

# CMI8330A/C3D

PnP Audio Chip

With

Software Wavetable

 Sensaura™

HRTF 3D Positional Audio

## FEATURES :

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- 👍 **Sound Blaster 16/PRO** compatible with stereo voice up to 48Khz sampling rates.
- 👍 **Digital audio SPDIF (Sony/Philips Digital Interface) Input/Output.**
- 👍 **HRTF 3D Positional Audio supports Microsoft Direct Sound 3D DirectX 5.0.** (HRTF library licensed from CRL UK).
- 👍 **Software Wavetable MIDI synthesizer. (DLS 3Q/98).**
- 👍 **Built-in 3D surround sound.**
- 📄 16-bits Microsoft Windows Sound System hardware compatible.
- 📄 Interface for Ad-Lib, Sound Blaster OPL2/OPL3/OPL4.
- 📄 ISA Bus Plug and Play
- 📄 Full Duplex 16-bits CODEC.
- 📄 Sound Blaster 16/PRO Mixer and Windows Sound System Mixer compatible.
- 📄 MIDI port - compatible with MPU-401 UART mode and Sound Blaster MIDI mode.
- 📄 Dual channel GAME port. (Support **Microsoft Game-Pad** up to 8 ports)

## 📁 GENERAL DESCRIPRION :

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CMI8330A/C3D are digital audio single chip with a total solution for the PC Audio applications. It does meet the PC98 requirements and covered the latest audio standard. With the minimum cost of hardware, it support wide range of Multimedia applications based on Sound Blaster 16/PRO, Microsoft Windows Sound System, Ad-Lib, MPU-401/Sound Blaster MIDI. The functions can give for the applications are listed as following :

- 👍 **Microsoft Direct Sound 3D DirectX 5.0 compatible**
- 👍 **Sound Blaster 16/PRO/2.0 and Ad-Lib compatible**
- 📄 Windows Sound System ver 2.0 compatible
- 👍 Hardware auto switch between WSS and SB16
- 📄 ISA Bus PnP, device support : SB16, WSS, MPU401, GAME

## HRTF 3D Positional / 16 Bit PnP Audio Solution

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- 👉 **Differential analog audio interface (CD in, Line-in)**
- 📄 Full duplex recording and playback (play and record wave file at the same time.
- 👉 support **Windows 95 / NT** and **OS/2 Warp 3.0**
- 👉 3D Surround
- 📄 OPL3 FM synthesizer emulator
- 📄 High speed 8/16 bits DMA interface (Built-in 16 bytes FIFO)
- 📄 MPU-401 UART mode and SB MIDI mode
- 📄 Dual channel GAME port
- 📄 Enhance Mixer (SB 16/PRO mixer and WSS mixer compatible)
- 📄 Wavetable synthesizer upgrade

### CMI8330 audio system support the following functions :

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- 📄 External Audio In
- 📄 CD-ROM audio analog in / **Digital in (Sony/Philips SPDIF)**
- 📄 stereo audio in
- 📄 Wavetable synthesizer
- 📄 Microphone
- 📄 PC speaker
- 📄 Audio Output Connector
- 📄 Audio Line-out
- 📄 External stereo speakers
- 📄 Game Port
- 📄 Joystick and MIDI connector
- 📄 Wavetable Connector

### Hardware Features :

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- 📄 Mixed mode high performance audio chips
- 📄 ISA bus Plug and Play interface device support : SB16, WSS, MPU401, GAME
- 📄 Five software select DMA lines (0, 1, 3, 5, 7)
- 📄 Six software select interrupt lines (5, 7, 9, 10, 11, 12)
- 📄 16 bit ISA I/O bus

## HRTF 3D Positional / 16 Bit PnP Audio Solution

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- 📄 8 bit or 16 bit DMA interface with FIFO
- 📄 MIDI port with input and output FIFO
- 📄 Joystick port
- 📄 8 bit or 16 bit mono/stereo digital audio from 4Khz to 48 Khz
- 📄 Full duplex for real time recording and playback

## 📁 Built-in Functional Block

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- 👉 **HRTF 3D Positional audio library**
- 👉 ISA Plug and Play logic and configuration ROM
- 👉 **Sony/Philips Digital Interface (SPDIF) logic**
- 📄 High speed 16 bit D/A and A/D converters with filters
- 📄 OPL3 synthesizer emulator
- 📄 SB16/PRO and WSS compatible MIXER with 8 sources :  
DAC, synthesizer, CD-ROM audio, PC speaker, line in, microphone, SPDIF, external wavetable.
- 👉 Differential analog audio interface (CD in, Line-in)
- 📄 High speed 8 bit or 16 bit DMA interface with FIFO
- 📄 MPU401 UART MIDI and SB MIDI controller with FIFO
- 📄 CD-ROM interface

