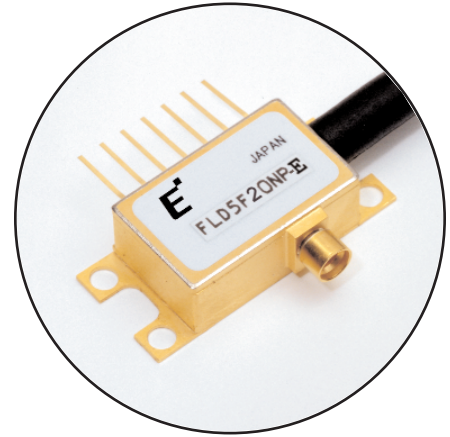


1,550nm Modulator Integrated DFB Laser

FLD5F20NP-E

FEATURES

- Modulator Integrated DFB Laser Diode Module
- CW operation of DFB laser section
- Modulation voltage applied only to modulator section
- High speed butterfly package with GPO connection
- Built-in optical isolator, monitor photodiode, thermistor, and thermo-electric cooler
- Available at C-Band ITU-T grid wavelengths between 1529.55nm thru 1563.05nm



APPLICATION

This MI DFB laser is intended for long reach applications (≤ 80 km) at 10Gb/s.

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. Extinction ratios of more than 10 dB can be achieved with 2.6 Vp-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.

ABSOLUTE MAXIMUM RATINGS ($T_{op}=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Storage Temperature	T_{stg}	-	-40	+85	$^{\circ}\text{C}$
Operating Case Temperature	T_{op}	-	-20	+70	$^{\circ}\text{C}$
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	CW	-5	+1	V
Photodiode Forward Current	-	-	-	1	mA
Photodiode Reverse Voltage	V_{DR}	-	-	10	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	-20	+70	$^{\circ}\text{C}$
Lead Soldering Time	-	260 $^{\circ}\text{C}$	-	10	sec

OPTICAL & ELECTRICAL CHARACTERISTICS (T_L = T_{set}, T_c = 25°C, BOL, unless otherwise specified)

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Type	Max.	
Peak Wavelength	λ_p		Note (4)			nm
Threshold Current	I_{th}	CW, $V_m=V_o$	-	-	30	mA
Operating Current	I_{op}		40	-	100	mA
Forward Voltage	V_F	CW, $I_F=I_{op}$	-	1.4	2.0	V
Optical Output Power (Avg. Power)	P_f	Note (1)	-2.0	-	-	dBm
Dispersion Penalty	dP		-	-	2	dB
Sidemode Suppression Ratio	SSR	Note (2)	35	-	-	dB
Wavelength Drift	-	after 20 years	-0.1	-	0.1	nm
Wavelength Stability with Case Temperature	-	-	-	-	± 1.0	pm/°C
Optical Isolation	I_s	T _c =-20 to +70°C	25	35	-	dB
On Level Modulation	V_o	-	-0.7	-	0	V
Modulator Drive Voltage	V_{mod}	(V_o-V_{mod}) \geq -3.3V, R _{ext} =10dB	-	-	2.6	V
Extinction Ratio	R _{ext}	$I_F=I_{op}$, $V_m=V_o$ (at On Level) $V_m=V_o-V_{mod}$ (at Off Level)	10	-	-	dB
Rise Time	T_r	$I_F=I_{op}$, $V_m=V_o$, 20 to 80%	-	20	25	ps
Fall Time	T_f		-	20	25	ps
Cut-off Frequency	S ₂₁	-3dB bandwidth, $V_m=V_o-0.5I_Vmod$ I, $I_F=I_{op}$	10	-	-	GHz
In-Band Ripple	ΔG	$I_F=I_{op}$, f=0.1-10GHz, $V_m=V_o-0.5I_Vmod$ I	-	-	± 1.0	dB
RF Return Loss	S ₁₁	f=DC-5GHz, 50Ω Test Set, $V_m=V_o$, $I_F=I_{op}$	8	-	-	dB
RF Return Loss	S ₁₁	f=5-10GHz, 50Ω Test Set, $V_m=V_o$, $I_F=I_{op}$	5	-	-	dB
Relative Intensity Noise	RIN	f=10 MHz to 8.5 GHz, $V_m=V_o$, $I_F=I_{op}$, 8% Reflection	-	-	-120	dB/Hz
TEC Capacity	ΔT	P _{TEC} =3.3W, $I_F=I_{op}$	70-T _{set}	-	-	°C
TEC Current	I _{TEC}	$I_F=I_{op}$, $\Delta T=(70-T_{set})[°C]$	-	-	1.3	A
TEC Voltage	V _{TEC}	$I_F=I_{op}$, $\Delta T=(70-T_{set})[°C]$	-	-	2.5	V
TEC Power Dissipation	P _{TEC}	$I_F=I_{op}$	-	-	3.3	W
Thermal Resistance	R _{th}	T _L =25°C, T _c =+25°C	9.5	10.0	10.5	kΩ
Thermistor B Constant (Note 3)	B		3,270	3,450	3,630	K

