



## DESCRIPTION

THE ES1946 PCI AudioDrive™ solution implements a single-chip PCI audio solution, providing high-quality audio processing while maintaining full legacy DOS game compatibility. With a dynamic range over 80 dB, the ES1946 complies with the Microsoft® PC 98 / PC 99 specifications and meets WHQL audio requirements. The ES1946 forms a complete audio subsystem on a single chip for notebook platforms.

The ES1946 operates at 3.3V digital supply and 5V analog supply. Combined with its built in power management support, the ES1946 is an ideal audio solution for notebooks.

The ES1946 includes an I<sup>2</sup>S Zoom Video port interface that allows playback of MPEG audio, using the 16-bit stereo music DAC, thus reducing the total audio solution chip count.

The ES1946 incorporates a microcontroller, ESFM™ music synthesizer, 16-bit stereo wave ADC and DAC, 16-bit stereo music DAC, MPU-401 UART mode serial port, I<sup>2</sup>S Zoom Video port, serial port interface to external wavetable music synthesizer, dual game port, hardware master volume control, direct memory access (DMA) control logic with FIFO, and PCI bus interface logic. There are three stereo inputs (typically line-in, CD audio, and auxiliary line) and a mono microphone input.

The ES1946 also incorporates Spatializer® VBX™ technology, provided by Desper Products, Inc., a subsidiary of Spatializer Audio Laboratories, Inc. This processor expands the stereo sound field emitted by two speakers to create a resonant 3D sound environment.

The ES1946 integrates the ESS Technology field-proven hardware design for DOS game compatibility with hardware FM synthesis (ESFM synthesis) and three methods for legacy audio control interface: PC/PCI, distributed DMA, and transparent DMA (TDMA). TDMA requires no sideband signals from PC core logic chipsets in addition to the standard PCI 2.2 bus. TDMA is compatible with the Intel® Pentium®, Pentium II®, and Celeron™ chipsets as well as standard PCI add-in cards.

The ES1946 provides a serial EEPROM interface for ease of programming the subsystem ID and subsystem vendor ID.

The ES1946 can record, compress, and play back voice, sound, and music with built-in mixer controls. It supports stereo full-duplex operation for simultaneous record and playback. The ESFM synthesizer has extended capabilities within native mode operation providing superior sound and power-down capabilities.

The ES1946 is compliant with Advanced Power Management (APM) 1.2, Advanced Configuration and Power Interface (ACPI) 1.0, and PCI Power Management Interface (PPMI) 1.0.

It is available in an industry-standard 100-pin low profile quad flat pack (LQFP) package.

## FEATURES

- Single, high-performance, mixed-signal, 16-bit stereo VLSI chip
- 3.3V PCI parallel bus interface, revision 2.2.
- Full native DOS games compatibility, via three technologies:
  - TDMA
  - DDMA
  - PC/PCI
- High-quality ESFM music synthesizer
- Dynamic range (SNR) over 80 dB
- Serial EEPROM interface for SID and SVID resource
- Integrated Spatializer3D VBX™ stereo audio effects technology provided by Desper Products, Inc., a subsidiary of Spatializer Audio Laboratories, Inc.

### Record and Playback Features

- Record, compress, and play back voice, sound, and music
- 16-bit stereo ADC and DAC
- Programmable independent sample rates from 6 kHz up to 48 kHz for record and playback
- Full-duplex operation for simultaneous record and playback
- 2-wire hardware volume control for up, down, and mute

### Inputs and Outputs

- Stereo inputs for line-in, auxiliary A (CD audio), and auxiliary B, and a mono input for microphone
- I<sup>2</sup>S Zoom Video port interface for MPEG audio at up to 48 kHz
- MPU-401 (UART mode) interface for wavetable synthesizers and MIDI devices
- Integrated dual game port
- Separate mono input and mono output for speakerphone

### Mixer Features

- 7-channel mixer with stereo inputs for line, CD audio, auxiliary line, music synthesizer, digital audio (wave files), and mono inputs for microphone and speakerphone
- Programmable 6-bit logarithmic master volume control

