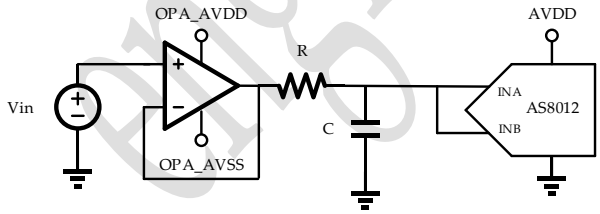
AS8012
Ultra-Nano-Power, 500nW 1.8V, 10 Bit, 2-KSPS, SAR ADC

Product Preview

1 Features

• Industry's newly developed SAR ADC with Nanowatt Power Consumption:
  ▪500 nW at 1 KSPS with 1.8-V AVDD
• package:
  ▪ TBD
• 2-KSPS Throughput with Zero Data Latency
• Wide Operating Range:
  ▪ AVDD: 1.6 V to 2 V
  ▪ DVDD: 1.6 V to 2 V (Independent of AVDD)
  ▪ Temperature Range: –40°C to 125°C
• Excellent Performance:
  ▪ 10-Bit Resolution with NMC
  ▪ ±0.8-LSB (Max) DNL , ±1-LSB (Max) INL
  ▪ 50-dB SNR with 1.8-V AVDD
  ▪ –67-dB THD with 1.8-V AVDD
• Unipolar Input Range: 225 mV to 775 mV
• Integrated Offset Calibration

Typical Application



2 Overview

The AS8012 is a 10-bit, 2-KSPS, analog-to-digital converter (ADC). The device supports a wide analog input voltage range (1.6 V to 2 V) and includes a capacitor-based, successive-approximation register (SAR) ADC with an inherent sample-and-hold circuit. The device supports a wide digital supply range (1.6 V to 2 V), enabling direct interface to a variety of host controllers. The AS8012 complies with the JESD8-7A standard for a normal DVDD range (1.6 V to 2 V).

The AS8012 is and is specified for operation from –40°C to 125° C. Miniature form-factor and extremely low-power consumption make this device suitable for space-constrained, battery-powered applications.

3 Applications

• Low-Power Data Acquisition
• Battery-Powered Handheld Equipment
• Level Sensors
• Ultrasonic Flow Meters
• Motor Control
• Wearable Fitness
• Portable Medical Equipment
• Hard Drives
• Glucose Meter

4 Specification

4.1 absolute maximum ratings

	MIN	MAX	UNIT
AVDD to GND	1.6	2	V
DVDD to GND	1.6	2	V
INA to GND	225	775	mV
INB to GND	225	775	V
Digital input voltage to GND	0	DVDD	V
Storage temperature	-60	150	°C

4.2 ESD ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human body model	±2000	V
	Charged device model	±1000	

4.3 recommended operating conditions

		MIN	MAX	UNIT
AVDD	Analog supply voltage range	1.6	2	V
DVDD	Digital supply voltage range	1.6	2	V
T_A	Operating free-air temperature	-40	125	°C

4.4 electrical characteristics

At T_A = -40°C to 125°C , AVDD = 1.6V to 2V , DVDD = 1.6V to 2V , f_{sample} = 1 KSPS , unless otherwise noted.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANALOG INPUT						
	full-scale input voltage span	Not include gain/offset error	0		550	mV
	absolute input voltage range, INA to GND		225		775	mV
	absolute input voltage range, INB to GND		225		775	mV
C_S	Sampling capacitance			15		pF
SYSTEM PERFORMANCE						
	Resolution			10		Bits
NMC	No missing codes		10			Bits
INL	Integral nonlinearity	@25°C, AVDD = 1.8V	-1		1	LSB

