LITTLE E3D2

PRODUCT SHEET

rev 1.0

LITTLE E3D2 is a small board containing ATMega128 microcontroller connected to RTL8019AS network interface. It is intended for embedding into a larger system which has to be connected to the Ethernet network. Available is a library which provides basic IP communication with a master system over the Ethernet network.

LITTLE E3D2 has been designed in mind of simple usage in various applications. Its design allows using it in very sophisticated applications with minimum effort. The philosophy behind that is simple: "Have every smart periphery tightly integrated on the small controller board, use single layer PCB for the rest".

LITTLE E3D2 BOARD FEATURES

 - ATMega128-16AI controller with integrated 128kB Flash memory, 4kB RAM and 1kB EEPROM.
 - 128kB battery backed static RAM memory.
 - 512kB (4Mb) Flash for user data.
 - Ethernet interface chip RTL8019AS connected to the ATMega128.
 - RJ45 Ethernet connector on the board.
 - RS232 interface with MAX232 driver connected to UART0.
 - RS485 interface driver connected to UART0.
 - DS1307 Real Time Clock.
 - 26 general purpose I/O lines (PORTB 4-7, PORTD 0-7, PORTE 2-7, PORTF 0-7).
    GPIO lines include 8 Channel 10-bit A/D converter, PWM, Analog Comparator, etc.
    Detailed description about GPIO can be found in ATmega128 datasheet.
 - In system programming connector.
 - Code security and protection.
 - Low noise 4-layer PCB.
 - Standard 2.54mm (0.1 inch) pitch headers used for interfacing.
 - Size 73x45 mm.
 - +5V power supply

LITTLE E3D2 has been designed for plugging into another board (called GEAR) that contains application specific electronics. As the voltage requirement of the LITTLE E3D2 is +5V the GEAR board usually contains linear or switching +5V power supply regulator along with necessary capacitors, protection circuits and diode bridge. Such board is supplied in the LITTLE E3D2 development kit (available from July 2004)

FUNCTIONAL BLOCKS DESCRIPTION

Serial Port 0

LITTLE E3D2 provides an on on-board RS232 level shifter (ST232) and RS485 bus driver (75176B), both connected to UART0 of the ATmega128 controller.
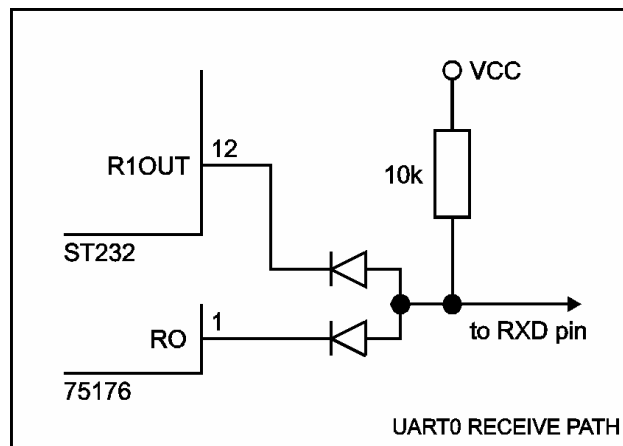
Principal schematics of the UART0 circuit

UART0 is connected to both drivers (RS232 and RS485) simultaneously. Everything that is being transmitted on RS485 is also transmitted on RS232. In the receive path the signals from RS232 and RS485 are logically ANDed and resulting signal is routed through 74HCT4053 multiplexer to UART0 RXD input. This means that LITTLE E3D2 is able to receive data either from RS232 or RS485. Such circuity is used mainly for development purpose, designer can connect RS232 leads to PC's RS232 serial port and then can use PC for simulation of further RS485 communication without using a RS232/RS485 converter.

Serial Port 1

RAW signals from the serial port 1 are accessible on external peripheral connector.

Real Time Clock

LITTLE E3D2 is equipped with Dallas DS1307 RTC chip. Real time and date is available either from that chip or from a time server, if such server exists on the network the LITTLE E3D2 is connected to. The designer can write his own protocol for synchronizing the LITTLE E3D2 RTC with that network time server.

