Single-Ended Inputs
An ADC with single-ended inputs digitizes the analog input voltage relative to ground. Single-ended inputs simplify ADC driver
requirements, reduce complexity and lower power dissipation in the signal chain. Single-ended inputs can either be unipolar or
bipolar, where the analog input on a single-ended unipolar ADC swings only above GND (0V to VFS, where VFS is the full-scale
input voltage that is determined by a reference voltage) (Figure 1a) and the analog input on a single-ended bipolar ADC also
called true bipolar, swings above or below GND (±VFS) (Figure 1b).

Pseudo-Differential Inputs
An ADC with pseudo-differential inputs digitizes the differential analog input voltage (IN+ – IN–) over a limited range. The IN+ input
has the actual analog input signal, while the IN– input has a restricted range.

A pseudo-differential unipolar ADC digitizes the differential analog input voltage (IN+ – IN–) over a span of 0V to VFS. In this range,
a single-ended unipolar input signal, driven on the IN+ pin, is measured with respect to the signal ground reference level, driven on
the IN– pin. The IN+ pin is allowed to swing from GND to VFS, while the IN– pin is restricted to around GND ± 100mV (Figure 2a).

A pseudo-differential bipolar ADC digitizes the differential analog input voltage (IN+ – IN–) over a span of ±VFS/2. In this range, a
single-ended bipolar input signal, driven on the IN+ pin, is measured with respect to the signal mid-scale reference level, driven on
the IN– pin. The IN+ pin is allowed to swing from GND to VFS, while the IN– pin is restricted to around VFS/2 ± 100mV (Figure 2b).

A pseudo-differential true bipolar ADC digitizes the differential analog input voltage (IN+ – IN–) over a span of ±VFS. In this range, a
ture bipolar input signal, driven on the IN+ pin, is measured with respect to the signal ground reference level, driven on the IN– pin.
The IN+ pin is allowed to swing above or below GND to ±VFS, while the IN– pin is restricted to around GND ± 100mV (Figure 2c).

Pseudo-differential inputs help separate signal ground from the ADC ground, allowing small common-mode voltages to be
cancelled. They also allow single-ended input signals that are referenced to ADC ground. Pseudo-differential ADCs are ideal for
applications that require DC common-mode voltage rejection, for single-ended input signals and for applications that do not want
the complexity of differential drivers. Pseudo-differential inputs simplify the ADC driver requirement, reduce complexity and lower
power dissipation in the signal chain.
Fully Differential Inputs

An ADC with fully-differential inputs digitizes the differential analog input voltage (IN+ – IN–) over a span of ±VFS. In this range, the IN+ and IN– pins should be driven 180º out-of-phase with respect to each other, centered on a fixed common mode voltage, for example, VREF/2 ±50mV. In most fully-differential ADCs, both the IN+ and IN– pins are allowed to swing from GND to VFS (Figure 3a), while in fully-differential true bipolar ADCs, both the IN+ and IN– pins are allowed to swing above or below GND to ±VFS (Figure 3b).

Fully-differential inputs offer wider dynamic range and better SNR performance over single-ended or pseudo-differential inputs. Fully differential ADCs are ideal for applications that require the highest performance.

Differential Inputs with Wide Input Common Mode

An ADC with differential inputs digitizes the voltage difference between the IN+ and IN– pins while supporting a wide common mode input range. The analog input signals on IN+ and IN– can have an arbitrary relationship to each other. In most differential ADCs, both IN+ and IN– remain between GND and VFS (Figure 4a), while in differential true bipolar ADCs, both the IN+ and IN– pins are allowed to swing above or below GND to ±VFS (Figure 4b). Differential inputs are ideal for applications that require a wide dynamic range with high common mode rejection. Being one of the most flexible ADC input types, an ADC with differential inputs can also digitize other types of analog input signals such as single-ended unipolar, pseudo-differential unipolar/bipolar and fully-differential.

<table>
<thead>
<tr>
<th>Input Types</th>
<th>Linear Technology SAR ADCs</th>
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<tbody>
<tr>
<td>Single-Ended</td>
<td>Single-Ended Unipolar: LTC1865, LTC2314, LTC2315, LTC2360, LTC2361, LTC2362, LTC2365, LTC2366</td>
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<td></td>
<td>Single-Ended True Bipolar: LTC1400, LTC1404, LTC1605, LTC1606, LTC1609</td>
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<tr>
<td>Pseudo-Differential</td>
<td>Pseudo-Differential Unipolar: LTC1864, LTC2305, LTC2306, LTC2308, LTC2309, LTC2364, LTC2367, LTC2368, LTC2369, LTC2370, LTC2389, LTC2372, LTC2373</td>
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<tr>
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<td>Pseudo-Differential Bipolar: LTC2305, LTC2306, LTC2308, LTC2309, LTC2389, LTC2372, LTC2373</td>
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<td>Pseudo-Differential True Bipolar: LTC1414, LTC1419, LTC1854, LTC1855, LTC1856, LTC1857, LTC1858, LTC1859, LTC2328, LTC2327, LTC2326</td>
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<tr>
<td>Fully Differential</td>
<td>Fully Differential: LTC2376, LTC2377, LTC2378, LTC2379, LTC2380, LTC2383, LTC2389, LTC2393, LTC2372, LTC2373</td>
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<tr>
<td></td>
<td>Fully Differential True Bipolar: LTC2338, LTC2337, LTC2336</td>
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<tr>
<td>Differential with Wide Input Common Mode</td>
<td>Differential: LTC1403, LTC1407, LTC1408, LTC2351, LTC2355, LTC2356, LTC2323, LTC2321, LTC2348</td>
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<tr>
<td></td>
<td>Differential True Bipolar: LTC1604, LTC1608, LTC2348</td>
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