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From simple drivers to complete systems.  
From prototype to series.

**High-end electronics solutions for your business.**

Our customers are innovators of the automotive, medical, broadcast and industrial sectors. For them, we develop custom-made high-end solutions in embedded electronic engineering beyond industrial standards.

Building on many years of experience, the know-how of our highly qualified and specialized engineers and technicians and our tireless pursuit of innovation, we constantly develop cutting-edge products. They include systems and modules composed of hardware, software and mechanical components and they offer solutions in the fields of highly integrated electronics and high-speed processor assemblies with complex user interfaces and programmable logic.

This catalog is divided into two parts: A listing of our market-ready products, available off the shelf, and an overview of our embedded solutions that our engineers can use as building blocks for your systems. Please do not hesitate to contact us if you have any questions. We look forward to providing the solution to your challenge.

**Solectrix – Innovative thinking in embedded electronic engineering at the highest level.**
Automotive

With modern cars incorporating more electronics every day, Advanced Driver Assistance Systems offer increasingly advanced applications for imaging systems.

From digital rear-view mirrors to advanced driver assistance systems with features like pedestrian detection: Modern car design increasingly relies on electronics for safety. Our experience working on such applications also extends to the hardware-in-the-loop systems needed during the verification and qualification phases.

- ADAS camera systems
- Video and data capturing
- HDR imaging
- Hardware-in-the-loop systems

Medical

With human lives at stake, medical applications leave no room for error.

Whether it’s the required real-time reaction to some critical event, impeccable measurement results from lab devices or reliably flawless images of surgery in progress, we deliver the results required to meet the medical market’s tough regulatory standards.

- Handheld diagnostic systems
- Medical device development
- 2D and 3D medical imaging
- Documented development processes
Whether it’s TV productions, live broadcasts or movies for the big screen: the quality demanded from digital imaging solutions is constantly increasing. 4K resolution, stereoscopic 3D, direct recording to formats like DNxHD and ProRes or the streaming of uncompressed video data over distances up to 180 meters: these are just a few of the challenges we have gladly accepted in past years. Our image processing, streaming and recording solutions satisfy even the most demanding filmmakers today and tomorrow.

**MARKETS**

**Broadcast**

- Camera development
- Sensor control
- Image processing
- Image compression and storage

**Industrial**

- Base board design
- Industrial control units
- Laser control units

Our experience with digital imaging and advanced pattern recognition algorithms can also be applied to industrial automation. Other industrial applications we have worked on include the control of potentially dangerous devices like lasers or heavy machinery where safe operation is paramount, leading to tough requirements for the embedded electronics.
Introducing the modular SX proFRAME system

The SX proFRAME system builds on years of experience developing Hardware-in-the-Loop (HiL) systems for safety-critical automotive applications. Its modular approach building on the flexibility of a powerful FPGA core provides the perfectly matched high-end solution for your HiL needs and is ideal for rapid prototyping. Use the SX proFRAME system for Man-in-the-Middle logging or develop your image processing algorithms on our universal system using data processing frameworks like OpenCV or CUDA before implementing them in your customized embedded control unit (ECU).

The unique range of our camera adapters allows you to connect nearly all types of automotive cameras.

Adapters for other camera models or other types of data (e.g., GigE Vision, Camera Link, HD-SDI, CAN ...) are available on request.

A typical system consists of an SX proFRAME base board equipped with multiple camera adapters for up to four cameras or ECUs. The base board is installed in a standard Windows or Linux-based host PC or a CompactPCI Serial system with the respective Solectrix software libraries and a customer-specific application. The SX proFRAME SYNC adapters enable synchronization of multiple base boards and the use of external trigger sources or receivers, e.g., for the synchronization of other in-car sensors like LiDAR.

Applications

- Hardware-in-the-Loop systems (HiL)
- Surround view camera systems
- Development, diagnostics and validation of Advanced Driver Assistance Systems (ADAS)
- R&D platform for IP module development (rapid prototyping)
SX proFRAME features and advantages

+ Base board in PCI Express or CompactPCI Serial form
+ Linux and Windows supported
+ Xilinx Artix-7 FPGA (PCIe) or Zynq UltraScale+ ZU4CG MPSoC (CompactPCI Serial)
+ Real-time processing of large amounts of data independent from other hardware requirements
+ Prepared for customer or Solectrix IP plugins
+ In-system-programming of FPGA logic for different operating modes
+ High-performance DMA engine for data transfers from/to host
+ Timestamp-based recording and playback/streaming of RAW video data
+ Recording of I²C messages between ECU and camera
+ ECU-independent I²C messaging to camera
+ Handling of a large number of data sources or targets (multiple ECUs) simultaneously
+ Synchronization of multiple cameras per base board
+ Synchronization of multiple base boards
+ Support for broadcast and nearly all types of automotive cameras via various adapters
+ Host-independent adapter management via internal softcore CPU
+ Quick integration of the latest camera models
+ Programmable pixel clock
**SX proFRAME**

Simplified example setup with a PCIe base board for two cameras and one ECU

- Support for a wide range of automotive and broadcast cameras
- More adapter types (e.g., HD-SDI, GigE Vision, Camera Link, CAN ...) available on request
- Short development time due to standardized interfaces
+ FPGA-based processing platform: Xilinx Artix-7 or Zynq UltraScale+ ZU4CG
+ FPGA with customer or Solectrix imaging IP for real-time processing of incoming data
+ Flexible system core for easy customization: Connect multiple adapters per base board!

