Product Overview

Juniper Networks EX8200 Ethernet line cards offer a variety of interfaces for supporting high-density 100 Mbps, Gigabit and 10 Gigabit Ethernet (GbE) deployments. Working with the Juniper Networks EX8208 eight-slot and EX8216 16-slot modular Ethernet switch chassis, the EX8200 Ethernet line cards offer flexible, high-density interfaces for high-performance data center and campus aggregation and core environments.

EX8200 Ethernet Line Cards

Your ideas. Connected.™

Product Description

The Juniper Networks® EX8200 line of Ethernet switches offer powerful, modular platforms that deliver the performance, scalability, and carrier-class reliability required for today’s high-density enterprise data center access and core and campus aggregation and core environments, as well as high-performance service provider interconnects.

EX8200 Ethernet line cards are specifically designed to optimize enterprise applications. Each EX8200 Ethernet line card includes either two or four on-board Packet Forwarding Engines—the EX-PFE2—that are equipped with two purpose-built, application-specific integrated circuits (ASICs), one to perform wire-speed packet processing at line rates, and another to perform internal deep packet queuing and buffering while providing a high-speed interface to the chassis switch fabric. In addition, each line card contains a local processor which provides scalable local control and status processing.

Eight versions of the EX8200 Ethernet line cards are available, each of which supports a consistent set of features and capabilities: the EX8200-48T, the EX8200-48F, the EX8200-8XS, the EX8200-40XS, the EX8200-40TL, the EX8200-48PL, the EX8200-2XS-40T and the EX8200-2XS-40P. Four of these cards are available in Extra Scale (ES) configurations—the EX8200-48T-ES, the EX8200-48F-ES, the EX8200-8XS-ES and the EX8200-40XS-ES—which are optimized for large-scale deployments such as large campuses, global data centers, or cloud-based applications.

EX8200-48T: The EX8200-48T Ethernet line card offers wire-rate 48 10/100/1000BASE-T ports with RJ-45 copper connectors. Designed for data center end-of-row server access, or campus applications where high densities, high performance, and high availability over copper links of up to 100 m are required, the EX8200-48T enables up to 384 line-rate ports in a single EX8208 chassis, or 768 ports in an EX8216 chassis.

EX8200-48F: The EX8200-48F is a 48-port wire-rate 100BASE-FX/1000BASE-X line card with modular small form-factor pluggable transceiver (SFP) interfaces for supporting a wide range of 100 Mbps or Gigabit Ethernet optical connections over multimode fiber, single-mode fiber, or copper cabling. Designed for high-performance enterprise and service provider distribution applications, the EX8200-48F also enables up to 384 line-rate ports in an EX8208 chassis, and 768 ports in an EX8216 chassis.

EX8200-8XS: The EX8200-8XS is an eight-port 10GBASE-X line card with compact, modular SFP+ fiber optic interfaces, enabling up to 64 line-rate 10-Gigabit Ethernet ports in an EX8208 chassis and 128 ports in an EX8216 chassis. The EX8200-8XS is ideal for enterprise applications such as campus or data center uplink aggregation, core and backbone interconnects, and for service provider deployments requiring high-density, wire-speed 10-Gigabit Ethernet interconnects in metro area networks, Internet exchange points, and points of presence (POPs). The 10-Gigabit Ethernet port densities afforded by the EX8200-8XS line cards also enable EX8200 switches to consolidate aggregation and core layers in the data center, simplifying the network architecture and reducing power, space, and cooling requirements while lowering total cost of ownership (TCO).
Oversubscribed Server and User Access
The EX8200 includes five oversubscribed line cards that provide cost-effective GbE and 10GbE server access for high-density data centers.

