

Ultra Low Power Mobile Audio and Telephony CODEC

Product Overview

For the full datasheet, visit

www.cirrus.com/codec-datasheets/CS42L73-41

- ◆ Stereo ADC
- ◆ Dual Analog or Digital MIC Support
- ◆ Dual MIC Bias Generators
- ◆ Four DACs Coupled to Five Outputs
 - Ground-Centered Stereo Headphone Amp.
 - Ground-Centered Stereo Line Output
 - Mono Ear Speaker Amplifier
 - Mono 1 W Speakerphone Amplifier
 - Mono Speakerphone Line Output for Stereo Speakerphone Expansion
- ◆ Three Serial Ports with Asynchronous Sample Rate Converters
- ◆ Digital Audio Mixing and Routing

Ultra Low Power Consumption

- ◆ 3.5 mW Quiescent Headphone Playback

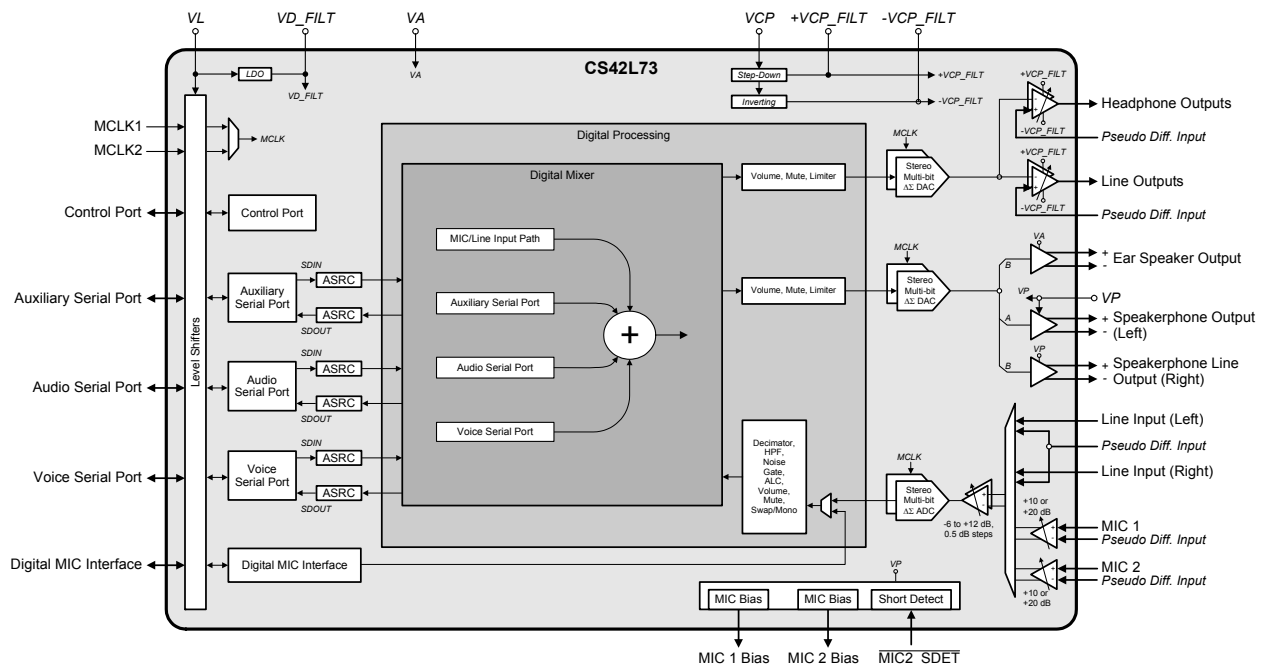
Applications

- ◆ Smart Phones, UMPCs, and MIDs

System Features

- ◆ Native (no PLL required) Support for 6/12/24 MHz, 13/26 MHz, and 19.2/38.4 MHz Master Clock Rates in Add. to Typ. Audio Clock Rates
- ◆ Integrated High-efficiency Power Management Reduces Power Consumption
 - Internal LDO Regulator to Reduce Internal Digital Operating Voltage to VL/2
 - Step-down Charge Pump Provides Low Headphone/Line Out Supply Voltage
 - Inverting Charge Pump Accommodates Low System Voltage by Providing Negative Rail for HP and Line Amp
- ◆ Flexible Speakerphone Amplifier Powering
 - 3.00 V to 5.25 V Range
 - Independent Cycling
- ◆ Power Down Management
 - Individual Controls for ADCs, Dig. MIC Interface, MIC Bias Generators, Serial Ports, and Output Amplifiers & Associated DACs
- ◆ Programmable Thermal Overload Notification
- ◆ High-speed I²C™ Control Port (400 kHz)

(Features continued on [page 2](#))



Advance Product Information

This document contains information for a new product. Cirrus Logic reserves the right to modify this product without notice.

