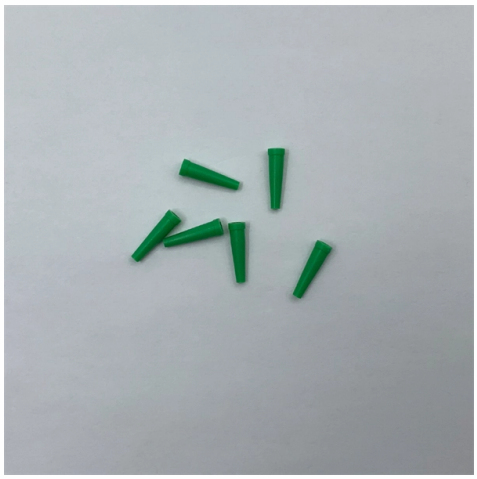
Optocoupler Circuit Design



Overview

Using Opto Couplers The start of the design process is to specify the input and output conditions the optocoupler is to link. Typical optocouplers can hand.

Key Takeaways

Optocoupler circuits provide electrical isolation between input and output, using an LED to drive a photosensitive device, with design focused on CTR, resistor selection, and configuration for inverting or non-inverting operation.

Basic Operation

An optocoupler (or opto-isolator) transfers electrical signals between two electrically isolated circuits using infrared light. The input side consists of an LED, which emits light proportional to the input current. The output side contains a photosensitive device such as a phototransistor, photodiode, or photo-SCR, which converts the light back into an electrical signal.

The LE

D and phototransistor are enclosed in a light-tight package, providing isolation typically rated from 2. 5 kV to 5 kV or higher, ensuring safety between high-voltage and low-voltage circuits.

Key Design Considerations

Current Transfer Ratio (CTR) CTR is the ratio of the output transistor collector current (IC) to the input LED forward current (IF), expressed as a percentage. It is analogous to the beta of a BJT and is critical for determining the required LED current to achieve a desired output current.

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CT

R varies with temperature, LED aging, and input current, so a design margin is recommended to maintain reliable operation over the device lifetime.

LE

D Drive and Resistor Selection A series resistor is used to limit the LED forward current to a safe value. The resistor value is calculated using Ohm's law: R = (V_in - V_f) / I_f, where V_in is the input voltage, V_f is the LED forward voltage, and I_f is the desired LED current.

For A

C applications, additional considerations like reverse voltage protection may be required.

Output Configuration

Inverting Configuration: The phototransistor is typically connected with a pull-up resistor to Vcc.

When the LE

D is on, the transistor conducts, pulling the output low.

Non-

Inverting Configuration: The transistor can be biased in the linear region or configured like a common-collector amplifier to produce a high output when the LED is on.

Temperature and Aging Effects CT

R decreases at high temperatures due to reduced LED efficiency and may degrade over time. Designers should account for a safety margin, often reducing the expected CTR by 20–25% to ensure reliable operation over the device's lifetime.

Practical Design Steps

Select the Optocoupler Type: Choose a phototransistor, photodiode, or photo-SCR based on speed, voltage, and current requirements.

Determine LE

D Current: Based on CTR and required output current, calculate the LED drive current. Choose Series Resistor: Limit LED current to safe levels while ensuring sufficient output signal. Configure Output Circuit: Decide between inverting or non-inverting output, and select pull-up or load resistors accordingly.

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Verify Performance: Check switching speed, voltage levels, and isolation requirements. Consider parasitic capacitance and frequency limitations for high-speed applications. Example ApplicationsTTL Logic Isolation: Using 4-pin or 6-pin optocouplers like CNY17x or SFH61xA to interface 5V logic with high-voltage circuits.

A

C Signal Isolation: Using phototransistor optocouplers with reverse voltage protection and AC drive circuits. Microcontroller Protection: Isolating sensitive microcontroller inputs from mains voltage or noisy industrial environments. By carefully considering CTR, LED drive, resistor selection, and output configuration, optocoupler circuits can reliably transmit signals while providing robust electrical isolation and protection.

Article Content

Using Opto Couplers

The start of the design process is to specify the input and output conditions the optocoupler is to link. Typical optocouplers can handle input and output currents

Optocoupler Tutorial and Optocoupler Application

PDF file

ANO007 | Understanding Phototransistor Optocouplers

In order to design a functionally robust and reliable application with optocouplers, it is essential to understand not only the device''s main parameters and parasitic elements, but also their tolerances

Optocouplers Guide: Understanding Types,

Learn how optocouplers ensure electrical isolation and signal transfer in circuits. This guide covers their components, working principles, and

Optocoupler Tutorial for Beginners

An optocoupler (or opto-isolator) is a component that transfer signals between circuits using light. In this guide, you''ll learn how they work and how you can use one in your own projects.

Optocoupler Circuits, Working, Characteristics, Interfacing

The figure above shows a basic optocoupler circuit. The amount of current that may pass through the phototransistor is determined by the applied forward bias current of the IR LED or the I

Application Examples

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The interfacing of the optocoupler between digital or analogue signals needs to be designed correctly for proper protection. The following examples help in this area by using DC- and AC-input

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

AN-3001 Optocoupler Input Drive Circuits

The circuit of Figure 13 shows how a PNP transistor is connected as an emitter follower, or common collector, to obtain current gain. When the output of the gate (G1) is low, Q1 is turned on

How Optocouplers Work

FREE COURSE!! Learn about optocouplers. We''ll look at how they are used to control circuits, how they work and also how to design some simple optocoupler circuits to show the working

Basic Characteristics and Application Circuit Design of Transistor

However, this circuit design is vulnerable to certain kinds of interference in signal transmission. While common-mode noise do not pose a problem because of the isolation characteristics of transistor

Application Examples

OPTOCOUPLERS IN IC LOGIC DESIGN To interface with TTL logic circuits, Vishay offers a wide range of 4 pin and 6 pin optocoupler series such as the CNY17x, SFH61xA, TCET110x, or K817P family.

10 MBd High-Speed Optocoupler Design Guide

10 MBd High-Speed Optocoupler Design Guide INTRODUCTION Optocouplers are popularly perceived as being “slow” and are thus excluded from many designs in which they could potentially serve as

Optocouplers, Optoisolators | Isolators | DigiKey

Optocouplers are essential in feedback loops, signal isolation, and safety-critical applications, particularly in switch-mode power supplies, PLC inputs, and motor drive circuits. When and Why to

Optocoupler Circuit: Isolation for Safety | Advanced PCB Design Blog ...

Optocoupler circuits offer critical electrical isolation from high-voltage sources that protect users and sensitive equipment.

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Optoelectronic Feedback Control Techniques for Linear and Switch

INTRODUCTION The power supply designer is continually being pressured to provide units which have higher efficiency, better regulation, less EMI and RFI, and smaller size and weight, all at a lower cost.

Designing Linear Amplifiers Using the IL300 Optocoupler

INTRODUCTION This application note presents isolation amplifier circuit designs useful in industrial test and measurement systems, instrumentation, and communication systems. It covers the IL300''s

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

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