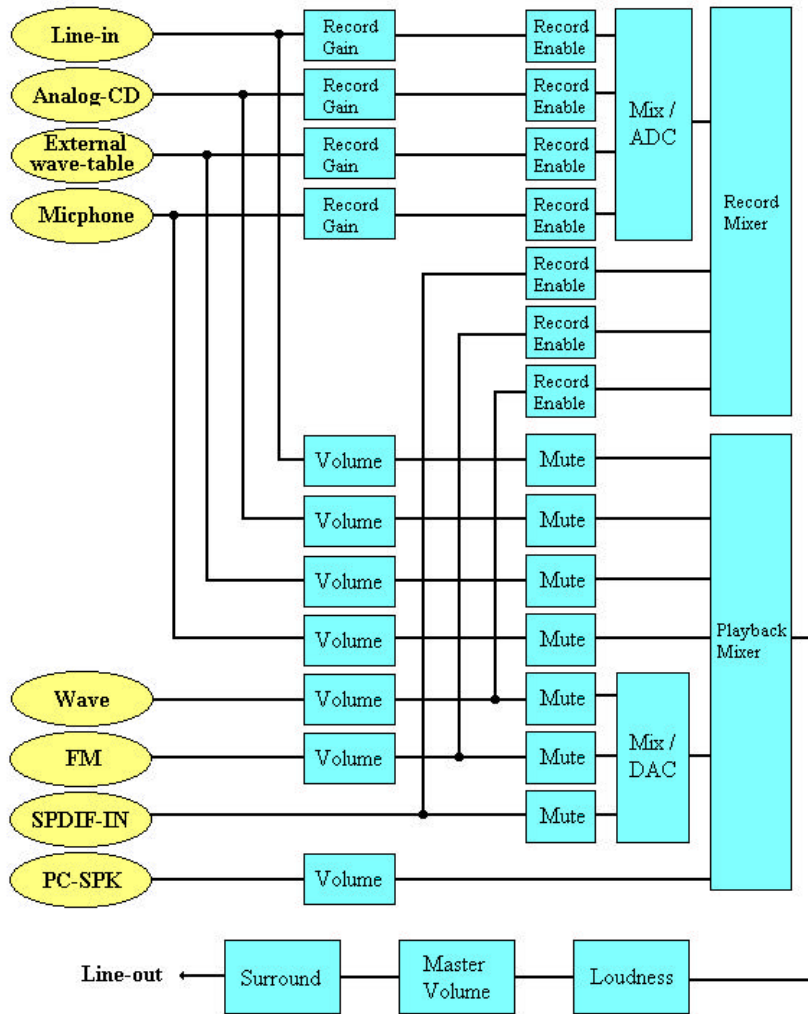
## 📁 Software Support :

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- 📄 Windows 3.1 / 95 / NT
- 👉 Direct Sound 3D DirectX 5.0
- 📄 Windows Sound System
- 📄 OS/2 warp 3.0
- 📄 All DOS-based games

📁 Mixer Block Diagram :

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**CMI8330 Mixer Block Diagram**

## Enhance Register List :

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WSS Mixer Port (Base I/O port depend on PnP device 0 allocation)

### Register 0Ch (write only)

D7	D6	D5	D4	D3	D2	D1	D0
xxxx	MODE2	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

MODE2 : Enhance register programming is enable when set to 1.

xxxx : Reserved

### Register 10h

D7	D6	D5	D4	D3	D2	D1	D0
Spiren	Ensbmix	3dsen	Rcdlen	Rcdren	Rlnlen	Rlnren	Rmicen

Rmicen : When set to 1,recording including Micphone.(default '0')

Rlnren : When set to 1,recording including LINE-IN right channel. (default '0')

Rlnlen : When set to 1,recording including LINE-IN left channel. (default '0')

Rcdren : When set to 1,recording including CD right channel. (default '0')

Rcdlrn : When set to 1,recording including CD left channel. (default '0')

3dsen : When set to 1 will enable 3D surround function. (default '0')

Ensbmix : When set to 0 will disable SB16 mixer. (default '1')

Spiren : When set to 1,recording including S/PDIF-IN channel. (default '0')

### Register 11h

D7	D6	D5	D4	D3	D2	D1	D0
Spiplay	Mgctl	xxxx	Vlnlm	Vlnrm	Vcdlm	Vcdrm	Vmicm

Vmicm : When set to 0 will mute Micphone channel.(default '0')

Vcdrm : When set to 0 will mute analog CD-in right channel.(default '0')

Vcdlm : When set to 0 will mute analog CD-in left channel.(default '0')

Vlnrm : When set to 0 will mute Line-in right channel.(default '0')

