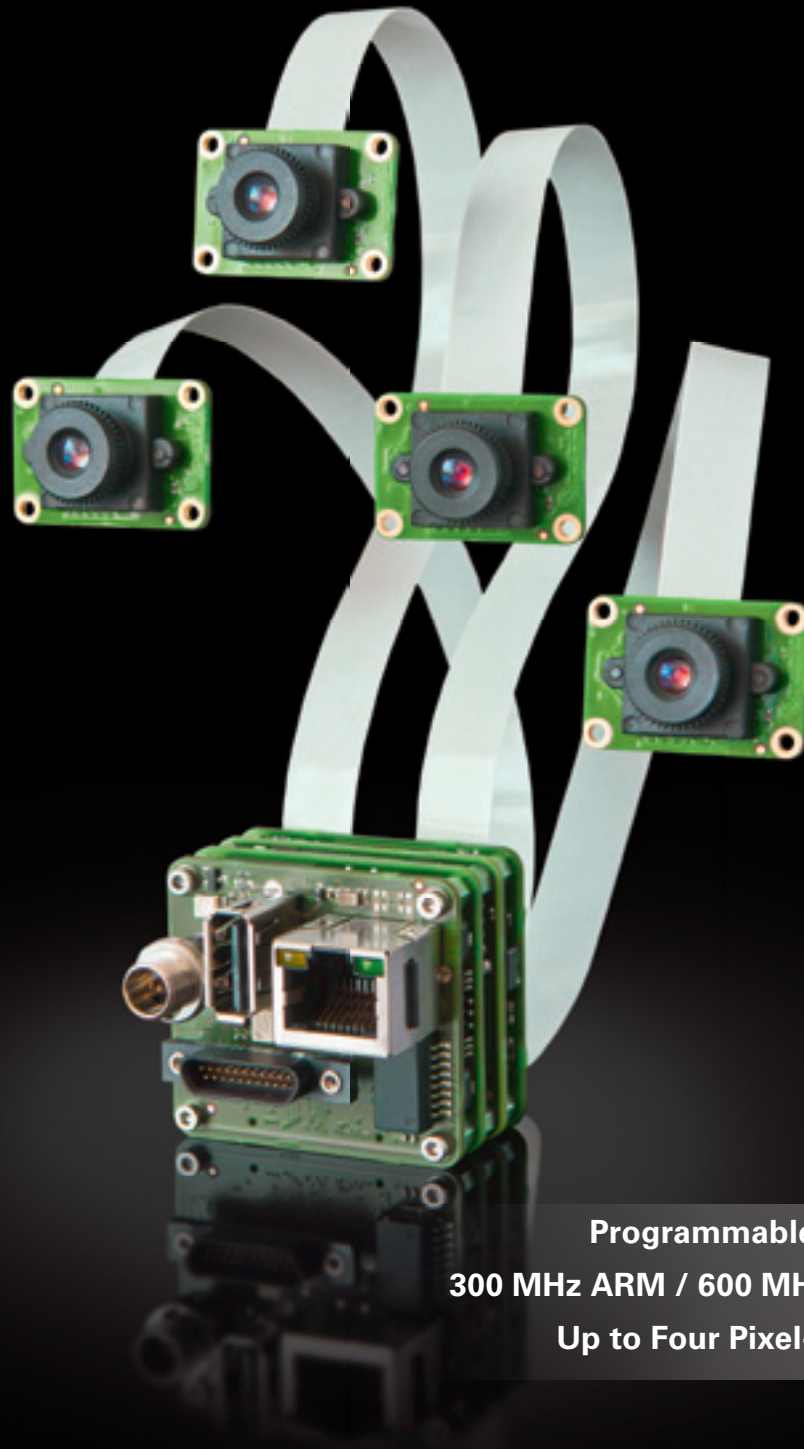


Intelligent Multi-Sensor Cameras

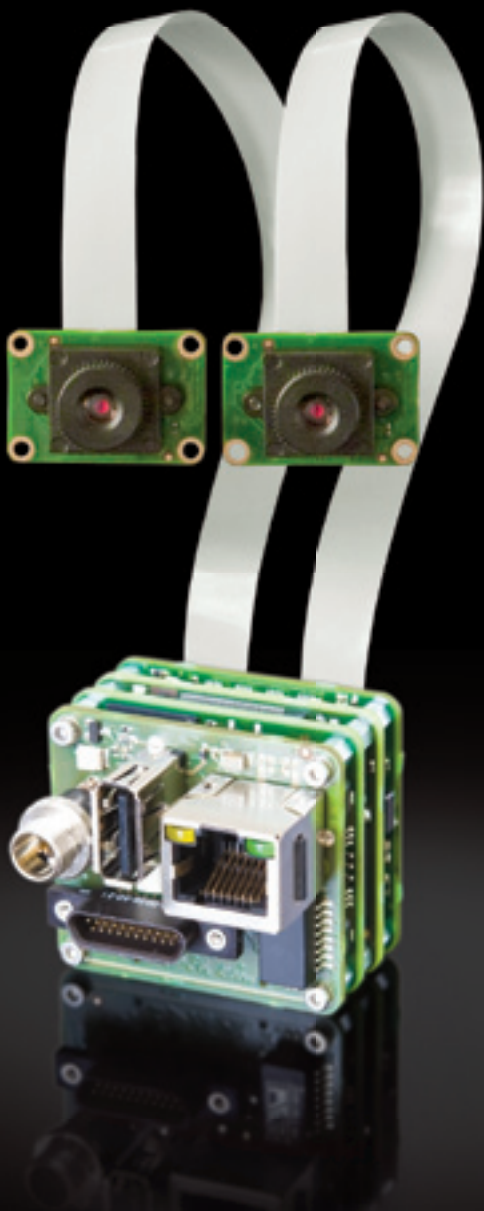


Programmable, Linux-Based Camera
300 MHz ARM / 600 MHz DSP with 4800 MIPS
Up to Four Pixel-Synchronous Sensors

2, 3, or 4 Pixel-Synchronous Sensors!

VRmagic's freely programmable multi-sensor cameras feature the DaVinci™ dual core from Texas Instruments, a combination of a DSP and ARM processor running on a Linux operating system. Developers can transfer their own algorithms to the camera conveniently by means of a cross-compiler. The fully autonomous intelligent components can thus be used just as an embedded PC.

The intelligent multi-sensor camera can be equipped with up to four external sensors. The sensors are connected to the camera by a flex-foil-cable with LVDS transmission and can be positioned freely. The pixel-synchronous image data is coordinated on a Xilinx FPGA module with 256 MB RAM.



Camera Features

Sensor Features

- Rolling shutter, global shutter, or interline transfer
- CMOS or CCD sensors
- Resolutions from VGA to three megapixels