**EX8200-40XS:** The EX8200-40XS is a 40-port oversubscribed 10GbE solution for data center end-of-row and middle-of-row server access, as well as for data center switch blade and top-of-rack or campus uplink aggregation deployments. Optimized for data center networks migrating from GbE to 10GbE interfaces where simultaneous line-rate performance is not required on all ports, the EX8200-40XS supports a wide range of both SFP (GbE) and SFP+ (10GbE) modular optical interfaces for connecting over multimode fiber, single mode fiber, and copper cabling. The 40 SFP/SFP+ ports on the EX8200-40XS are divided into eight independent groups of five ports each. Because port groups are independent of one another, each group can have its own oversubscription ratio, providing customers with maximum deployment flexibility. Each group dedicates 10 gigabits per second (Gbps) of switching bandwidth to be dynamically shared among the ports; queues are allocated within a 1 MB oversubscription buffer based on the number of active ports in a group and the types of interfaces installed. Users simply connect the cables and the EX8200-40XS automatically provisions each port group accordingly. No manual configuration is required. The EX8200-40XS line card can satisfy either 10GbE or GbE applications within each port group independently, providing the perfect migration vehicle for customers transitioning to higher speed connectivity.

**EX8200-48TL:** The EX8200-48TL offers 48 oversubscribed (2.4:1) 10/100/1000BASE-T RJ-45 ports to provide cost-effective GbE server access in high-density data center end-of-row applications. The EX8200-48TL also supports server access, converged access, and aggregation/core deployments, where it can be used to connect management stations, analyzers, sniffers, firewalls, intrusion detection and prevention/ intrusion detection service (IDP/IDS) devices, server load balancers, and other devices. The EX8200-48TL, which delivers up to 24 Gbps and 36 million packets per second (pps) performance, supports MACSec functionality on all GbE ports in hardware and features eight quality-of-service (QoS) queues per port. Configured exclusively with EX8200-48TL line cards, a single EX8208 chassis can support up to 384 GbE ports while a single EX8216 chassis can support up to 768 GbE ports.

**EX8200-48PL:** The EX8200-48PL is physically identical to the -48TL and includes support for the IEEE 802.3af Power over Ethernet (PoE) standard. It delivers up to 15.4 watts of Class 3 PoE on all 48 ports to power networked devices such as telephones, video cameras, and wireless LAN (WLAN) access points, providing an EX8200-based user access or converged access/core solution. In addition, the first 12 ports are capable of supporting the IEEE 802.3at PoE+ standard, which delivers up to 30 watts per port to power devices that require more than the 15.4 watts provided by Class 3 PoE.

**EX8200-2XS-40T:** The EX8200-2XS-40T is a combination card offering 40 oversubscribed (2.5:1) 10/100/1000BASE-T RJ-45 ports, four line-rate 100/1000BASE-SX SFP ports, and two line-rate 10GbE SFP+ ports for uplink connectivity. The EX8200-2XS-40T is ideal for providing GbE/10GbE uplink capacity by combining the fiber ports into a link aggregation group (LAG); meanwhile, the remaining slots in the EX8200 chassis can be populated with EX8200-48TL line cards to provide access connectivity. The two SFP+ 10GbE uplink ports can also be used as Virtual Chassis ports when the EX8200 is deployed in a Virtual Chassis configuration.

The EX8200-2XS-40T, which delivers up to 24 Gbps performance on the GbE ports and up to 20 Gbps performance on the 10GbE ports, supports MACSec functionality on all GbE ports in hardware. Configured exclusively with EX8200-2XS-40T line cards, a single EX8208 chassis can support up to 352 GbE ports and 16 10GbE ports, while a single EX8216 chassis can support up to 704 GbE ports and 32 10GbE ports. Each port features eight QoS queues and 21 MB (GbE) and 512 MB (10GbE) buffers.

**EX8200-2XS-40P:** The EX8200-2XS-40P is physically identical to the -40T and includes support for the IEEE 802.3af PoE standard, which delivers up to 15.4 watts of Class 3 PoE on all 40 ports to power networked devices such as telephones, video cameras, and wireless LAN (WLAN) access points. The first 12 ports are also capable of supporting the IEEE 802.3at PoE+ standard, which delivers up to 30 watts per port to power devices that require more than the 15.4 watts provided by Class 3 PoE.

