

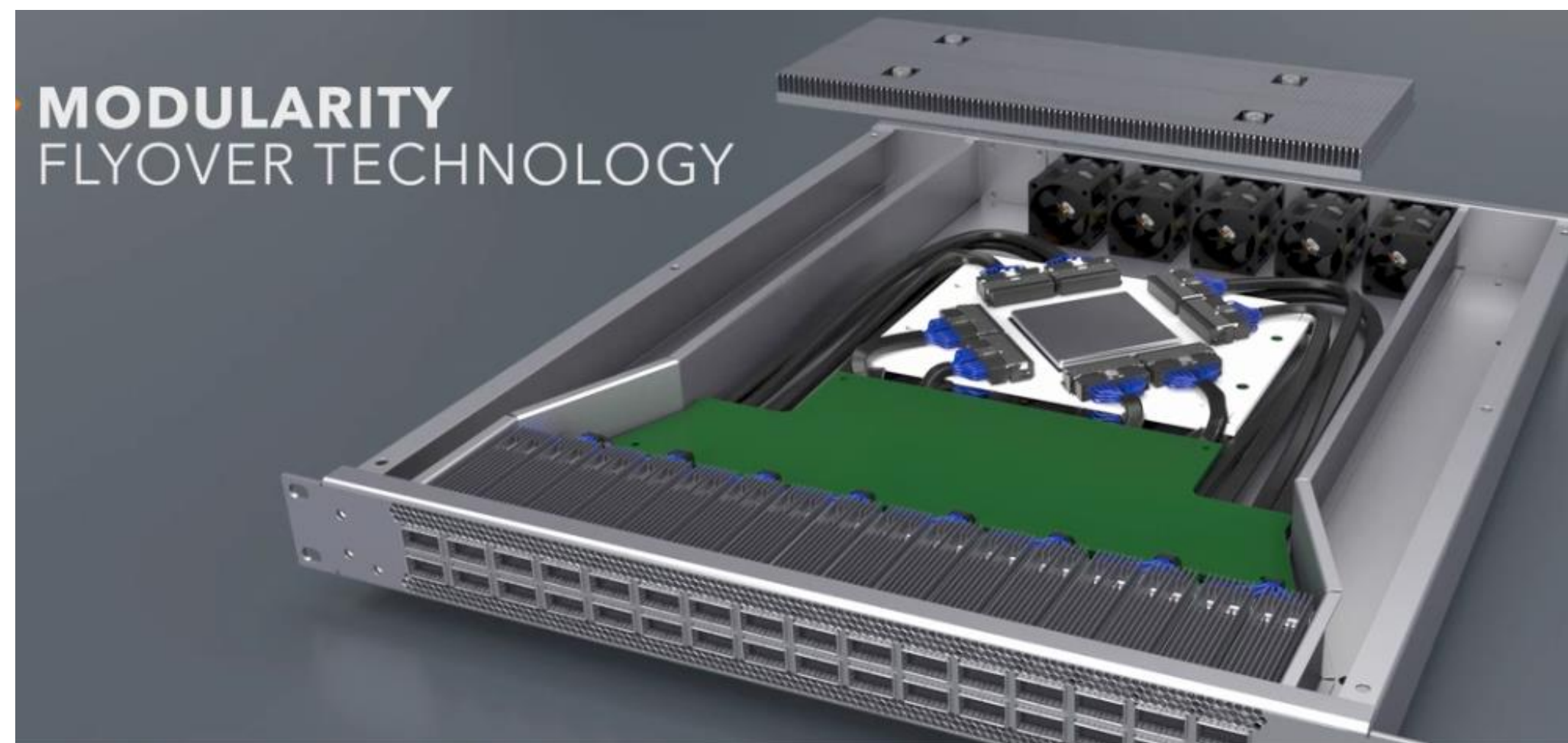
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OCP
SUMMIT



400G/800G Modular Architecture Enabled By Flyover™ Twin-Ax

Jignesh Shah
Sr. Technologist
Samtec

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A g e n d a

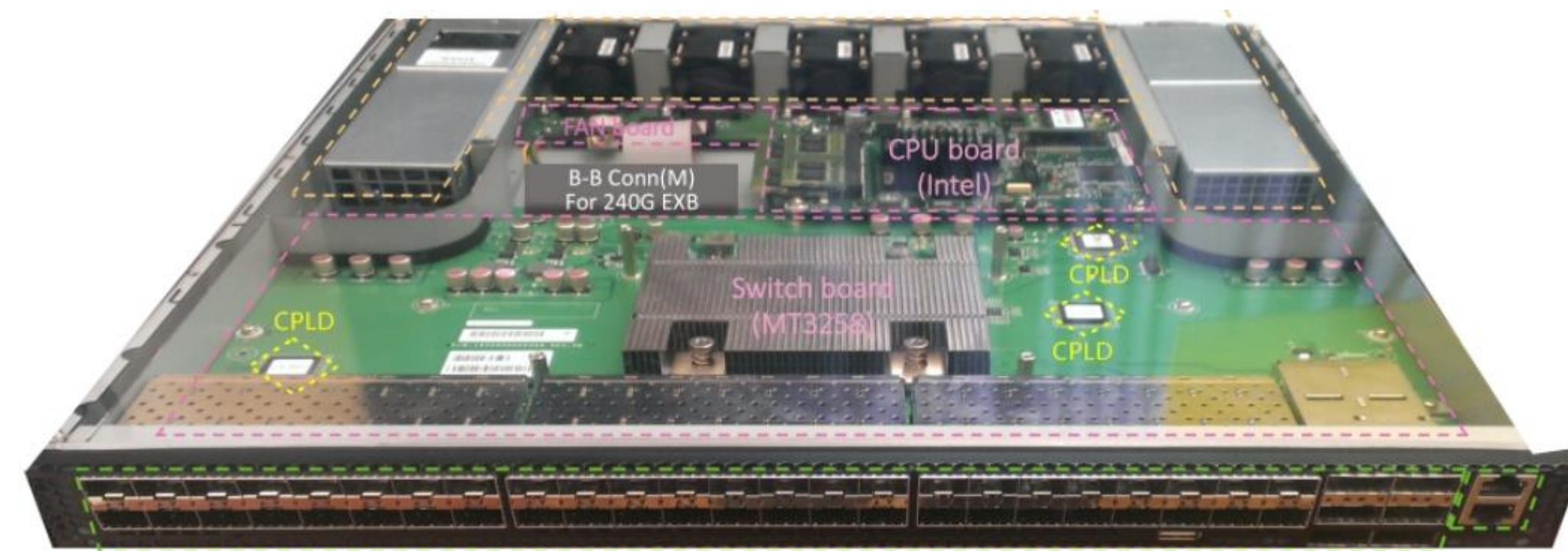
- Conventional Architecture
- Path to 800G
- Flyover Technology
- Modular Architecture
- Summary

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Conventional Architecture: Each design is a snowflake

Each design requires a unique Electrical/Mechanical/Thermal Design.
There are no key building blocks/ sub assemblies.



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Conventional Architecture: Lossy PCB



As bandwidth requirements rapidly increase to 800G, routing signals through lossy PCBs, vias and other components has become one of the most complex challenges designers face.



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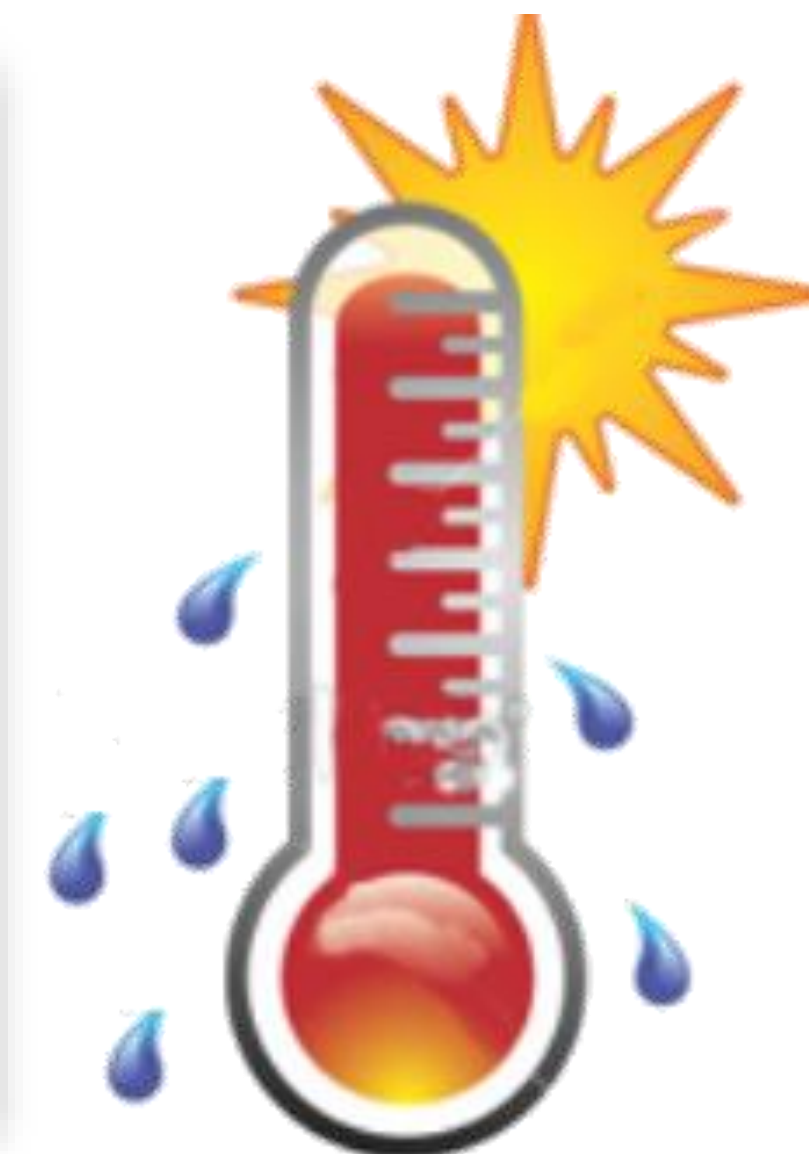
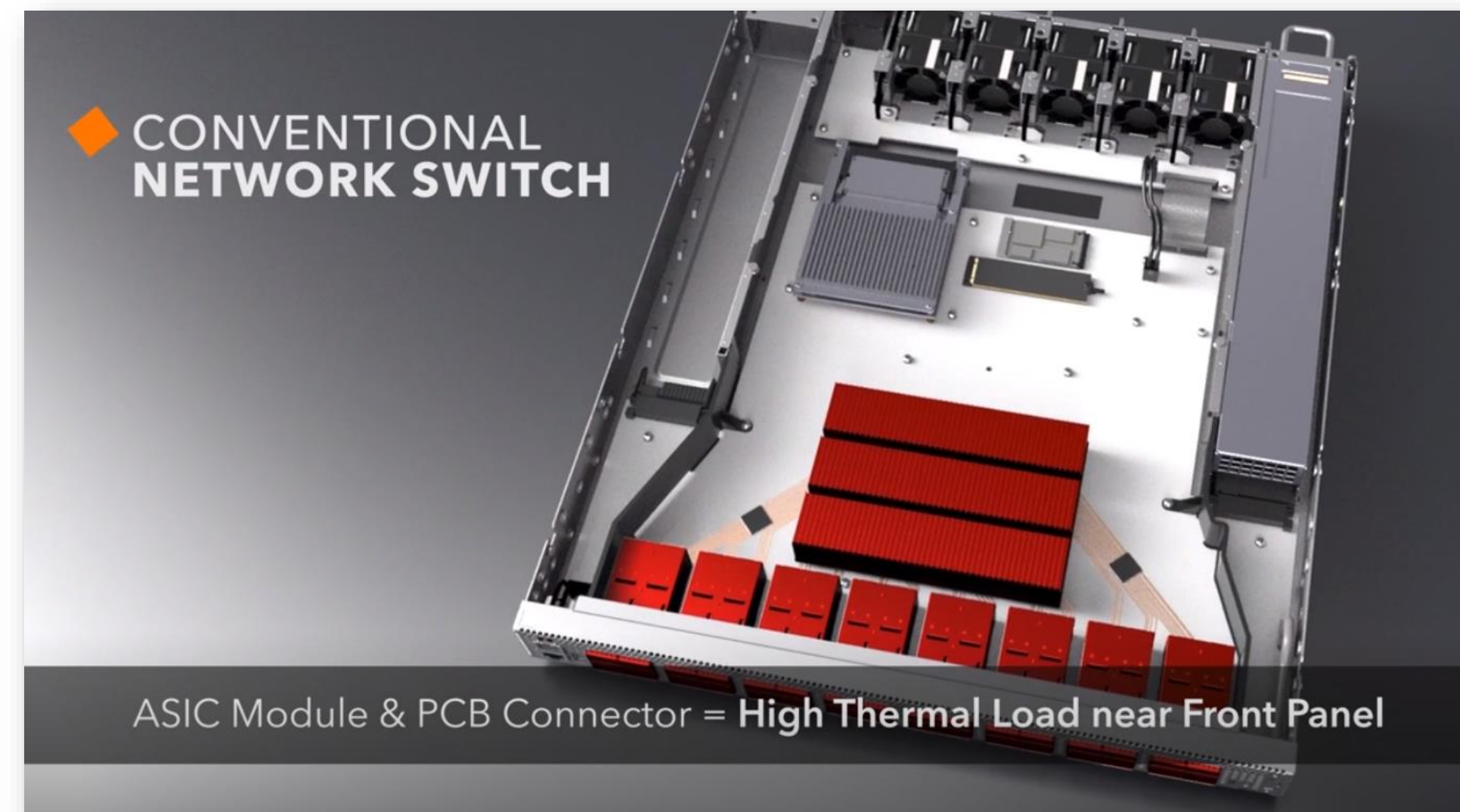


