

2002-September-27

Product Specification TE-BL

## Overview

The Buttons and Lights Expansion Board introduces basic display and diagnostics as well as more powerful interfaces like VGA output and USB interface to the Spartan-II Development System. The Development System can easily be expanded to reflect your application's requirements. The Development System is built from two distinct concepts: *Base Boards* and *Expansion Boards*.

*The Base Board carries an FPGA of a specific family and type and all required circuitry to supply and configure this device. Special care is taken to provide user's access to the device family's feature set. The Base Board is available with two FPGA variants (200k or 500k gates Spartan-II device)*

*Expansion Boards can be attached to a Base Board to add application specific components. Care has been taken to make Expansion connector fully compatible to previous versions of this board.*

Up to four Expansion Boards may be added to a single Base Board, giving plenty of room to your circuit ideas.

By implementing the Buttons and Lights Expansion as a removable Expansion Board, more I/Os are available for user application, if needed.

Please visit [www.trenz-electronic.de](http://www.trenz-electronic.de) and download application notes on how to use B&L peripherals.

The Spartan-II Development System provides the following key features:

- XC2S50 / XC2S200 FPGA with up to 200k system gates, 32 / 56k bits of block RAM and up to 200MHz clock speed.
- XC18V02 Flash PROM socket and XC17S200A OTP socket, providing non-volatile configuration.
- Access to 137 user I/Os and 4 global clocks.
- Powersupply with onboard voltage regulators. External 7-12V DC Power needed.
- Fully compatible to Xilinx' *WebPACK ISE* design software- a complete design entry, simulation, synthesis and implementation environment free of charge.
- Fully compatible to Xilinx' *Parallel Cable III* preventing the need of an additional download cable.

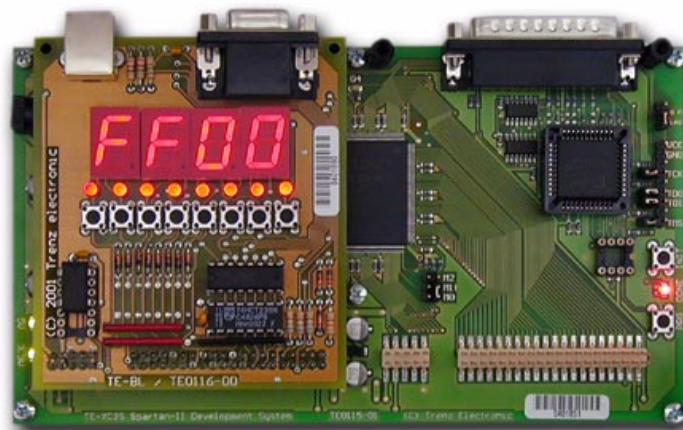


Figure 1: Spartan-II Development System equipped with Buttons & Lights Expansion

# Buttons & Lights Expansion

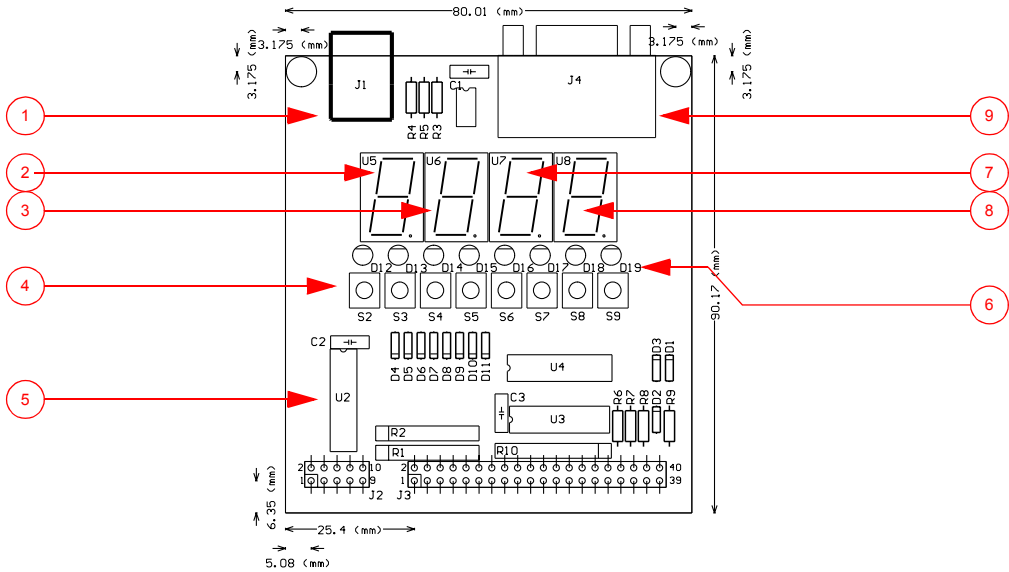


Figure 2: Placeplan of Buttons & Lights Expansion Board

- 1. USB Type "B" Receptacle (J1)
- 2. 7-Segment Display (U5)
- 3. 7-Segment Display (U6)
- 4. Push Buttons (S2..S9)
- 5. 48MHz Quartz Oscillator (U2)
- 6. LEDs (D12..D19)
- 7. 7-Segment Display (U7)
- 8. 7-Segment Display (U8)
- 9. VGA Connector (J4)

The Buttons & Lights Expansion provides the most commonly used I/O peripherals, namely push buttons, LEDs, and 7-segment displays. Furthermore a simple VGA output as well as a USB Transceiver have been added to interface with standard PC devices.

