How High Speed Video Is Unlocking Fast and Reliable Connectivity Solutions

Michael Walmsley

Senior Product Manager

EVERY CONNECTION COUNTS

Industry Trends – Video Processing

- Increasing demand for situational awareness capabilities for surveillance and autonomous navigation
- New challenges for video capture, compression, processing, and display
  - More complex video signal processing
  - Increasing number of video sources
  - Higher resolution imaging (4K, 8K)
  - Active video feeds
  - Requirement for low latency and high fidelity
- New architectures are emerging
  - Processing closer to the sensor
  - Higher speed protocols for transmission
  - Drive toward open standards - OpenVPX, Sensor Open Systems Architecture (SOSA), Small Form Factor VNX+

Video Protocols

Higher speed video protocols support high resolution imaging

- STANAG 3350 (Classes A, B and C)

- RS-170a Composite Video, Luminance/Chrominance

- SDI (HD-SDI, 3G-SDI, 6G-SDI, 12G-SDI)

- CoaXPress (CXP-1, CXP-2, CXP-3, CXP-5, CXP-6, CXP-10, CXP-12)

- ARINC 818 – Avionics Digital Video Bus - (1.0625 to 28.05 Gbaud)

Basic Elements of a System –
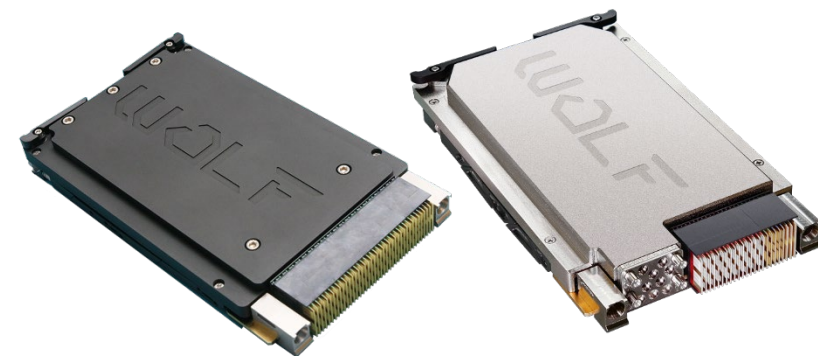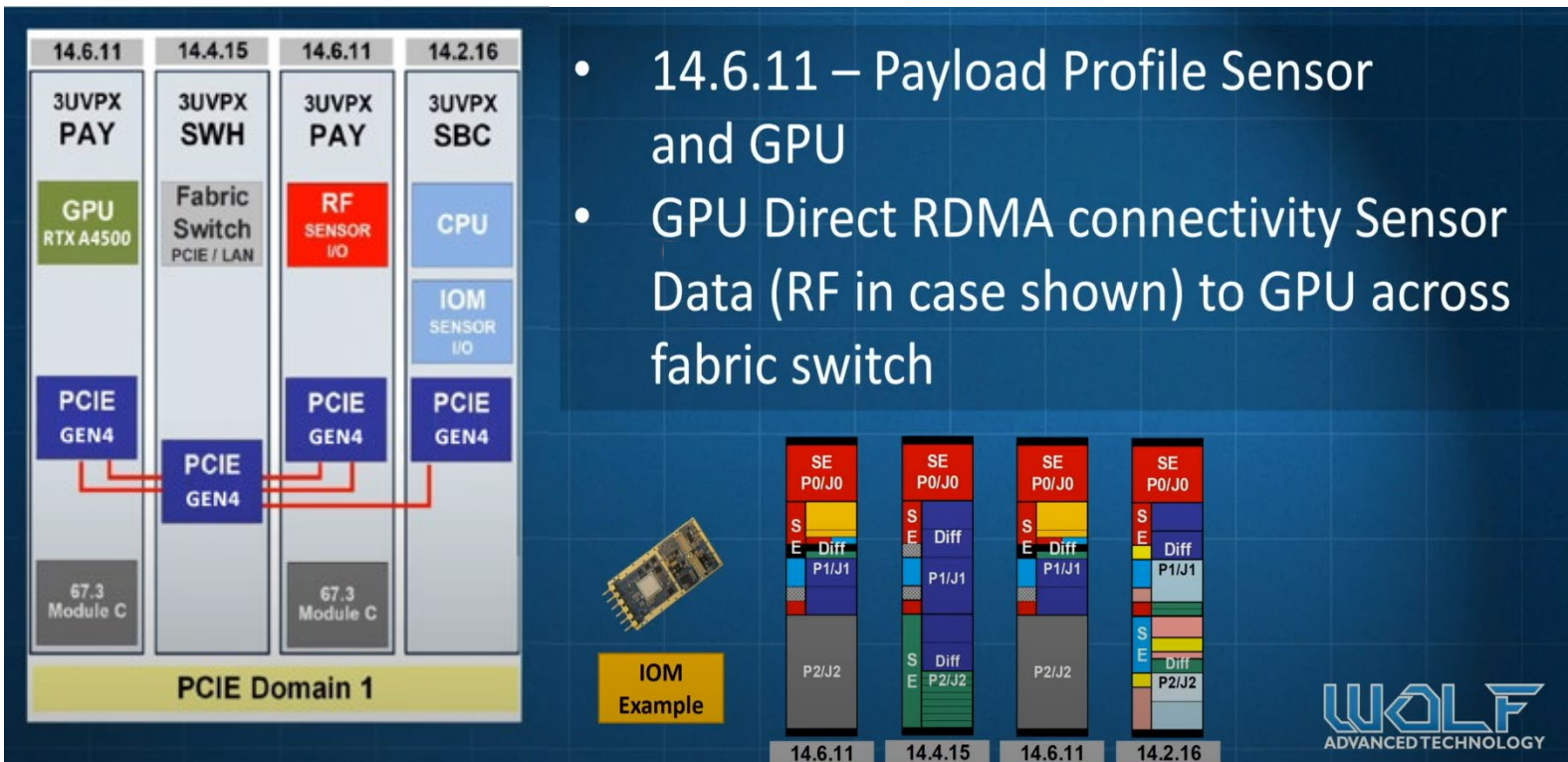# Video Capture / Processing / Output

