How to identify long-distance optical modules

Overview

This pairing ensures optimal performance, particularly for long-distance transmission applications where signal integrity is crucial.

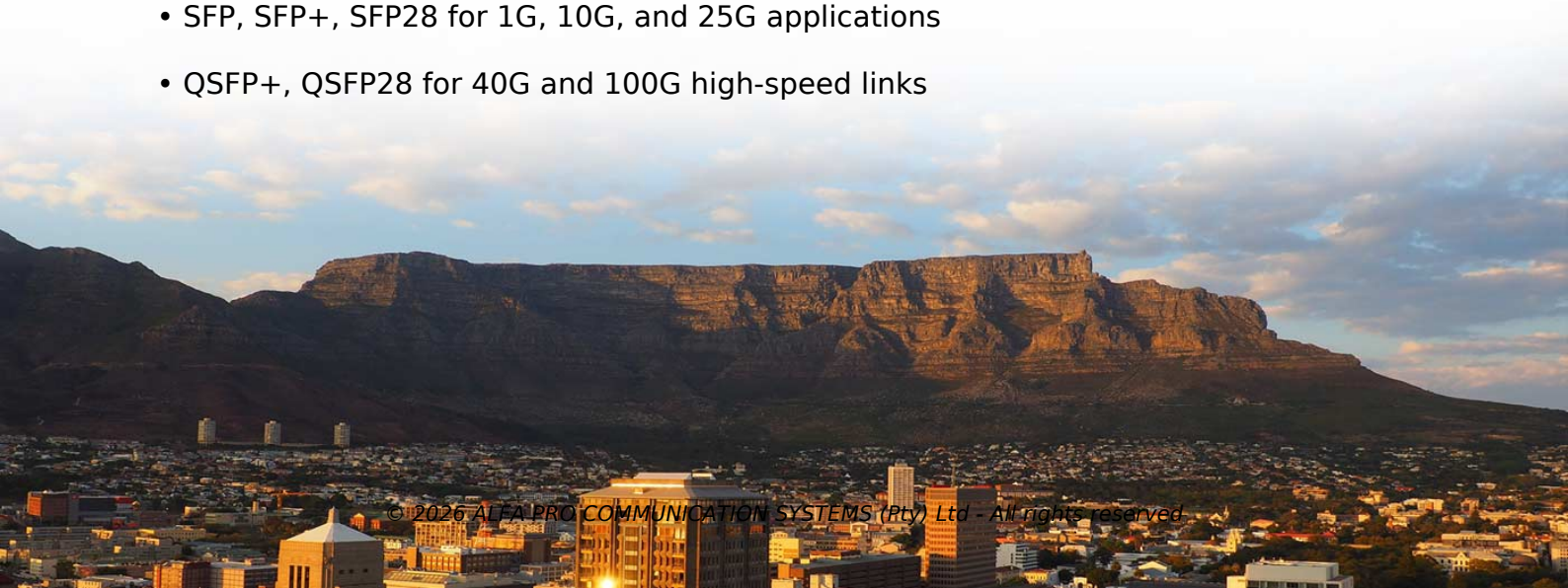
Key Takeaways

Long-distance optical modules are identified by their extended transmission range (typically 30 km or more), use of single-mode fiber, specific wavelengths (1310 nm or 1550 nm), and higher transmit power and receiver sensitivity compared to short-reach modules.Key Identification Features

1. Transmission Distance: Long-distance optical modules are designed to support links of 40 km, 80 km, 120 km, or more, depending on the module type and network requirements. Modules with a reach beyond 30 km are generally considered long-distance . 2. Wavelength: These modules typically operate at 1310 nm or 1550 nm, which minimizes attenuation over single-mode fiber. Short-range modules usually use 850 nm and multimode fiber . 3. Form Factor and Speed: Long-distance modules are available in various form factors compatible with network equipment:

• SFP, SFP+, SFP28 for 1G, 10G, and 25G applications

• QSFP+, QSFP28 for 40G and 100G high-speed links



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• XFP and 25G/40G/100G modules for extended reach . 4. Optical Power Specifications: Long-distance modules have higher transmit power (Tx) and sensitive receivers (Rx) to overcome fiber attenuation. They also have strict operational receive power ranges; exceeding these limits can damage the module . 5. Laser Type:

• DFB (Distributed Feedback) lasers are commonly used to reduce dispersion and maintain signal integrity over long distances.

• Some SFP+ long-distance modules use EML (Electro-absorption Modulated Laser) for improved accuracy and lower power consumption . 6. Color Coding and Central Wavelength: Modules may be color-coded to indicate their central wavelength. Long-distance modules often use color-coded optics to distinguish them from short-range modules, which helps in identifying the intended transmission band .
Practical Identification Tips
• Check the module label or datasheet: Look for specifications such as maximum reach, wavelength, and optical power budget.

• Observe the fiber type: Long-distance modules are almost always designed for single-mode fiber (SMF).

• Use optical power meters: Measure the received optical power to ensure it falls within the module's operational range, especially for long-haul links .

• Consider network application: Modules intended for metro, inter-campus, or carrier networks are typically long-distance, whereas data center short-range modules are for intra-building connections . By combining these characteristics—transmission distance, wavelength, form factor, optical power, and laser type—you can reliably identify long-distance optical modules and ensure proper deployment in extended fiber optic networks.

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Long-distance optical links are vital for enabling the spread of high-speed networking, but they come with unique

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Systematic classification of optical modules by data rate, form factor, transmission distance, and fiber type.

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