FOR ENERGY EFFICIENT INNOVATIONS

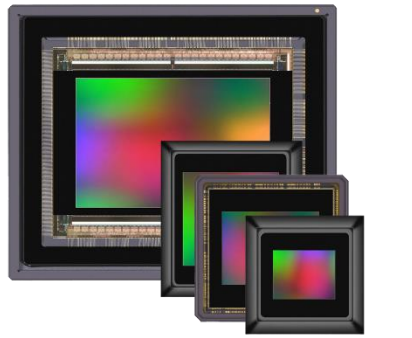
THINK ON.

www.onsemi.com

XGS Tools for Camera Developers

Public Information

XGS Image Sensor Family



Integrated portfolio of high performance, low noise image sensors

- High bandwidth, lower power architecture
- True global shutter
- Industry-leading image quality
- Resolutions up to 45 Mp
- One camera design supports multiple resolutions and configurations

General Purpose Machine Vision

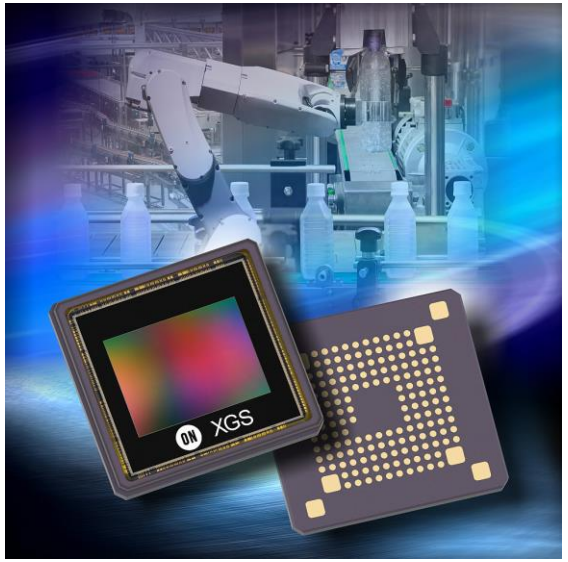
ITS

Broadcast

Key take aways XGS product family

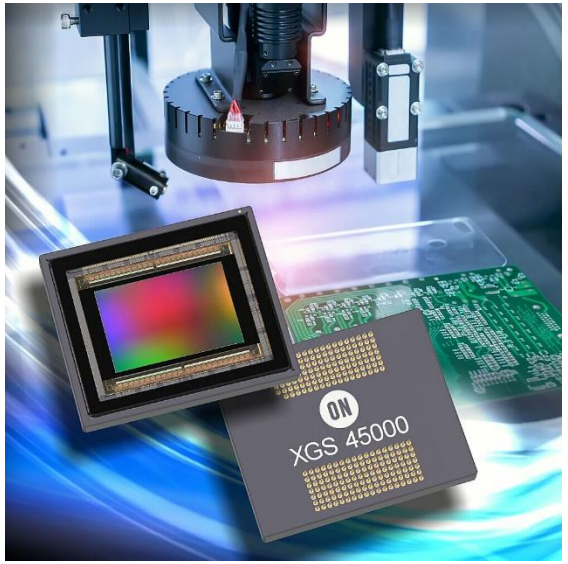
Aggressive price settings:

- Exceeds market expectations
- No price differentiation between color and monochrome devices
- Pretty flat price curve, limited volume dependency

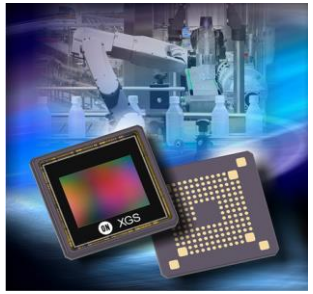


Value proposition:

- Family concept: one footprint supports all resolutions from 2Mp up to 16Mp, while a second footprint supports a 20Mp up to a 45Mp solution
- All XGS family member have the same ‘look and feel’ (IP reuse)
- High degree of footprint compatibility
- Better than ‘state of the art’ power dissipation
- 29x29mm2 camera format compatible (XGS 2000 – XGS 16000)
- Dedicated versions available for the ITS market segments, having an optimized CRA to reduce roll-off in the sensor corners



