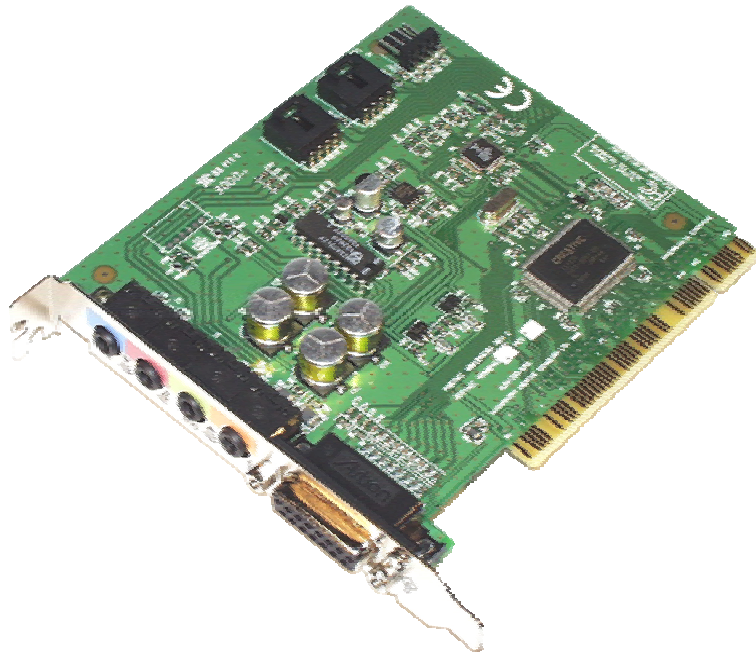

Model CT5801 OEM Guide

Creative Sound Blaster® AudioPCI™ 128
PCI Audio Card Hardware Applications
Revision 1.0, October 25, 2000



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Revision History

Revision	Written/Changes Made By	Dated	Revision History
1.0	Joanne Scanlon	10-25-00	Updated card picture to include PC99 colors on bracket.

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Table of Contents

REVISION HISTORY	2
INTRODUCTION	4
SB AUDIOPCI 128 CONFIGURATIONS	5
SYSTEM REQUIREMENTS	5
SB AUDIOPCI™ 128 SERIES FEATURES.....	5
DIGITIZED SOUNDS	5
SYNTHESIZED MUSIC.....	6
COMMUNICATIONS INTERFACE.....	6
Telephone Answering Device (TAD) interface	6
CREATIVE STEREO DIGITAL / ANALOG MIXER	6
MIDI INTERFACE	6
ADVANCED WAVE TABLE SYNTHESIS.....	6
SAMPLING SUBSYSTEM	7
3D AUDIO TECHNOLOGY	7
JOYSTICK PORT	7
SPDIF INTERFACE	7
INPUTS AND OUTPUTS	7
ES1373 INTEGRATED AUDIO CHIP - GENERAL DESCRIPTION	8
POWER MANAGEMENT	9
ES1373 INTEGRATED AUDIO CHIP - BLOCK DIAGRAM.....	10
SB AUDIOPCI 128 – ES1373 SERIES CONNECTIONS AND JUMPERS	11
ADAPTER CABLE FOR S/PDIF FEATURE	12
INTERNAL CONNECTORS - PIN ASSIGNMENTS	13
CD AUDIO CONNECTORS	13
SB AUDIOPCI 128 – ES1373 SERIES SPECIFICATIONS.....	14

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Introduction

This document is intended to provide a complete technical description of the features and specifications of the Sound Blaster® AudioPCI™ 128 advanced PCI audio cards. The SB AudioPCI™ 128 is a PCI audio chipset solution from the Ensoniq division of Creative Technology Ltd. The Sound Blaster® AudioPCI™ 128 along with an AC97 CODEC offers the next generation of audio performance in a PC while maintaining full legacy compatibility without old ISA bus solutions.

The Sound Blaster® AudioPCI™ 128 utilizes the ES1373 PCI audio chip sold in the OEM market. SB AudioPCI™ 128 is a PC99 compliant incorporating 3D Audio technology from Creative which immerses users in 3D audio space. What's more, the ES1373 supports 3D Positional Audio, Environmental Audio Extension (EAX) for DirectSound and DirectSound3D, and custom OEM configuration options for CDDA. In addition, Creative's 3D Audio technology dramatically improves sound clarity, spatial realism and sound effects, through the minimization of crosstalk, which will dynamically adjust for monophonic or stereophonic input without user intervention.

