Cisco CPAK 100GBASE Modules

Fiber line cards provide industry-leading port density while consuming up to 70 percent less power than competing models.

Product Overview

Cisco CPAK® 100GBASE fiber modules for Cisco® switches and routers offer a selection of high-density 100-Gbps connectivity solutions. The modules are especially well suited for connections in enterprise and service provider data centers and in service provider edge networks.

The line cards use the Cisco CPAK form factor. They are 20 percent smaller and consume 40 percent less power than C Form-Factor Pluggable 2 (CFP2) modules; they use 70 percent less power than the CFP interface. Cisco CPAK modules give you up to 20 percent greater port density and front-panel bandwidth than competing products.

Choose the model that matches the distance you need to cover, the type of fiber cabling you are using, and the Cisco networking product you are using. Cisco CPAK 100GBASE modules work in the following Cisco networking equipment: ASR 9000 Series Router; CRS-X Carrier Routing System; NCS 2000, 4000, and 6000 Series Routers; the Nexus 7000 and 7700 Series Switches, and the Cisco ONS Transport Platform.

Features and Benefits

Cisco CPAK modules combine the greatest density and bandwidth with the lowest power consumption available in the market. They are interoperable with any IEEE-compliant 100GBASE-LR4 or 100GBASE-SR10 for investment protection and product choice. Some models, including the Cisco CPAK 100GBASE-LR4, use Cisco complementary metal-oxide semiconductor (CMOS) photonic technology to provide industry-leading optical integration, performance, power savings, and scalability.

The key features of Cisco CPAK 100GBASE modules are listed in Table 1.

Table 1. Cisco CPAK 100GBASE Module Features and Benefits

Requirement	Cisco CPAK Module Supporting Feature
Accommodate ever-growing bandwidth requirements	Up to 10 100-Gigabit Ethernet connections deliver as much as 1 Tbps of front-panel bandwidth
Control costs	Form factor consumes 40% less power than CFP2 and 70% less power than CFP form factors
Real estate conservation	Minimal footprint allows 20% greater port density and bandwidth than competing products
High availability for business continuity	Hot-swappable input/output device plugs into a Cisco CPAK-module-based switch, router, or optical platform port
Accommodate a variety of distance and fiber type requirements	Flexible interface choices
Investment protection, affordable migration to higher bandwidth	• Support for a “pay-as-you-grow” model • Can plug any Cisco 100-Gbps, 40-Gbps, and 10-Gbps line cards into Cisco CPAK modules (supports the Cisco AnyPort solution)
Manage performance	Digital optical monitoring (DOM) support

Requirement	Cisco CPAK Module Supporting Feature
Standards compliance for equipment flexibility and choice	Interoperability with any IEEE-compliant: 100GBASE-SR4, 100GBASE-LR4, 100GBASE-SR10, 40GBASE-SR4, 10GBASE-SR, 10GBASE-LR MSA compliant to: 100GBASE CWDM4
Proper functioning and high performance with all Cisco platforms	Cisco quality identification (ID) feature enables a Cisco platform to identify whether the module is certified and tested by Cisco

Cisco CPAK 100GBASE-LR4 Module

The primary application of the Cisco CPAK 100GBASE-LR4 module (Figure 1) is to support 100-Gbps optical links over standard single-mode fiber (SMF, G.652) terminated with SC connectors. Nominal power consumption is less than 5.5W.

The LR4 module is IEEE 802.3ba-compliant and supports link lengths of up to 10 km over standard SMF, G.652. It delivers an aggregate data signal of 100 Gbps, carried over four LAN wavelength-division multiplexing (WDM) wavelengths operating at a nominal 25 Gbps per lane. Optical multiplexing and demultiplexing of the four wavelengths are managed within the module.

Figure 1. Cisco CPAK 100GBASE-LR Module

Cisco CPAK 100GBASE-ER4 Lite Module

The primary application of the Cisco CPAK 100GBASE-ER4 Lite module (Figure 2) is to support 100-Gbps optical links over standard single-mode fiber (SMF, G.652) terminated with SC connectors. Nominal power consumption is less than 7.5W.

