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Cisco Catalyst 3850 Series Switches

The digital transformation: Converged wired and wireless access and aggregation

The promise of digital for your business is all about innovating more quickly while reducing risk, cost, and complexity. It will be your network that forms the foundation of your business's transformation.

But supporting your digital organization will require your network to move beyond just connectivity to be a platform for insights, automation, and security.

This is the power of the Cisco® Digital Network Architecture (Cisco DNA).

Cisco DNA is a monumental shift on how to design and build networks. The Cisco Catalyst® 3850 Series, as part of the Cisco DNA portfolio of next-generation enterprise-class stackable Ethernet and Multigigabit Ethernet access and aggregation layer switches, securely enables time-saving virtualization, greater automation, and valuable analytics data that directly address your evolving business needs, including less cost to install and operate.

The Cisco Catalyst 3850 Series provides capabilities that ideally suited to support the convergence of wired and wireless access. The new Cisco Unified Access Data™ Plane (UADP) Application-Specific Integrated Circuit (ASIC) powers the switch and enables uniform wired-wireless policy enforcement, application visibility, flexibility, and application optimization. This convergence is built on the resilience of the new and improved Cisco StackWise®-480 technology.

The Cisco Catalyst 3850 Series Switches support full IEEE 802.3at Power over Ethernet Plus (PoE+), Cisco Universal Power Over Ethernet (Cisco UPOE®), modular and field-replaceable network modules, RJ-45 and fiber-based downlink interfaces, and redundant fans and power supplies.

Contents

Product Overview

- Integrated wireless controller capability with:
  - Up to 40G of wireless capacity per switch (48-port RJ45 models)
  - Support for up to 100 access points and 2000 wireless clients on each switching entity (switch or stack)
- 24 and 48 10/100/1000Mbps data PoE+ and Cisco UPOE models with Energy-Efficient Ethernet (EEE)
- 24 and 48 100Mbps/1/2.5/5/10 Gbps Cisco UPOE models with Energy-Efficient Ethernet (EEE)
- 12- and 24-port 1 Gigabit Ethernet SFP-based models
- 12- and 24-port 1/10 Gigabit Ethernet SFP+-based models
- 48-port 1/10 Gigabit Ethernet SFP+ model with 4 fixed 40 Gigabit Ethernet QSFP+ uplinks
- Cisco StackWise-480 technology provides scalability and resiliency with 480 Gbps of stack throughput[1]
- Cisco StackPower® technology provides power stacking among stack members for power redundancy[1]
- Five optional uplink modules[2] with 4 x Gigabit Ethernet, 2 x 10 Gigabit Ethernet, 4 x 10 Gigabit Ethernet[3], 8 x 10 Gigabit Ethernet4, or 2 x 40 Gigabit Ethernet QSFP+[4] ports
- Dual redundant, modular power supplies and three modular fans providing redundancy
- Full IEEE 802.3at (PoE+) with 30W power on all copper ports in 1 Rack Unit (RU) form factor
- Cisco UPOE with 60W power per port in 1 Rack Unit (RU) form factor
- IEEE 802.3bz (2.5/5 G/s BASE-T) to go beyond 1 Gb/s with existing Cat5e and Cat6
- IEEE 802.1ba AV Bridging (AVB) built-in to provide better AV experience for including improved time synchronization and QoS
- Software support for IPv4 and IPv6 routing, multicast routing, modular Quality of Service (QoS), Flexible NetFlow (FNF), and enhanced security features
- Single universal Cisco IOS® Software image across all license levels, providing an easy upgrade path for software features
- Cisco DNA services delivered through Cisco ONE™ Software, providing simplified, high-value solutions with license portability and flexibility
- Support for AES-256 with the powerful MACSEC 256-bit for SFP+ and Multigigabit models and 128-bit encryption algorithm available on all models
- Enhanced Limited Lifetime Warranty (E-LLW) with Next Business Day (NBD) advance hardware replacement and 90-day access to Cisco Technical Assistance Center (TAC) support

[1] StackWise and StackPower technologies are not supported on the 48-port SFP+ switch model.

[2] Optional uplink modules are not supported on the 48-port 10G SFP+ switch model.

[3] Compatible only with the 48-port RJ45 models and with the 12-port (or higher) 10 Gigabit capable models.

[4] Compatible only with Cisco Catalyst 3850 Multigigabit and 24-port SFP+ switch models.

Switch Models and Configurations

All switches ship with one of the five power supplies (350WAC, 715WAC, 750WAC, 1100WAC, or 440WDC)[5]. Figures 1 through 4 show the Cisco Catalyst 3850 Series Switches.

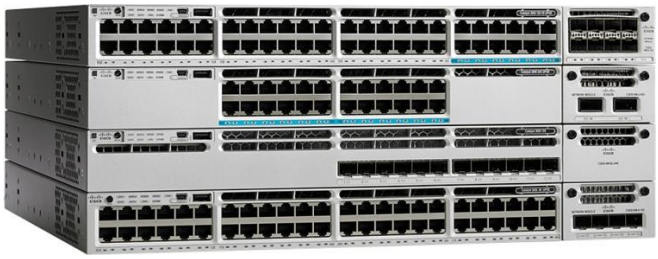

Figure 1.
Cisco Catalyst 3850 Series Switches

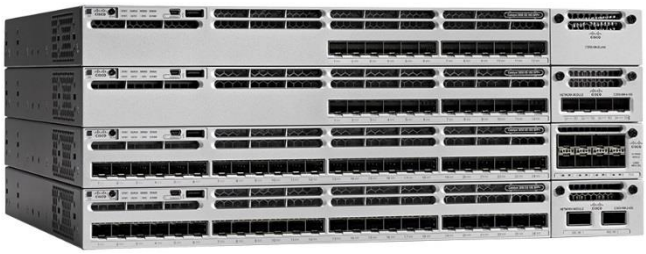

Figure 2.
Cisco Catalyst 3850 Series Switches with 12 and 24 1/10 Gigabit Ethernet SFP+ ports

Figure 3.
Cisco Catalyst 3850 Series Switches with 12 and 24 1 Gigabit Ethernet SFP ports

Figure 4.
Cisco Catalyst 3850 Series Switches with 10 Gigabit Ethernet 48 ports

Table 1 shows the Cisco Catalyst 3850 Series configurations.

[5] The 48-port 10G SFP+ switch model will only support dedicated power supplies with front-to-back and back-to-front configurations.

Table 1. Cisco Catalyst 3850 Series configurations

Model	Total 10/100/1000 or SFP or SFP+ ports	Default AC power supply	Available PoE power	POE budget with 1100W secondary PS	StackWise-480	StackPower
WS-C3850-24T	24	350WAC	-		Yes	Yes
WS-C3850-48T	48					
WS-C3850-24P	24 PoE+	715WAC	435W	1535W		
WS-C3850-48P	48 PoE+					
WS-C3850-48F	48 PoE+	1100WAC	800W	1900W		
WS-C3850-24U	24 UPOE	1100WAC	800W	1900W		
WS-C3850-48U	48 UPOE	1100WAC	800W	1900W		
WS-C3850-24XU	24 UPOE (100Mbps/1/2.5/5/10 Gbps)	1100WAC	580W	1680W		
WS-C3850-12X48U	48 UPOE (with 12 100Mbps/1/2.5/5/10 Gbps Ports)	1100WAC	630W	1730W		
WS-C3850-12S	12 SFP	350WAC				
WS-C3850-24S	24 SFP					
WS-C3850-12XS	12 1/10G SFP+	350WAC	-			
WS-C3850-24XS	24 1/10G SFP+	715 WAC	-			
WS-C3850-48XS	48 1/10G SFP+	750WAC (front to back)	-		No	No

Network modules

The Cisco Catalyst 3850 Series Switches support five optional network modules for uplink ports. The default switch configuration does not include the network module. At the time of switch purchase the customer has the flexibility to choose from the network modules described in Table 2.

Figure 5 shows the following network modules:

- 4 x Gigabit Ethernet with Small Form-Factor Pluggable (SFP) receptacles
- 2 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP receptacles
- 4 x 10 Gigabit Ethernet with SFP+ receptacles (supported only on the 48-port Gigabit Ethernet models or on the 12-port or higher 10 Gigabit Ethernet models)

Figure 5.
Network modules with four Gigabit Ethernet, two 10 Gigabit Ethernet SFP+, or four 10 Gigabit Ethernet SFP+ interfaces

Figure 6 shows the following network modules:

- 8 x 10 Gigabit Ethernet with Small Form-Factor Pluggable+ (SFP+) receptacles
- 2 x 40 Gigabit Ethernet with Quad Small Form-Factor Pluggable+ (QSFP+) receptacles

Figure 6.
Network modules with two 40 Gigabit Ethernet QSFP+ or eight 10 Gigabit Ethernet SFP+ interfaces

The C3850-NM-4-10G module is supported only on the 48-port Gigabit Ethernet models or on the 12-port or higher 10 Gigabit Ethernet models. The C3850-NM-8x10G and C3850-NM-2x40G modules are supported on the 24-port and 48-port multigigabit switches and also on the 24-port 10G SFP+ switch model. The C3850-NM-4-1G and C3850-NM-2-10G modules are not supported on the 12-port and 24-port SFP+ models.

Table 2. Network module compatibility matrix

Model	Network modules
WS-C3850-24T	C3850-NM-4-1G, C3850-NM-2-10G
WS-C3850-48T	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G
WS-C3850-24P	C3850-NM-4-1G, C3850-NM-2-10G

Model	Network modules
WS-C3850-48P	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G
WS-C3850-48F	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G
WS-C3850-24U	C3850-NM-4-1G, C3850-NM-2-10G
WS-C3850-48U	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G
WS-C3850-24XU	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G, C3850-NM-8-10G, C3850-NM-2-40G
WS-C3850-12X48U	C3850-NM-4-1G, C3850-NM-2-10G, C3850-NM-4-10G, C3850-NM-8-10G, C3850-NM-2-40G
WS-C3850-12S	C3850-NM-4-1G, C3850-NM-2-10G
WS-C3850-24S	C3850-NM-4-1G, C3850-NM-2-10G
WS-C3850-12XS	C3850-NM-4-10G
WS-C3850-24XS	C3850-NM-4-10G, C3850-NM-8-10G, C3850-NM-2-40G
WS-C3850-48XS	None

An SFP+ receptacle supports both 10 Gigabit Ethernet and Gigabit Ethernet modules, allowing customers to use their investment in Gigabit Ethernet SFP modules and upgrade to 10 Gigabit Ethernet when business demands change without having to do a comprehensive upgrade of the access switch. In contrast, SFP receptacles can be used only as Gigabit Ethernet ports, as shown in the examples in Table 3.

Table 3. Network module configuration examples

	Interface options	
Network module	**10 Gigabit Ethernet SFP+ ports**	**Gigabit Ethernet SFP ports**
4 x Gigabit Ethernet	0	4
4 x Gigabit Ethernet/2 x10 Gigabit Ethernet network modules	2	0
	1	3
	2	2
	0	4
4 x Gigabit Ethernet/4 x10 Gigabit Ethernet network modules	4	0
	0	4
	2	2
	3	1
	1	3

Dual redundant modular power supplies

The Cisco Catalyst 3850 Series Switches support dual redundant power supplies.[6] The switch ships with one power supply by default, and the second power supply can be purchased at the time of ordering the switch or at a later time. If only one power supply is installed, it should always be in power supply bay 1. The switch also ships with three field-replaceable fans. (See Figure 7.)

Figure 7.
Dual redundant power supplies

Table 4 shows the different power supplies available in these switches and available PoE power.

Table 4. Power supply models

Model	Default power supply	Available PoE power
24-port data switch	PWR-C1-350WAC	-
48-port data switch		
24-port PoE switch	PWR-C1-715WAC	435W
48-port PoE switch		
48-port full PoE switch	PWR-C1-1100WAC	800W
24-port UPOE switch	PWR-C1-1100WAC	800W
48-port UPOE switch		
24-port Multigigabit UPOE switch	PWR-C1-1100WAC	580W
48-port Multigigabit UPOE switch	PWR-C1-1100WAC	630W
12-port SFP switch	PWR-C1-350WAC	-
24-port SFP switch		
12-port SFP+ switch	PWR-C1-350WAC	-

[6] The 48-port 10G SFP+ switch model will only support dedicated power supplies with front-to-back and back-to-front configurations.

Model	Default power supply	Available PoE power
24-port SFP+ switch	PWR-C1-715WAC	-
48-port SFP+ switch (WS-C3850-48XS-S and WS-C3850-48XS-E)	PWR-C3-750WAC-R	-
48-port SFP+ switch (WS-C3850-48XS-F-S and WS-C3850-48XS-F-E)	PWR-C3-750WAC-F	-

In addition to the power supplies listed in Table 5, a 440WDC power supply is available as a configuration option and also as a spare (that is, it can be ordered separately) on all switch models. The DC power supply also delivers PoE capabilities for maximum flexibility (refer to Table 6 for available PoE budget with DC power supplies). Customers can mix and match the AC and DC power supplies in the two available power supply slots. Any of these power supplies can be installed in any of the switches.

Table 5. Available PoE with DC power supply

Model	Number of 440WDC power supplies	Total available PoE budget
24-port PoE switch	1	220W
	2	660W
48-port PoE switch	1	185W
	2	625W
24-port Multigigabit UPOE switch	2	360W
48-port Multigigabit UPOE switch	2	410W

Power over Ethernet Plus (PoE+)

In addition to PoE (IEEE 802.3af), the Cisco Catalyst 3850 Series Switches support PoE+ (IEEE 802.3at standard), which provides up to 30W of power per port. The Cisco Catalyst 3850 Series Switches can provide a lower Total Cost of Ownership (TCO) for deployments that incorporate Cisco IP phones, Cisco Aironet® wireless LAN (WLAN) access points, or any IEEE 802.3at-compliant end device. PoE removes the need for wall power to each PoE-enabled device and eliminates the cost for additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. Table 6 shows the power supply combinations required for different PoE needs.

Table 6. Power supply requirements for PoE and PoE+

	24-port PoE switch	48-port PoE switch
PoE on all ports (15.4W per port)	One PWR-C1-715WAC	One PWR-C1-1100WAC or two PWR-C1-715WAC
PoE+ on all ports (30W per port)	One PWR-C1-1100WAC or two PWR-C1-715WAC	Two PWR-C1-1100WAC or one PWR-C1-1100WAC and one PWR-C1-715WAC

Cisco Universal Power over Ethernet (Cisco UPOE)

Cisco UPOE (Table 7) is a breakthrough technology, offering the following services and benefits.

- 60W per port to enable a variety of end devices such as Samsung VDI client, BT IP turret systems in trading floors, Cisco Catalyst compact switches in retail/hospitality environments, personal Cisco TelePresence® systems, and physical access control devices
- High availability for power and guaranteed uninterrupted services, a requirement for critical applications (e911)
- Lowering OpEx by providing network resiliency at lower cost by consolidating backup power into the wiring closet
- Faster deployment of new campus access networking infrastructures by eliminating the need for a power outlet for every endpoint

Table 7. Power supply requirements for Cisco UPOE

	24-port UPOE switch	48-port UPOE switch	24-port Multigigabit UPOE switch	48-port multigigabit UPOE switch
UPOE (60W per port) on all (24 port switch) or max. 30 ports (48 port switch)	One PWR-C1-1100WAC and one PWR-C1-715WAC	Two PWR-C1-1100WAC	Two PWR-C1-1100WAC	Two PWR-C1-1100WAC

Cisco Catalyst Multigigabit Ethernet technology

Cisco Multigigabit Ethernet is a unique Cisco innovation to the new Cisco Catalyst Ethernet access switches. With the enormous growth of 802.11ac and new wireless applications, wireless devices are promoting the demand for more network bandwidth. This creates a need for a technology that supports speeds higher than 1 Gbps on all cabling infrastructure. Cisco Multigigabit technology allows you to achieve bandwidth speeds from 1 Gbps through 10 Gbps over traditional Cat 5e cabling or above. In addition, the Multigigabit ports on select Cisco Catalyst switches support UPOE, which is increasingly important for next-generation workspaces and Internet of Things (IoT) ecosystems.

Cisco Multigigabit technology offers significant benefits for a diverse range of speeds, cable types, and PoE power. The benefits can be grouped into three different areas:

- **Multiple speeds:** Cisco Multigigabit technology supports autonegotiation of multiple speeds on switch ports. The supported speeds are 100 Mbps, 1 Gbps, 2.5 Gbps, and 5 Gbps on Cat 5e cable and up to 10 Gbps over Cat 6a cabling.
- **Cable type:** The technology supports a wide range of cable types, including Cat 5e, Cat 6, and Cat 6a or above.
- **PoE power:** The technology supports PoE, PoE+, and UPOE for all the supported speeds and cable types.

For more information, visit https://www.cisco.com/c/en/us/solutions/enterprise-networks/catalyst-multigigabit-switching/index.html.

SD-Access architecture

What if you could give time back to IT? And provide network access in minutes for any user or device to any application – without compromise?

Cisco Software-Defined Access (SD-Access) is the industry's first intent-based networking solution for the enterprise, built on the principles of Cisco's Digital Network Architecture (Cisco DNA). SD-Access provides automated, end-to-end segmentation to separate user, device, and application traffic without the need to redesign the network. SD-Access automates user access policy so organizations can make sure the right policies are established for any user or device with any application across the network. This is accomplished with a single network fabric across LAN and WLAN, which creates a consistent user experience anywhere without compromising on security.

Organizations have many challenges today in managing the network to drive business outcomes. These limitations are due to manual configuration and fragmented tool offerings. SD-Access provides:

- A transformational management solution that reduces operational expenses and enhances business agility
- Consistent management of wired and wireless network provisioning and policy
- Automated network segmentation and group-based policy
- Contextual insights for fast issue resolution and capacity planning
- Open and programmable interfaces for integration with third-party solutions

For an overview of key use cases that SD-Access addresses, refer to the SD-Access Solution Overview.

SD-Access licensing

To be able to benefit from the SD-Access architecture, you must purchase an **add-on licensing package**. **Such licensing** package includes the Cisco DNA Essentials and Cisco DNA Advantage options. Add-on licenses have to be purchased for a 3-, 5-, (and hence are also known as term-based licenses). Product SKUs for these packages are given in Table 10 below.

Ordering and managing licenses with smart accounts: Creating smart accounts by using the Cisco Smart Software Manager (SSM) enables you to order devices and licensing packages and also to manage your software licenses from a centralized website. You can set up Cisco SSM to receive daily email alerts and to be notified of expiring add-on licenses that you want to renew. When the license term expires, you can either renew the add-on license to continue using it or deactivate the add-on license and then reload the switch to continue operating with the base license capabilities.

Note: You are not required to deploy Cisco DNA Center just to use one of the license packages.

Table 8 shows the features included in the Essentials and Advantage packages.

Table 8. Essentials and Advantage package features

Feature	Cisco DNA Essentials	Cisco DNA Advantage
Day o network bring-up automation Cisco Network Plug-and-Play application, network settings, device credentials	✓	✓
Element management Discovery, inventory, topology, software image, licensing, and configuration management	✓	✓
Element management Patching	✗	✓
Network monitoring Product Security Incident Response Team (PSIRT) compliance, end-of-life/end-of-sale reporting, telemetry quotient, client 360, device 360, top talkers/	✓	✓

Feature	Cisco DNA Essentials	Cisco DNA Advantage
NetFlow/streaming telemetry collection and correlation		
Static QoS configuration and monitoring EasyQoS application	✓	✓
Policy-based automation SD-Access, group-based policy for access, app prioritization, monitoring, and path selection; SD-Access with integrated wireless	✗	✓
Network assurance and analytics Insights gained from analytics and machine learning for the network, clients and applications that cover onboarding, connectivity, and performance	✗	✓

Table 9 shows the product IDs for these licenses.

Table 9. Essentials and Advantage package product IDs

	Product ID	Description
12-port	C3850-DNA-E-12	C3850 Cisco DNA Essentials, 12-port term licenses
	C3850-DNA-E-12-3Y	C3850 Cisco DNA Essentials, 12-port, 3-year term license
	C3850-DNA-E-12-5Y	C3850 Cisco DNA Essentials, 12-port, 5-year term license
	C3850-DNA-A-12	C3850 Cisco DNA Advantage, 12-port term licenses
	C3850-DNA-A-12-3Y	C3850 Cisco DNA Advantage, 12-port, 3-year term license
	C3850-DNA-A-12-5Y	C3850 Cisco DNA Advantage, 12-port, 5-year term license
24-port	C3850-DNA-E-24	C3850 Cisco DNA Essentials, 24-port term licenses
	C3850-DNA-E-24-3Y	C3850 Cisco DNA Essentials, 24-port, 3-year term license
	C3850-DNA-E-24-5Y	C3850 Cisco DNA Essentials, 24-port, 5-year term license
	C3850-DNA-A-24	C3850 Cisco DNA Advantage, 24-port term licenses
	C3850-DNA-A-24-3Y	C3850 Cisco DNA Advantage, 24-port, 3-year term license
	C3850-DNA-A-24-5Y	C3850 Cisco DNA Advantage, 24-port, 5-year term license
48-port	C3850-DNA-E-48	C3850 Cisco DNA Essentials, 48-port term licenses
	C3850-DNA-E-48-3Y	C3850 Cisco DNA Essentials, 48-port, 3-year term license
	C3850-DNA-E-48-5Y	C3850 Cisco DNA Essentials, 48-port, 5-year term license
	C3850-DNA-A-48	C3850 Cisco DNA Advantage, 48-port term licenses
	C3850-DNA-A-48-3Y	C3850 Cisco DNA Advantage, 48-port, 3-year term license
	C3850-DNA-A-48-5Y	C3850 Cisco DNA Advantage, 48-port, 5-year term license

	Product ID	Description
Spares	C3850-DNA-E-12=	C3850 Cisco DNA Essentials, 12-port term licenses spare
	C3850-DNA-A-12=	C3850 Cisco DNA Advantage, 12-port term licenses spare
	C3850-DNA-E-24=	C3850 Cisco DNA Essentials, 24-port term licenses spare
	C3850-DNA-A-24=	C3850 Cisco DNA Advantage, 24-port term licenses spare
	C3850-DNA-E-48=	C3850 Cisco DNA Essentials, 48-port term licenses spare
	C3850-DNA-A-48=	C3850 Cisco DNA Advantage, 48-port term licenses spare

Benefits

Converged wired plus wireless access

The Cisco Catalyst 3850 is the first stackable access switching platform that enables wired plus wireless services on a single Cisco IOS XE Software-based platform. With this, Cisco has pioneered a host of rich capabilities such as high availability based on Stateful Switchover (SSO) on stacking, granular QoS, security, and Flexible NetFlow (FNF) across wired and wireless in a seamless fashion. Also, the wired plus wireless features are bundled into a single Cisco IOS Software image, which reduces the number of software images that users have to qualify/certify before enabling them in their network. The single console port for Command-Line Interface (CLI) management reduces the number of touch points to manage for wired plus wireless services, thereby reducing network complexity, simplifying network operations, and lowering the TCO to manage the infrastructure.

Converged wired plus wireless not only improves wireless bandwidth across the network but also the scale of wireless deployment. Each 48-port Cisco Catalyst 3850 provides 40 Gbps of wireless throughput (20 Gbps on the 24-port/12-port models). This wireless capacity increases with the number of members in the stack. This makes sure that the network can scale with current wireless bandwidth requirements, as dictated by IEEE 802.11n-based access points and with future wireless standards such as IEEE 802.11ac. Additionally, the Cisco Catalyst 3850 distributes the wireless controller functions to achieve better scalability. Each Cisco Catalyst 3850 switch/stack can operate as the wireless controller in two modes (Figure 8):

- **Mobility Agent (MA):** This is the default mode in which a Cisco Catalyst 3850 switch ships. In this mode the switch is capable of terminating the CAPWAP tunnels from the access points and providing wireless connectivity to wireless clients. Maintaining wireless client databases and configuring and enforcing security and QoS policies for wireless clients and access points can be enforced in this mode. No additional license on top of IP Base is required to operate in the mobility agent mode.
- **Mobility Controller (MC):** In this mode, the Cisco Catalyst 3850 switch can perform all the mobility agent tasks in addition to mobility coordination, Radio Resource Management (RRM), and Cisco CleanAir® coordination within a mobility subdomain. The mobility controller mode can be enabled on the switch CLI. IP Base license level is required when the Cisco Catalyst 3850 switch is acting as the mobility controller. A centrally located Cisco 5508 Wireless LAN Controller (WLC 5508), Cisco Wireless Services Module 2 (WiSM2) (when running AireOS Version 7.3), and Wireless LAN Controller 5760 can also perform this role for larger deployments.

- With mobility agents located in the wiring closets providing 40 Gbps of wireless per 48-port Gigabit Ethernet RJ45 switch (**n** x 40 Gbps for a stack of **n** switches) and mobility controllers managing some of the central wireless functions, the converged access-based wireless deployment provides best-in-class scalability for wireless and significantly improved wireless throughput.

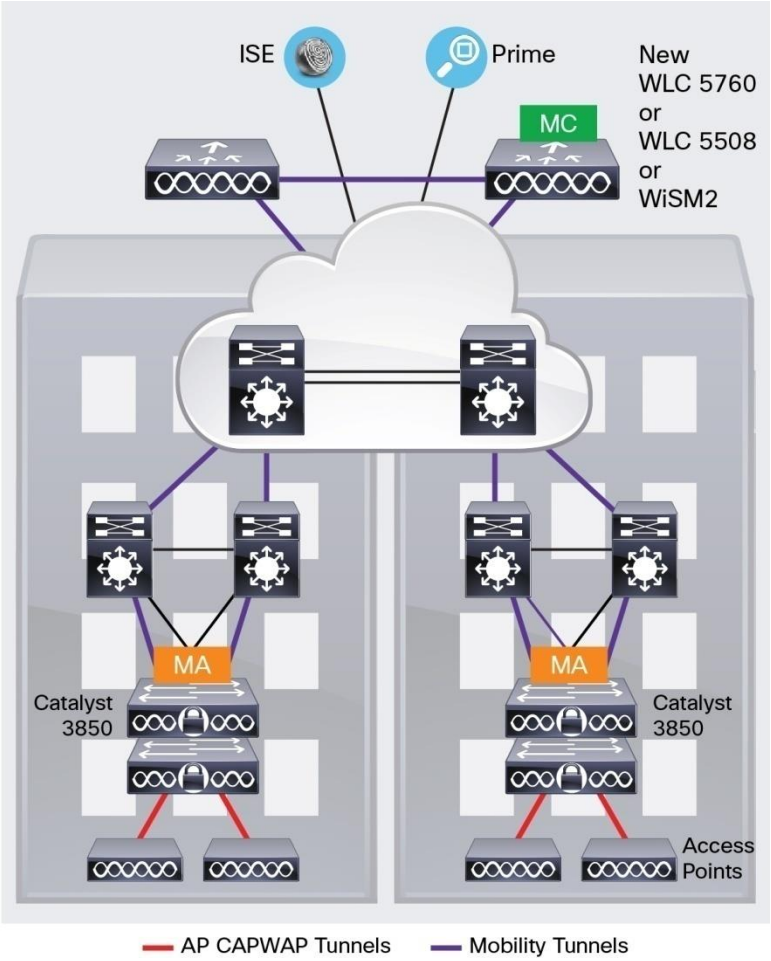

Figure 8.
Mobility Controller (MC) and Mobility Agent (MA)

For more information about Converged Wired plus Wireless Access, refer to the Q&A document here: https://www.cisco.com/c/dam/en/us/products/collateral/switches/catalyst-3850-series-switches/cisco-catalyst-3850-series-switches-faq.pdf.

Distributed intelligent services

Flexible NetFlow (FNF)

Full visibility into the wired plus wireless traffic is achieved because of the access point Control and Provisioning of Wireless Access Points (CAPWAP) tunnel termination on the switch. This helps identify users and user traffic flows in order to identify potential attackers and take corrective action at the access layer before the attack penetrates further into the network. This is achieved using FNF, which monitors every single flow entering and exiting the switch stack for wired and wireless users. It also helps identify the top wired/wireless talkers and enforce appropriate bandwidth provisioning policies.

QoS

The Cisco Catalyst 3850 switch has advanced wired plus wireless QoS capabilities. It uses the Cisco modular QoS command line interface (MQC). The switch manages wireless bandwidth using unprecedented hierarchical bandwidth management starting at the per-access-point level and drilling further down to per-radio, per-service set identification (SSID), and per-user levels. This helps manage and prioritize available bandwidth between various radios and various SSIDs (enterprise, guest, and so on) within each radio on a percentage basis. The switch is also capable of automatically allocating equal bandwidth among the connected users within a given SSID. This makes sure that all users within a given SSID get a fair share of the available bandwidth while being connected to the network. The UADP ASIC enables the hierarchical bandwidth management and fair sharing of bandwidth, thereby providing hardware-based QoS for optimized performance at line-rate traffic.

In addition to these capabilities, the switch is able to do Class of Service (CoS) or Differentiated Services Code Point (DSCP) based queuing, policing, shaping, and marking of wired plus wireless traffic. This enables users to create common policies that can be used across wired plus wireless traffic. The Cisco Catalyst 3850 also supports downloadable policy names from the Cisco Identity Services Engine (ISE) when a user successfully authenticates to the network using the ISE.

Security

The Cisco Catalyst 3850 provides a rich set of security features for wired plus wireless users. Features such as IEEE 802.1x, port security, Dynamic Host Configuration Protocol (DHCP) Snooping and Guard, Dynamic ARP Inspection, RA Guard, IP Source Guard, Control Plane Protection (CoPP), Wireless Intrusion Prevention Systems (WIPSs), and so on enable protection against unauthorized users and attackers. With a variety of wired plus wireless users connecting to the network, the switch supports session-aware networking, in which each device connected to the network is identified as one session, and unique Access Control Lists (ACLs) and/or QoS policies can be defined and applied using the ISE for each of these sessions, providing better control on the devices connecting to the network.

AES-256 MACsec encryption is the IEEE 802.1AE standard for authenticating and encrypting packets between switches and endpoints. The Cisco Catalyst 3850 Series switches support 256-bit (SFP+ and Multigigabit models only) and 128-bit Advanced Encryption Standard (AES) on all ports at all speeds, providing the most secure link encryption.

Resiliency

Cisco StackWise-480 technology

Cisco StackWise-480 technology is built on the highly successful industry-leading StackWise® technology, which is a premium stacking architecture[7]. StackWise-480 has a stack bandwidth of 480 Gbps. StackWise - 480 uses Cisco IOS Software SSO for providing resiliency within the stack. The stack behaves as a single switching unit that is managed by an "active" switch elected by the member switches.

The active switch automatically elects a standby switch within the stack. The active switch creates and updates all the switching/routing/wireless information and constantly synchronizes that information with the standby switch. If the active switch fails, the standby switch assumes the role of the active switch and continues to the keep the stack operational. Access points continue to remain connected during an active-to-standby switchover.

A working stack can accept new members or delete old ones without service interruption. StackWise-480 creates a highly resilient single unified system of up to nine switches, providing simplified management using a single IP address, single Telnet session, single CLI, autoversion checking, autoupgrading, autoconfiguration, and more. StackWise-480 also enables local switching in Cisco Catalyst 3850 Series Switches.

[7] StackWise and StackPower technologies are not supported on the 48-port SFP+ switch model.

Cisco StackPower technology

The Cisco Catalyst 3850 Series uses the Cisco StackPower[8] technology present on the Cisco Catalyst 3850 Series. StackPower is an innovative power interconnect system that allows the power supplies in a stack to be shared as a common resource among all the switches. Cisco StackPower unifies the individual power supplies installed in the switches and creates a pool of power, directing that power where it is needed. Up to four switches[9] can be configured in a StackPower stack with the special connector at the back of the switch using the StackPower cable, which is different than the StackWise-480 cables. (See Figure 9.)

Figure 9.
StackWise-480 and StackPower connectors

StackPower can be deployed in either power-sharing mode or redundancy mode. In power-sharing mode, the power of all the power supplies in the stack is aggregated and distributed among the switches in the stack. In redundant mode, when the total power budget of the stack is calculated, the wattage of the largest power supply is not included. That power is held in reserve and used to maintain power to switches and attached devices when one power supply fails, enabling the network to operate without interruption. Following the failure of one power supply, the StackPower mode becomes power sharing.

StackPower allows customers to simply add one extra power supply in any switch of the stack and either provide power redundancy for any of the stack members or simply add more power to the shared pool. StackPower eliminates the need for an external redundant power system or installation of dual power supplies in all the stack members. StackPower is available in LAN Base license level (or higher). For LAN Base, cables need to be purchased separately.

[8] StackPower is not supported on the 48-port 10G SFP+ switch model.

[9] Up to nine switches are supported in a star configuration with XPS-2200.

Foundation for Open Network Environment

The heart of the Cisco Catalyst 3850 is the UADP ASIC with programmability for future features and intelligence with investment protection. The new ASIC provides the foundation for converged APIs across wired and wireless, Cisco Open Network Environment, Software-Defined Networking (SDN) readiness, and OnePK SDK through software updates over the product lifetime.

Software features and services on Cisco Catalyst 3850 Series Switches

Software services supported on the Cisco Catalyst 3850 Series Switches can be classified into five broad categories:

- Ease of operations
- Advanced security features
- Resiliency
- Application visibility and control
- Audio Video Bridging

Ease of operations

The Cisco Catalyst 3850 helps reduce the operating costs through:

- Cisco Catalyst SmartOperations
- Easy-to-use deployment and control features
- Efficient switch operations
- Network management tools

Cisco Catalyst SmartOperations

Cisco Catalyst SmartOperations is a comprehensive set of capabilities that simplify LAN deployment, configuration, and troubleshooting. In addition to adaptive, always-on technologies such as StackWise-480 and StackPower, Cisco Catalyst SmartOperations enable zero-touch installation and replacement of switches, fast upgrade, and ease of troubleshooting with reduced operational cost. Features includes Smart Install, Auto Smartports, Smart Configuration, and Smart Troubleshooting to enhance operational excellence:

- Cisco Smart Install is a transparent plug-and-play technology to configure the Cisco IOS Software image and switch configuration without user intervention. Smart Install utilizes dynamic IP address allocation and the assistance of other switches to facilitate installation, providing transparent network plug and play.
- Cisco Auto Smartports provide automatic configuration as devices connect to the switch port, allowing autodetection and plug and play of the device onto the network.
- Cisco Smart Troubleshooting is an extensive array of debug diagnostic commands and system health checks within the switch, including Generic Online Diagnostics (GOLD) and Onboard Failure Logging (OBFL).
- Embedded Event Manager (EEM) is a powerful and flexible feature that provides real-time network event detection and onboard automation. Using EEM, customers can adapt the behavior of their network devices to align with their business needs. This feature requires the IP Base feature set.

Easy-to-use deployment and control features

- User experience:
  - IP Service-Level Agreements (SLAs) enable customers to assure new business-critical IP applications, as well as IP services that utilize data, voice, and video, in an IP network. This feature requires the IP Services feature set.
  - DHCP autoconfiguration of multiple switches through a boot server eases switch deployment.
  - Automatic QoS (AutoQoS) simplifies QoS configuration in Voice over IP (VoIP) networks by issuing interface and global switch commands to detect Cisco IP phones, classify traffic, and help enable egress queue configuration.
  - Autonegotiation on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.
  - Automatic media-dependent interface crossover (MDIX) automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight through) is installed.
  - AV Bridging provides reliable time synchronized transmission with no pops or clicks or video dropouts.
- Simplified configuration and connectivity:
  - Dynamic Trunking Protocol (DTP) facilitates dynamic trunk configuration across all switch ports.
  - Port Aggregation Protocol (PAgP) automates the creation of Cisco Fast EtherChannel groups or Gigabit EtherChannel groups to link to another switch, router, or server.
  - Link Aggregation Control Protocol (LACP) allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. This feature is similar to Cisco EtherChannel technology and PAgP.
  - Unidirectional Link Detection Protocol (UDLD) and aggressive UDLD allow unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
  - Cisco VLAN Trunking Protocol (VTP) Version 3 supports dynamic VLANs and dynamic trunk configuration across all switches.
  - AV Bridging provides reliable A/V streaming without the need for the installer to perform extensive hand tuning of the network.
- Efficient switch operation:
  - Switching Database Manager (SDM) templates, VLAN template (specific to LAN Base license level), and advanced template allow the administrator to automatically optimize the Ternary Content-Addressable Memory (TCAM) allocation to the desired features based on deployment-specific requirements.
  - Local proxy Address Resolution Protocol (ARP) works in conjunction with private VLAN edge to minimize broadcasts and maximize available bandwidth.
  - Stacking master configuration management with Cisco StackWise-480 technology helps make sure that all switches are automatically upgraded when the master switch receives a new software version. Automatic software version checking and updating help ensure that all stack members have the same software version.
  - Trivial File Transfer Protocol (TFTP) reduces the cost of administering software upgrades by downloading from a centralized location.
  - Network Timing Protocol (NTP) provides an accurate and consistent timestamp to all intranet switches.

- Multicast:
  - Optimized multicast for wired plus wireless: Cisco Catalyst 3850 offers greater multicast efficiency by receiving only one multicast stream and replicating it for all connected wired plus wireless devices connected to that switch.
  - Internet Group Management Protocol (IGMP) v1, v2, v3 snooping for IPv4: Multicast Listener Discovery (MLD) v1 and v2 snooping provides fast client joins and leaves of multicast streams and limits bandwidth-intensive video traffic to only the requestors.
- Monitoring:
  - Remote Switch Port Analyzer (RSPAN) allows administrators to remotely monitor ports in a Layer 2 switch network from any other switch in the same network.
  - For enhanced traffic management, monitoring, and analysis, the Embedded Remote Monitoring (RMON) software agent supports four RMON groups (history, statistics, alarms, and events).
  - Layer 2 traceroute eases troubleshooting by identifying the physical path that a packet takes from source to destination.
  - Wireless RF management provides both real-time and historical information about RF interference affecting network performance across controllers using systemwide Cisco CleanAir technology integration.

Efficient switch operation

Cisco Catalyst 3850 Series Switches, designed and engineered by Cisco, provide optimum power-saving, EEE (on RJ45 ports), low-power operations for industry best-in-class power management and power consumption capabilities. The Cisco Catalyst 3850 ports are capable of reduced power modes so that ports not in use can move into a lower power utilization state. Other efficient switch operation features are:

- Cisco Discovery Protocol Version 2 allows the Cisco Catalyst 3850 Series Switches to negotiate a more granular power setting when connecting to a Cisco powered device such as IP phones or access points than what is provided by IEEE classification.
- Per-port power consumption command allows customers to specify maximum power setting on an individual port. Per-port PoE power sensing measures actual power being drawn, enabling more intelligent control of powered devices.
- The PoE MIB provides proactive visibility into power usage and allows customers to set different power-level thresholds.

Environmental responsibility

Organizations may choose to turn off access point radios to reduce power consumption during off-peak hours. The integrated wireless LAN controller avoids the deployment of additional devices in the network.

Network management tools

The Cisco Catalyst 3850 Series Switches offer both a superior CLI for detailed configuration and Cisco Prime™ infrastructure for unified wired plus wireless management. Prime infrastructure provides day 0 and ongoing provisioning, ongoing monitoring and maintenance, configuration templates, and device and user 360-degree views and serves as the FNF collector for user traffic views using the Prime Assurance Manager module.

For detailed information about Cisco Prime infrastructure, go to https://www.cisco.com/en/US/products/ps12239/index.html.

Advanced Security Features

Cisco Catalyst 3850 Series Switches support advanced security features including but not limited to:

- Protection against attackers:

- Port security secures the access to an access or trunk port based on MAC address. It limits the number of learned MAC addresses to deny MAC address flooding.
- DHCP snooping prevents malicious users from spoofing a DHCP server and sending out bogus addresses. This feature is used by other primary security features to prevent a number of other attacks such as ARP poisoning.
- Dynamic ARP inspection (DAI) helps ensure user integrity by preventing malicious users from exploiting the insecure nature of ARP.
- IP source guard prevents a malicious user from spoofing (that is, taking over) another user's IP address by creating a binding table between the client's IP and MAC address, port, and VLAN, and by using it to selectively block bogus packets.
- The Unicast Reverse Path Forwarding (uRPF) feature helps mitigate problems caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address.
- Bidirectional data support on a SPAN port allows the Cisco Intrusion Detection System (IDS) to take action when an intruder is detected.

- User authentication:
  - Flexible authentication that supports multiple authentication mechanisms, including 802.1X, MAC authentication bypass, and web authentication using a single, consistent configuration.
  - RADIUS change of authorization and downloadable calls for comprehensive policy management capabilities.
  - Private VLAN edge restricts traffic between hosts in a switch by segregating traffic at Layer 2, turning a broadcast segment into a nonbroadcast multiaccess-like segment. Private VLAN edge provides security and isolation between switch ports, which helps ensure that users cannot snoop on other users' traffic.
  - Multidomain authentication allows an IP phone and a PC to authenticate on the same switch port while placing them on appropriate voice and data VLAN.
  - MAC address notification allows administrators to be notified of users added to or removed from the network.
  - Mobility and security for secure, reliable wireless connectivity and consistent end-user experience. Increased network availability through proactive blocking of known threats.
  - IGMP filtering provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
- ACLs:
  - Cisco security VLAN ACLs on all VLANs prevent unauthorized data flows from being bridged within VLANs.
  - Cisco standard and extended IP security router ACLs define security policies on routed interfaces for control-plane and data-plane traffic. IPv6 ACLs can be applied to filter IPv6 traffic.
  - Port-based ACLs for Layer 2 interfaces allow security policies to be applied on individual switch ports.

