

1,550nm Modulator Integrated DFB Laser

FLD5F20NP-C

FEATURES

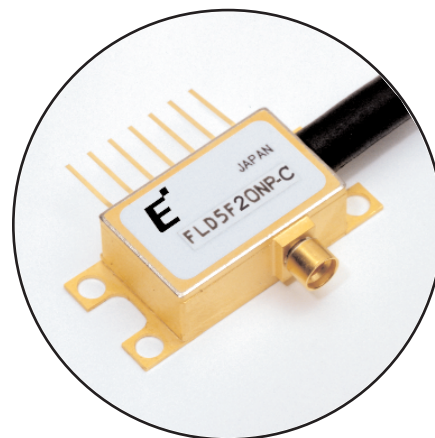
- Modulator Integrated DFB Laser Diode Module
- CW operation of DFB laser section
- Modulation voltage applied only to modulator section
- High speed butterfly package with GPO connection
- Built-in optical isolator, monitor photodiode, thermistor, and thermo-electric cooler

APPLICATION

This MI DFB laser is intended for long reach applications ($\leq 80\text{km}$) 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 ($T_{\text{op}}=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Operating Case Temperature	T_{op}	-	-20	+70	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-	-40	+85	$^{\circ}\text{C}$
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 ($T_L = 25^\circ\text{C}$, $T_{op} = 25^\circ\text{C}$, & BOL, unless otherwise specified)

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Type	Max.	
Peak Wavelength	λ_p	Note (1)	1530	-	1565	nm
Threshold Current	I_{th}	CW, $V_m = V_o$	-	-	30	mA
Threshold Power	P_{th}	CW, $I_F = I_{th}$, $V_m = V_o$	-	-	75	μW
Operating Current	I_{op}	-	40	-	100	mA
Forward Voltage	V_F	CW, $I_F = I_{op}$	-	1.4	2.0	V
Output Power	P_f	Note (1)	-1.0	-	-	dBm
Tracking Error	TE	CW, $I_F = I_{op}$, $V_m = V_o$, Im-APC, $T_c = -20$ to 70°C	-0.5	-	+0.5	dB
Spectral Width	$\Delta\lambda_p$	10Gb/s, NRZ, PRBS= $2^{23}-1$, $I_F = I_{op}$, $V_m = V_o$ & $(V_o - V_{mod})$, -3dB, FWHM	-	-	0.04	nm
		10Gb/s, NRZ, PRBS= $2^{23}-1$, $I_F = I_{op}$, $V_m = V_o$ & $(V_o - V_{mod})$, -20dB, FWHM	-	-	0.30	
Sidemode Suppression Ratio	SSR	Note (1)	35	-	-	dB
Relative Intensity Noise	RIN	$f = 10\text{MHz}$ to 8.5GHz , $V_m = V_o$, $I_F = I_{op}$, 8% Reflection	-	-	-120	dB/Hz
Kink	K	$I_{th} + 5\text{mA}$ to $1.5 \times I_{op}$	No Kink			-
Mode Hops	-	$I_{th} + 5\text{mA}$ to $1.5 \times I_{op}$	No Mode Hops			-
Optical Isolation	I_s	$T_c = -20$ to $+70^\circ\text{C}$	25	35	-	dB
On Level Modulation	V_o	-	-0.7	-	0	V
Modulator Drive Voltage	V_{mod}	$(V_o - V_{mod}) - 3.3\text{V}$, $R_{ext} = 10\text{dB}$	-	-	2.6	Vpp

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

Parameter	Symbol	Test Condition	Limits			Unit
			Min.	Type	Max.	
RF 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
Transmission Penalty due to Dispersion	P _d	Note (2)	-	-	2.0	dB
Rise/Fall Time	T _r , T _f	I _F =I _{op} , V _m =V _O , 20% to 80%	-	20	25	ps
Cut-off Frequency	S ₂₁	-3dB, I _F =I _{op} , V _m =V _O -0.5 V _{mod}	10	-	-	GHz
In-Band Ripple	ΔG	I _F =I _{op} , 0.1 to 10GHz, V _m =V _O -0.5 V _{mod}	-1.0	-	+1.0	dB
RF Return Loss	S ₁₁	DC to 5GHz, V _m =V _O , I _F =I _{op} , 50Ω Test Set	8	-	-	dB
		5 to 10GHz, V _m =V _O , I _F =I _{op} , 50Ω Test Set	5	-	-	dB
Monitor Current	I _m	Note (1), V _{DR} =5V	0.04	-	1.5	mA
Monitor Dark Current	I _d	V _{DR} =5V	-	2	100	nA
Monitor Diode Capacitance	C _t	V _{DR} =5V, f=10MHz	-	2	15	pF
TEC Capacity	ΔT	PTEC=2.4W, I _F =I _{op}	45	-	-	°C
TEC Current	I _{TEC}	I _F =I _{op} , ΔT=45°C	-	-	1.0	A
TEC Voltage	V _{TEC}	I _F =I _{op} , ΔT=45°C	-	-	2.4	V
TEC Power Dissipation	PTEC	I _F =I _{op}	-	-	2.4	W
Thermal Resistance	R _{th}	T _L =25°C	9.5	-	10.5	kΩ
Thermistor B Constant	B	-	3270	3450	3630	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})

