New Products

550 mW 980 nm Laser Diode Module for EDFA (FOL 0909 series)

1. INTRODUCTION

Accompanied by the increase in transmission capacity of backbone systems and metropolitan networks caused by the expansion of FTTH, erbium-doped fiber amplifier (EDFA) is playing an important role in a wavelength division multiplexing (WDM) system. For pumping sources of EDFA, laser modules (LDMs) of 1480 nm band and 980 nm band are used. 980 nm LDM, which has advantages of low noise and low power consumption, has conventionally been used as a preamplifier which needs relatively lower pumping power. Recently, 980 nm LDM becomes more reliable and has higher output power. A progress in 980 nm LDM enables such EDFA that uses a 980 nm LDM only, instead of using 1480 nm LDMs as a booster amplifier. This type of EDFA is becoming mainstream because of its features such as low power consumption, low price and space-saving. High output power of more than 500 mW is required in order to obtain EDFA gain using only one 980 nm LDM. Moreover, to adjust EDFA gain in accordance with the change of WDM count, a stable operation over a wide output power range is required.

Furukawa Electric has been producing 980 nm LDM with operating power up to 450 mW. A 550 mW 980 nm LDM (Figure 1), suitable for recent EDFA designs, has been newly developed and commercialized.

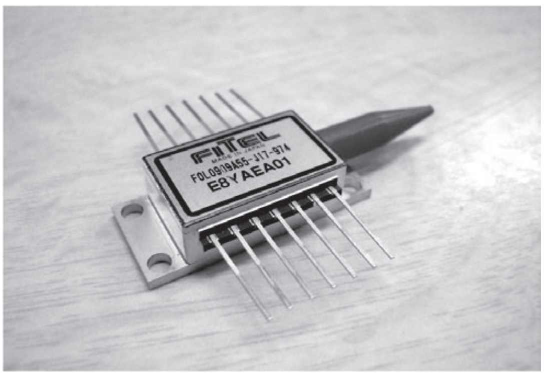

Figure 1 980 nm pump laser module.

2. FEATURES

2.1 High output power by electrical and optical design

A maximum operating power of LDM is determined by various factors such as the optical damage of a LD facet, the output power rollover by heat generation, the coupling efficiency between the LD chip and the optical fiber and so on.

In our 980 nm LD chip, the optical density at the active layer is lowered and, as a result, the suppression of the optical damage and the high reliability are achieved.

As a consequence of reducing the forward voltage, the suppression of the heat generation and the advancement of the thermal rollover point were realized. And the increase of the power consumption caused by higher operating power was designed to the minimum. In addition, the module design was also reviewed. By optimizing the mode field matching between the LD chip and the optical fiber, the coupling efficiency was improved and the high kink-free power was achieved. A light-current (*I*-*L*) and a voltage-current (*I*-*V*) characteristics of the 550 mW LDM are shown in Figure 2.

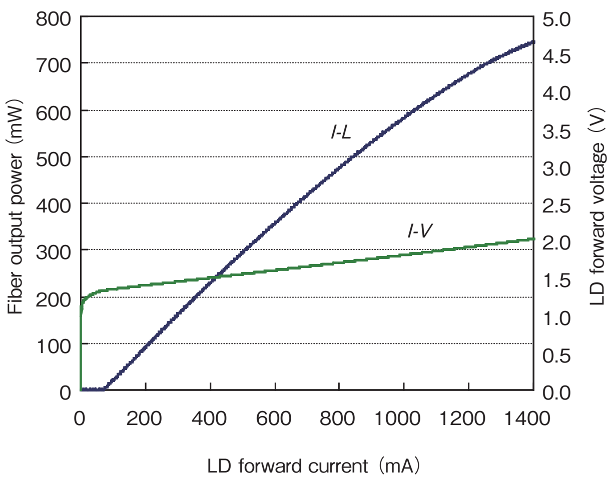

Figure 2 *I*-*L* and *I*-*V* curve.

2.2 Stabilization of output power by optimizing FBG parameters

Generally, fiber bragg grating (FBG) is used in order to stabilize the lasing wavelength of LDM. There is, however, a well known problem that the oscillation state of the laser becomes unstable due to the interaction between the LD chip and the reflected light from FBG, thereby the lasing wavelength or/and the output power fluctuate over time.

When the number of WDM channels is several, required 980 nm pump power is a couple of dozen mW. In such a lower power range, the suppression of fluctuation becomes more difficult. The newly developed LDM exhibits stable spectrum over a wide power range due to the optimization of the FBG parameters (Figure 3). Also, the power fluctuation is well stabilized to lower than 0.5% at high power range (-550 mW) and lower than 2% at low power range (30 mW-) (Figure 4).

