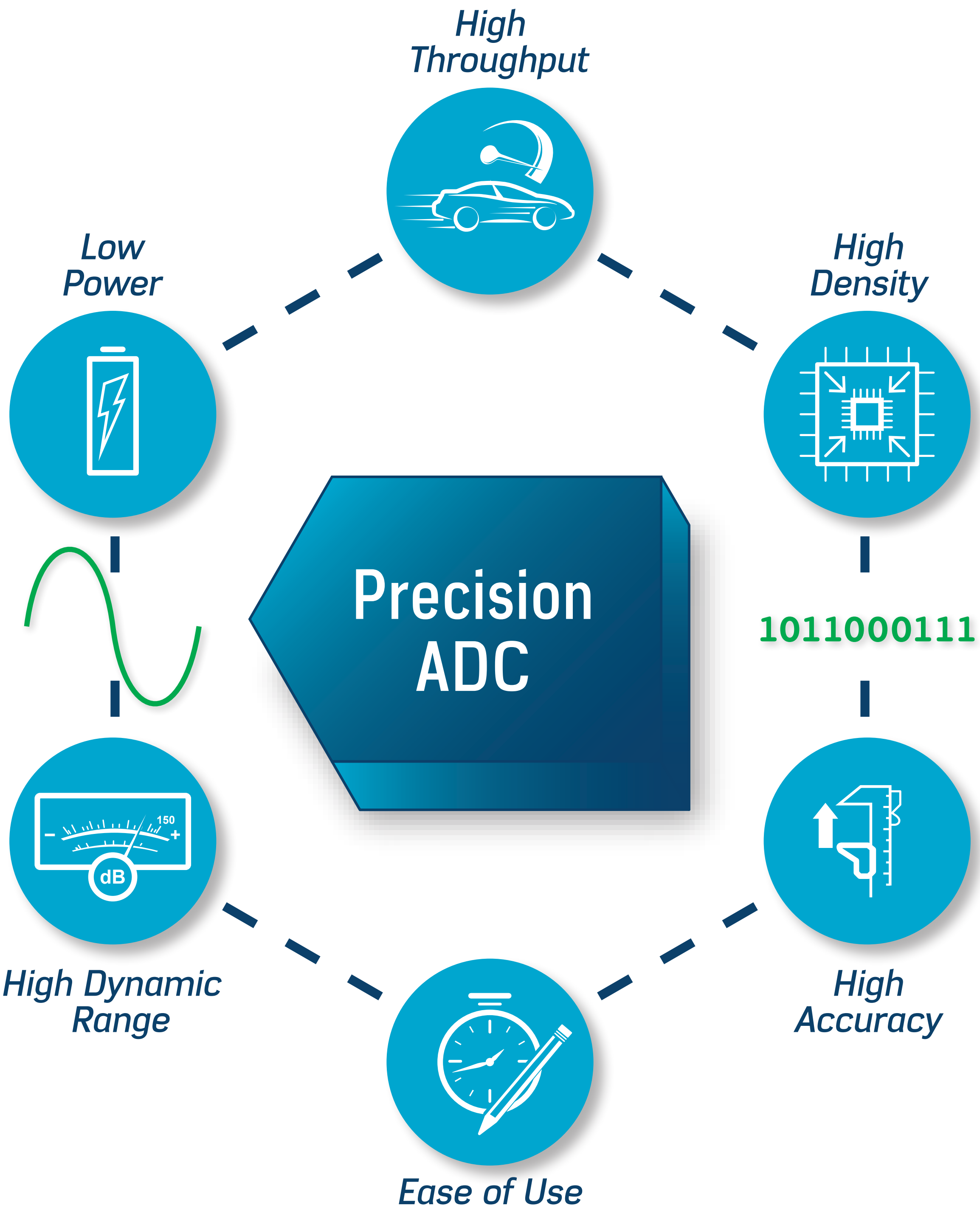
PRECISION ADC SELECTOR GUIDE



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SYMBOL KEY	
∿	Identifies ADCs that are optimize to maintain SINAD performance at high input signal frequencies within the Nyquist bandwidth of the ADC.
▶	Buffered Input: Identifies ADCs that incorporate buffers on the analog inputs. These ADCs offer substantial space and cost savings by eliminating front-end signal conditioning circuitry normally required to drive unbuffered switched-capacitor ADC inputs.
	PGIA Input: Identifies ADCs that incorporate a PGIA (programmable gain instrumentation amplifier) on the analog inputs. The high input impedance and programmable signal scaling functionality enable direct interface to sensor outputs.
	Resistive Input: Identifies ADCs that have a resistive input structure on the analog inputs. This input structure type enables true bipolar analog input signals to be connected directly to an ADC that operates off a single unipolar supply rail. These ADCs are ideally suited for direct connection to low output impedance sensors such as current transformers and voltage transformers and eliminate the need for front-end signal conditioning circuitry normally required to drive the ADC.

