

Amphenol *Active Optics* *Products*

Customer Presentation

CUSTOMER PRESENTATION

AAOP Introduction

AMPHENOL AOP OVERVIEW

About us

- Founded in 2003 (MergeOptics GmbH)
- Located in Berlin
- Legal entity "FCI Deutschland GmbH"
- ISO 9001 & 14001 certified

Product offering

- On-Board Transceiver up to 56Gpbs
- Optical Engines for Active Optical Cables up to 28Gbps

Market served

- Commercial datacom (data center, 5G, AI, supercomputer...)
- Industrial (machine vision systems...)
- Military & Aerospace

Capabilities

- Product Development
- Process Development
- NPI and Manufacturing

Our team

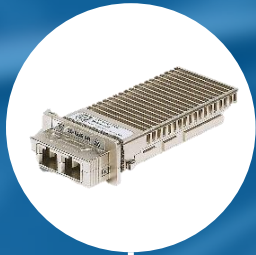
- 15 years of proven track record in designing and manufacturing optoelectronic products
- Core competencies in RF, optical packaging, optical engine integration, assembly process
- Product, process development and manufacturing hosted at the same location



PORTFOLIO HISTORY

X2 PRODUCT FAMILY

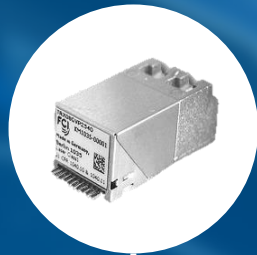
Development of 10Gbps X2 product portfolio using multimode and single mode technologies



2006

SCFF PLATFORM

Development of 10 Gbps SCFF product for short reach application



2008

AOC PORTFOLIO

Extension of 10Gbps per channel AOC portfolio with new form factors including QSFP, mSAS, CXP...



2010 - 2014

AOC NEW GENERATION

Co-development of 25Gbps per channel AOC's including QSFP28, QSFP-DD and CXP2



2016 - 2019

2007

2009

2015



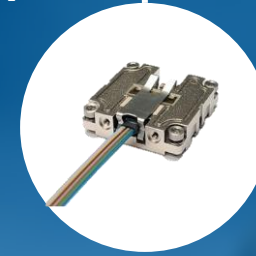
SFP+ PRODUCT FAMILY

Development of 10Gbps SFP+ product portfolio using multimode and single mode technologies



AOC

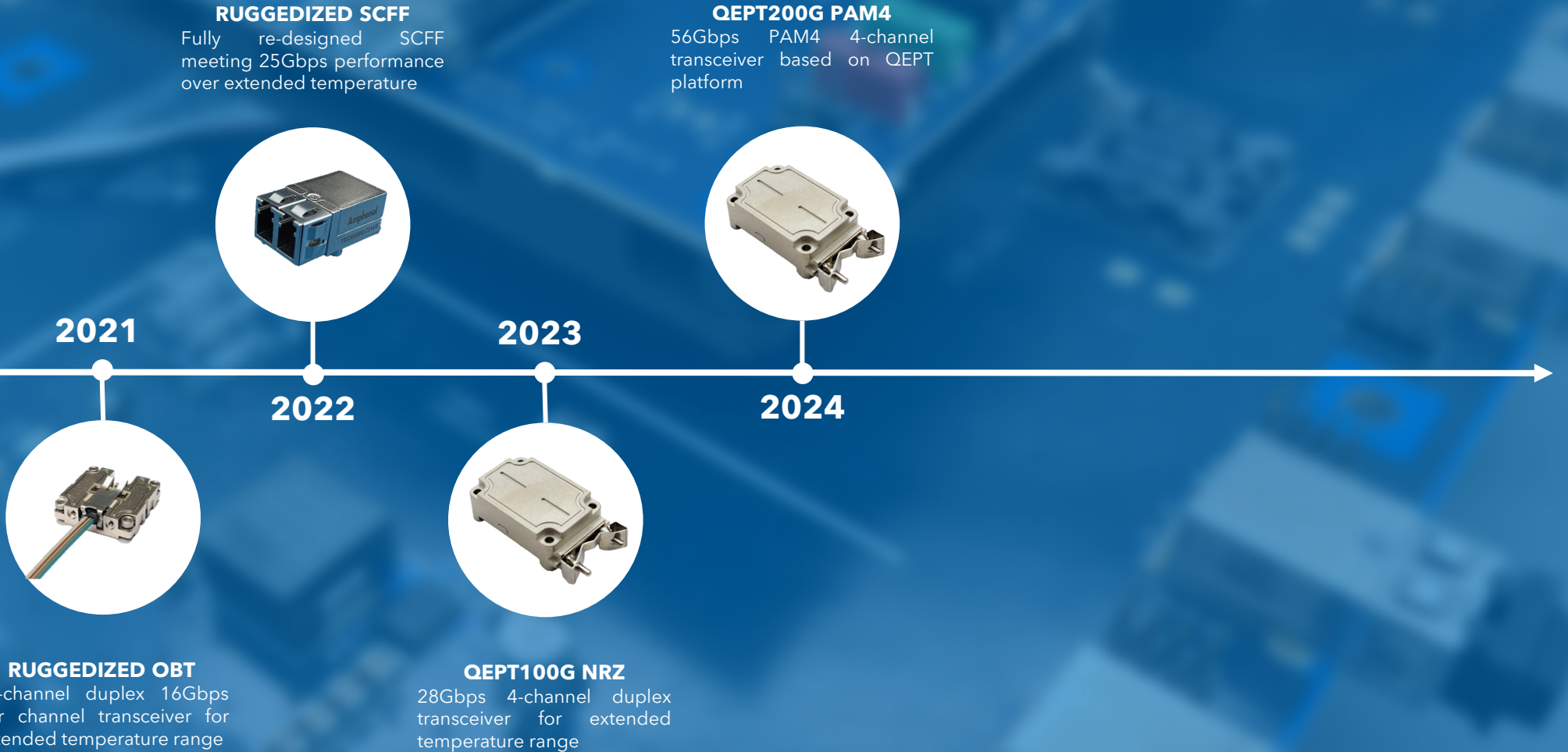
12-channel VCSEL-based active optical cable reaching aggregate 120 Gbps



