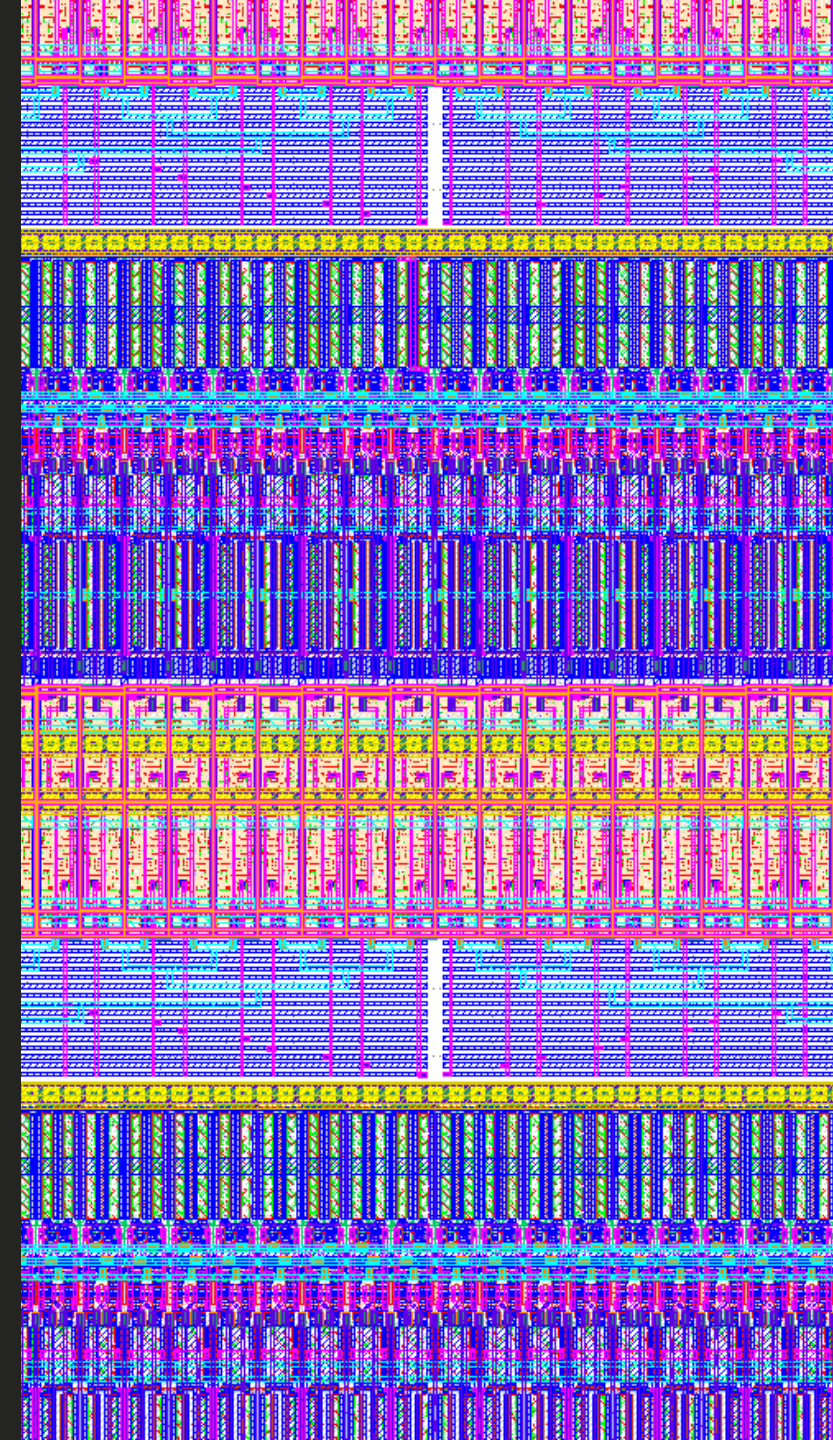


Talking to satellites with open silicon

Thomas Parry





Fully open source amateur radio satellite transceiver.

Designed with open-source tools, in the SKY130 open-source PDK and all design files freely available on GitHub.

Targeting the QO-100 and future satellites.

Designed for the 2.4, 5.8 and 10.2 GHz bands.

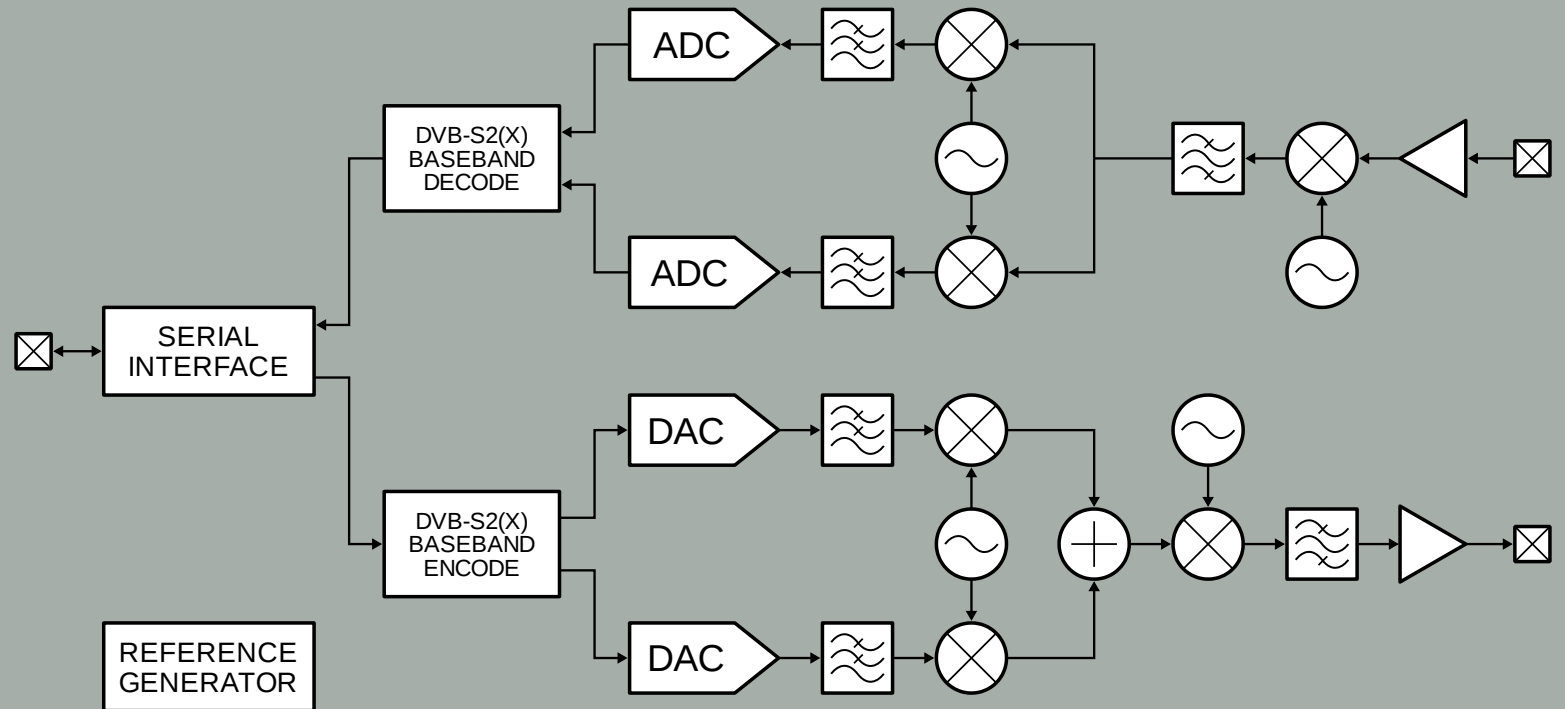
Single chip solution RF-to-bits.