Host PC with PCI Express or CompactPCI Serial system

Windows or Linux PC or CompactPCI Serial system running customer application with SX proFRAME software libraries
SX proFRAME 3.0
The new proFRAME base boards in CompactPCI Serial and PCIe form

SX proFRAME Base Board 3.0
CompactPCI Serial

The third generation of SX proFRAME base boards debuts in CompactPCI Serial form, offering four times the data rates of its predecessor to support state-of-the-art automotive cameras.

The new SX proFRAME Base Board is built around a Xilinx Zynq UltraScale+ ZU4CG MPSoC, enabling increased data transfer rates of up to 40 Gbit/s for each of its new-type camera adapter interfaces.

The corresponding SX camAD3 adapter modules take advantage of this, offering up to four camera inputs or outputs on a single adapter. proFRAME 3.0 adapters using GMSL2, GMSL3, FPD-Link III and FPD-Link IV (de)serializers are available or currently in development.

+ 2x SX camera adapter 3.0 interfaces, each max. 40 Gbit/s video data interface  
  • 4x CSI-2 interfaces 4 lanes each up to 2.5 Gbit/s.  
    Total 40 Gbit/s or  
  • 23x LVDS data lanes each up to 1.6 Gbit/s.  
    Total 36.8 Gbit/s  
  • 1x I²C interface to serializer and deserializer chips  
  • 1x I²C interface to internal devices  
    (e.g., EEPROM, interface FPGAs, PoC pot, …)  
  • 1x SPI interface to serializer and deserializer chips  
  • 5 to 24V supply for Power over Coax (PoC)  
  • FSYNC trigger, interrupt, reference clock and other GPIO signals

+ PCIe x8 Gen3 interface (64 Gbit/s) to CompactPCI Serial backplane
+ Xilinx Zynq UltraScale+ ZU4CG MPSoC (FBVB900)
+ 2 GB DDR4 of PS (processing system) memory, up to 150 Gbit/s
+ CompactPCI Serial 3U form factor
+ Temperature range: -20 to +85 °C

Art. No. 500911
SX camAD3 DUAL MAX9296A
Only for SX proFRAME 3.0 Base Boards
+ 2× Maxim MAX9296A deserializer
+ 4× camera input on Rosenberger FAKRA connectors
  Power over Coax (PoC), 5 to 24 V, 300 mA, external supply for PoC voltage supported
+ 4 CSI-2 interfaces to base board
+ Lattice MachXO3 management FPGA
+ Lock/Error status LEDs
+ Reference clock synchronization from base board
+ FSYNC trigger synchronization from base board

Adapters planned:
+ GMSL2: Maxim MAX9295A/MAX9296A
+ GMSL3: Maxim MAX967xx
+ FPD-Link III: Texas Instruments TI953/954
+ FPD-Link IV: Texas Instruments TI9xx/TI9xx

SX proFRAME 3.0 Base Board PCIe
All the advanced features of the CompactPCI Serial version, but realized as a PCI Express board for regular PC systems. Fully compatible with the new SX camAD3 camera adapter line.
+ 2× SX camera adapter 3.0 interface, each max. 40 Gbit/s video data interface
+ PCIe x8 Gen3 Interface (64 Gbit/s)
+ Xilinx Zynq UltraScale+ ZU4CG MPSoC (FBVB900)
+ 2 GB DDR4 of PS (processing system) memory, up to 150 Gbit/s
+ PCI Express form factor, board dimensions: 175 mm × 107 mm (full height, half length)
+ Temperature range: −20 to +85 °C
The core of the PC-based SX proFRAME 2.0 system is a standard PCI Express board with a Xilinx Artix-7 FPGA and 512 MByte of DDR memory.

The board’s FPGA-based real-time data processing enables the handling of large amounts of data independent from any other hardware requirements. For video data, take advantage of our imaging IP modules, building on Solectrix’s extensive know-how in the digital imaging field.

The SX proFRAME is also available as a version with two additional high-speed adapter interfaces, the SX proFRAME 2.0 HS. Each of these interfaces offers two lanes operating at up to 6.6 Gbit/s for a total of four high-speed lanes per base board.
SX proFRAME SYNC

The SX proFRAME SYNC adapters are galvanically isolated interfaces. They make it possible to obtain sync signals for camera triggering from external trigger sources and to generate trigger signals in our SX proFRAME boards. These signals can be sent to cameras or external trigger receivers. Our adapters are available as In/Out and Dual In.

SX proFRAME SYNC IN/OUT Art. No. 500627
SX proFRAME SYNC DUAL IN Art. No. 500629
SX proFRAME 2.0

PCIe-based grabbing system with standard SX camera adapter interface

SX proFRAME Base Board 2.0

The standard version of the SX proFRAME base board 2.0 supports data rates of up to 3.2 Gbit/s.