Extra Scale Line Cards
The EX8200 includes five oversubscribed line cards that provide cost-effective GbE and 10GbE server access for high-density data centers.

**EX8200-48F-ES and EX8200-40XS-ES:** The EX8200-48F-ES and EX8200-40XS-ES extra-scale line cards are optimized for large-scale deployments such as large campuses, global data centers, cloud-based applications, and internet peering environments. The ES cards provide twice the Forwarding Information Base (FIB) table capacity of the non ES cards, enabling them to support multiple copies of complete internet routing tables. Designed for internet-facing environments, the ES cards are otherwise identical to the non-ES versions and are available in both copper (EX8200-48T-ES) and fiber (EX8200-8XS-ES, EX8200-48F-ES and EX8200-40XS-ES) versions.
Features and Benefits

The EX8200 PFE2 complex is comprised of two ASICs: the packet processor and the switch fabric interface. The hardware pipeline on the packet processor ASIC supports approximately 960 Mpps of Layer 2 and Layer 3 IPv4 and IPv6 traffic in the EX8208, and more than 1900 Mpps in the EX8216. Wire-speed performance is maintained regardless of packet size, from 64- to 9216-byte jumbo frames across both L2 and L3 interfaces. Firewall (access control list) filtering, marking, and rate limiting also occur at wire rate, with up to 64,000 entries across L2-L4 packet headers that can be applied per port, per VLAN, and per routed interface.

The packet processor ASIC also supports generic routing encapsulation (GRE) tunneling and three-label MPLS in hardware at line rate. Additional packet processor ASIC capabilities include multiple queues for CPU-bound control traffic to protect the Routing Engine from denial of service (DoS) attacks, and support for up to seven mirrored analyzer sessions directed to individual ports, VLANs, or tunneled interfaces.

The switch fabric interface ASIC of the EX-PFE2 manages the large ingress and egress buffers that provide congestion avoidance and traffic prioritization. On ingress, each switch fabric interface queues packets based on destination using dedicated high- and low-priority buffers for each wire-speed, 10-Gigabit Ethernet egress port, or each group of 12 Gigabit Ethernet ports in the system. These weighted random early detection (WRED) virtual output queues—up to 8,192 in an EX8216 chassis—prevent “head-of-line blocking” among ports on the same line card, ensuring complete independence of traffic flows among all 10-Gigabit Ethernet ports in the system.

The switch fabric interface also manages the transfer of data across the distributed, single-tier crossbar switch fabric. Data is evenly distributed across the fabric to balance traffic load and ensure graceful degradation of performance in the event of a non-redundant switch fabric failure. Multicast traffic is also balanced across the system using the same line-rate, binary-tree replication process as the Juniper Networks T Series Core Routers and the Juniper Networks MX Series 3D Universal Edge Routers, minimizing fabric congestion while reducing latency.

On egress, the switch fabric interface provides eight dedicated queues per port, mapped according to class of service (CoS) or DiffServ code point (DSCP) values. A WRED scheduler is used for congestion avoidance within each queue, while administrator-configured strict and weighted round-robin priority options are available between queues on a single port. Multicast traffic is managed independent of unicast traffic.

Total buffer size is 512 MB on each EX8200-8XS 10-Gigabit Ethernet port or each EX8200-40XS port group, and 42 MB on each EX8200-48T and EX8200-48F Gigabit Ethernet port, providing 50-100 ms of bandwidth delay buffering. These deep buffers and ingress and egress queuing mechanisms are critical to managing mission-critical data, handling bursty traffic, and limiting TCP/IP retries at the application level to free up bandwidth, reduce latency and allow a higher quantity of both unicast and multicast application flows across the network.

