

TURBO PROGRAMMER BXTOP45P

USB, MMC, SIM DEVELOPMENT KIT

HARDWARE GUIDE

This document is part of Turbo Programmer documentation.
For Developer Documentation, Applications and Examples,
see <http://www.bladox.com/>

PRELIMINARY

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1. Overview

BLADOX introduces the Turbo Programmer, reference number BXTOP45P, which is an easy-to-use USB, SIM card and MMC card development kit. It is based on ATMEL ATmega128L microcontroller and FTDI FT8U245BM USB chip, both well known and documented with many application examples available worldwide.

ATmega128L microcontroller operates at speed of 8 MHz generated from crystal. It is possible to load bootloader at first on the top of its FLASH memory and doing only application program updates subsequently.

USB interface provides power supply for BXTOP45P. Developer must consider total current consumption in case of expanding BXTOP45P with additional modules not to exceed maximal 100 mA. Device drivers for FTDI devices are available on webpage www.ftdichip.com and are available for many operating systems.

Configuration serial EEPROM memory is connected to USB chip and holds specific settings of USB device (BXTOP45P here) important for operating system of host computer. Maximum current consumption, Vendor ID, device ID, Product string etc. should be defined here.

2. Features

- **Self powered USB device (maximal current from USB bus is 100 mA) with possibility of using external power supply**
- **ATMEL ATmega128L microcontroller**
 - **128 kB FLASH, 4 kB SRAM, 4 kB EEPROM**
 - **Timers, UARTs, SPI, I2C**
 - **ISP programming**
- **USB 1.1 interface (FTDI FT8U245BM based)**
- **SIM card interface (3 Volt SIM card power supply and signal levels)**
- **MMC card interface (esp. for ATMEL Dataflash memory card)**
- **256 kB extra SRAM memory**
- **External expansion connectors**
 - **One 50 pin MLW50G connector with SPI, I2C, CLK, DATA bus, etc.**
 - **Two 10 pin MLW10G connectors with 4 read and 4 write 8 bit data ports**
 - **Optional 50 pin SAMTEC MB1-150 connector used for TURBO ADAPTER**
- **Expanding modules with peripherals like LCD, keyboard, push buttons, communication modules etc.**
- **Bootloader**
- **Firmware update utility**

