ADS1115 may be destroyed

loek

ADS1115 may be destroyed

Mon Dec 22, 2014 1:46 pm

Bought some breakout boards ADS1115 for my project and I am puzzled by the warnings in the Adafruit documentation and driver software!

Literally it says:
Be careful to take note of the input voltage range when adjusting the gain or you can easily destroy the ADC!
and:
// The ADC input range (or gain) can be changed via the following
// functions, but be careful never to exceed VDD +0.3V max, or to
// exceed the upper and lower limits if you adjust the input range!
// Setting these values incorrectly may destroy your ADC!

The TI datasheet of the ADS1115 says about an input pin: voltage to GND = –0.3V to VDD + 0.3V. This makes sense and is independent of any internal gain settings. So, as long as an input pin stays within the electrical range mentioned above, one cannot destroy the chip be selecting a gain.

Or... am I missing something?

adafruit_support_bill

Re: ADS1115 may be destroyed

Mon Dec 22, 2014 3:13 pm

Can you post a link to where it says that? I don't see it in the tutorial.

loek

Re: ADS1115 may be destroyed

Tue Dec 23, 2014 3:10 am

Please find the snapshot of both warnings in the attachment. I now noticed that in the current version of the tutorial the remark has been removed (mine is of 08/2014 current is 11/2014). In the software (https://github.com/adafruit/Adafruit_AD ... eended.pde, etc) the warnings are still there.

Is it safe to assume that in the software the warnings should also be removed, i.e. the chip will not be destroyed by a large gain?

ATTACHMENTS

software.tiff (294.46 KiB) Viewed 2623 times

tutorial.tiff (190.36 KiB) Viewed 2623 times

adafruit_support_mike

Re: ADS1115 may be destroyed

Tue Dec 23, 2014 4:25 am

If you take a look at page 13 of the datasheet (http://www.adafruit.com/datasheets/ads1115.pdf),

it says:

> “

> Analog input voltages may never exceed the analog input voltage limits given in the Electrical Characteristics table

That table, on page 3, lists the full-scale analog input voltage as 4.096v/PGA.

There's some ambiguity as to whether exceeding the input range will damage the chip or just peg the output at a maximum value, but it's quite possible to mess up a PGA by exceeding its input range.. especially if the chip is using a switched capacitor feedback network instead of resistors. The datasheet says the ADS1115 uses a switched-cap delta-sigma ADC, so it's reasonable to think the PGA is made the same way.

You're welcome to try it and find out, but that's strictly an "at your own risk" kind of test.

loek

Re: ADS1115 may be destroyed

Tue Dec 23, 2014 5:26 am

I don't find the TI datasheet ambiguous. The "4.096v/PGA(1)" is a TYPICAL value of the full scale range, not a limit. The electrical limit can be found on the next line and under ABSOLUTE MAXIMUM RATINGS on page 2. The warning TI issues "(1) This parameter expresses the full-scale range of the ADC scaling. In no event should more than VDD + 0.3V be applied to this device." is for people who think that by setting the gain to 2/3 an electrical voltage of +/-6V would be allowed on an input... Not the other way around.

I'm disappointed that Adafruit apparently hasn't verified the assumption that their product can be destroyed with a simple software setting! I have nothing to prove, I believe you as the manufacturer have. I suggest Adafruit does its homework and then either reinstates the warning in the tutorial or removes the warning from the software. The current state of your documentation is what I call ambiguous.

Looking forward to your decision.

loek

Re: ADS1115 may be destroyed

Thu Jan 29, 2015 1:59 pm

Hi Mike,

As I didn't get any reaction from Adafruit, I took 5 minutes this morning to put your assumption to TI and got the following reply (http://e2e.ti.com/support/data_converte ... 89#1407689):

> Damage to the device may occur if the inputs go beyond VDD+0.3V or GND-0.3V (this is listed in the absolute maximum ratings on page 2 of the datasheet.
>
> However, if the inputs only over range the analog input (as in going beyond the full scale). There should be no risk of damage. The PGA is not implemented as an amplifier, but through a switched capacitor sampled scale, so there is no saturation to overcome. Also, the modulator is reset after each data sample sample is completed. The ADS1115 will give a full scale reading when over ranged and will give a correct reading in the first complete data period where the inputs are not over ranged.

I suggest you can safely remove the warnings from your documentation now.

loek

Re: ADS1115 may be destroyed

Tue Mar 24, 2015 1:41 pm

Apparently I'm talking to myself on this forum. Which is fine by me. Now telling myself not to buy Adafruit products anymore.

Thanks!

jtomerli

Re: ADS1115 may be destroyed

Tue Mar 24, 2015 6:40 pm

On the same subject, I have been having problems getting consistant readings from several ads1115's.
Is it safe to assume, if I use the gain setting of one that I need to use the arduino 3.3V as the VCC for the ads1115, since the 5V supply will be well over the 4.096V +.3V max?

loek

Re: ADS1115 may be destroyed

Fri Apr 10, 2015 2:35 am

Hello jtomerli,

Unlucky for you; you landed on a thread that is completely ignored by Adafruit Support. Let me try and help you.

