BLUE TECHNIX

Hardware User Manual

CM-BF533 V3.0

...maximum performance at minimum space

Contact

Bluetechnix Mechatronische Systeme GmbH

Waidhausenstraße 3/19

A-1140 Vienna

AUSTRIA/EUROPE

office@bluetechnix.at

http://www.bluetechnix.com

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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)

```
CM - BF537 - C - C - Q25 S32 F4 - -   (CM-BF537E)
```

Product Family
CM = Core Module
SBC = Single Board Computer

CPU-Type
Equals the name of CPU

Connection-Type
A = BGA
B = Border pad
C = Connector
S = Special

Operating Temperature Range
A = Automotive   (-40° to +125°)
C = Commercial   (0° to +70°)
I = Industry   (-40° to +85°)

Crystal Frequency
Notation: QXX[MHz]

Former name

Special
Custom Core Modules or specials
uC = uclinux

Extra controllers mounted
E = Ethernet
U = USB

Flash [MB]
F = NOR Flash [MB]
N = NAND Flash [MB]

RAM
S = SDRAM [MB]

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 CM-BF533 is optimized for performance and costs. The Core Module integrates processor, RAM, flash and power supply at a size of 31.5x36.5mm! It is based on the high performance ADSP-BF533 from Analog Devices. The Core Module is available for commercial and industrial temperature range. It addresses 32MByte SDRAM via its 16bit wide SDRAM bus and has an on-board NOR-flash of 2MByte.

1.1 Overview

The Core Module CM-BF533 consists of the following components
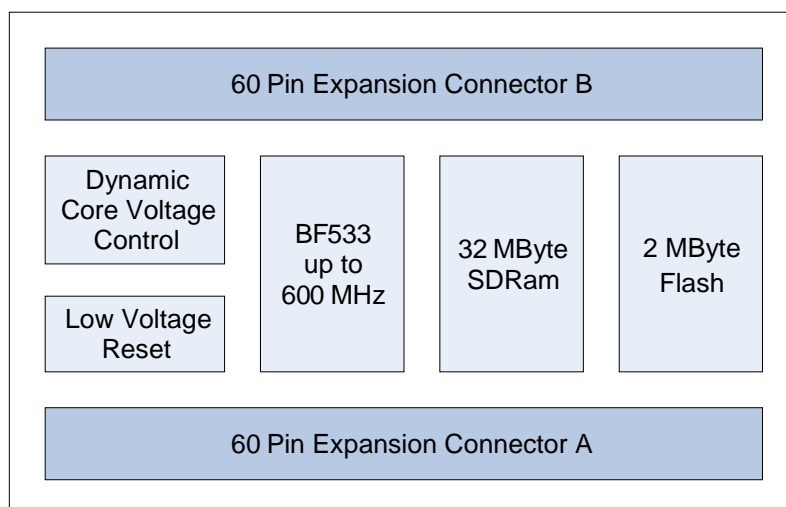
Figure 1-1: Main Components of the CM-BF533 module

- **Analog Devices Blackfin Processor BF533**
    - o ADSP-BF533SKBCZ600 (0°-70°C) Commercial grade
    - o ADSP-BF533SBBCZ500 (-40°-85°C) Industrial grade
- **32 MB SDRAM**
    - o SDRAM clock up to 133 MHz
    - o MT48LC16M16A2BG-7 (16Mx16 at 3.3 V)
- **2MB of Byte Addressable Flash**
    - o PC28F320J3D (2Mx16 at 3.3 V; 2MByte addressable only)
    - o Additionally flash memory can be connected through the expansion board as parallel flash using asynchronous chip select lines or as SPI flash.
- **Low Voltage Reset Circuit**
    - o Resets module if power supply goes below 2.93 V for at least 140 ms
- **Dynamic Core Voltage Control**
    - o Core voltage adjustable by setting software registers on the Blackfin Processor
    - o Core voltage range: 0.8 – 1.32V

- **Expansion Connector A**
  - o Data Bus
  - o Address Bus
  - o Control Signals
  - o Power Supply

