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IC Technologies and Circuits – mmWave to THz

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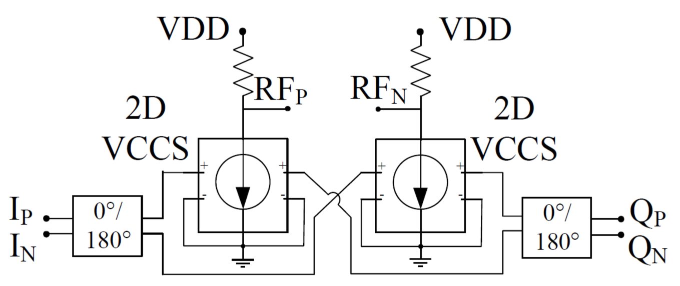
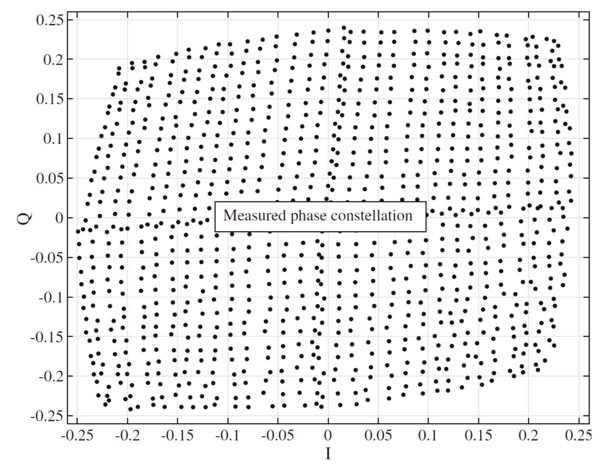
Key TRx blocks in mmWave

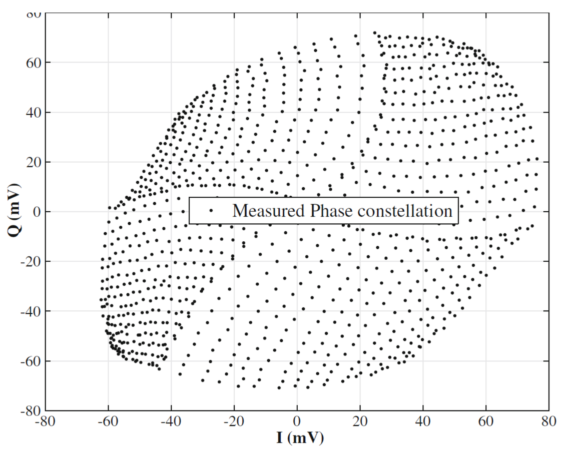
Active Phase Shifter

- 15 GHz design fabricated in 45 nm CMOS PDSOI technology
- Basic topology consists of variable summing of the original and 90 degrees rotated signal.



