12-Bit, 200kHz, *micro*Power Sampling ANALOG-TO-DIGITAL CONVERTER

FEATURES

- 200kHz Sampling Rate
- *micro*Power:
  1.6mW at 200kHz
  0.54mW at 75kHz
  0.06mW at 7.5kHz
- Power Down: 3µA max
- Mini-DIP-8, SO-8, and MSOP-8 Packages
- Pseudo-Differential Input
- Serial Interface

APPLICATIONS

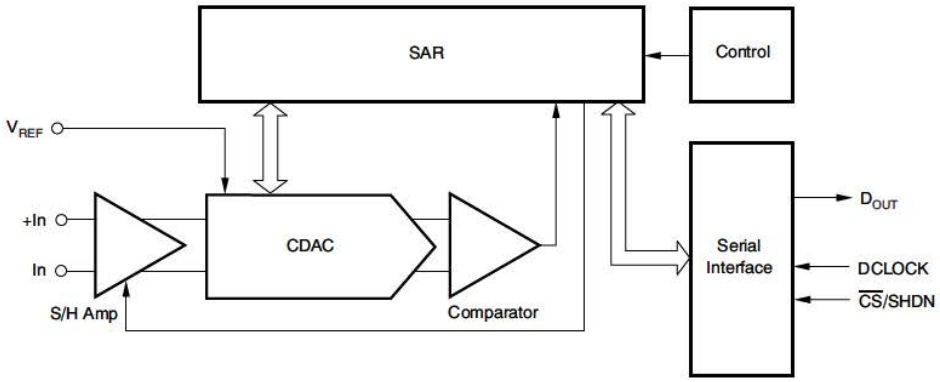
- Battery-Operated Systems
- Remote Data Acquisition
- Isolated Data Acquisition
- Simultaneous Sampling, Multichannel Systems

DESCRIPTION

The ADS7822 is a 12-bit sampling analog-to-digital (A/D) converter with ensured specifications over a 2.7V to 5.25V supply range. It requires very little power even when operating at the full 200kHz rate. At lower conversion rates, the high speed of the device enables it to spend most of its time in the power-down mode—the power dissipation is less than 60µW at 7.5kHz.

The ADS7822 also features operation from 2.0V to 5V, a synchronous serial interface, and a pseudo-differential input. The reference voltage can be set to any level within the range of 50mV to V_{CC}.

Ultra low power and small size make the ADS7822 ideal for battery-operated systems. It is also a perfect fit for remote data-acquisition modules, simultaneous multichannel systems, and isolated data acquisition. The ADS7822 is available in a plastic mini-DIP-8, an SO-8, or an MSOP-8 package.



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more suscept ble to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION(1)

PRODUCT	MAXIMUM INTEGRAL LINEARITY ERROR (LSB)	MAXIMUM DIFFERENTIAL LINEARITY ERROR (LSB)	PACKAGE-LEAD	PACKAGE DESIGNATOR	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING(2)	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
ADS7822E	±2	±2	MSOP-8	DGK	–40°C to +85°C	A22	ADS7822E/250	Tape and Reel, 250
							ADS7822E/2K5	Tape and Reel, 2500
ADS7822EB	±1	±1	MSOP-8	DGK	–40°C to +85°C	A22	ADS7822EB/250	Tape and Reel, 250
							ADS7822EB/2K5	Tape and Reel, 2500
ADS7822EC	±0.75	±0.75	MSOP-8	DGK	–40°C to +85°C	A22	ADS7822EC/250	Tape and Reel, 250
							ADS7822EC/2K5	Tape and Reel, 2500
ADS7822P	±2	±2	Plastic DIP-8	P	–40°C to +85°C	ADS7822P	ADS7822P	Rails, 50
ADS7822PB	±1	±1	Plastic DIP-8	P	–40°C to +85°C	ADS7822PB	ADS7822PB	Rails, 50
ADS7822PC	±0.75	±0.75	Plastic DIP-8	P	–40°C to +85°C	ADS7822PC	ADS7822PC	Rails, 50
ADS7822U	±2	±2	SO-8	D	–40°C to +85°C	ADS7822U	ADS7822U	Rails, 100
							ADS7822U/2K5	Tape and Reel, 2500
ADS7822UB	±1	±1	SO-8	D	–40°C to +85°C	ADS7822UB	ADS7822UB	Rails, 100
							ADS7822UB/2K5	Tape and Reel, 2500
ADS7822UC	±0.75	±0.75	SO-8	D	–40°C to +85°C	ADS7822UC	ADS7822UC	Rails, 100
							ADS7822UC/2K5	Tape and Reel, 2500

(1) For the most current package and ordering information, see the Package Option Addendum located at the end of this data sheet, or see the TI website at www.ti.com.
(2) Performance grade information is marked on the reel.

