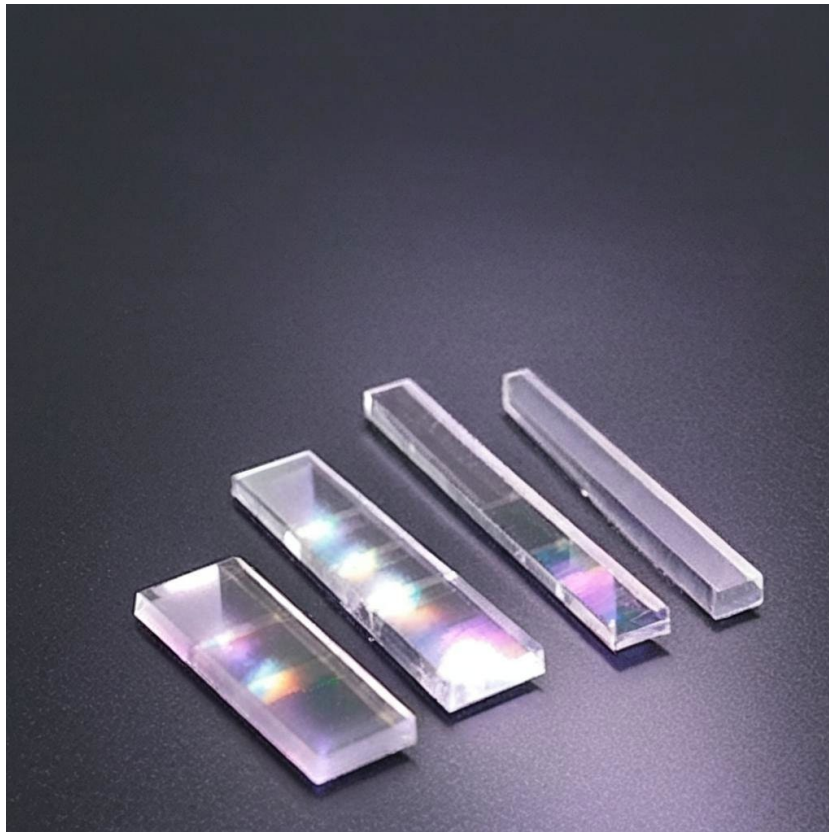


## POC-OC-122447-Er:YSGG Crystal Datasheet

### 1 Main Features

- Efficient laser material emitting at 2.79  $\mu\text{m}$  for advanced applications.
- High slope efficiency and broad absorption band optimized for 808 nm pumping.
- Excellent mechanical strength and thermal conductivity for enhanced stability.
- Low thermal lensing effect reduces heat generation during high-power operation.
- Custom doping levels and AR coatings available for tailored solutions.



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### 2. Material General Description

The Er:YSGG (Erbium-doped Yttrium Scandium Gallium Garnet) crystal is an exceptional mid-infrared laser material with emission at 2.79  $\mu\text{m}$ . This wavelength is highly absorbed by water molecules, making it suitable for medical, industrial, and environmental applications. Its superior mechanical and thermal properties enable reliable high-power laser operation with minimal thermal stress.

The crystal features a broad absorption band, which makes it highly compatible with 808 nm diode pumping and flashlamp systems. Its high emission efficiency and long fluorescence lifetime ensure consistent laser performance. The material is mechanically robust, has a high damage threshold, and can be manufactured to precise tolerances, making it versatile for both CW and pulsed laser operations.

### 3. General Application and Examples

Er:YSGG crystals are widely utilized in the following fields:

#### 1. Medical Applications:

- **Laser Dentistry:** The 2.79  $\mu\text{m}$  wavelength aligns with the water absorption peak, allowing precise cutting and ablation of hard and soft tissues with minimal thermal damage.
- **Surgery:** Er:YSGG lasers are employed in skin resurfacing, ophthalmology, and lithotripsy due to their precise and efficient tissue removal capabilities.
- **Dermatology:** Effective for treating scars, wrinkles, and other skin conditions with minimal invasiveness.

#### 2. Industrial Applications:

- Used in precision cutting, engraving, and material processing, especially where water or organic components play a role.
- Ideal for laser drilling and surface marking of delicate materials.

#### 3. Environmental Monitoring:

- Detection and measurement of water vapor and other molecules in the atmosphere for climate studies and industrial monitoring.

#### 4. Military and Defense:

- Mid-IR lasers based on Er:YSGG are ideal for rangefinding, optical communications, and secure target designation systems.

#### 5. Research and Development:

- Utilized in advanced spectroscopy, mid-infrared imaging, and optical parametric oscillators.
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### 4. Chemical, Physical, and Structural Properties

Property	Value
Crystal Formula	Er:YSGG (Y <sub>3</sub> Sc <sub>2</sub> Ga <sub>3</sub> O <sub>12</sub> )
Crystal Structure	Cubic
Lattice Parameter	12.42 Å
Density	5.67 g/cm <sup>3</sup>
Melting Point	~1900 °C
Mohs Hardness	8

Thermal Conductivity	8 W/m·K
Thermal Expansion	$8.1 \times 10^{-6}/K$
Doping Levels	Er: 0.5–1 at.%

## 5. Optical and Laser Properties

Property	Value
Emission Wavelength	2.79 $\mu$ m
Pump Bands	600–800 nm
Absorption Peaks	808 nm, 980 nm
Fluorescence Lifetime	1400 $\mu$ s
Emission Cross-Section	$5.2 \times 10^{-20} \text{ cm}^2$
Laser Transition	4I11/2 $\rightarrow$ 4I13/2
Refractive Index	1.92 at 1000 nm

## 6. Spectrum Transmission Curves

The Er:YSGG crystal demonstrates high transmission efficiency in the 2.79  $\mu$ m range, ideal for precision laser applications. Detailed transmission spectra can be provided upon request.

## 7. Coating Specifications

- **AR Coating:** Anti-reflective coatings for 2.79  $\mu$ m wavelength, optimized for high durability.
- **Reflectivity:**  $R < 0.2\%$  @ 2.79  $\mu$ m.
- **Damage Threshold:** Coatings are designed to withstand high-energy pulsed and CW operations.

## 8. Standard Fabrication Specifications

Parameter	Specification
Orientation	<111>
Diameter Tolerance	+0/-0.05 mm
Length Tolerance	$\pm 0.5$ mm
Surface Flatness	$\lambda/10$ @ 632 nm
Parallelism	<10 arc sec

Perpendicularity	<5 arc min
Surface Quality (Scratch/Dig)	10-5
Clear Aperture	>90%
Chamfer	0.1 mm x 45°

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## 9. POC Strength and Capabilities

Photonics On Crystals (POC) excels in delivering high-quality Er:YSGG crystals customized to meet specific requirements. Our strengths include:

- Expertise in doping and coating technologies for application-specific performance.
  - Advanced manufacturing capabilities to ensure precision and high optical quality.
  - Global reach with reliable delivery timelines and comprehensive support.
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## 10. Standard Products

Dimension	Length	End Faces	Coating	Price (USD)
3 x 3 mm	10 mm	Flat/Flat	AR @ 2.79 $\mu$ m	Request
5 x 5 mm	15 mm	Brewster	AR/HR @ 2.79 $\mu$ m	Request
8 x 8 mm	20 mm	Flat/Flat	Uncoated	Request
Custom	Custom	Custom	Custom	Request

*Customization options are available for size, doping level, and coatings.*