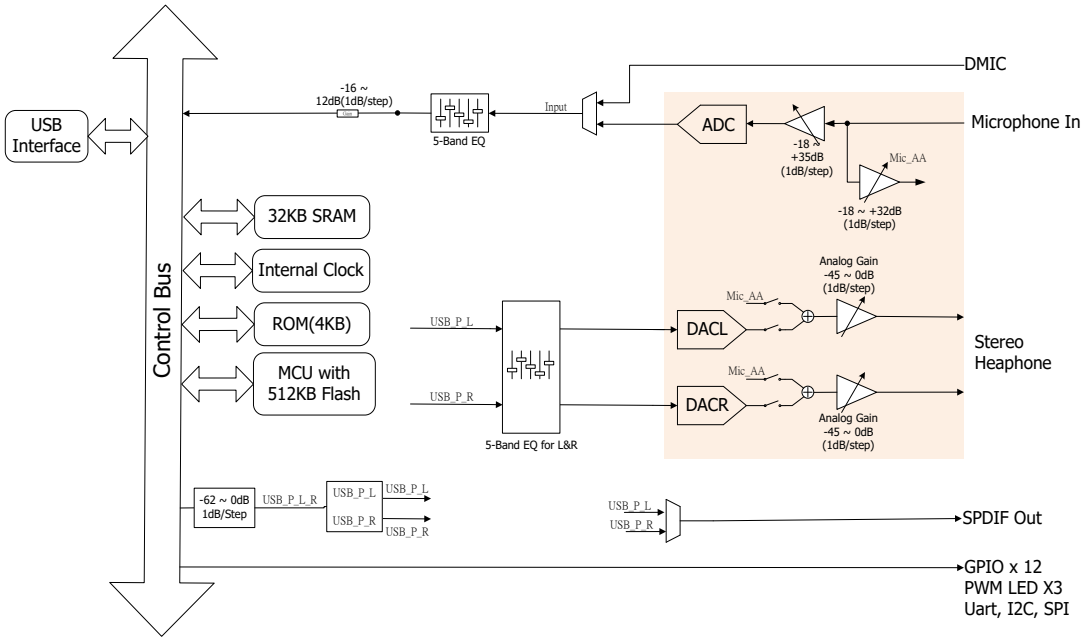
DESCRIPTION

The CM3271 is the new generation ultra-low-power USB audio single chip designed especially for mobile USB-C headset, audio adapter or dock applications. It features cap-less/anti-pop headphone driver, combo-jack swap & jack-detection, Google buttons detection, embedded oscillator, flash, tri-color LED PWM driver, Digital EQ, DC-DC converter, etc., which can fulfill cost-effective, low-power, and versatile USB Type-C Audio accessories in a concise design for Android smartphones, tablets, Teams Headset ,New iPad Pro(2018), and PC. It also supports automatic power-down and active modes switch when the 3.5mm headset is unplugged or plugged-in to save the power consumption in USB-C audio adapter/dongle applications. Besides, it has Google headset 4-button in-line control detection and CTIA/OMTP typed headset/headphone auto switch. The integrated digital EQ and tri-color LED driver can bring more differentiation to the USB-C audio accessories. Up-to -96KHz/24bit codec support can facilitate Hi-Res Audio products.

FEATURES

- Supports complete power management with auto power-down mode (no 3.5mm headset plug-in)
- Ultra-low-power consumption design with internal DC-DC converter (@USB5V) : 0A @ power-down; 18.7mA @standby; 22mA @active playback
- Accepts USB 5V or 3.3V power supply
- Embedded 8051 MCU with internal 512KB flash
- Embedded oscillator for Crystal-less design
- True Cap-less/zero-ground headphone driver with patent applied anti-pop technology
- Supports OMTP and CTIA 4-ring combo jack auto switch and jack detection
- Supports 4 in-line Google buttons headset detection
- Built-in 5-band parametric Equalizer for both playback and recording
- Integrated Tri-Color LED PWM driver
- 2-ch DACs w/ 96dB SNR; 1-ch ADC 90dB SNR
- Up to 96KHz/24bit Hi-Res playback or recording
- Built-in S/PDIF transmitter
- USB2.0 Full-Speed and USB Audio Device Class 1.0
- CM3271 Small QFN-48 package (5x5 mm)