- **Expansion Connector B**
  - o SPORT 0 and SPORT 1
  - o JTAG
  - o UART
  - o SPI
  - o PPI (Parallel Port Interface)
  - o GPIO's

1.2 Key Features

- ADSP BF533 DSP
- 32 MByte SD RAM up to 133Mhz
- MByte Flash
- Industrial or commercial Core Module (-40 to +85℃) or (0 to +70℃)

1.3 Applications

- Multimedia
- Home Audio/Video,
- Embedded Modems
- Instrumentation
- Imaging
- Industrial Control
- Voice Communication

2 General Description

2.1 Functional Description
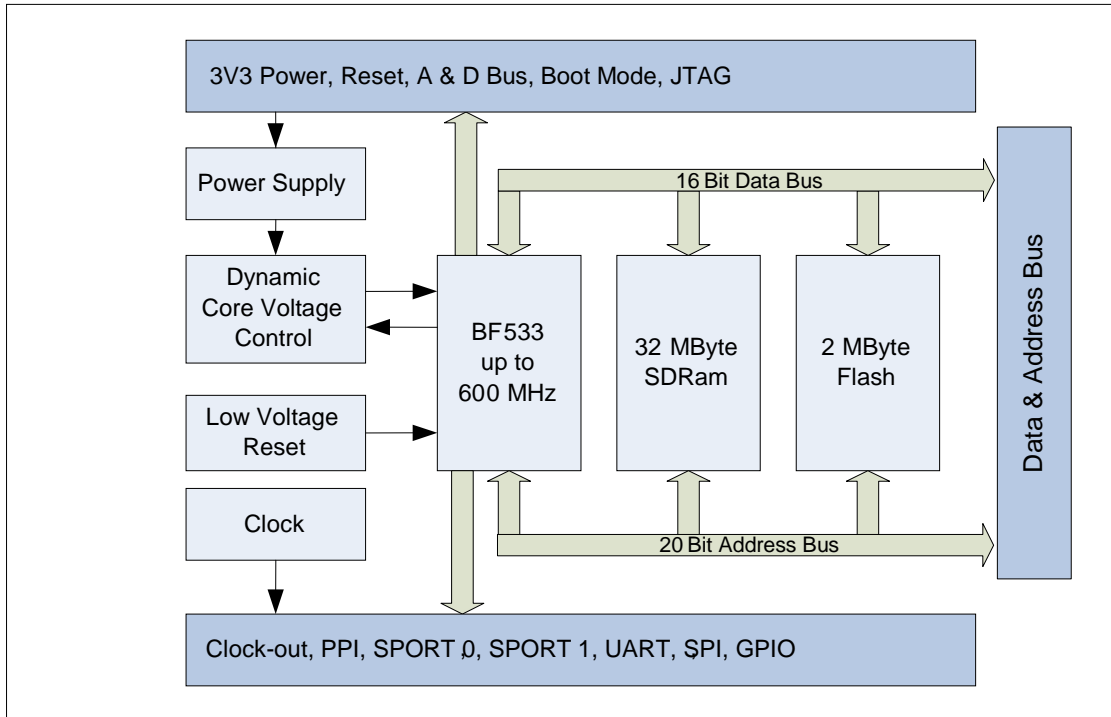
Figure 2-1: Detailed block diagram

Figure 2-1 shows a detailed block diagram of the CM-BF533 module. Beside the SDRAM control pins the CM-BF533 has all other pins of the Blackfin processor at its two main 60 pin connectors.

Dynamic voltage control allows reducing power consumption to a minimum adjusting the core-voltage and the clock frequency dynamically in accordance to the required processing power.

A low voltage reset circuit guarantees a power on reset and resets the system when the input voltage drops below 2.93V.

2.2 Boot Mode

Default Boot Mode = 00. BMODE0 and BMODE1 have internal pull-down resistor

Connect BMODE0 to Vcc and leave BMODE1 pin open for Boot Mode 01 (equals to 8 or 16 bit PROM/FLASH boot mode), this is the default boot mode of the BLACKSheep software.

