HIGH-SPEED SONET/SDH PICS

Product Overview

SONET/SDH is a widely deployed, mature enabling technology used in providing high-speed, large-scale IP networks. This dependable technology combines high-bandwidth capacity with efficient link utilization, making it a major building block for accommodating a fast growing IP infrastructure both in the core and on the edge.

As demand for more bandwidth increases, so does the demand to build out new, state-of-the-art IP infrastructures to achieve greater backbone throughput and faster network response times. Juniper Networks is at the forefront of IP infrastructure build-out with it's feature-rich offering of high speed OC-192c/STM-64 and OC-768c/STM-256 SONET PICs.

Product Description

The Juniper Networks® high-speed SONET/SDH PIC modules support rich packet processing, multiple IP services, and uncompromising performance while offering market-leading port density and flexibility. These modules provide IP-over-SONET/SDH optical connectivity to backbone and access circuits.

SONET/SDH PICs support SONET Automatic Protection Switching (APS), SDH Multiplexer Switching Protection (MSP), MPLS fast reroute, and link aggregation. Additionally, these PICs support filtering, sampling, load balancing, rate limiting, class of service (CoS), and other key features necessary for deploying secure, dependable, high-performance IP services.

Architecture and Key Components

Automatic Protection Switching

The SONET/SDH PICs support APS 1+1 switching (bidirectional), which enables two routers and a SONET add/drop multiplexer (ADM) to communicate. This functionality ensures a secondary path in the case of a router-to-ADM circuit failure, interface failure or router failure. This functionality is interoperable with any ADM that uses GR-253-CORE-style signaling (K1/K2). In addition to the automatic switchover, service providers can manually initiate the switchover.

MPLS Fast Reroute

MPLS fast reroute provides fast recovery if any circuit or router along a predetermined MPLS path, known as the label-switched path (LSP), fails. Each router along the LSP computes a standby detour path that avoids its downstream hop. If a circuit fails, the nearest upstream router automatically activates the detour paths.

Link Aggregation

Link aggregation is the ability to bundle together a set of ports configured with the same speed in full-duplex mode into a virtual link, thereby supporting simultaneous parallel physical links between Juniper Networks platforms. Service providers can configure up to 16 links per group and 16 groups per chassis. If a link goes down, the traffic is redistributed among the remaining links, thereby improving network reliability.

Features and Benefits

The Juniper Networks high-speed SONET/SDH PICs comprise the following:

· 1-port OC192c/STM64 with fixed Very Short Reach (VSR) optics
· 1-port OC192c/STM64 with pluggable XFP optics
· 4-port OC192c/STM64 with pluggable XFP optics
· 1-port OC768c/STM256 with fixed Short Reach (SR) optics

The 4-port OC-192c PIC supports both a four-fiber and a single-fiber solution. In the four-fiber solution, each fiber carries the OC-192 frames; in the single-fiber solution, an external passive multiplexer is used to aggregate the four data streams onto one fiber to carry OC-768 frames. For a detailed discussion on this PIC, please refer to the 4-port OC-192 PIC datasheet.

FEATURE	FEATURE DESCRIPTION	BENEFIT
Predictable performance and consistent service-enabling features across all M Series Multiservice Edge Routers and T Series Core Routers PICs	Supports rich IP service deployment across all interfaces	· Increases service reliability · Simplifies configuration · Accelerates deployment time · Reduces operational complexity · Decreases operational costs · Minimizes training time for operational staff
High-density interfaces with the ability to mix and match up to four PICs within a single Flexible PIC Concentrator (FPC) slot	Improves edge concentration and scalability of the core	· Increases configuration flexibility by enabling service providers to mix different speeds, technologies and IP services · Enables service providers to add uplink interfaces without wholly consuming an FPC slot · Reduces operational costs by maximizing Point of Presence (POP) space.
SONET APS, SDH MSP and MPLS fast reroute protection mechanisms	Multiple options for network reliability	· Increases network reliability with under 50 ms failover
Link aggregation	Allows a logical aggregation of multiple physical links to provide a single higher bandwidth link	· Increases performance by multiplying available bandwidth · Provides link redundancy · Increases scalability using existing SONET/SDH technology to provide additional bandwidth

Port Density and Flexibility

PLATFORM	OC-192C/STM-64		OC-768/STM-256
	1-PORT	4-PORT	1-PORT
M120			
Per chassis	6	–	–
Per rack	18	–	–
M320			
Per chassis	16	–	–
Per rack	32	–	–
T320			
Per chassis	16	–	–
Per rack	48	–	–
T640			
Per chassis	32	32	8
Per rack	64	64	16
T1600			
Per chassis	32	64	16
Per rack	64	128	32

Specifications

· 9,192-byte maximum transmission unit (MTU)

Encapsulation

· Cisco High-level Data Link Control (cHDLC)
· Point-to-Point Protocol (PPP)
· MPLS circuit cross-connect (CCC)
· MPLS translational cross-connect (TCC)
· Frame Relay
· MPLS

LEDs

· Off – PIC not enabled
· Green – online with no alarms or failures
· Amber – online with alarms for remote failures
· Red – active with a local alarm; router has detected a failure

Agency Approvals

EMC

· AS 3548 Class A (Australia)
· EN55022 Class A (Europe)
· FCC Class A (USA)
· VCCI Class A (Japan)
· BSMI Class A (Taiwan)

Specifications (continued)

Immunity

- EN-61000-3-2 Power Line Harmonics
- EN-61000-4-2 ESD
- EN-61000-4-3 Radiated Immunity
- EN-61000-4-4 EFT
- EN-61000-4-5 Surge
- EN-61000-4-6 Low Frequency Common Immunity
- EN-61000-4-11 Voltage Dips and Sags
- ETS-300386-2 Switching Equipment

