DESCRIPTION

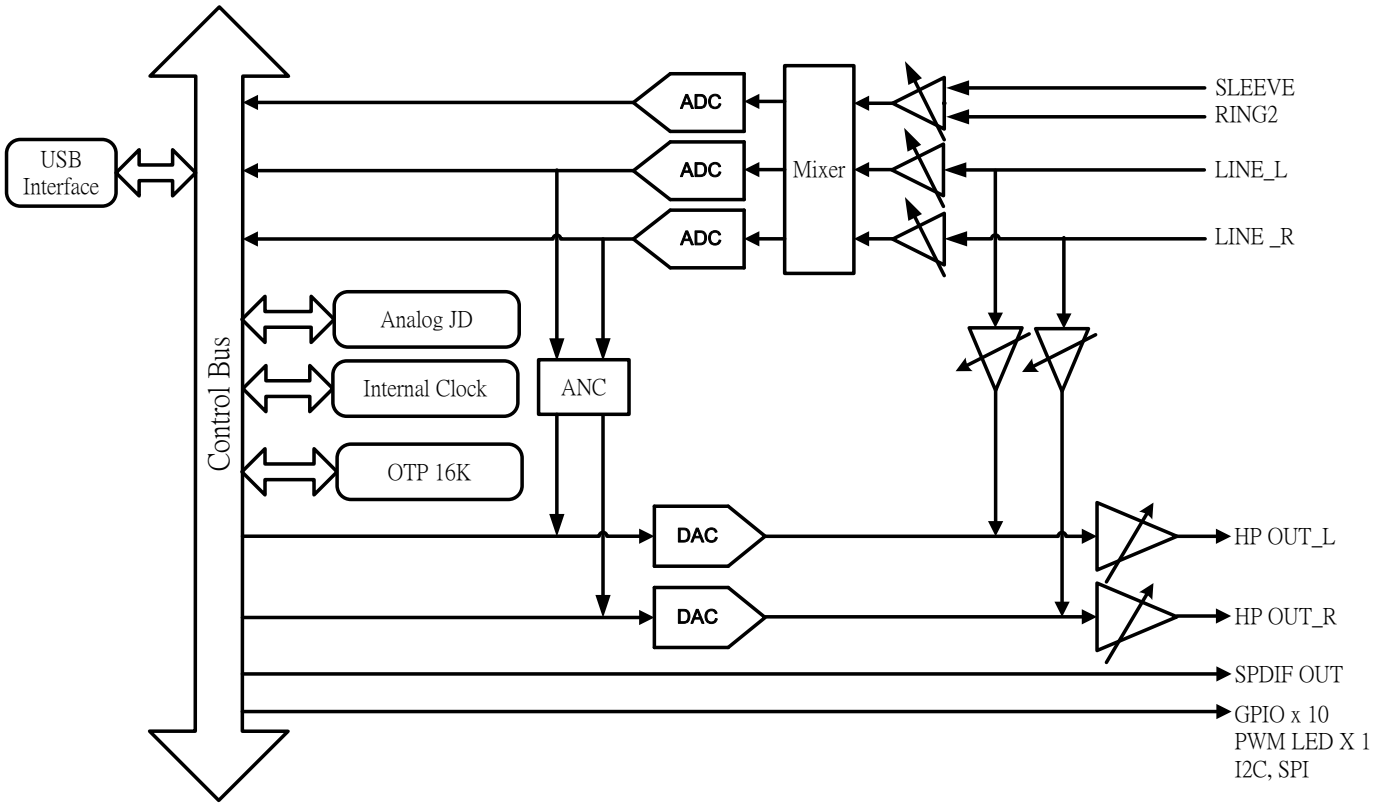
The CM6642 is a low power single chip USB 2.0 High-Speed audio codec built-in MCU for flexible applications. With integrated PWM LED driver and two (2)-channel ADC/DAC and S/PDIF interface that makes it suitable for headset, headphone, docking, speakers, and microphone applications. The internal MCU can also be developed to a lot of different applications, such as Microsoft™ Lync / Skype/VoIP device, Mobile Phone or Tablet/Slate docking device. The CM6642 is compatible with USB Audio Class 1.0 and USB 2.0 Full-Speed, thus it can plug & play without any additional software installation on major operating systems. The internal DAC support from 44.1~192 KHz and ADC support from44.1~192 KHz sampling rate with 16/24 bits resolution.

