BLUE MOJO™

Bluetooth based wireless stereo headset reference design

Quickfilter Blue Mojo Reference Board

1) Introduction

The Blue Mojo board is designed as a reference for a high quality stereo headset design using Quickfilter's QF1D512 digital filter IC's and CSR's BlueCore5-Multimedia IC (BC5-MM). The QF1D512's provide the user with the ability to implement high quality audio equalization on the left and right channels independently.

This Quick Start Guide describes how to easily and quickly begin to use the Quickfilter Blue Mojo reference design/development board in a Bluetooth environment. The Blue Mojo board can be used to develop custom Bluetooth application hardware and software while simultaneously testing digital filters for equalizing speakers/headsets to achieve superior audio performance. Out of the box, it is programmed with filters tailored for the included headset and can be used immediately to demonstrate the improvement in sound quality possible with Quickfilter technology.

The Blue Mojo development kit contains the following:

- Blue Mojo board.
- Blue Mojo interface board for connection to CSR's DEV-PC-1309C computer interface board.
- Lithium-polymer battery.
- USB cable for charging the included lithium-polymer battery.
- Headphones.

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2) Quick Setup
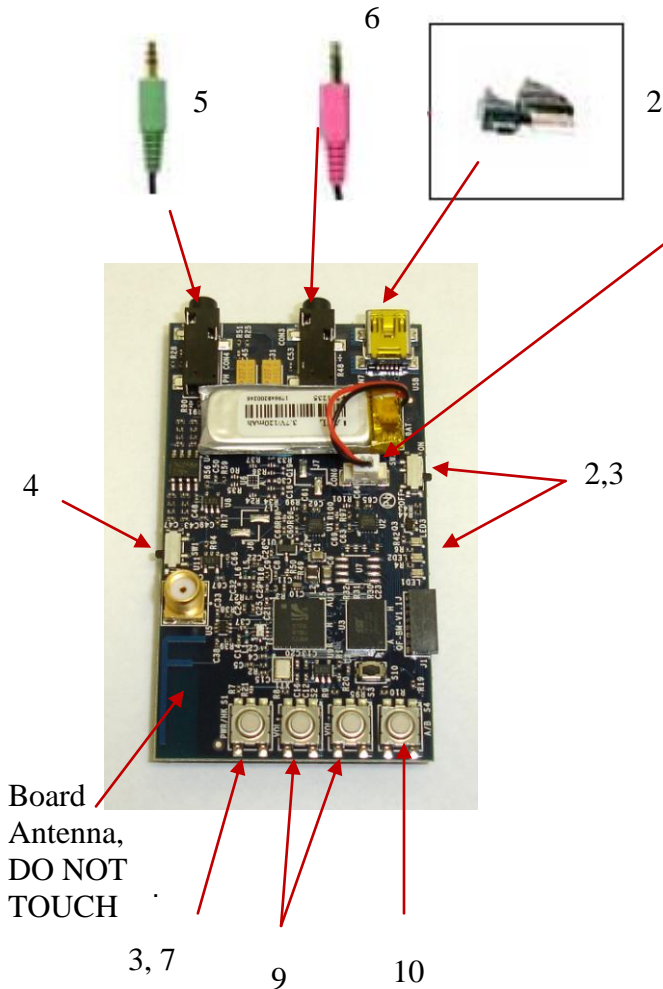
1. Connect the Lithium Ion Polymer battery

2. Charge the battery for two hours prior to first use. To charge, connect the USB cable to the USB/Charge port on Blue Mojo board and USB port on PC and slide the power on switch to the on position (shown off in photo).

3. Slide power switch to on position (shown off in photo). Press and release the power on button and wait 30 seconds until the Red and Green LEDs light up – Device is now booted. When Green LED is lit the filters are active, when not lit, the filters are bypassed

4. Slide antenna switch to ANT (as shown in photo)

5. Insert headphone speaker jack

6. Insert headphone microphone jack

7. Pairing instructions (see below)

8. Pair with music source – paring code is 0000 (Note 1)

9. Use volume buttons on Blue Mojo to adjust volume up or down

10. Use the A/B button to toggle between filtered and unfiltered audio.

Board Antenna, DO NOT TOUCH

Note 1 – Music source must be A2DP/AVRCP compliant in order to achieve stereo sound

Pairing Instructions:

1. Wait for the blue LED to begin slowly blinking.
2. Press and hold the PWR/HK button until the red LED lights.
3. As soon as the red LED lights , release the PWR/HK button. If you delay more than 2 seconds between the red LED lighting and the button release, it will be considered a long button press and the unit will power off.
4. As soon as you've released the PWR/HK button in step 4, immediately press and hold it again. You have about 4 seconds before the unit turns off.
5. Hold the PWR/HK button pressed until the blue LED flashes rapidly. It will first flash slowly and then, after a couple of seconds, it will flash rapidly.
6. Release the PWR/HK button. The Blue Mojo is in Pairing Mode and is trying to pair.
7. Pairing code is – 0000 (four zeros)

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3) Features and capabilities of the Blue Mojo development board.

Based on CSR's DEV-PC-1645B BlueTunes2 development board and Quickfilter's QF1D512 digital filter IC, the Quickfilter Blue Mojo board allows users to get to market quickly with a solution providing a higher quality audio capability than previously available in a Bluetooth environment.

