1.54μm Erbium Glass Microchip DPSS Laser

Model: ER100

1. PRODUCT DESCRIPTION

The ER100 is a 1535nm eye-safe erbium glass DPSS laser delivering ≥100μJ, 6 ns pulses at 1–10 Hz in a 21 × 8 × 6.8 mm³, 7 g package. Operating from 2 V / 8 A and qualified to MIL-STD-810G shock and vibration with a lifetime ≥ 10 million shots, it is ideal as a compact 1.54 μm source for laser rangefinders, LiDAR and board-level micro ranging modules.

2. TECHNICAL SPECIFICATIONS

Model	ER100
Laser Wavelength	1.54 μm
Eye safe	Class 1
Pulse energy	≥100 μJ
Laser Pulse width	6 ns
Drive pulse width	≤2.4 ms
Pulse repetition rate	1~10Hz
Pulse stability	10%
Raw Beam Diameter	0 .3 mm
Beam divergence angle	≤ 8 mrad
Beam Mode	TEM_{00}
Operating temperature	-40 ℃ ~ +65 ℃
Storage temperature	-55 ℃ ~+ 75℃
Dimension (mm)	21×8×6.8 mm³
Weight	7 g
Voltage	2 V
Electric current	8 A

Shock	1500 G, 0.5 ms
Vibration	20~2000 Hz/20 G
Service life	≥1million shots

3. OPERATION INSTRUCTIONS

1. **Pre-Power Inspection**

- Confirm that the laser and driver have been correctly wired according to the wiring diagram.
- Verify that the driver output voltage, current, pulse width, and repetition rate settings meet the limits specified for the ER100 (typical load voltage < 2 V, operating current 8 A, pulse width < 2 ms, repetition rate 10 Hz, unless otherwise stated in the factory test report).
- Make sure all connectors are firmly seated and that there are no loose wires, short circuits, or reversed polarity.
- Check that the laser output window is clean and free of dust, fingerprints, or other contamination.

2. **Power-On Sequence**

- Ensure that the driver output is **disabled** before powering on the system.
- Switch on the main power supply of the driver and confirm that the driver powers up normally (status indicators, GUI, or monitoring interface show no alarms).
- Wait for the driver and system to complete any internal self-tests, if applicable.

3. **Parameter Setting**

- According to the attached **factory test report**, set the driver parameters (output current, pulse width, repetition frequency, and any timing or trigger settings) to the recommended values.
- If the system supports external triggering, verify that the trigger source (internal / external), trigger level, and timing configuration are set correctly.
- Confirm the final parameter values on the GUI or front panel before enabling laser output.

4. **Laser Emission Operation**

- Enable the laser output on the driver (via “Enable” button, GUI command, or hardware switch, depending on the specific driver).
- Observe the driver status indicators and any monitoring signals to confirm that laser emission is normal and no over-current, over-temperature, or fault alarms are present.
- During operation, do **not** touch or obstruct the laser output window, and strictly follow the applicable laser safety regulations (wear appropriate protective eyewear, avoid direct or specular reflections into the eyes, and control the beam path).

5. **Shutdown Procedure**

- First **disable** the laser output on the driver.
- After confirming that laser emission has stopped, switch off the main power supply of the driver.
- If the system has a cooling fan or other thermal management devices, allow sufficient time for the system to cool down before disconnecting power completely or performing any maintenance.

6. **Post-Operation Checks**

- Inspect the laser and driver for abnormal odors, discoloration, or mechanical damage.
- Check the connectors and cables to ensure there is no overheating or insulation damage.
- If any abnormal condition or alarm is observed, stop using the device and contact technical support before the next operation.

4. MECHANICAL DIMENSIONS

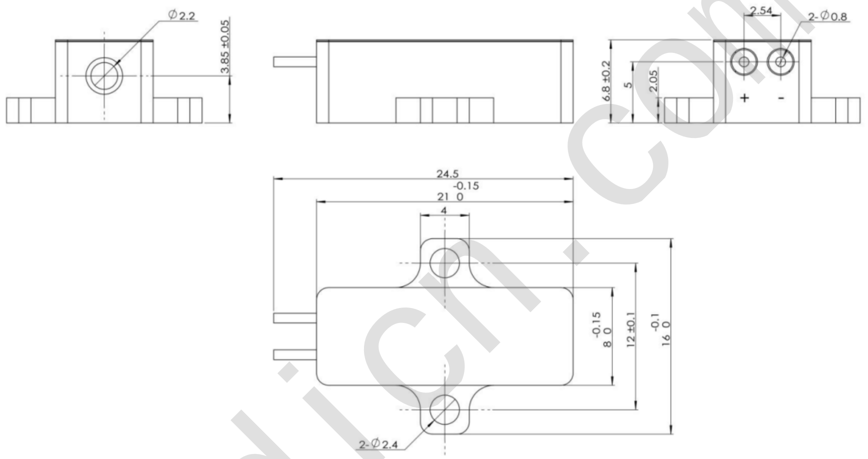
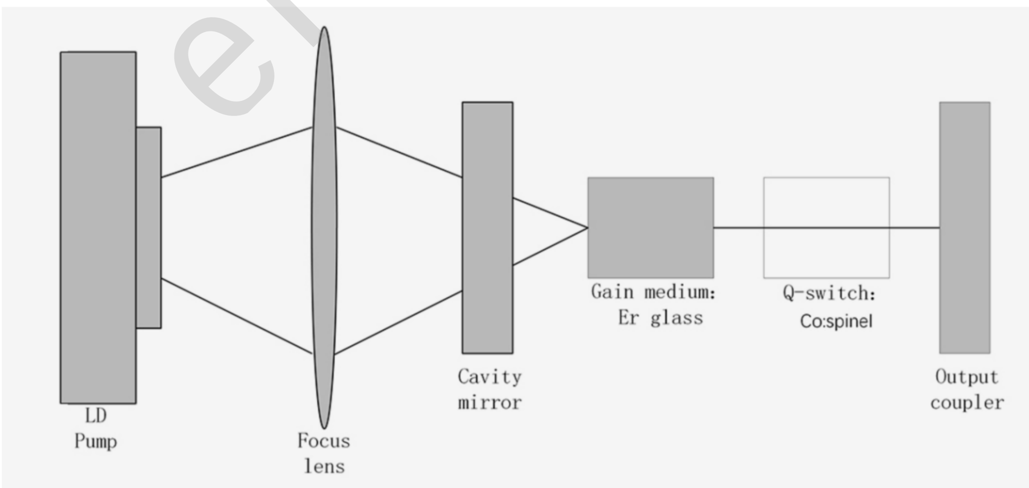


Figure 1 Outline Dimensions



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.





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