

PTX5000 and PTX3000 PICs

Product Overview

Increased interactions between people and machines are creating a deluge of traffic, with increasingly unpredictable patterns. These dynamics have intensified the challenge to support growth with traditional network products and architectures. A new approach, based on both physical and virtual innovations, is required to help service providers stay ahead of growing traffic demands while remaining profitable. PTX Series Packet Transport Routers with flexible pluggable interface cards (PICs) provide service providers with a transit router that offers the right interface options for their high-performance environment.

Product Description

Juniper Networks® PTX Series Packet Transport Routers are architected to provide industry-leading system density in a transit-optimized IP/MPLS design. They deliver the ability to match traffic capacity with superior performance, meet any operational environment with elegant deployability, and exercise precise programmable traffic control through SDN across core, peering, metro, and collapsed IP and optical applications. The multiple generations of PTX Series hardware are built on Juniper Networks purpose-built Express and ExpressPlus silicon for robust IP/MPLS functionality and line-rate, low-latency packet performance for 1GbE to 100GbE and beyond. The PTX Series pluggable interface cards (PICs) offer operators the flexibility to deploy the appropriate interface type for the right application. Core applications ranging from 1GbE access handoffs to high-density 10GbE bundles for peering, 40GbE handoffs for data center interconnect, and 100GbE ultra-high-speed IP/MPLS provider edge (PE) router, label edge router (LER), and label-switching router (LSR) interconnect are supported.

Features and Benefits

First-Generation PTX Series PICs

Juniper Networks PTX5000 Packet Transport Router: Operating at 500 Gbps per slot, the first-generation PTX5000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications, as well as Ethernet-contained optical transport network (OTN) framing. Table 1 details the interface options available with the first-generation PIC for the PTX5000.

Juniper Networks PTX3000 Packet Transport Router: Operating at 240 Gbps per slot, the first-generation PTX3000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications and Ethernet-contained OTN framing. Table 2 details the interface options available with the first-generation PIC for the PTX3000.

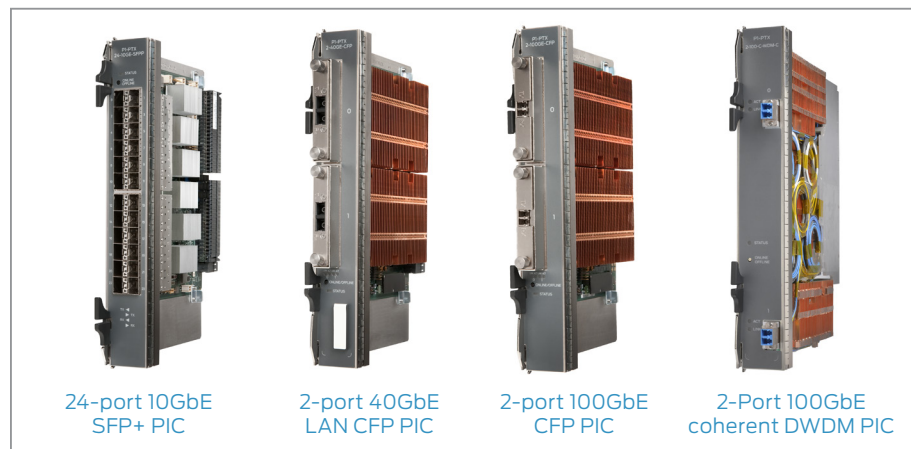


Table 1: PTX5000 First-Generation PIC Support Table

Interface Type	Interface Density	Description	PTX5000 FPC Compatibility	Model Number
10-Gigabit Ethernet LAN	24 x 10GbE	24 x 10GbE (LAN) PIC, first generation	PTX5000 FPC1 PTX5000 FPC2	P1-PTX-24-10GE-SFPP
10-Gigabit Ethernet OTN	24 x 10GbE OTN	24 x 10GbE (LAN/WAN) Layer 1 PIC, first generation	PTX5000 FPC1 PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P1-PTX-24-10G-W- SFPP
40-Gigabit Ethernet LAN	2 x 40GbE	2 x 40GbE PIC, first generation	PTX5000 FPC1 PTX5000 FPC2	P1-PTX-2-40GE-CFP
100-Gigabit Ethernet LAN	2 x 100GbE	2 x 100GbE PIC, first generation	PTX5000 FPC1 PTX5000 FPC2	P1-PTX-2-100GE-CFP
100-Gigabit Ethernet OTN DWDM	2 x 100GbE OTN DWDM	2-port 100GbE DWDM PIC, first generation	PTX5000 FPC1 PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P1-PTX-2-100G-WDM

24-Port 10GbE SFP+ PIC

The 24-port 10GbE LAN small form-factor pluggable plus (SFP+) transceiver PIC is a highly flexible module that provides market-leading 10GbE density with a variety of SFP+ connectivity options to support a broad range of short, medium, and long distance connections. This PIC is perfectly suited for dense 10GbE aggregation applications such as PE-to-PE link bundling, 10GbE fan-out, and edge router-to-core router aggregation.

24-Port 10GbE OTN SFP+ PIC

The 24-port 10GbE OTN SFP+ PIC is a highly flexible module that provides market-leading 10GbE density with a variety of SFP+ connectivity options to support a broad range of short, medium, and long distance connections. This PIC is perfectly suited for 10GbE applications interacting with Layer 1 optical transport networks. The 24-port 10GbE OTN SFP+ PIC supports full OTN performance monitoring, providing a fast reroute protection schema for improved network resiliency.

2-Port 40GbE LAN CFP PIC

The 2-port 40GbE LAN C form-factor pluggable (CFP) transceiver PIC is a highly flexible module that provides market-leading 40GbE density with a variety of CFP connectivity options to support a broad range of short, medium, and long distance connections. This PIC is perfectly suited for dense 40GbE aggregation applications such as PE-to-PE link bundling, 40GbE WAN-to-data center connections, and edge router-to-core router aggregation.

