

Hardware User Manual

CM-BF533

www.tinyboards.com

Maximum Power at Minimum Size

Contact

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Information

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

Warnings

Due to technical requirements components may contain dangerous substances

The Core Boards and Development systems contain ESD (electrostatic discharge) sensitive devices. Electrostatic 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 boards and development boards should be stored in the protective shipping package.



1 Introduction

The CM-BF533 is a tiny high performance and low power DSP/RISC core module incorporating Analog Devices Blackfin family of processors. The module allows easy integration into high demanding very space and power limited applications.

1.1 Overview

The Core module CM-BF533 consists of the following components:

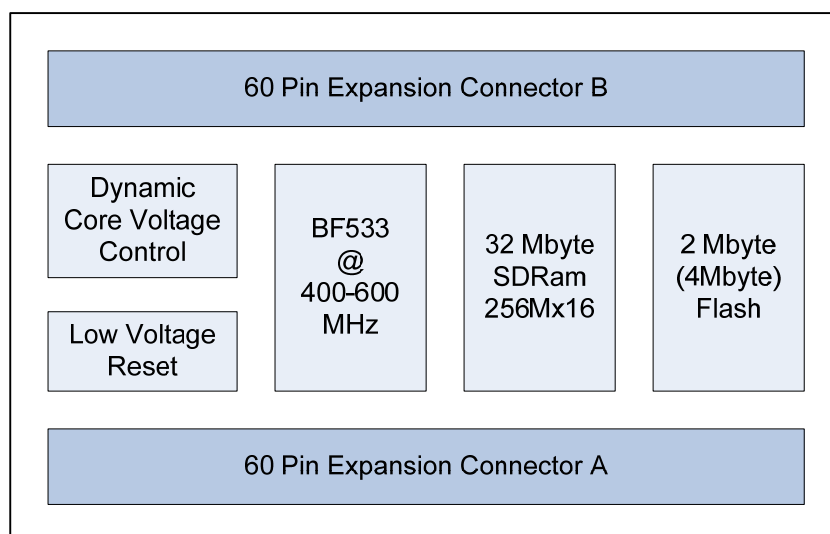


Figure 1-1: Main Components of the CM-BF533 module

- **Analog Devices Blackfin Processor BF533**
 - As of October 2004 only the 600MHz Version of the BF533 is supported
- **32 MB SDRAM**
 - SDRAM Clock up to 133MHz
 - 256Mx16 at 3.3V
- **2MB of Addressable Flash**
 - 32Mx16 Flash (2MByte direct addressable, 2MB addressable via PF3)
 - Additional Flash Memory can be connected through the expansion board as parallel Flash using asynchronous chip select lines or as a SPI flash.
- **Low Voltage Reset Circuit**

- o Resets module if power supply goes below 2.93V for at least 140ms
- **Dynamic Core Voltage Control**
 - o Allows to adjust core voltage by setting software registers at the Blackfin Processor
 - o Core voltage range: 0.7 – 1.24 V
- **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
- **BGA Option**
 - o For very low assembling height and small to medium volume production the module can also be delivered as a BGA version with an easy to route BGA footprint as can be seen in Figure 2-4.

1.2 Benefits

- The CM-BF533 is very compact and measures only 36x31 mm.
- Allows quick prototyping of product that comes very close to the final design.
- Reduces development costs and risk, faster time to market.
- Very cost effective for small and medium volumes up to 1000 units.
- Ideal for applications in mobile devices, high performance multiprocessor systems and robotic applications.

1.3 Applications

Generic high performance signal processor module

Multimedia and handheld applications

Standalone vision system with direct video camera connection

Robotics: Tiny processor module for mobile robots

1.4 Related Products

EVAL-Blackfin: Blackfin DSP Evaluation board with one socket for a CM-BF533 or a CM-BF561 core module. Additional periphery is available, such as a single camera plug and an SD-Card.

DEV-Blackfin: Blackfin DSP Development board with two sockets for any combination of CM-BF533 and CM-BF561 core modules. Additional periphery is available, such as CF-Card, SD-Card, DP-Ram, Ethernet, USB host and device, multi-port JTAG and 2 connectors for a digital stereo camera system.

CM-BF561: Blackfin DSP Processor Module powered by Analog Devices new dual core BF561 processor. Up to 2x 600MHz, 32MB RAM, 4MB Flash, 36x31mm, 120 pin expansion connector, BGA option.

Kit-CAM-OV: Camera Kit including 2 cameras for the Blackfin core boards and the respective software driver

For product development it is highly recommended to purchase the *DEV-Blackfin* development board which includes low level driver software for Blackfin periphery. Bluetechnix can not provide software support for the processor module if no *DEV-Blackfin* developer kit has been purchased.

