



DESCRIPTION

The ES1887 *AudioDrive*® is a single mixed-signal chip that adds 16-bit stereo sound and FM music synthesis to personal computers. It is equipped with an embedded microprocessor, a 20-voice *ESFM*™ music synthesizer, 16-bit stereo wave Codec, 16-bit stereo music DAC, hardware master volume control, MPU-401 UART mode serial port, dual game ports, two serial port interfaces to an external DSP and an external wavetable music synthesizer, DMA control logic with FIFO, and ISA bus interface logic. There are three external stereo inputs (typically line, CD audio, and auxiliary line) and a mono input for a microphone. All of this is embodied in a single chip that can be designed into a motherboard, add-on card, or integrated into other peripheral cards such as voice/fax/modem, VGA, LAN, I/O, and so forth.

The ES1887 *AudioDrive*® can record, compress, and play back voice, sound, and music with two built-in 6-channel symmetric mixer controls. It supports full-duplex operation for simultaneous record and playback using two DMA channels. One of these channels supports bidirectional, 8-bit programmed I/O or DMA data transfers and the other supports 8-bit or 16-bit DMA playback.

The MPU-401 hardware is for interfacing to an external MIDI serial port. The ES1887 music DAC allows the use of an external wavetable synthesizer through the ES1887's third serial port. The PC speaker volume can be controlled by software.

Two software address selection modes allow for BIOS Plug and Play configuration. The dual game ports support two joysticks both having X,Y resistor value settings and two pushbutton switches.

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

Advanced power management features include suspend/resume from disk or host-independent, self-timed power-down and automatic wake-up.

The ES1887 is backward compatible and pin compatible with the ES1888.

The ES1887 *AudioDrive*® is available in an industry-standard 100-pin Plastic Quad Flat Pack (PQFP) package.

APPLICATIONS

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

FEATURES

- Single, high-performance, mixed-signal, 16-bit stereo VLSI chip
- Supports enhanced telegaming architecture for Windows™ and DOS game-over-modem
- High-quality, 20-voice *ESFM*™ music synthesizer
- Patented *ESPCM*® compression
- New configurable DMA supports demand transfer and F-type

Record and Playback Features

- Record, compress, and play back voice, sound and music
- 16-bit stereo ADC and DAC
- Programmable sample rates from 4 kHz to 44.1 kHz for record and playback
- Full-duplex operation for simultaneous record and playback
- 2- or 3-button hardware volume control for up, down, and mute

Inputs/Outputs

- 3 stereo inputs for line-in, CD audio, and auxiliary line-in, and a mono input for microphone
- 3 stereo DAC with independent sample rate and filter control for simultaneous game, music, and system playback digital data streams
- MPU-401 (UART mode) interface for wavetable synthesizers and MIDI devices
- Integrated dual game port
- Software address mapping and DMA and IRQ selections for BIOS Plug and Play
- Wavetable serial port interface for ES689/ES690 to access the music DAC
- Serial port interface to external DSP
- PC speaker input/output with volume control

Mixer Features

- 6-channel playback mixer and 6-channel record mixer with stereo inputs for line, CD audio, auxiliary line, music synthesizer, digital audio (wave files), and a mono input for microphone
- Mixer-controlled record and playback with programmable 6-bit (64 step) 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
- Microsoft® Windows Sound System®
- Microsoft Windows®95 Hardware Design Guide Supplement



