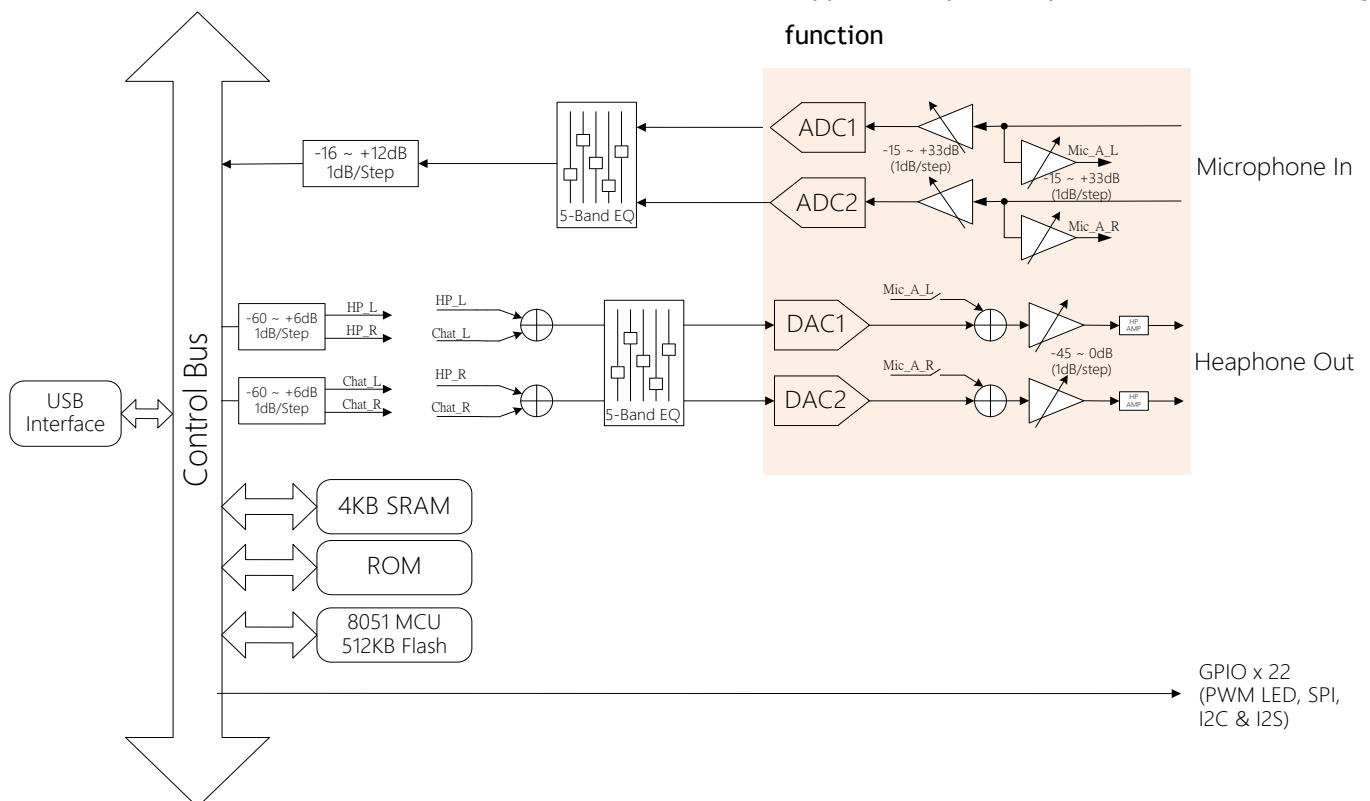


## DESCRIPTION

The CM6646X1 is a USB 2.0 high-speed audio codec with 2-channel DAC and 2-channel ADC for Gaming Headset applications. It supports two playback audio devices with independent volume control for game and chat. It also supports mixing function for two playback audio devices. Moreover, the CM6646X1 supports I2C, SPI, UART and GPIOs to communicate with external device. There are 5 bands EQ for both playback and recording interface to compensate the frequency response of speaker or MIC unit or to fulfill personal listening experience.

The CM6646X1 is embedded with 8051 MCU and 512KB flash makes it is very flexible to change the USB topology or communicate with external device by changing internal flash code. It also integrates 6 PWM LED drivers for status indication.