All packets pass through the entire EX-PFE2 ingress pipeline, the switch fabric, and the EX-PFE2 egress pipeline. This consistency of packet processing ensures that the EX-PFE2 is capable of delivering port-to-port latencies of under 10 μs, regardless of ingress or egress port location.

Up to 255 link aggregation groups (LAGs) are supported, ensuring that the large number of high-density Gigabit Ethernet LAGs found in campus and data center core and aggregation deployments can be accommodated. Up to 12 ports may be bundled into a single LAG, allowing 120 Gbps logical interfaces to be created using a full L2-L4 hash algorithm for optimal load balancing. Ports in a LAG may be distributed across line cards within an EX8200 switch for an added level of resiliency. Automatic detection, recovery, and redistribution of LAG traffic in the event of a port, link, or line card failure is supported for highly reliable connections.

Each line card contains a local CPU that is connected to the chassis’ redundant Routing Engines over dedicated internal gigabit control-plane links. This CPU manages the local line card components, distributes forwarding table and other control plane data from the Routing Engine to the local EX-PFE2 ASICs, and returns line card status and CPU-directed control plane packets to the Routing Engine. A second processor resident on each line card aggregates flow-based statistics and analyzes sampled packets without impacting control plane performance. Finally, hot insertion and removal of all line cards is supported for online maintenance and support.
## EX8200 Ethernet Line Card Features at a Glance

<table>
<thead>
<tr>
<th>Features</th>
<th>Details</th>
</tr>
</thead>
</table>
| **High availability** | Hardware designed for continuous operation:  
- Secure, modular architecture to isolate faults  
- Separate control and forwarding planes to enhance scalability and resiliency  
- Transparent failover and network recovery  
- Graceful Route Engine Switchover (GRES)  
- Nonstop Routing (NSR)  
- Nonstop Bridging (NSB)  
- Nonstop Software Upgrade (NSSU) |
| **Layer 2 features** | Jumbo frames (9216 byte)  
4,096 VLANs  
VLAN Registration Protocol (GVRP)  
802.3ad – Link Aggregation Control Protocol (LACP)  
802.1D – Spanning Tree Protocol (STP)  
802.1w – Rapid Spanning Tree (RSTP)  
802.1s – Multiple Instance Spanning Tree (MSTP)  
Redundant Trunk Group (RTG)  
VLAN Spanning Tree Protocol (VSTP) |
| **Layer 3 features** | Static routing  
RIP v1/v2  
OSPF v2  
Filter-based forwarding  
Virtual Router Redundancy Protocol (VRRP)  
BGP (Advanced Feature license)  
IS-IS (Advanced Feature license)  
IPv6 (Advanced Feature license)  
Bidirectional Forwarding Detection protocol (BFD)  
Virtual Routers (VRFs) |
| **Hardware tunneling** | GRE tunnels*  
MPLS capabilities (L3 VPNs, L2 VPNs/L2 circuits) (Advanced feature license) |
| **Multicast** | Internet Group Management Protocol (IGMP) v1/v2/v3  
IGMP snooping  
Protocol Independent Multicast PIM-SM, PIM-SSM, PIM-DM, MSDP |
| **Firewall filters** | Ingress and egress L2-L4 access control lists (ACLs):  
- Port ACLs  
- VLAN ACLs  
- Route ACLs  
Control plane denial of service (DoS) protection |
| **QoS** | 2,000 policers  
8 egress queues per port  
Weighted Random Early Drop (WRED) scheduling  
Scheduled Deficit Weighted Round Robin (SDWRR) queuing  
Strict Priority queuing  
Egress per port and per queue shaping  
Multi-field classification (L2 – L4) for scheduling and rewrite |
| **Convergence** | Full support for standards-based CEE / DCB (EX8200-40XS only)* |

