Data sheet microchip MC-1064-100ps

Microchip in reflection for pulsed laser emission
(Data sheet rev. 3.3 2014-11-24)

MC-1064-100ps - Microchip with 1064 nm laser emission and 100 ps pulse duration

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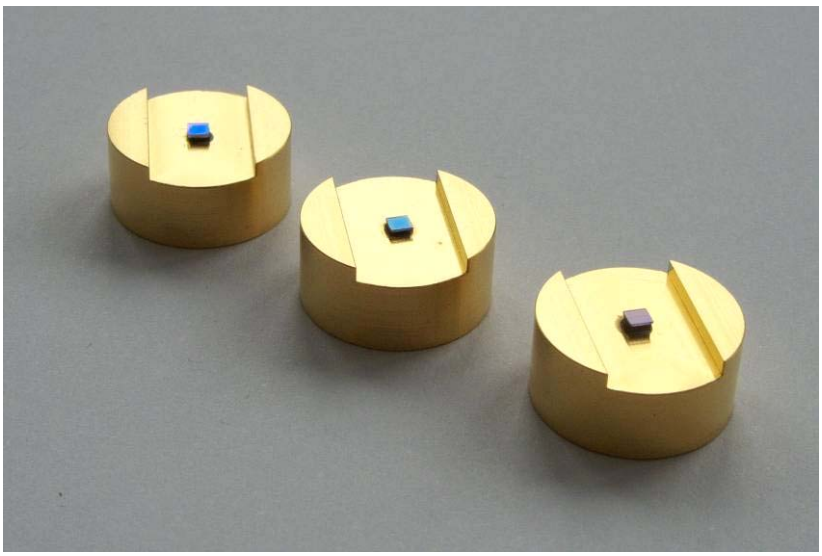
1. Microchip description and applications

The Microchip (MC) consists of a saturable absorber mirror bonded with a Nd:YVO_4 laser crystal. The MC can be used to generate pulsed laser radiation at 1064 nm wavelength if pumped with a pump diode at 808 nm. Possible application areas of this laser radiation are:

- micromachining
- light detection and ranging (LIDAR)
- precision measurements
- frequency conversion

The main advantage of a laser build with this microchip is the pump power dependent repetition rate with fixed pulse duration and pulse energy. By simply increasing the pump power at 808 nm the repetition rate - and consequently the average output power - will be increased proportionally starting from the laser threshold.



2. Microchip parameters

MC-1064-100ps

Optical Pump Parameters

Parameter at T=25°C	Min.	Typ.	Max.
Wavelength	806nm	808nm	810nm
Pump Power	70	150mW-200mW	300mW
Pump Spot Diameter	25µm	40µm	60µm
Fluorescent Lifetime		35 µs (3%)	
Pump Absorption @ 808nm	85%	90%	95%
Pump Power Density	5 kW/cm^2		24 kW/cm$^{2\,*}$

