EM8620L

EM8621L

Preliminary Information: Specifications may change in any manner without notice.

Digital Media Processors with WMV9/VC-1

Description

The EM8620L family supports MPEG-4, MPEG-2, Microsoft® Windows Media® 9 (WM9), SMPTE VC-1 and DVD decoding, and are designed specifically for consumer appliances such as digital media players, networked DVD players, IPTV set-top boxes and digital televisions.

The number of simultaneous programs that can be decoded and displayed depends on the source format and resolution:

- 720x576p or less: two MPEG-2, two MPEG-4 or one WMV9

- 1280x720p30: one MPEG-4 or one WMV9/VC-1

- 1280x720p60: one MPEG-2

- 1440x816p24: one WMV9/VC-1 (2:35:1 anamorphic movies)

- 1440x1040p24: one WMV9/VC-1 (1.85:1 anamorphic movies)

- 1920x1080i30, 1920x1080p30: one MPEG-2

Features

- Supports DVD-Video, Superbit™ DVD, DVD-R/-RW/+R/+RW, SVCD, VCD, CD/CD-HDCD®/CD-R/CD-RW, Picture CD (JPEG) media formats with HighMAT™ support

- Supports MPEG-2. MPEG-4, ISMA MPEG-4, MPEG-4 over MPEG-2 transport and WMV9 streaming with optional WM DRM 10 and DTCP/IP security

- Motion adaptive deinterlacing

- Advanced OSD with adaptive flicker filtering and scaling supports up to 32 bits per pixel

- Scaling and alpha mixing of video, OSD, subpicture, and hardware cursor
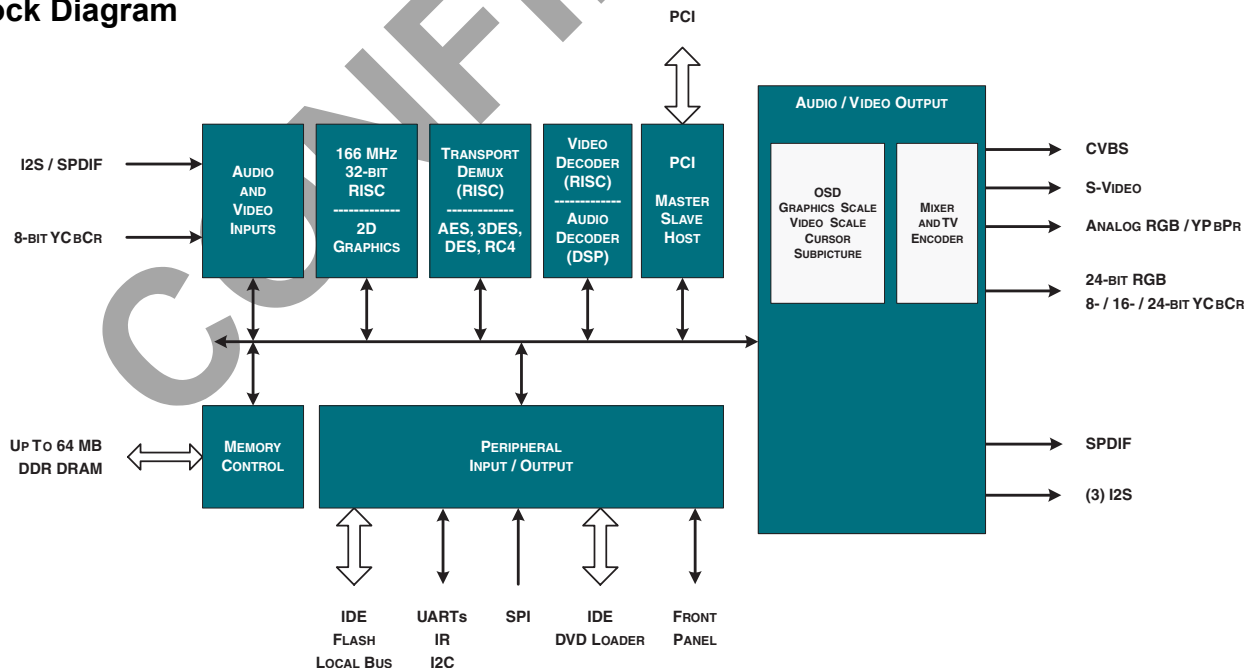
Block Diagram

SIGMA DESIGNS®

IP video encryption standards supported include WM DRM 10, DTCP/IP and SecureMedia.

The 32-bit DRAM interface supports 8-64 MB of 166 MHz DDR DRAM memory.

An external host CPU may optionally be used and software drivers for the x86 are available from Sigma Designs for the Windows CE®.NET and Linux operating systems. For other operating systems and CPUs (including MIPS and ARM), a software porting kit is available to major OEMs or our Professional Services Group can assist in supporting your requirements.

The EM8620L family provides highly-integrated solutions for IP video, DVD, MPEG-4 and WMV9/VC-1 decoding. Based on the company's award-winning REALmagic® Video Technology, they incorporate flexible, advanced audio/video processing, enabling cost-effective solutions for consumer appliances, such as low-cost digital media players, IPTV set-top boxes, networked DVD players and digital televisions. The EM8620L family also enables manufacturers to easily incorporate advanced capabilities such as streaming video, progressive DVD playback, video-on-demand (VOD), PVR and picture-in-picture (PIP) functionality into their products.

Bitstream Demultiplexing

On-chip demultiplexing supports the following formats:

- DVD-Video, Superbit DVD, SVCD, VCD Bitstreams (with Navigation Software)

- MPEG-1 System Bitstream, MPEG-2 Transport and Program Bitstreams

- MPEG-4 File, MPEG-4 over MPEG-2 Transport

- WM9 ASF or AVI Files

Data may be input via the SPI, PCI bus, IDE interface, Local Bus interface, etc. The bitstreams are loaded into DRAM, processed by the transport demultiplexer RISC (including any decryption) and the results written to DRAM. The audio and video decoder DSPs then read the data from DRAM and process it. Bitstreams and data not used by the EM862xL (such as EPG, etc.) are written to DRAM and passed on to the middleware for processing.