Measured phase constellation of the stand alone phase shifter



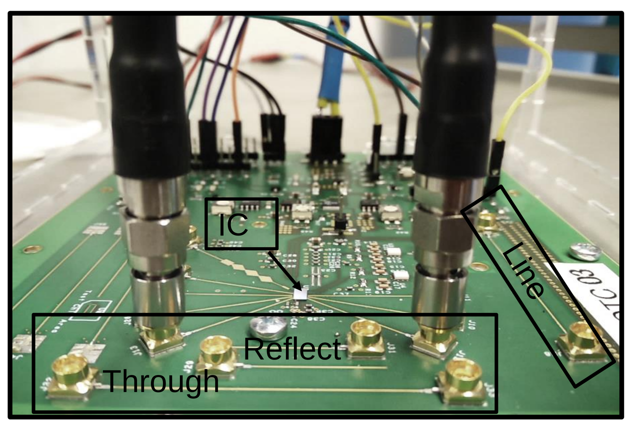


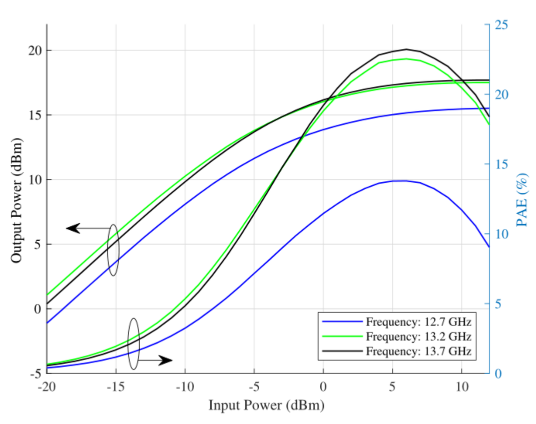
Phase constellation showing severe non-linearity due to internal circuit coupling

PA

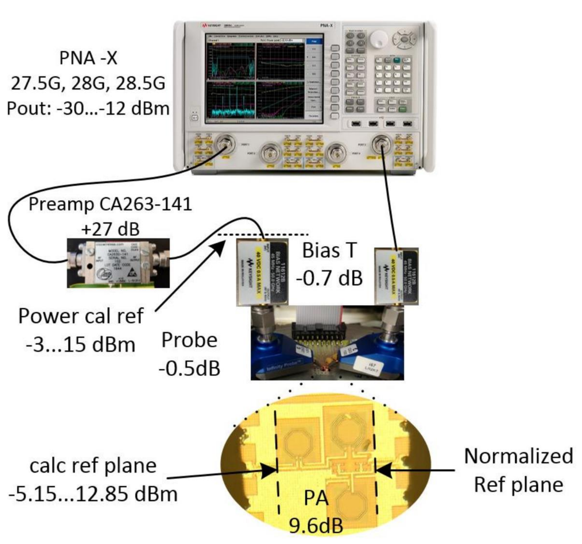
Due to limited available voltage swing in the current CMOS technologies, getting higher power is challenging. Stacked PA topology is a novel workaround towards this problem.

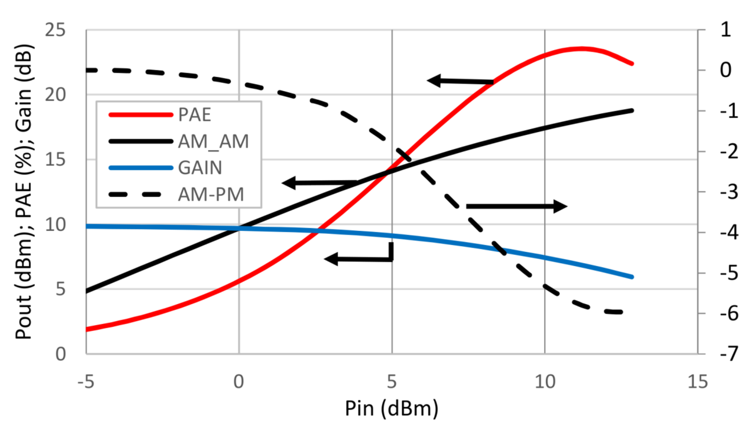
Measurement setup and results from a 15 GHz stacked PA fabricated in 45 nm CMOS PDSOI technology





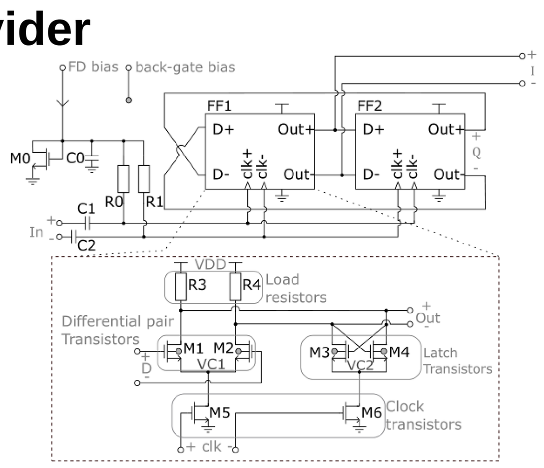
Measurement setup and results from a 25 to 30,5 GHz PA fabricated in 22 nm CMOS FDSOI technology