2-Port 100GbE CFP PIC

The 2-port 100GbE CFP PIC is a highly flexible module that provides market-leading 100GbE density with a variety of CFP

connectivity options to support a broad range of short, medium, and long distance connections. This PIC is perfectly suited for 100GbE interconnect applications such as LER, LSR, high capacity link bundling, and traffic demanding edge router-to-core router aggregation.

2-Port 100GbE Coherent DWDM PIC

The 2-port 100GbE coherent dense wavelength-division multiplexing (DWDM) PIC leverages the latest Optical Internetworking Forum (OIF)-compliant optical technology to deliver an interface that can be tuned to 96 different ITU extended C-Band channels. The 2-port 100GbE coherent DWDM PIC transmits a DP-QPSK signal that uses a MODEM ASIC to provide soft decision forward error correction (SD-FEC) to increase the optical margins for 100GbE over long distances. The PIC contains a coherent receiver to correct linear and nonlinear effects that have accumulated traversing the fiber span. The 2-port 100GbE coherent metro DWDM PIC supports full OTN performance monitoring, providing a fast reroute protection schema for improved network resiliency.

As network operators look for ways to accommodate unrelenting growth while trying to contain costs, they seek next-generation solutions that can scale efficiently. By integrating optical functionality into the router, service providers reduce the amount of optical equipment, rack space, and hardware needed to transmit the optical signal, resulting in lower power consumption. Optical integration into the PTX Series devices truly converges multiple networking layers into a single holistic network.

Table 2: PTX3000 First-Generation PIC Support Table

Interface Type	Interface Density	Description	PTX3000 FPC Compatibility	Model Number
10-Gigabit Ethernet LAN	24 x 10GbE	24 x 10GbE (LAN) PIC, first generation	PTX3000 SFF-FPC1	P1-PTX-24-10GE-SFPP
10-Gigabit Ethernet OTN	24 x 10GbE OTN	24 x 10GbE (LAN/WAN) L1 PIC, first generation	PTX3000 SFF-FPC1 PTX3000 SFF-FPC3	P1-PTX-24-10G-W- SFPP
40-Gigabit Ethernet LAN	2 x 40GbE	2 x 40GbE PIC, first generation	PTX3000 SFF-FPC1	P1-PTX-2-40GE-CFP
100-Gigabit Ethernet LAN	2 x 100GbE	2 x 100GbE PIC, first generation	PTX3000 SFF-FPC1	P1-PTX-2-100GE-CFP
100-Gigabit Ethernet OTN DWDM	2 x 100GbE OTN DWDM	2-port 100GbE DWDM PIC, first generation	PTX3000 SFF-FPC1 PTX3000 SFF-FPC3	P1-PTX-2-100G-WDM

Second-Generation PTX Series PICs

PTX5000: Operating at 1 Tbps per slot, the second-generation PTX5000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications, as well as Ethernet-contained OTN framing. Table 3 details the interface options available with the second-generation PIC for the PTX5000.

PTX3000: Operating at 1 Tbps per slot, the second-generation PTX3000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications, as well as Ethernet-contained OTN framing. Table 4 details the interface options available with the second-generation PIC for the PTX3000.

48-Port 10/40GbE QSFP PIC

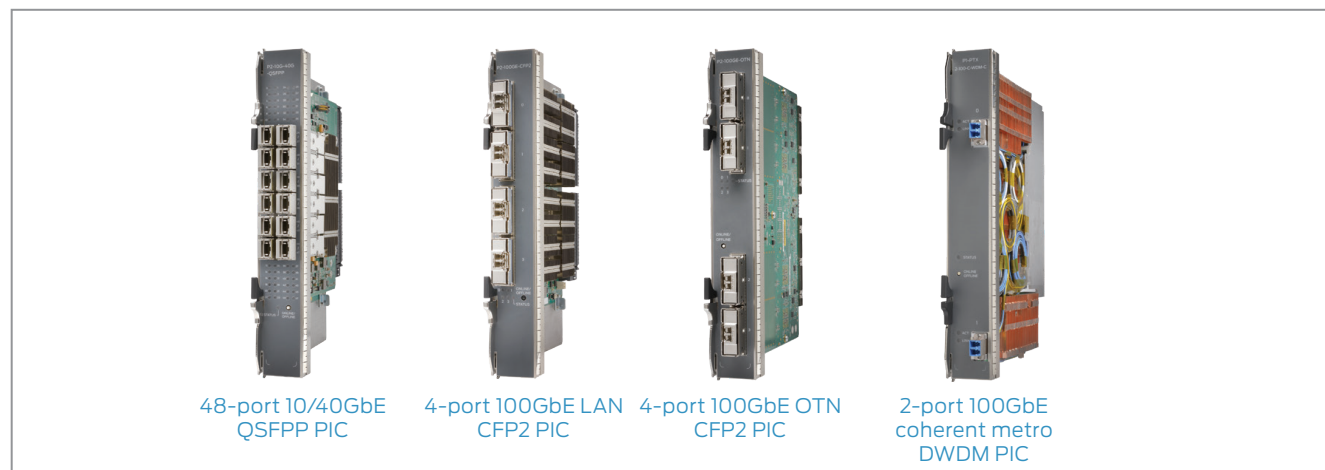
The multi-rate 48-port 10/40GbE PIC provides variable interface support for service providers, eliminating the risk of deploying the wrong interface type per deployment while maintaining the ability to scale up. The multi-rate 48-port 10/40GbE PIC leverages quad small form-factor pluggable plus (QSFP+) transceiver optics that can be configured for 48 interfaces of 10GbE LANPHY and 10GbE WAN PHY via a 12-pin MPO-to-LC connector breakout cable (see Figure 1). The same PIC can also be configured to support 40GbE LAN L1 and 40GbE OTU3e via QSFP+ pluggables.