DVD-Video Decryption

The EM862xL includes hardware CSS decryption and supports DVD-Video CSS procedural specifications. It also fully supports DVD-Video control features such as 16:9 and 4:3 aspect ratios, up to 8 language sound tracks, 32 subtitle settings, letterboxing, pan and scan, multiple angles and 3:2 pulldown.

Features

- PCI v2.1 (33 or 66 MHz) master / slave / host interface with optional AES, 3DES or DES security

- 2D graphics accelerator with OpenType font rendering acceleration

- MPEG-1, MPEG-2 MP@HL, MPEG-4 Part 2 ASP@L5[1] (720p) and WMV9/VC-1 MP@HL (720p) video decoding

- Dolby® Digital, MPEG-1 and MPEG-2 Layers I, II and III (MP3), MPEG-2 BC multi-channel Layers I, II and III, MPEG-2 and MPEG-4 AAC-LC, WMA9, WMA9 Lossless and WMA9 Pro audio decoding

- Flexible peripheral I/O supports IDE, Local Bus and parallel FLASH with optional AES, 3DES or DES security

- Embedded 166 MHz host CPU or an external host CPU may be used

Audio/Video Inputs

- 54 MHz YCbCr digital video input interface

- I^2S or S/PDIF digital audio input interface

Audio/Video Outputs

- NTSC/PAL composite and s-video outputs with optional Macrovision v7.1.L1 protection

- YPbPr / RGB video outputs with optional Macrovision v1.2 protection

- 150 MHz RGB/YCbCr digital video output interface

- Three I^2S serial digital outputs support 5.1-channel audio

- S/PDIF (IEC 60958) digital audio output

[1]Without global motion compensation (GMC)

Transport Demux

The transport demux block is capable of handling up to two multi-program bitstreams of up to 40 Mbps each, with an aggregate total of up to 40 Mbps.

The transport demux block supports

- Compliant DTV Standards
  - ISO/IEC 13818-1:2000
  - ATSC: A-65B
  - DVB: ETS 300 428 v.1.4.1
- Transport Stream Input Interface
  - Any combination of up to two transport or program streams, up to 40 Mbps total aggregate
  - Hardware/software configurable: one 8-bit parallel or two serial input interfaces
- Conditional Access
  - Supports NRSS-B (PCMCIA PC card form factor) interface for DVB-CI and ATSC A-70 (requires external SCM CiMAX chip)
- On-chip Ciphers
  - DES with CBC, ECB and OFB mode support
    - Block size: multiple of 64 bits
    - Key sizes: 56 bits
  - 3DES with TCBC, TECB and TOFB mode support
    - Block size: multiple of 64 bits
    - Key sizes: 56 bits (x3)
  - AES with CTR, ECB and OFB mode support
    - Block sizes: multiple of 128, 192, 256 bits
    - Key sizes: 128, 192, 256 bits

- RC4 (stream cipher)
  - Key sizes: 8 to 256 bits (increments of 8 bits)
  - Can encrypt / decrypt segments up to 65,535 bytes at a time.
- CSS for DVD-Video
- CPRM for playback of recordable DVD
- PID Filtering
  - Up to 84 programmable PID filters
    - 4 for audio and video
    - 16 for PSIP / SI / PSI
    - 64 for general purpose
  - Flexible duplicated or erroneous packet control under Software configuration
- Section Filtering
  - Up to 32, 8-byte match mask
- PSI/SI/PSIP Processing
  - 32-bit hardware based CRC checking at the end of section
  - Version number check for filtering out redundant sections (firmware)
- PES Header Filtering
  - PTS extraction
  - Private data PES stream type identification

Audio Processing

The audio decoder supports:

- Dolby Digital 5.1 with conformance to Group A (20-bit)

- DTS 5.1

- MPEG-1 and MPEG-2 Layers I, II and III (MP3) 2.0

- MPEG-2 BC multi-channel Layers I, II and III 5.1

- MPEG-2 and MPEG-4 AAC-LC 2.0

- WMA9 2.0, WMA9 Lossless 2.0, WMA9 Pro 5.1

- 16-bit linear PCM data with HDCD support

For MPEG-1 and MPEG-2 Layers I, II and III, bit rates up to 448 kbps (Layer I), 384 kbps (Layer II) or 320 kbps (Layer III) are supported with sample rates of 16, 22.05, 24, 32, 44.1 and 48 kHz. Single channel, dual channel, joint stereo, and stereo modes are supported.

For MPEG-2 BC multi-channel Layers I, II and III, bit rates up to 1150 kbps (Layer I), 1066 kbps (Layer II) or 1002 kbps (Layer III) are supported with sample rates of 16, 22.05, 24, 32, 44.1 and 48 kHz. Multi-channel (up to 5.1) operation is supported or only the stereo audio may be extracted. This audio format is backwards compatible to MPEG-1 audio.

For MPEG-2 and MPEG-4 AAC-LC, bit rates up to 384 kbps are supported with sample rates of 7.35, 8, 11.025, 12, 16, 22.05, 24, 32, 44.1 and 48 kHz.

For Dolby Digital, bit rates up to 640 kbps are supported with sample rates of 32, 44.1 and 48 kHz. Multi-channel (up to 5.1) operation is supported with optional downmixing to two-channel Dolby Pro Logic.

For DTS, bit rates up to 640 kbps are supported with sample rates of 32, 44.1 and 48 kHz. Multi-channel (up to 5.1) operation is supported with optional downmixing to two-channel.

