Optical module capacitor coupling pull-up voltage



Overview

We explained how AC-coupling UBB SiCaps are efficient in very high-speed optical modules, thanks to their specific design and low profile.

Key Takeaways

In optical modules, AC-coupling capacitors block DC while allowing high-speed signals to pass, and pull-up resistors set the output voltage level for proper logic operation. AC-Coupling Capacitors in Optical ModulesAC-coupling capacitors are commonly used in optical modules to isolate DC levels between circuits while allowing high-frequency signals to pass. These capacitors prevent DC bias from one side of the module from affecting the other, which is critical in differential signaling and high-speed data transmission.

Silicon capacitors (SiCaps) are often preferred for their low insertion loss, low parasitic capacitance, and minimal crosstalk, which improves signal integrity in both single-ended and differential modes. The capacitor value is chosen to ensure the high-pass cutoff frequency is well below the lowest frequency of the transmitted signal, avoiding signal distortion.

Pull-

Up Voltage ConsiderationsPull-up resistors are used on the output side of optocouplers or optical isolators to define the logic high voltage when the phototransistor is off. The pull-up voltage must match the logic level of the receiving circuit (e.g., 3. 3 V or 5 V for CMOS/HCT logic) and is selected to ensure fast rise times without exceeding the current rating of the phototransistor.

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The combination of the pull-up resistor and the output capacitance (including the AC-coupling capacitor) forms an RC time constant, which affects the signal rise and fall times. A smaller resistor or capacitor value increases speed but may increase power consumption or reduce voltage swing.

Practical Design Tips

Select capacitor values to pass the desired signal bandwidth while blocking DC. For high-speed digital signals, typical values range from tens to hundreds of nanofarads depending on the data rate. Choose pull-up voltage according to the logic family of the receiving circuit.

Ensure the phototransistor can sink enough current to pull the line low effectively.

Consider CT

R (Current Transfer Ratio) of the optocoupler, which affects the output current and thus the voltage across the pull-up resistor. High-speed digital isolators may include internal circuitry to regulate LED drive current, reducing the need for external adjustments. Minimize parasitic capacitance and crosstalk by using low-profile, high-resistivity capacitors, especially in differential signaling applications.

Summary

In optical modules, AC-coupling capacitors ensure DC isolation and signal integrity, while pull-up resistors and voltages define the output logic levels and timing characteristics. Proper selection of these components is essential for high-speed, reliable signal transmission across isolated circuits, balancing speed, voltage levels, and power consumption.

Article Content

Sicaps reduce Power consuption

We explained how AC-coupling UBB SiCaps are efficient in very high-speed optical modules, thanks to their specific design and low profile. We also saw the impact of the SNR on the power consumption

ANO007 | Understanding Phototransistor Optocouplers

01. INTRODUCTION An optocoupler, also known as photocoupler or opto-isolator, is a device which can transfer an electrical signal across two galvanically-isolated circuits by way of optical coupling. Unlike

Optocoupler Circuit Operation | Specification | Applications

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Specification: The partial specification for an optoelectronic coupler in Fig. 20-36 has three parts. The first part specifies the current and voltage conditions for the input (LED) stage. The second deals with

PC817 Optocoupler Module User Guide | Wiring & Setup

Using the module''s on-board pull-up in addition to the device''s internal pull-up can cause incorrect voltage levels. Removing the jumper lets the

Application for Ultra Broadband and Optical | Silicon Capacitors ...

Our Silicon Capacitor technology is well appreciated in Ultra broadband systems, especially thanks to their excellent electrical performances, such as ESR, ESL, insertion loss, and also thanks to their

OSFP OCTAL SMALL FORM FACTOR PLUGGABLE MODULE

The module supplier is responsible for defining a location in the module where the case temperature be measured or monitored. An internal component with the least thermal margin will be connected to

Basic Characteristics and Application Circuit Design of Transistor

Photocouplers optically links, via transparent isolating material, a light emitter and a photodetector. Used as an interface between circuits with different ground potentials, photocouplers replace isolation

Using Opto Couplers

Each logic family (e.g. LSTTL or CMOS types) may have different logic voltage levels and different input and output current requirements, and optocouplers can provide a convenient way of interfacing two

Isolator Presentation

The signal modulates a high-frequency carrier and is capacitively coupled from input to output. Either duty-cycle or frequency modulation techniques are used, and the signal is passed differentially

Capacitive Isolation: A Fundamental Building Block in Future AC/DC ...

Capacitive isolation is a mature solution developed over the past decade to replace optocouplers in signal isolators, isolated gate drivers, isolated transceivers, and other applications1. However, the

Sicaps reduce Power consuption

RF PERFORMANCES Murata proposes a full range of Ultra BroadBand (UBB) Silicon capacitors of various sizes and operating voltages, all of them providing very low insertion losses up to 220 GHz,

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What''s the difference between putting a coupling capacitor ...

For any practical AC-coupled load, there''s going to be some combination of factors that sets the DC bias point. That might be ground or it might be some other voltage. We also don''t know how long it''ll take

Guidelines for Reading an Optocoupler Datasheet

The coupling devices are designed for signal transmission between two electrically separated circuits. The couplers are end-stackable with 2.54 mm spacing. Creepage and clearance distances of > 8.0

Why don''t we use decoupling capacitors for open-drain outputs?

If an IC with open-drain outputs (and hence pull-up resistors) is used, we of course put decoupling capacitors on the IC supply, but why don''t we also add decoupling capacitors between

Gate Drivers and Gate Driving with SiC MOSFETs

Magnetic coupled drivers are a fairly mature technology but can be a concern in magnetic field applications. Capacitive coupled drivers have great

Ultra-broadband capacitors for optoelectronics – DENA

Also, providing 2-capacitor modules as a “single component” solution were hard to process, model, and added to overall height. For the optoelectronic and high reliability signal integrity markets, a new high

Pull-up Resistors

Another thing to point out is that the larger the resistance for the pull-up, the slower the pin is to respond to voltage changes. This is because the system that feeds

Optocouplers/Isolators | Vishay

Optocouplers/Isolators As safety products, optocouplers are designed to protect sensitive control circuitry or people from high voltages. They galvanically isolate the low- and high-voltage sides of a

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