## BLOCK DIAGRAM



## FEATURES

- USB specification 2.0 full-speed/high-speed compliant
- USB audio class 2.0 compliant
- USB human interface device (HID) class 1.1 compliant
- Support USB suspend/resume/reset functions
- Support control, interrupt and isochronous data transfers
- Integrate 2-channel DAC and 2-channel ADC
- True Cap-less/zero-ground headphone driver with patent applied anti-pop technology
- Embedded oscillator for Crystal-less design
- Embedded 7-bits SAR ADC supports Combo jack and Google button detection
- 2 stereo I2S serial audio output/input interfaces
- 1 I2C master, 1 I2C slave, 1 SPI master and 22 GPIOs
- Integrate 6 PWM LED drivers
- Support 5 bands playback and recording EQ
- Support 2 output end-points audio stream mixing function

## Release notes

Revision	Date	Description
0.90	2023/03/09	- Preliminary release
0.91	2023/04/27	- Wording modify
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## 1 Description and Overview

The CM6646X1 is a USB 2.0 high-speed audio codec with 2-channel DAC and 2-channel ADC for Gaming Headset applications. It supports two playback audio devices with independent volume control for game and chat. It also supports mixing function for two playback audio devices. Moreover, the CM6646X1 supports I2C, SPI, UART and GPIOs to communicate with external device. There are 5 bands EQ for both playback and recording interface to compensate the frequency response of speaker or MIC unit or to fulfill personal listening experience.

The CM6646X1 is embedded with 8051 MCU and 512KB flash makes it is very flexible to change the USB topology or communicate with external device by changing internal flash code. It also integrates 6 PWM LED drivers for status indication.

## 2 Ordering Information

Product	Package Marking	Package Type	Transport Media
CM6646X1	CM6646X1	QFN-68(7x7mm)	Tray

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### 3 Features

#### 3.1 USB Compliance

- USB 2.0 full-speed/high speed compliant
- USB audio class 2.0 compliant
- USB human interface device (HID) class 1.1 compliant
- Support USB suspend/resume/reset functions
- Support control, interrupt and isochronous data transfers

#### 3.2 Integrated 8051 Micro Processor

- Embedded 8051 micro-processor handles the USB transfers(control, isochronous and interrupt)
- Communicate with external peripheral devices(I2C, SPI, GPIO, etc.)
- The MCU speed is programmable from 3.072 to 65.536 MHz
- HID interrupts can be implemented via firmware codes
- Provide maximum HW configuration flexibility with a firmware code upgrade
- VID/PID/product string and others can be customized via firmware code programming

#### 3.3 Control Interface

- 1 Master I2C control interface to communicate with external devices or EEPROM, the master I2C speed supports standard mode(100KHz) and fast mode(400KHz)
- 1 Slave I2C control interface for external MCU communication, the slave I2C speed supports standard mode(100KHz) and fast mode(400KHz)
- 1 SPI master(share with GPIO), supports speed up to 24.576 Mb/s (Depends on MCU speed)
- 22 GPIOs(programmable multi functions I/O)
- 6 PWM LED drivers output share with GPIO

### 3.4 Audio Engine and Codec

#### ■ Playback Stream:

- Stereo DAC:
  - Sample Rates: 44.1/48/88.2/96/176.4/192KHz
  - Bit Depth: 16/24/32 bits
  - Analog Gain Range: -45 ~ 0dB, 1dB/step
  - Digital Gain Range: -60 ~ +6dB, 1dB/step
  - True Cap-less/zero-ground headphone driver with patent applied anti-pop technology
- Stereo I2S output interface:
  - Sample Rates: 44.1/48/88.2/96/176.4/192KHz
  - Bit Depth: 16/24/32 bits
- 5-band Digital Parametric Equalizer

**Notes: To support 2 output end-points audio stream mix together, the audio format of the 2 audio output end-points must be the same.**

#### ■ Recording Stream:

- Stereo ADC
  - Sample Rates: 44.1/48/88.2/96/176.4/192KHz
  - Bit Depth: 16/24/32 bits
  - Microphone gain range: -15~ +33dB, 1dB/step
  - Digital Gain Range: -16 ~ +12dB, 1dB/step
- Stereo I2S input interface:
  - Sample Rates: 44.1/48/88.2/96/176.4/192KHz
  - Bit Depth: 16/24/32 bits
- 5-band Digital Parametric Equalizer

#### ■ A-A Mixer (Sidetone):

- Analog input to analog output mixer path with independent volume control: -15 ~ +33dB, 1dB/step

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### 3.5 General

- Embedded USB 2.0 transceiver and power-on reset circuit
- Bus-power and self-power options
- Embedded oscillator for Crystal-less design
- True Cap-less/zero-ground headphone driver with patent applied anti-pop technology
- Single 5V power supply with embedded 5V to 3.3V regulator
- 3.3V digital I/O pads with 5V tolerance
- Compliant with USB IF certification requirements
- QFN-68 package (7 x 7 mm)

