



# **VA7000 CHIPSET FAMILY FOR ADAS**



# Best-in-Class Connectivity for Any High-Speed Application



**Valens**

**INFOTAINMENT CONNECTIVITY:**  
POWERING THE NEXT  
GENERATION OF IMMERSIVE  
EXPERIENCES

**VA6000**

CHIPSET FAMILY



**Valens**

**SENSOR CONNECTIVITY:**  
ACCELERATING THE ADAS  
AND AUTONOMOUS VISION

**VA7000**

CHIPSET FAMILY



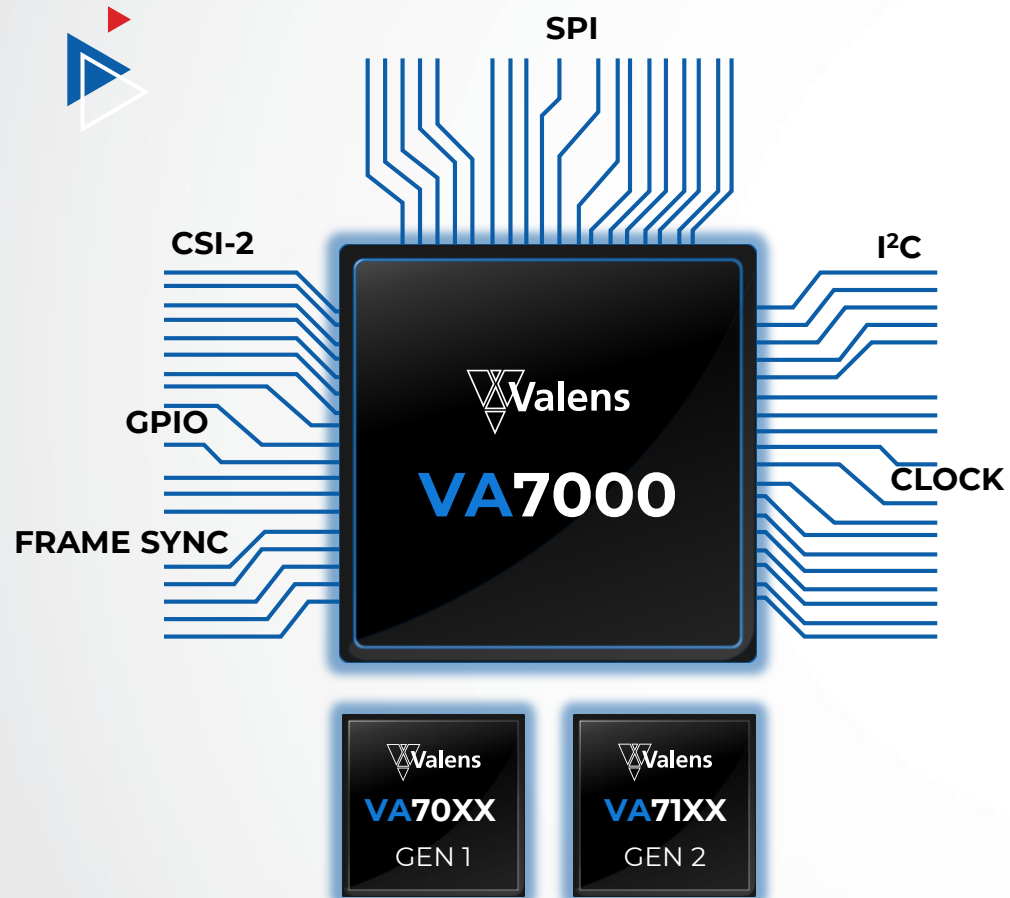
**Valens**

**DISPLAY CONNECTIVITY:**  
STEERING THE FUTURE  
OF THE DIGITAL COCKPIT

**VA8000**

CHIPSET FAMILY

# Sensor Connectivity: Accelerating the ADAS and Autonomous Vision



## Chip features

### Link Type:

Asymmetric

### Bandwidth:

4Gbps, 8Gbps, 12Gbps, 16Gbps

### Physical Channel:

UTP, Coax, SDP

### Application:

Sensors

SoCs

## Key Highlights

- MIPI A-PHY-compliant: the only standard for long-reach sensor connectivity
- Unprecedented bandwidth with a roadmap to 32Gbps
- Industry-lowest packet error rate of  $10^{-19}$



# MIPI A-PHY



# Valens is the First in the Industry with ▶ A-PHY-Compliant Chipsets



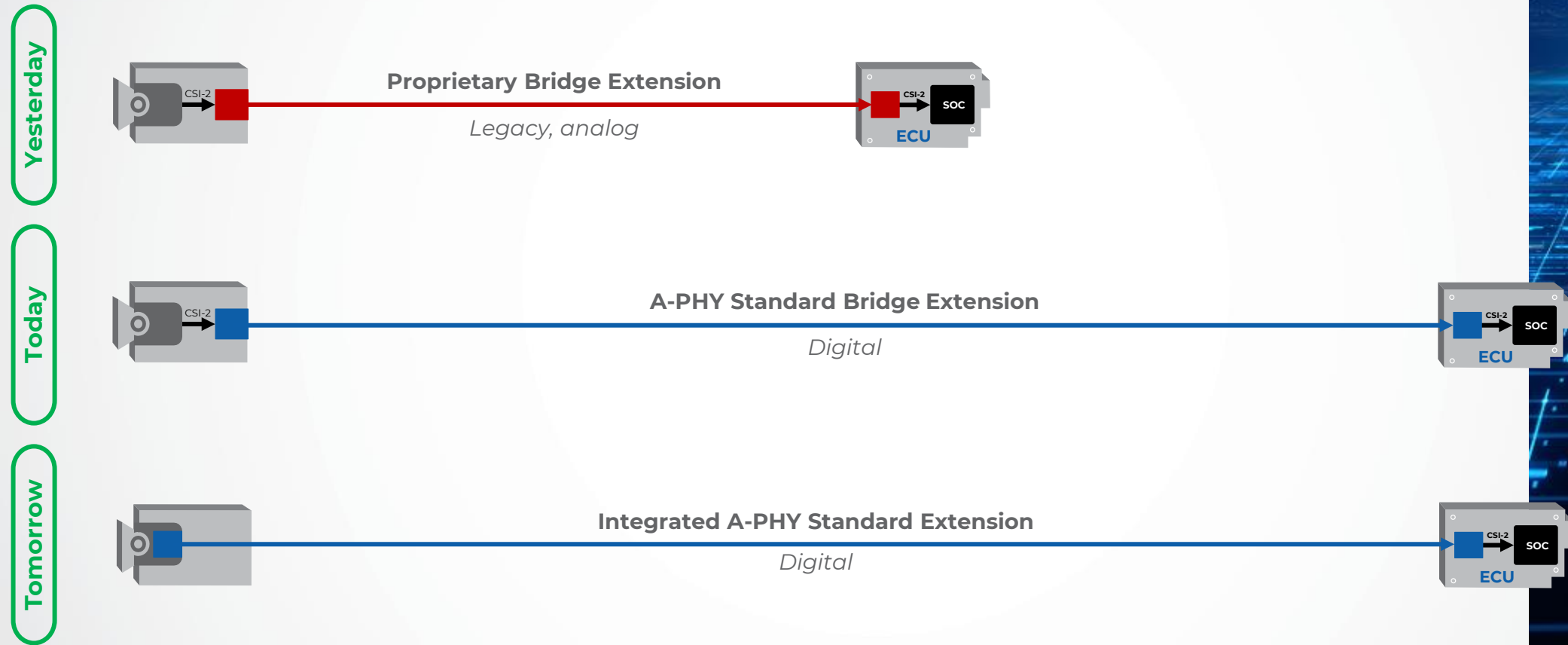
mipi alliance

## MIPI A-PHY DRIVERS

- › Best-in-class EMC performance
- › Clear roadmap to ultra-high bandwidth
- › Simple architecture
- › End-to-end safety
- › Seamless integration with CSI-2 and DSI-2 interfaces

# A-PHY: From Analog to Digital

## A Transformative, Standardized Technology



# Example A-PHY Integration: Sony

**Sony's new image sensors will feature the standard MIPI A-PHY interface.**

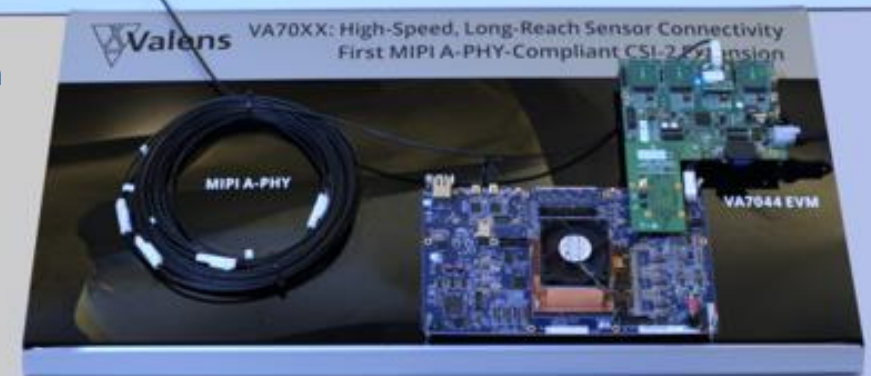
"We have already started A-PHY prototype development and are planning to have an interoperability test with Valens' A-PHY de-serializer. In collaborating with Valens, we will improve the technological maturity and integrate A-PHY into the sensor."

- Sony Semiconductor Solutions

## Extension of CSI-2 over MIPI A-PHY



Sony Camera



# mipi<sup>®</sup> alliance Automotive Ecosystem

## COMPANIES CONTRIBUTING TO MIPI A-PHY DEVELOPMENT



## ADOPTING DP and eDP ADAPTATION LAYER FOR A-PHY



## ADOPTED BY IEEE STANDARDS ASSOCIATION



## MIPI Liaisons:



# A-PHY: Gears and Bandwidth



| Gear   | Data Rate | Modulation        | Nyquist Frequency | Net Application Data Rate [Gbps] |
|--------|-----------|-------------------|-------------------|----------------------------------|
| 1      | 2Gbps     | NRZ-8b/10b        | 1Ghz              | 1.5                              |
|        |           | PAM 4 (Optional)* | 0.5Ghz            | 1.8                              |
| 2      | 4Gbps     | NRZ-8b/10b        | 2Ghz              | 3                                |
|        |           | PAM 4 (Optional)* | 1Ghz              | 3.6                              |
| 3      | 8Gbps     | PAM4              | 2Ghz              | 7.2                              |
| 4      | 12Gbps    | PAM8              | 2Ghz              | 10.8                             |
| 5      | 16Gbps    | PAM16             | 2Ghz              | 14.4                             |
| Uplink | 100Mbps   | NRZ-8b/10b        | -                 | 0.055 (55Mbps)                   |
|        | 200Mbps*  | PAM4-8b/10b       | -                 | 125                              |

\*Added as part of A-PHY v1.1

## A-PHY highlights

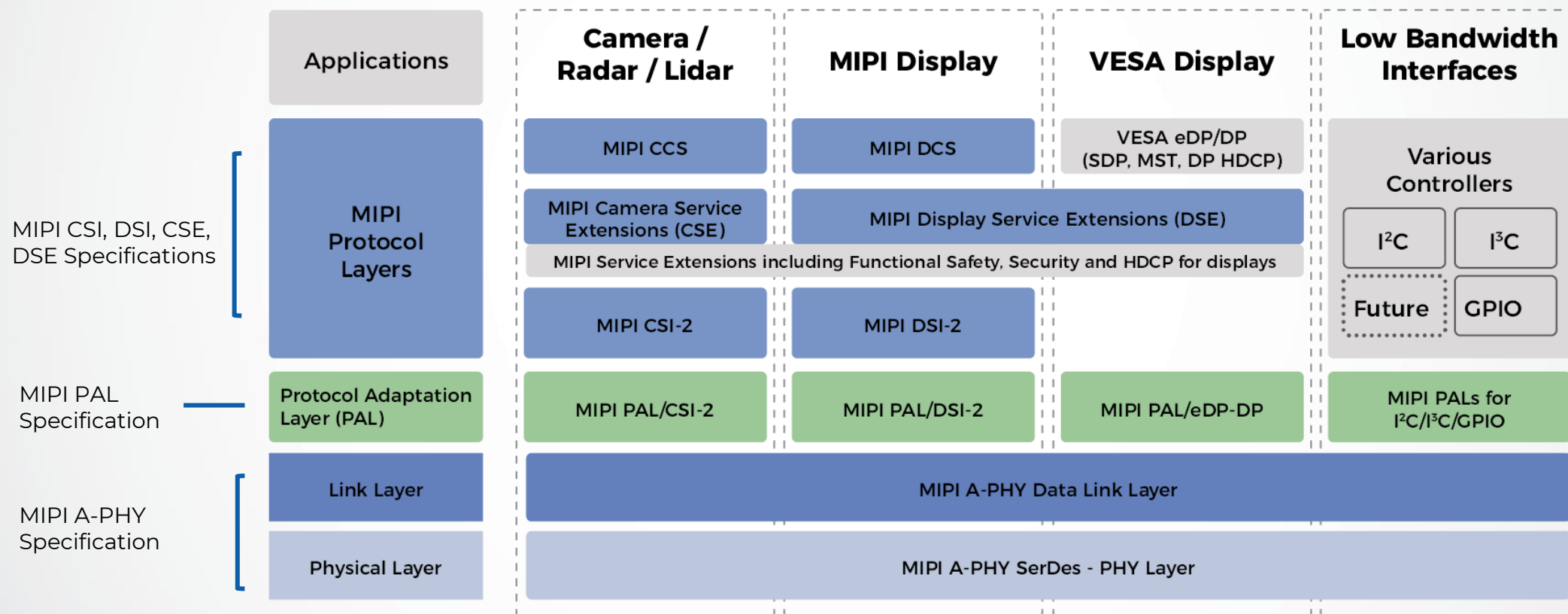
- MIPI A-PHY guarantees a PER of  $10^{-19}$
- Operating over low Nyquist frequency up to 16Gbps for reduced channel attenuation

## A-PHY v1.1 enhancements:

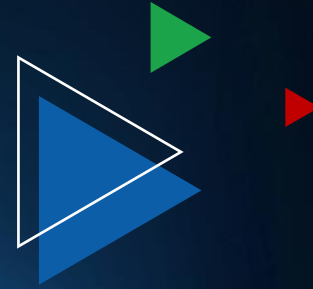
- 200 Mbps double rate uplink (U2)
- Enhanced performance at lower gears
  - Optional PAM4 modes for gear 1 & gear 2
- Adds STQ cable support
- Interoperable: Backwards and forwards compatible

