

2.5 Gb/s CWDM SFP Transceiver (Multirate) CT2 Series



Key Features

- SFP MSA compatible
- 2.5 Gb/s compliant CWDM performance for short haul and long haul
- Microprocessor-based design fully implements the Digital Diagnostic Monitoring Interface
- Automatic output power and extinction ratio control over temperature and lifetime to compensate for laser efficiency degradation
- Both PIN and APD versions meet -27 dB receiver reflectance
- Optical parameters tuned and optimized over temperature in production test

Applications

- Metro access
- Metro core
- Wide area networks
- Optical crossconnects

Compliance

- GR-253-CORE
- ITU-T G.957
- SFF-8472 Revision 9.3
- ITU-T G.695

The JDSU CT2 Series 2.5 Gb/s Coarse Wavelength Division Multiplexing (CWDM) transceiver integrates optics and electronics in a Small Form Factor Pluggable (SFP) package. It is Multisource Agreement (MSA) compatible and designed for CWDM operation per ITU-T G.695 for unidirectional 8 channel black-link transmission (S-C8S1-1DX and S-C8L1-1DX). Although optimized for 2.5 Gb/s, the CT2 provides multi-rate capabilities and can be used for various protocols ranging from OC-3 (155 Mb/s) up to 2.7 Gb/s including 622 Mb/s, 1x/2x FC, GbE and 2x GbE.

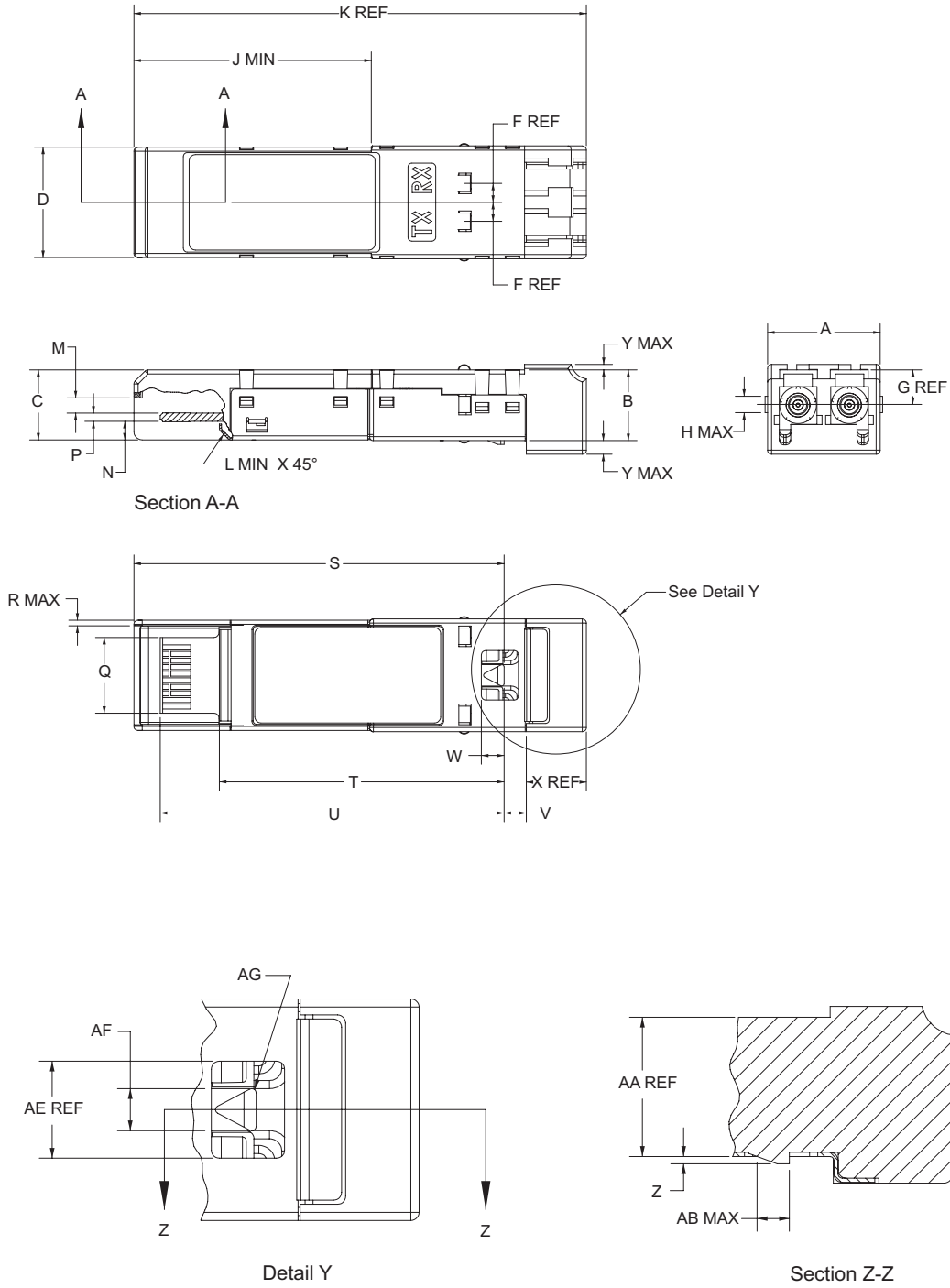
The CT2 Series CWDM SFP transceiver provides a fully G.695 8 channel black-link compliant interface between the optical Mux/Demux photonic layer and the electrical layer. Its microprocessor-based modular design implements all features specified in the SFP MSA compatible 2-wire Serial Digital Diagnostic Monitoring Interface for Optical Transceivers.

