24V Switching Power Supply Optocoupler Protection Circuit

Overview

Selective protection of 24 V DC load circuits EPD24 individually protects loads with the lowest power loss, and an impressive performance in severe conditions.

Key Takeaways

A 24V switching power supply can use an optocoupler for galvanic isolation and protection, with proper resistor selection, transistor driving, and overcurrent safeguards to ensure safe and efficient operation. Optocoupler Basics for 24V CircuitsAn optocoupler (or opto-isolator) transfers electrical signals between two isolated circuits using light, typically from an LED to a phototransistor, ensuring that high-voltage or noisy environments do not damage sensitive electronics like microcontrollers or I/O expanders. In a 24V switching power supply, the optocoupler can isolate the high-voltage side from the low-voltage control side while allowing signal transmission.

Input Side Design

The LE

D side of the optocoupler requires a series resistor to limit forward current. For a 24V input and a typical LED forward voltage of 1. 2–1.

3V, the resistor value can be calculated as: R = (V_in - V_f) / I_f where V_in = 24V, V_f ≈ 1. 2V, and I_f is the desired LED current (e.g., 1–10 mA depending on the optocoupler type). Using a low-current optocoupler like the FOD817 can reduce power dissipation significantly, e.g., to ~0.

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023W per channel.

Output Side Design

The phototransistor side can be connected in common-emitter configuration with a pull-up resistor to the low-voltage supply. The resistor value should ensure that the transistor saturates fully when conducting, minimizing voltage drop and power dissipation. For example, a 2N3904 transistor driven by the optocoupler can handle currents with minimal dissipation (~12 mW) if properly saturated.

Protection Considerations

Overcurrent Protection: Each 24V line should include overcurrent protection to prevent damage to the supply, cables, and connected devices. Selective protection can isolate only the faulty path without affecting other consumers.

Back EM

F Protection: For inductive loads like motors, a diode across the load prevents voltage spikes from damaging the optocoupler or transistor. Thermal Management: Ensure resistors and transistors are rated for the expected power dissipation. Using low-current optocouplers and efficient transistor switching reduces heat generation.

Efficiency Tips

Use low-current optocouplers to reduce series resistor power dissipation. Drive the phototransistor into saturation to minimize voltage drop and transistor heating. Consider resistor dividers or level-shifting circuits if optical isolation is not strictly required, which can further reduce power loss.

Summary

A well-designed 24V switching power supply with optocoupler protection should: Limit LED current with a series resistor. Saturate the phototransistor to reduce dissipation. Include overcurrent and back EMF protection.

Use low-power optocouplers for efficiency. Maintain galvanic isolation between high-voltage and control circuits. This approach ensures safe, efficient, and reliable operation of 24V switching circuits while protecting sensitive electronics.

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Article Content

Selective protection of 24 V DC load circuits

Selective protection of 24 V DC load circuits EPD24 individually protects loads with the lowest power loss, and an impressive performance in severe conditions.

24 V DC overcurrent protection and power distribution

Protection in the 24 V DC environment is indispensable in order to protect consumers, cables and installation against overcurrent. Furthermore it is necessary in the event of a fault to switch off as

transistors

We have a robot, and it has 32 digital output, fed into a homemade PCB. On the PCB we have optocouplers, which have a forward voltage around 1.2-1.3V. So I need to drop the voltage a lot.

Optocouplers in Switching Power Supplies

Basic insulation is required in an optocoupler interface between a hazardous voltage circuit and a non-touchable extra low voltage (ELV) circuit. The most widely used insulation for optocouplers in switch

Using Opto Couplers

The main purpose of an optocoupler interface is to completely isolate the input circuit from the output circuit, which normally means there will be two completely

EPD24 Selective Protection of 24V DC Load Circuits

EPD24-E4 and EPD24-A4 devices provide selective protection of 24 V DC power circuits against overcurrent (overload, short circuit). They can operate in a wide

How To Build an Optocoupler-Based 24V Relay Driver Using the

In this project, we will design a relay driver circuit that uses the TLP3120 optocoupler to switch a 24V relay on and off.

opto isolator

I have to provide some isolated inputs that accept 12-24V. There should be some protection against reverse polarization, transient over-voltage and permanent over voltage (up to 40V) to some degree.

Design Tutorial: Power-supply optocoupler basics

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An optocoupler solves this problem by sending feedback across the isolation barrier with light instead of a direct electrical connection. On the secondary side, a light-emitting diode inside the

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The microprocessor then sends a power supply control signal to hold the power supply in the on-state through the optocoupler U4. If the user presses the switch P1 again to command a turn off, the

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Explore LM2596 schematics with fixed (5V) and adjustable output buck converter circuits, including pinouts for efficient switching regulators.

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