



WT11-E

Data Sheet

Version 1.7

Friday, August 25, 2006

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VERSION HISTORY

Version:	Date:	Author:	Comments:
1.0	11.5.2005	MS	<i>Preliminary version</i>
1.1	14.9.2005	PR	<i>Dimension update</i>
1.2	30.1.2006	MS	<i>Images, dimensions and interfaces updated.</i>
1.3	6.2.2006	MS	<i>Foot print fixed</i>
1.4	2.3.2006	PR	<i>Figure 6 added</i>
1.5	26.4.2006	MS	<i>Minor updates, WT11-E dimensions</i>
1.6	26.4.2006	MS	<i>Certifications updated</i>
1.7	30.5.2006	MS	<i>FCC statement added</i>
1.8	30.5.2006	MS	<i>WT11-E Recommended antennas</i>

TERMS & ABBREVIATIONS

Term or Abbreviation:	Explanation:
<i>Bluetooth</i>	Set of technologies providing audio and data transfer over short-range radio connections
<i>CE</i>	Conformité Européene
<i>EDR</i>	Enhanced Data Rate
<i>FCC</i>	Federal Communications Commission
<i>HCI</i>	Host Controller Interface
<i>HID</i>	Human Interface Device
<i>iWRAP</i>	Interface for WRAP
<i>PCB</i>	Printed Circuit Board
<i>RoHS</i>	The Restriction of Hazardous Substances in Electrical and Electronic Equipment Directive (2002/95/EC)
<i>SPI</i>	Serial Peripheral Interface
<i>UART</i>	Universal Asynchronous Transmitter Receiver
<i>USB</i>	Universal Serial Bus
<i>VM</i>	Virtual Machine
<i>WRAP</i>	Wireless Remote Access Platform
<i>PCM</i>	Pulse Code Modulation
<i>DFU</i>	Device Firmware Upgrade

1. DEVICE FEATURES OVERVIEW

- Fully Qualified Bluetooth system v2.0 + EDR, CE and FCC
- Class 1, range up to 300 meters
- Integrated chip antenna or UFL connector
- Industrial temperature range from -40°C to +85°C
- Enhanced Data Rate (EDR) compliant with v2.0.E.2 of specification for both 2Mbps and 3Mbps modulation modes
- RoHS Compliant
- Full Speed Bluetooth Operation with Full Piconet
- Scatternet Support
- USB interface (USB 2.0 compatible)
- UART with bypass mode
- Support for 802.11 Coexistence
- 8Mbits of Flash Memory