XGS Global Shutter Product Summary

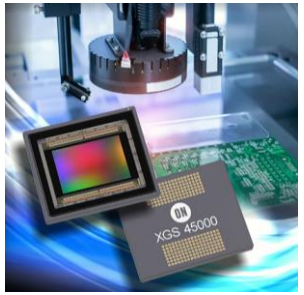


Aggressive price settings:

- Exceeds market expectations, beats competition
- No price differentiation between color and monochrome devices
- Pretty flat price curve, limited volume dependency

Value proposition:

- Excellent image quality, artifact/pattern free raw images
- Family concept: one footprint supports all resolutions from 2Mp up to 16Mp, while a second footprint supports a 20Mp up to a 45Mp solution
- All XGS family member have the same 'look and feel' (IP reuse)
- Better than 'state of the art' power dissipation
- 29x29mm2 camera format compatible (XGS 2000 – XGS 16000)
- Dedicated versions available for the ITS markets, incl. optimized CRA to reduce roll-off



29 x 29 mm² compatible, one single foot print, fully pin compatible

One single foot print, fully pin compatible

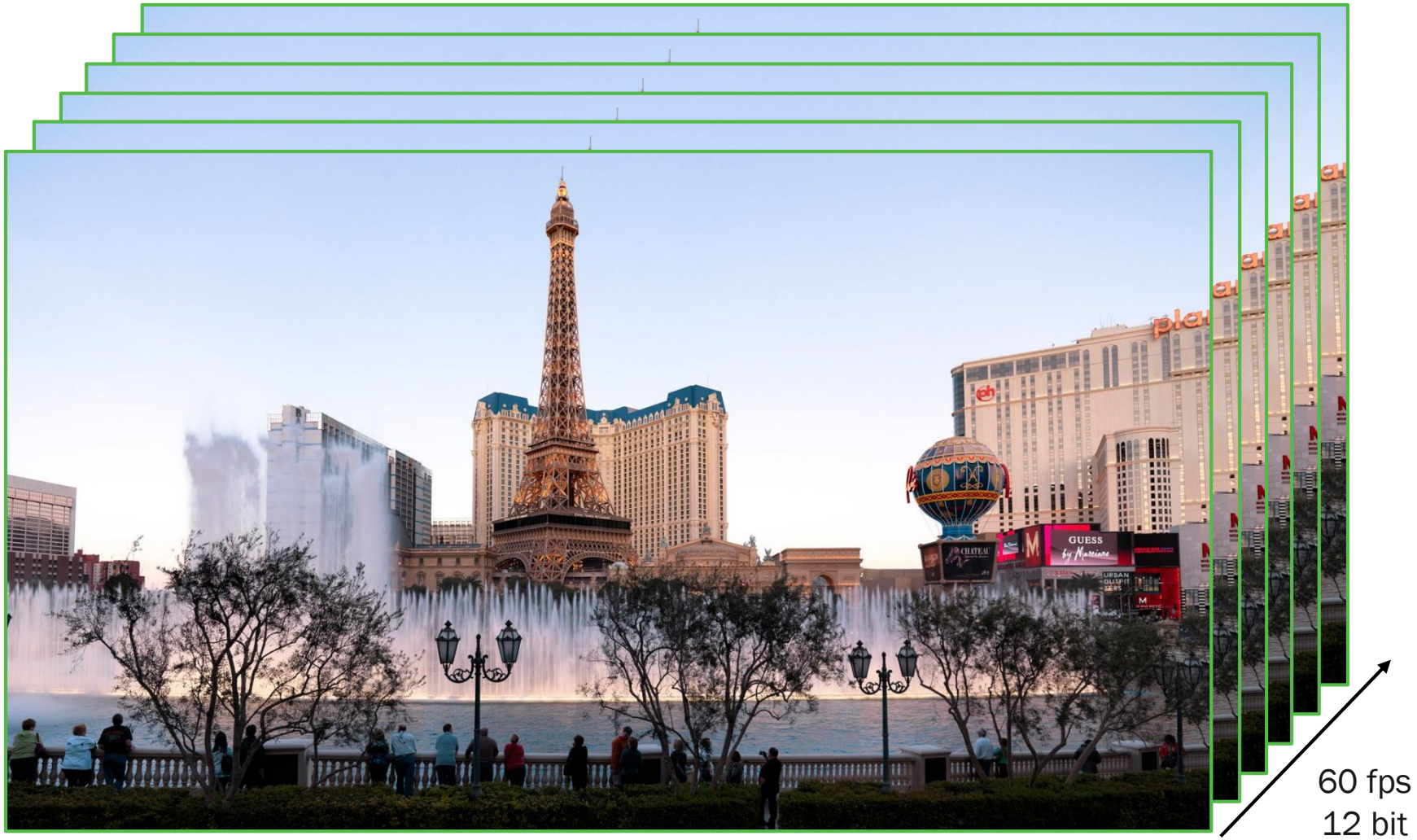
	XGS 2000	XGS 3000	XGS 5000	XGS 8000	XGS 9400	XGS 12000	XGS 16000	XGS 20000	XGS 30000	XGS 32000	XGS 45000
Resolution (x,y)	1920 x 1200	2048 x 1536	2592 x 2048	4096 x 2160	3072 x 3072	4096 x 3072	4000 x 4000	4500 x 4500	5460 x 5460	6580 x 4935	8192 x 5460
Resolution (Mp)	2.3	3.1	5.3	8.8	9.4	12.6	16.0	20	30	32	45
Imaging Diagonal (mm)	7.3	8.2	10.6	14.8	13.9	16.4	18,1	20.4 mm	24.9 mm	26.3 mm	31.6 mm
Optical Format	1/2.2	1/2	2/3	1/1.1	1/1.2	1	1.1"	4/3"	~ APS-C	APS-C	Super 35mm
Max Frame Rate (12 bit)	220	175	132 & 43	128 & 80	90 & 56	90 & 28	65 & 42 & 21	57 & 38	47 & 30	53 & 35	47 & 30 & 15
CRA Options	0 degree	4.7 degree	0/4.7 degree	0/7.3 degree	0 degree	0/7.3 degree	0 degree	10 degree			
Speed Grade	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Evaluation Kit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

