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DATASHEET

Cisco Nexus 7000 Series Switches

Product Overview

Cisco Nexus® 7000 Series Switches combine high levels of scalability with operational flexibility.

Cisco Nexus 7000 Series Switches provide the foundation for Cisco® Unified Fabric. They are a modular data center-class product line designed for highly scalable 1/10/40/100 Gigabit Ethernet networks with a fabric architecture that scales beyond 17 terabits per second (Tbps). Designed to meet the requirements of the most mission-critical data centers, the switches deliver continuous system operation and virtualized, pervasive services. The Cisco Nexus 7000 Series is based on the proven Cisco NX-OS Software operating system, with enhanced features to deliver real-time system upgrades with exceptional manageability and serviceability.

The first in the next generation of switch platforms, the Cisco Nexus 7000 Series (Figure 1) provides integrated resilience combined with features optimized specifically for the data center for availability, reliability, scalability, and ease of management.

Figure 1.   Cisco Nexus 7000 Series

Features and Benefits

Coupled with Cisco NX-OS, the Cisco Nexus 7000 Series delivers a comprehensive set of features with nonstop operation in four chassis form factors:

- 18-slot chassis with 18 front-accessible module slots and side-to-side airflow in a compact horizontal form factor with purpose-built integrated cable management.
- 10-slot chassis with 10 front-accessible vertical module slots and front-to-back airflow and an integrated cable management system.
- 9-slot with 9 front-accessible module slots and side-to-side airflow in a compact horizontal form factor with purpose-built integrated cable management.
- 4-slot chassis with all front-accessible module slots and side-to-back airflow in a small form factor with purpose-built integrated cable management.

All Cisco Nexus 7000 Series chassis use a passive mid-plane architecture, providing physical connectors and copper traces for interconnecting the fabric modules and the I/O modules for direct data transfer. All intermodule switching is performed via the crossbar fabric ASICs on the individual I/O modules and fabric modules. In the case of Cisco Nexus 7004 chassis, since there are no fabric modules, the mid-plane provides the connectors and traces to interconnect the fabric ASICs on the I/O modules directly.

A scalable, fully distributed fabric architecture composed of up to five fabric modules combined with the chassis midplane delivers up to 550 Gbps per slot for 8.8 Tbps, 9.9 Tbps, and 18.7 Tbps of forwarding capacity in the 9-slot, 10-slot, and 18-slot switches, respectively. The 4-slot chassis delivers up to 1.92 Tbps of forwarding capacity in combination with the built-in fabric system.

The midplane design on the 9-slot, 10-slot, and 18-slot chassis and the backplane design on the 4-slot chassis support flexible technology upgrades as your needs change, providing ongoing investment protection.

Cisco Nexus 7000 4-Slot Switch Chassis

The Cisco Nexus 7000 4-Slot chassis with two I/O module slots supports up to 96 x 1 and 10 Gigabit Ethernet ports, 12 x 40 Gigabit Ethernet ports and 4 x 100 Gigabit Ethernet ports, meeting the needs of small to medium-size data centers, co-locations, access- and aggregation-layer deployments, high-speed core deployments, and smaller operation zones. The Cisco Nexus 7000 4-Slot chassis also has two dedicated supervisor slots to provide full redundancy and high availability. The 4-slot chassis does not require fabric modules. The local I/O module fabrics are connected back to back to form a two-stage crossbar that interconnects the I/O modules and the supervisor engines. The backplane capacity is determined by the installed I/O modules.

- Side-to-rear airflow increases the system density in a seven-rack-unit (7RU) footprint, optimizing the use of rack space. The optimized density provides the capability to stack up to six 4-slot chassis in a 42RU rack.
- The fan tray with built-in fan and controller redundancy helps ensure reliability of the system and support for hot swapping of fan trays. The fan tray is on the top side of the chassis and draws the air from the right side of the chassis through the line card and supervisor slots and propagates it through the empty space on the left side of the chassis. The air then flows up to the fan tray on the top side and finally flows out from the vent holes on the back side of the chassis.
- Even though Nexus 7004 does not have fabric modules, fabric redundancy is still provided. If the local fabric on one of the I/O modules fails, the entire I/O module is taken offline.
- All modules, including power supplies and the fan tray, are accessible from the front.

Cisco Nexus 7000 9-Slot Switch Chassis

- The Cisco Nexus 7000 9-Slot chassis with up to seven I/O module slots supports up to 336 x 1 and 10 Gigabit Ethernet ports, 42 x 40 Gigabit Ethernet ports, and 14 x 100 Gigabit Ethernet ports, meeting the demands of mission-critical campus core and data center deployments. It has two dedicated supervisor slots to provide full redundancy.

- Side-to-side airflow increases the system density in a 14RU footprint, optimizing the use of rack space. The optimized density provides the capability to stack up to three 9-slot chassis in a 42RU rack.

- Independent variable-speed system and fabric fans provide efficient cooling capacity to the entire system. Fan-tray redundancy features help ensure reliability of the system and support for hot swapping of fan trays.

- I/O modules, supervisor modules, and fabric modules are accessible from the front. Power supplies and fan trays are accessible from the back.

Cisco Nexus 7000 10-Slot Switch Chassis

- The Cisco Nexus 7000 10-Slot chassis with up to eight I/O module slots supports up to 384 x 1 and 10 Gigabit Ethernet ports, 48 x 40 Gigabit Ethernet ports, and 16 x 100 Gigabit Ethernet ports, meeting the demands of large data center deployments. It has two dedicated supervisor slots to provide full redundancy.

- Front-to-back airflow helps ensure that use of the Cisco Nexus 7000 10-Slot chassis addresses the requirement for hot-aisle and cold-aisle deployments without additional complexity.

- The system uses dual system and fabric fan trays for cooling. Each fan tray is redundant and composed of independent variable-speed fans that automatically adjust to the ambient temperature, helping reduce power consumption in well-managed facilities while helping enable optimum operation of the switch. The system design increases cooling efficiency and provides redundancy capabilities, allowing hot swapping without affecting the system; if either a single fan or a complete fan tray fails, the system continues to operate without a significant degradation in cooling capacity.

- The system supports an optional air filter to help ensure clean air flow through the system. The addition of the air filter satisfies Network Equipment Building Standards (NEBS) requirements.

- I/O modules and supervisor modules are accessible from the front, and fabric modules, power supplies, and fan trays are accessible from the back.

Cisco Nexus 7000 18-Slot Switch Chassis

- The Cisco Nexus 7000 18-Slot chassis with up to 16 I/O module slots supports up to 768 x 1 and 10 Gigabit Ethernet ports, 96 x 40 Gigabit Ethernet ports, and 32 x 100 Gigabit Ethernet ports, meeting the demands of the largest data center deployments. It has two dedicated supervisor slots to provide full redundancy.

- Side-to-side airflow increases the system density in a 25RU footprint, optimizing the use of rack space. The optimized density provides more than 16RU of free space in a standard 42RU rack for cable management and patching systems.

- Independent variable-speed system and fabric fans provide efficient cooling capacity to the entire system. Fan-tray redundancy features help ensure reliability of the system and support for hot swapping of fan trays.

- I/O modules and supervisor modules are accessible from the front, and fabric modules, power supplies, and fan trays are accessible from the back.

Cisco Nexus 7000 Series Chassis Common Components

All Cisco Nexus 7000 Series chassis have the following components:

- Integrated cable management system designed to support the cabling requirements of a fully configured system at either or both sides of the switch, allowing outstanding flexibility. All system components can easily be removed with the cabling in place, providing ease of maintenance tasks with little disruption.
- A series of LEDs at the top of the chassis provide a clear summary of the status of the major system components, alerting operators to the need to conduct further investigation. These LEDs report the power supply, fan, fabric, supervisor, and I/O module status.
- A purpose-built optional front-module door provides protection from accidental interference with both the cabling and modules installed in the system. The transparent front door allows easy observation of cabling and module indicators and status lights without any need to open the doors, reducing the likelihood of faults caused by human interference. The door supports a dual-opening capability for flexible operation and cable installation while fitted. The door can easily be completely removed for both initial cabling and day-to-day management of the system.

Energy-Efficient Design

The Cisco Nexus 7000 Series uses power supplies that are up to 90 percent efficient, so less power is wasted as heat, and more power is available for the system to use than with typical power supplies.

The fan modules in the chassis adjust to compensate for changing thermal characteristics. At lower speeds, they use less power. In the 9-slot chassis, the fan tray is designed to completely turn off the power for a row of fans when the corresponding slots are unused.

Consolidation of multiple switches in the Cisco Nexus 7000 Series is enabled by the powerful combination of high density and performance, support for device virtualization, and comprehensive reliability and availability features. This consolidation increases the power efficiency by reducing wasted power from multiple partially loaded and inflexible systems.

Product Specifications

Table 1 lists the product specifications for the Cisco Nexus 7000 Series chassis.

Table 1. Product Specifications

Item	Specification			
	Cisco Nexus 7000 4-Slot Switch	**Cisco Nexus 7000 9-Slot Switch**	**Cisco Nexus 7000 10-Slot Switch**	**Cisco Nexus 7000 18-Slot Switch**
Product compatibility	Supports all Cisco Nexus 7000 Series Supervisor and I/O modules except the following: N7K-SUP1 N7K-M132XP-12 N7K-M148GS-11 N7K-M148GT-11 N7K-F132XP-15 Does not use fabric modules	Supports all Cisco Nexus 7000 Series Supervisor and I/O modules Supports Fabric2 modules Does not support Fabric1 modules	Supports all Cisco Nexus 7000 Series Supervisor and I/O modules Supports Fabric1 and Fabric2 modules	Supports all Cisco Nexus 7000 Series Supervisor and I/O modules Supports Fabric1 and Fabric2 modules

Item	Specification			
Max local switching capacity	600 Gbps	600 Gbps	600 Gbps	600 Gbps
Max inter-slot switching capacity	440 Gbps	550 Gbps	550 Gbps	550 Gbps
Software compatibility	Cisco NX-OS Software Release 6.1(2) or later	Cisco NX-OS Software Release 5.2 or later	Cisco NX-OS Software Release 4.0 or later	Cisco NX-OS Software Release 4.1 or later
Options	Lockable front module door	Lockable front module door	● Air filter ● Lockable front module doors	Lockable front module door
Performance	1.44 billion packets per second (bpps) (IPv4 unicast) in combination with supervisor module and built-in fabric	5.04 bpps (IPv4 unicast) in combination with supervisor and fabric modules	5.76 bpps (IPv4 unicast) in combination with supervisor and fabric modules	11.5 bpps (IPv4 unicast) in combination with supervisor and fabric modules
Reliability and availability	Online insertion and removal (OIR) of all redundant components: supervisor modules, power supplies, and fan trays	OIR of all redundant components: supervisor and fabric modules, power supplies, and fan trays	OIR of all redundant components: Supervisor and fabric modules, power supplies, and fan trays	OIR of all redundant components: supervisor and fabric modules, power supplies, and fan trays
MIBs	Supports Simple Network Management Protocol (SNMP) Versions 3, 2c, and 1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)
Network management	Cisco Data Center Network Manager (DCNM) 6.1.(2) or later	Cisco DCNM 5.2 or later	Cisco DCNM 4.0 or later	Cisco DCNM 4.1 or later
Programming interfaces	● XML ● Scriptable command-line interface (CLI) ● Cisco DCNM 6.1(2) web services	● XML ● Scriptable CLI ● Cisco DCNM 5.2 web services	● XML ● Scriptable CLI ● Cisco DCNM 4.0 web services	● XML ● Scriptable CLI ● Cisco DCNM 4.1 web services
Physical specifications	● Usable rack space: 7RU ● 4-slot chassis: 2 dedicated supervisor modules and 2 I/O modules ● 4 power supply slots ● Dimensions (H x W x D): 12.2 x 17.3 x 24 in. (30.9 x 43.9 x 61 cm) ● Chassis depth including cable management and chassis doors is 29.6 in. (75.2 cm) ● Unit is rack mountable in a standard 19-inch (482.6-mm) Electronic Industries Alliance (EIA) rack ● Weight 　◦ Chassis only: 45 lb. (20 kg) 　◦ Fan Tray: 25 lb (11.3 kg) ● Supports 3-kW AC and DC and 3.5-kW HV AC/DC power supplies ● Supports up to 6 chassis stacked in a 42RU rack	● Usable rack space: 14RU ● 9-slot chassis: 2 dedicated supervisor modules and 7 I/O modules ● 5 fabric module slots ● 2 power supply slots ● Dimensions (H x W x D): 24.5 x 17.3 x 24 in. (62.2 x 43.9 x 61 cm) ● Chassis depth including cable management and chassis doors is 29 in. (73.7 cm) ● Unit is rack mountable in a standard 19-inch (482.6-mm) EIA rack ● Weight 　◦ Chassis only: 100 lb. (45 kg) 　◦ Fabric Module: 5 lb (2.3 kg) 　◦ Fan Tray: 25 lb (11.3 kg) ● Supports 6-kW and 7.5-kW AC and DC power supplies ● Supports up to 3 chassis stacked in a 42RU rack	● Usable rack space: 21RU ● 10-slot chassis: 2 dedicated supervisor modules and 8 I/O modules ● 5 fabric module slots ● 3 power supply slots ● Dimensions (H x W x D): 36.5 x 17.3 x 33.1 in. (92.7 x 43.9 x 84.1 cm) ● Chassis depth including cable management and chassis doors is 38 in. (96.5 cm) ● Unit is rack mountable in a standard 19-inch (482.6-mm) EIA rack ● Weight 　◦ Chassis only: 200 lb. (90 kg) 　◦ Fabric Module: 4 lb (1.8 kg) 　◦ System Fan Tray: 20 lb (9.1 kg) 　◦ Fabric Fan Tray: 5 lb (2.3 kg) ● Supports 6-kW and 7.5-kW AC and DC power supplies	● Usable rack space: 25RU ● 18-slot chassis: 2 dedicated supervisor modules and 16 I/O modules ● 5 fabric module slots ● 4 power supply slots ● Dimensions (H x W x D): 43.5 x 17.3 x 33.1 in. (110.5 x 43.9 x 84.1 cm) ● Chassis depth including cable management and chassis doors is 38 in. (96.5 cm) ● Unit is rack mountable in a standard 19-inch (482.6-mm) EIA rack ● Weight 　◦ Chassis only: 187 lb. (85 kg) 　◦ Fabric Module: 7.5 lb (3.4 kg) 　◦ Fan Tray: 25.8 lb (11.7 kg) ● Supports 6-kW and 7.5-kW AC and DC power supplies

Item	Specification			
Environmental specifications	• Airflow direction: Side to rear • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 • Floor loading: 42 lb. per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 3500W per chassis (actual dissipation will be lower, depending on the chassis configuration)	• Airflow direction: Side to side • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 • Floor loading: 104 lb. per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 7500W per chassis (actual dissipation will be lower, depending on the chassis configuration)	• Airflow direction: Bottom front of chassis to top back • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 • Floor loading: 190 lb. per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: 1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 12,000W per chassis (actual dissipation will be lower, depending on the chassis configuration)	• Airflow direction: Side to side • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 • Floor loading: 190 lb. per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: 1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 18,000W per chassis (actual dissipation will be lower, depending on the chassis configuration)
Regulatory compliance	• EMC compliance • FCC Part 15 (CFR 47) (USA) Class A • ICES-003 (Canada) Class A • EN55022 (Europe) Class A • CISPR22 (International) Class A • AS/NZS CISPR22 (Australia and New Zealand) Class A • VCCI (Japan) Class A • KN22 (Korea) Class A • CNS13438 (Taiwan) Class A • CISPR24 • EN55024 • EN50082-1 • EN61000-3-2 • EN61000-3-3 • EN61000-6-1 • EN300 386			
Environmental standards	• NEBS criteria levels • SR-3580 NEBS Level 3 (GR-63-CORE and GR-1089-CORE) • Verizon NEBS compliance VZ.TPR.9203 – Data Center • CenturyLink NEBS requirements • ATT NEBS requirements • ATT TP76200 Carrier Grade Level 1 • ETSI • ETSI 300 019-1-1, Class 1.2 Storage • ETSI 300 019-1-2, Class 2.3 Transportation • ETSI 300 019-1-3, Class 3.2 Stationary Use • Reduction of Hazardous Substances (ROHS) 5			
Safety	• UL/CSA/IEC/EN 60950-1 • AS/NZS 60950			
Warranty	Cisco Nexus 7000 Series Switches come with the standard Cisco 1-year limited hardware warranty			

Software Requirements

All Cisco Nexus 7000 Series chassis are supported by Cisco NX-OS Software.

- The 4-slot chassis requires Cisco NX-OS Software Release 6.1(2) or later.

- The 9-slot chassis requires Cisco NX-OS Software Release 5.2 or later.

- The 10-slot chassis requires Cisco NX-OS Software Release 4.0 or later.

- The 18-slot chassis requires Cisco NX-OS Software Release 4.1 or later.

For the latest information about recommended releases, see
http://www.cisco.com/en/US/docs/switches/datacenter/sw/nx-os/recommended_releases/recommended_nx-os_releases.html.

Ordering Information

To place an order, visit the Cisco Ordering homepage. To download software, visit the Cisco Software Center. Table 2 provides ordering information.

Table 2. Ordering Information

Product Name	Part Number
System	
Cisco Nexus 7000 Series 9-Slot chassis including Fan Trays, No Power Supply	N7K-C7009
Cisco Nexus 7000 Series 9-Slot chassis No Fan Trays, No Power Supply	N7K-C7009=
Cisco Nexus 7000 Series-9-Slot Fan Tray Spare	N7K-C7009-FAN=
Cisco Nexus 7000 Series 4-Slot Chassis including Fan Tray, Cable Management Kit, No Power Supply	N7K-C7004
Cisco Nexus 7000 Series 4-Slot Chassis including Fan Tray, Cable Management Kit, No Power Supply	N7K-C7004=
Cisco Nexus 7000 Series 4-Slot Fan Tray Spare	N7K-C7004-FAN=
Cisco Nexus 7000 Series 10-Slot chassis including Fan Trays, No Power Supply	N7K-C7010
Cisco Nexus 7000 Series 10-Slot chassis including Fan Trays, No Power Supply	N7K-C7010=
Cisco Nexus 7000 Series-10-Slot System Fan Tray Spare	N7K-C7010-FAN-S=
Cisco Nexus 7000 Series-10-Slot Fabric Fan Tray Spare	N7K-C7010-FAN-F=
Cisco Nexus 7000 Series 18-Slot chassis including Fan Trays, No Power Supply	N7K-C7018
Cisco Nexus 7000 Series 18-Slot chassis No Fan Trays, No Power Supply	N7K-C7018=
Cisco Nexus 7000 Series-18-Slot Fan Tray Spare	N7K-C7018-FAN=
Cisco Nexus 7000 Series 4-Slot Accessories	
Cisco Nexus 7004 Rack Mount Kit	N7K-C7004-RMK=
Cisco Nexus 7004 Front Door Kit	N7K-C7004-FD-MB
Cisco Nexus 7004 Air Filter	N7K-C7004-AFLT=
Cisco Nexus 7000 Series 9-Slot Accessories	
Cisco Nexus 7009 Rack Mount Kit	N7K-C7009-RMK=
Cisco Nexus 7009 Front Top Section and Cable Mgmt Kit	N7K-C7009-CAB-TOP=
Cisco Nexus 7009 Front Door Kit	N7K-C7009-FD-MB
Cisco Nexus 7009 Bottom Support Kit	N7K-C7009-BSK
Cisco Nexus 7009 Fabric Module Blank	N7K-C7009-F-BLANK=
Cisco Nexus 7009 Center Mount Kit	N7K-C7009-CMK

Product Name	Part Number
Cisco Nexus 7000 Series 10-Slot Accessories	
Cisco Nexus 7010-Air Filter	N7K-C7010-AFLT=
Cisco Nexus 7000-Rack Mount Kit	N7K-RMK=
Cisco Nexus 7010-EMI Inlet Screen Kit	N7K-C7010-EMI-SC=
Cisco Nexus 7010 Front Door Top Section-including Cable Management Kit	N7K-C7010-FD-TOP=
Cisco Nexus 7010 Front Door-Kit	N7K-C7010-FD-MB=
Cisco Nexus 7000 Bottom Support Kit	N7K-BSK=
Cisco Nexus 7010 Fabric Module Blank	N7K-FAB-BLANK=
Cisco Nexus 7000 Series 18-Slot Accessories	
Cisco Nexus 7018 Rack Mount Kit	N7K-C7018-RMK=
Cisco Nexus 7018 Front Top Section and Cable Mgmt Kit	N7K-C7018-CAB-TOP=
Cisco Nexus 7018 Front Door Kit	N7K-C7018-FD-MB
Cisco Nexus 7018 Bottom Support Kit	N7K-C7018-BSK
Cisco Nexus 7018 Fabric Module Blank	N7K-C7018-F-BLANK=
Blank Panel Covers	
Cisco Nexus 7000 Series Supervisor Blank Slot Cover	N7K-SUP-BLANK=
Cisco Nexus 7000 Series Module Blank Slot Cover	N7K-MODULE-BLANK=
Cisco Nexus 7000 Series Network Clock Card Blank	N7K-CLK-BLANK=
Cisco Nexus 7000 Series 3 KW Power Supply Blank Slot Cover with Handle	N7K-3KPS-BLANK-H=
Cisco Nexus 7009 Chassis Power Supply Blank Slot Cover with Handle	N7K-PS-BLANK-H=
Cisco Nexus 7010 Chassis Power Supply Blank Slot Cover	N7K-PS-BLANK=
Cisco Nexus 7018 Chassis Power Supply Blank Slot Cover with Handle	N7K-PS-BLANK-H=

Service and Support

Cisco offers a wide range of services to help accelerate your success deploying and optimizing Cisco Nexus 7000 Series Switches in your data center. Our innovative services are delivered through a unique combination of people, processes, tools, and partners, and are focused on helping you increase operation efficiency and improve your data center network. Cisco Advanced Services use an architecture-led approach to help you align your data center infrastructure with your business goals and provide long-term value. Cisco SMARTnet® Service helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning resources. With this service, you can take advantage of the Cisco Smart Call Home service capability, which offers proactive diagnostic information and real-time alerts for your Cisco Nexus 7000 Series Switches. Spanning the entire network lifecycle, Cisco Services helps increase investment protection, optimize network operations, provide migration support, and strengthen your IT expertise. For more information about Cisco Data Center Services, visit http://www.cisco.com/go/dcservices.

