



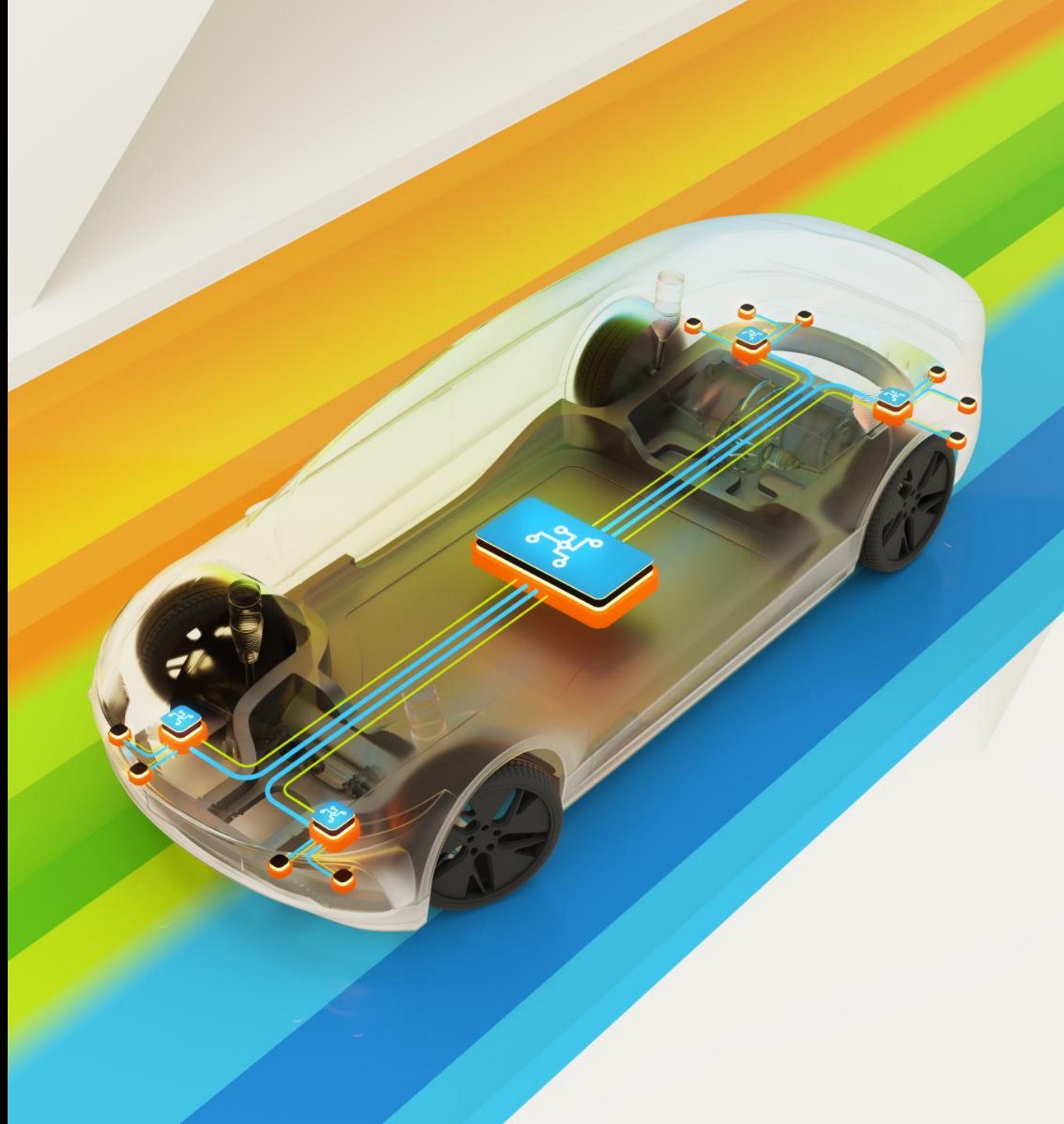
CAN XL use cases and technology strengths

Mike van Haare

Product Marketing Manager



CAN Evolution



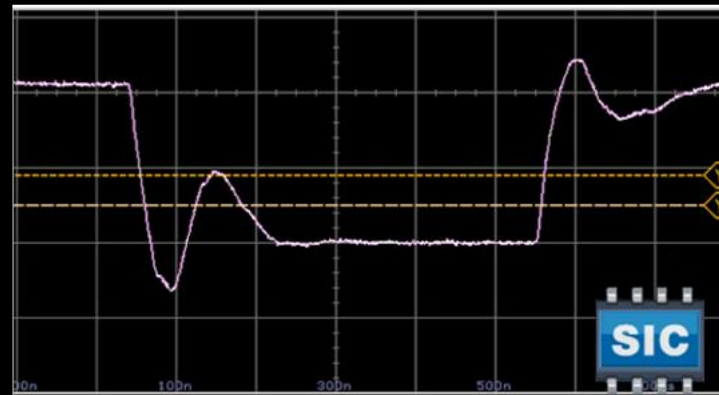
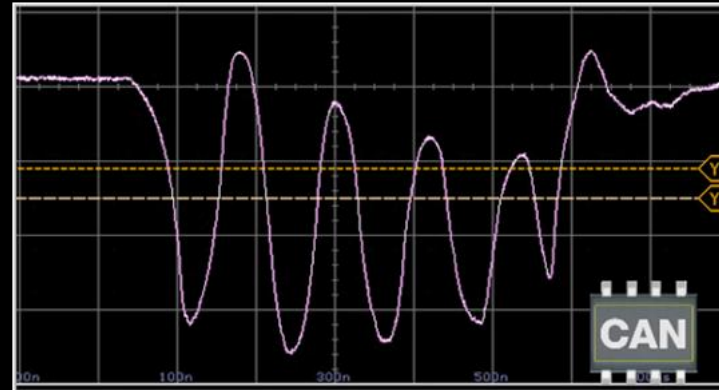
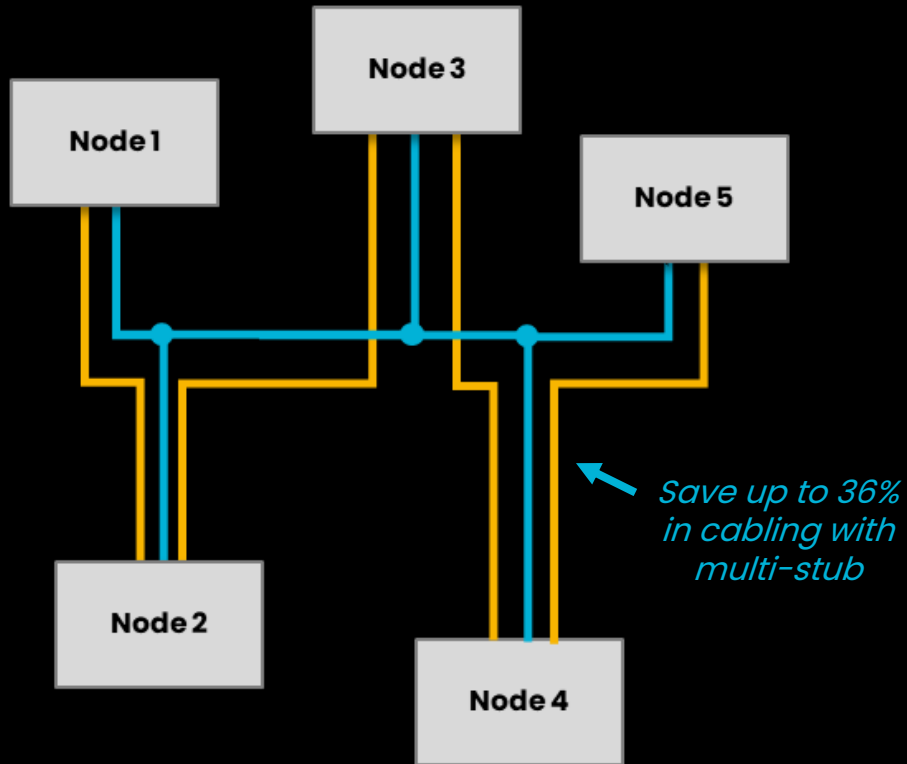
Towards higher bandwidth

