BLUE TECHNIX

Hardware User Manual

EXT-BF5xx-USB-ETH2 V2.x

...maximum performance at minimum space

Contact

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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.
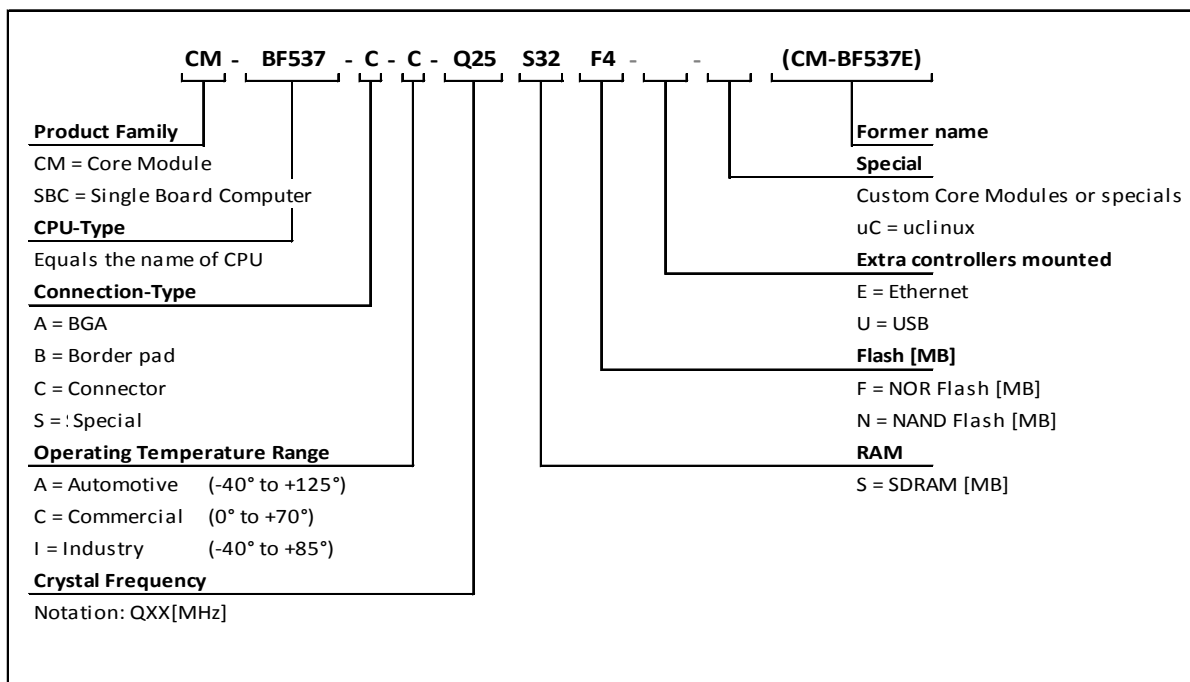
Core Module naming information

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                                                 Former name
 CM = Core Module                                               Special
 SBC = Single Board Computer                                    Custom Core Modules or specials
 CPU-Type                                                       uC = uclinux
 Equals the name of CPU                                         Extra controllers mounted
 Connection-Type                                                E = Ethernet
 A = BGA                                                        U = USB
 B = Border pad                                                 Flash [MB]
 C = Connector                                                  F = NOR Flash [MB]
 S = Special                                                    N = NAND Flash [MB]
 Operating Temperature Range                                    RAM
 A = Automotive    (-40° to +125°)                              S = SDRAM [MB]
 C = Commercial    (0° to +70°)
 I = Industry      (-40° to +85°)
 Crystal Frequency
 Notation: QXX[MHz]
```

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 EXT-BF5xx-USB-ETH2 is an extender board suitable for the DEV-BF5xxDA-Lite or the EVAL-BF5xx development boards. This stackable board features a USB2.0 device IC (NET2272), a 10/100Mbit Ethernet physical transceiver particularly for the TCM-BF537 and an Ethernet controller IC.

The EXT-BF5xx-USB-ETH2 is ideally suited to introduce network connectivity and USB2.0 functionality into your future embedded applications.

