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# T1, DS3, E1, E3 PICs Datasheet

Advantages | Description | Port Density and Flexibility | Key Features | Specifications | Ordering Information

DS3/E3 and T1/E1 circuits for Internet access represent a key component of service provider business. The highly dynamic nature of aggregation deployments requires that edge router interfaces be highly dependable, flexible, and operationally efficient.

Juniper Networks T1, DS3, E1, E3 Physical Interface Cards (PICs) offer highly available, highly flexible solutions for edge applications. These links deliver not only business-critical Internet connectivity, but also an ever increasing portfolio of rich IP services, such as VPNs and flexible bandwidth. Leveraging cross-platform predictable performance, uniform JUNOS software, and seamless, hardware-based features, these PICs enable service providers to rapidly deploy and provision new IP services with no performance trade-off.

New E3 4-port Intelligent Queuing (IQ) PIC offers new levels of functionality:

- Granular QoS capabilities enable carriers to offer profitable differentiated services without compromising performance. For example, with the E3 IQ PIC, traffic prioritization levels can be established with the high granularity of four queues per DLCI for Frame Relay.
- Extensive statistics on packets and bytes that are transmitted, received, or dropped. Packets can be inspected to determine what types of traffic is being transmitted, enabling carriers to bill for premium QoS and Service Level Agreement-based (SLA-based) services and to implement usage-based billing. In addition, they also provide the visibility needed into network operations to ensure that trends are anticipated and capacity is expanded to meet increasing demands.
- Rich, embedded diagnostic tools help network managers troubleshoot links using in band loopback testing and bit error rate diagnostics, supporting quicker provisioning, activation, servicing, and recovery.

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## Advantages

| Features | Benefits |
|---|---|
| • Predictable performance and consistent service-enabling features across all M-series and T-series PICs | • Supports rich IP service deployment across all interfaces<br>• Increases service reliability<br>• Simplifies configuration |

| | |
|---|---|
| | • Accelerates deployment time<br>• Reduces operational complexity<br>• Decreases operational costs<br>• Minimizes training time for operational staff |
| • High-density interfaces with the ability to mix and match up to four PICs within a single Flexible PIC Concentrator (FPC) slot | • Improves edge concentration and scalability of the core<br>• Increases configuration flexibility by enabling service providers to mix different speeds, technologies, and IP services<br>• Enables service providers to add uplink interfaces without wholly consuming an FPC slot<br>• Reduces operational costs by maximizing POP space |
| • Broad range of connectivity speeds | • Enables service providers to offer a wide range of IP services in diverse environments<br>• Enhances service definition richness by increasing configuration flexibility<br>• Ensures scalability for both subscriber and uplink interfaces |
| • DS3 and E3 integrated DSU | • Interoperable with leading vendors<br>• Provides subrate functionality |
| • Rate-limiting and multilink services | • Minimizes costs by maximizing bandwidth efficiency<br>• Enables service providers to deliver IP services according to dynamic customer requirements<br>• Decreases congestion<br>• Promotes customer loyalty by enabling rapid fine tuning of IP services |
| • Input policing and output shaping | • Reduces congestion<br>• Enables service providers to deliver and bill for a finer granularity of IP services |

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## Descriptions

| | |
|---|---|
| 2-port, 4-port DS3 and E3 | Greater demand for Internet applications is driving a need for high-speed backbone access connections. DS3 and E3 PICs are cost-effective solutions for connecting corporations and other high-bandwidth Internet subscribers to Internet backbones for greater throughput and faster response times. These PICs are also suitable in backbones where higher levels of DS3 and E3 density are needed to meet high-bandwidth demands while conserving valuable POP rack space.<br><br>The DS3 PIC delivers up to 44.736-Mbps connectivity, and the E3 PIC delivers 34.368 Mbps. |
| 4-port E1 and T1 | The E1 and T1 PICs offer high-density, clear-channel and fractional E1/T1 connectivity. These PICs enable service providers to deploy stable, highly reliable, dedicated, leased-line E1/T1 circuits to carry business-critical data in a variety of businesses, both large and small. In addition to providing affordable access, E1 and T1 PICs enable maximum flexibility through rate limiting and multilink services, allowing service providers to deliver IP services as customer needs dictate.<br><br>The E1 PIC delivers up to 2.048-Mbps connectivity, and the T1 PIC delivers 1.544 Mbps. |
| 4-port E3 IQ PIC | Comprehensive CoS/QoS services with four queues per physical / logical interface for service creation per-customer. This includes per-DLCI queuing, fine granularity of rate-control and scheduling, WRR scheduler and strict-priority queuing, RED\weighted RED, ingress and egress policing, egress shaping. Extensive instrumentation and diagnostics It also supports a flexible set of encapsulations including PPP, HDLC, Frame Relay, CCC, and TCC. |

