# Data sheet microchip MCT-1064-100ps

Microchip in transmission for pulsed laser emission
(Data sheet rev. 1.0, 2017-06-20)

MCT-1064-100ps - microchip with 1064 nm laser emission and 100 ps pulse duration

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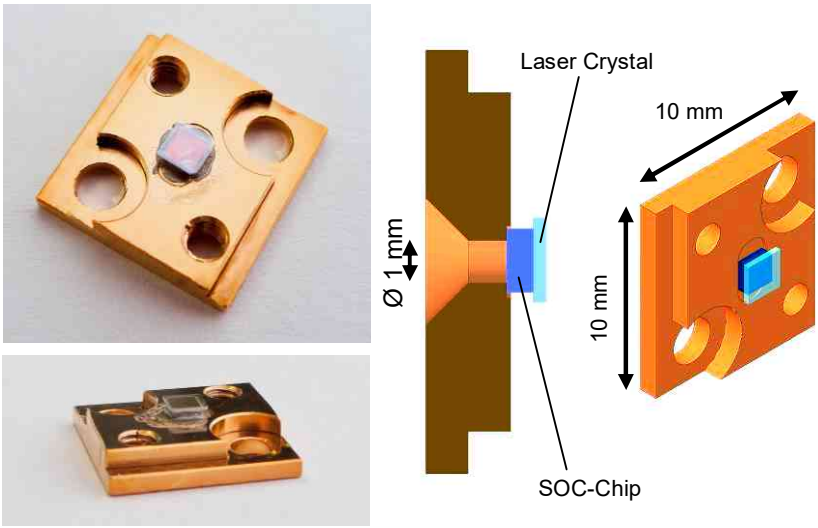
## 1. Microchip description and applications

The Microchip (MC) consists of a saturable output coupler 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

**MCT-1064-100ps**

Optical Pump Parameters

| *Parameter at T=25°C* | *Value* | *Units* |
|---|---|---|
| Wavelength | 808 ± 1 | nm |
| Optical Pump Power $P_p$*** | 70 - 300 | mW |
| Pump Spot Diameter | 25 - 100 | µm |
| Fluorescent Lifetime | 35 | µs |
| Pump Absorption @ 808nm | 90 ± 5 | % |
| Pump Power Density | 5 - 24 | $KW/cm^{2}$* |

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

| *Parameter at T=25°C* | *Value* | *Units* |
|---|---|---|
| Laser emission wavelength | 1064.3 ± 0.3 | nm |
| Laser wavelength drift | 0.45** | pm/mW |
| Beam waist diameter | 40 - 100 | µm |
| $M^2$ | 1.3 ± 0.2 | |
| Pulse energy E | ≥ 60 | nJ |
| Pulse duration | 100 ± 30 | ps |
| Differential efficiency | 17 ± 7 | % |
| Lasing pump threshold | 90 ± 20 | mW |
| Polarization extinction ratio | 30 | |
| Repetition rate $f_{Rep}$*** | ≤ 200 | kHz |

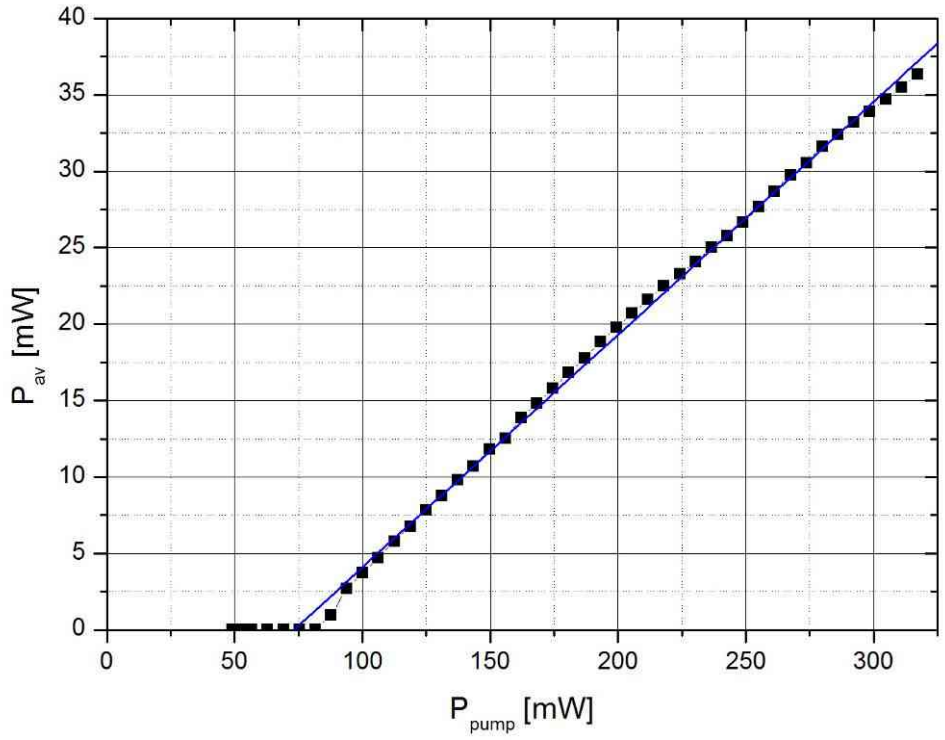
* Pump Power Density at 40 µm pump spot diameter and 300 mW pump power.

