

# Low Power Consumption Cooled Mini-Butterfly 980nm Pump Laser Module

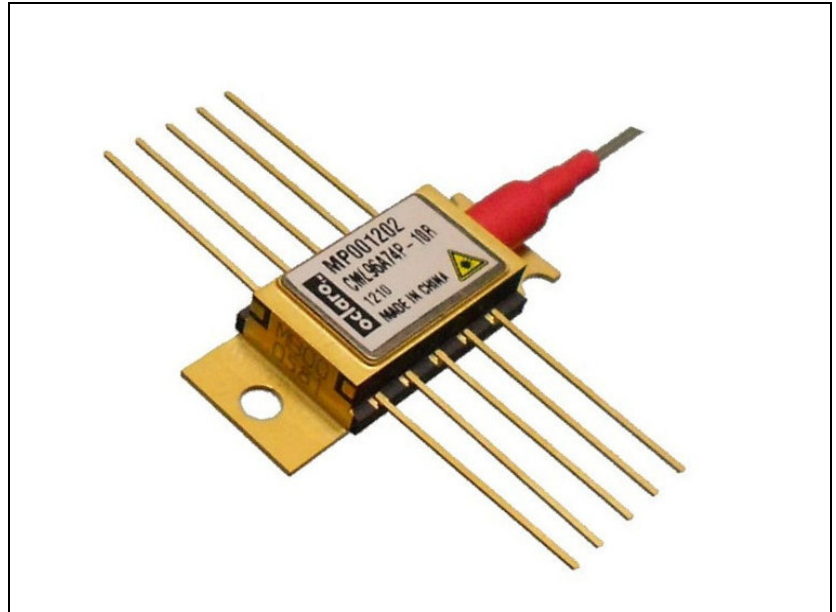
## CML96\* P-10R

### Features:

- High output power, up to 600mW kink free
- Polarization maintaining fiber pigtail
- Fiber Bragg grating stabilization for wavelength locking over the entire operating conditions
- Small form factor (mini-Butterfly) package
- Low power consumption
- Internal thermoelectric heatpump and monitor photodiode
- Hermetically sealed 10 pin butterfly package
- Telcordia GR-468-CORE compliant
- Field-proven high reliability
- RoHS compliant 

### Applications:

- Low noise EDFAs
- Dense wavelength division multiplexing (DWDM) EDFAs
- CATV Applications



These lasers are designed as pump sources for erbium doped fiber amplifier (EDFA) applications. Processes and techniques of coupling the fiber to the laser allow high output powers that are very stable with both time and temperature. The grating is located in the pigtail to stabilize the wavelength. Oclaro laser diode chips incorporate E2 front mirror passivation that prevents Catastrophic Optical Damage (COD) to the laser diode facet. Processes and techniques of coupling the fiber to the laser chip allow high output powers that are very stable with both time and temperature.

The CML96 P series pump modules operate at significantly reduced TEC and overall power consumption.

Devices are available with fiber output power up to 600mW.

## Operating Characteristics

Conditions unless otherwise stated:

Case temperature -20 to 75°C  
 Submount temperature 40°C  
 Monitor diode bias -5V  
 CW operation

Product Code	Operating Power	Kink Free Power	Product Code	Operating Power	Kink Free Power
CML96A74P-20R	365mW	400mW	CML96L74P-20R	455mW	500mW
CML96B74P-20R	375mW	410mW	CML96M74P-20R	465mW	510mW
CML96C74P-20R	380mW	420mW	CML96N74P-20R	475mW	520mW
CML96D74P-20R	390mW	430mW	CML96P74P-20R	480mW	530mW
CML96E74P-20R	400mW	440mW	CML96R74P-20R	490mW	540mW
CML96F74P-20R	410mW	450mW	CML96S74P-20R	500mW	550mW
CML96G74P-20R	420mW	460mW	CML96T74P-20R	510mW	560mW
CML96H74P-20R	425mW	470mW	CML96U74P-20R	520mW	570mW
CML96J74P-20R	435mW	480mW	CML96V74P-20R	525mW	580mW
CML96K74P-20R	445mW	490mW	CML96W74P-20R	535mW	590mW
			CML96X74P-20R	545mW	600mW

Operating power assumes a 10% ageing margin: Operating Power = Kink-Free Power/1.1

