

# Hardware User Manual

**EXT-BF5xx-VIDEO V1.x**

*...maximum performance at minimum space*

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## Table of Contents

BLACKFIN Products.....	<b>Error! Bookmark not defined.</b>
BLACKFIN Design Service.....	<b>Error! Bookmark not defined.</b>
1 Introduction .....	7
1.1 Overview.....	7
2 Specification.....	8
2.1 Overview.....	8
2.2 Connectors, PCB Placement .....	9
2.2.1 JP1-Power Supply Jumper .....	9
2.2.2 Y-IN .....	9
2.2.3 Cb-IN.....	10
2.2.4 Cr-IN .....	10
2.2.5 AV-IN.....	10
2.2.6 SVideo-IN .....	10
2.2.7 CVBS0-OUT .....	10
2.2.8 CVBS1-OUT .....	10
2.2.9 SVideo-OUT .....	10
2.2.10 EX1 and EX2 – Expansion Connectors .....	10
2.2.11 Expansion Connector Types .....	10
2.3 Mechanical Outline.....	11
2.4 Signal connection.....	11
3 Configuration.....	13
3.1 JP1 (Power Jumper) .....	13
3.2 S1 (Clock and Video Format Settings).....	13
3.2.1 Key 1 – 3: Clock Settings.....	13
3.2.2 Key 6 – 8: Video Format Select for PPI2 on CM-BF561 and CM-BF548.....	13
3.3 S2 (PPI configuration) .....	13
3.4 S3 (PPI configuration) .....	14
3.5 S4 (I2C settings) .....	15
3.6 S5 (Decoder signal settings) .....	15
4 Minimum and Maximum Ratings .....	17
4.1 Electrical specifications .....	17
4.2 Environment.....	17

5	Software Support .....	17
5.1	BLACKSheep Driver .....	17
5.2	uClinux.....	17
6	Known Bugs .....	17
7	Product Changes .....	18
8	Document Revision History .....	18
9	Abbreviations .....	18
A	List of Figures and Tables .....	18

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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>
- uClinix:** All the Core Modules are fully supported by uClinix. The required boot loader and uClinix can be downloaded from: <http://blackfin.uClinix.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-Video Board is an extender plug-on board for the DEV-BF5xx, the DEV-BF5xx-Lite or the EVAL-BF5xx board adding video-in and video-out capability to any Core Module. However, only with the CM-BF561 and CM-BF548 it is possible to use both video-in and video-out simultaneously.

### 1.1 Overview

The EXT-BF5xx-Video Board includes the following components:

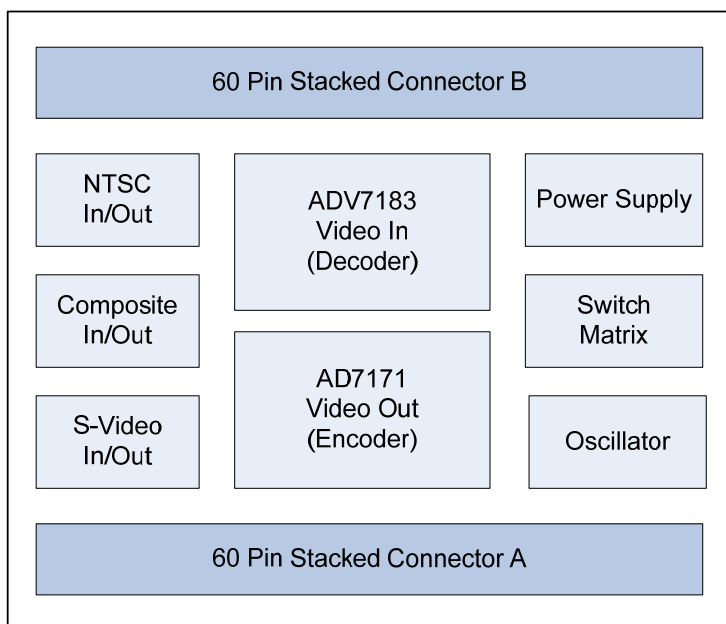


Figure 1-1: Overview of the EXT-BF5xx-Video Board

- **Video Decoder (ADC)**
  - ADV7183
- **Video Encoder (DAC)**
  - ADV7171
- **Stacked Connectors**
  - For plug-on to the Bluetechnix Developer and Evaluation Boards
- **S-Video Connectors**
  - For S-Video In and S-Video Out
- **Cinch Connectors**
  - For Video In and Video Out



