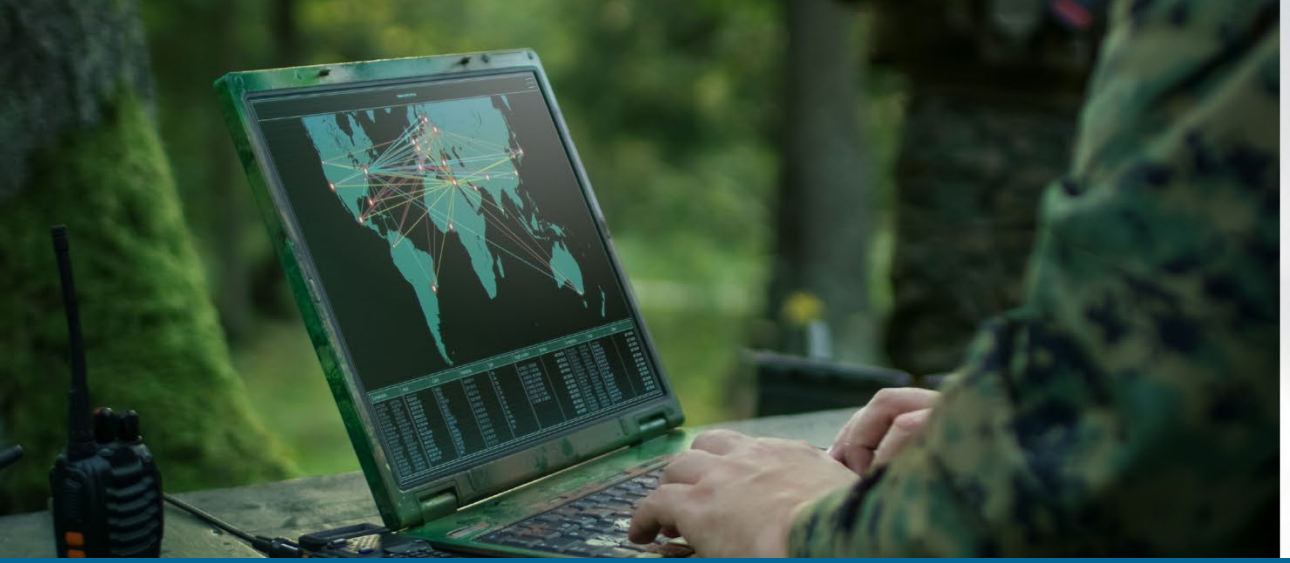


High-Performance COTS Optical Interconnects for Military / Aerospace Applications