8k video with 60 fps, 12-bit output

8K
7680 x 4320

XGS 45000

HDR mode available at 30 fps
(+6dB DR)



60 fps
12 bit

XGS Tools Overview

Demo Kit

- Demo3 hardware platform with DevWare software
- Full sensor evaluation, with access to all register settings
- Initial evaluation of performance

X-Celerator

- Direct interface to standard FPGA development environments (Xilinx, Altera)
- Max imager lanes/fps enabled
- Public FPGA code (no SLA required)

X-Cube

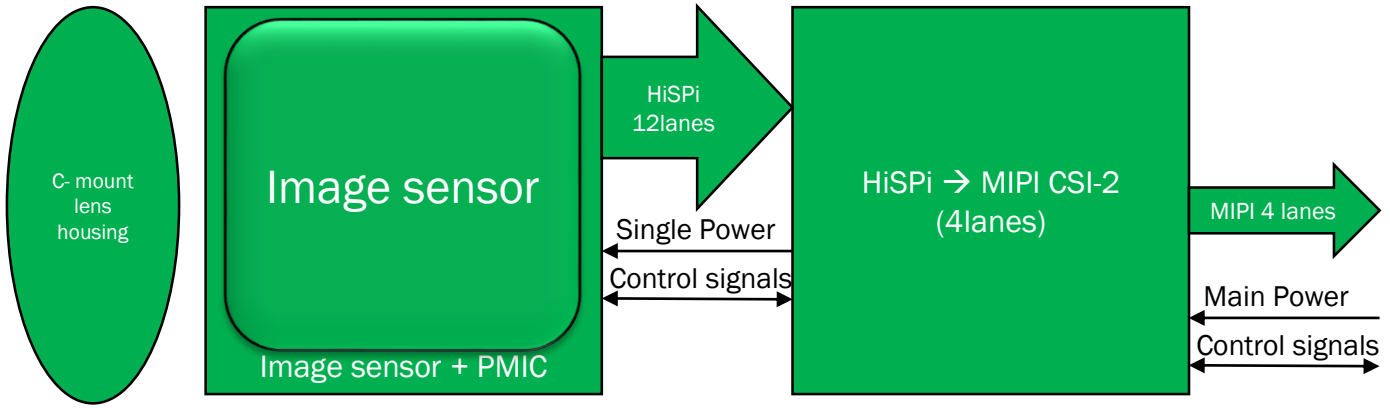
- Full 29 x 29 mm^2 reference design for XGS 16000 and smaller
- HiSPi-to-MIPI conversion via Lattice FPGA
- Image capture, processing, and analysis via DevWare

X-Cube – XGS Reference Design

What is X-Cube?