The major components in this module include an uncooled distributed feedback (DFB) based optical transmitter, a PIN or APD based optical receiver with integrated transimpedance amplifier (TIA), an APD high voltage circuit (if required), a microprocessor, a limiting post amplifier, and a laser driver. This CWDM transceiver design offers a "hot-pluggable" interface and is available in short haul (40 km, PIN) and long haul (80 km, APD) configurations.

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Dimensions Diagram

(Specifications in mm unless otherwise noted; see dimensions table on next page.)



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Dimension Table for the CT2

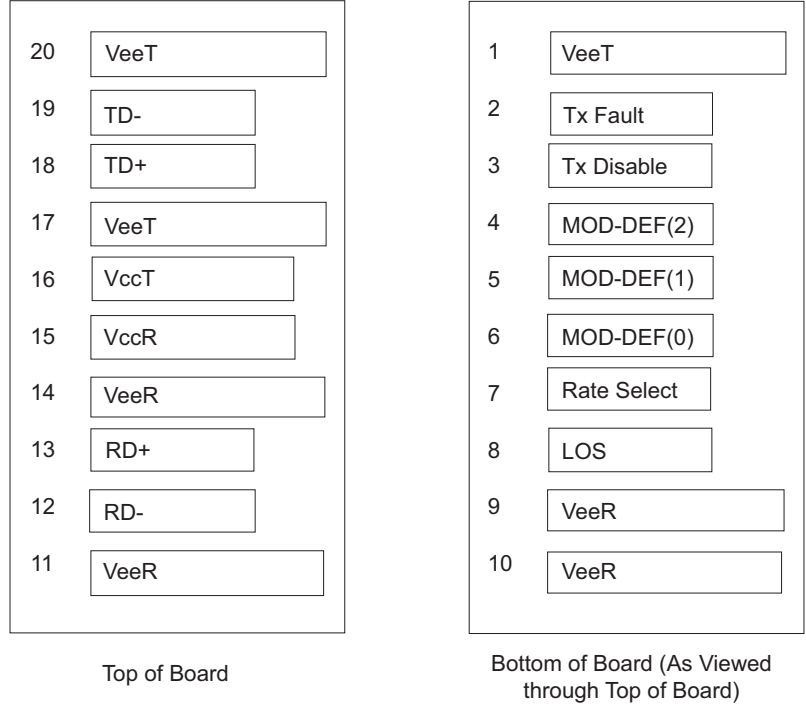
Designator	Dimension	Tolerance	Comments
A	13.7 mm	±0.1 mm	Transceiver width, nose piece or front that extends inside cage
B	8.6 mm	±0.1 mm	Transceiver height, front, that extends inside cage
C	8.5 mm	±0.1 mm	Transceiver height, rear
D	13.4 mm	±0.1 mm	Transceiver width, rear
E	1.0 mm	Maximum	Extension of front sides outside of cage
F	2.3 mm	Reference	Location of cage grounding springs from centerline, top
G	4.2 mm	Reference	Location of side cage grounding springs from top
H	2.0 mm	Maximum	Width of cage grounding springs
J	28.5 mm	Minimum	Location of transition between nose piece and rear of transceiver
K	55.0 mm	Reference	Transceiver overall length
L	1.1 mm x 45°	Minimum	Chamfer on bottom of housing
M	2.0 mm	±0.25 mm	Height of rear shoulder from transceiver printed circuit board
N	2.25 mm	±0.1 mm	Location of printed circuit board to bottom of transceiver
P	1.0 mm	±0.1 mm	Thickness of printed circuit board
Q	9.2 mm	±0.1 mm	Width of printed circuit board
R	0.7 mm	Maximum	Width of skirt in rear of transceiver
S	45.0 mm	±0.2 mm	Length from latch shoulder to rear of transceiver
T	34.6 mm	±0.3 mm	Length from latch shoulder to bottom opening of transceiver
U	41.8 mm	±0.15 mm	Length from latch shoulder to end of printed circuit board
V	2.7 mm	±0.05 mm	Length from latch shoulder to shoulder of transceiver outside of cage (location of positive stop)
W	2.7 mm	±0.1 mm	Clearance for actuator tines
X	7.3 mm	Reference	Transceiver length extending outside of cage
Y	2.0 mm	Maximum	Maximum length of top and bottom transceiver extending outside of cage
Z	0.45 mm	±0.05 mm	Height of latch boss
