

# 1,550nm MQW-DFB DWDM Direct Modulation Laser

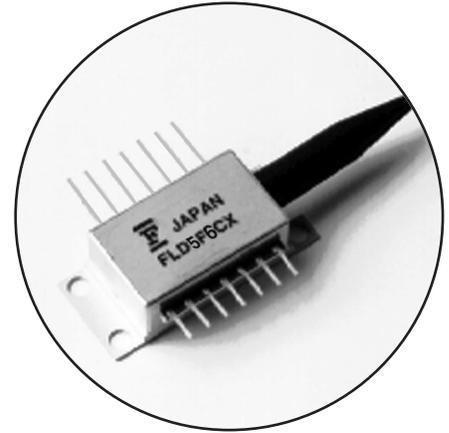
# FLD5F6CX-J

## FEATURES

- Direct Modulated MQW DFB Laser
- Built-in TEC, Thermistor and Monitor PD
- 14-Pin Butterfly Type Module
- 10mW Output Power
- Low Residual Chirp
- Optimized for 2.5 Gb/s Modulation Rates
- Selected wavelengths according to ITU-T grid available

## APPLICATIONS

This MQW laser is intended for the application of 2.5 Gb/s long haul Dense Wavelength Division Multiplexing (DWDM). Transmission spans of 100 km are possible without amplification.



## DESCRIPTION

The Multiple Quantum Well (MQW) Laser is a high power laser capable of 2.5 Gb/s transmission. It is packaged in a “butterfly” type module. The module employs a high efficiency optical coupling system, coupling the laser output through a built-in optical isolator into a single mode fiber pigtail. The modules also include 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<sub>c</sub>=25°C)

Parameter	Symbol	Condition	Ratings	Unit
Storage Temperature	T <sub>stg</sub>	-	-40 to +70	°C
Operating Case Temperature	T <sub>op</sub>	-	-20 to +65	°C
Optical Output Power	P <sub>f</sub>	CW	12.0	mW
Forward Current	I <sub>F</sub>	CW	150	mA
Reverse Voltage	V <sub>R</sub>	-	2	V
Photodiode Reverse Voltage	V <sub>DR</sub>	-	20	V
Photodiode Forward Current	I <sub>DF</sub>	-	10	mA
TEC Voltage	V <sub>c</sub>	-	2.5	V
TEC Current	I <sub>c</sub>	-	1.4	A
Lead Soldering Time	T <sub>sold</sub>	<260°C	10	sec
Environmental Operating Humidity	X <sub>op</sub>	T <sub>op</sub> <30°C	95	%
Environmental Storage Humidity	X <sub>st</sub>	T <sub>st</sub> <30°C	95	%

OPTICAL AND ELECTRICAL CHARACTERISTICS (T<sub>L</sub>=T<sub>set</sub>, T<sub>C</sub>=25°C, BOL, unless otherwise specified)

Parameter	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Laser Set Temperature	T <sub>set</sub>	-	20	-	35	°C
Threshold Current	I <sub>th</sub>	CW	3	-	40	mA
Forward Voltage	V <sub>FDC</sub>	CW, I <sub>F</sub> =30 mA, pin 12-13	-	1.6	1.75	V
Series Resistance	R <sub>S</sub>	CW, pin 12-13	22	25	28	Ω
Optical Output Power	P <sub>f</sub>	CW	10.0	-	-	mW
Slope Efficiency	η	CW, P <sub>f</sub> =10mW	0.14	-	-	mW/mA
Threshold Power	P <sub>th</sub>	I <sub>F</sub> =I <sub>th</sub> , CW	-	-	150	μW
Tracking Error (Note 1)	TE	P <sub>f</sub> =10mW, T <sub>C</sub> =-20 to 65°C	-0.5	-	+0.5	dB
Monitor Current	I <sub>m</sub>	CW, P <sub>f</sub> =10mW, V <sub>DR</sub> =5V	0.10	-	1.0	mA
Photodiode Dark Current	I <sub>D</sub>	V <sub>DR</sub> =5V	-	2	100	nA
Photodiode Capacitance	C <sub>t</sub>	V <sub>DR</sub> =5V, f=1 MHz	-	-	10	pF
Photodiode Cutoff Frequency	f <sub>cm</sub>	V <sub>DR</sub> =5V, 50Ω load	100	-	-	MHz
Peak Wavelength	λ <sub>p</sub>	Note (2)	Note (4)			nm
Side Mode Suppression	S <sub>r</sub>	Note (2)	33	35	-	dB
Spectral Width (-20dB)	-	Note (2)	-	-	0.5	nm
Rise Time (10%-90%)	t <sub>r</sub>	Note (2)	-	0.1	0.125	nsec
Fall Time (10%-90%)	t <sub>f</sub>	Note (2)	-	0.1	0.125	nsec
Cutoff Frequency	f <sub>c</sub>	P <sub>f</sub> =10mW, -3 dB	4.0	-	-	GHz
In-Band Ripple (Window)	S <sub>21</sub>	f=50 MHz~3 GHz	-	-	+/-1.5	dB
RF Return Loss	S <sub>11</sub>	f=50 MHz~2 GHz	8	-	-	dB
		f=2 GHz~3 GHz	6	-	-	dB
		f=3 GHz~5 GHz	3	-	-	dB
Optical Isolation	I <sub>s</sub>	T <sub>C</sub> =-20 to 65°C	25	35	-	dB
Relative Intensity Noise	RIN	f=2.5 GHz P <sub>f</sub> =10 mW, ORL=24 dB	-	-	-140	dB/Hz
Kinks (up to 2.4 mW)	Kns	-	None			
Pulsation	-	-	None			
BER Performance	ER	Note (3)	No Floor			
Power Penalty	PP	Note (3)	-	-	1.5	dB

