

# 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 solution as shown in [Table 1-1](#).

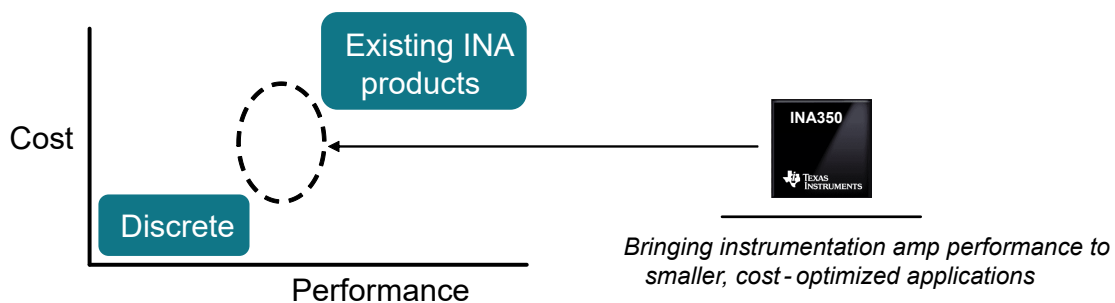


Figure 1-1. Instrumentation Amplifier Landscape

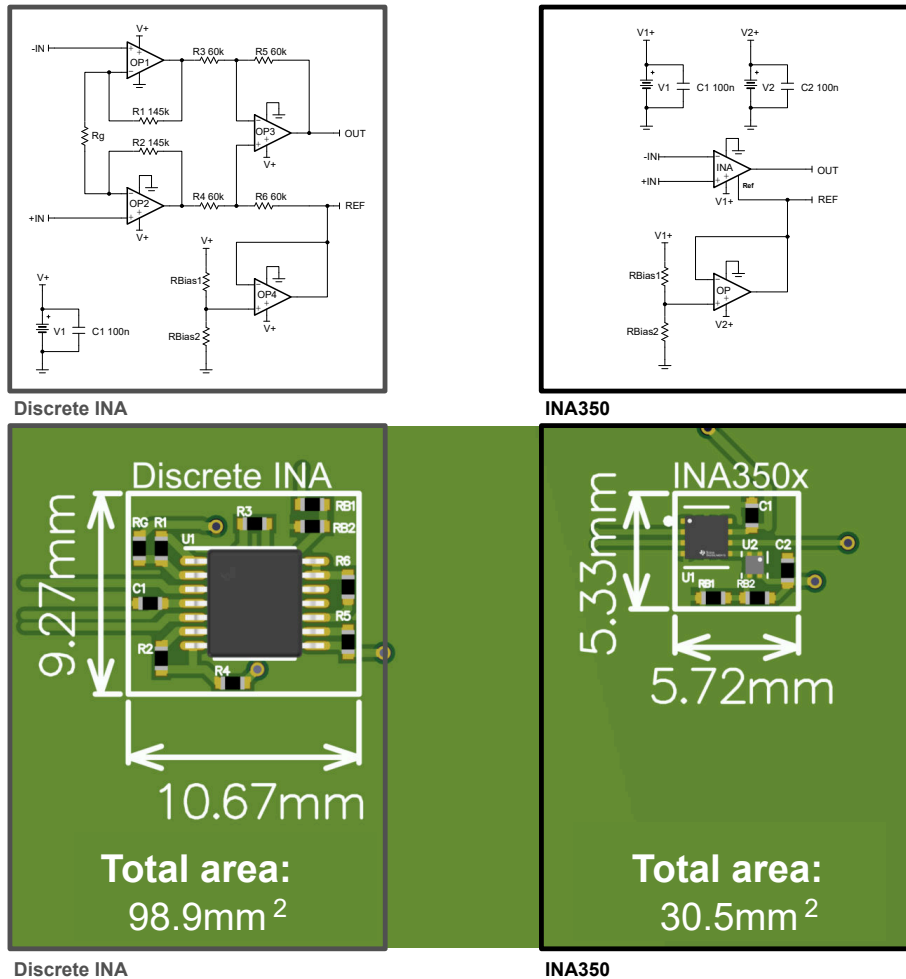
Table 1-1. Instrumentation Amplifier Key Specification Comparison

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

(1) Web price at time of writing

(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 1-2](#). 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 for the discrete solution.



**Figure 1-2. PCB Layout Comparison of a Discrete Solution Using TSSOP-14 (Left) vs INA350 in the WSON Package Plus TLV9041 in the X2SON Package (Right)**

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 Vout Calculations

Generic Part Number	Orderable Part Number	Gain Options	Package	Shutdown
INA350	<a href="#">INA350ABSIDDFR</a>	10 or 20	2.9 × 2.8 mm (SOT-23-THN)	Yes
	<a href="#">INA350ABSIDSGR</a>	10 or 20	2 × 2 mm (WSON)	
	<a href="#">INA350CDSIDDFR</a>	30 or 50	2.9 × 2.8 mm (SOT-23-THN)	
	<a href="#">INA350CDSIDSGR</a>	30 or 50	2 × 2 mm (WSON)	

For additional assistance, ask questions to TI engineers on the [TI E2E™ Amplifiers Support Forum](#).

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