512 kB Flash Memory

LITTLE E3D2 uses for data storage a serial AT45DB041B Flash memory chip that is connected to the ATmega128 via Serial Peripheral Interface (SPI) bus.
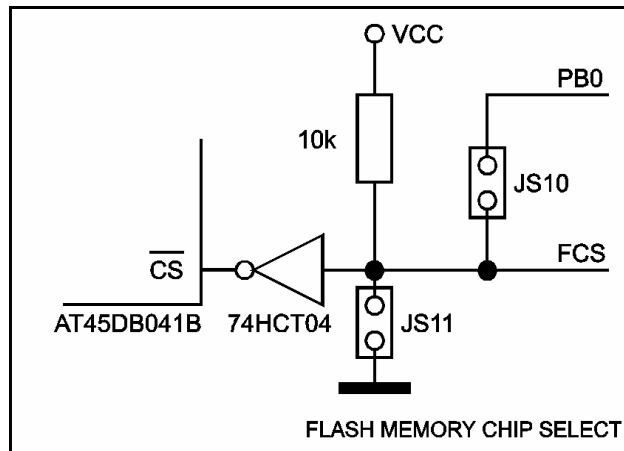

Flash memory chip select circuit

The flash memory is selected by FCS signal, which is in fact inverted PB0 signal. FCS signal is accessible on the external peripheral connector, therefore the flash memory can be optionally selected externally by resoldering proper configuration pads on the LITTLE E3D2 board, or it can be completely disabled.

RAM Memory

RAM memory has capacity of 128kB and is bank switched. There are four banks, each of 32kB capacity. MA15 and MA16 bank select signals are connected to PE6 and PE7 pins on ATmega128. The switching can be disabled by soldering and desoldering proper configuration pads on the LITTLE E3D board and by that the PE6 and/or PE7 pins can be freed from RAM bank switching. However the overall RAM capacity decreases to 64 or 32 kB respectively.

Bank switching circuit
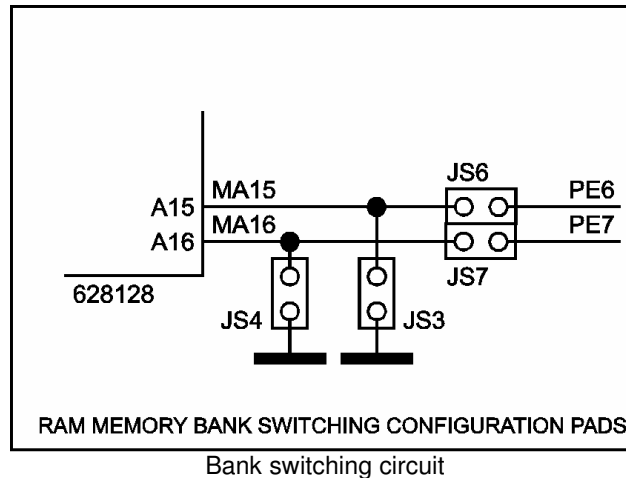
RAM memory chip is powered via BAS 40-05 low dropout dual schottky diode. Anodes of the BAS40-05 diode are connected to +5V power supply and to +3V battery while cathode is connected to pin 32 (VCC) of the 128kB RAM chip.

Powering the RAM
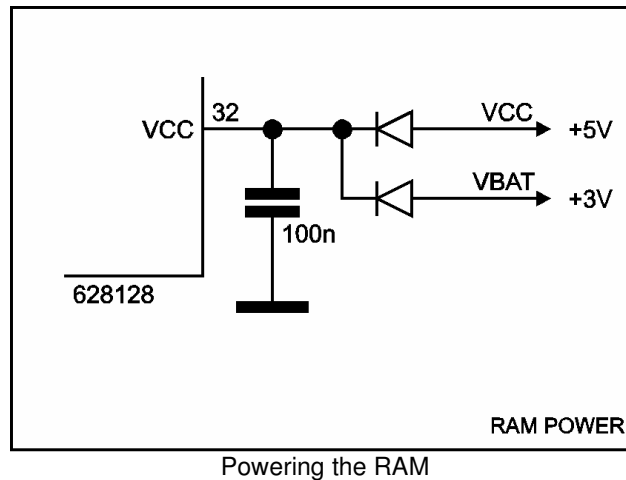
Battery

A standard CR2032 lihitium cell is used as a backup battery. If for some reason the battery is pulled out of the holder it must be ensured that + and - pads are always isolated (not connected together). The best way to do that is inserting a small piece of plastic between them.

