

IXIA Xcellon-Multis Load Modules

This chapter provides details about Xcellon-Multis family of load modules—specifications and features.

Xcellon-Multis is a new, next generation, high density, tri-speed, 100/40GE load module (i.e. NG 100GE) family of products. This load module family comprises the industry's highest density 40G and 100G higher speed Ethernet (HSE) test equipment, providing more flexible test coverage and 4x100GE, 12x40GE, or dual-rate 40GE/100GE, all in a single-slot load module. This is done using cable fan-out technology. Fan-out technology allows a higher speed port to fan-out to several ports of lower speed thus enabling you to have multiple speeds from a single port and higher port densities per chassis.

The Xcellon-Multis card has four Ethernet ports with 100GE speeds. The card has a transceiver corresponding to each port. In each port, you can insert a fan-out cable, which fans the output into multiple ports.

Xcellon-Multis supports the following:

- 4 x 100GE CXP ports per slot – 2x Xcellon-Lava.
- 12 x 40GE QSFP+ ports per slot – 3x Xcellon-Flex.
- 48x100GE or 144x40GEports per XG12 chassis.
- Broad Layer 23 protocol coverage.
- Multimode fiber support.

Key Features

The key features of Xcellon-Multis load modules are as follows:

Highest density

Xcellon-Multis comprises three CXP-based load modules in a single chassis slot

- 4x100GE only
- 12x40GE only, using fan-out technology
- Dual-rate 4x100GE and 12x40GE, using fan-out technology

Fan-out technology

- Provides high-density interfaces over multiple speeds.
- Increases interface flexibility.
- Facilitates a wide range of interoperability testing.

Multi-personality

- Supports 100/40GE speeds, all-in-one high density load module.
- Supports multiple interface types: CXP, QSFP interfaces.
- Facilitates multi-speed tests on a single card.

Layers 2-7 coverage

- Supports mid-range-to-high-scale protocol testing for L2-3 routing/switching and data center test cases.
- Provides L4-7 capability for all cards.

Same feature set across all speeds

- Provides data plane features for 100/40GE testing.
- Provides L23 protocol coverage for 100/40GE testing.

Load Modules

The Xcellon-Multis family consists of the following models on a single slot card:

- CXP, 100GE single rate module that has 4-ports of 100GE CXP, which is the highest density 100GE test module.
- CXP 100/40GE dual rate module that has 4-ports of 100GE CXP 12-ports of 40GE QSFP+ (using fan-out technology) providing the highest density 40GE test module test module.
- 12-ports of 40GE QSFP+ (using fan-out technology) providing the highest density 40GE test module test module.

Each of these load modules are described as follows:

XM100GE4CXP

Xcellon-Multis XM100GE4CXP is a 100-Gigabit Ethernet, single rate load module. It has 1-slot with 4-ports native CXP interfaces. It provides L2-7 support and is compatible with XM12 HP rackmount, XM2 desktop, and XG12 rackmount chassis.

You need to select one or more of the following per port:

- 948-0030 CXP 100GE pluggable
- Optical transceivers
- 942-0035 MTP-MTP 24-fiber multimode fiber cable, or point-to-point CXP Active Optical Cable (AOC)

The XM100GE4CXP load module is shown in the following figure:

Figure 35-1. Xcellon-Multis Module-XM100GE4CXP



XM100GE4CXP +FAN

Xcellon-Multis XM100GE4CXP+FAN is a 100/40-Gigabit Ethernet, dual rate load module. It has 1-slot with 4-ports native CXP interfaces and up to 12-ports of 40GE via fan-out cables. It provides L2-7 support and is compatible with XM12 HP rackmount, XM2 desktop, and XG12 rackmount chassis.

You can select one or more of the available media per port of the following:

- 948-0030 CXP 100GE pluggable, optical transceivers.

