

488 nm Laser Diode Choices and Applications

Single-mode 488 nm laser diode solutions range from 60 mW to 300 mW

The 488 nm wavelength is widely used in flow cytometry, fluorescence imaging, DNA analysis, microscopy, spectroscopy, particle detection, and medical diagnostic instrumentation. **Modern direct-emitting 488 nm laser diodes** provide a compact, efficient, and cost-effective alternative to traditional argon-ion and frequency-converted laser sources.

World Star Tech offers **single-mode 488 nm laser diode solutions from approximately 50–60 mW to 300 mW**, with wavelength selections of **488 ±5 nm, ±2 nm, and selected ±1 nm**.

Available as: Bare diodes • Wavelength-selected diodes • Collimated modules • Circular-beam modules • TEC-controlled systems • PM fiber-coupled lasers • Custom OEM assemblies

488 nm Laser Diode Options

Laser Diode	Optical Power	Wavelength	Package	Mode
PLT5 488 C1C6	60 mW	488 ±5 nm	5.6 mm TO56	Single mode
PLT5 488	60 mW	488 ±2 nm	5.6 mm TO56	Single mode
World Star Tech Selected PLT5 488	60 mW	488 ±1 nm	5.6 mm TO56	Single mode
PLT5 488HB_EP	300 mW	488 ±5 nm	5.6 mm TO56	Single mode
PLT5 488HB_EP-C2C5	300 mW	488 ±2 nm	5.6 mm TO56	Single mode
World Star Tech Selected PLT5 488HB	300 mW	488 ±1 nm	5.6 mm TO56	Single mode

This range gives OEM designers a straightforward choice between **power, wavelength tolerance, and cost**.

PLT5 488 — 60 mW Single-Mode 488 nm Laser Diode

The ams OSRAM PLT5 488 is a cost-effective choice for applications requiring good beam quality without hundreds of milliwatts of optical power. It is a direct-emitting, single-mode cyan laser diode in a standard **5.6 mm TO56 package**.

Key Specifications

- **Optical output power:** 60 mW CW
- **Nominal wavelength:** 488 nm
- **PLT5 488:** 486–490 nm
- **PLT5 488 C1C6:** 483–493 nm
- **Spectral bandwidth:** approximately 1 nm FWHM
- **Typical operating current:** 85 mA
- **TE polarization ratio:** 100:1
- **Integrated functions:** monitor photodiode and ESD protection diode
- **Emission:** single mode

The PLT5 488 is well suited to compact OEM instruments requiring **low power consumption, fast modulation, good spatial beam quality, and straightforward optical integration.**

PLT5 488 C1C6 — Cost-Optimized Option

For applications where exact wavelength is less critical, the **PLT5 488 C1C6** provides the same nominal 60 mW output with a wider **488 ±5 nm** wavelength range. It is a practical choice for cost-sensitive illumination and fluorescence systems with sufficiently broad excitation and filter bandwidths.

PLT5 488HB_EP — 300 mW High-Power Single-Mode Laser Diode

For higher-power applications, the **PLT5 488HB_EP** increases direct single-mode output to **300 mW** while retaining the compact 5.6 mm TO56 package.

Key Specifications

- **Optical output power:** 300 mW CW
- **Nominal wavelength:** 488 nm
- **PLT5 488HB_EP:** 483–493 nm / 488 ±5 nm
- **PLT5 488HB_EP-C2C5:** 486–490 nm / 488 ±2 nm
- **Spectral bandwidth:** approximately 1 nm FWHM
- **Typical operating current:** 280 mA
- **Typical beam divergence:** approximately 6.5° × 23° FWHM
- **TE polarization ratio:** typically, 100:1
- **Modulation bandwidth:** ≥100 MHz
- **Integrated functions:** monitor photodiode and ESD protection

Generating **300 mW directly from a single-mode 488 nm semiconductor emitter with a clean, side-lobe-free beam** creates new possibilities for compact, high-performance optical instruments.

- Stronger fluorescence excitation
- Larger illumination areas
- Higher-speed scanning
- Improved signal-to-noise ratio
- Compensation for optical and fiber-coupling losses
- Higher-power single-mode fiber delivery

Choosing the Right Wavelength Tolerance

World Star Tech can provide three wavelength-selection levels to balance precision and cost.

488 $\pm$ 5 nm — Cost Optimized

Best suited to applications with relatively broad excitation spectra and optical filters. Available with **PLT5 488 C1C6 (60 mW)** and **PLT5 488HB_EP (300 mW)**.

488 $\pm$ 2 nm — Standard Precision

A good choice for flow cytometry, fluorescence spectroscopy, diagnostics, and other instruments requiring tighter wavelength consistency. Available with **PLT5 488 (60 mW)** and **PLT5 488HB_EP-C2C5 (300 mW)**.

488 $\pm$ 1 nm — World Star Tech Selected

For tighter control, World Star Tech can **measure and select individual laser diodes for 488 $\pm$ 1 nm operation**, subject to quantity and availability.

- Instrument-to-instrument wavelength consistency
- Narrower optical filters
- Improved calibration repeatability
- Wavelength-sensitive optical response

This provides tighter wavelength control without requiring a more complex external-cavity or frequency-stabilized laser architecture.

Why Single-Mode Operation Matters

Optical power alone does not determine laser performance. In many analytical systems, **beam quality is equally important**.

- High spatial brightness
- Clean beam profile
- Small focused spot size
- Efficient single-mode fiber coupling
- Better beam-pointing definition
- Predictable optical system performance
- Improved confocal and scanning performance

The output of an edge-emitting laser diode is naturally elliptical because the fast-axis and slow-axis divergences are different. The PLT5 family, for example, has beam divergence of approximately **6–6.5° $\times$ 23° FWHM**. With suitable aspherical and beam-shaping optics, the output can be collimated and circularized for precision applications.

