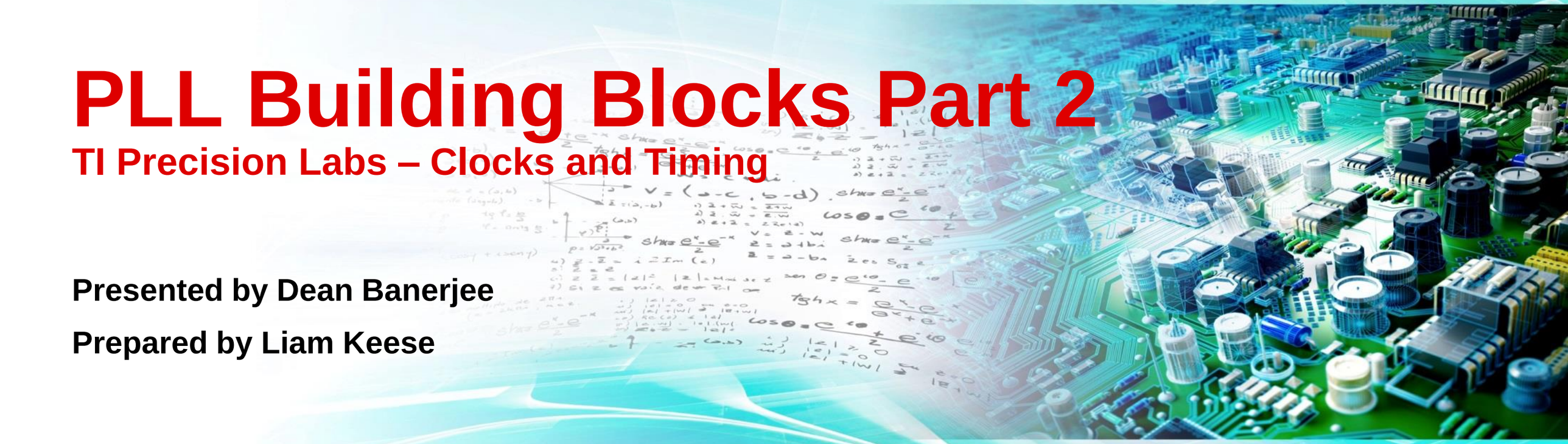
PLL Building Blocks Part 2

TI Precision Labs – Clocks and Timing