COLOR KEY	
	Suggested Part for that given cell. The ADCs are categorized by resolution, sampling rate and input channel count.
	Indicates that the ADC is **Higher Performance** versus a similar product in same cell.
	Indicates that the ADC enables a **Smaller Solution** size versus a similar product in same cell. The ADC may have a smaller package footprint or integrate additional functionality such as a voltage reference, reference buffer, input buffers or PGIA.
	Indicates that the ADC enables **Lower Power** versus a similar product in same cell. The ADC may have lower power consumption at the component level or may enable lower power at the signal chain level due to its ease of use features.

ADC Input Types

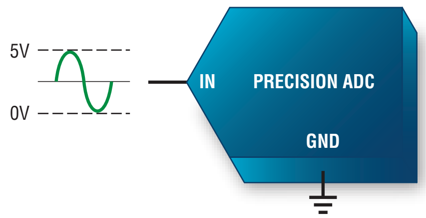

Figure 1a. Single-Ended Unipolar

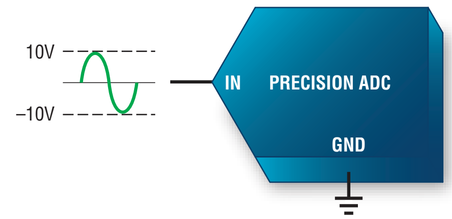

Figure 1b. Single-Ended True Bipolar

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 V_{FS}, where V_{FS} 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 ($\pm V_{FS}$) (Figure 1b).

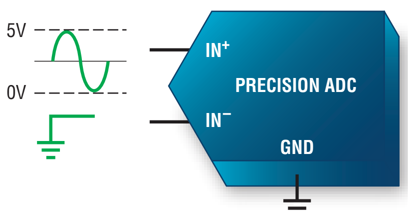

Figure 2a. Pseudo-Differential Unipolar

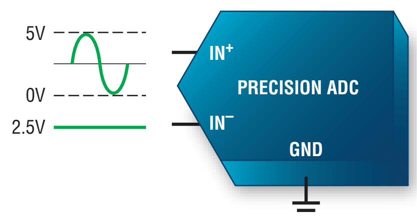

Figure 2b. Pseudo-Differential Bipolar

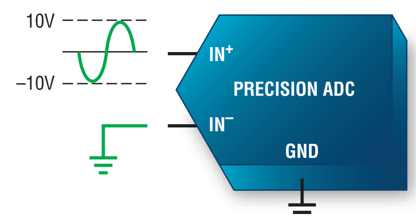

Figure 2c. Pseudo-Differential True Bipolar

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 V_{FS}. 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 V_{FS}, 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 $\pm V_{FS}/2$. 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 V_{FS}, while the IN– pin is restricted to around $V_{FS}/2$ ± 100mV (Figure 2b).

A pseudo-differential true bipolar ADC digitizes the differential analog input voltage ($IN^+ – IN^–$) over a span of $\pm V_{FS}$. In this range, a true 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 $\pm V_{FS}$, 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.