World Star Tech 488 nm Collimated Laser Modules

World Star Tech can integrate the PLT5 488 family into complete **488 nm laser modules**, reducing the optical, mechanical, thermal, and electronic work required to integrate a bare laser diode.

- Precision aspherical collimation
- Elliptical beam output
- Circularized beam output
- Custom beam diameter and divergence
- Integrated constant-current laser driver
- Thermoelectric temperature control
- Optical power control
- TTL or analog modulation
- Custom mechanical housing
- Custom OEM electrical interfaces

TEC stabilization can improve both **optical power and wavelength stability**, particularly in fluorescence, spectroscopy, and analytical instrumentation.

Clean Circular Beam Options

Many bioanalytical and imaging systems perform better with a circular beam than with the naturally elliptical output of a semiconductor laser. World Star Tech can provide **488 nm circular-beam laser modules** using precision beam-shaping optics.

- Flow cytometry
- Confocal microscopy
- Fluorescence microscopy
- Cell sorting
- Microfluidics
- Optical scanning
- Machine vision
- Particle detection
- Light scattering
- Precision focusing

Combining a **single-mode emitter with optimized beam-shaping optics** provides a clean and well-controlled source for demanding optical instruments.

Single-Mode and PM Fiber-Coupled 488 nm Lasers

World Star Tech also offers **single-mode fiber-coupled and polarization-maintaining (PM) fiber-coupled 488 nm laser solutions**. Systems can be supplied as fiber-pigtailed sources or as complete modules with integrated electronics and temperature control.

- Polarizing beam splitters
- Polarization-sensitive fluorescence optics
- Acousto-optic devices
- Interferometers
- Polarization-dependent filters
- Spectroscopic instrumentation

The approximately **100:1 polarization ratio** of the PLT5 family provides a strong starting point for polarization-sensitive optical systems.

60 mW or 300 mW?

The correct choice depends on the optical power required **at the sample or detector**, not simply the maximum available diode power.

Choose the 60 mW PLT5 488 When You Need

- Lower system cost
- Lower electrical power consumption
- Compact thermal design
- Moderate fluorescence excitation
- Portable instrumentation
- Low-to-medium fiber output power
- Fast modulation

For many finished modules, approximately **50 mW of usable free-space output** provides an attractive balance between performance and cost.

Choose the 300 mW PLT5 488HB_EP When You Need

- High-speed flow cytometry
- Strong fluorescence excitation
- High-throughput analytical instruments
- Larger illumination areas
- High-speed optical scanning
- Higher-power single-mode fiber coupling
- Compensation for significant optical losses
- High-performance microscopy and imaging
- Multi-channel bioanalytical instruments

Applications

Flow Cytometry

488 nm is one of the standard excitation wavelengths used in flow cytometry. The laser is typically focused into a small interrogation region as cells or particles pass through the detection volume, making beam quality and stable optical power critical. The 60 mW and 300 mW single-mode options cover systems ranging from compact analyzers to high-throughput instruments.

Fluorescence and Confocal Microscopy

Single-mode 488 nm lasers provide the beam quality needed for efficient focusing and controlled illumination. Circular beam shaping, fiber delivery, power control, and TEC stabilization can be integrated for fluorescence and confocal microscopy systems.

DNA Analysis and Bioanalytical Instrumentation

488 nm excitation is widely used in fluorescence-based biological analysis. The 300 mW PLT5 488HB_EP provides additional excitation power where measurement speed, signal level, or optical losses are important.

Medical and Diagnostic Instrumentation

The compact TO56 package and direct-emitting architecture simplify integration into diagnostic optical engines. Compared with traditional 488 nm laser technologies, semiconductor diodes reduce system size, electrical power, and thermal requirements.

Spectroscopy

Wavelength-selected 488 ± 2 nm and ± 1 nm devices can improve repeatability in fluorescence and optical spectroscopy systems where excitation response varies with wavelength.

Particle Detection and Light Scattering

The high spatial brightness and well-defined focused beam of a single-mode 488 nm laser make it suitable for particle analysis, aerosol measurement, light scattering, optical sensing, and microfluidic detection.

From Laser Diode to Complete OEM Laser Solution

Selecting the laser diode is only one part of developing a reliable optical source. Laser temperature, current noise, heat sinking, optics, mechanical alignment, beam shaping, and fiber coupling all influence final system performance.

**Bare diode → Wavelength-selected diode → Collimated laser → Circular-beam laser →
TEC-stabilized laser → PM fiber-coupled laser → Custom OEM laser subsystem**

This lets OEM customers choose the integration level that best fits their design, manufacturing, and cost requirements.

Summary

Modern direct-emitting **488 nm single-mode laser diodes** provide a compact and flexible platform for bioanalytical, fluorescence, imaging, spectroscopy, and diagnostic instrumentation.

The **60 mW PLT5 488 family** is well suited to cost-sensitive and moderate-power applications, while the **300 mW PLT5 488HB_EP family** provides substantially higher excitation power while retaining single-mode beam characteristics.

488 ±5 nm → 488 ±2 nm → World Star Tech selected 488 ±1 nm

Combined with World Star Tech capabilities in **wavelength selection, precision collimation, circular beam shaping, TEC stabilization, laser electronics, single-mode fiber coupling, PM fiber coupling, and custom OEM laser design**, these devices provide a versatile foundation for next-generation 488 nm laser systems.