- Device access:
  - Secure Shell (SSH) Protocol, Kerberos, and Simple Network Management Protocol Version 3 (SNMPv3) provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH Protocol, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
  - TACACS+ and RADIUS authentication facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
  - Multilevel security on console access prevents unauthorized users from altering the switch configuration.
- Bridge Protocol Data Unit (BPDU) Guard shuts down Spanning Tree PortFast-enabled interfaces when BPDUs are received to avoid accidental topology loops.
- Spanning Tree Root Guard (STRG) prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
- Wireless end-to-end security offers CAPWAP-compliant DTLS encryption to make sure of encryption between access points and controllers across remote WAN/LAN links.

Resiliency

Borderless networks enable enterprise mobility and business-grade video services. Industry's first unified network (wired plus wireless) location services enable tracking of mobile assets and the users of those assets for both wired plus wireless devices. The true borderless experience is enabled by the following feature sets in the Cisco Catalyst 3850 Series Switches:

- High availability
- High-performance IP routing
- Superior QoS

High availability

In addition to StackWise-480 and StackPower,[10] the Cisco Catalyst 3850 Series supports high-availability features including but not limited to the following:

- Cross-Stack EtherChannel provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
- Flexlink provides link redundancy with convergence time less than 100ms.
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) provides rapid spanning-tree convergence independent of spanning-tree timers and also offers the benefit of Layer 2 load balancing and distributed processing.
- Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning-tree (IEEE 802.1w) reconvergence on a per-VLAN spanning-tree basis, providing simpler configuration than MSTP. In both MSTP and PVRST+ modes, stacked units behave as a single spanning-tree node.
- Switch-port autorecovery ("err-disable" recovery) automatically attempts to reactivate a link that is disabled because of a network error.

[10] StackPower is not supported on the 48-port 10G SFP+ switch model.

High-performance IP routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in the Cisco Catalyst 3850 Series Switches:

- IP unicast routing protocols (static, Routing Information Protocol Version 1 [RIPv1], and RIPv2, RIPng, Enhanced Interior Gateway Routing Protocol [EIGRP] stub) are supported for small-network routing applications with the IP Base feature set. Limited static routing with the LAN Base feature set. Equal-cost routing facilitates Layer 3 load balancing and redundancy across the stack.
- Advanced IP unicast routing protocols (Open Shortest Path First [OSPF], EIGRP, Border Gateway Protocol Version 4 [BGPv4], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and constructing scalable LANs. IPv6 routing (OSPFv3, EIGRPv6) is supported in hardware for maximum performance. OSPF for routed access is included in the IP Base image. The IP Services feature set is required for full OSPF, EIGRP, BGPv4, and IS-ISv4.
- Policy-Based Routing (PBR) allows superior control by facilitating flow redirection regardless of the routing protocol configured. The IP Base feature set is required for PBR. Virtual Routing and Forwarding (VRF)-Lite enables a service provider to support two or more VPNs, with overlapping IP addresses. The IP Services feature set is required for VRF-Lite.
- Protocol-Independent Multicast (PIM) for IP multicast routing is supported, including PIM Sparse Mode (PIM-SM), PIM Dense Mode (PIM-DM), PIM sparse-dense mode, and Source-Specific Multicast (SSM). The IP Services feature set is required.
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting.

Superior QoS

The Cisco Catalyst 3850 Series offers Gigabit Ethernet speed with intelligent services that keep traffic flowing smoothly, even at 10 times the normal network speed. Industry-leading mechanisms for cross-stack marking, classification, and scheduling deliver superior performance for data, voice, and video traffic, all at wire speed.

The following are some of the QoS features supported in the Cisco Catalyst 3850 Series Switches:

- Granular wireless bandwidth management and fair sharing use Cisco's proven Cisco IOS Software and UADP ASIC technology to provide hierarchical bandwidth management at line rate (per access point, per radio, per SSID, per client-based policies). Fair sharing across the users within an SSID makes sure that no single user is starved because of other heavy-hitting users. Fair sharing is automatically enabled for wireless at user level as well as SSID level.
- 802.1p CoS and DSCP field classification is provided, using marking and reclassification on a per-packet basis by source and destination IP address, MAC address, or Layer 4 Transmission Control Protocol/User Datagram Protocol (TCP/UDP) port number.
- Shaped Round Robin (SRR) scheduling helps ensure differential prioritization of packet flows by intelligently servicing the ingress queues and egress queues. Weighted Tail Drop (WTD) provides congestion avoidance at the ingress and egress queues before a disruption occurs. Strict priority queuing helps ensure that the highest priority packets are serviced ahead of all other traffic.
- The Cisco Committed Information Rate (CIR) function provides bandwidth in increments as low as 8 Kbps.
- Rate limiting is provided based on source and destination IP address, source and destination MAC address, Layer 4 TCP/UDP information, or any combination of these fields, using QoS ACLs (IP ACLs or MAC ACLs), class maps, and policy maps.
- Eight egress queues per port for wired traffic and four egress queues for wireless help enable differentiated management of different traffic types across the stack for wired traffic. Up to 2000 aggregate policers are available per switch.

Application visibility and control using Flexible NetFlow

Cisco IOS Software FNF is the next generation in flow visibility technology, allowing optimization of the network infrastructure, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 3850 provides optimized application visibility with FNF across wired plus wireless. The switch is capable of up to 48,000 flow entries on 48-port models and up to 24,000 flow entries on 12-port and 24-port models across wired plus wireless. With UADP ASIC, Cisco Catalyst 3850 delivers next-generation flow technology with unprecedented flexibility and comprehensive visibility extending from Layer 2 (MAC and VLAN) to Layer 4 (TCP/UDP) flags and so on across wired plus wireless traffic. The Cisco Catalyst 3850 switch is medianet capable to provide visibility and troubleshooting capabilities across wired plus wireless video traffic. Specific medianet features will be enabled in future software updates.

The flow data collected by FNF can be exported to an external collector for analysis and reporting or tracked by the EEM. The Cisco Catalyst 3850 enables powerful on-box and customizable event correlation and policy actions with EEM, allowing the switches to trigger customized event alarms or policy actions when the predefined condition is met. With no external appliance required, customers are able to use existing infrastructure to perform traffic monitoring, making traffic analysis economical even on a large IP network.

Details about Cisco FNF are available at https://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6555/ps6601/ps6965/product_data_sheet0900aecd804b590b.html.

High-performance video over wireless integrates Cisco VideoStream technology to optimize the delivery of video applications across the WLAN.

Wired plus wireless IP telephony supports unified communications for improved collaboration through messaging, presence, and conferencing and supports all Cisco Unified Communications wireless IP phones for cost-effective, real-time voice service.

Audio video bridging

With Cisco IOS® XE Software Release 16.3, Cisco Catalyst 3850 Multigigabit and 3850 10G SFP+ now support the IEEE 802.1 AVB standard. This standard provided the means for highly reliable delivery of low-latency, time-synchronized AV streaming services through Layer 2 Ethernet networks. The standard also makes it easier to integrate new services and for AV equipment from different vendors to interoperate. Whether the AV endpoint connections are analog or are inflexible digital one to one, the network transport enables many-to-many transparent plug-and-play connections for multiple AV endpoints.

Benefits

- Improves quality of experience by lowering jitter and latency for time-synchronized delivery of high-quality AV
- Provides scalability of applications across networked deployments, including expansive and complex AV infrastructure
- Lowers Total Cost of Ownership (TCO) with reduced cabling (lowers CapEx) and no license fees (lowers OpEx)

*For more details about AVB and specific models supported, check https://www.cisco.com/go/avb.

Deployment options

Campus

In a campus-type deployment, operating the Cisco Catalyst 3850 in the mobility agent mode and centralizing the mobility controller functionality in a WLC 5760, WLC 5508, or WiSM2 helps achieve better scalability and performance. The Cisco Catalyst 3850 provides CAPWAP termination for access points, uniform policy enforcement for wireless clients, better wireless bandwidth, and uniform Cisco IOS Software-based configuration and monitoring for wired plus wireless features. The mobility controller provides central mobility, RRM, and CleanAir coordination.

Backward compatibility with traditional centralized wireless deployment mode on the WLC 5508, WiSM2, and WLC 5760 helps ensure that customers can migrate to the Cisco Catalyst 3850-based converged access approach in phases, providing a continued controller for existing access points. This migration also provides investment protection on the existing wireless controller infrastructure. A phased adoption of the new Cisco Catalyst 3850 helps ensure that migration to the converged access mode of wireless is seamless. Figure 10 shows a Cisco Catalyst 3850 Series Switch in a campus-type deployment.

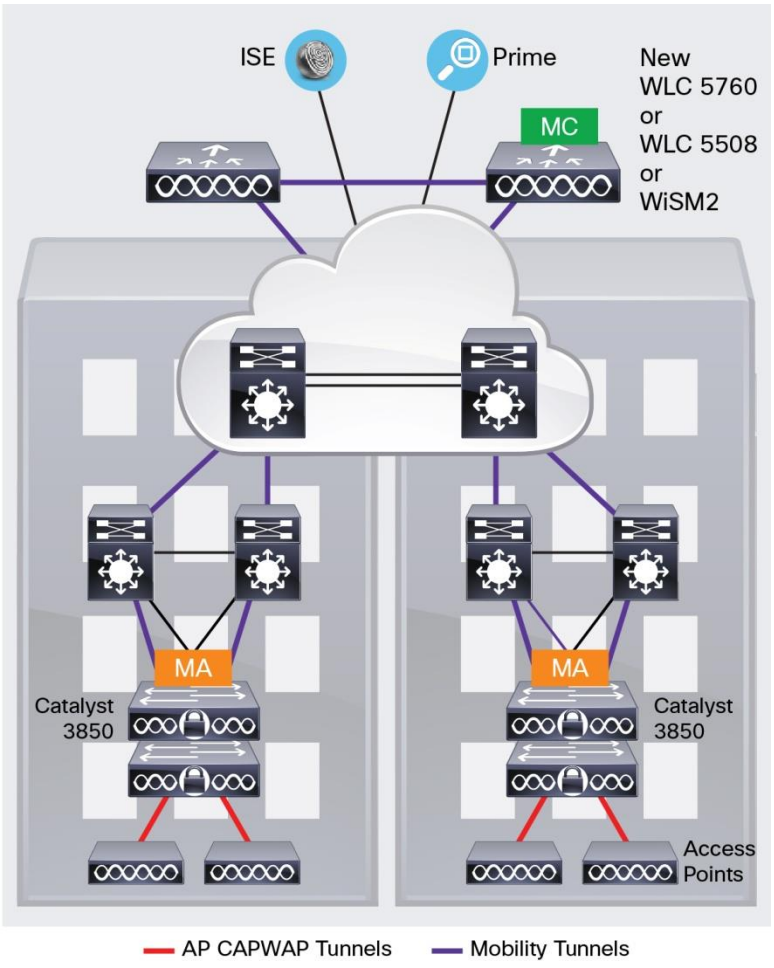

Figure 10.
Mobility Controller (MC) and Mobility Agent (MA)

Branch

The Cisco Catalyst 3850 is optimized for branch deployments when it operates in mobility controller mode. In this mode, not only can the switch terminate CAPWAP tunnels from the access points and provide client connectivity, it can also manage mobility within the branch. This eliminates the need for a local controller in every branch in addition to the access-layer switches. Also, complete visibility into the wired plus wireless traffic means that the WAN router can prioritize the right wired plus wireless traffic in and out of the branch. Figure 11 shows a Cisco Catalyst 3850 in a branch access type deployment.

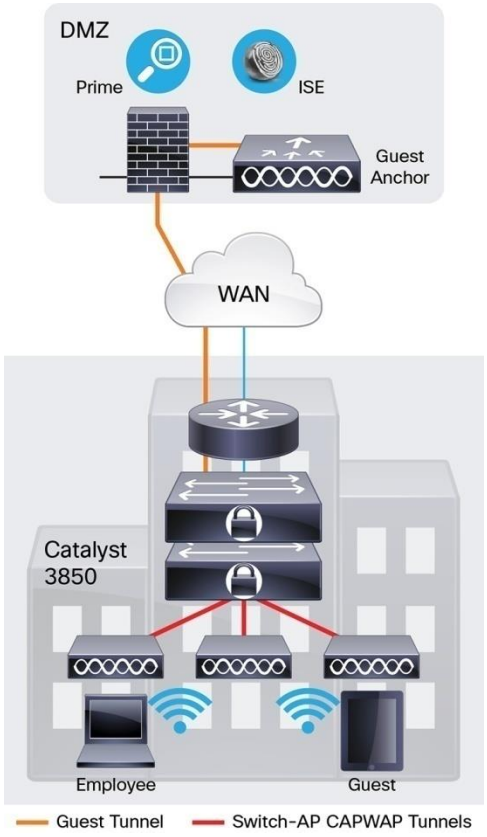

Figure 11.
Deploying the Cisco Catalyst 3850 Series for branch access

The new 12-port and 24-port SFP+ or SFP-based Cisco Catalyst 3850 models as well as the nonstackable 48-port SFP+ model can also be used in the branch to aggregate traffic from smaller access switches through fiber links for more secure and EMI-sensitive deployments (Figure 12).

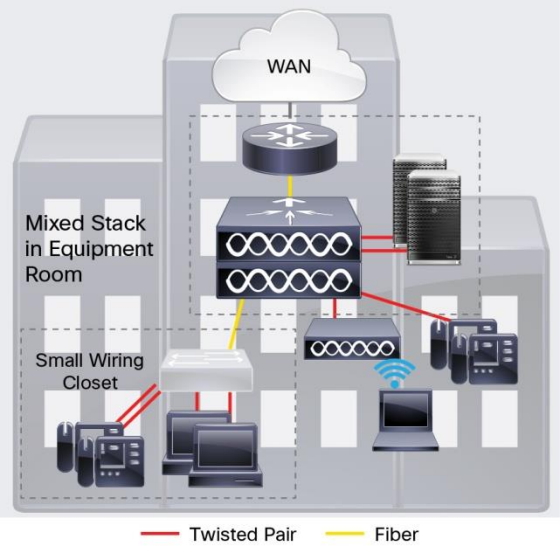

Figure 12.
Deploying mixed copper and fiber connections with a Cisco Catalyst 3850 stack in the branch

Specifications

Switch performance

Table 10 shows the Cisco Catalyst 3850 Series Switches performance specifications.

Table 10. Cisco Catalyst 3850 Series performance specifications

Performance numbers for all switch models	
Switching capacity	176 Gbps on 48-port Gigabit Ethernet model 92 Gbps on 24-port Gigabit Ethernet model 68 Gbps on 12-port Gigabit Ethernet model 640 Gbps on 24-port Multigigabit Ethernet model* 472 Gbps on 48-port Multigigabit Ethernet model 1280 Gbps on 48-port 10 Gigabit Ethernet SFP+ model* 640 Gbps on 24-port 10 Gigabit Ethernet SFP+ model* 320 Gbps on 12-port 10 Gigabit Ethernet SFP+ model*
Stacking bandwidth	480 Gbps
Total number of MAC addresses	32,000
Total number of IPv4 routes (ARP plus learned routes)	24,000
FNF entries	48,000 flow on 48-port Gigabit Ethernet models 24,000 flows on 12-port and 24-port Gigabit Ethernet models 96,000 flows on 48-port 10 Gigabit Ethernet SFP+ model 48,000 flows on 24-port 10 Gigabit Ethernet SFP+ model 24,000 flows on 12-port 10 Gigabit Ethernet SFP+ model
DRAM	4 GB (8 GB on 48-port SFP+ model)

Performance numbers for all switch models	
Flash	2 GB (4 GB on 12-port and 24-port SFP+ models, 8 GB on 48-port SFP+ model)
VLAN IDs	4,000
Total Switched Virtual Interfaces (SVIs)	1,000
Jumbo frame	9198 bytes
Total routed ports per 3850 stack	208
Wireless	
Number of access points per switch/stack	100
Number of wireless clients per switch/stack	2000
Total number of WLANs per switch	64
Wireless bandwidth per switch	Up to 40 Gbps on 48-port Gigabit Ethernet model Up to 20 Gbps on 24-port Gigabit Ethernet model
Supported Aironet access point series	3600, 3500, 2600, 1600, 1260, 1140, 1040
Forwarding rate of switch models (with 2 x 10 Gigabit + 2 x 1 Gigabit Ethernet uplinks for 12-port and 24-port models and 4 x 10 Gigabit Ethernet uplinks for 48-port models)	
Model	Forwarding rate
WS-C3850-12S	50.5 Mpps
WS-C3850-24T WS-C3850-24P WS-C3850-24S	68.4 Mpps
WS-C3850-48T WS-C3850-48P WS-C3850-48F	130.95 Mpps
WS-C3850-24XU	500 Mpps (80B packets)
WS-C3850-12X48U	460 Mpps (64B packets)
WS-C3850-12XS	227.28 Mpps
WS-C3850-24XS	454.55 Mpps
WS-C3850-48XS	909 Mpps

Dimensions, weight, acoustic, mean time between failures, and environmental range specifications for Cisco Catalyst 3850 Series Switches

Table 11 shows dimensions, weight, acoustic, Mean Time Between Failure (MTBF), and environmental range. Weight does not include an uplink FRU. Weight includes the chassis assembly as it is shipped (with fans), one power supply and, and one power supply slot blank.

Table 11. Dimensions, weight, acoustic, MTBF, and environmental range[11]

Dimensions (H x W x D)	Inches	Centimeters
WS-C3850-12S **WS-C3850-24S** **WS-C3850-24T** **WS-C3850-24P** **WS-C3850-48T** **WS-C3850-48P**	1.75 x 17.5 x 17.7	4.45 x 44.5 x 45.0
WS-C3850-48F **WS-C3850-48U** **WS-C3850-24U** **WS-C3850-24XU** **WS-C3850-12X48U**	1.75 x 17.5 x 19.2	4.45 x 44.5 x 48.8
WS-C3850-12XS **WS-C3850-24XS**	1.75 x 17.5 x 17.7	4.45 X 44.5 x 45.0
WS-C3850-48XS	1.75 x 17.5 x 20.1	4.45 X 44.5 x 51.1
Weight	**Pounds**	**Kilograms**
WS-C3850-12S	15.48	7.02
WS-C3850-24S	15.5	7.03
WS-C3850-24T	15.9	7.2
WS-C3850-24P	16.3	7.4
WS-C3850-24U	16.5	7.5
WS-C3850-48T	17.0	7.7
WS-C3850-48P	17.4	7.9
WS-C3850-48F	17.6	8.0
WS-C3850-48U	17.6	8.0

[11] Additional information about the 48-port SFP+ model will be provided at time of shipment.

Dimensions (H x W x D)	Inches	Centimeters
WS-C3850-24XU	17.6	8.0
WS-C3850-12X48U	17.6	8.0
WS-C3850-12XS	12.9	5.8
WS-C3850-24XS	13.5	6.1
WS-C3850-48XS	16.42	7.45
C3850-NM-4-1G	0.66	0.30
C3850-NM-2-10G	0.71	0.32
C3850-NM-4-10G	0.75	0.34
C3850-NM-8-10G	0.74	0.34
C3850-NM-2-40G	0.62	0.28
MTBF hours		
WS-C3850-12S	315,840	
WS-C3850-24S	300,760	
WS-C3850-24T	303,230	
WS-C3850-24P	269,450	
WS-C3850-24U	237,310	
WS-C3850-48T	303,660	
WS-C3850-48P	241,050	
WS-C3850-48F	241,050	
WS-C3850-48U	205,110	
WS-C3850-24XU	203,150	
WS-C3850-12X48U	202,030	
WS-C3850-12XS	371,440	
WS-C3850-24XS	307,990	
WS-C3850-32XS	307,990	
WS-C3850-48XS	286,900	
PWR-C1-350WAC	580,710	
PWR-C1-715WAC	664,055	

Dimensions (H x W x D)	Inches	Centimeters
PWR-C1-1100WAC	392,174	
PWR-C1-440WDC	469,350	
C3850-NM-4-1G	7,052,100	
C3850-NM-2-10G	4,315,970	
C3850-NM-4-10G	3,835,330	
C3850-NM-8-10G	6,544,410	
C3850-NM-2-40G	9,303,100	
Environmental ranges		
With AC power supply Operating environment and altitude	Normal operating temperature* and altitudes: • -5°C to +45°C, up to 5000 feet (1500m) • -5°C to +40°C, up to 10,000 feet (3000m) * Minimum ambient temperature for cold start is 32°F (0°C) Short-term* exceptional conditions: • -5°C to +50°C, up to 5000 feet (1500m) • -5°C to +45°C, up to 10,000 feet (3000m) • -5°C to +45°C, at sea level with single fan failure * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.	
With DC power supply Operating environment and altitude (NEBS)	Normal operating temperature and altitudes: • -5°C to +45°C, up to 6000 feet (1800m) • -5°C to +40°C, up to 10,000 feet (3000m) • -5°C to +35°C, up to 13,000 feet (4000m) Short-term* exceptional conditions: • -5°C to +55°C, up to 6000 feet (1800m) • -5°C to +50°C, up to 10,000 feet (3000m) • -5°C to +45°C, up to 13,000 feet (4000m) • -5°C to +45°C, at sea level with single fan failure * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.	
Relative humidity	10% to 95%, noncondensing	
Acoustic noise Measured per ISO 7779 and declared per ISO 9296 Bystander positions operating to an ambient temperature of 25°C	With AC or DC power supply (with 24 PoE+ ports loaded): • LpA: 43dB typical, 45dB maximum • LwA: 5.2B typical, 5.5B maximum Typical: Noise emission for a typical configuration Maximum: Statistical maximum to account for variation in production	
Storage environment	Temperature: -40°C to 70°C Altitude: 15,000 ft	
Vibration	Operating: 0.41Grms from 3 to 500Hz with spectral break points of 0.0005 G2/Hz at 10Hz and 200Hz 5dB/octave roll off at each end.	
	Nonoperating: 1.12Grms from 3 to 500Hz with spectral break points of 0.0065 G2/Hz at	

Dimensions (H x W x D)	Inches	Centimeters
	10Hz and 100Hz 5dB/octave roll off at each end.	
Shock	Operating: 30G, 2ms half sine	
	Nonoperating: 55G, 10ms trapezoid	

Connectors for Cisco Catalyst 3850 Series

Table 12 shows the supported connectors.

Table 12. Connectors

Connectors and cabling	• 1000BASE-T ports: RJ-45 connectors, 4-pair Cat-5E UTP cabling • Multigig-T ports: RJ-45 connectors, 4-pair Cat-5E, Cat-6, Cat6A UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Cat-5E UTP cabling • 100BASE-FX, 1000BASE-SX, -LX/LH, -ZX, -BX10, DWDM and CWDM SFP transceivers: LC fiber connectors (single-mode or multimode fiber) • 10GBASE-SR, LR, LRM, ER, ZR, DWDM SFP+ transceivers: LC fiber connectors (single-mode or multimode fiber) • CX1 cable assemblies: SFP+ connector • Cisco StackWise-480 stacking ports: copper-based Cisco StackWise cabling • Cisco StackPower: Cisco proprietary power stacking cables • Ethernet management port: RJ-45 connectors, 4-pair Cat-5 UTP cabling • Management console port: RJ-45-to-DB9 cable for PC connections
Power connectors	• Customers can provide power to a switch by using either the internal power or StackPower from another member in the power stack. The connectors are located at the back of the switch. • Internal power supply connector: The internal power supply is an autoranging unit. The internal power supply supports input voltages between 100 and 240VAC. Use the supplied AC power cord to connect the AC power connector to an AC power outlet.

For the latest Cisco transceiver module compatibility information, refer to https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html.

Management and standards support for Cisco Catalyst 3850 Series Switches

Table 13 shows management and standards support for the Cisco Catalyst 3850 Series.

Table 13. Management and standards support for the Cisco Catalyst 3850 Series

Description	Specification	
Management	BRIDGE-MIB	CISCO-SNMP-TARGET-EXT-MIB
	CISCO-AUTH-FRAMEWORK-MIB	CISCO-STACKMAKER-MIB
	CISCO-BGP4-MIB, BGP4-MIB	CISCO-MEMORY-POOL-MIB
	CISCO-BRIDGE-EXT-MIB	CISCO-STP-EXTENSIONS-MIB
	CISCO-BULK-FILE-MIB	CISCO-SYSLOG-MIB
	CISCO-CABLE-DIAG-MIB	CISCO-TCP-MIB
	CISCO-CALLHOME-MIB	CISCO-UDLDP-MIB
	CISCO-CEF-MIB	CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
	CISCO-CIRCUIT-INTERFACE-MIB	CISCO-VLAN-MEMBERSHIP-MIB
	CISCO-ENTITY-VENDORTYPE-OID-MIB	CISCO-VTP-MIB
	CISCO-CONTEXT-MAPPING-MIB	EtherLike-MIB
	CISCO-DEVICE-LOCATION-MIB	HC-RMON-MIB

Description	Specification	
	CISCO-DHCP-SNOOPING-MIB	IEEE8021-PAE-MIB
	CISCO-EIGRP-MIB	IEEE8023-LAG-MIB
	CISCO-EMBEDDED-EVENT-MGR-MIB	IF-MIB
	CISCO-ENTITY-FRU-CONTROL-MIB	IGMP-MIB
	CISCO-ENTITY-SENSOR-MIB	IGMP-STD-MIB
	ENTITY-MIB	IP-FORWARD-MIB
	CISCO-ERR-DISABLE-MIB	IP-MIB
	CISCO-CONFIG-COPY-MIB	IPMROUTE-STD-MIB
	CISCO-FLOW-MONITOR-MIB	LLDP-EXT-MED-MIB
	CISCO-FTP-CLIENT-MIB	LLDP-MIB
	CISCO-HSRP-EXT-MIB	NOTIFICATION-LOG-MIB
	CISCO-HSRP-MIB	OLD-CISCO-MEMORY-MIB
	CISCO-IETF-ISIS-MIB	CISCO-CDP-MIB
	CISCO-IF-EXTENSION-MIB	POWER-ETHERNET-MIB
	CISCO-IGMP-FILTER-MIB	RMON2-MIB
	CISCO-CONFIG-MAN-MIB	RMON-MIB
	CISCO-IP-CBR-METRICS-MIB	SNMP-COMMUNITY-MIB
	CISCO-IPMROUTE-MIB	SNMP-FRAMEWORK-MIB
	CISCO-IP-STAT-MIB	SNMP-MPD-MIB
	CISCO-IP-URPF-MIB	SNMP-NOTIFICATION-MIB
	CISCO-L2L3-INTERFACE-CONFIG-MIB	SNMP-PROXY-MIB
	CISCO-LAG-MIB	SNMP-TARGET-MIB
	CISCO-LICENSE-MGMT-MIB	SNMP-USM-MIB
	CISCO-MAC-AUTH-BYPASS-MIB	SNMPv2-MIB
	CISCO-MAC-NOTIFICATION-MIB	SNMP-VIEW-BASED-ACM-MIB
	CISCO-MDI-METRICS-MIB	TCP-MIB
	CISCO-FLASH-MIB	UDP-MIB
	CISCO-OSPF-MIB	CISCO-IMAGE-MIB
	CISCO-OSPF-TRAP-MIB	CISCO-STACKWISE-MIB
	CISCO-PAE-MIB	AIRESPMACE-WIRELESS-MIB
	CISCO-PAGP-MIB	CISCO-LWAPP-IDS-MIB
	CISCO-PIM-MIB	CISCO-LWAPP-AP-MIB
	CISCO-PING-MIB	CISCO-LWAPP-CCX-RM-MIB
	CISCO-PORT-QOS-MIB	CISCO-LWAPP-CLIENT-ROAMING-MIB
	CISCO-PORT-SECURITY-MIB	CISCO-LWAPP-DOT11-CCX-CLIENT-DIAG-MIB
	CISCO-PORT-STORM-CONTROL-MIB	CISCO-LWAPP-DOT11-CCX-CLIENT-MIB
	CISCO-POWER-ETHERNET-EXT-MIB	CISCO-LWAPP-DOT11-CLIENT-CCX-REPORTS-MIB
	CISCO-PRIVATE-VLAN-MIB	CISCO-LWAPP-DOT11-CLIENT-MIB
	CISCO-PROCESS-MIB	CISCO-LWAPP-DOT11-MIB
	CISCO-PRODUCTS-MIB	CISCO-LWAPP-DOWNLOAD-MIB
	CISCO-RF-MIB	CISCO-LWAPP-LINKTEST-MIB
	CISCO-RTP-METRICS-MIB	CISCO-LWAPP-MFP-MIB
	CISCO-RTTMON-MIB	

Description	Specification	
	CISCO-SMART-INSTALL-MIB	CISCO-LWAPP-MOBILITY-EXT-MIB CISCO-LWAPP-QOS-MIB CISCO-LWAPP-REAP-MIB CISCO-LWAPP-ROGUE-MIB CISCO-LWAPP-RRM-MIB CISCO-LWAPP-SI-MIB CISCO-LWAPP-TSM-MIB CISCO-LWAPP-WLAN-MIB CISCO-LWAPP-WLAN-SECURITY-MIB
Standards	IEEE 802.1as IEEE 802.1s IEEE 802.1w IEEE 802.11 IEEE 802.1x IEEE 802.1x-Rev IEEE 802.3ad IEEE 802.3af IEEE 802.3at IEEE 802.3bz IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports IEEE 802.1D Spanning Tree Protocol IEEE 802.1p CoS prioritization IEEE 802.1Qat Stream Reservation Protocol IEEE 802.1Qav IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification	RMON I and II standards SNMPv1, SNMPv2c, and SNMPv3

Power supply specifications

Table 14 lists the power specifications for the Cisco Catalyst 3850 Series based on the kind of power supply used.

Table 14. Power specifications for Cisco Catalyst 3850 Series

Description	Specification			
	PWR-C1-1100WAC	**PWR-C1-715WAC**	**PWR-C1-350WAC**	**PWR-C1-440WDC**
Power supply rated maximum	1100W	715W	350W	440W
Total output BTU (Note: 1000 BTU/hr = 293W)	3793 BTU/hr, 1100W	2465 BTU/hr, 715W	1207BTU/hr, 350W	1517BTU/hr, 440W
Input-voltage range and frequency	115-240VAC,	100-240VAC,	100-240VAC,	-36VDC to -72VDC

Description	Specification			
	50-60 Hz	50-60 Hz	50-60 Hz	
Input current	12-6A	10-5A	4-2A	<8A at -72VDC <16A at -36VDC
Output ratings	-56V at 19.64A	-56V at 12.8A	-56V at 6.25A	-56V at 7.86A
Output holdup time	10 ms minimum at 102.5VAC	16.7 ms minimum at 100VAC	16.7 ms minimum at 100VAC	> 2ms at -48VDC
Power-supply input receptacles	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	Terminal strip
Power cord rating	13A	13A	10A	20A at 100VDC
Physical specifications	(H x W x D): 1.58 X 3.25 X 13.7 in Weight: 3 lb (1.4 kg)	(H x W x D): 1.58 X 3.25 X 12.20 in Weight: 2.8 lb (1.3 kg)	(H x W x D): 1.58 X 3.25 X 12.20 in Weight: 2.6 lb (1.2 kg)	(H x W x D): 1.58 X 3.25 X 12.20 in Weight: 2.6 lb (1.2 kg)
Operating temperature	23 to 113°F (-5 to 45°C)			
Storage temperature	-40 to 158°F (-40 to 70°C)			
Relative humidity operating and nonoperating noncondensing	5 to 90% noncondensing			
Altitude	10,000 ft. (3000 meters), up to 45°C			
MTBF	Calculated MTBF must be greater than 300,000 using Telcordia SR-332, Method 1, Case 3. Demonstrated MTBF is 500,000 hr (with 90% confidence level).			
EMI and EMC compliance	FCC Part 15 (CFR 47) Class A ICES-003 Class A EN 55022 Class A CISPR 22 Class A AS/NZS 3548 Class A BSMI Class A (AC input models only) VCCI Class A EN 55024, EN300386, EN 50082-1, EN 61000-3-2, EN 61000-3-3 EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN 61000-6-1			
Safety compliance	UL 60950-1, CAN/CSA-C22.2 No. 60950-1, EN 60950-1, IEC 60950-1, CCC, CE Marking			
LED indicators	"AC OK": Input power to the power supply is OK "PS OK": Output power from the power supply is OK			

Power consumption of standalone Cisco Catalyst 3850 Series Switches

Table 15 shows power consumption of standalone Cisco Catalyst 3850 Series Switches based on Alliance for Telecommunications Industry Solutions (ATIS) testing using IMIX distribution stream traffic, with input voltage of 115VAC at 60 Hz and no PoE loading. The values given are the maximum possible power consumption numbers under the respective test scenarios.

Table 15. Power consumptions (in watts) of standalone Cisco Catalyst 3850 Series

Model	Uplink module	Power consumption (W) (no more than)			
		0% traffic	10% traffic	100% traffic	Weighted average
WS-C3850-12S	C3850-NM-4-1G	85.84	85.89	86.75	86.0
WS-C3850-24S		104.48	104.25	105.12	104.4
WS-C3850-12S	C3850-NM-2-10G	87.95	88.30	90.04	88.4
WS-C3850-24S		106.24	106.58	109.75	106.9
WS-C3850-24T	C3850-NM-4-1G	83.47	82.86	83.76	83.04
WS-C3850-24P		86.81	86.22	87.11	86.40
WS-C3850-24U		81.5	81.4	82.1	81.5
WS-C3850-48T		117.74	116.62	117.59	116.89
WS-C3850-48P		125.35	124.15	125.15	124.43
WS-C3850-48F		130.10	128.91	129.85	129.18
WS-C3850-48U		114.8	114.7	115.6	114.8
WS-C3850-24T	C3850-NM-2-10G	81.97	81.83	84.97	82.16
WS-C3850-24P		85.22	85.04	88.32	85.39
WS-C3850-24U		82.8	82.6	84.8	82.9
WS-C3850-48T		117.56	116.74	120.40	117.23
WS-C3850-48P		123.78	122.90	126.75	123.42
WS-C3850-48F		129.89	129.06	132.36	129.18
WS-C3850-48U		116.8	116.9	119.9	117.2
WS-C3850-48T	C3850-NM-4-10G	120.56	120.28	127.24	121.02
WS-C3850-48P		129.59	129.64	135.96	130.27
WS-C3850-48F		137.57	137.06	143.77	137.81
WS-C3850-48U		119.9	121.2	127.7	121.5
WS-C3850-12XS		109.0	109.5	112.7	109.7

Model	Uplink module	Power consumption (W) (no more than)			
		0% traffic	10% traffic	100% traffic	Weighted average
WS-C3850-24XU	C3850-NM-8-10G	229.7	231.2	248.1	232.7
WS-C3850-12X48U		191.3	193.6	208.1	194.8
WS-C3850-24XS		183.6	185.3	205.5	187.2
WS-C3850-24XS	C3850-NM-2-40G	159.2	161.1	177.0	162.5
WS-C3850-48XS	None	267.0	268.3	288.1	270.1

Safety and compliance

Table 16. Safety and compliance information for the Cisco Catalyst 3850 Series

Description	Specification
Safety certifications	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition NOM (obtained by partners and distributors)
Electromagnetic emissions certifications	47CFR Part 15 (CFR 47) Class A (FCC Part 15 Class A) AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A KCC CNS13438 Class A EN55024 CISPR24 KN24
Environmental	Reduction of Hazardous Substances (ROHS) 5
Noise specifications	Office Product Spec: 48dBA at 30°C (refer to ISO 7779)
Telco	CLEI code

Warranty

The Cisco Catalyst 3850 Series Switches come with an E-LLW that includes NBD delivery of replacement hardware where available and 90 days of 8x5 Cisco TAC support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

For further information about warranty terms, visit https://www.cisco.com/go/warranty. Table 17 provides information about the E-LLW.

Table 17. E-LLW details

	Cisco E-LLW
Device covered	Applies to Cisco Catalyst 3850 Series Switches.
Warranty duration	As long as the original customer owns the product.
EoL policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the RMA request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 3850 product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Licensing

The three feature sets available with all Cisco Catalyst 3850 Series Switches are:

- LAN Base: Enterprise access Layer 2 switching features
- IP Base: Enterprise access Layer 3 switching features
- IP Services: Advanced enterprise Layer 3 switching (IPv4 and IPv6) features

The LAN Base feature set offers enhanced intelligent services that include comprehensive Layer 2 features, with up to 255 VLANs. The IP Base feature set provides entry-level enterprise services in addition to all LAN Base features, with 1K VLANs. IP Base also includes the support for wireless controller functionality (mobility agent and mobility controller role; additional access point license required for mobility controller role), routed access, smart operations, FNF, and so on. The IP Services feature set provides full enterprise services that include advanced Layer 3 features such as EIGRP, OSPF, BGP, PIM, and IPv6 routing such as OSPFv3 and EIGRPv6. All software feature sets support advanced security and MQC-based QoS.

The Cisco Catalyst 3850 Series Switches with LAN Base feature set can only stack with other Cisco Catalyst 3850 Series LAN Base switches. The same applies to IP Base and IP Services as well. A mixed stack of LAN Base switch with IP Base or IP Services feature set is not supported.

The 12-port and 24-port SFP+- and SFP-based models as well as the 48-port SFP+ model can only be ordered with IP Base or IP Services licenses. Therefore, in order to stack with LAN Base models, they need to be configured in LAN Base mode from the CLI.

Customers can transparently upgrade the software feature set in the Cisco Catalyst 3850 Series Switches through Cisco IOS Software CLI using the Right To Use (RTU)-based software upgrade process. Software activation enables the Cisco IOS Software feature sets. Based on the license's type, Cisco IOS Software activates the appropriate feature set. License types can be changed, or upgraded, to activate a different feature set.

Access point license for Cisco Catalyst 3850 Series

An access point license is required for Cisco Catalyst 3850 Series Switches operating in mobility controller mode. No access point license is required for 3850 operating in mobility agent mode. This functionality is included in the IP Base feature set. Other devices that can act as mobility controller are the WLC 5760, WLC 5508, and WiSM2 wireless controllers. Access point licenses can be transferred only between two 3850 switches or between 3850 and 5760 controller and vice versa.

Software policy for Cisco Catalyst 3850 Series Switches

Customers with Cisco Catalyst LAN Base and IP Base software feature sets will be provided with maintenance updates and bug fixes designed to maintain the compliance of the software with published specifications, release notes, and industry standards compliance as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for this product, whichever occurs earlier. Customers with licenses for our IP Services software images require a service support contract such as Cisco Smart Net Total Care™ Service to download updates. This policy supersedes any previous warranty or software statement and is subject to change without notice.

Cisco ONE Software

Cisco ONE Software for Access Switching is available for the Cisco Catalyst 3850 Series Switches.

Cisco ONE Software is a new way for customers to purchase and use our infrastructure software. It offers a simplified consumption model, centered on common customer scenarios in the data center, WANs, and LANs.

Cisco ONE Software and services provide customers with four primary benefits:

- Software suites that address typical customer use scenarios at an attractive price
- Investment protection of their software purchase through software services-enabled license portability
- Access to ongoing innovation and new technology with Cisco Software Support Service (SWSS)
- Flexible licensing models to smoothly distribute customer's software spend over time

For ordering information for Cisco ONE Software for the Cisco Catalyst 3850 Series Switches, go to https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html.

Cisco and Partner Services

Enable the innovative, secure, intelligent edge in the Borderless Network Architecture using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst fixed switches into your architecture and incorporate network services onto

that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology.

Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. (See Table 18.)

Table 18. Technical services available for Cisco Catalyst 3850 Series Switches

Technical services
Cisco Smart Net Total Care™ Service • Around-the-clock, global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com knowledge base and tools • Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement and onsite parts replacement and installation available • Ongoing operating system software updates within the licensed feature set • Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
Cisco Smart Foundation Service • NBD advance hardware replacement as available • Business hours access to SMB TAC (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation Portal • Operating system software bug fixes and patches
Cisco SP Base Service • Around-the-clock, global access to the Cisco TAC • Registered access to Cisco.com • NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement; return to factory option available2 • Ongoing operating system software updates[1]
Cisco Focused Technical Support Services • Three levels of premium, high-touch services are available: ◦ Cisco High-Touch Operations Management Service ◦ Cisco High-Touch Technical Support Service ◦ Cisco High-Touch Engineering Service • Valid Cisco Smart Net Total Care or SP Base contracts on all network equipment are required

Notes

[1] Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

[2] Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with NBD delivery. Where NBD is not available, same day ship is provided. Restrictions apply; for details, review the appropriate service descriptions.

