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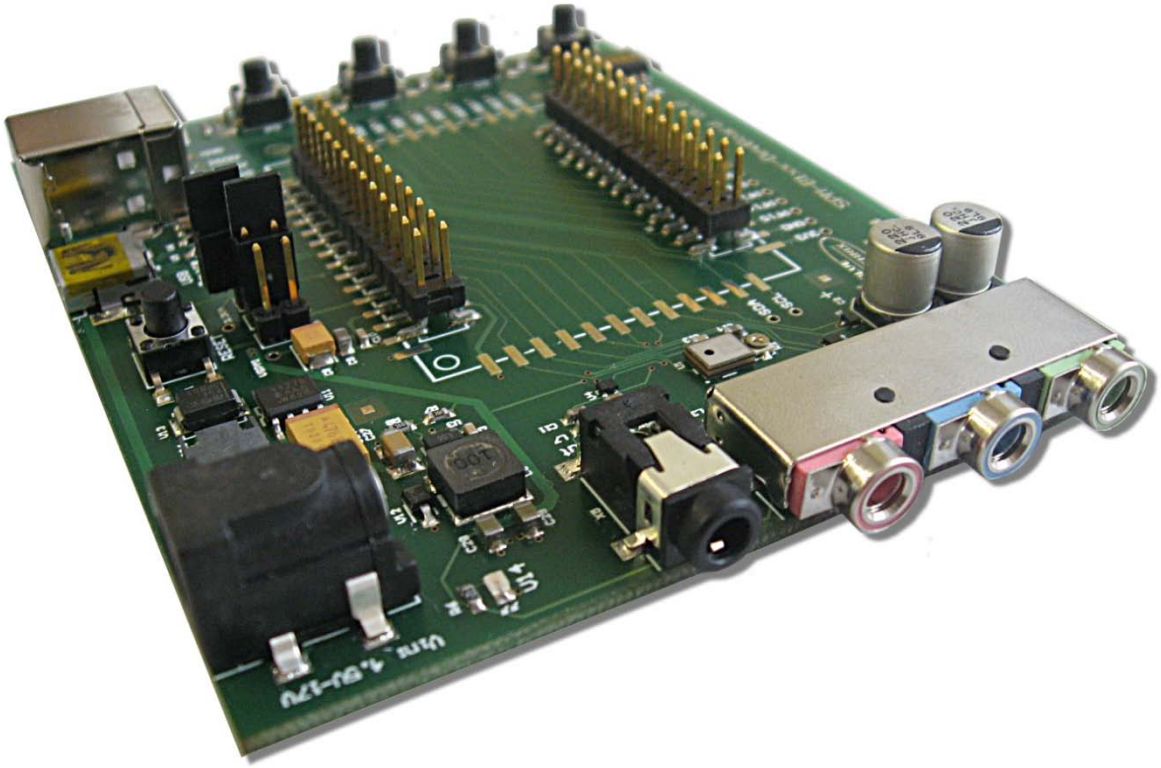

Hardware User Manual

ADEV-BF52xC V1.1

...maximum performance at minimum space

Contact

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Document No.: 100-8232-1-1.3

Date: 2011-05-30

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Information

For further information on technology, delivery terms and conditions and prices please contact Bluetechnix (http://www.bluetechnix.com).

Warning

Due to technical requirements components may contain dangerous substances.

Blackfin® Core Modules

TCM-BF518-C-C-Q25S32F2 (TCM-BF518)

The Tiny Core Module TCM-BF518 is powered by Analog Devices' single core ADSP-BF518 processor; up to 400MHz, 32MB SDRAM, up to 8MB flash. The 2x60 pin expansion connectors are backwards compatible with other Core Modules.

ACM-BF525C-C-C-Q25S64F4N1024

The Core Module ACM-BF525C is optimized for audio applications and performance. It is based on the high performance ADSPBF525Cfrom Analog Devices. It addresses 64MByte SDRAM via its 16bit wide SDRAM bus, has an onboard NOR-flash of 4MByte and a NAND-flash with 1024MByte.

CM-BF527-C-C-Q50S32F8 (CM-BF527)

The Core Module CM-BF527 is powered by Analog Devices' single core ADSP-BF527 processor; key features are USB OTG 2.0 and Ethernet. The 2x60 pin expansion connectors are backwards compatible with other Core Modules.

