Hardware User Manual

EXT-BF5xx-CAM v3.x

...maximum performance at minimum space

Contact

Bluetechnix Mechatronische Systeme GmbH

Lainzerstraße 162/3

A-1130 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.

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:

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.

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-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.

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-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.

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.

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.

eCM-BF561: Blackfin Processor Module 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.

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 .

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 EXT-BF5xx-Camera Board is an extender plug-on board for the DEV-BF5xx, the DEV-BF5xx-Lite or the EVAL-BF5xx board. The board supports the Omnivision OV7660, the OV2630 and the OV2640 camera modules and/or the TX09D50VM1CCA, TX09D70VM1CDA display from Hitachi or compatible devices.

1.1.   Overview

The EXT-BF5xx-Camera Board includes the following components:
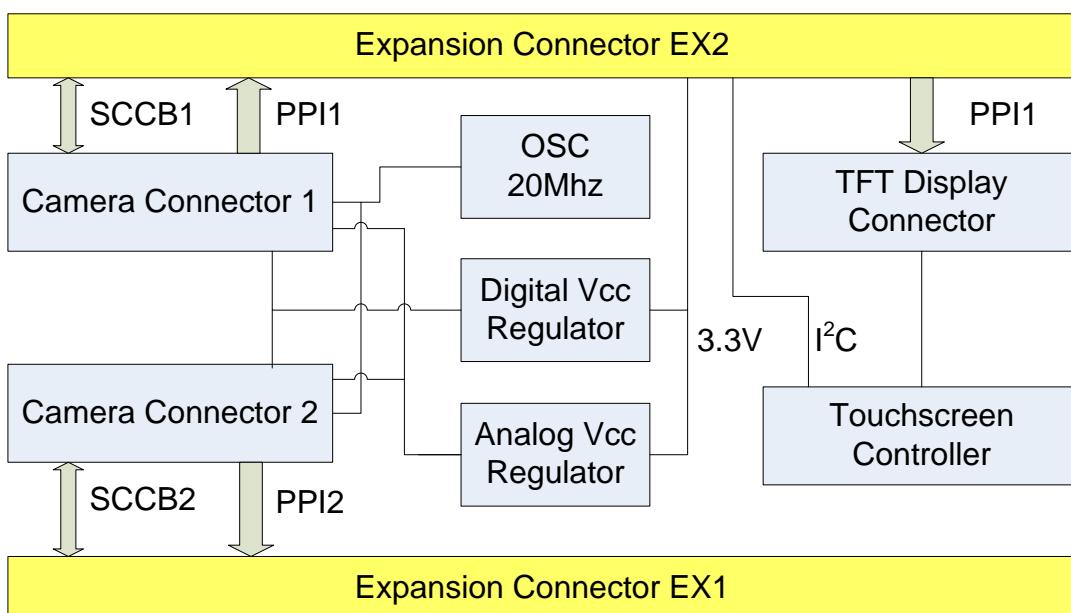
Figure 1-1: Overview of the EXT-BF5xx-Camera Board

- ▪ **2 Camera Connectors**

  - • Supported cameras: OV7660, OV2630 and OV2640*[1]
  - • Resolution: 640x480 @ max 30fps or 320x240@ max 60fps up to 2Mpixel (depends on the camera model connected)

  *[1] depends on the soldered mounting option.

- ▪ **TFT Display Connector**
  - • Supports Hitachi TX09D50VM1CCA Display with Touch screen (Note 1) or compatible devices.
  - • Supports Hitachi TX09D50VM1CDA Display.

  Both TFT Displays can be ordered from Bluetechnix.

- ▪ **Touch Screen controller**

  - • For using a touch screen the board includes a touch screen controller.

- **Stacked Connectors**

  - For connecting the base board or other extender boards.

1.2. Possible mount configurations

The possible mounting configurations are dependent on the used Core Module:

- **CM-BF561**

  1. 2 cameras inserted in Cam1 and Cam2 *[1]
  2. TFT display and camera module connected to Cam2 *[3]
  3. Only the TFT display: Do not connect Cam1 if you use the display!