- 4× SX camera adapter interface
  - 2× on top
  - 2× on bottom
- PCIe Gen2 x1/x4 interface
- Xilinx Artix-7 FPGA (XC7A200T)
  - 215,360 logic cells
  - 740 DSP slices
  - 12.83 Mbit block RAM
- Up to 512 MByte on-board DDR3 frame buffer memory
- Board dimensions: 195 mm × 110 mm, in-between a half-length and full-length PCIe board
- Optional: 12V external supply input instead of power via PCIe
- Optional: External supply input for Power over Coax (PoC)
SX camAD TI913/914

- Texas Instruments DS90UB913Q
  FPD-Link III serializer with bidirectional control channel, 10 to 100 MHz, 10- and 12-bit DC-balanced
- Texas Instruments DS90UB914Q
  FPD-Link III deserializer with bidirectional control channel, 10 to 100 MHz, 10- and 12-bit DC-balanced
- Camera input & output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback

SX camAD DUAL TI914

- 2× Texas Instruments DS90UB914Q
  FPD-Link III deserializer, 10 to 100 MHz, 10- and 12-bit DC-balanced
- 2× camera input on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
**SX proFRAME camera adapters**

Uniquely wide range for nearly all types of automotive cameras

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**SX camAD TI925/926**

- Texas Instruments DS90UB925Q-Q1
  - 24-bit color FPD-Link III serializer with bidirectional control channel, 5 to 85 MHz
- Texas Instruments DS90UB926Q
  - 24-bit color FPD-Link III deserializer with bidirectional control channel, 5 to 85 MHz
- Camera input and output on RosenbergerHSD plugs (D4S20G-400A5-Z)

**SX camAD TI933/934**

- Texas Instruments DS90UB933-Q1
  - FPD-Link III serializer for 1 MP/60 fps and 2 MP/30 fps cameras, 12-bit 100 MHz
- Texas Instruments DS90UB934-Q1
  - FPD-Link III deserializer for 1 MP/60 fps and 2 MP/30 fps cameras, 12-bit 100 MHz
- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  - Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  - for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback

Art. No. 500640
**SX camAD TI935/936**

- Texas Instruments DS90UB935-Q1
  MIPI CSI-2 FPD-Link III serializer for 2 MP/60 fps cameras and RADAR, up to 3.2 Gbit/s

- Texas Instruments DS90UB936-Q1
  MIPI CSI-2 FPD-Link III dual deserializer for 2 MP/60 fps cameras and RADAR

- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA

- Lattice MachXO3 FPGA (MachXO3LF-4300) for interfacing with the grabber board

- **I2C serial EEPROM** for link configuration and camera simulation

- **Pixel clock generator** for playback

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**SX camAD TI936**

- Texas Instruments DS90UB936-Q1
  MIPI CSI-2 FPD-Link III dual deserializer for 2 MP/60 fps cameras and RADAR

- 2× camera input on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA

- Lattice MachXO3 FPGA (MachXO3LF-4300) for interfacing with the grabber board

- **I2C serial EEPROM** for link configuration and camera simulation

- **Pixel clock generator** for playback
**SX proFRAME camera adapters**
Uniquely wide range for nearly all types of automotive cameras

**SX camAD DUAL TI953**
- 2x Texas Instruments DS90UB953-Q1
  MIPI CSI-2 FPD-Link III serializer for 2 MP/60 fps cameras and RADAR, up to 3.2 Gbps
- 2x camera output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO3 FPGA (MachXO3LF-4300) for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback

**SX camAD TI953/954**
- Texas Instruments DS90UB953-Q1
  MIPI CSI-2 FPD-Link III serializer for 2 MP/60 fps cameras and RADAR, up to 3.2 Gbps
- Texas Instruments DS90UB954-Q1
  MIPI CSI-2 FPD-Link III dual deserializer for 2 MP/60 fps cameras and RADAR
- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA, external supply for PoC voltage supported
- Lattice MachXO3 FPGA (MachXO3LF-4300) for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback

Art. No. 500639

Art. No. 500657
SX camAD TI954

- Texas Instruments DS90UB954-Q1
  Dual MIPI CSI-2 FPD-Link III deserializer
  for 2 MP/60 fps cameras and RADAR
- 2× camera input on Rosenberger
  FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA,
  external supply for PoC voltage supported
- Lattice MachXO3 FPGA (MachXO3LF-4300)
  for interfacing with the grabber board
- I²C serial EEPROM for link configuration
  and camera simulation
SX proFRAME camera adapters
Uniquely wide range for nearly all types of automotive cameras

**SX camAD DUAL MAX9240A**

- 2x Maxim MAX9240A
  25-bit GMSL deserializer, 6.25 to 100 MHz, with line fault detect
- 2x camera input on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  for interfacing with the grabber board
- **I2C serial EEPROM** for link configuration and camera simulation

**SX camAD MAX9240A/9271**

- Maxim MAX9240A
  25-bit GMSL deserializer, 6.25 to 100 MHz, with line fault detect
- Maxim MAX9271
  16-bit GMSL serializer, 6.25 to 100 MHz
- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  for interfacing with the grabber board
- **I2C serial EEPROM** for link configuration and camera simulation
- **Pixel clock generator** for playback
**SX camAD MAX96705/96706**

- Maxim MAX96705
  - 16-bit GMSL serializer with high-immunity/bandwidth mode
- Maxim MAX96706
  - 14-bit GMSL deserializer
- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  - Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice MachXO2 FPGA (XO2-1200U)
  - for interfacing with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback
SX proFRAME 2.0 LVDS
PCIe-based grabbing system with SX camera adapter LVDS interface

SX proFRAME Base Board 2.0 LVDS

This customized revision of the SX proFRAME base board 2.0 features an LVDS connection to the SX camera adapter ports, enabling support for higher data rates of up to 6 Gbit/s.

