

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

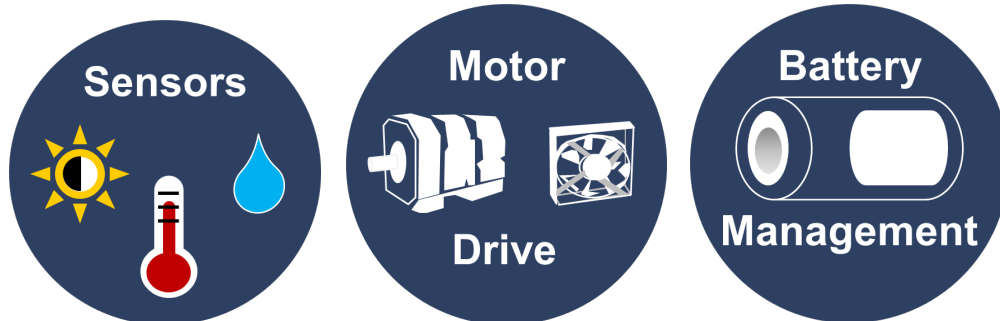
---

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



**ON Semiconductor®**

## **NCD98010 SAR ADC Evaluation Board User Guide**



**Table of Contents**

<a href="#"><u>Introduction</u></a> .....	<a href="#"><u>3</u></a>
<a href="#"><u>Startup Procedures</u></a> .....	<a href="#"><u>4</u></a>
<a href="#"><u>Performance Considerations</u></a> .....	<a href="#"><u>7</u></a>
<a href="#"><u>Board Options for Application Specific Development</u></a> .....	<a href="#"><u>8</u></a>
<a href="#"><u>Collateral Viewing</u></a> .....	<a href="#"><u>10</u></a>

# Introduction

The STR-NCD98010-GEVK SAR ADC evaluation board provides hardware to realize a full analog to digital signal path required to analyze the performance metrics of the NCD98010 ADC. The block diagram below shows the signal path used to capture samples from the ADC for analysis. The user’s computer running the Strata Application connects to the board’s USB connector for data transfer and power.