CM-BF533-C-C-Q25S32F2 (CM-BF533)

The Core Module CM-BF533 is powered by Analog Devices' single core ADSP-BF533 processor; up to 600MHz, 32MB SDRAM, 2MB flash, 2x60 pin expansion connectors at a size of 36.5x31.5mm.

TCM-BF537-C-I-Q25S32F8 (TCM-BF537)

The Tiny Core Module TCM-BF537 is powered by Analog Devices' single core ADSP-BF537 processor; up to 500MHz, 32MB SDRAM, 8MB flash, a size of 28x28mm, 2x60 pin expansion connectors, Ball Grid Array or Border Pads for reflow soldering, industrial temperature range -40°C to +85°C.

CM-BF537-C-C-Q25S32F4 (CM-BF537E)

The Core Module CM-BF537 is powered by Analog Devices' single core ADSP-BF537 processor; up to 600MHz, 32MB SDRAM, 4MB flash, integrated TP10/100 Ethernet physical transceiver, 2x60 pin expansion connectors at a size of 36.5x31.5mm.

CM-BF537-C-C-Q30S32F4-U (CM-BF537U)

The Core Module CM-BF537 is powered by Analog Devices' single core ADSP-BF537 processor; up to 600MHz, 32MB SDRAM, 4MB flash, integrated USB 2.0 Device, 2x60 pin expansion connectors at a size of 36.5x31.5mm.

CM-BF548-C-C-Q25S64F8 (CM-BF548)

The Core Module CM-BF548 is characterized by its numerous peripheral interfaces, its performance in combination with its high speed memory interface (DDR). Key features are 533MHz, 64MB DDR SD-RAM (266MHz), and 8MB flash.

CM-BF561-C-C-Q25S64F8 (CM-BF561)

The Core Module CM-BF561 is powered by Analog Devices' dual core ADSP-BF561 processor; up to 2x 600MHz, 64MB SDRAM, 8MB flash, 2x60 pin expansion connectors at a size of 36.5x31.5mm.

eCM-BF561-C-C-Q25S128F32 (eCM-BF561)

The Core Module CM-BF561 is powered by Analog Devices' dual core ADSP-BF561 processor; up to 2x 600MHz, 128MB SDRAM, 8MB flash, 2x100 pin expansion connectors and a size of 44x33mm.