+ 4× SX camera adapter LVDS interface, up to 6 Gbit/s
  • 2× on top
  • 2× on bottom

Other technical specs and options identical to standard SX proFRAME Base Board 2.0.

SX camAD MAX9295A/9296A
Only for SX proFRAME Base Board 2.0 LVDS

+ Maxim MAX9295A
  MIPI CSI-2 GMSL2 serializer with up to 6 Gbps

+ Maxim MAX9296A
  MIPI CSI-2 GMSL2 dual deserializer with up to 6 Gbps

+ Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA, external supply for PoC voltage supported

+ Lattice CrossLink FPGA (LIF-MD6000)
  for image data interfacing with the grabber board

+ Lattice MachXO3 FPGA
  for GPIO and frame synchronization with the grabber board

+ I²C serial EEPROM for link configuration and camera simulation

+ Pixel clock generator for playback
**SX camAD MAX9296A**
Only for SX proFRAME Base Board 2.0 LVDS

- Maxim MAX9296A
  MIPI CSI-2 GMSL2 dual deserializer with up to 6 Gbps
- 2x camera input on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA, external supply for PoC voltage supported
- Lattice CrossLink FPGA (LIF-MD6000)
  for image data interfacing with the grabber board
- Lattice MachXO3 FPGA
  for GPIO and frame synchronization with the grabber board
- I²C serial EEPROM for link configuration and camera simulation

**SX camAD TI9xx/9xx**
Only for SX proFRAME Base Board 2.0 LVDS

- Texas Instruments DS90UB9xx
  MIPI CSI-2 FPD-Link IV serializer with up to 6 Gbps
- Texas Instruments DS90UB9xx
  MIPI CSI-2 FPD-Link IV dual deserializer with up to 6 Gbps
- Camera input and output on Rosenberger FAKRA plugs (59S2AQ-40MT5-Z_1)
  Power over Coax (PoC), 5 to 10 V, 300 mA
- Lattice CrossLink FPGA (LIF-MD6000)
  for image interfacing with the grabber board
- Lattice MachXO3 FPGA
  for GPIO and frame synchronization with the grabber board
- I²C serial EEPROM for link configuration and camera simulation
- Pixel clock generator for playback

Art. No. 500783

Art. No. 500797
SX proFRAME 2.0 HS
PCIe-based grabbing system
with SX high-speed camera adapter interface

SX proFRAME Base Board 2.0 HS

A revision of the SX proFRAME base board 2.0 that features two additional high-speed connectors, enabling higher data rates for the connection of Solectrix’s CoaXPress camera adapters.

+ 2× SX high-speed adapter interface
  • 2× on top

+ 4× SX camera adapter interface
  • 2× on top
  • 2× on bottom

+ PCIe Gen2 x1/x4 interface

+ Xilinx Artix-7 FPGA (XC7A200T)
  • 215,360 logic cells
  • 740 DSP slices
  • 12.83 Mbit block RAM

+ Up to 512 MByte on-board DDR3 frame buffer memory

+ Board dimensions: 195 mm × 110 mm, in-between a half-length and full-length PCIe board

+ Optional: 12V external supply input instead of power via PCIe

Art. No. 500708
**SX camAD CoaXPress**  
Only for SX proFRAME 2.0 HS

- Microchip EQCO31R20
  - Coaxial cable video equalizer for bidirectional communication
  - 1.25 to 3.125 Gbps video downlink
  - Supports 8b/10 NRZ coding and the CoaXPress standard

- Camera input on coax connector
  (Cinch Connectivity Solutions UCBJE20-1)
  Power over Coax (PoC), 18 V, 1 A

- Atmel ATtiny85 microcontroller
  for control of Power over Coax (PoC) supply voltage

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**SX camAD DUAL CoaXPress**  
Only for SX proFRAME 2.0 HS

- 2× Microchip EQCO62R20
  - Coaxial cable video equalizer for bidirectional communication
  - 1.25 to 6.25 Gbps video downlink
  - Supports 8b/10 NRZ coding and the CoaXPress standard

- 2× camera input on coax connectors
  (Cinch Connectivity Solutions UCBJE20-1)
  Power over Coax (PoC), 18 V, 1 A

- 2× Atmel ATtiny85 microcontroller
  for control of Power over Coax (PoC) supply voltage
Integration of SX proFRAME boards into your Windows or Linux system is made easy by our custom software libraries.