Figure 1: NCD98010 Evaluation Board

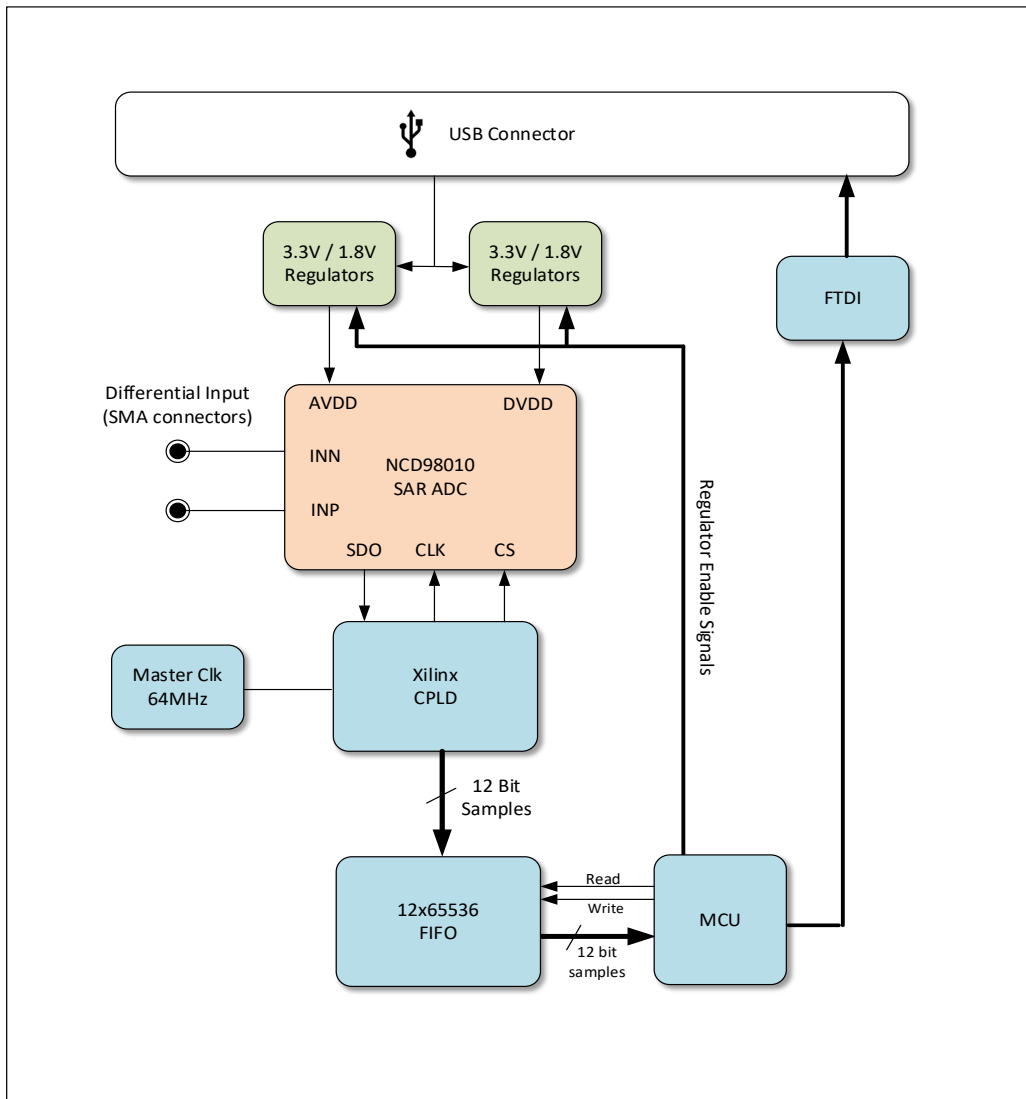


Figure 2: NCD98010 SAR ADC Evaluation Board Block Diagram

## Features

12-bit Analog to Digital Conversion	<ul style="list-style-type: none"> <li>Fully Differential Input</li> <li>Low 2pF Input Capacitance</li> </ul>
Digital SPI Interface	<ul style="list-style-type: none"> <li>Available in Signed and Unsigned Output Formats</li> </ul>
Split Analog / Digital Supplies	<ul style="list-style-type: none"> <li>Digital and Analog Supplies can be Supplied Separately from 1.65V to 3.6V</li> </ul>
Low Power Consumption	<ul style="list-style-type: none"> <li>7uA at 100 kSPS</li> <li>Analog Current Consumption can go down to nano-amps with Slower Clock Rates.</li> </ul>
Small Package Size	<ul style="list-style-type: none"> <li>1.5 x 1.5 mm 8-pin X2QFN</li> </ul>
Pre-Calibrated	<ul style="list-style-type: none"> <li></li> </ul>

## Applications

Low-Power Data Acquisition	<ul style="list-style-type: none"> <li>Battery-Powered Equipment</li> <li>Level Sensors</li> <li>Ultrasonic Flow Meters</li> <li>Motor Controls</li> <li>Wearable Fitness Devices</li> <li>Portable Medical Equipment</li> <li>Glucose Meters</li> </ul>
----------------------------	--

## Startup Procedure

1. Connect computer running the ON Semiconductor Strata Application to the evaluation board using the provided USB cable.