DIGITAL PIN DESCRIPTIONS

Name	I/O	Description
VDDD	I	Digital supply voltage (3.0 to 5.5 V).
GNDD	I	Digital ground.
VOLDN	I	Active-low, volume decrease button input.
VOLUP	I	Active-low, volume increase button input.
MUTE	I	Active-low, mute toggle button input.
GPO0	O	The GPO0 output that is set low by external reset and thereafter controlled by bit 0 of port 2x7H. Available to system software for power management or other applications.
GPO1	O	Output that is set high by external reset and thereafter controlled by bit 1 of port 2x7H. Available to system software for power management or other applications.
MSI	I	MIDI serial input. Either MPU-401 or Sound Blaster formats. Schmitt trigger input with internal pull-up resistor.
MSO	O	MIDI serial data output.
MCLK	I	Input with internal pull-up. Serial clock input from ES689/ES690.
MSD	I	Input with internal pull-up. Serial data input from ES689/ES690.
RESET	I	Active-high reset from ISA bus.
XO	O	Crystal oscillator output.
XI	I	Crystal oscillator input.
IORB	I	Active-low, read strobe from ISA bus.
IOWB	I	Active-low, write strobe from ISA bus.
A[9:0]	I	Address inputs from ISA bus.
A[11:10]	I	Address inputs from ISA bus. The ES1887 requires these pins to be low for all address decodes.
AEN	I	Active-low, address enable from ISA bus.
D[7:0]	I/O	Bidirectional data bus. These pins have weak pull-up devices to prevent these inputs from floating when not driven.
D[15:8]	I	High byte input data bus. This is used for the system DAC when the 16-bit DMA transfer mode is selected.
ENB245	O	Active-low, output when the ES1887 is being read or written to. Intended to be connected to the enable control of an external 74LS245.
SW(A-D)	I	Four (A,B,C,D) active-low, joystick switch setting inputs. These SW pins have an internal 2K pull-up resistor.
T(A-D)	I/O	Four (A,B,C,D) joystick timer pins. These pins connect to the X-Y positioning variable resistors for the two joysticks.
AMODE	I	Input pin with pull-down device. The ES1887 is disabled following a hardware reset and must be configured by one of two methods (optioned by AMODE) of software address selection: 0: Read-Sequence-Key method 1: System-Control-Register method
IRQ(A-E)	O	Five (A,B,C,D,E) active-high, interrupt requests to the ISA bus. Unselected IRQ outputs are high impedance. IRQs are software configurable.
DRQ(A-D)	O	Four (A,B,C,D) 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. Can be selected for 8-bit or 16-bit DMA transfers.
DACKB(A-D)	I	Four (A,B,C,D) active-low, DMA acknowledge inputs from the ISA bus.

Name	I/O	Description
PCSPKI	I	Normally low digital PC speaker signal input. This signal is connected to an analog signal with volume control and appears on analog output PCSPKO.
FSR	I	Input with internal pull-down. Frame sync for receive data from external DSP. Programmable for active-high or active-low.
FSX	I	Input with internal pull-down. Frame sync for transmit request from external DSP. Programmable for active-high or active-low.
DCLK	I	Input with internal pull-down. Serial data clock from external DSP. Typically 2.048 MHz.
DR	I	Input with internal pull-down. Data receive pin from external DSP.
DX	O	Tri-state output. Data transmit to external DSP. High impedance when not transmitting.
SE	I	Active-high to enable serial mode, i.e., enables an external DSP to control analog resources of the ES1887 through the DSP serial interface. This pin has an internal pull-down.

ANALOG PIN DESCRIPTIONS

Name	I/O	Description
VDDA	I	Analog supply voltage (4.5V to 5.5V). Should be greater than or equal to VDDD-0.3V.
GNDA	I	Analog ground.
MIC	I	Microphone input. MIC has an internal pull-up resistor to CMR.
LINE_L, LINE_R	I	Line inputs left and right. LINE_L, LINE_R have internal pull-up resistors to CMR.
AUXA_L, AUXA_R	I	Auxiliary inputs left and right. AUXA_L, AUXA_R have internal pull-up resistors to CMR. Normally intended for connection to an internal or external CD-ROM analog output.
AUXB_L, AUXB_R	I	Auxiliary inputs left and right. AUXB_L, AUXB_R have internal pull-up resistors to CMR. Normally intended for connection to an external music synthesizer or other line level music source. These pins have dual function with FDXI and FDXO.
FDXO	O	Normally connected to CMR via an internal resistor. Can be right channel DAC in DSP serial mode. Can be programmed to connect internal to FOUT_R during DSP serial mode. This pin has dual function with AUXB_R.
FDXI	I	Input with internal pull-up to CMR. Alternate input to left channel filter stage in DSP serial mode. This pin has dual function with AUXB_L.
FOUT_L, FOUT_R	O	Filter outputs left and right. AC coupled externally to CIN_L, 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	I	Capacitive coupled inputs left and right. These inputs have internal pull-up resistors to CMR of approximately 50K ohms.
VREF	O	Reference generator resistor divider output. Should be bypassed to analog ground with .01 μ F capacitor in parallel.
CMR	O	Buffered reference output. Should be bypassed to analog ground with a 47 μ F electrolytic capacitor with a 0.1 μ F capacitor in parallel.
AOUT_L, AOUT_R	O	Line level stereo outputs left and right.
PCSPKO	O	Analog output of PCSPKI with volume control.

