

±12-V Input, Next-Generation, Reinforced Isolated Amplifier for Voltage Sensing



Introduction

In high-voltage industrial applications in order to determine power and energy, both high-side voltage and current have to be measured. The voltage can be measured using a resistor divider circuit followed by an isolated amplifier. Texas Instruments offers a wide variety of basic and reinforced isolated amplifiers optimized for voltage and current sensing.

The **ISO224**, next generation ISO12x, is a high-precision reinforced isolated amplifier designed for isolated voltage sensing of ±10-V signals which are widely used in high-voltage industrial applications. The device features a very high input resistance, ideal for voltage sensing applications, and offers improved isolation ratings, higher performance, and simplified system-level design and diagnostics.

Typical applications include but not limited to:

- [Analog Input Modules](#)
- [AC Analog Input Modules](#)
- [Compact Relays](#)
- [Rail Transport](#)
- [Inverter and Motor Control](#)

Figure 1 shows ISO224 implementation in power line monitoring.

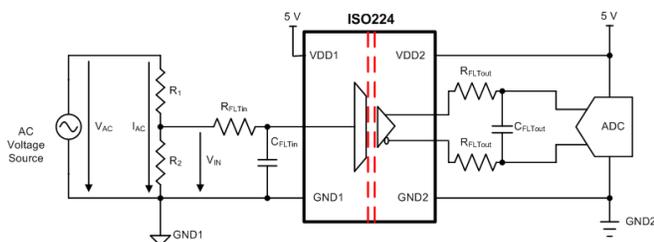


Figure 1. AC Voltage Sensing with the ISO224

ISO224 Improved Isolation Ratings

With TI's *Capacitive Isolation Technology* that enables higher working voltages and the longest insulation barrier lifetimes, engineers can now design more robust and reliable systems. The ISO224 is fully-certified per DIN VDE V 0884-11 and UL1577, can withstand an isolation working voltage breakdown of 1500 V_{RMS} , and provides reinforced galvanic isolation of 7071 kVpeak. The device also features high CMTI of 80 kV/μs (typ) to maintain safe operation and ensure data integrity in the presence of high common mode transients.

Table 1. Isolation Ratings

| Parameter | ISO124 | ISO224 |
|---|---------------|--------|
| Isolation Working Voltage (max) (V_{RMS}) per DIN VDE V 0884-11 | not specified | 1500 |
| Isolation Transient Overvoltage (max) (V_{PEAK}) | 2100 | 7071 |
| Surge Isolation Voltage (max) (V_{PEAK}) | 4000 | 12800 |
| CMTI (typ) (kV/μs) | not specified | 80 |

Higher Performance with the ISO224

The ISO224 is offered in 2 grades of performance and enables more stable and accurate measurements over extended industrial temperature range that allow engineers to design high-precision systems and overcome current performance limitations.

The ISO224 features:

- More accurate measurements with lower offset and gain error
- Lower impact of signal source impedance on overall gain error with higher input resistance of 1 MΩ (min)
- Higher temperature stability with lower offset and gain error drift over a wider temperature range
- Faster system response for broader use range with wider output bandwidth

Table 2. Electrical Parameters

| Parameter | ISO124 | ISO224A | ISO224B |
|--|------------|------------|------------|
| Input Resistance (typ) (MΩ) | 0.2 | 1.25 | 1.25 |
| Input Offset (max) (mV) | ±50 | ±50 | ±5 |
| Input Offset Drift (max) ($\mu V/^{\circ}C$) | ±200 (typ) | ±60 | ±15 |
| Gain Error (max) (%) | ±0.5 | ±1 | ±0.3 |
| Gain Error Drift (max) (ppm/ $^{\circ}C$) | ±10 (typ) | ±60 | ±35 |
| Output BW (typ) (kHz) | 50 | 185 | 275 |
| Temperature Range ($^{\circ}C$) | -25 to 85 | -55 to 125 | -55 to 125 |

ISO224 System-Level Improvement

The ISO224 operates of a single supply on the high-side, features an integrated voltage detection, an reduces the board space.

The ISO224 offers:

- Simplified design of isolated power supply and reduced system size and cost due to unipolar high-side supply VDD1
- Simplified system-level diagnostics with the ISO224

fail-safe mode, integrated voltage detection feature, that activates when the high-side supply VDD1 is missing

- Reduced board space due to fully-differential output structure that supports direct connectivity to an ADCs with 5 V input
- Reduced board space as a result of 60%+ smaller package

Table 3. Operating Conditions and Package Information

| Parameter | ISO124 | ISO224 |
|--------------------------|---------------------------------|-------------------------------|
| Power Supply | Bipolar | Unipolar |
| VDD1 (V) | ±15 | 4.5-18 (LDO) |
| VDD2 (V) | ±15 | 4.5-5.5 |
| Input Voltage Range (V) | ±10 / (FSR: ±12.5) | ±12 (FSR: ±12.3) |
| Fail Safe Mode | No | Yes |
| Output | Single-ended | Differential |
| Output Voltage Range (V) | ±10 | ±4 |
| Package | 17.9 mm × 7.5 mm (PDIP-16) | 5.85 mm × 7.50 mm (SOIC-8) |
| | 20.01 mm × 6.61 mm (SOIC-28) | |

Conclusion

With isolated amplifiers being a key components in high-voltage industrial applications, it is critical to choose the devices that not only meet the performance requirements, but also provide the highest reliability and support the longest lifetime in harsh environments. The ISO224 offers designers all of the benefits of reinforced isolation with higher working voltages and longer lifetimes, supports more stable and accurate measurements over extended temperature range, and reduces the board space for compact designs.

References

- [ISO224 Fail-Safe Output Feature Application Report](#)
- [±12-V Voltage Sensing Circuit With an Isolated Amplifier and Differential Input SAR ADC Application Report](#)
- [Isolated Amplifiers Overview](#)
- [TI Precision Labs - Isolation](#)

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