Parameter	Symbol	Measurement Conditions	Min	Typ	Max	Unit
Threshold current	I <sub>th</sub>	Thermistor @ 10kΩ		40	55	mA
Operating current	I <sub>op</sub>	365mW		560	620	mA
		375mW		575	635	
		380mW		590	655	
		390mW		600	670	
		400mW		615	685	
		410mW		625	695	
		420mW		640	710	
		425mW		655	725	
		435mW		670	745	
		445mW		680	755	
		455mW		690	770	
		465mW		705	785	
		475mW		720	800	
		480mW		735	820	
		490mW		750	835	
500mW		755	840			
510mW		770	860			
520mW		785	875			
525mW		795	885			
535mW		810	900			
545mW		820	920			
Operating forward voltage	V <sub>op</sub>			1.8	2.0	V

Parameter	Symbol	Measurement Conditions	Min	Typ	Max	Unit
Center wavelength	$\lambda_c$	974nm series 976nm series	973 975	974 976	975 977	nm
Spectral width at -13dB	$\Delta\lambda$			0.2	1.0	nm
Signal to noise ratio	SNR		20			dB
Temperature dependence of peak wavelength	$d\lambda/dT$			0.02		nm/°C
Monitor diode responsivity	Rmon		1		10	$\mu\text{A}/\text{mA}$
Photodiode dark current	I <sub>dark</sub>	-5V bias			50	nA
Fiber power stability >30mW 20 – 30mW 10 – 20mW 5 – 10mW		Peak-to-peak Time = 60sec DC to 50kHz			0.22 0.10 0.15 0.30	dB
Thermistor BETA value		±1%	3539	3575	3611	K
Thermistor resistance	R <sub>th</sub>	LD carrier temperature is set to 40°C	9.5	10.0	10.5	k $\Omega$

## Absolute Maximum Ratings

Parameter	Symbol	Measurement Conditions	Min	Max	Unit
Operating case temperature	T <sub>op</sub>		-20	75	°C
Storage temperature	T <sub>stg</sub>		-40	85	°C
Storage relative humidity	RH <sub>stg</sub>	But not to exceed 0.024kg of water per 1.0kg of dry air		85	%RH
Operating relative humidity	RH <sub>op</sub>		5	80	%RH
Pigtail axial pull force		3x10 seconds		10.0	N
Pigtail side pull force		3x10 seconds		5.0	N
Fiber bend radius			20		mm
Lead soldering temperature		10 sec		350	°C
Laser diode forward current	I <sub>f max</sub>	CW		1200	mA
Laser diode reverse Current	I <sub>r max</sub>	Reverse voltage <2V		10	$\mu\text{A}$
Laser diode current transient		t = 1000ns max.		1400	mA
Laser diode reverse voltage	V <sub>revLD</sub>			2	V

## Maximum TEC and Total Module Power Consumption values at different case temperatures

Drive current (mA)	-20°C case temperature				40°C case temperature				75°C case temperature			
	TEC Current (A)	TEC Voltage (V)	TEC Power (W)	Module Power (W)	TEC Current (A)	TEC Voltage (V)	TEC Power (W)	Module Power (W)	TEC Current (A)	TEC Voltage (V)	TEC Power (W)	Module Power (W)
500	-0.64	-1.30	0.83	1.59	0.16	0.20	0.03	0.79	0.70	1.60	1.12	1.90
600	-0.62	-1.28	0.79	1.74	0.19	0.25	0.05	0.98	0.74	1.65	1.22	2.13
700	-0.59	-1.25	0.74	1.89	0.22	0.30	0.07	1.20	0.78	1.70	1.33	2.46
800	-0.57	-1.20	0.68	2.00	0.26	0.40	0.10	1.43	0.83	1.80	1.49	2.83
900	-0.54	-1.18	0.64	2.17	0.30	0.45	0.14	1.66	0.88	1.90	1.67	3.22
1000	-0.50	-1.17	0.59	2.34	0.35	0.50	0.18	1.93	0.94	2.00	1.88	3.65

## Typical TEC and Total Module Power Consumption values at different case temperatures

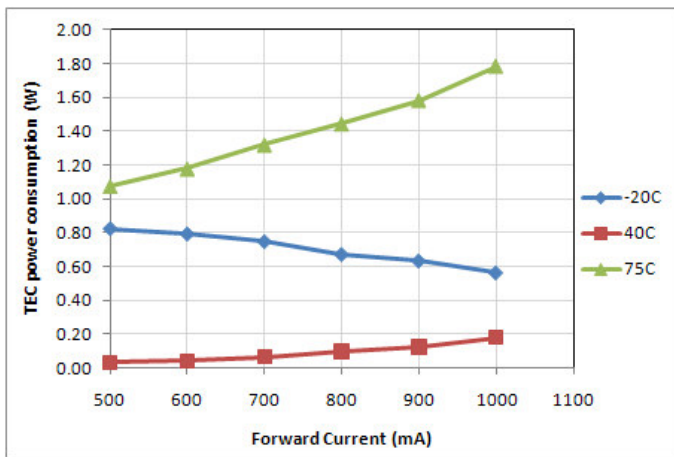


Figure 1: Typical TEC power consumption at different case temperatures.

