

NEXT-GEN HIGH-PRECISION LOW-POWER ULTRA-WIDEBAND

Imec pioneers ultra-wideband (UWB) impulse radio (IR) technology for next-generation products which require secure distance bounding and high-precision, agile spatial awareness capabilities based on secure and precise wireless distance measurement or 2D/3D localization. Imec's ultra-low power (ULP) circuit solutions offer 10x lower power consumption (<5mW Tx, <20mW Rx) than state-of-the-art products. Advanced localization algorithms to achieve 2x improved accuracy in challenging environments (<6cm). Based on imec's >15-year R&D track record on UWB technology, imec offers partners a wide portfolio of UWB hardware and software IP.

APPLICATIONS

- Secure Access and Mobile Payments
- VR/AR Gaming
- Indoor Location and Asset Tracking
- Hospital 5.0
- Industrial Micro-location Robotics, drones



Contactless payment

OFFERING

Imec's **UWB technology offering** comprises a wide range of available **whitebox hardware and software IP**, as well as expertise in hardware (integrated circuit, PCB demonstrators, antenna) and software (system to physical-layer algorithm) design.

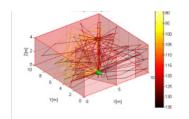
- Whitebox system and application IP and demonstrators, e.g., multi-anchor UWB localization demo, in-warehouse drone-based inventory inspection demo
 - Ranging (distance measurement) and direction finding (DF) algorithms for improved multi-path resilience and non-line-of-sight (NLOS) versus lineof-sight (LOS) detection to achieve best-in-class performance.
 - Advanced localization algorithms algorithms including neural networks for smart anchor selection, particle filtering and sensor fusion techniques to achieve <6cm accuracy in challenging environments (2x improved in warehouse scenario), using IMEC prototypes as well as commercially available UWB chips.
 - Secure Distance Bounding (SDB) for prevention of relay attacks
- Whitebox silicon IP offering analog and digital integrated circuit (IC) designs, layout databases and testbenches (40nm, 28nm) — of wireless transceivers and building blocks
 - Next-gen UWB transceiver cm-accurate, ultra-low power (<5mW Tx, <20mW Rx) and small area (<1mm2 for complete transceiver front-end including three Rx)
 - Supporting IEEE 802.15.4z UWB, basis for highimpact industry consortia such as the Car Connectivity Consortium (CCC) and Fine Ranging (FIRA) Consortium
 - Building blocks for UWB systems, e.g, RF front-end, all-digital phase-locked-loops (ADPLL), wakeup timers, timing references, analog-digital-converters (ADCs), power management (PMU), digital baseband (DBB)
- Access to proof-of-concept integrated circuit (IC) implementations and ranging/direction finding & localization (e.g., TWR and TDOA) demonstrators

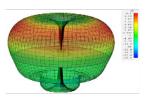
- including imec algorithms and 3rd-party MAC / SW stack (3rd party)
- Expertise in RF/analog, digital design, system and algorithm, protocol design, security & distance bounding against relay attacks, embedded software design for partner's custom UWB designs
- Expertise in antenna design General purpose or custom UWB antenna designs. Antenna array design for direction finding / angle-of-arrival (AoA).
- Imec participates in standardization bodies and industry consortia, e.g., IEEE, CCC, ETSI/FCC and others

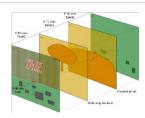
WORK WITH IMEC

- 'White box' IP licensing and technology transfer, including product design support, of silicon IP (e.g., analog/RFIC circuit design schematics and layout, digital RTL design and testbenches), algorithms and system models as well as demonstrators, HW/SW prototypes and measurement results.
- Insight partnerships Gain early stage insights on latest technology developments via technology concept and prototype evaluation briefs.
- Development on Demand (DoD) Custom R&D for your future product.









FLTR: 1 Circuits, 2 Algorithms, 3 Application demos (i.e., the drone) and 4 custom antenna designs.

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