## 2 Specification

### 2.1 Overview

Figure 2-1 shows how the main components of the EXT-BF5xx-Video are connected. For Video de- and encoding two chips from Analog Devices are used. For the video decoder (ADC) the ADV7183 is used and for the video encoder (DAC) the ADV7171.

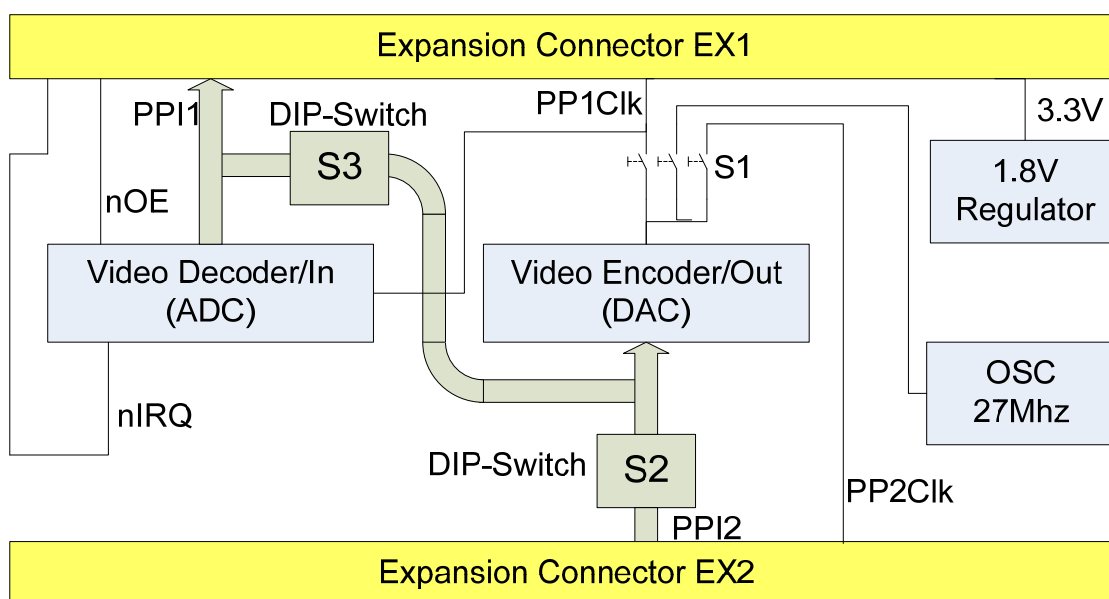


Figure 2-1: Detailed Block Diagram

## 2.2 Connectors, PCB Placement

Depending on the software configuration of the video encoder and decoder the video input and video output connectors may have different meanings. The naming for the connectors printed on the board show the names used in the Bluetechnix driver software

