

ATM Modular Interface Card for MX Series 3D Universal Edge Routers



Product Overview

The ATM Modular Interface Card (MIC) for Juniper Networks MX Series 3D Universal Edge Routers allows our customers to effectively migrate legacy ATM services to their IP/MPLS networks.

The comprehensive ATM traffic management capabilities provide a transport solution for all traffic types, improving traffic visibility and monitoring, simplifying operations, and creating substantial OpEx and CapEx cost savings for service providers and enterprises.

Product Description

Juniper Networks® MX Series 3D Universal Edge Routers help service providers and enterprises migrate their Asynchronous Transfer Mode (ATM) data service and voice traffic to a converged IP/MPLS infrastructure while maintaining premium service levels. Using ATM Modular Interface Cards (MICs), the MX Series enables the delivery of new revenue generating IP services to ATM-connected businesses such as Layer 2 and Layer 3 provider-provisioned VPNs. At the same time, they provide a robust set of quality-of-service (QoS) and traffic management features.

The ATM MIC has a comprehensive feature set, including per-virtual-circuit ATM service classes that enable constant bit rate (CBR), variable bit rate real time (VBR-rt), variable bit rate non-real time (VBR-nrt), MPLS, QoS, a high-performance segmentation and reassembly (SAR) architecture, and support for a large number of ATM virtual connections. All of these features are based on industry specifications and standards.

The ATM MIC delivers eight OC3c/STM-1 or two OC-12c/STM-4-c interfaces that can be used in all MX Series platforms.

Architecture and Key Components

The ATM MIC

The ATM MIC (MIC-3D-8OC3-2OC12-ATM), which offers eight OC3c/STM-1 or two OC-12c/STM-4-c interfaces, is supported on the MPC1, MPC2, MPC3, NG MPC2 and NG MPC3 Modular Port Copncentrators for the MX240, MX480, MX960, MX2010 and MX2020*. The ATM MIC is also supported in native MIC slots on the MX10, MX40, MX80 and MX104. For more information about MPCs, please download the data sheet at www.juniper.net/us/en/local/pdf/datasheets/1000294-en.pdf.

Migration of Legacy Services Over IP/MPLS

The ATM MIC enables the gradual migration of legacy infrastructures and services to IP/MPLS, which avoids forklift upgrades. Furthermore, converging applications over a single network, eliminates the operational expenses associated with maintaining separate IP/MPLS and legacy infrastructures. Fundamental advantages of Juniper's ATM migration solution include the following:

- Comprehensive MPLS L2 VPN and pseudowire emulation service portfolio
- DiffServ-aware traffic engineering for per-class resource reservation across the network
- Connection admission control mechanisms
- MPLS and ATM Operation, Administration, and Maintenance (OAM) interworking
- Rich queuing and class-of-service (CoS) preservation across an IP/MPLS network
- Virtual private LAN service (VPLS) over ATM bridged 2684 interfaces

*The MPC1 through MPC5 are supported on the MX2000 line of routers via an adapter card.

MPLS VPN Services

The ATM MIC enables the delivery of any combination of L2 and L3 VPN services to ATM customers. Our MPLS VPN solutions are particularly well suited for L3 VPN multicast services, broadcast video and IPTV wholesale, enterprise and financial infrastructures, and backhaul over a metro network. Juniper's industry-leading MPLS VPN toolkit offers numerous advantages:

- **Flexibility**—increases available service reach and options; enables intercity, national, and international L2 and L3 VPN services and carrier-of-carrier services; facilitates convergence through network mergers
- **Technology innovations**—improves efficiency and scalability; simplifies configurations and operations; accelerates deployment
- **MPLS plug-and-play**—significantly simplifies the provisioning of large-scale Ethernet networks and services, including the ease of managing and troubleshooting Metro Ethernet networks
- **Leading implementation**—mature deployments of L3 VPNs, VPLS, P2MP LSPs, and IPv6 VPNs
- **Comprehensive options**—support for multiple VPN topologies and traffic types with QoS, high availability, OAM, accounting, and security
- **Advanced VPN-aware services**—includes Network Address Translation (NAT), stateful firewall, IPsec, deep packet inspection, and more