BLOCK DIAGRAM



Release Notes

Revision	Date	Description
1.00	2022/01/01	Formal release

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1 Description and Overview

The CM3271 is the new generation ultra-low-power USB audio single chip designed especially for mobile USB-C headset, audio adapter or dock applications. It features cap-less/anti-pop headphone driver, combo-jack swap & jack-detection, Google buttons detection, embedded oscillator, flash, tri-color LED PWM driver, Digital EQ, DC-DC converter, etc., which can fulfill cost-effective, low-power, and versatile USB Type-C Audio accessories in a concise design for Android smartphones, tablets, Teams Headset, New iPad Pro(2018), and PC. It also supports power-down and active modes auto switch when the 3.5mm headset is unplugged or plugged-in. While no playback or recording activities, it will enter Standby mode to save the codec power consumption in USB-C audio adapter/dongle applications. Besides, it has Google headset 4-button in-line control detection and 4-ring CTIA/OMTP typed headset/3-ring headphone auto identification and switch. The integrated digital parametric 5-band Equalizers for both playback & recording streams and tri-color LED driver can bring more differentiation to the USB-C audio accessories. Up-to 96KHz/24bit codec support can facilitate Hi-Res Audio products.

2 Ordering Information

Product Name	Package Marking	Package Type	Transport Media	Storage Temperature
CM3271	CM3271	QFN-48 (5 x 5 mm) Green Package	Tray	-45 to 120℃

3 Features

3.1 Ultra-Low-Power Design

- Supports complete power management including power-down, standby (idle), active modes
- Supports auto power-down mode while 3.5mm headset is unplugged
- Built-in high efficiency DC-DC converter to avoid power consumption of analog regulators
- Low-power true Cap-less/zero-ground headphone driver with “Dynamic Power Saving” feature to adjust the power voltage according to the playback audio content dynamically
- Current consumption (@USB5V) : 0A @ power-down; 18.7mA @standby; 22mA @active playback
- Accepts single USB 5V or 3.3V power supply (3.3V can even lower the total power consumption)

3.2 Audio I/O

- True cap-less/zero-ground stereo headphone driver with patent applied anti-pop technology for power on/off
- Built-in charge pump for internal +/- power rails
- Mono microphone input with linear/low-noise preamp gain control and mic bias
- Supports different 4-pole headsets: CTIA/OMTP mic/ground auto switch
- 4-ring headset combo jack detection (plugging & unplugging)
- Supports 4 in-line Google Android headset buttons detection (Play_Pause/Vol+/Vol-/VoiceCommand)
- S/PDIF Out transmitter

3.3 Audio Engine and Codec

- Playback Stream:
  - Stereo DAC:
    - Sample Rates: 8K/11.025K/16K/22.05K/32K/44.1K/48K/88.2K/96K Hz
    - Bit Depth: 16/24 bit
    - Analog Gain Range: -45 ~ 0dB, 1dB/step
    - Digital Gain Range: -62 ~ 0dB, 1dB/step
    - SNR: ~96dB
  - S/PDIF Transmitter:
    - Sample Rates: 44.1K/48K/88.2K/96K
    - Bit Depth: 16/24 bits
  - 5-band Digital Parametric Equalizer
- Recording Stream:
  - Mono ADC
    - Sample Rates: 8K/11.025K/16K/22.05K/32K/44.1K/48K/88.2K/96K
    - Bit Depth: 16/24 bits
    - Microphone gain range is -18 ~ +35dB, 1dB/step

- Digital Gain Range: -16 ~ +12dB, 1dB/step
- SNR: ~90dB (86dB @+20dB Mic gain)

➢ 5-band Digital Parametric Equalizer

➢ Optional Mic Noise Gate and Mic AGC functions via FW programming

- A-A Mixer (Sidetone):
  - ➢ Analog input to analog output mixer path with independent volume control: -18 ~ +32dB, 1dB/step

Note: The settings/USB descriptors above are programmable by the embedded MCU firmware in the internal flash memory.