BMODE1–0	Description
00	Execute from 16-bit external memory (bypass boot ROM)
01	Boot from 8-bit or 16-bit FLASH
10	Boot from serial master connected to SPI
11	Boot from serial slave EEPROM /flash (8-,16-, or 24-bit address range)

Table 2-1 Bootmode

2.3 Memory Map

2.3.1 Core Module Memory

Memory Type	Start Address	End Address	Size	Comment
FLASH*)	0x20000000	0x201FFFFF	2MB	PC28F320J3D
SDRAM	0x00000000	0x01FFFFFF	32MB	16Bit Bus, Micron MT48LC16M16A2BG-7

Table 2-2: Memory map

*) Please be aware that you have to unlock the flash before starting an erase process!

2.3.2 Externally Addressable Memory (on connector)

The Blackfins External Bus Interface (EBI) allows connecting devices via an asynchronous memory interface.

AMS Line	Start Address	End Address	Max. Size
nAMS2	0x20200000	0x202FFFFF	1MB
nAMS3	0x20300000	0x203FFFFF	1MB

Table 2-3 External addressable memory

3 Specifications

3.1 Electrical Specifications

3.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	3.0	3.3	3.6	V
I_{3V3} [1]	3.3V current	-	250	-	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
f_{CCLK} [2]	Core clock frequency	100	-	600	MHz
f_{CCLK} [3]	Core clock frequency	100	-	500	MHz

Table 3-1: Electrical characteristics

[1] Average load @ 25°C ambient temperature

[2] Commercial grade

[3] Industrial grade

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	-0.5	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} [1]	Ambient temperature	0	70	°C
T_{AMB} [2]	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 3-2: Absolute maximum ratings

[1] Commercial grade

[2] Industrial grade

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

Pin No.	Signal	Signal Type.	Function
1	RSCLK0	I/O	SPORT0
2	DR0PRI	I	SPORT0
3	TSCLK0	I/O	SPORT0
4	DT0PRI	O	SPORT0
5	RSCLK1	I/O	SPORT1
6	DR1PRI	I	SPORT1
7	TSCLK1	I/O	SPORT1
8	DT1PRI	O	SPORT1
9	Vin 3V3	PWR	
10	Vin 3V3	PWR	
11	PPI1D0	I/O	PPI Data
12	PPI1D2	I/O	PPI Data
13	PF15 / PPI1D4	I/O	PPI Data
14	PF13 / PPI1D6	I/O	PPI Data
15	PF11 / PPI1D8	I/O – 10k pull up	PPI Data
16	PF9 / PPI1D10	I/O	PPI Data
17	PF7 / SPISEL7 / PPI1D12	I/O	PPI Data
18	PF5 / SPISEL5 / PPI1D14	I/O	PPI Data
19	PF3 / SPISEL3 / PPI1Sy3	I/O – 10k pull up	PPI Sync
20	TMR1 / PPI1_Sy1	I/O	PPI Sync
21	TMR0	I/O	Timer
22	PF1 / SPISEL1 / TMRCLK	I/O	Timer clock
23	RX	I – 100k pull up	UART
24	MOSI	I/O	SPI
25	SCK	I	SPI
26	BMODE0	I – 100k pull down	Boot mode
27	GND	PWR	
28	TCK	I – 10k pull up	JTAG
29	TDI	I – 10k pull up	JTAG
30	nTRST	I – 4k7 pull down	JTAG (active low)
31	nEMU	O	JTAG (active low)
32	TMS	I – 10k pull up	JTAG
33	TDO	O	JTAG
34	Disconnected	-	
35	Disconnected	-	
36	BMODE1	I – 100k pull down	Boot mode
37	MISO	I/O	SPI
38	TX	O	UART
39	PF0 / nSPISS	I/O	
40	PF2 / SPISEL2	I/O	
41	PPI_CLK	I/O	PPI Clock

