

RIVO MULTITRADE OPTICAL SYSTEMS

What is the size of the coupling capacitor for the optical module



Overview

The intent is to provide multiple voltage rails to minimize the need for voltage regulation on the optical module.

Key Takeaways

For optical modules, AC coupling capacitors typically range from 0.1 μF to 4.7 μF , with the exact value chosen based on data rate, impedance, and low-frequency signal requirements. Recommended Capacitance Range

In high-speed optical transceivers, the coupling capacitor is used to block DC while allowing AC signals to pass. For data rates up to 12.5 Gbps, standard low-cost capacitors in the range of 0.1 μF to 4.7 μF have been successfully used without significant signal degradation, even at frequencies from 50 MHz to 10 GHz (Microchip). The exact value depends on the low-frequency cutoff of the AC-coupling network and the input impedance of the receiver.

Capacitor Type and Package

- Ceramic SMT capacitors (e.g., 0402 size) are commonly used due to their low parasitic inductance and small footprint, which is critical in optical modules where space is limited.
- Silicon capacitors are also suitable for ultra-broadband optical applications, supporting very high modulation rates (56–112 GBaud) with low insertion loss and reduced PCB area.

- Tantalum or aluminum electrolytic capacitors are less common in high-speed optical modules due to larger size and higher parasitics, but may be used in lower-speed or legacy designs .

Design Considerations

- The low-frequency cutoff of the AC-coupling network should be chosen to minimize deterministic jitter in optical transceivers .
- The voltage rating should exceed the maximum expected DC bias in the system.
- ESR and ESL (equivalent series resistance and inductance) affect high-speed signal integrity, so low-ESR, low-ESL capacitors are preferred .
- For differential signaling, matched capacitors on both lines help maintain signal symmetry and reduce skew.

Practical Example

For a 400 GbE optical module operating at 56–112 GBaud per lane, a 0.1 μF to 1 μF ceramic or silicon capacitor is typically sufficient to maintain signal integrity while blocking DC, depending on the module's input impedance and PCB layout . In summary, select a capacitor in the 0.1–4.7 μF range, prioritize low parasitics, and ensure the low-frequency cutoff meets the system's jitter and signal fidelity requirements.

Article Content

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HFAN-01.1: Choosing AC-Coupling Capacitors | Analog Devices

When using AC-coupling in optical transceiver design, care should be taken to minimize the deterministic jitter associated with the

optical module PCB guide

The result is a complete, engineer-approved reference for optical module PCB design – suitable for hardware developers, PCB

Murata Silicon Capacitor

ULSC Capacitor targets Optical communication system such as ROSA/TOSA, SONET and all optoelectronics as well as High speed

Silicon-Capacitors-Catalogue-V1.5-Murata

The XBSC/UBSC/BBSC/ULSC capacitors target optical communication systems (ROSA/TOSA, SONET and all optoelectronics) as

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Optical Coupler

The coupling ratio (or splitting proportions) depends on the coupler configuration, which is the ratio that the input optical signals are

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What Is an Optical Module and Its FAQs (V200) Describes what an optical module is and FAQs, including the fundamentals,

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Co-Packaged Optic Assembly Guidance Document

The intent is to provide multiple voltage rails to minimize the need for voltage regulation on the optical module. 12V rail is for the main

Opto-isolator

An opto-isolator (also called an optocoupler, photocoupler, or optical isolator) is an electronic component that transfers electrical

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The optical module is composed of many devices, including optoelectronic devices, functional circuits, and optical

Optical Coupling

An NIR fluorescence endoscopic system should balance the sensitivity and size of the image detector, the optical coupling efficiency,

Optical module design resources | TI

Design requirements Modern optical module designs often require: Reduced power consumption to control and limit module

DesignCon 2002

A robust chip-to-module channel is critical to enable compatibility between a PHY or switch on a host board and the corresponding

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