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## Port Density and Flexibility

| Platform | DS3 and E3 | | E1 and T1 |
|---|---|---|---|
| | 2-port | 4-port | 4-port |
| M5/M7i | | | |
| Per chassis | 8 | 16 | 16 |
| Per rack | 120 | 240 | 240 |
| M10/M10i | | | |

| | | | |
|---|---|---|---|
| Per chassis | 16 | 32 | 32 |
| Per rack | 240 | 480 | 480 |
| M20 | | | |
| Per chassis | — | 64 | 64 |
| Per rack | — | 320 | 320 |
| M40e | | | |
| Per chassis | — | 128 | 128 |
| Per rack | — | 256 | 256 |
| M160 | | | |
| Per chassis | — | 128 | 128 |
| Per rack | — | 256 | 256 |
| M320 | | | |
| Per chassis | — | 128 | 128 |
| Per rack | — | 256 | 128 |
| T320 | | | |
| Per chassis | — | 64 | — |
| Per rack | — | 192 | — |
| T640 | | | |
| Per chassis | — | 128 | — |
| Per rack | — | 256 | — |
| — = Not applicable | | | |

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## Key Features

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A few of the key features supported by these PICs include integrated DSU, input policing, output shaping, and rate limiting. Additionally, they support filtering, sampling, load balancing, class of service, and other key features necessary for deploying secure, dependable, high-performance IP services.

DS3 and E3 Integrated DSU
The DS3 PIC is interoperable with Digital Link, Kentrox, and Larscom scrambling mechanisms and Digital

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and Kentrox and Digital Link scrambling mechanisms.

The integrated DSU functionality provides subrate DS3 and subrate E3 connectivity, enables more efficient use of POP rack space, and simplifies circuit management. Moreover, it reduces the number of devices that need to be managed and enables service providers to configure all devices through a single user interface.

Rich Service Creation
These PICs support a full suite of rate limiting features to enable service providers to control the bandwidth on access circuits without having to rely on DSU reconfiguration on the CPE. By simply adjusting the bandwidth rate-limiting configuration on the provider side, service providers can easily move subscribers from one bandwidth tier to another. A fine granularity of rate limiting (for example, by traffic type) is also supported.

IQ PICs support comprehensive QoS capabilities per logical interface for per-DLCI frame relay services. These PICs support ingress and egress policing and egress rate shaping. Service providers can then configure the router's random early detection (RED) or weighted RED mechanisms on outbound interfaces to drop out-of-profile packets more aggressively. Supports 4 queues per logical interface with weighted round robin scheduling and strict priority queuing for traffic prioritization on a per customer basis.

N x E1/T1 Service with MLPPP and MLFR
Using the E1 or T1 PIC with the Multilink Services PIC, service providers can provide n x E1 and n x T1 access service using MLPPP (RFC 1990) or MLFR (FRF.15 or FRF .16). The Link Services PIC bundles up to eight E1 or T1 links per interface, enabling service providers to leverage the existing E1 or T1 copper infrastructure for multimegabit tiered services, rather than migrating to a new capital instensive infrastructure, such as DS3 or E3. By using these PICs together, service providers can aggregate hundreds of multilink bundles in a single chassis without compromising forwarding performance. Any port on any PIC can be bundled with any other number of ports on any number of PICs, no constraints. This multilink solution enables service providers to offer a dynamic solution for growing bandwidth requirements from 1.5 Mbps to 12 Mb

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## Specifications

| Specification | Description |
|---|---|
| General | **DS3**<br>• B3ZS line encoding<br>• C-bit framing<br>• DSU Functionality<br>• DSU Scrambling: Larscom, Digital Link, and ADC Kentrox<br>• DSU Subrate: Larscom and Digital Link<br>• Encapsulations |

- Frame Relay
- HDLC
- MPLS Circuit Cross-connect
- PPP
- TCC

**E1**

- Balanced (120-Ω) and unbalanced (75-Ω) modes
- Encapsulations
  - Frame Relay
  - HDLC
  - MPLS Circuit Cross-connect
  - PPP
  - TCC
- HDB3 line encoding
- Large MTUs, up to 4,500 bytes