Conventional Architecture: ASIC placement concentrate heat



High speed materials and/or Retimers
increase cost and heat

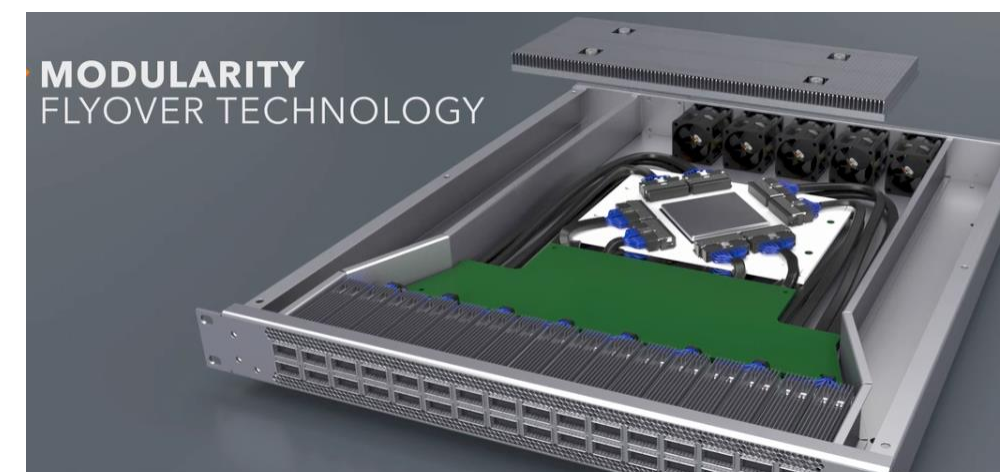
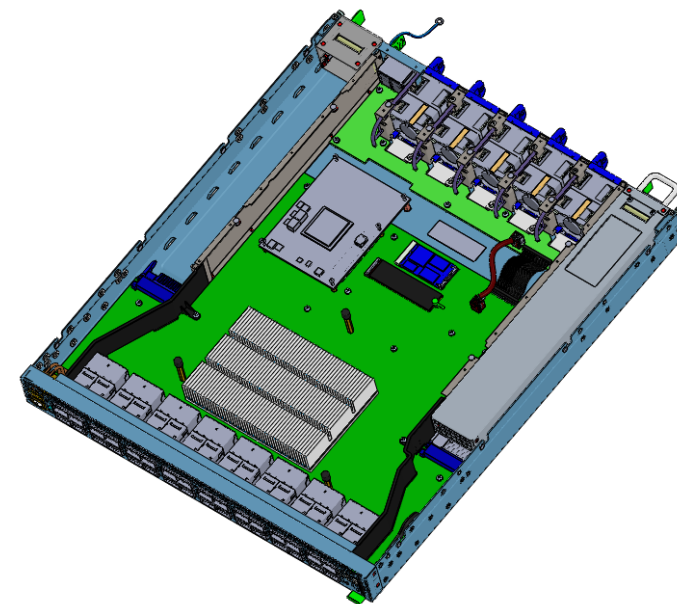
Localized Heat further increases trace
insertion loss



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Path to 800G



	Conventional	Modular with Flyover	Co-Packaged Optics
400G	✓	✓	NA
800G	✗	✓	✓
Latency	✗	✓	✓✓
Insertion Losses	✗	✓	✓✓
System Thermals	✗	✓	✓✓
Optics Thermals	✗	✓✓	✗
Manufacturability	✓	✓✓	✗
Cost	✓	✓	✗
Technology	✓	✓✓	✗

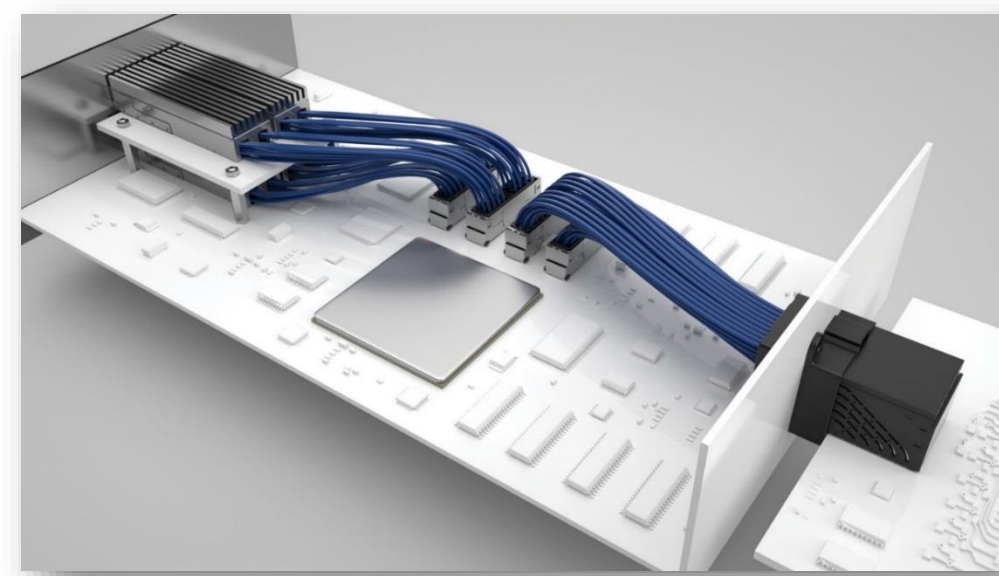


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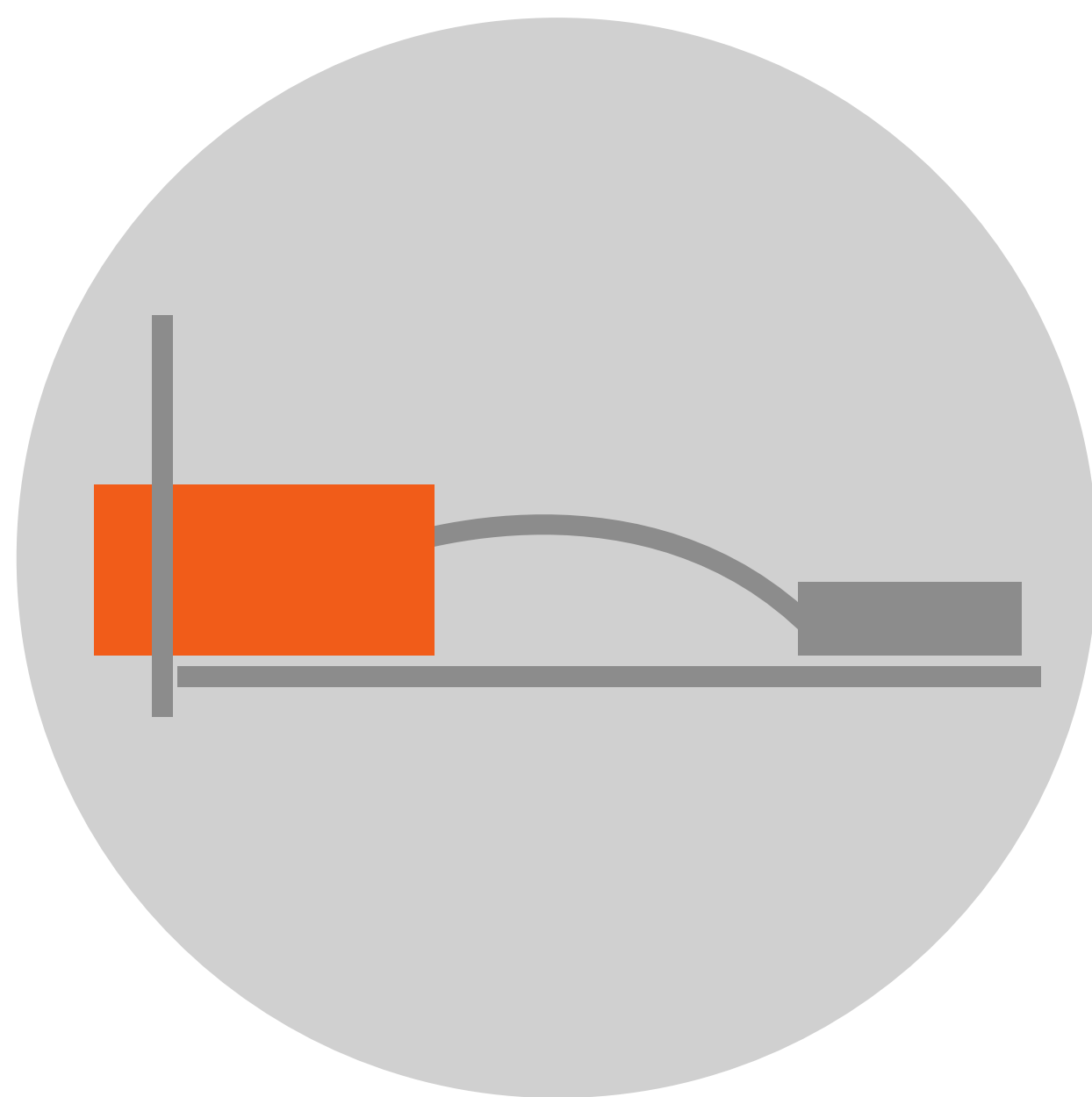
Flyover