The SB AudioPCI™ 128 series is fully Plug and Play compliant for ease of use in either DOS, Windows Millennium, Windows 2000, Windows 95, Windows 98 or Windows NT® applications. SB AudioPCI™ 128 provides General MIDI compatibility at an attractive price point. It provides a professional audio solution for today's newest generation of game, music and entertainment software. SB AudioPCI™ 128 also adds support for General Sound drum kit samples and cutting-edge positional 3D audio for true spatial localization of sounds and complies with the Roland™ MT-32 standard for wave table audio. It is fully compliant with Multimedia PC Level 3 specifications and with Microsoft® Multimedia extensions for Windows.

The CT5801 model of the SB AudioPCI™ 128 adds the capability of a SPDIF output. This output is shared with the Line-out, and has an audio sensing circuit to determine if the cable plugged into the jack is for analog or digital output. Details of the internal connection and SPDIF cable specifications can be found on pages 12 and 13 of this document.

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SB AudioPCI 128 Configurations

SB AudioPCI™ 128 Series is fully configurable as a professional quality audio. The features shown in the table below are described in detail in the following section of this document. SB AudioPCI 128 Series is available in the following configuration:

Model	Config	Host Ram	2,4,8 MB Sound Sets	3D Sound, Reverb, Chorus	Power Amp	Aux In	TAD In	CD Audio In	Bus Master PCI	SB PCI Compatible	SPDIF
ES1373	SB AudioPCI™ 128	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Key:

Host RAM - Uses system memory

SPDIF - provides output connection to a DAC receiver (ie DAT machine)

System Requirements

In order to install the SB AudioPCI™ 128 Series, the target system has to meet the following minimum requirements:

1. Plug and Play ready Pentium and AMD-K5 90 MHz, or 100% compatible system
2. 16MB RAM
3. 10MB free hard disk space
4. VGA display required
5. Windows Millennium, Windows 2000, Windows 95, Windows 98 or Windows NT Operating System
6. Available PCI slot

SB AudioPCI™ 128 Series Features

Digitized Sounds

- Sound Blaster 16 compatible.
- AC97 CODEC supporting stereo sampling 48kHz (Fixed); Multiple sample rate support
- Recording source: microphone, stereo line-in, CD-audio, video, modem or multiple source recording.
- PCI Bus Master for fast DMA
- Advanced 16-bit software-based real time audio compression/decompression system with the following standards:

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- i. CCITT A-law (16:8)
 - ii. CCITT μ -law (16:8)
- Up to 128 simultaneous voice polyphony
 - Full DOS Game Compatibility
 - 3 Stereo inputs and 2 mono inputs can be mixed into the output stream.
 - Direct I/O space access of the control registers.
 - 100 Pin PQFP or TQFP
 - External SPDIF Connector
 - Fully Compliant with PC99 Power Management specification

Synthesised Music

- 128 Voice WaveTable Synthesizer

Communications Interface

Telephone Answering Device (TAD) interface

- Telephony answering device for modem connection. Allows a single microphone and stereo speaker set to be used for both voice modem and sound card audio applications (message recording and playback, speakerphone, etc.)

Creative Stereo Digital / Analog Mixer

- Output mixing of all audio sources: Digitized sounds, synthesized music, line-in, CD-audio, TV-tuner, microphone.
- Input mixing sources: Synthesized music, microphone, video input, CD-audio, line-in
- Multiple source recording and L/R channels may be swapped or mixed.
- 7 channel mixer for access to digitized sound, synthesized music, microphone, CD-audio, line-in, video, phone
- Spatial audio control for digital audio and music synthesizer
- Reverb and chorus control for music synthesizer

MIDI Interface

- MPU-401 UART

Advanced Wave Table Synthesis

- Creative Advanced Synthesis Engine
- 128 voice polyphony and multi-timbral capability
- 128 GM wavetable instruments
- GS sound set + 10 drum kits in 4 & 8 MB sample sets
- 16 MIDI channels
- 128 MT-32 compatible instruments
- Digital effects engine for reverb and chorus

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- 2MB, 4MB, & 8MB sample sets

Sampling Subsystem

- Host memory support
- Virtually unlimited variations of sound

3D Audio Technology

- Supports EAX 1.0
- Multi-algorithm Reverb and Chorus
- Support Microsoft® DirectSound 3D
- Support Aureal A3D API
- Improves sound clarity, spatial realism and sound effects, through the minimization of crosstalk
- Dynamically adjust for monophonic or stereophonic input without user intervention

Joystick Port

- Standard PC joystick port for 1 or 2 joysticks.

