BLUE TECHNIX

Hardware User Manual

CM-BF537U V1.x

...maximum performance at minimum space

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Table of Contents

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Information

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Warning

Due to technical requirements components may contain dangerous substances.

The Core Modules and development systems contain ESD (electrostatic discharge) sensitive devices. Electro-static charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Unused Core Modules and Development Boards should be stored in the protective shipping

BLACKFIN Products

Core Modules:

CM-BF533:	Blackfin Processor Module powered by Analog Devices' single core ADSP-BF533 processor; up to 600MHz, 32MB SDRAM, 2MB flash, 2x60 pin expansion connectors and a size of 36.5x31.5mm.
CM-BF537E:	Blackfin Processor Module 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 and a size of 36.5x31.5mm.
CM-BF537U:	Blackfin Processor Module 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 and a size of 36.5x31.5mm.
TCM-BF537:	Blackfin Processor Module 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-BF561:	Blackfin Processor Module powered by Analog Devices' dual core ADSP-BF561 processor; up to 2x 600MHz, 64MB SDRAM, 8MB flash, 2x60 pin expansion connectors and a size of 36.5x31.5mm.
CM-BF527:	The new Blackfin Processor Module 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-BF548:	The new Blackfin Processor Module is powered by Analog Devices' single core ADSP-BF548 processor; key features are 64MB DDR SD-RAM 2x100 pin expansion connectors.
TCM-BF518:	The new Core Module CM-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.

Development Boards:

EVAL-BF5xx:	Low cost Blackfin processor Evaluation Board with one socket for any Bluetechnix Blackfin Core Module. Additional interfaces are available, e.g. an SD-Card.
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 one 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.

EXT-Boards: The following Extender Boards are available: EXT-BF5xx-AUDIO, EXT-BF5xx-VIDEO, EXT-BF5xx-CAM, EXT-BF5xx-EXP-TR, EXT-BF5xx-USB-ETH2, EXT-BF5xx-AD/DA, EXT-BF548-EXP and EXT-BF518-ETH. Furthermore, we offer the development of customized extender boards for our customers.

Software Support:

BLACKSheep: The BLACKSheep VDK is a multithreaded framework for the Blackfin processor family from Analog Devices that includes driver support for a variety of hardware extensions. It is based on the real-time VDK kernel included within the VDSP++ development environment.

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

uClinux: All the Core Modules are fully supported by uClinux. The required boot loader and uClinux can be downloaded from: http://blackfin.uClinux.org.

Upcoming Products and Software Releases:

Keep up-to-date with all the changes to the Bluetechnix product line and software updates at: http://www.bluetechnix.com .

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BLACKFIN Design Service

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

1 Introduction

The CM-BF537U is a tiny high performance and low power DSP/RISC Core Module incorporating Analog Devices Blackfin family of processors. The special feature of this module is the on-board USB 2.0 interface to enable a high speed Computer connection. The module allows easy integration into high demanding very space and power limited applications. The CM-BF537U is the same module as the CM-BF534U except for the processor. The ADSP-BF537 processor has an additional Ethernet MAC on-chip when compared to the ADSP-BF534 processor. The other difference is that the CM-BF534U operates at 500MHz.

1.1 Overview

The Core Module CM-BF537U consists of the following components:

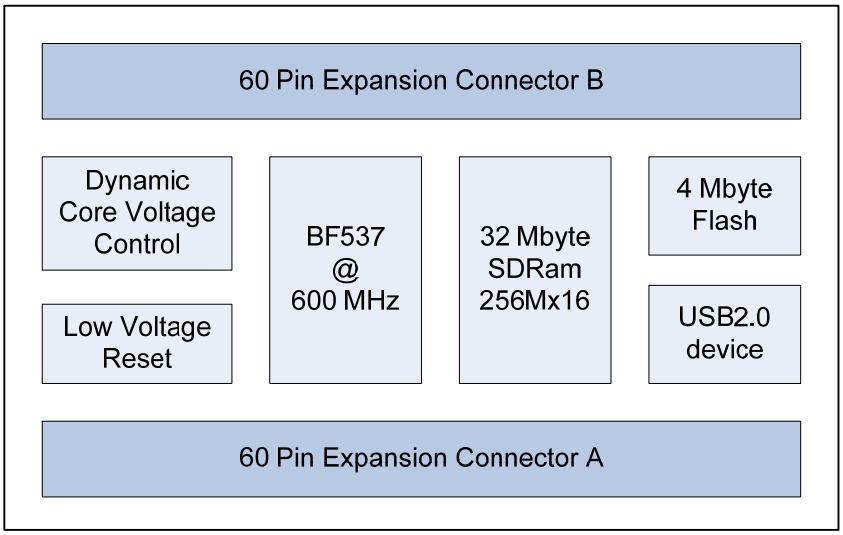

Figure 1-1: Main components of the CM-BF537U module

- **Analog Devices Blackfin Processor BF537**
  - Supported Chips :
    - ADSP-BF537SKBC1600 (0°-70°C) Standard Mount
- **32 MB SDRAM**
  - SDRAM Clock up to 133 MHz
  - MT48LC16M16A2BG-7 IT (16Mx16, 256Mbit at 3.3V)
- **4 MB of Byte Addressable Flash**
  - ITLRC28F320J3C110 (2Mx16; 32Mbit at 3.3 V; all 4 MBytes addressable)
  - Larger Flash sizes upon request.
- **USB2.0**
  - NET2272REV1A-BI USB2.0 Device Chip from PLXTech
- **Low Voltage Reset Circuit**
  - Resets module if power supply goes below 2.93V for at least 140ms

- **Dynamic Core Voltage Control**
  - Core voltage can be adjusted by setting software registers on the Blackfin processor.
  - Core voltage range: 0.8 – 1.32 V

- **Expansion Connector A**
  - Data Bus
  - Address Bus
  - Control Signals
  - Power Supply
  - USB2.0 Pins

- **Expansion Connector B**
  - SPORT 0
  - JTAG
  - UART0/UART1
  - CAN
  - TWI (I2C compatible)
  - SPI
  - PPI (Parallel Port Interface)
  - GPIO's

1.2 Key Features

- The CM-BF537U is very compact and measures only 36.5x31.5 mm.
- Allows quick prototyping of product that comes very close to the final design.
- Reduces development costs, faster time to market.

1.3 Target Applications

2 Specification

2.1 Functional Specification

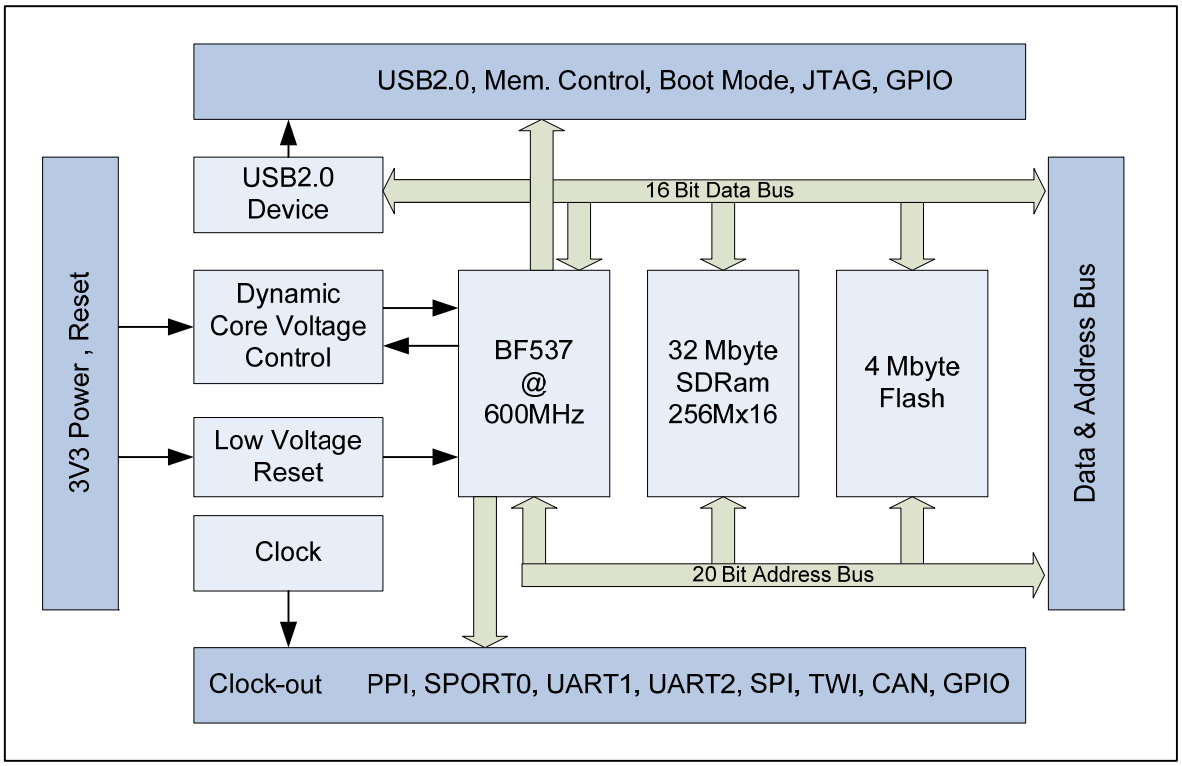

Figure 2-1: Detailed Block Diagram

Figure 2-1 shows a detailed block diagram of the CM-BF537U module. Beside the SDRAM control pins the CM-BF537U has all other pins of the Blackfin processor on its two main 60 pin connectors.