- Reference design for machine vision applications
- Conforms to the machine vision industry standard 29 x 29 mm form factor
- Single design supports XGS sensors up to 16 MP (XGS 16000)
- C-Mount Lens Housing
- MIPI CSI-2 image data output format
- All design files available for customer to use/modify
- Available for both Monochrome and Color sensors

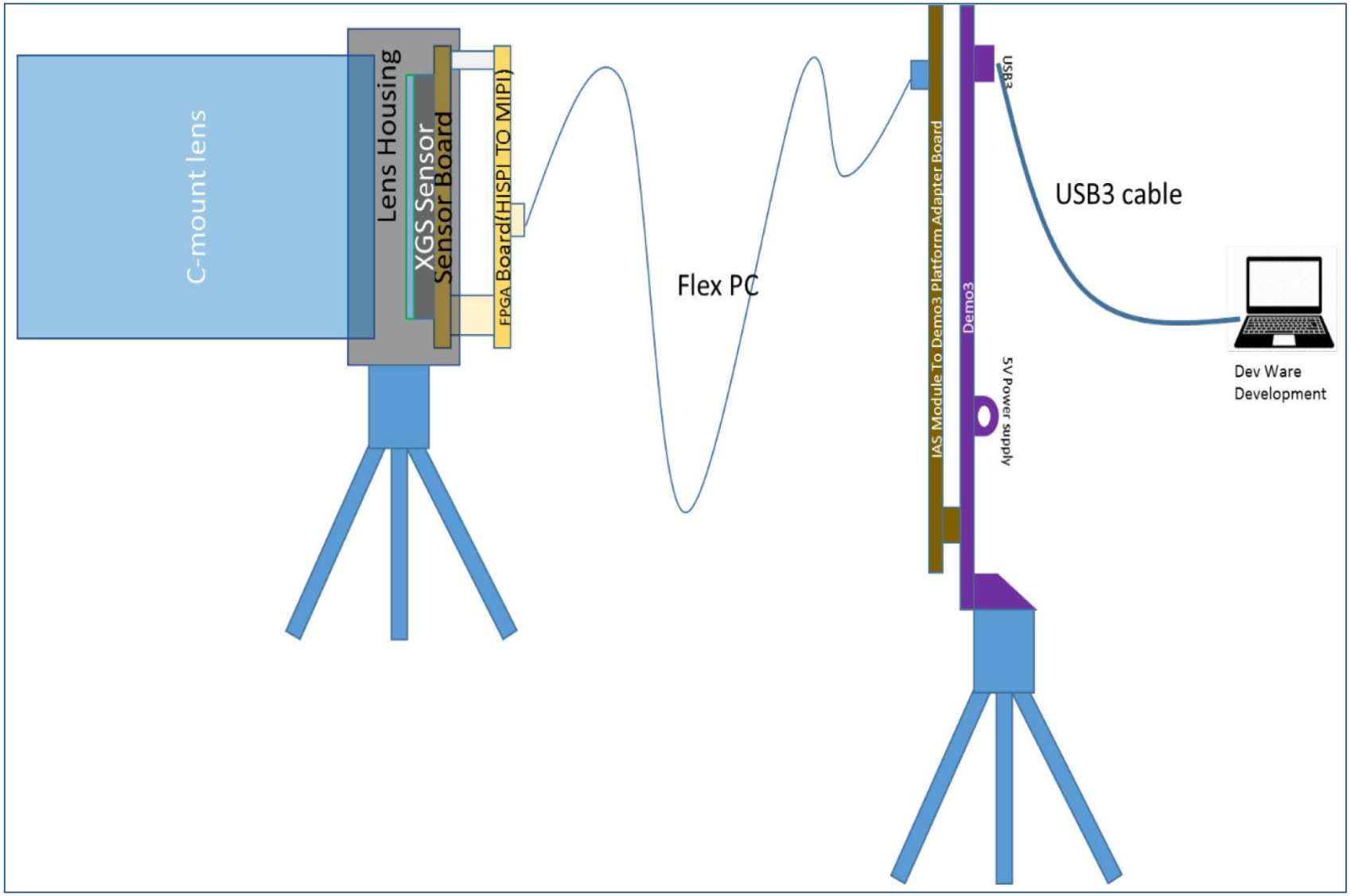
X-Cube - Features



- C-Mount Lens Housing
- XGS Imager Board
  - 12 lanes Implementation
  - Master/Slave modes
  - Single +5V Power supply input
  - PMIC generates all power supplies necessary for imager
  - Noise performance similar to DemoKit
- HiSPi-to-MIPI Converter Board
  - Lattice FPGA
  - 12 lane HiSPi Packetized-SP Mode image data input
  - 4 lane MIPI CSI-2 image data output (1.2Gbps)
  - Operates at up to 30fps (12MP resolution)
