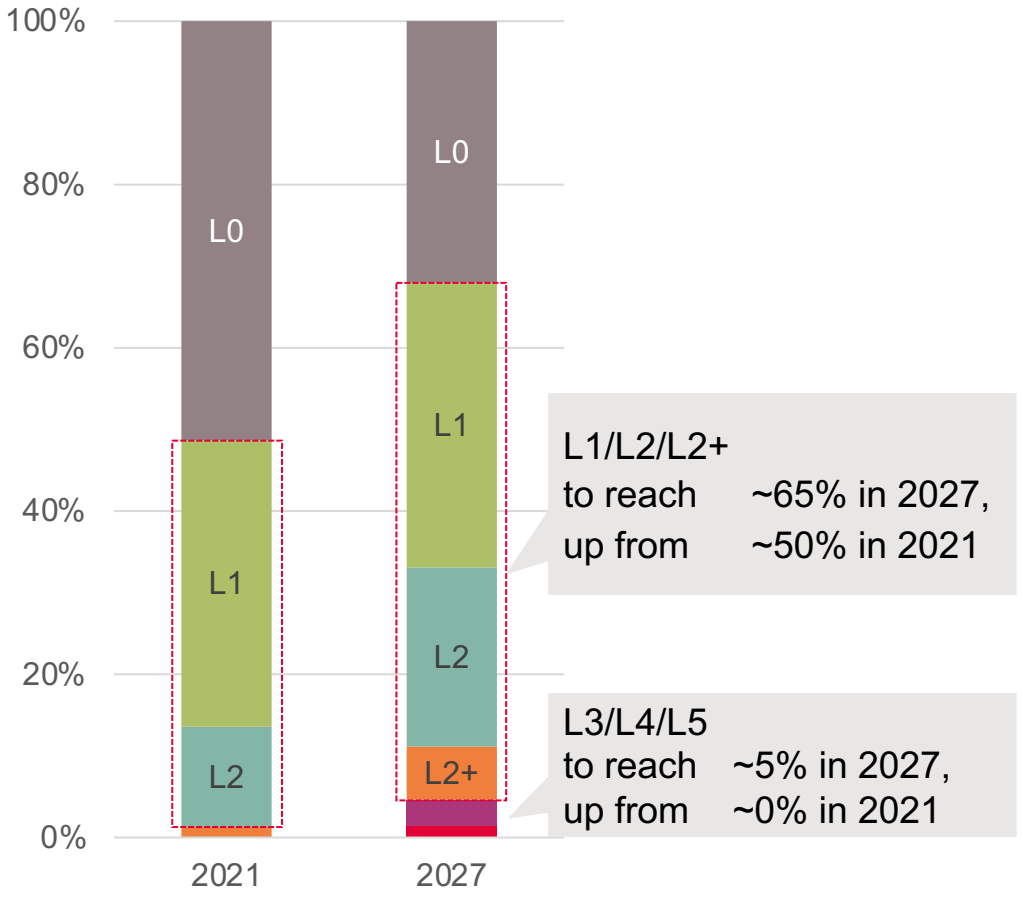


RASIC™ CTRX – 77 GHz automotive radar solutions

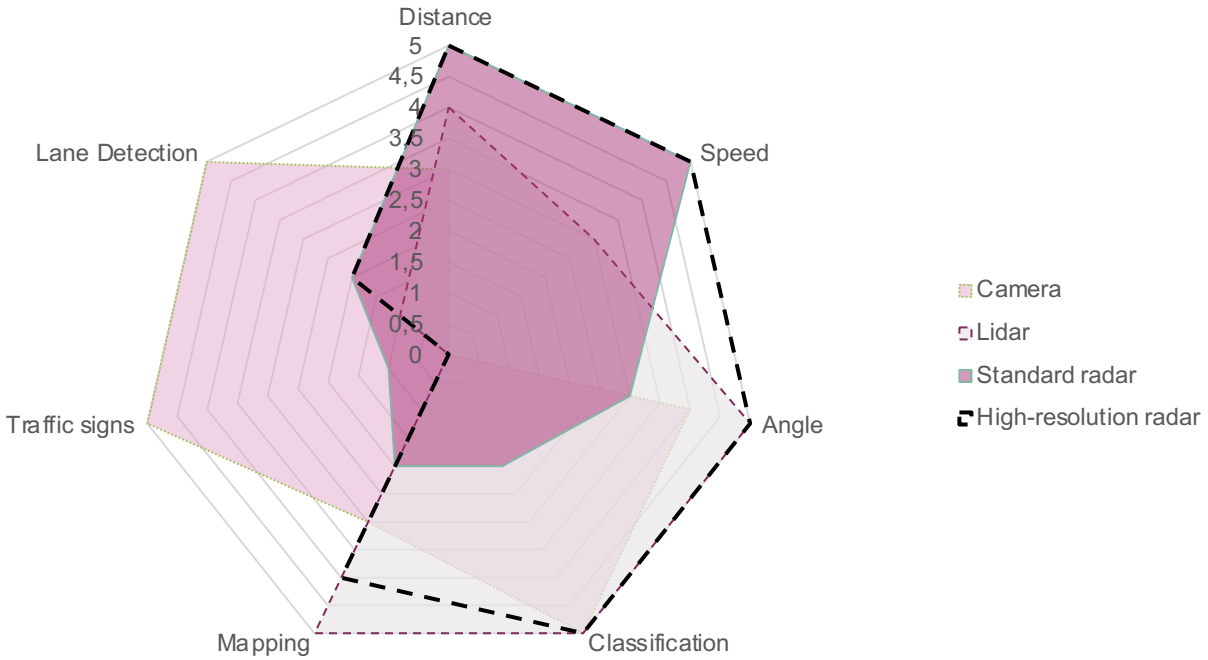
Matthias Halsband, Head of the Radar business line
Tomas Lucia, Head of Product Marketing Radar
electronica 2022