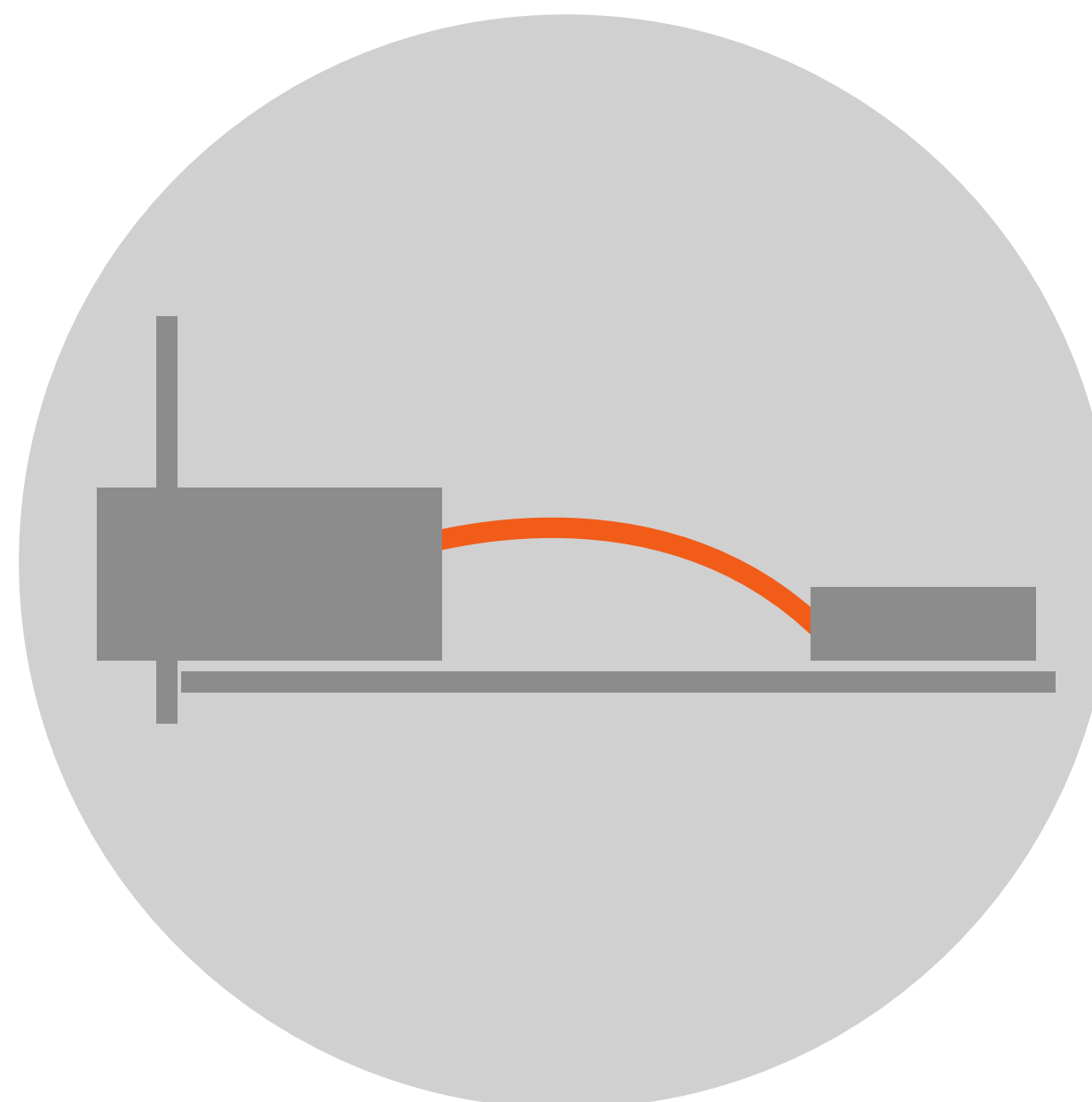
END 1: QSFP28 or QSFP28 Double Density

CABLE: Choice of Low Skew Twin-ax

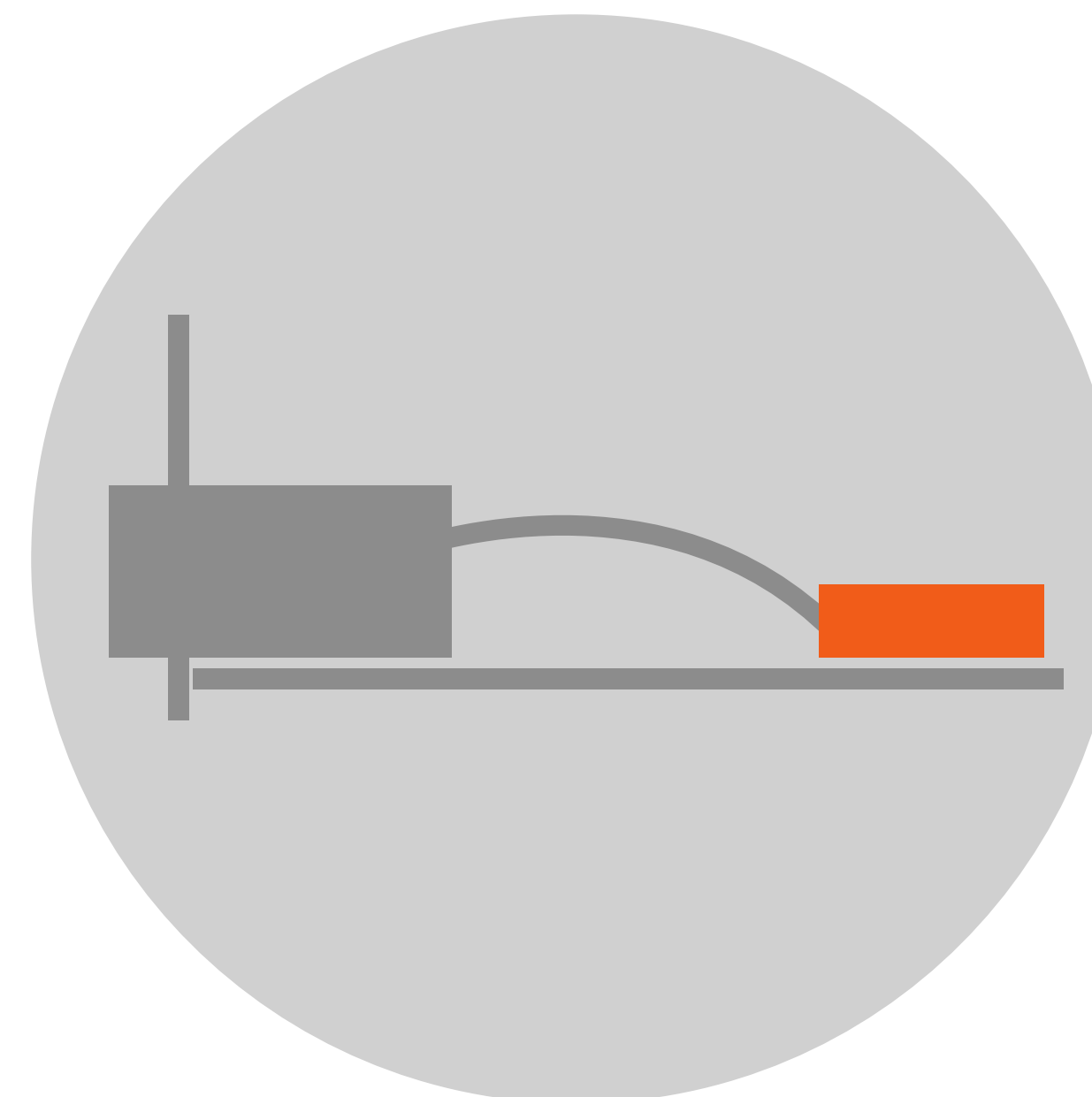
END 2: Choice of ASIC-Adjacent Connectors