2 Specification

2.1 Functional Specification

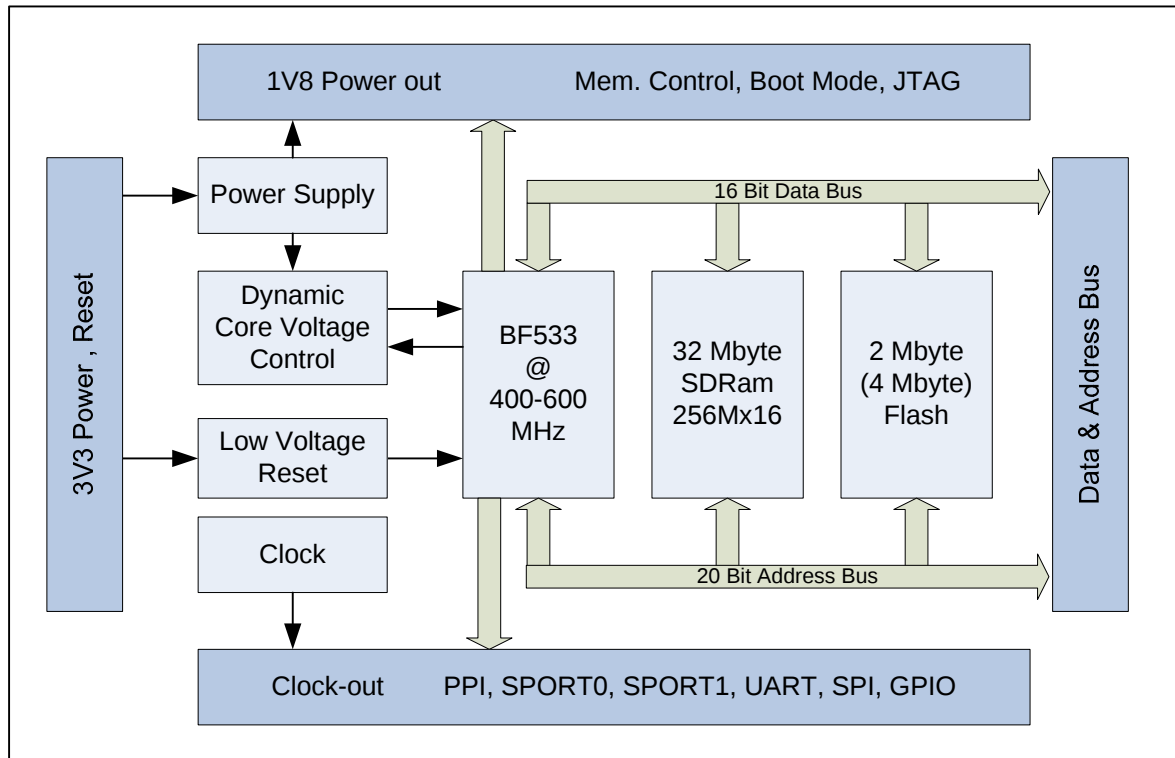


Figure 2-1: Detailed Block Diagram

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.

A special feature of the CM-BF533 module is the availability of a 1.8V output voltage pin where up to 150 mA of current can be drawn. In addition to the buffered main clock output of 25 MHz and the available PPI port a digital video camera can be connected to the modules dedicated camera connector requiring no additional hardware.

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 Mechanical Outline

TOP VIEW

All dimensions are given in millimeters!

