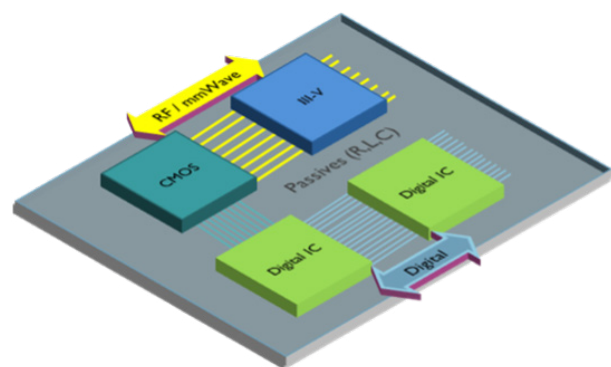


# RF Silicon Interposer for next-generation high-performance RF and mixed-signal applications

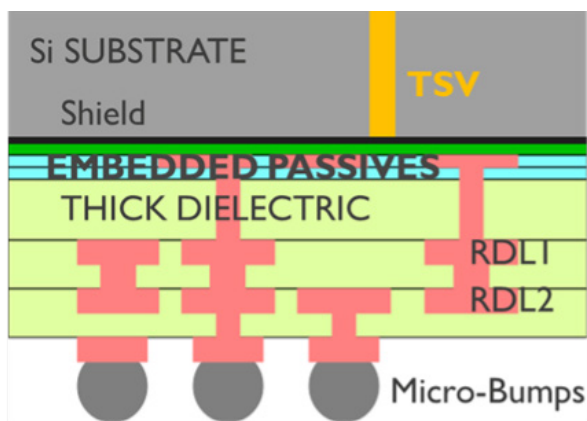
Imec's RF Si interposer technology serves as a heterogeneous integration platform for digital, analog, RF to sub-THz CMOS and III/V chiplets including high-quality passive components. By enabling extremely small footprint and low-loss RF interconnects, this technology paves the way for cost-effective, high-performance communication and sensing applications.

Imec's modular RF Si interposer technology serves as a versatile platform for the heterogeneous integration of RF and mixed-signal integrated circuits. This technology enables a wide range of applications including millimeter-wave phased arrays and radar, data center optical drivers and transimpedance amplifiers, test and measurement equipment, and more.

The main philosophy of this technology is to combine low-loss RF materials, similar to RF PCB technology, with the very fine via and pad dimensions of integrated circuit backend processing. As a result, it facilitates RF interconnects with much smaller footprint and lower loss compared to advanced PCB technology.



TECHNOLOGY / MATERIAL	IC Substrate + mSAP	Imec waferscale RF interposer
ROUTING LAYERS	4 - 8 mode	2 - 4
TRACE / SPACE	15 $\mu\text{m}$ / 15 $\mu\text{m}$	5 $\mu\text{m}$ / 5 $\mu\text{m}$
LAYER THICKNESS	10 - 30 $\mu\text{m}$	5 - 20 $\mu\text{m}$
BUMP PITCH	80 - 120 $\mu\text{m}$	20 - 40 $\mu\text{m}$
FLIP-CHIP FREQUENCY	300 GHz	500 GHz
FLIP-CHIP AREA	300 x 300 $\mu\text{m}^2$	100 x 100 $\mu\text{m}^2$
FLIP-CHIP LOSS @ 150 GHz	0.5 dB	0.2 dB
LINE LOSS @ 150 GHz	0.4 dB/mm	0.3 dB/mm



Example cross-section of imec's RF Si interposer technology.

## Imec's RF Si Interposer features

- Through Silicon Vias (TSVs)
- High density digital interconnects
- Thick RF polymer processing
- Multi-layer Redistribution layers
- High-Q passives including of resistors, inductors, MIM capacitors
- Micro-bumping to Cu & Au BEOL of ICs
- Improved thermal conductivity
- 300mm Fab compatible

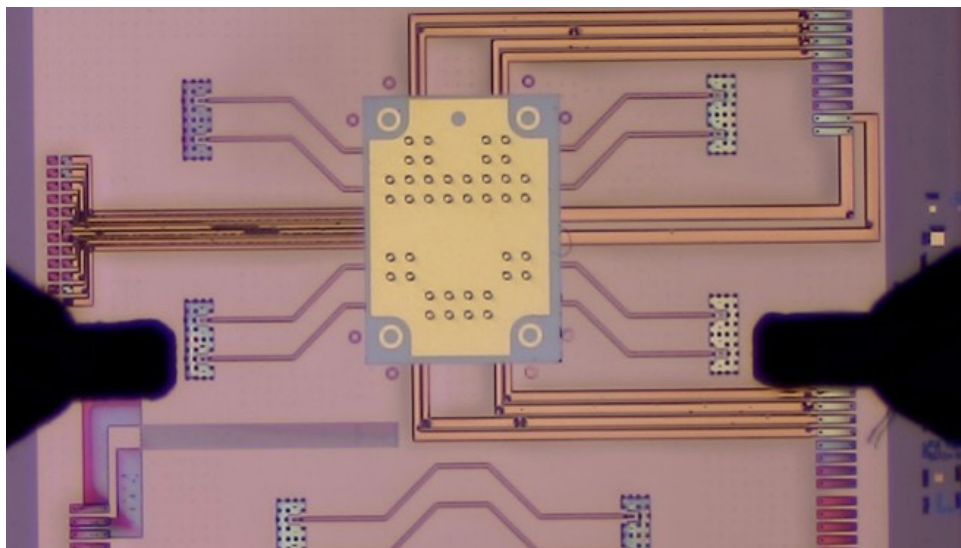
## Imec RF interposer offering

Imec's RF Si interposer offering combines its long-standing expertise in 2.5D/3D heterogeneous integration technologies with its world-class knowledge of RF circuit and system design. It includes:

- **RF Si Interposer R&D** developing new features (passives, TSV integration, wafer thinning, ...) and exploring new materials.
- **System-Technology Co-Optimization (STCO)** to achieve optimal radio functionality partitioning and guide the device process technologies and packaging/interconnection approaches.
- **Modeling and advanced characterization** to help the technology pathfinding, including reliability aspects and thermal design.
- **Access to RF Interposer R&D platform** for prototyping and the possibility to customize the technology to specific customer requirements

## Work with imec

- **Program partnership:** Join the program to get early access to imec's RF Interposer R&D results. Co-develop the next RF technologies through precompetitive, cost- and risk-shared research.
- **Bilateral development projects:** Leverage imec's RF Interposer technology and know-how to realize a prototype or technology demonstrator for your specific requirements.



InP Power Amplifier chiplet mounted on RF Silicon Interposer with 0.1 dB insertion loss at 140GHz. (S. Siddhartha et al., IEDM 2024)

Go to [www.imec-int.com/advancedRF](http://www.imec-int.com/advancedRF) for more info about the Advanced RF program, such as publications, presentations and upcoming events.

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