

## DESCRIPTION

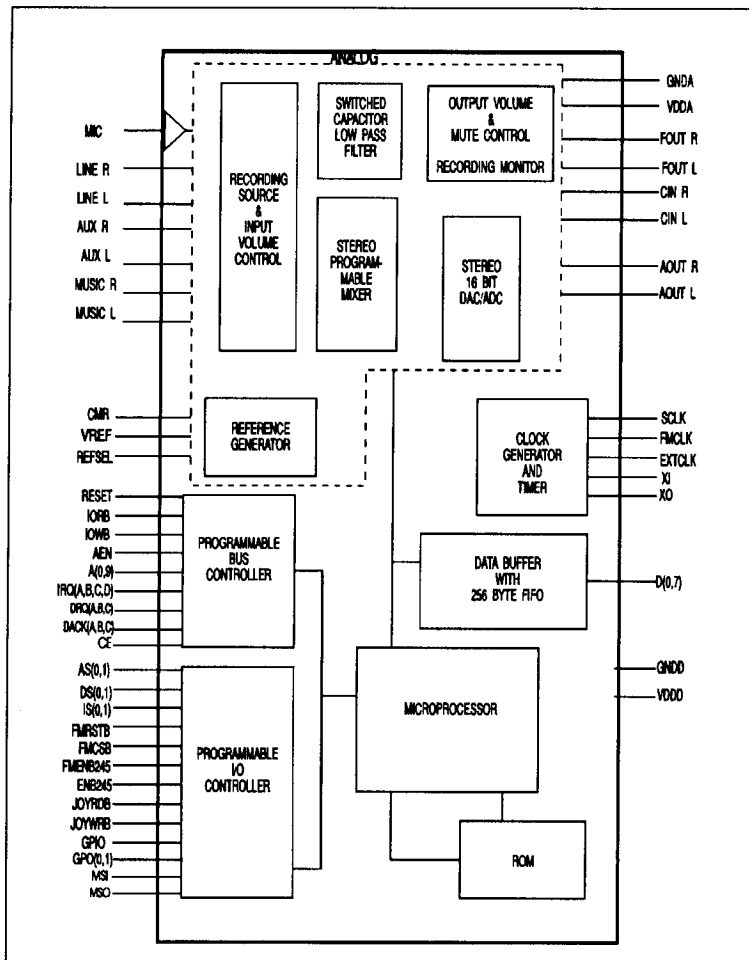
The ES688 AudioDrive® is a single, mixed-signal, 16 bit stereo, VLSI chip for adding audio to personal computers. The AudioDrive can record, compress, and playback voice, sound and music with mixer controls. It consists of an embedded microprocessor, 16-bit A/D and D/A, DMA control, internal programmable memory and timer as well as custom logic and PC bus interface logic. In addition, there is built-in circuitry to simplify connections to microphone. It has stereo inputs for CD-audio, line-in, and music synthesis chip, as well as connections to joystick, MIDI and speakers.

The AudioDrive has a built in 5 channel mixer for both record and playback. It has stereo inputs for CD-audio, line-in, music synthesis, and digital audio, and a mono input for a microphone.

It is available in an industry standard surface mount 100 pin plastic quad flat package (PQFP).

A complete set of reference designs, bundled software and drivers is available with the chip.

## BLOCK DIAGRAM



## FEATURES

- Single, mixed-signal, high performance VLSI chip
- 16-bit stereo
- Record, compress, and playback voice, sound and music
- 5 channel mixer
- Stereo inputs for line-in, CD-ROM, and music synthesis and a mono input for microphone
- Audio mixer controls for inputs and outputs
- Mixer controlled recording
- Data transfer via DMA or programmed I/O
- Address decode outputs for joystick and music synthesis
- Power management
- Integrated 16-bit A/D and D/A converters
- Patented ESPCM™ compression for lower bit rates
- Programmable volume control for both record and playback.
- Programmable sample rate from 4,000 to 44,100 Hz for record and playback
- Also supports 3.3 volt operation
- Windows compatible and OLE compliant
- Supports The Microsoft® Windows™ Sound System
- Sound Blaster™ compatible<sup>(\*)</sup> and Sound Blaster Pro™ compatible<sup>(\*\*)</sup> with FM synthesis chips
- MIDI support

## APPLICATIONS

- PC Audio
- Business Audio
- Microsoft's Windows Sound System
- Multimedia PC
- PC Games

## IMPLEMENTATION PLATFORMS

- Desktop Systems
- Green PCs
- Notebooks
- Motherboards
- Multifunction Cards
- Sound Cards

