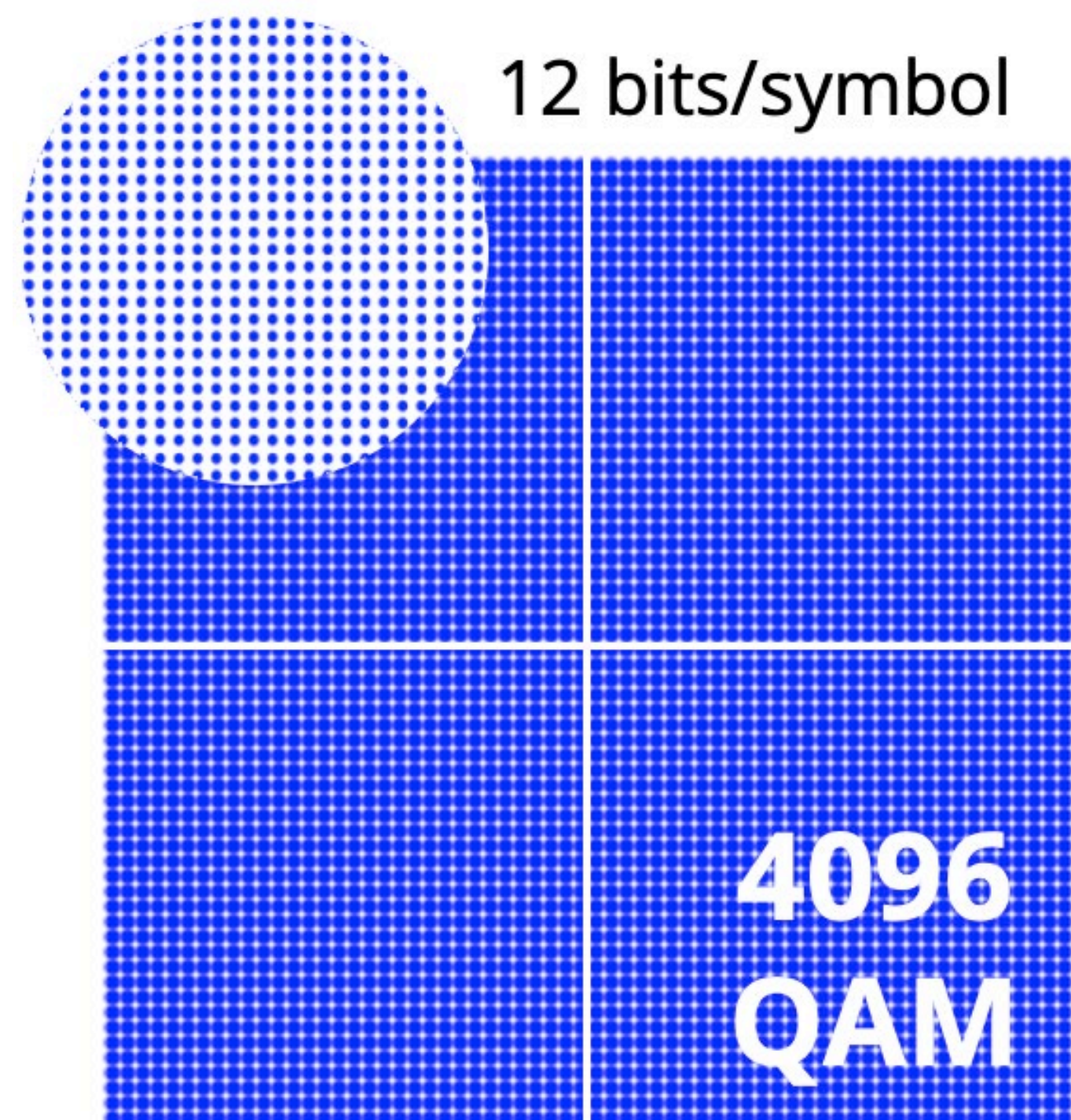


Demands for Low-Jitter Sub-6GHz PLL

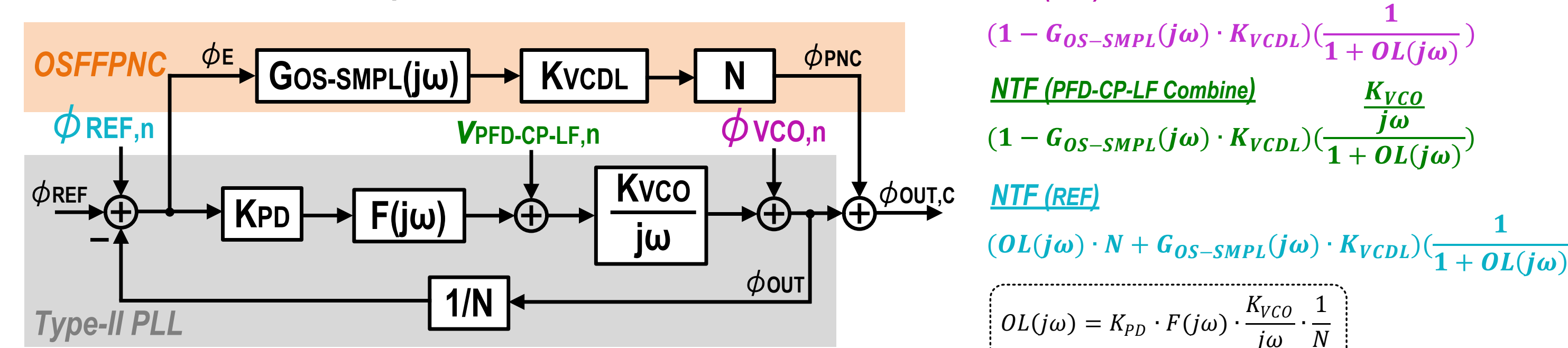


Wi-Fi 7 (IEEE 802.11be):

- Phase noise of LO causes the constellation diagram to rotate. → EVM degradation
- Stringent jitter requirement for the required EVM for high-order modulation schemes
