恩智浦新一代毫米波雷达芯片解析

杨昌
产品市场部, Radar&V2X

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SECURE CONNECTIONS
FOR A SMARTER WORLD

INDUSTRY'S MOST COMPLETE AUTOMOTIVE RADAR PORTFOLIO

SCALES FROM 1-CHIP TO 4D IMAGING RADAR, ALLOWS TAILORING FOR USE CASE

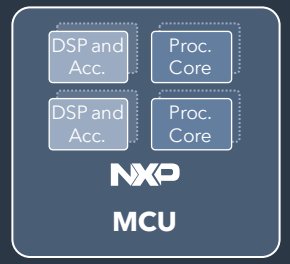
NXP | RADAR PRODUCT FAMILY

77GHz RFCMOS transceivers

Processors incl. safety and security

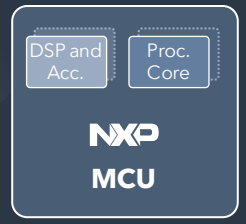
IMAGING RADAR 77 GHZ

Highest resolution and performance



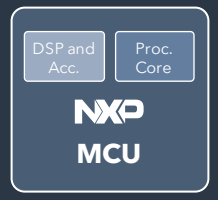
LONG-RANGE RADAR 77 GHZ

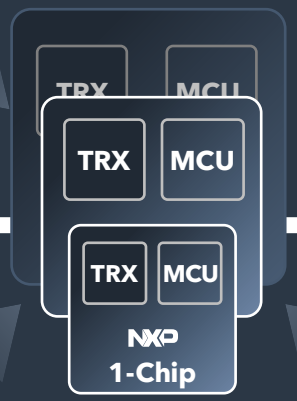
Front and rear higher performance



CORNER RADAR 77 GHZ

Multiple small modules





RADAR TECHNOLOGY LEADERSHIP

Leading edge technology nodes

16nm MCUs and 40nm RFCMOS TRX in production

1-Chip in 28nm RFCMOS coming up

State of the art 77GHz RFCMOS performance

3rd gen RF-CMOS

Best range at 2x of first generation

Unique Radar architecture and algorithms

Accelerators for 64x performance vs. standard cores

Minimal power dissipation and footprint

S32R4X BOOSTING PERFORMANCE WITH 3-IN-1 IMAGING RADAR FOR L2+ THROUGH L5

IMAGING RADAR 77 GHZ
Highest resolution and performance

LONG-RANGE RADAR 77 GHZ
Front and rear higher performance

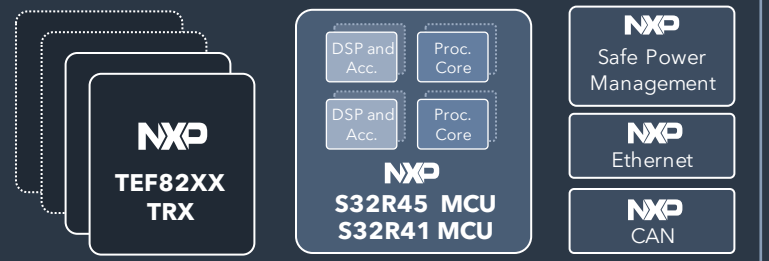
CORNER RADAR 77 GHZ
Multiple small modules

Simultaneous **3-in-1** sensor operation

NXP 4D IMAGING RADAR

- Radar acceleration: 64x ARM A53 equivalent
- Super-resolution radar algorithms
- RF-CMOS: 2x previous Gen RF budget
- Advanced MIMO wave-forms
- 3-in-1 sensor antenna design

