



# CMI 8768+

PCI 8CH Integrated Sound Chip

*Supports Dolby® Digital Live 5.1 Encoder*



Data Sheet

Rev. 1.0  
Dec. 1, 2004

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## 0. Revision History

Date	Rev.	Release Note
2003/06/13	Rev. 0.1	- Preliminary vision
2003/07/17	Rev. 0.2	- Change feature and pin description
2003/10/13	Rev. 0.3	- Add analog performance data
2004/12/01	Rev. 1.0	<ul style="list-style-type: none"><li>- Update feature/overview description (Support 96K/24Bit output)</li><li>- Clarify block diagram (no legacy/SBPRO support)</li><li>- Correct pin function (#125 XS6CH=&gt;GND; #90-97 XGD0-XGD7=&gt;NC; #59 EXTBASS type from analog output to input)</li><li>- Add pin #62 description: XINTREF =&gt; Internal reference voltage</li><li>- Clarify DirectX9.0 installed is required for 8ch playback support on Windows</li><li>- Indicate pin#9 IDSEL can work only with A16~31</li><li>- Modify SPDIF-Out high voltage from VDD to 5V</li><li>- Add Electrical Characteristics data and update analog performance</li></ul>

## 1. Features



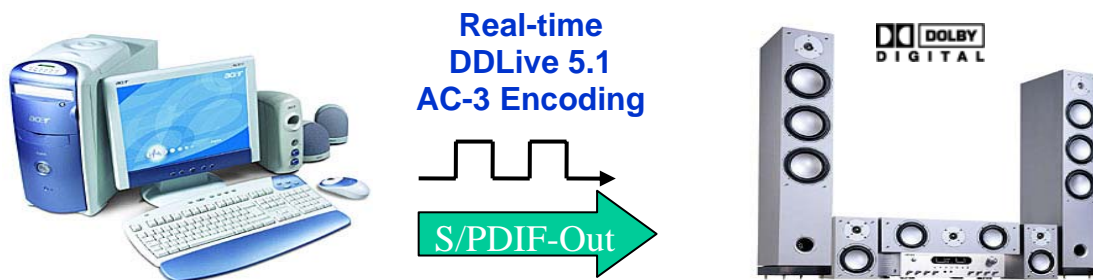
- The global first 8CH single sound chip supporting **Dolby® Digital Live 5.1 (AC-3) real-time interactive content encoder**
- **Full-duplex embedded 8CH DAC/2CH ADC**
- **Supports 96K/24bit playback; 48K/16bit recording**
- CE level high-quality Signal-to-Noise Ratio (SNR) ~ 100dB
- Integrated S/PDIF transmitter supports **44.1k/48k/96KHz sample-rate and 16/24bits resolution**
- **PCI Rev. 2.2** compliant with bus mastering modes
- Supports the latest **Dolby® Digital EX and DTS® ES 6.1/7.1CH DVD soundtrack playback**
- **Two S/PDIF inputs** for optical and coaxial connectors individually
- Built-in earphone buffer at Front-Out pins (32Ω loading)
- One GPIO (General purpose I/O) support
- External EEPROM Interface for SID R/W purpose
- Supports MPU401 MIDI UART port
- **DirectSound™ 3 HW acceleration compliant**
- **Power On/Off anti-pop circuit reference design**
- ACPI compliant power down management
- Zoomed Video Port support
- Industrial standard QFP-128 package
- Almost pin-to-pin compatible with CMI8738 series
- Digital power = 3.3V & 5V, Analog power = 5V

### Valuable S/W:

- **Dolby® Digital Live 5.1 (AC-3) real-time interactive content encoder** converting all digital audio sources (game audio, MP3, VCD, WMA, ...) into 5.1ch Dolby® Digital stream through S/PDIF output interface
- C-Media **Xear 3D™ 7.1 Virtual Speaker SHIFTER** technology
- Interesting **Magic Voice™** feature to disguise users' voice tone in all IP phones (Skype, MSN, Yahoo,...), online games, messenger, and Internet DJ/broadcasting applications
- Unique **Karaoke** functionality: Mic Echo, Key-shifting, Vocal Cancellation
- **CRL3D®** HRTF 3D positional sound enhancement from Sensaura® supporting multi-drive 7.1, EnvironmentFX, ZoomFX, MacroFX, etc.
- Supports most industrial standards of PC 3D sound for gaming, including **EAX™ 1.0&2.0, A3D™ 1.0, and DirectSound™ 3 SW**
- **10-band Equalizer** with 12 preset modes; **27 global environment effects**
- Support 7.1 CH digital audio playback for WinXP, 2K, ME, 98SE (Microsoft® DirectX V.9.0 above is required)
- WinCE driver and Linux OSS driver available (w/o DDLive)

