TI Designs
TI WiLink8™ Wi-Fi®/Bluetooth®/Bluetooth Smart Audio Multiroom Cape Reference Design

↯ TEXAS INSTRUMENTS

TI Designs

TI Designs provide the foundation that you need including methodology, testing and design files to quickly evaluate and customize the system. TI Designs help *you* accelerate your time to market.

Design Resources

TIDC-WL1837MOD-AUDIO-MULTIROOM-CAPE	Design Folder
WL1837MOD	Product Folder
PCM1808	Product Folder
PCM5101AQPWRQ1	Product Folder
TXS0108EPWR	Product Folder
TL1963A-33DCQT	Product Folder
TPS73618DBVT	Product Folder

ASK Our E2E Experts

TI E2E™ Community

Design Features

- Ultraprecise Audio Multiroom Synchronization (<20 µsecs) Between Multiple Speakers/Capes
- SDK Supports Rich Set of Online Music Services, UPnP, Airplay Audio Receiver, and GStreamer
- Wi-Fi ®Dual Band Support on 2.4-GHz Band (Featuring 2 × 2 MIMO) and Antenna Diversity on 5-GHz Band
- Wi-Fi/Bluetooth (A2DP)/Bluetooth™ Smart Co-ex and Multirole AP/Station Support
- Stereo ADC and DAC Support

Featured Applications

- Wireless Speakers
- Multiroom Speakers
- Home Theater
- Soundbar
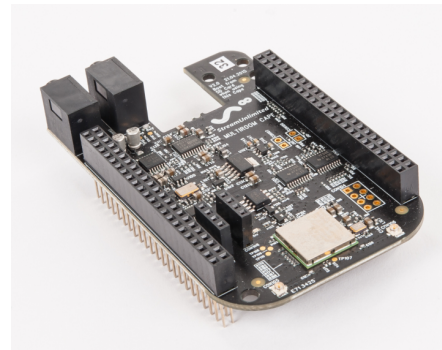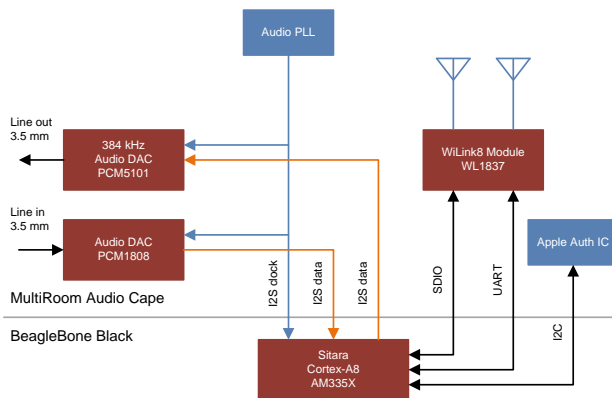
⚠ An IMPORTANT NOTICE at the end of this TI reference design addresses authorized use, intellectual property matters and other important disclaimers and information.

WiLink8, Sitara are trademarks of Texas Instruments.
Bluetooth is a trademark of Bluetooth SIG Inc.
IOS is a registered trademark of Cisco.
Android is a trademark of Google.
Linux is a registered trademark of Linus Torvalds.
Wi-Fi is a registered trademark of Wi-Fi Alliance.
All other trademarks are the property of their respective owners.

1   System Description

TI WiLink8™ WL1837MOD (http://www.ti.com/product/wl1837mod) Audio cape is a Wireless Multiroom Audio reference design used with BeagleBone Black (http://www.ti.com/tool/beaglebk featuring TI Sitara™ AM335x) TI WiLink 8 WLAN capability to capture and register precise arrival time of the connected AP's beacons is used to achieve ultraprecise synchronization between multiple connected audio devices. TI WL1837MOD offers integrated Wi-Fi/*Bluetooth*/*Bluetooth* Smart solution featuring 2.4-GHz MIMO and antenna diversity on 5-GHz band. The device offers an audio solution featuring Multiroom, Airplay receiver, full audio stack streaming, support for online music services, and more. This TI Design enables customers to design their own audio boards with TI WL1837MOD combo-connectivity and to evaluate Audio Multiroom Software.

