ESS Technology, Inc.

DESCRIPTION

The ES1869 *Audio*Drive® solution is a single, mixed-signal chip that adds 16-bit stereo sound and FM music synthesis to personal computers. It is compliant with the Microsoft® PC 97 and PC 98 specification and WHQL audio requirements. The ES1869 possesses an embedded microcontroller, OPL3™ superset **ESFM**™ music synthesizer, 16-bit stereo wave ADC and DAC, 16-bit stereo music DAC, MPU-401 UART mode serial port, dual game port, full Plug and Play support, CD-ROM IDE interface, hardware master volume control, two serial port interfaces to external DSP and external wavetable music synthesizer, I²S Zoom Video interface, DMA control logic with FIFO, and ISA bus interface logic. There are three stereo inputs (typically line, CD audio, and auxiliary line) and a mono microphone input. All of this on a single chip that can be designed into a motherboard, add-on card, or integrated into other peripheral cards such as Fax/Modem, VGA, LAN, I/O, etc.

The ES1869 *Audio*Drive® solution can record, compress, and play back voice, sound, and music with built-in mixer controls. It supports full-duplex operation for simultaneous record and playback using two DMA channels. The **ESFM**™ synthesizer has extended capabilities within native mode operation providing superior sound and power-down capabilities. It is a register compatible superset to the OPL3 FM synthesizer.

The ES1869 *Audio*Drive® solution supports the full ISA Plug and Play standard. It provides Plug and Play configuration for logical devices: audio, **ESFM**™ synthesizer, game port, MPU-401, IDE CD-ROM, MODEM, and an additional user defined device.

The MPU-401 serial port is for interfacing to an external MIDI device.

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 speakerphone application can be implemented either by digital interface through the DSP serial port, or by analog interface through Mono-In and Mono-Out.

A DSP serial interface in the ES1869 allows an external DSP to take over ADC or DAC resources.

The ES1869 *Audio*Drive® solution supports telegaming architecture with headsets and includes data paths for host-based Acoustic Echo Cancellation processing.

Advanced power management features include suspend/resume from disk or host-independent self-timed power-down and automatic wake-up. The ES1869 is compliant to the ACPI standard.

It is available in industry-standard 100-pin Plastic Quad Flat Pack (PQFP) and Thin Quad Flat Pack (TQFP) packages.

APPLICATIONS

- Business Audio
- Multimedia PCs
- PC Games
- Music Synthesis

FEATURES

- Single, high-performance, mixed-signal, 16-bit stereo VLSI chip
- High-quality, OPL3 superset **ESFM**™ music synthesizer
- IDE CD-ROM interface
- High-performance DMA supports Demand Transfer and F-type
- Integrated *Spatializer*® 3-D audio effects processor

Plug and Play Features

- On-chip Plug and Play support for audio, joystick port, FM, MODEM, MPU-401, CD-ROM, and a user-defined I/O device
- Software address mapping with software chip select, plus 3 DMA and 6 IRQ selections for motherboard implementation
- Internal configuration data for audio Plug and Play support
- Serial interface for Plug and Play resource EEPROM

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 to 48.0 kHz for record and playback
- Full-Duplex operation for simultaneous record and playback
- 2- and 3-button 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
- I²S Zoom Video port interface with a sample rate up to 48 kHz for MPEG audio
- Serial port interface to external DSP (e.g. AT&T, TI, API, and MWAVE)
- Separate mono input (MONO_IN) and mono output (MONO_OUT) for telegaming

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 with self-timed power-down, automatic wake-up, and suspend/resume to and from disk
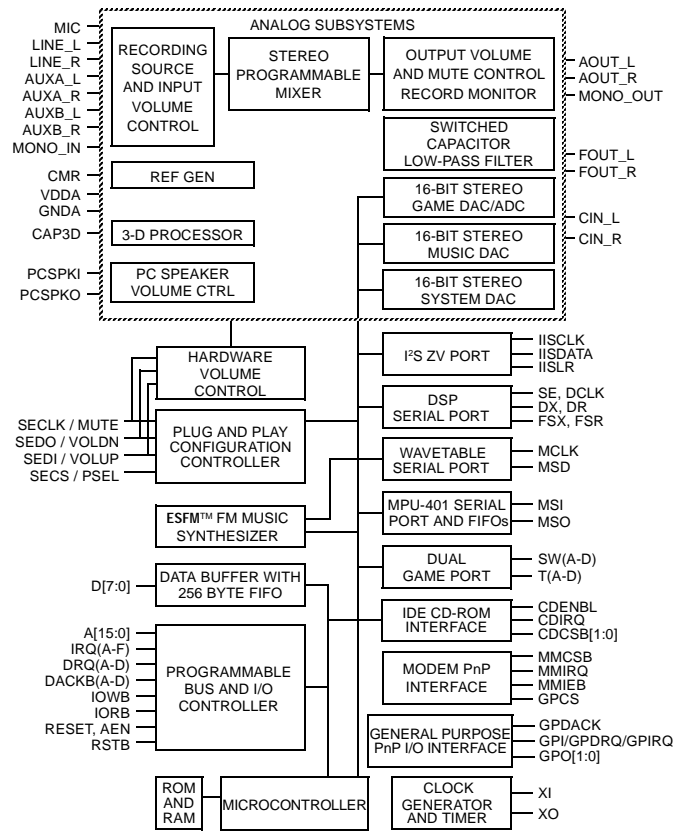- Supports 3.3 V or 5.0 V operation