Note (2) 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

Fig. 1 Lasing Spectrum

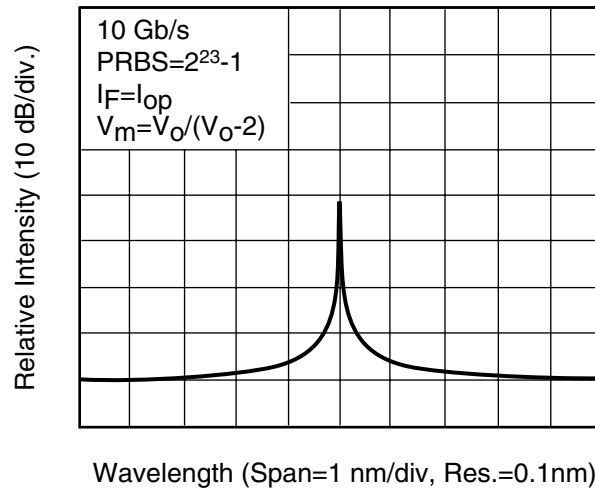


Fig. 2 Output Power & Monitor Current vs. Forward Current

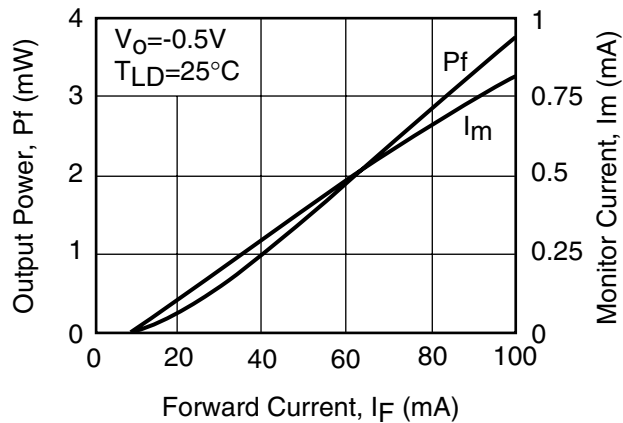


Fig. 3 Extinction Ratio vs. Modulation Applied Voltage

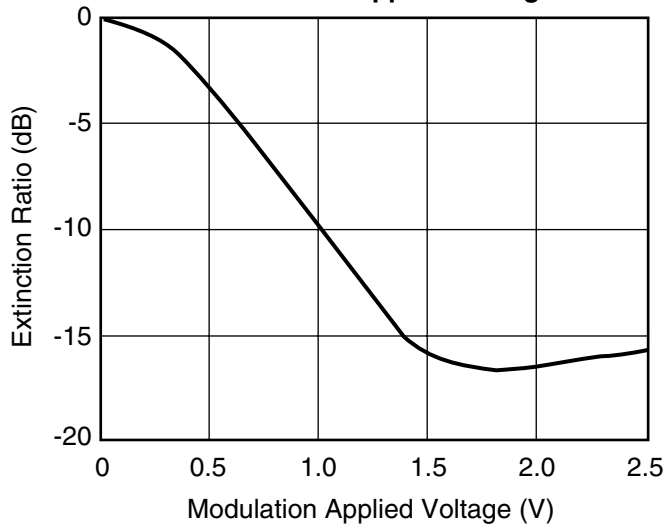


Fig. 4 Cut-off Frequency (S21)

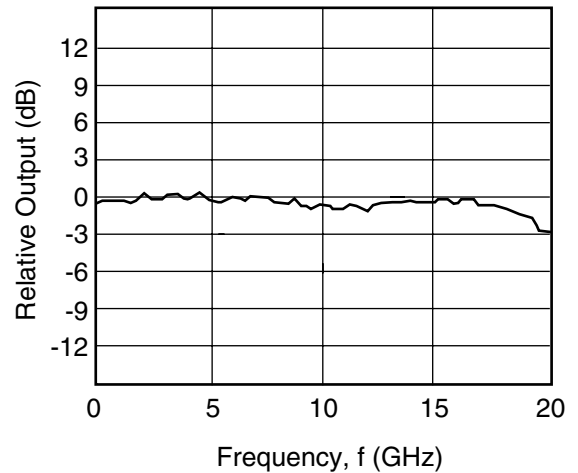


Fig. 5 RF Return Loss (S11)

