

TECHNICAL
NOTES

ESD Precautions

Thermal
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DFB Laser Concept

Tunable Diode
Laser Absorption
Spectroscopy

Reliability

ESD Precautions

Semiconductor Lasers

This note addresses the problem of electrostatic discharge (**ESD**), which is responsible for more than 30% of electronic failures. It is intended to help prevent damage to your nanoplus laser, as even an invisible 15 V ESD can destroy your device.

In the following, you will be made aware of the causes of electrostatic discharges and suitable protective measures.

Key recommendations:

- WRIST STRAPS
- FOOT STRAPS
- ESD-SAFE FLOORS
- NON-INSULATING SHOES



Use a wrist strap



Be aware of electrostatic discharge (ESD)

Electrostatic charging mainly occurs when **materials with different surface charges** are brought together or separated. **External electric fields** are another reason. For example, it is easy to generate voltages > 100 V simply by walking across a carpet.

Electrostatic discharging arise when the **charged object** is **connected to the ground or an object with a different potential**, resulting in the transfer of electrons. In principle, all objects

have a **different potential unless** they are on the **same ground**. The visible sparks reach 10,000 V, but even an invisible electrostatic discharge of 15 V is sufficient to destroy your device.

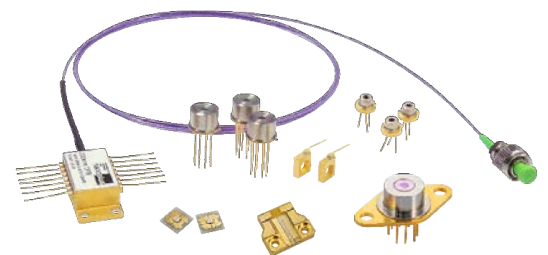
People are the **primary source of ESD**. Therefore, the only way to avoid ESD is to **put all parts of your setup**, including the operator, on the **same ground**.

This is as simple as wearing a **wrist strap** when working with a laser diode. The wrist strap must be connected to the same ground as the other items you use (tools, instruments, other materials).

In addition, you can use **ESD-safe floors, shoes, and foot straps**. Shoes that are not ESD-safe should have a strap connecting the inside of the operator's socks to the outside of the shoes, as these shoes are usually insulating. Creating an **ESD-safe area** is the best way to protect your equipment.

nanoplus accepts **no liability for ESD damage**. All devices leave nanoplus in tested condition and are properly packed to avoid ESD damage during transport. **ESD precautions** must be taken **before unpacking** the laser. For example, if you use a voltmeter for testing, this will immediately destroy the laser. Only use suitable instruments and tools to ensure a long service life for your laser.

"Protect your laser from ESD damage by creating an ESD-safe workspace."



nanoplus lasers are susceptible to ESD damage



[1] <http://www.esda.org/aboutesd.html>, [2] Semiconductor laser damage due to human-body-model electrostatic discharge, Twu, Y. et al, J. Appl. Phys. 74 (3), 1510-1520, 1993. [3] Human-body-model electrostatic-discharge and electrical-overstress studies of buried-heterostructure semiconductor lasers, Huang, J. et al, IEEE Transaction on Devices and Materials Reliability, 7 (3), 453-461, 2007.

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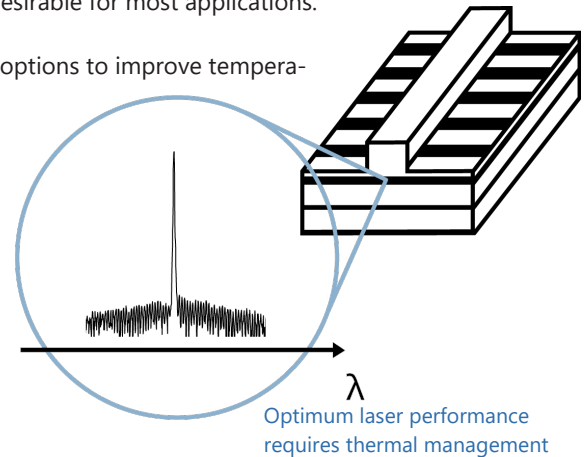
Thermal Management Design Considerations

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.

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.

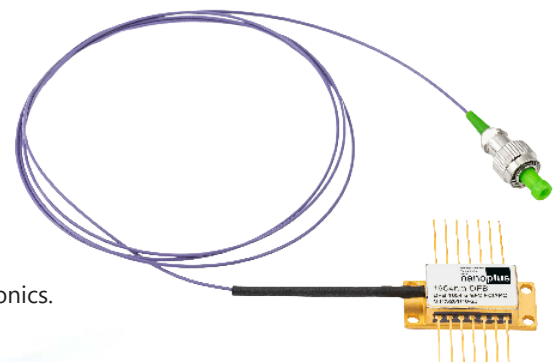
One option is to choose a laser housing with an integrated **thermoelectric cooler (TEC)** and thermistor. The nanoplus **TO5** and **TO66** housings have an in-built TEC, as do the **butterfly packages**. On the following page, we explain in more detail how to integrate these enclosures into your setup.

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.

"Maximize temperature stability to optimize laser performance."

If you want to **solder** a **wire** to the **pins**, use **280 °C** as the temperature for the **soldering 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.

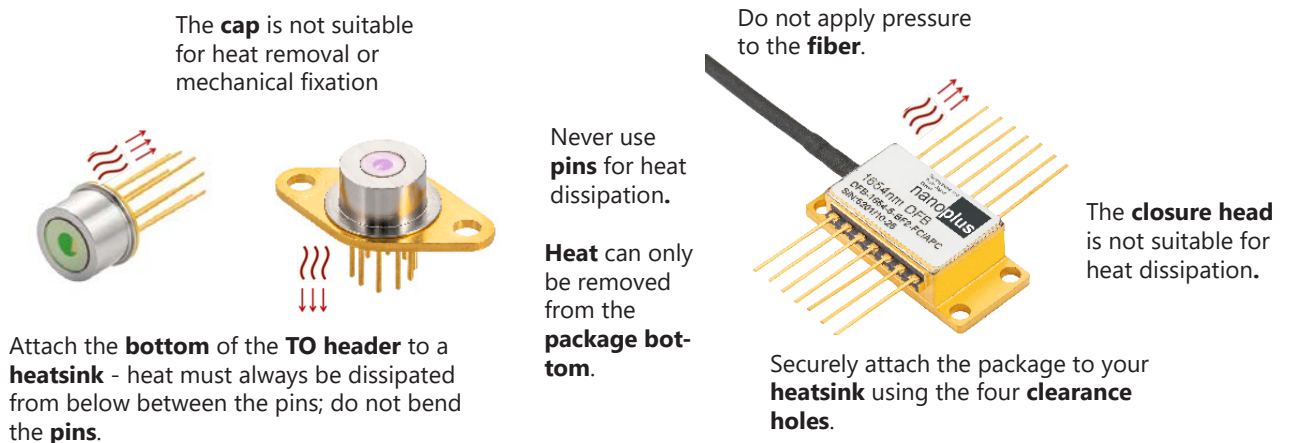


nanoplus laser in butterfly package with single mode fiber



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>



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.

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