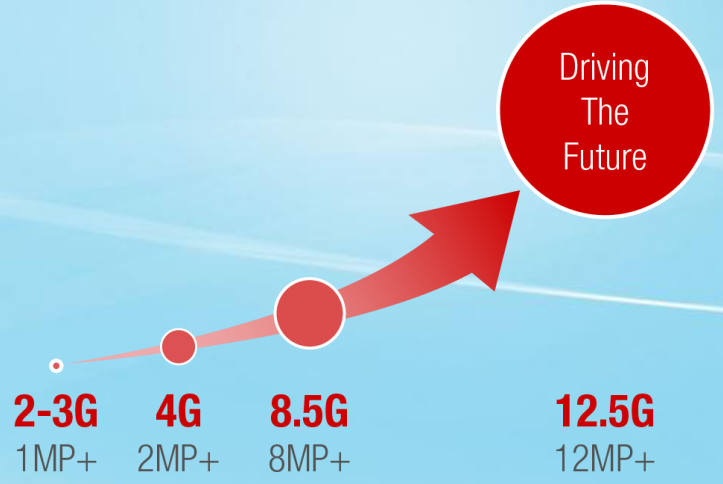
TI ADAS
FPD-Link™ SerDes

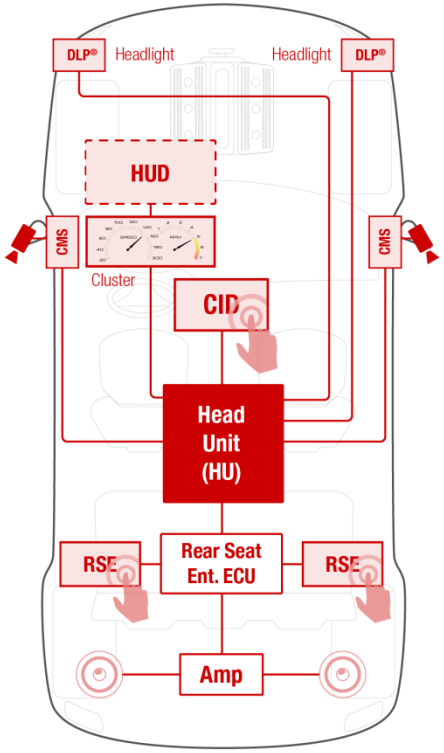


Ethernet & FPD-Link™ (EFL) Product Line

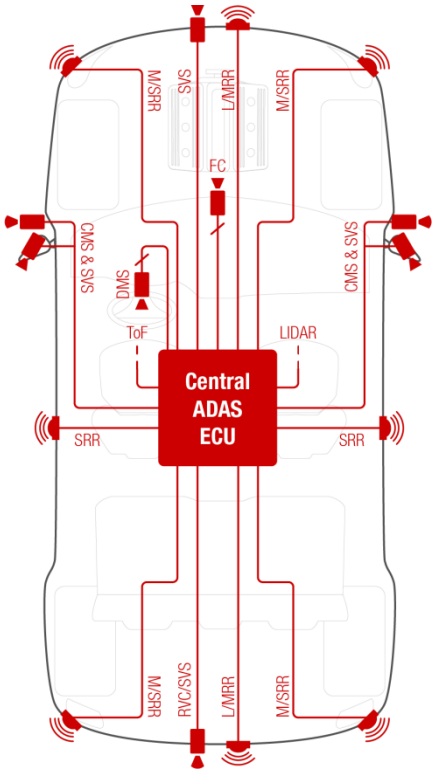
Santa Clara, CA, USA

TI Ethernet & FPD-Link™ Product Line

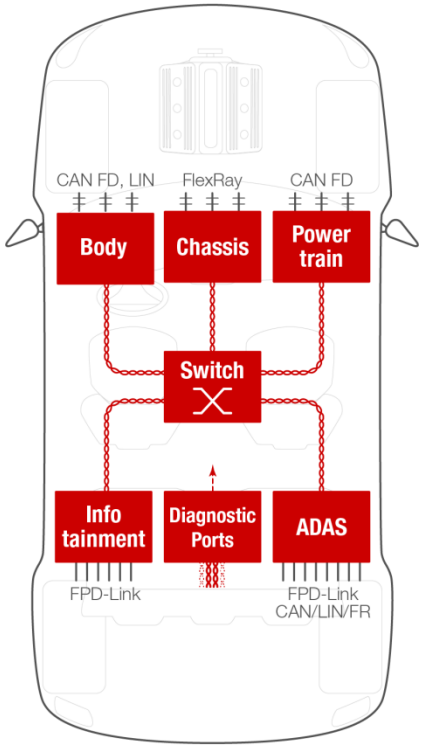
Infotainment FPD-Link™



ADAS FPD-Link™

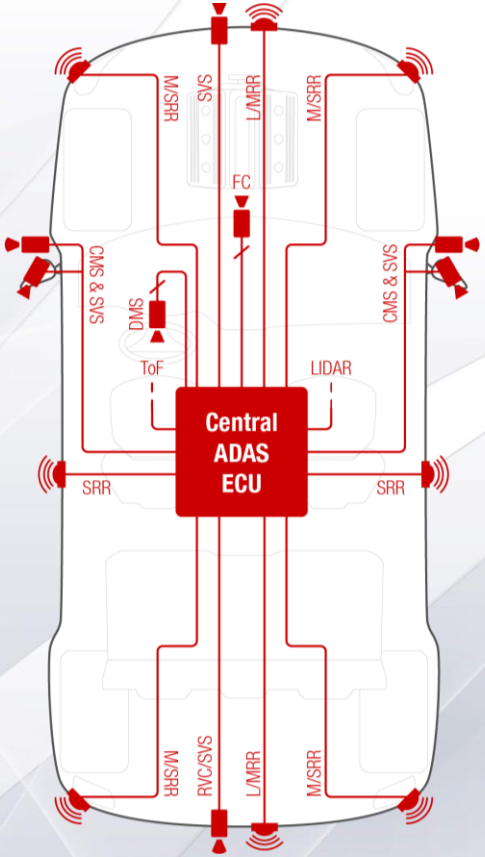


Ethernet Domain

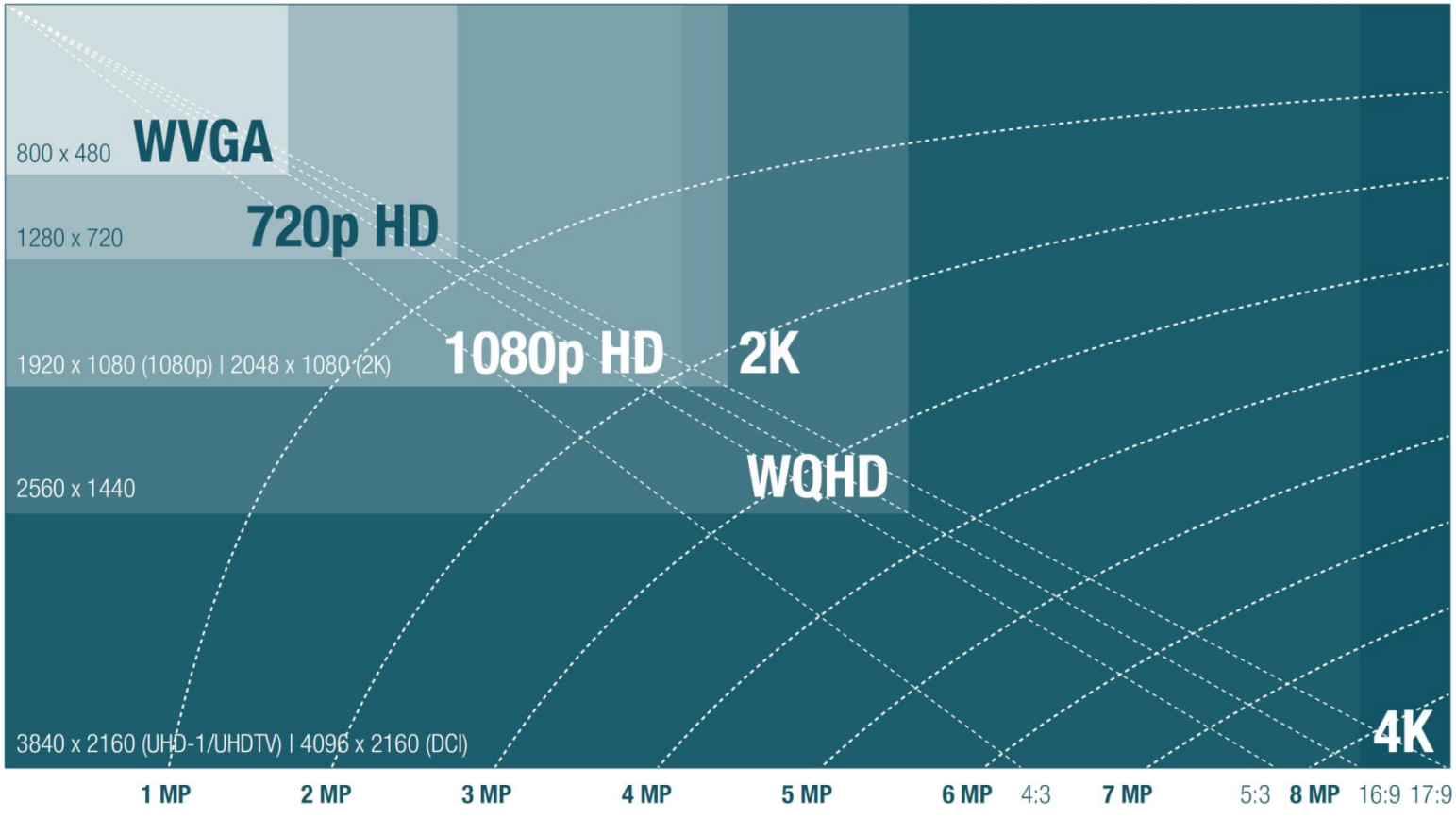


ADAS FPD-Link™ SerDes

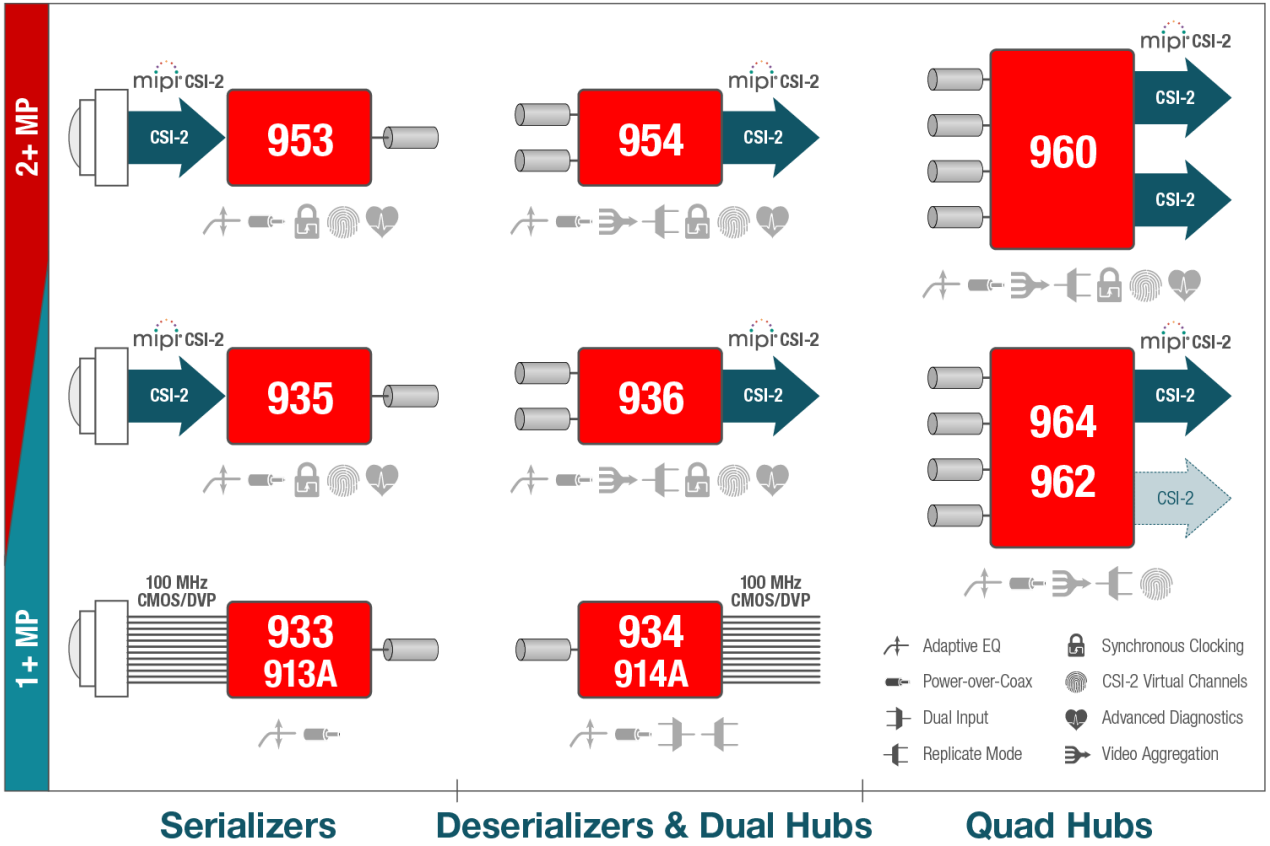
Connecting high-resolution imager, time-of-flight (ToF), RADAR, LIDAR, and others sensors

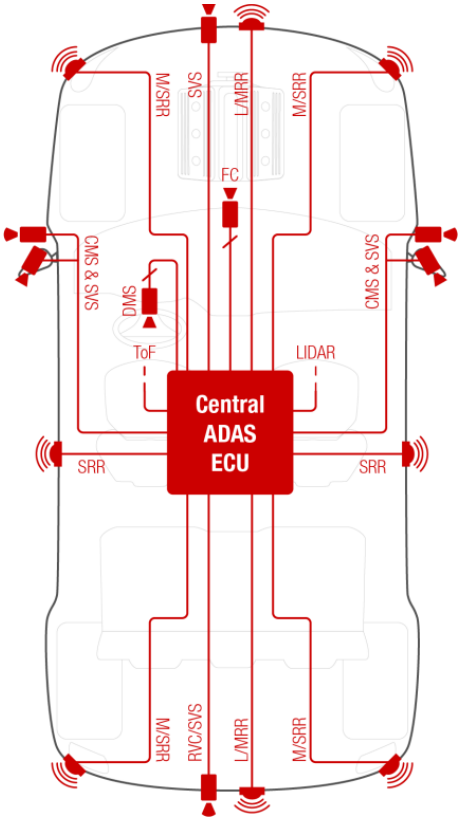


Camera & Display Resolutions



ADAS FPD-Link™ SerDes Portfolio



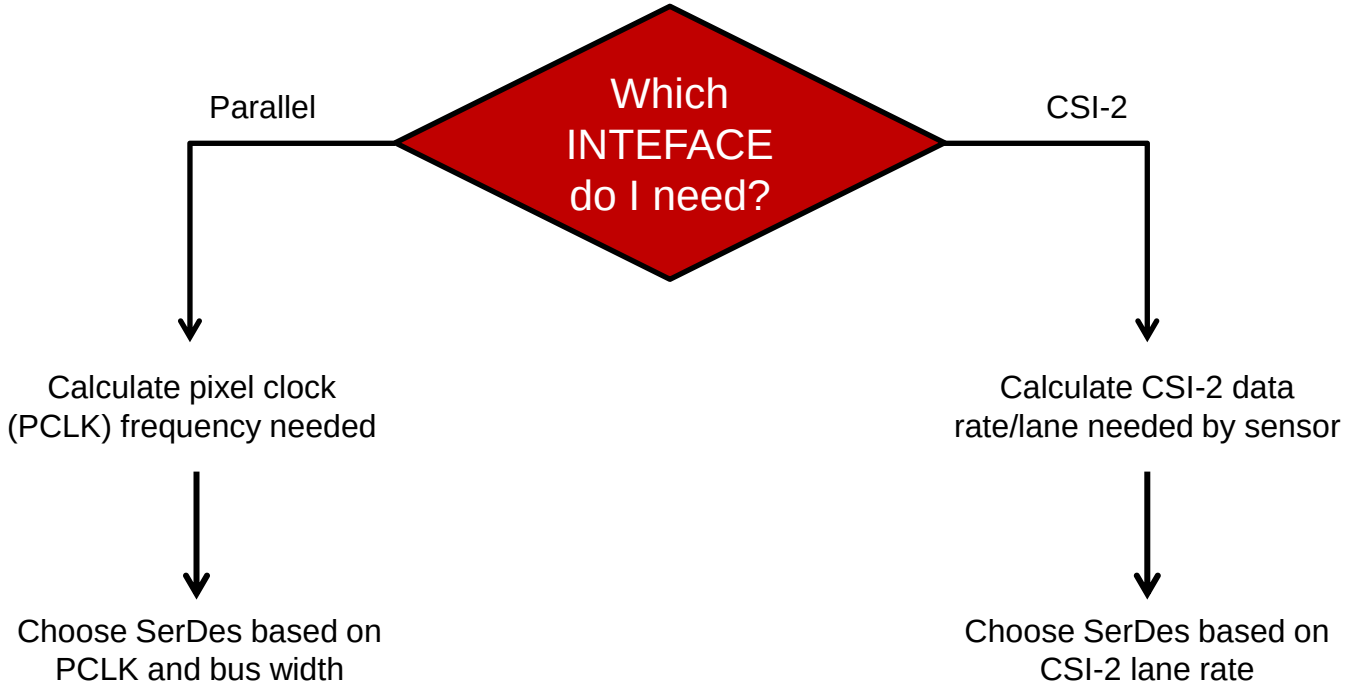


Common Imager/Serializer Combinations*

	1 MP		2 MP	
Frame Rate (fps)	**30**	**60**	**30**	**60**
Parallel	933	933	933	
MIPI CSI-2	935	935	935 953	953

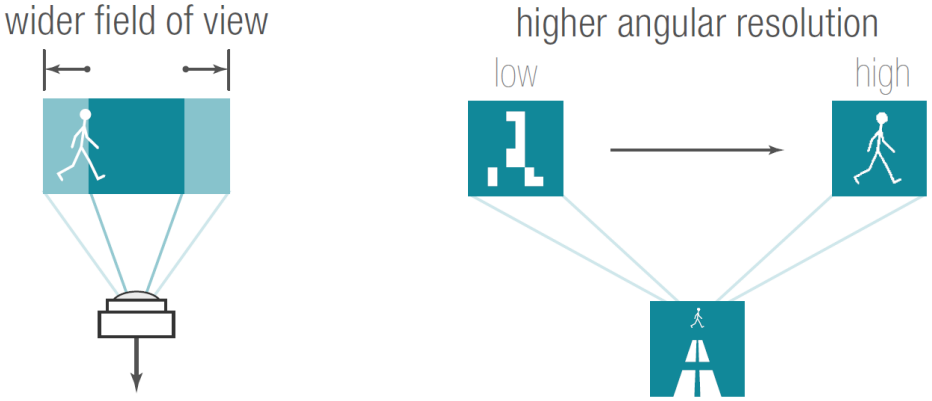