** Laser wavelength drift for 40µm pump spot diameter.

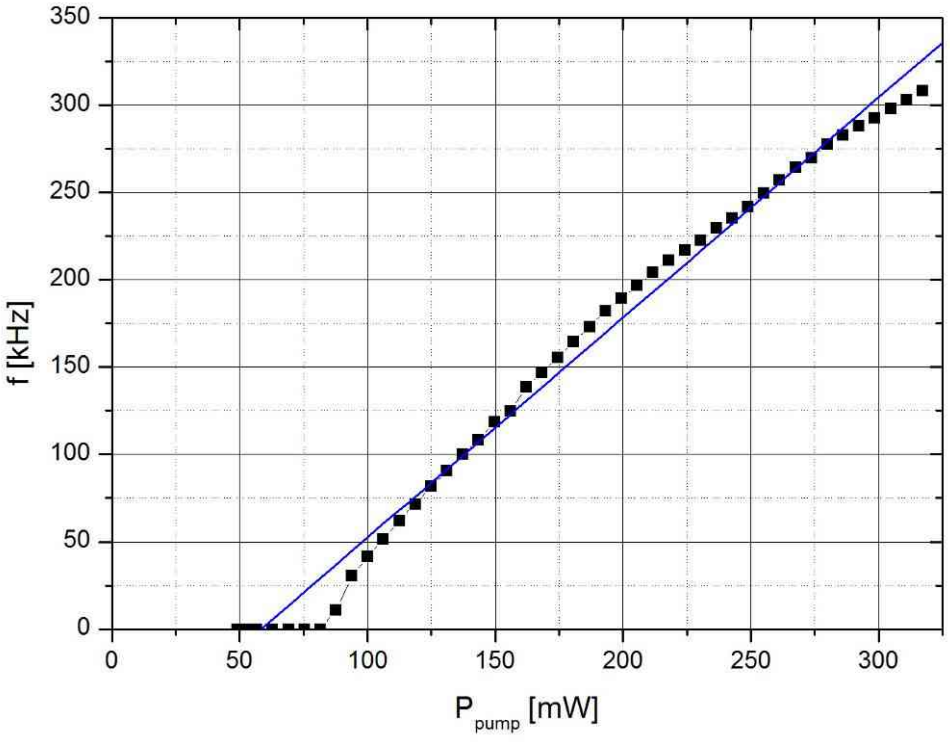
*** The long time degradation increases with increasing pump power.

The **repetition frequency $f_{Rep}$** increases above the laser threshold nearly linear with optical pump power → $f_{Rep} \sim P_p$ .The jitter of the repetition frequency decreases with increasing pump power.
The **average output power $P_{av}$** is the product of the pulse energy E and the repetition frequency → $P_{av} = E \cdot f_{Rep}$.

