AS5103
Delta Sigma Modulator ADC 16-Bit

IP Preview

Features

• 16-Bit Resolution
• 14-Bit Linearity
• ±80mV or ±320mV Input Range with Single +5V Supply
• 1% Internal Reference Voltage
• 1% Gain Error
• 40KHz Bandwidth
• Serial Interface with Clock and Data
• Implemented Binary Coding as Manchester Coding for One-Line Interfacing
• Operating Temperature Range: −40°C to +125°C

Overview

The AS5103 is a delta-sigma (ΔΣ) modulator, operating from a single +5V supply. The differential inputs are ideal for direct connection to transducers or low-level signals. With the appropriate digital filter and modulator rate, the device can be used to achieve 16-bit analog-to-digital (A/D) conversion with no missing codes. An effective resolution of 12 bits or more and SNR of 76dB (typical) can be maintained with a digital filter bandwidth of 40kHz at a modulator rate of 10MHz. The AS5103 is designed for use in medium to high-resolution measurement applications including current measurements, smart transmitters, and industrial process control.

Typical Applications

• Motor Control
• Current Measurement
• Industrial Process Control
• Instrumentation
• Smart Transmitters

Functional Block Diagram

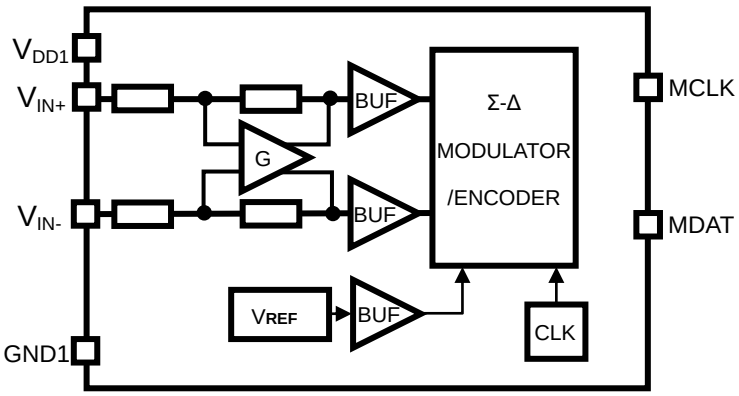

Table 3 Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units
Ambient Operating Temperature	T_A	-40	+105	°C
V_{DD1} Supply Voltage	V_{DD1}	4.5	5.5	V
Analog Input Voltage[a]	V_{IN+}, V_{IN-}	-50	+50	mV

a. Full scale signal input range ±80 mV.

Table 4 Electrical Specifications

Unless otherwise noted, T_A = -40°C to 105°C, V_{DD1} = 4.5V to 5.5V, V_{IN+} = -200 mV to +200mV, and V_{IN-} = 0V (single-ended connection); tested with Sinc^3 filter, 256 decimation ratio.

Parameter	Symbol	Min.	Typ.3	Max.	Units	Test Conditions/Notes	Fig.
STATIC CHARACTERISTICS							
Resolution		16			Bits	Decimation filter output set to 16 bits	
Integral Nonlinearity	INL	-16	±8	+16	LSB	See Definitions section	
Differential Nonlinearity	DNL	-0.9		0.9	LSB	No missing codes, guaranteed by design; see Definitions section	
Offset Error	V_{OS}	-.10	0.1	1.0	mV	T_A = 25°C; see Definitions section	5
Offset Drift vs. Temperature	TCV_{OS}		0.3	1.3	µV/°C		
Offset Drift vs V_{DD1}			70		µV/V		
Internal Reference Voltage	V_{REF}		80		mV		

Table 4 Continued

Parameter	Symbol	Min.	Typ.[a]	Max.	Units	Test Conditions/Notes	Fig.
Reference Voltage Tolerance	G_E	-1		1	%	T_A = 25°C, V_{IN+} = -80 mV to +80 mV; see Definitions section	
		-2		2	%	T_A = –40°C to +105°C, V_{IN+} = –80 mV to +80 mV	6
VREF Drift vs. Temperature	TCG_E		40		ppm/°C		
VREF Drift vs. VDD1			0.1		mV/V	See note[b]	
ANALOG INPUTS							
Full-Scale Differential	FSR		± 80		mV	V_{IN} = V_{IN+} – V_{IN-}; see note[c]	

Voltage Input Range							
Input Bias Current	I_{INA}		-200		µA	V_{DD1} = 5V, V_{DD2} = 5V, V_{IN+} = 0 V	7
Input Resistance	R_{IN}		1.9		kΩ	Across V_{IN+} or V_{IN-} to GND1	
Input Capacitance	C_{INA}		8		pF	Across V_{IN+} or V_{IN-} to GND1	
DYNAMIC CHARACTERISTICS						V_{IN+} = 100 mVpp, 1 kHz sine wave	
Signal-to-Noise Ratio	SNR	70	77		dB	T_A = –40°C to +105°C; see Definitions section	8
Signal-to-(Noise + Distortion) Ratio	SNDR	64	76		dB	T_A = –40°C to +105°C; see Definitions section	9
Effective Number of Bits	ENOB		12		Bits	see Definitions section	
DIGITAL OUTPUTS							
Output High Voltage	V_{OH}	V_{DD2} – 0.4	V_{DD2} – 0.2		V	I_{OUT} = –4mA	
Output Low Voltage	V_{OL}		0.2	0.4	V	I_{OUT} = 4mA	
POWER SUPPLY							
16-bit SD ADC Supply Current	I_{DD1}		1.4		mA		
VDD1 Total Supply Current	I_{DD1}		9	11	mA	V_{IN+} = –80 mV to +80 mV	10

a. All Typical values are at TA = 25°C, VDD1 = 5 V, VDD2 = 5 V.

b. VREF Drift vs. VDD1 can be expressed as –0.125%/V with reference to VREF.

c. Beyond the full-scale input range the data output is either all zeroes or all ones.