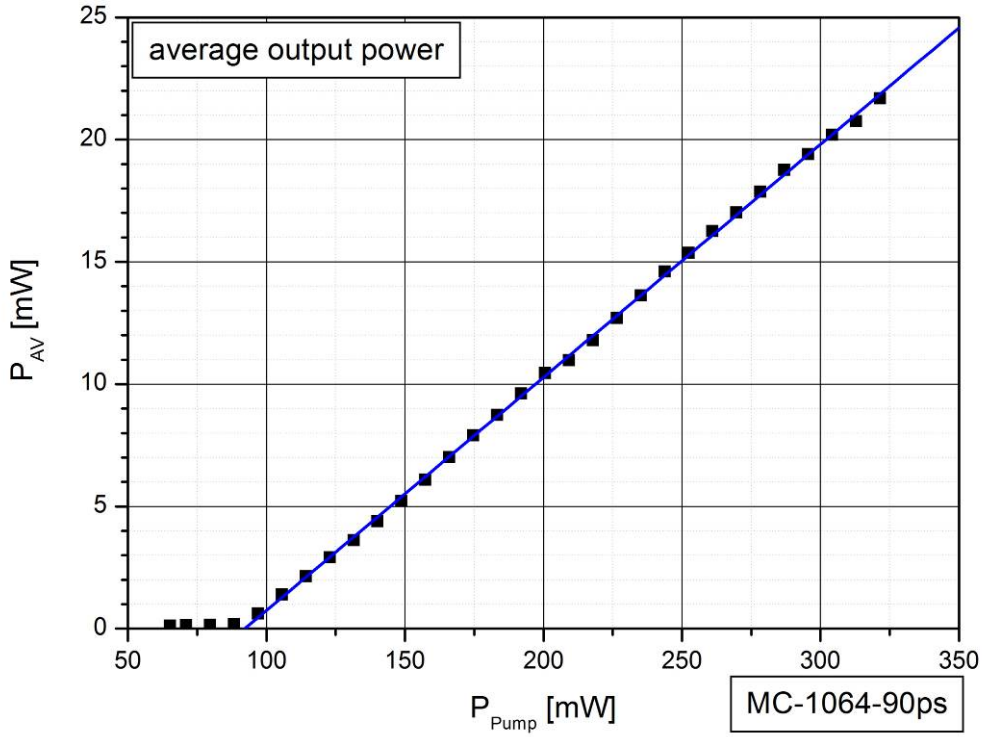
Lasing performance with 40µm pump spot size at 25°C

Parameter at T=25°C	Min.	Typ.	Max.
Laser Wavelength	1064.0nm	1064.3nm	1064.6nm
Laser Wavelength Drift		50 pm/100mW**	
Beam Waist Diameter	60 µm		100 µm
M^2	1.1	1.3	1.5
Pulse Energy	15 nJ	18 nJ	21 nJ
Pulse Duration	70ps	100ps	130ps
Differential Efficiency	8%	10%	13%
Laseing Thresold	100 mW	110 mW	120 mW
Polarization Extinction Ratio		100	
f_{rep}	75 kHz		700 kHz
P_{av} (150mW)	3,0 mW	4,0 mW	5,0 mW
P_{av} (200mW)	7,5 mW	9,0 mW	10,5 mW

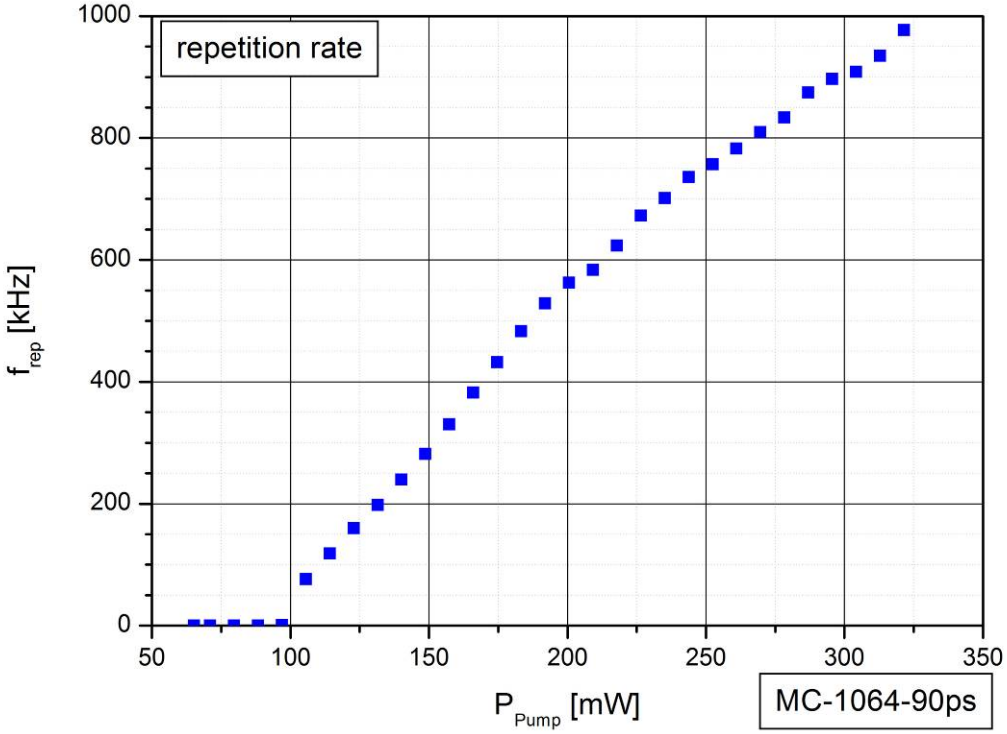
The average output power P and the repetition frequency f_R are a function of the optical pump power. These dependencies are nearly linear above the laser threshold. The jitter of the repetition frequency decreases with increasing pump power to about 2 %, whereas the pulse energy E_P remains constant.