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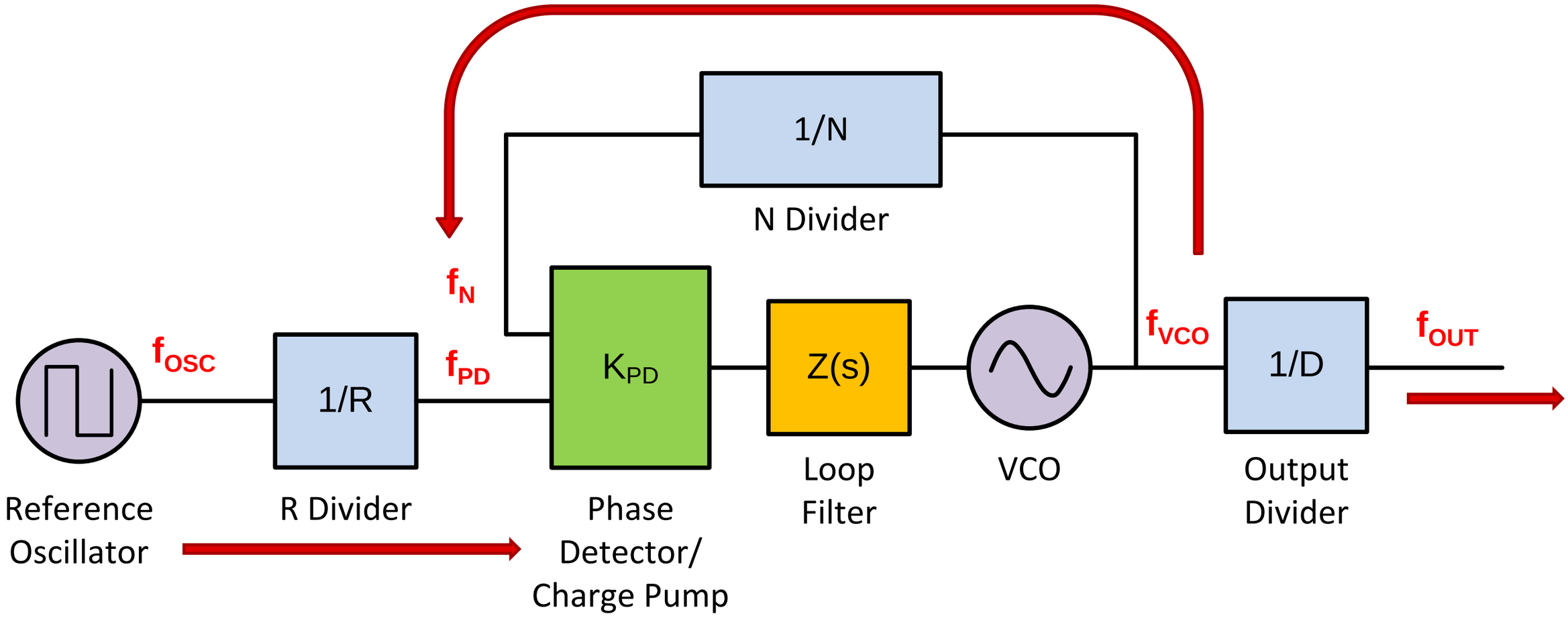
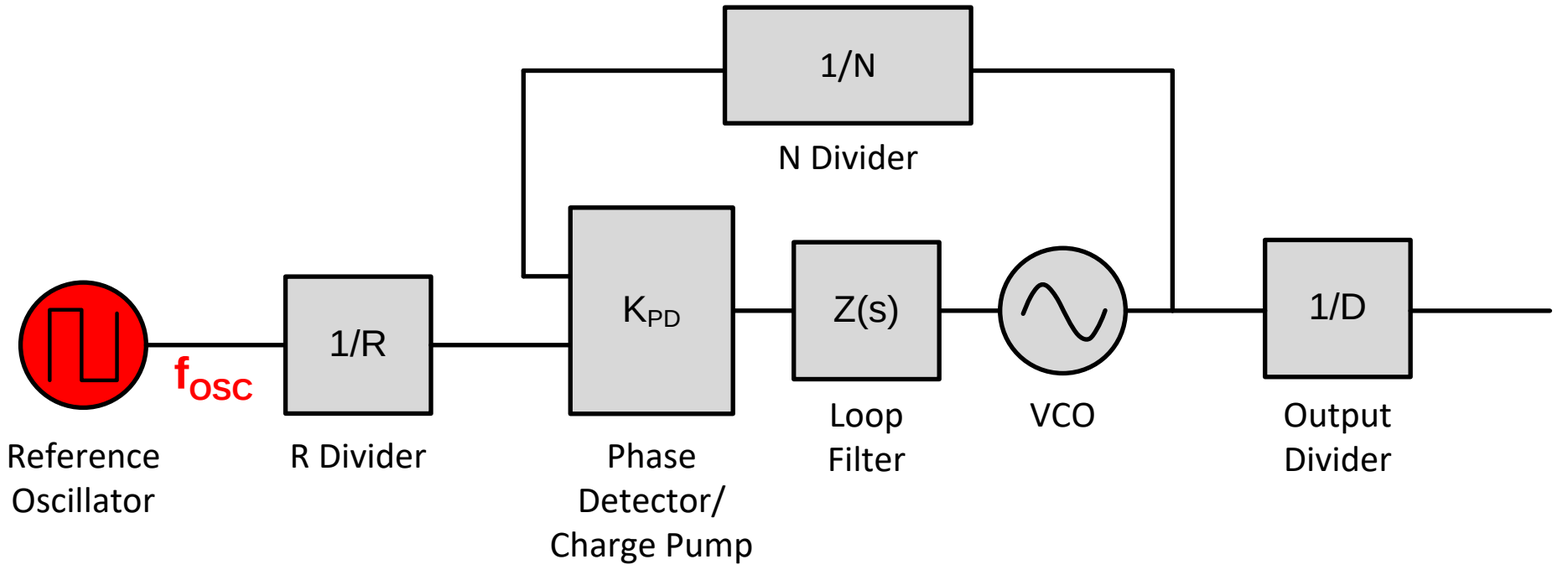
Prepared by Liam Keese