- ***Serializer choice depends on imager output data rate, which depends on actual imager configuration
- Calculate actual imager output data rate for your configuration before making final serializer selection!
- 4MP+: Contact your local TI sales representative

Which Serializer Do I Use?



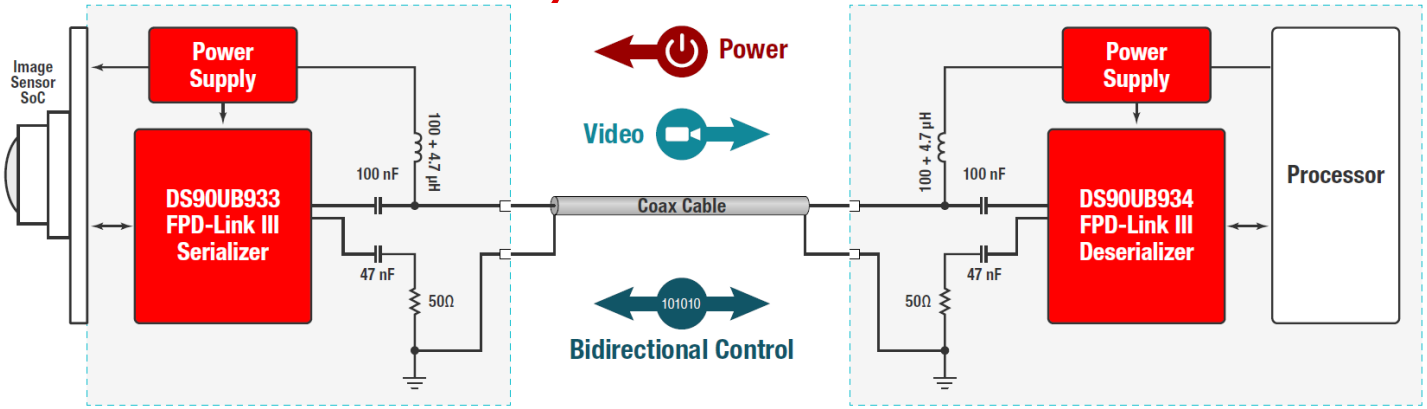
- Note on megapixels:
  - Typically 913A/933 are used for 1MP imagers and 953 for 2+MP imagers, but actual choice depends on imager configuration (frame rate, video format, number of exposures, on-imager video pre-processing, etc)

Driving Higher Resolutions



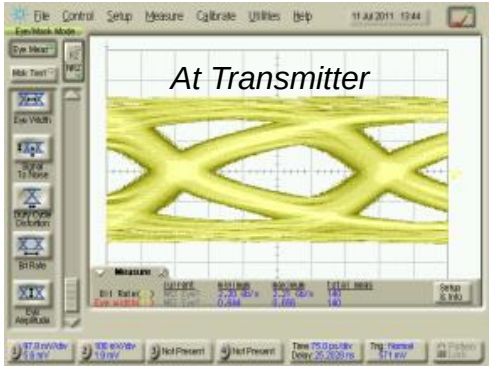
Camera System	Higher Resolution		Higher Frame Rate
	Wider Field of View Perceive Peripheral Objects	**Increased Angular Resolution** Detect Farther, Sooner	
Rear View Camera (RVC)	•		
Surround View System (SVS)	•		
Front Camera (FC)	•	•	•
Driver Monitoring System (DMS)	•		
Automotive Night Vision (ANV)		•	•
Camera Monitor System (CMS)	•	•	•