4-Port 100GbE LAN/OTN CFP2 PIC

The 4-port 100GbE LAN/OTN CFP2 PIC is a highly flexible module that provides market-leading 100GbE density with a variety of CFP2 connectivity options to support a broad range of short, medium, and long distance connections. This PIC is perfectly suited for 100GbE interconnect applications such as LER, LSR, high-capacity link bundling, and traffic demanding edge router to core router aggregation. The 4-port 100GbE LAN/OTN CFP2 PIC can be configured to support OTN performance monitoring, providing a fast reroute protection schema for improved network resiliency.

2-Port 100GbE Coherent Metro DWDM PIC

The 2-port 100GbE coherent metro DWDM PIC leverages the latest OIF-compliant optical technology to deliver an interface that can be tuned to 96 different ITU extended C-Band channels. The 2-port 100GbE coherent metro DWDM PIC transmits a DP-QPSK signal that uses a MODEM ASIC to provide soft decision forward error correction (SD-FEC) to increase the optical margins for 100GbE over long distances. The metro PIC contains a de-tuned coherent receiver to correct linear and nonlinear effects that have accumulated traversing the fiber span. The 2-port 100GbE coherent metro DWDM PIC supports full OTN performance monitoring, providing a fast reroute protection schema for improved network resiliency.



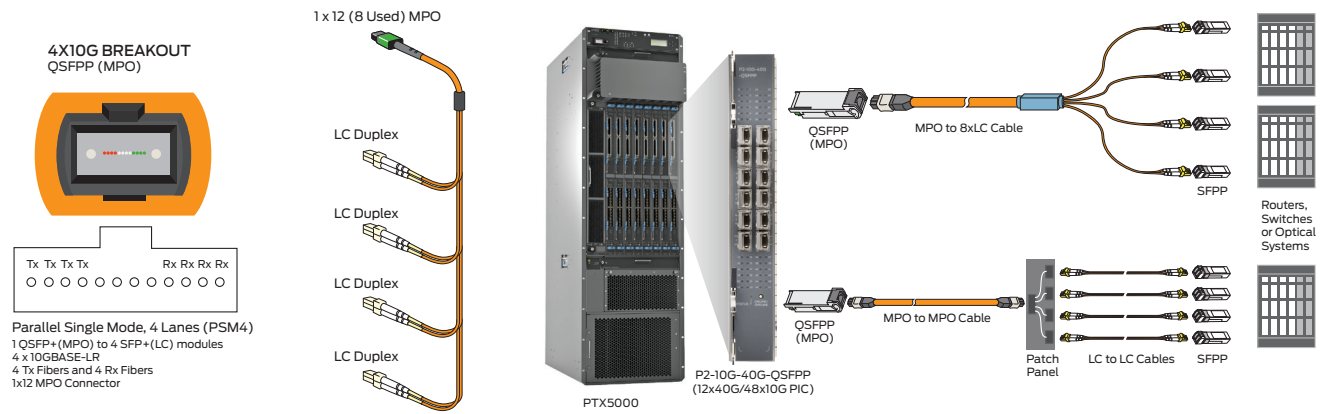


Figure 1: 10GbE configuration

Table 3: PTX5000 Second-Generation PIC Support Table

Interface Type	Interface Density	Description	PTX5000 FPC Compatibility	Model Number
10-Gigabit Ethernet LAN	48 x 10GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P2-10G-40G-QSFPP
10-Gigabit Ethernet WAN	48 x 10GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P2-10G-40G-QSFPP
40-Gigabit Ethernet LAN	12 x 40GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P2-10G-40G-QSFPP
100-Gigabit Ethernet LAN	4 x 100GbE	4 x 100GbE PIC for second-generation FPC, CFP2 pluggable optics	PTX5000 FPC2	P2-100GE-CFP2
100-Gigabit Ethernet OTN	4 x 100GbE OTN	4 x 100GbE Ethernet/OTN PIC for second-generation FPC, CFP2 pluggable optics	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P2-100GE-OTN
100-Gigabit Ethernet OTN DWDM	2 x 100GbE OTN DWDM	2-port 100GbE DWDM PIC metro second-generation	PTX5000 FPC1 PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P1-PTX-2-100G-WDM

Table 4: PTX3000 Second-Generation PIC Support Table

Interface Type	Interface Density	Description	PTX3000 FPC Compatibility	Model Number
10-Gigabit Ethernet LAN	48 x 10GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX3000 SFF-FPC3	P2-10G-40G-QSFPP
10-Gigabit Ethernet OTN	48 x 10GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX3000 SFF-FPC3	P2-10G-40G-QSFPP
40-Gigabit Ethernet LAN	12 x 40GbE	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	PTX3000 SFF-FPC3	P2-10G-40G-QSFPP
100-Gigabit Ethernet LAN	4 x 100GbE OTN	4 x 100GbE Ethernet/OTN PIC for second-generation FPC, CFP2 pluggable optics	PTX3000 SFF-FPC3	P2-100GE-OTN
100-Gigabit Ethernet OTN DWDM	2 x 100GbE OTN DWDM	2-port 100GbE DWDM PIC metro second generation	PTX3000 SFF-FPC1 PTX3000 SFF-FPC3	P1-PTX-2-100G-WDM

Third-Generation PTX Series PICs

PTX5000: Operating at 2-3 Tbps, the third-generation PTX5000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications, as well as Ethernet-contained OTN framing. Table 5 details the interface options available with the third-generation PIC for the PTX5000.

PTX3000: Operating at 1 Tbps per slot, the third-generation PTX3000 PIC provides the benefits of a pluggable optical module in popular short-reach and long-reach applications, as well as Ethernet-contained OTN framing. Table 6 details the interface options available with the third-generation PIC for the PTX3000.

Multi-Rate 96-Port 10/40GbE LAN PIC

The multi-rate 96-port 10/40GbE LAN QSFP PIC provides variable interface support for service providers, eliminating the risk of deploying the wrong interface type per deployment while maintaining the ability to scale up. The multi-rate 96-port 10/40GbE PIC leverages QSFP+ pluggable optics that can be configured for 96 interfaces of 10GbE LAN L1 via a 12-pin MPO-to-LC connector breakout cable or 24 interfaces of 40GbE LAN L1.

