M10i Multiservice Edge Router Interface Module Reference

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M10i Multiservice Edge Router Interface Module Reference

The information in this document is current as of the date on the title page.

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About the Documentation

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Documentation Conventions

Table 1 on page xii defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xii defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*

Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

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- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
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- Use the Case Management tool in the CSC at https://www.juniper.net/cm/.
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For international or direct-dial options in countries without toll-free numbers, see https://www.juniper.net/support/requesting-support.html.

PART 1

Overview

CHAPTER 1

M10i Interface Modules Support

M10i PICs Supported

Table 3 on page 3 lists the PICs supported in the M10i router. The PICs are listed alphabetically by PIC family.

NOTE: The M10i router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The "M10i End-of-Life PICs Supported" on page 6 topic lists PICs that moved to end-of-life before the M10i router itself moved to end-of-life.

Table 3: PICs Supported in the M10i Router

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
ATM2 IQ				
"ATM2 DS3 IQ PIC (M10i Router)" on page 27	4	PE-4DS3-ATM2	Coaxial: • 10 ft (3.05-m) posilock SMB to BNC (provided) • Four pairs of Rx and Tx coaxial cables	6.1
"ATM2 OC3/STM1 IQ PIC (M10i Router)" on page 29	2	PE-2OC3-ATM2-MM PE-2OC3-ATM2-SMIR	• SC/PC	6.0
"ATM2 OC12/STM4 IQ PIC (M10i Router)" on page 30	1	PE-1OC12-ATM2-MM PE-1OC12-ATM2-SMIR	• SC/PC	6.0
Channelized Enhanced IQ (IQE)				

Table 3: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
"Channelized DS3 and E3 Enhanced IQ (IQE) PIC (M10i Router)" on page 33 NOTE: Only the DS3 interface is channelized.	4	PE-4CHDS3-E3-IQE-BNC	• Standard DS3 BNC coaxial cable interfaces	10.2
"Channelized E1/T1 Enhanced IQ (IQE) PIC (M10i Router)" on page 36	10	PE-10CHE1-T1-IQE-RJ48	• 120-ohm RJ-48C connector (female)	10.2
"Channelized OC3/STM1 Enhanced IQ (IQE) with SFP (M10i Router)" on page 38	2	PE-2CHOC3-STM1-IQE-SFP	• LC/PC	10.2
"Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M10i Router)" on page 43	1	PE-1CHOC12STM4-IQE-SFP	• LC/PC	10.2
Circuit Emulation				
"Channelized OC3/STM1 Circuit Emulation PIC with SFP (M10I Router)" on page 49	4	PE-4CHOC3-CE-SFP	• LC/PC	9.3
"E1/T1 Circuit Emulation PIC (M10i Router)" on page 52	12	PE-12T1E1-CE-TELCO	• RJ-21 NOTE: Cables are rated for intra-building connections only.	9.3
DS3, E1, E3, and T1				
"DS3/E3 Enhanced IQ (IQE) PIC (M10i Router)" on page 57	4	PE-4DS3-E3-IQE-BNC	• Standard DS3 BNC coaxial cable interfaces	10.2
"E1 PIC (M10i Router)" on page 59	4	PE-4E1-RJ48	• Four RJ-48 connectors (one per port)	6.0
"E3 IQ PIC (M10i Router)" on page 61	4	PE-4E3-QPP	• Standard E3 BNC coaxial cable interfaces	6.1
Ethernet				
"Fast Ethernet PICs (M10i Router)" on page 63	4	PE-4FE-TX	• Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector • Pinout: MDI noncrossover	6.0
"Gigabit Ethernet PIC with SFP (M10i Router)" on page 65	1	PE-1GE-SFP	• LC/PC	6.3

Table 3: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	Connector	First Junos OS Release Support
Ethernet Enhanced IQ2 (IQ2E)				
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (M10i Router)" on page 67	4	PE-4GE-TYPE1-SFP-IQ2E	• Duplex LC/PC connector (Rx and Tx)	9.4
Services				
"Multiservices 100 PIC (M10i Router)" on page 71	0	PE-MS-100-1	• None	8.1
"Tunnel Services PIC (M10i Router)" on page 73	0	PE-TUNNEL	• None	6.0
Serial				
"EIA-530 PIC (M10i Router)" on page 75	2	PE-2EIA530	• Two DB-25 male connectors (one per port, included with PIC) • V.35 requires an EIA-530 to V.35 cable and connects to a V.35 DTE 34-pin Winchester type male cable (one per port) • X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable	6.0
SONET/SDH				
"SONET/SDH OC3/STM1 PIC with SFP (M10i Router)" on page 77	2	PE-2OC3-SON-SFP	• LC/PC	8.4
"SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M10i Router)" on page 80	4	PE-4OC3-STM1-IQE-SFP	• LC/PC	10.2
"SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP (M10i Router)" on page 82	4	PE-4OC3-1OC12-SON-SFP	• LC/PC	8.4
"SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP (M10i Router)" on page 85	1	PE-1OC12-SON-SFP	• LC/PC	8.4

Related Documentation

- *M10i PICs Description*
- M10i End-of-Life PICs Supported on page 6
- M10i PIC/CFEB Compatibility on page 8

M10i End-of-Life PICs Supported

Table 4 on page 6 lists the end-of-life PICs supported in the M10i router. The PICs are listed alphabetically by PIC family.

NOTE: The M10i router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The "M10i PICs Supported" on page 3 topic lists PICs that had not moved to end-of-life before the M10i router itself moved to end-of-life.

Table 4: End-of-Life PICs Supported in the M10i Router

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
ATM			
"ATM DS3 EOL PIC (M10i Router)" on page 90	4	PE-4DS3-ATM	6.1
"ATM E3 EOL PIC (M10i Router)" on page 91	4	PE-4E3-ATM	6.1
ATM2 IQ			
"ATM2 E3 IQ EOL PIC (M10i Router)" on page 93	2	PE-2E3-ATM2	6.1
Channelized			
"Multichannel DS3 EOL PIC (M10i Router)" on page 94	2	PE-2CHDS3	6.1
Channelized IQ			
"Channelized DS3 IQ EOL PIC (M10i Router)" on page 96	4	PE-4CHDS3-QPP	6.0
"Channelized E1 IQ EOL PIC (M10i Router)" on page 97	10	PE-10CHE1-RJ48-QPP	6.0
	10	PE-10CHE1-RJ48-QPP-N	9.1R4 9.2R3 9.3
"Channelized OC3 IQ EOL PIC (M10i Router)" on page 99	1	PE-1CHOC3-SMIR-QPP	7.6
"Channelized OC12 IQ EOL PIC (M10i Router)" on page 100	1	PE-1CHOC12SMIR-QPP	6.1
"Channelized STM1 IQ EOL PIC (M10i Router)" on page 102	1	PE-1CHSTM1-SMIR-QPP	6.0
"Channelized T1 IQ EOL PIC (M10i Router)" on page 104	10	PE-10CHT1-RJ48-QPP	7.4

Table 4: End-of-Life PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
DS3, E1, E3, T1			
"DS3 EOL PIC (M10i Router)" on page 106	2	PE-2DS3	6.0
	4	PE-4DS3	6.0
"E1 PIC (M10i Router)" on page 59	4	PE-4E1-COAX	6.0
"E3 PIC (M10i Router)" on page 107	2	PE-2E3	6.0
"T1 EOL PIC (M10i Router)" on page 109	4	PE-4T1-RJ48	6.0
Ethernet			
"Fast Ethernet PICs (M10i Router)" on page 63	8	PE-8FE-FX	6.1
	12	PE-12FE-TX-MDI PE-12FE-TX-MDIX	6.0
"Gigabit Ethernet EOL PIC (M10i Router)" on page 110	1	PE-1GE-LH PE-1GE-LX PE-1GE-SX	6.1
Ethernet IQ			
"Gigabit Ethernet IQ EOL PIC with SFP (M10i Router)" on page 111	1	PE-1GE-SFP-QPP	6.0
Ethernet IQ2			
"Gigabit Ethernet IQ2 EOL PIC with SFP (M10i Router)" on page 112	4	PE-4GE-TYPE1-SFP-IQ2	7.6R3
Services			
"Adaptive Services EOL PIC (M10i Router)" on page 114	0	PE-AS	6.1
"Adaptive Services II EOL PIC (M10i Router)" on page 116	0	PE-AS2	6.4
"Adaptive Services II Layer 2 Services EOL PIC (M10i Router)" on page 118	0	PB-AS2-LAYER2SERVICES	8.0R2
"Adaptive Services II FIPS EOL PIC (M10i Router)" on page 120	0	PE-AS2-FIPS	7.2
"ES EOL PIC (M10i Router)" on page 122	0	PE-ES-800	6.1

Table 4: End-of-Life PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	First Junos OS Release Support
"Link Services EOL PIC (M10i Router)" on page 123	0	PE-LS-4 PE-LS-32 PE-LS-128	6.1
"Monitoring Services EOL PIC (M10i Router)" on page 124	0	PE-PM	6.1
SONET/SDH			
"SONET/SDH OC3c/STM1 EOL PIC (M10i Router)" on page 125	2	PE-2OC3-SON-MM PE-2OC3-SON-SMIR	6.0
	4	PE-4OC3-SON-MM PE-4OC3-SON-SMIR	6.0
"SONET/SDH OC12c/STM4 EOL PIC (M10i Router)" on page 127	1	PE-1OC12-SON-MM PE-1OC12-SON-SMIR	6.0
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M10i Router)" on page 129	1	PE-1OC12-STM4-IQE-SFP	10.2
"SONET/SDH OC48c/STM16 EOL PIC with SFP" on page 132	1	PE-1OC48-SON-SFP	6.4

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3
- M10i PIC/CFEB Compatibility on page 8

M10i PIC/CFEB Compatibility

Table 5 on page 8 lists the PICs and CFEBs supported on the M10i router.

Table 5: PICs Supported in the M10i Router

PIC Family and Type	Ports	Model Number	CFEB	CFEB-E
ATM				
"ATM DS3 EOL PIC (M10i Router)" on page 90	4	PE-4DS3-ATM EOL (see notification PSN-2003-10-018)	6.1	
"ATM E3 EOL PIC (M10i Router)" on page 91	4	PE-4E3-ATM EOL (see notification PSN-2003-10-018)	6.1	
ATM2 IQ				
ATM2 DS3 IQ	4	PE-4DS3-ATM2	6.1	9.4

Table 5: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	CFEB	CFEB-E
ATM2 E3 IQ	2	PE-2E3-ATM2	6.1	9.4
ATM2 OC3/STM1 IQ	2	PE-2OC3-ATM2-MM PE-2OC3-ATM2-SMIR	6.1	9.4
ATM2 OC12/STM4 IQ	1	PE-1OC12-ATM2-MM PE-1OC12-ATM2-SMIR	6.1	9.4
Channelized				
"Multichannel DS3 EOL PIC (M10i Router)" on page 94	2	PE-2CHDS3 EOL (see notification PSN-2004-10-026)		
Channelized IQ				
Channelized DS3 IQ	4	PE-4CHDS3-QPP	6.1	9.4
Channelized E1 IQ	10	PE-10CHE1-RJ48-QPP-N	9.1R4 9.2R3 9.3	9.4
Channelized OC12 IQ	1	PE-1CHOC12SMIR-QPP	6.1	9.4
Channelized OC3 IQ	1	PE-1CHOC3-SMIR-QPP	7.1	9.4
Channelized STM1 IQ	1	PE-1CHSTM1-SMIR-QPP	6.1	9.4
Channelized T1 IQ	10	PE-10CHT1-RJ48-QPP	7.4	9.4
Channelized IQE				
Channelized DS3 and E3 Enhanced IQ (IQE)	4	PE-4CHDS3-E3–IQE-BNC	–	10.2
Channelized E1/T1 Enhanced IQ (IQE)	10	PE-10CHE-T1-IQE-RJ48	–	10.2
Channelized OC3/STM1 Enhanced IQ (IQE) with SFP	2	PE-2CHOC3-STM1-IQE-SFP	–	10.2
Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP	1	PE-1CHOC12STM4-IQE-SFP	–	10.2
Circuit Emulation				
Channelized OC3/STM1 Circuit Emulation	4	PE-4CHOC3-CE-SFP	9.3	9.5
E1/T1 Circuit Emulation	12	PE-12T1E1-CE-TELCO	9.3	9.5
DS3, E1, E3, and T1				

Table 5: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	CFEB	CFEB-E
DS3	2	PE-2DS3	6.1	9.4
	4	PE-4DS3	6.1	9.4
DS3/E3 Enhanced IQ (IQE)	4	PE-4DS3-E3-IQE-BNC	–	10.2
E1	4	PE-4E1-COAX PE-4E1-RJ48	6.1	9.4
E3	2	PE-2E3	6.0	9.4
E3 IQ	4	PE-4E3-QPP	6.1	9.4
T1	4	PE-4T1-RJ48	6.1	9.4
E3				
"E3 PIC (M10i Router)" on page 107	4	PE-4E3 EOL (see notification PSN-2003-10-018)	6.1	
Ethernet				
Fast Ethernet	4	PE-4FE-TX	6.1	9.4
	8	PE-8FE-FX	6.1	9.4
	12	PE-12FE-TX-MDI PE-12FE-TX-MDIX	6.1	9.4
"Gigabit Ethernet EOL PIC (M10i Router)" on page 110	1	PE-1GE-LH EOL (see notification PSN-2004-06-014) PE-1GE-LX EOL (see notification PF-HW-0103-001) PE-1GE-SX EOL (see notification PF-HW-0103-001)	6.1	
Gigabit Ethernet with SFP	1	PE-1GE-SFP	6.3	9.4
Ethernet IQ				
Gigabit Ethernet IQ	1	PE-1GE-SFP-QPP	6.1	9.4
Ethernet IQ2				
Gigabit Ethernet IQ2	4	PE-4GE-TYPE1-SFP-IQ2	7.6R3	9.4
Ethernet Enhanced IQ2 (IQ2E)				
Gigabit Ethernet IQ2E	4	PE-4GE-TYPE1-SFP-IQ2E	9.4	9.5R2
Services				

Table 5: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	CFEB	CFEB-E
Link Services	0	PE-LS-4 PE-LS-32 PE-LS-128	6.1	–
"Multiservices 100 PIC (M10i Router)" on page 71	0	PE-MS-100-1	8.1	9.4
"Tunnel Services PIC (M10i Router)" on page 73	0	PE-TUNNEL	6.1	9.4
"Adaptive Services EOL PIC (M10i Router)" on page 114	0	PE-AS EOL (see notification PSN-2005-06-007)	6.1	
"Adaptive Services II EOL PIC (M10i Router)" on page 116	0	PE-AS2 EOL (see notification PSN-2007-12-036)	6.4	9.4
"Adaptive Services II Layer 2 Services EOL PIC (M10i Router)" on page 118	0	PB-AS2-LAYER2SERVICES EOL (see notification PSN-2008-11-080)	8.0R2	
"Adaptive Services II FIPS EOL PIC (M10i Router)" on page 120	0	PE-AS2-FIPS EOL (see notification PSN-20011-09-381)		
"ES EOL PIC (M10i Router)" on page 122	0	PE-ES-800 EOL (see notification PSN-2010-04-734)	6.0	
"Link Services EOL PIC (M10i Router)" on page 123	0	PE-LS-4 EOL (see notification PSN-2008-11-080) PE-LS-32 EOL (see notification PSN-2008-11-080) PE-LS-128 EOL (see notification PSN-2008-11-080)	6.0	
"Monitoring Services EOL PIC (M10i Router)" on page 124	0	PE-PM EOL (see notification PSN-2005-06-007)	6.1	
Serial				
EIA-530	2	PE-2EIA530	6.1	9.4
SONET/SDH				
"SONET/SDH OC3/STM1 PIC with SFP (M10i Router)" on page 77	2	PE-2OC3-SON-SFP	8.4	9.6
"SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M10i Router)" on page 80	4	PE-4OC3-STM1-IQE-SFP	–	10.2

Table 5: PICs Supported in the M10i Router (continued)

PIC Family and Type	Ports	Model Number	CFEB	CFEB-E
"SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP (M10i Router)" on page 82	4	PE-4OC3-1OC12-SON-SFP	8.4	9.4
"SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M10i Router)" on page 129	1	PE-1OC12-STM4-IQE-SFP	–	10.2
"SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP (M10i Router)" on page 85	1	PE-1OC12-SON-SFP	8.4	9.4
"SONET/SDH OC48c/STM16 EOL PIC with SFP" on page 132	1	PE-1OC48-SON-SFP	6.4	–
"SONET/SDH OC3c/STM1 EOL PIC (M10i Router)" on page 125	2	PE-2OC3-SON EOL (see notification PSN-2007-12-037)	6.0	9.4
• SONET/SDH OC3c/STM1 PIC	2	PE-2OC3-SON-MM PE-2OC3-SON-SMIR		
• SONET/SDH OC3c/STM1 PIC	4	PE-4OC3-SON-MM PE-4OC3-SON-SMIR		
"SONET/SDH OC12c/STM4 EOL PIC (M10i Router)" on page 127	1	PE-1OC12-SON-MM EOL (see notification PSN-2007-12-037) PE-1OC12-SON-SMIR EOL (see notification PSN-2007-12-037)	6.0	9.4

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 2

Network Interface Specifications

Determining Transceiver Support and Specifications for M Series and T Series Routers

You can find information about the pluggable transceivers supported on your Juniper Networks device by using the Hardware Compatibility Tool. In addition to transceiver and connector type, the optical and cable characteristics—where applicable—are documented for each transceiver. The Hardware Compatibility Tool allows you to search by product, displaying all the transceivers supported on that device, or category, displaying all the transceivers by interface speed or type. The Hardware Compatibility Tool is located at https://apps.juniper.net/hct/.

