

**SI-1300M & RGB MegaCamera™**  
 1.3 Megapixel, 10-Bit, 40/80MHz  
 Progressive Scan 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 over 40 frames/second at its full 1280 x 1024 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. It is ideal for live visualization and handheld instrumentation.

**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. A programmable clock which ranges from 20-40MHz allows for trade-offs in speed versus exposure time and lower noise. Clock speeds up to 80MHz are possible with the High speed (-H) model.

**120 FPS VGA Subsampling - Fast Preview**

Ideal for high speed preview and focusing, the SI-1300 is capable of generating imagery at over 120 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.

**1000 FPS Windowing**

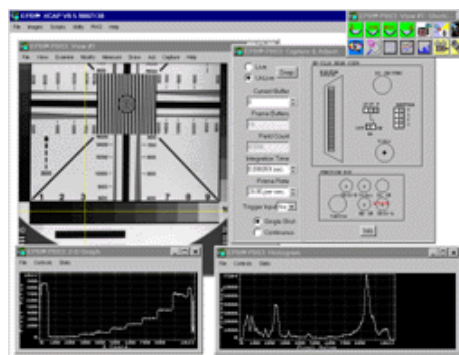
A small region of the imager can be readout at frame rates in excess of 1000fps (ex. 200 x 100), with speed increasing with reduced vertical and horizontal settings. The window size and position can be adaptively changed on frame-by-frame basis.

**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.

**CameraLink Digital Interfaces**

An industry standard forum has adopted Camera Link, for low cost connectivity and cabling of cameras and frame grabbers at very high speeds. The SI-1300-CL utilizes the high speed CameraLink interface to output 1280 x 1024 10 bit data at 40/80MHz continuously to a frame grabber and directly into PC memory for further processing. The single cable includes image data, vertical and horizontal synch, LVDS Triggering and 9600 baud Serial communication. For High-Speed communication, the SI-1300 also has a 57.6kb mode for faster register updates. This camera complies with the standard, it is compatible with many popular frame grabber and image processing hardware devices and fiber-optic extender for extended distance transmission.



**FEATURES**

- 1280 x 1024 Resolution (1.3 Million Pixels)
- 1/2" Imaging Format , 5.2um Square Pixel
- Rolling Shutter, Progressive scan
- 640 x 480 VGA Windowing at 120fps
- 10 Bits per Pixel with 68.2 dB Dynamic range
- 20 ~ 40/80MHz Programmable Clock (-H for 80MHz)
- > 20e-/sec Low Dark Current,
- Programmable Gain, Exposure & Clocks
- Auto Black Level Calibration
- Monochrome (M) & Color Bayer (RGB) Model
- Genlock option (-G)
- Cameralink Interface
- C-Mount Precision Housed & PCB Models

**SI-1300 MegaCamera CameraLink Specifications**

**SI-1300 Sensor:**

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

**CameraLink Frame Grabber Control:**

Serial Communication	RS-232 Protocol 9600bps (57.6k)
Signaling	TX & RX (LVDS)
Asynchronous Triggers	LVDS – CC1 (-CL) TTL Trigger-In / Strobe-Out (option)
Region-of-Interest	Programmable Horiz & Vertical
Programmable Modes	Exposure, Gain, Windowing, Clock rates, Auto black, image mirroring.
Gains (R,G,B,G & Global)	Individual RGB Gains Range: 15X, MIN step size 0.125

Temporal Noise	10 e-
Saturation Charge	40,000 e <sup>-</sup>
Dynamic Range	68.2 dB
SNR	> 45dB
Windowing (ROI)	Horizontal & Vertical speed crease
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	25 Rows (16 min)

### A/D Conversion & Sampling Clock Synthesizer

A/D Conversion	Nominal 48Mhz (30fps @ 1.3MP)
Vertical Resolution	10 Bit (Format = 12bit-CL 1-Tap)
Pixel Clock Frequency	20 ~ 40 Mhz Programmable 20 ~ 85 Mhz (-H High-Speed)
Adjustment Method	Serial command Protocol
Mean Black Level	32 Counts

