4-PORT OC-192 PIC FOR T SERIES CORE ROUTERS

Product Overview

As service provider networks drive towards provisioning multiplay offerings for consumers and business users, the need for high-throughput metro and core connectivity has never been greater. The 4-port OC-192 Type 4 PIC is ideal for establishing a range of cost-effective, high-bandwidth connectivity solutions in metro or intercity environments. This PIC enables full-frame OC-768 transmissions over a single fiber using XFP-based pluggable optics covering distances of up to 80 km.

This versatile interface supports insertion of four independent XFP optical transceivers to establish short, intermediate or long-reach OC-192 connectivity. Passive multiplexing scales connectivity to OC-768, delivering 40 Gbps of throughput without the need for optical amplification equipment.

Product Description

Designed for use in Juniper Networks® T640 Core Routers and Juniper Networks TX Matrix, the 4-port OFC-192 PIC uses XFP-based pluggable optics to support mixed reaches over fiber from a single interface module. By delivering connectivity options (at 10 Gbps or 40 Gbps) ranging from short-reach intra-POP to long-reach inter-POP (up to 80 km), this module is ideal for next-generation service provider networks. This unique solution—combining routing intelligence, high-bandwidth connectivity and long-reach capability—is ideal for facilitating the fast rollout of content-driven multiplay networks.

Compatible with all existing SONET/SDH PICs, the 4-port OC-192 PIC combines high-bandwidth capacity with efficient link utilization, making it a major building block for accommodating fast-growing IP infrastructures both in the core and at the network edge. As bandwidth demand increases, so does the demand to build out new, state-of-the-art IP infrastructures to achieve efficiency, leading to faster network response times.

Architecture and Key Components

The following figure illustrates both a four-fiber and a single-fiber solution using the 4-Port OC-192 PIC. In the four-fiber solution, each fiber carries the OC-192 frames; in the single-fiber solution, a passive multiplexer is used to aggregate the four data streams onto one fiber to carry OC-768 frames.
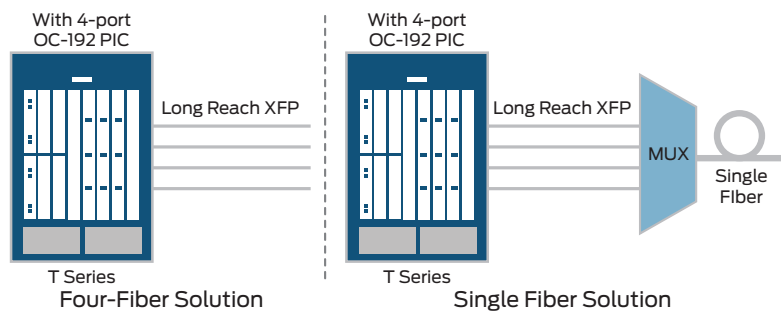
By using inverse multiplexing, four OC-192 ports can be aggregated to a full OC-768 frame

Features and Benefits

The 4-port OC-192 PIC offers several unique features and benefits to service providers who are looking to establish cost-effective, 40 Gbps links to support next-generation networks, either in an inter-POP environment or between central offices in a metro network.

Capable of supporting cabling distances of up to 80 km, this flexible PIC supports extremely high-bandwidth connections in an economical manner. Operators benefit from the simplicity of the solution, which does not require expensive and high-maintenance optical amplification. This dramatically reduces costs by transmitting large quantities of data over a single-fiber link. In addition, redundant links can be established by adding a second fiber, delivering a high-resiliency solution while still containing costs.

Routing Intelligence

Service providers benefit from the integration of optical transport technology into routing platforms, because they avoid the deployment of expensive DWDM and amplification equipment. This is tantamount to creating a Layer 3 transmission solution. Operators can leverage the IP intelligence of Juniper Networks Junos® operating system in T Series routers to determine new paths to destination networks in response to topology changes.

Inverse Multiplexing

A cost-effective solution for achieving ultra-high bandwidth 40 Gbps connectivity, inverse multiplexing allows the bandwidth of the four OC-192 ports to be aggregated to achieve full OC-768 frame link over a single fiber. Ideal for establishing inter-POP connections between routers in a metro environment, this approach also supports metro-to-metro connectivity at distances of up to 80 km—without the need to establish and maintain optical amplification systems.

Investment Protection

The modular architecture of the 4-port OC-192 Type 4 PIC provides significant investment protection via its XFP pluggable optical modules. As new modules are developed to provide additional connectivity options or enhanced cabling distances, service providers can simply insert the new optical module into the PIC without replacing the entire unit. The Type 4 PIC family is the newest PIC family for T Series routers.

Management

The solution provides support for per INF-8077i optical diagnostics and monitoring through use of XFP pluggable optics. SONET alarms and SNMP traps are also supported.

Product Options

The following table gives an overview of product options with the 4-port OC-192 PIC.

