

A 0.98 to 6.6 GHz Tunable Wideband VCO in a 180 nm CMOS Technology for Reconfigurable Radio Transceiver

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Purpose of this work

To realize low-noise, wide-tuning-range, small-area VCO for single-chip multi-band transceiver.

Target frequency tuning range : 800MHz - 6GHz

Techniques adopted

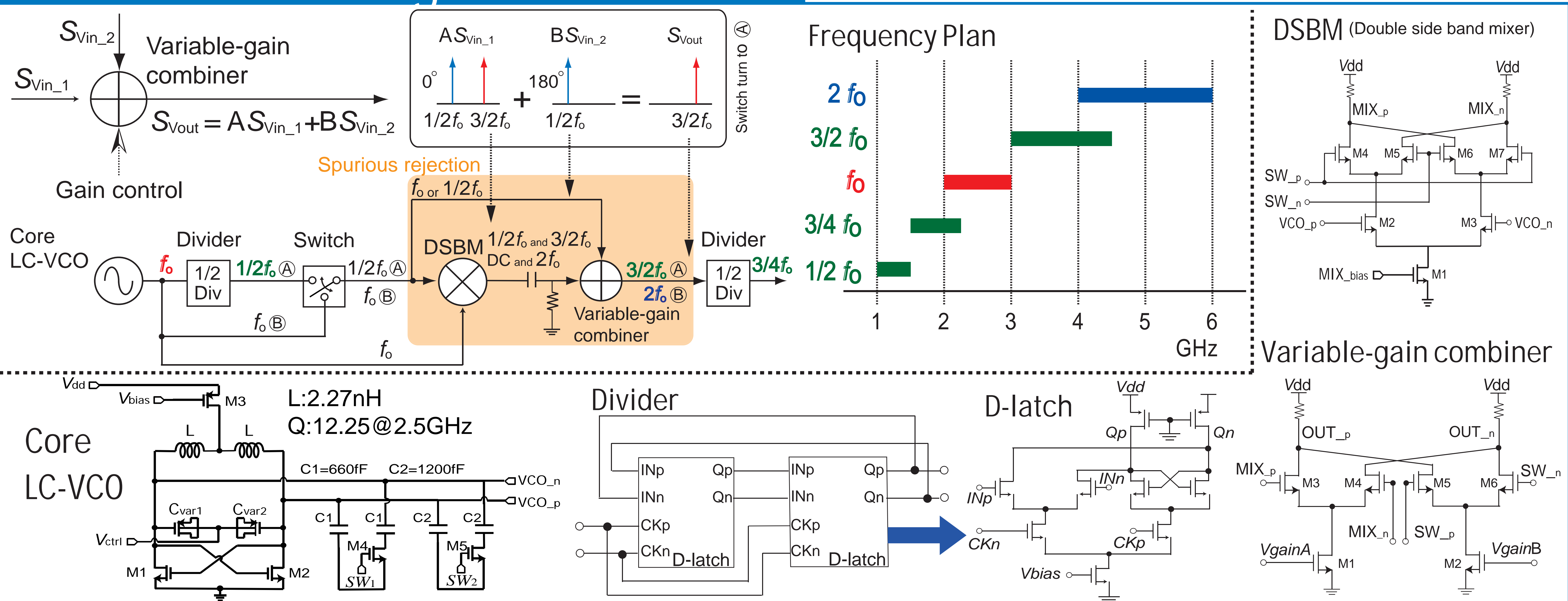
Architecture : Core VCO + tuning-range extender
Use differential VCO rather than QVCO.

The former has superior phase noise characteristics and smaller area.

