T4000 Core Router
Interface Module Reference

August 2013

This guide provides an overview and description of the PICs supported by the Juniper Networks T4000 Core Router.

Contents

T4000 PIC Description

PICs provide the physical connection to various network media types, receiving incoming packets from the network and transmitting outgoing packets to the network. During this process, each PIC performs framing and line-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs. Each PIC is equipped with an ASIC that performs control functions specific to the media type of that PIC.

The router supports various PICs, including ATM, Ethernet, and SONET/SDH interfaces. Blank PICs resemble other PICs but do not provide any physical connection or activity. When a slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system.

PICs are hot-removable and hot-insertable. Type 2 PICs have captive screws at their upper and lower corners. Type 3 PICs have an upper ejector handle and a lower captive screw. Type 4 and Type 5 PICs have an upper ejector handle and a lower ejector handle. Table 1 on page 3 indicates the number of PICs supported by each FPC.

Table 1: Number of PICs Supported in Each FPC

FPC Name	FPC Model Number	Maximum Number of PICs
Enhanced Scaling FPC2	T640-FPC2-ES	4
Enhanced Scaling FPC3	T640-FPC3-ES	4
T1600 Enhanced Scaling FPC4	T1600-FPC4-ES	2
Enhanced Scaling FPC4-1P	T640-FPC4-1P-ES NOTE: T640-FPC4-ES is not supported.	1
T4000 FPC5	T4000-FPC5-3D	2

Related Documentation
- T4000 PICs Supported
- Maintaining T4000 PICs
- Troubleshooting T4000 PICs

T4000 PICs Supported

Table 2 on page 4 through Table 9 on page 7 list the PICs supported by the T4000 router by PIC family. The First Junos OS Release Support column indicates the first release the PIC was supported on the T4000 router.

> NOTE: End of life (EOL) indicates that the product has been removed from the price list and is no longer available for purchase. End of support (EOS) indicates that no new support contracts are available on these products and the last contract will expire on the EOS date associated with each product. For more information about EOS or EOL products, see the product support notification (PSN) hardware end-of-life announcements.
>
> http://www.juniper.net/techpubs/hardware/eol.html

- ATM IQ PICs on page 4
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- 40-Gigabit Ethernet PICs on page 6
- 100-Gigabit Ethernet PICs on page 6
- Services PICs on page 7
- SONET/SDH PICs on page 7

ATM IQ PICs

Table 2 on page 4 lists the ATM IQ PICs supported by the T4000 router.

Table 2: ATM IQ PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"ATM2 OC12/STM4 IQ PIC (T4000 Router)" on page 17	2	PB-2OC12-ATM2-SMIR	Optical: SC	12.2R2

Channelized IQ PICs

Table 3 on page 5 lists the Channelized IQ PICs supported by the T4000 router.

Table 3: Channelized IQ PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"Channelized DS3 IQ PIC (T4000 Router)" on page 20	4	PB-4CHDS3-QPP	Coaxial	12.1R2
"Channelized OC12/STM4 Enhanced IQ (IQE) PICs with SFP (T4000 Router)" on page 36	4	PB-4CHOC12-STM4-IQE-SFP	Optical: LC	12.2R1
	4	PC-4CHOC12-STM4-IQE-SFP	Optical: LC	13.2
"Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)" on page 41	1	PB-1CHOC48-STM16-IQE-SFP	Optical: LC	12.2R1

Gigabit Ethernet PICs

Table 4 on page 5 lists the Gigabit Ethernet PICs supported by the T4000 router.

Table 4: Gigabit Ethernet PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"Gigabit Ethernet PICs with SFP (T4000 Router)" on page 56	2	PB-2GE-SFP	Optical: LC	12.2R2
	4	PB-4GE-SFP	Optical: LC	12.2R2
	10	PC-10GE-SFP	Optical: LC	12.1R2
"Gigabit Ethernet IQ PIC with SFP (T4000 Router)" on page 59	2	PB-2GE-SFP-QPP	Optical: LC	12.2R2
"Gigabit Ethernet IQ2 PICs with SFP (T4000 Router)" on page 61	8	PC-8GE-TYPE3-SFP-IQ2	Optical: LC	12.1R2
	8	PB-8GE-TYPE2-SFP-IQ2	Optical: LC	12.2R2
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (T4000 Router)" on page 65	8	PC-8GE-TYPE3-SFP-IQ2E	Optical: LC	12.1R2

10-Gigabit Ethernet PICs

Table 5 on page 6 lists the 10-Gigabit Ethernet PICs supported by the T4000 router.

Table 5: 10-Gigabit Ethernet PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"10-Gigabit Ethernet PIC with XENPAK (T4000 Router)" on page 76	1	PC-1XGE-XENPAK	Optical: SC	12.2R2
"10-Gigabit Ethernet DWDM OTN EOL PIC (T4000 Router)" on page 68	1	PC-1XGE-DWDM-OTN	Optical: SC	12.1R2
"10-Gigabit Ethernet IQ2 PIC with XFP (T4000 Router)" on page 70	1	PC-1XGE-TYPE3-XFP-IQ2	Optical: LC	12.1R2
"10-Gigabit Ethernet IQ2E PIC with XFP (T4000 Router)" on page 73	1	PC-1XGE-TYPE3-XFP-IQ2E	Optical: LC	12.1R2
"10-Gigabit Ethernet IQ2E PIC with XFP (T4000 Router)" on page 73	12	PF-12XGE-SFPP	Optical: LC	12.1
"10-Gigabit Ethernet LAN/WAN PIC with Oversubscription and SFP+ (T4000 Router)" on page 81	10	PD-5-10XGE-SFPP	Optical: LC	12.1R2
	24	PF-24XGE-SFPP	Optical: LC	12.2
"10-Gigabit Ethernet LAN/WAN PIC with XFP (T4000 Router)" on page 86	4	PD-4XGE-XFP	Optical: LC	12.1R2

40-Gigabit Ethernet PICs

Table 6 on page 6 lists the 40-Gigabit Ethernet PICs supported by the T4000 router.

Table 6: 40-Gigabit Ethernet PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"40-Gigabit Ethernet PIC with CFP (T4000 Router)" on page 89	4	PD-1XLE-CFP	Optical: SC	13.2

100-Gigabit Ethernet PICs

Table 7 on page 7 lists the 100-Gigabit Ethernet PICs supported by the T4000 router.

Table 7: 100-Gigabit Ethernet PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"100-Gigabit Ethernet PIC with CFP (T4000 Router)" on page 92	1	PF-1CGE-CFP	Optical: SC, LC, or 24-fiber MPO depending on the transceiver. See the PIC description for more information.	12.1
	1	PD-1CE-CFP-FPC4 (PIC and FPC) NOTE: This PIC is available only packaged in an assembly with the T1600-FPC4-ES FPC.	Optical: SC, LC, or 24-fiber MPO depending on the transceiver. See the PIC description for more information.	12.1R2

Services PICs

Table 8 on page 7 lists the services PICs supported by the T4000 router.

Table 8: Services PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"MultiServices PICs (T4000 Router)" on page 98	0	PB-MS-400-2	None	12.2
	0	PB-MS-500-3	None	12.1R2
"Tunnel Services PICs (T4000 Router)" on page 133	0	PC-TUNNEL	None	12.1R2
	0	PB-TUNNEL	None	12.2R2

SONET/SDH PICs

Table 9 on page 7 lists the SONET/SDH PICs supported by the T4000 router.

Table 9: SONET/SDH PICs Supported in the T4000 Router

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (T4000 Router)" on page 101	4	PB-4OC3-1OC12-SON2-SFP	Optical: LC	12.2R2
"SONET/SDH OC12c/STM4 EOL PIC (T4000 Router)" on page 104	4	PB-4OC12-SON-MM PB-4OC12-SON-SMIR	Optical: SC	12.2R2

Table 9: SONET/SDH PICs Supported in the T4000 Router *(continued)*

PIC Family and Type	Ports	Model Number	Connectors	First Junos OS Release Support
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (T4000 Router)" on page 107	4	PB-4OC3-4OC12-SON-SFP	Optical: LC	12.2R2
"SONET/SDH OC48c/STM16 PIC with SFP (T4000 Router)" on page 113	4	PC-4OC48-SON-SFP	Optical: LC	12.1R2
"SONET/SDH OC48c/STM16 EOL PICs (T4000 Router)" on page 110	4	PC-4OC48-SON-SMSR	Optical: SC	12.1R2
	1	PB-1OC48-SON-SMSR	Optical: SC	12.2R2
"SONET/SDH OC48c/STM16 EOL PIC with SFP (T4000 Router)" on page 116	1	PB-1OC48-SON-SFP	Optical: LC	12.2R2
"SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)" on page 119	4	PC-4OC48-STM16-IQE-SFP	Opticl: LC	13.2
"SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (T4000 Router)" on page 122	1	PB-1OC48-SON-B-SFP	Optical: LC	12.2R2
"SONET/SDH OC192/STM64 EOL PIC (T4000 Router)" on page 125	1	PC-1OC192-SON-SR2	Optical: SC	12.1R2
"SONET/SDH OC192/STM64 PICs with XFP (T4000 Router)" on page 127	1	PC-1OC192-SON-XFP	Optical: LC	12.1R2
	4	PD-4OC192-SON-XFP	Optical: LC	12.1
"SONET/SDH OC768c/STM256 PIC (T4000 Router)" on page 130	1	PD-1OC768-SON-SR	Optical: SC	12.1

Related Documentation

- T4000 PIC Description on page 3
- T4000 PIC/FPC Compatibility on page 10

T4000 FPCs Supported

T4000 Core Routers support the FPCs listed in Table 10 on page 9. You can install any combination of the following FPCs. The First Junos OS Release Supported column indicates the first release that the FPC is supported in the T4000 router.

Table 10: FPCs Supported by the T4000 Router

FPC Type	FPC Name	FPC Model Number	CLI Name	Maximum Number of PICs	Maximum Throughput per FPC	First Junos OS Release Supported
1	Enhanced Scaling FPC1	T640-FPC1-E2	**FPC Type 1-ES**	4	4 Gbps	12.1R2
2	Enhanced Scaling FPC2	T640-FPC2-ES	**FPC Type 2-ES**	4	16 Gbps	12.2
3	Enhanced Scaling FPC3	T640-FPC3-ES	**FPC Type 3-ES**	4	40 Gbps	12.1R2
4	T1600 Enhanced Scaling FPC4	T1600-FPC4-ES	**FPC Type 4-ES**	2	100 Gbps	12.1
	Enhanced Scaling FPC4-1P	T640-FPC4-1P-ES NOTE: T640-FPC4-ES is not supported.	**FPC Type 4.1-ES**	1	100 Gbps	12.1R2
5	T4000 FPC5	T4000-FPC5-3D	**FPC Type 5-3D**	2	240 Gbps	12.1
		T4000-FPC5-LSR	FPC Type 5 -LSR	2	240 Gbps	12.3R2 13.1

Related Documentation

- T4000 FPC Description
- T4000 PIC/FPC Compatibility
- *T4000 Core Router Hardware Guide*

T4000 PIC/FPC Compatibility

The PIC/FPC compatibility matrixes list the current PICs for the T4000 router. For example, Junos OS Release 12.1 is the first release in which the T1600-FPC4-ES supports the OC192/STM64, 4-port PIC in the T4000 router.

- PIC/FPC Compatibility (Type 1) on page 10
- PIC/FPC Compatibility (Type 2) on page 11
- PIC/FPC Compatibility (Type 3) on page 13
- PIC/FPC Compatibility (Type 4) on page 15
- PIC/FPC Compatibility (Type 5) on page 15

PIC/FPC Compatibility (Type 1)

Table 11 on page 10 provides a PIC/FPC compatibility matrix for the current Type 2 PICs for the T4000 router and Type 2 FPCs.

Table 11: T4000 PIC/FPC Compatibility Type 1

Type 1 PIC	PIC Model Number	T640-FPC1-ES
Channelized IQ PICs		
"Channelized DS3 IQ PIC (T4000 Router)" on page 20	PB-4CHDS3-QPP	12.1R2
"Channelized OC3 IQ PIC (T4000 Router)" on page 29	PB-1CHOC3-SMIR-QPP	12.1.R2
"Channelized STM1 IQ PIC (T4000 Router)" on page 46	PB-1CHSTM1-SMIR-QPP	12.1.R2
Channelized IQE PICs		
"Channelized DS3/E3 Enhanced IQ (IQE) PIC (T4000 Router)" on page 22	PB-4CHDS3-E3-IQE-BNC	12.1.R2
"Channelized E1/T1 Enhanced IQ (IQE) PIC (T4000 Router)" on page 26	PB-1OCHE1-T1-IQE-RJ48	12.1.R2
"Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (T4000 Router)" on page 31	PB-2CHOC3-STM1-IQE-SFP	12.1.R2

Table 11: T4000 PIC/FPC Compatibility Type 1 *(continued)*

Type 1 PIC	PIC Model Number	T640-FPC1-ES
"Channelized OC12/STM4 Enhanced IQ (IQE) PICs with SFP (T4000 Router)" on page 36	PB-1CHOC12-STM4-IQE-SFP	12.1.R2
DS3 and E3 PICs		
"DS3/E3 Enhanced IQ (IQE) PIC (T4000 Router)" on page 48	PB-4DS3-E3-IQE-BNC	12.1.R2
Fast Ethernet and Gigabit Ethernet PICs		
"Fast Ethernet PIC (T4000 Router)" on page 51	PB-4FE-TX	12.1.R2
"Gigabit Ethernet PICs with SFP (T4000 Router)" on page 53	PB-1GE-SFP	12.1.R2
Gigabit Ethernet IQ2 PICs		
"Gigabit Ethernet IQ2 PICs with SFP (T4000 Router)" on page 61	PB-4GE-TYPE1-SFP-IQ2	12.1.R2
Gigabit Ethernet IQ2E PICs		
Gigabit Ethernet IQ2E, 4-port SFP	PB-4GE-TYPE1-SFP-IQ2E	12.1.R2
Services PICs		
"Tunnel Services PICs (T4000 Router)" on page 133	PB-TUNNEL1	12.1.R2
SONET/SDH PICs		
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (T4000 Router)" on page 101	PB-4OC3-1OC12-SON-SFP	12.1.R2
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (T4000 Router)" on page 107	PB-1OC12-SON-SFP	12.1.R2

PIC/FPC Compatibility (Type 2)

provides a PIC/FPC compatibility matrix for the current Type 2 PICs for the T4000 router and Type 2 FPCs.

Table 12: T4000 PIC/FPC Compatibility Type 2

Type 2 PIC	PIC Model Number	T640-FPC2-ES
ATM PICs		

Table 12: T4000 PIC/FPC Compatibility Type 2 *(continued)*

Type 2 PIC	PIC Model Number	T640-FPC2-ES
"ATM2 OC12/STM4 IQ PIC (T4000 Router)" on page 17	PB-2OC12-ATM2-SMIR	12.2.R1
Channelized IQ PICs		
"Channelized OC12/STM4 Enhanced IQ (IQE) PICs with SFP (T4000 Router)" on page 36	PB-4CHOC12-STM4-IQE-SFP	12.2R2
"Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)" on page 41	PB-1CHOC48-STM16-IQE-SFP	12.2R2
Gigabit Ethernet PICs		
"Gigabit Ethernet PICs with SFP (T4000 Router)" on page 56	PB-2GE-SFP	12.2R2
	PB-4GE-SFP	12.2R2
"Gigabit Ethernet IQ PIC with SFP (T4000 Router)" on page 59	PB-2GE-SFP-QPP	12.2R2
"Gigabit Ethernet IQ2 PICs with SFP (T4000 Router)" on page 61	PB-8GE-TYPE2-SFP-IQ2	12.2R2
Services PICs		
"MultiServices PICs (T4000 Router)" on page 98	PB-MS-400-2	12.2
"Tunnel Services PICs (T4000 Router)" on page 133	PB-TUNNEL	12.2R2
SONET/SDH PICs		
"SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (T4000 Router)" on page 101	PB-4OC3-1OC12-SON2-SFP	12.2R2
"SONET/SDH OC12c/STM4 EOL PIC (T4000 Router)" on page 104	PB-4OC12-SON-MM	12.2R2
	PB-4OC12-SON-SMIR	
"SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (T4000 Router)" on page 107	PB-4OC3-4OC12-SON-SFP	12.2R2
"SONET/SDH OC48c/STM16 EOL PICs (T4000 Router)" on page 110	PC-4OC48-SON-SMSR	12.1R2
	PB-1OC48-SON-SMSR	12.2R2

Table 12: T4000 PIC/FPC Compatibility Type 2 *(continued)*

Type 2 PIC	PIC Model Number	T640-FPC2-ES
"SONET/SDH OC48c/STM16 EOL PIC with SFP (T4000 Router)" on page 116	PB-1OC48-SON-SFP	12.2R2
"SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (T4000 Router)" on page 122	PB-1OC48-SON-B-SFP	12.2R2

PIC/FPC Compatibility (Type 3)

Table 13 on page 13 provides a PIC/FPC compatibility matrix for the current Type 3 PICs for the T4000 router and Type 3 FPCs.