A special feature of the CM-BF537U Core Module is the on-board USB 2.0 interface to enable a high speed Computer connection.

Dynamic voltage control allows reduction of power consumption to a minimum by 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

By default the boot mode = 000 (BMODE2 = Low, BMODE1 = Low, BMODE0=Low). All BMODE pins have internal pull down resistors.

Connect BMODE0 to Vcc and leave BMODE1, BMODE2 pins open for Boot Mode 001 allows 8 or 16 bit PROM/FLASH boot mode, this is the default boot mode of the Blacksheep software. See Blackfin Datasheets or Eval/DevBoard manuals for more details.

2.3 Memory MAP

Memory Type	Start Address	End Address	Size	Comment

FLASH Bank0 PH0 Flag **Low**	0x20000000	0x201FFFFF	2MB	4MB Micron Flash, MT28F320J3FS-11
FLASH Bank1 PH0 Flag **High**	0x20000000	0x201FFFFF	2MB	
SD-RAM	0x00000000	0x01FFFFFF	32MB	16Bit Bus, Micron MT48LC16M16A2FG
USB2.0 PH15 Flag **Low**	0x20200000	0x2020003F	64Byte	NET2272

Table 2-1: Memory Map

The maximum amount of memory addressable by a single asynchronous memory bank, of the Blackfin processor is 2MB. In order to be able to use more than 2MB on a single bank, 2 GPIOs are used to select which 2MB section of flash is visible in the memory window of the Blackfin processor. This frees up the remaining banks for the user.

2.4 NETPLX2272 USB2.0 Chip Interconnection

The NET2272 chip is connected via the Data and Address Bus and selected through the nAMS2 and PH15 pins (OR wired). The Addresses LA0 to LA4 are connected to the Blackfin addresses A1-A5.

The following Port H Pins of the Blackfin BF537 are connected to the NET2272 Chip:

- PH13 : Is used as the nRESET of the NET2272 Chip
- PH14 : Is used as the INTERRUPT line from the NET2272 Chip to the Blackfin
- PH15 : Is OR wired with the nAMS2 of the Blackfin processor

2.5 Electrical Specification

2.5.1 Supply Voltage

- 3.3V DC +/-10%

2.5.2 Supply Voltage Ripple

- 100mV peak to peak 0-20MHz

2.5.3 Input Clock Frequency

- 30MHz

2.5.4 Real Time Clock Crystal

- 32.768kHz

2.5.5 Supply Current

- Maximum current: 350mA @ 3.3V
- Typical operating conditions:
    - Processor running at 500MHz, Core Voltage 1.2V, SDRAM 20% bandwidth utilization at 130MHz; USB Idle: 200mA @ 3.3V
    - Processor running at 300MHz, Core Voltage 0.8V SDRAM 20% bandwidth utilization at 130MHz; ; USB Idle: TBD @ 3.3V
    - Processor running at 500MHz, Core Voltage 1.2V, SDRAM 20% bandwidth utilization at 130MHz, USB TX/RX Active: 250mA

2.6 Environmental Specification

2.6.1 Temperature

- Operating at full 500MHz:: -40 to + 85° C

2.6.2 Humidity

- Operating: 10% to 90% (non condensing)

3 CM-BF537U

3.1 Mechanical Outline

All dimensions are given in millimeters!