## 2. Overview

CMI8768+ is the first high performance 8CH PCI integrated sound chip in the world supporting **Dolby® Digital Live 5.1 (AC-3) real-time interactive content encoder**. Dolby® Digital Live encodes all digital audio sources on PC such as 3D game audio, VCD, MP3, WMA, Internet radio... into 5.1CH Dolby® Digital stream transmitted via consumer standard S/PDIF link to external decoder/receiver and even Home Theater system. With Dolby® Digital Live encoder feature, users can easily connect PC audio to consumer sound system by S/PDIF interface. It realizes **Digital Home Entertainment PC** in the living room.



Integrated S/PDIF transmitter can also pass through 5.1 Dolby® Digital/DTS®, or 6.1/7.1 Dolby® Digital Surround EX/DTS ES DVD audio stream to external receiver satisfying audio enthusiasts and pioneers.



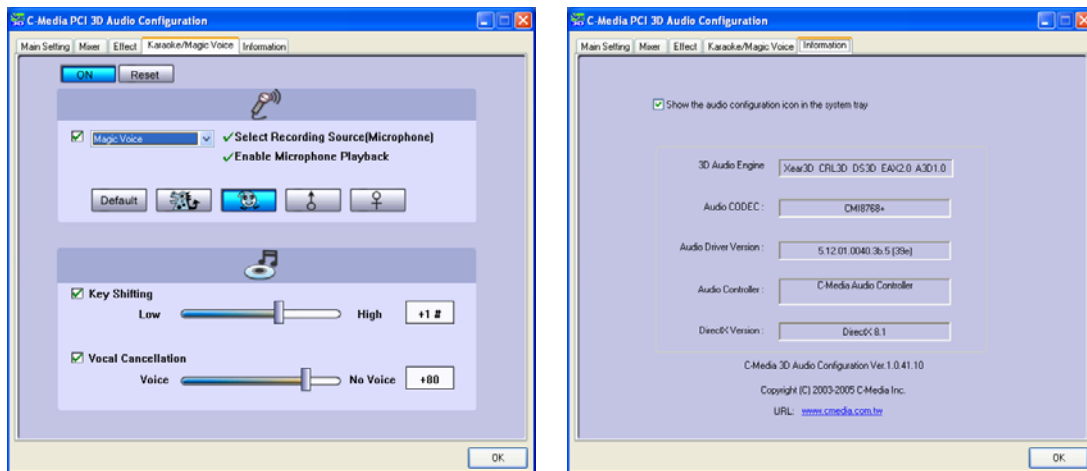
*Graphic User Interface Samples-- Main Setting & Mixer*

Being compatible with various industrial standards for gaming such as EAX™ 1.0&2.0, A3D™ 1.0, Direct Sound™ 3D powered by Sensaura® CRL3D HRTF 3D engine, C-Media CMI8768+ can provide enthusiastic gamers breathtaking sound experience in gaming.

C-Media proprietary **Xear 3D™ sound technology** empowers users to shift virtual speakers anywhere they want for optimizing the personal sound field. **Virtual speakers** can even deliver up-to-7.1 channel surround sounds over only 2 physical speakers or headphones. C-Media unique **Magic Voice™** functionality can reform your microphone voice through the recording process delivering amazing disguise effects for fun in many applications, such as Internet phone, messenger, online games, etc. **Microphone echo** and **key-shifting** features are well designed for karaoke application. Other sound effects like **10-band Equalizer** and **27 environment effects** can enrich user's audio experience and enjoyment.