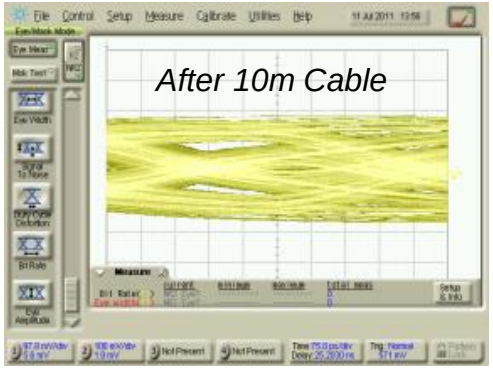
DS90UB933/934, DS90UB913A/914A

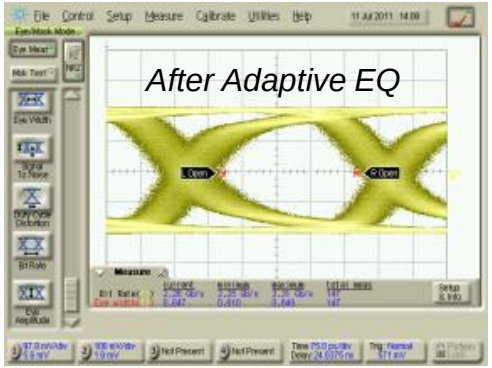


Feature	Benefit
12 bits up to 100 MHz	2MP/30 & 1MP/60 support
15 meters Coax or STP cables	Long haul interfacing
400 kHz I²C Embedded Control	Replaces CAN, LIN, MOST
5x5 mm package (serializer)	Small footprint for compact design
SSCG in deserializer	Reduces electromagnetic emission
Adaptive Equalization	Compensates cable degradation
2:1 input multiplexer	Select from two video sources
115°C 933A version coming soon!	More compact camera designs

Advanced Adaptive Equalization

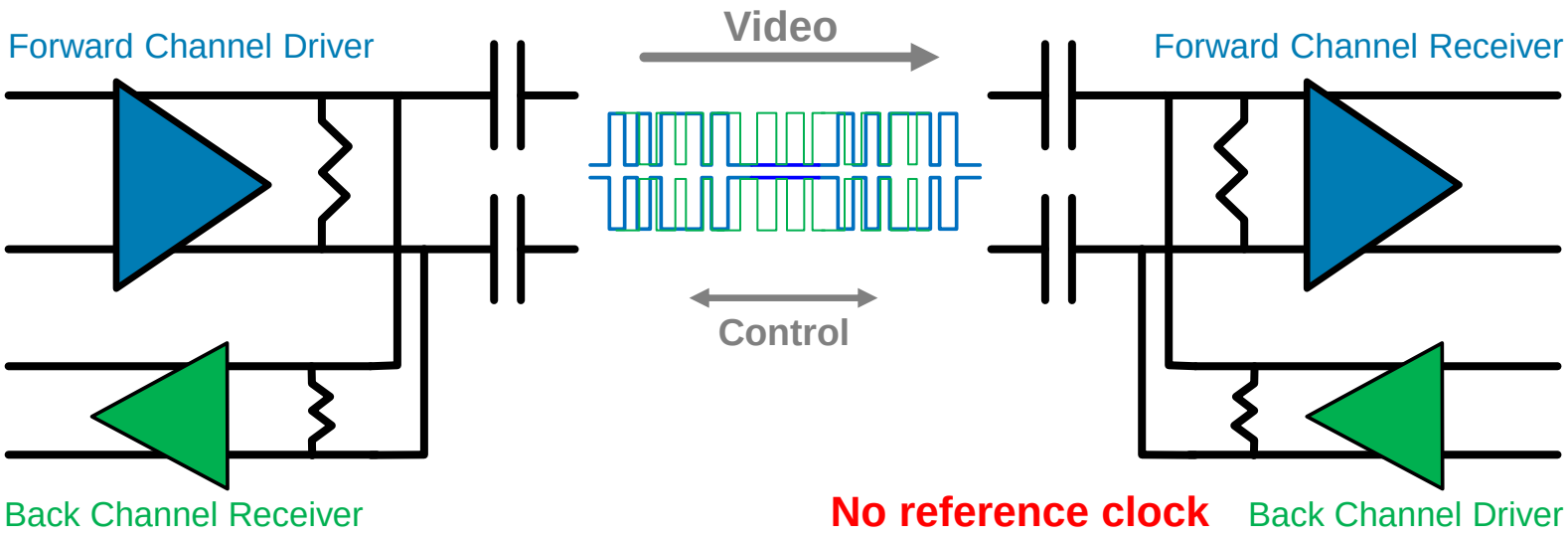






- Automatic algorithm
  - **No adjustment** – compensates for cable type, length, connectors, etc
  - **Adapts continually**
- **Compensates** for cable ageing effects
- No EMI impact
- Valuable diagnostic function
  - Read out EQ level to monitor cable health
- Supports future data rates over low cost cables

Continuous, Low-Latency Backchannel



- Ultra-low (<15µs) latency
  - Ideal for remote ISP & camera sync control
- EMI friendly
  - No common mode modulation
  - No pre-emphasis or tuning
- No waiting for video blanking
  - Backchannel sent continuously
- Single pair
  - Works over coax & STP

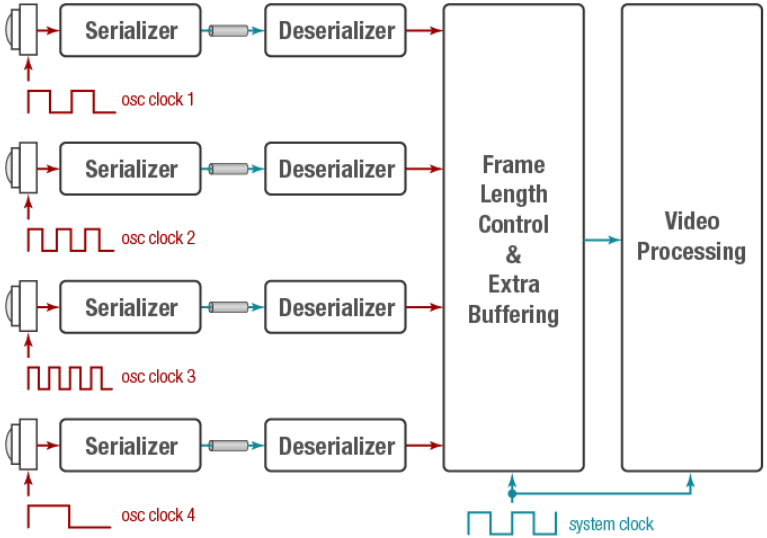
DS90UB95x/96x Features

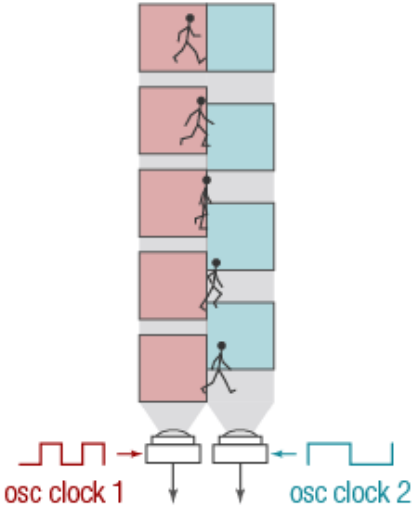
Synchronous Clocking, Link Aggregation & Replication, Diagnostics, & more…

Driving Innovation

- **Multi-megapixel** imager & RADAR, LIDAR, & ToF sensor support
- Precision **sensor synchronization**
- **Data aggregation** with different sensor types, resolutions, & timing
- Help meet **overall system functional safety**
- **Reduce BOM** (bill of materials)

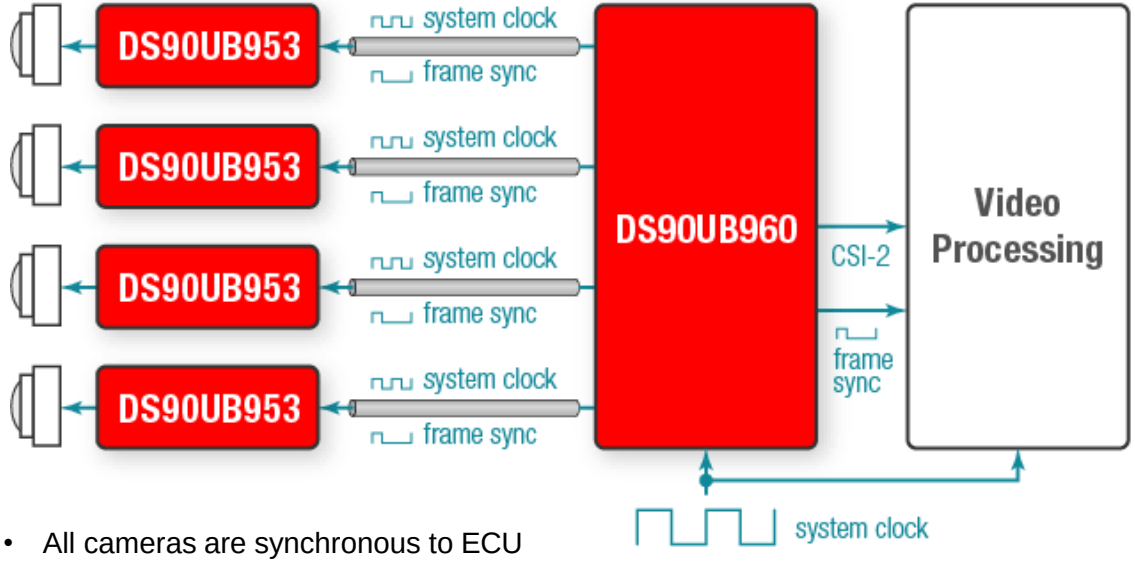
Traditional Unsynchronized Sensors

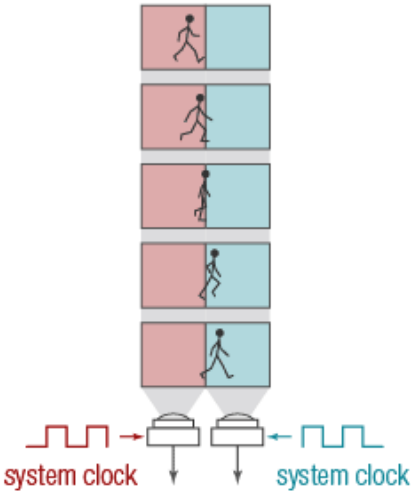




- Each camera oscillator runs at a slightly different frequency
  - Frequency differences exaggerated for clarity
- Extra processor resources required for stitching, etc
  - Timer, buffering, frame size control
- Potential for machine vision errors
- Not an elegant solution

