Safety Processor for the ADAS Domain

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One of the major functions of the AD/ADAS domain controller involve perception and planning. Perception function drives the requirement for very high performance (TOPS) while the subsequent path planning and actuation drives the need for ASIL D safety requirements (DMIPS). ADAS compute may not have ASIL D capabilities, but the ASIL D decision needs to be made in the domain controller. This is achieved by the use of a high-performance ASIL D processor called as safety processor, which acts as a redundant path evaluating the decision made by the ADAS compute.
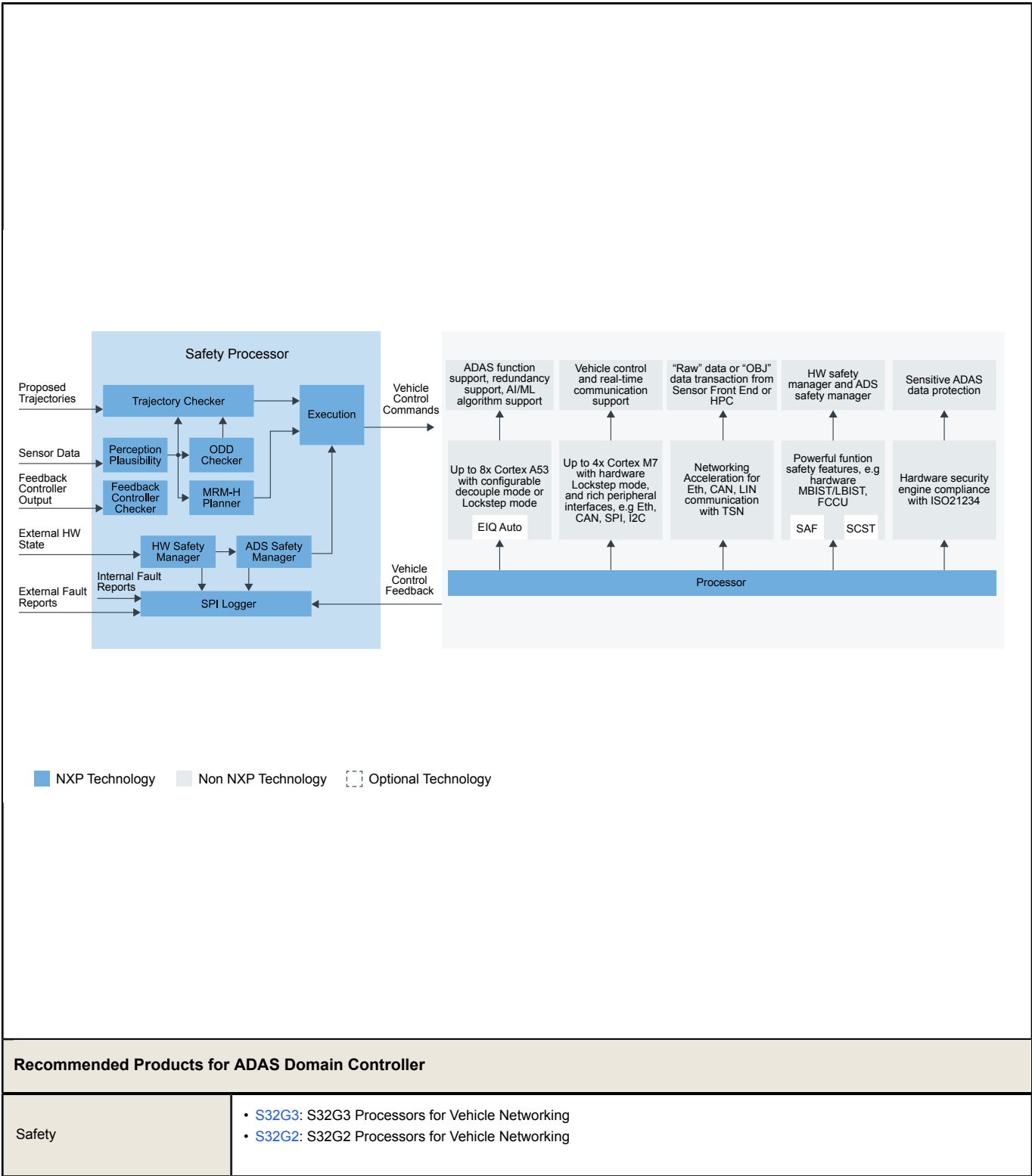
With advancement of ADAS technology, the implemented level of automation driving becomes increasingly higher. However, a degraded mode to keep basic function of ADAS should be supported if any failure leads to complex ADAS application failure. In this situation, a safety processor is needed, which supports powerful function safety features to detect/handle failure and owns enough resource to support degrade/redundancy.