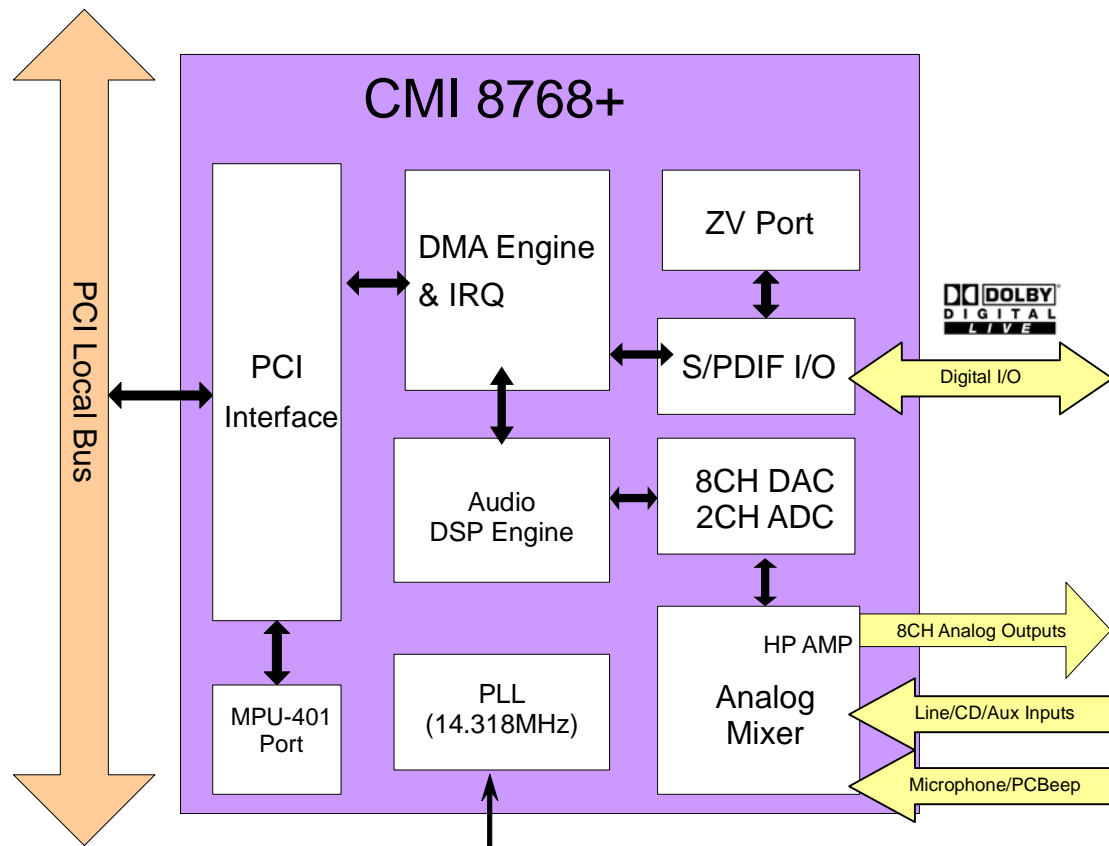
*Graphic User Interface Samples—DDLive Encoder, Virtual Speaker SHIFTER & Sound Effects*