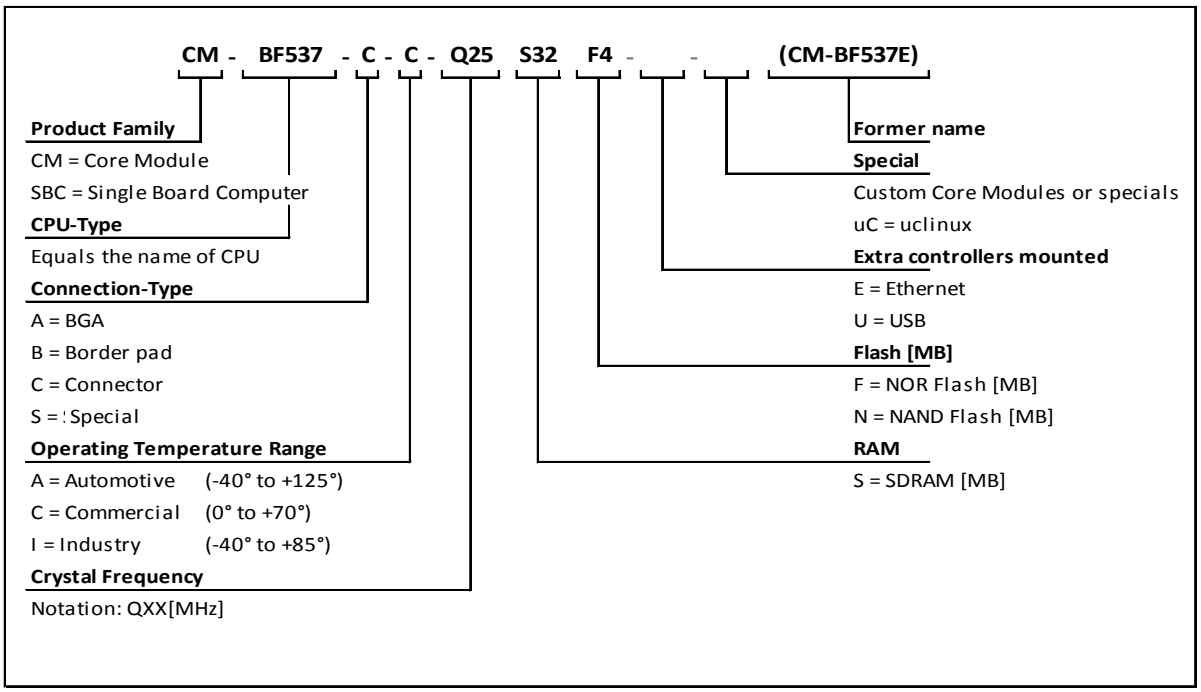
Core Module naming information

The idea is to put more Core Module specific technical information into the product name. New Core Module names will have following technical information covered in their names.

- Product Family,
- CPU-Type,
- Connection-Type,
- Operating Temperature Range,
- Crystal Frequency [MHz],
- RAM [MB],
- Flash [MB],
- External Controllers
- Optional
    - Special and/or
    - Former name

That expands of course the name but allows the customer to get the most important Core Module specific information at the first sight. Have a look at the example below to get an idea of the new Core Module names.

Example CM-BF537-C-C-Q25S32F4 (CM-BF537E)



Blackfin® Development Boards

ADEV-BF52xC

Feature rich, low cost embedded audio development platform which supports Audio Core Modules (ACM). The form factor of the ADEV-BF52xC allows easy integration of the board into OEM products. Dedicated interfaces such as USB2.0, Line In/Out, headphone out and an onboard silicon microphone turn the ADEV-BF52xC into a full-featured development platform for most embedded audio applications in commercial areas.

DEV-BF5xxDA-Lite

Get ready to program and debug Bluetechnix Core Modules with this tiny development platform including an USB-Based Debug Agent. The DEV-BF5xxDA-Lite is a low cost starter development system including a VDSP++ Evaluation Software License.

DEV-BF548-Lite

Low-cost development board with a socket for Bluetechnix' CM-BF548 Core Module. Additional interfaces are available, e.g. an SD-Card, USB and Ethernet.

DEV-BF548DA-Lite

Get ready to program and debug Bluetechnix CM-BF548 Core Module with this tiny development platform including an USB-Based Debug Agent. The DEV-BF548DA-Lite is a low-cost starter development system including a VDSP++ Evaluation Software License.

eDEV-BF5xx

Feature rich, low cost rapid development platform which provides all interfaces on dedicated connectors and has all Core Module pins routed to solder pads which easily can be accessed by the developers. The eDEV-BF5xx supports the latest debugging interface from Analog Devices - ADI-SADA (Analog Devices Stand Alone Debug Agent).

EVAL-BF5xx

Tiny, low cost embedded platform which supports Bluetechnix powerful Blackfin® based Core Modules. The form factor (75x75mm) of the EVAL-BF5xx allows easy integration of the board into OEM products. Dedicated interfaces such as USB2.0, SD-card slot, CAN interface connectors and of course Ethernet, turn the EVAL-BF5xx into a full-featured evaluation platform for most embedded applications.

Extender boards

Extender boards (EXT-BF5xx) are expanding the development and evaluation boards by several interfaces and functionalities. Targeted application areas are: audio/video processing, security and surveillance, Ethernet access, positioning, automation and control, experimental development and measuring.

Note! Bluetechnix is offering tailored board developments as well.

1 Introduction

The ADEV-BF52xC Development Board is a feature rich, low cost embedded audio development platform which supports Bluetechnix latest powerful Blackfin® based Audio Core Modules like the ACM-BF525C. Based on Bluetechnix' long experience in industrial and commercial embedded systems design this kit is suited to the market requirements to decrease time-to-market of your embedded audio applications.

The form factor of the ADEV-BF52xC allows easy integration of the board into OEM products. Dedicated interfaces such as USB2.0, Line In/Out, headphone out and an onboard silicon microphone turn the ADEV-BF52xC into a full-featured development platform for most embedded audio applications in commercial areas.

