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Infinera Groove (GX) Series G30 – Muxponder

Flexible Compact Modular with 600G Generation Coherent and Open APIs

With benefits including reduced vendor lock-in, faster innovation, and competitive pricing throughout the network lifecycle, leading to lower CapEx and OpEx, optical network disaggregation is being embraced by a wide range of network operators. At the same time, following the Groove (GX) Series G30's lead, the devices used for this network disaggregation have evolved to compact modular form factors with slot-based architectures that provide the flexibility to mix different types of sleds and evolve between technology generations with a common platform. The GX G30 muxponder application has also evolved with the addition of ADM functionality, Open ROADM-compliant options, and 600G generation coherent technology that enables significant improvements in terms of cost per bit, transport for 400 GbE services, power consumption, footprint, and fiber capacity.
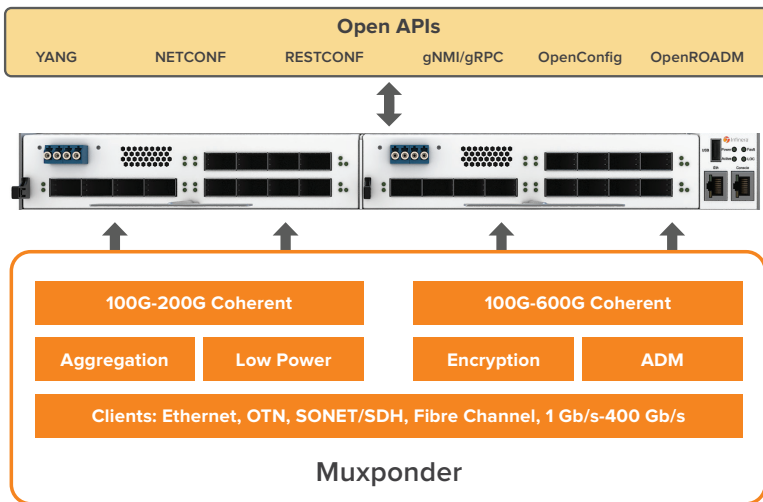

Figure 1: Groove (GX) G30 open muxponder

FLEXIBLE COMPACT MODULAR PLATFORM FOR NETWORK DISAGGREGATION

Part of the GX Series of compact modular platforms, the GX G30 is a 1RU compact modular system that can be supported in 19", 21", and 23" racks with 600 mm or greater depth. It supports redundant AC or DC power supplies, redundant fans with front-to-back airflow and a field-replaceable controller. It has four slots and supports a range of single-slot and double-slot hot-swappable sleds for muxponder applications (see Table 1) and open line system applications (see Infinera Groove (GX) G30 Open Line System Data Sheet).

BENEFITS OF GX G30 MUXPONDERS

- **Leverage** 600G generation coherent to dramatically lower cost per bit (~33% savings), power consumption (~0.2 W/G), and footprint (2.4 Tb/s coherent line per RU), and boost fiber capacity (38.4 Tb/s)

- **Reduce** vendor lock-in and save on CapEx with Open ROADM-compliance and the ability to deploy the GX G30 Muxponder over open line systems and legacy DWDM line systems from Infinera and third parties

- **Transport** 1 GbE, 10 GbE, 40 GbE, 100 GbE, 400 GbE, OTU2/2e, OTU3, OTU4, OC-192/STM-64, and 8G/16G Fibre Channel over a wide range of distances, with optional wire-speed encryption

- **Minimize** operational costs and speed service delivery with automation enabled by RESTCONF/NETCONF open APIs and gNMI/gRPC streaming telemetry

- **Address** muxponder and open line system applications with a common sled-based platform that offers the ability to mix these applications in a single GX G30

