

Hardware User Manual

EXT-BF5xx-AD-DA V1.x

...maximum performance at minimum space

Contact

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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 ADSPBF525C from 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.

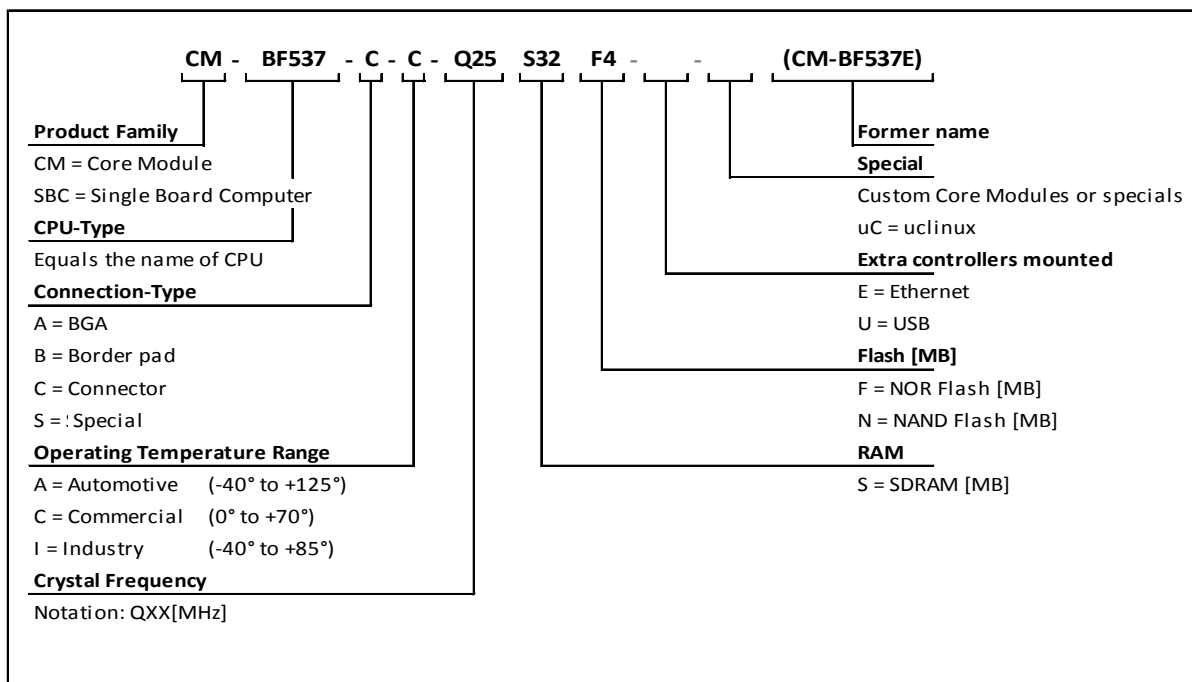
Core Module naming information

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 EXT-BF5xx-AD-DA is an extender board suitable for the DEV-BF5xxDA-Lite or the EVAL-BF5xx development boards. This stackable board features an AD7266 12-Bit multichannel Analog-Digital-Converter (12 channels, 2 MSPS), an AD5415 12-bit multichannel serial Digital-Analog-Converter (2 channels, 2.47 MSPS) and an AD5405 12-bit multichannel parallel Digital-Analog-Converter (2 channels, 21.3 MSPS). Two analog inputs are equipped with noise suppression. The EXT-BF5xx-AD-DA is ideally suited for your future embedded control applications.