SPDIF Interface

- 2-channel digital audio interface
- Output connector to a DAC receiver (i.e. digital speakers)

Inputs and Outputs

- Stereo 2W/Channel Power Amplifier
- Line In
- Line Out/SPDIF Out (SPDIF Out optional)
- Microphone In
- CD In
- TAD
- TV Tuner
- Joystick/Midi

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ES1373 Integrated Audio Chip - General Description

The ES1373 solution is Sound Blaster 16 compatible via emulation, Roland MPU401 compatible via emulation and in full compliance with Multimedia PC Level 3 specifications. In addition, the ES1373 meets Plug and Play specifications, eliminating any requirement for the user to select I/O and DMA address settings through hardware or software. The card is automatically recognized and configured by the Plug and Play host PC during installation.

ES1373 is a PCI bus master and slave device that is best understood by looking at the device as four interactive subsystems: the PCI interface, DMA control, LEGACY functions, and the CODEC.

The PCI subsystem is a bus master interface that performs the memory accesses to keep the audio cache buffers full and empties the A/D Converter (or I²S input) buffer to main memory as required. The fundamental concept of ES1373 is that the PCI interface controller has a sufficiently large internal (on-chip) memory cache to meet the memory bandwidth requirements. There is a sound cache block of 64 bytes for each of the audio channels. It is the responsibility of the DMA control and the software to keep the buffers full.

All system control registers are accessed via I/O on the PCI bus. The ES1373 uses 16 Long Words in the I/O space for control registers. All registers are read as Long Words. All registers are written in byte word or long word format.

The ES1373 essentially implements a 3-channel DMA controller. These virtual DMA channels are implemented via the CCB, PCI and Serial interface modules. The serial interface signals the CCB module when a cache transfer is required (playback or record). The CCB module then signals the PCI module to initiate a bus master data transfer. At this point the CCB and PCI modules will control the data transfer between host system memory and the ES1373 internal cache.

The LEGACY subsystem is the circuitry required to perform Sound Blaster, OPL-FM and MPU-401 emulation. Functionally the ES1373 traps on access of the Sound Blaster registers and then issues the appropriate IRQ or SERR command on the PCI bus. The ES1373 handles the Legacy DMA function in a similar fashion. The exact functionality of the block cannot be fully disclosed at this time due to pending patent protection for the application of this technique.

The CODEC controller supports any AC97 compliant CODEC. The functionality of the A/D and D/A sections are similar to those found in other standard CODECs. The A/D portion of the CODEC is handled as an independent asynchronous event with a DMA buffer control structure. Each time the A/D FIFO is filled, a Bus Master request occurs and the FIFO is transferred to main memory.

The ES1373 also incorporates a SPDIF output. This output is capable of providing stereo digital audio or compressed AC3 data from a soft DVD decoder.

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Power Management

All power management of the system is under software control. The AC97 CODEC and ES1373 can be powered down separately. Neither chip loses register information when powered down.

The ES1373 can be power managed by shutting down various sub-systems. The following blocks can be individually powered down: Joystick, UART, and Serial Interface. Although these blocks can be individually disabled this will not save an appreciable amount of power. ES1373 can also individually internally shut down the PCI clock and the Crystal input clock. The PCI clock when shut down will still be active to the PCI and Interrupt/Chip Select modules. The Crystal clock when shut down will be shut down for all internal modules as well as the output connection to the AC97 CODEC.

During operation, the ES1373 ASIC will have a typical power dissipation of 150mW. In power down, the ES1373 ASIC will have a typical power dissipation of 15mW.

CODEC Power Management

The AC97 CODEC is powered down by setting bit 1 (of control bits 7 - 0) in control register 16 (hex) to a zero. The AC97 CODEC control registers are written through the CODEC Interface block at address 14 (hex).