Pin No.	Signal	Signal Type.	Function
42	TMR2 / PPI1Sy2	I/O	PPI Sync
43	PF4 / SPISEL4 / PPI1D15	I/O	
44	PF6 / SPISEL6 / PPI1D13	I/O	
45	PF8 / PPI1D11	I/O	PPI Data
46	PF10 / PPI1D9	I/O – 10k pull up	PPI Data
47	PF12 / PPI1D7	I/O	PPI Data
48	PF14 / PPI1D5	I/O	PPI Data
49	PPI1D3	I/O	PPI Data
50	PPI1D1	I/O	PPI Data
51	GND	PWR	
52	GND	PWR	
53	DT1SEC	O	SPORT1
54	TFS1	I/O	SPORT1
55	DR1SEC	I	SPORT1
56	RFS1	I/O	SPORT1
57	DT0SEC	O	SPORT0
58	TFS0	I/O	SPORT0
59	DR0SEC	I	SPORT0
60	RFS0	I/O	SPORT0

Table 4-1: Connector description X1

4.2 Connector X2

Pin No.	Signal	IO Type.	Function
61	A1	O	Address Bus
62	A3	O	Address Bus
63	A5	O	Address Bus
64	A7	O	Address Bus
65	A9	O	Address Bus
66	A11	O	Address Bus
67	A13	O	Address Bus
68	A15	O	Address Bus
69	A17	O	Address Bus
70	A19	O	Address Bus
71	ABE1/SDQM1	O	Byte Enable
72	N.C.	-	
73	F_A21	O	Address Bus
74	F_A23	O	Address Bus
75	N.C.	O	
76	ADRY	I – 10k pull up	Hardware Ready Control
77	nBG	O	Bus Request (active low)
78	CLK_Out	O	Clock Output
79	GND	PWR	
80	nAMS3	O	Bank Select

Pin No.	Signal	IO Type.	Function
81	nAWE	O	Write Enable (active low)
82	NMI	I – 10k pull down	Non Maskable Interrupt
83	D0	I/O	Data Bus
84	D2	I/O	Data Bus
85	D4	I/O	Data Bus
86	D6	I/O	Data Bus
87	D8	I/O	Data Bus
88	D10	I/O	Data Bus
89	D12	I/O	Data Bus
90	D14	I/O	Data Bus
91	D15	I/O	Data Bus
92	D13	I/O	Data Bus
93	D11	I/O	Data Bus
94	D9	I/O	Data Bus
95	D7	I/O	Data Bus
96	D5	I/O	Data Bus
97	D3	I/O	Data Bus
98	D1	I/O	Data Bus
99	nReset	I – see chapter Figure 5-1	Reset
100	nAOE	O	Output Enable (active low)
101	nARE	O	Read Enable (active low)
102	nAMS2	O	Bank Select (active low)
103	VDD-RTC	PWR	RTC Supply
104	nBGH	O	Bus Grant Hang (active low)
105	nBR	I – 10k pull up	Bus Request (active low)
106	nWP	I	Write Protect (active low)
107	F_A24	O	Address Bus
108	F_A22	O	Address Bus
109	N.C.	-	
110	N.C.	-	
111	ABE0/SDQM0	O	Byte Enable
112	A18	O	Address Bus
113	A16	O	Address Bus
114	A14	O	Address Bus
115	A12	O	Address Bus
116	A10	O	Address Bus
117	A8	O	Address Bus
118	A6	O	Address Bus
119	A4	O	Address Bus
120	A2	O	Address Bus

Table 4-2: Connector description X2

5   Application Information

5.1   Reset circuit

The reset of the flash and the processor are connected to a power monitoring IC. The output can be used as power on reset for external devices, see Figure 5-1.
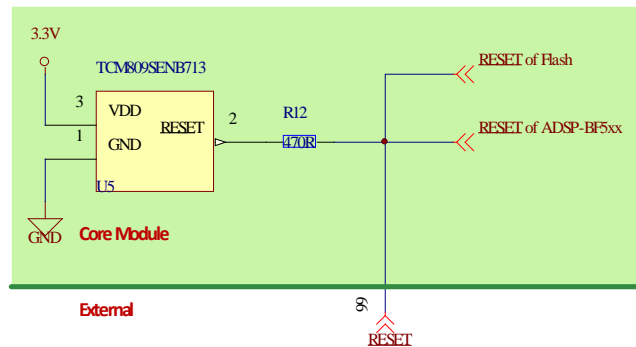

Figure 5-1: Schematic of reset circuit on the Core Module

5.2   Application Example Schematics

Have a look at our EVAL-BF5xx schematics, which can be found at www.bluetechnix.com/goto/eval-bf5xx to get application examples.