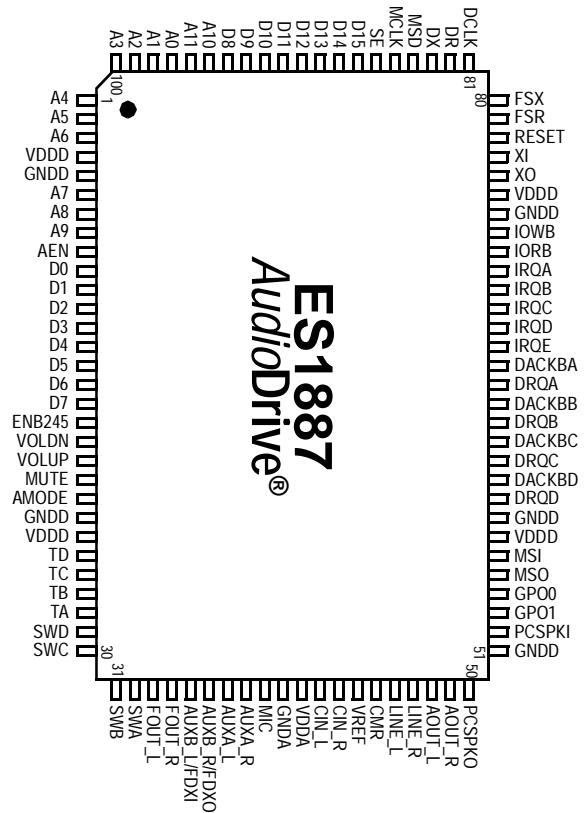
DIGITAL CHARACTERISTICS

Parameter	Pins	Min	Typ	Max	Unit (conditions)
VIH1	Input high voltage: All except XI	2.0		V	VDDD=min
VIH2	Input high voltage: XI	3.0		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=4mA, VDDD=min
VOH1	Output high voltage: All except D[7:0], DRQx, IRQx	2.4		V	IOH=-3mA, 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	2.4		V	IOH=-12mA, VDDD=max
VOL3	Output low voltage, Select DRQx when DMA inactive		0.4	V	IOL=0.8mA
ICC1	VDDD active		60	mA	VDDD=max osc. rate at 14.32 MHz
ICC2	VDDA active		40	mA	VDDA=max

ANALOG CHARACTERISTICS

Parameter	Pins	Min	Typ	Max	Unit
Reference voltage	CMR, VREF (VDDA=5.0V)		2.25		V
Input impedance	LINE_L, LINE_R, AUXA_L, AUXA_R, AUXB_L, AUXB_R, MIC	30K		100K	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		5K		Ω
Input voltage range	MIC	10		125	mVp-p
	LINE_L, LINE_R, AUXA_L, AUXA_R, AUXB_L, AUXB_R	0.5		VDDA -1.0	V
Output voltage range	AOUT_L, AOUT_R full-scale output range	0.5		VDDA -1.0	V
Gain	Mic preamp		26		dB