Note (1) Eudyna Test System
9.95328Gb/s, PRBS=2²³-1, $I_F=I_{op}$, $V_m=V_o$ and (V_o-V_{mod})
Dispersion=1600ps/nm, Dispersion penalty at
Bit Error Rate = 1.0E-10

Note (2) Eudyna Test System
9.95328Gb/s, PRBS=2²³-1, $I_F=I_{op}$, $V_m=V_o$ and (V_o-V_{mod})

Note (3) Relation between resistance and temperature (°K) is: R_{th}(T) = R_{th}(25°C)*exp[B/(1/T-1/298)]

Note (4) Reference Table 1 for Wavelength Table

Fig. 1 Lasing Spectrum

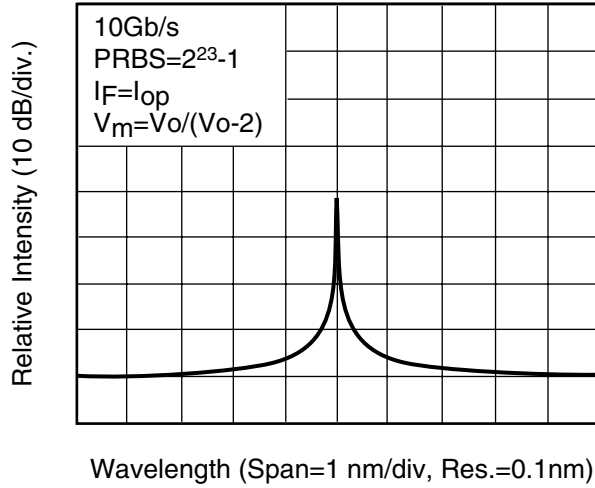


Fig. 2 Output Power & Monitor Current vs. Forward Current

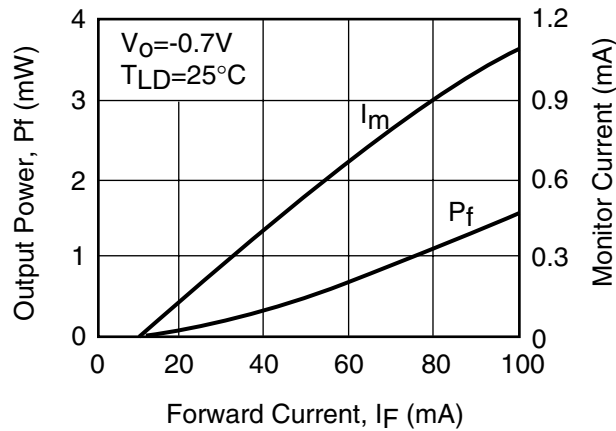


Fig. 3 Extinction Ratio vs. Modulation Applied Voltage

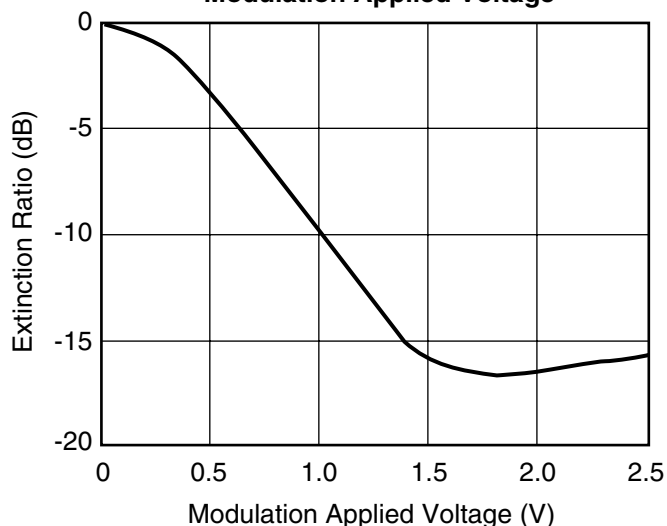


Fig. 4 Cut-off Frequency (S21)

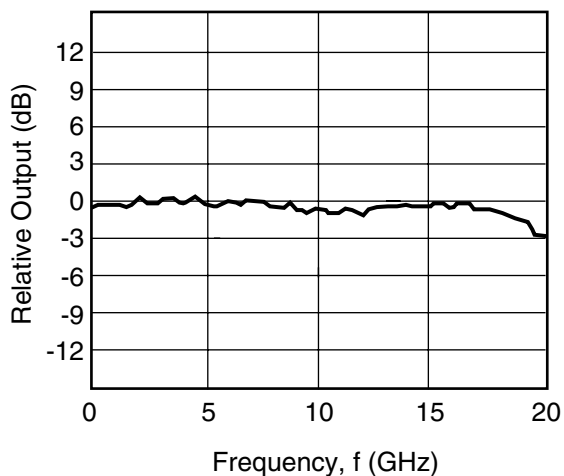


Fig. 5 RF Return Loss (S11)