- Monochrome or color with Bayer RGB matrix

Embedded System

- 300 MHz ARM9 processor
- 600 MHz C64x+ DSP with 4800 MIPs
- 256 MB RAM
- 512 MB flash memory
- Standard Debian Linux
- UBIFS file system
- Same API on camera and host
- Cross compiler

Supported Interfaces

- 100 Mbit Ethernet
- USB Host
- RS232
- Trigger and strobe
- General Purpose I/O (2in/3out)
- Analog video output (S-Video)
- Digital video output HDMI/DVI (optional)
- AC97 audio codec (optional)
- Additional GPIOs (optional)

ARM/DSP Dual Core Programming

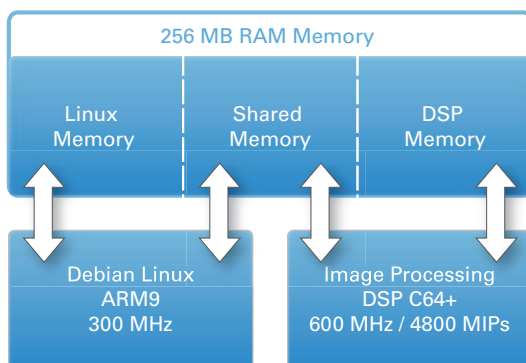


Convenient Application Programming

With a standard Debian Linux operating system and full access to the ARM/DSP processor from Texas Instruments, the intelligent cameras from VRmagic provide developers with a convenient platform for programming their own applications with C/C++ or any common programming language. Algorithms can be developed with standard environments such as MS Visual Studio or Code Composer Studio and transferred to the camera by means of cross-compilers. Host system and camera have the same API.

