LFG4
Quad Analog Frame Grabber

Active Silicon
COMPUTER IMAGING PRODUCTS

- ■ **PAL / NTSC / CCIR / RS-170 Frame Grabber.**
- ■ **Simultaneous acquisition from four cameras.**
- ■ **8x opto isolated and 8x TTL I/O.**
- ■ **Single lane (x1) v1.0a PCI Express interface.**

FEATURES

- ■ Acquires standard 50Hz or 60Hz analog video (mono / color).
- ■ 4 BNC inputs for easy setup.
- ■ Optional connectors allow up to 16 inputs on BNC or D-type, 12x audio, 8x opto isolated and 8x TTL I/O.
- ■ Maximum PCI Express burst rate of 190Mbytes/sec.
- ■ Software Development Kit (SDK) supports various operating systems for rapid integration.
- ■ Windows, Mac OS X, Linux and QNX support.
- ■ 3rd party drivers: DirectShow and VDIG/QuickTime.
- ■ Royalty-free JPEG compression.
- ■ RoHS compliant.

OVERVIEW

LFG4 combines four of Active Silicon's proven *LFG*s into one card, allowing simultaneous acquisition from four cameras. Even if simultaneous acquisition is not required, *LFG4* allows successive acquisition from the four sources without the synchronization delay normally expected. The *LFG4* is software compatible with existing *LFG* applications.

Full resolution color (PAL / NTSC / SECAM) or monochrome images are digitized in real time and transferred into system memory under master mode DMA without any software intervention.

There are four BNCs fitted as standard, to allow four composite/monochrome sources to be digitized simultaneously, each of which has a switch to select an optional 75Ω termination. Expansion connectors allow three additional sets of four BNCs to be fitted (again with termination switches). These expansion connectors allow four out of sixteen composite/monochrome sources to be digitized simultaneously.

Raw video data may be optionally converted into one of several formats suitable for image processing or direct display. These include 32, 24, 15 and 16 bit RGB (using the internal colorspace converter and formatter), as well as grayscale and YUV 4:2:2. Image transfer is done by DMA in hardware with no CPU intervention, along with optional hardware de-interlacing, region of interest generation and scaling, thus requiring no software overhead.

Standard drivers are included for DirectShow and VDIG/QuickTime including SecuritySpy (www.securityspy.com).

All hardware is provided with a one year warranty.

