DIODE LASER OPERATING MANUAL

1. General Instructions

1.1 Safety

High power diode lasers are - according to International Electronical Commission Standard[1] - class 4 laser products. The IEC-Standard includes safety regulations for eye and personnel protection that must be observed to avoid any harm to operating personnel.

Persons working with high power diode lasers must wear suitable laser protection glasses. The diode laser beam must not hit anyone's eye, because it may cause irreversible damage of the eye's retina.

Diode laser should be operated in a light-tight box, the door of which should be equipped with a switch, that shuts down the diode laser when the door is opened.

1.2 Storage and Shipping

Storage and shipping of diode lasers must be done with shortened electrical contacts and in a clean and dry atmosphere in a temperature range of 0°C up to 60°C.

1.3 Handling

Read this instruction carefully before unpacking to avoid damage of the diode lasers. Diode lasers should be handled and operated by qualified personnel only! Any violation of these instructions results in total loss of any warranty.

Diode lasers are very sensitive to over-voltages. Thus, their handling requires strict precautions against electrostatic charges. Every person and each tool that might get into contact with the diode laser must be continuously grounded.

Diode lasers must be operated with a suitable power supply in regulated current mode only, as even very short current or voltage spikes may destroy them. Precautions against spiking during switching on or off the power supply must be assured. Correct polarity of the power supply must be assured, because even small reverse voltages can cause irreversible damage of the diode laser.

Solvents, plastics and glues are not allowed near the diode lasers, because solvents could emerge and deposit on the facets. The semiconductor crystal and its coatings are very sensitive to any kind of solvents and liquids.

The diode lasers must be handled in a clean and dry atmosphere. Cleanroom facilities better than class 1000 and less than 60% relative humidity are recommended. There is no way to clean the front facets neither by solvents nor by mechanical tools. Especially, the diode laser front facet is extremely sensitive and must be kept free of dust, water and any other kind of contamination. Any contact to the laser front facet will lead to irreversible damage and failure of the diode laser, even if there is no sudden failure.

Soldering near the diode laser must be avoided. Fastening of the diode laser and connecting cables must be done by the way described in the manual. Diode lasers are also sensitive against thermal and mechanical stress.

[1] IEC Standard: Publication 825, Geneve 1984

2. Unpacking and Operating Instructions

2.1 Unpacking

The ATC-SEMICONDUCTOR DEVICES high power diode lasers are shipped in either plastic (housed lasers) box or sealed metal (non-housed lasers) container filled with dry nitrogen. Before unpack, diode lasers should be kept at least 4 hours in the rooms where the packaging will be opened to achieve thermal equilibrium. The packaging may be opened only in a clean environment and non-humid atmosphere (see 1.3).

Handling personnel and tools must be grounded for ESD-protection purpose.

Non-housed lasers: After achieving of thermal equilibrium the sealed metal shipping container can be carefully opened. The diode lasers are screwed to a container bottom by fixing screws. Do not loosen the assembly screws that keep the diode laser. Wear clean gloves and use plastic tweezers for not to contaminate the facet of the diode lasers. For removing a diode laser from container unscrew the fixing screw with a suitable screwdriver.

Housed lasers: After achieving of thermal equilibrium the conductive plastic box can be carefully opened. The diode lasers are placed between plastic gaskets. For removing a diode laser from the box extract upper gasket and carefully take diode laser. Remove special shorting wire before use.

Never loosen the shipping container, box and accessories, this leads to the loss of any warranty.

Never touch the diode laser front facet, output window or the microoptics with any kind of object!

Pay special attention not to scratch the bottom surface of diode lasers. Scratches will increase the thermal resistance of the mounded device and reduces the heat dissipating capacity, which might result in reduced efficiency and thermal overload of the diode laser.

2.2 Operating Conditions and Mounting

In general, appropriate cooling of the diode lasers is necessary. Before diode lasers are put to operation, they must be screwed to a flat submount surface that is actively cooled in case of a passively cooled diode laser to remove the dissipating heat. Passively cooled diode lasers must not be operated without proper thermal contact to a cooled submount surface.

The submount surface should be finely milled or lapped (roughness 0,63mkm, flatness 20 mkm), clean and free of scratches to guarantee good thermal contact. It must be kept at constant temperature (typically 25°C) even under thermal load. The diode laser must be tightly screwed to this surface. It is recommended to place heat **conductive foil** or paste between submount surface and diode laser.

Attention: ingress of paste on diode laser chip results to the inconvertible damage of laser **facets** during the operation.

Diode laser degradation accelerates with increased temperature. Therefore, housing or heatsink temperature should be minimized where possible.

Reduction the diode laser temperature below dew point is suitable for housed lasers only. In case of non-housed lasers before lowering the diode laser temperature user should place it in a closed housing with dry inert atmosphere (e.g. nitrogen). Condensation of water or other liquids irreversibly damages the diode lasers.

Diode lasers should be operated only in dust free environment. High electrical fields near the active region attract dust particles that cause irreversible damage of the facets during operation.

It is forbidden to irradiate laser diodes by emitters, for example, lasers as it can cause burning-through of the mirrors.