### 3.6 Xear™ Sound Processing

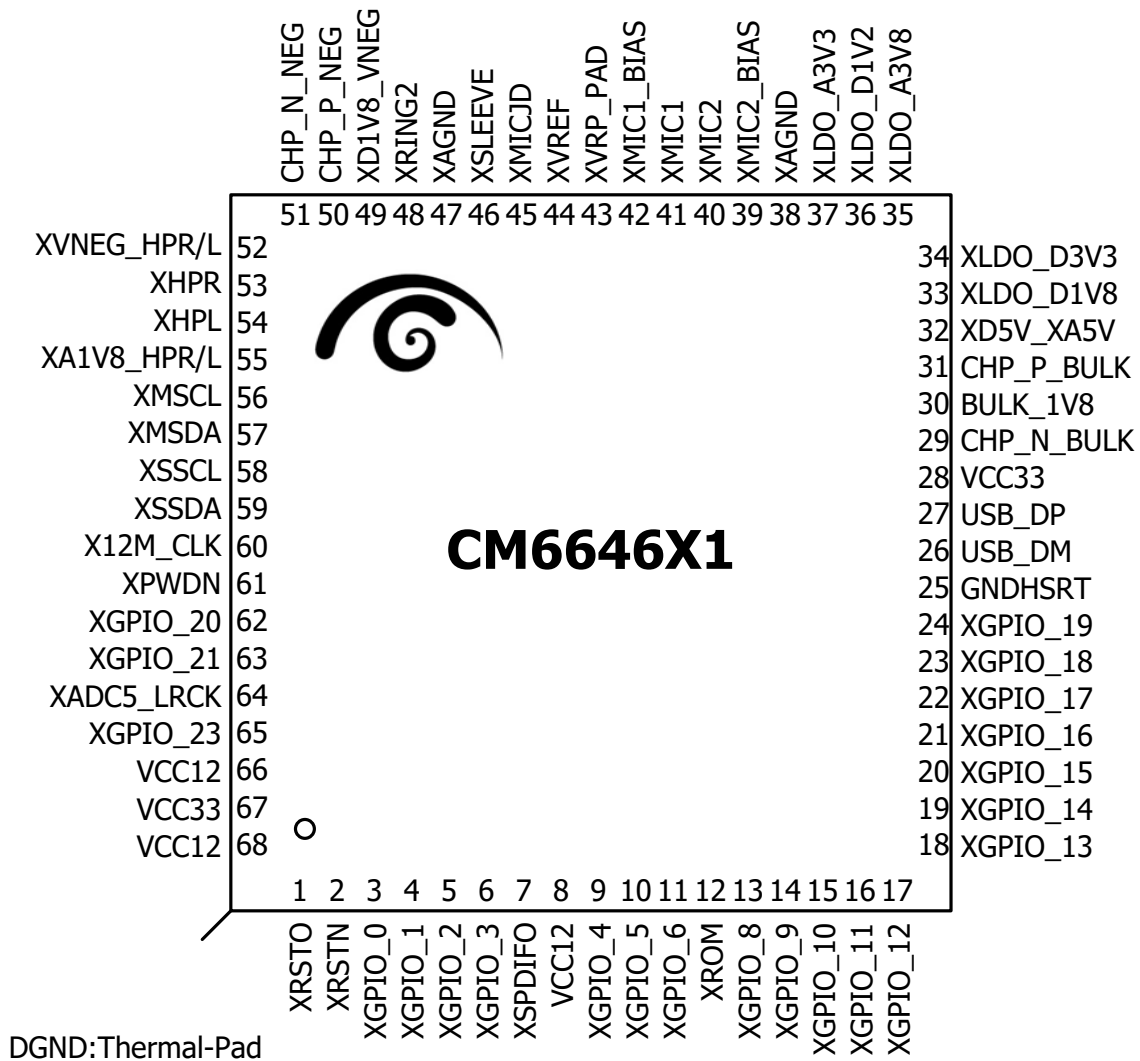
- Xear™ Surround Headphone
- Xear™ Software 10 Band Equalizer
- Xear™ Audio Brilliant
- Xear™ Dynamic Bass
- Xear™ Voice Clarity
- Xear™ Smart Volume
- Xear™ Magic Voice
- Xear™ AI Noise Cancellation