The features and benefits include:
- Two Quickfilter QF1D512 digital filters for independent digital filtering of left and right channels.
  - Virtually infinite filtering type options.
  - Fully reprogrammable filters.
- Multi-configurable audio front end.
  - Mono electret microphone input.
  - Single-ended stereo output.
  - External speaker interface.
- Man Machine Interface (MMI).
  - Four buttons (3 user-defined).
  - Three LEDs.
- RF front end.
  - Output can be mechanically switched between a printed antenna and an SMA connector.
- Integrated voltage regulators and charger circuit provided within BlueCore5-Multimedia Processor.
- Current measurement point.
- Li-Polymer battery.
- Complete application software.
  - A2DP, AVRCP & HF/HS profiles supported.
  - Other profiles supported by request.

The processor at the core of the Blue Mojo board, the BlueCore5-Multimedia External, is part of CSR's latest family of BlueCore single-chip ICs for 2.4GHz Bluetooth systems.

BlueCore5-Multimedia brings the following capabilities to the Blue Mojo reference design:

- Single-chip Bluetooth solution for mono and stereo headsets.
- Integrated stereo CODEC, DSP, battery charger and SMPS.
- Bluetooth V2.0+EDR compliant, Bluetooth V2.1 ready.
- Superior audio quality with -95dB audio DAC.
- Low power consumption due to 1.8V 0.13um process technology.
- Best in class radio design: +6.5 dBm transmit power and -90 dBm receive sensitivity.
- Interfaces with up to 32Mbits external flash.
- LFBGA package .

The BC5-MM features the highest level of integration with on-chip radio, baseband, DSP, stereo CODEC, charger and SMPS. When used with the CSR Bluetooth software stack it provides a fully Bluetooth V2.0+EDR compliant system for audio and data applications. In addition the chip architecture is ready for the Bluetooth V2.1 specification. The industry-leading level of integration reduces component count and BOM cost, allowing customers to achieve price/performance levels previously unattainable.

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The embedded Kalimba DSP core is an open-platform digital signal co-processor allowing product enhancing features such as advanced audio decoding (MP3, AAC, AAC+) and echo cancellation and noise reduction. A wide range of 3rd party software plug-ins are available through CSR's eXtension partner program.

The BC5-MM offers best in-class audio quality, power consumption and radio performance, making it ideal for high-quality mono and stereo Bluetooth headset designs. In the Blue Mojo reference design, this processor, combined with the unmatched filtering performance of Quickfilter's QF1D512 digital FIR filter IC, achieves even higher audio quality and performance.

The QF1D512 is a programmable digital filter designed for seamless insertion in the serial data path of a digital signal or used as an FIR coprocessor. The device can interface with almost all microcontrollers, ADCs, and DACs. It is easily configured with NO PROGRAMMING REQUIRED using our QuickPro™ design software. Virtually any FIR filter type can be implemented. The user is provided a free-form editor for complex, non-standard filters. The device can realize "brick wall" filters such as a low pass filter with a 1 kHz cutoff frequency, 140dB of rejection, and a total transition band of only 10 Hz. The filter can operate over a broad range of ADC data rates – up to 500ksps and can support ADC's with resolutions up to 24 bits

The software supplied with the Blue Mojo reference board is based on the Stereo Headset Application software compatible with the DEV_PC_1645B Development Board from CSR. This BlueCore5 Stereo Headset Application software forms part of the BlueTunes audio solution that enables low cost, feature-rich stereo headsets. It has been modified by Quickfilter with the addition of code necessary to initialize and configure the QF1D512 digital FIR filters present on the Blue Mojo board.

CSR DEV-PC-1645B Development Board

Standard Profile Functionality
The BlueCore5 Stereo Headset application has been written to comply with the following roles in the supported profiles. It supports all mandatory features for the role that are required by the profile specification.

- Handsfree Profile v1.5 (Handsfree role)

- Headset Profile v1.1 (Headset role)

- Advanced Audio Distribution Profile v1.2 (Sink role)

- A/V Remote Control Profile v1.0 (Target and Controller role)

Additional Profile Functionality
The application extends the standard profile functionality with the following features:

- A call to the last number dialed can be initiated from the Headset (listed as optional in the Handsfree Profile).

- Voice recognition on the AG can be activated from the Headset (listed as optional in the Handsfree Profile).

- On link loss the Headset automatically attempts to reconnect the Service Level Connection (SLC) to the last AG it was connected to (listed as optional in the Handsfree Profile).

- The audio volume control can be set from the AG as well as from the Headset (listed as optional in the Handsfree and Headset Profiles).

- Sniff mode is supported whenever the Headset has an established connection (not listed in the supported profiles).

- The Headset can play arbitrary tones, such as ring tones and warning beeps (not listed in the supported profiles).

- The Headset can display arbitrary LED flash patterns to indicate different states (not listed in the supported profiles).

- MPEG-1,2 Audio decoder is supported, if enabled (listed as optional in the Advanced Audio Distribution Profile).

- AAC\AAC+ Audio decoder is supported, if enabled (listed as optional in the Advanced Audio Distribution Profile).

- CSR's low-latency FastStream Audio encoder\decoder is supported, if enabled.

4) Summary

The Blue Mojo board is both a reference design for a high quality stereo headset and a development platform, using Quickfilter's QF1D512 digital filter IC's, providing the user with the ability to implement the highest quality audio output availble for Bluetooth. Fully compatible with CSR's BlueLab development environment and supported by Quickfilter's QuickPro design software, making the creation of sophisticated digital filters amazingly easy and fast, the Blue Mojo simplifies the creation of the highest performance custom Bluetooth headset designs..

Contact Information:

Quickfilter Technologies, Inc.
1024 S. Greenville Avenue, Suite 100
Allen, TX 75002-3324

General:	info@quickfilter.net
Applications:	apps@quickfilter.net
Sales:	sales@quickfilter.net
Phone:	214-547-0460
Fax:	214-547-0481
Web:	www.quickfiltertech.com