Multi-Rate 60-Port 10/40/100GbE LAN PIC

The multi-rate 60-port 10/40/100GbE LAN QSFP28 PIC provides variable interface support for service providers, eliminating the risk of deploying the wrong interface type per deployment while maintaining the ability to scale up. The multi-rate 60-port 10/40/100GbE PIC leverages QSFP+ pluggable optics that can be configured for 60 interfaces of 10GbE LAN L1 via a 12-pin MPO-to-LC connector breakout cable, or for 15 interfaces of 40GbE LAN L1. The same PIC can also be configured to support 15 interfaces of 100GbE LAN L1 via QSFP28 pluggable optics.

Multi-Rate 40-Port 10/40/100GbE LAN PIC

The multi-rate 40-port 10/40/100GbE LAN QSFP28 PIC provides variable interface support for service providers, eliminating the risk of deploying the wrong interface type while maintaining the ability to scale up. The multi-rate 40-port 10/40/100GbE PIC leverages QSFP+ pluggable optics that can be configured for 40 interfaces of 10GbE LAN L1 via a 12-pin MPO-to-LC connector breakout cable, or for 10 interfaces of 40GbE LAN L1. The same PIC can also be configured to support 10 interfaces of 100GbE LAN L1 via QSFP28 pluggable optics.

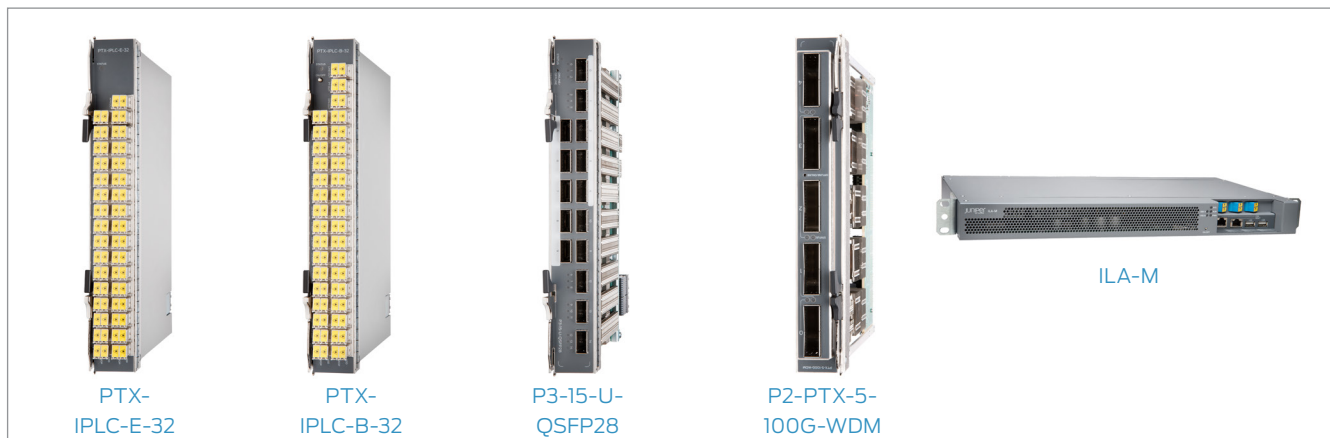
5-Port 100GbE Coherent DWDM PIC

The 5-port 100GbE coherent dense wavelength-division multiplexing (DWDM) PIC leverages the latest Optical Internetworking Forum (OIF)-compliant optical technology to deliver an interface that can be tuned to 96 different ITU extended C-Band channels at 50 GHz channel spacing. The 5-port 100GbE coherent DWDM PIC provides pay-as-you grow flexibility by using CFP2-ACO pluggable transceivers. The 5-port 100GbE coherent DWDM PIC transmits a DP-QPSK signal that uses a MODEM ASIC to provide both soft decision forward error correction (SD-FEC) and G.709 generic forward error correction to increase the optical margins for 100GbE over long distances. The PIC contains a coherent receiver to correct linear and nonlinear effects that have accumulated while traversing the fiber span. The 5-port 100GbE coherent DWDM PIC supports full OTN performance monitoring, providing a fast reroute protection schema for improved network resiliency.

As network operators look for ways to accommodate unrelenting growth while trying to contain costs, they seek next-generation solutions that can scale efficiently. By integrating optical functionality into the router, service providers can eliminate disparate optical equipment, saving rack space and lowering overall power consumption. Optical integration into the PTX Series devices truly converges multiple networking layers into a single holistic network fabric.

Integrated Photonics Line Card (IPLC)

The Integrated Photonics Line Card (IPLC) for the PTX3000 fully collapses the optical layer with the IP/MPLS layer in a single metro network solution, eliminating the need to deploy separate, dedicated equipment for both IP/MPLS and optical. The IPLC tightly couples a 1x2 WSS, embedded bi-directional switch gain amplifiers, optical multiplexer/de-multiplexers, and optical supervisory channel for optical management into a single package that supports up to 64 ITU-T C-band wavelengths at 50 GHz spacing via an IPLC expansion line card. The IPLC maintains the same PTX Series PIC form factor, allowing it to be provisioned in any of the eight PIC slots within a PTX3000 (the IPLC is only supported in the PTX3000). Built to the ITU-T C-band wavelength standard, the IPLC is fully interoperable with existing PTX Series DWDM interfaces such as 2-Port 100GbE Coherent



DWDM PIC, 5-Port 100GbE Coherent DWDM PIC, tunable DWDM pluggables for the 24x 10G LAN/WAN/OTN PHY PIC, and third-party external alien wavelengths. The IPLC can be used for both point-to-point and ring applications with in-service upgradability, starting at 3.2 Tbps and growing up to 6.4 Tbps of fiber capacity via the IPLC optical expansion card (OPEC).