Phase lock loop (PLL) overview

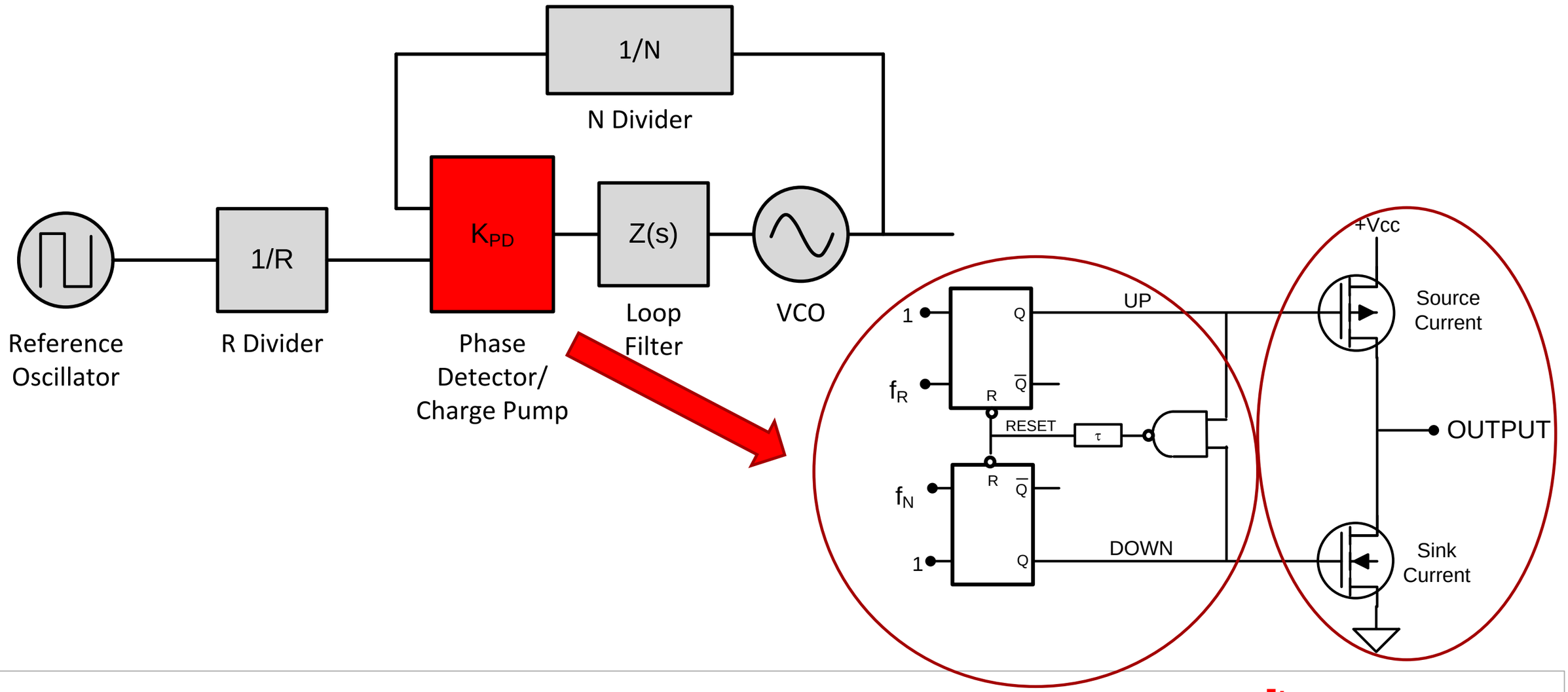


Input sources



- Crystal oscillator (XO)
- Temperature compensated crystal oscillator (TCXO),
- Oven controlled crystal oscillator (OCXO),
- Clock output from another device