WMA9 CBR bit rates up to 192 kbps, WMA9 VBR bit rates up to 360 kbps, WMA9 lossless bit rates up to 940 kbps and WMA9 Pro (CBR and VBR) bit rates up to 768 kbps are supported. Sample rates of 44.1, 48 and 96 kHz are supported.

PCM audio processing supports 16, 20 and 24 bits per sample, up to 5.1 channels with optional downmixing to 2 channels, and sample rates up to 192 kHz (2.0 channels) or 96 kHz (5.1 channels).

A bilingual mode is also supported (English on right or "sub" channel and another language on the left or "main" channel). Either language may be output onto both the left and right channels.

As the EM862xL does not support 6.1-channel audio outputs, Dolby Digital EX is decoded to 5.1 channels since it is compatible with Dolby Digital 5.1. Alternately, the S/PDIF output may be used to connect to a Dolby Digital EX compatible surround sound receiver for decoding the 6.1-channel audio.

Audio Input and Output Interfaces

I2S Digital Audio Outputs

Three sets of I²S digital audio outputs are available for interfacing to external audio DACs.

S/PDIF Digital Audio Output

In addition to outputting the same 2-channel PCM audio data as the left/right I²S digital outputs, the S/PDIF output can transmit compressed Dolby Digital, DTS, WMA9 Pro and MPEG audio data. SCMS (Serial Copy Management System) is supported.

I²S or S/PDIF Digital Audio Input

The I²S input port is designed to capture 2.0-channel PCM audio input data. The S/PDIF input port may capture 2.0-channel PCM audio data or any compressed audio data as defined by the S/PDIF specification and supported by the chip. The input audio may be mixed with other audio and the result output onto the audio outputs.

Video Processing

The video processing block (Figure 1) includes 5-way alpha mixing of

- Two video or one video + one graphics plane

- OSD plane

- Subpicture plane

- Hardware cursor (always on top)

Also contained within this block are the filters and scalers, 2D graphics engine and video output interfaces. Independent brightness (or "black level"), contrast (or "picture" or "white level") and saturation (or "color") controls are provided for each of the two video streams.

Common source program resolutions and frame refresh rates include:

- 640 x 480i @ 25, 29.97 and 30 Hz

- 640 x 480p @ 23.976, 24, 29.97, 30, 59.94 and 60 Hz

- 704/720 x 480i @ 29.97 and 30 Hz

- 704/720 x 480p @ 23.976, 24, 29.97, 30, 59.94 and 60 Hz

- 704/720 x 576i @ 25 Hz

- 704/720 x 576p @ 23.976, 24, 25 and 50 Hz

- 1280 x 720p @ 23.976, 24, 25, 29.97, 30, 50, 59.94 and 60 Hz

- 1920 x 1080i @ 25, 29.97 and 30 Hz

- 1920 x 1080p @ 23.976, 24, 25, 29.97 and 30 Hz

When decoding high-definition programs, only a single program may be decoded and the OSD should be limited to 8-bit HD resolution or 32-bit SD resolution (upscaled to HD resolution).

Video Plane

The video plane is used for the main video source. It supports the 4:1:1 and 4:2:2 YCbCr formats. Both standard definition and high-definition resolutions are supported.

Graphics Plane

The graphics plane is used for graphics images or a second video source. It supports the RGB and 4:2:0, 4:1:1, 4:2:2 and 4:4:4 YCbCr formats. Only standard definition resolutions are supported.

For RGB data, 4 palletized color depths are supported: 2 colors (1 bit per pixel), 4 colors (2 bits per pixel), 16 colors (4 bits per pixel) and 256 colors (8 bits per pixel). A 256x32 look-up table converts the 1-, 2-, 4- or 8-bit code into 24-bit YCbCr plus 8-bit alpha. A 16-bit per pixel format is available that supports the following formats: 565 RGB, 1555 ARGB and 4444 ARGB. 24-bit 888 RGB and 32-bit 8888 ARGB formats are also available.

Hardware Cursor

The hardware cursor supports up to 4096 4-bit pixels and feeds into the alpha mixer. It may be organized as any size, up to 255 pixels horizontally or vertically. A 16x32 lookup table converts the 4-bit cursor data to 24-bit YCbCr plus 8-bit alpha.

DVD Subpicture Plane

For DVD-Video, the four bits of subpicture data (background, pattern, emphasis 1, and emphasis 2) address a 16x24 lookup table which converts the 4-bit subpicture data to 24-bit YCbCr. The additional four bits of alpha data do not address the lookup table.

OSD (On-Screen Display) Plane

The OSD enables full-screen menus, images and text to be blended over the video, graphics and subpicture.

4 palletized color depths are supported: 2 colors (1 bit per pixel), 4 colors (2 bits per pixel), 16 colors (4 bits per pixel) and 256 colors (8 bits per pixel). A 256x32 look-up table converts the 1-, 2-, 4- or 8-bit code into 24-bit YCbCr plus 8-bit alpha.

A 16-bit per pixel format is available that supports the following formats: 565 RGB, 1555 ARGB and 4444 ARGB. 24-bit 888 RGB and 32-bit 8888 ARGB formats are also available.