Cisco Capital
Financing to Help You Achieve Your Objectives

Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

For More Information

For more information about the Cisco Nexus 7000 Series, visit the product homepage at http://www.cisco.com/go/nexus or contact your local account representative.

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ACF202BLK
Rack Side Air Distribution 2U 208/230 50/60HZ

has not been replaced. Please contact your customer care center for more information.

Overview

Description	Housing equipment with side to side airflow creates many challenges for IT and facility managers, particularly in regards to cooling. Because most enclosures are designed for a front to back airflow pattern, it is difficult to maintain ideal operating temperatures on side to side airflow equipment. The Rack Side Air Distribution Unit is a 2U rack mountable air distribution product for networking equipment or servers with side to side airflow. It pulls in conditioned air from the front of the rack and distributes it to the side air intake of the networking equipment.
Model Name	Rack Side Air Distribution 2U 208/230 50/60HZ
Includes	Installation guide , User Manual
Standard Lead Time	Usually in Stock
Product Distribution	Afghanistan , Albania , Algeria , Andorra , Angola , Argentina , Armenia , Australia , Austria , Azerbaijan , Bahrain , Bangladesh , Belarus , Belgium , Benin , Bhutan , Bosnia And Herzegovina , Botswana , Brazil , Brunei Darussalam , Bulgaria , Burkina Faso , Burundi , Cambodia , Cameroon , Canada , Cayman Islands , Central African Republic , Chad , Chile , China , Congo , CONGO, THE DEMOCRATIC REPUBLIC OF THE , Cook Islands , Cote D'Ivoire , Croatia , Cyprus , Czech Republic , Denmark , Djibouti , East Timor , Egypt , Equatorial Guinea , Eritrea , Estonia , Ethiopia , Fiji , Finland , France , Gabon , Gambia , Georgia , Germany , Ghana , Gibraltar , Greece , Guinea , Hong Kong , Hungary , Iceland , India , Indonesia , Iran (Islamic Republic Of) , Iraq , Ireland , Israel , Italy , Jordan , Kazakhstan , Kenya , KOREA, REPUBLIC OF , Kuwait , Latvia , Lebanon , Lesotho , Liberia , Liechtenstein , Lithuania , Luxembourg , Macedonia , Malawi , Malaysia , Mali , Malta , Mauritania , Moldova, Republic Of , Mongolia , Morocco , Mozambique , Myanmar , Namibia , Nepal , Netherlands , New Zealand , Niger , Nigeria , Norway , Oman , Pakistan , Papua New Guinea , Paraguay , Philippines , Poland , Portugal , Romania , Russian Federation , Rwanda , Saudi Arabia , Senegal , Sierra Leone , Singapore , Slovakia (Slovak Republic) , Slovenia , Somalia , South Africa , Spain , Sri Lanka , Sudan , Suriname , Sweden , Switzerland , Tajikistan , TANZANIA, UNITED REPUBLIC OF , Thailand , Togo , Tunisia , Turkey , Turkmenistan , Uganda , Ukraine , United Arab Emirates , United States , Uruguay , Uzbekistan , Viet Nam , Western Sahara , Yemen , Zambia , Zimbabwe

General

Air Flow	260.0

Input

Number of Power Cords	2
Nominal Input Voltage	200V 208V 230V
Input Frequency	50/60 Hz
Rack Height	2 U

Input Connections	C-13 , IEC-320 C14

Communications & Management

Control panel	Power on/off indicator

Physical

Maximum Height	87.0 mm
Maximum Width	431.0 mm
Maximum Depth	669.0 mm
Net Weight	14.55 kg
Shipping Weight	19.55 kg
Shipping Height	241.0 mm
Shipping Width	660.0 mm
Shipping Depth	787.0 mm
Color	Black

Conformance

Approvals	CE , GOST , UL Recognized , cUL Recognized
Standard warranty	2 years repair or replace

Sustainable Offer Status

Other Environmental Compliance	China RoHS

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MX SERIES 5G UNIVERSAL ROUTING PLATFORMS

Product Overview

Unrelenting traffic growth—driven by higher speeds, more subscribers, mobile penetration, cloud adoption, and ubiquitous video consumption—is straining traditional service provider and enterprise networks.
To accommodate this reality, Juniper's Secure Automated Distributed Cloud solution helps service providers react to changing market conditions and accelerate service delivery with world-class products and innovative architectural components. The MX Series is an integral part of this solution. Powered by the Junos OS and programmable Trio/Si5 silicon chipset, MX Series platforms deliver powerful routing, switching, security, and services features that help operators successfully transform their networks—and their businesses—in today's hyper-connected world.

Product Description

The continuous expansion of mobile, video, and cloud-based services is disrupting traditional networks and impacting the businesses that rely on them. While annual double-digit traffic growth requires massive resource investments to prevent congestion and accommodate unpredictable traffic spikes, capturing return on that investment can be elusive. Emerging trends such as 5G mobility, Internet of Things (IoT) communications, and the continued growth of cloud networking promise even greater network challenges in the near future. The Juniper Networks® MX Series 5G Universal Routing Platform delivers the industry's first end-to-end infrastructure security solution for enterprises as they look to move business-critical applications to public clouds. Delivering features, functionality, and secure services at scale in the 5G era with no compromises, the MX Series is a critical part of the network evolution happening now.

At the same time, traditional operations environments are increasingly challenged to meet consumer and business requirements for rapid service delivery and cloud-like network experiences. Issues related to monitoring and management are placing additional stress on already strained budgets and personnel, and promising technologies like Network Functions Virtualization (NFV) and SDN introduce an entirely new set of operational challenges.

Our hyper-connected world demands more agile, automated, and scalable networks. Now more than ever, network operators need to transform their networks—and their operations environments—to accommodate this reality.

Utilizing state-of-the-art software and hardware innovations, MX Series 5G Universal Routing Platforms are helping network operators worldwide successfully transform their networks and services. Powered by the Juniper Networks Junos® operating system and the programmable Trio chipset, MX Series platforms support a broad set of automation tools and telemetry capabilities that enable a rich set of business- and consumer-oriented services with predictable low latency and wire-rate forwarding at scale, while providing the reliability needed to meet strict service-level agreements (SLAs).

An Agile Family of Cloud-Era Universal Routing Platforms

The MX Series portfolio was designed for agility and built from the ground up to support a universal set of edge applications, helping Juniper customers rapidly respond to evolving business and technical requirements while simplifying operations without sacrificing their current infrastructure investments.

With its massive scale and efficiency, the MX Series is ideal for space- and power-constrained environments. It redefines per-slot economics, enabling customers to do more with less while simplifying network design, reducing OpEx. It also enables the profitable delivery of a broad range of business, residential, mobile, cable, data center, and cloud services while seamlessly supporting traditional and emerging network architectures with adaptive software and pervasive security. The flexibility of the MX Series is enabled by the programmable Trio chipset, which allows MX Series platforms to add support for new features, such as telemetry, without costly hardware upgrades. Additionally, support for the Junos Automation Toolkit and the Juniper Extension Toolkit provide modern programming languages that reduce costs and increase profitability by improving productivity and customization.

This agility is evident in the wide variety of MX Series use cases that have been proven in the world's largest and most demanding networks, including:

- **Business Edge**: MX Series platforms support the broadest range of L2/L2.5/L3 VPN services which, in combination with multilayer, multiprotocol resiliency, ensure that customer SLAs are met under all network conditions.
- **Internet/Peering Gateway**: MX Series platforms support the high performance, reliability, scale, and density needed to efficiently peer with Internet and other service provider networks.
- **Broadband Network Gateway (BNG)**: MX Series platforms offer the highest subscriber density and most sophisticated broadband edge features available in the industry.
- **Universal SDN Gateway**: The MX Series offers a comprehensive solution for interconnecting virtual and physical networks—as well as between virtual networks operating with different technologies—via support for Multiprotocol BGP (MBGP), dynamic tunnels using MPLSoGRE or Virtual Extensible LAN (VXLAN) encapsulation, virtual routing and forwarding (VRF) tables, E-VPNs, and Network Configuration Protocol (NETCONF), along with the ability to send traffic between VRF and global routing tables based on configuration and policy.

- **Data Center and Cloud Edge**: The MX Series is ideal for data center/cloud edge applications, with support for multiple overlay encapsulation methods, including VXLAN, Network Virtualization using Generic Routing Encapsulation (NVGRE), MPLSoUDP, MPLSoGRE, 802.1BR, SR-MPLS, and SR-V6. The MX Series also incorporates data plane security with inline IPsec/MACsec in the MPC-10E line cards, making it a perfect fit for data center and cloud deployments.
- **Enterprise WAN**: Enterprises and government agencies worldwide use MX Series platforms to build their own overlay network on top of a service provider's Layer 2 or MPLS network, using encapsulation technologies such as MPLSoGRE, VXLAN, and IPsec for secure transport.
- **Universal Metro/Aggregation**: MX Series platforms offer a full suite of routing and switching features, allowing you to choose a deployment model that best fits your business and technical needs. The MX Series can be deployed as IP/IP VPN edge routers, Ethernet VPN (EVPN) and virtual private LAN service (VPLS) provider edge (VPLS-PE) routers, MPLS label-switching (LSR) routers, and as Layer 2 Ethernet switches or Layer 3 IP routers.
- **Mobile Backhaul**: In addition to switching, routing, and security features, MX Series platforms support highly scalable and reliable hardware-based timing that meets the strictest LTE requirements, including Synchronous Ethernet for frequency and the Precision Time Protocol (PTP) for frequency and phase synchronization. In addition, the MX104 is ETSI 300-compliant, enabling deployment in next-generation mobile applications such as 5G.

At-a-Glance: MX Series 5G Universal Routing Platforms Comparison

The MX Series portfolio includes a wide range of physical and virtual platforms that share a common architecture and feature set. This enables Juniper customers to select the platform that best addresses their unique business goals and satisfies their scale, density, resiliency, space, power, and value-added service requirements without compromising on quality or features.

Modular MX Series Platforms

MX960, MX480, and MX240 5G Universal Routing Platforms are modular, chassis-based platforms.

- The MX960 has been proven in the world's largest service provider, cable, mobile, and data center networks, offering 12 Tbps of system capacity in support of business and residential broadband services as well as peering and provider edge applications.

- The MX480 is a modular, 9 Tbps-capable router that supports a wide range of cloud, campus, enterprise, data center, service provider, cable, and mobile service core applications.
- The MX240 is a compact, 3 Tbps-capable router ideal for space-constrained cloud, enterprise, data center, service provider, cable, and mobile service core deployments.

The latest generation of line card hardware for the MX960, MX480, and MX240 platforms delivers multi-terabit crypto capabilities with 256-bit encryption complying with AES-GCM encapsulation per RFC4303; AES-GCM encapsulation per RFC4106; AES-GMAC encapsulation per RFC4543; and AES-GMAC (IPv4/v6) encapsulation per RFCs 4302 and 4543. Along with multi-terabit routing, the latest MPC also delivers integrated Layer 2 MACsec features at flexible interface rates of 10GbE, 40GbE, and 100GbE.

Fixed-Configuration MX Series Platforms

MX204, MX150, MX104, MX80, MX40, MX10, and MX5 Universal Routing Platforms are fixed-configuration platforms that support modular interfaces.

- The MX204 is a space- and power-optimized router delivering ultra-high port density and throughput while consuming just 0.9 W/Gb. It addresses the emerging edge and metro Ethernet networking needs of service providers, mobile, web-scale operators, and MSOs by delivering 400 Gbps of throughput in support of high-density 100GbE, 40GbE, and discrete and breakout 10GbE and 1GbE interfaces—all in a single rack unit.
- The MX150 is a compact, full-featured router delivering 20 Gbps of throughput in support of 1GbE and 10GbE interfaces.

It provides a cost-effective solution for a wide range of low-bandwidth provider edge, business edge, broadband network gateway (BNG), and enterprise WAN applications.

- The MX104 is a mobile backhaul-optimized, ETSI 300 mm-compliant chassis with high redundancy and 80 Gbps of throughput. The MX104 offers four MIC slots and redundant fixed 10GbE interfaces for flexible network connectivity.
- The MX80, MX40, MX10, and MX5 are software upgradeable from 20 Gbps to 80 Gbps, enabling cost-effective "pay as you grow" scale. These platforms have up to four Modular Interface Card (MIC) slots and two fixed 10GbE interfaces for connecting to the network.

The following table provides a comparison between the various MX Series modular and fixed-configuration platforms.

Architecture and Key Components

Modular Components for Chassis-Based MX Series Platforms

The modular, chassis-based MX960, MX480, and MX240 share the following components:

- Modular Port Concentrators (MPCs) provide routing, MPLS, switching, inline services, subscriber management, and hierarchical quality of service (HQoS) among many other features. MPCs may also host interfaces directly or via Modular Interface Cards (MICs) that allow users to "mix and match" interface types. Powered by the programmable Trio chipset, MPCs collect and stream telemetry that identifies resource utilization, loss and delay, and other metrics.

Table 1: MX Series 5G Universal Routing Platforms at a Glance

	MX960	MX480	MX240	MX204	MX150	MX104	MX80	MX40	MX10	MX5
Rack units	16	8	5	1	1	3.5	2	2	2	2
Systems per rack	3	6	9	48	48	13	24	24	24	24
Slots	11 MPCs	6 MPCs	2 MPCs	8 10GbE, 4 100GbE	NA	4 10GbE, 4 MIC slots	4 10GbE, 3[1] MIC slots	2 10GbE, 3[2] MIC slots	3[3] MIC slots	3[4] MIC slots
Per slot capacity	1.5 Tbps	1.5 Tbps	1.5 Tbps	NA	NA	NA	NA	NA	NA	NA
Maximum system throughput[5]	12 Tbps	9 Tbps	3 Tbps	400 Gbps	20 Gbps	80 Gbps	80 Gbps	60 Gbps	40 Gbps	20 Gbps
PDH	Yes	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	NA
Sonet/SDH	Yes	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	NA
Maximum 1GbE	480	360	120	24	12	80	80	60	40	20
Maximum 10GbE	480	360	120	24	2	8	8	4	1	NA
Maximum 40GbE	120	90	30	4	NA	NA	NA	NA	NA	NA
Maximum 100GbE	120	90	30	4	NA	NA	NA	NA	NA	NA
Maximum 400GbE	24	18	6	NA	NA	NA	NA	NA	NA	NA
10GbE DWDM	88	48	16	8	NA	NA	NA	NA	NA	NA
100GbE DWDM	22	12	4	4	NA	NA	NA	NA	NA	NA

[1] The MX80 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[2] The MX40 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[3] The MX10 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[4] The MX5 has one front MIC slot and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[5] Full duplex maximum system throughput values (to determine half-duplex values, double system throughput)

- Switch Control Boards (SCBs) feature an integrated switch fabric that connects to all slots in the chassis in a nonblocking architecture. The SCBs house the Routing Engine, control power to MPCs, monitor and control system functions such as fan speed and the system front panel, and manage clocking, resets, and boots.
- The Routing Engine (RE) provides the control plane, runs Juniper Networks Junos® operating system, and handles all routing protocol processes as well as the software processes that control MPCs, chassis components, system management, and user access to the router. REs communicate with MPCs via dedicated out-of-band management channels.

MPC-10E Line Card

The MPC-10E line card is a key contributor to the service provider transformation in the cloud era when deployed with MX960, MX480, and MX240 platforms in a Juniper Secure Automated Distributed Cloud environment. By providing the underlying network infrastructure with scale, agility, routing innovation, and pervasive security while incorporating universal (10/40/100/400GbE) ports, the MPC-10E protects existing investments with disaggregated software innovation and infinite programmability. Built-in automation enables rapid deployment without disrupting the existing MX960/MX480/MX240 footprint. The MPC-10E line card is powered by the new Juniper Si5 silicon, which enables the benefits highlighted in Table 2.

Table 2: MPC-10E Line Card Benefits at a Glance

Attribute	Benefit
Performance	Triples MX960/MX480/MX240 chassis performance to 1/1.5 Tbps per slot with new SCBE3 fabric, enabling up to 10 Tbps throughput
Universal Interfaces	Reduces interface sparing with multi-rate 10/40/100GbE interfaces
Power Efficiency	Consumes ~0.5 W per gigabit per system level
Inline Data Plane Security	Features AES-256 MACsec line-side encryption and native IPsec tunnel support
Investment Protection	Backward compatible with existing MPCs and REs: PC3E/MPC4E/ MPC5E/MPC7E/NG-MPC, MS-MPC, NG-MSMPC, MPC2E/3E-NG, and 16x10G MPCs; RE-S-1800 and RE-S-X6 Routing Engine modules
Seamless Deployment	Reuse deployed MX960/MX480/MX240 chassis, power modules, and fan trays

Junos OS

Junos OS is a reliable, high-performance, modular network operating system that is supported across all of Juniper's physical and virtual routing, switching, and security platforms. Junos OS improves network operations and increases service availability, performance, and security with features like low-latency multicast, comprehensive quality of service (QoS), unified in-service software upgrade (unified ISSU), and Junos Continuity, which eliminates the risk and complexity of OS upgrades. With secure programming interfaces, versatile scripting support, and integration with popular orchestration frameworks, Junos OS offers flexible options for

DevOps style management that can unlock more value from the network.

The Programmable Trio Chipset

The programmable Trio chipset is Juniper-developed breakthrough silicon technology that is implemented across the MX Series portfolio. Its innovative design improves business economics by enabling a truly converged platform with maximum performance, service agility, and exceptional power and thermal efficiency.

Trio has a programmable forwarding data structure that allows fast microcode changes in the hardware itself, as well as a programmable lookup engine that allows inline service processing. Furthermore, Trio's programmable QoS engine supports coarse and fine-grained queuing to efficiently address the diverse requirements of core, edge, and aggregation use cases.

With its proven extensibility and agility, the programmable Trio chipset helps network operators worldwide successfully address their most complex technical and market challenges, and promises to meet the requirements of emerging applications for many years to come.

Network Edge Services

MX Series platforms can host optionally licensed Junos OS-based network edge services at scale, both inline on MPCs as well as on dedicated service cards. Hosting network edge services on MX Series platforms reduces network cost and complexity by eliminating numerous elements, operating systems, and interconnections.

- MPCs support inline services using the programmable Trio chipset; supported services include flow monitoring, 1:1 Network Address Translation (NAT), port mirroring, generic routing encapsulation (GRE), IP tunneling, logical tunnels, lawful intercept, and video monitoring.
- The MS-MPC and the MS-MIC provide dedicated processing for compute-intensive services such as carrier-grade NAT (CGNAT), IPsec, stateful firewall, deep packet inspection, flow monitoring, and load balancing.
- The MX-SPC3 provides security services such as carrier-grade NAT (CGNAT), stateful firewall, IDS, traffic load balancing, and DNS sinkhole.

MX Series Platform/Feature Matrix

		MX960	MX480	MX240	MX204	MX150	MX104	MX80	MX40	MX10	MX5
Security	Firewall filters/ACLs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DDoS—control plane	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DDoS—FlowSpec	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Stateless filters L2-L4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Stateful services	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
Inline Services	GRE reassembly	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1:1 NAT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Flow monitoring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Video monitoring	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Lawful intercept	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mirroring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Service Card Supported Services[6]	Deep packet inspection	✓	✓	✓	No	No	No	No	No	No	No
	CGNAT	✓	✓	✓		No	✓	✓	✓	✓	✓
	Flow monitoring	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Server traffic load balancing[7]	✓	✓	✓	No	No	No	No	No	No	No
	IPsec	✓	✓	✓	No	No	✓	✓	✓	✓	✓
	Stateful firewall	✓	✓	✓	No	No	✓	✓	✓	✓	✓
	HTTP header manipulation	✓	✓	✓	No	No	No	No	No	No	No
Resiliency	Redundant RE	✓	✓	✓	No	No	✓	No	No	No	No
	Unified ISSU	✓	✓	✓	No	No	✓	No	No	No	No
	Nonstop active routing (NSR)	✓	✓	✓	No	No	✓	No	No	No	No
	Fast restoration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Operation, Administration, and Maintenance (OAM)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
System Virtualization	Enhanced SLA and queuing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Junos Fusion Edge (AD)	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Logical systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Virtual router/switch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Path Computation Element Protocol (PCEP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	OpenConfig	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	YANG data modeling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Juniper Extension Toolkit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

[6]Service Card supported services are available via optional software license and require an MX-SPC3, MS-MPC, or MS-MIC.
[7]For more information, see https://www.juniper.net/documentation/en_US/junos/topics/concept/tdf-tlb-overview.html

Key Features and Benefits

Unmatched Network Availability

MX Series platforms ensure network and service availability with a broad set of multilayered physical, logical, and protocol-level resiliency features, including Juniper's Virtual Chassis technology, which supports chassis-level redundancy while enabling users to manage two routers as a single element. Additionally, a multichassis link aggregation group (MC-LAG) implementation supports stateful chassis, card, and port redundancy, as well as subscriber and session persistence.

