

FEATURES

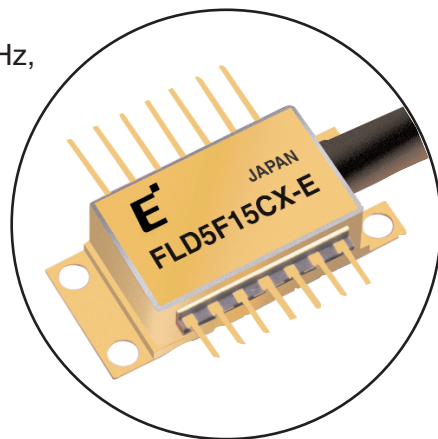
- Direct Modulation Laser for WDM systems
- Optimized for Long Distance Transmission (Dispersion 1800ps/nm)
- Peak wavelength 1527.99 to 1563.05nm (C-band: 191.8 to 196.2THz, 100GHz spacing)
- Output Power: 2mW
- 14-pin Butterfly type package
- Built-in Optical Isolator, Power Monitor PIN-PD, Thermistor, and Cooler
- Single Mode Fiber

APPLICATIONS

This laser is intended for the application of 2.5 Gb/s long haul Dense Wavelength Division Multiplexing (DWDM). Transmission spans of 100km (1800ps/nm) are possible.

DESCRIPTION

The laser is capable of 2.5 Gb/s transmission. It is packaged in a “butterfly” type module. The module employs a highly stable optical coupling system, coupling the laser output through a built-in optical isolator into a single mode fiber pigtail. The module also includes a monitor photodiode, a thermoelectric cooler (TEC), and thermistor. This device is designed for use in DWDM direct modulation transmission systems. Selected wavelengths specified to the ITU-T grid are available.



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

Parameter	Symbol	Condition	Ratings		Unit
			Min.	Max.	
Storage Temperature	T _{stg}	-	-40	+85	°C
Operating Case Temperature	T _{op}	-	-20	+70	°C
Optical Output Power	P _f	CW	-	5	mW
LD Forward Current	I _F	CW	-	150	mA
LD Reverse Voltage	V _R	-	-	2	V
PD Reverse Voltage	V _{DR}	-	-	20	V
PD Forward Current	I _{PF}	-	-	10	mA
Cooler Voltage	V _C	Cooling	-	2.5	V
		Heating	-2.5	-	
Cooler Current	I _C	Cooling	-	1.4	A
		Heating	-0.9	-	
Thermistor Temperature	T _{th}	ATC Operation	-20	+70	°C
Lead Soldering Time	T _{sold}	260°C	-	10	sec
Environmental Operating Humidity	X _{op}	T _{op} <30°C	-	95	%
Environmental Storage Humidity	X _{st}	T _{stg} <30°C	-	95	%

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

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Laser Set Temperature	T_{set}	-	20	-	35	$^{\circ}\text{C}$
Threshold Current	I_{th}	CW	4	-	40	mA
Forward Voltage	V_{FDC}	CW, $I_F=30\text{ mA}$, pin 12, 13	-	1.6	1.75	V
Series Resistance	R_S	CW, pin 12, 13	22	25	28	Ω
Optical Output Power	P_f	CW	2.0	-	-	mW
Slope Efficiency	η	CW, $P_f=2\text{mW}$	0.03	0.04	-	mW/mA
Threshold Power	P_{th}	$I_F=I_{th}$, CW	-	-	150	μW
Tracking Error (Note 1)	TE	$P_f=2\text{mW}$, $T_C=-20\text{ to }70^{\circ}\text{C}$, Im-APC	-0.5	-	+0.5	dB
Monitor Current	I_m	CW, $P_f=2\text{mW}$, $V_{DR}=5\text{V}$	0.25	-	2.0	mA
Photodiode Dark Current	I_D	$V_{DR}=5\text{V}$	-	2	100	nA
Photodiode Capacitance	C_t	$V_{DR}=5\text{V}$, $f=1\text{ MHz}$	-	-	10	pF
Photodiode Cutoff Frequency	f_{cm}	$V_{DR}=5\text{V}$, 50Ω load	100	-	-	MHz
Peak Wavelength	λ_p	Note (2)	Note (4)			nm
Wavelength Drift (after 20 yrs)	$\Delta\lambda$	Note (2)	-100	-	+100	pm
Wavelength Stability with Case Temperature	$d\lambda/dT_C$	$T_C=-20\text{ to }70^{\circ}\text{C}$	-1.0	-	+1.0	pm/ $^{\circ}\text{C}$
Side Mode Suppression	S_r	Note (2)	35	40	-	dB
Spectral Width (-20dB)	$\delta\lambda$	Note (2)	-	-	0.5	nm
Rise/Fall Time	T_r, T_f	20% to 80%	-	-	0.125	nsec
Cutoff Frequency	f_c	$P_f=2\text{mW}$, -3 dB	3.5	-	-	GHz
RF Return Loss	S_{11}	$f=50\text{ MHz} \sim 2\text{ GHz}$	8	-	-	dB
		$f=2\text{ GHz} \sim 3\text{ GHz}$	6	-	-	dB
		$f=3\text{ GHz} \sim 5\text{ GHz}$	3	-	-	dB
Optical Isolation	I_s	$T_C=-20\text{ to }70^{\circ}\text{C}$	25	35	-	dB
Relative Intensity Noise	RIN	$f=2.5\text{ GHz}$ $P_f=2\text{mW}$, ORL=24 dB	-	-	-140	dB/Hz
Kink	Kns	up to 2.4mW	No Kink			-
Dispersion Penalty	dP	Note (3)	-	-	2.0	dB

