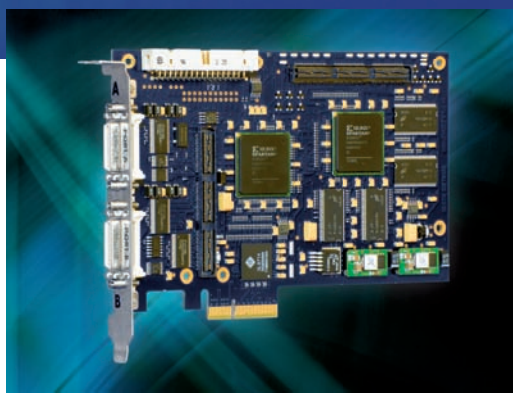
SILICONSOFTWARE

Join the World of Image Processing



SILICONSOFTWARE

**FULL x1 / FULL x4**

# microEnable IV

## Ideal solution for advanced image acquisition and image processing with a flexible and scalable product concept

### microEnable IV-FULL CHARACTERISTICS

- Performance solution for image acquisition and image processing
- Ultimative PCI Express performance
- Highly flexible and scalable product concept
- Numerous add-on boards for highest connectability

### microEnable IV-FULL FEATURES

- All CameraLink conform cameras with Base, Medium and Full Configuration supported
- Single and Quad Lane PCI Express interfaces
- 256 and 512 MB DDR-RAM on-board
- FPGA and on-board memory for pre-processing
- Highly reliable image acquisition
- Intuitive interface for an easy frame grabber and camera configuration
- Graphical and intuitive interface to program FPGA vision processors by VisualApplets®
- VisualApplets® compatible interface
- Additional extension boards for special features
- Included software package: microDisplay, Software Development Kit (SDK), Diagnosis tool

VisualApplets compatible

PCI Express v.1.2 compliant

CameraLink v.1.2 compliant

microEnable IV-FULL family is a PCIe based product line. The boards offer an exceptional image acquisition and processing performance. microEnable IV uses the experienced frame grabber technology with its high reliability, stability and robustness. Both board types cope even with advanced requirements of applications by the additional FPGA capabilities for customized adaptations with VisualApplets®.

**Standard Features**:

- Support of all gray CameraLink input formats (Single/Dual Tap, 8/10/12/14/16 bit/pixel)
- Max. image display size 16,383 x 65,536 pixels, max. pixel clock 85MHz , frequency up to 20,000 frames/s and settable exposure
- Transfer rate of up to 760 MB/s on PCIe quad lane or 200 MB/s on PCIe single lane systems
- On-board pixel reshuffling with support of various sensor readout strategies
- Knee Look-Up Table for piecewise linear conversion from 16 bit/pixel to 16 bit/pixel
- Internal 12 or 16bit processing
- Basic image processing, e. g. brightness, contrast and gamma-correction.
- White balancing
- Hardware generated image number
- Regions of Interest support
- 8bit or 16bit output per color component (Gray8/Gray16 or RGB24/RGB48)
- Image selector
- Latency of a single line
- Highly customizable trigger system
- Support of RS232 clser interface
- Camera detection abilities
- DigI/O and CC signals

**Special Features**:

- On-board Bayer Pattern interpolation (bi-linear, 8 bit input, 9 bit precision, correct edge handling)
- On-board Bayer filter demosaicing (high quality, 12bit precision, correct edge handling)
- On-board 1D (line scan cameras) or 2D (area scan cameras) Shading correction, which adjusts offset and gain for each pixel separately to rectify inherent distortions from the sensor and/or illumination
- On-board Shading Correction at full bandwidth
- On-board Fixed Pattern Noise Correction
- Shaft Encoder A/B support (revolving direction detection and compensation)
- Software trigger control
- Additional support for non-standard serial RGB formats, which enable RGB with higher bit/pixel through a CameraLink Base configuration (RGB assembled from Single Tap 8, 10, 12, 14, 16, and Dual Tap 8, 10, 12 at up to 85 MHz)

**Bayer Filter**: A Bayer filter is a color filtering array for arranging RGB colors on a monochromatic grid. The **Bilinear Demosaicing Algorithm for Bayer Filters** performs the color reconstruction according to a 3*3 reconstruction matrix. The calculations are performed with up to 12bit/pixel. The **High Quality (HQ) Demosaicing Algorithm for Bayer Filters** performs the color reconstruction according to a 7*5 reconstruction matrix with special edge treatment. The calculations are performed with up to 12bit/pixel accuracy.