An important feature of ADAS application is that the time-sensitive data or secret data will be transferred between ECU, domain controller and CCU, which drives the requirement that the safety processor in ADAS domain to have excellent networking capabilities for data transactions. It should support processing and forwarding time-sensitive data via time-bounded communication technology, for example, Time-Sensitive-Networking. To protect secret data, accelerated security services based on hardware security engine will be required.

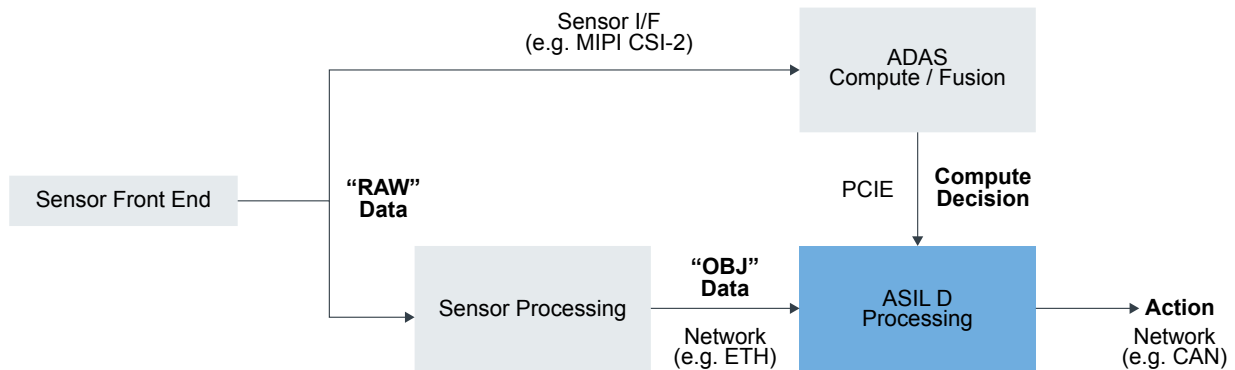NXP S32G meets all the above-mentioned requirements of ADAS safety co-processor to:

Support ASIL-D applications with powerful function safety features Support degraded mode of ADAS Support requirements of different ADAS levels Provide networking acceleration for CAN and Ethernet with TSN support Protect sensitive ADAS data with HSE Support high-level OS for SOA applications

ADAS Domain Controller Block Diagram

Safety Processor

Proposed Trajectories → Trajectory Checker → Execution → Vehicle Control Commands

Sensor Data → Perception Plausibility → ODD Checker

Feedback Controller Output → Feedback Controller Checker → MRM-H Planner

External HW State → HW Safety Manager → ADS Safety Manager

External Fault Reports / Internal Fault Reports → SPI Logger ← Vehicle Control Feedback

ADAS function support, redundancy support, AI/ML algorithm support	Vehicle control and real-time communication support	"Raw" data or "OBJ" data transaction from Sensor Front End or HPC	HW safety manager and ADS safety manager	Sensitive ADAS data protection
Up to 8x Cortex A53 with configurable decouple mode or Lockstep mode	Up to 4x Cortex M7 with hardware Lockstep mode, and rich peripheral interfaces, e.g Eth, CAN, SPI, I2C	Networking Acceleration for Eth, CAN, LIN communication with TSN	Powerful funtion safety features, e.g hardware MBIST/LBIST, FCCU	Hardware security engine compliance with ISO21234
EIQ Auto			SAF SCST	

Processor

Legend: ■ NXP Technology ■ Non NXP Technology ⬚ Optional Technology

Recommended Products for ADAS Domain Controller	
Safety	• S32G3: S32G3 Processors for Vehicle Networking • S32G2: S32G2 Processors for Vehicle Networking

AD / ADS Domain Controller Block Diagram

Sensor I/F
(e.g. MIPI CSI-2)