Stereo Analog to Digital Features

- ◆ 91 dB Dynamic Range (A-wtd)
- ◆ -85 dB THD+N
- ◆ Independent ADC Channel Control
- ◆ 2:1 Stereo Analog Input MUX
- ◆ Stereo Line Input
 - Shared Pseudo-differential Reference Input
- ◆ Dual Analog MIC Inputs
 - Pseudo-diff. or Single-ended
 - Two, Independent, Programmable, Low-noise, MIC Bias Outputs
 - MIC Short Detect to Support Headset Button
- ◆ Analog Programmable Gain Amplifier (PGA) (+12 to -6 dB in 0.5 dB steps)
- ◆ +10 dB or +20 dB Analog MIC Boost in Addition to PGA Gain Settings
- ◆ Programmable Automatic Level Control (ALC)
 - Noise Gate for Noise Suppression
 - Progr. Threshold & Attack/Release Rates

Dual Digital Microphone Interface

- ◆ Programmable Clock Rate
 - Integer Divide by 2 or 4 of Internal MCLK

Stereo DAC to Headphone Amplifier

- ◆ 94 dB Dynamic Range (A-wtd)
- ◆ -81 dB THD+N into 32 Ω
- ◆ Integrated Step-down/Inverting Charge Pump
- ◆ Class H Amplifier - Automatic Supply Adj.
 - High Efficiency
 - Low EMI
- ◆ Pseudo-differential Ground-centered Outputs
- ◆ High HP Power Output at -70/-81 dB THD+N
 - 2 x 17/8.5 mW into 16/32 Ω @ 1.8 V
- ◆ Pop and Click Suppression
- ◆ Analog Vol. Ctl. (+12 to -50 dB in 1 dB steps; to -76 dB in 2 dB steps) with Zero-cross Trans.
- ◆ Digital Vol. Ctl. (+12 to -102 dB in 0.5 dB steps) with Soft-ramp Transitions
- ◆ Programmable Peak-detect and Limiter

Stereo DAC to Line Outputs

- ◆ 97 dB Dynamic Range (A-wtd)
- ◆ -86 dB THD+N
- ◆ Class-H Amplifier
- ◆ Pseudo-differential Ground-centered Outputs
- ◆ 1 V_{RMS} Line Output @ 1.8 V
- ◆ Pop and Click Suppression

- ◆ Analog Vol. Ctl. (+12 to -50 dB in 1 dB steps; to -76 dB in 2 dB steps) with Zero-cross Trans.
- ◆ Digital Vol. Ctl. (+12 to -102 dB in 0.5 dB steps) with Soft-ramp Transitions
- ◆ Programmable Peak-detect and Limiter

Mono DAC to Ear Speaker Amplifier

- ◆ High Power Output at -70 dB (0.032%) THD+N
 - 45 mW into 16 Ω @ 1.8 V
- ◆ Pop and Click Suppression
- ◆ Digital Vol. Ctl. (+12 to -102 dB in 0.5 dB steps) with Soft-ramp Transitions
- ◆ Programmable Peak-detect and Limiter

Mono DAC to Speakerphone Amplifier

- ◆ High Output Power at $\leq 1\%$ THD+N
 - 1.18/0.84/0.66 W into 8 Ω @ 5.0/4.2/3.7 V
- ◆ Direct Battery-powered Operation
- ◆ Pop and Click Suppression
- ◆ Digital Vol. Ctl. (+12 to -102 dB in 0.5 dB steps) with Soft-ramp Transitions
- ◆ Programmable Peak-detect and Limiter

