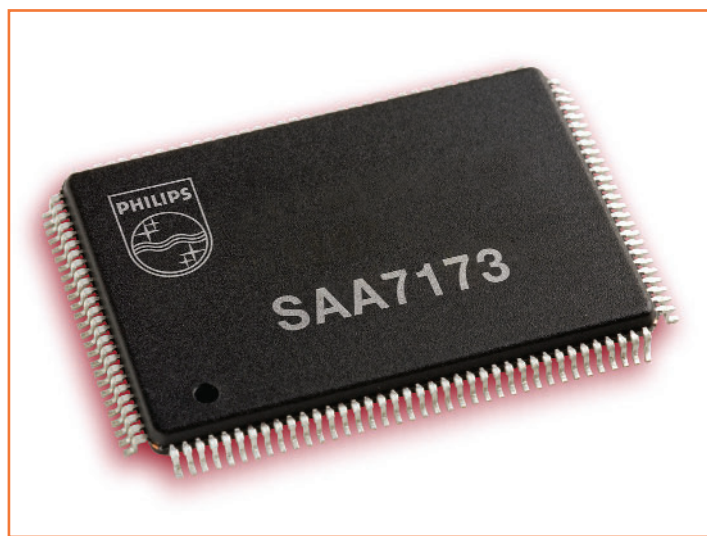


SAA7173

Integrating high-quality, multi-standard TV video (NTSC, PAL, and SECAM) and TV stereo (BTSC with dbx, SAP, and EIAJ) decoding, the Philips SAA7173 gives designers an efficient, low-BOM solution for adding analog TV features to a variety of computing and consumer products.



Key features

- > Fully automatic detection and decoding of worldwide analog TV video formats: PAL, NTSC, and SECAM
- > Automatic standard detection and decoding of TV stereo formats: BTSC (with dbx™ noise reduction), SAP, EIAJ, and FM radio
- > Supports simultaneous stereo decoding and adaptive 3D comb filtering to enhance picture quality
- > Certified three-level Macrovision® detection circuitry
- > Advanced audio feature processing: volume, balance, bass, treble, automatic volume leveling (AVL), and Philips Incredible Sound
- > Captures raw VBI data (for Closed Captioning, Teletext, etc.)
- > Superior subpixel-accurate horizontal and vertical scaling
- > Outputs digital I²S audio and ITU-656 video

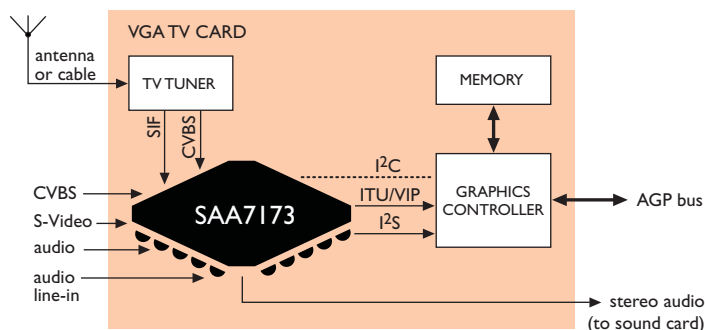
Analog TV video and stereo decoder for computing and consumer applications in North America and Japan



On a single chip, the SAA7173 TV video/stereo decoder handles fully automatic detection and decoding of all worldwide analog TV video standards and the TV stereo formats used in North America and Japan. It delivers exceptional picture quality and advanced video features: low-noise, high-quality ADCs, an adaptive comb filter, sub-pixel-accurate scaling, and certified three-level Macrovision detection circuitry. The SAA7173's flexible design, reusable components, and versatile external interfaces lower BOM and cost and support advanced TV decoder configurations.

Target applications

The SAA7173 is a space-efficient solution for adding high-quality multi-standard analog TV decoding to a wide variety of computing and consumer products. Its 100% pin compatibility with the Philips SAA7174 decoder enables efficient reuse of SAA7174 designs. The SAA7173 is targeted for products in North American and Japanese markets such as desktop and portable PCs, personal video recorders (with time shifting), hybrid (analog/digital) TVs and cable, terrestrial, and satellite set-top boxes, USB/1394 video dongles, DVD recorders, and more.