    - NOTE: When using the Demo3 board, the frame rate is limited to 20fps due to max data rate of 768 Mbps MIPI receivers on the Demo3 board

X-Cube – Set Up

- FLEX PCB output cable provides interface to IAS Adapter Board
- X-Cube version IAS Adapter Board allows connection to the Demo3 environment
- Supported in DevWare for image capture, display, and analysis



X-Cube - Support

- Documentation: Publicly available
  - X-Cube Developer Guide
  - XGS Imager Board Datasheet
  - HiSPi-to-MIPI Converter Board Datasheet

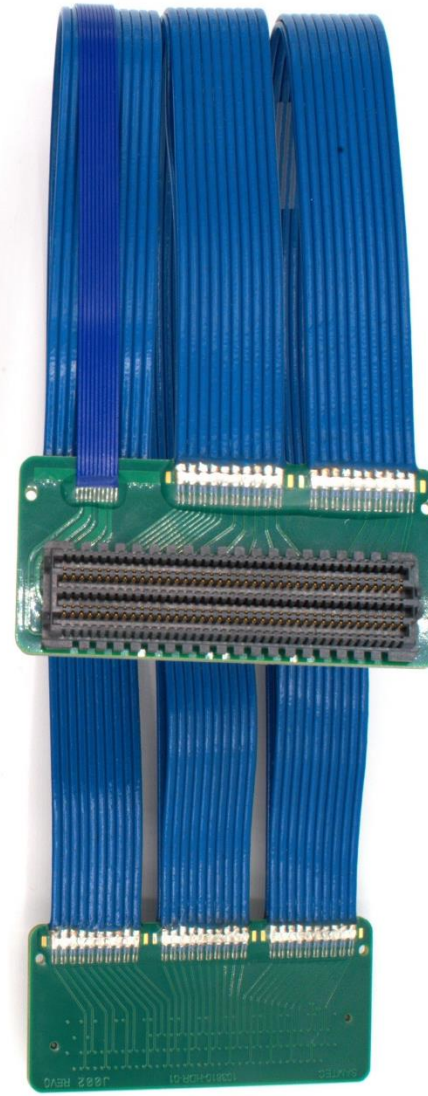
- Design files: Available under NDA
  - Schematics
  - PCB Layout
  - Lens mount CAD
  - Lattice FPGA programming file (.bin)

- Development Tools: X-Cube supported in DevWare
  - Demo using standard Demo3 Board interface
  - Use X-Cube-to-Demo3 IAS Adapter Board