System Reset

A MCP100/475 voltage supply supervisor is used for generating of system reset. Supply voltage may not drop below 4.75V, otherwise the LITTLE E3D2 will go into reset state. The reset signal for external resetting is also available on the external peripheral connector.

In-System Programming Port

This port allows serial programming of the ATmega128 FLASH and EEPROM memories without physical removal of the LITTLE E3D2 board from the system. A STK200 compatible standard is used for the ISP connectror pinning.

```
MOSI  ● ●  VCC
PROG  ● ●  GND
RST   ● ●  GND
SCK   ● ●  GND
MISO  ● ●  GND
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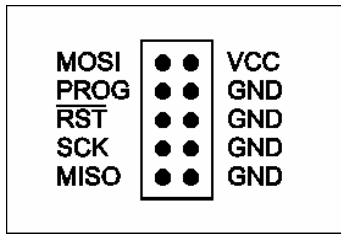
WARNING
Do not plug in or remove the programming adapter while the LITTLE E3D2 is powered on. You may damage the LITTLE E3D2 board or the parallel port on the PC.

RTL8019 Ethernet chip

RTL8019 chip is connected to ATmega128 a way that eliminates AC573 latch in the signal path. RTL8019 registers occupy upper half of the 64kB RAM address space.

Ethernet Port

LITTLE E3D2 provides an on board modular RJ-45 connector with integrated transformer/filter. Maximum cable length between LITTLE E3D2 and Ethernet hub or switch is 100 meters.

LED Indicators

LITTLE E3D2 board is equipped with 4 LED indicators, two of them are part of the RJ-45 Ethernet connector.
The indicators are:
 - Power On
 - Programming In Progress
 - Ethernet Link
 - Ethernet Transmit/Receive

Crystals

Totally four crystals are on the LITTLE E3D2 board.
They are:
14.745 MHz crystal which provides reference clock for ATmega128 controller
20.000 MHz crystal for RTL8019AS Ethernet chip
32768 kHz crystal for ATmega128 on-chip asynchronous timer
32768 kHz crystal drives DS1307 real time clock chip

Program Memory

ATmega128 controller provides 128kB on chip (64x16) flash memory for program storage.
Please refer to ATmega128 datasheet for additional information.

EEPROM Memory

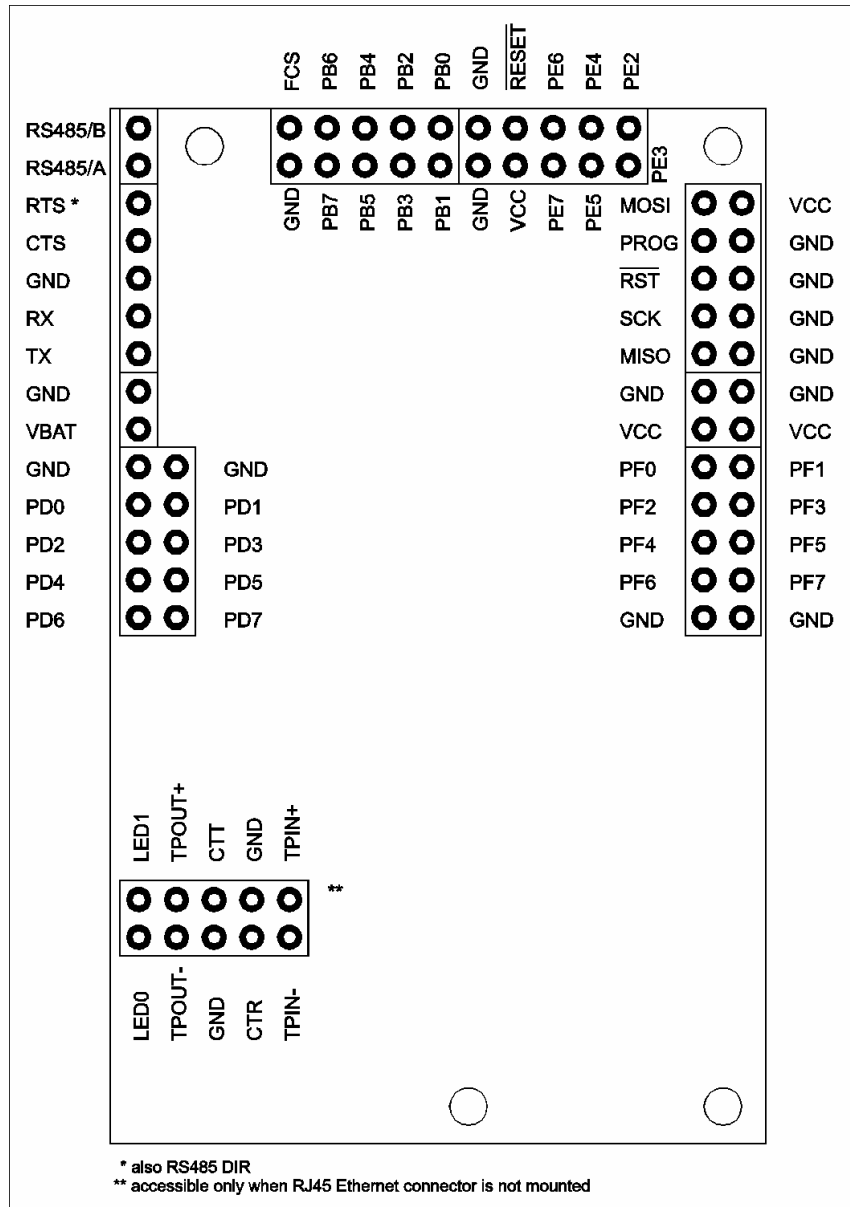ATmega128 controller provides 4kB (64x16) on chip EEPROM memory for general purpose using.
Please refer to ATmega128 datasheet for additional information.

Watchdog Timer

The ATmega128 controller provides an on-chip watchdog timer which
can be used to watch the program execution. If an application fails to reset this timer within given amount of time, the watchdog can force the system reset.

PIN DESCRIPTION