RF processing, data converters and digital baseband planned.

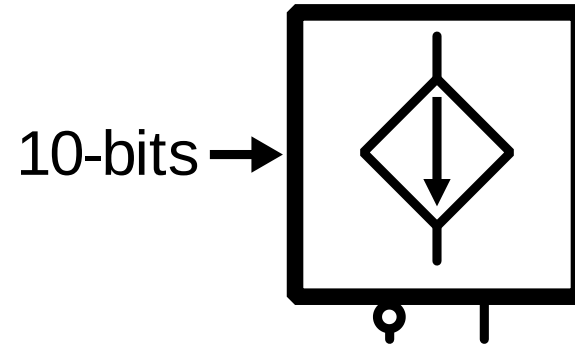
Typical Hetrodyne

System Architecture

The transceiver architecture consists of common functional blocks.



10-Bit 100 Msps Differential DAC

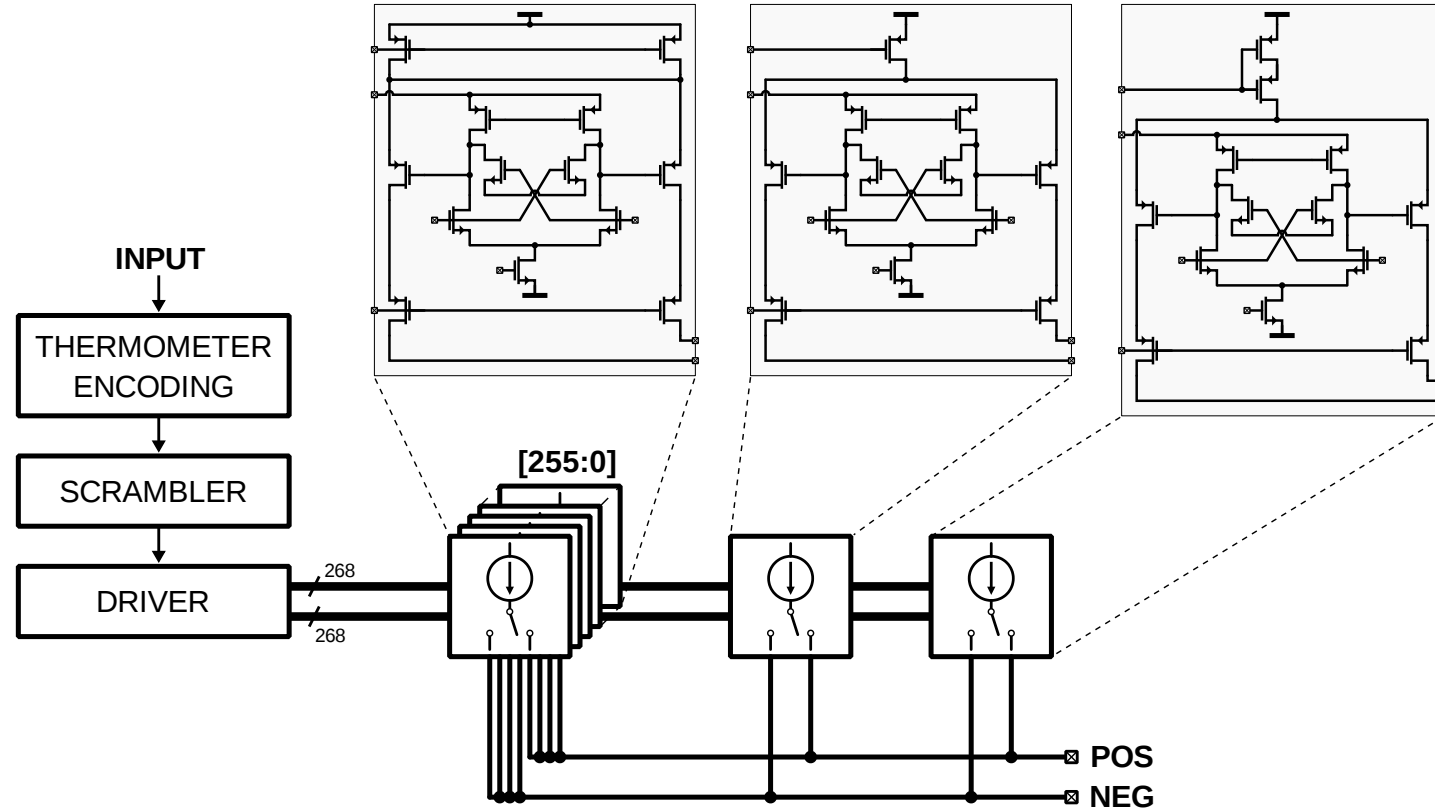


Current steering topology for high speed

Dynamic element matching

306 x 530 μm

10-Bit 100 Msp Differential DAC

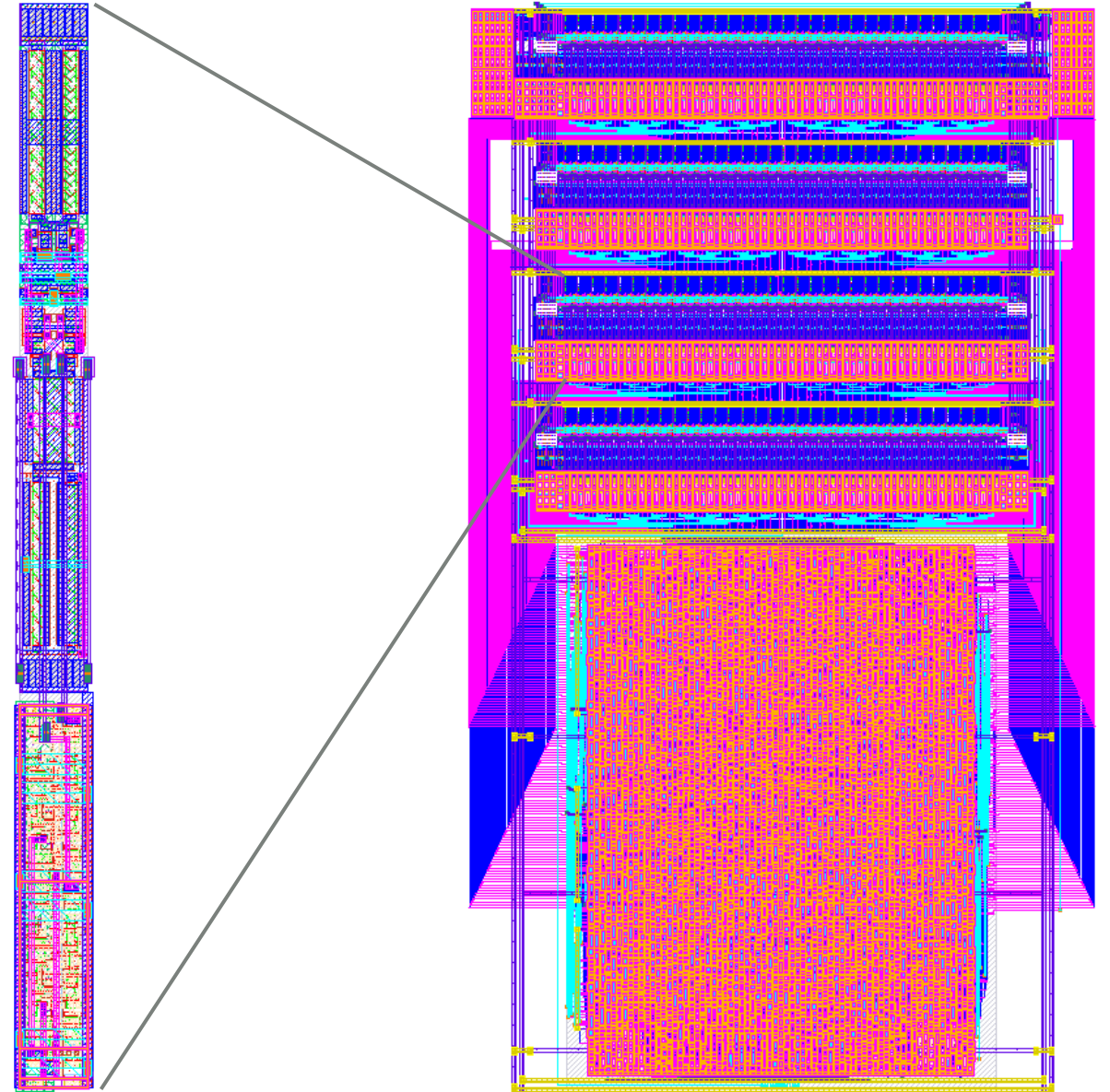


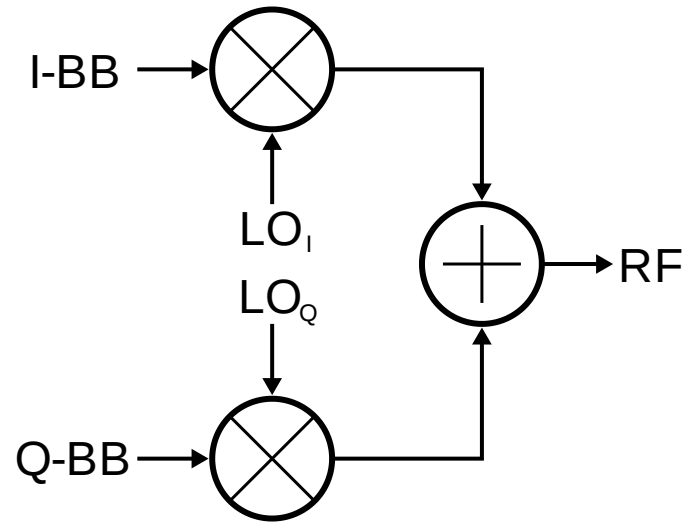
Current steering topology for high speed