Mono DAC to Speakerph. Line Output

- ◆ 84 dB Dynamic Range (A-wtd)
- ◆ -75 dB THD+N
- ◆ High Voltage (1.53 V_{RMS} @ V_A = 1.8 V, V_P = 3.7 V) Line Output to Ensure Maximum Output from a Wide Variety of External Amplifiers
- ◆ Pop and Click Suppression
- ◆ Digital Vol. Ctl. (+12 to -102 dB in 0.5 dB steps) with Soft-ramp Transitions
- ◆ Programmable Peak-detect and Limiter

Serial Ports

- ◆ Three Independent Serial Ports: Auxiliary, Audio, and Voice
- ◆ 8.00, 11.025, 12.00, 16.00, 22.05, 24.00, 32.00, 44.10, and 48.00 kHz Sample Rates
- ◆ All Ports Support Master or Slave Operation with I²S Interface
- ◆ Auxiliary and Voice Ports Support Slave Operation with PCM Interface
- ◆ Auxiliary and Audio Ports are Stereo-Input/Stereo-Output to/from Digital Mixer
- ◆ Voice Port is Mono-Input/Stereo-Output to/from Digital Mixer
- ◆ Integrated Asynch. Sample Rate Converters

General Description

The CS42L73 is a highly integrated, low-power, audio and telephony CODEC for portable applications such as smartphones and ultra mobile personal computers.

The CS42L73 features a **flexible clocking architecture**, allowing the device to utilize reference clock frequencies of 6, 12, 24, 13, 26, 19.2, or 38.4 MHz, or any standard audio master clock. Up to two reference/master clock sources may be connected; either one can be selected to drive the internal clocks and processing rate of the CS42L73. Thus, multiple master clock sources within a system can be dynamically activated and de-activated to minimize system-level power consumption.

Three asynchronous bidirectional serial ports (Auxiliary, Audio, and Voice Serial Ports) support multiple clock domains of various digital audio sources or destinations. Three low-latency, fast-locking, integrated **high-performance asynchronous sample rate converters** synchronize and convert the audio samples to the internal processing rate of the CS42L73.

A stereo line input or two mono (one stereo) microphone (MIC) inputs are routed to a **stereo ADC**. The MIC inputs may be selectively pre-amplified by +10 or +20 dB. Two independent, low-noise MIC bias voltage supplies are also provided. A programmable gain amplifier (PGA) is applied to the inputs before they reach the ADC.

The **stereo input path** that follows the stereo ADC begins with a multiplexer to selectively choose data from a **digital MIC interface**. Following the multiplexer, the data is decimated, selectively DC high-pass filtered, channel-swapped or mono-to-stereo routed (fanned-out), and volume adjusted or muted. The volume levels can be automatically adjusted via a programmable Automatic Level Control (ALC) and noise gate.

A **digital mixer** is utilized to mix and route the CS42L73's inputs (analog inputs to ADC, digital MIC, or serial ports) to outputs (DAC-fed amplifiers or serial ports). There is independent attenuation on each mixer input for each output.

The processing along the **output paths** from the digital mixer to the **two stereo DACs** includes volume adjustment and mute control. A peak-detector can be used to automatically adjust the volume levels via a programmable limiter.

The first stereo DAC feeds the **stereo headphone and line output amplifiers**, which are powered from a dedicated positive supply. An integrated **charge pump** provides a negative supply. This allows a ground-centered analog output with a wide signal swing, and eliminates external DC-blocking capacitors while reducing pops and clicks. Tri-level Class-H amplification is utilized to reduce power consumption under low-signal-level conditions. Analog volume controls are provided on the stereo headphone and line outputs.