Cameras

Processing

Display

Inside the Box – OpenVPX Architecture Example

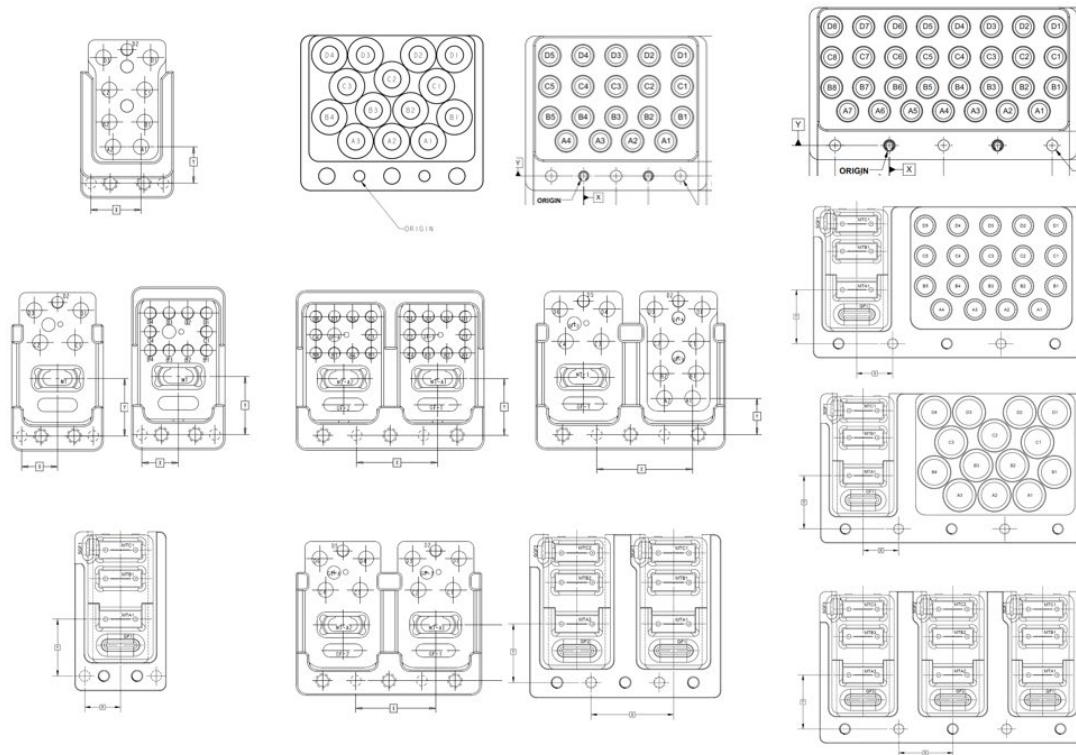OpenVPX Architecture with Modular System Components Provides Flexibility