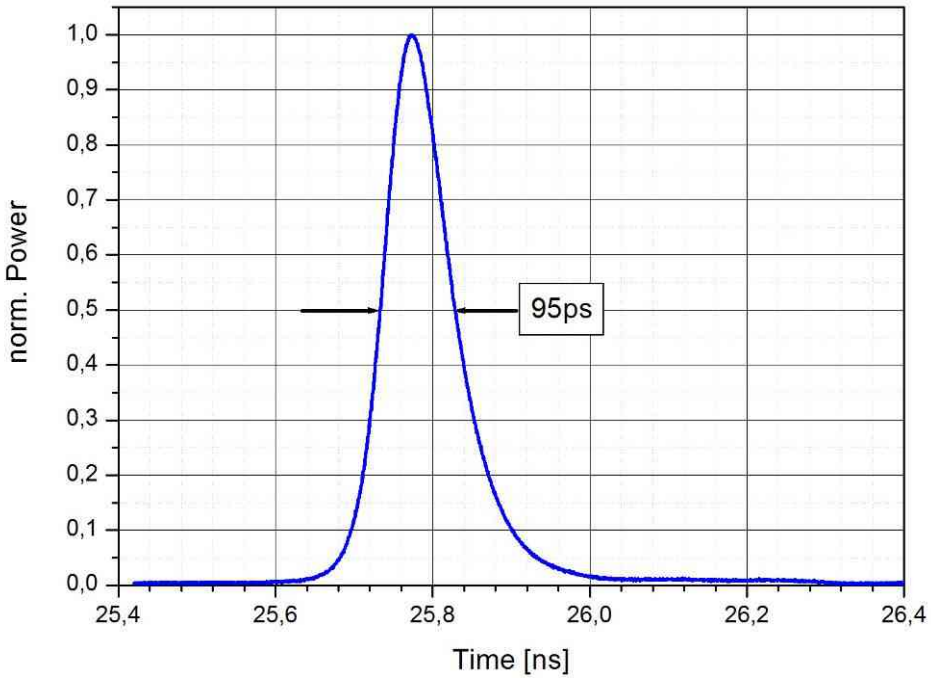
**Dependency of the average output power P on the pump power at 808 nm**



