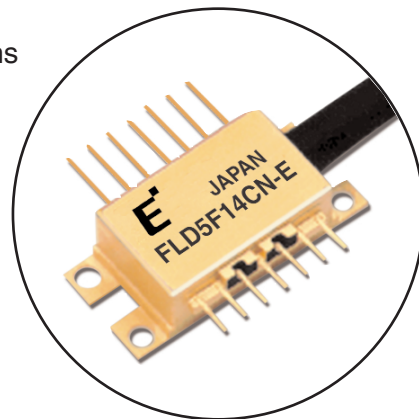


1,550nm Modulator Integrated DFB Laser

FLD5F14CN-E

FEATURES

- Long transmission capability of over 10,000ps/nm in 2.5 Gb/s systems
- Modulator Integrated DFB Laser Diode Module
- CW operation of DFB laser section
- Modulation voltage applied only to modulator section
- 1,550nm peak wavelength region and very low wavelength chirping
- 14-pin high speed butterfly package with fiber pigtail
- Built-in optical isolator, monitor photodiode, thermistor, and thermo-electric cooler
- Selected wavelength according to ITU-T grid available



APPLICATION

This MI laser is intended for application in 2.5 Gb/s long haul transmission links over 10,000ps/nm (with Erbium Doped Fiber Amplifiers (EDFA)).

DESCRIPTION

The Modulator Integrated DFB Laser (MI DFB Laser) has an electro-absorption modulator monolithically integrated with a conventional Distributed Feed-Back (DFB) laser. The modulation voltage is applied to the modulator section while the laser section operates CW allowing extremely low wavelength chirping. Transmission spans in excess of 10,000ps/nm are achievable. Extinction ratios of greater than 10 dB are achievable with 2Vp-p modulation. The MI laser is installed in a butterfly type package. The module incorporates a highly stable optical coupling system. The module includes an optical isolator, monitor photodiode, thermistor and a thermo-electric cooler. Selected wavelengths according to the ITU-T grid are available for Dense Wavelength Division Multiplexing (DWDM) applications.

ABSOLUTE MAXIMUM RATINGS (T_c=25°C, unless otherwise specified)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Operating Case Temperature	T _{op}	-	0	+65	°C
Storage Temperature	T _{stg}	-	-40	+70	°C
Optical Output Power	P _f	CW	-	5	mW
Laser Forward Current	I _F	CW	-	150	mA
Laser Reverse Voltage	V _R	CW	-	2	V
Modulator Forward Voltage	V _m		-	1	V
Modulator Reverse Voltage	V _{ear}		-	5	V
Monitor Diode Reverse Voltage	V _{monr}	-	-	20	mA
Monitor Diode Forward Current	I _{mon}	-	-	1	V
TEC Voltage	V _c	Cooling	-	+2.5	V
		Heating	-2.5	-	
TEC Current	I _c	Cooling	-	+1.4	A
		Heating	-0.9	-	
Thermistor Temperature	T _{th}	ATC Operation	0	+65	°C

MONITOR DIODE CHARACTERISTICS ($T_L = T_{set}$, $T_C = 25^\circ\text{C}$, BOL, unless otherwise specified)

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Typ.	Max.	
Monitor Current	I_m	CW, $I_F = I_{op}$, $V_m = V_o$, $V_{DR} = 5\text{V}$	50	-	2,000	μA
Monitor Dark Current	I_d	$V_{DR} = 5\text{V}$	-	2	100	nA
Monitor Diode Capacitance	C_t	$V_{DR} = 5\text{V}$, $f = 1\text{ MHz}$	-	2	20	pF

TEC AND THERMISTOR CHARACTERISTICS ($T_L = T_{set}$, $T_C = 25^\circ\text{C}$, BOL, unless otherwise specified)