Images courtesy of WOLF Advanced Technology

Inside the Box –
OpenVPX Interconnect for Coax and Optics

VITA 65 OpenVPX Slot Profiles include a range of options for coax and optics within a slot.

All coax interfaces in the OpenVPX standards today are 50 Ohm:

SMPM, SMPS, NanoRF

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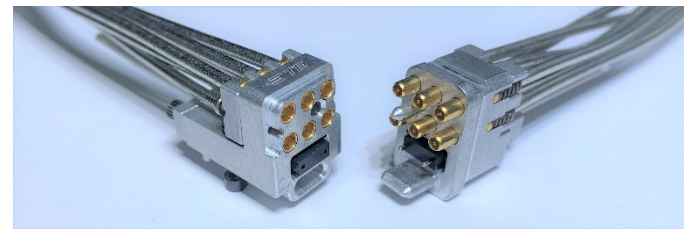
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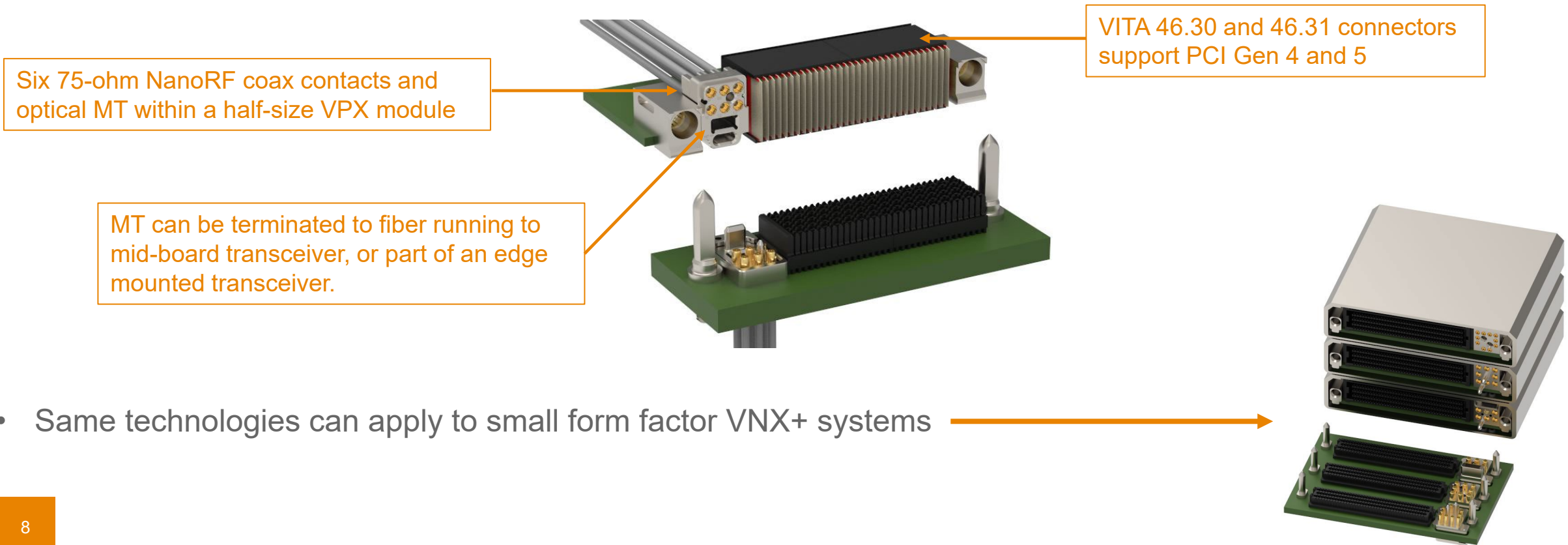
SMPM, SMPS, NanoRF