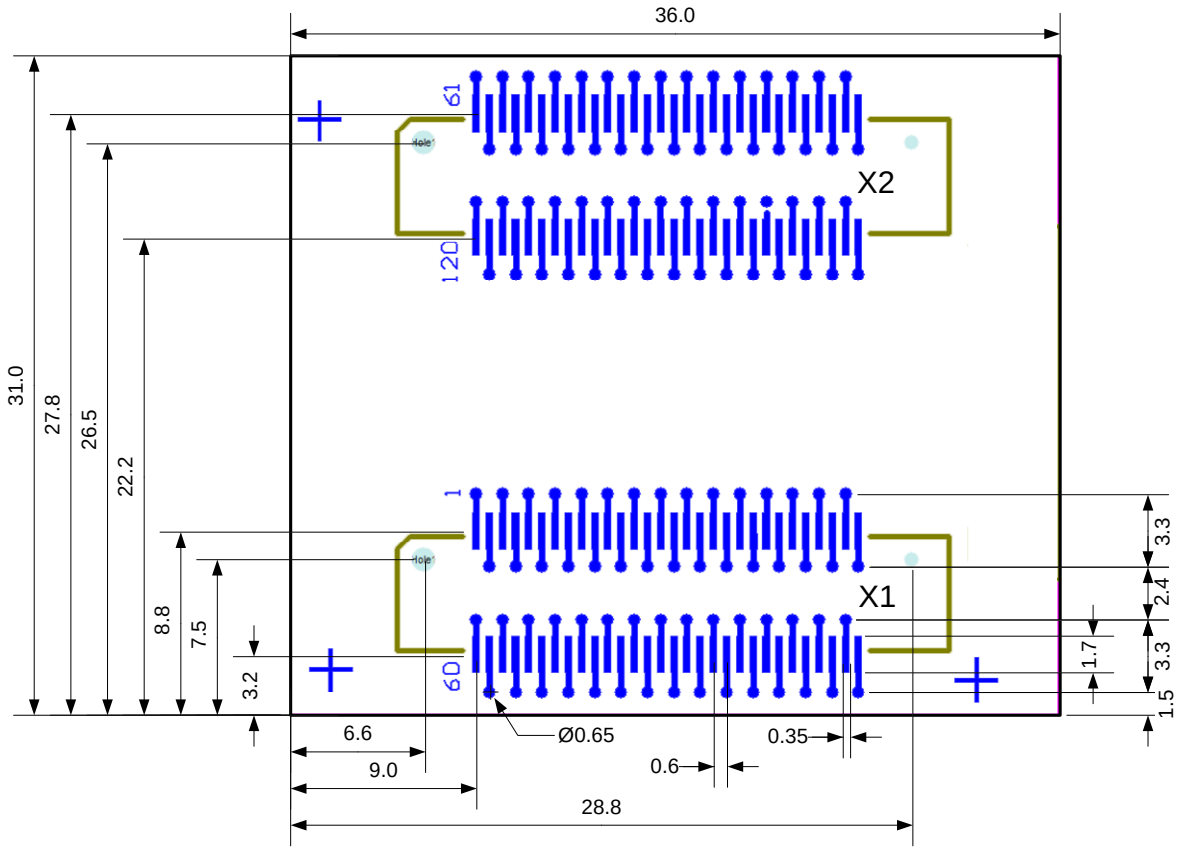

Figure 3-1: Mechanical outline and Bottom Connectors (top view)

The mechanical outline represents a top view of the connectors placed at the bottom of the Core Module.

The module is shipped with two 60pin connectors.

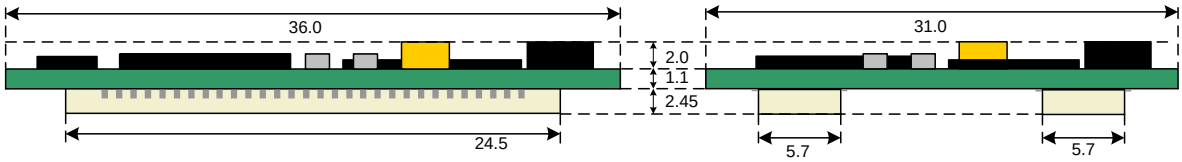

Figure 3-2: Side View with connectors mounted

The total minimum mounting height including receptacle at the motherboard is 6.1mm. The Connectors on the CM-BF537U are of the following type:

Part	Manufacturer	Manufacturer Part No.
X1, X2	Hirose 3mm height	FX8-60P-SV(21)

Table 3-1: Module connector types

3.2 Footprint

If the connector version (2x Hirose 0.6mm pitch) is used, the footprint for the baseboard should look as shown in Figure 3-3.

For the baseboard the following connectors must to be used.