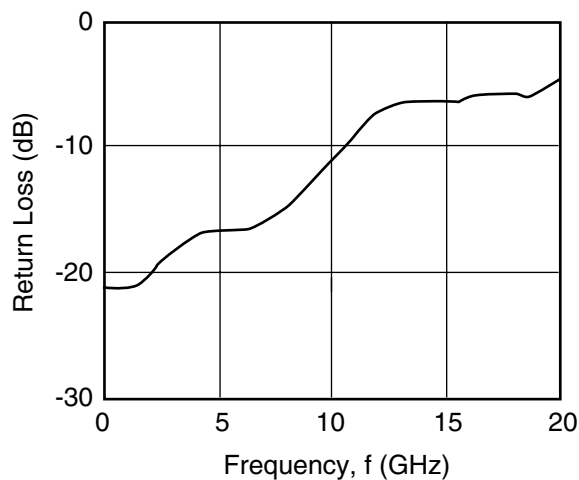
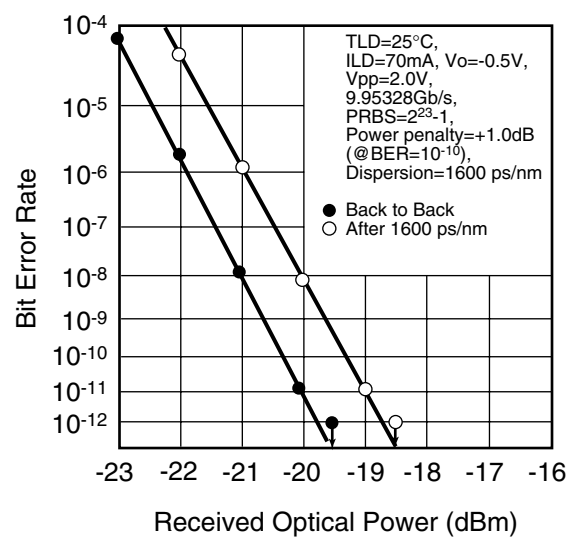
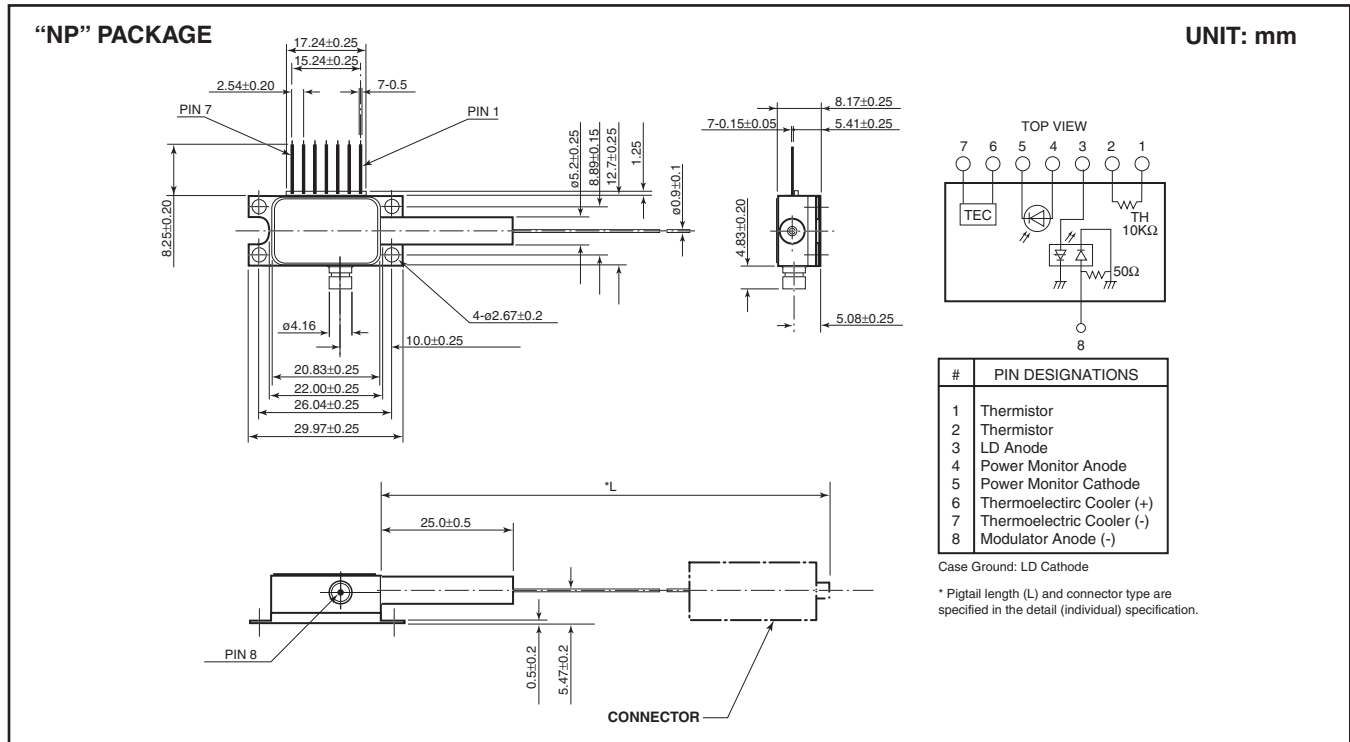


Fig. 6 Transmission Characteristics





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