* Pump Power Density at 40 µm pump spot diameter and 300 mW pump power
** Laser wavelength drift for 40µm pump spot diameter

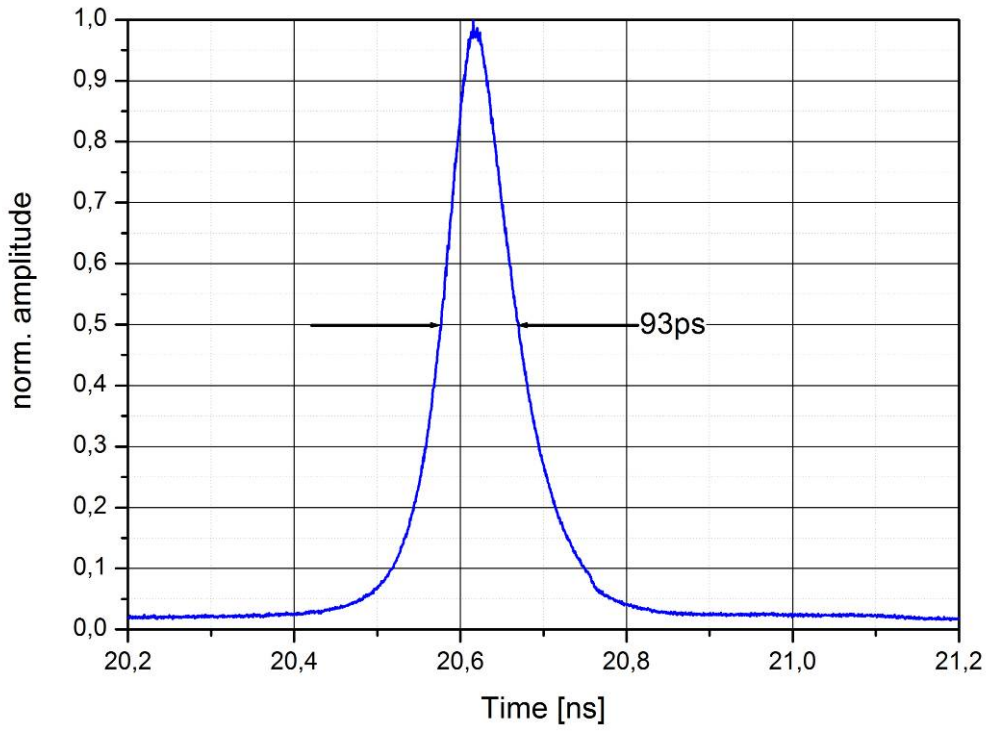
Dependency of the average output power P on the pump power at 808 nm