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

Table 3-2: Baseboard connector types

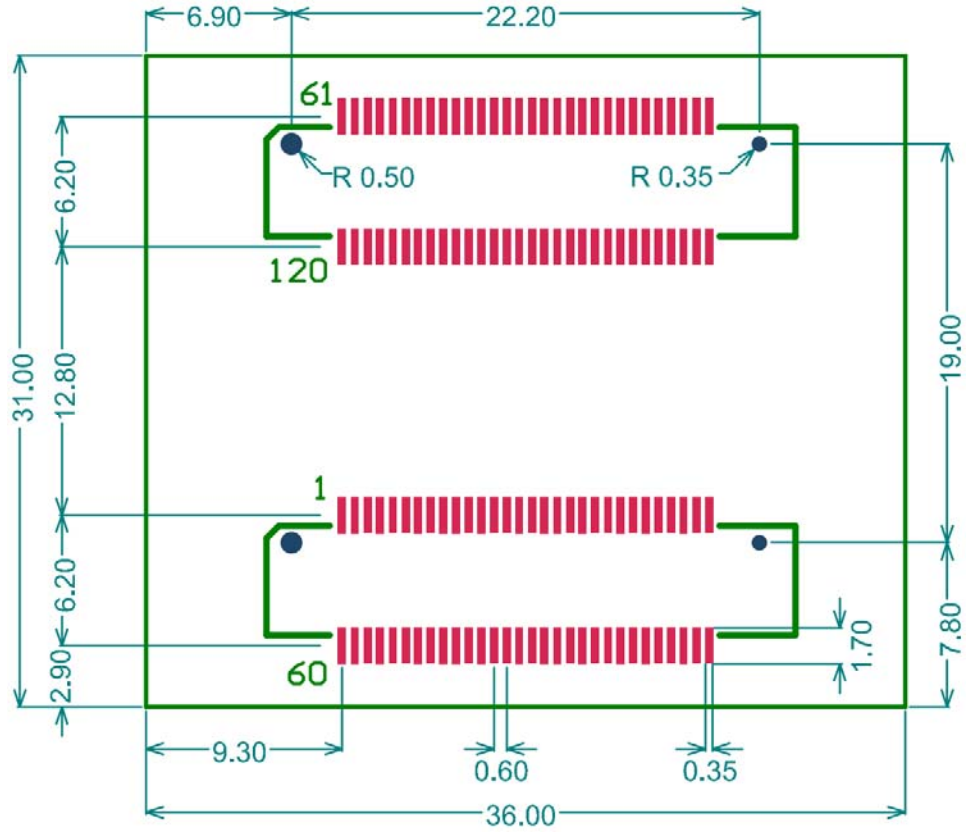

Figure 3-3: Recommended footprint for the Core Module (**top view**)

3.3 Top Mounted Components

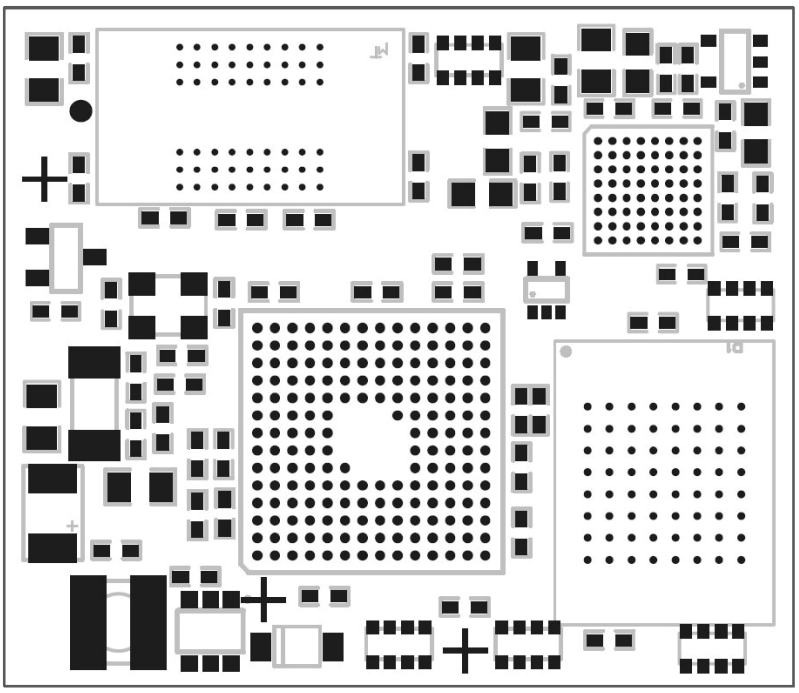

Figure 3-4: Coreboard (component side)