# MIPI Automotive SerDes Solutions (MASS<sup>SM</sup>)

MIPI A-PHY is a layer in a full stack offering that is already widely deployed



# VA7000 Family Introduction



# The VA7000 Chipset Family



**VA7021  
Serializer**

**Input:** 1 x CSI-2  
**Output:** 1 x 4Gbps A-PHY



**VA7031  
Serializer**

**Input:** 1 x CSI-2  
**Output:** 1 x 8Gbps A-PHY



**VA7042  
Deserializer**

**Input:** 2 x 8Gbps A-PHY,  
1 x CSI-2  
**Output:** 2 x CSI-2



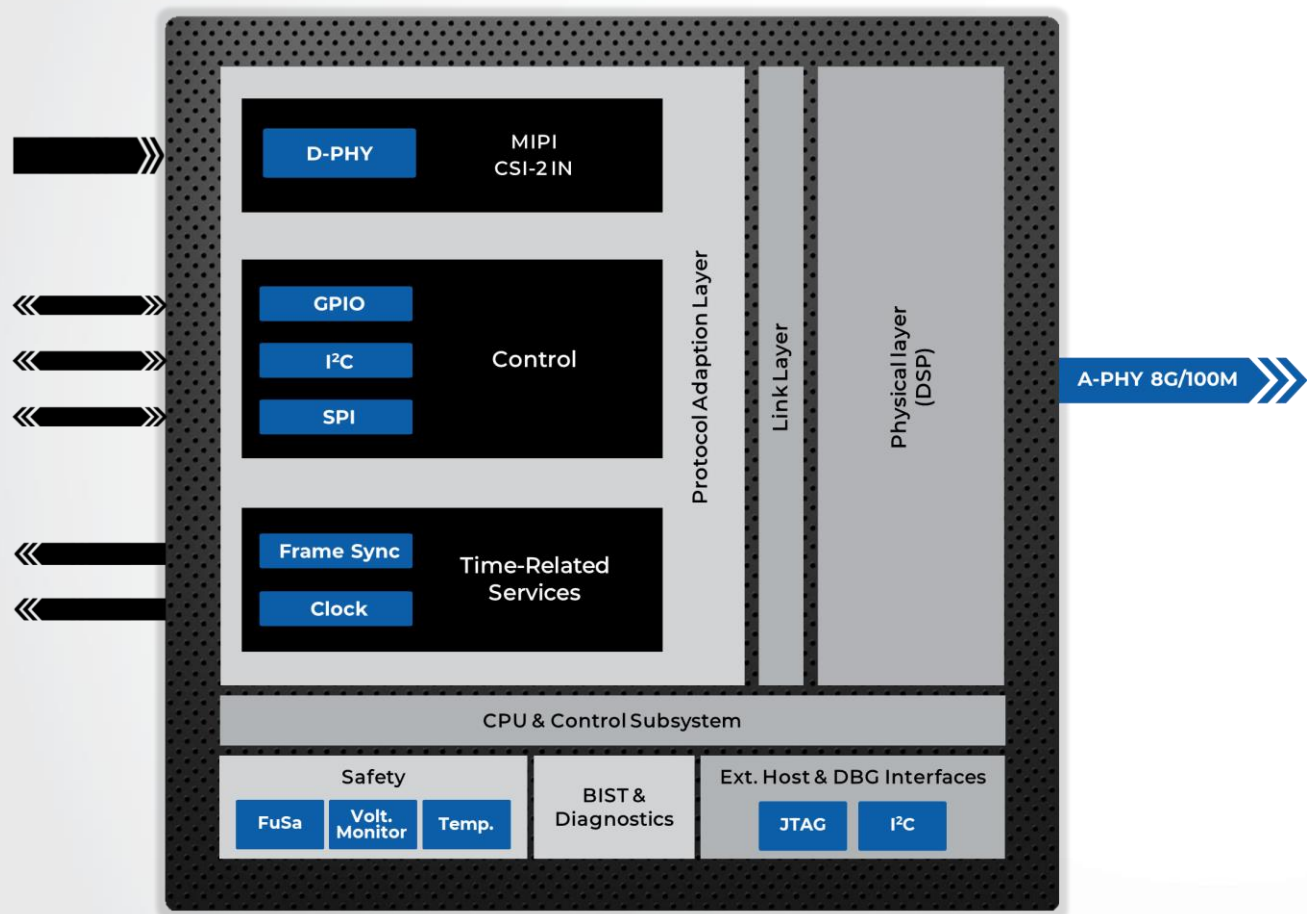
**VA7044  
Deserializer**

**Input:** 4 x 8Gbps A-PHY,  
1 x CSI-2  
**Output:** 2 x CSI-2

## High-speed 8Gbps links for remote sensor connectivity

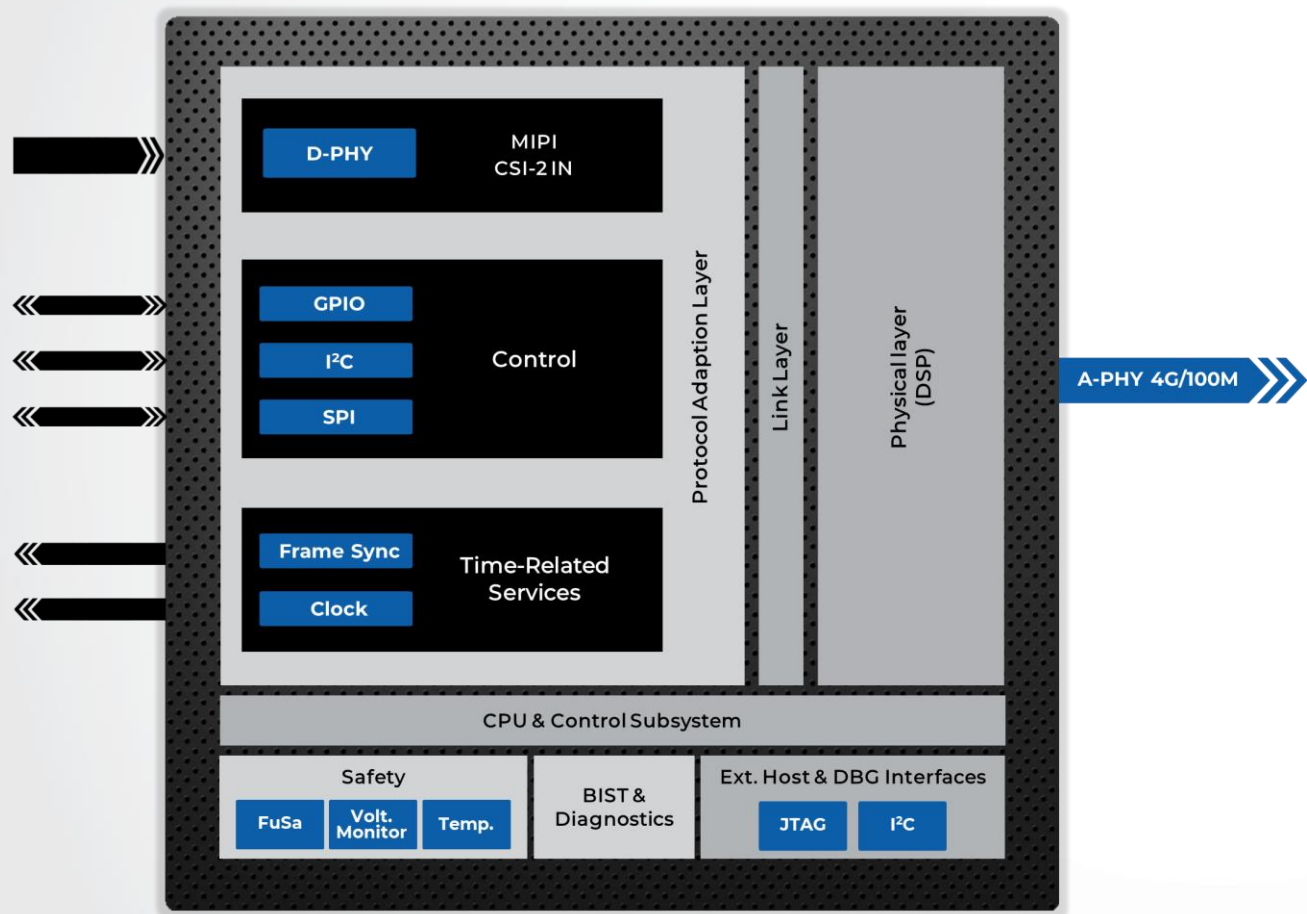
- › UTP for speeds up to 4Gbps per link
- › SDP, Coax for speeds up to 8Gbps per link
- › Tunneling of CSI-2, GPIO, SPI, I<sup>2</sup>C
- › DSI to CSI connectivity (SoC-to-SoC)
- › Extremely low packet error rate <1e<sup>-19</sup>

# VA7031: Serializer, 8Gbps Link



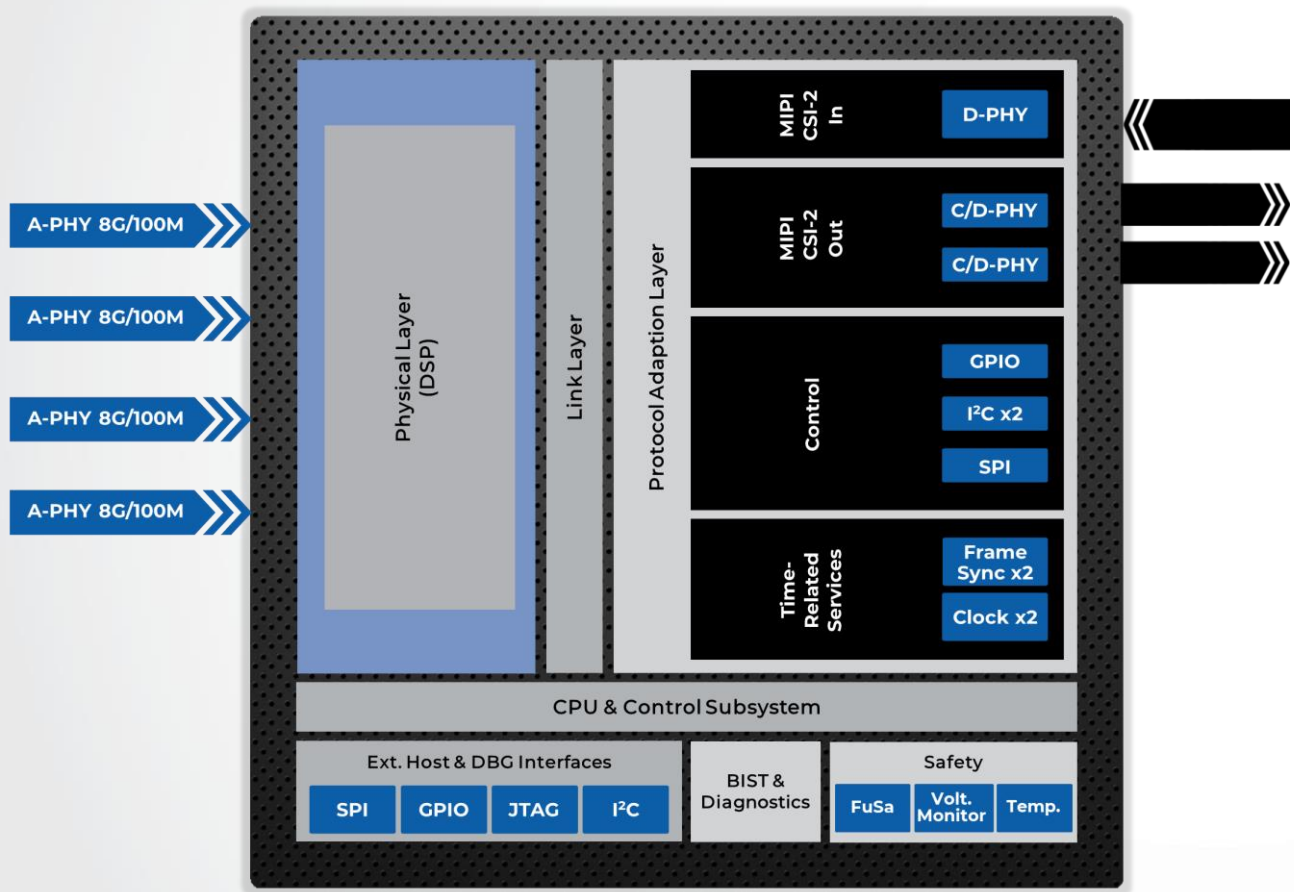
| Feature              | Description                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link                 | MIPI A-PHY Version 1.0                                                                                                                                                                                                                                                                                                                                                           |
| Configurable PHY     | <ul style="list-style-type: none"><li>• Main channel: 2Gbps, 4Gbps, 8Gbps</li><li>• Return channel: 100Mbps</li></ul>                                                                                                                                                                                                                                                            |
| Infrastructure       | <p>Operating over the MIPI® A-PHY channel</p> <ul style="list-style-type: none"><li>• Coax cable - Up to 15 meters/50 feet with up to four inline connectors</li><li>• Shielded differential pair (SDP) cable - Up to 10 meters/33 feet with up to four inline connectors</li><li>• Special mode for working over Unshielded Twisted Pair (UTP) channel at up to 4Gbps</li></ul> |
| MIPI CSI-2           | <ul style="list-style-type: none"><li>• D-PHY, CSI-2 Input</li><li>• 4 data lanes</li><li>• Up to 2.5 Gbps per lane</li><li>• Supporting up to 16 virtual channels</li></ul>                                                                                                                                                                                                     |
| I <sup>2</sup> C     | <ul style="list-style-type: none"><li>• Incorporating I<sup>2</sup>C control channel for remote management over A-PHY</li><li>• Option for local host management</li><li>• 100KHz-1MHz</li></ul>                                                                                                                                                                                 |
| SPI                  | <ul style="list-style-type: none"><li>• SPI interface for remote control by a deserializer</li><li>• Operating frequency of up to 40Mhz</li></ul>                                                                                                                                                                                                                                |
| Clock output         | <ul style="list-style-type: none"><li>• Local precision clock output</li><li>• Generated locally or via a remote centralized clock</li></ul>                                                                                                                                                                                                                                     |
| Synchronized Outputs | <ul style="list-style-type: none"><li>• Outputting remotely generated synchronized signals</li></ul>                                                                                                                                                                                                                                                                             |
| GPOs/GPIOs           | <ul style="list-style-type: none"><li>• Up to 3 general purpose output pins</li><li>• Up to 4 general purpose I/O pins</li></ul>                                                                                                                                                                                                                                                 |
| Safety               | ISO-26262, ASIL-B                                                                                                                                                                                                                                                                                                                                                                |
| Power Consumption    | Typical <300mW                                                                                                                                                                                                                                                                                                                                                                   |
| Package              | 6mmx6mm FO-CLP (with functional balls only on the outer rows. Low-cost PCB design)                                                                                                                                                                                                                                                                                               |
| Temperature          | AEC-Q100 Grade 2                                                                                                                                                                                                                                                                                                                                                                 |
| Power Supply Rails   | 1.8V, 0.8V                                                                                                                                                                                                                                                                                                                                                                       |

# VA7021: Serializer, 4Gbps Link



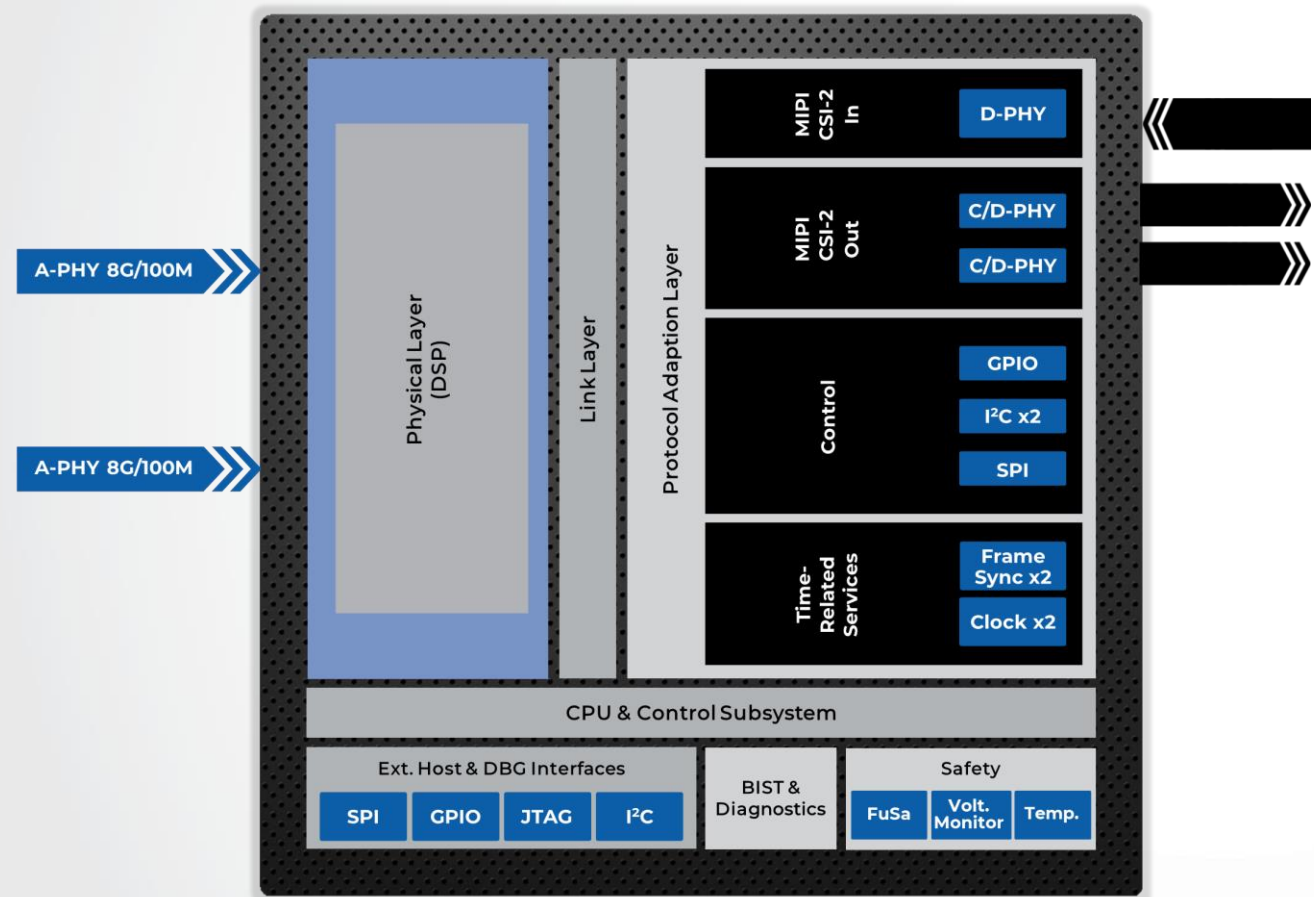
| Feature              | Description                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link                 | MIPI A-PHY Version 1.0                                                                                                                                                                                                                                                                                                                                                                  |
| Configurable PHY     | <ul style="list-style-type: none"><li>Main channel: 2Gbps, 4Gbps</li><li>Return channel: 100Mbps</li></ul>                                                                                                                                                                                                                                                                              |
| Infrastructure       | <p>Operating over the MIPI® A-PHY channel</p> <ul style="list-style-type: none"><li>Coax cable - Up to 15 meters/50 feet with up to four inline connectors</li><li>Shielded differential pair (SDP) cable - Up to 10 meters/33 feet with up to four inline connectors</li><li>Unshielded Twisted Pair (UTP) cable – Up to 10 meters/33 feet with up to four inline connectors</li></ul> |
| MIPI CSI-2           | <ul style="list-style-type: none"><li>D-PHY, CSI-2 Input</li><li>4 data lanes</li><li>Up to 2.5 Gbps per lane</li><li>Supporting up to 16 virtual channels</li></ul>                                                                                                                                                                                                                    |
| I <sup>2</sup> C     | <ul style="list-style-type: none"><li>Incorporating I<sup>2</sup>C control channel for remote management over A-PHY</li><li>Option for local host management</li><li>100KHz-1MHz</li></ul>                                                                                                                                                                                              |
| SPI                  | <ul style="list-style-type: none"><li>SPI interface for remote control by a deserializer</li><li>Operating frequency of up to 40Mhz</li></ul>                                                                                                                                                                                                                                           |
| Clock output         | <ul style="list-style-type: none"><li>Local precision clock output</li><li>Generated locally or via a remote centralized clock</li></ul>                                                                                                                                                                                                                                                |
| Synchronized Outputs | <ul style="list-style-type: none"><li>Outputting remotely generated synchronized signals</li></ul>                                                                                                                                                                                                                                                                                      |
| GPOs/GPIOs           | <ul style="list-style-type: none"><li>Up to 3 general purpose output pins</li><li>Up to 4 general purpose I/O pins</li></ul>                                                                                                                                                                                                                                                            |
| Safety               | ISO-26262, ASIL-B                                                                                                                                                                                                                                                                                                                                                                       |
| Power Consumption    | Typical <300mW                                                                                                                                                                                                                                                                                                                                                                          |
| Package              | 6mmx6mm FO-CLP (with functional balls only on the outer rows. Low-cost PCB design)                                                                                                                                                                                                                                                                                                      |
| Temperature          | AEC-Q100 Grade 2                                                                                                                                                                                                                                                                                                                                                                        |
| Power Supply Rails   | 1.8V, 0.8V                                                                                                                                                                                                                                                                                                                                                                              |

