

# Infinera CloudWave CHM2T/CHM1T Multiservice Transponder

*Doubles the Density, Halves the Power, and Ups the Speed by 50%*

The Infinera CloudWave CHM2T/CHM1T Multiservice Transponder is a hot-swappable slide-in unit of the Infinera Groove G30 Network Disaggregation Platform (NDP). Using Infinera CloudWave T Optics, the latest generation of Infinera coherent detection interface technology, the CHM2T/CHM1T multiservice transponder sets a new world record in capacity, density and low footprint. Delivering 2.4/4.8 Terabits of capacity per 1RU in a compact 2-slot/1-slot wide sled form factor, the new transponder sleds simplify provisioning of cloud connectivity services for metro, regional and long-haul DWDM transport applications. Designed to meet the scalability requirements of today's cloud and data center networks, CloudWave T technology features the industry's most compelling pay-as-you-grow approach that enables the lowest initial costs, reduced equipment sparing costs, and cost-effective scalability.

CloudWave T achieves its leading performance advantage by leveraging the latest innovations in digital signal processing and photonic/electrical integration. This latest generation of optical technology allows the user to increase optical bandwidth to 38.4 Tb/s per fiber pair, using advanced modulation formats and programmable spectrum per wavelength. CloudWave T technology enables a single optical wavelength to carry as much as 600 Gb/s of capacity. For long distance applications such as transcontinental or submarine networks, CloudWave T offers the opportunity to tailor the system to achieve an optimal balance between reach and performance thus maximizing spectral efficiency. Advanced programmability of the line side in terms of baud rate, forward error correction (FEC) and modulation depth allow adaption to any boundary condition to an extent that it is even possible to provide 400G wavelengths on a 50 GHz installed base or improve current 200G reach on a 50 GHz installed base by 40%.

## FEATURING MODULARITY AS A BUSINESS ENABLER

The CHM1T and CHM2T CloudWave T sleds in the Groove G30 NDP are based on the innovative three-tier modular architecture providing a number of competitive advantages to data center interconnect (DCI) and telecom network planners and architects. Four service slots in the Groove G30 1RU chassis support up to four 1-slot CHM1T sleds or two 2-slot CHM2T sleds that are field replaceable, individually configurable and hot swappable. Both the CHM2T and CHM1T provide two integrated 600G line side interfaces. The 2-slot CHM2T module can be equipped with up to 12x100G or 3x400G client interfaces (QSFP28/QSFP-DD). The 1-slot CHM1T module provides up to 3x400G client interfaces based on QSFP-DD pluggables. The sleds/modules and the pluggable interfaces can be purchased and deployed one at a time as required.

## BENEFITS OF THE INFINERA CLOUDWAVE CHM2T/CHM1T MULTISERVICE TRANSPONDER

- **Supports** up to 2.4/4.8 Tb/s client and 2.4/4.8 Tb/s line traffic in a compact 1RU high-density and scalable platform that cost effectively scales DC transport capacity up to 38.4 Tb/s per fiber pair and up to 200/400 Tb/s per 42RU rack
- **Offers** leading energy efficiency due to ultra-low power consumption of 16W per 100G and integrated state-of-the-art dual-carrier 1.2 Tb/s coherent DSP, employing recent advancements in photonic integration and ultra-dense client optics
- **Enables** the lowest first cost 10G to 400G services with an innovative three-tier modularity for capacity growth that includes differentiated pay-as-you-grow service planning and rollout and supports the lowest cost for onsite passive and active sparing
- **Delivers** a truly open platform free of proprietary software and hardware components for rapid introduction and integration within any DC or telecom operating environment and seamless interoperability with any existing metro or long-haul line system
- **Leverages** optical reach and spectrum programmability with line side support for unlimited combinations of modulation schemes and baud rates
- **Provides** open APIs for rapid automation and integration within any IT operational environment to enable fast service roll out and activation