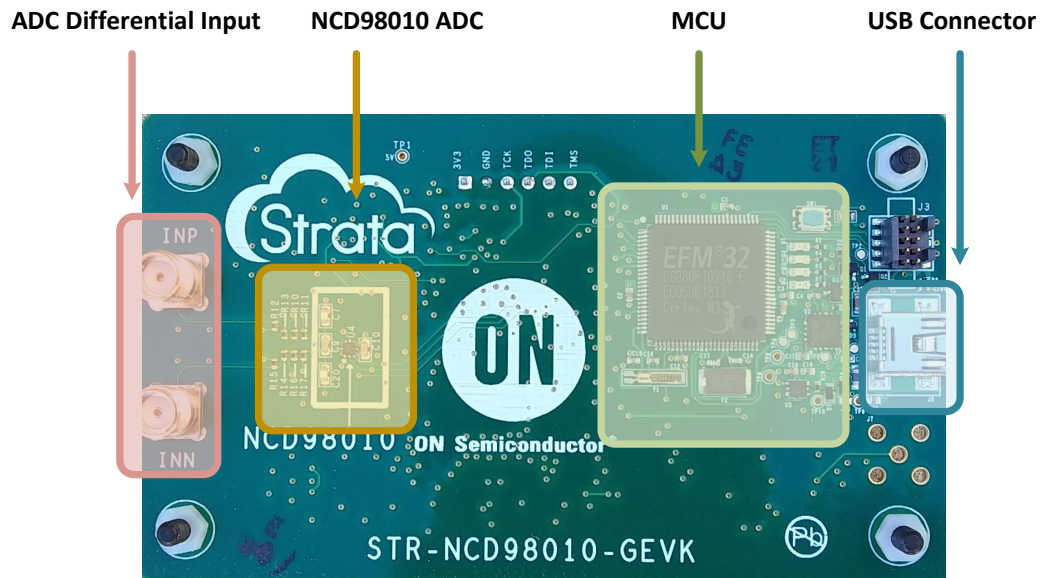


Figure 5: NCD98010 Evaluation Board Front

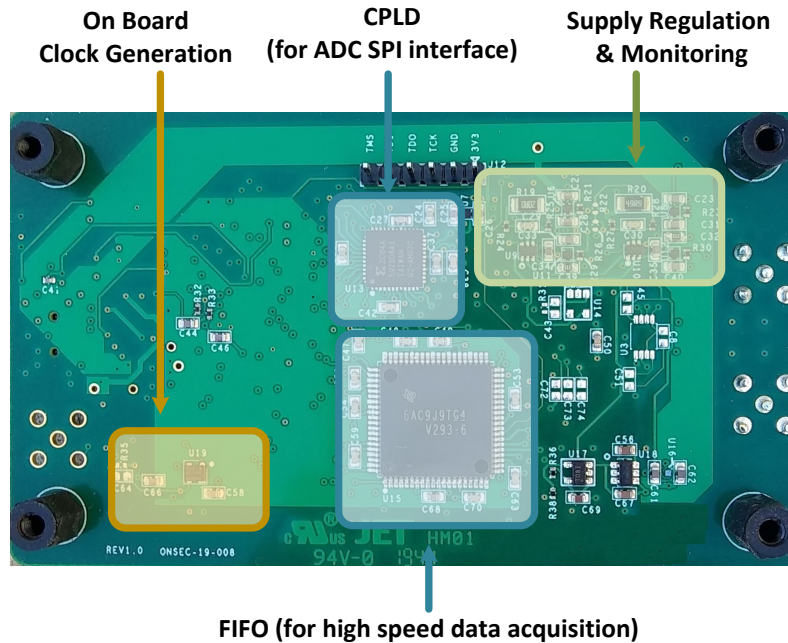


Figure 5: NCD98010 Evaluation Board Back

2. Start the Strata Application found at [onsemi.com/strata](https://onsemi.com/strata).
3. Create a login.

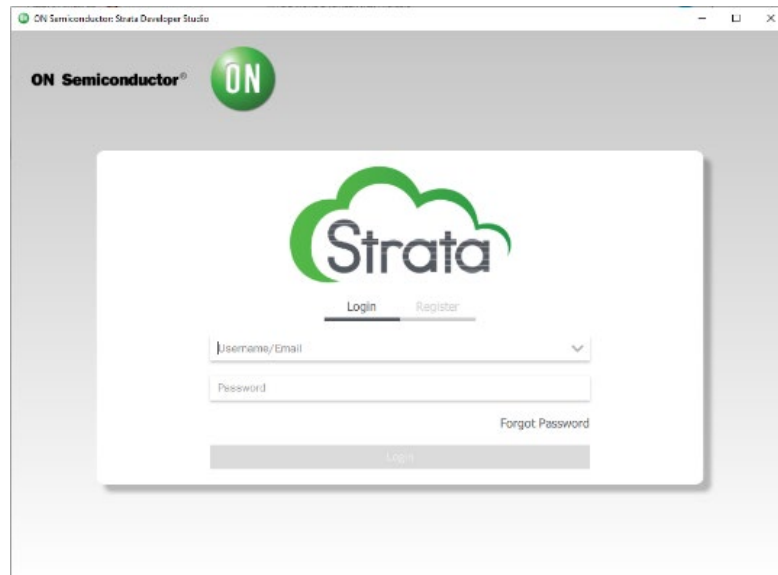


Figure 3: Strata Login Window

The Strata Application will recognize the evaluation board connected via USB and will bring up the evaluation board specific user interface. (The evaluation board can be connected after the Strata App has been launched).

- The user interface, as shown below, allows the user to change the NCD98010 clock and supply stimuli. The clock pull down menu allows the user to choose between a number of clock rates supported by the evaluation board. 3.3V and 1.8V options are available for both AVDD and DVDD supplies. Every time the supplies or the clock are changed by the user, the power consumption measurements are updated. The power consumption measurements are most accurate when the ADC INN and INP inputs are not active. Input signals may supply AC currents that can add to or subtract from the actual ADC current.