# VA7044: Quad Deserializer, 8Gbps Links

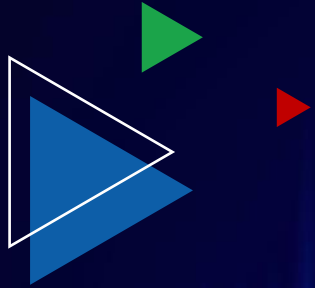


| Feature                            | Description                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link                               | 4 x MIPI A-PHY Version 1.0                                                                                                                                                                                                                                                                                                                                                         |
| Configurable Link Speed (per link) | <ul style="list-style-type: none"><li>• Main channel: 2Gbps, 4Gbps, 8Gbps</li><li>• Return channel: 100Mbps</li></ul>                                                                                                                                                                                                                                                              |
| Infrastructure                     | Operating over the MIPI® A-PHY channel <ul style="list-style-type: none"><li>• Coax cable - Up to 15 meters/50 feet with up to four inline connectors</li><li>• Shielded differential pair (SDP) cable - Up to 10 meters/33 feet with up to four inline connectors</li><li>• Special mode for working over Unshielded Twisted Pair (UTP) channel at up to 4Gbps per link</li></ul> |
| MIPI CSI-2 Output ports            | 2 x CSI-2 Output ports <ul style="list-style-type: none"><li>• Configurable D PHY or C PHY I/F per each port</li><li>• 4 data lanes (D-PHY) with up to 2.5 Gbps on each lane</li><li>• 3 data lanes (C-PHY) with up to 5.7 Gbps on each lane</li><li>• Flexible virtual channel routing scheme, including duplication</li></ul>                                                    |
| MIPI CSI-2 Input Port              | 1 x CSI-2 Input port <ul style="list-style-type: none"><li>• 4 data lanes (D-PHY) with up to 2.5 Gbps on each lane</li><li>• Supporting up to 16 virtual channels</li></ul>                                                                                                                                                                                                        |
| I²C                                | <ul style="list-style-type: none"><li>• 2 Independent I²C control channels for device management and remote device management</li><li>• 100KHz-1MHz</li></ul>                                                                                                                                                                                                                      |
| SPI                                | <ul style="list-style-type: none"><li>• SPI interface for remote control by a deserializer</li><li>• Operating frequency of up to 40Mhz</li></ul>                                                                                                                                                                                                                                  |
| Clock output                       | <ul style="list-style-type: none"><li>• Tunneling of clock signal to remote devices with precision reconstruction of clock signal at the remote ends</li></ul>                                                                                                                                                                                                                     |
| Synchronized Outputs               | <ul style="list-style-type: none"><li>• Outputting remotely generated synchronized signals</li></ul>                                                                                                                                                                                                                                                                               |
| GPOs/GPIOs                         | <ul style="list-style-type: none"><li>• Up to 13 general purpose output only pins</li><li>• Up to 12 general purpose I/O pins</li><li>• Support for multiple remote synchronous distribution</li></ul>                                                                                                                                                                             |
| Safety                             | ISO-26262, ASIL-B                                                                                                                                                                                                                                                                                                                                                                  |
| Power Consumption                  | <2.1W, Typical                                                                                                                                                                                                                                                                                                                                                                     |
| Package                            | 15mm x 15mm FCCSP                                                                                                                                                                                                                                                                                                                                                                  |
| Temperature                        | AEC-Q100 Grade 2                                                                                                                                                                                                                                                                                                                                                                   |
| Power Supply Rails                 | 1.8V, 0.8V                                                                                                                                                                                                                                                                                                                                                                         |

# VA7042: Quad Deserializer, 8Gbps Links



| Feature                            | Description                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link                               | 2 x MIPI A-PHY Version 1.0                                                                                                                                                                                                                                                                                                                                                         |
| Configurable Link Speed (per link) | <ul style="list-style-type: none"><li>• Main channel: 2Gbps, 4Gbps, 8Gbps</li><li>• Return channel: 100Mbps</li></ul>                                                                                                                                                                                                                                                              |
| Infrastructure                     | Operating over the MIPI® A-PHY channel <ul style="list-style-type: none"><li>• Coax cable - Up to 15 meters/50 feet with up to four inline connectors</li><li>• Shielded differential pair (SDP) cable - Up to 10 meters/33 feet with up to four inline connectors</li><li>• Special mode for working over Unshielded Twisted Pair (UTP) channel at up to 4Gbps per link</li></ul> |
| MIPI CSI-2 Output ports            | 2 x CSI-2 Output ports <ul style="list-style-type: none"><li>• Configurable D PHY or C PHY I/F per each port</li><li>• 4 data lanes (D-PHY) with up to 2.5 Gbps on each lane</li><li>• 3 data lanes (C-PHY) with up to 5.7 Gbps on each lane</li><li>• Flexible virtual channel routing scheme, including duplication</li></ul>                                                    |
| MIPI CSI-2 Input Port              | 1 x CSI-2 Input port <ul style="list-style-type: none"><li>• 4 data lanes (D-PHY) with up to 2.5 Gbps on each lane</li><li>• Supporting up to 16 virtual channels</li></ul>                                                                                                                                                                                                        |
| I²C                                | <ul style="list-style-type: none"><li>• 2 Independent I²C control channels for device management and remote device management</li><li>• 100KHz-1MHz</li></ul>                                                                                                                                                                                                                      |
| SPI                                | <ul style="list-style-type: none"><li>• SPI interface for remote control by a deserializer</li><li>• Operating frequency of up to 40Mhz</li></ul>                                                                                                                                                                                                                                  |
| Clock output                       | <ul style="list-style-type: none"><li>• Tunneling of clock signal to remote devices with precision reconstruction of clock signal at the remote ends</li></ul>                                                                                                                                                                                                                     |
| Synchronized Outputs               | <ul style="list-style-type: none"><li>• Outputting remotely generated synchronized signals</li></ul>                                                                                                                                                                                                                                                                               |
| GPOs/GPIOs                         | <ul style="list-style-type: none"><li>• Up to 13 general purpose output only pins</li><li>• Up to 12 general purpose I/O pins</li><li>• Support for multiple remote synchronous distribution</li></ul>                                                                                                                                                                             |
| Safety                             | ISO-26262, ASIL-B                                                                                                                                                                                                                                                                                                                                                                  |
| Power Consumption                  | <1.6W, Typical                                                                                                                                                                                                                                                                                                                                                                     |
| Package                            | 15mm x 15mm FCCSP                                                                                                                                                                                                                                                                                                                                                                  |
| Temperature                        | AEC-Q100 Grade 2                                                                                                                                                                                                                                                                                                                                                                   |
| Power Supply Rails                 | 1.8V, 0.8V                                                                                                                                                                                                                                                                                                                                                                         |



# VA7000 EMC

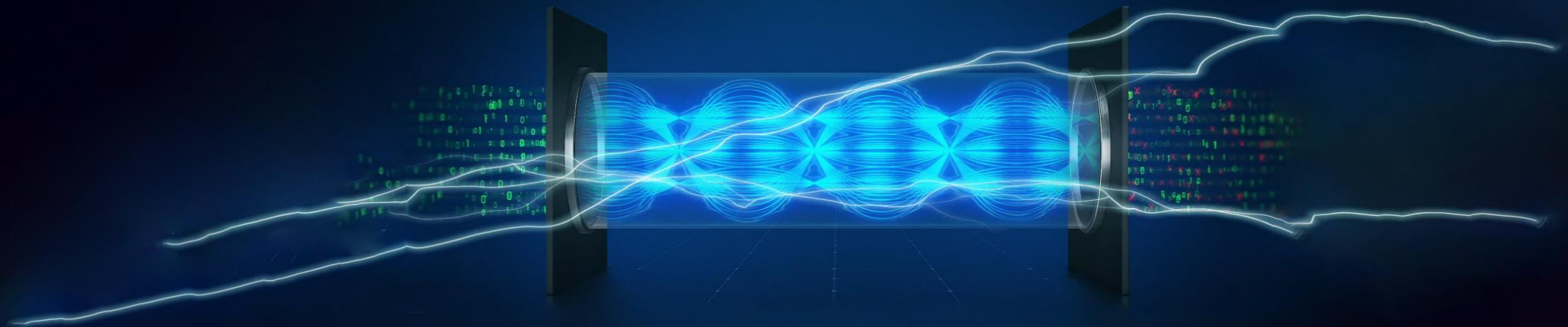


# The Valens Difference: Best-in-class EMC Performance



**While analog legacy solutions try to AVOID noise by:**

Reducing bandwidth | Adding expensive shielding | Shortening cable length | Restricting architecture



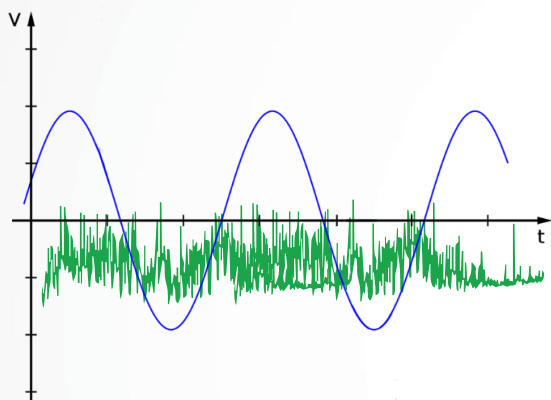
**Valens' DSP-based PHY technology WELCOMES noise**

**Providing the only multi-gig solution with error-free links**

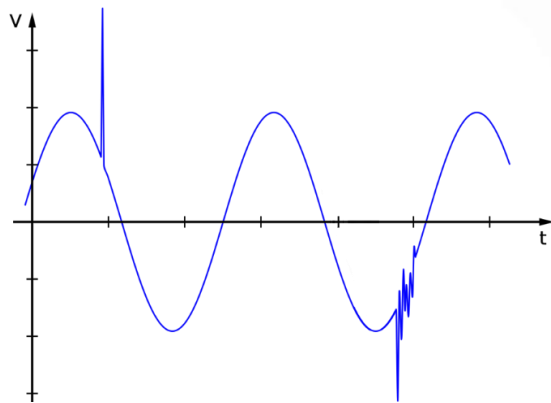
# A Digital Approach to Automotive EMI



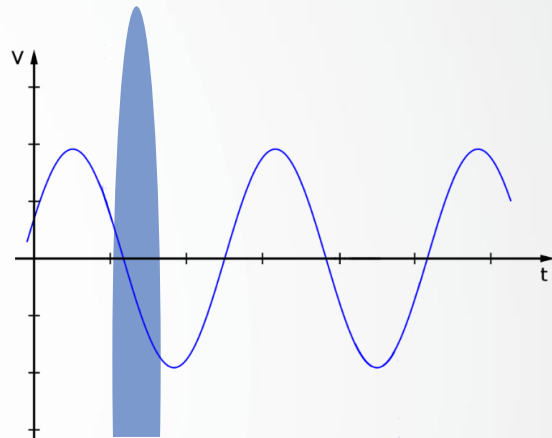
White Gaussian Noise



Transient On Line



Narrowband Interference



Analog  
solutions

Limited



Relies mainly on  
shielding and limiting  
architecture



Relies mainly on  
shielding and limiting  
architecture



Valens' Digital  
Solution

Dynamic PHY-level  
retransmission



Dynamic PHY-level  
retransmission



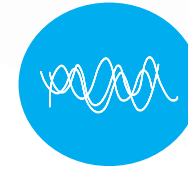
Just-in-time noise  
cancelling & dynamic  
PHY-level retransmission



# Industry-Best EMI Resilience

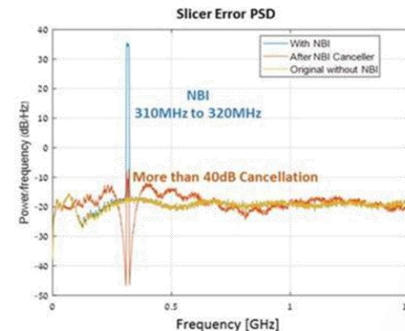


- › Valens technology is the most resilient for ultra-high-speed links with the best noise immunity
  - Packet Error Rate (PER) of  $10^{-19}$
- › DSP-managed physical layer
  - Optimal utilization of wire channel through PAM signaling
  - Narrowband Interference Cancellation (NBIC) with PHY-Level Retransmission Scheme (RTS)



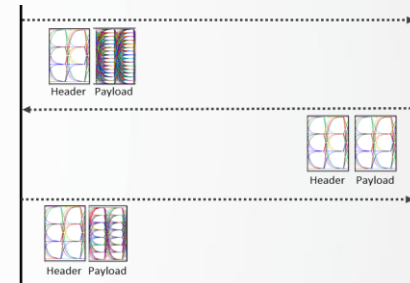
## Valens' Error Cancellation & Correction Mechanisms

### Just-in-Time Noise Cancellation



Fast adaptive noise cancellation to remove the effects of automotive EMI noises

### Dynamic Modulation Local Retransmission



Ultra-fast PHY-level retransmission mechanism for correction of packet errors

# The Valens Difference: Operating over UTP cabling

- › Unshielded channel for high bandwidth links (up to 4Gbps)
- › Lower cost cables and connectors
- › Removes potential ground loops in the cable, simplifying design
- › Maintains harness longevity vs. shielded cables that attenuate with mechanical stress (the shielding paradox)



