Cisco ONS 15454 12-Port and 4-Port Small Form-Factor Pluggable-Based Multirate Optics Card

The 12-Port and 4-Port SFP-Based Multirate Optics Card for the Cisco® ONS 15454 Multiservice Provisioning Platform (MSPP) improves the platform's system flexibility, scalability, and economics in multiple-port optical configurations.

Product Overview

The Cisco ONS 15454 12-Port and 4-Port SFP-Based Multirate Optics Card (MRC-12 and MRC-4) supports multiple Small Form-Factor Pluggable (SFP) modules, helping enable multirate SONET/SDH and multiple-reach capabilities. The MRC-12 card (Figure 1) operates in either Cisco ONS 15454 SONET or SDH systems, supporting optical line rates including OC-3/STM-1, OC-12/STM-4, and OC-48/STM-16 and optical reaches from short-reach/interoffice to long-reach/long-haul, including dense wavelength-division multiplexing (DWDM) and coarse wavelength-division multiplexing (CWDM). There are two versions of the MRC-12 card for SDH systems, limited to 10 Gbps and 2.5 Gbps of bandwidth capacity, respectively. The MRC-4 (Figure 2) operates only in Cisco ONS 15454 SONET systems, but at the same optical line rates and optical reaches, with up to 2.5 Gbps bandwidth.

Figure 1.   MRC-12 Card

Figure 2.   MRC-4 Card

The MRC cards, depending upon the selected SFP, can carry concatenated payloads of STS-3c/VC-4, STS-6c/VC-4-2c, STS-12c/VC-4-4c, STS-24c/VC-4-8c, and STS-48c/VC-4-16c as well as nonconcatenated payloads on an STS-1, VC-4, VC-3, VC-12, VC-11, and VT1.5 basis. In SONET applications, the cards are software-provisionable to transport SDH payloads over SONET in the form of STS-Nc-concatenated payloads. When operated within the outlined specifications, each card transports signals with a maximum bit error rate of 1 per trillion.

The MRC cards are deployable in any of the 12 service interface card slots of the Cisco ONS 15454 MSPP. Their bandwidth also depends upon the cross-connect card operating within the system as well as the interface slot where the cards are installed. Their ports can be commissioned for use in four different architectures – unidirectional-path switched ring/subnetwork connection protection (UPSR/SNCP), 2-fiber and 4-fiber bidirectional line switched ring/multiplex section-shared protection ring (BLSR/MS-SPR), 1+1 automatic protection switching/line multiplex section protection (APS/LMSP), or path-protected mesh network (PPMN) – providing the flexibility to build the type of networks required to meet service demands, traffic patterns, and user needs. This card-provisioning flexibility also helps to reduce the cost of inventory and simplifies engineering and deployment.

The MRC cards provide in-service upgrade capabilities from single-port optics cards utilizing the same service slot. They also support line-rate span upgrades through the upgrading of an SFP module.

The cards incorporate faceplate-mounted LEDs to provide a quick visual check of the operational status at the card as well as the individual ports. The fan-tray-mounted liquid crystal display (LCD) and soft keys provide the technician local access to the wavelength of each DWDM or CWDM optical port without the need to access the craft manager. Printed on the faceplate is an orange circle icon, which indicates the shelf slot where the card can be physically installed.

The card is supported by the integrated Cisco Transport Controller craft manager for the Cisco ONS 15454 MSPP. The controller provides the user with access to operations, administration, maintenance, and provisioning for the system. Access to inventory data for the installed MRC card and pluggable optics modules is available through the craft manager, the Cisco Transport Manager element management system, and Transaction Layer 1 requests.

The SFP modules used with the MRC cards are SONET/SDH-compliant (Telcordia Technologies GR-253-CORE and ITU G.957) optical interfaces. The transmitter and receiver reside on the same module and are interconnected to the fiber using small form-factor LC connectors. The SFP modules in the MRC cards support provisionable automatic laser shutdown feature (ITU G.664) to turn off the transmitting laser in the event of a fiber failure on the span. The SFP optical parameters, including laser bias current, optical transmit power, and optical receive power, are available through Cisco Transport Controller to enable simplified troubleshooting and advanced warning of potential impending issues using user-configurable high and low threshold crossing alerts. The SFP cages are angled down relative to the faceplate to reduce bend-induced stresses on the optical fibers exiting the faceplate.