- Ultra-low RMS jitter (~140 fs) is required for 4K-QAM

Phase Domain System Block Diagram

Phase Domain Model of Proposed OSFFPNC



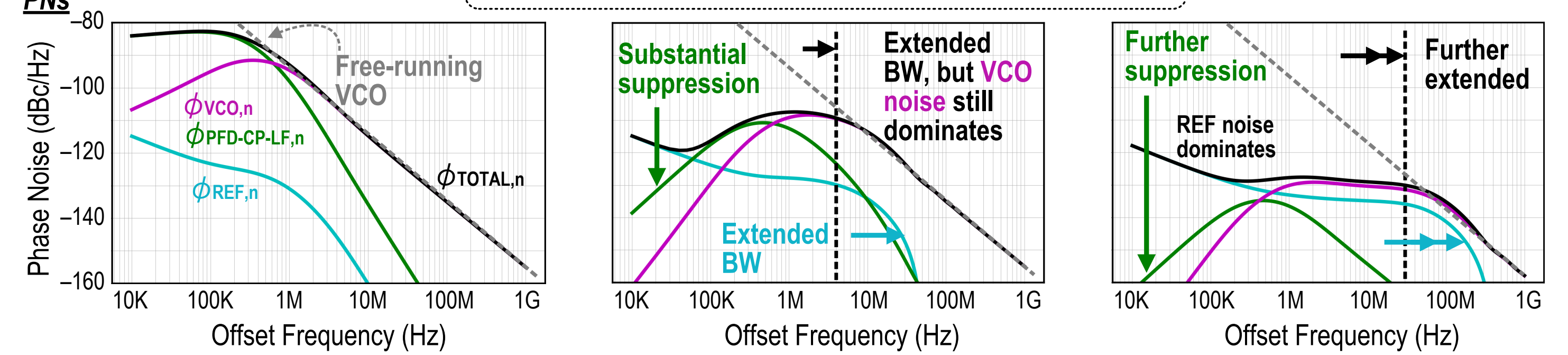
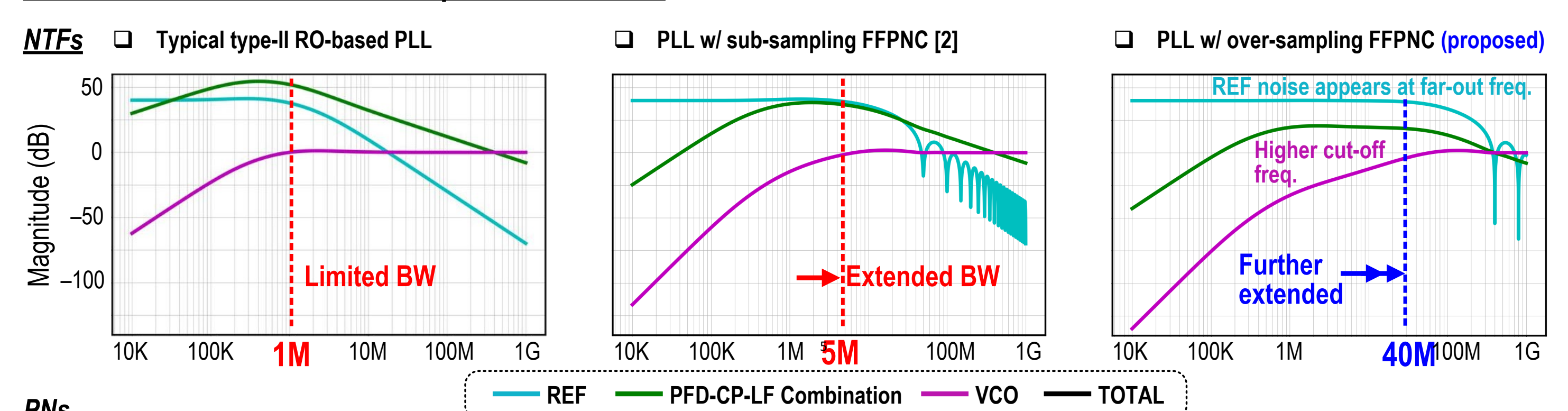
$$NTF(VCO) = (1 - G_{OS-SMPL}(j\omega) \cdot K_{VCDL}) \left(\frac{1}{1 + OL(j\omega)} \right)$$

