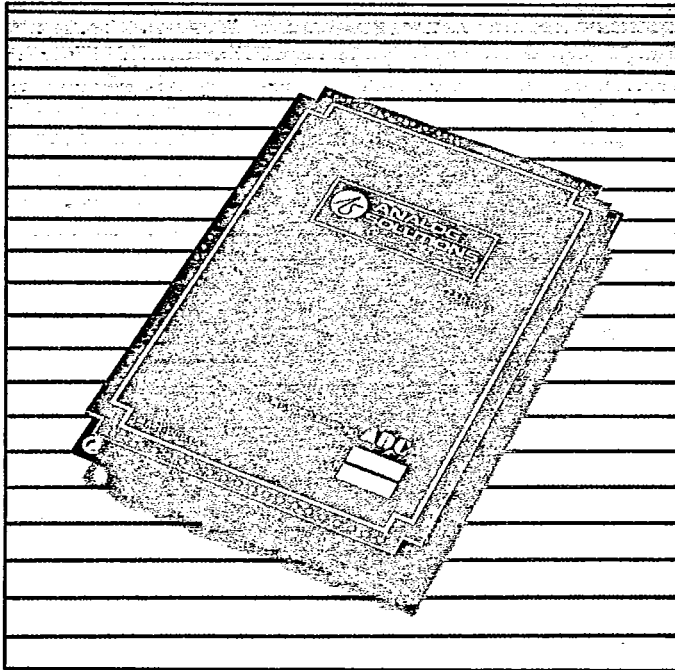




**ANALOG  
SOLUTIONS™**  
a subsidiary of Silicon General, Inc.

## ZAD1025

Video Sampling  
Analog-To-Digital Converter



### Applications

- Medical Imaging Systems
- Signature Analysis
- Spectrum Analysis
- Radar Digitizing
- Television Digitizing

### Key Features

- 10-bit @ 25 MHz Word Rates
- Fully Variable Conversion Speed
- Typical Power Consumption 13 Watts
- Built-In Track and Hold
- ECL Compatible
- Pin-Compatible with MOD-1020

## Solutions for Data Conversion

### General Description

The Analog Solutions model ZAD1025 is an ultra-high-speed, Sampling A/D Converter with 10-bit linearity at word rates to 25 MHz and at input signals to 25 MHz. The ZAD1025 utilizes a unique circuit design along with the latest custom semiconductor and Surface Mount Technology (SMT) to provide the high performance necessary in video converters.

The 1025 operates from DC to 25 MHz which eliminates the need to specify unit operation for fixed conversion rates. A maximum differential and integral non-linearity of  $\pm 1$  LSB is guaranteed. The ZAD1025 has fewer parts and 35% less power dissipation than earlier designs.

The ZAD1025 is constructed on a single 5" x 7" printed circuit board and is pin-compatible with the MOD1020, while offering superior performance. It is a complete converter including integral track-and-hold, timing circuitry, references and latched digital outputs. The outputs are a balanced parallel digital configuration. The A/D requires only an external encode command

input pulse and external power supplies for proper operation. With an input impedance greater than 500 ohms, the unit is easily terminated to match the lower impedance of the system.

The ZAD1025, with superior 10-bit linearity over the full input bandwidth, provides immediate performance improvements when replacing older video converters.

The ZAD1025 is ideally suited for systems requiring the ultimate in conversion speed, accuracy and flexibility. Such applications include variable frame rate television, radar digitizing, digital communications, medical instrumentation and many others.

