

2.5Gb/s D-WDM FGL Based Long Haul Optical Transmitter

Preliminary



Application:

- High Speed 2.5Gb/s transmission
- SONET/SDH OC-48/STM16 D-WDM links with down to 50GHz spacing.
- Metropolitan Area Networks

Features:

- MSA compatible, 24 pin package
- Fiber Bragg Grating Laser with ultrastable wavelength control (down to 50GHz)
- Wavelength range 1528.77 nm—1563.86nm (full ITU C-band)
- Clocked or unclocked operation with single-ended or differential inputs
- PECL Data and clock inputs
- Supply voltage: Either 3.3 V and 5 V or single 5V.
- Laser bias monitor alarm and laser back-facet monitor for diagnostics
- Transmitter-enable input
- Various connector options (FC, SC, MU, LC)
- Wide operating case temperature range –10°C to +70°C

Description

This FGL based, long-haul (up to 250km) 2.5 Gb/s D-WDM transmitter is designed for SONET OC-48 and SDH STM-16 D-WDM applications. It offers a 'plug and play' solution for high speed network designs which allows quick time-to-market for system providers.

The transmitter case temperature must be kept below 70°C to allow reliable operation of the device. Therefore it is recommended, that a heat sink is attached with good thermal connection to the module. E.g. assuming a max. ambient temperature of 40°C, the thermal resistance should be 5°C/W or better. In addition, free air cooling (for vertically mounted module) or forced air cooling (especially for horizontal mounting) is recommended.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings may cause permanent damage to the device. Exposure to absolute maximum ratings for extended periods can affect the device reliability. The specified performance can be achieved at the operating conditions, listed in this datasheet.

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	—	5.25	V
Operating Case Temperature	T_c	−10	70	°C
Storage Case Temperature	T_{stg}	−40	85	°C
Soldering Temperature/Time	—	—	250/10	°C/s
Relative Humidity (noncondensing)	RH	—	85	%
TEC Voltage	V_{TEC}	—	5.25	V

Electrical Characteristics

Minimum and maximum values specified over operating case temperature range at 50% duty cycle data signal. Typical values are measured at room temperature unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
DC Power Supply Voltage	V_{CC}	4.75	5.0	5.25	V
DC Power Supply Current:	I_{CC}		380	450	mA
Power Dissipation	P_{dis}		5.0	5.7	W
	$P_{dis} (TEC)$			3.2	W
	$P_{dis} (signal)$			2.5	W
Nonclocked/Clocked Select Voltage: ^a					
Clocked Operation	V_{SEL_CLK}	0.0		0.8	V
Nonclocked Operation	V_{DIS_CLK}	2.0		VCC	V
Transmitter Enable Voltage (TTL)	V_{EN}	0.0	—	0.8	V
Transmitter Disable Voltage (TTL)	V_{DIS}	2.0	—	VCC	V
Input Impedance	R_{IN}	—	50	—	Ω
Analog option:					
Laser Bias Monitor Voltage	V_{LBM}	—	20	—	mV/mA
Laser Back-facet Monitor Voltage (50% duty cycle) ^b	V_{BF}	—	500	—	mV/mW
TEC Current	I_{TEC}		0.6	1.2	A
TEC Voltage	V_{TEC}	3.0	3.3	3.5	V

^a Clocked operation is optional. For clocked operation, pin 5 must be a logic 0. With clocked operation, the optical output changes state with the rising edge of the input clock signal. If left unselected, clocked operation will be selected.

^b This voltage is measured from pin 2 to GND.

Signal and Alarm Levels

Parameter	Symbol	Min	Typ	Max	Unit
Input Data/Clock Voltage: ^c					
Single-ended Input	V _{IN}	250	900	1300	mVp-p
Differential Input	V _{IN}	125	450	650	mVp-p
Wavelength Deviation Alarm:					
Levels (CMOS) VOL	V _{NO-λALARM}	0		0.3	V
Levels (CMOS) VOH	λALARM	4.5		V _{CC}	V
Setting (active-high) ^d	λALARM	-100		100	pm
Digital option:					
Laser Degrade Alarm:					
Levels (CMOS) VOH	V _{NO-ALARM}	4.5		V _{CC}	V
Levels (CMOS) VOL	VALARM	0		0.3	V
Setting (active-low)	LDALARM			55	mA

^c Inputs are ac-coupled into an equivalent input impedance of 50 Ω. Single-ended or differential operation may be used. If the inputs are driven single-ended, the unused inputs must be terminated by 50 Ω.

