Optocouplers | Application Note

Using the IL300 Linear Optocoupler for Isolated Voltage and Current Monitoring

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INTRODUCTION

The IL300 optocoupler is a linear optically isolated device designed for precision analog signal transfer. Its dual photodiode architecture allows implementation of closed-loop feedback circuits for improved gain stability and linearity.

This device is commonly used for isolated voltage monitoring and current sensing in industrial control systems. An automotive-qualified option with extended temperature range is also available – the VOA300.

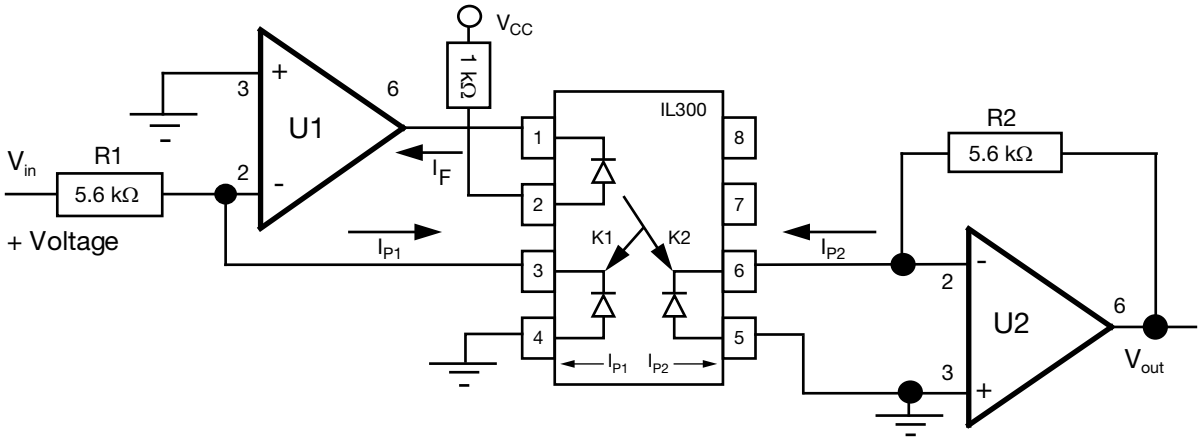

Fig. 1 - Typical Closed-Loop IL300 Isolation Amplifier Configuration

CIRCUIT DESCRIPTION

In this configuration, the IL300 is used as an isolation amplifier, where the gain can be individually adjusted:

- **U1** drives the LED input current (I_F)
- The primary feedback photodiode current (I_{P1}) is monitored by U1, forming a servo loop that linearizes LED current
- The secondary photodiode current (I_{P2}) is optically coupled and proportional to I_{P1}
- **U2** converts I_{P2} into an output voltage using R2

Due to matched photodiodes, transfer gain is set primarily by the external resistor ratio:

$$V_{OUT} \approx \left(\frac{R2}{R1}\right) \times K3 \times V_{IN}$$

Where **K3** is the photodiode transfer gain ratio specified in the datasheet, as:

$$K3 = \frac{K2}{K1} = \frac{\frac{I_{P2}}{I_F}}{\frac{I_{P1}}{I_F}} = \frac{I_{P2}}{I_{P1}}$$

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INPUT SIGNAL OPTIONS (V_{IN})

The input node can be derived from several measurement sources:

- Voltage drop across a **current sense shunt resistor**
- Output of a **high voltage divider**

This flexibility allows the same isolation topology to be used for both voltage and current measurement.

DESIGN CONSIDERATIONS

- Select precision resistors and arrays to maintain gain accuracy
- Account for K3 tolerance when calculating system errors
- Ensure op amp input bias current is low relative to photodiode current
- Verify isolation voltage rating for the target application