Dynamic element matching

306 x 530 μm

Unit cell layout



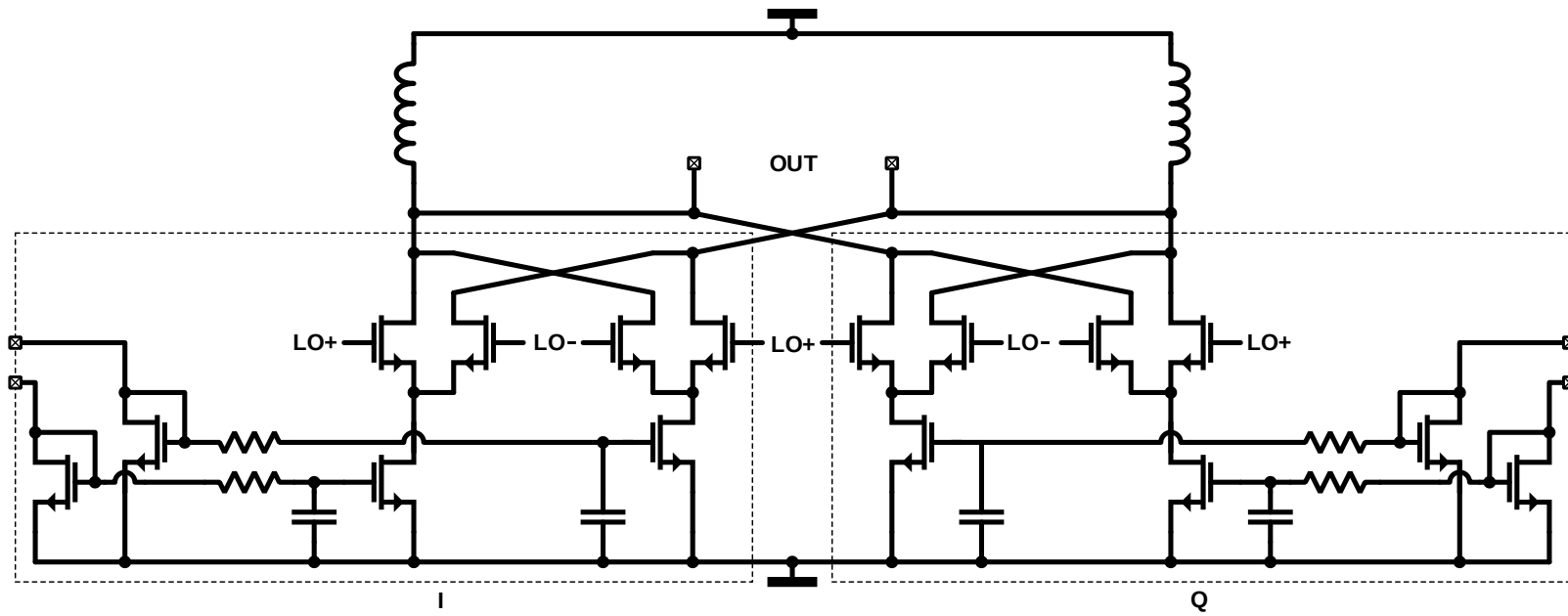


Transimpedance quadrature upconverter.

Current mode inputs from DAC.

Baseband to L band conversion.

Single pole low pass filter.

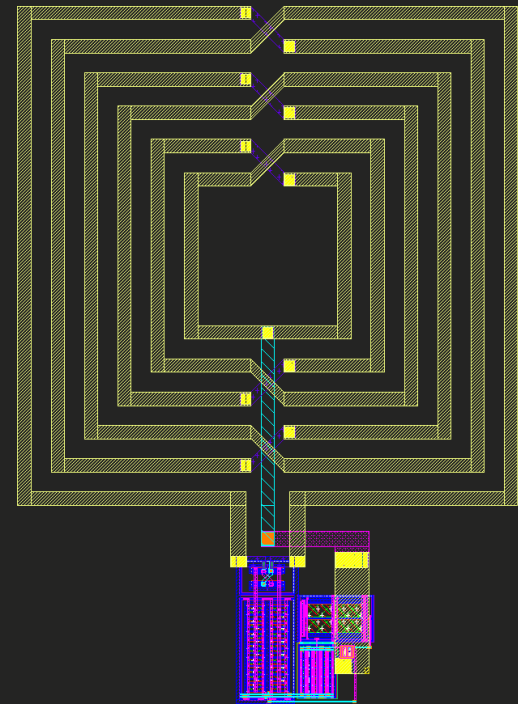


Transimpedance quadrature upconverter.

Current mode inputs from DAC.

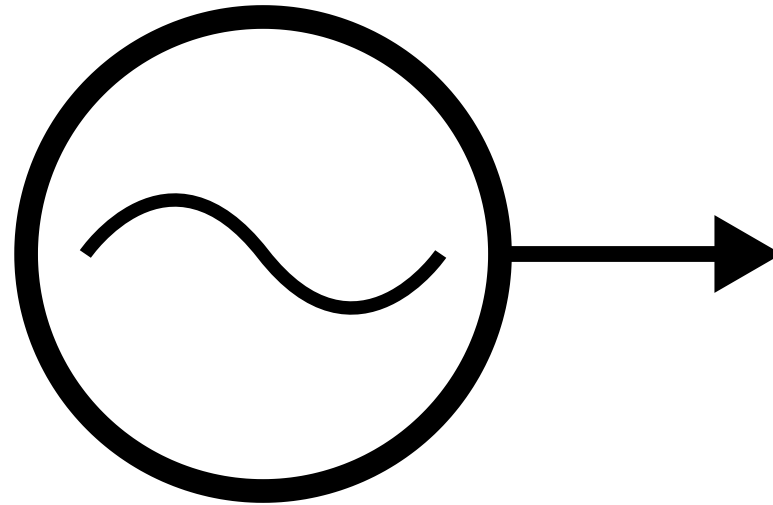
Baseband to L band conversion.

Single pole low pass filter.