1.1 Overview

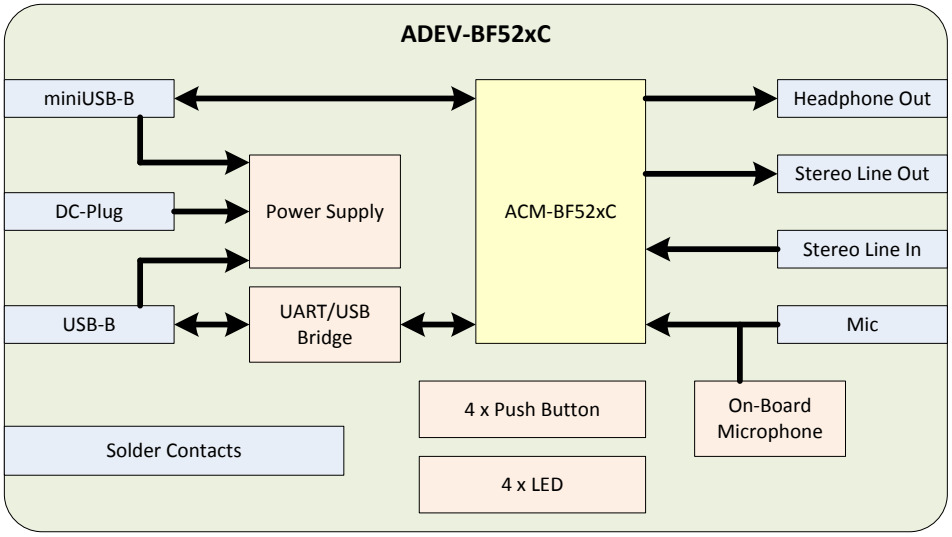


Figure 1-1: Block diagram

1.2 Key Features

- Mini USB-B connector
- USB-B connector routed to the UART-USB bridge
- 4 LEDs (red, green, yellow, orange)
- 4 push-buttons
- Analog Audio Interface with microphone input, stereo line in and out, stereo headphone output
- On-board microphone
- USB-powered or wide range external DC supply (4.5 to 17V)
- Solder contacts for every digital IO-pin

1.3 Applications

- Audio processing
- Speech recognition
- Synthesized voice
- Translation
- Voice control
- Talking toys

2 General Description

The ADEV-BF52xC has been designed as evaluation and development platform for both, **A**udio **C**ore **M**odules **ACM-BF52xC** or **S**peech **P**rocessing **M**odules e.g. **SPM-B1xx**. For more information about the modules refer the Hardware User Manuals on our website.

2.1 Functional Description

2.1.1 Powering

The Step-Down DC-DC converter allows powering the development board via the DC-power plug, by connecting an external power source between 4.5V and 17V.

Alternatively the board can be powered via either the USB-B or the mini USB-B connector. If so, the DC-DC converter is not used.

To choose the correct powering configuration, the right jumper-setting is needed (see Table 2-3).

2.1.2 USB Device

The ADSP-BF52xC has an integrated USBOTG controller. The USB-D+ and USB-D- Lines can be routed directly to a USB connector. The USB-ID Pin is used to indicate whether the SPM/ACM-BF52x is a USB-Device or a USB-Host. The VUSB pin is used to indicate, if a USB bus power is applied.

The USB data lines and the VBUS are protected against ESD complying with IEC61000-4-2 level 4 standard:

- 15kV air discharge
- 8kV contact discharge

The ADEV-BF52xC uses only a mini USB-B connector and does not support USBOTG (host-mode).

2.1.3 Analog Interface

All analog I/Os are connected to 35mm stereo audio jacks. The stereo line-out is routed to the black jack, the stereo headphone, the stereo line-in and the microphone lines are available on the standard-colored jacks.

Interface	Jack color	Function
Line In	Blue	Stereo audio input
Line Out	Black	Stereo audio output
Mic In	Red	Microphone input with phantom-power for electrets-microphones
HP out	Green	Stereo audio output capable for headphones

Table 2-1: Analog interface description

If no external microphone is plugged in to the red jack, the on-board microphone is active. To calibrate the gain there is a small trimmer potentiometer which allows adjusting the built-in preamp.