4.4 electrical characteristics (Continued)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
SYSTEM PERFORMANCE (CONTINUED)							
DNL	Differential nonlinearity		@25°C, AVDD = 1.8V	-0.8		0.8	LSB
E_O	Offset error	Uncalibrated			±3		LSB
		Calibrated	@25°C, AVDD = 1.8V	-2	±0.5	2	
dVos/dT	Offset error drift with temperature				10		ppm/°C
E_G	Gian error			-0.2	±0.1	0.2	%FS
	Gain error drift with temperature				±10		ppm/°C
SAMPLING DYNAMICS							
t_{ACQ}	Acquisition time			235			ns
	Maximum throughput rate		@25°C, AVDD = 1.8V			2	KHz
DYNAMIC CHARACTERISTICS							
SNR	Signal-to-noise ratio		@25°C, AVDD = 1.8V		50		dB
			@25°C, AVDD = 1.8V		50		
THD	Total harmonic distortion		@25°C, AVDD = 1.8V		-67		dB
SINAD	Signal-to-noise and distortion		@25°C, AVDD = 1.8V		49		dB
			@25°C, AVDD = 1.8V		49		
SFDR	Spurious-free dynamic range		@25°C, AVDD = 1.8V		70		dB
BW_{fp}	Full-power bandwidth		@-3dB, AVDD = 1.8V		25		MHz
DIGITAL INPUT/OUTPUT (CMOS Logic Family)							
V_{IH}	High-level input voltage			0.8 DVDD		DVDD	V
V_{IL}	low-level input voltage			0		0.2 DVD	V
V_{OH}	High-level output voltage			0.8 DVDD		DVDD	V
				0.8 DVDD		DVDD	
V_{OL}	low-level output voltage			0		0.2 DVDD	V
				0		0.2 DVDD	
POWER-SUPPLY REQUIREMENTS							
AVDD	Analog supply voltage			1.6		2	V
DVDD	Digital I/O supply voltage			1.6		2	V
I_{AVDD}	Total supply current						nA
			@1KSPS, AVDD = 1.8V		270		

4.4 electrical characteristics (Continued)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
POWER-SUPPLY REQUIREMENTS (CONTINUED)					
P_D Power dissipation					nW
	@1KSPS, AVDD = 1.8V		500		

4.5 typical characteristics (uncalibrated)

At T_A = 25°C , AVDD = 1.8V , DVDD = 1.8V , f_{sample} = 1 KSPS , unless otherwise noted.

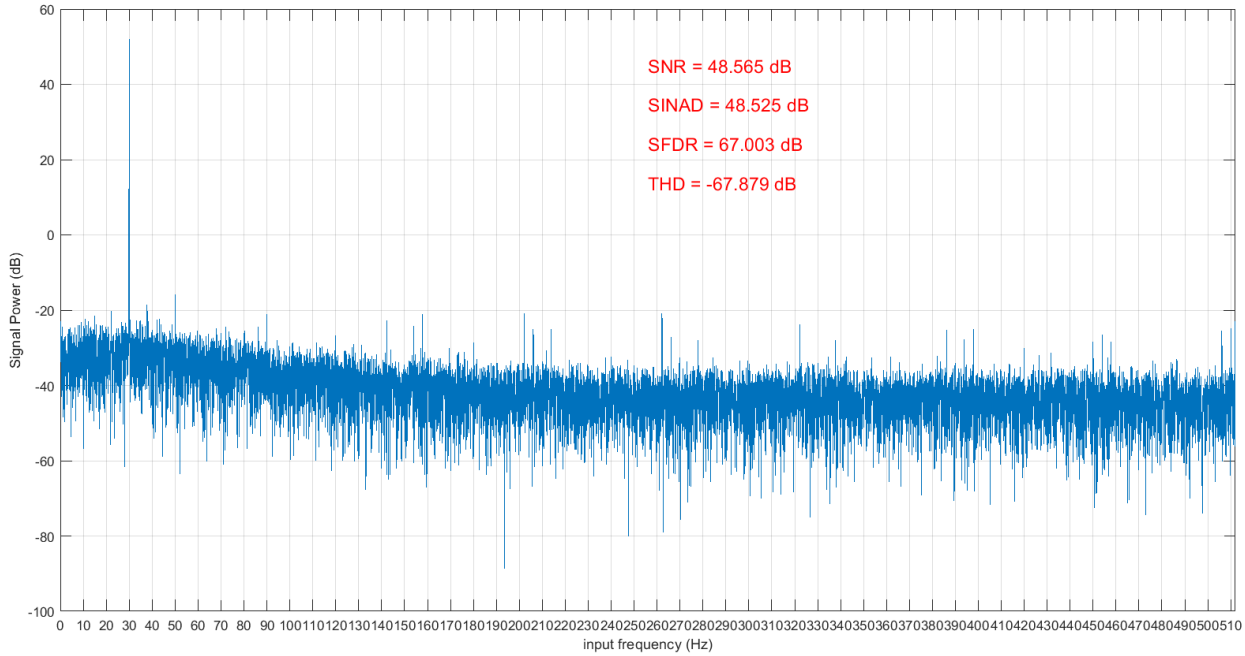


Figure 1. typical FFT (uncalibrated)

