

# Blind Mate Optical Transceivers for the VPX Backplane

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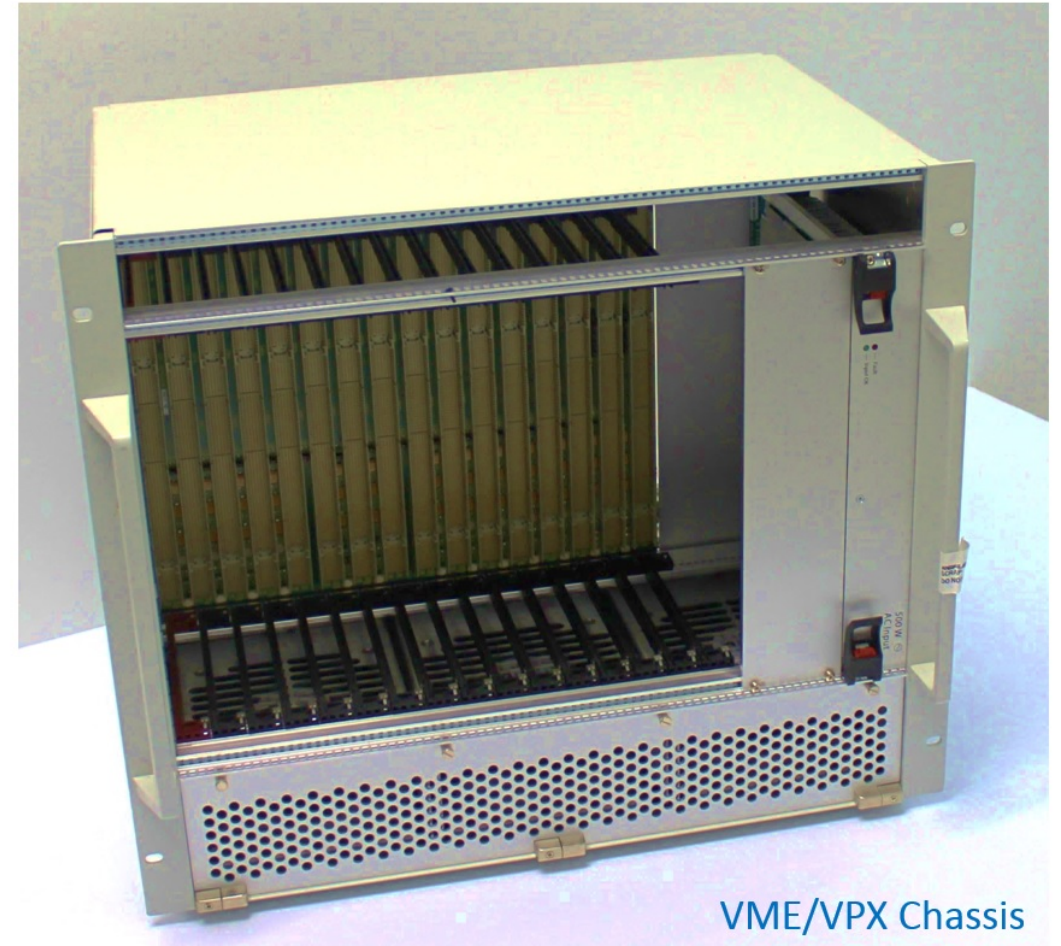
# Optics in Backplanes

- Recently there has been a growing effort to standardize optical interconnects into electrical backplanes.
- The VITA Standards Organization (VSO) has been on the forefront: ([www.vita.com](http://www.vita.com))

Fiber Optic Cable Types – Multimode and Single Mode



<https://www.rfindustries.com/resources/articles/fiber-optic-cable-types-multimode-and-single-mode.php>



VME/VPX Chassis

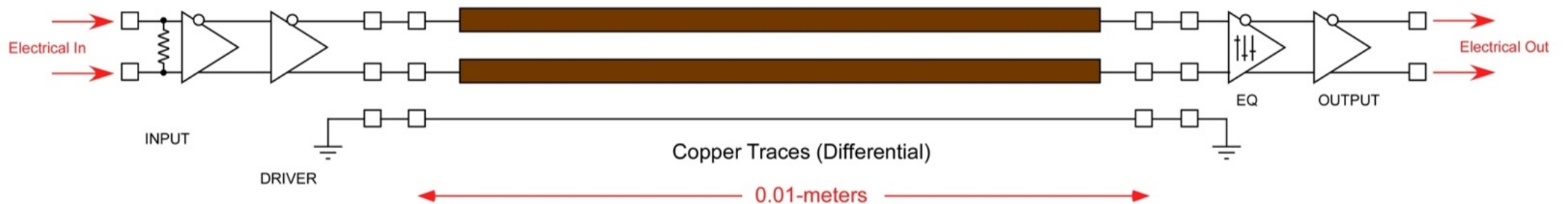


# Electrical Signaling

- As data rates increase above 10-Gbps, signal fidelity of an electrical signal between chips decreases the further it goes on a copper conductor.
- Furthermore, power consumption increases to further process electrical signals: clock-data recovery, equalization, pre-emphasis, etc.

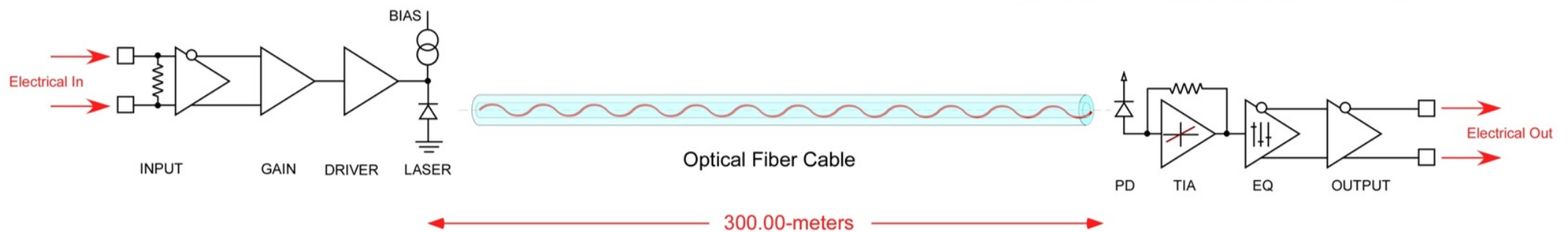
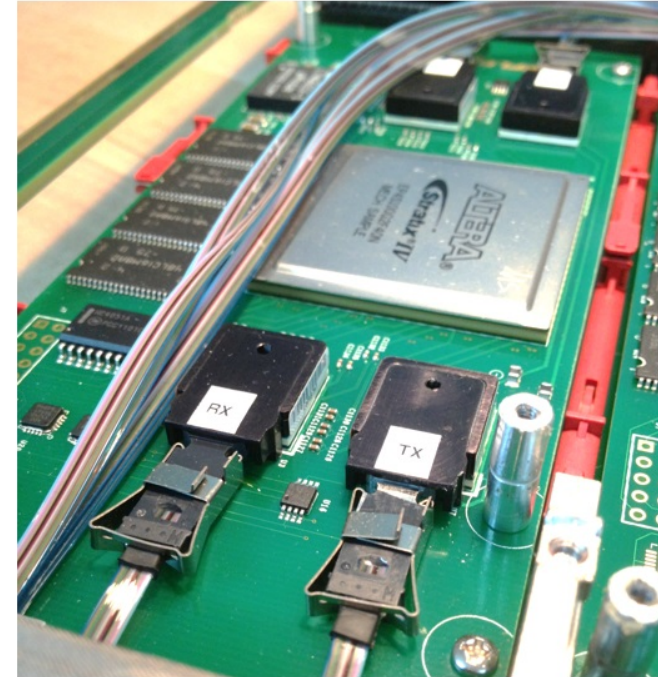


