XBlue1200™ Core

IPextreme

Bluetooth HCI Solution

PRODUCT BROCHURE

Bluetooth™

Easily Embeddable Bluetooth Core For:

- High volume, cost-sensitive applications
- Portable devices where size and power are important
- Applications requiring tight coordination with Bluetooth and other functions such as WiFi, GPS, or DSP

XBlue1200 Overview

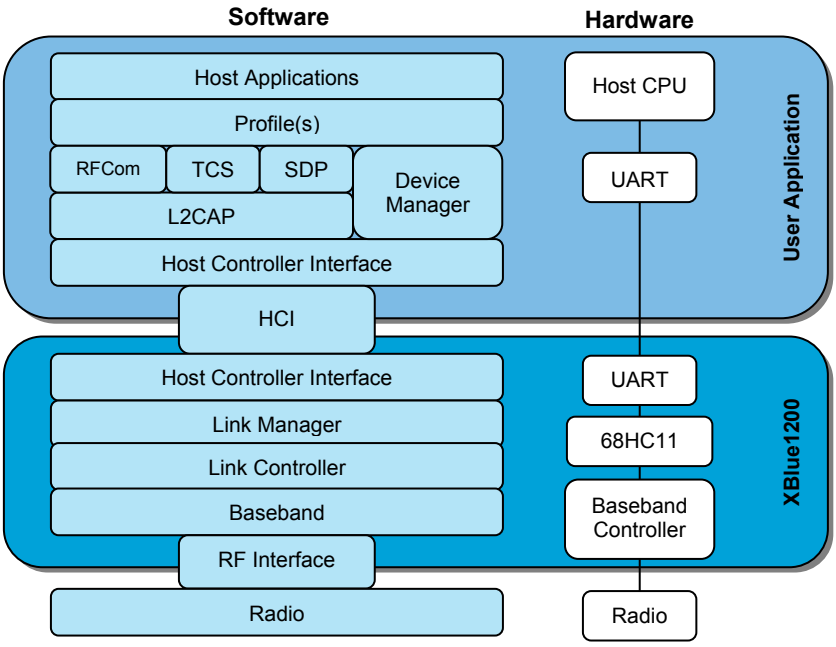
The IPextreme® XBlue1200™ is a complete, self-contained Bluetooth HCI solution consisting of a fully integratable baseband controller with v1.2 link manager software. It is ideal for applications that need to add Bluetooth connectivity, as well as cost reducing products that currently use an external Bluetooth baseband IC.

With its simple, on-chip serial interface and separate small processor running the lower software stack, the XBlue1200 provides the cost and power reductions of an embedded solution while maintaining a chip's ease of connection. Uniquely, it also supports several different common Bluetooth radio chips. It is ideal for cell phones, PDAs, GPSs, headsets, mice, laptops, and other high volume, portable applications that demand low cost and long battery life.