^d Deviation due to temperature variation detected by the thermistor

Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Average Optical Power Output	P AVG BOL P AVG EOL	0 -2.0		2.0 2.0	dBm dBm
Output Power Variation (over temperature and wavelength)	ΔP	-0.5		0.5	dBm
Center Wavelength Range (according to the ITU Grid)	λ _c	1528.77		1603.17	nm
Wavelength Accuracy @25°C	Δλ _c	-0.015		0.015	nm
Variation in Center Wavelength over Temperature	Δλ _T	-0.03		0.03	nm
Center Wavelength Aging	Δλ _{T_{EOL}}	-0.10		0.10	nm
Spectral Width (full width at -3 dB)	Δλ		0.1	0.30	nm
Spectral Width (full width at -20 dB) ^e	Δλ ₂₀		0.2	0.4	nm
Side-mode Suppression Ratio ^e	SMSR	30			dB

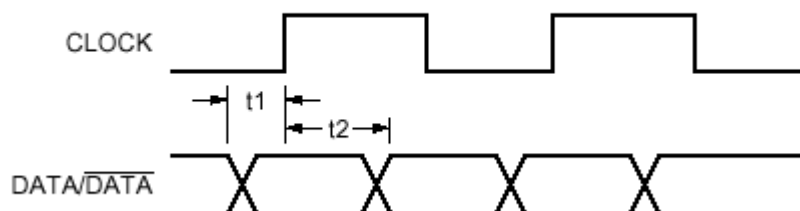
Parameter	Symbol	Min	Typ	Max	Unit
Dispersion Penalty					dB
Version A (1800ps/nm)	DP		1	1.5	
Version B (3200ps/nm)	DP		1	1.5	dB
Version C (4500ps/nm)	DP		1	2	dB
Jitter, Intrinsic [†]				0.05	UIp-p
Extinction Ratio	re	8.2			dB
Eye Mask of Optical Output		Meets SONET and ITU-T standards			
Optical Rise/Fall Time (20% - 80%)	t _r t _f			125	ps
Maximum Return Loss (optical)	ORL	—	—	24	dB

^e 2.5Gb/s modulated conditions.

[†] Filter bandwidth from 12 kHz—20 MHz, according to ITU-T G813.

Data Timing

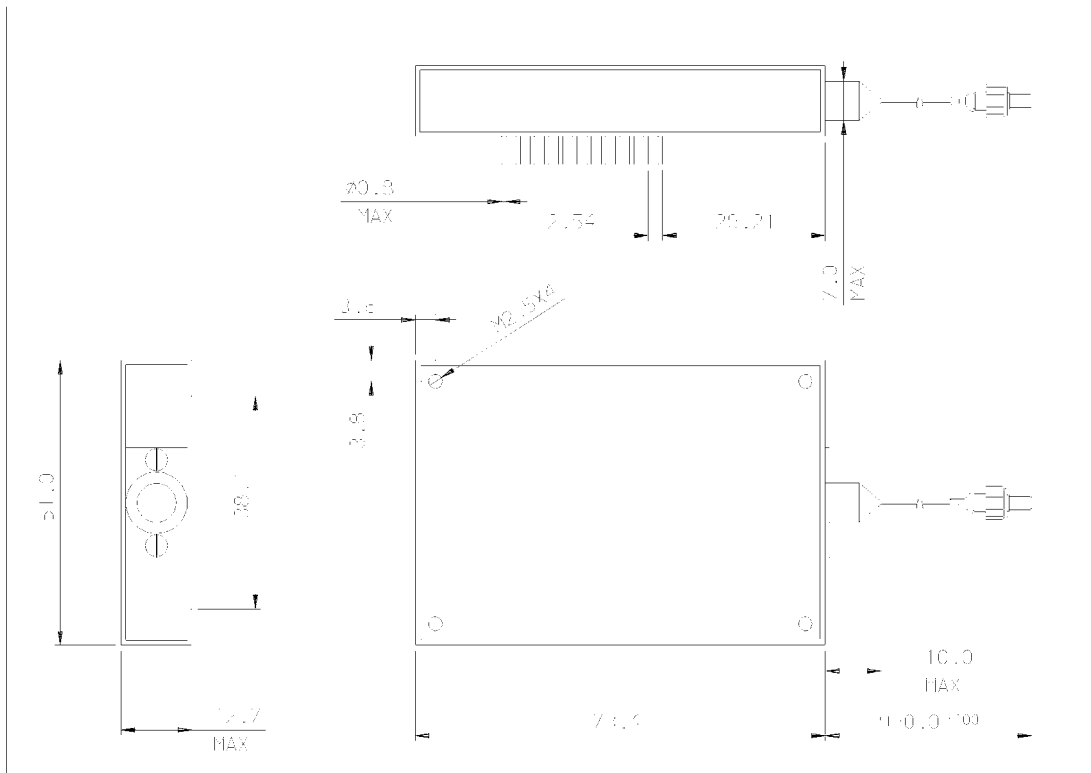
Symbol	Test Conditions	Setup (Min)	Hold (Min)	Unit
t1	CL = (TBD) pF	35	—	ps
t2	CL = (TBD) pF	—	60	ps



Data timing diagram

Outline Drawing

Dimensions are in millimeters



Pin Allocation

Pin	Name	Pin	Name
1	Ground (TEC) ¹	13	V _{CC} ²
2	Back-facet Monitor ⁴	14	V _{TEC}
3	Bias Monitor/Laser Degrade Alarm	15	Ground ¹
4	Tx Enable	16	DATA
5	Clock Select	17	Ground ¹
6	Ground ¹	18	DATA
7	Wavelength-Deviation Error Alarm	19	Ground ¹
8	NUC ³	20	CLOCK
9	NUC ³	21	Ground ¹
10	NUC ³	22	CLOCK
11	Vcc Ground ¹	23	Ground ¹
12	NUC ³	24	V _{CC} ²

¹ All ground pins including pin 1 (TEC ground) and pin 11 (Vcc ground) should be connected to a common ground plane. Thereby, pin 1 and pin 11 should have direct ground connection.