Kevin Burt

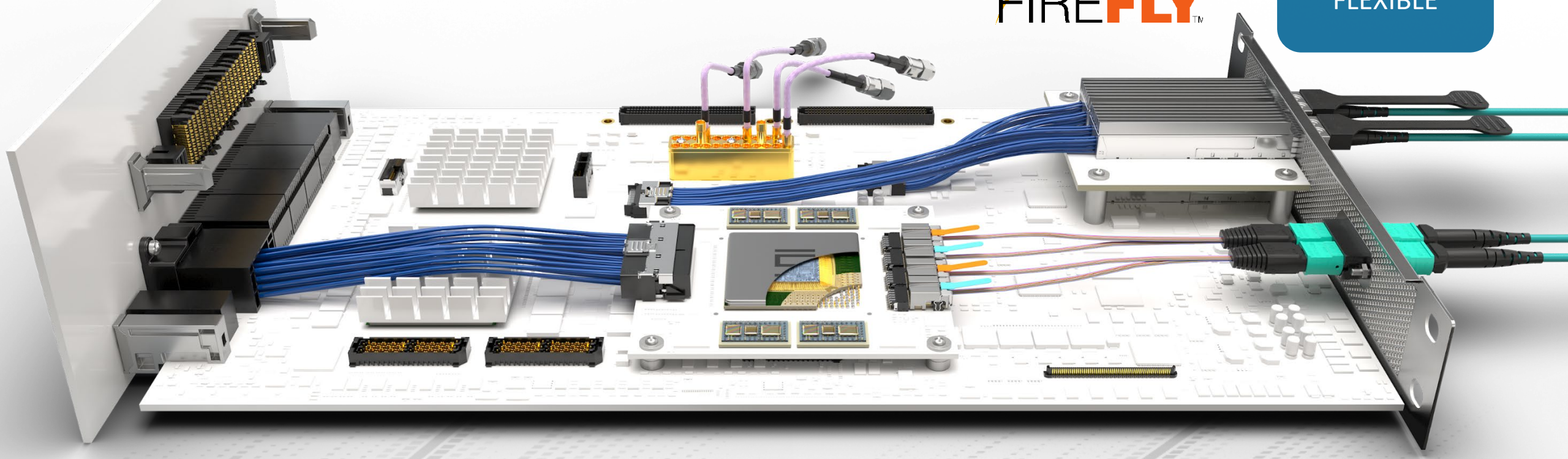
FIREFLY™ EMBEDDED OPTICAL MODULES

- Advantages of On-Board Optics (OBO)
- Options & Customization
- Harsh Environment Support
- Summary