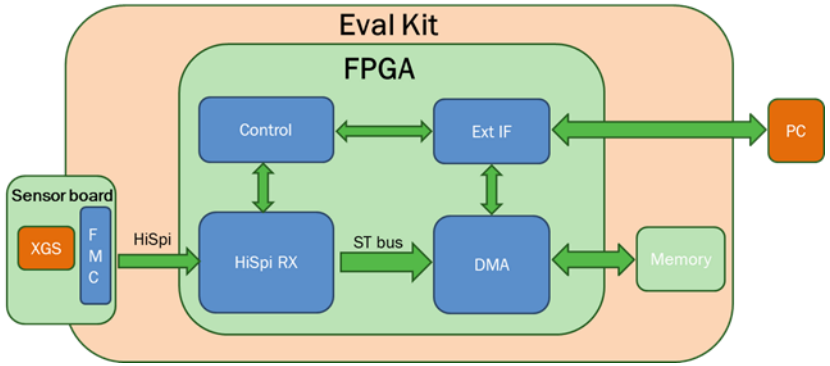
X-Celerator – FPGA Development Tool

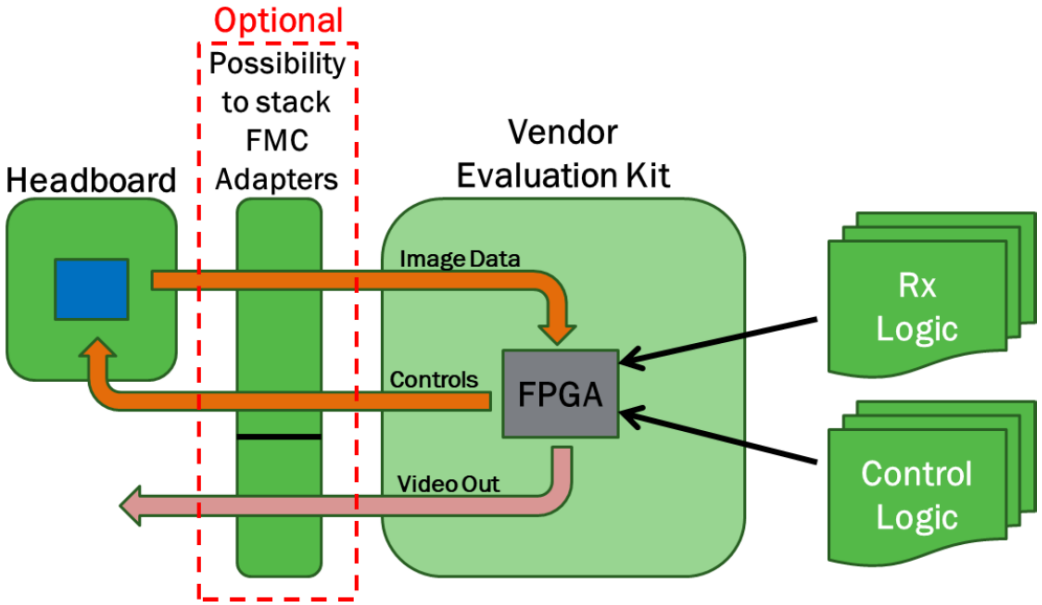
What is X-Celerator?

- Developer kit to enable FPGA development
- XGS sensor integrated on VITA 57.1 FPGA Mezzanine Card (FMC)
- C-Mount lens housing
- Tripod configuration option with FMC cable connector
- Modular RTL IP core blocks, customizable for different solutions
- All design files available for customers to use/modify
- Available for Mono and Color sensor