Note 1. TE=10\*log(pf(Tcase)/Pf(Tc=25°C))dB, APC

Note 2. 2.5 Gb/s NRZ, pseudo-random, P<sub>b</sub>=0.2mW, P<sub>peak</sub>=2.0mW

Note 3. Bit rate=2.48832 Gb/s, PRBS=2<sup>23</sup>-1, Dispersion=1,800 ps/nm (116km), P<sub>peak</sub>=10mW, P<sub>bias</sub>=1.0mW (Extinction ratio=10dB), B.E.R.=1x10<sup>-10</sup>  
Decision point: Center of Back-to-Back at 10Decision point: Center of Back-to-Back at 10<sup>-9</sup>, Receiver: Fujitsu Standard Receiver

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

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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.	
TEC Current	$I_C$	$T_L=T_{set}$ , $P_f=10\text{mW}$ , $T_C=65^\circ\text{C}$	-	-	1.0	A
TEC Voltage	$V_C$	$T_L=T_{set}$ , $P_f=10\text{mW}$ , $T_C=65^\circ\text{C}$	-	-	2.4	V
Cooler Power	$P_{TEC}$	$T_L=T_{set}$ , $P_f=10\text{mW}$ , $T_C=65^\circ\text{C}$	-	-	2.4	W
TEC Resistance	$R_{TEC}$	$T_L=T_{set}$ , $P_f=10\text{mW}$ , $T_C=65^\circ\text{C}$	2.0	2.4	3.2	$\Omega$
Thermistor Resistance	$R_{tr}$	$T_L=15$ to $35^\circ\text{C}$	7.7	-	12.6	k $\Omega$
Thermistor B Constant	B	-	3,270	3,450	3,630	K

