Fully-differential Signals and Their Advantages

- Improved rejection of common-mode perturbations and noise.
- Improved even-order Harmonic Distortion performance.
- Improved dynamic range: 2x differential-output signal swing.
Fully-differential Amplifier (FDA): Introduction

- Converts single-ended input to differential output.
- Converts differential input to differential output.
- Independent common-mode and differential gain control allows for output common-mode level shift.
FDA: Discrete-amplifier Realization

- High input impedance.
- Phase difference between inverting and noninverting outputs results in balance error.

\[ E_{n_{Out}} = \sqrt{E_{n_{Amp1}}^2 + 4 \times E_{n_{Amp2}}^2} \]

- Integrated solution can offer lower noise for same power consumption and better matching for reduced balance error.
• Integrated fully-differential, high-$A_{OL}$ amplifier.
• Integrated wide-bandwidth, common-mode feedback, error amplifier.
• Integrated resistors to detect the average output common-mode voltage.
• Integrated mid-supply, common-mode set resistors.
The voltage (DC and AC) at the inputs track each other exactly, similar to an op-amp’s virtual short across its inputs.
The two outputs are $180^\circ$ out of phase, AND

The two outputs have the same DC offset voltage equal to $V_{OCM}$.

\[ V_{OUT+}(t) - V_{OCM} = -(V_{OUT-}(t) - V_{OCM}) \]

\[ V_{OCM} = \frac{V_{OUT+}(t) + V_{OUT-}(t)}{2} \]