LEAP® OBT

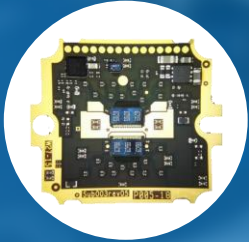
12-channel duplex 25Gbps per channel transceiver using multimode COB technology

PORTFOLIO HISTORY



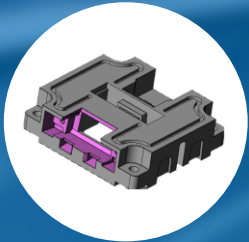
AMPHENOL AOP CAPABILITIES

PRODUCT DEVELOPMENT



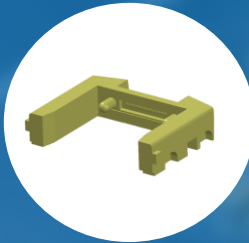
ELECTRONIC DESIGN

Transceiver & Active Optical Cables
PCB design and component integration
Connector design for optimal SI



MECHANICAL DESIGN

Die-casted and machined parts designs
Tolerance analysis
Simulations (thermal, mechanical stress)



OPTICAL DESIGN

Lens design for parallel optical beams
Mechanical designs of plastic molded parts



FIRMWARE & TEST

Firmware design programming
Standard compliant or customized FW
E/O performance testing capability
Characterization over temperatures and voltages

DIE / WIRE BONDING

High volume / high accuracy die-bonding
High-capacity gold wire bonding equipment
Development of tooling & processes



BURN-IN

VCSEL burn-in process development
High-capacity burn-in equipment
Pre- and post burn-in VCSEL
characterization



ACTIVE OPTICAL ALIGNMENT

Customized alignment station development
Automated optimal coupling process
Alignment algorithms programming



HIGH-SPEED E/O TEST

Fully automated E/O tester design
Measurements from -40°C to 85°C
Internal software development



PROCESS / MANUFACTURING

DIFFERENTIATORS

PORTFOLIO:

- **LATEST GENERATION DESIGNS:**
 - HIGH PERFORMANCE
 - SAFER SUPPLY CHAIN (RISK OF EOL MINIMIZED)
- **EXTENDED RANGE OF DATA RATES / CHANNELS SUPPORTED:**
 - SINGLE, 4-CHANNEL AND 12-CHANNEL
 - CHANNELS WORKING INDEPENDENTLY WITH ANY DATA RATE FROM 1.25GBPS TO 16GBPS , 28GBPS OR EVEN 56GBPS*
 - FOOTPRINT CAN BE RE-USED OVER SEVERAL GENERATIONS (QEPT PLATFORM)

PLUGGABILITY:

- **OPTICAL PLUGGABILITY: OPTICAL CABLES CAN BE REMOVED**
 - EASIER/MORE FLEXIBLE ROUTING
 - COST EFFECTIVE REPLACEMENT IN CASE OF FIBER DAMAGE
- **NEW: HOT-PLUGGABILITY (QEPT PLATFORM)**
 - NO NEED TO SHUT DOWN SYSTEM TO INSERT / REMOVE TRANSCEIVERS
 - PLUG&PLAY SOLUTION

THERMAL DESIGNS:

- **EFFECTIVE HEAT DISSIPATION**
 - HEAT DISSIPATED TOWARDS THE TOP FOR USE OF COOLING PLATE
 - NO CONSTRAINTS IN CUSTOMER BOARD DESIGN (NO DISSIPATION INSIDE THE BOARD)
- **EFFECTIVE MECHANICAL DESIGNS:**
 - DIE-CASTED HOUSINGS
 - SUPPORT CUSTOMIZED HEAT-SINK DESIGNS

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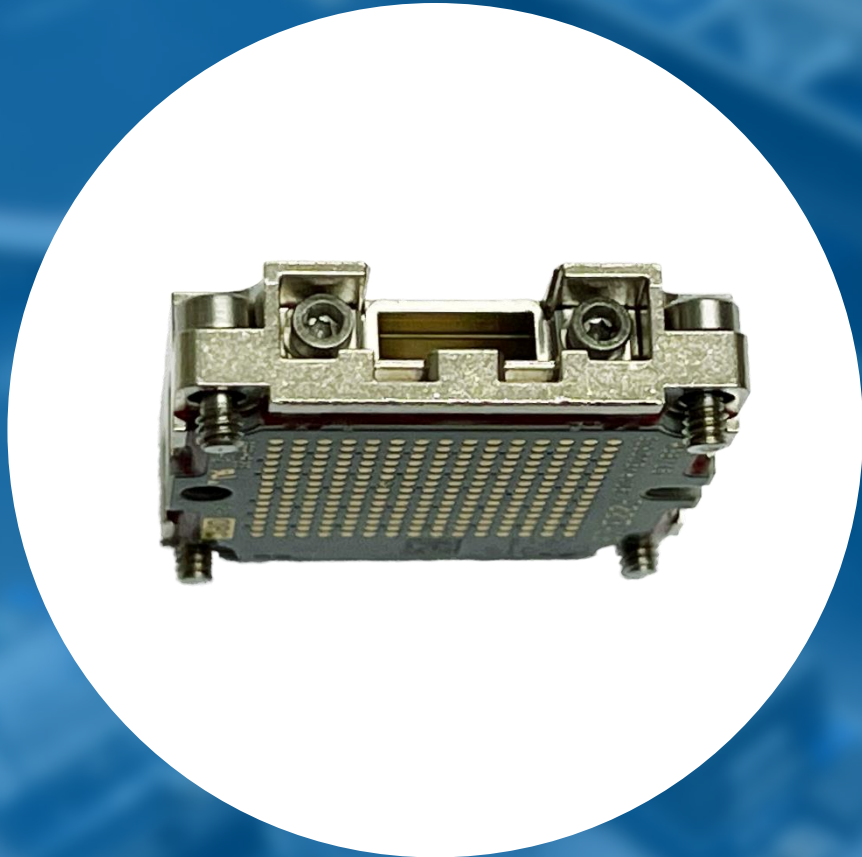
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CUSTOMER PRESENTATION