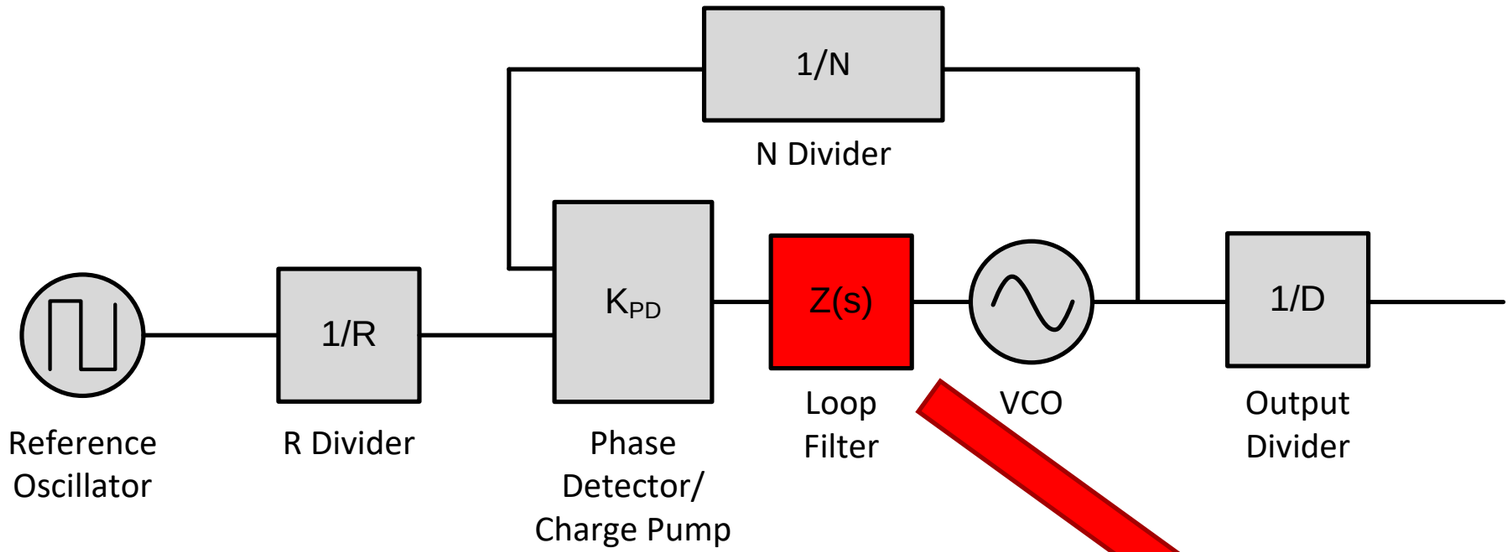
Phase frequency detector/charge pump

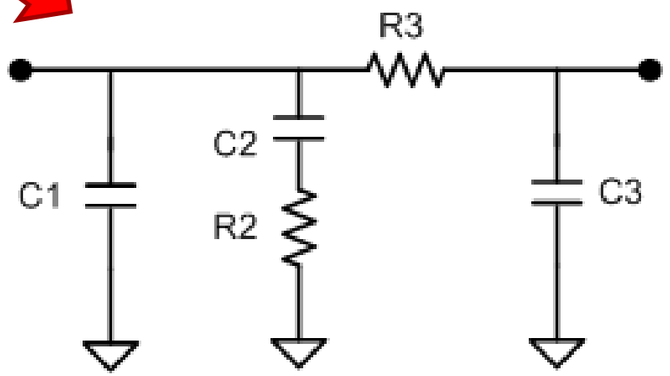


Phase detector/charge pump operation

- High Impedance (tri-state) if output frequency/phase is correct (within tolerances)
- Sources Current if output frequency/phase is too low
- Sinks Current if output frequency/phase is too high