Infinera Groove G30 Muxponder

		CHM2T	UTM2	CHM1G	CHM1	CHM2	XTM-2
	Slots	2	2	1	1	2	2
Line	Wavelengths	100G-600G	100G/200G	100G/200G	100G/150G/200G	100G/150G/200G	-
Line	Interfaces	2 x integrated	2 x CFP2-DCO	2 x CFP2-ACO	2 x CFP2-ACO	2 x CFP2-ACO	-
Line	Line per GX G30	2.4 Tb/s	400 Gb/s[1]	1.6 Tb/s	1.6 Tb/s	800 Gb/s	-
Clients	100G/400G QSFP	12 (3 x 400 GbE)	-	-	-	-	-
Clients	40G/100G QSFP	-	-	-	-	10 (4 x 100G, 10 x 40G, 40 x 10G)	-
Clients	100G QSFP28	-	2	4	4	-	2
Clients	40G/4 x 10G QSFP+		2				
Clients	10G SFP+	-	-	-	-	--	20
Clients	1G/10G SFP/SFP+	-	12	-	-	-	-
Other	Encryption	✓	✓	✓	-	✓	✓
Other	Open ROADM FEC	-	✓	✓	-	-	-
Other	ADM	-	✓	-	-	-	✓
Other	8G/16G Fibre Channel	-	✓	-	-	✓	✓

[1] Each UTM2 can support 2 x 100G coherent or 1 x 200G coherent

Table 1: GX G30 muxponder sleds

CHM2T: 600G GENERATION COHERENT MUXPONDER

The 600G generation CHM2T sled leverages a 16-nm DSP and high-performance indium phosphide modulators to deliver two wavelengths ranging from 100 Gb/s to 600 Gb/s in 50 Gb/s increments. It supports a tuneable baud rate from 28 to 72 Gbaud and PM-QPSK/8QAM/16QAM/32QAM/64QAM modulation. Advanced modulation features include hybrid modulation, which provides the ability to mix different QAM symbols in the time domain; geometric shaping, which optimizes the location of the constellation points; and set-partitioned PM-QPSK and PM-16QAM, which provide higher-performance alternatives to PM-BPSK and PM-8QAM respectively. These features have enabled the CHM2T to demonstrate 600G at 250 km. 600G distances of up to 150+ km, 400G distances of up to 2,000+ km, 300G distances of up to 4,000+ km, and 200G distances of up to 7,500+ km can also be achieved with the additional margin required for real network deployments, resulting in average cost savings of around 33% relative to 400G generation coherent. They also enable the CHM2T to maximize fiber capacity and spectral efficiency, delivering up to 38.4 Tb/s per fiber pair and 8 bits/s/Hz with PM-64QAM, while PM-32QAM and hybrid modulation enable increased fiber capacity over a wide range of distances.

| Tuneable Baud Rate (28-72 Gbaud) | High-order Modulation (32QAM and 64QAM) | Hybrid Modulation | Geometric Shaping | Set Partitioning (SP-QPSK, SP-16QAM) |

Figure 2: CHM2T 600G generation coherent

The dual-slot CHM2T provides two 100G-600G line interfaces and 12 x 100G client ports, three of which can be used for 400 GbE. LLDP and RMON are supported for 100 GbE. Wire-speed ODU4 AES-256 encryption for 100G and 400G clients is supported on the line interfaces. It can provide coherent transport for 1,056 x 100 GbE in a single rack and up to 38.4 Tb/s on a single fiber pair, with typical power consumption for a fully loaded G30 of around 0.2 W per Gb/s.

