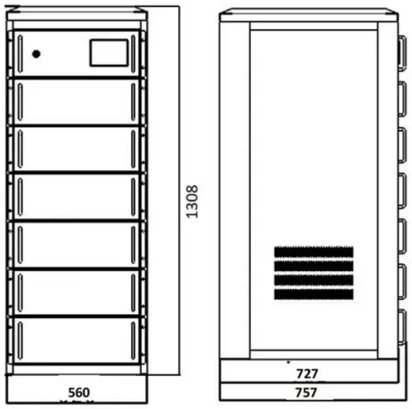
Typical Optical Coupler Circuit



Overview

An optocoupler (or opto-isolator) is a component that transfer signals between circuits using light.

Key Takeaways

An optical coupler circuit uses an LED and a photodetector to transfer signals between electrically isolated circuits, providing protection and signal integrity.

Overview

An optical coupler, also called an optocoupler or opto-isolator, is a semiconductor device that transmits electrical signals using light, typically infrared, between two electrically isolated circuits. The main purpose is to protect sensitive components like microcontrollers from high voltages or electrical noise while allowing signal transfer. Basic ComponentsLED (Transmitter): Converts the input electrical signal into light.

When current flows through the LED, it emits infrared light proportional to the input signal. Photodetector (Receiver): Detects the light from the LED and converts it back into an electrical signal. Common photodetectors include phototransistors, photodiodes, photo-FETs, or opto-triacs.

Working Principle

When the input circuit drives the LED, it emits light that falls on the photodetector. The photodetector then conducts, allowing current to flow in the output circuit. This optical link ensures electrical isolation, so the input and output circuits can operate at different voltage levels safely.

Optical couplers can also block noise transfer and prevent ground loops.

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Circuit Design Considerations

Current Transfer Ratio (CTR): Similar to a BJT's current gain, CTR is the ratio of the photodetector's output current to the LED's input current, expressed as a percentage. It is crucial for designing the correct input and output resistor values. Inverting vs Non-Inverting Configurations: An optocoupler can be configured as an inverting circuit (like a common-emitter BJT) or non-inverting (like a common-collector), depending on whether the output should follow or invert the input signal.

Resistors: Input resistors limit LED current, while output resistors convert phototransistor current into a voltage signal.

Applications

Microcontroller Isolation: Protects low-voltage logic circuits from high-voltage spikes. Switching Power Supplies: Transfers feedback signals across isolated sections. Sensor Circuits: Prevents noise from affecting sensitive measurements.

Digital Logic Level Conversion: Interfaces circuits operating at different voltage levels.

Example Circuit

A simple optocoupler circuit includes an input switch connected to the LED through a current-limiting resistor. When the switch closes, the LED emits light, turning on the phototransistor. The phototransistor conducts, generating a voltage across an output resistor, which can then drive a load or logic input.

By carefully selecting the LED current, phototransistor load resistor, and considering CTR, designers can create reliable optical coupler circuits for both digital and analog applications.

Article Content

Optocoupler Circuits, Working, Characteristics, Interfacing

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

Optocoupler Tutorial and Optocoupler Application

The basic design of an optocoupler consists of a light source, usually an LED (Light-Emitting Diode), driven by the input signal which could be a digital

Optocoupler Circuit Design and Detailed Analysis

Optocoupler circuit design is not that difficult as some thought. Once you know what a CTR is and learn how to use it, then Optocoupler circuit design is that easy.

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ANO007 | Understanding Phototransistor Optocouplers

Figure 26 shows a typical switching test circuit in a common-emitter configuration, where the optocoupler LED is driven with a square waveform (Vin) whose amplitude is adjusted based on the

Application Examples

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

OPTOCOUPLER DEVICES AND APPLICATION

An optocoupler (or an optoelectronic coupler) is basically an interface between two circuits which operate at (usually) different voltage levels. The key advantage of an optocoupler is the electrical

Optocoupler Circuit Operation | Specification | Applications

Optocoupler Circuit Operation: An Optocoupler Circuit Operation (optoelectronic coupler) is essentially a photo-transistor and an LED combined in one package. Figure 20-35 (a) and (b) shows the typical

AN-3001 Optocoupler Input Drive Circuits

In the optocoupler, or photon coupled pair, the coupling is achieved by light being generated on one side of a transparent insulating gap and being detected on the other side of the

Basic Characteristics and Application Circuit Design of Transistor Couplers

This document outlines the basic characteristics and application design of general-purpose transistor output photocouplers (optical isolators).

Grating Couplers on Silicon Photonics: Design

One important issue of silicon photonics that comes with its high integration density is an interface between its high-performance integrated

Optocouplers Selection Guide: Types, Features, Applications

Optocouplers are electronic components which use light waves to provide electrical isolation while transferring an electrical signal. They are sometimes known as opto-isolators, photocouplers, or

Optical Coupler

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6.1.2.3 The optical coupler Due to the circuit cannot support the large load voltage, an optical coupler is used to protect the controller from burning out. Optical coupler is a semiconductor device, which is

Fiber Couplers – optical fiber

Fiber couplers are fiber devices for coupling light from one or several input fibers to one or several output fibers, or from free space into a fiber.

Fiber Optical Coupler: Design, Working, and Its Types

An optical coupler is one of the most commonly used devices in the telecommunication and electronic industry. Since its introduction, it has become an extremely important component in

A Review of Optical Coupler Theory, Techniques, and Applications

Coupling at optical frequencies presents challenges to achieving high efficiency, compactness, high fabrication tolerance, and ease of integration in photonic integrated circuits.

What are Optocouplers? Definition, construction and working of ...

Optocouplers or optoelectronic couplers are electronic component that basically acts as an interface between the two separate circuits that operates at different voltage levels.

Application Examples

For simplicity, a typical CTR value of 100 % at IF = 10 mA is selected. Within the temperature range of - 20 °C to + 60 °C the CTR undergoes a change between + 12 % and - 17 %. The - 17 % reduction is

Optical Couplers | Springer Nature Link

Optical couplers are one of the most important classes of integrated optical components. These devices are used in directional routing of a light signal from one waveguide to another or in

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