Complete NXP Imaging Radar Solution



Maximum awareness: concurrent 3-in-1 sensing

Simultaneous multi-mode scan: wide, mid and far in 4 dimensions

Concurrent use of transmitters plus adv. coding and algorithms

Maximum efficiency for <1° resolution

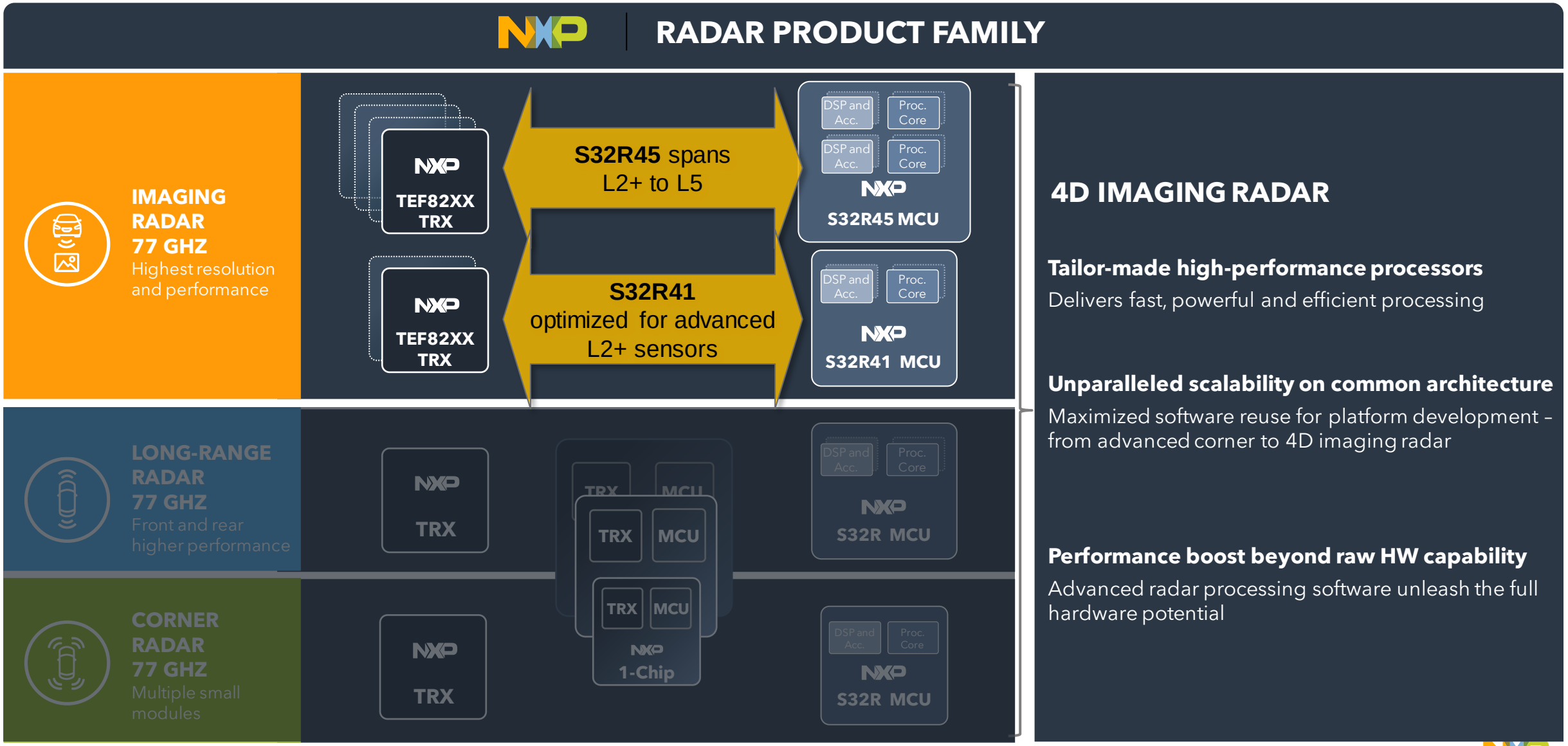
Up to 192 virtual channels and 12x efficiency gain