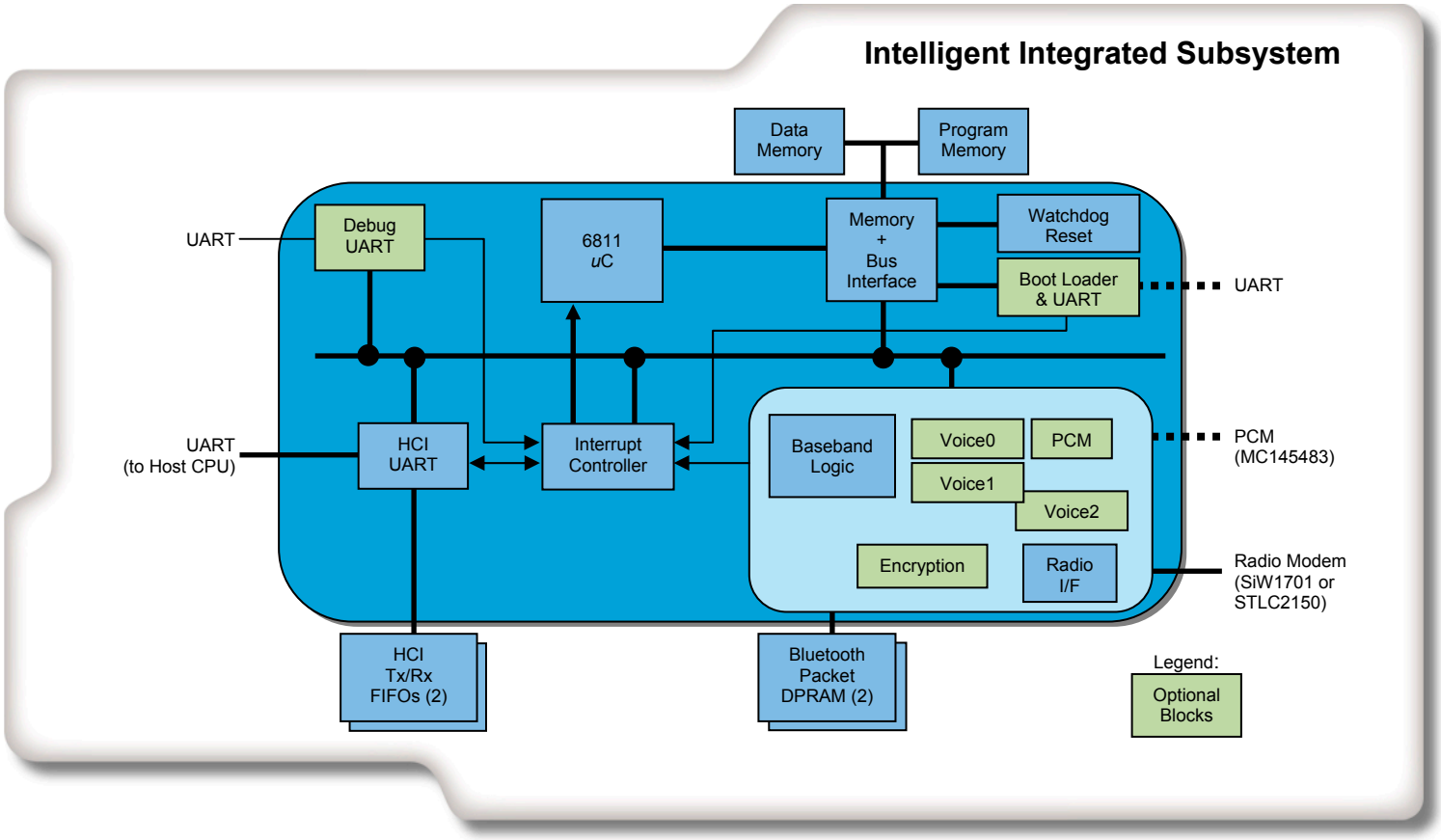
The XBlue1200 is offered in fully synthesizable RTL and ANSI C source code format along with a rich set of deliverables to maximize the value to our customers.

Key Features

- Support for Bluetooth v1.2 specification
- Ultra low power consumption that is up to 50% less than alternative solutions
- Small gate count and memory footprint
- "Drop-in" black box architecture dramatically reduces both hardware and software integration through the use of industry standard interfaces and APIs
- Unique RF interface supports multiple radios from different vendors and enables second sources
- Simple HCI-over-UART interface allows connection to any host processor
- User configurable to match application needs:
  - Up to three voice channels with optional PCM
  - Hardware encryption
  - Flexible memory interface supports RAM, ROM, and Flash configurations
- Bluetooth development kit available for application development on PC or other UART or USB-equipped hardware platform



Bluetooth System Block Diagram



Benefits of IPextreme XBlue1200 Architecture

Low Power

- Embedded 8-bit microcontroller efficiently handles all real-time events, reducing the MIPS load and power consumption of the host processor
- Sophisticated, automatic power management shuts down 99 percent of the baseband controller and CPU, and sleeps the radio when there is no Bluetooth activity
- Additional digital logic power savings of up to 40 percent achieved through automated power optimization EDA tools

Maximum Performance

- Time-critical Bluetooth functions are handled directly by dedicated hardware and the embedded microcontroller
- Host processor can deliver more performance to the host application or run at a lower frequency, because the embedded microcontroller handles all baseband processing