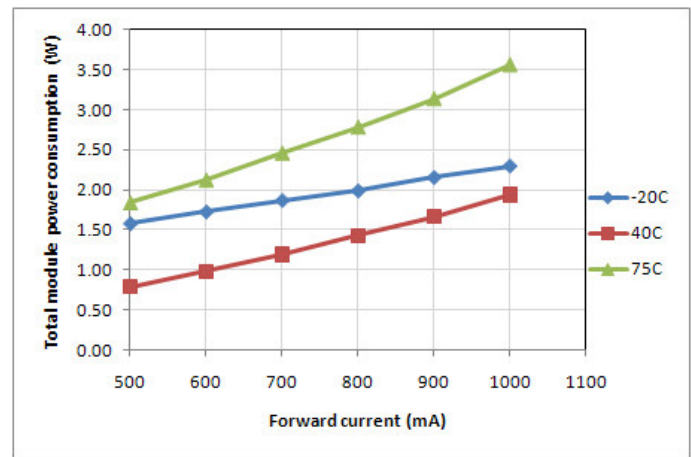


Figure 2: Typical total power consumption module at different case temperatures

## Fiber Specification

Parameter	Note	Min	Typ	Max	Unit
Fiber type	Nufern PM980-HP or Corning PM98-U25A				
Fiber termination	Bare fiber, rough cleave				
Cut-off wavelength		830	900	970	nm
Mode field diameter	@ 980nm	5.6	6.6	7.6	µm
Cladding diameter		124	125	126	µm
Fiber coating diameter	Acrylate material, mechanically strippable	230	245	260	µm
Grating recoat diameter		260	280	300	µm
Core/cladding concentricity				<0.5	µm
Coating-clad offset				≤5	µm
Fiber proof test		150			kpsi

Package Outline Drawing and Dimensions

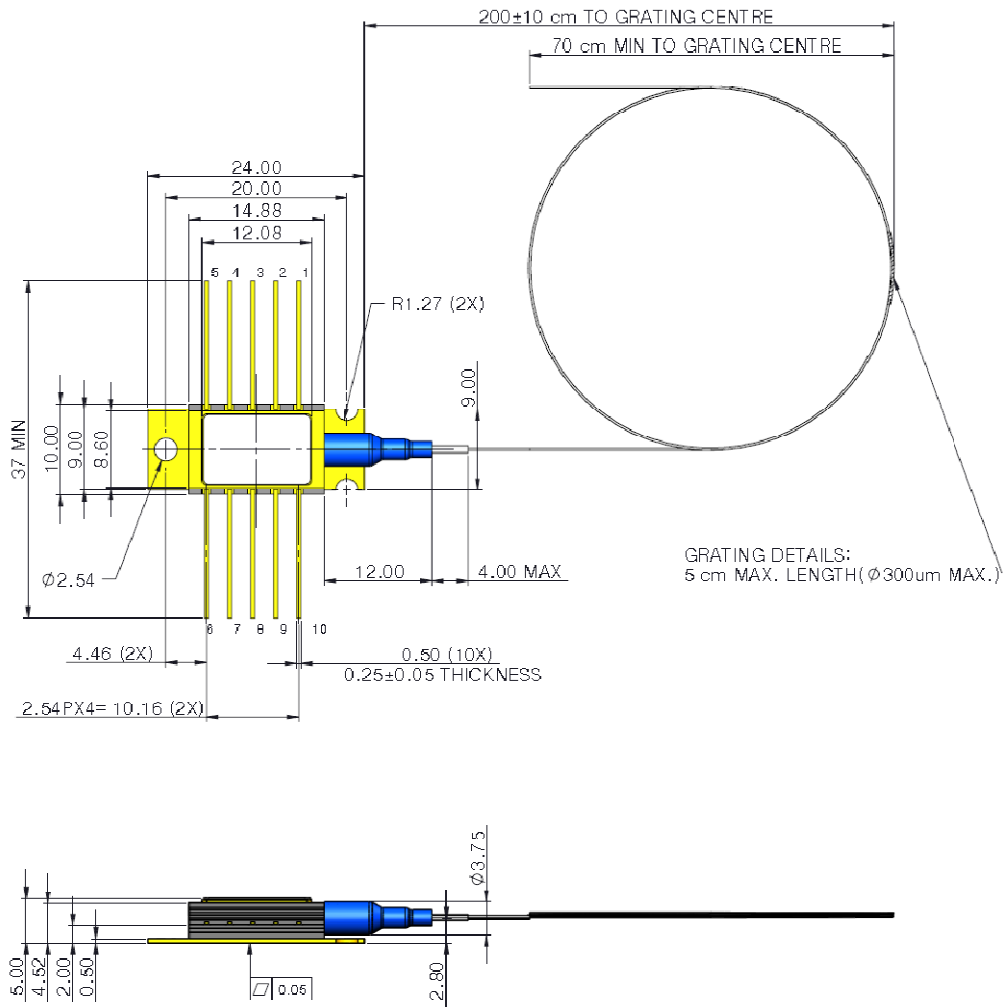
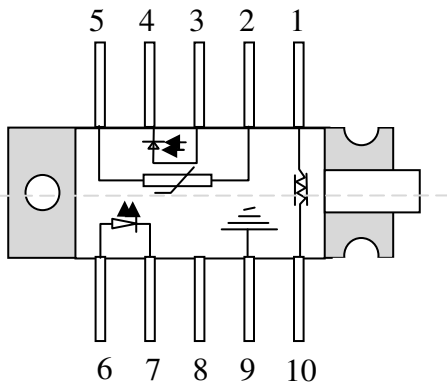