3. Block diagram

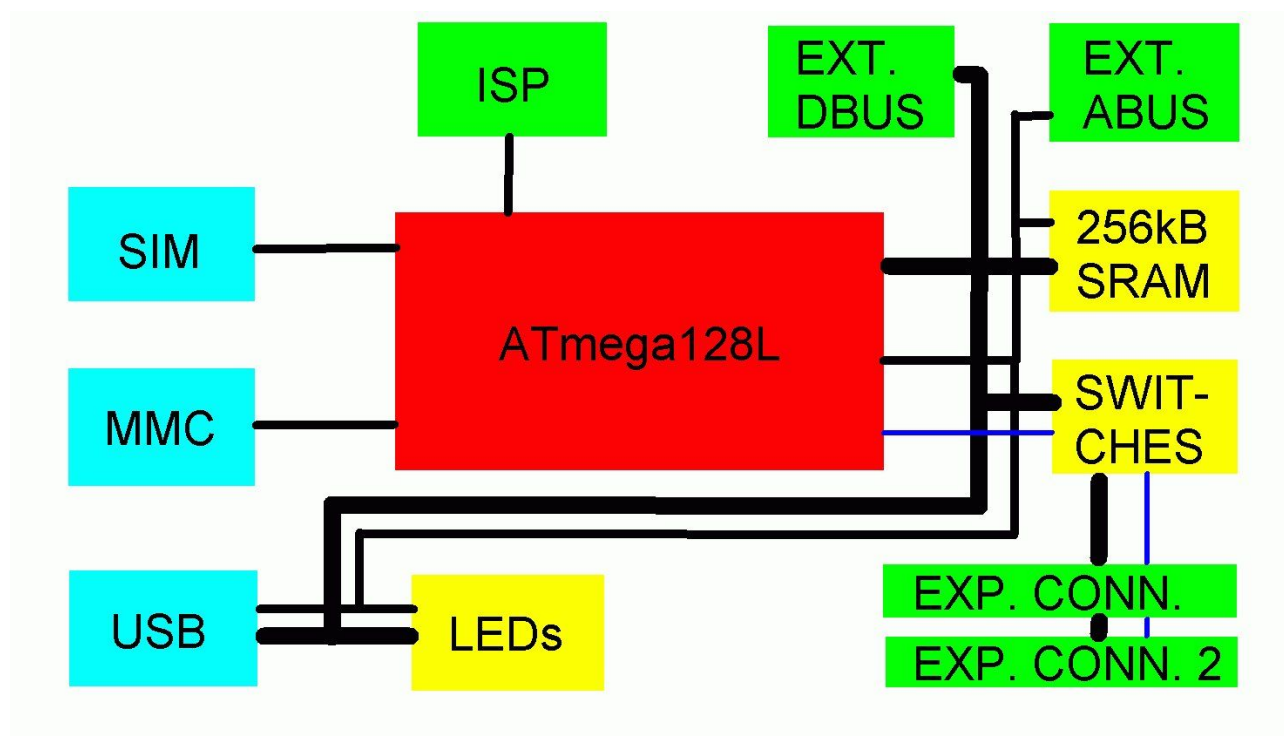


Figure 1: Block diagram

4.Connectors and jumpers

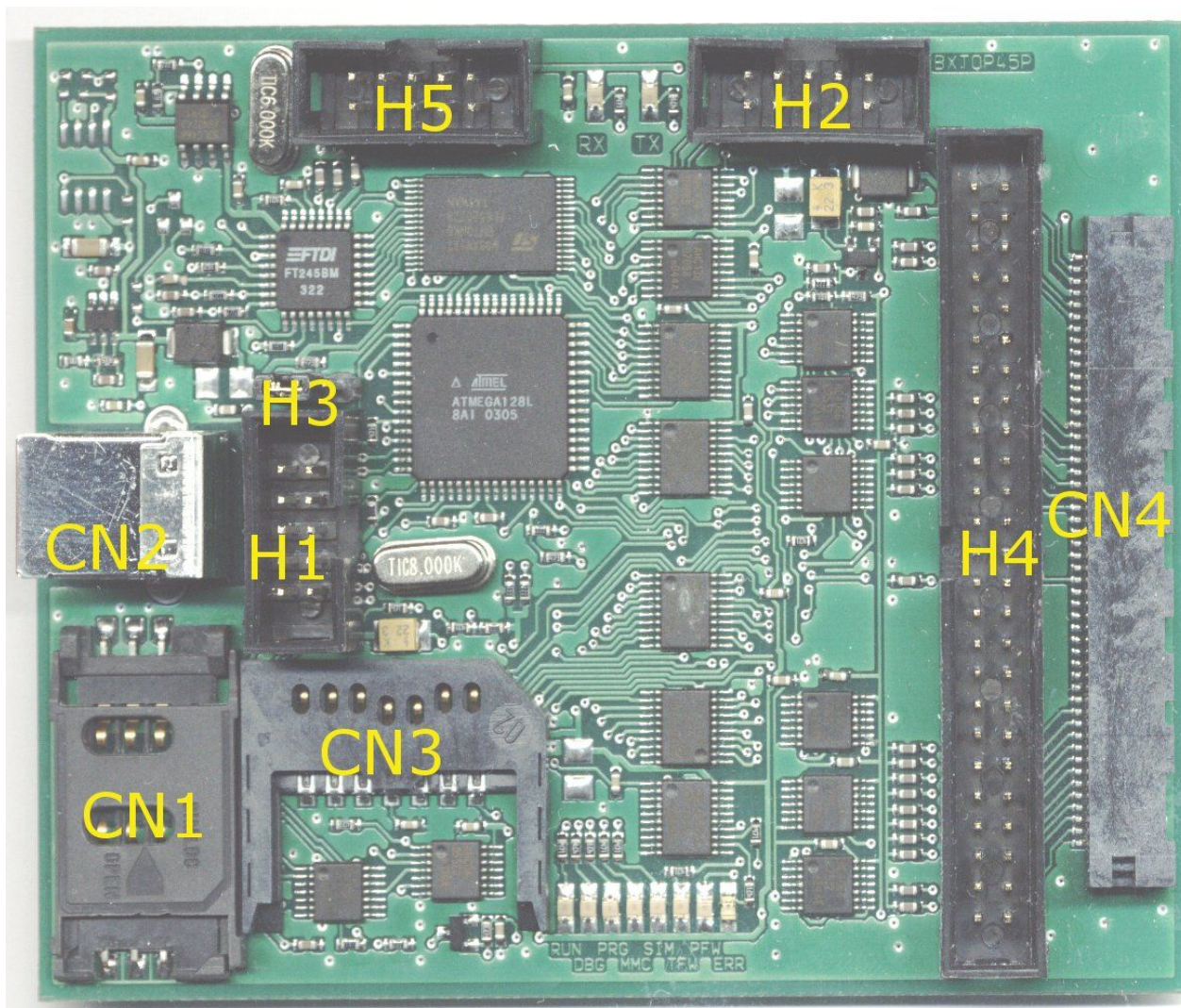
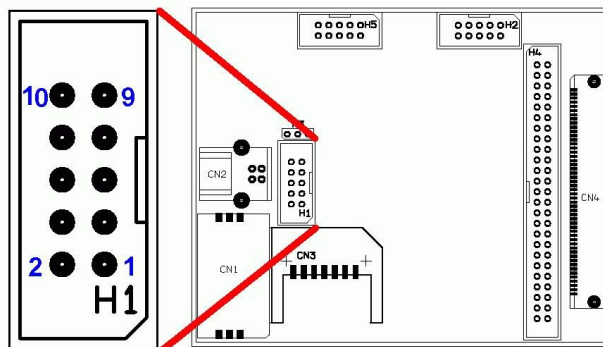


Figure 2: Connectors and jumpers

H1 – ISP programming connector

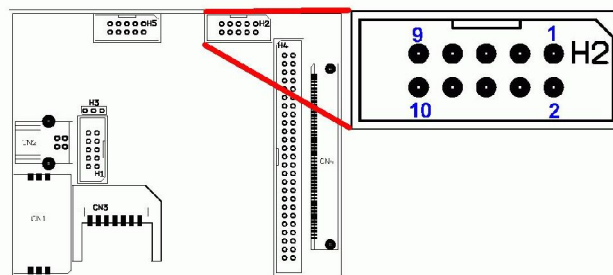
PIN	NAME	PIN	NAME
10	GND	9	-
8	-	7	-
6	PDO	5	PDI
4	SCK	3	-
2	#RESET	1	VCC 3V3

* REDUCTION TO ATMEL ISP IS AVAILABLE



H2 – External address bus connector

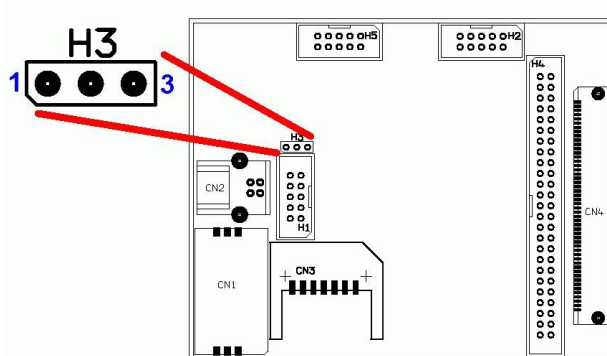
PIN	NAME	PIN	NAME
10	GND	9	#RDPORT7
8	#WRPORT7	7	#RDPORT6
6	#WRPORT6	5	#RDPORT5
4	#WRPORT5	3	#RDPORT4
2	#WRPORT4	1	VCC 3V3



H3 – Bootloader enable jumper

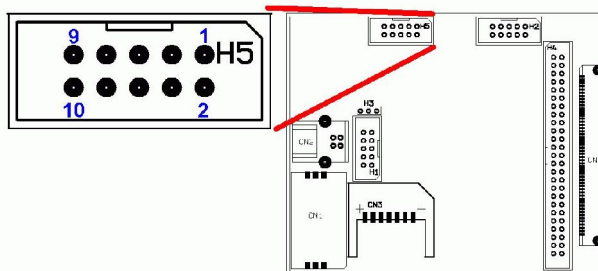
PIN	NAME
1	-
2	#EN_UPDATE
3	GND

* SHORT 2-3 TO ENABLE UPDATING OF BXTOP45P FIRMWARE (TURBO PROGRAMMER OPTION, NEEDS BOOTLOADER)