AA	8.6 mm	Reference	Transceiver height, front, that extends inside the cage
AB	2.6 mm	Maximum	Length of latch boss
AE	6.0 mm	Reference	Width of cavity that contains the actuator

Bail Latch Color Code Definition

Bail Latch Color	Wavelength	Typical Reach
Gray	1471 nm	Short haul/Long haul
Violet	1491 nm	Short haul/Long haul
Blue	1511 nm	Short haul/Long haul
Green	1531 nm	Short haul/Long haul
Yellow	1551 nm	Short haul/Long haul
Orange	1571 nm	Short haul/Long haul
Red	1591 nm	Short haul/Long haul
Brown	1611 nm	Short haul/Long haul

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CT2 Electrical Pad Layout



Transceiver Pin Descriptions

Pin	Description
TD	Un-clocked, multirate, differential serial bit stream (155 Mb/s to 2.7 Gb/s) used to drive the optical transmitter.
TDb	Internally AC coupled and terminated via internal 100 Ω differential impedance.
RD	Differential received electrical signal capable of detecting 155 Mb/s to 2.7 Gb/s bit patterns.
RDb	The differential pair is internally biased and AC coupled. This signal requires 100 Ω external differential termination.
Rate_select	Internally monitored and available for future use. Can be customized for specific applications.
TxDIS	Transmitter Disable Input. A logic HIGH on this input pin disables the transmitter's laser so that there is no optical output. If left open the transmitter will be disabled.
LOS	Loss of Signal (Open Collector). A logic HIGH on this output indicates an incoming signal level that is less than -25 dBm but no greater than -31 dBm for the 40 km configuration and less than -34 dBm but no greater than -40 dBm for the 80 km configuration. LOS shall deassert (logic LOW) when a 3 dB (maximum), 0.5 dB (minimum) hysteresis is obtained.
Tx_fault	Transmitter fault (Open collector). A logic HIGH indicates that the transmitter is in a fault condition.
MOD_DEF(0)	MOD_DEF(0) is internally grounded to indicate the presence of the module. Must be pulled-up on host board with 10 KΩ resistor.
MOD_DEF(1)	MOD_DEF(1) is the clock of the 2 wire interface for module monitoring.
MOD_DEF(2)	MOD_DEF(2) is the data line of the 2 wire interface for module monitoring.
VccR,VccT	Receiver, Transmitter power supply, respectively
VeeR, VeeT	Receiver, Transmitter ground, respectively. The chassis ground and circuit ground isolation is configurable.