## Shielded: Covering all link speeds

### Unshielded: Up to 4Gbps



**Unshielded**  
(UTP)



**Multi-Pin  
Connectors**



**Single Pair**



**Shielded** (SDP)



**Shielded** (Coax)

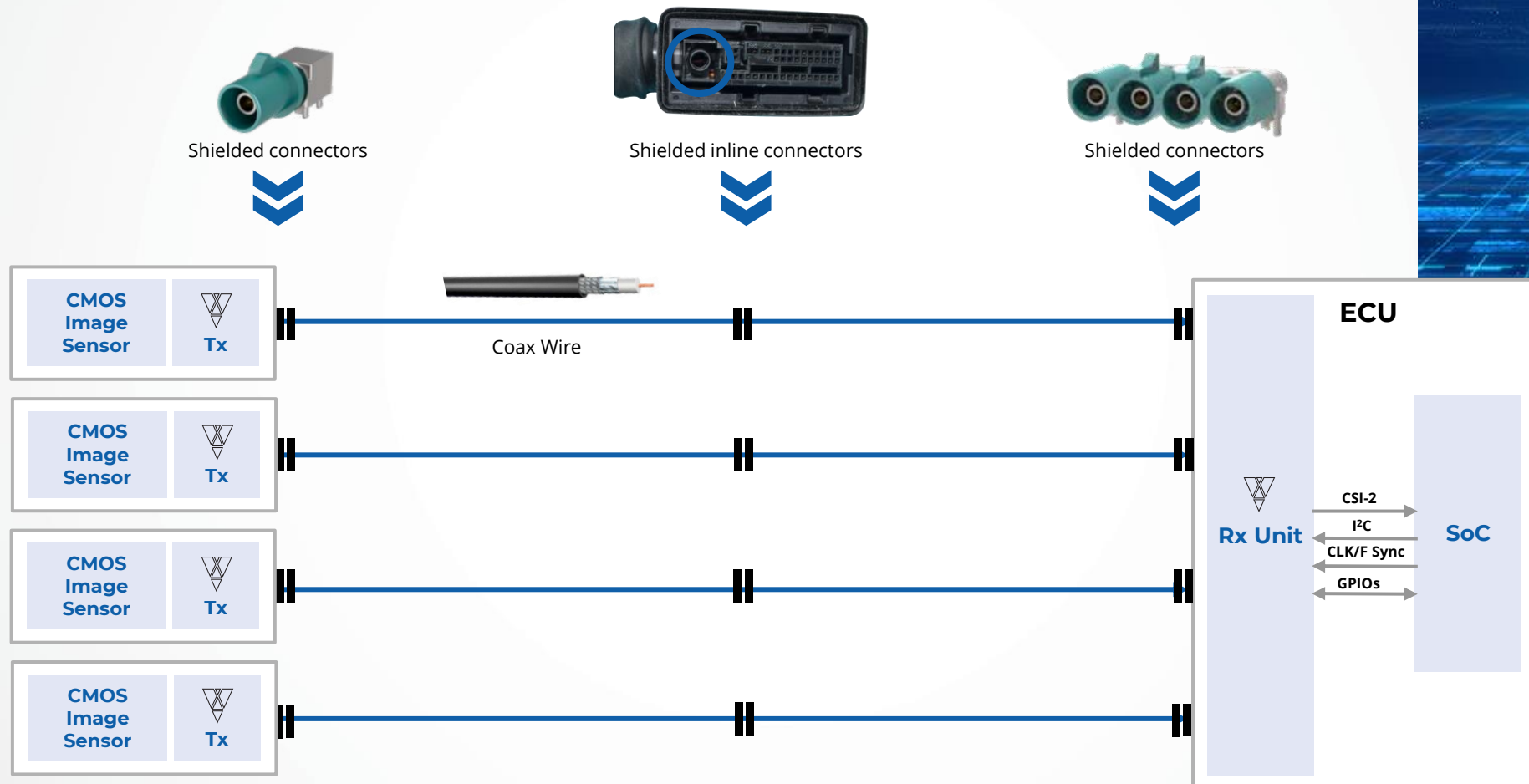


**Multi-Pin  
Connectors**

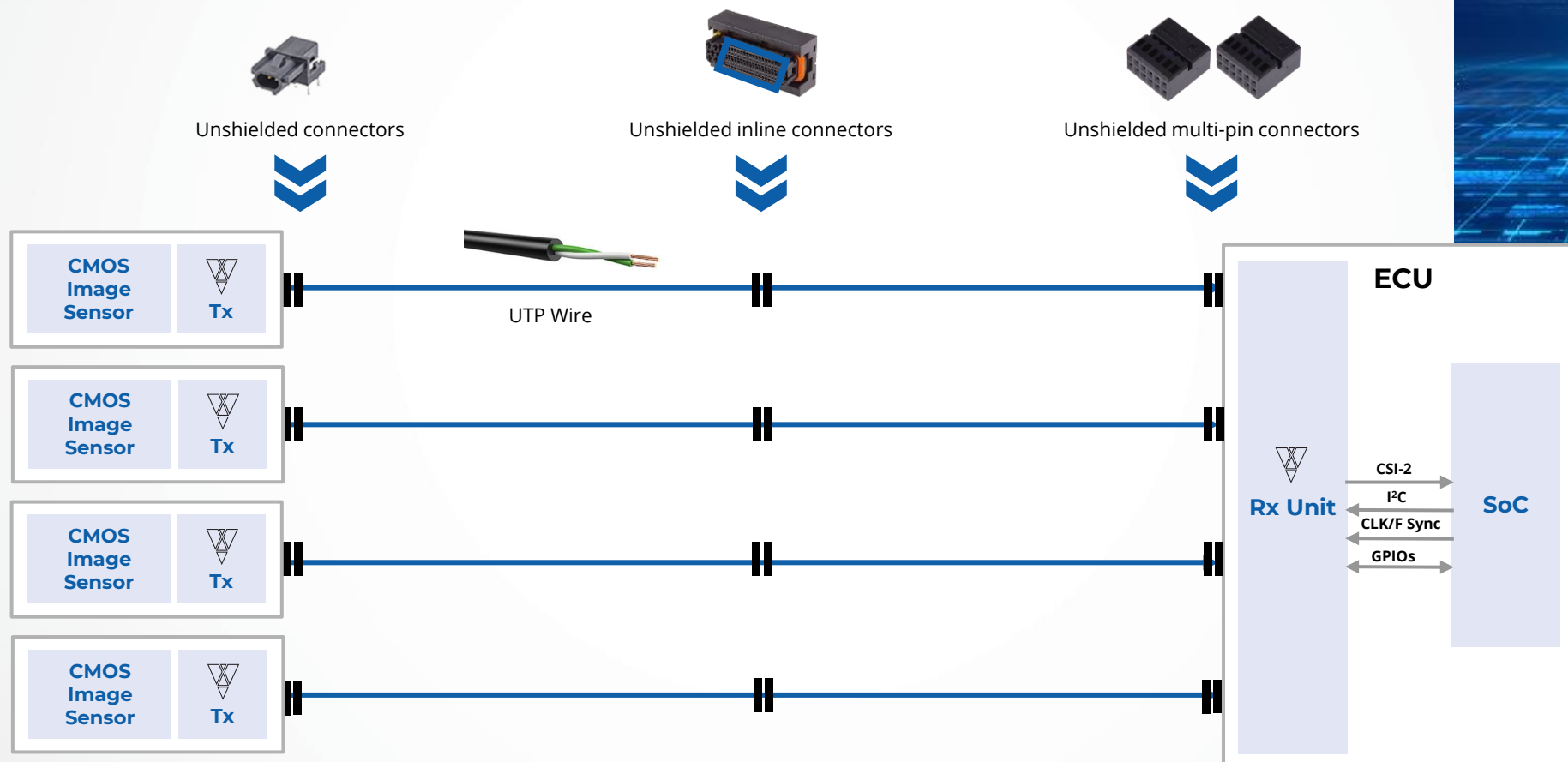


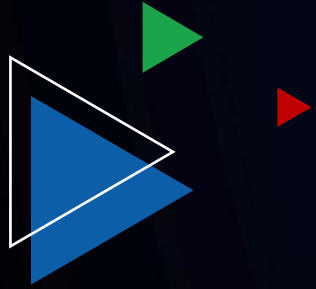
**Single Pair**

# Typical Surround View System: Existing Cables/Connectors



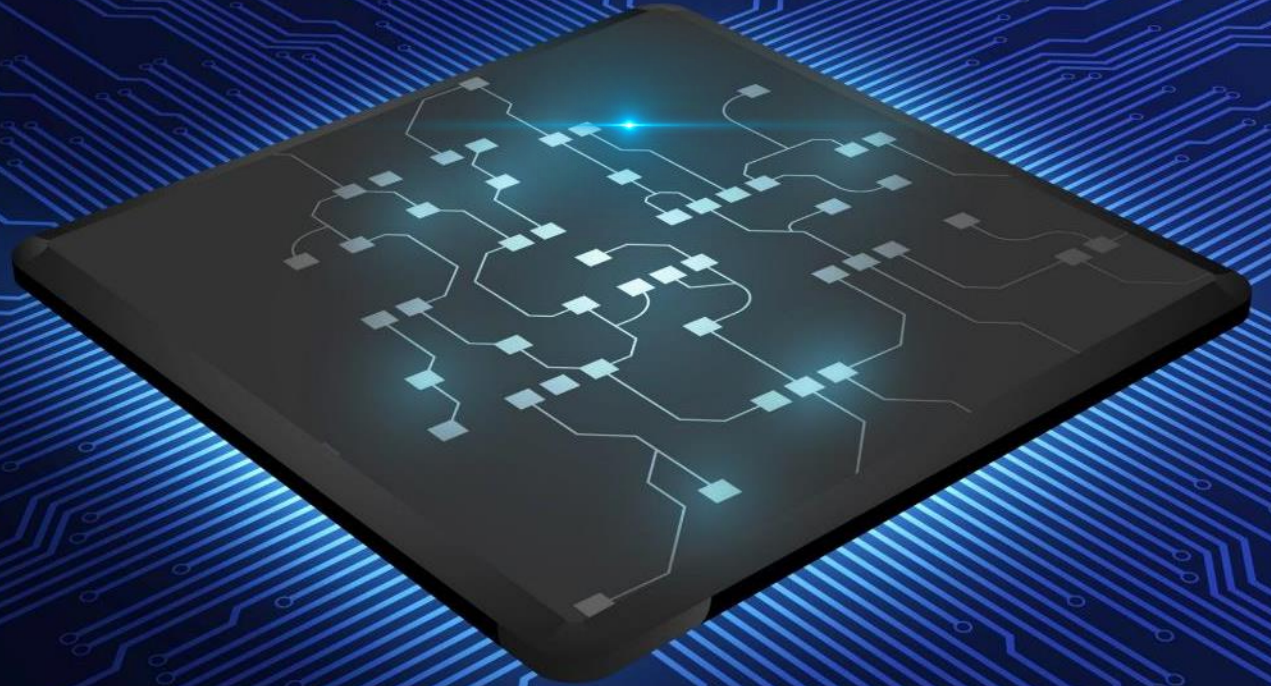
# Surround View System with the Valens VA7000 (Gears 1, 2)





# **VA7000**

## **Total System Cost**



# A-PHY: Lower Total System Cost



## Shorter design cycles

### Shorter EMC Tests Cycles

Low emission Power Spectrum Density  
PHY designed for any in-car EMC attack profile.

### Simple Architecture

ECU placement flexibility due to long-reach capabilities (15m/50ft).

### System Design

Extremely low PER (less than  $1e-19$ ) improves handling of ADAS algorithms.

### Plug & Play

Automatic tuning of the SerDes to the given cable.



## Low-cost harness

### Reduced frequency range

PAM8 coding scheme enables lower frequencies (4 times lower than competition)

### Unshielded (UTP)



- › Up to 4Gbps
- › Lower cost cables and connectors
- › Removes potential ground loops in the cable, simplifying design
- › Maintains harness longevity vs. shielded cables that attenuate with mechanical stress

### Shielded (STP, Coax)

- › Cables need to support only 2GHz spectrum for up to 16Gbps



## Standard

### Integrated A-PHY

Camera modules can include A-PHY in the image sensor, removing costly I/F bridges.

### Ecosystem of Suppliers

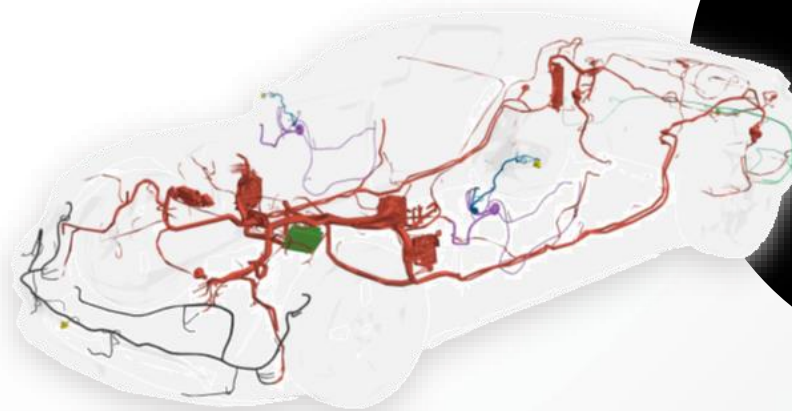
Leading to economies of scale

# Surround View System : Cost Savings Confirmed by 3<sup>rd</sup> Party Benchmarking Firm

- › 3rd-party system cost analysis done for a surround view application (4 cameras).
- › Showed significant savings when moving from existing solution, which require shielded cables/connectors, to Valens' unshielded solution.

Full report by A2MAC1:

<https://portal.a2mac1.com/form-costing-surroundviewsystem/>



15%  
TOTAL SYSTEM  
COST

# System Cost Comparison - 1.3MP Camera

~\$17 cost reduction  
when moving from  
proprietary bridge  
extension solutions +  
shielded harness to  
A-PHY bridge +  
unshielded harness

| Surround view system |                    |                    | Conventional GMSL based   | MIPI A-PHY based          |
|----------------------|--------------------|--------------------|---------------------------|---------------------------|
|                      |                    |                    | 2021<br>28k<br>USD / unit | 2021<br>28k<br>USD / unit |
| Material             | 1001               | Mechanical Parts   | 33,70                     | 32,71                     |
|                      | 1002               | Optics module Assy | 19,31                     | 19,31                     |
|                      | 1003               | Electronics        | 44,52                     | 45,78                     |
|                      | 1004               | Wireharness        | 23,49                     | 9,77                      |
|                      | Total BOM          |                    | 121,03 \$                 | 107,57 \$                 |
|                      | MGK                | 3,50%              | 4,24                      | 3,76                      |
|                      | Scrap              | 0,50%              | 0,61                      | 0,54                      |
|                      | Total Material     |                    | 125,87 \$                 | 111,87 \$                 |
| Assembly             | 1001               | PCB 1              | 1,40                      | 1,40                      |
|                      | 1002               | Final Assy         | 3,05                      | 2,98                      |
|                      | Total Production   |                    | 4,46 \$                   | 4,38 \$                   |
| Totals               | Manufacturing Cost |                    | 130,33 \$                 | 116,25 \$                 |
|                      | Overhead           | 12%                | 15,64                     | 13,95                     |
|                      | Profit             | 6%                 | 7,82                      | 6,98                      |
|                      | Total Cost         |                    | 153,78 \$                 | 137,18 \$                 |

# System Cost Comparison - 4MP Camera

~\$27 cost reduction when moving from proprietary bridge extension solutions + shielded harness to A-PHY bridge + unshielded harness

| Surround view system |                    |                    | Conventional TI based | MIPI A-PHY based |
|----------------------|--------------------|--------------------|-----------------------|------------------|
|                      |                    |                    | 2021<br>28k           | 2021<br>28k      |
|                      |                    |                    | USD / unit            | USD / unit       |
| Material             | 1001               | Mechanical Parts   | 33,70                 | 32,71            |
|                      | 1002               | Optics module Assy | 19,31                 | 19,31            |
|                      | 1003               | Electronics        | 61,37                 | 54,02            |
|                      | 1004               | Wireharness        | 23,49                 | 9,77             |
|                      | Total BOM          |                    | 137,87 \$             | 115,81 \$        |
|                      |                    |                    |                       |                  |
| Material             | MGK                | 3,50%              | 4,83                  | 4,05             |
|                      | Scrap              | 0,50%              | 0,69                  | 0,58             |
|                      | Total Material     |                    | 143,39 \$             | 120,45 \$        |
| Assembly             | 1001               | PCB 1              | 1,40                  | 1,40             |
|                      | 1002               | Final Assy         | 3,05                  | 2,98             |
|                      | Total Production   |                    | 4,46 \$               | 4,38 \$          |
| Totals               |                    |                    |                       |                  |
|                      | Manufacturing Cost |                    | 147,85 \$             | 124,83 \$        |
|                      |                    |                    |                       |                  |
|                      | Overhead           | 12%                | 17,74                 | 14,98            |
| Totals               | Profit             | 6%                 | 8,61                  | 7,49             |
|                      | Total Cost         |                    | 174,46 \$             | 147,30 \$        |

# Cost Savings Driven By:

- › **Simplified wire harness** – Using unshielded cables and in-line connectors.
- › **Camera design** – Cost saving on the internal PCB and camera design while simplifying the sealing of connectors by using flexible unshielded cabling.
- › **ECU design** – Switching from separate Fakra connectors to shared MQS pin connectors.