When decoding high-definition programs, the OSD is limited to 8-bit HD resolution or 32-bit SD resolution (upscaled to HD resolution).
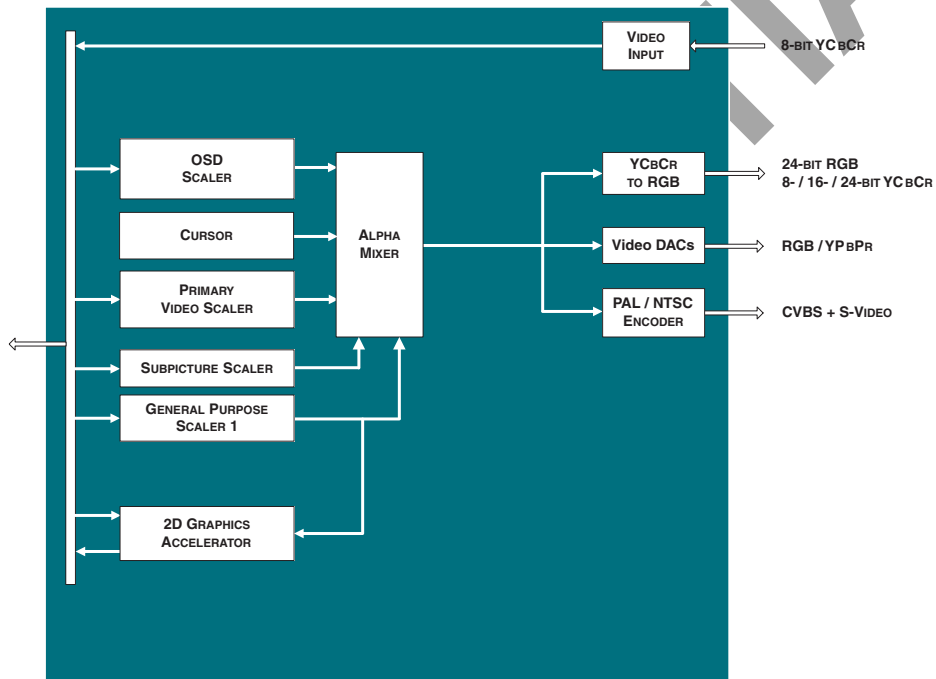
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Figure 1. Video Processing Block in Detail.

Deinterlacing

Three types of deinterlacing (or progressive scan conversion) are available when interlaced sources are to be viewed on a progressive display.

The *intra-field mode* uses scan line interpolation to convert an interlaced source into progressive.

The *flag mode* uses flags within the MPEG bitstream. This mode will not work with the digital video input port since the video data is not MPEG compressed.

The *inter-field* mode examines the content over multiple fields to determine how to best convert it to progressive. Due to memory bandwidth requirements, only one interlaced source at a time may be processed using this algorithm.

Video Formatter

Associated with each scaler are four 256x8 lookup tables. These may be used to convert pseudo-color data to 32-bit RGBA or YCbCrA data, convert 24-bit linear RGB data to 24-bit gamma-corrected RGB data or provide black level adjustment.

The **OSD scaler** is "4-tap" horizontally and vertically. They are implemented as four 63-coefficient, 16 times interpolating filters -- for each of the 16 interpolating positions, 4 coefficients (taps) are used. Adaptive flicker filtering may be done with edge detection. If the OSD is 32-bit and has a horizontal resolution >1024, processing is instead done on a 2x4 matrix of OSD data. Colorimetry conversion from BT.601 (SDTV) to BT.709 (HDTV) or BT.709 (HDTV) to BT.601 (SDTV) can also be performed.

The **primary video scaler** is "4-tap" horizontally and vertically. They are also implemented as four 63-coefficient, 16 times interpolating filters -- for each of the 16 interpolating positions, 4 coefficients (taps) are used. In addition to the normal linear horizontal and vertical scaling and the pan and zoom capabilities, a programmable nonlinear horizontal scaling mode is also available when displaying 4:3 content on a 16:9 display. Brightness (or "black level"), contrast (or "picture" or "white level") and saturation (or "color") controls are available. Colorimetry conversion from BT.601 (SDTV) to BT.709 (HDTV) or BT.709 (HDTV) to BT.601 (SDTV) can also be performed.

The **subpicture scaler** is "2-tap" horizontally and vertically.

There are also a **general purpose scaler** ('2-tap" horizontally and vertically) that can be used for scaling a second program for Picture-in-Picture (PIP) applications. Brightness (or "black level"), contrast (or "picture" or "white level") and saturation (or "color") controls are available. Colorimetry conversion from BT.601 (SDTV) to BT.709 (HDTV) or BT.709 (HDTV) to BT.601 (SDTV) can also be performed.

The **alpha mixer block** has the capability to alpha mix up to 2 video / graphics sources, in addition to the OSD, subpicture, and hardware cursor. Up to four sources may be mixed, in a programmable priority, for any given pixel.

Closed Captioning

EIA-608, EIA-708, and ETSI EN 301 775 (DVB) closed captioning data may be optionally decoded and displayed over the video. Support for popular proprietary closed captioning formats is also possible.

Closed captioning for either the main or PIP program should be able to be displayed.

Parental Control (V-chip)

EIA-608 and EIA-766 content advisory and program rating data may be optionally used to determine whether or not a program is to be displayed. If parental control is enabled and if the rating of a program is equal to or higher than that selected by the user, the program should not be output and a message is displayed instead.

Parental control, if enabled, should be applied to both the main and PIP programs.

DVB Subtitles and Teletext

DVB subtitles (ETSI EN 300 743) and teletext (ETSI EN 300 472 and ETSI EN 300 706) may be optionally decoded and displayed over the video.

Display Controllers

The video output ports may be operated as either a video timing master or slave:

- Master mode -- the display controller generates HSYNC and VSYNC from an internal or external video clock

- Slave mode -- the display controller receives HSYNC and VSYNC from an internal or external video clock

Commonly used output resolutions and frame refresh rates include:

- 704/720 x 480i @ 29.97 and 30 Hz

- 704/720 x 480p @ 59.94 and 60 Hz

- 704/720 x 576i @ 25 Hz

- 704/720 x 576p @ 50 Hz

- 1280 x 720p @ 50, 59.94 and 60 Hz

- 1366 x 768p @ 50, 59.94 and 60 Hz

- 1024 x 1024p @ 50, 59.94 and 60 Hz

- 1920 x 1080i @ 25, 29.97 and 30 Hz

- 1920 x 1080p @ 50, 59.94 and 60 Hz

As the video may be scaled to any resolution, these represent only the standard consumer resolutions. Resolutions unique to fixed-resolution displays, such as LCD, DLP, PDP, and LCOS, are easily accommodated.

