



Advanced Micro Peripherals Ltd.

MPEG4000

PC/104+ Multi-Channel MPEG4 Encoding

Video Frame Grabber

Hardware Reference Manual

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1 Introduction

The MPEG4000 is a real time multiple channel PAL/NTSC MPEG4 Encoding Frame Grabber for the PC/104+ bus. The MPEG4000 integrates on a single PC/104+ card up to 4 real time video frame grabbers, high performance MPEG4 video compression engine capable of MPEG4 encoding up to 4 independent video sources to disk, system memory or across a network. The MPEG4000 accepts live PAL or NTSC composite video from a variety of sources including video cameras, camcorders, VCR, laser disk, etc. The MPEG4000 video frame grabbers uses line-locking technique to lock onto the incoming video, digitise and forward to the MPEG4 encoding engine. This allows the MPEG4000 to quickly and accurately lock on to video signal regardless of their source. The digitised video is encoded in MPEG4 format and sent across the PC/104+ bus to memory. The MPEG4000 supports SIF and QSIF frame sizes in MPEG4 multiple concurrent channel streaming mode and full frame (768 x 576) in single channel mode all at full 25 or 30 fps/ frame rates.

1.1 Features

- Real time live video to MPEG4 standard
- Up to 4 concurrent Video Channels each at 30 frames/sec (320x240 pixels each)
- Full PAL/NTSC resolutions (768 x 576 pixels) single channel MPEG4 encoding
- 4-input software controlled Video Multiplexer per channel
- Video Preview to system display for 2 and 4-channel versions
- Inputs from Camcorder, Video camera, Laser disk, VCR, etc
- Low system bandwidth usage on PC/104+ bus
- Adjustable frame rate, compression, bit rate (VBR)
- Support for multiple MPEG4000 devices in a PC/104+ system
- PC/104+ DMA operation for low CPU usage
- High performance 132Mbytes DMA burst transfer on PC/104+
- Software support under Windows, Linux, RTOS
- Single +5V operation
- Compact 3.6in x 3.8in PC/104+ stackable card

1.2 Technical Specification

Video Input	1, 2 or 4 Channels Composite Video Monochrome/colour NTSC or PAL 4 software selectable video sources per Channel software selectable Brightness, Contrast and Saturation control 1V peak-to-peak (75 Ohms termination)
Video Compression	MPEG4 Video Compression ISO/IEC 14496-2, MPEG4 SOP @ LEVEL3 NTSC- 352x240 at 120fps, 720x480 at 30fps PAL – 352x288 at 100fps, 720x576 at 25fps Programmable Quantization value Constant Bit Rate (CBR), Variable Bit Rate (VBR) support Supports I, P Frame Compression
Audio Input	4 Channels Mono Input Sound Input from Microphone or VCR for each Channel Supports u-law PCM or ADPCM
System File Record	AVI and MP4 Formats
System File Playback	Windows Media Player (with DivX Decoder)

PC/104+	132Mbytes/sec bus bandwidth PC/104+ bus master/initiator Compliant with 3.3V and 5V PC/104+ bus signalling Jumper-selectable PC/104+ stack level
Power	single +5V @ 500mA (max)
Environmental	0 to 60degC 40 to +85degC (option)
Physical Size	standard 3.6in x 3.8in PC/104+ stackable card form

1.3 Functional Summary

1.3.1 Signal Sources

The MPEG4000 is designed to capture and record from up to 4 separate and unrelated video sources simultaneously. Each of the 4 video input channels of the MPEG4000 features a video Frame Grabber and an Audio digitiser. Each Frame Grabber contains a digital PAL/NTSC video decoder with a built-in 4-input video multiplexer. Therefore each channel of the MPEG4000 is able to route in one-of-four analogue video sources under software control and each video channel has an associated Audio Input. On 4 channel MPEG4000 controller therefore, up to 16 video sources can be monitored. A single Audio Input is associated with each live video channel.

1.3.2 Video Digitisation

Composite PAL or NTSC video is input to the MPEG4000 through the header VIDEO_IN. The video is AC-couple and fed to the on-board decoders of the individual Frame Grabbers. The video decoders automatically detect whether the incoming video signal is PAL or NTSC and generates the correct timing output signals. Each Video Channel is first decoded to Chrominance and Luminance signals and then digitised by high speed analogue-to-digital (A2D) converters. The A2Ds output are passed to an internal digital video Quad Frame Store Controller (QFSC) where scaling, filtering, interpolation and channel re-timing operations are performed prior to MPEG4 encoding.