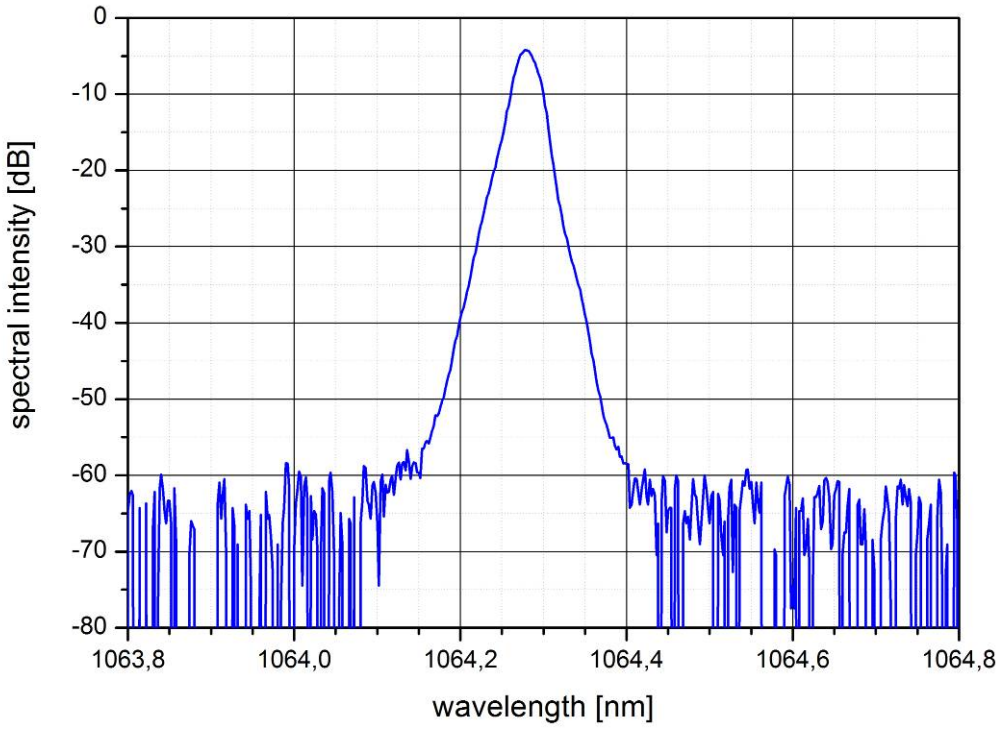
Dependency of the repetition rate f_{rep} on the pump power at 808 nm