The Cisco ONS 15454 12-Port Multirate Optics Card adds significant value to users' networks by enhancing system flexibility, improving card-slot usage of the shelf assembly, reducing intershelf complexity, and lowering system cost.
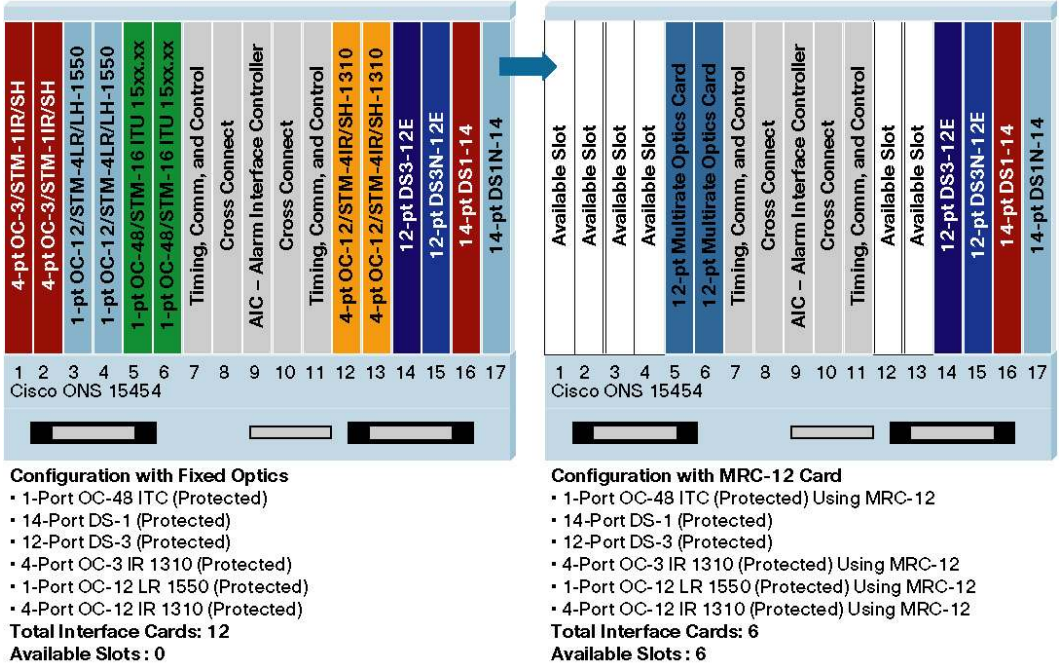
Applications

A Cisco ONS 15454 MSPP equipped with an MRC card provides application solutions for both service providers and enterprise managers, including the two following examples.

### Multiservice Aggregation and Transport System

The high-port-density and multiple-reach support of the MRC-12 card requires fewer cards to perform the same function as multiple fixed-rate/reach cards (Figure 2).

Figure 3. MRC-12 Card Frees Up Cisco ONS 15454 Shelf Slots

Configuration with Fixed Optics
- 1-Port OC-48 ITC (Protected)
- 14-Port DS-1 (Protected)
- 12-Port DS-3 (Protected)
- 4-Port OC-3 IR 1310 (Protected)
- 1-Port OC-12 LR 1550 (Protected)
- 4-Port OC-12 IR 1310 (Protected)
Total Interface Cards: 12
Available Slots : 0

Configuration with MRC-12 Card
- 1-Port OC-48 ITC (Protected) Using MRC-12
- 14-Port DS-1 (Protected)
- 12-Port DS-3 (Protected)
- 4-Port OC-3 IR 1310 (Protected) Using MRC-12
- 1-Port OC-12 LR 1550 (Protected) Using MRC-12
- 4-Port OC-12 IR 1310 (Protected) Using MRC-12
Total Interface Cards: 6
Available Slots : 6

The Cisco ONS 15454 shelf slots that are freed up by the MRC-12 card can be used for additional revenue-generating services, such as Fibre Channel, 10/100/1000 Mbps Ethernet, and so on (Figure 4).