Video Input and Output Interfaces

The video outputs on the EM8621L are automatically blanked while playing CSS-protected DVD-Video discs. The video outputs are also blanked if content protected by Microsoft® Windows Media® DRM 10 or DTCP/IP indicates to turn on analog copy protection.

VBI Support on Video Outputs

VBI data is present on the composite output, the Y channel of the s-video output, and the Y channel of the YPbPr output.

Two of the GPIO pins may be used for adding appropriate DC offsets to pins 8 and 16 of a SCART connector to indicate the program aspect ratio information. GPIO pins may also be used to control the Line 1, Line 2, and Line 3 signals, and monitor the Plug Detect signal, for the EIAJ CP-4120 D-Terminal interface.

Closed Captioning

NTSC closed captioning on lines 21 and 284, as defined by EIA-608, is supported.

EIA-608 and ETSI EN 301 775 (DVB) closed captioning data present in the MPEG-2 bitstream may be added to the 480i outputs on lines 21 and 284 when applicable. Support for popular proprietary closed captioning formats is also possible.

Widescreen Signaling and CGMS

480i widescreen signaling (WSS) and copy generation management (CGMS-A) on lines 20 and 283, as defined by IEC 61880-1 and EIAJ CPR1204, is supported. CGMS-A data is also present on line 284 per EIA-608B.

480p widescreen signaling (WSS) and copy generation management (CGMS-A) on line 41, as defined by EIAJ CPR1204-1, EIA-805 (Oct. 2000) and IEC 61880-2, is supported.

576i widescreen signaling (WSS) and copy generation management (CGMS-A) on line 23, as defined by ETSI EN 300 294 and ITU-R BT.1119, is supported.

576p widescreen signaling (WSS) and copy generation management (CGMS-A) on line 43, as defined by IEC 62375, is supported.

EIA-805 (Oct. 2000) data is supported when in 720p or 1080i output mode.

Teletext

PAL teletext data may be output on lines 6-22 and 318-335 or NTSC teletext data may be output on lines 10-21 and 272-284. Teletext for Europe (625-line system B), Japan (625-line system D), and United States (625-line system C) is supported. Teletext data may be present in the MPEG-2 bitstream (as specified by ETSI EN 301 775).

Digital Video Input

This interface is designed to capture 8-bit 4:2:2 YCbCr digital video data in the BT.656 format from an external NTSC/PAL decoder. It supports clock rates up to 54 MHz and resolutions up to 720x576p. Sliced (binary) VBI data from select NTSC/PAL video decoders may also be captured and saved to memory for further processing.

Video Outputs

Digital Video Output

This interface is designed to output 8-, 16-, or 24-bit YCbCr or RGB video data in the BT.601, BT.656, or VIP 2.0 format. It supports clock rates up to 150 MHz and resolutions up to 1920x1080p @ 60 Hz. When outputting anything other than 480i or 576i video, the composite and s-video analog outputs are blanked.

Supported YCbCr and RGB output formats include:

- 8-bit 4:2:2 YCbCr

- 16-bit 4:2:2 YCbCr

- 24-bit 4:4:4 YCbCr

- 24-bit RGB (888)

When the BT.601 format is used, the port can operate in master or slave timing mode. When the BT.656 format is used, the port can only operate in master timing mode. A "valid video" output signal is available for the BT.601, BT.656, and VIP 2.0 formats.

Independent brightness (or "black level"), contrast (or "picture" or "white level"), saturation (or "color") and hue (or "tint") controls are provided for this output. VBI data is not present on this output port due to the variety of standards used.

This output port may be used to interface to an external DVI or HDMI transmitter, such as those from Silicon Image. When the source is CSS, Microsoft® Windows Media® DRM 10 or DTCP/IP copy protected, DVI outputs that do not support HDCP are automatically disabled.

This port may also be used to interface to, and drive progressively, LCD, DLP, PDP and LCOS panels within a digital television.

When generating HDTV outputs, the ability to independently adjust the sync timing of this output port enables adjusting the DVI embedded sync to align with either the falling edge or the center (rising edge) of the YPbPr tri-level sync. This can prevent the DVI picture from being shifted by 2.3% relative to analog picture in some TVs.

When outputting RGB data, three programmable 256x8 lookup tables are available to adjust the gamma to match the requirements of LCD and PDP panels or black level adjustment. Additional circuitry is also provided to enable color temperature and white balance calibration.

Composite and S-Video Output

A high-quality NTSC/PAL encoder (with optional Macrovision v7.1.L1 protection) is available, supporting the NTSC-M, NTSC-J, PAL-B/D/G/H/I, PAL-60 and PAL-M baseband video standards. It features three 54 MHz 12-bit video DACs to generate simultaneous composite and s-video outputs, and may operate in either master or slave timing mode. The analog video outputs are capable of driving a doubly-terminated 75-ohm load.

Independent brightness (or "black level"), contrast (or "picture" or "white level"), saturation (or "color"), hue (or "tint") and sharpness controls are provided for this output.

Component Analog Output

The EM862xL also includes component YPbPr or RGB analog outputs (with optional Macrovision v7.1.L1 and v1.2 protection), featuring three 12-bit video DACs for generating high-quality video signals. Output resolutions up to 1920x1080i or 1280x720p are supported. It may operate in either master or slave timing mode and includes DAC attenuation compensation for 720p and 1080i output resolutions.