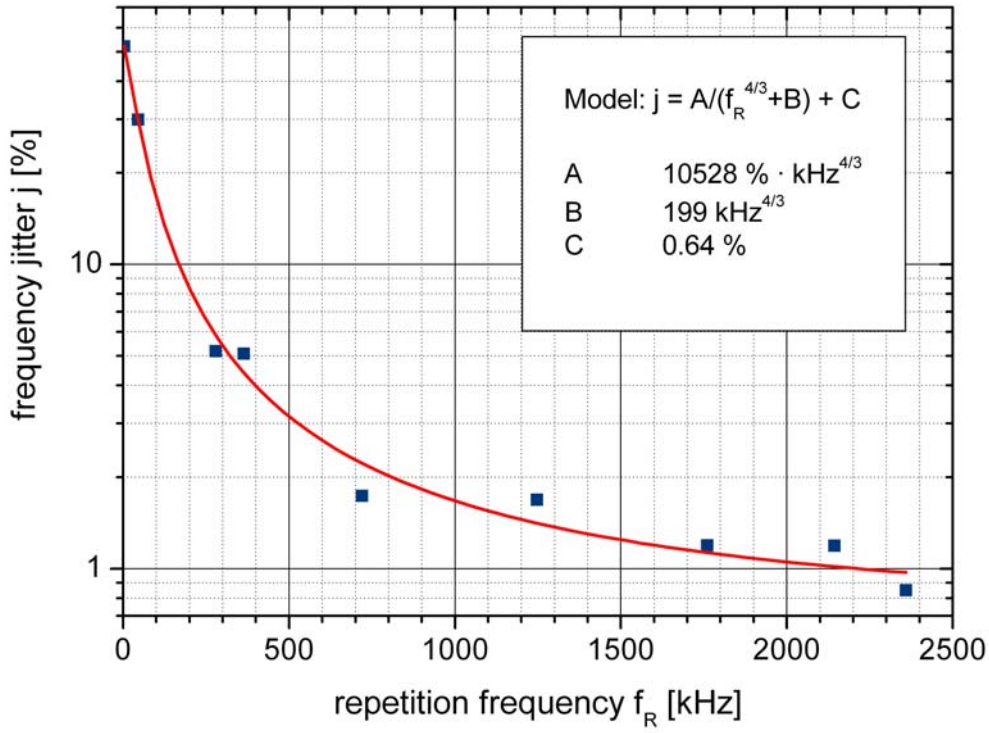
Pulse duration t_P



Pulse spectrum

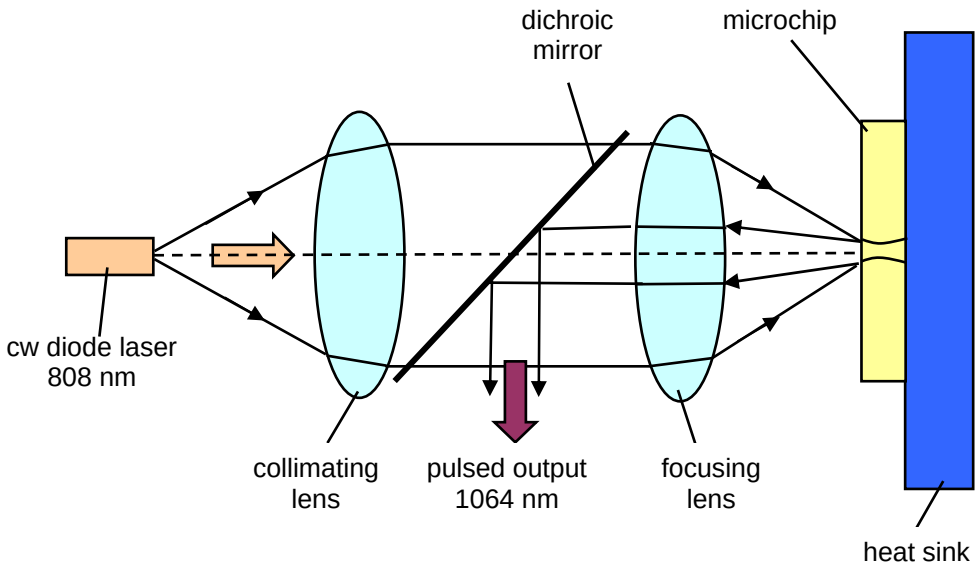


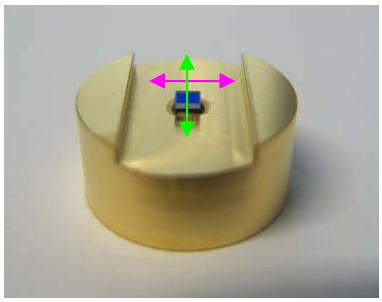
Dependency of the relative frequency jitter on the repetition rate f_R



3. Microchip laser setup

The microchip consists of a saturable absorber mirror (SAM) and a Nd:YVO_4 laser crystal. Because the SAM is not transparent, the laser setup must be in reflection mode. For optical pumping a multi-mode laser diode with about 500 mW cw output power at 808 nm wavelength is sufficient. The proposed laser setup using two lenses and a dichroic mirror is shown below.





The dichroic mirror has a high reflectance for the laser output at 1064 nm wavelength and a high transmittance for the 808 nm pump light.

The laser output is collimated and nearly diffraction limited, if the pump spot diameter in the laser crystal of the microchip is small enough. Typical pump spot diameter values are between 40 µm and 80 µm.

↔ The arrow shows the polarization direction of the emitted light (parallel to c-axis)

↕ The green arrow shows the recommended polarization direction of the pump light (perpendicular to the c-axis). The wrong pump light polarization leads to worse output parameters of the laser.

4. Mount Dimensions