Enabling higher bandwidth and topology freedom

Physical Layer	CAN	CAN SIC	CAN XL „SIC“	CAN XL „Fast“
Protocol	CAN FD	CAN FD	CAN XL	CAN XL
Transceiver	CAN FD	CAN SIC	CAN SIC	CAN SIC XL
Bandwidth	up to 5 Mbps	up to 8 Mbps	up to 8 Mbps	up to 20 Mbps
Frame size	64 Byte	64 Byte	2048 Byte	2048 Byte
IP communication	FDAL (under definition)	FDAL (under definition)	Yes	Yes
Partial networking	Yes	Yes	Yes ^(*)	Yes ^(*)
Error handling	Yes	Yes	Yes	Yes
Error frames on bus	Yes	Yes	Yes	No
Alternative technology	-	10BT1s FlexRay	10BT1s 100BT1	(10BT1s) 100BT1

(*): “XL Passive Feature“ with NXP’s SIC Transceiver TJA1465/66

CAN SIC transceivers | Enabling optimized topologies at higher data rates



CAN SIC enables 'real' 5Mbit/s communication





- Increased data rates from 2Mbit/s CAN FD to 5Mbit/s CAN SIC
 - Or even 8Mbit/s in small networks
- Allows more ECUs on a branch
- Allows longer branch and stub lengths
- Allows the use of lower quality cables (e.g. PVC)



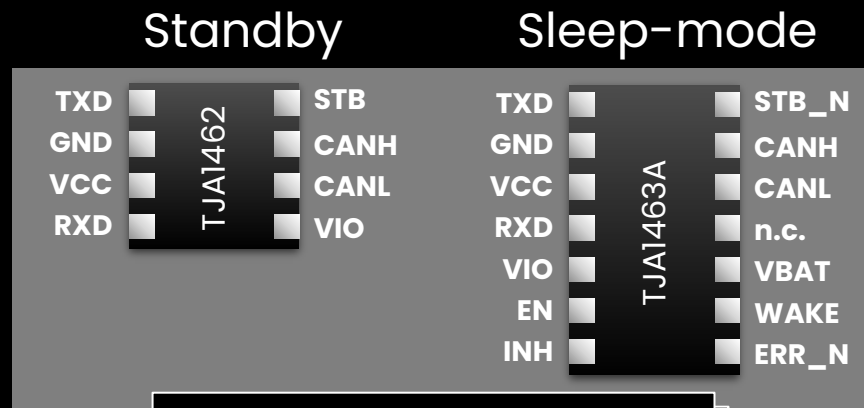
Backwards compatible to CAN FD (TJA1042 / TJA1044 or TJA1043 / TJA1443)

- Pin-to-pin **HW** and **SW** compatible
- ISO 11898-2:2024 third edition compliant
- SAE, VeLIO (**+SIC**) compliant
- **EMC** IEC TS62228-3 compliant
- AEC-Q100 **Grade-1 + extended mission profiles**
- Quality Managed



Improvements & upgrades

- AEC-Q100 Grade-0 variants available (T_{amb} = 150°C / 305°F)
- CAN SIC Evaluation Boards available



RELEASED / In Production

Orderable part number	Package	Function
TJA1462A	SO8 / HVSON8	Standby-mode with VIO pin
TJA1462B	SO8 / HVSON8	Standby-mode, only VCC
TJA1463A	SO14 / HVSON14	Sleep-mode with VIO, INH pins

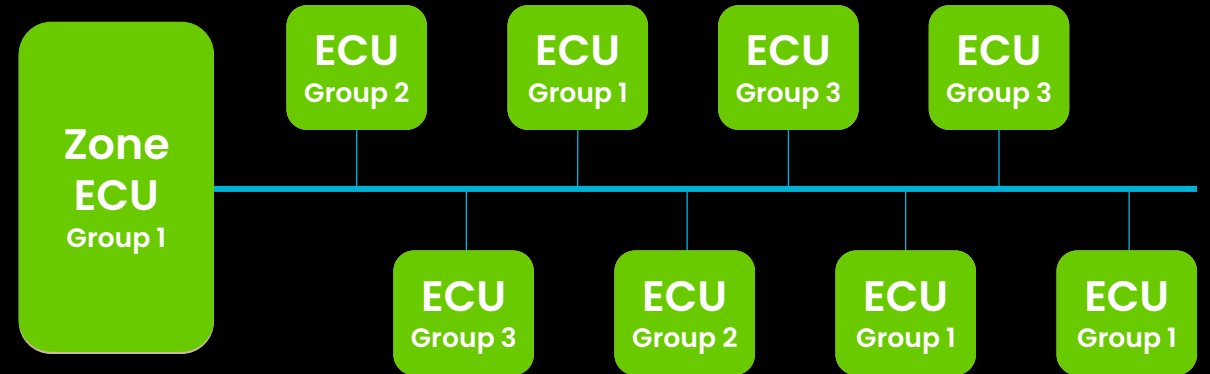
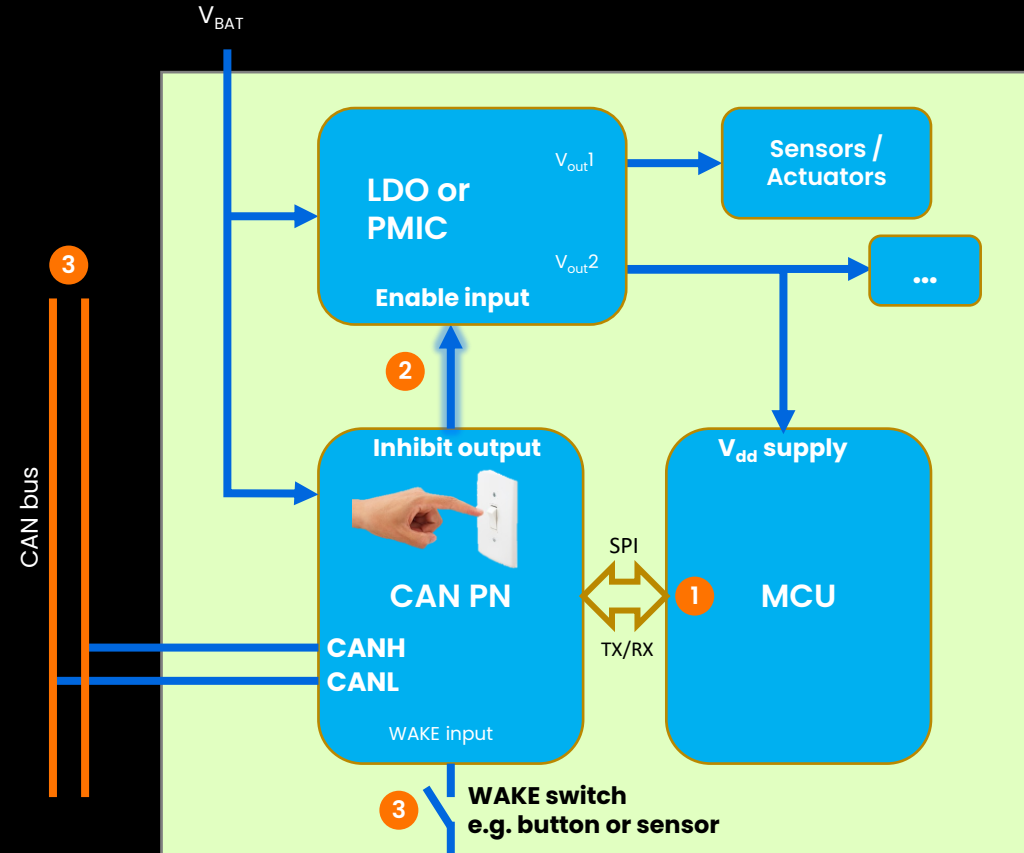
Find out more on [nxp.com/CAN-SIC](https://www.nxp.com/CAN-SIC)