- 942-0035 MTP-MTP 24-fiber multimode fiber cable, or point-to-point CXP Active Optical Cable (AOC), or CXP-to-3x40GE QSFP Active Optical Cable (AOC) for 3x40GE fan-out, or MTP-to-MTP passive fiber for 3x40GE Fan-out. This cable may be used with 948-0028 QSFP 40GBASE-SR4 transceivers. The XM100GE4CXP+FAN load module is shown in the following figure:

Figure 35-2. Xcellon-Multis Module-XM100GE4CXP+FAN



XM40GE12QSFP+FAN

Xcellon-Multis XM40GE12QSFP+FAN is a 40-Gigabit Ethernet load module. It has 1-slot with 12-ports of 40GE via fan-out cables and provides L2-7 support.

A quantity of 4 each, 3-meter CXP-to-3x40GE QSFP fan-out cables (942-0054) are available with this load module. This is compatible with XM12 HP rackmount, XM2 desktop, and XG12 rackmount chassis.

The XM40GE12QSFP+FAN load module is shown in the following figure:

Figure 35-3. Xcellon-Multis Module-XM40GE12QSFP+FAN



Part Numbers

Part Numbers for Xcellon-Multis Load Module and Supported Adapters are provided in the following table.

Table 35-1. Part Numbers for Xcellon-Multis Modules

Model Number	Part Number	Description
XM100GE4CXP	944-1100	<ul style="list-style-type: none">• 4-ports of 100GE with the CXP physical interface.• 100GE only.• Does not have 40GE or fan-out of 40GE.
XM100GE4CXP+FAN	944-1101	<ul style="list-style-type: none">• 4-ports of 100GE and upto 12 ports of 40GE with CXP physical interface (3x40GE fan-out x 4 ports).• 100GE and 40GE.• 40GE fan-out capable (3x40GE).
XM40GE12QSFP+FAN	944-1102	<ul style="list-style-type: none">• 12-port 40GE with QSFP physical interface.• 40GE only.• 100GE speed is disabled on all 4-ports.

Specifications

The load module specifications are contained in [Table 35-2](#).

Table 35-2. Xcellon-Multis Load Module Specifications

Feature	Xcellon-Multis (100 GE only)	Xcellon-Multis (100/40GE combo)	Xcellon-Multis (40GE only)
Load Modules	XM100GE4CXP	XM100GE4CXP+FAN	XM40GE12QSFP+FAN
Hardware Load Module Specifications			
Slot/Ports	1-slot / 4x100GE ports	1-slot / 4x100GE and 12x40GE ports	1-slot / 12x40GE ports
Physical Interface	CXP native	CXP 4x100GE (native) QSFP 12x40GE (fan-out)	12, via fan-out
Chassis Capacity: Maximum Number of Cards and Ports per Chassis Model			
XG12 Chassis (940-0005)	12 cards: <ul style="list-style-type: none"> 48-ports of 100GE 	12 cards: <ul style="list-style-type: none"> 48-ports of 100GE 144-ports of 40GE 	12 cards: <ul style="list-style-type: none"> 144-ports of 40GE
XM12 HP Chassis (941-0009)	8 cards: <ul style="list-style-type: none"> 32-ports of 100GE 	8 cards: <ul style="list-style-type: none"> 32-ports of 100GE 96-ports of 40GE 	8 cards: <ul style="list-style-type: none"> 96-ports of 40GE
XM2 Chassis (941-0003)	1 card: <ul style="list-style-type: none"> 4-ports of 100GE 	1 card: <ul style="list-style-type: none"> 4-ports of 100GE 2-ports of 40GE 	1 card: <ul style="list-style-type: none"> 12-ports of 40GE
CPU and Memory	Multicore processors with 4GB of memory per processor		
IEEE802.3ba-2010 Interface Protocols	100GBASE-SR10	100GBASE-SR10 40GBASE-SR4	40GBASE-SR4
Transceiver Support	Pluggable CXP, 12-lane, MMF for 100GE operation	Pluggable CXP, 12-lane, MMF for 100GE operation QSFP+ MSA	QSFP+ MSA
Operating Temperature Range	41°F to 95°F (5°C to 35°C), ambient air		
Load Module Dimensions	16.0" (L) x 12.0" (W) x 1.3" (H) 406mm (L) x 305mm (W) x 33mm (H)		
Transmit Feature Specifications			
Transmit Engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures		
Max. Streams per Port	100GE: 128	100GE: 128 40GE: 32 / fan-out link	40GE: 32 / fan-out link