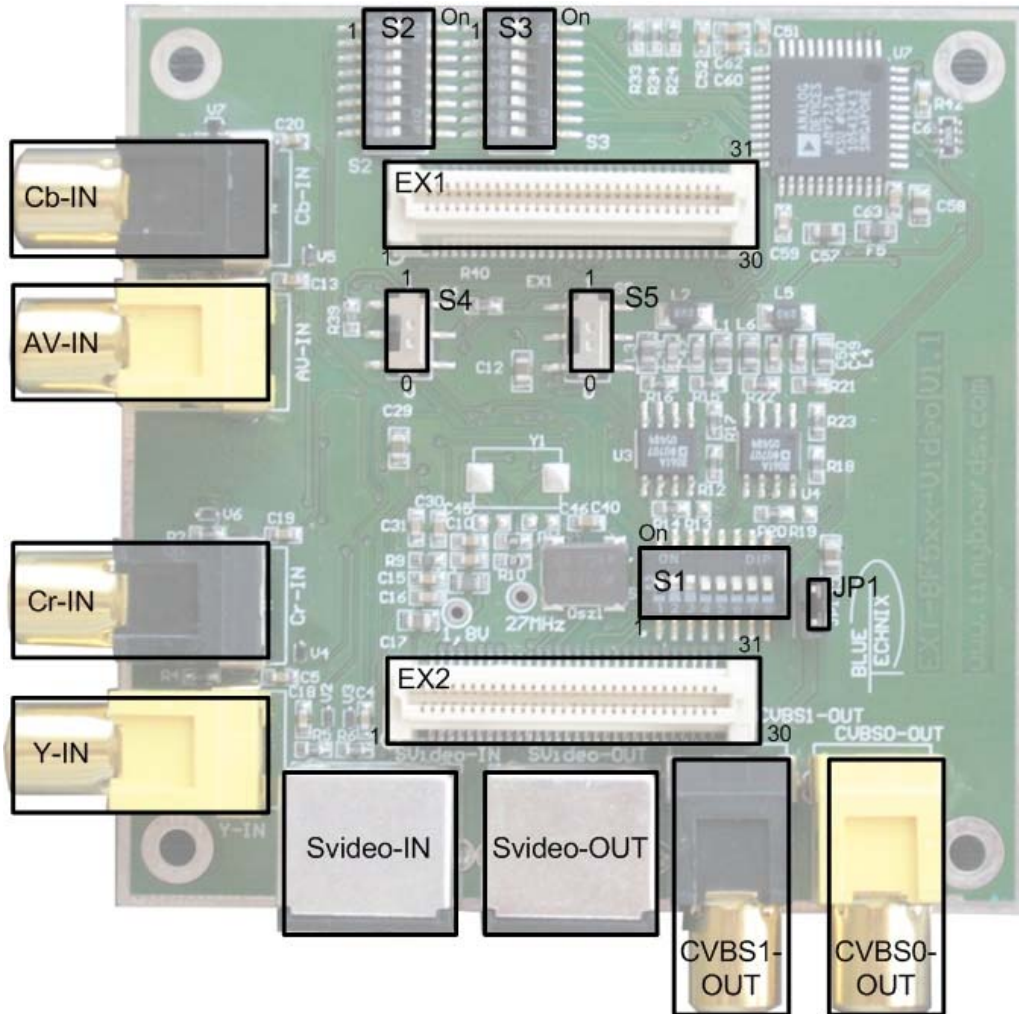


Figure 2-2: Connector PCB Placement

### 2.2.1 JP1-Power Supply Jumper

Removing this jumper disables the entire board.

If you remove the jumper and substitute it with an Ampere-meter you can measure the current of the entire EXT-BF5xx-Video board.

### 2.2.2 Y-IN

Y-Channel input of the video decoder in YCbCr mode

### 2.2.3 Cb-IN

Cb component input of the video decoder in YCbCr mode

### 2.2.4 Cr-IN

Cr component input of the video decoder in YCbCr mode

### 2.2.5 AV-IN

Composite input (CVBS) of the video decoder

### 2.2.6 SVideo-IN

Input of the video decoder for a SVideo-signal

### 2.2.7 CVBS0-OUT

Composite (CVBS) output signal of the video encoder, channel 0

### 2.2.8 CVBS1-OUT

Composite (CVBS) output signal of the video encoder, channel 1

### 2.2.9 SVideo-OUT

Composite (CVBS) output of the video encoder

### 2.2.10 EX1 and EX2 – Expansion Connectors

The pins of the EX1 and the EX2 connector mounted on the bottom side of the Extender board are routed through directly to the matching connectors on the top side 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.

### 2.2.11 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)	5-179010-2
Matching connector	AMP	179031-2

Table 2-1: EXT- BF5xx-Camera board connector types

These connectors can be ordered from Bluetechnix.