CAN SIC with Partial Networking | Addressing SDV E/E challenges



Can act as the ECU's
power switch

...and serve
SDV E/E use-cases

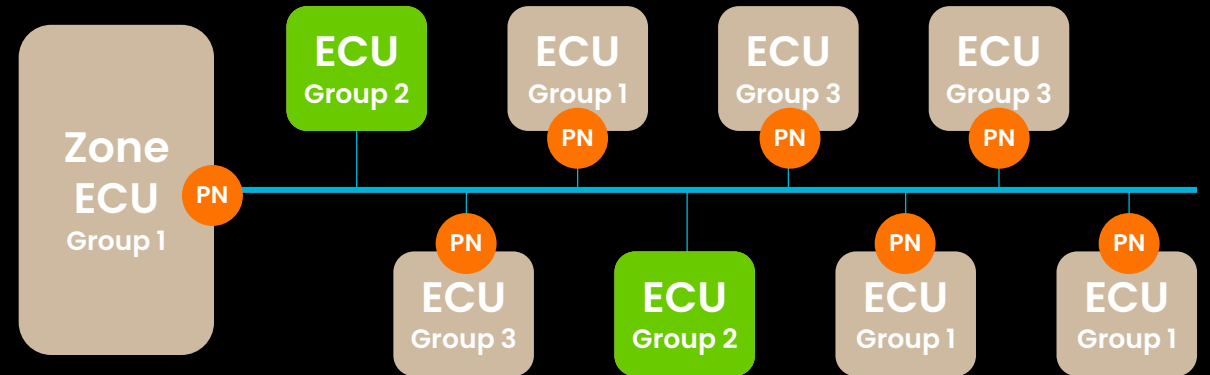
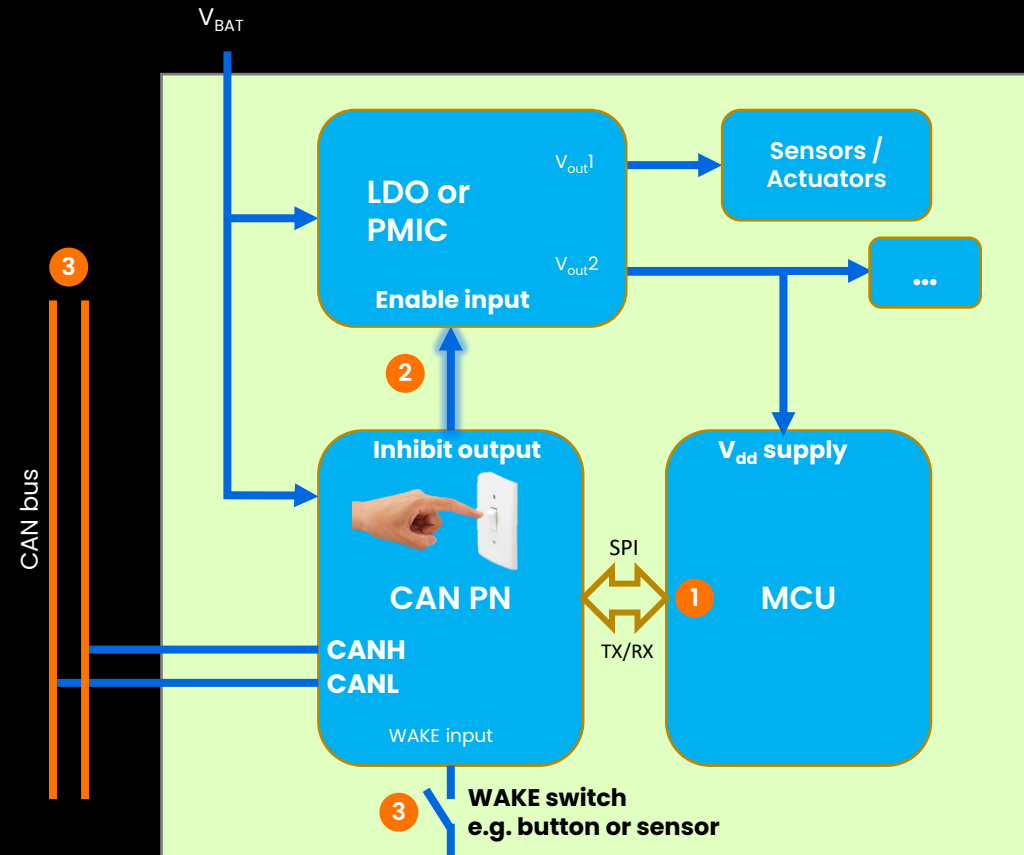


CAN SIC with Partial Networking | Addressing SDV E/E challenges



Can act as the ECU's
power switch

...and serve
SDV E/E use-cases



- Keep idle ECUs switched-off
- Minimize power waste
- Enable dynamic ECU on/off switching capability
- Reduce ECU degradation

CAN SIC with Partial Networking | NXP Solutions



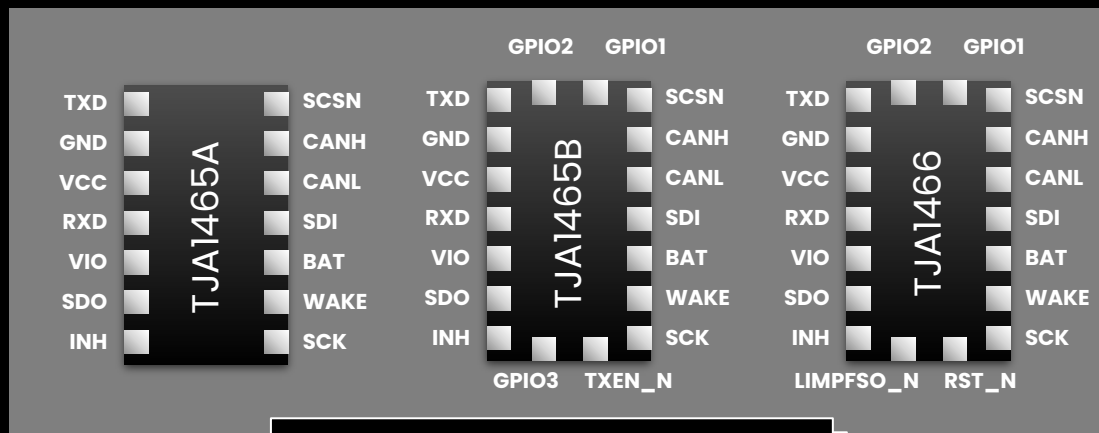
Key Features

- Pin-to-pin **HW** compatible to TJA1145(A)
- ISO 11898-2:2024 third edition compliant
- SAE, VeLIO (**+SIC**) compliant
- **CAN FD / CAN XL Passive** feature
- **EMC** IEC TS62228-3 compliant
- AEC-Q100 **Grade-1 + extended mission profiles**
- ISO 26262 **ASIL-B** compliant



Enablement support

- FoC Elektrobit & Vector drivers
- Evaluation IO plug-on boards
- Safety bundle (FMEDA, Safety Manual, ASIL B certificate)
- Part of NXP's longevity program 15years