1. Capacitance / Reflections at Thru-Hole
2. Local cross talk
3. Changes in trace width
4. Changes in trace spacing
5. Reflections due to stubs
6. Non uniform dielectrics
7. Surface thickness
8. Foil thickness
9. Conductive anodic filament shorting



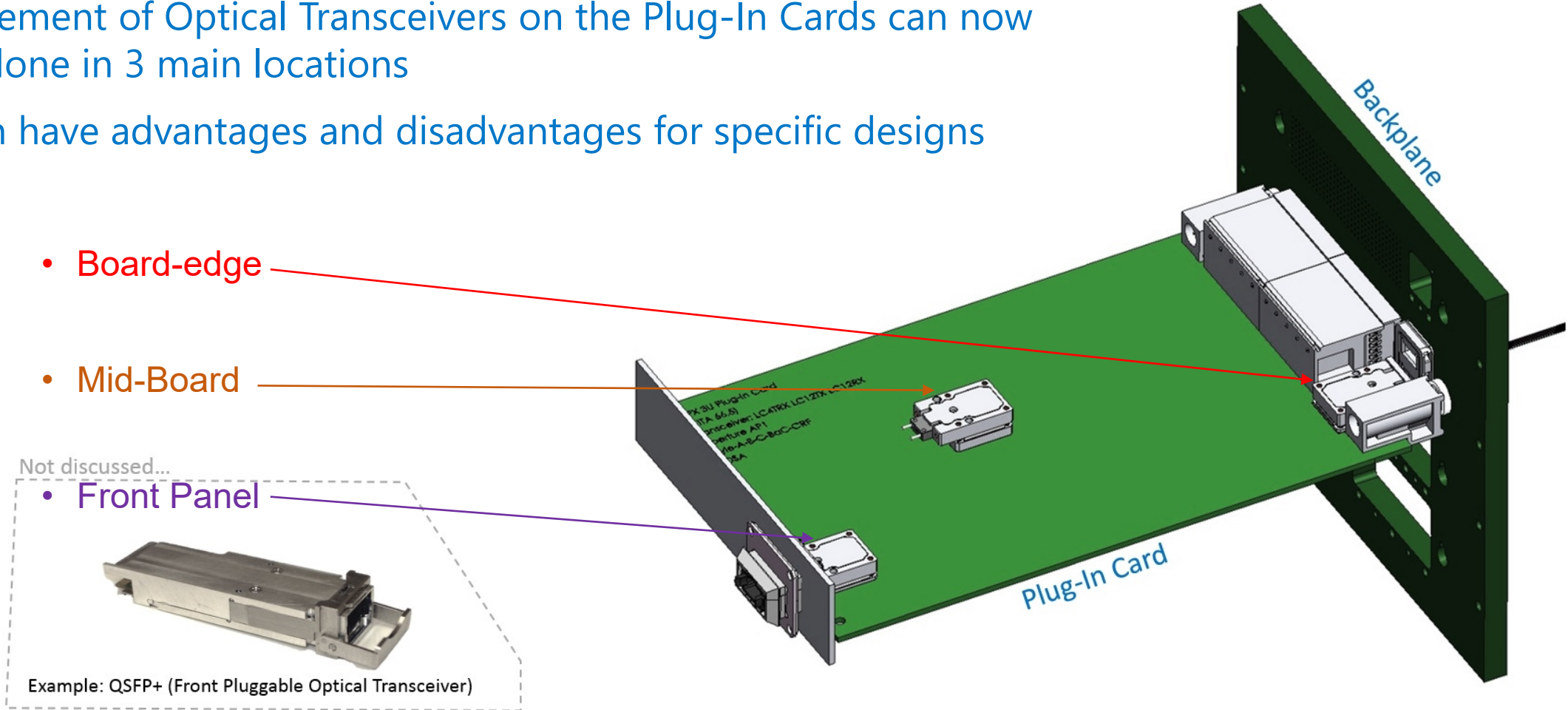
# The Optical Option

- Main motivation has been to move higher data rate signals further within and between the chassis.
- When cutting edge technology, such as the Xilinx® Virtex UltraScale+ has SERDES ports that reach 32.75 Gb/s, moving these electrical signals around even on a single board is difficult.