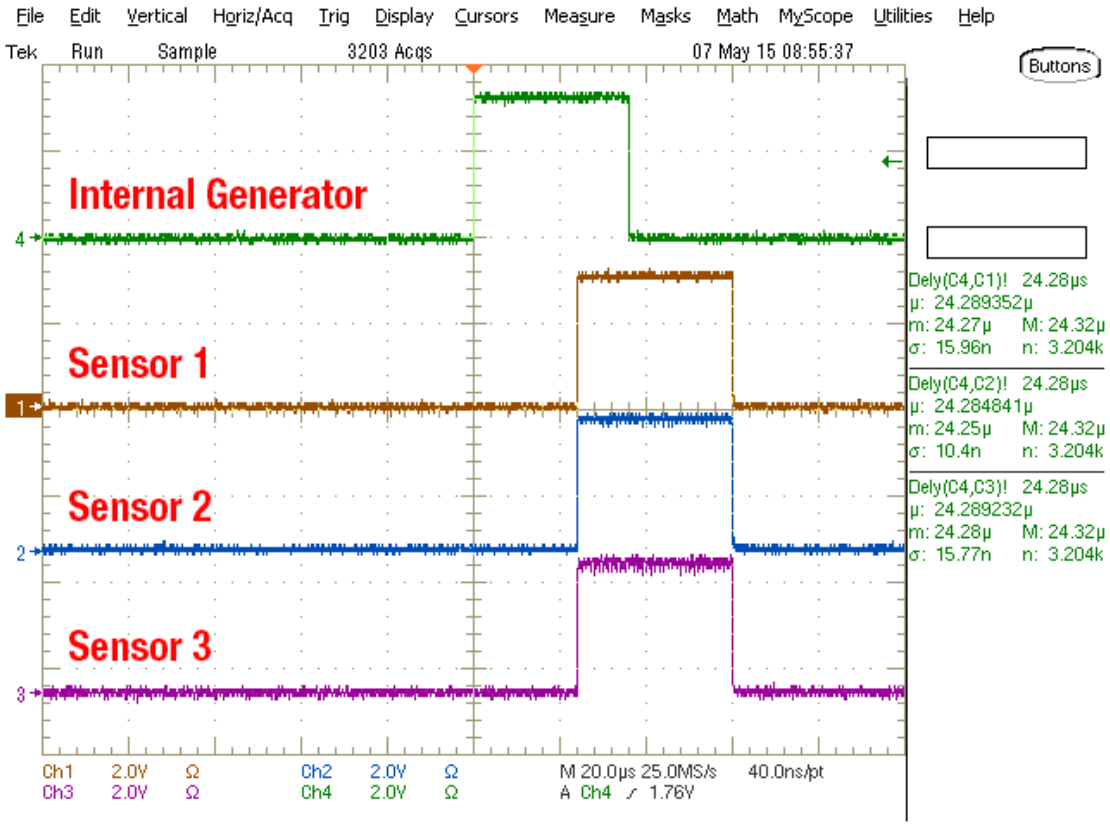
Synchronized Sensors with the 953/935





- All cameras are synchronous to ECU
  - also saves oscillator cost/space in cameras
- No frame buffers or extra circuitry required
  - saves four frames of buffer memory
- Enables easier seamless image stitching & sensor fusion
- The 960 or 954 also generates frame sync automatically (programmable)

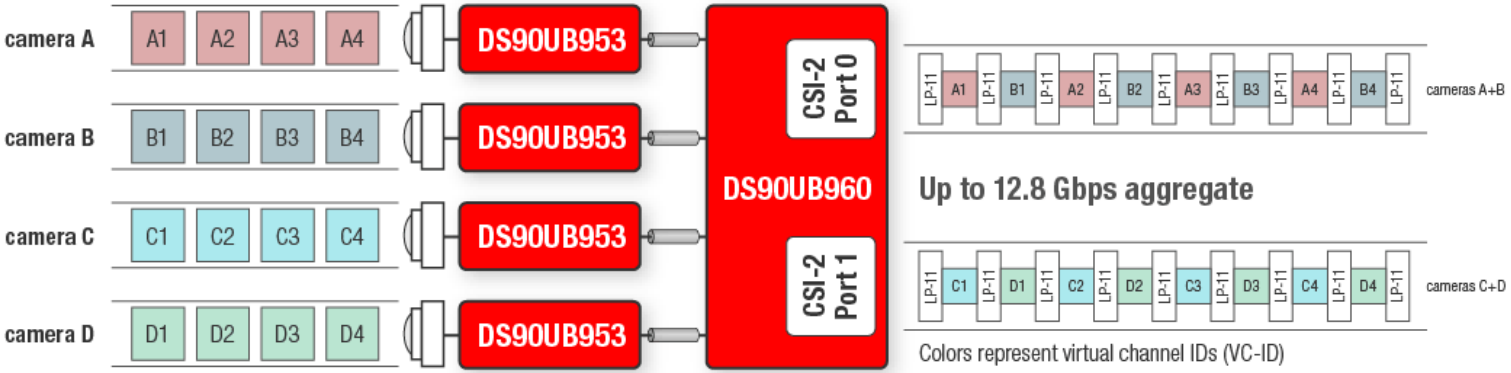
954/936/96x Precision Frame Sync Generator



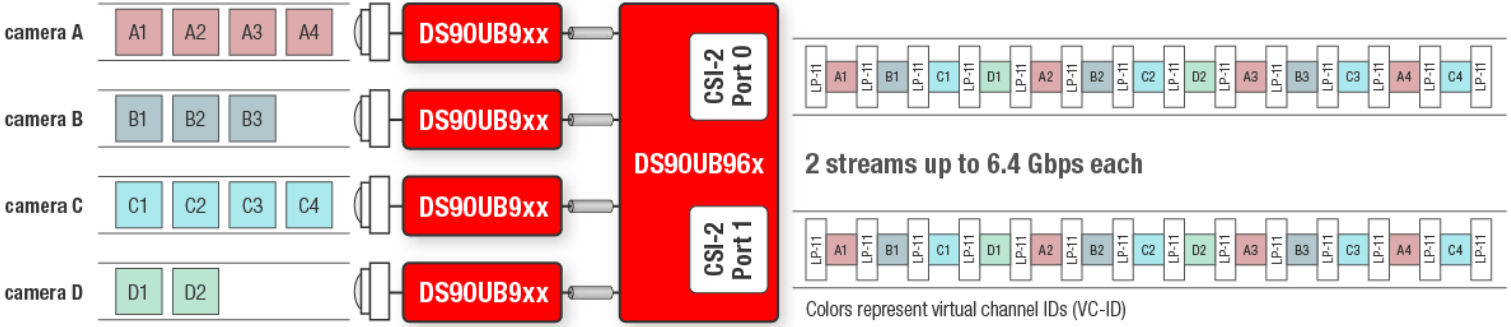
- **Internal Frame Sync**
  - Latency : ~600ns
  - Skew : ~40ns
  - Jitter for periodic signal : ~40ns
- **GPIO**
  - Latency : ~700ns to 1300ns
  - skew : ~40ns
  - jitter for periodic signal : ~600ns
- **I2C**
  - Latency (bit latency): ~700ns to 1300ns
  - skew : ~40ns
- All values assume 50 Mbps backchannel
- Based on simulations

Virtual Channels & Mapping/Replication Modes

Aggregation Mode

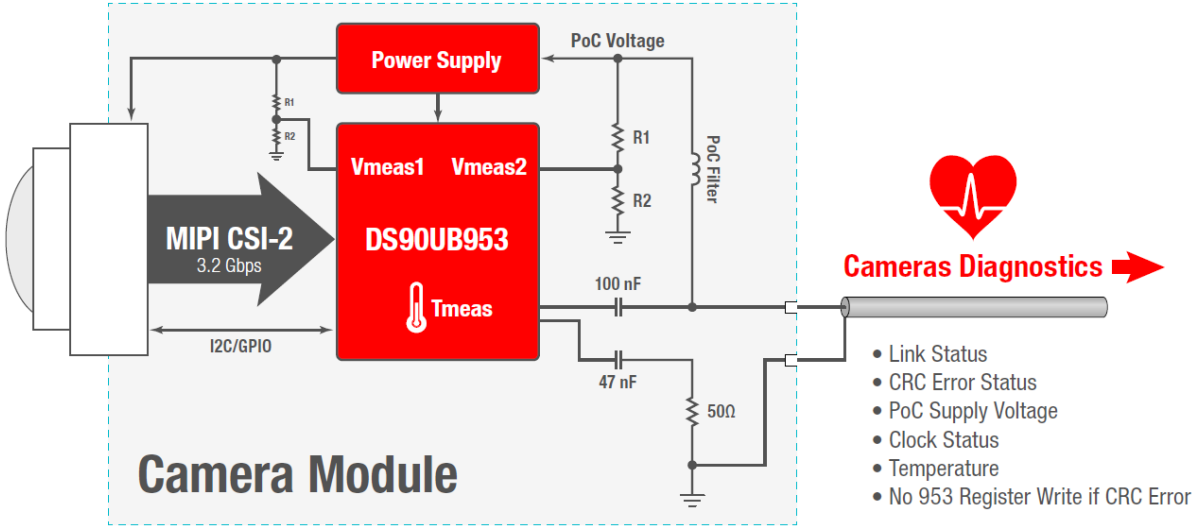


Replication Mode



Data Protection & Diagnostics
Supporting Overall System Functional Safety

- 953/935 send camera diagnostics to ECU
  - PoC voltage, temp, link & clock status, bit errors, etc.
- Programmable sensor module health alarm signal
- Multiple levels of CRC data protection & checking
- I2C write protection
- Line fault detection
- Unique die security ID
- See blog for more info



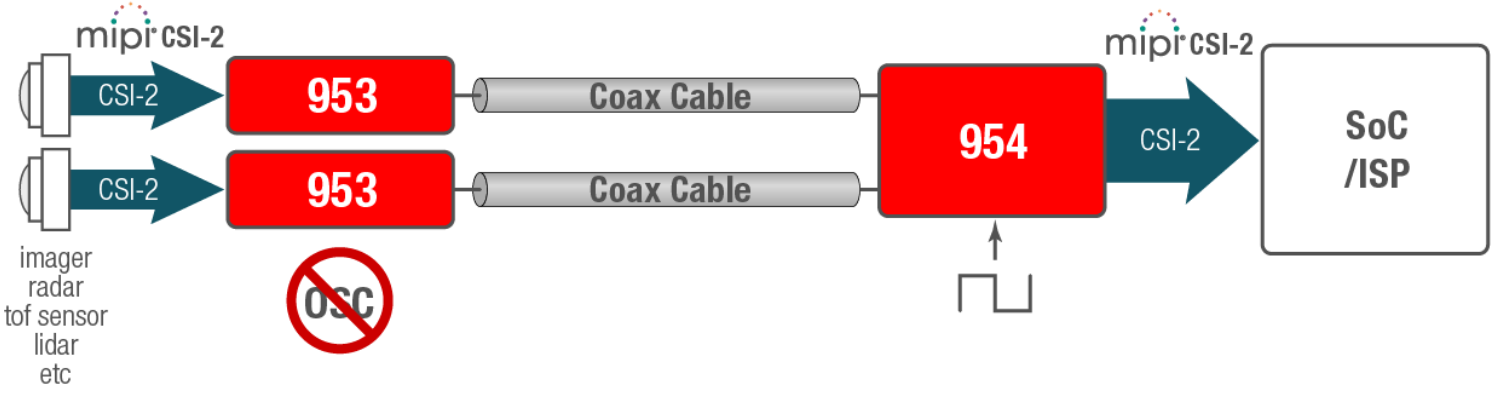
Link Diagnostics: Layered Protection

14	Pattern Generation	Generates video patterns for test	test mode
13	BIST	Bit error rate test	test mode
12	Prog. Interrupt	Programmable open drain interrupt pin flags errors to processor	always active
11	Prog. Alarm Bit	Programmable alarm signal provides module health monitoring (953/935)	always active
10	Voltage/Temp Meas	Monitors up to 2 voltages as well as internal temperature (953/935)	always active
9	Frame Count	Verifies no frozen frames (note: frame count is sent by imager)	always active
8	I2C Write Protect	Protects sensor module misconfiguration if I2C has bit errors (953/935)	always active
7	CSI-2 CRC	Verifies end-to-end link integrity and bit error rate (953/954/96x/935/936)	always active
6	SerDes CRC	Verifies SerDes link integrity and bit error rate	always active
5	CSI-2 Input Check	Checks for data integrity from sensor data at input to 953/935	always active
4	Lock Detect	Verifies link established	always active
3	Internal Oscillator	Internal serializer oscillator establishes link even without clock	always active
2	Adaptive EQ Level	Read relative cable quality via I2C (7 levels)	set at power up
1	Cable Fault Detect	Cable open, + to - short, short to ground, short to battery, incorrect link	always active