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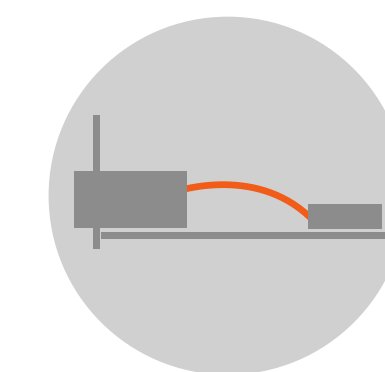
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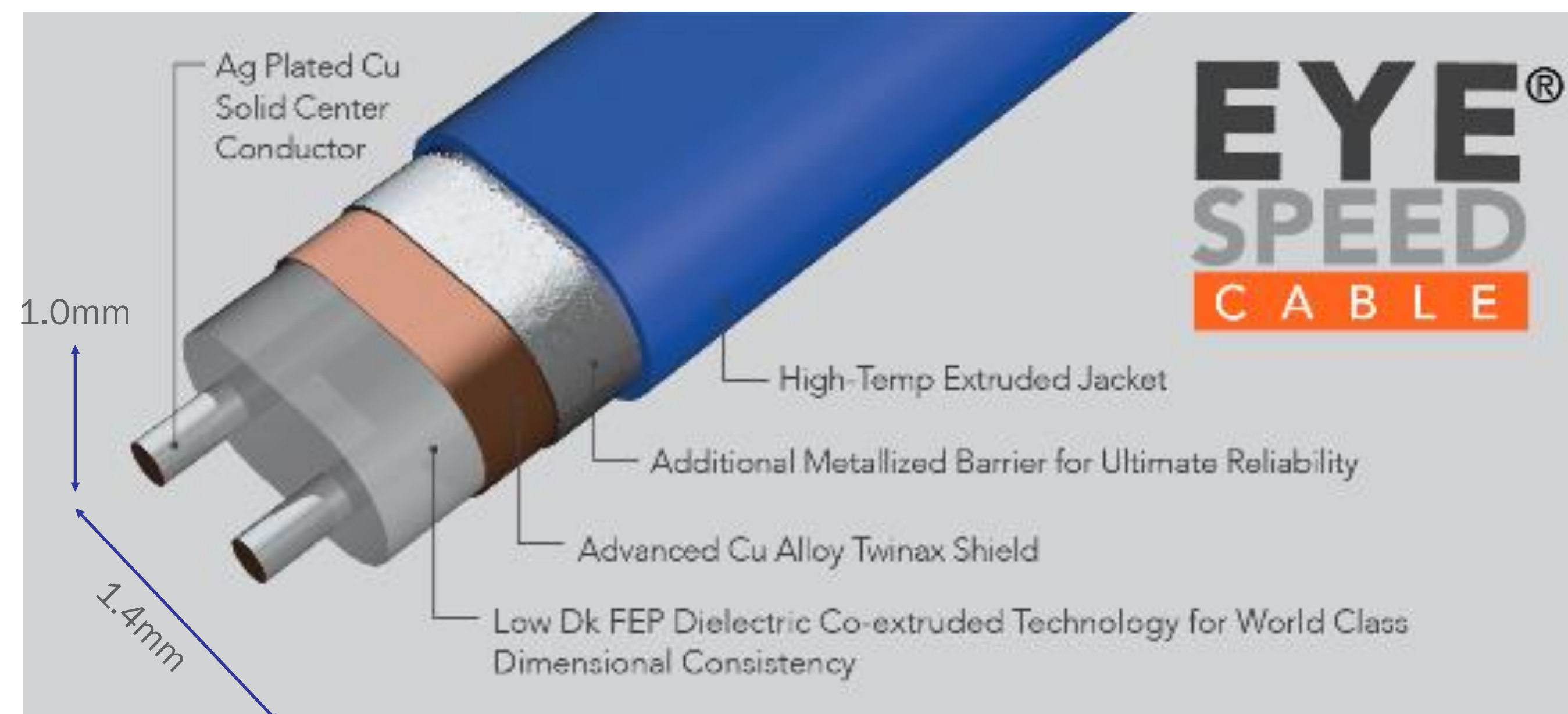
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Samtec High Speed Twinax Cable



- Co-extruded, low loss construction
 - Surrounded by low loss Dk
 - 360° Cu wrap Ground
 - Tighter tolerance between signal conductors
 - Flexible manufacturing lines to tune to 85/92/100 Ω
- Ultra low skew twinax < 3.5 ps/meter

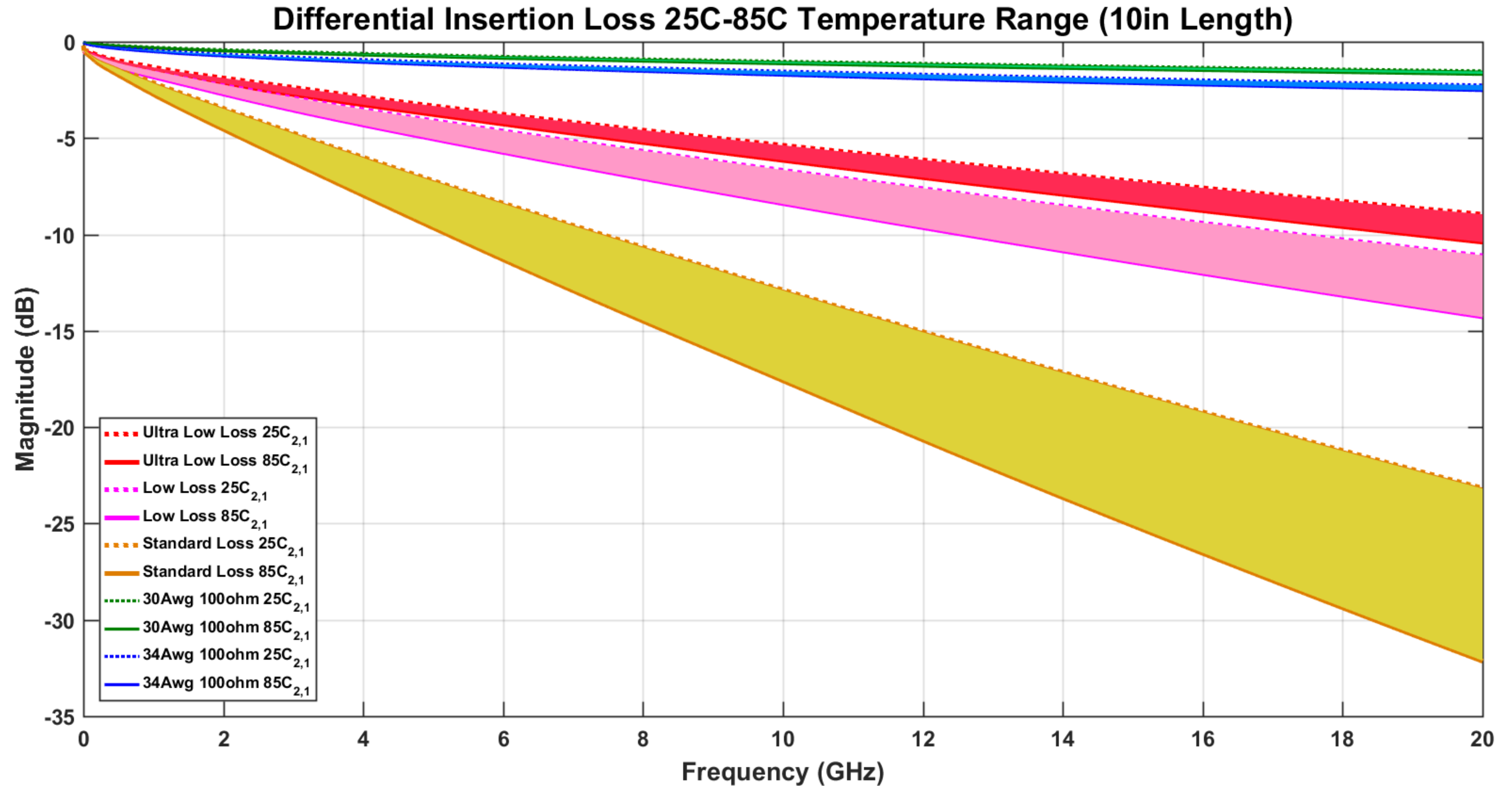


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Insertion Loss: Twin-Ax vs PCB



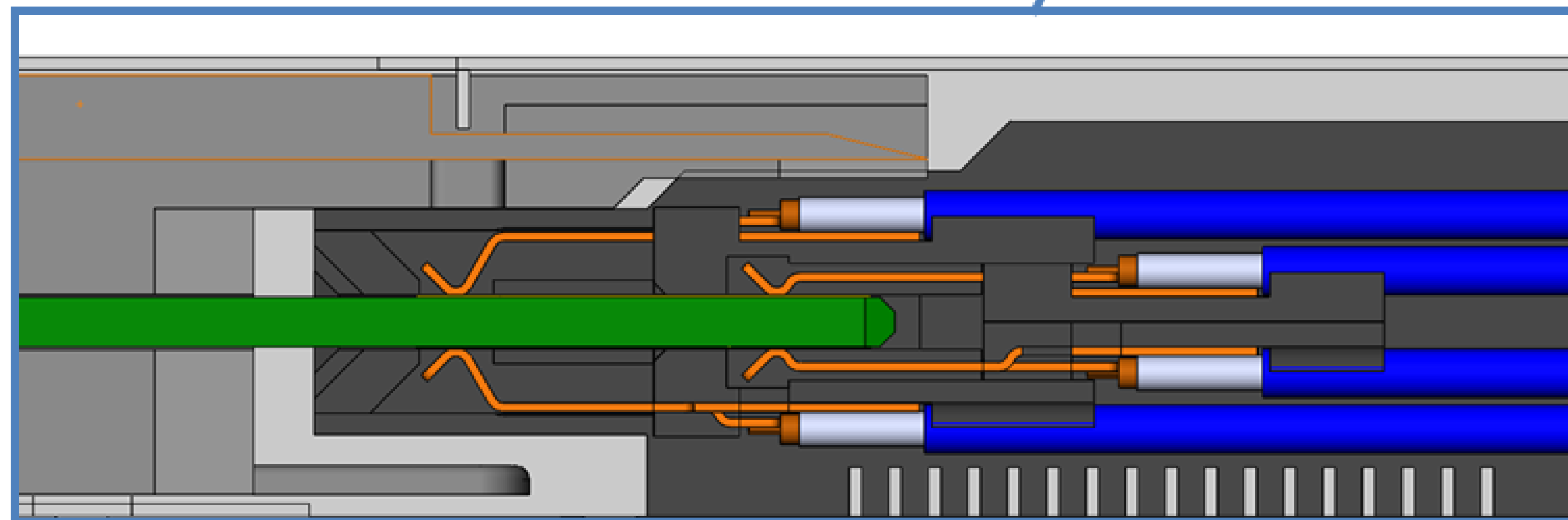
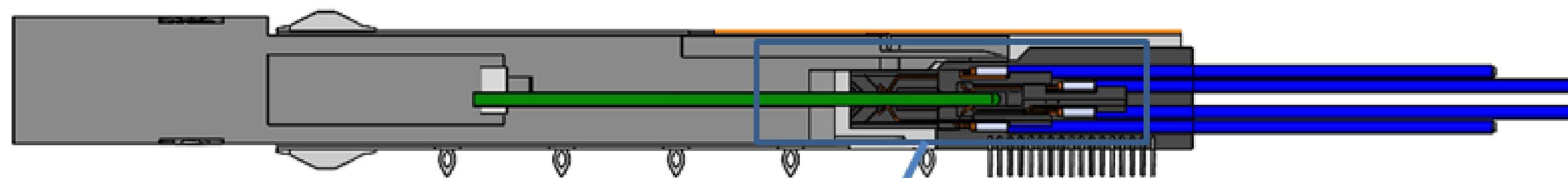
- 4x lower insertion loss than Megtron 7
- Lower temperature variation than Megtron 7

