Measure the distort of the wave through AD/DA converter

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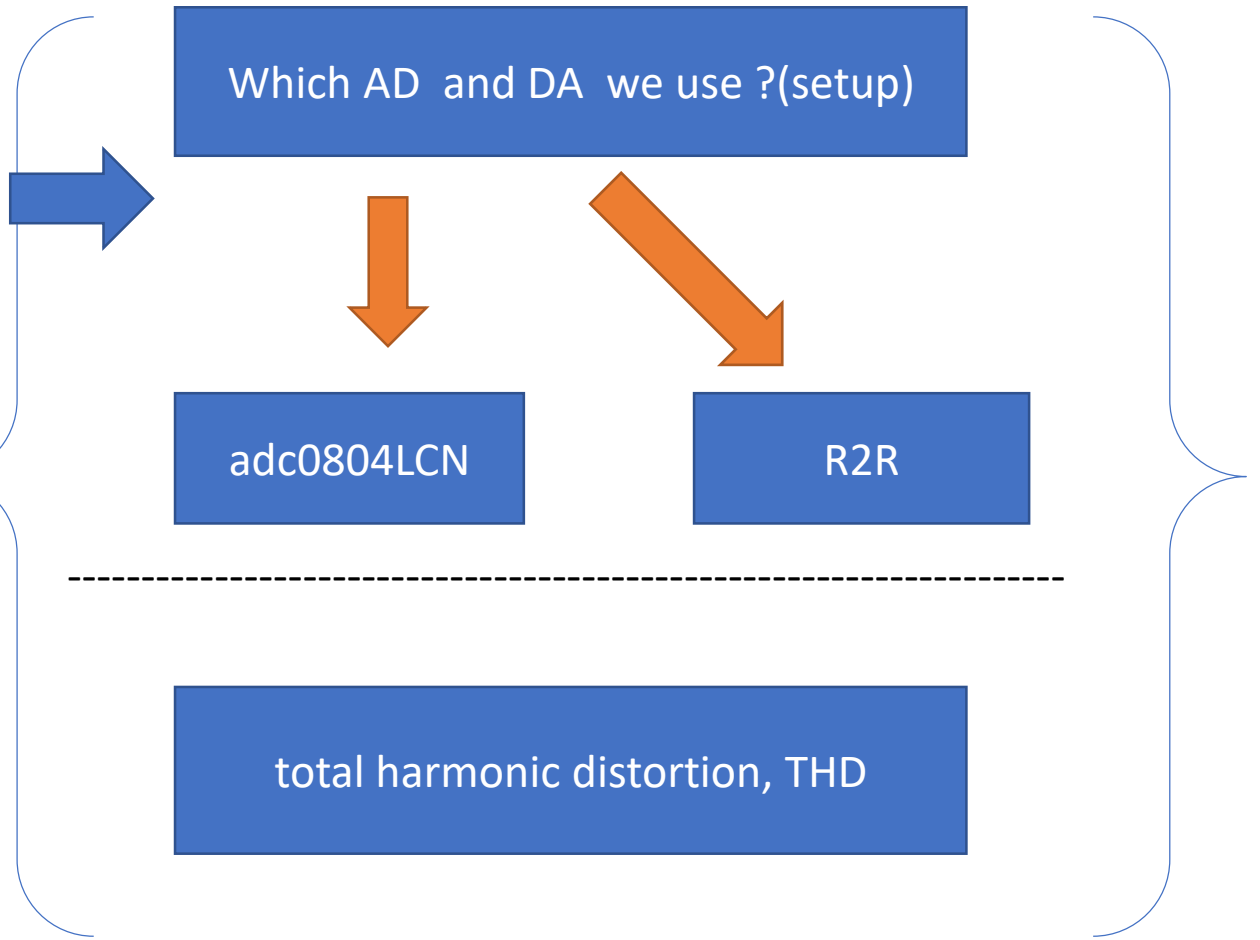
expected