# Optical Transceivers on the Plug-In Card

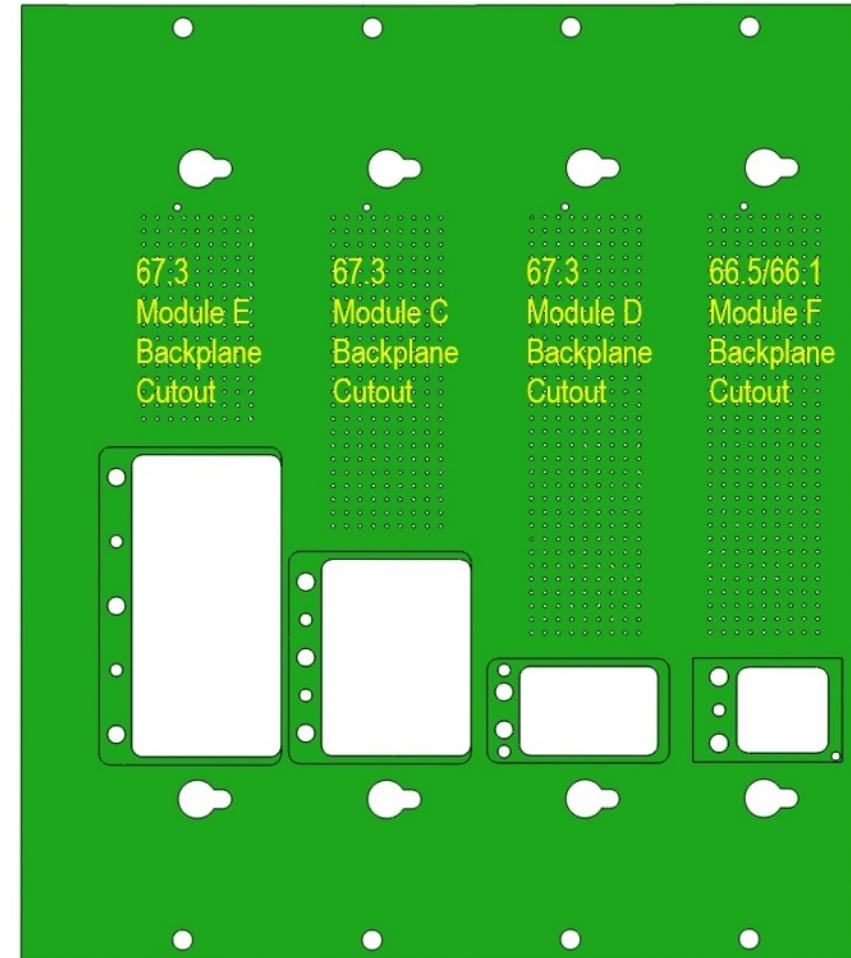
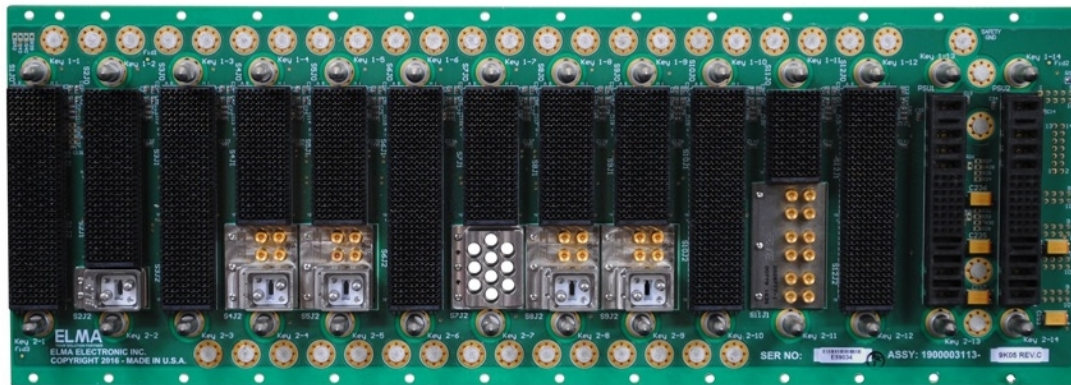
- Placement of Optical Transceivers on the Plug-In Cards can now be done in 3 main locations
- Each have advantages and disadvantages for specific designs





# Optical VPX Backplane

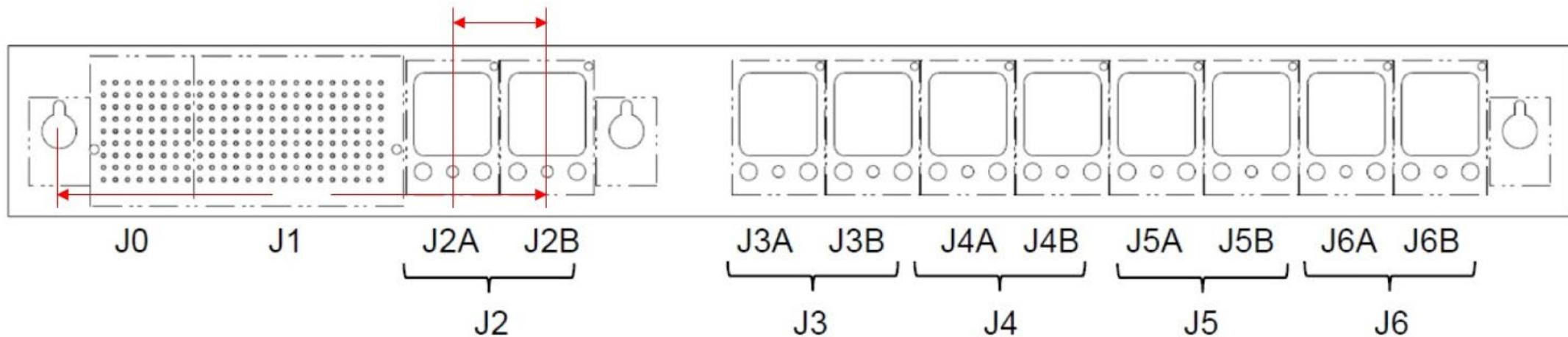
- Proposed within the VITA/ANSI 65 standard:
- 4 types of *backplane clear apertures*
- Based on VITA 66 "Optical Interconnect on VPX" and VITA 67 "Coaxial Interconnect on VPX".
- These half-width and full-width opening can be populated with optical connectors.



Courtesy ELMA

## Backplane Positions

- Positions that Optical Modules can be placed in along a 6U backplane allow any combination of half-width and full-width areas reserved for optical connectors.
- Transceivers on the Plug-In card are pitched at 14.4 mm but are referenced from the J0 guide pin