**Figure 4.**   MRC-12 Card Opens Up New Revenue Opportunities
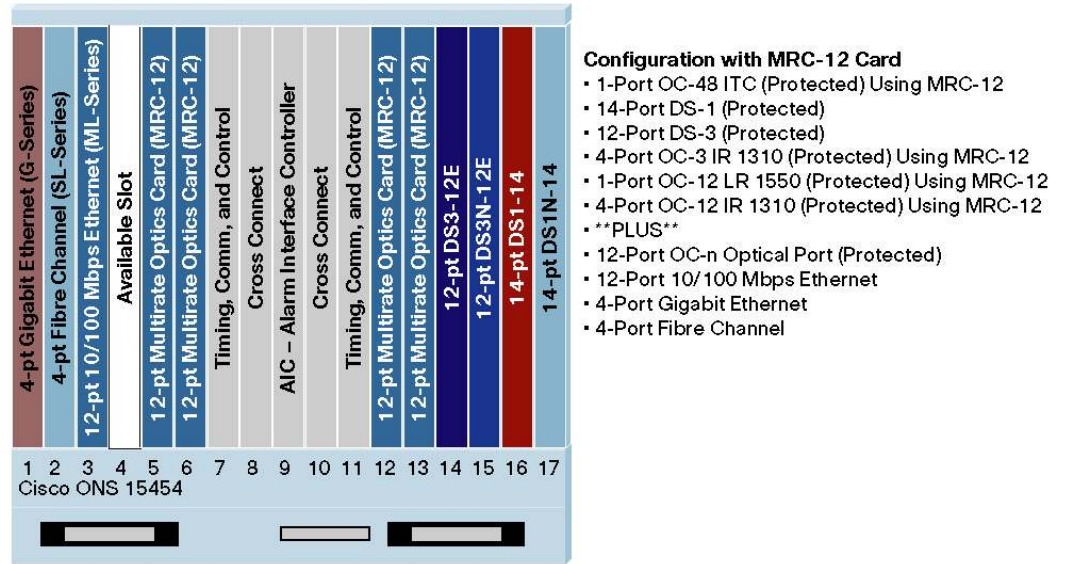
The MRC-12 card also lowers the capital expenditure cost of the Cisco ONS 15454 system by using many optical ports on a common carrier-based card.

Network Consolidation Node

Reducing network complexity and lowering capital expenditures is a primary need of many businesses. The high port density and multiple-reach support through pluggable optics modules enables users to consolidate network elements as well as simplify operations by reducing internetwork element cabling. Figure 5 shows a traditional service provider network, with access and interoffice networks collecting and transporting traffic. Figure 6 shows the same network using the high-density MRC-12 card.

Figure 5.   Typical Network Design
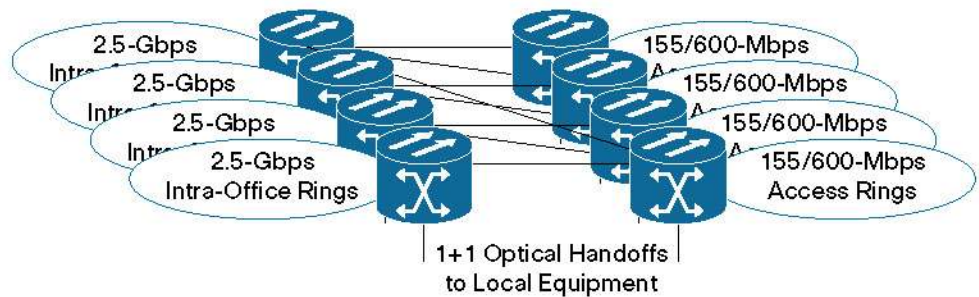
Figure 6.   Network Consolidation Design with MRC-12 Card
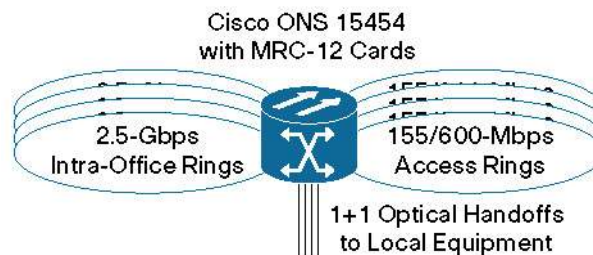
The high-density MRC-12 card with its flexible optical rate and reaches helps consolidate many network elements and significantly reduce the complexity of interworkings between the various networks. Manual cabling by an onsite technician is replaced by electronic cross-connections using the Cisco Transport Controller craft management system from anywhere with network connectivity. This helps improve response times to circuit additions and changes.