ADAS
Compute / Fusion

PCIE | **Compute
Decision**

Sensor Front End

**"RAW"
Data**

Sensor Processing

**"OBJ"
Data**

Network
(e.g. ETH)

ASIL D
Processing

Action
Network
(e.g. CAN)

■ NXP Technology   ■ Non NXP Technology   ⬚ Optional Technology

Recommended Products for AD / ADS Domain Controller	
Safety	• S32G3: S32G3 Processors for Vehicle Networking • S32G2: S32G2 Processors for Vehicle Networking

ADAS Example Block Diagram

Diagram labels:

RAW Sensor I/Fs

ADAS Compute / Fusion

ETH to Sensor

PCIE

Domain Controller (S32G)

RGMII — ETH to Backbone

RGMII

CAN

PCIE

SSD

CAN to Sensor/GW
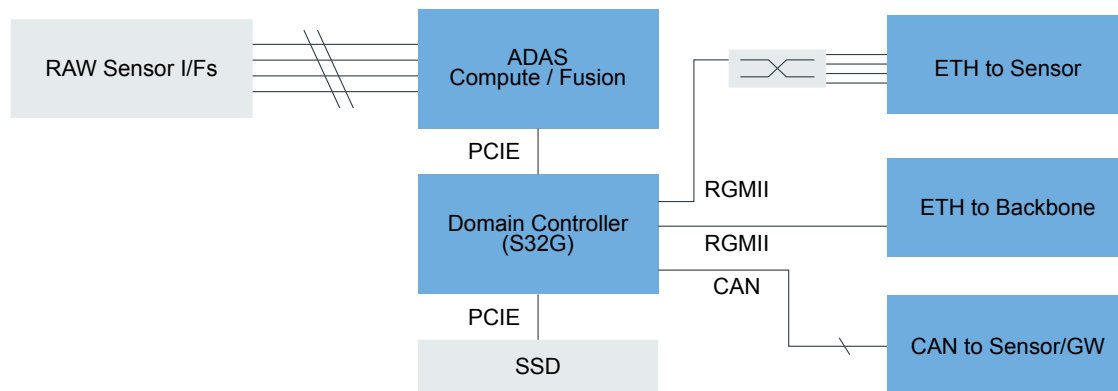
■ NXP Technology   ■ Non NXP Technology   ⬚ Optional Technology

Recommended Products for ADAS Example	
ADAS Compute / Fusion	• LX2162A: Layerscape® LX2162A, LX2122A, LX2082A Processors • FS5600: Automotive Dual Buck Regulator and Controller with Voltage Monitors and Watchdog Timer • FS86: Safety System Basis Chip For Domain Controller, Fit For ASIL B and D • LX2160A: Layerscape® LX2160A, LX2120A, LX2080A Processors
Domain Controller	• S32G2: S32G2 Processors for Vehicle Networking • S32G3: S32G3 Processors for Vehicle Networking • PF53: 12 A / 8 A / 15 A Core Supply Regulator with AVP and Watchdog • VR5510: Multi-Channel (9) PMIC for S32G Processor – 8 High Power, 1 Low Power, Fit for ASIL D Safety Level
Ethernet	• TJA1103: TJA1103, ASIL B Compliant Automotive Ethernet 100BASE-T1 PHY Transceiver • TJA1104: TJA1104, MACsec Enabled ASIL B Compliant Automotive Ethernet 100BASE-T1 PHY Transceiver • TJA1120: TJA1120, ASIL B Compliant Automotive Ethernet 1000BASE-T1 PHY Transceiver

Ethernet	• TJA1103: TJA1103, ASIL B Compliant Automotive Ethernet 100BASE-T1 PHY Transceiver • TJA1104: TJA1104, MACsec Enabled ASIL B Compliant Automotive Ethernet 100BASE-T1 PHY Transceiver • TJA1120: TJA1120, ASIL B Compliant Automotive Ethernet 1000BASE-T1 PHY Transceiver
CAN	• TJA1463: CAN Signal Improvement Capability Transceiver with Sleep Mode • TJA1462: CAN Signal Improvement Capability Transceiver with Standby Mode

View our complete solution for Safety Processor for the ADAS Domain.

Note: The information on this document is subject to change without notice.