Ordering Information

Table 19 lists ordering information for the Cisco Catalyst 3850 Series. To place an order, visit the Cisco Ordering homepage at https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 19. Cisco Catalyst 3850 Series ordering information

Product number	Description
Cisco Catalyst 3850 Series	

Product number	Description
WS-C3850-24T-L	Stackable 24 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-48T-L	Stackable 48 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-24P-L	Stackable 24 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-24U-L	Stackable 24 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-48P-L	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-48F-L	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 1100WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-48U-L	Stackable 48 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, LAN Base feature set (StackPower cables need to be purchased separately)
WS-C3850-24T-S	Stackable 24 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, IP Base feature set
WS-C3850-48T-S	Stackable 48 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, IP Base feature set
WS-C3850-24P-S	Stackable 24 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, IP Base feature set
WS-C3850-24U-S	Stackable 24 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, IP Base feature set
WS-C3850-48P-S	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, IP Base feature set
WS-C3850-48F-S	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 1100WAC power supply 1 RU, IP Base feature set
WS-C3850-48U-S	Stackable 48 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, IP Base feature set
WS-C3850-24T-E	Stackable 24 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, IP Services feature set
WS-C3850-48T-E	Stackable 48 10/100/1000 Ethernet ports, with 350WAC power supply 1 RU, IP Services feature set
WS-C3850-24P-E	Stackable 24 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, IP Services feature set
WS-C3850-24U-E	Stackable 24 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, IP Services feature set
WS-C3850-48P-E	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 715WAC power supply 1 RU, IP Services feature set

Product number	Description
WS-C3850-48F-E	Stackable 48 10/100/1000 Ethernet PoE+ ports, with 1100WAC power supply 1 RU, IP Services feature set
WS-C3850-48U-E	Stackable 48 10/100/1000 Ethernet UPOE ports, with 1100WAC power supply 1 RU, IP Services feature set
WS-C3850-12X48U-L	Stackable 48 10/100/1000 with 12 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, LAN Base feature set
WS-C3850-12X48U-S	Stackable 48 10/100/1000 with 12 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, IP Base feature set
WS-C3850-12X48U-E	Stackable 48 10/100/1000 with 12 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, IP Services feature set
WS-C3850-24XU-L	Stackable 24 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, LAN Base feature set
WS-C3850-24XU-S	Stackable 24 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, IP Base feature set
WS-C3850-24XU-E	Stackable 24 100Mbps/1/2.5/5/10 Gbps UPOE Ethernet ports, with 1100W AC power supply 1RU, IP Services feature set
WS-C3850-12S-S	Stackable 12 SFP Ethernet ports, with 350WAC power supply 1 RU, IP Base feature set
WS-C3850-12S-E	Stackable 12 SFP Ethernet ports, with 350WAC power supply 1 RU, IP Services feature set
WS-C3850-24S-S	Stackable 24 SFP Ethernet ports, with 350WAC power supply 1 RU, IP Base feature set
WS-C3850-24S-E	Stackable 24 SFP Ethernet ports, with 350WAC power supply 1 RU, IP Services feature set
WS-C3850-12XS-S	Stackable 12 SFP+ Ethernet ports, with 350WAC power supply 1 RU, IP Base feature set
WS-C3850-12XS-E	Stackable 12 SFP+ Ethernet ports, with 350WAC power supply 1 RU, IP Services feature set
WS-C3850-24XS-S	Stackable 24 SFP+ Ethernet ports, with 715WAC power supply 1 RU, IP Base feature set
WS-C3850-24XS-E	Stackable 24 SFP+ Ethernet ports, with 715WAC power supply 1 RU, IP Services feature set
WS-C3850-48XS-S	Standalone, 48 SFP+ and 4 QSFP+ Ethernet ports, with 750WAC front-to-back power supply 1 RU, IP Base feature set
WS-C3850-48XS-E	Standalone, 48 SFP+ and 4 QSFP+ Ethernet ports, with 750WAC front-to-back power supply 1 RU, IP Services feature set
WS-C3850-48XS-F-S	Standalone, 48 SFP+ and 4 QSFP+ Ethernet ports, with 750WAC back-to-front power supply 1 RU, IP Base feature set

Product number	Description
WS-C3850-48XS-F-E	Standalone, 48 SFP+ and 4 QSFP+ Ethernet ports, with 750WAC back-to-front power supply 1 RU, IP Services feature set
Cisco Catalyst 3850 bundles	
WS-C3850-24PW-S	Cisco Catalyst 3850 24-port PoE IP Base with 5 access point license
WS-C3850-48PW-S	Cisco Catalyst 3850 48-port PoE IP Base with 5 access point license
WS-C3850-24UW-S	Cisco Catalyst 3850 24 Port UPOE with 5 access point licenses IP Base
WS-C3850-48W-S	Cisco Catalyst 3850 48 Port PoE with 5 access point licenses IP Base
WS-C3850-48UW-S	Cisco Catalyst 3850 48 Port UPOE with 5 access point licenses IP Base
WS-C3850-24XUW-S	Cisco Catalyst 3850 24 Port UPOE with 24 100Mbps/1/2.5/5/10 Gbps and 5 access point licenses IP Base
WS-C3850-12X48UW-S	Cisco Catalyst 3850 48 Port UPOE with 12 100Mbps/1/2.5/5/10 Gbps and 5 access point licenses IP Base
WS-C3850-16XS-S	Cisco Catalyst 3850 12 SFP+ port stackable model, with C3850-NM-4-10G module and 350WAC power supply. 1 RU, IP Base feature set
WS-C3850-16XS-E	Cisco Catalyst 3850 12 SFP+ port stackable model, with C3850-NM-4-10G module and 350WAC power supply. 1 RU, IP Services feature set
WS-C3850-32XS-S	Cisco Catalyst 3850 24 SFP+ port stackable model, with C3850-NM-8-10G module and 715WAC power supply. 1 RU, IP Base feature set
WS-C3850-32XS-E	Cisco Catalyst 3850 24 SFP+ port stackable model, with C3850-NM-8-10G module and 715WAC power supply. 1 RU, IP Services feature set
Network modules for the Cisco Catalyst 3850 Series	
C3850-NM-4-1G=	4 x Gigabit Ethernet network module spare
C3850-NM-2-10G=	4 x Gigabit Ethernet/2 x 10 Gigabit Ethernet network module spare
C3850-NM-BLANK=	Network module blank spare
C3850-NM-4-10G=	4 x Gigabit Ethernet/4 x 10 Gigabit Ethernet network module spare
C3850-NM-8-10G=	8 x Gigabit Ethernet/8 x 10 Gigabit Ethernet network module spare
C3850-NM-2-40G=	2 x 40 Gigabit Ethernet network module spare
Software licenses	
C3850-12-S-E	Cisco Catalyst 3850 12-port IP Base to IP Services RTU paper license
C3850-24-L-S	Cisco Catalyst 3850 24-port Switch LAN Base to IP Base RTU paper license
C3850-48-L-S	Cisco Catalyst 3850 48-port Switch LAN Base to IP Base RTU paper license
C3850-24-L-E	Cisco Catalyst 3850 24-port LAN Base to IP Services RTU paper license
C3850-48-L-E	Cisco Catalyst 3850 48-port LAN Base to IP Services RTU paper license

Product number	Description
C3850-24-S-E	Cisco Catalyst 3850 24-port IP Base to IP Services RTU paper license
C3850-48-S-E	Cisco Catalyst 3850 48-port IP Base to IP Services RTU paper license
L-C3850-24-L-S	Cisco Catalyst 3850 24-port LAN Base to IP Base RTU electronic license
L-C3850-48-L-S	Cisco Catalyst 3850 48-port LAN Base to IP Base RTU electronic license
L-C3850-24-L-E	Cisco Catalyst 3850 24-port LAN Base to IP Services RTU electronic license
L-C3850-48-L-E	Cisco Catalyst 3850 48-port LAN Base to IP Services RTU electronic license
L-C3850-24-S-E	Cisco Catalyst 3850 24-port IP Base to IP Services RTU electronic license
L-C3850-48-S-E	Cisco Catalyst 3850 48-port IP Base to IP Services RTU electronic license
L-C3850-12-S-E	Cisco Catalyst 3850 12-port IP Base to IP Services RTU electronic license
Access point licenses	
L-LIC-CT3850-UPG	Primary upgrade license SKU for Cisco 3850 wireless controller (e-delivery)
L-LIC-CTIOS-1A	1 access point adder license for Cisco IOS Software based wireless controller (e-delivery)
LIC-CT3850-UPG	Primary upgrade license SKU for Cisco 3850 wireless controller (paper license)
LIC-CTIOS-1A	1 access point adder license for the Cisco IOS Software based wireless controller (paper license)
Power supplies and fan for the Cisco Catalyst 3850 Series	
PWR-C1-350WAC=	350WAC power supply spare
PWR-C1-715WAC=	715WAC power supply spare
PWR-C1-1100WAC=	1100WAC power supply spare
PWR-C1-440WDC=	440WDC power supply spare
PWR-C1-BLANK=	Power supply blank spare
PWR-C3-750WAC-R=	750WAC power supply spare front-to-back airflow for 48XS
PWR-C3-750WAC-F=	750WAC power supply spare back-to-front airflow for 48XS
PWR-C3-750WDC-R=	750WDC power supply spare front-to-back airflow for 48XS
PWR-C3-750WDC-F=	750WDC power supply spare back-to-front airflow for 48XS
FAN-T3-R=	Fan module spare front-to-back airflow for 48XS
FAN-T3-F=	Fan module spare back-to-front airflow for 48XS
C3850-FAN-T1=	Cisco Catalyst 3850 and WLC 5760 Type 1 Fan Module
StackWise-480 and StackPower cables for the Cisco Catalyst 3850 Series	

Product number	Description
STACK-T1-50CM=	Cisco StackWise-480 50cm stacking cable spare
STACK-T1-1M=	Cisco StackWise-480 1m stacking cable spare
STACK-T1-3M=	Cisco StackWise-480 3m stacking cable spare
CAB-SPWR-30CM=	Cisco Catalyst 3850 StackPower cable 30cm spare
CAB-SPWR-150CM=	Cisco Catalyst 3850 StackPower cable 150cm spare
Spare power cords for the Cisco Catalyst 3850 Series	
CAB-TA-NA=	AC power cord for Cisco Catalyst 3850 (North America)
CAB-TA-AP=	AC power cord for Cisco Catalyst 3850 (Australia)
CAB-TA-AR=	AC power cord for Cisco Catalyst 3850 (Argentina)
CAB-TA-SW=	AC power cord for Cisco Catalyst 3850 (Switzerland)
CAB-TA-UK=	AC power cord for Cisco Catalyst 3850 (United Kingdom)
CAB-TA-JP=	AC power cord for Cisco Catalyst 3850 (Japan)
CAB-TA-250VAC-JP=	Japan 250VAC power cord for Cisco Catalyst 3850 (Japan)
CAB-TA-EU=	AC power cord for Cisco Catalyst 3850 (Europe)
CAB-TA-IT=	AC power cord for Cisco Catalyst 3850 (Italy)
CAB-TA-IN=	AC power cord for Cisco Catalyst 3850 (India)
CAB-TA-CN=	AC power cord for Cisco Catalyst 3850 (China)
CAB-TA-DN=	AC power cord for Cisco Catalyst 3850 (Denmark)
CAB-TA-IS=	AC power cord for Cisco Catalyst 3850 (Israel)
CAB-ACBZ-12A=	AC power cord for Cisco Catalyst 3850 (Brazil), 12A/125V BR-3-20 plug up to 12A
CAB-ACBZ-10A=	AC power cord for Cisco Catalyst 3850 (Brazil), 10A/250V BR-3-10 plug up to 10A
CAB-C15-CBN	Cabinet jumper power cord, 250 VAC 13A, C14-C15 connectors
Spare accessory and rack-mount kits for the Cisco Catalyst 3850 Series	
C3850-ACC-KIT=	Accessory kit for Cisco Catalyst 3850 Series
C3850-RAC-KIT=	Rack mount kit for Cisco Catalyst 3850 Series
C3850-4PT-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 3850 Series

Optics compatibility information

The Cisco Catalyst 3850 Series supports a wide range of optics. Because the list of supported optics is updated on a regular basis, consult the tables available here for the latest QSFP+, SFP+, and SFP compatibility information: https://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.

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Cisco Catalyst 9200 Series Switches

Contents

Extend intent-based networking everywhere

Cisco® Catalyst® 9200 Series switches extend the power of intent-based networking and Catalyst 9000 hardware and software innovation to a broader set of deployments. With its family pedigree, Catalyst 9200 Series switches offer simplicity without compromise – it is secure, always on, and IT simplified.

As foundational building blocks for the Cisco Digital Network Architecture, Catalyst 9200 Series switches help customers simplify complexity, optimize IT, and reduce operational costs by leveraging intelligence, automation and human expertise that no other vendor can deliver regardless of where you are in the intent-based networking journey.

Catalyst 9200 Series switches provide security features that protect the integrity of the hardware as well as the software and all data that flows through the switch. It provides resiliency that keeps your business up and running seamlessly. Combine that with open APIs of Cisco IOS XE and programmability of the UADP ASIC technology, Catalyst 9200 Series switches give you what you need now with investment protection on future innovations.

With full PoE+ capability, power and fan redundancy, stacking bandwidth up to 160 Gbps, modular uplinks, Layer 3 feature support, and cold patching, Catalyst 9200 Series switches are the industry's unparalleled solution with differentiated resiliency and progressive architecture for cost-effective branch-office access.

Product overview

Product highlights

- Up to 48 ports of full Power over Ethernet Plus (PoE+) capability
- Resiliency with Field-Replaceable Units (FRU) and redundant power supply, fans, and modular uplinks
- Flexible downlink options with data, PoE+ or mGig
- Operational efficiency with optional backplane stacking, supporting stacking bandwidth up to 160 Gbps
- UADP 2.0 Mini with integrated CPU offers customers optimized scale with better cost structure
- Enhanced security with AES-128 MACsec encryption, policy-based segmentation, and trustworthy systems
- Layer 3 capabilities, including OSPF, EIGRP, ISIS, RIP, and routed access
- Advanced network monitoring using Full Flexible NetFlow
- Cisco Software-Defined Access (SD-Access):
  - Simplified operations and deployment with policy-based automation from edge to cloud managed with Cisco Identity Services Engine (ISE)
  - Network assurance and improved resolution time through Cisco DNA Center

- Plug and Play (PnP) enabled: A simple, secure, unified, and integrated offering to ease new branch or campus device rollouts or updates to an existing network
- Cisco IOS XE: A Common Licensing based operating system for the enterprise Cisco Catalyst 9000 product family with support for model-driven programmability and streaming telemetry
- ASIC with programmable pipeline and micro-engine capabilities, along with template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality of Service (QoS) entries

Features and benefits

Platform details

Switch models and configurations

Models	FRU Power Supply	FRU Fans	Modular Uplinks	Stacking Bandwidth Support	SD-Access Support[1]
Modular uplink models (C9200 SKUs)	✓	✓	✓	160 Gbps	Yes (4 Virtual Networks)
Fixed uplink Models (C9200L SKUs)	✓	✗	✗	80 Gbps	Limited (1 Virtual Network)

[1] Catalyst 9200 standalone and stack can support 25 Access Tunnels (for fabric enabled APs).
Note: Over the top fabric deployments eventually migrating to fabric wireless architecture should consider this limit during design/deployment

The Cisco Catalyst 9200 Series is made up of modular (C9200) and fixed (C9200L) switch models.

Figure 1.
Cisco Catalyst 9200 Series switches

Table 1. Cisco Catalyst 9200 Series Switch configurations

Switch model	Downlinks total 10/100/1000 or PoE+ copper ports	Uplink configuration	Default primary AC power supply	Fans
Modular uplink models				
C9200-24T	24 ports data	Modular uplink options	PWR-C5-125WAC	FRU redundant
C9200-24P	24 ports full PoE+	Modular uplink options	PWR-C5-600WAC	FRU redundant
C9200-48T	48 ports data	Modular uplink options	PWR-C5-125WAC	FRU redundant
C9200-48P	48 ports full PoE+	Modular uplink options	PWR-C5-1KWAC	FRU redundant
Fixed uplink models				
C9200L-24T-4G	24 ports data	4x 1G fixed uplinks	PWR-C5-125WAC	Fixed redundant
C9200L-24P-4G	24 ports full PoE+	4x 1G fixed uplinks	PWR-C5-600WAC	Fixed redundant
C9200L-48T-4G	48 ports data	4x 1G fixed uplinks	PWR-C5-125WAC	Fixed redundant
C9200L-48P-4G	48 ports full POE+	4x 1G fixed uplinks	PWR-C5-1KWAC	Fixed redundant
C9200L-24T-4X	24 ports data	4x 10G fixed uplinks	PWR-C5-125WAC	Fixed redundant
C9200L-24P-4X	24 ports full PoE+	4x 10G fixed uplinks	PWR-C5-600WAC	Fixed redundant
C9200L-48T-4X	48 ports data	4x 10G fixed uplinks	PWR-C5-125WAC	Fixed redundant
C9200L-48P-4X	48 ports full PoE+	4x 10G fixed uplinks	PWR-C5-1KWAC	Fixed redundant
C9200L-24PXG-4X	24 ports full PoE+ (8 mGig ports up to 10G, 16 ports up to 1G)	4x 10G fixed uplinks	PWR-C5-600WAC	Fixed redundant
C9200L-48PXG-4X	48 ports full POE+ (12 mGig ports up to 10G, 36 ports up to 1G)	4x 10G fixed uplinks	PWR-C5-1KWAC	Fixed redundant
C9200L-24PXG-2Y	24 ports full PoE+ (8 mGig ports up to 10G, 16 ports up to 1G)	2x 25G fixed uplinks	PWR-C5-600WAC	Fixed redundant
C9200L-48PXG-2Y	48 ports full POE+ (8 mGig ports up to 10G, 40 ports up to 1G)	2x 25G fixed uplinks	PWR-C5-1KWAC	Fixed redundant

Network modules

Cisco Catalyst 9200 Series switches come with modular or fixed uplinks as indicated in Table 1. With modular SKUs, the field-replaceable network modules provide infrastructure investment protection by allowing a nondisruptive migration from 1G to 10G and beyond. When you purchase the switch, you can choose from the network modules described in Table 2.

Figure 2.
Cisco Catalyst 9200 Series Switch network modules

Table 2. Network module part numbers and descriptions

Network module	Description
C9200-NM-4G	4x 1G network module
C9200-NM-4X	4x 1G/10G network module
C9200-NM-BLANK	No network module

For additional details, please read our FAQ:
https://www.cisco.com/c/dam/en/us/products/collateral/switches/catalyst-9000/nb-09-cat-9k-faq-cte-en.pdf.

Platform resiliency

Power supplies

Cisco Catalyst 9200 Series switches support dual field-replaceable power supplies (Figure 3). Each switch ships with one default power supply, and a second identical power supply can be purchased with the initial order or can be added at a later time. The second power supply can provide redundancy or additional power to PoE+ ports as needed.

Intelligent PoE+

- IEEE 802.3at PoE+ (up to 30W per port) is supported on Cisco Catalyst 9200 Series switches to lower the total cost of ownership for deployments that incorporate Cisco IP phones, Cisco Aironet® wireless access points, or other standards-compliant PoE+ end devices. PoE+ removes the need to supply wall power to PoE-enabled devices and eliminates the cost of adding electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. With Cisco Catalyst 9200 Series switches, PoE+ power allocation is dynamic, and power mapping scales up to a maximum of 1440W of PoE+ power.
- Perpetual PoE is supported on Cisco Catalyst 9200 Series switches, and maintains the PoE+ power during a switch reload. This is important for critical endpoints such as medical devices and for Internet of Things (IoT) endpoints such as PoE-powered lights, so that there is no disruption during a switch reboot.

- Fast PoE: When power is restored to a switch, Fast PoE starts delivering power to endpoints without waiting for the operating system to fully load, thereby speeding up the time for the endpoint to start up.

Figure 3.
Cisco Catalyst 9200 Series Switch dual redundant power supplies

Table 3 lists the PoE+ power availability for each model.

Table 3. PoE+ Power with primary and secondary power supplies

Model	Default primary power supply	Available PoE power with single primary power supply only*	Optional secondary power supply	Available PoE power with additional secondary power supply*
C9200-24P	PWR-C5-600WAC	370W	PWR-C5-600WAC / PWR-C6-600WAC	740W
C9200-48P	PWR-C5-1KWAC	740W	PWR-C5-1KWAC / PWR-C6-1KWAC	1440W
C9200L-24P-4G	PWR-C5-600WAC	370W	PWR-C5-600WAC	740W
C9200L-24P-4X	PWR-C5-600WAC	370W	PWR-C5-600WAC	740W
C9200L-48P-4G	PWR-C5-1KWAC	740W	PWR-C5-1KWAC	1440W
C9200L-48P-4X	PWR-C5-1KWAC	740W	PWR-C5-1KWAC	1440W
C9200L-24PXG-4X	PWR-C5-600WAC	370W	PWR-C5-600WAC	740W
C9200L-48PXG-4X	PWR-C5-1KWAC	740W	PWR-C5-1KWAC	1440W
C9200L-24PXG-2Y	PWR-C5-600WAC	370W	PWR-C5-600WAC	740W
C9200L-48PXG-2Y	PWR-C5-1KWAC	740W	PWR-C5-1KWAC	1440W

* Limited by port number and port rating (for example, 24 PoE+ 30W ports = 720W)

Stacking

Cisco Catalyst 9200 Series switch models are designed for stacking switches as a single virtual switch, enabling customers to have a single management plane and control plane for up to 384 access ports.

Table 4 lists the supported stacking options.

Table 4. Supported stacking options

Model	Stacking support	Stacking bandwidth support	Stacking hardware	Number of members	Supported stack members
Modular models (C9200 SKUs)	StackWise®-160	160 Gbps	C9200-STACK-KIT	8	Other C9200 models with same license level
Fixed models (C9200L SKUs)	StackWise-80	80 Gbps	C9200L-STACK-KIT	8	Other C9200L models with same license level

Mixed stacking is not supported. You cannot stack fixed (C9200L SKUs) with modular (C9200 SKUs) models, or other Catalyst switches, e.g. Cisco Catalyst 2960-X and 2960-XR Series.

The optional StackWise-160 and StackWise-80 kits consist of two adapters and a stacking cable. The default stacking cable is 0.5 m, but options of 1 m and 3 m are also available. Table 5 lists the stacking accessories.

Table 5. Stacking accessories

Model	Description
C9200-STACK-KIT	Stack kit for C9200 SKUs only: Two data stack adapters and one data stack cable
C9200L-STACK-KIT	Stack kit for C9200L SKUs only: Two data stack adapters and one data stack cable
STACK-T4-50CM	Data stack 50 cm cable (default cable with Stack Kit)
STACK-T4-1M	Data stack 1 m cable
STACK T4-3M	Data stack 3 m cable

Figure 4.
Cisco Catalyst 9200 Series Switch stacked units

Fan

Cisco Catalyst 9200 Series switches also come with dual fans and support redundancy. Cisco Catalyst 9200 Series switches support redundancy with dual fans. On the C9200 SKUs, the fan units are field-replaceable, whereas on the fixed C9200L SKUs, the fan units are fixed. Table 5 lists the fan module part number.

Table 6. Fan modules

Model	Description
C9200-FAN=	Fan module

Performance and scalability

Table 7 lists performance and scalability metrics for Cisco Catalyst 9200 Series switches. Table 8 lists the bandwidth specifications.

Table 7. Performance specifications

Description	C9200-24T, C9200-24P, C9200-48T, C9200-48P	C9200L-24T-4G, C9200L-24P-4G, C9200L-48T-4G, C9200L-48P-4G, C9200L-24T-4X, C9200L-24P-4X C9200L-48T-4X, C9200L-48P-4X, C9200L-24PXG-4X, C9200L-48PXG-4X, C9200L-24PXG-2Y, C9200L-24PXG-4X
Virtual Networks	4	1
Stacking bandwidth	160 Gbps	80 Gbps
Total number of MAC addresses	32,000	16,000
Total number of IPv4 routes (ARP plus learned routes)	14,000 (10,000 direct routes and 4,000 indirect routes)	11,000 (8,000 direct routes and 3,000 indirect routes)
IPv4 routing entries	4,000	3,000
IPv6 routing entries	2,000	1,500
Multicast routing scale	1,000	1,000
QoS scale entries	1,000	1,000
ACL scale entries	1,600	1,500
Packet buffer per SKU	6 MB buffers for 24- or 48-port Gigabit Ethernet models	6 MB buffers for 24- or 48-port Gigabit Ethernet models, 12 MB buffers for 24 or 48 port multigigabit models
Flexible NetFlow (FNF) entries	16,000 flows on 24- and 48-port Gigabit Ethernet models	16,000 flows on 24- and 48-port Gigabit Ethernet models, 32,000 flows on 24 or 48 port multigigabit models
DRAM	4 GB	2 GB
Flash	4 GB	4 GB
VLAN IDs	4096	1024
Total Switched Virtual Interfaces (SVIs)	1000	512
Jumbo frames	9198 bytes	9198 bytes
Wireless bandwidth per switch	Up to 48 Gbps on 24-port and 48-port Gigabit Ethernet model	N/A
IP SGT binding scale	8K	10K
Number of IPv4 bindings	8K	10K
Number of SGT/DGT policies	2K	2K
Number of SXP Sessions	200	200

Table 8. Bandwidth specifications

Description	Switching capacity	Switch capacity with Stacking	Forwarding rate	Forwarding rate with Stacking
C9200-24T	128 Gbps	288 Gbps	95.23 Mpps	214 Mpps
C9200-24P	128 Gbps	288 Gbps	95.23 Mpps	214 Mpps
C9200-48T	176 Gbps	336 Gbps	130.95 Mpps	250 Mpps
C9200-48P	176 Gbps	336 Gbps	130.95 Mpps	250 Mpps
C9200L-24T-4G	56 Gbps	136 Gbps	41.66 Mpps	101 Mpps
C9200L-24P-4G	56 Gbps	136 Gbps	41.66 Mpps	101 Mpps
C9200L-48T-4G	104 Gbps	184 Gbps	77.38 Mpps	137 Mpps
C9200L-48P-4G	104 Gbps	184 Gbps	77.38 Mpps	137 Mpps
C9200L-24T-4X	128 Gbps	208 Gbps	95.23 Mpps	155 Mpps
C9200L-24P-4X	128 Gbps	208 Gbps	95.23 Mpps	155 Mpps
C9200L-48T-4X	176 Gbps	256 Gbps	130.95 Mpps	190 Mpps
C9200L-48P-4X	176 Gbps	256 Gbps	130.95 Mpps	190 Mpps
C9200L-24PXG-4X	272 Gbps	352 Gbps	214.28 Mpps	262 Mpps
C9200L-24PXG-2Y	292 Gbps	372 Gbps	229.16 Mpps	277 Mpps
C9200L-48PXG-4X	392 Gbps	472 Gbps	291.66 Mpps	351 Mpps
C9200L-48PXG-2Y	340 Gbps	420 Gbps	252.97 Mpps	313 Mpps

* Measured with 64 byte packets

Software

Platform software benefits

Cisco IOS XE

Cisco IOS XE Software opens a completely new paradigm in network configuration, operation, and monitoring through network automation. Cisco's automation solution is open, standards-based, and extensible across the entire lifecycle of a network device. The various automation mechanisms are outlined below.

- Automated device provisioning is the ability to automate the process of upgrading software images and installing configuration files on Cisco Catalyst switches when they are being deployed in the network for the first time. Cisco provides turnkey solutions such as Plug and Play and Preboot Execution Environment (PXE) that enable an effortless and automated deployment.
- API-driven configuration is available with modern network switches such as Cisco Catalyst 9200 Series switches. It supports a wide range of automation features and provides robust open APIs over NETCONF and RESTCONF using YANG data models for external tools, both off the shelf and custom built, to automatically provision network resources.
- Granular visibility enables model-driven telemetry to stream data from a switch to a destination. The data to be streamed is identified through subscription to a data set in a YANG model. The subscribed data set is streamed to the destination at specified intervals. Additionally, Cisco IOS XE enables the

push model. It provides near-real-time monitoring of the network, leading to quick detection and rectification of failures.

- Seamless software upgrades and patching supports OS resilience. On Cisco Catalyst 9200 Series switches Cisco IOS XE supports cold patching with reboot, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This support lets you add patches without having to wait for the next maintenance release. Cold patching requires the switch to be rebooted after patching to allow the changes to take effect.
- Trustworthy solutions built with Cisco Trust Anchor Technologies provide a highly secure foundation for Cisco products. With Cisco Catalyst 9200 Series switches, these technologies enable hardware and software authenticity assurance for supply chain trust and strong mitigation against man-in-the-middle attacks that compromise software and firmware. Trust Anchor capabilities include image signing, Secure Boot, and Cisco Trust Anchor module.

- High availability: Cisco Catalyst 9200 Series switches support high-availability features, including the following:
  - Cross-stack EtherChannel provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
  - IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) provides rapid spanning tree convergence independent of spanning tree timers and also offers the benefit of Layer 2 load balancing and distributed processing.
  - Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning tree (IEEE 802.1w) reconvergence on a per-VLAN spanning tree basis, providing simpler configuration than MSTP. In both MSTP and PVRST+ modes, stacked units behave as a single spanning tree node.
  - Switch-port auto-recovery ("err-disable" recovery) automatically attempts to reactivate a link that is disabled because of a network error.

The Foundation of Software-Defined Access

Secure Segmentation with SD-Access

The enterprise network lies at the heart of digital transformation. A network that is open, programmable, integrated, and secure maximizes business agility, allowing new business opportunities to be pursued and captured.

Cisco DNA with SD-Access is the network fabric that powers business. It is an open and extensible software-driven architecture that accelerates and simplifies your enterprise network operations. The programmable architecture frees your IT staff from time-consuming, repetitive network configuration tasks so they can focus instead on innovation that positively transforms your business. SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include:

- Simplified device deployment
- Unified management of wired and wireless networks
- Network virtualization and segmentation
- Group-based policies
- Context-based analytics
- SD-Access: Cisco Catalyst 9200 Series switches are the entry-level devices for SD-Access, Cisco's lead enterprise architecture, with policy-based automation from edge to cloud.
  - Simplified segmentation and micro-segmentation, with predictable performance and scalability
  - Automation through Cisco DNA Center
  - Policy handled through the Cisco Identity Services Engine (ISE)
  - Faster launch of new business services and significantly improved issue resolution time
- Assurance
  - Full network visibility and monitoring
  - End-to-end Quality of Experience (QoE)
  - Fast issue resolution and network remediation
- Plug and Play (PnP) enabled: A simple, secure, unified, and integrated offering to ease new branch or campus device rollouts or updates to an existing network

Cloud Security

- Umbrella Integration :

  Small to midsize networks reliant on managed service providers can now host Cisco Umbrella agent directly on their Catalyst 9200 series switches. This allows the business to easily customize their DNS filtering policies to prevent BYOD or IoT guest or corporate users from accessing malicious or inappropriate websites, without having to rely on the MSP to push the policies out. It also lets them optimize use of bandwidth by allowing direct cloud access for trusted apps. Requires DNA-Advantage License and Umberlla License per device

Full Flexible NetFlow

- Full Flexible NetFlow (FNF): Cisco IOS FNF is the next generation in flow visibility technology. It enables optimization of the network infrastructure, reduces operation costs, and improves capacity planning and security incident detection with increased flexibility and scalability. Catalyst 9200 Series switches are capable of up to 16,000 flow entries on 48-port and 24 port models.

QoS

- Superior QoS: Cisco Catalyst 9200 Series switches offer Gigabit Ethernet speeds with intelligent services that keep traffic flowing smoothly, even at 10 times the normal network speed. Industry-leading mechanisms for cross-stack marking, classification, and scheduling deliver superior performance for data, voice, and video traffic at wire speed. Superior QoS includes granular wireless bandwidth management and fair sharing, 802.1p Class of Service (CoS) and Differentiated Services Code Point (DSCP) field classification, Shaped Round Robin (SRR) scheduling, Committed Information Rate (CIR), and eight egress queues per port.

Smart operation

- WebUI:

  WebUI is an embedded GUI-based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability, and to enhance the user experience. It comes with the default image, so there is no need to enable anything or install any license on the device. You can use WebUI to build configurations, and to monitor and troubleshoot the device without having CLI expertise.

- RFID tags:

  Cisco Catalyst 9200 Series switches have an embedded RFID tag that facilitates easy asset and inventory management using commercial RFID readers.

- Blue beacon:

  Cisco Catalyst 9200 Series switches support both front and back blue beacon LEDs for easy identification of the switch being accessed.

- Efficient switch operation*:

  Cisco Catalyst 9200 Series switches provide optimum power saving with Energy Efficient Ethernet (EEE) on the RJ-45 ports and low-power operations for industry best-in-class power management and power consumption capabilities. The ports support reduced power modes so that ports not in use can move into a lower power utilization state. Other efficient switch operation features are as follows:
  - Per-port power consumption command allows customers to specify a maximum power setting on an individual port.
  - Per-port PoE power sensing measures actual power being drawn, enabling more intelligent control of powered devices. The PoE MIB provides proactive visibility into power usage and allows you to set different power-level thresholds.

- Bluetooth ready:

  Cisco Catalyst 9200 Series switches have hardware support to connect a Bluetooth dongle to your switch, enabling you to use this wireless interface as an IP management port interface. The port can be used for configuration and troubleshooting using WebUI or the Command-Line Interface (CLI), and to transfer images and configurations.

High-performance ip routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in Cisco Catalyst 9200 Series switches, based on:

- IP unicast routing protocols (including static, Routing Information Protocol Version 1 [RIPv1], RIPv2, RIPng, and Open Shortest Path First [OSPF], Routed Access) are supported for small network routing applications with the Network Essentials stack. Equal-cost routing facilitates Layer 3 load balancing and redundancy across the stack.
- Advanced IP unicast routing protocols (including Full [OSPF], Enhanced Interior Gateway Routing Protocol [EIGRP], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and for constructing scalable LANs. IPv6 routing (using OSPFv3 and EIGRPv6) is supported in hardware for maximum performance.
- Protocol-Independent Multicast (PIM) for IP multicast routing is supported, including PIM sparse mode (PIM SM), and Source-Specific Multicast (SSM).
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting.

Licensing

Packaging: Network and Cisco DNA licensing

The Cisco Catalyst 9000 family of switches introduces a new and simplified licensing package in the form of base and add-on licenses.

- The perpetual licensing package includes the Network Essentials and Network Advantage licensing options that are tied to the hardware. Between them, the base licensing packages cover switching fundamentals, management automation, troubleshooting, and advanced switching features. These Network licenses are perpetual.
- The subscription licensing package includes the Cisco DNA Essentials and Cisco DNA Advantage options. In addition to on-box capabilities, the features available with this package provide Cisco innovations on the switch, as well as on Cisco DNA Center. The Cisco DNA subscription licenses are mandatory at the time of configuration.

License consumption is easily determined by the package itself. While perpetual licenses are always permanent and without an expiration date, subscription licenses have to be purchased for a 3-, 5-, or 7-year term (and hence are also known as term-based licenses). Table 12 shows the combinations of perpetual and subscription licenses that must be purchased.

Supported licensing combinations

Table 9. Licensing combinations

	Cisco DNA Premier	Cisco DNA Advantage	Cisco DNA Essentials
Network Essentials	No	No	Yes
Network Advantage	Yes	Yes	No*

* At the time of license renewal, the Cisco DNA Essentials license can be purchased to be used with Network Advantage.

Cisco DNA Premier subscription

Cisco DNA Premier subscriptions offer a flexible way to buy software for the access, WAN, and data center domains. At each stage in the product lifecycle, Cisco DNA Premier subscriptions help make buying, managing, and upgrading your network and infrastructure software easier. Cisco DNA Premier subscriptions provide:

- Flexible licensing models to smoothly distribute customers' software spending over time
- Investment protection for software purchases through software services–enabled license portability
- Lower cost of entry with the new Cisco DNA Premier Subscription for Switching model

For ordering information for Cisco DNA Premier Software for Cisco Catalyst 9200 Series switches, go to: https://www.cisco.com/c/en/us/products/collateral/software/one-subscription-switching/nb-06-dna-sw-sub-access-sw-ctp-en.html.

Cisco Catalyst 9200 Series switches run on Cisco IOS XE Release 16.9.2 or later. This software release includes all the features listed earlier in the Platform Software Benefits section.

Managing licenses with Smart Accounts: Creating Smart Accounts by using the Cisco Smart Software Manager (Cisco SSM) enables you to order devices and licensing packages and also manage your software licenses from a centralized website. You can set up Cisco SSM to receive daily email alerts and to be notified of expiring add-on licenses that you want to renew.

You must order an add-on license in order to purchase a switch. When the license term expires, you can either renew the add-on license to continue using it or deactivate the add-on license and then reload the switch to continue operating with the base license capabilities.

Both the base and add-on licenses are also available for a 90-day evaluation period. An evaluation license is activated temporarily, without purchase. An expired evaluation license cannot be reactivated after reload.

Note: It is not required to deploy Cisco DNA Center, just to use one of the above packages.

Tables 10 shows the features included in the Network Essentials and Advantage packages.

Table 11 shows the features included in the Cisco DNA Essentials and Advantage packages.

Network licensing

Table 10. Network essentials and advantage package features

Features on Cisco Catalyst uplink switches	Network Essentials	Network Advantage
Switch fundamentals Layer 2, Routed Access (RIP, EIGRP Stub, OSPF - 1000 routes), PBR, PIM Stub Multicast (1000 routes), PVLAN, VRRP, PBR, CDP, QoS, FHS, 802.1X, MACsec-128, CoPP, SXP, IP SLA Responder	✓	✓
Advanced switch capabilities and scale EIGRP, HSRP, IS-IS, BSR, MSDP, IP SLA, OSPF	✗	✓
Network segmentation VRF, VXLAN, LISP, SGT	✗	✓
Automation NETCONF, RESTCONF, YANG, PnP Agent, PnP	✓	✓
Telemetry and visibility Model-driven telemetry, sampled NetFlow, SPAN, RSPAN	✓	✓
Security MACsec-128	✓	✓

Cisco DNA licensing

Table 11. Cisco DNA Essentials, Advantage, and Premier Package Features

Features	Cisco DNA Essentials	Cisco DNA Advantage	Cisco DNA Premier
Switch features			
Advanced telemetry and visibility Full Flexible NetFlow, EEM	✓	✓	✓

Features	Cisco DNA Essentials	Cisco DNA Advantage	Cisco DNA Premier
Optimized telemetry and visibility AVC (NBAR2)	✗	✓	✓
Cisco DNA Center features			
Day-0 network bring-up automation Cisco Network Plug-and-Play application, network settings, device credentials, LAN automation, host onboarding	✓	✓	✓
Element management Discovery, inventory, topology, software image, licensing, and configuration management	✓	✓	✓
Element management Patch management	✗	✓	✓
Basic Assurance Health dashboards – Network, Client, Application; switch and wired client health monitoring	✓	✓	✓
SD-Access Policy-based automation and assurance for wired and wireless	✗	✓	✓
Network assurance and analytics Global insights, trends, compliance, custom reports; switch 360, wired client 360; fabric and non-fabric insights; app health, app 360, app performance (loss, latency, jitter)	✗	✓	✓
Other Software included (can be purchased separately)			
ISE Base	✗	✗	✓
ISE Plus	✗	✗	✓
StealthWatch	✗	✗	✓

Specifications

Dimensions, Eight, Acoustic, Mean time between failures

Table 12 shows the dimensions, weights, acoustic, and mean time between failures of all models of Cisco Catalyst 9200 Series switches.

Table 12. Model Dimensions, Weight, and Mean time between failures metrics

Platform Physical Specifications				
	Chassis Dimensions		Chassis + FEP + Fan Dimensions (HxWxD)	
Model	Inches	Centimeters	Inches	Centimeters
C9200-24T	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200-24P	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200-48T	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1

Platform Physical Specifications				
	Chassis Dimensions		Chassis + FEP + Fan Dimensions (HxWxD)	
Model	Inches	Centimeters	Inches	Centimeters
C9200-48P	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200L-24T-4G	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-24P-4G	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-48T-4G	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-48P-4G	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-24T-4X	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-24P-4X	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-48T-4X	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-48P-4X	1.73 x 17.5 x 11.3	4.4 x 44.5 x 28.8	1.73 x 17.5 x 12.9	4.4 x 44.5 x 32.9
C9200L-24PXG-4X	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200L-24PXG-2Y	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200L-48PXG-4X	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1
C9200L-48PXG-2Y	1.73 x 17.5 x 13.8	4.4 x 44.5 x 35.0	1.73 x 17.5 x 15.4	4.4 x 44.5 x 39.1

Model	Pounds	Kilograms
C9200-24T	11.02	5.0
C9200-24P	12.12	5.5
C9200-48T	11.02	5.0
C9200-48P	12.12	5.5
C9200L-24T-4G	9.59	4.35
C9200L-24P-4G	10.38	4.71
C9200L-48T-4G	9.97	4.53
C9200L-48P-4G	10.58	4.80
C9200L-24T-4X	9.59	4.35
C9200L-24P-4X	10.38	4.71
C9200L-48T-4X	9.97	4.53
C9200L-48P-4X	10.58	4.80
C9200L-24PXG-4X	12	5.44
C9200L-24PXG-2Y	12	5.44
C9200L-48PXG-4X	12.6	5.71
C9200L-48PXG-2Y	12.6	5.71

Mean time between failures (hours)	
C9200-24T	587,800
C9200-24P	422,310
C9200-48T	571,440
C9200-48P	375,570
C9200L-24T-4G	531,030
C9200L-24P-4G	392,210
C9200L-48T-4G	508,700
C9200L-48P-4G	347,760
C9200L-24T-4X	525,990
C9200L-24P-4X	390,310
C9200L-48T-4X	503,400
C9200L-48P-4X	346,270
C9200L-24PXG-4X	379,410
C9200L-24PXG-2Y	374,730
C9200L-48PXG-4X	337,360
C9200L-48PXG-2Y	337,260

Environmental ranges			
Acoustic noise Measured per ISO 7779 and declared per ISO 9296 Bystander positions operating to an ambient temperature of 25°C	With AC power supply (with 24 PoE+ ports loaded): • LpA: 42dB typical, 45 dB max • LwA: 5.3B typical, 5.6B max Typical: Noise emission for a typical configuration Maximum: Statistical maximum to account for variation in production		

Connectors

Table 13 shows the supported connectors for Cisco Catalyst 9200 Series switches.