Inline Amplifier Module (ILM-A)

Juniper now also offers a standalone 1 U inline switch-gain inline amplifier for data center interconnect, metro/regional, and long-distance applications. When used in conjunction with the coherent DWDM PICs and the IPLC, the PTX3000, running Junos, automatically provisions all of the photonic layer parameters and learns the optical topologies for applications like Connectivity Services Director (CSD) to provision, monitor, and troubleshoot.

Table 5: PTX5000 Third-Generation PIC Support Table

Interface Type	Interface Density	Description	PTX5000 FPC Compatibility	Model Number
10-Gigabit Ethernet	96 x 10GbE	24 x 40GbE, 96 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P3-24-U-QSFP28
	60 x 10GbE	15 x 100GbE QSFP28 or 15 x 40GbE, 60 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P3-15-U-QSFP28
	40 x 10GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps	P3-10-U-QSFP28
40-Gigabit Ethernet LAN	24 x 40GbE	24 x 40GbE, 96 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P3-24-U-QSFP28
	15 x 40GbE	15 x 100GbE QSFP28 or 15 x 40GbE, 60 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P3-15-U-QSFP28
	10 x 40GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps	P3-10-U-QSFP28
100-Gigabit Ethernet LAN	15 x 100GbE	15 x 100GbE QSFP28 or 15 x 40GbE, 60 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	P3-15-U-QSFP28
	10 x 100GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX5000 FPC3-2Tbps	P3-10-U-QSFP28
100-Gigabit Ethernet OTN DWDM	5 x 100GbE OTN DWDM	5-port 100GbE DWDM PIC third generation	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps	PTX-5-100G-WDM

Table 6: PTX3000 Third Generation PIC Support Table

Interface Type	Interface Density	Description	PTX3000 FPC Compatibility	Model Number
10-Gigabit Ethernet	96 x 10GbE	24 x 40GbE, 96 x 10GbE QSFP, universal PIC for third-generation FPC	PTX3000 SFF-FPC3	P3-24-U-QSFP28
	40 x 10GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX3000 SFF-FPC3	P3-10-U-QSFP28
40-Gigabit Ethernet LAN	24 x 40GbE	24 x 40GbE, 96 x 10GbE QSFP, universal PIC for third-generation FPC	PTX3000 SFF-FPC3	P3-24-U-QSFP28
	10 x 40GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX3000 SFF-FPC3	P3-10-U-QSFP28
100-Gigabit Ethernet LAN	10 x 100GbE	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	PTX3000 SFF-FPC3	P3-10-U-QSFP28
100-Gigabit Ethernet OTN DWDM	5 x 100GbE OTN DWDM	5-port 100GbE DWDM PIC third generation	PTX3000 SFF-FPC3	PTX-5-100G-WDM
Integrated Photonic Line Card (Base – 32 Channels)	32-Channel, 1x2 WSS, Optical Mux/De-Mux	32 Channel Mux/Demux with integrated 1x2 WSS, Optical Pre-amplifier, Booster amplifier, OSC; C-band, Odd; 100GHz, LC; Up to 64 channels supported with PTX-IPLC-E-32 (sold separately)	Not Applicable	PTX-IPLC-B-32
Integrated Photonic Line Card (Expansion – 32 Channels)	32 Channel Expansion module	32 Channel Passive Mux/Demux; C-band, Even, 50GHz, LC	Not Applicable	PTX-IPLC-E-32

Specifications

PIC Mechanical Parameters and Power Requirements

Table 7: PTX Series PIC Mechanical Parameters and Power Requirements

	PIC Model Number	Physical Dimensions	Weight	Power Requirements
First-generation PTX Series PICs	P1-PTX-24-10GE-SFPP	7.75 x 11 in (196.8 x 279.4 mm)	3.7 lb (1.7 kg)	1.45 A @ -48 V (70 W)
	P1-PTX-24-10G-W- SFPP	7.75 x 11 in (196.8 x 279.4 mm)	2.5 lb (1.1 kg)	2.67 A @ -48 V (128 W)
	P1-PTX-2-40GE-CFP	7.75 x 11 in (196.8 x 279.4 mm)	3.5 lb (1.6 kg)	0.7 A @ -48 V (35 W)
	P1-PTX-2-100GE-CFP	7.75 x 11 in (196.8 x 279.4 mm)	3.5 lb (1.6 kg)	1.6 A @ -48 V (75 W)
	P1-PTX-2-100G-WDM	7.75 x 11 in (196.8 x 279.4 mm)	5.5 lb (2.5 kg)	6.48 A @ -48 V (311 W)
Second-generation PTX Series PICs	P2-10G-40G-QSFPP	7.75 x 11 in (196.8 x 279.4 mm)	4.3 lb (2 kg)	10GbE Mode: 9.09 A @ -12.1 V (110 W) 40GbE Mode: 8.26 A @ -12.1 V (100 W)
	P2-100GE-CFP2	7.75 x 11 in (196.8 x 279.4 mm)	3.9 lb (1.8 kg)	1.66A@ -48 V (90 W)
	P2-100GE-OTN	7.75 x 11 in (196.8 x 279.4 mm)	4.4 lb (2 kg)	14.50A@ -12 V (176 W)
	P1-PTX-2-100G-WDM	7.75 x 11 in (196.8 x 279.4 mm)	5.5 lb (2.5 kg)	6.48 A @ -48 V (311 W)
Third-generation PTX Series PICs	P3-24-U-QSFP28	7.75 x 11 in (196.8 x 279.4 mm)	4.3 lb (1.95 kg)	3.86A @ -48V (186 W)
	P3-15-U-QSFP28	7.75 x 11 in (196.8 x 279.4 mm)	4.3 lb (1.95 kg)	3.1A @ -48V (149 W)
	P3-10-U-QSFP28	7.75 x 11 in (196.8 x 279.4 mm)	4.0 lb (1.81 kg)	2.36A @ -48V (113 W)
	PTX-5-100G-DWDM	7.75 x 11 in (196.8 x 279.4 mm)	5.5 lb (2.5 kg)	4.19A @ -48V (201 W)

LEDs

Table 8: PTX Series PIC LED Indication Table

Overlay Label	Color	Meaning
Status (Tri-color LED)	OFF	PIC is powered down and offline.
	AMBER	PIC is getting initialized by software.
	GREEN	PIC is online with all voltages in range.
	RED	PIC is in fail state.
Link/Activity/Alarm 0:0,0:1, 0:2,0:3,1:0...11:3 (10GbE ports) 0:0, 1:0, 2:0...11:0 (10GbE/40GbE/ 100GbE ports) (Dual-color LED)	OFF	Port is off.
	GREEN	Port is powered on and link is up. (This light only has meaning if the PIC status LED is lit and is green.)
	Flashing	Indicates link activity for that particular port sending/receiving packets.
	RED	Port has fault/alarm.