Note 1. $TE=10 \cdot \log\{P_f(T_{case})/P_f(T_C=25^{\circ}\text{C})\}$ (dB)

Note 2. 2.5 Gb/s NRZ, $P_{peak}=2\text{mW}$, $R_{ext}=8.2\text{dB}$, PRBS= $2^{23}-1$,

Note 3. Bit rate=2.48832 Gb/s, PRBS= $2^{23}-1$, Dispersion=1,800 ps/nm, $P_{peak}=2\text{mW}$, $R_{ext}=8.2\text{dB}$

Decision point: Center of Back-to-Back at 10^{-9} , No Floor,

Receiver: Eudyna Standard Receiver

Note 4. The selected wavelengths available are listed in Fig. 8

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

Parameter	Symbol	Test Conditions	Limit			Unit
			Min.	Typ.	Max.	
Cooler Current	I_C	$T_L=T_{set}$, $P_f=2\text{mW}$, $T_C=70^\circ\text{C}$	-	-	1.0	A
Cooler Voltage	V_C		-	-	2.4	V
Cooler Power	P_C		-	-	2.4	W
Thermistor Resistance	R_{tr}	$T_L=25^\circ\text{C}$	9.5	10.0	10.5	$k\Omega$
Thermistor B Constant	B		3,270	3,450	3,630	K

