



**ANALOG
SOLUTIONS™**

a subsidiary of Silicon General, Inc.

ZAD2735

**Low Distortion 15-Bit
Sampling A/D Converters**

T-51-10-90



Applications

- Medical Imaging Data Acquisition
- Satellite Communications
- High-Speed Automatic Test
- Professional Studio Audio
- Program Audio for Broadcast

Key Features

- No Over-Range Output Foldover
- Optional Offset Binary Coding
- High Speed: 125 kHz Throughput
- Built-In Sample-Hold
- Superior Linearity Throughout Signal Range
- Optimized for MRI and Audio Applications
- Low Harmonic Distortion
- Pin-Compatible with MP2735

Solutions for Data Conversion

Offering enhanced performance and improved reliability, the Analog Solutions ZAD2735 Series sets a new standard for 15-bit sampling A/D converters. Utilizing the latest IC technology and Analog Solutions' advanced circuit designs, the ZAD2735 contains up to 20 percent fewer parts than earlier designs, resulting in enhanced reliability and performance.

The ZAD2735 Series is the solution to your A/D conversion needs.

General Description

The ZAD2735 is a high-performance, high-speed, 15-bit sampling A/D converter designed for audio and MRI applications. With zero crossover linearity and mid-range differential linearity of only 0.25 LSB, the ZAD2735 faithfully digitizes complex waveforms.

Good digitization of audio and MRI signals requires exceptional linearity and long-term stability around zero. This critical high performance is provided through proprietary circuit design that reduces the converter's sensitivity to individual component drift, and through the use of carefully selected and tested resistor networks.

The ZAD2735 is available with or without the built-in sample/hold and with binary coding, offset binary coding, or complementary offset coding. See the ordering guide on the back for details.

PERFORMANCE SPECIFICATIONS

ZAD2735 LOW DISTORTION 15-BIT SAMPLING A/D CONVERTERS

<p>ANALOG INPUT</p> <p>Full-Scale Range (FSR) ± 5 V</p> <p>Input Impedance 100 MΩ//10 pF</p> <p>Reference Input Voltage -6.4 V</p> <p>Reference Input Impedance 2.7 kΩ</p>	<p>DIGITAL CONTROLS</p> <p>Control Compatibility TTL logic levels</p> <p>Trigger (positive transition):</p> <p> Fan In 1 TTL unit load</p> <p> Width 50 ns min</p>
<p>ACCURACY</p> <p>Resolution 15 bits</p> <p>Quantization Error ± 0.5 LSB</p> <p>Relative Accuracy of ADC @ 200 kHz Conversion Rate $\pm 0.005\%$ FSR max</p> <p>FSR Factory-Adjusted to $\pm 0.01\%$¹</p> <p>Offset Factory-Adjusted to ± 1 mV¹</p> <p>Differential Linearity ± 0.5 LSB max, 0.25 LSB typical at ≤ 0.25 FSR</p> <p> ± 1 LSB max, ± 0.25 LSB typical at > 0.25 FSR</p> <p>Monotonicity Guaranteed</p> <p>Noise (10 Hz to 100 kHz) 25 μV rms</p> <p>Zero Code (0° to 60°C) Continuous and mono- tonic through zero</p> <p>Missing Codes³ None over 0°C to 60°C</p>	<p>AC CHARACTERISTICS</p> <p>Conversion Rate:</p> <p>ZAD2735-1, ZAD2735-1B 125 kHz min²</p> <p>ZAD2735-2, ZAD2735-2B 200 kHz min</p> <p>A/D Conversion Time:</p> <p> ZAD2735-1, -1B 5 μs max</p> <p> ZAD2735-2, -2B 5 μs max</p> <p>S/H Acquisition Time 3 μs max</p> <p>S/H Slew Rate 10 V/μs</p> <p>S/H Aperture Delay⁴ 8 ns typical, 12 ns max</p> <p>S/H Aperture Uncertainty⁴ ± 0.2 ns, ± 0.4 ns, max</p> <p>S/H Feedthrough⁴ -96 dB typical, -90 dB max</p> <p>Harmonic Distortion $\pm 0.005\%$ max⁴</p>
<p>STABILITY</p> <p>Temperature Coefficient of Differential Linearity for Mid-Range Outputs (± 0.125 FSR) ± 0.5 ppm FSR/$^{\circ}$C max</p> <p>Over the Full-Scale Range ± 1 ppm FSR/$^{\circ}$C max</p> <p>Temperature Coefficient of Gain ± 10 ppm/$^{\circ}$C, typical ± 30 ppm/$^{\circ}$C max</p> <p>Temperature Coefficient of Offset ± 10 ppm FSR/$^{\circ}$C max</p> <p>Power Supply Sensitivity:</p> <p> Gain $\pm 0.001\%$ per % change in power supply</p> <p> Offset ± 15 ppm of FSR per volt change in power supply</p> <p>Warm-Up Time 10 minutes</p>	<p>POWER</p> <p>+15 V $\pm 3\%$ 45 mA typical</p> <p>-15 V $\pm 3\%$ 60 mA typical</p> <p>+ 5 V $\pm 5\%$ 65 mA typical</p> <p>- 5 V $\pm 5\%$ 55 mA typical</p> <p>ENVIRONMENTAL</p> <p>Temperature Range:</p> <p> Rated Performance 0°C to 60°C</p> <p> Storage -25°C to 70°C</p> <p>Relative Humidity 0 to 85% non-condensing up to 40°C</p>
<p>DIGITAL OUTPUTS</p> <p>Parallel Data:</p> <p> Fan Out 2 TTL unit loads/line</p> <p> Coding:</p> <p> ZAD2735-1, ZAD2735-2 Complementary Offset Binary</p> <p> ZAD2735-1B, ZAD2735-2B Normal Offset Binary</p> <p>End of Conversion (EOC) High during conversion</p> <p> Fan Out 2 TTL unit loads</p>	<p>MECHANICAL</p> <p>Packaging:</p> <p> Dimensions 3"×4"×0.44"</p> <p>Shielding Electromagnetic 5 sides Electrostatic 6 sides</p> <p>Case Potential Ground</p>