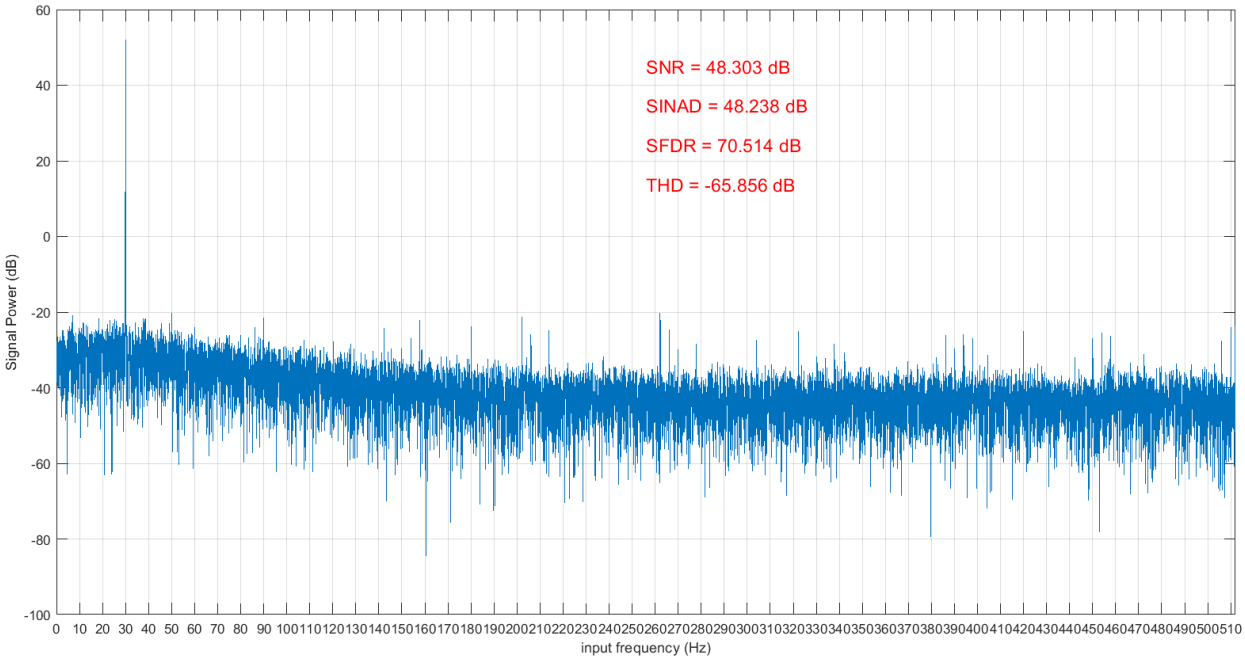


Figure 2. typical FFT (uncalibrated)

4.5 typical characteristics (uncalibrated)(continued)

