Comparison of Two Commercial ADC Specifications

AVC868 - Advanced Sensors and Interface Electronics

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1 Introduction

Analog-to-Digital Converters (ADCs) are essential components that convert real-world analog signals into digital representations for processing in modern electronic systems. Depending on the application, ADCs may prioritize high precision and low noise (for instrumentation and sensor applications) or very high sampling speeds and wide bandwidth (for communications and radar).

In this report, two commercially available ADCs from Analog Devices are compared:

- **AD7124-8** – a 24-bit sigma-delta precision ADC designed for low-frequency, high-accuracy sensor measurements.
- **AD9680** – a 14-bit pipelined high-speed ADC designed for RF sampling in communication and radar applications.

2 Discussion

2.1 AD7124-8

The AD7124-8 is optimized for applications where accuracy and resolution are more important than speed. With 24-bit resolution, programmable gain, and an integrated reference, it is particularly suited for precision measurement systems such as industrial transmitters, pressure sensors, and medical instruments. Its ultra-low power consumption makes it ideal for battery-operated devices.

2.2 AD9680

The AD9680, on the other hand, prioritizes speed and dynamic performance. With a sampling rate of up to 1 GSPS and wide input bandwidth, it is suitable for high-speed communications, software-defined radio (SDR), and radar front-ends. It consumes significantly higher power but enables the capture of wideband signals with high fidelity.

3 Comparison of Specifications

Parameter	**AD7124-8 (Precision)**	**AD9680 (High-Speed)**
Manufacturer	Analog Devices	Analog Devices
Architecture	24-bit Sigma-Delta with PGA	14-bit Pipelined (dual-channel)
Resolution	24 bits	14 bits
Max Sampling Rate	19.2 kSPS	Up to 1 GSPS
Channels	8 differential / 15 single-ended	Dual ADC cores (2 channels)
Input Range	Up to on-chip 2.5 V reference	1.70 V_{p-p} differential
Noise Performance	RMS noise as low as 24 nV (with PGA)	Noise density ≈ -154 dBFS/Hz
SNR / SINAD	Up to 22 noise-free bits	SNR $\approx$ 67 dBFS @ 10 MHz, ENOB 10.8 bits
THD / Distortion	Optimized for DC/low-frequency accuracy	SFDR $\approx$ 85 dBFS @ 340 MHz
INL / DNL	$\pm$4 to $\pm$15 ppm of FSR (depending on gain)	INL $\pm$2.5 LSB, DNL $\pm$0.5 LSB
Power Consumption	255–930 μA (operating), 5 μA (power-down)	2.2–3.7 W total (at GSPS speeds)
Interface	SPI / QSPI	JESD204B (data), SPI (control)
Special Features	On-chip reference, PGA, sensor excitation, 50/60 Hz rejection	Digital down-converters, wide input bandwidth, programmable termination
Typical Applications	Industrial sensors, medical instrumentation, precision logging	SDR, radar, communications receivers, test equipment

Table 1: Comparison of AD7124-8 and AD9680 ADCs.

4 Conclusion

The AD7124-8 and AD9680 represent two ends of the ADC design spectrum. The AD7124-8 is chosen for ultra-precise, low-power, low-frequency applications, while the AD9680 is chosen for high-speed, wideband, data-intensive applications. The selection between them depends entirely on the intended system requirements: precision versus bandwidth.