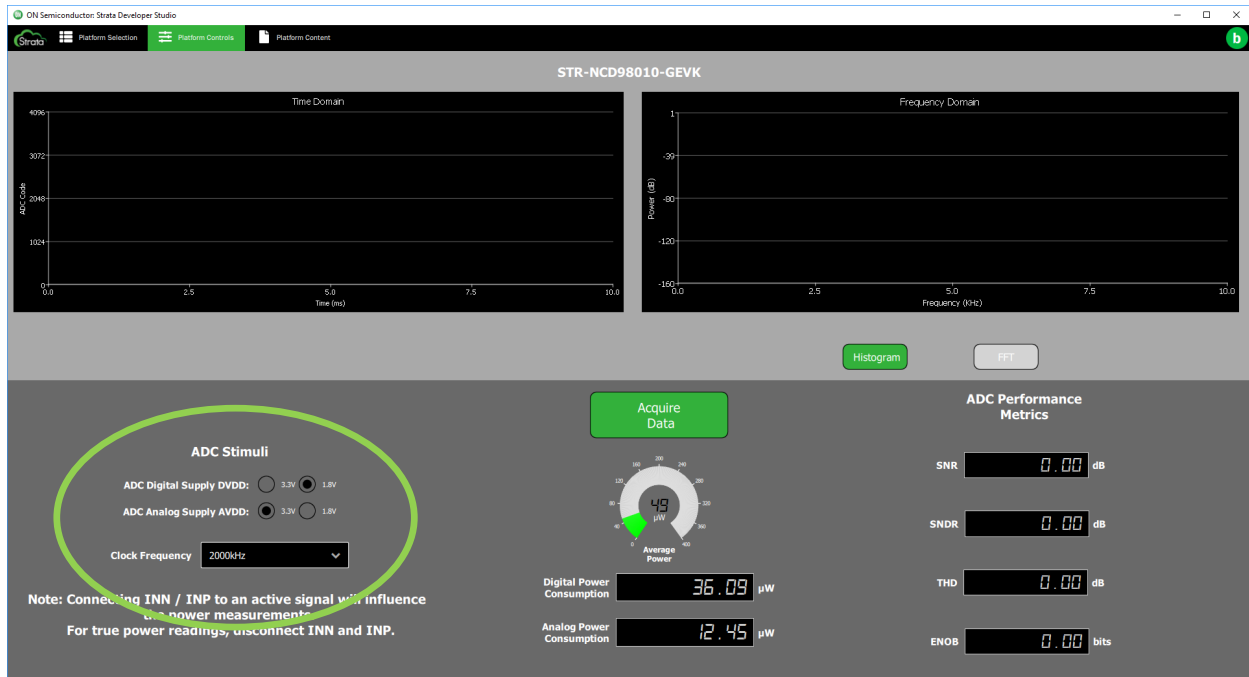


Figure 4: NCD98010 SAR ADC Strata UI Window

- Connect the INN and INP inputs to the ADC to a signal generator. With the differential inputs active, the setup is ready to acquire data.
- Click the “Acquire Data” button. 8,192+ samples will be collected from the ADC at the sample rate of clock/16 and loaded into the evaluation board FIFO. The contents of the FIFO will then be communicated to the Strata GUI. During this time there will be a green LED indicating this communication.