*Graphic User Interface Samples—Karaoke & Magic Voice & Information*



### 3. Block Diagram



*Block Diagram*

## 4. Pin Assignment



*Top View of CMI8768+*

## 5. Pin Description

### Digital I/O

Pin No	Signal Name	Type	Description
1-2, 5-7, 12-16, 19-21, 32-35, 38-41, 43-44, 47-52, 126-128	XA31 - XA0	I/O	PCI bus address and data lines
117	XINTA	O	Interrupt request, active-low
119	XPRST	I	Reset
120	XCLK33	I	PCI bus clock
121	XGNT	I	Bus master grant, active-low.
122	XREQ	O	Bus master request, tri-state output, active-low.
9	XIDSEL	I	ID select, active-high. (only works with A16~31 pin of host controller)
23	XFRAME	I/O	Cycle frame, active-low.
24	XIRDY	I/O	Initiator ready, active-low. The bus master device is ready to transmit or receive data.
25	XTRDY	I/O	Target ready, active-low. The target device is ready to transmit or receive data.
26	XDEVSEL	I/O	Device select, active-low. The target device has decoded the address of the current transaction as its own chip select range.
29	XSTOP	I/O	Stop transaction, active-low. The target device request to the master to stop the current transaction.
30	XPAR	I/O	Parity. The pin indicates even parity across XA31-XA9 and XCBE3-XCBE0 for both address and data phases.
8, 22, 31, 42	XCBE0 XCBE3	- I/O	Multiplexed command / byte enable. These pins indicate cycle type during the address phase of a transaction.
88	XTXD	O	MIDI transmit data
89	XRXD	I	MIDI receive data
55	XIN	I	14.318 MHz crystal input or ext. oscillator input
56	XOUT	O	13.318 MHz crystal output or NC
87	XGBIO0	I/O	General purpose I/O
84	XEECS	O	EEPROM chip select
85	XMBCSZ	I	Audio chip enable select (low:enable)
112	ZVCLK	I	ZV port clock
98	XSPDIFO	O	S/PDIF output (5V)
86	XSPDIFI	I	S/PDIF input 1 / ZV port LR channel clock
113	XSPDIFI2	I	S/PDIF input 2 (TTL 5V) / ZV port data input

## Analog I/O

Pin No	Signal Name	Type	Description
57,58	XSUROUTL-R	O	Back surround out L/R channel
59	EXTBASS	I	External bass input
62	XINTREF	O	Internal reference voltage (for testing purpose)
64,65	XADOUTL-R	O	Front out L/R channel
66,67	XADCFL-R	O	ADC S/H capacitors
68	XCNOUT	O	Center channel output
69	XBSOUT	O	Bass channel output
70	XCDGND	O	CD audio differential ground channel output
71,72	XCDL-R	O	CD audio differential L/R channel output
73,74	XREARL-R	O	Side surround out L/R channel
75,76	XLNL-R	I	Line-In L/R channel
77,78	XAUXL-R	I	Aux input L/R channel
79	XPCSPKIN	I	PC beep or mono input
80	XMIC	I	Microphone input

## Power & Ground

Pin No	Signal Name	Type	Description
4, 10, 18, 27, 37, 45, 100, 124	VDDIO	I	PCI I/O power pin (3.3V)
54, 115	VDDCORE	I	Core logic power pin (3.3V)
83	VDD5V	I	PCI I/O power pin (5V)
3, 11, 17, 28, 36, 46, 53, 82, 99, 116, 125	GND	I	Digital ground
61, 81	AVDD	I	Analog I/O power pin
60, 82	AGND	I	Analog ground

## NC

Pin No	Signal Name
63, 90-97, 101 - 111, 114, 118, 123	NC

## 6. Electrical Characteristics

### Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Digital power voltage	DVDD	3	3.6	V
Analog power voltage	AVDD	3	5.5	V
Digital Input Voltage	VIND	-0.5	3.6	V
Analog Input Voltage	VINA	-0.5	5.5	V
Operating temperature range	TO	0	70	°C
Storage temperature range	TST	-40	125	°C
Maximum power dissipation	PDMAX		300	MW

### Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Digital Operating Voltage	DVDD	3.135	3.3	3.465	V
Analog Operating voltage	AVDD	4.75	5	5.25	V
Operating Ambient Temperature	TO	0	25	70	°C

### Power Consumption

Parameter	Min.	Typ.	Max.	Unit
Power Supply Current (Normal)				
AVDD (5.0V)	-	35	-	mA
DVDD (3.3V)	-	10	-	mA

### Digital Characteristics

PARAMETER	Symbol	Condition	Min.	Typ.	Max.	Unit
Input high voltage(PCI I/O)	VIH		2.0	-	VDD+0.3	V
Input low voltage (PCI I/O)	VIL		-0.5	-	0.8	V
Output high voltage	VOH	I <sub>OH</sub> =1.5mA	2.4	-	VDD	V
Output low voltage	VOL	I <sub>OL</sub> =-0.5mA	0.0	0.2	0.4	V
Input Leakage Current	IIL	0<Vin<VDD	-70	-	70	μA
Output Leakage Current	IOL		-70	-	70	μA
SPDIF IN input high voltage	VIH1		2.6	-	-	V
SPDIF IN input low voltage	VIL1		-	-	2.4	V
SPDIF output high voltage	VOH1		-	VDD5V	-	V
SPDIF output low voltage	VOL1		-	GND	-	V

