

SI-1300-M & RGB MegaCamera™

1.3 Megapixel, 10-Bit Low-Noise, 40MHz
USB 2.0 High-Speed Digital Camera

Silicon Imaging Inc.



Silicon Imaging is proud to continue its innovation in high-resolution color vision camera. Driven by the growing demand for consumer Digital Still Cameras, CMOS sensors are continuing to break technical barriers and surpass the performance characteristics of CCD's in many photonic, imaging and consumer applications. By utilizing a single highly integrated CMOS device, which incorporates Megapixel sensing areas, timing generation, signal processing and high bandwidth outputs, Silicon Imaging has developed a very compact, low-power, ultra high speed Megapixel digital camera system.

1280 x 1024 Megapixel - Ultra Resolution

The SI-1300 is an all-digital CMOS camera that delivers 1.3 Million pixels of resolution and is capable of running at 30 frame/sec at 1024 x 1024 resolution and 25fps at its full 1280x1024 resolution. The entire package is only 45 x 52 x 50mm (33 x 40mm x 22mm in PCB) and is small enough to be placed on a robot for semiconductor machine vision inspection or placed in an outdoor housing for remote surveillance. For handheld instrumentation designs the 'R' version PCB is small enough to fit into a 27mm diameter.

10-Bits Low-Noise (<20e-) – Sub-Pixel Accuracy

The SI-1300 MegaCamera uses 10-Bit digitizers to sample the pixel data. Converting the pixel data directly to digital at the sensor head eliminates pixel-sampling jitter and enables accurate sub-pixel metrology, image analysis and improved live video reconstruction. The results are impressive with low-noise and low-dark currents to allow increases in gain and exposure time for improved signal noise. Image transfer can be switched from 8 to 16bit mode, to get full 10bit data. A programmable 10~40MHz clock allows for trade-off in bit-depth and speed versus exposure time and lower noise.

75 FPS VGA Subsampling - Fast Preview

Ideal for high speed preview and focusing, the SI-1300 is capable of generating imagery at over 100 frames per second by reducing the size of the readout image in color subsampling mode. This entire imager is readout by skipping pairs of pixels (4:2) to maintain color information of neighboring bayer groups. In this way, the 640x480 accurately represents the full size 1280x1024 image.

Automatic Black Level Correction – IR Sensitivity

The SI-1300 has automatic black level calibration, which measures the average value of 256 pixels from two dark rows of the imager for each of the four colors. The pixels are averaged as if they were light sensitive and passed through the appropriate color gain. This average is then digitally filtered over many frames and compared to minimum and maximum acceptable thresholds for automatic correction.

USB2.0 Bus-Powered – 40MB/sec Transfers

For low-cost and portable connectivity, with data transfer rates up to 40MB/sec, the SI-1300U provide convenient capture using the High-Speed 480Mb/sec USB 2.0 interface. It is a bus-powered unit, consuming less than 500mA at 5VDC and will operate without any external power supply. The precision-machined C-mount housing includes an integrated tethered USB cable and optional 3-pin trigger/strobe connection. For OEM board level configurations, two General Purpose Outputs are accessible; Pull-Up and pull-down driven transistors to be used to control light sources and switches.

Microsoft-XP™ Live Mode Kernel Driver - Fast captures

For applications which require a combination of high-resolution and streaming high-frame rate video images, Silicon Imaging has developed a custom driver which can request and capture double buffered images at the driver level. This method enables immediate request to camera for next image without user level software intervention. The double-buffers allow one image to be processed by the host PC, while another image is being readout from the camera and filled into the user allocated memory space.



FEATURES

- 1280 x 1024 Resolution (1.3 Million Pixels)
- 1/2" Imaging Format, 5.2um Square Pixel
- Rolling Shutter, Progressive scan
- 120fps Windowing at 320 x 240 QVGA
- 10 Bits per Pixel, 35MHz Sampling (Nominal)
- 10 ~ 45MHz Programmable Clock
- IR-Sensitivity & Low-dark Currents (<20e-)
- Programmable Gain, Exposure & Clocks
- Auto Black Level Calibration
- Monochrome & Color Bayer RGB Model
- Custom PCB Version
- USB2.0 High-Speed, 480Mb/sec Interface
- C-Mount Precision Machined Housing
- Image Capture & Color Processing SDK

SI-1300 MegaCamera USB 2.0 Specifications

SI-1300 Sensor:

Optical Imaging Format	1/2" (6.83mm x 5.45mm)
Active Pixels	1,280H x 1,024V
Pixel Size (pitch)	5.2 µm x 5.2 µm
Pixel Type	CMOS

USB2.0 High-Speed Interface & Control:

USB Speed	480Mb/sec (High-Speed)
Serial Communication	Endpoint 0, Vendor Protocol
Data Interface	Endpoint 2, 2K FIFO
Programmable Modes	Exposure, Gain, Windowing, Clock rates, Auto black, mirroring.