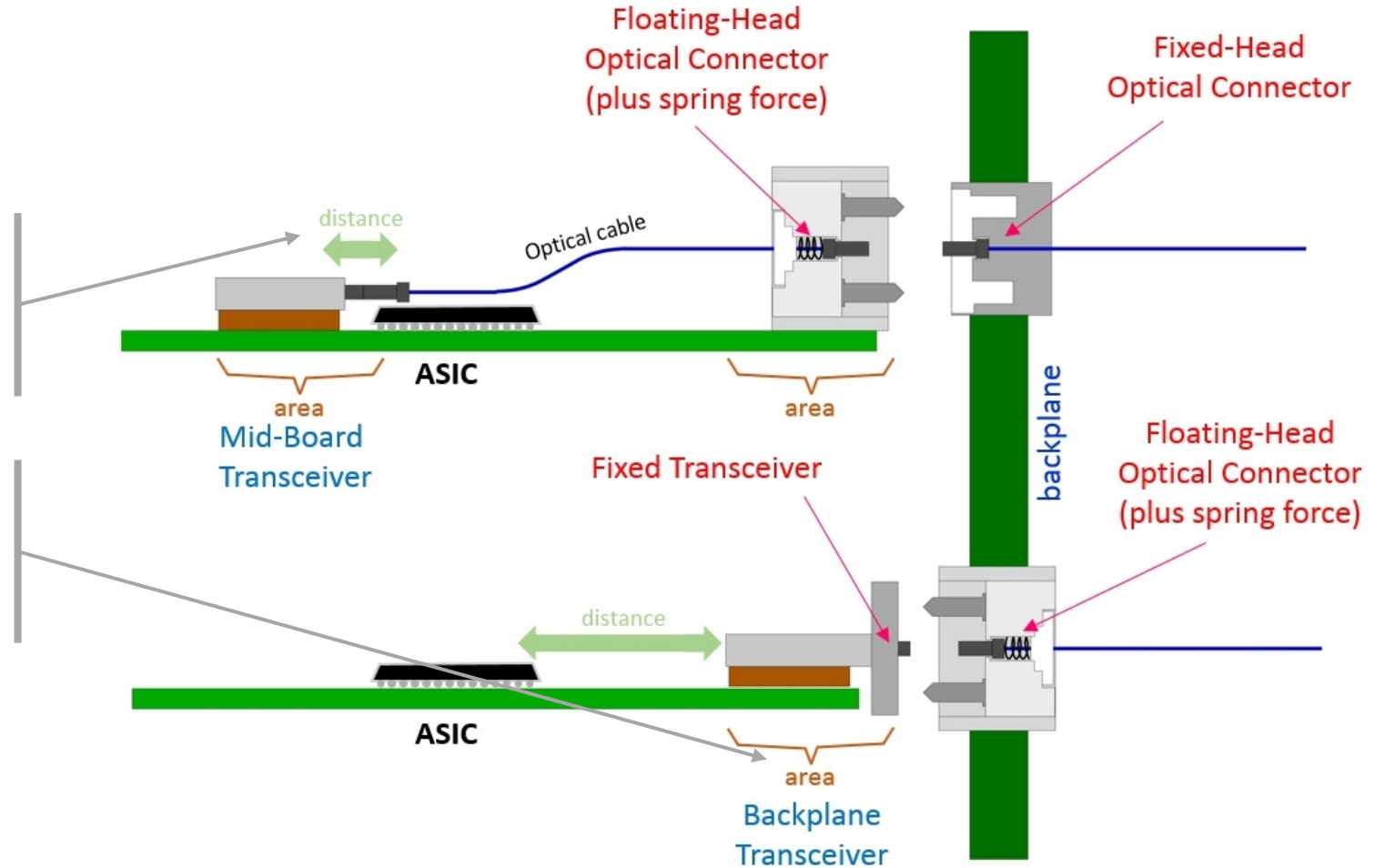


**Half-width backplane interconnect locations illustrations.**  
**One backplate slot shown (top side view) Applicable to 3U and 6U slots.**

# Design Options

## The 2 options for Plug-In card:

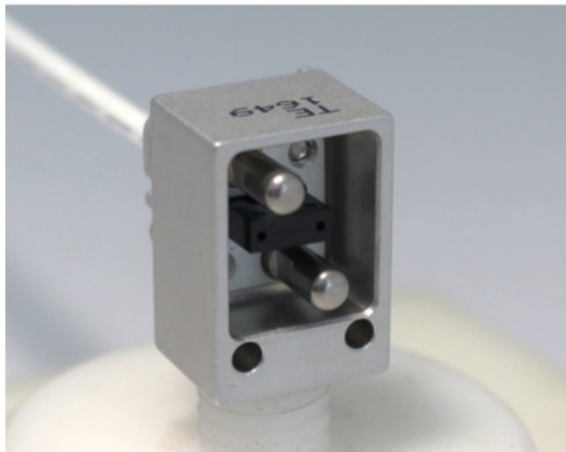
- The cabled/mid-board transceiver
  - The board-edge transceiver
1. The first minimizes electrical distance from an ASIC chip to the transceiver
  2. The second minimizes the area consumed by the devices on the plug-in card





## Passive Connectors

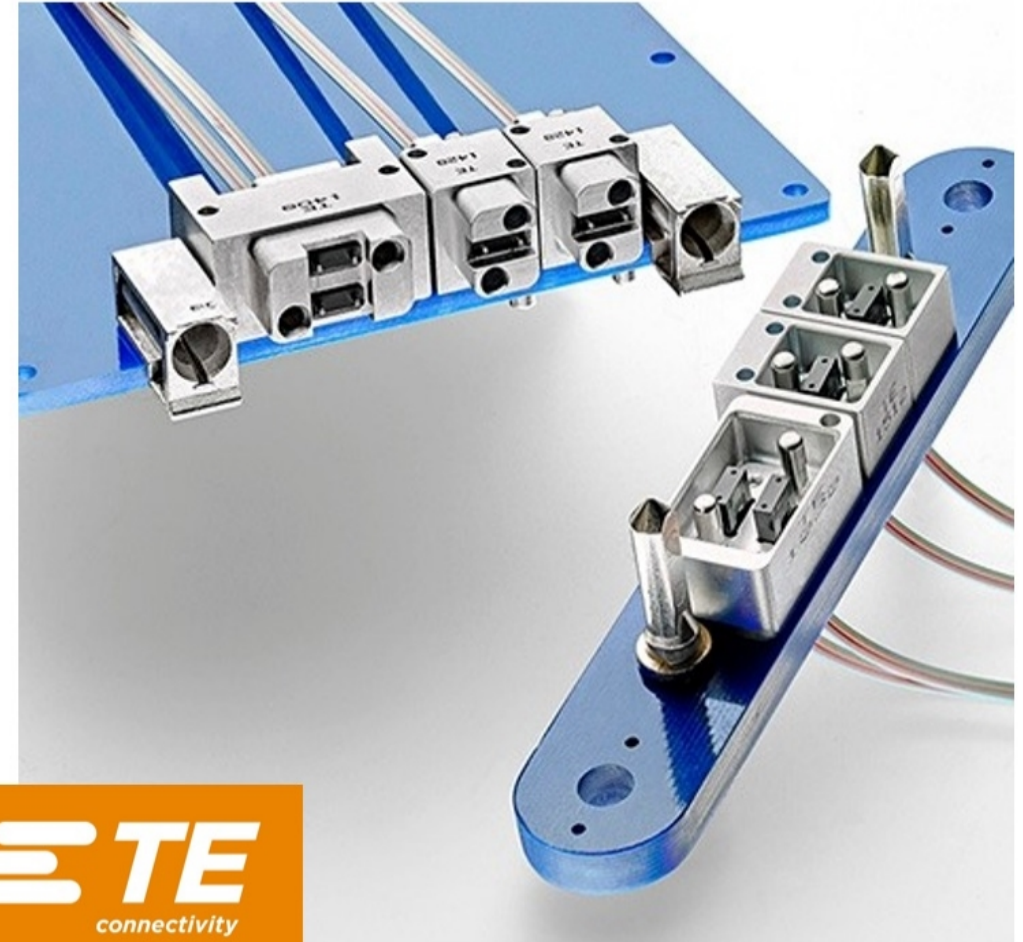
- Passive optical backplane connectors under VITA 66 are being used in numerous applications.
- Number of ferrule connectors and numbers of channels can be scaled to upwards of 72