Feature	Xcellon-Multis (100 GE only)	Xcellon-Multis (100/40GE combo)	Xcellon-Multis (40GE only)
Max. Streams per Port in Data Center Ethernet	Supported	Supported	Supported
Stream Controls	Rate and frame size change on the fly, sequential and advanced stream scheduler		
Minimum Frame Size	100GE: <ul style="list-style-type: none"> • 60 bytes (line rate) • 49 bytes (< line rate) 	100GE: <ul style="list-style-type: none"> • 60 bytes (line rate) • 49 bytes (< line rate) 40GE: <ul style="list-style-type: none"> • 64 bytes (line rate) • 49 bytes (< line rate) 	40GE: <ul style="list-style-type: none"> • 64 bytes (line rate) • 49 bytes (< line rate)
Maximum Frame Size	14,000 bytes		
Maximum Frame Size in Data Center Ethernet	9,216 bytes		
Priority Flow Control	18 line-rate-capable queues with each supporting up to 2,500 byte frame lengths 1 queue supporting up to 9,216 byte frame lengths		
Frame Length Controls	Fixed, increment by user-defined step, weighted pairs, uniform, repeatable random, IMIX, and Quad Gaussian		
User defined fields (UDF)	Fixed, increment or decrement by user-defined step, sequence, value list, and random configurations. Up to ten, 32-bit wide UDFs are available.		
Value Lists (max.)	4 million / UDF	100GE: 4 million / UDF 40GE: 1 million / UDF	40GE: 1 million / UDF
Sequence (max.)	256K / UDF	100GE: 256K / UDF 40GE: 64K / UDF	40GE: 64K / UDF
Error Generation	Generate good CRC or force bad CRC, undersize and oversize standard Ethernet frame lengths, and bad checksum		
Hardware Checksum Generation	Checksum generation and verification for IPv4, IP over IP, IGMP/GRE/TCP/UDP, L2TP, GTP		
Link Fault Signaling	Reports, no fault, remote fault, and local fault port statistics		
Latency Measurement Resolution	100GE: 2.5 nanoseconds	100GE: 2.5 nanoseconds 40GE: 2.5 nanoseconds	40GE: 2.5 nanoseconds
Intrinsic Latency Compensation	Removes inherent latency error from 40GE or 100GE port electronics		
Transmit line clock adjustment	Ability to adjust the parts per million line frequency over a range of -100 ppm to +100 ppm per resource group		