6 Mechanical Outline
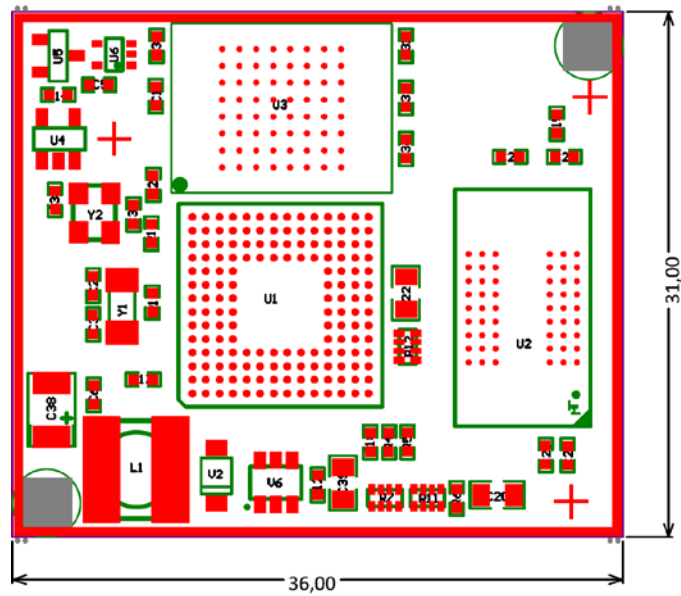
All dimensions are given in millimeters!

6.1 Top View

Figure 6-1: Top view of the module
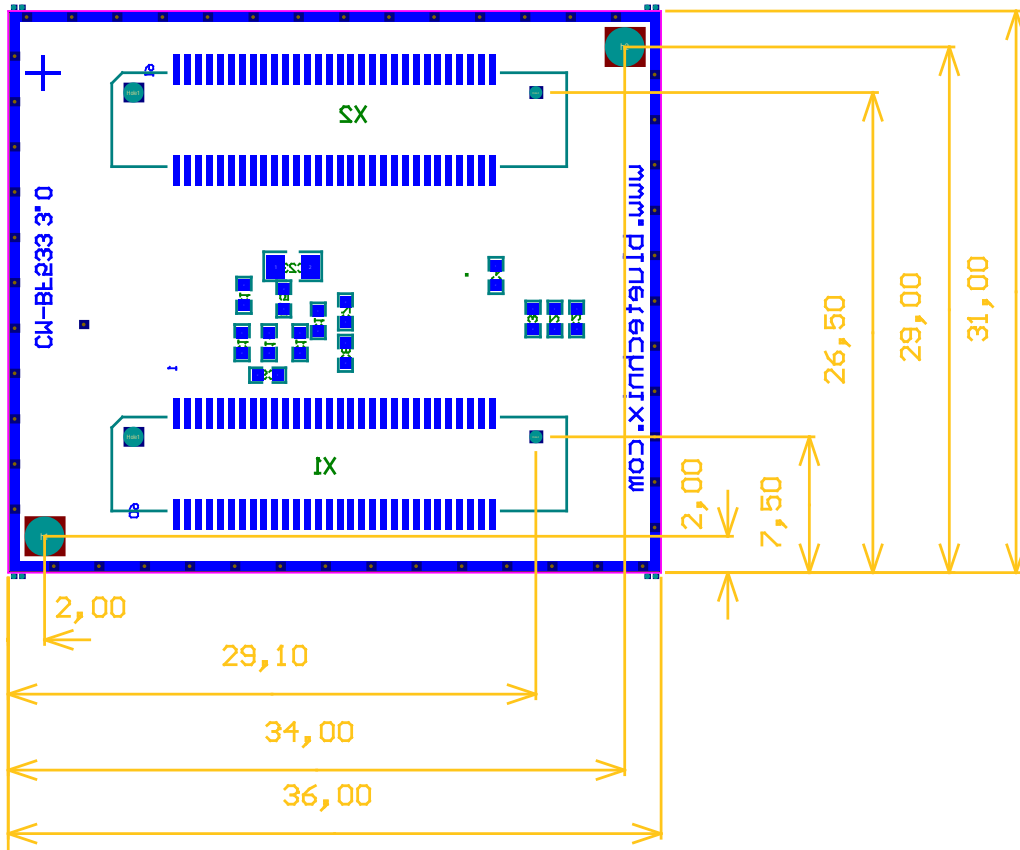
6.2 Bottom View