3.4 Schematic Symbol (Signals of P1 and P2)

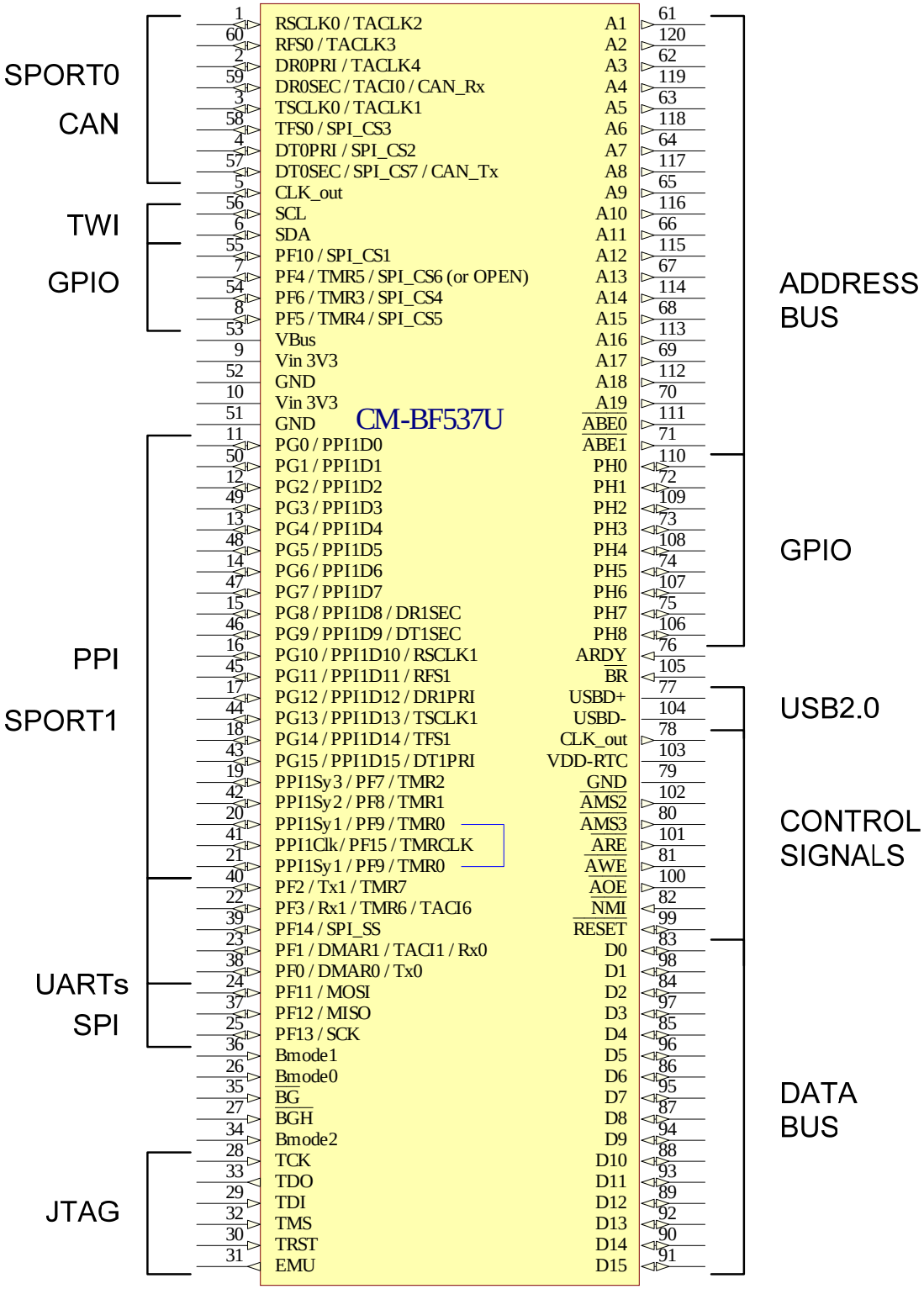

Figure 3-5: Schematic Symbol of Module

Note: The PPI1Sy1/PF9/TMR0 signal appears twice on the connector.

