



DESCRIPTION

The ES1878 *AudioDrive*® is a mixed-signal single-chip solution that adds 16-bit stereo sound and FM music synthesis to notebook computers. The ES1878 includes an embedded microprocessor, a 20-voice ESFM™ music synthesizer, 16-bit stereo ADCs and DACs, 16-bit stereo music DAC, optional ISA Plug and Play (PnP) support, hardware master volume control, DMA control logic with FIFO, ISA bus interface logic, general-purpose I/O, and digital dual game port. The ES1878 also incorporates three serial ports which allow interfacing with external DSP, wavetable, and MIDI (MPU-401 UART mode compatible). In addition, the ES1878 offers I²S Zoom Video interface and support for the optional ES978 Expansion Audio Mixer in docking stations.

A four-wire expansion analog bus and two-wire serial control bus connect the ES1878 with the ES978, allowing the ES1878 to engage the docking station's audio resources when docked.

The ES1878 *AudioDrive*® can record, compress, and play back voice, sound, and music with built-in mixer controls. Using two high-performance DMA channels, the ES1878 supports 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 ES1878 is register compatible with Yamaha's OPL3™ FM synthesizer.

The ES1878 *AudioDrive*® supports optional ISA Plug and Play with configuration for 4 logical devices: configuration device, audio plus ESFM™, game port, and MPU-401.

The MPU-401 serial port is for interfacing with an external MIDI device. The digital dual game port supports two joysticks with hardware timing.

A DSP serial interface in the ES1878 allows an external DSP to take over ADC or DAC resources. A wavetable serial port allows the ES1878 to interface with either the ES689 or ES690 wavetables. I/O address, DMA, and interrupt selection can be controlled through system software or Plug and Play.

Advanced Power Management (APM) features include suspend and resume from disk.

The ES1878 is available in an industry-standard 100-pin Small Quad Flat Pack (SQFP) package.

APPLICATIONS

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

FEATURES

- Single, high-performance, mixed-signal, 16-bit stereo VLSI chip for digital audio
- High-quality, 20-voice ESFM™ music synthesizer; patents pending
- Patented ESPCM® compression

Record and Playback Features

- Record, compress, and play back voice, sound, and music
- 16-bit stereo ADC/DAC for digital audio
- 2 additional stereo DACs for music synthesis and I²S from PC card
- Programmable sample rate from 4 kHz to 44.1 kHz for record and playback
- 2-button or 3-button hardware volume control for up, down, and mute
- Full-duplex operation for simultaneous record and playback

Mixer Features

- 6-channel stereo mixer inputs for line, auxiliary A (CD audio), auxiliary B, digital audio (wave files), music synthesizer, I²S Zoom Video port plus a mono channel mixer input for microphone
- Programmable 6-bit logarithmic master volume control

Interfaces to Expansion Audio Mixer (ES978)

- Simple hot-docking interface to ES978 expansion audio mixer
- Two-wire digital status and data communication between ES1878 and ES978 supports register mirroring with worst case latency of approximately 140 μsec
- Has on-chip dual pairs of analog differential signals for audio I/O with ES978 expansion audio mixer