Table 13: T4000 PIC/FPC Compatibility Type 3

Type 3 PIC	PIC Model Number	T640-FPC3-ES
Channelized IQE		
"Channelized OC12/STM4 Enhanced IQ (IQE) PICs with SFP (T4000 Router)" on page 36	PC-4CHOC12-STM4-IQE-SFP	13.2
Gigabit Ethernet PICs		
"Gigabit Ethernet PICs with SFP (T4000 Router)" on page 56	PC-10GE-SFP	12.1R2
"Gigabit Ethernet IQ2 PICs with SFP (T4000 Router)" on page 61	PC-8GE-TYPE3-SFP-IQ2	12.1R2
"Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (T4000 Router)" on page 65	PC-8GE-TYPE3-SFP-IQ2	12.1R2

Table 13: T4000 PIC/FPC Compatibility Type 3 *(continued)*

Type 3 PIC	PIC Model Number	T640-FPC3-ES
10-Gigabit Ethernet PICs		
"10-Gigabit Ethernet PIC with XENPAK (T4000 Router)" on page 76	PC-1XGE-XENPAK	12.2R2
"10-Gigabit Ethernet DWDM OTN EOL PIC (T4000 Router)" on page 68	PC-1XGE-DWDM-OTN	12.1R2
"10-Gigabit Ethernet IQ2 PIC with XFP (T4000 Router)" on page 70	PC-1XGE-TYPE3-XFP-IQ2	12.1R2
"10-Gigabit Ethernet IQ2E PIC with XFP (T4000 Router)" on page 73	PC-1XGE-TYPE3-XFP-IQ2E	12.1R2
Services PICs		
"MultiServices PICs (T4000 Router)" on page 98	PC-MS-500-3	12.1R2
"Tunnel Services PICs (T4000 Router)" on page 133	PC-TUNNEL	12.1R2
SONET/SDH PICs		
"SONET/SDH OC48c/STM16 EOL PICs (T4000 Router)" on page 110	PC-4OC48-SON-SMSR	12.1R2
"SONET/SDH OC48c/STM16 PIC with SFP (T4000 Router)" on page 113	PC-4OC48-SON-SFP	12.1R2
"SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)" on page 119	PC-4OC48-STM16-IQE-SFP	13.2

PIC/FPC Compatibility (Type 4)

Table 14 on page 15 provides a PIC/FPC compatibility matrix for the current Type 4 PICs for the T4000 router and Type 4 FPCs.

Table 14: T4000 PIC/FPC Compatibility Type 4

Type 4 PIC	PIC Model Number	T640-FPC4-1P-ES	T1600-FPC4-ES
10-Gigabit Ethernet PICs			
"10-Gigabit Ethernet LAN/WAN PIC with Oversubscription and SFP+ (T4000 Router)" on page 81	PD-5-10XGE-SFPP	12.1R2	12.1 NOTE: To support PD-5-10XGE-SFPP, the hardware version of the T1600-FPC4-ES (part number 710-013037) **REV 13** or later is required.
"10-Gigabit Ethernet LAN/WAN PIC with XFP (T4000 Router)" on page 86	PD-4XGE-XFP	12.1R2	12.1
40-Gigabit Ethernet PICs			
"40-Gigabit Ethernet PIC with CFP (T4000 Router)" on page 89	PD-1XLE-CFP	—	13.2
100-Gigabit Ethernet PICs			
"100-Gigabit Ethernet PIC with CFP (T4000 Router)" on page 92	PD-1CE-CFP-FPC4 (PIC and FPC) NOTE: This PIC is available only packaged in an assembly with the T1600-FPC4-ES FPC.	—	12.1R2
SONET/SDH PICs			
"SONET/SDH OC192/STM64 PICs with XFP (T4000 Router)" on page 127	PD-4OC192-SON-XFP	12.1R2	12.1
"SONET/SDH OC768c/STM256 PIC (T4000 Router)" on page 130	PD-1OC768-SON-SR	12.1R2	12.1

PIC/FPC Compatibility (Type 5)

Table 15 on page 16 provides a PIC/FPC compatibility matrix for the current Type 5 PICs for the T4000 router and Type 5 FPCs.
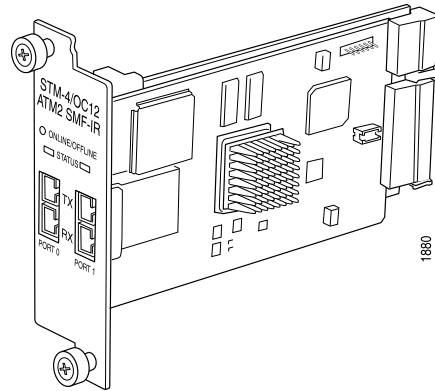
Table 15: T4000 PIC/FPC Compatibility Type 5

Type 5 PIC	PIC Model Number	T4000-FPC5-3D	T4000-FPC5-LSR
10-Gigabit Ethernet PICs			
"10-Gigabit Ethernet LAN/WAN PIC with SFP+ (T4000 Router)" on page 78	PF-12XGE-SFPP	12.1	12.3R2
"10-Gigabit Ethernet LAN/WAN PIC with Oversubscription and SFP+ (T4000 Router)" on page 81	PF-24XGE-SFPP	12.2	12.3R2
100-Gigabit Ethernet PICs			
"100-Gigabit Ethernet PIC with CFP (T4000 Router)" on page 92	PF-1CGE-CFP	12.1	12.3R2

Related Documentation

- T4000 PIC Description on page 3

- T4000 PICs Supported on page 4

- T4000 FPCs Supported on page 9

ATM2 OC12/STM4 IQ PIC (T4000 Router)

Figure 1: 2-Port ATM2 OC12/STM4 IQ PIC

Software release	• 2-port: Junos OS Release 12.2R2 and later (Type 2)
	For information on which FPCs support this PIC, see .
Description	• Two OC12 ports
	• Power requirement: 0.52 A @ 48 V (25 W)
	• 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
	• Model number: PB-2OC12-ATM2-SMIR
Hardware features	• ATM2 IQ 2-port OC12 PICs have dual 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

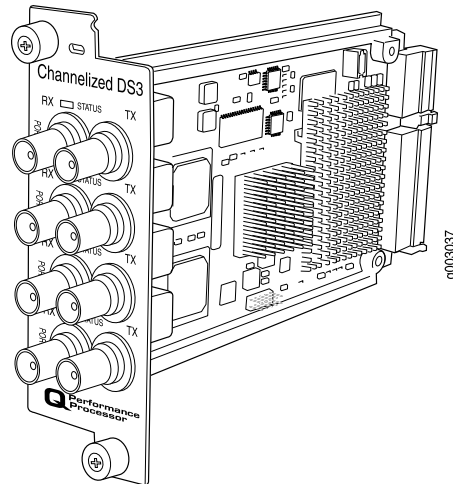|	

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 connector (Rx and Tx)
	• SONET/SDH OC12/STM4 fixed transceivers:
	  • Multimode
	  • Intermediate reach (IR-1)
	Optical interface specifications—see *SONET/SDH OC12/STM4 Optical Interface Specifications*

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—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 cell delineation (LOC)
	• Loss of frame (LOF)
	• Loss of pointer (LOP-P)
	• Loss of signal (LOS)
	• Payload mismatch (PLM-P)
	• Payload unequipped (unequipped STS at path level) (UNEQ-P)
	• Remote defect indication—line (RDI-L)
	• Remote defect indication—path (RDI-P)
	• Error detection:
	  • Bit interleaved parity errors B1, B2, B3
	  • Errored seconds (ES-S, ES-L, ES-P)
	  • Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
	  • Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (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)
	  • 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Channelized DS3 IQ PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see .

Description	• Four DS3 ports
	• Power requirement: 0.32 A @ 48 V (15.6 W)
	• Fine-grained queuing per logical interface
	• Channelization: DS3, DS0
	• Model number: PB-4CHDS3-QPP

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

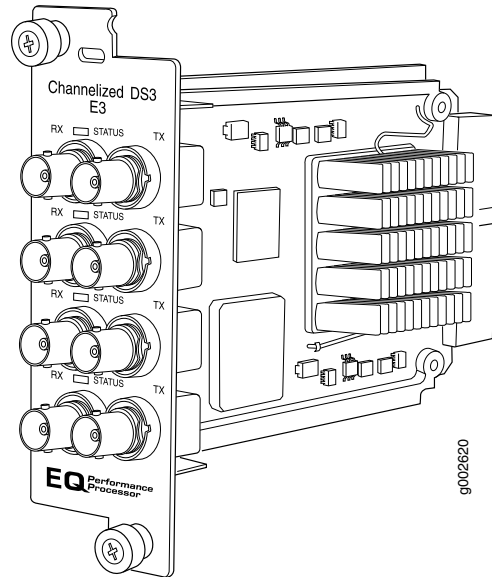| Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Simple Network Management Protocol (SNMP): DS1 MIB, DS3 MIB
	• Dynamic, arbitrary channel configuration
	• Encapsulations:
	• Circuit cross-connect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

Channelized DS3/E3 Enhanced IQ (IQE) PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

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)
	• Model number: PB-4CHDS3-E3-IQE-BNC

Hardware features	• Ports are numbered 0 through 3 top to bottom

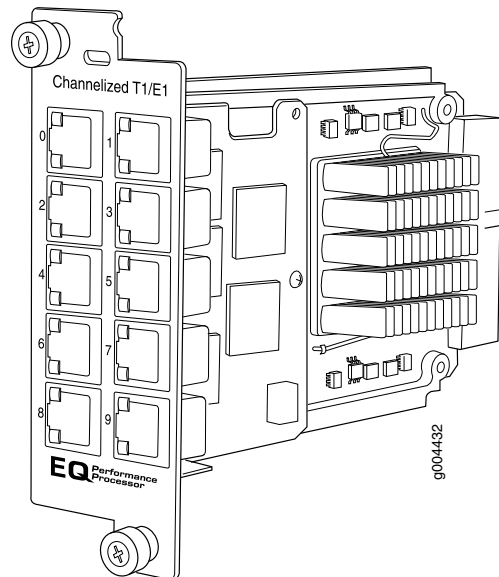|	

Software features	• Maximum transmission units (MTUs) of up to 9000 bytes
	• Dynamic, arbitrary channel configuration
	• Subrate and scrambling:
	
	NOTE: Only DS3 interfaces supports 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 DS1 channels
	• 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 *Junos OS Class of Service Library for Routing Devices* 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

- T4000 PIC Description on page 3

- T4000 PICs Supported on page 4

Channelized E1/T1 Enhanced IQ (IQE) PIC (T4000 Router)

Software release	• Junos OS Release12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

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 *Junos OS Class of Service Library for Routing Devices* 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)

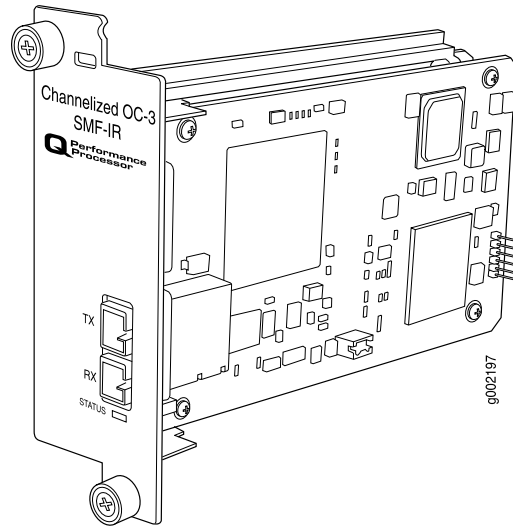|	
LEDs	One tricolor per port: • Off—Not enabled • Green—Online with no alarms or failures • Yellow—Online with alarms for remote failures • Red—Active with a local alarm; router has detected a failure

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

Channelized OC3 IQ PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One OC3 port
	• Power requirement: 0.39 A @ 48 V (18.6 W)
	• Fine-grained queuing per logical interface
	• Channelization: DS3, DS1, DS0
	• Model number: PB-1CHOC3-SMIR-QPP

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:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)
Cables and connectors	• Duplex SC/PC connector (Rx and Tx)
	• Single-mode fiber SONET/SDH OC3/STM1 intermediate-reach (IR-1) fiber
	• Optical interface specifications—see *SONET/SDH OC3/STM1 Optical Interface Specifications*
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

Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see .

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 (Junos OS Release 10.1 and later)
	• 168 DS1 channels (Junos OS Release 10.1 and later)
	• 1011 DS0 channels
	• Power requirement: 0.56 A @ 48 V (27.1 W)
	• Model number: PB-2CHOC3-STM1-IQE-SFP

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 *Junos OS Class of Service Library for Routing Devices* 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 fiber-optic SFPs:
	  - Multimode (model number: SFP-OC3-SR)
	  - Intermediate reach (IR-1) (model number: SFP-OC3-IR)
	  - Long reach (IR-1) (model number: SFP-OC3-LR)
	  Optical interface specifications—see *SONET/SDH OC3/STM1 Optical Interface Specifications*

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 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 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 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 clock (TU-LOC)
- 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)
  - 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**

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Channelized OC12/STM4 Enhanced IQ (IQE) PICs with SFP (T4000 Router)
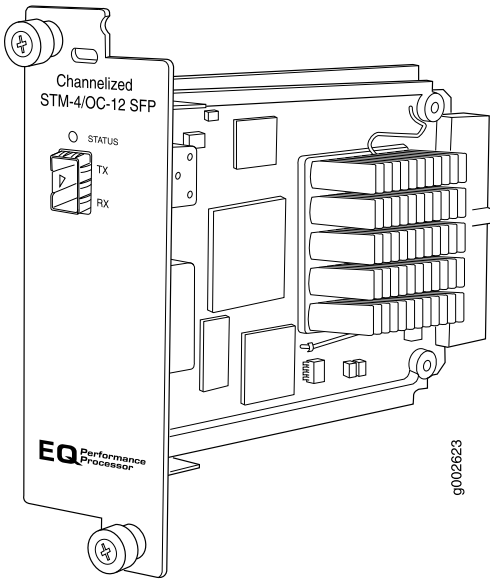
Figure 2: 1-Port IQE PIC

Figure 3: 4-Port IQE PIC (Type 2)
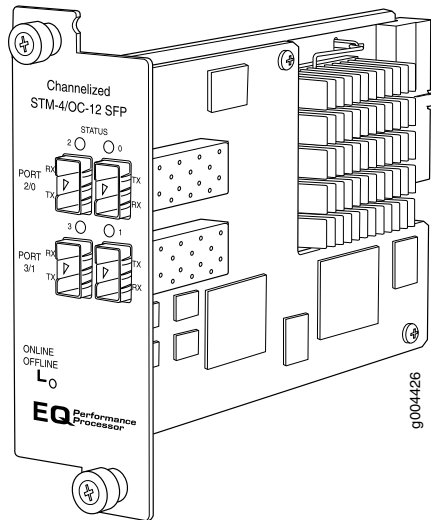
Figure 4: 4-Port IQE PIC (Type 3)
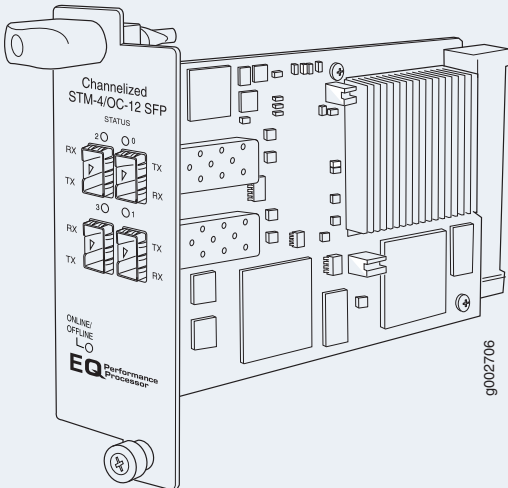
Software release	• Junos OS Release 12.1R2 (Type 1)
	• Junos OS Release 12.2R2 (Type 2)
	• Junos OS Release 13.2 (Type 3)
	For information on which FPCs support these PICs, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Four OC12/STM4 ports
	• SONET or SDH is configurable on a per-port granularity
	• SONET channelization (4-port PIC):