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

PINOUT
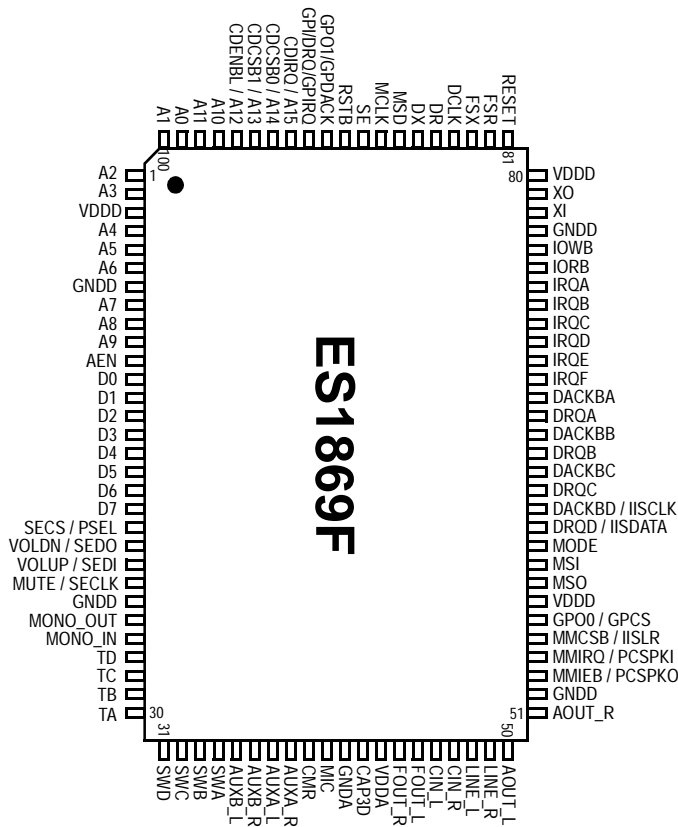
BLOCK DIAGRAM

PIN DESCRIPTION

Name	Number	I/O	Description
A[11:0]	99,100, 1, 2, 6:4, 10:8, 97, 98	I	Address inputs from the ISA bus.
VDDD	3, 57, 80	I	Digital supply voltage (4.5 to 5.5 V).
GNDD	7, 24, 52, 77	I	Digital ground.
AEN	11	I	Active-low address enable from the ISA bus.
D[7:0]	19:12	I/O	Bidirectional data bus. These pins have weak pull-up devices to prevent these inputs from floating when not driven.
PSEL	20	I	This pin selects the PnP ROM device used: 0 Internal ROM 1 93LC66 – 512 x 8, 9 address bits
SECS		I/O	Serial EEPROM CS. This is an input pin during RESET.
SEDO	21	I	Data output pin of external PnP serial EEPROM.
VOLDN		I	Active-low volume decrease button input with internal pull-up (shared with the SEDO pin).
SEDI	22	O	Data input pin to external PnP serial EEPROM.
VOLUP		I	Active-low volume increase button input with internal pull-up (shared with the SEDI pin).
MUTE	23	I	Active-low mute toggle button input with internal pull-up (shared with the SECLK pin).
SECLK		O	External serial EEPROM clock output for PnP.
MONO_OUT	25	O	Mono output with source select and volume control (including mute). This pin can drive an external 5k ohm load.
MONO_IN	26	I	Mono input to mixer and ADC. This pin has an internal pull-up to CMR.
T(A-D)	27:30	I/O	Joystick timer pins. These pins connect to the X-Y positioning variable resistors for the two joysticks.
SW(A-D)	31:34	I	Active-low, joystick switch setting inputs. These SW pins have an internal pull-up resistor.
AUXB_L, AUXB_R	35, 36	I	Auxiliary inputs, left and right. AUXB_L and AUXB_R have internal pull-up resistors to CMR.
AUXA_L, AUXA_R	37, 38	I	Auxiliary 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 ± 5%) This pin should be bypassed to analog ground with a 47 μF electrolytic capacitor with a .1 μF capacitor in parallel.
MIC	40	I	Microphone input. MIC has an internal pull-up resistor to CMR.
GNDA	41	I	Analog ground.