FEATURE	DESCRIPTION
Ports	Four line-rate OC-192c/STM-64c ports
Framing	SONET or SDH, configuration through command line interface (CLI)
Data Rate	OC-192c, OC-768c via inverse multiplexing across all four 0C-192 ports; configuration through CLI
Optics	XFP
Transmission distance	Flexible, XFP-based connectivity: SR1, IR2, LR2
Diagnostic optical monitoring (INF 8077i)	Transceiver temperature; Tx bias current; Tx optical power output; Rx optical power receive signal
Supported platforms	T640, TX Matrix

LEDs

LEDs are as follows:

- PORT 0
- PORT 1
- PORT 2
- PORT 3
- 768 over 192
- ONLINE/OFFLINE

One tricolor LED is supported per port and one board-level LED is supported:

- Off: 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

Software Features

The following software features are supported with Junos OS 8.1 and above:

- Optical characteristics measured by CLI: temperature, bias current, Tx and Rx power
- SONET link aggregation: including mixed speed links in same bundle
- SONET APS: 1+1, bidirectional and unidirectional, revertive and nonrevertive
- Hitless switchover between master and standby RE
- Interface clocking including internal line timing and external loop timing
- Mixed SONET and SDH framing configurable per port
- Tricolor marking
- MPLS FRR
- Encapsulations: HDLC, PPP, CCC, TCC, FR

Pluggable Optics

XFP STANDARD	MEDIUM	CONNECTOR	REACH
SR1	SM, 1310 nm	LC	10 km
IR2	SM, 1550 nm	LC	40 km
LR2	SM, 1550 nm	LC	40 km

Diagnostic and Monitoring Capabilities

All optical XFPs support full diagnostic and monitoring capabilities, as defined per the XFP MSA specification. The following is a list of SONET alarms and defects.

Physical

- PLL: Phase-locked loop out of lock
- LOL: Loss of light

Section

- BIP-B1: Bit interleave parity error B1
  - SEF: Severely errored framing
  - LOF: Loss of frame
  - LOS: Loss of signal
  - ES-S: Error seconds
  - SES-S: Severely errored seconds
  - SEFS-S: Severely errored framing seconds

Line

- BIP-B2: Bit Interleave Parity Error B2
  - REI-L: Far-end bit errors
  - AIS-L: Alarm indication signal-line
  - RDI-L: Remote defect indication—line
  - RFI-L: Remote failure indication-line
  - BER-SD: Bit error rate defect-signal degrade
  - BER-SF: Bit error rate fault-signal fail
  - ES-L: Error seconds
  - SES-L: Severely errored seconds
  - UAS-L: Unavailable seconds
  - ES-LFE: Far-end errored seconds
  - SES-LFE: Far-end severely errored seconds
  - UAS-LFE: Far-end unavailable seconds

Path

- BIP-B3: Bit interleave parity error B3
  - REI-P: Far-end bit errors
  - AIS-P: Alarm indication signal-path
  - RDI-P: Remote defect indication—path
  - LOP-P: Loss of pointer-path
  - UNEQ-P: Path unequipped
  - PLM-P: Payload label mismatch
  - ES-P: Error seconds
  - SES-P: Severely errored seconds
  - UAS-P: Unavailable seconds
  - ES-PFE: Far-end errored seconds
  - SES-PFE: Far-end severely errored seconds
  - UAS-PFE: Far-end unavailable seconds

Agency Approvals

Safety

- CAN/CSA-C22.2 No. 60950-1-03 - UL 60950-1 Safety of Information Technology Equipment
- EN 60950-1 Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EN 60825-2 Safety of Laser Products - Part 2: Safety of Optical Fibre Communication Systems

EMC

- AS 3548 Class A (Australia)
- EN55022 Class A (Europe)
- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)
- BSMI Class A (Taiwan)

EMI

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- EN55022 Class A (Europe)
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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

NEBS

- SR-3580 NEBS Criteria Levels (Level 3 Compliance)
- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

ETSI

- ETSI EN-300386-2: Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

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/.**

Pluggable Optics

MODEL NUMBER	DESCRIPTION	PLATFORMS
4-port OC-192 Type 4 PIC		
PD-4OC192-SON-XFP	4-port OC-192c/STM-64c Type 4 PIC: Supports mixed reaches in a single physical PIC and provides OC-768 support via interleaving over four ports; requires XFP modules; requires Junos OS 8.1 software or later	T640, TX Matrix
XFP Optical Transceivers		
XFP-10G-L-OC192-SR1	10GBASE-LR/ OC192 SR1 single-mode pluggable interface; 1300 nm; 10 km; LC connector	T640, TX Matrix
XFP-10G-L-OC192-IR2	10GBASE-ER/ OC192 IR2 single-mode pluggable interface; 1550 nm; 40 km; LC connector	T640, TX Matrix
LR2 – XFP-10G-Z-OC192-LR2	10GBASE-ZR/OC192LR2 single- mode pluggable interface, 1550 nm, 80 km, LC connector	T640, TX Matrix

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**.

To purchase Juniper Networks solutions, please contact your Juniper Networks representative at 1-866-298-6428 or authorized reseller.

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