- 4 OC12 channel
  - 16 OC3 channels
  - 48 DS3 channels
  - 672 DS1 channels
  - 974 DS0 channels
- SDH channelization (4-port PIC):
  - 4 STM4 channel
  - 16 STM1 channels
  - 48 E3 channels
  - 504 E1 channels
  - 48 DS3 channels
  - 672 DS1 channels
  - 974 DS0 channels
- Power requirement: 1.08 A @ −48V (52 W)
- Model number (Type 1): PB-1CHOC12-STM4-IQE-SFP
- Model number (Type 2): PB-4CHOC12-STM4-IQE-SFP
- Model number (Type 3): PC-4CHOC12-STM4-IQE-SFP

Hardware features	1-port: Port is numbered 0. 4-port: Ports are numbered: - Top row: 2 and 0 from left to right - Bottom row: 3 and 1 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 *Junos OS Class of Service Library for Routing Devices* 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) - 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 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*

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)
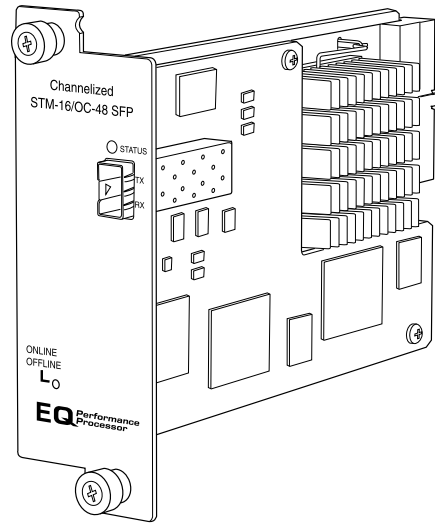 - Unavailable seconds (UAS)

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

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)

Software release	• Junos OS Release 12.2R2 and later (Type 2)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One OC48/STM16 port
	• SONET or SDH is configurable on a per-port granularity
	• SONET channelization:
	• 4 OC12 channels
	• 16 OC3 channels
	• 48 DS3 channels
	• 672 DS1 channels
	• 975 DS0 channels
	• SDH channelization:
	• 4 STM4 channels
	• 16 STM1 channels
	• 48 E3 channels
	• 504 E1 channels
	• 48 DS3 channels
	• 672 DS1 channels
	• 975 DS0 channels
	• Power requirement: 1.10 A @ 48V (53 W)
	• Model number: PB-1CHOC48-STM16-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 *Junos OS Class of Service Library for Routing Devices* 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): OC12, OC3 MIB, DS3 MIB, T1 MIB
	• Dynamic, arbitrary channel configuration
	• 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 connector (Rx and Tx); single-mode fiber
	• SONET/SDH OC48/STM16 fiber-optic 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*

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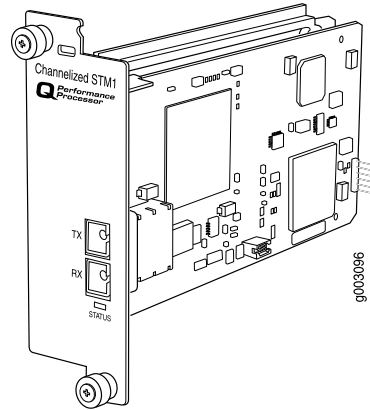
Instrumentation (counters)	• Layer 2 per-queue and per-channel packet and byte counters

Table 16: PICs Supported in Fourth Slot of T640-FPC2-E and T640-FPC2-E2 with Type 2 IQE PICs

PIC Name	PIC Model Number
Gigabit Ethernet, 2-port SFP	PB-2GE-SFP
Gigabit Ethernet, 4-port SFP	PB-4GE-SFP
Gigabit Ethernet IQ, 2-port SFP	PB-2GE-SFP-QPP
SONET/SDH OC12c/STM4, 4-port with multimode transceivers installed	PB-4OC12-SON-MM
SONET/SDH OC12c/STM4, 4-port with single-mode intermediate reach transceivers installed	PB-4OC12-SON-SMIR
SONET/SDH OC48/STM16, 1-port SFP	PB-1OC48–SON-SFP
Tunnel Services	PB-TUNNEL

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

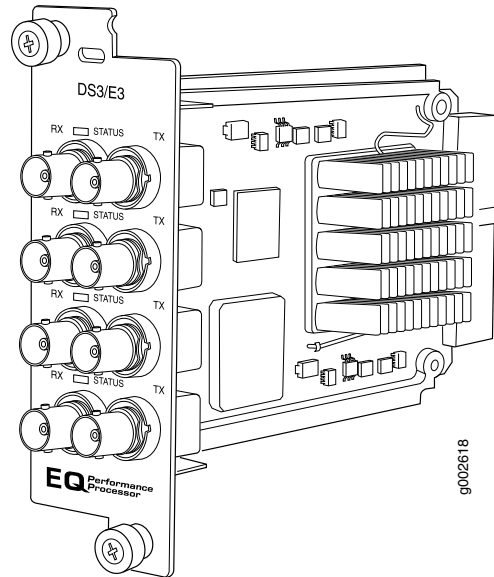## Channelized STM1 IQ PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One STM1 port • Power requirement: 0.39 A @ 48 V (18.6 W) • Fine-grained queuing per logical interface • Channelization: STM1c, fractional E1, framed and unframed DS0 • Model number: PB-1CHSTM1-SMIR-QPP
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 fiber • Intermediate-reach fixed transceiver • Optical interface specifications—see *SONET/SDH OC3/STM1 Optical Interface Specifications* NOTE: This PIC supports only SDH.

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—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 errors B1, B2, B3 (CV-S, CV-L, CV-P) • Loss of frame (LOF) • Loss of pointer (LOP-P) • Loss of signal (LOS) • Payload mismatch (PLM-P) • Payload unequipped (unequipped STS at path level) (UNEQ-P) • Remote defect indication—line (RDI-L) • Remote defect indication—path (RDI-P) Error detection: • Errored seconds (ES-S, ES-L, ES-P) • Far-end bit errors, remote error indication—line (REI-L), far-end line coding violations (CV-LFE) • Far-end bit errors, remote error indication—path (REI-P), far-end path coding violations (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) • 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

DS3/E3 Enhanced IQ (IQE) PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
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

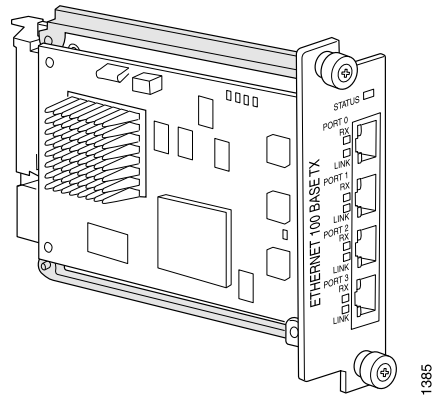|	

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 *Junos OS Class of Service Library for Routing Devices* 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)
	
	 • 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Fast Ethernet PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• 4 100Base-TX ports
	• Power requirement: 0.14 A @ 48 V (6.8 W)
	• Model number: PB-4FE-TX

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
	• MTUs up to 4500 bytes
	• 1,024 autosensing 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

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.

Related Documentation

Gigabit Ethernet PICs with SFP (T4000 Router)
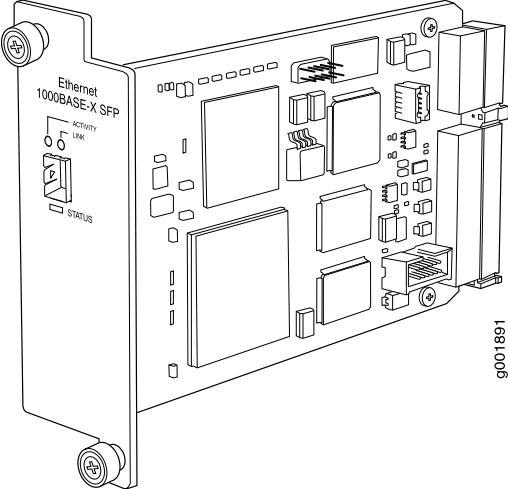
Figure 5: 1-Port Gigabit Ethernet PIC
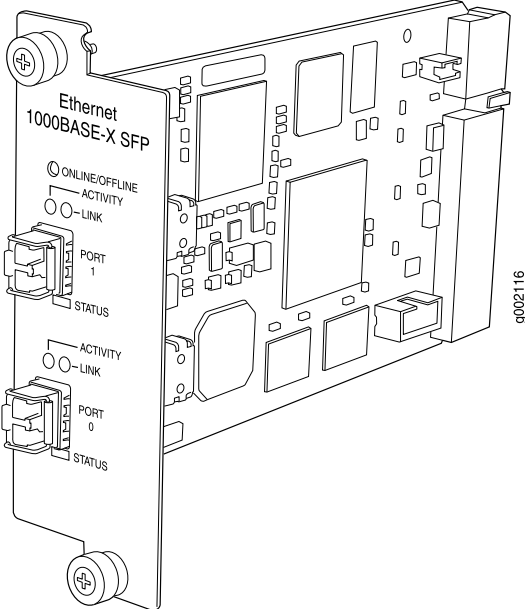
Figure 6: 2-Port Gigabit Ethernet PIC
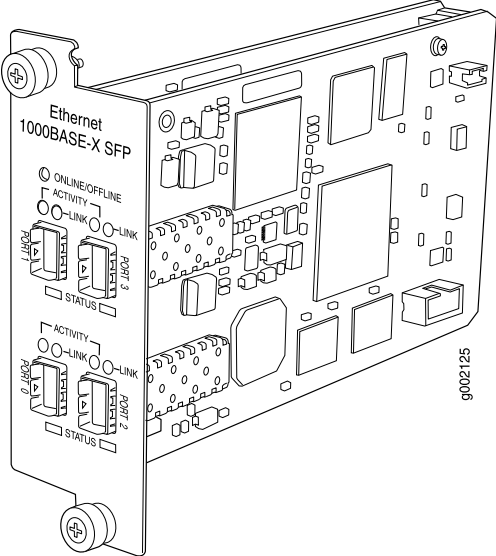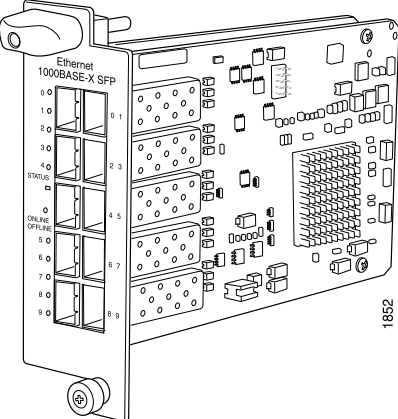
Figure 7: 4-Port Gigabit Ethernet PIC

Figure 8: 10-Port Gigabit Ethernet PIC

Software release	• 1-port: Junos OS Release 12.1R2 and later (Type 1)
	• 2-port: Junos OS Release 8.5 and later (Type 2)
	• 4-port: Junos OS Release 8.5 and later (Type 2)
	• 10-port: Junos OS Release 8.5 and later (Type 3)
	For information on which FPCs support this PIC, see *T1600 PIC/FPC Compatibility*.
Description	• One, two, four, or ten Gigabit Ethernet ports
	• Power requirement:
	• 1-port: 0.25 A @ 48 V (11.9 W)
	• 2-port: 0.25 A @ 48 V (11.9 W)
	• 4-port: 0.50 A @ 48 V (23.8 W)
	• 10-port: 0.62 A @ 48 V (29.9 W)
	• Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
	• Model number for 1-Port Gigabit Ethernet PIC: PB-1GE-SFP
	• Model number for 2-Port Gigabit Ethernet PIC: PB-2GE-SFP
	• Model number for 4-Port Gigabit Ethernet PIC: PB-4GE-SFP
	• Model number for 10-Port Gigabit Ethernet PIC: PB-10GE-SFP
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
	• Optical diagnostics and related alarms on the 2-port, 4-port, and 10-port PICs
	• 64 source MAC filters per VLAN on the 1-port, 2-port, and 4-port PICs
	• 1024 source MAC filters per port on the 1-port, 2-port, and 4-port PICs
	• Flexible Ethernet encapsulation on the 1-port, 2-port, and 4-port PICs
	• Multiple tag protocol identifiers (TPID) support on the 1-port, 2-port, and 4-port PICs
	• Source MAC learning on the 1-port, 2-port, and 4-port PICs
	• MAC accounting and policing—Dynamic local address learning of source MAC addresses on the 1-port, 2-port, and 4-port PICs
	• Passive monitoring for IPv4 packets on the 10-port PIC for Junos OS Release 11.1 and later.
	NOTE: The 10-port Gigabit Ethernet PIC with SFP does not support MAC accounting and policing, MAC learning, TPID, or flexible Ethernet encapsulation.
	The 10-port Gigabit Ethernet PIC supports 64 source MAC filters per port.

Cables and connectors	• You can install any transceiver supported by the PIC.
	• Fiber-optic SFP transceivers:
	• Duplex LC/PC connector (Rx and Tx)
	• 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 *Gigabit Ethernet 1000BASE Optical Interface Specifications*
	• 1000BASE-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—See *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
	• Copper transceiver:
	• Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
	• 1000BASE-T (model number: SFP-1GE-T)
	• Pinout: MDI crossover
	• Copper interface specifications—see *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*
	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

Gigabit Ethernet PICs with SFP (T4000 Router)

Figure 9: 2-Port Gigabit Ethernet PIC

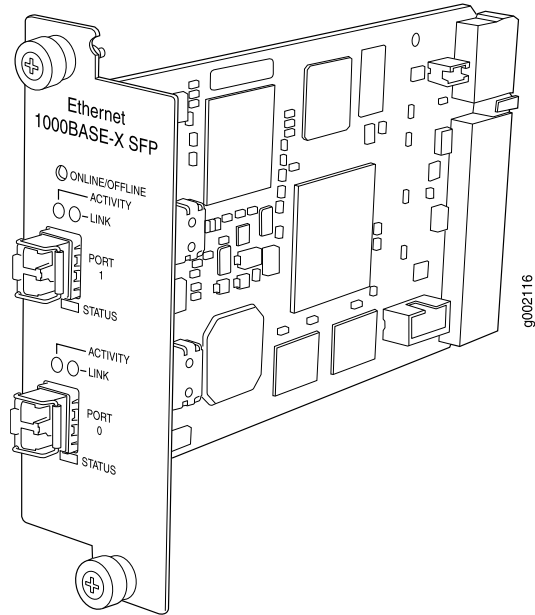Figure 10: 4-Port Gigabit Ethernet PIC
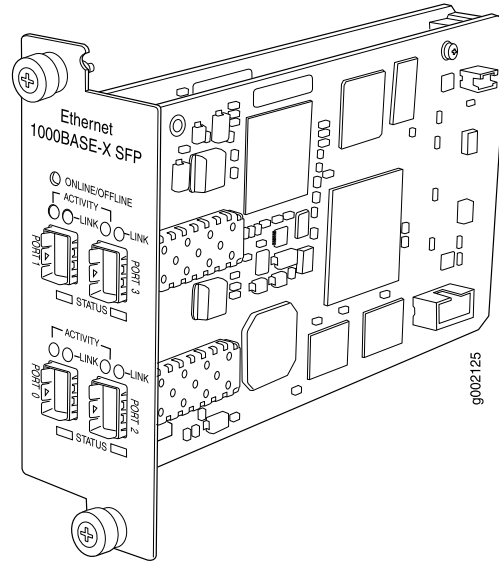
Figure 11: 10-Port Gigabit Ethernet PIC
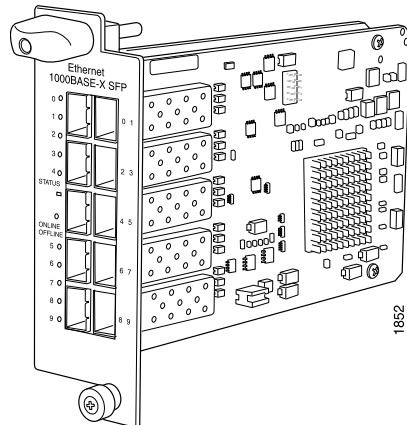
Software release	• 2-port: Junos OS Release 12.2R2 and later (Type 2)
	• 4-port: Junos OS Release 12.2R2 and later (Type 2)
	• 10-port: Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	

- Ten Gigabit Ethernet ports
- Power requirement: 0.62 A @ 48 V (29.9 W)
- Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
- Model number for 2-port Gigabit Ethernet PIC: PB-2GE-SFP
- Model number for 4-port Gigabit Ethernet PIC: PB-4GE-SFP
- Model number for 10-port Gigabit Ethernet PIC: PC-10GE-SFP

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 - Optical diagnostics and related alarms - Passive monitoring for IPv4 packets NOTE: The 10-port Gigabit Ethernet PIC with SFP does not support MAC accounting and policing, MAC learning, TPID, or flexible Ethernet encapsulation. The 10-port Gigabit Ethernet PIC supports 64 source MAC filters per port.
Cables and connectors	- You can install any transceiver supported by the PIC. - Fiber-optic SFP transceivers: - Duplex LC connector (Rx and Tx) 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 *Gigabit Ethernet 1000BASE Optical Interface Specifications* 1000BASE-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—See *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications* - Copper transceiver: - Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector 1000BASE-T (model number: SFP-1GE-T) - Pinout: MDI crossover - Copper interface specifications—see *Gigabit Ethernet 1000BASE-T Copper Interface Specifications* 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.