- **75-Ohm NanoRF** brings 75-ohm matched impedance coax to support higher speed video.
- Hybrid with optical MT adds capability for ARINC 818 over fiber.
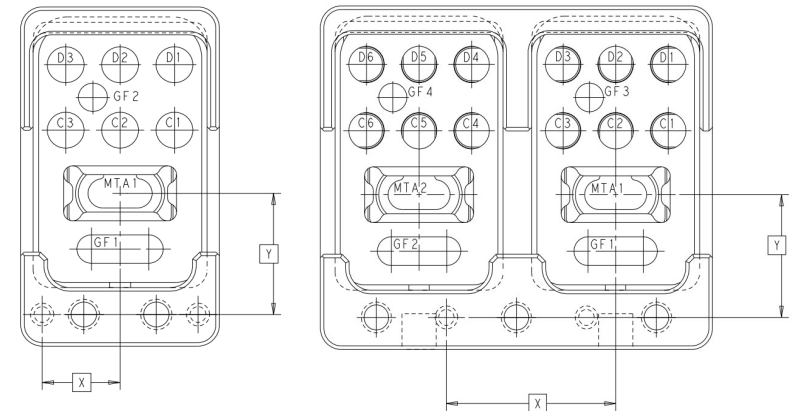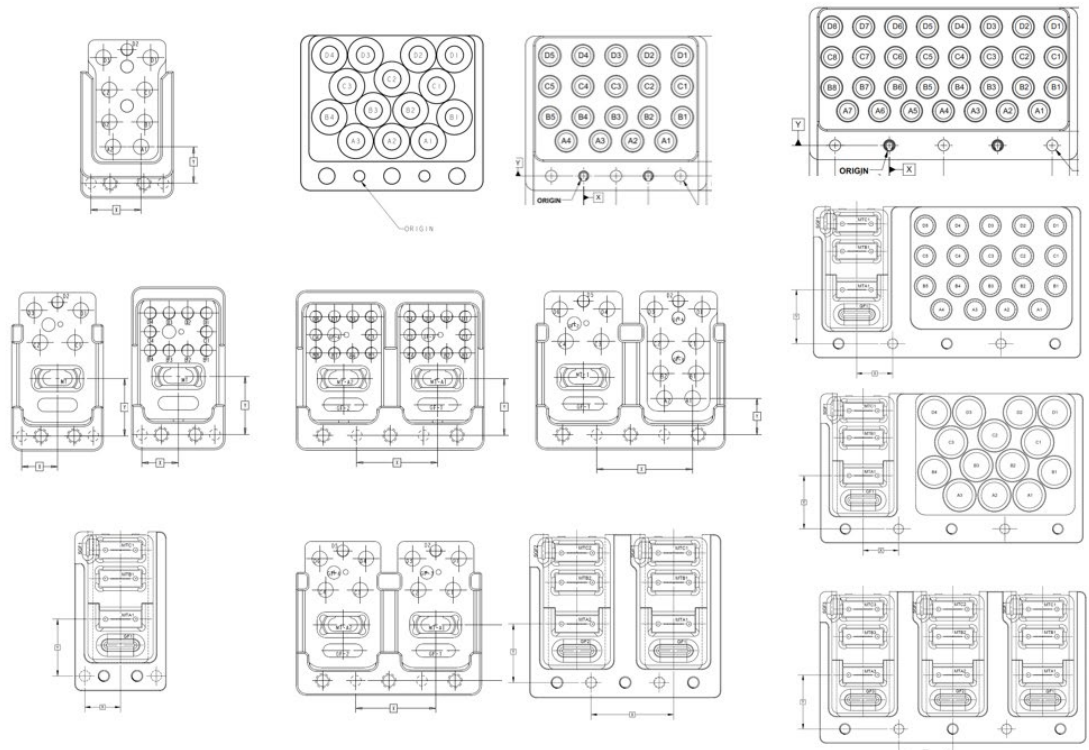
Inside the Box – OpenVPX Interconnect

- Plug-in Module to Backplane interface includes digital signals over high-speed diff pairs, and can combine with 75-ohm coax and optics for video signals

- 75-Ohm coax + optical connector modules are proposed for next revision of VITA 65.1.