UTM2: OPEN ROADM-COMPLIANT TRANSPONDER/MUXPONDER/ADM

The UTM2 is a dual-slot transponder/muxponder/ADM with two CFP2 ports, two QSFP28 ports, two QSFP+ ports, and 12 SFP+ ports. The UTM2 can deliver 2 x 100G or 1 x 200G coherent leveraging CFP2-DCOs with 16-nm DSP technology, with support for 100G (PM-QSPK), 200G (PM-16QAM), and 200G (PM-8QAM). When available, it will also leverage 7-nm CFP2-DCOs with 100G (PM-QSPK), 200G (PM-16QAM), 200G (PM-8QAM), and 200G (PM-QPSK). It provides Open ROADM-compliant oFEC and ZR/ZR+-compliant cFEC/cFEC+. The two QSFP28 interfaces can support 100G/OTU4, and each of two QSFP+ interfaces can support 40 GbE/OTU3 or 4 x 10G with a QSFP+ breakout cable. The 12 SFP/SFP+ interfaces can support 1 GbE, 10G DWDM, 10 GbE, OTU2/OTU2e, STM-16, OC-48, STM-64, OC-192, and 8G/16G Fibre Channel. Applications include muxponder (i.e., 8 x 1G->10G, 10 x 10G- >100G, 20 x 10G->200G, 2 x 100G->200G), transponder (i.e., 10G->10G DWDM, 100G->100G DWDM), and OTN ADM with support for ODUk hairpinning on both the coherent line and client ports.

CHM2/CHM2L: 200G GENERATION MUXPONDER WITH 100G/40G/10G CLIENTS

The dual-slot CHM2 sled provides two CFP2-ACO coherent flexible rate interfaces with each interface able to support QPSK (100G), 8QAM (150G), and 16QAM (200G). FEC options include 25% FEC with an 11.8 dB net coding gain and 15% FEC for reduced spectrum. Advanced features include non-differential encoding and spectral shaping, including WSS filtering mitigation. It supports chromatic dispersion of >14,000 km (>300 ns/nm), up to 50 ps mean DGD, and SOP rotation (i.e., lightning) tolerance of >3 Mrad/s. Performance monitoring includes CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement, TCM, and PRBS test/loopback.

On the client side, the CHM2 provides for 10 hot-pluggable QSFP ports enabling 10 x 40G QSFP+ (SR4, LR4), 4 x 100G QSFP28 (SR4, PSM4, LR4, CLR4/CWDM4), or 40 x 10GbE with QSFP+ breakout cable (eSR4, LR4). Client services include 10 GbE, 40 GbE, 100 GbE, OTU2/2e, OTU3, OTU4, STM-64, OC-192, and 8/16 Fibre Channel. LLDP is supported for Ethernet clients. An encryption-capable variant of the CHM2 is available with support for wire-speed AES-256 of ODU2 and ODU4 payloads on the line interface. The CHM2L variant has a fixed CFP2-ACO for optimized ultra-long-haul/subsea performance.

Wavelength Speed	Modulation	Max Reach	Fiber Capacity
200 Gb/s	PM-16QAM	1,000 km	25.6 Tb/s
150 Gb/s	PM-8QAM	2,000 km (2,500 km subsea)	19.2 Tb/s
100 Gb/s	PM-QPSK	4,000 km (12,000 km subsea)	9.6 Tb/s

Table 2: CHM1/CHM2 reach and fiber capacity

CHM1/CHM1L: HIGH-DENSITY 200G GENERATION MUXPONDER

The CHM1 is a single-slot version of the CHM2 sled with 4 x 100GbE/OTU4 QSFP28 (SR4, PSM4, LR4, CLR4/CWDM4) enabling up to 1.6 Tb/s of coherent line capacity and 16 x 100G clients in a single rack unit. The CHM2L variant has a fixed CFP2-ACO for optimized ultra-long-haul/subsea performance. Typical power consumption for a fully loaded GX G30 (i.e., 4 x CHM1) is less than 0.45 W per Gb/s.

CHM1G: POWER-EFFICIENT 200G GENERATION MUXPONDER WITH 100G CLIENTS

The CHM1G is a version of the CHM1 leveraging a 16-nm ASIC/DSP to deliver 30% lower power consumption (<0.3 W per Gb/s). It supports an Open ROADM 100G-compliant 7% staircase FEC and a 200G mode leveraging 42 Gbaud and PM-8QAM. A variant of the CHM1G is available with support for wire-speed ODU4 AES-256 encryption on the line port. Typical power consumption for a fully loaded GX G30 is less than 0.3 W per Gb/s.