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Absolute Maximum Ratings

Parameter	Minimum	Maximum
Standard operating case temperature range	0 °C	70 °C
Extended operating case temperature range	-5 °C	85 °C
Storage case temperature range	-40 °C	85 °C
Supply voltage	-0.5 V	4.0 V
Voltage on any input/output pin	0 V	V _{cc}
High-speed output source current	-	50 mA
Lead soldering temperature/time	-	250 °C/10 seconds
Operating relative humidity (non-condensing)	5%	85%
Receiver optical input power		
PIN	-	3 dBm
APD	-	0 dBm

Transceiver Electrical Input/Output Characteristics(V_{cc} = 3.3 V±5%)

Parameter	Minimum	Maximum
Input data signal levels input voltage swing, DVIN (internally AC coupled)	200 mV	2000 mV
Transmitter disable input (disabled/enabled)	2.0 V/0 V	V _{cc} /0.8 V
Rate select input (high data rate/low data rate)	2.8 V/0 V	V _{cc} /0.6 V
Transmitter fault output (asserted/deasserted)	2.4 V/0 V	V _{cc} /0.5 V
Output data signal levels ¹ output voltage swing, DVOOUT (internally AC coupled)	400 mV	2000 mV
Loss-of-signal output (output high, VOH/output low, VOL)	2.4 V/0 V	V _{cc} /0.5 V

1. Terminated into 100 Ω differential. These levels are guaranteed down to 2 dB lower than the typical receiver sensitivity for each data rate and reach.

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Timing of Status and Control Input/Output

Parameter	Symbol	Condition	Specification
TX_DISABLE assert time	t_off	Time from rising edge of TX_DISABLE to when the output optical power falls below 10% of nominal	Maximum 10 μ s
TX_DISABLE deassert time	t_on	Time from falling edge of TX_DISABLE to when the output optical power rises above 90% of nominal	Maximum 1 ms
Time to initialize	t_init	Upon power up or negation of TX_FAULT due to TX_DISABLE	Maximum 300 ms
TX_FAULT assert time	t_fault	Time from a fault condition to TX_FAULT assertion	Maximum 100 μ s
TX_DISABLE for reset	t_reset	Time TX_DISABLE must be held HIGH to reset TX_FAULT	Minimum 10 μ s
LOS assert time	t_loss_on	Time from loss of signal to assertion of LOS	Maximum 100 μ s
LOS deassert time	t_loss_off	Time from non-loss condition to LOS deassertion	Maximum 100 μ s
2-wire serial clock rate	f_serial_clock	-	Maximum 100 kHz

Power Supply Voltage

Parameter		Short Haul (40 km, PIN)	Long Haul (80 km, APD)
Supply voltage	Minimum	3.1 V	3.1 V
	Typical	3.3 V	3.3 V
	Maximum	3.5 V	3.5 V
Power supply current drain ¹	Typical	275 mA	285 mA
	Maximum	320 mA	350 mA