² Pin 13 and pin 24 (Vcc) should be directly connected to the Vcc voltage supply.

³ Pins designated for no user connection (NUC) must **not** be tied to ground or any other circuit potential.

⁴ The output bias monitor output will optionally be either a logic signal (LDA) or an analog voltage. (See Electrical Characteristics table)

Fiber Pigtail Specification

Parameter	Limits	Unit
Fiber type	SM	
Fiber length	100+/-5	cm
Mode field diameter	8.3±1	µm
Cladding diameter	125±2	µm
Secondary coating outer diameter	0.9±0.1	mm
Connector	See ordering info	
Optical return loss of connector	40 (min)	dB

Ordering Information

TX -	F -	□ □ □ □	□ □ -	AI00
Transmitter Module	F: 2.5Gb/s FGL based D-WDM transmitter A: analog laser bias current monitor D: digital laser degrade alarm A: 1800ps/nm B: 3200ps/nm C: 4500ps/nm	I0xx: ITU C-band, channel xx	FC: FC/PC SC: SC/PC MU: MU LC: LC	Standard spec AIFOtec

Wavelength Table (C-band: 1528,77nm-1563,86nm)

Full Part Number (with FC/PC connector)	Nominal ITU channel	Wavelength (nm)	Frequency (THz)
TX-F □ □-I017-FC-AI00	17	1563,86	191,7
TX-F □ □-I018-FC-AI00	18	1563,05	191,8
TX-F □ □-I019-FC-AI00	19	1562,23	191,9
TX-F □ □-I020-FC-AI00	20	1561,42	192,0
TX-F □ □-I021-FC-AI00	21	1560,61	192,1
TX-F □ □-I022-FC-AI00	22	1559,79	192,2
TX-F □ □-I023-FC-AI00	23	1558,98	192,3
TX-F □ □-I024-FC-AI00	24	1558,17	192,4
TX-F □ □-I025-FC-AI00	25	1557,36	192,5
TX-F □ □-I026-FC-AI00	26	1556,55	192,6
TX-F □ □-I027-FC-AI00	27	1555,75	192,7
TX-F □ □-I028-FC-AI00	28	1554,94	192,8
TX-F □ □-I029-FC-AI00	29	1554,13	192,9
TX-F □ □-I030-FC-AI00	30	1553,33	193,0
TX-F □ □-I031-FC-AI00	31	1552,52	193,1
TX-F □ □-I032-FC-AI00	32	1551,72	193,2
TX-F □ □-I033-FC-AI00	33	1550,92	193,3
TX-F □ □-I034-FC-AI00	34	1550,12	193,4
TX-F □ □-I035-FC-AI00	35	1549,32	193,5
TX-F □ □-I036-FC-AI00	36	1548,51	193,6
TX-F □ □-I037-FC-AI00	37	1547,72	193,7
TX-F □ □-I038-FC-AI00	38	1546,92	193,8
TX-F □ □-I039-FC-AI00	39	1546,12	193,9
TX-F □ □-I040-FC-AI00	40	1545,32	194,0
TX-F □ □-I041-FC-AI00	41	1544,53	194,1
TX-F □ □-I042-FC-AI00	42	1543,73	194,2
TX-F □ □-I043-FC-AI00	43	1542,94	194,3
TX-F □ □-I044-FC-AI00	44	1542,14	194,4
TX-F □ □-I045-FC-AI00	45	1541,35	194,5
TX-F □ □-I046-FC-AI00	46	1540,56	194,6
TX-F □ □-I047-FC-AI00	47	1539,77	194,7
TX-F □ □-I048-FC-AI00	48	1538,98	194,8
TX-F □ □-I049-FC-AI00	49	1538,19	194,9
TX-F □ □-I050-FC-AI00	50	1537,40	195,0
TX-F □ □-I051-FC-AI00	51	1536,61	195,1
TX-F □ □-I052-FC-AI00	52	1535,82	195,2
TX-F □ □-I053-FC-AI00	53	1535,04	195,3
TX-F □ □-I054-FC-AI00	54	1534,25	195,4
TX-F □ □-I055-FC-AI00	55	1533,47	195,5
TX-F □ □-I056-FC-AI00	56	1532,68	195,6
TX-F □ □-I057-FC-AI00	57	1531,90	195,7
TX-F □ □-I058-FC-AI00	58	1531,12	195,8
TX-F □ □-I059-FC-AI00	59	1530,33	195,9
TX-F □ □-I060-FC-AI00	60	1529,55	196,0
TX-F □ □-I061-FC-AI00	61	1528,77	196,1