For the ADS1115 you should use the highest Vcc possible so: 5V and not 3.3V. Having 5V, any input of the ADS1115 must be between -0.3V and +5.3V. So if your input is say 4V you are very safe. Note: this is safe for ALL possible gain settings. A high software gain setting will, at worst, cause your output signal to clip but it will NOT DESTROY your chip.

Hope this helps!

jtomerli

Re: ADS1115 may be destroyed

Fri Apr 10, 2015 10:51 am

Hi loek,

Thanks for your help, yes that does clarify it.
I was using the 3.3V hoping it had some filtering, since my USB power is very noisey. I am trying to accurately measure a mV signal, which is why I went with the 16 bit card to begin with and the noise doesn't help. Thanks again.

For whomever reads this, or not, I think the board is of good quality. The associated documentation and code are good, but written from a level that may be higher than many that will buy this card, me for one. In the past Adafruit products have a more hand-holding approach to the tutorial, ie fill in more of the blanks and questions that entry level users and coders will have. I have 5 cards, all of them have one problem or the other, usually one channel will not function or reads too high or low. I realize that there is a high probability that this is my doing, but I would think that a little more rudimentary instruction set or an overvoltage safety will help those of us
trying to learn electronics, which in my mind is the tenant that Arduino was built on.

loek

Re: ADS1115 may be destroyed

Fri Apr 10, 2015 11:35 am

Hello jtomerli,

Yes, I would agree with you. Scaring people doesn't make any sense, let alone when it is technically unfounded. I have a degree in electronics and software and a good 40 years of experience with product development, so I don't scare that easily!

To help setup the ADS1115 correctly for your application, cold you describe the source and the nature of the mV signals you are measuring? I use autoscaling software to get maximum resolution out of the ADC, but that really depends on the type of signal you are looking at.

jtomerli

Re: ADS1115 may be destroyed

Fri Apr 10, 2015 11:45 am

Hi loek,,

I am using a switching 18.5V power supply (i know, its inherently noisey), powering a heating element. I am using a DC shunt (10mV = 1A) to measure current, and a 6:1 voltage divider to measure the 18.5V. Calculating Watts is the ultimate goal. Given I am one channel down, so I am using one channel as single ended to measure the higher voltage, and the other two channels set as differential to measure across the shunt.

The problem I have been having is every time I work on this project, something changes. One day I can read V & mV steadily, others the mV or V will fluctuate wildly, or not read at all. Yesterday, all seemed fine. Somedays none of the channels on the 16bit card work, this week 3 will work. I added the RBG LCD to get away from reading values via USB and to be able to eventually run a quieter power supply for the Arduino Mega.

Thanks.

loek

Re: ADS1115 may be destroyed

Fri Apr 10, 2015 12:16 pm

Hi jtomerli,

I understand. It seems (apart from possibly the switching noise, which you should be able to get rid of) quite a static, almost DC setup.

I assume the GND of the ADS1115 is connected to the GND of the power supply. Now the interesting thing is where the shunt is positioned. Is it in the lead connected to the PLUS of the power supply or also to the GND?

jtomerli

Re: ADS1115 may be destroyed

Sat Apr 18, 2015 12:45 pm

I finally got the board outputting a stable reading, but I am not sure why it works now, vs. when the readings were un-stable.

I am using the "noisy" switching PSU powering a heating element, but now get a clean reading, even across my DC shunt, reading ~ 35mV.
I have added the solid state relay back in, switching the element with PWM, V and mV measurements are stable.
I confirmed the readings with a DVM and changing to a lab grade PSU with V and I readings, set to constant V powering the same heating element.
The switching PSU is now installed and all is well.

The things I have changed:
Using the RGB with buttons, shield as a display instead of the serial monitor, I don't know if that is a factor or not. does serial.print slow or affect the loop as opposed to lcd.print?

I used a different ADS1115 but, it is one I used in the past that I couldn't get to work correctly.

Last, I changed the typical Arduino jumper wires for standard chassis wire, I am wondering if the jumpers are not that well suited as signal wires. It doesn't make sense, since the new wire is not twisted or shielded, maybe the little crimped pins not the end are not ideal? I don't know.

So I am happy with the results, but unfortunately I can't give any concrete advise to someone still struggling with this board. Check everything, from VCC to ground, to wiring, to code. Remove everything from your 'duino, including all other I2C wires, start with the example code, read a AA battery, if that works, the start moving toward your desired setup, one piece of hardware, one change in code at a time.

Would I buy it again: Yes.

loek

Re: ADS1115 may be destroyed

Sun Apr 19, 2015 9:35 am

Hi jtomerli,

Nice that everything is now as you expected it!

If one day you should again have unstable outputs, put your DVM between the GND of the ADS1115 and any one of the 4 analog inputs. If you measure more than +5,3 V or less than -0,3 V, then that analog input is outside it's electrical range and you may be "frying" the ADS1115. I suspect your shunt was/is pushing it's 2 analog inputs to +18 V thus causing the erratic behaviour.

LOCKED

20 posts 1 2

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