3.4 USB Compliance

- USB 2.0 full-speed compliant
- USB Audio Class 1.0 compliant
- USB Human Interface Device (HID) Class 1.1 compliant
- Supports USB suspend/resume/reset functions
- Supports control, interrupt, bulk, and isochronous data transfers
- Supports Teams application and button functions

3.5 Integrated 8051 Micro-processor

- Embedded 8051 micro-processor to handle the command/protocol transactions
- Embedded 512KB Flash memory for FW to save the external memory cost and size
- HID interrupts can be implemented via firmware codes
- VID/PID/Product String/USB Audio Descriptors/HW Configuration can be programmable via the MCU firmware
- Provides firmware upgrade capability through USB interface

3.6 Digital/Control Interface

- Built-in Tri-color LED PWM Driver for fashionable shiny headset design
- Master/Slave I2C control interface (100/400Kbps)
- One high-speed 4-wire SPI mater / slave interface (150K to 12M bps)
- Max. 12 GPIO pins can be configured via firmware programming (3.3V digital I/O pads with 5V tolerance)
- USB HID button controls such as Vol+/Vol-/Play_Pause/Next/Previous/Playback Mute/etc. could be done via GPIO pins and FW programming

3.7 Miscellaneous

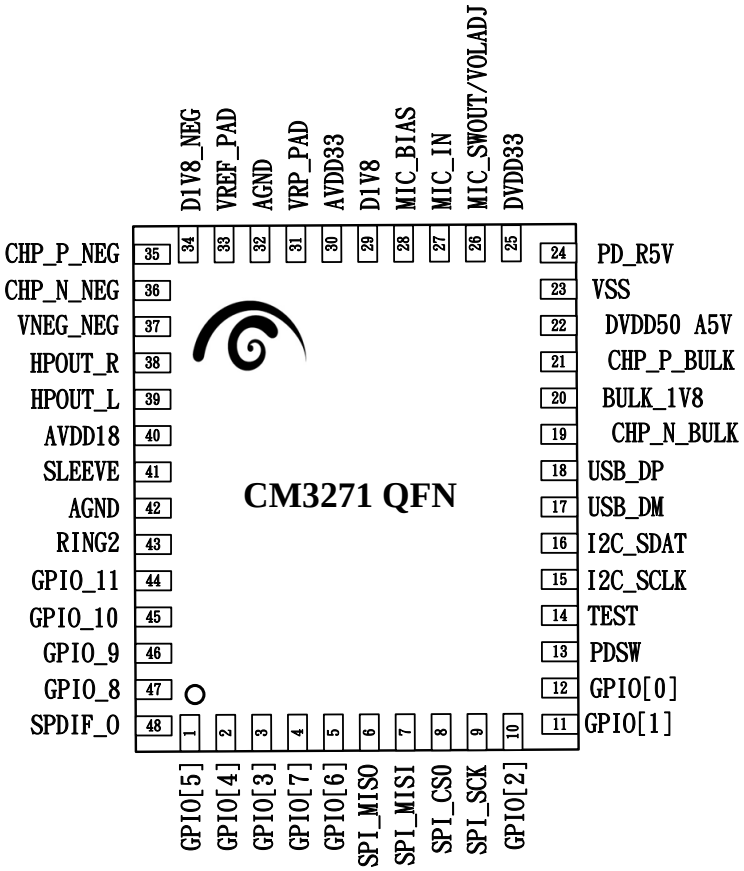
- Integrated oscillator/PLL circuit for crystal-less design (saving the external crystal)
- Industrial standard QFN-48 small package (5x5 mm)

4 Applications

- Low-power USB-C Teams Headset
- Low-power USB-C Audio Adaptors (USB to 3.5mm headset jack, with or w/o USB PD charging feature) for Android Smartphones/Apple New iPad Pro/PC
- Low-power USB-C Headsets for Android Smartphones/Apple New iPad Pro/PC
- USB-C Audio Dock Stations for Android Smartphones/Apple New iPad Pro/PC
- Low-power/High-quality USB Microphone

