C-Cam Technologies

BCi$_4$ CMOS Camera

- **1280 x 1024 pixels (H x V)**
- **Compact design**
- **Area with Window Of Interest**
- **Single Line-scan**
- ***n*-Line scan**
- **Monochrome and Colour versions available**
- **8 bit, 10 bit or 12 bit digital output**
- **Serial LVDS, USB 2.0, IEEE-1394 or Camera Link interface**

BCi$_4$ CMOS Camera

The BCi4 camera is a very compact, high-resolution CMOS camera. The camera is equipped with the Ibis4 image sensor. With 7 µm square pixels, the user can define any Window Of Interest within a 1280 x 1024 pixel area, also known as the SXGA format. A separate Line Scan Mode complements the operation of this versatile camera. The sensor has a remarkably good signal-to-noise ratio in combination with excellent contrast performance. Also the dark current of the sensor is much lower than in classical CMOS image sensors allowing longer exposure times.

The image sensor has excellent contrast coupled to a high linear dynamic range. By programming the “Well Enhancement” the user can extend the dynamic range further. The saturation range covers more than 80dB with a non-linear upper curve.

The digital camera operates in single shot mode, which makes it ideal for machine vision applications. In this mode, the user has the freedom to decide when the camera has to capture an image, not the other way around, as is the case with most analogue camera systems. Continuous capture mode for area-scan or line-scan is also supported. The *n*-line scan operation allows selecting vertical segments on the sensor.

The in-camera memory of 8Mbytes is used as image FIFO in USB2.0 and IEEE-1394 interfaces and can be used with custom camera logic for other purposes, such as reference image, camera calibration data…

C-Cam Technologies supply several standard interfaces: Serial LVDS, USB 2.0, IEEE-1394 or Camera Link. The Camera Link and Serial LVDS interfaces allow for remote triggering via the interface cable. They also have a local trigger input and output. The IEEE-1394 and USB 2.0 versions have local trigger input and output. The IEEE-1394 camera is IIDC/DCAM 1.30 compliant.

The BCi4 comes with Drivers and DLL files and sample code in Visual C (Windows 98,Me, 2000 and NT4.0). Software engineers can easily adapt the code to integrate into their own applications. Include-files for Visual Basic and Delphi are supplied.

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Sensor Specifications

Imager type	CMOS integrating active pixel sensor (APS) IBIS4 by FillFactory with on-chip non-uniformity correction
Sensor types	Monochrome or colour in diagonal RGB pattern
Total pixels	1,324,580 (1286H x 1030V)
Total light-sensitive pixels	1,310,720 (1280H x 1024V)
Window Of Interest (WOI)	Any rectangle image format specified by the user
Active image area	8.96mm (H) x 7.17mm (V)
Pixel pitch	7 x 7 µm
Fill factor	60 % (no microlenses)
Spectral response	More than 30 %
Temporal noise	20 electrons, 500 µV RMS
Well capacity	more than 75,000 electrons (55,000 linear range)
Enhanced Full Well	programmable up to 64000 electrons (linear range)
Dark current signal	787 electrons/sec.@ 21°C
Avg. auto-saturation time	51 seconds @ 21°C
Dark current	255 pA/cm2 @ 21°C
Blooming suppression	1 x 10^5
Smear	None
Dynamic range	std. 68 dB (55,000/20 = 2750:1) linear 70 dB enhanced linear
High dynamic range	100 dB in Limited Exposure Technology (LET) mode
Grey level resolution	8 bits = 256 grey levels or 10 bits = 1024 grey levels or 12 bits = 4096 grey levels
MTF	0,4 - 0,5 @ 450 nm 0,25 - 0,35 @ 650 nm
PRNU	10% p/p with 1/2 saturation

Image Specifications

Pixel rate	20 MHz
Frame speed (full resolution)	Approx. 14 frames/second continuous mode
Shutter	On-chip electronic shutter rolling curtain type
Shutter synchronisation	Remote via software or via cable. Local via I/O i/face
Maximum Exposure time	200 msec
Minimum exposure time	2 lines, 135 µsec typical at 20 MHz

In-camera Resources

Memory	8Mbytes
FPGA Logic	100 k gates

Interface Specifications

Interface type	Serial LVDS, USB 2.0 IEEE-1394, Camera Link
Interface connector	
LVDS	Binder 712 series 7-pole,
USB 2.0	Binder 712 series 4-pole,
IEEE-1394	std. 6-pole
Camera Link	MDR26p
Cable length	
LVDS	3, 5, 7m
USB 2.0	0.5, 1, 2, 3, 5m
IEEE-1394	max 4.5m
Camera Link	3, 5, 7, 10 m
Remote Trigger	via LVDS or Camera Link interface
Local Trigger	Isolated, 1 input, 1 output
Local Trigger Connector	Binder 712 series 3-pole

Mechanical Specifications

Dimensions	(not incl. lens)
LVDS, Camera Link, USB	50 x 50 x 53 mm.
IEEE-1394	50 x 50 x 62 mm.
Weight	< 200 grams (not incl. lens)
Housing	Aluminium black anodised
Lens adapter	C-mount standard stainless steel, adjustable
Tripod mount	1/4 inch mount (1 off)
Machine mount	M6 x 1 (2 x 2 off)

Environmental Requirements

Operating temperature	0°C to +50°C
Storage temperature	-30°C to +80°C (non-condensing conditions)

Power Requirements

LVDS, IEEE-1394,USB	Power supply through Interface cable
Camera Link	8 - 12 Volts via separate Binder 712 series 2-pole connector
Power consumption	< 2 Watt

Ordering Information

BCI4		Mono-chrome	Color		20MHz	Local triggering
			RGB	Bayer		
Interface	Code	M	C	B	20	✓
LVDS	LS	✓	✓		✓	Isolated
Camera Link	CL	✓	✓		✓	Isolated
IEEE-1394	1394	✓	✓		✓	Isolated
USB 2.0	U	✓	✓		✓	Isolated

E.g. BCI4-U-M-20 specifies a Monochrome BCi4 with 20 MHz pixel rate, USB 2.0 interface.

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