X-Celerator - Features





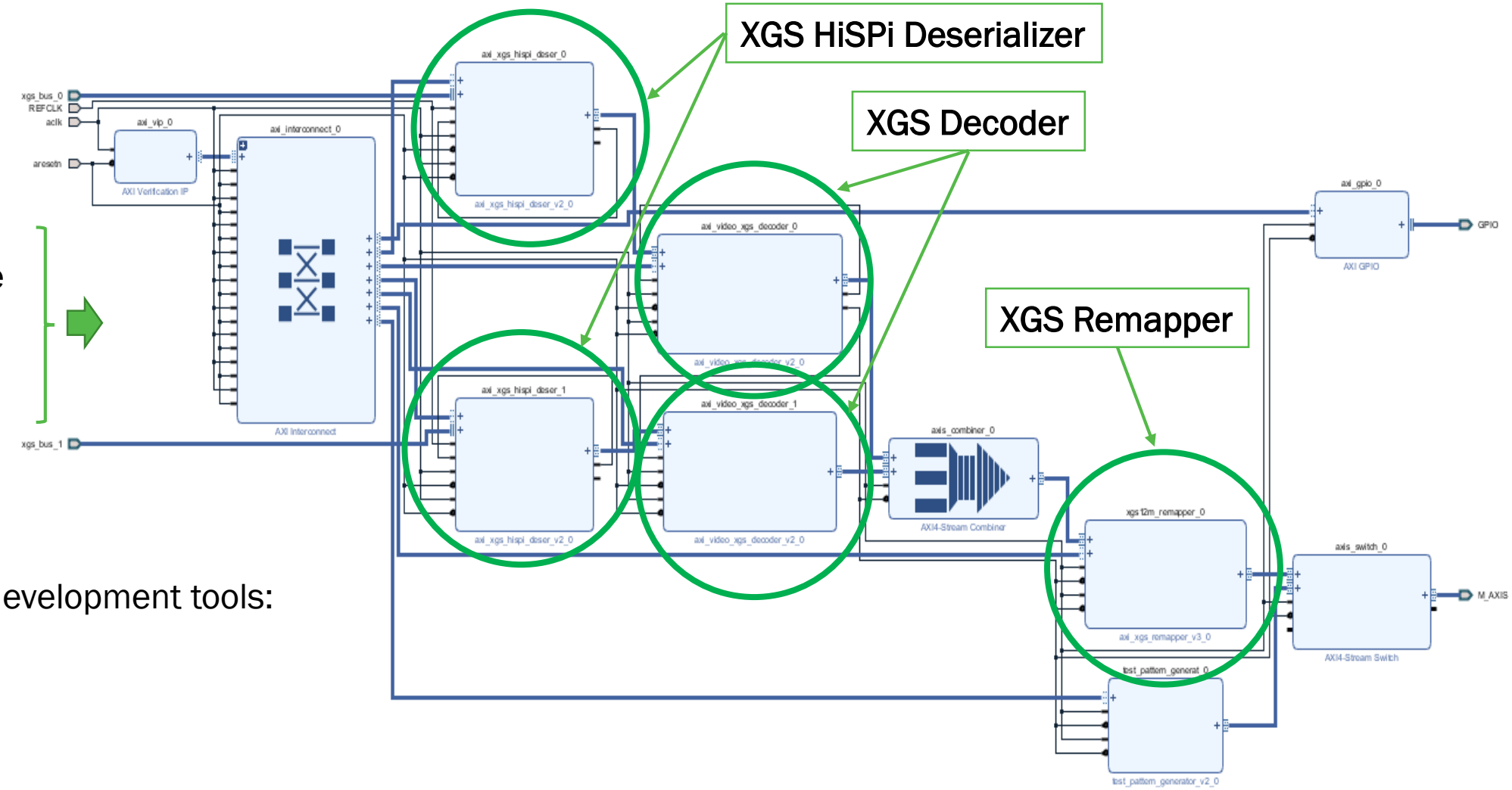
- C-Mount Lens Housing

- XGS 12000 Imager Headboard
  - 24 lanes (full speed) implementation
  - Master/Slave modes
  - Single +5V Power supply input
  - PMIC generates all necessary power supplies
  - HPC or LPC FMC connection

- RTL IP Core Block Architecture for AXI-Stream Interface
  - 3 different RTL IP core blocks:
    1. XGS HiSPi Deserializer
    2. XGS Decoder
    3. XGS Remapper
  - Xilinx Kintex UltraScale example implementation available for Vivado 2018.2

X-Celerator - Development Tools

TCL file to generate a block diagram example for XGS 12000 in the Xilinx Kintex UltraScale architecture

