

AN-21

Interfacing CDK8307 with VCA8617

Introduction

The CDK8307 is perfectly suited for portable ultrasound applications. The 8-channel 12/13-bit analog to digital converter can be combined with the 8-channel variable gain amplifier VCA8617 from Texas Instruments. This will make a complete input signal chain for low power, high performance ultrasound applications.

The total power dissipation per channel with this configuration will be from 125mW (20MSPS) to 160mW (80MSPS).

The VCA8617 has a 3V power supply, while the CDK8307 has a 1.8V power supply. This has consequences for interfacing the devices, since the output common mode from the VCA8617 override the input common mode of the CDK8307.

Interface Configuration

The outputs from VCA8617 is driven by the internal PGA and filtered through a 2-pole passive filter. The output common mode is around 1.5 V. This makes it necessary to AC-couple the outputs on VCA8617 with the inputs of CDK8307.

The input common mode for the converter can either be set by an external reference or by the VCM output from CDK8307 as shown on Figure 1. It is recommended to use the VCM output from the converter. The best value for the common mode is $AVDD1V8/2$. A resistor value between $1k\Omega$ and $10k\Omega$ between the differential signals and the common mode is recommended.

The output swing from the VCA8617 is 2Vpp, and match the input range of the converter which is 2Vpp. This makes it a perfect match, and no special care to adjust the output swing and the input range is necessary.

It is recommended to use a series resistor between the VCA8617 and the CDK8307 inputs. A typical value of this resistor is 33Ω .

It is advisable to make space for a shunt capacitor, typically $33pF$, on the ADC input. The use of this should be investigated for the specified application.

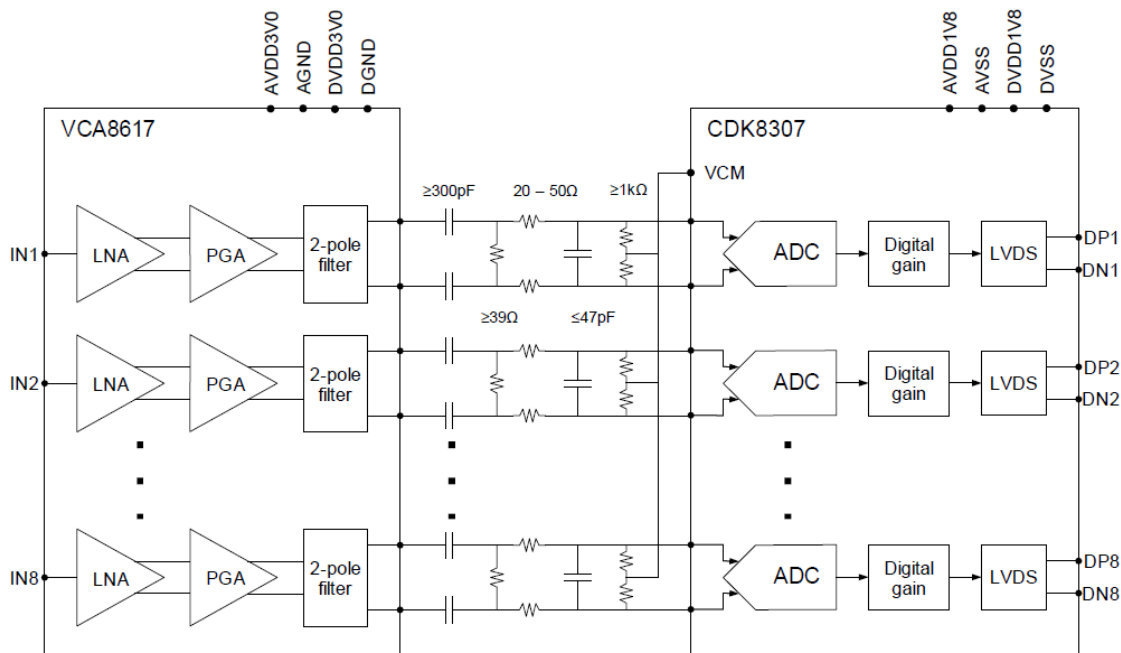


Figure 1: Interfacing CDK8307 with VCA8617



The ADC will produce a kick back for each sample, which is a result from discharging the sampling capacitors. This kick back needs to be settled away before next sample. The bandwidth of the 2-pole filter in the VCA is 15MHz, which means that it will not be settled if the sampling frequency is over 5MSPS.

To terminate the kick back before it reaches the VCA a shunt resistor is added between the AC-coupling capacitor and the series resistor. The value of this should be as small as possible. It is restricted by the acceptable attenuation loss on the signal.

The VCA has an output impedance of 10Ω. If a 50Ω shunt resistor is chosen, the attenuation loss will be 17%. In addition there will be a 3% attenuation loss due to the series resistor and the common mode termination.

CADEKA recommends the user to test and validate values of these capacitors and resistors in order to identify the combination that work best in the application.

Overload Conditions

There are two overload cases to pay attention to. The first is when the input swing exceeds the input range. The second is when the input signal level exceeds the supply voltage.

The second case will cause the internal protection diode to be forward biased and open a low-impedance path to ac-ground. No DC current will flow because of the AC-coupling. But it would severely load the VCA outputs.

Using the interface configuration shown in Figure 1, prevents the second case to occur. The maximum input level on the ADC inputs is $AVDD1V8 + 0.3V$. This can be a voltage around 1.9V. With the recommended VCM settings, the VCA8617 would need to generate a voltage swing of more than 3.6Vpp to generate this condition on the ADC inputs. The VCA8617 datasheet only gives a typical value of the differential output swing, which is 2Vpp. This is well within the range of safe operation.

The first overload condition, when the input swing is higher than input range, will result in clipping of the signal. The output data will be all 1's or all 0's when the signal is over and under the input range as long as the overload condition persist. No roll over will occur. The CDK8307 will recover after 1 clock cycle when coming out of over range.

The attenuation loss because of the shunt resistor and the common mode termination will prevent any over range signal on the ADC input. So the conclusion is that this setup is will not cause any overload condition.

It is also possible to fine tune the input range of the converter within $\pm 10\%$ to maximize the dynamic range of the desired signal, or prevent over range conditions.

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