VITA 46.30 and 46.31 connectors support PCI Gen 4 and 5

Six 75-ohm NanoRF coax contacts and optical MT within a half-size VPX module

MT can be terminated to fiber running to mid-board transceiver, or part of an edge mounted transceiver.

- Same technologies can apply to small form factor VNX+ systems

Implementation in a 3U VPX Video Processing Unit (VPU)
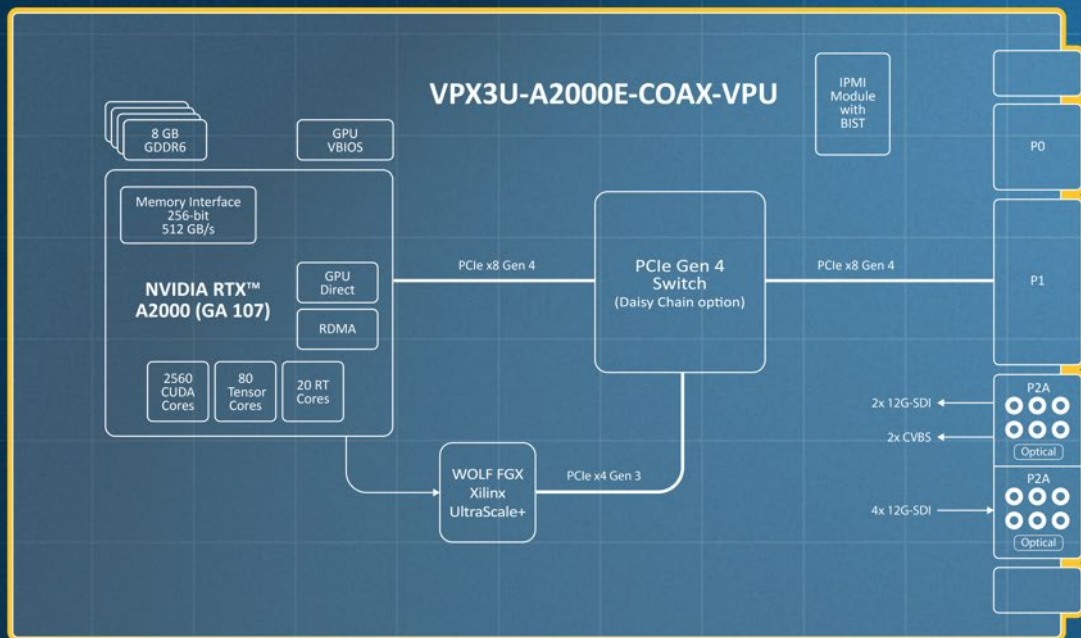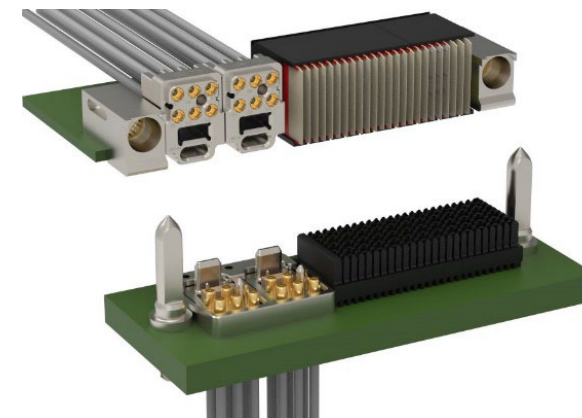
Image courtesy of WOLF Advanced Technology

Outside the Box –
High Density Coax in D38999 Connectors

Legacy Size #12 Contacts for 75 Ohm cables

- Mechanically fit 75 ohm cables
  (RG-179 or equivalent)