### Digital Video Output

Readout Rate	20 ~ 85Mhz x 12bit format	
Readout Format	CL-12 (Duplicated on Ports AB)	
Frame Rate	48Mhz	60Mhz
1280 x 1024	30	38
1280 x 720	43	54
640 x 480	110	137
320 x 240	334	417
200 x 200	407	509
160 x 120	654	817
Frame Time (default)	1524 x 1050 rows @48Mhz = 30fps	

Setting Timing	Next top of Frame
Ext Clock Sync	Clock in or Clock Out (-X Option)

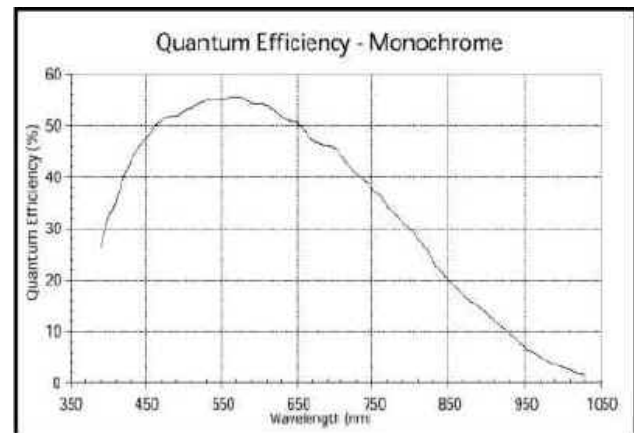
### Power

Input Voltage	+5 VDC +/- 10%
Power	2.5 Watts
Power/Trigger Connection	Tajimi RO3-PB3M 3Pin (-CL) Tajimi RO3-PB5M 5Pin (-X)

### Mechanical

Lens Mount	C-Mount, 7mm Back focus Adj.
Enclosure Size	45mm W x 52mm H x 50mm L
Weight	12 oz.
Camera Mount	¼" x 20 standard tripod mount
Cable Connector	Cameralink MDR-26

### Spectral Response Curve (Monochrome)

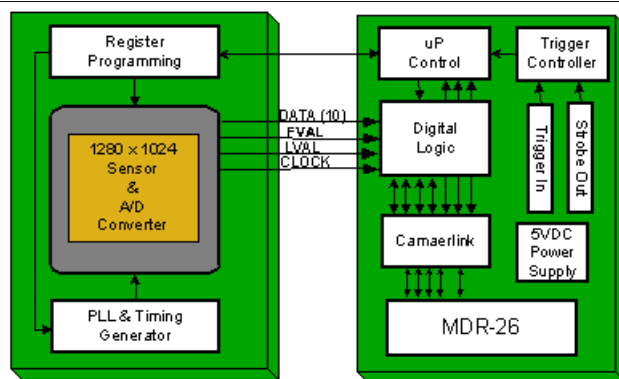


Command	Clock Rate MHz	SI-1300 CL Frame Rate						
		1280x1024	1280x720	640x480	320x240	200 x200	160 x 120	100 x100
lc306886	20	13	18	46	143	169	268	315
lc30b689	25	16	22	57	178	211	335	393
lc37cb8f	30	19	27	68	214	253	403	472
lc35d40b	35	22	31	80	249	296	470	551
lc306882	40	25	36	91	285	338	537	629
lc35e709	45	28	40	103	321	380	604	708
lc356e03	48	<b>30</b>	43	109	342	406	644	755
lc34b689	50	32	45	114	356	422	671	787
lc34b688	55	35	49	125	392	465	738	865
lc36cb8f	60	38	53	137	428	507	805	944
lc367307	65	41	58	148	463	549	872	1023
lc344081	67	42	<b>60</b>	153	478	566	899	1054

### 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 (1023)	Window height (number of rows - 1) Min = 0x0002.
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	<b>Green1 Gain</b>	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	<b>Blue Gain</b>	0x0008 (8) 1x gain.													
0x2D	<b>Red Gain</b>	0x0008 (8) 1x gain.													
0x2E	<b>Green2 Gain</b>	0x0008 (8) 1x gain.													
0x35	<b>Global Gain</b>	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.												



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