Some transceivers support additional monitoring using the operational mode CLI command **show interfaces diagnostics optics**. Use the Hardware Compatibility Tool to determine if your transceiver supports monitoring. See the Junos OS documentation for your device for a description of the monitoring fields.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

Fast Ethernet 100BASE-FX Optical Interface Specifications

Table 6 on page 14 shows the optical interface specifications for the 100BASE-FX standard.

Table 6: Fast Ethernet 100BASE-FX Optical Interface Specifications

Parameter	100BASE-FX
Rate	100 Mbps
Optical interface	Multimode
Maximum distance	50/125 MMF cable: 1640 ft (500 m) 62.5/125 MMF cable: 6562 ft (2 km)
Transmitter wavelength	1270 through 1380 nm
Average launch power	–19 through –14 dBm
Average receive power	–31 through –14 dBm
Receiver saturation	–14 dBm
Receiver sensitivity	–31 dBm

SONET/SDH OC3/STM1 Optical Interface Specifications

SONET/SDH OC3/STM1 Specifications

Table 7 on page 14 shows the multimode SONET/SDH OC3/STM1 optical interface specifications.

Table 7: SONET/SDH OC3/STM1 Multimode Optical Interface Specifications

Parameter	Multimode
Optical interface	Multimode
Maximum distance	MMF cable: 1.2 miles (2 km)
Standard	Multivendor agreement
Transmitter wavelength	1270 through 1380 nm
Average launch power	–20 through –14 dBm
Receiver saturation	–14 dBm

Table 7: SONET/SDH OC3/STM1 Multimode Optical Interface Specifications (continued)

Parameter	Multimode
Receiver sensitivity	–30 dBm

SONET/SDH OC3/STM1 Intermediate Reach (IR-1) Specifications

Table 8 on page 15 shows the SONET/SDH OC3/STM1 intermediate reach (IR-1) optical interface specifications.

Table 8: SONET/SDH OC3/STM1 Intermediate Reach Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)
Standard	Telcordia GR-253
Transmitter wavelength	1261 through 1360 nm
Average launch power	–15 through –8 dBm
Receiver saturation	–8 dBm
Receiver sensitivity	–28 dBm

SONET/SDH OC3/STM1 Long Reach (LR-1) Specifications

Table 9 on page 15 shows the SONET/SDH OC3/STM1 long reach (LR-1) optical interface specifications.

Table 9: SONET/SDH OC3/STM1 Long Reach -1 Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 24.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1263 through 1360 nm
Average launch power	–5 through 0 dBm
Receiver saturation	–10 dBm
Receiver sensitivity	–34 dBm

SONET/SDH OC12/STM4 Optical Interface Specifications

SONET/SDH OC12/STM4 Short Reach (SR-1) Specifications

Table 10 on page 16 shows the SONET/SDH OC12/STM4 short reach (SR-1) optical interface specifications.

Table 10: SONET/SDH OC12/STM4 Short Reach (SR-1) Optical Interface Specifications

Parameter	Short Reach (SR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 1.24 miles (2 km)
Standard	Telcordia GR-253
Transmitter wavelength	1261 through 1360 nm
Average launch power	–15 through –8 dBm
Receiver saturation	–8 dBm
Receiver sensitivity	–23 dBm

SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Specifications

Table 11 on page 16 shows the SONET/SDH OC12/STM4 short reach (IR-1) optical interface specifications.

Table 11: SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)
Standard	Telcordia GR-253
Transmitter wavelength	1274 through 1356 nm
Average launch power	–15 through –8 dBm

Table 11: SONET/SDH OC12/STM4 Intermediate Reach (IR-1) Optical Interface Specifications (continued)

Parameter	Intermediate Reach (IR-1)
Receiver saturation	–8 dBm
Receiver sensitivity	–28 dBm

SONET/SDH OC12/STM4 Long Reach (LR-1) Specifications

Table 12 on page 17 shows the SONET/SDH OC12/STM4 short reach (LR-1) optical interface specifications.

Table 12: SONET/SDH OC12/STM4 Long Reach (LR-1) Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 24.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1280 through 1335 nm
Average launch power	–3 through +2 dBm
Receiver saturation	–8 dBm
Receiver sensitivity	–28 dBm

SONET/SDH OC12/STM4 Long Reach (LR-2) Specifications

Table 13 on page 17 shows the SONET/SDH OC12/STM4 short reach (LR-2) optical interface specifications.

Table 13: SONET/SDH OC12/STM4 Long Reach (LR-2) Optical Interface Specifications

Parameter	Long Reach (LR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.70 miles (80 km)
Standard	Telcordia GR-253
Transmitter wavelength	1480 through 1580 nm
Average launch power	–3 through 2 dBm
Receiver saturation	–8 dBm

Table 13: SONET/SDH OC12/STM4 Long Reach (LR-2) Optical Interface Specifications (continued)

Parameter	Long Reach (LR-2)
Receiver sensitivity	–28 through –8 dBm

SONET/SDH OC48/STM16 Optical Interface Specifications

SONET/SDH OC48/STM16 Short Reach (SR-1) Specifications

Table 14 on page 18 shows the SONET/SDH OC48/STM16 short reach (SR-1) optical interface specifications.

Table 14: SONET/SDH OC48/STM16 Short Reach (SR-1) Optical Interface Specifications

Parameter	Short Reach (SR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 1.24 miles (2 km)
Standard	Telcordia GR-253
Transmitter wavelength	1266 through 1360 nm
Average launch power	–10 through –3 dBm
Receiver saturation	–3 dBm
Receiver sensitivity	–18 dBm

SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Specifications

Table 15 on page 18 shows the SONET/SDH OC48/STM16 intermediate reach (IR-1) optical interface specifications.

Table 15: SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Optical Interface Specifications

Parameter	Intermediate Reach (IR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 9.3 miles (15 km)

Table 15: SONET/SDH OC48/STM16 Intermediate Reach (IR-1) Optical Interface Specifications (continued)

Parameter	Intermediate Reach (IR-1)
Standard	Telcordia GR-253
Transmitter wavelength	1260 through 1360 nm
Average launch power	–5 through 0 dBm
Receiver saturation	0 dBm
Receiver sensitivity	–18 dBm

SONET/SDH OC48/STM16 Long Reach (LR-1) Specifications

Table 16 on page 19 shows the SONET/SDH OC48/STM16 long reach (LR-1) optical interface specifications.

Table 16: SONET/SDH OC48/STM16 Long Reach (LR-1) Optical Interface Specifications

Parameter	Long Reach (LR-1)
Optical interface	Single-mode
Maximum distance	SMF cable: 28.85 miles (40 km)
Standard	Telcordia GR-253
Transmitter wavelength	1280 through 1335 nm
Average launch power	–2 through +3 dBm
Receiver saturation	–9 dBm
Receiver sensitivity	–28 dBm

SONET/SDH OC48/STM16 Long Reach (LR-2) Specifications

Table 17 on page 19 shows the SONET/SDH OC48/STM16 long reach (LR-2) optical interface specifications.

Table 17: SONET/SDH OC48/STM16 Long Reach (LR-2) Optical Interface Specifications

Parameter	Long Reach (LR-2)
Optical interface	Single-mode
Maximum distance	SMF cable: 49.71 miles (80 km)
Standard	Telcordia GR-253

Table 17: SONET/SDH OC48/STM16 Long Reach (LR-2) Optical Interface Specifications (continued)

Parameter	Long Reach (LR-2)
Transmitter wavelength	1500 through 1580 nm
Average launch power	–2 through +3 dBm
Receiver saturation	–9 dBm
Receiver sensitivity	–28 dBm

CHAPTER 3

Cable Pinouts

RJ-48 Cable Pinouts for E1 and T1 PICs

The E1 and T1 PICs use an RJ-48 cable, which is not supplied with the PIC.

CAUTION: **To maintain agency approvals, use only a properly constructed, shielded cable.**

Table 18 on page 21, Table 19 on page 22, Table 20 on page 22, and Table 21 on page 23 describe the RJ-48 connector pinouts.

Table 18: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	1	RX, Ring, –
2	2	RX, Tip, +
4	4	TX, Ring, –
5	5	TX, Tip, +
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect

Table 19: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	4	RX/Ring/– <––>TX/Ring/–
2	5	RX/Tip/+ <––>TX/Tip/+
4	1	TX/Ring/– <––>RX/Ring/–
5	2	TX/Tip/+ <––>RX/Tip/+
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect

Table 20: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	11	RX/Ring/– <––>RX/Ring/–
2	3	RX/Tip/+ <––>RX/Tip/+
4	9	TX/Ring/– <––>TX/Ring/–
5	1	TX/Tip/+ <––>TX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect

Table 20: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router (continued)

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Table 21: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	9	RX/Ring/– <––>TX/Ring/–
2	1	RX/Tip/+ <––>TX/Tip/+
4	11	TX/Ring/– <––>RX/Ring/–
5	3	TX/Tip/+ <––>RX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

Related Documentation

- *Maintaining M120 PICs and PIC Cables*
- *Installing an M120 PIC Cable*
- *M120 PICs Description*

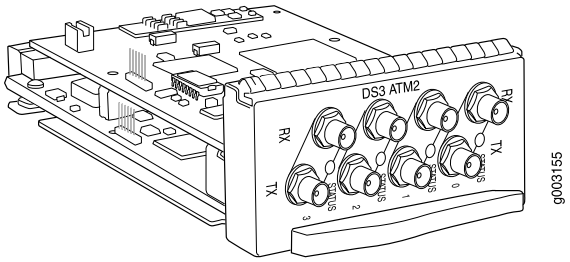
PART 2

PIC Descriptions

CHAPTER 4

ATM2 IQ PIC Descriptions

ATM2 DS3 IQ PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later
Description	• Four DS3 ports • Power requirement: 0.41 A @ 48 V (20.0 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface. • ATM standards compliant

Hardware features	• 16-MB SDRAM memory for ATM segmentation and reassembly (SAR)
	• ATM switch ID
	• Configurable framing options:
	  ◦ C-bit with ATM direct mapping
	  ◦ C-bit with Physical Layer Convergence Protocol (PLCP) framing (default)
	  ◦ M23 ATM direct mapping
	  ◦ M23 with PLCP framing
	• Internal and loop timing

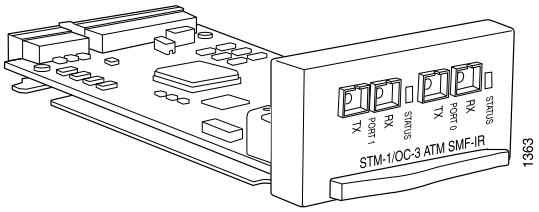
Software features	• Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	• Unspecified bit rate (UBR) traffic shaping
	• Fine-grained variable bit rate (VBR) traffic shaping
	• Circuit cross-connect (CCC)
	• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• AAL5 encapsulations:
	  ◦ ATM-VC-MUX
	  ◦ ATM-NLPID
	  ◦ ATM-Cisco-LLPID
	  ◦ ATM-SNAP
	  ◦ ATM-CCC-VC-MUX

Cables and connectors	Coaxial: • 10 ft (3.05 m) posilock SMB to BNC (provided) • Four pairs of Rx and Tx coaxial cables
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Far-end block error (FEBE) • Frame error • Idle code • Idle received • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Path parity error • Yellow alarm

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

ATM2 OC3/STM1 IQ PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later
Description	• Two OC3 ports • Power requirement: 0.41 A @ 48 V (20 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 • ATM and SONET/SDH standards compliant • Alarm and event counting and detection • Compatible with well-known ATM switches • ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches
Hardware features	• Single 3010 SAR for segmentation and reassembly into 53 byte ATM cells • High-performance parsing of SONET/SDH frames • ASIC-based packet segmentation and reassembly (SAR) management and output port queuing • 64 MB SDRAM memory for ATM SAR • Packet buffering, Layer 2 parsing

Software features	• Circuit cross-connect (CCC) for leveraging ATM access networks
	• User-configurable virtual circuit (VC) and virtual path (VP) support
	• Support for idle cell or unassigned cell transmission
	• OAM fault management processes alarm indication signal (AIS), remote defect indicator (RDI) cells, and loop cells
	• Point-to-point and point-to-multipoint mode Layer 2 counters per VC and per VP
	• Local and remote loopback
	• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• Unspecified bit rate (UBR), non-real-time variable bit rate (VBR), and constant bit rate (CBR) traffic shaping
	• Per-VC or per-VP traffic shaping
	• Support for F4 OAM cells
	• Support for 16 bit VCI range

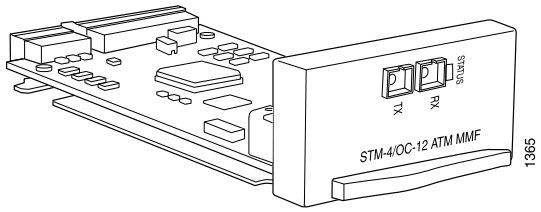
Cables and connectors	• Duplex SC/PC connector (RX and TX)
	• SONET/SDH OC3/STM1 fixed transceivers:
	  ◦ Multimode
	  ◦ Intermediate reach (IR-1)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), 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) • Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Remote defect indication (RDI-L, RDI-P) • 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)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

ATM2 OC12/STM4 IQ PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later

Description	• One OC12 port • Power requirement: 0.41 A @ 48 V (20 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 • Complies with ATM and SONET/SDH standards • Alarm and event counting and detection • Compatible with well-known ATM switches • ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches
Hardware features	• One 3010 SAR for segmentation and reassembly into 53-byte ATM cells • High-performance parsing of SONET/SDH frames • ASIC-based packet segmentation and reassembly (SAR) management and output port queuing • 64 MB SDRAM memory for ATM SAR • Packet buffering, Layer 2 parsing

Software features	• Circuit cross-connect for leveraging ATM access networks
	• User-configurable virtual circuit (VC) and virtual path (VP) support
	• Support for idle cell or unassigned cell transmission
	• OAM fault management processes alarm indication signal (AIS), remote defect indication (RDI), and loop cells
	• Point-to-point and point-to-multipoint mode Layer 2 counters per VC and per VP
	• Local and remote loopback
	• ATM Inverse ARP, which enables routers to automatically learn the IP address of the router on the far end of an ATM PVC
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• Unspecified bit rate (UBR), non-real-time variable bit rate (VBR), and constant bit rate (CBR) traffic shaping
	• Per-VC or per-VP traffic shaping
	• Support for F4 OAM cells
	• Support for 16-bit VCI range

Cables and connectors	• Duplex SC/PC connector (Rx and Tx)
	• SONET/SDH OC12/STM4 fixed transceiver:
	  ◦ Multimode
	  ◦ Intermediate reach (IR-1)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), 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) • Loss of cell delineation (LOC), loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Remote defect indication (RDI-L, RDI-P) • 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)

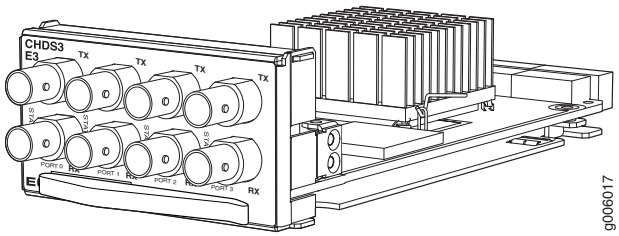
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 5

Channelized Enhanced IQ (IQE) PIC Descriptions

Channelized DS3 and E3 Enhanced IQ (IQE) PIC (M10i Router)



Software release	• Junos OS Release 10.2 and later (Type 1)

Description	• Four E3 or Channelized DS3 ports
	• E3 or Channelized DS3 is configurable on a per-port granularity
	• DS3 channelization:
	  ◦ 4 DS3 channels
	  ◦ 112 DS1 channels
	  ◦ 1011 DS0 channels
	• Power requirement: 0.53 A @ 48 V (25.4 W)

Hardware features	• Ports are numbered 0 through 3 from left to right

Software features	• Maximum transmission units (MTUs) of up to 9000 bytes
	• Dynamic, arbitrary channel configuration
	• Subrate and scrambling:
	NOTE: Only DS3 interfaces support subrate and scrambling.
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox

	• Larscom • ADTRAN • Verilink (subrate: only port A mode) NOTE: For DS3 interfaces, Verilink does not function if an IQE interface is paired with an IQ interface. • Data service unit (DSU) functionality • B3ZS line encoding • Framing: M13, C-bit parity, framed clear channel • Full bit error rate test (BERT) for DS0, DS1, and DS3 • ANSI T1.403 FDL • Internal and loop clocking for DS3 and DS1 • DS3 far end alarm and control (FEAC) channel • Local line, remote line, and remote playback loopback testing for each DS3 and DS1channels • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features. • Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB • Encapsulations: • Circuit cross-connect (CCC) • Translational cross-connect (TCC) • Extended Frame Relay for CCC and TCC • Flexible Frame Relay • Frame Relay • Frame Relay for CCC • Frame Relay for TCC • Frame Relay port CCC • High-Level Data Link Control (HDLC) • HDLC framing for CCC • HDLC framing for TCC • MPLS CCC • MPLS TCC • Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16) • Point-to-Point Protocol (PPP) • PPP for CCC • PPP for TCC
Cables and connectors	• Standard DS3 BNC coaxial cable interfaces
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