1.1   TI WL1837MOD

The certified WiLink 8 module from TI offers high throughput and extended range along with Wi-Fi and *Bluetooth* coexistence in a power-optimized design. The WL18x7MOD is a Wi-Fi, dual-band, 2.4- and 5-GHz module solution with two antennas supporting industrial temperature grade. The device is FCC, IC, ETSI/CE, and TELEC certified for AP (with DFS support) and client. TI offers drivers for high-level operating systems, such as Linux® and Android™. Additional drivers, such as WinCE and RTOS, which includes QNX, Nucleus, ThreadX, and FreeRTOS, are supported through third parties. The TI WL1837MOD offers a unique feature of time synchronization using AP beacons that are used to achieve ultraprecise Audio Multiroom/Speaker synchronization.

1.2   TI PCM1808

The PCM1808 device is a high-performance, low-cost, single-chip, stereo analog-to-digital converter with single-ended analog voltage input. The PCM1808 device uses a delta-sigma modulator with 64-times oversampling and includes a digital decimation filter and high-pass filter that removes the dc component of the input signal. For various applications, the PCM1808 device supports master and slave mode and two data formats in serial audio interface.

1.3   TI PCM5101AQPWRQ1

The PCM510xA devices are a family of monolithic CMOS-integrated circuits that include a stereo digital-to-analog converter and additional support circuitry in a small TSSOP package. The PCM510xA devices use the latest generation of TI's advanced segment-DAC architecture to achieve excellent dynamic performance and improved tolerance to clock jitter.

1.4   TXS0108EPWR

The TXS0108EPWR is an 8-bit non-inverting translator that uses two separate configurable power-supply rails. The A port is designed to track VCCA. VCCA accepts any supply voltage from 1.2 V to 3.6 V. The B port is designed to track VCCB. VCCB accepts any supply voltage from 1.65 V to 5.5 V. This allows for low-voltage bidirectional translation between any of the 1.2-V, 1.5-V, 1.8-V, 2.5-V, 3.3-V, and 5-V voltage nodes.

1.5   TL1963A-33DCQT

The TL1963A-xx devices are low-dropout (LDO) regulators optimized for fast transient response. The device can supply 1.5 A of output current with a dropout voltage of 340 mV. Operating quiescent current is 1 mA, dropping to less than 1 µA in shutdown. Quiescent current is well controlled; it does not rise in dropout as with many other regulators. In addition to fast transient response, the TL1963A-xx regulators have very low output noise, which makes them ideal for sensitive RF supply applications.

1.6   TPS73618DBVT

The TPS736xx family of low-dropout (LDO) linear voltage regulators uses a new topology: an NMOS pass element in a voltage-follower configuration. This topology is stable using output capacitors with low ESR, and even allows operation without a capacitor. It also provides high reverse blockage (low reverse current) and ground pin current that is nearly constant over all values of output current.