SYSTEM BLOCK DIAGRAM

Note: This is a simplified block diagram that only shows the main data and control paths.
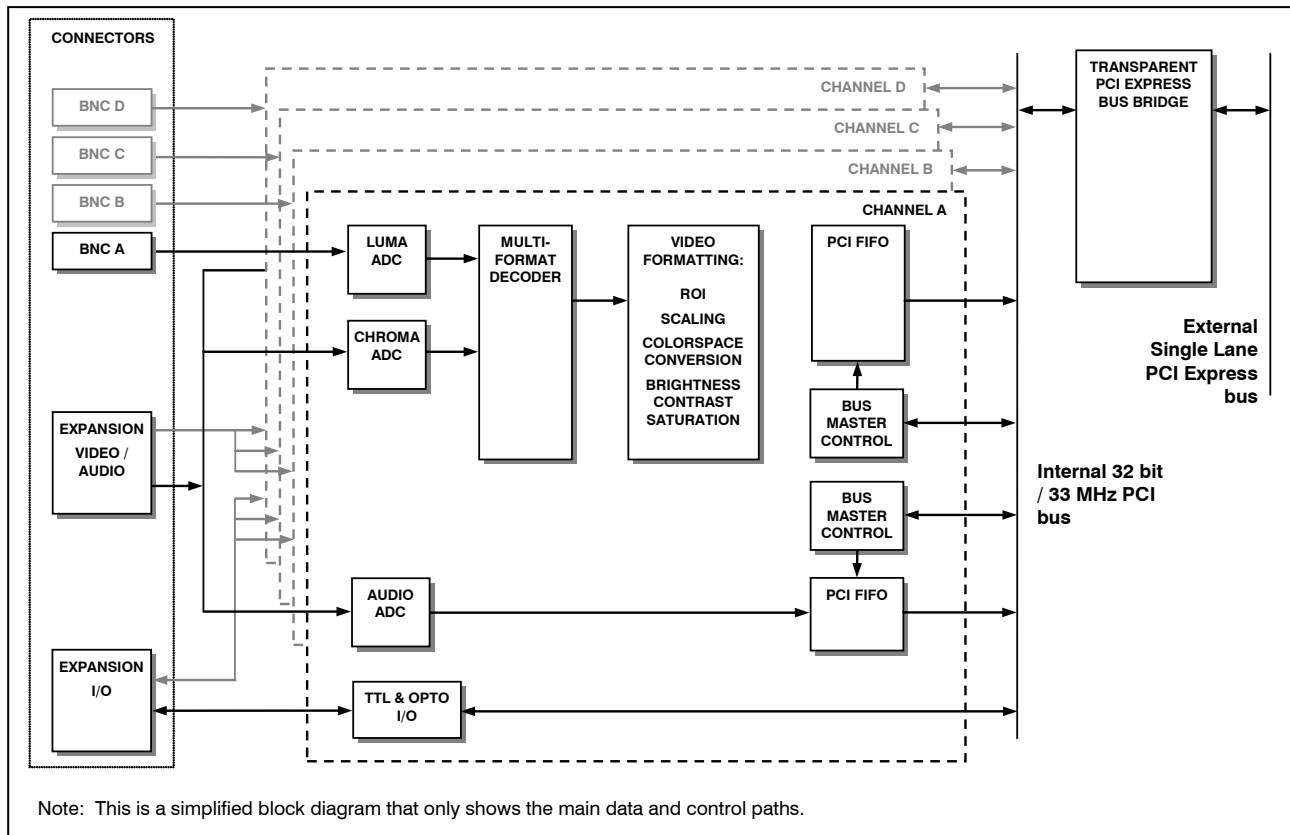
HARDWARE SPECIFICATION

Video Chip:	**LFG4** is based around the Fusion 878 video decoder, using one decoder per channel. The drivers are 100% proprietary and written by Active Silicon for cross-platform operation.
Channels:	The four channels are completely independent. Except where stated otherwise, this specification applies to each channel individually, e.g. channel A can be digitizing a PAL source at full resolution to BGRX32 format, and channel C a region of a 60Hz mono source at 4:1 scaling to Y8 format.
Video Input:	Each of the four channels has four luminance/composite inputs. This architecture allows one input per channel to be digitized simultaneously, and those inputs can be multiplexed between four composite/monochrome sources. As standard one luminance/composite input from each channel is available on the PCI end bracket. All the inputs are available using the expansion connectors.
Video Termination:	A four way switch on the PCI end bracket allows each of the four BNC video inputs to be terminated via a 75Ω resistor, or left unterminated to allow a loop-through connection.
Audio Input:	Each of the four channels can digitise one of three 8 / 16 bit mono audio inputs, with sampling from 8kHz @ 8 bit to 44kHz @ 16 bit. These inputs are available using the expansion connectors.