The ER4 Lite module is compatible with the 100GBASE-ER4 standard and supports link lengths up to about 25 km over standard SMF, G.652. It delivers an aggregate data signal of 100 Gbps, carried over four LAN wavelength-division multiplexing (WDM) wavelengths operating at a nominal 25 Gbps per lane. The module can be used over longer distances in engineered links with CPAK-100G-ER4L modules at both ends. Optical multiplexing and demultiplexing of the four wavelengths are managed within the module.

Figure 2. Cisco CPAK 100GBASE-ER4 Lite Module

Cisco CPAK 10x10GBASE-LR Module

The Cisco CPAK 10x10G-LR module (Figure 3) is used in 10 x 10-Gb mode along with ribbon-to-duplex SMF breakout cables for connectivity to ten 10GBASE-LR optical interfaces. It supports link lengths up to 10km over standard SMF, G.652. The module delivers 100-Gbps links over 24-fiber ribbon cables terminated with MPO/MTP connectors.

Figure 3. Cisco CPAK 10X 10GBASE-LR Module

Cisco CPAK 100GBASE-SR10 Module

The Cisco CPAK 100GBASE-SR10 module (Figure 4) delivers 100-Gbps links over 24-fiber ribbon cables terminated with MPO/MTP connectors. It can also be used in 10 x 10-Gb mode along with ribbon-to-duplex-fiber breakout cables for connectivity to ten 10GBASE-SR optical interfaces. It supports link lengths of 100m and 150m on laser-optimized OM3 and OM4 multifiber cables, respectively.

Figure 4. Cisco CPAK 100GBASE-SR10 Module

Cisco CPAK 10x10GBASE-ERL Module

The Cisco CPAK 10x10G-ERL module (Figure 5) is used in 10 x 10Gb mode along with ribbon-to-duplex SMF breakout cables for connectivity to ten 10GBASE-ER optical interfaces. It supports link lengths up to 25km over standard SMF, G.652. The module delivers 100-Gbps links over 24-fiber ribbon cables terminated with MPO/MTP connectors.

Figure 5. Cisco CPAK 10X10GBASE-ERL Module

Cisco CPAK 100GBASE-SR4 Module

The Cisco 100GBASE-SR4 CPAK Module (Figure 6) supports link lengths of up to 70m (100m) over OM3 (OM4) Multimode Fiber with MPO connectors. It primarily enables high-bandwidth 100G optical links over 12-fiber parallel fiber terminated with MPO multifiber connectors. CPAK-100GE-SR4 supports 100GBase Ethernet rate.

Figure 6. Cisco CPAK 100GBASE-SR4 Module

Cisco CPAK 100GBASE CWDM4 Module

The Cisco CPAK-100G-CWDM4 Module (Figure 7) supports link lengths of up to 2 km over a standard pair of G.652 single-mode fiber (SMF) with duplex LC connectors. The 100 Gigabit Ethernet signal is carried over four wavelengths. Multiplexing and demultiplexing of the four wavelengths are managed within the device.

Figure 7. Cisco CPAK 100GBASE CWDM4 Module

Technical Specifications

Platform Support

Cisco CPAK modules are supported on Cisco high-end switches, routers, and transport equipment:

- ASR 9000 Series Router
- CRS-X Carrier Routing System
- NCS 2000, 4000, and 6000 Series Routers
- Nexus 7000 and 7700 Series Switches
- Cisco ONS Transport Platform

Connectors and Cabling

- Dual SC/PC connector (Cisco CPAK 100GBASE-LR4 and Cisco CPAK 100GBASE-ER4 Lite module)

  For duplex SMF modules, only connections with patch cords terminated with PC or UPC connectors are supported.

- Dual LC connector (CPAK 100GBASE CWDM4 module)

  For duplex SMF modules, only connections with patch cords terminated with PC or UPC connectors are supported.