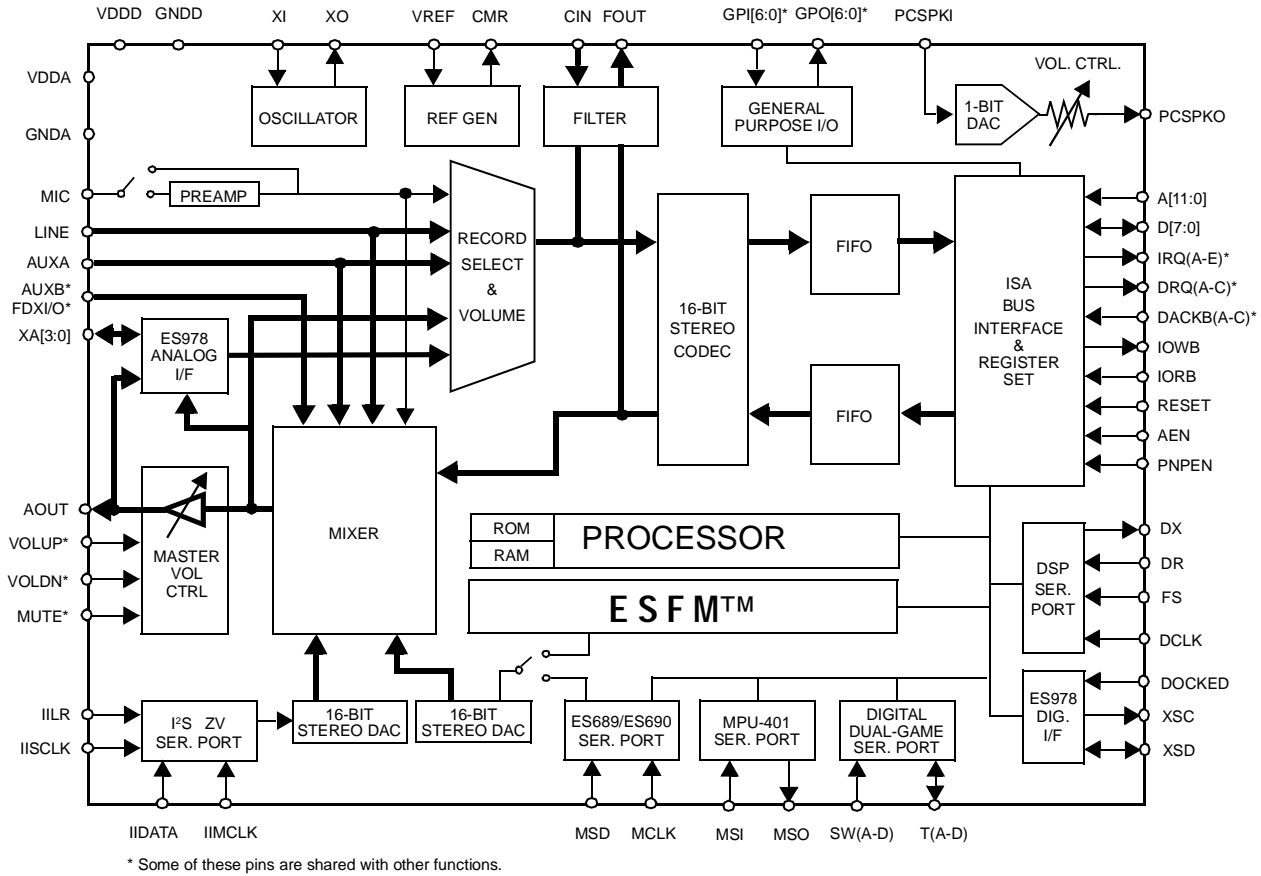
Inputs and Outputs

- MIDI serial port compatible with MPU-401 UART mode
- Supports up to 7 general purpose inputs and 7 general purpose outputs that can be slaved with corresponding pins of ES978 expansion audio mixer
- ESS high performance dual game port with hardware timing
- Data transfer via normal or F-mode DMA
- Optional full ISA Plug and Play support
- Software address mapping, DMA and IRQ selections for motherboard implementation
- I²S Zoom Video port interface with a sample rate up to 48 kHz for MPEG audio
- Wavetable serial port interface to ES689/ES690 for direct access to the music DAC

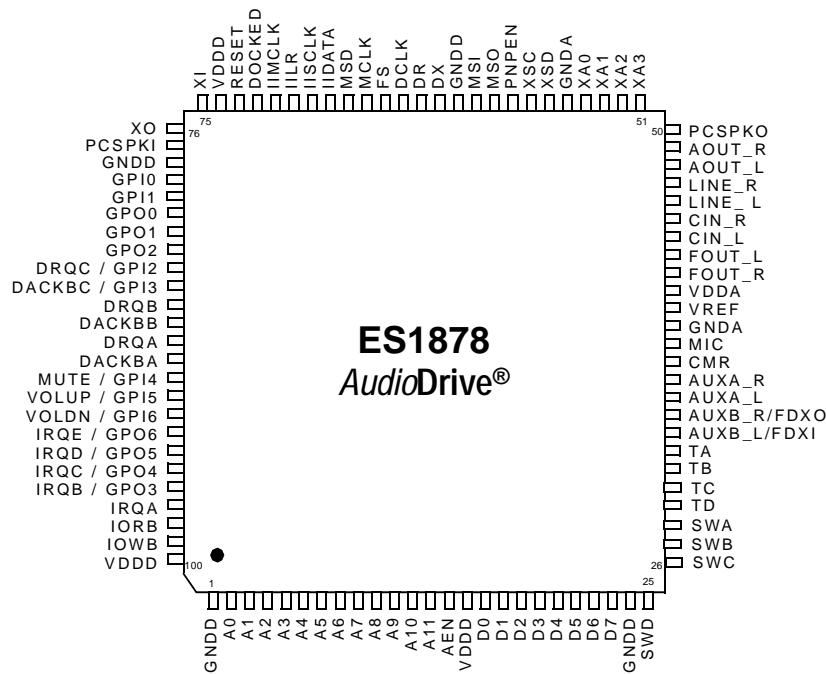
Compatibility

- Supports PC games in Sound Blaster™ and Sound Blaster™ Pro modes
- Supports Microsoft® Windows™ Sound System®

