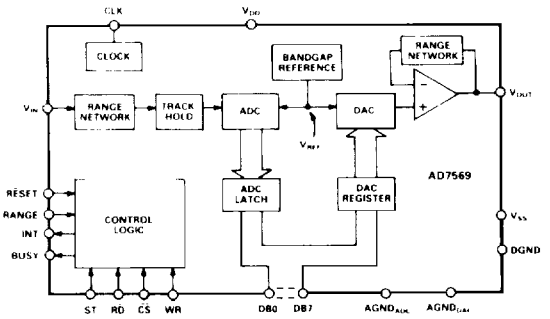
ANALOG DEVICES

LC²MOS
Complete, 8-Bit Analog I/O Systems

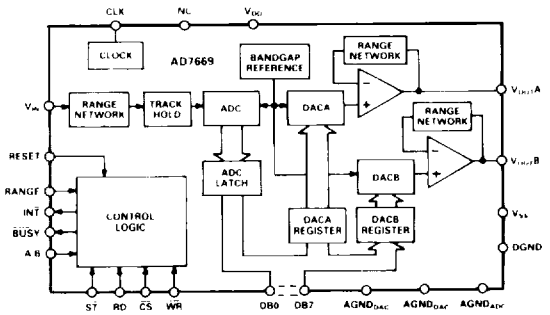
AD7569/AD7669

FEATURES
- 2 µs ADC with Track/Hold
- 1 µs DAC with Output Amplifier
  - AD7569, Single DAC Output
  - AD7669, Dual DAC Output
- On-Chip Bandgap Reference
- Fast Bus Interface
- Single or Dual 5 V Supplies

AD7569 FUNCTIONAL BLOCK DIAGRAM



AD7669 FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The AD7569/AD7669 is a complete, 8-bit, analog I/O system on a single monolithic chip. The AD7569 contains a high speed successive approximation ADC with 2 µs conversion time, a track/hold with 200 kHz bandwidth, a DAC and output buffer amplifier with 1 µs setting time. A temperature-compensated 1.25 V bandgap reference provides a precision reference voltage for the ADC and the DAC. The AD7669 is similar but contains two DACs with output buffer amplifiers.

A choice of analog input/output ranges is available. Using a supply voltage of +5 V, input and output ranges of zero to 1.25 V and zero to 2.5 volts may be programmed using the RANGE input pin. Using a ±5 V supply, bipolar ranges of ±1.25 V or ±2.5 V may be programmed.

Digital interfacing is via an 8-bit I/O port and standard microprocessor control lines. Bus interface timing is extremely fast, allowing easy connection to all popular 8-bit microprocessors. A separate start convert line controls the track/hold and ADC to give precise control of the sampling period.

The AD7569/AD7669 is fabricated in Linear-Compatible CMOS (LC²MOS), an advanced, mixed technology process combining precision bipolar circuits with low power CMOS logic. The AD7569 is packaged in a 24-pin, 0.3" wide "skinny" DIP, a 24-terminal SOIC and 28-terminal PLCC and LCCC packages. The AD7669 is available in a 28-pin, 0.6" plastic DIP, 28-terminal SOIC, and 28-terminal PLCC package.

PRODUCT HIGHLIGHTS

1. Complete Analog I/O on a Single Chip.
   The AD7569/AD7669 provides everything necessary to interface a microprocessor to the analog world. No external components or user trims are required, and the overall accuracy of the system is tightly specified, eliminating the need to calculate error budgets from individual component specifications.
2. Dynamic Specifications for DSP Users.
   In addition to the traditional ADC and DAC specifications the AD7569/AD7669 is specified for AC parameters, including signal-to-noise ratio, distortion and input bandwidth.
3. Fast Microprocessor Interface.
   The AD7569/AD7669 has bus interface timing compatible with all modern microprocessors, with bus access and relinquish times less than 75 ns and Write pulse width less than 80 ns.

AD7569/AD7669–SPECIFICATIONS

DAC SPECIFICATIONS[1] (V_{DD} = +5 V ± 5%; V_{SS}[2] = RANGE = $AGND_{DAC}$ = $AGND_{ADC}$ = DGND = 0 V; R_L = 2 kΩ, C_L = 100 pF to $AGND_{DAC}$ unless otherwise noted. All specifications T_{MIN} to T_{MAX} unless otherwise noted.)