1.1 Overview

The EXT-BF5xx-AD-DA Board includes the following components:

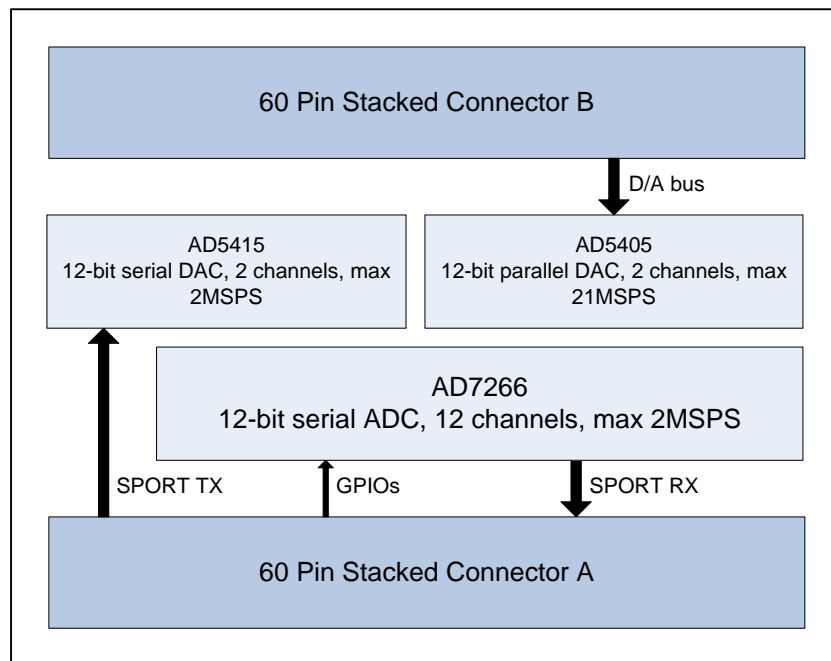


Figure 1-1: Overview of the EXT-BF5xx-AD-DA

- **Stacked Connectors**
 - To connect with EVAL-BF5xx, DEV-BF5xxDA-Lite, DEV-BF548-lite or the DEV-BF548DA-lite.
- **ADC Interface¹**
 - Analog Devices AD7266 Analog Digital Converter
 - 12 bit, 3-channel ADC
 - Max throughput rate 2MSPS
 - 12-channel single-ended or 6 channel differential input
 - 70dB SNR at 50 kHz input frequency
 - Accurate on-chip reference of 2,5V
 - High speed serial interface, DSP compatible
 - -40°C to +125°C operation

¹ Not supported by CM-BF527 – see chapter 1.4

- **DAC Interface**

- Analog Devices AD5405 parallel Digital to Analog Converter
 - 12 bit, dual-channel DAC
 - Max 21,3 MSPS update rate
 - Parallel interface
 - Power-on reset
 - -40°C to +125°C operation
- ²Analog Devices AD5415 serial Digital to Analog Converter
 - 12 bit, dual-channel DAC
 - Max 2,47 MSPS update rate
 - 50 MHz serial interface
 - Power-on reset
 - -40 °C to +125°C operation

1.2 Key Features

- Low noise power supply
- 12-bit ADC (12 channels - 2Msps)
- 12-bit serial DAC (2 channels - 2Msps)
- 12 bit parallel DAC (2 channels 21.3 Msps)
- 2x Noise suppressed analog inputs
- 2x Anti-aliasing filter for DAC outputs

1.3 Applications

- Embedded control
- Automation
- Control systems
- Measuring systems

1.4 Supported Core Modules

Core Modules	
TCM-BF518	CM-BF537-U
CM-BF527*	TCM-BF537
CM-BF533	CM-BF548
CM-BF537	CM-BF548

Table 1-1: Supported Core Modules

***NOTE:** CM-BF527 does only support the parallel DAC AD5405 due to different SPORT assignment!

² Not supported by CM-BF527 – see chapter 1.4

2 General Description

2.1 Blackfin® address and PIN-assignment

2.1.1 Base address of parallel DAC

The following table shows which base address is assigned to the parallel DAC depending on the positions of Key 3 and Key 4 of S101 and the Core Module inserted on the base board.