Fig. 1 Forward Current vs Output Power

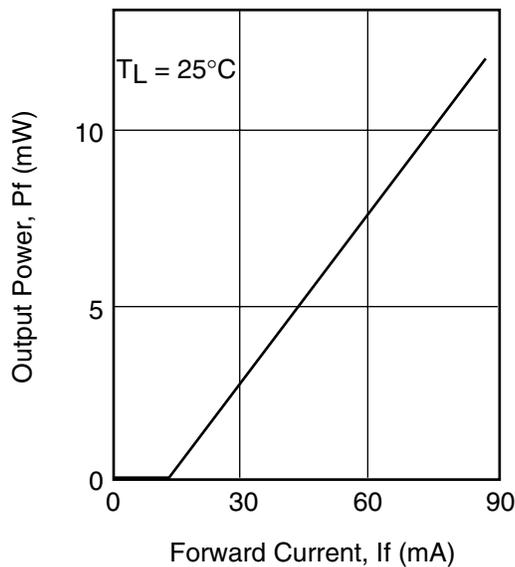


Fig. 2 Frequency Response

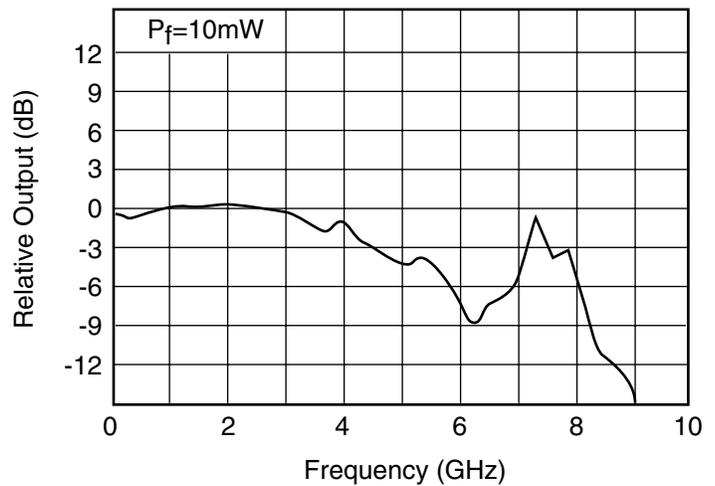


Fig. 3 RF Return Loss

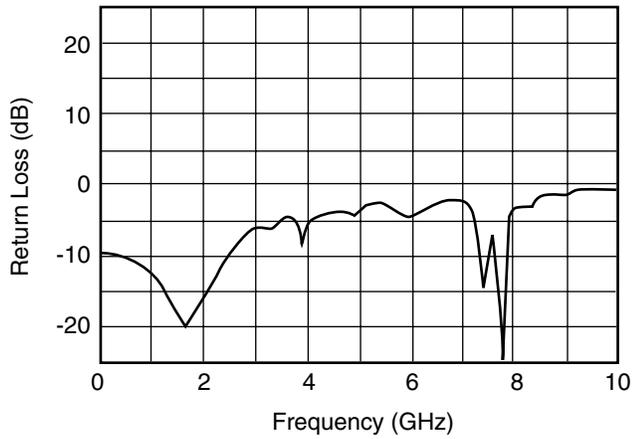


Fig. 4 Cooler Voltage -Current

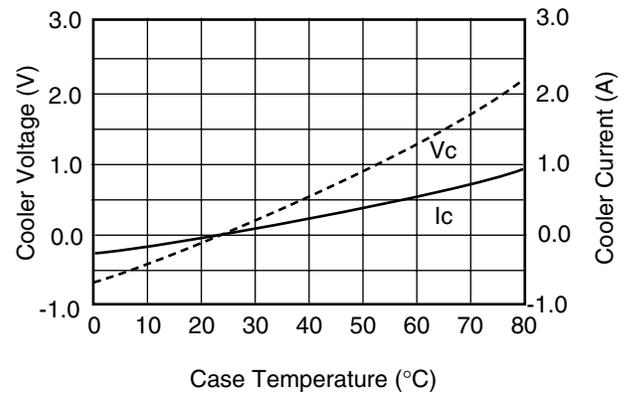


Fig. 5 Spectrum

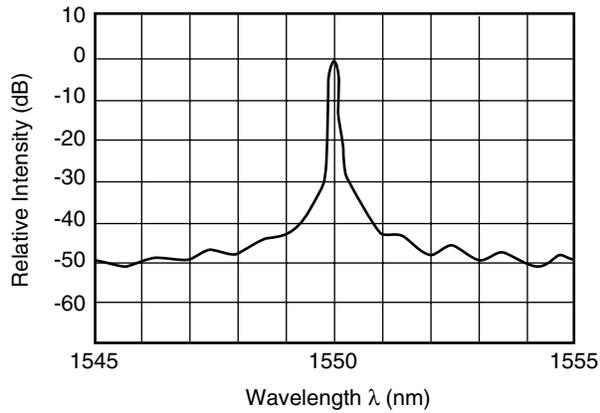
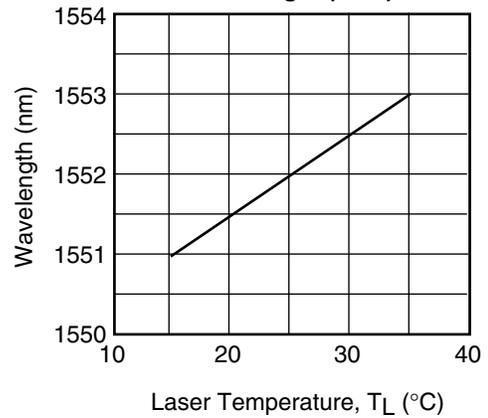
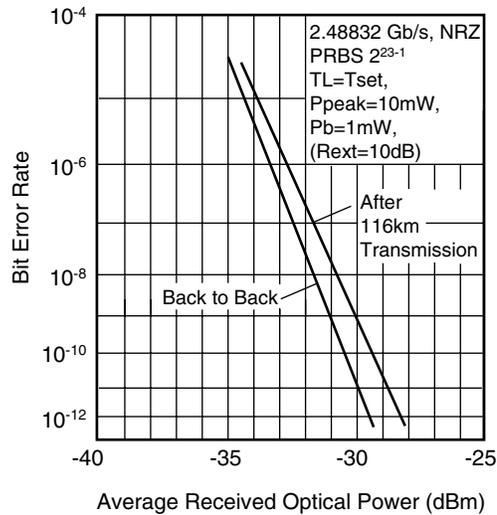


Fig. 6 Temperature Dependence of Wavelength (ACC)