schedule

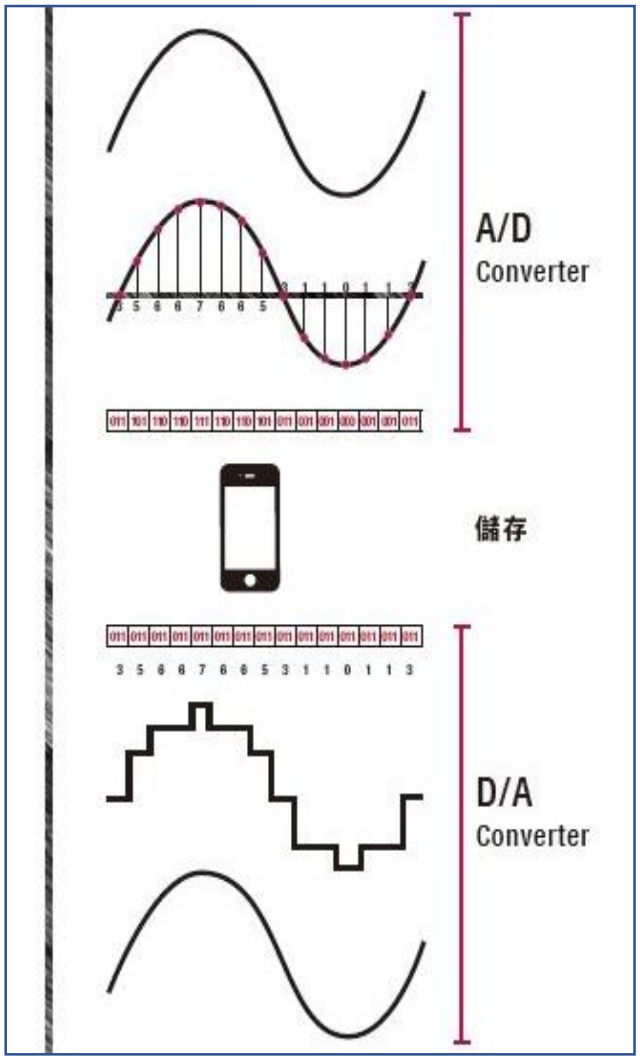


Purpose

To understand more about the principle of the AD/DA converter and

find some solution that may lead to distort.

How does the wave convert through AD/DA?



