

Block 23 — Comparator Circuits

Student Group

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Block 23 — Comparator Circuits

Learning objectives

After this 90-minute block, you can

- ...

Preparation at Home

Well, again

- read through the present chapter and write down anything you did not understand.
- Also here, there are some clips for more clarification under 'Embedded resources' (check the text above/below, sometimes only part of the clip is interesting).

For checking your understanding please do the following exercises:

- ...

90-minute plan

1. Warm-up (x min):
 1.
2. Core concepts & derivations (x min):
 1. ...
3. Practice (x min): ...
4. Wrap-up (x min): Summary box; common pitfalls checklist.

Conceptual overview

1. ...

Core content

Comparator

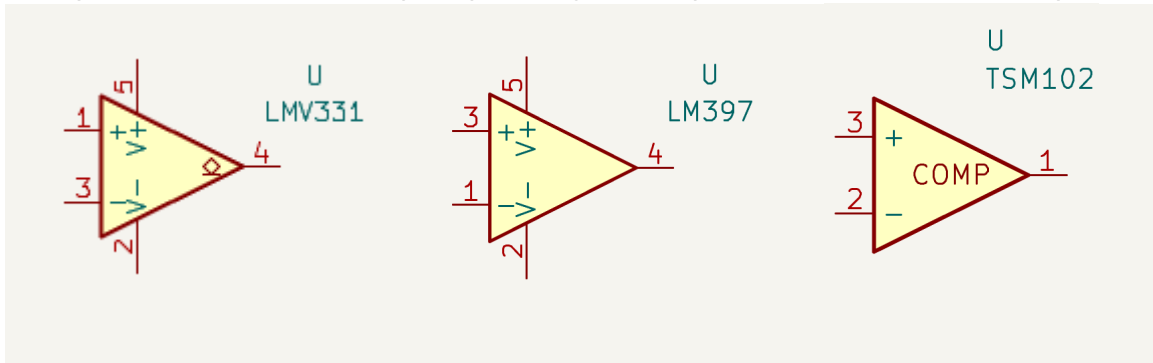
Up to now we focussed on operational amplifier, which is only usable in a closed-loop setup. However, it also as a “special brother”, the **comparator**.

The differences form the comparator in contrast to the operational amplifier are:

1. It is **only used in positive feedback**. It should never be used in negative feedback.
2. It is optimized for **fast switching**

3. It only outputs **in saturation**, which means it only has two possible outputs, see details below.

The symbol is related to the op-amps triangular shape - often the exact same symbol is used.



So, but what is the output, now? For this, it helps to have a look onto the simulation below.

There are two types of comparators:

1. comparators with open-collector output:

This type outputs the minimum value, when the non-inverted input is bigger than the inverted one.

Otherwise, the output is **high-ohmic** or **undefined**.

This is sometimes shown by a diamond shape \diamond on the output.

$$U_{\text{O,OC}} = \begin{cases} \text{undefined} & U_{\text{I,1}} > U_{\text{I,2}} \\ \text{sat, min} & U_{\text{I,1}} < U_{\text{I,2}} \end{cases}$$

2. comparators with push-pull output:

This type outputs the minimum value, when the non-inverted input is bigger than the inverted one.

Otherwise, it outputs the maximum value.

$$U_{\text{O,PP}} = \begin{cases} \text{sat, max} & U_{\text{I,1}} > U_{\text{I,2}} \\ \text{sat, min} & U_{\text{I,1}} < U_{\text{I,2}} \end{cases}$$

Common pitfalls

- ...

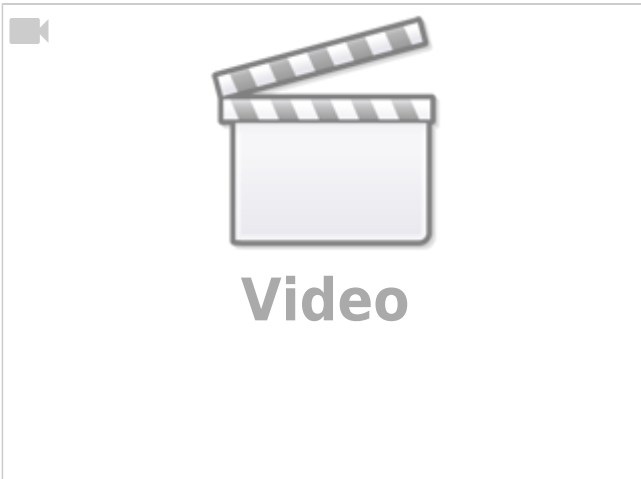
Exercises

Worked examples

...

Embedded resources

Longer tutorial on Schmitt trigger



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