



## 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

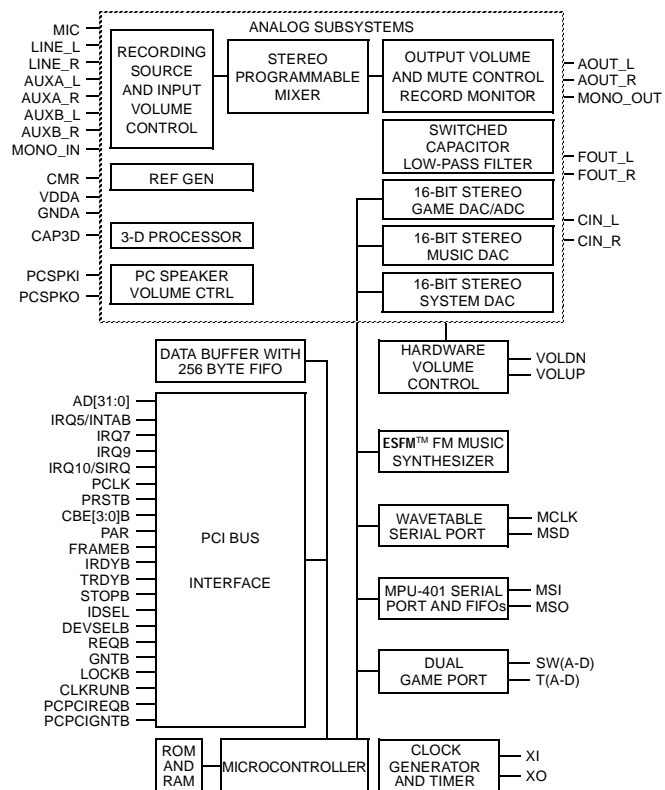
### Power

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

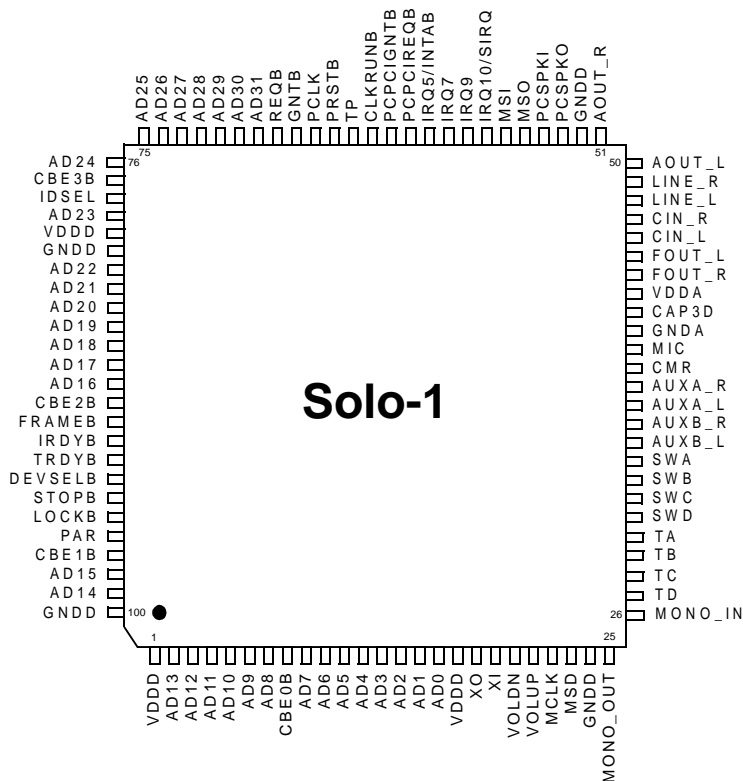
### Compatibility

- 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 ( $2.25\text{ V} \pm 5\%$ ). Bypass this pin to analog ground with 47 $\mu\text{F}$ electrolytic in parallel with a .1 $\mu\text{F}$ 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 ( $5\text{ V} \pm 5\%$ ). 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
					Vp-p
Output voltage	AOUT_L, AOUT_R full-scale output range	0.5		VDDA - 1.0	Vp-p
Gain	Mic preamp		26		dB

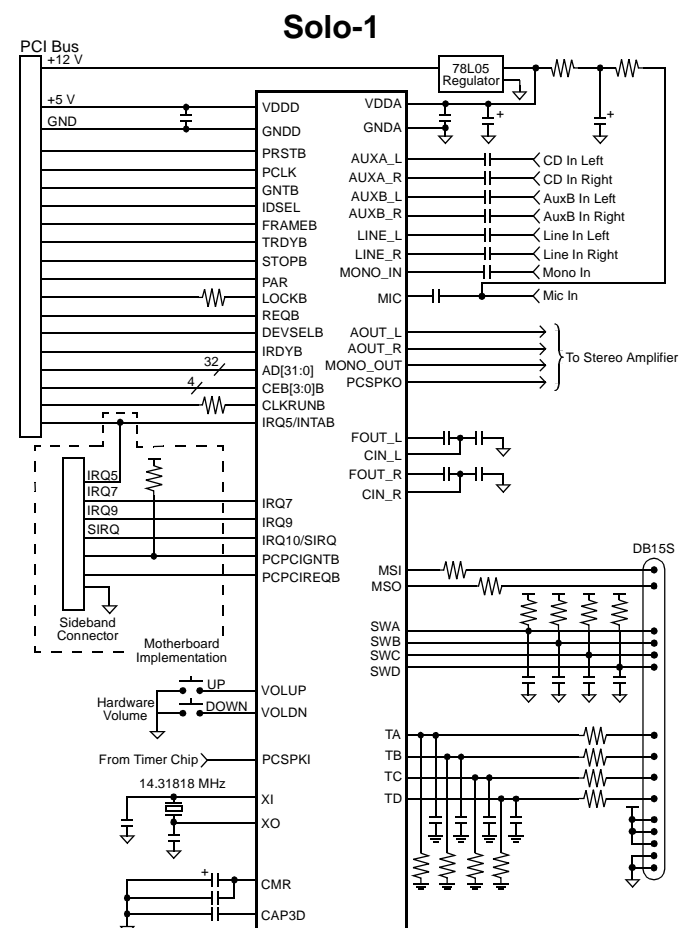
## DIGITAL CHARACTERISTICS

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



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