Smart and lean design vs. ordinary antenna count scaling

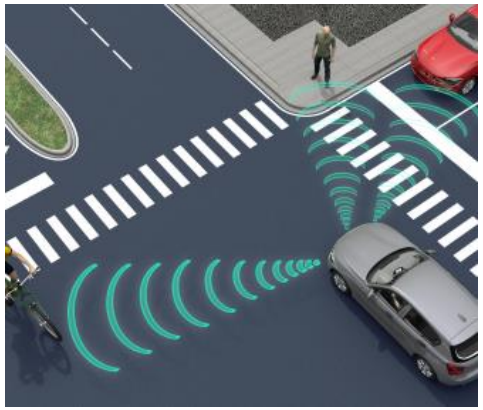
ENABLING MASS ADOPTION OF L2+

4D IMAGING RADAR BIFURCATION REQUIRES OPTIMIZATION FOR USE CASE

SCALABLE S32R4X ARCHITECTURE: EASY SCALING AND MIGRATION



GEN 2 CMOS MMIC – TEF82XX

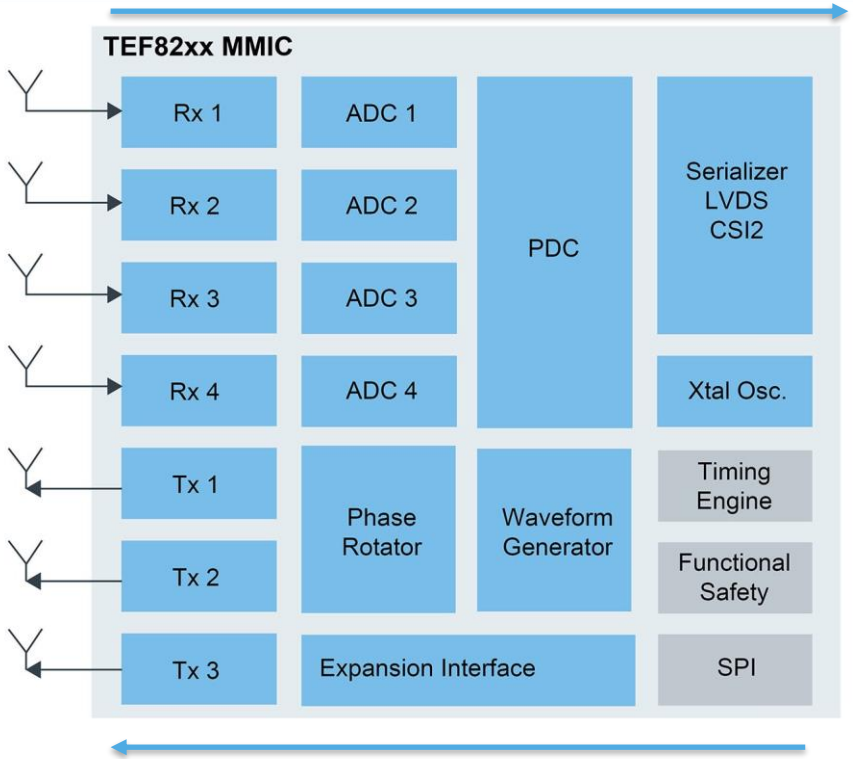


OVERVIEW

The TEF82xx car radar transceiver is a single-chip, low power automotive FMCW radar transceiver for short-, medium- and long-range radar applications including cascaded high-resolution imaging radar, covering the full car radar frequency band from 76 GHz to 81 GHz. The fully integrated RFCMOS chip contains 3 transmitters, 4 receivers, ADC conversion, phase rotator and a low-phase-noise VCO. The device also includes built-in safety monitors and external interface capability for MIPI-CSI2 and LVDS.

- Capability: Fully integrated RFCMOS automotive radar transceiver for 76–81 GHz
- Quality: ISO26262 compliant, ASIL Level B
- Functionality: Optimized for fast chirp modulation
- System: Fully compatible with NXP S32R29x and S32R45x radar microcontrollers