2.1.4 Digital Interface

All digital I/O signals are available on solder-pads. Some of them are routed to other parts (see Table 2-2 for detailed interconnection information).

Signal	Alt. Function	Interface	Connected to
PG13	UART1RX	UART	Routed to the UART-USB bridge
PG12	UART1TX	UART	Routed to the UART-USB bridge
PG2	SCLK	SPI	
PG3	MISO	SPI	
PG4	MOSI	SPI	
SDA		I^2C	
SCL		I^2C	
PG5	TMR1	GPIO	DIP-switch S2 (usable for bootstrap implementations)
PG6	TMR2	GPIO	DIP-switch S2 (usable for bootstrap implementations)
PG7	TMR3	GPIO	push-button SW0
PG8	TMR4	GPIO	red LED
PG9	TMR5	GPIO	orange LED
PG10	TMR6	GPIO	yellow LED
PG11	TMR7	GPIO	green LED
PG14		GPIO	push-button SW1
PF14		GPIO	push-button SW2
PF15		GPIO	push-button SW3
PF0	PPI.D0	GPIO	
PF1	PPI.D1	GPIO	
PF2	PPI.D2	GPIO	
PF3	PPI.D3	GPIO	
PF4	PPI.D4	GPIO	
PF5	PPI.D5	GPIO	
PF6	PPI.D6	GPIO	
PF7	PPI.D7	GPIO	
PPI.CLK[1)]		PPI	
PPI.FS1		PPI	