The CM6642 also integrates 16K Byte OTP and crystal but requires few passive components to make a finish product. Thus, it can save the total BOM cost and PCB area can be smaller.

FEATURES

- USB 1.1/2.0 Full-Speed and High-Speed compliant
- USB Audio Class 1.0 and 2.0 compliant
- Two (2)-channel DAC for audio output interface
- Two (2)-channel ADC for audio input interface
- Built-in S/PDIF transmitter
- Built-in Hardware ANC (Active Noise Cancellation)
- Supports USB suspend/resume/reset functions
- Embedded low-power MCU with 16K Byte OTP
- Supports OMTP and CTIA auto switch on a 4-pole jack
- Integrated PWM LED driver
- Master/Slave H/W I2C/SPI control interface for external audio devices or FLASH access
- Supports embedded oscillator without external crystal
- Built-in Class-G Ultra low Power headphone amplifier
- On chip watchdog timer
- Audio jack detection function
- Support JD,4-Button Headset in line with customizable multi function control support

BLOCK DIAGRAM



Release Notes

Revision	Date	Description
0.9	2016/10/05	First release.
0.91	2016/12/12	ADC Sample rate support 192KHz

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1 Description and Overview

The CM6642 is a low power single chip USB 2.0 High-Speed audio codec built-in MCU for flexible applications. With integrated PWM LED driver and two (2)-channel ADC/DAC and S/PDIF interface that makes it suitable for headset, headphone, docking, speakers, and microphone applications. The internal MCU can also be developed to a lot of different applications, such as Microsoft™ Lync/Skype/VoIP device, Mobile Phone or Tablet/Slate docking device. The CM6642 is compatible with USB Audio Class 1.0 and USB 2.0 Full-Speed, thus it can plug & play without any additional software installation on major operating systems. The internal DAC support from 44.1~192 KHz and ADC support from 44.1~192 KHz sampling rate with 16/24 bits resolution.

The CM6642 also integrates 16K Byte OTP and crystal but requires few passive components to make a finish product. Thus, it can save the total BOM cost and PCB area can be smaller.

2 Features

2.1 USB Compliance

- USB 1.1/2.0 Full-Speed and High-Speed compliant
- USB Audio Class 1.0 and 2.0 compliant
- USB Human Interface Device (HID) Class 1.1 compliant
- Supports USB suspend/resume/reset functions
- Support Selective Suspend mode

2.2 Integrated Micro Controller Unit Microprocessor

- Embedded MCU micro-processor to handle the command/protocol transactions
- Embedded 16K Byte OTP
- 4K Byte RAM for firmware extension and plug-in
- HID interrupts/buttons/functions can be implemented via firmware codes
- Provides maximum hardware configured flexibility with firmware code upgrade
- VID/PID/Product String can program by firmware

2.3 Control Interface

- 12 GPIO pins and firmware programmable
- GPIOs are configured as HID key and LED indicators
- PWM LED Driver

2.4 General

- Crystal-less (embedded crystal function)
- Single 5V power supply (embedded 5V to 1.8V regulator for digital core, 5V to 1/8/3.3V regulator for digital IO, 5V to 1.8V regulator for analog codec)
- 1.8/3.3V digital I/O pads with 5V tolerance
- Industrial standard QFN-48 package (5x6.5mm)

2.5 Audio I/O

- Playback Stream:
  - Speaker/Headphone

- Sample Rates: 44.1K/48K/96K/192KHz
- Supports Bit Length: 16/24bits
- DAC Gain Range is -65.6 ~ 0dB, 1.5dB/step

➢ S/PDIF transmitter

- Sample Rates: 44.1K/48K/96K/192KHz
- Supports Bit Length: 16/24 bits

- Recording Stream:

➢ Microphone

- Sample Rates: 44.1K/48K/96K/192KHz
- Supports Bit Length: 16/24 bits
- ADC gain range is -33.5 ~ 30dB, 1.5dB/step

- A-A path Stream:

➢ Line_In to playback A-A path

- Mix Line input to stereo playback both L/R channel
- The Line_In A-A path gain range is -34.5 ~ 12dB, 1.5dB/step