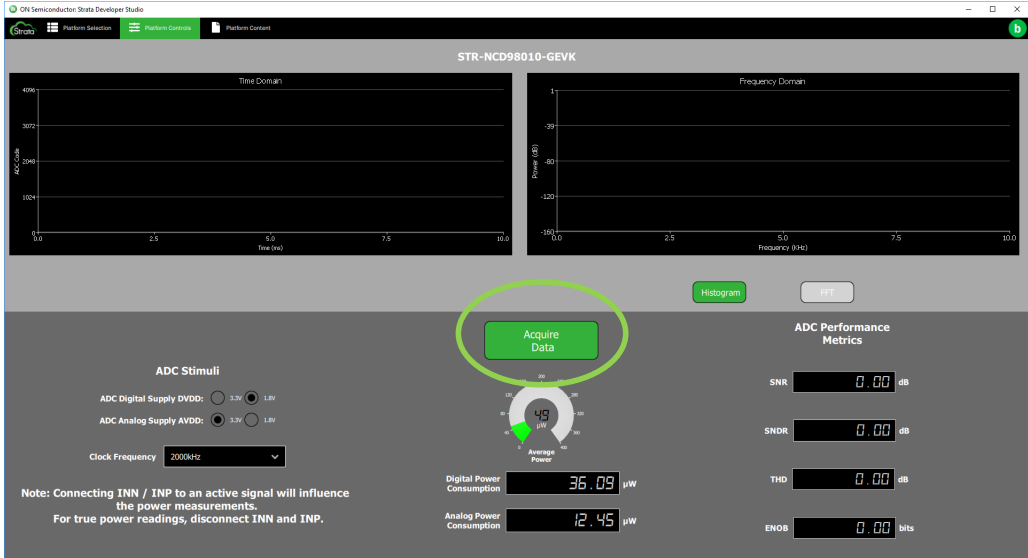


Figure 6: SAR ADC Data Acquisition Button

- 7. Once the data has been transmitted, the Strata GUI will analyze and plot the data. After some time, the time domain, frequency domain, and histogram plots will be populated.



Figure 7: SAR ADC UI Post Data Acquisition

## Performance Considerations

The data from any differential signal connected to the ADC inputs will be shown in the time domain plot. However, the AC metrics shown on the right hand side of the user interface are best demonstrated when the differential signal has the following characteristics:

- Single frequency, differential signal, where INN and INP inverted from one another and in sync with each other.
- Differential input signal fundamental is less than 1/2 the Nyquist frequency, where the Nyquist frequency is defined as  $F_{\text{NYQUIST}} = \text{clock}/32$ .
- Differential input amplitude is very near the analog supply so that nearly the full range of the ADC is utilized. If 3.3V is selected for the analog supply, then the differential input amplitude should be  $\sim 3.29\text{V}$  peak to peak.
- Common mode of the differential input signal should be the center of the ADC range. For a 3.3V analog supply, the common mode should be 1.65V. For a 1.8V analog supply, the common mode should be 900mV. The analog supply (AVDD) is the ADC reference voltage.
- Input frequency should not be a multiple of the clocking frequency. If the input frequency is a direct multiple of the sampling rate, aliasing may occur, which will negatively affect performance metrics.
- Differential input must be supplied by a low noise low jitter source. The board's anti-aliasing filter will help to remove frequency content higher than the Nyquist frequency. Any noise less than 2 MHz will pass through the input filtering and will adversely affect the ADC performance metrics.

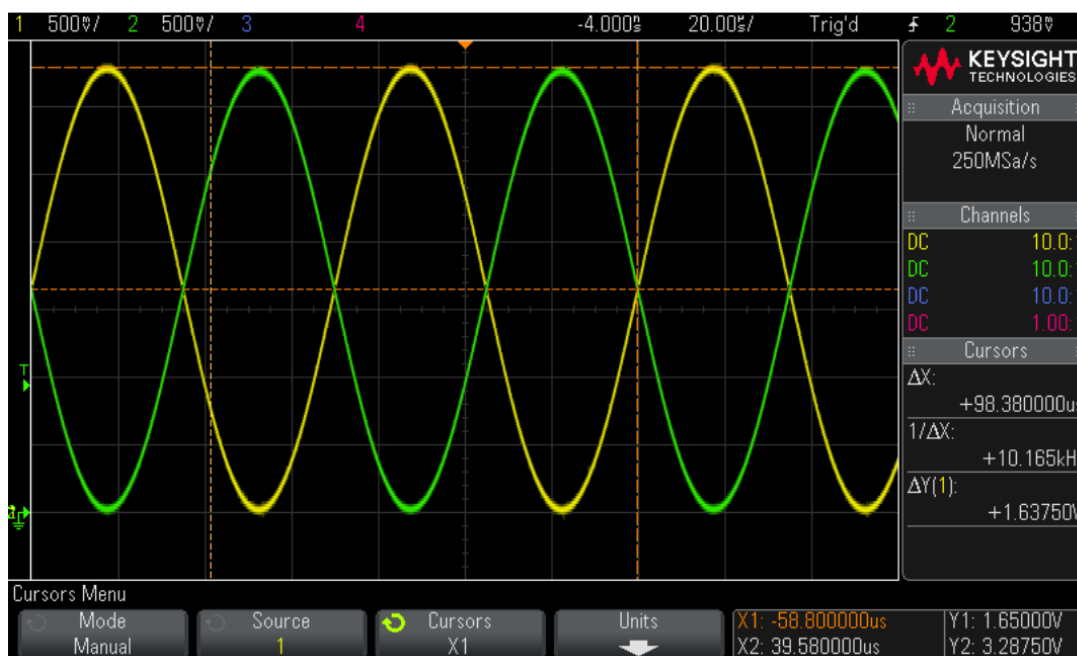


Figure 8: Sinusoidal Differential Input Signal Example

## Board Options for Application Specific Development

The NCD98010 evaluation board has additional utility allowing the user to use the board for application development.