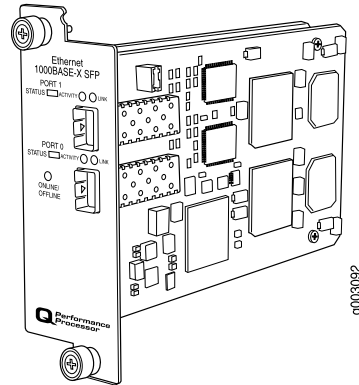Port LEDs, labeled **0** through **9**, one per port:

- 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Gigabit Ethernet IQ PIC with SFP (T4000 Router)

Figure 12: 2-Port Gigabit Ethernet IQ PIC

Software release	• 2-port: Junos OS Release 12.2R2 and later (Type 2): For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Two Gigabit Ethernet ports • Power requirement: 0.46 A @ 48 V (22 W) • Fine-grained queuing per logical interface • Model number: PB-2GE-SFP-QPP
Hardware features	• High-performance throughput on each port at speeds up to 1 Gbps • Full-duplex mode • Large MTUs of up to 9192 bytes
Software features	• 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 • 802.1q virtual LANs (VLANs) • VLAN stacking and rewriting • Flexible Ethernet encapsulation • MAC policing, accounts, and filters

Cables and connectors	• You can install any transceiver supported by the PIC.
	• Fiber-optic small form-factor pluggable (SFP) transceivers:
	◦ Duplex LC connector (Rx and Tx)
	◦ 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 *Gigabit Ethernet 1000BASE Optical Interface Specifications*
	◦ 1000BASE-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—See *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
	• Copper transceiver:
	◦ Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
	◦ 1000BASE-T (model number: SFP-1GE-T)
	◦ Pinout: MDI crossover
	◦ Copper interface specifications—see *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*
	NOTE: Do not install SONET/SDH OC48c/STM16 SFPs in a Gigabit Ethernet port. The port will not recognize the SFP.
LEDs	**Status** LED, 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.
	NOTE: The green **Status** LED is lit on the 2-port Gigabit Ethernet IQ PIC when at least one port is online.
	Port LEDs, one per port:
	• Off—Port is down.
	• Green—Link is established.

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Gigabit Ethernet IQ2 PICs with SFP (T4000 Router)

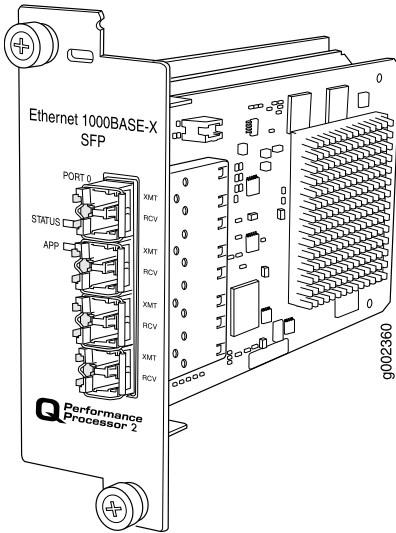Figure 13: 4-Port Gigabit Ethernet IQ2 PIC (Type 1)

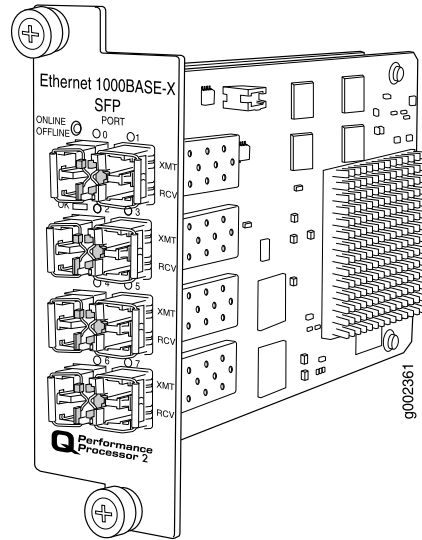Figure 14: 8-Port Gigabit Ethernet IQ2 PIC (Type 2)

Figure 15: 8-Port Gigabit Ethernet IQ2 PIC (Type 3)
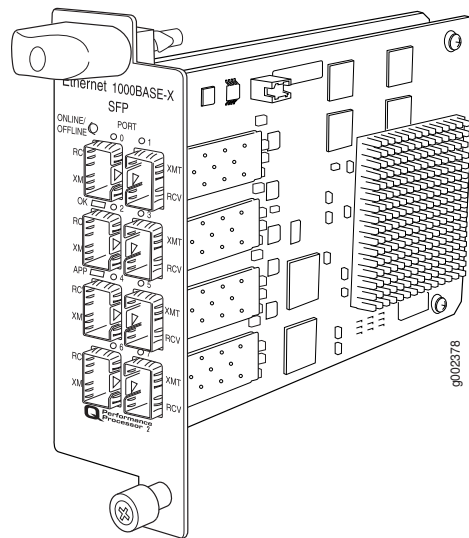
Software release	• 4-port: Junos OS Release 12.1R2 and later (Type 1)
	• 8-port: Junos OS Release 12.2R2 and later (Type 2)
	• 8-port: Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Eight Gigabit Ethernet ports
	• Power requirement: 1.25 A @48 V (60 W)
	• Model number for 4-Port Gigabit Ethernet IQ2 PIC: PB-4GE-TYPE1-SFP-IQ2
	• Model number for 8-port Type 2 Gigabit Ethernet IQ2 PIC: PB-8GE-TYPE2-SFP-IQ2
	• Model number for 8-port Type 3 Gigabit Ethernet IQ2 PIC: PC-8GE-TYPE3-SFP-IQ2
Hardware features	• High-performance throughput: speeds up to 1 Gbps on each port
	• Full-duplex mode
	• Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• 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.
	NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.
	• Fiber-optic SFP transceivers:
	• Duplex LC connector (Rx and Tx)
	• 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 *Gigabit Ethernet 1000BASE Optical Interface Specifications*
	• 1000BASE-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—See *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
	• Copper transceiver:
	• Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
	• 1000BASE-T (model number: SFP-1GE-T)
	• Pinout: MDI crossover
	• Copper interface specifications—see *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*

LEDs

OK or **Status** 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, labeled **0** through **9**, one per port:

- Off—Port is not enabled.
- Green—Port is online with no alarms or failures.

Related Documentation

Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (T4000 Router)

Figure 16: 8-Port Gigabit Ethernet IQ2E PIC (Type 3)
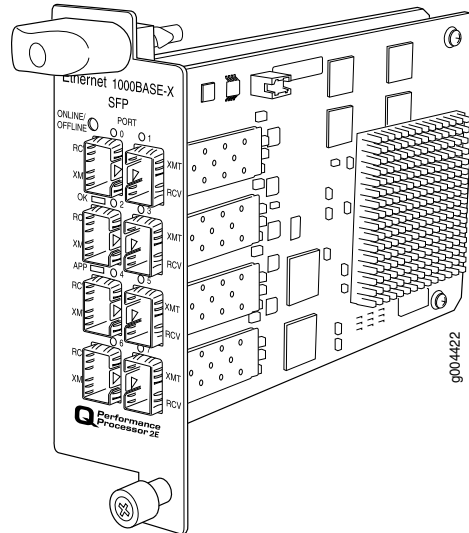
Software release	• 8-port: Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Eight Gigabit Ethernet ports • Power requirement: • 8-port (Type 3): 1.25 A @48 V (60 W) • Model number: PC-8GE-TYPE3-SFP-IQ2E
Hardware features	• High-performance throughput: speeds up to 1 Gbps on each port • Full-duplex mode • Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• 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
	• Hierarchical shaping and hierarchical scheduler
	• Virtual Router Redundancy Protocol (VRRP) support
	• 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.
	NOTE: Do not install SONET/SDH SFPs in the Gigabit Ethernet port. The port will not recognize the SFP.
	• Fiber-optic small form-factor pluggable transceivers (SFPs):
	• Duplex LC connector (Rx and Tx)
	• 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 *Gigabit Ethernet 1000BASE Optical Interface Specifications*
	• 1000BASE-BX (model number pairs: SFP-GE10KT13R14 with SFP-GE10KT14R13, SFP-GE10KT13R15 with SFP-GE10KT15R13, SFP-GE40KT13R15 with SFP-GE40KT15R13)—See *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
	• Copper transceiver:
	• Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector
	• 1000BASE-T (model number: SFP-1GE-T)
	• Pinout: MDI crossover
	Copper interface specifications—see *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*

LEDs	**OK** or **Status** 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.

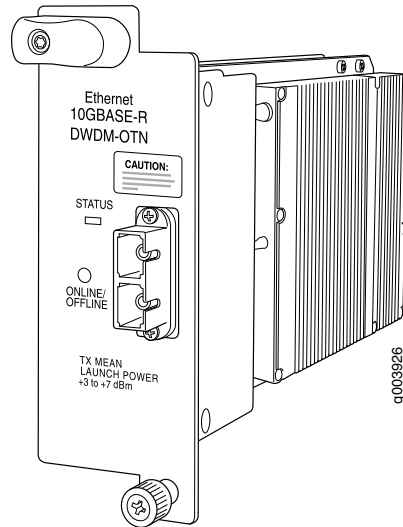Port LEDs, labeled **0** through **9**, one per port:

- Off—Port is not enabled.
- Green—Port is online with no alarms or failures.

Related Documentation

10-Gigabit Ethernet DWDM OTN EOL PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 3) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One 10-Gigabit Optical Transport Network (OTN) port for transport of 10-Gigabit Ethernet (10GBASE-R) traffic • Power requirement: 0.55 A @ 48 V (26.6 W) • Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network • Model number: PC-1XGE-DWDM-OTN
Hardware features	• C-band ITU-Grid with 50 GHz spacing • High-performance throughput at speeds up to 10 Gbps • Full-duplex mode • Maximum transmission units (MTUs) up to 9192 bytes • 64 source MAC address filters • 960 destination MAC filters • 89 individual wavelengths
Software features	• Enhanced optical monitoring capabilities • CLI configurable wavelength support • Virtual Router Redundancy Protocol (VRRP) support • 802.1q virtual LANs (VLANs) support • IEEE 802.3ad Link Aggregation • RMON EtherStats
Cables and connectors	• Duplex SC/PC connector (RX and TX) • Fixed transceiver • Dense wavelength division multiplexing (DWDM) optical transport network (OTN) transceiver. Optical interface specifications—see *10-Gigabit Ethernet DWDM OTN Optical Interface Specifications* and *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*.

LEDs	**Status** LED, one bicolor:
	• Off—PIC is not enabled.
	• Green—PIC is operating normally.
	• Red—PIC has an error or is in line-side loopback.

Related Documentation

10-Gigabit Ethernet IQ2 PIC with XFP (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One 10-Gigabit Ethernet port
	• Power requirements: 1.2 A @48 V (56 W)
	• Model number: PC-1XGE-TYPE3-XFP-IQ2

Hardware features	• High-performance throughput
	• WAN-PHY mode at 9.953 Gbps
	• LAN-PHY mode at 10.3125 Gbps
	• Full-duplex mode
	• Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED) • Configurable WAN-PHY mode options: 　• loopback 　• mpls 　• path-trace 　• trigger • 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. • Fiber-optic 10-Gigabit small form-factor pluggable (XFP) transceivers: 　• Duplex LC connector (Rx and Tx) 　• 10-Gigabit Ethernet XFP transceivers: 　　• 10GBASE-S (model number: XFP-10G-S) 　　• 10GBASE-L (model number: XFP-10G-L-OC192-SR1) 　　• 10GBASE-E (model number: XFP-10G-E-OC192-IR2) 　　• 10GBASE-Z (model number: XFP-10G-Z-OC192-LR2) 　　Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
LEDs	**OK** LED, one tricolor: • Off—PIC is offline and safe to remove from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. **APP** LED, one: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. • Yellow—Monitoring application is overloaded. **LINK STATUS** LED, one: • Off—Port is down. • Green—Port is online. Link is established.

Related Documentation
- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

10-Gigabit Ethernet IQ2E PIC with XFP (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One 10-Gigabit Ethernet port
	• Power requirements: 1.2 A @48 V (56 W)
	• Model number: PC-1XGE-TYPE3-XFP-IQ2E

Hardware features	• High-performance throughput
	• WAN-PHY mode at 9.953 Gbps
	• LAN-PHY mode at 10.3125 Gbps
	• Full-duplex mode
	• Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• 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
	• Hierarchical shaping and hierarchical scheduler
	• Configurable WAN-PHY mode options:
	  • loopback
	  • mpls
	  • path-trace
	  • trigger
	• Virtual Router Redundancy Protocol (VRRP) support
	• Fine-grained queueing 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.
	• Fiber-optic 10-Gigabit small form-factor pluggable (XFP) transceivers:
	  • Duplex LC connector (Rx and Tx)
	  • 10-Gigabit Ethernet XFP transceivers:
	    • 10GBASE-S (model number: XFP-10G-S)
	    • 10GBASE-L (model number: XFP-10G-L-OC192-SR1)
	    • 10GBASE-E (model number: XFP-10G-E-OC192-IR2)
	    • 10GBASE-Z (model number: XFP-10G-Z-OC192-LR2)
	    Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*

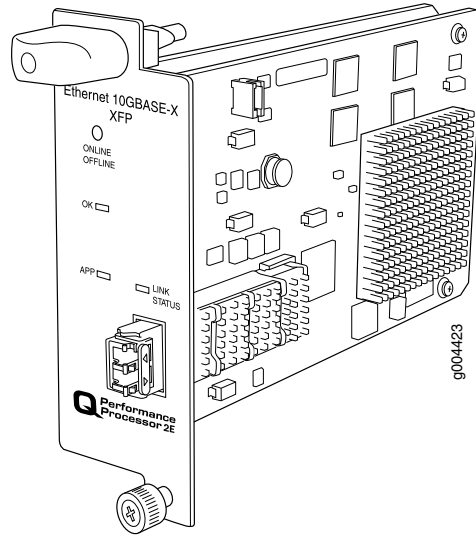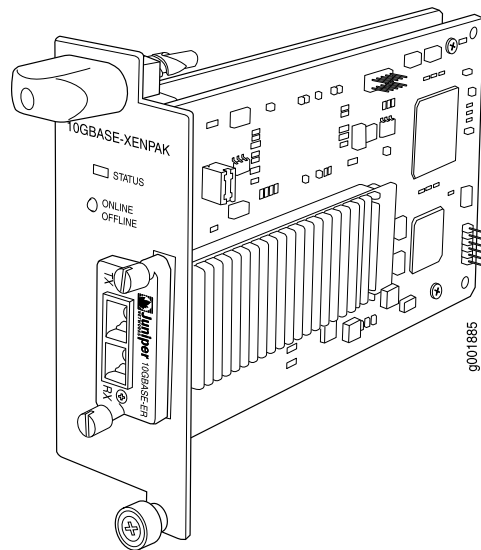| LEDs	**OK** LED, one tricolor:
	• Off—PIC is offline and safe to remove from the router. • Green—PIC is operating normally. • Yellow—PIC is initializing. • Red—PIC has an error or failure. **APP** LED, one: • Off—Monitoring application is not running. • Green—Monitoring application is running under acceptable load. • Yellow—Monitoring application is overloaded. **LINK STATUS** LED, one: • Off—Port is down. • Green—Port is online. Link is established.