## 4 Applications

- PC Gaming Headset with 2-Output End Point mixing function
- USB Audio Dongle
- Live streaming mixer box

## 5 Pin Assignment

### 5.1 Pin-out Diagram





## 5.2 I/O Type Description

I/O Type	Description
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
DIL	Digital Input with internal pull-down 50K
DIH	Digital Input with internal pull-up 50K
DO	Digital Output
DIOL	Digital Input/Output with internal pull-down 50K
DIOH	Digital Input/Output with internal pull-up 50K
IOU	USB related IO
PWRO	Power output pin
PWRI	Power input pin
GND	Ground related pin

## 5.3 Pin Description

Pin #	Symbol	I/O	Description
<b>USB 2.0 BUS Interface</b>			
27	USB_DP	IOU	USB 2.0 data positive
26	USB_DM	IOU	USB 2.0 data negative
<b>Power/Ground</b>			
25	GNDHSRT	GND	Digital ground
32	XD5V_XA5V	PWRI	Digital/Analog supply power (4.3V~5V) ; Connect to capacitor filter
38	XAGND	GND	Analog ground
47	XAGND	GND	Analog ground
30	BULK_1V8	PWRO	DC to DC 1.8V output, 40mA driving current ; Connect to capacitor filter
49	XD1V8_VNEG	PWRI	DC to DC 1.8V input Input power of negative charge pump ; Connect to capacitor filter
55	XA1V8_HPR/L	PWRI	Analog 1.8V input Positive Power of headphone driver R/L CH ; Connect to capacitor filter
52	XVNEG_HPR/L	PWRO	DC to DC -1.8V output, 10mA driving current ; Connect to capacitor filter
35	XLDO_A3V8	PWRO	LDO 3.8V output, 20mA driving current ; Connect to capacitor filter
37	XLDO_A3V3	PWRO	LDO 3.3V output, 20mA driving current ; Connect to capacitor filter
34	XLDO_D3V3	PWRO	LDO 3.3V output, 30mA driving current ; Connect to capacitor filter
33	XLDO_D1V8	PWRO	LDO 1.8V output, 20mA driving current ; Connect to capacitor filter
36	XLDO_D1V2	PWRO	LDO 1.2V output, 10mA driving current ; Connect to capacitor filter
28	VCC33	PWRI	VCC 3.3V input Digital supply voltage 3.3V for digital I/O
8	VCC12	PWRI	VCC 1.2V input Digital supply voltage 3.3V for digital core
66	VCC12	PWRI	VCC 1.2V input Digital supply voltage 3.3V for digital core

67	VCC12	PWRI	VCC 1.2V input Digital supply voltage 3.3V for digital core
68	VCC12	PWRI	VCC 1.2V input Digital supply voltage 3.3V for digital core
69		GND	DGND=Thermal pad
<b>Analog</b>			
44	XVREF	AO	Voltage reference for common mode voltage (-1.5V)
43	XVRP_PAD	AO	Voltage reference for DAC (-3.1V)
42	XMIC1_BIAS	AO	Microphone 1 bias voltage output (-3.1V)
41	XMIC1	AI	Microphone 1 input
39	XMIC2_BIAS	AO	Microphone 2 bias voltage output (-3.1V)
40	XMIC2	AI	Microphone 2 input
45	XMICJD	AO	Combo jack detect and auto switch, detect combo jack type and switch to XRING2 or XSLEEVE
46	XSLEEVE	AI	Combo jack connectoe: Sleeve
48	XRING2	AI	Combo jack connector: Ring2
31	CHP_P_BULK	AO	Charge pump positive output of DC to DC
29	CHP_N_BULK	AO	Charge pump negative output of DC to DC
50	CHP_P_NEG	AO	Charge pump positive output of high negative DC to DC
51	CHP_N_NEG	AO	Charge pump negative output of high negative DC to DC
54	XHPL	AO	Headphone driver output L CH
53	XHPR	AO	Headphone driver output R CH
<b>S/PDIF I/O</b>			
7	XSPDIFO	DO	S/PDIF transmitter
<b>GPIO</b>			
3	XGPIO_0	DIOL	1). General purpose input/output 0 (default input) 2). LED module 1 output 3). R8051 SPI master clock output, Internal pull low, 4mA driving current
4	XGPIO_1	DIOL	1). General purpose input/output 1 (default input) 2). LED module 2 output 3). R8051 SPI master data output, Internal pull low, 4mA driving current
5	XGPIO_2	DIOL	1). General purpose input/output 2 (default input) 2). LED module 3 output 3). R8051 SPI master data input, Internal pull low, 4mA driving current
6	XGPIO_3	DIOL	1). General purpose input/output 3 (default input) 2). LED module 4 output 3). R8051 SPI master chip enable 0 output, Internal pull low, 4mA driving current

