

# SCD5932

Digital-to-Analog Converter, 14-Bit, Latched, Buffered Output

# RHD5932

## Features

- Radiation performance
  - Total dose:  $>1$  Mrad(Si); Dose rate = 50-300 rad(Si)/s
  - ELDRS Immune
  - SEL Immune:  $>100$  MeV-cm<sup>2</sup>/mg
  - Neutron Displacement Damage:  $>10^{14}$  neutrons/cm<sup>2</sup>
- 14-Bit DAC
- Buffered Output
- Single power supply operation +5V
- Low Power
- Full 4-quadrant multiplying DAC
- CMOS/TTL inputs
- Full military temperature range
- Designed for aerospace and high reliability space applications
- Packaging – Hermetic ceramic SOIC
  - 20 leads, 0.514"L x 0.300"W x 0.120"Ht
  - Typical Weight 1.0 grams
- **Radiation Hardness Assurance Plan: DLA Certified to MIL-PRF-38534, Appendix G.**

## General Description

The RHD5932 is a radiation hardened, single supply, 14-Bit, Buffered, DAC in a 20-pin SOIC package. The RHD5932 design uses specific circuit topology and layout methods to mitigate Total Ionizing Dose effects and Single Event Latchup. These characteristics make the RHD5932 especially suited for the harsh environment encountered in Deep Space missions. It is guaranteed operational from -55°C to +125°C. Available screened in accordance with MIL-PRF-38534 Class K, the RHD5932 is ideal for demanding military and space applications.

## Organization and Application

The CAES RHD5932 14-Bit DAC is a standard CMOS R/2R Kelvin resistor network with a buffered output. The digital inputs, D13<sub>(MSB)</sub> through D00<sub>(LSB)</sub>, are buffered to drive single-pole double-throw CMOS switches to apply either the PREF or NREF signals to the 2R legs of the resistor network.

PREF and NREF inputs can be any static or dynamic voltage within the power supply range. The nominal values for R and 2R are 4K and 8K respectively. The characteristic impedance of the resistor network is approximately 4K.

The voltage-output configuration of the integrated circuit can be thought of as a digitally controlled voltage with a value of PREF-NREF with a high output impedance. The output will swing rail-to-rail if unloaded. Applications include digital potentiometers, programmable voltage sources and a large variety of other circuits that can be found in many industry references.

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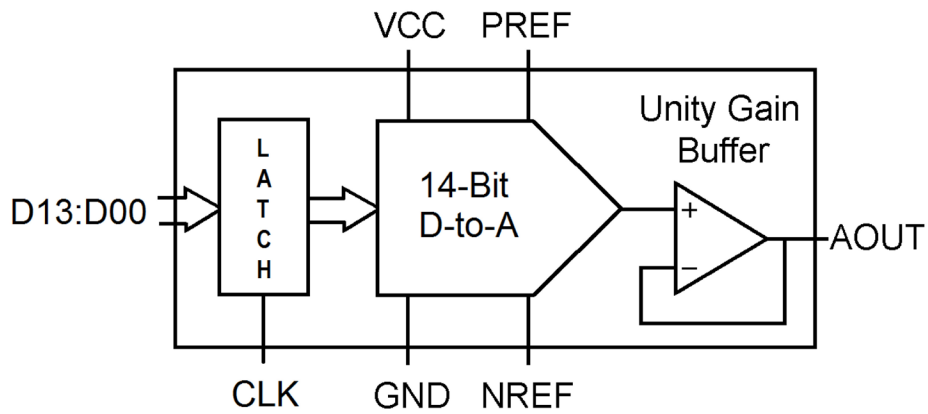