$$NTF(PFD-CP-LF Combine) = (1 - G_{OS-SMPL}(j\omega) \cdot K_{VCO}) \left(\frac{K_{VCO}}{j\omega} \right) \left(\frac{1}{1 + OL(j\omega)} \right)$$

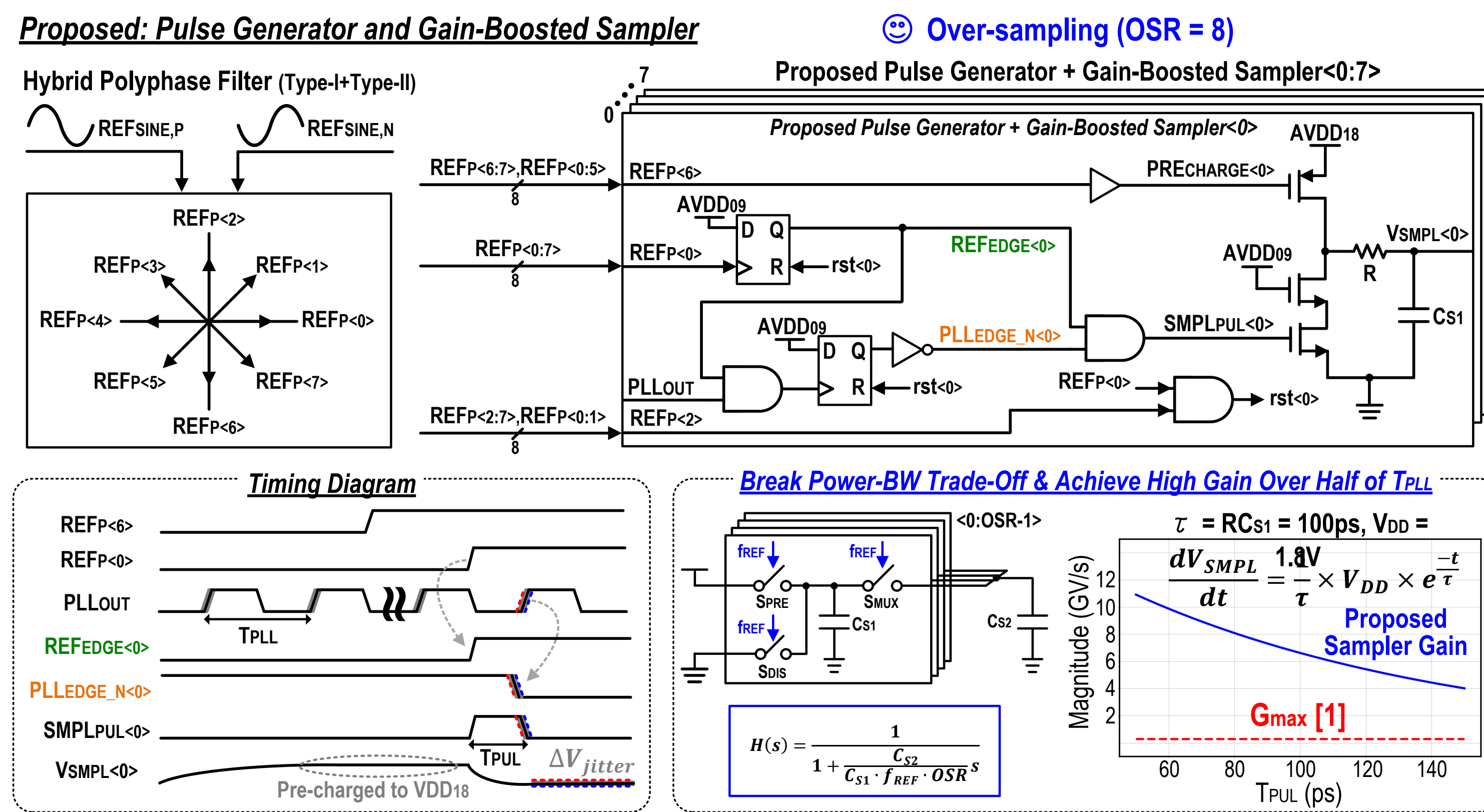
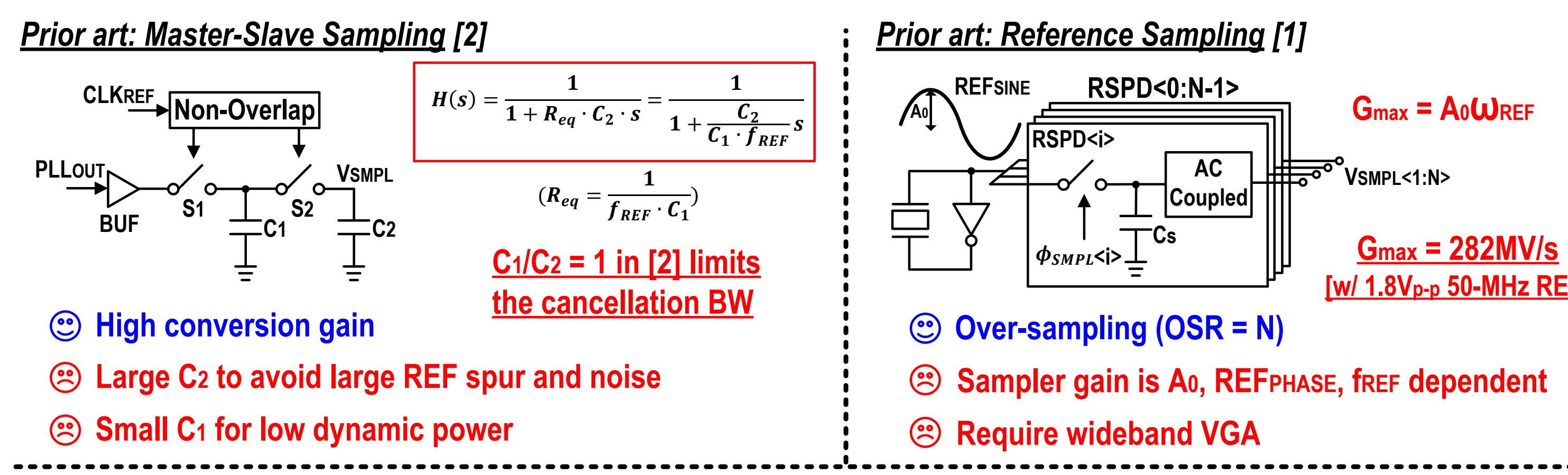
$$NTF(REF) = (OL(j\omega) \cdot N + G_{OS-SMPL}(j\omega) \cdot K_{VCDL}) \left(\frac{1}{1 + OL(j\omega)} \right)$$

$$OL(j\omega) = K_{PD} \cdot F(j\omega) \cdot \frac{K_{VCO}}{j\omega} \cdot \frac{1}{N}$$