These include drivers and sources for base boards, camera and sync adapters, a GPU-accelerated software library for realization of image signal processing functions, and various simple example applications for basic camera control.

Our specialists are available to support your team during the initial commissioning phase.

**Base board drivers and sources**
+ for Linux and Windows 10
+ DMA-based for high data throughput
+ Trigger and synchronization functions
+ I2C camera control and link configuration

**Configuration for various camera types**
+ Omnivision
+ ON Semiconductor
+ Sony
+ and more

**Camera adapter drivers and sources**
+ Programmable Power over Coax (PoC)
+ Programmable pixel clock for playback modes

**Sample applications for camera control**
+ Image capturing
+ Image playback
+ I2C control
+ and more

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<th>Software Library</th>
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<td>500803</td>
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FPGA-Based Imaging Modules

Take advantage of the flexibility of the SX proFRAME’s FPGA-based design! The base board’s Xilinx Artix-7 FPGA or UltraScale+ ZU4CG MPSoC both offer plenty of resources to implement advanced image processing functions, enabling superior visual quality while freeing up the CPU to handle other tasks.

Solectrix has over 10 years of experience developing all kinds of standard and customer-specific FPGA modules. Pick one from the following list or challenge us to implement an all-new type of processing module specifically for your project!

Our IP Core Expertise

- **Sensor Interfacing and Control**
  - Sensor synchronization and I²C control
  - Sensor power sequencing
- **Color Processing**
  - HDR, HQ, high performance
  - Log-based de-mosaicing and defective pixel correction
  - Real-time resizers, split screens, overlays
  - Edge enhancement, noise filter
  - Contrast, tonemap, color correction, AWB
- **Image Processing and Analysis**
  - Hardware analyzing blocks for real-time adjustments
  - Pattern recognition
  - Stitching
  - 3D/360º processing
- **Streaming Server and Interfacing**
  - Image and metadata streaming
  - Time stamp generation
  - Image CODECs
**SXC2 and SXC3**

High-resolution camera heads for cutting-edge applications in medical technology and industrial automation

The next generation of high-end camera heads by Solectrix

More than 15 years of experience in the development of state-of-the-art camera technology for cinema and television productions flowed into the new generation of camera heads. They combine image quality for the highest demands with the reliability that we achieve with our automotive camera systems, making them ideal for use in industrial automation and modern medical technology.

- Image sensor Sony IMX183CQJ-C, rolling shutter, 11 mm
- Color images at 10 bit color depth
- Resolution 3840 × 2160 pixels
- Framerate 30 fps
- Weight: 105 g
- Dimensions: 44 × 44 × 35 mm (w × h × d)
The SXC2 is equipped with a 9-megapixel color sensor while the SXC3 features a 20-megapixel sensor for monochromatic images. The FPD-Link III interface enables use with a wide range of capturing systems, including our own SX proFRAME 2.0. The physical connection is realized via a single coax cable for both data and power.

Both models support C and CS mount lenses.

- Image sensor Sony IMX183CLK-J, rolling shutter, 16 mm
- Monochromatic images at 12 bit color depth
- Resolution 5496 × 3672 pixels
- Framerate 15 fps
- Weight: 400 g
- Dimensions: 42 × 42 × 55 mm (w × h × d)
Solectrix has many years of experience in developing professional mobile devices. Supporting our customers in developing their mobile devices is the motivation behind the SX Mobile Device Kit (MDK). Based on the NXP i.MX8M Mini CPU, the SX Mobile Device Kit is designed as a versatile mobile device platform. Special needs of mobile devices like low power consumption or a reliable battery supply and charging operation are considered.

All areas of a product development like electronics, software, design and construction are covered. Focusing on mobile vision applications, the MDK provides the opportunity to be extended with a set of imaging sensors. Use the MDK to evaluate the imaging sensor that best fits your application!

Board support packages including driver support for all elementary interfaces and components that are present on the MDK are provided. Solectrix offers customized engineering services for the integration of your specific software components.

You can choose to build a mobile device based on the MDK PCBA as it is or to modify the MDK to exactly fulfill the specific needs of your application. In any case, using the MDK can help you achieve shorter development times. Initiating a functional model phase with the MDK enables you to start the software development early. Concurrently, you can develop the prototype according to your detailed requirements.
Technical Specifications

- **CPU**  
  - NXP i.MX8M Mini  
  - up to quad-core Cortex-A53, 2.0 GHz  
  - Single-core Cortex-M4F, 400 MHz  
  - 2D/3D GPU (OpenGL ES 2.0)

- **DRAM:** 2 GB LPDDR4

- **Storage:** 8 GB eMMC Flash

- **Wireless:**  
  - Redpine RS9116  
  - 802.11 a/b/g/n (2.4 GHz and 5 GHz), 802.11j  
  - Dual-mode Bluetooth 5 (Bluetooth Classic and Bluetooth Low Energy)

- **Display**  
  - 4-lane MIPI DSI  
  - Capacitive touch interface  
  - Ready for DEM 7201280A display module  
  - 5" TFT, resolution 720 × 1280 pixels