Product Portfolio

LEAP[®] ON-BOARD TRANSCEIVER



KEY FEATURES

12-channel duplex transceiver
1 to 25Gbps per channel (300Gbps aggregate data rate)
0°C to 70°C operating case temperature
Standard MT-24 ferrule compatible
LGA mount (compatible with Amphenol LGA/BGA socket)

PERFORMANCE

12 CHANNELS

25GBPS

BER < 10⁻¹²

0°C TO 70°C

P_{TYP.} = 6.0W

FEATURES

INTEGRATED CDR

**TX EQUALIZER
RX AMP. & DE-EMP.**

DIGITAL MONITORING

**INTERNAL PRBS9
PPG & ED**

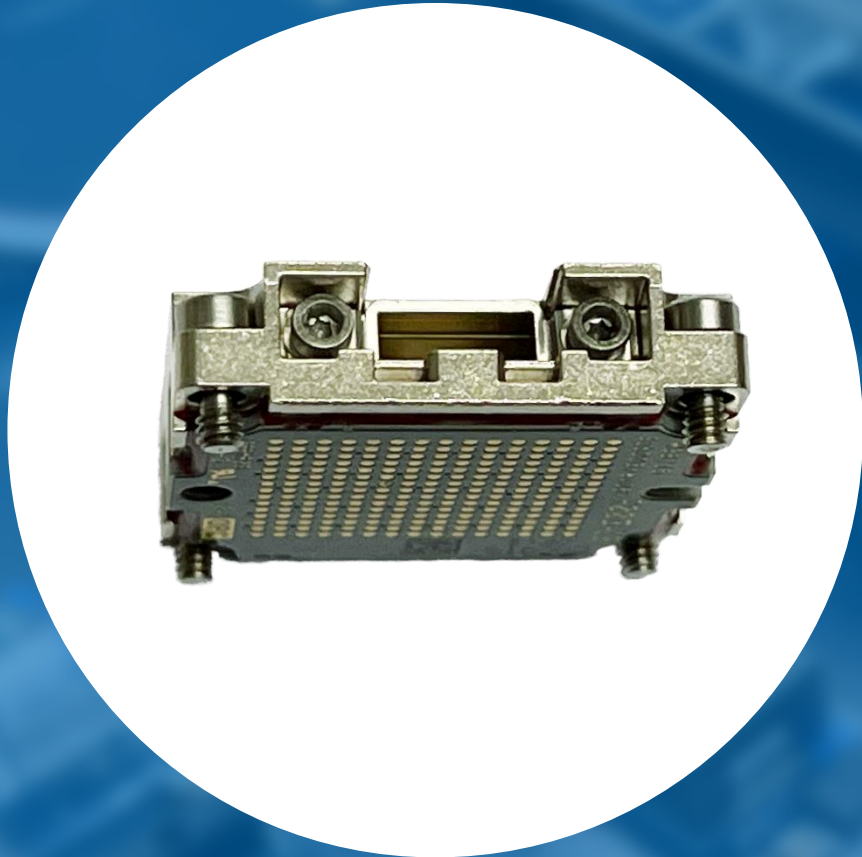
MECHANICAL INFO

**VARIOUS HEAT SINK
VERSIONS**

**PLUGGABLE
MT-24 FERRULE**

SOCKET MOUNTED

RUGGEDIZED ON-BOARD TRANSCEIVER



KEY FEATURES

12-channel duplex transceiver
1 to 16Gbps per channel (192Gbps aggregate data rate)
-40°C to 85°C operating case temperature
Standard MT-24 ferrule compatible
LGA mount (compatible with Amphenol LGA/BGA socket)

PERFORMANCE

12 CHANNELS

16GBPS

BER < 10⁻¹²

-40°C TO 85°C

P_{TYP.} = 3.5W

FEATURES

TX EQUALIZER
RX AMP. & DE-EMP.

DIGITAL MONITORING

MECHANICAL INFO

VARIOUS HEAT SINK
VERSIONS

PLUGGABLE
MT-24 FERRULE

SOCKET MOUNTED

SCFF COMMERCIAL VERSION



KEY FEATURES

single-channel duplex transceiver
1.25 to 28Gbps per channel*
0°C to 70°C operating case temperature
Standard duplex LC-connector
12-pin solderable proprietary connector

PERFORMANCE

1 CHANNEL

28GBPS

BER < 10⁻¹²

0°C TO 70°C

P_{MAX.} < 0.8W

FEATURES

INTEGRATED CDR

TX EQUALIZER
RX AMP. & DE-EMP.

DIGITAL MONITORING

MECHANICAL INFO

DIE-CASTED HOUSING

STANDARD DUPLEX LC

SOLDERABLE
CONNECTOR

* 10Gbps version available

SCFF RUGGEDIZED VERSION



KEY FEATURES

single-channel duplex transceiver
1.25 to 28Gbps per channel*
-40°C to 85°C operating case temperature
Standard duplex LC-connector
12-pin solderable proprietary connector

PERFORMANCE

1 CHANNEL

28GBPS

BER < 10⁻¹²

-40°C TO 85°C

P_{MAX.} < 1.1W

FEATURES

INTEGRATED CDR

TX EQUALIZER
RX AMP. & DE-EMP.

