



WT32 Bluetooth® Audio Module

9.6.2008

Agenda

- **Features Overview**
- **Firmware Overview**
- **DSP Extensions**
- **Certifications**
- **Evaluation & Development Tools**
- **Use Cases**



Features Overview

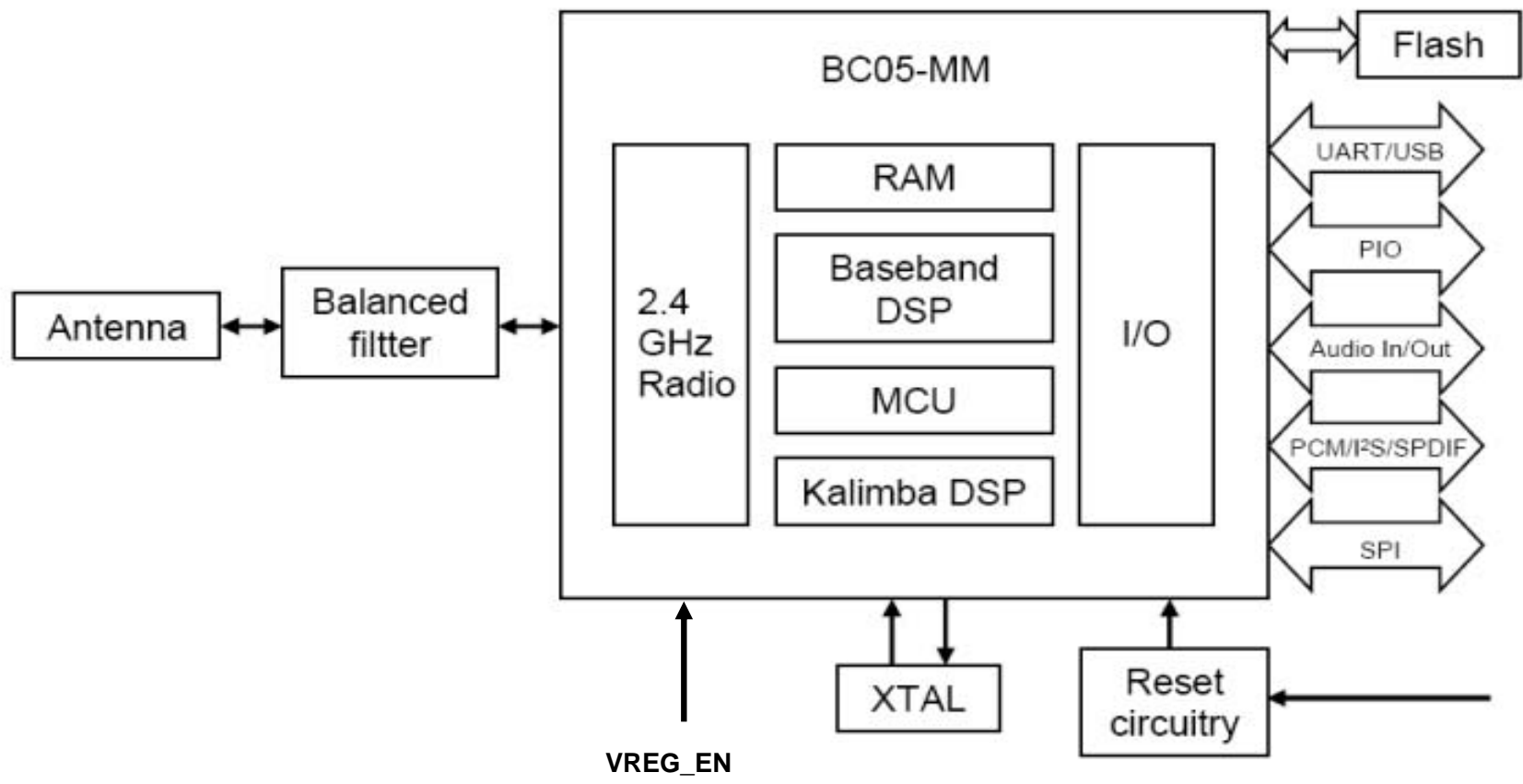


WT32



- Plug n' play Bluetooth solution for stereo and mono audio solutions
- *Bluetooth*® 2.1 + EDR compliant, power class 2
- Integrated chip antenna, W.FL connector and RF pin
- Based on CSR BlueCore5-Multimedia
- Temperature range from -30°C to +85°C
- RoHS compliant
- Simple iWRAP™ firmware for controlling *Bluetooth*® wireless technology
- Dimensions (l x w x h): 24 x 16 x 2 mm
- *Bluetooth*® 2.1+EDR, CE, IC and FCC qualified

WT32





WT32: Radio characteristics

- **Operating freq. (ISM):** 2402 – 2480 MHz
- **TX power:**
 - +7 dBm (Enhanced Data Rate)
 - +4 dBm (Basic Data Rate)
- **RX sensitivity:** -88 dBm
- **Modulation methods:**
 - 1 Mbps GFSK (BRD)
 - 2 Mbps Π / 4DQPSK (EDR)
 - 3 Mbps 8DPSK (EDR)
- **Range:**
 - WT32 to WT32 LoS ~100 meters (SPP)
 - Audio ~30 meters



WT32: Interfaces

- **UART:**
 - 1200 bps – 4Mbps
 - RTS/CTS flow control
 - Bypass mode
 - 1.8V to 3.3V
- **USB:**
 - USB 2.0 compliant
 - USB device role
 - Bus / Self powered
- **GPIO:**
 - 10 x GPIO available
 - 1.8V to 3.3V
 - Software controllable
 - 802.11 co-existence interface
- **AIO:**
 - 2 x AIO
 - + 2 x internal (battery voltage and temperature)
 - 10 bit
- **SPI**
 - SPI for firmware updates and parameters only
- **LED driver:**
 - Indicates charger status
- **VREG_EN:**
 - Controls the internal regulator

WT32: Audio Interfaces



- **Dual analog inputs:** Left / right channel
