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
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

<table>
<thead>
<tr>
<th>Resolution (x,y)</th>
<th>XGS 2000</th>
<th>XGS 3000</th>
<th>XGS 5000</th>
<th>XGS 8000</th>
<th>XGS 9400</th>
<th>XGS 12000</th>
<th>XGS 16000</th>
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<tbody>
<tr>
<td>Resolution (Mp)</td>
<td>2.3</td>
<td>3.1</td>
<td>5.3</td>
<td>8.8</td>
<td>9.4</td>
<td>12.6</td>
<td>16.0</td>
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<tr>
<td>Imaging Diagonal (mm)</td>
<td>7.3</td>
<td>8.2</td>
<td>10.6</td>
<td>14.8</td>
<td>13.9</td>
<td>16.4</td>
<td>18.1</td>
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<td>Optical Format</td>
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<td>1/2</td>
<td>2/3</td>
<td>1/1.1</td>
<td>1/1.2</td>
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<td>1.1&quot;</td>
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<tr>
<td>Max Frame Rate (12 bit)</td>
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<td>175</td>
<td>132 &amp; 43</td>
<td>128 &amp; 80</td>
<td>90 &amp; 56</td>
<td>90 &amp; 28</td>
<td>65 &amp; 42 &amp; 21</td>
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<td>0/7.3 degree</td>
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<td>Speed Grade</td>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
</tbody>
</table>
8k video with 60 fps, 12-bit output

8K
7680 x 4320

XGS 45000

8k Video Crop

HDR mode available at 30 fps (+6dB DR)
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 mm² 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
TCL file to generate a block diagram example for XGS 12000 in the Xilinx Kintex UltraScale architecture

Vendor specific FPGA development tools:
- Vivado
- Quartus
- ...

XGS HiSi Deserializer
XGS Decoder
XGS Remapper
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