RELEASED / In Production

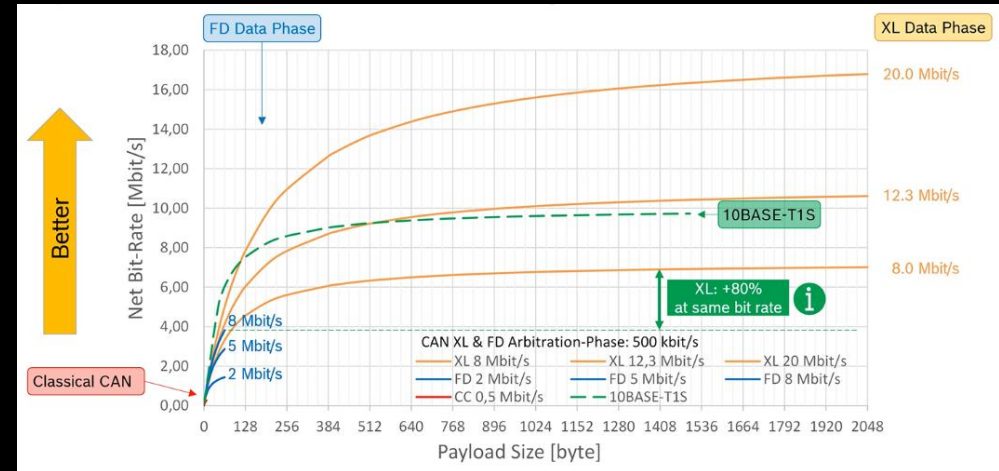
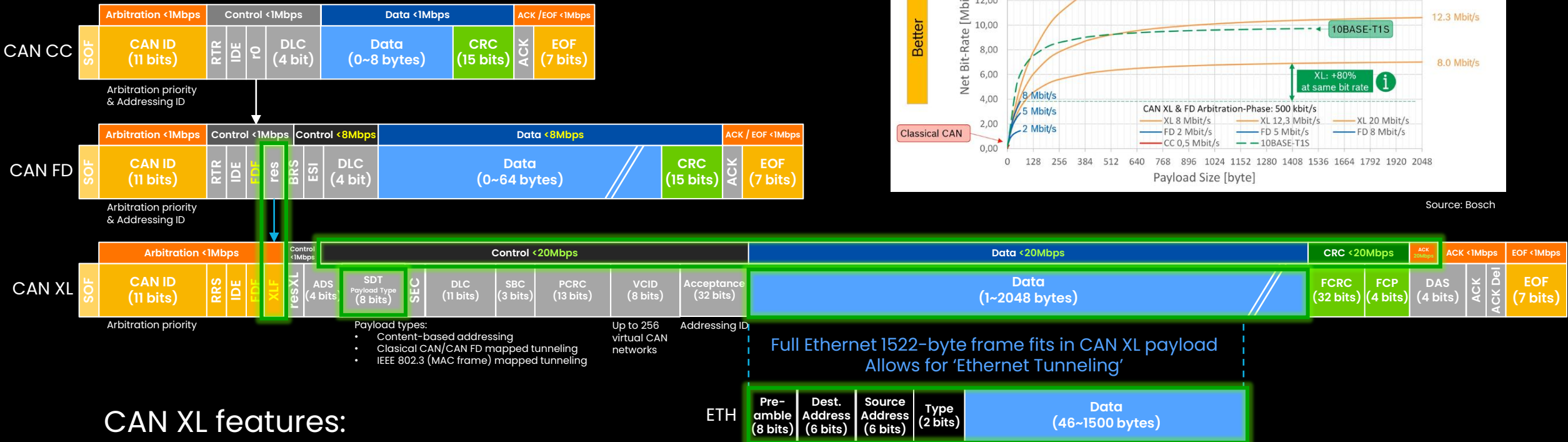
Orderable part number	Package	Function
TJA1465A	SO14 / HVSON14	CAN SIC + PN
TJA1465B	DHVQFN18	CAN SIC + PN + GPIOs
TJA1466A B C	DHVQFN18	CAN SIC + PN + GPIOs + Watchdog

Find out more on [nxp.com/CAN-PN](https://www.nxp.com/CAN-PN)



CAN XL | The next step into the future

(Frame lengths not to scale)



Source: Bosch

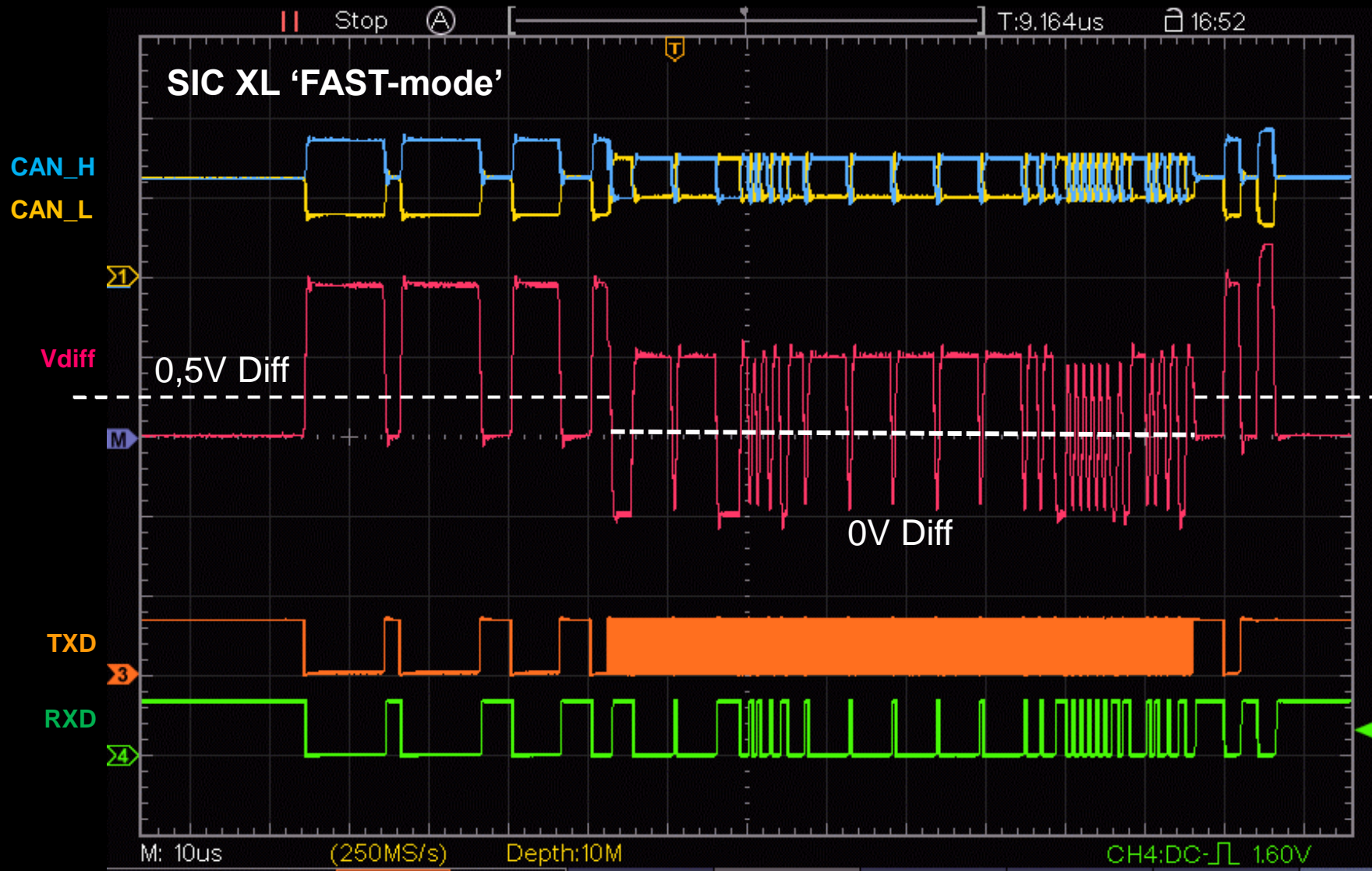
CAN XL features:

- Faster speed up to 20 Mbps
- Larger payload up to 2048 bytes
- Backward compatible through CAN FD reserved bit
- Prepared for ethernet tunneling in SDT (payload type) and payload size which can fit full Ethernet frame

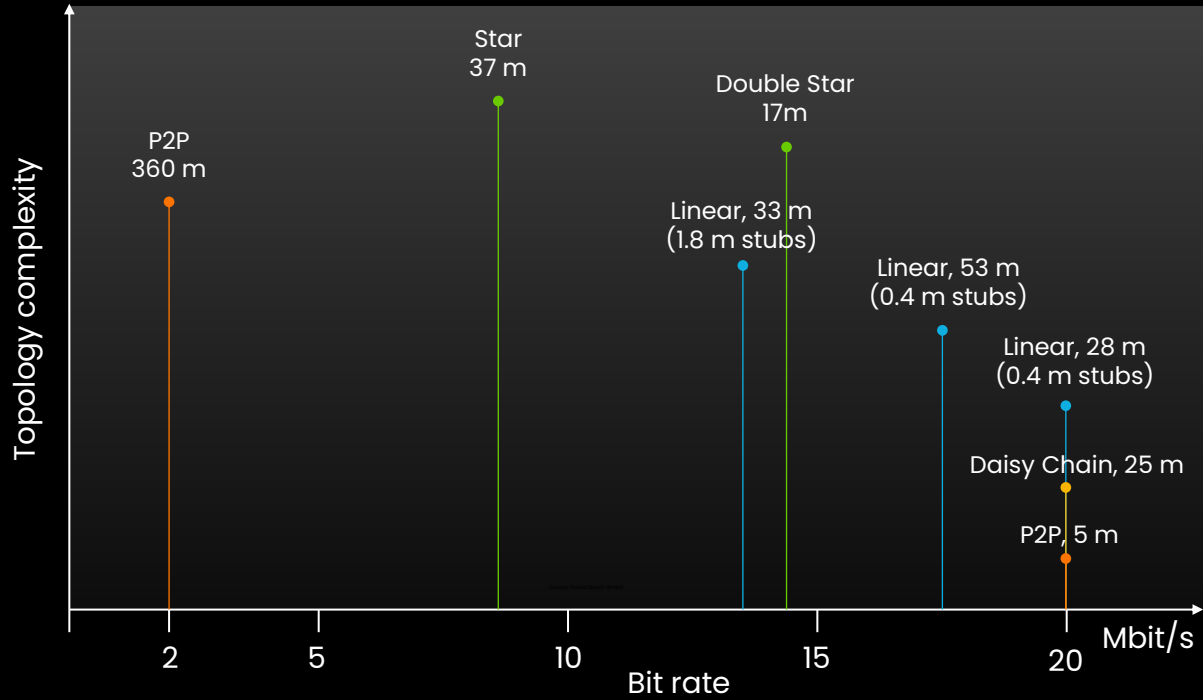
CAN XL | New CAN bus voltage scheme | SIC-mode