Easy Integration

- Fully-integrated, lower-level stack eliminates complicated software merging and memory sharing
- Compatible with any host processor (ARM, MIPS, etc), operating system, and qualified upper-layer Bluetooth protocol stack through a standard HCI-over-UART transport
- High compatibility with legacy software since off-chip Bluetooth solutions usually use a similar serial connection
- Optimized for direct connection to the Silicon Wave SiW1701 or STMicroelectronic STLC2150 Bluetooth Radio Modems, other radios are easily supported
- Simple connection to standard memories
- Architecture and automation allows user to easily configure the fully synthesizable RTL and drop the configured subsystem into an SoC design

Host Platform Independence

- Includes source code for both hardware in Verilog (VHDL on request) and lower layers of the protocol stack (ANSI C)
- Also includes object code for users preferring to work directly with a ROM image

Flexible Memory Interface

User-configurable memory interface allows a variety of different memory implementations as follows:

- Program Memory can use Flash, ROM, or RAM
- Memory can be on-chip, off-chip or a combination
- Flash or RAM-based Program Memory implementations can be downloaded over a second UART connection
- Data Memory and RAM-based Program Memory can share the same physical RAM

Flexible Solution for One or Two CPU Architectures

While the IPextreme XBlue1200 two-CPU architecture is well-suited 'as-is' for most Bluetooth applications, certain applications may benefit further by using XBlue1200 in a one-CPU configuration, attaching the baseband controller directly to the host CPU.

A user can directly connect the XBlue1200 Baseband controller and peripherals to the chosen host processor through XBlue1200's AMBA APB local bus interface and the software (provided in source format) ported to the host CPU.

Alternatively for simple applications such as a wireless keyboard or mouse, the entire application can run on the small processor found within the XBlue1200 core.

Integration Testbench for SoC Integration

An integration testbench is included for the purpose of ensuring the XBlue1200 is correctly connected and working properly. Included in the testbench are:

- Self checking tests to ensure correct integration
- Models of all required components included for SoC integration, including: bus functional models (BFM) for PCM device, SiW1701/STLC2150 Radio Modem, UART, EEPROM, and memory models

Bluetooth Development Kit

To aid in software application development, IPextreme offers a Bluetooth Development Kit (officially listed with the Bluetooth Special Interest Group). The Kit contains the qualified IPextreme XBlue core in silicon and a SiW1701 radio modem. It also includes a demonstration version of Cambridge Consultant's Interface Express™ product, which incorporates BlueStack, the industry's most widely adopted high-level Bluetooth stack and profile software.

XBlue1200 Development Kit

Partnerships with Bluetooth Leaders for Complete Solution

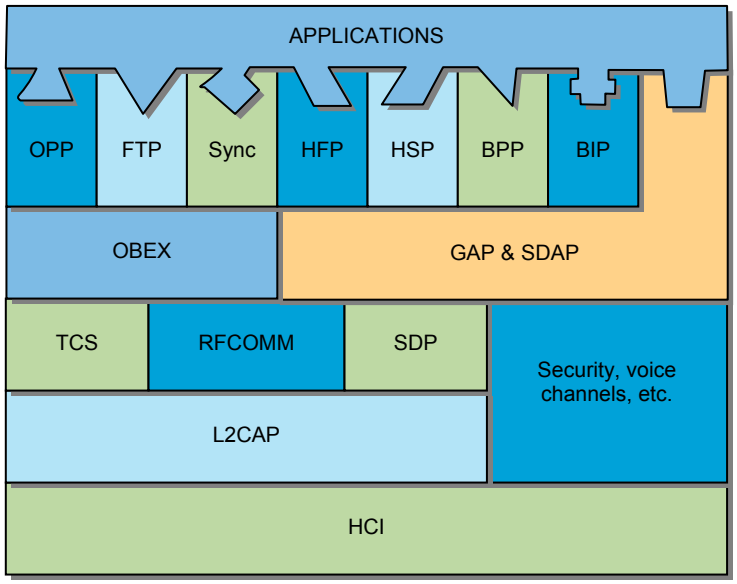
To ensure a complete and easy-to-integrate solution, IPextreme worked with leading providers of Bluetooth upper stack software and Bluetooth radio hardware. IPextreme partnered with Cambridge Consultants to develop the Bluetooth lower stack that is included with the IPextreme XBlue1200 core, and offers Cambridge Consultant's upper stack and profiles to XBlue1200 users. The combination of Cambridge Consultant's upper stack Bluetooth software and the XBlue1200 core provides a complete and fast-to-market solution for customers wanting to incorporate Bluetooth into new or existing designs.