Table 2-2: Digital interface description

[1)] Not available on connector version of the Core Module

2.2 PCB Placement

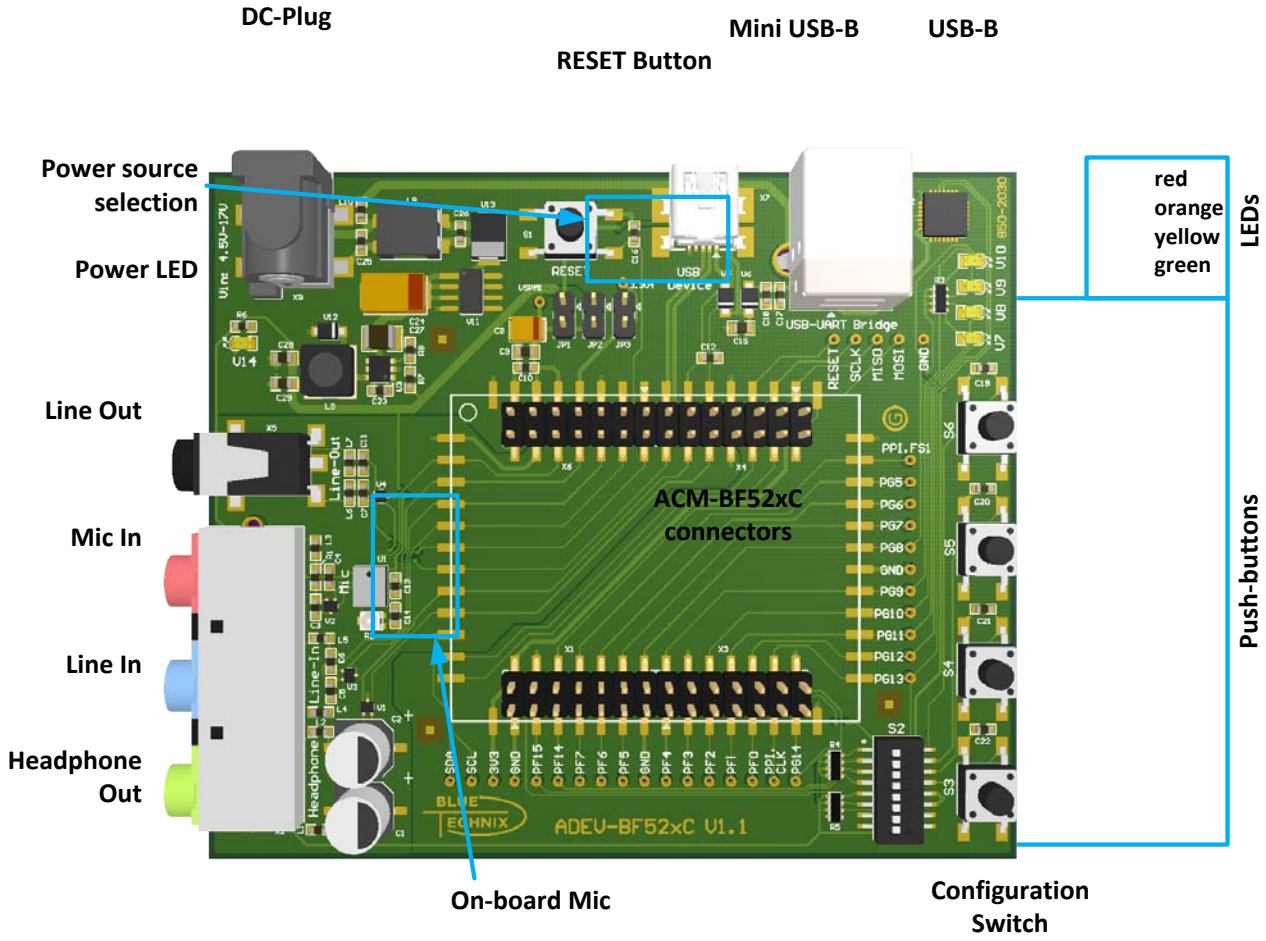


Figure 2-1: Board Layout

2.3 Switches, Jumpers and LEDs

The following section describes the Functionality of all jumpers switches and LEDs.

2.3.1 Power Source Selection Jumper

JP1	JP2, JP3	Power source	Comment
short	**open**	Board powered via USB connectors	Power source for Core Module is 5.0V
open	**short**	Board powered via DC-plug	Power source for Core Module is 3.3V

Table 2-3: Power source selection

2.3.2 Power LED

The green power LED indicates that a power source is plugged into the board.

2.3.3 GPIO LEDs

Four LEDs are connected to GPIOs of the SPM. They can be free programmed by the developer.

LED	Color	Blackfin GPIO
V10	Red	PG8
V9	Orange	PG9
V8	Yellow	PG10
V7	Green	PG11

Table 2-4: LED Description

2.3.4 GPIO Button

The four GPIO push-buttons are connected to Blackfin GPIOs of the SPM. They can be used to program a user interaction. All buttons have a de-bouncing capacitor.

Button	Blackfin GPIO
S3	PF15
S3	PF14
S5	PG14
S6	PG7

Table 2-5: Push-Button Description

2.3.5 Reset Button

The Reset button ties the SPM Reset to GND. Also the Reset button is de-bounced by hardware.

2.3.6 DIP-Switch

The DIP switch (S2) allows to disconnect the push-buttons from the GPIOs and to implement bootstrap configurations.

Way	Blackfin GPIO	Function (ON State)
1	PG7	Connect to S6
2	PG14	Connect to S5
3	PF14	Connect to S4
4	PF15	Connect to S3
5	PG6	Tie PG6 to GND
6	PG5	Tie PG5 to GND
7	Not Connected	-
8	Not Connected	-