Application Aware Networking

MX Series platforms use deep packet inspection to detect applications, and they consult with user-defined policies to determine traffic treatment on a per-application basis, enabling highly customized and differentiated services at scale. Working in conjunction with Juniper Networks Contrail® Cloud Platform™, MX Series routers can also steer into complex service chains and stream granular data to analytics engines and back-office systems to permit real-time charging and end-user engagement at the application and content level.

Junos Continuity and Unified In-Service Software Upgrade (Unified ISSU)

Junos Continuity and unified ISSU features remove the downtime risks associated with implementing new hardware or upgrading operating systems.

- Junos Continuity eliminates OS upgrades and system reboots when adding new hardware to MX Series platforms; a plug-in package provides the drivers and support files needed to bring the hardware online.
- Unified ISSU reduces the risks associated with OS upgrades by enabling upgrades between two different Junos OS releases (major or minor) with no control plane disruption and minimal traffic disruption on the forwarding plane.

Junos Telemetry Interface

The Junos Telemetry Interface feature streams component-level data to monitoring, analytics, performance management, and visualization tools as well as to Path Computation Elements such as Juniper Networks NorthStar Controller. Analytics derived from this streaming telemetry can identify current and trending congestion, resource utilization, traffic volume, and buffer occupancy, which can be used to make informed decisions on network design and investments.

Integrated Timing

MX Series platforms support highly scalable and reliable hardware-based timing that meets the strictest LTE requirements, including Synchronous Ethernet for frequency, and the Precision Time Protocol (PTP) for frequency and phase synchronization. Synchronous Ethernet and PTP can be combined in a "hybrid" mode to achieve the highest level of frequency (10 ppb) and phase (< 1.5 uS) accuracy required for LTE-Advanced, eliminating the need for external clocks.

Junos Fusion Provider Edge

Junos Fusion Provider Edge enables MX Series platforms to act as aggregation devices for the Juniper Networks EX4300 Ethernet Switch and QFX5100 line of data center switching platforms acting as satellite devices while appearing to management as a single, port-dense device managed by a single IP address. Junos Fusion Provider Edge significantly expands the number of network interfaces on the MX Series router while keeping operations simple.

Automated Support and Prevention

Juniper's Automated Support and Prevention consists of an ecosystem of tools, applications, and systems that simplify and streamline operations, delivering operational efficiency, reducing downtime, and increasing your network's ROI running Junos OS. Automated Support and Prevention brings operational efficiency by automating several time-consuming tasks such as incident management, inventory management, proactive bug notification, and on-demand End-of-Life/End-of-Support/End-of-Engineering (EOL/EOS/EOE) reports. The Junos Space® Service Now and Service Insight service automation tools are standard entitlements of all Juniper Care contracts.

Junos Automation Toolkit and Juniper Extension Toolkit

Included in Junos OS software, the Junos Automation Toolkit is a suite of tools supported on all Juniper Networks switches, routers, and security devices. These tools, which leverage the native XML capabilities of Junos OS, include commit scripts, op scripts, event policies and event scripts, and macros that help automate operational and configuration tasks. Additionally, the platform-independent Juniper Extension Toolkit provides a modern programming tool kit that includes support for:

- OpenConfig/YANG
- gRPC, Thrift, NETCONF
- JSON/XML
- API support for all modern programming languages
- Rich on-box scripting support using Python
- REST APIs

Together, Junos OS automation and programmability features simplify complex configurations and reduce the potential for configuration errors. They also save time by automating operational and configuration tasks, speed troubleshooting, and maximize network uptime by warning operators of potential problems and automatically responding to system events.

Security Intelligence for the Edge

The MX960, MX480, and MX240 can be used for advanced threat prevention when deployed as edge routers, further extending security coverage to applications and infrastructure.

Using Juniper's SecIntel capabilities, these MX Series routers offer another layer of network security by identifying and blocking command and control traffic discovered by Juniper Threat Labs and other industry-leading threat feeds, as well as by utilizing custom blacklists and whitelists at a network hardware level. This feature makes your MX Series router an information security enforcement point without having to invest in additional hardware.

MX960

MX240

MX480

MX204

MX150

MX80/40/10/5

MX104

Specifications

Layout		MX960	MX480	MX240	MX204	MX150	MX104	MX80-MX5
Layout	System capacity	12 Tbps	9 Tbps	3 Tbps	400 Gbps	20 Gbps	80 Gbps	80 Gbps to 20 Gbps
	Slot orientation	Vertical	Horizontal	NA	Horizontal	NA	Horizontal	Horizontal
	Mounting	Front or center	Front or center	Front or center	Front or center	Front or center	Front or center	Front or center
Physical Specification	Dimensions (W x H x D)	17.37 x 27.75 x 23 in (44.11 x 70.49 x 58.42 cm)	17.45 x 14 x 24.5 in (44.3 x 35.6 x 62.2 cm)	17.45 x 8.71 x 24.5 (44.3 x 22.1 x 62.2 cm)	17.6 x 1.75 x 18.7 in (44.7 x 4.45 x 47.5 cm)	17.36 x 1.72 x 12 in (44.09 x 4.37 x 30.48 cm)	17.22 x 9.46 x 6.09 in (43.7 x 24 x 15.47 cm)	17.5 x 3.5 x 23.46 in (44.5 x 8.9 x 59.6 cm)
	Weight fully loaded	334 lb/151.6 kg	180 lbs/81.6 kg	130 lb/59 kg	23.15 lb/10.5 kg	9.48 lb / 4.3 kg	32 lb/14.5 kg	30 lb/13.7 kg
	Weight unloaded	150 lbs/68.1 kg	65.5 lbs/29.7 kg	52 lbs/23.6 kg	17 lb/7.71 kg	NA	NA	NA
Routing Engine	Default memory	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	32GB DDR4; 2x100 GB SSD	Xeon D processor running Wind River Linux 7; 32 GB DDR4 RAM; 400 GB SSD	4 MB boot flash; 8 GB of NAND Flash; 4 GB of DDR3 RAM	8 MB boot flash; 4 GB on NAND flash storage; 2 GB of DDR2 RAM
	Number of cores	6 cores	6 cores	6 cores	8 cores	6 cores	1 core	1 core
Redundancy	Components	Power supplies, REs, fans	Power supplies, REs, fans	Power supplies, REs, fans	Power supplies and fans	Fans	Power supplies, REs, fans	Power supplies and fans
Environmental	Air flow	Front to back	Side to side	Side to side	Front to back	Front to back	Side to side [forced air]	Side to side [forced air]
	Operating temperature	32° to 115° F (0° to 46° C) at sea level	32° to 115° F (0° to 46° C) at sea level	32° to 115° F (0° to 46° C) at sea level	32° to 115° F (0° to 46° C)	32° to 122° F (0° to 50° C)	-40° to 149° F (-40° to 65° C)	32° to 115° F (0° to 46° C) at sea level
	Operating humidity	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%
	Operating altitude	10,000 ft (3048 m)	10,000 ft (3048 m)	10,000 ft (3048 m)	6,000 ft (1900 m)			10,000 ft (3048 m)
Certifications	NEBS	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	NA	- SR-3580 (2007) NEBS Criteria Levels (Level 3 Compliance) - GR-63-Core (2006) NEBS Physical Protection - GR-1089-Core (2006) EMC and Electrical Safety - GR-3108-CORE Issue 2, December 2008 - IEEE 1613: 2009 - IEC 61850-3: 2013	- GR-63-Core Physical Protection - GR-1089-Core:EMC and Electrical Safety

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Ordering Information

MX5, MX10, MX40, and MX80 Base Product Bundles

Product	Product Number	Description
MX5-MX80	MX5BASE-T	MX5 chassis with timing support—includes dual power supplies, MIC-3D-20GE-SFP, S-MX80-ADV-R, S-MX80-Q, and S-ACCT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX10BASE-T	MX10 chassis with timing support—includes dual power supplies, MIC-3D-20GE-SFP, 1 empty MIC slot, S-MX80-ADV-R, S-MX80-Q, and S-ACCT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX40BASE-T	MX40 chassis with timing support—includes dual power supplies, 2 empty MIC slots, 2x10GbE fixed ports, S-MX80-ADV-R, S-MX80-Q, and S-AC CT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX80BASE-P	MX80 chassis with PTP and Synchronous Ethernet support—includes one power supply, 2 empty MIC slots, 4x10GbE 10-gigabit small form-factor pluggable transceiver (XFP) built-in ports, fan tray with filter. Power supply cable needs to be ordered separately.
	MX80BASE-T	MX80 chassis with timing support—includes one power supply, 2 empty MIC slots, 4x10GbE XFP built-in ports, fan tray with filter. Power supply cable needs to be ordered separately.
MX104	MX104-AC	MX104 chassis with 4 MIC slots, 4X10GbE SFPP built-in ports (license required for activation), AC power supply, fan tray with filter, Packet Forwarding Engine and Routing Engine, Altius-MX104.
	MX104-DC	MX104 chassis with 4 MIC slots, 4X10GbE SFPP built-in ports (license required for activation), DC power supply, fan tray with filter, Packet Forwarding Engine and Routing Engine, Altius-MX104.

MX5, MX10, MX40, and MX80 A La Carte Chassis

Product	Product Number	Description
MX5	MX5-T-AC	AC chassis
	MX5-T-DC	DC chassis
MX10	MX10-T-AC	AC chassis
	MX10-T-DC	DC chassis
MX40	MX40-T-AC	AC chassis
	MX40-T-DC	DC chassis
MX80	MX80-T-AC	AC chassis
	MX80-T-DC	DC chassis
	MX80-AC	AC chassis
	MX80-DC	DC chassis
	MX80-48T-AC	AC chassis
	MX80-48T-DC	DC chassis

MX5, MX10, and MX40 Upgrade Licenses

Product	Product Number	Description
MX5	MX-5-10-UPG-B	Software upgrade for MX5 to MX10
	MX-5-40-UPG-B	Software upgrade for MX5 to MX40
	MX-5-80-UPG-B	Software upgrade for MX5 to MX80
MX10	MX-10-40-UPG-B	Software upgrade for MX10 to MX40
	MX-10-80-UPG-B	Software upgrade for MX10 to MX80
MX40	MX-40-80-UPG-B	Software upgrade for MX40 to MX80

MX80 Software Licenses

Product	Product Number	Description
MX80	S-MX80-ADV-R	License to support full scale L3 route and L3 VPN on MX80
	S-MX80-Q	License to support per VLAN queuing on MX80
	S-MX80-SA-FP	Subscriber Management Feature Pack License
	S-MX80-SSM-FP	Subscriber Service Management Feature Packet License (RADIUS/SRC Series-based service activation and deactivation) per service accounting features for subscribers, MX80

MX104 A La Carte Chassis

Product	Product Number	Description
MX104	MX104-AC-Base	MX104 base chassis with 1 AC power supply, fan tray, filter, 1 RE, 4 MIC slots (optics for fixed ports not included, MICs not included)
	MX104-DC-Base	MX104 base chassis with 1 DC power supply, fan tray, filter, 1 RE, 4 MIC slots (optics for fixed ports not included, MICs not included)

MX104 Upgrade Licenses

Product	Product Number	Description
MX104	S-MX104-UPG-2x10GE	Upgrade license to activate 2 x 10GbE fixed ports
	S-MX104-UPG-4x10GE	Upgrade license to activate 4 x 10GbE fixed ports

MX104 Software Licenses

Product	Product Number	Description
MX104	S-MX104-SSM-FP	L3 Subscriber Service Management Feature Packet License, MX104
	S-MX104-Q	License to support per VLAN queuing on MX104
	S-MX104-ADV-R	License to support full-scale L3 route and L3 VPN on MX104

MX150 Base Bundle

Product	Product Number	Description
MX150	MX150-R	MX150 with 10 10/100/1000BASE-T ports, two 100/1000BASE-X SFP ports, and two 10GBASE-X SFP+ ports (optics sold separately), 6-core x86 processor, 400 GB SSD, and 32 GB memory. Supports full L2/L3 feature sets including HQoS.

MX150 A La Carte Chassis

Product	Product Number	Description
MX150	MX150	MX150 with 10 10/100/1000BASE-T ports, two 100/1000BASE-X SFP ports, and two 10GBASE-X SFP+ ports (optics sold separately), 6-core x86 processor, 400 GB SSD, and 32 GB memory. Supports basic L2 features.

MX150 Upgrade Licenses*

Product	Product Number	Description
MX150	S-MX150-IR	Software license to support full L2 and limited L3 features and performance
	S-MX150-R	Software license to support full L2/L3 features and scale, including HQoS

*Both S-MX150-IR and S-MX150-R are needed to upgrade from MX150 to MX150-R

MX204 Base Product Bundles

Product	Product Number	Description
MX204	MX204	MX204 chassis with 3 fan trays and 2 power supplies
	MX204-R	MX204 chassis with 3 fan trays and 2 power supplies, R mode
	MX204-IR	MX204 chassis with 3 fan trays and 2 power supplies, IR mode

MX204 Chassis

Product	Product Number	Description
MX204	JNP204-CHAS	MX204 chassis, spare

MX204 Power Supply

Product	Product Number	Description
MX204	JPSU-650W-AC-AO	MX204 AC power supply, spare
	JPSU-650W-DC-AFO	MX204 DC power supply, spare

MX204 Fan Trays

Product	Product Number	Description
MX204	JNP-FAN-1RU	MX204 fan tray

MX240, MX480, and MX960 Base Bundles

Product	Product Number	Description
MX240	MX240BASE-AC-HIGH	4 slot MX240 base chassis with 1 AC power supply, 1 SCB
	MX240BASE-AC-LOW	4 slot MX240 base chassis with 2 AC power supplies, 1 SCB
	MX240BASE3-DC	4 slot MX240 base 3 chassis, DC power
	MX240BASE-DC	4 slot MX240 base chassis with 1 fan tray, 1 DC power supply, 1 SCB
	MX240BASE3-ACH	4 slot MX240 base 3 chassis, highline AC power
	MX240BASE3-ACL	4 slot MX240 base chassis, lowline AC power
MX480	MX480BASE3-AC	8 slot MX480 base bundle, AC power
	MX480BASE-AC	8 slot MX480 AC base chassis, 1 fan tray, 3 AC power supplies, 1 SCB, 1 RE
	MX480BASE3-DC	8 slot MX480 base 3 chassis, DC power
	MX480BASE-DC	8 slot MX480 base chassis with 1 fan tray, 2 DC power supplies, 1 SCB, 1 RE
MX960	MX960BASE3-AC	14 slot MX960 base 3 chassis, AC power
	MX960BASE-AC	14 slot MX960 base chassis with 2 fan trays, 3 AC power supplies, 2 SCBs, 1 RE
	MX960BASE3-AC-ECM	14 slot MX960 base 3 chassis with AC power and extended cable manager
	MX960BASE-AC-ECM	14 slot MX960 base chassis with AC power and extended cable manager
	MX960BASE3-DC	14 slot MX960 base 3 chassis, DC power
	MX960BASE-DC	14 slot MX960 base chassis with 2 fan trays, 2 DC power supplies, 2 SCBs, 1 RE
	MX960BASE3-DC-ECM	14 slot MX960 base 3 chassis with DC power and extended cable manager
	MX960BASE-DC-ECM	14 slot MX960 base chassis with DC power extended cable manager

MX240, MX480 and MX960 Premium Bundles

Product	Product Number	Description
MX240	MX240-PREMIUM2-AC-HIGH	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, highline AC power
	MX240-PREMIUM2-AC-LOW	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, lowline AC powe
	MX240-PREMIUM2-DC	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, DC power
	MX240-PREMIUM3-ACH	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, highline AC power
	MX240-PREMIUM3-ACL	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, lowline AC power
	MX240-PREMIUM3-DC	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, DC power
MX480	MX480-PREMIUM2-AC	8 slot MX480 premium 2 chassis with midplane, redundant RE, SCBEs, AC power
	MX480-PREMIUM2-DC	8 slot MX480 premium 2 chassis with midplane, redundant RE, SCBEs, DC power
	MX480-PREMIUM3-AC	8 slot MX480 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, AC power
	MX480-PREMIUM3-DC	8 slot MX480 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, DC power
MX960	MX960-PREMIUM2-AC-ECM	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, AC power, and extended cable manager
	MX960-PREMIUM2-DC-ECM	14 slot MX960 premium2 chassis with midplane, redundant Routing Engine, SCBEs, DC power, and extended cable manager
	MX960-PREMIUM3-AC-ECM	14 slot MX960 premium 3 chassis with enhanced midplane, redundant Routing Engine, SCBEs, AC power, and extended cable manager
	MX960-PREMIUM3-DC-ECM	14 slot MX960 premium 3 chassis with enhanced midplane, redundant Routing Engine, SCBEs, DC power, and extended cable manager
	MX960-PREMIUM2-AC	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, AC power
	MX960-PREMIUM2-DC	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, DC power
	MX960-PREMIUM3-AC	14 slot MX960 premium 3 chassis with midplane, redundant Routing Engine, SCBEs, AC power
	MX960-PREMIUM3-DC	14 slot MX960 premium 3 chassis with midplane, redundant Routing Engine, SCBEs, DC power

MX240, MX480, and MX960 Chassis

Base Unit	MX240	MX480	MX960
DC Chassis	MX240BASE-DC, MX240BASE3-DC	MX480BASE-DC, MX480BASE3- DC	MX960BASE3-DC; MX960BASE-DC
AC Chassis	MX240BASE-AC, MX240BASE3- ACH, MX240BASE3-ACL	MX480BASE-AC, MX480BASE3-AC	MX960BASE3-AC; MX960BASE-AC

MPCs

Product Number	Description
MPC10E-10C-P-BASE	Modular port concentrator with 8xQSPF28 multirate ports (10/40/100GbE) plus 2xQSFP56-DD multirate ports (10/40/100/400GbE) with perpetual base bundle; includes 128K FIB, 8 VRFs, and 128K MAC with standard Junos features
S-MPC10E-10C-A1-5	Modular port concentrator with 8xQSPF28 multirate ports (10/40/100GbE) plus 2xQSFP56-DD multirate ports (10/40/100/400GbE) with advanced subscription license for 5-year term; includes 4M FIB, 2K VRFs, 32K L2 VPN Ckts, 1M MAC, 128K LSP, and 8K queues with advanced Junos features
S-MPC10E-10C-P1-5	Modular port concentrator with 8xQSPF28 multirate ports (10/40/100GbE) plus 2xQSFP56-DD multirate ports (10/40/100/400GbE) with premium subscription license for 5-year term; includes 8M+ FIB, 4K+ VRFs, 256K+ L2 VPN CKts, 1M+ MAC, 256K+ LSP, and 32K queues with premium Junos features
MPC10E-15C-P-BASE	Modular port concentrator with 12xQSPF28 multirate ports (10/40/100GbE) plus 3xQSFP56-DD multirate ports (10/40/100/400GbE) with perpetual base bundle; includes 128K FIB, 8 VRFs , and 128K MAC with standard Junos features
S-MPC10E-15C-A1-5	Modular port concentrator with 12xQSPF28 multirate ports (10/40/100GbE) plus 3xQSFP56-DD multirate ports (10/40/100/400GbE) with advanced subscription license for 5-year term; includes 4M FIB, 2K VRFs, 32K L2 VPN Ckts, 1M MAC, 128K LSP, and 8K queues with advanced Junos features
S-MPC10E-15C-P1-5	Modular port concentrator with 12xQSPF28 multirate ports (10/40/100GbE) plus 3xQSFP56-DD multirate ports (10/40/100/400GbE) with premium subscription license for 5-year term; includes 8M+ FIB, 4K+ VRFs, 256K+ L2 VPN CKts, 1M+ MAC, 256K+ LSP, and 32K queues with premium Junos features
MPC7E-10G	Fixed 40x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC7E-10G-RB	Fixed 40x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-10G-I-RB	Fixed 40x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC7E-MRATE	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28), with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC7E-MRATE-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28); includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-MRATE-I-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28); includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances
MPC7E-MRATE-Q	Fixed 12xQSFP line card for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; with full-scale L2/L2.5 and reduced scale L3 features
MPC7E-MRATE-Q-RB	Fixed 12xQSFP line card bundle; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-MRATE-Q-I-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances

Product Number	Description
MPC5E-100G10G	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC5E-100G10G-IRB	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5, L3 features and up to 16 L3VPN instances; optional license permits up to 32,000 queues with HQoS
MPC5E-100G10G-RB	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G-IRB	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5, L3 features and up to 16 L3VPN instances; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G-RB	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features; optional license permits up to 32,000 queues with HQoS
MPC5EQ-100G10G	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5 and reduced scale L3 features
MPC5EQ-100G10G-IRB	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC5EQ-100G10G-RB	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC5EQ-40G10G	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5 and reduced scale L3 features
MPC5EQ-40G10G-IRB	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC5EQ-40G10G-RB	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC4E-3D-2GE	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 feature
MPC4E-3D-32XGE-SFPP	Fixed 32x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features
MPC4E-3D-2CGE-8XGE-IRB	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5, L3 features; up to 16 L3VPNs per MPC
MPC4E-3D-32XGE-IRB	Fixed 32x10GbE SFPP line card bundle with full-scale L2/L2.5, L3 features; up to 16 L3VPNs per MPC
MPC4E-3D-2CGE8XGE-RB	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features
MPC4E-3D-32XGE-RB	Fixed 32XGbE small form-factor pluggable transceiver (SFP) line card bundle with full-scale L2/L2.5, L3, and L3VPN features
MX-MPC3E-3D	MPC3 with support for 100GbE, 40GbE, and 10GbE interfaces, L2.5 features, optics sold separately
MX-MPC3E-3D-R-B	MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces; includes full-scale L2, L3, L3VPN features; optics sold separately
MPC3E-3D-NG	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E

Product Number	Description
MX-MPC3E-3D-R-B	MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces; includes full-scale L2, L3, L3VPN features; optics sold separately
MPC3E-3D-NG	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-R-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 features, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q-R-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 features, L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC-3D-16XGE-SFPP	Fixed 16x10GbE line card bundle with L2.5 features
MPC-3D-16XGE-SFPP-R-B	Fixed 16x10GbE line card bundle with full-scale L2/L2.5 and L3 features
MPC2E-3D-NG	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E

Product Number	Description
MPC2E-3D-NG-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MX-MPC2-3D	MPC2 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ	MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ-R-B	MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full-scale L3, L2, and L2.5 features
MX-MPC2-3D-Q	MPC2 line card bundle with per-IFL HQoS, 256,000 queues (max 128,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-Q-R-B	MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2-3D-R-B	MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D-R-B	Enhanced MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D	Enhanced MPC2 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ	Enhanced MPC2 with per-IFL HQoS, 512,000 queues; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ-R-B	Enhanced MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D-P	Enhanced MPC2 with 1588v2, port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P-Q-B	Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P	Enhanced MPC2 with 1588v2, port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P-Q-B	Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-Q	Enhanced MPC2 line card bundle; includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-Q-R-B	Enhanced MPC2E line card bundle; includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full-scale L3, L2, and L2.5 features
MX-MPC1-3D	MPC1 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q	MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q-R-B	MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC1-3D-R-B	MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features

Product Number	Description
MX-MPC1E-3D	Enhanced MPC1 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q	Enhanced MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q-R-B	Enhanced MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress) line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC1E-3D-R-B	Enhanced MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features
MS-MPC-128	Multiservices MPC supports a variety of optionally licensed applications, including stateful firewall, carrier-grade NAT, and deep packet inspection (DPI); each purchased separately
MX-SPC3	Security services card supports a variety of optionally licensed applications, including stateful firewall, carrier-grade NAT, IDS, traffic load balancing, and DNS sinkhole

Flex Software Subscription

Product Number	Description
S-MPC10E-10C-A1-5	MPC10E advanced subscription license for 5-year term; includes 4M FIB, 2K VRFs, 32K L2 VPN Ckts, 1M MAC, 128K LSP, and 8K queues with advanced Junos features
S-MPC10E-10C-A1-5	MPC10E premium subscription license for 5-year term; includes 8M+ FIB, 4K+ VRFs, 256K+ L2 VPN Ckts, 1M+ MAC, 256K+ LSP, and 32K queues with premium Junos features
S-MPC10E-15C-A1-5	MPC10E advanced subscription license for 5-year term; includes 4M FIB, 2K VRFs, 32K L2 VPN Ckts, 1M MAC, 128K LSP, and 8K queues with advanced Junos features
S-MPC10E-15C-P1-5	MPC10E premium subscription license for 5-year term; includes 8M+ FIB, 4K+ VRFs, 256K+ L2 VPN Ckts, 1M+ MAC, 256K+ LSP, and 32K queues with premium Junos features
S-MX204-A-5	MX204 advanced subscription license for 5-year term; includes 4M FIB, 2K VRFs, 32K L2 VPN Ckts, 1M MAC, 128K LSP, and 32K queues with advanced Junos features
S-MX204-P-5	MX204 premium subscription license for 5-year term; includes 8M+ FIB, 4K+ VRFs, 256K+ L2 VPN Ckts, 1M+ MAC, 256K+ LSP, and 256K queues with premium Junos features

Modular Interface Cards

Product Number	Description
MIC3-3D-10XGE-SFPP	MIC with 10x10GbE small form-factor pluggable plus transceiver (SFP+) interface; optics sold separately
MIC3-3D-1X100GE-CFP	MIC with 1x100GbE C form-factor pluggable transceiver (CFP) interface; optics sold separately
MIC3-3D-1X100GE-CXP	MIC with 1x100GbE 100-gigabit small form-factor pluggable transceiver (CXP) interface; optics sold separately
MIC3-100G-DWDM	MIC with 1x100GbE OTU4 dense wavelength-division multiplexing (DWDM) PIC, DP-QPSK, full C-band tunable, GFEC, HGFEC, SDFEC; requires MPC3E or MPC3E-NG; optics sold separately
MIC3-3D-2X40GE-QSFPP	MIC with 2x40GbE quad small form-factor pluggable plus transceiver (QSFP+) interface; optics sold separately
MIC-3D-1CHOC48	1 port channelized OC48/channelized STM16 (down to DS0) MIC
MIC-3D-1OC192-XFP	1 port OC192/STM64 MIC
MIC-3D-20GE-SFP	20x10/100/1000 MIC for MX Series; requires optics sold separately
MIC-3D-2XGE-XFP	2x10GbE MIC for MX Series; requires optics sold separately
MIC-3D-40GE-TX	40x10/100/1000 RJ-45 full height MIC (fixed optics)
MIC-3D-4CHOC3-2CHOC12	4 port channelized OC3/2 port channelized OC12 (down to DS0) MIC
MIC-3D-4COC3-1COC12-CE	Multi-rate circuit emulation MIC; 4 port channelized OC3/STM1 (to DS0) or 1 port channelized OC12/STM4 (to DS0)

Product Number	Description
MIC-MACSEC-20GE	2x10GbE/20x10GbE MACsec MIC for MX80/MX104/MX240/MX480/MX960, supports both 128b AES and 256b AES MACsec

Routing Engines

Product Number	Description
RE-S-X6-64G-BB	6 Core 2.0 GHz CPU and 64 GB memory, base bundle
RE-S-X6-64G-S	6 Core 2.0 GHz CPU and 64 GB memory, spare
RE-S-X6-64G-R	6 Core 2.0 GHz CPU and 64 GB memory, redundant RE
RE-S-X6-64G-LT-S	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, spare
RE-S-X6-64G-LT-BB	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, base bundle
RE-S-X6-64G-LT-R	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, redundant
RE-S-X6-128G-S-BB	6 Core 2.0 GHz CPU with 128 GB memory, base bundle
RE-S-X6-128G-S-S	6 Core 2.0 GHz CPU with 128 GB memory, spare
RE-S-X6-128G-S-R	6 Core 2.0 GHz CPU with 128 GB memory, redundant
RE-S-1300-2048-BB	1.3 GHz CPU and 2 GB memory, base bundle
RE-S-2000-4096-UPG-BB	2 GHz CPU and 4 GB memory, base bundle
RE-S-1300-2048-R	1.3 GHz CPU and 2 GB memory, redundant
RE-S-2000-4096-R	2 GHz CPU and 4 GB memory, redundant
RE-S-1800X2-8G-R	Dual-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X2-16G-R	Dual-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X4-8G-R	Quad-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X4-16G-R	Quad-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X2-8G-UPG-BB	Dual-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X2-16G-UPG-BB	Dual-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-8G-UPG-BB	Quad-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X4-16G-UPG-BB	Quad-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-32G-BB	Quad core 1.8GHz CPU with 32 GB memory, base bundle
RE-S-1800X4-32G-R	Quad core 1.8GHz CPU with 32 GB memory, redundant
RE-S-1800X4-32G-S	Quad core 1.8GHz CPU with 32 GB memory, spare
RE-S-1800X4-32G-UB	Quad core 1.8GHz CPU with 32 GB memory, upgrade for base bundle
RE-S-1800X4-32G-WS	Quad core 1.8GHz CPU with 32 GB memory, worldwide version

Switch Control Board

Product Number	Description
SCB-MX960-BB	SCB for MX240, MX480, and MX960
SCBE-MX-BB	Enhanced Switch Control Board (SCBE) for MX240, MX480, and MX960
SCBE2-MX-BB	SCBE for MX240, MX480, and MX960
SCBE3-MX-BB	1.5 T fabric card for MX240, MX480, and MX960

Broadband Network Gateway (BNG) Licensing

Subscriber Access Feature Pack Licenses

One Subscriber Access (SA) license is required per chassis, and provides:

- Per-subscriber RADIUS accounting (time- and volume-based)
- RADIUS-based authentication and authorization
- Subscriber configuration via client profiles at subscriber login
- RADIUS and/or SDX-based address (pool) management
- Static and dynamic IP management
- Dynamic auto-sensed VLANs

Product Number	Description
S-SA-FP2	Subscriber Access feature pack license for MX240, MX480, MX960, MX2010, and MX2020
S-MX104-SA-FP	Subscriber Management feature pack license for MX104 including S-LNS-IN feature license
S-MX80-SA-FP	Subscriber Management feature pack license for MX80 including S-LNS-IN feature license

Note: Using the MX150 as a BNG requires a vBNG license. Please refer to the vMX data sheet for more information.

Subscriber Services Management Feature Pack Licenses

Subscriber Services Management licenses are optional additions to Subscriber Access licenses that offer:

- Per-service RADIUS accounting (time- and volume-based)
- Service profile activation/deactivation at subscriber login via RADIUS grants/access accepts (services activation/deactivation VSAs); or change existing sessions via RADIUS COA/RID or Session and Resource Control (SRC)
- Parameterization of service profiles
- ANCP QoS adjustment based on sync rate via Access Node Control Protocol (ANCP)

Product Number	Description
S-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX240, MX480, MX960, MX2010, and MX2020
S-MX104-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX104
S-MX80-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX80
S-SSP-FP	Subscriber Traffic Lawful Intercept feature pack License, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-BB-NASREQ	Junos Broadband Policy Enforcement feature license for dynamic subscriber authentication and authorization using NASREQ, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020

Additional Subscriber Services Management licenses are available to support Inline L2TP LNS Tunneling, Subscriber-Based Lawful Intercept, Virtual Chassis, and interface with policy management systems, as indicated in the table below.

Product Number	Description
S-BB-GX	Junos Broadband Policy Enforcement feature license for PCRF communications using 3GPP Gx and Gx+, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-BB-GY	Junos Broadband Policy Enforcement feature license for online charging using 3GPP Gy interface, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-LNS-IN	Software license for Inline L2TP LNS, for MX240, MX480, MX960, MX2010, and MX2020
S-VCR	Software license for single member of an MX Series Virtual Chassis

Subscriber Access Scale Licenses

These tiered licenses support from 4000 to 256,000 sessions and are bound to one chassis.

Product Number	Description
S-SA-4K	Subscriber scale license, up to 4000 subscribers
S-SA-8K	Subscriber scale license, up to 8000 subscribers
S-SA-16K	Subscriber scale license, up to 16,000 subscribers
S-SA-32K	Subscriber scale license, up to 32,000 subscribers
S-SA-64K	Subscriber scale license, up to 64,000 subscribers
S-SA-128K	Subscriber scale license, up to 128,000 subscribers
S-SA-256K	Subscriber scale license, up to 256,000 subscribers

Subscriber Access Scale Upgrade Licenses

These tiered licenses support from 4000 to 256,000 sessions and are bound to one chassis.

Product Number	Description
S-SA-UP-8K	Subscriber scale upgrade, from 4000 to 8000 subscribers
S-SA-UP-16K	Subscriber scale upgrade, from 8000 to 16,000 subscribers
S-SA-UP-32K	Subscriber scale upgrade, from 16,000 to 32,000 subscribers
S-SA-UP-64K	Subscriber scale upgrade, from 32,000 to 64,000 subscribers
S-SA-UP-96K	Subscriber scale upgrade, from 64,000 to 96,000 subscribers
S-SA-UP-128K	Subscriber scale upgrade, from 96,0000 to 128,000 subscribers
S-SA-UP-256K	Subscriber scale upgrade, from 128,000 to 256,000 subscribers

Junos OS

- USA: Junos OS
- Worldwide: Junos-WW

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

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MX Series 5G Universal Routing Platforms

Product Overview

Unrelenting traffic growth—driven by higher speeds, more subscribers, mobile penetration, cloud adoption, and ubiquitous video consumption—is straining traditional service provider and enterprise networks.

To accommodate this reality, Juniper's Secure Automated Distributed Cloud solution helps service providers react to changing market conditions and accelerate service delivery with world-class products and innovative architectural components. The MX Series is an integral part of this solution.

Powered by the Junos OS and programmable Trio/Si5 silicon chipset, MX Series platforms deliver powerful routing, switching, security, and services features that help operators successfully transform their networks—and their businesses—in today's hyper-connected world.

Product Description

The continuous expansion of mobile, video, and cloud-based services is disrupting traditional networks and impacting the businesses that rely on them. While annual double-digit traffic growth requires massive resource investments to prevent congestion and accommodate unpredictable traffic spikes, capturing return on that investment can be elusive. Emerging trends such as 5G mobility, Internet of Things (IoT) communications, and the continued growth of cloud networking promise even greater network challenges in the near future. The Juniper Networks® MX Series 5G Universal Routing Platform delivers the industry's first end-to-end infrastructure security solution for enterprises as they look to move business-critical applications to public clouds. Delivering features, functionality, and secure services at scale in the 5G era with no compromises, the MX Series is a critical part of the network evolution happening now.

At the same time, traditional operations environments are increasingly challenged to meet consumer and business requirements for rapid service delivery and cloud-like network experiences. Issues related to monitoring and management are placing additional stress on already strained budgets and personnel, and promising technologies like Network Functions Virtualization (NFV) and SDN introduce an entirely new set of operational challenges.

Our hyper-connected world demands more agile, automated, and scalable networks. Now more than ever, network operators need to transform their networks—and their operations environments—to accommodate this reality.

Utilizing state-of-the-art software and hardware innovations, MX Series 5G Universal Routing Platforms are helping network operators worldwide successfully transform their networks and services. Powered by the Juniper Networks Junos® operating system and the programmable Trio chipset, MX Series platforms support a broad set of automation tools and telemetry capabilities that enable a rich set of business- and consumer-oriented services with predictable low latency and wire-rate forwarding at scale, while providing the reliability needed to meet strict service-level agreements (SLAs).

An Agile Family of Cloud-Era Universal Routing Platforms

The MX Series portfolio was designed for agility and built from the ground up to support a universal set of edge applications, helping Juniper customers rapidly respond to evolving business and technical requirements while simplifying operations without sacrificing their current infrastructure investments.

With its massive scale and efficiency, the MX Series is ideal for space- and power-constrained environments. It redefines per-slot economics, enabling customers to do more with less while simplifying network design, reducing OpEx. It also enables the profitable delivery of a broad range of business, residential, mobile, cable, data center, and cloud services while seamlessly supporting traditional and emerging network architectures with adaptive software and pervasive security. The flexibility of the MX Series is enabled by the programmable Trio chipset, which allows MX Series platforms to add support for new features, such as telemetry, without costly hardware upgrades. Additionally, support for the Junos Automation Toolkit and the Juniper Extension Toolkit provide modern programming languages that reduce costs and increase profitability by improving productivity and customization.

This agility is evident in the wide variety of MX Series use cases that have been proven in the world's largest and most demanding networks, including:

- **Business Edge**: MX Series platforms support the broadest range of L2/L2.5/L3 VPN services which, in combination with multilayer, multiprotocol resiliency, ensure that customer SLAs are met under all network conditions.

- **Internet/Peering Gateway**: MX Series platforms support the high performance, reliability, scale, and density needed to efficiently peer with Internet and other service provider networks.

- **Broadband Network Gateway (BNG)**: MX Series platforms offer the highest subscriber density and most sophisticated broadband edge features available in the industry.

- **Universal SDN Gateway**: The MX Series offers a comprehensive solution for interconnecting virtual and physical networks—as well as between virtual networks operating with different technologies—via support for Multiprotocol BGP (MBGP), dynamic tunnels using MPLSoGRE or Virtual Extensible LAN (VXLAN) encapsulation, virtual routing and forwarding (VRF) tables, E-VPNs, and Network Configuration Protocol (NETCONF), along with the ability to send traffic between VRF and global routing tables based on configuration and policy.

- **Data Center and Cloud Edge**: The MX Series is ideal for data center/cloud edge applications, with support for multiple overlay encapsulation methods, including VXLAN, Network Virtualization using Generic Routing Encapsulation (NVGRE),

MPLSoUDP, MPLSoGRE, 802.1BR, SR-MPLS, and SR-V6. The MX Series also incorporates data plane security with inline IPsec/MACsec in the MPC-10E line cards, making it a perfect fit for data center and cloud deployments.

- **Enterprise WAN**: Enterprises and government agencies worldwide use MX Series platforms to build their own overlay network on top of a service provider's Layer 2 or MPLS network, using encapsulation technologies such as MPLSoGRE, VXLAN, and IPsec for secure transport.

- **Universal Metro/Aggregation**: MX Series platforms offer a full suite of routing and switching features, allowing you to choose a deployment model that best fits your business and technical needs. The MX Series can be deployed as IP/IP VPN edge routers, Ethernet VPN (EVPN) and virtual private LAN service (VPLS) provider edge (VPLS-PE) routers, MPLS label-switching (LSR) routers, and as Layer 2 Ethernet switches or Layer 3 IP routers.

- **Mobile Backhaul**: In addition to switching, routing, and security features, MX Series platforms support highly scalable and reliable hardware-based timing that meets the strictest LTE requirements, including Synchronous Ethernet for frequency and the Precision Time Protocol (PTP) for frequency and phase synchronization. In addition, the MX104 is ETSI 300-compliant, enabling deployment in next-generation mobile applications such as 5G.

At-a-Glance: MX Series 5G Universal Routing Platforms Comparison

The MX Series portfolio includes a wide range of physical and virtual platforms that share a common architecture and feature set. This enables Juniper customers to select the platform that best addresses their unique business goals and satisfies their scale, density, resiliency, space, power, and value-added service requirements without compromising on quality or features.

Modular MX Series Platforms

MX960, MX480, and MX240 5G Universal Routing Platforms are modular, chassis-based platforms.

- The MX960 has been proven in the world's largest service provider, cable, mobile, and data center networks, offering 10 Tbps of system capacity in support of business and residential broadband services as well as peering and provider edge applications.

- The MX480 is a modular, 5 Tbps-capable router that supports a wide range of cloud, campus, enterprise, data center, service provider, cable, and mobile service core applications.

- The MX240 is a compact router ideal for space-constrained cloud, enterprise, data center, service provider, cable, and mobile service core deployments.

The latest generation of line card hardware for the MX960, MX480, and MX240 platforms delivers multi-terabit crypto capabilities with 256-bit encryption complying with AES-GCM encapsulation per RFC4303; AES-GCM encapsulation per RFC4106; AES-GMAC encapsulation per RFC4543; and AES-GMAC (IPv4/v6) encapsulation per RFCs 4302 and 4543. Along with multi-terabit routing, the latest MPC also delivers integrated Layer 2 MACsec features at flexible interface rates of 10GbE, 40GbE, and 100GbE.

Fixed-Configuration MX Series Platforms

MX204, MX150, MX104, MX80, MX40, MX10, and MX5 Universal Routing Platforms are fixed-configuration platforms that support modular interfaces.

- The MX204 is a space- and power-optimized router delivering ultra-high port density and throughput while consuming just 0.9 W/Gb. It addresses the emerging edge and metro Ethernet networking needs of service providers, mobile, web-scale operators, and MSOs by delivering 800 Gbps of throughput in support of high-density 100GbE, 40GbE, and discrete and breakout 10GbE and 1GbE interfaces—all in a single rack unit.

- The MX150 is a compact, full-featured router that supports 1GbE and 10GbE interfaces. It provides a cost-effective solution for a wide range of low-bandwidth provider edge, business edge, broadband network gateway (BNG), and enterprise WAN applications.

- The MX104 is a mobile backhaul-optimized, ETSI 300 mm-compliant chassis with high redundancy and 160 Gbps of throughput. The MX104 offers four MIC slots and redundant fixed 10GbE interfaces for flexible network connectivity.