Parallelization of Image Processing on the Dual Core Chip

Intelligent components feature a highly-integrated dual core chip from Texas Instruments with parallel processing architecture. The DSP is entirely available for image processing tasks.



Communication between DSP and ARM is carried out through the TI Codec Engine. For the DSP, Texas Instruments offers various open source algorithms for image processing as well as closed source commercial codecs.

TI Libraries

- C64x+IMGLIB
- C64x+DSPLIB
- JPEG
- H.264 Codec
- etc.

Open-source Projects

Open-source projects with the target platform Linux run without problems on the intelligent cameras. Linux also provides drivers for USB devices such as WLAN or Bluetooth sticks, as well as hard disks or mouse and keyboard input devices.

Fast Compiling

- Complete pre-configured ARM tool chain for Windows and Linux on CD *free of charge*
- Downloadable TI DSP compiler and tools, *120 day trial version available*

Easy Debugging

- Same API on host and intelligent camera; Testing of camera application on host possible (ARM only)
- Remote-debugging via Ethernet, for example with Eclipse and gdbserver (ARM only)
- TI TraceUtil enables printf-debugging of DSP code
- JTAG port for connection with real-time emulators (XDS510 or XDS560) and DSP debugging with CCS

Easy Data Transfer Between Camera and Host

- Windows/Samba-share
- NFS or FTP server/client
- USB-stick etc.

Software Development Kit

Features of the Software Development Kit

The free software development kit contains a single API that works with all models from VRmagic. The self-describing property interface allows for generic code development - an exchange of the camera model later on is thus possible without additional programming. The provided user interface allows unlimited access to the uncompressed sensor data. Demo applications and free source code for several developing platforms are included.

Demos including Sources on CD

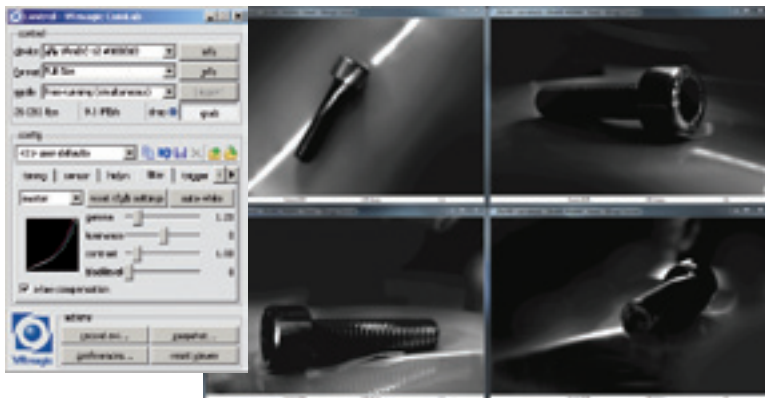
- Bayer/Grey to RGB565 converter on ARM or DSP
- Demo for integration of customer specific DSP codecs (JPEG, Sobel, etc.)
- Viewer for S-Video output (DirectFB and SDL)
- Control of general purpose I/O's

Rescue USB-Stick for Simple Updates and Inexpensive Maintenance

Updates of the application software running on the intelligent camera can be applied in just a few minutes with the Rescue USB-Stick from VRmagic. Developers can create their own update stick by means of a simple script. This stick can then be used to install the current software version on a camera.

The Rescue USB-Stick can also be used to restore a camera's internal Linux operating system to its factory state quickly and easily if necessary. This can be done by simply connecting the USB-stick to the USB host port of the camera and then rebooting the camera.

The Rescue USB-Stick is included in the accessory package.