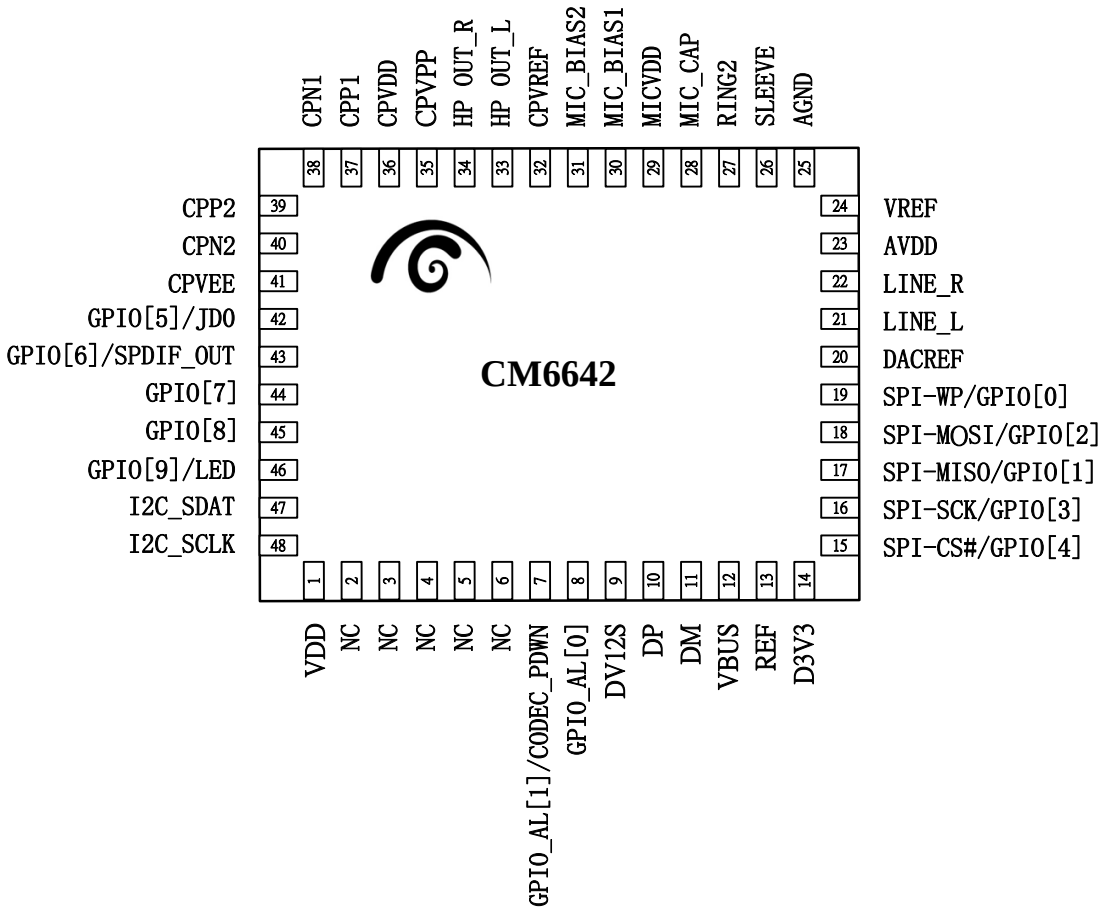
**Note 1: A-A path means Analog to Analog Mixer path

3 Applications

- Microsoft™ Lync/Skype VoIP Headset
- Tablet/Notebook/PCs Docking
- Android Phone/Slate Docking
- USB/Type C Speaker
- USB/Type C Microphone
- USB/Type C Headphone
- USB/Type C ANC Headphone/Headset
- USB/Type C Headset/Gaming Headset