- 24-fiber MPO/MTP connector (Cisco CPAK 100GBASE-SR10 module receives a female MPO/MTP-24 connector) Spring force required is 20N.
- 24-fiber MPO/MTP connector (Cisco CPAK 10x10G-LR and CPAK-10X10G-ERL modules receive a female MPO/MTP-24 APC connector). The MPO-24 SMF APC connector used on the CPAK-10X10G-LR and CPAK-10X10G-ERL has been designed to be compliant to IEC 61754-7-1, dated 2008-03. The standard specifies a nominal spring force of 10N for the connector. Performance of these devices is specified with the use of connectors with a 10N spring force. Customers should be careful not to use 22N spring force connectors at this time. Performance of the modules is not guaranteed with the higher spring force.

Note: All cables and cable assemblies used must be compliant with the standards specified in the Regulatory and Standards Compliance section.

For more compatibility details, refer to Cisco 100 Gigabit Ethernet Transceiver Modules Compatibility Matrix.

Product Specifications

Tables 2 and 3 provide specifications for Cisco CPAK port cabling and modules.

Table 2. Cisco CPAK Port Cabling Specifications

Cisco CPAK Module	Wavelength (nm)	Cable Type	Core Size (Microns)	Modal Bandwidth (MHz*km)[a]	Cable Distance[b]
Cisco CPAK 100GBASE-LR4	1310	SMF Duplex	9-micron core SMF per G.652	-	10 km
Cisco CPAK 100GBASE-ER4Lite	1310	SMF Duplex	9-micron core SMF per G.652	-	25 km
Cisco CPAK 10x10G-LR	1310	SMF (24 fibers)	9-micron core SMF per G.652	-	10 km
Cisco CPAK 10x10G-ERL	1550	SMF (24 fibers)	9-micron core SMF per G.652	-	25 km

Cisco CPAK Module	Wavelength (nm)	Cable Type	Core Size (Microns)	Modal Bandwidth (MHz*km)[a]	Cable Distance[b]
Cisco CPAK 100GBASE-SR10	850	MMF (24 fibers)	50.0 50.0	2000 (OM3) 4700 (OM4)	100m 150m[c]
Cisco CPAK 100GBASE-SR4	850	MMF (12 fibers)	50.0 50.0	2000 (OM3) 4700 (OM4)	70m 100m[c]
Cisco CPAK 100G CWDM4	1271, 1291, 1311, 1331	SMF Duplex	9-micron core SMF per G.652	-	2 km

[a] Specified at transmission wavelength.
[b] Minimum cabling distance for -LR4 modules is 2 meters, according to the IEEE 802.3ba.
[c] Considered an engineered link with maximum 1dB allocated to connectors and splice loss.

Table 3 lists the primary optical characteristics and specifications for Cisco CPAK 100GBASE modules.

Table 3. Optical Transmit and Receive Specifications

Module	Type	Transmit Power (dBm)[1]		Receive Power (dBm)[1]		Transmit and Receive Center Wavelength Range (nm)
		Maximum	Minimum	Maximum	Minimum	
Cisco CPAK 100GBASE-LR4	100GBASE-LR4 1310 nm SMF	4.5 per lane	-4.3 per lane	4.5 per lane	-10.6 per lane	Four lanes: 1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19
Cisco CPAK 100GBASE-ER4Lite	100GBASE-LR4 1310 nm SMF	2.9 per lane	-2.9 per lane	4.5 per lane	-14 per lane[2]	Four lanes: 1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19
Cisco CPAK 10x 10GBASE-LR[3]	1310 nm SMF	0.5 per lane	-8.2 per lane	0.5 per lane	-14.4 per lane	Ten lanes 1260 to 1355 nm
Cisco CPAK 10x 10GBASE-ERL[3]	1550 nm SMF	4.0 per lane	-7.7 per lane[4]	0.5 per lane	-14.4 per lane	Ten lanes 1530 to 1565 nm
Cisco CPAK 100GBASE-SR10	100GBASE-SR10 850 nm MMF	-1.0 per lane	-7.6 per lane	2.4 per lane	-9.5 per lane	Ten lanes: 850 to 860 nm
Cisco CPAK 100GBASE-SR4	100GBASE-SR4 850 nm MMF	+2.4, per lane	-8.4, per lane	+2.4, per lane	-5.2, per lane	Four lanes: 840 to 860 nm
Cisco CPAK CWDM4	100GBASE CWDM4 SMF	+2.5, per lane	-6.5, per lane	+2.5, per lane	-10, per lane	Four lanes: 1271, 1291, 1311, 1331