Name	Number	I/O	Description
CAP3D	42	I	Bypass capacitor to analog ground for 3-D effect.
VDDA	43	I	Analog supply voltage (4.5 to 5.5 V). Should be greater than or equal to VDDD -0.3 V.
FOUT_L, FOUT_R	44, 45	O	Filter outputs, left and right. AC-coupled externally to CIN_L and CIN_R to remove DC offsets. These outputs have internal series resistors of about 5k ohms. Capacitors to analog ground on these pins can be used to create a low-pass filter pole that removes switching noise introduced by the switched-capacitor filters.
CIN_L, CIN_R	46, 47	I	Capacitive coupled inputs, left and right. These inputs have internal pull-up resistors to CMR of approximately 50k ohms.
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. Can drive a 10k ohm load.
MMIEB [0]	52	I	Modem interrupt enable active-low input. Generated from the modem UART.
PCSKPO [1]		O	PC speaker analog output.
MMIRQ [0]	53	I	Modem interrupt request active-high input.
PCSPKI [1]		I	Normally low digital PC speaker input. This signal is converted to an analog signal with volume control and appears on analog output PCSPKO.
IISLR [1]	55	I	Left/right strobe for I²S interface. This pin has a pull-down.
MMCSB [0]		O	Output from ES1869 for the modem CSB.
GPCS	56	O	If selected by the PnP logic, pin 56 becomes an active-high chip select for external general-purpose device.
GPO0		O	The GPO0 output that is set low by external reset and thereafter programmable by system software for power management or other applications
MSO	58	O	MIDI serial data output.
MSI	59	I	MIDI serial input. Schmitt trigger input with internal pull-up resistor.
MODE	60	I	Mode function pin. Connect to either GNDD or VDDD to select the function of the groups of multiple function pins set apart below.
DRQD [0]	61	O	Tri-state output. Optional 16-bit DMA request for IDE interface.
IISDATA [1]		I	Serial data for I²S interface. This pin has a pull-down.
DACKBD [0]	62	I	Optional 16-bit DMA acknowledge for IDE interface.
IISCLK [1]		I	Serial shift clock for I²S interface. This pin has a pull-down.
DRQ(A-C)	75, 65, 63	O	Three (A,B,C) active-high DMA requests to the ISA bus. Unselected DRQ outputs are high impedance. When DMA is not active, the selected DRQ output has a pull-down device that holds the DRQ line inactive unless another device that shares the same DRQ line can source enough current to make the DRQ line active. DRQs are software configurable.
DACKB(A-C)	68, 66, 64	I	Three (A,B,C) active-low DMA acknowledge inputs.
IRQ(A-F)	69:74	O	Six (A,B,C,D,E,F) active-high interrupt requests to the ISA bus. Unselected IRQ outputs are high impedance. IRQs are software configurable.
IORB	75	I	Active-low read strobe from the ISA bus.
IOWB	76	I	Active-low write strobe from the ISA bus.
XI	78	I	Crystal oscillator input. Connect to external 14.318 MHz crystal or clock source with CMOS levels.
XO	79	O	Crystal oscillator output. Connect to external 14.318 MHz crystal.
RESET	81	I	Active-high reset from the ISA bus.
FSR	82	I	Input with internal pull-down. Frame sync for receive data from external DSP. Programmable for active-high or active-low.
FSX	83	I	Input with internal pull-down. Frame sync for transmit request from external DSP. Programmable for active-high or active-low.
DCLK	84	I	Input with internal pull-down. Serial data clock from external DSP. Typically 2.048 MHz.
DR	85	I	Input with internal pull-down. Data receive pin from external DSP.
DX	86	O	Tri-state output. Data transmit to external DSP. High impedance when not transmitting.
MSD	87	I	Input with internal pull-down. Music serial data from external ES689/ES69x wavetable music synthesizer.
MCLK	88	I	Input with internal pull-down. Music serial clock from external ES689/ES69x wavetable music synthesizer.
SE	89	I	Input with internal pull-down. Active-high to enable serial mode, i.e., enables an external DSP to control analog resources of the ES1869.
RSTB	90	O	Inverted RESET output.
GPDACK	91	O	Active-low DMA acknowledge output to general-purpose device that uses DMA.
GPO1		O	Output that is set high by external reset and thereafter programmable by system software for power management or other applications.
GPDRQ	92	I	DMA request output from general-purpose device that uses DMA.
GPI		I	General-purpose input option.
GPIRQ		I	Interrupt request output from the general-purpose device.
CDIRQ [0]	93	I	Interrupt request input from the IDE interface.
CDCSB0 [0]	94	O	Active-low IDE interface chip select #0.
CDCSB1 [0]	95	O	Active-low IDE interface chip select #1.
CDENBL [0]	96	O	Active-low IDE data bus transceiver enable.
A[15:12] [1]	93:96	I	Address inputs from the ISA bus.