With its flexibility, density, and wide selection of service modules, the Cisco ONS 15454 MSPP supports a comprehensive mix of applications, allowing a single platform type to meet many business requirements. These capabilities allow users to lower their operational costs by reducing technician training to a smaller base of platform types, reducing sparing requirements, and decreasing service turn-up time for improved revenues.

Key Features and Benefits

Table 1 outlines some of the key features and benefits of the MRC-12 card.

Table 1. Features and Benefits

Feature	Benefits
Multiple-port design	Provides cost-effective services aggregation, expands flexibility to support multiple-network hubbing architectures (ring and point-to-point), and frees shelf slots for additional service cards.
SFP module-based	More cost-effective sparing of SFP cards than fixed-card alternatives. Allows common carrier card to support many user applications through plug-in devices and simplifies support for system changes caused by network turnover.
Multiple-reach	Suitable for all metro applications between central offices, collocation offices, or enterprise and campus facilities with span lengths from 2 km to 80 km.
Provisionable J0 section/regenerator section and J1 path trace support	Enhances network maintenance and troubleshooting activities.
Per port line/multiplex section and section/regenerator section overhead provisioning of data communications channel (DCC)	Allows DCC connectivity from any network port, providing user flexibility.
Support for SDH tunneling over SONET	Allows transport for SDH terminal equipment over installed optical network.
User-defined automatic in-service (AINS) of ports	Allows service port and path to be created awaiting valid signal without creating invalid system alarms.
Telcordia Technologies OSMINE	Support for TIRKS for both card and pluggable optics modules in card. GFDS for slot management and dynamic inventory management. HESIG codes for each supported service type.

Regulatory Compliance

Table 2 outlines the regulatory compliance specifications followed for the MRC-12 card.

Table 2.   Regulatory Compliance

Regulatory Compliance	
Homologation	
SONET/ANSI System	**SDH/ETSI Systems**
Canada	Australia
European Union (EU)	China
Japan	EU
Korea	Hong Kong
Mexico	Korea
United States	Mexico
	New Zealand
	Singapore
Electromagnetic Compliance	
ETSI 300-386-TC	
IEC CISPR 22	
IEC CISPR 24	
ICES-003, Issue 3, 1997	
FCC 47CFR15	
EU EN55024	
Safety	
CSA CAN/CSA-C22.2 No. 950-95, 3rd Edition	
Telcordia Technologies GR-1089-CORE, Type 4 and Type 2 equipment ports	
UL60950, 3rd edition or UL60950-1, 1st edition	
Laser Safety	
UL60950	
IEC60950/EN60950	
21CFR1040	
IEC 60825-1 Am.2, 2001	
IEC 60825-2, 2000	
Environmental	
Telcordia Technologies GR-63-CORE, Level 3	
ETS 300 019-2-1 (Storage, Class 1.1)	
ETS 300 019-2-2 (Transportation, Class 2.3)	
ETS 300 019-2-3 (Operational, Class 3.1E)	
Telecom	
Telcordia Technologies GR-253-CORE	
Brazil 225-100-509	
European Union G.707	
European Union G.825	
European Union G.957	
Japan JATE Green Book	

Regulatory Compliance
Other
AT&T Network Equipment Development Standards (NEDS) Generic Requirements, AT&T 802-900-260, Issue 3, December 1999
SBC TP76200MP, May 2002
Verizon SIT.NEBS.TE.NPI.2002.010, October 2002
MCI ESD

Product Specifications

Table 3 outlines the MRC-12 product specifications. Table 4 outlines the optical specifications for the SFP modules.