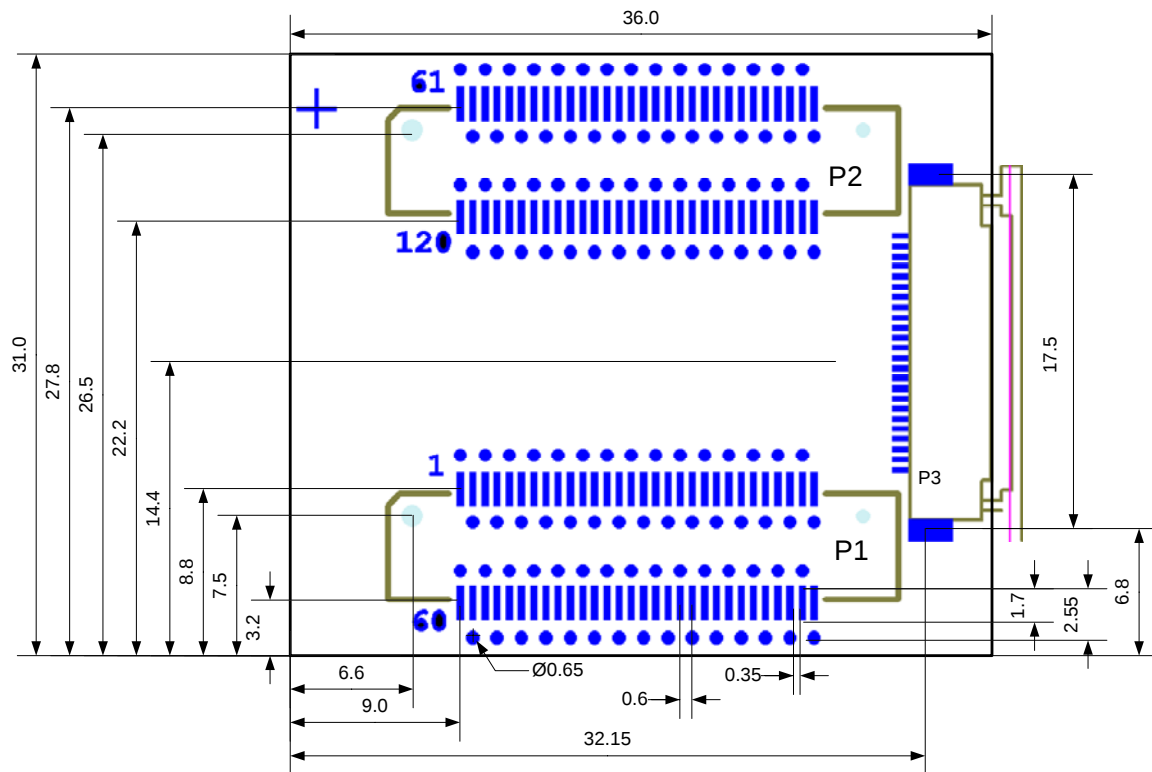


Figure 2-2: Mechanical outline and Bottom Connectors

The mechanical outline represents a top view of the connectors placed at the bottom of the core board. In addition to the connectors the balls for the BGA version are designed in as well as they are at the bottom layer of the CM-BF533 module.

The module ships either as a BGA version (Order Nr. 100-1202) or as a standard version with two 60pin connectors (Order Nr. 100-1201)

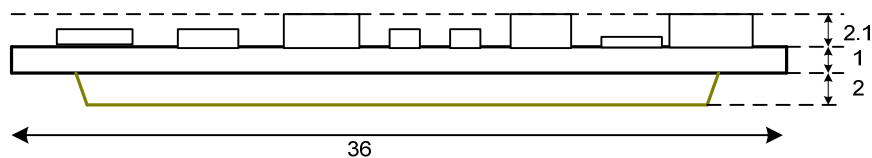


Figure 2-3: Side View with Connector mounted

The total minimum mounting height including receptacle at the motherboard is 6.1mm.

If the BGA version is used the mounting height reduces to only 3.3mm!

2.2.1 Footprint - BGA Version

For the BGA version, the footprint for the baseboard may look like follow:

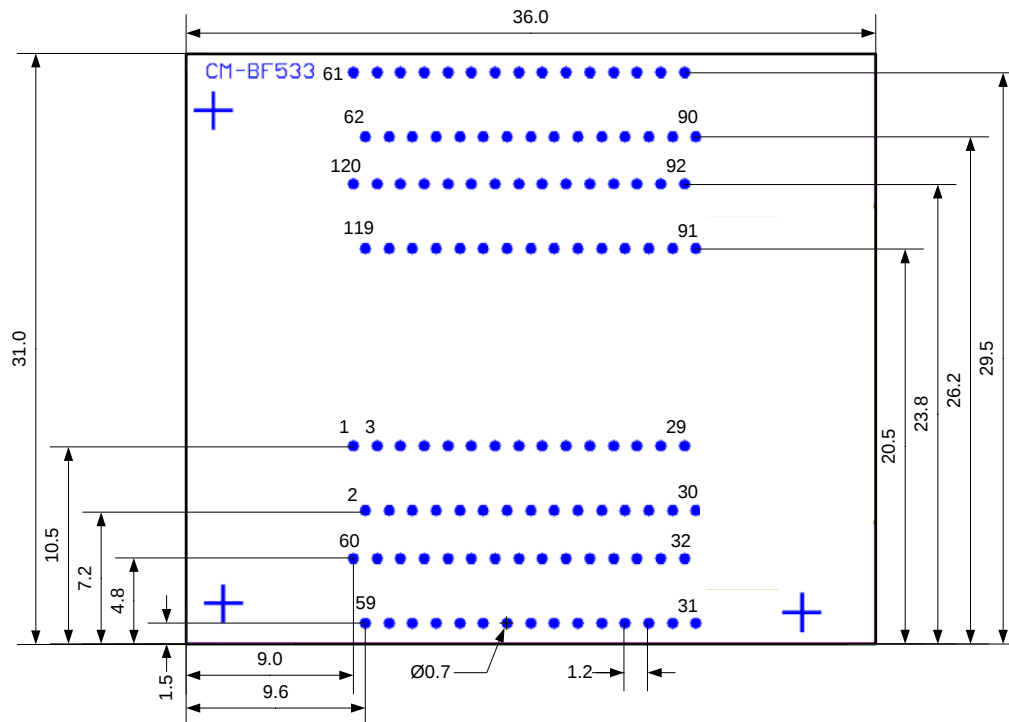


Figure 2-4: Connector Footprint for BGA Version

2.2.2 Footprint - Connector Version

If the Connector version (2x Hirose 0.6mm pitch) is used, the footprint for the baseboard may look as shown in Figure 2-5.