- Contacts are not impedance matched

- Limited to frequency of 3 GHz or less

M39029/28-211
Pin Contact

M39029/75-416
Socket Contact

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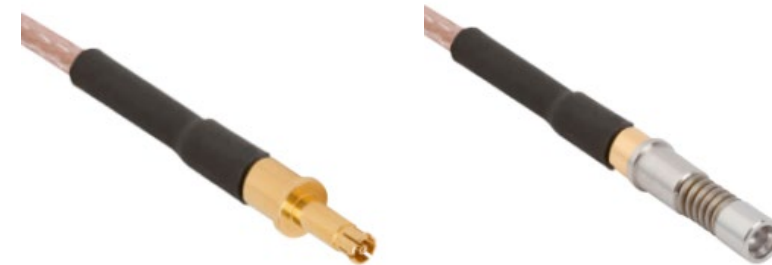

M39029/28-211
Pin Contact

M39029/75-416
Socket Contact

75-ohm **Impedance-Matched** Size #12 Contacts

- Leverages existing Size #12 50-Ohm SMPM contacts
- Designed for 75 ohm impedance within contact structure and interface
- Supports frequencies of 20 GHz and higher

75 Ohm SMPM type Size 12 contacts

75-Ohm SMPM and D38999 Images courtesy of SV Microwave

Outside the Box –
Optical Termini in D38999 Connector Shell

Single Fiber Termini - MIL-PRF-29504

- Physical Contact and Expanded Beam (Lens)

- Single-mode and multimode

- Fits 38999 Series III cavity, size 16

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Multi-fiber MT ferrules – VITA 87 Connectors

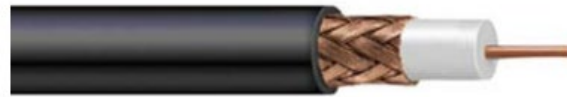Significant density increase – 8 to 48 fibers per MT (12-32 most common)

Multi-MT configurations can support an MT for ARINC 818 and MT(s) for Ethernet in a common connector

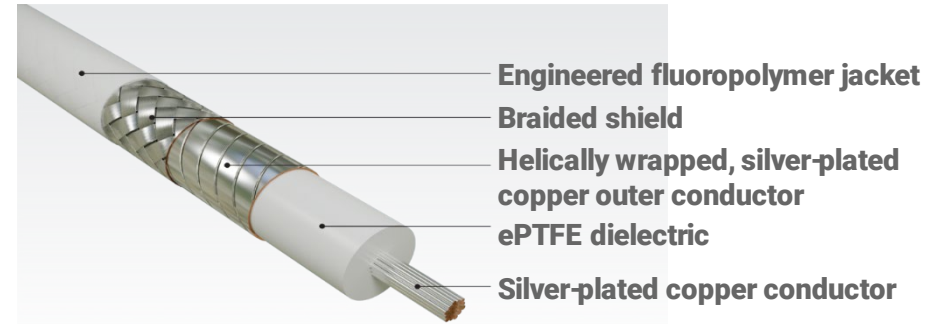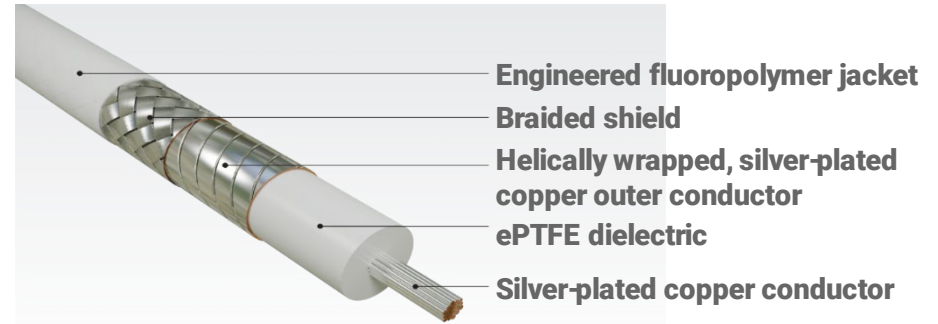| Configuration	Interface Type	Fiber Type	Fiber Count
MM8F	Physical Contact	Multi-Mode, 50um	8
MM12F	Physical Contact	Multi-Mode, 50um	12
MM24F	Physical Contact	Multi-Mode, 50um	24
MM48F	Physical Contact	Multi-Mode, 50um	48
SM8F	Physical Contact	Single-Mode, 8-9um	8
SM12F	Physical Contact	Single-Mode, 8-9um	12
SM24F	Physical Contact	Single-Mode, 8-9um	24
SM48F	Physical Contact	Single-Mode, 8-9um	48
LMM12F	Lens	Multi-Mode, 50um	12
LMM16F	Lens	Multi-Mode, 50um	16
LMM32F	Lens	Multi-Mode, 50um	32
LMM48F	Lens	Multi-Mode, 50um	48