The growth of L1/L2/L2+ is the main driver of ADAS semi content until 2027; low near-term impact from L3/L4/L5

Car production by degree of automation (SAE level)



Radar are essential to meet decisive requirements of ADAS/AD

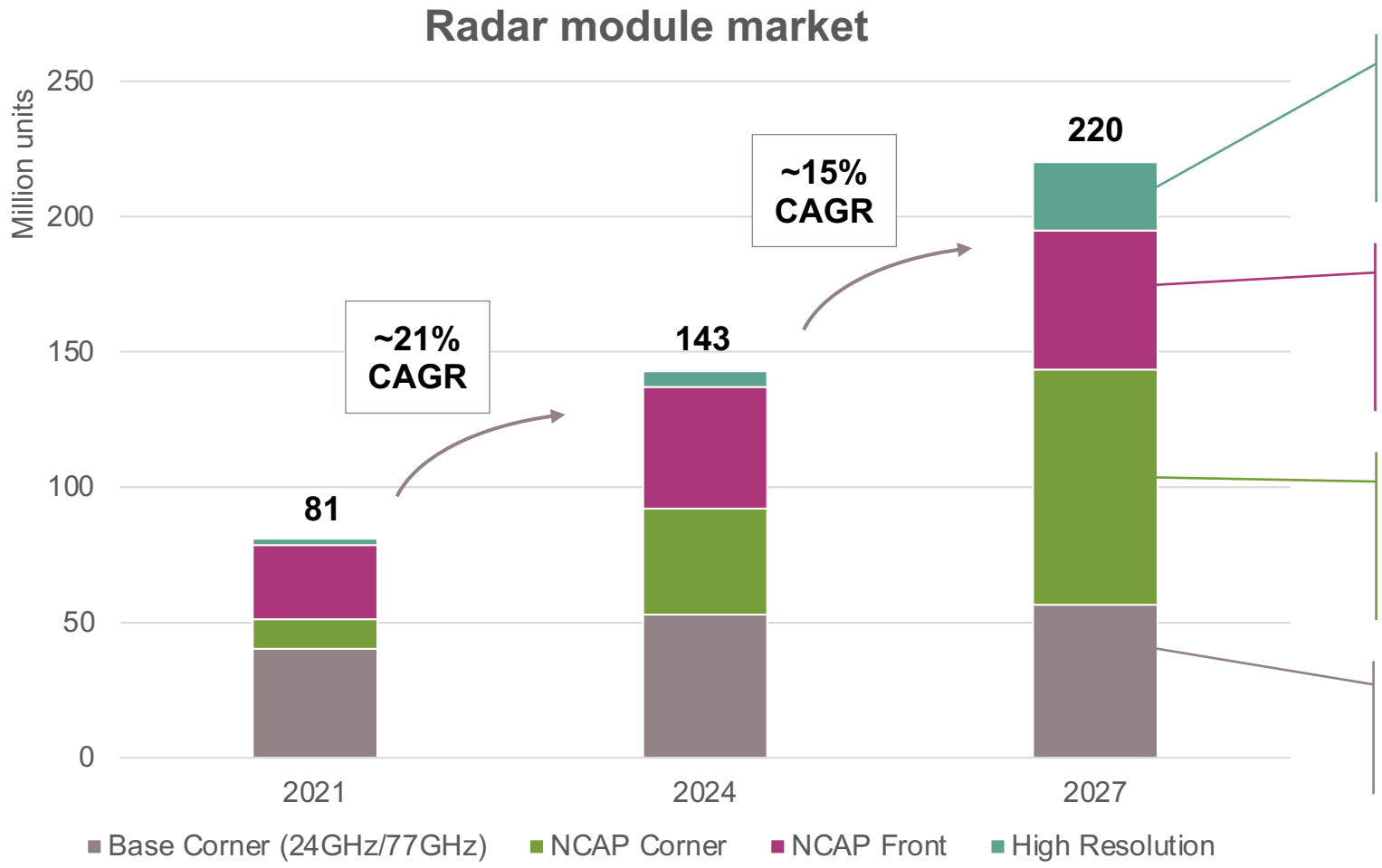


- Standard radar is **the** technology to detect distance and speed
- High-resolution radar significantly improves angle and classification

Market research sources; Infineon

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NCAP corner segment with new junction scenarios will triple the radar module market



High-Resolution radar:
Lidar-like object detection with maximum range and maximum resolution driven by Level 3 and Level 4 automation (e.g. autonomous trucks)

NCAP Front:
Autonomous Emergency Braking (AEB), mandatory in various regions (e.g. EU in 2024, South-Korea in 2024, Australia in 2023)

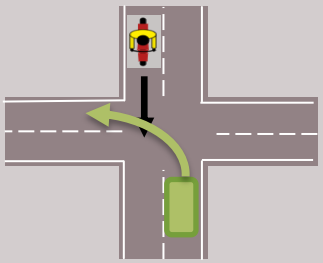
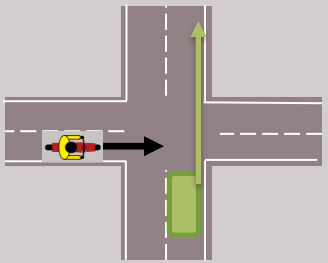
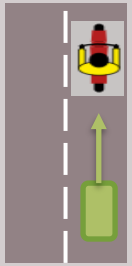
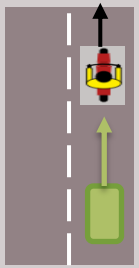
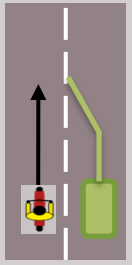
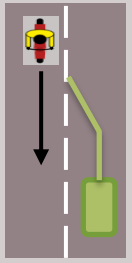
NCAP Corner:
Mainly Cross-Traffic- Alert (CTA), driven by new junction scenarios detecting other road users including motor-cycles and pedestrians

Base Corner:
Mainly Blind-Spot-Detection based on 24 GHz technology today. Will transform into 77 GHz.

*Source: Yole, Infineon Marketing Office

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New test cases VRU – Power-two-wheeler integration test target and integration of turning and LSS scenarios

	**CMFtap** Car-to-Motorcyclist Turn-Across-Path	**CMFC** Car-to-Motorcyclist Farside Crossing	**CMRs** Car-to-Motorcyclist Rear stationary	**CMRb** Car-to-Motorcyclist Rear breaking	**LSS** Lateral support system	
					Overtaking	Oncoming
VUT speed	10-20 km/h	Not part of the Euro NCAP protocol 2023 Expected in **2025**	10-60 km/h	50 km/h	50, 72 km/h	72 km/h
EMT speed	30, 45, 60 km/h		0 km/h	50 km/h	60, 80 km/h	50 km/h
Obstruction	No		No	No	No	no
AEB/FCW/LSS	AEB		AEB	AEB/FCW	LSS	LSS
Pictogram						
Points	3	--	1.5	1.5	1	2
	Corner radar required					

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Infineon is the industry's radar gold standard for 77 GHz

More than 15 years of radar experience with >300 Mpcs RASIC™ MMICs and >200 Mpcs AURIX™ microcontrollers on the road.

