

ETHERNET AND ETHERNET IQ PICS

Product Overview

Ethernet's flexibility, cost effectiveness and proven interoperability, along with a continuous stream of enhancements, have made it a widely adopted form of connectivity—from data centers and peering at Internet exchange points to the growing trend of metropolitan Ethernet access. The Juniper Networks portfolio of Ethernet interfaces is broad, supporting various port densities of 10/100 Fast Ethernet, as well as 1- and 10-Gbps Gigabit Ethernet on the M Series Multiservice Edge Routers and T Series Core Routers.

Product Description

Juniper Networks® Ethernet and Ethernet IQ PICs enhance network scalability and flexibility in both core and edge networks by supporting predictable performance, standards-based features, granular QoS, and a wide range of port densities and speeds.

Fast Ethernet – The 4-, 8-, 12-, and 48-port Fast Ethernet PICs are ideal for peering and intra-POP connectivity, data center connectivity, and Web hosting server aggregation. By eliminating the need for incremental switches, you can simplify network configuration tasks and lower costs. By deploying these cost-efficient PICs in today's architectures, you are setting the stage for a smooth migration to higher bandwidths in the future.

1-Gbps Gigabit Ethernet – Gigabit Ethernet PICs provide 1 Gbps per link, supporting a number of different applications. This PIC is available in 1-, 2- 4-, and 10-port models. As well, 1- and 2-port Gigabit Ethernet IQ PICs with intelligent queuing capabilities are available.

- Customer facing access links—for metropolitan Ethernet applications, leveraging LX optics that span distances of 6.2 mi/10 km and LH optics for distances up to 43.5 mi/70 km.
- Intra-POP connectivity—as the backbone scales, intra-POP connections between core routers and edge aggregation routers must also scale. Gigabit Ethernet PICs enable the aggregation of large numbers of edge circuits onto high-speed Internet backbone circuits.
- Peering connectivity at interexchange points—interconnections between service providers at network access points (NAPs) must also scale. Gigabit Ethernet PICs connect M Series and T Series to NAPS that are migrating to Gigabit Ethernet as a shared medium.
- Connectivity for Web hosting and data center servers—Juniper Networks platforms support Web and content hosting applications where traffic demands require Gigabit Ethernet up-links from server farms. Combined with the high performance of M Series and T Series, these PICs enable you to connect to an Internet backbone circuit for faster Web response times.

10-Gbps Gigabit Ethernet – For the highest speed connectivity, Juniper offers the 10-Gigabit Ethernet PICs as an effective means to providing high-speed intra-POP connectivity or metropolitan Ethernet uplinks into the core. Both a 1-port 10-GbE with XENPAK optics and a 4-port 10-GbE with XFP optics are available.

Intelligent Queuing

Juniper Networks has further enhanced its portfolio with the advent of Ethernet Intelligent Queuing (IQ) PICs. These advanced PICs are based on the Q Performance Processor (QPP), a custom high-performance ASIC designed to deliver granular per-VLAN quality-of-service (QoS) capabilities, along with extensive instrumentation and diagnostics on a per-VLAN and per-MAC address basis.

- Granular per-VLAN QoS, such as weighted round-robin, strict priority scheduling, random early detection (RED), weighted random early detection (WRED), policing, marking and shaping, supports differentiated services and converged applications over a single interface without compromising performance.
- MAC policing and filtering enables you to establish peering arrangements without complex routing configurations, and also supports additional levels of QoS enforcement.
- VLAN rewrite, tagging and deleting, enables flexible use of VLAN address space to support more customers and services.

- Extensive per-MAC and per-VLAN billing and accounting capabilities are supported by multiple counters for gathering statistics on frames, packets and bytes that are transmitted, received or dropped. This feature enables you to perform usage-based billing for premium QoS and service-level agreement (SLA)-based services and to provide visibility into network operations to ensure that trends are anticipated to meet increasing demands.

Ethernet IQ PICs have been combined with the Juniper Networks JUNOS® Software virtual private LAN service (VPLS) capability to deliver metro Ethernet services. VPLS enables you to deliver true multipoint-to-multipoint (MP2MP) Ethernet services over IP/MPLS networks across both single metropolitan and geographically disparate metro areas. This compelling capability enables the provider edge (PE) routers to automatically build a full mesh of label-switched paths (LSPs) and to switch Ethernet frames based on MAC address into the appropriate LSP. Thus, IP/MPLS is leveraged to provide a new level of scalability and resiliency that was previously unavailable in purely switched metropolitan Ethernet infrastructures.