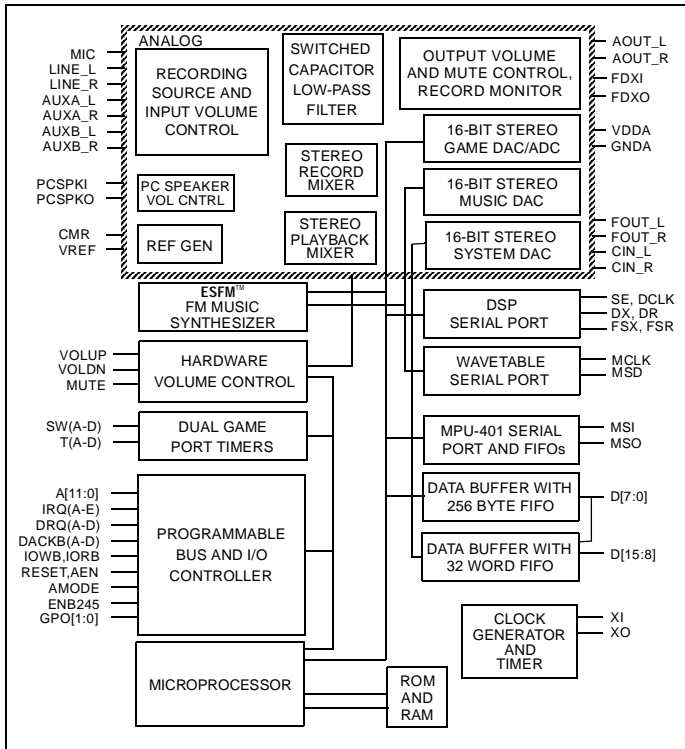
PINOUT



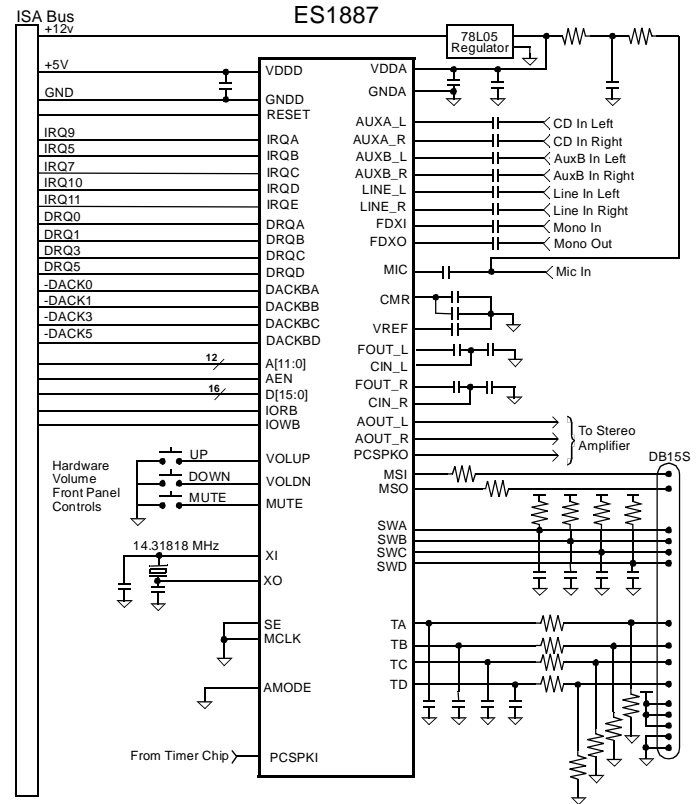
MAXIMUM RATINGS

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

BLOCK DIAGRAM



TYPICAL APPLICATION



BUNDLED APPLICATIONS AND DRIVERS

- *AudioRack™*
- Bundled Drivers
 - Microsoft Windows®95
 - Microsoft® Windows™ 3.1
 - Microsoft Windows for Workgroups
 - Microsoft Windows NT™ 3.51 and 4.0
 - IBM® OS/2® Warp™

SERVICE AND SUPPORT

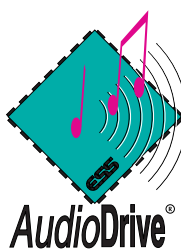
- Evaluation Kit
- Manufacturing Kit
- Reference Design

IMPLEMENTATION PLATFORMS

- Desktop PCs
- Notebook PCs
- Motherboards
- Multifunction Cards
- Sound Cards
- Voice/Fax/Modem Cards



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