1. Applies to hardware revision 2. Does not include output termination resistor current.

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Optical Specifications

Parameter		40 km (PIN) at OC-48	80 km (APD) at OC-48
Average output power ¹	Minimum	0 dBm	0 dBm
	Typical	2.0 dBm	2 dBm
	Maximum	4 dBm	4 dBm
BOL power output ¹	Minimum	1 dBm	1 dBm
	Typical	2 dBm	2 dBm
	Maximum	3 dBm	3 dBm
TX operating wavelength	Minimum	-6.5 nm	-6.5 nm
	Typical	Center	Center
	Maximum	6.35 nm	6.35 nm
Spectral width ²	Typical	0.3 nm	0.3 nm
	Maximum	1 nm	1 nm
Side mode suppression ratio (DFB laser) ³	Minimum	30 dB	30 dB
Extinction ratio ⁴ (BOL)	Minimum	9.0 dB	9 dB
	Typical	10.0 dB	10 dB
	Maximum	11.5 dB	11.5 dB
Extinction ratio ⁴ (EOL)	Minimum	8.2 dB	8.2 dB
	Maximum	12.0 dB	12.0 dB
Optical rise and fall times (20 to 80%) ⁵	Maximum	200 ps	200 ps
Eye mask of optical output		Compliant with GR-253 and ITU-T G.957	Compliant with GR-253 and ITU-T G.957
Eye mask margin (filtered)	Minimum	10%	10%
	Typical	15%	15%
Jitter generation (peak-to-peak) ⁶	Maximum	70 mUI _{P-P}	70 mUI _{P-P}
Jitter generation (rms) ⁶	Maximum	7 mUI _{rms}	7 mUI _{rms}
Power output with transmitter disabled	Typical	-50 dBm	-
	Maximum	-40 dBm	-40 dBm
Receiver sensitivity (BOL, BER=1 x 10 ⁻¹⁰ , ER=10 dB)	Minimum	-21 dBm	-30 dBm
	Typical	-23 dBm	-32 dBm
Receiver sensitivity (EOL, BER=1 x 10 ⁻¹⁰ , ER=8.2 dB)	Minimum	-18 dBm	-28 dBm
Maximum received optical power	Minimum	0 dBm	-8 dBm
Link status response time	Minimum	3 μs	3 μs
	Typical	50 μs	50 μs
	Maximum	100 μs	100 μs
Receiver operating wavelength	Minimum	1260 nm	1260 nm
	Maximum	1620 nm	1620 nm
Optical path penalty	Maximum	1 dB	2 dB
Dispersion ⁷	Maximum	800 ps/nm	1600 ps/nm
Receiver reflectance	Maximum	-27 dB	-27 dB
Minimum optical return loss	Minimum	-24 dB	-24 dB
BER floor	Maximum	10 ⁻¹⁵	10 ⁻¹⁵
Reflect into Tx for <1 dB degradation at the receiver	Maximum	-24 dB	-24 dB
Bit rate		155 to 2700 Mb/s	155 to 2700 Mb/s

1. Measured as fiber coupled power into a standard single mode fiber, typical connector repeatability is ±1 dB. LC duplex cables manufactured by Stratos are not recommended due to a potentially larger window of repeatability.

2. Full spectral width measured 20 dB down from the central wavelength peak under fully modulated conditions.

3. Ratio of the average output power in the dominant longitudinal mode to the power in the most significant side mode in fully modulated conditions.

4. Ratio of logic 1 output power to logic 0 output power under fully modulated conditions with a PRBS 23 data pattern.

5. GR-253-CORE, ITU-T, Recommendation G.957. Tested at STM1, STM4, STM16.

6. Formatted OC-48 pattern with scrambled PRBS payload using an Agilent OmniBer as the optical source driving the CT2 optical receiver. The differential data outputs of this optical receiver are used as the electrical inputs for the CT2 transmitter which optically drives the OmniBer receiver input to complete the jitter test circuit. This is a 60 second test as recommended in GR-253.