Table 2-6: DIP Switch Functionality

2.4 Mechanical Outline

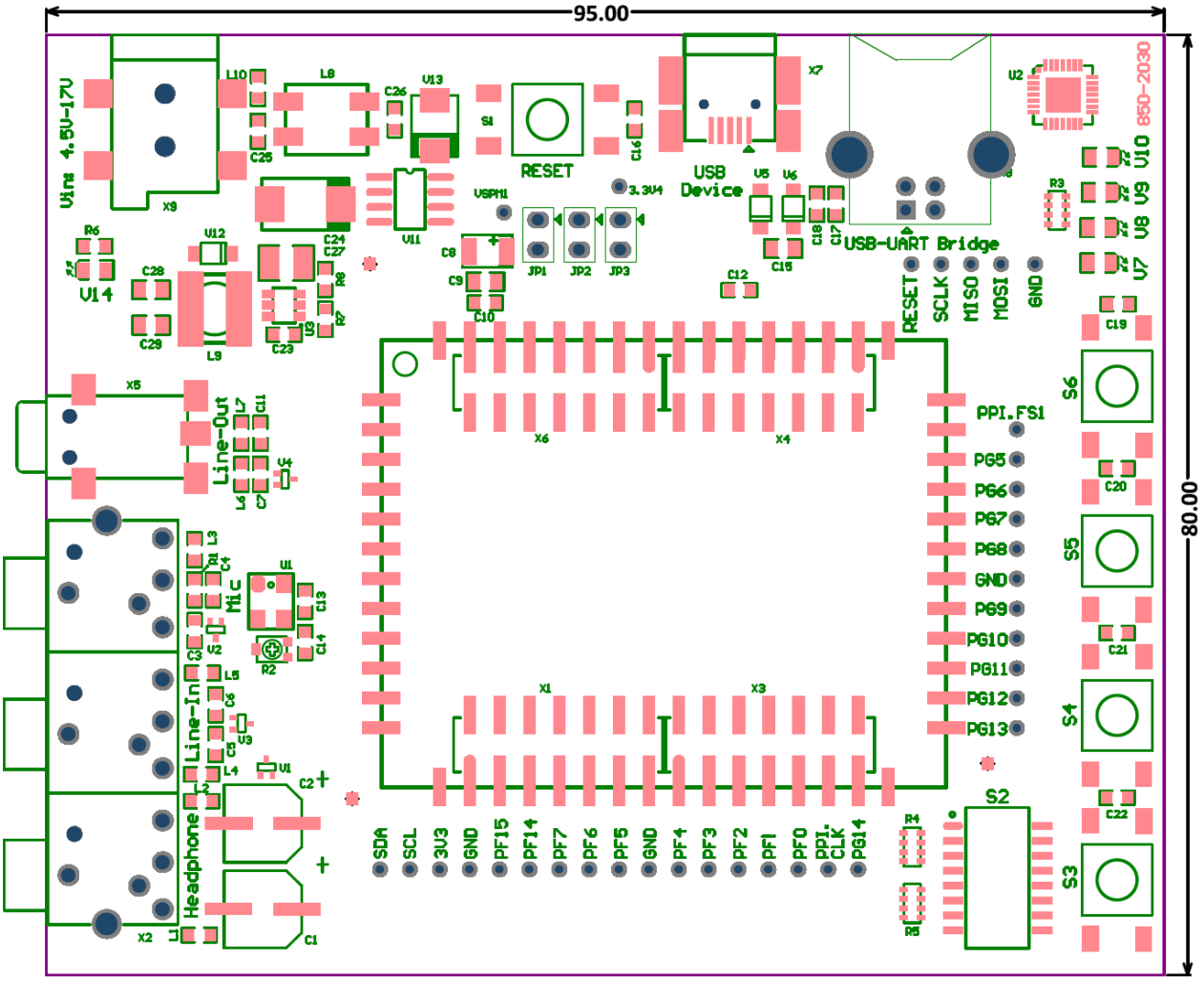


Figure 2-2: Board Outline Dimension

2.5 Electrical Specifications

2.5.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{INDC}	Input supply voltage on DC-plug	4.5		17	V
V_{INUSB}	Input supply voltage on USB connectors	4.5	5.0	5.5	V
I_{3V3}	3.3V current			150	mA
V_{OH}	High level output voltage	2.4			V
V_{OL}	Low level output voltage			0.4	V
I_{IH}	IO input current			10	µA
I_{OZ}	Three state leakage current			10	µA

Table 2-7: Electrical Characteristics

2.5.2 Maximum Ratings

Stressing the device above the rating listed in the absolute maximum ratings table may cause permanent damage to the device. These are stress ratings only. Operation of the device at these or any other conditions greater than those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Min	Max	Unit
V_{IO}	Input or output voltage	-0.5	3.6	V
V_{IN}	Input supply voltage	3.0	5.5	V
I_{OH}/I_{OL}	Current per pin	0	10	mA
T_{AMB}	Ambient temperature	-40	85	°C
T_{STO}	Storage temperature	-55	150	°C
T_{SLD}	Solder temperature for 10 seconds		260	°C
φ_{AMB}	Relative ambient humidity		90	%

Table 2-8: Absolute Maximum Ratings

2.5.3 ESD Sensitivity

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

3 Support

3.1 General Support

General support for products can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki

3.2 Board Support Packages

Board support packages and software downloads are for registered customers only https://support.bluetechnix.at/software/

3.3 Blackfin® Software Support

3.3.1 BLACKSheep® OS

BLACKSheep® OS stands for a powerfully and multithreaded real-time operating system (RTOS) originally designed for digital signal processing application development on Analog Devices Blackfin® embedded processors. This high-performance OS is based on the reliable and stable real-time VDK kernel from Analog Devices that comes with VDSP++ IDE. Of course BLACKSheep® OS is fully supported by all Bluetechnix Core-Modules and development hardware.