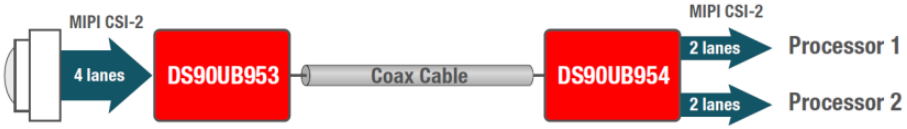
*: 953/954/960/935/936 for ADAS only

test mode normal operation

953/954 MIPI CSI-2 Interface Ser/Des



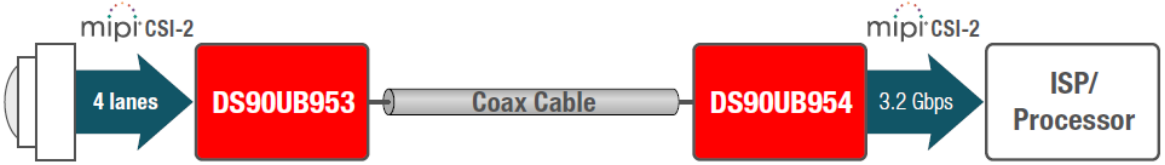
- Supports 2MP image sensors with MIPI CSI-2 interfaces
  - Up to 4 data lanes and clock lane
  - YUV, RAW and RGB data types
- Receiver-side clocking ensures all cameras are synchronous
- Forward and back channel CRC
- No 953 register writes if control channel errors present
- Reads Power-over-Coax (PoC) input voltage & internal temp
- Easier PoC support, smaller inductors
- 954 has 2 independent camera “hub” inputs and output replicate mode
- Small 5x5 mm serializer & PoC footprint enables compact module designs
- Lower speed 935/936 versions also available



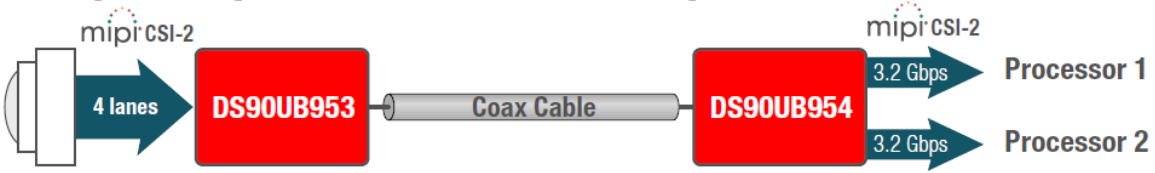
Replication Mode Example

953/954 Flexible Interface Examples

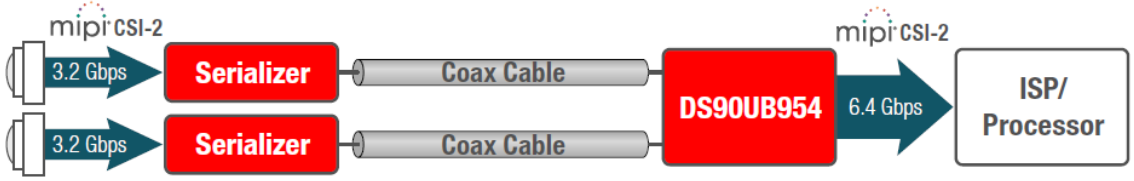
Single 2MP camera example



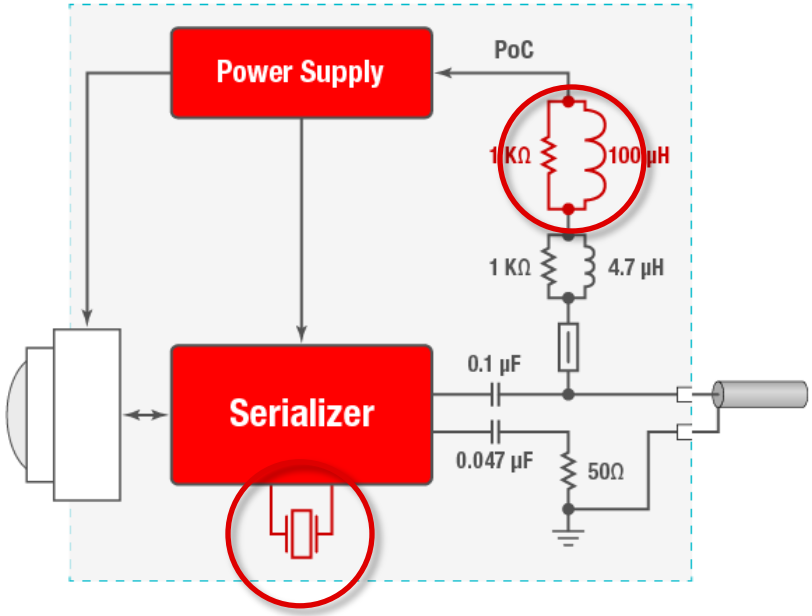
Output replicate mode example



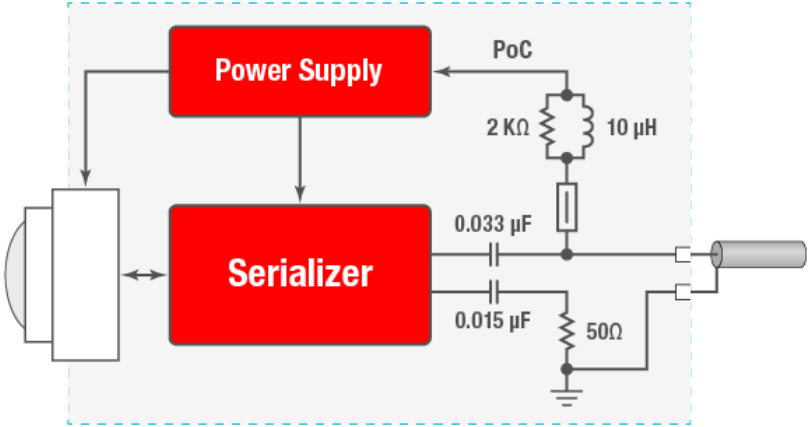
Dual camera example



953/935: Smaller Sensor Module Footprint

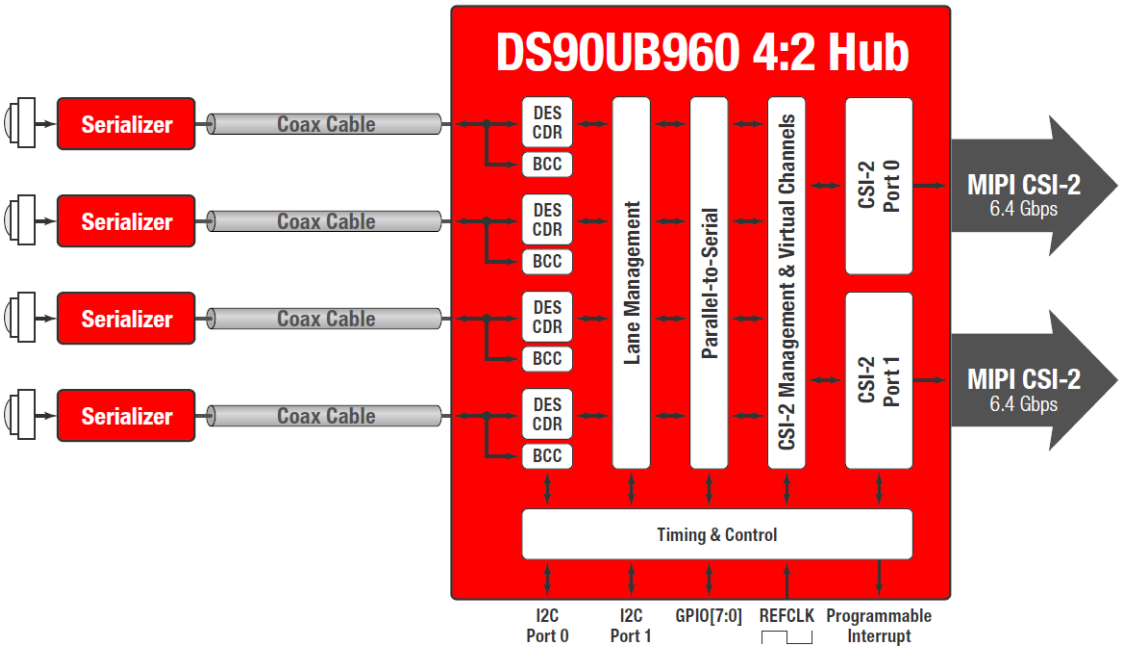


Traditional Camera



953-based Camera

96x Quad Deserializer Hubs



- Aggregates up to four sensors
  - Full 2MP HD & 60fps support (960)
  - Coaxial or single differential pair
- 2x 6.4 Gbps MIPI CSI-2 output ports
  - Flexible mapping of cameras to port(s)
  - Aggregate & replicate modes
- CSI-2 virtual channel support
- Synchronous clocking mode (960+953)
- Programmable frame sync generator
- Adaptive Receiver Equalization
- 2x I2C ports up to 1MHz
  - Program 2 cameras using both I2C buses or multiple cameras using I2C broadcast
- 8 GPIOs
- 964, 962, & 960 versions available

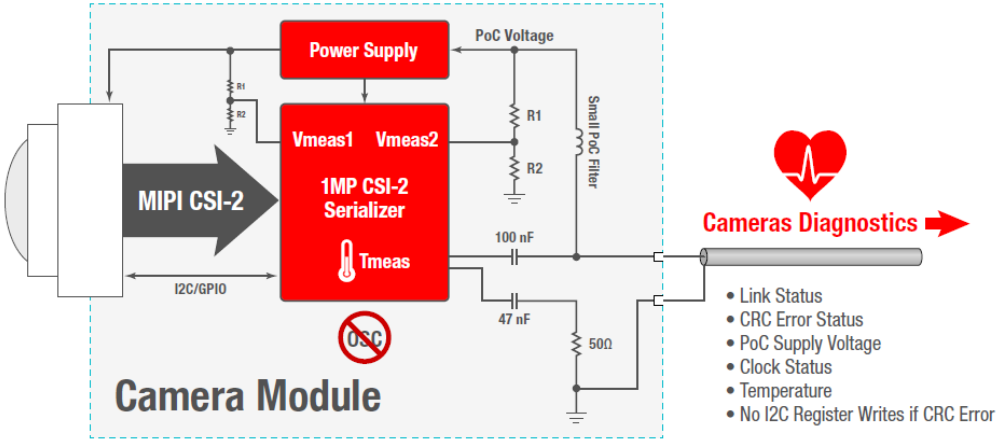
Quad & Dual Deserializer Hub Portfolio

Device	DS90UB962	DS90UB964	DS90UB960	DS90UB936	DS90UB954
Function	**Quad Hub**			**Dual Hub**	
Typical Resolution	1MP+	1MP+	2MP+	1MP+	2MP+
Serializers Supported	DS90UB913A DS90UB933	DS90UB913A DS90UB933	DS90UB913A DS90UB933 DS90UB935 DS90UB953	DS90UB913A DS90UB933 DS90UB935	DS90UB913A DS90UB933 DS90UB935 DS90UB953
Output Interface	1x CSI-2 Ports 1.6 Gbps/lane (max)	2x CSI-2 Ports 1.6 Gbps/lane (max)	2x CSI-2 Ports 1.6 Gbps/lane (max)	1x CSI-2 Ports 1.6 Gbps/lane (max)	1x CSI-2 Ports 1.6 Gbps/lane (max)
Imager Examples	720p/60fps or 1080p/30fps	720p/60fps or 1080p/30fps	1080p/60fps	720p/60fps or 1080p/30fps	1080p/60fps
CSI-2 Port Replication	No	Yes	Yes	Yes	Yes
Deserializer-Side Synchronous Clocking	No	No	Yes (with 953)	Yes (with 935)	Yes (with 953)
Frame Sync	GPIO or internal FSIN generator	GPIO or internal FSIN generator	GPIO or internal FSIN generator	GPIO or internal FSIN generator	GPIO or internal FSIN generator
Diagnostics	Backchannel CRC, link status, PRBS BIST	Backchannel CRC, link status, PRBS BIST	Forward (with 953) & backchannel CRC, link status, PRBS BIST, 953 voltage & temp readings, programmable interrupt	Forward (with 935) & backchannel CRC, link status, PRBS BIST, 935 voltage & temp readings, programmable interrupt	Forward (with 953) & backchannel CRC, link status, PRBS BIST, 953 voltage & temp readings, programmable interrupt

954/936 are effectively half of 96x. 934 and 964 can support the 953 up to 12 bits at 100 MHz, if the 953 is placed into backward-compatible ‘DVP” mode. The 962 is compatible with the 964 but has only one CSI-2 output port.

