector Module Qualification Test Report</td>
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</table>
VITA 46 Board – Module Layout

**Keying Guide Module**

- **P6** Diff, SE, RF Optics or Empty (VITA 66/67)
- **P5** Diff, SE, RF Optics or Empty (VITA 66/67)
- **P4** Diff or SE
- **P3** Diff or SE

**Keying Guide Pin**

- **J6**
- **J5**
- **J4**
- **J3**
- **J2**
- **J1**
- **J0**

**Daughtercard**

**Backplane**

**3U Configuration**

**6U Configuration**

*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)

2262027-1 New 25mm Mezzanine connector

1410140-1

Row indicators

1410140-1

Column 16

Column 1

Open VPX Module

VPX Functional Backplane

VPX Standard 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

Column 16

1410187-3

Column 1

Open VPX Module

VPX Standard Backplane
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
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TE MIL-Spec Mini-Box PCB Connectors (MIL-DTL-55302)

• Industry-proven in high reliability applications.

Four-Beam Box Contact
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)
Fortis Zd Connector System

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

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