RUGGED

SERVICEABLE

FLEXIBLE

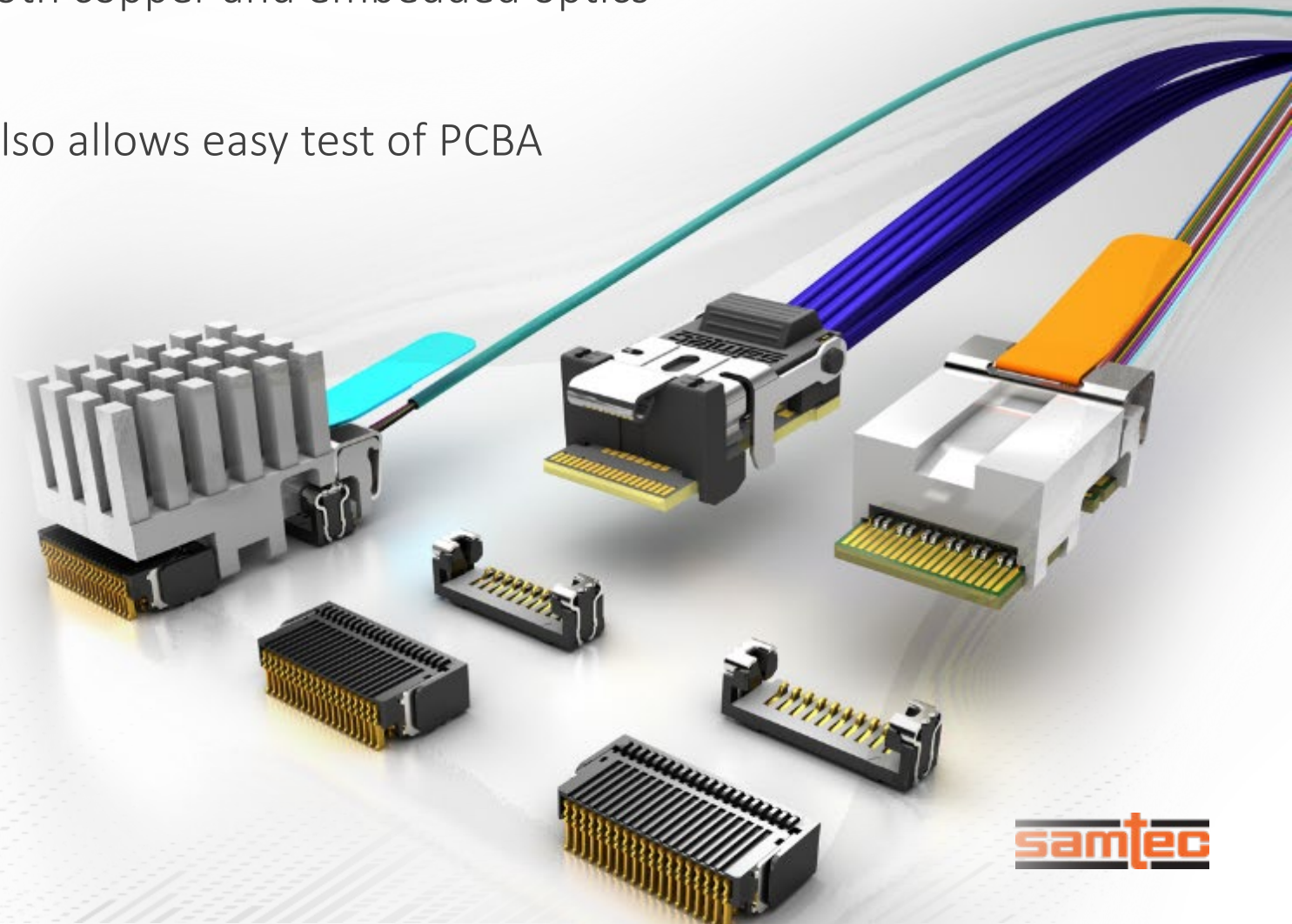


samtec

FIREFLY INTERCHANGEABLE COPPER & OPTICS

- Samtec is the only company to offer both copper and embedded optics in the same footprint
- In addition to the design flexibility, it also allows easy test of PCBA before the optics are added

Both Modules Fit in the Same Connector System



SAMTEC FIREFLY™ ADVANTAGES

- FireFly™ On Board Optics Has a Large Commercial Customer Base
  - FPGA, Automated Test Equipment, ASIC, Supercomputing, Industrial, and Medical applications
  - Optical PCIe®
- The Commercial FireFly™ Business (COTS) Gives Us Volume