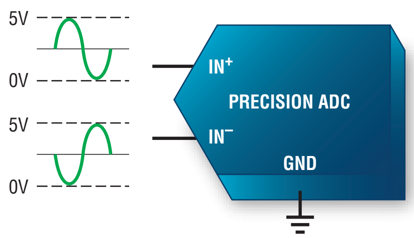

Figure 3a. Fully Differential

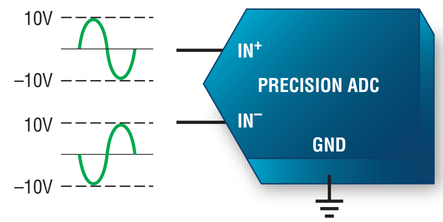

Figure 3b. Fully Differential True Bipolar

Fully Differential Inputs

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

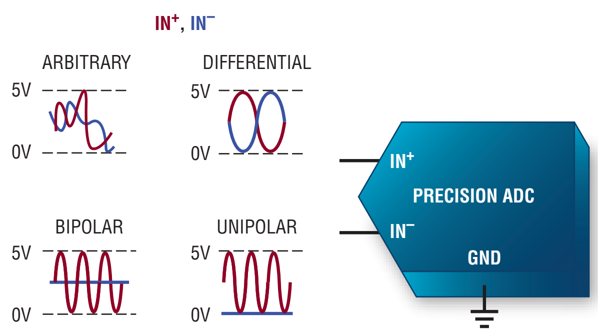

Figure 4a. Differential with Wide Input Common Mode

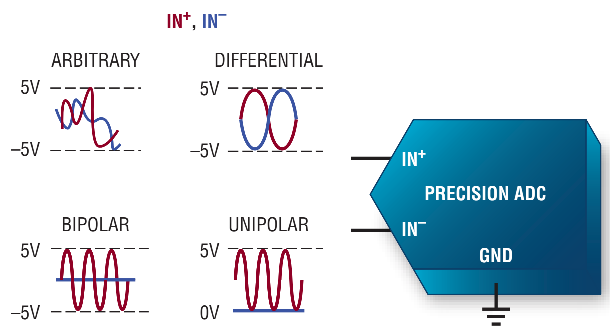

Figure 4b. Differential True Bipolar

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 V_{FS} (Figure 4a), while in differential true bipolar ADCs, both the IN^+ and $IN^–$ pins are allowed to swing above or below GND to $\pm V_{FS}$ (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.

Precision ADC Selector Guide

Single Channel SAR ADCs

Resolution	Input Type	≤200ksps	≤250ksps	≤500ksps	≤1Msps	≤1.8Msps	≤2Msps	≤6Msps	≤10Msps	≤15Msps
24-Bit	Fully Differential						LTC 2380-24			
24-Bit	Pseudo-Differential				LTC 2368-24					
20-Bit	Fully Differential		LTC 2376-20	LTC 2377-20	LTC 2378-20	AD 4020 ∿				
18-Bit	Fully Differential	AD 7989-1	LTC 2376-18 AD 7691	LTC 2377-18 AD 4011 ∿	LTC 2378-18 AD 4007 ∿	LTC 2379-18 AD 7984	AD 4003 ∿ AD 7986	LTC 2385-18 ∿ AD 7960 ∿	LTC 2386-18 ∿	LTC 2387-18 ∿
18-Bit	Fully Differential ±10V True Bipolar		LTC 2336-18 ʍ	LTC 2337-18 ʍ	LTC 2338-18 ʍ					
18-Bit	Pseudo-Differential		LTC 2364-18	LTC 2367-18	LTC 2368-18	LTC 2369-18	LTC 2389-18			
18-Bit	Pseudo-Differential ±10V True Bipolar		LTC 2326-18 ʍ	LTC 2327-18 ʍ	LTC 2328-18 ʍ					
16-Bit	Fully Differential		LTC 2376-16 AD 7687	LTC 2377-16	LTC 2378-16 AD 4005 ∿		LTC 2380-16 AD 4001 ∿ LTC 2310-16 ∿	LTC 2385-16 ∿ AD 7961 ∿ LTC 2311-16 ∿	LTC 2386-16 ∿ AD 7626 ∿	LTC 2387-16 ∿
16-Bit	Fully Differential ±2.5V True Bipolar		LTC 1603	LTC 1604 LTC 1608						
16-Bit	Pseudo-Differential Unipolar	AD 7683 AD 7988-1	LTC 2364-16 AD 7685 AD 7694	LTC 2367-16 AD 7686 AD 7988-5	LTC 2368-16 AD 7981 AD 4004 ∿	AD 7983	LTC 2370-16 AD 4000 ∿	AD 7985		
16-Bit	Pseudo-Differential True Bipolar		LTC 2326-16 ʍ	LTC 2327-16 ʍ	LTC 2328-16 ʍ					
16-Bit	Single-Ended ±10V True Bipolar	LTC 1605 ʍ LTC 1609 ʍ	LTC 1606 ʍ							

∿ Improved SINAD at High F_{IN}
ʍ Resistive Input

Suggested Part | Higher Performance | Lower Power | Smaller Solution

Single Channel SAR ADCs (Continued)