Cambridge Consultant's Interface Express Software

The Cambridge Consultant's product family provides for rapid, low-risk and cost-effective Bluetooth application development for IPextreme's XBlue1200 as well as other Bluetooth solutions. Cambridge Consultant's flagship product, Interface Express, takes away the complexities of Bluetooth communications and enables users to create and test custom profiles in minutes.

Features

- Cambridge Consultant's Interface Express, a powerful PC-hosted configuration tool that produces fully working skeleton applications, for example, Bluetooth printing for embedded, Win32 Console, or MFC targets, in minutes.
- BlueStack®, Cambridge Consultant's qualified higher layer Bluetooth v1.2 protocol software, includes optional and mandatory protocol features, such as : HCI, L2CAP, RFCOMM, SDP and TCS
- Qualified to v1.2 of the Bluetooth specification and utilized in the majority of qualified Bluetooth designs
- Code, including many examples, written in ANSI C and C++ for maximum portability, with no restriction on porting architectures or OS environments
- Code has been successfully ported to ARM7, V850, XAP2, PowerPC, Intel Pentium and Motorola 68K architectures, and PalmOS, Win32, WinCE, Linux, QNX, and REX operating systems
- Debug support in the form of Watch Windows
- Comprehensive user guides, API descriptions, and design documents
- Interface Express profile abstraction software which supports the following: SDAP, SPP, OPP, Sync, FTP, BPP, BIP, DU, LAN, HSP, HFP, HCRP, CTP, Intercom, FAX, and more
- Modular, extensible, scalable architecture at both profile and protocol levels, with either profile or protocol level APIs



Using Cambridge Consultant's Interface Express Software – This diagram shows the components typically required to add Bluetooth to a mobile telephone. The consistent approach to integration with the software makes it very easy to support many profiles.

XBlue1200 Supported Radios

The XBlue1200 directly interfaces with the Silicon Wave SiW1701 and ST Microelectronics STLC2150 radios and takes full advantage of the radio's low-power features. Simulation models of the SiW1701 and the STLC2150 are included in the XBlue1200 integration testbench.

STLC2150 Bluetooth Radio Transceiver

The STLC2150 is a fully integrated Bluetooth single chip radio transceiver. Together with XBlue1200, it offers a compact and complete solution for short-range wireless connectivity for a variety of applications.

The STLC2150 implements a low-IF receiver for Bluetooth modulated input signals and no external IF filtering is required. The GFSK demodulator is fully integrated and supplies digital output data and RSSI. The transmit section features a fully integrated GFSK modulator, followed by a direct up-conversion stage, giving an output signal of 0 dBm. Optional power control is available.

On-chip VCO covers full Bluetooth band and contains all of the tank resonator circuitry. Unidirectional BlueRF compatible interface and 4-wire serial JTAG interface are used to control all functions of radio transceiver, enabling operation with wide range of baseband processors.

- Bluetooth v1.2 specification compliant
- Fully integrated single chip:
  - Transceiver with minimum of external RF components
  - PLL completely integrated
  - Integrated antenna switch
- Supports Power Class 2 and 3 operation with power control
- Supports Power Class 1 operation with an external Power Amplifier
- Outstanding maximum usable input signal
- Interface with base-band:
  - BlueRF compatible
  - Unidirectional
  - Received data: RxMode2 and RxMode2+ are supported
  - Serial interface: JTAG
- CMOS technology
- Standard VFQFPN-48 package
- Low standby power consumption
- Extended temperature range
- Compliant to automotive specification AEC-Q100.

For radio diagrams and specifications, contact STMicroelectronics directly at: www.st.com.

SiW1701 Radio Modem

The SiW1701 IC combines a 2.4-GHz radio transceiver and a GFSK modem with digital control functions. This results in an ultra low power radio with a highly configurable, 100 percent digital interface that is compatible with IPextreme XBlue1200. The SiW1701 radio features high-functional integration, a simplified system design and reduced external components, resulting in low system cost, less power consumption and smaller size.