Related Documentation

10-Gigabit Ethernet PIC with XENPAK (T4000 Router)

Software release	• Junos OS Release 12.2R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One 10-Gigabit Ethernet port
	• Power requirement: 0.55 A @ 48 V (26.6 W)
	• Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
	• Model number: PC-1XGE-XENPAK

Hardware features	• High-performance throughput at speeds up to 10 Gbps
	• Full-duplex mode
	• Maximum transmission units (MTUs) up to 9192 bytes
	• 64 source MAC address filters
	• 960 destination MAC filters

Software features	• Virtual Router Redundancy Protocol (VRRP) support
	• 802.1q virtual LANs (VLANs) support
	• IEEE 802.3ad Link Aggregation
	• RMON EtherStats
	• Optical diagnostics and related alarms :
	• Transceiver temperature
	• Laser bias current
	• Laser output power
	• Receive optical power

Cables and connectors	• Duplex SC connector (RX and TX)
	• 10-Gigabit Ethernet XENPAK transceivers:
	   • 10GBASE-SR, LAN Rate (model number: XENPAK-1XGE-SR)
	   • 10GBASE-LR, LAN Rate (model number: XENPAK-1XGE-LR)
	   • 10GBASE-ER, LAN Rate (model number: XENPAK-1XGE-ER)
	   • 10GBASE-ZR, LAN Rate (model number: XENPAK-1XGE-ZR) EOL (see PSN-2010-02-649)
	Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*

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: • Link—If green, the port is online; if there is no light, the port is down. • RX—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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

10-Gigabit Ethernet LAN/WAN PIC with SFP+ (T4000 Router)
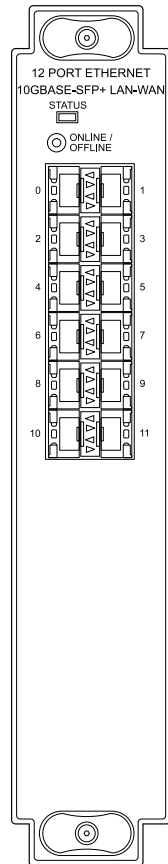

Software release	• Junos OS Release 12.1 and later (Type 5) For information on which FPCs support these PICs, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Twelve 10-Gigabit Ethernet SFP+ ports • Power requirements: 0.69 A @48 V (33 W) • Model number: PF-12XGE-SFPP
Hardware features	• Online/Offline button • Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• LAN-PHY mode selectable per port supported on Junos OS 12.1 and later
	• WAN-PHY mode selectable per port supported on Junos OS 12.1R2 and later
	• Interface hold timer
	• SNMP support to access all 10 Gigabit Ethernet port counters.
	• Graceful Routing Engine switchover (GRES) supported on Junos OS Release 12.1R2 and later
	• Layer 2 protocols:
	  • Flexible Ethernet service
	  • Ethernet circuit cross-connect (CCC)

- Ethernet translational Ethernet circuit cross-connect (TCC)
- Ethernet VPLS
- VLAN CCC
- Extended VLAN CCC
- Extended VLAN TCC
- VLAN VPLS

- Layer 3 protocols:
  - IPv4
  - IPv6
  - MPLS

- MAC filtering, accounting, policing, and learning for source media access control (MAC) on logical interfaces supported on Junos OS Release 12.1R2 and later.
- Flexible encapsulation.
- Single, stacked, and flexible VLAN tagging modes.
- Native VLAN configuration to allow untagged frames to be received on the tagged interfaces.
- IEEE 802.3ad Link Aggregation (on single chassis)
- Defining the VLAN rewrite operation to be applied to the incoming and outgoing frames on logical interfaces on this PIC.

NOTE: Only the Tag Protocol Identifier (TPID) 0x8100 is supported.

- Interoperability with other 10-Gigabit Ethernet PICs on M Series and T Series routers in LAN PHY and WAN PHY mode.
- Behavior aggregate (BA) classification (IPv4 DSCP, IPv6 DSCP, Inet precedence, IEEE 802.1P, IEEE 802.1AD, MPLS EXP) and fixed classification.

Cables and connectors	You can install any transceiver supported by the PIC. • Duplex LC connector (Rx and Tx) • Fiber-optic 10-Gigabit small form-factor pluggable (SFP+) transceivers • 10GBASE-SR (model number: SFPP-10GE-SR) • 10GBASE-LR (model number: SFPP-10GE-LR) • 10GBASE-ER (model number: SFPP-10GE-ER) Junos OS Release 12.1R2 and later • 10GBASE-ZR (model number: SFPP-10GE-ZR) Junos OS Release 12.3 and later Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
LEDs	PIC **STATUS** LED: • Off—PIC is powered down and offline. • Green—PIC is online with all voltages in range. • Yellow—PIC is initializing. • Red—PIC has an error or failure.

Alarms	Alarms are vendor-specific. Some transceiver vendors might not support every alarm. • Input laser power • Input loss of lock • Input loss of signal • Input Rx path • Output A/D data not ready • Output CDR (clock data recovery) • Output laser bias current • Output laser power • Output laser safety • Output Tx path • Module temperature • Module MOD_NR (module not ready) • Module P_DOWN (module down) • Module unplugged or down • Wire unplugged or down

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

10-Gigabit Ethernet LAN/WAN PIC with Oversubscription and SFP+ (T4000 Router)

Figure 17: 10-Port Type 4 PIC with Oversubscription
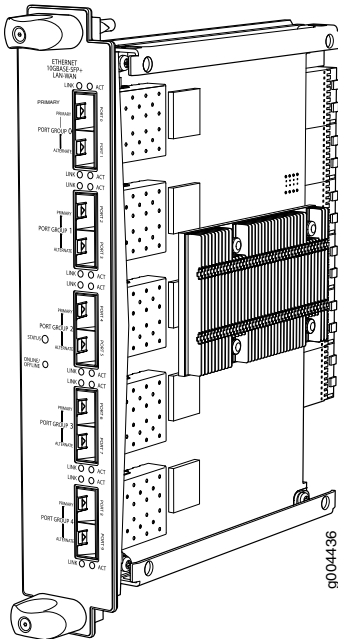
Figure 18: 24-Port Type 5 PIC with Oversubscription
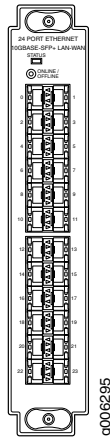
Software release	• Junos OS Release 12.1R2 and later (Type 4)
	NOTE: In some Juniper Networks documentation, the 10-Gigabit Ethernet LAN/WAN PIC with SFP+ (PD-5-10XGE-SFPP) is referred to as the 10-port 10-Gigabit Oversubscribed Ethernet PIC or 10-port 10-Gigabit OSE PIC.
	In oversubscribed Ethernet mode (default), all 10 ports are enabled and oversubscription is permitted. In line-rate mode, this PIC does not allow oversubscription and supports only 5 ports (**0**, **2**, **4**, **6**, and **8**).
	• Junos OS Release 12.2 and later (Type 5)
	NOTE: In oversubscribed Ethernet mode (default), all 24 ports are enabled and oversubscription is permitted. In line-rate mode, this PIC does not allow oversubscription and supports only 12 ports (**0** through **12**).
	For information on which FPCs support these PICs, see "T4000 PIC/FPC Compatibility" on page 10.
Description	Type 4 PIC
	• Ten 10-Gigabit Ethernet SFP+ ports (only ports **0**, **2**, **4**, **6**, and **8** are supported in line-rate mode)
	• Total bandwidth: 50 Gbps
	• Power requirements: 3.3 A @ −48 V (158.4 W)
	• Model number for 10-port Type 4 PIC with Oversubscription: PD-5-10XGE-SFPP

Type 5 PIC

- Twenty four 10-Gigabit Ethernet SFP+ ports (only ports **0** through **12** are supported in line-rate mode)
- Power requirements: 0.94 A @48 V (45 W)
- Model number for 24-Port Type 5 PIC with Oversubscription: PF-24XGE-SFPP

Hardware features	Type 4 PIC
	- High-performance throughput:
	- WAN-PHY mode at 9.953 Gbps
	- LAN-PHY mode at 10.3 Gbps
	- Full-duplex mode
	- Large maximum transmission units (MTUs) of up to 9192 bytes
	Type 5 PIC
	- Oversubscribed mode
	- Online/Offline button
Software features for Type 4 PIC	- Two modes of operation: 5 ports in line-rate mode, 10 ports in oversubscribed mode
	- Intelligent handling of oversubscribed traffic
	- Flexible mapping of port-assigned queues and scheduler resources at both ingress and egress
	- Strict-priority queue available on a per-port basis
	- QoS available on a per-port basis
	- Weighted round-robin (WRR)
	- L2 Protocol support:
	- Ethernet CCC, Ethernet TCC, Ethernet VPLS
	- VLAN CCC
	- Extended VLAN TCC
	- VLAN VPLS
	- Flexible-Ethernet-services
	- L3 Protocol support
	- IPv4
	- IPv6
	- MPLS
	- VLAN support
	- 4000 VLANs per PIC
	- Flex-VLAN tagging support
	- Interrupt driven link-down detection
	- Pause frame support
	- Jumbo frame support
	- MAC learning, aging, and filtering
	- MAC policing
	- Virtual Router Redundancy Protocol (VRRP) support
	- IEEE 802.3ad Link Aggregation
	NOTE: For PICS that support oversubscription, the PIC must be in line-rate mode to support aggregated Ethernet.
	- DSCP rewrite

Software features for Type 5 PIC	• Two modes of operation: 12 ports in line-rate mode, 24 ports in oversubscribed mode
	• Intelligent handling of oversubscribed traffic
	• LAN-PHY mode or WAN-PHY mode selectable per port
	• IEEE 802.3ad Link Aggregation (on single chassis)
	
	NOTE: For PICs that support oversubscription, the PIC must be in line-rate mode to support aggregated Ethernet.
	
	• Interface hold timer
	• SNMP support to access all 10 Gigabit Ethernet port counters
	• Graceful Routing Engine switchover (GRES)
	• L2 Protocol support:
	  • Ethernet CCC, Ethernet TCC, Ethernet VPLS
	  • VLAN CCC
	  • Extended VLAN TCC
	  • VLAN VPLS
	  • Flexible-Ethernet-services
	• L3 Protocol support
	  • IPv4
	  • IPv6
	  • MPLS
	• MAC filtering, accounting, policing, and learning for source media access control (MAC) on logical interfaces
	• Flexible encapsulation
	• Single, stacked, and flexible VLAN tagging modes
	• Native VLAN configuration to allow untagged frames to be received on the tagged interfaces
	• IEEE 802.3ad Link Aggregation (on single chassis)
	
	NOTE: For PICS that support oversubscription, the PIC must be in line-rate mode to support aggregated Ethernet.
	
	• Defining the VLAN rewrite operation to be applied to the incoming and outgoing frames on logical interfaces on this PIC.
	
	NOTE: Only the Tag Protocol Identifier (TPID) 0x8100 is supported.
	
	• Interoperability with other 10-Gigabit Ethernet PICs on M Series and T Series routers in LAN PHY and WAN PHY mode.
	• Behavior aggregate (BA) classification (IPv4 DSCP, IPv6 DSCP, Inet precedence, IEEE 802.1P, IEEE 802.1AD, MPLS EXP) and fixed classification.

Cables and connectors	You can install any transceiver supported by the PIC.
	• Duplex LC/PC connector (Rx and Tx)
	• Fiber-optic 10-Gigabit small form-factor pluggable (SFP+) transceivers.
	Type 4 PIC:
	• 10GBASE-ER (model number: SFPP-10GE-ER)
	• 10GBASE-LR (model number: SFPP-10GE-LR)
	• 10GBASE-SR (model number: SFPP-10GE-SR)
	• 10BASE-ZR (model number: SFPP-10GE-ZR) Junos OS Release 12.3 and later
	Type 5 PIC:
	• 10GBASE-SR (model number: SFPP-10GE-SR)
	• 10GBASE-LR (model number: SFPP-10GE-LR)
	• 10GBASE-ER (model number: SFPP-10GE-ER) Junos OS Release 12.1R2 and later
	• 10BASE-ZR (model number: SFPP-10GE-ZR) Junos OS Release 12.3 and later
	Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
LEDs	PIC **STATUS** LED, one tricolor:
	• Off—PIC is offline and safe to remove from the router.
	• Green—PIC is operating normally.
	• Yellow—PIC is initializing.
	• Red—PIC has an error or failure.
	Port LEDs, one pair for each port. The ports on the Type 4 PIC are labeled **PORT 0** through **PORT 9**. The ports on the Type 5 PIC are labeled **0** through **23**.
	• Link status LED. The LEDs on the Type 4 PIC are labeled **LINK**. The Type 5 PIC has no labels for the link status LED.
	• Green—Port is online with no alarms or failures.
	• Red—The router has detected a failure with alarms.
	• Off—Port is not enabled.
	• Link activity LED. The LED on the type 4 PIC is labeled **ACT**. The type 5 PIC has no label for the link activity LED.
	• Green flashing—Port is sending or receiving packets.
	• Off—No packet activity detected on the port.

Alarms

Alarms are vendor-specific. Some transceiver vendors might not support every alarm.

- Input laser power
- Input loss of lock
- Input loss of signal
- Input Rx path
- Output A/D data not ready
- Output CDR (clock data recovery)
- Output laser bias current
- Output laser power
- Output laser safety
- Output Tx path
- Module temperature
- Module MOD_NR (module not ready)
- Module P_DOWN (module down)
- Module unplugged or down
- Wire unplugged or down

Related
Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

10-Gigabit Ethernet LAN/WAN PIC with XFP (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 4)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• Four 10-Gigabit Ethernet ports
	• Power requirements: 0.9 A @48 V (43 W)
	• Model number: PD-4XGE-XFP

Hardware features	• High-performance throughput
	• WAN-PHY mode at 9.953 Gbps
	• LAN-PHY mode at 10.3125 Gbps
	• Full-duplex mode
	• Large maximum transmission units (MTUs) of up to 9192 bytes

Software features	• Configurable WAN-PHY mode options:
	• loopback
	• mpls
	• path-trace
	• trigger
	• Optical diagnostics, monitoring, and alarms
	• Flexible Ethernet Services Encapsulation
	• 802.1q virtual LANs (VLANs)
	• Ethernet OAM 802.1ag continuity check
	• Ethernet OAM 802.3ah (remote loopback is not supported for this PIC)
	• VLAN stacking
	• Channels defined by two stacked VLAN tags
	• Multiple tag protocol identifiers (TPID) support
	• IP service for nonstandard TPID and stacked VLAN tags
	• MAC learning, accounting, and filtering
	• Virtual Router Redundancy Protocol (VRRP) support
Cables and connectors	• You can install any transceiver supported by the PIC.
	• Connector: Duplex LC (Rx and Tx)
	• Fiber-optic 10-Gigabit small form-factor pluggable (XFP) transceivers:
	• 10GBASE-S (model number: XFP-10G-S)
	• 10GBASE-L (model number: XFP-10G-L-OC192-SR1)
	• 10GBASE-E (model number: XFP-10G-E-OC192-IR2)
	• 10GBASE-Z (model number: XFP-10G-Z-OC192-LR2)
	• Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
	• DWDM Tunable XFP transceivers:
	• 10GBASE-ZR (model number: XFP-10G-CBAND-T50-ZR)
	• Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
	• DWDM supported wavelengths—see *10-Gigabit Ethernet DWDM Transceiver Wavelengths*
LEDs	Port LED, labeled **PORT 0** through **PORT 3**, one for each port:
	• Off—Port is not enabled.
	• Green—Port is online with no alarms or failures.
	• Yellow—Port is online with alarms for remote failures.
	• Red—The router has detected a failure with alarms for local failures.