Flexible, Scalable Connectivity

PLATFORM	FAST ETHERNET				1-GBPS GIGABIT ETHERNET				1-GBPS GIGABIT ETHERNET IQ		10-GBPS GIGABIT ETHERNET	
	4-PORT	8-PORT	12-PORT	48-PORT	1-PORT	2-PORT	4-PORT	10-PORT	1-PORT	2-PORT	1-PORT	4-PORT
M7i												
Per Chassis	16	32	48	–	4	–	–	–	4	–	–	–
Per Rack*	384	768	1,152	–	96	–	–	–	96	–	–	–
M10i												
Per Chassis	32	64	96	–	8	–	–	–	8	–	–	–
Per Rack	288	576	864	–	72	–	–	–	72	–	–	–
M40e												
Per Chassis	128	256	384	384	32	16	32	–	32	16	–	–
Per Rack	256	512	768	768	64	32	64	–	64	32	–	–
M120												
Per Chassis	64	128	192	768	16	32	64	40	16	32	4	–
Per Rack	256	512	768	3,072	64	128	256	160	64	128	16	–
M320												
Per Chassis	128	256	384	1,536	32	64	128	160	32	64	16	–
Per Rack	256	512	768	3,072	64	128	256	320	64	128	32	–
T320												
Per Chassis	64	–	192	768	16	32	64	160	16	32	16	–
Per Rack	192	–	576	2,304	48	96	192	480	48	96	48	–

Ethernet Port Densities (continued)

PLATFORM	FAST ETHERNET				1-GBPS GIGABIT ETHERNET				1-GBPS GIGABIT ETHERNET IQ		10-GBPS GIGABIT ETHERNET	
	4-PORT	8-PORT	12-PORT	48-PORT	1-PORT	2-PORT	4-PORT	10-PORT	1-PORT	2-PORT	1-PORT	4-PORT
T640												
Per Chassis	128	–	–	–	32	64	128	320	32	64	32	32
Per Rack	256	–	–	–	64	128	256	640	64	128	64	64
T1600												
Per Chassis	128	–	–	–	32	64	128	320	32	64	32	64
Per Rack	256	–	–	–	64	128	256	640	64	128	64	128

Consult technical documentation for more details.

* Per-rack densities are based on 48 RU (84 in /213.36 cm).

– Not applicable

Key Features

A few of the key features supported by Ethernet PICs include support for integrated 802.1Q VLAN, link aggregation, Circuit Cross-connect (CCC), Virtual Router Redundancy Protocol (VRRP), Layer 2 to Layer 3 mapping, and port monitoring. Additionally, Ethernet PICs support filtering, sampling, load balancing, rate limiting, class of service (CoS) and other key features necessary for deploying secure, dependable, high-performance IP services.

Virtual Private LAN Service

VPLS is an MP2MP Ethernet service that uses IP and a tunnel mechanism (typically MPLS) to provide connectivity across an IP cloud between multiple enterprise sites—as if these sites were attached to the same Ethernet LAN. This capability enables the PE routers to automatically build a full mesh of LSPs and to actually switch frames based on Ethernet MAC address into the appropriate LSP. This results in an Ethernet service where the provider network looks like a large broadcast domain to the enterprise customer, and the customer has a simple Ethernet handoff from the provider. It allows you to deliver this LAN interconnect service between sites within a metro or across geographically disparate metros.

Granular QoS

Quality of service is the ability to prioritize traffic during periods of congestion. Gigabit Ethernet IQ PICs enable QoS on a per-VLAN basis, which means that if each customer is assigned a VLAN, then that customer can have four different levels of traffic priority. There are a number of tools supported by Gigabit Ethernet IQ PICs that support congestion management, including per-VLAN and per-queue shaping, per-VLAN and per-MAC policing (including hard policing [drop] and soft policing [marking]), and RED and WRED with multiple drop profiles per queue.

802.1Q VLAN Support

Ethernet PICs support 802.1Q VLANs. In a hosting environment, VLANs enable you to partition traffic from different servers into separate subnets without having to use separate physical circuits between the switch and the router. The router partitions the traffic according to the VLAN tags within the packets, supporting multiple VLANs per port.