Table 13. Connectors

Connectors and cabling	• 1000BASE-T ports: RJ-45 connectors, 4-pair Cat 5E UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Cat 5E UTP cabling • 100BASE-FX, 1000BASE-SX, -LX/LH, -ZX, -BX10, dense wavelength-division multiplexing (DWDM) and Coarse Wavelength-Division Multiplexing (CWDM) SFP transceivers: LC fiber connectors (single-mode or multimode fiber) • 10GBASE-SR, LR, LRM (only C9200), ER, ZR, DWDM SFP+ transceivers: LC fiber connectors (single-mode or multimode fiber) • SFP+ connector • Cisco StackWise-160/80 stacking ports: copper-based Cisco StackWise cabling

	• Ethernet management port: RJ-45 connectors, 4-pair Cat 5 UTP cabling • Management console port: RJ-45-to-DB9 cable for PC connections, USB-C adaptor, USB adaptor
Power connectors	• Internal power supply connector: The internal power supply is an auto-ranging unit. It supports input voltages between 100 and 240 VAC. Use the supplied AC power cord to connect the AC power connector to an AC power outlet.

For the latest Cisco transceiver module compatibility information, refer to https://www.cisco.com/c/en/us/td/docs/interfaces_modules/transceiver_modules/compatibility/matrix/TMG_CM_Tool_User_Manual.html.

Management and standards support

Table 14 shows management and standards support for Cisco Catalyst 9200 Series switches.

Table 14. Management and standards support*

Description	Specification	
Management	BRIDGE-MIB	CISCO-NHRP-EXT-MIB
	CISCO-BRIDGE-EXT-MIB	CISCO-NTP-MIB
	CISCO-BULK-FILE-MIB	CISCO-PAGP-MIB
	CISCO-CABLE-DIAG-MIB	CISCO-PORT-SECURITY-MIB
	CISCO-CALLHOME-MIB	CISCO-PORT-STORM-CONTROL-MIB
	CISCO-CEF-MIB	CISCO-POWER-ETHERNET-EXT-MIB
	CISCO-CIRCUIT-INTERFACE-MIB	CISCO-PRIVATE-VLAN-MIB
	CISCO-CONFIG-COPY-MIB	CISCO-PROCESS-MIB
	CISCO-CONFIG-MAN-MIB	CISCO-PRODUCTS-MIB
	CISCO-DEVICE-LOCATION-MIB	CISCO-RF-MIB
	CISCO-DHCP-SNOOPING-MIB	CISCO-RTP-METRICS-MIB
	CISCO-EIGRP-MIB	CISCO-RTTMON-ICMP-MIB
	CISCO-EMBEDDED-EVENT-MGR-MIB	CISCO-STACKWISE-MIB
	CISCO-ENTITY-FRU-CONTROL-MIB	CISCO-STP-EXTENSIONS-MIB
	CISCO-ENTITY-SENSOR-MIB	CISCO-SYSLOG-MIB
	CISCO-ENTITY-VENDORTYPE-OID-MIB	CISCO-TCP-MIB
	CISCO-ERR-DISABLE-MIB	CISCO-UDLDP-MIB
	CISCO-FLASH-MIB	CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
	CISCO-FLOW-MONITOR-MIB	ENTITY-MIB
	CISCO-FTP-CLIENT-MIB	HC-ALARM-MIB
	CISCO-HSRP-EXT-MIB	HC-RMON-MIB
	CISCO-HSRP-MIB	IEEE8023-LAG-MIB
	CISCO-IETF-BFD-MIB	IF-MIB
	CISCO-IETF-PPVPN-MPLS-VPN-MIB	IP-FORWARD-MIB
	CISCO-IETF-PW-MPLS-MIB	IP-MIB
	CISCO-IF-EXTENSION-MIB	LLDP-EXT-MED-MIB
	CISCO-IGMP-FILTER-MIB	LLDP-MIB
	CISCO-IMAGE-LICENSE-MGMT-MIB	MAU-MIB
	CISCO-IMAGE-MIB	MPLS-L3VPN-STD-MIB
	CISCO-IP-CBR-METRICS-MIB	MPLS-LSR-STD-MIB

Description	Specification	
	CISCO-IP-STAT-MIB CISCO-IP-TAP-MIB CISCO-IP-URPF-MIB CISCO-IPSEC-FLOW-MONITOR-MIB CISCO-IPSEC-MIB CISCO-IPSEC-PROVISIONING-MIB CISCO-IPSLA-AUTOMEASURE-MIB CISCO-IPSLA-ECHO-MIB CISCO-IPSLA-JITTER-MIB CISCO-L2-CONTROL-MIB CISCO-L2L3-INTERFACE-CONFIG-MIB CISCO-LAG-MIB CISCO-LICENSE-MGMT-MIB CISCO-LOCAL-AUTH-USER-MIB CISCO-MAC-NOTIFICATION-MIB CISCO-MDI-METRICS-MIB CISCO-MEDIA-METRICS-MIB CISCO-MEMORY-POOL-MIB CISCO-MPLS-LSR-EXT-STD-MIB CISCO-NBAR-PROTOCOL-DISCOVERY-MIB	MPLS-VPN-MIB OLD-CISCO-CHASSIS-MIB OLD-CISCO-CPU-MIB OLD-CISCO-INTERFACES-MIB OLD-CISCO-IP-MIB OLD-CISCO-MEMORY-MIB OLD-CISCO-SYS-MIB OLD-CISCO-TCP-MIB OLD-CISCO-TS-MIB POWER-ETHERNET-MIB RFC1213-MIB RMON-MIB RMON2-MIB SMON-MIB SNMPv2-MIB SONET-MIB TCP-MIB UDP-MIB
Standards	EEE 802.1s IEEE 802.1w IEEE 802.1x IEEE 802.1x-Rev IEEE 802.3ad IEEE 802.3af IEEE 802.3at IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports IEEE 802.1D Spanning Tree Protocol IEEE 802.1p CoS prioritization IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification	RMON I and II standards SNMPv1, v2c, and v3

Power supply specifications

Table 15 lists the power specifications for Cisco Catalyst 9200 Series switches based on the kind of power supply used.

Table 15. Power supply specifications

Description	Specification					
	PWR-C5-125WAC	PWR-C6-125WAC	PWR-C5-600WAC	PWR-C6-600WAC	PWR-C5-1KWAC	PWR-C6-1KWAC
Power supply rated maximum	125W	125W	600W	600W	1000W	1000W
Total output BTU (note: 1000 BTU/hr = 293W)	426.5 BTU/hr, 125W	426.5 BTU/hr, 125W	2047.3 BTU/hr, 600W	2047.3 BTU/hr, 600W	3412 BTU/hr, 1000W	3412 BTU/hr, 1000W
Input-voltage range and frequency	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz
Input current	1.6-0.7A	1.6-0.7A	7-2.8A	7-2.8A	12-6A	12-6A
Output ratings	12V at 10.5A	12V at 10.5A	54V at 11.1A	54V at 11.1A	54V at 16.5A	54V at 16.5A
Output holdup time	20 ms minimum at 100 VAC	20 ms minimum at 100 VAC	20 ms minimum at 100 VAC	20 ms minimum at 100 VAC	20 ms minimum at 100 VAC	20 ms minimum at 100 VAC
Power-supply input receptacles	IEC 320-C14 (IEC60320-C14)	IEC 320-C14 (IEC60320-C14)	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)
Power cord rating	10A	10A	15A	15A	15A	15A
Physical specifications	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 1.5 lb (0.68 kg)	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 1.5 lb (0.68 kg)	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 1.7 lb (0.77 kg)	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 1.7 lb (0.77 kg)	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 2 lb (0.9 kg)	(H x W x D): 1.58" x 4.0" x 7.6" Weight: 2 lb (0.9 kg)
Supported Product Family	C9200, C9200L	C9200	C9200, C9200L	C9200	C9200, C9200L	C9200
Operating temperature	Normal operating temperature* and altitudes: • -5°C to +45°C, up to 5000 feet (1500m) • -5°C to +40°C, up to 10,000 feet (3000m) * Minimum ambient temperature for cold start is 32°F (0°C) Short-term* exceptional conditions: • -5°C to +50°C, up to 5000 feet (1500m) • -5°C to +45°C, up to 10,000 feet (3000m) • -5°C to +45°C, at sea level with single fan failure * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences					
Storage temperature	-40° to 158°F (-40° to 70°C)					
Relative humidity operating and nonoperating noncondensing	5% to 90% noncondensing					
Altitude	10,000 ft. (3000 meters), up to 45°C					

Description	Specification
EMI and EMC compliance	FCC Part 15 (CFR 47) Class A ICES-003 Class A EN 55032 Class A CISPR 32 Class A AS/NZS 3548 Class A BSMI Class A VCCI Class A CISPR 35 EN 55024, EN300 386*, EN 61000-3-2, EN 61000-3-3 EN 61000-6-1
Safety compliance	UL 60950-1, CAN/CSA-C22.2 No. 60950-1, EN 60950-1, IEC 60950-1, CCC, CE Marking
LED indicators	“AC OK”: Input power to the power supply is OK “PS OK”: Output power from the power supply is OK

* Use shielded cables for locations other than telecom centers

Power consumption of Standalone 9200 Series switches

Table 16 shows the power consumption of standalone Cisco Catalyst 9200 Series switches based on Alliance for Telecommunications Industry Solutions (ATIS) testing using Internet Mix (IMIX) distribution stream traffic, with input voltage of 115VAC at 60 Hz and no PoE loading. The values given are the maximum possible power consumption numbers under the respective test scenarios.

Table 16. Power consumption of Standalone Catalyst 9200 Series switches

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
SKU	FEP	Uplink	Input	0.01% / EEE	10%	30%	50%	100%	0.01% / EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9200-24T	125W (C5/C6)	C9200-NM-4X1G	115VAC	33.09	36.08	36.15	36.20	36.34	35.51	41.78	41.89	42.00	42.27	41.20	30.65				
			230VAC	33.15	35.95	36.00	36.06	36.19	35.36	41.50	41.62	41.74	42.01	40.94	30.53				
C9200-24T	125W	C9200-NM–4X10G	115VAC	33.62	36.99	37.29	37.58	38.26	35.41	42.00	42.55	43.11	44.49	41.588	32.20				
			230VAC	33.70	36.85	37.13	37.41	38.10	35.40	41.75	42.30	42.85	44.22	41.364	31.90				
C9200-24P	600W (C5/C6)	C9200-NM-4X1G	115VAC	43.57	47.37	47.42	47.47	47.68	46.82	53.79	53.91	54.02	54.30	53.14	40.75	150.71	251.67	416.85	457.98
			230VAC	43.38	46.92	46.95	47.03	47.18	46.35	53.23	53.34	53.45	53.76	52.59	40.43	148.14	247.03	406.62	446.27
C9200-24P	600W (C5/C6)	C9200-NM-4X10G	115VAC	44.62	48.49	48.79	49.11	49.88	47.02	54.18	54.77	55.34	56.77	53.72	42.55	144.60	245.42	410.22	451.45
			230VAC	44.32	48.06	48.37	48.66	49.40	46.41	53.38	53.99	54.51	55.96	52.94	42.26	142.29	241.14	400.76	440.37

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
C9200-48T	125W (C5/C6)	C9200-NM-4X1G	115VAC	36.57	45.09	45.45	45.63	45.70	36.98	53.95	55.36	53.91	55.87	52.445	36.98				
			230VAC	36.99	45.58	45.65	45.71	45.86	36.48	54.51	54.64	54.7	55.04	52.76	36.48				
C9200-48T	125W (C5/C6)	C9200-NM-4X10G	115VAC	38.84	47.07	48.67	48.71	50.41	39.20	56.33	58.36	58.75	61.80	55.164	38.38				
			230VAC	39.1	47.11	47.91	48.37	49.65	39.46	56.32	57.25	58.19	60.72	55.074	38.67				
C9200-48P	1000W (C5/C6)	C9200-NM-4X1G	115VAC	56.07	60.25	60.31	60.36	60.55	56.45	69.33	69.46	69.56	69.87	68.10	50.42	262.61	467.50	812.39	899.99
			230VAC	55.66	59.98	60.05	60.05	60.27	56.09	69.07	69.20	69.30	69.58	67.83	50.04	258.08	457.61	785.35	867.75
C9200-48P	1000W (C5/C6)	C9200-NM-4X10G	115VAC	54.27	61.71	62.20	62.68	63.88	56.114	70.93	70.95	71.92	74.39	69.79	52.26	262.38	467.41	812.23	899.40
			230VAC	53.89	61.09	61.60	62.07	63.24	55.79	69.52	70.47	71.43	73.89	68.58	51.34	257.97	457.30	785.03	867.35
C9200L-24T-4G	125W (C5)	Fixed	115VAC	30.03	32.15	32.17	32.2	32.33	32.03	35.90	35.98	36.06	36.23	35.546	27.39				
			230VAC	29.81	32.26	32.23	32.22	32.35	31.86	35.86	35.94	36.03	36.28	35.502	27.50				
C9200L-24P-4G	600W (C5)	Fixed	115VAC	39.28	43.98	44.04	44.08	44.22	38.95	48.47	48.6	48.74	49.00	47.571	39.59	153.06	256.56	423.44	466.34
			230VAC	38.88	43.6	43.66	43.69	43.83	38.57	48.09	48.22	48.35	48.62	47.191	39.20	150.51	252.10	413.89	455.15
C9200L-24T-4X	125W (C5)	Fixed	115VAC	30.99	31.98	32.21	32.43	33.04	33.29	36.62	37.02	37.47	38.6	36.485	27.82				
			230VAC	30.98	32.02	32.24	32.46	33.02	33.24	36.59	36.96	37.41	38.52	36.448	27.90				
C9200L-24P-4X	600W (C5)	Fixed	115VAC	42.83	44.15	44.62	44.72	45.39	45.45	51.08	51.52	52.2	53.49	50.758	40.17	144.82	241.99	401.32	445.35
			230VAC	42.36	44.19	44.47	44.61	45.28	44.6	49.33	49.91	50.36	51.51	49.075	39.48	142.32	237.52	392.77	434.06
C9200L-48T-4G	125W (C5)	Fixed	115VAC	33.85	40.11	40.20	40.24	40.34	32.74	46.65	46.88	46.96	47.33	45.327	33.85				
			230VAC	33.62	40.5	40.57	40.63	40.74	33.06	46.8	46.91	47.05	47.49	45.495	34.16				
C9200L-48P-4G	1000W (C5)	Fixed	115VAC	45.07	52.15	52.22	52.28	52.44	44.6	58.59	58.7	58.81	59.1	57.242	45.82	270.96	484.59	842.07	933.03
			230VAC	44.55	51.5	51.55	51.6	51.77	44.08	57.82	57.91	58.04	58.29	56.493	45.17	266.35	474.24	814.85	899.58
C9200L-48T-4X	125W (C5)	Fixed	115VAC	35.52	42.36	42.9	43.35	43.69	35.06	49.27	50.24	51.19	53.60	48.282	36.08				
			230VAC	35.84	42.60	43.09	43.58	44.81	35.27	49.41	50.36	51.33	53.67	48.422	36.38				
C9200L-48P-	1000W (C5)	Fixed	115VAC	53.12	56.89	57.34	57.80	57.81	55.22	63.92	64.86	65.84	68.36	63.494	50.31	262.59	463.36	789.46	872.6
			230VAC	52.63	56.37	56.82	57.3	58.47	54.71	63.41	64.32	65.27	67.64	62.963	50.02	258.64	453.81	766.04	843.89

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
4X																			
C9200L-48PXG-4X	1000W (C5)	Fixed	115VAC	82.60	87.80	88.28	88.76	89.95	92.56	103.53	104.55	105.57	108.19	102.90	72.14	291.62	496.85	842.43	930.11
			230VAC	81.77	86.62	87.11	87.60	88.82	91.87	102.05	103.02	103.98	106.40	101.47	72.50	286.71	486.25	814.71	898.24
C9200L-24PXG-4X	600W (C5)	Fixed	115VAC	70.94	73.88	74.37	74.84	76.02	77.37	84.12	85.06	86.00	88.32	83.86	64.54	173.05	271.04	431.68	472.39
			230VAC	70.10	73.04	73.62	74.07	75.15	76.74	82.96	83.86	84.78	87.09	82.75	64.04	170.02	265.51	420.96	459.88
C9200L-48PXG-2Y	1000W (C5)	Fixed	115VAC	81.81	85.14	85.81	86.49	88.08	89.40	96.32	97.51	98.71	101.76	96.17	71.45	294.56	500.25	846.33	934.08
			230VAC	79.59	82.94	83.64	84.28	85.81	88.20	95.17	96.36	97.52	100.40	95.00	70.28	283.88	483.54	812.20	894.11
C9200L-24PXG-2Y	600W (C5)	Fixed	115VAC	70.54	73.04	73.78	74.46	76.10	76.25	83.50	84.78	86.09	89.26	83.35	65.58	178.82	280.13	446.82	489.62
			230VAC	68.89	72.02	72.66	73.35	74.93	75.32	82.00	83.34	84.64	87.87	81.92	65.01	175.55	274.59	434.38	475.39

Safety and compliance

Table 17 lists the safety and compliance information for Cisco Catalyst 9200 Series switches.

Table 17. Safety and compliance information

Description	Specification
Safety certifications	• IEC 60950-1 • UL 60950-1 • CAN/CSA C22.2 No. 60950-1 • EN 60950-1 • AS/NZS 60950.1 • Class I Equipment
Electromagnetic emissions certifications	• 47 CFR Part 15 • CISPR 22 Class A • CISPR 32 Class A • CNS 13438 • EN 300 386* • EN 55022 Class A • EN 55032 Class A • EN61000-3-2 • EN61000-3-3 • ICES-003 Class A • KN 32 • TCVN 7189 Class A • V-3 Class A • CISPR 24 • EN 300 386* • EN 55024 • KN 35 • TCVN 7317
Environmental	Reduction of Hazardous Substances (ROHS) 5

* Use shielded cables for locations other than telecom centers

Warranty

Cisco enhanced limited lifetime hardware warranty

Cisco Catalyst 9200 Series switches come with a Cisco Enhanced Limited Lifetime Warranty (E-LLW) that includes Next-Business-Day (NBD) delivery of replacement hardware where available and 90 days of 8x5 Cisco Technical Assistance Center (TAC) support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the information packet that accompanies your Cisco product. We encourage you to review the warranty statement shipped with your specific product carefully before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

For further information about warranty terms, visit https://www.cisco.com/go/warranty. Table 18 provides information about the E-LLW.

Table 18. E-LLW details

	Cisco E-LLW
Devices covered	Applies to Cisco Catalyst 9200 Series switches.
Warranty duration	As long as the original customer owns the product.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the Return Materials Authorization (RMA) request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week, basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 9200 Series product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Cisco services for next-generation Cisco Catalyst switches

Achieve infrastructure excellence faster and with less risk. Cisco Catalyst 9000 Switch Services provide expert guidance to help you successfully deploy, manage and support the Cisco Catalyst 9000 switches. With unmatched networking expertise, best practices and innovative tools, we can help you reduce overall upgrade, refresh, and migration costs as you introduce new hardware, software and protocols into the network. Offering a comprehensive lifecycle of services – from implementation, optimization, technical and managed services – Cisco experts help you minimize disruption and achieve operational excellence to extract maximum value from your Cisco DNA ready infrastructure.

Learn more about Cisco Services for Enterprise Networks

Software Policy for Cisco Catalyst 9200 Series switches

Software Policy for Network Stack Components

Customers with the Network Essentials Stack and Network Advantage Stack software feature sets are provided with maintenance updates and bug fixes designed to maintain compliance of the software. This includes compliance with published specifications, release notes, and industry standards as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for the product, whichever occurs earlier.

Cisco Embedded Support for Cisco DNA Term Components

Cisco Embedded Support delivers the right support for Cisco software products and suites. It will keep your business applications performing as expected and protect your investment. Cisco Embedded Support for the Cisco DNA Essentials and Cisco DNA Advantage term components is included. Cisco Embedded Support provides access to TAC support, major software updates, maintenance and minor software releases, and the Cisco Embedded Support site, for increased productivity with anytime access.

Ordering

Ordering information

Table 19 lists ordering information for Cisco Catalyst 9200 Series switches. To place an order, visit the Cisco Ordering home page at https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 19. Ordering information

Switches	
Product number	Product description
C9200-24T-A	Catalyst 9200 24-port Data Switch, Network Advantage
C9200-24T-E	Catalyst 9200 24-port Data Switch, Network Essentials
C9200-24P-A	Catalyst 9200 24-port PoE+ Switch, Network Advantage
C9200-24P-E	Catalyst 9200 24-port PoE+ Switch. Network Essentials
C9200-48T-A	Catalyst 9200 48-port Data Switch, Network Advantage
C9200-48T-E	Catalyst 9200 48-port Data Switch, Network Essentials
C9200-48P-A	Catalyst 9200 48-port PoE+ Switch, Network Advantage
C9200-48P-E	Catalyst 9200 48-port PoE+ Switch, Network Essentials
C9200L-24T-4G-A	Catalyst 9200L 24-port Data 4x1G uplink Switch, Network Advantage
C9200L-24T-4G-E	Catalyst 9200L 24-port Data 4x1G uplink Switch, Network Essentials
C9200L-24P-4G-A	Catalyst 9200L 24-port PoE+ 4x1G uplink Switch, Network Advantage
C9200L-24P-4G-E	Catalyst 9200L 24-port PoE+ 4x1G uplink Switch, Network Essentials
C9200L-48T-4G-A	Catalyst 9200L 48-port Data 4x1G uplink Switch, Network Advantage
C9200L-48T-4G-E	Catalyst 9200L 48-port Data 4x1G uplink Switch, Network Essentials
C9200L-48P-4G-A	Catalyst 9200L48-port PoE+ 4x1G uplink Switch, Network Advantage
C9200L-48P-4G-E	Catalyst 9200L48-port PoE+ 4x1G uplink Switch, Network Essentials
C9200L-24T-4X-A	Catalyst 9200L 24-port Data 4x10G uplink Switch, Network Advantage
C9200L-24T-4X-E	Catalyst 9200L 24-port Data 4x10G uplink Switch, Network Essentials
C9200L-24P-4X-A	Catalyst 9200L 24-port PoE+ 4x10G uplink Switch, Network Advantage
C9200L-24P-4X-E	Catalyst 9200L 24-port PoE+ 4x10G uplink Switch, Network Essentials
C9200L-48T-4X-A	Catalyst 9200L 48-port Data 4x10G uplink Switch, Network Advantage
C9200L-48T-4X-E	Catalyst 9200L 48-port Data 4x10G uplink Switch, Network Essentials

Switches	
C9200L-48P-4X-A	Catalyst 9200L 48-port PoE+ 4x10G uplink Switch, Network Advantage
C9200L-48P-4X-E	Catalyst 9200L 48-port PoE+ 4x10G uplink Switch, Network Essentials
C9200L-24PXG-4X-E	Catalyst 9200L 24-port 8xmGig, 16x1G, 4x10G, PoE+, Network Essentials
C9200L-24PXG-4X-A	Catalyst 9200L 24-port 8xmGig, 16x1G, 4x10G, PoE+, Network Advantage
C9200L-48PXG-4X-E	Catalyst 9200L 48-port 12xmGig, 36x1G, 4x10G PoE+, Network Essentials
C9200L-48PXG-4X-A	Catalyst 9200L 48-port 12xmGig, 36x1G, 4x10G PoE+, Network Advantage
C9200L-24PXG-2Y-E	Catalyst 9200L 24-port 8xmGig, 16x1G, 2x25G, PoE+, Network Essentials
C9200L-24PXG-2Y-A	Catalyst 9200L 24-port 8xmGig, 16x1G, 2x25G, PoE+, Network Advantage
C9200L-48PXG-2Y-E	Catalyst 9200L 48-port 8xmGig, 40x1G, 2x25G PoE+, Network Essentials
C9200L-48PXG-2Y-A	Catalyst 9200L 48-port 8xmGig, 40x1G, 2x25G PoE+, Network Advantage
Network modules	
Product number	Product description
C9200-NM-4G	Catalyst 9200 4 x 1GE Network Module
C9200-NM-4X	Catalyst 9200 4 x 10GE Network Module, spare
C9200-NM-BLANK	Catalyst 9200 BLANK Network Module
StackWise-80 and StackWise-160 Kit and cables	
Product number	Product description
C9200-STACK-KIT=	C9200 Stack Kit Spare
C9200L-STACK-KIT=	C9200L Stack Kit Spare
STACK-T4-50CM	50CM Type 3 Stacking Cable
STACK-T4-50CM=	50CM Type 3 Stacking Cable, spare
STACK-T4-1M	1M Type 3 Stacking Cable
STACK-T4-1M=	1M Type 3 Stacking Cable, spare
STACK-T4-3M	3M Type 3 Stacking Cable
STACK-T4-3M=	3M Type 3 Stacking Cable, spare
Software licenses	
Product number	Product description
C9200-DNA-P-24	C9200 Cisco DNA Premier Term, 24-Port: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9200-DNA-P-24-3Y	C9200 Cisco DNA Premier, 24-port, 3Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200-DNA-P-24-5Y	C9200 Cisco DNA Premier, 24-port, 5Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200-DNA-P-24-7Y	C9200 Cisco DNA Premier, 24-port, 7Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH

Switches	
C9200-DNA-P-48	C9200 Cisco DNA Premier Term, 48-Port: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9200-DNA-P-48 -3Y	C9200 Cisco DNA Premier, 48-port, 3Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200-DNA-P-48 -5Y	C9200 Cisco DNA Premier, 48-port, 5Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200-DNA-P-48 -7Y	C9200 Cisco DNA Premier, 48-port, 7Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200-DNA-E-24	C9200 Cisco DNA Essentials Term 24-port
C9200-DNA-E-24-3Y	C9200 Cisco DNA Essentials, 24-port, 3 Year Term license
C9200-DNA-E-24-5Y	C9200 Cisco DNA Essentials, 24-port, 5 Year Term license
C9200-DNA-E-24-7Y	C9200 Cisco DNA Essentials, 24-port, 7 Year Term license
C9200-DNA-E-48	C9200 Cisco DNA Essentials Term 48-port
C9200-DNA-E-48-3Y	C9200 Cisco DNA Essentials, 48-port, 3 Year Term license
C9200-DNA-E-48-5Y	C9200 Cisco DNA Essentials, 48-port, 5 Year Term license
C9200-DNA-E-48-7Y	C9200 Cisco DNA Essentials, 48-port, 7 Year Term license
C9200-DNA-A-24	C9200 Cisco DNA Advantage Term 24-port
C9200-DNA-A-24-3Y	C9200 Cisco DNA Advantage, 24-port, 3 Year Term license
C9200-DNA-A-24-5Y	C9200 Cisco DNA Advantage, 24-port, 5 Year Term license
C9200-DNA-A-24-7Y	C9200 Cisco DNA Advantage, 24-port, 7 Year Term license
C9200-DNA-A-48	C9200 Cisco DNA Advantage Term 48-port
C9200-DNA-A-48-3Y	C9200 Cisco DNA Advantage, 48-port, 3 Year Term license
C9200-DNA-A-48-5Y	C9200 Cisco DNA Advantage, 48-port, 5 Year Term license
C9200-DNA-A-48-7Y	C9200 Cisco DNA Advantage, 48-port, 7 Year Term license
C9200L-DNA-P-24	C9200L Cisco DNA Premier Term, 24-Port: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9200L-DNA-P-24-3Y	C9200L Cisco DNA Premier, 24-port, 3Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-P-24-5Y	C9200L Cisco DNA Premier, 24-port, 5Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-P-24-7Y	C9200L Cisco DNA Premier, 24-port, 7Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-P-48	C9200L Cisco DNA Premier Term, 48-Port: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance

Switches	
C9200L-DNA-P-48-3Y	C9200L Cisco DNA Premier, 48-port, 3Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-P-48 -5Y	C9200L Cisco DNA Premier, 48-port, 5Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-P-48 -7Y	C9200L Cisco DNA Premier, 48-port, 7Y Term – Cisco DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9200L-DNA-E-24	C9200L Cisco DNA Essentials Term 24-port
C9200L-DNA-E-24-3Y	C9200L Cisco DNA Essentials, 24-port, 3 Year Term license
C9200L-DNA-E-24-5Y	C9200L Cisco DNA Essentials, 24-port, 5 Year Term license
C9200L-DNA-E-24-7Y	C9200L Cisco DNA Essentials, 24-port, 7 Year Term license
C9200L-DNA-E-48	C9200L Cisco DNA Essentials Term 48-port
C9200L-DNA-E-48-3Y	C9200L Cisco DNA Essentials, 48-port, 3 Year Term license
C9200L-DNA-E-48-5Y	C9200L Cisco DNA Essentials, 48-port, 5 Year Term license
C9200L-DNA-E-48-7Y	C9200L Cisco DNA Essentials, 48-port, 7 Year Term license
C9200L-DNA-A-24	C9200L Cisco DNA Advantage Term 24-port
C9200L-DNA-A-24-3Y	C9200L Cisco DNA Advantage, 24-port, 3 Year Term license
C9200L-DNA-A-24-5Y	C9200L Cisco DNA Advantage, 24-port, 5 Year Term license
C9200L-DNA-A-24-7Y	C9200L Cisco DNA Advantage, 24-port, 7 Year Term license
C9200L-DNA-A-48	C9200L Cisco DNA Advantage Term 48-port
C9200L-DNA-A-48-3Y	C9200L Cisco DNA Advantage, 48-port, 3 Year Term license
C9200L-DNA-A-48-5Y	C9200L Cisco DNA Advantage, 48-port, 5 Year Term license
C9200L-DNA-A-48-7Y	C9200L Cisco DNA Advantage, 48-port, 7 Year Term license
C9200-LIC=	Electronic Cisco DNA Upgrade License for C9200 switches. Note: when upgrading from Cisco DNA Essentials to Cisco DNA Advantage, Network Essentials is upgraded to Network Advantage
C9200-24-E-A	C9200 24-port NW & DNA Essentials to NW & DNA Advantage Upgrade
C9200-24-E-A-3	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 3Y
C9200-24-E-A-5	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 5Y
C9200-24-E-A-7	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 7Y
C9200-48-E-A	C9200 48-port NW & DNA Essentials to NW & DNA Advantage Upgrade
C9200-48-E-A-3	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 3Y
C9200-48-E-A-5	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 5Y
C9200-48-E-A-7	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 7Y
C9200L-LIC=	Electronic Cisco DNA Upgrade License for C9200L switches. Note: when upgrading from Cisco DNA Essentials to Cisco DNA Advantage, Network Essentials is upgraded to Network Advantage
C9200L-24-E-A	C9200L 24-port NW & DNA Essentials to NW & DNA Advantage Upgrade
C9200L-24-E-A-3	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 3Y
C9200L-24-E-A-5	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 5Y

Switches	
C9200L-24-E-A-7	24-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 7Y
C9200L-48-E-A	C9200L 48-port NW & DNA Essentials to NW & DNA Advantage Upgrade
C9200L-48-E-A-3	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 3Y
C9200L-48-E-A-5	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 5Y
C9200L-48-E-A-7	48-port NW & Cisco DNA Ess to NW&DNA Adv Upgrade License 7Y
Power supplies	
Product Number	Product Description
PWR-C5-125WAC (=)	125W AC Config 5 Power Supply
PWR-C5-125WAC/2	125W AC Config 5 Power Supply - Secondary Power Supply
PWR-C5-600WAC (=)	600W AC Config 5 Power Supply
PWR-C5-600WAC/2	600W AC Config 5 Power Supply - Secondary Power Supply
PWR-C5-1KWAC (=)	1KW AC Config 5 Power Supply
PWR-C5-1KWAC/2	1KW AC Config 5 Power Supply - Secondary Power Supply
PWR-C6-125WAC (=)	125W AC Config 6 Power Supply
PWR-C6-125WAC/2	125W AC Config 6 Power Supply - Secondary Power Supply
PWR-C6-600WAC (=)	600W AC Config 6 Power Supply
PWR-C6-600WAC/2	600W AC Config 6 Power Supply - Secondary Power Supply
PWR-C6-1KWAC (=)	1KW AC Config 6 Power Supply
PWR-C6-1KWAC/2	1KW AC Config 6 Power Supply - Secondary Power Supply
PWR-C5-BLANK=	Blank Module
Spare power cords	
CAB-TA-NA=	AC power cord for Cisco Catalyst (North America)
CAB-TA-AP=	AC power cord for Cisco Catalyst (Australia)
CAB-TA-AR=	AC power cord for Cisco Catalyst (Argentina)
CAB-TA-SW=	AC power cord for Cisco Catalyst (Switzerland)
CAB-TA-UK=	AC power cord for Cisco Catalyst (United Kingdom)
Power supplies	
Spare power cords	
CAB-TA-JP=	AC power cord for Cisco Catalyst (Japan)
CAB-TA-250V-JP=	Japan 250VAC power cord for Cisco Catalyst (Japan)
CAB-TA-125V-JP=	Japan 125V AC Type A Power Cable (Japan – 48 port only)
CAB-TA-EU=	AC power cord for Cisco Catalyst (Europe)
CAB-TA-IT=	AC power cord for Cisco Catalyst (Italy)
CAB-TA-IN=	AC power cord for Cisco Catalyst (India)
CAB-TA-CN=	AC power cord for Cisco Catalyst (China)

Switches	
CAB-TA-DN=	AC power cord for Cisco Catalyst (Denmark)
CAB-TA-IS=	AC power cord for Cisco Catalyst (Israel)
CAB-ACBZ-12A=	AC power cord for Cisco Catalyst (Brazil), 12A/125V BR-3-20 plug up to 12A
CAB-ACBZ-10A=	AC power cord for Cisco Catalyst (Brazil), 10A/250V BR-3-10 plug up to 10A
CAB-C15-CBN	Cabinet jumper power cord, 250VAC 13A, C14-C15 connectors

Optics online reference

Cisco Catalyst 9200 Series switches support a wide range of optics. Because the list of supported optics is updated on a regular basis, consult the tables available here for the latest SFP+ and SFP compatibility information: https://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.

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Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

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Document History

New or revised topic	Described In	Date
Added New Power Supply information PWR-C6-600WAC	Table 3, 15, 16, 19	October 09, 2019
Forwarding rate with Stacking	Table 8	October 09, 2019
Cloud Security Information	General Information	October 09, 2019
Adding C9200L mGig SKUs	Table 1, 3, 8, 12, 16	May 14, 2019
Revisions of Weight, addition of LIC upgrade and other minor edits	Software licenses table and weights table	April 01, 2019
Revised Table of Contents Headings	Specifications (was "Dimensions, eight, acoustic, mean time between failures"), added Document History	January 03, 2019

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C78-741344-04 10/19

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

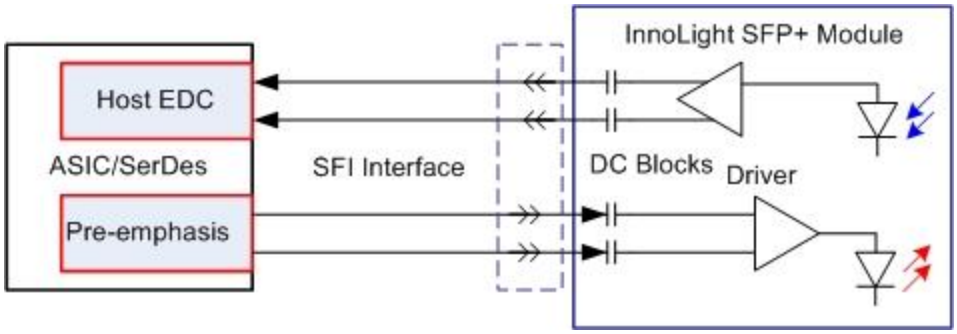


Figure1: Application in System

1. GENERAL DESCRIPTION

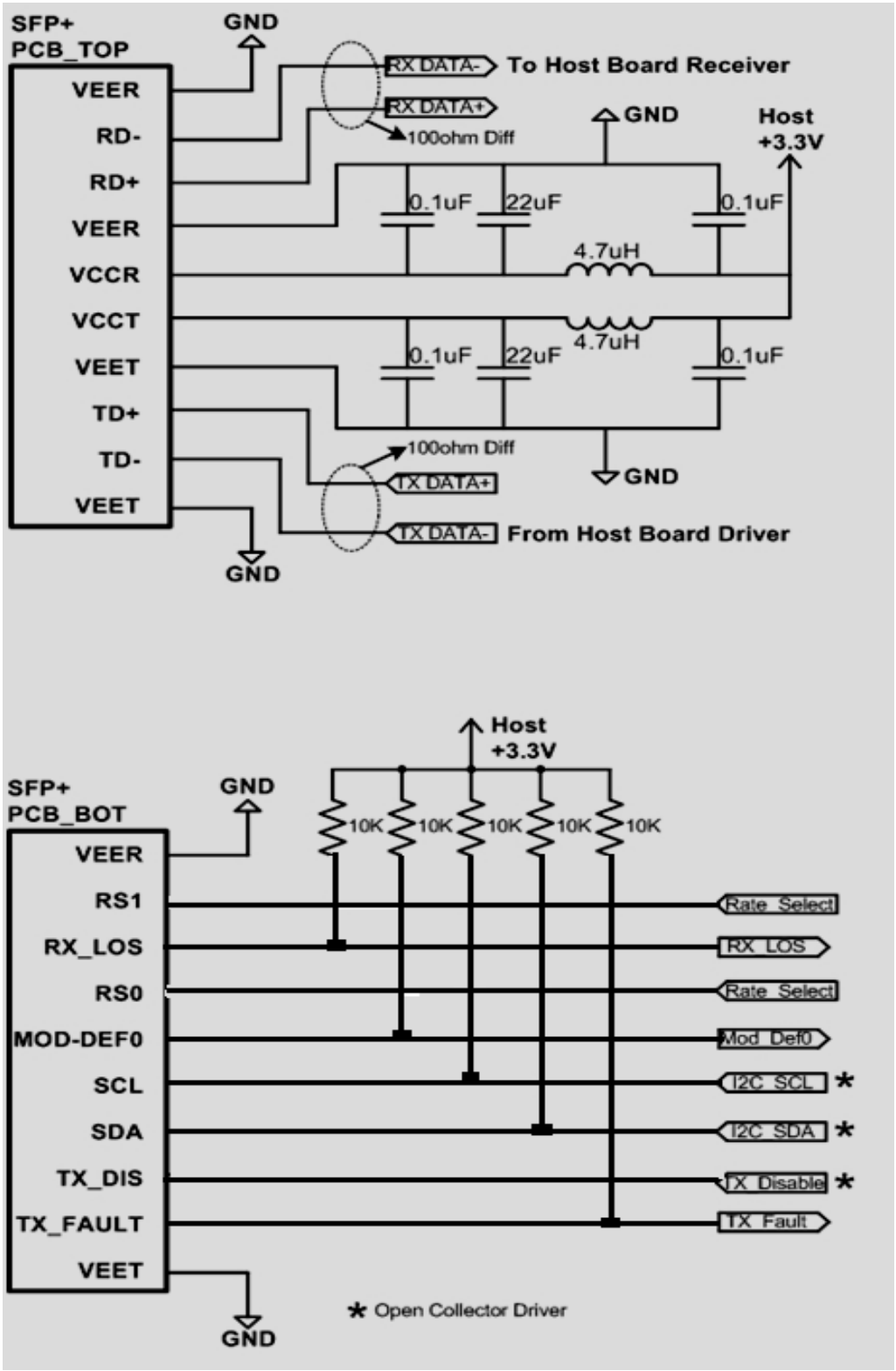
This 10Gigabit SFP+ BiDi transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 20km.

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.

2. PROPOSED APPLICATION SCHEMATICS



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.