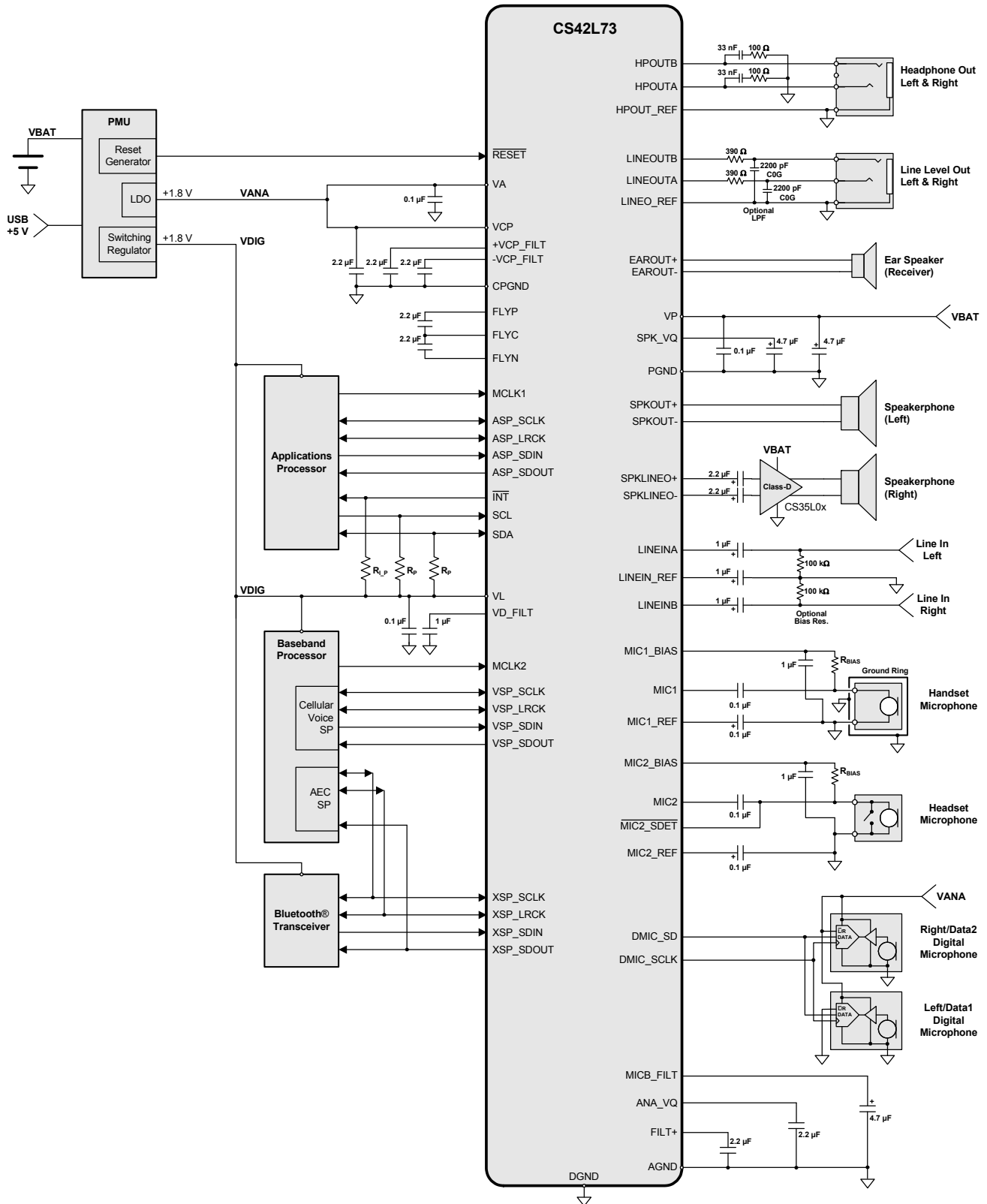
The second stereo DAC feeds several mono outputs. The left channel of the DAC sources a **mono, differential-drive, speakerphone amplifier** for driving the handset speakerphone. The right channel sources a **mono, differential-drive, earphone amplifier** for driving the handset earphone. The right channel is also routed to a **mono, differential-drive, speakerphone line output**, which may be connected to an external amplifier to implement a stereo speakerphone configuration when it is used in conjunction with the integrated speakerphone amplifier.

The CS42L73 implements **robust power management** to achieve ultra-low power consumption. High granularity in power-down controls allows individual functional blocks to be powered down when unused. The internal low drop-out regulator (LDO) saves power by running the internal digital circuits at half the logic interface supply voltage (VL/2). In a system with an existing high-efficiency supply at VL/2, the internal LDO may be disabled and the digital circuits powered directly by the external VL/2 supply.

A high-speed **I²C control port** interface capable of up to 400 kHz operation facilitates register programming.

The CS42L73 is available in space-saving 64-ball WLCSP and 65-ball FBGA packages for the commercial (-40° to +85° C) grade.