ADC from 8 kHz upto 44.1 kHz
Routed to internal codec
- **Dual analog outputs:** Left / right channel
DAC from 8 khz upto 48 kHz
Routed from internal codec
- **Microphone input** Internal / external biasing
- **Digital audio interfaces:** PCM for SCO audio
SPDIF for A2DP audio
I²S for A2DP audio (slave and master modes)



WT32: Extra features

- **Built-in DSP**
 - 64 MIPS
 - 156k RAM
 - Independent from the main processor
 - 24-bit fixed point arithmetic
 - Shared command & data channel with the main CPU
 - Can access GPIO and AIO
 - Low power: ~0,4mA / MIPS
- **Built-in stereo codec**
 - 16-bit
 - Fully differential
 - 95 dB Signal-to-Noise Ratio (SNR)
- **Built-in battery charger**
 - For Li-Ion and Li-Poly
 - Upto 4.2V
 - Tri-state
 - Configurable charging current and voltage



WT32: Current consumption

- **A2DP streaming (SBC)**
 - 19 mA @ 1 meter distance
 - 20 mA @ 5 meter distance
 - 22 mA @ 10 meter distance

 - 15 mA @ 5 meter distance + SNIFF mode
 - 16 mA @ 10 meter distance + SNIFF mode
- **HFP streaming**
 - 19 mA @ 1-10 meter distance

 - 15 mA @ 1-10 meter distance + SNIFF mode
- **Inquiry, Page** 20 mA
- **Idle** 1-2 mA
- **Deep sleep** 0,1 mA



WT32: Key design tips

- Voltage levels of the IO pins depends on VDD_IO (1.8V – 3.3V)
- The battery charger on the module is configurable – and may need to be configured on the production line
 - Charging current
 - Battery trim
- Audio design rules depends on configuration: stereo, mono, microphone etc.
 - Design guide contains references for different configurations
- VREG_EN pin can be used to power down / wake up the module