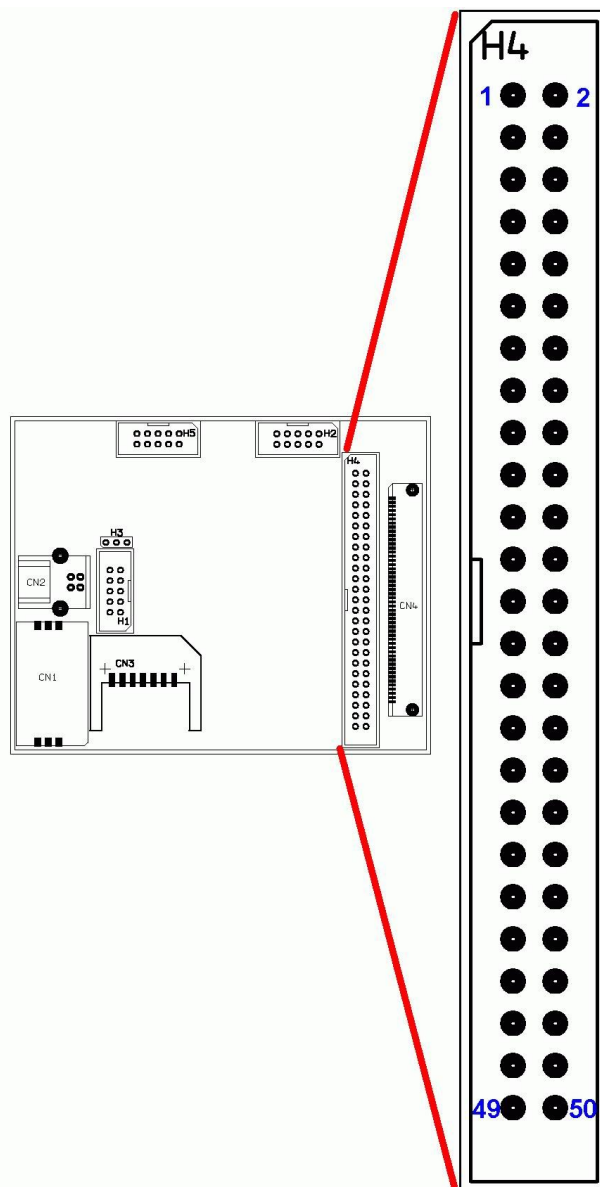
H5 – External data bus connector

PIN	NAME	PIN	NAME
10	GND	9	AD7
8	AD6	7	AD5
6	AD4	5	AD3
4	AD2	3	AD1
2	AD0	1	VCC 3V3



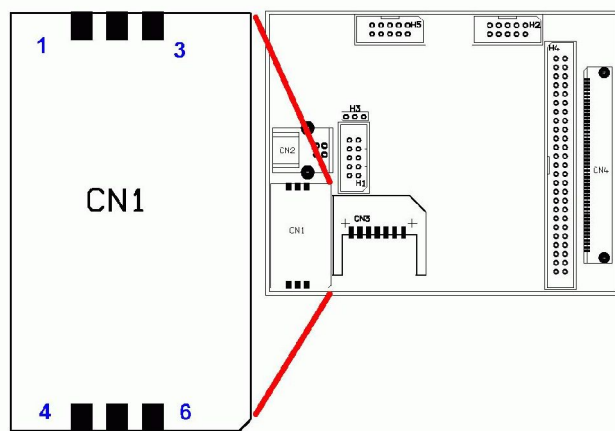
H4 – Expansion connector

PIN	NAME	PIN	NAME
1	VCC_3V3	2	GND
3	T_#RESET	4	T_VCC
5	GND	6	T_CLK
7	GND	8	-
9	-	10	-
11	-	12	-
13	-	14	-
15	GND	16	T_MISO
17	T_MOSI	18	T_SCK
19	GND	20	T_#SS
21	T_INT0_SCL	22	T_INT1_SDA
23	GND	24	-
25	-	26	GND
27	-	28	T_#WR/BSY
29	-	30	-
31	-	32	-
33	-	34	-
35	-	36	-
37	-	38	GND
39	T_AD7	40	T_AD6
41	T_AD5	42	T_AD4
43	T_AD3	44	T_AD2
45	T_AD1	46	T_AD0
47	GND	48	T_PDO
49	T_PDI	50	GND