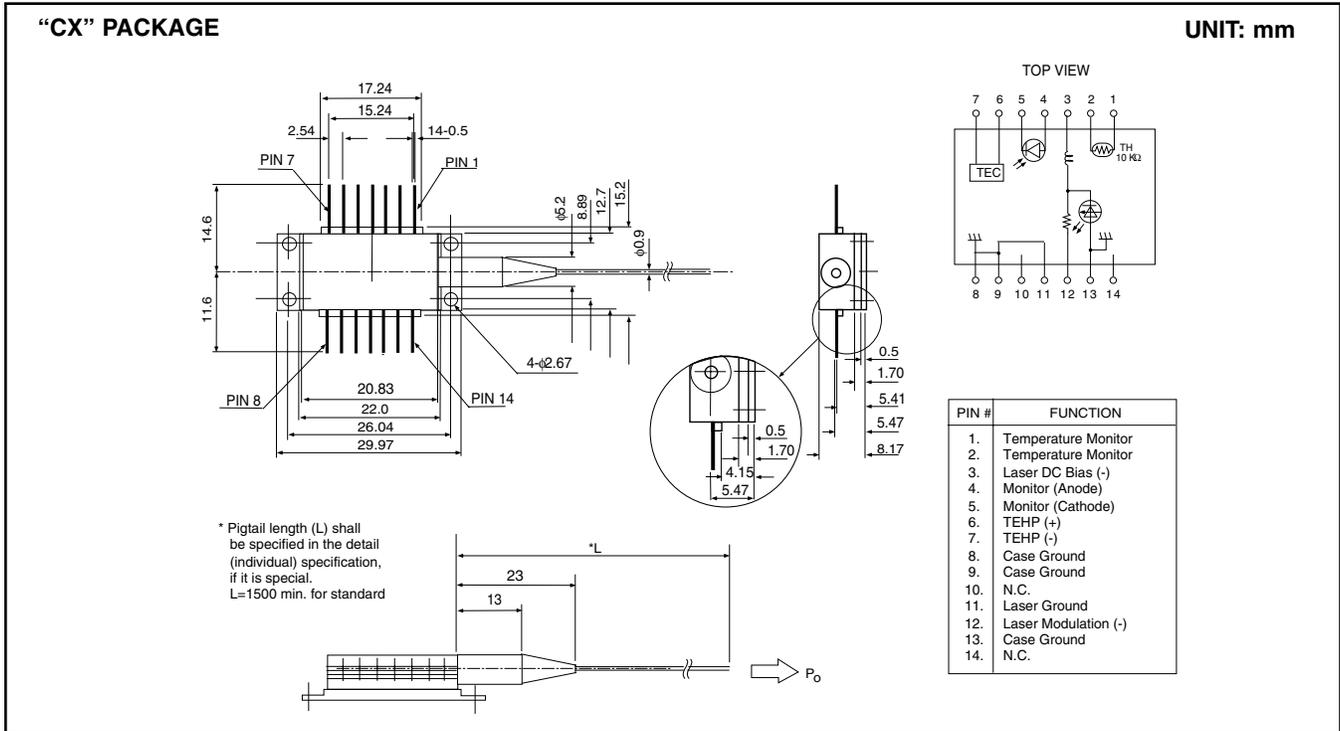
**Fig. 7 Transmission Characteristics**



**Fig. 8 Wavelength Table**

Part Number	Wavelength (nm) (TL=Tset) (in vacuum)	Tolerance (nm)
FLD5F6CX-J62	1527.99	±0.1
-J61	1528.77	±0.1
-J60	1529.55	±0.1
-J59	1530.33	±0.1
-J58	1531.12	±0.1
-J57	1531.90	±0.1
-J56	1532.68	±0.1
-J55	1533.47	±0.1
-J54	1534.25	±0.1
-J53	1535.04	±0.1
-J52	1535.82	±0.1
-J51	1536.61	±0.1
-J50	1537.40	±0.1
-J49	1538.19	±0.1
-J48	1538.98	±0.1
-J47	1539.77	±0.1
-J46	1540.56	±0.1
-J45	1541.35	±0.1
-J44	1542.14	±0.1
-J43	1542.94	±0.1
-J42	1543.73	±0.1

-J41	1544.53	±0.1
-J40	1545.32	±0.1
-J39	1546.12	±0.1
-J38	1546.92	±0.1
-J37	1547.72	±0.1
-J36	1548.51	±0.1
-J35	1549.32	±0.1
-J34	1550.12	±0.1
-J33	1550.92	±0.1
-J32	1551.72	±0.1
-J31	1552.52	±0.1
-J30	1553.33	±0.1
-J29	1554.13	±0.1
-J28	1554.94	±0.1
-J27	1555.75	±0.1
-J26	1556.55	±0.1
-J25	1557.36	±0.1
-J24	1558.17	±0.1
-J23	1558.98	±0.1
-J22	1559.79	±0.1
-J21	1560.61	±0.1
-J20	1561.42	±0.1
-J19	1562.23	±0.1
-J18	1563.05	±0.1



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