



SP8890(P)

MPEG2 Decoder for Digital TV/ Set-top Box

SPaSE PRODUCT INFO

Features

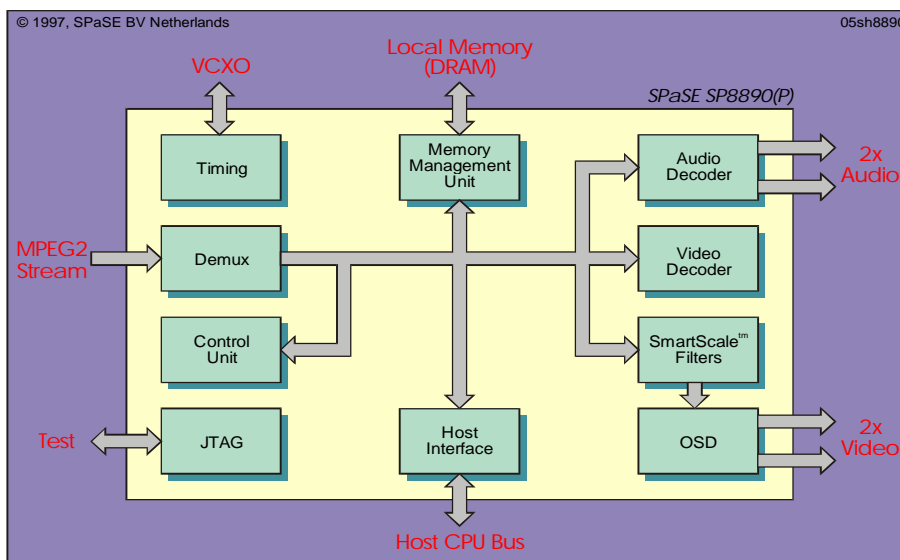
- DVB MP@ML MPEG2 Video Decoder
- MPEG1/2/Dolby AC-3 Audio Decoder
- 80-Mbps 36-Filters Transport Demux
- 4 PES- and 32 PSI Section Filters
- Section CRC Calculation and Reassembly
- 50-Mbps 4:2:2 Video Decoding
- 256-Color Full Motion OSD
- Glueless 68K-type Host Interface
- Parallel- (DVB CI/PI) or Serial Input
- Requires one 27-MHz VCXO
- Primary and Secondary V/A Outputs
- ITU-R 601/656 and RGB Outputs
- Full 2-D Sample Rate Conversion
- Pan/Scan and Letterbox Display for 16:9 and 2.21:1 Source Material
- Frame/Field Rate Conversion
- I²S/Sony/MEC/SPDIF-compatible Stereo Audio Output Formats
- Volume Control on One Audio Port
- DRAM requirements:
Dual Prime: ≥ 1 MB
MP@ML: ≥ 4 MB
422@ML: ≥ 4 MB
- 1-MB mode with Dual-Prime Video
- On-chip Control Unit takes care of all Video and Audio Synchronization
- IEEE 1149.1 Boundary Scan Port
- ANSI-C Compliant Software API, independent of any RTOS
- Microcode Available for Various Applications
- 3.3-Volt Operation, 5V-tolerant
- PQFP 208-pins Package
- Commercial Grade 0-70°C

General

The SP8890(P) is a fully DVB-compliant multiprocessor integrated decoder for digital TV satellite receivers, cable decoders, interactive TV systems and terrestrial receivers. It is also usable in broadcast and Digital Satellite News Gathering applications. Running standard microcode, it can be used by non-MPEG-experts.

At its input, it takes a descrambled DVB Transport Stream. It performs demultiplexing, MPEG2 main profile @ main level video decoding and MPEG1 or -2 layers I and II digital audio decoding. Using other microcode it may decode dual-prime video (1-MByte) or Dolby AC-3 audio. Generally, it will need 4-MB of DRAM.

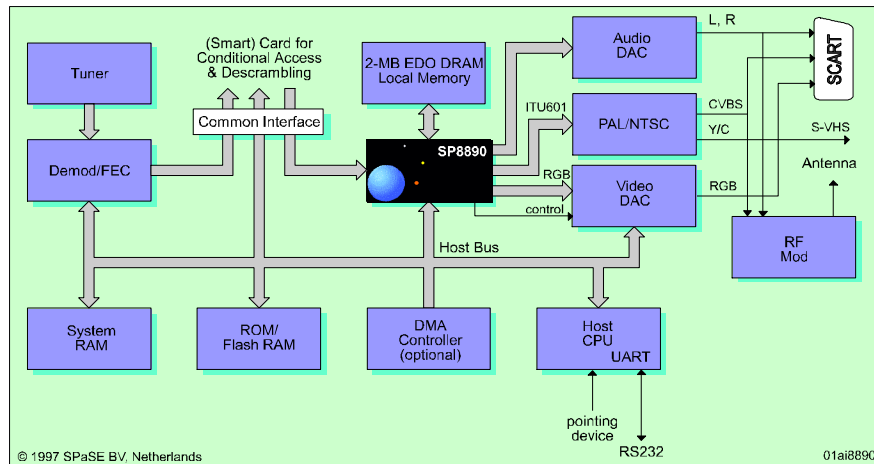
The SP8890(P) has powerful OSD (On-Screen Display) capabilities and a 68K-type host interface enabling fast access to the OSD planes.