Further cost reduction opportunities for OEMs resulting from native **integration of A-PHY** into image sensors.



**An industry switchover to A-PHY-based extension solutions could save real money – for OEMs and ultimately for consumers as well.**

Abhishek Gandhi,  
Cost Engineer at A2MAC1

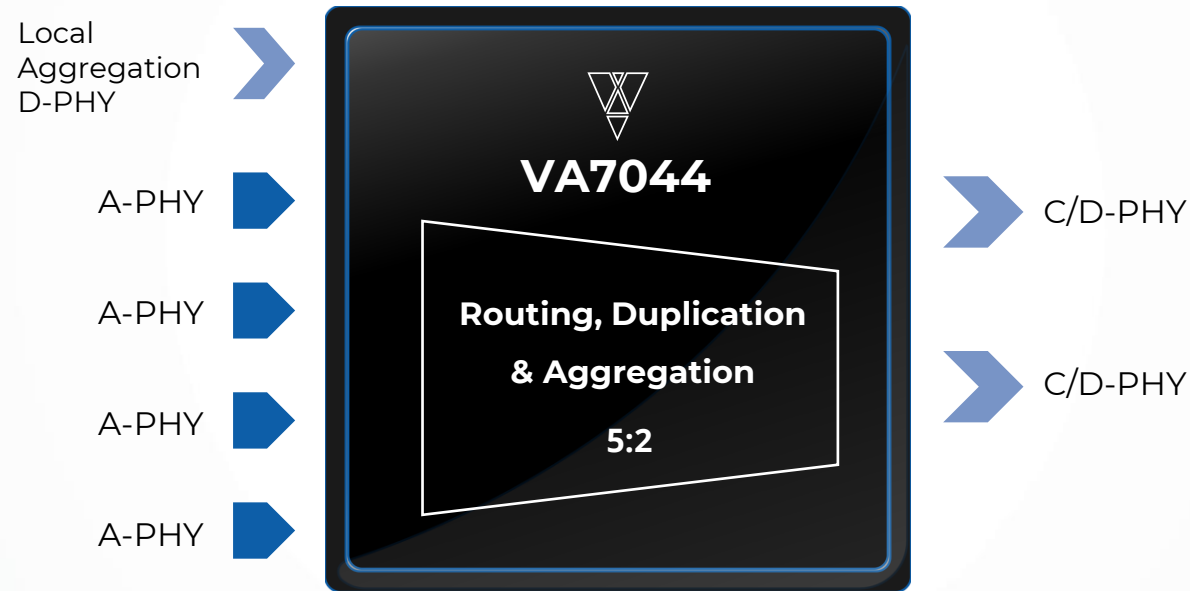
# VA7000 Use Cases (Camera, Radar & LiDAR)



# Building Blocks for Any In-Vehicle Architecture

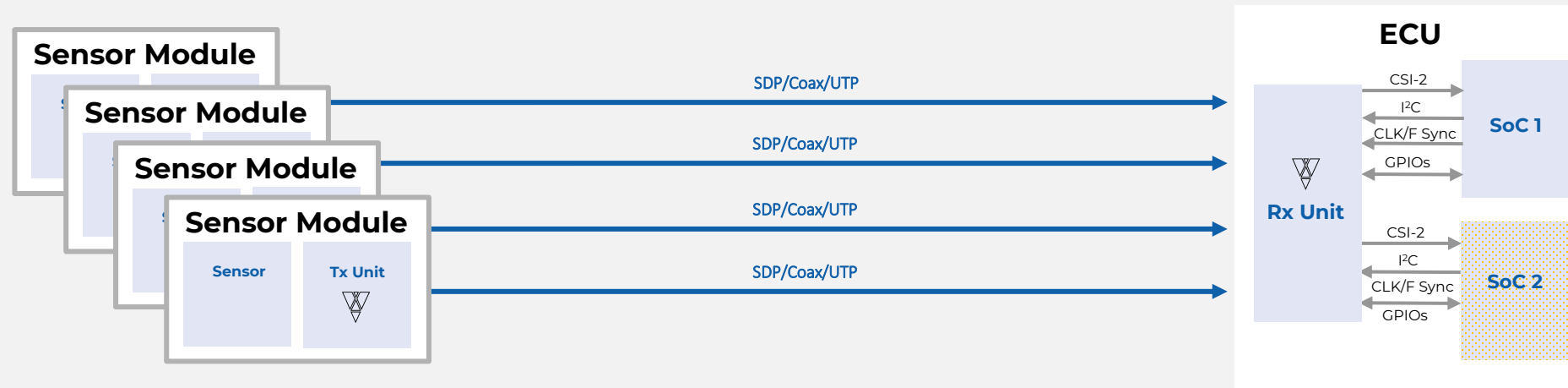


**Full crossbar between any input and any output**

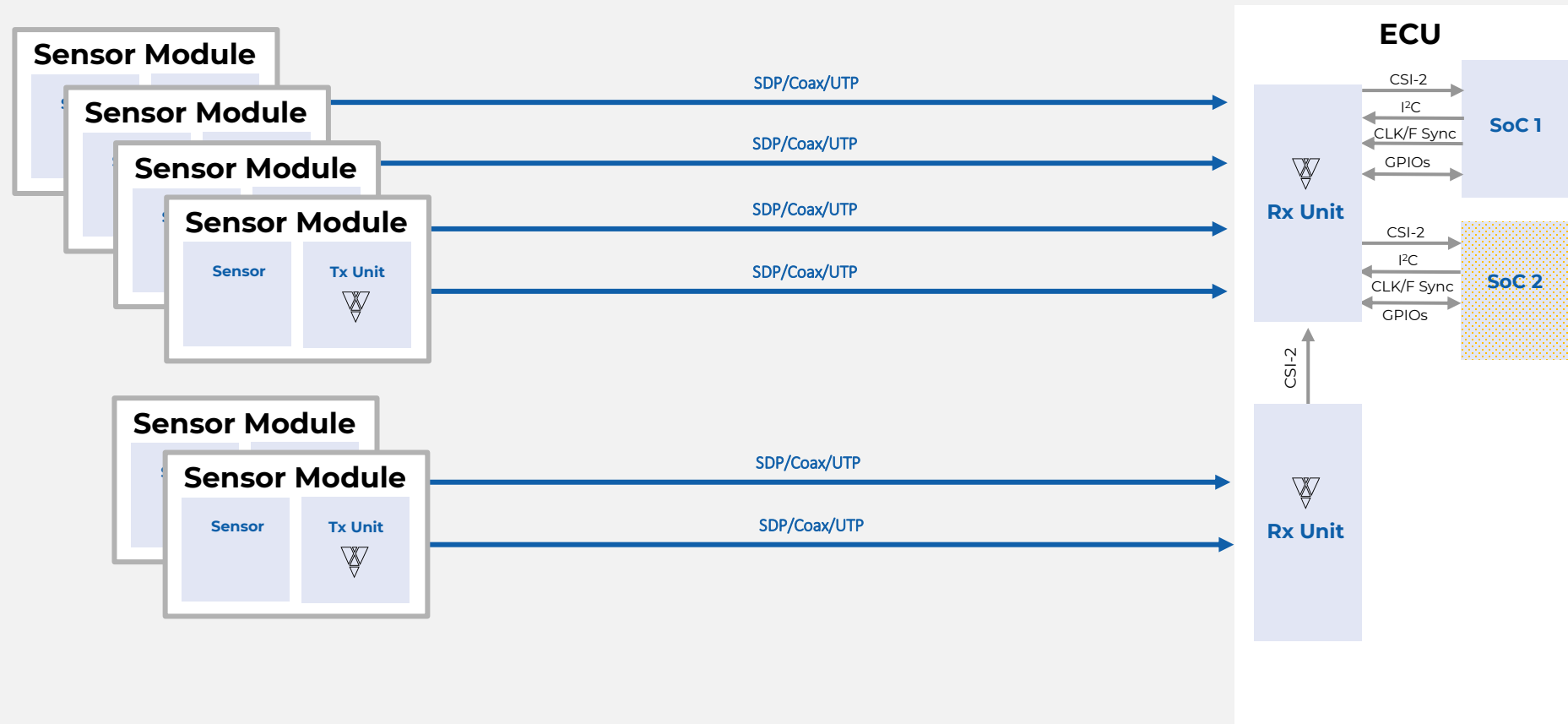


**This results in flexible architecture:**  
**Daisy-chaining | Cascading | Aggregation**

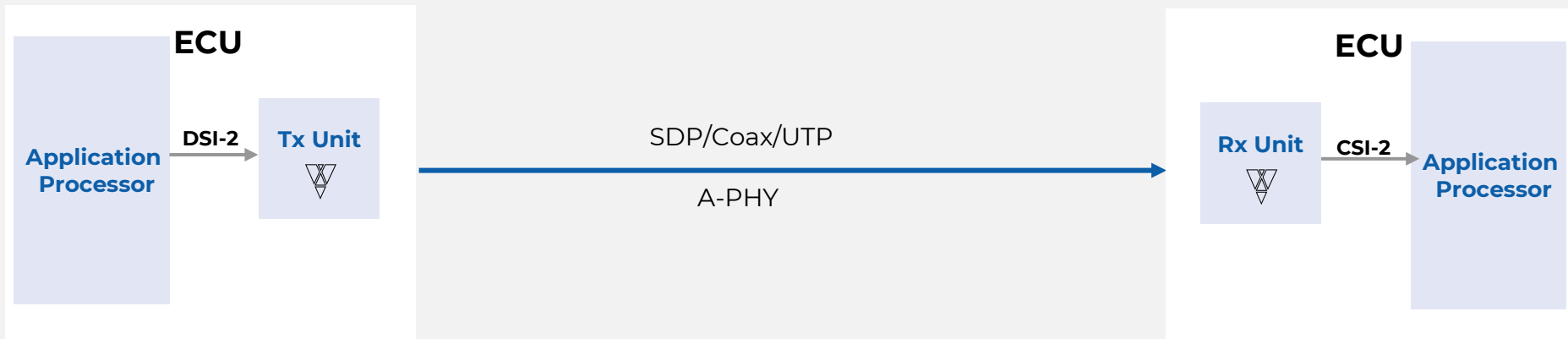
# Sensors to Single or Dual SoC



# Multiple Sensor Aggregation and Cascading



# ECU-to-ECU, DSI-over-CSI Video Distribution

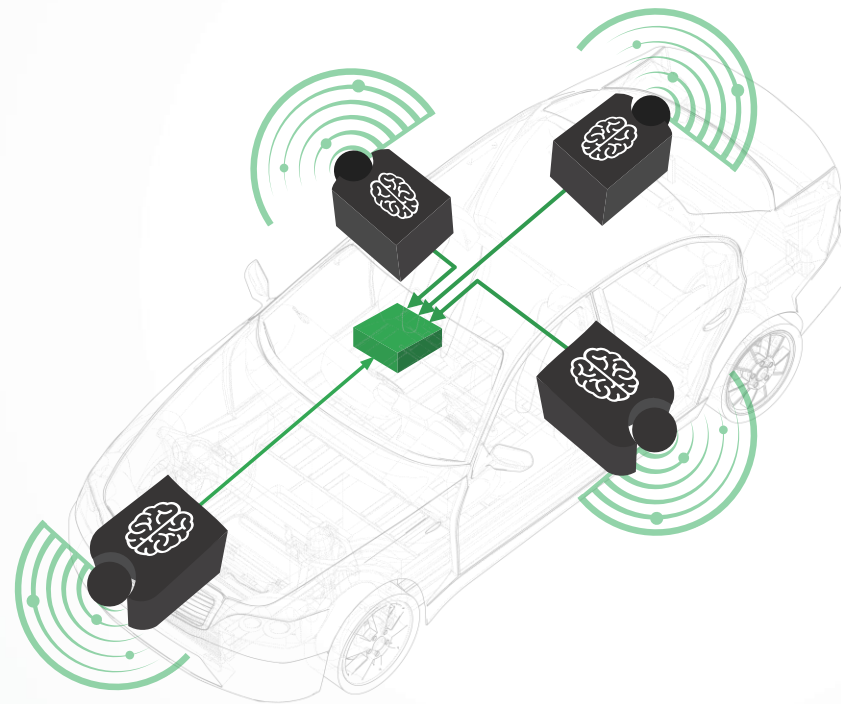


# Satellite Radar Concept

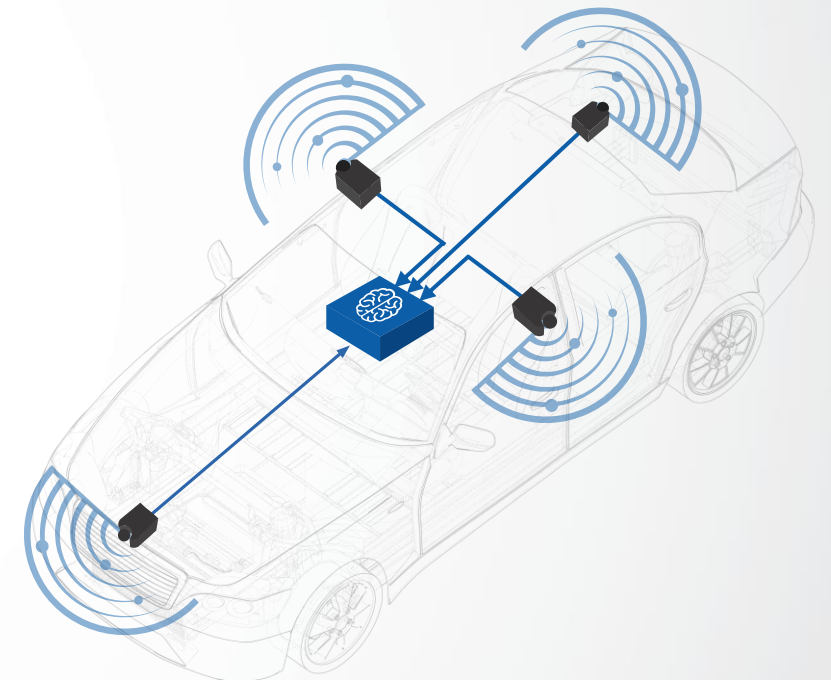
- › SW/HW separation
- › Centralized processing
  - › Facilitating sensor fusion
  - › Lowering the complexity and cost of radars
- › Centralized power management and PoDL
- › Future-proof