Input Pin Capacitance	Cin		-	-	10	pF
Pin Inductance	Lpin		-	-	20	nH

## AC Characteristics

Parameter	Symbol	Condition	Min.	Max.	Units
High Clamp Current	Ich	$V_{dd}+4 > V_{in} \geq V_{dd}+1$	$25+(V_{in}-V_{dd}-1)/0.015$	-	mA
Low Clamp Current	Icl	$-3 < V_{in} \leq -1$	$-25+(V_{in}+1)/0.015$	-	mA
Output Rise Slew Rate	SLEW <sub>r</sub>	0.2V <sub>dd</sub> -0.6V <sub>dd</sub> load	1	4	V/ns
Output Fall Slew Rate	SLEW <sub>f</sub>	0.6V <sub>dd</sub> -0.2V <sub>dd</sub> load	1	4	V/ns

## Analog Performance

The measurements are performed under the circumstance as:

$T_{\text{ambient}} = 25^{\circ}\text{C}$ ,  $AV_{\text{dd}} = 5.0\text{V} \pm 5\%$ ,  $DV_{\text{dd}} = 3.3\text{V} \pm 5\%$ , 10k $\Omega$ /50pF external load. Input is 1 kHz sine wave; Sampling frequency = 48 kHz; Bandwidth = 20 to 20 kHz; 0dB attenuation; All sound effects such as 3D effects are disabled.

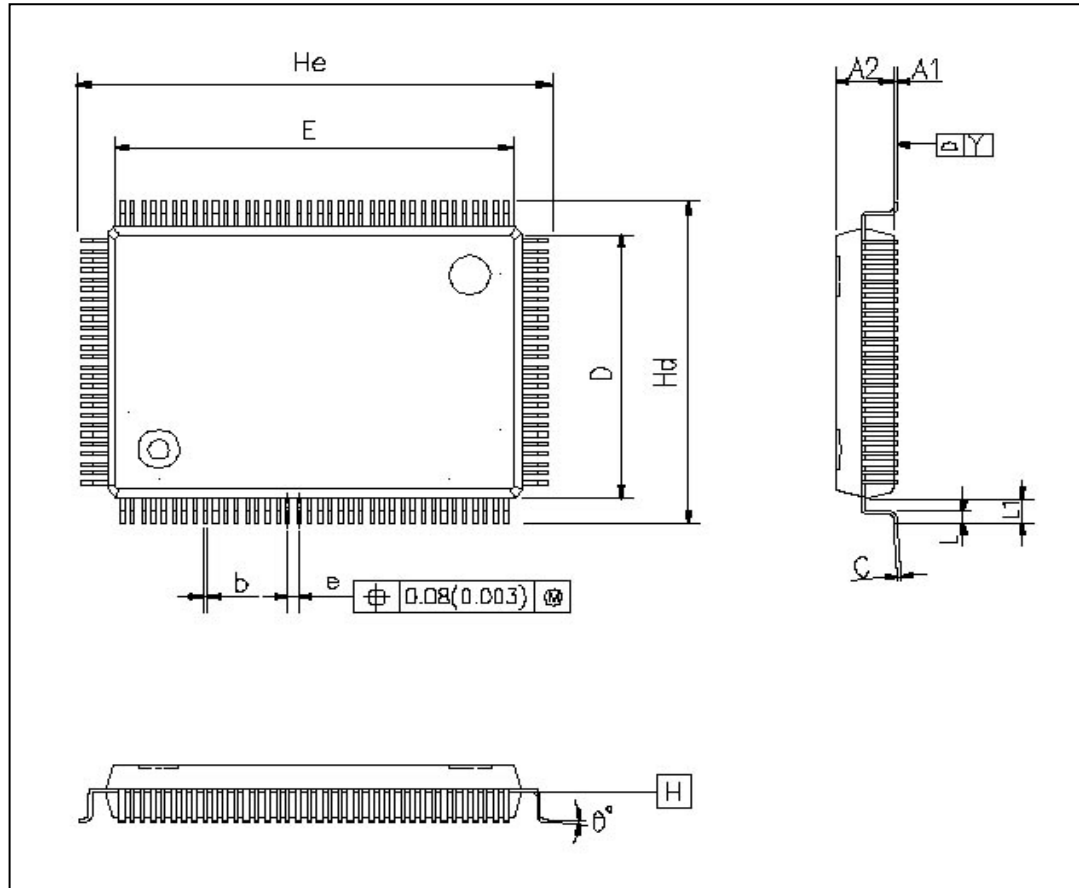
Parameter	Minimum	Typical	Maximum	Units
Full Scale Input Voltage:				
Line Inputs (Mixer)	-	1.1	1.25	Vrms
Line Inputs (A/D)	-	-	1.25	Vrms
Mic Inputs (20dB boost)	-	0.1	1.25	Vrms
Full Scale Output Voltage:				
Front_Out	-	1.1	-	Vrms
Side_Surround_Out	-	1.1	-	Vrms
Center / LFE_out	-	1.1	-	Vrms
Back_Surround_Out	-	1.1	-	Vrms
SNR (Idle)				-
A/A	-	100	-	dB
D/A	-	101	-	dB
A/D	-	86	-	dB
Dynamic Range (-60dB)				
A/A	-	100	-	dB
D/A	-	94	-	dB
A/D	-	85	-	dB
THD+N				
A/A	-	0.005	-	%
D/A	-	0.017	-	%
A/D	-	0.015	-	%
Frequency Response				
A/A	5	-	22,000	Hz
D/A	5	-	22,000	Hz
A/D	10	-	22,000	Hz
Cross-talk @ 10KHz (A/A)	-	100	-	dB
Transition Band	19,200		28,800	Hz
Stop Band	28,800		$\infty$	Hz
Stop Band Rejection	-	-70	-	dB
Out-Of-Band Rejection	-	-65	-	dB
Power Supply Rejection Ratio	-	-65	-	dB
Master Volume Gain (32 steps)				
Step Size		1.5		dB
Control Range	-54	-	+6	dB
Analog Input Gain (16 steps)				
Step Size		2		dB
Control Range	-30	-	0	dB
Mic Input Gain (16 steps)				
Step Size		3		dB
Control Range	-22	-	+24	dB
Mic Boost Gain	-	+20	-	dB
PCSPK Input Gain (4 steps)				
Step Size		8		dB
Control Range	-24	-	0	dB
Recording Gain (16 steps)				
Step Size		1.5		dB
Control Range	0	-	+22.5	dB
Input Impedance				