5 Pin Assignment

5.1 Pin-out Diagram



5.2 Pin Description

Pin #	Symbol	I/O	Description
USB2.0 FS BUS Interface			
18	USB_DP	AIO	USB data positive (USB D+ signal).
17	USB_DM	AIO	USB data negative (USB D- signal).
Power/Ground			
25	DVDD33	AO	Digital 3.3V regulator output, drive capacity
29	D1V8	AO	Digital 1.8V output, no current drive capacity
22	DVDD50 A5V	PWR	USB5V digital/analog single power
30	AVDD33	PWR	Analog 3.3V regulator output, no current drive capacity
34	D1V8_NEG	PWR	Power of negative charge pump
40	AVDD18	PWR	Analog 1.8V input to Digital power
19	CHP_N_BULK	PWR	Charge pump negative output of DC to DC
20	BULK_1V8	PWR	DC to DC step down regulator output
21	CHP_P_BULK	PWR	Charge pump positive output of DC to DC
23	VSS	GND	Digital Ground
42	AGND	GND	Analog Ground
32	AGND	GND	Analog Ground
37	VNEG_NEG	PWR	Negative charge pump output
36	CHP_N_NEG	PWR	Charge pump negative output of DC to DC
35	CHP_P_NEG	PWR	Charge pump positive output of DC to DC
49	VSS	GND	Digital Ground.
Audio Interface			
43	RING2	AI	Combo jack connector: Ring2
41	SLEEVE	AI	Combo jack connector: Sleeve
27	MIC_IN	AI	Microphone Input
28	MIC_BIAS	AO	Microphone Bias for ECM microphone
26	MIC_SWOUT/ VOLADJ	AIO	Combo jack switch output to microphone input pin; or potentiometer input (SAR ADC) when combo jack switch is not used
33	VREF_PAD	AO	Voltage reference for common mode voltage
31	VRP_PAD	AO	Voltage reference for DAC
39	HPOUT_L	AO	Line/HP out left channel
38	HPOUT_R	AO	Line/HP out right channel
S/PDIF I/O			
48	SPDIF_O	DO	S/PDIF transmitter SPDIF_O is an output buffer with 8mA Tri-state.
GPIO			
12	GPIO_0	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
11	GPIO_1	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
10	GPIO_2	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
3	GPIO_3	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
2	GPIO_4	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
1	GPIO_5	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
5	GPIO_6	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input

4	GPIO_7	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
47	GPIO_8	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
46	GPIO_9	DIO	3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
45	GPIO_10	DIO	(DMIC_CLK) 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
44	GPIO_11	DIO	(DMIC_DAT) 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
4-Wire SPI Serial Bus			
6	SPI_MISO	DIO	SPI data master in/slave out, 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-down for input
7	SPI_MOSI	DIO	SPI data master out/slave in, 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-down for input
8	SPI_CS0	DIO	SPI chip select, 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-up for input
9	SPI_SCK	DIO	SPI clock, 3.3V I/O, 5V tolerance, bidirectional buffer with 8mA driving current, Default weak pull-down for input
2-Wire Serial Bus (I2C)			
16	I2C_SDAT	DIO	2-wire serial data, 3.3V I/O, 5V tolerant, bidirectional buffer with 8mA driving current, Default weak pull-up for input
15	I2C_SCLK	DIO	2-wire serial clock, 3.3V I/O, 5V tolerant, bidirectional buffer with 8mA driving current, Default weak pull-up for input
Miscellaneous			
13	PDSW	DO	Power Down Switch is an output buffer with 8mA Tri-state output Active mode: 0 Suspend mode: 1
14	TEST	DI	The TEST pin is used IC test, another one is in the situation when F/W was crash or USB was not recognized, Set TEST pin to 3.3V before USB connect can force MCU into boot loader mode and able to update F/W via configuration tool, Default weak pull-down for input 1: Boot loader mode 0 or floating: Normal operation
24	PD_R5V	DI	Power Down pin for jack detection

**Note1: GPIOs, I2C, SPI, SPDIF, MIC_JD, MIC_IN, RING2, MBIASL, MBIASR_SLEEVE, VAG, LOUTL, LOCOM, LOUTR, VOLADJ, PDSW pins can be left floating if not in use.