9	XGPIO_4	DIOL	1). General purpose input/output 4 (default input) 2). LED module 5 output 3). I2C slave interrupt output to external MCU Internal pull low, 4mA driving current
10	XGPIO_5	DIOL	1). General purpose input/output 5 (default input) 2). LED module 6 output 3). I2C slave data ready indication output Internal pull low, 4mA driving current
11	XGPIO_6	DIOL	General purpose input/output 6 (default input) Internal pull low, 4mA driving current
13	XGPIO_8	DIOL	1). General purpose input/output 8 (default input) 2). I2S DAC4 master clock output Internal pull low, 4mA driving current
14	XGPIO_9	DIOL	1). General purpose input/output 9 (default input) 2). I2S DAC4 bit clock input/output Internal pull low, 4mA driving current
15	XGPIO_10	DIOL	1). General purpose input/output 10 (default input) 2). I2S DAC4 left/right clock input/output Internal pull low, 4mA driving current
16	XGPIO_11	DIOL	1). General purpose input/output 11 (default input) 2). I2S DAC4 serial data output Internal pull low, 4mA driving current
17	XGPIO_12	DIOL	1). General purpose input/output 12 (default input) 2). LED module 1 output 3). I2S DAC5 master clock output Internal pull low, 4mA driving current
18	XGPIO_13	DIOL	1). General purpose input/output 13 (default input) 2). LED module 2 output 3). I2S DAC5 bit clock input/output Internal pull low, 4mA driving current
19	XGPIO_14	DIOL	1). General purpose input/output 14 (default input) 2). LED module 3 output 3). I2S DAC5 left/right clock input/output Internal pull low, 4mA driving current
20	XGPIO_15	DIOL	1). General purpose input/output 15 (default input) 2). I2S DAC5 serial data output Internal pull low, 4mA driving current

21	XGPIO_16	DIOL	1). General purpose input/output 16 (default input) 2). I2S ADC4 master clock output Internal pull low, 4mA driving current
22	XGPIO_17	DIOL	1). General purpose input/output 17 (default input) 2). I2S ADC4 bit clock input/output Internal pull low, 4mA driving current
23	XGPIO_18	DIOL	1). General purpose input/output 18 (default input) 2). R8051 serial 1 interface transmit data, TXD1 3). I2S ADC4 left/right clock input/output Internal pull low, 4mA driving current
24	XGPIO_19	DIOL	1). General purpose input/output 19 (default input) 2). R8051 serial 1 interface transmit data, RXD1 3). I2S ADC4 serial data input Internal pull low, 4mA driving current
62	XGPIO_20	DIOL	1). General purpose input/output 20 (default input) 2). LED module 4 output 3). R8051 I2C serial clock 4). I2S ADC5 master clock output Internal pull low, 4mA driving current
63	XGPIO_21	DIOL	1). General purpose input/output 21 (default input) 2). LED module 5 output 3). R8051 I2C serial data 4). I2S ADC5 bit clock input/output Internal pull low, 4mA driving current
64	XADC5_LRCK	DIOL	1). I2S ADC5 left/right clock input/output
65	XGPIO_23	DIOL	1). General purpose input/output 23 (default input) 2). R8051 Timer 2 capture trigger input 4). I2S ADC5 serial data input Internal pull low, 4mA driving current
<b>I2C Master Serial Bus</b>			
56	XMSCL	DIOH	1). I2C master serial clock 2). R8051 I2C serial clock
57	XMSDA	DIOH	1). I2C master serial data 2). R8051 I2C serial data
<b>I2C Slave Serial Bus</b>			
58	XSSCL	DIOH	1). I2C slave serial clock 2). R8051 I2C serial clock (This function is disabled, if R8051 I2C is connected to XMSCL and XMSDA)

59	XSSDA	DIOH	1). I2C slave serial data 2). R8051 I2C serial data (This function is disabled, if R8051 I2C is connected to XMSCL and XMSDA)
<b>Miscellaneous</b>			
1	XRSTO	DIOL	External codec reset output (default tri-state)
2	XRSTN	DIH	Reset input, active low
12	XROM	DIL	Reserve for restore to ROM mode
60	X12M_CLK	DIOL	12 MHz clock output
61	XPWDN	DIOL	Power down output signal for external device output (default tri-state)

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