1.1 Overview

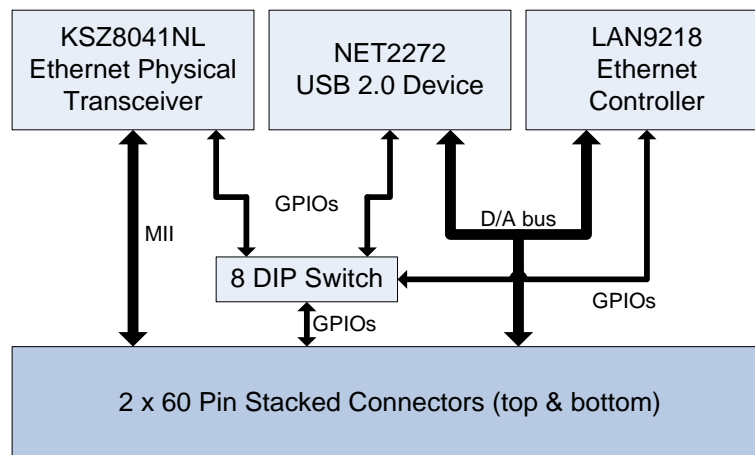The following figure gives an overview of the main used components and the board interconnection.

Figure 1-1: Overview of the EXT-BF5xx-USB-ETH2 board

The EXT-BF5xx-USB-ETH2 Board features the following components:

1.1.1 KSZ8041NL Ethernet physical chip

- 100BASE-TX/10BASE-T
- Fully compliant to IEEE 802.3u standard
- Auto negotiation as well as manual selection
- Half and Full Duplex mode
- Supports HP MDI/MDI-X auto crossover
- Only supported by TCM-BF537

For detail description refer to the manufacturer's homepage: http://micrel.com/

1.1.2 LAN9218

- Single chip Ethernet controller
- Optimized for highest performance
- Efficient architecture for low CPU overhead
- Easy external 32- or 16-bit bus interface

- Integrated 10/100 Ethernet PHY with HP Auto-MDIX
- Supports high definition (HD) MPEG2 streams

For detail description refer to the manufacturer's homepage: http://www.smsc.com/

1.1.3   NET2272 USB 2.0 device chip

- USB Specification r2.0
- USB full (12MBps) and high (480Mbps)
- Three Configurable Physical Endpoints, in addition to Endpoint 0
- 30 Configurable Virtual endpoints
- Configurable endpoints can be Isochronous, Bulk, or Interrupt, as well as IN or OUT
- High Bandwidth Isochronous Mode
- Maximum Packet Size up to 1 KB, double buffers
- Internal 3 KB Memory provides Transmit and Receive buffers
- 8- or 16-bit CPU or DMA bus transfers
- Automatic Retry of failed packets

For detail description refer to the manufacturer's homepage: http://plxtech.com/products/net2000/

2 Overview

2.1 PCB Placement of connectors
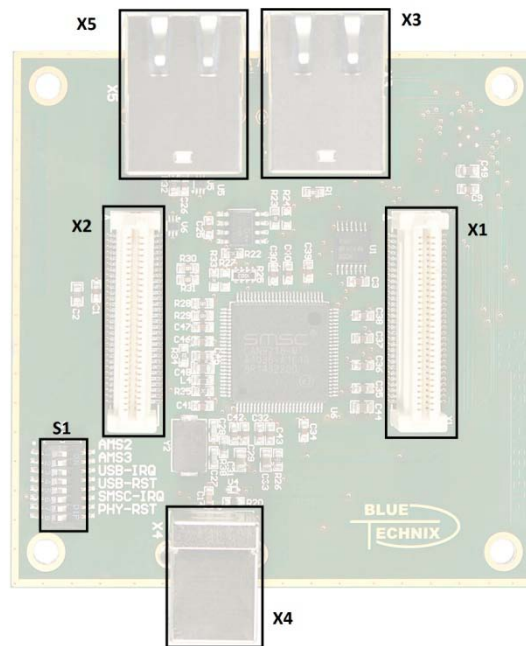

Figure 2-1: PCB Placement of connectors

2.1.1 X5

RJ45 Ethernet socket for the LAN9218

2.1.2 X3

RJ45 Ethernet socket for the KSZ8041NL

2.1.3 X4

USB 2.0 device plug for the Net2272 chip

2.1.4 X1, X2 Expansion Connectors

The Expansion Connectors have the same pin out as on the base board. They are directly routed through. Please refer to the appropriate base board for a pin description.

The connectors on the EXT-BF5xx-USB-ETH2 board for a Stacked Height of 16mm are of the following type:

Part	Manufacturer	Manufacturer Part Nr.
X1, X2	AMP (Stacked Height = 16mm)	5-5179010-2
Matching connector	AMP	5179031-2

Table 2-1: EXT-BF5xx- USB-ETH2 board connector types

These connectors can be ordered from Bluetechnix.

2.1.5 S1 DIP Switch

This switch allows to select each device and to disconnect the Blackfin GPIOs from the control signals, if the device won't be used.