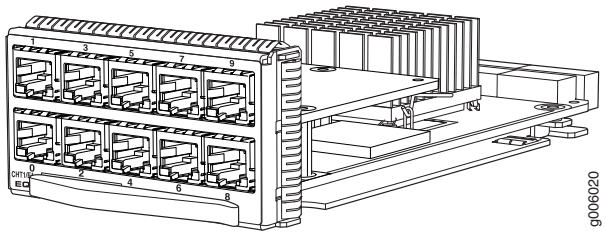
Alarms, errors, and events	• Alarm reporting for error statistics and failure counts
	• DS1 alarms:
	  • Alarm indication signal (AIS)
	  • Loss of frame (LOF)
	  • Remote alarm indication signal (RAIS)
	• DS1 error detection:
	  • Bursty errored seconds (BES)
	  • CRC errors
	  • Errored seconds (ES)
	  • Line errored seconds (LES)
	  • Loss of framing seconds (LOFS)
	  • Loss of signal seconds (LOSS)
	  • Severely errored seconds (SES)
	  • Severely errored framing seconds (SEFS)
	  • Unavailable seconds (UAS)
	• DS3 alarms:
	  • Alarm indication signal (AIS)
	  • Loss of frame (LOF)
	  • Loss of signal (LOS)
	  • Phase lock loop (PLL)
	• DS3 error detection:
	  • C-bit code violations (CCV)
	  • C-bit errored seconds (CES)
	  • C-bit severely errored framing seconds (CEFS)
	  • CRC errors
	  • Excessive zeros (EXZ)
	  • Far-end block error (FEBE)
	  • Far-end receive failure (FERF)
	  • Line errored seconds (LES)
	  • Parity bit (P-bit) code violations (PCV)
	  • Parity bit (P-bit) errored seconds (PES)
	  • Parity bit (P-bit) severely errored framing seconds (PSES)
	  • Severely errored framing seconds (SEFS)
	  • Unavailable seconds (UAS)

Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized E1/T1 Enhanced IQ (IQE) PIC (M10i Router)



Software release	• Junos OS Release 10.2 and later (Type 1)

Description	• Ten E1 or T1 ports
	• DS1 and E1 interfaces are selectable on a per-port granularity
	• E1 channelization per PIC:
	  • 10 E1 channels
	  • 310 DS0 channels
	• T1 channelization per PIC:
	  • 10 T1 channels
	  • 240 DS0 channels
	• Power requirement: 0.52 A @ 48 V (24.73 W)
	• Model number: PB-10CHE1-T1-IQE-RJ48

Hardware features	Ports are numbered: • Top row: 0 and 1 from left to right • Second row: 2 and 3 from left to right • Third row: 3 and 4 from left to right • Bottom row: 5 and 6 from left to right

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Support sending and receiving in-band loopback codes in both framed and unframed mode:
	  • Framed in-band loopback at CSU
	  • Framed in-band loopback at Smartjack (ANSI)
	  • Unframed in-band loopback at CSU
	  • Unframed in-band loopback at Smartjack (ANSI)
	• You can configure the following framing modes using the CLI:
	  • T1—SF (D4/superframe), ESF (extended superframe)
	  • E1—G704, G704–no-crc4, unframed
	• Packet buffering, Layer 2 parsing
	• Local line, remote line, and remote payload loopback testing; each channel can be looped individually and independently of other channels (DS1/E1 channels)
	• Simple Network Management Protocol (SNMP): T1 MIB (RFC 1406)
	• Dynamic, arbitrary channel configuration

	• Full bit error rate test (BERT)
	• Clocking: internal and loop (clock recovered from network and use for transmit). Internal timing is the default for channelized T1 ports. The external master clock can be a multiple of 2.048 MHz or 1.544 MHz for E1 or T1 operation.
	• Line coding:
	  • T1—CLI configurable as AMI or B8ZS
	  • E1—HDB3
	• Encapsulations:
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Extended Frame Relay for CCC and TCC
	  • Flexible Frame Relay
	  • Frame Relay
	  • Frame Relay for CCC
	  • Frame Relay for TCC
	  • Frame Relay port CCC
	  • High-Level Data Link Control (HDLC)
	  • HDLC framing for CCC
	  • HDLC framing for TCC
	  • MPLS CCC
	  • MPLS TCC
	  • Point-to-Point Protocol (PPP)
	  • PPP for CCC
	  • PPP for TCC
	• Encapsulations available only for DS0 and DS1:
	  • Multilink Frame Relay end-to-end (MLFR FRF.15)
	  • Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  • Multilink PPP (MLPPP)
	• Encapsulations available only for DS1:
	  • PPP over Frame Relay

Cables and connectors	• 120-ohm RJ-48C connector (female)
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

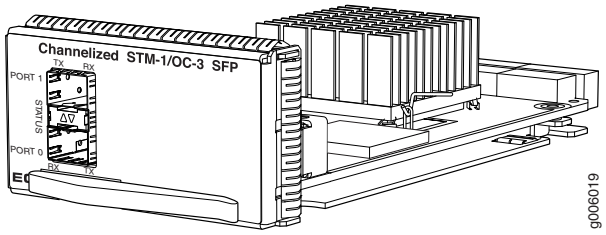
Alarms, errors, and events	• DS1 alarms:
	  • Alarm indication signal (AIS)
	  • Loss of frame (LOF)
	  • Remote alarm indication signal (RAIS)
	  • 24-hour alarm reporting history maintained for error statistics and failure counts, 15-minute intervals on all errors
	• DS1 error detection:
	  • Bursty errored seconds (BES)
	  • CRC errors
	  • Errored seconds (ES)
	  • Line errored seconds (LES)
	  • Loss of framing seconds (LOFS)
	  • Loss of signal seconds (LOSS)
	  • Severely errored seconds (SES)
	  • Severely errored framing seconds (SEFS)
	  • Unavailable seconds (UAS)

Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters • Layer 2 per-queue and per-channel packet and byte drop counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized OC3/STM1 Enhanced IQ (IQE) with SFP (M10i Router)



Software release	• Junos OS Release 10.2 and later

Description	• Two OC3 or STM1 ports
	• SONET or SDH is configurable on a per-port granularity
	• SONET channelization:
	  ◦ 2 OC3 channels
	  ◦ 6 DS3 channels
	  ◦ 168 DS1 channels
	  ◦ 1011 DS0 channels
	• SDH channelization:
	  ◦ 2 STM1 channels (non-concatenated)
	  ◦ 6 E3 channels
	  ◦ 126 E1 channels
	  ◦ 6 DS3 channels
	  ◦ 168 DS1 channels
	  ◦ 1011 DS0 channels
	• Power requirement: 0.56 A @ 48 V (27.1 W)

Hardware features	• Ports are numbered 0 and 1 from left to right

Software features	• Dynamic, arbitrary channel configuration
	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	  ◦ Larscom
	  ◦ ADTRAN
	  ◦ Verilink
	• Packet buffering, Layer 2 parsing
	• M13/C-bit parity encoding
	• DS3 far-end alarm and control (FEAC) channel support
	• Local line, remote line, and remote payload loopback testing
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Extended Frame Relay for CCC and TCC
	  ◦ Flexible Frame Relay
	  ◦ Frame Relay
	  ◦ Frame Relay for CCC
	  ◦ Frame Relay for TCC
	  ◦ Frame Relay port CCC
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ HDLC framing for CCC
	  ◦ HDLC framing for TCC
	  ◦ MPLS CCC
	  ◦ MPLS TCC
	  ◦ Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  ◦ Point-to-Point Protocol (PPP)
	  ◦ PPP for CCC
	  ◦ PPP for TCC
	• Encapsulations available only for DS1:
	  ◦ Multilink Frame Relay end-to-end (MLFR FRF.15)
	  ◦ Multilink PPP (MLPPP)
	  ◦ PPP over Frame Relay

Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 SFPs:
	  ◦ Multimode (model number: SFP-OC3-SR)
	  ◦ Intermediate Reach (IR-1) (model number: SFP-OC3-IR)
	  ◦ Long reach (LR-1) (model number: SFP-OC3-LR)
	Optical interface support—See "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	One tricolor Status LED per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • Loss of clock (LOC)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of pointer (LOP)
	  • Loss of signal (LOS)
	  • Payload label mismatch (PLM-P)
	  • Remote defect indication—line (RDI-L)
	  • Remote defect indication—path (RDI-P)
	  • Remote error indication (REI)
	  • Payload unequipped (unequipped STS at path level) (UNEQ-P)
	  • Virtual container—alarm indication signal (VAIS)
	  • Virtual container—loss of clock (VLOC)
	  • Virtual container—loss of pointer (VLOP)
	  • Virtual container—mismatch (VMIS)
	  • Virtual container—remote defect indication (VRD1)
	  • Virtual container—unequipped (VUNEQ)
	• SDH alarms:
	  • 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, B2, B3
	  • Higher order path—alarm indication signal (HP-AIS)
	  • Higher order path—far-end receiver error (HP-FERF)
	  • Higher order path—payload label mismatch (HP-PLM)
	  • Higher order path—loss of pointer (HP-LOP)
	  • Higher order path—remote defect indication (HP-RDI)
	  • Higher order path—unequipped (HP-UNEQ)
	  • Loss of clock (LOC)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of signal (LOS)
	  • Multiplex section—alarm indication signal (MS-AIS)
	  • Multiplex section—far-end receive error (MS-FERF)
	  • Multiplex section—remote defect indication (MS-RDI)
	  • Multiplex section—remote error indication (MS-REI)

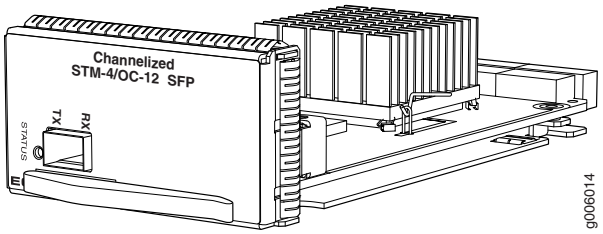
  - Phase lock loop (PLL)
  - Remote error indication (REI)
  - Severely errored frame (SEF)
  - Tributary unit—alarm indication signal (TU-AIS)
  - Tributary unit—loss of clock (TU-LOC)
  - Tributary unit—loss of pointer (TU-LOP)
  - Tributary unit—mismatch (TU-MIS)
  - Tributary unit—remote defect indication (TU-RDI)
  - Tributary unit—unequipped (TU-UNEQ)
- DS1 alarms:
  - Alarm indication signal (AIS)
  - Loss of frame (LOF)
  - Remote alarm indication signal (RAIS)
- DS1 error detection:
  - Bursty errored seconds (BES)
  - CRC errors
  - Errored seconds (ES)
  - Line errored seconds (LES)
  - Loss of framing seconds (LOFS)
  - Loss of signal seconds (LOSS)
  - Severely errored seconds (SES)
  - Severely errored framing seconds (SEFS)
  - Unavailable seconds (UAS)
- DS3 alarms:
  - Alarm indication signal (AIS)
  - Loss of frame (LOF)
  - Loss of signal (LOS)
  - Phase lock loop (PLL)
- DS3 error detection:
  - C-bit code violations (CCV)
  - C-bit errored seconds (CES)
  - C-bit severely errored framing seconds (CEFS)
  - CRC errors
  - Excessive zeros (EXZ)
  - Far-end block error (FEBE)
  - Far-end receive failure (FERF)
  - Line errored seconds (LES)
  - Parity bit (P-bit) code violations (PCV)
  - Parity bit (P-bit) errored seconds (PES)
  - Parity bit (P-bit) severely errored framing seconds (PSES)
  - Severely errored framing seconds (SEFS)
  - Unavailable seconds (UAS)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M10i Router)

Figure 1: 1-Port IQE PIC



Software release	• Junos OS Release 10.2 and later (Type 1)

Description	• One OC12/STM4 port
	• SONET channelization:
	  • 1 OC12 channel
	  • 4 OC3 channels
	  • 12 DS3 channels
	  • 336 DS1 channels
	  • 1011 DS0 channels
	• SDH channelization:
	  • 1 STM4 channel
	  • 4 STM1 channels
	  • 12 E3 channels
	  • 252 E1 channels
	  • 12 DS3 channels
	  • 336 DS1 channels
	  • 1011 DS0 channels
	• Power requirement: 0.64 A @ –48 V (30.7 W)

Hardware features	• Port is numbered 0.

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Subrate and scrambling:
	  • Digital Link/Quick Eagle
	  • Kentrox
	  • Larscom
	  • ADTRAN
	  • Verilink
	• Packet buffering, Layer 2 parsing
	• M13/C-bit parity encoding
	• DS3 far-end alarm and control (FEAC) channel support
	• Local line, remote line, and remote payload loopback testing
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	  NOTE: BERT is not applicable for SONET/SDH channels.
	• Encapsulations:
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Extended Frame Relay for CCC and TCC
	  • Flexible Frame Relay
	  • Frame Relay
	  • Frame Relay for CCC
	  • Frame Relay for TCC
	  • Frame Relay port CCC
	  • High-Level Data Link Control (HDLC)
	  • HDLC framing for CCC
	  • HDLC framing for TCC
	  • MPLS CCC
	  • MPLS TCC
	  • Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  • Point-to-Point Protocol (PPP)
	  • PPP for CCC
	  • PPP for TCC
	• Encapsulations available only for DS1:
	  • Multilink Frame Relay end-to-end (MLFR FRF.15)
	  • Multilink PPP (MLPPP)
	  • PPP over Frame Relay

Cables and connectors	• Duplex LC/PC connector (Rx and Tx); single-mode fiber
	• SONET/SDH OC12/STM4 fiber-optic SFP transceivers:
	  • Short reach (model number: SFP-OC12-SR)
	  • Intermediate reach (IR-1) (model number: SFP-OC12-IR)
	  • Long reach (LR-1) (model number: SFP-OC12-LR)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of pointer (LOP)
	  • Loss of signal (LOS)
	  • Payload label mismatch (PLM-P)
	  • Remote defect indication—line (RDI-L)
	  • Remote defect indication—path (RDI-P)
	  • Remote error indication (REI)
	  • Payload unequipped (unequipped STS at path level) (UNEQ-P)
	  • Virtual container—alarm indication signal (VAIS)
	  • Virtual container—loss of pointer (VLOP)
	  • Virtual container—mismatch (VMIS)
	  • Virtual container—remote defect indication (VRD1)
	  • Virtual container—unequipped (VUNEQ)
	• SDH alarms:
	  • 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, B2, B3
	  • Higher order path—alarm indication signal (HP-AIS)
	  • Higher order path—far-end receive failure (HP-FERF)
	  • Higher order path—payload label mismatch (HP-PLM)
	  • Higher order path—loss of pointer (HP-LOP)
	  • Higher order path—remote defect indication (HP-RDI)
	  • Higher order path—unequipped (HP-UNEQ)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)

- Loss of signal (LOS)
- Multiplex section—alarm indication signal (MS-AIS)
- Multiplex section—far-end receive failure (MS-FERF)
- Multiplex section—remote defect indication (MS-RDI)
- Multiplex section—remote error indication (MS-REI)
- Phase lock loop (PLL)
- Remote error indication (REI)
- Severely errored frame (SEF)
- Tributary unit—alarm indication signal (TU-AIS)
- Tributary unit—loss of pointer (TU-LOP)
- Tributary unit—mismatch (TU-MIS)
- Tributary unit—remote defect indication (TU-RD1)
- Tributary unit—unequipped (TU-UNEQ)

- DS1 alarms:
  - Alarm indication signal (AIS)
  - Loss of frame (LOF)
  - Remote alarm indication signal (RAIS)
- DS1 error detection:
  - Bursty errored seconds (BES)
  - CRC errors
  - Errored seconds (ES)
  - Line errored seconds (LES)
  - Loss of framing seconds (LOFS)
  - Severely errored seconds (SES)
  - Severely errored framing seconds (SEFS)
  - Unavailable seconds (UAS)
- DS3 alarms:
  - Alarm indication signal (AIS)
  - Loss of frame (LOF)
  - Yellow alarm
- DS3 error detection:
  - C-bit code violations (CCV)
  - C-bit errored seconds (CES)
  - C-bit severely errored framing seconds (CEFS)
  - CRC errors
  - Excessive zeros (EXZ)
  - Far-end block error (FEBE)
  - Far-end receive failure (FERF)
  - Line errored seconds (LES)
  - Parity bit (P-bit) code violations (PCV)
  - Parity bit (P-bit) errored seconds (PES)
  - Parity bit (P-bit) severely errored framing seconds (PSES)
  - Severely errored framing seconds (SEFS)
  - Unavailable seconds (UAS)

Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

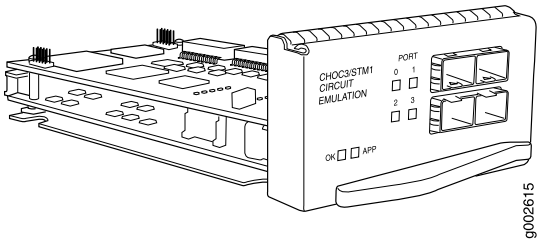
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 6

