

Blue laser light-emitting diode



Article Overview

A blue laser diode emits light in the 400–480 nm range, typically using GaN or InGaN semiconductors, offering high efficiency, high optical power, and applications in lighting, displays, and communication.

Overview

Blue laser diodes (LDs) are semiconductor devices that emit electromagnetic radiation in the visible blue spectrum, generally between 400 and 480 nanometers. Wavelengths below 445 nm appear violet but are still classified as blue lasers . Modern blue LDs are primarily based on gallium nitride (GaN) or indium gallium nitride (InGaN), which form the active layers that generate photons through quantum well structures . These devices have significantly improved in output power, efficiency, and lifetime compared to early GaN lasers, which suffered from high defect densities and short lifetimes .

Key Specifications and Advancements

Recent high-power blue laser diodes, such as the ams OSRAM PLPT9 450LC_E, operate at 455 nm with optical power up to 5.5 W and a wall-plug efficiency of 43% . Advanced packaging, like the TO90 Metal Can™, ensures low thermal resistance and robust performance. Some GaN-based diodes have achieved optical output powers exceeding 10 W per emitter, making them suitable for industrial laser processing and high-intensity illumination .

Applications...

Article Content

May 22, 2026

III-Nitride Light-Emitting Devices

III-nitride light-emitting devices have been subjects of intense research for the last several decades owing to the

Oct 28, 2025

Solid State Lighting with Blue Laser Diodes

Abstract A new source of solid-state white illumination is proposed using methods involving blue lasers and yellow phosphor. This

Sep 10, 2025

An Introduction to Laser Diodes

A laser diode is a semiconductor laser device that is very similar, in both form and operation,

Mar 12, 2026

Blue laser

Blue, direct diode semiconductor lasers can be built using inorganic gallium nitride (GaN) or InGaN gain

Oct 18, 2025

Focus on perovskite emitters in blue light-emitting diodes

Blue perovskite light-emitting diodes (PeLEDs) are essential in pixels of perovskite displays, while their progress lags

Jan 05, 2026

S. Nakamura et al., The Blue Laser Diode

1.1 LEDs and LDs The light emitting diode (LED) could be considered the ultimate general source of continuous light due to its high

Feb 15, 2026

Progress and Future Prospects in Eco-Friendly Blue Quantum Dot

This review summarized the development of blue InP QDs, ZnSe QDs, lead-free perovskite QDs and other eco

Apr 06, 2026

Blue Lasers | 420-499nm, pulsed, CW & diode lasers

The light emitting region of the laser diode is commonly called the emitter. The emitter size and the

Jan 03, 2026

How Blue LEDs Work, and Why They Deserve the Physics Nobel

Thus many were surprised to see the 2014 prize honor a very practical invention: blue light emitting diodes. Yet this

Oct 07, 2025

The Blue Laser Diode: GaN Based Light Emitters and Lasers

One of the aims of the present book is to close this information gap, another important aim is to provide a report on the development

Aug 25, 2025

Light-emitting diode

A light-emitting diode (LED) is an electronic component that uses a semiconductor to emit light when

Dec 16, 2025

Spontaneous Emission Studies for Blue and Green

We investigated the efficiency droop phenomenon in blue and green GaN-based light

Feb 08, 2026

InGaN-based blue light-emitting diodes and laser diodes

InGaN single-quantum-well-structure blue light-emitting diodes (LEDs) were grown on epitaxially laterally overgrown

Nov 01, 2025

Laser diode

Laser diodes have the same reliability and failure issues as light-emitting diodes. In addition, they are

Oct 01, 2025

The Blue Laser Diode: The Complete Story | Springer

For the first time it is possible to produce lasers with various wavelengths, ranging from red through yellow

Aug 19, 2025

ams OSRAM 455 nm High-Efficiency Blue Laser Diode

Whether for large-scale projections or intricate laser displays, this blue laser diode delivers exceptional

May 02, 2026

(PDF) Blue Diode Lasers

Layered light-emitting heterostructures based on gallium nitride are quite different from their gallium arsenide cousins.

Sep 22, 2025

Invention, development, and status of the blue light-emitting diode ...

Here we discuss the initial invention of blue LEDs, historical developments that led to their current state-of-the-art

Aug 21, 2025

Light-emitting Diodes and Lasers | part of Group III-Nitride ...

Abstract: Since the blue end of the spectrum can be reached using low In-content indium gallium nitride (InGaN) and other

Nov 10, 2025

Blue laser diode (LD) and light emitting diode (LED) applications

The family of blue LEDs, edge emitting and surface emitting lasers, enable a number of applications. Blue lasers are

Jun 26, 2026

The Blue Laser and Its Applications in Industry and

The blue laser is a device that emits a light beam in the wavelength range between 400 nm and 500 nm,

Dec 16, 2025

Comparison between blue lasers and light-emitting diodes for future ...

Comparison between blue lasers and light-emitting diodes for future solid-state lighting: Comparison between blue

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EFFICIENT BLUE LIGHT-EMITTING DIODES LEADING TO BRIGHT

Efficient blue light-emitting diodes leading to bright and energy-saving white light sources on semiconductor components, with

Jul 22, 2026

Light emission moves into the blue

Many years of effort were needed to develop blue light-emitting diodes and lasers, but devices based on indium gallium

Aug 01, 2025

Comparison between blue lasers and light-emitting diodes for future ...

Pending a solution to efficiency droop, an alternative device could be a blue laser diode (LD). LDs, operated in

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