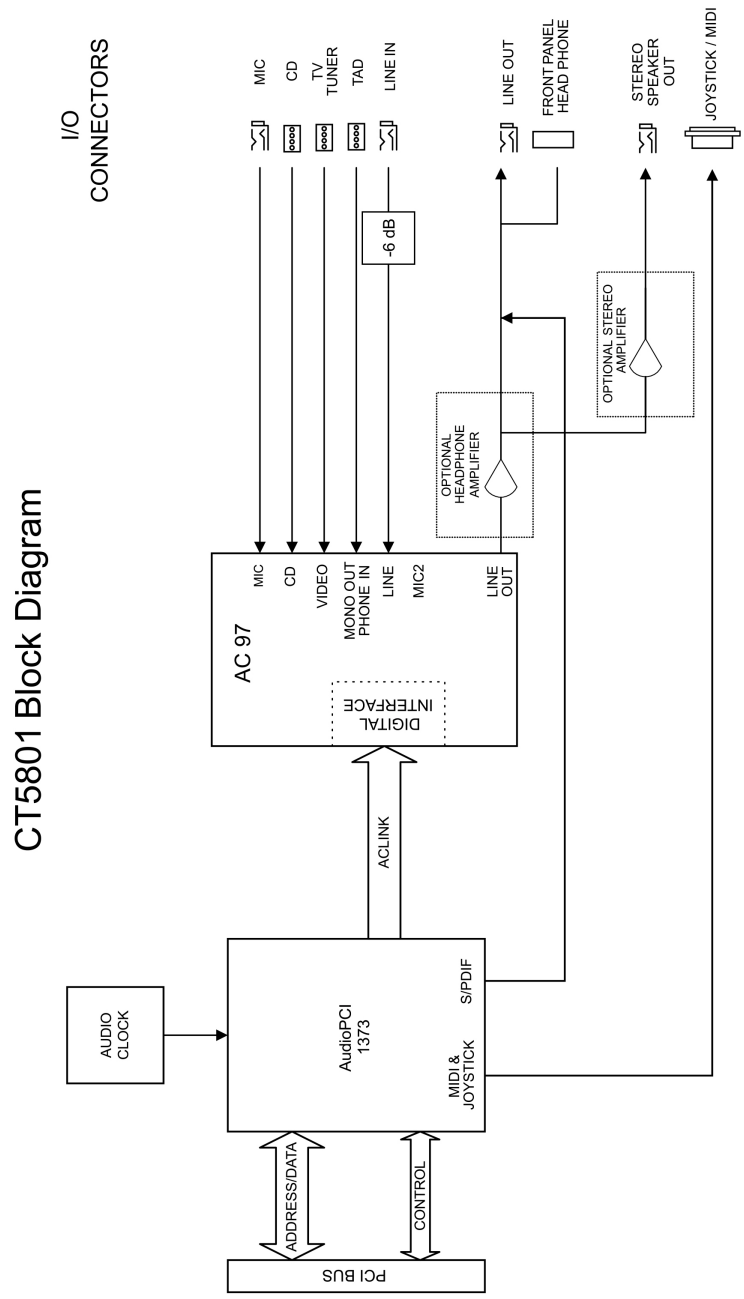
ES1373 Power Management

As mentioned above, the Joystick, UART, and Serial Interface modules of the ES1373 chip can be individually powered down. The remaining modules will be in a powered up condition. The ES1373 modules are powered down by setting bits 6 - 2 (of control bits 31 - 0) to zero. The ES1373 control register is located in the IRQ and Chip Select Block at address 00 (hex). Note that the Serial Interface actually has three separate enable bits, one for each of the playback channels and one for the record channel.

Although these blocks can be individually disabled this will not save an appreciable amount of power. ES1373 can also individually internally shut down the PCI clock and the Crystal input clock. The PCI clock when shut down will still be active to the PCI and Interrupt/Chip Select modules. The Crystal clock when shut down will be shut down for all internal modules as well as the output connection to the AC97 CODEC.

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ES1373 Integrated Audio Chip - Block Diagram



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SB AudioPCI 128 – ES1373 Series Connections and Jumpers



The board consists of the following connectors that support the connection of internal devices or hardware configuration changes:

1. **CD Audio In – J6**
 - 4 pin Molex CD Audio connector
2. **TV Tuner – J8**
 - 4 pin Molex connector
 - Connector for TV Tuner, IDE CD Audio or other auxiliary audio input
3. **TAD I/O – J10**
 - Connection to a standard voice modem

The card features the following external jacks and connectors on the back panel:

- J1 - Stereo jack for Line in (Black jack with blue color and wording “IN” on bracket)
- J2 - Stereo jack Mic (Black jack with microphone symbol and pink color on bracket)
- J3 - Stereo jack for Line-out (Black jack with green color and wording “OUT” on bracket)
- J4 – Stereo speaker output (Black jack with stereo symbol and orange color on bracket)
- J5 - Joystick/Midi port (Black jack with joystick symbol on bracket)