TODAY



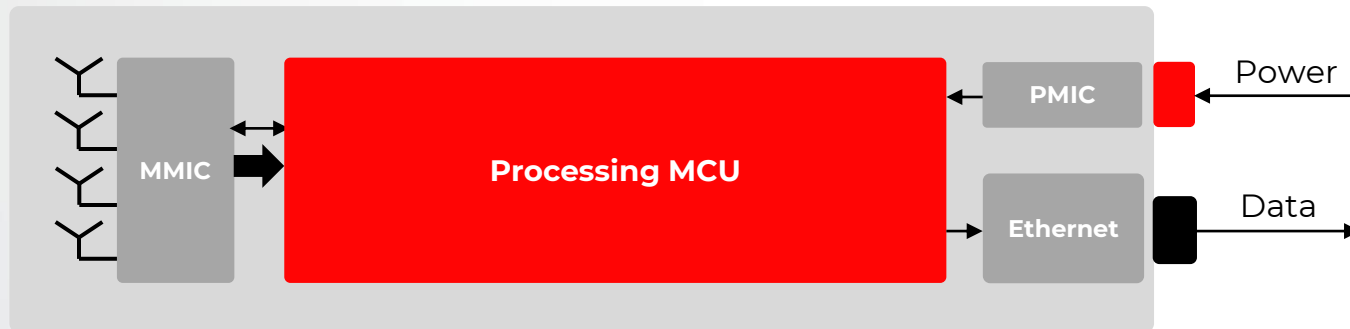
FUTURE



# Simplifying the Radar

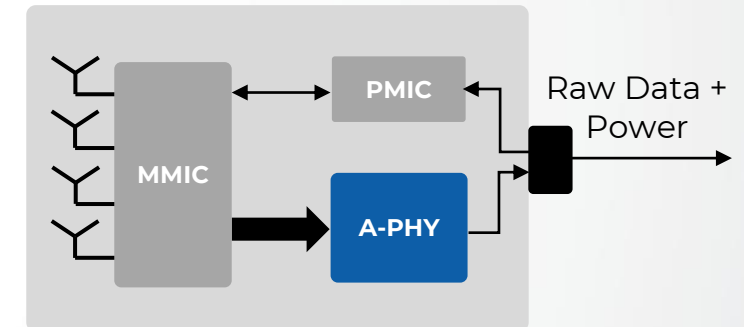
Today

**Legacy Radar**  
Edge processing

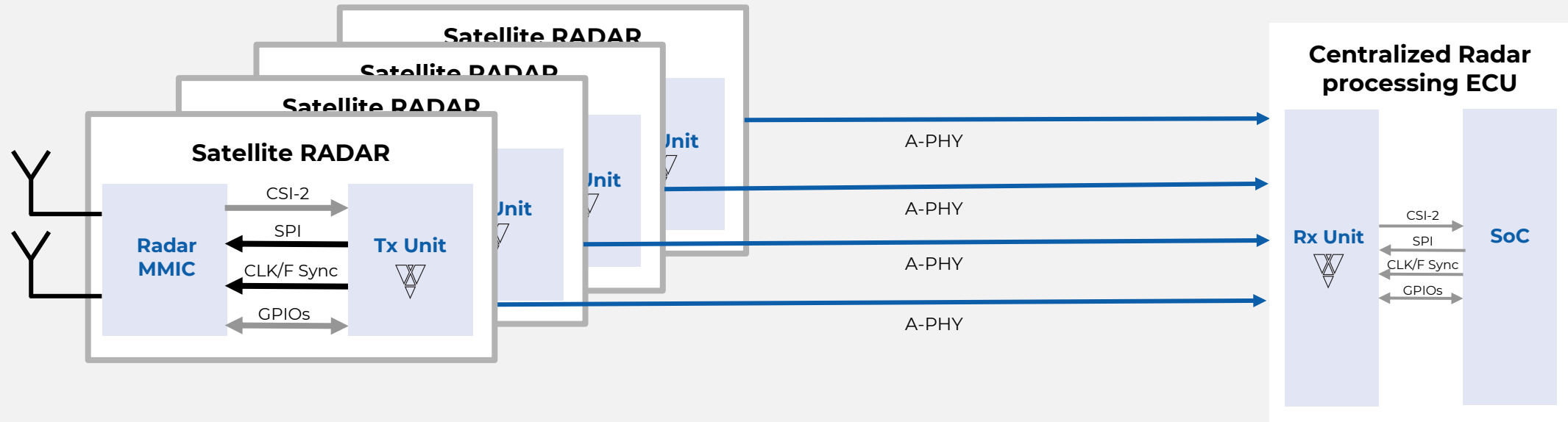


Future

**Satellite Radar**  
Centralized processing & power



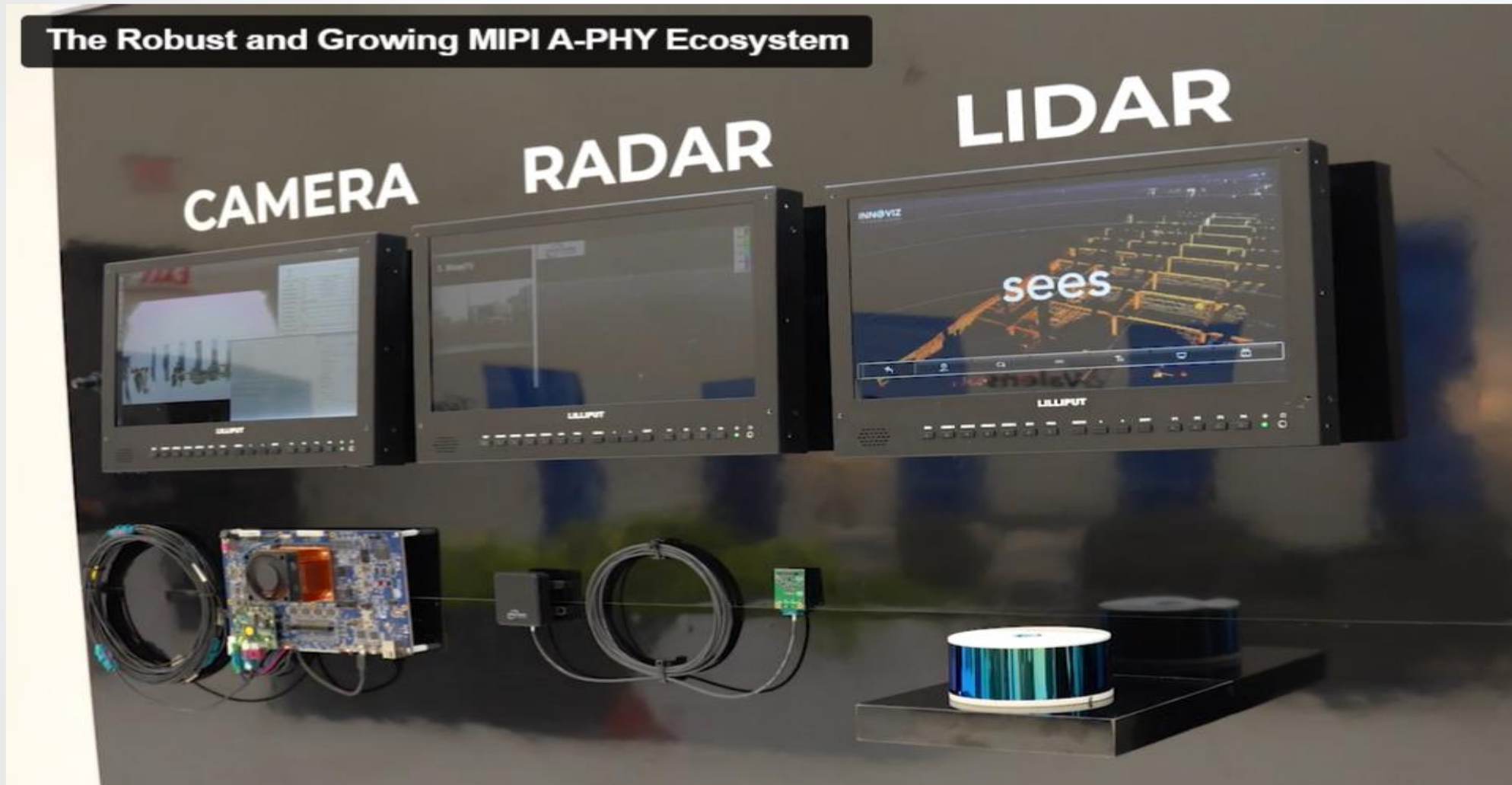
# Optimizing Radar with A-PHY



## › Example features for optimal satellite radar support:

- › High BW RAW data tunneling
- › Flexible SPI control for fast chirp control
- › ASIL-B
- › Reference clocks on all satellite radars are kept completely coherent and synchronous
- › Frame synchronization pulses can be triggered simultaneously with extremely high accuracy (low jitter)

# CES 2023 in Valens booth



# CES 2023 : 3 Awards



## NEWS FROM CES

PRESS RELEASE

### Valens to Showcase Latest Innovations for In-Vehicle Connectivity at CES 2023



Embedded Technologies



Vehicle Tech & Advanced Mobility



In-Vehicle Entertainment & Safety



PR: Valens Semiconductor to Present its Latest Connectivity Solutions for Vehicle Safety at CES 2023



### CES 2023 Innovation Awards



Embedded Technologies



Vehicle Tech & Advanced Mobility



In-Vehicle Entertainment & Safety



PR: Valens Semiconductor Named Honoree in Three CES 2023 Innovation Award Categories

*“The Valens Semiconductor chipset with A-PHY compliance will help accelerate the transition to software-defined vehicles, supported by intelligently connected architectures such as Aptiv’s Smart Vehicle Architecture™. These architectures, and the software they support, are the foundation for delivering on our mission of enabling a safer, greener, more connected future of mobility. Aptiv is excited to collaborate with Valens Semiconductor on its innovative connectivity technologies.”*



# Collaboration with INNOVIZ



Innoviz Testimonial: 360° Lidar with A-PHY

mipi alliance  
**INNOVIZ**  
TECHNOLOGIES

INNOVIZ360

The New Standard  
For 360° Lidar  
Performance Samples  
Available Q1, 2023

0.3m-300m  
Detection Range

360°x64°  
Maximum Field  
View (HxV)

1280  
Points per Frame

5mm  
Resolution (HxV)

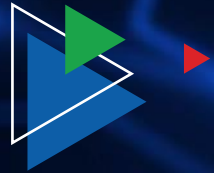
**Oren Buskila**

Chief R&D Officer & co-founder at Innoviz Technologies

**Daniel Schwartzberg**

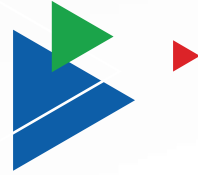
Director of Automotive System Solutions, Valens Semiconductor

**VA7000**



# **Features & Capabilities**

# Functional Safety

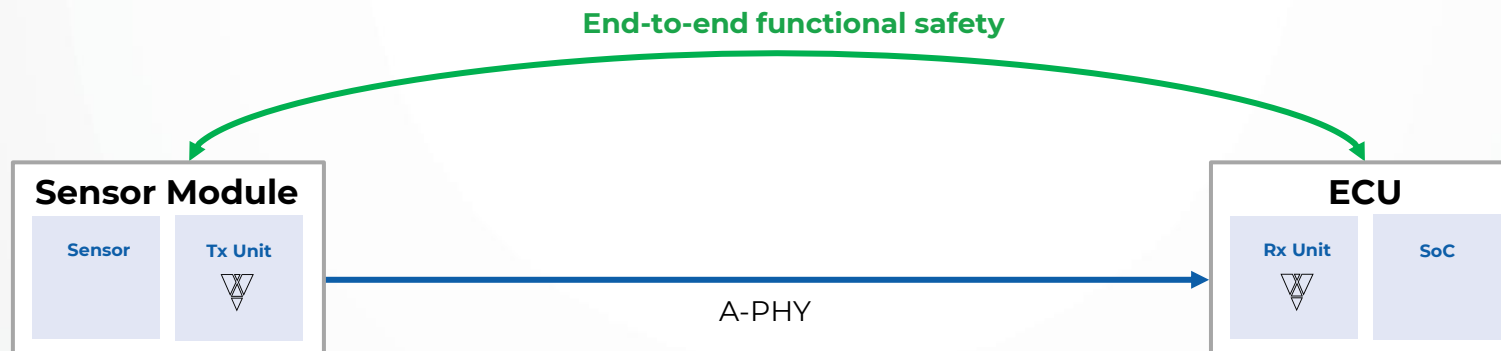


## › Safety level:

- ASIL-B support
- ASIL-D can be achieved through the composition of two redundant ASIL-B devices

## › Mechanisms:

- VA70XX adds CRC and Message Counter Protection for FuSa, as defined by the MIPI standard
- End-to-end functional safety between SoC and FuSa-capable display

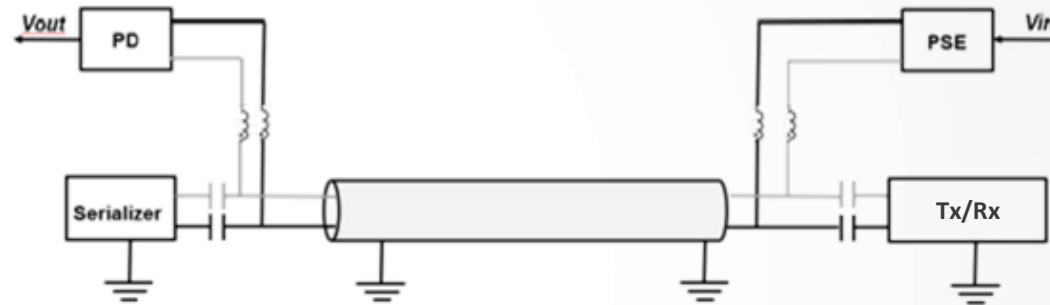


# Power Over Cable

Power over cable is defined by the MIPI A-PHY spec and supported by all Valens devices

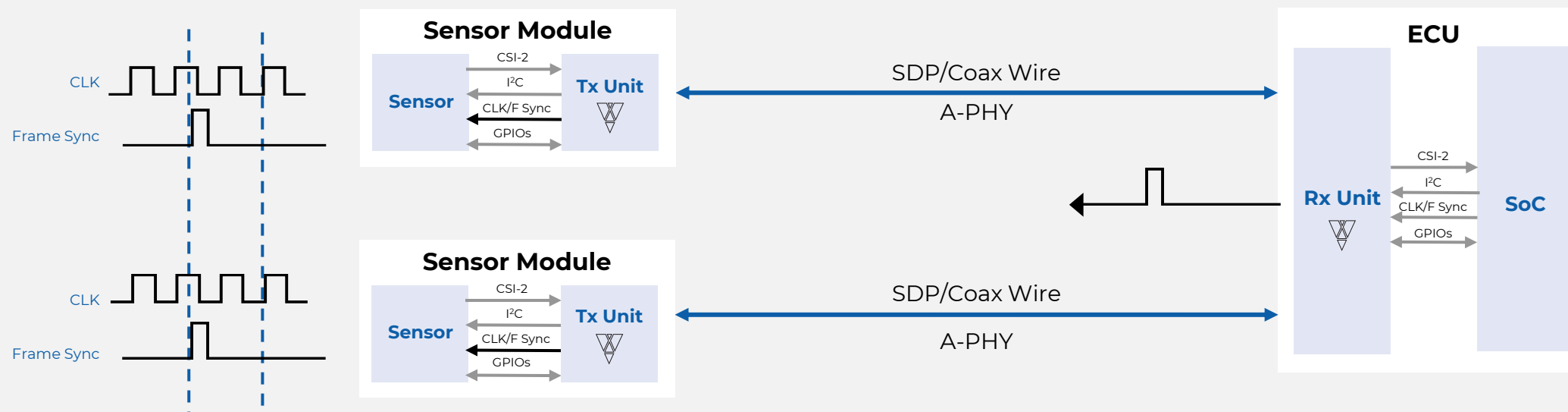


## PoC works on all cable types – UTP, STP, Coax



| Parameter    | Description             | Min  | Typ | Max | Units    |
|--------------|-------------------------|------|-----|-----|----------|
| $P_{PD}$     | PD drawn power          | –    | –   | 6   | W        |
| $V_{PSEOUT}$ | PSE output voltage      | 8    | 12  | 13  | V        |
| $I_{TLIS}$   | TLIS current capability | 0.75 | –   | –   | A        |
| $R_{LOOP}$   | DC loop resistance      | –    | –   | 4   | $\Omega$ |

# Sensor Synchronization



- › Reference clocks on all edges are kept completely coherent and synchronous
- › Frame synchronization pulses on all edges can be triggered simultaneously with extremely high accuracy (low jitter)
- › Example use cases: Surround view, stereo cameras, multi-radar systems, sensor fusion, and more

# Example Support For Image Sensors



| Resolution | FPS | Pixel Width (bpp) | Blanking Overhead Factor | Bit Rate Incl. Overhead (Gbps) | Gear 1: 2Gbps<br>(up to 1.5Gbps net) | Gear 2: 4Gbps<br>(up to 3.6Gbps net) | Gear 3: 8Gbps<br>(up to 7.2Gbps net) |
|------------|-----|-------------------|--------------------------|--------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
|            |     |                   |                          |                                | UTP, STP, Coax                       |                                      | STP, Coax                            |
| 1MP        | 30  | 12                | 1.1                      | 0.40                           | Supported                            | Supported                            | Supported                            |
|            | 30  | 16                | 1.1                      | 0.53                           | Supported                            | Supported                            | Supported                            |
|            | 60  | 12                | 1.1                      | 0.79                           | Supported                            | Supported                            | Supported                            |
|            | 60  | 16                | 1.1                      | 1.06                           | Supported                            | Supported                            | Supported                            |
| 2MP        | 30  | 12                | 1.1                      | 0.79                           | Supported                            | Supported                            | Supported                            |
|            | 30  | 16                | 1.1                      | 1.06                           | Supported                            | Supported                            | Supported                            |
|            | 60  | 12                | 1.1                      | 1.58                           |                                      | Supported                            | Supported                            |
|            | 60  | 16                | 1.1                      | 2.11                           |                                      | Supported                            | Supported                            |
| 3MP        | 30  | 12                | 1.1                      | 1.19                           | Supported                            | Supported                            | Supported                            |
|            | 30  | 16                | 1.1                      | 1.58                           |                                      | Supported                            | Supported                            |
|            | 60  | 12                | 1.1                      | 2.38                           |                                      | Supported                            | Supported                            |
|            | 60  | 16                | 1.1                      | 3.17                           |                                      | Supported                            | Supported                            |
| 5MP        | 30  | 12                | 1.1                      | 1.98                           |                                      | Supported                            | Supported                            |
|            | 30  | 16                | 1.1                      | 2.64                           |                                      | Supported                            | Supported                            |
|            | 60  | 12                | 1.1                      | 3.96                           |                                      |                                      | Supported                            |
|            | 60  | 16                | 1.1                      | 5.28                           |                                      |                                      | Supported                            |
| 8MP        | 30  | 12                | 1.1                      | 3.17                           |                                      | Supported                            | Supported                            |
|            | 30  | 16                | 1.1                      | 4.22                           |                                      |                                      | Supported                            |
|            | 60  | 12                | 1.1                      | 6.34                           |                                      |                                      | Supported                            |
|            | 50  | 16                | 1.1                      | 7.04                           |                                      |                                      | Supported                            |
| 15MP       | 30  | 12                | 1.1                      | 5.94                           |                                      |                                      | Supported                            |

