

What are the wavelengths of optical modules



Overview

The biggest difference between colored optical modules and other types of optical modules lies in the center wavelength.

Key Takeaways

Optical modules commonly use wavelengths of 850 nm, 1310 nm, and 1550 nm, with additional options for CWDM and DWDM applications. Standard Wavelengths

Optical modules are designed to operate at specific center wavelengths that optimize transmission over fiber. The most common wavelengths are:

- 850 nm: Primarily used for short-range multimode fiber (MMF) applications, such as within data centers, due to higher modal dispersion but cost-effective deployment .
- 1310 nm: Used for medium-range single-mode fiber (SMF) links, suitable for campus or metropolitan networks, offering lower attenuation and reduced dispersion compared to 850 nm .
- 1550 nm: Designed for long-range or ultra-long-range SMF transmission, often used in metropolitan, regional, or long-haul networks. This wavelength benefits from minimal fiber attenuation and supports optical amplification and DWDM systems .

Advanced Wavelength Options

- CWDM (Coarse Wavelength Division Multiplexing): Uses multiple wavelengths spaced typically 20 nm apart within the 1270-1610 nm range, allowing multiple channels over a single fiber .

- DWDM (Dense Wavelength Division Multiplexing): Employs tightly spaced wavelengths (often 0.8 nm or 100 GHz spacing) in the 1525–1565 nm range for high-capacity long-haul networks .

Module Types and Wavelengths

Different optical module form factors support these wavelengths:

- SFP/SFP+ modules: Commonly available at 850 nm, 1310 nm, 1490 nm, 1550 nm, CWDM, and DWDM, supporting data rates from 100 Mbit/s to 10 Gbit/s .
- XFP and CFP modules: Typically used for higher-speed or long-haul applications, often at 1310 nm or 1550 nm.
- BiDi modules: Use WDM to transmit and receive on different wavelengths over a single fiber, requiring paired modules with complementary wavelengths .

Practical Considerations

Choosing the correct wavelength is critical for:

- Fiber compatibility: MMF vs. SMF.
- Transmission distance: Short-reach (850 nm), medium-reach (1310 nm), long-reach (1550 nm).
- Link stability and performance: Incorrect wavelength selection can cause high attenuation, dispersion issues, or link failure .
- Network design: Wavelength affects attenuation, dispersion, bit error rate (BER), and the feasibility of optical amplification or multiplexing . In summary, 850 nm, 1310 nm, and 1550 nm are the primary wavelengths in optical modules, with CWDM and DWDM providing additional multiplexing options for high-capacity networks. Module selection depends on fiber type, distance, and network requirements.

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