DIGITAL MONITORING

MECHANICAL INFO

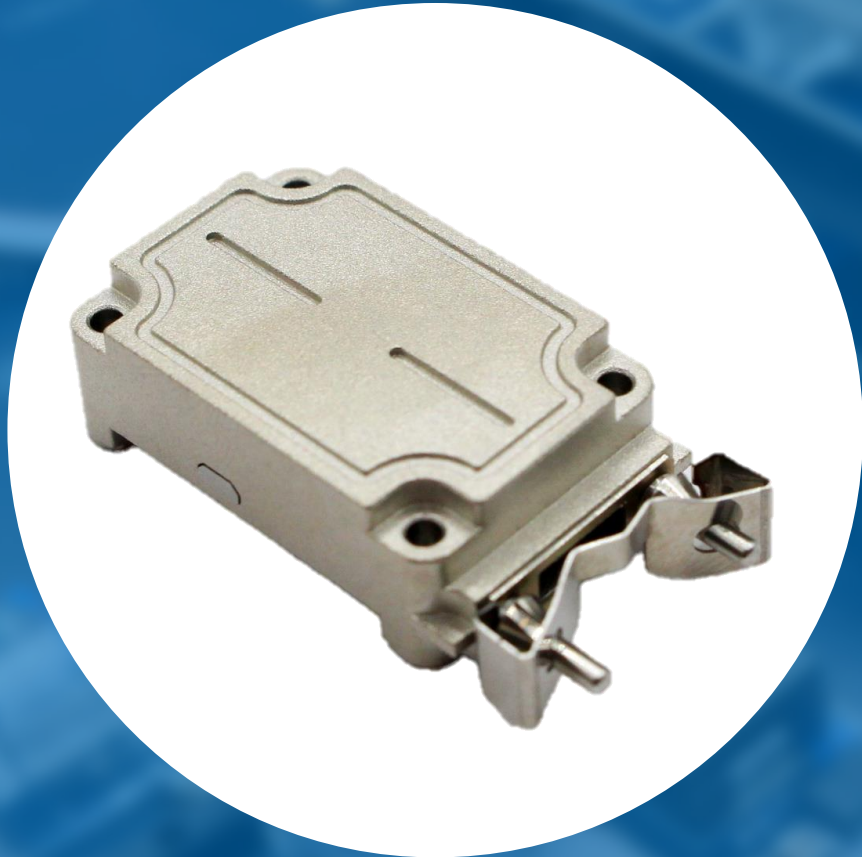
DIE-CASTED HOUSING

STANDARD DUPLEX LC

SOLDERABLE
CONNECTOR

* 10Gbps version available

QEPT100G NRZ



KEY FEATURES

4-channel duplex transceiver*
1.25 to 28Gbps per channel
-40°C to 85°C operating case temperature
Pluggable MT-12F ferrule
Hot-pluggable mezzanine mounted

PERFORMANCE

4 CHANNELS*

28GBPS

BER < 10⁻¹²

-40°C TO 85°C

P_{TYP.} = 1.6W

FEATURES

INTEGRATED CDR

TX EQUALIZER
RX AMP. & DE-EMP.

DIGITAL MONITORING

SPACE VERSION

MECHANICAL INFO

FLAT TOP OR HEAT SINK
VERSIONS

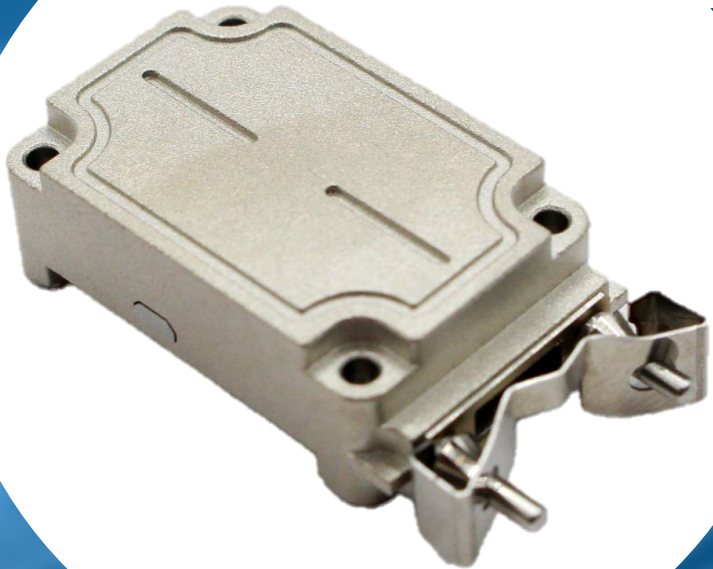
STANDARD MT-12
FERRULE

MEZZANINE
CONNECTOR

* Other versions in development (8-TX and 8-RX)

QEPT200G PAM4

COMING SOON



KEY FEATURES

4-channel duplex transceiver*
25Gbps NRZ and 56Gbps PAM4 per channel
0°C to 70°C operating case temperature
Pluggable MT-12F ferrule
Hot-pluggable mezzanine mounted

PERFORMANCE

4 CHANNELS*

56GBPS PAM4

BER < $2.4 \cdot 10^{-4}$

0°C TO 70°C

$P_{TYP.} = 3.0W$

FEATURES

INTEGRATED CDR

TX EQUALIZER
RX AMP. & DE-EMP.