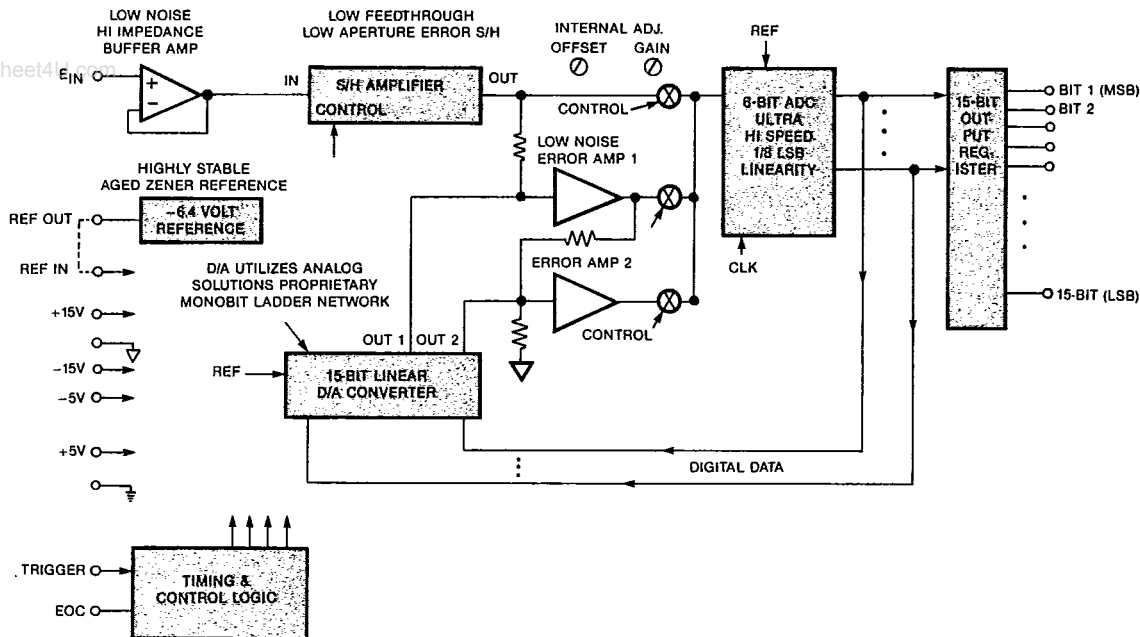
¹ Internal pots allow field calibration.

² Including internal S/H.

³ These specifications represent enhanced performance.

⁴ For full-scale 20 kHz input.

⁵ Unit contains CMOS devices and should be handled with standard CMOS safety precautions.



ZAD2735 Three-Pass Digitally Corrected Sub-Ranging (DCSR) Architecture

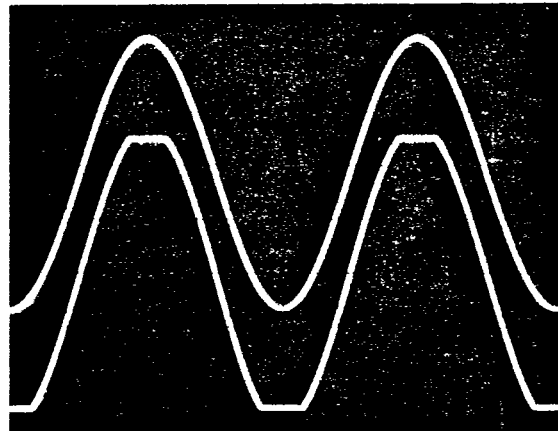
Description of Converter

The ZAD2735 Series provides premium converter performance. The Series design is based on a proprietary three-pass Digitally Corrected Sub-Ranging (DCSR) technique which is applied in conjunction with our proven "monobit" D/A converter architecture.