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Typ.	Max.	
TEC Current	I_C	CW, $I_F = I_{op}$, $V_m = V_o$, $T_L = T_{set}$, $T_C = +65^\circ\text{C}$	-	-	1.0	A
TEC Voltage	V_C	CW, $I_F = I_{op}$, $V_m = V_o$, $T_L = T_{set}$, $T_C = +65^\circ\text{C}$	-	-	2.4	V
TEC Power Consumption	P_C	CW, $I_F = I_{op}$, $V_m = V_o$, $T_L = T_{set}$, $T_C = +65^\circ\text{C}$	-	-	2.4	W
TEC Resistance	R_{tec}	CW, $I_F = I_{op}$, $V_m = V_o$	2.0	2.3	3.2	Ω
Thermistor Resistance	R_{th}	$T_L = +15$ to $+35^\circ\text{C}$	6.3	-	15.4	k Ω
Thermistor B Constant	B	-	3,270	3,450	3,630	K
Tracking Error	TE	CW, $I_F = I_{op}$, $V_m = V_o$, $T_C = 0$ to $+65^\circ\text{C}$	-0.5	-	+0.5	dB

BOL: Beginning of Life

OPTICAL & ELECTRICAL CHARACTERISTICS ($T_L = T_{set}$, $T_c = 25^\circ\text{C}$, BOL, unless otherwise specified)

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Type	Max.	
Laser Set Temperature	T_{set}	-	+15	-	+35	$^\circ\text{C}$
On Level Modulation	V_o	-	-1	-	0	V
Threshold Current	I_{th}	CW, $V_m = V_o$	2	-	40	mA
Operating Current	I_{op}	CW	40	-	90	mA
Dispersion Penalty	dP	Note (1)	-	-	1.5	dB
Optical Output Power	P_f	CW, $I_F = I_{op}$, $V_m = V_o$	0	-	-	dBm
Forward Voltage	V_F	CW, $I_F = I_{op}$	-	1.4	2.0	V
Extinction Ratio	R_{ext}	CW, $I_F = I_{op}$, $V_m = V_o/(V_o - 2)$	10	12	-	dB
Peak Wavelength (Note 4)	λ_p	Note (2)	Note (4)			nm
Sidemode Suppression Ratio	SSR	Note (2)	33	38	-	dB
Spectral Width	$\Delta\lambda$	Note (3)	-	0.05	0.10	nm
Rise Time	T_r	Note (2), 20 to 80%	-	90	125	ps
Fall Time	T_f	Note (2), 20 to 80%	-	90	125	ps
Input Impedance	Z	CW, $V_m < 0$	-	50	-	Ω
RF Return Loss	S_{11}	$f = 2.5\text{ GHz}$, 50Ω Test Set, $V_m = V_o$, $I_F = I_{op}$	10	-	-	dB
Cut-off Frequency	S_{21}	-3dB bandwidth, 50Ω Test Set, $V_m = V_o - 0.5(V_{mod})$, $I_F = I_{op}$	3.5	-	-	GHz
Relative Intensity Noise	RIN	$f = 2.5\text{ GHz}$, $V_m = V_o$, $I_F = I_{op}$, ORL $\geq 24\text{ dB}$	-	-	-145	dB/Hz
Optical Isolation	I_s	$T_c = -20$ to $+65^\circ\text{C}$	25	35	-	dB

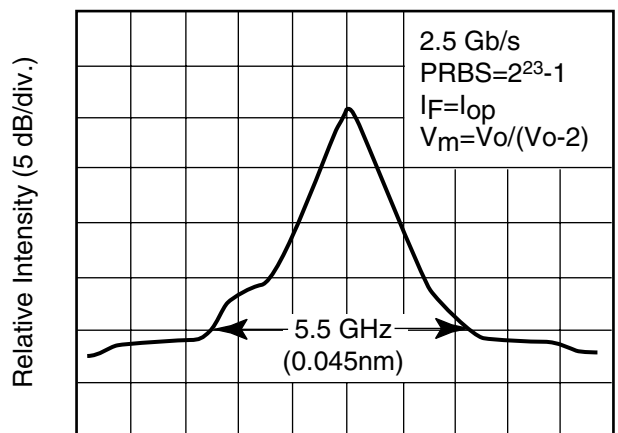
Note (1) Eudyna Test System
2.48832Gb/s, PRBS=2²³-1, $I_b = I_{op}$, $V_m = V_o/(V_o - 2)$
Dispersion = 10,000ps/nm
Dispersion penalty at bit - error - rate = 10⁻¹⁰

Note (2) Eudyna Test System
2.48832Gb/s, PRBS=2²³-1, $I_b = I_{op}$, $V_m = V_o/(V_o - 2)$