Alarms	Alarms are vendor-specific. Some transceiver vendors might not support every alarm. • Input laser power • Input loss of lock • Input loss of signal • Input Rx path • Output A/D data not ready • Output CDR (clock data recovery) • Output laser bias current • Output laser power • Output laser safety • Output Tx path • Module temperature • Module MOD_NR (module not ready) • Module P_DOWN (module down) • Module unplugged or down • Wire unplugged or down

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

40-Gigabit Ethernet PIC with CFP (T4000 Router)
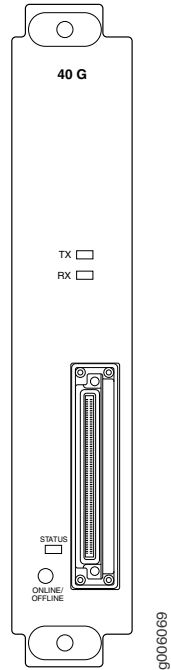
Software release	• Junos OS Release 13.2
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One 40-Gigabit Ethernet port
	• Power requirement: 1.46 A @ −48 V (70.0 W)
	• Model number: PD-1XLE-CFP
Hardware features	• Maximum transmission units (MTUs) up to 9192 bytes

Software features	• Media Access Control (MAC) accounting
	
	NOTE: MAC accounting on this PIC is not supported when aggregated Ethernet is configured.
	
	• Source and destination MAC address filtering
	• Ethernet OAM 802.3ah (remote loopback is not supported for this PIC)
	• Layer 2 filtering and accounting based on Layer 2 headers
	• Multiple tag protocol identifiers (TPIDs) used for filtering and counting
	• Flexible virtual LAN (VLAN) tagging
	• Channels defined by two stacked VLAN tags
	• Layer 2 protocols:
	
	    • Flexible Ethernet service
	    • Ethernet circuit cross-connect (CCC)
	    • Ethernet translational cross-connect (TCC)
	    • Ethernet virtual private LAN service (VPLS)
	    • VLAN CCC
	    • Extended VLAN TCC
	    • VLAN VPLS
	
	Layer 3 protocols:
	
	    • IPV4
	    • IPV6
	    • MPLS
	
	• Optical control features (vendor dependent)
	• IEEE 802.3ad Link Aggregation
	• Graceful Routing Engine switchover (GRES)

Cables and connectors	• Duplex SC/PC connector (RX and TX) • 40-Gigabit Ethernet CFP transceiver: 40GBASE-LR4 (model number: CFP-40GBASE-LR4) • Optical interface specifications—see *40-Gigabit Ethernet 40GBASE-R Optical Interface Specifications*
LEDs	**STATUS** LED: • Green—Online with no alarms or failures • Yellow—PIC is initializing • Red—PIC has a remote or local fault • Off—Not enabled **RX** LED: • Green—Port is receiving data • Off—Port might be on, but there is a local or remote fault **TX** LED: • Green—Port is transmitting data • Off—Port might be on, but there is a local fault

Alarms, errors, and events	- Alarm indication signal (AIS) - Laser bias current high/low alarms and warnings - Laser Rx power high/low alarms and warnings - Module not ready alarm - Module power down alarm - Module temperature high/low alarms and warnings - Rx CDR loss of lock alarm - Rx loss of signal alarm - Rx not ready alarm - Tx CDR loss of lock alarm - Tx data not ready alarm - Tx laser fault alarm - Tx not ready alarm

Related Documentation

- T4000 PIC Description on page 3
- T4000 PIC/FPC Compatibility on page 10
- T4000 PICs Supported on page 4

100-Gigabit Ethernet PIC with CFP (T4000 Router)

Figure 19: Type 5 100-Gigabit Ethernet PIC
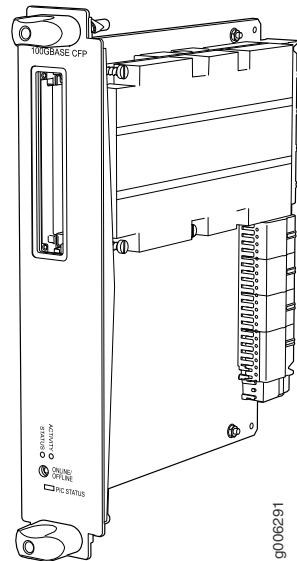
Figure 20: Type 4 100-Gigabit Ethernet PICs in a T1600-FPC4-ES FPC
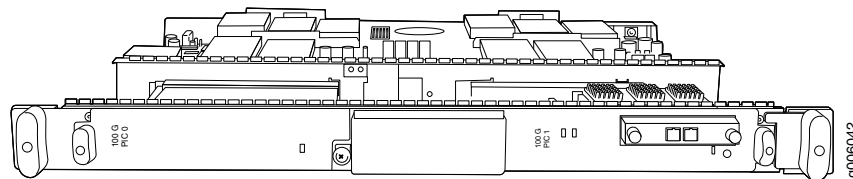
Software release	• Junos OS Release 12.1R1 and later (Type 5)
	• Junos OS Release 12.1R2 and later (Type 4)

NOTE: The Type 4 100-Gigabit Ethernet PIC is available only packaged in an assembly with the T1600-FPC4-ES FPC.

For information on which FPCs support these PICs, see "T4000 PIC/FPC Compatibility" on page 10.

Description	Type 5 PIC
	• One 100-Gigabit Ethernet port
	• Power requirements with LR4 transceiver: 1.19 A @48 V (57 W)
	• Model number: PF-1CGE-CFP

Type 4 PIC

- One 100-Gigabit Ethernet port
- Power requirements for PD-1CE-CFP-FPC4 (PIC and FPC): 9.48 A @48 V (455 W)
- Model number: PD-1CE-CFP-FPC4
- **PIC 0** and **PIC 1** are connected by a bridge board.
- There are two physical interfaces when the 100-Gigabit Ethernet PIC is online. Each physical interface represents one of two internal 50-Gigabit Ethernet Packet Forwarding Engines (PFEs) in the FPC. PFE0 is physical interface 0, PFE1 is physical interface 1.

  The following example shows the CLI representation of the physical interface. The interface type is **et**, *fpc* is the FPC slot number, the PIC slot is always **0**, and the PFEs are **0:0** for PFE0 and **0:1** for PFE1.

  - **et-***fpc***/0/0:0**
  - **et-***fpc***/0/0:1**

- You must also configure two logical interfaces under each physical interface. The following CLI example shows the logical interfaces.
  - **et-***fpc***/0/0:0.0** and **et-***fpc***/0/0:0.1**
  - **et-***fpc***/0/0:1.0** and **et-***fpc***/0/0:1.1**

  NOTE: For more information about CLI commands, see *Ethernet Interfaces*.

  NOTE: When bringing the PIC online and offline using the **request chassis pic (offline | online) fpc-slot** *slot-number* **pic-slot** *slot-number* command, you must specify **pic-slot** *slot-number* **0**. See *request chassis pic*.

Hardware features	- Support for MTUs up to 9192 bytes

Software features for Type 5 PIC	• Interface hold timer
	• Support for 100 Gigabit Ethernet MIBs
	• Graceful Routing Engine switchover (GRES) supported on Junos OS Release 12.1.R2 and later.
	• Layer 2 protocols:
	• Flexible Ethernet service
	• Ethernet circuit cross-connect (CCC)
	• Ethernet translational cross-connect (TCC)
	• Ethernet virtual private LAN service (VPLS)
	• VLAN CCC
	• Extended VLAN TCC
	• VLAN VPLS
	• Layer 3 protocols:
	• IPV4
	• IPV6
	• MPLS
	• MAC filtering, accounting, policing, and learning for source media access control (MAC) on logical interfaces supported on Junos OS Release 12.1R2 and later
	• Flexible encapsulation
	• Single, stacked, and flexible VLAN tagging modes
	• Native VLAN configuration to allow untagged frames to be received on the tagged interfaces
	• IEEE 802.3ad Link Aggregation (on single chassis)
	• Defining the VLAN rewrite operation to be applied to the incoming and outgoing frames on logical interfaces on this PIC
	NOTE: Only the Tag Protocol Identifier (TPID) 0x8100 is supported.
	• Behavior aggregate (BA) classification (IPv4 DSCP, IPv6 DSCP, Inet precedence, IEEE 802.1P, IEEE 802.1AD, MPLS EXP) and fixed classification.
	• Type 5 (model number PF-1CGE-CFP) interoperability with the 100-Gigabit Ethernet PIC (model number PD-1CE-CFP-FOC4) supported in Junos OS Release 12.1R2 and later

Software features for Type 4 PIC	• Media Access Control (MAC) accounting
	NOTE: MAC accounting on this PIC is not supported when aggregated Ethernet is configured.

- Source and destination MAC address filtering
- Ethernet OAM 802.3ah (remote loopback is not supported for this PIC)
- Layer 2 filtering and accounting based on Layer 2 headers
- Multiple tag protocol identifiers (TPIDs) used for filtering and counting
- Flexible virtual LAN (VLAN) tagging
- Channels defined by two stacked VLAN tags
- Layer 2 protocols:

  - Flexible Ethernet service
  - Ethernet circuit cross-connect (CCC)
  - Ethernet translational cross-connect (TCC)
  - Ethernet virtual private LAN service (VPLS)
  - VLAN CCC
  - Extended VLAN TCC
  - VLAN VPLS

- Layer 3 protocols:

  - IPV4
  - IPV6
  - MPLS

- Optical control features (vendor dependent)
- IEEE 802.3ad Link Aggregation

NOTE: Aggregated Ethernet must be configured on this PIC to support interoperability with 100-Gigabit Ethernet PIC (model number PF-1CGE-CFP) or the 100-Gigabit Ethernet MIC (model number MIC3-3D-1X100GE-CFP) .

- Graceful Routing Engine switchover (GRES)
- Interoperability for Type 4 (model number: PD-1CE-CFP-FPC4)

  - VLAN-steering provides interoperability with 100-Gigabit Ethernet interfaces from other vendors
  - Interoperability between 100-Gigabit Ethernet PIC (model number PD-1CE-CFP-FPC4) and the 100-Gigabit Ethernet PIC (model number PF-1CGE-CFP) supported in Junos OS Release 12.1R2 and later
  - Interoperability between 100-Gigabit Ethernet PIC (model number PD-1CE-CFP-FPC4) and the 100-Gigabit Ethernet MIC (model number MIC3-3D-1X100GE-CFP) supported in Junos OS Release 12.1R2

Cables and connectors	• You can install any 100-Gigabit Ethernet CFP transceiver supported by the PIC.
	• 100GBASE-LR4 (model number: CFP-100GBASE-LR4)
	• Duplex SC connector (RX and TX)
	• Junos OS Release 12.1 and later
	• 100GBASE-ER4 (model number: CFP-100GBASE-ER4)
	• Duplex LC connector (RX and TX)
	• Junos OS Release 12.3 and later
	• 100GBASE-SR10 (model number: CFP-100GBASE-SR10)
	• 24-fiber MPO
	• Junos OS Release 12.3 and later
	• Optical interface specifications—see *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
LEDs	Type 5 PIC LEDs
	• **PIC STATUS** LED:
	• Off—PIC is powered down and offline
	• Green—PIC is online with all voltages in range
	• Yellow—PIC is initializing
	• Red—PIC has an error or failure
	• Link **STATUS** LED:
	• Off—Port is off
	• Green—Port is online and link is up
	• Red—Port detecting failure with alarms
	• Link **ACTIVITY** LED:
	• Off—No link activity
	• Flashing green—Indicates link activity for the port
	Type 4 PIC LEDs
	• Two tricolor **STATUS** LEDs (**P1C 0** and **P1C 1**)
	• Green—PIC is online with no alarms or failures
	• Yellow—PIC is initializing
	• Red—PIC has a remote or local fault
	• Off—PIC is not enabled
	• RX LED (**P1C 1**):
	• Green—Port is receiving data
	• Off—Port might be on, but there is a local or remote fault
	• TX LED (**P1C 1**):
	• Green—Port is transmitting data
	• Off—Port might be on, but there is a local fault

Alarms

Alarms are vendor-specific. Some transceiver vendors might not support every alarm.

- Input laser power
- Input loss of lock
- Input loss of signal
- Input Rx path
- Output A/D data not ready
- Output CDR (clock data recovery)
- Output laser bias current
- Output laser power
- Output laser safety
- Output Tx path
- Module temperature
- Module MOD_NR (module not ready)
- Module P_DOWN (module down)
- Module unplugged or down
- Wire unplugged or down

Related Documentation

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

MultiServices PICs (T4000 Router)

Figure 21: MultiServices 400 PIC
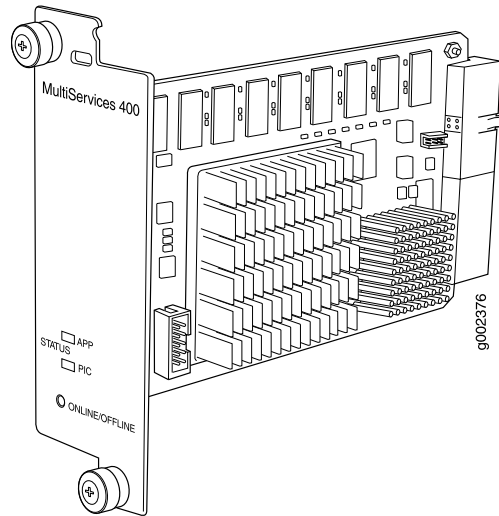
Figure 22: MultiServices 500 PIC

Software release	• MultiServices 400: Junos OS Release 12.2 and later (Type 2)
	• MultiServices 500: Junos OS Release 12.1R2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• Individual licenses must be purchased for services.
	• Power requirement:
	• Multiservices 400: 0.69 A @ 48 V (33 W)
	• Multiservices 500: 0.83 A @ 48 V (40 W)

	• Model number for Multiservices 400 PIC: PB-MS-400-2
	• Model number for Multiservices 500 PIC: PB-MS-500-3
Hardware features	• Multiservices 400: up to 3.2 million flows
	• Multiservices 500: up to 3.2 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 17 on page 99. For more information about the software features available for services PICs, see the *Junos OS Services Interfaces Library for Routing Devices*.
LEDs	**PIC 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 **APP STATUS** LED, one bicolor:
	• Off—Service is not running.
	Green—Service is running under acceptable load.
	• Yellow—Service is overloaded.