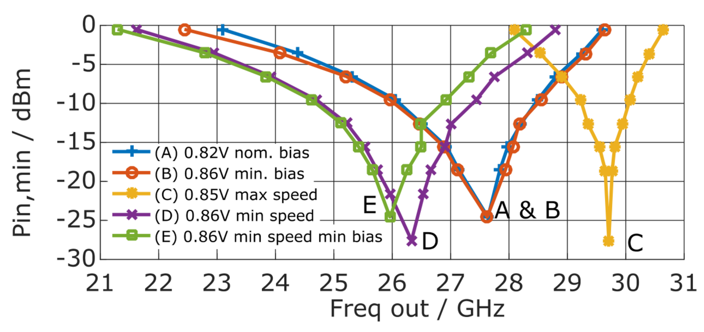




Frequency Divider

A classic divide by 2 circuit implementation using 22nm FDSOI technology.

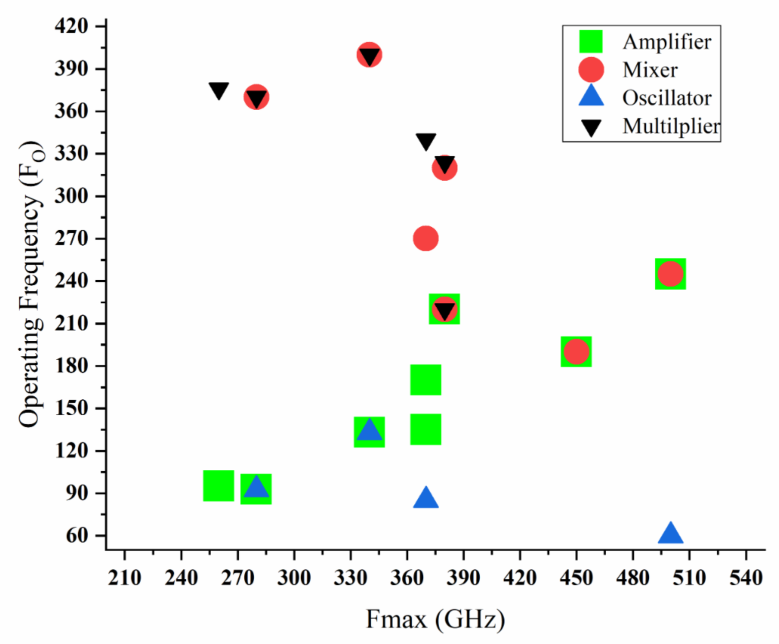


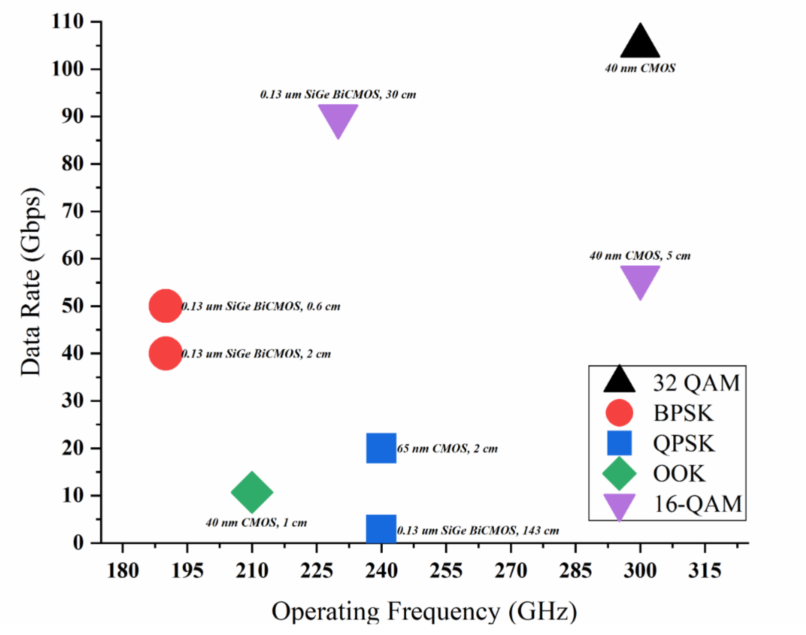


Sensitivity curve for the divider

Going to THz

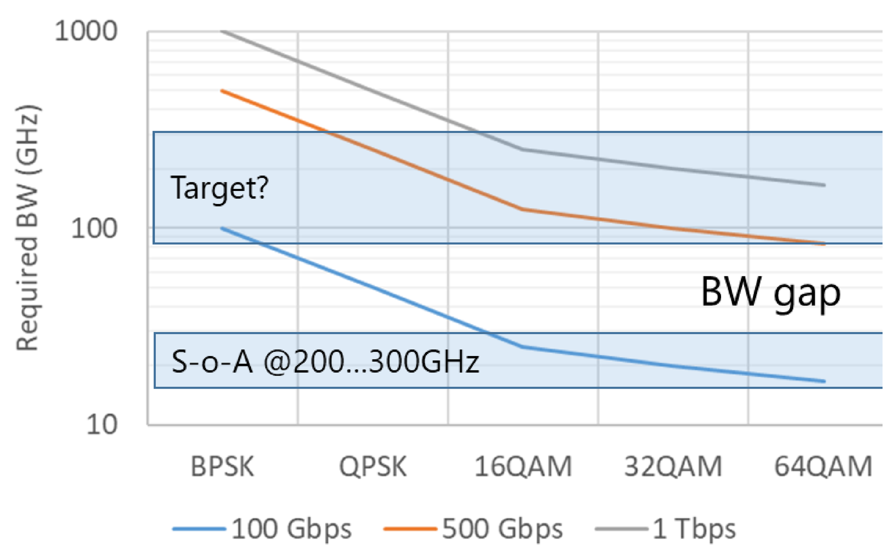
Below is literature survey of highest operation frequency achieved with different process nodes, and right the highest data rates achieved. Some of the transceivers have a nonlinear element next to the antenna, allowing only amplitude modulation.