Can use unshielded cables & small form factor connectors



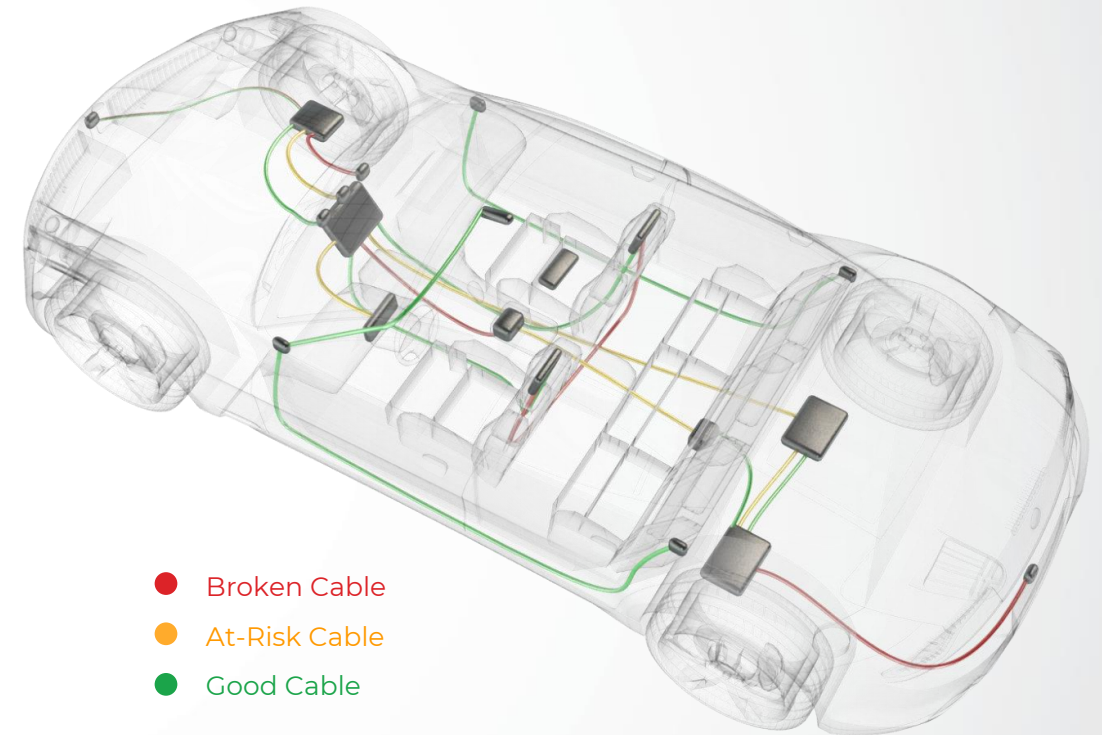
Must use shielded cables & connectors



# Built-In Advanced Diagnostics



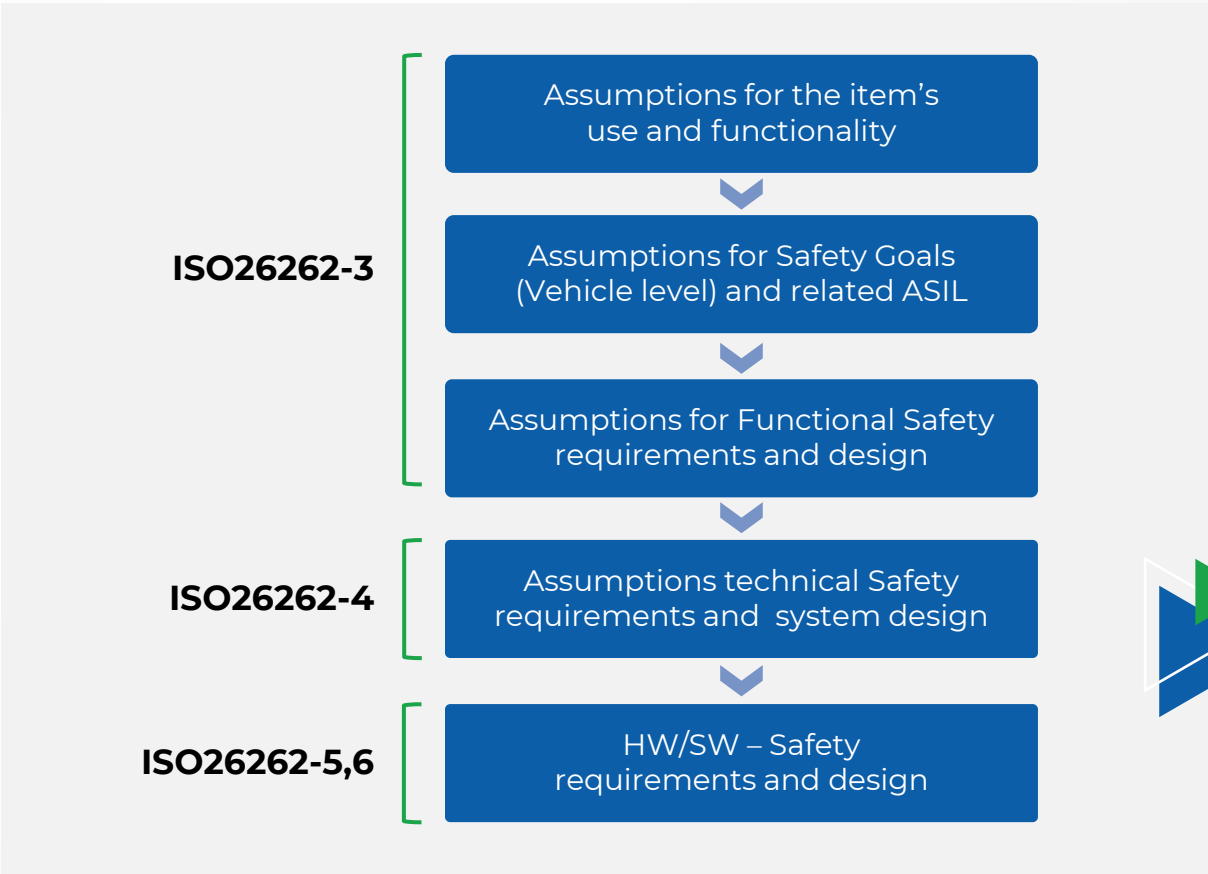
- › **Advanced cable diagnostics mode built into the chip, capable of detecting:**
  - Open-circuit (one or both wires in the pair)
  - Short-circuit (to Vbatt, ground, or between wires in the pair)
  - Changes to the cable impedance for preventive maintenance before the link fails
- › **Indication of the location of the fault**
- › **Valens provides a software development kit (SDK) to assist in implementing diagnostics and link monitoring functionality**
  - Applying diagnostics and monitoring for the entire Valens Automotive network and mapping the vehicle harness condition



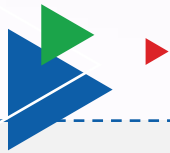
# Built-in Functional Safety



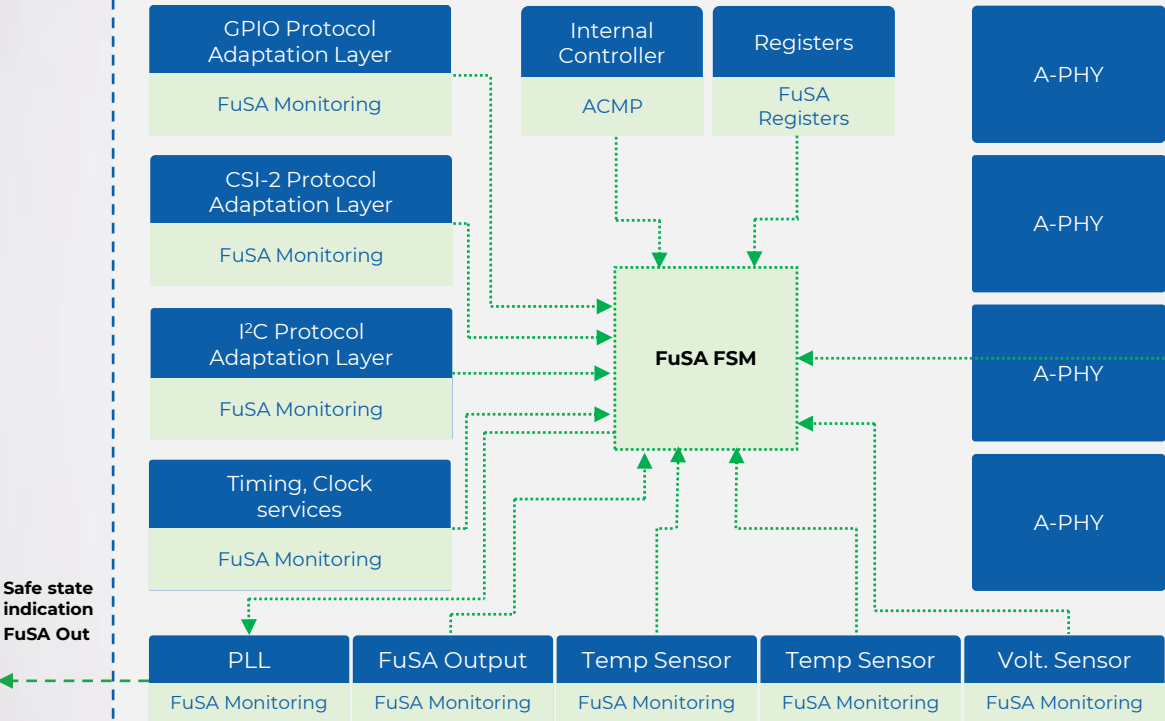
## Following ISO 26262 Functional Safety Standard



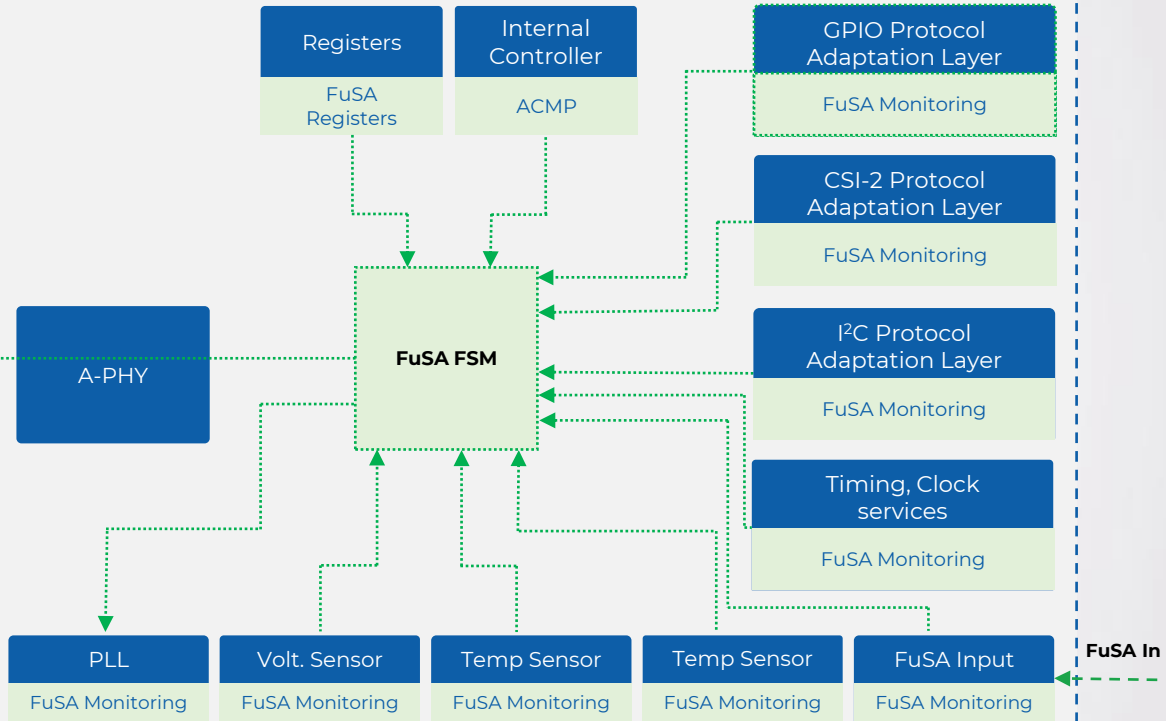
# Built-in Functional Safety



## VA7044



## VA7031



Detailed descriptions of the diagnostic and monitoring coverage supplied in the Functional Safety Manual of each device

# Demo Videos



# Sony 8MP Camera + Mobileye EyeQ5 EVK

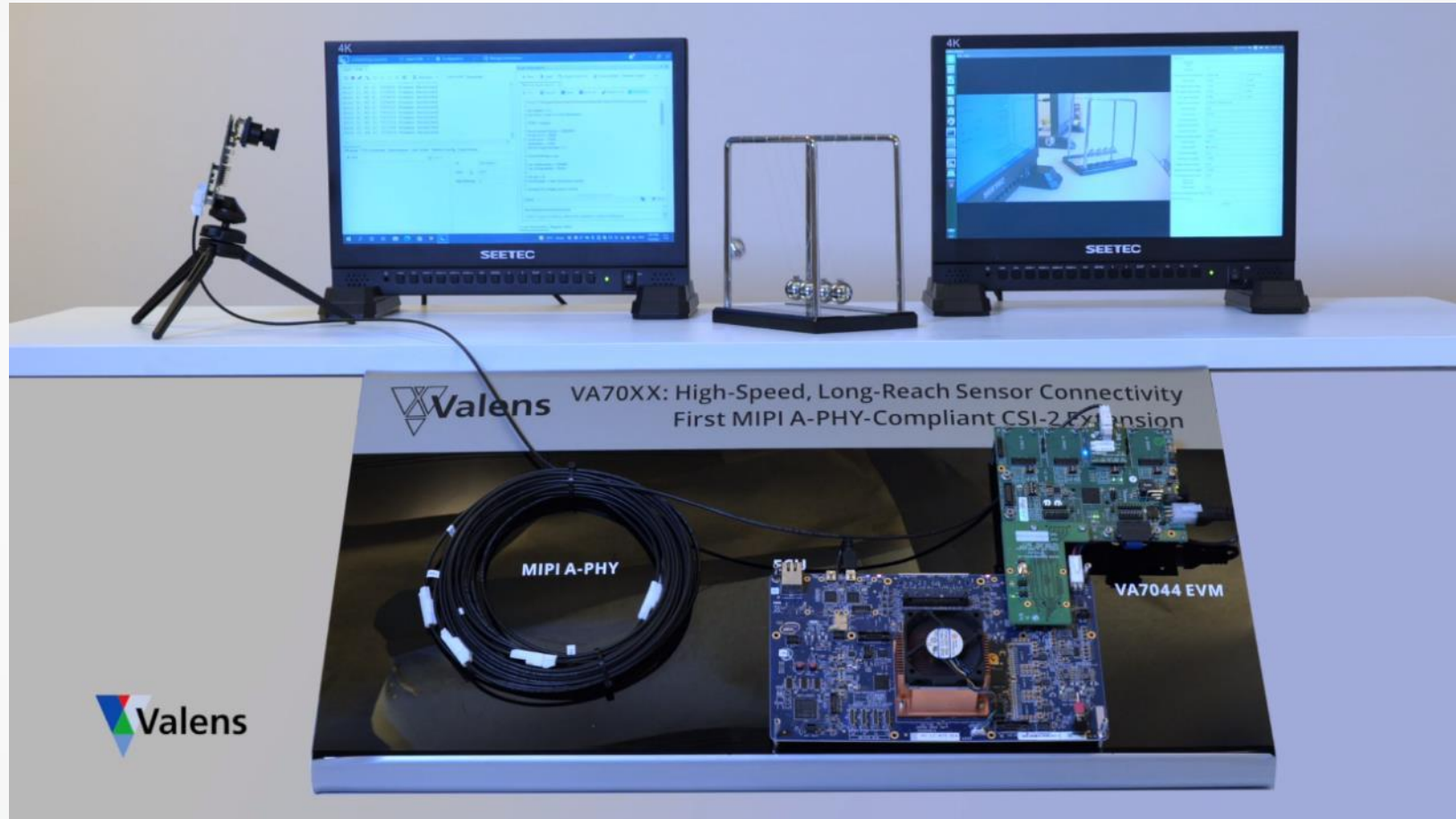


## Sensor:

Sony IMX424  
(8MP)