When generating 480i or 576i video, the DACs operate at 54 MHz; for 480p or 576p video, the DACs operate at 108 MHz; for 1920x1080i or 1280x720p video, the DACs operate at 74.25 MHz. When outputting 480i or 576i YPbPr or RGB video, the composite and s-video outputs are also present. When outputting anything other than 480i or 576i video, the composite and s-video outputs are blanked.

Supported analog formats are:

- RGB with separate composite video for SCART support

- RGB with sync on green

- SMPTE GBR

- Consumer YPbPr (no sync on Pb and Pr)

Independent brightness (or "black level"), contrast (or "picture" or "white level"), saturation (or "color") and hue (or "tint") controls are provided for this output.

If CSS protection is used on a DVD, the resolution on the analog YPbPr / RGB outputs may not be higher than standard definition (720x480 or 720x576). If the output is configured to be progressive YPbPr, only 480p or 576p video may be generated.

PCI Master / Slave / Host Interface

The 32-bit PCI master / slave / host interface (33 or 66 MHz) is designed for both reads and writes with programmable burst length and is compliant with PCI v2.1 specifications. It supports 3.3V and 5V operation and ACPI power management from the PCI v2.2 specification.

Up to three external PCI devices may be controlled by the EM862xL in PCI host mode.

Content over this interface may be optionally AES, 3DES or DES encrypted / decrypted.

Peripheral Bus Interface

The peripheral bus interface allows Local Bus peripherals, IDE peripherals, CompactFlash, and parallel FLASH memory to be connected to the device using a single bus.

IDE Interface

The IDE (ATA/ATAPI-4) interface enables CD or DVD drives, hard disc drives (HDD), CompactFlash or memory stick readers to be easily incorporated into a system. It supports both PIO and DMA. Two IDE devices may be connected to the IDE port, although only one at a time may be used.

Content over this interface may be optionally AES, 3DES or DES encrypted / decrypted.

FLASH Interface

The 8-bit parallel Flash interface supports up to 16 MB of NOR Flash memory with 24 address bits and one chip select.

Flash content can be optionally AES, 3DES or DES encrypted.

Local Bus Interface

The Local Bus interface supports either 16 data bits and 14 address bits, or 16 multiplexed data/address bits. This interface may be used to connect to an external MPEG encoder chip, smart card interface chip, or ethernet controller chip.

Content over this interface may be optionally AES, 3DES or DES encrypted / decrypted.

IDE / DVD Loader Interface

This interface may be configured to be either an IDE or DVD loader interface.

The IDE (ATA/ATAPI-6) interface enables CD or DVD drives, hard disc drives (HDD), CompactFlash or memory stick readers to be easily incorporated into a system. It supports both PIO and DMA. Two IDE devices may be connected to the IDE port, although only one at a time may be used.

Content over this interface may be optionally AES, 3DES or DES encrypted / decrypted.

The 8-/16-bit parallel DVD loader interface is compatible with a variety of loaders.

Peripheral I/O Interfaces

Front Panel Controller Interface

The front panel controller interface directly supports the NEC uPD16311, NEC uPD16312, PTC PT6311 and PTC PT6312. Other front panel controllers may be used by interfacing to the UART or GPIO.

I^{2}C Master / Slave Interface

The I^{2}C master / slave interface enables the EM862xL to read from and write to external devices.

SPI / SSI Inputs

This input, may be configured as either one 8-bit parallel (SPI) or two serial (SSI) interfaces.

AES, 3DES or DES encrypted content may be received over this interface and decrypted.

IR Input

The infrared input allows interfacing to an external IR receiver. The NEC and Philips RC5 IR formats, commonly used by consumer equipment, are supported.

Host CPU

The internal 166 MHz 32-bit RISC CPU is designed for use with applications that require ARM (version 4T) instructions. It has an internal 16KB instruction cache, 16KB data cache, and 16KB of SRAM on-chip. MMU support is not included, so the Linux and CE. NET operating systems are not supported on-chip. Our reference designs typically use the μClinux embedded OS.

Alternately, an external host CPU (such as x86, MIPS or ARM) may be used.

Additional Software Available

MPEG-2 and MPEG-4 VOD Client Software

VOD client software is available that supports select MPEG-2 and MPEG-4 video servers. For the latest list, please check with your local sales representative.

ISMA MPEG-4 VOD Client Software

VOD client software is available that supports ISMA MPEG-4 streaming.

IP Multicasting Client Software

IP multicasting client software is available.

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Application Example: Networked DVD Player

The networked DVD player example below provides the typical functionality required for a networked DVD player. System integration requires very little external logic since the EM8620L provides most of the features including:
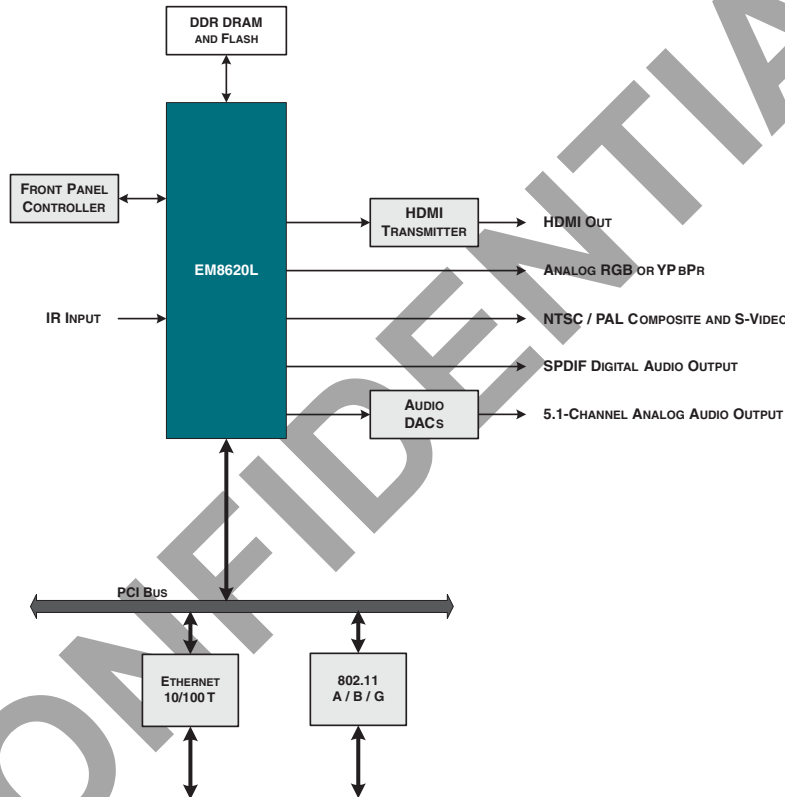
- Progressive DVD-Video and WMV9 playback