sample

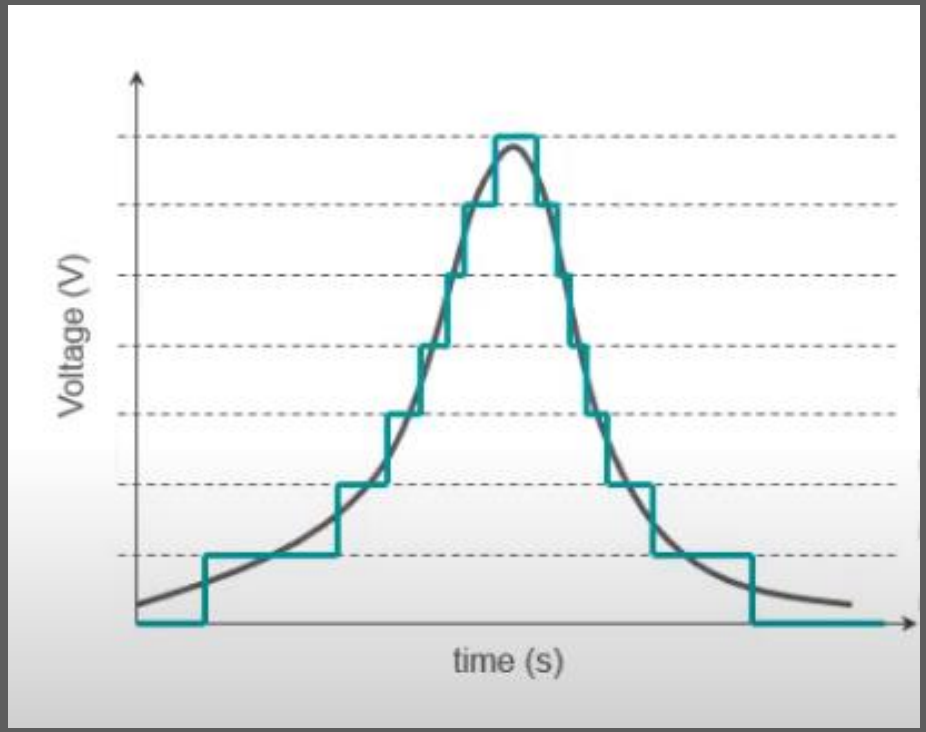
quantizing

encoding

sampling

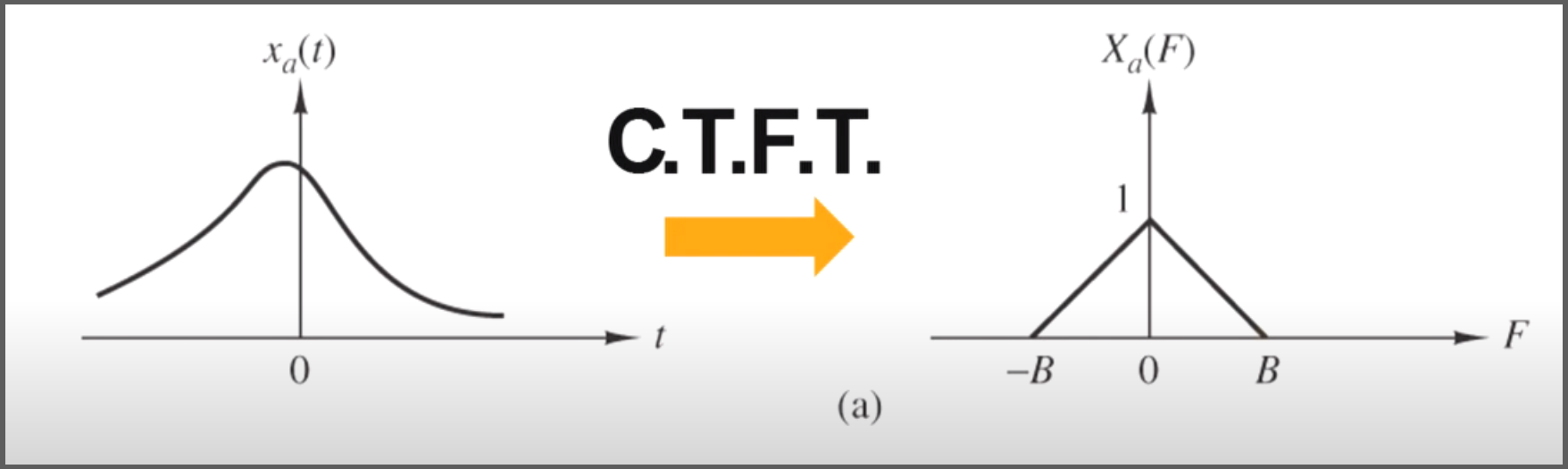
quantizing

encoding

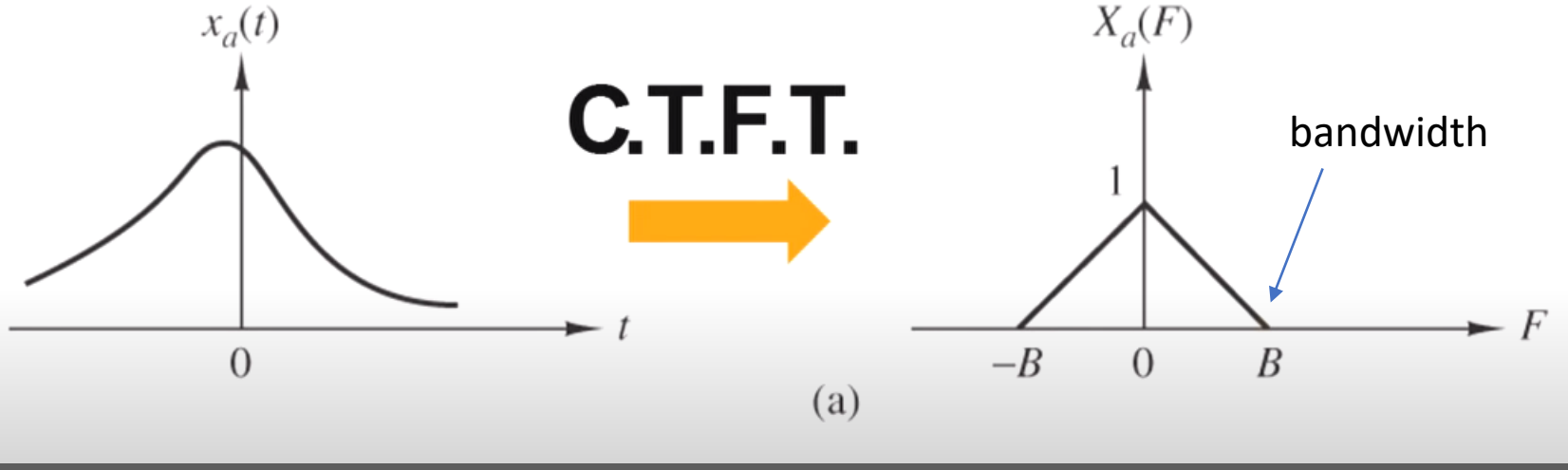


Sampling Theorem