- **CM-BF533, CM-BF527, TCM-BF5xx and CM-BF548**

  1. Only 1 camera in Cam1 is possible*[2]

- **CM-BF537E/U**

  1. Only one camera on Cam1 *[2]
  2. Only the display: Do not connect Cam1 if you use the display!

*[1] Do not connect the display, if you insert two cameras. The camera Cam1 and the Display share the same PPI interface!

*[2] Leave camera Cam2 and display P1 disconnected!

*[3] Leave camera Cam1 disconnected!

2. Specification

Here a detailed specification of the EXT-BF5xx-Camera board is provided. Figure 2-1 shows the top view of the EXT-BF5xx-Camera board.
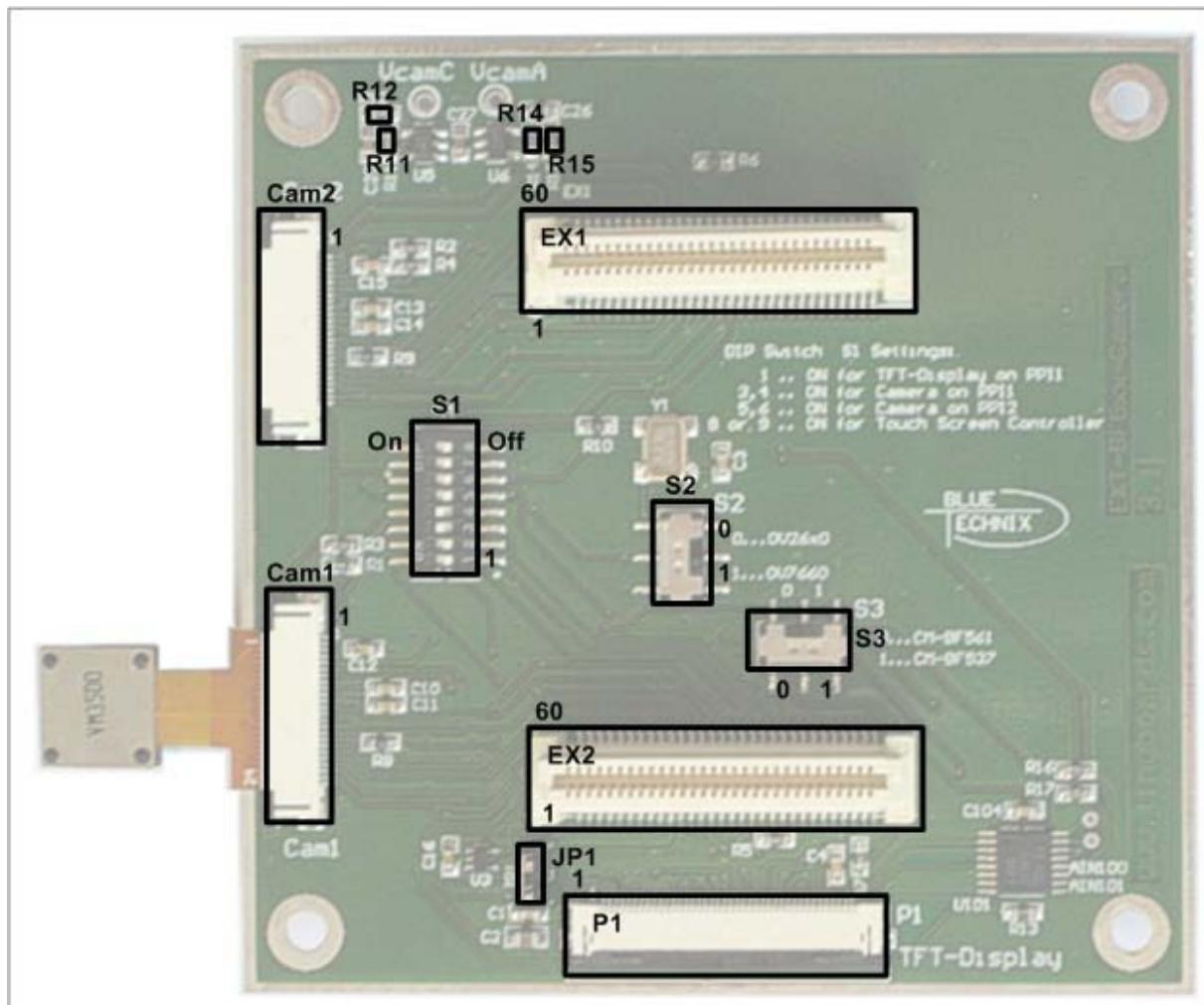
Figure 2-1: Connector PCB Placement

Legend:

Cam1 and Cam2	Camera Connector
P1	Display Connector
EX1 and EX2	bottom side board connectors routed directly through to the top side connectors
S1	Switch for selecting the appropriate Camera and Display connections
S2	resolution switch
S3	selects the appropriate Core Modules

R11, R12, R14 and R15   are used to adjust the camera's core and analog voltages

See the detailed description below.