For the baseboard the following connectors have to be used.

Part Baseboard	Manufacturer	Manufacturer ID
P1,P2	Hirose	FX8-60S-SV
P4 (top)	Harwin	M50-3600522

Table 2-1: Baseboard connector types

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

Part	Manufacturer	Manufacturer Part Nr.
P1,P2	Hirose 3mm height	FX8-60P-SV(21)
P3	Molex	52435-2491
P4 (top)	Harwin	M50-3150522

Table 2-2: Module connector types

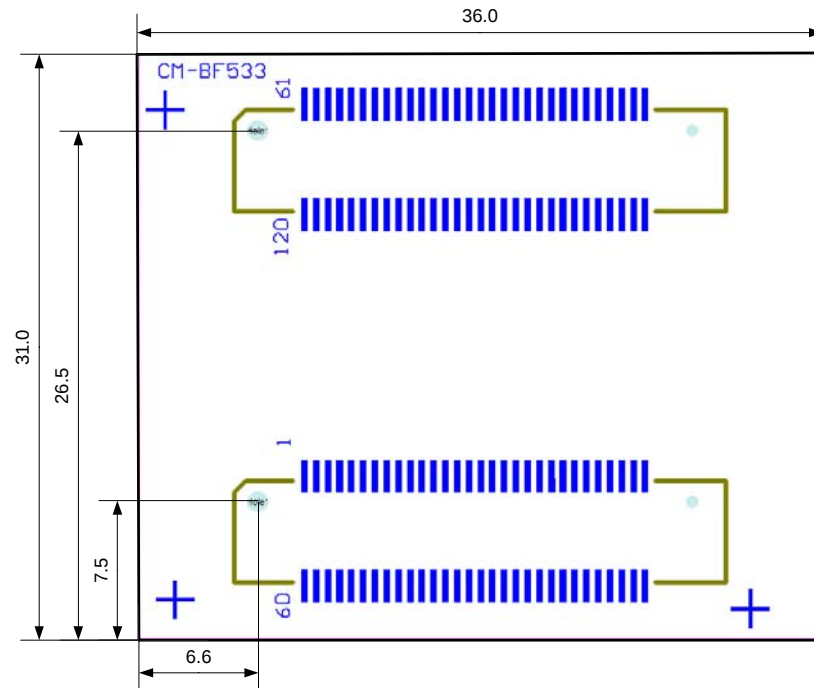


Figure 2-5: Connector Footprint for Baseboard

2.2.3 Top Mounted connector

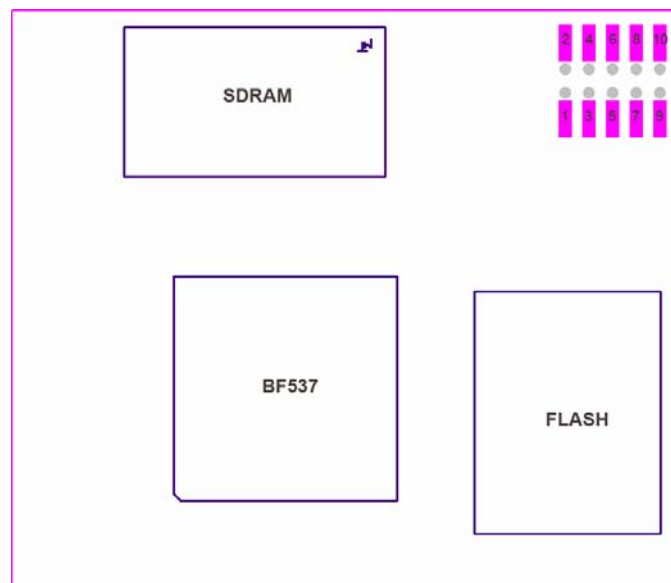


Figure 2-6: TOP VIEW

2.3 Schematic Symbol (Signals of P1 and P2)

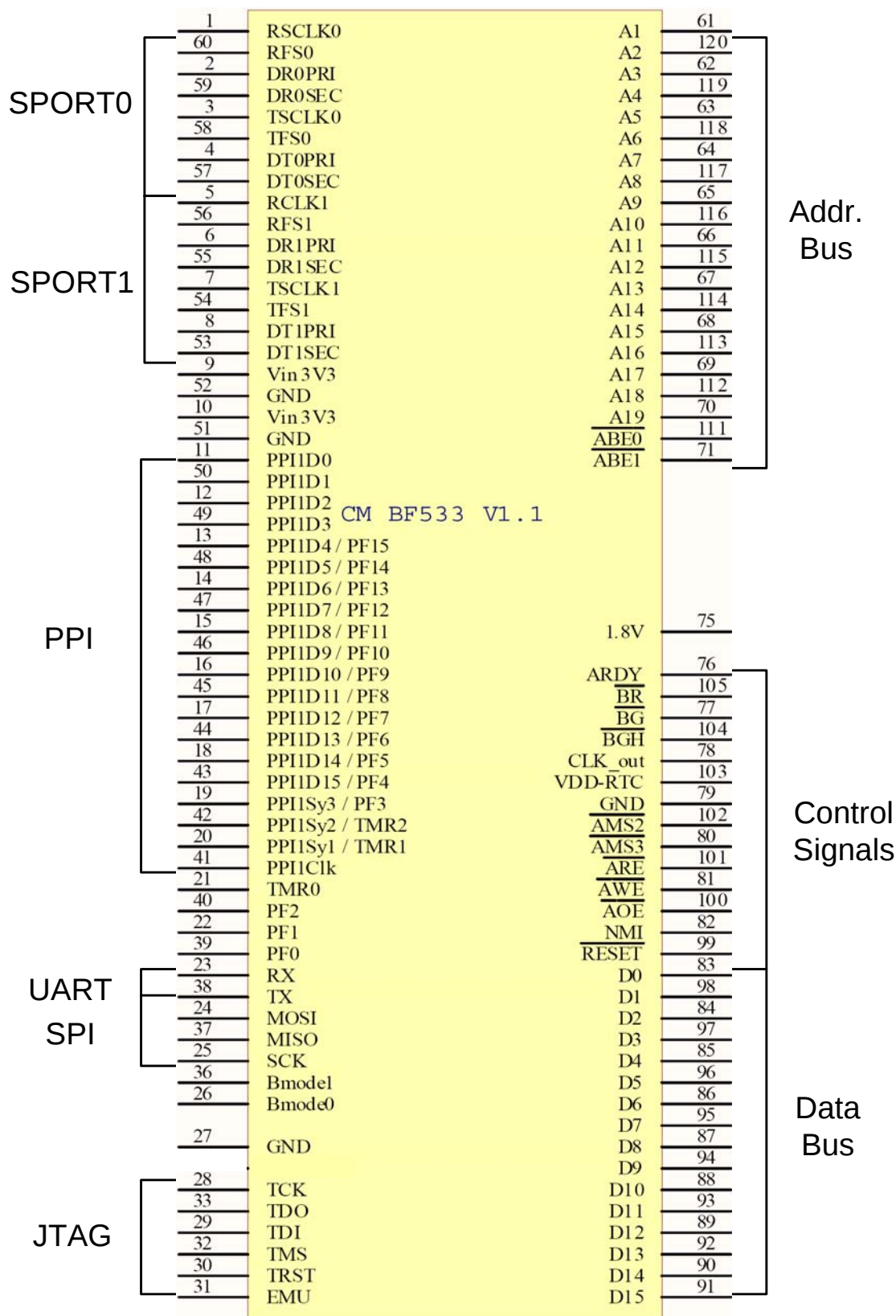


Figure 2-7: Schematic Symbol of Module

2.4 Connectors PIN Assignment

2.4.1 Connector P1 – (1-60)

PIN Number	Signal	Signal type	Pin Number	Signal	Signal type