Figure 6-2: Mechanical outline and Bottom Connectors (Top-View)

6.3 Side View

The module is shipped with two 60pin connectors. The total minimum mounting height including receptacle at the motherboard is 6.1 mm.
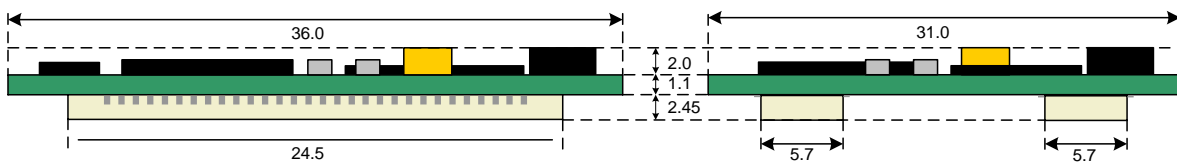

Figure 6-3: Side View with connectors mounted

6.4 Footprint

The footprint for Altium Designer is available on request. The used connectors can be found in Table 6-1. For detailed dimensions of the connectors please see the datasheet from the manufacturer's homepage.
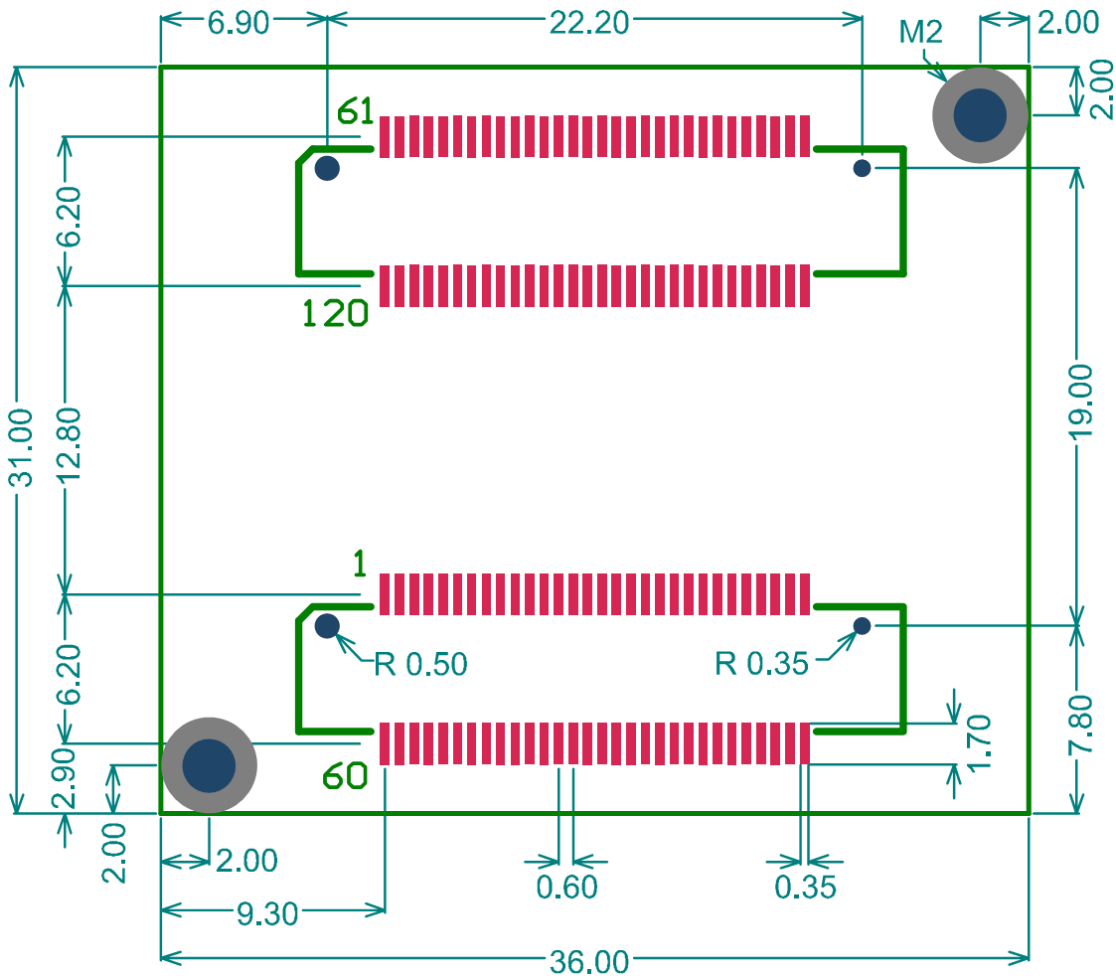
Figure 6-4: Recommended footprint for the Core Module (top view)