ES1878 FUNCTIONAL BLOCK DIAGRAM



PINOUT



DIGITAL PIN DESCRIPTIONS

Name	I/O	Description
Miscellaneous		
VDDD	I	Digital power supply (3.0 - 5.5 V)
GNDD	I	Digital ground.
XI	I	14.31818 MHz clock input, or external crystal.
XO	O	Output to external 14.31818 MHz crystal.
GPO[2:0]	O	General purpose outputs.
GPI[1:0]	I	General purpose inputs.
PCSPKI	I	PC speaker digital input.
PNPEN	I	When high, Plug and Play enabled. When low, Plug and Play disabled (configured by software).
ISA Interface		
A[11:0]	I	ISA address bus.
AEN	I	ISA address valid when active-low, DMA when high.
D[7:0]	I/O	ISA data bus. 24 mA drivers.
IOWB	O	ISA active-low write strobe.
IORB	I	ISA active-low read strobe.
IRQA	O/Hi Z	ISA interrupt request. 16 mA driver.
IRQB/GPO3	O	ISA interrupt request or general-purpose output 3.
IRQC/GPO4	O	ISA interrupt request or general-purpose output 4.
IRQD/GPO5	O	ISA interrupt request or general purpose output 5.
IRQE/GPO6	O	ISA interrupt request or general-purpose output 6.
DACKBA	I	ISA active-low DMA acknowledge.
DRQA	O/Hi Z	ISA active-high DMA request.
DACKBB	I	ISA active-low DMA acknowledge.
DRQB	O/Hi Z	ISA active-high DMA request.
DACKBC/GPI3	I	ISA active-low DMA acknowledge or general-purpose input 3.
DRQC/GPI2	O/Hi Z	ISA active-high DMA request or general-purpose input 2.
RESET	I	ISA active-high reset.
ES978 Interface		
DOCKED	I	Status input that is active-high when the ES1878 is docked to the ES978.
XSC	O	Expansion serial bus clock and frame sync.
XSD	I/O	Expansion serial bus data I/O.
MPU-401 Serial Port (MIDI) and FIFOs		
MSO	O	MIDI serial output.
MSI	I	MIDI serial input. MSI has an internal pull-up device.
Dual Game Port Joystick		
SW(A-D)	I	Joystick switch inputs. These pins have internal pull-ups to VDDD.
T(A-D)	I/O	Joystick timers. The timers use the digital power supply. These pins have internally weak pull-downs to GND (> 1M ohm).
I²S Interface		
IISCLK	I	Serial shift clock for I ² S interface. This pin has an internal pull-down to GND.
IIDATA	I	Serial data for I ² S interface. This pin has an internal pull-down to GND.

Name	I/O	Description
IILR	I	Left / right signal for I ² S interface. This pin has an internal pull-down to GND.
IIMCLK	I	Oversampling clock for I ² S interface (software selectable to set x256, x384 or x512 sample rate). This pin has an internal pull-down to GND.
ES689/ES690 Interface		
MCLK	I	Serial clock input from ES689/ES690. This pin has an internal pull-down to GND.
MSD	I	Serial data input from ES689/ES690. This pin has an internal pull-down to GND.
DSP/CODEC Interface		
FS	I	Frame sync input. Software programmable to be active-high or active-low. This pin has an internal pull-down to GND.
DCLK	I	Serial clock input. This pin has an internal pull-down to GND.
DR	I	Serial data receive. This pin has an internal pull-down to GND.
DX	O/Hi Z	Serial data transmit.
External Volume Control		
VOLDN/GPI6	I	Active-low volume-down input. This pin has an internal pull-up to VDD. Optionally used as general-purpose input 6.
VOLUP/GPI5	I	Active-low volume-up input. This pin has an internal pull-up to VDD. Optionally used as general-purpose input 5.
MUTE/GPI4	I	Active-low mute input. This pin has an internal pull-up to VDD. Optionally used as general-purpose input 4.