Table 17: MultiServices PICs Software Features Supported on the T4000 Router

Software Feature	MultiServices 400	MultiServices 500	
GRE Key	–	–	
GRE dont-fragment	–	–	
Stateful firewall with packet inspection: detects SYN attacks, ICMP and UDP floods, and ping-of-death attacks	–	–	
Network Address Translation (NAT) for IP addresses	–	–	
Port Address Translation (PAT) for port numbers	–	–	
IP Security (IPSec) encryption	–	–	
Flow aggregation	–	12.1R2	
Active flow monitoring exports cflowd version 5 and version 8 records	–	12.1R2	
Active flow monitoring exports flow monitoring version 9 records, based on RFC 3954	–	12.1R2	

Table 17: MultiServices PICs Software Features Supported on the T4000 Router *(continued)*

Software Feature	MultiServices 400	MultiServices 500	
Passive flow monitoring	12.2	–	
Passive flow collection	12.2	–	
Flow-tap	–	–	
Dynamic flow capture	12.2	–	
Real-time performance monitoring	–	–	
Link Services	–	–	
Traffic sampling	–	12.1R2	
Tunnel services: • IP-IP unicast tunneling • GRE unicast tunneling—Supports GRE fragmentation • Protocol Independent Multicast (PIM) sparse mode unicast tunneling	–	–	
Virtual tunnel interface for Layer 3 VPNs	–	–	
Layer 2 Tunneling Protocol (L2TP)	–	–	
Voice services: • Compressed Real-Time Transport Protocol (CRTP)	–	–	
Encapsulations: • Multilink Frame Relay (MLFR) • Multilink Point-to-Point Protocol (MLPP)	–	–	

Related Documentation
- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (T4000 Router)

Figure 23: SONET/SDH OC3/STM1
(Multi-Rate) PIC (Type 1)
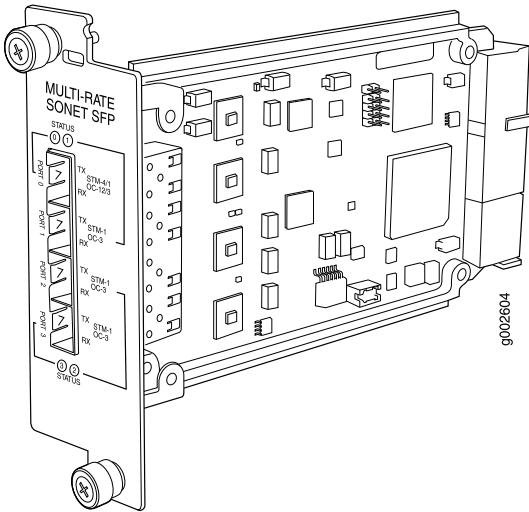
Figure 24: SONET/SDH OC3/STM1
(Multi-Rate) PIC (Type 2)
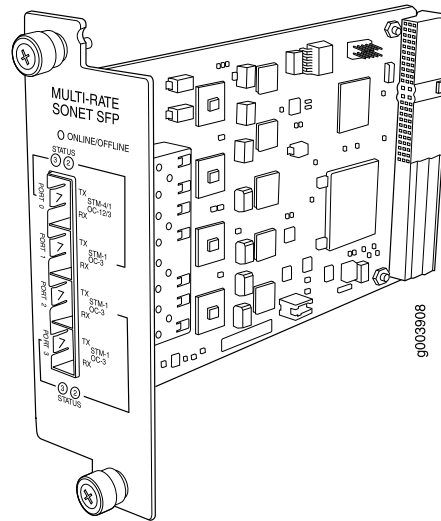
Software release	• 4-port: Junos OS Release 12.1R2 and later (Type 1)
	• 4-port: Junos OS Release 12.2R2 and later (Type 2)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

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)
	• Model number for SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type_1): PB-40C3-1OC12-SON-SFP
	• Model number for SONET/SDH OC3/STM1 (Multi-Rate) PIC (Type_2): PB-4OC3-1OC12-SON2-SFP

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

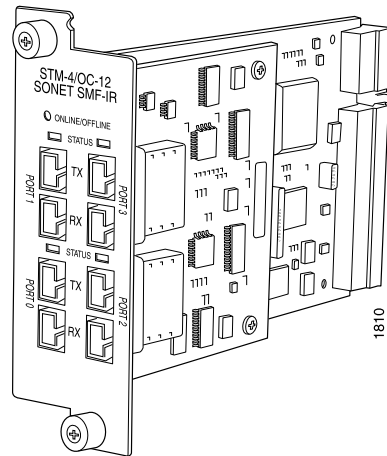|	

Software features	- Optical diagnostics and related alarms
	- Per-port SONET/SDH framing
	- IEEE 802.3ad Link Aggregation
	- Alarm and event counting and detection
	- Dual-router automatic protection switching (APS)
	- Multiprotocol Label Switching (MPLS) fast reroute
	- Encapsulations:
	  - Circuit cross-connect (CCC)
	  - Translational cross-connect (TCC)
	  - Frame Relay
	  - High-Level Data Link Control (HDLC)
	  - Point-to-Point Protocol (PPP)

Cables and connectors	You can install any transceiver supported by the PIC. For information about installing and removing transceivers.
	
	- Duplex LC 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*
	- SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	  - Short reach (model number: SFP-OC12-SR)
	  - Intermediate reach (IR-1) (model number: SFP-OC312-IR)
	  - Long reach (LR-1) (model number: SFP-OC12-LR)
	  Optical interface specifications—see *SONET/SDH OC12/STM4 Optical Interface Specifications*
	
	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 *request chassis pic*.

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, B2, B3
	• Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
	• Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
	• Loss of frame (LOF)
	• Loss of pointer (LOP-P)
	• Loss of signal (LOS)
	• Payload 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:
	• 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—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 signal (LOS)
	• Multiplex section—alarm indication signal (MS-AIS)
	• Multiplex section—remote defect indication (MS-RDI)
	• Multiplex section—remote error indication (MS-REI)
	• Error detection:
	• 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

SONET/SDH OC12c/STM4 EOL PIC (T4000 Router)

Figure 25: 4-Port SONET/SDH OC12c/STM4 PIC

Software release	• Junos OS Release 12.2R2 and later (Type 2) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Four ports • Power requirement: 0.23 A @ 48 V (10.8 W) • Model number: PB-4OC12-SON-MM • Model number: PB-4OC12-SON-SMIR
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing
Software features	• SONET/SDH framing • IEEE 802.3ad Link Aggregation • Alarm and event counting and detection • Dual-router automatic protection switching (APS) • Multiprotocol Label Switching (MPLS) fast reroute • Layer 2 protocols: • 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 connector (Rx and Tx) • SONET/SDH OC12/STM4 fixed transceiver: 4-port: Multimode 4-port: Single-mode Intermediate reach (IR-1) Optical interface specifications—see *SONET/SDH OC12/STM4 Optical Interface Specifications* 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 *request chassis pic*.
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

- T4000 PIC Description on page 3

- T4000 PICs Supported on page 4

SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (T4000 Router)
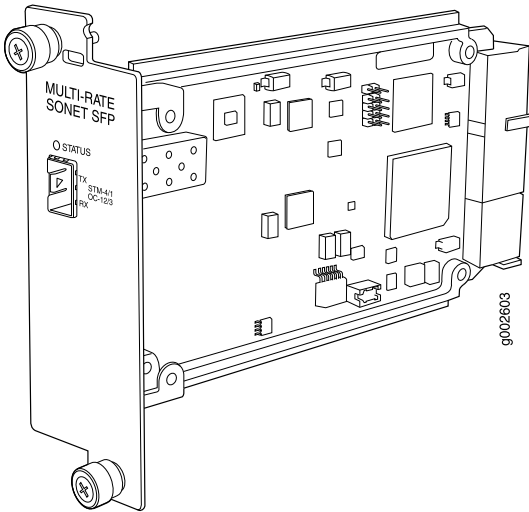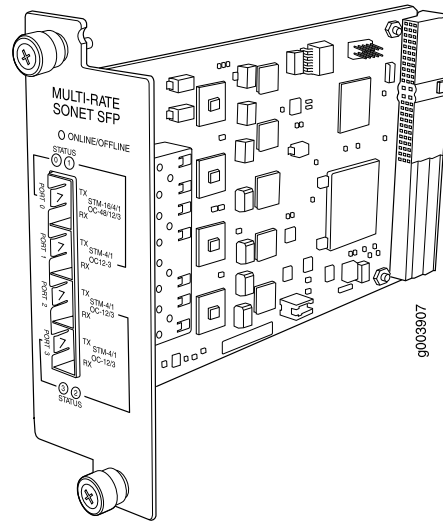
Figure 26: 1-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC

Figure 27: 4-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC

Software release	• Junos OS Release 12.1R2 ander later
	• Junos OS Release 12.2R2 and later (Type 2)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• 1-port: Rate-selectable using one of the following rates:
	• 1-port OC3/STM1
	• 1-port OC12/STM4
	• 1-port OC12c/STM4c
	• 4-port: Rate-selectable using one of the following rates:
	• 1-port OC12/STM4
	• 1-port OC48/STM16
	• 1-port OC48c/STM16c
	• 4-port OC3c/STM1c
	• 4-port OC12c/STM4c
	• Power requirement:
	• 1-port: 0.20 A @ 48 V (9.5 W)
	• 4-port: 0.40 A @ 48 V (19 W)
	• Model number for 1-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC: PB-1OC12-SON-SFP
	• Model number for 4-Port SONET/SDH OC12/STM4 (Multi-Rate) PIC: PB-4OC3-4OC12-SON-SFP
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:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)
Cables and connectors	You can install any transceiver supported by the PIC. For information about installing and removing transceivers.
	• 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*
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	• Short reach (model number: SFP-OC12-SR)
	• Intermediate reach (IR-1) (model number: SFP-OC312-IR)
	• Long reach (LR-1) (model number: SFP-OC12-LR)
	Optical interface specifications—see *SONET/SDH OC12/STM4 Optical Interface Specifications*
	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 *request chassis pic*.
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, B2, B3
	• Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
	• Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
	• Loss of frame (LOF)
	• Loss of pointer (LOP-P)
	• Loss of signal (LOS)
	• Payload 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:
	• 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—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 signal (LOS)
	• Multiplex section—alarm indication signal (MS-AIS)
	• Multiplex section—remote defect indication (MS-RDI)
	• Multiplex section—remote error indication (MS-REI)
	• Error detection:
	• 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

SONET/SDH OC48c/STM16 EOL PICs (T4000 Router)
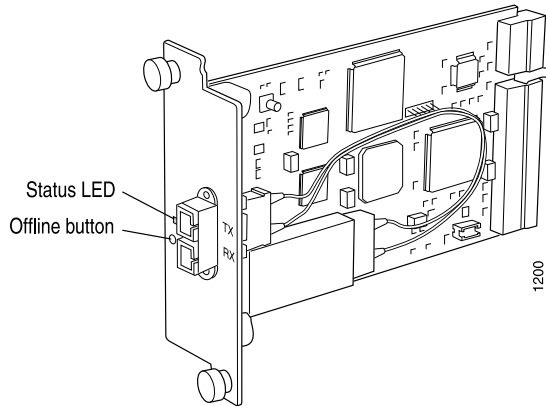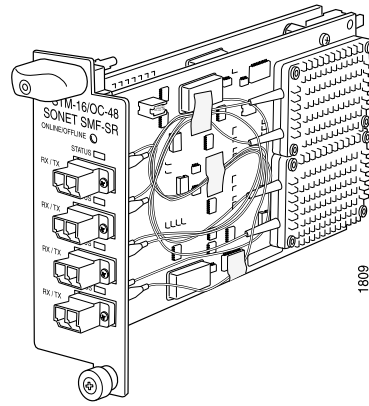
Figure 28: 1-Port SONET/SDH OC48c/STM16 PIC

Figure 29: 4-Port SONET/SDH OC48c/STM16 PIC

Software release	• 1-port: Junos OS Release 12.2R2 and later (Type 2) • 4-port: Junos OS Release 12.1R2 and later (Type 3) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One or four OC48 ports • 1-port: 0.38 A @ 48 V (8 W) • 4-port: 0.86 A @ 48 V (41.4 W) • Model number for 1-port SONET/SDH OC48c/STM16 PIC: PB-1OC48-SON-SMSR • Model number for 4-port SONET/SDH OC48c/STM16 PIC: PC-4OC48-SON-SMSR
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Point-to-Point Protocol (PPP)

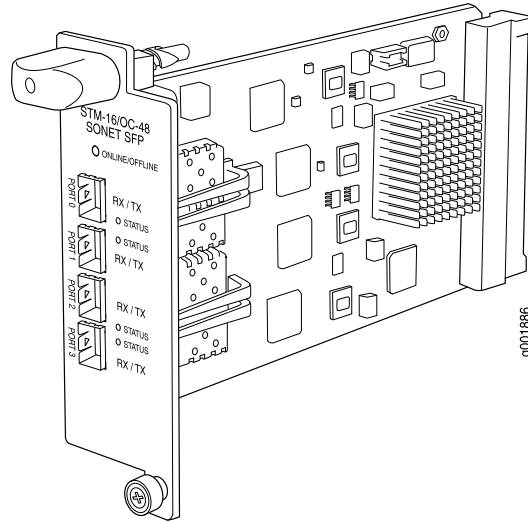| Cables and connectors	• Duplex SC Connector (Rx and Tx)
	• 1-port and 4-port: SONET/SDH OC48/STM16 fixed transceiver: short reach (SR-1)
	• 1-port: Long reach (LR-1)
	• Optical interface specifications—see *SONET/SDH OC48/STM16 Optical Interface Specifications*
	NOTE: To extend the life of the laser, 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 *request chassis pic*.
LEDs	**STATUS** LED, 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

• T4000 PIC Description on page 3

• T4000 PICs Supported on page 4

SONET/SDH OC48c/STM16 PIC with SFP (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• Four OC48 ports
	• Power requirement: 0.46 A @ 48 V (22.1 W)
	• Model number: PC-4OC48-SON-SFP

Hardware features	• Multiplexing and demultiplexing on the 1-port PIC
	• Rate policing on input
	• Rate shaping on output
	• Packet buffering, Layer 2 parsing

Software features	• Optical diagnostics and related alarms
	• Configuration of SONET or SDH framing on a per-port basis
	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)

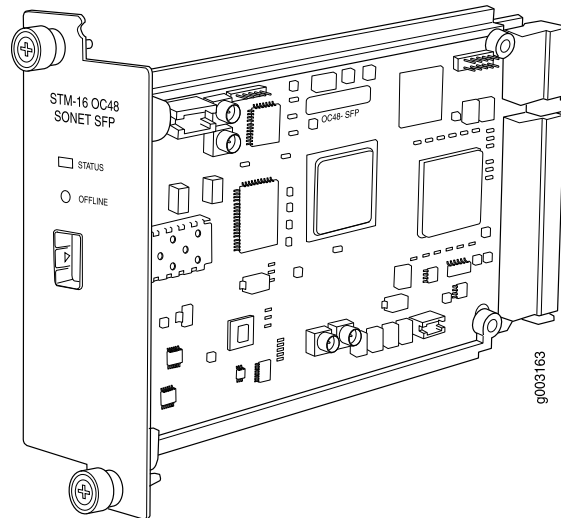|	

Cables and connectors	You can install any transceiver supported by the PIC. For information about installing and removing.
	
	 • Duplex LC connector (Rx and Tx)
	 • SONET/SDH OC48/STM16 fiber-optic 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*
	
	 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 *request chassis pic*.

LEDs	**STATUS** LED, 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:

- 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, B2, B3
  - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
  - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
  - Loss of frame (LOF)
  - Loss of pointer (LOP-P)
  - Loss of signal (LOS)
  - Payload 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:
  - 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—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 signal (LOS)
  - Multiplex section—alarm indication signal (MS-AIS)
  - Multiplex section—remote defect indication (MS-RDI)
  - Multiplex section—remote error indication (MS-REI)

- Error detection:

  - 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

SONET/SDH OC48c/STM16 EOL PIC with SFP (T4000 Router)

Software release	• Junos OS Release 12.2R2 and later (Type 2) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One OC48 port • Power requirement: 0.33 A @ 48 V (16 W) • Model number: PB-1OC48-SON-SFP
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Point-to-Point Protocol (PPP)

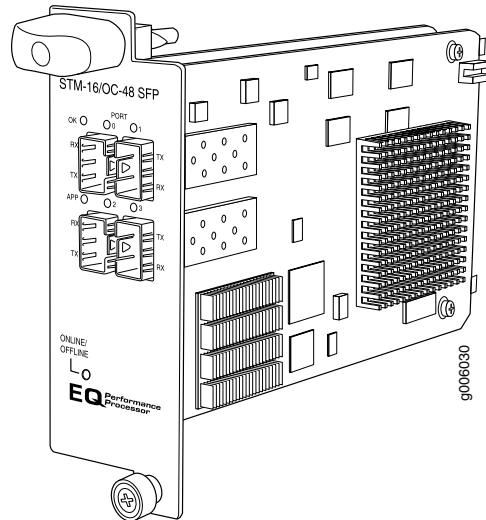|	

Cables and connectors	• Duplex LC Connector (Rx and Tx)
	• SONET/SDH OC48/STM16 fiber-optic 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*
	
	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 *request chassis pic*.

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

• T4000 PIC Description on page 3

• T4000 PICs Supported on page 4

SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (T4000 Router)

Software release	• Junos OS Release 13.2 and later (Type 3)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Four OC48/STM16 ports
	• Clear channel functionality
	• SONET and SDH is configured on a per-port granularity
	• Power requirement: 1.06 A @ 48 V (51 W)
	• Weight: 1.6 lb (0.725 kg)
	• Model number: PC-4OC48-STM16-IQE-SFP
Hardware features	• Ports are numbered:
	• Top row: 0 and 1 from left to right
	• Bottom row: 2 and 3 from left to right
	• Maximum transmission units (MTUs) of up to 9192 bytes
Software features	• Quality of service (QoS) per channel: weighted round-robin (WRR), random early detection (RED), weighted random early detection (WRED)
	• Fine-grained egress queuing per logical interface. See the *Junos OS Class of Service Library for Routing Devices* for more information about class-of-service features
	• Packet buffering
	• Local line and remote payload loopback testing
	• Optical diagnostics and monitoring
	• Clocking options: internal or external/loop mode. Each OC48 transmitter port is configured either in internal or external mode. The default clocking option is internal mode.
	• Encapsulations:
	• Extended Frame Relay for circuit cross-connect (CCC) and translational cross-connect (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

Cables and connectors	You can install any transceiver supported by the PIC.
	