- Very low power consumption in active/standby modes
- Radio and modem on a single IC
- Fully compliant with Bluetooth specification 1.1
- Class 1 with external power amplifier (+20)
- Class 2 transmit output power (+4 dBm) with output power (control.dBm) and output power control
- Class 3 transmit output power (0 dBm) with output power control
- Single-ended RF I/O reduces system BOM
- Industrial or commercial temperature ratings available
- Direct-conversion architecture with no external channel filter or VCO resonator components
- On-chip voltage regulation with direct input from battery supply possible
- Programmable digital interface with selectable output data sampling rate
- Supports multiple crystal reference frequencies including 12 MHz, 13 MHz, 32 MHz, and 48 MHz
- Accepts multiple reference clock frequencies from the host. Common references such as 12 MHz, 13 MHz, 19.68 MHz and 38.4 MHz are among those supported
- Exceptional adjacent channel rejection and blocking performance for ease of integration.

For radio diagrams and specifications, contact Silicon Wave directly at: www.siliconwave.com.

IPextreme XBlue1200

Core Technical Specifications:

- Support of v1.2 specification
- Small gate count (60-105K depending on configuration)
- Small memory footprint:
  - 160 KB program memory, 16-32 KB data memory
  - (2) 401 byte data buffers, (2) 256 byte/10bits HCI UART buffers
- Connection to host processor subsystem via standard HCI-over-UART transport
  - Supports any qualified Bluetooth high-level stack and profiles
- RF interface optimized for direct connection to the Silicon Wave SiW1701 and STMicroelectronics STLC2150 radio modem ICs
- Supports piconets with up to seven active slaves
- Authentication and optional encryption
- 0 to 3 eSCO/SCO voice links with optional PCM interface
- Master-slave switch support
- Embedded 68HC11 microcontroller (included) handles the lower layers of the Bluetooth protocol stack (below HCI)
- Separate clocks for power efficiency include the following:
  - 20 MHz minimum for 68HC11 µC
  - 4 MHz minimum for baseband hardware
- Support of Bluetooth v1.2 features eSCO, faster connection and adaptive frequency hopping

Deliverables for IPextreme XBlue1200 Core:

- RTL source for hardware synthesis and simulation in Verilog (VHDL on request)
- Firmware (in both 68HC11 object code & ANSI C)
- Integration testbench to quickly verify top level connections
- Simulation model of SiW1701 and STLC2150 radios
- Full documentation
- XPack™ environment

Additional Services Available:

- Integration into a SoC design
- Conversion to single-CPU architecture for your chosen host processor
- Application development and firmware porting
- Support for additional Bluetooth radios
- Bluetooth end-product design

System Requirements:

The XBlue1200 XPack requires a Solaris or Linux workstation and is compatible with all major EDA tools

Optional (not required): Metrowerks C compiler for the 68HC11 embedded microcontroller, available at http://www.metrowerks.com/embedded/motoHC11

The Customer Experience

The IPextreme engineering team has been creating quality IP for a decade, such as the first fully synthesizable ARM processor, the Infineon C166S, MPEG decoders, and Bluetooth. Our engineers understand integration challenges, and so rework and package the design for maximum ease of use. They will typically limit parameters to those most important, simplify interfaces, bundle software, supply suites that verify connectivity, and generally transfer just the necessary knowledge from the original designers.

All the IP we ship is packaged in our patent pending XPack, which maximizes ease of use by letting the integration engineers configure complex IP through an intelligent user interface that outputs the configuration and constraints files for common tools from Cadence, Mentor, and Synopsys. During the preparation and packaging of the IP our engineers learn enough about it to offer excellent support. IPextreme takes advantage of professional commercial IP delivery software systems and our engineers stick with the customer to ensure they successfully integrate IP purchased from us.

See our website for more information on XPack.

IPextreme

IPextreme, Inc.
307 Orchard City Drive
M.S. 202
Campbell, CA 95008
800-289-6412 (toll-free)
408-608-0421 (fax)

www.ip-extreme.com