* Roadmap
# EX8200 Ethernet Line Card Specifications

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Port quantity and type</strong></td>
<td>48 RJ-45</td>
<td>48 SFP</td>
<td>8 SFP+</td>
<td>40 SFP/ SFP+</td>
<td>48 RJ-45 / 4 SFP / 2 SFP+</td>
</tr>
<tr>
<td>PoE/PoE+ ports</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>48/12 (48PL only)</td>
</tr>
<tr>
<td><strong>Port speed</strong></td>
<td>10/100/1000 Mbps</td>
<td>10 Gbps</td>
<td>1 Gbps/10 Gbps</td>
<td>10/100/1000 Mbps</td>
<td>10/100/1000 Mbps; 10 Gbps; 1 Gbps/10 Gbps</td>
</tr>
<tr>
<td><strong>Max ports per system</strong></td>
<td>384 (EX8208); 768 (EX8216)</td>
<td>64 (EX8208); 128 (EX8216)</td>
<td>320 (EX8208); 640 (EX8216)</td>
<td>384 (EX8208); 768 (EX8216)</td>
<td>368 (EX8208); 736 (EX8216)</td>
</tr>
<tr>
<td><strong>Forwarding rate</strong></td>
<td>71 Mpps</td>
<td>71 Mpps</td>
<td>71 Mpps</td>
<td>71 Mpps</td>
<td>71 Mpps</td>
</tr>
<tr>
<td><strong>Data rate</strong></td>
<td>10/100/1000 Mbps</td>
<td>10 Gbps</td>
<td>1 Gbps/10 Gbps</td>
<td>10/100/1000 Mbps</td>
<td>10/100/1000 Mbps</td>
</tr>
<tr>
<td><strong>Fabric connection</strong></td>
<td>80 Gbps (160 Gbps full duplex)</td>
<td>80 Gbps (160 Gbps full duplex)</td>
<td>160 Gbps (320 Gbps full duplex)</td>
<td>160 Gbps (320 Gbps full duplex)</td>
<td>80 Gbps (160 Gbps full duplex)</td>
</tr>
<tr>
<td><strong>Queues per port</strong></td>
<td>8 per port</td>
<td>8 per port</td>
<td>8 per port</td>
<td>Ingress: 6 per port group. Egress: 8 per port and 8 per port group.</td>
<td>Ingress: 1 SP queue for 24 ports and 1 queue per port group of 8 ports for BE traffic. Egress: 8 SDWRR queues with SP.</td>
</tr>
<tr>
<td>Policers</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>3,000</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total buffer size</strong></td>
<td>42 MB per port</td>
<td>42 MB per port</td>
<td>512 MB per port</td>
<td>1 MB per port group and 512 MB per port group within the PFE</td>
<td>1 MB per port group of 24 and 512 MB per port group within the PFE</td>
</tr>
<tr>
<td><strong>Scheduler</strong></td>
<td>WRED, SDWRR</td>
<td>WRED, SDWRR</td>
<td>WRED, SDWRR</td>
<td>SDWRR per port group at ingress; WRED, SDWRR</td>
<td>SDWRR per port group at ingress; WRED &amp; SDWRR for egress</td>
</tr>
<tr>
<td>Jumbo frames</td>
<td>9216 bytes</td>
<td>9216 bytes</td>
<td>9216 bytes</td>
<td>9216 bytes</td>
<td>9216 bytes</td>
</tr>
<tr>
<td>LAG (ports/groups)</td>
<td>12/255</td>
<td>12/255</td>
<td>12/255</td>
<td>12/255</td>
<td>12/255</td>
</tr>
<tr>
<td>MAC addresses</td>
<td>160,000</td>
<td>160,000</td>
<td>160,000</td>
<td>160,000</td>
<td>160,000</td>
</tr>
<tr>
<td>IPv4 unicast routes*</td>
<td>500,000/1 million</td>
<td>500,000/1 million</td>
<td>500,000/1 million</td>
<td>500,000/1 million</td>
<td>500,000/1 million</td>
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<tr>
<td>IPv4 multicast routes*</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
</tr>
<tr>
<td>IPv6 unicast routes*</td>
<td>250,000/500,000</td>
<td>250,000/500,000</td>
<td>250,000/500,000</td>
<td>250,000/500,000</td>
<td>250,000/500,000</td>
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<tr>
<td>IPv6 multicast routes*</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
<td>100,000/200,000</td>
</tr>
<tr>
<td>VLANs</td>
<td>4,096</td>
<td>4,096</td>
<td>4,096</td>
<td>4,096</td>
<td>4,096</td>
</tr>
<tr>
<td>Firewall filters (ACLs)</td>
<td>54,000 entries</td>
<td>54,000 entries</td>
<td>54,000 entries</td>
<td>54,000 entries</td>
<td>54,000 entries</td>
</tr>
<tr>
<td>ARP entries</td>
<td>Up to 100,000**</td>
<td>Up to 100,000**</td>
<td>Up to 100,000**</td>
<td>Up to 100,000**</td>
<td>Up to 100,000**</td>
</tr>
<tr>
<td>L3 next hops</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Number of multicast groups</td>
<td>26,000</td>
<td>26,000</td>
<td>26,000</td>
<td>26,000</td>
<td>26,000</td>
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<tr>
<td>Virtual routers</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252</td>
</tr>
<tr>
<td>MPLS L3 VPNs</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252/1,022</td>
<td>252</td>
</tr>
<tr>
<td>MPLS L2 VPNs/ L2 Circuits</td>
<td>512/1,022</td>
<td>512/1,022</td>
<td>512/1,022</td>
<td>512/1,022</td>
<td>512</td>
</tr>
<tr>
<td>Analyzer sessions</td>
<td>7 (local or remote)</td>
<td>7 (local or remote)</td>
<td>7 (local or remote)</td>
<td>7 (local or remote)</td>
<td>7 (local or remote)</td>
</tr>
<tr>
<td>Max. power consumption</td>
<td>350 W</td>
<td>330 W</td>
<td>450 W</td>
<td>550 W</td>
<td>320 W (+900 W for PoE PD)</td>
</tr>
<tr>
<td>Typical power consumption</td>
<td>194 W</td>
<td>185 W</td>
<td>299 W</td>
<td>427 W</td>
<td>280 W (+900 W for PoE PD)</td>
</tr>
</tbody>
</table>