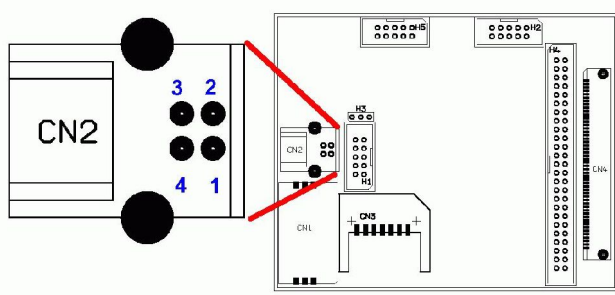
CN1 – SIM card connector

PIN	NAME	PIN	NAME
3	SIM_CLK	6	SIM_IO
2	SIM_RST	5	-
1	SIM_VCC	4	GND



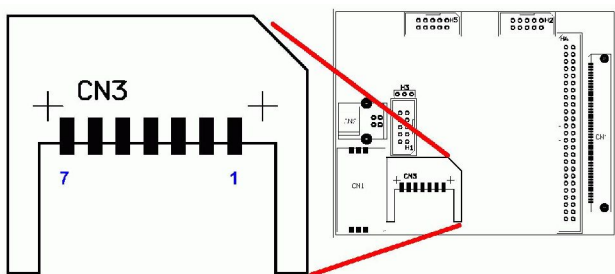
CN2 – USB connector

PIN	NAME	PIN	NAME
3	USBDP	2	USBDM
4	GND	1	USB_VCC



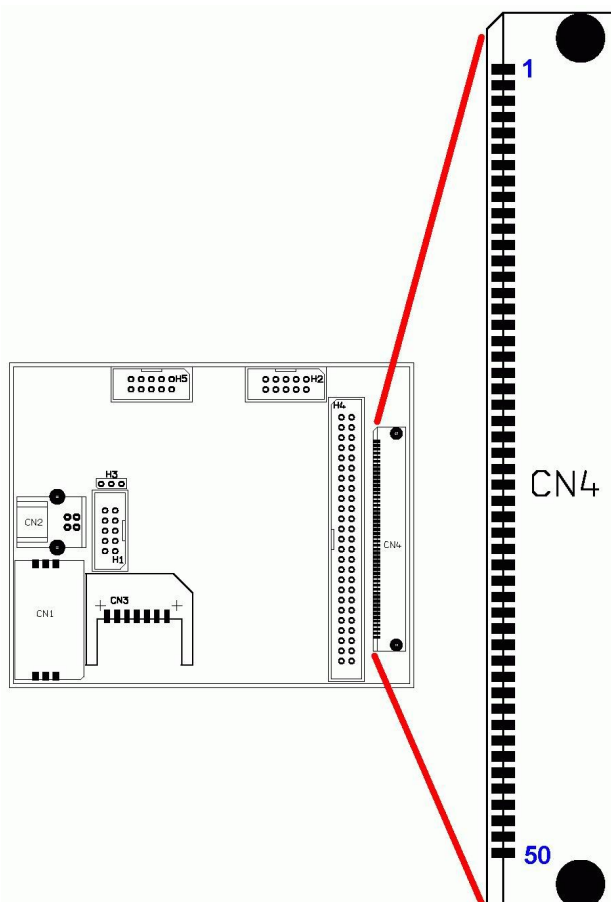
CN3 – MMC card connector

PIN	NAME	PIN	NAME
1	#SS_MMC	5	SCK
2	MOSI	6	GND
3	GND	7	MISO
4	VCC_MMC	-	-



CN4 – Expansion connector

PIN	NAME	PIN	NAME
1	VCC_3V3	2	GND
3	T_#RESET	4	T_VCC
5	GND	6	T_CLK
7	GND	8	-
9	-	10	-
11	-	12	-
13	-	14	-
15	GND	16	T_MISO
17	T_MOSI	18	T_SCK
19	GND	20	T_#SS
21	T_INT0_SCL	22	T_INT1_SDA
23	GND	24	-
25	-	26	GND
27	-	28	T_#WR/BSY
29	-	30	-
31	-	32	-
33	-	34	-
35	-	36	-
37	-	38	GND
39	T_AD7	40	T_AD6
41	T_AD5	42	T_AD4
43	T_AD3	44	T_AD2
45	T_AD1	46	T_AD0
47	GND	48	T_PDO
49	T_PDI	50	GND



5.Address map

Address	Size	Read	Write
0x0000	1	USB data	USB data
0x0001	1	Data bus from expansion connectors H4 and CN4	LED diodes
0x0002	1	Not used	8 internal enabling signals for 4066 switches between ATmega128L and expansion connectors H4 and CN4
0x0003	1	Not used	8 internal enabling signals for 4066 switches between ATmega128L and expansion connectors H4 and CN4
0x0004	1	External data port read from connector H5	External data port write to connector H5
0x0005	1	External data port read from connector H5	External data port write to connector H5
0x0006	1	External data port read from connector H5	External data port write to connector H5
0x0007	1	External data port read from connector H5	External data port write to connector H5

Table 1: Address map of I/O ports

Address	Size	Read	Write
0x00000	0x10000	64kB SRAM memory bank	64kB SRAM memory bank

Table 2: Address map of memory

Signal “#RAM/PORT” (pin PF3 of ATmega128L) is used to access I/O port or memory address space.

Special care must be taken accessing lower 4kB of memory space of ATmega128L. See code examples or ATMEL documentations.

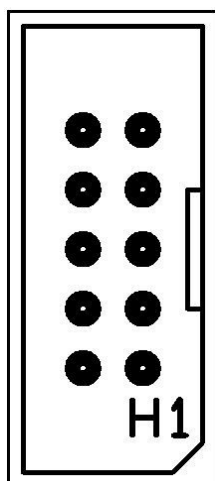
6. ATmega pins

PIN	NAME	DESCRIPTION
1	-	-
2	PDI	ISP programming data input
3	PDO	ISP programming data output
4	-	-
5	-	-
6	#EN_UPDATE	Enables firmware updating
7	USB_WR_BSY#	Stores data from expansion bus to PORT1 buffer
8	USB_TXE#	Transmit fifo of USB chip empty
9	USB_RXF#	Receive fifo of USB chip full
10	SW_#SS_MCU	SPI #SS signal to/from ATmega128L
11	SCK	SPI SCK clock
12	SW_MOSI	SPI MOSI signal
13	SW_MISO	SPI MISO signal
14	#EN_SIM_VCC	Enables VCC to SIM card
15	SW_CLKA	Alternative clock signal (divided oscillator CLK)
16	EN_USB_DBG	Connects expansion data bus to ATmega128L data bus
17	#EN_LED	Enables LEDs, can be used to control intensity
18	EN_SIM_CLKA	Connect alternative clock to SIM card
19	EN_SIM_CLK	Connect clock to SIM card
20	#RESET	Resetting of ATmega128L
21	VCC_3V3	Power supply for ATmega128L, MMC, SRAM, expansion connectors, ISP
22	GND	Ground
23	XTAL2	Crystal oscillator output, used to drive clock tree
24	XTAL1	Crystal oscillator input
25	SW_INT0_SCL	I2C SCL clock or interrupt INT0 from expansion connector
26	SW_INT1_SDA	I2C SDA clock or interrupt INT1 from expansion connector
27	SW_IO_FB	UART1 RX signal derived from SIM card's IO signal
28	SW_IO,LDR_IO	UART1 TX signal for SIM card's IO signal
29	SW_RST	Resetting signal for SIM card
30	SW_#RESET	Resetting signal to expansion connector
31	USB_SIWU	Controls transmitting data to USB host
32	SW_#SS_MMC	SPI chip select signal for MMC
33	#WR	Write strobe signal
34	#RD	Read strobe signal