Parameter	Minimum	Typical	Maximum	Units
Line-In, CD, Aux, PCSPK	-	60	-	K $\Omega$
Mic (w/o Boost)	-	30	-	K $\Omega$
Mic (w/ Boost)	-	10	-	K $\Omega$
Output Impedance				
Amplifier Output	-	2	-	$\Omega$
Non-amp Output	-	200	-	$\Omega$
Output Power				
Line-Out (Front) @32 $\Omega$ Load	-	50	-	mW
Line-Out (Front) @10K $\Omega$ Load	-	0.16	-	mW
Vrefout	-	2.25	-	V



## 7. Mechanical Dimensions

### QFP-128



*Mechanical Dimension*

Symbols	Min.	Typ.	Max.	Notes
A1	0.25	0.35	0.45	1. Jeduc outline : N/A 2. Datum plane $\square H$ is located at the bottom of the mold parting line coincident with where the lead exits the body.
A2	2.57	2.72	2.87	
b	0.10	0.20	0.30	
C	0.10	0.15	0.20	
D	13.90	14.00	14.10	3. Dimensions E and D do not include mold protrusion. Allowable protrusion is 0.25 mm per side. Dimensions E and D do include mold mismatch and are determined at datum plane $\square H$ . 4. Dimension b does not include dambar protrusion.
E	19.90	20.00	20.10	
e	-	0.50	-	
Hd	17.00	17.20	17.40	
He	23.00	23.20	23.40	
L	0.65	0.80	0.95	
L1	-	1.60	-	
Y	-	-	0.08	
$\theta^\circ$	0	-	12	

**Unit : mm**

~The End of Datasheet~