2   Block Diagram and System Design Theory

Figure 1 shows the WL1837MOD audio multiroom cape block diagram.
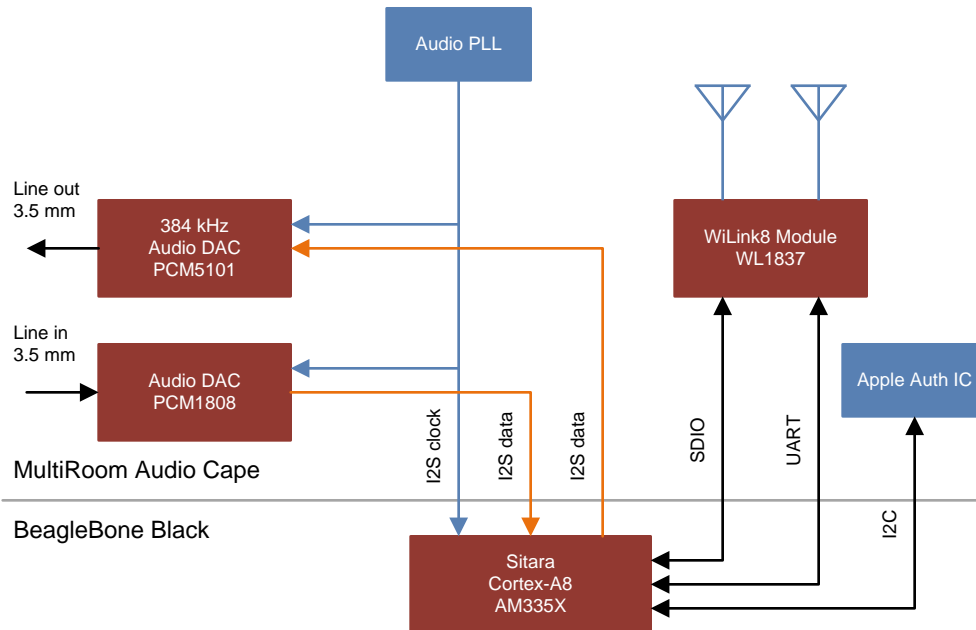
Figure 1. WL1837MOD Audio Multiroom Cape Block Diagram

This wireless multiroom audio reference design combines the latest dual-Band TI WiLink 8 module WL1837MOD with all software building blocks required for a high-end streaming audio platform from StreamUnlimited.

Analog audio IN and OUT are provided, which supports sound reproduction at up to 384-kHz sampling frequency. Using technology that is co-developed by TI and StreamUnlimited Engineering, the audio is synchronized at few microseconds precision between multiple devices. The mainline Linux based SDK of StreamUnlimited combines this highly-accurate synchronization with a rich set of online music services, a customizable user interface offering both local control and display and control through IOS® and Android devices.

The cape is used with BeagleBone Black, as shown in Figure 1. The Host Processor AM335x is connected to WL1837MOD through SDIO bus (for WLAN IP) and UART (BT IP). For MFi Licensees, there is also a provision to connect MFi sub-pcb. There are 2-U.FL antenna ports where external antennas must be connected, and an onboard audio PLL provides a I2 S clock.

3   Test Setup and Data

3.1   Regulatory Certification

For TI WL1837MOD certifications, see http://processors.wiki.ti.com/index.php/WL18xxMOD_Certificates.

3.2   WL1837MOD Time Synchronization

For TI WL1837MOD time synchronization, see http://www.ti.com/lit/an/swaa162/swaa162.pdf.

3.3   Multiroom Ultralow Synchronization Testing on Oscilloscope

StreamUnlimited provides software that plots audio analog data or digital I2-S data on an oscilloscope. For more details, see http://www.streamunlimited.com/products/wifiaudiocape.html.

4   Getting Started

4.1   *Schematics*

To download the schematics, see the design files at http://www.ti.com/tool/TIDC-WL1837MOD-AUDIO-MULTIROOM-CAPE.

4.2   *Bill of Materials*

To download the Bill of Materials, see the design files at http://www.ti.com/tool/TIDC-WL1837MOD-AUDIO-MULTIROOM-CAPE .

4.3   *Gerber Files*

To download the Gerber files, see the design files at http://www.ti.com/tool/TIDC-WL1837MOD-AUDIO-MULTIROOM-CAPE.

4.4   *Assembly Drawings*

To download the Assembly Drawings, see the design files at http://www.ti.com/tool/TIDC-WL1837MOD-AUDIO-MULTIROOM-CAPE.

5   Software Files

TI partner StreamUnlimited provides software for BeagleBone Black and WL1837MOD Audio Multiroom cape, for more details see http://www.streamunlimited.com/products/wifiaudiocape.html .

6   About the Author

This project was made possible with the collaboration of TI WiLink engineers SAURABH NARANG, EITAN BAR, and StreamUnlimited.

IMPORTANT NOTICE FOR TI REFERENCE DESIGNS