## Processor:

MobileEye EyeQ5



<https://vimeo.com/689280787>

# OMNIVISION ARDS 8MP Camera + Venus EVK

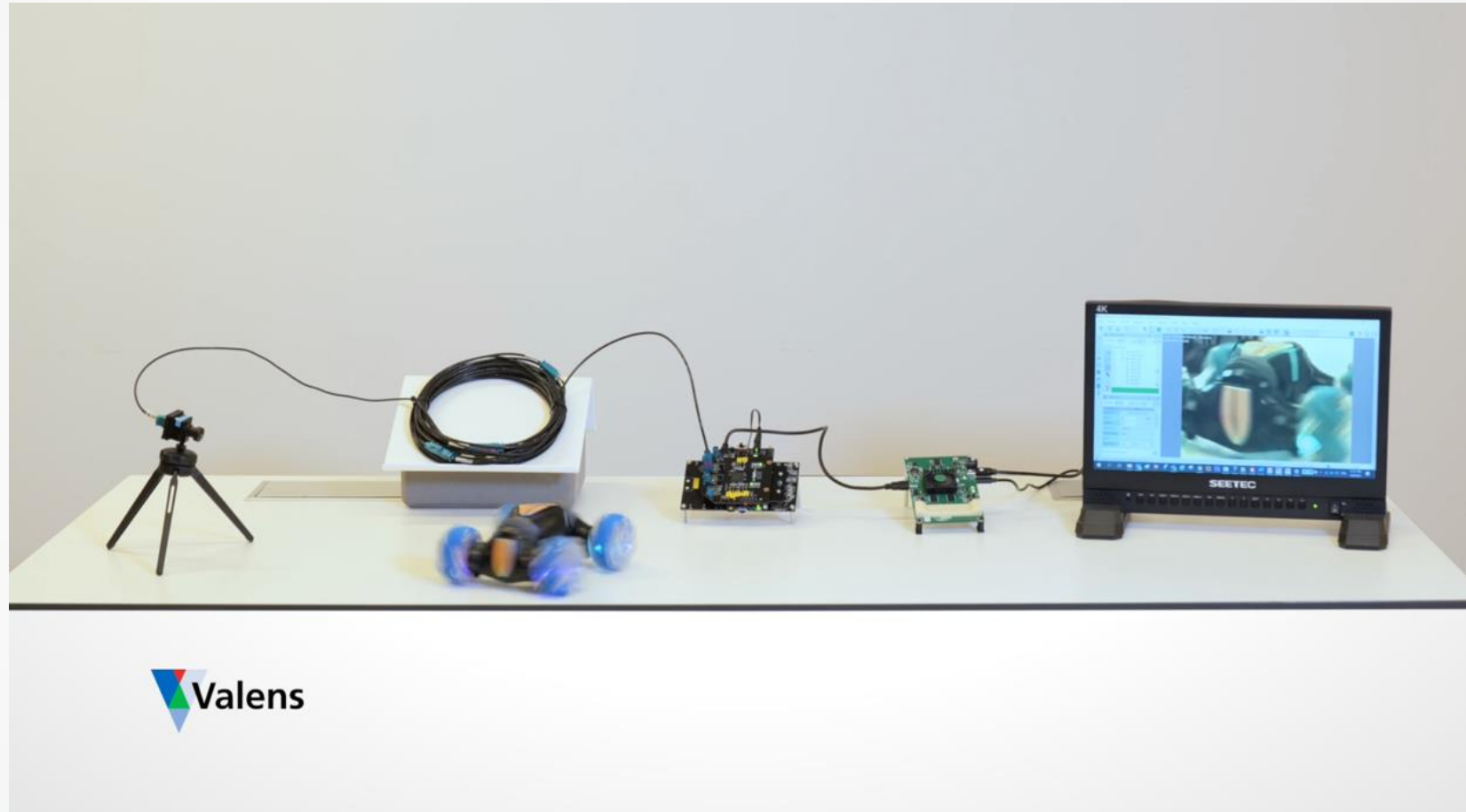


## Sensors:

4 x Omnivision  
0x08B4C

## Processor:

Omnivision ARDS



<https://vimeo.com/689280787>

# onsemi 8MP Cameras + Valens EVK over UTP Links

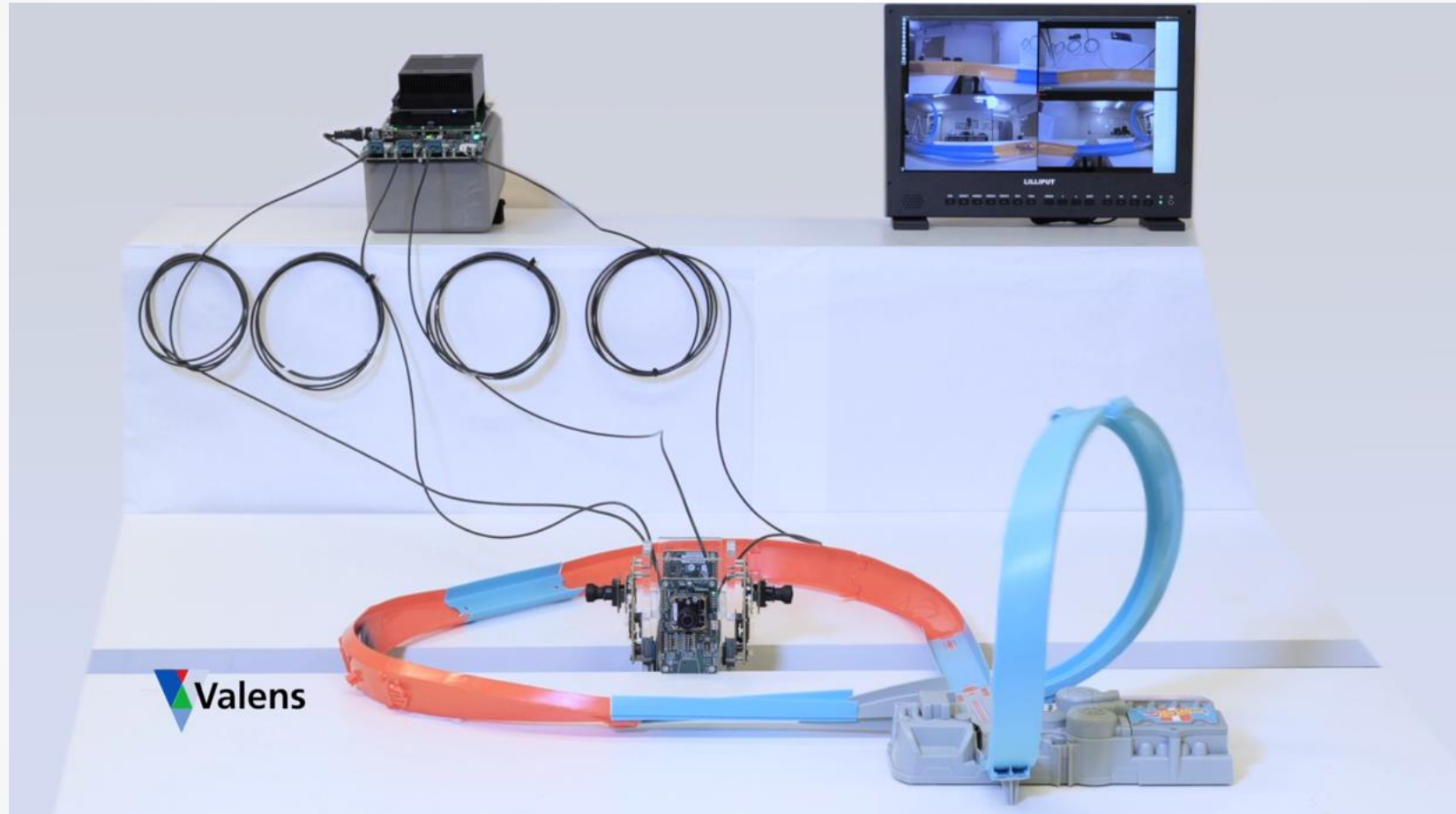


## Sensors:

4 x onsemi  
AR0820

## Processor:

NVIDIA Xavier

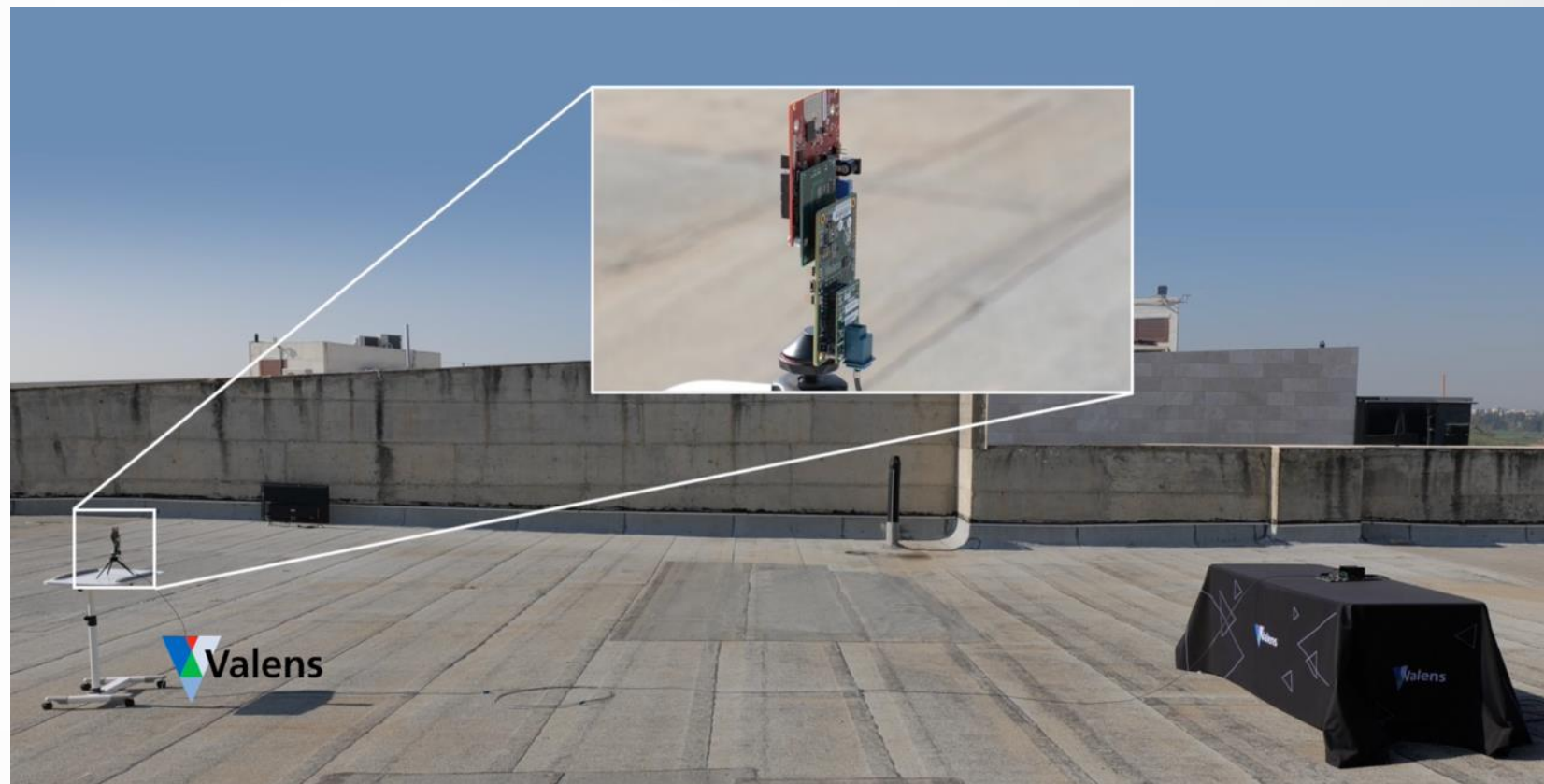
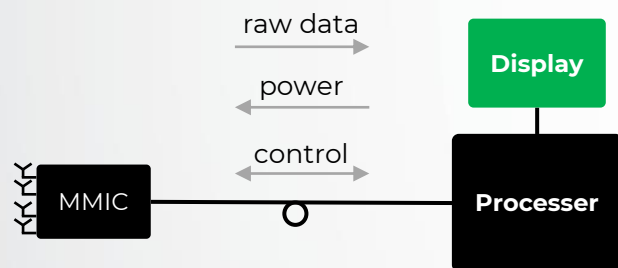


<https://vimeo.com/669864914>

# Satellite Radar + Valens EVK



**Data, control and power  
over a single UTP Link**



<https://vimeo.com/669864678>



**Valens**

**Thank You**

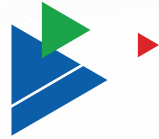


[www.valens.com](http://www.valens.com)  
[Info@valens.com](mailto:Info@valens.com)

# Appendix



# VA7000 Cable options



## Shielded: Covering all link speeds

### Unshielded: Up to 4Gbps



#### Unshielded Twisted Pair (UTP)

Leoni Dacar 647



#### Shielded Differential Pair (SDP)

GG X9305  
Leoni Dacar 647-4  
Leoni Dacar 686-3



#### Coax

##### Standard

GG 59998  
Leoni Dacar 302-3

##### Dynamic

Leoni Dacar 462  
GG X8804

**Note:**

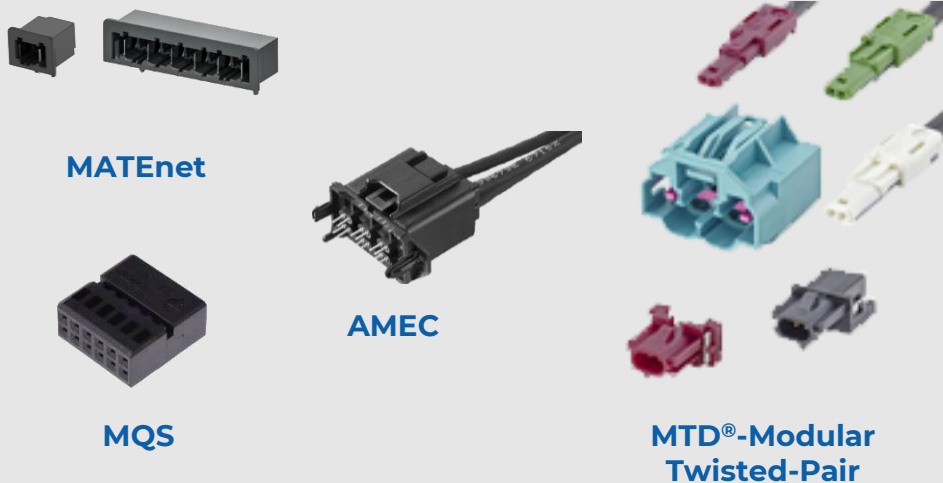
*The assembly of connectors and cables needs to comply to the A-PHY channel specification. The listed components are suggestions; you should always refer to the A-PHY specification.*

# VA7000 Connector options

## Shielded: Covering all link speeds

### Unshielded: Up to 4Gbps

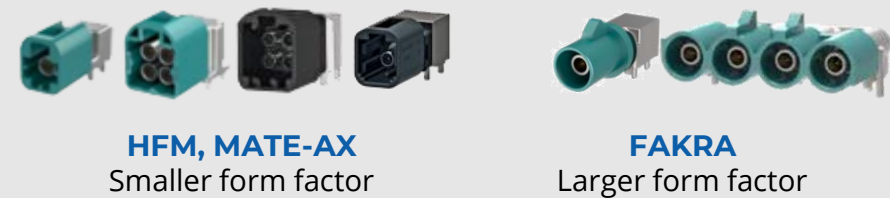
#### Unshielded Twisted Pair (UTP)



#### Shielded Differential Pair (SDP)



#### Coax



**Note:**

The assembly of connectors and cables needs to comply to the A-PHY channel specification. The listed components are suggestions; you should always refer to the A-PHY specification.