<i>PIN</i>	<i>NAME</i>	<i>DESCRIPTION</i>
35	A8	Address bus, bit 8
36	A9	Address bus, bit 9
37	A10	Address bus, bit 10
38	A11	Address bus, bit 11
39	A12	Address bus, bit 12
40	A13	Address bus, bit 13
41	A14	Address bus, bit 14
42	A15	Address bus, bit 15
43	ALE	Address latch enable signal to store lower byte of address
44	AD7	Multiplexed address/data bus, bit 7
45	AD6	Multiplexed address/data bus, bit 6
46	AD5	Multiplexed address/data bus, bit 5
47	AD4	Multiplexed address/data bus, bit 4
48	AD3	Multiplexed address/data bus, bit 3
49	AD2	Multiplexed address/data bus, bit 2
50	AD1	Multiplexed address/data bus, bit 1
51	AD0	Multiplexed address/data bus, bit 0
52	VCC_3V3	Power supply for ATmega128L, MMC, SRAM, expansion connectors, ISP
53	GND	Ground
54	-	-
55	-	-
56	-	-
57	-	-
58	#RAM/PORT	Select SRAM or I/O PORTs
59	A18	Address bit 18 for SRAM only
60	A17	Address bit 17 for SRAM only
61	A16	Address bit 16 for SRAM only
62	-	-
63	GND	Ground
64	VCC_3V3	Power supply for ATmega128L, MMC, SRAM, expansion connectors, ISP

7.ISP programming

ATmega128L microcontroller can be programmed using ISP interface. Pinout of onboard ISP connector differs from original ATMEL 10 pin ISP connector.



PIN	NAME	PIN	NAME
10	GND	9	-
8	-	7	-
6	PDO	5	PDI
4	SCK	3	-
2	#RESET	1	VCC 3V3

BLADOX ISP CONNECTOR PINOUT

PIN	NAME	PIN	NAME
10	GND	9	PDO
8	GND	7	SCK
6	GND	5	#RESET
4	GND	3	-
2	VCC	1	PDI

ATMEL ISP CONNECTOR PINOUT

WARNING: Pinout of onboard ISP connector differs from original ATMEL 10 pin ISP connector. Reduction BLADOX <-> ATMEL ISP connector is available, see web page <http://www.bladox.com/>

8.Bootloader and firmware updating

FLASH memory of ATmega128L microcontroller has 1,2,4 or 8 Kbytes bootloader section depending on programmed BOOTSZ1 and BOOTSZ0 bits in Fuse High Byte. Code from bootloader section is executed after reset of ATmega128L only if reset vector bit BOOTRST in Fuse High Byte is programmed.

BXTOP45P board is designed to allow updating of application section of FLASH memory executing such bootloader code residing at bootloader section of FLASH, doing so-called firmware updating.

New firmware (new code for application section of FLASH) can be obtained from USB, USART, SPI, I2C interfaces. There is jumper H3 on the BXTOP45P board used for enabling firmware updating.

Scenario for firmware updating through USB bus would be following:

- disconnect BXTOP45P board from USB bus

- set jumper H3 to 2-3 position (enable firmware updating)
- plug BXTOP45P into USB again (bootloader recognizes FW updating request)
- use utility for new firmware updating

Other scenarios of FW updating are possible depending on user needs.

NOTE: Visit web page <http://www.bladox.com/> for bootloader examples.

9. Redefining USB device settings

BXTOP45P board uses FTDI's FT8U245BM chip as USB bus interface. BXTOP45P board acts as USB device for USB host and its default USB parameters are stored in FT8U245BM chip. However user defined values for some of USB parameters can redefine default values. Such customization is made by attaching serial EEPROM to FT8U245BM chip and program it with the replacement parameters. FT8U245BM chip supports direct programming of serial EEPROM over USB using a programming utility.

Following parameters can be redefined:

USB Vendor ID and Product ID numbers, Self Powered or Bus Powered, Current Consumption, Manufacturer, Product Description, Serial Number.

NOTE: Go web page <http://www.bladox.com/> to download EEPROM programming utility to customize USB parameters of your BXTOP45P board.

10. Application examples

Application examples for USB , SIM, MMC and others will be available soon.

NOTE: Check web page <http://www.bladox.com/> to download actual application examples and application notes files.