Firmware Options

Firmware Overview

iWRAP	DSP	Custom
<ul style="list-style-type: none"> • Easy-to-use modem like firmware • Full Bluetooth stack run inside WT32 • Operated with simple ASCII commands over UART interface • Provides access to most common Bluetooth functions • Can be configured to operate autonomously • Combined with MCU offers a platform to create sophisticated applications 	<ul style="list-style-type: none"> • Additional DSP algorithms • Audio processing, enhancement etc. • IO sampling, ADC & DAC conversions • Available via 3rd party companies & CSR extension program 	<ul style="list-style-type: none"> • WT32 modules has an internal RISC processor • Enables creating a custom firmware • Simple application functionality can be embedded into the module. For example simple data processing / routing or automated network setup • Bluegiga can offer project based iWRAP customization • Customer developed firmware <ul style="list-style-type: none"> • With BlueLab SDK • Software requires Bluetooth qualification!



DSP Extensions

DSP Extensions

- **The standard DSP software use only fraction of available processing power**
 - SBC coding ~9 MIPS
 - MP3 coding ~13 MIPS
- **The extra resources can be used for additional functionality**
 - Audio processing
 - Audio enhancement
 - Extra encryption
 - etc.
- **A lot of third party DSP software exists**
 - There is no need to develop everything yourself
 - Simple licensing model

WT32: DSP extensions

apt-X[®]