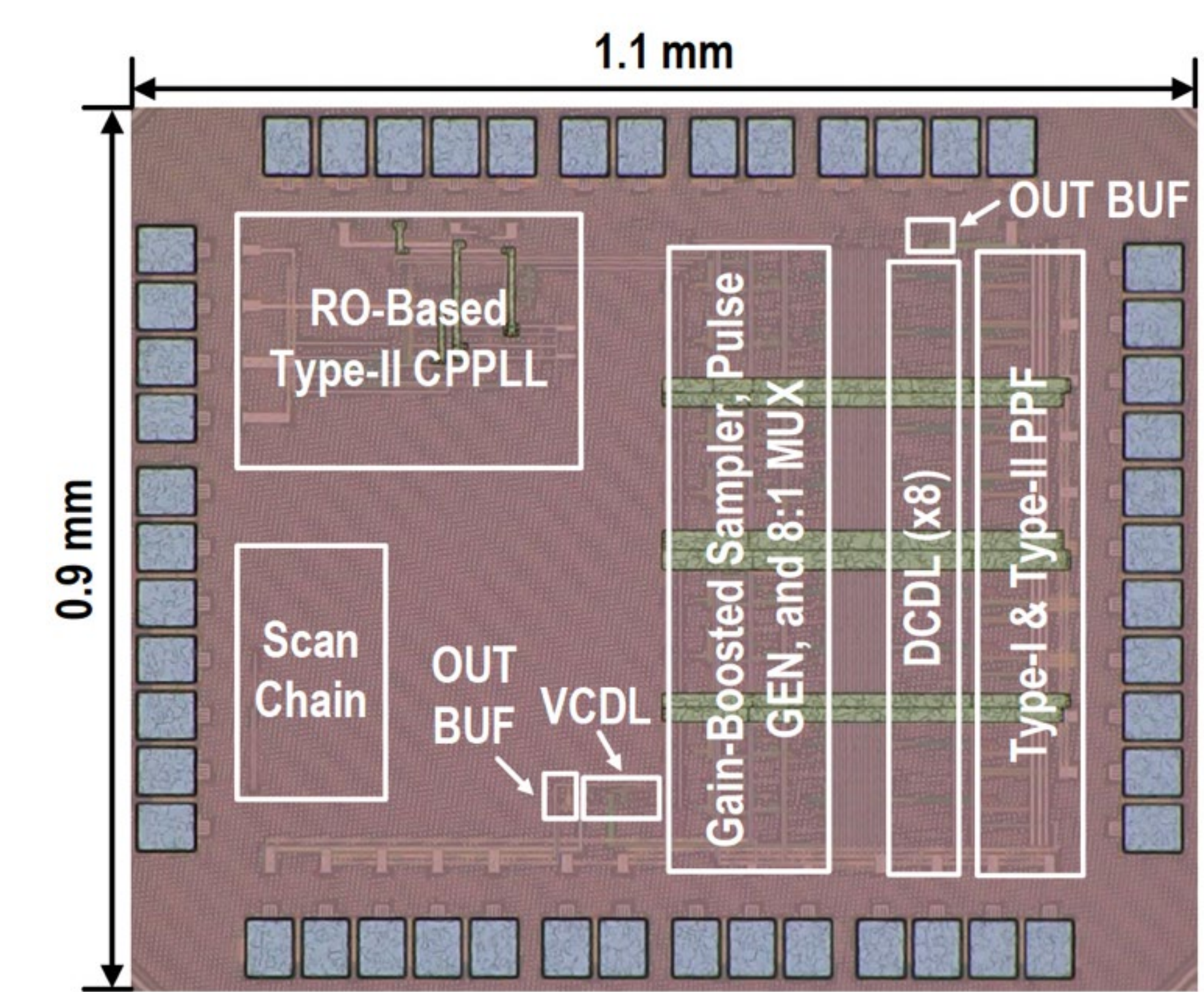
NTFs and Simulated PNs of Proposed OSFFPNC