NEBS

- SR-3580 NEBS Criteria Levels
- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

Alarms

SONET Alarms

- Alarm indication signal—line (AIS-L)
- Alarm indication signal—path (AIS-P)
- Bit error rate signal degrade (BERR-SD)
- Bit error rate signal fail (BERR-SF)
- Bit interleaved parity (BIP) error B1
- Bit interleaved parity (BIP) error B2
- Bit interleaved parity (BIP) error B3
- Loss of frame (LOF)
- Loss of pointer (LOP-P)
- Loss of signal (LOS)

Alarms (cont'd)

- Far-end bit error: remote error indication—line (REI-L) (CV-LFE)
- Far-end bit error: remote error indication—path (REI-P) (CV-PFE)
- Payload mismatch (path label mismatch) (PLM-P)
- Payload unequipped (unequipped STS at path level) (UNEQ-P)
- Remote defect indication—line (RDI-L)
- Remote defect indication—path (RDI-P)

SDH Alarms

- Multiplex section alarm indication signal (MS-AIS)
- Administrative unit alarm indication signal (AU-AIS)
- Bit error rate signal degrade (BERR-SD)
- Bit error rate signal fail (BERR-SF)
- Bit interleaved parity (BIP) error B1
- Bit interleaved parity (BIP) error B2
- Bit interleaved parity (BIP) error B3
- Loss of frame (LOF)
- Loss of pointer (HP-LOP)
- Loss of signal (LOS)
- Multiplex section remote error indication (MS-REI)
- Higher path label mismatch (HP-PLM)
- Higher path unequipped (HP-UNEQ)
- Multiplex section remote defect indication (MS-RDI)
- Higher path remote defect indication (HP-RDI)
- Errored seconds (ES-S, ES-L, ES-P), far-end errored seconds (ES-LFE, ES-PFE), far-end severely errored seconds (SES-LFE, SES-PFE), far-end unavailable seconds (UAS-LFE, UAS-PFE)
- Severely errored framing (SEF), severely errored framing seconds (SEFS-S), severely errored seconds (SES-S, SES-L, SES-P), unavailable seconds (UAS-L, UAS-P)

	OC-192C/STM-64 1-PORT	OC-192C/STM-64 WITH XFP 1-PORT AND 4-PORT			OC-768C/STM-256 1-PORT
Transceiver	Very Short Reach (VSR) 1	Short reach (SR-1)	Intermediate Reach (IR-2)	Long Reach (LR-2)	Short Reach (SR)
Transceiver model number	N/A	XFP-10G-L-OC192-SR1	XFP-10G-E-OC192-IR2	XFP-10G-Z-OC192-LR2	N/A
Optical interface	Multi-Mode	Single-Mode	Single-Mode	Single-Mode	Single-Mode
Transceiver type	Fixed	XFP	XFP	XFP	Fixed
Standard	OIF VSR4-1	Telcordia GR-253 OC192 SR1	Telcordia GR-253 OC192 SR1	Telcordia GR-253 OC192 SR1	300-pin multi-source agreement (MSA) ITU G.693 VSR2000–3R2
Maximum distance	MMF cable: 984.25 feet/300 m	SMF cable: 6.21 miles/10 km	SMF cable: 24.8 miles/40 km	SMF cable: 49.71 miles/80 km	1.24 miles/2 km
Transmitter wavelength	830 nm through 860 nm	1290 nm through 1330 nm	1530 nm through 1565 nm	1530 nm through 1565 nm	1530 nm through 1565 nm
Average launch power	−10 through −3 dBm	−6 through −1 dBm	−1.0. through 2 dBm	0 through 4 dBm	0 through +3 dBm
Receiver saturation	-3 dBm	-1.0 dBm	-1.0 dBm	-7.0 dBm	3 dBm
Receiver sensitivity	-16 dBm	-11 dBm	-14 dBm	-24 dBm	-6 dBm

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services and support, which are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to bring revenue-generating capabilities online faster so you can realize bigger productivity gains and faster rollouts of new business models and ventures. At the same time, Juniper Networks ensures operational excellence by optimizing your network to maintain required levels of performance, reliability, and availability. For more details, please visit **www.juniper.net/us/en/products-services/.**

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at **www.juniper.net**.

Ordering Information

MODEL NUMBER	PIC	PLATFORM
OC-192c/STM-64		
M120-cFPC-10C192-XFP	1-port, pluggable XFP Optics	M120
PC-1OC192-SON-VSR	1-port, very short reach (VSR) 1 fixed optics	M120, M320, T320, T640, T1600
PD-1OC192-SON-XFP	1-port, pluggable XFP optics	M120, M320, T320, T640, T1600
PD-4OC192-SON-XFP	PD-4OC192-SON-XFP 4-port, pluggable XFP optics	T640, T1600
OC-768c/STM-256		
PD-1OC768-SON-SR	1-port, single-mode, short reach fixed optics	T640, T1600

Optical Modules Options

MODEL NUMBER	DESCRIPTION
OC-192c/STM-64	
XFP-10G-L-OC192-SR1	OC-192 XFP, 1290 nm through 1330 nm, 10 km reach, single-mode
XFP-10G-E-OC192-IR2	OC-192 XFP, 1530 nm through 1565 nm, 40 km reach, single-mode
XFP-10G-Z-OC192-LR2	OC-192 XFP, 1530 nm through 1565 nm, 80 km reach, single-mode

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1000046-002-EN   Feb 2010

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