[1] Transmitter and receiver power are in averages, unless specified.
[2] Receiver sensitivity does not fully meet IEEE 100GBASE-ER4 specifications. Application of this module is targeted for links less than 25km with links where Cisco CPAK modules are at both ends of the link.
[3] Tx Disabled power for an individual lane is <-10dBm.
Host FEC is required when operating in OTN mode.
[4] Output power of this module is 3dB below the IEEE 100GBASE-ER specification. Application of this module is targeted for links less than 25km where Cisco CPAK modules are at both ends of the link.

Dimensions

Maximum outer dimensions for the Cisco CPAK modules (H x W x D):

11.6 x 34.8 x 101.2 mm (0.46 x 1.37 x 3.98 in).

The Cisco CPAK modules typically weigh approximately 127 grams (4.48 oz.).

Environmental Conditions and Power Requirements

- Storage temperature range: -40 to 85° C (-40 to 185° F)
- Operating temperature range: 0 to 70° C (32 to 158° F)
- Cisco CPAK 100GBASE-LR4 power consumption at 70° C: <6.75W maximum
- Cisco CPAK 100GBASE-ER4L power consumption at 70° C: <7.5W maximum
- Cisco CPAK 10x 10GBASE-LR power consumption at 70° C: <5.0W maximum
- Cisco CPAK 10x 10GBASE-ERL power consumption at 70° C: <5.0W maximum
- Cisco CPAK 100GBASE-SR10 power consumption at 70° C: <4.5W maximum
- Cisco CPAK 100GBASE-SR4 power consumption at 70° C: <7.0W maximum
- Cisco CPAK 100GBASE-CWDM4 power consumption at 70° C: <7.0W maximum

Warranty

- Standard warranty: 1 year
- Extended warranty (optional): Cisco CPAK modules can be covered in a Cisco SMARTnet® Service support contract for the Cisco switch or router chassis

Ordering Information

Table 4 provides ordering information for Cisco CPAK modules and related cables.

Table 4. Ordering Information

Description	Product Number
100GBASE-LR4 Cisco CPAK Module for SMF	CPAK-100G-LR4
100GBASE-ER4Lite Cisco CPAK Module for SMF	CPAK-100G-ER4L
10x10G-LR Cisco CPAK Module for SMF	CPAK-10X10G-LR
100GBASE-SR10 Cisco CPAK Module for MMF	CPAK-100G-SR10
10x10G-ERL Cisco CPAK Module for SMF	CPAK-10X10G-ERL
100GBASE-SR4 Cisco CPAK Module for MMF	CPAK-100G-SR4
100GBASE-CWDM4 Cisco CPAK Module for SMF	CPAK-100G-CWDM4

Regulatory and Standards Compliance

Standards:

- GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
- GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
- IEEE 802.3ba (LR4, ER4, 10GBASE-LR, SR10)
- Reduction of Hazardous Substances (RoHS) 6 compliant

Safety:

Product	Laser Class
Cisco CPAK 100GBASE-LR4	1
Cisco CPAK 100GBASE-ER4Lite	1
Cisco CPAK 10x 10GBASE-LR	1
Cisco CPAK 100GBASE-SR10	1
Cisco CPAK 10x 10GBASE-ERLite	1
Cisco CPAK 100GBASE-SR4	1
Cisco CPAK 100GBASE-CWDM4	1

Next Steps

Learn more about Cisco CPAK 100GBASE switch and router modules by contacting your sales representative or visiting http://www.cisco.com/go/dcnm.

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