Core Module	Key 3 ON, Key 4 OFF	Key 4 ON, Key 3 OFF
CM-BF533	0x20200000 (nAMS2)	0x20300000 (nAMS3)
CM-BF537	0x20200000 (nAMS2)	0x20300000 (nAMS3)
TCM-BF537x	0x20200000 (nAMS2)	0x20300000 (nAMS3)
CM-BF561	0x28000000 (nAMS2)	0x24000000 (nAMS1)
CM-BF527	0x20200000 (nAMS2)	0x20300000 (nAMS3)
TCM-BF518	0x20200000 (nAMS2)	0x20300000 (nAMS3)
CM-BF548	0x28000000 (nAMS2)	0x24000000 (nAMS1)

Table 2-1: Base address of parallel DAC

2.1.2 Blackfin® GPIO assignment

The table below shows which GPIOs are used for the relevant Core Modules inserted in the base board.

Core Module	A0 of AD7266	A1 of AD7266	A2 of AD7266
CM-BF533	n.s. ¹⁾	PF9	PF8
CM-BF537x	PF5	PG10	PG11
TCM-BF537x	PF5	PG10	PG11
CM-BF561x	PF4	PF42	PF43
CM-BF527	USB_VBUS	PF10	PF11
TCM-BF518	PG0	PF10	PF11
CM-BF548	PA1	PD10	PD11

Table 2-2: GPIO assignment

¹⁾ Pin 53 of EX100 is not usable as a GPIO if the CM-BF533 is inserted on the base board. For this reason not all channels of the ADC are available. Only the even channels can be read if a CM-BF533 is used because A0 is not available.

