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10G (OC-192/STM-64) Module Technical Specifications

OC-192/STM-64

Requirements	Meets the requirements of GR-253 (OC-192) and ITU-T G.707 (STM-64)
Line Code	NRZ
Mapping	OC-192: STS-48, STS-192c (per ANSI T.105.02) STM-64: AU-4-64c, AU-4-16c (per ITU-T G.707) Configuration-dependent support of additional mappings listed in the OC-48/STM-16 and OC-1/STM-0 through OC-12/STM-4 sections
Line Rate	Tx: N x 51.84 MHz, Rx: N x 51.84 MHz, Stratum III compliant, offset capability ±100 ppm
Input Signal Measurement	Optical power meter: 0 to -26 dBm, ±1.5 dB, Frequency measurement range: N x 51.84 MHz, ±200 ppm
Synchronization	Internal, received SONET or SDH signal, BITS (1.544 Mbps), SETS (2.048 Mbps)
Level (Tx)	1310 nm: single-mode, Intermediate reach-compliant, 1290 to 1330 nm, 1310 nm typical, 0 dB 1550 nm: Intermediate reach-compliant, single-mode, 1530 to 1565 nm, 1550 nm typical, 0 dB
Level (Rx)	-2 dBm to -14 dBm, -20 typical minimum at 10^{-10} BER with 2^{23} -1 PRBS
Spectral Range (Rx)	1290-1600 nm
Connectors	SC, FC-PC, ST
Error Measurement	OC-192: B1, B2, REI-L, B3, REI-P, BIT, NDF errors STM-64: B1, B2, MS-REI, B3, HP-REI, BIT, NDF errors (performance measurements per G.821, G.826, M.2101.1)
Alarm Detection	OC-192: LOF, LOS, SEF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P, pattern sync, concatenation: RS-TIM, HP-TIM, HP-PLM; STM-64: LOF, LOS, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, RS-TIM, HP-TIM, HP-PLM, pattern sync, concatenation
Alarm Generation	OC-192: LOF, LOS, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P; STM-64: LOF, LOS, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ
Patterns	PRBS (normal and inverted): 2^{15}-1 PRBS, 2^{23}-1 PRBS, 2^{31}-1 PRBS, all 0's, all 1's, user-defined 32-bit pattern (per ITU-T 0.151)
APS Commands	Supports transmission/reception of linear and ring-mode command sequences for K1/K2 bytes (per G.841)
Pointer Control	New value, single adjustments (increment or decrement), burst 2^{-8} adjustments, increment-decrement, decrement-increment, NDF control, SPE offset, pointer sequences
Control and Monitoring	OC-192: Overhead: Transmit control over bytes: Transport OH: A1, A2, C1, Z0, D1-D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; Path OH: C2, F2, G1, J1 (Trace), Z3, Z4, Z5; Receive monitor: Transport OH: All bytes; Path OH: All bytes STM-64: Overhead: Transmit control over bytes: MSOH: A1, A2, Z0, D1-D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; HP OH: C2, F2, G1, J1 (Trace), F3, K3, N1; Receive monitor: RSOH: All bytes HP OH: All bytes
Intrusive / Non-intrusive Through Mode	Provides the ability to regenerate optical signal and optionally modify section and line overhead bytes
Error Injection	OC-192: B1, B2, REI-L, B3, REI-P, BIT STM-64: B1, B2, MS-REI, B3, HP-REI, BIT
Error Injection Rate	BIT: Single, 10^{-10} to 10^{-3}, user-programmable; other errors: Single, 10^{-10} to maximum, user-programmable
Switch to Protect Measurement	Measure on B1, SEF, OOF, AIS-L, MS-AIS, AIS-P, AU-AIS, and PRBS; 125 microsecond resolution
Round-Trip Delay (RTD) Measurement	Measurement ranges: 125 microseconds resolution
Tandem Connection Monitor	In accordance with G.707/ Annex D for High Order Path (via N1), Errors/Alarms: TC-IEC, TC-REI, TC-OEI, TC-AIS,TC-UNEQ, TC-RDI, TC-ODI, TC-LOF, TC-API

10G Packet over SONET/SDH Option

No. of Ports/Modules	1
Packet Statistics	NRZ
Mapping	Counts, seconds: All sent frames, all received frames, all received bytes, all de-stuffed bytes, all PPPs, valid PPPs, all IPs, valid IPs, all UDPs, valid UDPs; Counts, average rate, current rate, seconds: Invalid frame check (CRC-32), invalid UDP, BIT errors for a specified substream (destination IP address, pattern, protocol)
Error Generation	FCS errors (CRC32), IP checksum and BIT errors
Traffic Generation	Single-signal traffic generators with configurable: Source IP address (fixed), destination IP address (fixed), source port, destination port, transmit protocol UDP, payload size, data rate - % bandwidth, pattern -32 BIT, user defined pattern, PRBS^31, or PRBS^31 inverted
Frame Length	Octet synchronous HDLC-like, framing (RFC 1619 / 1662), variable from 40 bytes to 1.5 Kbytes
Maximum Packet Rate	1 flag between packets -> 29.22 million packets/second at 40 bytes
IP.UDP	Checksum
PPP	LCP/IPCP/negotiation

Specifications are subject to change without notice.