*Infinera Groove G30 CHM2T  
Multiservice Transponder*

# KEY ADVANTAGES OF THE INFINERA CLOUDWAVE CHM2T/CHM1T MULTISERVICE TRANSPONDER

- Highest density
  - 9.6 Tb/s of capacity in compact and modular 1RU
  - 2x improvement over the closest comparable solution
  - Unprecedented OpEx savings as networks scale
- Lowest power consumption
  - 0.16 Watts per Gigabit
  - Up to half the power consumption of competing solutions
  - Ultra-power-efficient, power-as-you-grow operations
- Advanced programmability
  - Programmable baud rate (30-70G baud); FEC (0-27%); fractional QAM and geometrical shaping
  - Optimal spectral efficiency, reach and lowest latency
  - Encryption at line speed
- Unmatched speed and reach
  - 600 Gb/s transmission over a single wavelength (up to 38.4 Tb/s of capacity per fiber)
  - Support for 1000 km terrestrial reach at 400G per wavelength, 4000 km at 200G
  - Support for 400G wavelengths over a deployed 50 GHz grid

## LEVERAGING PROGRAMMABLE MODULATION FORMATS AND BAUD RATES

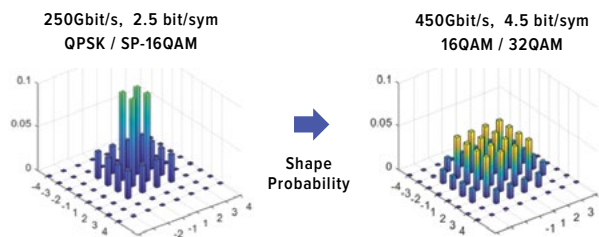
Powered by Infinera CloudWave Optics, the CloudWave T coherent transponder modules, the CHM2T and CHM1T, support programmable DWDM line interface bandwidth and performance to optimize high-capacity transmission from 100G to 600G per wavelength in metro, regional or long-haul applications. The CHM2T/CHM1T feature an almost infinite number of different user programmable line rates and modulation formats to further cost optimize each network design for optimal transparent reach and fiber spectral utilization. Each CloudWave T line side port can be independently configured with modulation formats ranging from QPSK to 64QAM, including space partitioning (e.g., SP-16QAM) or hybrid modulation formats. Advancements in FEC algorithms provide industry-leading signal robustness. The size of the FEC overhead can be programmed up to 27% of the payload signal used. The resulting bandwidth of each individual wavelength is measured by its signal rate, which can range from 30 to 70 GBaud, with the corresponding spectrum used per channel between 31 and 75 GHz (or higher, if desired). Existing networks with a fixed channel grid can be easily reused when adapting the used baud rates to the spectral width of the existing filters.

### MODULATION SHAPING IN THREE DIMENSIONS

**Fractional QAM:** Shape probability of constellation points to adapt capacity to reach

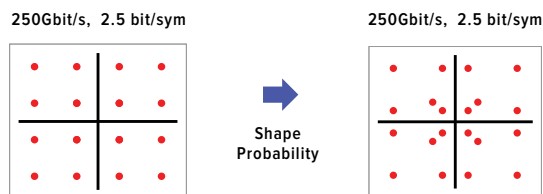
**Geometrical Shaping:** Shape location of constellation points to optimize sensitivity

**Adaptive Baud Rate:** Shape spectrum to available passband



### ENHANCED SD-FEC

Configurable overhead and FEC iterations  
15% overhead and 27% overhead



### LOW POWER CONSUMPTION

Constellations, FEC bandwidth, and baud tuned to desired reach/capacity

Maximum capacity for any network, any distance, any passband

Figure 1: Modulation Shaping with Infinera CloudWave Optics

## SUPPORTING OPEN, FLEXIBLE BANDWIDTH

Each of the eight CloudWave T line side wavelengths can be independently tuned over the entire C-band supporting full flexibility per channel. This means that 96 or 128 channel plans are history and each service will only use the spectrum necessary for its error-free transmission. CloudWave T supports seamless interworking with all Infinera and third-party flexi-grid capable line systems. This includes the Groove G30 OLS and Infinera hiT 7300 Multi-Haul Transport Platform for long-haul interconnectivity applications, as well as any third-party line system that supports either fixed-grid or flexible spectrum provisioning. Optional management and control are available through the Infinera Transcend Software Suite, including the Infinera Transcend Chorus for Transport network management system and the Infinera Transcend Symphony multi-vendor SDN controller.