Table 3.   Product Specifications

Parameter	Value
SFP capacity	12 modules
Supported payloads	
SONET	VT1.5, VT2, STS-1, -3c, -6c, -9c, -12c, -24c, and -48c
SDH	VC-11, VC-12, VC-3, VC-4, VC-4-2c, VC-4-3c, VC-4-4c, VC-4-6c, VC-4-8c, VC-4-12c, and VC-4-16c
Management	
Card LEDs	
Failure (FAIL)	Red
Active/standby (ACT/STBY)	Green/Amber
Signal fail (SF)	Yellow
Port LEDs	
Operational state (tri-color) Operational, ready to carry traffic Line condition present Operations, standby (protect)	Green Red Amber
Card power draw, maximum	
Without SFP optics	25W
Fully loaded with SFP optics	38W for 12-port and 30W for 4-port
Operating environment	
Temperature • Standard (with CWDM and DWDM SFPs)	−23 to 131°F (−5 to 55°C)
• Extended	−40 to 149°F (−40 to 65°C)
Humidity	5 to 95% noncondensing
Storage environment	
Temperature	−40 to 185°F (−40 to 85°C)
Humidity	5 to 95% noncondensing
Physical dimensions	
Size	1 card slot
Weight, fully populated with 12 SFPs	2.68 lb. (1.22 kg)

Table 4.   SFP Optical Specifications

SFP Type (Part Number)	Attenuation Range (dB)	Transmit Output Power – Minimum (dBm)	Transmit Output Power – Maximum (dBm)	Receiver Sensitivity – Minimum[1] (dBm)	Receiver Sensitivity– Maximum (dBm)	Dispersion Tolerance (ps/nm)	Optical Power Penalty – Maximum (dB)
OC-3/STM-1 IR1/S-1.1 (ONS-SI-155-I1)	0–12	−15	−8	−28	−8	–	1
OC-3/STM-1 LR1/L-1.1 (ONS-SI-155-L1)	10–28	−5	0	−34	−10	–	1
OC-3/STM-1 LR2/L-1.2 (ONS-SI-155-L2)	10–28	−5	0	−34	−10	–	1
OC-3/STM-1 CWDM (ONS-SE-155-xxxx)	13–33	0	5	−34	−7	1600	1
Dual-Rate OC-12/STM-4 and OC-3/STM-1 SR/I-1/I-4, IR1/S-1.1/S-4.1 (ONS-SI-622-I1)	0–12	−15	−8	−28	−8	–	1
OC-12/STM-4 LR1/L-4.1 (ONS-SI-622-L1)	10–24	−3	2	−28	−8	–	1
OC-12/STM-4 LR2/L-4.2 (ONS-SI-622-L2)	10–24	−3	2	−28	−8	–	1
OC-12/STM-4 CWDM (ONS-SE-622-xxxx)	13–27	0	5	−28	−7	1600	1
OC-48/STM-16 SR/I-16 (ONS-SI-2G-S1)	0–7	−10	−3	−18	−3	12	1
OC-48/STM-16 IR1/S-16.1 (ONS-SI-2G-I1)	0–12	−5	0	−18	0	–	1
OC-48/STM-16 LR1/L-16.1 (ONS-SI-2G-L1)	10–24	−2	3	−27	−9	–	1
OC-48/STM-16 LR2/L-16.2 (ONS-SI-2G-L2)	10–24	−2	3	−28	−9	1200–1600	2
OC-48/STM-16 DWDM100 (ONS-SC-2G-xx.x)	13–27	0	4	−28	−9	Power Ltd −800 to 2400	3 OSNR 21dB[2]
				−22	−9	Noise Ltd −800 to 2400	3 OSNR=19[3]

1. Bit Error Rate = 1×10^{-12}

2. OSNR @ 0.1nmBW (Noise penalty = 0 dB)

3. OSNR @ 0.1nmBW (Power penalty = 0 dB)

System Capacity

Table 5 outlines bandwidth matrix by port number and port grouping for the MRC-12 and MRC-4 cards.