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10G (OC-192/STM-64) Module Technical Specifications

10G Mapping Option

Requirements	Meets the requirements of GR-253 (OC-192) and ITU-T G.707 (STM-64)
Line Code	NRZ
Mapping	OC-192: STS-192/STS-192c, STS-192/STS-48c, STS-192/STS-12c, STS-192/STS-3c, STS-192/STS-1 (per ANSI T.105.02) STM-64: AUG64/AU-4-64c, AUG64/AUG16/AU-4-16c, AUG64/AUG16/AU-4-4c, AUG64/AUG16/AUG4/ AUG1/AU-4, AUG64/AUG16/AUG4/AUG1/AU-3 (per ITU-T G.707)
Line Rate	10 Gbps, Stratum III compliant, offset capability ±100 ppm
Input Signal Measurement	Optical power meter: 0 to -26 dBm, ±1.5 dB, Frequency measurement range: N x 51.84 MHz, ±200 ppm
Synchronization	Internal, received SONET or SDH signal, BITS (1.544 Mbps), SETS (2.048 Mbps)
Level (Tx)	1310 nm: Intermediate reach-compliant, single-mode, 1290 to 1330 nm, 1310 nm typical, 0 dB 1550 nm: Intermediate reach-compliant, single-mode, 1530 to 1565 nm, 1550 nm typical, 0 dB
Level (Rx)	-2 dBm to -14 dBm, -20 typical minimum at 10-10 BER with 2^{23}-1 PRBS
Spectral Range (Rx)	1290 to 1600 nm
Connectors	SC, FC-PC, ST
Error Measurement	OC-192: B1, B2, REI-L, B3, REI-P, BIT, NDF errors; STM-64: B1, B2, MS-REI, B3, HP-REI, BIT, NDF errors (performance measurement per G.821, G.826, M.2101.1)
Alarm Detection	OC-192: LOF, LOS, SEF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P, pattern sync, concatenation: RS-TIM, HP-TIM, HP-PLM; STM-64: LOF, LOS, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, RS-TIM, HP-TIM, HP-PLM, pattern sync, concatenation
Alarm Generation	OC-192: LOF, LOS, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P; STM-64: LOF, LOS, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ
Patterns PRBS (normal and inverted)	2^{15}-1 PRBS, 2^{23}-1PRBS, 2^{31}-1, PRBS, all 0's, all 1's, user-defined 32-bit pattern (per ITU-T 0.151)
APS Commands	Supports transmission/reception of linear and ring-mode command sequences for K1/K2 bytes (per G.841)
Pointer Control	New value, single adjustments (increment or decrement), burst 2^{-8} adjustments, increment-decrement, decrement-increment, NDF control, SPE offset, pointer sequences
Control and Monitoring	OC-192: Overhead: Transmit control over bytes: Transport OH: A1, A2, C1, Z0, D1-D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; Path OH: C2, F2, G1, J1 (Trace), Z3, Z4, Z5; receive monitor: Transport OH: all bytes Path OH: all bytes, STM-64: Overhead: Transmit control over bytes: Section OH: A1, A2, Z0, D1 to D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; HP OH: C2, F2, G1, J1 (Trace), F3, K3, N1; receive monitor: Section OH: All bytes, HP OH: All bytes
Intrusive/Non-Intrusive Through Mode	Provides the ability to regenerate optical signal and optionally modify section and line overhead bytes
Patterns	2^9-1, 2^9-1 inverted, 2^1 -1, 2^{11}-1 inverted, 2^{15}-1, 2^{15}-1 inverted, 2^{20}-1, 2^{20}-1 inverted, 2^{23}-1, 2^{23}-1 inverted, any user-defined pattern up to 32 bits, ATM (mapping); pass through with drop and insert: E3 pass through with drop/insert of a single E1 for test (per ITU-T 0.151)
Error Injection	OC-192: B1, B2, REI-L, B3, REI-P, BIT STM-64: B1, B2, MS-REI, B3, HP-REI, BIT
Error Injection Rate	BIT: Single, 10^{-10} to 10^{-3}, user-programmable; other errors: Single, 10^{-10} to maximum, user-programmable
Switch to Protect Measurement	Measure on B1, SEF, OOF, AIS-L, MS-AIS, AIS-P, AU-AIS, and PRBS; 125 microsecond resolution
Round-Trip Delay (RTD) Measurement	Measurement ranges: 125 microseconds resolution
Tandem Connection Monitor	In accordance with G.707/ Annex D for High Order Path (via N1), Errors/Alarms: TC-IEC, TC-REI, TC-OEI, TC-AIS, TC-UNEQ, TC-RDI, TC-ODI, TC-LOF, TC-API

Digital Lightwave®

www.lightwave.com
info@lightwave.com

United States/Caribbean
15550 Lightwave Drive
Clearwater, FL 33760
Toll free: +1 877 442 DIGL
T: +1 727 442 6677
F: +1 727 442 5660

Europe/Middle East/Africa
Eastway Enterprise Centre
7 Paynes Park
Hitchin Hertfordshire
England SG51EH
T: +44 (0) 1462 429719
F: +44 (0) 1462 429760

Asia/Pacific Rim
Digital Lightwave Asia Pacific Pty. Ltd.
236 Balaclava Road
Caulfield North, Victoria
Australia 3161
T: +61 3 9509 4610
F: +61 3 9509 4615

Latin America
Digital Lightwave Ltd.
Rua Helade, 81
Sao Paulo, Brazil 04634-000
T: +55 11 5034 7277
F: +55 11 5034 7424

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