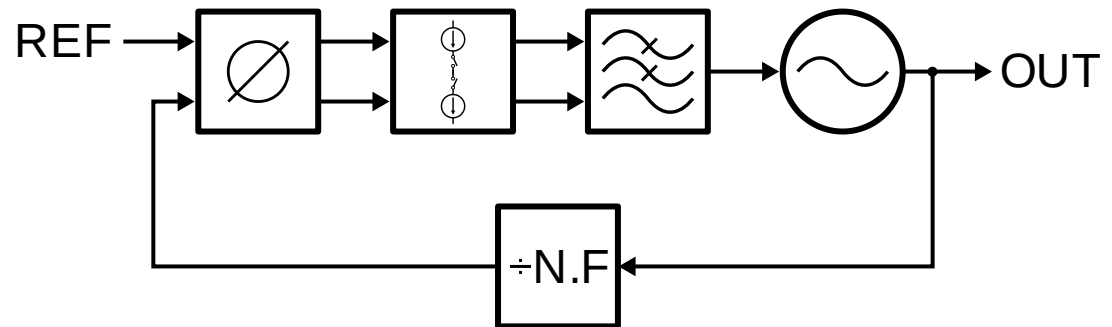
Phase Locked Loop

Fractional-N with dithered noise
shaping



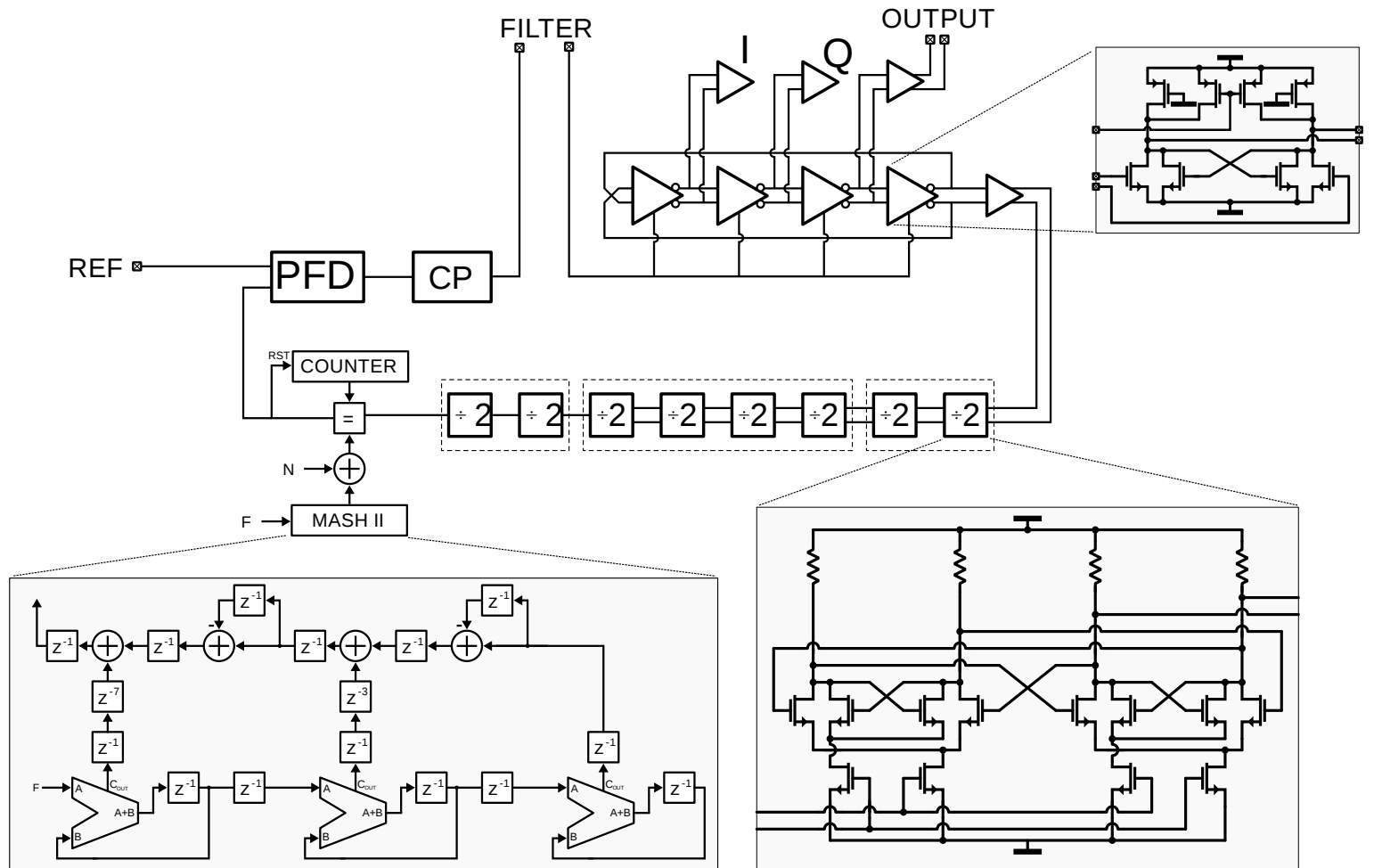
Phase Locked Loop

Fractional-N with dithered noise shaping