11.Component placement on BXTOP45P

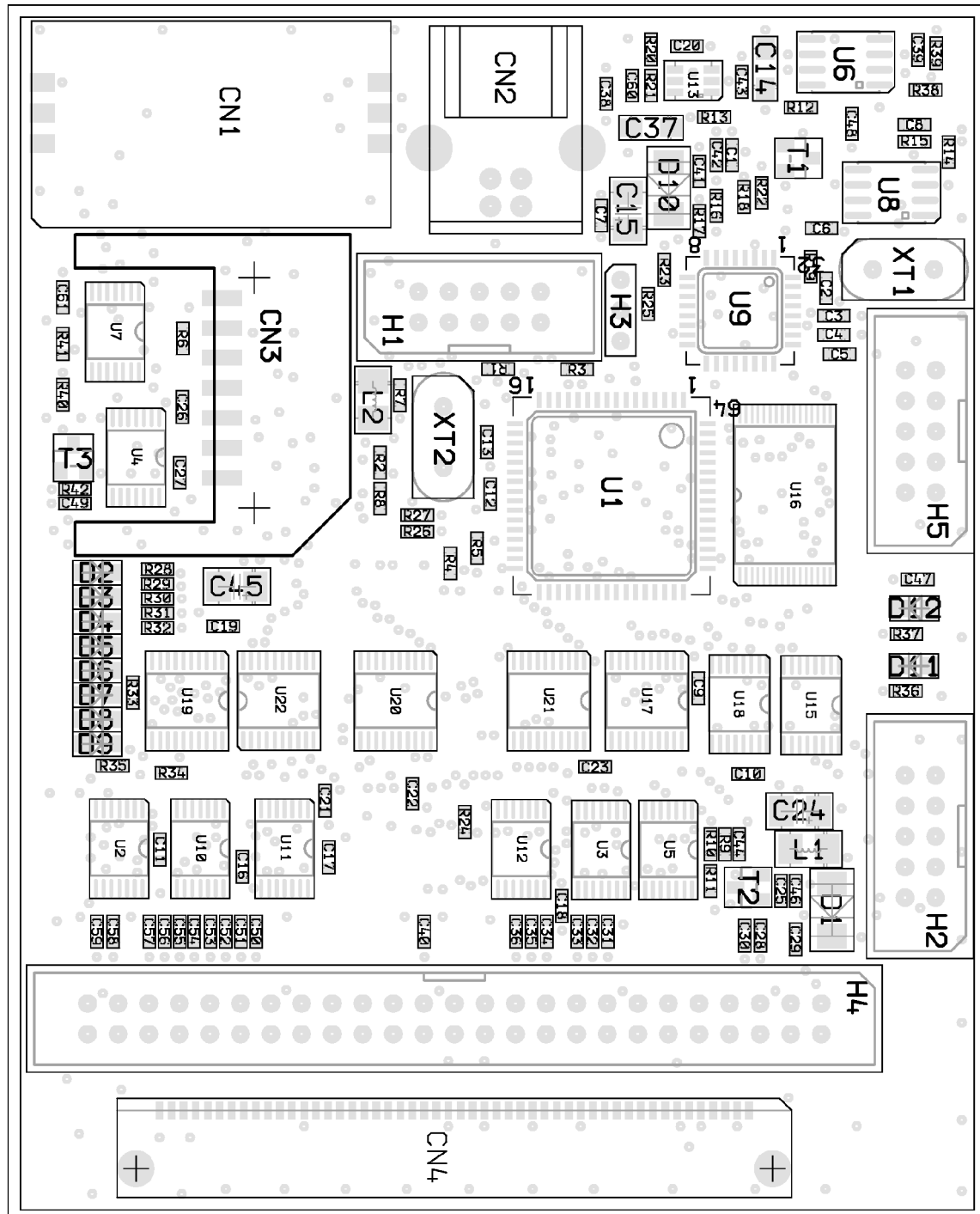


Figure 3: Component placement