Typical SAA7173 configuration for an analog VGA TV add-in card

PHILIPS

SAA7173

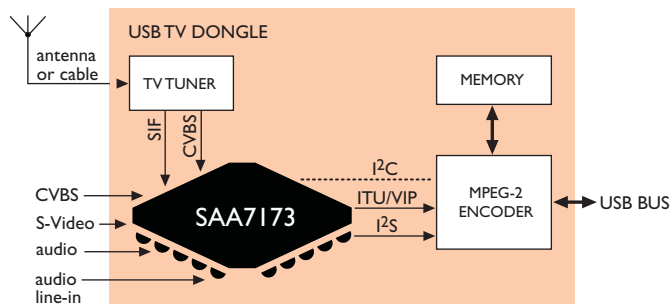
Analog TV video and stereo decoder for computing and consumer applications in North America and Japan



Analog TV video capture and decoding

Analog video is sampled through five video inputs, supporting any combination of CVBS and S-Video signals from TV tuners and devices such as analog VCRs and camcorders. The SAA7173 automatically detects 50- and 60-Hz field frequencies and all analog TV video standards (PAL, NTSC, and SECAM). Video is digitized by sophisticated, low-noise, nine-bit ADCs with built-in white and color peak control, clamping, and programmable gain control. Support for 27-MHz oversampling, twice the ITU-601 standard, ensures an exceptional signal-to-noise ratio for maximum picture clarity. Additional features include single crystal support for all video standards, ultra-fast frame lock (for fast input-switching in surveillance applications and VCR fast search, shuttle, and freeze frame), and forced-field toggle (for non-interlaced inputs to avoid VCR 'blue screen').

The SAA7173 decodes composite video into ITU-601-compatible component color values. Its high-quality, multi-standard, adaptive four-line comb filter performs best-in-class luma/chroma separation of CVBS signals from all sources, significantly reducing dot crawl and enhancing image resolution and detail. The decoder integrates separate brightness-contrast-saturation circuitry for CVBS, S-Video, and raw VBI samples and hue control for CVBS and S-Video signals.



Typical SAA7173 configuration for an USB dongle add-in card

The SAA7173 supports fully automatic, three-level hardware Macrovision detection with active-status interrupt. By ensuring the content's original analog copy protection is still intact, Macrovision prevents unauthorized recording of copyrighted material transmitted through analog video outputs in applications such as time-shift or archive recording or large screen display.

Video scaling, matrix, clipping

The SAA7173 incorporates an adaptive filter and circuitry to crop, scale, and reduce frame rate. It can perform horizontal or vertical video down scaling or zooming to support playback windows of any size. Two alternating settings for active video scaling support independent capture and preview definition. Adaptive anti-alias filters reduce board space, system costs, and external components.

Optional YUV-to-RGB and RGB-to-YUV matrices and a color lookup table can be used to normalize ITU-standard color values to the full RGB range and apply gamma correction as needed to optimize screen contrast and color.

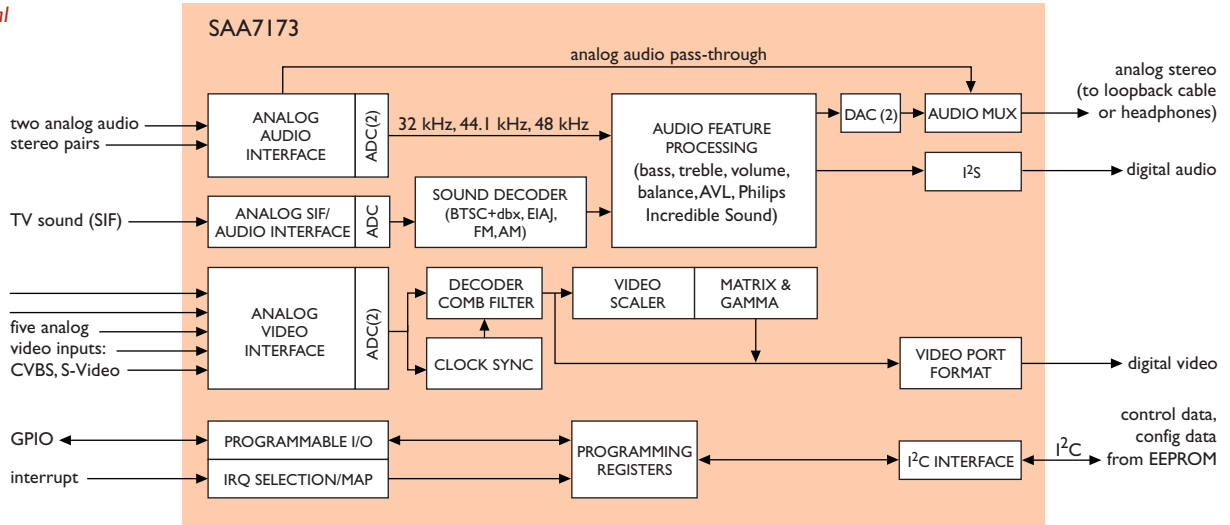
Video output

Decoded, scaled video is output through a digital video output port in various YUV or RGB formats, including packed and planar, gamma-compensated, or black-stretched.

VBI capture

The SAA7173 captures raw VBI samples to memory, making them available to software components for decoding. The VBI sampling rate can be adjusted as needed by the data slicing software. Supported VBI formats include Closed Captioning, Teletext, WST, NABST, CGMS, and WSS.

