Product Overview

Small-Size INA35x Versus Discrete Instrumentation Amps

Integrated instrumentation amplifiers have long been inaccessible for many designers building extremely cost-optimized products due to their price tag. However, not every design needs the precision and accuracy that comes with the vast majority of instrumentation amplifiers. Many designers instead build discrete instrumentation amplifier circuits using three amplifiers of a quad-channel op amp and a network of resistors. This was the only option that fit the budget of these designs until the release of the INA35x family. INA35x re-defines the instrumentation amplifier landscape by offering an integrated solution within the price range of a discrete design as shown in Table 1. INA350 is a selectable-gain instrumentation amplifier built with precision matched integrated resistors using a traditional three-amplifier architecture. The INA351 has even more integration and precision than INA350 because the device includes an integrated reference buffer for the reference pin and a much-improved maximum gain error specification of just 0.1%.

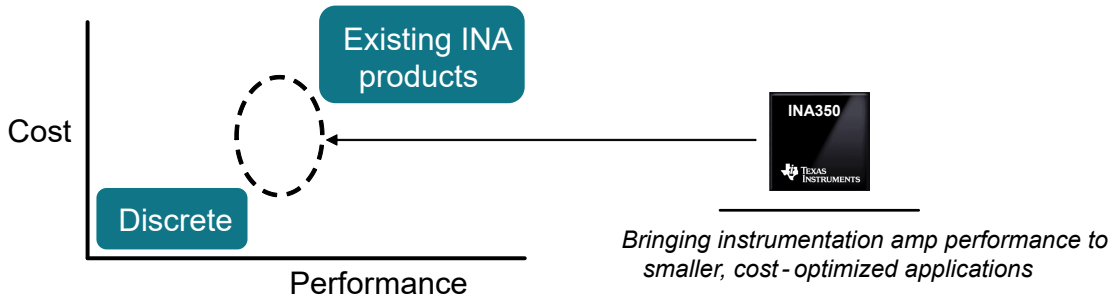

Figure 1. Instrumentation Amplifier Landscape

Table 1. Instrumentation Amplifier Key Specification Comparison

Key Specifications	Discrete	INA350	INA351	Existing INAs
Maximum gain error	About 2%	**0.6 %**	**0.1 %**	< 0.1 %
Minimum CMRR	About 60 dB	**85 dB**	**86 dB**	> 100 dB
Maximum offset	About 3 mV	**1.2 mV**	**1.3 mV**	< 0.25 mV
Web price(1)	About 0.09(2)	**$ 0.14**	**$ 0.24**	> $0.50

(1) Web price as of January 2023
(2) Approximate price based on online price of general-purpose op amp (LM324LV) + 1% discrete resistors

In addition to the performance benefits, the INA35x also extends TI's instrumentation amplifier package lineup with new smaller packages that help reduce the amount of printed-circuit-board (PCB) space compared to discrete solutions by up to 70%, as shown in Figure 2. This figure compares a typical layout including the resistor network, decoupling capacitors, and a voltage reference buffer. The TLV9041 is used as the reference buffer for INA350, and the fourth channel in a quad-amplifier is used as the reference buffer for the discrete solution while the INA351 has the reference buffer integrated.

Figure 2 shows the PCB layout comparison of a discrete design using TSSOP-14 (left) vs INA350 + TLV9041 as reference buffer in the X2QFN and X2SON, respectively (middle) vs INA351 with integrated reference buffer in the X2QFN (right).