935/936 CSI-2 SerDes Product Preview

Product Preview

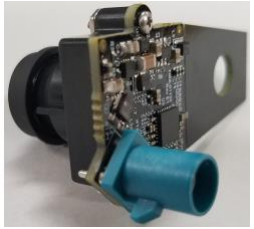


- 1MP+ CSI-2 serializer (2.5 Gbps video payload)
- Pin-compatible with the DS90UB953/954 for easy upgrade to 2MP/60
- Sync mode clocking for easier video stitching
  - Uses central clock from ECU to synchronize all cameras
- Smaller camera design than existing solutions
  - No large 100 uH coil for PoC
  - No external oscillator
- PoC & supply voltage health monitoring
- Small 5x5 mm QFN serializer package
- Enhanced data protection & diagnostics
  - CRC data protection on both video and control channels
  - “I2C write protection” to help prevent camera from being falsely configured if an error occurs on I2C
  - Imager output parity checking to determine where problem is if errors occur
  - Camera voltage and temp monitoring
  - Programmable alarm signal
- Also ideal for satellite RADAR, ToF, and other sensors
- Enhanced security
  - Unique serializer die ID to help prevent spoofing and connection of unofficial cameras to ECU

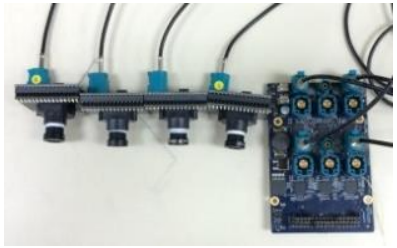
953/954/960 App Note Examples

Content title	Type	Literature Number
How to Design Using DS90UB953 & DS90UB954	Application Report	SNLA267 (in draft)
Schematic and Layout Checklist for DS90UB953	Application Report	SNLA271 (in draft)
DS90UB953-Q1 EVM User's Guide	User's Guide	SNLU224
DS90UB954-Q1 EVM User's Guide	User's Guide	SNLU223
Send Power Over Coax in DS90UB953 Designs	Application Report	SNLA272 (in draft)
DS90UB953-Q1 DVP Backward Compatibility Modes	Application Report	SNLA270
I2C over DS90UB913/4 FPD-Link III with Bidirectional Control Channel	Application Report	SNLA222
Channel Requirements	Application Report	Contact your local support representative

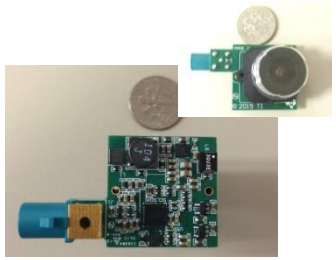
FPD-Link™ Serializer Camera Reference Designs



TIDA-01130 2MP Camera
- OV2775+DS90UB953
- TLV702-Q1 300mA, Low IQ LDO
- TPS62172-Q1 3-17V 0.5A Buck in 2x2 QFN
- Small 20x20 mm PCB



TIDA-00162 Multi-Camera System
- Supports up to 6 cameras
- OV10635+DS90UB913A/914 A
- FMC connector plugs into FPGA or MCU board for video processing
- Available from Spectrum Digital

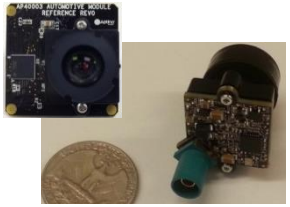


PMP10653 Camera Module
- OV10640+DS90UB913A
- Wide-Vin LM53603Q1 DC/DC
- High PSRR LDO LP5907

PMP9351 Camera Module
- OV10635+DS90UB913Q
- LP3990 linear Vreg

TIDA-01002 1MP Camera
- 1MP HDR YUV422 rear cam
- AS0140AT +DS90UB913A
- TPS62170-Q1, TPS62171-Q1 regulators

TIDA-00421 1.3MP Camera
- OV10640 +DS90UB913A
- TLV702 300 mA LDO
- TPS62170 Buck in 2x2 QFN
- Small 20x20 mm PCB



TIDA-00262 1MP Camera
- AR0140AT+DS90UB913A
- TPS3836E18-Q1 220nA Supervisor
- TPS62170-Q1 DC/DC

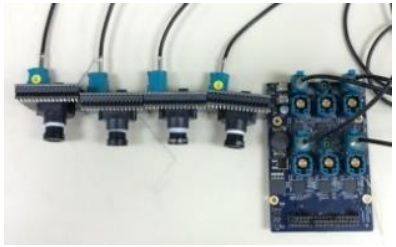
TIDA-00098 1MP Camera
- AP0101AT+DS90UB913A
- LM34919C, TPS62231 buck regulators

Leopard Imaging 1MP, 2MP, & 7-8MP Camera Modules
DS90UB953 with AR0231, AR0220, OV10640+OV490, OV2775, OV10650 (soon), IMX390, IMX324, IMX224

IMI MiniCube Cameras
- Complete automotive camera module
- Multiple imager options
- Available at disti Macnica

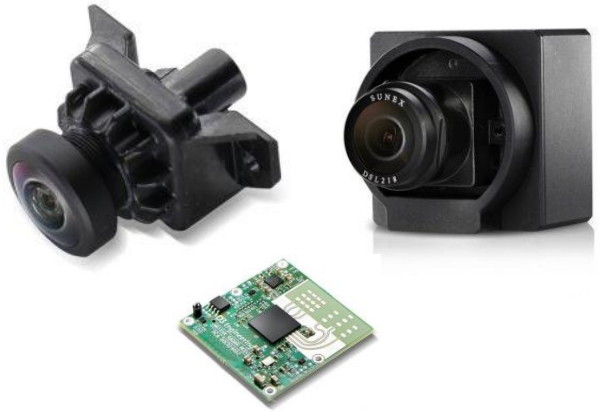
FPD-Link™ Serializer Camera Modules & Ref Designs

Ref Number	Serializer	Imager	Comment
TIDA-01130	953	OV2775	TLV702-Q1 300mA, Low IQ LDO, TPS62172-Q1 3-17V 0.5A Buck in 2x2 QFN
Leopard Imaging	953, 971	AR0231, AR0220, OV10640+OV490, OV2775, OV10650), IMX390, IMX324, IMX224, 2G1, AR0820	More coming soon!
D3 Engineering	953	IMX290/390, Samsung	Contact D3 for more info
TIDA-01xxx	953	IMX390	Coming soon!
TIDA-01xxx	953	AR0233	Coming soon!
TIDA-01004	933	AR0140AT	TPS62170-Q1, TPS62231-Q1, TPS3808G18-Q1
TIDA-01392	933	OV10640	TPS62172-Q1, TPS79915-Q1, TLV70018-Q1
TIDA-01002	913A	AS0140AT	TPS62170-Q1, TPS62171-Q1
TIDA-01003	913A	AS0140AT	LM53600-Q1, TPS62261-Q1, LP5907-Q1
TIDA-00162 Multi-Cam	913A	OV10635	Connect up to 6 cameras (Order from Spectrum Digital)
TIDA-00421	913A	OV10640	TLV702 300, TPS62170
PMP10653	913A	OV10640	LM53603Q1
TIDA-00262	913A	AR0140AT	TPS3836E18-Q1, TPS62170-Q1
TIDA-00098	913A	AP0101AT	LM34919C, TPS62231
PMP9351	913	OV10635	STQ cable, LP399
IMI MiniCube Cameras	953, 933, 913A	OVT, OnSemi, Sony IMX390	Available at distributor Macnica
More 2MP, 7MP, & 8MP designs coming soon!			



Camera Modules — Order Online

D3 Engineering & IMI



D3 Engineering & IMI Online Store

- IMI MiniCube Cameras
- D3 Camera Modules
- RADAR Modules
- Automotive Development Kits
- Industrial Development Kits
- IMX390/290/224, OV10640/ISP, RADAR, & more!

Leopard Imaging

Leopard Imaging Online Store

- OmniVision OV10640+OV490, OV2775/10650
- OnSemi AR0231/0220/0820
- Sony IMX390/324/224/324
- Samsung 2G1

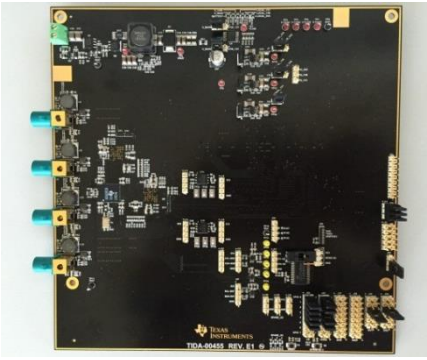
FPD-Link™ SerDes ECU Reference Designs & Demos

TDA Ruggedized Video Processor (RVP)

- Performs CMS, SVS, stereo cam, mono cam+ RADAR fusion, & other applications
- TDA3x or TDA2x +DS90UB960
- Supports Aptina, OVT, & Sony sensors
- Samples NOW
- Contact sales@D3Engineering.com

SoC/FPGA Partner Reference Designs

- TI TDA SoCs
- Mobileye: EyeQ3 & EyeQ4
- NVidia various platforms
- Qualcomm SnapDragon
- Intel various platforms
- Freescale/NXP: Contact Avnet China
- Renesas: SVS reference design available from Cogent Systems
- Altera: FMC adapter board available
- Xilinx: Contact Xylon/Logicbricks
- *Please contact partners for details*



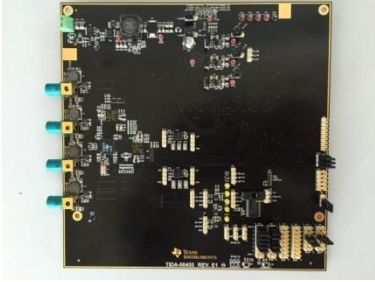
TIDA-00455 SVS Reference Design

- OV10640+DS90UB964+OV490
- TDA2xx processor
- ***TIDA-01323 DS90DB960 2MP version coming soon!***

