Description of Operation Principle

6.1 RF Receiver

The receiver features a near-zero Intermediate Frequency (IF) architecture that allows the channel filters to be integrated on to the die. Sufficient out-of-band blocking specification at the Low Noise Amplifier (LNA) input allows the radio to be used in close proximity to Global System for Mobile Communications (GSM) and Wideband Code Division Multiple Access (W-CDMA) cellular phone transmitters without being desensitised. The use of a digital Frequency Shift Keying (FSK) discriminator means that no discriminator tank is needed and its excellent performance in the presence of noise allows BlueCore3-Audio Flash to exceed the Bluetooth requirements for co-channel and adjacent channel rejection.

6.1.1 Low Noise Amplifier

The LNA can be configured to operate in single-ended or differential mode. Single-ended mode is used for Class 1 Bluetooth operation; differential mode is used for Class 2 operation.

6.1.2 Analogue to Digital Converter

The Analogue to Digital Converter (ADC) is used to implement fast Automatic Gain Control (AGC). The ADC samples the Received Signal Strength Indicator (RSSI) voltage on a slot-by-slot basis. The front-end LNA gain is changed according to the measured RSSI value, keeping the first mixer input signal within a limited range. This improves the dynamic range of the receiver, improving performance in interference limited environments.

6.2 RF Transmitter

6.2.1 IQ Modulator

The transmitter features a direct IQ modulator to minimise the frequency drift during a transmit timeslot, which results in a controlled modulation index. Digital baseband transmit circuitry provides the required spectral shaping.

6.2.2 Power Amplifier

The internal Power Amplifier (PA) has a maximum output power of +6dBm allowing BlueCore3-Audio Flash to be used in Class 2 and Class 3 radios without an external RF PA. Support for transmit power control allows a simple implementation for Class 1 with an external RF PA.

6.2.3 Auxiliary DAC

An 8-bit voltage Auxiliary DAC is provided for power control of an external PA for Class 1 operation.

6.3 RF Synthesiser

The radio synthesiser is fully integrated onto the die with no requirement for an external Voltage Controlled Oscillator (VCO) screening can, varactor tuning diodes, LC resonators or loop filter. The synthesiser is guaranteed to lock in sufficient time across the guaranteed temperature range to meet the Bluetooth specification v1.2.

6.4 Power Control and Regulation

6.4.1 Switch-Mode Regulator

BlueCore3-Audio Flash contains a high efficiency step-down switch mode 1.8V regulator, which can be used to power the complete chip from a single Lithium Ion battery (or other external voltage source). The circuit requires only two external passive filter components and has an internal PID feedback for very low supply ripple.

6.4.2 Linear Regulator

As an alternative, BlueCore3-Audio Flash also contains a 1.8V linear regulator which can be used to power the complete chip. This is less efficient than the switch-mode regulator, but requires less space for external components and can run at lower input voltages.

6.4.3 Integrated Battery Charger Circuit

BlueCore3-Audio Flash contains a fully integrated battery charger circuit, suitable for charging a Lithium Ion/Polymer battery. The circuit requires no external components.

Important Notes:

Protection Module

Lithium Ion/Polymer batteries are capable of delivering high currents of several amperes when short-circuited. This can damage connecting wires, and Printed Circuit Board (PCB) components. More seriously, pressure can build up in the cell envelope, causing it to explode and injure the user.

CSR strongly suggests that Lithium Ion/Polymer batteries incorporate an integral protection module. This is typically a small Integrated Circuit (IC) and Field Effect Transistor (FET) interposed between the battery body and its connecting wires. The protection module limits the short circuit current. Good modules will also prevent over-charge and over-discharge, which can also cause damage to the battery.

Additional Precautions

CSR also suggests that the following additional precautions are observed:

- The Direct Current (DC) inlet socket used on the appliance should be of a proprietary design, preventing users from attaching the charger or supply connector for another appliance (e.g. a mobile phone or laptop computer). The use of popular 2.1mm and 2.5mm DC jack sockets must be avoided for this reason.
- Include a voltage limiting circuit (clamp) on the charger inlet. Remember that this circuit could be exposed to voltages as high as 30V (of either polarity) if a laptop computer power supply has been connected. Include a small fuse in series with the DC inlet, but prior to the clamp.
- Never bring the Lithium Ion/Polymer battery connections directly to charging pins on the outside of the appliance casing, where they could be short-circuited by keys in the user's pocket, for example.

Temperature Extremes

Some Lithium Ion/Polymer cells can be damaged by charging at temperature extremes (e.g. below 0°C or above 50°C). Consult the battery manufacturer for guidance.

For more information, see the CSR document Lithium Ion/Polymer Battery Safety Information Note.

6.5 Clock Input and Generation

The reference clock for the system is generated from a TCXO or crystal input between 8 and 40MHz. All internal reference clocks are generated using a phase locked loop, which is locked to the external reference frequency.