Half-width VITA 66.4  
(Backplane Side)

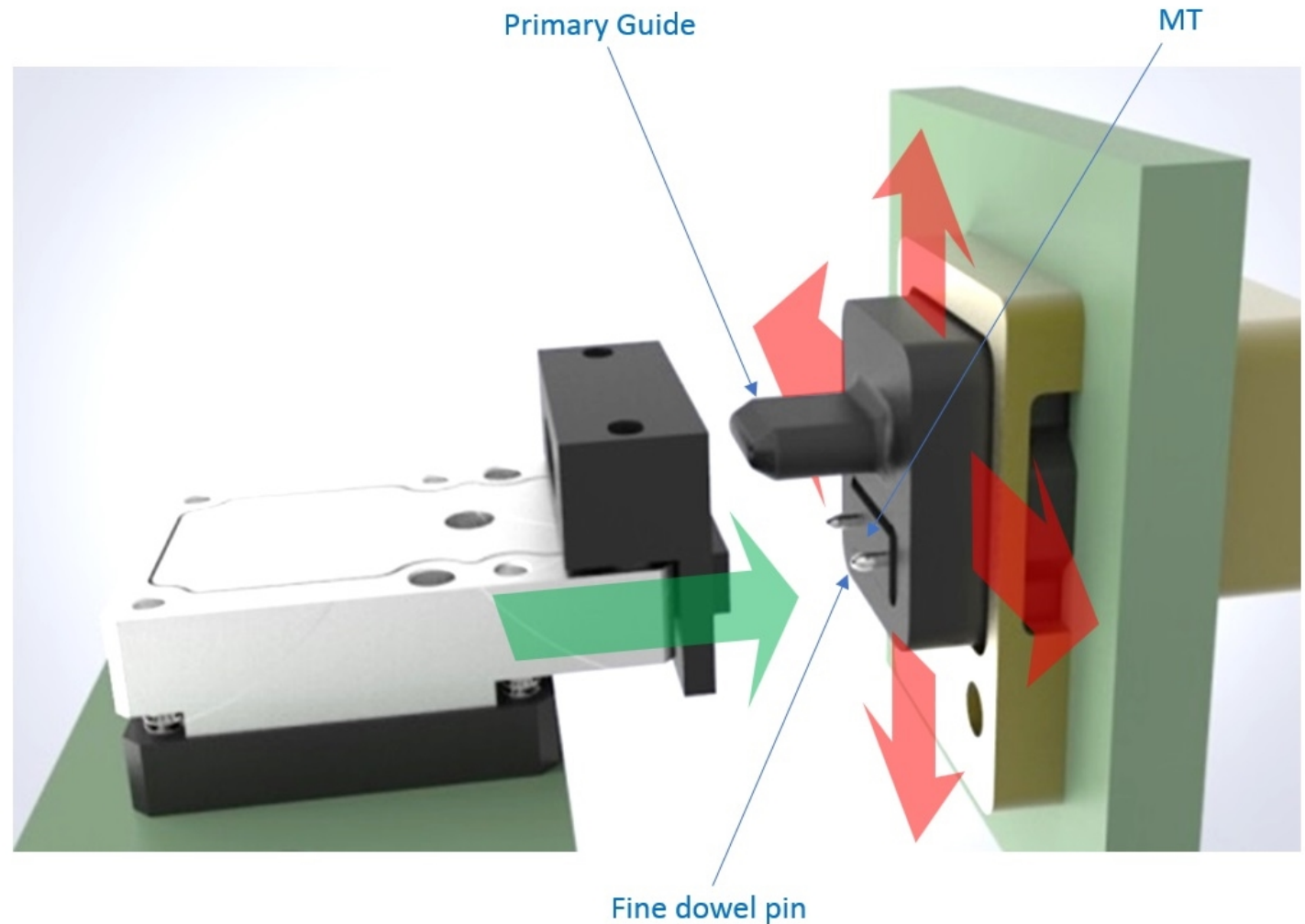


72-fiber MTP/MPO



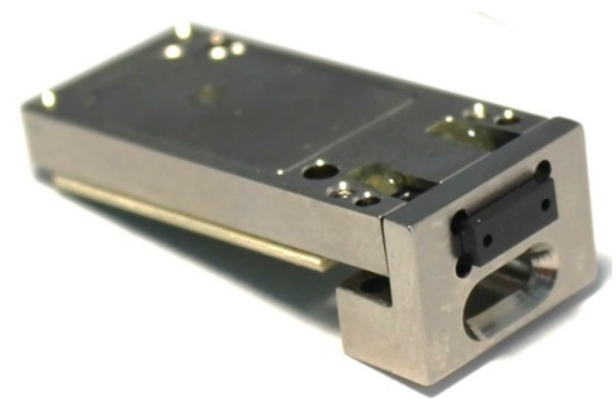
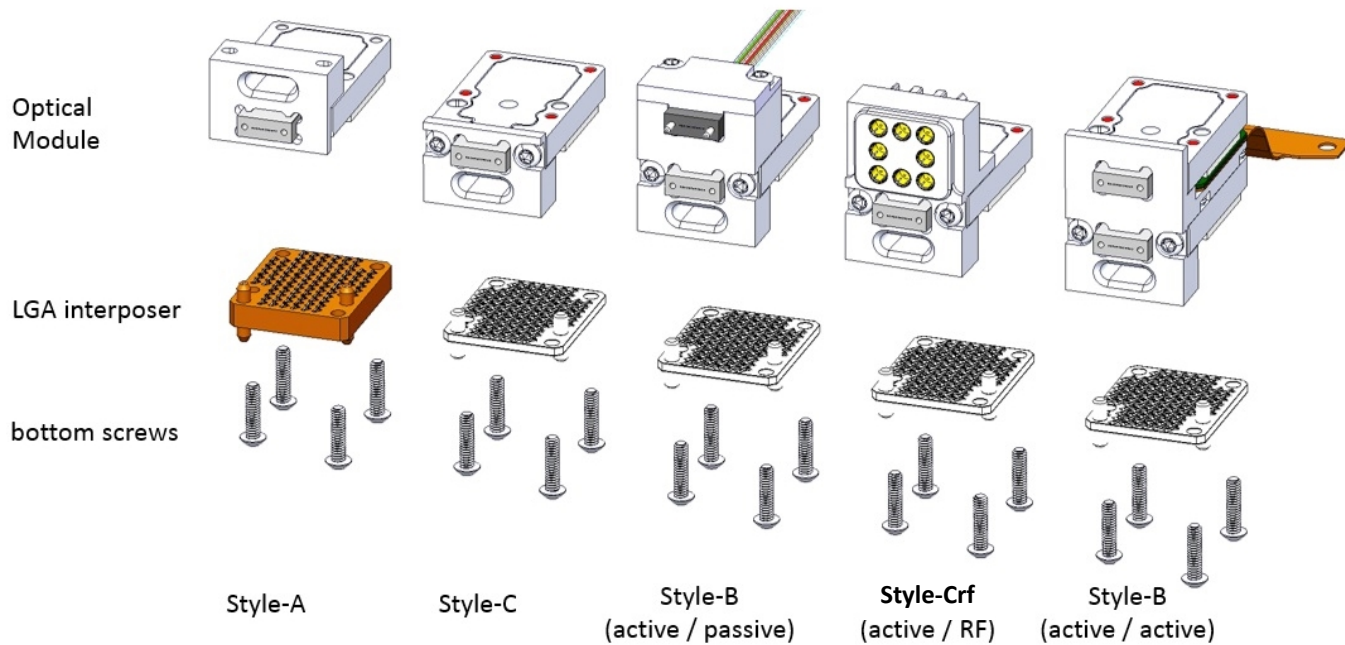
## Active Connectors

- Standard 'MT' optical connector facets.
- Support 4, 12 and 24 channels, each channel at 10 and 25 Gb/s.
- **Lateral and Vertical movement in the backplane connector**