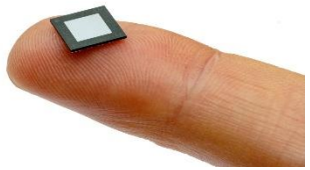
TEF82xx BLOCK DIAGRAM



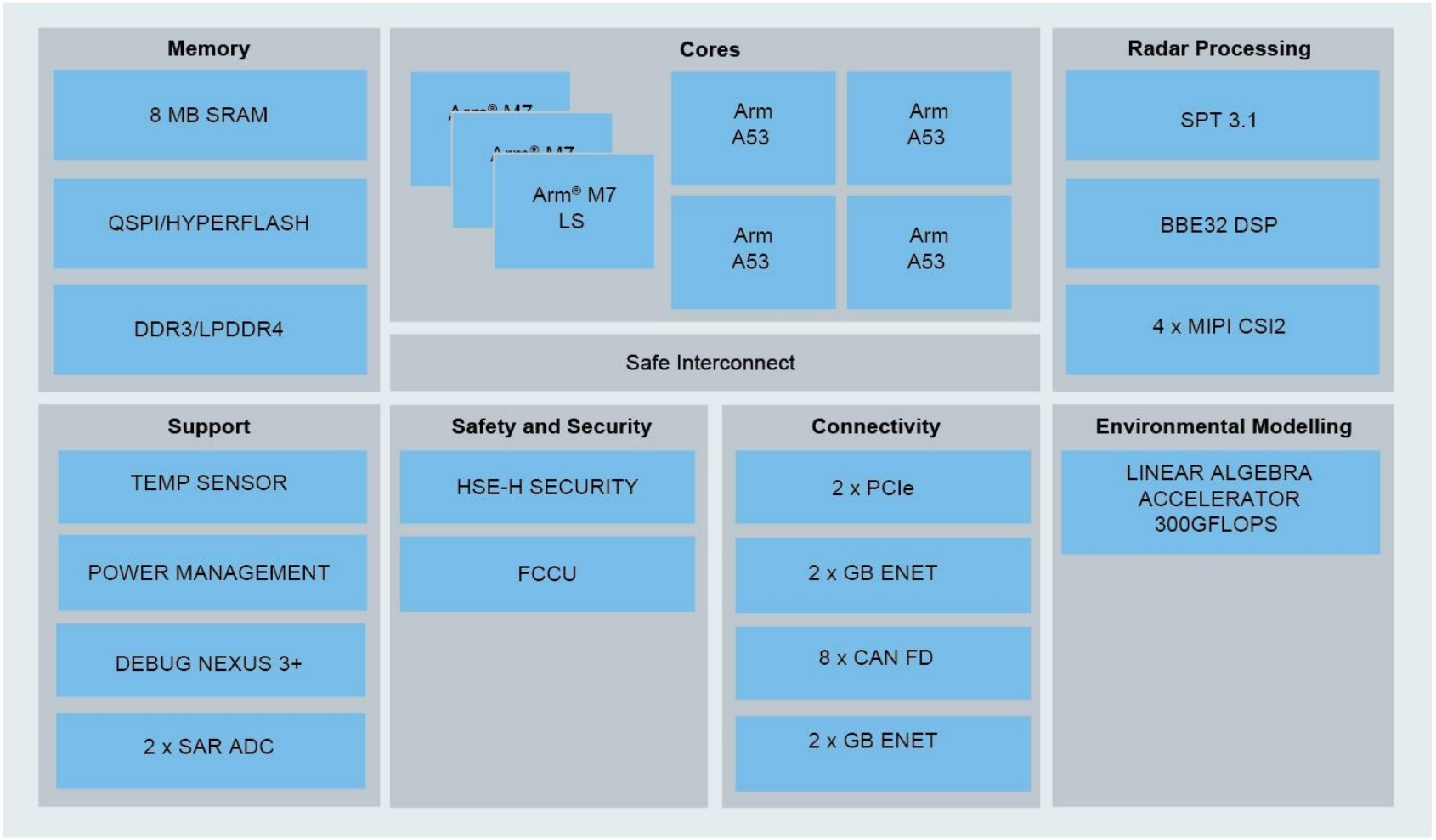
Channels	3 Tx (w/ phase rotator) and 4 Rx	**Cascading**	4 chips for up to 12 Tx and 16 Rx
Frequency Range	76–81 GHz	**Package**	165 pin eWLB 7.5 x 7.5 mm
Output Power	13.5 dBm	**ADC Sample Rate**	40 MS/s
Noise Figure	11.5 dB	**Interface**	CSI-2 or LVDS
Phase Noise	-95 dBc/Hz	**Temperature Range**	-40 to 135 °C Tj
Power Consumption	1.5 W (2 Tx 50%)	**Effective Chirp BW**	4 GHz

TARGET APPLICATIONS

- Cascaded imaging radar
- Adaptive cruise control
- Autonomous emergency braking
- Blind spot detection
- Front/Rear cross-traffic-functions
- Lane change assistance
- Parking