**PERFORMANCE SPECIFICATIONS**

**ZAD1025 VIDEO SAMPLING ANALOG-TO-DIGITAL CONVERTER**

<p><b>SPECIFICATIONS*</b></p> <p>Resolution 10 bits (0.1% FS)                  LSB Weight 1 mV or 2 mV depending upon selected input range</p>		<p><b>DYNAMIC CHARACTERISTICS</b></p> <table border="1"> <thead> <tr> <th>AC Linearity</th> <th>Spurious Signals</th> <th>S/N Ratio</th> </tr> </thead> <tbody> <tr> <td>DC to 0.5 MHz</td> <td>-64 dB max. -68 dB typ.</td> <td>56 dB min. 58 dB typ.</td> </tr> <tr> <td>0.5 MHz to .99 MHz</td> <td>-62 dB max. -67 dB typ.</td> <td>54 dB min. 56 dB typ.</td> </tr> <tr> <td>1 to 4.99 MHz</td> <td>-59 dB max. -64 dB typ.</td> <td>51 dB min. 53 dB typ.</td> </tr> <tr> <td>5 to 8.99 MHz</td> <td>-56 dB max. -60 dB typ.</td> <td>47 dB min. 50 dB typ.</td> </tr> <tr> <td>9 to 12.49 MHz</td> <td>-51 dB max. -55 dB typ.</td> <td>45 dB min. 47 dB typ.</td> </tr> <tr> <td>12.5 to 15 MHz</td> <td>-48 dB max. -50 dB typ.</td> <td>43 dB min. 45 dB typ.</td> </tr> <tr> <td>Conversion Rate</td> <td colspan="2">DC to 25 MHz fully variable</td> </tr> <tr> <td>Aperture Time Delay</td> <td colspan="2">5 ns max.</td> </tr> <tr> <td>Aperture Jitter</td> <td colspan="2">10 ps rms max.</td> </tr> <tr> <td>Power Supply Sensitivity</td> <td colspan="2">Output Change &lt;0.1%/V change on any supply</td> </tr> <tr> <td>Input Bandwidth</td> <td colspan="2">DC to 12.5 MHz</td> </tr> <tr> <td>Flat within ±0.2 dB</td> <td colspan="2">DC to 12.5 MHz</td> </tr> <tr> <td>Flat within ±0.6 dB</td> <td colspan="2">DC to 25 MHz</td> </tr> <tr> <td>Transient Response<sup>2</sup></td> <td colspan="2">50 ns</td> </tr> <tr> <td>Overvoltage Recovery<sup>3</sup></td> <td colspan="2">50 ns</td> </tr> <tr> <td>Conversion Time</td> <td colspan="2">55 ns + 2 clock periods. Output data valid after third convert command (2 pipeline delays). Use of the data-ready output is recommended for strobing output data into external registers.</td> </tr> </tbody> </table>			AC Linearity	Spurious Signals	S/N Ratio	DC to 0.5 MHz	-64 dB max. -68 dB typ.	56 dB min. 58 dB typ.	0.5 MHz to .99 MHz	-62 dB max. -67 dB typ.	54 dB min. 56 dB typ.	1 to 4.99 MHz	-59 dB max. -64 dB typ.	51 dB min. 53 dB typ.	5 to 8.99 MHz	-56 dB max. -60 dB typ.	47 dB min. 50 dB typ.	9 to 12.49 MHz	-51 dB max. -55 dB typ.	45 dB min. 47 dB typ.	12.5 to 15 MHz	-48 dB max. -50 dB typ.	43 dB min. 45 dB typ.	Conversion Rate	DC to 25 MHz fully variable		Aperture Time Delay	5 ns max.		Aperture Jitter	10 ps rms max.		Power Supply Sensitivity	Output Change <0.1%/V change on any supply		Input Bandwidth	DC to 12.5 MHz		Flat within ±0.2 dB	DC to 12.5 MHz		Flat within ±0.6 dB	DC to 25 MHz		Transient Response <sup>2</sup>	50 ns		Overvoltage Recovery <sup>3</sup>	50 ns		Conversion Time	55 ns + 2 clock periods. Output data valid after third convert command (2 pipeline delays). Use of the data-ready output is recommended for strobing output data into external registers.	
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<p><b>ANALOG INPUT</b></p> <p>Voltage Range 1 Vp-p or 2 Vp-p depending upon hook-up (see figure on page 4)                  Impedance 1000 ohm (2 V Input Range)                  500 ohm (1 V Input Range)                  Offset Preset at factory to Bipolar input range. Adjustable to Unipolar range with on board potentiometer (see table 4)                  Maximum Input Voltage 15 V (2 V input range)                  8 V (1 V input range)</p>																																																							
<p><b>ACCURACY</b></p> <p>No Missing Codes Guaranteed                  Monotonicity Guaranteed                  Differential Non-Linearity: ±½ LSB typ., ±1 LSB max. @ DC to 10MHz                  Integral Non-Linearity: ±½ LSB typ., ±1 LSB max.</p>																																																							
<p>Gain Error Adjustable to zero with on-board potentiometer                  Gain Versus Temp. ±0.015% of FSR/°C                  Offset Error Adjustable to zero with on-board potentiometer                  Offset vs Temperature: ±0.025% FSR/°C</p>																																																							
<p><b>ENCODE COMMAND INPUT</b></p> <p>Balanced input; ENCODE and <u>ENCODE</u>                  Start conversion on rising edge of ENCODE.                  Logic Compatibility Balanced ECL:                  0 = -1.7V, 1 = -0.9V                  Impedance 100 ohm line-to-line                  Rise and Fall Time 5 ns max.                  Duration (Min/Max) 10 ns/70% of duty cycle                  Frequency DC to 25 MHz, fully variable</p>		<p><b>DIGITAL OUTPUT DATA</b></p> <p>Format 10 parallel bits, NRZ                  Logic Levels, ECL Compatible (Balanced Output) "0" = -1.7 V                  "1" = -0.9 V                  Drive 75 ohm to 100 ohm Line-to-Line                  Time Skew 5 ns max.                  Coding Binary, Offset binary, 2's Complement</p>																																																					
<p><b>DATA READY OUTPUT</b></p> <p>Logic Level, ECL Compatible (Balanced Output) 0 = -1.7 V                  1 = -0.9V                  Rise and Fall Times 5 ns max.                  Duration 20 ns ±3 ns</p>		<p><b>POWER REQUIREMENTS</b></p> <table border="1"> <tbody> <tr> <td>+ 15 V ±5%</td> <td>225 mA.</td> </tr> <tr> <td>- 15 V ±5%</td> <td>195 mA.</td> </tr> <tr> <td>+ 5 V ±5%</td> <td>160 mA.</td> </tr> <tr> <td>-5.2 V ±5%</td> <td>1.3 A.</td> </tr> <tr> <td>Power Consumption</td> <td>13.9 W</td> </tr> </tbody> </table>			+ 15 V ±5%	225 mA.	- 15 V ±5%	195 mA.	+ 5 V ±5%	160 mA.	-5.2 V ±5%	1.3 A.	Power Consumption	13.9 W																																									
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<p><b>TEMPERATURE RANGE</b></p> <p>Operating 0 to 70°C                  Storage -55 to +85°C                  Cooling requirement-forced airflow of 500 lfpm required at ambient temperatures above 35°C.</p>		<p><b>PHYSICAL CHARACTERISTICS</b></p> <p>CONSTRUCTION Single Printed Circuit Card 5" × 7"</p>																																																					