	- Duplex LC 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*
	
	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 *request chassis pic*.

LEDs	OK LED, one tricolor: - Off—PIC is offline and safe to remove from the router - Green—PIC is operating normally - Yellow—PIC is initializing - Red—PIC has an error or failure APP LED, one green per port: - Off—Service is not running - Green—Service is running under acceptable load Port 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: - Loss of light (LOL) - Phase lock loop (PLL) - Loss of frame (LOF) - Loss of signal (LOS) - Severely errored frame (SEF) - Alarm indicator signal—line (AIS-L) - Alarm indicator signal—path (AIS-P) - Loss of pointer (LOP)

- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Remote defect indicator—line (RDI-L)
- Remote defect indicator—path (RDI-P)
- Remote error indicator (REI)
- Unequipped (UNEQ)
- Payload label mismatch—path (PLM-P)

SDH alarms:

- Loss of light (LOL)
- Phase lock loop (PLL)
- Loss of frame (LOF)
- Loss of signal (LOS)
- Severely errored frame (SEF)
- Multiplex-section alarm indicator signal (MS-AIS)
- H Path alarm indicator signal (HP-AIS)
- Loss of pointer (LOP)
- Bit error rate—signal degrade (BERR-SD)
- Bit error rate—signal fail (BERR-SF)
- Multiplex section—far end receive failure (MS-FERF)
- High order path—far end receive failure (HP-FERF)
- Remote error indicator (REI)
- Unequipped (UNEQ)
- High order path—payload label mismatch - Path (HP-PLM)

Optical diagnostics related alarms:

NOTE: Transceivers from some vendors do not support these fields.

- Temperature high/low alarms and warnings
- Supply voltage high/low alarms and warnings
- Tx bias current high/low alarms and warnings
- Tx output power high/low alarms and warnings
- Rx received power high/low alarms and warnings

Related Documentation

SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (T4000 Router)
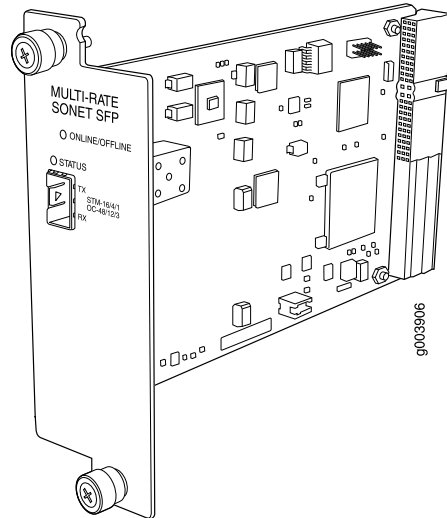
Software release	• Junos OS Release 12.2R2 and later (Type 2)
	For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Rate-selectable using one of the following rates:
	• 1-port OC3c/STM1c
	• 1-port OC12/STM4
	• 1-port OC12c/STM4c
	• 1-port OC48/STM16
	• 1-port OC48c/STM16c
	• Power requirement: 0.20 A @ 48 V (9.5 W)
	• Model number: PB-1OC48-SON-B-SFP
Hardware features	• Multiplexing and demultiplexing
	• Rate policing on input
	• Rate shaping on output
	• Packet buffering, Layer 2 parsing

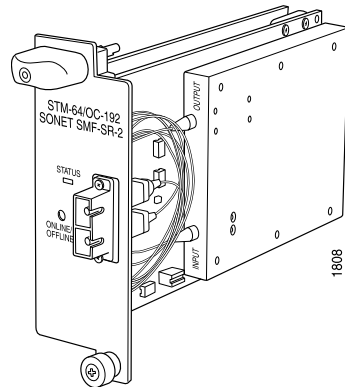| Software features	• Optical diagnostics and related alarms
	• Per-port SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)
Cables and connectors	You can install any transceiver supported by the PIC. For information about installing and removing transceivers.
	• Duplex LC 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*
	• SONET/SDH OC12/STM4 small form-factor pluggable (SFP) transceivers:
	• Short reach (model number: SFP-OC12-SR)
	• Intermediate reach (IR-1) (model number: SFP-OC312-IR)
	• Long reach (LR-1) (model number: SFP-OC12-LR)
	Optical interface specifications—see *SONET/SDH OC12/STM4 Optical Interface Specifications*
	• SONET/SDH OC48/STM16 fiber-optic 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*
	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 *request chassis pic*.
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, B2, B3
	• Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
	• Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
	• Loss of frame (LOF)
	• Loss of pointer (LOP-P)
	• Loss of signal (LOS)
	• Payload 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:
	• 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—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 signal (LOS)
	• Multiplex section—alarm indication signal (MS-AIS)
	• Multiplex section—remote defect indication (MS-RDI)
	• Multiplex section—remote error indication (MS-REI)
	• Error detection:
	• 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

SONET/SDH OC192/STM64 EOL PIC (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 3)
Description	• One OC192 port • Power requirement: 0.45 A @ 48 V (21.6 W) • Model number: PC-1OC192-SON-SR2
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

Software features	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	  • High-Level Data Link Control (HDLC)
	  • Frame Relay
	  • Circuit cross-connect (CCC)
	  • Translational cross-connect (TCC)
	  • Point-to-Point Protocol (PPP)

Cables and connectors	SONET/SDH OC192/STM64 fixed transceiver: Short reach (SR-2): duplex SC connector (Rx and Tx) • Optical interface specifications—see *SONET/SDH OC192/STM64 Optical Interface Specifications* 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 *request chassis pic*.

LEDs	STATUS LED, 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
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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

SONET/SDH OC192/STM64 PICs with XFP (T4000 Router)
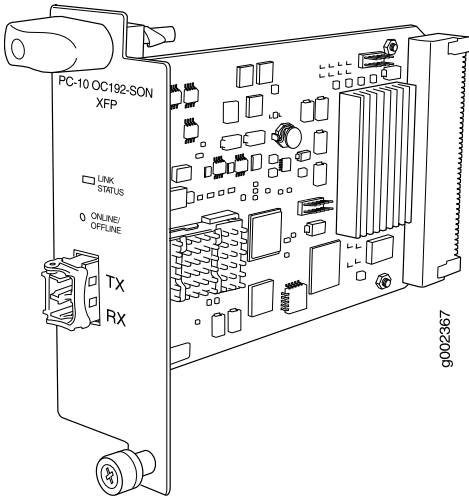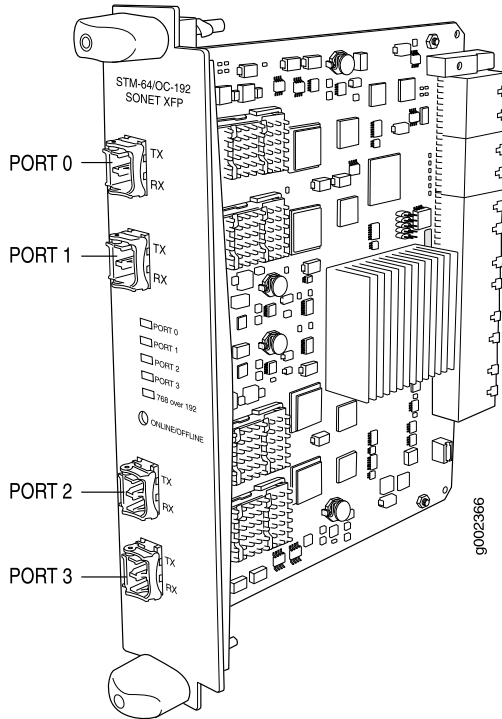
Figure 30: 1-Port SONET/SDH OC192/STM64 PIC

Figure 31: 4-Port SONET/SDH OC192/STM64 PIC

Software release	• 1-port: Junos OS Release 12.1R2 and later (Type 3)
	• 4-port: Junos OS Release 12.1 and later (Type 4)

For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.

Description	• One or four OC192 ports

NOTE: Four OC192 links can be aggregated into one OC768 link or two OC256 links. The four fiber links should be on the same fiber path or the same fiber.

- Power requirement:
  - 1-port (Type 3): 0.52 A @ 48 V (25 W)
  - 4-port (Type 4): 1.11 A @ 48 V (53.1 W)
- Model number for 1-port SONET/SDH OC192/STM64 PIC: PC-1OC192-SON-XFP
- Model number for 4-port SONET/SDH OC192/STM64 PIC: PD-4OC192-SON-XFP

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

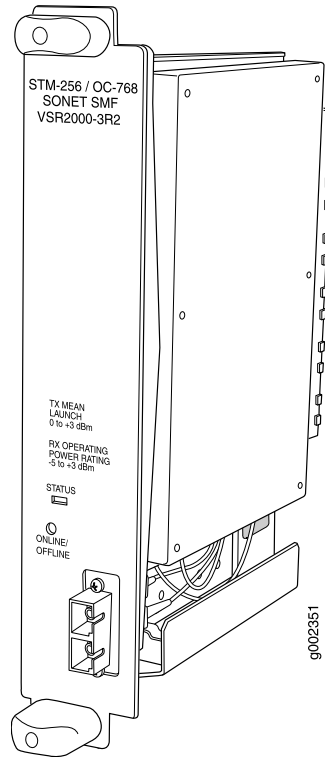|	
Software features	• Configuration of SONET or SDH framing on a per-port basis on the 4-port Type 4 PIC .
	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Encapsulations:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)
Cables and connectors	• Duplex LC connector (Rx and Tx)
	• SONET/SDH OC192c/STM64 XFP transceivers:
	• Short reach (SR-1) (model number: XFP-10G-L-OC192-SR1)
	• Intermediate reach (IR-1) (model number: XFP-10G-E-OC192-IR2)
	• Long reach (LR-1) (model number: XFP-10G-Z-OC192-LR2)
	Optical interface specifications—see *SONET/SDH OC192/STM64 Optical Interface Specifications*
	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 *request chassis pic*.
LEDs	1-port PIC:
	• **LINK STATUS LED**
	• Off—Port is down.
	• Green—Port is online. Link is established
	4-port PIC:
	• Port LEDs labeled **PORT 0** through **PORT 3**, one tricolor 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
	• One **768 over 192** LED:
	• 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, B2, B3
	• Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE)
	• Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE)
	• Loss of frame (LOF)
	• Loss of pointer (LOP-P)
	• Loss of signal (LOS)
	• Payload 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:
	• 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—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 signal (LOS)
	• Multiplex section—alarm indication signal (MS-AIS)
	• Multiplex section—remote defect indication (MS-RDI)
	• Multiplex section—remote error indication (MS-REI)
	• Error detection:
	• 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

SONET/SDH OC768c/STM256 PIC (T4000 Router)

Software release	• Junos OS Release 12.1 and later (Type 4) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• One OC768 port • Power requirement: 1.37 A @ 48 V (65.7 W) • Model number: PD-1OC768-SON-SR
Hardware features	• Multiplexing and demultiplexing • Rate policing on input • Rate shaping on output • Packet buffering, Layer 2 parsing

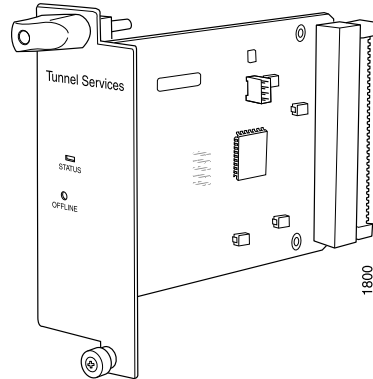|	
Software features	• SONET/SDH framing
	• IEEE 802.3ad Link Aggregation
	• Alarm and event counting and detection
	• Dual-router automatic protection switching (APS)
	• Multiprotocol Label Switching (MPLS) fast reroute
	• Layer 2 protocols:
	• Circuit cross-connect (CCC)
	• Translational cross-connect (TCC)
	• Frame Relay
	• High-Level Data Link Control (HDLC)
	• Point-to-Point Protocol (PPP)
	• Optical diagnostics and related alarms
	• Laser bias
	• Transmit optical power
	• Receiver optical power
	• Laser temperature
Cables and connectors	• Duplex SC connector (Rx and Tx)
	• SONET/SDH OC768c/STM265 Short reach (SR-1) fixed transceiver
	Optical interface specifications—see *SONET/SDH OC768/STM256 Optical Interface Specifications*
	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 *request chassis pic*.
LEDs	One **STATUS** LED:
	• 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, B2, B3 - Far-end bit error: remote error indication—line (REI-L), far-end line coding violations (CV-LFE) - Far-end bit error: remote error indication—path (REI-P), far-end path coding violations (CV-PFE) - Loss of frame (LOF) - Loss of pointer (LOP-P) - Loss of signal (LOS) - Payload 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: - 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—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 signal (LOS) - Multiplex section—alarm indication signal (MS-AIS) - Multiplex section—remote defect indication (MS-RDI) - Multiplex section—remote error indication (MS-REI) - Error detection: - 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

Tunnel Services PICs (T4000 Router)

Software release	• Junos OS Release 12.1R2 and later (Type 1) • Junos OS Release 12.2R2 and later (Type 2) • Junos OS Release 12.1R2 and later (Type 3) For information on which FPCs support this PIC, see "T4000 PIC/FPC Compatibility" on page 10.
Description	• Power requirement: 0.07 A @ 48 V (3.4 W) • Model number for Type 1 Tunnel Services PIC: PB-TUNNEL1 • Model number for Type 2 Tunnel Services PIC: PB-TUNNEL • Model number for Type 3 Tunnel Services PIC: PC-TUNNEL
Hardware features	• Loopback function that encapsulates and de-encapsulates packets • OC12/STM4 tunneling bandwidth on Type 1 FPC • OC48/STM16 tunneling bandwidth on Type 2 FPC • OC192/STM64 tunneling bandwidth on Type 3 FPC
Software features	For a list of the software features available for services PICs, see the *Junos Services Interfaces Configuration Release*. • IP-IP unicast tunneling • GRE unicast tunneling • PIM sparse mode unicast tunneling
LEDs	One **STATUS** LED, 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

- T4000 PIC Description on page 3
- T4000 PICs Supported on page 4

Junos OS Documentation and Release Notes

For a list of related Junos OS documentation, see
http://www.juniper.net/techpubs/software/junos/.

If the information in the latest release notes differs from the information in the
documentation, follow the *Junos OS Release Notes.*

To obtain the most current version of all Juniper Networks® technical documentation,
see the product documentation page on the Juniper Networks website at
http://www.juniper.net/techpubs/.

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance
Center (JTAC). If you are a customer with an active J-Care or JNASC support contract,
or are covered under warranty, and need post-sales technical support, you can access
our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies,
  review the *JTAC User Guide* located at
  http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf .

- Product warranties—For product warranty information, visit
  http://www.juniper.net/support/warranty/ .

- JTAC hours of operation—The JTAC centers have resources available 24 hours a day,
  7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online
self-service portal called the Customer Support Center (CSC) that provides you with the
following features:

- Find CSC offerings: http://www.juniper.net/customers/support/

- Search for known bugs: http://www2.juniper.net/kb/

- Find product documentation: http://www.juniper.net/techpubs/

- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/

- Download the latest versions of software and review release notes:
  http://www.juniper.net/customers/csc/software/

- Search technical bulletins for relevant hardware and software notifications:
  https://www.juniper.net/alerts/

- Join and participate in the Juniper Networks Community Forum:
  http://www.juniper.net/company/communities/

- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.

- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

Revision History

August 2013—For Junos OS Release 12.1R2 and 13.2, added support for additional PICs.

June 2013—For Junos OS Release 12.2, added support for additional PICs and corrected SR10 cable information.

May 2013—Changed title to *T4000 Core Router Interface Module Reference*.

January 2013—For Junos OS Release 12.3, added support of additional PICs and transceivers.

September 2012—For Junos OS Release 12.2, added support of additional PICs.

May 2012—For Junos OS Release 12.1R2, added support of the 10-Gigabit Ethernet LAN/WAN PIC with XFP and the 10-port 10-Gigabit Ethernet LAN/WAN PIC with SFP+.

March 2012—For Junos OS Release 12.1, initial PIC guide for the T4000 router.