The converter consists of an ultra-linear sample/hold (ZAD2735-1, -1B), an eight-bit flash, and a 15-bit accurate monobit DAC. The flash is utilized only to the six-bit level to ensure long-term accuracy. The monobit DAC reduces the converter's sensitivity to resistor drift.

The combination of the three-pass DCSR technique and monobit DAC provides up to four times more allowance for component variation and drift than the older two-pass sub-ranging converters.

This conservative design approach ensures that the unit will stay within specification over its full temperature range and that long-term drift is minimized.



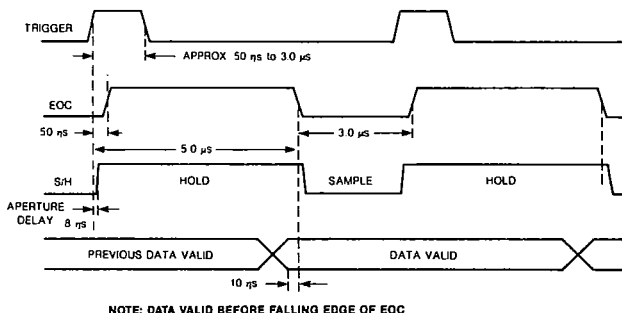
Reconstructed Output Signals

Foldover

Some ADC designs experience a condition of "foldover", where the output code returns to the active region even though the input voltage has exceeded the full-scale range.

This severe performance limitation can cause system problems, for there is no way that the digital system can know that the input voltage has exceeded the linear range.

To avoid the problem of "foldover", some users reduce the input signal range to assure themselves that the input never exceeds full scale. This reduces the dynamic range and reduces the effectiveness of using a 15-bit converter. By eliminating the "foldover" problem, the ZAD2735 allows the user to utilize the full dynamic range of the converter. The $\pm FS$ codes can then be used as limits, correctly indicating maximum signal input or over-range. Note $\pm FS$ outputs in diagram above.



Timing Diagram

Coding

The ZAD2735 series is available with either Complementary Offset Binary coding or normal Offset Binary coding. See ordering guide for model number description.

COMPLEMENTARY OFFSET

Input Voltage	Output Code	
	MSB	LSB
+ 4.999694 V	00	.....00
+ 0.000305 V	011	.....10
+ 0.000000 V	011	.....11
- 0.000305 V	100	.....00
- 5.000000 V	11	.....11

OFFSET BINARY

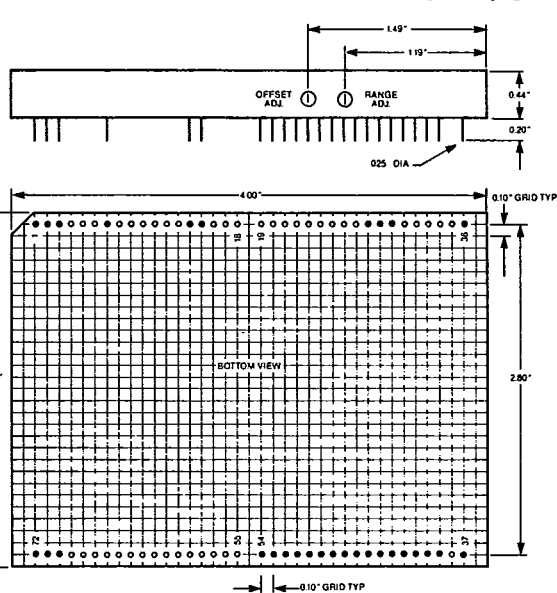
Input Voltage	Output Code	
	MSB	LSB
+ 4.999694 V	11	.....11
+ 0.000305 V	10	.....01
+ 0.000000 V	10	.....00
- 0.000305 V	01	.....11
- 5.000000 V	00	.....00

Additional Products from Analog Solutions:

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

Custom Products

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



Contact the factory for mechanical details.

Mounting Dimensions

Pin Assignments

1. +15V	37. TRIGGER	48. BIT 7
2. -15V	39. DIG. GND. ²	49. BIT 6
3. ANA. GND. ⁵	40. BIT 15 (LSB)	50. BIT 5
7. TEST POINT* ¹	41. BIT 14	51. BIT 4
14. ANA. GND. ⁴	42. BIT 13	52. BIT 3
15. ANA. IN	43. BIT 12	53. BIT 2
28. ANA. GND.	44. BIT 11	54. BIT 1 (MSB)
29. REF. IN	45. BIT 10	70. DIG. GND.
30. REF. OUT	46. BIT 9	71. -5 V
36. EOC	47. BIT 8	72. +5 V

NOTES:

- Pin 7 (test point) must be left open. Do not use as tie point.
- Digital and analog grounds are internally connected.
- Connect pin 29 to pin 30 if external reference is not used.
- All analog grounds are internally connected.
- Case connected to pin 3.

Ordering Guide

To order simply specify:

ZAD2735-1	Complementary offset coding incl. internal S/H
ZAD2735-1B	Offset binary coding incl. internal S/H
ZAD2735-2	Complementary offset coding without internal S/H
ZAD2735-2B	Offset binary coding without internal S/H

To place your order, contact Analog Solutions



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