2.1.   Camera Support

The board supports the following three cameras from Omni Vision:

- OV7660
- OV2630
- OV2640

However each camera needs different core and analog voltages. Since the supported camera modules have different core and analog voltage levels the power supply for the camera modules is realized using two adjustable linear voltage regulators.

The appropriate voltage level must be adjusted by a pair of resistors for each linear regulator. For the core voltage R11 and R12 are involved, R14 and R15 are used for the analog voltage level. Please refer to Figure 2-1(above) **Error! Reference source not found.**to see the positions of the resistors on the PCB. The board is shipped with the appropriate resistor values to support the camera included in the package. In the table below you can find the voltage levels (VccC and VccA) and the appropriate resistor values for each supported camera module.

Resistors	OV7660FSG	OV2640FSL	OV2630FSL
VccC	1.86	1.29	1.75
R11	10k	10k	47k
R12	18k	120k	100k
VccA	2.51	2.71	2.92
R14	11k	14k	68k
R15	10k	10k	47k

Table 2-1: Resistor values for the adjustable voltage regulators

2.2.   Connectors, PCB Placement and PIN Assignment

The following sections describe the signal and pin assignment depending upon which core module is connected to the base board.

2.2.1. EX1 and EX2 – Expansion Connectors

The pins of the EX1 and the EX2 connector mounted on the bottom site of the Extender board are routed through directly to the matching connectors on the top site of the board. For pin assignment please refer to the base board manual (EVAL-BF5xx, DEV-BF5xxDA-Lite, DEV-BF5xx, DEV-BF5xx-FPGA, etc.). The pin assignment of the expansion connectors depends on the Core Module inserted on the base board.

2.2.2. Cam1 – Camera Connector 1

Pin	Description	Pin on CM-BF533	Pin on CM-BF537E/U	Pin on CM-BF561
1	n.c.	n.c.	n.c.	n.c.
2	AGND	n.c.	n.c.	n.c.
3	SIO_D	PPI1D12	PPI1D12	PPI1D12
4	AVDD	n.c.	n.c.	n.c.
5	SIO_C	PPI1D15	PPI1D15	PPI1D15
6	RESET	n.c.	n.c.	n.c.
7	VSYNC	PPI1Sy2	PPI1Sy2	PPI1Sy2
8	PWDN	n.c.	n.c.	n.c.
9	HREF	PPI1Sy1	PPI1Sy1	PPI1Sy1
10	DVDD	n.c.	n.c.	n.c.
11	DOVDD	n.c.	n.c.	n.c.
12	D7	PPI1D7	PPI1D7	PPI1D7
13	CamClk	n.c.	n.c.	n.c.
14	D6	PPI1D6	PPI1D6	PPI1D6
15	DGND	n.c.	n.c.	n.c.
16	D5	PPI1D5	PPI1D5	PPI1D5
17	PCLK	PPI1Clk	PPI1Clk	PPI1Clk
18	D4	PPI1D4	PPI1D4	PPI1D4
19	D0	PPI1D0	PPI1D0	PPI1D0
20	D3	PPI1D3	PPI1D3	PPI1D3
21	D1	PPI1D1	PPI1D1	PPI1D1
22	D2	PPI1D2	PPI1D2	PPI1D2
23	D8	PPI1D8	PPI1D8	PPI1D8
24	D9	PPI1D9	PPI1D9	PPI1D9

Table 2-1: Connector Cam1 pin assignment

2.2.3. Cam2 – Camera Connector 2

A camera connected on Cam2 is only supported with a CM-BF561 connected to the base board. It does not work with the other Core Modules because they do not have a second PPI interface.