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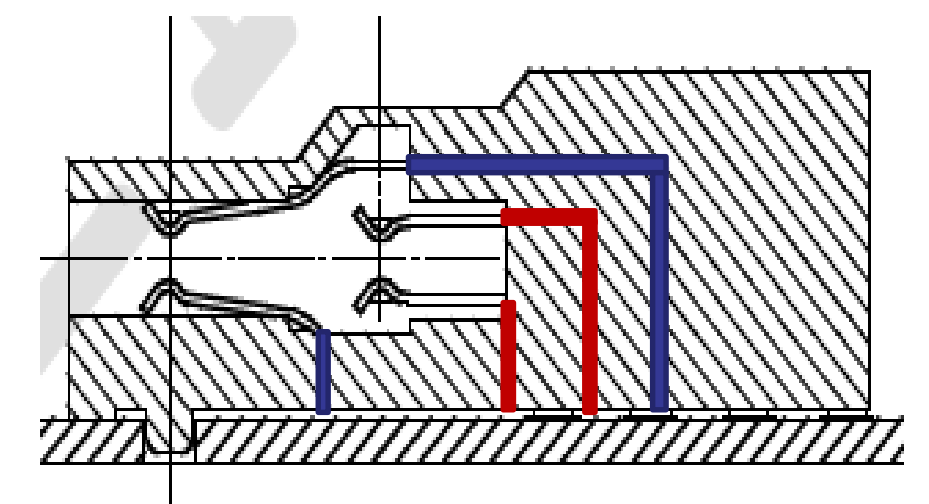


End 1: Flyover QSFP and QSFP-DD

Optimized SI and X-talk performance due to elimination of tight bends, equal lengths of 4 rows of pins



Conventional QSFP-DD Quad Contact Approach



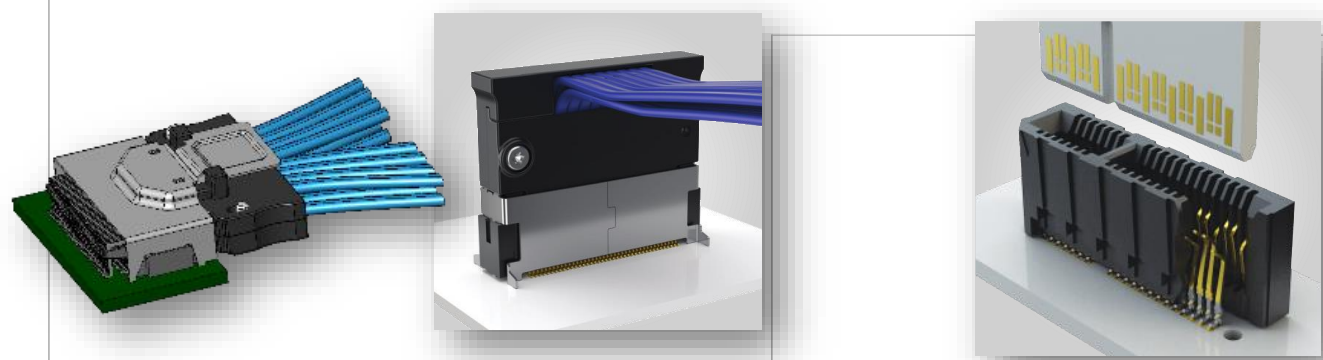
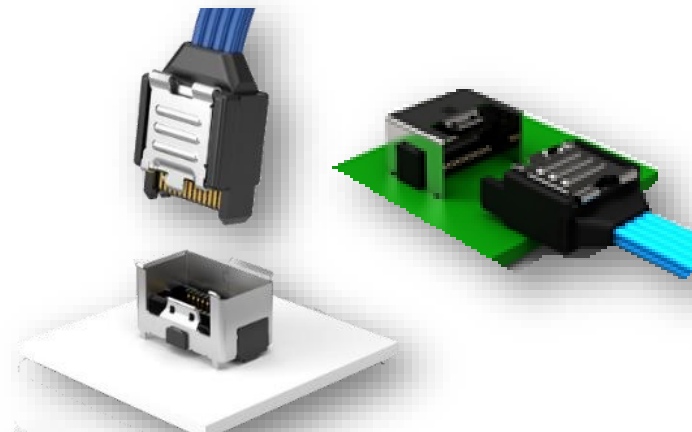
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End 2: Choice of ASIC-adjacent connectors

Vertical & Horizontal

	Mini Edge Card Cable	Edge Rate [®] DP Edge Card Sockets	ExaMAX [®] High Speed Backplane	AcceleRate [™] Cable	NovaRay [™] Cable
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DataRate	NRZ 28 Gbps	PAM4 56 Gbps	PAM4 56 Gbps	PAM4 56 Gbps	PAM4 112 Gbps
Features	Use of Substrate Allows Customized Signal Mapping 	High-Density, High-Performance 	Direct Attach Technology Excellent Blend of Performance and Density 	The Ultimate in Performance 	



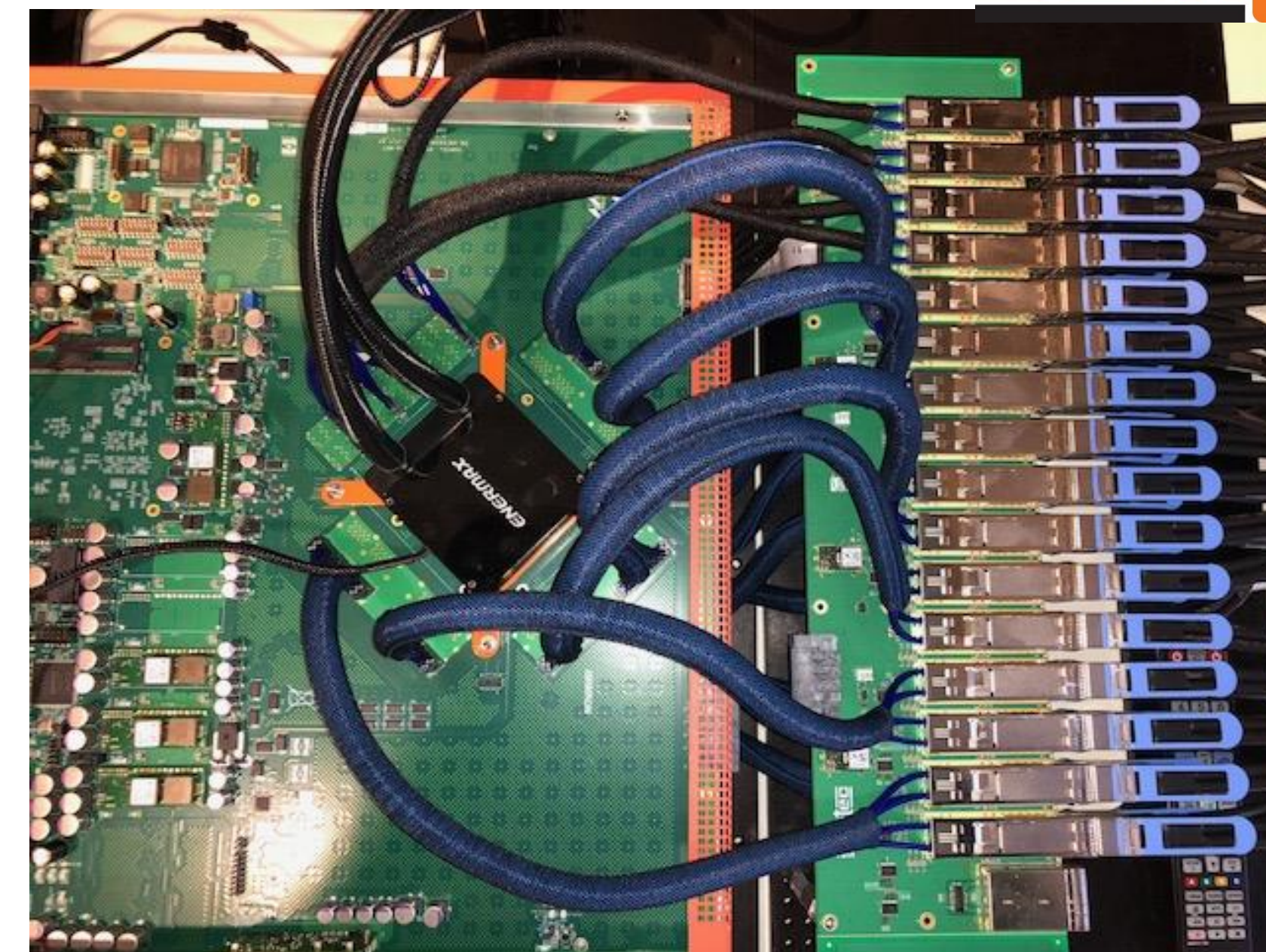
400G/800G Demo

samtec

12.8 Tb Switch (400G per port)

- 32 QSFP-DD
- 18" Samtec Flyover QSFP-DD to NovaRay/AcceleRate
- BER 1 e-12 Pre-FEC
- Apples to apples comparison:
 - 1e-3 to 1e-7 for Conventional design with same board stack up