CAN XL | New CAN bus voltage scheme | FAST-mode



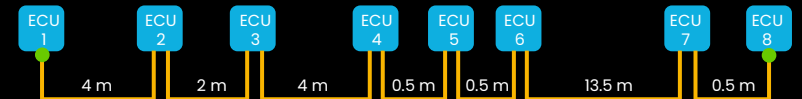
CAN XL | CiA PlugFest results on CAN XL network architectures



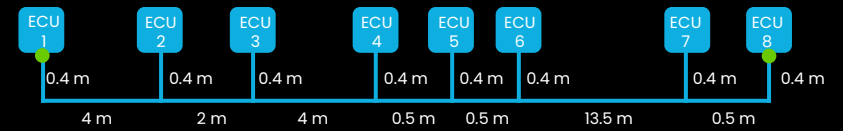
P2P
5m & 360m



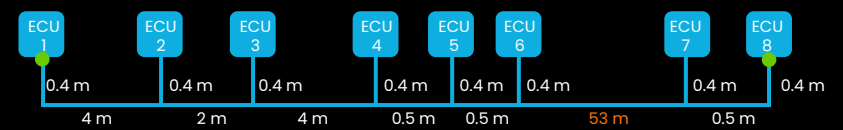
Daisy Chain
25m



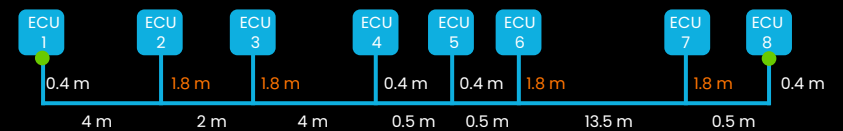
Linear
28m, 0.4m stubs



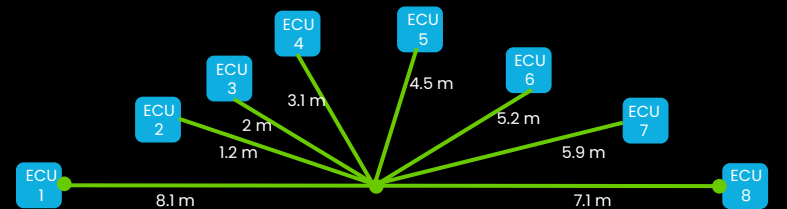
Linear
53m, 0.4m stubs



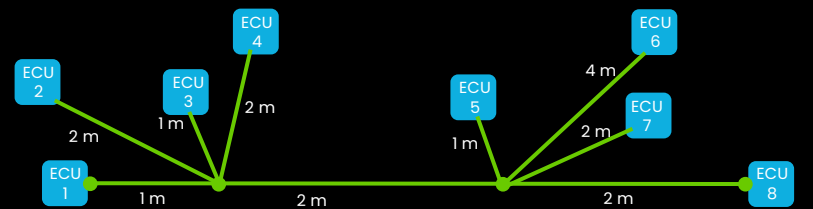
Linear
33m, 1.8m stubs



Star
37m, long stubs



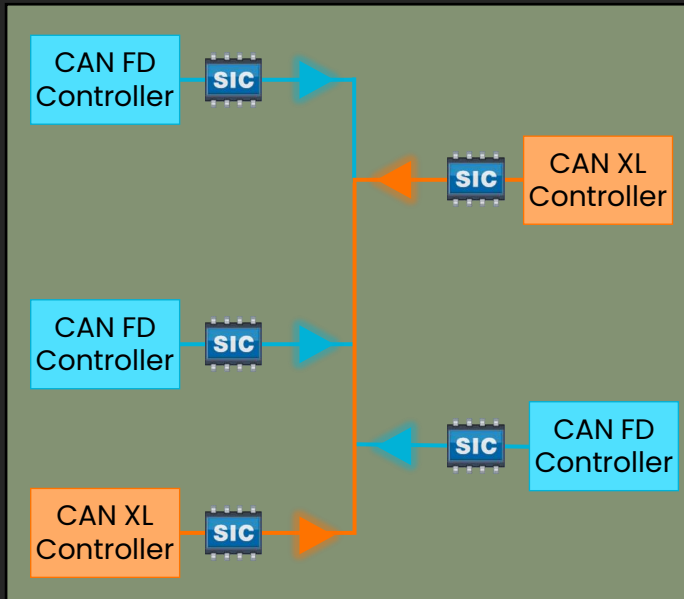
Double Star
17m, long stubs



Evolution to CAN XL | Transitioning from CAN FD to CAN XL

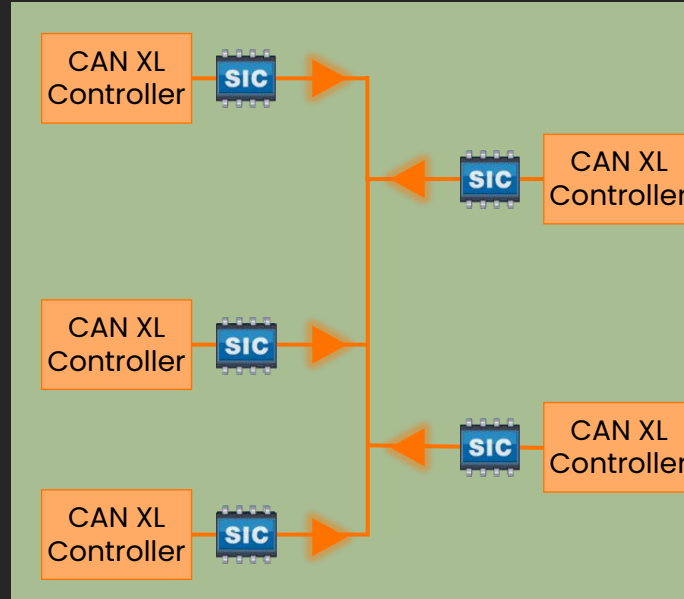


Mixed CAN FD and CAN XL "SIC"



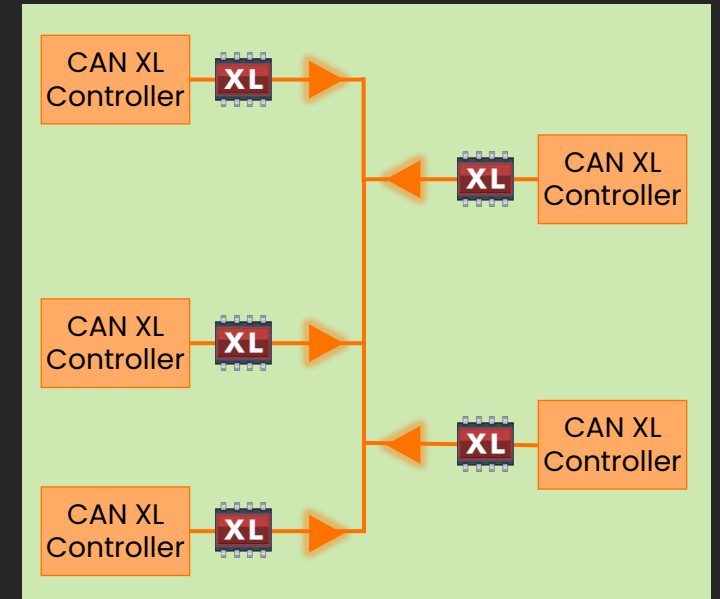
- Full network can communicate **CAN FD**
- Few may communicate CAN XL
CAN FD nodes ignore bus and wait till EOF
- Up to **8 Mbps** with **CAN SIC transceivers**

CAN XL "SIC"



- CAN XL controllers and CAN SIC transceivers
- Full **CAN XL** protocol & frame communication
- Up to **8 Mbps** with **CAN SIC transceivers**