ATTENTION: Do not connect Cam2 if the CM-BF533 Core Module is connected.

Pin	Description	Pin on CM-BF561
1	n.c.	n.c.
2	AGND	n.c.
3	SIO_D	PPI2D11
4	AVDD	n.c.
5	SIO_C	PPI2D10
6	RESET	n.c.
7	VSYNC	PPI2Sy2
8	PWDN	n.c.
9	HREF	PPI2Sy1
10	DVDD	n.c.
11	DOVDD	n.c.
12	D7	PPI2D7
13	CamClk	n.c.
14	D6	PPI2D6
15	DGND	n.c.
16	D5	PPI2D5
17	PCLK	PPI2Clk
18	D4	PPI2D4
19	D0	PPI2D0
20	D3	PPI2D3
21	D1	PPI2D1
22	D2	PPI2D2
23	D8	PPI2D8
24	D9	PPI2D9

Table 2-2: Connector Cam2 pin assignment

2.2.4. P1 – TFT Display Connector

The TFT-Display is only supported with CM-BF537E/U and CM-BF561. Touch screen is only supported if a compatible display with touch screen is used.

ATTENTION: Do not connect the display while the CM-BF533 Core Module inserted.

Pin	Description	Pin on CM-BF537E/U	Pin on CM-BF561
1	VDD	n.c.	n.c.
2	VDD	n.c.	n.c.
3	VDD	n.c.	n.c.
4	DCLK	PPI1Clk / TMR3	PPI1Clk / TMR6
5	GND	n.c.	n.c.
6	HSYNC	PPI1Sy1	PPI1Sy1
7	GND	n.c.	n.c.
8	DTMG	PPI1Sy2	PPI1Sy2
9	GND	n.c.	n.c.
10	n.c.	n.c.	n.c.
11	GND	n.c.	n.c.
12	R5	PPI1D0	PPI1D0
13	R4	PPI1D1	PPI1D1
14	R3	PPI1D2	PPI1D2
15	GND	n.c.	n.c.
16	R2	PPI1D3	PPI1D3
17	R1	PPI1D4	PPI1D4
18	R0	PPI1D0	PPI1D0
19	GND	n.c.	n.c.
20	G5	PPI1D5	PPI1D5
21	G4	PPI1D6	PPI1D6
22	G3	PPI1D7	PPI1D7
23	GND	n.c.	n.c.
24	G2	PPI1D8	PPI1D8
25	G1	PPI1D9	PPI1D9
26	G0	PPI1D10	PPI1D10
27	GND	n.c.	n.c.
28	B5	PPI1D11	PPI1D11
29	B4	PPI1D12	PPI1D12
30	B3	PPI1D13	PPI1D13
31	GND	n.c.	n.c.
32	B2	PPI1D14	PPI1D14
33	B1	PPI1D15	PPI1D15
34	B0	PPI1D11	PPI1D11
35	PCI	PF14	PF0

36	PWM	TMR4	TMR5
37	XR	n.c.	n.c.
38	YL	n.c.	n.c.
39	XL	n.c.	n.c.
40	YU	n.c.	n.c.

Table 2-3: Connector P1 (TFT-Display) pin assignment

2.2.5. Expansion Connector Types

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

Part	Manufacturer	Manufacturer Part Nr.
EX1, EX2	AMP (Stacked Height = 16mm)	5-5179010-2
Matching connector	AMP	5179031-2

Table 2-4: EXT-BF5xx-Camera board connector types

These connectors can be ordered from Bluetechnix.

2.2.6. JP1 - Power Supply Jumper

This jumper can be removed in order to insert an Ampere-meter to measure the current of the entire EXT-BF5xx-Camera or to disable the entire board.