Proposed Gain-boosted PD

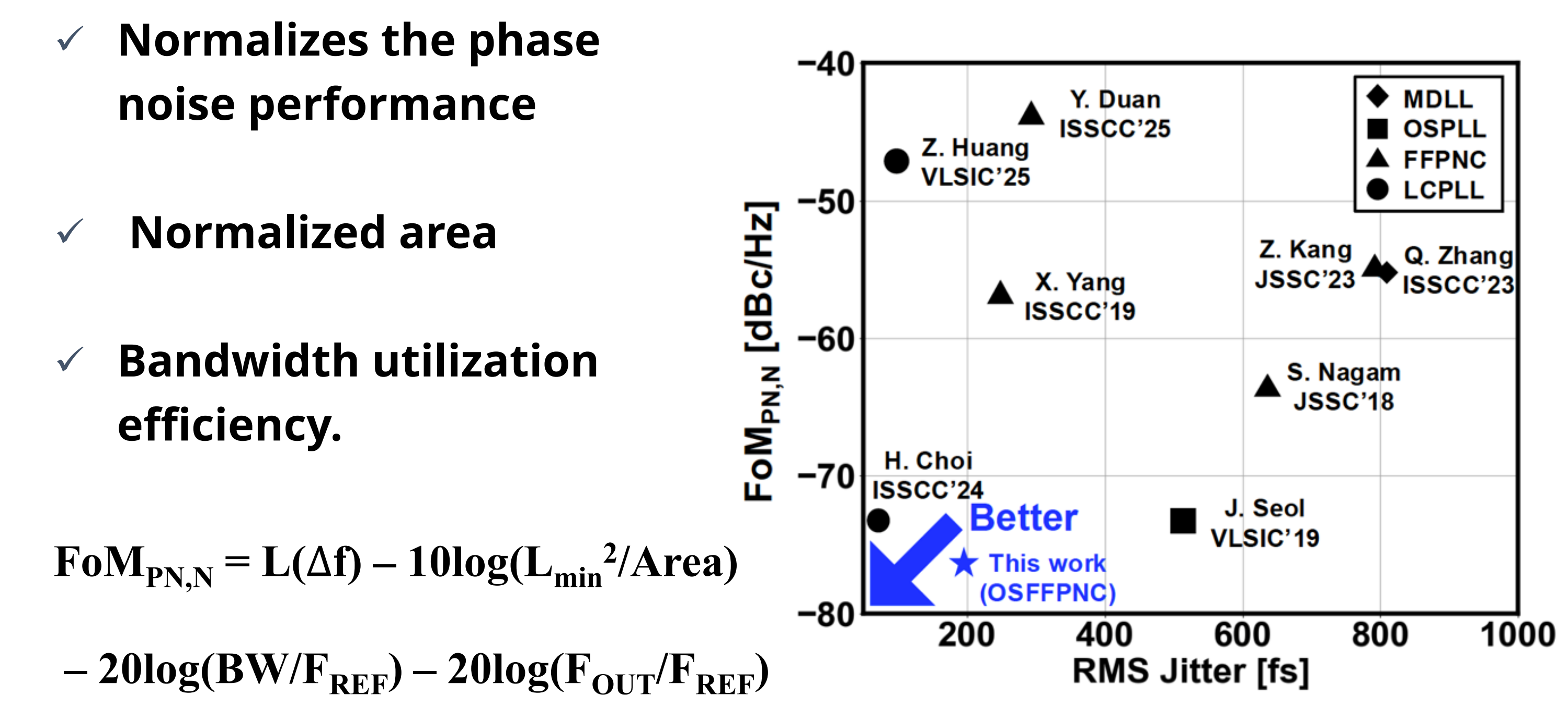


Chip Micrograph

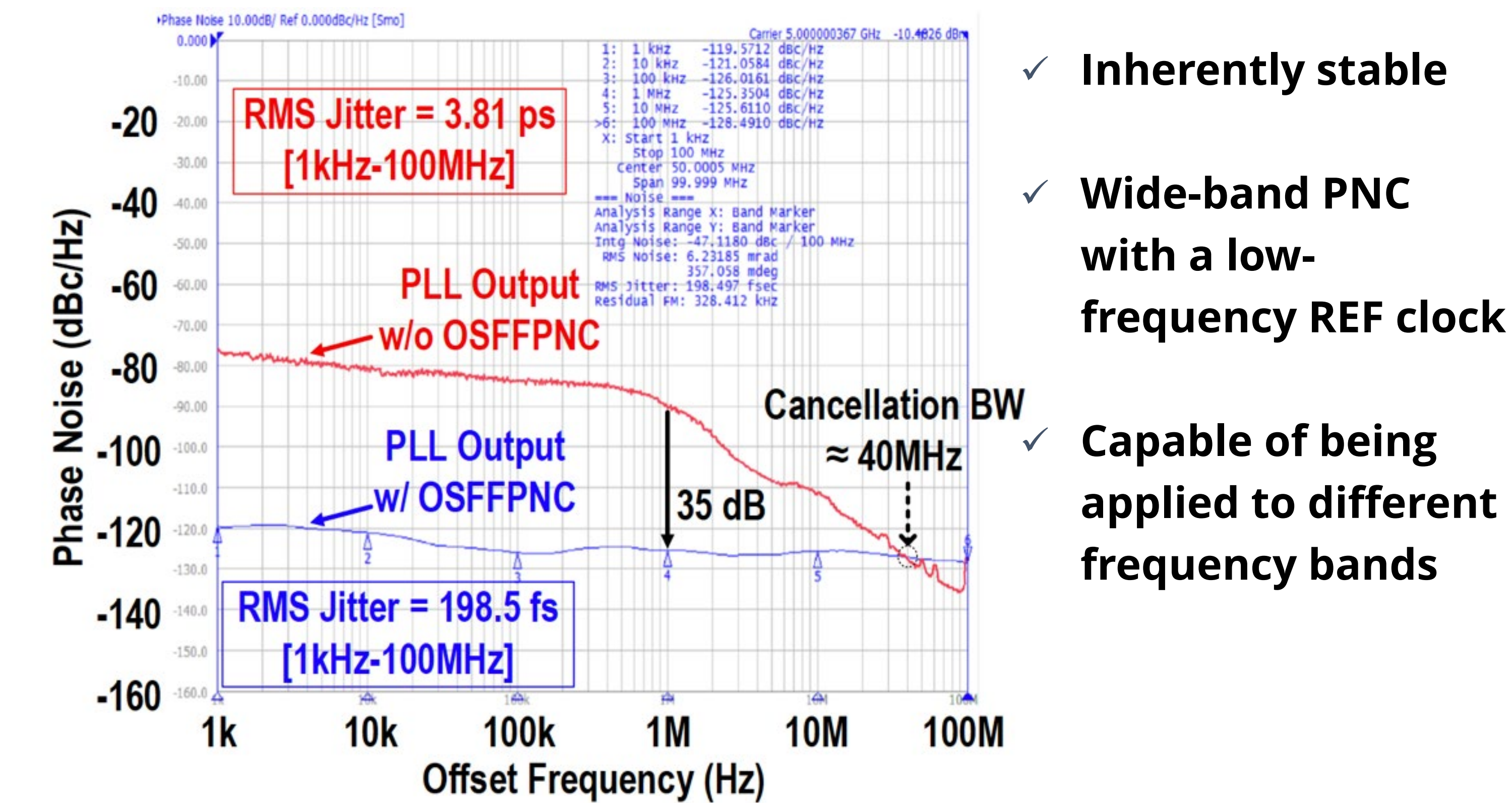


- Type-II analog PLL with Ring-based VCO.
- 8x time interleaved feedforward phase noise cancellation path
- TSMC 28nm CMOS process.

Comparison with prior art



Measurement Results and Conclusions



- Inherently stable
- Wide-band PNC with a low-frequency REF clock
- Capable of being applied to different frequency bands

Proposed Over-Sampling FFPNC PLLs