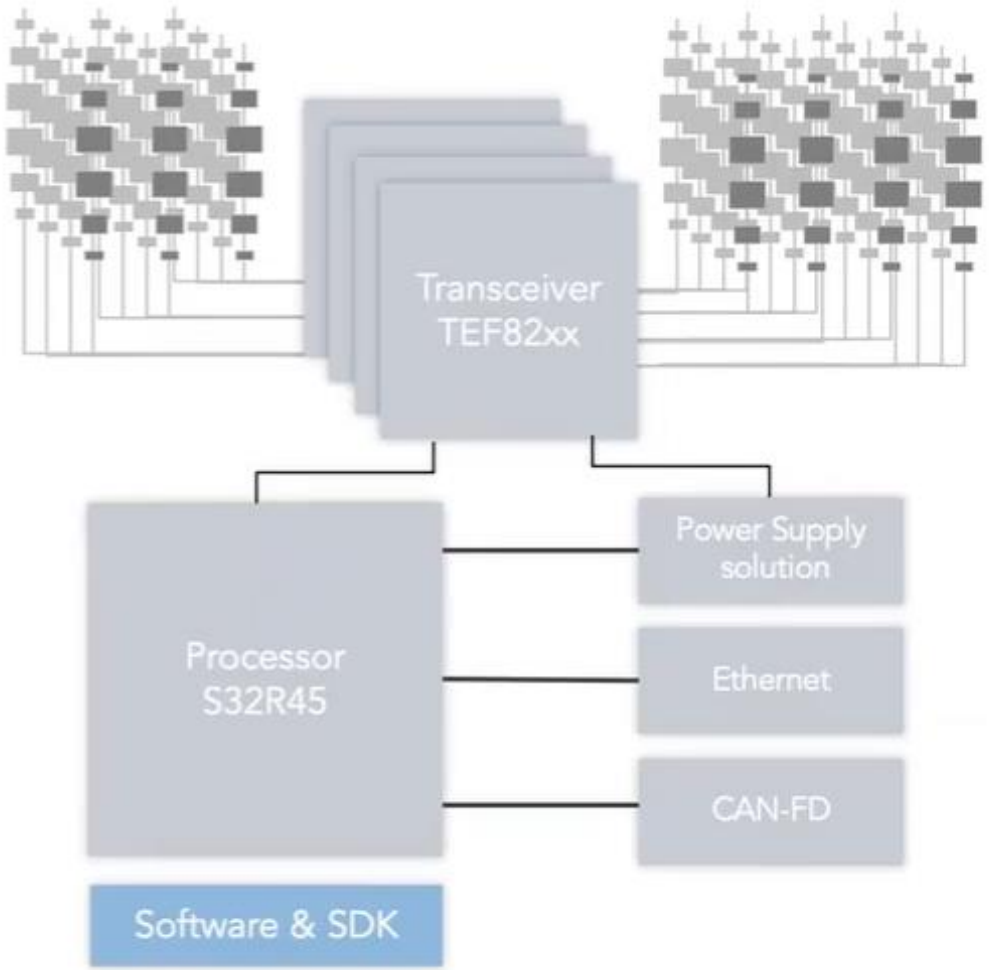
IMAGING RADAR PROCESSOR – S32R45

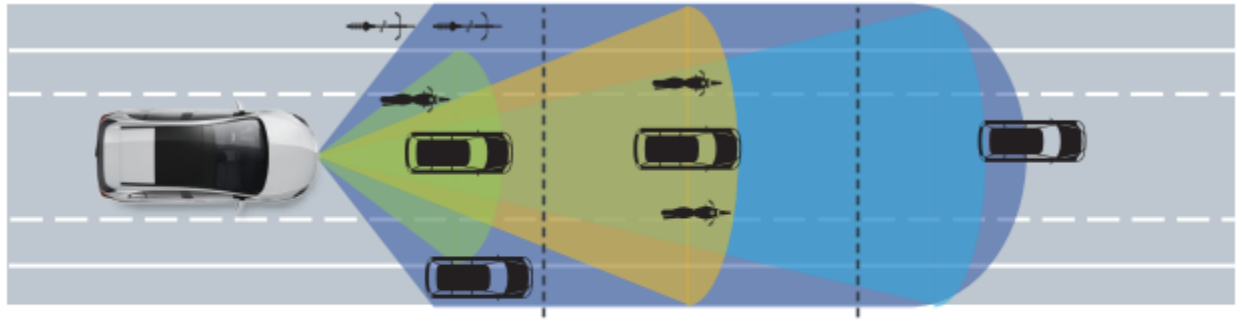


KEY FEATURES

- Quad Arm Cortex-A53 @ 800 MHz, flexible lockstep
- Triple Arm Cortex-M7 lockstep pairs @ 400 MHz
- LAX 1.0: >300 GFLOPS
- SPT 3.1 @ 600 MHz with integrated DSP and multi-threading
- 8 MB SRAM with ECC
- DDR3L-1600 with 16-/32-bit support and LP-DDR4-1600/3200 with 16-/32-bit support
- HSE High
- 2 x SAR ADC 16-ch.
- 4x MIPI CSI2
- PCIe 2 x Gen2/3, 2 lanes
- 2 x GbE 10/100/1000 Mbit/s
- 8 x FlexCAN with FD
- ISO26262 SEooC ASIL B(D)