Feature	Xcellon-Multis (100 GE only)	Xcellon-Multis (100/40GE combo)	Xcellon-Multis (40GE only)
Receive Feature Specifications			
Receive Engine	Wire-speed packet filtering, capturing, real-time latency and inter-arrival time for each packet group, with data integrity, sequence and advanced sequence checking capability		
Trackable Receive Flows per Port	100GE: 512K	100GE: 512K 40GE: 128K	40GE: 128K
Minimum Frame Size	64 bytes at line rate ≥ 49 bytes not a line rate		
Filters (User-Defined Statistics, UDS)	2 SA/DA pattern matchers, 2x16-byte user-definable patterns with offsets capability for start of: frame, IP, or protocol. Up to 6 UDS counters are available		
Hardware Capture Buffer per Port or Resource Group	100GE: 2GB	100GE: 2GB 40GE: 2GB per 1, user-selected link of the 3x40GE fan-out link resource group	40GE: 2GB per 1, user-selected link of the 3x40GE fan-out link resource group
Statistics and Rates	Link state, line speed, frames sent, valid frames received, bytes sent/received, fragments, undersize, oversize, CRC errors, VLAN tagged frames, 6 user-defined stats, capture trigger (UDS 3), capture filter (UDS 4), 8 QoS counters, data integrity frames, data integrity errors, sequence and advanced sequence checking frames, sequence checking errors, ARP, and PING requests and replies		
PCS Lanes Port Statistics	PCS Sync Errors, Illegal Codes, Remote Faults, Local Faults, Illegal Ordered Set, Illegal Idle, Illegal SOF, Out Of Order SOF, Out Of Order EOF, Out Of Order Data, Out Of Order Ordered Set		
Latency / Jitter Measurements	Cut-through, store & forward, forwarding delay, up to 16 time bins latency/jitter, MEF jitter, and inter-arrival time		
L2/3 Routing, Bridging, and Timing	<p>Routing: RIP, RIPng, OSPFv2/v3, ISISv4/v6, EIGRP, EIGRPv6, BGP/BGP+</p> <p>MPLS: RSVP-TE, RSVP-TE P2MP, LDP, mLDP, BGP RFC 3107, MPLS-TP, MPLS OAM</p> <p>MPLS VPN: L2VPN PW, L3VPN/6VPE, 6PE, VPLS-LDP, VPLS-BGP, VPLS-BGP AD and LDP FEC 129, Inter-AS VPN Option A, B, and C, Seamless MPLS, Carrier Supporting Carrier (CsC), GRE mVPN, NG MVP (mLDP and RSVP-TE P2MP), EVPN/PBB-EVPN</p> <p>High-Availability: BFD, Graceful Restart, MPLS Ping/TraceRoute, LSP BFD, VCCV BFD, Real-time dynamic label swap for convergence time measurement up to millisecond accuracy</p> <p>IP Multicast: IGMPv1/v2/v3, MLDv1/v2, PIM-SM/SSM, PIM-BSR, multicast VPN</p> <p>Switching: STP/RSTP, MSTP, PVST+/RPVST+, LACP, LLDP, Protocols over LACP Bundle</p> <p>Carrier Ethernet: Link OAM, CFM, Service OAM, PBT/PBB-TE, SyncE, PTP (1588v2), E-LMI</p>		

Feature	Xcellon-Multis (100 GE only)	Xcellon-Multis (100/40GE combo)	Xcellon-Multis (40GE only)
Data Center Ethernet	Priority Class-Based Flow Control (IEEE802.1Qbb), FCoE/ FIP, LLDP/DCBX, VNTAG/ VIC, OpenFlow, FabricPath, TRILL, SPBM, VEPA, VXLAN		
Broadband Access	Broadband: ANCP, PPPoX, DHCPv4 client/server, DHCPv6 client/server, L2TPv2, Radius Attributes for L2TP, Dual-Stack PPPoX, AMT Authentication: 802.1x, WebAuth, Cisco NAC		

Application Support

The Ixia application support for Xcellon-Multis CXP load modules is provided in the following table:

Table 35-3. Xcellon-Multis Application Support

Application	Support
IxNetwork	Provides wire-rate traffic generation with service modeling that builds realistic, dynamically-controllable data-plane traffic. IxNetwork offers the industry's best test solution for functional and performance testing by using comprehensive emulation for routing, switching, MPLS, IP multicast, broadband, authentication, Carrier Ethernet, and data center Ethernet protocols.
IxAutomate	IxAutomate application offers a powerful, customizable test tool to automate the performance, scalability, and functional testing of network devices. IxAutomate provides a simple to use graphical user interface (GUI) to configure custom automated test scenarios and analyze test results. IxAutomate provides a rich suite of pre-built tests based on industry-standard RFCs and customer requirements.
Tcl API	Custom user script development for layer 1-7 testing.

Mechanical Specifications

Front Panel

The Front panel of Xcellon-Multis load module is shown in the following figure:

Figure 35-4. Front panel of Xcellon-Multis



Led Panel

The LED panel specifications are provided in the following table.