XTM2: 10G TO 100G AGGREGATION

The dual-slot XTM2 provides two 100G/OTU4 QSFP28 ports and 20 SFP+ ports that can be used for 10 GbE, OTU2/2e, STM-64, OC-192, and 8G/16G Fibre Channel. The XTM2 can be used to provide 10G interfaces (groomed onto OTU4s) for GX G30 sleds such as the CHM1, CHM1G, and CHM2T. It provides ODUk-level cross-connection including hairpinning, enabling it to act as an ADM. It can also be used as a 10 x 10G transponder leveraging tuneable DWDM SFP+ pluggables in the 10G line ports. A variant of the XTM2 is available with support for wire-speed AES-256 encryption of ODU2/ODU2e payloads on the OTU2 interfaces and ODU2/ODU2e/ODU4 payloads on the OTU4 interfaces.

LEVERAGE THE SAME PLATFORM FOR OPEN LINE SYSTEM FUNCTIONS

The GX G30 supports a wide range of optical layer functions, including variable gain amplifiers, OTDR, optical protection switching, optical channel monitoring, optical supervisory channel, tuneable dispersion compensation, eight-channel DWDM filters, eight- and 16-channel colorless add/drop, dynamic gain equalization, and 4 x 1 WSS for four-degree ROADM application in the compact OFP2 form factor of Infinera's innovative Pluggable Optical Layer. Up to three of these OFP2s can be housed in the double-slot OCC-2 sled. A nine-degree ROADM with integrated amplifiers, OCMs, and Open ROADM-compliant OSC is available as a double-slot sled, as are 48- and 96-channel mux/demux filters. ROADM add/drop options include colored-directional, colorless-directional, and colorless-directionless. A 64-channel 75 GHz filter for high-baud-rate wavelengths is available as a 2RU external unit. Leveraging these functions, the GX OLS can address a wide range of applications, including point-to-point DCI, ring, and chain topologies, as well as metro-regional mesh ROADM. For more details see the Groove (GX) G30 - Open Line System Data Sheet.

AUTOMATION ENABLED BY OPEN APIS AND STREAMING TELEMETRY

The GX G30 Muxponder supports management, automation, and streaming telemetry via open interfaces. It supports WebGUI, CLI, SNMP, TACACS+, syslog and YANG-modeled NETCONF and RESTCONF APIs, and gNMI/gRPC streaming telemetry. It is OpenConfig and Open ROADM compliant. An OSPF-based DCN is supported with in-band management via GCC (or OSC with GX G30 OLS) and out-of-band management via RJ-45 Ethernet interfaces. Multiple GX G30 units can be managed as a single entity, while additional manageability features include zero-touch commissioning (ZTC), RMON, LLDP, and PRBS test generation and loopbacks. The GX G30 is also supported under Infinera Transcend Controller/NMS and Infinera DNA NMS.

TECHNICAL SPECIFICATIONS

Groove G30 Physical Dimensions
- Height: 1RU, 44 mm, 1.73 inches
- Width: 440 mm, 17.3 in
- Depth: 510 mm, 20.1 in
- Rack installation into two- or four-post standard 19-inch, 21-inch, and 23-inch racks
- Weight: 3.2 kg/7.1 lb configuration without sleds

Groove G30 System Configuration and Modularity
- Four single-slot sleds
- Two dual-slot sleds
- Single-slot sleds and dual-slot sleds can be mixed within the same system
- All sleds are field replaceable and hot swappable

Electrical Power
- 220 V AC PSU
- 48 V DC PSU
- 240 V DC PSU
- 1:1 PSU redundancy
- Field-replaceable units

Cooling and Fans
- Front-to-back straight-through air flow
- 4:1 fans, field-replaceable units, indefinite operation with a single fan failure
- Filler cards required in unused slots