Fig. 1 Forward Current vs Output Power

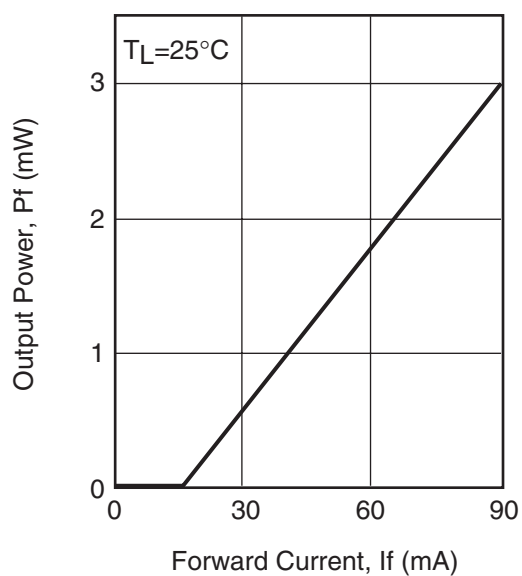


Fig. 2 Frequency Response

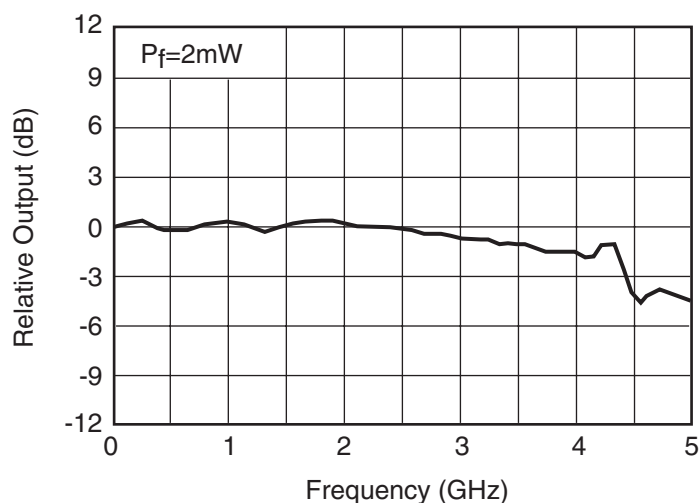


Fig. 3 RF Return Loss

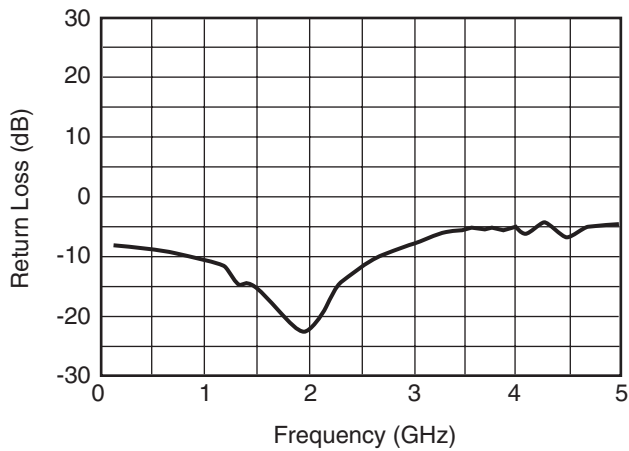


Fig. 4 Cooler Voltage -Current

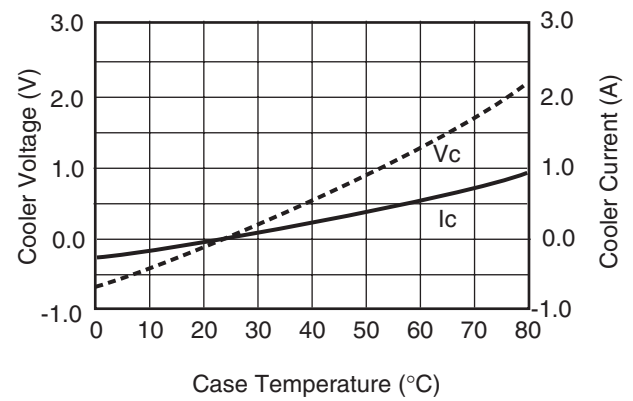


Fig. 5 Spectrum

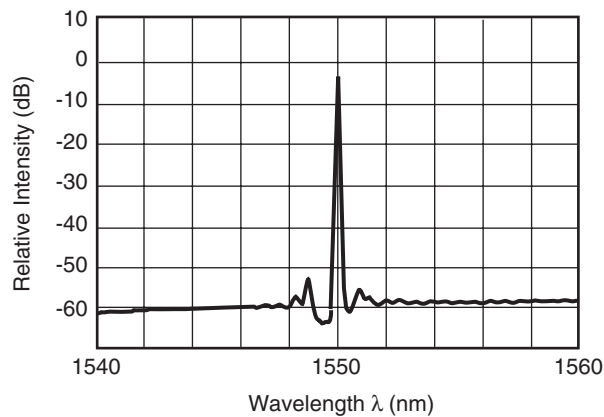


Fig. 6 Temperature Dependence of Wavelength (ACC Operation)