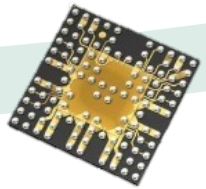
Autonomous Driving + Vision Zero

Innovations for driver, road and pedestrian safety

"ATLAS" IC
1st SiGe 77 GHz Transceiver



Mid-Range Radar
1st 77 GHz product in eWLB package



Complete Radar Chipset

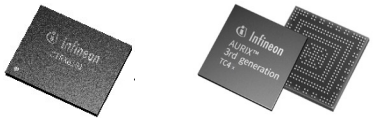
Fully integrated 77 GHz Transceiver + AURIX™ 2G + Power Supply



Next Generation Radar Solutions

AD market
Imaging radar + AURIX™

ADAS market
CMOS Transceiver + AURIX™ TC4x



2009 2012 2019 2025

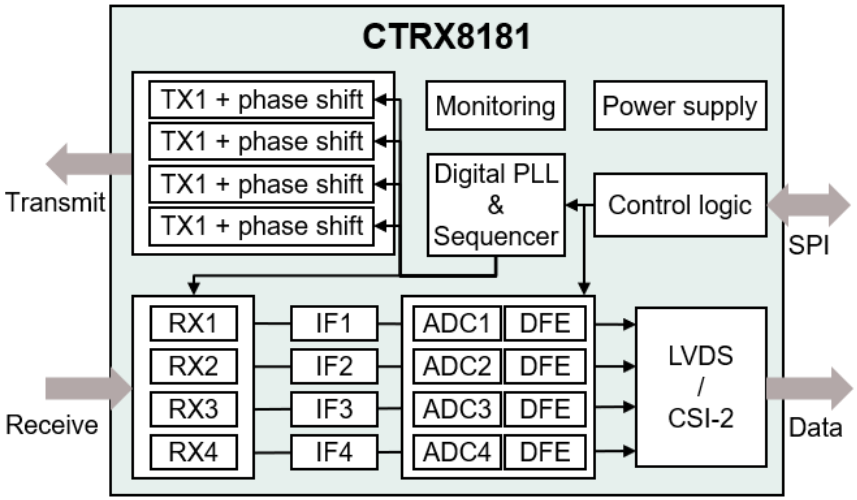
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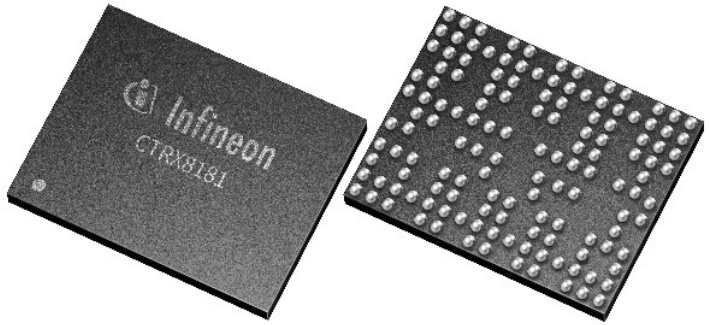
Infineon's CTRX radar MMIC platform addresses all radar segments

Future-proof performance and architecture flexibility for todays and future radar needs.

CTRX8181 key characteristics

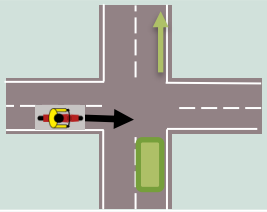
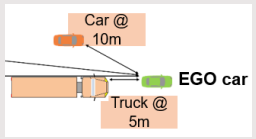
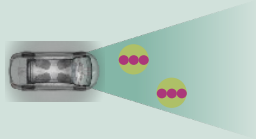
- 4 Transmitters + 4 Receivers (CTRX8181PLA)
- Frequency range: 76 to 81 GHz w/ up to 4 GHz BW
- Best-in-class SNR & linearity for maximum range and best separability
- First digital PLL in the market enables situation based **on-the fly modulation adaption** enables use cases **from highway** (high speed) **to parking** (high resolution) due to **CTRX digital PLL's modulation capabilities**
- **MMIC platform approach** enables addressing all market segments with highest R&D reuse for hardware & software





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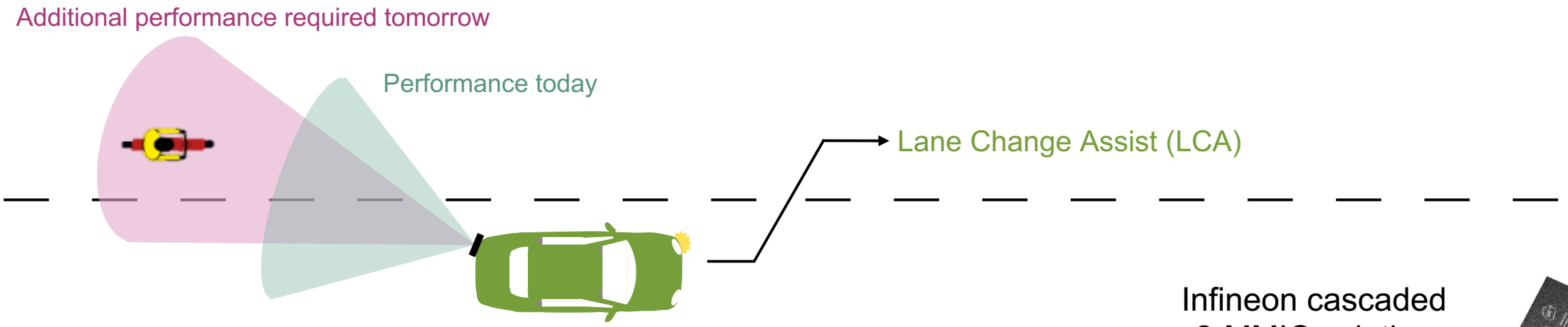
Great improvement of CTRX compared to market available products