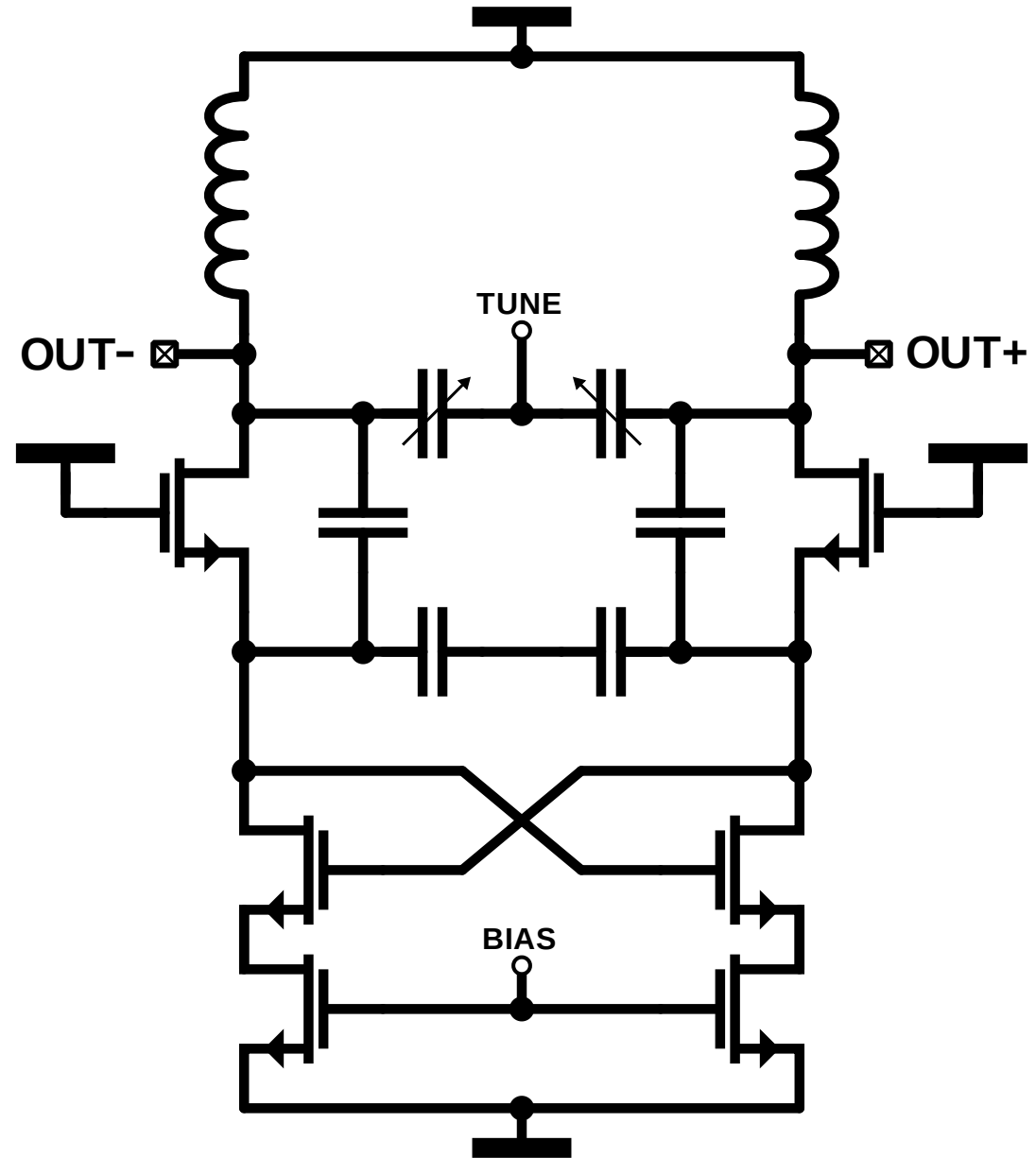
Phase Locked Loop

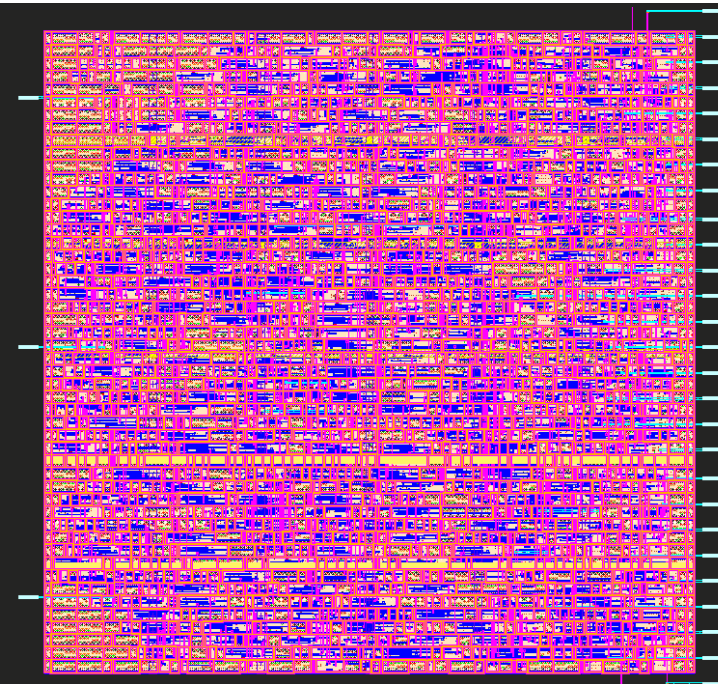
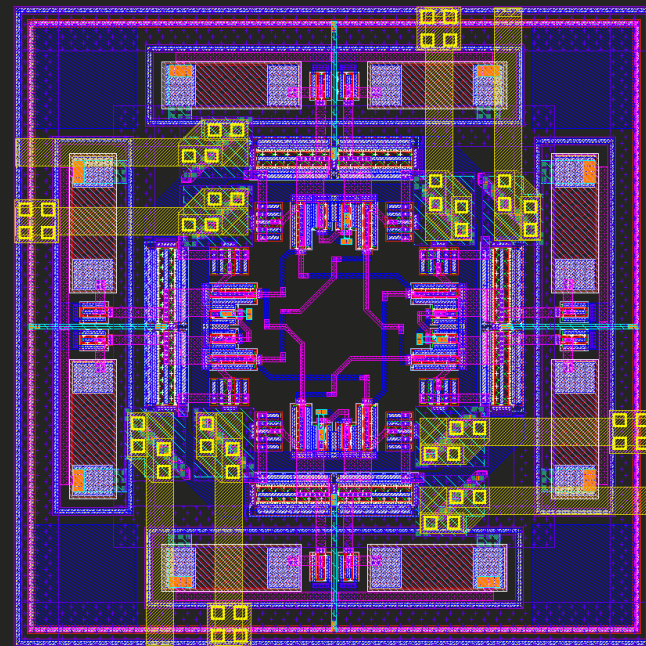
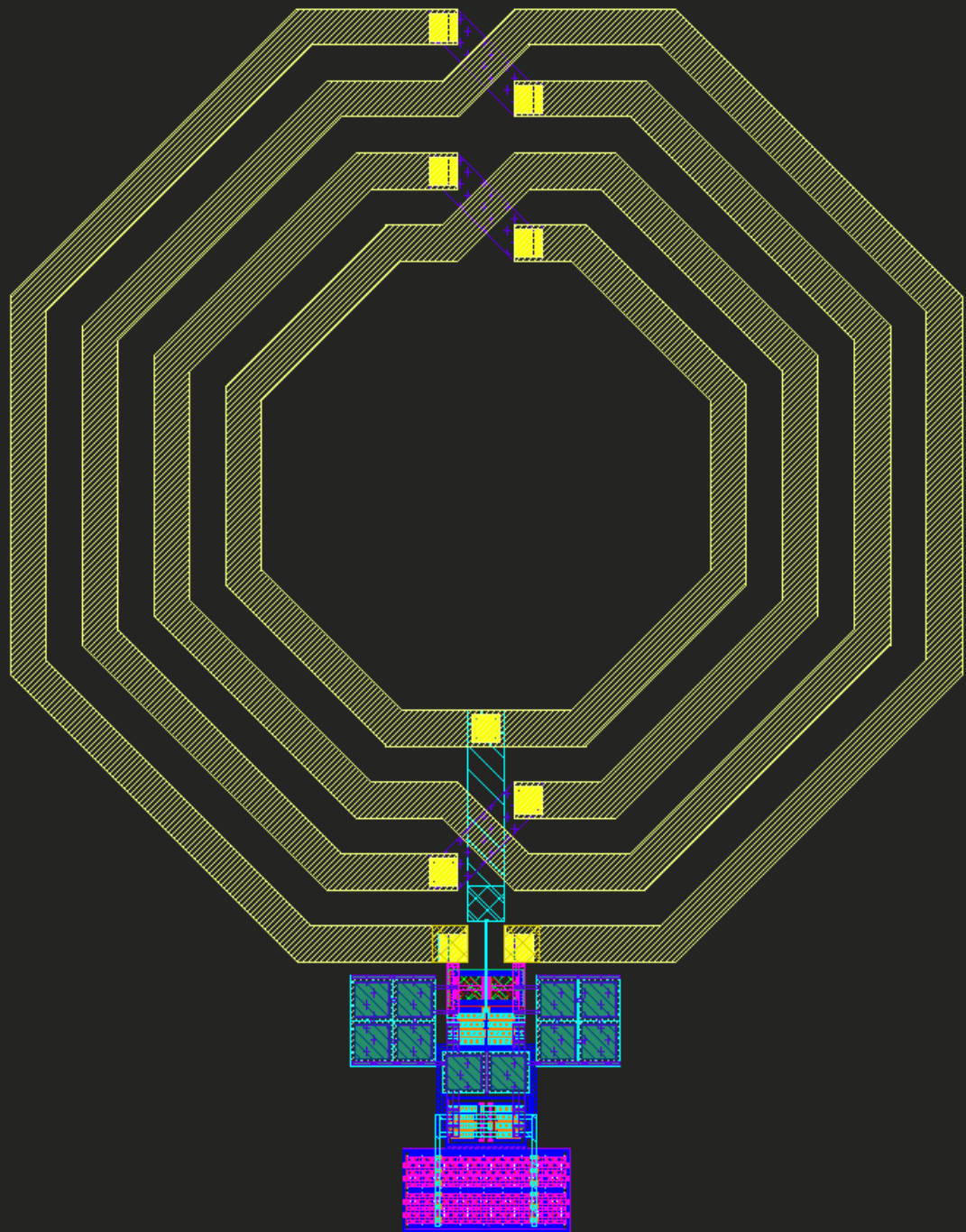
Fractional-N with dithered noise shaping