```
              FCS PB6 PB4 PB2 PB0 GND RESET PE6 PE4 PE2

RS485/B   O       O  O  O  O  O  O  O  O  O  O
RS485/A   O       O  O  O  O  O  O  O  O  O  O   PE3
RTS *     O      GND PB7 PB5 PB3 PB1 GND VCC PE7 PE5   MOSI  O O  VCC
CTS       O                                            PROG  O O  GND
GND       O                                            RST   O O  GND
RX        O                                            SCK   O O  GND
TX        O                                            MISO  O O  GND
GND       O                                            GND   O O  GND
VBAT      O                                            VCC   O O  VCC
GND       O O  GND                                     PF0   O O  PF1
PD0       O O  PD1                                     PF2   O O  PF3
PD2       O O  PD3                                     PF4   O O  PF5
PD4       O O  PD5                                     PF6   O O  PF7
PD6       O O  PD7                                     GND   O O  GND


          LED1 TPOUT+ CTT GND TPIN+
          O    O      O   O   O        **
          O    O      O   O   O
          LED0 TPOUT- GND CTR TPIN-
```

* also RS485 DIR
** accessible only when RJ45 Ethernet connector is not mounted

Mapping of the on-board peripherals to the ATmega128 ports

PORTA[0..7]   ADDRESS/DATA BUS
PORTB[0..3]   SERIAL FLASH
PORTC[0..7]   ADDRESS BUS
PORTD[0..1]   DS1307 RTC
PORTE[0..1]   RS232/RS485
PORTE2   RS232 RTS/RS485 DIR
PORTE3   RS232 CTS/NC*
PORTE[6..7]   A16,A17/NC*

* depends on configuration

System RAM memory map
0000 - 10FF   4kB internal RAM on ATmega128 chip
1100 - 7FFF   External RAM window
8000 - FFFF   Realtek RTL8019AS