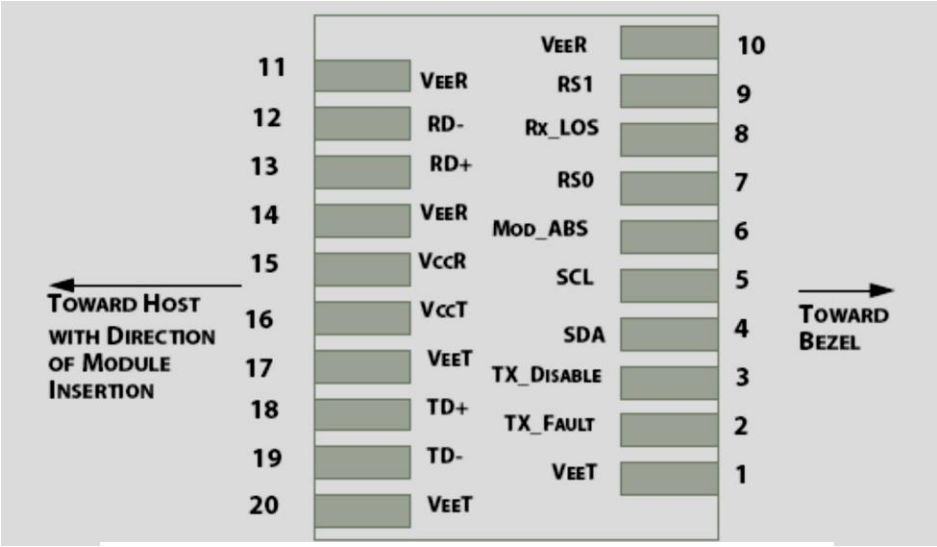


Figure 3: Module Interface to Host

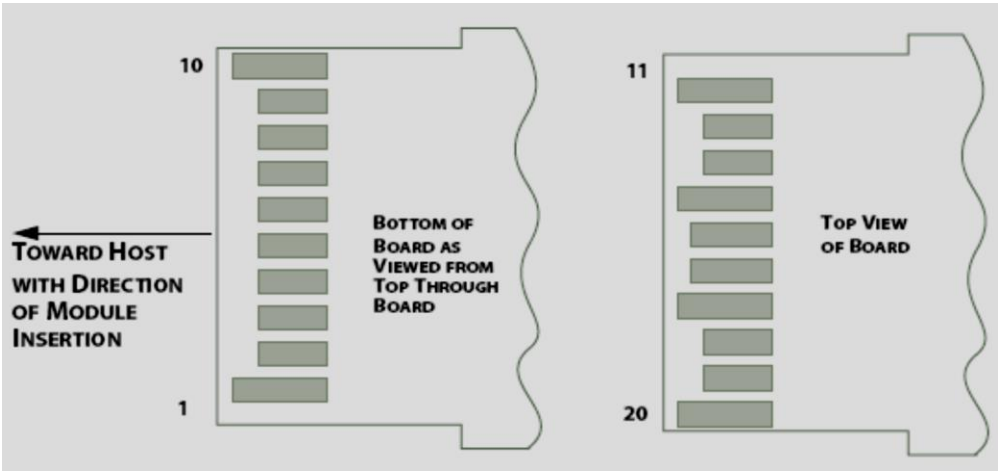


Figure 4: Module Contact Assignment

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

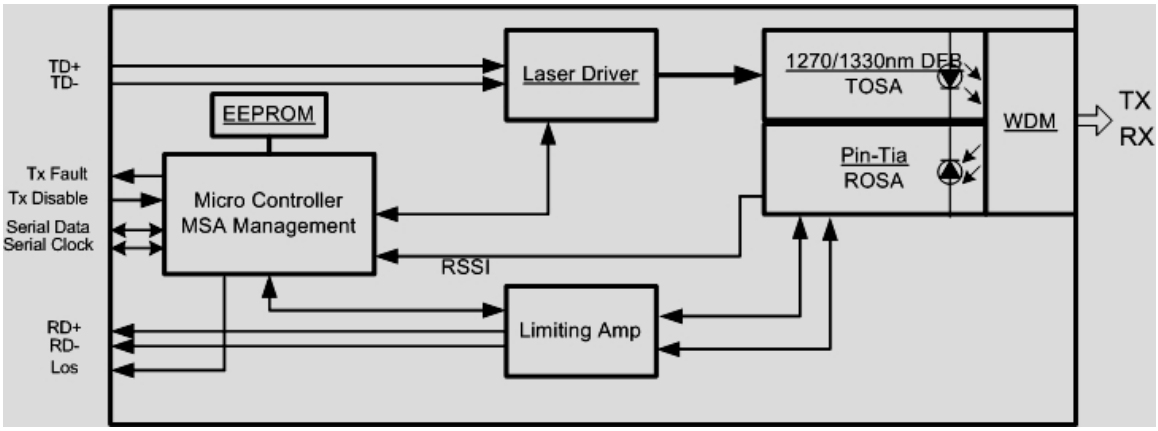
Table 1: SFP+ Module PIN Definition

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.

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

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

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.

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

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

10. CONTROL AND STATUS I/O TIMING CHARACTERISTICS

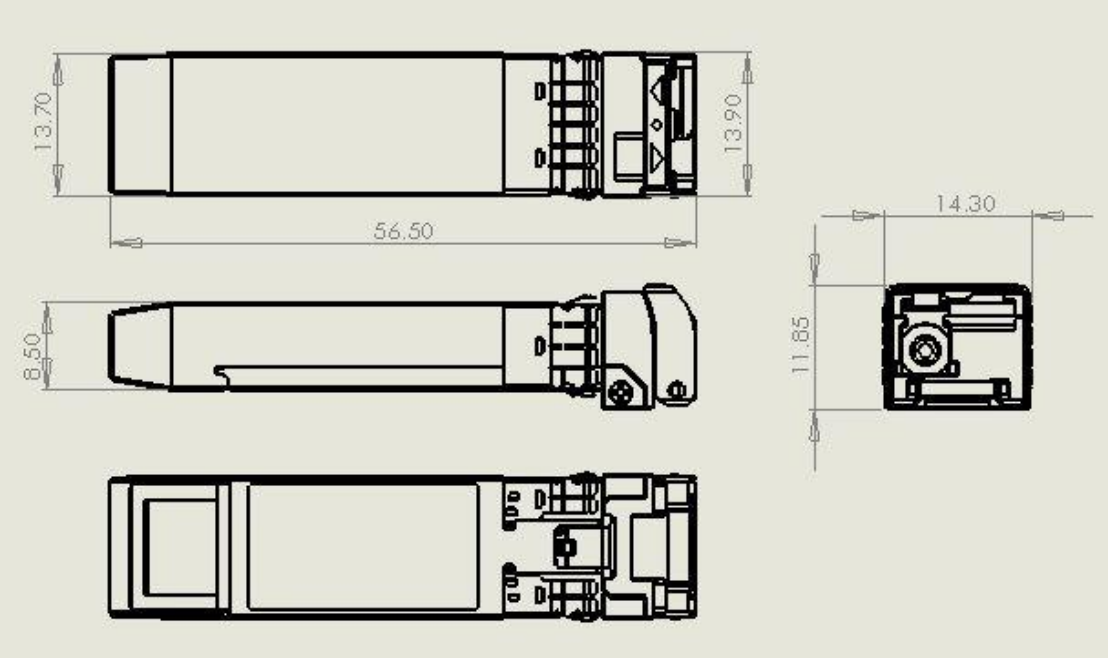
Timing characteristics of control and status I/O are included in Table 8, which is also defined in SFF-8431.

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

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)

10/100/1000 BASE-T Copper SFP Transceiver
DC-EG1RJx-B

Features

- Up to 1.25 Gb/s bi-directional data links
- Low power dissipation(1.05W typical)
- Compact RJ-45 connector assembly
- Fully metal enclosure, for lower EMI
- RoHS compliant and lead-free
- 10/100/1000 BASE-T operation in host systems with SGMII interface
- Single +3.3V power supply
- Case operating temperature:

  Commercial: 0°C to +70°C

  Extended: -10°C to +80°C

  Industrial: -40°C to +85°C

Applications

- 1.25 Gigabit Ethernet over Cat 5 cable
- Switch to Switch Interface

1. GENERAL DESCRIP

10/100/1000 BASE-T Copper Small Form Pluggable (SFP) transceivers are based on the SFP Multi Source Agreement (MSA) . They are compatible with the Gigabit Ethernet standards as specified in IEEE Std 802.3 .The 10/100/1000 BASE-T physical layer IC (PHY) can be accessed via I2C, allowing access to all PHY settings and features.

It is compatible with 1000BASE-X auto-negotiation, but does not have a link indication feature (RX_LOS is internally grounded).

Address : Room 426 Bu,No.4 Building, 1st. Software Park, KeJi Middle 3rd, Middle Zone, Hi-Tech Park,Shenzhen,China
Tel: +86-755-26819856
Web:www.do-networks.com

2. PIN DEFINITION

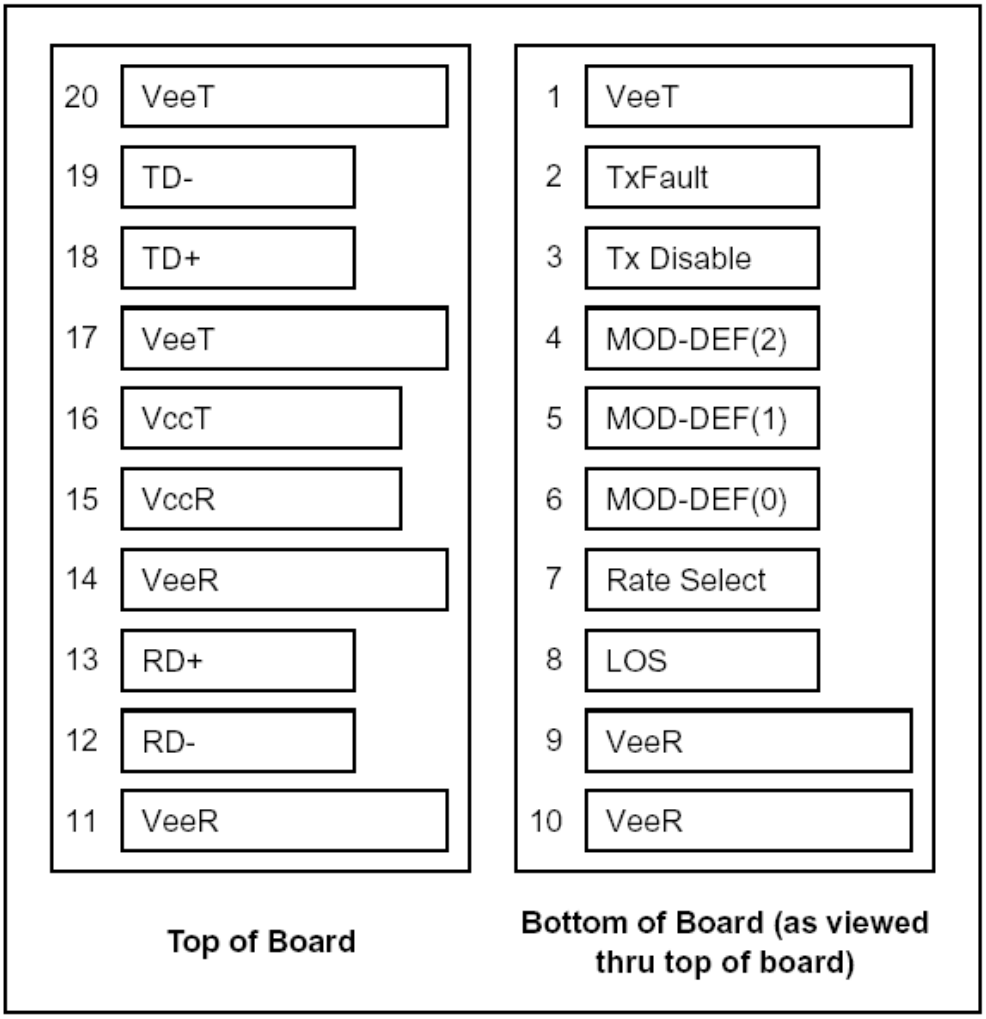


Figure 1. Pin Definitions

Pin	Symbol	Name/Description	NOTE
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault. Not supported.	
3	T_{DIS}	Transmitter Disable. Not supported.	
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	2
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	2
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	2
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	3
9	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
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 connected to chassis ground
2. Should be pulled up with 4.7k - 10k Ohms on host board to a voltage between 2.0 V and 3.6 V. MOD_DEF(0) pulls line low to indicate module is plugged in.

3. LVTTL compatible with a maximum voltage of 2.5V.

3. +3.3V Volt ElECTRICAL POWER INTERFACE

The 10/100/1000base-T has an input voltage range of 3.3 V +/- 5%. The 4V maximum voltage is not allowed for continuous operation.

Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
Supply Current	Is		320	375	mA	1.2W max power over full range of voltage and temperature. See caution note below
Input Voltage	Vcc	3.13	3.3	3.47	V	Referenced to GND
Maximum Voltage	Vmax			4	V	
Surge Current	Isurge			30	mA	Hot plug above steady state current. See caution note below

Caution: Power consumption and surge current are higher than the specified values in the SFP MSA

4. LOW-SPEED SIGNALS,ELECTRONIC CHARACTERISTICS

MOD_DEF(1) (SCL) and MOD_DEF(2) (SDA), are open drain CMOS signals (see section 9, "Serial Communication Protocol"). Both MOD_DEF(1) and MOD_DEF(2) must be pulled up to host_Vcc

Parameter	Symbol	Min	Max	unit	Notes/Conditions
SFP Output LOW	VOL	0	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Output HIGH	VOH	host_Vcc -0.5	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Input LOW	VIL	0	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
SFP Input HIGH	VIH	2	Vcc + 0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector

5. HIGH-SPEED ELECTRICAL INTERFACE,TRANSMISSION LINE-SFP

All high-speed signals are AC-coupled internally.

High-Speed Electrical Interface, Transmission Line-SFP						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**unit**	**Notes/Conditions**
Line Frequency	fL		125		MHz	5-level encoding, per IEEE 802.3
Tx Output Impedance	Zout,TX		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	Zin,RX		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz

6. HIGH-SPEED ELECTRICAL INTERFACE,HOST-SFP

High-Speed Electrical Interface, Host-SFP						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**unit**	**Notes/Conditions**
Single ended data input swing	Vinsing	250		1200	mV	Single ended
Single ended data output swing	Voutsing	350		800	mV	Single ended
Rise/Fall Time	T_r,T_f		175		psec	20%-80%
Tx Input Impedance	Zin		50		Ohm	Single ended
Rx Output Impedance	Zout		50		Ohm	Single ended

7. GENERAL SPECIFICATIONS

General						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**unit**	**Notes/Conditions**
Data Rate	BR	10		1000	Mb/sec	IEEE 802.3 compatible. See Notes 2 through 4 below
Cable Length	L			100	m	Category 5 UTP. BER

Notes:

1. Clock tolerance is +/- 50 ppm
2. By default, the 10/100/1000 BASE-T is a full duplex device in preferred master mode
3. Automatic crossover detection is enabled. External crossover cable is not required
4. 10/100/1000 BASE-T operation requires the host system to have an SGMII interface with no clocks.

8. ENVIRONMENTAL SPECIFICATIONS

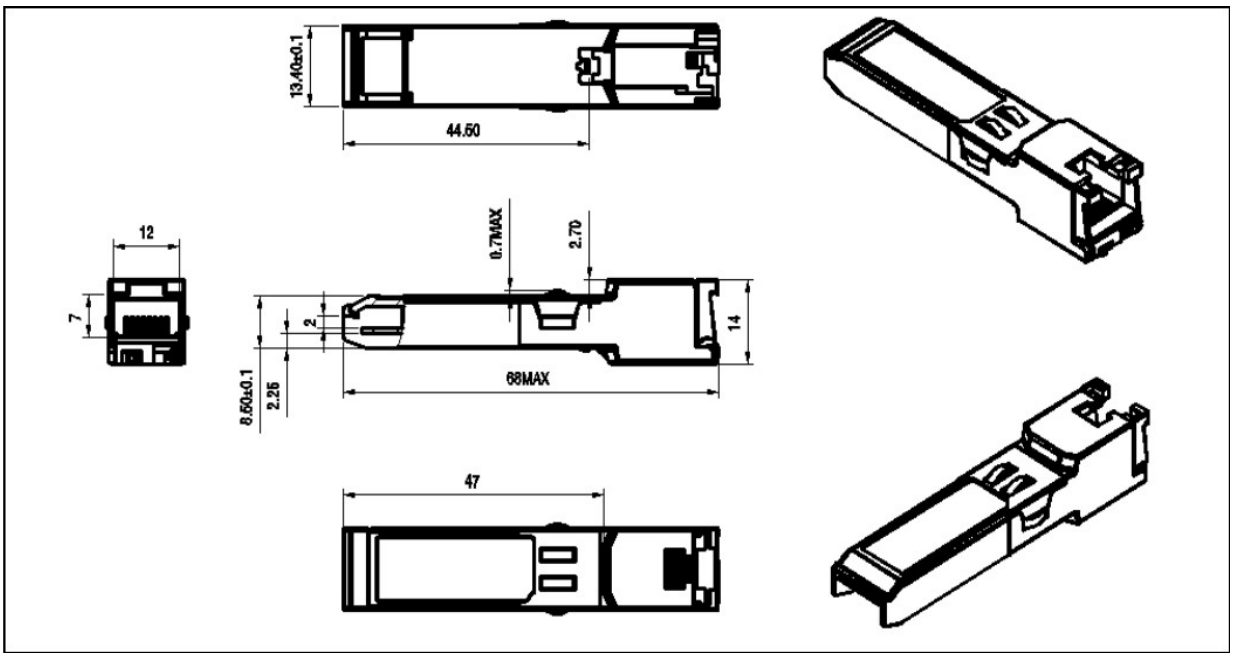
Environmental Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**unit**	**Notes/Conditions**
Case Operating Temperature	Tcase	0		70	°C	commercial
		-10		80	°C	extended
		-40		85	°C	industrial
Storage Temperature	Tsto	-40		85	°C	Ambient temperature

9. SERIAL COMMUNICATION PROTOCOL

10/100/1000 BASE-T support the 2-wire serial communication protocol outlined in the SFP MSA. It uses an Atmel AT24C02B 256 byte EEPROM with an address of A0h.

Serial Bus Timing Requirements						
Parameter	Symbol	Min	Typ	Max	unit	Notes/Conditions
I ^{2}C Clock Rate		0		100,000	Hz	

10. MECHANICAL



40Gb/s QSFP+ ER4 Optical Transceiver

DC-IQ31C-40

Product Specification

Features

- Compliant with 40G Ethernet IEEE802.3ba and 40GBASE-ER4 Standard
- QSFP+ MSA compliant
- Compliant with QDR/DDR Infiniband dat rates
- Up to 11.2Gb/s data rate per wavelength
- 4 CWDM lanes MUX/DEMUX design
- Up to 20km transmission on single mode fiber (SMF)
- Operating case temperature: 0~70°C
- Maximum power consumption 3.5W
- LC duplex connector
- RoHS compliant

Applications

- 40GBASE-ER4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 40G Telecom connections

Part Number Ordering Information

DC-IQ31C-40	QSFP+ ER4 20km optical transceiver with full real-time digital diagnostic monitoring and pull tab

1. General Description

This product is a transceiver module designed for 20km optical communication applications. The design is compliant to 40GBASE-ER4 of the IEEE P802.3ba standard. The module converts 4 inputs channels (ch) of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid defined in ITU-T G694.2. It contains a duplex LC connector for the optical interface and a 148-pin connector for the electrical interface. To minimize the optical dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module.

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.

2. Functional Description

This product converts the 4-channel 10Gb/s electrical input data into CWDM optical signals (light), by a driven 4-wavelength Distributed Feedback Laser (DFB) array. The light is combined by the MUX parts as a 40Gb/s data, propagating out of the transmitter module from the SMF. The receiver module accepts the 40Gb/s CWDM optical signals input, and de-multiplexes it into 4 individual 10Gb/s channels with different wavelength. Each wavelength light is collected by a discrete avalanche photodiode (APD), and then outputted as electric data after amplified by a TIA. Figure 1 shows the functional block diagram of this product.

A single +3.3V power supply is required to power up this product. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As 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, this product responds to 2-wire serial communication commands. The ModSelL allows the use of this product on a single 2-wire interface bus – individual ModSelL lines 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 reset, returning the 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 it indicates a completion of the reset interrupt. The product 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 product 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 product, is normally pulled up to the host Vcc. When the product 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 its present by setting ModPrsL to a "Low" state.

Interrupt (IntL) is an output pin. "Low" indicates a possible 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

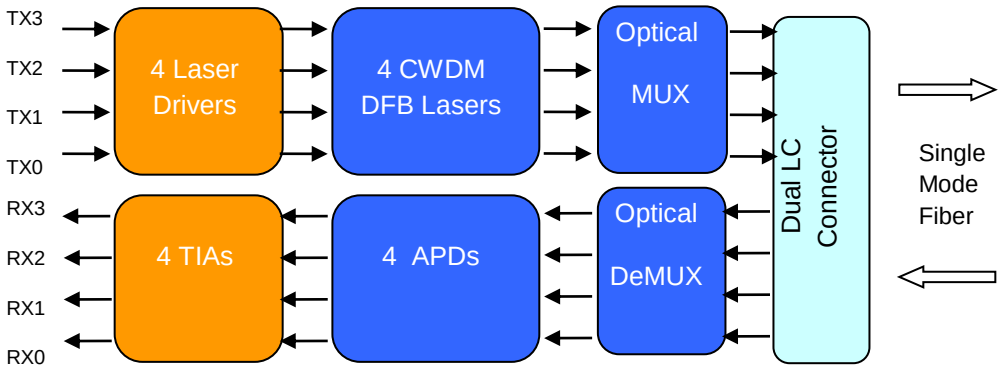


Figure 1. Transceiver Block Diagram

4. Pin Assignment and Pin Description

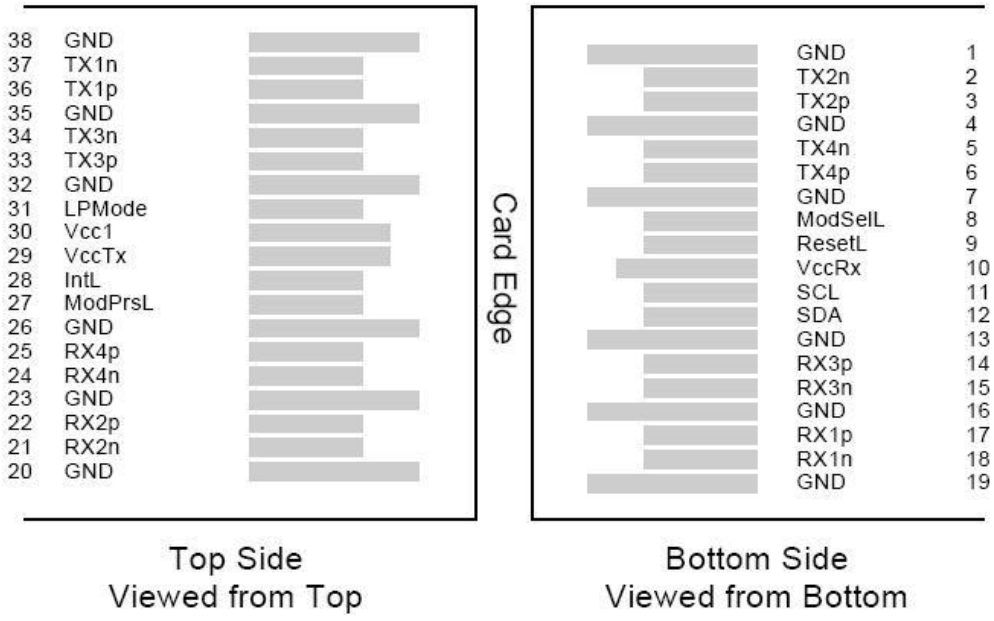


Figure 2. MSA compliant Connector

5. Pin Definition

PIN	Logic	Symbol	Name/Description	Notes
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
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.
2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 3 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.

6. Recommended Power Supply Filter

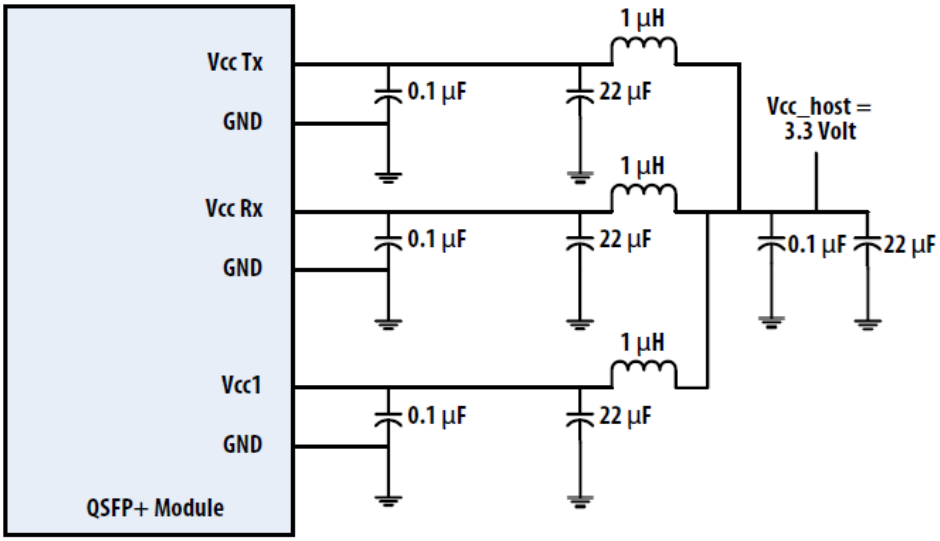


Figure 3. Recommended Power Supply Filter

7. 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	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	3.8		dBm	

8. Recommended Operating Conditions and Power Supply Requirements

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

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 with G652	D			30	km

9. 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				3.5	W	
Supply Current	Icc			1.1	A	
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	190		700	mVpp	
Differential Input Impedance	Zin	90	100	110	Ω	
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	

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	300		850	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 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.

10. Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Wavelength Assignment	L0	1264.5	1271	1277.5	nm	
	L1	1284.5	1291	1297.5	nm	
	L2	1304.5	1311	1317.5	nm	
	L3	1324.5	1331	1337.5	nm	
Transmitter						
Side Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	P_T			10.5	dBm	
Average Launch Power, each Lane	P_{AVG}	-3.7		4.5	dBm	
Optical Modulation Amplitude (OMA), each Lane	P_{OMA}	-0.7		5	dBm	1
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			4.7	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane	OMA-TDP	-1.5			dBm	
TDP, each Lane	TDP			2.6	dB	
Extinction Ratio	ER	5.5			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	12dB reflection
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	R_T			-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25,0.4,0.45,0.25,0.28,0.4}				
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Receiver						

Damage Threshold, each Lane	TH_d	3.8			dBm	2
Average Power at Receiver Input, each Lane		-18.5		-1.5	dBm	
Receiver Reflectance	R_R			-26	dB	
Receive Power (OMA), each Lane				-1	dBm	
Stressed Receiver Sensitivity (OMA), each Lane				-15.8	dBm	3
Receiver Sensitivity (OMA), each Lane	SEN			-18	dBm	
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			7	dB	
LOS Assert	LOSA	-35			dBm	
LOS Deassert	LOSD			-20	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			12.3	GHz	
Conditions of Stress Receiver Sensitivity Test (Note 4)						
Vertical Eye Closure Penalty, each Lane			2.2		dB	
Stressed Eye J2 Jitter, each Lane			0.3		UI	
Stressed Eye J9 Jitter, each Lane			0.47		UI	

Notes:

1. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified

here.

2. 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.
3. Measured with conformance test signal at receiver input for BER = $1x10^{-12}$.
4. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

11. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

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	-0.1	0.1	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	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:

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

12. Mechanical Dimensions

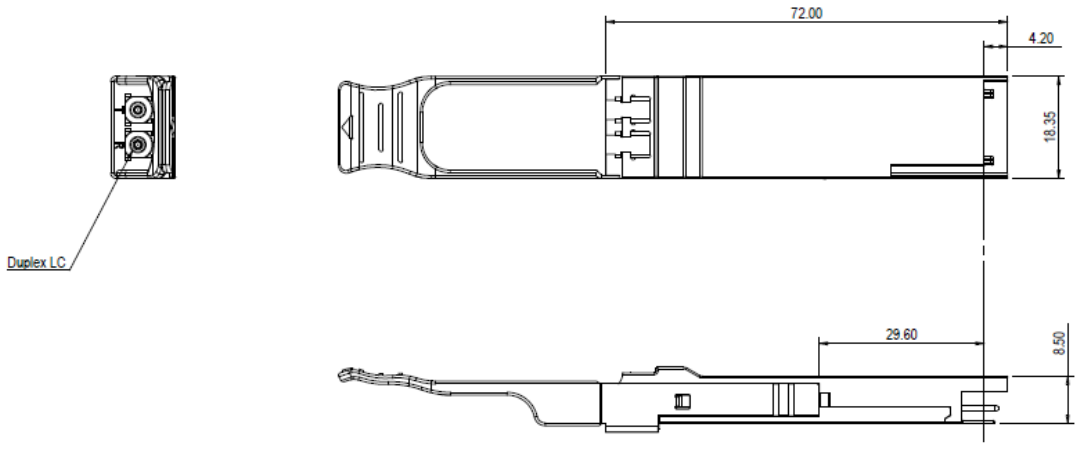


Figure 4. Mechanical Outline

13. ESD

This transceiver is specified as ESD threshold 1kV for SFI pins 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.

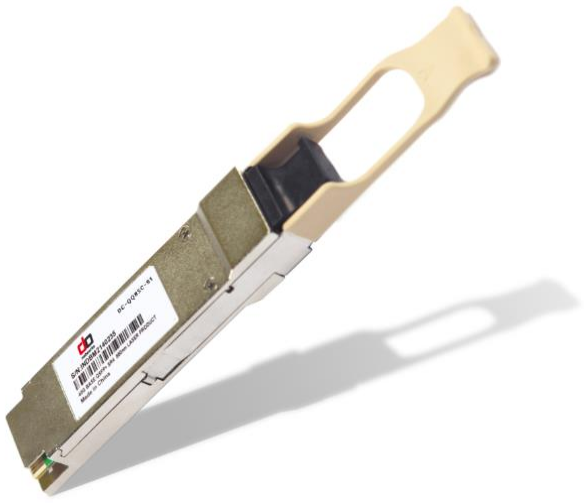
14. Laser Safety

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).

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

Part Number Ordering Information

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

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

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

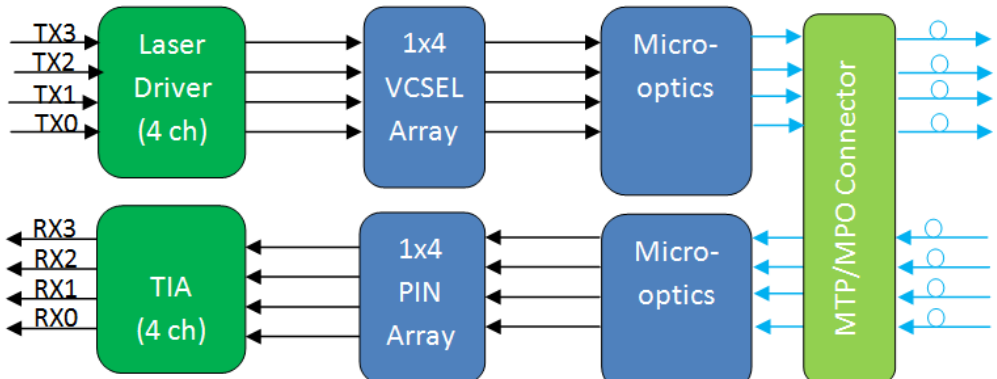


Figure 1. Transceiver Block Diagram

4. Pin Assignment and Pin Description

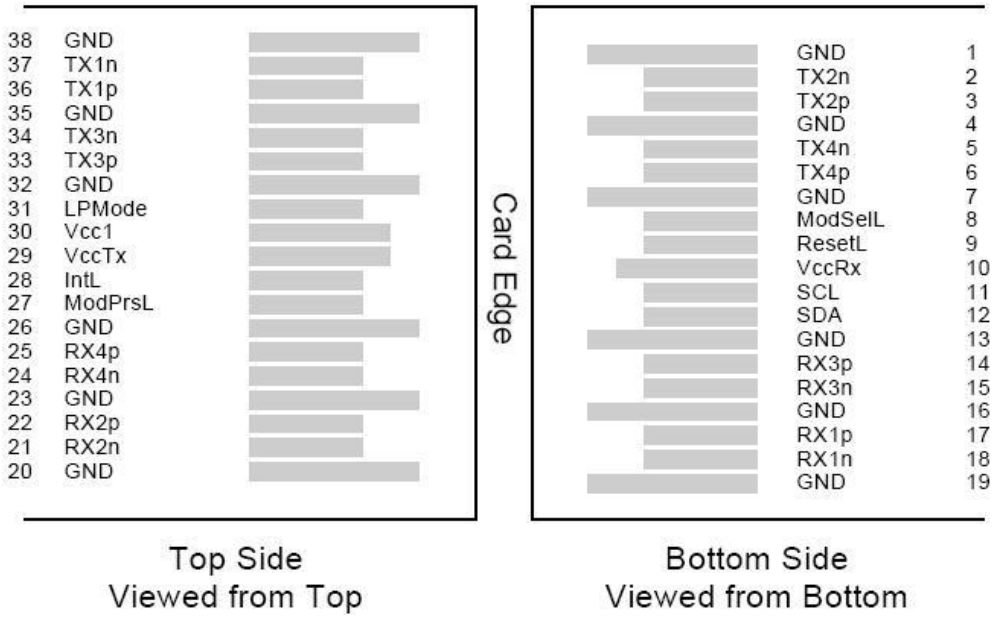


Figure 2. QSFP+ Transceiver Electrical Pad Layout

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

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.

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.

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.

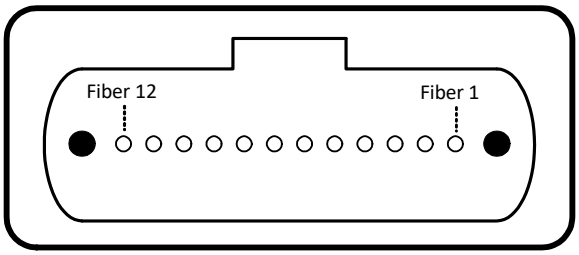


Figure 3. Outside View of the QSFP+ Module MPO

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

7. Recommended Power Supply Filter

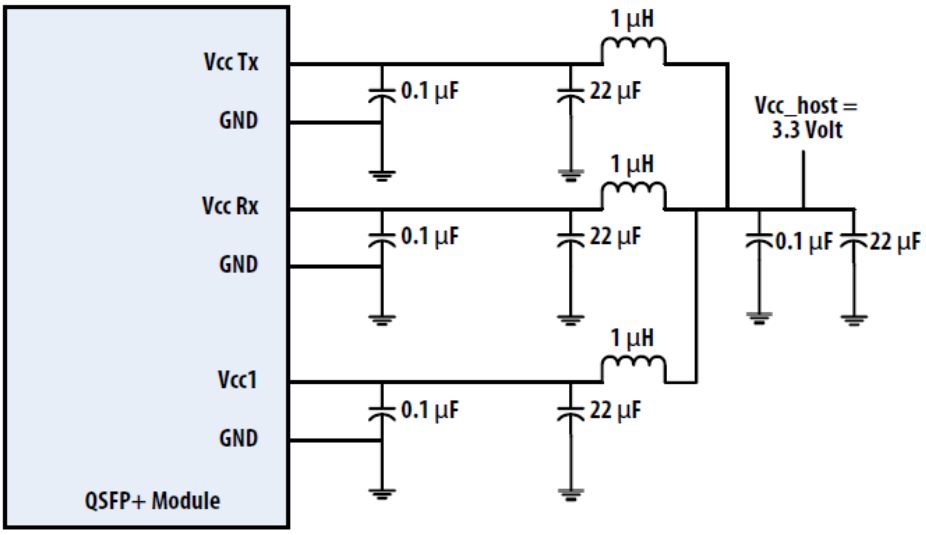


Figure 4. Recommended Power Supply Filter

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

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	

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

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	

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-

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 = $1x10^{-12}$.
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.

13. Mechanical Dimensions

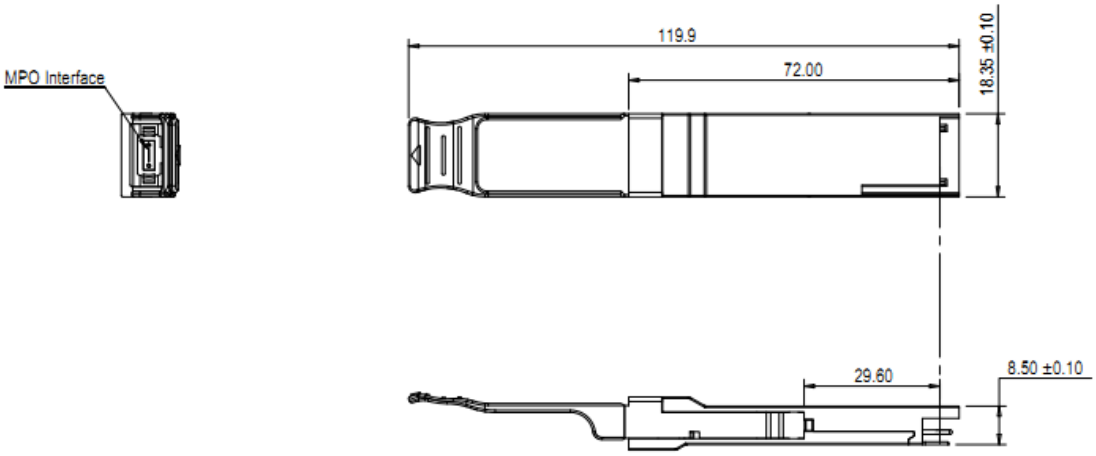


Figure 5. Mechanical Outline

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).

Cisco Nexus 2300 Platform Fabric Extenders

Product Overview

Simplify your data center access architecture and operations with the Cisco Nexus® 2300 platform fabric extenders, the successors to the industry's widely adopted Cisco Nexus 2000 Series Fabric Extenders. The Cisco Nexus 2300 platform with its Cisco® fabric extender architecture provides a highly scalable unified server-access platform across a range of connectivity options such as 100 Megabit Ethernet; 1, 10, and 40 Gigabit Ethernet; unified fabric; copper and fiber connectivity; and rack and blade server environments.

The platform offers excellent support for migration from traditional 1 Gigabit Ethernet to 10 and 40 Gigabit Ethernet and virtual machine - aware unified fabric technologies.

The Cisco Nexus 2300 platform maintains all the existing Cisco Nexus 2000 Series features, including a single point of management, high availability with virtual PortChannels (vPC), vPC+, Enhanced vPC, and LAN and SAN convergence using Fibre Channel over Ethernet (FCoE). With the addition of true 40 Gigabit Ethernet support, deep buffers to handle bursts of traffic common in today's data center, and unified port capability (on 2348UPQ with 5600 only starting 7.3 release), the Cisco Nexus 2300 platform is suitable for highly virtualized, automated, and cloud environments.

The Cisco Nexus 2300 fabric extenders provide a 1-rack-unit (1RU) energy-efficient platform with a choice of front-to-back (port-side exhaust) and back-to-front (port-side intake) airflow options that offer 100 Megabit Ethernet; 1, 10, and 40 Gigabit Ethernet; Fibre Channel (on 2348UPQ with 5600 only starting 7.3 release); and FCoE for a broad range of traditional data center and large-scale virtualized cloud deployments.

The Cisco Nexus 2300 platform provides:

- **Architecture flexibility with simplified operations:** The fabric extender support unified ports (on 2348UPQ with 5600 only starting 7.3), allowing flexible deployment and LAN and SAN convergence in a heterogeneous architecture. A common, scalable, and adaptive architecture across data center racks and points of delivery (PoDs)[τ] supports a variety of server options, connectivity options, physical topologies, and evolving needs. A single point of management and policy enforcement using upstream Cisco Nexus switches eases the commissioning and decommissioning of server racks through zero-touch installation and automatic configuration of fabric extenders.
- **Highly scalable server access:** Today's data centers require massive scalability to manage the increasing number of servers and higher demand for bandwidth from each server. The Cisco Nexus 2300 platform meets this need with higher-density ports facing servers and the parent switch without any changes to the existing cable plant. The 100 Megabit, 1 and 10 Gigabit Ethernet server access, and the 40 Gigabit network access are scalable, with no reliance on Spanning Tree Protocol. The Cisco Nexus 2300 platform can also provide up to 2:1 oversubscription.

[τ] A PoD is a module or group of network, computing, storage, and application components that work together to deliver a network service. The PoD is repeatable pattern, and its components increase the modularity, scalability, and manageability of data centers

- **Enhanced buffer for applications:** In today's data center, application teams require the network to be flexible and capable of handling the rapid growth of applications. The Cisco Nexus 2300 platform provides deep shared buffers (32 MB) to absorb bursts of traffic from storage devices and a wide variety of applications, such as multicast feeds, voice traffic, video traffic, and healthcare applications. These deep buffers also provide flexibility to expand your network as your needs change. The shared buffers are also very useful in situations in which one or more servers are consuming most of the bandwidth in highly oversubscribed environments.
- **Increased business benefits:** The Cisco Nexus 2300 platform helps data centers keep their space, power, and cooling requirements under control while reducing their carbon footprints. Through consolidation, the fabric extenders reduce cabling, rack space, and power and cooling demands. By inheriting features from the parent switch, they offer investment protection and the capability to add functions without the need for a major upgrade of server-attached infrastructure. This capability helps reduce operating expenses (OpEx) and capital expenditures (CapEx). The 40-Gbps Quad Enhanced Small Form-Factor Pluggable (QSFP+) fabric interfaces offer cost-effective, simplified connectivity to Cisco Nexus parent switches and support for QSFP 40-Gbps bidirectional (BiDi) short-reach transceivers.

The Cisco Nexus 2300 platform has a compact 1RU design that aligns with server designs. It offers front-to-back cooling that is compatible with data center hot-aisle and cold-aisle designs. All switch ports are at the rear of the unit close to server ports, and all user-serviceable components are accessible from the front panel. The platform also offers back-to-front cooling, with switch ports in the front of the chassis aligned with the cold aisle for optimized cabling in network racks. The Cisco Nexus 2300 platform is built for nonstop operation with redundant hot-swappable power supplies and a hot-swappable fan tray with redundant fans. The 1RU form factor takes up little space, making it easy to incorporate into rack designs. The fabric extenders are available in several models with a range of speed, connectivity, and port-density options (Figure 1).

Figure 1. Cisco Nexus 2300 Platform Fabric Extenders: Cisco Nexus 2332TQ (Top Left), Cisco Nexus 2348UPQ (Middle Left), Cisco Nexus 2348TQ (Bottom Left), and Cisco Nexus 2348TQ-E (Right)

The Cisco Nexus 2300 platform provides two types of ports: ports for end-host attachment (host interfaces) and uplink ports (fabric interfaces).

Fabric interfaces (yellow/white) provide connectivity to the upstream parent Cisco Nexus switch.

Models and Configuration

Table 1 provides summarizes the Cisco Nexus 2300 platform.