Circuit Emulation PIC Descriptions

Channelized OC3/STM1 Circuit Emulation PIC with SFP (M10I Router)



Software release	• Junos OS Release 9.3 and later
Description	• Four OC3/STM1 ports • Power requirement: 0.52 A @ 48 V (25 W) • Channelization: DS1 Channelization down to E1/T1 Each port can be channelized as 84 T1 ports for a total of 336 T1 pseudowires or 63 E1 ports for a total of 252 pseudowires.
Hardware features	• Subrate and scrambling: ◦ Digital Link/Quick Eagle ◦ Kentrox ◦ Larscom ◦ ADTRAN ◦ Verilink • M13/C-bit parity encoding • Local and remote loopback testing

Software features	• Loop timing
	• Optical diagnostics
	• AM1 or B8ZS line encoding
	• APS/SDH MSP
	• Fractional mode and framed clear channel mode
	• Superframe (D4/SF) and extended superframe (ESP) framing
	• Simple Network Management Protocol (SNMP):
	  ◦ OC3 MIB
	  ◦ T1 MIB
	  ◦ ATM MIB (Junos OS Release 10.2 and later)
	• Automatic protection switching (APS)
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations: Structure-agnostic time-division multiplexing (TDM) over packet (SAToP) (RFC 4553)
	• Pseudowire emulation edge-to-edge (PWE3) for ATM (RFC 4717) (Junos OS Release 9.6 and later)
	• ATM Pseudowire emulation edge-to-edge via dynamic labels (LDP, RSVP-TE) (Junos OS Release 9.6 and later)
	• Inverse mulitplexing (IMA) for ATM (Junos OS Release 10.0 and later)
	• ATM QoS (Junos OS Release 10.2 and later):
	  ◦ Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	  ◦ Unspecified bit rate (UBR) traffic shaping
	  ◦ Fine-grained real-time variable bit rate (rtVBR) and real-time variable bit rate (nrtVBR) traffic shaping
	  ◦ Port-level egress shaping
	  ◦ Constant bit rate (CBR)
	  ◦ Policing on a per virtual circuit basis
	  ◦ Independent peak cell rate (PCR) and sustained cell rate (SCR) policing
	  ◦ Counting, tagging, or discard policing actions

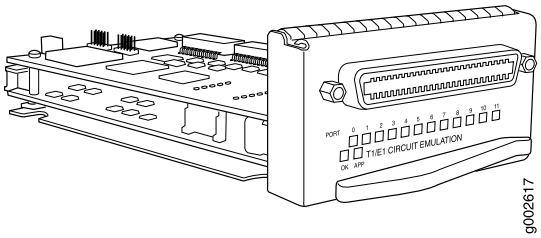
Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 SFPs:
	  ◦ Multimode (model number: SFP-OC3-SR)
	  ◦ Intermediate reach (IR-1) (model number: SFP-OC3-IR)
	  ◦ Long reach (LR-1) (model number: SFP-OC3-LR)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	OK LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. APP LED, one bicolor: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	Structure agnostic alarms for T1 interface: • Alarm indication signal (AIS-L, AIS-P) • Loss of signal (LOS) • Errored seconds (ES) • Line-errored seconds (LES) • Severely errored seconds (SES) • Unavailable errored seconds (UAS) • Bipolar violation (BPV) • Controlled slip (CS) • Line code violation (LCV) Structure agnostic alarms for E1 interface: • Alarm indication signal (AIS-L, AIS-P) • Loss of signal (LOS) • Errored seconds (ES) • Line-errored seconds (LES) • Severely errored seconds (SES) • Unavailable errored seconds (UAS) • Bipolar violation (BPV) • Controlled slip (CS) • Line code violation (LCV)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

E1/T1 Circuit Emulation PIC (M10i Router)



Software release	• Junos OS Release 9.3 and later
Description	• Configurable as either twelve E1 ports or twelve T1 ports NOTE: Mixing E1 and T1 ports on the same PIC is not supported. • Power requirement: 0.52 A @ 48 V (25 W) • Onboard DSU functionality for E1 connectivity

Hardware features	• Maximum transmission units (MTUs) of up to 1024 bytes
	• Per-interface diagnostics and loopback control
	• Per-interface alarm and event counting and detection
	• Framing
	  ◦ 4-bit CRC for G.704 framed mode
	  ◦ G.704 without CRC4
	  ◦ Unframed
	• Balanced and unbalanced modes
	• Full bit error rate test (BERT)

Software features	• PIC can be configured as twelve T1 ports or twelve E1 ports
	• Local and remote loopback diagnostics
	• E1 ports
	  • High-performance throughput on each port at speeds up to 2048 Mbps, full duplex
	  • HDB3 line encoding
	  • Integrated support for G.704 framed mode with CRC; this feature is user-configurable
	  NOTE: The G.704 implementation supports speeds slower than 2.048 Mbps; multiple channels within a single E1 interface are not supported.
	  • G.704 framed without CRC4
	  • Unframed
	  • Framed clear channel mode
	  • Unframed clear channel mode
	  • Framed fractional mode
	• T1 ports
	  • High-performance throughput on each port at speeds up to 1544 Mbps, full duplex
	  • AMI and B8ZS line encoding
	  • Framed clear channel mode
	  • Fractional mode
	  • Superframe (D4/SF) and extended superframe (ESF) framing
	  • ESF CSU counters, WRT impairments, and CRC checking
	  • Local DS1 line loopback, remote line loopback
	• Loop timing and PIC line timing
	• Encapsulations: Structure-agnostic time-division multiplexing (TDM) over packet (SAToP) (RFC 4553)
	• Pseudowire emulation edge-to-edge (PWE3) for ATM (RFC 4717) (Junos OS Release 9.6 and later)
	• ATM Pseudowire emulation edge-to-edge via dynamic labels (LDP, RSVP-TE) (Junos OS Release 9.6 and later)
	• Inverse mulitplexing (IMA) for ATM (Junos OS Release 10.0 and later)
	• Simple Network Management Protocol (SNMP): ATM MIB (Junos OS Release 10.2 and later)
	• ATM QoS (Junos OS Release 10.2 and later)
	  • Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	  • Unspecified bit rate (UBR) traffic shaping
	  • Fine-grained real-time variable bit rate (rtVBR) and real-time variable bit rate (nrtVBR) traffic shaping
	  • Port-level egress shaping
	  • Constant bit rate (CBR)
	  • Policing on a per virtual circuit basis
	  • Independent peak cell rate (PCR) and sustained cell rate (SCR) policing
	  • Counting, tagging, or discard policing actions

Cables and connectors	• RJ-21 connector • Cables are rated for intra-building connections only.

LEDs	OK LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. APP LED, one bicolor: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	Structure agnostic alarms for T1: • Alarm indication signal (AIS) • Loss of signal (LOS) • Errored seconds (ES) • Line code violation (LCV) • Line errored seconds (LES) • Severely errored seconds (SES) • Unavailable seconds (UAS) Structure agnostic alarms for E1: • Alarm indication signal (AIS) • Errored seconds (ES) • Line code violation (LCV) • Line errored seconds (LES) • Severely errored seconds (SES) • Unavailable seconds (UAS) Structure aware alarms for E1: • Alarm indication signal (AIS) • Loss of frame (LOF) • Loss of signal (LOS) • Yellow alarm (remote alarm indication (RAI) (YLW) • Far-end block error (FEBE) • Cylical Redundancy Check (CRC) • CRC major • CRC minor • Line code violation (LCV) • Path code violation (LCV) • Errored seconds (ES) • Bursty errored seconds (BES) • Line errored seconds (LES) • Severely errored seconds (SES) • Severely errored frame seconds (SEFS) • Unavailable seconds (UAS)

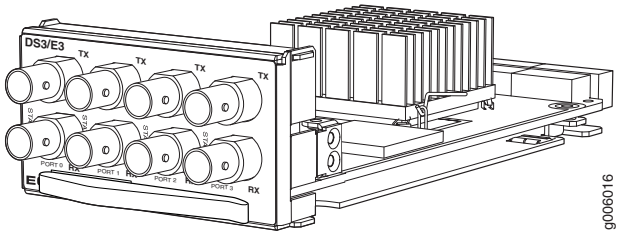
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 7

DS3, E1, E3, and T1 PIC Descriptions

DS3/E3 Enhanced IQ (IQE) PIC (M10i Router)



Software release	• Junos OS Release 10.2 and later
Description	• Four DS3 or E3 ports • DS3 or E3 is configurable on a per-port granularity • Power requirement: 0.51 A @ 48 V (24.7 W) • Model number: PB-4DS3-E3-IQE-BNC
Hardware features	• Ports are numbered 0 through 3 top to bottom
Software features	• Maximum transmission units (MTUs) of up to 9192 bytes • Subrate and scrambling: NOTE: Only DS3 interfaces support subrate and scrambling. ◦ Digital Link/Quick Eagle ◦ Kentrox ◦ Larscom ◦ ADTRAN ◦ Verilink (subrate: only port A mode) NOTE: For DS3 interfaces, Verilink does not function if an IQE interface is paired with an IQ interface. • Data service unit (DSU) functionality

	• B3ZS line encoding
	• Framing: M13, C-bit parity, framed clear channel
	• Full bit error rate test (BERT)
	• ANSI T1.403 FDL
	• Internal and loop clocking
	• DS3 far end alarm and control (FEAC) channel
	• Local line, remote line, and remote playback loopback testing
	• Simple Network Management Protocol (SNMP): DS3 MIB
	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Encapsulations:
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Extended Frame Relay for CCC and TCC
	  ◦ Flexible Frame Relay
	  ◦ Frame Relay
	  ◦ Frame Relay for CCC
	  ◦ Frame Relay for TCC
	  ◦ Frame Relay port CCC
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ HDLC framing for CCC
	  ◦ HDLC framing for TCC
	  ◦ MPLS CCC
	  ◦ MPLS TCC
	  ◦ Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  ◦ Point-to-Point Protocol (PPP)
	  ◦ PPP for CCC
	  ◦ PPP for TCC

Cables and connectors	• Standard DS3 BNC coaxial cable interfaces
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

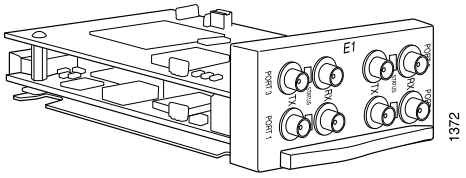
Alarms, errors, and events	• DS3 alarms:
	  • Alarm indication signal (AIS)
	  • Loss of frame (LOF)
	  • Loss of signal (LOS)
	  • Phase lock loop (PLL)
	  • Yellow alarm
	• DS3 error detection:
	  • C-bit code violations (CCV)
	  • C-bit errored seconds (CES)
	  • C-bit severely errored framing seconds (CEFS)
	  • CRC errors
	  • Excessive zeros (EXZ)
	  • Far-end block error (FEBE)
	  • Far-end receive failure (FERF)
	  • Line errored seconds (LES)
	  • Parity bit (P-bit) code violations (PCV)
	  • Parity bit (P-bit) errored seconds (PES)
	  • Parity bit (P-bit) severely errored framing seconds (PSES)
	  • Severely errored framing seconds (SEFS)
	  • Unavailable seconds (UAS)

Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

E1 PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-891)

Description	• Four E1 or coaxial ports
	  • 4-port, 120-ohm, RJ-48
	  • 4-port, 75-ohm, coaxial
	• Power requirement: 0.08 A @ 48 V (3.74 W)
	• Onboard DSU functionality for E1 connectivity

Hardware features	• High-performance throughput on each port at speeds up to 2.048 Mbps, full duplex • Maximum transmission units (MTUs) of up to 4500 bytes • Per-interface diagnostics and loopback control • Per-interface shaping on output • Per-interface alarm and event counting and detection • HDB3 line coding • 4-bit CRC for G.704 framed mode • Per-port loop timing • Balanced and unbalanced modes • Packet buffering, Layer 2 parsing • Full bit error rate test (BERT)

Software features	• Integrated support for G.703 unframed mode and G.704 framed mode with CRC; this feature is user-configurable
	NOTE: The G.704 implementation supports speeds slower than 2.048 Mbps; multiple channels within a single E1 interface are not supported.
	• Configurable clock source: Internal or loop
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

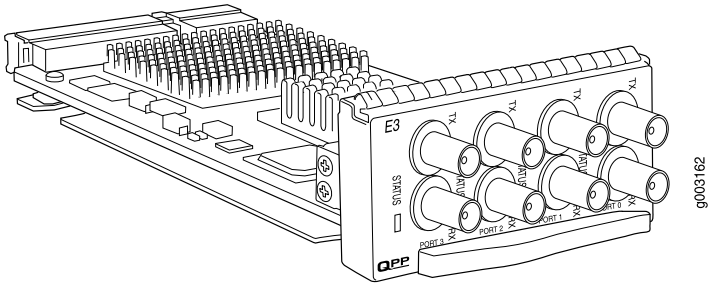
Cables and connectors	• Two versions:
	  ◦ Four RJ-48 connectors (one per port)
	  ◦ Four coaxial connectors
	• Custom 10-ft (3.05-m) posilock to BNC male cable, separate Rx and Tx

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Bipolar violations • Excessive zeros • Far-end block errors (FEBE, E-bit errors) • Loss of frame (LOF), Loss of signal (LOS) • Local and remote loopback diagnostics • Yellow alarm bit (X-bit) disagreements

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

E3 IQ PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later
Description	• Four E3 ports • Power requirement: 0.38 A @ 48 V (18 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface

Hardware features	• Clear-channel (34.368-Mbps) and subrate E3
	• Unframed or ITU G.751 framing
	• Data service unit (DSU) functionality
	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	• HDB3 line encoding
	• Full bit error rate test (BERT)
	• Local and remote loopback testing

Software features	• Quality of service (QoS) per port: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): E3 MIB, QoS MIB
	• Input policing and output shaping
	• Provider-side rate limiting
	• Full data link connection identifier (DLCI) range with sparse channel numbering
	• Per-DLCI queues with weighted deficit round-robin and strict priority
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Standard E3 BNC coaxial cable interfaces

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Equipment failure (does not affect service) • Frame error • Line code violation • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm bit (A-bit) disagreements
Instrumentation (counters)	• Layer 2 per-queue packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 8

Ethernet PIC Descriptions

Fast Ethernet PICs (M10i Router)

Figure 2: 4-Port Fast Ethernet PIC

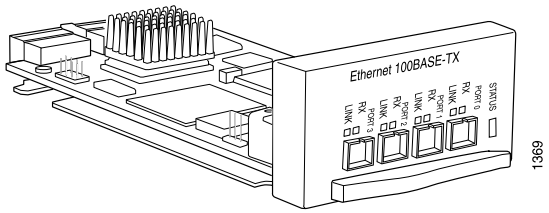


Figure 3: 8-Port Fast Ethernet PIC

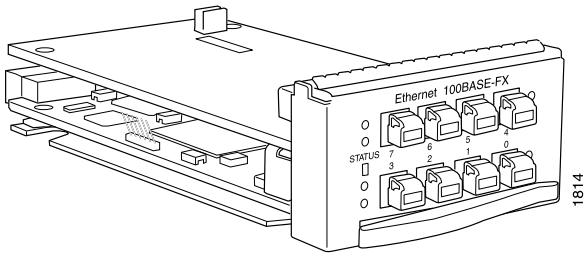


Figure 4: 12-Port Fast Ethernet PIC

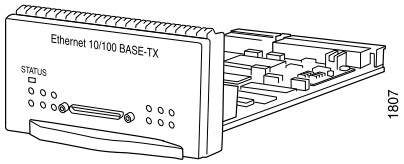
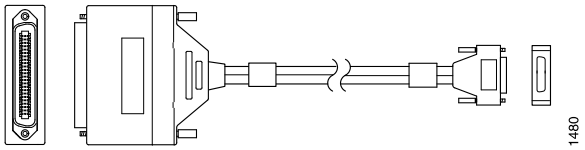


Figure 5: VHDCI to RJ-21 cable



Software release	• PE-4FE-TX: Junos OS Release 6.0 and later • PE-8FE-FX: Junos OS Release 6.1 and later End-of-life (see notification PSN-2013-03-891) • PE-12FE-TX-MDI: Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-891) • PE-12FE-TX-MDIX: Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-891)

Description	• 4 or 12 100Base-TX ports; 8 100Base-FX ports
	• Power requirement:
	  ◦ 4-port: 0.14 A @ 48 V (6.8 W)
	  ◦ 8-port: 0.26 A @ 48 V (12.5 W)
	  ◦ 12-port: 0.23 A @ 48 V (11 W)

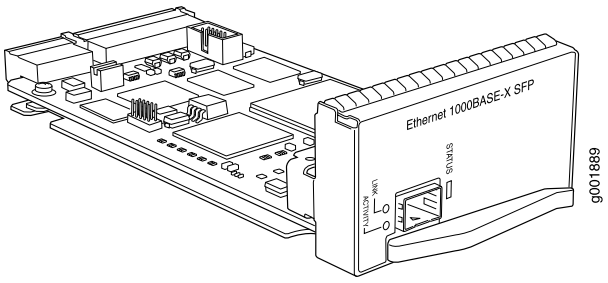
Hardware features	• High-performance throughput on each port at speeds up to 100 Mbps
	• Source and destination Media Access Control (MAC) address filtering
	• RMON EtherStats packet buffering
	• 802.3 Ethernet standard compliant
	• 4-port PICs support:
	  ◦ MTUs of up to 9192 bytes
	  ◦ 1024 802.1Q VLANs per port
	• 8-port and 12-port PICs support
	  ◦ MTUs of up to 1532 bytes
	  ◦ 16 802.1Q VLANs per port

Software features	• Autosensing full-duplex and half-duplex modes • Virtual Router Redundancy Protocol (VRRP) • 802.1q virtual LANs (VLANs) • Circuit cross-connect (CCC) VLAN
Cables and connectors	4-port PIC: • Connector: Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector • Pinout: MDI noncrossover 8–port PIC: • Connector: MT-RJ female FX optical interface-see "Fast Ethernet 100BASE-FX Optical Interface Specifications" on page 13 12-port PIC: • Connector: One very high density connector interface (VHDCI) to RJ-21 cable that connects to an RJ-45 patch panel

LEDs	Status LED, one bicolor: • Off—PIC ports not enabled. • Green—PIC is operating normally. • Red—PIC has an error or failure. 4-port PIC—One pair of port LEDs: • Link LED—If green, the port is online; if there is no light, the port is down. • RX LED—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data. 8-port PIC—One pair of port LEDs per port: • Port link LED—If green, the port is online; if there is no light, the port is down NOTE: The Link LED remains lit on the 8-port PIC when the port is down. • Port RX LED—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data 12-port PIC—One port LED per port: • Green—100-Mbps link established • Flashing green—100-Mbps activity • Yellow—10-Mbps link established • Flashing yellow—10-Mbps activity • Off—No link present NOTE: The port LEDs remain lit on the 12-port PIC when the ports are down.