1	RSCLK0	I/O	2	DR0PRI	I
3	TSCLK0	I/O	4	DT0PRI	O
5	RSCLK1	I/O	6	DR1PRI	I
7	TSCLK1	I/O	8	DT1PRI	O
9	Vin 3V3	PWR	10	Vin 3V3	PWR
11	PPI0	I/O	12	PPI2	I/O
13	PF15 / PPI4	I/O	14	PF13 / PPI6	I/O
15	PF11 / PPI8	I/O	16	PF9 / PPI10	I/O
17	PF7/SPISEL7/PPI12	I/O	18	PF5/SPISEL5/PPI14	I/O
19	PF3/SPISEL3/PPI_FS3	I/O	20	TMR1 / PPI_FS1	I/O
21	TMR0	I/O	22	PF1	I/O
23	RX	I	24	MOSI	I/O
25	SCK	I	26	BMODE0	I
27	GND	PWR	28	TCK	I
29	TDI	I	30	TRST	I
31	EMU	O	32	TMS	I
33	TDO	O	34	nc	-
35	nc	-	36	BMODE1	I
37	MISO	I/O	38	TX	O
39	PF0 / #SPISS	I/O	40	PF2	I/O
41	PPI_CLK	I/O	42	TMR2 / PPI_FS2	I/O
43	PF4/SPISEL4/PPI15	I/O	44	PF6/SPISEL6/PPI13	I/O
45	PF8 / PPI11	I/O	46	PF10 / PPI9	I/O
47	PF12 / PPI7	I/O	48	PF14 / PPI5	I/O
49	PPI3	I/O	50	PPI1	I/O
51	GND	PWR	52	GND	PWR
53	DT1SEC	O	54	TFS1	I/O
55	DR1SEC	I	56	RFS1	I/O
57	DT0SEC	O	58	TFS0	I/O
59	DR0SEC	I	60	RFS0	I/O

