Making a buffer with OP37G

Why do we need a buffer?

During crack propagation, we measured the velocity of crack propagation, which involved passing the position signal through a differentiator. However, it is important to isolate the circuit preceding this differentiator. Indeed, without the buffer, a huge amount of current is drawn from the power input of the differentiator, inducing disturbances in the output voltage. Hence, an error on the position measurement, and an even greater error on our velocity.

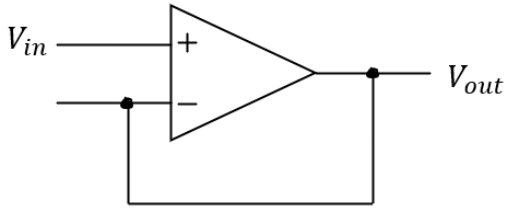

Figure 1: General buffer circuit (follower amplifier)

How to make a buffer with OP37G?

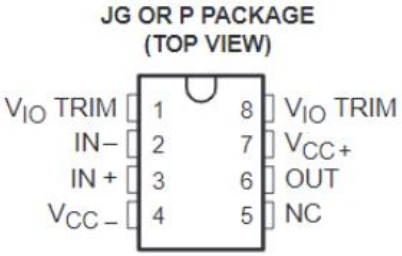

Figure 2: OP37G connections

From the given datasheet, the OPA37 amplifier is the most straightforward option to make the buffer needed. However, in class, only the OP37G amplifier was available. As both of them have the same gain-bandwidth product, and basically nearly the same internal architecture, the two can be used to make our buffer.

It is important to note that just like the OPA37, the OP37G is not unity gain stable. There are two options to make a stable buffer with OP37G:

1- If we need to keep a gain of 1
2- If it is possible to have a gain $G \geq 5$

For the first option, a different set-up must be built, similar to the set-up required to obtain a unit gain buffer with OPA37:

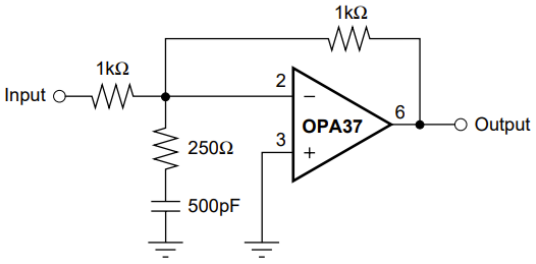

Figure 3: High Slew Rate Unity-Gain Inverting Amplifier from OPA37 datasheet

In the second case, we know from the datasheet that OP37G is stable for gains superior or equal to 5. However, increasing the buffer gain will reduce the bandwidth so it is important to keep the gain as low as possible. Thus, a non-inverting circuit was built with 2 resistors giving a gain of 5.6:

- $R_1 = 1k\Omega$: plugged on the V_{in} branch
- $R_2 = 4.6k\Omega$: plugged on the feedback loop

Checking the actual gain on the oscilloscope we have $G = 5.8$. The new bandwidth is then: $63/5.8 = 10.86\ [MHz]$, which remains quite high for our application, considering we need to go up to a few Mega Hertz. Thus, we would advise making this setup to build a stable buffer with OP37G.