**E3**

- Encapsulations
  - Frame Relay
  - HDLC
  - MPLS Circuit Cross-connect
  - PPP
  - TCC
- HDB3 line encoding

**E3 IQ**

- Encapsulations
  - Frame Relay
  - HDLC
  - MPLS Circuit Cross-connect
  - PPP
  - TCC
- HDB3 line encoding

**T1**

- B8ZS or AMI line coding
- Encapsulations
  - Frame Relay
  - HDLC

| | |
|---|---|
| | o MPLS Circuit Cross-connect<br>o PPP |
| Interfaces | **DS3, E3**<br>• 10 ft / 3.05 m posilock SMB to BNC<br>• TX and RX coaxial cables ship with the PIC |
| | **E3 IQ**<br>• Standard E3 BNC connector |
| | **E1**<br>• Connectors<br>o 75-Ω mini-BNC connectors<br>o 120-Ω RJ-48 connectors<br>• 10-ft / 3.05-cm cable ships with the 75-Ω version of the PIC |
| | **T1**<br>• 100-Ω RJ-48 connectors |
| LEDs | One tricolor LED per port<br>Green — Port is online with no alarms or failures<br>Amber — Port is online with alarms or remote failures<br>Red — Port is active with a local alarm; failure detected<br>Off — Port is not enabled |
| Agency Approvals | Safety<br>• CAN/CSA-C22.2 No. 60950-00/UL 60950—Third Edition, Safety of Information Technology Equipment<br>• EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide<br>• EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems<br>• EN 60950, Safety of Information Technology Equipment<br>EMC<br>• AS/NZS 3548 Class A (Australia / New Zealand)<br>• BSMI Class A (Taiwan)<br>• EN 55022 Class A Emissions (Europe) |

| | |
|---|---|
| | • FCC Part 15 Class A (USA)<br>• VCCI Class A (Japan) |
| Immunity | • EN 61000-3-2 Power Line Harmonics<br>• EN 61000-4-2 ESD<br>• EN 61000-4-3 Radiated Immunity<br>• EN 61000-4-4 EFT<br>• EN 61000-4-5 Surge<br>• EN 61000-4-6 Low Frequency Common Immunity<br>• EN 61000-4-11 Voltage Dips and Sags |
| NEBS | Designed to meet these standards<br>• GR-63-CORE: NEBS, Physical Protection<br>• GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment<br>• SR-3580 NEBS Criteria Levels (Level 3 Compliance) |
| ETSI | • ETS-300386-2 Telecommunication Network Equipment Electromagnetic Compatibility Requirements |

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## Ordering Information

| PIC | Platform | Model Number |
|---|---|---|
| DS3 | | |
| 2-port (ships with cables) | M5, M7i, M10, M10i | PE-2DS3 |
| 4-port (ships with cables) | M5, M7i, M10, M10i | PE-4DS3 |
| | M20 | P-4DS3 |
| | M40e, M160, M320, T320, T640 | PB-4DS3 |
| E1 | | |
| 4-port, 75-Ω BNC connectors (ships with cables) | M5, M7i, M10, M10i | PE-4E1-COAX |
| | M20 | P-4E1-COAX |
| | M40e, M160, M320 | PB-4E1-COAX |
| 4-port, 120-Ω RJ-48 connectors | M5, M7i, M10, M10i | PE-4E1-RJ48 |

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| | | |
|---|---|---|
| | M20 | P-4E1-RJ48 |
| | M40e, M160, M320 | PB-4E1-RJ48 |
| E3 | | |
| 2-port (ships with cables) | M5, M7i, M10, M10i | PE-2E3 |
| 4-port (ships with cables) | M5, M10 | PE-4E3 |
| | M20 | P-4E3 |
| | M40e, M160, M320 | PB-4E3 |
| E3 IQ | | |
| 4-port | M5, M7i, M10, M10i | PE-4E3-QPP |
| | M20 | P-4E3-QPP |
| | M40e, M160, M320, T320, T640 | PB-4E3-QPP |
| T1 | | |
| 4-port, 100-☊ RJ-48 connectors | M5, M7i, M10, M10i | PE-4T1-RJ48 |
| | M20 | P-4T1-RJ48 |
| | M40e, M160, M320 | PB-4T1-RJ48 |

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