  - Wide range of products (x4, x12), environmental ratings and speeds (up to 28G)
  - Easier for us to ramp when volumes take off
  - More experience and better statistics for reliability and lifetime
  - Incentives to continually improve yields, processes and components
- Product Portfolio Includes Extended Temperature & Ruggedized Products
  - Large range of options and customization
  - Offer a wide range of Mil/Aero products, including Flyover® cables

FLEXIBILITY MODULAR DESIGN

MULTIPLE DATA RATES
10G
14/16G
25/28G

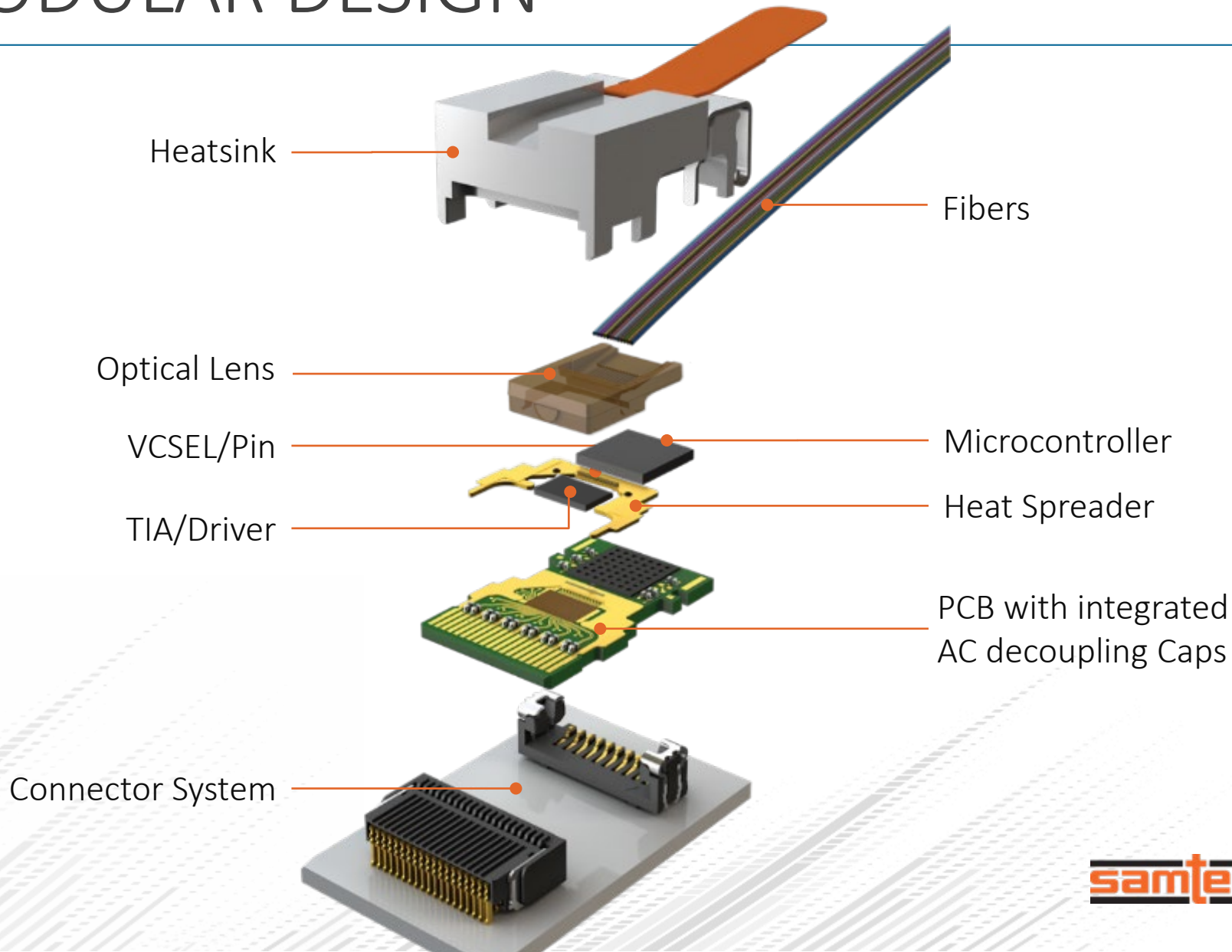
NUMBER OF CHANNELS
x4 duplex
x12 simplex