Features and Benefits

Table 1: Key Features and Benefits

Feature	Benefit
Extensive ATM transport features: <ul style="list-style-type: none"> • ATM over Pseudowire Emulation Edge to Edge (PWE3) (RFC 4717) • ATM PWE3 control word • ATM PWE3 via dynamic labels.(LDP, RSVP-TE) • ATM virtual channel identifier/virtual path identifier (VPI/VCI) swapping (different VP/VC on base transceiver station than on backhaul)) • ATM idle/unassigned cell suppression • ATM support for N-to-1 pseudowires; promiscuous modes (one pseudowire per port or one pseudowire per VPI) 	<ul style="list-style-type: none"> • Reduces OpEx; allows carriers to transport their legacy ATM traffic across a packet-based network
Comprehensive ATM traffic management capabilities	<ul style="list-style-type: none"> • Accommodates a wide range of service types with superior traffic handling, from UBR, rt VBR, nrt VBR and CBR
Advanced queuing, classification, and CoS: <ul style="list-style-type: none"> • Per-virtual circuit output traffic shaping • Weighted round-robin (WRR) with priority queuing • Configurable queue length • Random early detection (RED) and early packet discard (EPD) • Mapping of ATM CoS to IP/MPLS CoS <ul style="list-style-type: none"> - 8 classes of queuing - Strict and weighted fair queuing (WFQ) scheduling - Egress shaping per port, or VC via user configuration - Ingress policing per VC via user configuration - Mapping ATM service categories (ATM CBR, rt-VBR, nrt-VBR, UBR) to MPLS EXP bits - Multiple queues per VC (for non-pseudowire encapsulations) 	<ul style="list-style-type: none"> • Supports multiple tiered services per customer • Preserves CoS models across the IP/MPLS domain • Minimizes congestion
Support for the entire VCI/VPI range: <ul style="list-style-type: none"> • 16 bit VCI range • 8 bit VPI range for UNI 	<ul style="list-style-type: none"> • Simplifies operations • Reduces CapEx by maximizing the number of customers/interfaces per port
Wide range of pseudowire emulation and L2 VPN encapsulations: <ul style="list-style-type: none"> • RFC4717 • Cell relay mode (port and virtual path mode) • ATM Adaptation Layer 5 (AAL5) mode 	<ul style="list-style-type: none"> • Provides a transport solution for all traffic • Allows for the progressive migration of legacy networks to IP/MPLS
Advanced diagnostics: <ul style="list-style-type: none"> • F4 and F5 OAM loopback cells • Support for remote and local loopback • Per-VC and per-VRF counters 	<ul style="list-style-type: none"> • Improves traffic visibility and monitoring capabilities • Decreases repair time

Support

MPCs

- MPC1-Q, MPC1-EQ
- MPC2-Q, MPC2-EQ
- MPC2E-Q, MPC2E-EQ
- MPC2E-3D-Q, MPC2E-3D-EQ
- MPC2E-3D-NG with flexible queuing option, MPC2E-3D-NG-Q
- MPC3E-3D-NG with flexible queuing option, MPC3E-3D-NG-Q

Platform

- MX2000 line (with adapter card), MX960, MX480, MX240, MX104, MX80, MX40, MX10, MX5



Specifications

Physical (W x H x D)

- 7.75 x 4.125 x 11.125 in (19.69 x 10.48 x 28.26 cm)

Encapsulation

- ATM-ccc-Cell-Relay
- ATM-ccc-VC-Mux

OC12 Standards Supported

- ATM over SONET scrambler ($X^43 + 1$ scrambler)
- Cell scrambling (UNI)
- SONET Automatic Protection Switching (APS)
- SDH Multiplexor Switching Protection (MSP) (APS for SDH)
- Cyclic redundancy check (CRC) (Standard AAL5 CRC)
- SONET-level error detection
- SONET/SDH MIB
- Clocking: Internal, line timing (system level only), and loop timing.