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*Shared—total route capacity depends on prefix distribution
**Up to 52,000 with aggregate Ethernet interfaces, routed VLAN interfaces or Virtual Chassis technology.
Specifications

Physical Specifications

Dimensions (W x H x D):
- 14.40 x 1.59 x 20.51 in (36.58 x 4.04 x 52.09 cm)

Weight:
- EX8200-48T: 11.26 lb (5.11 kg)
- EX8200-48F: 13.26 lb (6.01 kg)
- EX8200-8XS: 15.30 lb (6.94 kg)
- EX8200-40XS: 15.30 lb (6.94 kg)
- EX8200-48TL: 10.2 lb (4.63 kg)
- EX8200-48PL: 10.4 lb (4.72 kg)
- EX8200-2XS-40T: 11.2 lb (5.08 kg)
- EX8200-2XS-40P: 11.6 lb (5.26 kg)

Layer 2 Switching

- GVRP
- Physical port redundancy: Redundant trunk group (RTG)
- STP/RSTP (802.1D-2004)
- VSTP (Compatible with PVST+)
- STP enable/disable per port
- MSTP (802.1Q-2003)
- Number of MST instances supported: 64
- LLDP
- RVI (Routed VLAN Interface)
- FCoE- and CEE-capable (EX8200-40XS)*

Layer 3 Features: IPv4

- Routing protocols: RIPv1/v2, OSPF, BGP, IS-IS
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRP
- Layer 3 sub-interfaces
- IP directed broadcast

Layer 3 Features: IPv6

- Routing protocols: RIPng, OSPFv3, BGP, IS-IS, PIM, MLD
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRPV6
- Layer 3 sub-interfaces
- IP directed broadcast