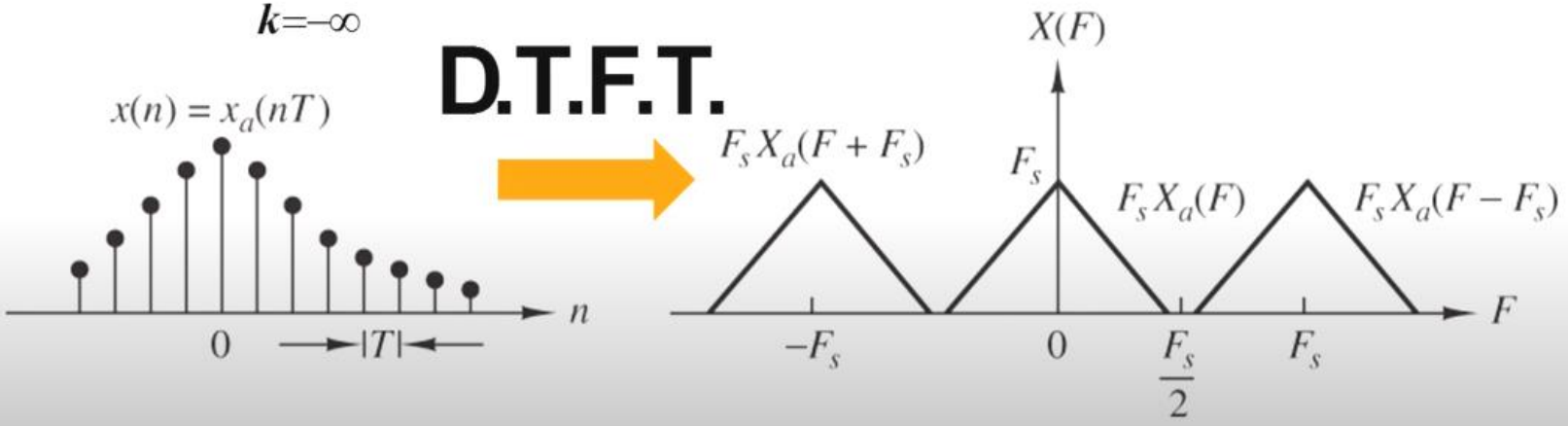
Sampling Theorem



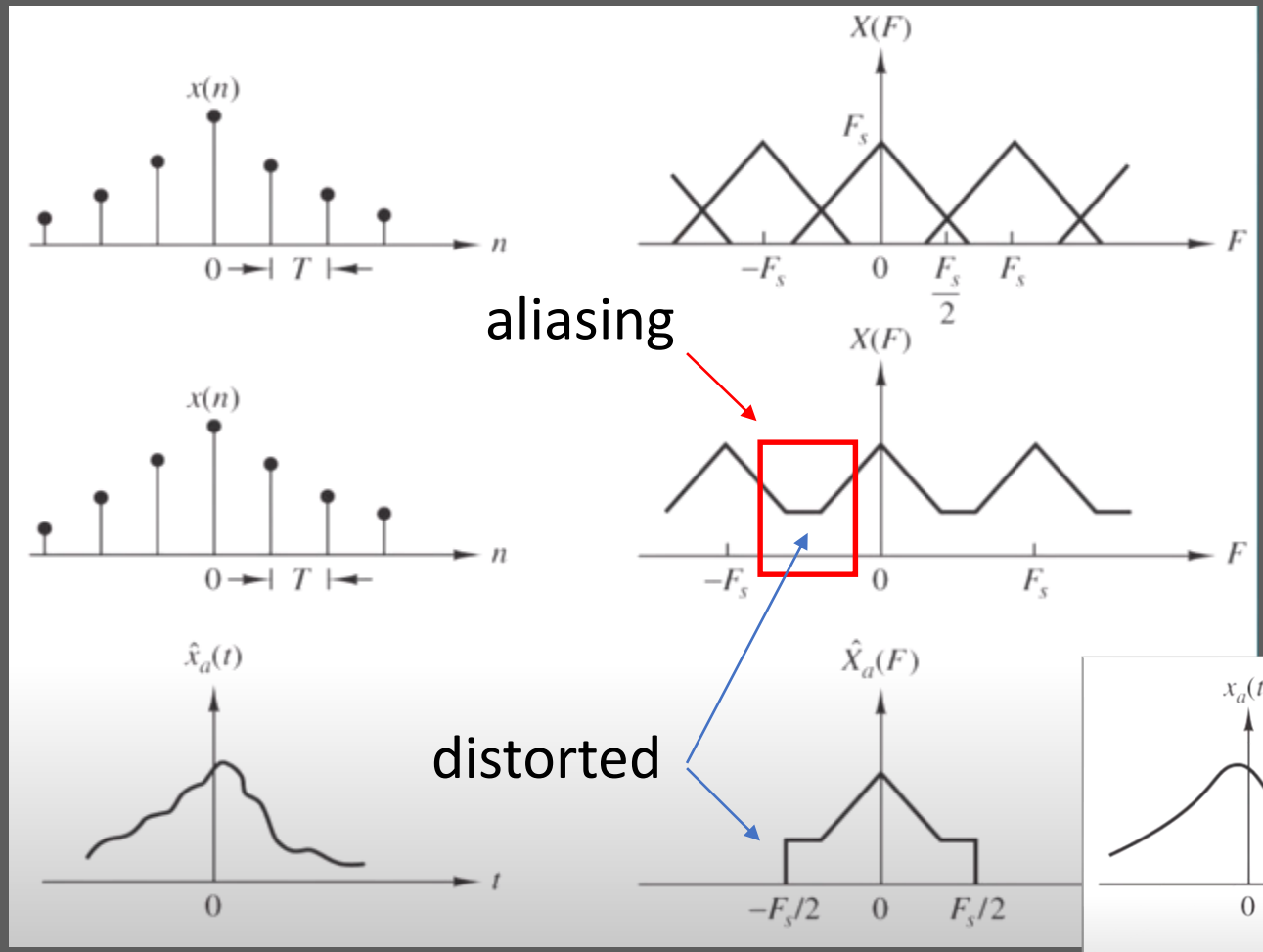
Sampling Theorem



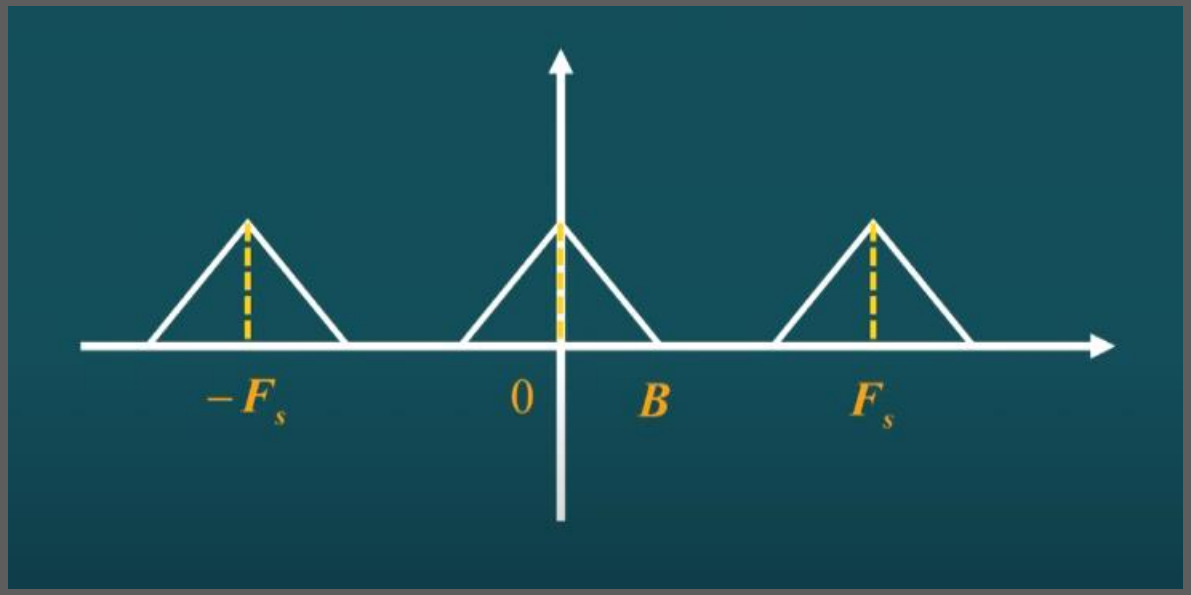
$$X(F) = F_s \sum_{k=-\infty}^{\infty} X_a(F - kF_s)$$