### 2.3 Mechanical Outline

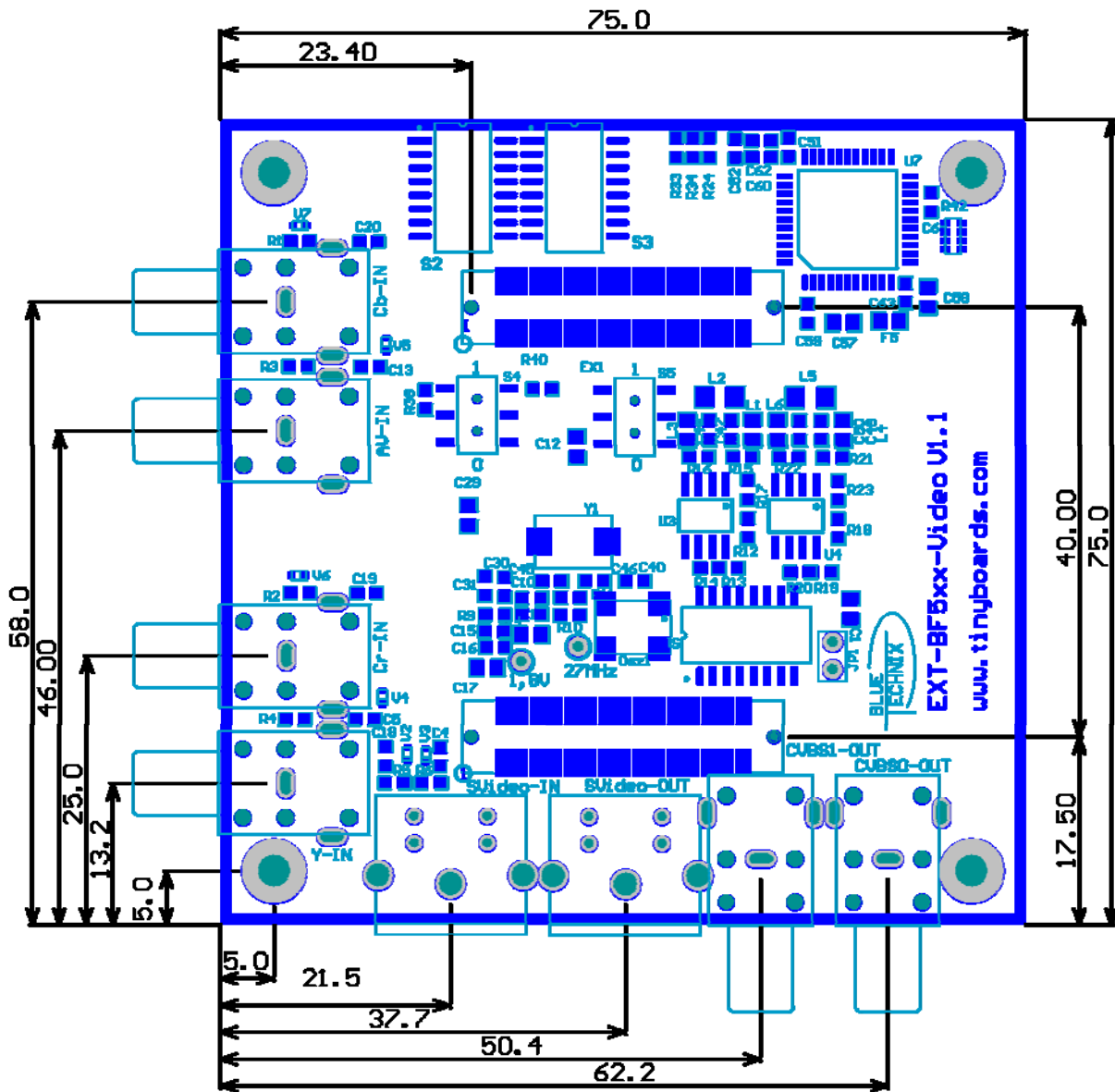


Figure 2-3: Mechanical Outline – Expansion Connector Placement

### 2.4 Signal connection

This section describes the connection between some signals on the extender board and the

GPIO signals of the Core Modules.