**Note2: Suggest connect TEST pin to GND by default.

6 Electrical Characteristics

6.1 Absolute Maximum Ratings

Test conditions: DV50 = 5V, AV50 = 5V, DGND =0V, TA=+25°C

Parameter	Symbol	Min.	Typ	Max.	Unit
Storge temperature	T_S	-45	-	120	°C
Operating ambient temperature	T_A	-15	25	70	°C
Power supply voltage(DVDD50_A5V)		3.0	5.0	5.5	V
Digital I/O pin voltage	-	GND	3.3	5.0	V
ESD (Body mode)			±4000		V
ESD (Machine mode)			±200		V

6.2 Recommended Operation Conditions

Parameter	Symbol	Min.	Typ	Max.	Unit
Power supply voltage	-	3.3	4.3	4.7	V
Operating ambient temperature		0	25	70	°C
MCU Clock	-		12.000		MHz

6.3 Power Consumption

Test Conditions: DVDD50_A5V=USB 5V, DGND =0V, TA=+25°C, MCU Clock = 12MHz @ Active, Sample Rate=48kHz, 16Bits, EQ/SPDIF-Out/A-A disable, 32ohm loading

Items	Test Conditions	Test Values			Unit
		Min.	Typ.	Max.	
Current consumption @ Power down	Jack unplugged power-down mode		0		mA
Current consumption @ Standby (Idle)	MCU clock=3MHz		18.7		mA
Current consumption @ Active	Play+Record		22		mA
Current consumption @ Suspend	USB Suspend		1.1		mA

6.4 DC Characteristics

Test Conditions: DVDD50_A5V=5V, DVDD33=3.3V, DGND =0V, TA=+25°C,

Parameter	Symbol	Min.	Typ	Max.	Unit
Operation Voltage range	DVDD	3.3	4.3	4.7	V
DC Input voltage range (GPIO,I2C,SPI,SPDIF)	DCVin	-0.3		5.5	V
Input High-level voltage (GPIO,I2C,SPI,SPDIF)	Vih	2			V
Input Low-level voltage (GPIO,I2C,SPI,SPDIF)	Vil			0.8	V
Output High-level voltage (GPIO,I2C,SPI,SPDIF)	Voh	2.4	3.3	3.6	V
Output Low-level voltage (GPIO,I2C,SPI,SPDIF)	Vol	0		0.4	V
Output source current (GPIO, I2C,SPI,SPDIF)	IOH		8		mA
Output sink current (GPIO, I2C,SPI,SPDIF)	IOL		8		mA

6.5 Analog I/O Characteristics

Parameter	Symbol	Pin Name	Limit Values			Unit	Test Conditions
			Min.	Typ.	Max		
Microphone Input Impedance	MII	MIC IN	20		45	kΩ	
Microphone A-A Input Impedance	MAII	MIC IN		20		kΩ	Mic Gain=0dB
Headphone Output Impedance	HPOI	HPOUT_L HPOUT_R		TBD		Ω	Master Volume =0dB
Microphone Bias Open Circuit Voltage	VMICBIAS	MIC_BIAS	2.55	2.75	2.95	V	
Microphone Bias Output Current	IMICBIAS	MIC_BIAS			1.25	mA	RMIN=2.2kΩ
Microphone Bias Output Impedance	ROUTMICB	MIC_BIAS	600	650	700	Ω	
Power Supply Rejection Ratio (PSRR) for Microphone Bias	PSRRMICB	MIC_BIAS		100		dB	Internal regulators active, at maximum load current (0.5 mA), 1 kHz sine wave at 100 mVrms

6.6 Audio Performance

6.6.1 DAC Audio Quality

TA=25℃, DVDD50_A5V=5V, 1KHz Sinewave, 48KHz/16bit, Equalizer disable
Test Platform: DELL Desktop 32BWS02, 4G RAM, Windows 8.1 CHT