Table 1. Cisco Nexus 2300 Platform Fabric Extenders

Fabric Extender	Description
Cisco Nexus 2348UPQ 10GE	48 x 1/10 Gigabit Ethernet and unified port host interfaces (SFP+) and up to 6 QSFP+ 10/40 Gigabit Ethernet fabric interfaces
Cisco Nexus 2348TQ 10GE	48 x 100MBASE-T and 1/10GBASE-T port host interfaces (RJ-45) and up to 6 QSFP+ 10/40 Gigabit Ethernet fabric interfaces; FCoE support up to 30m with Category 6a and 7 cables
Cisco Nexus 2332TQ 10GE	32 x 100MBASE-T and 1/10GBASE-T port host interfaces (RJ-45) and up to 4 QSFP+ 10/40 Gigabit Ethernet fabric interfaces; FCoE support up to 30m with Category 6a and 7 cables
Cisco Nexus 2348TQ-E 10GE	48 x 100MBASE-T and 1/10GBASE-T port host interfaces (RJ-45) and up to 6 QSFP+ 10/40 Gigabit Ethernet fabric interfaces; FCoE support up to 30m with Category 6a and 7 cables

Cisco Nexus 2348UPQ Fabric Extender

The Cisco Nexus 2348UPQ fabric extender (Figure 2) is a general-purpose unified port - capable (currently, Fibre Channel functions are supported only in Nexus 5600 since 7.3(0) N1 (1)) 1/10 Gigabit Ethernet fabric extender for workloads such as large-volume databases, distributed storage, and video editing. The Cisco Nexus 2348UPQ supports 48 x 1- and 10-Gbps host unified ports as well as up to six 40-Gbps uplink ports to the parent switch. The 40-Gbps uplinks support BiDi optics for simple connectivity using your existing cable plan. The unified ports provide connectivity to 2-, 4-, 8-, and 16-Gbps Fibre Channel (24 ports for 16 Gbps) as well as 1 and 10 Gigabit Ethernet and FCoE connectivity options (currently, Fibre Channel functions are supported only in hardware). The Cisco Nexus 2348UPQ has a deep 32-MB shared buffer that helps increase performance, and it supports FCoE and Data Center Bridging (DCB) network technologies, which boost the reliability, efficiency, and scalability of Ethernet networks. These features provide support for multiple traffic classes over a lossless Ethernet fabric, enabling consolidation of LAN, SAN, and cluster environments.

Figure 2. Cisco Nexus 2348UPQ Fabric Extender (Port View)

Support for both forward (port-side exhaust) and reverse (port-side intake) airflow schemes is available. Forward airflow is useful when the port side of the switch sits on a hot aisle and the power-supply side sits on a cold aisle. Reverse airflow is useful when the power-supply side of the switch sits on a hot aisle and the port side sits on a cold aisle. The Cisco Nexus 2348UPQ has two 1+1 redundant hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy.

Colored handles on each fan or power supply clearly indicate the airflow direction, as shown in Figure 3.

Figure 3. Cisco Nexus 2348UPQ with Blue Handles Indicating Forward Airflow

Cisco Nexus 2348TQ Fabric Extender

The Nexus 2348TQ (Figure 4) is a low-power platform that is well suited for migration to 10GBASE-T. It supports high-density 100 Megabit Ethernet and 1 and 10 Gigabit Ethernet environments and has 48 x 100MBASE-T and 1/10GBASE-T host interface (HIF) ports as well up to six 40-Gbps uplink ports to the parent switch. The 40-Gbps uplinks support BiDi optics for simple connectivity using your existing cable plan, while lowering power and solution costs. The Cisco Nexus 2348TQ supports FCoE.

Figure 4. Cisco Nexus 2348TQ Fabric Extender (Port View)

Support for both forward (port-side exhaust) and reverse (port-side intake) airflow schemes is available. Forward airflow is useful when the port side of the switch sits on a hot aisle and the power-supply side sits on a cold aisle. Reverse airflow is useful when the power-supply side of the switch sits on a hot aisle and the port side sits on a cold aisle. The Cisco Nexus 2348TQ has two 1+1 redundant hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy.

Colored handles on each fan or power supply clearly indicate the airflow direction, as shown in Figure 5.

Figure 5. Cisco Nexus 2348TQ with Blue Handles Indicating Forward Airflow

Cisco Nexus 2332TQ Fabric Extender

The Cisco Nexus 2332TQ (Figure 6) is a low-port-count, low-power 10GBASE-T platform with 32 100MBASE-T and 1/10GBASE-T HIF ports as well as four 40-Gbps uplink ports to the parent switch. This platform is well suited for customers with lower power requirements and with lower port density in the rack. The 40-Gbps uplinks support BiDi optics for simple connectivity using your existing cable plan, while lowering power and solution costs. The Cisco Nexus 2332TQ supports FCoE.

Figure 6. Cisco Nexus 2332TQ Fabric Extender (Port View)

Support for both forward (port-side exhaust) and reverse (port-side intake) airflow schemes is available. Forward airflow is useful when the port side of the switch sits on a hot aisle and the power-supply side sits on a cold aisle. Reverse airflow is useful when the power-supply side of the switch sits on a hot aisle and the port side sits on a cold aisle. The Cisco Nexus 2332TQ has two 1+1 redundant hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy. Colored handles on each fan or power supply clearly indicate the airflow direction, as shown in Figure 7.

Figure 7. Cisco Nexus 2332TQ with Blue Handles Indicating Forward Airflow

Cisco Nexus 2348TQ-E Fabric Extender

The Nexus 2348TQ-E (Figure 4) is a cost optimized platform that is well suited for migration to 10GBASE-T. It supports high-density 100 Megabit Ethernet and 1 and 10 Gigabit Ethernet environments and has 48 x 100MBASE-T and 1/10GBASE-T host interface (HIF) ports as well up to six 40-Gbps uplink ports to the parent switch. The 40-Gbps uplinks support BiDi optics for simple connectivity using your existing cable plan, while lowering power and solution costs. The Cisco Nexus 2348TQ-E supports FCoE.

Figure 8. Cisco Nexus 2348TQ-E Fabric Extender (Port View)

Support for both forward (port-side exhaust) and reverse (port-side intake) airflow schemes is available. Forward airflow is useful when the port side of the switch sits on a hot aisle and the power-supply side sits on a cold aisle. Reverse airflow is useful when the power-supply side of the switch sits on a hot aisle and the port side sits on a cold aisle. The Cisco Nexus 2348TQ has two 1+1 redundant hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy.

Colored handles on each fan or power supply clearly indicate the airflow direction, as shown in Figure 5.

Figure 9. Cisco Nexus 2348TQ-E with Blue Handles Indicating Forward Airflow

Cisco Nexus 2300 platform fabric extenders connect to a parent Cisco Nexus switch through their fabric links using CX1 copper cable, short-reach or long-reach optics, cost-effective Cisco Fabric Extender Transceivers, and QSFP 40-Gbps bidirectional short-reach transceivers. Fabric Extender Transceivers are optical transceivers that provide a highly cost-effective solution for connecting the fabric extender to its parent switch over OM3 or OM4 multimode fiber.

Cisco Nexus 2300 platform fabric extenders behave like remote line cards for a parent Cisco Nexus 5500, 5600, 7700,6000, 7000 or 9000 Series Switches. Working in conjunction with Cisco Nexus switches, the fabric extenders extend the capabilities and benefits offered by the parent Cisco Nexus switch while providing flexible, scalable, and cost-effective server access. A deployment of Cisco Nexus 2300 platform fabric extenders connected to a Cisco Nexus 5500, 5600, 7700,6000,7000 or 9000 Series Switch supports highly scalable 100 Megabit Ethernet and 1 and 10 Gigabit Ethernet environments.

Cisco Nexus 2300 Platform Deployment Scenarios

The fabric extenders can be used in the following deployment scenarios:

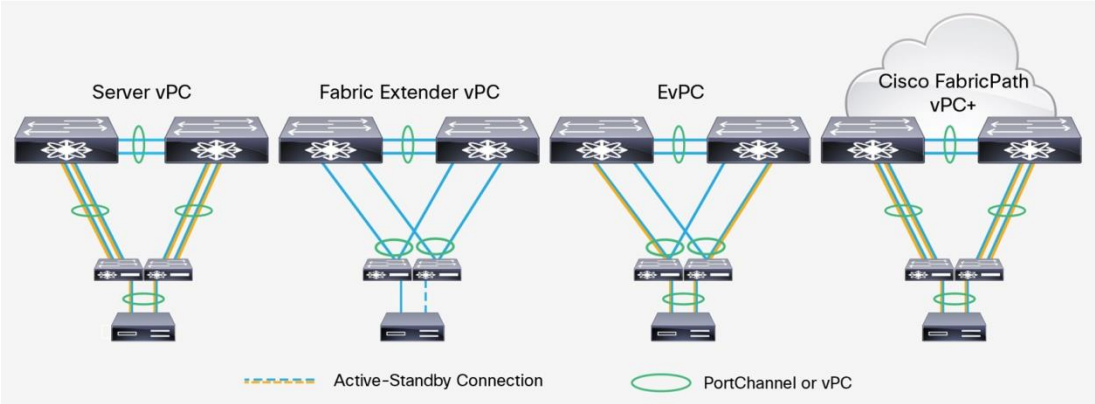
- Rack servers with 100 Megabit Ethernet, 1 Gigabit Ethernet, or 10 Gigabit Ethernet network interface cards (NICs); the fabric extender can be physically located at the top of the rack, and the Cisco Nexus parent switch can reside in the middle or at the end of the row, or the fabric extender and the Cisco Nexus parent switch can both reside at the end or middle of the row
- 10 Gigabit Ethernet and FCoE deployments, using servers with converged network adapters (CNAs) for unified fabric environments
- 100MBASE-T and 1/10GBASE-T server connectivity with ease of migration from 100MBASE-T to 1GBASE-T to 10GBASE-T and reuse of structured cabling
- 1 and 10 Gigabit Ethernet blade servers with pass-through blades
- SAN connectivity (2348UPQ with 5600 only)
- Low-latency, high-performance computing environments
- Virtualized access

For more information, visit the Cisco Nexus 2000 Series case studies page: http://www.cisco.com/en/US/products/ps10110/prod_case_studies_list.html

The Cisco Nexus 2300 platform can be used in conjunction with a Cisco Nexus parent switch in four main design scenarios (Figure 10):

- Cisco Nexus 2300 platform single-connected to one upstream Cisco Nexus 5500, 5600, 7700, 6000,7000 or 9000 Series Switch: In this deployment model, access-layer redundancy is achieved through redundant server connections to two upstream distributed modular systems using vPC (Cisco Nexus 5500, 5600, or 7700 platform or 6000 or 7000 Series) or server NIC teaming to two Cisco Nexus 2300 platform fabric extenders.
- Cisco Nexus 2300 platform dual-connected to two upstream Cisco Nexus 5500, 5600, 7700, 6000, or 7000 Series Switches (vPC): In this deployment model, access-layer redundancy is achieved with a combination of Cisco Nexus 2300 platform fabric extenders dual-connected to an upstream parent switch and server NIC teaming.
- Enhanced vPC (EvPC): In this deployment model, access-layer redundancy is achieved in two ways: through redundant connections between the Cisco Nexus 2300 platform and the Cisco Nexus parent switches using vPC; and through redundant server connections to two fabric extenders using vPC and active-active server NIC teaming. This scenario is supported only with the Cisco Nexus 5500 or 5600 or 6000 Series used as upstream switches. The Cisco Nexus 7000 Series and 7700 platform currently are not supported as upstream switches in this scenario.
- vPC+: In this deployment model, access-layer redundancy is achieved through server vPC, fabric extender vPC, and EvPC. In addition, a vPC+ domain allows the Cisco Nexus parent switch and the fabric extenders to be viewed as a single virtual switch in a Cisco FabricPath network.

Figure 10. Cisco Nexus 2300 Platform Fabric Extenders Design Models, from Left to Right: Server vPC, Fabric Extender vPC, EvPC, and vPC+



All topologies are supported with the Cisco Nexus 5000 and 6000. Server vPC and Fabric Extender vPC are supported on the Nexus 7000 series. Server vPC is supported on Nexus 9000 series.

Product Specifications

Tables 2 through 6 provide product specifications, and Table 7 lists standards support for the Cisco Nexus 2300 platform fabric extenders.

Table 2. Cisco Nexus 2300 Platform 10 Gigabit Ethernet Fabric Extender Product Specifications

Description	Cisco Nexus 2348UPQ	Cisco Nexus 2348TQ	Cisco Nexus 2332TQ	Cisco Nexus 2348TQ-E
Fabric extender host interfaces	48	48	32	48
Fabric extender host interface type	For 48 x 1/10 Gigabit Ethernet host interface ports • 1/10 Gigabit Ethernet ports SFP/SFP+ (supported transceiver and cables include Twinax SFP-H10GB-CU1M, SFP-H10GB-CU1-5M, SFP-H10GB-CU2M, SFP-H10GB-CU2-5M SFP-H10GB-CU3M, SFP-H10GB-CU5M, SFP-H10GBACU7M, and SFP-H10GB-ACU10M; SFP+ SFP-10G-SR, SFP-10G-SR-S, SFP-10G-LR, and SFP-10G-LR-S; and SFP GLC-T, GLC-SX-MM, GLC-LH-SM, SFP-GE-T, SFP-GE-S, and SFP-GE-L) • AOC cables: SFP-10G-AOC1M, SFP-10G-AOC2M, SFP-10G-AOC3M, SFP-10G-AOC5M, SFP-10G-AOC7M, and SFP-10G-AOC10M • DS-SFP-FC16G-SW (16, 8 and 4G modes),DS-SFP-FC16G-LW (16, 8 and 4G modes),DS-SFP-FC8G-SW,DS-SFP-FC8G-LW,DS-SFP-FC4G-SW, DS-SFP-FC4G-LW	48 100M/1/10GBASE-T ports: RJ-45 connectors	32 100M/1/10GBASE-T ports: RJ-45 connectors	48 100M/1/10GBASE-T ports: RJ-45 connectors

Description	Cisco Nexus 2348UPQ	Cisco Nexus 2348TQ	Cisco Nexus 2332TQ	Cisco Nexus 2348TQ-E
Fabric extender fabric interfaces	6 x 40 Gigabit Ethernet QSFP (24 x 10 Gigabit Ethernet)	6 x 40 Gigabit Ethernet QSFP (24 x 10 Gigabit Ethernet)	4 x 40 Gigabit Ethernet QSFP (16 x 10 Gigabit Ethernet)	6 x 40 Gigabit Ethernet QSFP (24 x 10 Gigabit Ethernet)
Fabric extender fabric interface type	• Fiber: QSFP-40G-SR-BD, QSFP-40G-SR4,QSFP-40G-SR4-S, QSFP-40G-LR4, QSFP-40G-LR4-S, and QSFP-40G-CSR4-S • Copper: 40 Gigabit Ethernet QSFP+ active Twinax cables (QSFP-H40G-ACU7M and QSFP-H40G-ACU10M (no passive cables) • AOC cables: QSFP-H40G-AOC1M, QSFP-H40G-AOC2M, QSFP-H40G-AOC3M, QSFP-H40G-AOC5M, QSFP-H40G-AOC7M, QSFP-H40G-AOC10M, and QSFP-H40G-AOC15M • AOC breakout cables: QSFP-4X10G-AOC1M, QSFP-4X10G-AOC2M, QSFP-4X10G-AOC3M, QSFP-4X10G-AOC5M, QSFP-4X10G-AOC7M, and QSFP-4X10G-AOC10M • Copper breakout cables: QSFP-4x10G-AC7M and QSFP-4x10G-AC10M (no passive cables) • Distance between Cisco Nexus 2300 fabric extender and Cisco Nexus 5500 switch is up to 10 km (up to 3 km for FCoE traffic), and for the Cisco Nexus 5600 switch or 6000 Series Switch the distance is up to 3 km (300m for FCoE traffic) • All equivalent S-class optics are supported • Cisco 40GBASE QSFP to SFP+/SFP adapter (CVR-QSFP-SFP10G)	• Fiber: QSFP-40G-SR-BD, QSFP-40G-SR4,QSFP-40G-SR4-S, QSFP-40G-LR4, QSFP-40G-LR4-S, and QSFP-40G-CSR4-S • Copper: 40 Gigabit Ethernet QSFP+ active Twinax cables (QSFP-H40G-ACU7M and QSFP-H40G-ACU10M (no passive cables) • AOC cables: QSFP-H40G-AOC1M, QSFP-H40G-AOC2M, QSFP-H40G-AOC3M, QSFP-H40G-AOC5M, QSFP-H40G-AOC7M, QSFP-H40G-AOC10M, and QSFP-H40G-AOC15M • AOC breakout cables: QSFP-4X10G-AOC1M, QSFP-4X10G-AOC2M, QSFP-4X10G-AOC3M, QSFP-4X10G-AOC5M, QSFP-4X10G-AOC7M, and QSFP-4X10G-AOC10M • Copper breakout cables: QSFP-4x10G-AC7M and QSFP-4x10G-AC10M (no passive cables) • Distance between Cisco Nexus 2300 fabric extender and Cisco Nexus 5500 switch is up to 10 km (up to 3 km for FCoE traffic), and for the Cisco Nexus 5600 switch or 6000 Series Switch the distance is up to 3 km (300m for FCoE traffic) • All equivalent S-class optics are supported • Cisco 40GBASE QSFP to SFP+/SFP adapter (CVR-QSFP-SFP10G)	• Fiber: QSFP-40G-SR-BD, QSFP-40G-SR4,QSFP-40G-SR4-S, QSFP-40G-LR4, QSFP-40G-LR4-S, and QSFP-40G-CSR4-S • Copper: 40 Gigabit Ethernet QSFP+ active Twinax cables (QSFP-H40G-ACU7M and QSFP-H40G-ACU10M (no passive cables) • AOC cables: QSFP-H40G-AOC1M, QSFP-H40G-AOC2M, QSFP-H40G-AOC3M, QSFP-H40G-AOC5M, QSFP-H40G-AOC7M, QSFP-H40G-AOC10M, QSFP-H40G-AOC15M • AOC breakout cables: QSFP-4X10G-AOC1M, QSFP-4X10G-AOC2M, QSFP-4X10G-AOC3M, QSFP-4X10G-AOC5M, QSFP-4X10G-AOC7M, and QSFP-4X10G-AOC10M • Copper breakout cables: QSFP-4x10G-AC7M and QSFP-4x10G-AC10M (no passive cables) • Distance between Cisco Nexus 2300 fabric extender and Cisco Nexus 5500 switch is up to 10 km (up to 3 km for FCoE traffic), and for the Cisco Nexus 5600 switch or 6000 Series Switch the distance is up to 3 km (300m for FCoE traffic) • All equivalent S-class optics are supported	• Fiber: QSFP-40G-SR-BD, QSFP-40G-SR4,QSFP-40G-SR4-S, QSFP-40G-LR4, QSFP-40G-LR4-S, and QSFP-40G-CSR4-S • Copper: 40 Gigabit Ethernet QSFP+ active Twinax cables (QSFP-H40G-ACU7M and QSFP-H40G-ACU10M (no passive cables) • AOC cables: QSFP-H40G-AOC1M, QSFP-H40G-AOC2M, QSFP-H40G-AOC3M, QSFP-H40G-AOC5M, QSFP-H40G-AOC7M, QSFP-H40G-AOC10M, and QSFP-H40G-AOC15M • AOC breakout cables: QSFP-4X10G-AOC1M, QSFP-4X10G-AOC2M, QSFP-4X10G-AOC3M, QSFP-4X10G-AOC5M, QSFP-4X10G-AOC7M, and QSFP-4X10G-AOC10M • Copper breakout cables: QSFP-4x10G-AC7M and QSFP-4x10G-AC10M (no passive cables) • Distance between Cisco Nexus 2300 fabric extender and Cisco Nexus 5500 switch is up to 10 km (up to 3 km for FCoE traffic), and for the Cisco Nexus 5600 switch or 6000 Series Switch the distance is up to 3 km (300m for FCoE traffic) • All equivalent S-class optics are supported • Cisco 40GBASE QSFP to SFP+/SFP adapter (CVR-QSFP-SFP10G)
Fabric speed	Up to 240 Gbps in each direction (480-Gbps full duplex)	Up to 240 Gbps in each direction (480-Gbps full duplex)	Up to 160 Gbps in each direction (320-Gbps full duplex)	Up to 240 Gbps in each direction (480-Gbps full duplex)
Oversubscription	Up to 2:1	Up to 2:1	Up to 2:1	Up to 2:1
Performance	Hardware forwarding at 1440 Gbps or 2160 million packets per second (mpps)	Hardware forwarding at 1440 Gbps or 2160 mpps	Hardware forwarding at 960 Gbps or 1440 mpps	Hardware forwarding at 1440 Gbps or 2160 mpps
FCoE	FCoE supported (Cisco Nexus 5500 and 5600 platforms and 6000 Series) (select N7k platforms since 7.3 release)	FCoE support up to 30m with Category 6a and 7 cables (Cisco Nexus 5500 and 5600 platforms and 6000 Series)	FCoE support up to 30m with Category 6a and 7 cables (Cisco Nexus 5500 and 5600 platforms and 6000 Series)	FCoE support up to 30m with Category 6a and 7 cables (Cisco Nexus 5500 and 5600 platforms and 6000 Series)

Description	Cisco Nexus 2348UPQ	Cisco Nexus 2348TQ	Cisco Nexus 2332TQ	Cisco Nexus 2348TQ-E
Cisco parent switch	• Cisco Nexus 5500 and 5600 platforms • Cisco Nexus 6000 Series • Cisco Nexus 7000 Series and 7700 platform • Cisco Nexus 9300 and 9500 Series	• Cisco Nexus 5500 and 5600 platforms • Cisco Nexus 6000 Series • Cisco Nexus 7000 Series and 7700 platform • Cisco Nexus 9300 and 9500 Series	• Cisco Nexus 5500 and 5600 platforms • Cisco Nexus 6000 Series • Cisco Nexus 9300 and 9500 Series	• Cisco Nexus 5500 and 5600 platforms • Cisco Nexus 6000 Series • Cisco Nexus 9300 and 9500 Series
Minimum software	• Cisco NX-OS Release 7.0(3)N1(1) (Cisco Nexus 5500 and 5600 platforms and 6000 Series) • Cisco NX-OS Release 7.2.0D1(1) • (Cisco Nexus 7000 Series and 7700 platform) • Cisco NX-OS Release 7.0(3)I2(1) • (Cisco Nexus 9300 Series and 9500 platform) • Native FC support: Cisco NX-OS Release 7.3(0)N1(1) (Cisco Nexus 5600 platforms Only)	• Cisco NX-OS Release 7.1(0)N1(1) (Cisco Nexus 5500 and 5600 platforms and 6000 Series) • Cisco NX-OS Release 7.2.0D1(1) • (Cisco Nexus 7000 Series and 7700 platform) • Cisco NX-OS Release 7.0(3)I2(1) • (Cisco Nexus 9300 Series and 9500 platform)	• Cisco NX-OS Release 7.1(0)N1(2) (Cisco Nexus 5500 and 5600 platforms and 6000 Series)	• Cisco NX-OS Release 7.3(0)N1(1) (Cisco Nexus 5500 and 5600 platforms and 6000 Series)
Dimensions (H x W x D)	• 1.72 x 17.3 x 14.05 in. (4.37 x 43.94 x 35.69 cm)	• 1.72 x 17.3 x 17.07 in. (4.37 x 43.94 x 43.36 cm)	• 1.72 x 17.3 x 14.07 in. (4.37 x 43.94 x 35.69 cm)	• 1.72 x 17.3 x 17.07 in. (4.37 x 43.94 x 43.36 cm)
Weight	• 15.50 lbs. (7.0 kg)	• 17.7 lbs. (8.0 kg2)	• 15.00 lbs. (6.8 kg)	• 17.7 lbs. (8.0 kg2)
Environment	• Operating temperature: 32 to 131°F (0 to 55°C) • Non-operating temperature: -40 to 158°F (-40 to 70°C) • Humidity: 5 to 95 percent (noncondensing) • Altitude: 0 to 10,000 ft. (0 to 3000m)	• Operating temperature: 32 to 131°F (0 to 55°C) • Non-operating temperature: -40 to 158°F (-40 to 70°C) • Humidity: 5 to 95 percent (noncondensing) • Altitude: 0 to 10,000 ft. (0 to 3000m)	• Operating temperature: 32 to 131°F (0 to 55°C) • Non-operating temperature: -40 to 158°F (-40 to 70°C) • Humidity: 5 to 95 percent (noncondensing) • Altitude: 0 to 10,000 ft. (0 to 3000m)	• Operating temperature: 32 to 131°F (0 to 55°C) • Non-operating temperature: -40 to 158°F (-40 to 70°C) • Humidity: 5 to 95 percent (noncondensing) • Altitude: 0 to 10,000 ft. (0 to 3000m)
Power supply	• N2200-PAC-400W, N2200-PAC-400W-B, N2200-PDC-400W, N2200-PDC-350W-B, NXA-PHV-500W, and NXA-PHV-500W-B	• N2200-PAC-400W, N2200-PAC-400W-B, N2200-PDC-400W, N2200-PDC-350W-B, NXA-PHV-500W, and NXA-PHV-500W-B	• N2200-PAC-400W, N2200-PAC-400W-B, N2200-PDC-400W, N2200-PDC-350W-B, NXA-PHV-500W, and NXA-PHV-500W-B	• N2200-PAC-400W, N2200-PAC-400W-B, N2200-PDC-400W, and N2200-PDC-350W-B
Fan modules	• NXA-FAN-30CFM-F and NXA-FAN-30CFM-B (N+1 redundancy = 3 fans)	• NXA-FAN-30CFM-F and NXA-FAN-30CFM-B (N+1 redundancy = 3 fans)	• NXA-FAN-30CFM-F and NXA-FAN-30CFM-B (N+1 redundancy = 3 fans)	• NXA-FAN-30CFM-F and NXA-FAN-30CFM-B (N+1 redundancy = 3 fans)
Typical input operating power	• 125W at 30m (maximum 200W)	• 280W at 30m (maximum 350W)	• 190W at 30m (maximum 250W)	• 280W at 30m (maximum 350W)
Heat dissipation	• 425 BTU/hour (typical); 680 BTU/hour (maximum)	• 952 BTU/hour (typical); 1190 BTU/hour (maximum)	• 510 BTU/hour (typical); 850 BTU/hour (maximum)	• 952 BTU/hour (typical); 1190 BTU/hour (maximum)

Table 3. Cisco Nexus Fabric Extender Transceiver Specifications

Cisco Fabric Extender Transceiver	Specification				
	Support Matrix	**Form Factor**	**Cable**	**Distance**	**Power**
Cisco Fabric Extender Transceiver (FET-10G)	• Supported for fabric links only (Cisco Nexus 2300 platform to Cisco parent switch) • Cisco Fabric Extender Transceiver must be connected to another Fabric Extender Transceiver • Supported on Cisco Nexus 2300 platform uplinks • Supported on Cisco Nexus 5500 and 5600 platforms and 6000 and 7000 Series	SFP	Multimode fiber (MMF)	• 25m (OM2) • 100m (OM3)	Approximately 1W per transceiver
Cisco Fabric Extender Transceiver (FET-40G)	• Supported for fabric links only (Cisco Nexus 2300 platform to Cisco parent switch) • Cisco Fabric Extender must be connected to another Fabric Extender Transceiver • Supported on Cisco 2300 platform uplinks • Supported on Cisco Nexus 5500 and 5600 platforms and 6000 and 7000 Series.	SFP	MMF	• 30m (OM2) • 100m (OM3)	Approximately 1.5W per transceiver

Table 4. Cisco Nexus 2300 Platform Spare Weight Specifications

Cisco Nexus 2300 Platform	Weight	
	Pounds	**Kilograms**
N2200-PAC-400W=	2.2 lb	1 kg
N2200-PAC-400W-B=	2.2 lb	1 kg
N2200-PDC-400W=	2.2 lb	1 kg
N2200-PDC-350W-B=	2.2 lb	1 kg
NXA-PHV-500W	2.2 lb	1 kg
NXA-PHV-500W-B	2.2 lb	1 kg
NXA-FAN-30CFM-F	0.25 lb	0.11 kg
NXA-FAN-30CFM-B	0.25 lb	0.11 kg

Table 5. Cisco Nexus 2300 Platform Power Specifications

Cisco Nexus 2300 Platform	Specification					
	N2200-PAC-400W	**N2200-PAC-400W-B**	**N2200-PDC-400W**	**N2200-PDC-350W-B**	**NXA-PHV-500W**	**NXA-PHV-500W-B**
Platform	Cisco Nexus 2348UPQ, 2348TQ,2332TQ and 2348TQ-E	Cisco Nexus 2348UPQ, 2348TQ, 2332TQ and 2348TQ-E	Cisco Nexus 2348UPQ, 2348TQ, 2332TQ and 2348TQ-E	Cisco Nexus 2348UPQ, 2348TQ, 2332TQ and 2348TQ-E	Cisco Nexus 2348UPQ, 2348TQ and 2332TQ	Cisco Nexus 2348UPQ, 2348TQ and 2332TQ
Compatible fan tray	NXA-FAN-30CFM-F	NXA-FAN-30CFM-B	NXA-FAN-30CFM-F	NXA-FAN-30CFM-B	NXA-FAN-30CFM-F	NXA-FAN-30CFM-B
Compatible power supply	N2200-PAC-400W	N2200-PAC-400W-B	N2200-PDC-400W	N2200-PDC-350W-B	NXA-PHV-500W	NXA-PHV-500W-B
Airflow	Port-side exhaust	Port-side intake	Port-side exhaust	Port-side intake	Port-side exhaust	Port-side intake
Input voltage	90 to 264V AC	90 to 264V AC	-40 to -72V DC	-40 to -72V DC	192 to 400 VDC 100 to 277 VAC	192 to 400 VDC 100 to 277 VAC
Frequency	50 to 60 Hz	50 to 60 Hz	DC	DC	50 to 60 Hz	50 to 60 Hz

Cisco Nexus 2300 Platform	Specification					
Efficiency	• 90 to 92% (110 to 240V input) at typical power draw • 88 to 91% (110 to 240V input) at maximum power draw	• 90 to 92% (110 to 240V input) at typical power draw • 88 to 91% (110 to 240V input) at maximum power draw	• 88% (-48V input) at typical power draw • 85% (-48V input) at maximum power draw	• 88% (-48V input) at typical power draw • 85% (-48V input) at maximum power draw	• 92 to 94% (110 to 240V input) at typical power draw • 91 to 93% (110 to 240V input) at maximum power draw	• 92 to 94% (110 to 240V input) at typical power draw • 91 to 93% (110 to 240V input) at maximum power draw
RoHS compliance	RoHS-6 compliant	RoHS-6 compliant	RoHS-6 compliant	RoHS-6 compliant	RoHS-6 compliant	RoHS-6 compliant
Hot swappable	Yes	Yes	Yes	Yes	Yes	Yes
Maximum rated output power	400W	400W	400W	350W	500W	500W
Power-cord rating	6A at 100V input; 3A at 240V input maximum	6A at 100V input; 3A at 240V input maximum	• 15A at -48V input; 8A at -60V input maximum • Maximum 14AWG wire	• 15A at -48V input; 8A at -60V input maximum • Maximum 14AWG wire	• 4A at 240 Vin and 277 Vin • 3A at 380Vin	• 4A at 240 Vin and 277 Vin • 3A at 380Vin

Table 6. Cisco Nexus 2300 Airflow Optimization Accessories

Accessories	Airflow Extension Sleeve
Part number	NXA-AIRFLOW-SLV-E=
Description	Cisco Nexus airflow extension sleeve: Optimizes airflow in port-side exhaust (front to back) airflow deployments for alignment of port in back of rack and extension of power-supply side of chassis to front of rack with airflow sleeve
Compatibility	Cisco Nexus 2300 platform chassis
Dimensions (H x W x D)	• 1.72 (1RU) x 17.3 x 8.5 in. (fully retracted) or 12.9 in. (fully extended) • Adjustable depth for the fabric extender: 26 to 30 in.
Weight	• 5.7 lb (2.6 kg)

Table 7. Cisco Nexus 2300 Platform Compliance Information

Specification	Description
Regulatory Compliance	Products should comply with CE Markings according to directives 2004/108/EC and 2006/95/EC
Safety	• UL 60950-1 • CAN/CSA-C22.2 No. 60950-1EN 60950-1 • IEC 60950-1AS/NZS 60950-1GB4943
EMC: Emissions	• 47CFR Part 15 (CFR 47) Class A • AS/NZS CISPR22 Class A • CISPR22 Class A • EN55022 Class A • ICES003 Class A • VCCI Class A • EN61000-3-2 • EN61000-3-3 • KN22 Class A • CNS13438 Class A

Specification	Description
EMC: Immunity	• EN50082-1 • EN61000-6-1 • EN55024 • CISPR24 • EN300386 • KN 61000-4 series
RoHS	The Cisco Nexus 2348UPQ, 2348TQ, and 2332TQ are RoHS-6 compliant
Network Equipment Building Standards (NEBS)	The Cisco Nexus 2348UPQ, 2348TQ, and 2332TQ meet NEBS level-3 standards (hardware revision 3) (not currently supported)

Feature support for the Cisco Nexus 2300 platform is mainly derived from the parent switch feature set. Please consult the Cisco Nexus parent switch data sheets for a comprehensive list of features supported. Table 8 lists the hardware capabilities of the Cisco Nexus 2300 platform.

Table 8. Feature Support for Cisco Nexus 2300 Platform

Description	Specification
Layer 2 features	• Layer 2 VLAN trunks • IEEE 802.1Q VLAN encapsulation • Cisco EtherChannel technology on uplinks • PortChannel on server ports on Cisco Nexus 2300 platforms • Advanced PortChannel hashing • Jumbo frames on all ports (up to 9216 bytes) • Pause frames (Priority Flow Control [PFC] and IEEE 802.3x) • Private VLANs (promiscuous only on uplinks) • Local multicast replication on Cisco Nexus 2300 platform (8000 entries) • Autonegotiation to 1000BASE-T; full duplex on host interfaces
Enhanced Ethernet	• DCB
Quality of service (QoS)	• Layer 2 IEEE 802.1p (class of service [CoS]) • Eight hardware queues per port (Cisco Nexus 2300 platforms) • Per-port QoS configuration • Local policing on Cisco Nexus 2300 platform (64 policers) • CoS trust • Configurable tail-drop threshold on Cisco Nexus 2300 platform • Egress strict-priority queuing • Egress port-based scheduling: Weighted Round Robin (WRR)
High availability	• Hot-swappable field-replaceable power supplies and fan modules • 1:1 power redundancy • Uplink traffic management through Cisco EtherChannel hashing or static port pinning • vPCs for dual-homed active-active connectivity across two Cisco Nexus parent switches • vPCs for dual-homed straight-through NIC connectivity across two Cisco Nexus 2300 platform fabric extenders • In-Service Software Upgrade (ISSU)
Security	• Local classification (256 access control list [ACL] entries)
Management	• Fabric extender management using in-band management • Locator and beacon LEDs on front and back of chassis (locator beacons on the front and rear of the chassis help reduce errors when the equipment is serviced) • Per-port locator and beacon LEDs • Syslog • Simple Network Management Protocol Versions 1, 2, and 3 (SNMP v1, v2, and v3) • Enhanced SNMP MIB support • XML (NETCONF) support • Remote Monitoring (RMON) • Cisco Discovery Protocol Versions 1 and 2

Description	Specification
	• Cisco Switched Port Analyzer (SPAN) source on server ports • Power-on self-test (POST) • Cisco Generic Online Diagnostics (GOLD): Ethernet • Comprehensive bootup diagnostic tests • CiscoWorks • Cisco Data Center Network Manager (DCNM); the Cisco Nexus 2300 platform is managed through the parent Cisco Nexus switch using DCNM and standard SNMP, XML interface, and command-line interface (CLI)
Configuration MIBs	• ENTITY-MIB • IF-MIB • FABRIC-EXTENDER MIB • CISCO-ENTITY-EXT-MIB • CISCO-ENTITY-FRU-CONTROL-MIB • CISCO-ENTITY-SENSOR-MIB • CISCO-ETHERNET-FABRIC-EXTENDER-MIB
Monitoring MIBs	• RMON-MIB
Industry standards	• IEEE 802.1p: CoS prioritization • IEEE 802.1Q: VLAN tagging • IEEE 802.3: Ethernet • IEEE 802.3ae: 10 Gigabit Ethernet • SFF 8431 SFP+ support • IEEE 802.3u 100BASE-TX specification • IEEE 802.3ab 1000BASE-T specification • IEEE 802.3an 10GBASE-T • 10GBASE-SR • 10GBASE-LR • RMON • SFF-8461

Cisco Nexus 2300 Platform Ordering Information

Table 9 provides ordering information for the Cisco Nexus 2300 platform fabric extenders.

Table 9. Ordering Information

Part Number	Description
Cisco Nexus 2300 Platform Chassis	
N2K-C2348UPQ	Cisco Nexus 2348UPQ 10GE Fabric Extender, 2PS, 3 Fan Module, 48x1/10GE (req SFP/SFP+) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply
N2K-C2348TQ	Cisco Nexus 2348TQ 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 48x100M/1/10GT (RJ45) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply
N2K-C2332TQ	Cisco Nexus 2332TQ 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 32x100M/1/10GT (RJ45) + 4x40G QSFP+(req QSFP+), choice of airflow and power supply.
N2K-C2348TQ-E	Cisco Nexus 2348TQ-E 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 48x100M/1/10GT (RJ45) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply
Cisco Nexus 2300 Platform Chassis with Fabric Extender and BiDI Optics	
N2K-C2348UPQ4F	Cisco Nexus 2348UPQ 10GE Fabric Extender, 2PS, 3 Fan Module, 48x1/10GE (req SFP/SFP+) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply includes 4/8/12 x Fabric extender transceivers (FET 10G-FET 40G) or QSFP-Bidi
N2K-C2348UPQ8F	
N2K-C2348UPQ12F	
N2K-C2348UPQF-QSA	Cisco Nexus 2348UPQ 10GE Fabric Extender, 2PS, 3 Fan Module, 48x1/10GE (req SFP/SFP+) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply includes 12 x Fabric extender transceivers (FET 10G) and 6 x QSA
N2K-C2348TQ4F	Cisco Nexus 2348TQ 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 48x100M/1/10GT (RJ45) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply includes 4/8/12 x Fabric extender transceivers (FET 10G/FET 40G) or QSFP-Bidi
N2K-C2348TQ8F	
N2K-C2348TQ12F	

Part Number	Description
N2K-C2332TQ4F	Cisco Nexus 2332TQ 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 32x100M/1/10GT (RJ45) + 4x40G QSFP+(req QSFP+), choice of airflow and power supply includes 4/8 x Fabric extender transceivers (FET 10G/FET 40G) or QSFP-Bidi
N2K-C2332TQ8F	
N2K-C2348TQ4F-E	Cisco Nexus 2348TQ-E 10G BASE T Fabric Extender, 2PS, 3 Fan Module, 48x100M/1/10GT (RJ45) + 6x40G QSFP+(req QSFP+), choice of airflow and power supply includes 4/8/12 x Fabric extender transceivers (FET 10G/FET 40G) or QSFP-Bidi
N2K-C2348TQ8F-E	
N2K-C2348TQ12F-E	
Fan Modules	
NXA-FAN-30CFM-F=	Cisco Nexus FEX Fan Module (Std airflow, port side exhaust; Color coding: Blue), spare
NXA-FAN-30CFM-B=	Cisco Nexus FEX Fan module (Reversed airflow, port side intake; Color coding: Red), spare
Power Supplies	
N2200-PAC-400W=	Cisco Nexus 2200 AC Power supply (Std airflow, port side exhaust), spare
N2200-PAC-400W-B=	Cisco Nexus 2200 AC Power supply, Back-to-front airflow (Reversed airflow, port side intake), spare
N2200-PDC-400W=	Cisco Nexus 2200 DC Power supply (Std airflow, port side exhaust), spare
N2200-PDC-350W-B=	Cisco Nexus 2200 DC Power supply, Back-to-front airflow (Reversed airflow, port side intake), spare
N2200-P-BLNK=	Cisco Nexus 2200 Power supply Blank, spare
NXA-PHV-500W=	Nexus Access 500W 277VAC HVDC PSU, Port side exhaust, spare
NXA-PHV-500W-B=	Nexus Access 500W 277VAC HVDC PSU, Port side intake, spare
1 Gigabit Ethernet Transceivers and Cables	
GLC-T(=)	1000BASE-T SFP
GLC-SX-MM(=)	GE SFP, LC connector SX transceiver
GLC-LH-SM(=)	GE SFP, LC connector LX/LH transceiver
SFP-GE-T(=)	1000BASE-T SFP, Extended Temperature Range
SFP-GE-S(=)	GE SFP, LC connector SX transceiver, with Digital Optical Monitoring (DOM) and Extended Temperature Range
SFP-GE-L(=)	GE SFP, LC connector LX/LH transceiver, with Digital Optical Monitoring (DOM) and Extended Temperature Range
10 Gigabit Ethernet Transceivers and Cables	
SFP-10G-SR(=)	10GBASE-SR SFP+ Module
SFP-10G-LR(=)	10GBASE-LR SFP+ Module
SFP-10G-SR-S(=)	10GBASE-SR SFP Module, Enterprise-Class
SFP-10G-LR-S(=)	10GBASE-LR SFP Module, Enterprise-Class
SFP-H10GB-CU1M(=)	10GBASE-CU SFP+ Passive Cable 1 Meter
SFP-H10GB-CU3M(=)	10GBASE-CU SFP+ Passive Cable 3 Meter
SFP-H10GB-CU5M(=)	10GBASE-CU SFP+ Passive Cable 5 Meter
SFP-H10GB-ACU7M(=)	10GBASE-CU SFP+ Active Cable 7 Meter
SFP-H10GB-ACU10M(=)	10GBASE-CU SFP+ Active Cable 10 Meter
40 Gigabit Ethernet Transceivers and Cables	
QSFP-40G-SR4(=)	40GBASE-SR4 QSFP module, (multi-mode fiber, MMF at 100m)
QSFP-40G-CSR4(=)	40GBASE Extended CSR4 QSFP module, (multi-mode fiber, MMF at 300m)
QSFP-40G-LR4(=)	Cisco 40GBASE-LR4 QSFP Module for SMF
QSFP-40G-SR-BD(=)	Cisco QSFP40G BiDi Short-reach Transceiver
QSFP-H40G-ACU7M(=)	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 7-meter, active
QSFP-H40G-ACU10M(=)	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 10-meter, active
QSFP-4x10G-AC7M(=)	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 7-meter, active
QSFP-4x10G-AC10M(=)	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 10-meter, active

Part Number	Description
AOC Cables	
SFP-10G-AOC1M(=)	Cisco 10GBASE-AOC SFP+ Cable 1 Meter
SFP-10G-AOC2M(=)	Cisco 10GBASE-AOC SFP+ Cable 2 Meter
SFP-10G-AOC3M(=)	Cisco 10GBASE-AOC SFP+ Cable 3 Meter
SFP-10G-AOC5M(=)	Cisco 10GBASE-AOC SFP+ Cable 5 Meter
SFP-10G-AOC7M(=)	Cisco 10GBASE-AOC SFP+ Cable 7 Meter
SFP-10G-AOC10M(=)	Cisco 10GBASE-AOC SFP+ Cable 10 Meter
QSFP-4X10G-AOC1M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 1-meter
QSFP-4X10G-AOC2M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 2-meter
QSFP-4X10G-AOC3M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 3-meter
QSFP-4X10G-AOC5M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 5-meter
QSFP-4X10G-AOC7M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 7-meter
QSFP-4X10G-AOC10M(=)	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 10-meter
QSFP-H40G-AOC1M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 1-meter
QSFP-H40G-AOC2M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 2-meter
QSFP-H40G-AOC3M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 3-meter
QSFP-H40G-AOC5M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 5-meter
QSFP-H40G-AOC7M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 7-meter
QSFP-H40G-AOC10M(=)	Cisco 40GBase-AOC QSFP direct-attach Active Optical
SFP-10G-AOC1M(=)	Cisco 10GBASE-AOC SFP+ Cable 1 Meter
Accessory Kit	
N2300-ACC-KIT=	Cisco Nexus 2300 FEX Accessory Kit, spare (includes rack mount kit, ground lug kit, and ESD strap)
NXA-AIRFLOW-SLV-E=	Nexus 2K/3K airflow extension sleeve
NXA-ACC-KIT-BAV	Airflow Vent 2348TQ, 2348TQ-E and 2332TQ only.
Power Cords	
CAB-N5K6A-NA(=)	Power Cord, 210/220V 30A North America
CAB-AC-250V/13A(=)	Power Cord for North America, 125VAC/13A
CAB-C13-C14-JMPR(=)	Recessed receptacle AC power cord 27
CAB-C13-C14-2M(=)	Power Cord Jumper, C13-C14 Connectors, 2 Meter Length
CAB-C13-C14-AC(=)	Power Cord Jumper, C13-C14 Connectors, 3 Meter Length
CAB-C13-CBN(=)	Cabinet Jumper Power Cord, 250 VAC 16A, C14-C13 Connectors
CAB-9K12A-NA(=)	Power Cord, 125VAC 15A NEMA 5-15 Plug, North America
SFS-250V-10A-AR(=)	SFS Power Cord - 250V, 10A - Argentina
CAB-9K10A-AU(=)	Power Cord, 250VAC 10A 3112 Plug, Australia
SFS-250V-10A-CN(=)	SFS Power Cord - 250V, 10A - PRC
CAB-9K10A-EU(=)	Power Cord, 250VAC 10A CEE 7/7 Plug, EU
SFS-250V-10A-ID(=)	SFS Power Cord - 250V, 10A - South Africa, UAE, India
CAB-IND-10A(=)	10A Power cable for India
SFS-250V-10A-IS(=)	SFS Power Cord - 250V, 10A - Israel
CAB-9K10A-IT(=)	Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy
CAB-9K10A-SW(=)	Power Cord, 250VAC 10A MP232 Plug, Switzerland
CAB-9K10A-UK(=)	Power Cord, 250VAC 13A BS1363 Plug (13 A fuse), UK

Warranty

The Cisco Nexus 2300 platform fabric extenders have a 1-year limited hardware warranty. The warranty includes hardware replacement with a 10-day turnaround from receipt of a return materials authorization (RMA).