Table 35-4. Led panel Specifications of XM100GE4CXP Load Module

Feature	Specification
Tx Status	<ul style="list-style-type: none"> • OFF indicates port is inactive or no power • Solid Red indicates link is down • Solid Green indicates link is up • Blinking Green indicates Tx is active
Rx Status	<ul style="list-style-type: none"> • OFF indicates port is inactive or no power • Blinking Red indicates Rx is active with errors • Blinking Green indicates Rx is active
Mode Status	<ul style="list-style-type: none"> • Solid Red indicates card fault • OFF indicates that port is in 100G mode

Table 35-5. Led panel Specifications of XM40GE12QSFP+FAN (40GE only) Load Module

Feature	Specification
Tx Status	<ul style="list-style-type: none"> • OFF indicates ports are inactive or no power • Solid Red indicates link is down on all 3 ports • Solid Yellow indicates link is partially up or down (any of the 3 ports) • Solid Green indicates link is up on all 3 ports • Blinking Green indicates Tx is active
Rx Status	<ul style="list-style-type: none"> • OFF indicates port is inactive or no power • Blinking Red indicates Rx is active with errors • Blinking Green indicates Rx is active
Mode Status	<ul style="list-style-type: none"> • Solid Red indicates card fault • Solid Green indicates that port is in 40G mode

Fan-out Capability

The 3x40GE fan-out is a new capability that provides up to 12 independent 40GE QSFP+ links or generic 40GE fiber links. There are up to three 40GE QSFP+ fiber-based links provided via a cable per 100GE CXP physical port, using all of the 4-ports of 100GE CXP on the Multis load module.

Fan-out Cable Options

The Xcellon-Multis cable options are described in the following sections.

100GE CXP-to-3x40GE QSFP+ AOC fiber fan-out cables

CXP-to-3x40GE QSFP Active Optical Cable (AOC) cables are used with Xcellon-Multis XM100GE4CXP+FAN 100/40GE (944-1101) and XM40GE12QSFP+FAN 40GE (944-1102) load modules.

100GE CXP-to-3x40GE QSFP+ AOC fiber fan-out cables have the following features:

- Active Optical Cable (AOC)
- Multi-mode fiber (MMF), 850nm
- 942-0053 – 1 meter
- 942-0054 – 3 meter
- 942-0055 – 5 meter

The 100GE CXP-to-3x40GE QSFP+ AOC fiber fan-out cable is shown in the following figure:

Figure 35-5. 100GE CXP-to-3x40GE QSFP+ AOC fiber fan-out cable



MT-MT 3x40GE passive fiber fan-out cables

The MT-MT 3x40GE passive fiber fan-out cables requires 1 each CXP 100GE pluggable optical transceiver (948-0030). This combination is compatible with Xcellon-Multis XM100GE4CXP+FAN 100/40GE (944-1101) and XM40GE12QSFP+FAN 40GE load modules.

The MT-MT 3x40GE passive fiber fan-out cables have the following features:

- Multi-mode frequency (MMF), 850nm
- F-F key-up compatible with CXP & QSFP optical transceivers

- 942-0060 – 3 meter
- 942-0061 – 5 meter
- Transceivers are sold separately

The MT-MT 3x40GE passive fiber fan-out cable is shown in the following figure:

Figure 35-6. MT-MT 3x40GE passive fiber fan-out cable



CXP point-to-point AOC Cable (no fan-out)

The CXP point-to-point AOC cable has the following features:

- Active Optical Cable (AOC)
- Multi-mode frequency (MMF), 850nm
- 942-0052 – 3 meter

The CXP point-to-point AOC cable is shown in the following figure:

Figure 35-7. CXP point-to-point AOC cable



Features

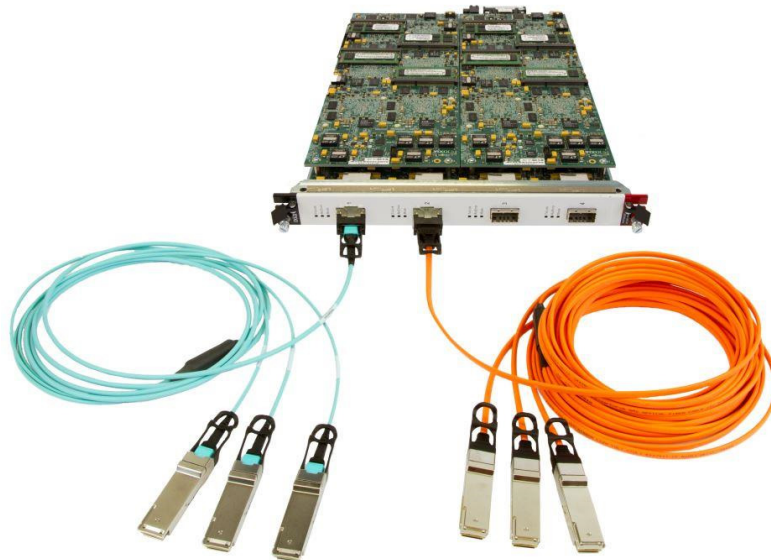
The 100GE fan-out capability has the following features:

- Each 100GE port and transceiver combination has the ability to fan-out to three 40GE QSFP+ links using a fiber fan-out cable media type, or a pluggable transceiver used with a fiber-only fan-out cable.
- Each 100GE port, when in the 3x40GE fan-out configuration, supports one-user for all three 40GE links.
- Each 100GE port with a transceiver that uses a fan-out cable to produce 3x40GE links will equally divide and allocate the data and control plane resources of the 100GE port to each 40GE link.
- There are 32 transmit streams for each of 40GE link in a 3x40GE fan-out configuration and at least 64K Rx PGID capacity per link.
- There is one LED per 100GE CXP port that indicates that the port is in fan-out mode.

- PCS lanes and Link Fault Signaling port counter support supports link troubleshooting for the entire port.

The Xcellon-Multis load module with CXP-to-3x40GE fan-out fiber cables for a 100GE CXP port with a 100GE transceiver installed, is shown in the following figure.

Figure 35-8. Xcellon-Multis load module with CXP-to-3x40GE fan-out



Benefits

Due to the enormous growth in Internet users and devices, the total bandwidth requirements of a single switch or router has reached multiple terabits. Devices that scale up to hundreds of 40GE and 100GE ports, instead of dozens, are needed to match such huge bandwidth requirements.

Xcellon-Multis family of load modules allows Higher Speed Ethernet testing using cable fan-out technology. This allows higher ports speeds to fan-out to several ports (links) of another speed. It also has the following benefits:

- 100GE/40GE fan-out technology separates a physical interface into multiple interfaces.
- The same features for 100GE and 40GE can be used from a single port or a group of ports.
- The same features for 100GE and 40GE all able to be used from a single port or a group of ports.
- Enables higher port densities per chassis – 2x the 100GE capacity and 3x the 40GE capacity.
- A simple fan-out cable allows you to have 3 ports of 40GE QSFP at a lower cost than a new, full load module.
- Multis provide an efficient way to have 100GE using the native physical port of CXP, and then have in the same port of the same card 3x40GE QSFP inter-

faces. A second card with 40GE QSFP naïve interface is not needed. This saves a slot in your chassis.

- The fan-out technology allows the user to have 100GE/40GE port all emanating from a single card. Compared to traditional Ixia cards, this saves power because you do not have to have two or three different cards in the chassis to perform 100GE/40GE tests.
- Every chassis in the lab produces less heat output to be cooled with less total number of load module installed in the chassis. Multis reduces the number of load modules in the chassis by being:
 - High port density
 - Providing Fan-out technology

Transceivers and Cables

The Xcellon-Multis family supports optical transceivers and fiber cables for each of the physical interfaces that are supported.

The following are the two types of 3x40GE fan-out cables:

- Active Optical cable (AOC): CXP to (3) QSFP+, fiber, active, fan-out cable.
- Fiber fan-out cable: MTP to (3) MTP QSFP+, fiber, passive, fan-out cable.

Active Optical Cable

The following tables list the specifications of the AOC cable.