PAM4
56
G b p s



800G performance of Flyover QSFP-DD

- Credo Pelican chip
- BER 3e-7 Pre-FEC

PAM4
112
G b p s

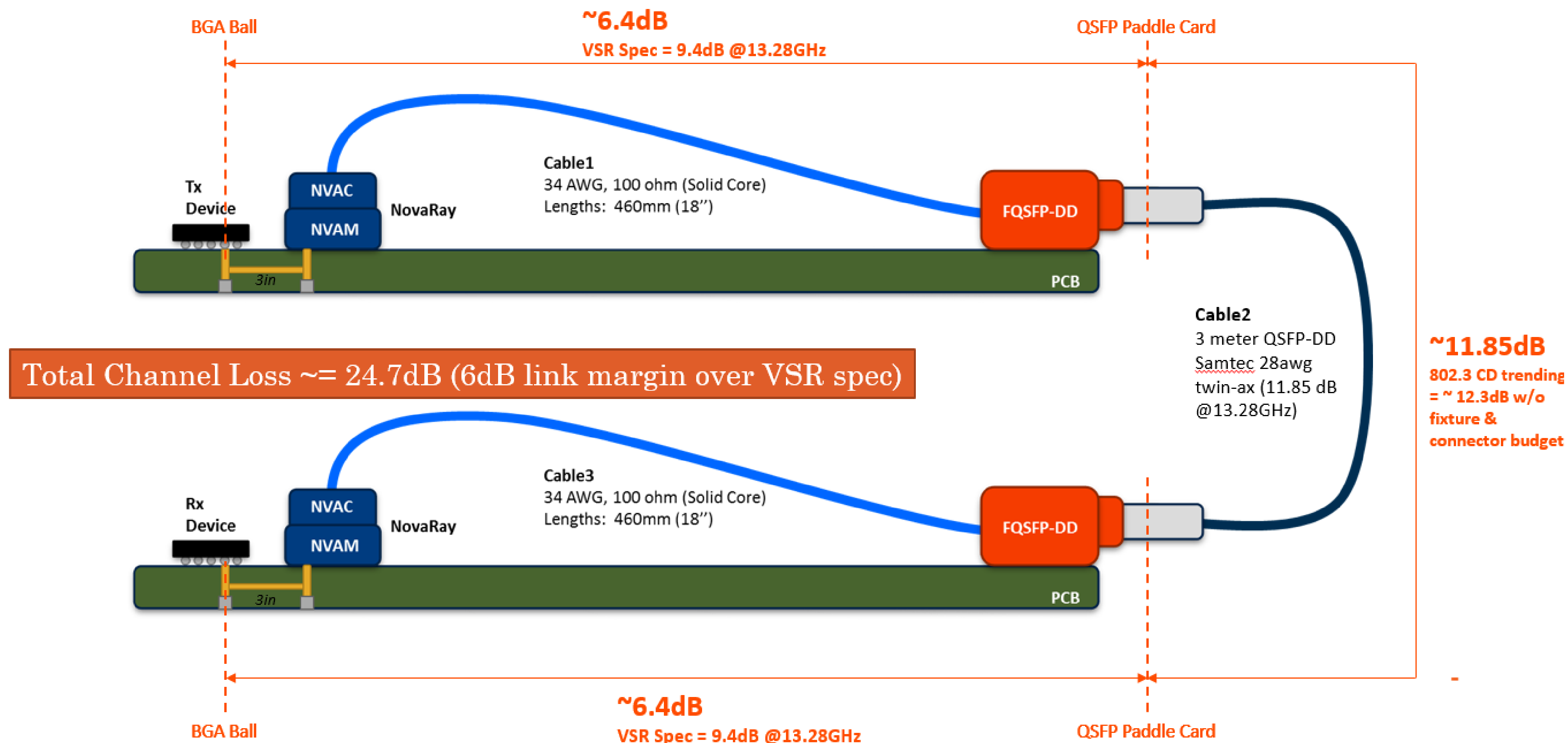


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Insertion Loss Breakdown 400G (56G PAM4)



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But customers always ask...



How do you fit all these cables into a 1RU?

Will the cables impede air flow and thermals?

Isn't Flyover an expensive solution?



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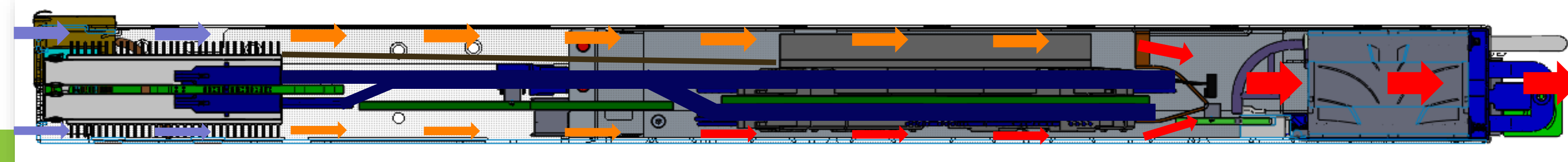
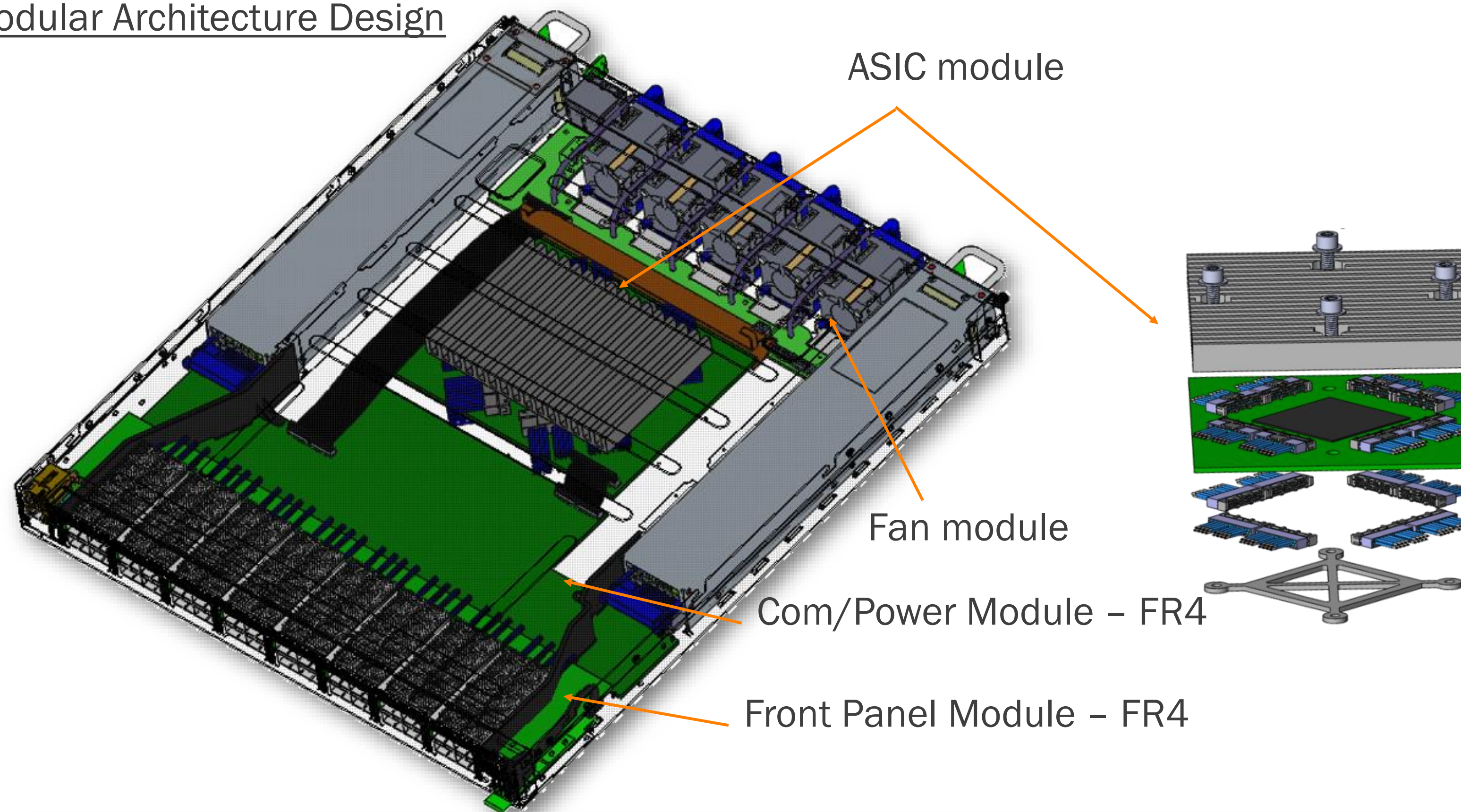




The Solution: Modular Architecture



Modular Architecture Design



Conventional OCP Wedge Design

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Cable Management

Architect in 3 dimensions

- Cables take up <1% of available volume in 1RU
 - Cables laid flat to ease air flow
 - Longer cables are easier to manage than very short cables.
 - Pushing the ASIC further back has the advantage of separating the high power ASIC away from the temperature sensitive QSFP-DD → much better thermal solution
 - Multiple cable management options available
- <https://vimeo.com/260765517>