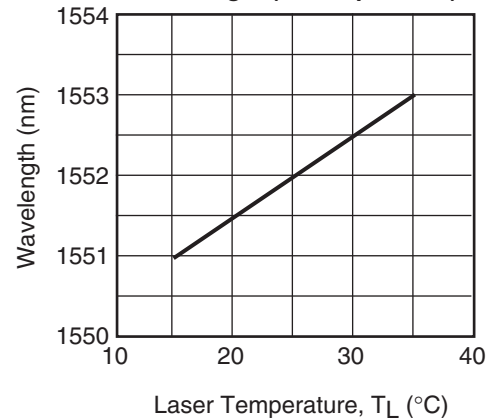


Fig. 7 Transmission Characteristics

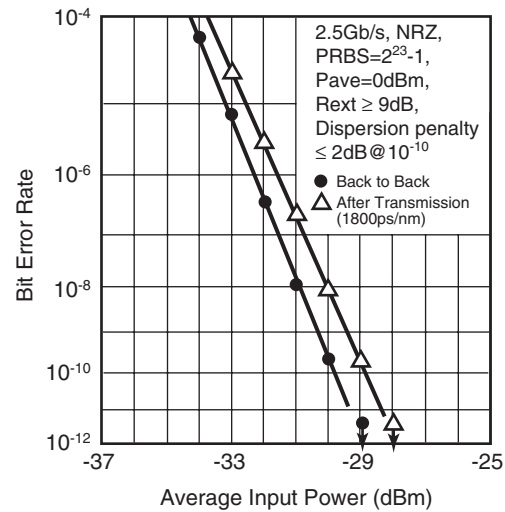


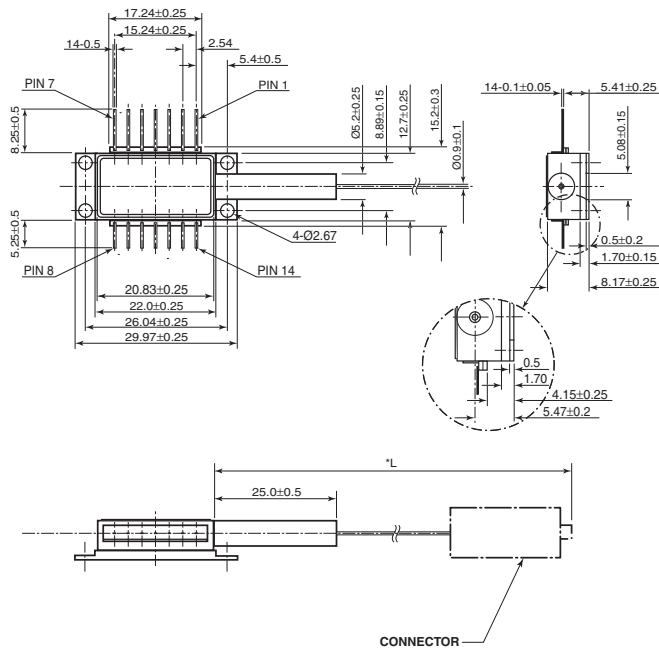
Fig. 8 Wavelength Table

Part Number	Wavelength (nm) (TL=Tset) (in vacuum)	Tolerance (nm)
FLD5F15CX-E9620	1527.99	±0.1
-E9610	1528.77	±0.1
-E9600	1529.55	±0.1
-E9590	1530.33	±0.1
-E9580	1531.12	±0.1
-E9570	1531.90	±0.1
-E9560	1532.68	±0.1
-E9550	1533.47	±0.1
-E9540	1534.25	±0.1
-E9530	1535.04	±0.1
-E9520	1535.82	±0.1
-E9510	1536.61	±0.1
-E9500	1537.40	±0.1
-E9490	1538.19	±0.1
-E9480	1538.98	±0.1
-E9470	1539.77	±0.1
-E9460	1540.56	±0.1
-E9450	1541.35	±0.1
-E9440	1542.14	±0.1
-E9430	1542.94	±0.1
-E9420	1543.73	±0.1

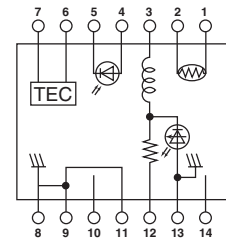
-E9410	1544.53	±0.1
-E9400	1545.32	±0.1
-E9390	1546.12	±0.1
-E9380	1546.92	±0.1
-E9370	1547.72	±0.1
-E9360	1548.51	±0.1
-E9350	1549.32	±0.1
-E9340	1550.12	±0.1
-E9330	1550.92	±0.1
-E9320	1551.72	±0.1
-E9310	1552.52	±0.1
-E9300	1553.33	±0.1
-E9290	1554.13	±0.1
-E9280	1554.94	±0.1
-E9270	1555.75	±0.1
-E9260	1556.55	±0.1
-E9250	1557.36	±0.1
-E9240	1558.17	±0.1
-E9230	1558.98	±0.1
-E9220	1559.79	±0.1
-E9210	1560.61	±0.1
-E9200	1561.42	±0.1
-E9190	1562.23	±0.1
-E9180	1563.05	±0.1

"CX" PACKAGE

UNIT: mm



Grounded Type	
PIN #	FUNCTION
1.	Thermistor
2.	Thermistor
3.	Laser DC Bias (-)
4.	Monitor (Anode)
5.	Monitor (Cathode)
6.	Thermoelectric Cooler (+)
7.	Thermoelectric Cooler (-)
8.	Case Ground
9.	Case Ground
10.	N.C.
11.	Case Ground
12.	Laser Modulation (-)
13.	Case Ground
14.	N.C.



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