- **Longitudinal movement of the plug-in card is generating backplane spring compression and mating force.**



# Board-edge Transceivers

- Multiple versions for density and data-type, including hybrids that include RF coaxial.
- All modules are “half-width” to be populated side-by-side in the given slot size.



*LightCONEX® 12TX or 12RX, Style C*

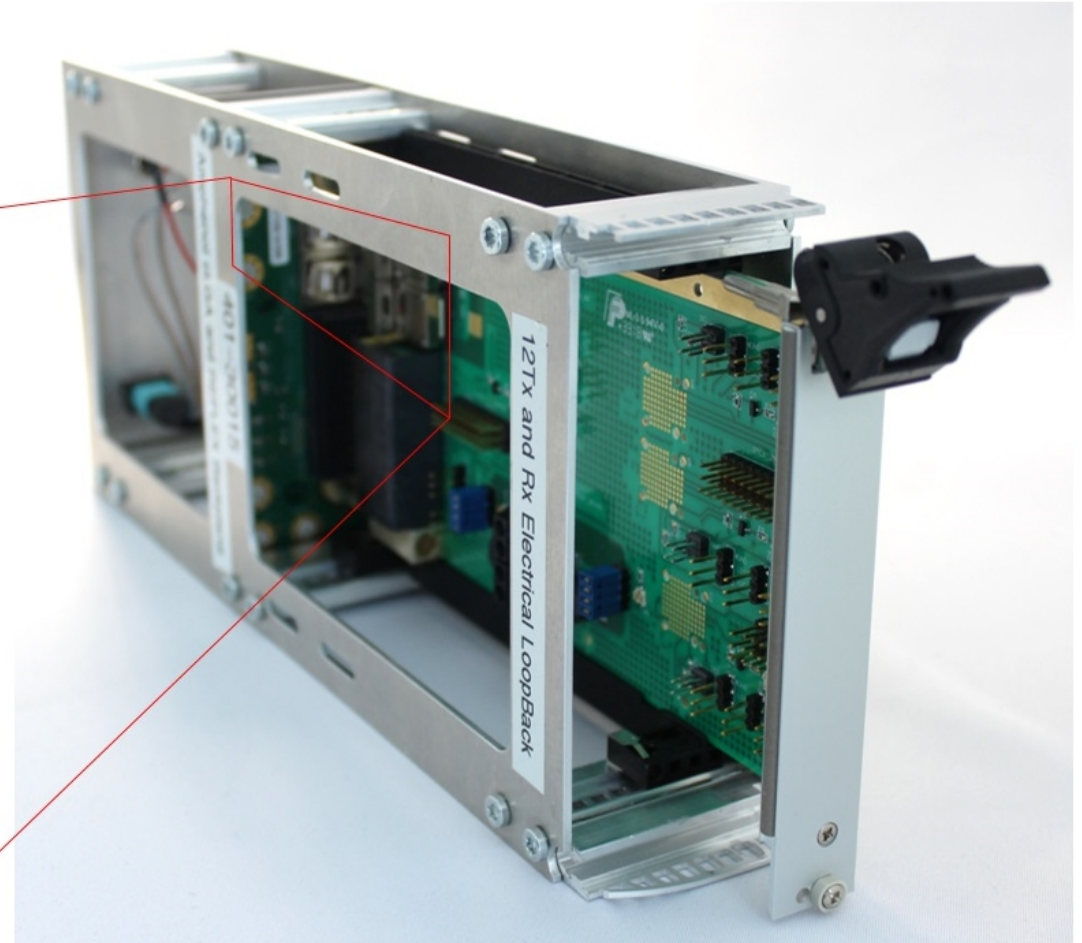
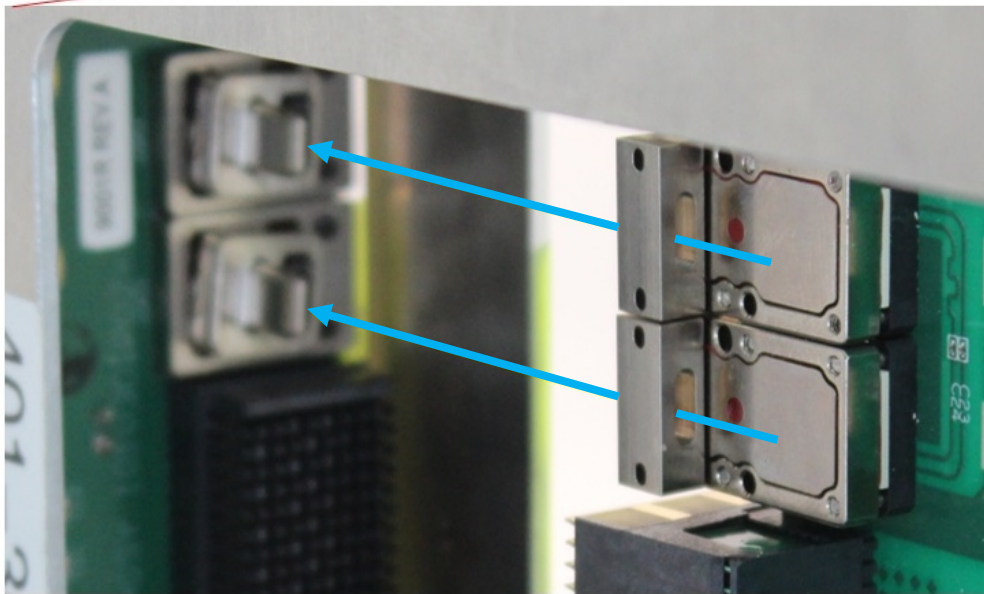