DIGITAL MONITORING

INTERNAL PRBS13Q
PPG & ED

MECHANICAL INFO

FLAT TOP OR HEAT SINK
VERSIONS

STANDARD MT-12
FERRULE

MEZZANINE
CONNECTOR

* Other versions in development (8-TX and 8-RX)

CUSTOMER PRESENTATION

Customer Support

EVALUATION KITS

PRODUCT DESCRIPTION

Evaluation board including high-speed electrical I/O

Functional transceiver

USB to i²c adapter

Graphical User Interface software to access customer registers
Fiber Optics cable assemblies and RF cables available in option

AVAILABLE VERSIONS

LEAP® OBT 300G

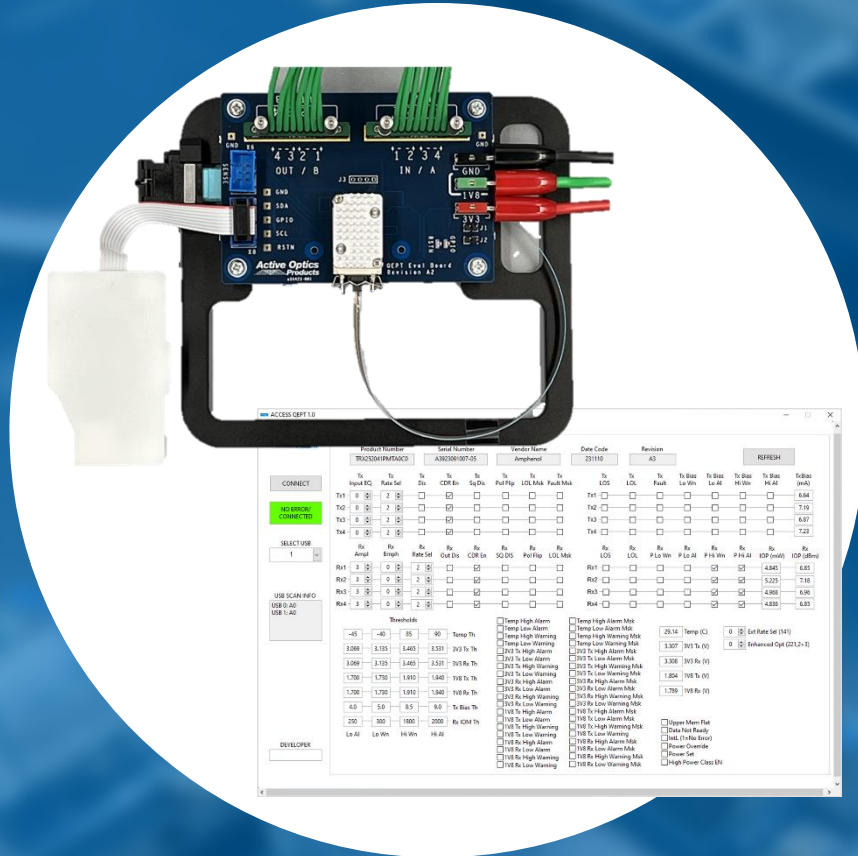
RUGGEDIZED OBT

SCFF COMMERCIAL VERSION

QEPT100G NRZ

SCFF RUGGEDIZED VERSION

QEPT200G PAM4*



* Coming soon

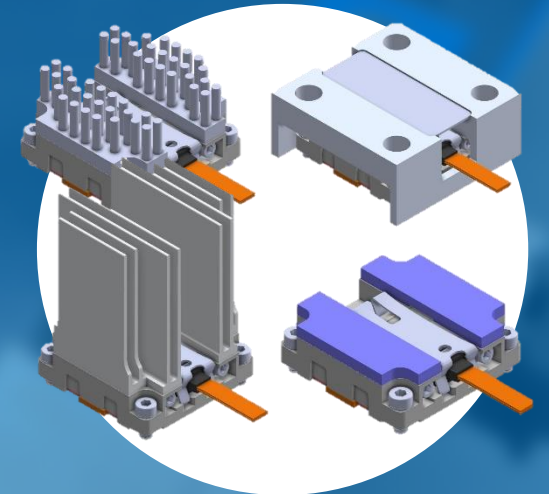
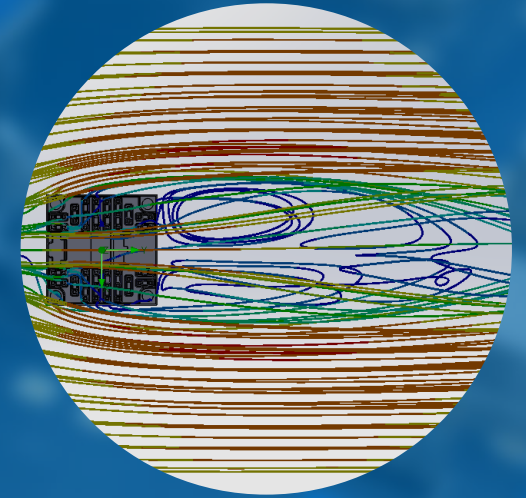
DESIGN-IN SUPPORT

OFFERING:

- PRODUCT DOCUMENTATION INCL. APPLICATION NOTES
- CUSTOMER DESIGN REVIEW
- REFERENCE DESIGN BASED ON EVALUATION BOARDS
- ENGINEERING TEAM EASILY REACHABLE
- THERMAL SIMULATION SUPPORT

"CUSTOMER ORIENTED" DESIGNS:

- CUSTOMER-FRIENDLY FUNCTIONALITIES IMPLEMENTED EARLY ON IN DESIGN PHASE
- CUSTOMIZED HEAT-SINK DESIGNS
- FIELD FW UPGRADE, BIT ERROR RATE GENERATION OR TEST INCLUDED IN SOME TRANSCEIVERS