Related Documentation
- *M10i PICs Description*
- M10i PICs Supported on page 3

Gigabit Ethernet PIC with SFP (M10i Router)



Software release	• Junos OS Release 6.3 and later For information on which CFEBs support this PIC, see "M10i PIC/CFEB Compatibility" on page 8.
Description	• One Gigabit Ethernet port • Power requirement: 0.15 A @ 48 V (7.3 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network

Hardware features	• High-performance throughput on each port at speeds up to 1 Gbps • Autonegotiation between Gigabit Ethernet circuit partners • Full-duplex mode • Maximum transmission units (MTUs) of up to 9192 bytes
Software features	• Virtual Router Redundancy Protocol (VRRP) support • 802.1q virtual LANs (VLANs) support • 960 destination MAC filters per port • Flexible Ethernet encapsulation • Multiple tag protocol identifiers (TPID) support • Source MAC learning • MAC accounting and policing—Dynamic local address learning of source MAC addresses
Cables and connectors	• You can install any transceiver supported by the PIC. • Fiber-optic SFP transceivers: • Duplex LC/PC connector (Rx and Tx) NOTE: Do not install Gigabit Ethernet SFPs in the SONET/SDH port. The port will not recognize the SFP.
LEDs	Status LED, one bicolor: • Off—PIC is not enabled. • Green—PIC is operating normally. • Red—PIC has an error or failure. Port LEDs, one pair per port: • Link—If green, the port is online; if there is no light, the port is down. • Activity—If flashing green, the port is receiving data; if there is no light, the port might be on but is not receiving data.

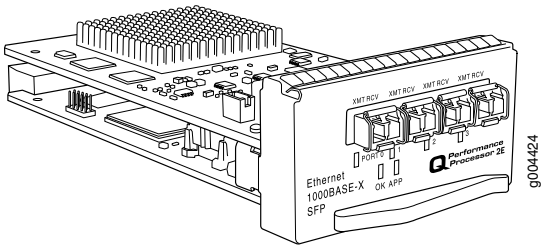
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 9

Ethernet Enhanced IQ2 (IQ2E) PIC Descriptions

Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (M10i Router)



Software release	• Junos OS Release 9.4 and later
Description	• Four Gigabit Ethernet ports • Power requirement: 0.67 A @ 48 V (32 W)
Hardware features	• High-performance throughput on each port: speeds up to 1 Gbps • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• Intelligent handling of oversubscribed traffic • Optical diagnostics and related alarms • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Drop statistics reported per queue for each of four priority-based drop profiles • Four levels of strict priorities with priority propagation among scheduling levels • Virtual Router Redundancy Protocol (VRRP) support • Hierarchical shaping and hierarchical scheduler • Fine-grained queuing and shaping per logical interface at both ingress and egress • 802.1q virtual LANs (VLANs) • VLAN stacking and rewriting • Channels defined by two stacked VLAN tags • Multiple tag protocol identifiers (TPID) support • IP service for nonstandard TPID and stacked VLAN tags • 802.1p rewrite per channel • Flexible mapping of channels and scheduler resources at both ingress and egress • 16,000 schedulers (2,000 schedulers with 8 queues each or 4,000 schedulers with 4 queues each) • Scheduler resources dynamically allocated across ports • Flexible Ethernet encapsulation • MAC learning, policing, accounting, and filtering

Cables and connectors	• You can install any transceiver supported by the PIC. For information about installing and removing transceivers, see the hardware guide for your router.
	• Duplex LC/PC connector (Rx and Tx)
	• Fiber-optic small form-factor pluggable transceivers (SFPs):
	  ◦ 1000Base-LH (model number: SFP-1GE-LH)
	  ◦ 1000Base-LX (model number: SFP-1GE-LX)
	  ◦ 1000Base-SX (model number: SFP-1GE-SX)
	  ◦ Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
	• Copper small form-factor pluggable transceivers (SFPs):1000Base-T (model number: SFP-1GE-T). Copper interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
	NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.

LEDs	OK LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. APP LED, one bicolor: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. Port LEDs, one per port: • Off—Port is not enabled. • Green—Port is online with no alarms or failures.

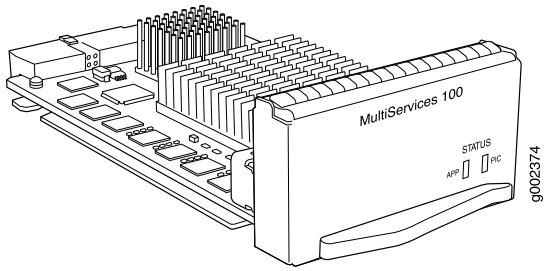
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 10

Services PIC Descriptions

Multiservices 100 PIC (M10i Router)



Software release	• Junos OS Release 8.1 and later
Description	• Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services. • Power requirement: 0.52 A @ 48 V (25 W)
Hardware features	• Active monitoring on up to 1.6 million flows
Software features	• Support for up to 2000 service sets • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 22 on page 72. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.

LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. Application LED, one bicolor: • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 22: Multiservices PICs Software Features Supported by the M10i Router

Software Feature	Multiservices 100
GRE Key	8.1
GRE dont-fragment	8.1
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping of death attacks	8.1
Network Address Translation (NAT) for IP addresses	8.1
Port Address Translation (PAT) for port numbers	8.1
IP Security (IPSec) encryption	8.1
Active flow monitoring exports cflowd version 5 and version 8 records	8.1
Active flow monitoring exports flow monitoring version 9 records, based on RFC 3954	8.3
Passive flow monitoring	–
Passive flow collection	–
Flow-tap	8.2
Dynamic flow capture	–
RPM	8.2
Link services	8.1
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.1

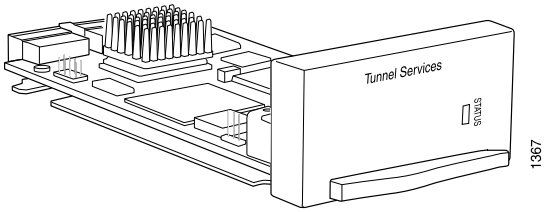
Table 22: Multiservices PICs Software Features Supported by the M10i Router (continued)

Software Feature	Multiservices 100
Virtual tunnel interface for Layer 3 VPNs	8.1
Layer 2 Tunneling Protocol (L2TP)	8.2
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	8.1
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	8.1

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Tunnel Services PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later
Description	• Power requirement: 0.07 A @ 48 V (3.4 W)
Hardware features	• Loopback function that encapsulates and de-encapsulates packets • SONET/SDH OC12/STM4 tunneling bandwidth
Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*. • IP-IP unicast tunneling • GRE unicast tunneling • PIM sparse mode unicast tunneling
LEDs	One tricolor: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

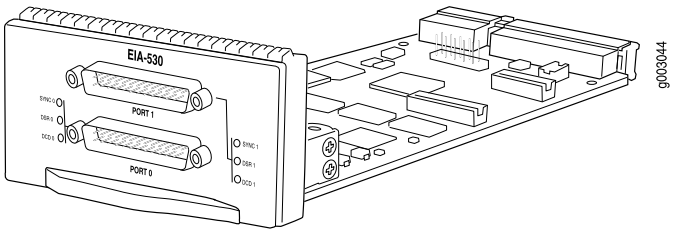
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 11

Serial PIC Descriptions

EIA-530 PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later
Description	• Two EIA-530, X.21 or V.35 serial ports • Power requirement: 0.07 A @ 48 V (3.4 W)
Hardware features	• Configured as data terminal equipment (DTE) ports • Resynchronization signal • Receives clock rates up to 16 Mbps • Local, data communications equipment (DCE) local, and DTE remote loopbacks

Software features	• Supports four queues per port
	• Random early detection (RED)
	• Transmitter Signal Element Timing is looped from the timing received on the Transmitted Signal Element DCE. EIA-530 ports support the ability to invert the Transmit Data Element. The EIA-530 ports support the following rates:
	  ◦ 2.048 Mbps
	  ◦ 2.341 Mbps
	  ◦ 2.731 Mbps
	  ◦ 3.277 Mbps
	  ◦ 4.09 Mbps
	  ◦ 5.461 Mbps
	  ◦ 8.192 Mbps
	  ◦ 16.384 Mbps
	• V.35 ports support up to 2.048 Mbps
	• X.21 ports support up to 10 Mbps
	• Encapsulations
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Two DB-25 male connectors (one per port, included with PIC) • V.35 requires an EIA-530 to V.35 cable and connects to a V.35 DTE 34-pin Winchester type male cable (one per port) • X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable

LEDs	Three bicolor per port:
	• Data set ready (DSR):
	  ◦ Green—DSR is detected or ignored
	  ◦ Red—DSR expected but not present
	• Data carrier detect (DCD):
	  ◦ Green—DCD is detected or ignored
	  ◦ Red—DCD expected but not present
	• Resynchronization:
	  ◦ Green—Keepalives are being received
	  ◦ Red—Data terminal ready (DTR) toggled from low to high (resynchronization pulses are being sent)

Instrumentation (counters)	• Per-port packet and byte counters
	• Resynchronization counters:
	  ◦ Number of resynchronizations initiated
	  ◦ Time of last resynchronization

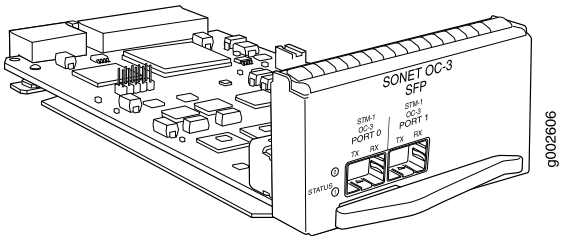
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

CHAPTER 12

SONET/SDH PIC Descriptions

SONET/SDH OC3/STM1 PIC with SFP (M10i Router)



Software release	• Junos OS Release 8.4 and later
Description	• Two OC3c ports • Power requirement: 0.25 A @ 48 V (12 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:
	  • Multimode (model number: SFP-OC3-SR)
	  • Intermediate reach (IR-1) (model number: SFP-OC3-IR)
	  • Long reach (LR-1) (model number: SFP-OC3-LR)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

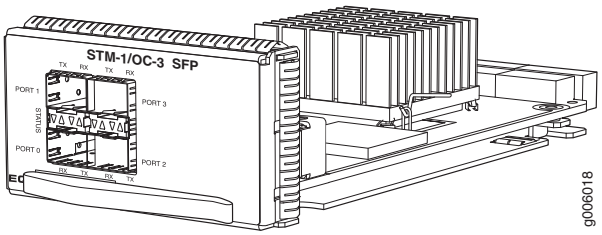
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M10i Router)



Software release	• Junos OS Release 10.2 and later (Type 1)
Description	• Four OC3 or STM1 ports • SONET or SDH is configurable on a per-port granularity • Power requirement: 0.6 A @ 48 V (28.8 W) • Model number: PB-4OC3-STM1-IQE-SFP
Hardware features	• Top row: Ports are numbered 0 and 1 from left to right • Bottom row: Ports are numbered 2 and 3 from left to right

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Packet buffering, Layer 2 parsing
	• Local line and remote payload loopback testing
	• Simple Network Management Protocol (SNMP): OC3 MIB
	• Encapsulations:
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Extended Frame Relay for CCC and TCC
	  ◦ Flexible Frame Relay
	  ◦ Frame Relay
	  ◦ Frame Relay for CCC
	  ◦ Frame Relay for TCC
	  ◦ Frame Relay port CCC
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ HDLC framing for CCC
	  ◦ HDLC framing for TCC
	  ◦ MPLS CCC
	  ◦ MPLS TCC
	  ◦ Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  ◦ Point-to-Point Protocol (PPP)
	  ◦ PPP for CCC
	  ◦ PPP for TCC

Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 fiber-optic SFP transceivers:
	  • Multimode (model number: SFP-OC3-SR)
	  • Intermediate reach (IR-1) (model number: SFP-OC3-IR)
	  • Long reach (LR-1) (model number: SFP-OC3-LR)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	One tricolor **Status** LED per port: • Off—Not enabled. • Green—Online with no alarms or failures. • Yellow—Online with alarms for remote failures. • Red—Active with a local alarm; router has detected a failure.

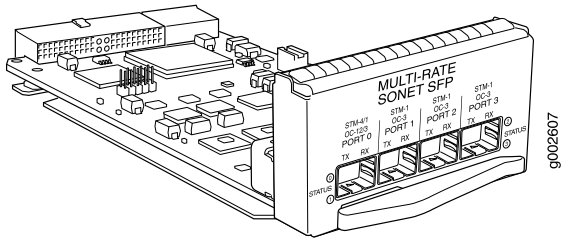
Alarms, errors, and events	• SONET alarms:
	  • Alarm indication signal—line (AIS-L)
	  • Alarm indication signal—path (AIS-P)
	  • Bit error rate—signal degrade (BERR-SD)
	  • Bit error rate—signal fail (BERR-SF)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of pointer (LOP)
	  • Loss of signal (LOS)
	  • Payload label mismatch (PLM-P)
	  • Phase lock loop (PLL)
	  • Remote defect indication—line (RDI-L)
	  • Remote defect indication—path (RDI-P)
	  • Remote error indication (REI)
	  • Payload unequipped (unequipped STS at path level) (UNEQ-P)
	  • Severely errored frames (SEF)
	• SDH alarms:
	  • 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, B2, B3
	  • Higher order path—alarm indication signal (HP-AIS)
	  • Higher order path—far-end receive failure (HP-FERF)
	  • Higher order path—payload label mismatch (HP-PLM)
	  • Higher order path—loss of pointer (HP-LOP)
	  • Higher order path—remote defect indication (HP-RDI)
	  • Higher order path—unequipped (HP-UNEQ)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of signal (LOS)
	  • Multiplex section—alarm indication signal (MS-AIS)
	  • Multiplex section—far-end receive failure (MS-FERF)

	• Multiplex section—remote defect indication (MS-RDI)
	• Multiplex section—remote error indication (MS-REI)
	• Phase lock loop (PLL)
	• Remote error indication (REI)
	• Severely errored frames (SEF)
	• Error detection:
	  • Errored seconds (ES-S, ES-L, ES-P)
	  • Severely errored framing seconds (SEFS-S)
	  • Severely errored seconds (SES-S, SES-L, SES-P)
	  • Unavailable seconds (UAS-L, UAS-P)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP (M10i Router)



Software release	• Junos OS Release 8.4 and later

Description	• Rate-selectable using one of the following rates:
	  • 1-port OC12/STM4
	  • 1-port OC12c/STM4c
	  • 4-port OC3c/STM1c
	• Power requirement: 0.40 A @ 48 V (19 W)

Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• Per-port SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	You can install any transceiver supported by the PIC.
	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:
	  ◦ Multimode (model number: SFP-OC3-SR)
	  ◦ Intermediate reach (IR-1) (model number: SFP-OC3-IR)
	  ◦ Long reach (LR-1) (model number: SFP-OC3-LR)
	  Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	  ◦ Short reach (SR-1)
	  ◦ Intermediate reach (IR-1)
	  ◦ Long reach (LR-1)
	  Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

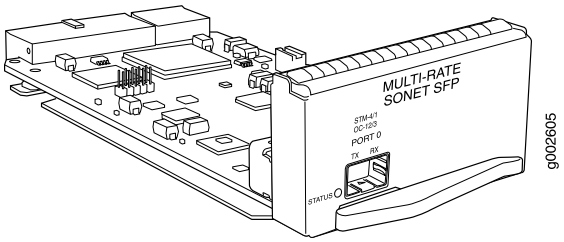
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP (M10i Router)



Software release	• JUNOS 8.4 and later

Description	• Rate-selectable using one of the following rates:
	  ◦ 1-port OC3
	  ◦ 1-port OC12
	  ◦ 1-port OC12c
	• Power requirement: 0.20 A @ 48 V (9.5 W)

Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• Per-port SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	You can install any transceiver supported by the PIC. For information about installing and removing transceivers, see the hardware guide for your router.
	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 small form-factor pluggable (SFP) transceivers:
	  • Multimode
	  • Intermediate reach (IR-1)
	  • Long reach (LR-1)
	  Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	  • Short reach (SR-1)
	  • Intermediate reach (IR-1)
	  • Long reach (LR-1)
	  Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

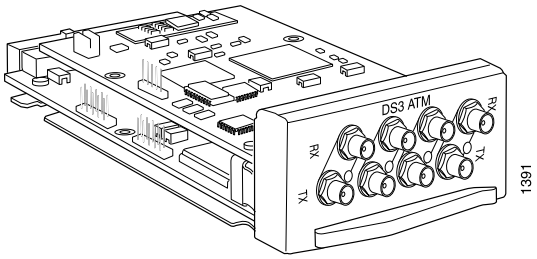
Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3
- M10i PIC/CFEB Compatibility on page 8

CHAPTER 13

End-of-Life PIC Descriptions

ATM DS3 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later • End-of-life (see notification PSN-2003-10-018)
Description	• Four DS3 ports • Power requirement: 0.39 A @ 48 V (19 W) • Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 • Asynchronous Transfer Mode (ATM) standards compliant • Alarm and event counting and detection • Compatible with well-known ATM switches • ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches

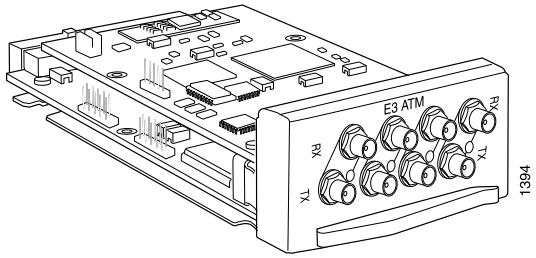
Hardware features	• OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells
	• ASIC-based packet segmentation and reassembly (SAR) management and output port queuing
	• 16-MB SDRAM memory for ATM SAR
	• Packet buffering, Layer 2 parsing
	• Configurable framing options:
	  ◦ C-bit with ATM direct mapping
	  ◦ C-bit with PLCP framing (default)
	  ◦ M23 ATM direct mapping
	  ◦ M23 with PLCP framing

Software features	• Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks • Support for user-configurable virtual circuits (VC) and virtual paths (VP) • ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC) • Unspecified bit rate (UBR) traffic shaping • Fine-grained variable bit rate (VBR) traffic shaping • Outbound PIC queues cells on a per-VC basis • Encapsulations—AAL5 subnetwork attachment point (SNAP)
Cables and connectors	• 10-ft (3.05-m) posilock SMB to BNC • Four pairs of RX and TX coaxial cables

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Far-end block error (FEBE) • Frame error • Idle code • Idle received • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Path parity error • Yellow alarm

Related Documentation
- *M10i PICs Description*

ATM E3 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later End-of-life (see notification PSN-2003-10-018)
Description	• Four E3 ports • Power requirement: 0.43 A @ 48 V (20.8 W) • Conforms to ANSI T1.105-1991 and T1E1.2/93-020R1 • Asynchronous Transfer Mode (ATM) standards compliant • Alarm and event counting and detection • Compatible with well-known ATM switches • ATM switch ID, which displays the switch IP address and local interface name of the adjacent Fore ATM switches

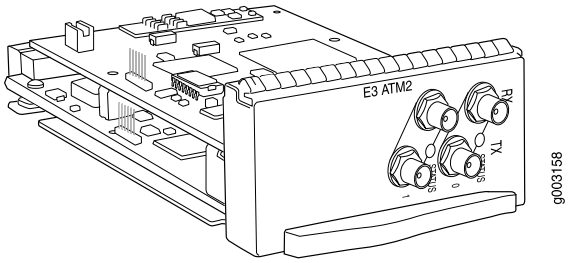
Hardware features	• OAM fault management processes alarm indication signal (AIS) and remote defect indicator (RDI) cells
	• ASIC-based packet segmentation and reassembly (SAR) management and output port queuing
	• 16-MB SDRAM memory for ATM SAR
	• Packet buffering, Layer 2 parsing
	• Configurable framing options:
	  ◦ G.751 direct mapping
	  ◦ G.751 with PLCP encapsulation (default)
	  ◦ G.832 ATM direct mapping

Software features	• Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC) for leveraging ATM access networks • Support for user-configurable virtual circuits (VC) and virtual paths (VP) • ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC) • Unspecified bit rate (UBR) traffic shaping • Fine-grained variable bit rate (VBR) traffic shaping • Outbound PIC queues cells on a per-VC basis • Encapsulations—AAL5 subnetwork attachment point (SNAP)
Cables and connectors	• 10-ft (3.05-m) posilock SMB to BNC • Four pairs of RX and TX coaxial cables
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Frame Error • Line code violation • Local and remote loopback • Loss of signal (LOS) • Out of fFrame (OOF) • Yellow alarm

Related Documentation

- *M10i PICs Description*

ATM2 E3 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later End-of-life (see notification PSN-2013-03-891)
Description	• Two E3 ports • Power requirement: 0.41 A @ 48 V (20 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • ATM standards compliant

Hardware features	• 16-MB SDRAM memory for ATM segmentation and reassembly (SAR)
	• ATM switch ID
	• Configurable framing options:
	  ◦ G.751 direct mapping
	  ◦ G.751 with PLCP encapsulation (default)
	  ◦ G.832 ATM direct mapping
	• Internal and loop timing

Software features	• Per-virtual circuit (VC) and per-virtual path (VP) traffic shaping
	• Unspecified bit rate (UBR) traffic shaping
	• Fine-grained variable bit rate (VBR) traffic shaping
	• Circuit cross-connect (CCC)
	• ATM Inverse Address Resolution Protocol (ARP), which enables routers to automatically learn the IP address of the router on the far end of an ATM permanent virtual circuit (PVC)
	• Simple Network Management Protocol (SNMP):
	  ◦ Management Information Base (MIB) 2 (RFC 1213)
	  ◦ ATM MIB (RFC 1695)
	  ◦ SONET MIB
	• AAL5 encapsulations:
	  ◦ ATM-VC-MUX
	  ◦ ATM-NLPID
	  ◦ ATM-Cisco-LLPID
	  ◦ ATM-SNAP
	  ◦ ATM-CCC-VC-MUX

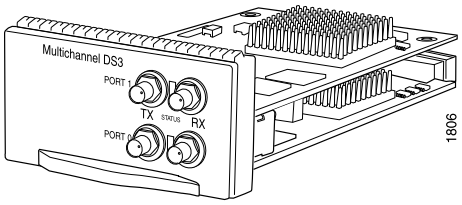
Cables and connectors	• 10 ft (3.05 m) posilock SMB to BNC (provided)
	• Four pairs of Rx and Tx coaxial cables
	• SONET/SDH OC3/STM1 fixed transceiver:
	  ◦ Multimode
	  ◦ Intermediate reach (IR-1)
	Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Frame error • Line code violation • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Multichannel DS3 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later End-of-life (see notification PSN-2004-10-026)
Description	• Two DS3 ports • Power requirement: 0.31 A @ 48 V (14.9 W) • Supports up to 128 logical customer channels per DS3 port
Hardware features	• Support for *N*xT1 by interoperating with the Link Services and Multilink Services PICs, using MLPPP and MLFR protocols • Onboard DSU functionality

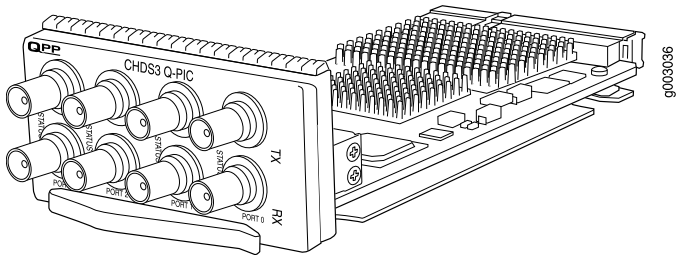
Software features	• Support for four data-link connection identifiers (DLCIs) per logical customer channel
	• DS3 alarm and event counting
	• DS3 alarm and event detection
	• DS3 diagnostics and loopback control
	• DS3 framing: M13, C-bit
	• T1 framing: super frame (SF) and extended super frame (ESF)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Custom 10 ft/3.05 m posilock to BNC male cable, separate Rx and Tx
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Far-end block error (FEBE) • Parity bit (P-bit) disagreements • Path priority error • Alarm indication signal (AIS) • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm • AIS received • Simultaneous BERT functionality • Idle received • Local and remote loopback

Related Documentation

- *M10i PICs Description*

Channelized DS3 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-892)
Description	• Four DS3 ports • Power requirement: 0.32 A @ 48 V (15.6 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Channelization: DS3, DS0

Hardware features	• Data service unit (DSU) functionality
	• Subrate and scrambling:
	  • Digital Link/Quick Eagle
	  • Kentrox
	  • Larscom
	  • ADTRAN
	  • Verilink
	• B3ZS line encoding
	• M13 or C-bit parity
	• Full bit error rate test (BERT)
	• Local and remote loopback testing

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB
	• Dynamic, arbitrary channel configuration
	• Encapsulations:
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Point-to-Point Protocol (PPP)

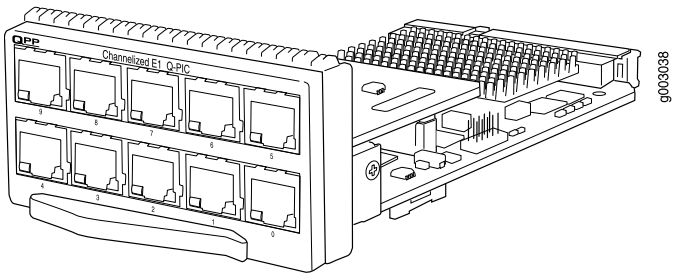
Cables and connectors	• Standard DS3 BNC coaxial cable interfaces

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Excessive zeros (EXZ) • Far-end block error (FEBE) • Frame error • Idle code, Idle received • Line code violation (LCV) • Loss of signal (LOS) • Out of frame (OOF) • Parity bit (P-bit) disagreements • Path parity error • Yellow alarm bit (X-bit) disagreements
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized E1 IQ EOL PIC (M10i Router)



Software release	• 10-port: PE-10CHE1-RJ48-QPP-N: Junos OS Release 9.1R4, 9.2R3, 9.3 and later End-of-life (see notification PSN-2013-03-892) • 10-port: PE-10CHE1-RJ48-QPP: Junos OS Release 6.0 and later End-of-life (see notification PSN-2008-10-038)
Description	• Ten E1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface. • Channelization: E1, DS0

Hardware features	• Data service unit (DSU) functionality • Ports configurable as clear channel E1 interfaces with 2.048-Mbps connectivity • Supports unframed E1 G.703 and G.704 framing modes • Supports HDB3 line coding • CRC4 configurable • Local and remote loopback testing

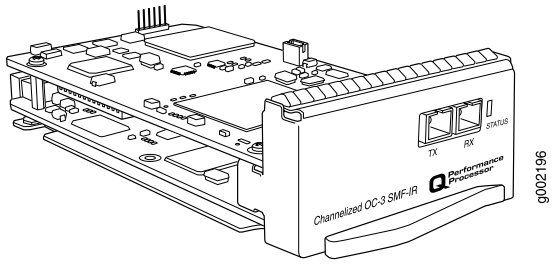
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): E1 MIB, DS0 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 120-ohm RJ-48C
LEDs	One bicolor per E1 port: • Off—Port not enabled • Green—Physical E1 link is up; individual subchannels can be down • Red—Physical E1 link is down
Alarms, errors, and events	• Alarm indication signal (AIS) • Loss of frame (LOF) • Out of frame (OOF) • Failed signal rate (FSR)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized OC3 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 7.6 and later End-of-life (see notification PSN-2013-03-892)
Description	• One OC3 port • Power requirement: 0.39 A @ 48 V (18.6 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Channelization: DS3, DS1, DS0

Hardware features	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	  ◦ Larscom
	  ◦ ADTRAN
	  ◦ Verilink
	• Packet buffering, Layer 2 parsing
	• M13/C-bit parity encoding
	• DS3 far-end alarm and control (FEAC) channel support
	• Local and remote loopback testing

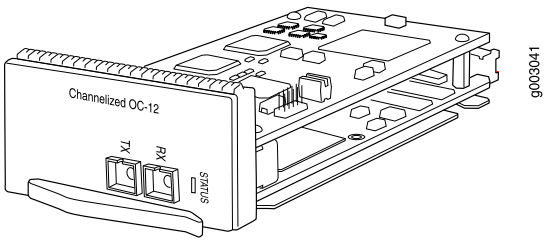
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex SC/PC connector (Rx and Tx); single-mode fiber intermediate-reach fiber • SONET/SDH OC3/STM1 fixed transceivers: ◦ Intermediate reach (IR-1) Optical interface specifications—see "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), Far-end block error (FEBE), 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) • Frame error • Idle code, Idle received • Loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Out of frame (OOF) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Parity bit (P-bit) disagreements • Path parity error • Remote defect indication (RDI-L, RDI-P) • 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) • Yellow alarm bit (X-bit) disagreements

Related Documentation
- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized OC12 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later End-of-life (see notification PSN-2013-03-892)
Description	• One OC12 port • Power requirement: 0.23 A @ 48 V (10.8 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Channelization: OC3, DS3, DS1, DS0

Hardware features	• Subrate and scrambling:
	  ◦ Digital Link/Quick Eagle
	  ◦ Kentrox
	  ◦ Larscom
	  ◦ ADTRAN
	  ◦ Verilink
	• Packet buffering, Layer 2 parsing
	• M13/C-bit parity encoding
	• DS3 far-end alarm and control (FEAC) channel support
	• Local and remote loopback testing

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

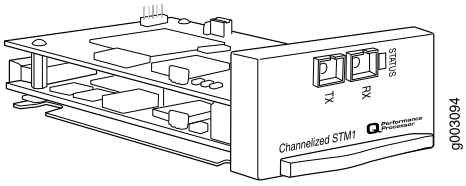
Cables and connectors	• Duplex SC/PC connector (Rx and Tx); single-mode fiber • SONET/SDH OC12/STM4 fixed transceivers: ◦ Intermediate reach (IR-1) Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P) • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), far-end block error (FEBE), 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) • Frame error • Idle code, Idle received • Loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Out of frame (OOF) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Parity bit (P-bit) disagreements • Path parity error • Remote defect indication (RDI-L, RDI-P) • 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) • Yellow alarm bit (X-bit) disagreements
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized STM1 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-892)
Description	• One STM1 port • Power requirement: 0.39 A @ 48 V (18.6 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface • Channelization: STM1c, fractional E1, framed and unframed DS0
Hardware features	• Packet buffering, Layer 2 parsing • Local and remote loopback testing

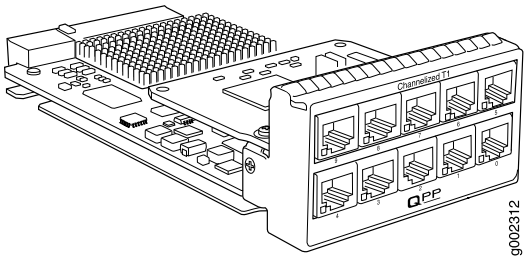
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• SNMP: SONET/SDH MIB, T1/E1 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT) patterns at E1 and DS0 levels
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex SC/PC connector (Rx and Tx); single-mode intermediate-reach fiber
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS-L, AIS-P) • Bit error rate signal degrade (BERR-SD), bit error rate signal fail (BERR-SF) • Bit interleaved parity errors B1, B2, B3 (CV-S, CV-L, CV-P) • Errored seconds (ES-S, ES-L, ES-P), far-end bit errors REI-L, REI-P (CV-LFE, CV-PFE), 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) • Loss of frame (LOF), loss of pointer (LOP-P), loss of signal (LOS) • Payload mismatch (PLM-P), payload unequipped (UNEQ-P) • Remote defect indication (RDI-L, RDI-P) • 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)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Channelized T1 IQ EOL PIC (M10i Router)



Software release	• Junos OS Release 7.4 and later End-of-life (see notification PSN-2013-03-892)
Description	• Ten T1 ports • Power requirement: 0.15 A @ 48 V (7.2 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per logical interface. • Channelization: T1, FT1, *N*xDS0

Hardware features	• Data service unit (DSU) and channel service unit (CSU) functionality
	• Ports configurable as clear channel T1 interfaces with 1.544-Mbps connectivity
	• Framing: Superframe (SF or D4) and Extended Superframe (ESF)
	• Supports B8ZS (bipolar 8-zero substitution) and AMI (alternate mark inversion) line coding
	• Local, remote, and payload loopback testing
	• ANSI T1.403 loopback support:
	  • Responds to embedded loopback commands upon receipt of an FDL command from remote end with loopup and loopdown at both line and payload level
	  • Insertion of loopback commands enables remote CSU/NIU/Smartjack to enter loopback and loopdown at both the line and payload level (ANSI and Telcordia)
	• Inband loopback support:
	  • Responds to inband loopback commands at both the line and payload level (ANSI and Telcordia)
	  • Insertion of inband loopback commands at both the line and payload level (ANSI and Telcordia)
	• Clocking support of external (line) and internal
	• Buildout support of the following ranges:
	  • 0 through 132 (Line buildout is from 1 through 132 feet)
	  • 133 through 265 (Line buildout is from 133 through 265 feet)
	  • 266 through 398 (Line buildout is from 266 through 398 feet)
	  • 399 through 531 (Line buildout is from 399 through 531 feet)
	  • 532 through 655 (Line buildout is from 532 through 655 feet)