Table 5. Bandwidth Matrix by Port Number and Port Grouping for MRC-12 and MRC-4

	Port Numbers	1	2	3	4	5	6	7	8	9	10	11	12
	Port Groupings	1	2			3				4			
Slot Bandwidth	622 Mbps	OC12/STM4											
		OC3/STM1			OC3/STM1			OC3/STM1			OC3/STM1		
	2.5 Gbps	OC48/STM16											
		OC12/STM4			OC12/STM4			OC12/STM4			OC12/STM4		
		Port 1 must be used for OC48/STM16 SFP. Ports 1, 4, 7, and 10 support OC12/STM-16 SFPs. All ports can be used for OC3/STM1 SFPs where the port group aggregated bandwidth does not exceed 622 Mbps.											
	10G	OC48/STM16			OC48/STM16			OC48/STM16			OC48/STM16		
		Up to 2.5 Gbps (max)	Up to 2.5 Gbps (max)			Up to 2.5 Gbps (max)				Up to 2.5 Gbps (max)			
		Ports 1, 4, 7, and 10 must be used when OC48/STM16 SFPs are used. Each port group can support a combination of SFPs whose aggregated bandwidth does not exceed 2.5 Gbps.											

This table shows the rules regarding port usage on the MRC-12. This table does not show ALL possible configurations.

Scenario 1: MRC-4

Maximum bandwidth of backplane for slot is STS-12; card is installed in drop slot (slots 1-4 and 14-17) with XC-VT.

Port	1	2	3	4
Port rate	OC-3	OC-3	OC-3	OC-3
	OC-12			

Scenario 2: MRC-4

Maximum bandwidth of card is 2.5 Gbps (STS-48); card is installed in trunk slot with XC-VT or in a drop slot or trunk slot with XC-10G or XC-VXC-10G.

Port	1	2	3	4
Port rate	OC-3/-12	OC-3	OC-3	OC-3
	OC-3/-12	OC-12	OC-3	OC-3
	OC-3/-12	OC-3	OC-12	OC-3
	OC-3/-12	OC-12	OC-12	OC-3
	OC-3/-12	OC-3	OC-3	OC-12
	OC-3/-12	OC-12	OC-3	OC-12
	OC-3/-12	OC-3	OC-12	OC-12
	OC-3/-12	OC-12	OC-12	OC-12
	OC-48			

Table 6 outlines the shelf slot bandwidths available by cross-connect card.

Table 6. Shelf Slot Bandwidth by Cross-Connect Card

	XC-VT	XC-VXC-10G XC-VXL-10G XC-10G	XC-VXL-2.5G
622 Mbps	1 to 4 and 14 to 17	–	–
2.5 Gbps	5, 6, 12, 13	1 to 4 and 14 to 17	1 to 6 and 12 to 17
10 Gbps	Not Supported	5, 6, 12, 13	Not Supported

System Requirements

Table 7 outlines the minimum requirements to operate the MRC-12 and MRC-4 cards.

Table 7.   System Requirements

Parameter	Cisco ONS 15454 SONET/ANSI System	Cisco ONS 15454 SDH/ETSI System
Shelf assembly	SA-HD, SA-ANSI, SA-NEBS3E, SA-HD_DDR	SA-ETSI
Timing, communications, and control card	TCC2 or TCC2P	TCC2 or TCC2P
Cross-connect card	XC-VXC-10G, XC-10G, XC-VT	XC-VXC-10G, XC-VXL-10G, XC-VXL-2.5G
Cisco ONS 15454 system software	Release 6.0 or later for MRC-12 Release 8.0 or later for MRC-4	Release 6.0 or later for MRC-12 Release 8.0 or later for MRC-12-2.5G
Slot compatibility	XC-VXC-10G and XC-10G cards: Slots 1–4 and 14–17 up to 2.5 Gbps capacity Slots 5, 6, 12, 13 up to 10 Gbps capacity XC-VT card: Slots 1–4 and 14–17 up to 622 Mbps capacity Slots 5, 6, 12, 13 up to 2.5 Gbps capacity	XC-VXC-10G and XC-VXL-10G cards: Slots 1–4 and 14–17 up to 2.5 Gbps capacity Slots 5, 6, 12, 13 up to 10 Gbps capacity XC-VXL-2.5G card: All 12 slots up to 2.5 Mbps capacity