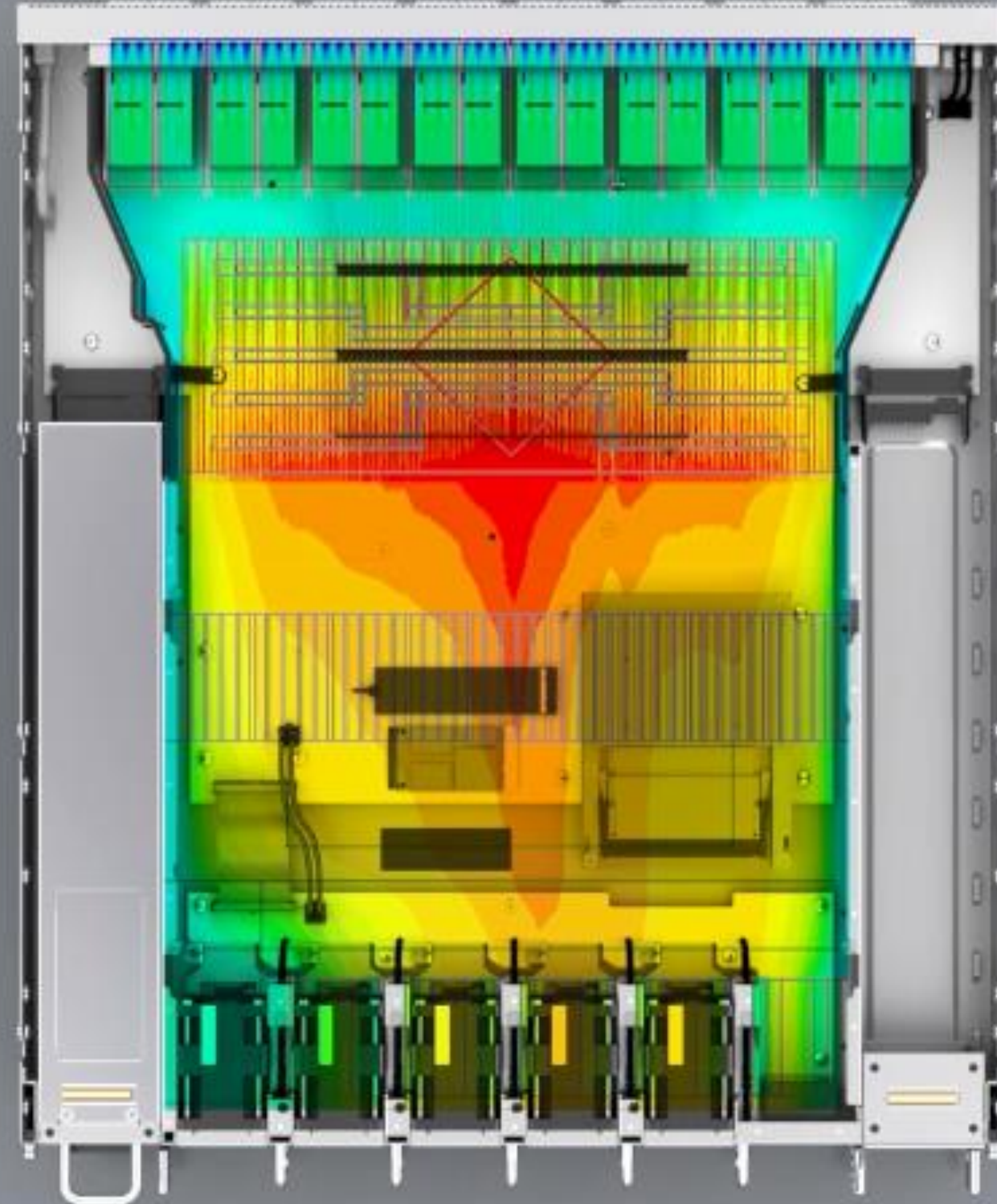


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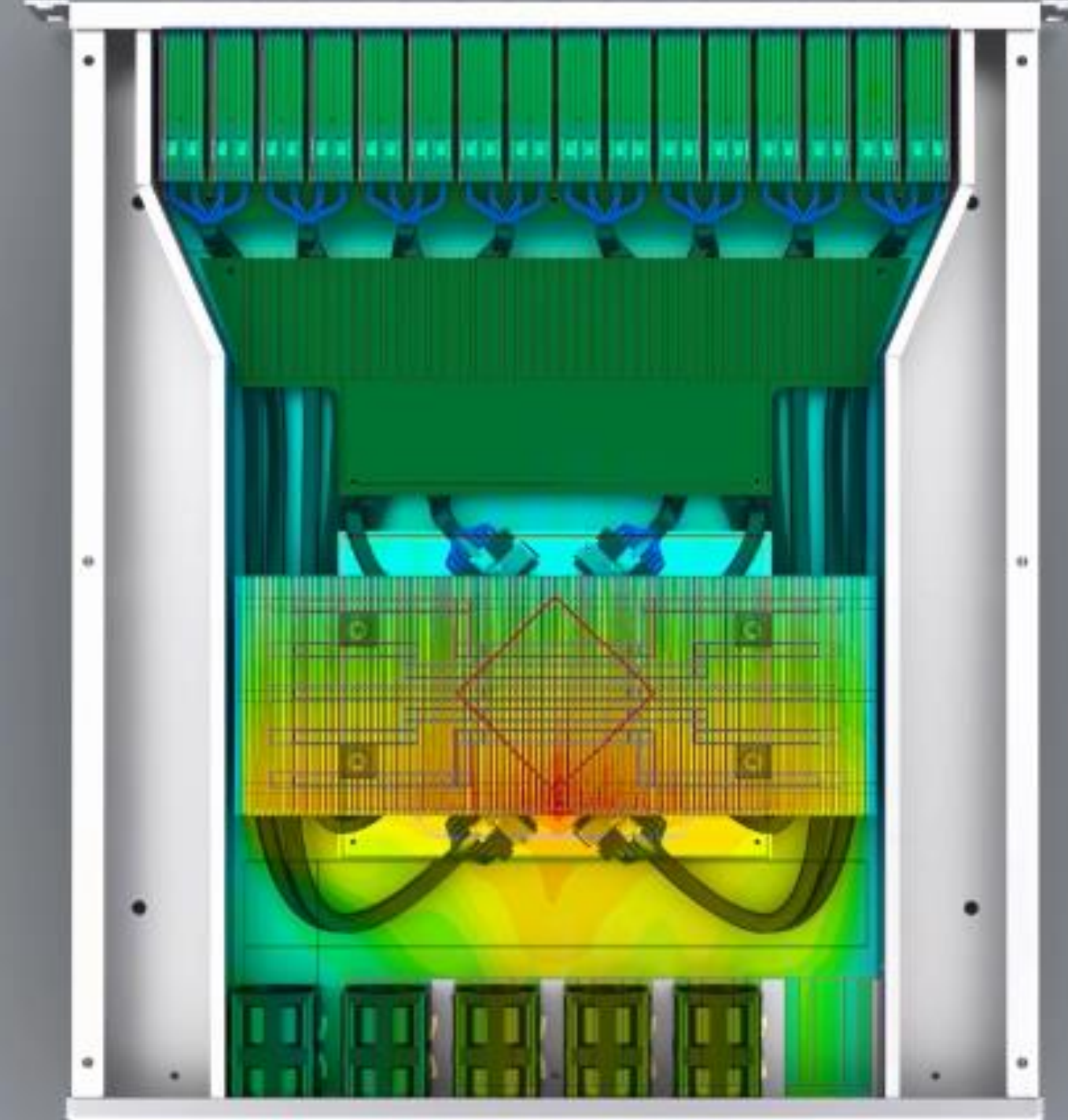
Thermal Management



Conventional Network Switch



Using Flyover Technology



- Separation of ASIC and Optics → better thermals
- Belly to Belly Optics → better thermals

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Cost



- PCB Cost Savings
 - Only the ASIC Module PCB is of a high speed material
 - ~1/4th the size and fewer layers than a conventional PCB
 - All other PCBs are simple FR4
- No re-timers needed
- Lower thermal cost
- Can enable >3m DAC → significant cost savings to the end user
- ASIC Module can be re-sued in different switch designs
- All these savings make the Modular architecture cost competitive or cheaper than the conventional architecture while still delivering a superior SI, low latency and Thermal Performance



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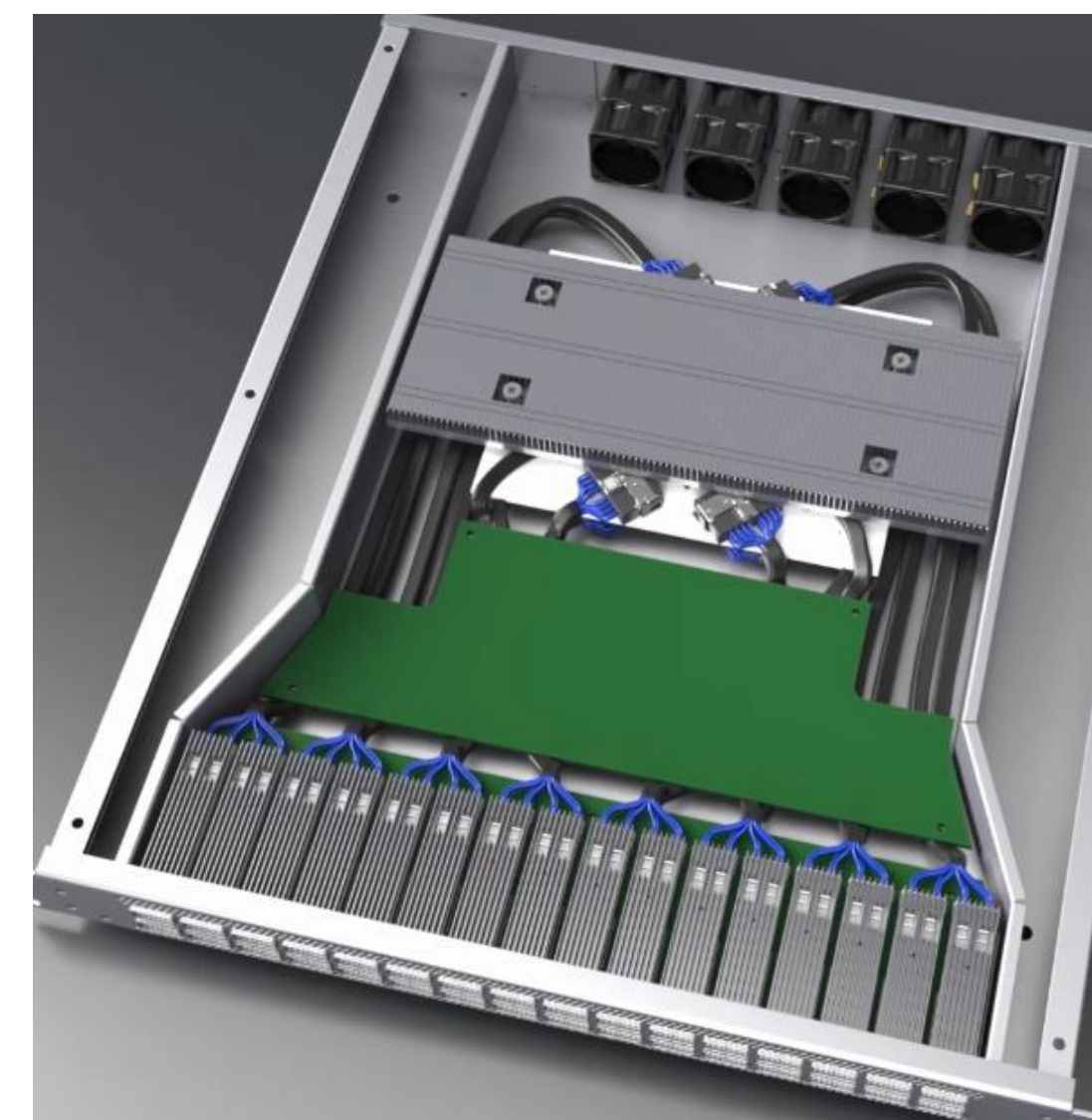
Typical Applications

At 400G, Flyover QSFP-DD is being used in hybrid solutions in which some of the outer or mezzanine ports are Flyover