Switch	BF Signal	Device Signal	Device	Description
1	$\overline{AMS2}$	$\overline{AMS}$	NET2272 / LAN9218	use $\overline{AMS2}$ for enabling devices
2	$\overline{AMS3}$	$\overline{AMS}$	NET2272 / LAN9218	use $\overline{AMS3}$ for enabling devices
3	GPIO[1]	$\overline{IRQ}$	NET2272	set off if USB won't be used
4	GPIO[1]	$\overline{RESET}$	NET2272	set off if USB won't be used
5	GPIO[1]	$\overline{IRQ}$	LAN9218	set off if LAN9218 won't be used
6	3.3V	$\overline{RESET}$	KSZ8041	set off if KSZ8041won't be used

Table 2-2: DIP-Switch functionality

[1] The Table 2-5 shows the GPIO assignment for all supported Core Modules.

2.2 Solder Jumper on DEV-BF5xxDA-lite (EVAL-BF5xx)

To use the KSZ8041NL (Ethernet Phy) on the EXT-BF5xx-USB-ETH2 with a DEV-BF5xxDA-lite or EVAL-BF5xx you have to short JP4 and JP5.

See DEV-BF5xxDA-lite (EVAL-BF5xx) manual for more details.

2.3　Base Addresses and GPIO Assignment

2.3.1　Memory Mapping

The following table shows the base address of the NET2272 and the LAN9218 depending on the position of the switches 1 and 2 on S1.

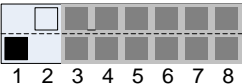**Positions that are not shown in the table (both ON, or both OFF) are not allowed!**

Switch Setting		NET2272	LAN9218
On Off 1 2 3 4 5 6 7 8	$\overline{AMS2}$	0x2020'0000	0x2020'8000*)
On Off 1 2 3 4 5 6 7 8	$\overline{AMS3}$	0x2030'0000	0x2030'8000*)

Table 2-3: Base addresses for all Core Modules except CM-BF561
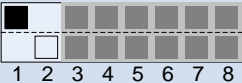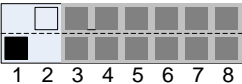
Switch Setting		NET2272	LAN9218
On Off 1 2 3 4 5 6 7 8	$\overline{AMS2}$	0x2800'0000	0x2800'8000*)
On Off 1 2 3 4 5 6 7 8	$\overline{AMS1}$	0x2400'0000	0x2400'8000*)

Table 2-4: Base Addresses for the CM-BF561

*) Memory mapping for V1.0.1 0x2**8'0000

2.3.2　GPIO Assignment

The table below shows which GPIO is connected to the NET2272 (USB) and the LAN9218 (ETH2) depending on the core module inserted on the base board.

Switch N°	Signal Description	(T)CM-BF527	(T)CM-BF537	CM-BF533	CM-BF548	CM-BF561
3	USB-IRQ	PF13	PG 13	PF 6	PD13	PF 45
4	USB-RESET[1]	PF14	PG 14	PF 5	n.a.	PF 46
5	ETH2-IRQ	PF11	PG 11	PF 8	PD11	PF 43

Table 2-5: GPIO assignment for the supported Core Modules

[1] Note that the NET2272 USB Controller shares the reset line with the S6 push-button located on the Dev-Boards. Don't use this button together with the USB device controller!