< Multi Viewer Support

The CamLab from VRmagic offers multi viewer support for the multi-sensor camera; The pixel-synchronous images of up to four connected external sensors can be displayed on the PC desktop at the same time. Further user-friendly features include the graphical configuration of regions of interest and the configuration of camera parameters without grabbing. The API allows users to access multiple frames of the host ring buffer simultaneously.

Available Designs & Sensors

Designs

Intelligent multi-sensor cameras consist of a central unit and up to four offset sensor boards. The sensor boards are connected to the main unit by flex-foil cable.

- mOEM Series: Sensor Boards without Optics
- mCOB Series: Sensor Boards with Optics

OEM Backends with PicoBlade™ Connectors

For applications requiring a more compact design, the standard backend of the board level cameras can be exchanged with a Molex PicoBlade™ backend featuring miniature connectors for all interfaces of the standard backend.

Optional Digital Video Output Interfaces

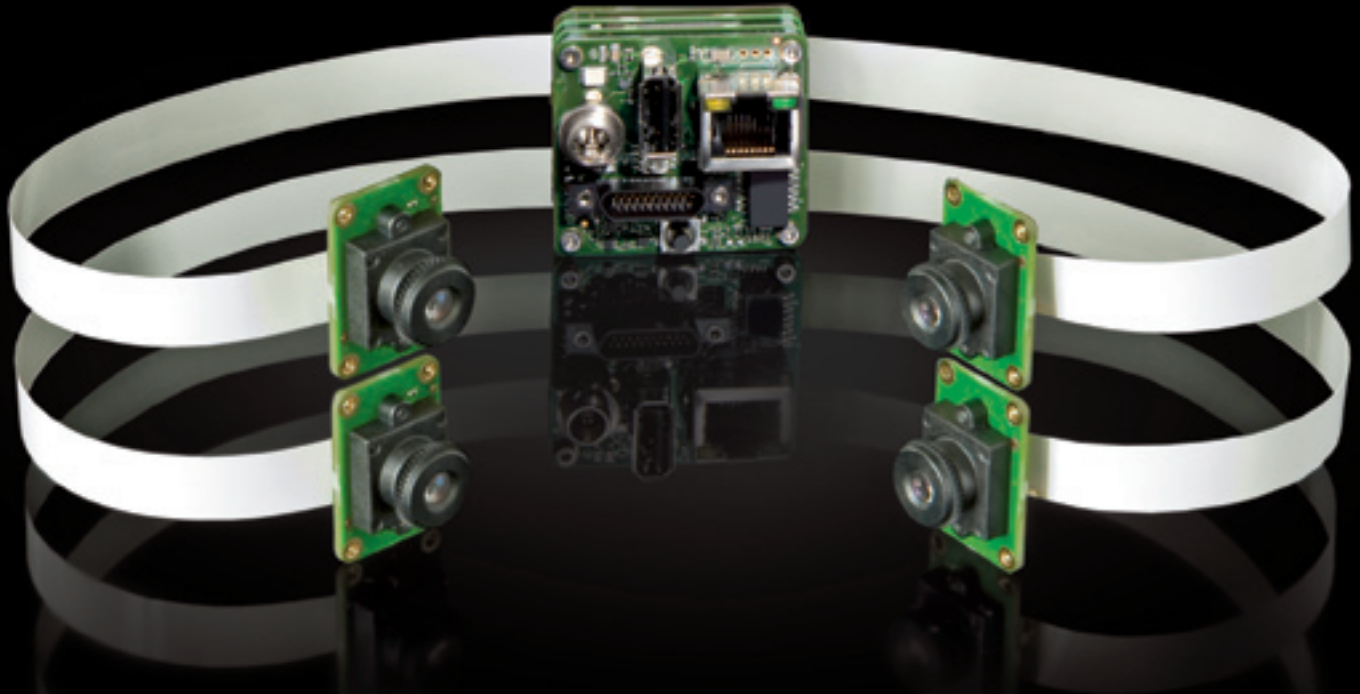
A RGB888 interface of the PicoBlade™ backend allows for connecting an additional DVI or HDMI interface on an external board to the camera using a flexible printed circuit cable. The camera sensors can be synchronized to the RGB888 video output.