2. GENERAL DESCRIPTION

2.1 Physical Outlook

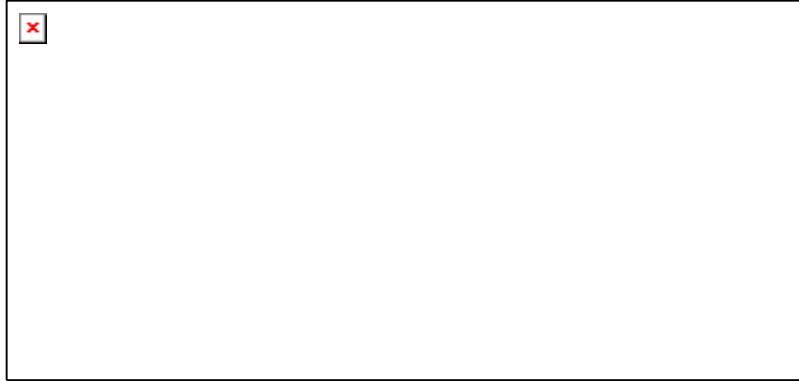


Figure 1: Physical outlook of WT11-E

2.2 Block Diagram and Descriptions

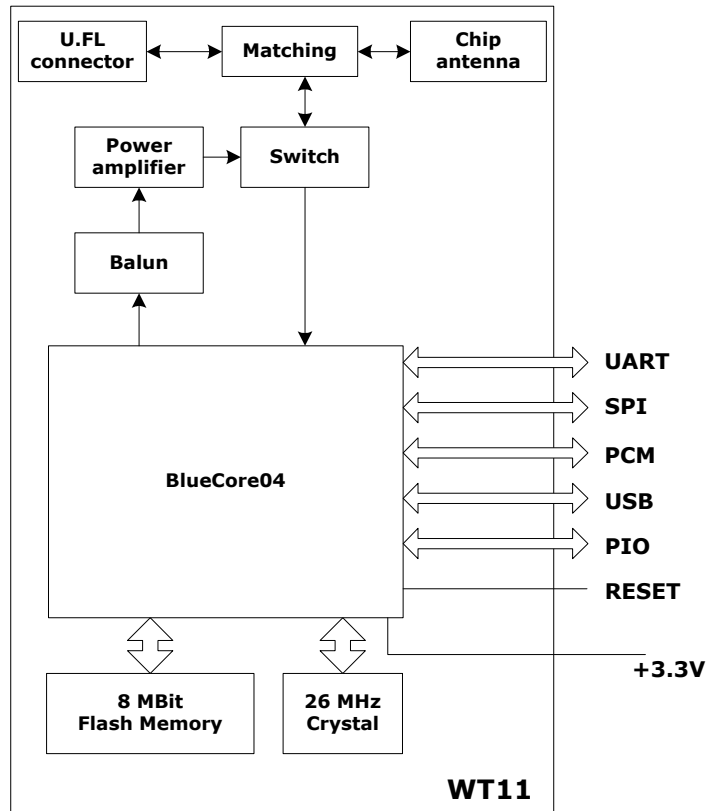


Figure 2: Block Diagram of WT11

2.2.1 BlueCore04

BlueCore4 is a single chip Bluetooth solution which implements the Bluetooth radio transceiver and also an on chip microcontroller. BlueCore4 implements Bluetooth® 2.0+EDR (Enhanced Data Rate) and it can deliver data rates up to 3 Mbps.

The microcontroller (MCU) on BlueCore04 acts as interrupt controller and event timer run the Bluetooth software stack and control the radio and host interfaces. A 16-bit reduced instruction set computer (RISC) microcontroller is used for low power consumption and efficient use of memory.

BlueCore04 has 48Kbytes of on-chip RAM is provided to support the RISC MCU and is shared between the ring buffers used to hold voice/data for each active connection and the general purpose memory required by the Bluetooth stack.

2.2.2 Crystal

The crystal oscillates at 26MHz.

2.2.3 Flash

Flash memory is used for storing the Bluetooth protocol stack and Virtual Machine applications. It can also be used as an optional external RAM for memory intensive applications.

2.2.4 Balun

Balun changes the balanced input/output signal of the module to unbalanced signal of the monopole antenna.

2.2.5 Power amplifier

Power amplifier is used to increase the output power to a level required by class 1 specification.

2.2.6 Switch

Switch is used to separate transmission and receiver modes.

2.2.7 Matching

Antenna matching components match the antenna to 50 Ohms and also selects between chip antenna and UFL connector.

2.2.8 U.FL

This is a standard U.FL male connector for the external antenna

2.2.9 USB

This is a full speed Universal Serial Bus (USB) interface for communicating with other compatible digital devices. WT11 acts as a USB peripheral, responding to requests from a Master host controller such as a PC.

2.2.10 Synchronous Serial Interface

This is a synchronous serial port interface (SPI) for interfacing with other digital devices. The SPI port can be used for system debugging. It can also be used for programming the Flash memory.

2.2.11 UART

This is a standard Universal Asynchronous Receiver Transmitter (UART) interface for communicating with other serial devices.

2.2.12 Audio PCM Interface

The audio pulse code modulation (PCM) Interface supports continuous transmission and reception of PCM encoded audio data over Bluetooth.

2.2.13 Programmable I/O

WT11 has a total of 6 digital programmable I/O terminals. These are controlled by

firmware running on the device.

2.2.14 Reset

This can be used to reset WT11.

2.2.15 802.11 Coexistence Interface

Dedicated hardware is provided to implement a variety of coexistence schemes. Channel skipping AFH (Adaptive Frequency Hopping), priority signaling, channel signaling and host passing of channel instructions are all supported. The features are configured in firmware. Since the details of some methods are proprietary (e.g. Intel WCS) please contact Bluegiga Technologies for details.

2.3 Applications

WT11 Bluetooth module is designed for:

- Hand held terminals
- Industrial devices
- Point-of-Sale systems
- PCs
- Personal Digital Assistants (PDAs)
- Computer Accessories
- Access Points
- Automotive Diagnostics Units

2.4 Product names and codes

iWRAP firmware:

- WT11 with UFL connector, iWRAP firmware: WT11-E-AI

HCI firmware:

- WT11 with UFL connector, HCI firmware: WT11-E-HCI

Custom firmware:

- WT11 with UFL connector, custom firmware: WT11-E-C

Notes:

HCI firmware is delivered with USB as host interface

Custom firmware requires properly filled custom firmware document or custom firmware ID.

3. PHYSICAL LAYER SPECIFICATIONS

The common physical layer specifications are shown in the table below.