OC3 Standards Supported

- ATM over SONET scrambler ($X^43 + 1$ scrambler)
- Cell scrambling (UNI)
- SONET APS
- SDH MSP (APS for SDH)
- CRC (Standard AAL5 CRC)
- SONET-level error detection
- SONET/SDH MIB
- Clocking

ATM Statistics

- Uncorrectable header error checksum (HCS) errors
- Correctable HCS errors
- Tx cell first-in, first-out (FIFO) overruns
- Rx cell FIFO overruns
- Input cell count
- Output cell count
- Output idle cell count
- Output VC queue drops
- Input length errors
- Input timeouts
- Input invalid VCs
- Input bad CRCs

LED Support

- MIC LED
 - GREEN: No Fault on any of the MIC ports
 - AMBER: Faults indicated on one or more ports
- PORT LED
 - GREEN: Link is up, no fault indicated
 - OFF: Port is not connected
 - Fast Blink: Local fault on the port
 - Slow Blink: Remote fault received on the port

Bit Error Rate Test (BERT) Support

- Eight independent modules generate and monitor packets or ATM cells at line-rate speeds for diagnostic purposes. The payload of the generated traffic can be filled with a fixed pattern or with pseudo random binary sequence (PRBS).

General

- Supports ITU-T/ANSI container processing

Diagnostics

- Optical diagnostics for small form-factor pluggable transceiver (SFP) supported according to specification SFF-8472

Agency Approvals

- Safety
 - UL 60950 Safety of Information Technology Equipment
 - EN 60950-1 Safety of Information Technology Equipment
 - EN 60825-1/EN 60825-2 Safety of Laser Products
- EMI
 - AS/NZS 3548 Class A (Australia)
 - EN 55022 Class A (Europe)
 - FCC Class A (U.S.)
 - VCCI Class A (Japan)
 - BSMI Class A (Taiwan)
 - Class B specification limits for CISPR/CSA/FCC

Immunity

Table 2: Immunity Standards Support

Standard	Description
EN-61000-3-2	Power line harmonics
EN-61000-3-3	Voltage fluctuations and flicker
EN-61000-4-2	Electrostatic discharge (ESD)
EN-61000-4-3	Radiated immunity
EN-61000-4-4	Electrical fast transient (EFT)
EN-61000-4-5	Surge
EN-61000-4-6	Low frequency common immunity
EN-61000-4-11	Voltage dips and sags

Alarms

SONET Alarms

- Loss of light (LOL)
- Phase-locked loop (PLL)
- Loss of signal (LOS)
- Loss of frame (LOF)
- Severely errored framing (SEF)
- Alarm indication signal–line (AIS-L)
- Remote defect indication–line (RDI-L)
- Alarm indication signal–path (AIS-P)
- Loss of pointer path (LOP-P)
- Bit error rate–signal degrade (BER-SD)
- Bit error rate–signal fail (BER-SF)
- Remote defect indication–path (RDI-P)
- Payload label mismatch–path (PLM-P)
- Unequipped path (UNEQ-P)

- Remote error indication–path (REI-P)
- Virtual container alarm indication signal (VAIS)
- Virtual container loss of pointer (VL0P)
- Virtual container remote defect indicator (VRDI)
- Virtual container unequipped (VUNEQ)
- Virtual container mismatch (V-MIS)

