

XTM SERIES

INTELLIGENT SFP (iSFP)-TDM MODULES

For Transparent TDM Over Packet

Infinera's range of intelligent small form-factor pluggables (iSFP) time-division multiplexing (TDM) modules is used with Infinera's packet-optical transport switches EMXP and network interface devices (NID) to extend capabilities to remote locations or to add TDM functionality to a specific port. The modules included in the iSFP-TDM range integrate intelligent and innovative circuit emulation functions into an SFP module.

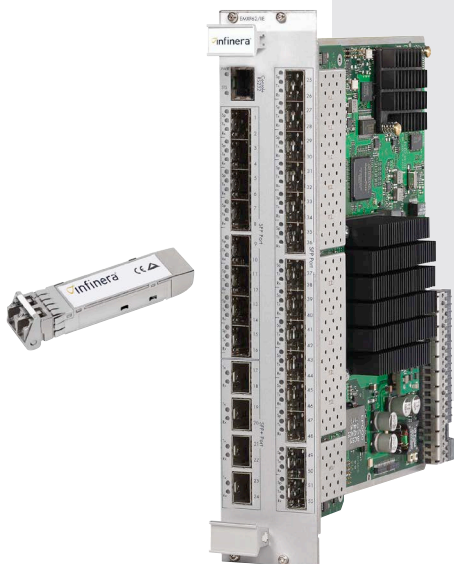
The modules included in the iSFP-TDM range are: iSFP-TDM155, iSFP-TDM622, iSFP2488, iSFP-VC12, iSFP-E1 and iSFP-T1.

The iSFP-TDM modules, together with the EMXPs, are the enabling technology in the Infinera TDM Migration solution.

Integrated with the EMXP

The iSFP-TDM155/622/2488 and iSFP VC12 are managed as an integral part of the EMXP/IIe via the Digital Network Administrator for XTM Series (DNA-M), the Infinera multi-layer management system. This provides a fully integrated and managed solution and allows the iSFP-TDM155/622/2488 and iSFP VC12 to be configured and monitored through the EMXP/IIe.

The iSFP-E1 can be used with the EMXP/IIe, the EMXP/II and the NID-GE. The iSFP-T1 can be used with the EMXP/IIe and the EMXP/II. In cases where the iSFP-E1 is used with the NID-GE, the



Key benefits:

- Provides an SDH/SONET and E1/T1 migration solution through EMXP integration
- Maintains SDH/SONET and E1/T1 services while migrating product offering to Layer 2
- Pluggable technology – enables reuse of EMXP ports for improved economics and flexibility
- Provides fully transparent transport of TDM payload, overhead and synchronization
- Allows Layer 1, Layer 2 and Layer 1 over Layer 2 services to be managed with one common multi-layer management system, DNA-M

NID-GE automatically configures itself to use both client ports. This enables both the E1 and GbE client ports to be used at the same time. The iSFP-E1 and iSFP-T1 have no configuration options and do not need to be managed in the same way as the other iSFP modules.

Migration of TDM Services

With the iSFP-TDM modules, the TDM services are smoothly migrated to the packet-optical network, and are thereby carried over the same network as the Ethernet services. This avoids the need to maintain two separate networks.

Pluggable Technology for Improved Flexibility

When migrating from an SDH/SONET architecture to a Layer 2 network architecture, the ports on the EMXP/IIe can be used individually for either iSFP-TDM modules or as regular gigabit Ethernet ports. Since the iSFP-TDM modules are pluggable, it is easy to move between supporting TDM services and Ethernet services on the same port as demands change over time.

The first figure below shows how the iSFP-TDM155 and the iSFP-TDM622 modules provide fully transparent transport of STM-1/OC-3 and STM-4/OC12 services over a packet-optical network.

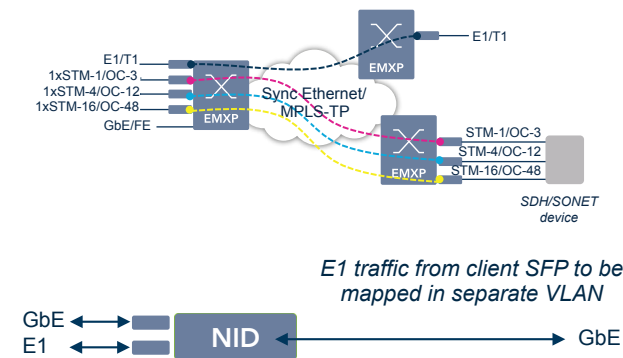


Fig 1 & 2. TDM Services Transparently Transported Over a Packet-Optical Architecture Using the iSFP-TDM Modules.

The second figure shows how the iSFP-E1 module provides an E1 service over a packet-optical architecture.