## SIMPLIFYING INTEGRATION AND OPERATION IN CLOUD AND DATA CENTER ENVIRONMENTS

The CHM2T and CHM1T are delivered within the Groove G30 NDP and provide standards-based interfaces that simplify integration and operation within cloud and data center environments, including support for open Northbound Interfaces (NBIs) and APIs. The supported interfaces include CLI, Web GUI, SNMP Fault and Performance Management, Syslog, Zero Touch Commissioning (ZTC), NETCONF, RESTCONF and gRPC machine-to-machine APIs. The Groove G30 MUX provides a set of native YANG models that can map into any industry standard-defined or proprietary YANG model. These interfaces enable rapid integration of the Groove G30 NDP into traditional telecommunications environments and data center software defined networking (SDN) environments. The Groove G30, including CloudWave T, is fully integrated with Infinera planning, management and control solutions, including Transcend Chorus and the Infinera Transcend Software Suite.

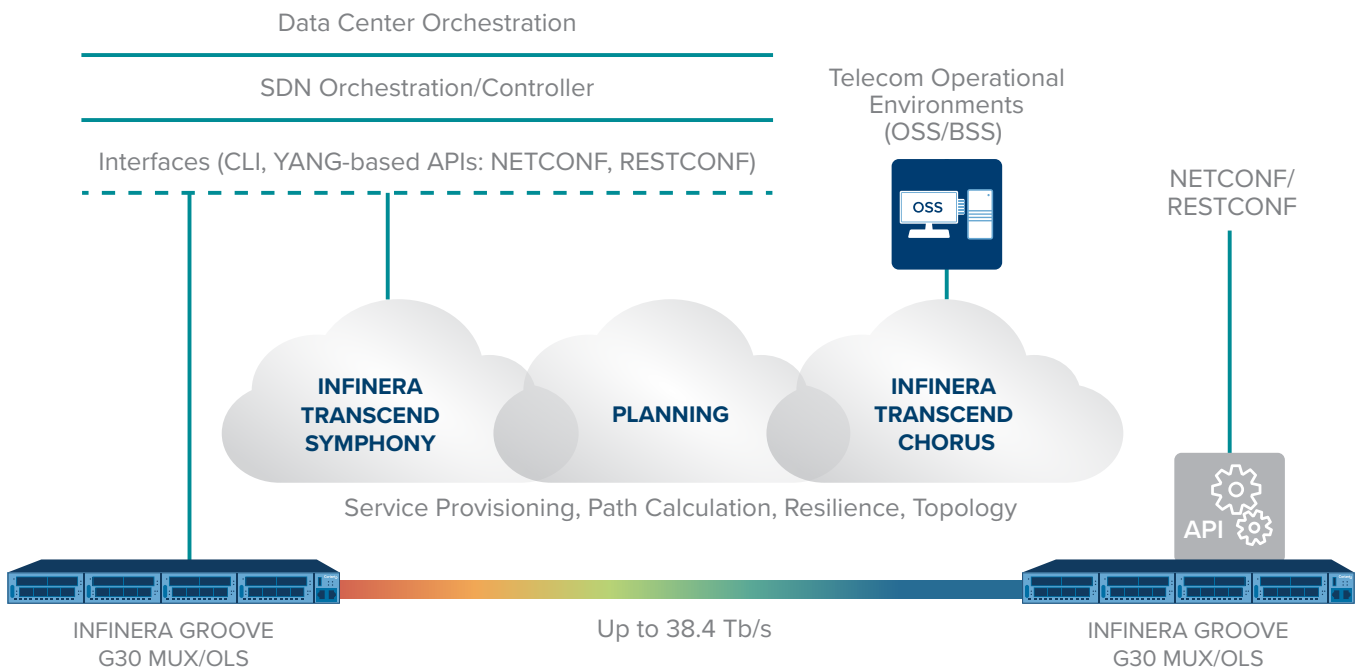


Figure 2: Infinera Groove G30 MUX and OLS Management and Control

**Physical Dimensions of Groove G30**

- 440 x 43.7 x 510 mm / 17.32 x 1.72 x 20.08 in (W x H x D)
- Supports 600 mm depth with cabling
- Rack installation into 2- or 4-post standard 19-inch, 21-inch and 23-inch racks
- Height: 1RU
- Weight: 6.4 kg / 14 lb for 3.2 Tb/s configuration without pluggables