### Power

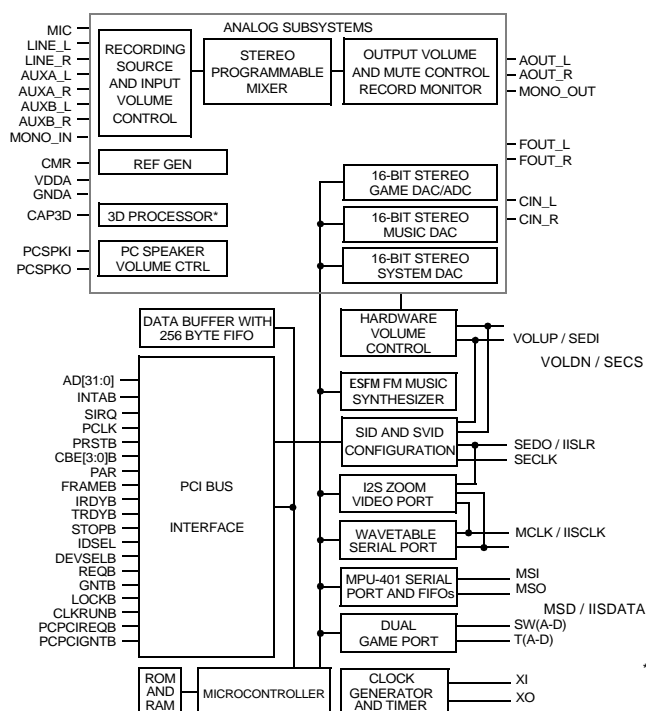
- Advanced power management meets APM 1.2, ACPI 1.0, and PPMI 1.0 standards
- 3.3V digital supply operation

### Compatibility

- Supports PC games and applications for SoundBlaster™ and SoundBlaster Pro™
- Meets PC98 / PC99 and WHQL specifications

## BLOCK DIAGRAM

Figure 1 shows the ES1946 block diagram.



\* 3D Processor uses Spatializer VBX 3D technology provided by Desper Products, Inc. a subsidiary of Spatializer Audio Laboratories, Inc.

Figure 1 ES1946 Block Diagram.

## PINOUT

Figure 2 shows the ES1946 pinout diagram.

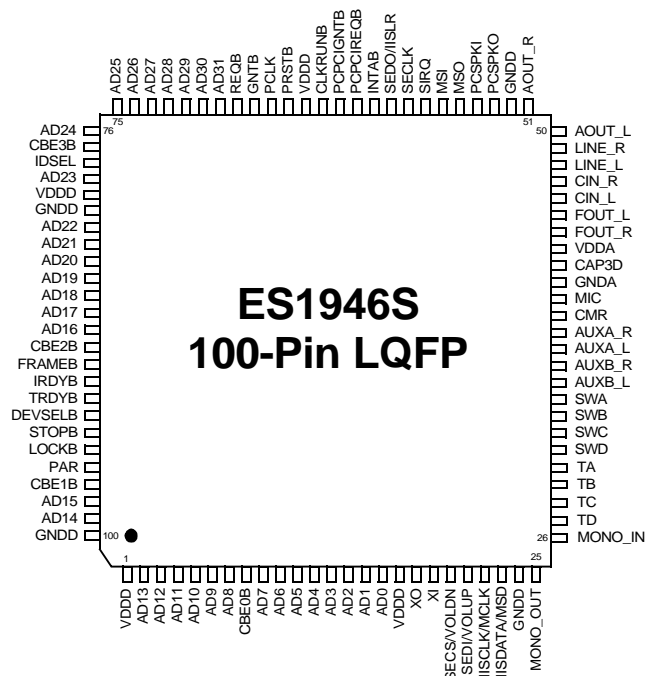


Figure 2 ES1946 Pinout Diagram

## ES1946 PIN DESCRIPTION

Table 1 lists the ES1946 pin descriptions.