### Differential Input Filtering

The noise performance of the ADC can never be better than the noise content in the differential input. For this reason, an input anti-aliasing filter is critical for good SNR performance. The evaluation board has a generic common mode filter and low pass filters on INN and INP. The values of the passives for these filters can be altered to improve the ADC performance for clock rates lower than 32 MHz. See the applications section of the NCD98010/1 datasheet for more information regarding input filtering.

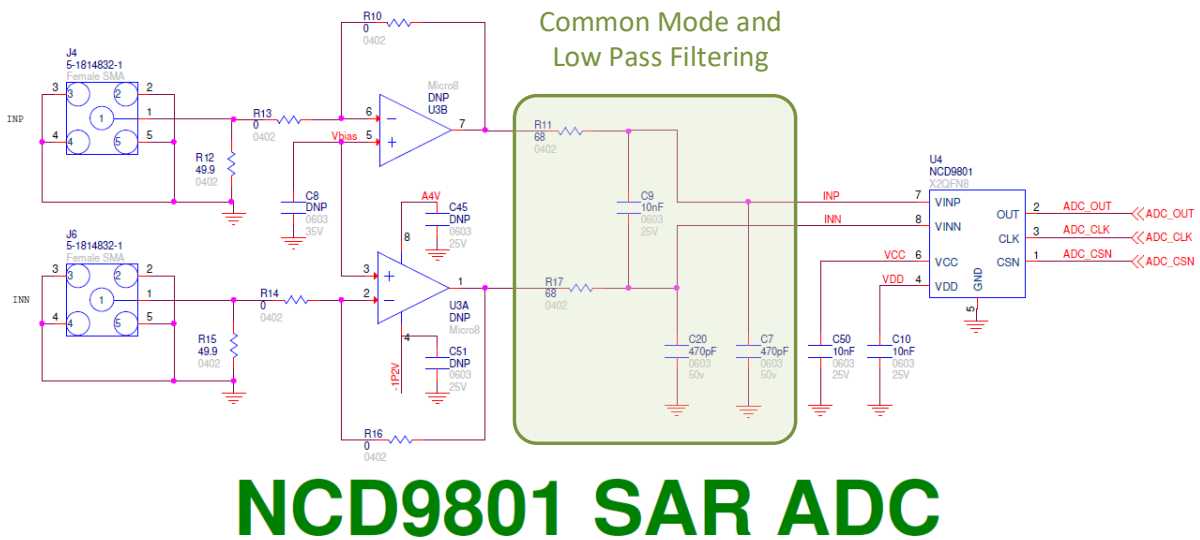


Figure 9: Differential Input Common Mode and Low Pass Filters

### Differential Input Buffering

The board provides vacant spots for amplifiers on the INN and INP inputs that can be used for buffering and active filtering. This may be useful if the user is connecting the board to a very high impedance application. The board has 50Ω termination resistors from INN and INP to ground. These can be removed if the differential input source cannot drive 50Ω termination. The input impedance of the NCP98010 is extremely high, with very little input capacitance. This alleviates the need for an input buffer in most cases.