Figure 1: Package Outline Drawing and Dimensions (mm)

Connections



Pin #	Description	Pin#	Description
1	TEC (+)	6	Laser anode (+) 1
2	Thermistor	7	Laser cathode (-) 1
3	Monitor anode (-)	8	NC
4	Monitor cathode (+)	9	Package ground
5	Thermistor	10	TEC (-)

Figure 2: Connections

## RoHS Compliance



Oclaro is fully committed to environment protection and sustainable development and has set in place a comprehensive program for removing polluting and hazardous substances from all of its products. The relevant evidence of RoHS compliance is held as part of our controlled documentation for each of our compliant products. RoHS compliance parts are available to order, please refer to the ordering information section for further details.

## Contact Information    Ordering Information

[www.oclaro.com](http://www.oclaro.com)

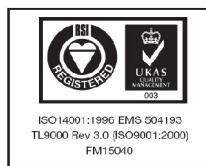
Kink-free Power	Operating Power	974nm Code	976nm Code
400mW	365mW	CML96A74P-10R	CML96A76P-10R
410mW	375mW	CML96B74P-10R	CML96B76P-10R
420mW	380mW	CML96C74P-10R	CML96C76P-10R
430mW	390mW	CML96D74P-10R	CML96D76P-10R
440mW	400mW	CML96E74P-10R	CML96E76P-10R
450mW	410mW	CML96F74P-10R	CML96F76P-10R
460mW	420mW	CML96G74P-10R	CML96G76P-10R
470mW	425mW	CML96H74P-10R	CML96H76P-10R
480mW	435mW	CML96J74P-10R	CML96J76P-10R
490mW	445mW	CML96K74P-10R	CML96K76P-10R
500mW	455mW	CML96L74P-10R	CML96L76P-10R
510mW	465mW	CML96M74P-10R	CML96M76P-10R
520mW	475mW	CML96N74P-10R	CML96N76P-10R
530mW	480mW	CML96P74P-10R	CML96P76P-10R
540mW	490mW	CML96R74P-10R	CML96R76P-10R
550mW	500mW	CML96S74P-10R	CML96S76P-10R
560mW	510mW	CML96T74P-10R	CML96T76P-10R
570mW	520mW	CML96U74P-10R	CML96U76P-10R
580mW	525mW	CML96V74P-10R	CML96V76P-10R
590mW	535mW	CML96W74P-10R	CML96W76P-10R
600mW	545mW	CML96X74P-10R	CML96X76P-10R

## Patents

This product is protected by US patent numbers 6,359,330, 6,528,329, 6,782,024, 6,798,815, 6,837,075, 7,173,953 and 7,218,659 and other patents and applications pending worldwide.

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