Aspect Ratio	1 : 1
Spectral Response	350 ~ 1000 nm
Peak QE	56% Monochrome @ 570nm
Minimum Illumination:	0.3 lux nominal (SNR =1, f# = 2.8, exposure = 100ms, daylight)
Responsivity	2.1 V/lux-sec
Dark Current @ 25°C	20 e-/sec
Temporal Noise	10 e-
Saturation Charge	40,000 e ⁻
Dynamic range	68.2 dB
Windowing (ROI)	Horizontal & Vertical speed increase
Sub-sampling	Full, 1/2, 1/4, 1/8
Gain MAX	15X, min step size 0.125
Readout Method	Progressive Scan
Black Level	Auto Black Level Calibration
Shutter	Rolling Shutter and Single Frame
Shutter Speed	Variable, 1 to 16383 row times
Horizontal Blanking	244 Clocks/line
Minimum Row Time	548 Clocks (304+ 244 Blanking)
Vertical Blanking	26 Rows
Row/Frame Time	1524 clocks/row x 1050/rows = 30fps

Region-of-Interest	Programmable Horiz & Vertical
Gains (R,G,B,G & Global)	Individual R,G1,B, G2 Gains Range: 15X, MIN step size 0.125
Setting Timing	Next top of Frame
Ext Clock Sync	Clock in or Clock Out (-X Option)
External Triggers	TTL Trigger-In / Strobe-Out w/3-Pin connection (option)

Power

Input Voltage	+5 VDC +/- 10% < 500mA
Power Consumption	2.0 Watts
Trigger Connection (opt)	Tajimi RO3-PB3M 3Pin (optional)
Connection	USB Bus Powered

Mechanical

Lens Mount	C-Mount, 7mm Back focus adj.
Enclosure Size	45mm W x 52mm H x 50mm L
Weight	8.5 oz. / 240g
Camera Mount	¼" x 20 standard tripod mount
Cable Connector	USB-A Cable Integrated

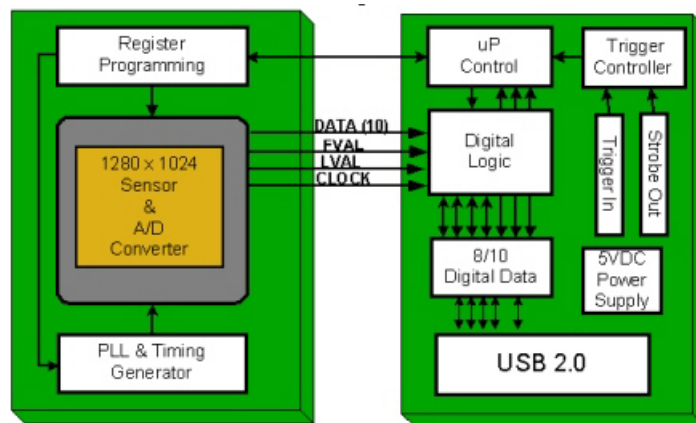
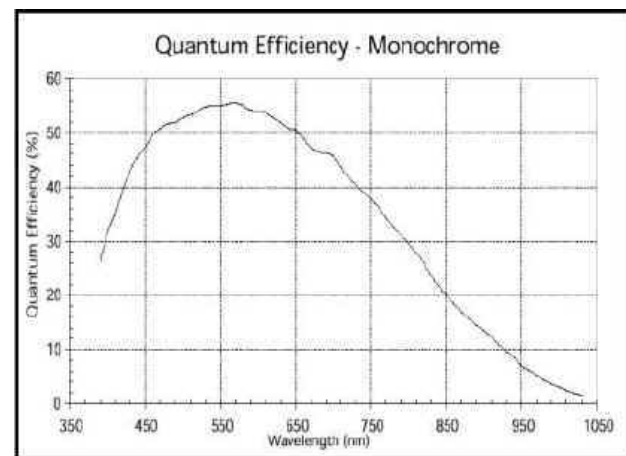
A/D Conversion & Sampling Clock Synthesizer

A/D Conversion	Nominal 35Mhz (24fps @ 1.0MP)
Vertical Resolution	10 Bit
Pixel Clock Frequency	10 ~ 40 Mhz Programmable