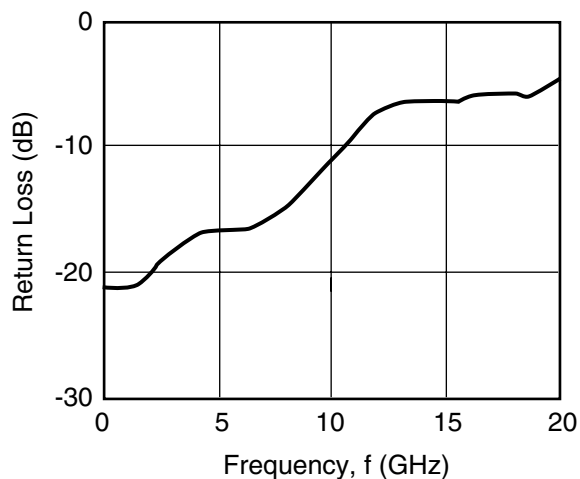


Fig. 6 Transmission Characteristics

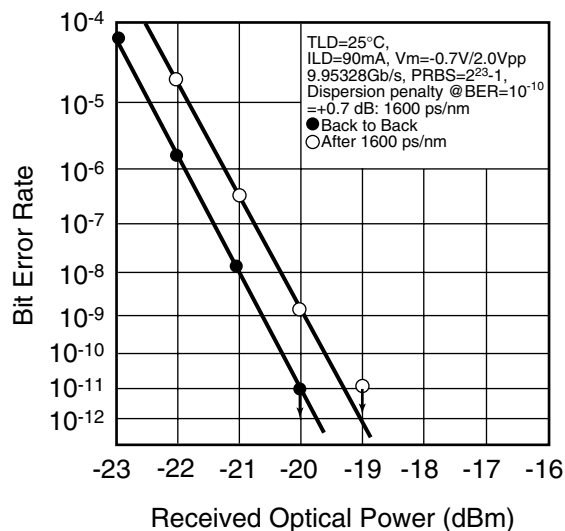
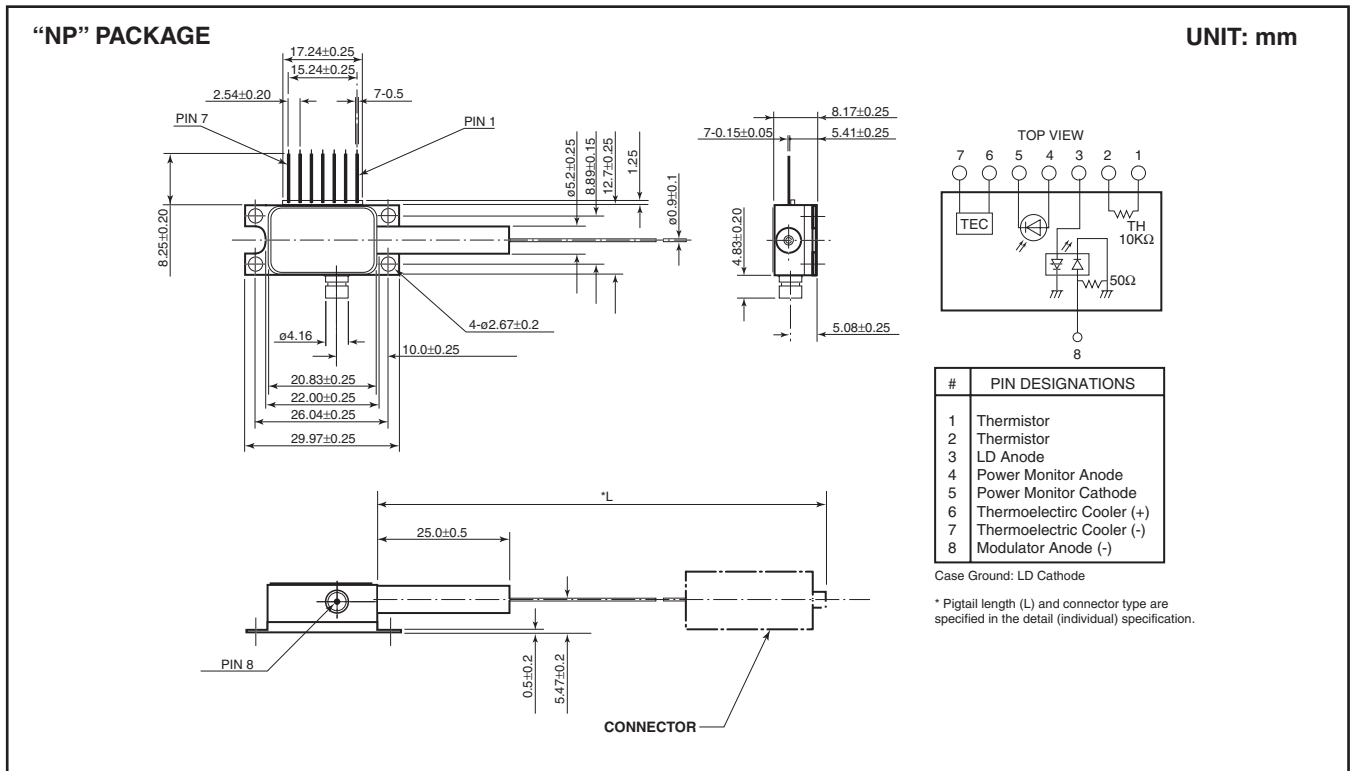