- The MX80, MX40, MX10, and MX5 are software upgradeable from 40 Gbps to 160 Gbps, enabling cost-effective "pay as you grow" scale. These platforms have up to four Modular Interface Card (MIC) slots and two fixed 10GbE interfaces for connecting to the network.

The following table provides a comparison between the various MX Series modular and fixed-configuration platforms.

Table 1: MX Series 5G Universal Routing Platforms at a Glance

	MX960	MX480	MX240	MX204	MX150	MX104	MX80	MX40	MX10	MX5
Rack units	16	8	5	1	1	3.5	2	2	2	2
Systems per rack	3	6	9	48	48	13	24	24	24	24
Slots	11 MPCs	6 MPCs	2 MPCs	8 10GbE, 4 100GbE	NA	4 10GbE, 4 MIC slots	4 10GbE, 3[1] MIC slots	2 10GbE, 3[2] MIC slots	3[3] MIC slots	3[4] MIC slots
Per slot capacity	480 Gbps	480 Gbps	480 Gbps	NA	NA	20 Gbps	20 Gbps	20 Gbps	20 Gbps	20 Gbps
Maximum system throughput[5]	10.56 Tbps	5.76 Tbps	1.92 Tbps	800 Gbps	40 Gbps	160 Gbps	160 Gbps	120 Gbps	80 Gbps	40 Gbps
PDH	Yes	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	NA
Sonet/SDH	Yes	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	NA
Maximum 1GbE	440	240	80	24	12	80	80	60	40	20
Maximum 10GbE	440	240	80	24	2	8	8	4	1	NA
Maximum 40GbE	132	72	24	4	NA	NA	NA	NA	NA	NA
Maximum 100GbE	44	24	8	4	NA	NA	NA	NA	NA	NA
10GbE DWDM	88	48	16	NA	NA	NA	NA	NA	NA	NA
100GbE DWDM	22	12	4	NA	NA	NA	NA	NA	NA	NA

[1] The MX80 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[2] The MX40 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[3] The MX10 has two front MIC slots and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[4] The MX5 has one front MIC slot and one rear MIC slot. The rear MIC slot only supports the MS-MIC.
[5] Note, system throughput is calculated as (per slot capacity) x (number of slots) x (2).

Architecture and Key Components

Modular Components for Chassis-Based MX Series Platforms

The modular, chassis-based MX960, MX480, and MX240 share the following components:

- Modular Port Concentrators (MPCs) provide routing, MPLS, switching, inline services, subscriber management, and hierarchical quality of service (HQoS) among many other features. MPCs may also host interfaces directly or via Modular Interface Cards (MICs) that allow users to "mix and match" interface types. Powered by the programmable Trio chipset, MPCs collect and stream telemetry that identifies resource utilization, loss and delay, and other metrics.

- Switch Control Boards (SCBs) feature an integrated switch fabric that connects to all slots in the chassis in a nonblocking architecture. The SCBs house the Routing Engine, control power to MPCs, monitor and control system functions such as fan speed and the system front panel, and manage clocking, resets, and boots.

- The Routing Engine (RE) provides the control plane, runs Juniper Networks Junos® operating system, and handles all routing protocol processes as well as the software processes that control MPCs, chassis components, system management, and user access to the router. REs communicate with MPCs via dedicated out-of-band management channels.

MPC-10E Line Card

The MPC-10E line card is a key contributor to the service provider transformation in the cloud era when deployed with MX960, MX480, and MX240 platforms in a Juniper Secure Automated Distributed Cloud environment. By providing the underlying network infrastructure with scale, agility, routing innovation, and pervasive security while incorporating universal (10/40/100/400GbE) ports, the MPC-10E protects existing investments with disaggregated software innovation and infinite programmability. Built-in automation enables rapid deployment without disrupting the existing MX960/MX480/MX240 footprint. The MPC-10E line card is powered by the new Juniper Si5 silicon, which enables the benefits highlighted in Table 2.

Table 2: MPC-10E Line Card Benefits at a Glance

Attribute	Benefit
Performance	Triples MX960/MX480/MX240 chassis performance to 1/1.5 Tbps per slot with new SCBE3 fabric, enabling up to 10 Tbps throughput
Universal Interfaces	Reduces interface sparing with multi-rate 10/40/100GbE interfaces
Power Efficiency	Consumes ~0.5 W per gigabit per system level
Inline Data Plane Security	Features AES-256 MACsec line-side encryption and native IPsec tunnel support
Investment Protection	Backward compatible with existing MPCs and REs: PC3E/MPC4E/MPC5E/MPC7E/NG-MPC, MS-MPC, NG-MSMPC, MPC2E/3E-NG, and 16x10G MPCs; RE-S-1800 and RE-S-X6 Routing Engine modules
Seamless Deployment	Reuse deployed MX960/MX480/MX240 chassis, power modules, and fan trays

Junos OS

Junos OS is a reliable, high-performance, modular network operating system that is supported across all of Juniper's physical and virtual routing, switching, and security platforms. Junos OS improves network operations and increases service availability, performance, and security with features like low-latency multicast, comprehensive quality of service (QoS), unified in-service software upgrade (unified ISSU), and Junos Continuity, which eliminates the risk and complexity of OS upgrades. With secure programming interfaces, versatile scripting support, and integration with popular orchestration frameworks, Junos OS offers flexible options for DevOps style management that can unlock more value from the network.

The Programmable Trio Chipset

The programmable Trio chipset is Juniper-developed breakthrough silicon technology that is implemented across the MX Series portfolio. Its innovative design improves business economics by enabling a truly converged platform with maximum performance, service agility, and exceptional power and thermal efficiency.

Trio has a programmable forwarding data structure that allows fast microcode changes in the hardware itself, as well as a programmable lookup engine that allows inline service processing. Furthermore, Trio's programmable QoS engine supports coarse and fine-grained queuing to efficiently address the diverse requirements of core, edge, and aggregation use cases.

With its proven extensibility and agility, the programmable Trio chipset helps network operators worldwide successfully address their most complex technical and market challenges, and promises to meet the requirements of emerging applications for many years to come.

Network Edge Services

MX Series platforms can host optionally licensed Junos OS-based network edge services at scale, both inline on MPCs as well as on dedicated service cards. Hosting network edge services on MX Series platforms reduces network cost and complexity by eliminating numerous elements, operating systems, and interconnections.

- MPCs support inline services using the programmable Trio chipset; supported services include flow monitoring, 1:1 Network Address Translation (NAT), port mirroring, generic routing encapsulation (GRE), IP tunneling, logical tunnels, lawful intercept, and video monitoring.

- The MS-MPC and the MS-MIC provide dedicated processing for compute-intensive services such as carrier-grade NAT (CGNAT), IPsec, stateful firewall, deep packet inspection, flow monitoring, and load balancing.

MX Series Platform/Feature Matrix

		MX960	MX480	MX240	MX204	MX150	MX104	MX80	MX40	MX10	MX5
Security	Firewall filters/ACLs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DDoS—control plane	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DDoS—FlowSpec	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Stateless filters L2-L4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Stateful services[6]	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
Inline Services	GRE reassembly	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1:1 NAT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Flow monitoring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Video monitoring	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Lawful intercept	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mirroring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Service Card Supported Services[6]	Deep packet inspection	✓	✓	✓	No	No	No	No	No	No	No
	CGNAT	✓	✓	✓	No	No	✓	✓	✓	✓	✓
	Flow monitoring	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Traffic load balancing	✓	✓	✓	No	No	No	No	No	No	No
	IPsec	✓	✓	✓	No	✓	✓	✓	✓	✓	✓
	Stateful firewall	✓	✓	✓	No	No	✓	✓	✓	✓	✓
	HTTP header manipulation	✓	✓	✓	No	No	No	No	No	No	No
Resiliency	Redundant RE	✓	✓	✓	No	No	✓	No	No	No	No
	Unified ISSU	✓	✓	✓	No	No	No	No	No	No	No
	Nonstop active routing (NSR)	✓	✓	✓	No	No	✓	No	No	No	No
	Fast restoration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Operation, Administration, and Maintenance (OAM)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
System Virtualization	Enhanced SLA and queuing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Junos Fusion Edge (AD)	✓	✓	✓	✓	No	✓	✓	✓	✓	✓
	Logical systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Virtual router/switch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Path Computation Element Protocol (PCEP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	OpenConfig	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	YANG data modeling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Juniper Extension Toolkit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

[6] Service Card supported services are available via optional software license and require an MS-MPC or MS-MIC.

Key Features and Benefits

Unmatched Network Availability

MX Series platforms ensure network and service availability with a broad set of multilayered physical, logical, and protocol-level resiliency features, including Juniper's Virtual Chassis technology, which supports chassis-level redundancy while enabling users to manage two routers as a single element. Additionally, a multichassis link aggregation group (MC-LAG) implementation supports stateful chassis, card, and port redundancy, as well as subscriber and session persistence.

Application Aware Networking

MX Series platforms use deep packet inspection to detect applications, and they consult with user-defined policies to determine traffic treatment on a per-application basis, enabling highly customized and differentiated services at scale. Working in conjunction with Juniper Networks Contrail® Cloud Platform™, MX Series routers can also steer into complex service chains and stream granular data to analytics engines and back-office systems to permit real-time charging and end-user engagement at the application and content level.

Junos Continuity and Unified In-Service Software Upgrade (Unified ISSU)

Junos Continuity and unified ISSU features remove the downtime risks associated with implementing new hardware or upgrading operating systems.

- Junos Continuity eliminates OS upgrades and system reboots when adding new hardware to MX Series platforms; a plug-in package provides the drivers and support files needed to bring the hardware online.

- Unified ISSU reduces the risks associated with OS upgrades by enabling upgrades between two different Junos OS releases (major or minor) with no control plane disruption and minimal traffic disruption on the forwarding plane.

Junos Telemetry Interface

The Junos Telemetry Interface feature streams component-level data to monitoring, analytics, performance management, and visualization tools as well as to Path Computation Elements such as Juniper Networks NorthStar Controller. Analytics derived from this streaming telemetry can identify current and trending congestion, resource utilization, traffic volume, and buffer occupancy, which can be used to make informed decisions on network design and investments.

Integrated Timing

MX Series platforms support highly scalable and reliable hardware-based timing that meets the strictest LTE requirements, including Synchronous Ethernet for frequency, and the Precision Time Protocol (PTP) for frequency and phase synchronization. Synchronous Ethernet and PTP can be combined in a "hybrid" mode to achieve the highest level of frequency (10 ppb) and phase (<1.5 uS) accuracy required for LTE-Advanced, eliminating the need for external clocks.

Junos Fusion Provider Edge

Junos Fusion Provider Edge enables MX Series platforms to act as aggregation devices for the Juniper Networks EX4300 Ethernet Switch and QFX5100 line of data center switching platforms acting as satellite devices while appearing to management as a single, port-dense device managed by a single IP address. Junos Fusion Provider Edge significantly expands the number of network interfaces on the MX Series router while keeping operations simple.

Automated Support and Prevention

Juniper's Automated Support and Prevention consists of an ecosystem of tools, applications, and systems that simplify and streamline operations, delivering operational efficiency, reducing downtime, and increasing your network's ROI running Junos OS. Automated Support and Prevention brings operational efficiency by automating several time-consuming tasks such as incident management, inventory management, proactive bug notification, and on-demand End-of-Life/End-of-Support/End-of-Engineering (EOL/EOS/EOE) reports. The Junos Space® Service Now and Service Insight service automation tools are standard entitlements of all Juniper Care contracts.

Junos Automation Toolkit and Juniper Extension Toolkit

Included in Junos OS software, the Junos Automation Toolkit is a suite of tools supported on all Juniper Networks switches, routers, and security devices. These tools, which leverage the native XML capabilities of Junos OS, include commit scripts, op scripts, event policies and event scripts, and macros that help automate operational and configuration tasks. Additionally, the platform-independent Juniper Extension Toolkit provides a modern programming tool kit that includes support for:

- OpenConfig/YANG
- gRPC, Thrift, NETCONF
- JSON/XML
- API support for all modern programming languages
- Rich on-box scripting support using Python
- REST APIs

Together, Junos OS automation and programmability features simplify complex configurations and reduce the potential for configuration errors. They also save time by automating operational and configuration tasks, speed troubleshooting, and maximize network uptime by warning operators of potential problems and automatically responding to system events.

MX204

MX150

MX80/40/10/5

MX960

MX480

MX104

MX240

Specifications

		MX960	MX480	MX240	MX204	MX150	MX104	MX80-MX5
Layout	System capacity	10.56 Tbps	5.76 Tbps	1.92 Tbps	800 Gbps	40 Gbps	160 Gbps	160 Gbps to 40 Gbps
	Slot orientation	Vertical	Horizontal	NA	Horizontal	NA	Horizontal	Horizontal
	Mounting	Front or center	Front or center	Front or center	Front or center	Front or center	Front or center	Front or center
Physical Specification	Dimensions (W x H x D)	17.37 x 27.75 x 23 in (44.11 x 70.49 x 58.42 cm)	17.45 x 14 x 24.5 (44.3 x 35.6 x 62.2 cm)	17.45 x 8.71 x 24.5 (44.3 x 22.1 x 62.2 cm)	17.6 x 1.75 x 18.7 in (44.7 x 4.45 x 47.5 cm)	17.36 x 1.72 x 12 in (44.09 x 4.37 x 30.48 cm)	17.22 x 9.46 x 6.09 in (43.7 x 24 x 15.47 cm)	17.5 x 3.5 x 23.46 in (44.5 x 8.9 x 59.6 cm)
	Weight fully loaded	334 lb/ 151.6 kg	180 lbs/ 81.6 kg	130 lb/ 59 kg	23.15 lb/ 10.5 kg	9.48 lb / 4.3 kg	32 lb/14.5 kg	30 lb/13.7 kg
	Weight unloaded	150 lbs/ 68.1 kg	65.5 lbs/ 29.7 kg	52 lbs/ 23.6 kg	17 lb/ 7.71 kg	NA	NA	NA
Routing Engine	Default memory	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	2x16 MB NOR flash storage; 64 GB of DDR4 RAM; 2x50 GB SSD	32GB DDR4; 2x100 GB SSD	Xeon D processor running Wind River Linux 7; 32 GB DDR4 RAM; 400 GB SSD	4 MB boot flash; 8 GB of NAND Flash; 4 GB of DDR3 RAM	8 MB boot flash; 4 GB on NAND flash storage; 2 GB of DDR2 RAM
	Number of cores	6 cores	6 cores	6 cores	8 cores	6 cores	1 core	1 core
Redundancy	Components	Power supplies, REs, fans	Power supplies, REs, fans	Power supplies, REs, fans	Power supplies and fans	Fans	Power supplies, REs, fans	Power supplies and fans
Power	Power input [AC]	200 to 240 V AC	100 to 240 V AC	100 to 240 V AC	100 to 240 V AC	100 to 240 V AC	100 to 240 V AC	100 to 240 V AC
	Power input [DC]	–40 to –72 V DC	–40 to –72 V DC	–40 to –72 V DC	–40 to –72 V DC	NA	–40 to –72 V DC	–40 to –72 V DC
	Typical power draw (AC)	6520 W	3470 W	1860 W	260 W	140 W	325 W	365 W
	Typical power draw (DC)	6670 W	3150 W	1690 W	260 W	NA	350 W	310 W

	MX960	MX480	MX240	MX204	MX150	MX104	MX80-MX5
Environmental	Air flow	Front to back	Side to side	Side to side	Front to back	Front to back	Side to side [forced air]	Side to side [forced air]
	Operating temperature	32º to 115º F (0º to 46º C) at sea level	32º to 115º F (0º to 46º C) at sea level	32º to 115º F (0º to 46º C) at sea level	32º to 115º F (0º to 46º C)	32º to 122º F (0º to 50º C)	–40º to 149º F (-40º to 65º C)	32º to 115º F (0º to 46º C) at sea level
	Operating humidity	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%	5% to 90%
	Operating altitude	10,000 ft (3048 m)	10,000 ft (3048 m)	10,000 ft (3048 m)	6,000 ft (1900 m)			10,000 ft (3048 m)
Certifications	NEBS	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	- GR-1089-Core EMC and Electrical Safety - Common Bonding Network (CBN) - National Electrical Code (NEC) - GR-63-Core Physical Protection	NA	- SR-3580 (2007) NEBS Criteria Levels (Level 3 Compliance) - GR-63-Core (2006) NEBS Physical Protection - GR-1089-Core (2006) EMC and Electrical Safety - GR-3108-CORE Issue 2, December 2008 - IEEE 1613: 2009 - IEC 61850-3: 2013	- GR-63-Core Physical Protection - GR-1089-Core:EMC and Electrical Safety

Ordering Information

MX5, MX10, MX40, and MX80 Base Product Bundles

Product	Product Number	Description
MX5-MX80	MX5BASE-T	MX5 chassis with timing support—includes dual power supplies, MIC-3D-20GE-SFP, S-MX80-ADV-R, S-MX80-Q, and S-ACCT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX10BASE-T	MX10 chassis with timing support—includes dual power supplies, MIC-3D-20GE-SFP, 1 empty MIC slot, S-MX80-ADV-R, S-MX80-Q, and S-ACCT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX40BASE-T	MX40 chassis with timing support—includes dual power supplies, 2 empty MIC slots, 2x10GbE fixed ports, S-MX80-ADV-R, S-MX80-Q, and S-ACCT-JFLOW-IN-5G licenses. Power supply cable needs to be ordered separately.
	MX80BASE-P	MX80 chassis with PTP and Synchronous Ethernet support—includes one power supply, 2 empty MIC slots, 4x10GbE 10-gigabit small form-factor pluggable transceiver (XFP) built-in ports, fan tray with filter. Power supply cable needs to be ordered separately.
	MX80BASE-T	MX80 chassis with timing support—includes one power supply, 2 empty MIC slots, 4x10GbE XFP built-in ports, fan tray with filter. Power supply cable needs to be ordered separately.

Product	Product Number	Description
MX104	MX104-AC	MX104 chassis with 4 MIC slots, 4X10GbE SFPP built-in ports (license required for activation), AC power supply, fan tray with filter, Packet Forwarding Engine and Routing Engine, Altius-MX104.
	MX104-DC	MX104 chassis with 4 MIC slots, 4X10GbE SFPP built-in ports (license required for activation), DC power supply, fan tray with filter, Packet Forwarding Engine and Routing Engine, Altius-MX104.

MX5, MX10, MX40, and MX80 A La Carte Chassis

Product	Product Number	Description
MX5	MX5-T-AC	AC chassis
	MX5-T-DC	DC chassis
MX10	MX10-T-AC	AC chassis
	MX10-T-DC	DC chassis
MX40	MX40-T-AC	AC chassis
	MX40-T-DC	DC chassis
MX80	MX80-T-AC	AC chassis
	MX80-T-DC	DC chassis
	MX80-AC	AC chassis
	MX80-DC	DC chassis
	MX80-48T-AC	AC chassis
	MX80-48T-DC	DC chassis

MX5, MX10, and MX40 Upgrade Licenses

Product	Product Number	Description
MX5	MX-5-10-UPG-B	Software upgrade for MX5 to MX10
	MX-5-40-UPG-B	Software upgrade for MX5 to MX40
	MX-5-80-UPG-B	Software upgrade for MX5 to MX80
MX10	MX-10-40-UPG-B	Software upgrade for MX10 to MX40
	MX-10-80-UPG-B	Software upgrade for MX10 to MX80
MX40	MX-40-80-UPG-B	Software upgrade for MX40 to MX80

MX80 Software Licenses

Product	Product Number	Description
MX80	S-MX80-ADV-R	License to support full scale L3 route and L3 VPN on MX80
	S-MX80-Q	License to support per VLAN queuing on MX80
	S-MX80-SA-FP	Subscriber Management Feature Pack License
	S-MX80-SSM-FP	Subscriber Service Management Feature Packet License (RADIUS/SRC Series-based service activation and deactivation) per service accounting features for subscribers, MX80

MX104 A La Carte Chassis

Product	Product Number	Description
MX104	MX104-AC-Base	MX104 base chassis with 1 AC power supply, fan tray, filter, 1 RE, 4 MIC slots (optics for fixed ports not included, MICs not included)
	MX104-DC-Base	MX104 base chassis with 1 DC power supply, fan tray, filter, 1 RE, 4 MIC slots (optics for fixed ports not included, MICs not included)

MX104 Upgrade Licenses

Product	Product Number	Description
MX104	S-MX104-UPG-2x10GE	Upgrade license to activate 2 x 10GbE fixed ports
	S-MX104-UPG-4x10GE	Upgrade license to activate 4 x 10GbE fixed ports

MX104 Software Licenses

Product	Product Number	Description
MX104	S-MX104-SSM-FP	L3 Subscriber Service Management Feature Packet License, MX104
	S-MX104-Q	License to support per VLAN queuing on MX104
	S-MX104-ADV-R	License to support full-scale L3 route and L3 VPN on MX104

MX150 Base Bundle

Product	Product Number	Description
MX150	MX150-R	MX150 with 10 10/100/1000BASE-T ports, two 100/1000BASE-X SFP ports, and two 10GBASE-X SFP+ ports (optics sold separately), 6-core x86 processor, 400 GB SSD, and 32 GB memory. Supports full L2/L3 feature sets including HQoS and IPsec.