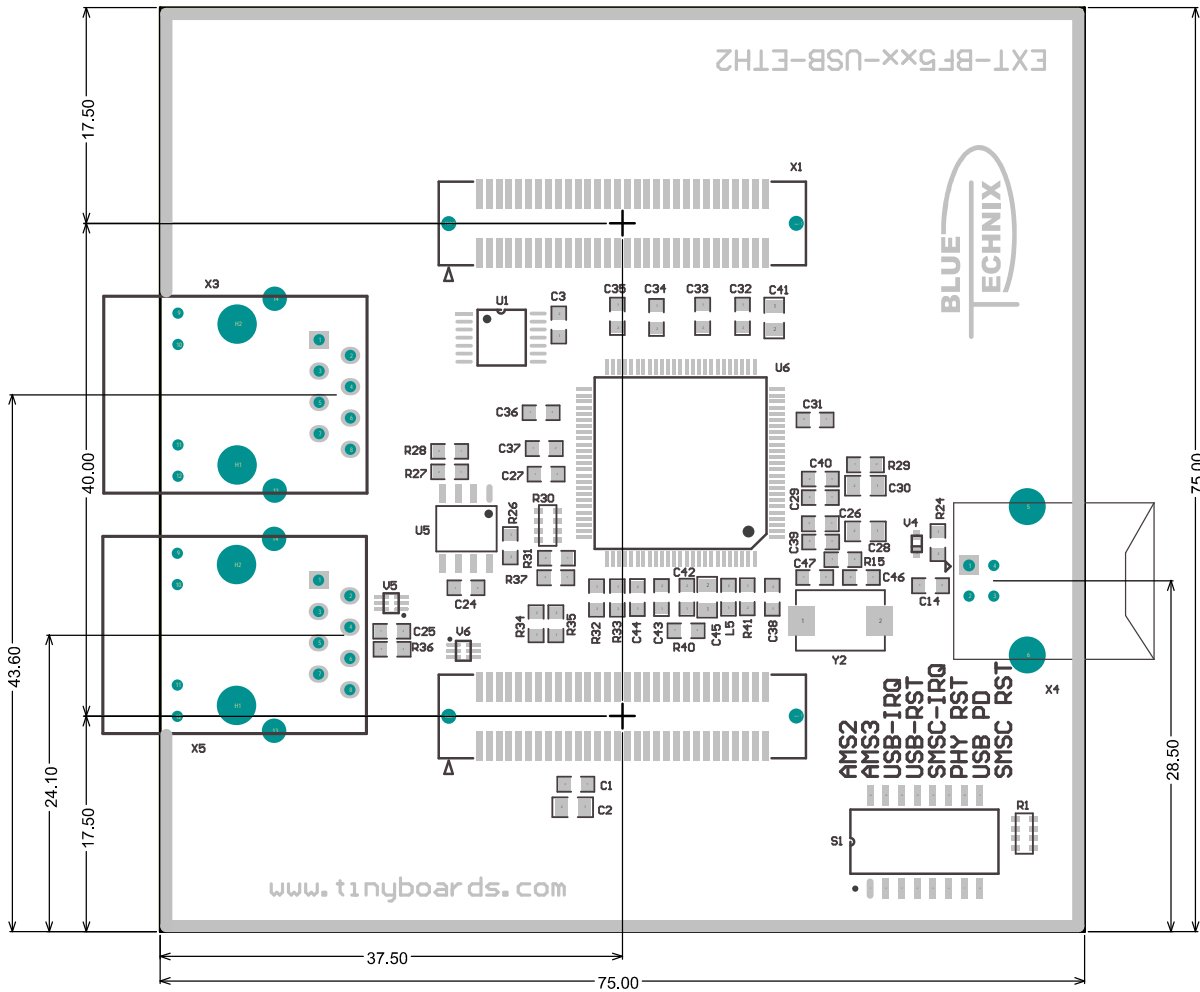
2.4 Mechanical Outline

Figure 2-2: Mechanical outline – expansion connector placement

3 Specifications

3.1 Electrical Specifications

3.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage		3.3	3.6	V
V_{OH}	High level output voltage	$0.7*V_{IN}$			V
V_{OL}	Low level output voltage			$0.3*V_{IN}$	V
I_{USB}	V_{USB} current		500		mA

Table 3-1: Electrical characteristics

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
I_{OH}/I_{OL}	Current per pin	0	10	mA
T_{AMB}	Ambient temperature	0	70	°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

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 Support

4.1 General Support

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

4.2 Board Support Packages

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

4.3 Blackfin® Software Support

4.3.1 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.

4.3.2 LabVIEW

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

4.3.3 uClinux

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

4.4 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.

4.4.1 Upcoming Products and Software Releases

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

5 Ordering Information

5.1 Predefined mounting options for EXT-BF5xx-USB-ETH2

Article Number	Name	Description
100-2275-2	EXT-BF5xx-USB-ETH2	USB-ETH2 extender board

Table 5-1: Ordering information

NOTE: Custom hard and software developments are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom hard- and software developments.

6 Dependability

6.1 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 development board 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 development board components. 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.

7 Product History

7.1 Version Information

Version	Date	Changes
2.0	2009 12 03	First release V2.0 of the Hardware.

Table 7-1: Overview product changes

7.2 Anomalies

Version	Date	Description
1.0	2009 12 03	No anomalies reported yet.

Table 7-2: Overview product anomalies

8 Document Revision History

Version	Date	Document Revision
1	2009 12 03	First release V1.0 of the Document
2	2011 11 29	Updated Table 2-2

Table 8-1: Revision history

9 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 9-1: List of abbreviations

A   List of Figures and Tables

Figures

Tables