*LightCONEX® 4+4 12G RX, Style A*



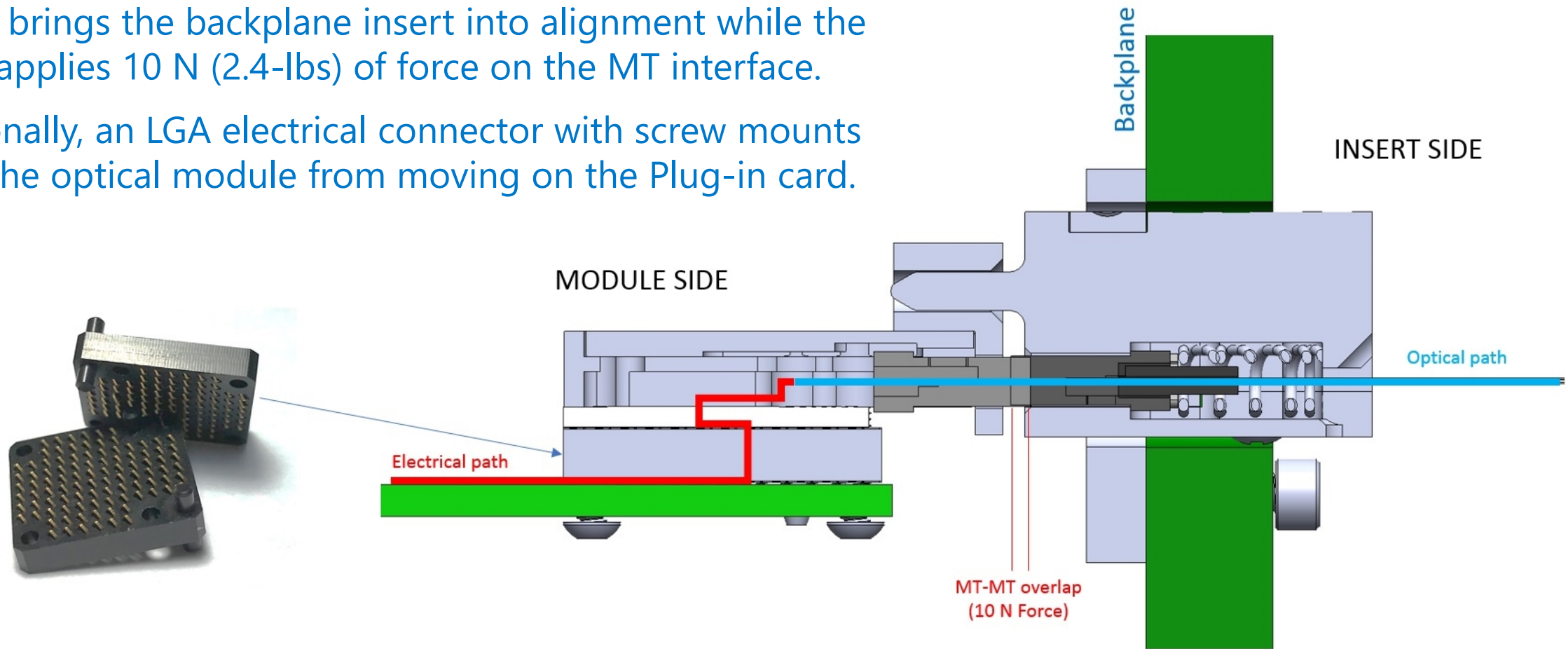
# Optical Plug-In Card

- A pair of board-edge optical transceivers is mated to a pair of optical backplane connectors.
- The mating force is delivered by the backplane connector.