6.5 Connectors

The connectors on the CM-BF533 are of the following type:

Connector	Manufacturer	Manufacturer Part No.
X1,X2	Hirose	FX8-60P-SV

Table 6-1: Core Module connector types

For the baseboard the following connectors have to be used:

Connector	Manufacturer	Manufacturer Part No.
X1,X2	Hirose	FX8-60S-SV

Table 6-2: Core Module connector types

7 Support

7.1 General Support

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

7.2 Board Support Packages

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

7.3 Blackfin® Software Support

7.3.1 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.

7.3.2 LabVIEW

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

7.3.3 uClinux

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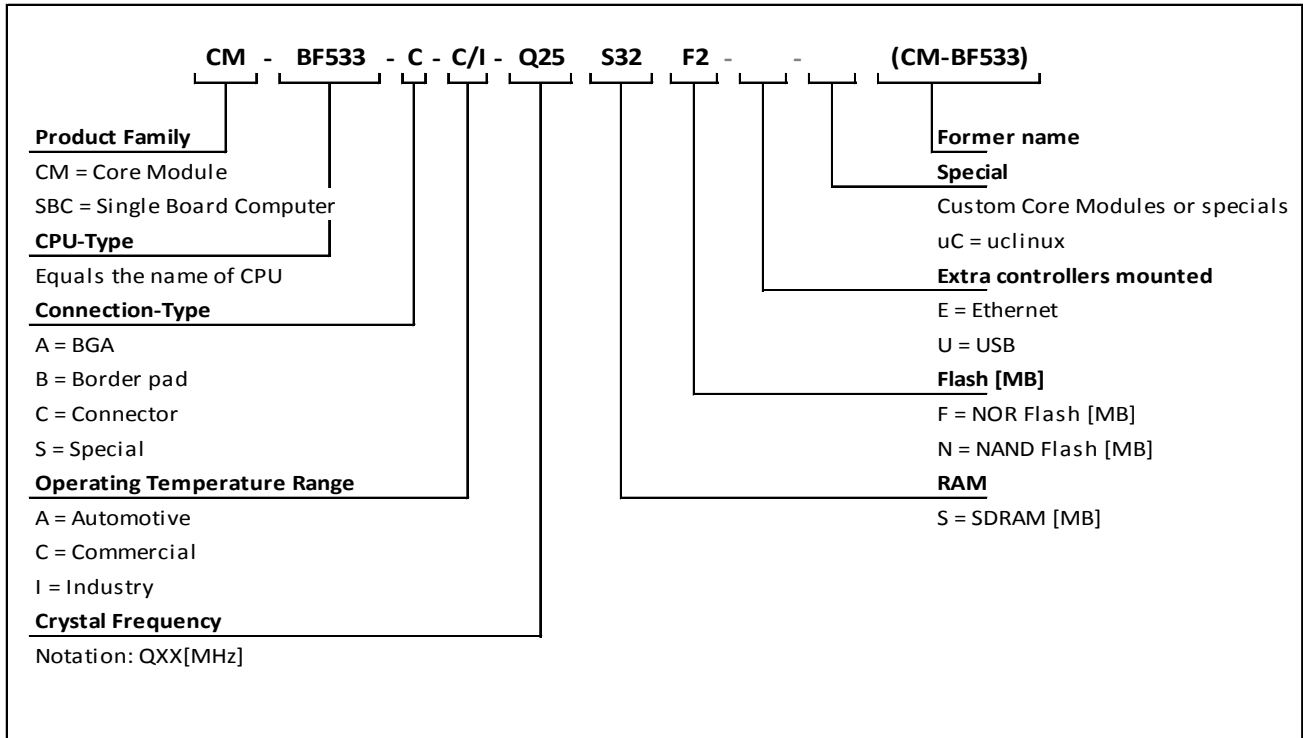
7.4 Blackfin® Design Services