### USB Receptable

The USB Transceiver provides the electrical interface to the Universal Serial Bus. The speed is fixed to Full-Speed, i.e. 12Mbps nominal data rate. A standard USB A-B cable can be used to connect the PC to J1 of the B&L Expansion Board.

### Clock

A quartz oscillator provides a clock frequency of 48MHz. The oscillator is located in a socket for easy replacement in case other frequencies are required. 48MHz frequency is needed to work with Trezz Electronic's USB Application Notes.

### Buttons and Lights

The 7-segment displays, the LEDs, and the push buttons are addressed using a 3-to-8 multiplexer. Once the target is selected, the 8 segment lines are used to address the individual segments, LEDs, or buttons.

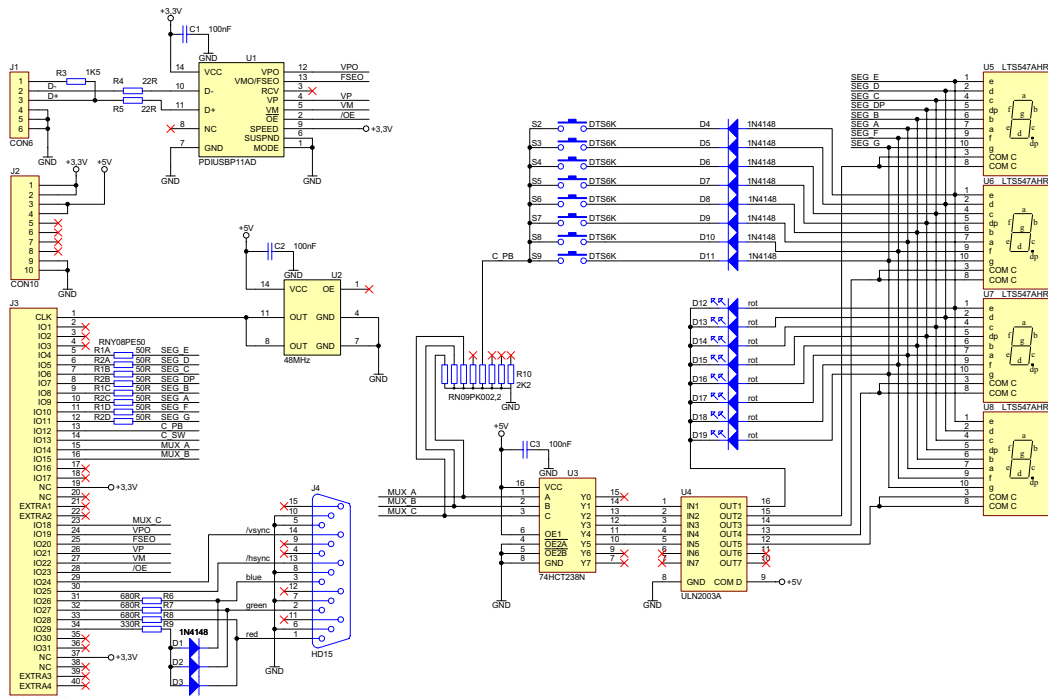


Figure 3: Schematic of Buttons & Lights Expansion

	7-segment displays	LEDs	push buttons
SEG_E	E	D12	S2
SEG_D	D	D13	S3
SEG_C	C	D14	S4
SEG_DP	DP	D15	S5
SEG_B	B	D16	S6
SEG_A	A	D17	S7
SEG_F	F	D18	S8
SEG_G	G	D19	S9

Table 1: Segment Addressing

MUX_[C,B,A] = IO[14, 15, 18]	Activate unit
001	LED row
010	7-segment U5
011	7-segment U6
100	7-segment U7
101	7-segment U8
000	unused (read push buttons)
110	
111	

Table 2: Unit Addressing

The VGA output can be used to create up to 16 colors with a simple passive DAC.





red (IO28), green (IO27), blue (IO26), brightness (IO29)	color
0, 0, 0, 0	 black
0, 0, 0, 1	 grey
0, 0, 1, 0	 blue
0, 0, 1, 1	 light blue
0, 1, 0, 0	 green
0, 1, 0, 1	 light green
0, 1, 1, 0	 cyan
0, 1, 1, 1	 light cyan
1, 0, 0, 0	 red
1, 0, 0, 1	 light red
1, 0, 1, 0	 magenta
1, 0, 1, 1	 light magenta
1, 1, 0, 0	 yellow
1, 1, 0, 1	 light yellow
1, 1, 1, 0	 light grey
1, 1, 1, 1	 white

Table 3: VGA colors

## Ordercode

Ordercode is TE0116-00

## References

*PDIUSBP11A*

*Universal Serial Bus Transceiver*

*Product Specification*

Philips Semiconductors

June 04, 1999

Application Note: Buttons and Lights

Trenz Electronic GmbH

May 2002

## Revisions History

Version	Date	Who	Description
0.9	2001jul31	FB	Created
1.0	2001sep12	FB	Minor HW changes
1.1	2002jul7	TT	adopted to new HW

**Table 4: Revisions History**