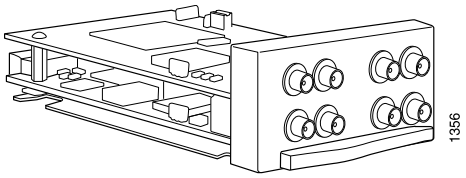
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• SNMP: T1 MIB and DS0 MIB
	• Dynamic, arbitrary channel configuration
	• Full bit error rate test (BERT) patterns at T1 and DS0 levels
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 120-ohm RJ-48C connector (female)
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Remote defect indication (RDI) • Loss of frame (LOF) • Loss of signal (LOS) • Bipolar violation (BPV) • Excessive zero (EXZ) • Line code violation (LCV) • Error seconds (ES) • Severely errored seconds (SES) • Severely errored frames (SEF) • Bit error event (BEE)
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters • 24–hour history or error counter updated at 15–minute intervals

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

DS3 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2010-02-648)
Description	• Two or four DS3 ports • Power requirement: 0.47 A @ 48 V (22.5 W) • Integrated DSU interoperability with leading DSU vendors

Hardware features	• High-performance throughput on each port at speeds up to 44.736 Mbps, full duplex
	• C-bit framing
	• B3ZS line encoding
	• Subrate and scrambling:
	  ◦ Digital Link
	  ◦ Kentrox
	  ◦ Larscom
	• Per-port rate policing on input
	• Per-port rate shaping on output
	• Packet buffering, Layer 2 parsing

Software features	• DS3 functionality:
	  ◦ C-bit framing
	  ◦ B3ZS line encoding
	• DS3 diagnostics and loopback control
	• DS3 alarm and event counting and detection
	• Per-packet counts and byte counts
	• Local and remote loopback testing, as well as BERT testing per DS3
	• DS3 far-end alarm and control (FEAC) channel support
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Custom 10 ft (3.05 m) posilock SMB to BNC male cable, separate Rx and Tx (provided)

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Bit error rate test (BERT) functionality on PIC (you can configure one DS3 channel in BERT mode and configure the remaining channels to transmit and receive normal traffic) • Equipment failure (does not affect service) • Far-end block error (FEBE) • Frame error • Idle code, Idle received • Local and remote loopback • Loss of signal (LOS) • Out of frame (OOF) • Parity bit (P-bit) disagreements • Path parity error • Yellow alarm bit (X-bit) disagreements

Related Documentation
- *M10i PICs Description*
- M10i PICs Supported on page 3

E3 PIC (M10i Router)

Figure 6: 2-port E3 PIC

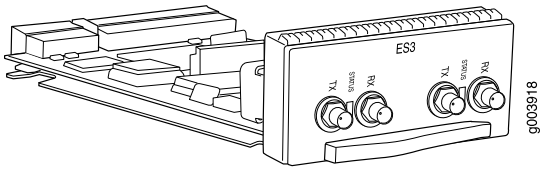
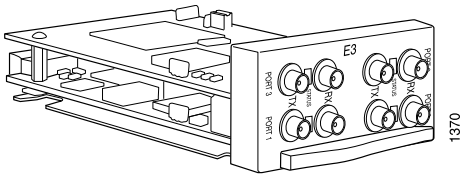


Figure 7: 4-port E3 PIC



Software release	• 2-port: Junos OS Release 6.0 and later End-of-life (see notification PSN-2010-02-648) • 4-port: Junos OS Release 6.1 and later
Description	• Two or four E3 ports • Power requirement: 0.47 A @ 48 V (22.5 W) • Integrated DSU interoperability

Hardware features	• High-density E3 (34.368-Mbps) connectivity • High-performance throughput on each port at speeds up to 34.368 Mbps, full duplex • Scrambling support • Subrate clocking support • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing • Large MTUs, up to 9192 bytes • Local and remote loopback

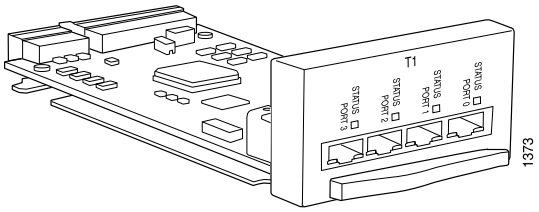
Software features	• Supports G-751 framing
	• E3 diagnostics and loopback control
	• E3 alarm and event counting and detection
	• DS3 diagnostics and loopback control
	• Bit error rate test (BERT); you can configure one port in BERT mode and configure the remaining channels to transmit and receive normal traffic
	• Encapsulations:
	  ◦ High-level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Multiprotocol Label Switching (MPLS) circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Custom 10 ft (3.05 m) posilock to BNC male cable, separate RX and TX
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Equipment failure (does not affect service) • Frame error • Line code violation • Loss of signal (LOS) • Out of frame (OOF) • Yellow alarm bit (A-bit) disagreements

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

T1 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-891)
Description	• Four T1 ports • Power requirement: 0.08 A @ 48 V (3.7 W) • Supports clear channel T1 per port (1.544 Mbps per channel) • Supports attenuation up to –12 dBm
Hardware features	• Per-port loop timing • Onboard DSU functionality for T1 connectivity

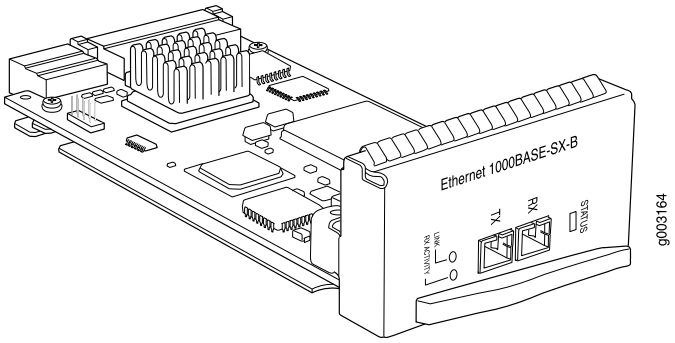
Software features	• ESF and SF framing
	• B8ZS and AMI coding
	• ESF CSU counters, WRT impairments, and CRC checking
	• Local DS1 line loopback, remote line loopback
	• Configurable clock source—internal or loop
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• 100-ohm RJ-48 connector
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Alarms, errors, and events	• Alarm indication signal (AIS) • Bipolar violations • Excessive zeros • Far-end block errors (FEBE, E-bit errors) • Loss of frame (LOF), Loss of signal (LOS) • Yellow alarm bit (X-bit) disagreements

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Gigabit Ethernet EOL PIC (M10i Router)



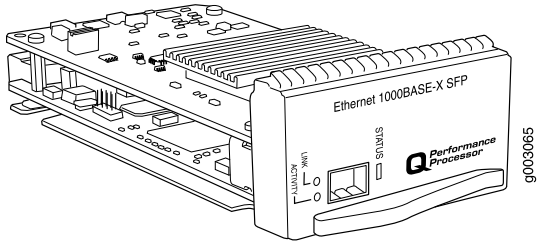
Software release	• Junos OS Release 6.1 and later • PE-1GE-LH End-of-life (see notification PSN-2004-06-014) • PE-1GE-LX End-of-life (see notification PF-HW-0103-001) • PE-1GE-SX End-of-life (see notification PF-HW-0103-001)
Description	• One Gigabit Ethernet port • Power requirement: 0.27 A @ 48 V (13.2 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
Hardware features	• High-performance throughput on all ports at speeds up to 1 Gbps • Autonegotiation between Gigabit Ethernet circuit partners • Full-duplex mode • Maximum transmission units (MTUs) of up to 9192 bytes
Software features	• Virtual Router Redundancy Protocol (VRRP) support • 802.1Q virtual LANs (VLANs) support • 64 source MAC address filters per port • 960 destination MAC filters per port

Cables and connectors	• Duplex SC connector (TX and RX)
	• 1000Base SFPs:
	  • 1000Base-LH (model number: SFP-1GE-LX)
	  • 1000Base-LX (model number: SFP-1GE-LH)
	  • 1000Base-SX (model number: SFP-1GE-SX)
	Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/

LEDs	Status LEDs, one bicolor: • Off—PIC not enabled • Green—PIC is operating normally • Red—PIC has an error or failure Port LEDs, one pair per port: • Link—If green, the port is online; if there is no light, the port is down • Activity—If flashing green, the port is receiving data; if there is no light, the port might be on, but is not receiving data

Related Documentation
- *M10i PICs Description*

Gigabit Ethernet IQ EOL PIC with SFP (M10i Router)



Software release	• Junos OS Release 6.0 and later End-of-life (see notification PSN-2013-03-892)
Description	• One Gigabit Ethernet port • Power requirement: 0.46 A @ 48 V (22 W) • Intelligent queuing (IQ) PICs support fine-grained queuing per-logical interface.
Hardware features	• High-performance throughput at speeds up to 1 Gbps • Full-duplex mode • Large MTUs of up to 9192 bytes
Software features	• Optical diagnostics and related alarms (Junos OS Release 8.2 and later) • Quality of service (QoS) per channel: Weighted round-robin (WRR), Random early drop (RED), Weighted random early drop (WRED) • Virtual Router Redundancy Protocol (VRRP) support • 802.1Q Virtual LANs • VLAN stacking and rewriting • MAC policing, accounting, and filters • Flexible Ethernet encapsulation

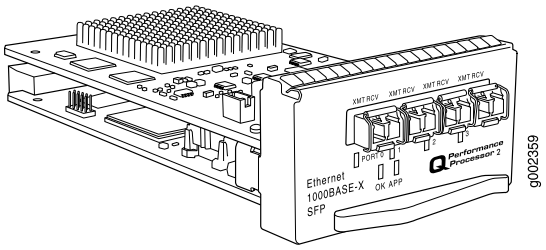
Cables and connectors	• You can install any transceiver supported by the PIC.
	• Duplex LC/PC connector (RX and TX)
	• Fiber-optic small form-factor pluggable (SFP) transceivers:
	  • 1000Base-LH (model number: SFP-1GE-LH)
	  • 1000Base-LX (model number: SFP-1GE-LX)
	  • 1000Base-SX (model number: SFP-1GE-SX)
	  • Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
	• Copper small form-factor pluggable (SFP) transceivers: 1000Base-T (model number: SFP-1GE-T)
	Copper interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/

LEDs	• Status LEDs, one tricolor:
	  • Off—Not enabled.
	  • Green—Online with no alarms or failures.
	  • Yellow—Online with alarms for remote failures.
	  • Red—Active with a local alarm; router has detected a failure.
	• Port LEDs, one per port:
	  • Off—Port is down.
	  • Green—Link is established.

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Gigabit Ethernet IQ2 EOL PIC with SFP (M10i Router)



Software release	• Junos OS Release 7.6R3 and later End-of-life (see notification PSN-2013-03-892)
Description	• Four Gigabit Ethernet ports • Power requirement: 0.65 A @ 48 V (31 W)
Hardware features	• High-performance throughput on each port: speeds up to 1 Gbps • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• Intelligent handling of oversubscribed traffic • Optical diagnostics and related alarms • Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Virtual Router Redundancy Protocol (VRRP) support • Hierarchical shaping • Fine-grained queuing and shaping per logical interface at both ingress and egress • 802.1q virtual LANs (VLANs) • VLAN stacking and rewriting • Channels defined by two stacked VLAN tags • Multiple tag protocol identifiers (TPID) support • IP service for nonstandard TPID and stacked VLAN tags • 802.1p rewrite per channel • Flexible mapping of channels and scheduler resources at both ingress and egress • Flexible Ethernet encapsulation • MAC learning, policing, accounting, and filtering

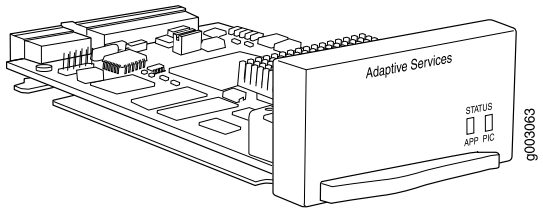
Cables and connectors	• You can install any transceiver supported by the PIC. For information about installing and removing transceivers, see the hardware guide for your router.
	• Duplex LC/PC connector (Rx and Tx)
	• Fiber-optic small form-factor pluggable transceivers (SFPs):
	  ◦ 1000Base-LH (model number: SFP-1GE-LH)
	  ◦ 1000Base-LX (model number: SFP-1GE-LX)
	  ◦ 1000Base-SX (model number: SFP-1GE-SX)
	  ◦ Optical interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
	• Copper small form-factor pluggable transceiver (SFP):1000Base-T (model number: SFP-1GE-T). Copper interface specifications—see the Hardware Compatibility Tool at https://apps.juniper.net/hct/
	NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.

LEDs	OK LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. APP LED, one bicolor: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. Port LEDs, one per port: • Off—Port is not enabled. • Green—Port is online with no alarms or failures.

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

Adaptive Services EOL PIC (M10i Router)



Software release	• Junos OS Release 6.1 and later • End-of-life (see notification PSN-2005-06-007)
Description	• Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services such as Network Address Translation (NAT), stateful firewall, intrusion detection services (IDS), IPSec, J-Flow accounting, and voice services. For information about which services are supported by PIC and platform type, see the *Junos OS Services Interfaces Library for Routing Devices*. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	• Throughput speeds up to 800 Mbps of unidirectional traffic or 400 Mbps of bidirectional traffic, determined by packet size • Active monitoring on any interface up to 250,000 packets per second • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces

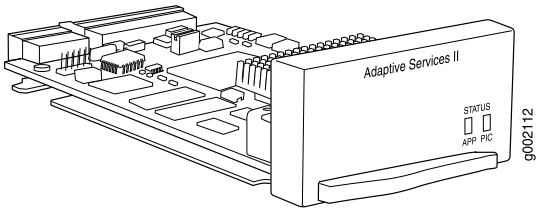
Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
	
	Depending on your Junos OS Release and individual licenses, software features for this PIC can include:
	
	• Stateful firewall with packet inspection
	  ◦ Detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks
	• NAT for IP addresses
	• Port Address Translation (PAT) for port numbers
	• J-Flow accounting exports cflowd version 5 and version 8 records
	• Tunnel services:
	  ◦ IP-IP unicast tunneling
	  ◦ GRE unicast tunneling—supports GRE fragmentation
	  ◦ PIM sparse mode unicast tunneling
	  ◦ Virtual loopback tunnel interface for VRF table lookup
	• L2TP services
	• IPSec encryption
	• Voice services:
	  ◦ Compressed Real-Time Transport Protocol (CRTP)
	  ◦ Compressed User Datagram Protocol (CUDP)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Point-to-Point Protocol (PPP)

LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. Application LED, one tricolor: • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Related Documentation

- *M10i PICs Description*

Adaptive Services II EOL PIC (M10i Router)



Software release	• Junos OS Release 6.4 and later • Junos OS Release 9.4 and later supports the PE-AS2 PIC on the Enhanced Compact Forwarding Engine Board (CFEB-E) • End-of-life (see notification PSN-2007-12-036)
Description	• Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	• Support for up to 2000 service sets • Active monitoring on up to 1 million flows • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces
Software features	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 23 on page 116. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. Application LED, one bicolor: • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 23: Adaptive Services PICs Software Features

Software Feature	Adaptive Services II PIC
GRE Key	7.1
GRE dont-fragment	6.4
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping of death attacks	6.4

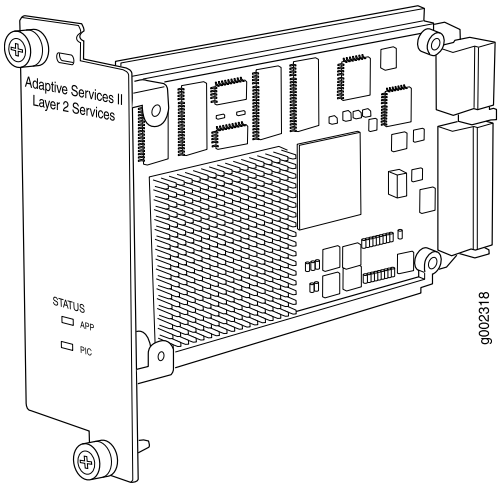
Table 23: Adaptive Services PICs Software Features (continued)

Software Feature	Adaptive Services II PIC
Network Address Translation (NAT) for IP addresses	6.4
Port Address Translation (PAT) for port numbers	6.4
IP Security (IPSec) encryption	6.4
Active flow monitoring exports cflowd version 5 and version 8 records	7.0
Active flow monitoring exports version 9 records, based on RFC 3954 (IP v4 templates only)	8.3
Passive flow monitoring	–
Passive flow collection	–
Flow-tap	8.1
Dynamic flow capture	–
Real-time performance monitoring	8.3
Link services	7.3
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	6.4
Virtual tunnel interface for Layer 3 VPNs	6.4
Layer 2 Tunneling Protocol (L2TP)	–
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	7.3
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	7.1

Related Documentation

- *M10i PICs Description*

Adaptive Services II Layer 2 Services EOL PIC (M10i Router)