Table 2-3: Connector P1 pin assignment

All PIN names of the connectors correspond to the names found in the Blackfin BF533 datasheet from Analog Devices.

Boot Mode:

Default Boot Mode = 00 (BMODE1 = LOW, BMODE0 = LOW)

BMODE0, BMODE1 has 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, see Blackfin Datasheets for more details.

Non processor PINS: 1V8 out: Provides a regulated output able to draw up to 150 mA

2.4.2 Connector P2 – (61-120)

PIN Number	Signal	Signal type	Pin Number	Signal	Signal 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	ABE1	O	72	NC	-
73	NC	-	74	NC	-
75	1V8	O	76	ADRY	I
77	/BG	O	78	CLK_Out 25MHz	O
79	GND	PWR	80	/AMS3	O
81	/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	/Reset	I	100	/AOE	O
101	/ARE	O	102	/AMS2	O
103	VDD-RTC	PWR	104	/BGH	O
105	/BR	I	106	NC	-
107	NC	-	108	NC	-
109	NC	-	110	NC	-
111	ABE0	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 2-4: Connector P2 pin assignment

Non processor PINS:

CLK_OUT: 25MHz Buffered output clock of main Oscillator

All other pins are connected directly to the respective BF533 processor pins.
For details about the meaning of the signal names consult the Blackfin BF533 datasheet.

GREY Shaded Connector PINS indicate difference to CM-BF561

2.4.3 ITU656 Camera Connector P3 (1-22)

The ITU656 connector has been tested only for the OmniVision cameras available in our camera kit Kit-CAM-OV (Order Nr. 100-9901)

PIN Number	Signal	Signal type	PIN Number	Signal	Signal type
1	N.C.	-	2	AGND	PWR
3	SIO_D	I/O	4	AVDD	PWR
5	SIO_C	I	6	RESET	I
7	VSYNC	O	8	PWDN	I
9	HREF	O	10	DVDD	PWR
11	DOVDD	PWR	12	D7	O
13	CamClk (*)	I	14	D6	O
15	DGND	PWR	16	D5	O
17	PCLK	O	18	D4	O
19	D0	O	20	D3	O
21	D1	O	22	D2	O
23	N.C.	-	24	N.C.	-

Table 2-5: Connector P3 pin assignment

2.4.4 Connector P4 (1-10)

The top mounted connector P4 can be used as a standalone connector for a system requiring only power supply and one or two communication ports (UART and SPI)

PIN Number	Signal	Signal type	Pin Number	Signal	Signal type
1	RX	I	2	TX	O
3	MOSI	I/O	4	GND	PWR
5	SCK	I/O	6	PF0	I/O
7	PF2	I/O	8	MISO	I/O
9	3V3	PWR	10	PF1	I/O

Table 2-6: Connector P4 pin assignment

2.5 Memory MAP

Memory Type	Start Address	End Address	Size	Comment
FLASH PF3 Flag Low	0x20000000	0x200FFFFFF	2MB	4MB Micron Flash, MT28F320J3FS-11
FLASH PF3 Flag High	0x20000000	0x200FFFFFF	2MB	4MB Micron Flash, MT28F320J3FS-11
SD-RAM	0x00000000	0x01FFFFFFF	32MB	16Bit Bus, Micron MT48LC16M16A2FG

2.6 Electrical Specification

2.6.1 Supply Voltage

- 3.3V DC +/-10%

2.6.2 Supply Voltage Ripple

- 100mV peak to peak 0-20 MHz

2.6.3 Supply Current

- Maximum current: 250mA at 3.3V (Worst case temperature)
- Operating conditions:
 - Processor in idle mode, SDRAM in power down: TBD
 - Processor running at 600MHz, Core Voltage 1.2V, SDRAM 20% bandwidth utilization at 130MHz: 150mA
 - Processor running at 300MHz, Core Voltage 0.8V SDRAM 20% bandwidth utilization at 130MHz: 90mA

2.7 Environmental Specification

2.7.1 Temperature

Development Version:

- Operating at full 600MHz: 0 to + 70° C
- Operating at full 300MHz: -10 to + 85° C

Industrial Version: (Only available upon request at a MOQ)

- Operating 500MHz graded: -40 to + 85° C

2.7.2 Humidity

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

3 Application Examples

In the following some application examples are shown including block diagrams and schematics.