SILICONSOFTWARE
Steubenstrasse 46
D-68163 Mannheim
Germany

Phone: +49(0)621 789507-0
Fax: +49(0)621 789507-10

Email: info@silicon-software.de
Web: www. silicon-software.de
www. silicon-software.com

SILICON**SOFTWARE**

# Technical Specifications

**Camera Interface**:
- CameraLink interface with Base, Medium and Full Configuration
- All CameraLink conform cameras supported
- Pixel clock 85MHz

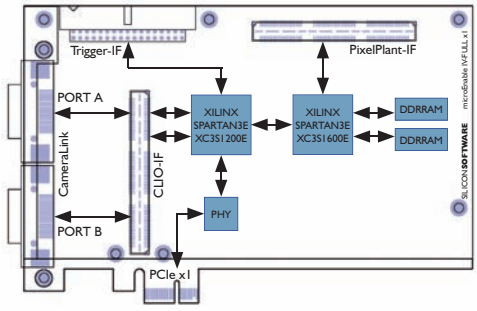
**PC Interface**:
- PCI host interface PCIe x1 or x4

**Performance Data**:
- Xilinx Spartan 3 XC3S 1600E or 4000 FPGA
- 256MB or 512MB on-board DDR-RAM memory

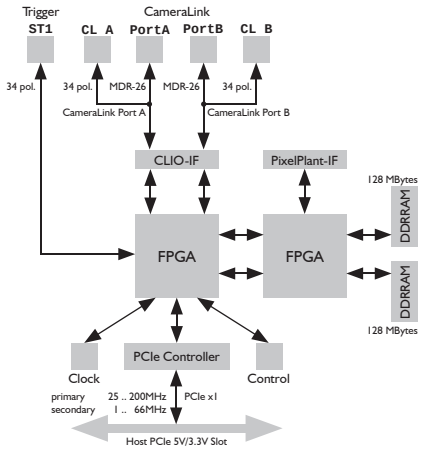
**Available Product Types**:
- microEnable IV - FULL x1
- microEnable IV - FULL x4

**Available Add-on Boards**:
- TTL and opto trigger boards
  - 8 inputs and 8 outputs
  - Both ports identical
  - Usable with included software package (microDisplay, SDK)
  - Usable with VisualApplets
- CameraLink Input / Output (CLIO)
  - Fixed plug
  - Distribute camera data for up to 256 frame grabber
  - Complex calculations: Images will be divided per image number or part of an image
  - Different calculation methods on original image
- PixelPlant
  - PX100
    - Xilinx Spartan 3 XC3S 1600E FPGA
    - 256MB DDR-RAM
    - 1GB/s read + write
  - PX200
    - Xilinx Spartan 3 XC3S 4000 FPGA
    - 512MB DDR-RAM
    - 1GB/s read + write

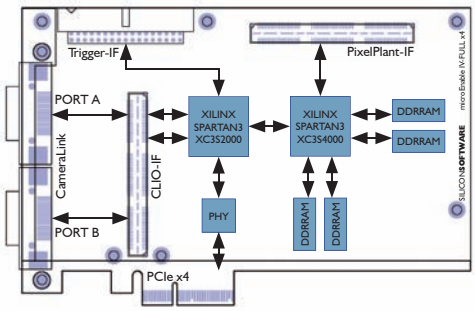
**Available Software Products**:
- VisualApplets®
- microDisplay
- microDiagnosis
- microEnable SDK