Table 35-6. CXP to 3-QSFP+ 40GE AOC fan-out

CXP AOC part number	Cable length	Cards/Adapters to Interoperate with
ICD120GVP2420-05	5.0 m	MK, 4x40GE, K2
1110251303	3.0 m	MK, 4x40GE, K2
1110251305	5.0 m	MK, 4x40GE, K2
1110251307	7.0 m	MK, 4x40GE
1110251310	10.0 m	MK, 4x40GE

Table 35-7. CXP 100GE Active Optical Cable

CXP AOC part number	Cable length	Cards/Adapters to Interoperate with
FCBGD10CD1C03/ ICD120GVP2410-03	5.0 m	MK, K2
FCBGD10CD1C05/ ICD120GVP2410-05	3.0 m	MK

CXP AOC part number	Cable length	Cards/Adapters to Interoperate with
FCBGD10CD1C10/ ICD120GVP2410-10	5.0 m	MK
FCBGD10CD1C20/ ICD120GVP2410-20	7.0 m	MK

Fibre Fan-out Cable

The following table lists the specifications of the fibre fan-out cable.

Table 35-8. MTP to (3) MTP QSFP+, fiber, passive, fan-out

MTP Fan-out part number	Cable length	Cards/Adapters/Optics to Interoperate with
Custom	1.0 m	QSFP optic, MK, 4x40GE, Combo
Custom	3.0 m	QSFP optic, MK, 4x40GE, Combo
Custom	5.0 m	QSFP optic, MK, 4x40GE, Combo
Custom	10.0 m	QSFP optic, MK, 4x40GE, Combo

CXP

CXP is useful in the clustering and high-speed computing areas. It is about one-fourth the size of a CFP transceiver providing higher density network interfaces. It is an excellent low cost 100GE system for Multimode fiber cables.

CXP is a copper connector system. It provides twelve 10 Gbps links suitable for 100 Gigabit Ethernet, three 40 Gigabit Ethernet channels, or twelve 10 Gigabit Ethernet channels or a single Infiniband 12× QDR link.

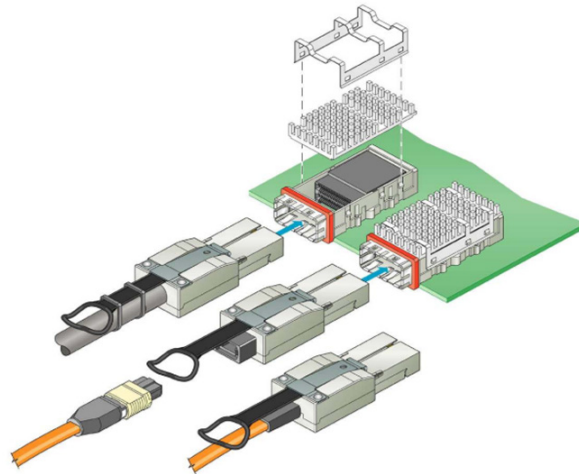
CXP components are low cost, field proven and available in volume.

The following are the CXP formats:

- Pluggable transceiver
- Active Optical Cable

The following figure shows the CXP Active Copper, Optical (pluggable), Active Optical:

Figure 35-9. CXP Active Copper, Optical (pluggable), Active Optical



QSFP

The Quad (4-channel) Small Form-factor Pluggable (often abbreviated as QSFP or QSFP+) is a compact, hot-pluggable transceiver used for data communications applications. It interfaces a network device (switch, router, media converter or similar device) to a fiber optic cable.

The QSFP specification supports Ethernet, Fibre Channel, InfiniBand and SONET/SDH standards with different data rate options. QSFP+ transceivers are designed to support Serial Attached SCSI, 40G Ethernet, 20G/40G Infiniband, and other communications standards. QSFP modules increase the port-density by 3x-4x compared to CFP modules.

The following figures show the QSFP+ Pluggable and Cable modules:

Figure 35-10. QSFP+ Pluggable module



Figure 35-11. QSFP+ Cable module