Item	Specification
Operating Frequency	2400 MHz to 2483.5 MHz (ISM-Band)
Carrier Spacing	1.0 MHz
Channels	79
Duplexing	TDD
Symbol Rate	1 Msymbol/s
TX Modulation Polarity	Binary one: Positive frequency deviation
	Binary zero: Negative frequency deviation
RX Data Out Polarity	$F_C + dF$: "H"
	$F_C - dF$: "L"

Table 1: Common physical layer specifications

4. GENERAL SPECIFICATIONS

Item	Specification
Supply voltage	2.7 – 3.6V regulated voltage. (Noise < 10 mV _{p-p})
Supply current	Maximum current in TX mode: 170.0mA Maximum current in RX mode: 170.0mA
Frequency range	2400 MHz ... 2483.5 MHz (ISM-Band)
Guard band	2 MHz < F < 3.5 MHz (Europe, Japan, USA)
Carrier frequency	2402 MHz ... 2480 MHz, F = 2402 + k MHz, k = 0 ... 78
Modulation method	GFSK (1 Mbps), $\Pi/4$ DQPSK (2Mbps) and 8DQPSK (3Mbps)
Hopping	1600 hops/s, 1 MHz channel space
Maximum data rate	<p>GFSK: Asynchronous, 723.2 kbps / 57.6 kbps Synchronous: 433.9 kbps / 433.9 kbps</p> <p>$\Pi/4$ DQPSK: Asynchronous, 1448.5 kbps / 115.2 kbps Synchronous: 869.7 kbps / 869.7 kbps</p> <p>8DQPSK: Asynchronous, 2178.1 kbps / 177.2 kbps Synchronous: 1306.9 kbps / 1306.9 kbps</p>
Receiving signal range	-82 to -20 dBm (Typical)
Receiver IF frequency	1.5 MHz (Center frequency)

Transmission power	Minimum: -11 ...-9 dBm Maximum +14 ... +18 dBm
RF input impedance	50 Ω
Baseband crystal OSC	26 MHz
Output interfaces	6xGPIO, PCM, SPI, UART, USB, 1xAIO
Operation temperature	-40°C ... +85°C
Storage temperature	-40°C ... +105°C
Compliance	Bluetooth specification, version 2.0 + EDR
USB specification	USB specification, version 1.1 (USB 2.0 compliant)

Table 2: General specifications

5. ELECTRICAL CHARACTERISTICS

Rating	Min	Max
Storage temperature	-40°C	+150°C
Supply Voltage: VDD	2.7V	3.6V

Table 3: Absolute Maximum Ratings

Operating conditions	Min	Max
Operating Temperature Range:	-40°C	+85°C
Supply Voltage: VDD	2.7V	3.6V

Table 4: Recommended Operating Conditions

Digital terminals	Min	Typ	Max	Unit
Input voltage				
V _{IL} input logic level low (VDD=3.3V)	-0.4		+0.8	V
V _{IH} input logic level high	0.7VDD		VDD+0.1	V
Output voltage				
V _{OL} output logic level low (VDD=3.3V) (I _o = 3.0mA)			0.2	V
V _{OH} output logic level high (VDD=3.3V) (I _o = -3.0mA)	VDD-0.2			V

Table 5: Input/Output Terminal Characteristics

WT11 PIN description

The PIN description of WT11 is shown in the table below.

No.	Pin name	I/O	Description
1	GND	GND	Ground
2	3V3	VDD	Power supply connection
3	PIO2	I/O	Programmable I/O lines
4	PIO3	I/O	Programmable I/O lines
5	NRTS	O	UART RTS (internal pull-up, active low)
6	RXD	I	UART RX (internal pull down)
7	PCMO	O	Synchronous 8 kbps data out (internal Pull down)
8	USB_D+	A	USB data plus (Internal 22 ohm serial resistor)
9	USB_D-	A	USB data minus (Internal 22 ohm serial resistor)
10	NCTS	I	UART CTS (internal pull down, active low)
11	PCMI	I	Synchronous 8 kbps data in (internal pull-down)
12	PCMC	I/O	Synchronous data clock (internal pull-down)
13	PCMS	I/O	Synchronous data strobe (internal pull-down)
14	GND	GND	Ground
15	GND	GND	Ground
16	3V3	VDD	Power supply connection
17	RES	I	Reset input (active high)

18	PIO6	I/O	Programmable I/O lines
19	PIO7	I/O	Programmable I/O lines
20	PIO4	I/O	Programmable I/O lines
21	NCSB	I	Chip selection for SPI (internal pull up, active low)
22	SCLK	I/O	SPI Clock (internal pull down)
23	MISO	O	SPI data output (pull down)
24	MOSI	I	SPI data input (pull down)
25	PIO5	I/O	Programmable I/O lines
26	TXD	O	UART TX (internal pull up)
27	AIO	I/O	Analog I/O line
28	GND	GND	Ground

Table 6: WT11 PIN configuration

Notes: Voltage level of input (I), output (O) and input/output (I/O) pins is 3.3V.

