ERDI LASER® ERDI TECH LTD

1.54μm Erbium Glass Microchip DPSS Laser

Model: ER300

1. PRODUCT DESCRIPTION

The ER300 is a 1535nm eye-safe erbium glass microchip DPSS laser that delivers ≥300μJ, 5ns pulses at 1–10Hz in a 25×8×6.8mm, 8.5g package. With −40°C to +65°C operating range, 1500G shock and 20–2000Hz / 20G vibration tolerance, it is a compact 1.54μm source for long-range LiDAR, laser rangefinders and target designation modules.

2. TECHNICAL SPECIFICATIONS

Model	ER300
Laser Wavelength	1535nm
Eye safe	Class 1
Pulse energy	≥300 μJ
Laser Pulse width	5 ns
Drive pulse width	≤2.4 ms
Pulse repetition rate	1~10Hz
Pulse stability	10%
Raw Beam Diameter	0 .3 mm
Beam divergence angle	≤ 7 mrad
Beam Mode	TEM_{00}
Operating temperature	-40 ℃ ~ +65 ℃
Storage temperature	-55 ℃ ~+ 75℃
Dimension (mm)	25×8×6.8 mm^3
Weight	8.5 g
Voltage	2 V
Electric current	12 A
Shock	1500 G, 0.5 ms

Vibration	20~2000 Hz/20 G
Lifetime	＞1million shots

3. OPERATION INSTRUCTIONS

1. **Match the laser driver to the ER300 laser.**
   The laser driver power supply must be properly matched to the laser.
   The typical load voltage of the **ER300** is **< 2 V**, with an operating current of **12 A**, pulse width **< 2 ms**, and a repetition rate of **10 Hz**. For the exact operating parameters, please refer to the attached factory test report. The laser driver power supply must meet these requirements; otherwise, the laser may fail to operate properly or could be overloaded and permanently damaged. Therefore, **before wiring**, carefully check the laser specification sheet and confirm that the laser is compatible with the selected driver.
2. **Always disconnect power before wiring.**
   Before making any connections, make sure the power is switched off and completely isolated. During wiring, carefully check the positive and negative terminals of the laser and ensure correct polarity. After the wiring is completed, perform a thorough inspection to confirm that all connections are correct, in order to avoid short circuits, reverse polarity, and other faults. At the same time, make sure all terminals are firmly secured to prevent poor contact due to loose wiring.
3. **Set operating parameters according to the factory test report.**
   After confirming that the wiring is correct, set the corresponding parameters on the driver according to the attached factory test report. Once the parameters are correctly set, turn on the driver; the laser should then operate normally.
4. **Keep the laser output window clean.**
   Take care to keep the laser output window clean and do not touch the window surface. If contamination occurs, clean the window thoroughly **before** operating the laser.

4. MECHANICAL DIMENSIONS

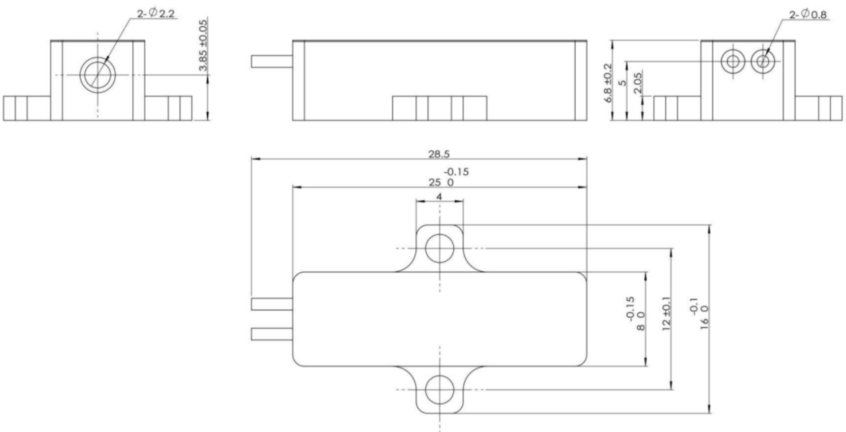
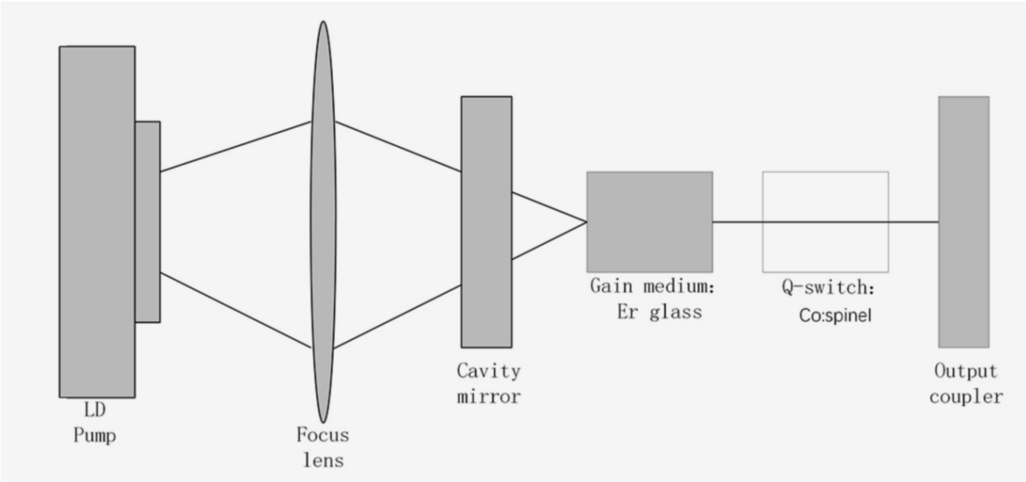