SPECIALTY PROTOCOLS
PCIe® over Fiber

HEATSINKING

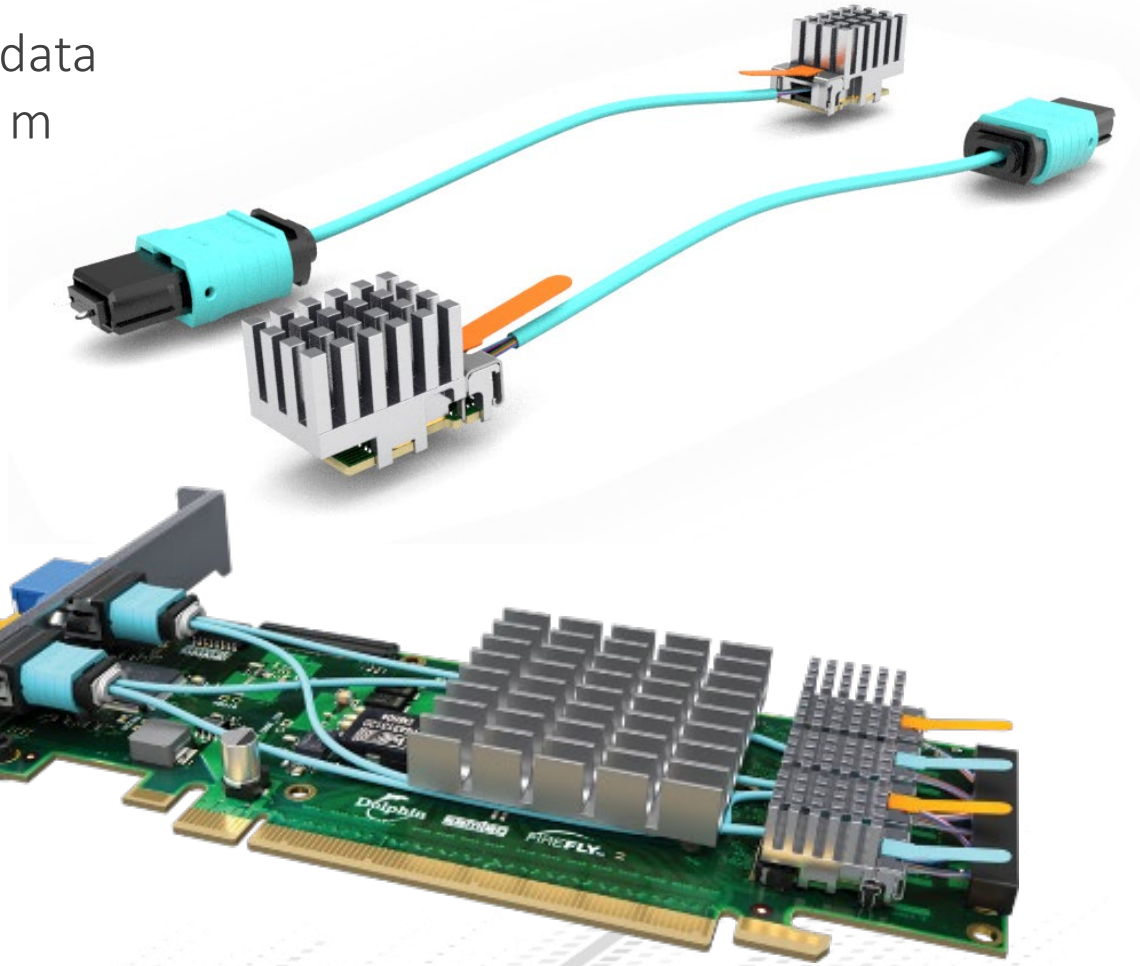
FIBER TYPES

OPTICAL CONNECTORS



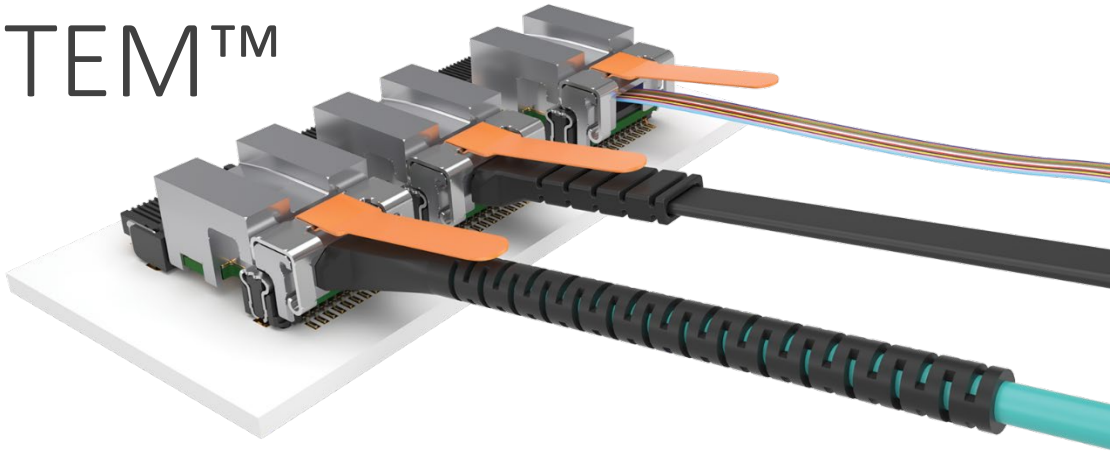
FLEXIBILITY PCIE® OVER FIBER – PCIE®4.0

- Transmits PCIe® signals at PCIE® 1.0/2.0/3.0/4.0 data transfer rates through FireFly™ optical up to 100 m
- Supports PCIe® protocol for low latency, power savings and guaranteed transmission
- Transparent and non-transparent bridging
- Easy design enables compact end points
- Full system support includes a transparent and non-transparent add-in extension cards supporting x4 links up to four x4 / dual x8 / x16 links



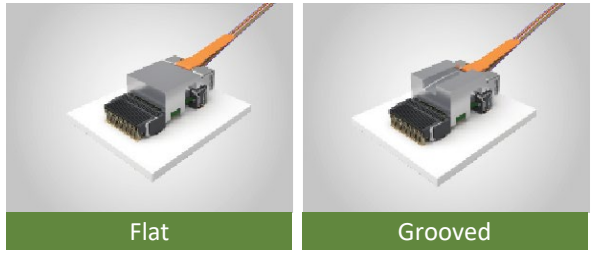
FIREFLY™ MICRO FLYOVER SYSTEM™

Multiple Fiber constructions supported
including non-PVC, high temperature protection



HEAT SINK FLEXIBILITY

Conduction Cooling



Flat | Grooved

Groove allows ribbon cables to pass through so FireFly™ can be placed closer together