4 Pin Assignment

4.1 CM6642 Pin-out Diagram (QFN48)



4.2 Pin Description

Pin #	Symbol	I/O	Description
USB2.0 BUS Interface			
10	USB_DP	AIO	USB 2.0 data positive (USB D+ signal).
11	USB_DM	AIO	USB 2.0 data negative (USB D- signal).
13	REF	GND	External Reference. Requires 1% precision 6.25k/6.2k resistor to ground
Power/Ground			
1	VDD	AO	VDD for companion digital IO power
9	DV12S	AO	Regulated 1.2V output for core power
14	D3V3	AO	3.3V power output from integrated VBUS-to-3.3V regulator and I/O interface
12	VBUS	AI	USB bus 5.0V power input for integrated multiple regulators. This power pin can accept 3.3V of USB power input for 3.3V system
23	AVDD	AO	Analog power
35	CPVPP	AO	Charge Pump Positive Voltage Output
36	CPVDD	AO	Charge Pump Voltage Input
41	CPVEE	AO	Charge Pump Negative Voltage Output
29	MICVDD	AO	Microphone bias power
25	AGND	GND	Analog Ground.
24	VREF	AO	Analog I/O reference voltage
32	CPVREF	AO	Analog I/O reference voltage
20	DACREF	AO	DAC/ADC reference voltage
38	CPN1	AO	Charge pump Bucket Capacitor
37	CPP1	AO	Charge pump Bucket Capacitor
40	CPN2	AO	Charge pump Bucket Capacitor
39	CPP2	AO	Charge pump Bucket Capacitor
Analog Audio Interface			
21	LINE_L	AI	Line input left channel
22	LINE_R	AI	Line input right channel
26	SLEEVE	AI	Combo jack microphone input
27	RING2	AI	Combo jack microphone input
34	HP OUT_R	AO	Headphone output Right channel
33	HP OUT_L	AO	Headphone output Left channel
30	MIC_BIAS1	AO	MIC BIAS Voltage output
31	MIC_BIAS2	AO	MIC BIAS Voltage output
28	MIC_CAP	AI	Microphone input reference voltage
GPIO/SPI/SPDIF Interface			
8	GPIO_AL[0] /IRQ	DIO	General purpose input and output; operates even in USB suspend mode
7	GPIO_AL[1] /Codec_PWDN	DIO	General purpose input and output; operates even in USB suspend mode
19	SPI-WP#/GPIO[0]	DIO	SPI serial flash write protected/General purpose input and output
17	SPI-MISO/GPIO[1]	DIO	Serial data out from external flash/General purpose input and output
18	SPI-MOSI/GPIO[2]	DIO	Serial data in to external flash/General purpose input and output
16	SPI-SCK/GPIO[3]	DIO	Clock signal to external flash/General purpose input and output
15	SPI-CS#/GPIO[4]	DIO	Chip select to external flash/General purpose input and output
42	GPIO[5]/JD0	DIO	Serial data receive/General purpose input and output/Jack detection
43	GPIO [6] /SPDIF_OUT	DIO	Serial data transmit/General purpose input and output/SPDIF-Out
44	GPIO[7]	DIO	General purpose input and output
45	GPIO[8]	DIO	General purpose input and output
46	GPIO[9]/LED	DIO	General purpose input and output/LED controller
2-Wire Serial Bus (I2C)			
47	I2C_SDAT	DIO	I2C Bus Data Pin
48	I2C_SCLK	DIO	I2C Bus Clock to Host

5 Electrical Characteristics

5.1 Absolute Maximum Ratings

Table. Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supplies Digital Power	VBus	-0.3	5.0	5.5	V
Ambient Operating Temperature	Ta	0	-	+70	°C
Storage Temperature	Ts	-40	-	+125	°C
ESD (Electrostatic Discharge)					
-	Susceptibility Voltage				
All Pins	Pass 3500V				

5.2 Recommended Operation Condition

Table. Operation Condition

Symbol	Description	Min.	Typ.	Max.	Unit
VBus	Supply Voltage	4.75	5	5.25	V

5.3 DC Characteristics

Table. DC Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit
V_{IH}	Input Voltage High	2	-	3.3	V
V_{IL}	Input Voltage Low	-0.5	-	0.8	V
V_{OH}	Output Voltage High	2.4	-	-	V
V_{OL}	Output Voltage Low	-	-	0.4	V
I_{OH}	Output Current High	-	-	4	mA
I_{OL}	Output Current Low	-	-	4	mA

5.4 SPDIF Output Timing

Table 1. SPDIF Output Timing

Parameter	Symbol	Minimum	Typical	Maximum	Units
SPDIF-OUT Frequency	-	-	3.072	-	MHz
SPDIF-OUT Period	Tcycle	-	325.6	-	ns
SPDIF-OUT Jitter	Tjitter	-	-	4	ns
SPDIF-OUT High Level Width	THigh	156.2 (48%)	162.8 (50%)	169.2 (52%)	ns (%)
SPDIF-OUT Low Level Width	TLow	156.2 (48%)	162.8 (50%)	169.2 (52%)	ns (%)

Parameter	Symbol	Minimum	Typical	Maximum	Units
SPDIF-OUT Rising Time	Trise	-	2.0	-	ns
SPDIF-OUT Falling Time	Tfall	-	2.0	-	ns