Service and Support

Cisco offers a wide range of services to support the deployment and optimization of Cisco Nexus 2300 platform fabric extenders in your data center. These innovative Cisco Services offerings 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 achieve long-term value. Cisco Smart Net Total Care™ 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 capability, which offers proactive diagnostics and real-time alerts on your Cisco Nexus 5500 and 5600 platform switches, Cisco Nexus 6000 and 7000 Series Switches, and Cisco Nexus 2000 Series Fabric Extenders. Spanning the entire network lifecycle, Cisco Services offerings help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise. For more information about Cisco Nexus services, visit http://www.cisco.com/go/nexusservices.

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For More Information

- Cisco Nexus 2000 Series Fabric Extenders: http://www.cisco.com/go/nexus2000
- Cisco Nexus 5000 Series Switches: http://www.cisco.com/go/nexus5000
- Cisco Nexus 6000 Series Switches: http://www.cisco.com/go/nexus6000
- Cisco Nexus 7000 Series Switches: http://www.cisco.com/go/nexus7000b
- Cisco Nexus 9000 Series Switches: http://www.cisco.com/go/nexus9000
- Cisco NX-OS Software: http://www.cisco.com/go/nxos

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Cisco Nexus 5600 Platform 10-Gbps Switches

Product Overview

In today's data centers, virtualization deployments have become commonplace, and this trend is increasing rapidly with the availability of 10 Gigabit Ethernet servers at attractive prices. The combination of increased adoption of these servers and applications with higher bandwidth requirements is increasing the need for dense 10 and 40 Gigabit Ethernet switching. Moreover, data center architectures are changing as application environments create new demands for IT infrastructure. Application workloads are deployed across a mix of virtualized and nonvirtualized server and storage infrastructure, requiring a network infrastructure that provides consistent connectivity, security, and visibility across a range of bare-metal, virtualized, and cloud computing environments.

The Cisco Nexus® 5600 platform is the third generation of the Cisco Nexus 5000 Series Switches: the industry's leading data center server access switches. The Cisco Nexus 5600 platform switches can be categorized into 10-Gbps and 40-Gbps switches. This data sheet focuses on the 10-Gbps switches only. Cisco Nexus 5600 platform 10-Gbps switches are the successors to the industry's widely adopted Cisco Nexus 5500 platform switches. The switches maintain all the existing Cisco Nexus 5500 platform features, including LAN and SAN convergence (unified ports and Fibre Channel over Ethernet [FCoE]), fabric extenders, and Cisco® FabricPath. In addition, the Cisco Nexus 5600 platform 10-Gbps switches bring integrated line-rate Layer 2 and 3 capabilities with true 40 Gigabit Ethernet support (on uplink and network-facing ports), Cisco programmable fabric innovations, Network Virtualization Using Generic Routing Encapsulation (NVGRE), Virtual Extensible LAN (VXLAN) bridging and routing, network programmability and visibility, large buffer capacity, and significantly greater scalability and performance for highly virtualized, automated, and cloud environments.

The Cisco Nexus 5600 platform 10-Gbps switches include both 1-Rack-Unit (1RU) and 2RU switches built to meet the challenges of today's data centers with a flexible, agile, and energy-efficient design. These 10-Gbps switches are an important component of the Cisco Unified Data Center architecture, complementing existing Cisco Nexus switches. These energy-efficient switches offer 10 and 40 Gigabit Ethernet and FCoE, providing integrated Layer 2 and 3 features at wire speed and low latency of approximately 1 microsecond for any packet size. With a choice of port-side intake and fan-side intake airflow options to align with cold-aisle and hot-aisle placement in the data center, the 10-Gbps switches are designed for a broad range of traditional data center and large-scale virtualized cloud deployments.

The 10-Gbps switches together with the Cisco NX-OS Software operating system provides customers with features and capabilities that are widely deployed in data centers around the world. NX-OS is a purpose-built data center operating system designed for performance, resiliency, scalability, manageability, and programmability. It meets Ethernet and storage networking requirements, providing a robust and comprehensive feature set that can meet the demanding requirements of virtualization and automation in present and future data centers.

The Cisco Nexus 5600 platform 10-Gbps switches are designed for Top-of-Rack (ToR) and Middle-of-Row (MoR) deployment in data centers that support enterprise applications, service provider hosting, and cloud computing environments.

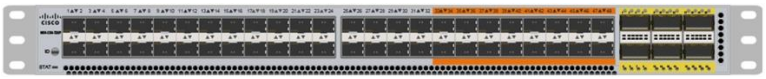
Models and Configurations

The Cisco 5600 platform 10-Gbps switches come in these configurations.

Cisco Nexus 5672UP Switch

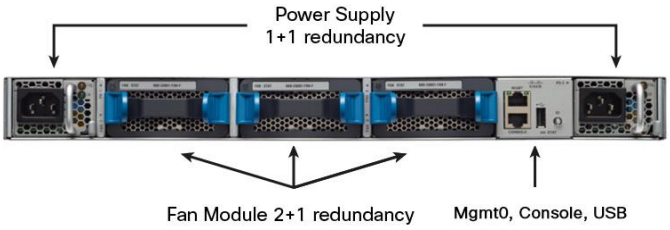
- The Cisco Nexus 5672UP Switch (Figure 1) is a 10 and 40 Gigabit Ethernet (40-Gbps on uplink and network-facing ports) switch offering wire-speed performance for up to seventy-two 10 Gigabit Ethernet ports (using Quad Small Form-Factor Pluggable [QSFP] breakout cables). The Cisco Nexus 5672UP Switches are Layer 2 and 3 nonblocking 10 and 40 Gigabit Ethernet and FCoE-capable switches with up to 1.44 Terabits per second (Tbps) of internal bandwidth. The Cisco Nexus 5672UP offers 48 fixed 1 and 10 Gigabit Ethernet ports, of which the last 16 ports (highlighted in orange on the chassis for easy identification) are unified ports. All 48 fixed ports support classical Ethernet and FCoE. In addition, the 16 unified ports provide 8-, 4-, and 2-Gbps Fibre Channel, as well as 10 Gigabit Ethernet and FCoE connectivity options. The Cisco Nexus 5672UP also offers 6 ports of 40 Gbps using QSFP transceivers for Ethernet and FCoE support. The Cisco Nexus 5672UP has three fan modules and two power supplies. The Cisco Nexus 5672UP supports VXLAN in bridging and routing modes on all ports at line rate, enabling the migration of virtual machines between servers across Layer 3 networks. The switch also offers up to 15 buffer-to-buffer credits per port, helping provide SAN extension of up to 3.7 kilometers at 8-Gbps Fibre Channel speed assuming full Fibre Channel frame size of 2112 bytes.

Figure 1. Cisco Nexus 5672UP Switch (Port-Side View)



The Cisco Nexus 5672UP is constructed with the components shown in Figure 2. The Cisco Nexus 5672UP has two 1+1 redundant, hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy.

Figure 2. Cisco Nexus 5672UP Switch (Fan-Side View)



The Cisco Nexus 5672UP supports both port-side intake (red handle) and fan-side intake (blue handle) airflow options for flexible mounting.

Cisco Nexus 5672UP-16G Switch

- The Cisco Nexus 5672UP-16G Switch (Figure 3) is a 10 and 40 Gigabit Ethernet (40-Gbps on uplink and network-facing ports) switch offering wire-speed performance for up to seventy-two 10 Gigabit Ethernet ports (using QSFP breakout cables). The Cisco Nexus 5672UP-16G Switches are Layer 2 and 3 nonblocking 10 and 40 Gigabit Ethernet and FCoE-capable switches with up to 1.44 Tbps of internal bandwidth.

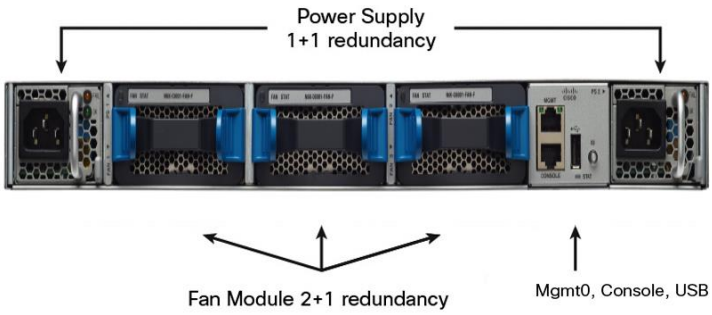
The Cisco Nexus 5672UP-16G offers 48 10 Gigabit Ethernet ports, of which the first 24 ports are capable of doing 1/10G Ethernet and the last 24 ports (highlighted in orange on the chassis for easy identification) are unified ports that support 16-, 8-, 4-, and 2-Gbps Fibre Channel. All 48 fixed ports support classical Ethernet and FCoE.

The 24 unified ports provide 16-, 8-. 4-, and 2-Gbps Fibre Channel as well as 10 Gigabit Ethernet and FCoE connectivity options. The Cisco Nexus 5672UP-16G also offers 6 ports of 40 Gbps using QSFP transceivers for Ethernet and FCoE support. The Cisco Nexus 5672UP-16G has three fan modules and two power supplies and supports VXLAN in bridging and routing modes on all ports at line rate, enabling the migration of virtual machines between servers across Layer 3 networks. The switch also offers up to 128 buffer-to-buffer credits per port, helping provide SAN extension of up to 16 kilometers at 16-Gbps Fibre Channel speed assuming full Fibre Channel frame size of 2122 bytes.

Figure 3. Cisco Nexus 5672UP-16G Switch (Port-Side View)

The Cisco Nexus 5672UP-16G platform is constructed with the components shown in Figure 4. The Cisco Nexus 5672UP-16G has two 1+1 redundant, hot-swappable power supplies and three hot-swappable independent fans with support for 2+1 redundancy.

Figure 4. Cisco Nexus 5672UP-16G Switch (Fan-Side View)

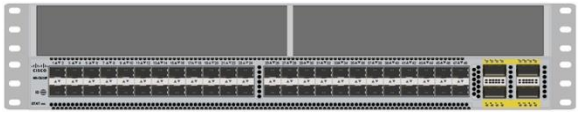


The Cisco Nexus 5672UP-16G supports both port-side intake (red handle) and fan-side intake (blue handle) airflow options for flexible mounting.

Cisco Nexus 56128P Switch

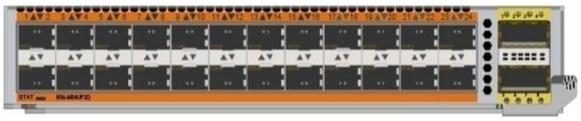
The Cisco Nexus 56128P Switch (Figure 5) is a 2RU switch that supports 2.56 Tbps of bandwidth across 48 fixed 1 and 10 Gigabit Ethernet SFP+ ports and four 40-Gbps QSFP+ ports. The 48 ports on the base chassis support 10 Gigabit Ethernet and FCoE. The 4 QSFP ports support 40 Gigabit Ethernet and FCoE.

Figure 5. Cisco Nexus 56128P Switch (Port-Side View)



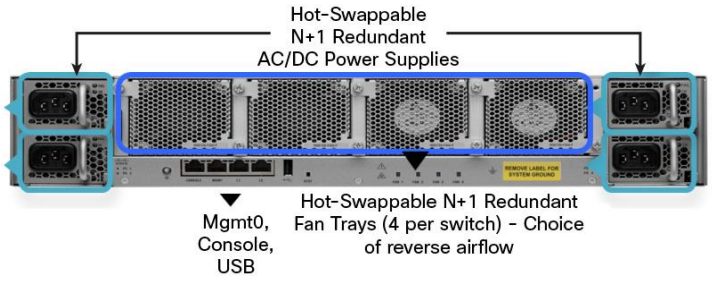
The Cisco Nexus 56128P also offers two slots for a Generic Expansion Module (GEM). The GEM (Figure 6) for the Cisco Nexus 56128P provides 24 SFP+ ports for 10 Gigabit Ethernet and FCoE or 2-, 4-, and 8-Gbps Fibre Channel, and 2 QSFP+ ports for 40 Gigabit Ethernet and FCoE. The expansion module supports native 40 Gigabit Ethernet on the QSFP+ ports. The GEM is supported on the Cisco Nexus 56128P chassis only and can be populated in either of the two expansion slots.

Figure 6. Cisco Nexus 56128P Generic Expansion Module



The Cisco Nexus 56128P is constructed with the components shown in Figure 7. The Cisco Nexus 56128P has four 2+2 redundant, hot-swappable power supplies and four 3+1 redundant, hot-swappable independent fans. The Cisco Nexus 56128P supports both port-side intake (red handle) and fan-side intake (blue handle) airflow options.

Figure 7. Cisco Nexus 56128P Switch (Fan-Side View)



The Cisco Nexus 56128P supports VXLAN bridging and routing modes on all ports at line rate, enabling the migration of virtual machines between servers across Layer 3 networks.

With the Cisco Nexus 5600 10-Gbps platform, organizations can quickly and easily upgrade existing data centers through advanced Cisco bidirectional (BiDi) optics, which enable the use of existing 10 Gigabit Ethernet fiber (a pair of multimode fiber strands) to carry 40 Gigabit Ethernet to the aggregation layer or to the spine (in a leaf-and-spine configuration) without requiring any change to the existing cabling infrastructure. Additionally, the platform can be deployed in MoR or EoR configurations to meet the 10 and 40 Gigabit Ethernet connectivity requirements of multiple racks or pods.

When used with Cisco Nexus 2000 Series Fabric Extenders, the Cisco Nexus 5600 platform 10-Gbps switches can support even more servers in a collapsed access- and aggregation-layer design, supporting 1 and 10 Gigabit Ethernet connectivity across multiple racks.

Features and Benefits

The following are some of the primary features of the Cisco Nexus 5600 10-Gbps platform switches:

- **Optimization for virtualization and cloud deployments:** Today, high-performance servers deployed in the cloud can support many more virtual machines and workloads than ever before. The requirement to be able to deploy new servers on demand puts additional strain on the network fabric. The 10-Gbps switches address this challenge by providing scalability and performance, making it an excellent platform for meeting current and future needs.

- **Density and resilience:** Built for today's data centers, the switches are designed just like the servers they support. Ports and power connections are at the rear, close to server ports, helping keep cable lengths as short as possible and delivering to rack servers benefits traditionally offered only on blade servers. Hot-swappable power and fan modules can be accessed from the front panel, where status lights offer an at-a-glance view of switch operation. Front-to-back or back-to-front cooling is consistent with server designs, supporting efficient data center hot- and cold-aisle designs. Serviceability is enhanced with all customer-replaceable units accessible from the front panel.
- **Energy efficiency:** The 10-Gbps switches help data centers operate within their space, power, and cooling parameters while reducing their carbon footprints. The switch power supplies are also capable of maintaining 90 percent efficiency at load conditions of as low as 25 percent utilization. This capability allows the switch to make efficient use of power while still being appropriately sized to support the conditions of a full system load.
- **Low latency:** Cut-through switching enables these switches to support approximately 1 microsecond of port-to-port latency for any packet size with features enabled.
- **Intelligent Cisco Switched Port Analyzer (SPAN) and Encapsulated SPAN (ERSPAN):** SPAN and ERSPAN can be used for troubleshooting and robust monitoring of traffic. The SPAN and ERSPAN capabilities are nondisruptive, with only extra bandwidth capacity used for SPAN and ERSPAN traffic. Enhancements include more efficient allocation of bandwidth to SPAN and ERSPAN traffic so that any fabric bandwidth not used for data traffic can be allocated to SPAN or ERSPAN traffic. The switch can support up to 31 line-rate SPAN and ERSPAN sessions.
- **Flexible buffer management:** The 10-Gbps switches support a 25-MB packet buffer shared by every 3 ports of 40 Gigabit Ethernet or every 12 ports of 10 Gigabit Ethernet. The flexible buffer management capability allows dynamic tuning of the sizes of the shared and dedicated buffers in the event of congestion.
- **Multicast enhancements:** These switches support line-rate Layer 2 and 3 multicast throughput for all frame sizes. They offer optimized multicast replication through the fabric and at the egress point. Support is provided for 32,000 multicast routes and for Internet Group Management Protocol (IGMP) snooping tables in hardware. Multicast enhancements include flow-based hashing for multicast traffic over a port channel and enhanced Bidirectional Protocol-Independent Multicast (Bidir-PIM) support. The switch also supports IP-based forwarding for IGMP snooping.
- **Inter-Switch Link (ISL):** The Cisco Nexus 5672UP-16G switch supports 16-Gbps Fibre Channel ISLs in a Fibre Channel–only environment or, in the case of FCoE, 40-Gbps ISLs. With six such 40-Gbps links available, the ISLs support bandwidth of 240 Gbps. Improved buffer-to-buffer credits (up to 128) on the new switch now provide support for 16-Gbps Fibre Channel ISLs across distances of up to 16 kilometers.

For a complete list of the latest software features supported on the Cisco Nexus 5600 10-Gbps platform, see the product bulletin at https://www.cisco.com/c/en/us/products/collateral/switches/nexus-5000-series-switches/bulletin-c25-735319.html.

Applications

The Cisco Nexus 5600 10-Gbps platform supports a number of application scenarios, making it a versatile data center option.

Cisco Fabric Extender Architecture: High-Density Fabric Extender Aggregator

Cisco Fabric Extender Technology (FEX Technology) enables you to build a single, modular fabric that extends from Cisco Nexus switches to Cisco Unified Computing System™ (Cisco UCS®) servers, to adapters (Cisco Adapter FEX), and to virtual machines (Cisco Data Center Virtual Machine FEX [VM-FEX]). FEX Technology is based on the emerging standard IEEE 802.1BR. Designing the network using FEX Technology provides flexibility, reduced cabling infrastructure, and a single point of management, helping customers scale their networks. When the 10-Gbps switches are part of a fabric that includes Cisco Nexus 2200 and 2300 platform fabric extenders, you can use these fabric extenders in single- or dual-connected mode, using enhanced virtual port-channel (vPC+) technology to two upstream 10-Gbps switches. Servers and end hosts can connect to single or dual Cisco Nexus 2200 and 2300 platform fabric extenders using Network Interface Card (NIC) teaming when the parent Cisco Nexus 5600 platform 10-Gbps switch has vPC+ enabled.

Following are some common deployment options using the Cisco Nexus 2000 Series (including the 2200 and 2300 platforms) and 5600 10-Gbps platform:

- Rack servers with 100 Megabit Ethernet, 1 Gigabit Ethernet, or 10 Gigabit Ethernet NICs; the fabric extender can be physically located at the top of the rack, and the 10-Gbps switch can reside in the middle or at the end of the row, or the fabric extender and the 10-Gbps switch can both reside in the middle or at the end of the row
- Rack servers with 10 Megabit Ethernet NICs in full duplex mode connected using the Cisco Nexus 2248TP-E Fabric Extender in conjunction with the Cisco Nexus 5600 platform
- Mixed 1 and 10 Gigabit Ethernet environments in which rack servers are running at either speed in the same rack or in adjacent racks
- 10 Gigabit Ethernet and FCoE deployments using servers with Converged Network Adapters (CNAs) for unified fabric environments
- 10GBASE-T server connectivity with ease of migration from 1 to 10GBASE-T and effective reuse of structured cabling
- 1 and 10 Gigabit Ethernet blade servers with pass-through blades
- Low-latency, high-performance computing environments
- Virtualized access

In addition to these options, the 10-Gbps switches provide unique value as a high-density fabric extender aggregation platform. For example, the switches can be used in conjunction with the Cisco Nexus 2348UPQ, 2348TQ, 2332TQ, 2248PQ, 2232PP, 2248TP-E, 2232TM-E, 2232TM, 2248TP, and 2224TP Fabric Extenders as a high-density switching system, consolidating 10 Gigabit Ethernet connections in a single management plane. In addition, a variety of blade fabric extender options can be aggregated into the Cisco Nexus 5600 10-Gbps platform switches using 10 Gigabit Ethernet, providing a single point of management for blade server deployments.

Table 1 lists the fabric extenders that are supported by the Cisco Nexus 5600 10-Gbps platform switches. For more information about the products and the minimum software releases supported, see the Cisco Nexus 2200 and 2300 platform data sheets and release notes.

Table 1. Supported Fabric Extenders

Fabric Extender	Description
Cisco Nexus 2332TQ	32 x 1/10GBASE-T port host interfaces (SFP+) and up to 4 QSFP+ 10/40 Gigabit Ethernet fabric interfaces; FCoE support up to 30m with Category 6a or 7 cables
Cisco Nexus 2348TQ	48 x 1/10GBASE-T port host interfaces (SFP+) and up to 6 QSFP+ 10/40 Gigabit Ethernet fabric interfaces; FCoE support up to 30m with Category 6a or 7 cables
Cisco Nexus 2348UPQ	48 x 1 and 10 Gigabit Ethernet and unified port host interfaces (SFP+) and up to 6 QSFP+ 10/40 Gigabit Ethernet fabric interfaces
Cisco Nexus 2224TP	24 x 100/1000BASE-T host interfaces and 2 x 10 Gigabit Ethernet fabric interfaces (SFP+)
Cisco Nexus 2248TP	48 x 100/1000BASE-T host interfaces and 4 x 10 Gigabit Ethernet fabric interfaces (SFP+)
Cisco Nexus 2248TP-E	48 x 100/1000BASE-T host interfaces and 4 x 10 Gigabit Ethernet fabric interfaces (SFP+; 32-MB shared buffer)
Cisco Nexus 2232PP	32 x 1/10 Gigabit Ethernet and FCoE host interfaces (SFP+) and 8 x 10 Gigabit Ethernet and FCoE fabric interfaces (SFP+)
Cisco Nexus 2248PQ	48 x 1/10 Gigabit Ethernet SFP+ host interface and 4 x 40 Gigabit Ethernet (16 x 10 Gigabit Ethernet SFP+) network interfaces
Cisco Nexus 2232TM	32 x 1/10GBASE-T host interfaces and 8 x 10 Gigabit Ethernet (SFP+) uplink modules
Cisco Nexus 2232TM-E	32 x 1/10GBASE-T host interfaces and 8 x 10 Gigabit Ethernet (SFP+) uplink modules (lower power consumption and improved Bit Error Rate [BER])
Cisco Nexus B22HP	16 x 1/10GBASE-KR internal host interfaces and 8 x 10 Gigabit Ethernet fabric interfaces (SFP+; network interfaces)
Cisco Nexus B22F	16 x 10GBASE-KR internal host interfaces and 8 x 10 Gigabit Ethernet fabric interfaces (SFP+; network interfaces)
Cisco Nexus B22DELL	16 x 10GBASE-KR internal host interfaces and 8 x 10 Gigabit Ethernet fabric interfaces (SFP+; network interfaces)
Cisco Nexus B22IBM	14 x 1/10GBASE-KR internal host interfaces and 8 x 10 Gigabit Ethernet fabric (SFP+; network interfaces)

Large-Scale Fabric (Layers 2 and 3): Leaf and Spine Architecture

Data center designs are evolving, with customers seeking to build large-scale nonblocking fabrics to accommodate different applications, creating patterns of heavy east-west and north-south traffic. The Cisco Nexus 5600 platform 10-Gbps switches are well suited for leaf and spine nodes in a Layer 2 or 3 fabric design. Leaf-and-spine designs using high-density and low-latency switches lead to flatter network architecture, allowing connections that scale from hundreds to more than 10,000 servers with high bidirectional bandwidth and helping ensure low-latency fabric with a low hop count. The spine switches create a nonblocking, low-latency fabric, forwarding packets between leaf switches. The leaf switches provide connectivity to servers. Use of a highly meshed architecture helps ensure the highest possible network availability with little impact on customer traffic in the event of a failure. The 10-Gbps switches can be deployed as Layer 2 or 3 spine or leaf switches, providing a high degree of design flexibility.

Multihop FCoE

Cisco Unified Fabric combines data center and storage networks to deliver a single high-performance, highly available, and scalable network. With the Cisco Nexus 5600 10-Gbps platform switches, Cisco can support end-to-end data center convergence, from the server to storage, by delivering multihop FCoE capability in the data center. The FCoE capability complements the existing FCoE function on the Cisco Nexus 5600 10-Gbps platform. With this broad selection of standards-based FCoE switches, Cisco provides unified fabric support to both the access and core network layers, supporting all storage traffic (FCoE, Small Computer System Interface over IP [iSCSI], and Network-Attached Storage [NAS]) over a simplified infrastructure based on lossless 10 and 40 Gigabit Ethernet.

High-Performance Computing

The Cisco Nexus 5600 10-Gbps platform switches can be deployed as high-density Small Form-Factor (SFF) access-layer switches to consolidate a large number of 10 Gigabit Ethernet servers in deployments that call for only a small number of hops from the server to the upstream network to reduce latency. They have a high density of 10 Gigabit Ethernet ports per rack unit, approximately 1 microsecond of latency port to port for any packet size, integrated line-rate Layer 2 and 3 features, scalability, and integrated data analytics with programmability. They address the needs of High-Performance Computing (HPC) and High-Frequency Trading (HFT) environments, for which InfiniBand solutions lack management visibility and high performance of bulk data transfers across traditional applications.

The capability to function in all these capacities helps protect investments in the data center with a deployment model in which additional features can be enabled as they are needed.

Cisco NX-OS Software Overview

NX-OS is a purpose-built data center operating system designed for performance, resiliency, scalability, manageability, and programmability. NX-OS meets Ethernet and storage networking requirements, providing a robust and comprehensive feature set that can meet the demanding requirements of virtualization and automation in present and future data centers. The enhanced Cisco fabric solution allows the transparent integration of the virtual and physical devices on a unified network. In addition, users can use the comprehensive NX-OS service set to create unique innovations for customized solutions. With its MIBs, native XML interface, and Command-Line Interface (CLI) like that of Cisco IOS® Software, NX-OS provides drastically simplified management for the devices in which it runs.

For a complete list of all the features and benefits of NX-OS, see https://www.cisco.com/en/US/prod/collateral/iosswrel/ps9494/ps9372/data_sheet_c78-652063.html.

Cisco Prime Data Center Network Manager

Cisco Prime™ Data Center Network Manager (DCNM) provides LAN and SAN management capabilities for the Cisco Nexus and Cisco MDS 9000 Families. DCNM provides a GUI that reduces Operating Expenses (OpEx) compared to traditional CLI methods and allows efficient operation control, monitoring, provisioning, and troubleshooting for your NX-OS devices. The main features include the following:

- Unified fabric visibility and topology display with VMware vSphere integration shows the connectivity from the virtual machine to the VMware ESX host and to the switch and the storage array.
- Event aggregation and filtering helps you quickly find the information you need and identify network problems.
- Deployment wizards and user-modifiable templates help you implement best practices.
- Role-Based Access Control (RBAC) helps secure devices and provide appropriate delegation.
- Integrated domain dashboards, health monitoring, reporting, change tracking, and user auditing provides comprehensive management capabilities.
- Trend monitoring of ports and traffic allow you to optimize your existing resources and anticipate new resource requirements.

Specifications

Table 2 lists the specifications for the Cisco Nexus 5600 10-Gbps platform switches. For a complete list of features supported, see the software release notes at https://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus5600/sw/release/notes/7x/Nexus5600_Release_Notes_7x.html.

Table 2. Product Specifications

Performance
• Cisco Nexus 5672UP-16G: Layer 2 and 3 hardware forwarding at 1.44 Tbps; 1071 million packets per second (mpps; 64-byte packets) • Cisco Nexus 5672UP: Layer 2 and 3 hardware forwarding at 1.44 Tbps; 1071 mpps (64-byte packets) • Cisco Nexus 56128P: Layer 2 and 3 hardware forwarding at 2.56 Tbps; 1904 mpps (64-byte packets) • Support for up to 256,000 combined entries of MAC addresses and Address Resolution Protocol (ARP) entries • Low latency of approximately 1 microsecond using cut-through forwarding for predictable, consistent traffic latency regardless of packet size, traffic pattern, or features enabled on 10 and 40 Gigabit Ethernet interfaces • 25-MB buffer per 12 x 10 Gigabit Ethernet SFP+ interfaces • Line-rate traffic throughput on all ports in Layer 2 and 3 mode
Interfaces
• Cisco Nexus 5672UP-16G: 48 fixed 10 Gigabit Ethernet SFP+ ports with 24 of the 48 ports being unified, and 6 fixed 40 Gigabit Ethernet QSFP+ ports with 10 and 40 Gigabit Ethernet FCoE support on all respective ports and 2/4/8/16-Gbps Fibre Channel on all the unified ports. First 24 ports can support 1G Ethernet. • Cisco Nexus 5672UP: 48 fixed 1/10 Gigabit Ethernet SFP+ ports with 16 of the 48 ports being unified, and 6 fixed 40 Gigabit Ethernet QSFP+ ports with 10 and 40 Gigabit Ethernet FCoE support on all respective ports and 2/4/8-Gbps Fibre Channel on all the unified ports • Cisco Nexus 56128P: 48 fixed 1/10 Gigabit Ethernet SFP+ ports with 4 x 40 Gigabit Ethernet QSFP+ fixed ports and 2 expansion slots • Expansion module: 24 SFP+ unified ports plus 2 x 40 Gigabit Ethernet QSFP+ ports • Conversion of 40 Gigabit Ethernet ports to 10 Gigabit Ethernet interfaces through QSFP+ breakout cable • Fabric extension through the Cisco Nexus 2200 and 2300 platforms
Layer 2 Features
• Layer 2 switch ports and VLAN trunks • IEEE 802.1Q VLAN encapsulation • Support for up to 4000 VLANs • Support for up to 4000 access control list (ACL) entries • Rapid Per-VLAN Spanning Tree Plus (PVRST+) (IEEE 802.1w compatible) • Multiple Spanning Tree Protocol (MSTP) (IEEE 802.1s): 64 instances • Spanning Tree PortFast • Spanning Tree root guard • Spanning Tree Bridge Assurance • Cisco EtherChannel technology (up to 16 ports per EtherChannel) • Cisco vPC technology • vPC configuration synchronization • vPC shutdown • Link Aggregation Control Protocol (LACP): IEEE 802.3ad • Advanced port-channel hashing based on Layer 2, 3, and 4 information • Jumbo frames on all ports (up to 9216 bytes) • Pause frames (IEEE 802.3x) • Storm control (unicast, multicast, and broadcast) • Private VLANs • Private VLAN over trunks (isolated and promiscuous) • Private VLANs over vPC and EtherChannels • VLAN remapping • FabricPath • EvPC and vPC+ with FabricPath • Adapter FEX • Data Center VM-FEX • Support for up to 24 fabric extenders (Layer 2) with each Cisco Nexus 5672UP, 5672UP-16G, and 56128P Switch • RDMA over Converged Ethernet (RoCE) using Data Center Bridging (DCB) support (DCB Exchange [DCBX] no drop and Priority Flow Control [PFC])

Layer 3 Features
• Layer 3 interfaces: Routed ports, Switch Virtual Interface (SVI), port channels, subinterfaces, and port-channel subinterfaces • Support for up to 32,000 IPv4 and 8000 IPv6 host prefixes • Support for up to 8000 multicast routes (IPv4) • Support for up to 8000 IGMP snooping groups • Support for 4000 Virtual Routing and Forwarding (VRF) entries • Support for up to 4096 VLANs • Equal-Cost Multipathing (ECMP) up to 64 ways • 4000 flexible ACL entries • Routing protocols: Static, Routing Information Protocol Version 2 (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First Version 2 (OSPFv2), Border Gateway Protocol (BGP), and Intermediate System-to-Intermediate System (IS-IS) • IPv6 routing protocols: Static, OPFv3, BGPv6, and EIGRPv6 • IPv6 VRF-lite • BFD support: OSPFv2, BGPv4, EIGRP, and VRF instances • Policy-Based Routing (IPv4 and IPv6) • Hot-Standby Router Protocol (HSRP) and Virtual Router Redundancy Protocol (VRRP) • IP direct broadcast • vPC+ routing protocol peering • ACL: Routed ACL with Layer 3 and 4 options to match ingress and egress ACL • Multicast: Protocol Independent Multicast Version 2 (PIMv2) sparse mode, Source-Specific Multicast (SSM), Bidir-PIM, Multicast Source Discovery Protocol (MSDP), IGMPv2 and v3, and Multicast VLAN Registration (MVR) • VRF: VRF-lite (IP VPN); VRF-aware unicast; and BGP-, OSPF-, RIP-, and VRF-aware multicast • Unicast Reverse-Path Forwarding (uRFP) with ACL; strict and loose modes • Jumbo frame support (up to 9216 bytes) • Support for up to 24 fabric extenders on each Cisco Nexus 5600 10-Gbps platform switch
Quality of Service (QoS)
• Layer 2 IEEE 802.1p (Class of Service [CoS]) • 8 unicast queues and 8 multicast queues per port • Per-port QoS configuration • CoS trust • Port-based CoS assignment • Modular QoS CLI (MQC) compliance: IPv4 and IPv6 • ACL-based QoS classification (Layers 2, 3, and 4) • Flexible TCAM carving • MAC and ARP hardware carving • MQC CoS marking • Per-port virtual output queuing • CoS-based egress queuing • Egress strict-priority queuing • Egress port-based scheduling: Deficit Weighted Round-Robin (DWRR) • Control-Plane Policing (CoPP): IPv4 and IPv6
Security
• Ingress ACLs (standard and extended) on Ethernet and virtual Ethernet ports • Standard and extended Layer 2 ACLs: MAC addresses, protocol type, etc. • Standard and extended Layer 3 and 4 ACLs: IPv4 and IPv6, Internet Control Message Protocol (ICMP and ICMPv6), TCP, User Datagram Protocol (UDP), etc. • Ingress policing • VLAN-based ACLs (VACLs) • Port-based ACLs (PACLs) • Named ACLs • Optimized ACL distribution • ACLs on virtual terminals (vtys) • ACL logging (IPv4 only) • Dynamic Host Configuration Protocol (DHCP) snooping with Option 82 • Dynamic ARP Inspection • IP source guard

- DHCP relay (up to 32 destinations)
- Ethernet port security
- IPv6 RACL, PACL, and VACL
- iSCSI Type-Length-Value (TLV)

High-Availability Features

- Cisco In-Service Software Upgrade (ISSU) for Layer 2
- Hot-swappable field-replaceable power supplies and fan modules
- N+1 and N+N power redundancy
- N+1 fan module redundancy

Management

- Switch management using 10/100/1000-Mbps management or console ports
- CLI-based console to provide detailed out-of-band management
- In-band switch management
- Port-based locator and beacon LEDs
- Configuration synchronization
- Configuration rollback
- Secure Shell Version 2 (SSHv2)
- Telnet
- Authentication, Authorization, and Accounting (AAA)
- AAA with RBAC
- RADIUS
- TACACS+
- Syslog (8 servers)
- Embedded packet analyzer
- SNMPv1, v2, and v3 (IPv4 and IPv6)
- Enhanced SNMP MIB support
- XML (NETCONF) support
- Remote monitoring (RMON)
- Advanced Encryption Standard (AES) for management traffic
- Unified username and passwords across CLI and SNMP
- Microsoft Challenge Handshake Authentication Protocol (MS-CHAP)
- Digital certificates for management between switch and RADIUS server
- Cisco Discovery Protocol Versions 1 and 2
- RBAC
- SPAN on physical, PortChannel and VLAN
- ERSPAN
- Ingress and egress packet counters per interface
- Network Time Protocol (NTP)
- Cisco Generic Online Diagnostics (GOLD)
- Comprehensive bootup diagnostic tests
- Cisco Embedded Event Manager (EEM)
- Cisco Call Home
- Cisco Smart Call Home
- Default Interface
- Cisco Fabric Manager
- Cisco Prime DCNM
- CiscoWorks LAN Management Solution (LMS)

Data Center Bridging

- CEE- and IEEE-compliant PFC (per-priority Pause frame support: IEEE 802.1Qbb)
- PFC link distance support: 20 km
- CEE-compliant DCBX Protocol
- CEE- and IEEE-compliant enhanced transmission selection

FCoE Features (Require Storage Services License)
• T11 standards-compliant FCoE (Fibre Channel-BB-5) • T11 FCoE Initialization Protocol (FIP) (Fibre Channel-BB-5) • Any 10 or 40 Gigabit Ethernet port configurable as FCoE • SAN administration separate from LAN administration • Fibre Channel forwarding (FCF) • Fibre Channel enhanced port types: VE, VF and VNP • Direct attachment of FCoE targets • Fabric Device Management Interface (FDMI) • Fibre Channel ID (FCID) persistence • Distributed device alias services • In-order delivery • Port tracking • Cisco FCoE NPV technology • N-port Identifier Virtualization (NPIV) • Fabric services: Name server, Registered State Change Notification (RSCN), login services, and name-server zoning • Per-VSAN fabric services • Cisco Fabric Services • Distributed device alias services • Host-to-switch and switch-to-switch Fibre Channel-SP authentication • Fabric Shortest Path First (FSPF) • Standard zoning • Enhanced zoning • Cisco Fabric Analyzer • Cisco DCNM-SAN • Storage Management Initiative Specification (SMI-S) • Boot from SAN over vPC and Enhanced vPC (EvPC) • FCP • VSAN trunking • Fabric Device Management Interface (FDMI) • Fibre Channel ID (FCID) persistence • Distributed device alias services • In-order delivery • Port tracking • Cisco NPV technology • Fabric binding for Fibre Channel • Port security • Fibre Channel traceroute • Fibre Channel ping • Fibre Channel debugging
SNMP MIBs
Generic MIBs
• SNMPv2-SMI • CISCO-SMI • SNMPv2-TM • SNMPv2-TC • IANA-ADDRESS-FAMILY-NUMBERS-MIB • IANAifType-MIB • IANAiprouteprotocol-MIB • HCNUM-TC • CISCO-TC • SNMPv2-MIB • SNMP-COMMUNITY-MIB • SNMP-FRAMEWORK-MIB • SNMP-NOTIFICATION-MIB • SNMP-TARGET-MIB

• SNMP-USER-BASED-SM-MIB • SNMP-VIEW-BASED-ACM-MIB • CISCO-SNMP-VACM-EXT-MIB
Layer 3 MIBs
• UDP-MIB • TCP-MIB • OSPF-MIB • BGP4-MIB • CISCO-HSRP-MIB
Ethernet MIBs
• CISCO-VLAN-MEMBERSHIP-MIB • CISCO-Virtual-Interface-MIB • CISCO-VTP-MIB
Configuration MIBs
• ENTITY-MIB • IF-MIB • CISCO-ENTITY-EXT-MIB • CISCO-ENTITY-FRU-CONTROL-MIB • CISCO-ENTITY-SENSOR-MIB • CISCO-FLASH-MIB • CISCO-SYSTEM-MIB • CISCO-SYSTEM-EXT-MIB • CISCO-IP-IF-MIB • CISCO-IF-EXTENSION-MIB • CISCO-SERVER-INTERFACE-MIB • CISCO-NTP-MIB • CISCO-IMAGE-MIB • CISCO-IMAGE-CHECK-MIB • CISCO-IMAGE-UPGRADE-MIB • CISCO-CONFIG-COPY-MIB • CISCO-ENTITY-VENDORTYPE-OID-MIB • CISCO-BRIDGE-MIB
Monitoring MIBs
• DIFFSERV-DSCP-TC • NOTIFICATION-LOG-MIB • DIFFSERV-MIB • CISCO-CALLHOME-MIB • CISCO-SYSLOG-EXT-MIB • CISCO-PROCESS-MIB • RMON-MIB • CISCO-RMON-CONFIG-MIB • CISCO-HC-ALARM-MIB • LLDP-MIB
Security MIBs
• CISCO-AAA-SERVER-MIB • CISCO-AAA-SERVER-EXT-MIB • CISCO-COMMON-ROLES-MIB • CISCO-COMMON-MGMT-MIB • CISCO-RADIUS-MIB • CISCO-SECURE-SHELL-MIB • TCP/IP MIBs • INET-ADDRESS-MIB • TCP-MIB • CISCO-TCP-MIB

- UDP-MIB
- IP-MIB
- CISCO-IP-PROTOCOL-FILTER-MIB
- CISCO-DNS-CLIENT-MIB
- CISCO-PORTSECURITY-MIB

Miscellaneous MIBs

- START-MIB
- CISCO-LICENSE-MGR-MIB
- CISCO-FEATURE-CONTROL-MIB
- CISCO-CDP-MIB
- CISCO-RF-MIB
- CISCO-ETHERNET-FABRIC-EXTENDER-MIB
- CISCO-BRIDGE-MIB
- CISCO-FCOE-MIB
- CISCO-PORTCHANNEL-MIB
- CISCO-ZS-MIB

Standards

Industry Standards

- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1p: CoS prioritization
- IEEE 802.1Q: VLAN tagging
- IEEE 802.1Qaz: Enhanced transmission selection
- IEEE 802.1Qbb: Per-priority Pause
- IEEE 802.1s: Multiple VLAN instances of Spanning Tree Protocol
- IEEE 802.1w: Rapid reconfiguration of Spanning Tree Protocol
- IEEE 802.3: Ethernet
- IEEE 802.3ad: LACP with fast timers
- IEEE 802.3ae: 10 Gigabit Ethernet
- IEEE 802.3ba: 40 Gigabit Ethernet (Applies to 40G SR4, SR4-S, LR4, LR4-S, and CSR4 optics only)
- SFF 8431 SFP+ CX1 support
- RMON

Power Supply

Table 3 lists the power supply properties of the Cisco Nexus 5600 10-Gbps platform.