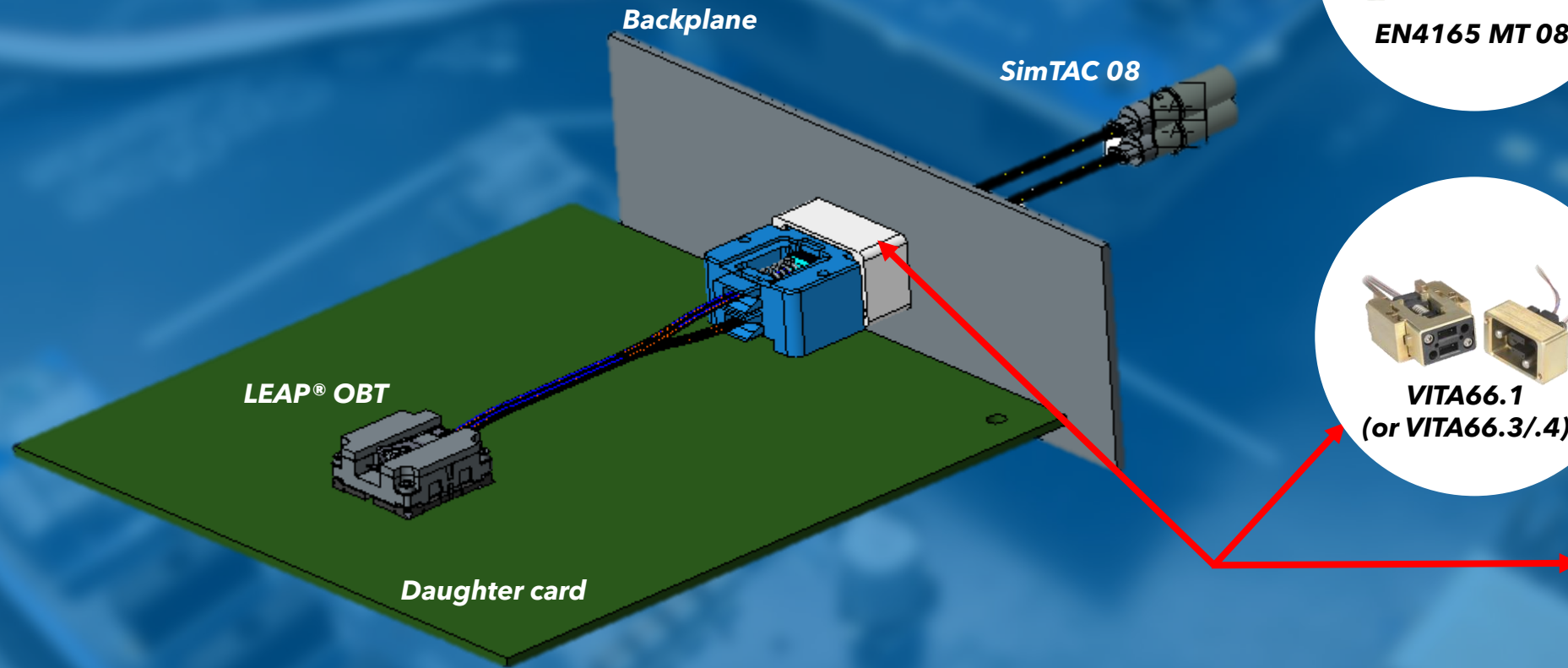


CUSTOMER PRESENTATION

Fiber Optics End-to-End Solutions

AHES FO END-TO-END SOLUTIONS

RECTANGULAR INTERCONNECTS



EN4165 MT 08



**ARINC600
MT 08**



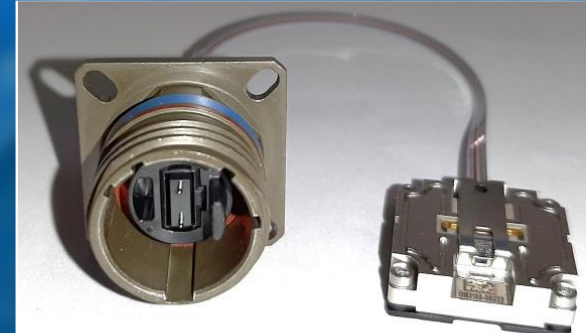
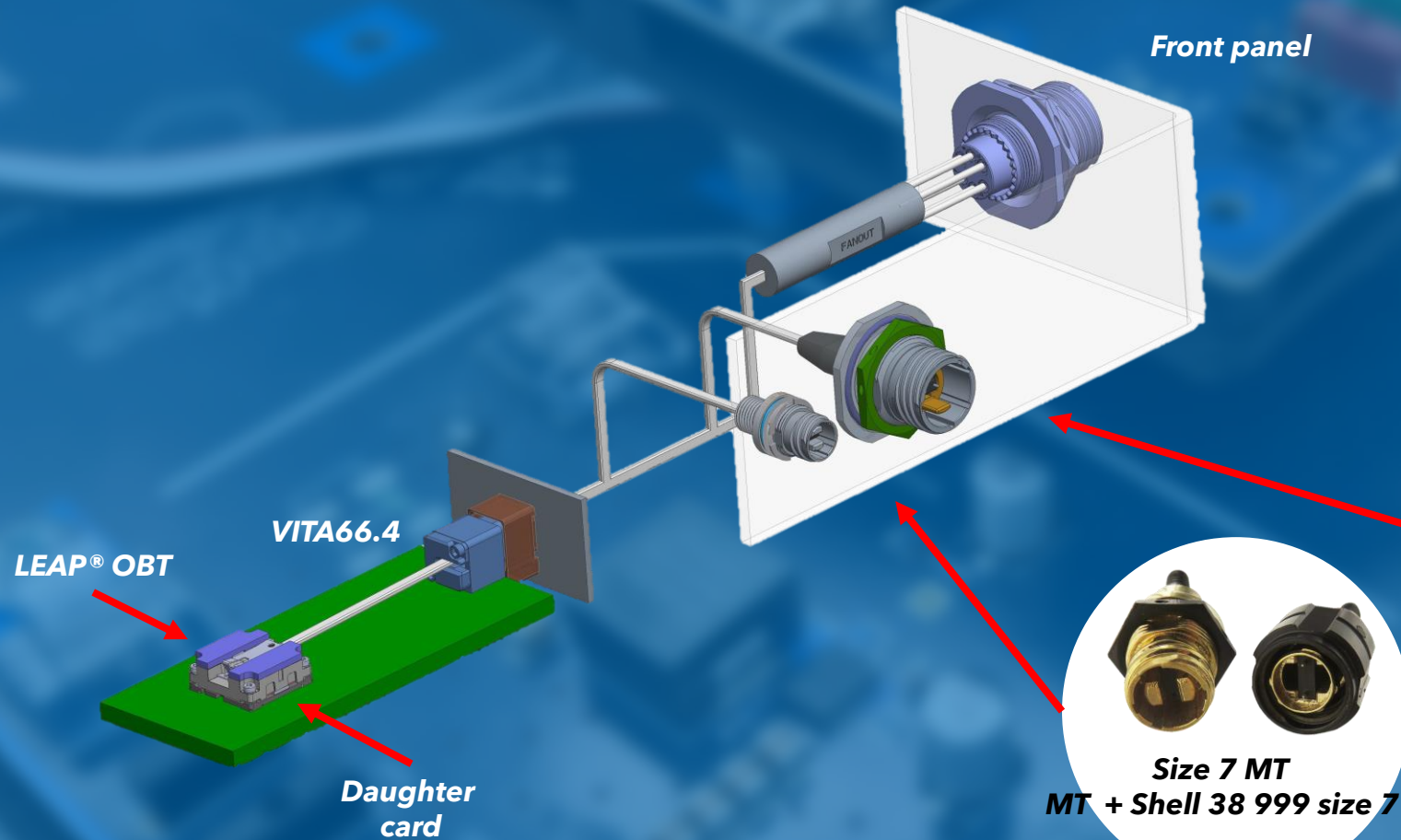
**VITA66.1
(or VITA66.3/.4)**



