ANALOG DEVICES

LC²MOS Octal 8-Bit DAC

AD7228A

FEATURES

Eight 8-Bit DACs with Output Amplifiers
Operates with Single +5 V, +12 V or +15 V or Dual Supplies
µP Compatible (95 ns $\overline{WR}$ Pulse)
No User Trims Required
Skinny 24-Pin DIPs, SOIC, and 28-Terminal Surface Mount Packages

GENERAL DESCRIPTION

The AD7228A contains eight 8-bit voltage-mode digital-to-analog converters, with output buffer amplifiers and interface logic on a single monolithic chip. No external trims are required to achieve full specified performance for the part.

Separate on-chip latches are provided for each of the eight D/A converters. Data is transferred into the data latches through a common 8-bit TTL/CMOS (5 V) compatible input port. Address inputs A0, A1 and A2 determine which latch is loaded when $\overline{WR}$ goes low. The control logic is speed compatible with most 8-bit microprocessors.

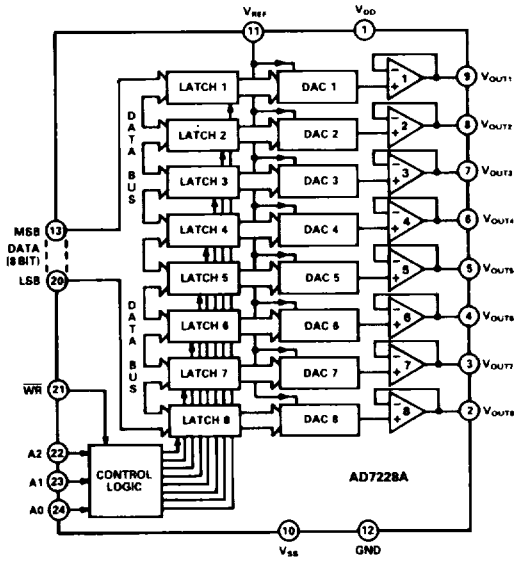
Specified performance is guaranteed for input reference voltages from +2 to +10 V when using dual supplies. The part is also specified for single supply +15 V operation using a reference of +10 V and single supply +5 V operation using a reference of +1.23 V. Each output buffer amplifier is capable of developing +10 V across a 2 kΩ load.

The AD7228A is fabricated on an all ion-implanted, high-speed, Linear Compatible CMOS (LC²MOS) process which has been specifically developed to integrate high-speed digital logic circuits and precision analog circuits on the same chip.

PRODUCT HIGHLIGHTS

1. Eight DACs and Amplifiers in Small Package
   The single-chip design of eight 8-bit DACs and amplifiers allows a dramatic reduction in board space requirements and offers increased reliability in systems using multiple converters. Its pinout is aimed at optimizing board layout with all analog inputs and outputs at one side of the package and all digital inputs at the other.
2. Single or Dual Supply Operation
   The voltage-mode configuration of the DACs allows single supply operation of the AD7228A. The part can also be operated with dual supplies giving enhanced performance for some parameters.
3. Microprocessor Compatibility
   The AD7228A has a common 8-bit data bus with individual DAC latches, providing a versatile control architecture for simple interface to microprocessors. All latch enable signals are level triggered and speed compatible with most high performance 8-bit microprocessors.

FUNCTIONAL BLOCK DIAGRAM



ORDERING GUIDE

Model[1]	Temperature Range	Total Unadjusted Error (LSB)	Package Option[2]
AD7228ABN	–40°C to +85°C	±2 max	N-24
AD7228ACN	–40°C to +85°C	±1 max	N-24
AD7228ABP	–40°C to +85°C	±2 max	P-28A
AD7228ACP	–40°C to +85°C	±1 max	P-28A
AD7228ABR	–40°C to +85°C	±2 max	R-24
AD7228ACR	–40°C to +85°C	±1 max	R-24
AD7228ABQ	–40°C to +85°C	±2 max	Q-24
AD7228ACQ	–40°C to +85°C	±1 max	Q-24
AD7228ATQ[3]	–55°C to +125°C	±2 max	Q-24
AD7228AUQ[3]	–55°C to +125°C	±1 max	Q-24

NOTES
[1]To order MIL-STD-883, Class B processed parts, add /883B to part number. Contact your local sales office for military data sheet and availability.
[2]N = Plastic DIP; P = Plastic Leaded Chip Carrier (PLCC); Q = Cerdip; R = Small Outline IC (SOIC). For outline information see Package Information section.
[3]These grades will be available to /883B processing only.

AD7228A–SPECIFICATIONS

DUAL SUPPLY (V_{DD} = 10.8 V to 16.5 V; V_{SS} = −5 V ± 10%; GND = 0 V; V_{REF} = +2 V to +10 V[1]; R_L = 2 kΩ, C_L = 100 pF unless otherwise noted.) All specifications T_{MIN} to T_{MAX} unless otherwise noted.