75-Ohm Coax Cables

75-ohm cables have evolved for higher speed video applications. Constructions are designed for lower attenuation, higher frequencies and increased stability under temperature and flexure.

single braid, 94.4% nominal coverage
1 GHz, -40 to 85C, solid PE

Engineered fluoropolymer jacket

Braided shield

Helically wrapped, silver-plated copper outer conductor

ePTFE dielectric

Silver-plated copper conductor

Legacy MIL-C-17 RG-59 Cable

Gore 75-Ohm Coaxial Cable - CXN3671
Image courtesy of W.L. Gore & Associates

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Gore 75-Ohm Coaxial Cable - CXN3671
Image courtesy of W.L. Gore & Associates

For inside-the-box cabling, 75-ohm conformable cables support higher frequencies in smaller diameters and are hand formable for ease of routing in tight packages
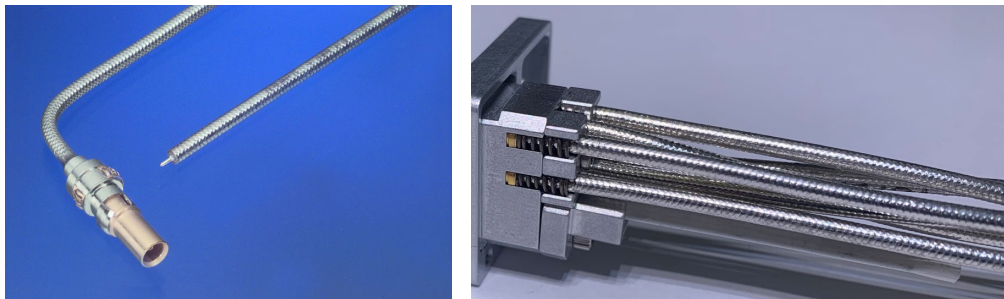
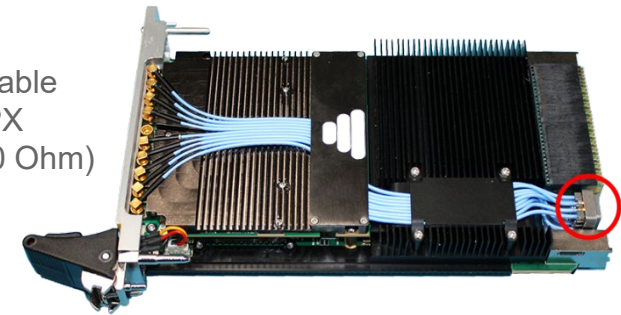Example of coax cable routing within a VPX Plug-In Module (50 Ohm)

Image courtesy of Annapolis Micro Systems, Inc.

Examples of Interconnect Standardization for High Speed Video Transmission

Camera Interfaces
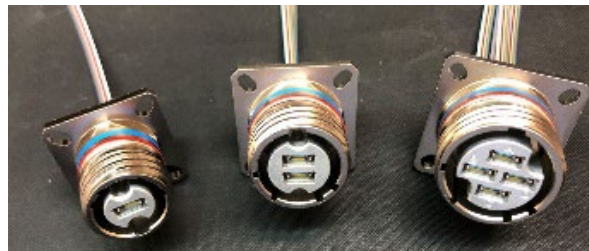
IEC 61169-70 (HD-BNC)

