

AD1851/AD1861
FEATURES
110 dB SNR
Fast Settling Permits $16 \times$ Oversampling
 ± 3 V Output
Optional Trim Allows Super-Linear Performance
 ± 5 V Operation
16-Pin Plastic DIP and SOIC Packages
Pin-Compatible with AD1856 & AD1860 Audio DACs
2s Complement, Serial Input
APPLICATIONS
High-End Compact Disc Players
Digital Audio Amplifiers
DAT Recorders and Players
Synthesizers and Keyboards
PRODUCT DESCRIPTION

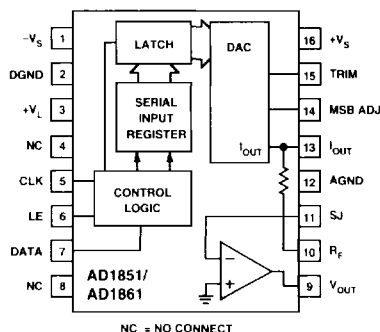
The AD1851/AD1861 is a monolithic PCM audio DAC. The AD1851 is a 16-bit device, while the AD1861 is an 18-bit device. Each device provides a voltage output amplifier, DAC, serial-to-parallel register and voltage reference. The digital portion of the AD1851/AD1861 is fabricated with CMOS logic elements that are provided by Analog Devices' $2 \mu\text{m}$ ABCMOS process. The analog portion of the AD1851/AD1861 is fabricated with bipolar and MOS devices as well as thin-film resistors.

This combination of circuit elements, as well as careful design and layout techniques, results in high performance audio playback. Laser-trimming of the linearity error affords low total harmonic distortion. An optional linearity trim pin is provided to allow residual differential linearity error at midscale to be eliminated. This feature is particularly valuable for low distortion reproductions of low amplitude signals. Output glitch is also small, contributing to the overall high level of performance. The output amplifier achieves fast settling and high slew rates, providing a full ± 3 V signal at load currents up to 8 mA. When used in current output mode, the AD1851/AD1861 provides a ± 1 mA output signal. The output amplifier is short circuit protected and can withstand indefinite shorts to ground.

The serial input interface consists of the clock, data and latch enable pins. The serial 2s complement data word is clocked into the DAC, MSB first, by the external clock. The latch enable signal transfers the input word from the internal serial input register to the parallel DAC input register. The AD1851 input clock can support a 12.5 MHz data rate, while the AD1861 input clock can support a 13.5 MHz data rate. This serial input port is compatible with second generation digital filter chips used in consumer audio products. These filters operate at oversampling rates of $2 \times$, $4 \times$, $8 \times$ and $16 \times$ sampling frequencies.

The critical specifications of THD+N and signal-to-noise ratio are 100% tested for all devices.

The AD1851/AD1861 operates with ± 5 V power supplies, making it suitable for home use markets. The digital supply, V_{I1} , can be separated from the analog supplies, V_S and V_{S2} , for reduced

FUNCTIONAL BLOCK DIAGRAM


digital crosstalk. Separate analog and digital ground pins are also provided. Power dissipation is 100 mW typical.

The AD1851/AD1861 is available in either a 16-pin plastic DIP or a 16-pin plastic SOIC package. Both packages incorporate the industry standard pinout found on the AD1856 and AD1860 PCM audio DACs. As a result, the AD1851/AD1861 is a drop-in replacement for designs where ± 5 V supplies have been used with the AD1856/AD1860. Operation is guaranteed over the temperature range of -25°C to $+70^\circ\text{C}$ and over the voltage supply range of $+4.75$ V to ± 5.25 V.

PRODUCT HIGHLIGHTS

1. AD1851 16-bit resolution provides 96 dB dynamic range. AD1861 18-bit resolution provides 108 dB dynamic range.
2. No external components are required.
3. Operates with ± 5 V supplies.
4. Space saving 16-pin SOIC and plastic DIP packages.
5. 100 mW power dissipation.
6. High input clock data rates and 1.5 μs settling time permits $2 \times$, $4 \times$, $8 \times$ and $16 \times$ oversampling.
7. ± 3 V or ± 1 mA output capability.
8. THD + Noise and SNR are 100% tested.
9. Pin-compatible with AD1856 & AD1860 PCM audio DACs.