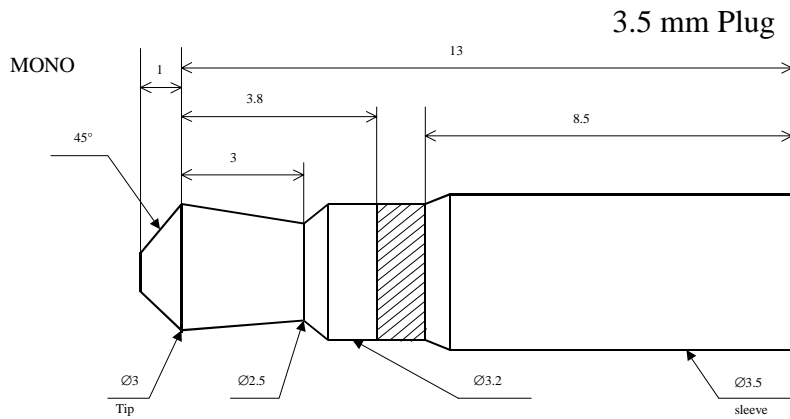
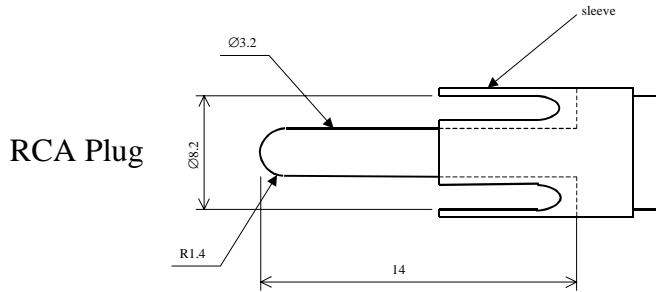
The AudioPCI 128 ES1373 Series cards are 2 layer PCB construction. The descriptions for all back panel connections are located on the bracket.

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Adapter Cable for S/PDIF Feature

Length: 6 Feet
 Impedance: 75 Ohm
 Type: Coaxial
 Soundcard End: 3.5 mm Male (Earphone) Mono Plug
 Receiver End: RCA (Male) Plug

The cable shield is connected to the sleeve of the 3.5 mm plug and the sleeve of the RCA plug. The center conductor is connected to the tip of both the RCA plug and the 3.5 mm plug.



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Internal Connectors - Pin Assignments

CD Audio Connectors

J6 - Molex CD-IN Pin Assignments		
PIN	SIGNAL	I/O
1	Left Channel	IN
2	Ground	IN
3	Ground	IN
4	Right Channel	IN

J8 - Molex TV Tuner Pin Assignments		
PIN	SIGNAL	I/O
1	Left Channel	IN
2	Ground	IN
3	Ground	IN
4	Right Channel	IN

J10 - Molex TAD Pin Assignments		
PIN	SIGNAL	I/O
1	Modem Audio In	IN
2	Ground	IN
3	Ground	IN
4	Boosted Mic Output 30dB	IN

J12 Front Panel Header Signal		
PIN	SIGNAL	I/O
1	Front Panel Left Out	OUT
2	Front Panel Left Return	IN
3	Ground	IN
4	Ground	IN
5	Front Panel Right Return	IN
6	Front Panel Right Out	OUT

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SB AudioPCI 128 – ES1373 Series Specifications

Typical Audio Performance

Frequency Response (+0/-3dB)	20 Hz to 20 kHz (Source: Line in) 20 Hz to 20 kHz (Source: Mic)
Line-In Voltage Range	0 to 2 Vrms
Line-Out voltage at 0dB	0 to 2 Vrms (10kohms load)

Reference signal 1KHz (measured with wide-band filter 22Hz-22kHz):

Signal to Noise Ratio	> 90 dBr (Source: Line-in)
THD+ N	.005% (Source: Line-in) .01% (Source: 35dBu Mic-in)

Microphone Input Range	0 to 100 mVrms
Line-In Impedance	10 kohms
CD Audio-In Impedance	10 kohms
CD Audio-In Input Range	0 to 1 Vrms

Power Consumption (estimated)

+5 Volt Current Consumption	50 mA (Typ)
+12 Volt Current Consumption	75 mA (Typ)
-12 Volt Current Consumption	35 mA (Typ)

Temperature range

Operation	10 to 50 degree C
Non-operating	-40 to 125 degree C

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