MX150 A La Carte Chassis

Product	Product Number	Description
MX150	MX150	MX150 with 10 10/100/1000BASE-T ports, two 100/1000BASE-X SFP ports, and two 10GBASE-X SFP+ ports (optics sold separately), 6-core x86 processor, 400 GB SSD, and 32 GB memory. Supports basic L2 features.

MX150 Upgrade Licenses*

Product	Product Number	Description
MX150	S-MX150-IR	Software license to support full L2 and limited L3 features and performance
	S-MX150-R	Software license to support full L2/L3 features and scale, including HQoS and IPsec

* Both S-MX150-IR and S-MX150-R are needed to upgrade from MX150 to MX150-R

MX204 Base Product Bundles

Product	Product Number	Description
MX204	MX204	MX204 chassis with 3 fan trays and 2 power supplies
	MX204-R	MX204 chassis with 3 fan trays and 2 power supplies, R mode
	MX204-IR	MX204 chassis with 3 fan trays and 2 power supplies, IR mode

MX204 Chassis

Product	Product Number	Description
MX204	JNP204-CHAS	MX204 chassis, spare

MX204 Power Supply

Product	Product Number	Description
MX204	JPSU-650W-AC-AO	MX204 AC power supply, spare
	JPSU-650W-DC-AFO	MX204 DC power supply, spare

MX204 Fan Trays

Product	Product Number	Description
MX204	JNP-FAN-1RU	MX204 fan tray

MX240, MX480, and MX960 Base Bundles

Product	Product Number	Description
MX240	MX240BASE-AC-HIGH	4 slot MX240 base chassis with 1 AC power supply, 1 SCB
	MX240BASE-AC-LOW	4 slot MX240 base chassis with 2 AC power supplies, 1 SCB
	MX240BASE3-DC	4 slot MX240 base 3 chassis, DC power
	MX240BASE-DC	4 slot MX240 base chassis with 1 fan tray, 1 DC power supply, 1 SCB
	MX240BASE3-ACH	4 slot MX240 base 3 chassis, highline AC power
	MX240BASE3-ACL	4 slot MX240 base chassis, lowline AC power
MX480	MX480BASE3-AC	8 slot MX480 base bundle, AC power
	MX480BASE-AC	8 slot MX480 AC base chassis, 1 fan tray, 3 AC power supplies, 1 SCB, 1 RE
	MX480BASE3-DC	8 slot MX480 base 3 chassis, DC power
	MX480BASE-DC	8 slot MX480 base chassis with 1 fan tray, 2 DC power supplies, 1 SCB, 1 RE
MX960	MX960BASE3-AC	14 slot MX960 base 3 chassis, AC power
	MX960BASE-AC	14 slot MX960 base chassis with 2 fan trays, 3 AC power supplies, 2 SCBs, 1 RE
	MX960BASE3-AC-ECM	14 slot MX960 base 3 chassis with AC power and extended cable manager
	MX960BASE-AC-ECM	14 slot MX960 base chassis with AC power and extended cable manager
	MX960BASE3-DC	14 slot MX960 base 3 chassis, DC power
	MX960BASE-DC	14 slot MX960 base chassis with 2 fan trays, 2 DC power supplies, 2 SCBs, 1 RE
	MX960BASE3-DC-ECM	14 slot MX960 base 3 chassis with DC power and extended cable manager
	MX960BASE-DC-ECM	14 slot MX960 base chassis with DC power extended cable manager

MX240, MX480 and MX960 Premium Bundles

Product	Product Number	Description
MX240	MX240-PREMIUM2-AC-HIGH	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, highline AC power
	MX240-PREMIUM2-AC-LOW	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, lowline AC power
	MX240-PREMIUM2-DC	4 slot MX240 premium 2 chassis with midplane, redundant RE, SCBEs, DC power
	MX240-PREMIUM3-ACH	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, highline AC power
	MX240-PREMIUM3-ACL	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, lowline AC power
	MX240-PREMIUM3-DC	4 slot MX240 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, DC power

Product	Product Number	Description
MX480	MX480-PREMIUM2-AC	8 slot MX480 premium 2 chassis with midplane, redundant RE, SCBEs, AC power
	MX480-PREMIUM2-DC	8 slot MX480 premium 2 chassis with midplane, redundant RE, SCBEs, DC power
	MX480-PREMIUM3-AC	8 slot MX480 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, AC power
	MX480-PREMIUM3-DC	8 slot MX480 premium 3 chassis with enhanced midplane, redundant RE, SCBEs, DC power
MX960	MX960-PREMIUM2-AC-ECM	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, AC power, and extended cable manager
	MX960-PREMIUM2-DC-ECM	14 slot MX960 premium2 chassis with midplane, redundant Routing Engine, SCBEs, DC power, and extended cable manager
	MX960-PREMIUM3-AC-ECM	14 slot MX960 premium 3 chassis with enhanced midplane, redundant Routing Engine, SCBEs, AC power, and extended cable manager
	MX960-PREMIUM3-DC-ECM	14 slot MX960 premium 3 chassis with enhanced midplane, redundant Routing Engine, SCBEs, DC power, and extended cable manager
	MX960-PREMIUM2-AC	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, AC power
	MX960-PREMIUM2-DC	14 slot MX960 premium 2 chassis with midplane, redundant Routing Engine, SCBEs, DC power
	MX960-PREMIUM3-AC	14 slot MX960 premium 3 chassis with midplane, redundant Routing Engine, SCBEs, AC power
	MX960-PREMIUM3-DC	14 slot MX960 premium 3 chassis with midplane, redundant Routing Engine, SCBEs, DC power

MX240, MX480 MX960 Chassis

Base Unit	MX240	MX480	MX960
DC Chassis	MX240BASE-DC, MX240BASE3-DC	MX480BASE-DC, MX480BASE3-DC	MX960BASE3-DC; MX960BASE-DC
AC Chassis	MX240BASE-AC, MX240BASE3-ACH, MX240BASE3-ACL	MX480BASE-AC, MX480BASE3-AC	MX960BASE3-AC; MX960BASE-AC

MPCs

Product Number	Description
MPC10E-10C	Modular port concentrator with 8xQSPF28 multirate ports (10/40/100GbE) plus 2xQSFP56-DD multirate ports (10/40/100/400GbE)
MPC10E-15C	Modular port concentrator with 12xQSPF28 multirate ports (10/40/100GbE) plus 3xQSFP56-DD multirate ports (10/40/100/400GbE)

Product Number	Description
MPC7E-10G	Fixed 40x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC7E-10G-RB	Fixed 40x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-10G-I-RB	Fixed 40x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC7E-MRATE	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28), with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC7E-MRATE-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28); includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-MRATE-I-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28); includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances
MPC7E-MRATE-Q	Fixed 12xQSFP line card for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; with full-scale L2/L2.5 and reduced scale L3 features
MPC7E-MRATE-Q-RB	Fixed 12xQSFP line card bundle; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC7E-MRATE-Q-I-RB	Fixed 12xQSFP line card bundle for the MPC7-MRATE only; all ports support 4x10GbE and 40GbE, and 4 ports support 100GbE (QSFP 28) with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC5E-100G10G	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC5E-100G10G-IRB	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5, L3 features and up to 16 L3VPN instances; optional license permits up to 32,000 queues with HQoS
MPC5E-100G10G-RB	Fixed 2x100GbE and 4x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G-IRB	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5, L3 features and up to 16 L3VPN instances; optional license permits up to 32,000 queues with HQoS
MPC5E-40G10G-RB	Fixed 6x40GbE or 24x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features; optional license permits up to 32,000 queues with HQoS

Product Number	Description
MPC5EQ-100G10G	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5 and reduced scale L3 features
MPC5EQ-100G10G-IRB	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC5EQ-100G10G-RB	Fixed 2x100GbE and 4x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC5EQ-40G10G	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5 and reduced scale L3 features
MPC5EQ-40G10G-IRB	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPN instances
MPC5EQ-40G10G-RB	Fixed 6x40GbE or 24x10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full-scale L2/L2.5, L3, and L3VPN features
MPC4E-3D-2GE	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features
MPC4E-3D-32XGE-SFPP	Fixed 32x10GbE line card bundle with full-scale L2/L2.5 and reduced scale L3 features
MPC4E-3D-2CGE-8XGE-IRB	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5, L3 features; up to 16 L3VPNs per MPC
MPC4E-3D-32XGE-IRB	Fixed 32x10GbE SFPP line card bundle with full-scale L2/L2.5, L3 features; up to 16 L3VPNs per MPC
MPC4E-3D-2CGE8XGE-RB	Fixed 2x100GbE and 8x10GbE line card bundle with full-scale L2/L2.5, L3, and L3VPN features
MPC4E-3D-32XGE-RB	Fixed 32XGbE small form-factor pluggable transceiver (SFP) line card bundle with full-scale L2/L2.5, L3, and L3VPN features
MX-MPC3E-3D	MPC3 with support for 100GbE, 40GbE, and 10GbE interfaces, L2.5 features, optics sold separately
MX-MPC3E-3D-R-B	MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces; includes full-scale L2, L3, L3VPN features; optics sold separately
MPC3E-3D-NG	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MX-MPC3E-3D-R-B	MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces; includes full-scale L2, L3, L3VPN features; optics sold separately
MPC3E-3D-NG	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E, MPC2E, and MPC3E

Product Number	Description
MPC3E-3D-NG-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-R-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q	Next-generation MPC3E with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 features, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q-IR-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC3E-3D-NG-Q-R-B	Next-generation MPC3E line card bundle with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 features, L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by the MPC1E, MPC2E, and MPC3E
MPC-3D-16XGE-SFPP	Fixed 16x10GbE line card bundle with L2.5 features
MPC-3D-16XGE-SFPP-R-B	Fixed 16x10GbE line card bundle with full-scale L2/L2.5 and L3 features
MPC2E-3D-NG	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with the MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5 and reduced scale L3 features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3 features, and up to 16 L3VPNs per MPC; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E

Product Number	Description
MPC2E-3D-NG-Q-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, and L3VPN features; flexible queuing option enables HQoS support with up to 32,000 total queues; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q	Next-generation MPC2E with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, reduced scale L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q-IR-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3, up to 16 L3VPN features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MPC2E-3D-NG-Q-R-B	Next-generation MPC2E line card bundle with upgraded CPU and memory; offers full feature parity with MPC1E, MPC2E, and MPC3E; includes full-scale L2/L2.5, L3 features, and HQoS with up to 512,000 queues per slot; supports all MICs supported by MPC1E and MPC2E
MX-MPC2-3D	MPC2 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ	MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-EQ-R-B	MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full-scale L3, L2, and L2.5 features
MX-MPC2-3D-Q	MPC2 line card bundle with per-IFL HQoS, 256,000 queues (max 128,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2-3D-Q-R-B	MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2-3D-R-B	MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D-R-B	Enhanced MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D	Enhanced MPC2 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ	Enhanced MPC2 with per-IFL HQoS, 512,000 queues; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-EQ-R-B	Enhanced MPC2 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC2E-3D-P	Enhanced MPC2 with 1588v2, port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P-Q-B	Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-P	Enhanced MPC2 with 1588v2, port queuing; includes full-scale L2/L2.5 and reduced scale L3 features

Product Number	Description
MX-MPC2E-3D-P-Q-B	Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-Q	Enhanced MPC2 line card bundle; includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC2E-3D-Q-R-B	Enhanced MPC2E line card bundle; includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full-scale L3, L2, and L2.5 features
MX-MPC1-3D	MPC1 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q	MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1-3D-Q-R-B	MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC1-3D-R-B	MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC1E-3D	Enhanced MPC1 with port queuing; includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q	Enhanced MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress); includes full-scale L2/L2.5 and reduced scale L3 features
MX-MPC1E-3D-Q-R-B	Enhanced MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress) line card bundle; includes full-scale L3, L2, and L2.5 features
MX-MPC1E-3D-R-B	Enhanced MPC1 line card bundle; includes full-scale L3, L2, and L2.5 features
MS-MPC-128	Multiservices MPC supports a variety of optionally licensed applications, including stateful firewall, carrier-grade NAT, and deep packet inspection (DPI); each purchased separately

Modular Interface Cards

Product Number	Description
MIC3-3D-10XGE-SFPP	MIC with 10x10GbE small form-factor pluggable plus transceiver (SFP+) interface; optics sold separately
MIC3-3D-1X100GE-CFP	MIC with 1x100GbE C form-factor pluggable transceiver (CFP) interface; optics sold separately
MIC3-3D-1X100GE-CXP	MIC with 1x100GbE 100-gigabit small form-factor pluggable transceiver (CXP) interface; optics sold separately
MIC3-100G-DWDM	MIC with 1x100GbE OTU4 dense wavelength-division multiplexing (DWDM) PIC, DP-QPSK, full C-band tunable, GFEC, HGFEC, SDFEC; requires MPC3E or MPC3E-NG; optics sold separately
MIC3-3D-2X40GE-QSFPP	MIC with 2x40GbE quad small form-factor pluggable plus transceiver (QSFP+) interface; optics sold separately
MIC-3D-1CHOC48	1 port channelized OC48/channelized STM16 (down to DS0) MIC
MIC-3D-1OC192-XFP	1 port OC192/STM64 MIC
MIC-3D-20GE-SFP	20x10/100/1000 MIC for MX Series; requires optics sold separately

Product Number	Description
MIC-3D-2XGE-XFP	2x10GbE MIC for MX Series; requires optics sold separately
MIC-3D-40GE-TX	40x10/100/1000 RJ-45 full height MIC (fixed optics)
MIC-3D-4CHOC3-2CHOC12	4 port channelized OC3/2 port channelized OC12 (down to DS0) MIC
MIC-3D-4COC3-1COC12-CE	Multi-rate circuit emulation MIC; 4 port channelized OC3/STM1 (to DS0) or 1 port channelized OC12/STM4 (to DS0)

Routing Engines

Product Number	Description
RE-S-X6-64G-BB	6 Core 2.0 GHz CPU and 64 GB memory, base bundle
RE-S-X6-64G-S	6 Core 2.0 GHz CPU and 64 GB memory, spare
RE-S-X6-64G-R	6 Core 2.0 GHz CPU and 64 GB memory, redundant RE
RE-S-X6-64G-LT-S	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, spare
RE-S-X6-64G-LT-BB	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, base bundle
RE-S-X6-64G-LT-R	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, redundant
RE-S-X6-64G-LT-BB	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, base bundle
RE-S-X6-64G-LT-R	6 Core 2.0 GHz CPU with 64 GB memory, limited encryption version, redundant
RE-S-1300-2048-BB	1.3 GHz CPU and 2 GB memory, base bundle
RE-S-2000-4096-UPG-BB	2 GHz CPU and 4 GB memory, base bundle
RE-S-1300-2048-R	1.3 GHz CPU and 2 GB memory, redundant
RE-S-2000-4096-R	2 GHz CPU and 4 GB memory, redundant
RE-S-1800X2-8G-R	Dual-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X2-16G-R	Dual-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X4-8G-R	Quad-core 1.8 GHz CPU and 8 GB memory, redundant
RE-S-1800X4-16G-R	Quad-core 1.8 GHz CPU and 16 GB memory, redundant
RE-S-1800X2-8G-UPG-BB	Dual-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X2-16G-UPG-BB	Dual-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-8G-UPG-BB	Quad-core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle
RE-S-1800X4-16G-UPG-BB	Quad-core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle
RE-S-1800X4-32G-BB	Quad core 1.8GHz CPU with 32 GB memory, base bundle
RE-S-1800X4-32G-R	Quad core 1.8GHz CPU with 32 GB memory, redundant
RE-S-1800X4-32G-S	Quad core 1.8GHz CPU with 32 GB memory, spare
RE-S-1800X4-32G-UB	Quad core 1.8GHz CPU with 32 GB memory, upgrade for base bundle
RE-S-1800X4-32G-WS	Quad core 1.8GHz CPU with 32 GB memory, worldwide version

Switch Control Board

Product Number	Description
SCB-MX960-BB	SCB for MX240, MX480, and MX960
SCBE-MX-BB	Enhanced Switch Control Board (SCBE) for MX240, MX480, and MX960
SCBE2-MX-BB	SCBE for MX240, MX480, and MX960
SCBE3-MX-BB	1.5 T fabric card for MX240, MX480, and MX960

Broadband Network Gateway (BNG) Licensing

Subscriber Access Feature Pack Licenses

One Subscriber Access (SA) license is required per chassis, and provides:

- Per-subscriber RADIUS accounting (time- and volume-based)
- RADIUS-based authentication and authorization
- Subscriber configuration via client profiles at subscriber login
- RADIUS and/or SDX-based address (pool) management
- Static and dynamic IP management
- Dynamic auto-sensed VLANs

Product Number	Description
S-SA-FP2	Subscriber Access feature pack license for MX240, MX480, MX960, MX2010, and MX2020
S-MX104-SA-FP	Subscriber Management feature pack license for MX104 including S-LNS-IN feature license
S-MX80-SA-FP	Subscriber Management feature pack license for MX80 including S-LNS-IN feature license

Note: Using the MX150 as a BNG requires a vBNG license. Please refer to the vMX data sheet for more information.

Subscriber Services Management Feature Pack Licenses

Subscriber Services Management licenses are optional additions to Subscriber Access licenses that offer:

- Per-service RADIUS accounting (time- and volume-based)
- Service profile activation/deactivation at subscriber login via RADIUS grants/access accepts (services activation/deactivation VSAs); or change existing sessions via RADIUS COA/RID or Session and Resource Control (SRC)
- Parameterization of service profiles
- ANCP QoS adjustment based on sync rate via Access Node Control Protocol (ANCP)

Product Number	Description
S-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX240, MX480, MX960, MX2010, and MX2020
S-MX104-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX104
S-MX80-SSM-FP	Subscriber Service Management feature pack license (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers, for MX80
S-SSP-FP	Subscriber Traffic Lawful Intercept feature pack License, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-BB-NASREQ	Junos Broadband Policy Enforcement feature license for dynamic subscriber authentication and authorization using NASREQ, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020

Additional Subscriber Services Management licenses are available to support Inline L2TP LNS Tunneling, Subscriber-Based Lawful Intercept, Virtual Chassis, and interface with policy management systems, as indicated in the table below.

Product Number	Description
S-BB-GX	Junos Broadband Policy Enforcement feature license for PCRF communications using 3GPP Gx and Gx+, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-BB-GY	Junos Broadband Policy Enforcement feature license for online charging using 3GPP Gy interface, for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020
S-LNS-IN	Software license for Inline L2TP LNS, for MX240, MX480, MX960, MX2010, and MX2020
S-VCR	Software license for single member of an MX Series Virtual Chassis

Subscriber Access Scale Licenses

These tiered licenses support from 4000 to 256,000 sessions and are bound to one chassis.

Product Number	Description
S-SA-4K	Subscriber scale license, up to 4000 subscribers
S-SA-8K	Subscriber scale license, up to 8000 subscribers
S-SA-16K	Subscriber scale license, up to 16,000 subscribers
S-SA-32K	Subscriber scale license, up to 32,000 subscribers
S-SA-64K	Subscriber scale license, up to 64,000 subscribers
S-SA-128K	Subscriber scale license, up to 128,000 subscribers
S-SA-256K	Subscriber scale license, up to 256,000 subscribers

Subscriber Access Scale Upgrade Licenses

These tiered licenses support from 4000 to 256,000 sessions and are bound to one chassis.

Product Number	Description
S-SA-UP-8K	Subscriber scale upgrade, from 4000 to 8000 subscribers
S-SA-UP-16K	Subscriber scale upgrade, from 8000 to 16,000 subscribers
S-SA-UP-32K	Subscriber scale upgrade, from 16,000 to 32,000 subscribers
S-SA-UP-64K	Subscriber scale upgrade, from 32,000 to 64,000 subscribers
S-SA-UP-96K	Subscriber scale upgrade, from 64,000 to 96,000 subscribers
S-SA-UP-128K	Subscriber scale upgrade, from 96,0000 to 128,000 subscribers
S-SA-UP-256K	Subscriber scale upgrade, from 128,000 to 256,000 subscribers

Junos OS

- USA: Junos OS
- Worldwide: Junos-WW

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

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10Gb/s SFP+ BiDi Optical Transceiver

DC-9223C-20, 20Km SMF Application

10GBASE-LR/LW Bi-directional, LC connector

Features

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-LR, single LC connector for bi-directional application, over20km SMF

- Electrical interface compliant to SFF-8431 specifications

- 1270/1330nm DFB transmitter, PIN photo-detector, integrated WDM

- 2-wire interface for management specifications compliant with SFF 8472

- Part number (-40°C to 85°C):

    – TR-DX12I-V00, 1270TX/1330RX

    – TR-DX33I-V00, 1330TX/1270RX

- Line side, client side loopback function;

- Advanced firmware allow customer system encryption information to be stored in transceiver

- ROHS compliant

Applications

- High speed storage area networks

- Computer cluster cross-connect

- Custom high-speed data pipes
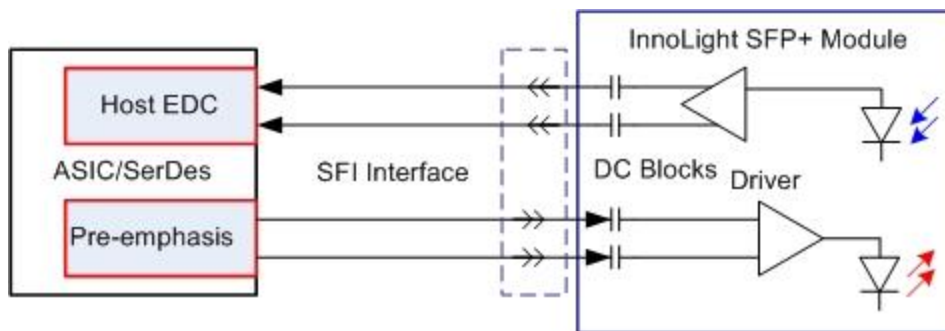
Figure1: Application in System

1. GENERAL DESCRIPTION

This 10Gigabit SFP+ BiDi transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 20km.