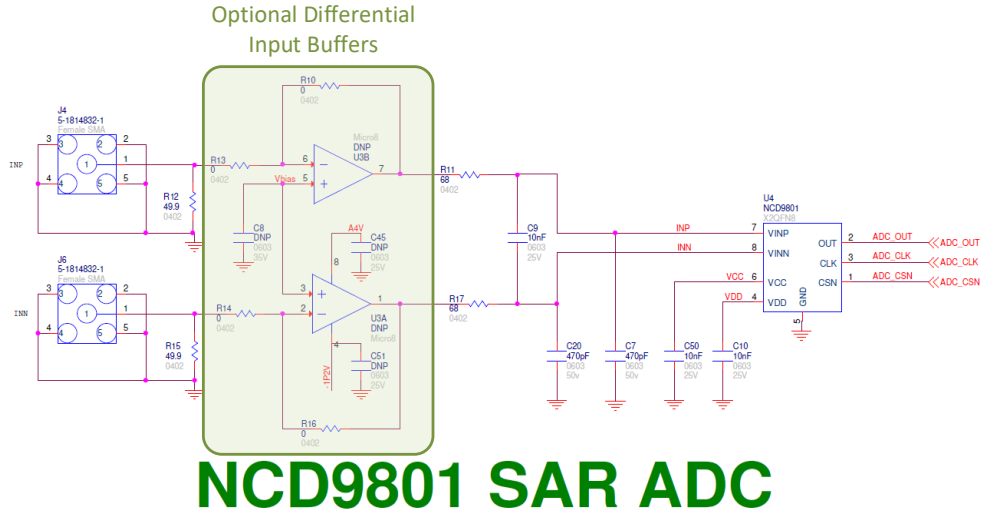


Figure 10: Optional Input Buffering

If the input buffer is populated, a location for additional circuitry for generating a common mode voltage is also provided.

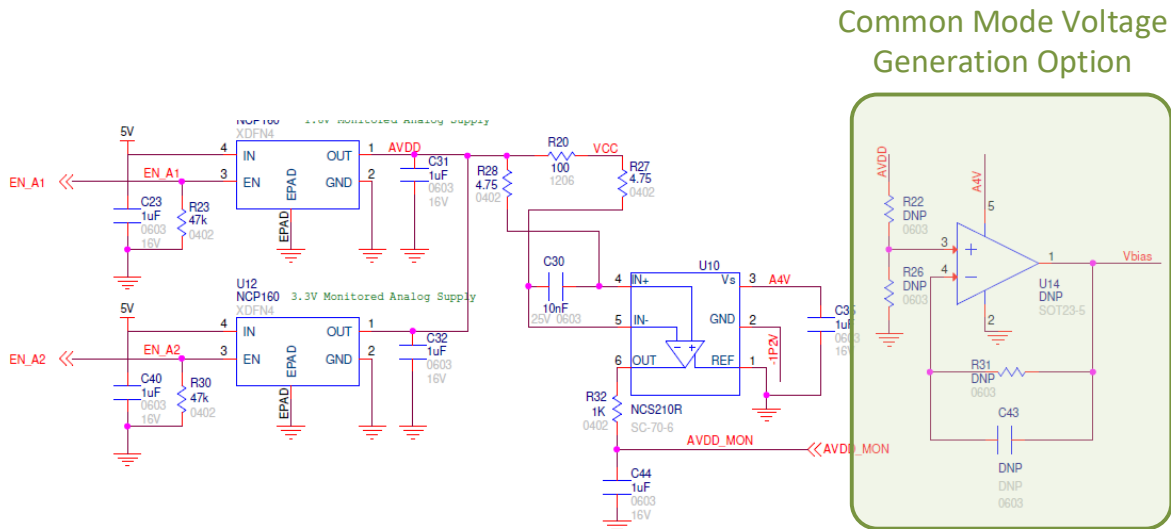


Figure 11: Optional common mode voltage generation for differential input buffers

The differential input buffers and common mode voltage generation circuitry is not populated by default.

## Collateral Viewing

Click the “Platform Content” button at the top of Strata to view system content. This content always pulls from the most current documentation and allows the user to access the following documentation all in one place:

- Evaluation Board Schematic
- Evaluation Board Layout
- Evaluation Board BOM
- Test Report
- Evaluation Board Users Guide
- Block Diagram
- Demo Setup
- Part Datasheets
- Fabrication Files
- Cad Design Files

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <https://www.onsemi.com/site/pdf/Patent-Markinq.pdf>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULLFILLMENT:

Literature Distribution Center for ON Semiconductor 19521  
E. 32nd Pkwy, Aurora, Colorado 80011 USA

**Phone:** 303-675-2175 or 800-344-3860 Toll Free  
USA/Canada

**Fax:** 303-675-2176 or 800-344-3867 Toll Free  
USA/Canada

**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

### N. American Technical Support:

800-282-9855 Toll Free USA/Canada

### Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910

### ON Semiconductor Website:

<https://www.onsemi.com/>

### Order Literature:

<https://www.onsemi.com/orderlit>

For additional information, please contact your  
local Sales Representative