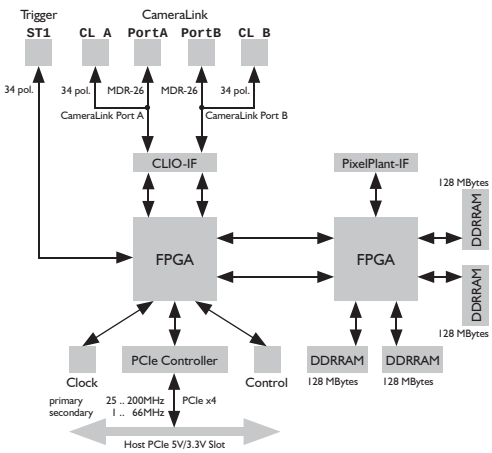

Scematic layout of microEnable IV-FULL x1




Block diagram of microEnable IV-FULL x1




Scematic layout of microEnable IV-FULL x4




Block diagram of microEnable IV-FULL x4

Supported Features
Sorted by Hardware Applets for

microEnable IV-FULL x1
microEnable IV-FULL x4

| | | Single Area Bayer HQ | Single Area Gray Shading 16 | Dual Area Bayer 12 | Dual Area Gray 16 | Dual Area RGB 48 | Dual Line Gray 16 | Dual Line RGB 30 | MEDIUM Area Gray 16 | MEDIUM Area RGB 36 | MEDIUM Line Gray 16 | MEDIUM Line RGB 36 | FULL Area Gray 8 | FULL Line Gray 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CameraLink | BASE Configuration | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | MEDIUM Configuration | | | | | | | | ■ | ■ | ■ | ■ | | |
| | FULL Configuration | | | | | | | | | | | | ■ | ■ |
| Camera Type | Area Scan / Line Scan | A | A | A | A | A | L | L | A | A | L | L | A | L |
| | GrayScale / RGB / Bayer | BAY | G | BAY | G | RGB | G | RGB | G | RGB | G | RGB | G | G |
| | 1- / 2-Camera Operation | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Color Processing | White Balancing | ■ | ■ | ■ | | ■ | | ■ | | ■ | | ■ | | |
| | Bayer Filter Feature | ■ | | ■ | | | | | | | | | | |
| | Bayer Bilinear Algorithm | | | ■ | | | | | | | | | | |
| | Bayer High Quality Algorithm | ■ | | | | | | | | | | | | |
| Image Enhancement | Knee-LUT Table | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Image Processing | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Image Correction | Sensor Correction | | | | | | | | ■ | | | | ■ | ■ |
| | Shading Correction 1D | | | | | | ■ | ■ | | | ■ | ■ | | |
| | Shading Correction 2D | | ■ | | | | | | | | | | | |
| Acquisition Modes | Image Selector | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Area Trigger | ■ | ■ | ■ | ■ | ■ | | | ■ | ■ | | | ■ | |
| | Line Trigger | | | | | | ■ | ■ | | | ■ | ■ | | ■ |
| | Shaft Encoding | | | | | | | | | | | | | |
| Performances | Max. width (in k pixels) | 4 | 8 | 4 | 16 | 16 | 16 | 4 | 8 | 2 | 16 | 16 | 2 | 16 |
| | Max. height (in k lines) | 64 | 4 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 |
| | Image frequency (in k fps) | 10 | 10 | 10 | 20 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Image Formats | Gray8 or RGB24 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Gray16 or RGB 48 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Transfer Rates | FULL x1 (in MB/s) | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| | FULL x4 (in MB/s) | 680 | 230 | 750 | 380 | 600 | 380 | 600 | 700 | 600 | 700 | 600 | 640 | 640 |



SILICON**SOFTWARE**
Steubenstrasse 46
D-68163 Mannheim
Germany

Phone: +49(0)621 789507-0
Fax: +49(0)621 789507-10

Email: info@silicon-software.de
Web: www. silicon-software.de
www. silicon-software.com