- -40 °C to 150 °C (Tj) AEC-Q100 Grade-1

IMAGING RADAR 12TX16RX APPLICATION

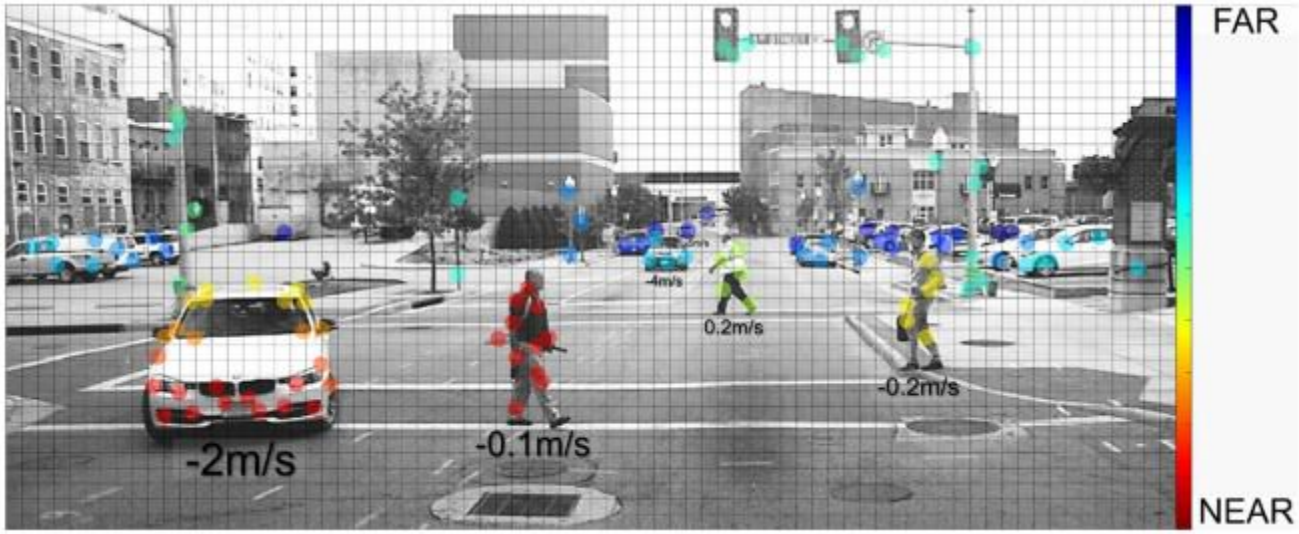




Short-range (up to 50m):
- Enable autonomy in busy urban settings
- High-density point cloud across wide field of view
- Detect many objects, precisely separate small ones next to large ones and reliably classify in real time

Mid-range (50 .. 100m):
- Open country driving
- Discern multiple objects and interpret multi-object scenarios

Long-range (100 .. 300m):
- High-speed highway driving scenarios
- Detection of objects up to 300m
- Accurate sensing of speed for cruise control