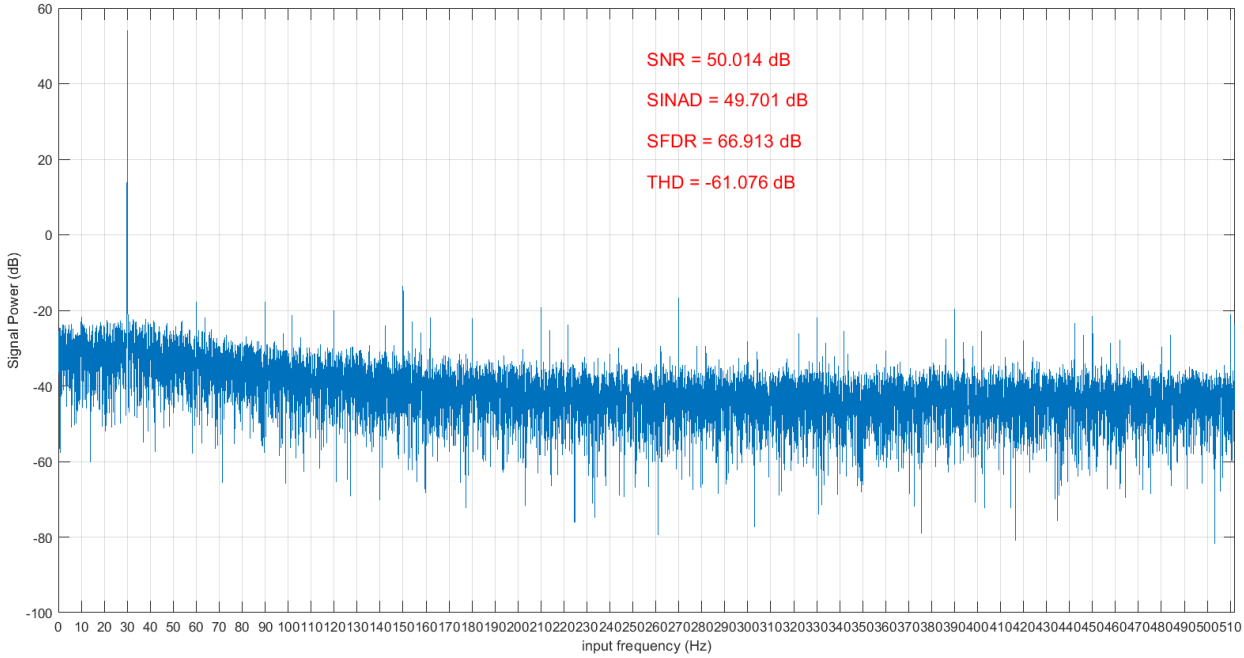


Figure 3. typical FFT (uncalibrated)

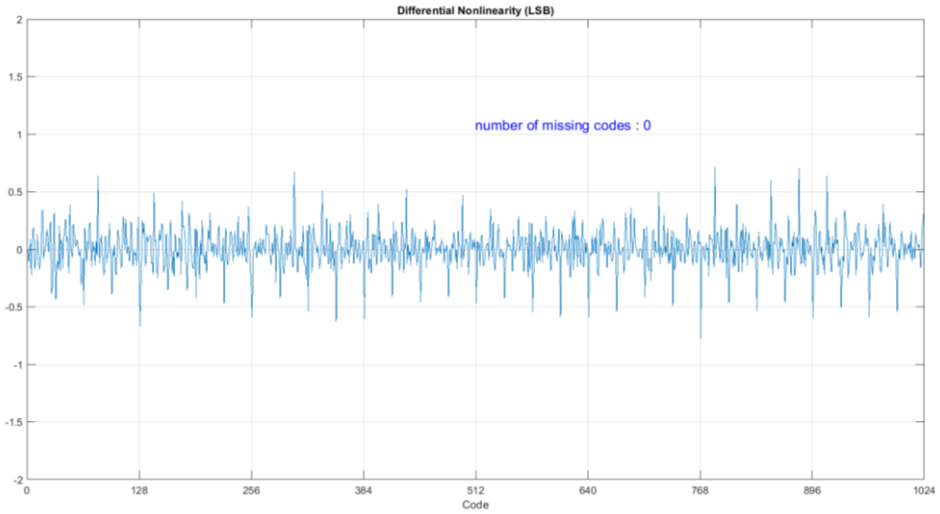


Figure 4. typical DNL (uncalibrated)

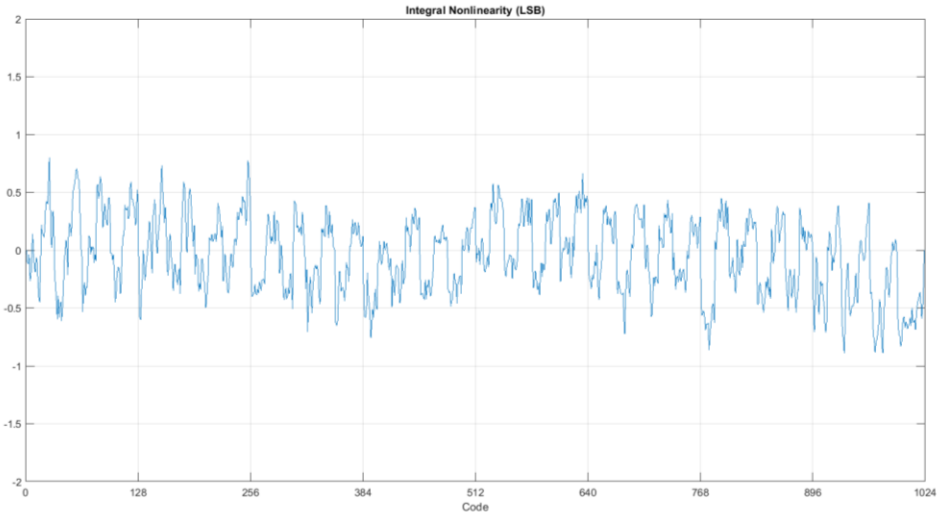


Figure 5. typical INL (uncalibrated)