0: Pins enabled by MODE = 0 (pin 60).
1: Pins enabled by MODE = 1 (pin 60).

ESS Technology, Inc.

ANALOG CHARACTERISTICS

Parameter	Pins	Min	Typ	Max	Unit
Reference voltage	CMR, VREF (VDDA = 5.0 V)		2.25		V
Input impedance	LINE_L, LINE_R, AUXA_L, AUXA_R, AUXB_L, AUXB_R, MIC		125k		Ω
	CIN_L, CIN_R	35k	50k	65k	Ω
Output impedance	FOUT_L, FOUT_R	3.5k	5k	6.5k	Ω
	AOUT_L, AOUT_R max load for full-scale output range			10k	Ω
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

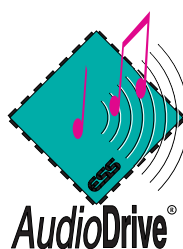| Symbol	Parameters	Min	Max	Unit	Conditions
VIH1	Input high voltage: All except VOLUP, VOLDN, MUTE, PSEL, SW(A-D)	2.5		V	VDDD = min
VIH2	Input high voltage: VOLUP, VOLDN, MUTE, PSEL, SW(A-D)	4.0		V	VDDD = min
VIL	Input low voltage		0.8	V	VDDD = max
VOL1	Output low voltage: All except D[7:0], DRQx, IRQx		0.4	V	IOL = 4 mA, VDDD = min
VOH1	Output high voltage: All except D[7:0], DRQx, IRQx	2.5		V	IOH = -3 mA, VDDD = max
VOL2	Output low voltage: D[7:0], DRQx, IRQx		0.4	V	IOL = 16mA, VDDD = min
VOH2	Output high voltage: D[7:0], DRQx, IRQx	2.5		V	IOH = -12 mA, VDDD = max

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

IMPLEMENTATION PLATFORMS

- Desktop PCs
- Motherboards
- Sound Cards
- Multifunction Cards – Audio/Fax/Modem with Speakerphone

TYPICAL SOUND CARD APPLICATION

ES1869

BUNDLED SOFTWARE AND DRIVERS

- *Audio*Rack™
- Device Drivers for:
  - Microsoft Windows®95/Windows®98
  - Microsoft Windows 3.1
  - Microsoft Windows for Workgroups™
  - Microsoft Windows NT™
  - IBM® OS/2® Warp™

SERVICE AND SUPPORT

- Evaluation Kit
- Manufacturing Kit
- Reference Design

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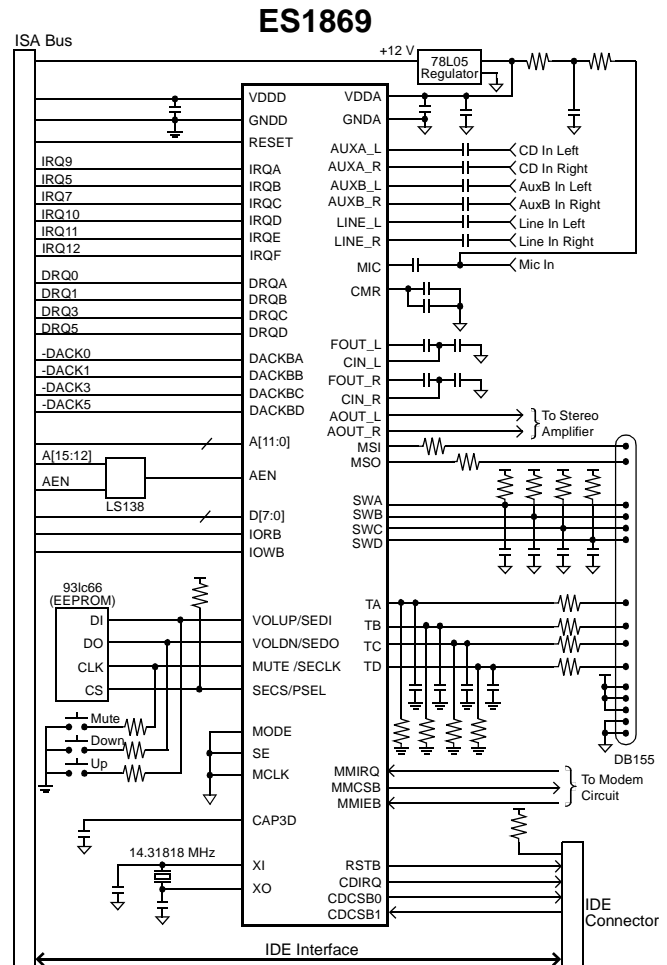**Tel: 510-492-1088**
Fax: 510-492-1098

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

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SAM0113-102397