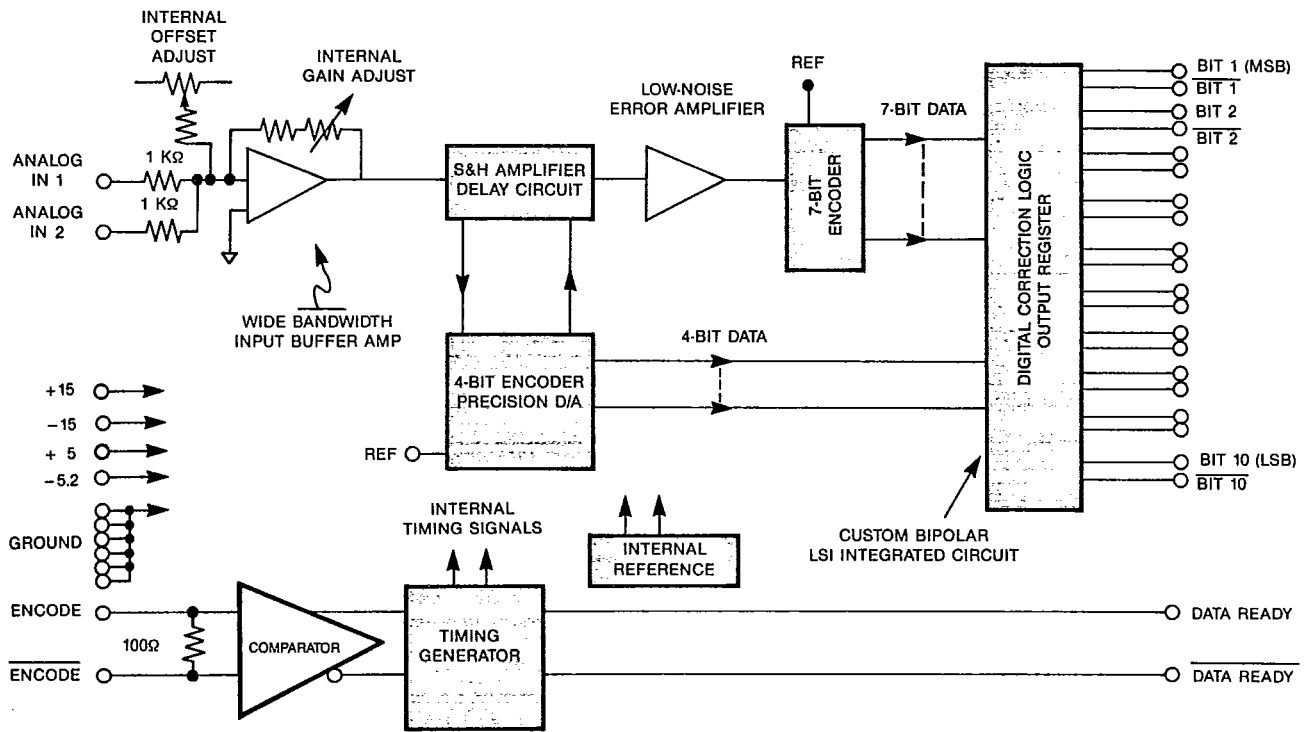
**Notes:**

\*Specifications apply at 25°C and nominal supply voltages unless otherwise indicated.

- 1) RMS signal to RMS noise ratio with 500 kHz analog input.
- 2) For full-scale step input attains 10-bit accuracy in time specified.

3) Recovers to 10-bit accuracy after 2 X FS input over voltage in specified time.

4) Shaded areas denote enhanced performance. Specifications subject to change without notice.



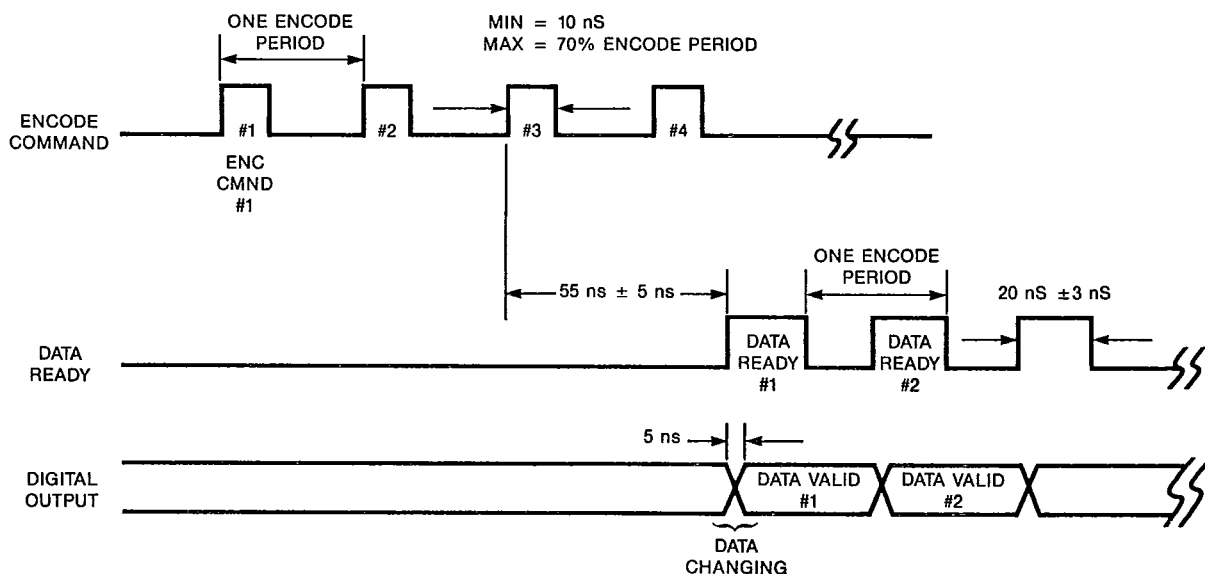
Block Diagram

### Description of ZAD1025

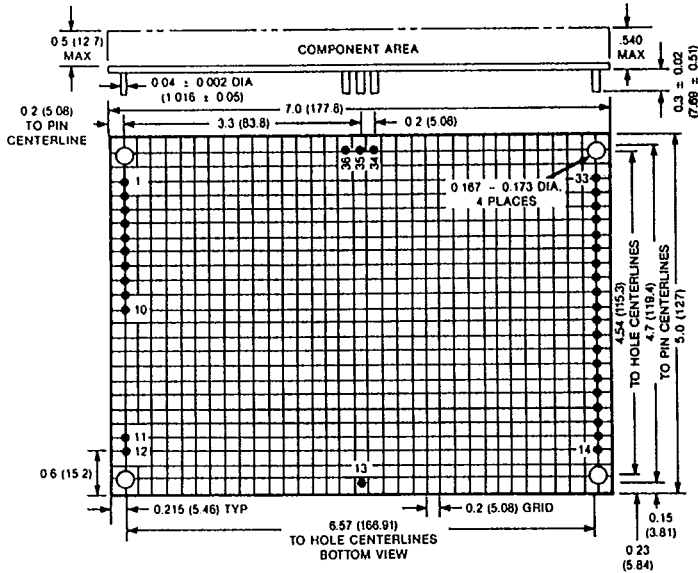
The analog input signal is applied through the input buffer amplifier to a proprietary ultra-high-speed 4-bit flash converter and S/H amplifier. The output of the 4-bit flash is applied to a true 10-bit video speed DAC. This output is subtracted from the input and the output is then digitized by a 7-bit flash converter. The 4-bit initial conversion and 7-bit second conversion are combined with 1 bit of digital correction overlap, to provide the 10-bit output results. This A/D architecture is a Digitally Corrected Sub-Ranging (DCSR) structure and has all of the error correction benefits of this approach.