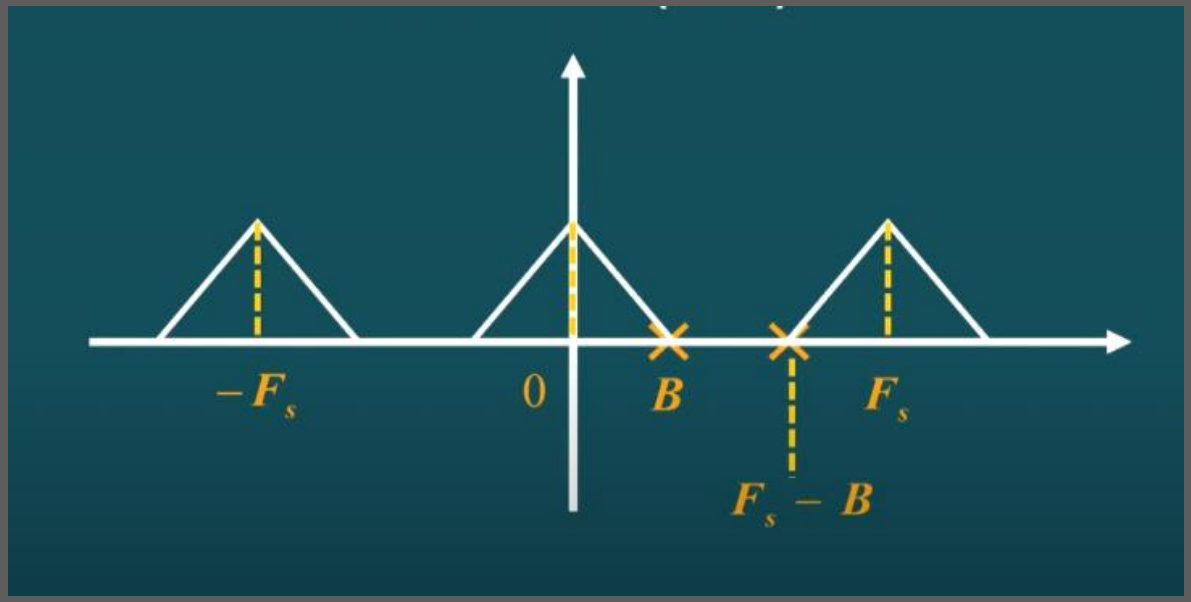
Sampling Theorem



Sampling Theorem
-relation between F_S and B



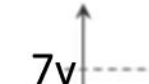
Sampling Theorem
-relation between F_S and B