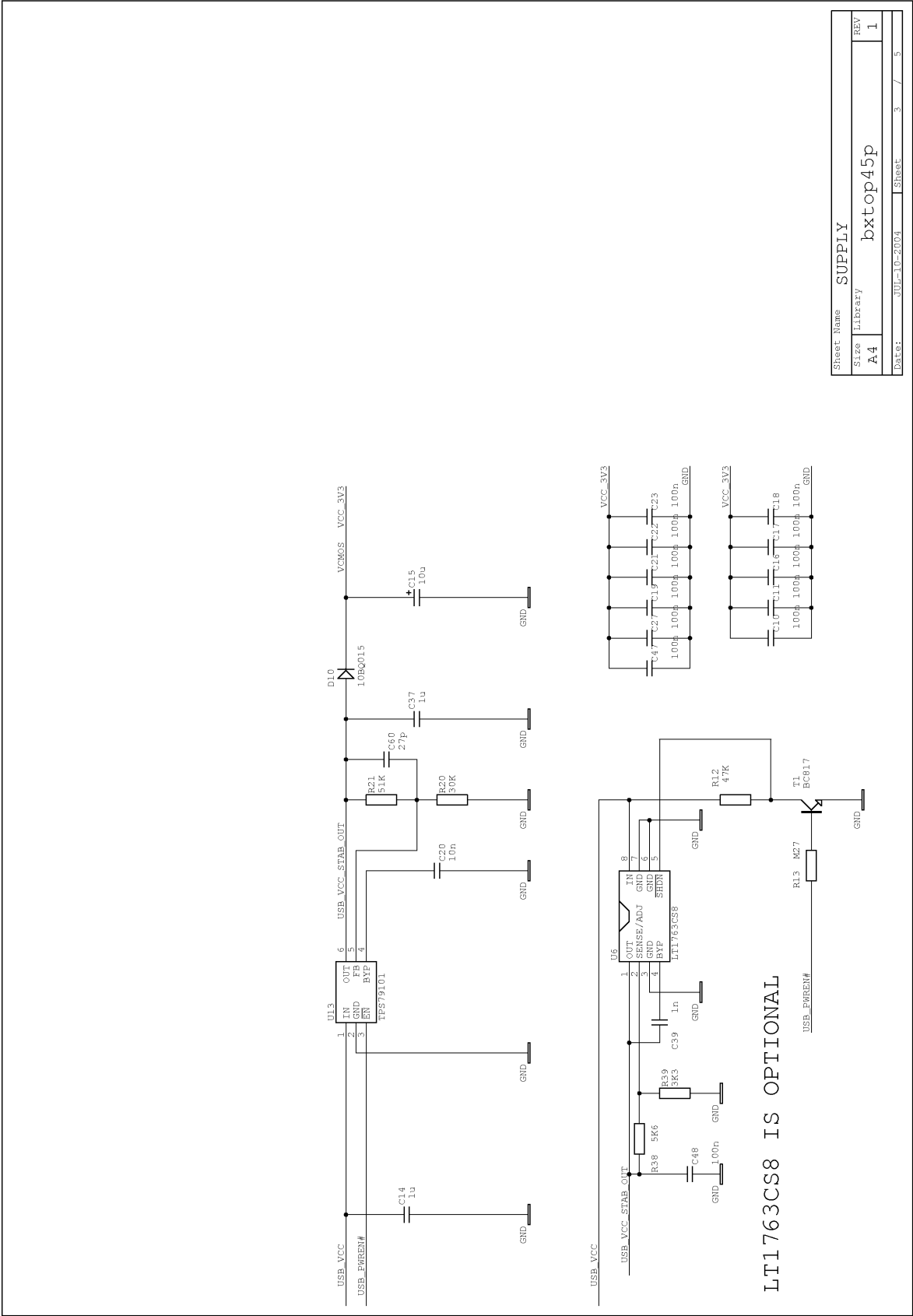
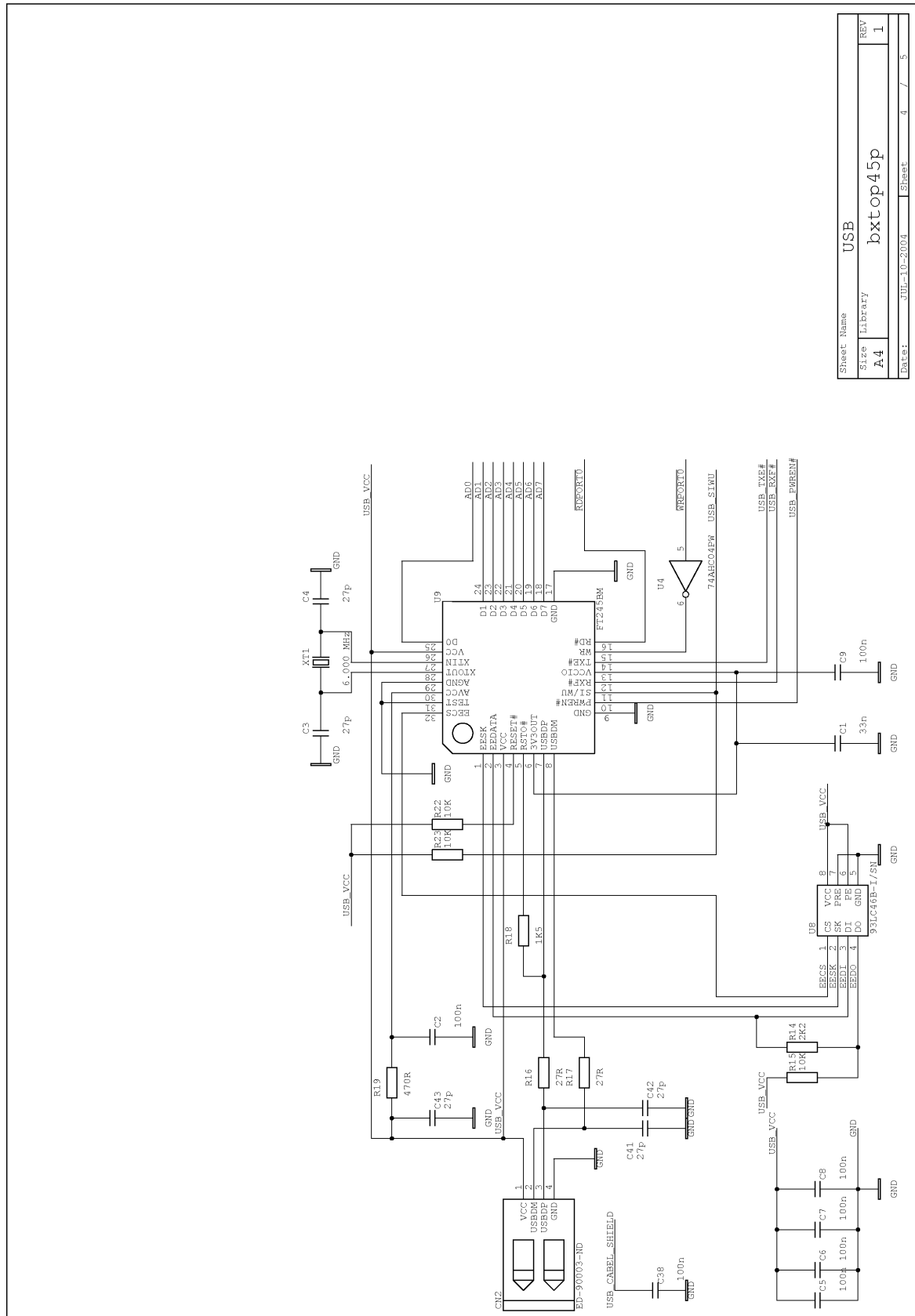