802.3ad Link Aggregation

Link aggregation is the ability to bundle together a set of ports configured with the same speed in full-duplex mode into a virtual link, thereby supporting simultaneous parallel physical links between Juniper Networks platforms. You can configure up to 16 groups per router, and each group supports up to 8 ports. If a link goes down, the traffic is redistributed among the remaining links, thereby improving network reliability.

Layer 2 VPN VLAN Support

Juniper Networks supports the transport of Ethernet frames across an MPLS network via a number of different Layer 2 VPN solutions: Layer 2 draft Martini circuits, Layer 2 draft Kompella VPNs, and CCC. Any of these technologies can be used to map VLANs on an Ethernet interface to MPLS LSPs, thereby leveraging the IP infrastructure by combining Layer 2 switching capabilities with IP traffic engineering and tunneling capabilities. On any given port, you can terminate, switch or tunnel the VLAN. CCC also enables the stitching together of traffic engineering domains. You can interconnect LSPs across different domains without IP routing, thereby enabling them to remain private.

Ethernet Circuit Cross-Connect

Additionally, for one- and two-port Gigabit Ethernet interfaces, when an Ethernet CCC connection is established between two Gigabit Ethernet ports, all packets from the ingress port are forwarded to the egress port without any portions of the packet being modified. This simple Layer 2 pass-through connection can be rate limited or policed.

VRRP Support

Ethernet PICs support VRRP at the physical interface level and independently over each 802.1Q VLAN. Hence, a physical port can act as a backup for another physical port, or you can configure VLANs on two physical ports to act as backups for each other.

Layer 2 to Layer 3 Mapping

Layer 2 information (VLAN tags or 802.1p CoS) is mapped to Layer 3 for transport over the routed WAN. For example, 802.1p tags map into DiffServ of MPLS experimental bits, so that CoS can be carried end to end with Ethernet ingress and egress circuits.

Port Monitoring

Ethernet PICs support the collection of port statistics using the EtherStats portion of the RMON MIB. These statistics are available both through the CLI and through SNMP. Additionally, the CLI provides full- and half-duplex auto-negotiation information.

Features and Benefits

FEATURE	BENEFIT
Highly granular per-VLAN QoS <ul style="list-style-type: none">• Four queues per VLAN; weighted round robin or strict priority scheduler• RED and WRED per queue• Policing (ingress/egress) and filtering per MAC and per VLAN• Shaping per VLAN and per queue	<ul style="list-style-type: none">• Customizes services on a per-user basis for maximum revenues• Migrates Ethernet traffic to an IP/MPLS infrastructure• Delivers new levels of security• Enables oversubscription of uplinks to ensure maximum capital efficiency• Policing enables rate limiting to deliver sub-rate Fast Ethernet or Gigabit Ethernet for which you can charge accordingly, and later increase to the full rate on demand• Paired with VPLS, delivers a solution for intra- and inter-metro MP2MP Ethernet connectivity—MPLS infrastructure appears as an extension of the LAN to end users
Rich per-MAC and per-VLAN accounting, including support for stacked VLANs	<ul style="list-style-type: none">• Enables you to simply monitor and account for peering traffic without complex routing policies• Supports usage-based billing and SLA verification• Enables you to bill for premium QoS and SLA-based services, and to recommend upgrades if a customer's SLA has been exceeded• Provides the needed visibility into network operations to ensure that trends are anticipated and capacity is expanded to meet increasing demand• Enables you to associate MAC counters with a VLAN pair (inner and outer VLAN tag)
VLAN rewrite, tagging and deleting, including support for stacked VLANs	<ul style="list-style-type: none">• Enables flexible use of VLAN address space to support more customers and services• Resolves conflicts between service provider VLANs and customer VLANs• Supports stacked VLANs—look-up, rewrite, deletion on both the inner and outer VLAN tag and associate the VLAN to a particular customer or service• Stacked VLANs enable increase in address space and compatibility with customer premise devices that use stacked VLAN
Predictable performance and consistent service-enabling features across all M Series and T Series PICs	<ul style="list-style-type: none">• Supports rich IP service deployment across all interfaces• Increases service reliability• Simplifies configuration• Accelerates deployment time• Reduces operational complexity• Decreases operational costs• Minimizes training time for operational staff
High-density interfaces with the ability to mix and match up to four PICs within a single FPC slot	<ul style="list-style-type: none">• Increases configuration flexibility by enabling you to mix different speeds, technologies and IP services• Enables you to add uplink interfaces without wholly consuming an FPC slot• Reduces operational costs by maximizing POP space• Improves edge concentration and scalability of the core• Dramatically increases density to provide industry-leading Ethernet density