6. FOOT PRINT



Figure 3: WT11 foot print and dimension (top view)

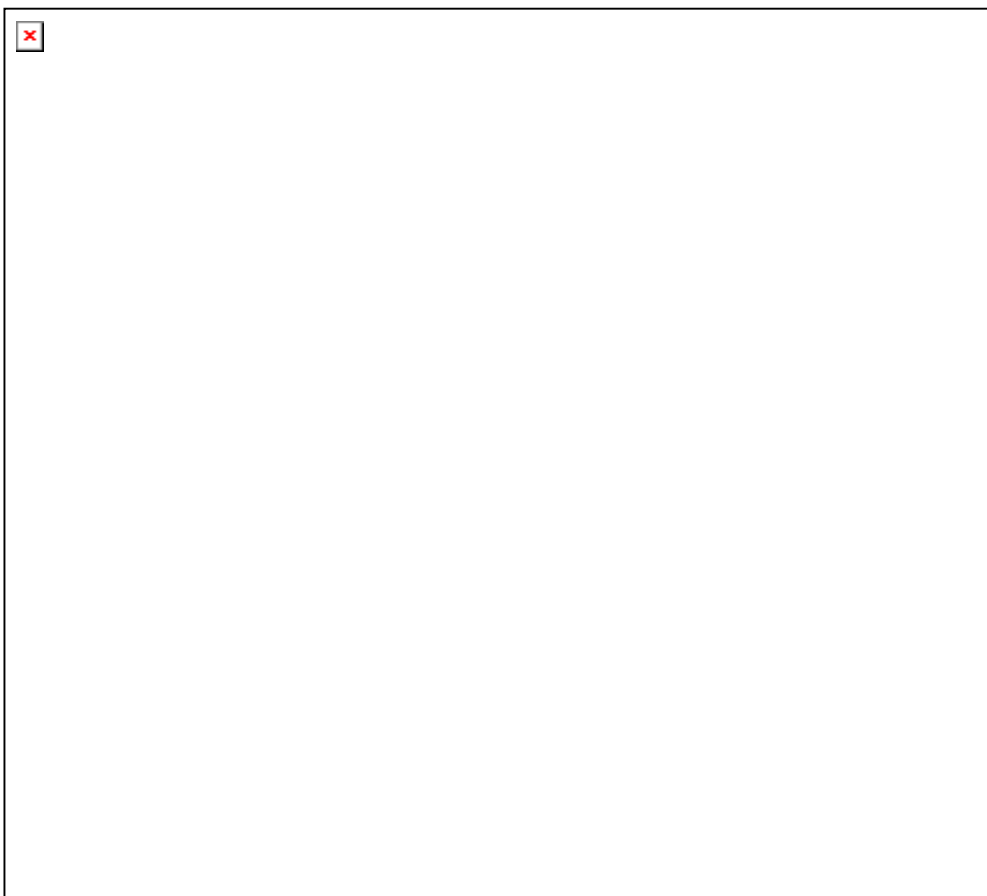


Figure 4: WT11 pad dimensions

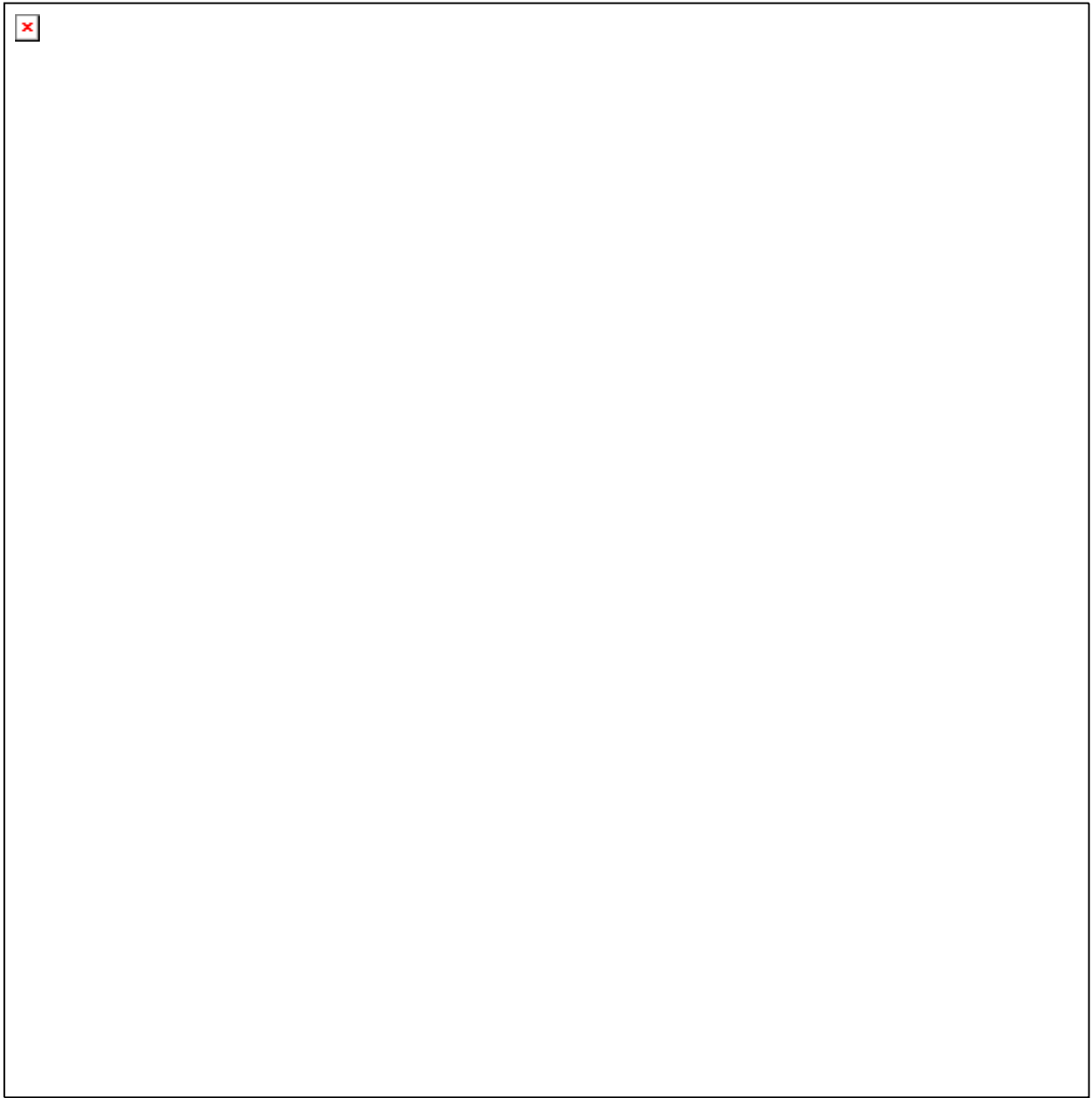


Figure 5: WT11-E dimensions

7. PHYSICAL INTERFACES

7.1 UART Interface

WT11 Universal Asynchronous Receiver Transmitter (UART) interface provides a simple mechanism for communicating with other serial devices using the RS232 standard¹.

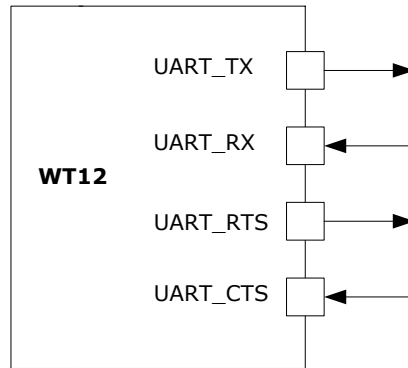


Figure 6: WT11 UART interface

Four signals are used to implement the UART function, as shown in Figure 11.12. When WT11 is connected to another digital device, UART_RX and UART_TX transfer data between the two devices. The remaining two signals, UART_CTS and UART_RTS, can be used to implement RS232 hardware flow control where both are active low indicators. All UART connections are implemented using CMOS technology and have signaling levels of 0V and VDD_PADS.

Notes:

In order to communicate with the UART at its maximum data rate using a standard PC, an accelerated serial port adapter card is required for the PC.

1. Uses RS232 protocol but voltage levels are 0V to VDD_USB, (requires external RS232 transceiver chip)

Parameter		Possible values
Baud rate	Minimum	1200 baud (d2%Error)
		9600 baud (d1%Error)
	Maximum	3.0Mbaud (d1%Error)
Flow control		RTS/CTS, none
Parity		None, Odd, Even

UART Configuration While RESET is Active

The UART interface for WT11 while the chip is being held in reset is tri-state. This will allow the user to daisy chain devices onto the physical UART bus. The constraint on this method is that any devices connected to this bus must tri-state when WT11reset is de-asserted and the firmware begins to run.

7.2 USB Interface

WT11 USB devices contain a full speed (12Mbps/s) USB interface that is capable of driving a USB cable directly. No external USB transceiver is required. The device operates as a USB peripheral, responding to requests from a master host controller such as a PC. Both the OHCI and the UHCI standards are supported. The set of USB endpoints implemented can behave as specified in the USB section of the Bluetooth v2.0 + EDR specification or alternatively can appear as a set of endpoint appropriate to USB audio devices such as speakers.

As USB is a Master/Slave oriented system (in common with other USB peripherals), WT11 only supports USB Slave operation.

7.2.1 USB Data Connections

The USB data lines emerge as pins USB_DP and USB_DN. These terminals are connected to the internal USB I/O buffers of the WT11 and therefore have low output impedance. To match the connection to the characteristic impedance of the USB cable, resistors are included with USB_DP / USB_DN and the cable.