	Key MMIC Parameter	CTRX8181	Todays state-of-art	Impact on module performance
	Number of channels	4TX/ 4RX	3TX/ 4RX	Additional TX channel: +33% higher angular resolution
	Signal to Noise Ratio	~2 dB improvement compared to previous generation		Operating Range / Field of View improved by ~12%
	Linearity (P1dB)	~5 dB improvement compared to previous generation		Much better separation of weak and strong objects, reduction of ghost targets due to less frequency intermodulation products, reduction of impact of bumper reflections
	RF port isolation	40 dB	30 dB	lower PCB costs
	Flexible Ramps and larger bandwidth	Digital PLL 400 MHz/µs 4GHz	Analog PLL 45 MHz/µs 4GHz	Multiple frequency ramps for urban, highway, parking scenarios (short/long ramps), lead to better range resolution
	Fly-back	1 µs for 4 GHz	4 µs for 2 GHz	More ramps can detect higher maximum velocity. Lower power consumption

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Future NCAP/NCAP+ scenarios demand detection of small objects in larger distances (>200m) which require cascaded radars using CTRX8191

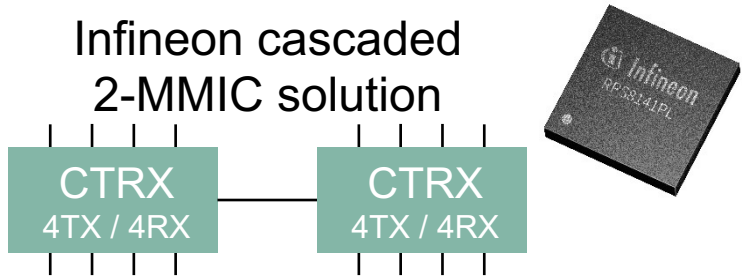
Detect "motorcycle from behind" as early as possible



Longer range → Higher output power

Multi-mode for 2x FoVs → Higher number of channels

Infineon cascaded 2-MMIC solution



CTRX8191 enables cascaded radar with 8 TX / 8 RX channels

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Infineon solutions offer seamless transition between radar segments optimizing time-to-market and SW/HW reuse

Centralized Front Corner	**Base** Corner	**NCAP** Front Corner	**NCAP+** Advanced Corner	**NCAP+** High Resolution
CTRX8181 4TX / 4RX	**CTRX8161** 2TX / 4RX	**CTRX8181** 4TX / 4RX	**CTRX8191** **CTRX8191** 4TX / 4RX	**CTRX8191** **CTRX8191** **CTRX8191** **CTRX8191** 4TX / 4RX
AURIX™ Pre-processing MCU	**AURIX™** Full-processing MCU	**AURIX™** Full-processing MCU	**AURIX™** Full-processing MCU	**AURIX™** Full-processing MCU

RASIC™ CTRX81xx: Infineon's 28 nm CMOS Radar MMIC platform covers all market segments.

AURIX™: Infineon's automotive MCU platforms with scalable performance and dedicated radar accelerators.

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Infineon is your partner for 77 GHz automotive radar

QUALITY LEADER



Zero Defect is part of our DNA. Infineons products are designed with **reliability** and **manufacturability** in mind → ensuring high product quality at lowest dpm level resulting in **reliable radar sensors.**

PERFORMANCE FIT



Infineon offering **longest range, widest field-of-view, and most robust radar sensors** thanks to best-in-class RF & compute performance.

BROAD PORTFOLIO



Infineon covers all radar sensor segments – from standard NCAP radar sensor to Base Corner to High resolution radars – **and across all architectures** – from Full-processing to Pre-processing to Raw-data streaming.

MOST EXPERIENCED



Infineon is the industry's radar gold standard for 77 GHz: **More than 15 years of Radar experience with >300 Mpcs RASIC™ MMICs and >200 Mpcs AURIX™ micro-controllers on the road.**

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