IC research directions

GaN / GaAs — CMOS co-design

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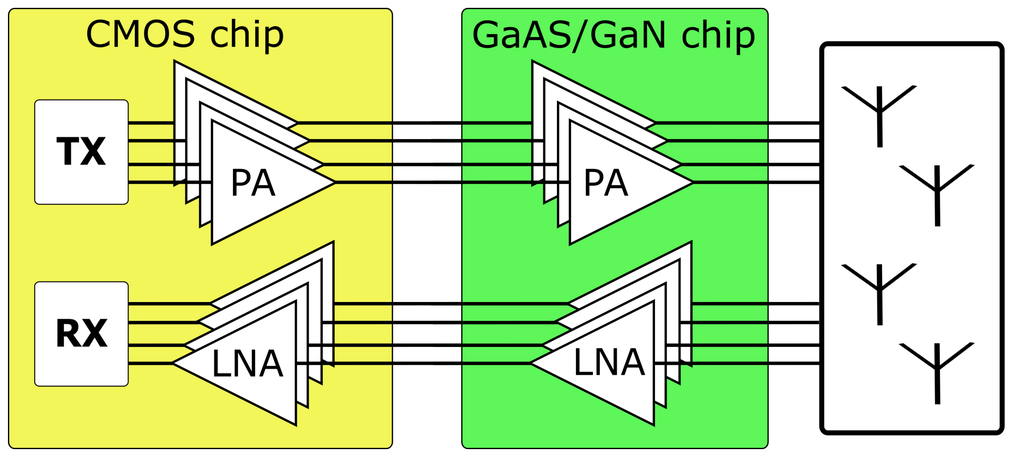
RF SAMPO

❖ Veturi program

❖ Business Finland

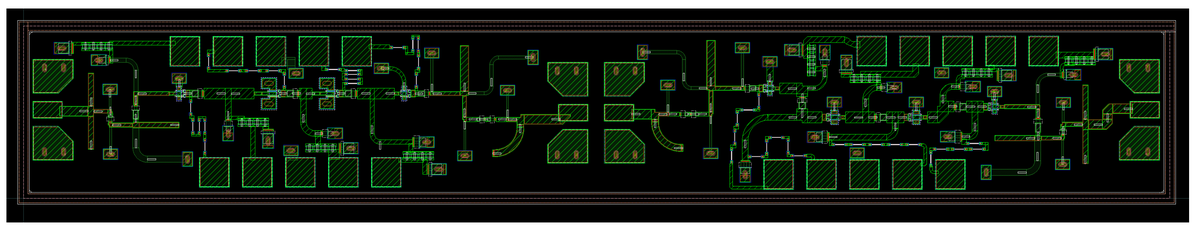
Motivation

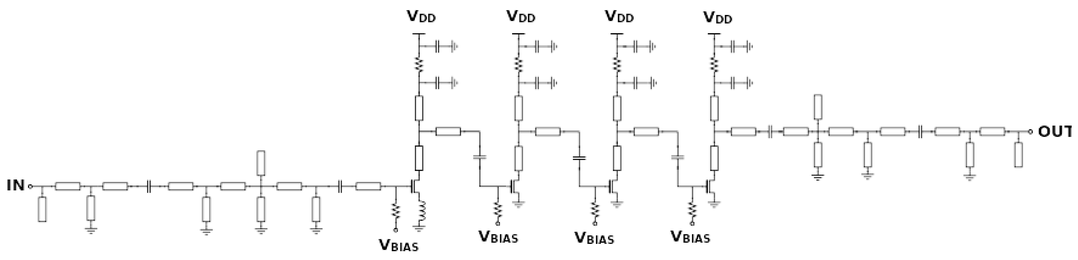
- GaN /GaAs front-ends offer higher sensitivity and better power efficiency
- GaN booster die enables high output power
- 3D-integration enables dense phased array implementations