**DIGITAL PIN DESCRIPTION**

VDDD, GNDD	Power	Digital Supply and Ground Pins																				
FMCLK	Output	Input Clock divided by 4 (3.58 MHz) for external FM synthesis chip such as YM3812																				
FMCSB	Output	Active low address decode output for external FM synthesis chip. This output is active low when AEN=0 and A[9:0] are among the set 388H-389H, 2x8H-2x9H, 2x0H-2x3H.																				
JOYWRB	Output	Active low decode for joystick, write to port 201H.																				
JOYRDB	Output	Active low decode for joystick, read from port 201H.																				
GPO0	Output	Output that is set low when the ES688 is powered-up and set high when the ES688 is powered-down.																				
GPO1	Output	MIDI serial data output.																				
GPI0	Input	Option input: 0: ES688 Emulates Sound Blaster v. 2.1 I; 1: ES688 Emulates Sound Blaster PRO v. 3.1																				
GPI1	Input	MIDI serial data input.																				
RESET	Input	Active high reset from AT bus.																				
FMRSTB	Output	Inverted RESET output for external FM synthesizer.																				
SCLK	Input	Option input: 0: Clock from EXTCLK input 1: Clock from crystal connected to pins XI and XO																				
EXTCLK	Input	14.32 MHz clock input from AT bus. No connection if SCLK=1.																				
XO	Output	Optional crystal oscillator output.																				
XI	Input	Optional crystal oscillator input. No connection if SCLK=0.																				
IORB	Input	Active low read strobe from AT bus.																				
IOWB	Input	Active low write strobe from AT bus.																				
A0-A9	Inputs	Address inputs from AT bus.																				
AEN	Input	Active low address enable from AT bus.																				
D0-D7	I/O	Bi-directional data bus. These pins have weak pull-up devices to prevent these inputs from floating when not driven.																				
ENB245	Output	Active low output when ES688 is being read or written to. Intended to be connected to the enable control of an external 74LS245.																				
FMENB2	Output	Similar to ENB245, except also is active for read/writes to any FM port such that FMCSB is active low.																				
IS0,IS1	Inputs	Inputs with internal pull-down devices. These inputs select the interrupt request pin: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>IS1</th> <th>IS0</th> <th>IRQx</th> <th>Recommended ISA/IRQ</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>IRQA</td> <td>IRQ9</td> </tr> <tr> <td>0</td> <td>1</td> <td>IRQB</td> <td>IRQ5</td> </tr> <tr> <td>1</td> <td>0</td> <td>IRQC</td> <td>IRQ7</td> </tr> <tr> <td>1</td> <td>1</td> <td>IRQD</td> <td>IRQ10</td> </tr> </tbody> </table>	IS1	IS0	IRQx	Recommended ISA/IRQ	0	0	IRQA	IRQ9	0	1	IRQB	IRQ5	1	0	IRQC	IRQ7	1	1	IRQD	IRQ10
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AS0,AS1	Inputs	Inputs with internal pull-down devices. These inputs select the address bank: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>AS1</th> <th>AS0</th> <th>Address Bank</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>22X</td> </tr> <tr> <td>0</td> <td>1</td> <td>23X</td> </tr> <tr> <td>1</td> <td>0</td> <td>24X</td> </tr> <tr> <td>1</td> <td>1</td> <td>25X</td> </tr> </tbody> </table>	AS1	AS0	Address Bank	0	0	22X	0	1	23X	1	0	24X	1	1	25X					
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DS0,DS1	Inputs	Inputs with internal pull-down devices. These inputs select the DMA channel: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>DS1</th> <th>DS0</th> <th>DRQx/DACKBx</th> <th>Recommended ISA D RQ/DACK</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>NONE</td> <td>---</td> </tr> <tr> <td>0</td> <td>1</td> <td>DRQA, DACKBA</td> <td>DRQ0/DACK0</td> </tr> <tr> <td>1</td> <td>0</td> <td>DRQB, DACKBB</td> <td>DRQ1/DACK1</td> </tr> <tr> <td>1</td> <td>1</td> <td>DRQC, DACKBC</td> <td>DRQ3/DACK3</td> </tr> </tbody> </table>	DS1	DS0	DRQx/DACKBx	Recommended ISA D RQ/DACK	0	0	NONE	---	0	1	DRQA, DACKBA	DRQ0/DACK0	1	0	DRQB, DACKBB	DRQ1/DACK1	1	1	DRQC, DACKBC	DRQ3/DACK3
DS1	DS0	DRQx/DACKBx	Recommended ISA D RQ/DACK																			
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1	1	DRQC, DACKBC	DRQ3/DACK3																			
IRQ A,B,C,D	Outputs	Active high interrupt request to AT bus. Unselected IRQ outputs are high impedance.																				
DRQ A,B,C	Outputs	Active high DMA request to AT bus. Unselected DRQ outputs are high impedance. When DMA is not active, the selected DRQ output has a weaker 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.																				
DACKB A,B,C	Inputs	Active low DMA acknowledge inputs from AT bus.																				