**CHM2T System Capacity and Scalability**

- Maximum line side capacity: 2.4 Tb/s
- Maximum client side capacity: 2.4 Tb/s
- Up to 12 x QSFP28 pluggable (100G)
- Up to 3 x QSFP-DD pluggable (400G)

**CHM1T System Capacity and Scalability**

- Maximum line side capacity: 4.8 Tb/s
- Maximum client side capacity: 4.8 Tb/s
- Up to 3 x QSFP-DD pluggable (400G)

**System Configuration and Modularity in the Groove G30**

- Maximum capacity per fiber: 38.4 Tb/s
- Maximum capacity per rack: ~400 Tb/s
- Four individually configurable and hot-swappable single slot FRUs (1.2T sleds CHM1T)
- Two individually configurable and hot-swappable dual slot FRUs (1.2T sleds CHM2T)
- Single slot FRUs and dual slot FRUs can be mixed within the same system
- Up to 24 x QSFP28 pluggable (100G) in 1RU
- Up to 12 x QSFP-DD pluggable (400G)

**Electrical Power**

- 16W per 100G
- Typical: 200W, Maximum: 240W

**In-band General Communication**

**Channel (GCC) Support**

- Support for GCC0 on line port OTUk (CHM1T/CHM2T)
- 2 GCC channels per module (CHM1T/CHM2T)

**Client Side Interface 400G**

- QSFP-DD LR4, FR4

**Client Side Interfaces 100G/OTU4**

- QSFP28 SR4 (100 m) 100 GbE
- QSFP28 LR4 (10 km) 100 GbE
- QSFP28 CWD4 (2 km) 100 GbE
- QSFP28 PSM4 (500 m) 100 GbE
- QSFP28 Active Optical Cable (3 m and 10 m) 100 GbE

**Line Side Interfaces**

- Integrated Tunable Optical Transceiver
- Line Rate 100 Gb/s to 600 Gb/s
- Tunable Signal Rate 30 Gbaud to 70 Gbaud
- Modulation Formats: CP-QPSK, SP-16QAM, 16QAM, 32QAM, 64QAM, hybrid

**Data Encryption**

- Integrated wire-speed ODU4 AES-256 payload encryption
- Diffie-Hellman (D-H) dynamic key exchange
- Secure key transmission via local OTUk GCC0 communications channel

**Regulatory and Compliance**

- RoHS-6 compliant and lead-free per Directive 2002/95/EC
- GR-3160-Core Generic Requirements for Telecommunications Data Center Equipment and Spaces
- Emissions: FCC Part 15 Class A, EN55022/CISPR Class A Compliant, CE Laser Safety: ANSI Class 1M, IEC Class 1M, EN 60825-1/2, 21 CFR 1040 US FDA CDR, Class 1
- Electrical Safety: UL 60950, CSA22.2 60950 and IEC 60950

**Environmental**

- Operating Temperature: 0°C to 40°C / 32°F to 104°F
- Transport and Storage: -40°C to +70°C / -40°F to 158°F / 40°C + 93% RH
- Humidity: 5% to 90% non-condensing

**Performance Monitoring in the Groove G30**

- Ethernet PMs: 24 hour, 15 min, 1 week, 1 month
- OTN PMs: Tx/Rx, FEC

**Groove G30 Management Options**

- Management and control platforms:
  - Infinera Transcend Chorus for Transport
  - Infinera Transcend Symphony
- NETCONF and RESTCONF YANG model based machine-to-machine APIs
- Command Line Interface (CLI)
- Zero Touch Commissioning (ZTC)
- SNMP fault management
- GUI based Craft Terminal

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