



## DESCRIPTION

The Solo-1™ 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 Solo-1 complies with the Microsoft® PC 97/PC 98 specifications and meets WHQL audio requirements. The Solo-1 forms a complete audio subsystem on a single chip for both add-in card and motherboard platforms.

The Solo-1 incorporates a microcontroller, ESFM™ music synthesizer, 3-D stereo effects processor, 16-bit stereo wave ADC and DAC, 16-bit stereo music DAC, MPU-401 UART mode serial port, dual game port, hardware master volume control, a serial port interface to external wavetable music synthesizer, 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 Solo-1 integrates ESS' field-proven hardware design for DOS game compatibility with hardware FM synthesis (ESFM™) and three methods for legacy audio control interface: PC/PCI, Distributed DMA, and Transparent DMA. Transparent DMA requires no sideband signals from PC core logic chipsets in addition to the standard PCI 2.1 bus. TDMA is compatible with Pentium® and Pentium Pro® chipsets as well as standard PCI add-in cards.

The Solo-1 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 integrated 3-D audio effects processor uses technology from Spatializer® Audio Laboratories, Inc. and expands the sound field emitted by two speakers to create a resonant 3-D sound environment.

The Solo-1 is compliant with Advanced Configuration and Power Interface (ACPI) standards.

It is available in an industry-standard 100-pin Thin Quad Flat Pack (TQFP) package.

## IMPLEMENTATION PLATFORMS

- Motherboards (desktop and notebook)
- Sound Cards
- Multifunction Cards – Audio/Fax/Modem with speakerphone

## FEATURES

- Single, high-performance, mixed-signal, 16-bit stereo VLSI chip
- PCI parallel bus interface, version 2.1
- Full native DOS games compatibility, via three technologies:
  - TDMA
  - DDMA
  - PC/PCI
- High-Quality ESFM™ music synthesizer
- Dynamic range (SNR) over 80 dB
- Integrated Spatializer® 3-D audio effects processor

## Record and Playback Features

- Record, compress, and play back voice, sound, and music
- 16-Bit stereo ADC and DAC
- Programmable independent sample rates from 4 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
- MPU-401 (UART mode) interface for wavetable synthesizers and MIDI devices
- Integrated dual game port
- Separate mono input (MONO\_IN) and mono output (MONO\_OUT) 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