conclusion

$$F_s - B \geq B$$
$$\Rightarrow F_s \geq 2B$$

sampling



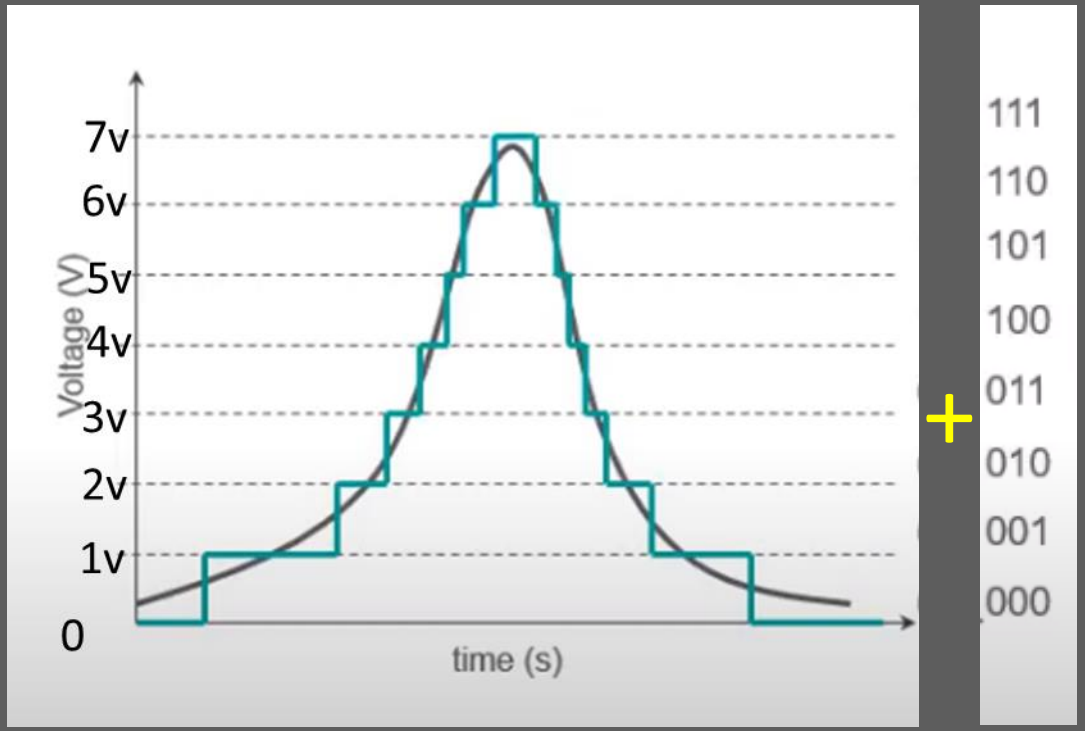
quantizing

encoding

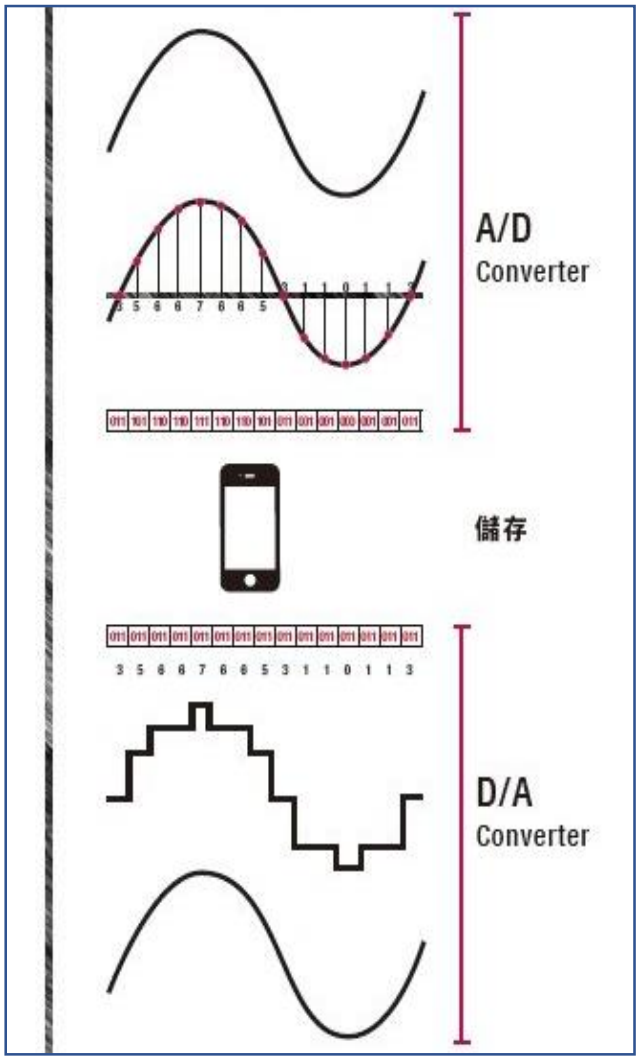
sampling

quantizing

encoding



How does the wave convert through AD/DA?