Convection Cooling

PCIe® Pin-Fin | Standard Pin-Fin | High-Performance

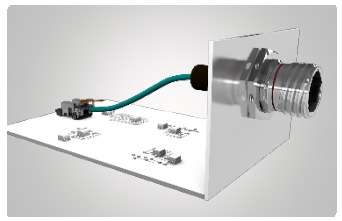
PCIe® card height compliant

Accommodates applications with specific power and temperature requirements

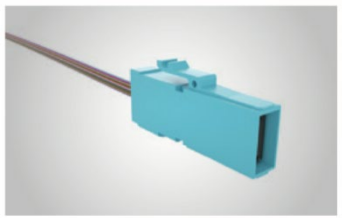
END OPTION FLEXIBILITY

MPO (MTP®)
High-density connectors for panel applications and minimal keep-out areas on the board

MT
Low insertion force connectors for high-density cabling and backplane applications

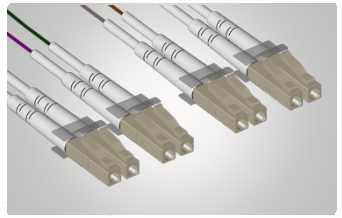


MT 38999



MXC®
High-density connectors for front panel or backplane applications

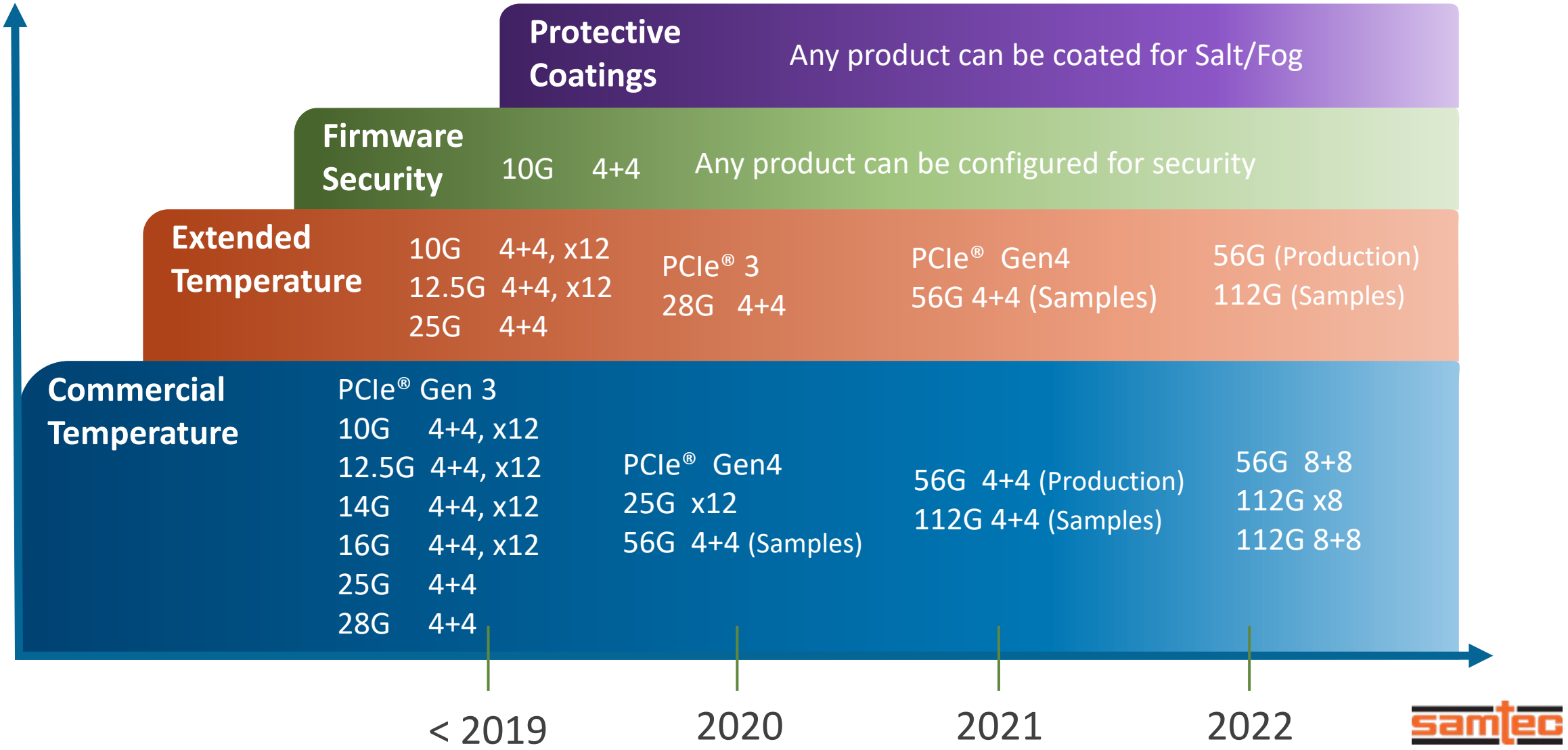
ARIB STD-B58 Interface
BNC-type connector with optical MT ferrule for ultra-high density applications