2.3. Mechanical Outline
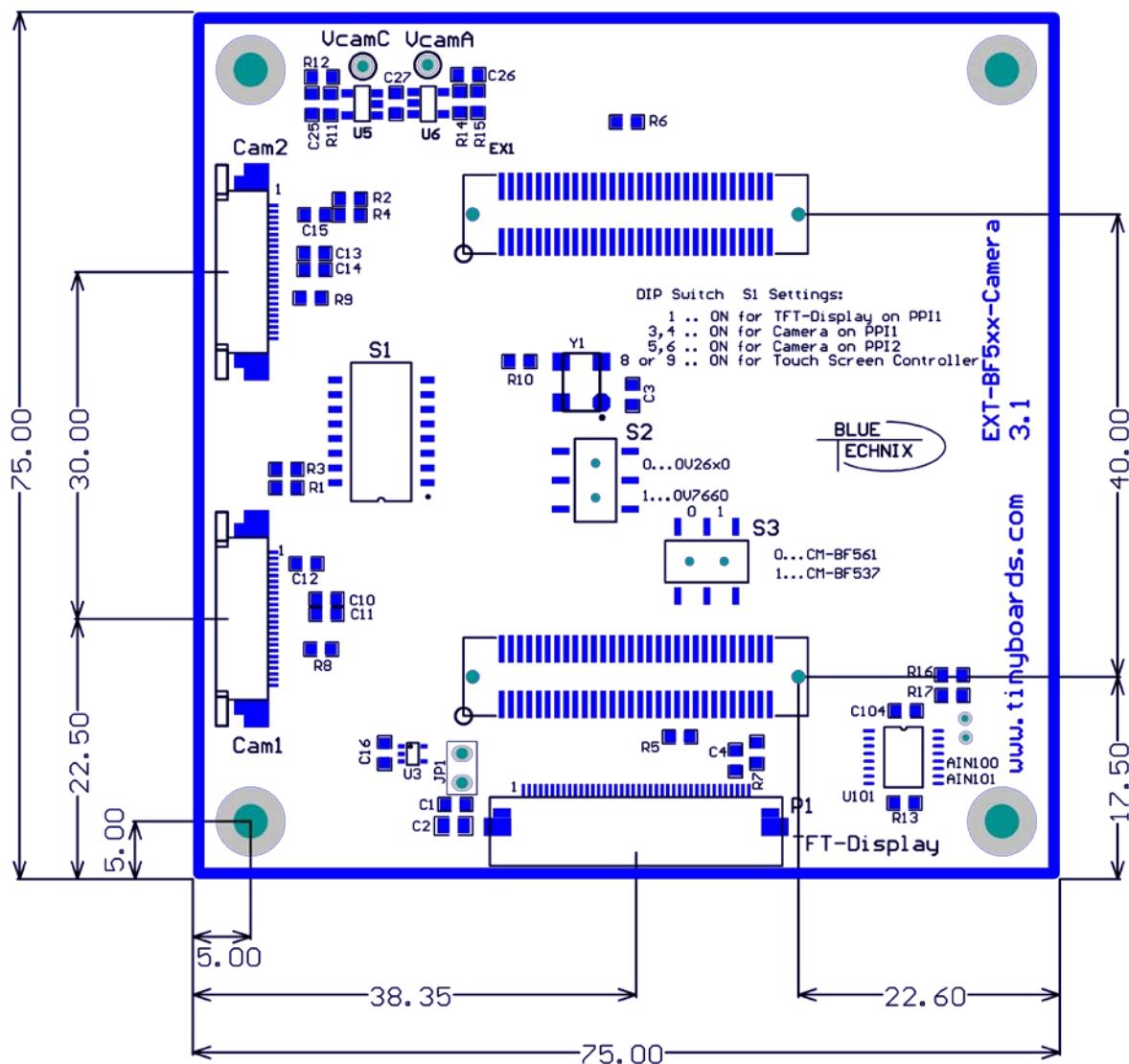
Figure 2-2: Mechanical Outline (Top View)

2.4. Configuration

This section describes the settings of all switches depending on the inserted Core Module on the base board.

2.4.1. JP1 - Power Supply Jumper

Always on, otherwise the entire board is deselected (powered off).

2.4.2. S1 – DIP Switch

The DIP-Switch controls the SCCB signals of Cam1 and Cam2. Further the I^{2}C signals and the PPIClk signal.