Vlnlm : When set to 0 will mute Line-in left channel.(default '0')

Mgctl : When set to 0 makes sound output louder. (default '1')

Spiplay : When set to 0 will mute S/PDIF-IN channel.(default '0')

xxxx : Reserved

**Register 12h**

D7	D6	D5	D4	D3	D2	D1	D0
Vadmic2	Vadmic1	Vadmic0	Vspk1	Vspk0	Vmic2	Vmic1	Vmic0

Vmic 0-2 : Micphone channel volume control. (default '000')

Vspk 0-1 : PC speaker volume control. (default '10')

Vadmic 0-2 : Micphone recording gain control. (default '000')

**Register 13h**

D7	D6	D5	D4	D3	D2	D1	D0
Vmastl3	Vmastl2	Vmastl1	Vmastl0	Vmastr3	Vmastr2	Vmastr1	Vmastr0

Vmastr 0-3 : Master right channel volume control.(default '1100')

Vmastl 0-3 : Master left channel volume control.(default '1100')

**Register 14h**

D7	D6	D5	D4	D3	D2	D1	D0
Vlnl3	Vlnl2	Vlnl1	Vlnl0	Vlnr3	Vlnr2	Vlnr1	Vlnr0

Vlnr 0-3 : Line-in right channel volume control.(default '0000')

Vlnl 0-3 : Line-in left channel volume control.(default '0000')

**Register 15h**

D7	D6	D5	D4	D3	D2	D1	D0
Vcdl3	Vcdl2	Vcdl1	Vcdl0	Vcdr3	Vcdr2	Vcdr1	Vcdr0

Vcdr 0-3 : Analog CD-in right channel volume control.(default '0000')

Vcdl 0-3 : Analog CD-in left channel volume control.(default '0000')

**Register 16h**

D7	D6	D5	D4	D3	D2	D1	D0
Vsynl3	Vsynl2	Vsynl1	Vsynl0	Vsynr3	Vsynr2	Vsynr1	Vsynr0

Vsynr 0-3 : External wave-table right channel volume control.(default '0000')

Vsynl 0-3 : External wave-table left channel volume control.(default '0000')

**Register 17h**

D7	D6	D5	D4	D3	D2	D1	D0
xxxx	xxxx	Rsynren	Rsynlen	Fmute	Wssm	Vsynlm	Vsynrm

Vsynrm : When set to 0 will mute external wave-table right channel.(default '0')

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Vsynlm : When set to 0 will mute external wave-table left channel.(default '0')

Wssm : When set to 1 will mute WSS playback channel muted,replaced by software MIDI channel. (default '0')

Fmute : When set to 1 will mute FM channel. (default '0')

Rsynlen : When set to 1,recording including external wave-table left channel. (default '0')

Rsynren : When set to 1,recording including external wave-table right channel. (default '0')

### Register 18h

D7	D6	D5	D4	D3	D2	D1	D0
Rsynl3	Rsynl2	Rsynl1	Rsynl0	Rsynr3	Rsynr2	Rsynr1	Rsynr0

Rsynr 0-3 : External wave-table right channel recording gain control.(default '0000')

Rsynl 0-3 : External wave-table left channel recording gain control.(default '0000')

### Register 19h

D7	D6	D5	D4	D3	D2	D1	D0
Rlnl3	Rlnl2	Rlnl1	Rlnl0	Rlnr3	Rlnr2	Rlnr1	Rlnr0

Rlnr 0-3 : Line-in right channel recording gain control.(default '0000')

Rlnl 0-3 : Line-in left channel recording gain control.(default '0000')

### Register 1Ah

D7	D6	D5	D4	D3	D2	D1	D0
Rcdl3	Rcdl2	Rcdl1	Rcdl0	Rcdr3	Rcdr2	Rcdr1	Rcdr0

Rcdr 0-3 : Analog CD-in right channel recording gain control.(default '0000')


Rcdl 0-3 : Analog CD-in left channel recording gain control.(default '0000')



 **Technical Specifications :**

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 **Analog Characteristics :**

 **Absolute Maximum Ratings Ta = 25°C J**

Parameter	Symbol	Ratings	Unit
Supply voltage	Vdd	-0.3 to +7.0	V
Input voltage	Vi	-0.3 to Vdd+0.3	V
Output voltage	Vo	-0.3 to Vdd+0.3	V
permissible package power dissipation	Pd	220(Ta = 75°C J	mW
Operating ambient temperature	Topt	-20 to +75	°C J
Storage temperature	Tstg	-40 to +125	°C J