2.2 PCB Placement

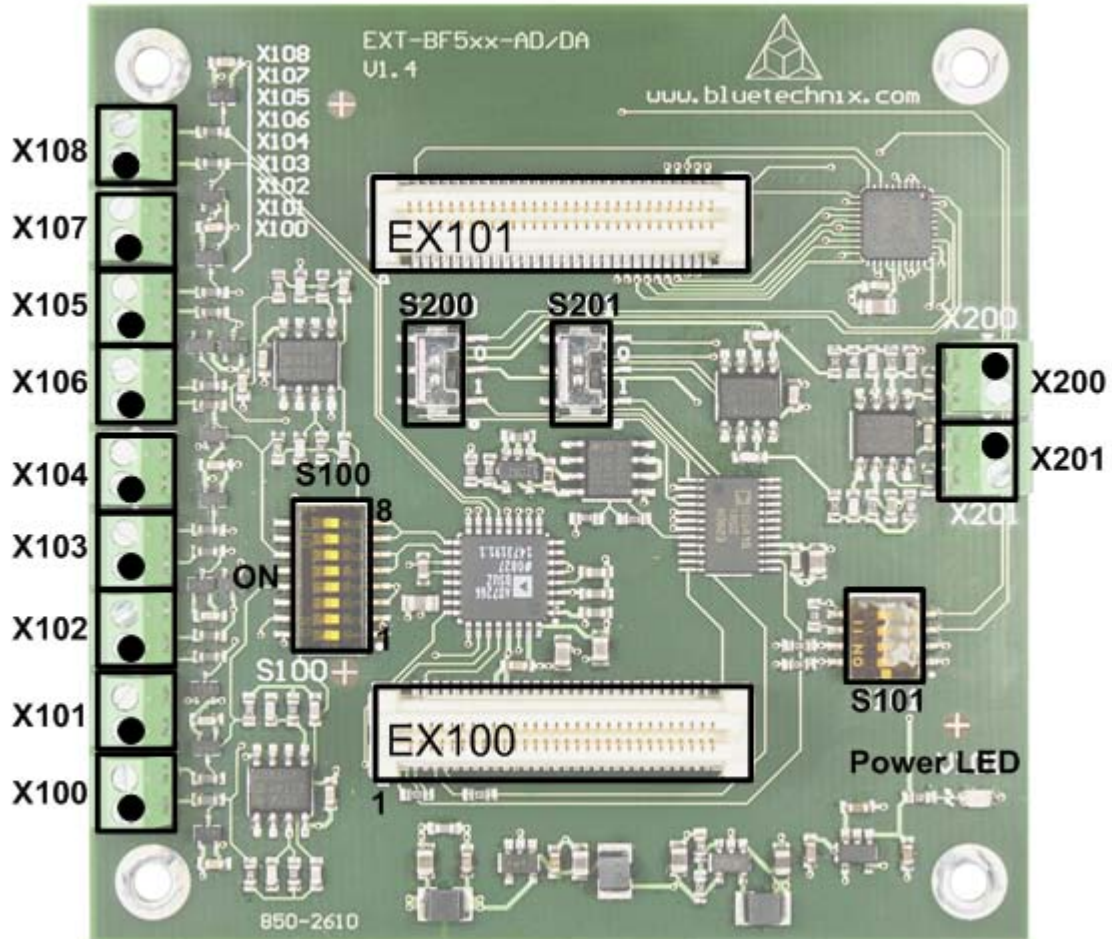


Figure 2 - PCB Placement

2.3 Mechanical Outline

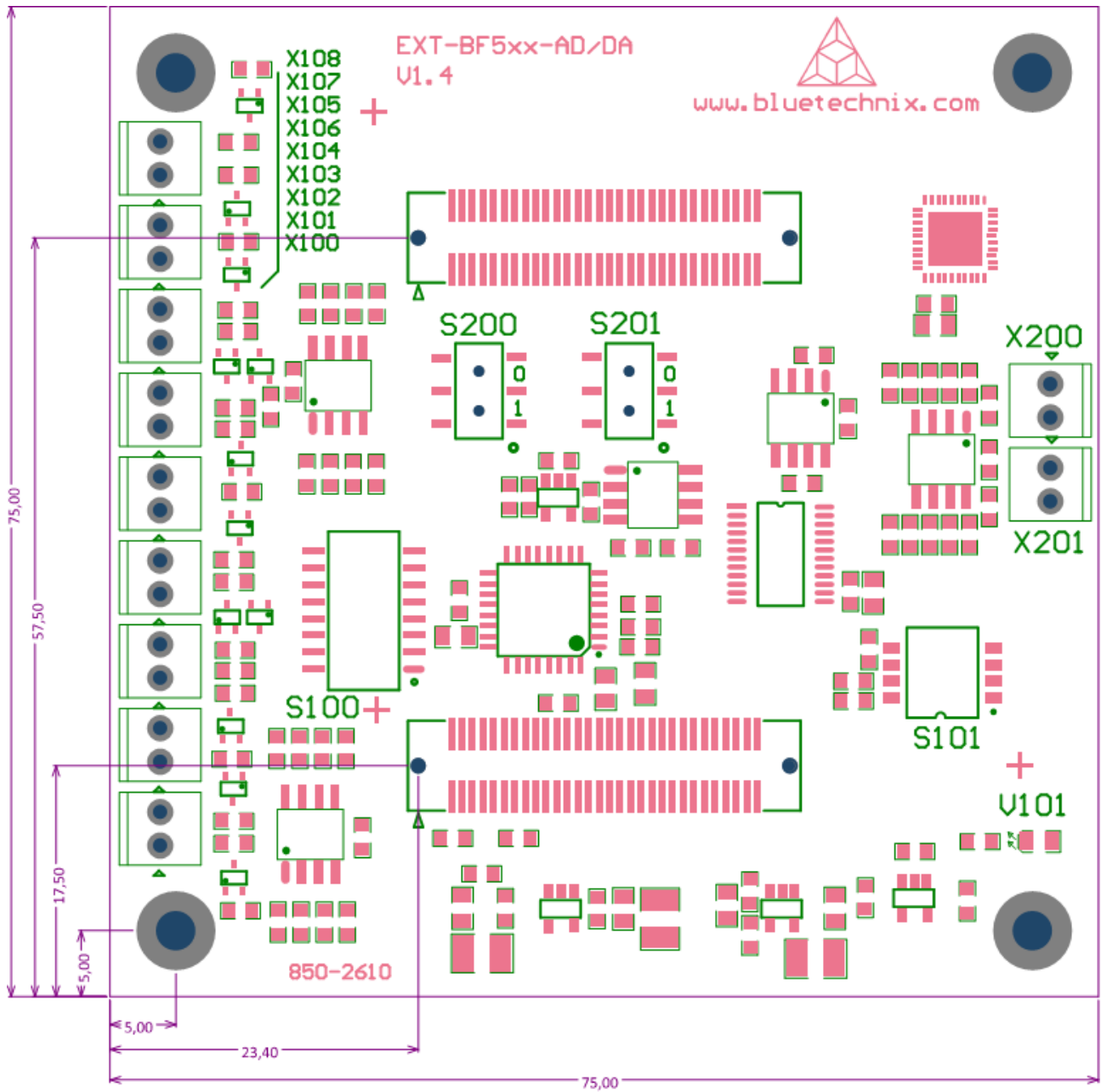


Figure 2-3: Expansion connector placement

3 Specifications

3.1 Electrical Specifications

3.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	2.7	3.3	5	V
I_{3V3}	3.3V current			500 ¹	mA
$V_{ADC\ Single\ Ended}^2$	ADC Input voltage single-ended	0		2.5	V
$V_{ADC\ Diff.\ full}^2$	ADC Input voltage differential full	0		5	V
$V_{ADC\ Diff.}^2$	ADC Input voltage differential	0		2.5	V
I_{DAC}	DAC Output current			+/- 80	mA

Table 3-1: Electrical characteristics

¹@25°C ambient temperature

² see chapter 5.25.2

3.1.2 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	-0.3	3.6	V
V_{IN}	Input supply voltage	-0.3	6	V
V_{ADC}	ADC Input voltage	-0.3	5.3	V
V_{DAC}	DAC Output voltage	-0.3	5.5	V
T_{AMB}	Ambient temperature	0	70	°C
T_{STO}	Storage temperature	-55	150	°C
T_{SLD}	Solder temperature for 10 seconds		260	°C
ϕ_{AMB}	Relative ambient humidity		90	%

Table 3-2: Absolute maximum ratings

3.1.3 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.

4 Connector Description

4.1 Connector X1

The connectors X100-X108 are connected to the input channels of the ADC (AD7266). The following table shows the signal assignment for each connector. The signal name corresponds to the pin name of the ADC. Pin 1 of each connector is marked with a black point in the figure of the PCB placement.