ORDERING GUIDE

Model	Resolution	THD + N	Package Option*
AD1851N	16 Bits	0.008%	N-16
AD1851N-J	16 Bits	0.004%	N-16
AD1851R	16 Bits	0.008%	R-16
AD1851R-J	16 Bits	0.004%	R-16
AD1861N	18 Bits	0.008%	N-16
AD1861N-J	18 Bits	0.004%	N-16
AD1861R	18 Bits	0.008%	R-16
AD1861R-J	18 Bits	0.004%	R-16

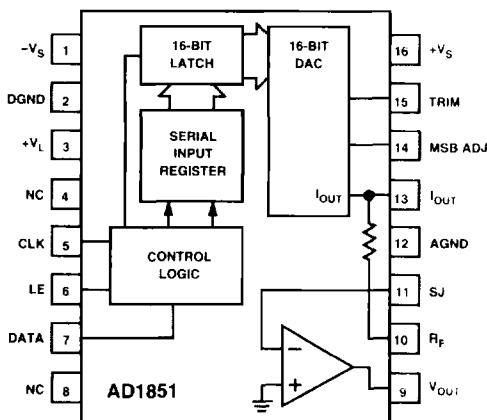
*N = Plastic DIP Package; R = Small Outline (SOIC) Package. For outline information see Package Information section.

To obtain the most recent version or complete data sheet, call our fax retrieval system at 1-800-446-6212 or visit our World Wide Web site at <http://www.analog.com>.

AD1851/AD1861—SPECIFICATIONS (T_A @ +25°C and ± 5 V supplies, unless otherwise noted)

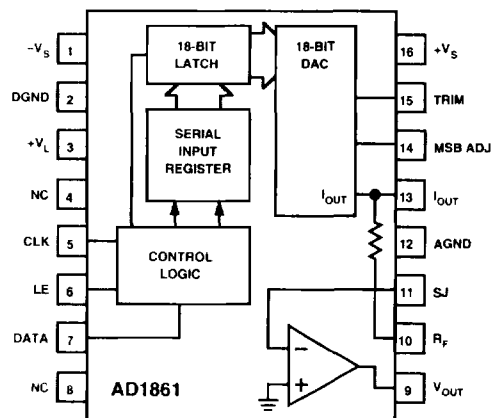
	Min	Typ	Max	Units
DIGITAL INPUTS				
V_{IH}	2.0		$+V_L$	V
V_{IL}			0.8	V
$I_{IH}, V_{IH} = V_L$			1.0	μ A
$I_{IL}, V_{IL} = 0.4$			-10	μ A
ACCURACY				
Gain Error		+1		%
Midscale Output Voltage		± 10		mV
DRIFT (0°C to +70°C)				
Total Drift		± 25		ppm of FSR/°C
Bipolar Zero Drift		± 4		ppm of FSR/°C
SETTLING TIME (To $\pm 0.0015\%$ of FSR)				
Voltage Output				
6 V Step		1.5		μ s
1 LSB Step		1.0		μ s
Slew Rate		9		V/ μ s
Current Output				
1 mA Step 10 Ω to 100 Ω Load		350		ns
1 k Ω Load		350		ns
OUTPUT				
Voltage Output Configuration				
Bipolar Range	± 2.88	± 3.0	± 3.12	V
Output Current	± 8			mA
Output Impedance		0.1		Ω
Short Circuit Duration		Indefinite to Common		
Current Output Configuration				
Bipolar Range ($\pm 30\%$)		± 1.0		mA
Output Impedance ($\pm 30\%$)		1.7		k Ω
POWER SUPPLY				
Voltage				
$+V_L$ and $+V_S$	4.75		5.25	V
$-V_S$	5.25		-4.75	V
TEMPERATURE RANGE				
Specification	0	+25	+70	°C
Operation	25		+70	°C
Storage	60		+100	°C
WARM-UP TIME				
	1			min

Specifications subject to change without notice.



NC = NO CONNECT

AD1851 Functional Block Diagram



NC = NO CONNECT

AD1861 Functional Block Diagram