The SFP+ BiDi module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

The transmitter converts 10Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic "1" or no connection on this pin will disable the laser from transmitting. Logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

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2. PROPOSED APPLICATION SCHEMATICS

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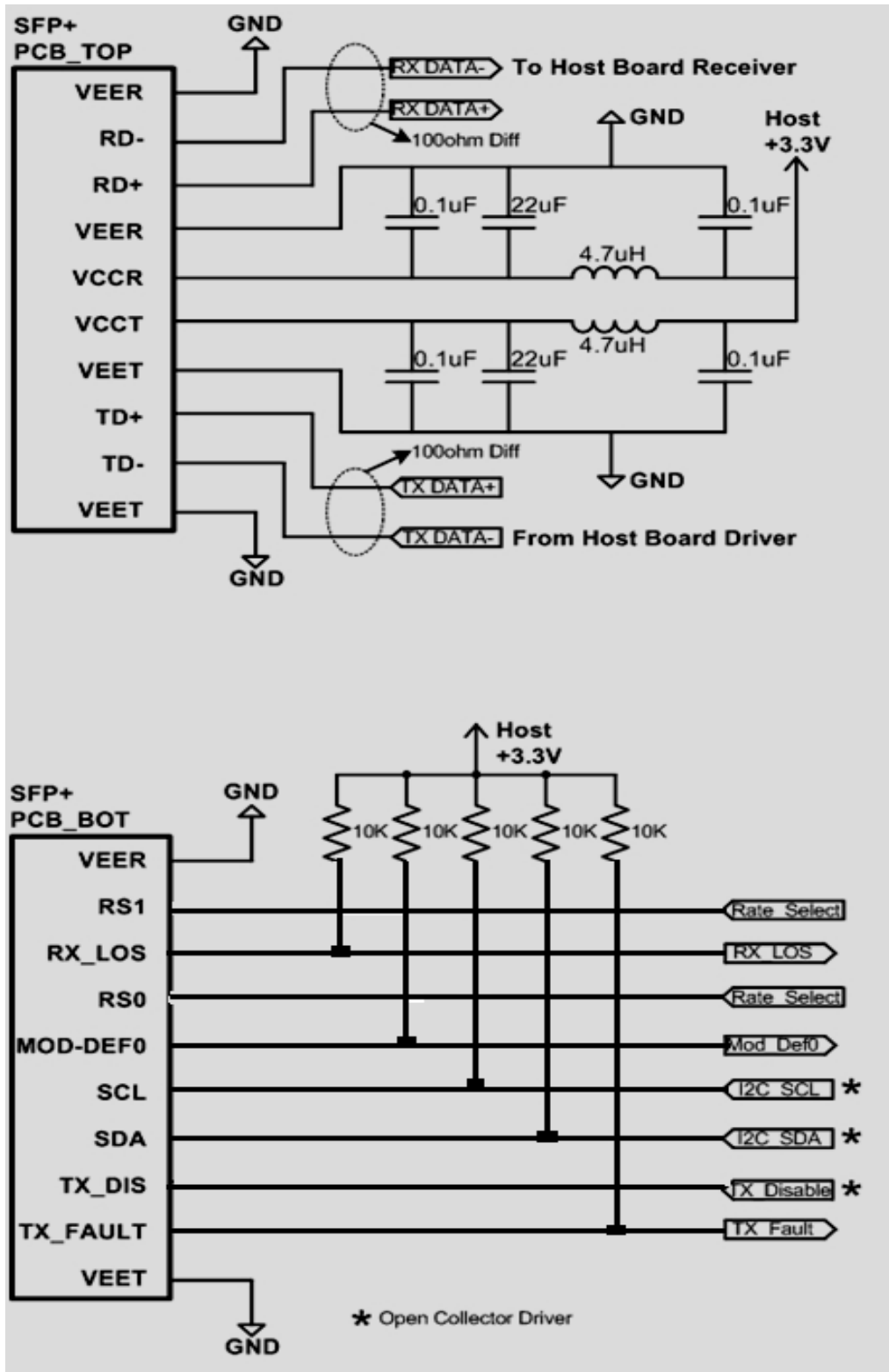
3. PIN DEFINITION

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance.   Host PCB contact assignment is shown in Figure 3 and contact definitions are given in Table 2. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 4 and the contact sequence order listed in Table 2.
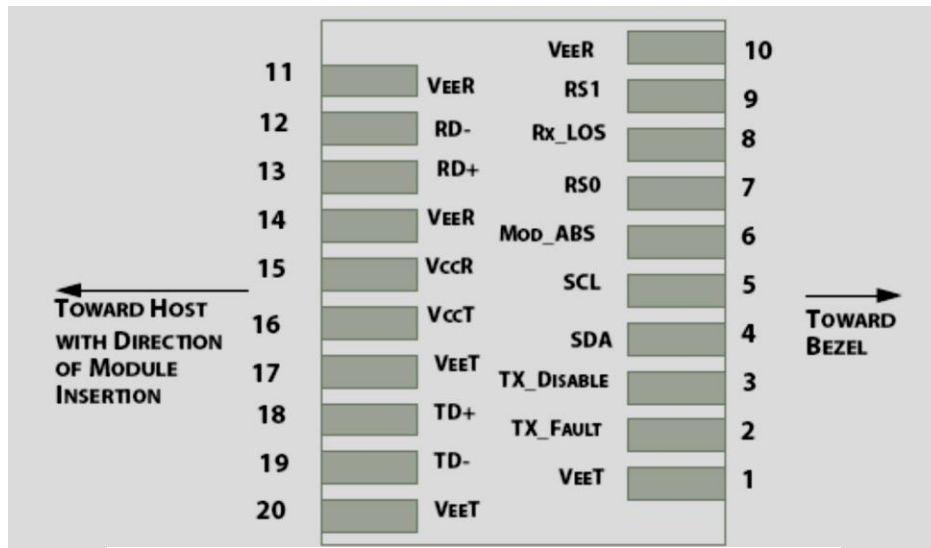
Figure 3: Module Interface to Host
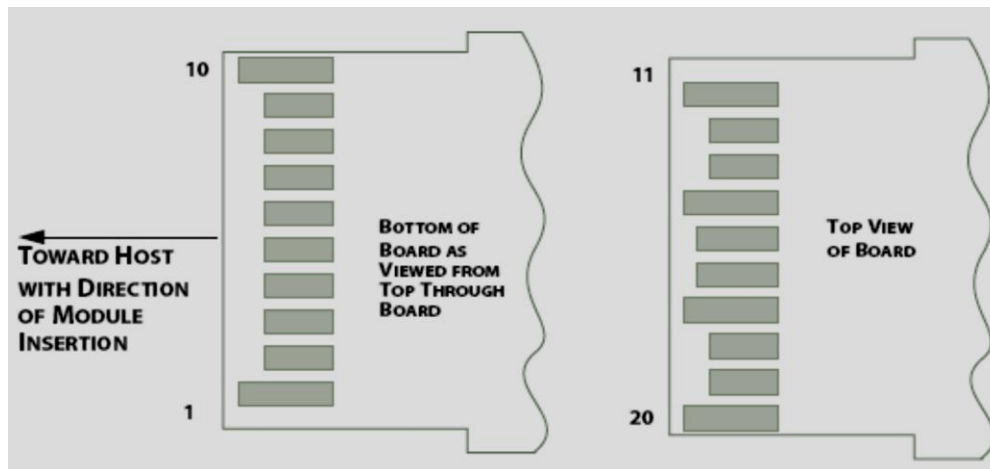
Figure 4: Module Contact Assignment

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PIN	Logic	Symbol	Name / Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Not used	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active High	
9	LVTTL-I	RS1	Not used	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

Table 1: SFP+ Module PIN Definition

Note:

1. Module ground pins GND are isolated from the module case.

2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

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4. TRANSCEIVER BLOCK DIAGRAM

5. ABSOLUTE MAXIMUM RATING

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	V_{CC}	0	3.6	V
Storage Temperature	Tc	-40	85	°C
Operating Case Temperature	Tc	-40	85	°C
Relative Humidity	RH	5	95	%
RX Input Average Power	Pmax	-	1.5	dBm

Table 2: Absolute Maximum Rating

6. RECOMMENDED OPERATING ENVIRONMENT

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameters	Symbol	Min.	Typical	Max	Unit
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Power Supply Current	Icc			300	mA
Operating Case Temperature, V00	T_{C-V}	-40	25	85	°C

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Table 3: Recommended Operating Environment

7. OPTICAL CHARACTERISTICS

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Note
Operating Reach				20	km	
Transmitter						
Center wavelength TR-DX12I-V00	λ	1265		1275	nm	
TR-DX33I-V00		1325		1335	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Launched power	Po	-4.4		0.5	dBm	
Transmitter and dispersion penalty	DP			3.2	dB	
Average launch power of OFF transmitter	Poff			-30	dBm	
Extinction ratio	ER	3.5			dB	
RIN	RIN			-128	dB/Hz	
Optical Return Loss Tolerance	RL	12			dB	
Receiver						
Center wavelength TR-DX12I-V00	λ	1325		1335		
TR-DX33I-V00		1265	-	1275	nm	
Receiver Overload		0.5			dBm	1
Receiver Sensitivity	RSEN			-14.4	dBm	1

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Receiver Reflectance	Rf			-12	dB	
Vertical eye closure penalty				2.2	dB	3
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-14.5	dBm	
LOS Hysteresis		0.5			dB	
Stressed eye jitter		0.3			UI	2
Receive electrical 3dB upper cutoff frequency				12.3	GHz	
Receiver power (damage)				1.5	dBm	

Table 4: Optical Characteristics

Notes:

1. Average optical power shall be measured using the methods specified in TIA/EIA-455-95.

2. Receiver sensitivity is informative. Stressed receiver sensitivity shall be measured with conformance test signal for BER =1x 10^{-12} .

3. Vertical eye closure penalty and stressed eye jitter are the test conditions for measuring stressed receiver sensitivity. They are not the required characteristic of the receiver.

4. Power budget is defined as the different between the Rx sensitivity and the Tx output power of the interface.

5. Path penalty is intended as the power penalty of the interface between back-to-back and the maximum applied dispersion.

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8. DITITAL DIAGNOSTIC FUNCTIONS

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales stuff.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Laser power monitor absolute error	DMI_TX	-3	3	dB	
RX power monitor absolute error	DMI_RX	-3	3	dB	-1dBm to -15dBm range
Supply voltage monitor absolute error	DMI_VCC	-0.18	0.1	V	Full operating range
Bias current monitor	DMI_Ibias	-10%	10%	mA	

Table5: Digital diagnostic specification table

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9. ELECTRICAL CHARACTERISTICS

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Data Rate		-	10.3125	-	Gbps	
Power Consumption		-	800	1000	mW	
Transmitter						
Single Ended Output Voltage Tolerance		-0.3	-	4	V	
C common mode voltage tolerance		15	-	-	mV	
Tx Input Diff Voltage	VI	180		700	mV	
Tx Fault	VoL	-0.3		0.4	V	At 0.7mA
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	
Receiver						
Single Ended Output Voltage Tolerance		-0.3	-	4	V	
Rx Output Diff Voltage	Vo	300		850	mV	
Rx Output Rise and Fall Time	Tr/Tf	30			ps	20% to 80%
Total Jitter	TJ			0.7	UI	
Deterministic Jitter	DJ			0.42	UI	

Table 6: Electrical Characteristics

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10. CONTROL AND STATUS I/O TIMING CHARACTERISTICS

Timing characteristics of control and status I/O are included in Table 8, which is also defined in SFF-8431.

Parameter	Symbol	Min	Max	Unit	Condition
TX_Disable assert time	t_off		10	Us	Timing from rising edge of TX_Disable to when the optical output falls below 10% of nominal
TX_Disable negate time	t_on		1	ms	Timing from falling edge of TX_Disable to when the modulated optical output rises above 90% of nominal
Time to initialize Including reset of TX_Fault	t_init		300	ms	From power on or negation of TX Fault using TX Disable
TX_fault assert time	TX_fault		100	us	From occurrence of fault to assertion of TX_fault
TX Disable to reset	t_reset	10		us	Time TX_Disable must be held high to reset TX_fault
Los assert time	t_loss_on		100	us	Time from LOS state to Rx_Los assert
Los Deassert Time	t_loss_off		100	us	Time from non_ LOS state to Rx_Los deassert
Rate-Select Change Time	t_ratesel		10	us	Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification
Serial ID Clock Rate	f_serial_clock		100	kHz	

Table 7: Timing Characteristics

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11. MECHANICAL

Comply with SFF-8432 rev. 5.0, the improved Pluggable form factor specification.
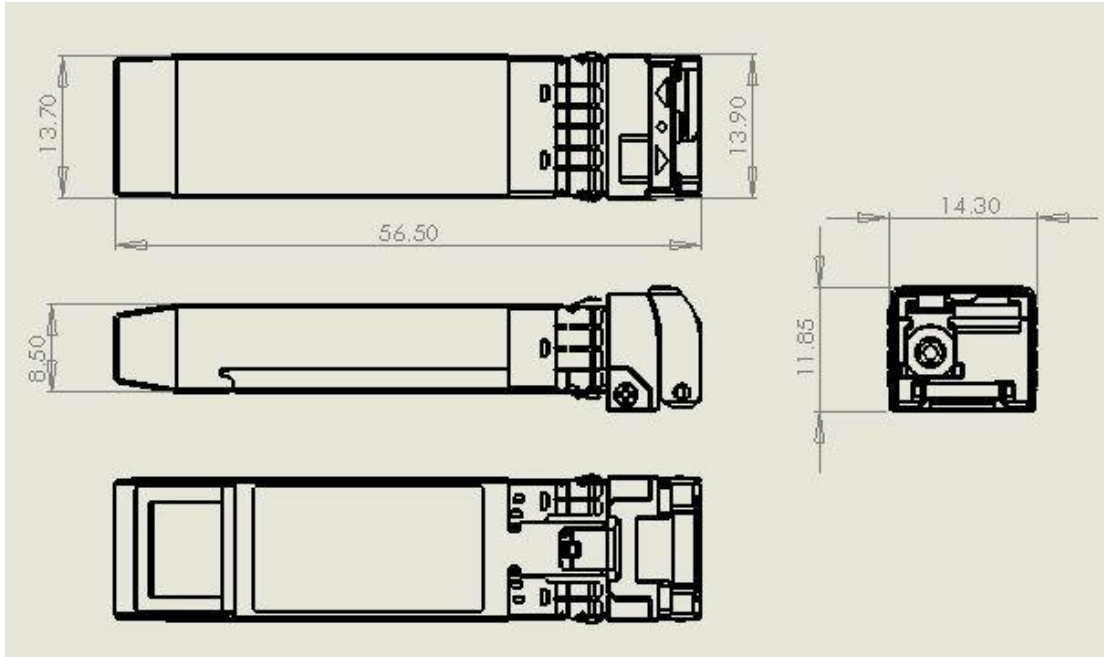
12. ESD

This transceiver is specified as ESD threshold 1kV for SFI pin and 2kv for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

13. LASER SAFTY

This is a Class 1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007)

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40Gb/s QSFP+ SR4 Optical Transceiver Module

DC-QQ85C-S1

Product Specification

Features

- 4 independent full-duplex channels

- Up to 11.2Gb/s data rate per channel

- MTP/MPO optical connector

- QSFP+ MSA compliant

- Digital diagnostic capabilities

- Up to 100m transmission on OM3 multi-mode ribbon fiber

- CML compatible electrical I/O

- Single +3.3V power supply

- Operating case temperature: 0~70°C

- XLPPI electric interface

- Maximum power consumption 1.5W

- RoHS-6 compliant
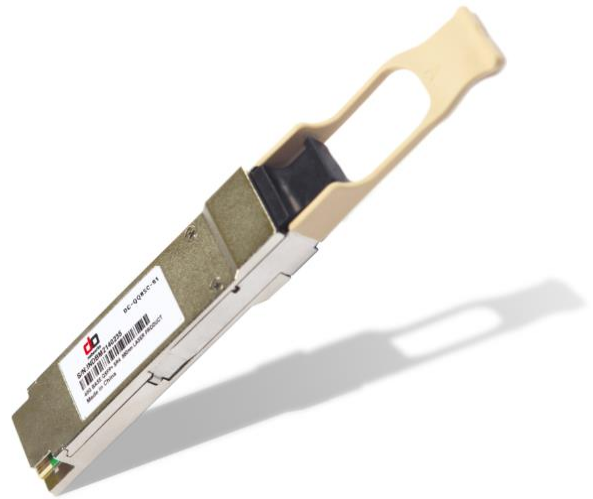
Applications

- Rack to Rack

- Data Center

- Infiniband QDR, DDR and SDR

- 40G Ethernet

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Part Number Ordering Information

DC-QQ85C-S1	QSFP+ SR4 100m optical transceiver with full real-time digital diagnostic monitoring and pull tab

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1. General Description

This product is a parallel 40Gb/s Quad Small Form-factor Pluggable (QSFP+) optical module. It provides increased port density and total system cost savings. The QSFP+ full-duplex optical module offers 4 independent transmit and receive channels, each capable of 10Gb/s operation for an aggregate data rate of 40Gb/s on 100 meters of OM3 multi-mode fiber.

An optical fiber ribbon cable with an MTP/MPO connector can be plugged into the QSFP+ module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually can not be twisted for proper channel to channel alignment. Electrical connection is achieved though a z-pluggable 38-pin IPASS® connector.

The module operates by a single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt and Low Power Mode, are available with the modules. A 2-wire serial interface is available to send and receive more complex control signals, and to receive digital diagnostic information. Individual channels can be addressed and unused channels can be shut down for maximum design flexibility.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP+ Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

2. Functional Description

This product converts parallel electrical input signals into parallel optical signals, by a driven Vertical Cavity Surface Emitting Laser (VCSEL) array. The transmitter module accepts electrical input signals compatible with Common Mode Logic (CML) levels. All input data signals are differential and internally terminated. The receiver module converts parallel optical input signals via a photo detector array into parallel electrical output signals. The receiver module outputs electrical signals are also voltage compatible with Common Mode Logic (CML) levels. All data signals are differential and support a data rates up to 10Gb/s per channel. Figure 1 shows the functional block diagram of this product.

A single +3.3V power supply is required to power up the module. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As

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per MSA specifications the module offers 7 low speed hardware control pins (including the 2-wire serial interface): ModSelL, SCL, SDA, ResetL, LPMode, ModPrsL and IntL.

Module Select (ModSelL) is an input pin. When held low by the host, the module responds to 2-wire serial communication commands. The ModSelL allows the use of multiple QSFP+ modules on a single 2-wire interface bus – individual ModSelL lines for each QSFP+ module must be used.

Serial Clock (SCL) and Serial Data (SDA) are required for the 2-wire serial bus communication interface and enable the host to access the QSFP+ memory map.

The ResetL pin enables a complete module reset, returning module settings to their default state, when a low level on the ResetL pin is held for longer than the minimum pulse length. During the execution of a reset the host shall disregard all status bits until the module indicates a completion of the reset interrupt. The module indicates this by posting an IntL (Interrupt) signal with the Data_Not_Ready bit negated in the memory map. Note that on power up (including hot insertion) the module should post this completion of reset interrupt without requiring a reset.

Low Power Mode (LPMode) pin is used to set the maximum power consumption for the module in order to protect hosts that are not capable of cooling higher power modules, should such modules be accidentally inserted.

Module Present (ModPrsL) is a signal local to the host board which, in the absence of a module, is normally pulled up to the host Vcc. When a module is inserted into the connector, it completes the path to ground though a resistor on the host board and asserts the signal. ModPrsL then indicates a module is present by setting ModPrsL to a "Low" state.

Interrupt (IntL) is an output pin. Low indicates a possible module operational fault or a status critical to the host system. The host identifies the source of the interrupt using the 2-wire serial interface. The IntL pin is an open collector output and must be pulled to the Host Vcc voltage on the Host board.

