Self-Oscillating Class-D

Topologies

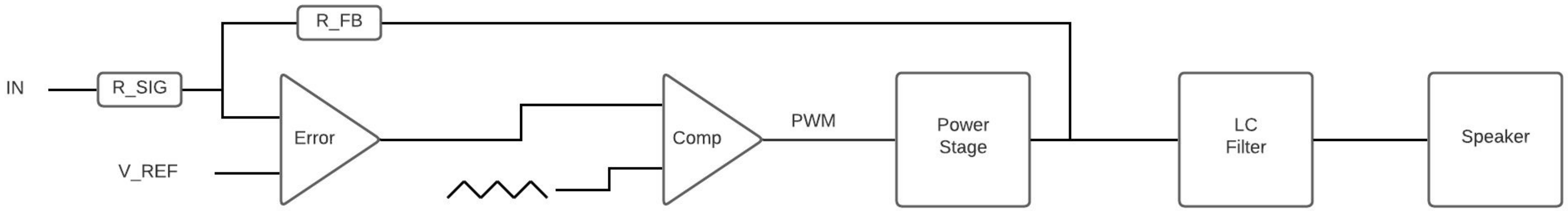
Last videos

- Analog fixed-frequency PWM based Class-D (see video #2 and #12)
- Digital fixed-frequency PWM based Class-D (see video #18)

This video

- Analog self-oscillating Class-D

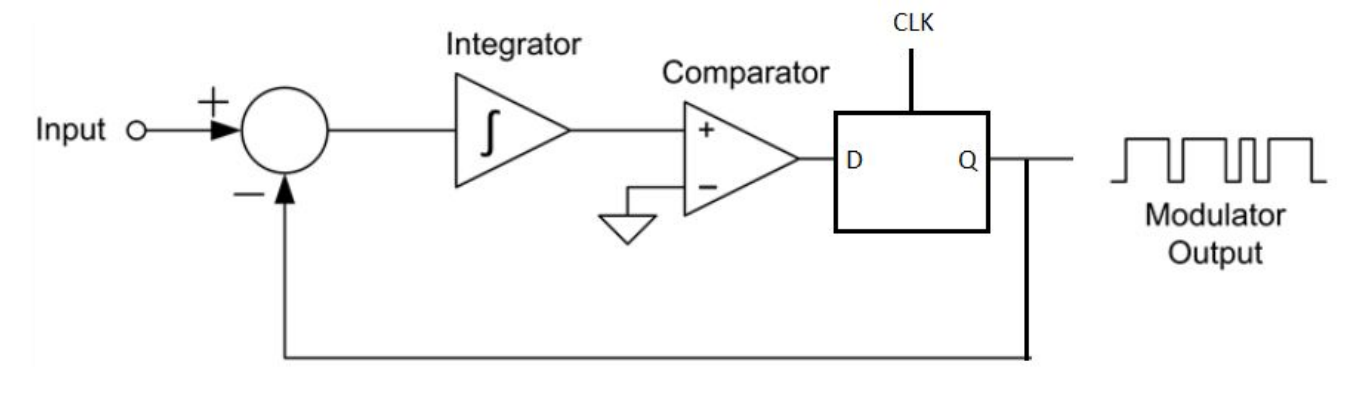
PWM based Class-D



- Consists always out of error-amplifier + PWM modulator
    - Errorsignal is modulated into linear PWM with comparator + sawtooth
- Frequency is always fixed (frequency of the sawtooth signal)
- Signal is regulated by the error-amplifier

Refresh: Sigma Delta Conversion

- Sigma Delta converts an analog signal into a 1-bit bitstream (same signal represented in 1’s and 0’s)
- Output bitstream is based on a clock
- The output signal is ideally the same as the input signal
- Practically the signal quality depends on the “oversampling rate” (baseband-frequency of the signal vs clocking speed of the modulator) -> the more oversampling, the better the output signal regarding signal-noise ratio

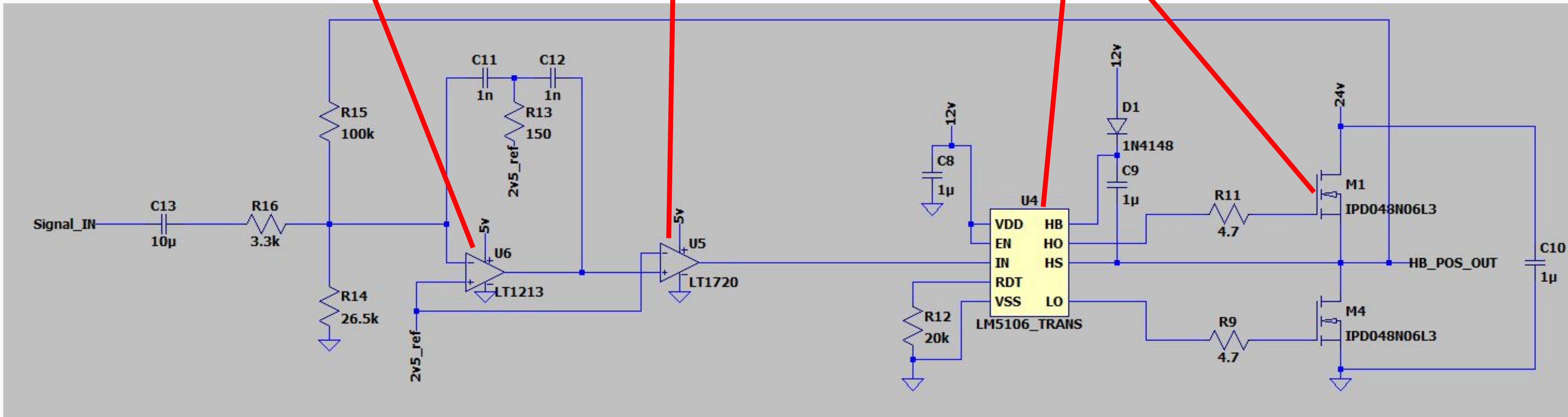


Self-Oscillating Class-D / Sigma-Delta

Integrator

Comparator (1-bit quantizer)

Power-Stage



Self-Oscillating Class-D / Sigma-Delta

Self-Oscillating Class-D is a “high-power” Sigma-Delta converter

- It is **not** PWM based
- The power-stage is amplifying a PDM stream

The self-oscillating Class-D is not based on an external clock and is not using any flip-flop behind the comparator (in comparison to a classical sigma-delta)

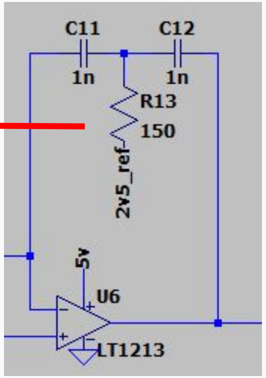
- Timing resolution is not limited to a clock cycle-time
  Therefore -> “virtually” endless oversampling

Self-Oscillating Frequency

The frequency of the self-oscillating Class-D is influenced by

- Power supply voltage
- Integrator behavior
- Propagation delays of the comparator and the power-stage

Practically, the designer sets the “idle” frequency by adjusting the integrator-circuit



Typical values:

C2=C3 -> 1nF to 10nF

R3 -> 15 ohms to 300 ohms

Self-Oscillating Frequency

The frequency of the self-oscillating Class-D is highest in idle-operation (no signal applied)

The frequency drops, the higher the modulation