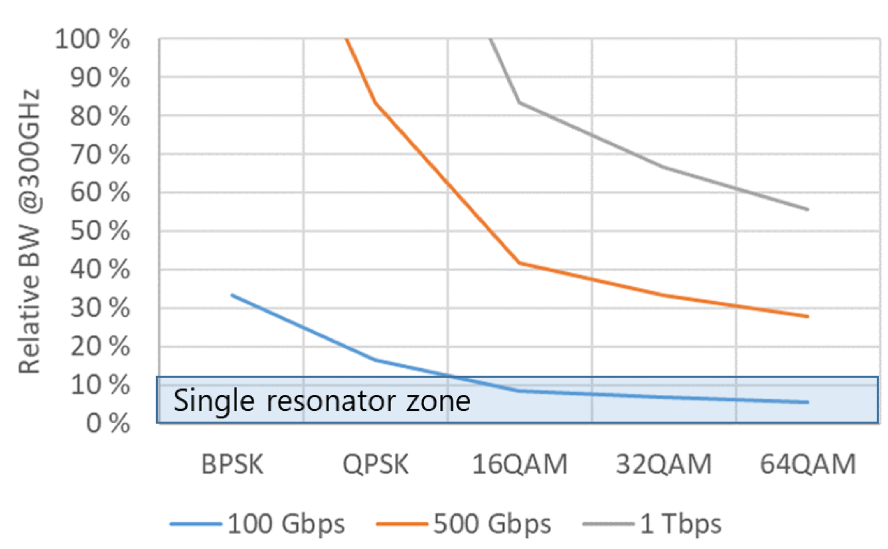




Some challenges on the way to THz:

- Affordable technology choices (IC etc.)
- Speed of transistor f_T / f_{max}
- Gain and output power
- Increased noise $NF \sim \left(\frac{\omega_0}{\omega_T}\right)^2$
- Integration with antennas and steerable arrays
- Absolute and relative bandwidth required for Tbps
- Is spectrally efficient waveform feasible?





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