Camera Features

- Individual adjustment of exposure time, auto exposure, gain, auto gain, and white balance for each sensor
- Correction of gamma, luminance, and contrast via look-up tables
- Freely definable ROI (region of interest)
- Pixel formats: 8bit, 16bit, 8bit RLE (lossless real-time compression)
- Unrestricted access to raw sensor data
- Trigger/strobe settings
- Soft-trigger, timestamps, framecounter



< The external board with DVI interface (optional HDMI interface) can be connected to the PicoBlade™ backend of the intelligent camera using a flexible printed circuit cable.



Sensor Characteristics

	VRmDMFC-8-(2/3/4)	VRmDMFC-9-(2/3/4)	VRmDMFC-12-(2/3/4)	VRmDMFC-14-(2/3/4)
Manufacturer	Aptina	Aptina	Aptina	Sony
Type	MT9T001 ①	MT9M001 ①	MT9V024	ICX445 ①
Technology	CMOS	CMOS	CMOS	CCD
Shutter	rolling	rolling	global	interline transfer
Color	●		●	●
Monochrome		●	●	●
Sensor Size	1/2"	1/2"	1/3" wide	1/3"
Resolution	2056 x 1544	1288 x 1032	754 x 480	1296 x 966
Pixel Size [µm]	3.2 x 3.2	5.2 x 5.2	6 x 6	3.75 x 3.75
FPS (Full Resolution)	13	30	69	22 ②
Min. Exposure Time [µs]	60	38	30	to be defined
Bit Depth	8/16	8/16	8/16	8/16
Pixelclock [MHz]	to be defined	to be defined	26.6	36 ②

① available soon

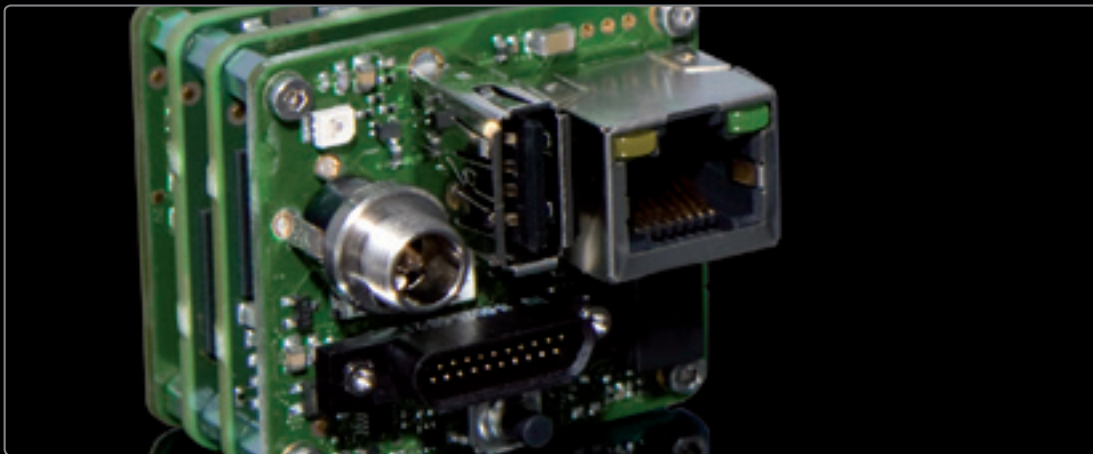
② subject to change

Physical Characteristics

	VRmDMFC-8-(2/3/4)	VRmDMFC-9-(2/3/4)	VRmDMFC-12-(2/3/4)	VRmDMFC-14-(2/3/4)
Main Board Size [mm]	42 x 38 x 41 (28)			
mOEM Sensor Board Size [mm]	42 x 38 x 7	42 x 38 x 7	28 x 19 x 7	42 x 38 x 9
mCOB Sensor Board Size [mm]	42 x 38 x 20	42 x 38 x 20	28 x 19 x 11	42 x 38 x 20

All dimensions W x H x D without lens and including connectors. Dimensions in brackets apply to depth of backends with PicoBlade™ connectors.

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