1.3.3 Digital Video Quad Frame Store Controller (QFSC)

The Quad Frame Store Controller contains 4 Mbytes of high speed SDRAM memory used as Frame Stores for each of the 4 digitised video streams. The QFSC co-ordinates writing of asynchronous video streams to the Frame Store and synchronous reading out of all 4 channels to the MPEG4 encoding engine.

1.3.4 Real time Live Video MPEG4 Encoding

Digital video data stream from the 4 Frame Stores are routed to the hardware MPEG4 encoder engine where the video can be compressed in one of two framing modes.

In the default mode, each of the video channels is compressed to a separate MPEG4 stream resulting in 4 separate MPEG4 streams which can be written to disk (or LAN) as separate files. Alternatively, each of channels can be regarded as occupying 1 quadrant of the picture frame thus allowing the four channels to be encoded to a single MPEG4 stream or file.

The encoding engine continuously encodes the video streams and uses its PC/104+ bus Master/Initiator interface to transfer data across the PC/104+ to the system memory or disk.

1.3.5 Host Interface

The MPEG4000 has a full 32-bit PC/104+ (PCI Rev 2.1) host interface to the host computer. On board jumpers allow the MPEG4000 to be configured for any of the 4 logical PC/104+ stack levels of the host computer. The jumpers plus a number of solid-state switches help to route the appropriate PC/104+ control signals to the controller on the MPEG4000. Signals routed include the PCI clocks and ID-selects, Interrupts and DMA handshakes.

1.4 Ordering Information

The following part number(s) can be used when ordering:

MPEG4000-1	Single Channel MPEG4 Video Encoder
MPEG4000-2	Double-Channel MPEG4 Video Encoder
MPEG4000-4	4 Channel MPEG4 Video Encoder

1.5 Related Documentation and Software

Other Documentation and software that may be of use whilst reading this document are described in the table below:

- MPEG4000 Driver Diskette or CDROM
- MPEG4000 Software Driver Model Programmers Guide
- MPEG4000 User Test Application User Guide

2 Installation

Warning: The board(s) supplied contain electrostatic components that are susceptible to permanent damage from electrostatic discharge (static electricity). To prevent electrostatic discharge, the boards are supplied in anti-static packaging. When handling a board, following a few simple precautions can alleviate risk of damage.

- Remove a board from the packaging only when you are working on an anti-static, earthed surface and wearing an anti-static wrist strap.
- Retain the anti-static packaging that a board is supplied in. If you remove the board from a system store it in this packaging.

2.1 System Requirements

PC/104+ Host computer	Pentium-class CPU at 266MHz or faster 128 Mbytes memory or more PC/104+ bus Windows-NT/2000/XP-E or Linux Operating System
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2.2 Physical Description