Avoid polluting the laser diodes **case window**, since the polluted area could crumble under the high power density of the laser radiation

Mechanical damaging of the diode laser or the sealing leads to total loss of any warranty.

2.3 Operating Instructions

Observe laser safety precautions.

Ensure that your diode driver is suitable for diode laser operation.

Switch off and shorten the power supply before contacting the diode laser.

Assure that all connectors in the electrical circuit guarantee a good contact. It is recommended to use slide-contact socket for connection of laser diode to the power supply. Soldering of the connecting cable to the diode laser is allowed under the following conditions. In case of soldering with dipping or with soldering wave:

- soldering temperature should be not more than 250 ^{0}C;
- soldering time for each lead should be less than 3 seconds;
- distance between laser case to the solder along the lead should be not less than 5 mm;
- time interval between repeated soldering of the same LD should be not less than 5 minutes

In case of soldering with an electric soldering-iron:

- soldering iron should be disconnected from the power network during soldering;
- temperature of soldering kernel should be not more than 250 ^{0}C;
- soldering time for each lead should be less than 3 seconds;
- distance between laser case to the place of soldering along the lead should be not less than 5 mm;
- time interval between repeated soldering of the adjacent leads should be not less than 5 minutes

Electrical cables should be arranged in a low-inductance constellation to avoid any tendency towards current oscillations.

If the diode laser has to be electrically insulated from the mounting surface, insulation may only be achieved by a thin flat ceramic plate of high thermal conductivity. Plastic insulation foil (e.g. Kapton) will effect laser lifetime because of an increased thermal resistance and possible solvent emerging that might damage the semiconductor crystal.

Before switching on the power supply assure that the current preset is set to zero. Then, switches on the power supply and follow to the guidelines of Laser Diode Driver Manual.

Do not exceed the maximum operating current according to the supplied data sheet.

Check the emission wavelength at the specified current. A much longer wavelength than specified indicates bad thermal contact and thermal overload of the diode laser. Then the thermal contact has to be improved before continuing laser operation. (The emission wavelength shifts with approx. 0.25 nm/K.)

To protect the laser diodes from radiant sources it is recommended that a beam splitter should be placed between the emitter and the laser diodes. The beam splitter should be coated according to the wavelength formed by the diode and should reflect the radiation of other emitters to reduce the radiation intensity that falls upon the diode. To exclude the radiation of laser diodes by reflected radiation one should use the optics coated according to the wavelength formed by the diode and the residual coefficient of reflection of this wavelength no more than 0.5 per cent. If it is impossible to place coated optics, the reflecting surface should be set at the angle with the axis of the reflection of the diode for the reflected radiation to go past the laser diode.

3. Warranty

Unless otherwise specified, ATC-SEMICONDUCTOR DEVICES diode lasers are inspected, tested and certified before they are shipped to the customer.

Manufacturer shall warrant, that the Goods at the time when the risk passes over to Purchaser are not affected by defects associated both with the fabricated material and production process within 3 (Three) months from the date of Goods delivery.

Manufacturer shall assume no warranty for damages caused by negligent or improper unpacking, storage, handling and use, overloading, using for the wrong purpose, insufficient and/or incorrect assembly and operation by nonqualified personnel as well as non-compliance of the present Manual requirements. Diode lasers with the following visual defects can not be replaced under the warranty obligations:

- with any mechanical damages (for example, taken off contact wires, a broken crystal, a deformed heat sink, a microlens or an output window of the case) even if these damages happened after a cause of a trouble (that was the reason to return the goods) appeared;
- with a contaminated safety glass;
- with scratches and cavities on the bottom surface of the case or the heat sink (even if no other damages exist) because these damages increase thermal resistance and influence the main characteristics of the product (P, I, U);
- with outburnt spots on the front mirror that are caused by excess of peak current through the diode;
- with outburnt spots on the front mirror that are caused by irradiation (for example, radiation of another laser);
- with outburnt spots on the front mirror that are caused by contamination of the active area of the front mirror because of installation of the product on the open heat sink.

Manufacturer's deliveries have to be inspected after receipt. User have to complain obvious visual defects and shortage of delivery within 2 (Two) weeks by writing stating the number of diode laser serial number and the delivery note, otherwise the warranty is excluded.

Defects that are assessable during the incoming inspection cannot be considered after diode lasers were put into operation, because later induced defects or degradation disguise the initial defect reason.

On Manufacturer's request Purchaser shall be obliged to forward the good for the purpose of rectification, replacement or any other form of characterization and confirmation. The costs for the dispatch and characterization shall be borne by Manufacturer, if the defect is confirmed, otherwise they are charged to Purchaser.

The warranty for the delivered diode lasers shall be limited either to rectification or replacement of the defect diode lasers.

In case of warrant rectification or replacement the warranty term shall be prolonged for the period of rectification and delivery of Goods.

Date of issue: 31.07.2006

P.O.Box 29, St.Petersburg 194156 Russia, http://www.atcsd.ru
Phone +7-812-294-2532, Fax +7-812-703-1526, e-mail: Sales@atcsd.ru