Micro-MT

AHES FO END-TO-END SOLUTIONS

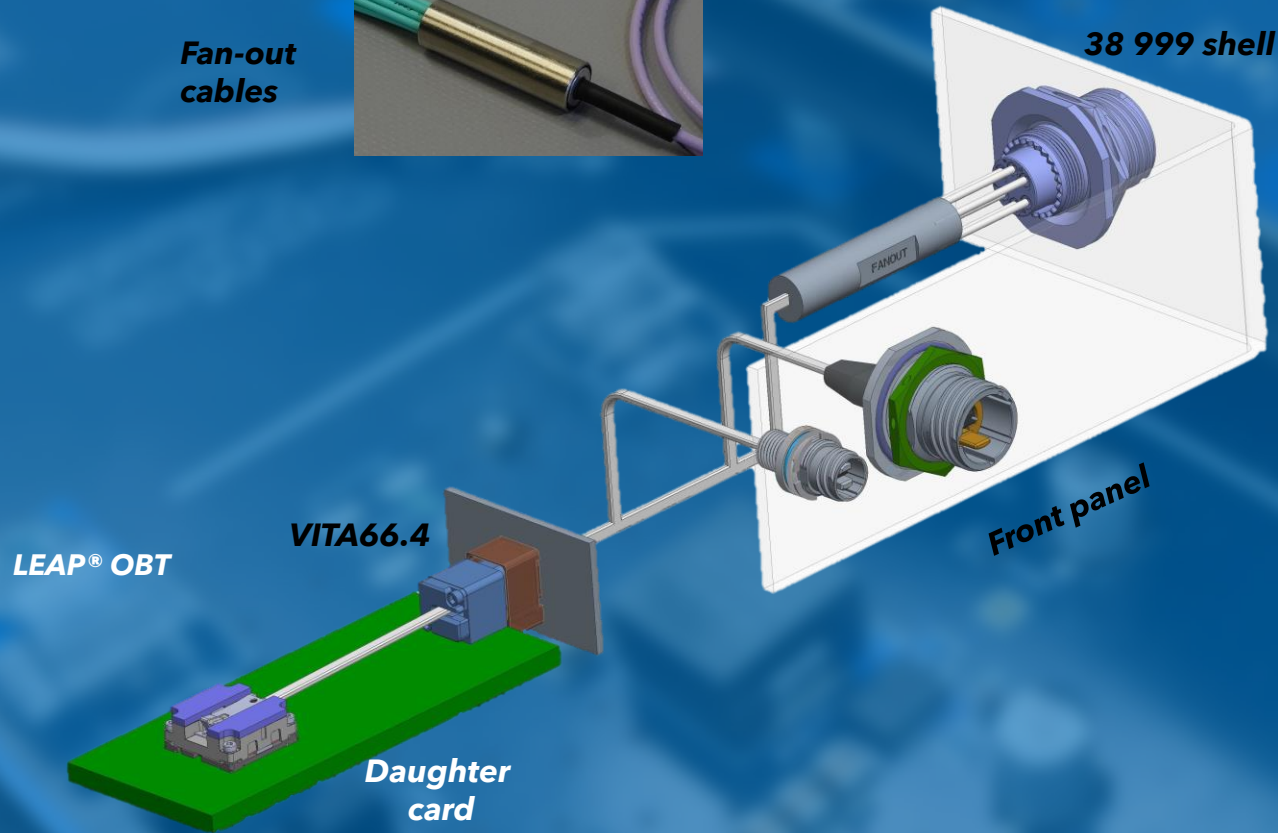
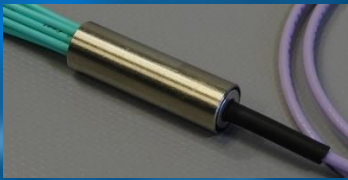
CIRCULAR INTERCONNECTS



AHES FO END-TO-END SOLUTIONS

CIRCULAR INTERCONNECTS

Fan-out cables



TV + 29504/4 & /5
38 999 shell
ceramic optical termini 29504 (butt joint)



38 999 LUX-BEAM
38999 + Optical termini
Luxbeam #16 EN4869
Expanded beam termini



ARINC 801
38 999 shell, ARINC 801 insert
ceramic optical termini 1,25mm (butt joint)