TDA3x Automotive Low-Cost Starter Kit

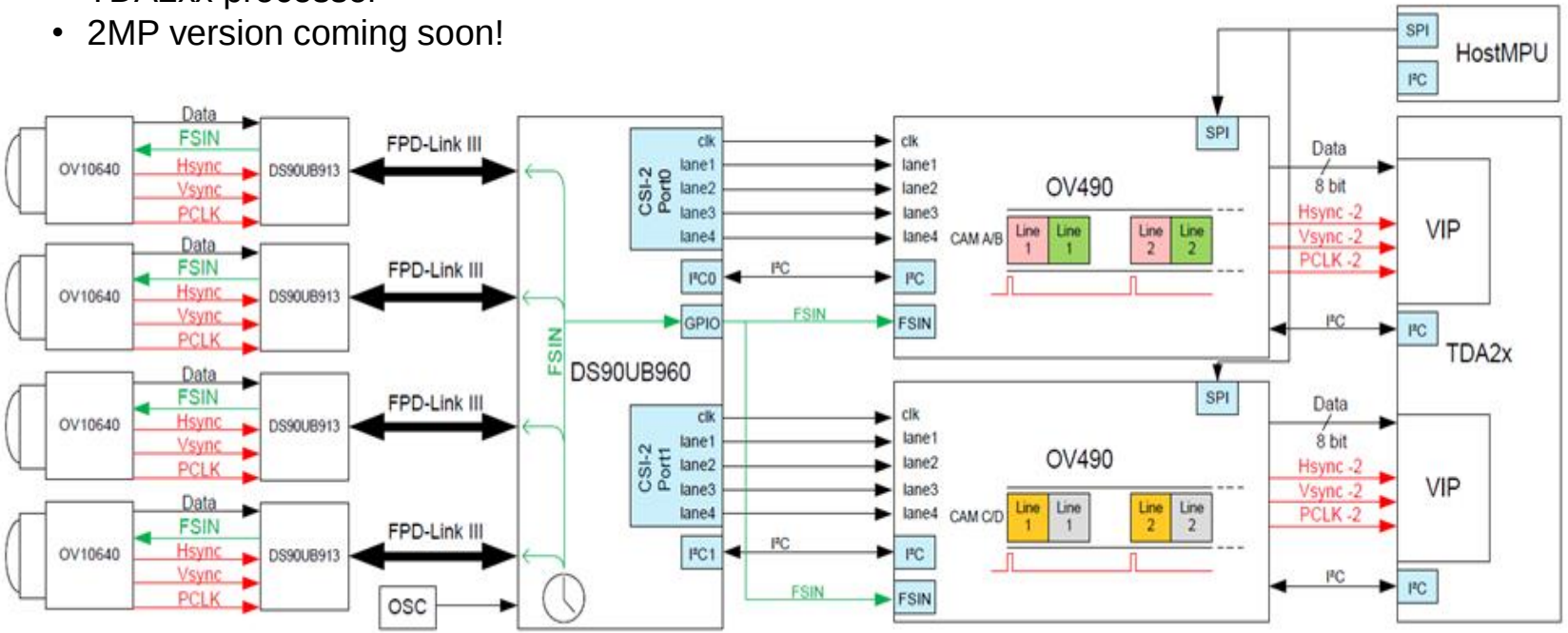
- Multiple sensor module options available
- TDA3xx processor
- Only $549

TIDA-000455 SVS Reference Design

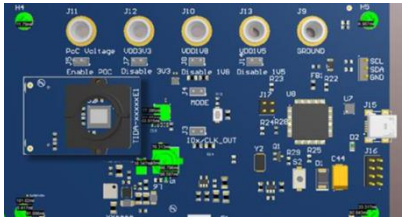


TIDA-00455 Surround View System (SVS) Reference Design

- OV10640+DS90UB964+OV490
- TDA2xx processor
- 2MP version coming soon!

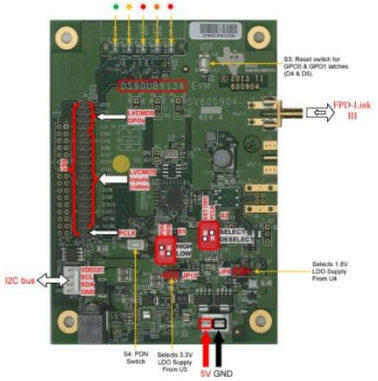


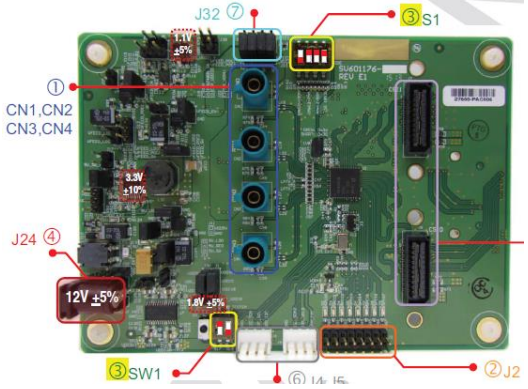
ADAS FPD-Link™ SerDes EVMs



DS90UB95x

- DS90UB953Q1-EVM
  - OV2775, OV10640, IMX290/390, IMX224, AR0231 & others, TI AR12xx RADAR
- DS90UB954Q1-EVM





DS90UB96x

- 960 and 964 versions
- Generic or TDA3x interface
- DS90UB964 available now
- DS90UB960 EVM available now through your local TI sales rep

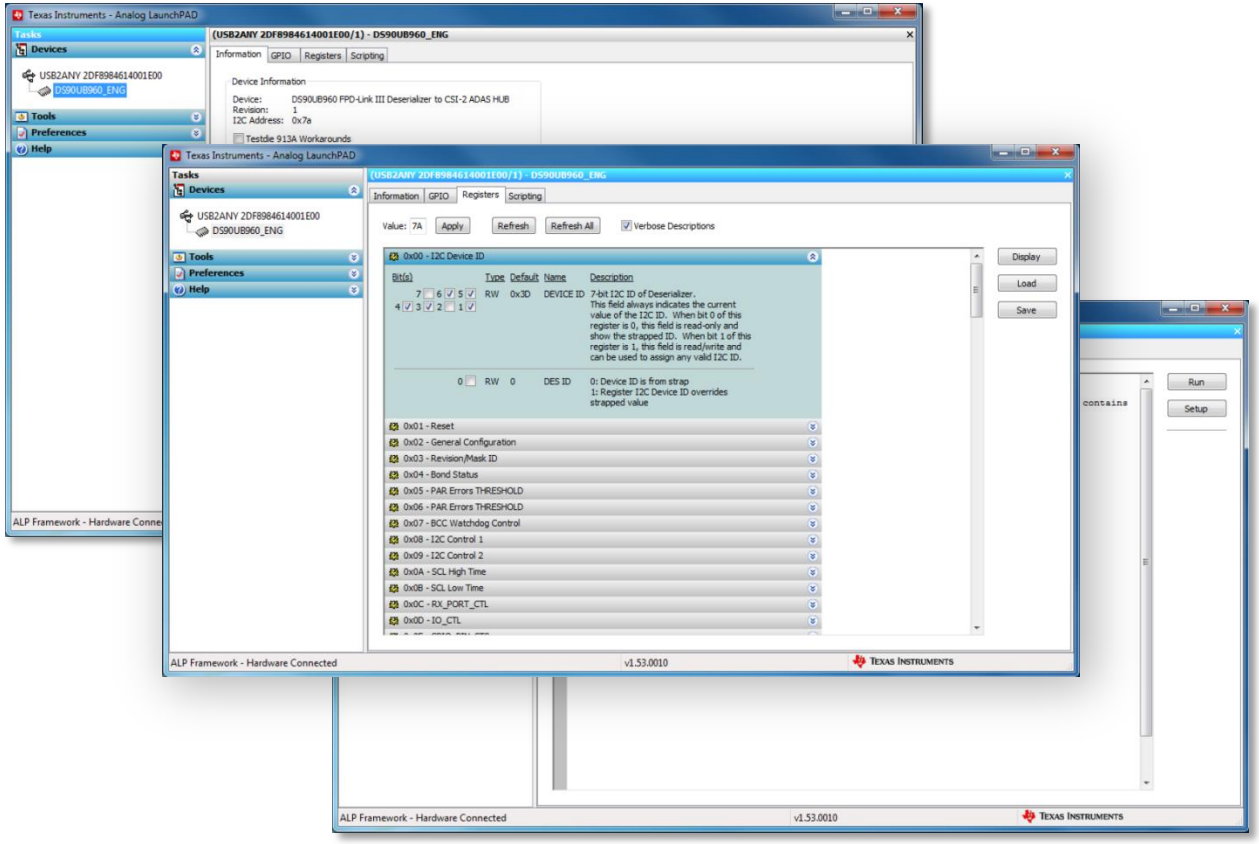
DS90UB91x

EVMs for Coax Cable:

- DS90UB933Q1-EVM
- DS90UB934Q1-EVM
- DS90UB913A-CXEVM
- DS90UB914A-CXEVM

EVM for Shielded Twisted Pair: serdesub-913ros

Analog LaunchPad (ALP) EVM GUI Software



Download ALP

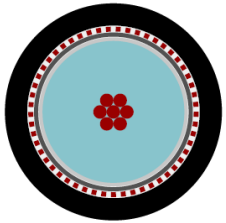
Video

Using ALP GUI to configure FPD-Link™ SerDes EVMs

Common Coax & STP Cables

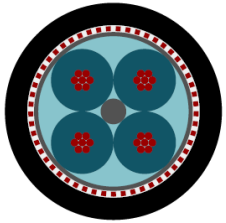
Coaxial Cable	G&G 102969	G&G 69337	Leoni Dacar 462	Leoni Dacar 300	Leoni Dacar 110	Leoni Dacar 310	Leoni Dacar 037-3	Leoni Dacar 302
Type	Low Loss	RG58 Low Loss	RG 174	RG 174	RG 58	RG 58	RG 58 Low Loss	Low Loss
Construction	Coax	Coax	Coax	Coax	Coax	Coax	Coax	Coax
Diameter (mm)	3.3	4.6	2.8	2.8	4.95	4.95	4.95	3.3
Flexibility	Static	Static	Dynamic	Dynamic	Static	Static	Static	Static
Bending Radius Single / Multiple (mm)	16 48	23 46	9 28	14 28	25 50	25 50	23 69	17 50
Insertion Loss per 100m @1GHz / @2GHz (dB)	60.1 90.2	42.45 72	88 128.6	91.9 135.5	60.4 92.7	60.4 92.7	37.6 56.6	48.9 70.5
Typical Connector(s)	FAKRA SF FAKRA 2	FAKRA 2	FAKRA SF FAKRA 2	FAKRA SF FAKRA 2	FAKRA 2	FAKRA 2	FAKRA 2	FAKRA SF FAKRA 2
Future Connector	Minicoax	–	Minicoax	Minicoax	–	–	–	Minicoax

Coaxial Cable



Shielded Twisted Quad (STQ) Cable	G&G 122239	Leoni Dacar 535	Leoni Dacar 535-2	Leoni Dacar 636	Leoni Dacar 636-2	Leoni Dacar 566
Type	STQ	STQ	STQ	STQ	STQ	STQ
Conductors (mm^2)	4 x 0.14	4 x 0.14	4 x 0.14	4 x 0.14	4 x 0.14	4 x 0.5
Diameter	4.6	4.6	4.6	4.6	4.6	6
Flexibility	Static	Static	Dynamic	Static	Dynamic	Static
Bending Radius Single / Multiple (mm)	14 46	14 46	14 20	14 46	14 40	20 50
Insertion Loss per 100m @500MHz / @1GHz (dB)	73.5 112.5	81 124	81 124	81 113	81 113	58 92
Typical Connector	HSD	HSD	HSD	HSD	HSD	HSD

STQ Cable



Source: MD ELEKTRONIK

MD ELEKTRONIK
MD-ELEKTRONIK.com/FPD-Link

FPD-Link™ Learning Center Videos Online

Visit the FPD-Link™ Learning Center!!