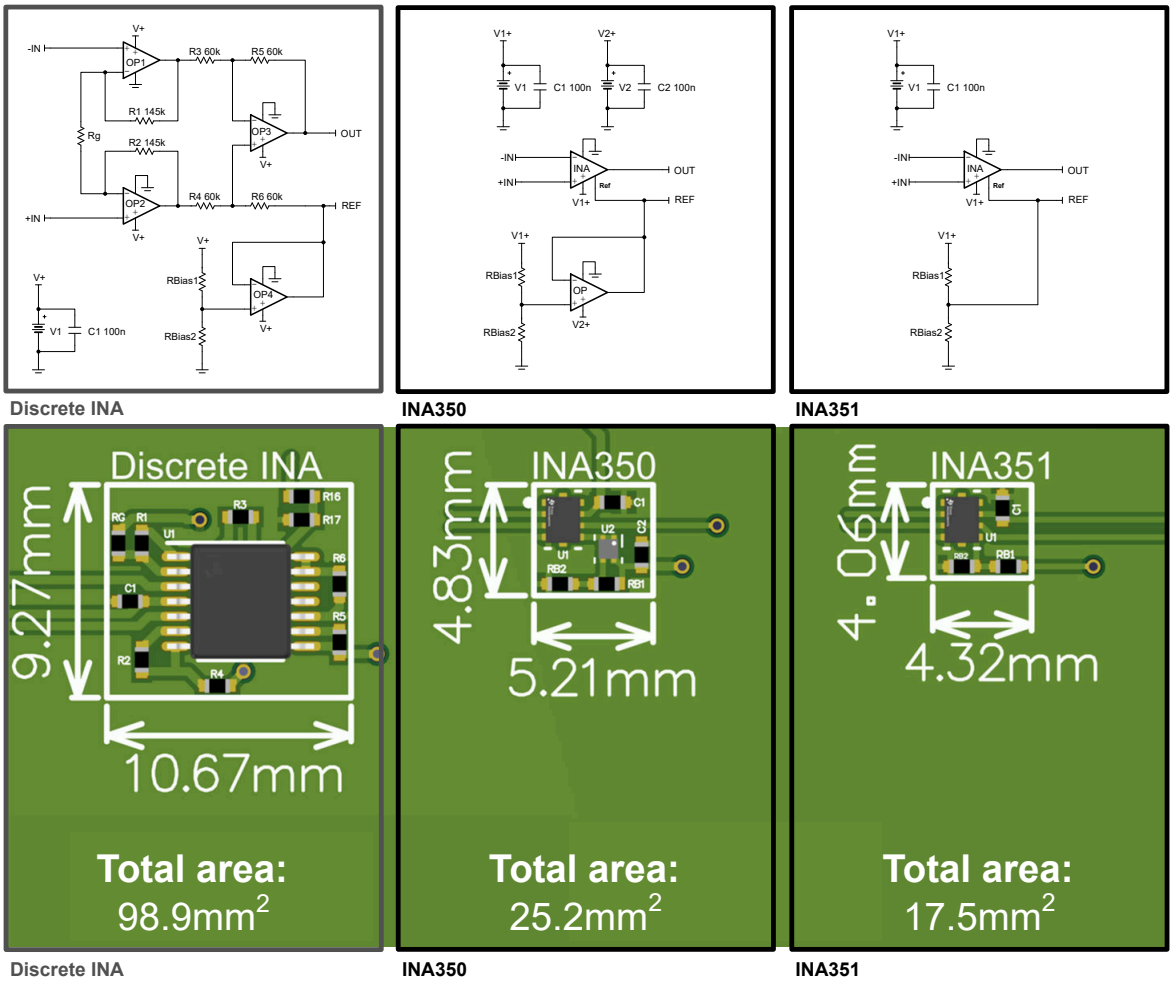

Figure 2. PCB Layout Comparison of Three Designs

Learn more about how INA35x can help reduce space and improve performance while simplifying the BOM, and start your evaluation with the following content:

Learn More

- Watch the New Product Update Webinar featuring INA350
- How to pair INA35x with general-purpose ADCs in a Bridge Sensor Solution

Evaluate the Design

- Leverage existing simulation models available in TINA-TI or PSpice for TI
- Employ the Analog Engineer's Calculator for INA Vcm vs V_{OUT} Calculations

Generic Part Number	Orderable Part Number	Gain Options	Package	Shutdown
INA350	INA350ABSIDDFR	10 or 20	2.9 × 2.8 mm (SOT-23-THN)	Yes
	INA350ABSIDSGR	10 or 20	2 × 2 mm (WSON)	
	INA350CDSIDDFR	30 or 50	2.9 × 2.8 mm (SOT-23-THN)	
	INA350CDSIDSGR	30 or 50	2 × 2 mm (WSON)	
INA351	INA351ABSIDSGR	10 or 20	2 × 2 mm (WSON)	

For additional assistance, ask questions to TI engineers on the *TI E2E™ Amplifiers Support Forum*.

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