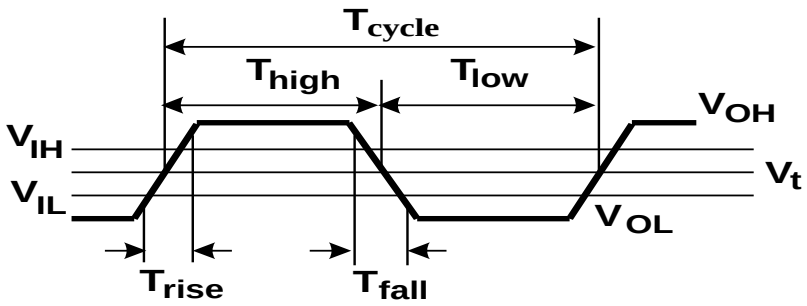


Figure 1. SPDIF Output Timing

5.5 I2C Control Interface

Table 2. I2C Control Interface

Parameter	Symbol	Min	Typ	Max	Units
Clock Low pulse duration	Tw(9)	1.3	-	-	μs
Clock High pulse duration	Tw(10)	0.6	-	-	μs
Clock frequency	f	0	-	400(*2)	KHz
Setup time for a repeated START condition	Tsu(6)	600	-	-	ns
Start Hold time	Th(5)	600	-	-	ns
Data Setup time	Tsu(7)	100	-	-	ns
Data Hold time	Th(6)	-	-	900	ns
Rising time	Tr	-	-	300	ns
Falling time	Tf	-	-	300	ns
Setup time	Tsu(8)	600	-	-	ns
Bus free time between a STOP and START condition	Tbuf	1.3	-	-	μs
Pulse width of spikes suppressed input filter	Tsp	0	-	50	ns

Note 1: The host must be applied the MCLK clock during I2C control interface access.

*Note 2: If MCLK provide 256*8KHz, I2C clock frequency only can support 400 KHz*

Note 3: There is no need for MCLK in I2C communications.