DIN 1.0/2.3

Chassis Interfaces

VITA 67.3
MIL-C-39029

MIL-DTL-38999

VITA 87

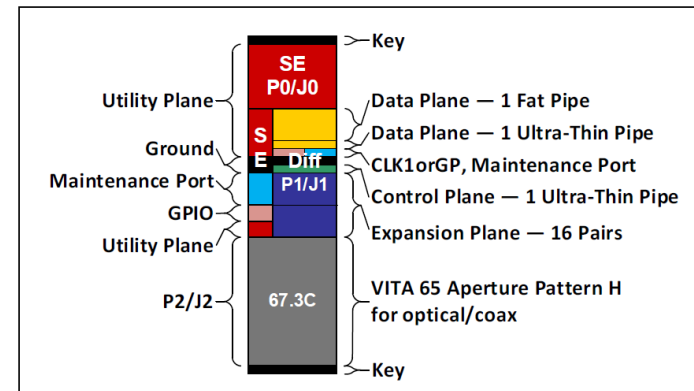**Plug-In Module / Backplane Interfaces**

VITA 65.0
VITA 65.1

VITA 67.3
VITA 66.5

VITA 46.X

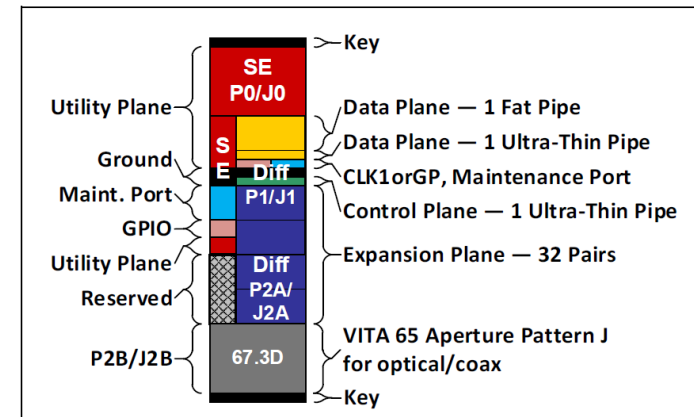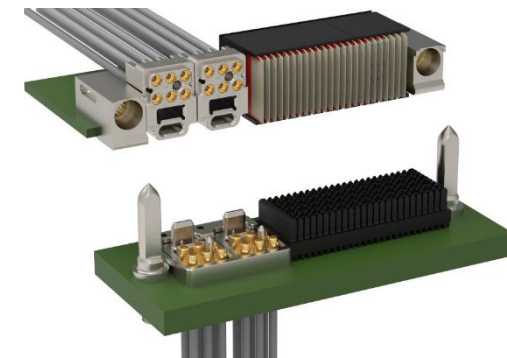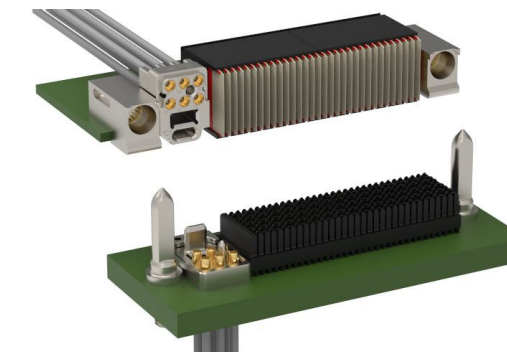Figure 14.6.11-1 SLT3-PAY-1F1U1S1S1U1U2F1H-14.6.11-n

Figure 14.6.13-1 SLT3-PAY-1F1U1S1S1U1U4F1J-14.6.13-n

Summary

- Demands for higher resolution imaging and processing with low latency is driving changes in the system design for video applications.

- Video protocols have evolved to support data rates of 12 Gbaud and higher.

- New developments in interconnect are addressing the need for higher bandwidth and meeting signal integrity challenges at higher data rates, from box to box and within a chassis.

- Industry standards are capturing these interconnect solutions to assure interoperability and optimize implementation.

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CONNECT LIKE THE WORLD DEPENDS ON IT. BECAUSE IT DOES.

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TE connectivity