2.2.1 Connector Assignment and Configuration

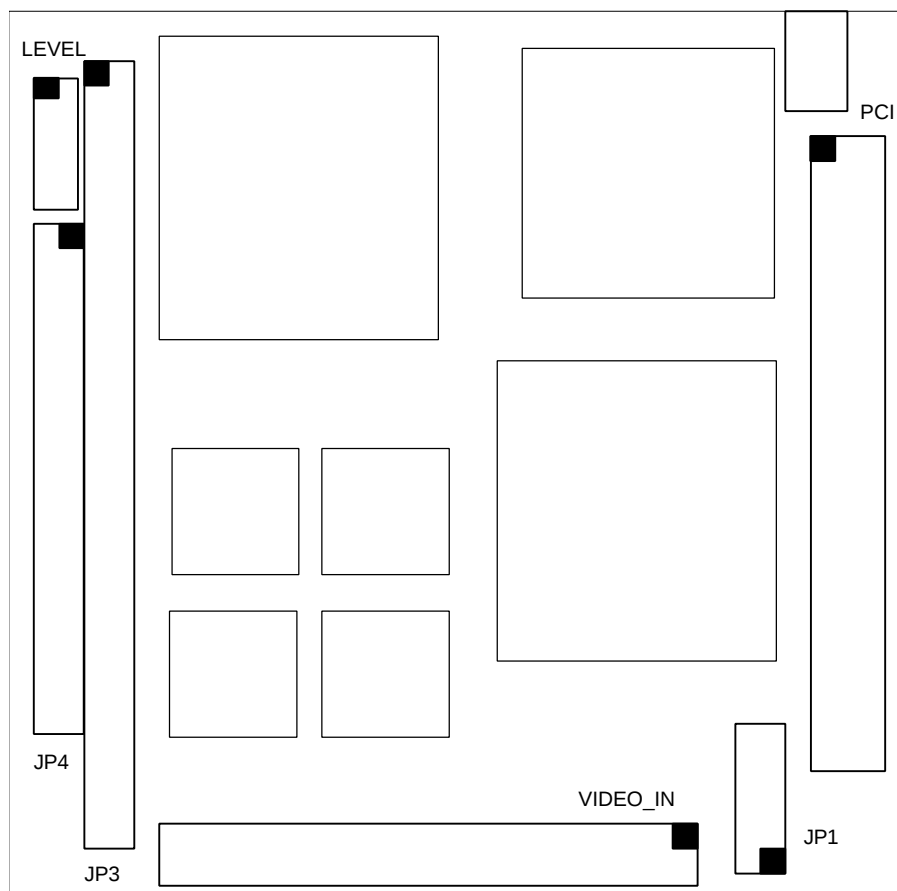


Figure 1 - MPEG4000 MPEG4 Encoding Video Frame Grabber

2.2.2 Main Analogue Video and Audio Inputs

2.2.2.1 VIDEO_IN Input for PAL/NTSC Video and Audio

This connector provides an easy way for attaching Video sources to the MPEG4000. An optional cable (MP4-Cable4) is available with phono plugs for connecting cameras to the Composite Video Inputs of the header VIDEO_IN.

Pin-out of the VIDEO_IN header for the 4 four channels A, B, C, D is shown in following tables. Note that Even number pins (2, 4, 6, 8, 10, etc) are Ground Returns from Camera and Audio source.

Channel-A

Pin	Signal	Pin	Signal
1	CompVidA1	2	GND
3	CompVidA2	4	GND
5	CompVidA3	6	GND
7	CompVidA4	8	GND
9	Audio-A	10	GND

Channel-B

Pin	Signal	Pin	Signal
11	CompVidB1	12	GND
13	CompVidB2	14	GND
15	CompVidB3	16	GND
17	CompVidB4	18	GND
19	Audio-B	20	GND

Channel-C

Pin	Signal	Pin	Signal
21	CompVidC1	22	GND
23	CompVidC2	24	GND
25	CompVidC3	26	GND
27	CompVidC4	28	GND
29	Audio-C	30	GND

Channel-D

Pin	Signal	Pin	Signal
31	CompVidD1	32	GND
33	CompVidD2	34	GND
35	CompVidD3	36	GND
37	CompVidD4	38	GND
39	Audio-D	40	GND

2.2.3 Bus Connectors

JP3 and JP4 16-bit PC/104 Bus

These connectors are currently not used on the MPEG4000 card except for routing signals to other PC/104 cards.

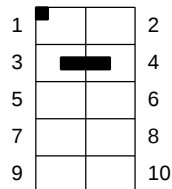
PCI PC/104+ Bus

Standard 32-bit PC/104+ bus PCI Rev 2.1 compliant, 3.3V and +5V tolerant operation.

2.3 Board Configuration

2.3.1.1 Card IDSEL selection

The setting of the first two links on the LEVEL header determines the logical stack position of the MPEG4000 on the PC/104+ stack. The setting on this header effectively routes the appropriate IDSEL, PCICLK, REQ and GNT signals to the MPEG4000 Frame Grabber.



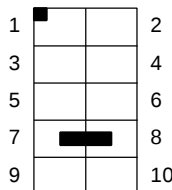
The following configurations are valid.

Pin3-4	Pin1-2	IDSEL	PCICLK	REQ/GNT	Comment
Closed	Closed	IDSEL0	PCICLK0	0/0	
Closed	Open	IDSEL1	PCICLK1	1/1	Default setting
Open	Closed	IDSEL2	PCICLK2	2/2	
Open	Open	IDSEL3	PCICLK3	2/2	Reserved for LAN on Mobile786EBX

Note that when using multiple MPEG4000 devices in a system, each must have different REQ/GNT pair depending on the level of the device on the PC/104+ stack.