3.5 Connector P1 – (1-60)

Pin No.	Signal	IO Type.
1	RSCLK0/TACLK2	I/O
2	DR0PRI/ TACLK4	I
3	TSCLK0/TACLK1	I/O
4	DT0PRI/SSEL2	O
5	CLK_out	O
6	SDA	I/O
7	PF4/TMR5/SSEL6	I/O
8	PF5/TMR4/SSEL5	I/O
9	Vin 3V3	PWR
10	Vin 3V3	PWR
11	PG0/PPI1D0	I/O
12	PG2/PPI1D2	I/O
13	PG4/PPI1D4	I/O
14	PG6/PPI1D6	I/O
15	PG8/PPI1D8/DR1SEC	I/O
16	PG10/PPI1D10/RSCLK1	I/O
17	PG12/PPI1D12/DR1PRI	I/O
18	PG14/PPI1D14/TFS1	I/O
19	PPI1SY3/PF7/TMR2	I/O
20	PPI1SY1/PF9/TMR0	I/O
21	PH13	I/O
22	PF3/Rx1/TMR6/TACI6	I/O
23	PF1/DMAR1/TACI1/Rx0	I/O
24	PF11/MOSI	I/O
25	PF13/SCK	I/O
26	BMODE0	I
27	GND	PWR
28	TCK	I
29	TDI	I
30	$\overline{\text{TRST}}$	I
31	$\overline{\text{EMU}}$	O
32	TMS	I
33	TDO	O
34	BMODE2	I
35	N.C.	-
36	BMODE1	I
37	PF12/MISO	I/O
38	PF0/DMAR0/Tx0	I/O
39	PF14/SPI_SS	I/O
40	PF2/Tx1/TMR7	I/O
41	PPI1Clk/PF15/TMRCLK	I/O
42	PPI1Sy2/PF8/TMR1	I/O

43	PG15/PPI1D15/DT1PRI	I/O
44	PG13/PPI1D13/TSCLK1	I/O
45	PG11/PPI1D11/RFS1	I/O
46	PG9/PPI1D9/TD1SEC	I/O
47	PG7/PPI1D7	I/O
48	PG5/PPI1D5	I/O
49	PG3/PPI1D3	I/O
50	PG1/PPI1D1	I/O
51	GND	PWR
52	GND	PWR
53	VBUS	O
54	PF6/TMR3/SSEL4	I/O
55	PF10/SSEL1	I
56	SCL	I/O
57	DT0SEC/CANTX/SSEL7	O
58	TFS0	I/O
59	DR0SEC/TACI0/CANRX	I
60	RFS0/TACLK3	I/O

Table 3-3: Connector P1 pin assignment

The PIN PH0 is by default internally connected to the address A21 of the Flash memory (for addressing the upper 2MB of the 4MB Flash). PH1, PH2, PH3 are used as address lines A22, A23, A24 for optional larger Intel P30 Flash types of up to 32MB.

3.6 Connector P2 – (61-120)

Pin No.	Signal	IO Type.
61	A1	O
62	A3	O
63	A5	O
64	A7	O
65	A9	O
66	A11	O
67	A13	O
68	A15	O
69	A17	O
70	A19	O
71	$\overline{ABE1}$ / SDQM1	O
72	PH5	I/O
73	PH7	I/O
74	PH9	I/O
75	PH11	I/O
76	ADRY	I
77	USBD+	I/O
78	CLK_out	O
79	GND	PWR
80	$\overline{AMS3}$	O

81	$\overline{AWE}$	O
82	NMI	I
83	D0	I/O
84	D2	I/O
85	D4	I/O
86	D6	I/O
87	D8	I/O
88	D10	I/O
89	D12	I/O
90	D14	I/O
91	D15	I/O
92	D13	I/O
93	D11	I/O
94	D9	I/O
95	D7	I/O
96	D5	I/O
97	D3	I/O
98	D1	I/O
99	$\overline{RESET}$	I
100	$\overline{AOE}$	O
101	$\overline{ARE}$	O
102	$\overline{AMS2}$	O
103	VDD-RTC	PWR
104	USBD-	I/O
105	nBR	I
106	PH12	I/O
107	PH10	I/O
108	PH8	I/O
109	PH6	I/O
110	PH4	I/O
111	$\overline{ABE0}$/ SDQM0	O
112	A18	O
113	A16	O
114	A14	O
115	A12	O
116	A10	O
117	A8	O
118	A6	O
119	A4	O
120	A2	O

Table 3-4: Connector P2 pin assignment

3.7 Pin Description

All pin names except 53, 77 and 104 of the connectors correspond to the names found in the Blackfin BF537 datasheet from Analog Devices.

PIN Nr.	Name	Description	PIN Nr.
53	VBUS	USB +5V VCC	53
77	USBD+	USB + Data line	77
102	USBD-	USB – Data line	102