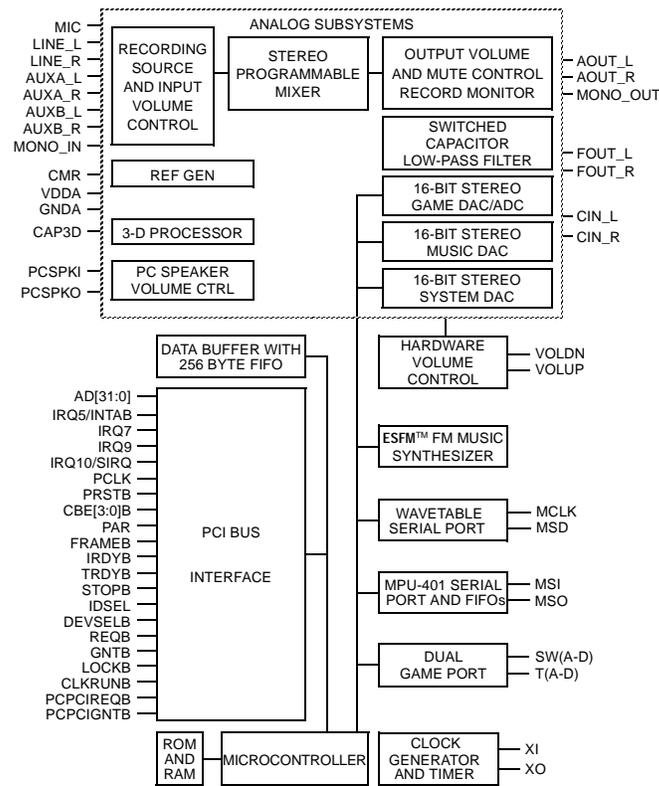
## Power

- Advanced power management meets ACPI standards
- Supports 5.0 V operation

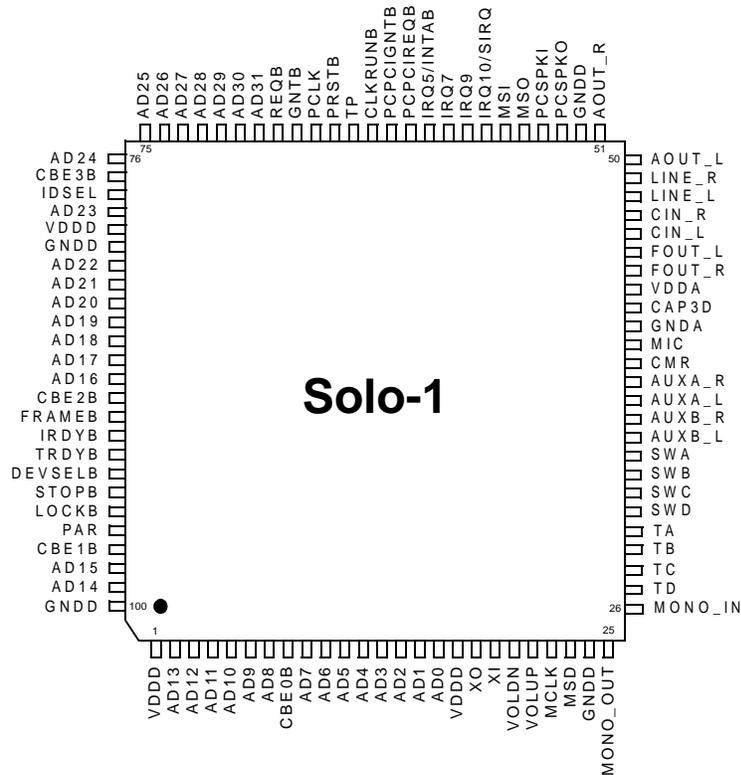
## Compatibility

- Supports PC games and applications for Sound Blaster™ and Sound Blaster™ Pro
- Supports Microsoft® Windows™ Sound System®
- Meets PC 97/PC 98 and WHQL specifications

### BLOCK DIAGRAM



### PINOUT



## PIN DESCRIPTION

Name	Number	I/O	Description
VDDD	1,17,80	I	Digital supply voltage, 5 V.
AD[31:0]	69:76,79,82:88, 98:99,2:7,9:16	I/O	Address and data lines from the PCI bus.
CBE[3:0]B	77,89,97,8	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.
VOLUP	21	I	Active-low volume increase button input with internal pull-up.
MCLK	22	I	Input with internal pull-down. Music serial clock from external wavetable music synthesizer (ES692).
MSD	23	I	Input with internal pull-down. Music serial data from external wavetable music synthesizer (ES692).
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 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.
SW(A-D)	34:31	I	Active-low joystick switch setting inputs. These SW pins have an internal pull-up resistor.
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. Normally intended for connection to an internal or external CD-ROM analog output.
CMR	39	O	Common mode reference voltage (2.25 V $\pm$ 5%). Bypass this pin to analog ground with 47 $\mu$ F electrolytic in parallel with a .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 3-D effects.
VDDA	43	I	Analog supply voltage (5 V $\pm$ 5%). Must be greater than or equal to VDDD-0.3 V.
FOUT_R, FOUT_L	44,45	O	Filter outputs, left and right. AC-coupled externally to CIN_L and CIN_R to remove DC offsets.
CIN_L, CIN_R	46,47	I	ADC and first channel DAC mixer inputs. These pins have internal 50k 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 ohm AC load.
PCSPKO	53	O	Analog output of PCSPKI with volume control.
PCSPKI	54	I	Normally low digital PC speaker signal input. This signal is converted to an analog signal with volume control and appears on analog output PCSPKO.
MSO	55	O	MIDI serial data output.
MSI	56	I	MIDI serial input. Schmitt trigger input with internal pull-up resistor. Either MPU-401 or Sound Blaster formats.
IRQ10	57	O	Active-high ISA interrupt request.
SIRQ		I/O	Serialized IRQ.
IRQ[7,9]	59,58	O	Active-high ISA interrupt requests.
IRQ5	60	O	Active-high ISA interrupt request.
INTAB		O	PCI interrupt request.
PCPCIREQB	61	O	PC/PCI serialized DREQ output. (Motherboard implementation.)
PCPCIGNTB	62	I	PC/PCI serialized DACK input. (Motherboard implementation.)
CLKRUNB	63	I/O	PCI clock state for power management.
TP	64	I	Test pin.
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, tristate 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.

### ANALOG CHARACTERISTICS

Parameter	Pins	Min	Typ	Max	Unit
Reference voltage	CMR (VDDA = 5.0 V)		2.25		V
Input impedance	LINE_L, LINE_R, AUXA_L, AUXA_R, AUXB_L, AUXB_R, MIC		125k		$\Omega$
	CIN_L, CIN_R	35k	50k	65k	$\Omega$
Output impedance	FOUT_L, FOUT_R	3.5k	5k	6.5k	$\Omega$
	AOUT_L, AOUT_R max load for full-scale output range		10k		$\Omega$
Input voltage	MIC – preamp ON			125	mVp-p
	– preamp OFF			2.8	Vp-p
	LINE_L, LINE_R, AUXA_L, AUXA_R, AUXB_L, AUXB_R			3.4	Vp-p
Output voltage	AOUT_L, AOUT_R full-scale output range	0.5		VDDA - 1.0	Vp-p
Gain	Mic preamp		26		dB