- Design ins with Tier1 customers



At 800G, Flyover QSFP-DD will be the solution of choice for all ports

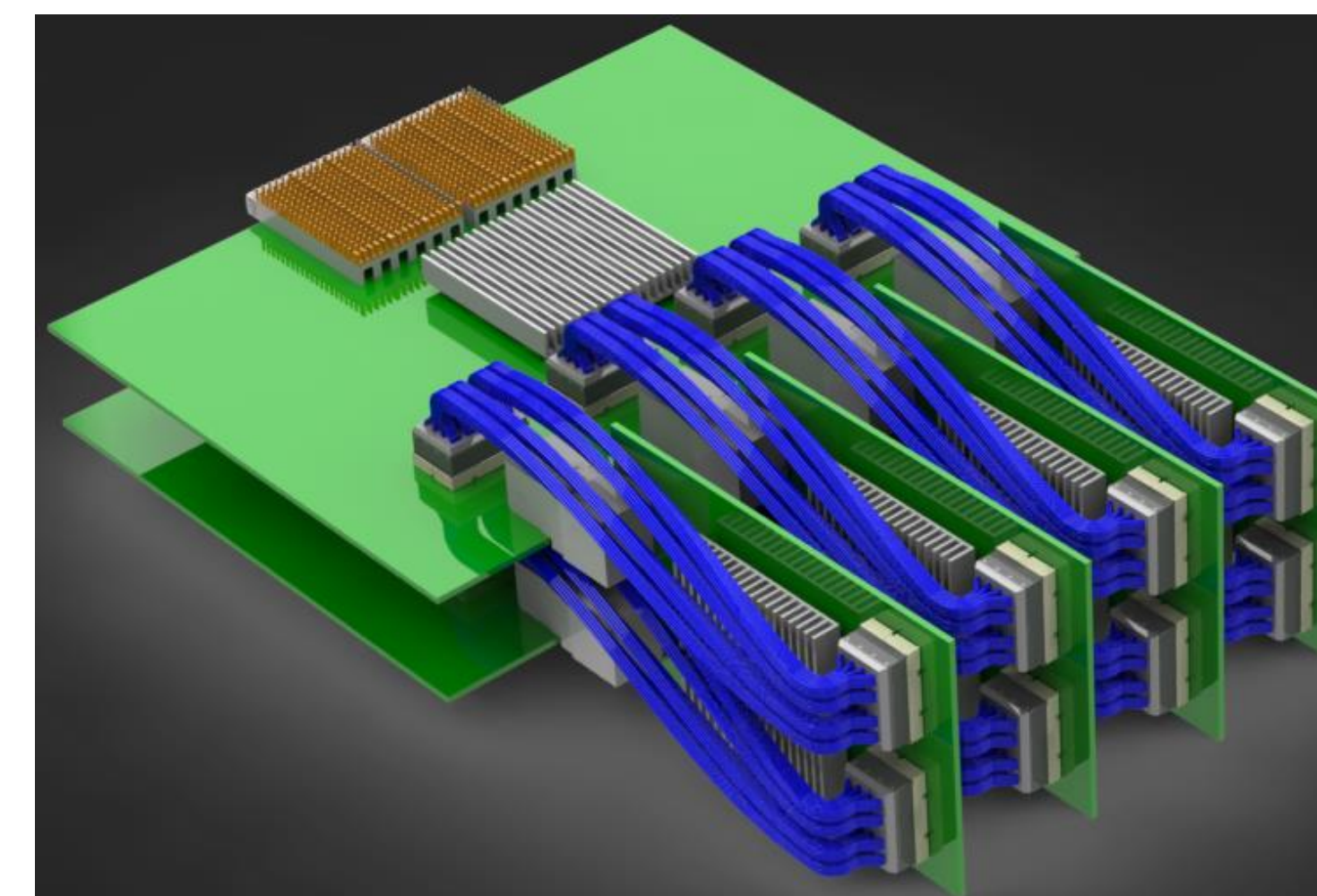
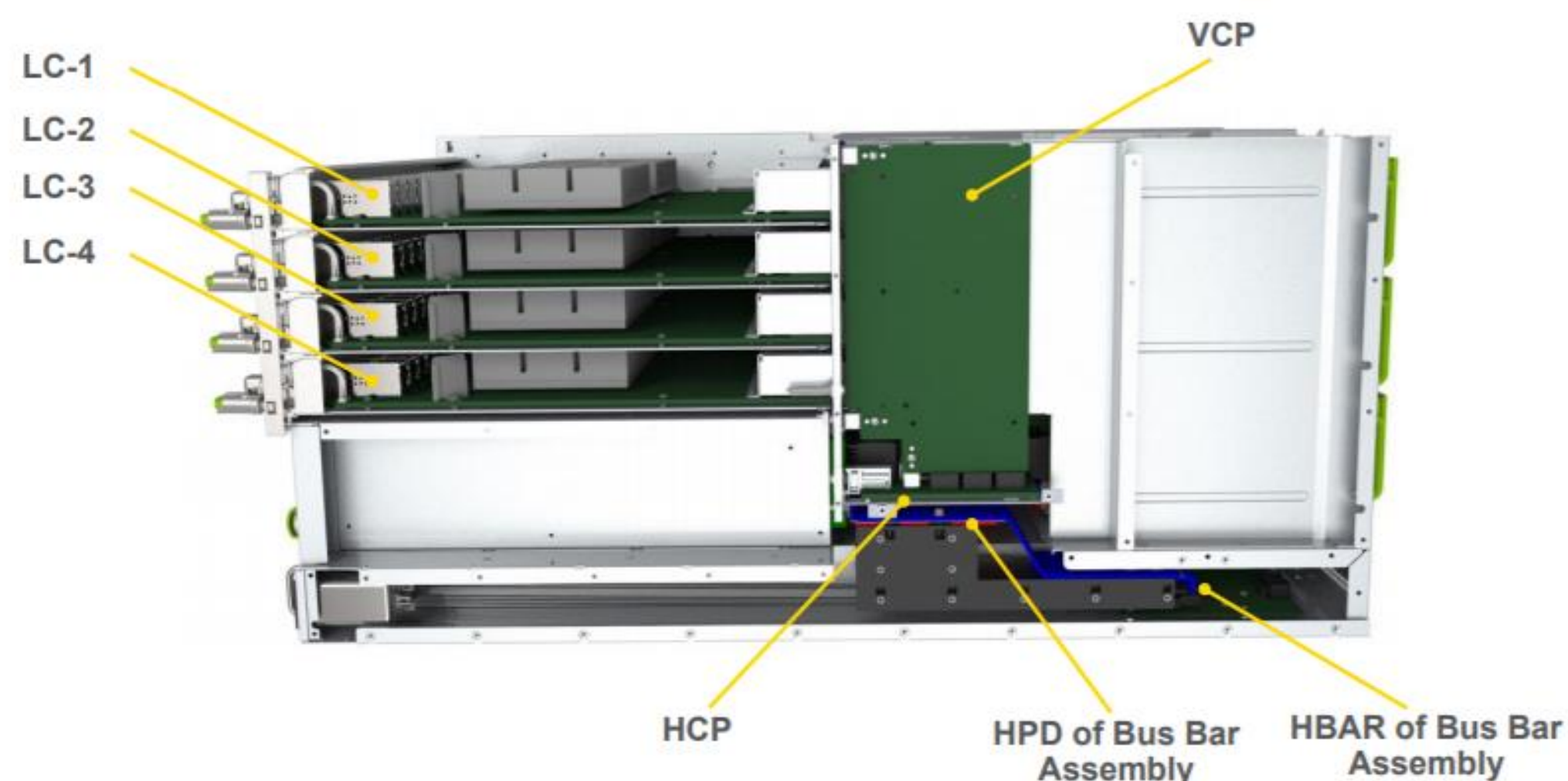


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Other OCP Products

- The OCP Wedge can be easily scaled from 3.2 Tbps to 6.4 /12.8/ 25.6 Tbps with this modular architecture.
- The various modules in this architecture can also be used-as-is to fit into different OCP Top of Racks (ToR) like Telco, OCPv2 and Olympus.
- The same modularity can be applied to Middle of Row (MoR), End of Row(EoR) and Spine Switches by leveraging the OCP Facebook BackPack's and SidePlane's concept.

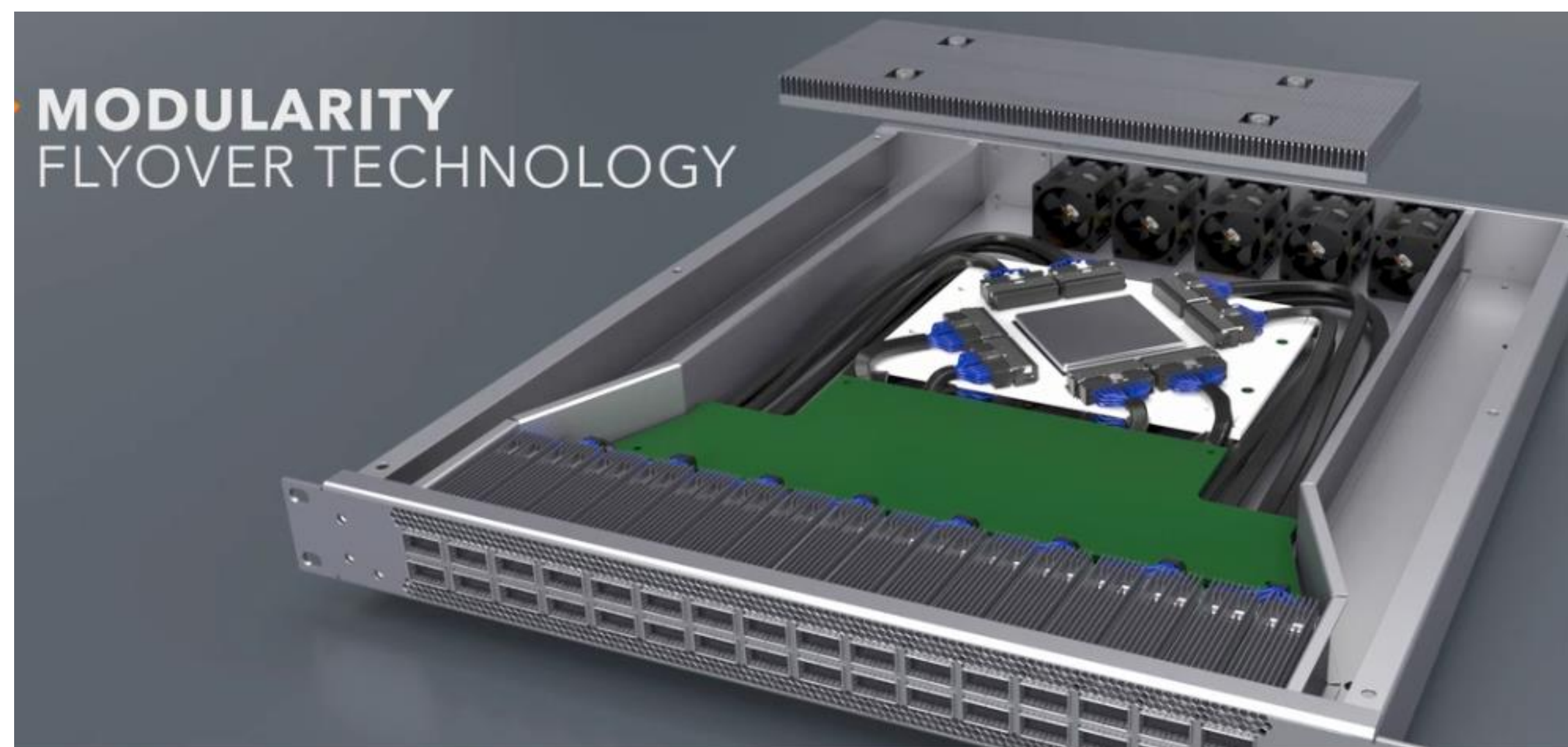


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Summary

Modular Architecture enabled by Flyover results in a cost competitive while still delivering a superior SI, low latency and Thermal Performance while showing easy scalability to 800G.



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