ABSOLUTE MAXIMUM RATINGS(1)

over operating free-air temperature range (unless otherwise noted)

	ADS7822	UNIT
V_{CC}	+6	V
Analog input	–0.3 to V_{CC} + 0.3	V
Logic input	–0.3 to 6	V
Case temperature	+100	°C
Junction temperature	+150	°C
Storage temperature	+125	°C
External reference voltage	+5.5	V

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS: $+V_{CC}$ = +2.7V

At –40°C to +85°C, $+V_{CC}$ = +2.7V, V_{REF} = +2.5V, f_{SAMPLE} = 75kHz, and $f_{CLK} = 16 \times f_{SAMPLE}$, unless otherwise noted.

PARAMETER		TEST CONDITIONS	ADS7822			ADS7822B			ADS7822C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
ANALOG INPUT												
Full-scale input span		+In – (–In)	0		V_{REF}	0		V_{REF}	0		V_{REF}	V
Absolute input range		+In – GND	–0.2		V_{CC} + 0.2	–0.2		V_{CC} + 0.2	–0.2		V_{CC} + 0.2	V
		–In – GND	–0.2		+1.0	–0.2		+1.0	–0.2		+1.0	V
Capacitance				25			25			25		pF
Leakage current				±1			±1			±1		µA
SYSTEM PERFORMANCE												
Resolution				12			12			12		Bits
No missing codes			11			12			11			Bits
Integral linearity error			–2	±0.5	+2	–1	±0.5	+1	–0.75	±0.25	+0.75	LSB[1]
Differential linearity error			–2	±0.5	+2	–1	±0.5	+1	–0.75	±0.25	+0.75	LSB
Offset error			–3		+3	–3		+3	–1		+1	LSB
Gain error			–3		+3	–3		+3	–1		+1	LSB
Noise				33			33			33		µVrms
Power-supply rejection				82			82			82		dB
SAMPLING DYNAMICS												
Conversion time					12			12			12	Clk Cycles
Acquisition time			1.5			1.5			1.5			Clk Cycles
Throughput rate					75			75			75	kHz
DYNAMIC CHARACTERISTICS												
Total harmonic distortion		V_{IN} = 2.5V_{PP} at 1kHz		–82			–82			–82		dB
SINAD		V_{IN} = 2.5V_{PP} at 1kHz		71			71			71		dB
Spurious-free dynamic range		V_{IN} = 2.5V_{PP} at 1kHz		86			86			86		dB
REFERENCE OUTPUT												
Voltage range			0.05		V_{CC}	0.05		V_{CC}	0.05		V_{CC}	V
Resistance		$\overline{CS}$ = GND, f_{SAMPLE} = 0Hz		5			5			5		GΩ
		$\overline{CS}$ = V_{CC}		5			5			5		GΩ
Current drain		At code 710h		8	40		8	40		8	40	µA
		f_{SAMPLE} = 7.5kHz		0.8			0.8			0.8		µA
		$\overline{CS}$ = V_{CC}		0.001	3		0.001	3		0.001	3	µA
DIGITAL INPUT/OUTPUT												
Logic family				CMOS			CMOS			CMOS		
Logic levels	V_{IH}	I_{IH} = +5µA	2.0		5.5	2.0		5.5	2.0		5.5	V
	V_{IL}	I_{IL} = +5µA	–0.3		0.8	–0.3		0.8	–0.3		0.8	V
	V_{OH}	I_{OH} = –250µA	2.1			2.1			2.1			V
	V_{OL}	I_{OL} = 250µA			0.4			0.4			0.4	V
Data format				Straight Binary			Straight Binary			Straight Binary		
POWER-SUPPLY REQUIREMENTS												
V_{CC}		Specified performance	2.7		3.6	2.7		3.6	2.7		3.6	V
		See Notes [2] and [3]	2.0		2.7	2.0		2.7	2.0		2.7	V
		See Note [3]	2.7		3.6	2.7		3.6	2.7		3.6	V
Quienscent current		f_{SAMPLE} = 7.5kHz[4][5]		20			20			20		µA
		f_{SAMPLE} = 75kHz[5]		200	325		200	325		200	325	µA
Power down		$\overline{CS}$ = V_{CC}			3			3			3	µA
TEMPERATURE RANGE												
Specified performance			–40		+85	–40		+85	–40		+85	°C

(1) LSB means least significant bit. With V_{REF} equal to +2.5V, one LSB is 0.61mV.
(2) The maximum clock rate of the ADS7822 is less than 1.2MHz in this power-supply range.
(3) See the Typical Characteristics for more information.
(4) f_{CLK} = 1.2MHz, $\overline{CS}$ = V_{CC} for 145 clock cycles out of every 160.
(5) See the Power Dissipation section for more information regarding lower sample rates.