- **Camera**  
  - Flexible sensor extension interface  
  - 4-lane MIPI CSI-2  
  - Power supply for sensor extension boards  
  - I²C interface for sensor configuration  
  - GPIO signals for flash/illumination control

- **Location**  
  - Quectel L86  
  - Compact GNSS module (GPS, GLONASS, and QZSS)

- **Audio**  
  - Maxim MAX98357A PCM Class D Amplifier  
  - Magnetic speaker (0.7 W/88 dB)  
  - PDM microphone

- **Connectivity**  
  - microSD card slot  
  - 2× USB Type-C (1× charging only/1× USB OTG)  
  - PCIe Mini Card slot  
  - RJ45 Gigabit Ethernet (optional)  
  - 1× USB Type-A (optional)  
  - FT232 USB-to-UART

- **Power**  
  - Power Supply via USB Type-C  
  - 18650 Li-Ion battery holder  
  - TI bq24161 charger on-board  
  - TI bq27520 fuel gauge on-board  
  - Wireless charging extension connector

- **Operating Systems:**  
  - Android 9 ("Pie")  
  - Yocto Linux BSP  
  - Debian Linux BSP

- **PCB Dimensions:** 125 mm × 78 mm
The System-on-Module approach

System-on-Modules are the state-of-the-art solution for applications in highly technologized areas such as medical technology, the automotive industry, industrial automation, aerospace and others. Their modular approach allows for a high degree of customization on the application hardware side while offering a wide choice of standardized system cores compliant with the respective SoM format.

The need for ultra-compact modules that combine CPU and FPGA led to the launch of the SXoM series, a line of System-on-Module boards by Solectrix. Special cooling solutions are available as accessories.

Applications

Motion capturing and analysis
Security and surveillance
Traffic monitoring
Medical and scientific imaging
High-end machine vision
Airborne imaging

SXoM advantages

+ **State-of-the-art technology**
  SXoMs are based on the latest technology. Profit from our specialists' research and development know-how!

+ **Lower development risk and costs**
  SXoMs offer proven and reliable solutions. Building on ready-to-use SXoMs enables you to reduce your development and project costs.

+ **Shorter time-to-market**
  Our SXoMs provide basic design structures. This allows you to focus on the development of the application-specific parts of your product and to achieve a shorter time-to-market.
The SXoM family of products includes the world’s first System-on-Modules (SOMs) based on the Smart Mobility ARCHitecture (SMARC) by SGET that feature CPU and FPGA in one chip.

The core of the Solectrix System-on-Module family consists of the SXoM MS1-C5, the SXoM MS2-K7 and the upcoming SXoM MS2-ZU based on the Xilinx Zynq UltraScale+ MPSoC, all of which adhere to the SMARC standard and are suited for use in a wide variety of projects. Applications for SXoM MS1-C5 include pedestrian recognition and advanced driver assistance systems. The SXoM MS2-K7 is used for the processing of 4K video data.

Solectrix also offers the SMARC carrier board SXoM CBS2, compatible with SMARC 1.1 and 2.0 modules, as well as an eNUC-based SMARC carrier board and a suitable PSU module in miniERP form factor.

Solectrix is a member of SGET, the Standardization Group for Embedded Technologies. For more information on the SMARC specification please visit: www.sget.org
SXoM MS2-K7
System-on-Module compliant with SMARC 2.0 specification

- System-on-Module compliant with SMARC 2.0 specification by SGET
- Ultra-compact form factor: 82 mm × 50 mm
- Powered by Xilinx Zynq Z-7030/7035/7045 SoC
- FPGA IP cores and implementation support available on request
- Accessory options:
  - SXoM MS2-K7 heat spreader, Art. No. 500768
  - SXoM MS2-K7 heat sink, Art. No. 500769
  - Linux board support package (BSP), Art. No. 500923

**FPGA Fabric Features**
- Kintex-7 FPGA fabric
- 125K – 350K logic elements
- 9.3 – 19.1 Mbit block memory
- 400 – 900 DSP blocks
- 1 GByte DDR3 SDRAM ×32 bit for the FPGA

**CPU Features**
- Dual-core ARM Cortex-A9 MPCore processor, 667 – 1000 MHz clock frequency
- 5,000 MIPS (Dhrystone 2.1) at 1,000 MHz (two cores)
- 32 KByte of L1 instruction cache and 32 KByte of L1 data cache per processor
- 512 KByte of shared L2 cache
- 256 KByte of on-chip RAM
- 512 MByte DDR3 SDRAM ×32 bit for the CPU

Art. Nos. 500623 (default model with XC7Z035-2FFG676E),
500712 – 500716
SXoM Starter Kit
SMARC 2.0 Starter Kit with SXoM MS2-K7 including module, eval carrier and all accessories

Kickstart your SMARC 2.0 development! The SXoM Starter Kit combines a SXoM MS2-K7 SMARC 2.0 module by Solectrix with a conga-SEVAL evaluation carrier board and a full set of accessories by congatec.

The evaluation carrier board provides a wide selection of physical connectors for the standard interfaces featured on the SMARC 2.0 connector. From a matching PSU and customized heat sinks to a DVI display adapter and various cables, all the hardware you need to develop your application for a SMARC 2.0 module is included in this comprehensive starter kit. It also comes with an SD card with a board support package for quick setup of the SXoM MS2-K7 module.