7.2.2 USB Pull-Up Resistor

WT11 features an internal USB pull-up resistor. This pulls the USB_DP pin weakly high when

WT11 is ready to enumerate. It signals to the PC that it is a full speed (12Mbit/s) USB device. The USB internal pull-up is implemented as a current source, and is compliant with Section 7.1.5 of the USB specification v1.2. The internal pull-up pulls USB_DP high to at least 2.8V when loaded with a 15k: r5% pull-down resistor (in the hub/host) when VDD =3.3V. This presents a Therein resistance to the host of at least 900Ohms. Alternatively, an external 1.5k: pull-up resistor can be placed between a PIO line and D+ on the USB cable. The firmware must be alerted to which mode is used by setting PS Key PSKEY_USB_PIO_PULLUP appropriately. The default setting uses the internal pull-up resistor.

7.2.3 Power Supply

The USB specification dictates that the minimum output high voltage for USB data lines is 2.8V. To safely meet the USB specification, the voltage on the VDD_USB supply terminals must be an absolute minimum of 3.1V. CSR recommends 3.3V for optimal USB signal quality.

7.2.4 Detach and Wake-Up Signaling

WT11 can provide out-of-band signaling to a host controller by using the control lines called 'USB_DETACH' and 'USB_WAKE_UP'. These are outside the USB specification (no wires exist for them inside the USB cable), but can be useful when embedding WT11 into a circuit where no external USB is visible to the user. Both control lines are shared with PIO pins and can be assigned to any PIO pin by setting the PS Keys PSKEY_USB_PIO_DETACH

and PSKEY_USB_PIO_WAKEUP to the selected PIO number.

USB_DETACH is an input which, when asserted high, causes WT11 to put USB_DN and USB_DP in high impedance state and turned off the pull-up resistor on D+. This detaches the device from the bus and is logically equivalent to unplugging the device. When USB_DETACH is taken low, WT11 will connect back to USB and await enumeration by the USB host.

USB_WAKE_UP is an active high output (used only when USB_DETACH is active) to wake up the host and allow USB communication to recommence. It replaces the function of the software USB WAKE_UP message (which runs over the USB cable), and cannot be sent while WT11 is effectively disconnected from the bus.

Figure 7: USB_DETACH and USB_WAKE_UP Signal

7.2.5 USB Driver

A USB Bluetooth device driver is required to provide a software interface between WT11 and Bluetooth software running on the host computer. Suitable drivers are available from www.bluegiga.com/techforum/.

7.2.6 USB 1.1 Compliance

WT11 is qualified to the USB specification v1.1, details of which are available from <http://www.usb.org>. The specification contains valuable information on aspects such as PCB track impedance, supply inrush current and product labeling.

Although WT11 meets the USB specification, CSR cannot guarantee that an application circuit designed around the chip is USB compliant. The choice of application circuit, component choice and PCB layout all affect USB signal quality and electrical characteristics. The information in this document is intended as a guide and should be read in association with the USB specification, with particular attention being given to Chapter 7. Independent USB qualification must be sought before an application is deemed USB compliant and can bear the USB logo. Such qualification can be obtained from a USB plug fest or from an independent USB test house.

Terminals USB_DP and USB_DN adhere to the USB specification 2.0 (Chapter 7) electrical requirements.

7.2.7 USB 2.0 Compatibility

WT11 is compatible with USB v2.0 host controllers; under these circumstances the two ends agree the mutually acceptable rate of 12Mbits/s according to the USB v2.0 specification.

7.3 SPI Interface

The synchronous serial port interface (SPI) for interfacing with other digital devices. The SPI port can be used for system debugging. It can also be used for programming the Flash memory. SPI interface is connected using the MOSI, MISO, CSB and CLK pins.

7.4 I/O Parallel Ports

The Parallel Input Output (PIO) Port is a general-purpose I/O interface to WT11. The port

consists of six programmable, bi-directional I/O lines, PIO[2:7].

Programmable I/O lines can be accessed either via an embedded application running on WT11 or via private channel or manufacturer-specific HCI commands.

All PIO lines are configured as inputs with weak pull downs at reset.

PIO[2] / USB_PULL_UP (1)

This is a multifunction terminal. The function depends on whether WT11 is a USB or UART capable version. On UART versions, this terminal is a programmable I/O. On USB versions, it can drive a pull-up resistor on USB_D+. For application using external RAM this terminal may be programmed for chip select.

PIO[3] / USB_WAKE_UP (1)

This is a multifunction terminal. On UART versions of WT11 this terminal is a programmable I/O. On USB versions, its function is selected by setting the Persistent Store Key PSKEY_USB_PIO_WAKEUP (0x2cf) either as a programmable I/O or as a USB_WAKE_UP function.

PIO[4] / USB_ON (1)

This is a multifunction terminal. On UART versions of WT11 this terminal is a programmable I/O. On USB versions, the USB_ON function is also selectable.