DIGITAL CHARACTERISTICS

Symbol	Parameter	Min	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 = 4 mA, VDDD = min
VOH1	Output high voltage: All except D[7:0], DRQx, IRQx	2.4		V	IOH = -3 mA, VDDD = max
VOL2	Output low voltage: D[7:0], DRQx, IRQx		0.4	V	IOL = 16 mA, VDDD = min
VOH2	Output high voltage: D[7:0], DRQx, IRQx	2.4		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

ANALOG PIN DESCRIPTIONS

Name	I/O	Description
VDDA	I	Analog power supply, 4.75 - 5.25 V.
GNDA	I	Analog ground.
LINE_L, LINE_R	I	Line inputs, left and right. 70k ohm pull-ups to CMR.
AUXA_L, AUXA_R	I	Aux A (CD) inputs, left and right. 70k ohm pull-ups to CMR.
AUXB_L/ FDXI	I	Aux B input, left. Also used with DSP interface as line-level mono input.
AUXB_R/ FDXO	I/O	Aux B input, right. Also used with DSP interface as line-level mono output, capable of driving a 5k ohm load.
MIC	I	Mic input to +26 dB internal preamp.
VREF	I	2.25 V reference generator.
CMR	O	2.25 V reference buffer output.
FOUT_L, FOUT_R	O	Filter outputs, left and right. These pins are normally AC coupled to CIN_L and CIN_R.
CIN_L, CIN_R	I	Capacitive coupled inputs, left and right. The input resistance is about 50k ohms.
AOUT_L, AOUT_R	O	Analog outputs, left and right, from master volume. These pins can drive a 10k ohm load.
XA[3:0]	I/O	Expansion audio bus. These are analog signals that are DC coupled to the corresponding pins of the ES978.
PCSPKO	O	PC speaker analog output.

ANALOG CHARACTERISTICS

Parameter	Pins	Min	Typ	Max	Unit
Reference voltage	CMR, VREF (VDDA=5.0 V)		2.25		V
Input impedance	LINE_L/R, AUXA_L/R, AUXB_L/R, MIC	30k	70k	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	10k	10k		Ω
Input voltage range	MIC	10		125	mVp-p
	LINE_L/R, AUXA_L/R, AUXB_L/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

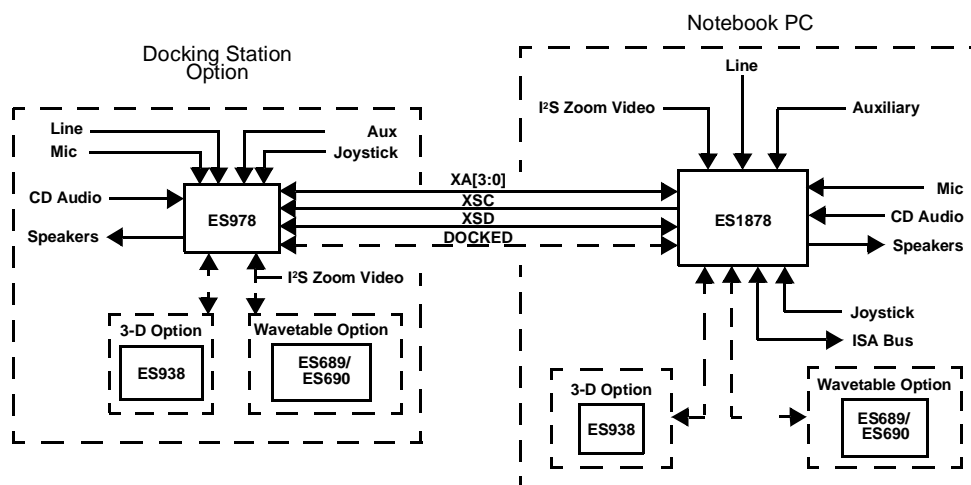
SERVICE AND SUPPORT

- Evaluation Kit
- Manufacturing Kit
- Reference Design

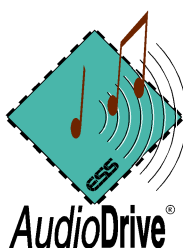
BUNDLED SOFTWARE AND DRIVERS

- **AudioRack™**
- Bundled Drivers for:
 - Microsoft Windows 3.1
 - Microsoft Windows for Workgroups™
 - Microsoft Windows NT™
 - Microsoft Windows®95
 - IBM® OS/2®

TYPICAL APPLICATION



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