Management and Console Ports
- 2 x RJ-45 front access
- 2 x RJ-45 rear access
- 1 x USB front access
- Field-replaceable controller and SD memory card

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
- Telcordia GR-326-Core Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- Telcordia GR-1435-Core Generic Requirements for Multi-Fiber Optical Connectors
- 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

Management Options
- Management and control platforms:
  - Infinera Transcend Controller
  - Infinera Transcend NMS
  - Infinera DNA NMS
- Command line interface (CLI)
- Zero-touch commissioning (ZTC)
- Syslog
- TACACS+
- WebGUI
- NETCONF
- Declarative Config
- RESTCONF
- Native YANG models
- OpenConfig
- Open ROADM
- gNMI/gRPC
- SNMP Fault and Performance Management
- OSPF-based DCN
- Multiple GX G30 units can be managed as a single entity

CHM2T
- Dual-slot (max two per GX G30)
- 600G generation coherent technology with 16-nm dual-wavelength DSP and high-performance indium phosphide modulators

CHM2T cont.
- 2 x integrated coherent line Interfaces
  - 100 Gb/s-600 Gb/s in 50G Increments
  - Tuneable 28-72 Gbaud
  - PM-QPSK/8QAM/16QAM/32QAM/64QAM
  - Time domain hybrid modulation
  - Geometric shaping
  - Set partitioning:
  - PM-SP-QPSK (2 bits/symbol), high-performance alternative to PM-BPSK
  - PM-SP-16QAM (6 bits/symbol), high-performance alternative to PM-8QAM
  - Non-differential encoding
  - FEC: 27% (12 dB NCG) or 15%
  - Spectral shaping including WSS filtering mitigation
  - Non-linear compensation
  - 50 ms line protection including coherent colorless add/drop
  - Performance monitoring: CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement
  - Chromatic dispersion tolerance of >300 ns/nm (100 Gb/s PM-QPSK)
  - PMD: Up to 50 ps mean DGD (100 Gb/s PM-QPSK)
  - SOP rotation tolerance: >3 Mrad/s (100 Gb/s PM-QPSK)
- 12 x QSFP client interfaces
  - 12 x 100 GbE/OTU4 QSFP28 (SR4, LR4, ER4, PSM4, CWDM4, active optical cable)
  - 3 x 400 GbE QSFP-DD (SR8/AOC, FR4, DR4, LR8)
- GCCO in-band management on the line port OTUk
- PRBS test and loopback
- LLDP and RMON support (100 GbE)
- Wire-speed ODU4 AES-256 encryption for 100G and 400G clients on line interfaces
- Power consumption: ~0.2 W per Gb/s (fully loaded GX G30 at 600 Gb/s line rate)

UTM2
- Dual-slot (max two per GX G30)
- Applications: transponder, muxponder, ADM
- 2 x 100G/200G CFP2-DCO
  - CFP2-DCO options with Open ROADM-compliant FEC (oFEC) and ZR/ZR+-compliant FEC (cFEC/cFEC+)
  - Max 2 x 100G coherent or 1 x 200G coherent per UTM2

- 2 x QSFP28
  - 100GbE/OTU4)
- 2 x QSPF+
  - 40G (40 GbE/OTU3)
  - 4 x 10G with QSFP+ breakout
- 12 x SFP/SFP+
  - 1 GbE, 10 GbE, OTU2/OTU2e, STM-64, OC-192, and 8G/16G Fibre Channel
  - Tuneable DWDM SFP+ option
- GCCO in-band management on the line port OTUk
- PRBS test and loopback
- LLDP support (Ethernet clients)
- Wire-speed AES-256 encryption (hardware-ready)