Pluggable Optical Module Support Table

Table 9: PTX Series PIC Pluggable Optical Module Support Table

PIC Model Number	Transceivers Support	Junos OS Release Support
P1-PTX-24-10GE-SFPP	SFPP-10GE-ER	12.1X48
	SFPP-10GE-LR	12.3
	SFPP-10GE-SR	13.2
	SFPP-10GE-ZR	
	SFPP-10G-ZR-OTN-XT	
	SFPP-10G-DT-ZRC2	
P1-PTX-24-10G-W-SFPP	SFP-1GE-LX	
	SFP-1GE-SX	
	SFPP-10GE-ER	12.3R2
	SFPP-10GE-LR	13.2
	SFPP-10GE-SR	
	SFPP-10GE-ZR	
P1-PTX-2-40GE-CFP	SFPP-10G-CT50-ZR	
	SFPP-10G-DT-ZRC2	
	CFP-40GBASE-LR4	12.1X48
		12.3
		13.2
P1-PTX-2-100GE-CFP	CFP-100GBASE-ER4	12.1X48
	CFP-GEN2-CGE-ER4	12.3
	CFP-100GBASE-LR4	13.2
	CFP-GEN2-100GBASE-LR4	
	CFP-100GBASE-SR10	
	CFP-100GBASE-ZR	
P2-10G-40G-QSFPP	QSFP-4X10GE-SR	14.1R2
	QSFP-40GBASE-SR4	15.2R1
	QSFP-40GBASE-LR4	
	QSFP-4X10GE-LR	
P2-100GE-CFP2	CFP2-100G-LR4-D	14.1
	CFP2-100GBASE-SR10	
	CFP2-100G-ER4-D	
	CFP2-100GBASE-LR4	
	CFP2-100GBASE-SR10	

PIC Model Number	Transceivers Support	Junos OS Release Support
P2-100GE-OTN	CFP2-100G-LR4-D CFP2-100GBASE-SR10 CFP2-100G-ER4-D CFP2-100GBASE-LR4 CFP2-100GBASE-SR10	14.1R2
P3-24-U-QSFP28	QSFP-4X10GE-SR QSFP-4X10GE-LR QSFP-40GBASE-SR4 QSFP-40GBASE-LR4 QSFP-100GBASE-SR4 QSFP-100GBASE-LR4	15.1F3 15.1F4
P3-15-U-QSFP28	QSFP-4X10GE-SR QSFP-4X10GE-LR QSFP-40GBASE-SR4 QSFP-40GBASE-LR4 QSFP-100GBASE-SR4 QSFP-100GBASE-LR4	15.1F5
P3-10-U-QSFP28	QSFP-4X10GE-SR QSFP-4X10GE-LR QSFP-40GBASE-SR4 QSFP-40GBASE-LR4 QSFP-100GBASE-SR4 QSFP-100GBASE-LR4	15.1F6 15.1F5
PTX-5-100G-DWDM	TCFP2-100G-C (CFP2-ACO)	15.1F6

100GbE Coherent DWDM PIC Interface Specifications

Table 10: Optical DWDM Specification

	P1-PTX-2-100G-WDM-C	PTX-5-100G-DWDM
Data rate	OTU4v mode: 127.14 Gbps	OTU4v mode: 120.58 Gbps
Optics	DP-QPSK with coherent receiver	DP-QPSK with coherent receiver
Connector type	LC - straight	LC - straight
Channel range	191.25 THz to 196 THz	191.15 THz to 196.10 THz
Framing	ODU4v	ODU4v
Forward error correction (FEC)	G.709 FEC + SD-FEC	G.709 FEC + SD-FEC
OSNR sensitivity	14.5 dB EOL	14.7 dB EOL
CD tolerance	50,000 ps/nm	40,000 ps/nm
PMD tolerance	80 ps DGD	80 ps DGD
Tx optical output power	-2 dBm	-12 to 0 dBm
Rx optical input power	-18 to -5 dBm	-18 to 0 dBm

Standards Compliance and Interoperability

Optical Standards: P1-PTX-2-100G-WDM; PTX-5-100G-WDM

- ITU-T G.709, G.798, G.694.1, FC 3591
- Telcordia GR-63 Issue 4: 2012
- EN 60825-1 (2007) Safety of Laser Products—Part 1: Equipment classification and requirements
- FDA CDRH21 CFR-1040 Environment
- Operating Temperature: 32° to 104° F, 0° to 40° C
- Storage Temperature: -40° to 158° F, -40° to 70° C
- Relative Humidity: (Operating) 5 to 90% noncondensing
- CAN/CSA-C22.2 No. 60950-1 (2007) Information Technology Equipment—Safety
- UL 60950-1 (2nd Ed.) Information Technology Equipment—Safety
- EN 60950-1 (2005) Information Technology Equipment—Safety
- IEC 60950-1 (2005) Information Technology Equipment—Safety (All country deviations)
- EN 60825-1 +A1+A2 (1994) Safety of Laser Products—Part 1: Equipment Classification