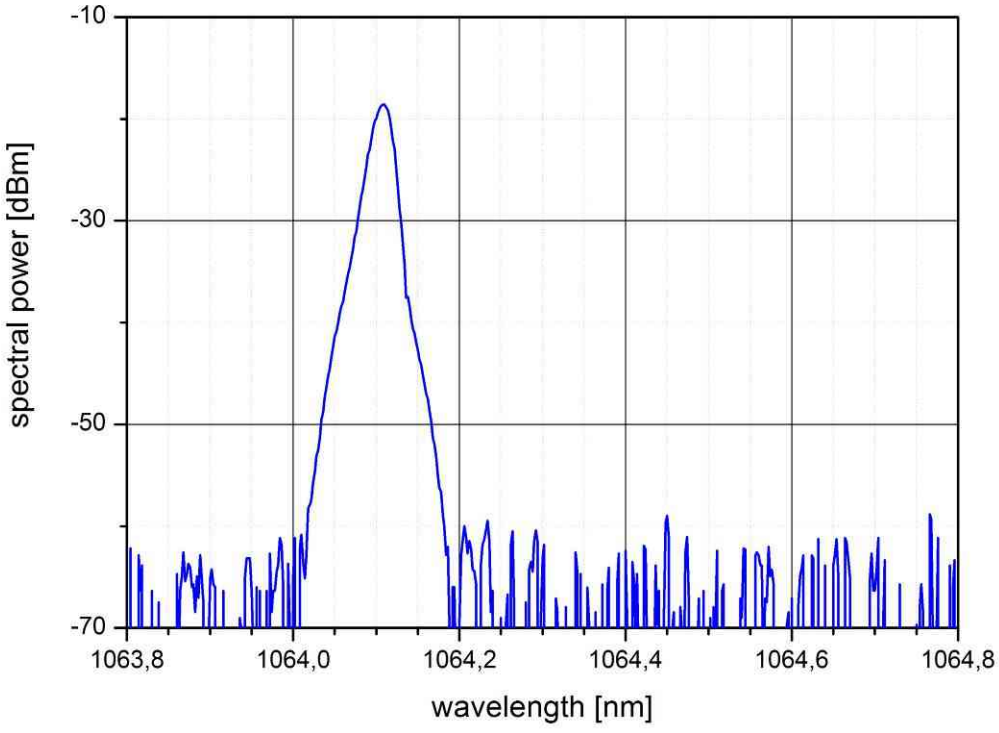

**Dependency of the repetition rate $f_{rep}$ on the pump power at 808 nm**



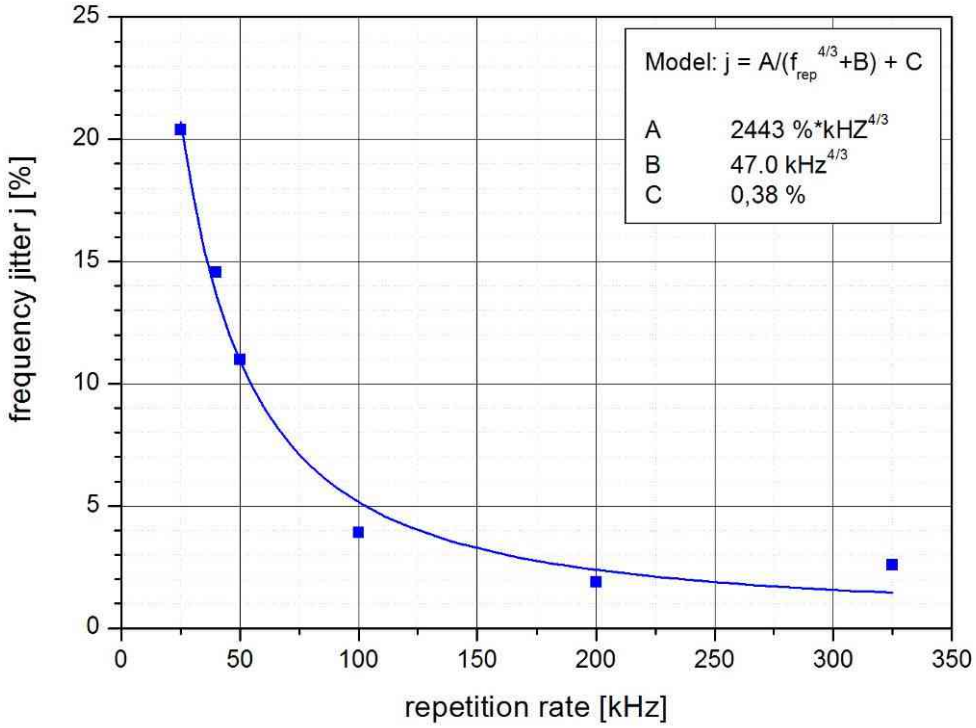
**Pulse duration**




**Pulse spectrum**

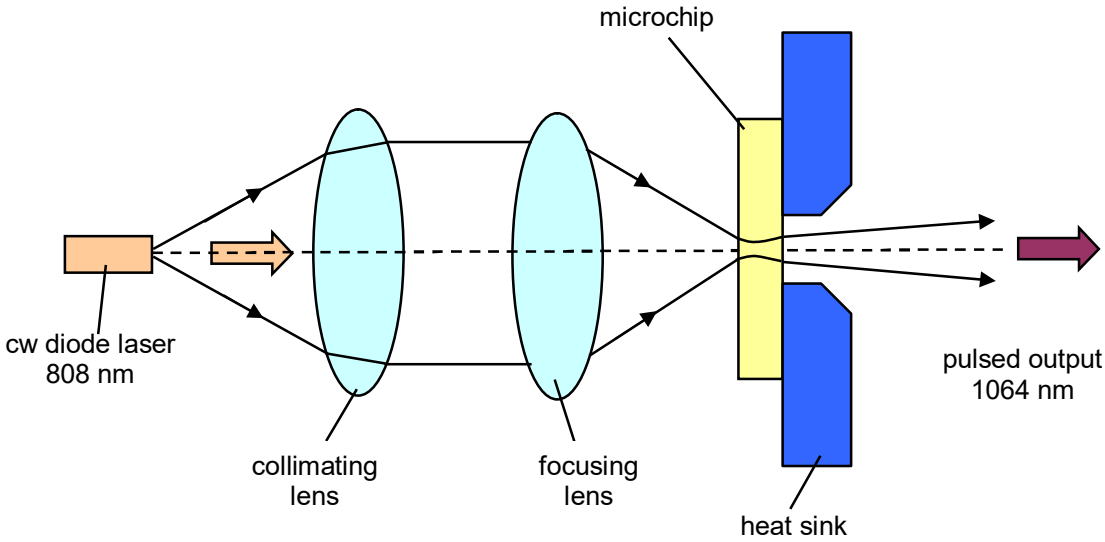


**Dependency of the relative frequency jitter on the repetition rate $f_R$**

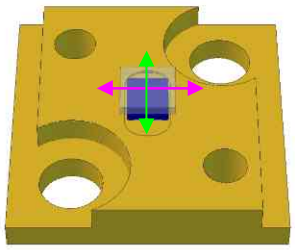



## 3. Microchip laser setup

The microchip consists of a saturable output coupler (SOC) and a Nd:$YVO_4$ laser crystal. Because the SOC is transparent, the laser setup must be in transmission 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 is shown below.



The laser output is not collimated. 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). This is also the direction for the strongest pump light absorption resulting in the highest laser efficiency.

↕ If the polarization direction of the pump light is perpendicular to the c-axis (green arrow) then the laser efficiency is somewhat lower but the long time degradation of the microchip is lower according to experimental tests.

## 4. Mount Dimensions