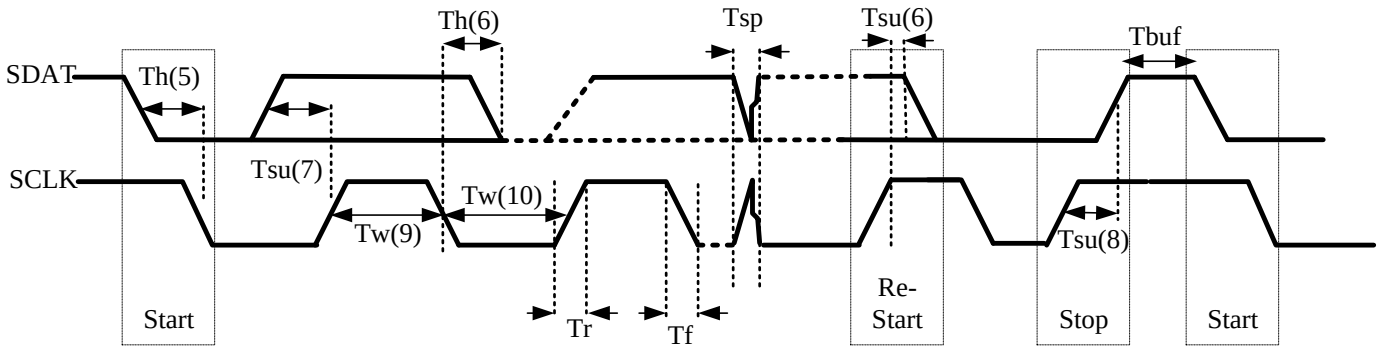


Figure 2. I2C Control Interface

5.6 Analog Performance

Standard Test Conditions Tambient=25°C, VBUS=5.0V ±5%

1kHz input sine wave; Sampling frequency=48kHz; 0dB=1Vrms

10KΩ/50pF load; Test bench Characterization BW: 20Hz~22kHz

Table 3. Analog Performance

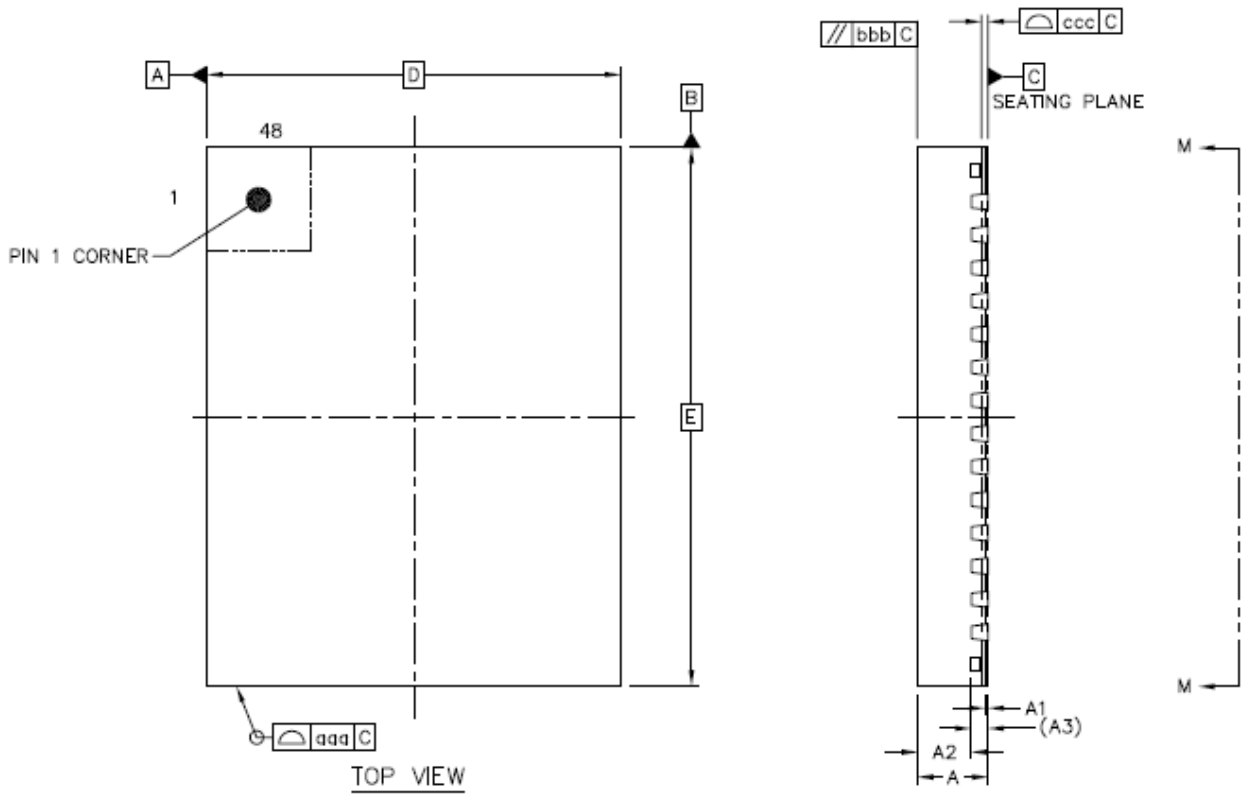
Parameter	Min	Typ	Max	Units
Full-Scale Input Voltage				
All ADC (Gain=0dB)	-	0.6	-	Vrms
Line Input		0.6		
MIC Input		0.6		
Full-Scale Output Voltage	-		-	
All DAC (Gain=0dB)	-	1.0	-	
Headphone Out @10KΩ load	-	1.0	-	Vrms
Headphone Out @32Ω load	-	1.0	-	
Headphone Out @16Ω Load	-	0.9	-	
SNR (A Weighted)				
ADC	-	94	-	
DAC	-	100	-	
Headphone Out @32Ω Load	-	98	-	dB FSA
Headphone Out @16Ω Load	-	98	-	
MIC_IN to Stereo ADC with 0dB	-	93	-	
LINE_IN to stereo ADC with 0dB	-	93	-	