Figure 1: Block Diagram

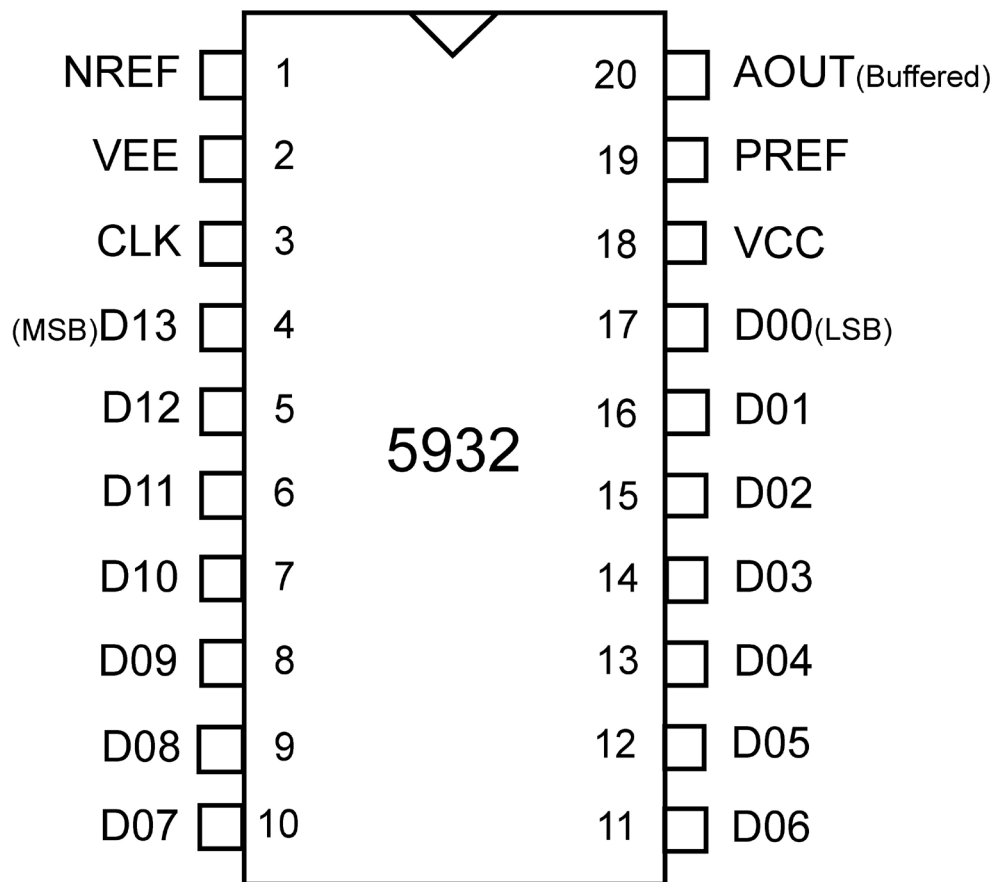


Figure 2: Package Pinouts

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Pin #s	Signal	Definition	Pin #s	Signal	Definition
1	NREF	Low Reference Voltage	11	D06	Digital input Bit 6
2	VEE	- Voltage Supply.	12	D05	Digital input Bit 5
3	CLK	A Low-to-High transition will Latch the input 14 bit configuration	13	D04	Digital input Bit 4
4	D13 <sub>(MSB)</sub>	Most significant Digital Input (Bit 13)	14	D03	Digital input Bit 3
5	D12	Digital input Bit 12	15	D02	Digital input Bit 2
6	D11	Digital input Bit 11	16	D01	Digital input Bit 1
7	D10	Digital input Bit 10	17	D00 <sub>(LSB)</sub>	Least significant Digital Input (Bit 0)
8	D09	Digital input Bit 9	18	VCC	+ Voltage Supply.
9	D08	Digital input Bit 8	19	PREF	High Reference Voltage
10	D07	Digital input Bit 7	20	AOUT	Buffered Output of the converter

Figure 3: Package Pinout Definitions

## Absolute Maximum Ratings

Parameter	Range	Units
Case Operating Temperature Range	-55 to +125	°C
Storage Temperature Range	-65 to +150	°C
Junction Temperature	+150	°C
Lead Temperature (soldering, 10 seconds)	300	°C
Thermal Resistance, Junction to Case, $\theta_{jc}$	10	°C/W
Supply Voltage +V <sub>CC</sub>	+7.0	V
PREF relative to NREF	+6.0	V
Digital Input Voltage	V <sub>CC</sub> +0.4 GND -0.4	V
Power @25°C	60	mW

## Notice:

- 1) Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only; functional operation beyond the "Operation Conditions" is not recommended and extended exposure beyond the "Operation Conditions" may affect device reliability.

## Recommended Operating Conditions

Symbol	Parameter	Typical	Units
+V <sub>CC</sub>	Power Supply Voltage	5.0	V

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**Electrical Performance Characteristics**(T<sub>c</sub> = -55°C to +125°C, +V<sub>CC</sub> = +5.0V -- Unless otherwise specified)