Resolution	Input Type	≤100ksps	≤250ksps	≤500ksps	≤1.5Msps	≤3Msps	≤6Msps
14-Bit	Differential with Wide Input Common Mode					LTC1403A∿, LTC2310-14∿	LTC2355-14∿, LTC2356-14∿, LTC2311-14∿
14-Bit	Fully Differential ±10V True Bipolar			AD7899	AD7951		
14-Bit	Pseudo-Differential		AD7942	AD7946		AD7944, LTC1403A∿, LTC2310-14∿	LTC2355-14∿, LTC2356-14∿, LTC2311-14∿
14-Bit	Pseudo-Differential ±10V True Bipolar				AD7951		
14-Bit	Single-Ended Unipolar	AD7940		LTC2312-14∿	AD7485	AD7484, LTC2313-14∿	LTC2314-14∿
14-Bit	Single-Ended ±10V True Bipolar		AD7894				
12-Bit	Fully Differential			AD7452	AD7450A		
12-Bit	Differential with Wide Input Common Mode					LTC1403∿, LTC2310-12∿	LTC2355-12∿, LTC2356-12∿, LTC2311-12∿
12-Bit	Pseudo-Differential	AD7457, LTC2301*	LTC1860	AD7453, LTC2302	AD7472	LTC1403∿, LTC2310-12∿	LTC2355-12∿, LTC2356-12∿, LTC2311-12∿
12-Bit	Single-Ended Unipolar	AD7466		LTC2312-12∿	AD7091, AD7091R	AD7274, AD7482, AD7276, LTC2313-12∿	LTC2315-12∿
12-Bit	Single-Ended ±10V True Bipolar	AD7893	AD7895, AD7898				

∿Improved SINAD at High F_{IN}

* I^2C

Suggested Part   Higher Performance   Lower Power

µModule Data Acquisition Systems

Resolution	Input Type	Max Output Data Rate	
		≤500ksps	≤1Msps
16-Bit	Pseudo-Differential	ADAQ7988	ADAQ7980

Simultaneous Sampling ADCs (High Resolution)

Resolution		Input Type	Channels	≤200 ksps/ch	≤400 ksps/ch	≤700 ksps/ch	≤1 Msps/ch	≤2 Msps/ch	≤5 Msps/ch
RESOLUTION	24-Bit	Fully Differential/ Pseudo-Differential	8	AD 7779 (PGIA); AD 7770 (PGIA); AD 7771 (PGIA)	AD 7768				
	24-Bit	Fully Differential/ Pseudo-Differential	4		AD 7768-4				
	18-Bit	Differential with Wide Input Common Mode	2			LTC 2341-18			
	18-Bit	Differential with Wide Input Common Mode	4		LTC 2344-18				
	18-Bit	Differential with Wide Input Common Mode	8	LTC 2345-18					
	18-Bit	Differential ±10V True Bipolar	2			LTC 2353-18 (Buffered)			
	18-Bit	Differential ±10V True Bipolar	4		LTC 2357-18 (Buffered)				
	18-Bit	Differential ±10V True Bipolar	8	AD 7609 (Resistive); LTC 2358-18 (Buffered, Smaller Solution); LTC 2348-18					
	18-Bit	Pseudo-Differential True Bipolar	8	AD 7608 (Resistive)					
	16-Bit	Fully Differential	2				AD 7903		
	16-Bit	Differential with Wide Input Common Mode	2			LTC 2341-16		LTC 2321-16 (Improved SINAD)	LTC 2323-16 (Improved SINAD)
	16-Bit	Differential with Wide Input Common Mode	4		LTC 2344-16			LTC 2324-16 (Improved SINAD)	LTC 2325-16 (Improved SINAD)
	16-Bit	Differential with Wide Input Common Mode	8	LTC 2345-16	AD 7761			LTC 2320-16 (Improved SINAD)	
	16-Bit	Differential ±10V True Bipolar	2			LTC 2353-16 (Buffered)			
	16-Bit	Differential ±10V True Bipolar	4		LTC 2357-16 (Buffered)				
	16-Bit	Differential ±10V True Bipolar	8	LTC 2348-16; LTC 2358-16 (Buffered, Smaller Solution)					
	16-Bit	Pseudo-Differential Single-Ended	2			LTC 2341-16	AD 7902		
	16-Bit	Pseudo-Differential Single-Ended	4		LTC 2344-16				
	16-Bit	Pseudo-Differential Single-Ended	8	LTC 2345-16					
	16-Bit	Pseudo-Differential ±10V True Bipolar	4	AD 7606-4 (Resistive)	AD 7605-4 (Resistive)				
	16-Bit	Pseudo-Differential ±10V True Bipolar	6	AD 7606-6 (Resistive)	AD 7656A/-1				
	16-Bit	Pseudo-Differential ±10V True Bipolar	8	ADAS 3023 (PGIA, Smaller Solution); LTC 2358-16 (Buffered, Smaller Solution); AD 7606 (Resistive); LTC 2348-16					