CAN XL "FAST"

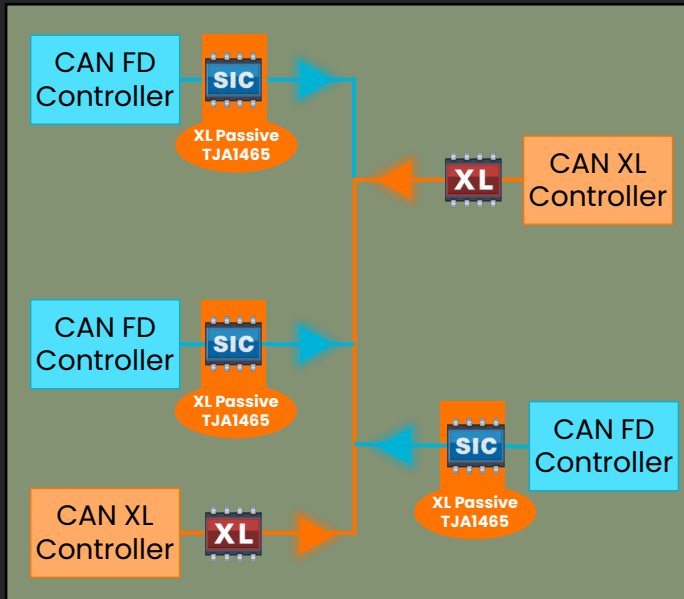


- CAN XL controllers and CAN XL transceivers for full CAN XL experience
- **CAN XL frame size**, speed up to **20 Mbps**

Evolution to CAN XL | Transitioning from CAN FD to CAN XL

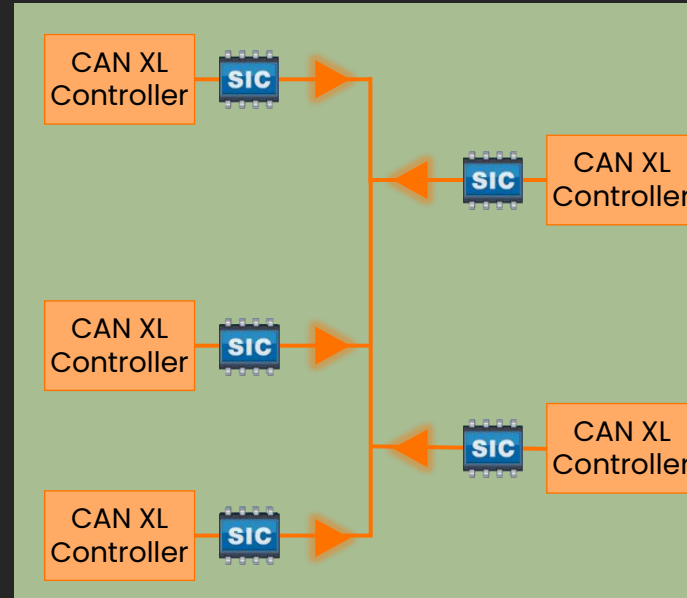


Mixed CAN FD and CAN XL "FAST"



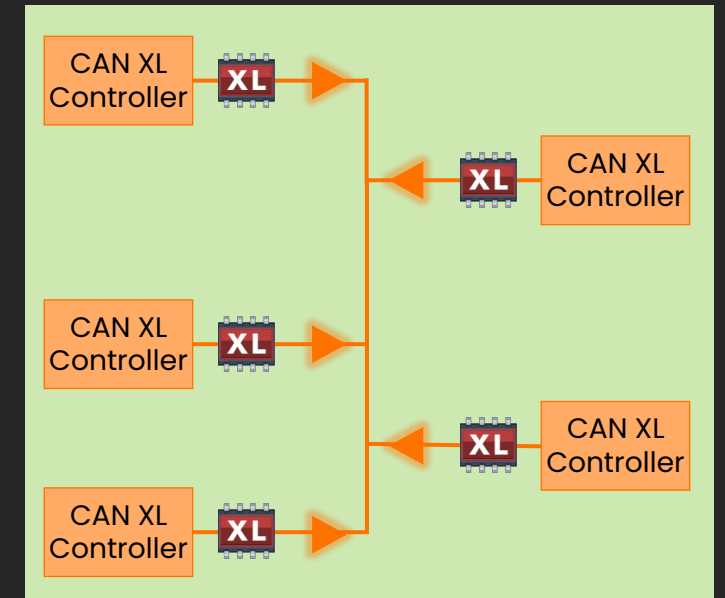
- Full network can communicate **CAN FD**
- Few may communicate CAN XL
CAN FD nodes ignore bus and wait till EOF
- Up to **8 Mbps** between **CAN SIC transceivers**
- Up to **20 Mbps** between **CAN XL transceivers**

CAN XL "SIC"



- CAN XL controllers and CAN SIC transceivers
- Full **CAN XL** protocol & frame communication
- Up to **8 Mbps** with **CAN SIC transceivers**








CAN XL "FAST"



- CAN XL controllers and CAN XL transceivers for full CAN XL experience
- **CAN XL frame size**, speed up to **20 Mbps**

CAN XL | Use case advantages



Compared to		CAN XL Technology Advantage	CAN XL Use Case Advantage
CAN FD or CAN SIC		Allows larger networks (bus and stub length, number of nodes)	Cost-down and topology simplification
		Helps to reduce the bus load	Creates margin, enhances safety and robustness
		Supports large payload 2048 bytes	Prevents multi-frame data packaging, improves processing and response time
10BASE-T1S	 1110010101	Offers lower latency due to CAN priority-based arbitration (Collision Detection) vs Ethernet PLCA (Collision Avoidance) round robin (TSN might come close)	Improves response time for latency critical real-time applications
		Offers instant bus wake-up <math><1 \mu\text{sec}</math> vs Ethernet wake-up forwarding / link establishment <math><100 \text{ msec}</math>	Improves system responsiveness
		Requires less external BoM components and works with standard 100 μH CMC vs Ethernet more expensive 240 μH CMC, XTAL + extra capacitors & resistors	Enables lower system cost
		Less complex software stack and high re-use possible from CAN FD	Easier to implement when coming from CAN FD legacy

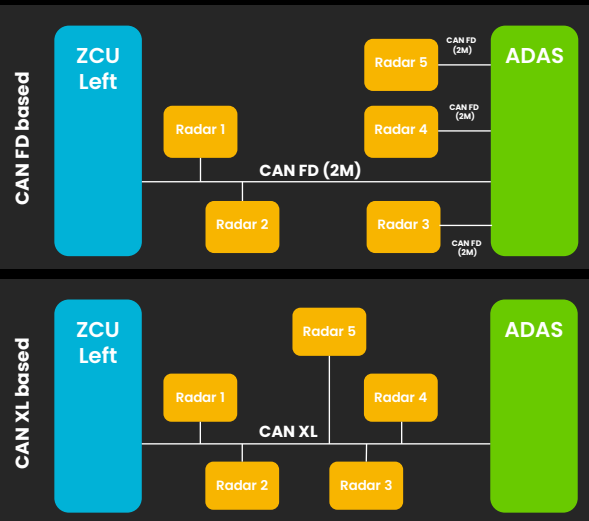
CAN XL | Example use cases



Increased bandwidth applications

ADAS / Radar example:

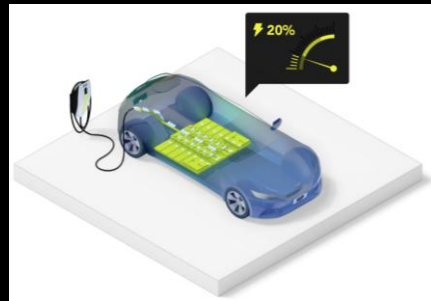
Merging multiple CAN FD sub-branches into single CAN XL branch for cable/connector saving. Enabled by CAN XL increased bandwidth



Large payload applications

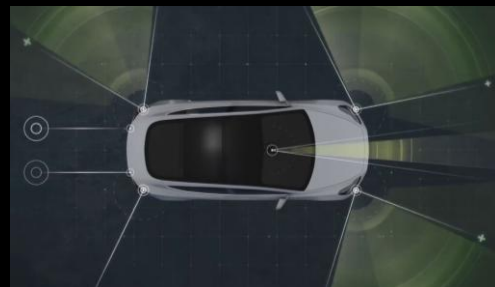
BMS:

Voltage, Current, Temperature, State of Charge, State of Health, Status Flags, Balancing Status, Fault Codes, Timestamp or Cycle Count. CAN XL large payload supports higher update frequency and bus load margin



Corner radar:

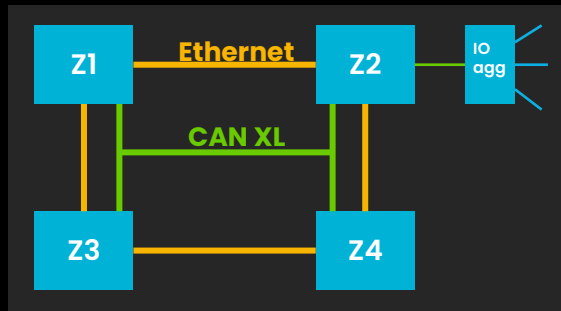
Increasing number of object detection – today 30 objects, tomorrow 50-60 objects. CAN XL large payload prevents data segmentation



Diversified zonal redundancy

Redundancy example:

CAN XL used for low-latency & low-cost service channel (Ethernet tunneling over CAN XL) and diversified fail-safe backup channel in case of Ethernet failure



Latency critical applications

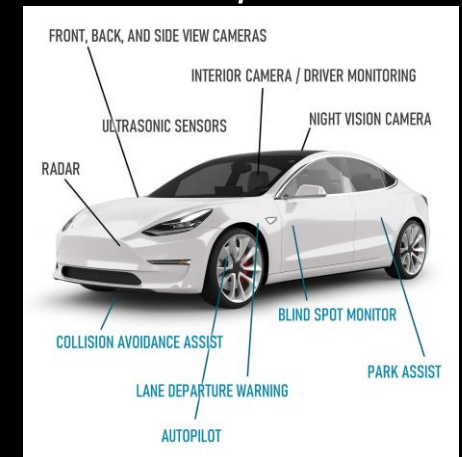
Steer by wire



Brake by wire



ADAS / RADAR





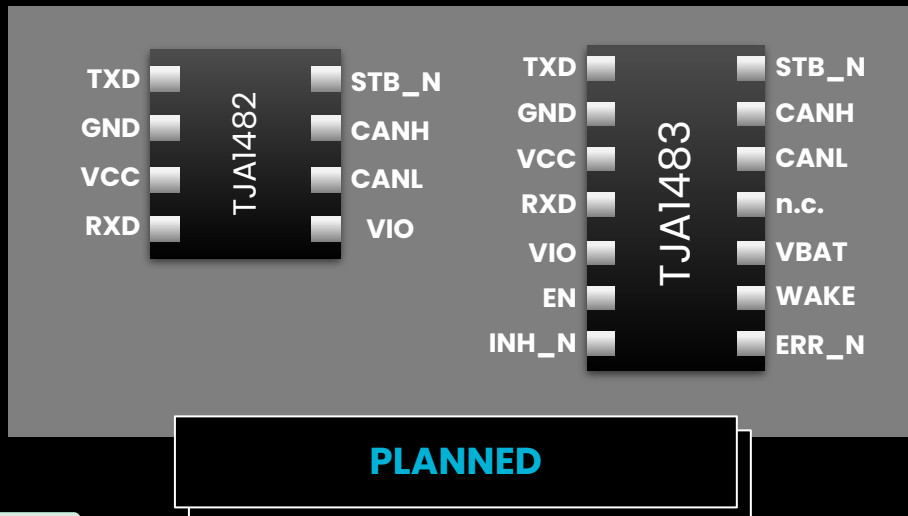
Key Features

- ISO 11898-2:2024 compliant to CAN SIC and **CAN XL**
- **EMC** IEC TS62228-3 compliant
- AEC-Q100 **Grade-1 + extended mission profiles**
- HVSON14 package



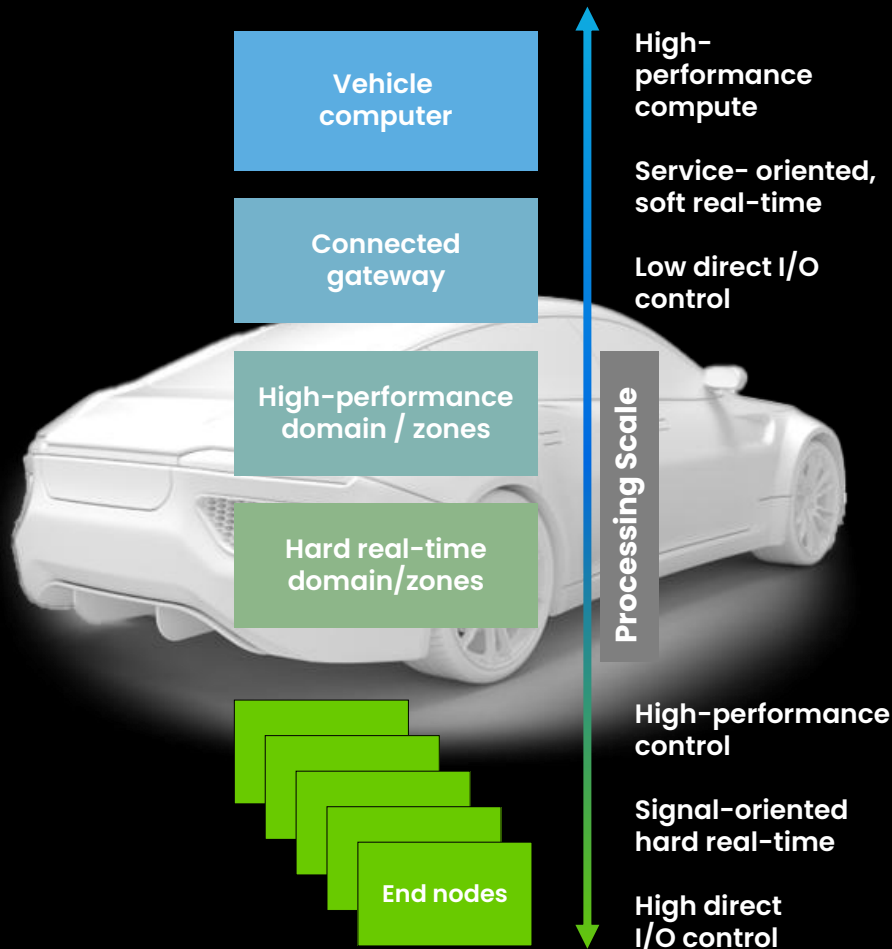
Enablement support

- FoC LL drivers
- Evaluation IO plug-on boards
- Part of NXP's longevity program 15years



Orderable part number	Package	Function
TJA1482A	HVSON8	CAN SIC XL with Standby-mode
TJA1483A	HVSON14	CAN SIC XL with Sleep-mode and INH pin