Connector	Pin 1	Pin 2
X100	Va1	Va2
X101	AGND (Analog ground)	AGND (Analog ground)
X102	Va3	Va4
X103	Va5	Va6
X104	AGND (Analog ground)	AGND (Analog ground)
X105	Vb3	Vb4
X106	Vb1	Vb2
X107	AGND (Analog ground)	AGND (Analog ground)
X108	Vb5	Vb6

Table 4-1: Connector – pin assignment of X100 – X108

The Connectors X101, X104 and X107 can be used to connect the signal source with the Analog Ground if the ADC operates in single ended mode.

On the connectors X100 and X106 a 600 kHz low pass Tschebyschef filter can be inserted in the signal path. Switch S100 chooses if the signal on these connectors is routed directly to the ADC inputs or through the low pass filter.

4.2 Connector X2

The connectors X200 and X201 are routed to the outputs of either the parallel DAC (AD5405) or the serial DAC (AD5415) depending on the positions of S200 and S201. The pin name is the same on both DACs.

Connector	Pin 1	Pin 2
X200	AGND (Analog ground)	lout1A
X201	AGND (Analog ground)	lout1B

Table 4-2: Connector – pin assignment of X200 and X201

4.3 Expansion Connector Types (EX100, EX101)

The Expansion Connectors on the EXT-BF5xx AD-DA board for a Stacked Height of 16mm are of the following type:

Part	Manufacturer	Manufacturer Part Nr.
EX100, EX101	AMP (Stacked Height = 16mm)	5-5179010-2
Matching connector	AMP	5179031-2

Table 4-3: EXT-BF5xx-AD-DA board connector types

These connectors can be ordered from Bluetechnix.