SP8890(P)

System

The SP8890(P) is VCR-friendly. For this purpose, it has primary and secondary video and audio outputs. The set of primary outputs can have OSD and sound control, while the secondary outputs may be unaffected. The chip directly interfaces with video encoders and audio DACs. Video formats are ITU601 and/or RGB888. The outputs are programmable for video and/or OSD. The SP8890(P) has full two-dimensional



sample rate conversion, as well as frame/field rate conversion. This even allows display of NTSC programs on a PAL TV or vice versa. The SP8890(P) can be timing master of the system, based on the timing data in the Transport Stream. Alternatively, an external source of MPEG data may be the timing master using a clock of 384 times the audio sample frequency.

Software Support

The SP8890(P) comes with standard microcode to perform MPEG2 Transport Stream filtering and video and audio decoding. Video and audio synchronization is done completely in microcode without any intervention of the host CPU. For cleared Dolby licensees, microcode for AC-3 decoding is available as an option.

A library of function calls is available, allowing software developers to develop drivers for whatever realtime operating system they wish to use, keeping the system future-proof. The function calls are in ANSI C and do provide basic building blocks to speed up application developing.

Developers may wish to check with SPaSE Marketing and Sales if a set of drivers is available for their operating system.

Data Input

The MPEG Transport Stream can be input as parallel data directly from the DVB Common Interface, as serial data, or it can be input through the host interface. An input data rate of 80-Mbit per second can be maintained with both the parallel and serial input methods.

Demux

The Demux is a dual-processor structure filtering on up to 36 PIDs. The PCR is filtered out and forwarded to the Control Unit and System Timing blocks. Four elementary streams (video, audio, DVB Subtitle, DVB Teletext) are filtered out. Video and audio are forwarded to the Video Decoder and Audio Decoder, via FIFOs contained in Local Memory. Subtitling and Teletext undergo secondary filtering before being forwarded to the host CPU.

Up to thirty-two streams of PSI data can be filtered on their `table_id`, `table_id_extension`, `version_#` and `section_#`. For these streams, continuity and CRC checking are done and the reassembly addresses are calculated. A software function call is available to reassemble the sections easily without further application software interaction.

Memory Management Unit

Memory access on hyperpage mode (i.e. EDO) DRAM is done at the speed of the *system clock*, usually between 40- and 50-MHz. Accesses can be 32-bit wide, giving a maximum of 200-MB/s. For simple operation of the SP8890(P), around 100-MB/s is required. More regular and more advanced operation, including use of medium bandwidth OSD, the video scaler, field rate conversion, etc., may require up to 150 or 200-MB/s. In these cases, it may be necessary to use multiple DRAM chips on the 32-bit wide memory interface.

System Timing

An external VCXO of 27-MHz is synchronized with the PCRs from the incoming MPEG Transport Stream. From the 27-MHz clock, the SP8890(P) synthesizes three internal clocks, using on-chip PLLs: the 54-MHz *Video clock*, the 40- and 50 MHz *System clock*, and the *ADACLK*, which is 384 times the audio sample frequency. The *Video clock* is used in the Video Display Generator, the *ADACLK* is used for outputting audio data.

Video Decoder

The Video Decoder takes its data from Local Memory (the external DRAM chip). It decodes up to main profile at main level format, as well as 4:2:2 professional. In both cases, more than 2-MBytes of Local Memory is required. The maximum rate of input video data is 50-Mbit/s. The Video Decoder sends the decoded data back to Local Memory, where it is picked up again by the SmartScale™ filters.

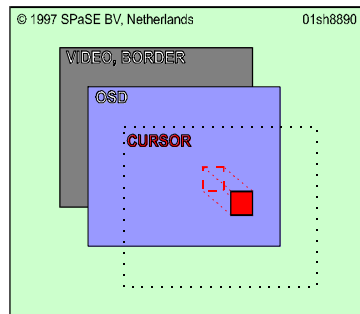
422 Professional!

SmartScale™ Filtering

SPaSE's proprietary filtering technology for video scaling allows continuous zooming in and out of video. It includes availability of a 1-2-1 filter which is useful when interlaced source material is zoomed in an even number of times, and a 1-3-3-1 filter which is useful when progressive source material is blown up an even number of times, such as for full scale display of MPEG1.

SmartScale™ filtering also enables all kinds of letterbox display, pan/scan, and even NTSC-to-PAL conversion and vice versa. For the latter, simple field rate conversion is also provided, repeating every fifth or skipping every sixth frame. MPEG windowing and 2-D scaling is possible, allowing (parts of) the decoded video to be shown anywhere on the screen (respecting color pixel boundaries).