Table 1 ES1946 Pin Descriptions

Names	Pin Numbers	I/O	Descriptions
VDDD	1, 17, 64, 80	I	Digital supply voltage ( $3.0V \pm 3.6V$ ).
AD[31:0]	2:7, 9:16, 69:76, 79, 82:88, 98, 99	I/O	Address and data lines from the PCI bus.
CBE[3:0]B	8, 77, 89, 97	I/O	PCI command/byte enable.
XO	18	O	Oscillator output. Connect to external 14.318-MHz crystal.
XI	19	I	Oscillator/external clock input. Connect to external 14.318-MHz crystal or clock source (must be CMOS levels).
VOLDN	20	I	Active-low volume decrease button input with internal pull-up.
SECS		O	Serial EEPROM chip select.
VOLUP	21	I	Active-low volume increase button input with internal pull-up.
SEDI		O	Serial data output to EEPROM.
MCLK	22	I	Input with internal pull-down. Music serial clock from external wavetable music synthesizer.
IISCLK		I	Serial shift clock for I <sup>2</sup> S interface.
MSD	23	I	Input with internal pull-down. Music serial data from external wavetable music synthesizer.
IISDATA		I	Serial data for I <sup>2</sup> S interface. IIS and hardware wavetable cannot coexist.
GNDD	24, 52, 81, 100	I	Digital ground.
MONO_OUT	25	O	Mono output with source select and volume control (including mute). This pin can drive an external 5k $\Omega$ AC load.
MONO_IN	26	I	Mono input to mixer and ADC. This pin has an internal pull-up to CMR.
T(A-D)	30:27	I/O	Joystick timer pins. These pins connect to the X-Y positioning variable resistors for the two joysticks. 5V-tolerant.
SW(A-D)	31:34	I	Active-low joystick switch setting inputs. These SW pins have internal pull-up resistors. 5V-tolerant pins.
AUXB_L, AUXB_R	35, 36	I	Auxiliary B inputs, left and right. AUXB_L and AUXB_R have internal pull-up resistors to CMR.
AUXA_L, AUXA_R	37, 38	I	Auxiliary A inputs, left and right. AUXA_L and AUXA_R have internal pull-up resistors to CMR.
CMR	39	O	Common mode reference voltage ( $2.25V \pm 5\%$ ). Bypass this pin to analog ground with 47- $\mu$ F electrolytic in parallel with a 0.1- $\mu$ F capacitor.
MIC	40	I	Microphone input. MIC has an internal pull-up resistor to CMR.
GNDA	41	I	Analog ground.
CAP3D	42	I	Bypass capacitor to analog ground for 3D effects.
VDDA	43	I	Analog supply voltage ( $5V \pm 5\%$ ). Must be greater than or equal to VDDD–0.3V.
FOUT_R, FOUT_L	44, 45	O	Filter outputs, right and left. AC-coupled externally to CIN_R and CIN_L to remove DC offsets.
CIN_L, CIN_R	46, 47	I	ADC and first channel DAC mixer inputs. These pins have internal 50k $\Omega$ pull-up resistors to CMR.
LINE_L, LINE_R	48, 49	I	Line inputs, left and right. LINE_L and LINE_R have internal pull-up resistors to CMR.
AOUT_L, AOUT_R	50, 51	O	Line-level stereo outputs, left and right. These pins can drive a 5k $\Omega$ AC load.

Table 1 ES1946 Pin Descriptions (Continued)

Names	Pin Numbers	I/O	Descriptions
PCSPKO	53	O	Analog output of PCSPKI with volume control.
PCSPKI	54	I <sup>a</sup>	Normally low digital PC speaker signal input. This signal is converted to an analog signal with volume control and appears on analog output PCSPKO. 5V-tolerant input.
MSO	55	O	MIDI serial data output.
MSI	56	I <sup>a</sup>	MIDI serial input. Schmitt trigger input with internal pull-up resistor. Either MPU-401 or SoundBlaster formats.
SIRQ	57	I/O	Serialized IRQ.
SECLK	58	O	Clock for serial EEPROM. Pull-up to VDDD via external 47k $\Omega$ resistor.
SEDO	59	I	Serial data input from EEPROM.
IISLR		I	Left/Right strobe for I <sup>2</sup> S interface.
INTAB	60	O	PCI interrupt request.
PCPCIREQB	61	O	PC/PCI serialized DREQ output (optional motherboard PC/PCI implementation).
PCPCIGNTB	62	I	PC/PCI serialized DACK input (optional motherboard PC/PCI implementation).
CLKRUNB	63	I/O	PCI clock state for power management.
PRSTB	65	I	PCI reset.
PCLK	66	I	PCI clock. This clock times all PCI transactions.
GNTB	67	I	PCI busmaster grant.
REQB	68	O	PCI busmaster request, tri-state output.
IDSEL	78	I	PCI device select for configuration.
FRAMEB	90	I/O	PCI cycle frame.
IRDYB	91	I/O	PCI initiator ready.
TRDYB	92	I/O	PCI target ready.
DEVSELB	93	I/O	PCI device select.
STOPB	94	I/O	PCI stop transaction.
LOCKB	95	I/O	PCI lock.
PAR	96	I/O	PCI parity.

a. 1<sup>a</sup> pins are 5V pins with 3.3V digital supply on VDDD.

## ORDERING INFORMATION

Part Number	Description	Package
ES1946S	PCI <i>AudioDrive</i> Controller for Notebook	100-pin LQFP



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