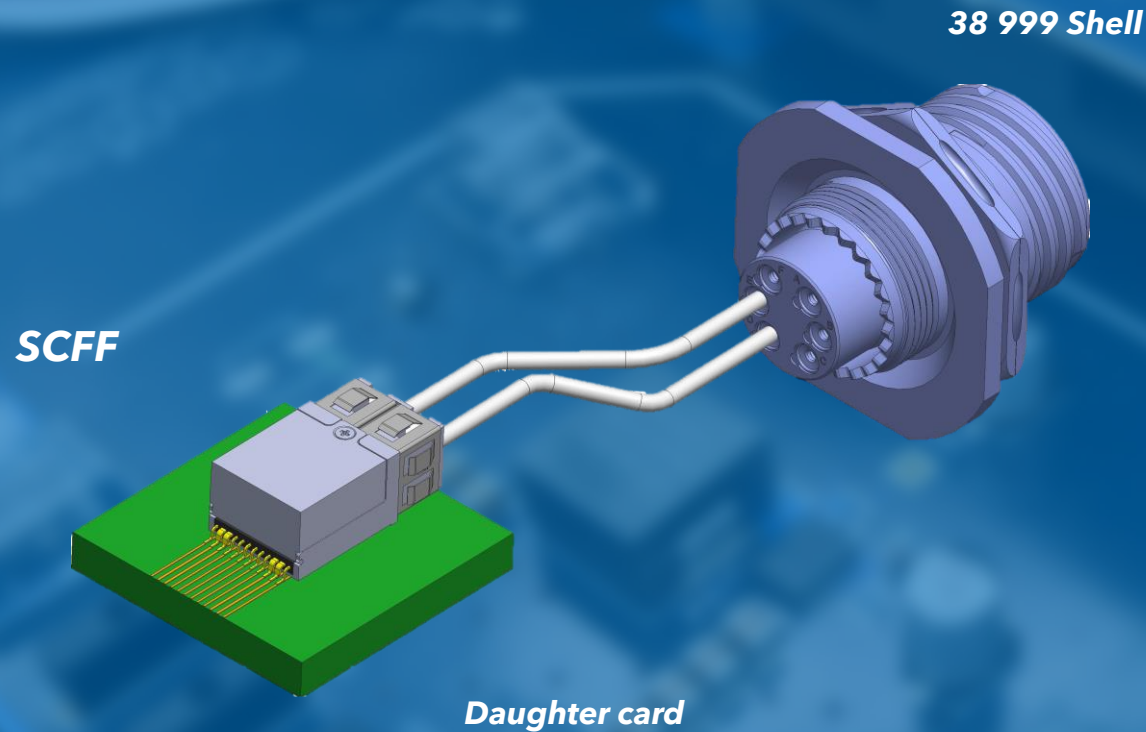


TVOP
38 999 shell
Ceramic optical termini 2,5mm (butt joint)



AHES FO END-TO-END SOLUTIONS

SCFF-BASED EXAMPLES



NGCON
M64266



LC Field



Double LuxBeam



VITA INTEGRATION



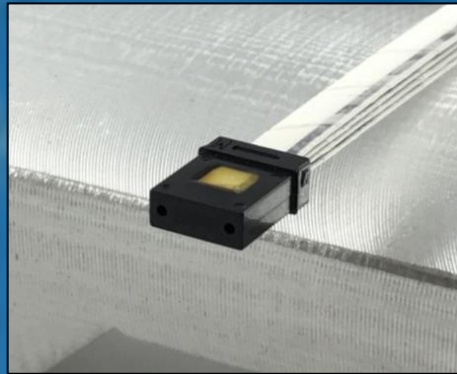
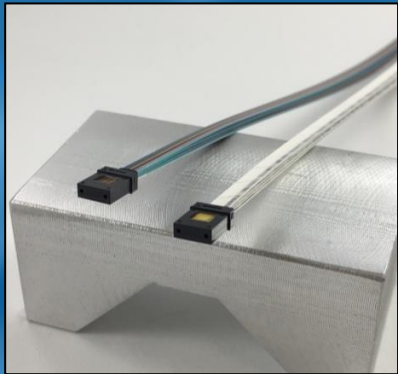
RF & OPTICS INTEGRATED INTO VITA

- VITA 67 contain RF and Fiber hybrid for first time
 - Amphenol collaborative demo kit
- Support for 3 (2 x 24) fiber channels and 19 RF
 - Current draft in VITA 66.5 limits MT locations

AHES FO END-TO-END SOLUTIONS

HARSH ENVIRONMENT FO CABLING SOLUTIONS

THDM to MTP
24 Channels crossover



MT Ferrule 48Channels
Termination capabilities

MT38999 to M29504/04
Short Fanout assembly



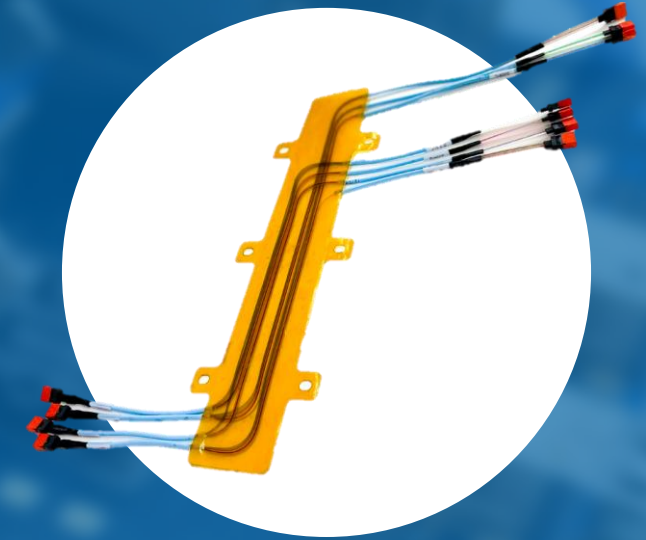
MT38999 to FC connector
Loop back (2 channels) + right angle back shell

AHES FO END-TO-END SOLUTIONS

OPTICAL FLEX PLANES

PRODUCT SPECIFICATION:

- Ideal for high density applications
- Can be designed for routing around Board Level components
- Improves Airflow for cooling vs Traditional cable approach
- Temp Range -55 to +95C
- Flame resistant substrate



Amphenol *Active Optics Products*

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