PIO[5] / USB_DETACH (1)

This is a multifunction terminal. On UART versions of WT11 this terminal is a programmable I/O. On USB versions, the USB_DETACH function is also selectable.

PIO[6] / CLK_REQ

This is multifunction terminal, its function is determined by Persistent Store Keys. Using PSKEY_CLOCK_REQUEST_ENABLE, (0x246) this terminal can be configured to be low when WT11 is in deep sleep and high when a clock is required. The clock must be supplied within 4ms of the rising edge of PIO[6] to avoid losing timing accuracy in certain Bluetooth operating modes.

PIO[7]

Programmable I/O terminal.

8. RESET

The RESET pin is an active high reset and is internally filtered using the internal low frequency clock oscillator. A reset will be performed between 1.5 and 4.0ms following RESET being active. It is recommended that RESET be applied for a period **greater than 5ms**.

9. SOFTWARE STACKS

WT11 is supplied with Bluetooth v2.0 + EDR compliant stack firmware, which runs on the internal RISC microcontroller.

The WT11 software architecture allows Bluetooth processing and the application program to be shared in different ways between the internal RISC microcontroller and an external host processor (if any). The upper layers of the Bluetooth stack (above HCI) can be run either on-chip or on the host processor.

9.1 iWRAP Stack

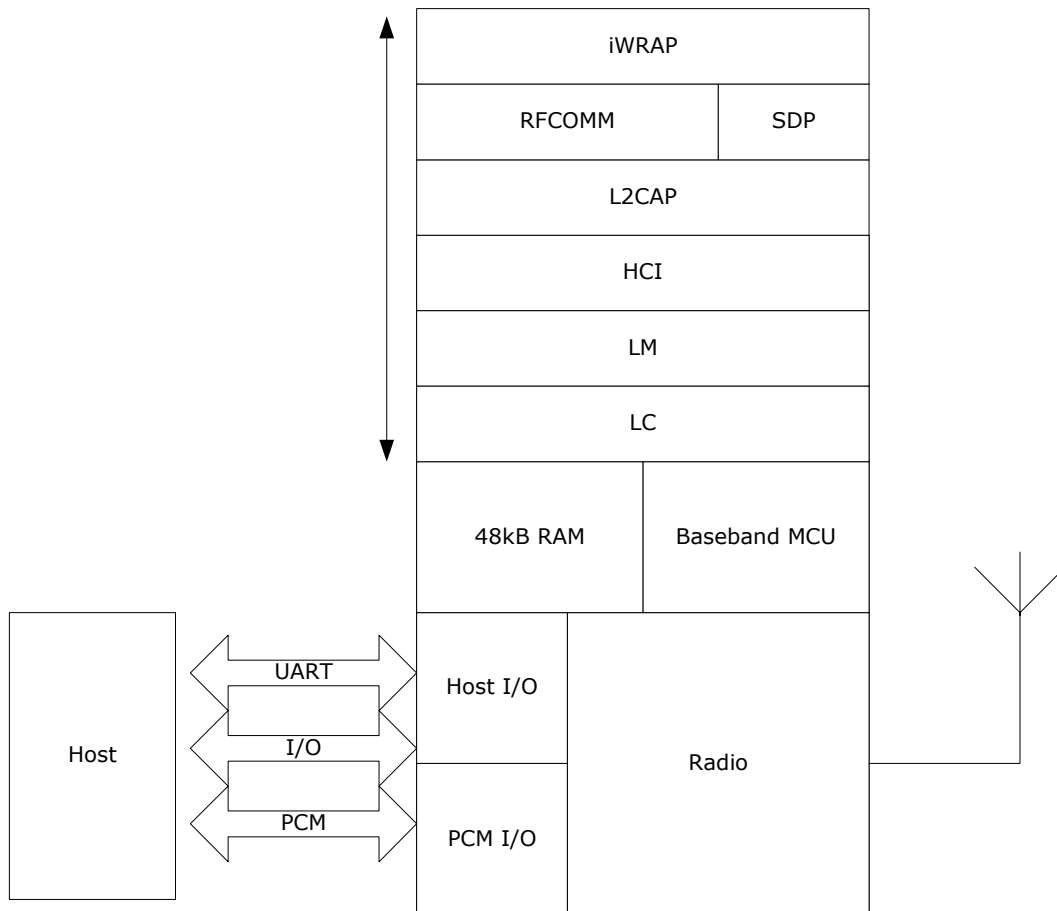


Figure 8: WRAP THOR VM Stack

In figure above, the iWRAP software solution is described. In this version of the stack firmware shown no host processor is required to run the Bluetooth protocol stack. All software layers, including application software, run on the internal RISC processor in a protected user software execution environment known as a Virtual Machine (VM).