3. CONCLUSION

The high power 980 nm LDM has been developed as an EDFA pumping source and fiber output power of 550 mW has been realized. In addition, the fluctuation of the output power is suppressed over a wide operating power range. Therefore this product can fully meet your needs as a pumping source for high performance EDFAs.

For more information, please contact
Global Business Solutions, Telecommunications Company
Tel: +81-3-3286-3253 Fax: +81-3-3286-3978

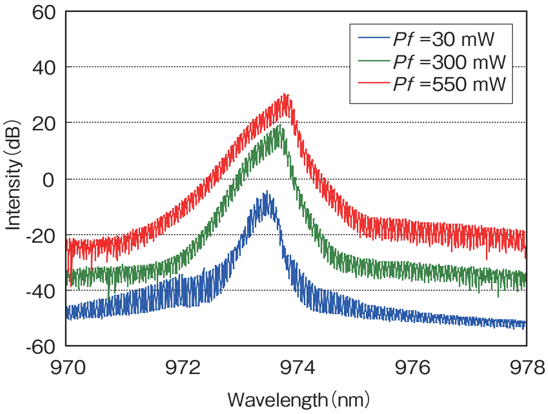

Figure 3 Output spectrum.

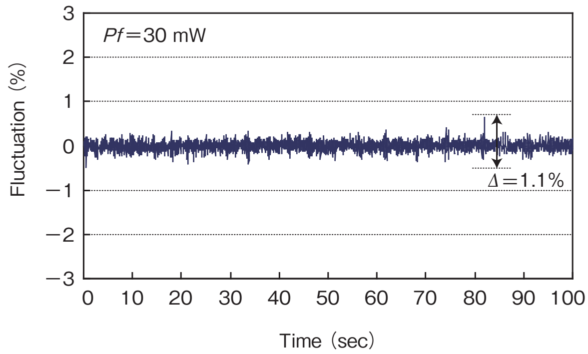

Figure 4 Power stability vs time.

Table 1 Performance specifications.

Ts=25°C

Parameters	Sym.	Min.	Typ.	Max.	Unit	Condition
Output power						
FOL0909A46		460	–	–		If (BOL)=<890 mA
FOL0909A47		470	–	–		If (BOL)=<910 mA
FOL0909A48		480	–	–		If (BOL)=<930 mA
FOL0909A49		490	–	–		If (BOL)=<950 mA
FOL0909A50	*Pf*	500	–	–	mW	If (BOL)=<970 mA
FOL0909A51		510	–	–		If (BOL)=<990 mA
FOL0909A52		520	–	–		If (BOL)=<1010 mA
FOL0909A53		530	–	–		If (BOL)=<1030 mA
FOL0909A54		540	–	–		If (BOL)=<1050 mA
FOL0909A55		550	–	–		If (BOL)=<1070 mA
LD Threshold Current	*Ith*	–	70	85	mA	CW
Peak Wavelength	*λc*	λ −1	λ	λ +1	nm	Peak, Pf=Rated Power λ =974 nm～976 nm
Spectral Width	Δλ	–	–	2	nm	FWHM, Pf=Rated Power
LD Forward Voltage	*Vf*	–	–	2.5	V	Pf=Rated Power
LD Forward Current (EOL)	*If* (EOL)	=<1.1 x If (BOL) max.			mA	End of Life
Kink Free Power	*Pkink*	=1.1 x Rated Power			mW	–
Kink Free Current	*Ikink*	=1.15 x If (BOL)			mA	–
Pf Stability	*Pstb*	–	–	2.0	%	Pf=30 mW～Rated power, 60 sec, peak to peak, Fiber pigtail is fixed
Monitor Responsivity	*Im/Pf*	2	–	20	mA/mW	VrPD=5 V, average Pf=0 mW～Rated Power
Monitor Dark Current	*Id*	–	–	100	nA	VrPD=5 V
TEC Current	*Itec*	–	–	1.5	A	If (EOL), ΔT=50℃
TEC Voltage	*Vtec*	–	–	3.5	V	If (EOL), ΔT=50℃
Tracking Error	*T.E.*	−0.5	–	0.5	dB	Pf/Im Tc=−20～75℃, referred to @25℃
Thermistor Resistance	*Rth*	9.5	10	10.5	kΩ	Ts=25℃
Thermistor B constant	*Bth*	–	3900	–	K	Ts=25℃