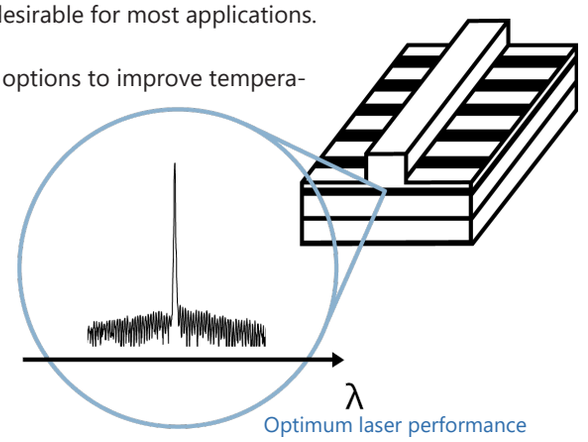
Nanosystems and Technologies GmbH
nanoplus

Thermal Management
Design Considerations

TECHNICAL NOTES

When using nanoplus lasers, temperature control, and thermal management in all aspects of your system are very important. Many critical parameters, such as wavelength tuning, lifetime, daily repeatability, threshold current, and efficiency, depend highly on the laser temperature. Temperature stability < 10 mK is desirable for most applications.

In this technical note you will learn more about different options to improve temperature control and thermal management in your system.



Optimum laser performance requires thermal management

Key recommendations:

- THERMOELECTRIC COOLER (TEC)
- TEMPERATURE CONTROLLER
- HEATSINK
- SOCKETS


nanoplus heatsink for heat distribution

Distributed Feedback Lasers (DFB) must be used in the indicated **operating temperature** range to achieve the specified **target wavelength** and **tuning behavior**.
The details of the **setup** should therefore be determined by how the temperature of the laser can be kept as stable as possible.

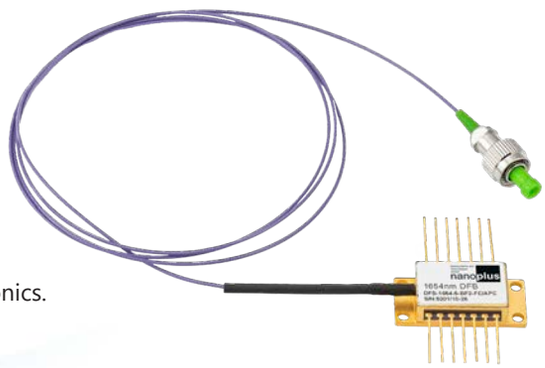
One option is to choose a laser housing with an integrated **thermoelectric cooler (TEC)** and thermistor. The nanoplus **TO5** and **TO66** housings have an in-built TEC, as do the **butterfly packages**. On the following page, we explain in more detail how to integrate these enclosures into your setup.

> **"Maximize temperature stability to optimize laser performance."**

If you use a **temperature controller**, ensure that its **current limit** is below the maximum rated power of the TEC module. To avoid oscillations, set the values of your **proportional-integral-differential (PID) controller** according to the thermal load. Temperatures above 130 °C can damage the laser mount! Use a **female connector** to connect the pins to your circuit.

If you want to **solder** a **wire** to the **pins**, use **280 °C** as the temperature for the s**oldering iron** and hold the soldering iron to the pins for less than **3 seconds**.
Poor heat management can result in high temperatures that damage the bonding. Ask the temperature controller manufacturer for advice if you are unsure about the electronics.

A suitable **heatsink** for better **heat distribution** is available from nanoplus. It is designed as a **plug-and-play system** and has **standard connections** for the TEC controller and the laser diode driver.


nanoplus laser in butterfly package with single mode fiber

REGISTERED COMPANY ISO 9001 14001

ATTENTION OBSERVE PRECAUTION FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

Nanosystems and Technologies GmbH

Design Considerations: TO5 and Butterfly Housings

Diode lasers and their associated optics can be much smaller and lighter than other types of lasers. Therefore, the scale of the assembly is often different. The illustration shows our TO5, TO66 and butterfly packages. Technical drawings can be found on our website: https://nanoplus.com/packaging

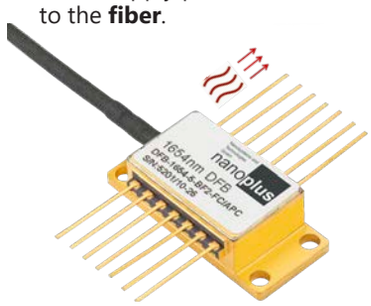
The **cap** is not suitable for heat removal or mechanical fixation

Attach the **bottom** of the **TO header** to a **heatsink** - heat must always be dissipated from below between the pins; do not bend the **pins**.

Never use **pins** for heat dissipation**.**

Heat can only be removed from the **package bottom**.

Do not apply pressure to the **fiber**.



The **closure head** is not suitable for heat dissipation**.**

Securely attach the package to your **heatsink** using the four **clearance holes**.

nanoplus DFB laser in TO5 housing with TEC and thermistor

nanoplus DFB laser in butterfly package with TEC and thermistor

In the TO5 housing shown, the laser chip is soldered to a heat spreader mounted on the thermoelectric cooler (TEC). The bottom of the TEC is attached to the TO5 base plate of the header.

Because of the heat radiation and air currents, it is advisable to enclose the laser mount in a container that will also keep dust out of the system and insulate it from vibration.

This TO5 enclosure will not sufficiently remove the heat without further measures! Therefore, heat must be dissipated from the bottom of the TO5 enclosure, as shown in the illustration.

Use thermal paste only in thin layers and consider the long-term behavior.

The thermal management of the device is beyond our control. Therefore nanoplus cannot be held responsible for thermally damaged lasers, which will void any **warranty**. All devices leave nanoplus in checked condition and in a suitable environment to avoid damage in transit. Before unpacking the laser, please note the heat management and use only suitable instruments to ensure a long lifetime of your laser.

Our sales and R&D teams have long-standing experience in developing lasers.
They will advise you in your design and realization phase as well as after-sales:

We make market leaders!

accessories

sockets

heatsinks for TO5 and TO66 (cubic mounts)

Technical drawings & accessories are available at: https://nanoplus.com/packaging

Please contact sales@nanoplus.com for customized specifications, quotes and further questions.
Visit our website for technical notes, application samples or literature referrals.

nanoplus Nanosystems and Technologies GmbH, www.nanoplus.com, phone: +49 (0) 3693 50 5000-0, email: sales@nanoplus.com