ELECTRICAL CHARACTERISTICS: $+V_{CC}$ = +5V

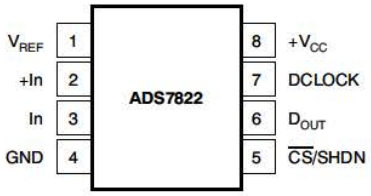
At –40°C to +85°C, $+V_{CC}$ = +5V, V_{REF} = +5V, f_{SAMPLE} = 200kHz, and $f_{CLK} = 16 \times f_{SAMPLE}$, unless otherwise noted.

PARAMETER		TEST CONDITIONS	ADS7822			ADS7822B			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
ANALOG INPUT									
Full-scale input span		+In – (–In)	0		V_{REF}	0		V_{REF}	V
Absolute input range		+In – GND	–0.2		V_{CC} + 0.2	–0.2		V_{CC} + 0.2	V
		–In – GND	–0.2		+1.0	–0.2		+1.0	V
Capacitance				25			25		pF
Leakage current				±1			±1		µA
SYSTEM PERFORMANCE									
Resolution				12			12		Bits
No missing codes			11			12			Bits
Integral linearity error			–2		+2	–1		+1	LSB[1]
Differential linearity error				±0.8		–1	±0.5	+1	LSB
Offset error			–3		+3	–3		+3	LSB
Gain error			–4		+4	–3		+3	LSB
Noise				33			33		µVrms
Power-supply rejection				70			70		dB
SAMPLING DYNAMICS									
Conversion time					12			12	Clk Cycles
Acquisition time			1.5			1.5			Clk Cycles
Throughput rate					200			200	kHz
DYNAMIC CHARACTERISTICS									
Total harmonic distortion		V_{IN} = $5V_{PP}$ at 10kHz		–78			–78		dB
SINAD		V_{IN} = $5V_{PP}$ at 10kHz		71			71		dB
Spurious-free dynamic range		V_{IN} = $5V_{PP}$ at 10kHz		79			79		dB
REFERENCE OUTPUT									
Voltage range			0 05		V_{CC}	0.05		V_{CC}	V
Resistance		$\overline{CS}$ = GND, f_{SAMPLE} = 0Hz		5			5		GΩ
		$\overline{CS}$ = V_{CC}		5			5		GΩ
Current drain		At code 710h		40	100		40	100	µA
		f_{SAMPLE} = 12.5kHz		2.5			2.5		µA
		$\overline{CS}$ = V_{CC}		0 001	3		0.001	3	µA
DIGITAL INPUT/OUTPUT									
Logic family				CMOS			CMOS		
Logic levels	V_{IH}	I_{IH} = +5µA	3.0		5.5	3.0		5.5	V
	V_{IL}	I_{IL} = +5µA	–0.3		0.8	–0.3		0.8	V
	V_{OH}	I_{OH} = –250µA	3.5			3.5			V
	V_{OL}	I_{OL} = 250µA			0.4			0.4	V
Data format				Straight Binary			Straight Binary		
POWER-SUPPLY REQUIREMENTS									
V_{CC}		Specified performance	4.75		5 25	4.75		5.25	V
Quienscent current		f_{SAMPLE} = 200kHz		320	550		320	550	µA
Power down		$\overline{CS}$ = V_{CC}			3			3	µA
TEMPERATURE RANGE									
Specified performance			–40		+85	–40		+85	°C

(1) LSB means least significant bit. With V_{REF} equal to +5V, one LSB is 1.22mV.

PIN CONFIGURATION

D, DGK, OR P PACKAGE
SO, MSOP, or DIP
(TOP VIEW)



PIN ASSIGNMENTS

PIN		DESCRIPTION
NAME	NO.	
V_{REF}	1	Reference input
+In	2	Noninverting input
–In	3	Inverting input. Connect to ground or to remote ground sense point.
GND	4	Ground
$\overline{CS}$/SHDN	5	Chip select when low; Shutdown mode when high.
D_{OUT}	6	The serial output data word is comprised of 12 bits of data. In operation, the data are valid on he falling edge of DCLOCK. The second clock pulse after the falling edge of $\overline{CS}$ enables he serial output. After one null bit, the data are valid for the next edges.
DCLOCK	7	Data clock synchronizes the serial data transfer and determines conversion speed.
$+V_{CC}$	8	Power supply

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