FEATURE	BENEFIT
Broad range of connectivity	<ul style="list-style-type: none"> • Enables you to offer a wide range of IP services in diverse environments • Enhances service definition richness by increasing configuration flexibility • Ensures scalability for both subscriber and uplink interfaces
IEEE standards-based Ethernet features, such as 802.1Q and VRRP	<ul style="list-style-type: none"> • Increases interoperability • Enhances reliability
Layer 2 to Layer 3 mapping	<ul style="list-style-type: none"> • Allows for end-to-end CoS • Preserves VLAN information over IP • Enables multi-tiered Web-hosting services
IEEE 802.3ad link aggregation	<ul style="list-style-type: none"> • Increases performance by multiplying available bandwidth • Increases network reliability • Provides link redundancy • Increases scalability using existing Ethernet technology to provide additional bandwidth
CCC and Layer 2 VPNs on unlike ingress and egress interfaces	Provides interconnection for IP traffic between Ethernet VLAN interfaces and other interfaces

Specifications

Interfaces

Fast Ethernet: 4-port

- 100BASE-TX
- Autosensing full or half duplex
- Connector: Two-pair, category 5 unshielded twisted pair connectivity through an RJ-45 connector
- Pinout: MDI non-crossover

Fast Ethernet: 8-port

- 8 100BASE-FX MTRJ multimode fiber ports
- Autosensing full or half duplex
- Connector: MT-RJ connector
- FX, multimode optical interface
 - Length: 1.24 mi/2 km reach on 62.5/125 micrometer MMF
 - Wavelength: 1,270 to 1,380 nm
 - Average launch power: -20 to -14 dBm
 - Receiver saturation: -14 dBm
 - Receiver sensitivity: -34 dBm

Fast Ethernet: 12-port

- 100BASE-TX
- Autosensing full or half duplex
- Connector: Single VHDCI connector that services all twelve 10/100 Mbps ports
- Cable: VHDCI to RJ-21 cable used to connect to an RJ-45 patch panel
 - Length: 9.84 ft/3 m
 - Compliance: Category 5
 - Pinout: MDI or MDI-X

Fast Ethernet: 48-port

- 100BASE-TX
- Autosensing full or half duplex
- Connector: Four VHDCI connectors; each connector services twelve 10/100 Mbps ports
- Cable: VHDCI to RJ-21 cable used to connect to an RJ-45 patch panel
 - Length: 9.84 ft/3 m
 - Compliance: Category 5
 - Pinout: MDI or MDI-X

1-Gbps Gigabit Ethernet: 1-port, 2-port, 4-port and 10-port

1-Gbps Gigabit Ethernet IQ: 1-port and 2-port

- SFP pluggable optics (SX, LX, LH and copper)
- SX optical interface (IEEE 802.3 compliant)
 - Connector: Duplex LC/PC (Rx and Tx)
 - Length
 - 656 ft/200 m reach on 62.5/125 micrometer MMF
 - 1,640 ft/500 m reach on 50/125 micrometer MMF
 - Wavelength: 770 to 869 nm
 - Average launch power: -9.5 to 0 dBm
 - Receiver saturation: 0 dBm
 - Receiver sensitivity: -17 dBm
- LX optical interface (IEEE 802.3 compliant)
 - Connector: Duplex LC/PC (Rx and Tx)
 - Length
 - 6.2 mi/10 km reach on 9/125 micrometer SMF
 - 1,804.5 ft/550 m reach on 62.5/125 and 50/125 micrometer MMF
 - Wavelength: 1,270 to 1,355 nm
 - Average launch power: -11.5 to -3 dBm
 - Receiver saturation: -3 dBm
 - Receiver sensitivity: -19 dBm
- LH optical interface (IEEE 802.3 compliant)
 - Connector: Duplex LC/PC (Rx and Tx)
 - Length: 43.5 mi/70 km reach on 9/125 micrometer SMF
 - Wavelength: 1,355 to 1,580 nm
 - Average Launch Power: -3 to +3 dBm
 - Receiver Saturation: -3 dBm
 - Receiver Sensitivity: -20 dBm (BER 1012) for SMF
- Copper UTP interface (IEEE 802.3 compliant)
 - Connector: Four-pair, category 5 UTP connectivity through an RJ-45 connector
 - Pinout: MDI crossover
 - Length: 328 ft/100 m
 - Receiver sensitivity: -10.3 dBm