Parameter	AD7569 J, A Versions[3] AD7669 J Version	AD7569 K, B Versions	AD7569 S Version	AD7569 T Version	Units	Conditions/Comments
STATIC PERFORMANCE						
Resolution[4]	8	8	8	8	Bits	
Total Unadjusted Error[5]	±2	±2	±3	±3	LSB typ	
Relative Accuracy[5]	±1	±1/2	±1	±1/2	LSB max	
Differential Nonlinearity[5]	±1	±3/4	±1	±3/4	LSB max	Guaranteed Monotonic
Unipolar Offset Error						DAC data is all 0s; V_{SS} = 0 V
@ 25°C	±2	±1.5	±2	±1.5	LSB max	Typical tempco is 10 µV/°C for +1.25 V range
T_{MIN} to T_{MAX}	±2.5	±2	±2.5	±2	LSB max	
Bipolar Zero Offset Error						DAC data is all 0s; V_{SS} = −5 V
@ 25°C	±2	±1 5	±2	±1.5	LSB max	Typical tempco is 20 µV/°C for ±1.25 V range
T_{MIN} to T_{MAX}	±2.5	±2	±2.5	±2	LSB max	
Full-Scale Error[6] (AD7569 Only)						V_{DD} = 5 V
@ 25°C	±2	±1	±2	±1	LSB max	
T_{MIN} to T_{MAX}	±3	±2	±4	±3	LSB max	
Full-Scale Error[6] (AD7669 Only)						V_{DD} = 5 V
@ 25°C	±3				LSB max	
T_{MIN} to T_{MAX}	±4.5				LSB max	
DACA/DACB Full Scale Error Match[6] (AD7669 Only)	±2.5				LSB max	V_{DD} = 5 V
ΔFull Scale/ΔV_{DD}, T_A = +25°C	0.5	0.5	0.5	0.5	LSB max	V_{OUT} = 2.5 V; ΔV_{DD} = ±5%
ΔFull Scale/ΔV_{SS}, T_A = +25°C	0.5	0.5	0.5	0.5	LSB max	V_{OUT} = −2.5 V; ΔV_{SS} = ±5%
Load Regulation at Full Scale	0.2	0.2	0.2	0.2	LSB max	R_L = 2 kΩ to °/C
DYNAMIC PERFORMANCE						
Signal-to-Noise Ratio[5] (SNR)	44	46	44	46	dB min	V_{OUT} = 20 kHz full-scale sine wave with $f_{SAMPLING}$ = 400 kHz
Total Harmonic Distortion[5] (THD)	48	48	48	48	dB max	V_{OUT} = 20 kHz full-scale sine wave with $f_{SAMPLING}$ = 400 kHz
Intermodulation Distortion[5] (IMD)	55	55	55	55	dB typ	fa = 18.4 kHz, fb = 14.5 kHz with $f_{SAMPLING}$ = 400 kHz
ANALOG OUTPUT						
Output Voltage Ranges						
Unipolar	0 to +1.25/2.5				Volts	V_{DD} = +5 V, V_{SS} = 0 V
Bipolar	±1.25/±2.5				Volts	V_{DD} = +5 V, V_{SS} = −5 V
LOGIC INPUTS						
$\overline{CS}$, $\overline{X}$/B,$\overline{WR}$, RANGE, $\overline{RESET}$, DB0–DB7						
Input Low Voltage, V_{INL}	0.8	0.8	0.8	0.8	V max	
Input High Voltage, V_{INH}	2.4	2.4	2.4	2.4	V min	
Input Leakage Current	10	10	10	10	µA max	V_{IN} = 0 to V_{DD}
Input Capacitance[7]	10	10	10	10	pF max	
DB0–DB7						
Input Coding (Single Supply)			Binary			
Input Coding (Dual Supply)			2s Complement			
AC CHARACTERISTICS[7]						
Voltage Output Settling Time						Settling time to with in ±1/2 LSB of final value
Positive Full-Scale Change	2	2	2	2	µs max	Typically 1 µs
Negative Full-Scale Change (Single Supply)	4	4	4	4	µs max	Typically 2 µs
Negative Full-Scale Change (Dual Supply)	2	2	2	2	µs max	Typically 1 µs
Digital-to-Analog Glitch Impulse[5]	15	15	15	15	nV secs typ	
Digital Feedthrough[5]	1	1	1	1	nV secs typ	
V_{IN} to V_{OUT} Isolation	60	60	60	60	dB typ	V_{IN} = ±2.5 V, 50 kHz Sine Wave
DAC to DAC Crosstalk[5] (AD7669 Only)	1				nV secs typ	
DACA to DACB Isolation[5] (AD7669 Only)	−70				dB max	
POWER REQUIREMENTS						
V_{DD} Range	4.75/5.25	4.75/5.25	4.75/5.25	4.75/5.25	V min/V max	For Specified Performance
V_{SS} Range (Dual Supplies)	−4.75/−5.25	−4.75/−5.25	−4.75/−5.25	4.75/−5.25	V min/V max	Specified Performance also applies to V_{SS} = 0 V for unipolar ranges.
I_{DD}						V_{OUT} = V_{IN} = 2.5 V; Logic Inputs = 2.4 V; CLK = 0.8 V
(AD7569)	13	13	13	13	mA max	Output unloaded
(AD7669)	18				mA max	Outputs unloaded
I_{SS} (Dual Supplies)						V_{OUT} = V_{IN} = −2.5 V; Logic Inputs = 2.4 V; CLK = 0.8 V
(AD7569)	4	4	4	4	mA max	Output unloaded
(AD7669)	6				mA max	Outputs unloaded
DAC/ADC MATCHING						
Gain Matching[6]						V_{IN} to V_{OUT} match with V_{IN} = ±2.5 V,
@ 25°C	1	1	1	1	% typ	20 kHz sine wave
T_{MIN} to T_{MAX}	1	1	1	1	% typ	

NOTES

[1]Specifications apply to both DACs in the AD7669. V_{OUT} applies to both V_{OUT}A and V_{OUT}B of the AD7669.

[2]Except where noted, specifications apply for all output ranges including bipolar ranges with dual supply operation.

[3]Temperature ranges as follows: J, K versions; 0°C to +70°C
A, B versions; −25°C to +55°C
S, T versions; −55°C to +125°C

[4]1 LSB = 4.88 mV for 0 V to +1.25 V output range, 9.76 mV for 0 V to +2.5 V and ±1.25 V ranges and 19.5 mV for ±2.5 V range.

[5]See Terminology.

[6]Includes internal voltage reference error and is calculated after offset error ha s been adjusted out. Ideal unipolar full-scale voltage is (FS − 1 LSB); ideal bipolar positive full-scale voltage is (FS/2 − 1 LSB) and ideal bipolar negative full-scale voltage is −FS/2.

[7]Sample tested at +25°C to ensure compliance.

Specifications subject to change without notice.