Table 1 Wavelength Table

Part Number	Wavelength (nm) (TL=Tset) (in vacuum)	Frequency (THz)	Tolerance (nm)
FLD5F20NP-E60	1529.55	196.00	±0.1
FLD5F20NP-E59	1530.33	195.90	±0.1
FLD5F20NP-E58	1531.12	195.80	±0.1
FLD5F20NP-E57	1531.90	195.70	±0.1
FLD5F20NP-E56	1532.68	195.60	±0.1
FLD5F20NP-E55	1533.47	195.50	±0.1
FLD5F20NP-E54	1534.25	195.40	±0.1
FLD5F20NP-E53	1535.04	195.30	±0.1
FLD5F20NP-E52	1535.82	195.20	±0.1
FLD5F20NP-E51	1536.61	195.10	±0.1
FLD5F20NP-E50	1537.40	195.00	±0.1
FLD5F20NP-E49	1538.19	194.90	±0.1
FLD5F20NP-E48	1538.98	194.80	±0.1
FLD5F20NP-E47	1539.77	194.70	±0.1
FLD5F20NP-E46	1540.56	194.60	±0.1
FLD5F20NP-E45	1541.35	194.50	±0.1
FLD5F20NP-E44	1542.14	194.40	±0.1
FLD5F20NP-E43	1542.94	194.30	±0.1
FLD5F20NP-E42	1543.73	194.20	±0.1
FLD5F20NP-E41	1544.53	194.10	±0.1
FLD5F20NP-E40	1545.32	194.00	±0.1
FLD5F20NP-E39	1546.12	193.90	±0.1
FLD5F20NP-E38	1546.92	193.80	±0.1
FLD5F20NP-E37	1547.72	193.70	±0.1
FLD5F20NP-E36	1548.51	193.60	±0.1
FLD5F20NP-E35	1549.32	193.50	±0.1
FLD5F20NP-E34	1550.12	193.40	±0.1
FLD5F20NP-E33	1550.92	193.30	±0.1
FLD5F20NP-E32	1551.72	193.20	±0.1
FLD5F20NP-E31	1552.52	193.10	±0.1
FLD5F20NP-E30	1553.33	193.00	±0.1
FLD5F20NP-E29	1554.13	192.90	±0.1
FLD5F20NP-E28	1554.94	192.80	±0.1
FLD5F20NP-E27	1555.75	192.70	±0.1
FLD5F20NP-E26	1556.56	192.60	±0.1
FLD5F20NP-E25	1557.36	192.50	±0.1
FLD5F20NP-E24	1558.17	192.40	±0.1
FLD5F20NP-E23	1558.98	192.30	±0.1
FLD5F20NP-E22	1559.79	192.20	±0.1
FLD5F20NP-E21	1560.61	192.10	±0.1
FLD5F20NP-E20	1561.42	192.00	±0.1
FLD5F20NP-E19	1562.23	191.90	±0.1
FLD5F20NP-E18	1563.05	191.80	±0.1



For further information please contact:

Eudyna Devices USA Inc.

2355 Zanker Rd.
 San Jose, CA 95131-1138, U.S.A.
 TEL: (408) 232-9500
 FAX: (408) 428-9111
www.us.eudyna.com

Eudyna Devices Europe Ltd.

Network House
 Norreys Drive
 Maidenhead, Berkshire SL6 4FJ
 United Kingdom
 TEL: +44 (0) 1628 504800
 FAX: +44 (0) 1628 504888

Eudyna Devices Asia Pte Ltd.

Hong Kong Branch
 Rm. 1101, Ocean Centre, 5 Canton Rd.
 Tsim Sha Tsui, Kowloon, Hong Kong
 TEL: +852-2377-0227
 FAX: +852-2377-3921

Eudyna Devices Inc.

Sales Division
 1, Kanai-cho, Sakae-ku
 Yokohama, 244-0845, Japan
 TEL: +81-45-853-8156
 FAX: +81-45-853-8170

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