Specifications (continued)

10-Gbps Gigabit Ethernet: 1-port

- XENPAK pluggable optics (SR, LR, ER, ZR)
- Connector: SC/PC duplex (RX and TX)
- SR optical interface (IEEE 802.3ae compliant)
 - Length: 984 feet/300 m on 50/125 MMF cable, 2000 MHz-km
269 feet/82 m on 50/125 MMF cable, 500 MHz-km
217 feet/66 m on 50/125 MMF cable, 400 MHz-km
108 feet/33 m on 62.5/125 MMF cable, 200 MHz-km
85 feet/26 m on 62.5/125 MMF cable, 160 MHz-km
 - Wavelength: 840 to 860 nm
 - Average launch power: -4.5 through -1 dBm
 - Receiver saturation: -1 dBm
 - Receiver sensitivity: -9.9 dBm
- LR optical interface (IEEE 802.3ae compliant)
 - Length: 6.2-mile / 10-km reach on 9/125 micrometer SMF
 - Wavelength: 1,260 to 1,355 nm
 - Average launch power: -4 through 0.5 dBm
 - Receiver saturation: 0.5 dBm
 - Receiver sensitivity: -14.4 dBm
- ER optical interface (IEEE 802.3ae compliant)
 - Length: 24.8-mile / 40-km reach on 9/125 micrometer SMF
 - Wavelength: 1,530 to 1,565 nm
 - Average launch power: -4.7 through 4 dBm
 - Receiver saturation: -1 dBm
 - Receiver sensitivity: -15.8 dBm
- ZR optical interface (IEEE 802.3ae compliant)
 - Length: 49.6-mile / 80-km reach on 9/125 micrometer SMF
 - Wavelength: 1,530 to 1,565 nm
 - Average launch power: 0 through 4 dBm
 - Receiver saturation: -7 dBm
 - Receiver sensitivity: -24 dBm

10-Gbps Gigabit Ethernet: 4-port

- XFP pluggable optics (S, L, E, Z)
- Connector: Duplex LC/PC (Rx and Tx)
- S multimode optical interface (IEEE 802.3ae compliant)
 - Length: 984 feet/300 m on 50/125 MMF cable, 2000 MHz-km
269 feet/82 m on 50/125 MMF cable, 500 MHz-km
217 feet/66 m on 50/125 MMF cable, 400 MHz-km
108 feet/33 m on 62.5/125 MMF cable, 200 MHz-km
85 feet/26 m on 62.5/125 MMF cable, 160 MHz-km
 - Wavelength: 840 to 860 nm
 - Average launch power: -4.5 through -1 dBm
 - Receiver saturation: -1 dBm
 - Receiver sensitivity: -9.9 dBm
- L single-mode optical interface (IEEE 802.3ae compliant)
 - Length: 6.2-mile / 10-km reach on 9/125 micrometer SMF
 - Wavelength: 1,260 to 1,355 nm
 - Average launch power: -8.2 through 0.5 dBm
 - Receiver saturation: 0.5 dBm
 - Receiver sensitivity: -14.4 dBm
- E single-mode optical interface (IEEE 802.3ae compliant)
 - Length: 24.8-mile / 40-km reach on 9/125 micrometer SMF
 - Wavelength: 1,530 to 1,565 nm
 - Average launch power: -4.7 through 4 dBm
 - Receiver saturation: -1 dBm
 - Receiver sensitivity: -15.8 dBm

- Z single-mode optical interface (IEEE 802.3ae compliant)
 - Length: 49.6-mile / 80-km reach on 9/125 micrometer SMF
 - Wavelength: 1,530 to 1,565 nm
 - Average launch power: 0 through 4 dBm
 - Receiver saturation: -7 dBm
 - Receiver sensitivity: -24 dBm

Agency Approvals

Safety

- CAN/CSA-C22.2 No. 60950-00/UL 60950—Third Edition, Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide
- EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems
- EN 60950, Safety of Information Technology Equipment

EMC

- AS/NZS 3548 Class A (Australia / New Zealand)
- BSMI Class A (Taiwan)
- EN 55022 Class A Emissions (Europe)
- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common Immunity
- EN 61000-4-11 Voltage Dips and Sags

NEBS

Designed to meet these standards

- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment
- SR-3580 NEBS Criteria Levels (Level 3 Compliance)

Performance-Enabling Services and Support

Juniper Networks is the leader in performance-enabling services and support, which are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to bring revenue-generating capabilities online faster so you can realize bigger productivity gains, faster rollouts of new business models and ventures, and greater market reach, while generating higher levels of customer satisfaction. At the same time, Juniper Networks ensures operational excellence by optimizing your network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/products-services.