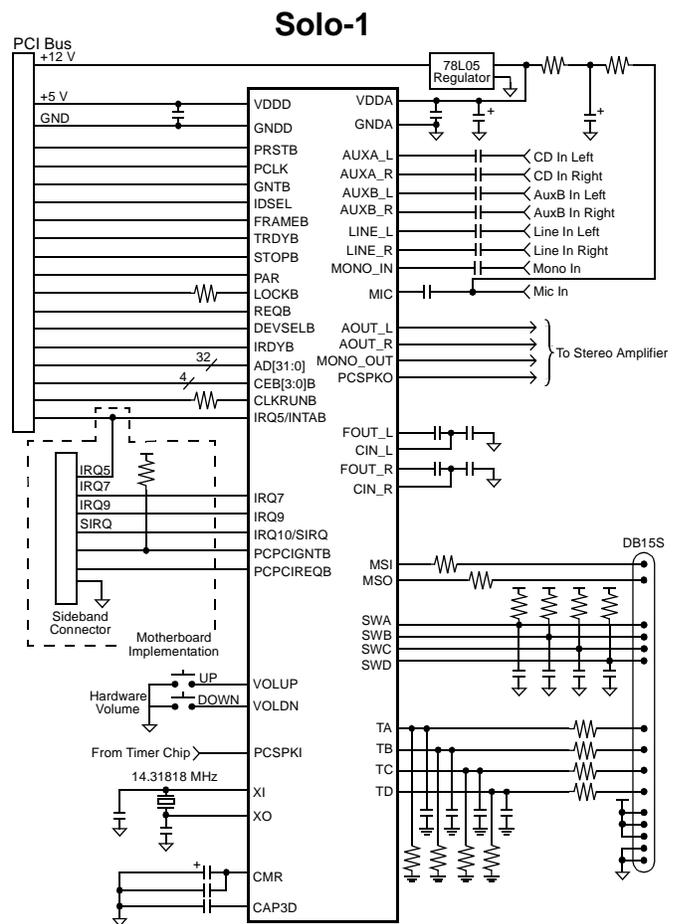
### DIGITAL CHARACTERISTICS

Symbol	Parameters	Min	Max	Unit	Conditions
VIH1	Input high voltage: All inputs except MSD, MCLK, SW(A-D), VOLUP, VOLDN	2.2		V	VDDD = min
VIH2	Input high voltage: MSD, MCLK	2.6		V	VDDD = min
VIH3	Input high voltage: SW(A-D), VOLUP, VOLDN	4.1		V	VDDD = min
VIL1	Input low voltage: All inputs except MSD, MCLK, SW(A-D), VOLUP, VOLDN		0.8	V	VDDD = max
VIL2	Input low voltage: MSD, MCLK		1.2	V	VDDD = max
VIL2	Input low voltage: SW(A-D), VOLUP, VOLDN		1.3	V	VDDD = max
VOH1	Output high voltage: All outputs except IRQ[5,7,9,10]	2.4		V	VDDD = min IOH = -3 mA
VOH2	Output high voltage: IRQ[5,7,9,10]	2.4		V	VDDD = min IOH = -8 mA
VOL1	Output low voltage: All outputs except IRQ[5,7,9,10]		0.55	V	VDDD = max IOL = 6 mA
VOL2	Output low voltage: IRQ[5,7,9,10]		0.4	V	VDDD = max IOL = 12 mA

### MAXIMUM RATINGS

Rating	Symbol	Value
Analog supply voltage	VDDA	-0.3 to 7.0 V
Digital supply voltage	VDDD	-0.3 to 7.0 V
Input voltage	VIN	-0.3 to 7.0 V
Operating temperature range	TA	0 to 70 °C
Storage temperature range	TSTG	-50 to 125 °C

### TYPICAL APPLICATION



### BUNDLED SOFTWARE AND DRIVERS

- AudioRack™
- Device Drivers for:
  - Microsoft Windows®95/Windows®98
  - Microsoft Windows™ NT 4.0

### SERVICE AND SUPPORT

- Evaluation Kit
- Manufacturing Kit
- Reference Design



ESS Technology, Inc.  
 48401 Fremont Blvd.  
 Fremont, CA 94538  
 Tel: 510-492-1088  
 Fax: 510-492-1098



No part of this publication may be reproduced, stored in a retrieval system, transmitted, or translated in any form or by any means, electronic, mechanical, manual, optical, or otherwise, without the prior written permission of ESS Technology, Inc.

ESS Technology, Inc. makes no representations or warranties regarding the content of this document.

All specifications are subject to change without prior notice.

ESS Technology, Inc. assumes no responsibility for any errors contained herein.

(P) U.S. Patent 4,214,125 and others, other patents pending.

AudioDrive® is a registered trademark of ESS Technology, Inc.

Solo-1™, ESFM™, and AudioRack™ are trademarks of ESS Technology, Inc.

All other trademarks are owned by their respective holders and are used for identification purposes only.