LFG4 MULTIMEDIA
Quad Analog Frame Grabber

Active Silicon
COMPUTER IMAGING PRODUCTS

- **PAL / NTSC / CCIR / RS-170 video capture.**
- **Simultaneous acquisition from four cameras.**
- **4 BNC inputs for easy setup.**
- **Single lane (x1) v1.0a PCI Express interface.**

FEATURES

- Low cost version of LFG4 targeted for multimedia applications.
- Acquires standard 50Hz or 60Hz analog video (mono / color).
- Maximum PCI Express burst rate of 190Mbytes/sec.
- Optional expansion allows up to 16 inputs on BNC connectors.
- Windows, Mac OS X, Linux support.
- 3rd party drivers: DirectShow and VDIG/QuickTime. For customers who need external I/O, or a full Software Development Kit (SDK) see the datasheet for the standard version of this board, the LFG4-PE1.
- RoHS compliant.
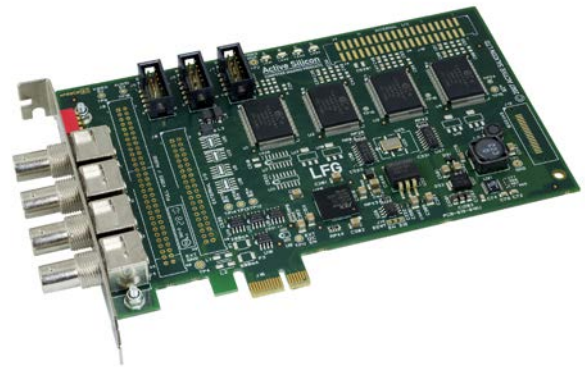
OVERVIEW

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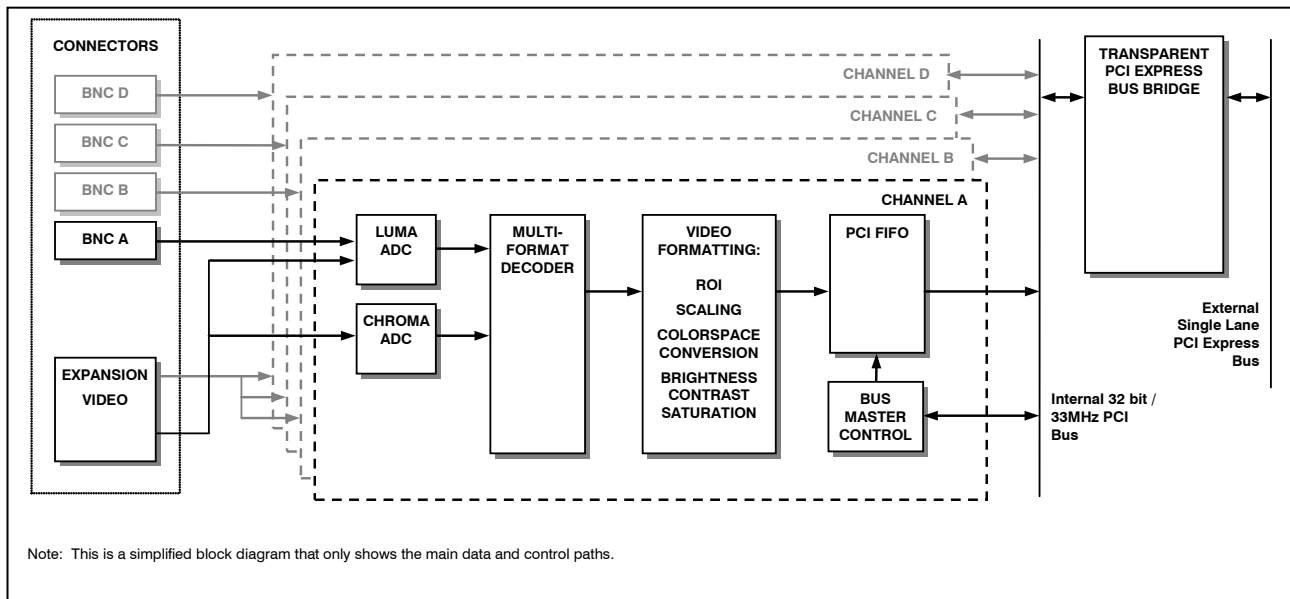
There are four BNCs fitted as standard, to allow four composite/monochrome sources to be digitized simultaneously, each of which has a switch to select an optional 75Ω termination. Expansion connectors allow three additional sets of four BNCs to be fitted (again with termination switches). These expansion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

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-MM-PE1 is a single lane card (x1) however it is compatible with x4, x8 and x16 multi-lane slots.
Test Options:	Optional hardware generated color bars for test purposes.
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***.

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
AS-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.
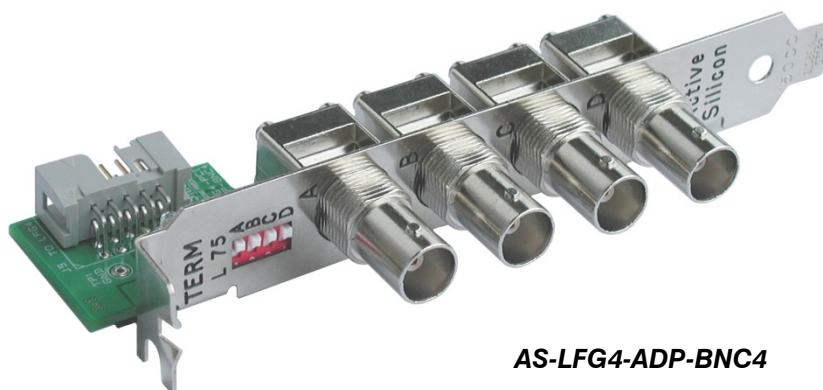
AS-LFG4-ADP-BNC4

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:	167mm by 111mm
	Overall:	188mm by 126mm including end bracket and connectors.
Approximate weight:	183g.	
Power consumption (typical):	+3.3V	+12V
(excluding power out)	1.2W	6.1W
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-MM-PE1	Analog multi-channel frame grabber, multimedia version. 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.

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-PE1** analog multi-channel frame grabber with single lane (x1) PCI Express bus.

They are available in standard PCI, PCI Express, 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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24-Jul-14