Sampling:	The internal video clock operates at 4x color subcarrier frequency (17.73MHz for PAL and 14.31818MHz for NTSC). Analog video is sampled at double this frequency and low-pass filtered prior to decimation to the 4x subcarrier sampling rate.
	The effective output pixel rate is programmable, but typically square pixel rates would be used for full resolution (14.75MHz for 50Hz systems and 12.27MHz for 60Hz systems).
Color Decoder:	PAL, NTSC and SECAM support using either standard notch and bandpass filters, or a single line comb filter.
Digital Levels:	Normal operation: Luma 16 to 235. Chroma 2 to 253 (128 = no color). Full Range: Luma 0 to 255. Chroma 2 to 253 (128 = no color).
Video Controls:	Hue Adjustment: +90 degrees to −90 degrees. Contrast: 0 to 200%. Saturation: 0 to 200%. Brightness: -128 to +127 offset on luma digital level.
AGC:	Automatic gain control on luma and optional automatic gain control on chroma.
Scaling:	Down-scaling to 16:1, independently in both horizontal and vertical directions. Horizontal scaling uses a 6-tap interpolation filter and vertical scaling uses a 5-tap filter with a line store.
Region of Interest:	Region of interest (ROI) readout is achieved using cropping registers that define the start and active regions independently in the horizontal and vertical directions.
ColorSpace Conversion:	Optional colorspace conversion from YUV4:2:2 to various RGB formats as listed below.
Data Formats:	BGRX32, BGR24, RGB16, RGB15, YUV422, Y8 (grayscale) packed formats with optional endian control.
DMA Control:	Bus master operation using a RISC engine to read DMA instructions from host memory. These instructions contain scatter/gather table information, as physical addresses and lengths, encoded in the RISC/DMA instructions. This results in full resolution, continuous DMA without any software intervention.
DMA FIFO:	For each channel, a 70 by 32 bit FIFO for luma and a 35 by 32 bit FIFO for each of U and V of chroma. The FIFO is located between the output of the data formatter and the DMA engine.
Bus Bridge:	A "transparent" bridge is used, which means that no user software is needed to control it, and standard drivers (such as the Linux bttv driver) will recognise the four Fusion 878s.
PCI Express Compatibility:	The LFG4-PE1 is a single lane card (x1) however it is compatible with x4, x8 and x16 multi-lane slots.
Interrupts:	Field, Frame, End of Sequence and Trigger interrupts are available.
Test Options:	Optional hardware generated color bars for test purposes.
5V & 12V Outputs:	5V is supplied to all three expansion connectors through a 200mA resettable fuse. 12V is supplied to all three expansion connectors through a 500mA resettable fuse. These power outputs can be used for camera power.

I/O:	Each of the four channels has:

- Two TTL I/O lines with output capability of +64mA @ 0.55V / −32mA @ 2.0V. These are on the External I/O expansion connector.

- One opto-isolated input that senses voltages between 3.3V and 24V as a logic high input. This can be used as a trigger input for synchronisation with external events − for example to synchronise to a strobed flash gun. It can generate an interrupt. A 4.7kΩ current limiting series resistor is fitted. This input is on the External I/O Expansion Connector.

- One opto-isolated output that sinks up to 20mA of current, and will withstand 24V when "off". This output is on the External I/O Expansion Connector.

- Five unbuffered TTL I/O lines with an output capability of +6mA @ 0.4V / 1.2mA @ 2.4V. These are on the Internal I/O Expansion Connector.

Channel A also has an I2C port as described below.

Connectors:	Four 75Ω BNC sockets are fitted on the PCI end bracket.

The BNC Expansion Connectors are three internal 0.1" IDC 10 way headers that allow three more sets of four 75Ω BNC sockets to be fitted to adjacent slots using **AS-LFG4-ADP-BNC4**.

A 60 way header forms the Full Video/Audio Expansion Connector, a 40 way header forms the External I/O Expansion Connector, and another 40 way header forms the Internal I/O Expansion Connector. Both 40 way headers are pinned to allow connection to a standard IDC 37 way D type.

CONNECTOR PINOUTS

End Bracket BNCs

LFG4 is fitted with four video BNCs on the PCI end bracket.
Connector type: Standard 75Ω BNC sockets.

These are connected to inputs Video A1, B1, C1 and D1. See note below for the signal naming convention.

NOTE:
The signal naming uses the channel number followed by the input number within that channel, so e.g. Video B1 is the first video input on channel B.

BNC Expansion Connector

LFG4 is fitted with a three internal 10 way headers for additional BNC connections using A*S-LFG4-ADP-BNC4*.
Connector type: Standard 10 way 0.1" pitch box header for use with IDC sockets.

PIN	SIGNAL	PIN	SIGNAL
1	Video GND	2	Video An
3	Video GND	4	Video Bn
5	Video GND	6	Video Cn
7	Video GND	8	Video Dn
9	Video GND	10	Video GND

NOTES:
1. The signal naming uses the channel number followed by the input number within that channel, so e.g. Video B3 is the third video input on channel B. The "n" represents the input number within the channel, i.e. "2" on the first connector, "3" on the second, and "4" on the third.
2. These video inputs are unterminated, allowing *AS-LFG4-ADP-BNC4* to provide termination switches, as shown in the photograph below.