Items	Test Conditions	Test Values			Unit
		Min.	Typ.	Max.	
Full Scale Output Voltage	10KΩ loading fs=48kHz/16bit		1.0		Vrms
	32Ω loading fs=48kHz		0.86		Vrms
THD+N	10KΩ loading fs=48kHz/16bit, -3dBFS		-86dB (@1KHz)		dB
	32Ω loading fs=48kHz/16bit, -3dBFS		-80dB (@1KHz)		dB
Dynamic Range	32Ω loading fs=48kHz/16bit,-60dBFS, A-Weighted		91		dB
SNR (Noise level during playback)	10KΩ loading fs=48kHz/16bit,-96dBFS, A-Weighted		95		dB
	32Ω loading fs=48kHz/16bit,-96dBFS, A-Weighted		96		dB
Inter-Channel Phase Delay	100Hz ~ 20kHz	+0.01		+0.97	Deg
Sampling Frequency Accuracy	10KΩ loading fs=48kHz/16bit	-0.0046		+0.0078	%

Channel Separation(Crosstalk)	10KΩ loading fs=48kHz/16bit		92		dB
	32Ω loading fs=48kHz/16bit		68		dB
Frequency Response	10KΩ loading fs=48kHz/16bit	-0.075 (20Hz)		-0.967 (20KHz)	dB
Passband Ripple	10KΩ loading fs=48kHz/16bit			0.244	dB

6.6.2 ADC Audio Quality

TA=25℃, DVDD50_AV5=5V, Mic input 1KHz sinewave, Equalizer disable, AGC off, Mic Gain=0dB if not specified
Test Platform DELL Desktop 32BWS02, 4G RAM, Windows 8.1 CHT

Items	Test Conditions	Test Values			Unit
		Min.	Typ.	Max.	
Full Scale Input Voltage	Microphone fs=48kHz		800m		Vrms
THD+N	Microphone fs=48kHz/16bit, -3dBFS		-84		dB
Dynamic Range	Microphone fs=48kHz/16bit, -60dBFS, A-Weighted		90		dB
SNR (Noise level during record)	Microphone fs=48kHz/16bit, -96dBFS, A-Weighted		90 (@0dB) 86 (@+20dB)		dB
Sampling Frequency Accuracy	Microphone fs=48kHz/16bit	-0.0032		+0.0071	%
Channel Separation(Crosstalk)	Microphone fs=48kHz/16bit		80		dB
Frequency Response	Microphone fs=48kHz/16bit	0.035 (20Hz)		-0.527 (20KHz)	dB
Passband Ripple	Microphone fs=48kHz/16bit		0.244	0.3	dB