	CM-BF533	CM-BF537E/U	CM-BF561	CM-BF527	TCM-BF518	CM-BF548
I2C SCL	PF4	SCL	PF10	SCL	SCL	SCL0
I2C SDA	PF7	SDA	PF9	SDA	SDA	SDA0

<b>Decoder nIRQ</b>	PF0	PF14	PF35	PG1	PG11	PF12
<b>Decoder nOE</b>	PF6	PG13	PF36	PF13	PF13	PF11

Table 2-2: Signal connection

### 3 Configuration

This section describes the needed settings for the DIP-switches, switches and jumpers depending on the Core Module inserted on the basis board and the desired configuration.

The video decoder or the video encoder can be connected to the (E)PPI0 interface. See the DIP-switch settings for S2 and S3.

Using a CM-BF561 Core Module the video decoder is connected to PPI1 and the video encoder can be connected either to PPI2 or PPI1 depending on the DIP-switch settings of S1, S2 and S3.

Using a CM-BF548 Core Module the video decoder is connected to EPPI1 and the video encoder can be connected either to EPPI0 or EPPI1 depending on the DIP-switch settings of S1, S2 and S3.

#### 3.1 JP1 (Power Jumper)

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

#### 3.2 S1 (Clock and Video Format Settings)

##### 3.2.1 Key 1 – 3: Clock Settings

Key 3: ON for CM-BF561, OFF for all other Core Modules.

If video encoder is used on PPI1: Key 1 ON, Key 2 ON.

Using the 27Mhz Oscillator for encoder and decoder: Key 1 ON, Key 2 ON.

Using the decoder clock out for the encoder: Key 2 OFF, Key 1 ON.

##### 3.2.2 Key 6 – 8: Video Format Select for PPI2 on CM-BF561 and CM-BF548

Key 6, 7 and 8 of S1 connects the Sync-Signals of the DAC (VideoEncoder) to the appropriate Signals of PPI2 or EPPI0. So if you want to be able to use a Video Format other than ITU656 on the PPI of the CM-BF561 or CM-BF548 which uses HSYNC, VSYNC and FS you have to switch them on. For all other modes and all other Core Modules switch them off.

On (E)PPI1 only the Sync-Signals of the ADC (Video Decoder) are available.

#### 3.3 S2 (PPI configuration)

	Only Decoder Active	Only Encoder Active	Both Active
<b>CM-BF533</b>	All OFF	All OFF (Note 2)	n.s. (Note 1)
<b>CM-BF537E/U</b>	All OFF	All OFF (Note 2)	n.s. (Note 1)
<b>TCM-BF537</b>	All OFF	All OFF (Note 2)	n.s. (Note 1)
<b>CM-BF561</b>	All OFF (Note 5)	All ON (Note 4)	All ON (Note 3)
<b>CM-BF527</b>	All OFF	All OFF (Note 2)	n.s. (Note 1)
<b>CM-BF548</b>	All OFF	All ON (Note 6)	All ON (Note 7)
<b>TCM-BF518</b>	All OFF	All OFF (Note 2)	n.s. (Note 1)

Table 3-1: S2 DIP-switch settings

- Note 1: An activation of video encoder and video decoder simultaneously is only supported for the CM-BF561 and BF548 because only these processor has two PPI interfaces.
- Note 2: Please ensure that the video decoder is deactivated.
- Note 3: Video decoder connected to PPI1 and video encoder connected to PPI2
- Note 4: Video encoder connected to PPI2
- Note 5: Video decoder connected to PPI1
- Note 6: Video decoder connected to EPPI1
- Note 7: Video encoder connected to EPPI0

### **Direct Loop Through**

It is possible to directly connect the video decoder with the video encoder to provide a direct loop through without using the PPI interfaces of the Blackfin. Remember that although you do not need the PPI interfaces of the Blackfin you have to initialize the video decoder and encoder devices via the I2C interface.