7. Assumes 1550nm wavelength @ 40km with 17.5 ps/nm*km fiber at 2.48832Gb/s PRBS 23 data pattern.

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Optical Specifications	Continued		
Parameter		80 km at GbE	120 km at GbE
Average output power ¹	Minimum	0 dBm	0 dBm
	Typical	2.0 dBm	2.0 dBm
	Maximum	4 dBm	4 dBm
BOL power output ¹	Minimum	1.0 dBm	1.0 dBm
	Typical	2.0 dBm	2.0 dBm
	Maximum	3 dBm	3 dBm
TX operating wavelength	Minimum	1430 nm	1500 nm
	Typical	1550 nm	1550 nm
	Maximum	1580 nm	1580 nm
Spectral width ²	Typical	0.3 nm	0.3 nm
	Maximum	1 nm	1 nm
Side mode suppression ratio (DFB laser) ³	Minimum	30 dB	30 dB
Extinction ratio ⁴ (BOL)	Minimum	9.5 dB	9.5 dB
	Typical	11.5 dB	11.5 dB
	Maximum	14.0 dB	14.0 dB
Extinction ratio ⁴ (EOL)	Minimum	9.0 dB	9.0 dB
Optical rise and fall times (20 to 80%)	Maximum	200 ps	200 ps
Eye mask of optical output		Compliant with GR-253 and ITU-T G.957	Compliant with GR-253 and ITU-T G.957
Eye mask margin (filtered) ⁵	Minimum	25%	10%
	Typical	-	15%
Jitter generation (peak-to-peak) ⁶	Maximum	70 mUI _{P-P}	70 mUI _{P-P}
Jitter generation (rms) ⁶	Maximum	7 mUI _{rms}	7 mUI _{rms}
Power output with transmitter disabled	Typical	-50 dBm	-
	Maximum	-40 dBm	-40 dBm
Receiver sensitivity (BOL, BER=1 x 10 ⁻¹⁰ , ER=10 dB)	Minimum	-25 dBm	-34.5 dBm
Receiver sensitivity (EOL, BER=1 x 10 ⁻¹⁰ , ER=9 dB)	Minimum	-23 dBm	-33 dBm
Maximum received optical power	Minimum	0 dBm	-8 dBm
Link status response time	Minimum	3 μs	3 μs
	Typical	50 μs	50 μs
	Maximum	100 μs	100 μs
Receiver operating wavelength	Minimum	1260 nm	1260 nm
	Maximum	1620 nm	1620 nm
Optical path penalty	Maximum	1 dB	2 dB
Dispersion	Maximum	1600 ps/nm	2400 ps/nm
Receiver reflectance	Maximum	-27 dB	-27 dB
Minimum optical return loss	Minimum	-24 dB	-24 dB
BER floor	Maximum	10 ⁻¹⁵	10 ⁻¹⁵
Reflect into Tx for <1 dB degradation at the receiver	Maximum	-24 dB	-24 dB
Bit rate		155 to 2700 Mb/s	155 to 2700 Mb/s

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Ordering Information

For more information on this or other products and their availability, please contact your local JDSU account manager or JDSU directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide or via e-mail at customer.service@jdsu.com.

Sample: CT2-MI2LBCW13C4

CT2-								
Code	Rate	Code	Connector/ Pigtail Length	Code	Format/ITU Channel/ Wavelength	Code	Custom Options (Output Power/ Dispersion/Channel Spacing)¹	
M	2.5 Gb/s (multirate) ¹	L	LC duplex	CW1	CWDM Channel 1 (1471 nm)	C	Standard	
G	Long reach GbE at 1.25 Gb/s (and 622 Mb/s)	P	Plastic LC receptacle	CW2	CWDM Channel 2 (1491 nm)			
				CW3	CWDM Channel 3 (1511 nm)			
Code	Reach²	Code	Temperature Range/ Package	CW4	CWDM Channel 4 (1531 nm)	Code	Hardware Revision	
S1	Short reach, 1310 nm	A	0 to 70 °C case temperature	CW5	CWDM Channel 5 (1551 nm)	4	Hardware revision 4	
I1	Intermediate reach, 1310 nm	B	-5 to 75 °C case temperature	CW6	CWDM Channel 6 (1571 nm)	5	Hardware revision 5	
I2	Intermediate reach, 1550 nm (80 km for GbE)	F	-5 to 85 °C case temperature	CW7	CWDM Channel 7 (1591 nm)			
L1	Long reach, 1310 nm	K	-40 to 85 °C case temperature	CW8	CWDM Channel 8 (1611 nm)			
L2	Long reach 1550 nm (120 km for GbE)			Code	Software Feature Set			
				1	Software release 1, long reach			
				3	Software release 3, short reach			

1. Fully G.695 compliant at 2.5 Gb/s
2. Per GR-253-Core
3. Customer specific options available upon request

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