Core Module	Switch Positions
CM-BF533	Only Cam1 connected: 3,4 ON / 1,5,6,7,8 OFF *$^{1)}$
CM-BF537E/U	Only Cam1 connected: 3,4 ON / 1,5,6,7,8 OFF *$^{1)}$ Only TFT-Display connected: 1,7,8 ON / 3,4,5,6 OFF *$^{2)}$
CM-BF561	Cam1 and Cam2 connected: 3,4,5,6 ON / 1,7,8 OFF *$^{3)}$ Only TFT-Display connected: 1,7,8 ON / 3,4,5,6 OFF *$^{2)}$ TFT-Display and camera on Cam2 connected: 1,5,6,7,8 ON / 3,4 OFF *$^{4)}$
CM-BF548	Only Cam1 connected: 3,4 ON / 1,5,6,7,8 OFF *$^{1)}$
CM-BF527	Only Cam1 connected: 3,4 ON / 1,5,6,7,8 OFF *$^{1)}$
TCM-BFxx	Only Cam1 connected: 3,4 ON / 1,5,6,7,8 OFF *$^{1)}$

Table 2-5: S1 DIP-Switch configuration

*$^{1)}$ Leave Cam2 and P1 disconnected
*$^{2)}$ Leave Cam1 and Cam2 disconnected
*$^{3)}$ Leave P1 disconnected
*4$^{)}$ Leave Cam1 disconnected

If you have connected a camera on Cam2 please set the Ethernet switches on the EVAL-BF5xx, the DEV-BF5xxDA-Lite and the DEV-BF5xx to 'All OFF'.
If you are using the Ethernet functionality, disconnect Cam 2.

2.4.3. S2 – Reset Polarity Select

This switch selects the polarity of the RESET signal on the camera module(s).

Camera module(s) inserted	Switch position	Clock Polarity
OV7660	1	low
OV2630	1	low
OV2640	0	high

2.4.4. S3 – PF Flag select for the IRQ-Flag of the Touch screen Controller

This switch selects the general purpose flag connected to the touch screen IRQ (interrupt) flag.

Core module on basis board	Switch position	PF Flag
CM-BF533	X *[1]	X *[1]
CM-BF537E/U	1	PF2
CM-BF534	1	PF2
CM-BF561	0	PF19

Table 2-6: PF flag for touch screen IRQ

*[1] TFT Display not supported using CM-BF533

2.4.5. Timer used to drive the TFT-Display signals

This section describes which Blackfin timer pin is used to drive the TFT-Display, depending upon the connected Core Module on the base board.

Core module	DCLK	DTMG	HSYNC	DTMG phase shift	PWM
CM-BF533	n.s.	n.s.	n.s.	n.s.	n.s.
CM-BF537E/U	TMR3	TMR1	TMR0	TMR6	TMR4
CM-BF561	TMR6	TMR9	TMR8	TMR1	TMR5

Table 2-7: Timer assignment

ATTENTION: Do not connect P1 while the CM-BF533 Core Module is connected.

3.   Software Support

3.1.   BLACKSheep Driver

The current version of the BLACKSheep extender board driver can be downloaded at the Bluetechnix website (http://www.bluetechnix.com).

Refer to the "README.TXT" files within the examples to see which hardware configuration the example needs.

Please consult the software development documents.

3.2.   uClinux

There is no uClinux support by default. Please refer to http://blackfin.uClinux.org for possible camera and display driver support. Bluetechnix offers the development of uClinux drivers.

4. Anomalies

2007-05-08	Wrong legend for switch S2 on PCB

Table 4-1: Anomalies

5.   Product Changes

Version	Changes
2.0 to 3.1	Display support for CM-BF561
2.0 to 3.1	Support of OV2630 and OV2640 Omni Vision Cameras
1.2 to 2.0 (1.3)	Pin 75 (1.8V) in a future revision not supported
1.2 to 2.0	Crystal frequency (27MHz to 25MHz)
1.2 to 2.0	Boot mode default settings from 00 to 01
1.2 to 2.0	RoHS compliant

Table 5-1: Product Changes

6. Document Revision History

Version	Date	Document Revision
5	2010-07-13	Compatibility for CM-BF527, CM-BF548 and TCM-BFxx added
4	2009-01-07	Figure 1-1 changed.
3	2008-08-14	English checked for spelling, grammar and clarity.
2	2007-11-12	
1	2007-05-08	Initial release of the Document

Table 6-1: Document Revision History

7.   Abbreviations

n.c.   not connected

n.s.   not supported

A   List of Figures and Tables

Figures

Tables