Note (3) Spectrum measurement equipment is "Monochrometer"
or "Fabry-Perot Etalon".
Spectral width at -20dB under the modulation condition of Note (2)

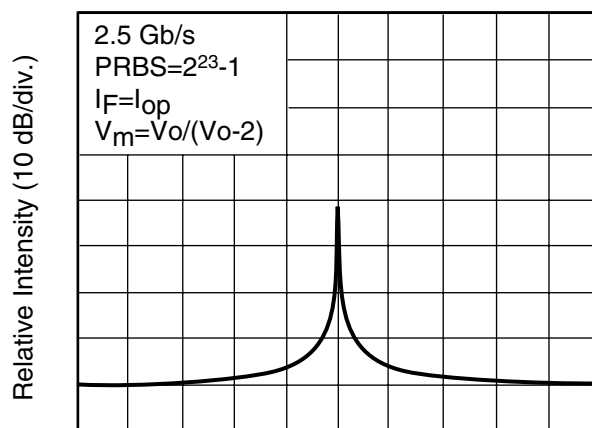
Note (4) The selected wavelengths available are listed in Fig. 9.

Fig. 1 Lasing Spectrum



Wavelength (Span=1 GHz/div, Res.=100 MHz)

Fig. 2 Lasing Spectrum



Wavelength (Span=1 nm/div, Res.=0.1nm)

Fig. 3 Temperature Dependence of Wavelength (ACC)

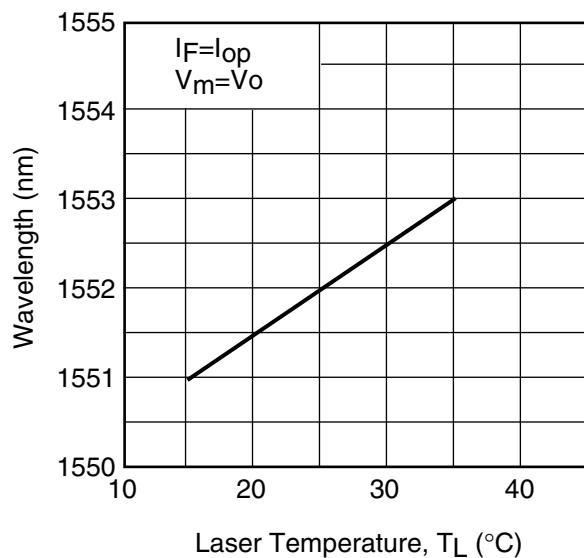
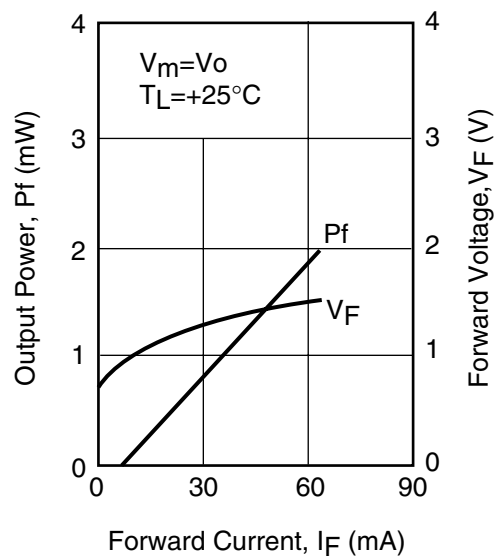


Fig. 4 Forward Current vs. Output Power and Forward Current vs. Forward Voltage



**Fig. 5 Extinction Ratio
vs. Modulation Voltage**

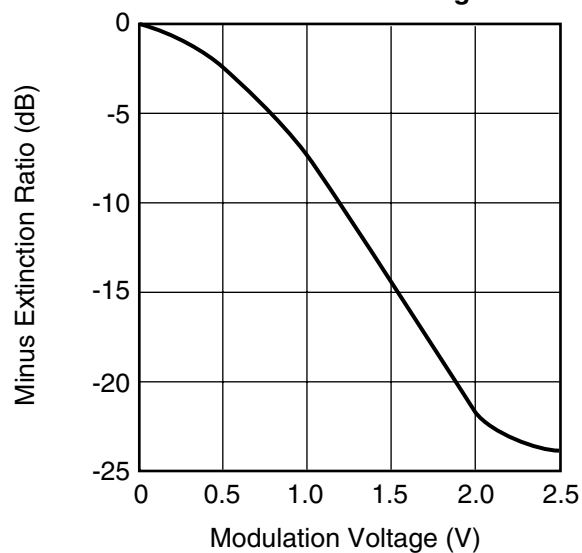


Fig. 6 Cut-off Frequency (S21)