LC "Octopus"

samtec

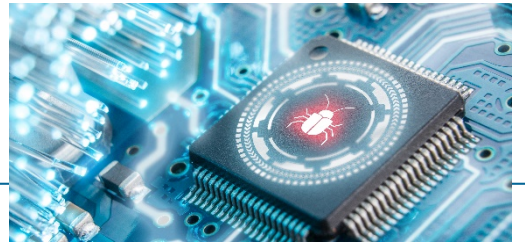
COTS ROADMAP FOR HARSH ENVIRONMENTS



samtec

FIRMWARE SECURITY

THE SOFT BATTLEFIELD



New technology enables new threats to system security

- Viruses / Ransomware / Phishing / leaks

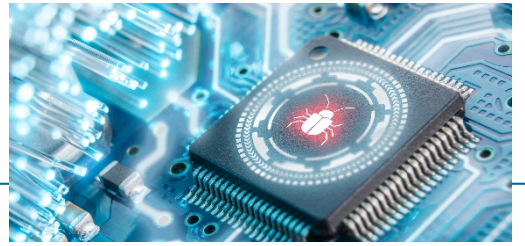
Supply chains are also under threat:

- 2000: compromised Nortel systems in White House
- 2018: Reports of Lenovo servers having extra chips inserted during manufacturing

Nation state level attacks this sophisticated need people to think differently:

- Can subcomponents be used to compromise classified systems/data?
- Can subcomponents be used to hack data buses / systems?

MARKET **REQUIREMENTS**



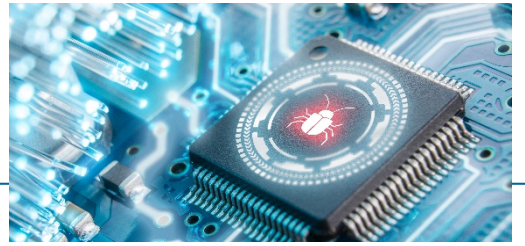
No customer/end system access to Non-Volatile Memory

No third-party access to microprocessor or memory

Ability to sanitise storage

- “NSA Erase”
- “DoD Erase”

COMMERCIAL CHALLENGES - **ACCESS**



NVM Access

- Manufacturing back doors
- Customer passwords

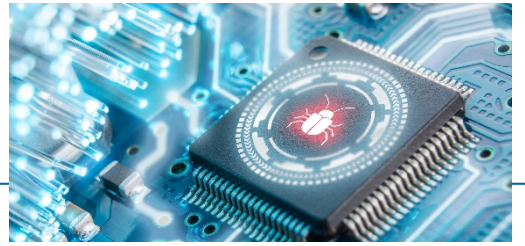
Microprocessor Access

- JTAG / PDI Interface
- Wipe / Erase

Third Party Access

- Field Upgradeable firmware
- GIT

COMMERCIAL CHALLENGES - **ERASE**



Field Upgradeable Firmware

- Bootloader

Microprocessor Erase Function

- Erase all ≠ Erase All

Commercial first approach

- Applications do not like to erase themselves

CONCLUSIONS

SUMMARY

Commercial first approach has many benefits

- Volume market drives volume which reduces cost
- Enables more options
  - Bandwidth
  - Heatsinking
  - Optical Connectivity

Also leads to security challenges

- Firmware development
- Component Selection
- Firmware Architecture
- Back doors
- Operational security

These can all be solved, however needs a robust approach

kevin.burt@samtec.com