∿ Improved SINAD at High F_{IN}
ʍʍ Resistive Input
▶ Buffered Input
PGIA Input
Suggested Part
Smaller Solution

Simultaneous Sampling ADCs (Continued)

Resolution		Input Type	Channels	<150ksps/ch	≤400ksps/ch	≤1Msps/ch	≤2Msps/ch	≤5Msps/ch
RESOLUTION	14-Bit	Fully Differential	2			AD 7264		
		Differential with Wide Input Common Mode	2				LTC 1407A, LTC 2321-14	LTC 2323-14, AD 7357
			4				LTC 2324-14	LTC 2325-14
			6	LTC 1408	LTC 2351-14			
			8				LTC 2320-14	
		Pseudo-Differential ±10V True Bipolar	6		AD 7657			
			8	AD 7607				
	12-Bit	Fully Differential	2			AD 7265, AD 7262	AD 7266	
		Differential with Wide Input Common Mode	2				LTC 1407, LTC 2321-12	LTC 2323-12, AD 7352, AD 7356
			4				LTC 2324-12	LTC 2325-12
			6	LTC 1408-12	LTC 2351-12			
			8				LTC 2320-12	
		Pseudo-Differential ±10V True Bipolar	6		AD 7658			

PGIA Input ∿ Improved SINAD at High F_{IN} Resistive Input — Suggested Part — Higher Performance — Lower Power

Isolated Sigma Delta Modulators

Channels	Interface	Integrated	Isolated Working Voltage V_{RMS}: $400V_{RMS}$	$884V_{RMS}$
1	CMOS	Clock	AD 7400A	AD 7402
1	CMOS		AD 7401A	AD 7403
1	LVDS			AD 7405
2	SPI	isoPower	ADE 7912	
2	CMOS	isoPower	ADE 7932	
3	SPI	isoPower	ADE 7913	
3	CMOS	isoPower	ADE 7933	

±250mV Analog Input Range — ±500mV, ±31.25mV Analog Input Range

MUXed Input SAR ADCs

RESOLUTION		Input Type	Channels	≤250ksps	≤500ksps	≤1Msps	≤1.6Msps
	18-Bit	Fully Differential	8		LTC 2372-18	LTC 2373-18	
	18-Bit	Fully Differential ±10V True Bipolar	8			LTC 2333-18, LTC 2335-18	
	18-Bit	Pseudo-Differential	8		LTC 2372-18		
	18-Bit	Pseudo-Differential ±10V True Bipolar	8			LTC 2333-16	
	16-Bit	Fully Differential	8		LTC 2372-16	LTC 2373-16	LTC 2374-16
	16-Bit	Fully Differential ±10V True Bipolar	8	LTC 1856, LTC 1859		LTC 2333-16, LTC 2335-16	
	16-Bit	Pseudo-Differential	2	LTC 1865			
	16-Bit	Pseudo-Differential	4	AD 7682			
	16-Bit	Pseudo-Differential	8	LTC 1867, AD 7689	LTC 2372-16, AD 7699	LTC 2373-16, ADAS 3022	
	16-Bit	Pseudo Differential ±10V True Bipolar	8	LTC 1856, LTC 1859		LTC 2333-16, ADAS 3022	
	16-Bit	Pseudo Differential ±10V True Bipolar	16			AD 7616	
	14-Bit	Fully Differential	4	LTC 1855, LTC 1858			
	14-Bit	Pseudo-Differential	8	AD 7949			
	14-Bit	Pseudo-Differential ±10V True Bipolar	8	LTC 1855, LTC 1858			

Resistive Input
Buffered Input
PGIA Input

Suggested Part
Higher Performance
Lower Power
Smaller Solution

MUXed Input SAR ADCs (Continued)