Radar SDK Scope

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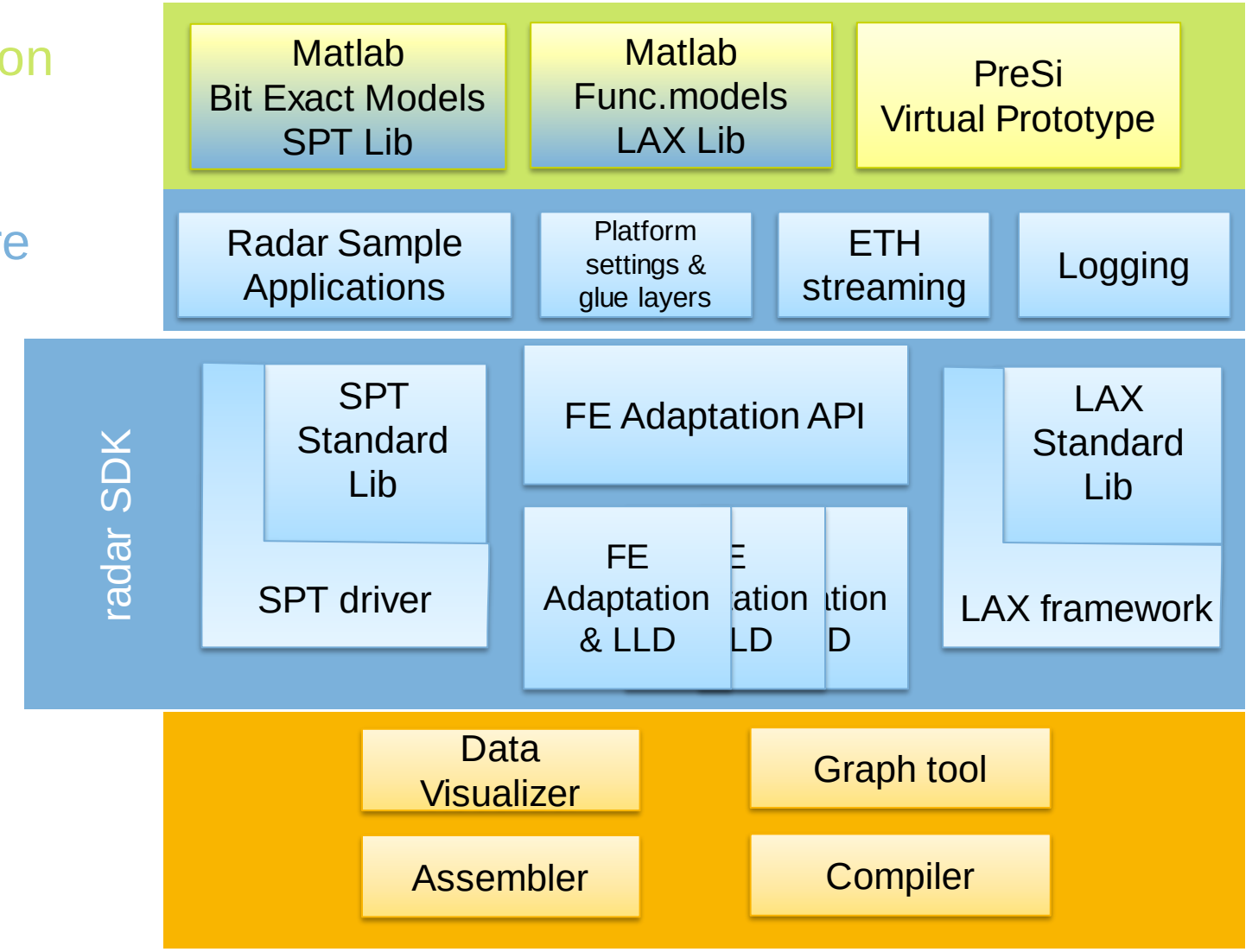
CONTEXT OF RADAR SDK