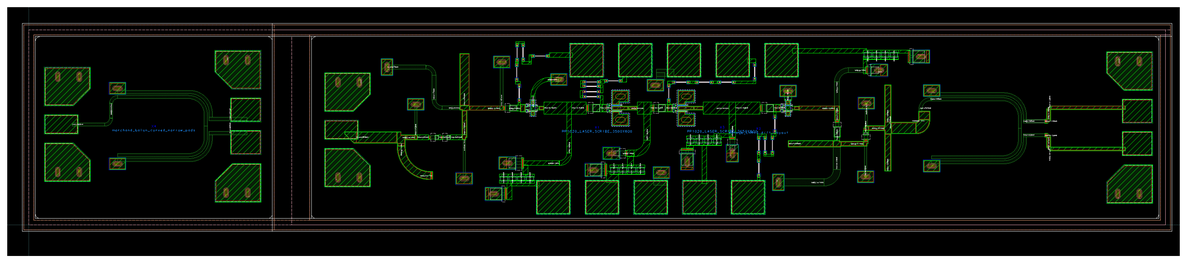


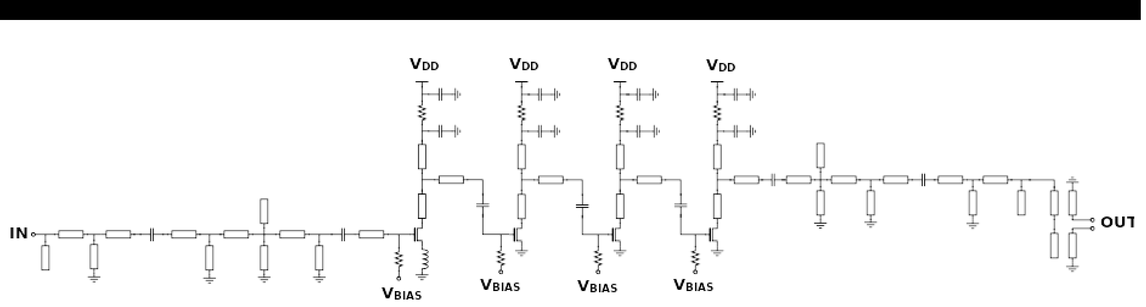
GaAs LNA

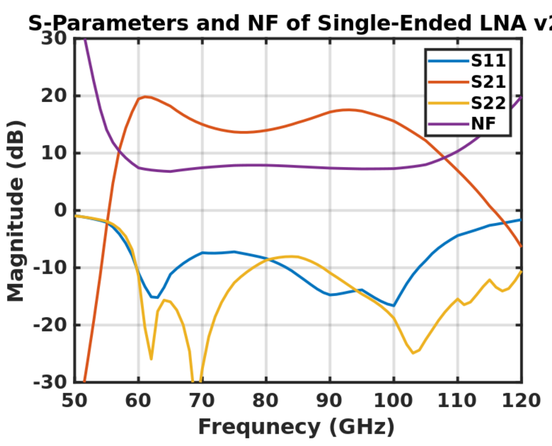
- Wideband four-stage pre-amplifier for a CMOS receiver with a 0.1 µm GaAs pHEMT technology
- Three versions have been designed with single-ended and balanced output
- BW=60…100 GHz, Gain=15 dB, NF=8 dB, DC = 27 mA / 1V
- Die size 4 x 0,6 mm

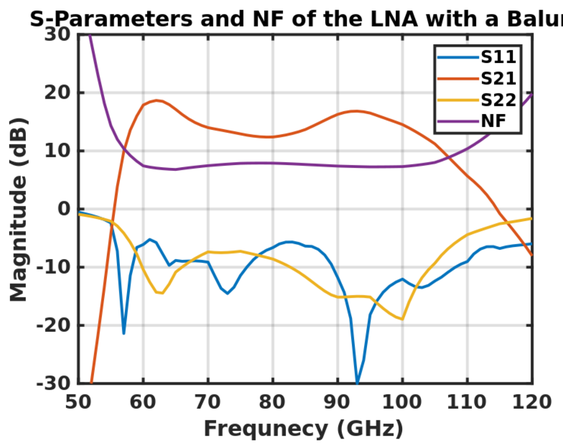












GaN PA, LNA and VCO

- Aalto's first tape-out on 0.15 µm GaN D-HEMT process
- A learning experience: simple LNA, PA, VCO
- Sensors for temperature analysis

LNA is a current re-use two-stage amplifier:

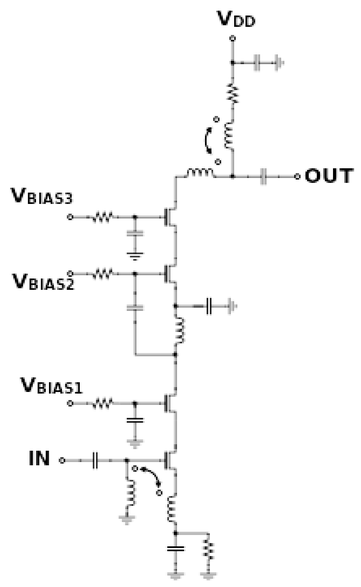
At 25 GHz Gain =14 dB, NF=3 dB, Pin,1db=-13dBm

PA is a three-stage amplifier operating at 25 GHz:

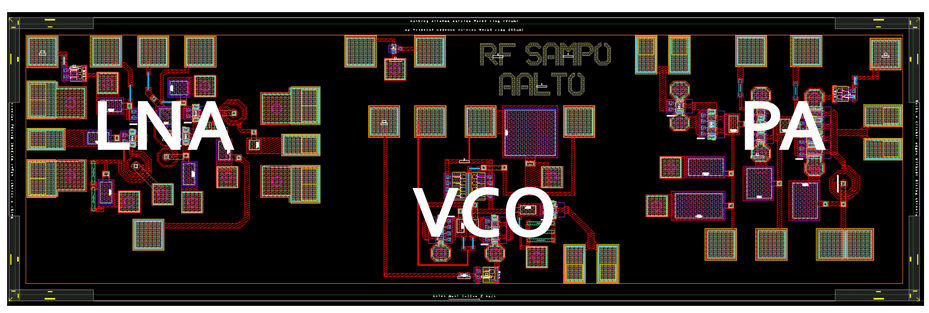
Gain=23 dB, Pout,1dB=26 dBm, DC= 260 mA / 10V

VCO is a cross-coupled transistor-pair LC-oscillator:

Freq=25-29 GHz, phase noise = -116 dBc/Hz@1MHz at 29 GHz



Current re-use LNA



Die size 3 x 1 mm

Acknowledgement

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