Figure 6: Schematics, section POWER SUPPLY



Sheet Name	USB
Size	A4
Library	bxtop45p
Rev	1
Date	2004-10-10
Sheet	4
Page	5

Figure 7: Schematics, section USB

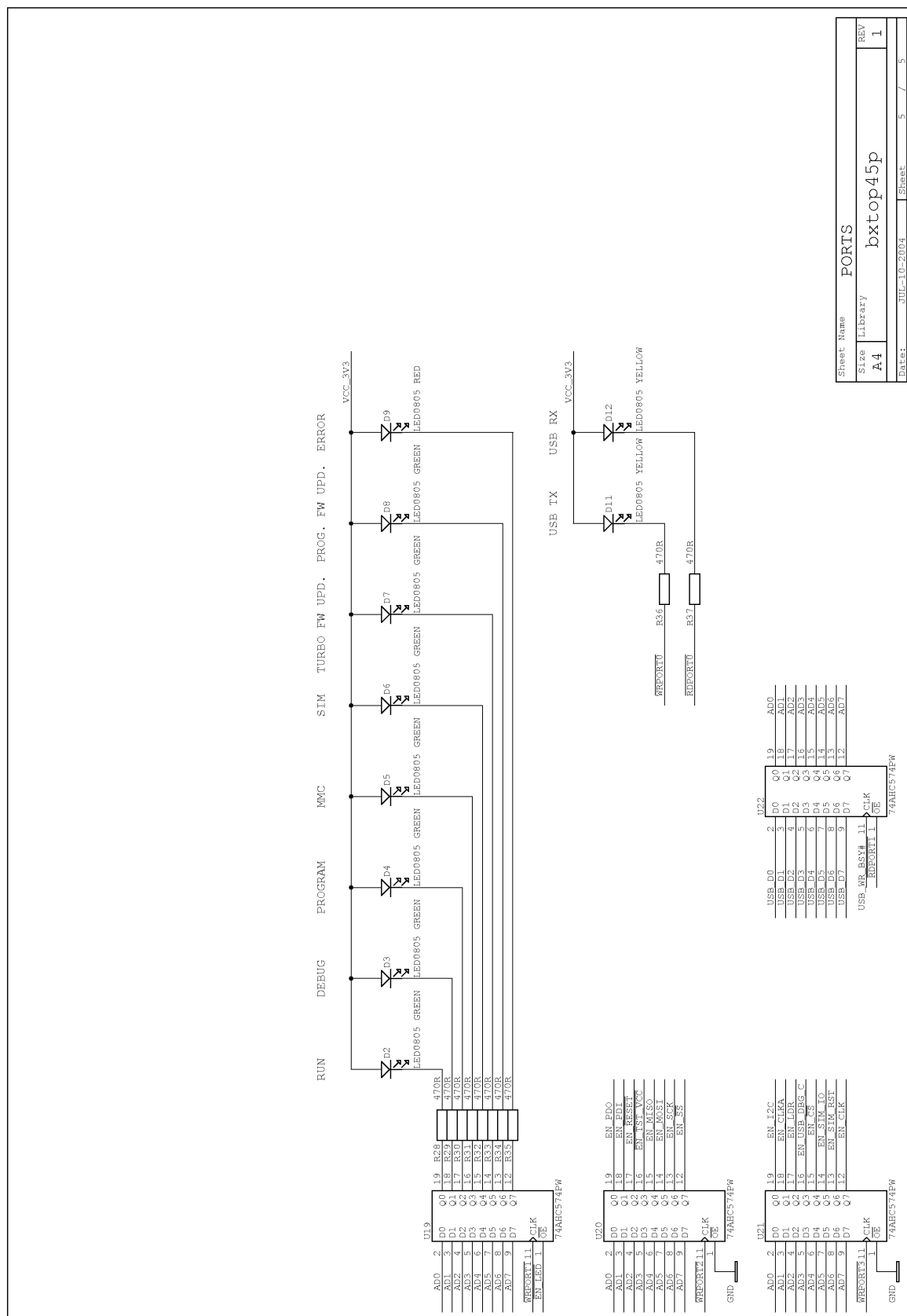


Figure 8: Schematics, section PORTS

13. Electrical characteristics

DC characteristics

<i>Symbol</i>	<i>Parameter</i>	<i>Condition</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
USB_VCC	USB Voltage		4,75	5,00	5,25	V
USB_VCC_STAB	USB stabilizer Voltage		3,20	3,30	3,40	V
VCC_3V3	ATmega, MMC, SRAM Voltage		3,05	3,15	3,25	V
SIM_VCC	SIM Voltage		2,95	3,05	3,15	V
TST_VCC	Expansion Voltage		2,90	3,00	3,10	V

Crystal oscillator frequency

<i>Symbol</i>	<i>Parameter</i>	<i>Condition</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
f_{xtal}	Crystal oscillator frequency			8,00		MHz

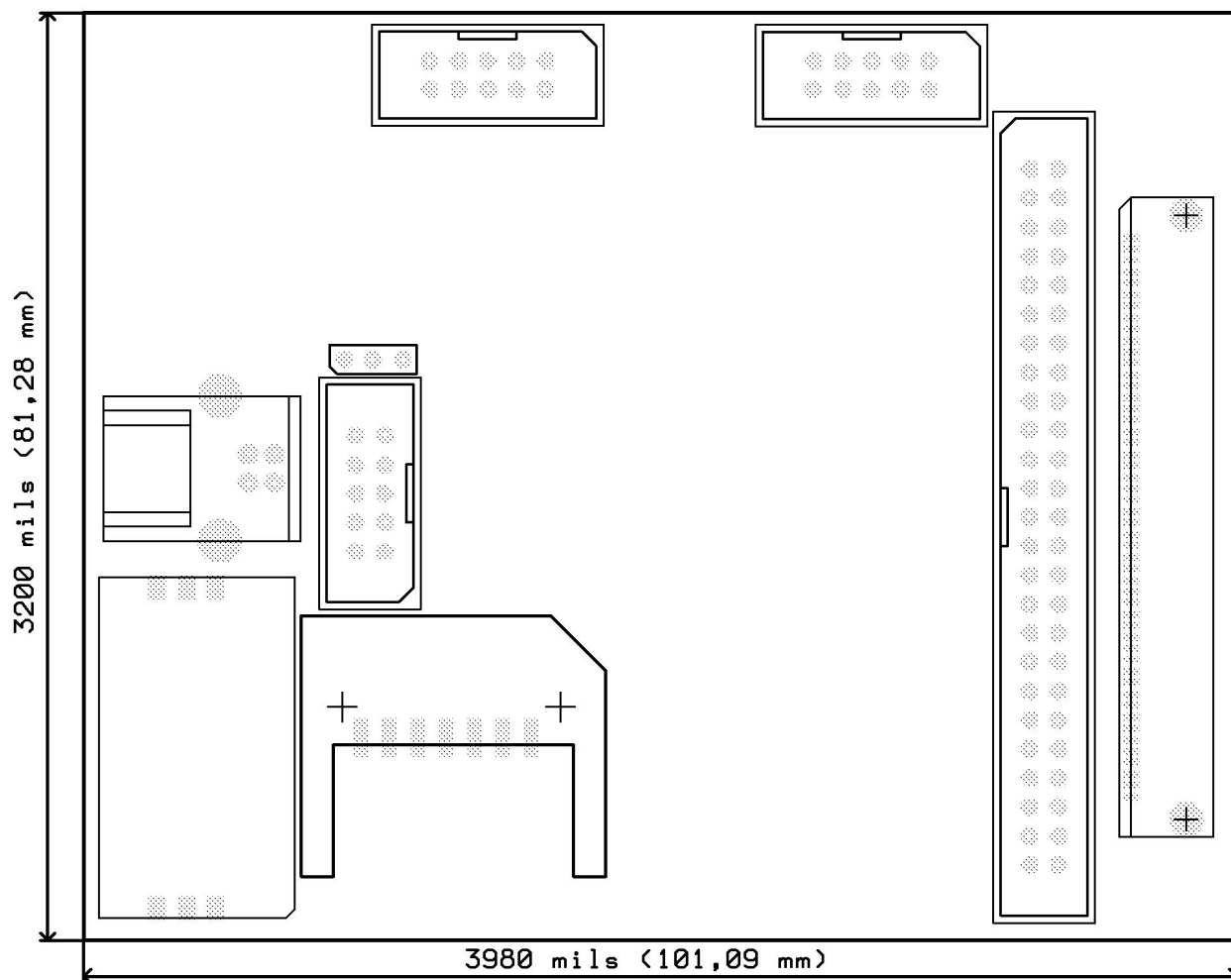
SPI interface timing

<i>Symbol</i>	<i>Parameter</i>	<i>Condition</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
f_{SPL_MMC}	SCK frequency, MMC mode	Master		$f_{xtal}/4$		MHz
f_{SPL_DEBUG}	SCK frequency, DEBUG mode	Slave		$f_{xtal}/128$		MHz
f_{SPL_PROG}	SCK frequency, MMC mode	Master		$f_{xtal}/128$		MHz
f_{SPL_PROGHS}	SCK frequency, MMC mode	Master		$f_{xtal}/16$		MHz
f_{SPL_PROGES}	SCK frequency, MMC mode	Master		$f_{xtal}/16$		MHz

SRAM memory timing

<i>Symbol</i>	<i>Parameter</i>	<i>Condition</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
t_{RLRH}	RD pulse width	1 wait state		$2/f_{xtal}-15$		ns
t_{WLWH}	WR pulse width	1 wait state		$2/f_{xtal}-15$		ns

14.Mechanical drawing



15.Errata

More information, documentation and application notes available on web page
<http://www.bladox.com/>