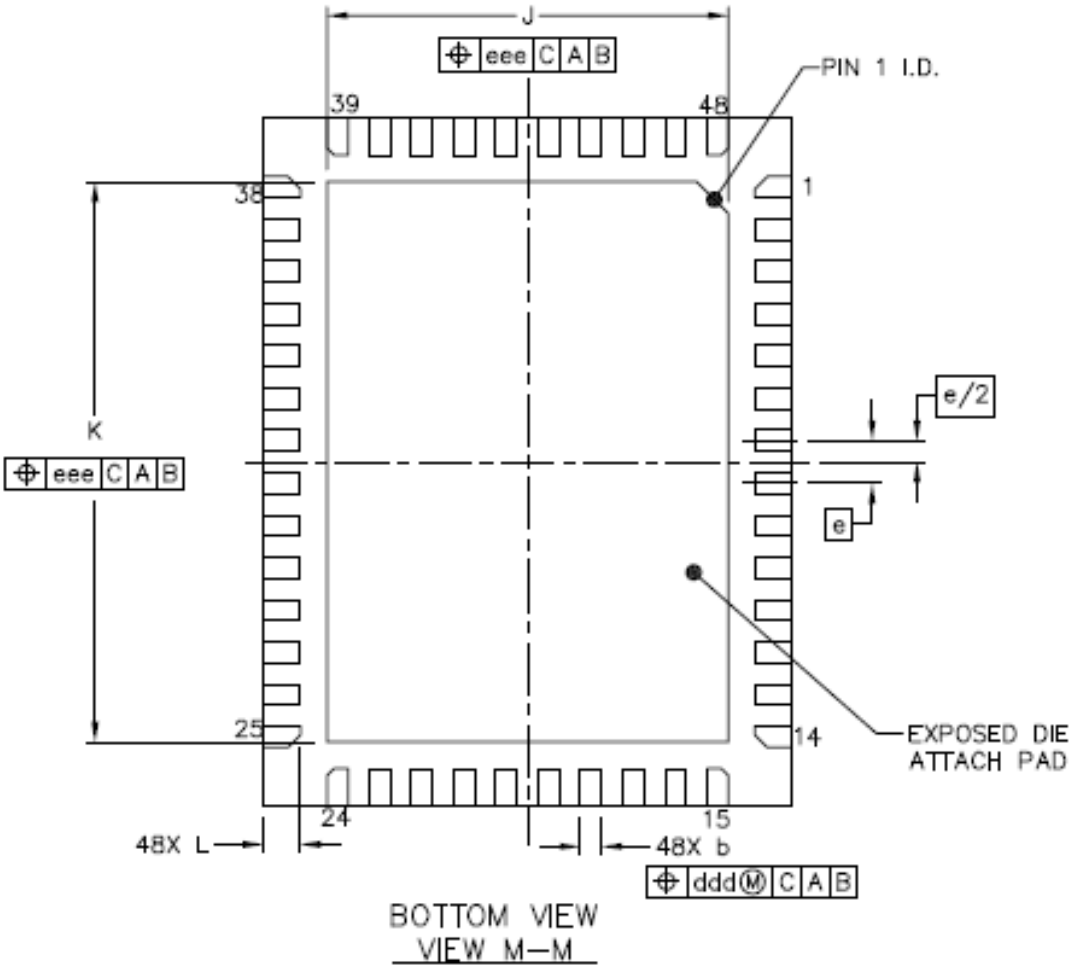
Parameter	Min	Typ	Max	Units
Total Harmonic Distortion Plus Noise, THD+N				
ADC	-	-84	-	
DAC	-	-85	-	dB FS
Headphone Out @32Ω Load	-	-81	-	
Headphone Out @16Ω Load	-	-81	-	
Frequency Response				
ADC (-3dB lower edge, -1dB higher edge)	10	-	0.454*Fs	Hz
DAC (-3dB lower edge, -1dB higher edge)	10	-	0.454*Fs	
Crosstalk	-	-80	-	dB
Current consumption @ Idle(No loading)	-	-	32	mA
Current consumption @ Idle(32Ω loading)	-	-	32	
Current consumption @ Active (Play+Record No loading)	-	-	33	mA
Current consumption @ Active (Play+Record 32Ω loading)	-	-	59	
Current consumption @ Suspend	-	-	455	μA

Note: FSA=Full-Scale with A-weighting filter. FS=Full-Scale.

6.Package Dimension of CM6642

48-Lead Thin Plastic Quad Flatpack (QFN)





		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	0.9
STAND OFF		A1	0	0.035	0.05
MOLD THICKNESS		A2	---	0.65	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		5 BSC	
	Y	E		6.5 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	J	3.7	3.8	3.9
	Y	K	5.2	5.3	5.4
LEAD LENGTH		L	0.3	0.35	0.4
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		bbb		0.1	
COPLANARITY		ccc		0.08	
LEAD OFFSET		ddd		0.1	
EXPOSED PAD OFFSET		eee		0.1	

—End of Datasheet—

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