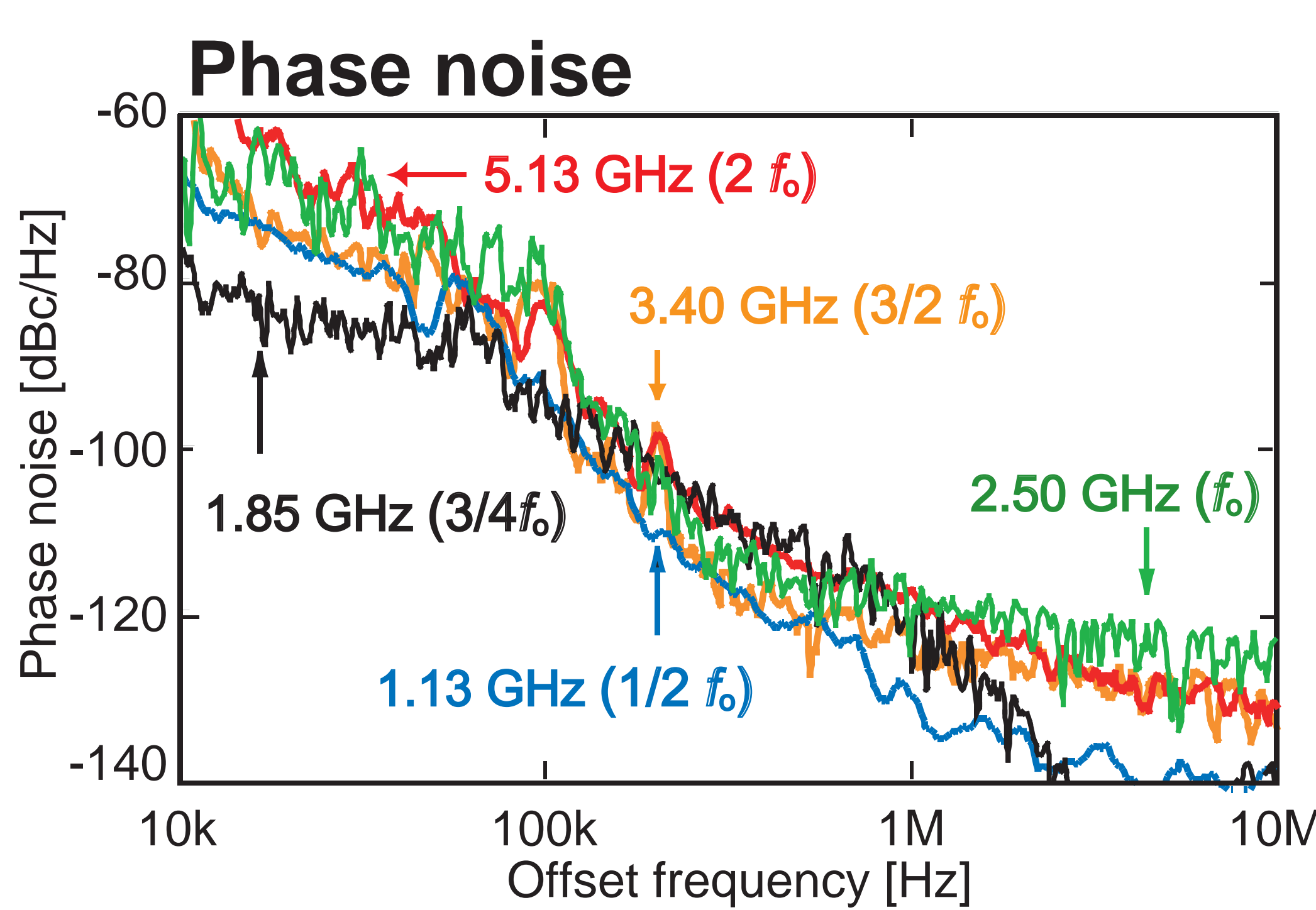