3.1 Minimum Configuration

The minimum configuration can be used in case the CM-BF533 is used as a high performance Co-processor module.

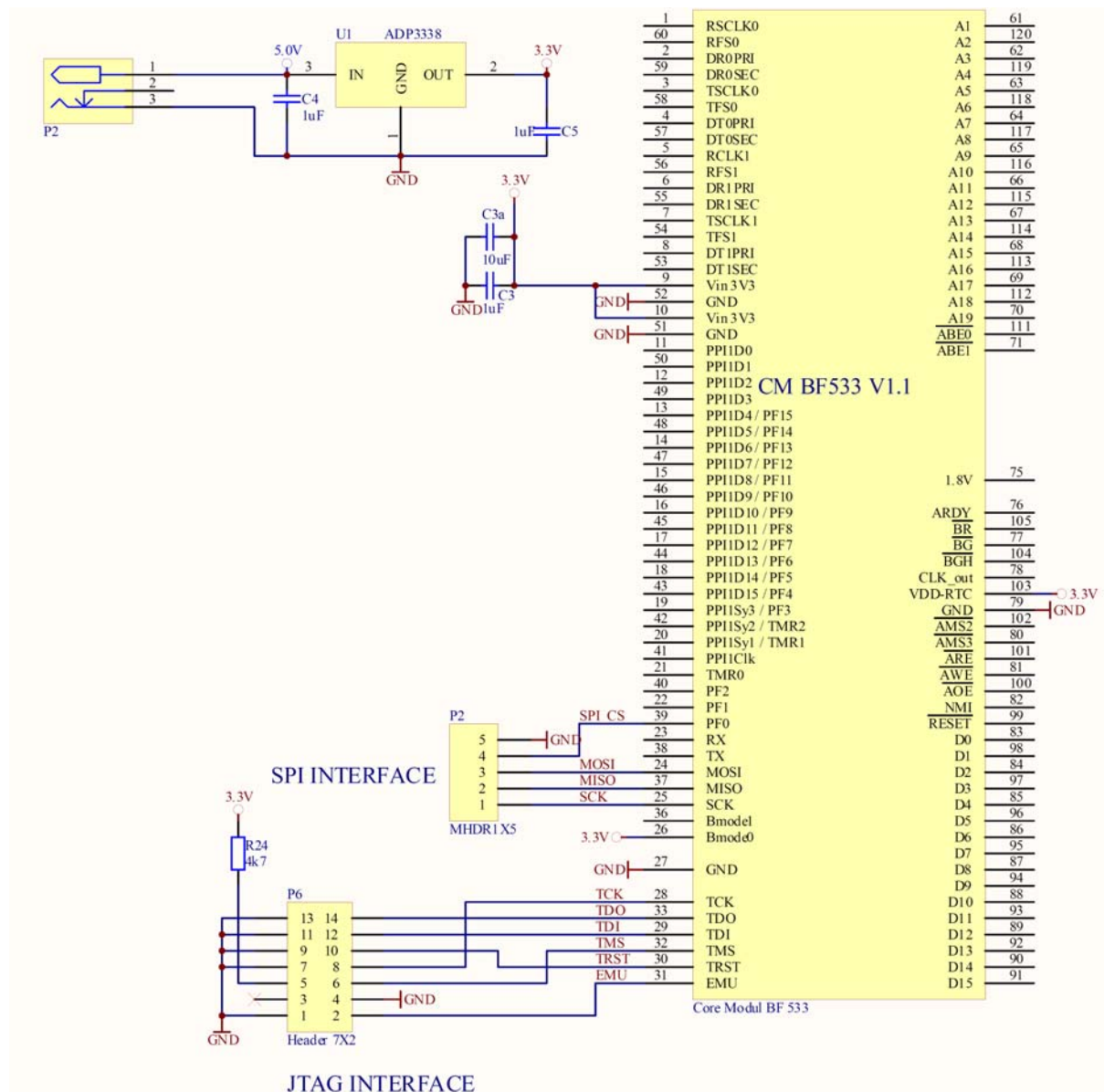


Figure 3-1: Minimum Configuration with SPI and JTAG Connector

3.2 Standalone Camera System

The CM-BF533 module can be used as a standalone module for a camera system requiring only power supply and the direct attachment of a compatible video camera. A camera kit including drivers can be purchased from Bluetechnix: KIT-CAM-OV (O.Nr 100-9901)

The digital ITU656 camera directly connects to P3 while the power supply and any of two communication ports (SPI and UART) can be connected to the 10 pin P4 connector as well as over the large connectors P1 and P2 at the bottom.