Parameter	B Version[2]	C Version	T Version	U Version	Units	Conditions/Comments
STATIC PERFORMANCE						
Resolution	8	8	8	8	Bits	
Total Unadjusted Error[3]	±2	±1	±2	±1	LSB max	V_{DD} = +15 V ± 10%, V_{REF} = +10 V
Relative Accuracy	±1	±1/2	±1	±1/2	LSB max	
Differential Nonlinearity	±1	±1	±1	±1	LSB max	Guaranteed Monotonic
Full-Scale Error[4]	±1	±1/2	±1	±1/2	LSB max	Typical tempco is 5 ppm/°C with V_{REF} = +10 V
Zero Code Error						
@ 25°C	±25	±15	±25	±15	mV max	Typical tempco is 30 μV/°C
T_{MIN} to T_{MAX}	±30	±20	±30	±20	mV max	
Minimum Load Resistance	2	2	2	2	kΩ min	V_{OUT} = +10 V
REFERENCE INPUT						
Voltage Range[1]	2 to 10	2 to 10	2 to 10	2 to 10	V min/V max	
Input Resistance	2	2	2	2	kΩ min	
Input Capacitance[5]	500	500	500	500	pF max	Occurs when each DAC is loaded with all 1s.
AC Feedthrough	70	70	70	70	dB typ	V_{REF} = 8 V p-p Sine Wave @ 10 kHz
DIGITAL INPUTS						
Input High Voltage, V_{INH}	2.4	2.4	2.4	2.4	V min	
Input Low Voltage, V_{INL}	0.8	0.8	0.8	0.8	V max	
Input Leakage Current	±1	±1	±1	±1	μA max	V_{IN} = 0 V or V_{DD}
Input Capacitance[5]	8	8	8	8	pF max	
Input Coding	Binary	Binary	Binary	Binary		
DYNAMIC PERFORMANCE[5]						
Voltage Output Slew Rate	2	2	2	2	V/μs min	
Voltage Output Settling Time						
Positive Full-Scale Change	5	5	5	5	μs max	V_{REF} = +10 V; Settling Time to ±1/2 LSB
Negative Full-Scale Change	5	5	5	5	μs max	V_{REF} = +10 V; Settling Time to ±1/2 LSB
Digital Feedthrough	50	50	50	50	nV secs typ	Code transition all 0s to all 1s. V_{REF} = 0 V; $\overline{WR}$ = V_{DD}
Digital Crosstalk[6]	50	50	50	50	nV secs typ	Code transition all 0s to all 1s. V_{REF} = +10 V; $\overline{WR}$ = 0 V
POWER SUPPLIES						
V_{DD} Range	10.8/16.5	10.8/16.5	10.8/16.5	10.8/16.5	V min/V max	For Specified Performance
V_{SS} Range	4.5/5.5	4.5/5.5	4.5/5.5	4.5/5.5	V min/V max	For Specified Performance
I_{DD}						Outputs Unloaded; V_{IN} = V_{INL} or V_{INH}
@ 25°C	16	16	16	16	mA max	
T_{MIN} to T_{MAX}	20	20	22	22	mA max	
I_{SS}						Outputs Unloaded; V_{IN} = V_{INL} or V_{INH}
@ 25°C	14	14	14	14	mA max	
T_{MIN} to T_{MAX}	18	18	20	20	mA max	

SINGLE SUPPLY (V_{DD} = +15 V ± 10%, V_{SS} = GND = 0 V; V_{REF} = +10 V; R_L = 2 kΩ, C_L = 100 pF unless otherwise noted.) All specifications T_{MIN} to T_{MAX} unless otherwise noted.

STATIC PERFORMANCE						
Resolution	8	8	8	8	Bits	
Total Unadjusted Error[3]	±2	±1	±2	±1	LSB max	
Differential Nonlinearity	±1	±1	±1	±1	LSB max	Guaranteed Monotonic
Minimum Load Resistance	2	2	2	2	kΩ min	V_{OUT} = +10 V
REFERENCE INPUT						
Input Resistance	2	2	2	2	kΩ min	
Input Capacitance[5]	500	500	500	500	pF max	Occurs when each DAC is loaded with all 1s.
DIGITAL INPUTS	As per Dual Supply Specifications					
DYNAMIC PERFORMANCE[5]						
Voltage Output Slew Rate	2	2	2	2	V/μs min	
Voltage Output Settling Time						
Positive Full-Scale Change	5	5	5	5	μs max	Settling Time to ±1/2 LSB
Negative Full-Scale Change	7	7	7	7	μs max	Settling Time to ±1/2 LSB
Digital Feedthrough	50	50	50	50	nV secs typ	Code transition all 0s to all 1s. V_{REF} = 0 V; $\overline{WR}$ = V_{DD}
Digital Crosstalk[6]	50	50	50	50	nV secs typ	Code transition all 0s to all 1s. V_{REF} = +10 V; $\overline{WR}$ = 0 V
POWER SUPPLIES						
V_{DD} Range	13.5/16.5	13.5/16.5	13.5/16.5	13.5/16.5	V min/V max	For Specified Performance
I_{DD}						Outputs Unloaded; V_{IN} = V_{INL} or V_{INH}
@ 25°C	16	16	16	16	mA max	
T_{MIN} to T_{MAX}	20	20	22	22	mA max	

NOTES

[1] V_{OUT} must be less than V_{DD} by 3.5 V to ensure correct operation.

[2] Temperature ranges are as follows:
B, C Versions: −40°C to +85°C.
T, U Versions: −55°C to +125°C.

[3] Total Unadjusted Error includes zero code error, relative accuracy and full-scale error.

[4] Calculated after zero code error has been adjusted out.

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

[6] The glitch impulse transferred to the output of one converter (not addressed) due to a change in the digital input code to another addressed converter.

Specifications subject to change without notice.