The host processor interfaces to iWRAP software via one or more of the physical interfaces which are also shown in the figure above. The most common interfacing is done via UART interface using the ASCII commands supported by the iWRAP software. With these ASCII commands the user can access Bluetooth functionality without paying any attention to the complexity which lies in the Bluetooth protocol stack.

The user may write applications code to run on the host processor to control iWRAP software with ASCII commands and to develop Bluetooth powered applications.

Notes:

More details of iWRAP software and its features can be found from *iWRAP User Guide* which can be downloaded from www.bluegiga.com.

10. SOLDERING

10.1 Reflow Soldering

The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder re-flow. There are four zones:

1. Preheat Zone - This zone raises the temperature at a controlled rate, typically 1-2.5°C/s.
2. Equilibrium Zone - This zone brings the board to a uniform temperature and also activates the flux. The duration in this zone (typically 2-3 minutes) will need to be adjusted to optimize the out gassing of the flux.
3. Reflow Zone - The peak temperature should be high enough to achieve good wetting but not so high as to cause component discoloration or damage. Excessive soldering time can lead to intermetallic growth which can result in a brittle joint.
4. Cooling Zone - The cooling rate should be fast, to keep the solder grains small which will give a longer lasting joint. Typical rates will be 2-5°C/s.
5. Solder Re-Flow Profile for Devices with Lead-Free Solder Balls

Composition of the solder ball: Sn 95.5%, Ag 4.0%, Cu 0.5%

Key features of the profile:

- Initial Ramp = 1-2.5°C/sec to 175°C±25°C equilibrium
- Equilibrium time = 60 to 180 seconds
- Ramp to Maximum temperature (250°C) = 3°C/sec max.
- Time above liquidus temperature (217°C): 45-90 seconds
- Device absolute maximum reflow temperature: 260°C

Devices will withstand the specified profile. Lead-free devices will withstand up to three reflows to a maximum temperature of 260°C.

Certifications

WT11 is compliant to the following specifications

10.2 Bluetooth

The WT11-E module is *Bluetooth* qualified and listed as an end product. If not modified in any way, it is a complete *Bluetooth* entity, containing software and hardware functionality as well as the whole RF-part including the antenna. This practically translates to that if the module is used without modification of any kind, it does not need any *Bluetooth* approval work. If changes are made in the parameter set, added profiles or in the antenna design, it is required to be submitted to a BQB (*Bluetooth* Qualification Body) for evaluation on what needs to be tested.

With HCI firmware WT11 will not meet the requirements of end product qualification.

WT11 is Bluetooth compliant to the following specifications

1. RF as defined in Part A of the Bluetooth specification v2.0+EDR, Vol.2 Core System Package [Controller volume] (Class 1 operation) with all optional and mandatory features supported.
2. BB as defined in Part B of the Bluetooth specification v2.0+EDR, Vol.2 Core System Package [Controller volume], and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B01294)
3. LM as defined in Part C of the Bluetooth specification v2.0+EDR, Vol.2 Core System Package [Controller volume], and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B01294)
4. L2CAP as defined in Part A of the Bluetooth specification v2.0+EDR, Vol.3 Core System Package [Controller volume], and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B00477)
5. SDP as defined in Part B of the Bluetooth specification v2.0+EDR, Vol.3 Core System Package [Controller volume], and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B00477)
6. RFCOMM as defined in PART F:1 of the Bluetooth Core Specification v1.1 and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B00047).
7. Generic Access GAP as defined in PART C of the Bluetooth Core Specification v2.0+EDR, Vol.3 Core Systems Package [Host Volume], and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B00047).
8. Serial Port Profile (SPP) as defined in PART K:5 of the Bluetooth Profile Specification v1.1, and specified in the covered functionality of the Software Integrated Component (Bluetooth ID: B00047).

Bluetooth identifier: B03005

10.3 FCC

Federal Communications Commission (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Operation is subject to the following two conditions:

- This device may not cause interference and
- This device must accept any interference, including interference that may cause undesired operation of the device.

FCC RF Radiation Exposure Statement:

- This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Note: The end product shall have the words "*Contains Transmitter Module FCC ID: QOQWT11E*"

10.4 CE

WT11 meets the requirements of the standards below and hence fulfills the requirements of EMC Directive 89/336/EEC as amended by Directives 92/31/EEC and 93/68/EEC within CE marking requirement.

- Electromagnetic emission EN 301 489-17 V.1.2.1
 - EN 55022:1998+A
 - EN 55022:2000+A3
 - EN 55022:2003 Class B
 - EN 61000-3-2:2001
 - EN 61000-3-3:1995 A1:2001
 - EN 61000-4-3:2002
 - EN 61000-4-4:1995 A1:2000
 - EN 61000-4-5:1995 A1:2000
 - EN 61000-4-6:1996 A1:2000
 - EN 61000-4-11:1994 A1:2000

11. CONTACT INFORMATION

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