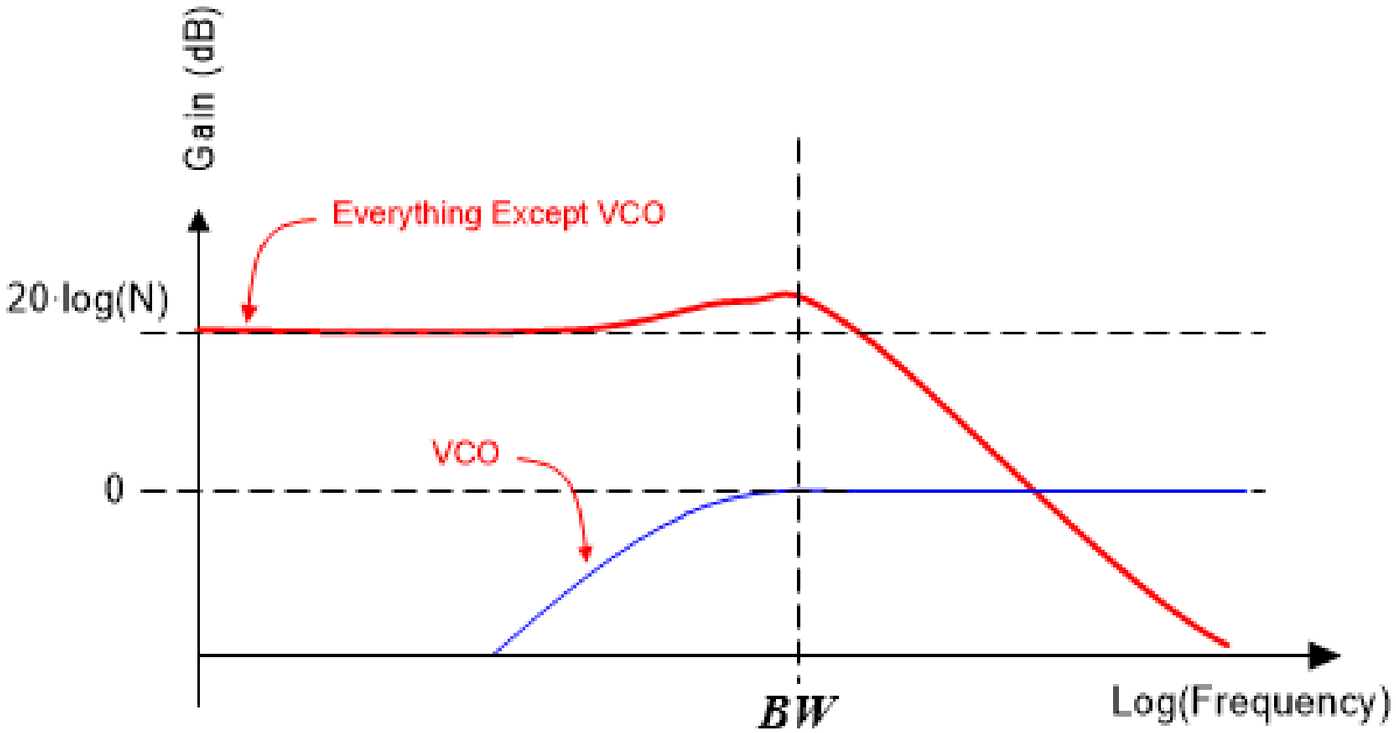
Loop filter

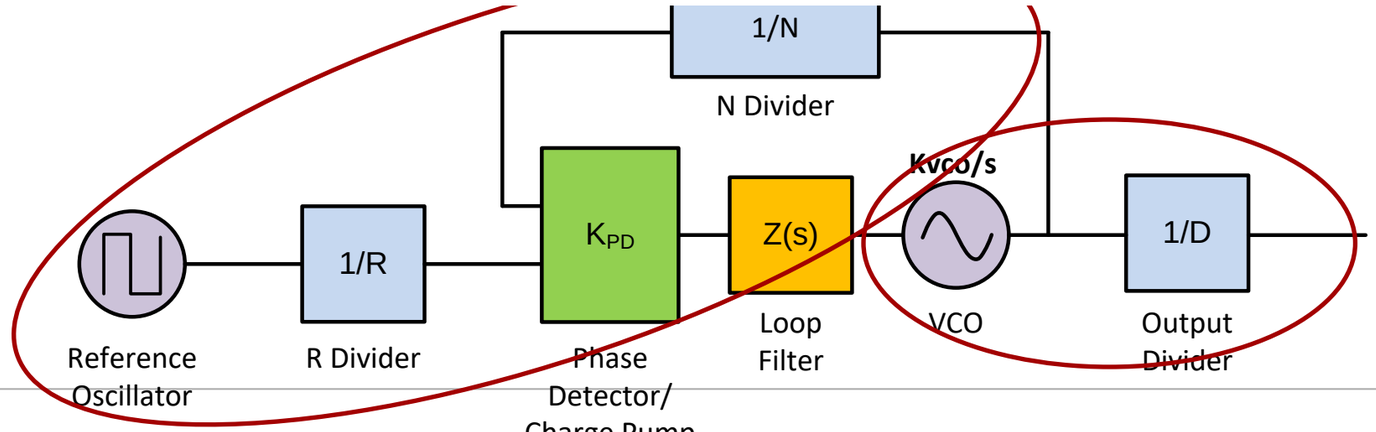




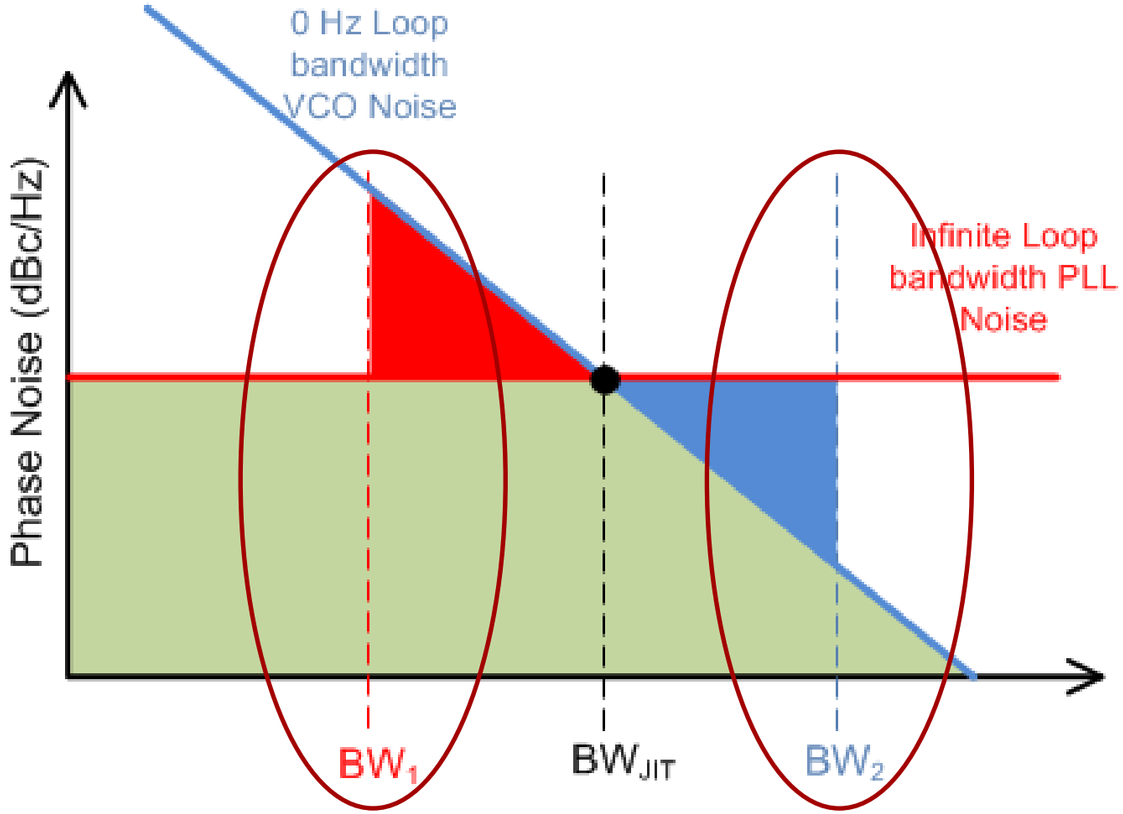
- The loop filter is a low pass filter
  - Has a dramatic effect on performance

Brief overview of loop dynamics





Choosing loop bandwidth



- Choose optimal jitter loop bandwidth to be BW_{JIT} to minimize area under the curve

Choosing loop bandwidth

Design Goal	Bandwidth
Minimize Jitter	$BW = BW_{JIT}$
Minimize Phase Noise at offset < BW_{JIT}	$BW > BW_{JIT}$
Minimize Phase Noise at offset > BW_{JIT}	$BW < BW_{JIT}$
Minimize Lock Time	$BW > BW_{JIT}$
Minimize Spurs	$BW < BW_{JIT}$

To find more technical resources and search products, visit ti.com/clocks

Short Quiz

1. True or False:

The reference input frequency is provided by VCO.

Short Quiz

1. True or False:

The reference input frequency is typically fixed frequency and provided by a stable reference source such as crystal oscillator.

Short Quiz

2. Choose one:

The phase detector will

(a) Sink and source current to the loop filter

(b) Sample the phase error between the R and N counter

(c) Provide the output frequency

Short Quiz

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(a) Sink and source current to the loop filter

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Short Quiz

3. True or False:

Choose loop bandwidth to be the point where VCO noise is equal to PLL noise to minimize jitter.

Short Quiz

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Choose loop bandwidth to be the point where VCO noise is equal to PLL noise to minimize jitter.

Short Quiz

4. Choose all that apply:

When choosing a loop bandwidth, which of these tradeoff are correct?

a) To reduce lock time, increase the loop bandwidth

b) To reduce spurious noise, increase the loop bandwidth

c) To reduce phase noise at larger frequency offsets, reduce the loop bandwidth

Short Quiz

4. Choose all that apply:

When choosing a loop bandwidth, which of these tradeoff are correct?

a) To reduce lock time, increase the loop bandwidth

b) To reduce spurious noise, increase the loop bandwidth

c) To reduce phase noise at larger frequency offsets, reduce the loop bandwidth

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