FmcAdc100M14b4cha

with higher input impedance

The performance estimation

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Abstract

ADC board parameters

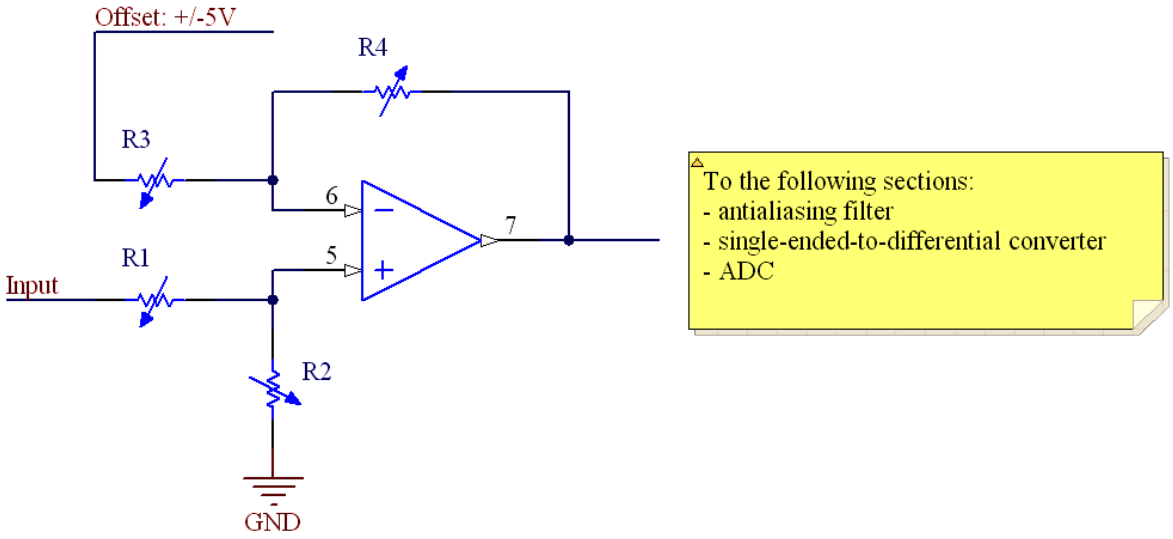
Bandwidth	>= 20 MHz
Sample rate	>= 40 MSPS
Resolution	>= 8 bit
Input voltage range	>= +/- 5V
Offset	Full range (+/-5V as well)
Input impedance	50 Ohm or 1 MOhm (selectable by the software)

The easiest solution is to take the existing FmcAdc100M14b4cha design, modify it by removing unnecessary switches and other components, and changing the resistors values to achieve the expected impedance and input voltage range.

The voltage step corresponding to the ADC resolution is:

$$\frac{+/-5V}{2^8} = \frac{10\text{V}}{256} = 0{,}0390625\,V \approx 40\,mV$$

The FmcAdc100M14b4cha's inputs can be treated as a differential amplifier, like shown below.



The relationship between resistors has to pass the rule:

$$\frac{R1}{R2} = \frac{R3}{R4}$$

For the +/-5 V of input voltage range:

R1 = 10 * R2 (R3 = 10 * R4).

Most important ADA4899 parameters:

Polarization current	100 nA
Current noise	5.2 pA /√Hz
Voltage noise	1 nV/√Hz
Input capacitance	4.4 pF
Input resistance: differential	4 kOhm
Input resistance: common mode	7 MOhm

Performance estimation. The noise level is compared with the maximum RMS at the output of the input amplifier (for 1 Vpp it is 350 mV).

Input impedance	Resistors' values	Offset caused by amplifier's polarization current	Noise Level (RMS)	Noise level (for the 20 MHz bandwidth) [dB]	ENOB (Equivalent Number Of Bits)	Bandwidth (limited by the OPAMP input capacitance)
1 MOhm	R1 = 910 kOhm R2 = 91 kOhm	9 mV	2 mV	44.86 dB	7.15 its	400 kHz
300 kOhm	R1 = 270 kOhm R2 = 27 kOhm	2.8 mV	640 uV	58.84 dB	9.5 bit	1.34 MHz
100 kOhm	R1 = 91 kOhm R2 = 9.1 kOhm	0.9 mV	220 uV	64 dB	10.33 bit	4 MHz
30 kOhm	R1 = 27 kOhm R2 = 2.7 Ohm	0.28 mV	70 uV	74dB	12 bit	13.4 MHz
10 kOhm	R1 = 9.1 kOhm R2 = 910 Ohm	0.09 mV	30 uV	81 dB	13.16 bit	40 MHz