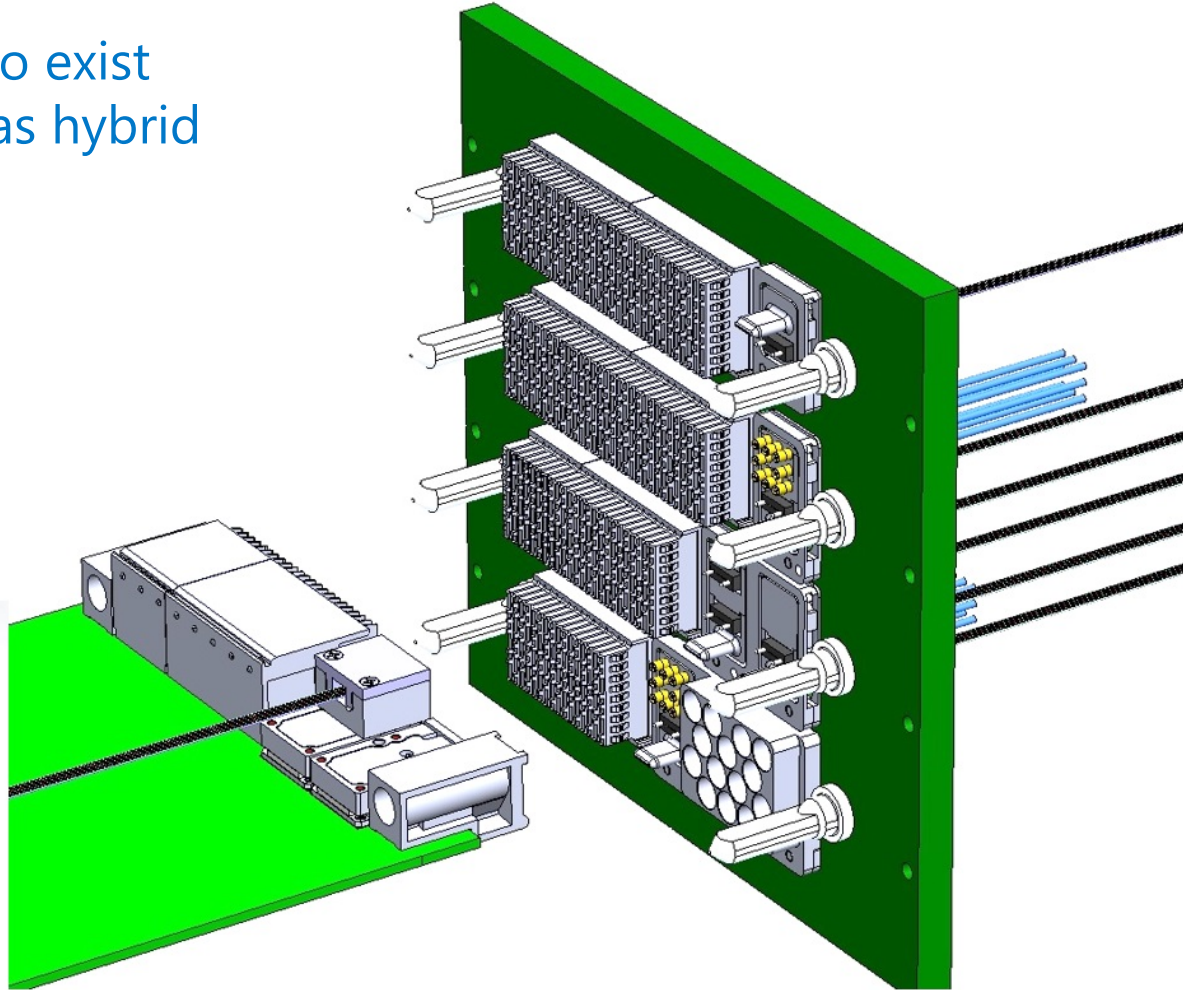
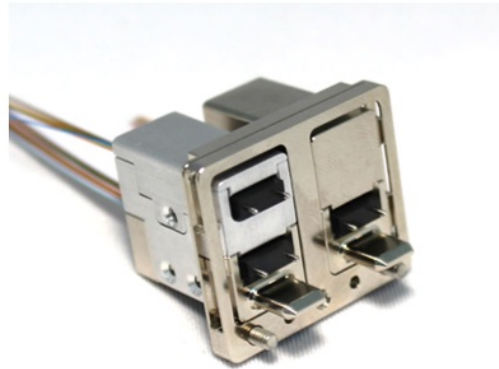
# Optical Mating

- A cross-section of the assembly shows how the alignment feature brings the backplane insert into alignment while the spring applies 10 N (2.4-lbs) of force on the MT interface.
- Additionally, an LGA electrical connector with screw mounts keeps the optical module from moving on the Plug-in card.



## Backplane Insert Options

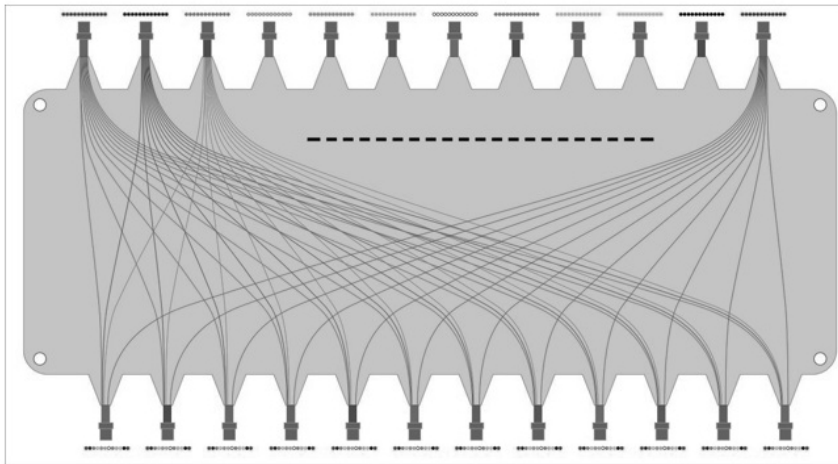
- Other Floating Inserts for the Backplane also exist that have optical I/O combinations as well as hybrid RF connections.





# Optical Cable Management

- While optical cables in the backplane can be routed independently depending on the end-application, cable management can also be used.
- Example of a layered Full-Optical-Mesh that links all Plug-In cards for more complicated network topologies is possible.



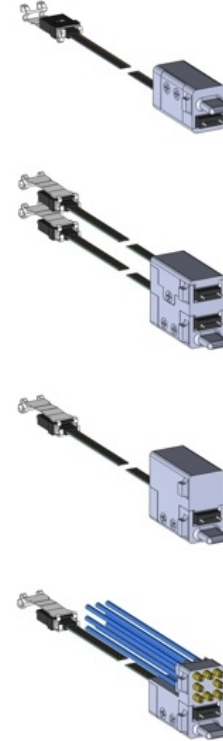
# Summary

The selection of optical options is dependent on the application's data-requirement...

- Data requirements drive the
- ↓
- Transceiver, that drives the
- ↓
- Insert, that drives the
- ↓
- Faceplate & Aperture, that drives
- ↓
- The Backplane.



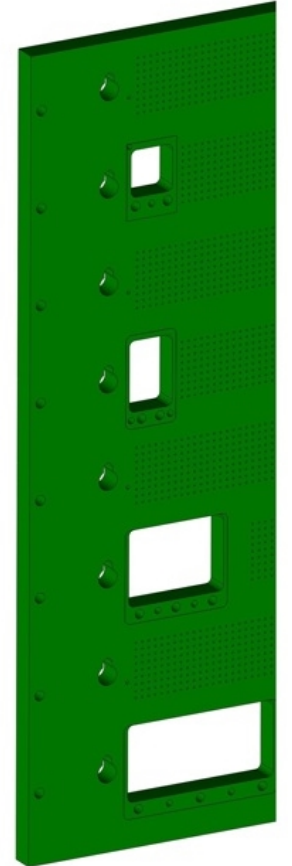
Plug-In Module Transceivers



Backplane Inserts



Backplane Faceplates



Backplane Apertures