Digital Video Output

Readout Format	8-bit or 16bit (10-bit data)	
Readout Rate	10 ~ 40Mhz (8bit format)	
	10~ 25Mhz (16-bit format)	
Max Transfer Rate	~ 40MB/sec(ICH4 or higher)	
Frame Rate	40MHZ	20MHZ
1280 x 1024	25	12
1024 x 1024	30	15
1280 x 720	35	17
1024 x 768	40	20
640 x 480	85	42
320 x 240	220	110
Row Time	clocks/row / Clock =Row_Time 1524 / 40MHz = 38.1usec/row	
Exposure Time	N-Row Times	

Spectral Response Curve (Monochrome)

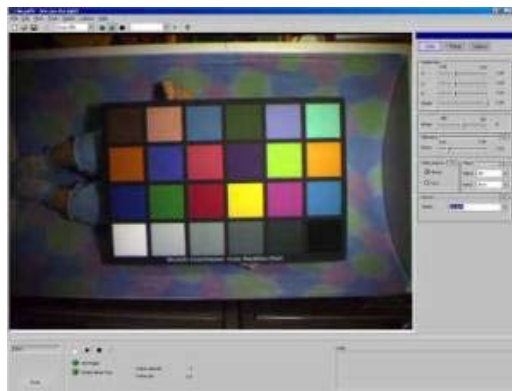


SI-1300 Register Programming

0x00	Chip Version	0x8421 0x8431	
0x01	Row Start	0x000C (12)	(First row to be read out + 12)
0x02	Column Start	0x0014 (20)	(First column to be read out + 14) Register value must be an even number.
0x03	Window Height	0x03FF	Window height (number of rows - 1) Min = 0x0002.

		(1023)													
0x04	Window Width	0x04FF (1279)	Window width (number of columns - 1) Register value must be an odd number. Min = 0x0003												
0x05	Horizontal Blanking	0x0013 (19)	Number of extra row blanking clocks + 19 Row Blanking = 244 clocks + (Regx05 -19)												
0x06	Vertical Blanking	0x0019 (25)	Number of extra rows added into the vertical blanking period. Typically used to slow down frame rate and allow time for register updates between images.												
0x09	Exposure	0x0419 (1049)	Number of rows of integration												
0x0C	Shutter Delay (Short Exposure)	0x0000 (0)	Number of master clocks times 4 that the sensor waits before asserting the reset for a given row.												
0x1E	Subsampling & Snapshot Mode	0x80xx (x8000)	0 0 (do not change) 1 0 (do not change) 2 Column Skip 4—default is 0 (disable), 1 = enable. 3 Row Skip 4—default is 0 (disable), 1 = enable. 4 Column Skip 8—default is 0 (disable), 1 = enable. 5 Row Skip 8—default is 0 (disable), 1 = enable. 6 0 (do not change). 7 0 (do not change). 8 Snapshot Mode—default is 0 (continuous mode). 1 = enable Snapshot TRIGGER can come from CC-1 or from serial interface command.												
0x20	Subsampling 2 & Scan Reversal	0x11xx (0x1104)	0 No bad frames: 0 (default) = only good frames, 1 = all frames 1 0 (do not change) 2 1 (do not change) 3 Column skip2: 0= normal readout (default), 1= skip by 2 4 Row skip2: 0 = normal readout (default), 1= skip by 2 5 0 (do not change) 6 0 (do not change) 7 Flip Row: 0 = normal, 1= Scan reversal 8 1 (do not change)												
0x2B	Green1 Gain	0x0008 (8) 1x gain.	<table border="1"> <thead> <tr> <th>Gain</th> <th>Increments</th> <th>Settings</th> </tr> </thead> <tbody> <tr> <td>1.000 to 4.000</td> <td>0.125</td> <td>0x08 to 0x20</td> </tr> <tr> <td>4.25 to 8.00</td> <td>0.25</td> <td>0x51 to 0x60</td> </tr> <tr> <td>9.0 to 15.0</td> <td>1.0</td> <td>0x61 to 0x67</td> </tr> </tbody> </table>	Gain	Increments	Settings	1.000 to 4.000	0.125	0x08 to 0x20	4.25 to 8.00	0.25	0x51 to 0x60	9.0 to 15.0	1.0	0x61 to 0x67
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0x2C	Blue Gain	0x0008 (8) 1x gain.													
0x2D	Red Gain	0x0008 (8) 1x gain.													
0x2E	Green2 Gain	0x0008 (8) 1x gain.													
0x35	Global Gain	0x0008 (8) 1x gain.	This register can be used to set all four gains at once. When read, it will return the value stored in Reg0x2B.												

USB CAMERA & - MEGAXV SOFTWARE



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