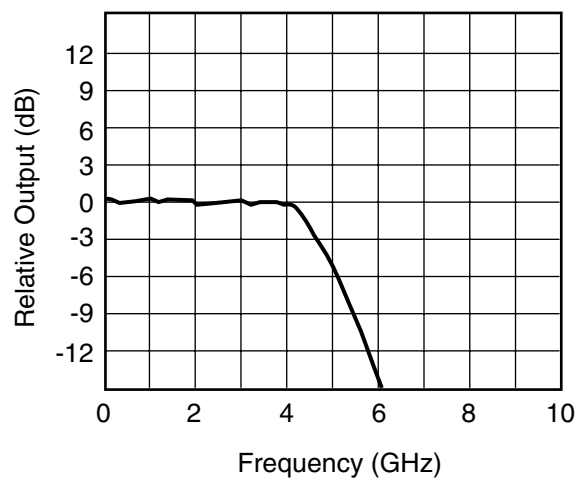


Fig. 7 RF Return Loss (S11)

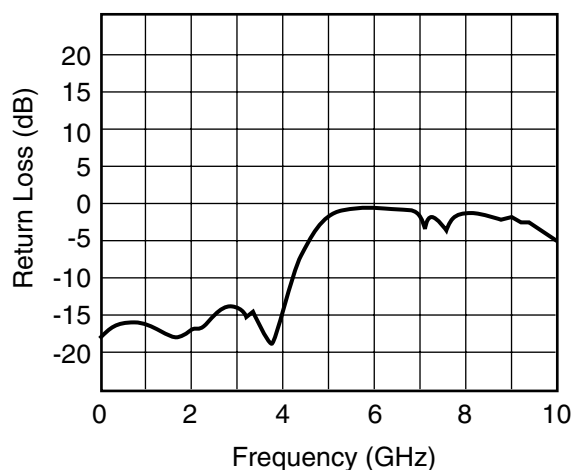


Fig. 8 Transmission Characteristics

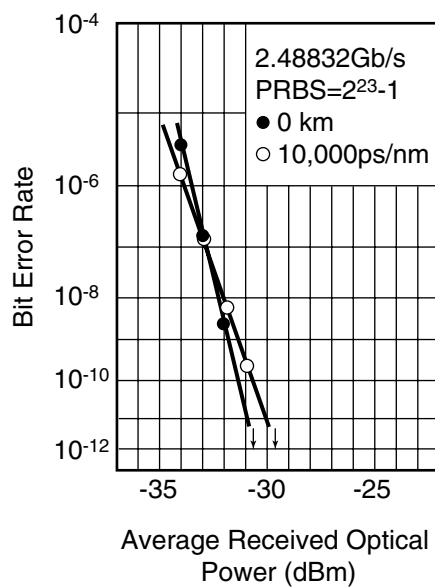
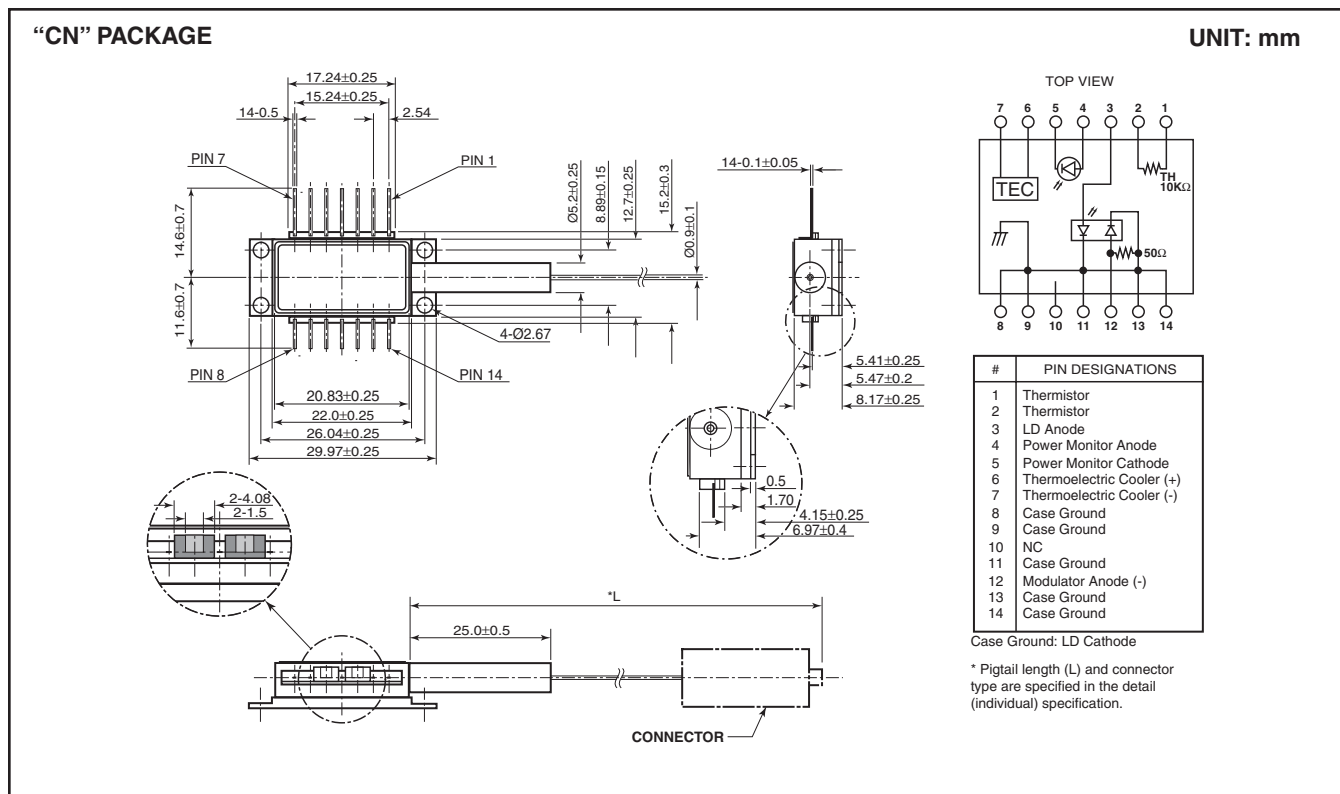


Fig. 9 Wavelength Table

Part Number	Wavelength (nm) (TL=Tset) (in vacuum)	Tolerance (nm)
FLD5F14CN-E59	1530.33	±0.1
-E58	1531.12	±0.1
-E57	1531.90	±0.1
-E56	1532.68	±0.1
-E55	1533.47	±0.1
-E54	1534.25	±0.1
-E53	1535.04	±0.1
-E52	1535.82	±0.1
-E51	1536.61	±0.1
-E50	1537.40	±0.1
-E49	1538.19	±0.1
-E48	1538.98	±0.1
-E47	1539.77	±0.1
-E46	1540.56	±0.1
-E45	1541.35	±0.1
-E44	1542.14	±0.1
-E43	1542.94	±0.1
-E42	1543.73	±0.1
-E41	1544.53	±0.1
-E40	1545.32	±0.1
-E39	1546.12	±0.1
-E38	1546.92	±0.1
-E37	1547.72	±0.1
-E36	1548.51	±0.1
-E35	1549.32	±0.1
-E34	1550.12	±0.1
-E33	1550.92	±0.1
-E32	1551.72	±0.1
-E31	1552.52	±0.1
-E30	1553.33	±0.1
-E29	1554.13	±0.1
-E28	1554.94	±0.1
-E27	1555.75	±0.1
-E26	1556.55	±0.1
-E25	1557.36	±0.1
-E24	1558.17	±0.1
-E23	1558.98	±0.1
-E22	1559.79	±0.1
-E21	1560.61	±0.1

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