Video Display

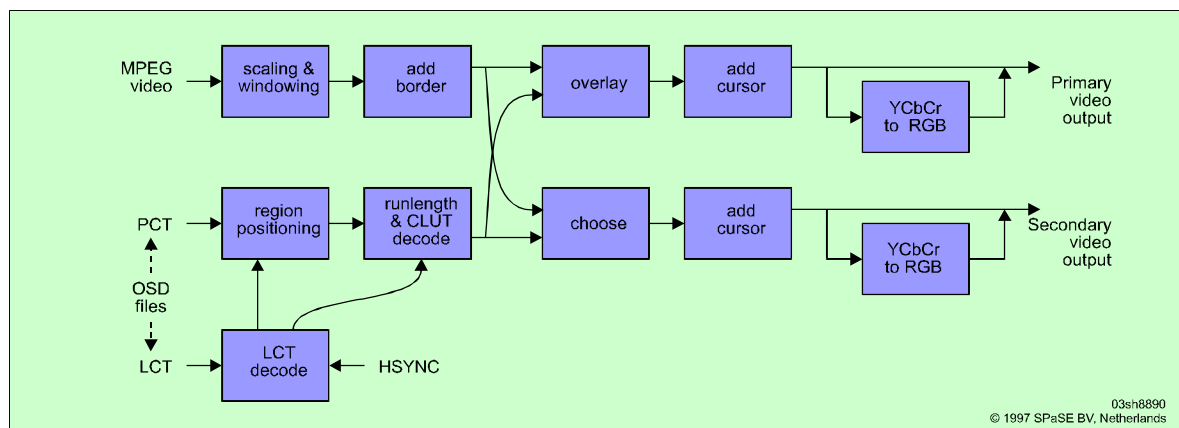
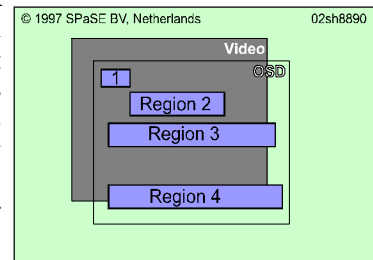


The Video Display block displays decoded video and OSD through two video output ports. The Primary Video output shows video with/without OSD. The Secondary Video port shows video or OSD. Display is always in interlaced format, ITU-R BT.601/656 or RGB888 multiplexed over 8 pins.

MPEG windowing and 2-D scaling is provided, allowing (parts of) the decoded video to be shown anywhere on the screen (respecting color pixel boundaries). The video may be blown up to any size, or shrunk down to half size. Vertical and horizontal scaling factors can both be set, allowing pan/scan, letterboxing, conversion from PAL encoded material to NTSC display, or vice versa.

For the latter, simple field rate conversion is also provided, repeating every fifth or skipping every sixth frame.

The video display window is surrounded on the screen by a programmable border color. In front of the video and border is the OSD plane, and most in front is the 16 x 16-pixels, 4-color cursor.



The maximum resolution of the OSD screen is 720 x 576 pixels. All OSD uses a YCbCrT format of 16-bits (6442), in accordance with DVB Subtitling. The OSD plane may contain regions of OSD. Two regions can not be (partially) next to each other, which limits the number of regions to the number of lines (480 for NTSC and 576 for PAL). A region has programmable location, size and shape, as long as it is not interrupted on one scan line. The available OSD formats are:

- bitmap Y Cb Cr T (24 bits for 2 pixels)
- bitmap CLUT 4 colors, 64 banks
- bitmap CLUT 16 colors, 16 banks
- bitmap CLUT 256 colors, 1 bank
- runlength CLUT 128 colors, 2 banks

Pixel data is stored in Local Memory (external DRAM) in a file called the Pixel Control table. Pointers to this file allow actions such as scrolling, file swap, etc..

Another file, the Line Control table, is optionally available. It allows reprogramming of OSD parameters in lockstep with the display of field lines. This of course includes reprogramming the 256 locations of the CLUT.

Audio Decoder

The Audio Decoder decodes MPEG1 or 2, layer I or II data, all according to DVB requirements. It can also extract stereo from an MPEG2 multichannel signal.

For licensees, optional microcode for Dolby AC-3 is available. In case a 5.1 channel surround signal is broadcast, the Audio decoder can perform downmixing to Dolby Prologic format. The Dolby audio stream is also available in digital form (SPDIF).

The Audio Decoder has a Primary and a Secondary output, like the Video Display Generator. In this case, the Primary output has volume control.

Audio output is in I²S, Sony, Matsushita compatible formats, or SPDIF (EBU).

SPaSE / Contact

For further information, contact:
SPaSE Marketing & Sales
Kerkenbos 1021, 6546 BB Nijmegen,
The Netherlands
Tel +31 24 378 2882, fax +31 24 378 8388
Find us on the web <http://www.spase.com>
For sales support and orders, contact your local
SPaSE office, agent or distributor:



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