+ SXoM MS2-K7 SMARC 2.0 module feat. Xilinx Zynq Z-7035 SoC with Kintex-7 FPGA and ARM CPU
+ conga-SEVAL evaluation carrier board
+ Lower development risk and costs
+ SXoM MS2-K7 heat sink
+ SXoM MS2-K7 heat spreader
+ Complete cable set
+ ATX power supply (180 W)
SXoM MS1-C5
System-on-Module compliant with SMARC 1.1 specification

System-on-Module compliant with SMARC 1.1 specification by SGET
Ultra-compact form factor: 82 mm × 50 mm
Powered by Intel/Altera Cyclone V SX SoC 5CSX C2/C4/C5/C6
FPGA IP cores and implementation support available on request
Accessory options:
• SXoM MS1-C5 heat spreader, Art. No. 500585
• Linux board support package (BSP), Art. No. 500924

FPGA Fabric Features
Intel/Altera Cyclone V FPGA fabric
25K – 110K logic elements
1.4 – 5.6 Mbit block memory
36 – 112 DSP block
up to 2 GByte DDR3 SDRAM ×32 bits for the FPGA

CPU Features
Dual-core ARM Cortex-A9 MPCore processor, 700 – 925 MHz clock frequency
More than 4,000 MIPS (Dhrystone 2.1) for under 1.8 W
512 KByte of shared L2 cache
64 KByte of on-chip RAM
up to 2 GByte DDR3 SDRAM ×32 bits for the CPU

Art. Nos. 500578 (default model with 5CSXFC6C6U23I7N), 500600 – 500602, 500704 – 500607
**SXoM MS2-ZU**  
System-on-Module compliant with SMARC 2.0 specification

![Image of SXoM MS2-ZU System-on-Module](image)

**FPGA Fabric Features**
- 192K – 504K logic elements
- 4.5 – 11 Mbit block RAM
- 13.5 – 27 Mbit UltraRAM
- 728 – 1728 DSP blocks

**CPU Features**
- **APU** (Application Processing Unit): Dual-core (with CG MPSoC) or quad-core (with EG MPSoC)  
  ARM Cortex-A53 MPCore, 1.2 GHz clock frequency (speed grade –1)
- **RPU** (Real-Time Processing Unit): Dual-core ARM Cortex-R5, 500 MHz clock frequency (speed grade –1)
- **GPU** (Graphics Processing Unit): ARM Mali-400 MP2, 600 MHz clock frequency (speed grade –1, only with EG MPSoC)
- 2 GB DDR4 SDRAM (default, 4 GB optional), 64-bit interface up to 2,400 Mb/s
- 8 GB eMMC
- 512 Mb QSPI serial NOR Flash

**Accessory options:**
- SXoM MS2-ZU heat spreader, Art. No. 500928
- Linux board support package (BSP), Art. No. 500925

Default version based on the Zynq UltraScale+ ZU4CG MPSoC (speed grade –1), more powerful models (ZU4EG, ZU5CG/EG, ZU7CG/EG) and higher speed grades can be realized on request.

**SOLUTIONS**
**SXoM CBS2**
Carrier board for SMARC 1.1/2.0 modules

The SXoM CBS2 is a SMARC carrier board compatible with SMARC 1.1 and 2.0 modules.

It provides essential standard interfaces in the form of dual USB and dual Ethernet connectors and an SD card socket. Most of the SMARC connector’s signals are led to three separate board-to-board connectors for connection of an application-specific I/O board. As a universal SMARC carrier board, the SXoM CBS2 enables fast software evaluation on your System-on-Module target platform, shortening your development time.

- SMARC interface for SMARC 2.0 (e.g., SXoM MS2-K7) and SMARC 1.1 (e.g., SXoM MS1-C5) modules
- Dual Ethernet interface
- Dual USB interface
- SD Card socket
- 4× board-to-board connectors
  - 48V power interface on 4-pin Samtec SQT connector
  - High-speed interface on 60-pin Samtec LSHM connector
  - I/O interface on 100-pin Samtec LSHM connector
  - Additional SMARC 1.1 signals (e.g., from SXoM MS1-C5) on 60-pin Samtec LSHM connector
- I²C multiplexer Texas Instruments PCA9545A for control of:
  - I²C GPIO expander Maxim MAX7314
  - 9 GPIO lines to 3 on-board RGB LEDs
  - 4 GPIO lines to board-to-board I/O interface
  - 2 GPIO lines to I²C fan controllers
  - 1 GPIO line to I²C temperature sensor
  - 2× I²C fan controller Maxim MAX6650
  - I²C temperature sensor Texas Instruments LM75B
  - I²C EEPROM Atmel AT24C04D
- Battery socket (CR2032) for real-time clock on SMARC module
- 2× fan interface on 3-pin Molex PicoBlade connector
- Board dimensions: 100 mm × 100 mm
SXM ME-ZU
System-on-Module compliant with COM Express specification

- System-on-Module compliant with COM Express specification
- COM Express Basic form factor: 95 mm × 125 mm
- COM Express Type 7 connectors
- Powered by Xilinx Zynq UltraScale+ ZU11/17/19EG MPSoC
- Gigabit Ethernet and USB 2.0 PHYs
- FPGA IP cores and implementation support available on request
- Accessory options:
  - SXoM ME-ZU active cooling solution, Art. No. 500922
  - Linux board support package (BSP), Art. No. 500926

Default version based on the Zynq UltraScale+ ZU11EG MPSoC (speed grade –1), more powerful models (ZU17EG, ZU19EG) and higher speed grades can be realized on request.