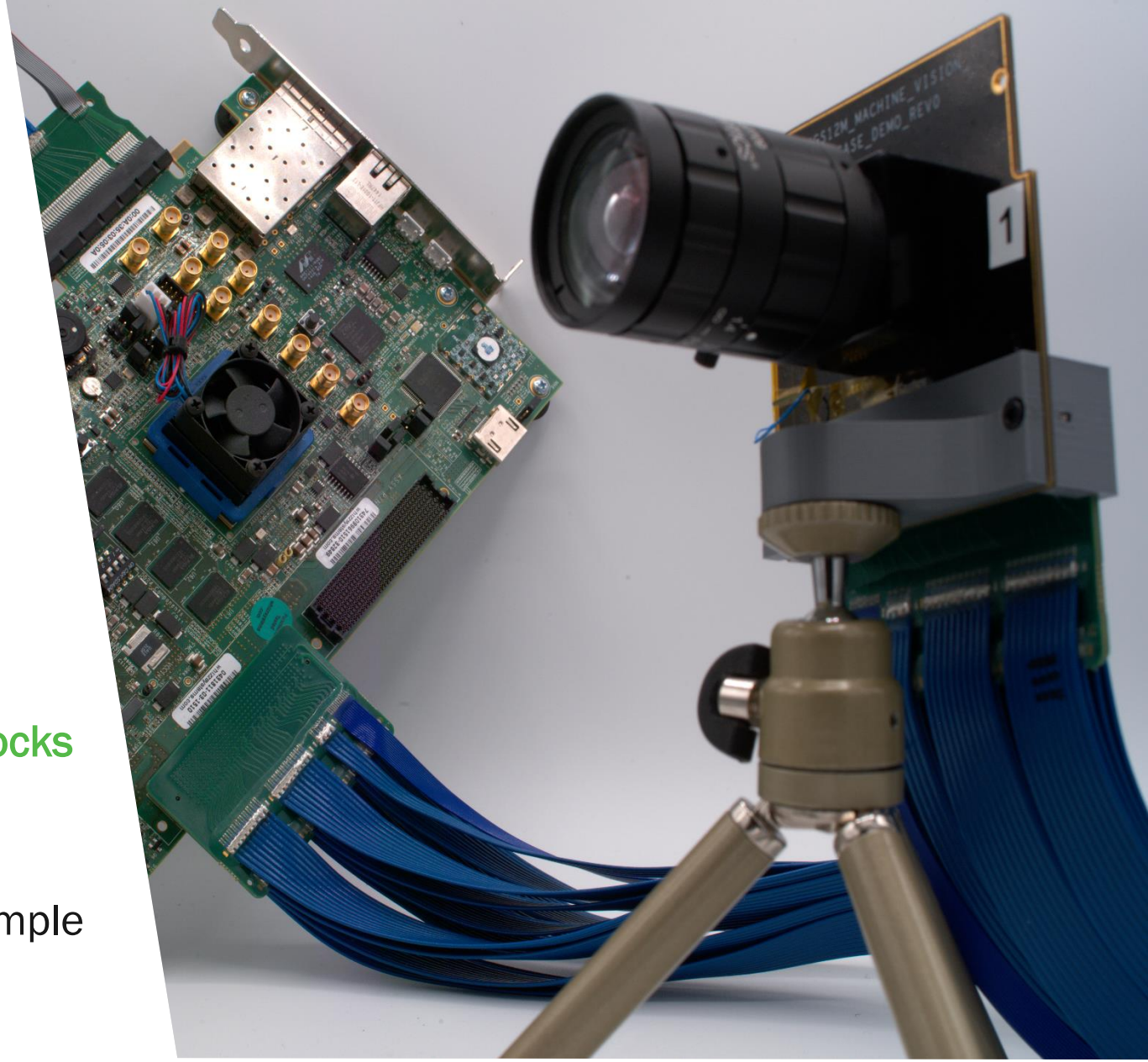


Vendor specific FPGA development tools:

- Vivado
- Quartus
- ...

X-Celerator - Support

- Documentation: Publicly available
  - X-Celerator Evaluation Board User Manual
- Design files: Available under NDA
  - Schematics
  - PCB Layout
  - Lens Mount + Tripod Mount Design files
  - RTL IP Core Blocks
- Development Tools: X-Celerator HW & IP Core Blocks
  - Devware demo support
  - Vendor FPGA environment IDEs
  - Xilinx Kintex UltraScale XGS 12000 RTL Example



X-Cube and X-Celerator - Documentation

- X-Cube Developer Guide

https://www.onsemi.com/pub/Collateral/AND9891-D.PDF

- X-Cube XGS Imager Board User Manual

https://www.onsemi.com/pub/Collateral/EVBUM2636-D.PDF

- X-Cube HiSPi-to-MIPI Converter Board User Manual

https://www.onsemi.com/pub/Collateral/EVBUM2635-D.PDF

- X-Celerator Evaluation Board User Manual

https://www.onsemi.com/pub/Collateral/EVBUM2747-D.PDF