Multi-camera Systems with DS90UB960 Deserializer Hub and TDA Driver-assisted SoCs

Todd Toporski & Jelena Nikolic-Popovic
Automotive Field Applications
System-level use cases for DS90UB960 deserializer hub: Aggregation and replication
Traditional multi-camera system

- 4 individual ports into SoC
  - Physical channels
- 4-5 devices on the ECU PCB
- Sensor-side clocking
  - Susceptible to drift
Multi-camera system with DS90UB960

- A single port into SoC
  - Virtual channels
- 1 device on the ECU PCB
- ECU-side clocking mode
  - Synchronized clocking mode available
  - Sent across backchannel
  - Shared oscillator
Synchronous clocking & FrameSync mode

• Reference clock is provided by ‘960 and sent to serializer (‘953) via backchannel:
  – The serializer will re-lock onto the extracted back channel reference clock once available.
  – There is no need for local crystal oscillator at the sensor.
  – Send internally-generated frame sync via a backchannel GPIO to trigger simultaneous exposure across multiple sensors.

• Configuration:
  – ‘953: Select MODE pin=0 via strap voltage (see ‘953 datasheet, “Table 8. Strap Configuration Mode Select”)
  – ‘960: FS_CTL.FS_GEN_ENABLE = 1
Virtual channels

- Physical channels are interleaved on CSI-2 port as virtual channels.
- CSI-2 packets have a Virtual Channel IDentification (VC-ID) field to create distinct virtual data streams.
- Multi-input “hub” receiver remaps duplicate inbound virtual channels to unused VC-IDs so the ECU can distinguish packets correctly (changes CSI packet header).
- Configuration:
  - CSI_VC_MAP register, and RAWx_VC (default is FPDlink Rx Port number - 0,1,2,3)
Multi-camera system with DS90UB960 and cloning

- Use cases:
  - Dual-purpose camera processing (e.g., viewing vs analytics)
  - Data logging
- Configuration:
  - Replicate mode turn on, and enable the second CSI channel
Replication use case #1: View vs analyze

DS90UB960

- SerDes Port 0
- SerDes Port 1
- SerDes Port 2
- SerDes Port 3

CSI port 0

SoC 1
Analytics
e.g., Object Detection
with Deep Learning

SoC 2
(Viewing)

Display (optional)

Display
Replication use case #2: Data recording

DS90UB960
- SerDes Port 0
- SerDes Port 1
- SerDes Port 2
- SerDes Port 3

CSI port 0
CSI Port 1

SoC 1
(real-time processing)

Display (optional)

De-serialize

Store for off-line processing

Reserialize