**ANALOG PIN DESCRIPTION**

VDDA, GNDA	Power	Analog supply and ground.
MIC	Input	Microphone input. MIC has an internal pull-up resistor to CMR.
LINE L,R CMR.	Input	Line input left,right. LINE L,R have internal pull-up resistors to CMR
AUX L, R	Input	Aux(CD) input left, right. AUXL, R have internal pull-up resistors to CMR.
MUSIC L,R	Input	Music input left, right. MUSIC L,R have internal pull-up resistors to CMR
FOUT L,R	Output	Filter outputs left, right. A.C. coupled externally to CIN L,R in order 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 lowpass filter pole that removes switching noise introduced by the switched capacitor filters.
CIN L,R	Input	Capacitive coupled inputs left, right. These inputs have internal pull-up resistors to CMR.
VREF	Output	Reference generator resistor divider output. Should be bypassed to analog ground with a .047 uf capacitor.
CMR	Output	Buffered reference output. Should be bypassed to analog ground with a 10 uf tantalum capacitor.
AOUT L,R	Output	Line level stereo outputs, left, right.
MOUT	Output	Mono output of AOUT L and AOUT R summed. MOUT can drive an A.C.-coupled 100 ohm load.
REFSEL	Input	Option input. Analog GND: normal operation Analog VDD: reserved.



**ANALOG CHARACTERISTICS**

Parameter	Pins	Min	Typ	Max	Unit (Conditions)
Reference Voltage	CMR, VREF		2.25		Volts (VDDA = 5.0 V)
Input Impedance	LINE L/R, AUX L/R, MUSIC L/R, MIC	30K		100K	Ohms
	CIN L/R	35K	50K	65K	Ohms
Output Impedance	FOUT L/R	3.5K	5K	6.5K	Ohms
	AOUT L/R max load for full-scale output range		5K		Ohms
Input Voltage Range	MIC	10		125	mVp-p
	LINE L/R, AUX L/R, MUSIC L/R	0.5		VDDA-0.5	Volts
Output Voltage Range	AOUT L/R, full-scale output range	0.5		VDDA-1.0	Volts
Gain	Mic Preamp		26		dB
I/O Range	Input Volume Range	0		22.5	dB
	Output Volume Range	-46.5		+10	dB

**DIGITAL CHARACTERISTICS**

Symbol	Parameter	Min	Max	Unit	Conditions
VIH1	Input High Voltage: All except GPI1	2.0		V	VDDD=min
VIH2	Input High Voltage: GPI1	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 = -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
VOL3	Output Low Voltage, Select DRQx when DMA inactive.		0.4	V	IOL = 0.8 mA
ICC1	VDDD, VDDA Standby Current		40	uA	VDDD= max, D[7:0] high or floating, Other inputs at VDDD or GND and static.
ICC2	VDDD, VDDA Active		50	mA	VDDD= max, Oscillator rate at 14.32 MHz

**MAXIMUM RATINGS**

Ratings	Symbol	Value	Units
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	Deg C
Storage Temperature Range	TSTG	-50 to 125	Deg C

**SERVICE & SUPPORT**

- Bundled Drivers:
  - Microsoft Windows
  - Microsoft Windows NT
  - Microsoft Windows Sound System
  - IBM® OS/2®
- Evaluation Kit
- Manufacturing Kit
- Bundled Audio Application Software
- Reference Design

**BUNDLED SOFTWARE**

- Audio Recorder
- Audio Reminder
- Audio Clip Library
- Chime
- Mixer
- Stopwatch
- Talking Calculator
- Talking Clock
- Timer

(P) US Patent 4,214,125 and others  
 ESPCM, and AudioDrive are trademarks of ESS Technology, Inc.  
 Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.  
 IBM, OS/2 and Operating System/2 are registered trademarks of International Business Machines Corporation  
 Sound Blaster and Sound Blaster Pro are trademarks of Creative Labs, Inc.  
 (\*) Compatible with Sound Blaster™ version 2.01 voice I/O functions as documented in the Sound Blaster Series Developer Kit (except 44KHz playback)  
 (\*\*) Compatible with Sound Blaster Pro™ version 3.01 voice and MIDI I/O functions as documented in the Sound Blaster Series Developer Kit.



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