Training Subjects:

1. Introduction to FPD-Link SerDes
2. Diagnostic & Data Protection
3. FPD-Link Parameters & Transmission Channel
4. Power over Coax (PoC)
5. Interfaces
6. Tools

		Duration
1	**Introduction to FPD-Link SerDes**	
1.1	ADAS product portfolio overview	20:52
2.	**Diagnostic & Data Protection**	
2.1	Diagnostics status monitoring, data protection & built-in self-test (BIST)	20:17
3	**FPD-Link Parameters & Transmission Channel**	
3.1	High-speed serial link basics	18:16
3.2	Basic transmission parameters	8:05
3.3	Common connectors & cables for automotive applications	6:18
3.4	What you need to know about the transmission channel	16:36
3.5	Inline & common mode chokes - use & effect on the transmission channel	4:34
4	**Power over Coax (PoC)**	
4.1	Power over Coax (PoC) basics	5:15
4.2	Power over Coax (PoC) design	12:45
4.3	Power over Coax (PoC) evaluation	5:01
5	**Interfaces**	
5.1	Infotainment (IVI) back channel basics	10:44
5.2	FPD-Link IO interfaces: RGB, OLDI, HDMI, D-PHY/CSI, D-PHY/DSI	10:13
5.3	Bidirectional communication channel in FPD-Link ADAS products	13:48
5.4	ADAS serializer clocking modes	10:31
5.5	Advanced ADAS serializer clocking mode	19:12
6	**Tools**	
6.1	Use of Analog Launch Pad (ALP) GUI to configure the FPD-Link EVMs	16:37

Note: Subject to Change

ADAS FPD-Link™ SerDes Compatibility

Serializers		Deserializers/Hubs					
		914A	934	936	964/962	954	960
		Parallel CMOS Out		CSI-2 Out			
913A	Parallel CMOS	•	•	•	•	•	•
933		•	•	•	•	•	•
935	CSI-2	935 in 12-bit HF mode	935 in 12-bit HF mode	•	Use 960	•	•
953		953 in 12-bit HF mode	953 in 12-bit HF mode	Use 954	Use 960	•	•

PoC Filter & AC Coupling Compatibility

Serializer			Deserializer			Hub	
			914A	934	954/936	964/962	960
			Parallel CMOS Out	Par CMOS or CSI-2	CSI-2 Out		
			10/12-bit 100/75MHz	12-bit 100 MHz	1 port x 3.2 Gbps	2 ports x 6.4 Gbps	
913A	Parallel CMOS	10/12-bit 100/75MHz	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx
933		12-bit/100MHz	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx
953/935	CSI-2	up to 800Mbps per lane[1]	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 4G AC Cap: 15 - 47 nF & 33 - 100nF	PoC for 2G AC Cap: 100nF on Tx and Rx	PoC for 4G AC Cap: 15 - 47 nF & 33 - 100nF

[1] max CSI throughput must not exceed deserializer FPD3 data rate when in 28-bit mode.

PoC for 4G	**Return loss profile >10dB at 2.1GHz >25dB at 20MHz**	example: FB + FB + FB + (10uH // 4k)
PoC for 2G	**Return loss profile >10dB at 820MHz/1000MHz >25dB at 2MHz**	example: FB + FB + FB + (10uH // 4k) + (100uH // 4k)

*For a single 953 board to work with 954/960 and 914/934/964, choose PoC for 2G and AC caps as 100nF

Target Development Schedules

Milestone	DS90UB953 Serializer	DS90UB954 Deserializer	DS90UB960 Deserializer Hub	DS90UB964 Deserializer Hub
Product Preview Sheets	Available	Available	Available	Available
Alpha Samples*	Available	Available	Available	Available
Production intent samples**	Available	Available	Available	Available
AEC-Q100 / Full production	Available	Available	April 2018	Available

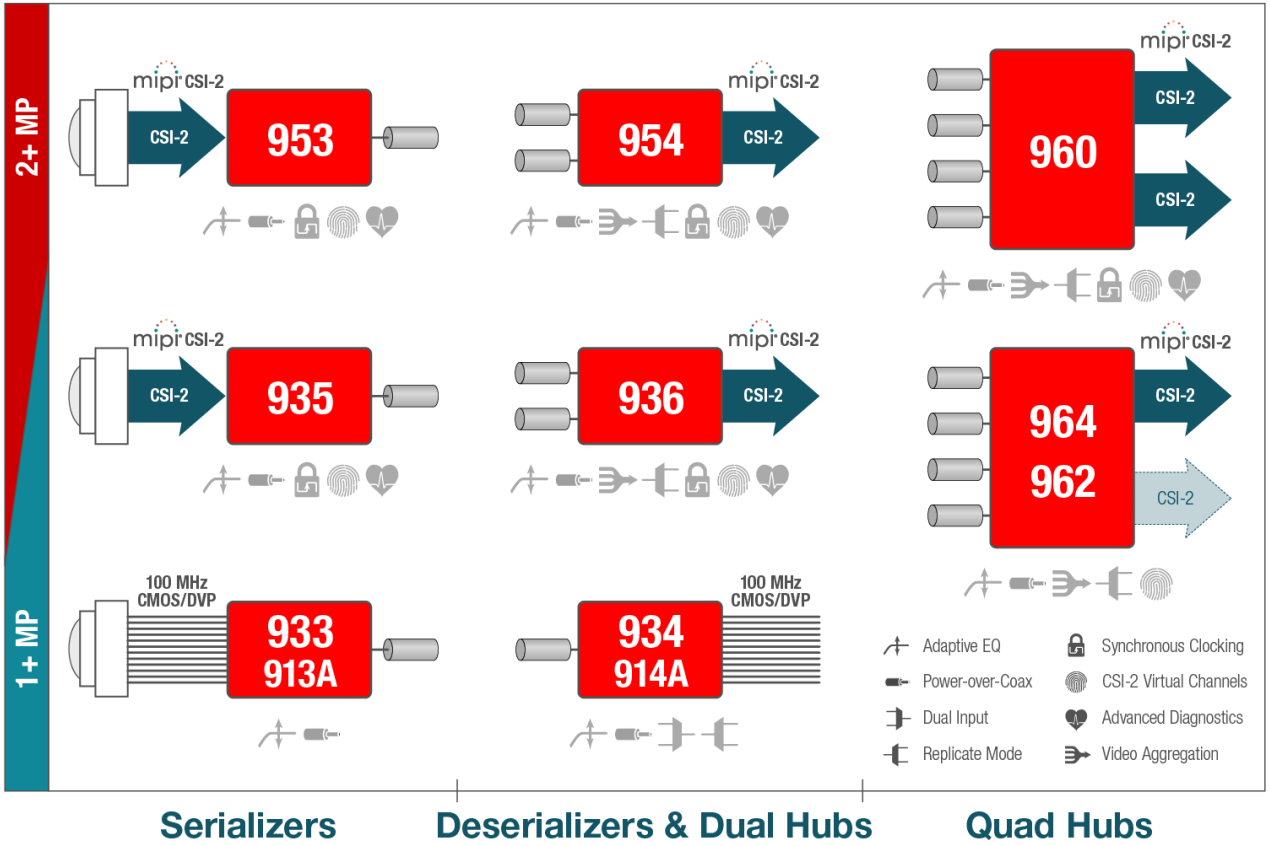
Milestone	DS90UB953A 115°C Ser	DS90UB962 Deserializer Hub	DS90UB935/6 Ser/Des
Product Preview Sheets	Mar 2018	Available	Available
Alpha Samples*	Mar 2018	Use 964 in interim	Use 953/4 in interim
Production intent samples**	Jun 2018	Apr 2018	Feb 2018
AEC-Q100 / Full production	Sep 2018	May 2018	Mar 2018

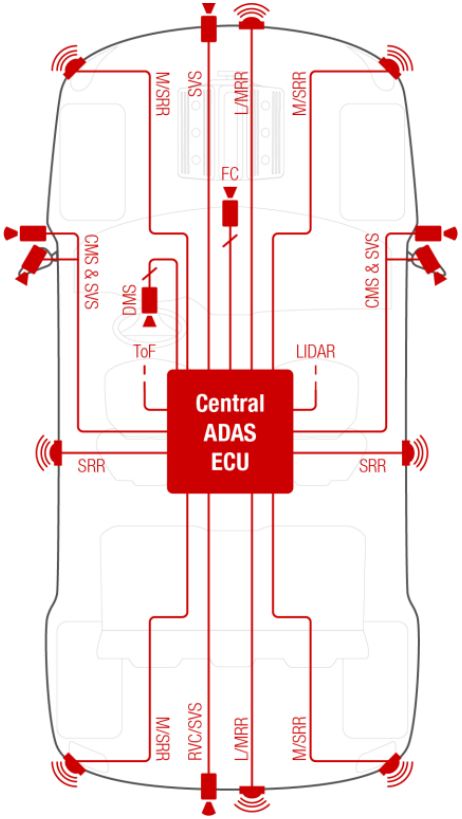
* SVB or EVMs & Preliminary Datasheets Available
** Pinout finalized

TI Confidential – NDA Restrictions

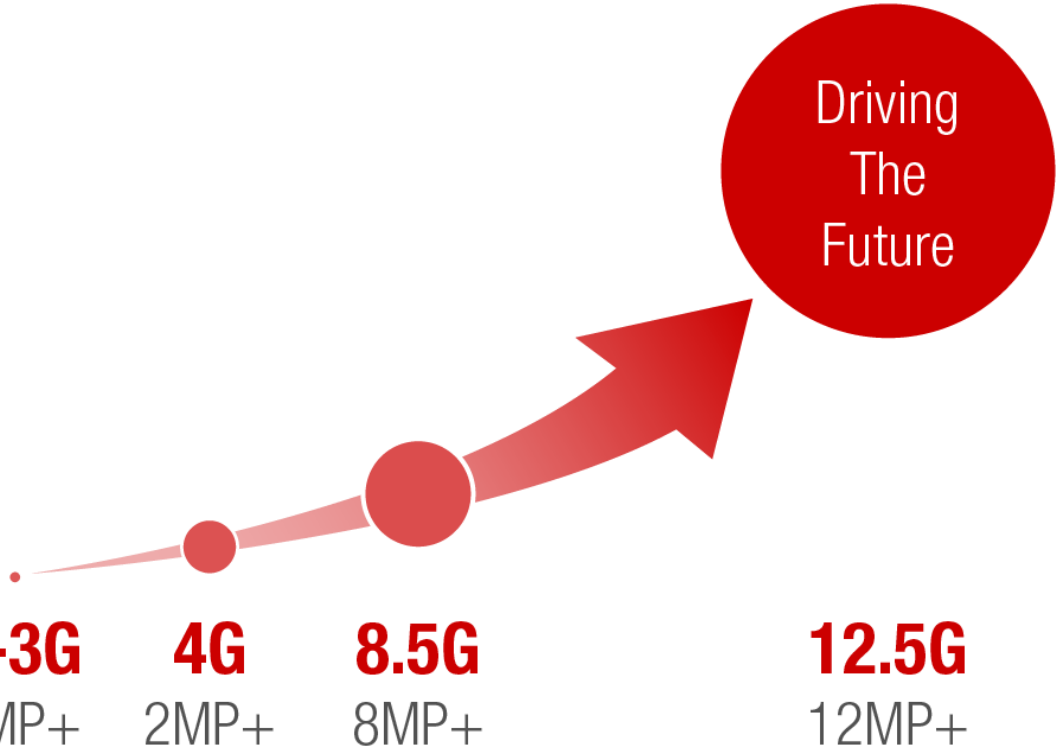
Note: Dates subject to change.

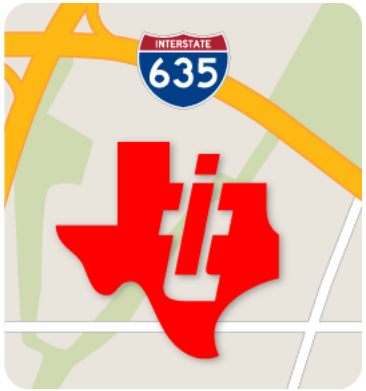
ADAS FPD-Link™ SerDes Portfolio





ADAS FPD-Link™ SerDes Roadmap





- 8.5 & 12.5 Gbps to support 8+MP imagers
- SerDes hub/repeater
- Multi-input-port CSI-2 serializer
- More diagnostic features

감사합니다!

Merci!

謝謝！

Questions?

Thank you!

ありがとうございます。！

Danke!

Gracias!