sample

quantizing

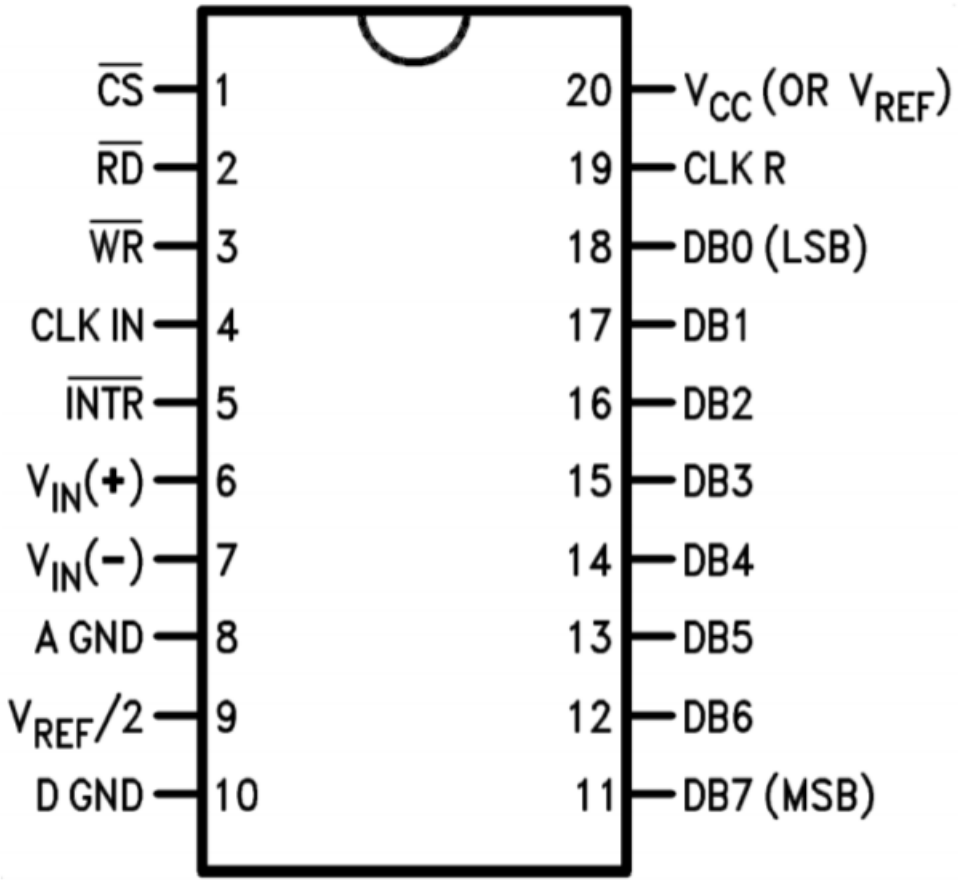
encoding

ADC0804LCN

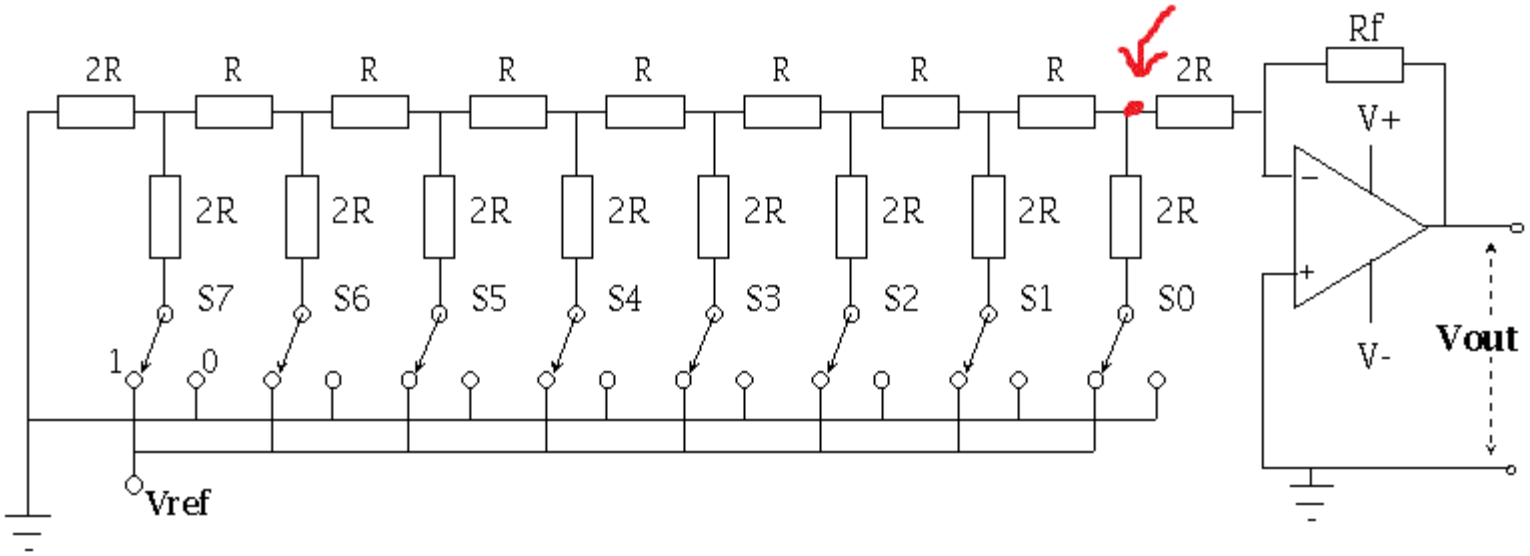
Resolution: 8 bit

Sampling Rate: 10 kS/s

Operating Supply Voltage: 5 V

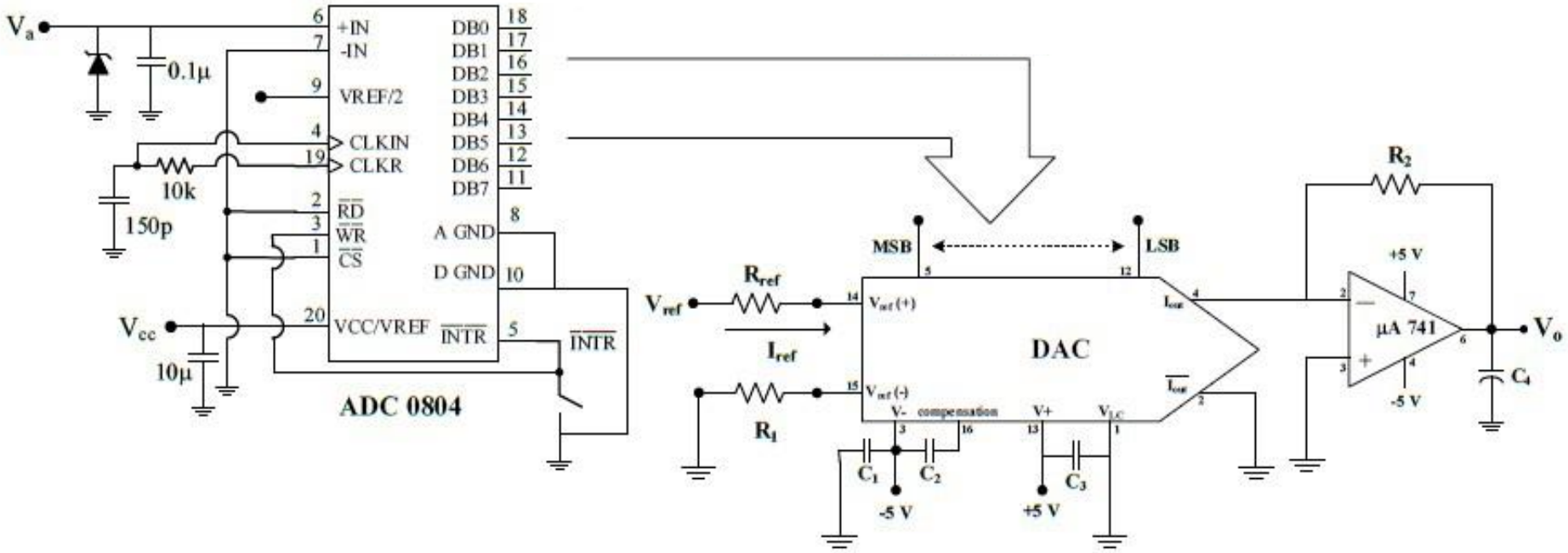


R2R DA convertor



$$Vout = \frac{Rf}{2R} \frac{Vref}{3} N$$

Circuit diagram



Total Harmonic Distortion, THD

Ratio of the RMS amplitude of a set of higher harmonic frequencies

to the RMS amplitude of the first harmonic.

$$\mathrm{THD_F} = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \cdots}}{V_1}$$

Use Fourier analysis to decompose the signal into fundamental frequency and harmonic components. And calculate the ratio of each harmonic to the fundamental frequency.

expected

1.We expected that the conversion of the waveform will have

a relatively large difference at the peak than others.

2.We expected when the signal frequency is above 5KHz, the value of THD will increase significantly.

schedule

Week1	Set up AD and DA and test them
Week2	Switch the various frequency and do FET
Week3	Analyze experimental data
Week4	Do unfinished things