Ordering Information

MODEL NUMBER	PIC	PLATFORM
Fast Ethernet		
PE-4FE-TX	4-port TX interface with RJ-45 connector; Type 1	M7i, M10i
PB-4FE-TX	4-port TX interface with RJ-45 connector; Type 1	M40e, M120, M320, T320, T640, T1600
PE-8FE-FX	8-port FX interface with MT-RJ connector, MMF; Type 1	M7i, M10i
PB-8FE-FX	8-port FX interface with MT-RJ connector, MMF; Type 1	M40e, M120, M320
PE-12FE-TX	12-port TX interface; requires RJ-45 patch panel (available in MDI or MDI-X pinout); Type 1	M7i, M10i
PB-12FE-TX	12-port TX interface; requires RJ-45 patch panel (available in MDI or MDI-X pinout); Type 1	M40e, M120, M320, T320
PB-48FE-TX	48-port TX interface; requires RJ-45 patch panel (available in MDI or MDI-X pinout); Type 1	M40e, M120, M320
1-Gbps Gigabit Ethernet		
PE-1GE-SFP	1-port SFP (requires pluggable SFP optics module; see below); Type 1	M7i, M10i
PB-1GE-SFP	1-port SFP (requires pluggable SFP optics module; see below); Type 1	M40e, M120, M320, T320, T640, T1600
PB-2GE-SFP	2-port SFP (requires pluggable SFP optics module; see below); Type 2	M40e, M120, M320, T320, T640, T1600
PB-4GE-SFP	4-port SFP (requires pluggable SFP optics module; see below); Type 2	M40e, M120, M320, T320, T640, T1600
PC-10GE-SFP	10-port SFP (requires pluggable SFP optics module; see below); Type 3	M120, M320, T320, T640, T1600
1-Gbps Gigabit Ethernet IQ		
PE-1GE-SFP-QPP	1-port SFP (requires pluggable SFP optics module; see below); Type 1	M7i, M10i
PB-1GE-SFP-QPP	1-port SFP (requires pluggable SFP optics module; see below); Type 1	M40e, M120, M320, T320, T640, T1600
PB-2GE-SFP-QPP	2-port SFP (requires pluggable SFP optics module; see below); Type 2	M40e, M120, M320, T320, T640, T1600
10-Gbps Gigabit Ethernet		
PC-1XGE-XENPAK	1-port, XENPAK (requires XENPAK pluggable optics module ; see below); Type 3	M120, M320, T320, T640, T1600
PD-4XGE-XFP	4-port, XFP (requires XFP pluggable optics module; see below); Type 4	T640, T1600
Pluggable Optic Modules		
SFP-1GE-SX	SFP 1000BASE-SX Gigabit Ethernet optics module	
SFP-1GE-LX	SFP 1000BASE-LX Gigabit Ethernet optics module	
SFP-1GE-LH	SFP 1000BASE-LH Gigabit Ethernet optics module	
SFP-1GE-T	SFP 1000BASE-T Gigabit Ethernet optics module (copper)	
XENPAK-1XGE-SR	XENPAK pluggable 10GBASE-SR optics module	
XENPAK-1XGE-LR	XENPAK pluggable 10GBASE-LR optics module	
XENPAK-1XGE-ER	XENPAK pluggable 10GBASE-ER optics module	
XENPAK-1XGE-ZR	XENPAK pluggable 10GBASE-ZR optics module	
XFP-10G-S	XFP pluggable 10GBASE-S optics module	
XFP-10G-L-OC192-SR1	Dual-rate XFP pluggable 10GBASE-L optics module, 1,310 nm for 10-km transmission	
XFP-10G-E-OC192-IR2	Dual-rate XFP pluggable 10GBASE-E optics module, 1,500 nm for 40-km transmission	
XFP-10G-Z-OC192-LR2	Dual-rate XFP pluggable 10GBASE-Z optics module, 1,500 nm for 80-km transmission	

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at www.juniper.net.

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