Access Control Lists (ACLs) (Junos® OS firewall filters)

- Port-based ACL (PACL) – Ingress and Egress
- VLAN-based ACL (VAACL) – Ingress and Egress
- Router-based ACL (RAACL) – Ingress and Egress
- ACL counters
- Layer 2-4 classification criteria: Interface, MAC address, EtherType, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Control Plane DoS protection

Link Aggregation

- 802.3ad (LACP) support:
- Number of LAGs supported: 255
- Max number of ports per LAG: 12
- LAG load-sharing algorithm:
  - IP: S/D MAC, S/D IP
- Non-IP: S/D MAC
- Tagged ports support in LAG

QoS

- Ingress policing: single rate 2 color
- Hardware queues per port: 8
- Scheduling methods (egress): Strict priority (SP), Shaped Deficit Weighted Round-Robin (SDWRR)
- 802.1p, DSCP/IP Precedence trust, classification, and marking
- Layer 2-4 classification criteria: Interface, MAC address, EtherType, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Egress WRED: Per queue per CoS threshold
- CoS-based fabric ingress and egress queuing

Environmental Ranges

- Operating temperature: 32° to 104° F (0° to 40° C)
- Storage temperature: -40° to 158° F (-40° to 70° C)
- Operating altitude: up to 10,000 ft (3,048 m)
- Non-operating altitude: up to 16,000 ft (4,877 m)
- Relative humidity operating: 5% to 90% (non-condensing)
- Relative humidity non-operating: 0% to 95% (non-condensing)

Safety and Compliance

- IEC 60950-1 (2001) Safety of Information Technology Equipment (with country deviations)
- C-UL to CAN/CSA 22.2 No.60950-1(First Edition)
- TUV/GS to EN 60950-1, Amendment A1-A4, A11
- CB-IEC60950-1, all country deviations
- CE
Electromagnetic Compatibility (EMC)

- EN 300 386 V1.3.3 (2005) Telecom Network Equipment—EMC requirements
- ICES-003 Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A

Immunity

- EN-61000-4-2 +A1 +A2 (1995) Electrostatic Discharge
- EN-61000-4-3 +A1+A2 (2002) Radiated Immunity
- EN-61000-4-5 (2006) Surge
- EN-61000-4-6 (2007) Immunity to Conducted Disturbances
- EN-61000-4-11 (2004) Voltage Dips and Sags

Customer-Specific Requirements

- GR-1089-Core (2006) EMC and Electrical Safety for Network Telecommunications Equipment
- SR-3580 (1995) NEBS Criteria Levels (Level 3) (pending)

Environmental

- Reduction of Hazardous Substances (ROHS) 5/6

Telco

- Common Language Equipment Identifier (CLEI) code

Juniper Networks Services and Support

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](http://www.juniper.net/us/en/products-services).