3.3.2 LabVIEW

You can get LabVIEW embedded support for Bluetechnix Core Modules by Schmid-Engineering AG http://www.schmid-engineering.ch.

3.3.3 uClinux

You can get uClinux support (boot loader and uClinux) for Bluetechnix Core Modules at http://blackfin.uClinux.org.

3.4 Blackfin® Design Services

Based on more than seven years of experience with Blackfin, Bluetechnix offers development assistance as well as custom design services and software development.

3.4.1 Upcoming Products and Software Releases

Keep up to date with all product changes, releases and software updates of Bluetechnix at http://www.bluetechnix.com.

4 Ordering Information

4.1 Predefined mounting options for ADEV-BF52xC

Article Number	Name	Description
100-8232-1	ADEV-BF52xC	ADEV-BF52xC Audio Development Board
100-3306	ADK - Audio Development Kit	ADK - Audio Development Kit with ACM-BF525C and ADEV-BF52xC
100-3307	Embedded Speech Processing Kit SPM-B101	Embedded Speech Processing Kit with ADEV-BF52xC and SPM-B101

Table 4-1 - Ordering information

NOTE: Custom hard and software developments are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom hard- and software developments.

5 Dependability

5.1 MTBF

Please keep in mind that a part stress analysis would be the only way to obtain significant failure rate results, because MTBF numbers just represent a statistical approximation of how long a set of devices should last before failure. Nevertheless, we can calculate an MTBF of the development board using the bill of material. We take all the components into account. The PCB and solder connections are excluded from this estimation. For test conditions we assume an ambient temperature of 30°C of all development board components. We use the MTBF Calculator from ALD (http://www.aldservice.com/) and use the reliability prediction MIL-217F2 Part Stress standard. Please get in touch with Bluetechnix (office@bluetechnix.com) if you are interested in the MTBF result.

6 Product History

6.1 Version Information

Version	Date	Changes
1.1	2011-03-28	Bootstrap pin PG15 changed to PG5 LED order changed to green-yellow-orange-red
1.0	2010-12-21	First hardware release, thus no changes to report.

Table 6-1: Overview product changes

6.2 Anomalies

Version	Date	Description
1.1	2011 04 12	No anomalies reported yet.
1.0	2011 04 12	No anomalies reported yet.

Table 6-2: Overview product anomalies

7 Document Revision History

Version	Date	Document Revision
3	2011-05-30	Updated HUM design.
2	2011-04-12	Update for the new hardware release V1.1
1	2009 -12-03	Preliminary release V1.0 of the Document.

Table 7-1: Revision History

8 List of Abbreviations

Abbreviation	Description
ADI	Analog Devices Inc.
AI	Analog Input
AMS	Asynchronous Memory Select
AO	Analog Output
CM	Core Module
DC	Direct Current
DSP	Digital Signal Processor
eCM	Enhanced Core Module
EBI	External Bus Interface
ESD	Electrostatic Discharge
GPIO	General Purpose Input Output
I	Input
I²C	Inter-Integrated Circuit
I/O	Input/Output
ISM	Image Sensor Module
LDO	Low Drop-Out regulator
MTBF	Mean Time Between Failure
NC	Not Connected
NFC	NAND Flash Controller
O	Output
OS	Operating System
PPI	Parallel Peripheral Interface
PWR	Power
RTOS	Real-Time Operating System
SADA	Stand Alone Debug Agent
SD	Secure Digital
SoC	System on Chip
SPI	Serial Peripheral Interface
SPM	Speech Processing Module
SPORT	Serial Port
TFT	Thin-Film Transistor
TISM	Tiny Image Sensor Module
TSC	Touch Screen Controller
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
USBOTG	USB On The Go
ZIF	Zero Insertion Force

Table 8-1: List of abbreviations

A List of Figures and Tables

Figures

Tables