Software release	• Junos OS Release 8.0R2 and later (Type 1) • End-of-life (see notification PSN-2008-11-080) NOTE: This PIC is not supported in Junos OS Release 8.1R1.
Description	• Supports Layer 2 Service package only. Tunnel services are included with the PIC. Other services require an individual license. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	• Support for up to 2000 service sets • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces
Software features	Depending on your Junos OS Release and individual licenses, software features for this PIC can include the features listed in Table 24 on page 119. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. Application LED, one bicolor: • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Table 24: Adaptive Services PICs Software Features

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
GRE Key	–	–
GRE dont-fragment	–	–
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	8.0R2	–
Network Address Translation (NAT) for IP addresses	8.0R2	–
Port Address Translation (PAT) for port numbers	8.0R2	–
IP Security (IPSec) encryption	8.0R2	–
Active flow monitoring exports cflowd version 5 and version 8 records	8.0R2	–
Active flow monitoring exports flow monitoring version 9 records, based on RFC 3954 (IP v4 templates only)	8.3	–
Passive flow monitoring	–	–
Passive flow collection	–	–
Flow-tap	–	–
Dynamic flow capture	–	–
Real-time performance monitoring	8.3	–
Link services	8.0R2	8.0R2
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	8.0R2	8.0R2
Virtual tunnel interface for Layer 3 VPNs	8.0R2	–
Layer 2 Tunneling Protocol (L2TP)	8.0R2	8.0R2

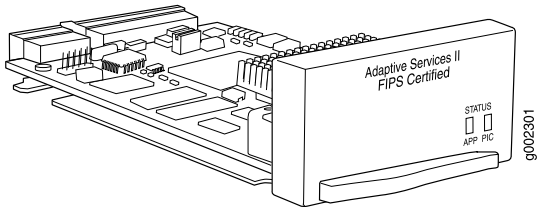
Table 24: Adaptive Services PICs Software Features (continued)

Software Feature	Adaptive Services II PIC	Adaptive Services II Layer 2 Services PIC
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	8.0R2	8.0R2
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	8.0R2	–

Related Documentation

- *M10i PICs Description*

Adaptive Services II FIPS EOL PIC (M10i Router)



Software release	• Junos OS Release 7.2 and later • End-of-life (see notification PSN-20011-09-381)
Description	• Junos-FIPS requires an Adaptive Services II FIPS PIC for external IPSec connections. See the *Secure Configuration Guide for Common Criteria and Junos-FIPS* for more information. • Supports tunnel services. This feature is included with the PIC and does not require an individual license. • Individual licenses must be purchased for additional services such as Network Address Translation (NAT), stateful firewall, intrusion detection services (IDS), IPSec. J-Flow accounting, and voice services. For information about which services are supported by PIC and platform type, see the *Junos OS Services Interfaces Library for Routing Devices*. • Power requirement: 0.4 A @ 48 V (19 W)
Hardware features	• Support for up to 2000 service sets • Active monitoring on up to 1 million flows • Support for MTUs up to 9192 bytes for Gigabit Ethernet and SONET interfaces

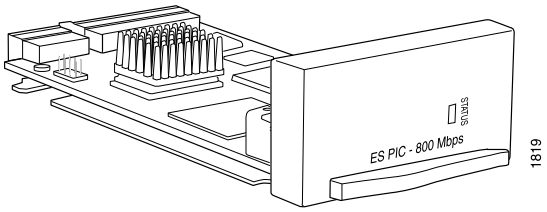
Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
	
	Depending on your Junos OS release and individual licenses, software features for this PIC can include:
	
	• Stateful firewall with packet inspection:
	  ◦ Detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks
	• NAT for IP addresses
	• Port Address Translation (PAT) for port numbers
	• J-Flow accounting exports cflowd version 5 and version 8 records
	• Tunnel services:
	  ◦ IP-IP unicast tunneling
	  ◦ GRE unicast tunneling—Supports GRE fragmentation
	  ◦ PIM sparse mode unicast tunneling
	  ◦ Virtual tunnel interface for Layer 3 VPNs
	• IPSec encryption
	• Voice services:
	  ◦ Compressed Real-Time Protocol (CRTP)
	• Encapsulations:
	  ◦ Multilink Frame Relay (MLFR)
	  ◦ Multilink Point-to-Point Protocol (MLPP)

LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis. Application LED, one tricolor: • Off—Service is not running. • Green—Service is running under acceptable load. • Yellow—Service is overloaded.

Related Documentation

- *M10i PICs Description*

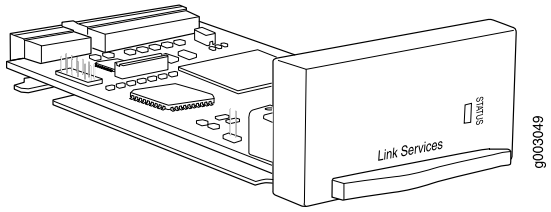
ES EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later • End-of-life (see notification PSN-2010-04-734)
Description	• High-bandwidth encryption (in accordance with IPSec standards) • Power requirement: 0.21 A @ 48 V (10 W) • Support for IPSec encryption, decryption, and key calculation acceleration NOTE: The ES PIC does not support reassembly and decryption of encrypted packets that were fragmented in an IPSec tunnel.
Hardware features	• Extends the existing security functionality to Internet traffic at high-performance rates • Throughput at 800 Mbps, half duplex • 1000 IPSec tunnels or 2000 IPSec security association (SA) pairs • Supports MTUs of up to 3900 bytes
Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*. • Support for IPv4 • Authentication hash algorithms: MD-5 and SHA-1 • Encryption algorithms: DES, 3-DES, and Null • Automated key management using Diffie-Hellman key establishment • Support for preshared key management • Authentication Header and Encapsulating Security Payload (ESP) independently or in bundle mode • Tunnel mode IPSec encryption and decryption for data traffic • Transport mode IPSec encryption and decryption for control traffic • Static and dynamic security associations (SA) supported • SA lifetime configurable in seconds and kilobytes
LEDs	One tricolor: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure
Instrumentation (counters)	• Input and output bytes per tunnel • Total authentication failures • Total antireply failures • Total encryption ASIC errors per PIC

Related Documentation
- *M10i PICs Description*

Link Services EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later • PE-LS-4 End-of-life (see notification PSN-2008-11-080) • PE-LS-32 End-of-life (see notification PSN-2008-11-080) • PE-LS-128 End-of-life (see notification PSN-2008-11-080)

Description	• Power requirement: 0.17 A @ 48 V (8 W)
	• Three versions:
	  ◦ 4 multilink bundles, 256 LFI links
	  ◦ 32 multilink bundles, 256 LFI links
	  ◦ 128 multilink bundles, 256 LFI links
	• Multilink bonding, link fragmentation and interleaving (LFI), and tunneling

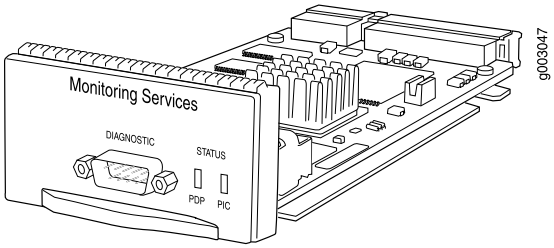
Hardware features	• Rate limiting/policing per multilink bundle • Byte-wise load balancing across multilink bundles • Bonding T1 links enable service ranging from 1.5 Mbps through 12 Mbps • Bonding E1 links enable service ranging from 2 Mbps through 16 Mbps • Loopback function that encapsulates and de-encapsulates packets

Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
	• Protocol support:
	  ◦ Multilink PPP (MLPPP)
	  ◦ Multilink Frame Relay (MLFR)—FRF.15 and FRF.16
	  ◦ Link fragmentation and interleaving (LFI)—FRF.12
	  ◦ LFI over MLPPP
	• IP-IP unicast tunneling
	• GRE unicast tunneling
	• PIM sparse mode unicast tunneling

LEDs	One bicolor: • Off—PIC is offline • Green—PIC is online and at least one configured bundle is operating • Yellow—PIC is online, but no configured bundles are operating

Related Documentation
- *M10i PICs Description*

Monitoring Services EOL PIC (M10i Router)



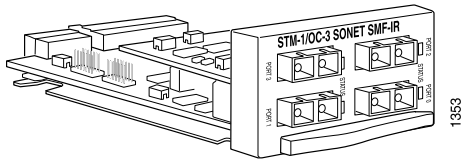
Software release	• Junos OS Release 6.1 and later • End-of-life (see notification PSN-2005-06-007)
Description	• Active traffic monitoring • Power requirement: 0.19 A @ 48 V (9 W) • Monitors IPv4 packets • Support for collecting and exporting cflowd records
Hardware features	• Monitors up to 100,000 packets per second • Support for MTUs up to 4474 bytes for SONET interfaces

Software features	For a list of the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
	• Load distribution across multiple PICs
	• cflowd version 5 support
	• Provides start and end times of each export
	• Supports firewall filtering and filter-based forwarding (FBF)
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• DB-9 diagnostic serial console port
LEDs	Status LED, one tricolor: • Off—PIC is offline and it is safe to remove it from the chassis • Green—PIC is operating normally • Yellow—PIC is initializing • Red—PIC has an error or failure and no further harm can be done by removing it from the chassis Application LED, one tricolor: • Off—Flow collector is not running • Green—Flow collector is running under acceptable load • Yellow—Flow collector is overloaded

Related Documentation
- *M10i PICs Description*

SONET/SDH OC3c/STM1 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later (Type 1) NOTE: Although the illustration shows a multimode PIC, a multimode PIC and a single-mode intermediate reach PIC are both supported. • Junos OS Release 9.4 and later supports the PE-4OC3-SON-MM and PE-4OC3-SON-SMIR PICs on the Enhanced Compact Forwarding Engine Board (CFEB-E) • End-of-life (see notification PSN-2007-12-037)
Description	• Two or four OC3 ports • Power requirements: 0.49 A/48 V @ 23.7 W
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex SC/PC connector (Rx and Tx)
	• SONET/SDH OC3/STM1 SFPs:
	  ◦ Intermediate Reach (model number: SFP-OC3-IR)
	  ◦ Multimode (model number: SFP-OC3-SR)
	Optical interface specifications—See "SONET/SDH OC3/STM1 Optical Interface Specifications" on page 14
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

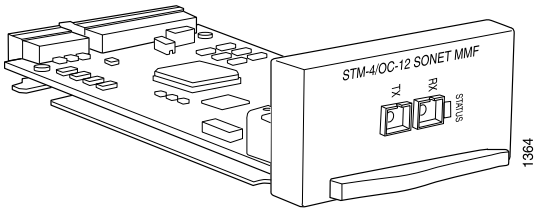
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

Related Documentation

- *M10i PICs Description*
- SONET/SDH OC3/STM1 Optical Interface Specifications on page 14

SONET/SDH OC12c/STM4 EOL PIC (M10i Router)



Software release	• Junos OS Release 6.0 and later • Junos OS Release 9.4 and later supports the PE-1OC12-SON-MM and PE-1OC12-SON-SMIR PICs on the Enhanced Compact Forwarding Engine Board (CFEB-E) • PE-1OC12-SON-MM End-of-life (see notification PSN-2007-12-037) • PE-1OC12-SON-SMIR End-of-life (see notification PSN-2007-12-037)
Description	• One port • Power requirement: 0.23 A @ 48 V (10.8 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex SC/PC connector (Rx and Tx)
	• SONET/SDH OC12/STM4 SFPs:
	  ◦ Intermediate Reach (model number: SFP-OC12-IR)
	  ◦ Multimode (model number: SFP-OC12-SR)
	Optical interface support—See "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

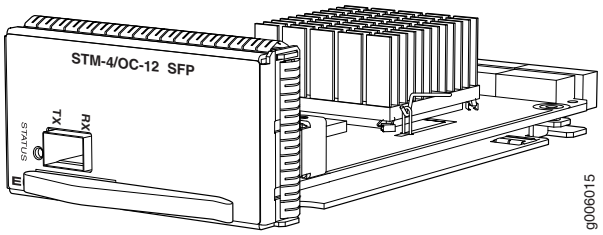
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

Related Documentation

- *M10i PICs Description*
- SONET/SDH OC12/STM4 Optical Interface Specifications on page 16

SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M10i Router)



Software release	• Junos OS Release 10.2 and later (Type 1) End-of-life (see notification PSN-2013-03-892)
Description	• One OC12/STM4 port • SONET or SDH is configurable on a per-port granularity • Power requirement: 0.58 A @ 48 V (27.8 W) • Model number: PB-1OC12-STM4-IQE-SFP
Hardware features	• Port is numbered 0.

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Enhanced fine-grained queuing per logical interface. See the *Class of Service Feature Guide for Routing Devices and EX9200 Switches* for more information about class of service features.
	• Packet buffering, Layer 2 parsing
	• Local line and remote payload loopback testing
	• Encapsulations:
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Extended Frame Relay for CCC and TCC
	  ◦ Flexible Frame Relay
	  ◦ Frame Relay
	  ◦ Frame Relay for CCC
	  ◦ Frame Relay for TCC
	  ◦ Frame Relay port CCC
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ HDLC framing for CCC
	  ◦ HDLC framing for TCC
	  ◦ MPLS CCC
	  ◦ MPLS TCC
	  ◦ Multilink Frame Relay (MLFR) UNI NNI (MFR FRF.16)
	  ◦ Point-to-Point Protocol (PPP)
	  ◦ PPP for CCC
	  ◦ PPP for TCC
	• Encapsulations available only for DS1:
	  ◦ Multilink Frame Relay end-to-end (MLFR FRF.15)

	• Multilink PPP (MLPPP) • PPP over Frame Relay

Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC12/STM4 fiber-optic SFP transceivers:
	  • Short reach (model number: SFP-OC12-SR)
	  • Intermediate reach (IR-1) (model number: SFP-OC12-IR)
	  • Long reach (LR-1) (model number: SFP-OC12-LR)
	Optical interface specifications—see "SONET/SDH OC12/STM4 Optical Interface Specifications" on page 16

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

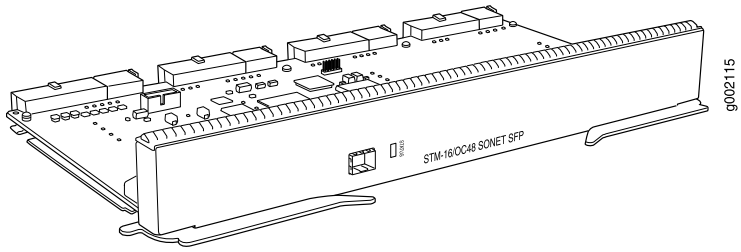
Alarms, errors, and events	• SONET alarms:
	  • Alarm indication signal—line (AIS-L)
	  • Alarm indication signal—path (AIS-P)
	  • Bit error rate signal degrade (BERR-SD)
	  • Bit error rate signal fail (BERR-SF)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of pointer (LOP)
	  • Loss of signal (LOS)
	  • Payload label mismatch (PLM-P)
	  • Remote defect indication—line (RDI-L)
	  • Remote defect indication—path (RDI-P)
	  • Remote error indication (REI)
	  • Payload unequipped (unequipped STS at path level) (UNEQ-P)
	• SDH alarms:
	  • 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, B2, B3
	  • Higher order path—alarm indication signal (HP-AIS)
	  • Higher order path—far-end receive failure (HP-FERF)
	  • Higher order path—payload label mismatch (HP-PLM)
	  • Higher order path—loss of pointer (HP-LOP)
	  • Higher order path—remote defect indication (HP-RDI)
	  • Higher order path—unequipped (HP-UNEQ)
	  • Loss of frame (LOF)
	  • Loss of light (LOL)
	  • Loss of signal (LOS)
	  • Multiplex section—alarm indication signal (MS-AIS)
	  • Multiplex section—far-end receive failure (MS-FERF)
	  • Multiplex section—remote defect indication (MS-RDI)
	  • Multiplex section—remote error indication (MS-REI)
	  • Phase lock loop (PLL)
	  • Remote error indication (REI)
	  • Severely errored frame (SEF)

Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3

SONET/SDH OC48c/STM16 EOL PIC with SFP



Software release	• Junos OS Release 6.4 and later End-of-life (see notification PSN-2013-03-891)
Description	• One OC48 port • Power requirement: 0.86 A @ 48 V (41.4 W)
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• SONET/SDH framing
	• Link aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	  ◦ High-Level Data Link Control (HDLC)
	  ◦ Frame Relay
	  ◦ Circuit cross-connect (CCC)
	  ◦ Translational cross-connect (TCC)
	  ◦ Point-to-Point Protocol (PPP)

Cables and connectors	• Duplex LC/PC connector (Rx and Tx)
	• SONET/SDH OC48/STM16 small form-factor pluggable (SFP) transceivers:
	  ◦ Short reach (SR-1) (model number: SFP-1OC48-SR)
	  ◦ Intermediate reach (IR-1) (model number: SFP-1OC48-IR)
	  ◦ Long reach (LR-1) (model number: SFP-1OC48-LR)
	Optical interface specifications—see "SONET/SDH OC48/STM16 Optical Interface Specifications" on page 18
	
	NOTE: To extend the life of the laser, when a PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. For information about taking a PIC offline, see the **request chassis pic offline** command in the CLI Explorer.

LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

Alarms, errors, and events	• 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)
	  • 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)

Related Documentation

- *M10i PICs Description*
- M10i PICs Supported on page 3