CAN XL | NXP Ecosystem



Microcontrollers

High-end MPU central compute	
MPU	CAN XL ports
S32N	4x
S32Z2	2x
S32E2	2x

Mid-end MCU Zonal/Domain control	
MCU	CAN XL ports
S32K5	1x / 2x



Transceivers

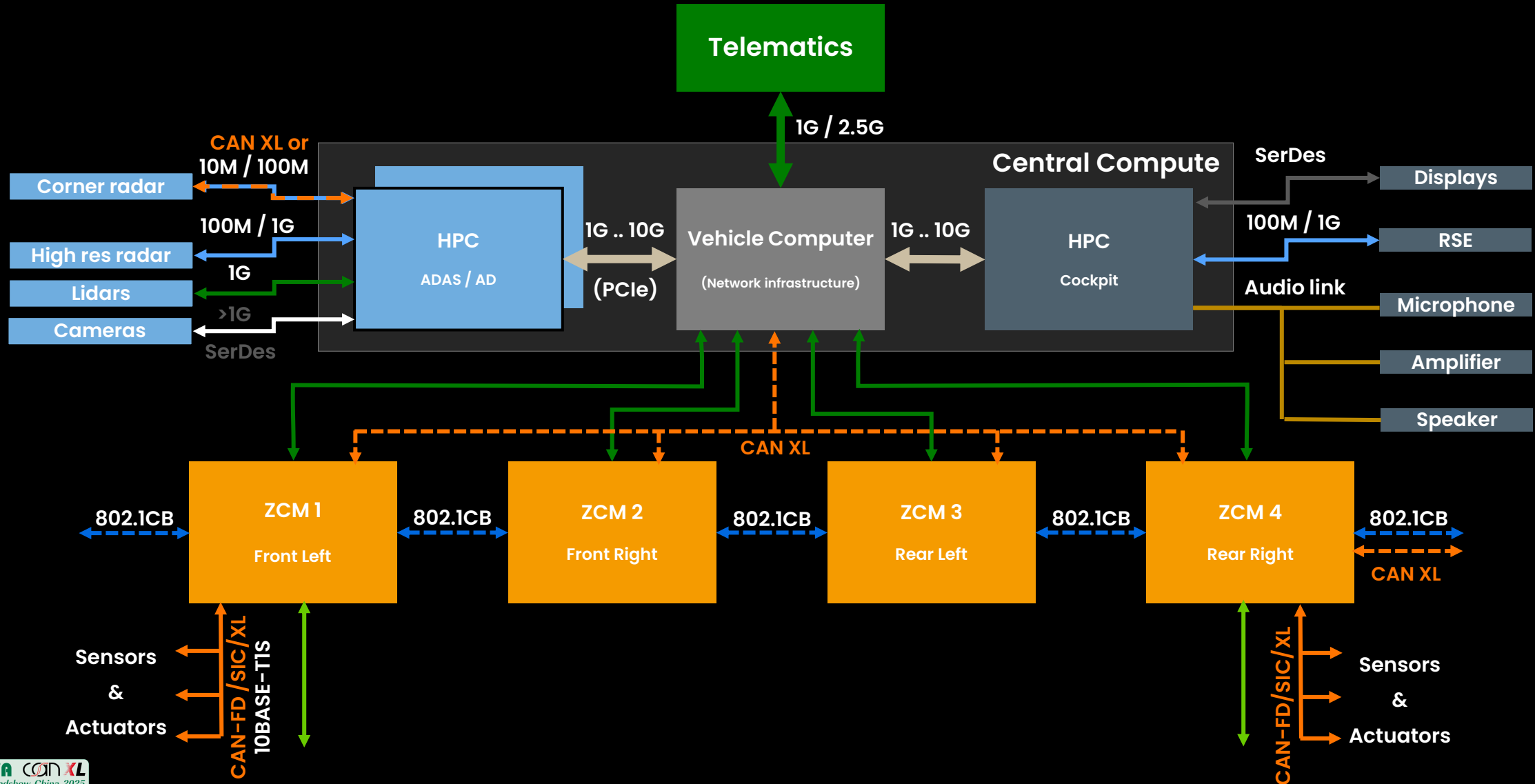
CAN SIC transceivers CAN XL 'SIC-mode'	
Transceiver	Speed
TJA1462 / 63	≤8Mbit/s
TJA1465 / 66	≤8Mbit/s

CAN SIC XL transceivers CAN XL 'FAST-mode'	
Transceiver	Speed
ALB12.0 test chip	≤20Mbit/s
TJA1482 (planned)	≤20Mbit/s
TJA1483 (planned)	≤20Mbit/s

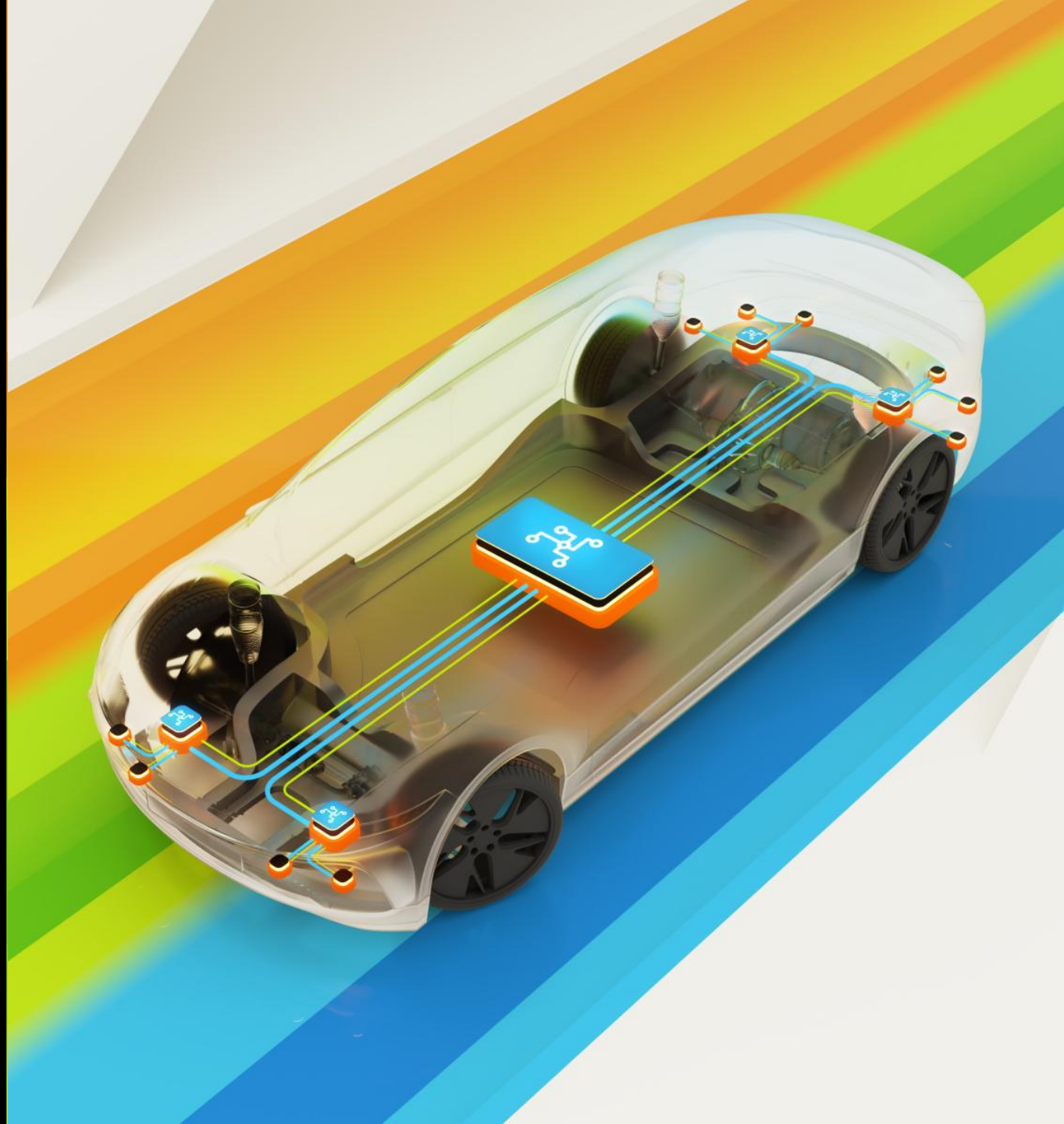
Generalized hybrid zonal E/E architecture

HPC = High Performance compute ECU/Module

ZCM = Zonal control module



Conclusion



Conclusions

Evolution of CAN

- CAN has evolved over 4 generations into the definition of CAN XL
- Each new generation has resulted in increased speed, payload and topology support
- Each new generation has been designed for backward compatibility on the protocol side
- CAN XL can be used in a mixed topology with CAN FD

CAN XL Use Cases

- CAN XL has its clear technology strengths, which create a perfect fit for the use cases:
 - Increased bandwidth applications
 - Large payload applications
 - Physical layer redundancy & diversification with Eth tunneling
 - Low latency applications

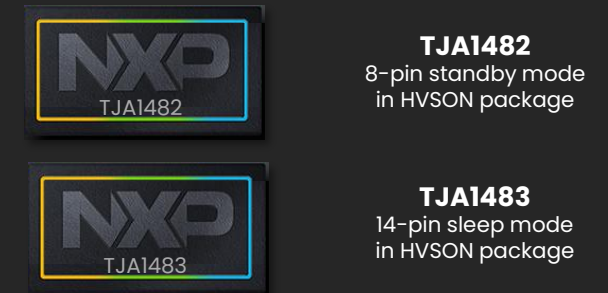
CAN XL Eco system

- NXP enables the CAN XL eco system through MPUs, MCUs and CAN SIC XL transceivers

NXP CAN XL-enabled MPUs and MCUs



NXP CAN SIC XL Transceivers





Get in touch

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