LC VCO

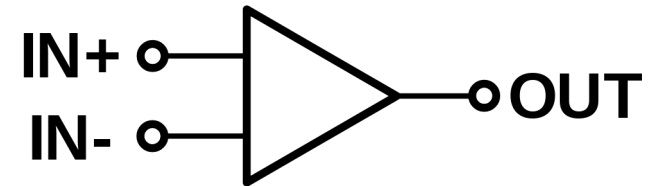
8 GHz Colpitts topology





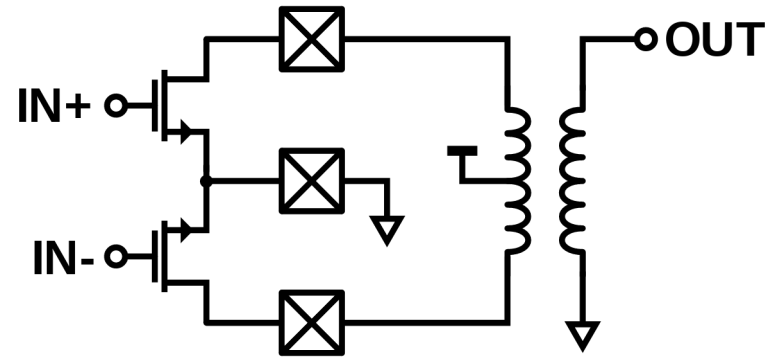
Simple RF Driver

External Resonant Circuit

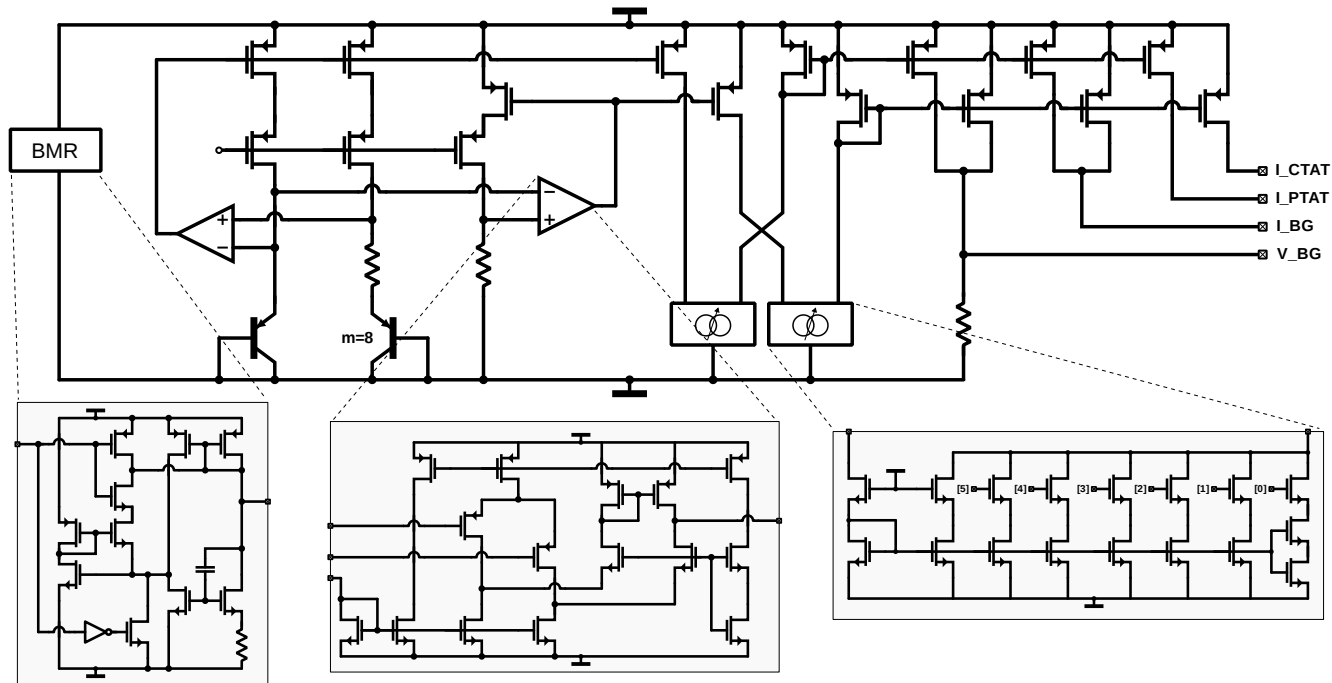


Simple RF Driver

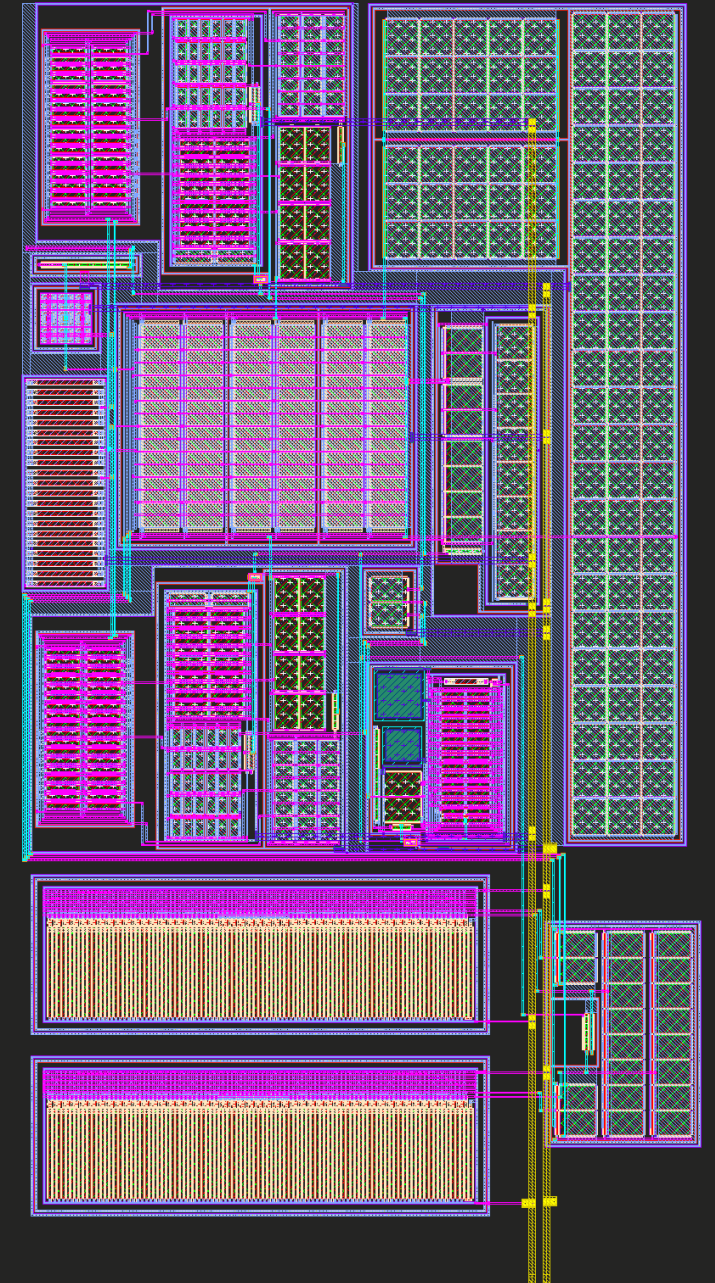