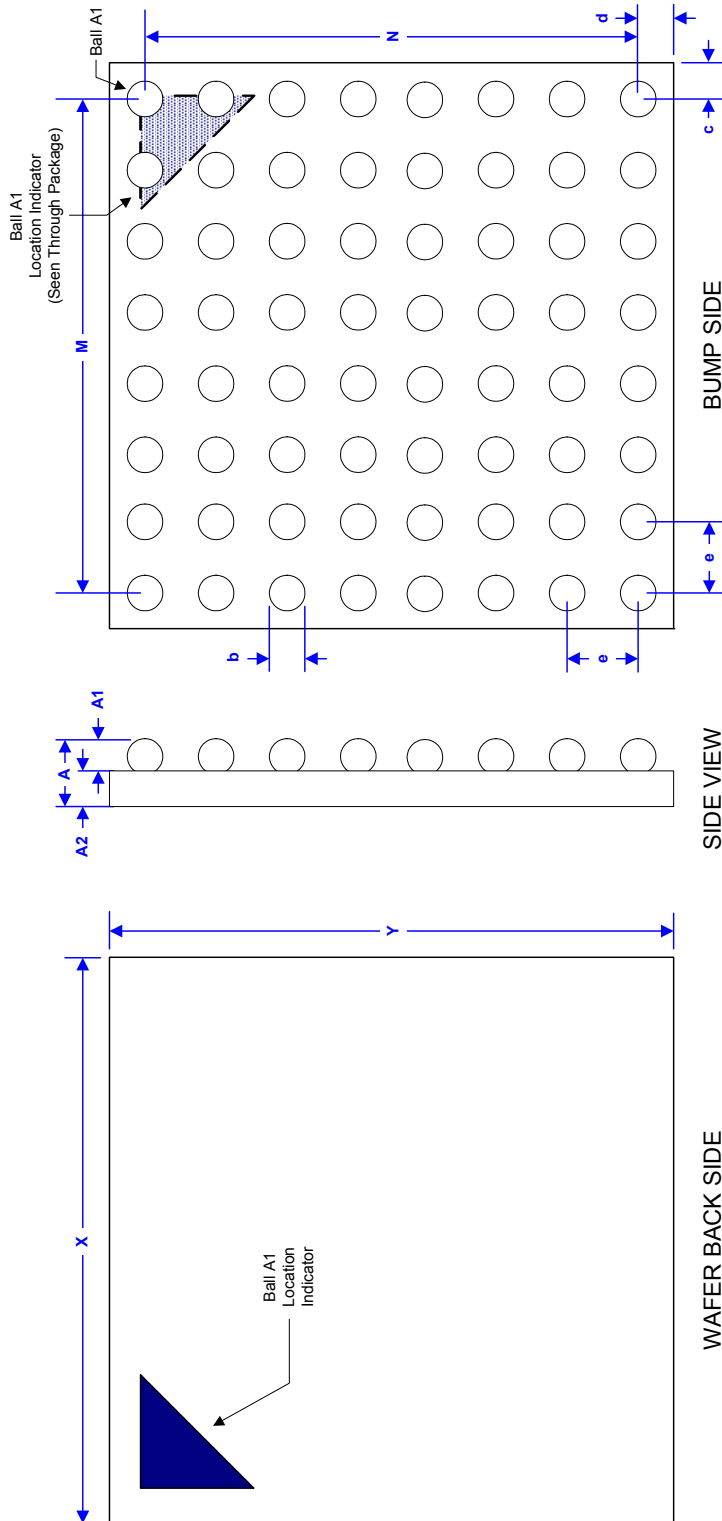
1. TYPICAL CONNECTION DIAGRAM



2. PACKAGE DIMENSIONS

2.1 WLCSP Package

64 Ball WLCSP (3.44 x 3.44 mm Body) Package Drawing



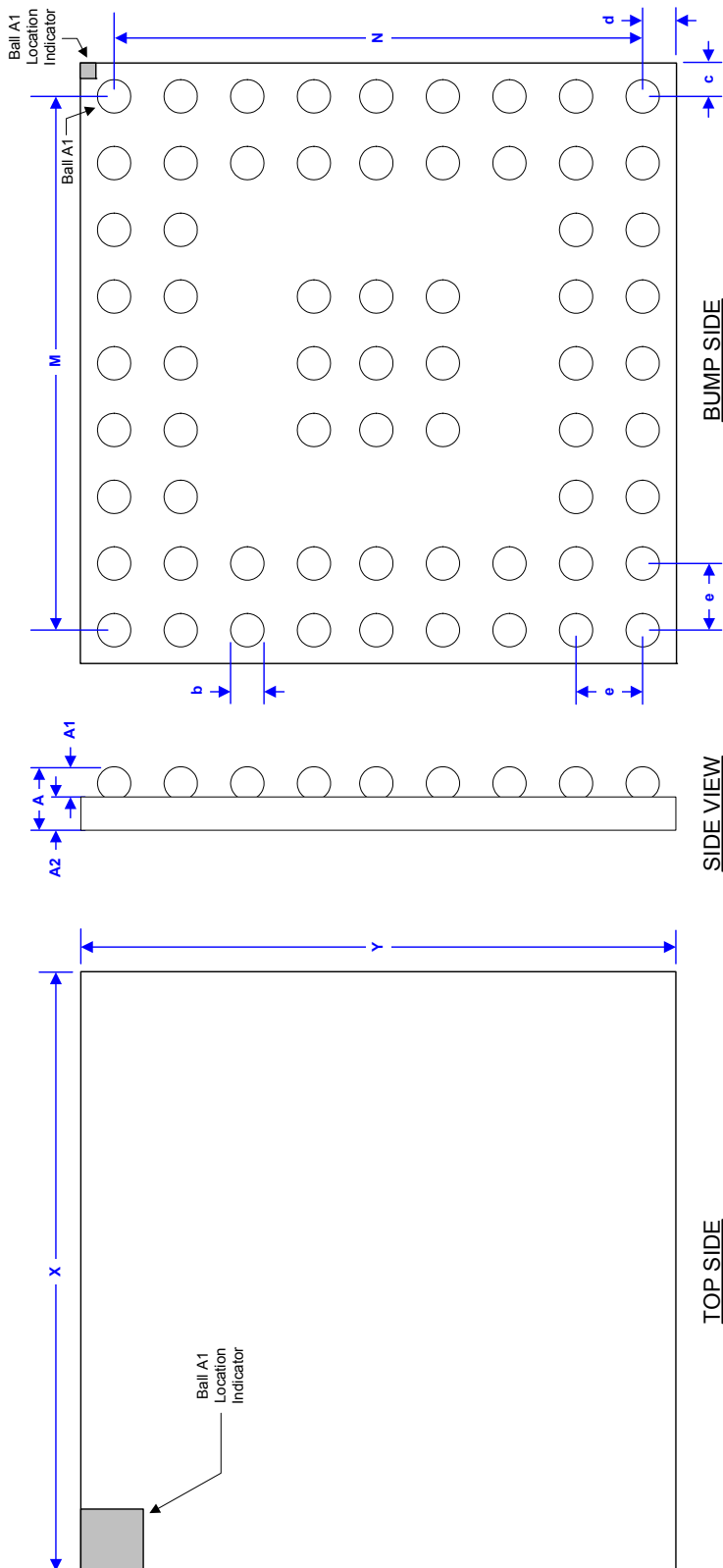
Notes:

1. Controlling dimensions are in millimeters.
2. Dimensioning and tolerances per ASME Y 14.5M-1994.
3. Dimension "b" applies to the solder sphere diameter and is measured at the midpoint between the package body and the seating plane.
4. Unless otherwise specified, tolerances are: Linear ± 0.05 mm, Angular $\pm 1^\circ$.

Dim	MILLIMETERS		
	MIN	NOM	MAX
A	0.450	0.505	0.560
A1	0.170	0.200	0.230
A2	0.280	0.305	0.330
M	-	2.800	-
N	-	2.800	-
b	0.230	0.260	0.290
c	-	0.320	-
d	-	0.320	-
e	-	0.400	-
X	3.415	3.440	3.465
Y	3.415	3.440	3.465

Controlling Dimension is Millimeters.

Table 1. WLCSP Package Dimensions

2.2 FBGA Package
65 Ball FBGA (5 x 5 mm Body) Package Drawing

Notes:

1. Controlling dimensions are in millimeters.
2. Dimensioning and tolerances per ASME Y 14.5M-1994.
3. Dimension "b" applies to the solder sphere diameter and is measured at the midpoint between the package body and the seating plane.
4. Unless otherwise specified, tolerances are: Linear ± 0.05 mm, Angular $\pm 1^\circ$.