 **Recommended Operating conditions :**

Parameter	Symbol	condition	Min.	Typ.	Max.	Unit
Supply voltage	Vdd		4.5	5.0	5.5	V
Logic input voltage (High)	Vih		0.7Vdd		Vdd	V
Logic input voltage (Low)	Vil		0		0.3Vdd	V
Ambient temperature	Ta		-20	+25	+75	°C J
Output load resistance	Rl	R.OUT, L.OUT pins	5			KOhm
Clock frequency	fclk			14.31818		Mhz
SPDIF Input Voltage	Vspi		4.5	5.0	5.5	V
SPDIF Output Voltage	Vspo		4.5	5.0	5.5	V

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□ DAC Electrical Characteristics (Ta = 25°C, V<sub>DD</sub> = +5V,  
fs = 76.4Khz)

Parameter	symbol	Condition	Min.	Typ.	Max.	Unit
Resolution	RES			16		Bit
Total Harmonic distortion	THD	Fin=1Khz, 0dB		0.04	0.09	%
Full-scale output voltage	Vfs			3.0		Vp-p
S/N ratio	S/N	With A-weight filter	93	100		dB
Dynamic Range	D.R	Fin=1Khz, -60dB	89	96		dB
Crosstalk	C.T	One side channel=0dB, Fin=1Khz	82	96		dB

### Pin list :

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PIN NAME	PIN NUMBER	PIN TYPE	FUNCTION
XA0-XA11	8-19	IN	ISA ADDRESS A0 to A11
XSD0-XSD7	34-41	I/O	ISA 8 BITS DATA BUS
XSD8-XSD15	95-88	I/O	ISA 16 BITS DATA BUS
XACDEF	20	IN	Address enable for A12 to A15
XRST	44	IN	RESET ; 1=RESET
RSTZ	21	OUT	Buffered Reset ,Active low
XAEN	33	IN	Address enable
XIOW	31	IN	I/O write
XIOR	30	IN	I/O read
XIRQ9	32	OUT	IRQ9
XIRQ7	23	OUT	IRQ7
XIRQ5	22	OUT	IRQ5
XIRQ10	6	OUT	IRQ10
XIRQ11	5	OUT	IRQ11
XIRQ12	4	OUT	IRQ12
XDK3N	27	IN	DACK3
XDQ3	26	OUT	DRQ3

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## HRTF 3D Positional / 16 Bit PnP Audio Solution

XDK1N	25	IN	DACK1
XDQ1	24	OUT	DRQ1
XDK0N	1	IN	DACK0
XDQ0	100	OUT	DRQ0
XDK5N	99	IN	DACK5
XDQ5	98	OUT	DRQ5
XDK7N	97	IN	DACK7
XDQ7	96	OUT	DRQ7
XTXD	81	OUT	MIDI TXD
XXRD	82	IN	MIDI RXD
XGD7-XGD4	71-74	IN	Game port switch in
XGD3-XGD0	77-80	I/O	Game port R/C in
XSPDIFI	46	IN	SPDIF Digital CD in(44.1Khz)
XSPDIFO	45	OUT	SPDIF out (44.1Khz 0-5V )
X3DEN	47	OUT	3D surround enable;1=enable
NC	83,84,85,86	NC	test pin
XIN	7	IN	14.318Mhz IN
<b>PIN NAME</b>	<b>PIN NUBER</b>	<b>PIN TYPE</b>	<b>FUNCTION</b>
XPCSPKIN	66	Analog IN	PC speaker
XMICIN	50	Analog IN	Active MIC in
XCDR	60	Analog IN	Analog CD right channel IN
XCDL	61	Analog IN	Analog CD left channel IN
XCDGND	62	Analog IN	Differential CD Ground
XLNR	63	Analog IN	Analog LINE right channel IN
XLNL	64	Analog IN	Analog LINE left channel IN
XLNGND	65	Analog IN	Differential LINE-in Ground
XSYNR	69	Analog IN	External wave-table right IN
XSYNL	70	Analog IN	External wave-table left IN
XDACINL	57	Analog IN	Left channel DAC filter in
XDACINR	56	Analog IN	Right channel DAC filter in
XDACOL	58	Analog out	Left channel DAC filter out
XDACOR	59	Analog out	Right channel DAC filter out
XADCHL	54	Analog I/O	ADC left channel filter

## HRTF 3D Positional / 16 Bit PnP Audio Solution

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XADCHR	51	Analog I/O	ADC right channel filter
XADOUTL	49	Analog out	Left channel audio output (Max=3Vp-p,10ma)
XADOUTR	48	Analog out	Right channel audio output (Max=3Vp-p,10ma)
AVDD	52,67	AVDD	Analog VDD=+5V
AGND	53,68	AGND	Analog GND=0V
DVDD	2,28,42,75	DVDD	Digital VDD=+5V
DGND	3,29,43,76,87	DGND	Digital GND=0V

Note : All of analog input resistance is 75Kohm , Max Vin=3Vp-p