External Resonant Circuit

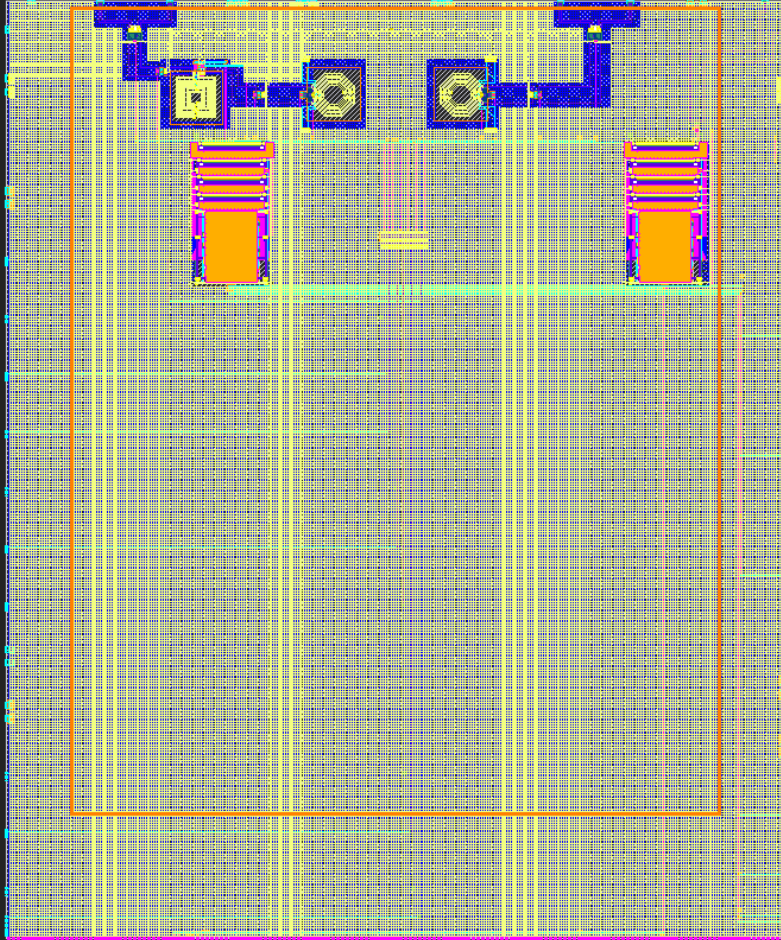


Bandgap Reference



Less than $\pm 0.2\%$ variation from -40° to 125°





That's all.

Thanks for listening.

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🌐 Thomas Parry