Resolution		Input Type	Channels	≤250ksps	≤500ksps	≤1Msps	≤1.6Msps
RESOLUTION	12-Bit	Fully Differential	4		LTC 1853		LTC 1851
		Fully Differential ±10V True Bipolar	4	LTC 1854, LTC 1857			
		Pseudo-Differential	2	AD 7921, LTC 2305 *, LTC 1861	LTC 2306	AD 7922, AD 7091R-2	
			4	AD 7091R-5 *, AD 7923	AD 7934-6	AD 7924, AD 7091R-4	AD 7934
			8	LTC 1863, AD 7927, LTC 2309 *, AD 7998 *	LTC 2308, AD 7938-6, LTC 1853	AD 7091R-8	LTC 1851, AD 7938
			16			AD 7490	
		Pseudo-Differential ±10V True Bipolar	2		AD 7321	AD 7322	
			4		AD 7323	AD 7324	
			8	LTC 1854, LTC 1857		AD 7329, AD 7328	
	10-Bit	Single-Ended Unipolar	2	AD 7911		AD 7912	
			4	AD 7995 *		AD 7914	AD 7933
			8	AD 7997 *		AD 7918	AD 7939

* I²C Interface

Suggested Part | Smaller Solution | Higher Performance | Lower Power

Wideband Oversampled ADCs (FIR Filter)

Resolution		Input Type	Digital Filter Bandwidth (–3dB Point) ≤5kHz	≤12.5kHz	≤25kHz	≤50kHz	≤125kHz	≤250kHz	≤1MHz
RESOLUTION	32-Bit	Fully Differential	LTC 2508-32					LTC 2500-32	
	24-Bit	Fully Differential		AD 7767-2, AD 7766-2	AD 7767-1, AD 7766-1	AD 7767, AD 7766, AD 7765 ▶	AD 7764 ▶	AD 7762 ▶, AD 7763 ▶, LTC 2512-24	AD 7760 ▶

▶ Buffered Input

Narrowband Oversampling ADCs

Resolution		Input Type	Channels	Output Data Rate ≤0.05ksps	≤0.5ksps	≤ 5ksps	≤20ksps	≤50ksps	≤250ksps	≤2Msps
RESOLUTION	32-Bit	Fully Differential/ Pseudo-Differential	2/4				AD 7177-2 ▶			
	24-Bit	Fully Differential	1	LTC 2400 LTC 2484 LTC 2485 *		LTC 2440				LTC 2380-24
		Pseudo-Differential	1							LTC 2368-24
		Fully Differential/ Pseudo-Differential	1/1		AD 7797 ⚡					
			2/2		AD 7191 ⚡					
			2/4			AD 7190 ⚡ AD 7192 ⚡ AD 7195 ⚡		AD 7172-2 ▶	AD 7175-2 ▶ AD 7176-2	
			3/3		AD 7793 ⚡ AD 7799 ⚡					
			4/7 or 8			AD 7193 ⚡	AD 7124-4 ⚡	AD 7172-4 ▶		
			6/6		AD 7794 ⚡					
			8/15 or 16			AD 7194 ⚡	AD 7124-8 ⚡	AD 7173-8 ▶	AD 7175-8 ▶	
		Fully Differential/ Single-Ended	2/4	LTC 2492 LTC 2493 *			LTC 2442			
			4/8				LTC 2444 LTC 2445 LTC 2446 LTC 2447			
			8/16	LTC 2498 LTC 2499 *			LTC 2448 LTC 2449			

▶ Buffered Input
⚡ PGIA Input
* I²C Interface

Suggested Part

Narrowband Oversampling ADCs (Continued)

Resolution	Input Type	Channels	Output Data Rate ≤0.05ksps	Output Data Rate ≤0.5ksps	Output Data Rate ≤5ksps
16-Bit	Fully Differential	1	LTC2452, LTC2462, LTC2482, LTC2453*, LTC2463*, LTC2483*		LTC2472, LTC2473*
16-Bit	Fully Differential/ Pseudo-Differential	1/1		AD7796✦	
16-Bit	Fully Differential/ Pseudo-Differential	3/3		AD7792✦, AD7798✦	
16-Bit	Fully Differential/ Pseudo-Differential	6/6		AD7795✦	
16-Bit	Fully Differential/ Single-Ended	2/4	LTC2488, LTC2489*, LTC2486✦, LTC2487✦*		
16-Bit	Fully Differential/ Single-Ended	8/16	LTC2496, LTC2497*, LTC2494✦, LTC2495✦*		
16-Bit	Single-Ended	1	LTC2450, LTC2451*, LTC2460, LTC2461*		LTC2470, LTC2471*

▶ Buffered Input
✦ PGIA Input
* I^2C Interface

Suggested Part

0817

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