- Interlaced or progressive YPbPr or RGB video outputs

- NTSC / PAL composite and s-video outputs

- 5.1-channel and S/PDIF audio outputs

- I^2C bus master function for controlling other chips

- RISC CPU for operating system, middleware and applications
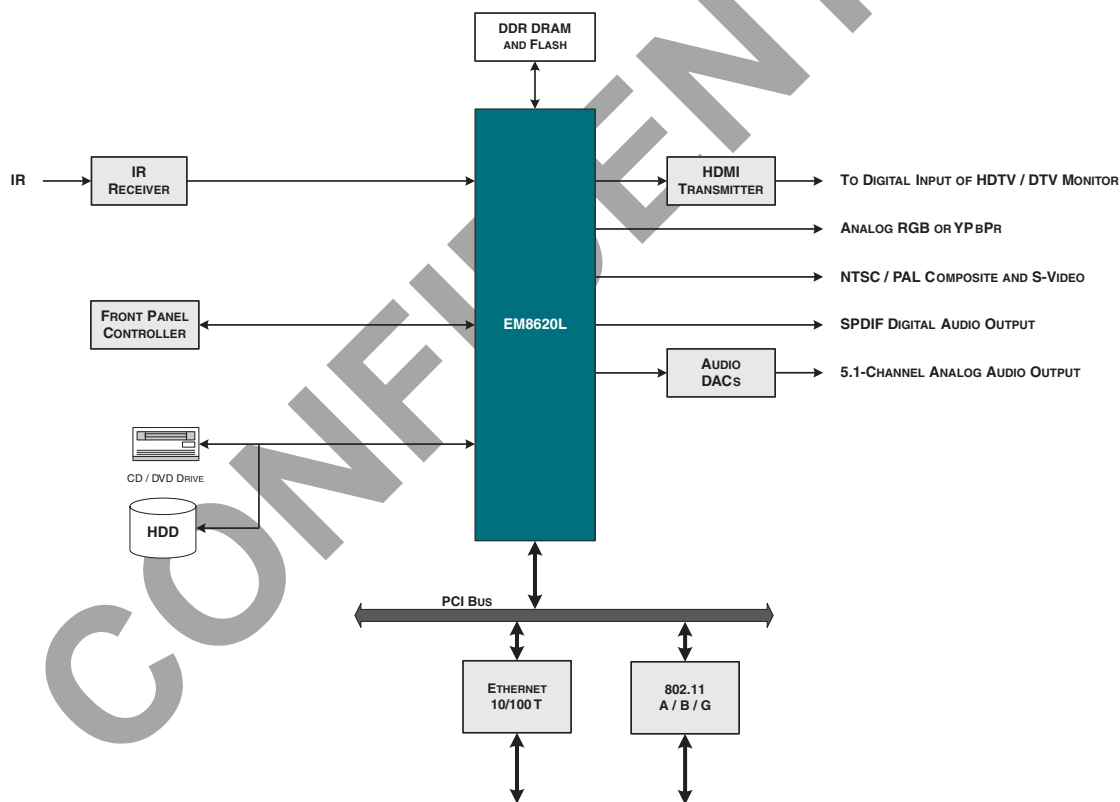
Application Example: Digital Media Adapter or IPTV Set-top Box

The Digital Media Adapter or IPTV Set-top Box example requires very little external logic since the EM862xL provides most of the features including:

- IP (streaming) video or video-on-demand (VOD) playback

- 2D graphics, OSD and deinterlacing

- Interlaced or progressive YPbPr or RGB video outputs

- NTSC / PAL composite and s-video outputs

- 5.1-channel and S/PDIF audio outputs

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General Specifications

Transport Formats

- Transport input interfaces

    - (1) 8-bit SPI or (2) SSI

    - PCI, IDE, Local Bus

    - Transport demux supports 2 dedicated PIDs (audio, video), 16 general PIDs

    - Transport input data rate: 40 Mbps maximum (aggregate)

Media Formats

- DVD-Video, Superbit DVD, SVCD (IEC 62107-2000), VCD 1.x and 2.0

- DVD-R, DVD-RW, DVD+R, DVD+RW (conditional, no CPRM)

- Audio CD (with optional HDCD), CD-R, CD-RW, CompactFlash

    - WMA, JPEG, MP3 and MPEG-4[1] AVI files using ISO 9660 or HighMAT™ format

- Picture CD (JPEG files using ISO 9660 format)

- Navigation software, HighMAT™ support

Streaming Formats

- ISMA (Internet Streaming Media Alliance) MPEG-4

- MPEG-2, MPEG-4, MPEG-4 over MPEG-2 Transport

- WMV9 with DRM

Video Decoding Standards

- MPEG-1, MPEG-2 MP@HL[2]

- MPEG-4 Part 2 ASP@L5[1, 3]. Rectangular shape video decoding up to 1280x720p, support for B Pictures, data partitioning support for error resiliency, up to 4 objects decoded in CIF Resolution.