Parameter	Symbol	Conditions	MIN	MAX	Units
Resolution <u>2</u> /	N			14	Bits
Supply Current	I <sub>CC</sub>	Toggle Inputs, V <sub>CC</sub> , GND		8	mA
Quiescent Current <u>1</u> /	I <sub>CCQ</sub>	All Inputs = V <sub>CC</sub>		7	mA
Relative Accuracy <u>1</u> /	INL	PREF = 4.9 V, NREF = 0.1 V		60	LSBs
Gain Error <u>1</u> /	A <sub>E</sub>	PREF = 4.9 V, NREF = 0.1 V		100	LSBs
Offset Error <u>1</u> /	O <sub>FF</sub>	PREF = 4.9 V, NREF = 0.1 V		75	LSBs
Differential Nonlinearity <u>1</u> /	DNL	PREF = 4.9 V, NREF = 0.1 V		10	LSBs
Output Settling Time	T <sub>D</sub>	All inputs = GND to V <sub>CC</sub> , PREF = 4.9 V, NREF = 0.1 V, Output = 1/2 LSB of Nominal		5	us
Input Hi Voltage <u>1</u> /	V <sub>IH</sub>	PREF = 4.9 V, NREF = 0.1 V	3.5		V
Input Lo Voltage <u>1</u> /	V <sub>IL</sub>	PREF = 4.9 V, NREF = 0.1 V		1.5	V
PREF Input Z <u>1</u> /	Z <sub>P</sub>			4	KΩ
NREF Input Z <u>1</u> /	Z <sub>N</sub>			4	KΩ
Input Leakage <u>1</u> /	I <sub>IL</sub>	Input under test = GND		5	nA
Input Leakage <u>1</u> /	I <sub>IH</sub>	Input under test = V <sub>CC</sub>		5	nA

**Notes:**

- 1) Specification derated to reflect Total Dose exposure to 1 Mrad(Si) @ +25°C.
- 2) Not Tested. Shall be guaranteed by design, characterization, or correlation to other test parameters.

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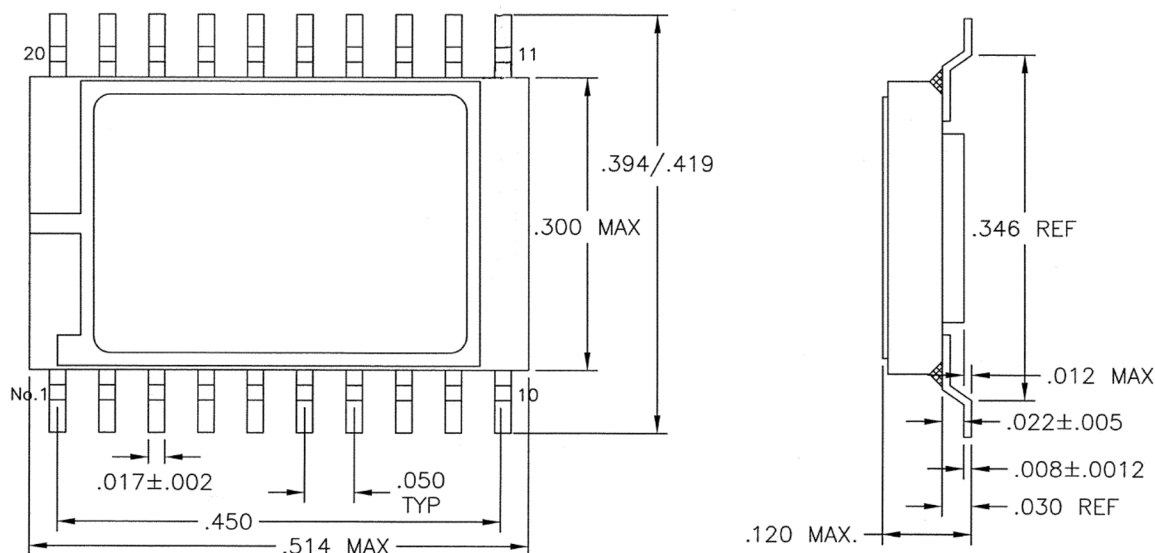


Figure 2: Package Outline

**Note:**

- 1) Package and lid are electrically isolated from signal pads.

## Ordering Information

Model	DLA SMD #	Screening	Package
RHD5932-7	-	Commercial Flow, +25°C testing only	20-pin SOIC Package
RHD5932-S	-	Military Temperature, -55°C to +125°C Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications	
RHD5932-201-1S	5962-1320101KXC	In accordance with DLA SMD	
RHD5932-201-2S	5962-1320101KXA		
RHD5932-901-1S	5962H1320101KXC	In accordance with DLA Certified RHA Program Plan to RHA Level "H", 1 Mrad(Si)	
RHD5932-901-2S	5962H1320101KXA		

## Revision History

Date	Revision	Change Description
03/28/2016	C	Import into CAES format
03/17/2021	D	Revised per ECN 23555

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**Datasheet Definitions**

	DEFINITION
Advanced Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet <b>is subject to change</b> . Specifications can be <b>TBD</b> and the part package and pinout are <b>not final</b> .
Preliminary Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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