Table 3. Power Supply Properties

Power Supply Properties	N55-PAC-1100W	N55-PDC-1100W	NXA-PAC-1100W	NXA-PHV-1100W
Typical operating power	650 watts (W)	650W	650W	650W
Maximum power	1100W	1100W	1100W	1100W
Input voltage	94 to 264 VAC	–40 to –72 VDC	94 to 264 VAC	90 to 305 HVAC, 192 to 400 HVDC
Frequency	47 to 63 Hz	–	47 to 63 Hz	47 to 63 Hz
Efficiency	92%/88% (50%/100% load) @230VAC	88%/85% (50%/100% load)	94%/91% (50%/100% load) @230VAC	94%/91% (50%/100% load) @230VAC
RoHS compliance	Yes	Yes	Yes	Yes
Hot-swappable	Yes	Yes	Yes	Yes
Heat dissipation	45 BTU/hr	260 BTU/hr	45 BTU/hr	170 to 130 BTU/hr
Front-to-back (fan-side intake) airflow power supply	Yes	Yes	Yes	Yes
Back-to-front (port-side intake) airflow power supply	Yes	No	Yes	Yes

Environment

Table 4 lists the environment properties of the Cisco Nexus 10-Gbps 5600 platform.

Table 4. Environment Properties

Property	Cisco Nexus 5600 Platform
Physical (height x width x depth)	• Cisco Nexus 5672UP and 5672UP-16G: 1.75 x 17.3 x 30 in. (4.4 x 43.9 x 76.2 cm) • Cisco Nexus 56128P: 3.5 x 17.3 x 30 (8.8 x 43.9 x 76.2 cm)
Operating temperature	32 to 104°F (0 to 40°C)
Nonoperating (storage) temperature	–40 to 158°F (–40 to 70°C)
Humidity	5 to 95% (noncondensing)
Altitude	0 to 10,000 ft (0 to 3000m)
Weight	• Cisco Nexus 5672UP/5672UP-16G: 32 lb (2 power supplies) • Cisco Nexus 56128P: 60 lb (2 expansion modules and 4 power supplies)

Regulatory Standards Compliance

Table 5 summarizes regulatory standards compliance for the Cisco Nexus 5600 10-Gbps platform.

Table 5. Regulatory Standards Compliance: Safety and EMC

Specification	Description
Regulatory compliance	Products should comply with CE Markings according to directives 2004/108/EC and 2006/95/EC.
Safety	• UL 60950-1 Second Edition • CAN/CSA-C22.2 No. 60950-1 Second Edition • EN 60950-1 Second Edition • IEC 60950-1 Second Edition • AS/NZS 60950-1 • GB4943
EMC: Emissions	• 47CFR Part 15 (CFR 47) Class A • AS/NZS CISPR22 Class A • CISPR22 Class A • EN55022 Class A • ICES003 Class A • VCCI Class A • EN61000-3-2 • EN61000-3-3 • KN22 Class A • CNS13438 Class A
EMC: Immunity	• EN55024 • CISPR24 • EN300386 • KN 61000-4 series
RoHS	The product is RoHS 6 compliant with exceptions for leaded **Ball Grid Array** (BGA) balls and lead press-fit connectors.

Cisco Nexus 5600 10-Gbps Platform Transceiver and Cabling Options

The Cisco Nexus 5600 platform 10-Gbps switches support a wide variety of 1, 10, and 40 Gigabit Ethernet connectivity options. Table 6 lists the transceivers supported for 1 and 10 Gigabit Ethernet connectivity, and Table 7 lists the 40 Gigabit Ethernet QSFP+ transceivers supported.

Table 6. Cisco Nexus 5600 Platform 1 and 10 Gigabit Ethernet and 4-, 8-, and 16-Gbps Fibre Channel SFP+ Transceiver Support Matrix

Cisco SFP	Description
FET-10G	10-Gbps SFP+ module for Cisco Nexus 2000 Series to Cisco Nexus 5000 Series connectivity
SFP-10G-SR	10GBASE-SR SFP+ module (multimode fiber [MMF])
SFP-10G-SR-S	10GBASE-SR SFP Module, Enterprise-Class
SFP-10G-LR	10GBASE-LR SFP+ module (single-mode fiber [SMF])
SFP-10G-LR-S	10GBASE-LR SFP Module, Enterprise-Class
SFP-10G-ER	10GBASE-ER-SFP+ module (SMF)
SFP-10G-ER-S	10GBASE-ER SFP Module, Enterprise-Class
SFP-H10GB-CU1M	10GBASE-CU SFP+ cable, 1m (Twinax cable)
SFP-H10GB-CU1.5M	10GBASE CU SFP+ cable, 1.5m (passive Twinax cable)
SFP-H10GB-CU2M	10GBASE CU SFP+ cable, 2m (passive Twinax cable)
SFP-H10GB-CU2.5M	10GBASE CU SFP+ cable, 2.5m (passive Twinax cable)
SFP-H10GB-CU3M	10GBASE-CU SFP+ cable, 3m (Twinax cable)
SFP-H10GB-CU5M	10GBASE-CU SFP+ cable, 5m (Twinax cable)
SFP-H10GB-ACU7M	10GBASE-CU SFP+ cable, 7m (active Twinax cable)
SFP-H10GB-ACU10M	10GBASE-CU SFP+ cable, 10m (active Twinax cable)
SFP-10G-AOC1M	10GBASE-AOC SFP+ cable, 1m
SFP-10G-AOC2M	10GBASE-AOC SFP+ cable, 2m
SFP-10G-AOC3M	10GBASE-AOC SFP+ cable, 3m
SFP-10G-AOC5M	10GBASE-AOC SFP+ cable, 5m
SFP-10G-AOC7M	10GBASE-AOC SFP+ cable, 7m
SFP-10G-AOC10M	10GBASE-AOC SFP+ cable, 10m
GLC-T	1000BASE-T SFP
GLC-ZX-SMD	1000BASE-ZX SFP transceiver module, SMF, 1550-nm wavelength, dual LC/PC connector, digital optical monitoring (DOM); not supported on Cisco Nexus 5672UP-16G
GLC-SX-MMD	Gigabit Ethernet SFP, LC connector SX transceiver (MMF), extended temperature range and DOM
GLC-EX-SMD	1000BASE-EX SFP transceiver module, SMF, 1310-nm wavelength, dual LC/PC connector, digital optical monitoring (DOM); not supported on Cisco Nexus 5672UP-16G
GLC-LH-SMD	Gigabit Ethernet SFP, LC connector LX/LH transceiver (SMF), extended temperature range and DOM
SFP-GE-T	1000BASE-T SFP, extended temperature range; not supported on Cisco Nexus 5672UP-16G
DS-SFP-FC16G-SW	16-Gbps Fibre Channel shortwave SFP+, LC connector (16-Gbps Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G)
DS-SFP-FC16G-LW	16-Gbps Fibre Channel longwave SFP+, LC connector (16-Gbps Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G)
DS-SFP-FC8G-SW	8-Gbps Fibre Channel shortwave SFP+, LC connector (Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G, on last 16 ports of Cisco Nexus 5672UP, and on GEM on Cisco Nexus 56128P)
DS-SFP-FC8G-LW	8-Gbps Fibre Channel longwave SFP+, LC connector (Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G, on last 16 ports of Cisco Nexus 5672UP, and on GEM on Cisco Nexus 56128P)
DS-SFP-FC4G-SW	4-Gbps Fibre Channel shortwave SFP, LC connector (Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G, on last 16 ports of Cisco Nexus 5672UP, and on GEM on Cisco Nexus 56128P)
DS-SFP-FC4G-LW	4-Gbps Fibre Channel long-wave SFP, LC connector (Fibre Channel support only on last 24 ports of Cisco Nexus 5672UP-16G, on last 16 ports of Cisco Nexus 5672UP, and on GEM on Cisco Nexus 56128P)

Table 7. Cisco Nexus 5600 Platform 40 Gigabit Ethernet QSFP+ Transceiver Support Matrix (on 6 Uplink Ports)

Cisco QSFP	Description
QSFP-40G-SR4	40GBASE-SR4 QSFP module, MMF, MPO connector. 100m
QSFP-40G-SR4-S	40GBASE-SR4 QSFP module, MPO connector, enterprise class
QSFP-40G-CSR4	40GBASE extended CSR4 QSFP module, MMF, 300m
QSFP-4X10G-LR-S	QSFP 4x10G Transceiver Module, SM MPO, 10KM, Enterprise-Class (N5672UP only)
QSFP-40G-LR4	40GBASE extended LR4 QSFP module, LC connector, 10 km
QSFP-40G-LR4-S	QSFP 40GBASE-LR4 module, LC connector, 10 km, enterprise class
WSP-Q40G-LR4L	QSFP 40 Gigabit Ethernet, LR4 Lite, LC connector, 2 km
QSFP-40G-SR-BD	QSFP40G BiDi short-reach transceiver
QSFP-40G-ER4	QSFP 40GBASE-ER4 Module, LC connector, 40 km
QSFP-4SFP10G-CU1M	40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 1m
QSFP-4SFP10G-CU3M	40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 3m
QSFP-4SFP10G-CU5M	40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 5m
QSFP-4x10G-AC7M	40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 7m, active
QSFP-4x10G-AC10M	40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 10m, active
QSFP-H40G-CU1M	40GBASE-CR4 QSFP+ direct-attach copper cable, 1m, passive
QSFP-H40G-CU3M	40GBASE-CR4 QSFP+ direct-attach copper cable, 3m, passive
QSFP-H40G-CU5M	40GBASE-CR4 QSFP+ direct-attach copper cable, 5m, passive
QSFP-H40G-ACU7M	40GBASE-CR4 QSFP+ direct-attach copper cable, 7m, active
QSFP-H40G-ACU10M	40GBASE-CR4 QSFP+ direct-attach copper cable, 10m, active
QSFP-4X10G-AOC1M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 1m
QSFP-4X10G-AOC2M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 2m
QSFP-4X10G-AOC3M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 3m
QSFP-4X10G-AOC5M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 5m
QSFP-4X10G-AOC7M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 7m
QSFP-4X10G-AOC10M	40GBASE-AOC QSFP to 4 SFP+ active optical breakout cable, 10m
QSFP-H40G-AOC1M	40GBASE-AOC QSFP direct-attach active optical cable, 1m
QSFP-H40G-AOC2M	40GBASE-AOC QSFP direct-attach active optical cable, 2m
QSFP-H40G-AOC3M	40GBASE-AOC QSFP direct-attach active optical cable, 3m
QSFP-H40G-AOC5M	40GBASE-AOC QSFP direct-attach active optical cable, 5m
QSFP-H40G-AOC7M	40GBASE-AOC QSFP direct-attach active optical cable, 7m
QSFP-H40G-AOC10M	40GBASE-AOC QSFP direct-attach active optical cable, 10m
QSFP-H40G-AOC15M	40GBASE-AOC QSFP direct-attach active optical cable, 15m
CVR-QSFP-SFP10G[1]	QSFP to SFP 10-Gbps adapter. All 1-Gbps and 10-Gbps Ethernet optics listed in Table 6 are supported.

The platform supports an innovative Twinax copper cabling solution that connects to standard QSFP connectors for in-rack use and optical cabling for longer cable runs (Table 8).

For in-rack or adjacent-rack cabling, the Cisco Nexus 5600 10-Gbps platform switch supports QSFP+ direct-attach 40 Gigabit Ethernet copper cables, an innovative solution that integrates transceivers with Twinax cables into an energy-efficient, low-cost, and low-latency solution. QSFP+ direct-attach 40 gigabit Twinax copper cables use only 1.5 watts of power per transceiver and introduce approximately 0.1 microsecond of latency per link.

[1] Requires interface breakout configuration.

An alternative to copper cables is fiber through active optical cables that integrate the transceivers with multimode fiber.

For longer cable runs, the Cisco Nexus 5600 10-Gbps platform supports multimode, short-reach optical QSFP+ transceivers. These optical transceivers use approximately 1.5 watts per transceiver and have a latency of approximately 0.1 microsecond.

Table 8. Cisco Nexus 5600 10-Gbps Platform Cabling Support Matrix

Connector (Media)	Cable	Distance	Maximum Power Consumption	Transceiver Latency
SFP+ CU copper	Twinax	1, 1.5, 2, 2.5, 3, and 5m	Approximately 0.1W	Approximately 0.1 microsecond
SFP+ ACU copper	Active Twinax	7 and 10m	Approximately 0.1W	Approximately 0.1 microsecond
SFP+ fiber	Active Optical	1, 2, 3, 5, 7, and 10m		
FET-10G MMF **SFP+ SR MMF** **SFP+ SR-S MMF**	MMF (OM2) MMF (OM3)	82m 100m	1W	Approximately 0.1 microsecond
SFP+ LR SMF **SFP+ LR-S SMF**	SMF	10 km	1W	Approximately 0.1 microsecond
SFP+ ER SMF **SFP+ ER-S SMF**	SMF	40 km	1.5W	Approximately 0.1 microsecond
QSFP CU copper	Twinax	1, 3, and 5m	Approximately 1.5W	Approximately 0.25 microsecond
QSFP ACU copper	Active Twinax	7 and 10m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP fiber	Active Optical	1, 2, 3, 5, 7, and 10m		
QSFP SR4 MMF **QSFP SR4-S MMF**	MMF (OM3) MMF (OM4)	100m 150m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP CSR4 MMF	MMF (OM3) MMF (OM4)	300m 400m	Approximately 1.5W	Approximately 0.1 microsecond
QSFP LR4 SMF **QSFP LR4-S SMF**	SMF	10 km	Approximately 3.5W	Approximately 0.1 microsecond
QSFP LR4L	MMF	2 km	Approximately 3.5W	Approximately 0.1 microsecond
QSFP ER4 SMF **QSFP ER4-S SMF**	SMF	40 km	Approximately 3.5W	Approximately 0.1 microsecond
QSFP BIDI	MMF (OM3)[1] MMF (OM4)[2] MMF (OM4+)[3]	100m 125m 150m	Approximately 3.5W	Approximately 0.1 microsecond

[1] Connector loss budget for OM3 fiber is 1.5 dB.

[2] 125m over OM4 fiber is with an engineered link with 1 dB budget for connector loss.

[3] 150m over OM4+ fiber is an engineered link with 1 dB budget for connector loss. One of the recommended fibers for OM4+ is Panduit's Signature Core Fiber. Refer to the following link for additional information: https://www.panduit.com/en/signature-core.

Cisco NX-OS Software Packaging for Cisco Nexus 5600 Platform 10-Gbps Switches

The software packaging for the Cisco Nexus 5600 10-Gbps platform offers flexibility and a comprehensive feature set. The default system software has a comprehensive Layer 2 feature set with a number of security and management features. To enable advanced Layer 2 and 3 functions, additional licenses need to be installed.

Table 9 lists the license details and features supported with each license on the Cisco Nexus 5600 platform 10-Gbps switches.

Table 9. Software Packaging and Licensing

License Package	Part Number	Features Supported
FabricPath Services Package: ENHANCED_LAYER2_PKG	N5672-EL2-SSK9 N56128-EL2-SSK9	FabricPath
FCoE NPV Package: FCOE_NPV_PKG	N56-FNPV-SSK9	FCoE NPV
Layer 3 Base Services Package: LAN_BASE_SERVICES_PKG[1]	N56-BAS1K9	Unlimited static routes and maximum of 256 dynamic routes: • Static routes • RIPv2 • OSPFv2 and OSPFv3 • EIGRP stub • HSRP[2] • VRRP[3] • IGMP v2 and v3 • PIMv2 (sparse mode) • VRF-lite • RACL • Network Address Translation (NAT)
Layer 3 Enterprise Services Package: LAN_ENTERPRISE_SERVICES_PKG[4, 5]	N56-LAN1K9	N56-LAN1K9 license includes the following features in addition to the ones with the N56-BAS1K9 license: • BGP • PBR • Full EIGRP • PIMv2 (all modes) • Layer 3 IS-IS[6] • uRPF • MSDP • Sampled NetFlow • VXLAN flood and learn
Network Services Package: NETWORK_SERVICES_PKG	N56-SERVICES1K9[7]	• Cisco Remote Integrated Services Engine • Cisco Intelligent Traffic Director (ITD)
Storage Protocols Services Package: Fibre Channel_FEATURES_PKG **ENTERPRISE_PKG**	N56-12P-SSK9 N56-16P-SSK9 N5672-72P-SSK9 N56128-128P-SSK9	• Native Fibre Channel • FCoE • NPV • Fibre Channel port security • Fabric binding • Fibre Channel security protocol (Fibre Channel-SP) authentication
VM-FEX Package	N56-VMFEX9	Data Center VM-FEX

[1] LAN_BASE_SERVICES_PKG provides unlimited static routes and a maximum of 256 dynamic routes across all the protocols.

[2] Although this feature can be enabled and configured in the CLI without this license, it does not function until the license is installed.

[3] Although this feature can be enabled and configured in the CLI without this license, it does not function until the license is installed.

[4] The LAN_BASE_SERVICES_PKG license needs to be installed to use the LAN_ENTERPRISE_SERVICES_PKG license.

[5] Routes above 256 for all protocols are included in the LAN_ENTERPRISE_SERVICES_PKG license.

[6] Layer 3 IS-IS is available starting with Cisco NX-OS 7.0(1) N1 (1).

[7] N56-SERVICES1K9 is available starting with Cisco NX-OS 7.2(0)N1(1). If you need to use Remote Integrated Services Engine and ITD features with the Cisco NX-OS 7.1(1)N1(1), use the ENHANCED_LAYER2_PKG license.

Cisco ONE Software

Licenses can be purchased individually for each feature as shown in Table 9 or through Cisco ONE™ Software for Data Center Networking which is available for the Cisco Nexus 5600 platform 10-Gbps switches.

Cisco ONE Software provides a new way for customers to purchase and use our infrastructure software. It offers a simplified consumption model focused on common customer scenarios for the data center, WAN, and LAN.

Cisco ONE Software and services provide customers with four main benefits:

- Software suites that address typical customer use scenarios at an attractive price
- Investment protection of the customer's software purchase through software services-enabled license portability
- Access to ongoing innovation and new technology with Cisco Software Support Service (SWSS)
- Flexible licensing models to smoothly distribute the customer's software spending over time

For ordering information for Cisco ONE Software for the Cisco Nexus 5600 platform 10-Gbps switches, click here.

Ordering Information

Table 10 provides ordering information for the Cisco Nexus 5600 10-Gbps platform switches. Notice that you can order the Cisco Nexus 2200 platform fabric extenders either separately or along with the Cisco Nexus 5600 platform 10-Gbps switches.

Table 10. Ordering Information

Part Number	Description
Chassis	
N5K-C5672UP-16G	Cisco Nexus 5672UP-16G 1RU, 24p 10-Gbps SFP+, 24 Unified Ports, 6p 40G QSFP+
N5K-C5672UP-16G=	Cisco Nexus 5672UP-16G 1RU, 24p 10-Gbps SFP+, 24 Unified Ports, 6p 40G QSFP+, Spare
N5K-C5672UP	Cisco Nexus 5672UP 1RU, 32 p 10-Gbps SFP+, 16 Unified Ports, 6p 40G QSFP+
N5K-C5672UP=	Cisco Nexus 5672UP 1RU, 32 p 10-Gbps SFP+, 16 Unified Ports, 6p 40G QSFP+, Spare
N5K-C56128P	Cisco Nexus 56128P 2RU, 48x 10-Gbps SFP+, 4 x 40G QSFP+ Fixed Ports (Base)
N5K-C56128P=	Cisco Nexus 56128P 2RU, 48x 10-Gbps SFP+, 4 x 40G QSFP+ Fixed Ports, Spare (Base)
Fan Modules	
N6K-C6001-FAN-F	Cisco Nexus 5672UP/5672UP-16G Fan Module, Front-to-Back (Fan Side Intake) Airflow
N6K-C6001-FAN-F=	Cisco Nexus 5672UP/5672UP-16G Fan Module, Front-to-Back (Fan Side Intake) Airflow, spare
N6K-C6001-FAN-B	Cisco Nexus 5672UP/5672UP-16G Fan Module, Back-to-Front (Port Side Intake) Airflow
N6K-C6001-FAN-B=	Cisco Nexus 5672UP/5672UP-16G Fan Module, Back-to-Front (Port Side Intake) Airflow, spare
N56128-FAN-B=	Cisco Nexus 56128P Fan Module, Back-to-Front (Port Side Intake) Airflow, spare
N56128-FAN-B	Cisco Nexus 56128P Fan Module, Back-to-Front (Port Side Intake) Airflow
N56128-FAN-F=	Cisco Nexus 56128P Fan Module, Front-to-Back (Fan Side Intake) Airflow, spare
N56128-FAN-F	Cisco Nexus 56128P Fan Module, Front-to-Back (Fan Side Intake) Airflow
Expansion Modules	
N56-M24UP2Q	Cisco Nexus 56128P Expansion Module, 24x 10-Gbps SFP+ UP, 2 x QSFP+ fixed ports
N56-M24UP2Q=	Cisco Nexus 56128P Expansion Module, 24x 10-Gbps SFP+ UP, 2 x QSFP+ fixed ports, Spare

Part Number	Description
Power Supplies	
N55-PDC-1100W(=)	Cisco Nexus 5500/6000/5600 PSU Front-to-Back Airflow module spare, DC, - 40 to -72VDC, 1100W
N55-PAC-1100W(=)	Cisco Nexus 5500/6000/5600 PSU Front-to-Back Airflow module spare, AC, 94 to 240 VAC, 1100W
NXA-PAC-1100W(=)	Cisco Nexus 5500/6000/5600 Platinum PSU Front-to-Back Airflow module spare, A/C, 100-240V, 1100W
NXA-PAC-1100W-B(=)	Cisco Nexus 5500/6000/5600 Platinum PSU Back-to-Front Airflow module spare, A/C, 100-240V, 1100W
NXA-PHV-1100W(=)	Cisco Nexus 5500/6000/5600 Platinum HV-AC-DC PS, Front-to-Back Airflow module spare, 1100W
NXA-PHV-1100W-B(=)	Cisco Nexus 5500/6000/5600 Platinum HV-AC-DC PS, Back-to-Front Airflow module spare, 1100W
Software	
N6KUK9-730N1.1A	Cisco Nexus 5600/6000 Base OS Software Rel 7.3(0)N1(1)
N6KUK9-730N1.1A=	Cisco Nexus 5600/6000 Base OS Software Rel 7.3(0)N1(1), spare
N6KUK9-707N1.1	Cisco Nexus 5600/6000 Base OS Software Rel 7.0(7)N1(1)
N6KUK9-707N1.1=	Cisco Nexus 5600/6000 Base OS Software Rel 7.0(7)N1(1), spare
Cables and Optics	
FET-10G	10-Gbps SFP+ module for Cisco Nexus 2000 Series to Cisco Nexus 5000 Series connectivity
SFP-10G-SR	10GBASE-SR SFP+ module (multimode fiber [MMF])
SFP-10G-SR-S	10GBASE-SR SFP Module, Enterprise-Class
SFP-10G-LR	10GBASE-LR SFP+ module (Single-Mode Fiber [SMF])
SFP-10G-LR-S	10GBASE-LR SFP Module, Enterprise-Class
SFP-10G-ER	10GBASE-ER-SFP+ module (SMF)
SFP-10G-ER-S	10GBASE-ER SFP Module, Enterprise-Class
SFP-H10GB-CU1M	10GBASE-CU SFP+ cable 1m (Twinax cable)
SFP-H10GB-CU1.5M	10GBASE CU SFP+ cable, 1.5m (passive Twinax cable)
SFP-H10GB-CU2M	10GBASE CU SFP+ cable, 2m (passive Twinax cable)
SFP-H10GB-CU2.5M	10GBASE CU SFP+ cable, 2.5m (passive Twinax cable)
SFP-H10GB-CU3M	10GBASE-CU SFP+ cable 3m (Twinax cable)
SFP-H10GB-CU5M	10GBASE-CU SFP+ cable 5m (Twinax cable)
SFP-H10GB-ACU7M	10GBASE-CU SFP+ cable 7m (active Twinax cable)
SFP-H10GB-ACU10M	10GBASE-CU SFP+ cable 10m (active Twinax cable)
SFP-10G-AOC1M	Cisco 10GBASE-AOC SFP+ Cable 1 Meter
SFP-10G-AOC2M	Cisco 10GBASE-AOC SFP+ Cable 2 Meter
SFP-10G-AOC3M	Cisco 10GBASE-AOC SFP+ Cable 3 Meter
SFP-10G-AOC5M	Cisco 10GBASE-AOC SFP+ Cable 5 Meter
SFP-10G-AOC7M	Cisco 10GBASE-AOC SFP+ Cable 7 Meter
SFP-10G-AOC10M	Cisco 10GBASE-AOC SFP+ Cable 10 Meter
GLC-T	1000BASE-T SFP
GLC-ZX-SMD	1000BASE-ZX SFP transceiver module, SMF, 1550-nm wavelength, dual LC/PC connector, Digital Optical Monitoring (DOM)
GLC-EX-SMD	1000BASE-EX SFP transceiver module, SMF, 1310-nm wavelength, dual LC/PC connector, DOM
GLC-SX-MMD	Gigabit Ethernet SFP, LC connector SX transceiver (MMF), extended temperature range and DOM
Cisco GLC-LH-SMD	Gigabit Ethernet SFP, LC connector LX/LH transceiver (SMF), extended temperature range and DOM
SFP-GE-T	1000BASE-T SFP, extended temperature range
DS-SFP-FC16G-SW	16-Gbps Fibre Channel shortwave SFP+, LC connector (16G Fibre Channel support only on last 24 ports (highlighted in Orange on the chassis for easy identification) of the Cisco Nexus 5672UP-16G
DS-SFP-FC16G-LW	16-Gbps Fibre Channel longwave SFP+, LC connector (16G Fibre Channel support only on last 24 ports (highlighted in Orange on the chassis for easy identification) of the Cisco Nexus 5672UP-16G)

Part Number	Description
DS-SFP-FC8G-SW	8 Gbps Fibre Channel SW SFP+, LC connector (Fibre Channel support only on last 24 ports (highlighted) of the Cisco Nexus 5672UP-16G, on last 16 ports (highlighted) of Cisco Nexus 5672UP and UP GEM module on 56128P)
DS-SFP-FC8G-LW	8 Gbps Fibre Channel LW SFP+, LC connector, (Fibre Channel support only on last 24 ports (highlighted in Orange on the chassis for easy identification) of the Cisco Nexus 5672UP-16G, on last 16 ports (highlighted) of Cisco Nexus 5672UP and UP GEM module on 56128P)
DS-SFP-FC4G-SW	4 Gbps Fibre Channel-SW SFP, LC connector, (Fibre Channel support only on last 16 ports (highlighted) of Cisco Nexus 5672UP and UP GEM module on 56128P)
DS-SFP-FC4G-LW	4 Gbps Fibre Channel-LW (up to 10 km) SFP, LC connector, (Fibre Channel support only on last 16 ports (highlighted) of Cisco Nexus 5672UP and UP GEM module on 56128P)
QSFP-40G-SR4	40GBASE-SR4 QSFP module, (multi-mode fiber, MMF at 100m)
QSFP-40G-SR4-S	40GBASE-SR4 QSFP Module, MPO Connector, Enterprise-Class
QSFP-40G-CSR4	40GBASE Extended CSR4 QSFP module, (multimode fiber, MMF at 300m)
QSFP-40G-SR-BD	Cisco QSFP40G BiDi Short-reach Transceiver
QSFP-40G-ER4	Cisco 40GBASE-ER4 QSFP+ transceiver module for SMF, duplex LC connector
QSFP-40G-LR4	Cisco 40GBASE-LR4 QSFP+ transceiver module for SMF, duplex LC connector
QSFP-40G-LR4-S	QSFP 40GBASE-LR4 Module, LC connector, 10km, Enterprise-Class
WSP-Q40GLR4L	QSFP 40G Ethernet - LR4 Lite, LC connector, 2 km
QSFP-4SFP10G-CU1M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 1m
QSFP-4SFP10G-CU3M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 3m
QSFP-4SFP10G-CU5M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ passive direct-attach copper transceiver assembly, 5m
QSFP-4x10G-AC7M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 7-meter, active
QSFP-4x10G-AC10M	Cisco 40GBASE-CR4 QSFP+ to 4 10GBASE-CU SFP+ direct-attach breakout cable, 10-meter, active
QSFP-H40G-CU1M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 1-meter, passive
QSFP-H40G-CU3M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 3-meter, passive
QSFP-H40G-CU5M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 5-meter, passive
QSFP-H40G-ACU7M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 7-meter, active
QSFP-H40G-ACU10M	Cisco 40GBASE-CR4 QSFP+ direct-attach copper cable, 10-meter, active
QSFP-4X10G-AOC1M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 1m
QSFP-4X10G-AOC2M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 2m
QSFP-4X10G-AOC3M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 3m
QSFP-4X10G-AOC5M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 5m
QSFP-4X10G-AOC7M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 7m
QSFP-4X10G-AOC10M	Cisco 40GBase-AOC QSFP to 4 SFP+ Active Optical breakout Cable, 10m
QSFP-H40G-AOC1M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 1m
QSFP-H40G-AOC2M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 2m
QSFP-H40G-AOC3M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 3m
QSFP-H40G-AOC5M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 5m
QSFP-H40G-AOC7M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 7m
QSFP-H40G-AOC10M	Cisco 40GBase-AOC QSFP direct-attach Active Optical Cable, 10m
QSFP-H40G-AOC15M	40GBASE-AOC QSFP direct-attach active optical cable, 15m
CVR-QSFP-SFP10G=	Cisco 40GBASE QSFP to SFP+/SFP Adapter (QSA) for all 1-Gbps and 10-Gbps Ethernet optics listed in table 6.
Power Cords	
CAB-250V-10A-AR	AC Power Cord - 250V, 10A - Argentina (2.5m)
CAB-9K10A-AU	Power Cord, 250VAC 10A 3112 Plug, Australia (2.5m)
CAB-250V-10A-BR	AC Power Cord - 250V, 10A - Brazil(2.1m)
CAB-250V-10A-CN	AC Power Cord - 250V, 10A - PRC (2.5m)

Part Number	Description
CAB-9K10A-EU	Power Cord, 250VAC 10A CEE 7/7 Plug, EU (2.5m)
CAB-IND-10A	10A Power cable for India (2.5m)
CAB-250V-10A-IS	AC Power Cord - 250V, 10A - Israel (2.5m)
CAB-9K10A-IT	Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy (2.5m)
CAB-250V-10A-ID	AC Power Cord - 250V, 10A, South Africa(2.5m)
CAB-9K10A-SW	Power Cord, 250VAC 10A MP232 Plug, SWITZ (2.5m)
CAB-9K10A-UK	Power Cord, 250VAC 10A BS1363 Plug (13 A fuse), UK (2.5m)
CAB-9K12A-NA	Power Cord, 125VAC 13A NEMA 5-15 Plug, North America (2.5m)
CAB-AC-250V/13A	North America, NEMA L6-20 250V/20A plug-IEC320/C13 receptacle (2.0m)
CAB-N5K6A-NA	Power Cord, 200/240V 6A North America (2.5m)
CAB-C13-CBN	Cabinet Jumper Power Cord, 250 VAC 10A, C14-C13 Connectors (0.7m)
CAB-C13-C14-2M	Power Cord Jumper, C13-C14 Connectors, 2 Meter Length (2m)
CAB-C13-C14-AC	Power cord, C13 to C14 (recessed receptacle), 10A (3m)
Accessory Kit	
N5596-ACC-KIT=	Cisco Nexus 56128P Chassis Accessory Kit, spare
N5672-ACC-KIT=	Cisco Nexus 5672UP/5672UP-16G Chassis Accessory Kit, spare

Warranty

The Cisco Nexus 5600 10-Gbps platform switches have a 1-year limited hardware warranty. The warranty includes hardware replacement with a 10-day turnaround from receipt of a Return Materials Authorization (RMA).

Service and Support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco Nexus 5600 10-Gbps platform in your data center. The innovative Cisco 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 uses an architecture-led approach to help you align your data center infrastructure with your business goals and achieve 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 diagnostics and real-time alerts on your Cisco Nexus 5600 platform 10-Gbps switch. Spanning the entire network lifecycle, Cisco Services offerings help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise.

Cisco Capital Financing to Help You Achieve Your Objectives

Cisco Capital® financing can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce Capital Expenditures (CapEx), accelerate your growth, and 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 financing is available in more than 100 countries. Learn more.

For More Information

- Cisco Nexus 5600 platform switches: https://www.cisco.com/go/nexus5000.
- Cisco Nexus 2000 Series Fabric Extenders: https://www.cisco.com/go/nexus2000.
- Cisco NX-OS Software: https://www.cisco.com/go/nxos.

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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 ~ +70°C

  Extended: -10 ~ +80°C

  Industrial: -40 ~ +85°C

Applications

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

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Tel：+86-755-26819856 Web: www.do-networks.com

Part Number Ordering Information

Part Number	Data Rate (Gb/s)	Wavelength (nm)	Transmission Distance(m)	Temperature (°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

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	°C	
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	°C	commercial
		-40		85	°C	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

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

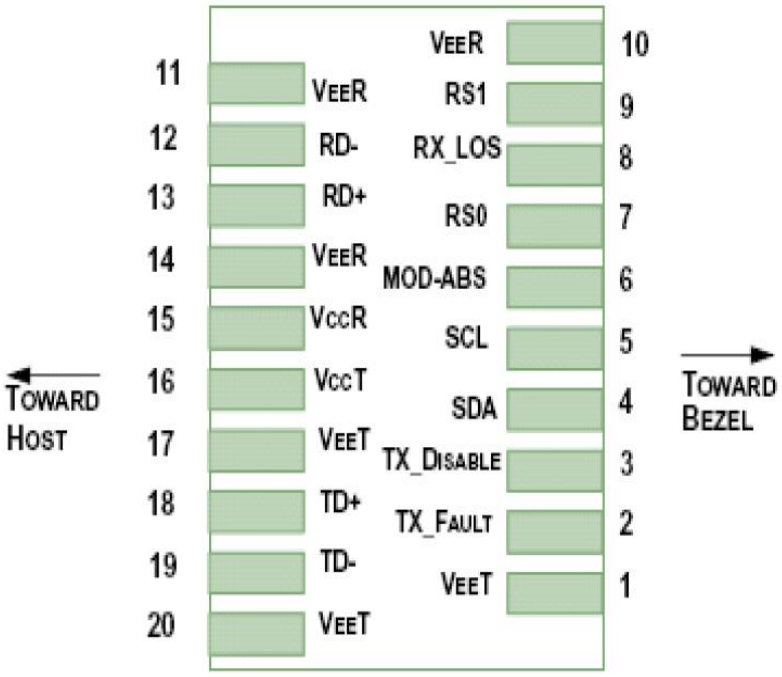

Figure1. Diagram of host board connector block pin numbers and names

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

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

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

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

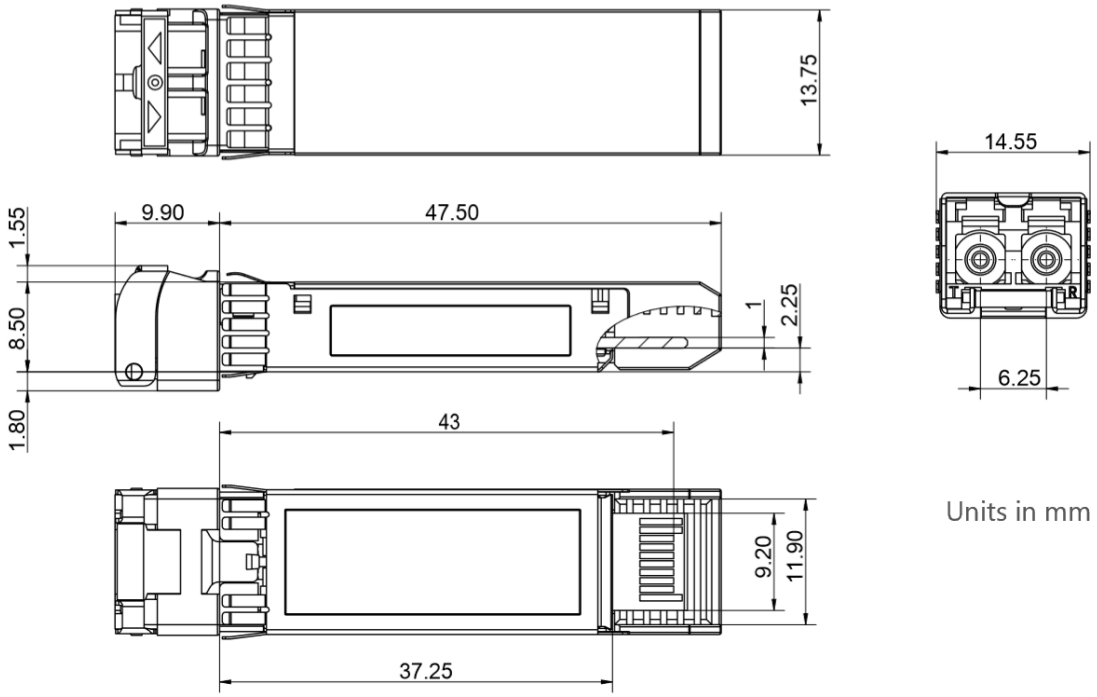

Figure2. Mechanical Outline