Dim	MILLIMETERS		
	MIN	NOM	MAX
A	0.74	0.87	1.00
A1	0.16	0.21	0.26
A2	0.58	0.66	0.74
M	-	4.00	-
N	-	4.00	-
b	0.27	0.30	0.37
c	-	0.50	-
d	-	0.50	-
e	-	0.50	-
X	4.90	5.00	5.10
Y	4.90	5.00	5.10

Controlling Dimension is Millimeters.

Table 2. FBGA Package Dimensions

3. THERMAL CHARACTERISTICS

Parameter (Notes 1 and 2)	Symbol	Min	Typ	Max	Units
WLCSP Package					
Junction to Ambient Thermal Impedance	θ_{JA}	-	43	-	°C/Watt
FBGA Package					
Junction to Ambient Thermal Impedance	θ_{JA}	-	58	-	°C/Watt

Notes:

1. Test Printed Circuit Board Assembly (PCBA) constructed in accordance with JEDEC standard JESD51-9. Two signal, two plane (2s2p) PCB utilized.
2. Test conducted with still air in accordance with JEDEC standards JESD51, JESD51-2A, and JESD51-8.

4. ORDERING INFORMATION

Product	Description	Package	Pb-Free	Grade	Temp Range	Container	Order #
CS42L73	Ultra Low Power Mobile Audio and Telephony CODEC	64 Ball WLCSP	YES	Commercial	-40 to +85 °C	Tray	CS42L73-CWZ
						Tape & Reel	CS42L73-CWZR
		65 Ball FBGA				Tray	CS42L73-CRZ
						Tape & Reel	CS42L73-CRZR

Contacting Cirrus Logic Support

For all product questions and inquiries, contact a Cirrus Logic Sales Representative. To find one nearest you, go to www.cirrus.com.

IMPORTANT NOTICE

"Advance" product information describes products that are in development and subject to development changes. Cirrus Logic, Inc. and its subsidiaries ("Cirrus") believe that the information contained in this document is accurate and reliable. However, the information is subject to change without notice and is provided "AS IS" without warranty of any kind (express or implied). Customers are advised to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, indemnification, and limitation of liability. No responsibility is assumed by Cirrus for the use of this information, including use of this information as the basis for manufacture or sale of any items, or for infringement of patents or other rights of third parties. This document is the property of Cirrus and by furnishing this information, Cirrus grants no license, express or implied under any patents, mask work rights, copyrights, trademarks, trade secrets or other intellectual property rights. Cirrus owns the copyrights associated with the information contained herein and gives consent for copies to be made of the information only for use within your organization with respect to Cirrus integrated circuits or other products of Cirrus. This consent does not extend to other copying such as copying for general distribution, advertising or promotional purposes, or for creating any work for resale.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). CIRRUS PRODUCTS ARE NOT DESIGNED, AUTHORIZED OR WARRANTED FOR USE IN PRODUCTS SURGICALLY IMPLANTED INTO THE BODY, AUTOMOTIVE SAFETY OR SECURITY DEVICES, LIFE SUPPORT PRODUCTS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF CIRRUS PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK AND CIRRUS DISCLAIMS AND MAKES NO WARRANTY, EXPRESS, STATUTORY OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WITH REGARD TO ANY CIRRUS PRODUCT THAT IS USED IN SUCH A MANNER. IF THE CUSTOMER OR CUSTOMER'S CUSTOMER USES OR PERMITS THE USE OF CIRRUS PRODUCTS IN CRITICAL APPLICATIONS, CUSTOMER AGREES, BY SUCH USE, TO FULLY INDEMNIFY CIRRUS, ITS OFFICERS, DIRECTORS, EMPLOYEES, DISTRIBUTORS AND OTHER AGENTS FROM ANY AND ALL LIABILITY, INCLUDING ATTORNEYS' FEES AND COSTS, THAT MAY RESULT FROM OR ARISE IN CONNECTION WITH THESE USES.

Cirrus Logic, Cirrus, and the Cirrus Logic logo designs are trademarks of Cirrus Logic, Inc. All other brand and product names in this document may be trademarks or service marks of their respective owners.

°C is a trademark of Philips Semiconductor.

Bluetooth is a registered trademark of the Bluetooth Special Interest Group (SIG).