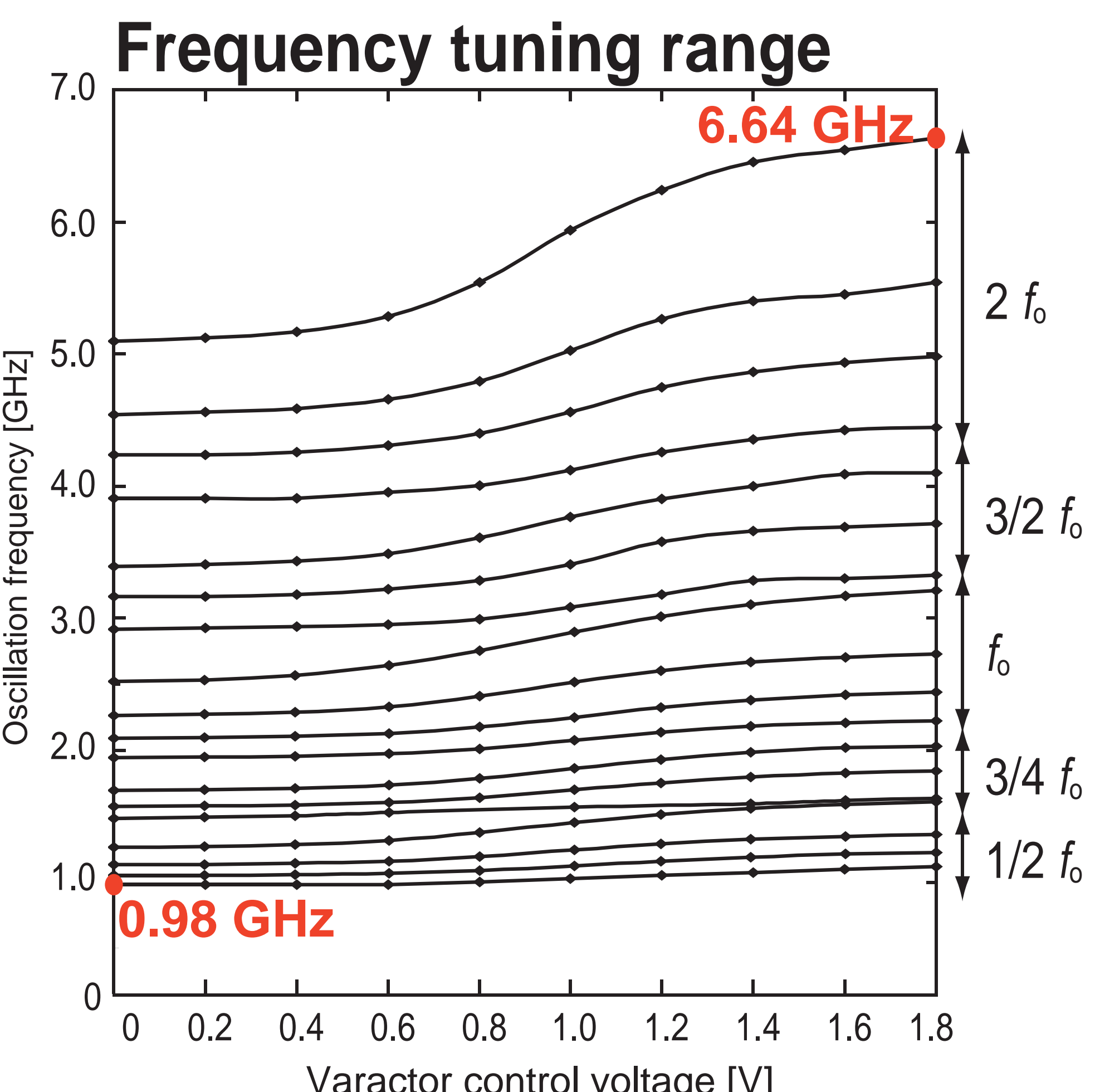