S2 switch settings for a direct loop through: All OFF (for all Core Modules)

### **3.4 S3 (PPI configuration)**

	<b>Only Decoder Active</b>	<b>Only Encoder Active</b>	<b>Both Active</b>
<b>CM-BF533</b>	All OFF	All ON (Note 2)	n.s. (Note 1)
<b>CM-BF537E/U</b>	All OFF	All ON (Note 2)	n.s. (Note 1)
<b>TCM-BF537</b>	All OFF	All ON (Note 2)	n.s. (Note 1)
<b>CM-BF561</b>	All OFF (Note 5)	All ON (Note 4)	All ON (Note 3)
<b>CM-BF527</b>	All OFF	All ON (Note 2)	n.s. (Note 1)
<b>CM-BF548</b>	All OFF	All ON (Note 6)	All ON (Note 7)
<b>TCM-BF518</b>	All OFF	All ON (Note 2)	n.s. (Note 1)

Table 3-2: S3 DIP-switch settings

**Note 1:** An activation of video encoder and video decoder simultaneously is only supported for the CM-BF561 because only the ADSP-BF561 processor has two PPI interfaces.

**Note 2:** Please ensure that the video decoder is deactivated

**Note 3:** Video decoder connected to PPI1 and video encoder connected to PPI2

**Note 4:** Video encoder connected to PPI2

**Note 5:** Video decoder connected to PPI1

**Note 6:** Video decoder connected to EPPI1

**Note 7:** Video encoder connected to EPPI0

### **Direct Loop Through**

It is possible to directly connect the video decoder with the video encoder to provide a direct loop through without using the PPI interfaces of the Blackfin. Remember that although you do not need the PPI interfaces of the Blackfin you have to initialize the video decoder and encoder devices over the I2C interface.

S3 switch settings for a direct loop through: All ON (for all Core Modules)

### **3.5 S4 (I2C settings)**

<b>Core Module</b>	<b>Switch Settings</b>
<b>CM-BF533</b>	0
<b>CM-BF537E/U</b>	1
<b>TCM-BF537</b>	1
<b>CM-BF561</b>	1
<b>CM-BF527</b>	1
<b>CM-BF548</b>	1
<b>TCM-BF518</b>	1

Table 3-3: S4 switch settings

### **3.6 S5 (Decoder signal settings)**

<b>Core Module</b>	<b>Switch Settings</b>
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<b>CM-BF533</b>	0
<b>CM-BF537E/U</b>	0
<b>TCM-BF537</b>	0
<b>CM-BF561</b>	1
<b>CM-BF527</b>	0
<b>CM-BF548</b>	1
<b>TCM-BF518</b>	0

Table 3-4: S5 switch settings

## 4 Minimum and Maximum Ratings

### 4.1 Electrical specifications

Parameter	Min	Typ	Max	Unit	Test Conditions
Input voltage	3.0	3.3	3.5	V	
Input current		330	400	mA	After power on

Table 4-1: Electrical specifications

### 4.2 Environment

Storage temperature: -65°C to 150°C

Operating temperature: 0°C to 70°C

## 5 Software Support

### 5.1 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.

### 5.2 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.

## 6 Known Bugs

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Table 6-1: Known Bugs

## 7 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 7-1: Product Changes

## 8 Document Revision History

Version	Date	Document Revision
4	2010-07-13	Compatibility for CM-BF548, CM-BF5527 and TCM-BF518 added
3	2008-12-15	Minor changes on layout
2	2008-08-13	English checked for grammar, spelling and clarity
1	2007-05-18	Initial release of the Document for Revision V1.1

Table 8-1: Document Revision History

## 9 Abbreviations

n.c. not connected

n.s. not supported

## A List of Figures and Tables

### Figures

Figure 1-1: Overview of the EXT-BF5xx-Video Board.....	7
Figure 2-1: Detailed Block Diagram.....	8
Figure 2-2: Connector PCB Placement.....	9
Figure 2-3: Mechanical Outline – Expansion Connector Placement.....	11

**Tables**

Table 2-1: EXT- BF5xx-Camera board connector types .....	10
Table 2-2: Signal connection .....	12
Table 3-1: S2 DIP-switch settings .....	14
Table 3-2: S3 DIP-switch settings .....	14
Table 3-3: S4 switch settings .....	15
Table 3-4: S5 switch settings .....	16
Table 4-1: Electrical specifications.....	17
Table 6-1: Known Bugs .....	17
Table 7-1: Product Changes.....	18
Table 8-1: Document Revision History .....	18