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

7.4.1 Upcoming Products and Software Releases

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

8 Ordering Information

```
CM  -  BF533  -  C  -  C/I  -  Q25   S32   F2  -   -   (CM-BF533)
```

Product Family
CM = Core Module
SBC = Single Board Computer
CPU-Type
Equals the name of CPU
Connection-Type
A = BGA
B = Border pad
C = Connector
S = Special
Operating Temperature Range
A = Automotive
C = Commercial
I = Industry
Crystal Frequency
Notation: QXX[MHz]

Former name
Special
Custom Core Modules or specials
uC = uclinux
Extra controllers mounted
E = Ethernet
U = USB
Flash [MB]
F = NOR Flash [MB]
N = NAND Flash [MB]
RAM
S = SDRAM [MB]

8.1 Predefined mounting options for CM-BF533

Article Number	Name	Temperature Range
100-1207-3	CM-BF533-C-C-Q25S32F2 (CM-BF533)	Commercial
100-1206-3	CM-BF533-C-I-Q25S32F2 (CM-BF533-I)	Industrial

Table 8-1: Ordering information

NOTE: Custom Core Modules are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom Core Modules.

9 Dependability

9.1 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 Core Module 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 Core Module components except the Blackfin® processor (80°C) and the memories (70°C). 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.

10 Product History

10.1 Version Information

10.1.1 CM-BF533-C-C-Q25S32F4 (CM-BF533)

Version	Component	Type
3.0.2	Processor RAM Flash	ADSP-BF533SKBCZ600 (Rev 0.6) MT48LC16M16A2BG-75IT (32MB) PC28F320J3D75 (4MB)

Table 10-1: Overview CM-BF533-C-C-Q25S32F4 product changes

10.1.2 CM-BF533-C-I-Q25S32F4 (CM-BF533-I)

Version	Component	Type
3.0.1	Processor RAM Flash	ADSP-BF533SBBCZ500 (Rev 0.6) MT48LC16M16A2BG-75IT (32MB) PC28F320J3D75 (4MB)

Table 10-2: Overview CM-BF533-C-I-Q25S32F4 product changes

10.2 Anomalies

Version	Date	Description
V3.0	2011-10-14	No anomalies reported yet.

Table 10-3: Overview product anomalies

11 Document Revision History

Version	Date	Document Revision
1	2011 10 14	First release V1.0 of the Document

Table 11-1: Revision history

12 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 12-1: List of abbreviations

A   List of Figures and Tables

Figures

Tables