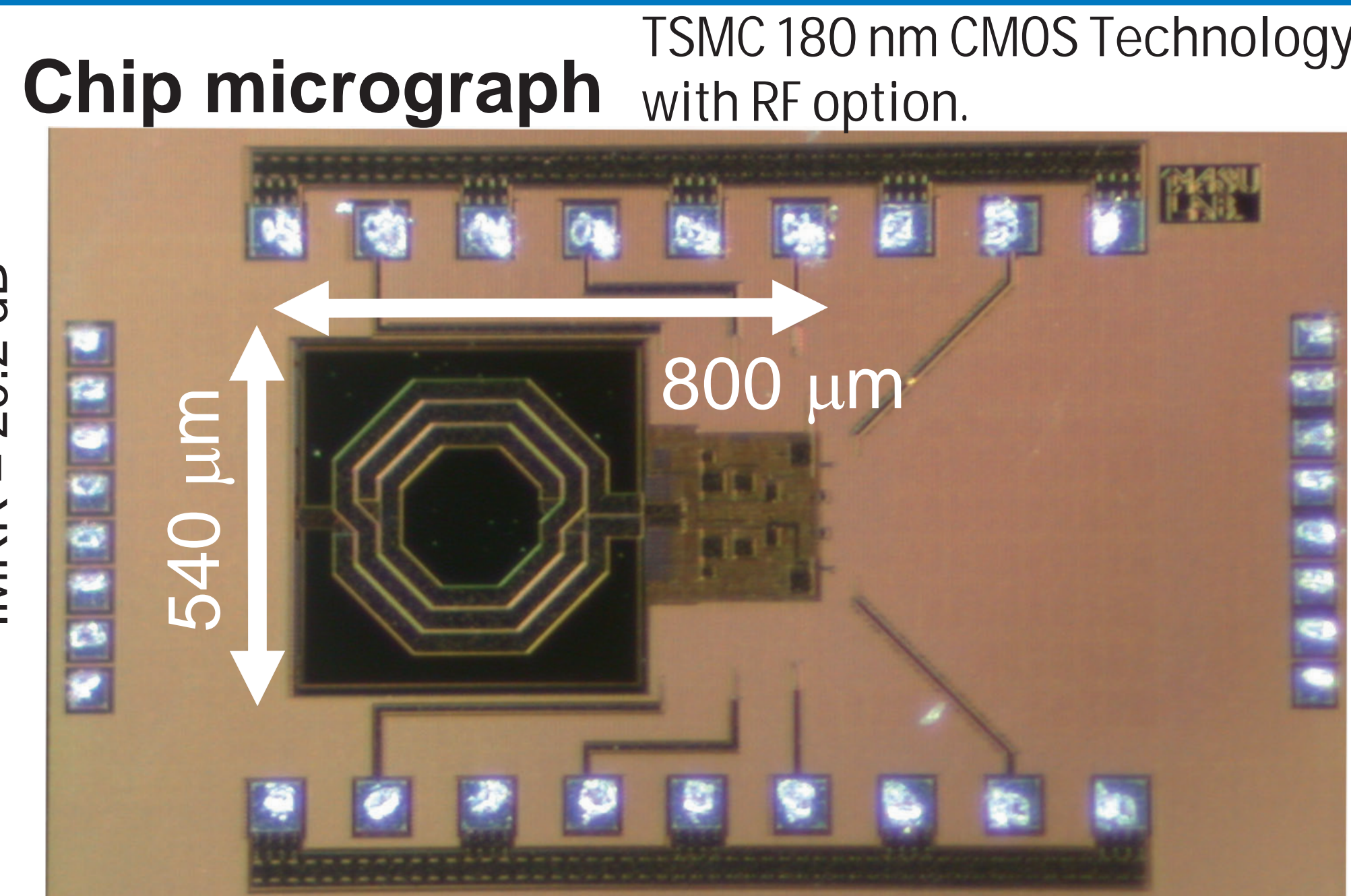
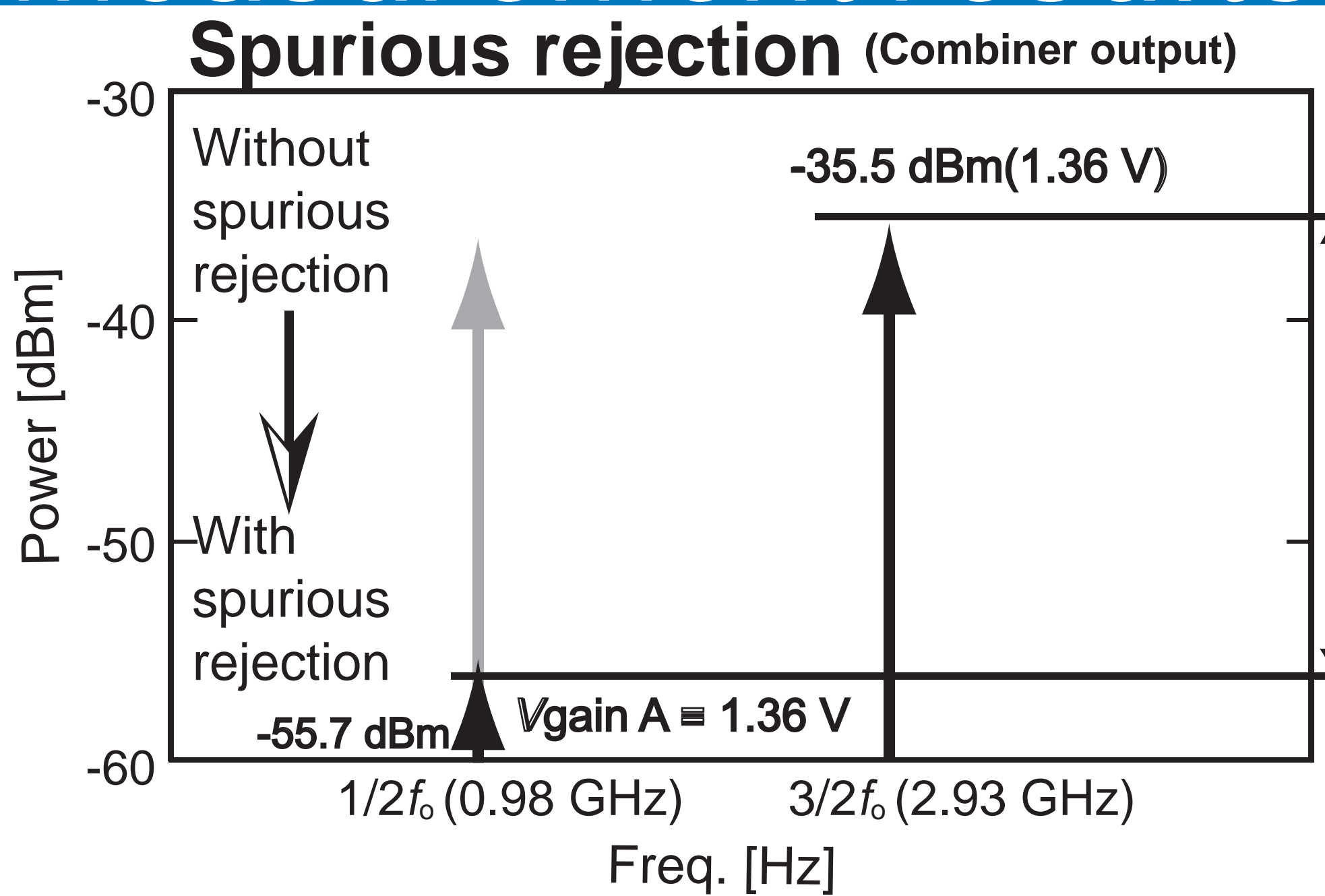
Use DSBM rather than SSBM.