SDH Alarms

- Loss of light (LOL)
- Phase-locked loop (PLL)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Severely errored framing (SEF)
- Multiplex section–alarm indication signal (MS-AIS)
- High order path–alarm indication signal (HP-AIS)
- Loss of pointer (LOP)
- Bit error rate–signal degrade (BER-SD)
- Bit error rate–signal fail (BER-SF)
- Multiplex section–far end receive failure (MS-FERF)
- High order path–far end receive failure (HP-FERF)
- Remote error indication (REI)
- Unequipped (UNEQ)
- High order path–payload label mismatch (HP-PLM)
- Tributary unit–alarm indication signal (TU-AIS)
- Tributary unit–loss of pointer (TU-LOP)
- Tributary unit–remote defect indication (TU-RDI)
- Tributary unit–unequipped (TU-UNEQ)
- Tributary unit–mismatch (TU-MIS)

Small Form-Factor Pluggable Transceiver (SFP) Specifications

Table 3: OC-3/STM-1 SFP

Parameter	Multimode (SR)	Intermediate	Long Reach (LR-1)
Transceiver model number	SFP-OC3-SR	SFP-OC3-IR	SFP-OC3-LR
Optical interface	Multimode	Single-mode	Single-mode
Transceiver type	SFP	SFP	SFP
Maximum distance	MMF: 1.2 miles/2 km	SMF: 9.3 miles/15 km	SMF: 24.85 miles/40 km
Standard	Multivendor agreement	Telcordia GR-253	Telcordia GR-253
Transmitter wavelength	1,270 through 1,380 nm	1,261 through 1,360 nm	1,263 through 1,360 nm
Average launch power	–20 through –14 dBm	–15 through –8 dBm	–5 through 0 dBm
Receiver saturation	–14 dBm	–8 dBm	–10 dBm
Receiver sensitivity	–30 dBm	–28 dBm	–34 dBm

Table 4: OC-12/STM-4 SFP

Parameter	Short Reach (SR-1)	Intermediate Reach (IR-1)	Long Reach (LR-1)	Long Reach (LR-2)
Transceiver model number	SFP-OC12-SR	SFP-OC12-IR	SFP-OC12-LR	SFP-OC12-LR2
Optical interface	Single-mode	Single-mode	Single-mode	Single-mode
Transceiver type	SFP	SFP	SFP	SFP
Maximum distance	SMF: 1.24 miles/2 km	SMF: 9.3 miles/15 km	SMF: 24.85 miles/40 km	SMF: 49.7 miles/80 km
Standard	Telcordia GR-253	Telcordia GR-253	Telcordia GR-253	Telcordia GR-253
Transmitter wavelength	1,261 through 1,360 nm	1,274 through 1,356 nm	1,280 through 1,335 nm	1,480 through 1,580 nm
Average launch power	-15 through -8 dBm	-15 through -8 dBm	-3 through +2 dBm	-3 through +2 dBm
Receiver saturation	-8 dBm	-8 dBm	-8 dBm	-8 dBm
Receiver sensitivity	-23 dBm	-28 dBm	-28 dBm	-28 dBm

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

Model Number	Description	Platforms
Clear-Channel Multiservice Interface MICs		
MIC-3D-8OC3-2OC12-ATM	Multi-rate 8 port non-channelized ATM OC3/STM1 or 2 port non-channelized OC12/STM4 ATM MIC	MX2020 MX2010 MX960 MX480 MX240 MX104 MX80 MX40 MX10 MX5

Model Number	Description	Platforms
SFP Options		
SFP-1OC3-SR	OC-3 SFP 1,310 nm 2 km reach multimode	
SFP-1OC3-IR	OC-3 SFP 1,310 nm 15 km reach single-mode	
SFP-1OC3-LR	OC-3 SFP 1,310 nm 40 km reach single-mode	
SFP-1OC12-SR	OC-12 SFP 1,310 nm 2 km reach single-mode	
SFP-1OC12-IR	OC-12 SFP 1,310 nm 15 km reach single-mode	
SFP-1OC12-LR	OC-12 SFP 1,310 nm 40 km reach single-mode	
SFP-OC12-LR2	OC-12 SFP 1,310 nm 40 km reach single-mode	

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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