AS-LFG4-ADP-BNC4

Full Video / Audio Expansion Connector

LFG4 is fitted with an internal 60 way header for video and audio.
Connector type: Standard 60 way 0.1" pitch box header for use with IDC sockets.

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	Video GND	2	Video A1	31	Audio A1	32	Audio A2
3	Video A2	4	Video GND	33	Audio GND	34	Audio A3
5	Video A3	6	Video A4	35	Audio B1	36	Audio GND
7	Chroma A	8	Video GND	37	Audio B2	38	Audio B3
9	Video B1	10	Video B2	39	Audio GND	40	Audio C1
11	Video GND	12	Video B3	41	Audio C2	42	Audio GND
13	Video B4	14	Chroma B	43	Audio C3	44	Audio D1
15	Video GND	16	Video C1	45	Audio GND	46	Audio D2
17	Video C2	18	Video GND	47	Audio D3	48	Audio GND
19	Video C3	20	Video C4	49	GND	50	GND
21	Chroma C	22	Video GND	51	GND	52	GND
23	Video D1	24	Video D2	53	GND	54	GND
25	Video GND	26	Video D3	55	5V	56	5V
27	Video D4	28	Chroma D	57	5V	58	5V
29	Video GND	30	Audio GND	59	12V	60	12V

NOTES:

1. The signal naming uses the channel number followed by the input number within that channel, so e.g. Video B3 is the third video input on channel B.
2. The video and chroma inputs are unterminated, thus allowing the option of termination on whatever unit plugs into this connector. A total of three external components (two resistors, one capacitor) are needed per video input. These would usually be placed on a custom circuit board plugged into this 60 way connector.
3. The audio signals on pins 30 to 48 can be connected to a standard 25 way D-type without needing additional components.

CONFORMANCE

PCI Interface:		PCI (Peripheral Component Interconnect) Bus to PCI Express Bus Specification Revision 1.0a. ***LFG4*** implements a single lane Gen1 PCI Express interface.
Approvals:	EU	C€ mark for compliance with EMC EN 55022:1998 (class B) and EN 55024:1998 in accordance with EU directive 89/336/EEC. RoHS Compliant.
	USA	FCC mark for compliance with EMC FCC Class B.
		The printed circuit board is manufactured by UL recognised manufacturers and has a flammability rating of 94-V0.

PHYSICAL AND ENVIRONMENTAL DETAILS

Dimensions:	PCB: Overall:	167mm by 111mm 188mm by 126mm including end bracket and connectors.
Approximate weight:	183g.	
Power consumption (typical): *(excluding power out)*	+3.3V 1.2W	+12V 6.8W
Storage Temperature:	-15°C to +70°C.	
Operating Temperature:	0°C to +55°C.	
Relative Humidity:	10% to 90% non-condensing (operating and storage).	

ORDERING INFORMATION

PART NUMBER	DESCRIPTION
AS-LFG4-PE1	Analog multi-channel frame grabber. PCI Express bus with a single lane (x1) interface.
AS-LFG4-PCI-ADP-BNC4	Additional four BNC video inputs on a PCI end bracket, complete with termination switch and cable to connect to the BNC Expansion Connectors.
AS-LFG4-PCI-ADP-EIO37	37-way D-type socket on a PCI end bracket, complete with cable to connect to the External I/O Expansion Connector.
AS LFG SDK xxx	Software Developer's Kit for xxx operating system. xxx can be WIN, MAC, LIN or QNX.

THE LFG RANGE

The following products are available in the LFG range:

- **LFG** analog low cost frame grabber with 32 bit, 33MHz PCI bus.
- **LFG4-MM-PE1** analog multi-channel frame grabber with single lane (x1) PCI Express bus.

They are available in standard PCI Express, PCI, PMC and PC/104-Plus form factors, with a Software Development Kit (SDK) supporting Windows, Mac OS X, Linux and QNX operating systems.

More products are in development. Please consult your distributor for information on the availability of other camera interface, PCI interface, and form-factor options.

Active Silicon
COMPUTER IMAGING PRODUCTS

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