CPU Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>APU (Application Processing Unit)</td>
<td>Quad-core ARM Cortex-A53 MPCore, 1.2 GHz clock frequency (speed grade –1)</td>
</tr>
<tr>
<td>RPU (Real-Time Processing Unit)</td>
<td>Dual-core ARM Cortex-R5, 500 MHz clock frequency (speed grade –1)</td>
</tr>
<tr>
<td>GPU (Graphics Processing Unit)</td>
<td>ARM Mali-400 MP2, 600 MHz clock frequency (speed grade –1)</td>
</tr>
<tr>
<td>Memory</td>
<td>2 GB DDR4 SDRAM + 512 MB ECC memory, 72-bit interface up to 2,400 Mb/s</td>
</tr>
<tr>
<td>Storage</td>
<td>8 GB eMMC</td>
</tr>
<tr>
<td>Flash</td>
<td>2x 512 Mb QSPI serial NOR Flash</td>
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</tbody>
</table>

FPGA Fabric Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Logic elements</td>
<td>599K – 1,143K</td>
</tr>
<tr>
<td>Block RAM</td>
<td>21.1 – 34.6 Mbit</td>
</tr>
<tr>
<td>DSP blocks</td>
<td>1,590 – 2,928</td>
</tr>
<tr>
<td>SDRAM interface</td>
<td>2 GB, 64-bit up to 2,400 Mb/s</td>
</tr>
</tbody>
</table>

Art. No. 500921
(default model with XCZU11EG-1FFVC1760E)
The SXoM CBS2 eNUC 1 is a universal carrier board for SMARC 2.0 modules.

The board provides USB and Gigabit Ethernet interfaces and an M.2 slot (B+M type). An FMC extension slot enables the connection of an application-specific I/O board to take advantage of the flexibility offered by CPU+FPGA modules like the Solectrix SXoM MS2-K7 or the upcoming SXoM MS2-ZU. The PCB is based on the embedded NUC (eNUC) standard and compatible with the ARINC 836A (miniMRP) form factor. It was designed for use in aviation applications.

+ Carrier Board for SMARC 2.0 modules
+ FMC extension slot
+ M.2 slot (B+M type) with PCIe x4
+ microSD card slot
+ USB interface
+ Gigabit Ethernet interface
+ Expansion interface for additional high-speed lines from selected SMARC modules (8 Tx, 8 Rx), e.g., the upcoming SXoM MS2-ZU
+ 9 – 36 VDC in; 80 W power supply
+ PCB based on embedded NUC (eNUC) standard
+ Compatible with ARINC 836 A form factor
+ Operating temperature –10 to +60 °C out of housing, ext. temperature –20 to +85 °C on request
+ Accessories available on request: M.2 SSD

Art. No. 500763
The SXoM EDC eNUC 1 is a power supply board.
The PCB is based on the embedded NUC (eNUC) standard and compatible with the ARINC 836A (miniMRP) form factor.
**SXoM EUSB3 200**

8× video capturing and streaming platform based on USB 3.0

**Board Features**

- USB 3.0 client interface on type C receptacle, up to 5.0 Gbit/s
- High-speed expansion connector for accessories like PCIe converter, HDMI output etc.
- Powered via USB receptacle or separate wide voltage range input
- Compact format of 80 × 120 mm

**FPGA Fabric Features**

- Xilinx Artix-7 FPGA fabric
- 215K logic elements
- 13 Mbit block memory
- 740 DSP slices
- 2 GByte DDR3 SDRAM x 64
- MicroBlaze soft processor for system control

**SXoM EUSB3 200** is a universal platform for easy connection of up to 8 image sensors via a USB 3.0 client interface.

Its core is a Xilinx Artix-7 FPGA that handles sensor control, image processing and data transfer to the host PC, supporting video streaming as a standard UVC device (USB Video Class). Each sensor is connected with up to 4 lanes of CSI-2 for up to 4K resolution at 60 fps. Each has its own unshared I²C-bus for individual configuration and accurate synchronization via dedicated connectors.

Support for various sensor types, e.g., Sony IMX230 and Sony IMX214.
With a team of qualified and specialized engineers and technicians, Solectrix considers itself an innovator and independent service provider in the development of high-end electronics solutions.

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<th>Our R&amp;D competence</th>
<th>Our services</th>
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<td>+ Hardware</td>
<td>+ Consulting</td>
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<td>+ FPGA</td>
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<td>+ Cameras</td>
<td>+ Design</td>
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<td>+ System Engineering</td>
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<td>+ Lifecycle Management</td>
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<td>+ Support</td>
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