Ordering Information

To place an order, visit the Cisco Ordering Home Page. Table 8 lists the orderable part numbers for the MRC cards. Table 9 lists the orderable part numbers for the SFP modules that are qualified for the MRC cards.

Table 8.   Ordering Information: MRC-12 Card

Product Name	Part Number
12-port SFP-based multirate optics card, intra-office, SONET systems	15454-MRC-I-12
12-port SFP-based multirate optics card, intra-office, SDH systems, 10G capacity	15454E-MRC-I-12
12-port SFP-based multirate optics card, intra-office, SDH systems, 2.5G capacity	15454E-MRC-2.5G12
4-port SFP-based multirate optics card, intra-office, SONET systems	15454-MRC-2.5G4

Table 9 outlines the SFP modules that are qualified for operation with the MRC-12 card.

Table 9.   Ordering Information: SFP Modules

Product Name	Part Number
OC-3/STM-1 IR1/S-1.1, 1310 nm single-mode fiber (SMF), SFP, ITEMP	ONS-SI-155-I1
OC-3/STM-1 LR1/L-1.1, 1310 nm SMF, SFP, ITEMP	ONS-SI-155-L1
OC-3/STM-1 LR/L-1.2, 1550 nm SMF, SFP, ITEMP	ONS-SI-155-L2
OC-3/STM-1 CWDM, 14xx nm SMF, SFP*	ONS-SE-155-xxxx
OC3/STM1, IR1/S1.1.,1310 nm, Multi Mode , Small Form Pluggable (SFP), I Temp	ONS-SI-155-SR-MM=
Dual-rate OC-12/STM-4 and OC-3/STM-1 SR/I-1/I-4, IR1/S-1.1/S-4.1, 1310 nm SMF, SFP ITEMP	ONS-SI-622-I1
OC-12/STM-4 LR1/L-4.1, 1310 nm SMF, SFP, ITEMP	ONS-SI-622-L1
OC-12/STM-4 LR/L-4.2, 1550 nm SMF, SFP, ITEMP	ONS-SI-622-L2
OC-12/STM-4, CWDM, 1470 nm SMF, SFP*	ONS-SE-622-xxxx
OC12/STM4, IR1/S4.1.,1310 nm, Multi Mode , Small Form Pluggable (SFP), I Temp	ONS-SI-622-SR-MM=
OC-48/STM-16 SR/I-16, 1310 nm SMF, SFP, ITEMP	ONS-SI-2G-S1
OC-48/STM-16 IR/S-16.1, 1310 nm SMF, SFP, ITEMP	ONS-SI-2G-I1
OC-48/STM-16 LR/L-16.1, 1310 nm SMF, SFP, ITEMP	ONS-SI-2G-L1
OC-48/STM-16 LR/L-16.2, 1550 nm SMF, SFP, ITEMP	ONS-SI-2G-L2

Product Name	Part Number
OC-48/STM-16 LR DWDM, 15xx.xx nm SMF, 100 GHz, SFP*	ONS-SC-2G-xx.x
OC48/STM16/GE, CWDM, 1610 nm, Small Form Pluggable (SFP), C Temp	ONS-SC-Z3-xxxx=
Tri-rate OC48IR1,12/3SR1,GE LX STM S-16.1,I-4,I-1 EXT SFP	ONS-SE-Z1=
STM1 Electrical SFP C-TEMP for SDH mode	ONS-SC-155-EL=

*Standard temperature

Service and Support

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