A custom digital IC provides the digital correction circuitry and output latches necessary for the ZAD1025's proper operation.

Using custom IC's and the latest analog circuit design, the ZAD1025 has fewer parts and dissipates 35% less power than older designs. This reduction in component count and heat dissipation results in a converter that is more stable and much more reliable.



ZAD1025 Timing Diagram



Mechanical Configuration

Pin Assignments

1	GROUND	19	BIT 8
2	ENCODE COMMAND	20	BIT 7
3	ENCODE COMMAND	21	BIT 7
4	GROUND	22	BIT 6
5	-5.2 V	23	BIT 6
6	+15 V	24	BIT 5
7	-15 V	25	BIT 5
8	GROUND	26	BIT 4
9	ANALOG INPUT #1	27	BIT 4
10	ANALOG INPUT #2	28	BIT 3
11	+5 V	29	BIT 3
12	GROUND	30	BIT 2
13	GROUND	31	BIT 2
14	BIT 10 (LSB)	32	BIT 1
15	BIT 10	33	BIT 1 (MSB)
16	BIT 9	34	DATA READY
17	BIT 9	35	GROUND
18	BIT 8	36	DATA READY

All ground pins are connected together within the ADC.

Offset and Gain Adjustment

The offset of the ZAD1025 is adjusted by varying the offset adjustment potentiometer. Apply an input voltage corresponding to positive full scale to the analog input. Adjust the offset adjustment potentiometer such that the digital output is changing between 111111111 and 111111110.

The gain of the ZAD1025 can be adjusted by varying the gain adjustment potentiometer. Apply an input voltage to the analog input that corresponds to negative full scale. Adjust the gain adjustment potentiometer such the digital output is between 000000000 and 000000001. Refer to diagram to determine proper input voltages for the offset and gain adjustments.

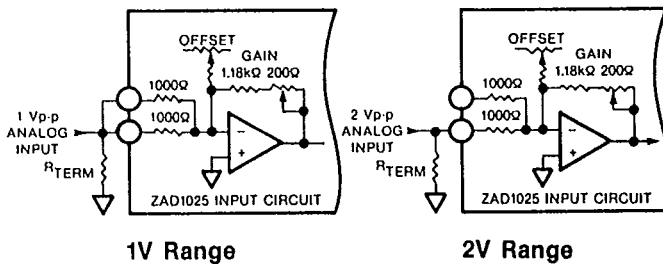


Figure 4 — Input Connection

Table 4 — Input Voltage

Offset Adjust Setting	1V Range	2V Range
1/8 from full CW (Bipolar)	- .4995V, + .4995V	- .999V, + .999V
1/8 from full CW (Unipolar)	0V, + .999V	0V, + 1.998V

Additional Products from Analog Solutions

- Precision Sampling A/D Converters
- Precision 16-bit and 18-bit D/A Converters
- High-Performance Sample/Hold Amplifiers
- Special Amplifiers: Logarithmic, Isolation
- High-Speed Telecommunications A/D and D/A Systems
- High-Speed Industrial Control Interfaces
- Precision Strain Gage and Load Cell Measurement Sub-systems

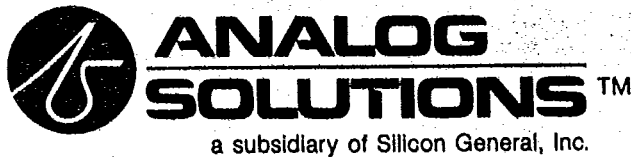
Custom Products

We invite customers to take full advantage of our custom design capability to provide the optimum product solution. Please contact our sales department for further information.

To Order Simply Specify:

Since every ZAD1025 operates over the full DC to 25 MHz conversion rate, no special encode rate suffixes are required.

For more information, contact Analog Solutions



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