6.6.3 A-A Path (Sidetone) Audio Quality

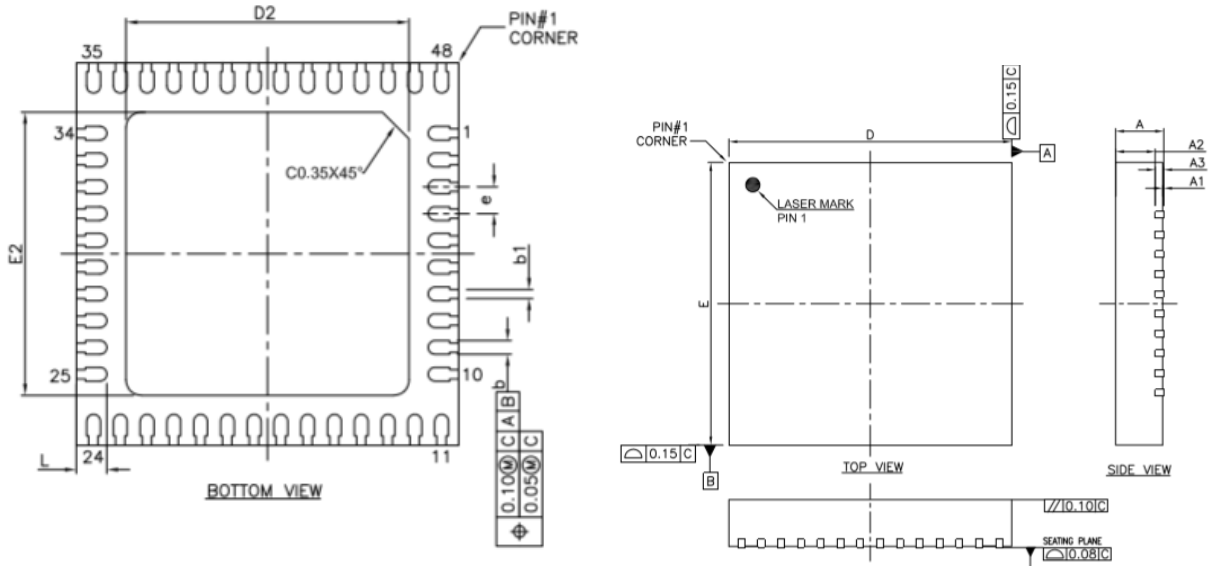
TA=25℃, DVDD50_A5V=5V, A-A Volume=0dB, 1KHz Sinewave, Mic-In to HP-Out
Test Platform: DELL Desktop 32BWS02, 4G RAM, Windows 8.1 CHT

Items	Test Conditions	Test Values			Unit
		Min.	Typ.	Max.	
Full Scale Output Voltage	10KΩ loading		800m		Vrms
THD+N	10KΩ loading, -3dBFS		-91		dB
Dynamic Range	10KΩ loading, -60dBFS, A-Weighted		93		dB
SNR (Noise level during active)	10KΩ loading, -96dBFS, A-Weighted		93		dB
Channel Separation (Cross-talk)	10KΩ loading,		90		dB

Frequency Response	10KΩ loading	+0.001 (20Hz)		-0.098 (20KHz)	dB
Passband Ripple	10KΩ loading			0.002	dB

Package Dimensions

CM3271 QFN-48 pin (5x5 mm)

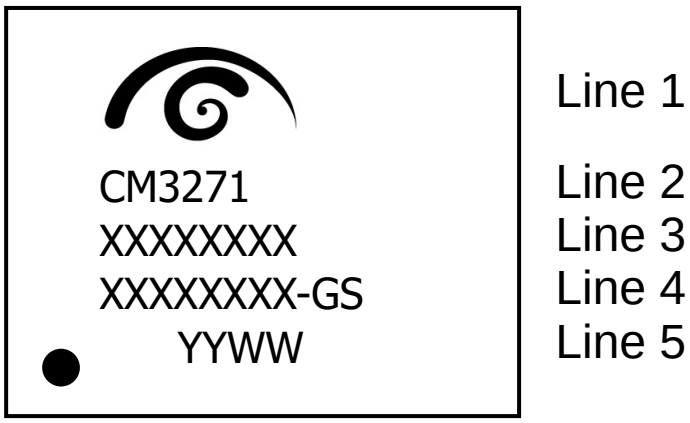


	SYMBOL	MIN.	NOM	MAX.
Total thickness	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Mold thickness	A2	0.65	0.70	0.75
Lead thickness	A3	0.15		0.203
Body size	D	4.95	5.00	5.05
	E	4.95	5.00	5.05
Lead width	b	0.13	0.18	0.23
	b1	0.07	0.12	0.17
Exposed pad width	D2	3.65	3.70	3.75
Exposed pad length	E2	3.65	3.70	3.75
Lead pitch	e		0.35 BSC	
Lead length	L	0.35	0.40	0.45
Lead count	N		48L	

CM3271
Top Marking

7 Marking Information

Description:
1. Device Name: CM3271
2. Package Type: QFN 48L 5X5 mm
3. Line 1: C-Media Logo
4. Line 2: Device Name/Part Number
5. Line 3: Internal Control Code.
6. Line 4: Internal Control Code (GS: Green Product)
7. Line 5: Date Code (YYWW)



—End of Datasheet—

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