### Ordering Information

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td></td>
</tr>
<tr>
<td>EX8200-48T</td>
<td>48-port 10/100/1000BASE-T RJ-45 line card</td>
</tr>
<tr>
<td>EX8200-48T-ES</td>
<td>48-port 10/100/1000BASE-T RJ-45 extra scale line card</td>
</tr>
<tr>
<td>EX8200-48F</td>
<td>48-port 100FX/1000BASE-X SFP line card; requires SFP optics sold separately</td>
</tr>
<tr>
<td>EX8200-48F-ES</td>
<td>48-port 100FX/1000BASE-X SFP extra scale line card; requires SFP optics sold separately</td>
</tr>
<tr>
<td>EX8200-8XS</td>
<td>8-port 10GbE SFP+ line card; requires SFP+ optics sold separately</td>
</tr>
<tr>
<td>EX8200-8XS-ES</td>
<td>8-port 10GbE SFP+ extra scale line card; requires SFP+ optics sold separately</td>
</tr>
<tr>
<td>EX8200-40XS</td>
<td>40-port 10GbE SFP/SFP+ line card; requires SFP+/SFP+ optics sold separately</td>
</tr>
<tr>
<td>EX8200-40XS-ES</td>
<td>40-port 10GbE SFP/SFP+ extra scale line card; requires SFP+/SFP+ optics sold separately</td>
</tr>
<tr>
<td>EX8200-48T+L</td>
<td>48-port 10/100/1000BASE-T RJ-45 20 Gbps line card</td>
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<tr>
<td>EX8200-48PL</td>
<td>48-port PoE+ 10/100/1000BASE-T RJ-45 20 Gbps line card</td>
</tr>
<tr>
<td>EX8200-2XS-40T</td>
<td>Combo 40-port 10/100/1000BASE-T RJ-45/4-port 10GBASE-X SFP / 4-port 10GbE SFP+ 40 Gbps line card; requires optics sold separately</td>
</tr>
<tr>
<td>EX8200-2XS-40P</td>
<td>Combo PoE+ 40-port 10/100/1000BASE-T RJ-45 / 4-port 1000BASE-X SFP / 2-port 10GbE SFP+ 40 Gbps line card; requires optics sold separately</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pluggable Optics</th>
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<tbody>
<tr>
<td>EX-SFP-1GE-SX</td>
<td>SFP 1000BASE-SX; LC connector; 850nm; 550m reach on multimode fiber</td>
</tr>
<tr>
<td>EX-SFP-1GE-LX</td>
<td>SFP 1000BASE-LX; LC connector; 1310nm; 10km reach on single-mode fiber</td>
</tr>
<tr>
<td>EX-SFP-1GE-LX4OK</td>
<td>SFP 1000BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber</td>
</tr>
<tr>
<td>EX-SFP-1GE-LH</td>
<td>SFP 1000BASE-LH; LC connector; 1550nm; 70km reach on single-mode fiber</td>
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<tr>
<td>EX-SFP-1GE-T</td>
<td>SFP 10/100/1000BASE-T copper; 100m reach on UTP</td>
</tr>
<tr>
<td>EX-SFP-1FE-FX</td>
<td>SFP 1000BASE-FX; LC connector; 1310nm; 2km reach on multimode fiber</td>
</tr>
<tr>
<td>EX-SFP-10GE-SR</td>
<td>SFP+ 10GBASE-SR; LC connector; 850nm; 300m reach on 50 microns multimode fiber; 33m on 62.5 microns multimode fiber</td>
</tr>
<tr>
<td>EX-SFP-10GE-LRM</td>
<td>SFP+ 10GBASE-LRM; LC connector; 1010m; 220m reach on multimode fiber</td>
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<tr>
<td>EX-SFP-10GE-LR</td>
<td>SFP+ 10GBASE-LR; LC connector; 1310nm; 10km reach on single-mode fiber</td>
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<tr>
<td>EX-SFP-10GE-ER</td>
<td>SFP+ 10GBASE-ER; LC connector; 1550nm; 40km reach on single-mode fiber</td>
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<tr>
<td>EX-SFP-10GE-USR</td>
<td>SFP+ 10GBASE-USR; LC connector; 850nm; 100m reach on multimode fiber</td>
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<tr>
<td>EX-SFP-10GE-DAC-1M</td>
<td>10GBASE-CR: SFP+ connector; 1m reach on twin-ax copper</td>
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<tr>
<td>EX-SFP-10GE-DAC-3M</td>
<td>10GBASE-CR: SFP+ connector; 3m reach on twin-ax copper</td>
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<tr>
<td>EX-SFP-10GE-DAC-5M</td>
<td>10GBASE-CR: SFP+ connector; 5m reach on twin-ax copper</td>
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<tr>
<td>EX-SFP-10GE-DAC-7M</td>
<td>10GBASE-CR: SFP+ connector; 7m reach on twin-ax copper</td>
</tr>
</tbody>
</table>
About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.