3.3V Power, SPI, UART

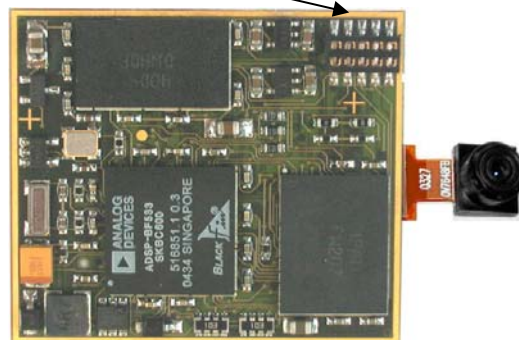


Figure 3-2: Standalone Camera System

3.3 Generic Signal Processing System

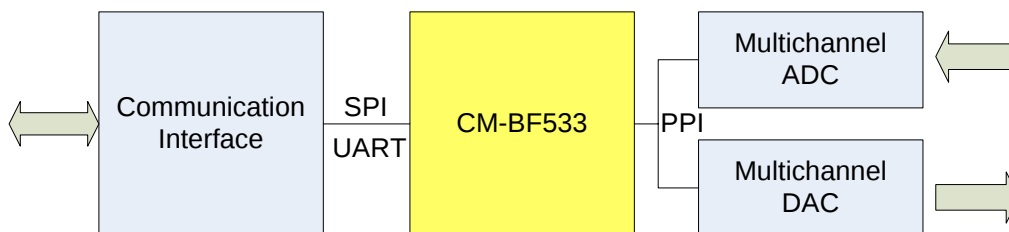


Figure 3-3: Block Diagram – Analog Signal Processing Module

3.4 Co-processor Application

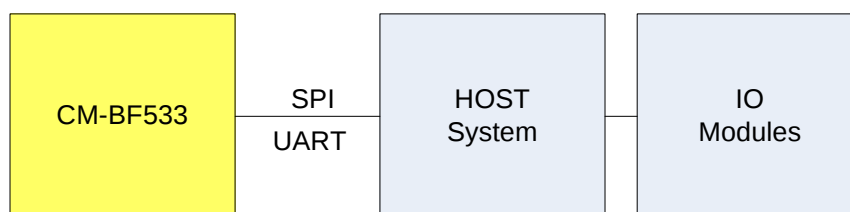
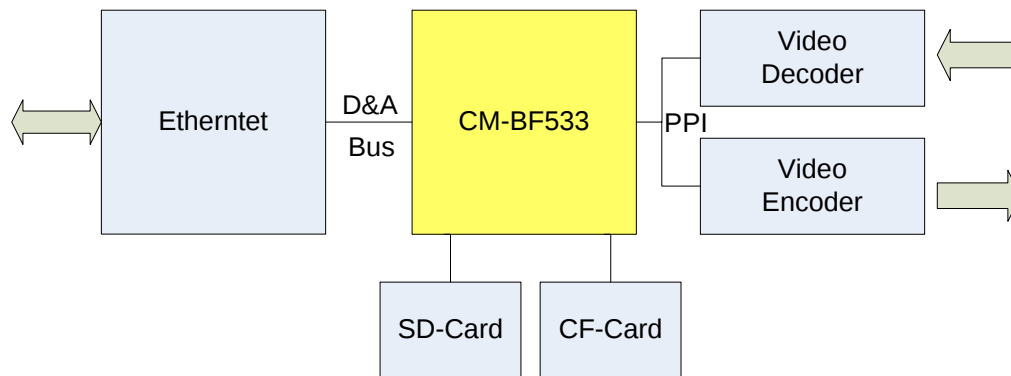


Figure 3-4: Block Diagram – Co-Processor Module

3.5 Digital Video System



Figur 3-5: Block Diagram: Digital Video System

For product development it is highly recommended to purchase the *DEV-Blackfin* development board which includes low level driver software for Blackfin periphery. Bluetechnix can not provide software support for the processor module if no *DEV-Blackfin* developer kit has been purchased.

Contact Bluetechnix for further details about availability of additional hardware and software modules for your Blackfin design!

4 Known Bugs

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5 Revision History

28 08 2004	First release V1.0 of the Document
18 12 2004	Updated Symbol – Exchanged P1 and P2
09 01 2005	Memory Map added
03 10 2005	Modifications on Table 2-3: EMU and TMS Signal type changed, Signal names of PPI and timer pins changed.
10 10 2005	Adapted for hardware version 1.3

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