Emulation

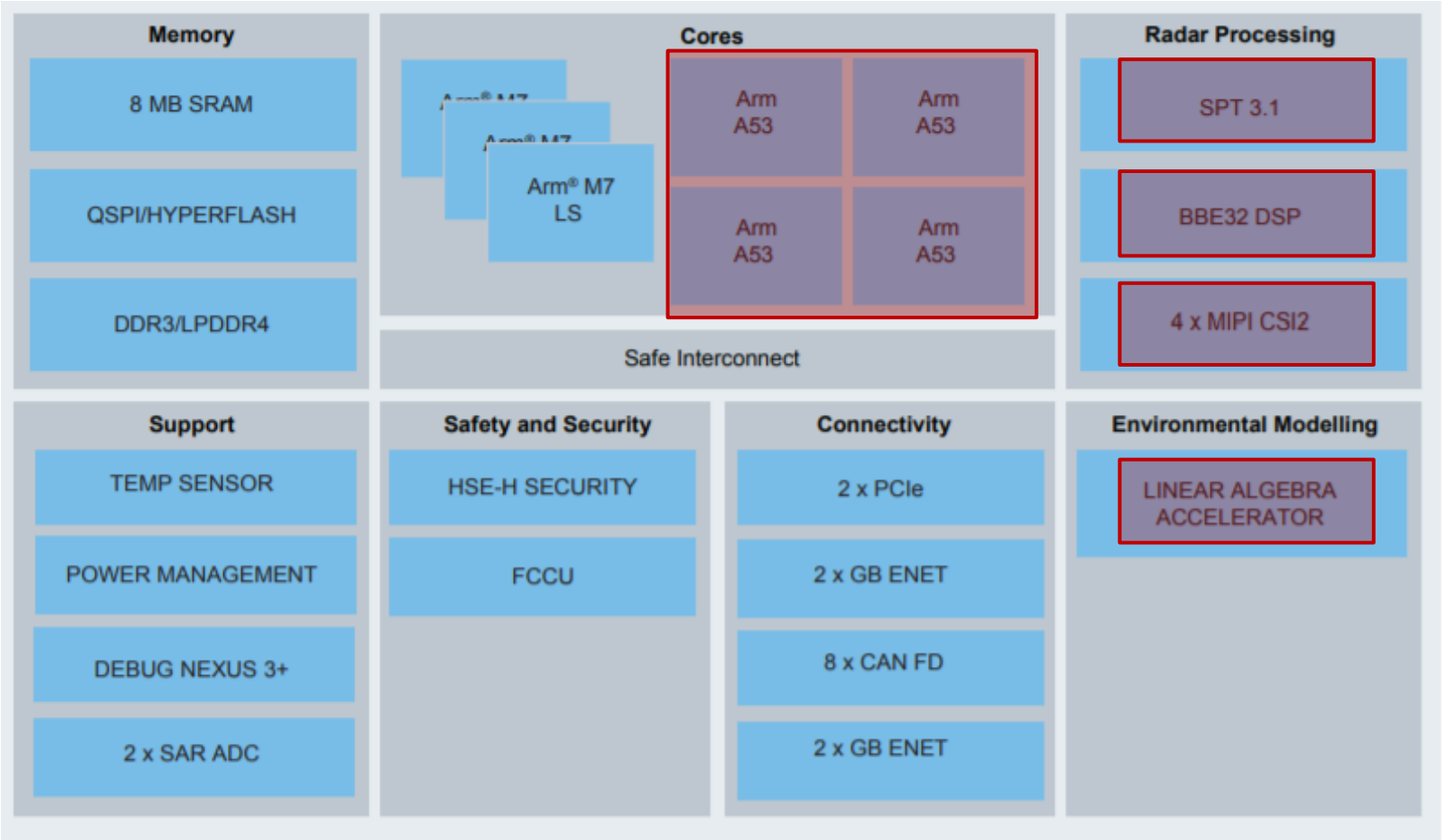
Software on target

Tools



- ***RF Abstract API*** for MMIC
- ***SPI & CSI2 drivers***
- ***SPT Driver***
- ***SPT Kernels***
- ***DSP Dispatcher*** (BBE32)
- ***DSP Algos*** (examples)
- ***LAX framework***
- ***LAX kernel library***
- ***Sample Apps*** (with and without RF)
- ***User Guide*** (doxy generated)
- ***Supported platforms:*** S32R274 S32R372 S32R294 S32R45 S32R41

RADARSDK: SUPPORT FOR S32R45



- Arm based platform
- Added DDR
- Support for Linux

- Added DSP and LAX accelerators
- Up to 4 frontends
- SPT 3.x – supports threads

Thank you

- View more at nxp.com under the Driving Automation and Radar Training Academy

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