3. Transceiver Block Diagram
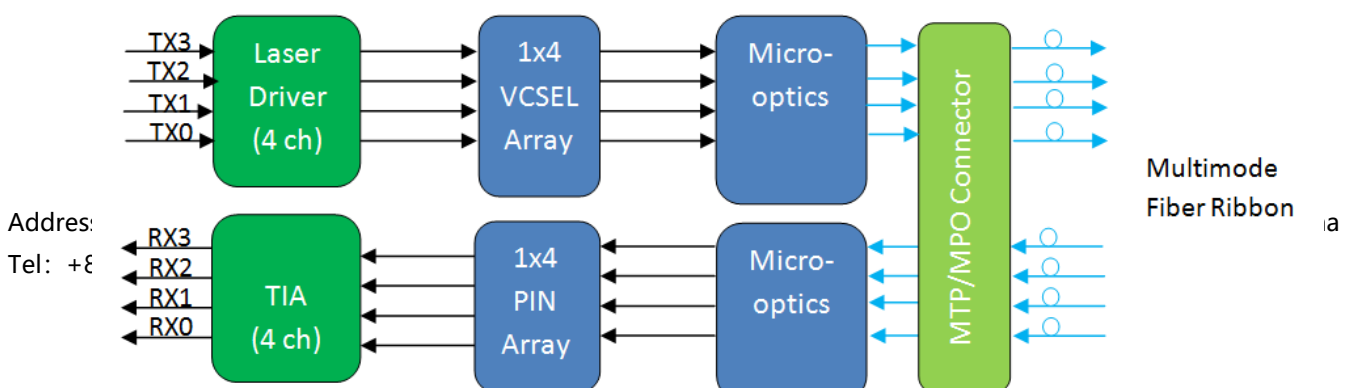
Figure 1. Transceiver Block Diagram

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4. Pin Assignment and Pin Description
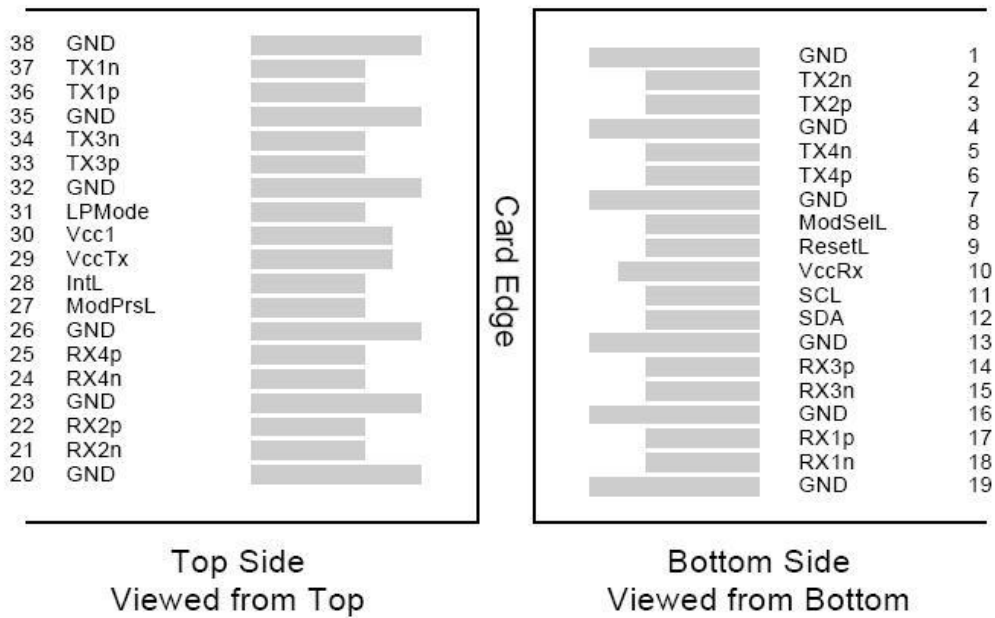
Figure 2. QSFP+ Transceiver Electrical Pad Layout

5. Pin Definition

PIN	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2

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11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.

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2. VccRx, Vcc1 and VccTx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 4 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

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6. Optical Interface Lanes and Assignment

Figure 3 shows the orientation of the multi-mode fiber facets of the optical connector. Table 1 provides the lane assignment.
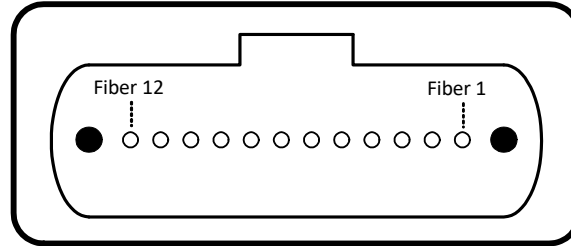
Figure 3. Outside View of the QSFP+ Module MPO

Table 1:   Lane Assignment

Fiber #	Lane Assignment
1	RX0
2	RX1
3	RX2
4	RX3
5,6,7,8	Not used
9	TX3
10	TX2
11	TX1
12	TX0

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7. Recommended Power Supply Filter
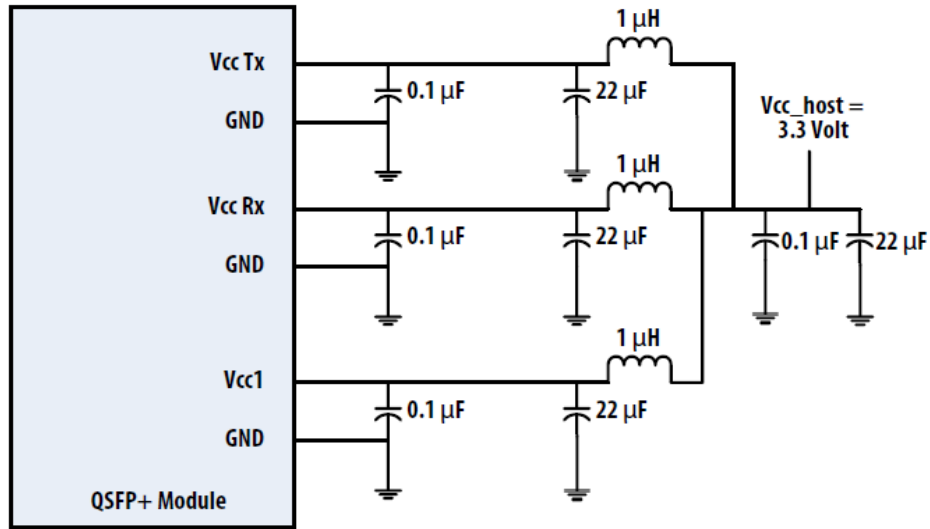
Figure 4. Recommended Power Supply Filter

8. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Unit	Note
Storage Temperature	T_S	-40	85	degC	
Operating Case Temperature	T_{OP}	0	70	degC	
Power Supply Voltage	V_{CC}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	TH_d	3.4		dBm	

9. Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T_{OP}	0		70	degC

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Power Supply Voltage	V$_{CC}$	3.135	3.3	3.465	V
Data Rate, each Lane			10.3125	11.2	Gb/s
Control Input Voltage High		2		Vcc	V
Control Input Voltage Low		0		0.8	V
Link Distance (OM3)	D			100	m

10. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Power Consumption				1.5	W	
Supply Current	Icc			450	mA	
Transceiver Power-on Initialization Time				2000	ms	1
Transmitter (each Lane)						
Single-ended Input Voltage Tolerance (Note 2)		-0.3		4.0	V	Referred to TP1 signal common
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing Threshold		50			mVpp	LOSA Threshold
Differential Input Voltage Swing	Vin,pp	180		1200	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	
Differential Input Return Loss		See IEEE 802.3ba 86A.4.11			dB	10MHz-11.1GHz
J2 Jitter Tolerance	Jt2	0.17			UI	
J9 Jitter Tolerance	Jt9	0.29			UI	

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Data Dependent Pulse Width Shrinkage (DDPWS) Tolerance		0.07			UI	
Eye Mask Coordinates {X1, X2 Y1, Y2}		0.11, 0.31 95, 350			UI mV	Hit Ratio = 5x10^{-5}
Receiver (each Lane)						
Single-ended Output Voltage		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage (RMS)				7.5	mV	
Differential Output Voltage Swing	Vout,pp	600		800	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	
Termination Mismatch at 1MHz				5	%	
Differential Output Return Loss		See IEEE 802.3ba 86A.4.2.1			dB	10MHz-11.1GHz
Common Mode Output Return Loss		See IEEE 802.3ba 86A.4.2.2			dB	10MHz-11.1GHz
Output Transition Time		28			ps	20% to 80%
J2 Jitter Output	Jo2			0.42	UI	
J9 Jitter Output	Jo9			0.65	UI	
Eye Mask Coordinates {X1, X2 Y1, Y2}		0.29, 0.5 150, 425			UI mV	Hit Ratio = 5x10^{-5}

Notes:

1. Power-on Initialization Time is the time from when the power supply voltages

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reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.

2. The single ended input voltage tolerance is the allowable range of the instantaneous input signals

11. Optical Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_C	840	850	860	nm	
RMS Spectral Width	$\Delta\lambda_{rms}$		0.5	0.65	nm	
Average Optical Power, each Lane	P_{AVG}	-7.6		1.0	dBm	1
Optical Modulation Amplitude (OMA), each Lane	P_{OMA}	-5.6		3.0	dBm	2
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			4.0	dB	
Peak Power, each Lane	PP_T			4.0	dBm	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane	OMA-TDP	-6.5			dBm	
TDP, each Lane				3.5	dB	
Extinction Ratio	ER	3.0			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	12dB reflection
Optical Return Loss Tolerance	TOL			12	dB	
Encircled Flux		>86% at 19um <30% at 4.5um				
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		0.23, 0.34, 0.43, 0.27, 0.35, 0.4				
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	

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Receiver							
Center Wavelength	λ_C	840	850	860	nm	
Damage Threshold, each Lane	TH_d	3.4			dBm	3
Average Power at Receiver Input, each Lane		-9.5		2.4	dBm	
Receiver Reflectance	R_R			-12	dB	
Receive Power (OMA), each Lane				3.0	dBm	
Stressed Receiver Sensitivity (OMA), each Lane				-5.4	dBm	4
Receiver Sensitivity (OMA), each Lane	SEN			-7.5	dBm	
Peak Power, each Lane	PP_R			4.0	dBm	
LOS Assert	LOSA	-30			dBm	
LOS Deassert	LOSD			-12	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Conditions of Stress Receiver Sensitivity Test (Note 5):						
Vertical Eye Closure Penalty, each Lane			1.9		dB	
Stressed Eye J2 Jitter, each Lane			0.3		UI	
Stressed Eye J9 Jitter, each Lane			0.47		UI	
OMA of each aggressor lane			-0.4		dBm	

Notes:

1. The maximum transmitter average optical power of 1.0 dBm is well within the

    guardband of receiver overload specifications of commercially available 10GBASE-

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SR SFP+ transceivers offered by Datacomm and other vendors.

2. Even if the TDP < 0.9 dB, the OMA min must exceed the minimum value specified here.

3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

4. Measured with conformance test signal at receiver input for BER = 1×10^{-12}.

5. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

12. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8436.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI _VCC	-0.15	0.15	V	Full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	Ch1~Ch4
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:
1. Due to measurement accuracy of different multi-mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

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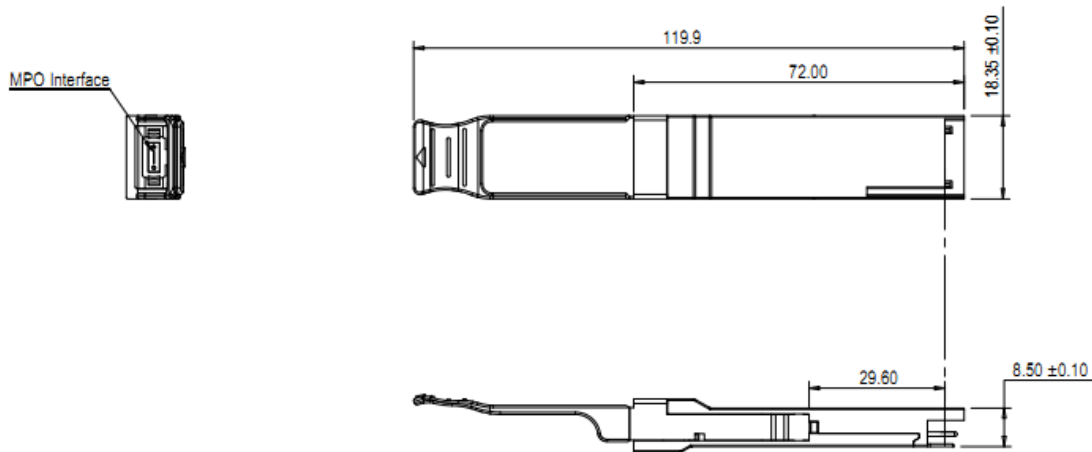
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13. Mechanical Dimensions

Figure 5. Mechanical Outline

14. ESD

This transceiver is specified as ESD threshold 1KV for SFI pins and 2KV for all others electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

15. Laser Safety

This is a Class 1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

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10Gb/s SFP+ 850nm Optical Transceiver Module
SFP-10G-SR-x

Features

- Up to 11.3Gb/s data links
- 850nm VCSEL laser and PIN receiver
- Up to 300m on 50/125μm MMF
- Hot-pluggable SFP+ footprint
- Duplex LC/UPC type pluggable optical interface
- RoHS compliant and lead-free
- Support Digital Diagnostic Monitoring interface
- Compliant with SFF+MSA and SFF-8472
- Single +3.3V power supply
- Metal enclosure, for lower EMI
- Meet ESD requirements, resist 8KV direct contact voltage
- Case operating temperature

  Commercial: 0 ~ +70ºC

  Extended: -10 ~ +80ºC

  Industrial: -40 ~ +85ºC

Applications

- 10GBASE-SR/SW & 10G Ethernet
- SDH STM64
- Other Optical Links

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Part Number Ordering Information

Part Number	Data Rate (Gb/s)	Wavelength (nm)	Transmission Distance(m)	Temperature (^{o}C) (Operating Case)
SFP-10G-SR-C	10.3125	850	300m MMF	0~70 commercial
SFP-10G-SR-E	10.3125	850	300m MMF	-10~80 Extended
SFP-10G-SR-I	10.3125	850	300m MMF	-40~85 Industrial

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1. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	T_S	-40	85	ºC	
Power Supply Voltage	V_{CC}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	TH_d	5		dBm	

2. Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T_{OP}	0		70	ºC	commercial
		-40		85	ºC	Industrial
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate			10.3125		Gb/s	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			300	m	50/125um

3. General Description

do-networks' SFP-10G-SR-x SFP+ transceiver is designed for use in 10-Gigabit Ethernet links up to 300m over Multi-mode fiber. The module consists of 850nm VCSEL Laser, PIN and Preamplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

SFP-10G-SR-x transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP+ MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial

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interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.
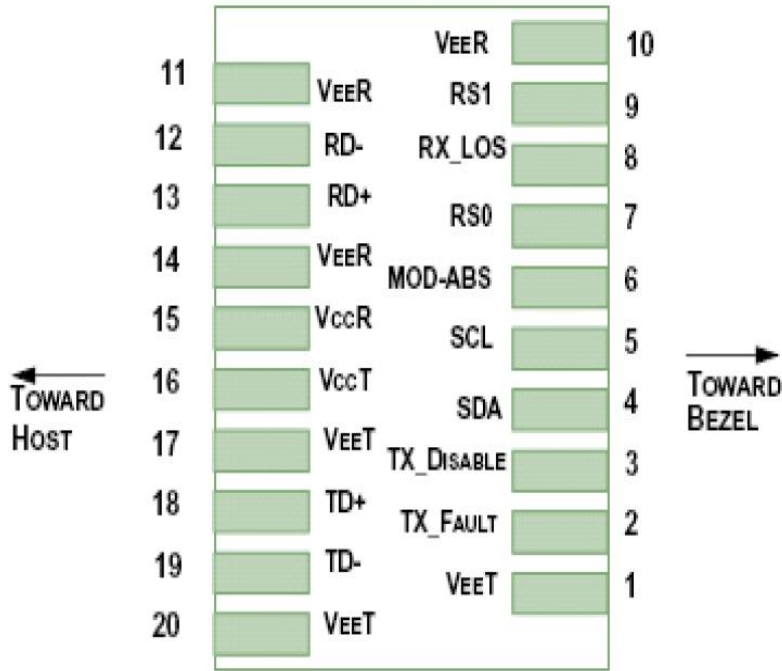
4. Pin Assignment and Pin Description

Figure1. Diagram of host board connector block pin numbers and names

Pin	Symbol	Name/Description	Notes
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault.	2
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4

7	RS0	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	
10	V$_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
11	V$_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V$_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
15	V$_{CCR}$	Receiver Power Supply	
16	V$_{CCT}$	Transmitter Power Supply	
17	V$_{EET}$	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V$_{EET}$	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.

2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7kΩ-10kΩ resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V.A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.

3. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.

4. Should be pulled up with 4.7kΩ-10kΩ on host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.

5. Internally pulled down per SFF-8431 Rev 4.1.

6. LOS is open collector output. It should be pulled up with 4.7kΩ-10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

5. Electrical Characteristics

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The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Power Consumption	p			1.0	W	
Supply Current	Icc			300	mA	
Transmitter						
Single-ended Input Voltage Tolerance	Vcc	-0.3		4.0	V	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing	Vin,pp	180		700	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	Vdis	Vcc-1.3		Vcc	V	
Transmit Enable Voltage	Ven	Vee		Vee +0.8	V	2
Receiver						
Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	3
Data output rise/fall time	Tr/Tf	28			ps	4
LOS Assert Voltage	VlosH	Vcc-1.3		Vcc	V	5
LOS De-assert Voltage	VlosL	Vee		Vee +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.

2. Or open circuit.

3. Input 100 ohms differential termination.

4. These are unfiltered 20-80% values.

5. Loss of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

6. Optical Characteristics

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The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_C	840	850	860	nm	1
Optical Spectral Width	$\Delta\lambda$			0.85	nm	
Average Optical Power	P_{AVG}	-6		-1	dBm	2
Optical Extinction Ratio	ER	3.0			dB	
Transmitter OFF Output Power	Poff			-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
Receiver						
Center Wavelength	λ_C	770	850	860	nm	
Receiver Sensitivity (Average Power)	Sen.			-10	dBm	3
Input Saturation Power (overload)	Psat	0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-14	dBm	
LOS Hysteresis	LOSH	0.5			dB	

Notes:

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.

2. Launched power (avg.) is power coupled into a single mode fiber with master connector (Before of Life).

3. Measured with Light source 850nm, ER=3.0dB; BER =<10^-12 @10.3125Gbps, PRBS=2^31-1 NRZ.

7. Digital Diagnostic Functions

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The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

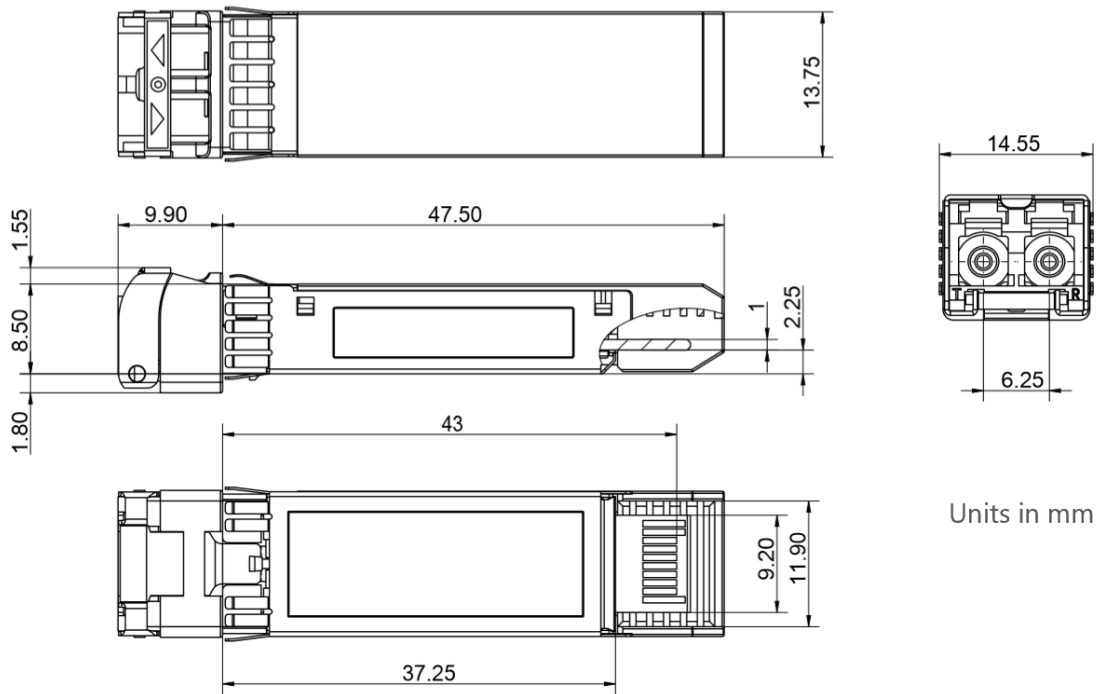| Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_ Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI _VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_ bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

8. Mechanical Dimensions

Figure2. Mechanical Outline

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