Figure 1 Outline Dimensions(mm)



5. BRIEF INTRODUCTION TO THE PRINCIPLE

I. Basic Structure and Pumping Mechanism

The LD (laser diode)–pumped erbium-doped glass laser is a solid-state laser that uses erbium-doped (Er^{3+}) glass as the gain medium and a semiconductor laser as the pump source. Its core operating principle is as follows:

- **Pump source:** The laser diode (LD) emits light at a specific wavelength (typically around 940 nm), which excites erbium ions to a metastable high-energy level through direct absorption or indirect energy transfer.
- **Gain medium:** During stimulated emission, Er^{3+} ions in the erbium-doped glass transition from the 4I13/2^4I_{13/2}4I13/2 energy level to the ground state 4I15/2^4I_{15/2}4I15/2 , releasing laser radiation at a wavelength of approximately 1.535 μm.
- **Resonator (laser cavity):** The laser cavity consists of a high-reflectivity mirror and a partially reflective output coupler. Multiple reflections within the cavity amplify photons and form a coherent laser output.

II. Characteristics of the Eye-Safe Wavelength Band

The output wavelength of an erbium-doped glass laser is around 1.5 μm, which lies in the near-infrared band. This wavelength region is classified as “eye-safe” (Class 1M) under international laser safety standards. Because the photon energy at this wavelength is relatively low and is strongly absorbed by the anterior structures of the eye (such as the cornea and lens), it greatly reduces the risk of retinal damage. This makes it particularly suitable for use in open and man-in-the-loop environments.

6. TECHNICAL ADVANTAGES

I. Compactness

LD-pumped technology offers a very small form factor and long service life, making it ideal for integration into portable and embedded systems.

II. Narrow Pulse Width

When combined with passive Q-switching, the laser can generate nanosecond pulses with peak power in the kilowatt to megawatt range, fully meeting the requirements of long-range laser ranging.

III. Environmental Adaptability

At 1.5 μm, the laser exhibits low atmospheric transmission loss (with strong penetration capability in fog, rain, and aerosol conditions) and provides excellent immunity to background light interference.

7. APPLICATIONS OF LASER RANGING

I. Basic Principle

Laser ranging is based on the **Time-of-Flight (ToF)** method: a laser pulse is emitted toward the target, and the time delay of the returned echo is measured.

II. System Composition

- **Transmitter:** The LD-pumped erbium-doped glass laser generates high-energy, narrow laser pulses (on the order of nanoseconds), which are then collimated by the transmit optics and projected toward the target.
- **Receiver:** An InGaAs APD (avalanche photodiode), matched to the 1.5 μm wavelength, is used to detect the return echo. A high-sensitivity analog front-end (such as a transimpedance amplifier) processes the weak optical signal.
- **Time-measurement unit:** A time-to-digital converter (TDC) or high-speed counter provides picosecond-level timing resolution, enabling centimeter-level ranging accuracy.

III. Key Technical Parameters

- **Pulse width:** The narrower the pulse width (e.g., a few nanoseconds), the higher the timing precision and the better the range resolution (down to the centimeter level).
- **Peak power:** High peak power (from kilowatts to megawatts) improves long-range detection performance, with typical measurement distances from hundreds of meters to tens of kilometers.
- **Repetition rate:** A high pulse repetition frequency (up to the kHz level) supports fast, continuous ranging and is well suited for dynamic target tracking.

IV. Application Scenarios

- **Military applications:** Used in fire-control systems for tanks and naval vessels, as well as in handheld laser rangefinders, providing both safety and low observability. The compact LD-pumped architecture enables lightweight systems suitable for mobile platforms such as UAVs and micro/small electro-optical gimbals.

- **Topographic mapping:** Airborne and spaceborne LiDAR systems employ erbium-doped glass lasers to generate high-precision three-dimensional terrain maps.
- **Industrial inspection:** Applied to structural health monitoring of bridges and buildings, as well as obstacle ranging and environment perception in robotic navigation.
- **Microjoule-level products:** These lasers are very compact and lightweight, making them easy to integrate at the board level in micro and small laser rangefinder modules.
- **Millijoule-level products:** These lasers provide high single-pulse energy and high peak power, making them suitable for long-range systems with detection distances beyond 15 km, such as miniaturized electro-optical pods.