SAA7173 conceptual block diagram



Stereo capture, decoding, and output

The SAA7173 handles capture and on-chip decoding of stereo formats used in North American (BTSC with dbx noise reduction and SAP) and Japanese (EIAJ) TV broadcasts. After capture from the TV tuner through a Sound Intermediate Frequency (SIF) port, TV stereo is digitized and FM or AM demodulated. The audio standard is automatically detected, the pilot tone is investigated (mono, stereo, dual), and the signal is decoded.

Two 16-bit audio ADCs support capture of audio signals from nonstandard sources such as video cameras, VCRs, and AM (mono) or FM (stereo) radio through two stereo line-in inputs. An analog audio pass-through enables an incoming signal to be rerouted without processing and output through an external loop-back cable to a sound card. A field-locked audio clock samples a constant number of audio clocks per video field, guaranteeing synchronization of audio and video streams.

Decoded digital audio is output through an I²S port or can be reconverted to analog (by on-chip stereo DACs) and rerouted through a loop-back cable to a sound card.

Advanced audio feature processing

The SAA7173 incorporates advanced on-chip audio feature processing to improve user control and perceived audio quality. Philips Incredible Mono™ adds stereo-like sound impression to monaural audio signals. Philips Incredible Stereo™ widens the stereo image, immersing the listener in the screen action. Additional on-chip audio features include volume, balance, bass/treble controls, and automatic volume leveling (AVL).

Versatile external interface

The SAA7173's flexible design, reusable components, and versatile external interfaces lower BOM and cost and support advanced decoder configurations. Such flexibility is made possible, in part, through 28 general purpose I/O (GPIO) pins, initially dedicated to provide a digital video port, an I²S digital audio output port, and peripheral interrupt input.

GPIO pins can be reassigned if dedicated functions are not needed in a specific product configuration. In addition, unassigned pins can be utilized for GPIO under direct software control.

	audio loop-back	mono	FM-radio	A2/ Dual-FM	NICAM	BTSC (+ dbx)	SAP	EIAJ	Incredible Mono Incredible Stereo
SAA7173	•	•	•			•	•	•	•
SAA7174	•	•		•	•				

SAA717x family audio feature comparison

SAA7173

Analog TV video and stereo decoder for computing and consumer applications in North America and Japan



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Technical specifications

PHYSICAL

Package	Rectangular LQFP128; 128 pins
Power	<i>supply</i> 3.3 V <i>consumption</i> 1.35 W (typical application)
Temperature	0 to 70 °C

ANALOG VIDEO SUBSYSTEM

Input	Five (5) analog input ports supporting any combination of CVBS (NTSC, PAL, SECAM) or S-Video signals
ADCs	Two (2) 9-bit CMOS ADCs, 27-MHz oversampling
Output	<i>digital video port (GPIO)</i> ITU-656, YUV-VMI (8-bit), VIP 1.1 or VIP 2.0 (8- or 16-bit), ZV (16-bit), ITU-601 (16-bit)
Sample rate	720 pixels/line (ITU 601)
XTAL reference	32.11 or 24.576 MHz, supports all video standards
Comb filter	NTSC/PAL adaptive 4-line Y-C separation for all sources including broadcast and VCR
Scaling	Downscaling: horizontal, vertical, and by field rate Scalable from 10 taps H (for ratios close to 1:1) to 74 taps (icon-sized video)
VBI formats	Closed Captioning, Teletext, NABST, CGMS, WST, WSS
Macrovision	3-level with active status interrupt; complies with Macrovision's Copy Protection Detect Specification, Revision 1.00

AUDIO SUBSYSTEM

Input	One (1) analog SIF port Two pairs (2) analog stereo baseband inputs
Output	<i>analog</i> One (1) analog stereo port (for loop-back to sound card or local headphones) <i>digital</i> Up to four (4) channels through two (2) I ² S ports
Decode formats	BTSC (with dbx noise reduction), SAP, EIAJ
Sample rates	32 kHz, 44.1 kHz, 48 kHz

AUDIO SUBSYSTEM (CONT.)

Clocks	Selectable: 768*fs, 512*fs, 384*fs or 256*fs 24.576 MHz to external audio reference clock Locked to video frame rate
ADCs	Two (2) 16-bit baseband audio One (1) 8-bit SIF, 24.576 MHz
Audio features	Volume, balance, bass, treble, AVL, Philips Incredible Stereo, Philips Incredible Mono

GENERAL PURPOSE I/O

Total pins	28
Dedicated	Digital video output, peripheral interrupts, two (2) I ² S ports

I²C INTERFACE

Modes	Bus-master interface, multi-master capable Slave interface
Power	3.3 V and 5 V signal-level compatible Includes peripheral reset and power-down control
Rates	100 kHz and 400 kHz

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