The pin assignment of the connectors is the same as on the base board. Please refer to the Hardware User Manual of the appropriate base board to see the pin assignment.

5 Switches, Jumpers and LEDs

5.1 DIP Switch S100

Note: Please handle the dip switches with care!

The S100 switch selects the behavior of the input signal on the X100 and X106 connectors. Key 1-4 operates on connector X100 and determines whenever the signal on pin 1 and pin 2 of X100 should be directly routed to the ADC inputs Va1 and Va2 or if they should be first filtered by a 600 kHz low pass Tschebyscheff filter. Key 5-8 do the same for the signals on X106. Refer to the schematics to see how the filter is inserted in the signal path.

Switch position for filtering input signals:

X100: 1, 3 ON; 2, 4 OFF

X101: 5, 7 ON; 6, 8 OFF

Switch position for routing input signals directly to the ADC inputs:

X100: 2, 4 ON; 1, 3 OFF

X101: 6, 8 ON; 5, 7 OFF

5.2 DIP Switch S101

Note: Please handle the dip switches with care!

Key 1: ON: ADC (AD7266) operates in Single Ended mode, **OFF:** ADC operates in differential mode

Key 1: ON: ADC (AD7266) operates in 5V full scale mode (max input voltage is 5V), **OFF** ADC operates in 2,5V full range mode (max input voltage is 2,5V)

Key 3: ON if nAMS2 (Pin 102 of EX101) should be used as ADC CS otherwise **OFF**

Key 4: ON if nAMS1 (Pin 80 of EX101) should be used as ADC CS otherwise **OFF**

Attention: Never set Key 3 and Key 4 of S100 to ON at the same time!

5.3 Switch S200

Position 0: Output channel A of the parallel DAC (AD5405) is routed to connector X200

Position 1: Output channel A of the serial DAC (AD5415) is routed to connector X200

5.4 Switch S201

Position 0: Output channel B of the parallel DAC (AD5405) is routed to connector X201

Position 1: Output channel B of the serial DAC (AD5415) is routed to connector X201

6 Support

6.1 General Support

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

6.2 Board Support Packages

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

6.3 Blackfin® Software Support

6.3.1 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.

6.3.2 LabVIEW

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

6.3.3 uClinux

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

6.4 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.

6.4.1 Upcoming Products and Software Releases

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

7 Ordering Information

7.1 Predefined mounting options for EXT-BF5xx-AD-DA

Article Number	Name	Description
100-2255-1	EXT-BF5xx-AD-DA	EXT-BF5xx-AD-DA Blackfin Extender Board

Table 7-1: 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.

8 Dependability

8.1 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.

9 Product History

9.1 Version Information

Version	Date	Changes
1.2	2011 10 25	Current version V1.2 of the Hardware.
1.4	2012 02 02	Added anti-aliasing filter to DAC outputs

Table 9-1: Overview product changes

9.2 Anomalies

Version	Date	Description
1.2	2007 09 13	Please turn of the CAN transceiver on your base board (EVAL-BF5xx, DEV-BF5xxDA-lite, DEV-BF54).
1.4	2012 02 02	Please turn of the CAN transceiver on your base board (EVAL-BF5xx, DEV-BF5xxDA-lite, DEV-BF54).

Table 9-2: Overview product anomalies

10 Document Revision History

Version	Date	Document Revision
8	2012-02-02	Updated file for board revision V1.4
7	2011-10-25	Updated file to new design. Added CM-BF527 notifications.
6	2010-07-13	Support for CM-BF527, TCM-BF518 and BF548 added
5	2010-02-09	Redesign of Manual
4	2008-08-14	English checked for grammar, spelling and clarity.
3	2008-08-01	LabVIEW support
2	2007-09-13	CAN issue
1	2007-06-30	Initial release of the Document for board revision V1.2

Table 10-1: Revision history

11 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 11-1: List of abbreviations

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