Optical Standards: All 10GbE, 40GbE, 100GbE PICs

- Telcordia GR-63 Issue 4: 2012
- EN 60825-1 (2007) Safety of Laser Products—Part 1: Equipment classification and requirements
- FDA CDRH21 CFR-1040 Environment
- Operating Temperature: 32° to 104° F, 0° to 40° C
- Storage Temperature: -40° to 158° F, -40° to 70° C
- Relative Humidity: (Operating) 5 to 90% noncondensing
- CAN/CSA-C22.2 No. 60950-1 (2007) Information Technology Equipment—Safety
- UL 60950-1 (2nd Ed.) Information Technology Equipment—Safety
 - EN 60950-1 (2005) Information Technology Equipment—Safety
- IEC 60950-1 (2005) Information Technology Equipment—Safety (All country deviations)
- EN 60825-1 +A1+A2 (1994) Safety of Laser Products—Part 1: Equipment Classification

Electromagnetic Compatibility

- EN 300 386 V1.4.1 (2008) Telecom Network Equipment—EMC requirements
 - EN 55024 +A1+A2 (1998) Information Technology Equipment Immunity Characteristics

EMI

- FCC CFR 45, Part 15 Class A (2009) USA Radiated Emissions
- EN 55022 Class A (2006) + A1 2007 European Radiated Emissions
- VCCI Class A (2007) Japanese Radiated Emissions
- BSMI CNS 13438 and NCC C6357 Taiwan Radiated Emissions
- AS/NZS CISPR22:2009

Customer-Specific Requirements

- GR-63-Core (2006) Network Equipment, Building Systems (NEBS) Physical Protection
- GR-1089-Core Issue 5 (2009) EMC and Electrical Safety for Network Telecommunications Equipment
- SR-3580 (2007) NEBS Criteria Levels (Level 3)
- ETSI EN 300 019: Environmental Conditions & Environmental Tests for Telecommunications Equipment
- ETSI EN 300 019-2-1 (2000)—Storage
- ETSI EN 300 019-2-2 (1999)—Transportation
- ETSI EN 300 019-2-3 (2003)—Stationary Use at Weather-protected Locations
- ETSI EN 300 019-2-4 (2003)—Stationary Use at Non-Weather-protected Locations
- ETS 300753 (1997)—Acoustic noise emitted by telecommunications equipment
- 1 TR 9 (2005) Deutsche Telekom EMC Specification
- British Telecom EMC Immunity Requirements (2004)
- ITU-T K.21 (2003) Resistibility of telecommunication equipment installed in customer premises to over voltages and over currents

Mandatory Power Supply Markings

- Power Supply integrated in system (with metal enclosure or open frame)
 - UL, CSA: UL/CSA 60950-1 (2007)
 - TUV: EN 60950-1 2nd Edition (2005)
 - CE: EN55022 Class B (2006), EN55024 + A1 + A2 (1998), EN60950-1 2nd Edition (2005)
 - China CCC
 - Argentina IRAM/S-mark

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Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

PIC Model Number	PIC Description	Pluggable Model Number	Pluggable Description	Compatibility
PI-PTX-24-10GE-SFPP	24 x 10GbE (LAN) PIC, first generation	SFPP-10GE-ER	SFP+ 10GbE pluggable transceiver, SMF, 1550 nm for 40 km transmission	PTX5000 FPC1 PTX5000 FPC2 PTX3000 SFF-FPC1
		SFPP-10GE-LR	SFP+ 10GbE pluggable transceiver, single-mode fiber-optic (SMF), 1310 nm for 10 km transmission	
		SFPP-10GE-SR	SFP+ 10GbE pluggable transceiver, multimode fiber-optic (MMF), 850 nm for 300 m transmission	
		SFPP-10GE-ZR	SFP+ 10GbE pluggable transceiver, SMF, 1550 nm for 80 km transmission	
		SFPP-10G-ZR-OTN-XT	SFP+ 10GbE pluggable transceiver, SMF, 1550 nm for 80 km transmission, extended temperature	
		SFPP-10G-DT-ZRC2	10GbE DWDM SFP+ low power (1.6 W), 80 km reach, tunable across C-Band 50 GHz channel spacing, supports LAN/WAN and OTN rates (OTU2 and OTU2e)	
		SFP-1GE-LX	SFP transceiver 1000Base-LX GbE optic module	
		SFP-1GE-SX	SFP transceiver 1000Base-SX GbE optic module	
PI-PTX-24-10G-W-SFPP	24 x 10GbE (LAN/WAN) L1 PIC, first generation	SFPP-10GE-ER	SFP+ 10GbE pluggable transceiver, SMF, 1550 nm for 40 km transmission	PTX5000 FPC1 PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC1 PTX3000 SFF-FPC3
		SFPP-10GE-LR	SFP+ 10GbE pluggable transceiver, SMF, 1310 nm for 10 km transmission	
		SFPP-10GE-SR	SFP+ 10GbE pluggable transceiver, MMF, 850 nm for 300 m transmission	
		SFPP-10GE-ZR	SFP+ 10GbE pluggable transceiver, SMF, 1550 nm for 80 km transmission	
		SFPP-10G-CT50-ZR	10GbE DWDM SFP+, 80 km reach, tunable across C-Band 50 GHz channel spacing, compliant with ITU-T G.698.1	
		SFPP-10G-DT-ZRC2	10GbE DWDM SFP+ low power (1.6 W), 80 km reach, tunable across C-Band 50 GHz channel spacing, supports LAN/WAN and OTN rates (OTU2 and OTU2e)	