CHM2
- Dual-slot (max two per GX G30)
- 2 x coherent flexible rate line interfaces
  - CFP2-ACO pluggables
  - PM-QPSK (100 Gb/s)
  - PM-8QAM (150 Gb/s)
  - PM-16QAM (20 0Gb/s)
  - FEC: 25% (11.8 dB NCG) or 15%
  - Non-differential encoding
  - Spectral shaping including WSS filtering mitigation
  - Chromatic dispersion tolerance of >300 ns/nm (100 Gb/s PM-QPSK)
  - PMD: Up to 50 ps mean DGD (100 Gb/s PM-QPSK)
  - SOP rotation tolerance: >3 Mrad/s (100 Gb/s PM-QPSK)
  - Performance monitoring: CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement, and TCM
  - 50 ms line protection including coherent colorless add/drop
- 10 x QSFP client interfaces
  - 10 x 40 GbE QSFP+ (LR4, eSR4, IR4, ER4)
  - 40 x 10 GbE/8G FC/16G FC (QSFP+ with breakout cable)
  - 4 x 100G/OTU4 QSFP28 (SR4, LR4, ER4, PSM4, CWDM4, active optical cable)
- GCCO in-band management on the line port OTUk
- PRBS test and loopback
- LLDP support (Ethernet clients)
- Wire-speed AES-256 encryption of ODU2/ODU2e and ODU4 payloads on the line interfaces (requires encryption hardware variant)

CHM1
- Single-slot (max four per GX G30)
- 2 x coherent flexible rate line interfaces
  - CFP2-ACO pluggables
  - PM-QPSK (100 Gb/s)
  - PM-8QAM (150 Gb/s)
  - PM-16QAM (200 Gb/s)
  - FEC: 25% (11.8 dB NCG) or 15%
  - Non-differential encoding
  - Spectral shaping including WSS filtering mitigation
  - Chromatic dispersion tolerance of >14,000 km (>300 ns/nm)
  - PMD: Up to 50 ps mean DGD
  - SOP rotation tolerance: >3 Mrad/s
  - Performance monitoring: CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement, and TCM
  - 50 ms line protection including coherent colorless add/drop
- 4 x 100G/OTU4 QSFP28 (SR4, LR4, ER4, PSM4, CWDM4, active optical cable)
- GCCO in-band management on the line port OTUk
- PRBS test and loopback
- Power consumption: <0.45 W per Gb/s (fully loaded GX G30 at 200 Gb/s line rate)

CHM1G
- Single-slot (max four per GX G30)
- Low-power 16-nm DSP
- <0.3 W per Gb/s in fully loaded GX G30
- 2 x coherent flexible rate line interfaces
  - CFP2-ACO pluggables
  - 100 Gb/s (PM-QPSK)
  - 200 Gb/s (PM-16QAM)
  - Extended reach 200 Gb/s (PM-8QAM, 42 Gbaud)
  - FEC: 7% staircase (Open ROADM-compliant for 100G), 15%, 25%
- 4 x 100G/OTU4 QSFP28 (SR4, LR4, ER4, PSM4, CWDM4, active optical cable)
- GCCO in-band management on the line port OTUk
- PRBS test and loopback
- Wire-speed AES-256 encryption of ODU4 payloads on the line interfaces (requires encryption hardware variant)
- Power consumption: <0.3 W per Gb/s (fully loaded GX G30 at 200 Gb/s line rate)

XTM2
- Dual-slot (max two per GX G30)
- 2 x QSFP28
  - OTU4 (SR4, LR4, ER4)
- 20 x SFP+:
  - 10 GbE, OTU2/2e, STM-64, OC-192, 8G/16G FC
  - Tuneable (88 channels) DWDM SFP+ option

- Applications: 10G aggregation/fanout, 10 x 10G transponder, ADM
- Wire-speed AES-256 encryption of ODU2/ODU2e payloads on the OTU2 interfaces and ODU2/ODU2e/ODU4 payloads on the OTU4 interfaces (requires encryption hardware variant)

Product features and specifications are subject to change