Product Overview

Small-Size INA500x Versus Discrete Difference Amps

Many designers often build discrete difference amplifiers using an op amp and discrete components to fit a design budget. These discrete designs tend to have more error and take more printed circuit board (PCB) space than the integrated counterparts. However, integrated difference amplifiers possibly do not meet the budgetary requirements of extremely cost-optimized products, nor does every design need the precision and accuracy that comes with the vast majority of integrated difference amplifiers. INA500x re-defines the difference amplifier landscape by offering an integrated design within the price range of a discrete design as shown in Table 1. The gain used in Table 1 is 0.5. The INA500x is able to achieve a lower gain error and higher common-mode rejection ratio (CMRR) than the discrete design through the use of precision matched integrated resistors.

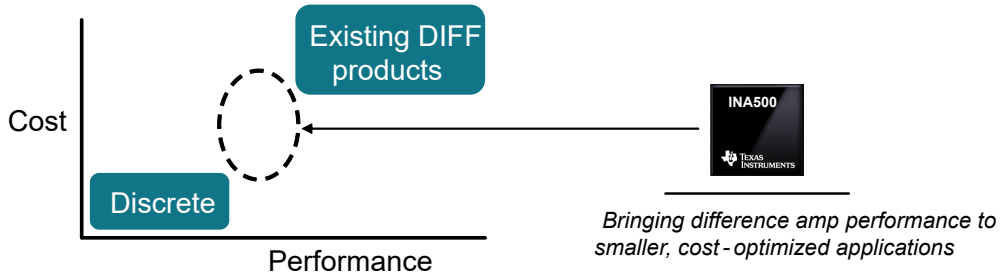

Figure 1. Difference Amplifier Landscape

Table 1. Difference Amplifier Key Specification Comparison

Key Specifications	Discrete	INA500	Existing Diff Amps
Gain error (max)	1.02 %	**0.05 %**	< 0.05 %
Gain error drift (max)	±200ppm/°C	**±1ppm/°C**	±0.5ppm/°C
CMRR (min)	32dB	**77dB**	> 80dB
Offset (max)	6mV	**2.7mV**	< 250uV
Web price(1)	$ 0.12(2)	**$ 0.14**	> $ 0.88

(1) Web price as of April 2024
(2) Approximate price based on online price of general-purpose op amp (TLV6001) + 1% discrete resistors

In addition to the performance benefits, the INA500x also extends TI's difference amplifier package lineup with new smaller packages, such as the X2SON (DTQ), that help reduce the amount of PCB space compared to discrete designs by up to 67%, as shown in Figure 2. This makes the INA500x the industries smallest difference amplifier, even compared to other integrated designs. The discrete design uses a typical layout with a resistor network and decoupling capacitors. All resistors and capacitors are 0402 package sized.

Figure 2 shows the PCB layout comparison of a discrete design using SOT-23-70 (left) vs INA500x in the SOT-23-SC70 (middle) vs INA500x in the X2SON (right).

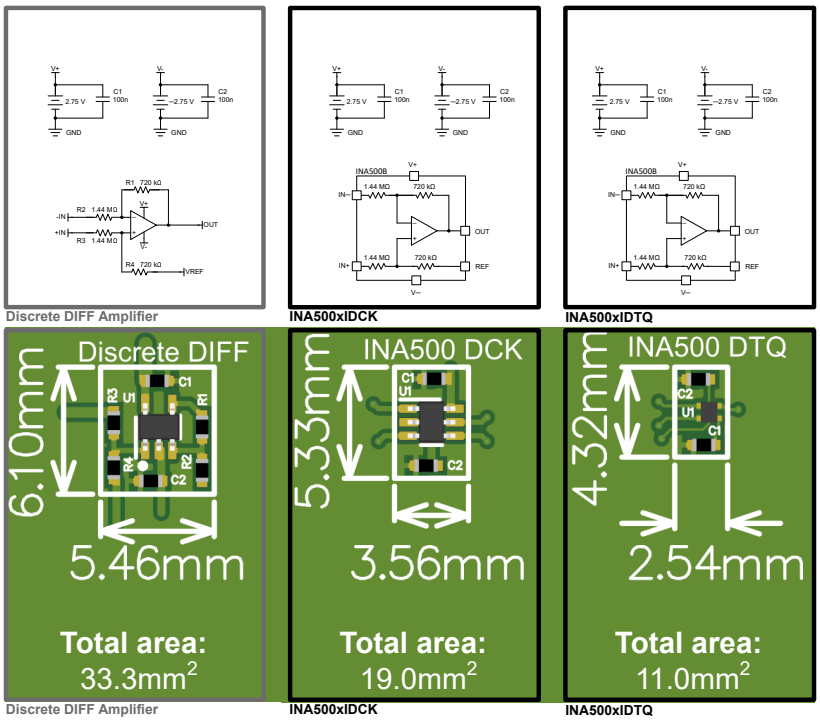

Figure 2. PCB Layout Comparison of Three Designs

Learn more about how INA500x can help reduce space and improve performance while simplifying the BOM, and start your evaluation with the following content:

Learn More

- Texas Instruments, *INA500 Cost and Size Optimized, Low Power, 1.7V to 5.5V Difference Amplifier with >1MΩ Input Impedance* data sheet.

Evaluate the Design

- Leverage existing simulation models available in TINA-TI or PSpice for TI

Generic Part Number	Orderable Part Number	Gain Option	Package
INA500	INA500AIDBVR	1	2.9 x 2.8mm (DBV)
	INA500AIDCKR	1	2.1 x 1.25mm (DCK)
	INA500AIDTQR	1	1.0 × 0.8mm (DTQ)
	INA500BIDBVR	0.5	2.9 x 2.8mm (DBV)
	INA500BIDCKR	0.5	2.1 x 1.25mm (DCK)
	INA500BIDTQR	0.5	1.0 × 0.8mm (DTQ)
	INA500CIDBVR	0.25	2.9 x 2.8mm (DBV)
	INA500CIDCKR	0.25	2.1 x 1.25mm (DCK)
	INA500CIDTQR	0.25	1.0 × 0.8mm (DTQ)

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

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