2.3.1.2 Card PCI Interrupt selection

The setting of the 3rd and 4th links on the LEVEL header determines which of the 4 PCI Interrupts would service the MPEG4000 card on the PC/104+ stack.



The following configurations are valid.

Pin7-8	Pin5-6	INTERRUPT	Comment
Closed	Closed	INTA	
Closed	Open	INTB	Default setting
Open	Closed	INTC	
Open	Open	INTD	

3 MPEG4000 Multi-Channel Recording Modes

The MPEG4000 can operate in Split Channel Mode or Merged Channel Mode to encode multiple video channels. In either mode there is the option to record only video or both video and audio.

3.1.1 Split Channel Mode

In the Split Channel Mode, video from the 4 Frame Grabber channels A, B, C D are recorded as 4 separate and individual streams. In this mode, encoding parameters can be set for each channel on a per-channel basis allowing different settings for each of the channels. Each channel may be recorded with Audio in the Split Channel Mode.

3.1.2 Merged Channel Mode

In the Merged Channel Mode, each of the channels is positioned in a quadrant of a full frame video and MPEG4 encoding proceeds as if there were a single (composite) video frame. Thus the four channels are merged into the single frame (640x 480 for NTSC or 720 x 576 for PAL) and encoded to a single MPEG4 file. Note that only one Audio channel (software selectable) can be recorded in the Merged Channel Mode.

The table below shows the picture sizes supported for the Channel Modes under PAL and NTSC.

	Split Channel Mode	Merged Channel Mode
PAL	352 x 288 per Channel	720 x 576 (default) or 720 x 288 (option)
NTSC	352 x 240 per Channel	720 x 480 (default) or 720 x 240 (option)

3.1.3 Frame Rates

The default frame rates are 25fps and 30fps for PAL and NTSC respectively. However, for increased flexibility the following additional fractional frame rates are supported.

PAL Frame Rates are 25 (default), 12.5, 6.25, 3.125, 1.562 and 0.7813 frames per second.

NTSC Frame Rates are 30 (default), 15, 7.5, 3.75, 1.87, and 0.9375 frames per second.

3.1.4 Frame Type Encoding

The MPEG4000 supports two of frame encoding schemes within the MPEG4 requirements to provide flexibility and optimise encoding efficiency and storage space. The default is I/P encoding where I and P frame as are involved in the encoding. An alternative is I-only encoding. With I-only encoding, the I interval can be set to 2, 4, 6, 8, 16, 32, 64 (default), 128 or 256 frames.

3.1.5 Video Bit Rate Control

The Video Bit Rate can be set separately for each channel when the MPEG4000 is configured for the Split Channel Mode. Compression (and hence storage efficiency) can be affected by using either of the two bit rate control schemes – Variable Bit Rate (VBR) and Constant Bit Rate (CBR).

With VBR, the Quantization value (default of 10) can also be set between 1 and 31 to optimise efficiency for a particular application. The default bit rate for CBR is 512Kbits/sec. However, the actual bit rate may change by +/-10% around the set figure until the system ‘settles down’. CBR therefore does not guarantee that the bit rate in practice will be exactly as set – the MPEG4000 simply does its best to achieve the set CBR figure. The real life bit rate when in CBR mode will depend on the incoming video, motion and other environmental factors.

It may be worth finding out experimentally the optimum CBR setting for a particular application environment in order to make the best use of CBR configuration.

Hints for Reducing Bit Rates

In general there are 4 ways to reduce the bit rate and hence optimise storage.

Reduce the picture size

Increase the Quantization value

Reduce the Frame Rate

Increase the I picture interval

Note however that the above options might not be available under CBR.

In CBR, Quantization value is controlled by the MPEG4000 to meet the set bit rate once the picture size, frame rate and I picture interval are fixed.

4 MPEG4000 Card Installation

This section describes MPEG4000 hardware and software installation procedures. Software for the MPEG4000 is provided on a CDROM or floppy diskettes.

The optional Video Input cable (MP4-Cable4) should be plugged into VIDEO_IN to provide live video to the CompVid1 input the MPEG4000.

For most recent BIOS and Operating System software, the MPEG4000 is automatically detected.

Software driver installation should be done from the supplied CDROM or diskette.

Further instructions (and demo programmes) pertinent to particular Operating Systems are provided on the driver CDROM or diskette.

5 Technical Support

The AMP office can be reached in a number of ways. The preferred medium for support issues is via electronic mail using the address given at the end of this section.

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