PIC Model Number	PIC Description	Pluggable Model Number	Pluggable Description	Compatibility
P1-PTX-2-40GE-CFP P1-PTX-2-100GE-CFP	2 x 40GbE PIC, first generation	CFP-40GBASE-LR4	One 40GBASE-LR4 CFP pluggable module compliant with IEEE 802.3ba	PTX5000 FPC1 PTX5000 FPC2 PTX3000 SFF-FPC1 PTX5000 FPC1 PTX5000 FPC2 PTX3000 SFF-FPC1
		CFP-100GBASE-ER4	CFP 100GbE pluggable transceiver, SMF, for 40 km transmission and compliant with IEEE 802.3ba	
		CFP-GEN2-CGE-ER4	100GBASE-ER4 CFP (second generation) pluggable module compliant with IEEE 802.3ba	
		CFP-100GBASE-LR4	One 100GBASE-LR4 CFP pluggable module compliant with IEEE 802.3ba	
		CFP-GEN2-100GBASE-LR4	100GBASE-LR4 CFP (second generation) pluggable module compliant with IEEE 802.3ba	
		CFP-100GBASE-SR10	CFP 100GbE pluggable transceiver, MMF, 850 nm for 200 m transmission	
		CFP-100GBASE-ZR	CFP 100G pluggable transceiver, non-tunable, 1550.92 nm, SMF, for 80 km transmission	
P1-PTX-2-100G-WDM	2-port 100GbE DWDM PIC, first generation	N/A	N/A	PTX5000 FPC1 PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC1 PTX3000 SFF-FPC3
P2-10G-40G-QSFPP	48 x 10GbE/12 x 40GbE/OTN PIC for second-generation FPC, QSFP+ pluggable optics	QSFP-4X10GE-SR	QSFP+ 4 x 10GBASE SR4 module	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC3
		QSFP-40GBASE-SR4	One 40GBASE-SR4 QFP+ pluggable module	
		QSFP-40GBASE-LR4	One 40GBASE-LR4 QSFP+ pluggable module	
		QSFP-4X10GE-LR	QSFP+ 4 x 10GBASE LR4 module	
P2-100GE-CFP2	4 x 100GbE PIC for second-generation FPC, CFP2 pluggable optics	CFP2-100G-LR4-D	100GBASE-LR4 CFP2 dual-rate (Ethernet and OTN rate) pluggable module	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps
		CFP2-100G-ER4-D	100GBASE-ER4 CFP2 dual-rate (Ethernet and OTN rate) pluggable module	
		CFP2-100GBASE-LR4	CFP2 100GbE optics	
		CFP2-100GBASE-SR10	CFP2 100GbE short range optics for Ethernet only	
P2-100GE-OTN	4 x 100GbE Ethernet/OTN PIC for second-generation FPC, CFP2 pluggable optics	CFP2-100G-LR4-D	100GBASE-LR4 CFP2 dual-rate (Ethernet and OTN rate) pluggable module	PTX5000 FPC2 PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC3
		CFP2-100G-ER4-D	100GBASE-ER4 CFP2 dual-rate (Ethernet and OTN rate) pluggable module	
		CFP2-100GBASE-LR4	CFP2 100GbE optics	
		CFP2-100GBASE-SR10	CFP2 100GbE short range optics for Ethernet only	
P3-24-U-QSFP28	8 x 100GbE QSFP28 or 24 x 40GbE, 96 x 10GbE QSFP, universal PIC for third-generation FPC	QSFP-4x10GBASE-SR4	4x10GBASE-SR4 QSFP+ pluggable module	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC3
		QSFP-4x10GBASE-LR4	4x10GBASE-LR4 QSFP+ pluggable module	
		QSFP-40GBASE-SR4	40GBASE-SR4 QSFP+ pluggable module	
		QSFP-40GBASE-LR4	40GBASE-LR4 QSFP+ pluggable module	
		QSFP-100GBASE-SR4	100GBASE-SR4 QSFP28 (Ethernet only) pluggable module	
		QSFP-100GBASE-LR4	100GBASE-LR4 QSFP28 (Ethernet only) pluggable module	

PIC Model Number	PIC Description	Pluggable Model Number	Pluggable Description	Compatibility
P3-15-U-QSFP28	15 x 100GbE QSFP28 or 15 x 40GbE, 60 x 10GbE QSFP, universal PIC for third-generation FPC	QSFP-4x10GBASE-SR4	4x10GBASE-SR4 QSFP+ pluggable module	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps
		QSFP-4x10GBASE-LR4	4x10GBASE-LR4 QSFP+ pluggable module	
		QSFP-40GBASE-SR4	40GBASE-SR4 QSFP+ pluggable module	
		QSFP-40GBASE-LR4	40GBASE-LR4 QSFP+ pluggable module	
		QSFP-100GBASE-SR4	100GBASE-SR4 QSFP28 (Ethernet only) pluggable module	
		QSFP-100GBASE-LR4	100GBASE-LR4 QSFP28 (Ethernet only) pluggable module	
P3-10-U-QSFP28	10 x 100GbE QSFP28 or 10 x 40GbE, 40 x 10GbE QSFP, universal PIC for third-generation FPC	QSFP-4x10GBASE-SR4	4x10GBASE-SR4 QSFP+ pluggable module	PTX5000 FPC3-2Tbps PTX3000 SFF-FPC3
		QSFP-4x10GBASE-LR4	4x10GBASE-LR4 QSFP+ pluggable module	
		QSFP-40GBASE-SR4	40GBASE-SR4 QSFP+ pluggable module	
		QSFP-40GBASE-LR4	40GBASE-LR4 QSFP+ pluggable module	
		QSFP-100GBASE-SR4	100GBASE-SR4 QSFP28 (Ethernet only) pluggable module	
		QSFP-100GBASE-LR4	100GBASE-LR4 QSFP28 (Ethernet only) pluggable module	
PTX-5-100G-DWDM	5 x 100GbE OTN DWDM, CFP2-ACO, PIC for third-generation FPC	TCFP2-100G-C (CFP2-ACO)	TCFP2-100G-C CFP2-ACO, pluggable module	PTX5000 FPC3-2Tbps PTX5000 FPC3-3Tbps PTX3000 SFF-FPC3
PTX-IPLC-B-32	32 Channel Mux/Demux with integrated 1x2 WSS, Optical Pre-amplifier, Booster amplifier, OSC; C-band, Odd; 100GHz, LC; Up to 64 channels supported with PTX-IPLC-E-32 (sold separately)	N/A	N/A	Only Supported in PTX3000
PTX-IPLC-E-32	32 Channel Passive Mux/Demux; C-band, Even, 50GHz, LC	N/A	N/A	Only Supported in PTX3000

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