- WMV9/VC-1 MP@HL[4] up to 1280x1720p30 or 1440x1040p24 resolution, progressive sources only

- DVD-Video and Superbit DVD

    - CSS decryption

    - 16:9 and 4:3 playback, letterbox, 3:2 pull-down

    - Multiple angles and sub-picture

- Error concealment, deblocking filter

- Elementary video stream bit rate

    - MPEG-2 SDTV (HDTV): 20 (25) Mbps maximum

    - MPEG-4 SDTV (HDTV): 10 (20) Mbps maximum

    - WMV9/VC-1 SDTV (HDTV): 10 (20) Mbps maximum

Video Processing

- Brightness, color, contrast controls for each output port

- Hardware cursor (4096 pixels, 4 bits per pixel, up to 255 pixels horizontally and vertically)

- 2D graphics accelerator (up to 75M samples per second operation for most operations)

    - Line, Rectangle, Ellipse and Circle: generate a single-color line, rectangle, ellipse or circle

    - Blend: alpha blend one rectangular region onto another

    - Move: move a rectangular region to another location

    - Replace: modified version of Move

    - Raster Ops: standard 256 Boolean operations

    - OpenType font rendering acceleration

- 32-bit OSD with flicker filtering and scaling

- Optional deinterlacing of interlaced sources

- Arbitrary scaling of video and OSD up to 1920x1080 pixels

- Alpha mixing of video, cursor and OSD

[1]Without GMC

[2]1920x1080i @ 30 fps, 8-bit OSD

[3]1280x720p @ 30 fps, 8-bit OSD

[4]1280x720p @ 30 fps or 1440x1040p @ 24 fps, 8-bit OSD

General Specifications (continued)

Video Interfaces

- Video inputs

  - 54 MHz YCbCr digital video input interface

    - 8-bit BT.656 (4:2:2 YCbCr data)

- Video outputs

  - NTSC/PAL composite analog output with optional Macrovision v7.1.L1 protection (54 MHz, 12-bit DAC)

  - NTSC/PAL s-video analog output with optional Macrovision v7.1.L1 protection (54 MHz, 12-bit DACs)

  - Analog YPbPr / RGB with optional Macrovision v7.1.L1 and v1.2 protection in 480i, 576i, 480p and 576p YPbPr output modes (12-bit DACs, interlaced or progressive, SDTV or HDTV resolution)

  - 150 MHz YCbCr / RGB digital video output interface

    - 8-bit 4:2:2 YCbCr data

    - 16-bit 4:2:2 YCbCr data

    - 24-bit 4:4:4 YCbCr data

    - 24-bit RGB data (888)

    - BT.601, BT.656, or VIP 2.0, "video valid" output signal

    - Master or slave timing

Audio Decoding Standards

- MPEG-1 and MPEG-2 Layers I, II and III (MP3) 2.0

- MPEG-2 BC multi-channel Layers I, II and III 5.1

- MPEG-2 and MPEG-4 AAC-LC 2.0

- Dolby Digital 5.1

- DTS 5.1

- WMA9@L3 2.0, WMA9 Lossless 2.0, WMA9 Pro@M2 5.1

Audio Interfaces

- Audio inputs

  - I^2S or S/PDIF serial digital audio input

- Audio outputs

  - S/PDIF (IEC 60958) serial digital audio output for 2.0 linear PCM and compressed Dolby Digital, DTS, WMA Pro and MPEG

  - Three I^2S serial digital outputs support external audio DACs

PCI / IDE / FLASH Interfaces

- 32-bit PCI v2.1 (33 or 66 MHz) bus master / slave / host

- IDE (ATA/ATAPI-6) or DVD loader (supports Samsung, Sanyo, Sony and Thomson DVD loaders)

- Peripheral bus supports IDE (ATA/ATAPI-4), CompactFlash, Local Bus and parallel FLASH

Front Panel Controller Interface

- Supports NEC uPD16311, NEC uPD16312, PTC PT6311 and PTC PT6312 Front Panel Controllers

RISC CPU

- 166 MHz 32-bit RISC (no MMU) designed for use with applications that require ARM (version 4T) instructions

- Interrupt controller and real-time clock

Power Management

- 1.2V core with 3.3V I/O (5V tolerant)

- Typical power dissipation:

  - Analog video outputs off: tbd

  - Analog video outputs on: tbd

Package

- 469-pin BGA

EM862xL Product Selection Guide

Feature	EM8620L[3]	EM8621L
Macrovision v7.1.L1 protection on NTSC/PAL Composite, S-video and 480i and 576i YPbPr Outputs	yes	-
Macrovision v1.2 protection for 480p and 576p YPbPr outputs	yes	-
Package	469 BGA	469 BGA

[1]Software that enables Dolby Digital feature requires customer have license from Dolby. Software that enables DTS feature requires customer have license from DTS. Software that enables HighMAT, WMA, WMV and / or WM DRM feature requires customer have license(s) from Microsoft. Software that enables DVD-Video playback feature requires customer have license from DVD CCA (for CSS). Software that enables recordable DVD playback feature requires customer have license from 4C (for CPRM for DVD). Software that enables DTCP/IP feature requires customer have license from DTLA.

[2]MPEG and VC-1 video features require license(s) from MPEG LA. MPEG audio features require license(s) from Via Licensing, Audio MPEG and / or MP3 Licensing. DVD features require licenses from DVD FLLC (for logo and format) and Philips.

[3]Customer must be a Macrovision licensee prior to purchasing Macrovision-enabled chips.

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