Table 3-5: Pin description of all non Processor Pins on the CM-BF534

4 Test Points

4.1 Footprint – Test Points

Figure 4-1 shows the test points at the bottom side of the Core Module

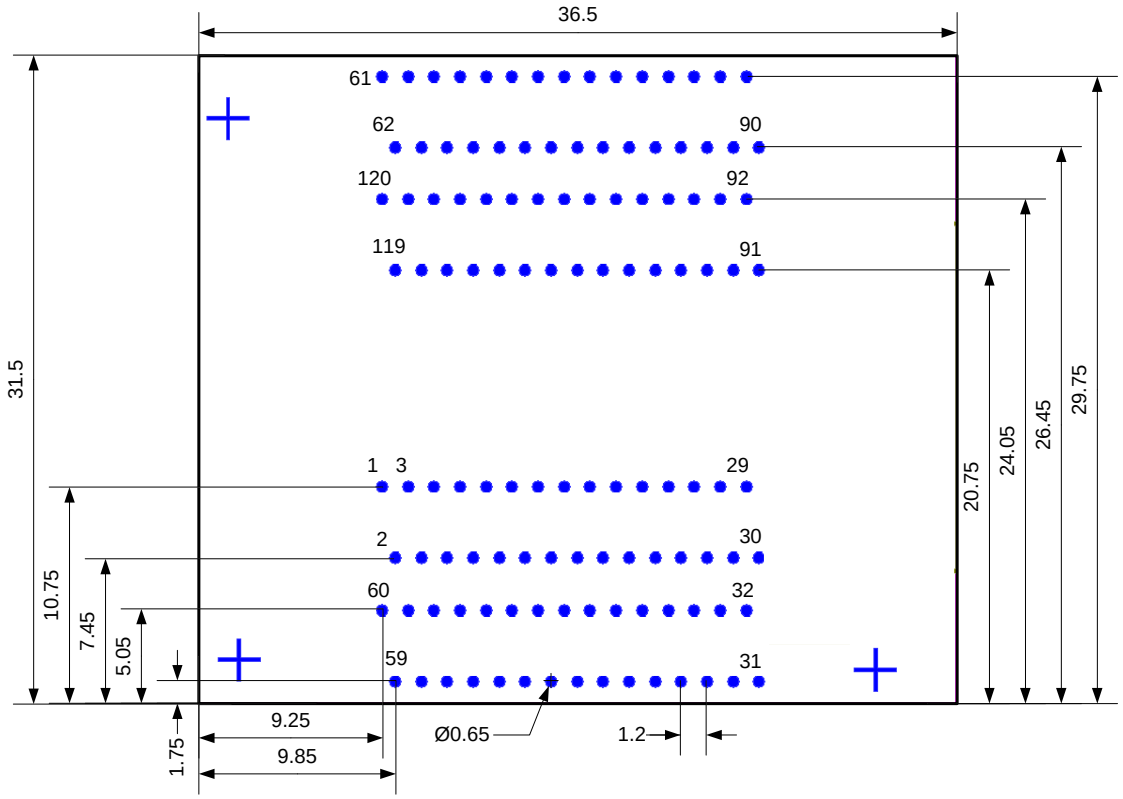

Figure 4-1: Test Points of the Core Module (top view)

5 Software Support

5.1 BLACKSheep

The Core Module is delivered with a pre-flashed basic version of the BLACKSheep VDK multithreaded framework. It contains a boot-loader for flashing the Core Module via the serial port.

Please consult the software development documents.

5.2 uClinux

The Core Module is fully supported by the open source platform at http://blackfin.uclinux.org. Since the Core Modules are pre-flashed with BLACKSheep you have to flash uBoot first. To flash the uBoot you can use the BLACKSheep boot-loader.

6 Anomalies

For the latest information regarding anomalies for this product, please consult the product home page:

http://www.bluetechnix.com/goto/cm-bf537u

7 Production Report

7.1 CM-BF537U (100-1223)

Version	Component Type	Component Description
V1.2	Processor	ADSP-BF537 KBCZ-6A (Rev 0.2)
	RAM	MT48LC16M16A2BG-75 IT:D
	FLASH	PC28F320J3D
V1.3.1	Processor	ADSP-BF537 KBCZ-6A (Rev 0.3)
	RAM	MT48LC16M16A2BG-75 IT:D
	FLASH	PC28F320J3D

Table 7-1: Production Report CM-BF537U

8 Product Changes

For the latest product change information please consult the product web-page at:

http://www.bluetechnix.com/goto/cm-bf537u

9 Document Revision History

Version	Date	Document Revision
7	2010-02-02	Redesign of Manual
6	2008-09-03	Footprint and mechanical drawings updated
5	2008-08-14	English checked for grammar, spelling and clarity.
4	2008-06-11	Some corrections in table 3-4
3	2007-04-05	BGA option removed
	2007-04-04	Layout Changed and additional information
2	2006-04-26	Update of drawings correcting Symbol and pin definitions
1	2006-02-02	First release V1.0 of the Document

Table 9-1: Revision History

A List of Figures and Tables

Figures

Tables