High quality audio coding
nearly lossless audio



Multipoint HFP
CVC Echo Cancellation

DYNAMICHEARING
Our World is Sound

Echo cancellation
Active noise reduction



Text-to-Speech

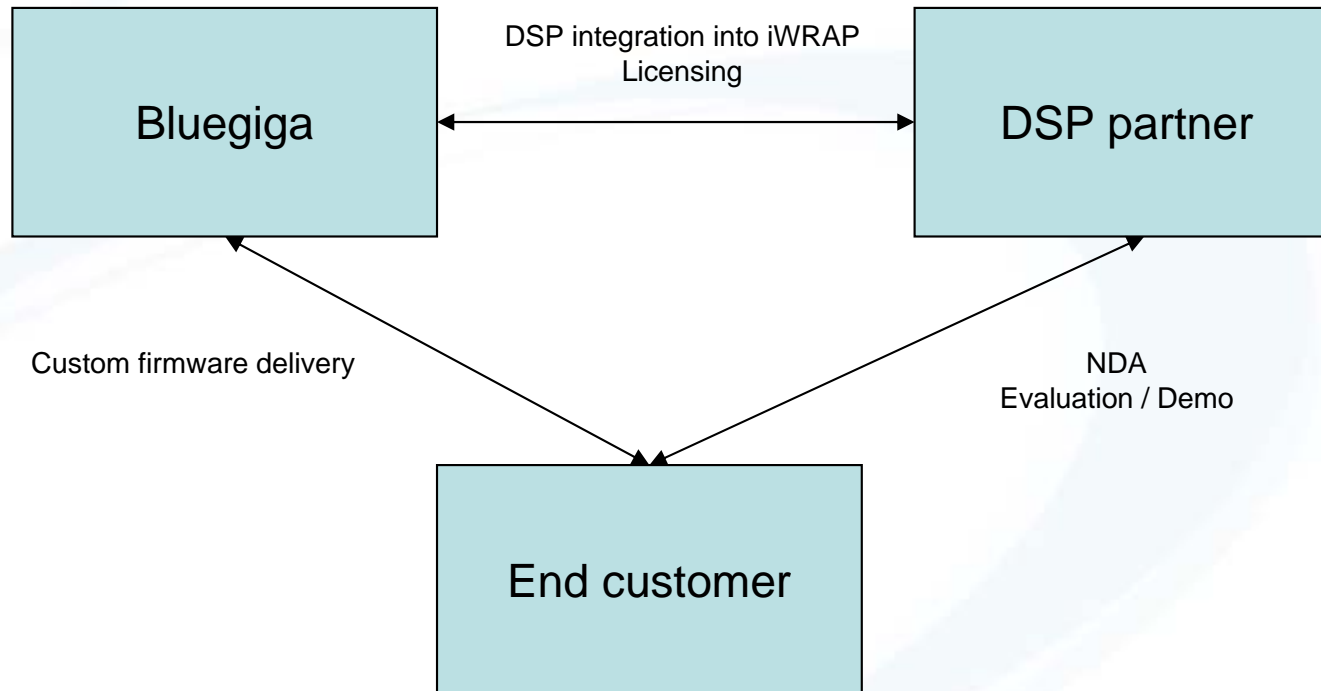


Audio enhancement



Bass boost

DSP Extensions



Evaluation & Development Tools

Evaluation tools

PCB with integrated WT32 module

- Full RS-232 interface
- USB interface
- SPI
- All I/O signals
- External audio PA
- Reset and 4 software configurable buttons
- Li-Ion battery
- 3 x 3.5 audio connectors (line in, line out and mic)

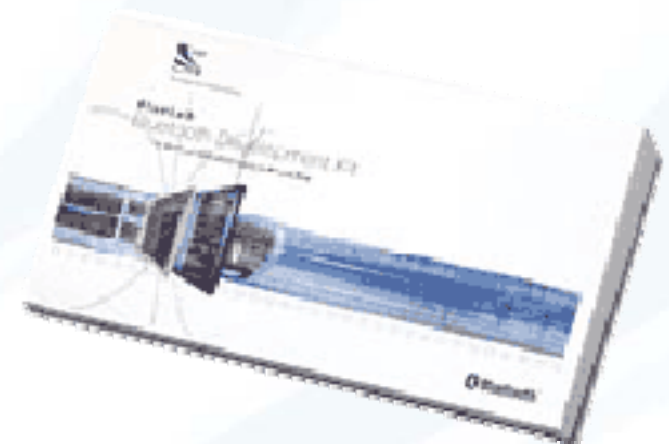
Package contains:

- 1 x WT32 Evaluation Boards
- 1 x USB cable
- 1 x RS232 cable
- 1 x On-board Installation Kit
- 1 x Stereo headphones



Development tools

- **WT32 has a 16-bit RISC processor and 64MIPS DSP inside**
 - They can host custom applications and custom DSP extensions
- **BlueLab Professional Software Development Kit (SDK) is available for this purpose**
 - New Bluetooth profiles can be implemented
 - Custom applications for data processing, I/O, SPI, I2C functionality
 - DSP algorithms (audio enhancement, noise cancellation etc.)
- **Programming language for the RISC processor is C and Assembler for the DSP**
- **Comes with a smart Windows based IDE**
 - Documentation
 - Example Applications



Certifications

Certifications

- **Bluetooth 2.1 + EDR**
 - End product certified
 - iWRAP3: A2DP, AVRCP, HID, OPP (client), HFP, SPP and DI

- **CE**
 - EN300328
 - EMC

- **FCC**
 - Modular approval

- **Industry Canada**

- **Antenna list**
 - EAD
 - EAD
 - EAD
 - Antenova
 - Kinsus
 - Pulse

MMTX-EA-79A, 2.4 GHz SMA M, Dipole antenna 2dBi
BT-Stubby, Dipole antenna 0dBi
MTX-BT-Blade, Dipole antenna 2dBi
Titanis, Dipole antenna 4.4dBi
2.4 GHz SMA M, 5dBi
Chip antenna

Use Cases

WT32 Use Cases:



Digital to Analogue converter for high end audio equipment

- 120dB dynamic range
- Analog and digital audio inputs/outputs
- WT32 as Bluetooth A2DP sink

WT32 Use Cases:



Push-to-talk application

- Utilizes GSM/GPRS network for audio/signaling
- Wireless Bluetooth headset

WT32 runs all the software

- BoM saving, longer battery life

DSP

- Runs echo/noise cancellation

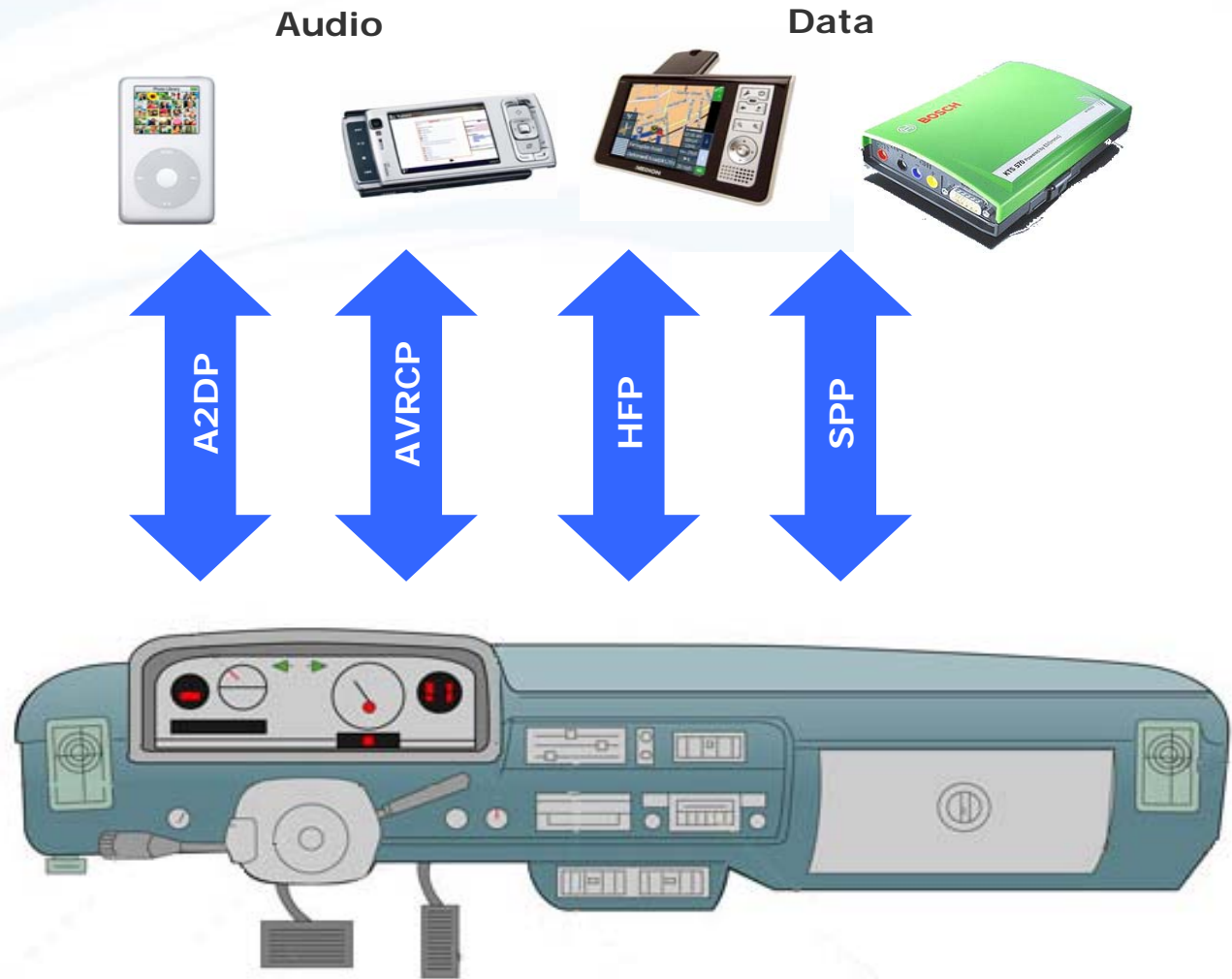
WT32 Use Cases:

- Hands-Free applications
 - BoM, Size savings
- Faster Time-to-market
 - Less development effort
- Echo cancellation, Text-to-speech with DSP
 - More functionality



WT32 Use Cases:

- In car entertainment systems
 - A2DP and AVRCP
- In car hands free systems
 - HFP
- Wireless diagnostics
 - SPP



WT32 Use Cases:

- AIO and GPIO sampling with DSP
 - High resolution (44.1kHz)
- Data transmitted with conventional profiles like SPP
- Extra interfaces can be supported with DSP code + GPIO
 - SPI
 - I2C
 - SDIO





Thank You