DSBM is composed of smaller number of components.

Details of the design



Measurement results

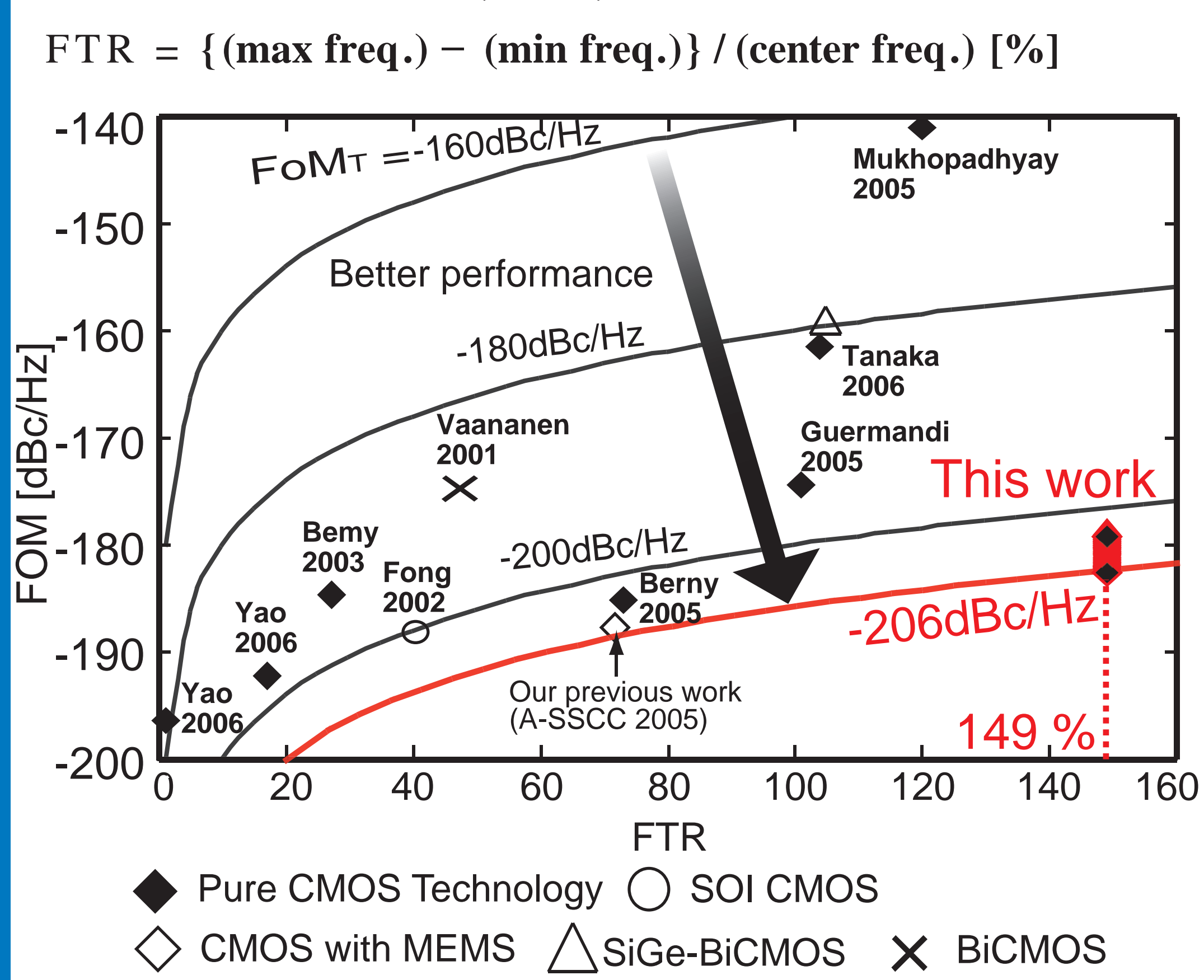


Supply voltage V_{DD}	1.8 V
VCO core current	2.45 ~ 14.9 mA
Frequency tuning range (FTR)	0.98 GHz ~ 6.64 GHz (149%)
Chip area	800μm x 540μm
Image rejection ratio (IMRR)	- 20.2 dB

Impact

$$FoM_T = L\{f_{offset}\} - 20\log\left(\frac{f_0}{f_{offset}} \cdot \frac{FTR}{10}\right) + 10\log\left(\frac{P_{DC}}{1\text{ mW}}\right)$$

$$= FoM - 20\log\left(\frac{FTR}{10}\right)$$



Oscillation frequency	Phase noise @ 1 MHz offset [dBc/Hz]	FoM [dBc/Hz]	FoM _T [dBc/Hz]
5.12 GHz (2f ₀)	- 117	- 179	- 203
3.40 GHz (3/2f ₀)	- 122	- 179	- 203
2.50 GHz (f ₀)	- 125	- 183	- 206
1.85 GHz (3/4f ₀)	- 128	- 180	- 203
1.13 GHz (1/2f ₀)	- 130	- 179	- 202

The widest frequency tuning range and the best FoM_T are achieved.

Conclusion

Low-phase-noise small-area VCO with the widest frequency tuning range of 0.98 - 6.64 GHz is realized.