Migration of Channelized E1 Over STM-1

The iSFP-VC12 converts a fully channelized SDH signal to a packet stream. It has the capability to selectively handle the individual E1 channels carried in VC12 containers within the STM-1. Each E1 can be mapped into its own VLAN and handles two layers of VLAN tagging to identify the individual channels. The individual E1 channels are

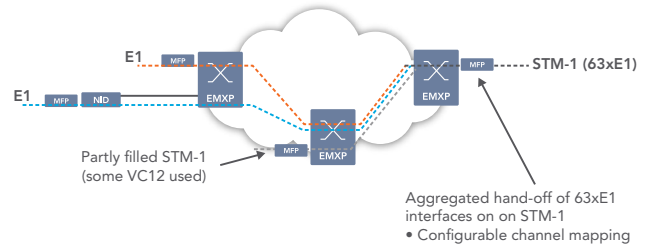


Fig 3. The iSFP-VC12 Enables Both Aggregation of E1 Traffic for Channelized Handoff and the Possibility to Aggregate Traffic from Partly Filled STM-1s.

thus handled independent of each other through the network and are fully transparent.

iSFP-TDM Converts TDM Services into Ethernet Streams

The iSFP-TDM155, iSFP-TDM622 and iSFP-TDM2488 modules perform packetization of the SDH/SONET services, converting an STM-1/OC-3, STM-4/OC-12 or STM-16/OC-48 service into an Ethernet stream of 170, 680 or 2700 Mb/s, creating a transparent bit pipe between two locations in the packet-optical network.

Similarly, the iSFP-E1 converts the E1 service into ≈ 2.2 Mb/s of Ethernet capacity and the iSFP-T1 converts the T1 service into ≈ 1.7 Mb/s of Ethernet capacity.

This allows the migration of the existing E1/T1/SDH/SONET services to the Ethernet network with service adaption at the edge of the network and standard Ethernet traffic between these locations.

The traffic is mapped into an Ethernet virtual circuit (EVC) that can either be transported as an Ethernet service VLAN or via MPLS-TP services.

The transparent SDH/SONET over packet (TSoP) adaption is currently outlined in an open Internet Engineering Task Force (IETF) draft.

This transparent transport ensures complete transfer of data and payload structure, all overhead bytes, protection protocols and synchronization at both STM-1/OC-3, STM-4/OC-12 and STM-16/OC-48.

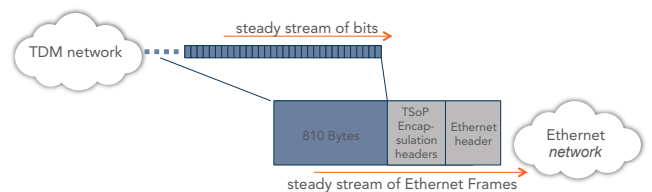


Fig 4. SDH/SONET to Ethernet Mapping.

The illustration above shows how the SDH/SONET to Ethernet mapping (TSoP) works.

The mapping of E1/T1 traffic into packet is performed according to the SAToP standard (RFC4553).

Specifications (iSFP-TDM155, iSFP-TDM622, iSFP-TDM2488 and iSFP-VC12)

| | |
|-----------------------------|--|
| Interfaces | STM-1/OC-3, S1.1 (15 km), 1310, SM (iSFP-TDM155-GE-15 km) STM-4/OC-12, S4.1 (15 km), 1310, SM (iSFP-TDM622-GE-15 km) STM-16/OC-48, SR-1 (2 km), 1310, SM (iSFP-TDM2488-10GE-2 km) STM-1 channelized 1310, SM (iSFP-VC12-GE-15km) |
| Features | Transparent SONET/SDH over packet protocol Digital diagnostics monitoring (DDM) Fully transparent transport of: <ul style="list-style-type: none"> • Payload structures • Overhead bytes and protection protocols • Synchronization • Differential clock recovery with SyncE as the reference clock for RTP (for the non-channelized versions transparency is on interface level, for the channelized version transparency is provided for each individual E1) |
| Management and Support | iSFP-TDM155, iSFP-TDM622, iSFP-TDM2488 and iSFP-VC12 are managed as a port device from EMXP62/Ile and EMXP48/Ile |
| Mechanical | Compliant with SFP MSA LC duplex connector |
| Operating Temperature Range | -40 °C to 85 °C / -40 °F to 185 °F (I-temp) iSFP-TDM2488: 0°C to 70°C / 32 °F to 158 °F |

Specifications (iSFP-E1 and iSFP-T1)

| | |
|-----------------------------|---|
| Interfaces | E1 electrical balanced 120 ohm T1 electrical balanced 100 ohm |
| Features | Transparent E1/T1 over packet protocol Digital diagnostics monitoring (DDM) TDM over packet with RFC4553 (SAToP) Fully transparent transport of: <ul style="list-style-type: none"> • Payload structures • Overhead bytes and protection protocols • Synchronization • Differential clock recovery with SyncE as the reference clock for RTP |
| Management and Support | iSFP-E1 and iSFP-T1 are unmanaged. If no pseudo wire packets are received on the Ethernet side, AIS is sent in the signal |
| Mechanical | Compliant with SFP MSA RJ45 connector |
| Operating Temperature Range | -40 °C to 85 °C / -40 °F to 185 °F (I-temp) |

Specifications and Features Are Subject to Change

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