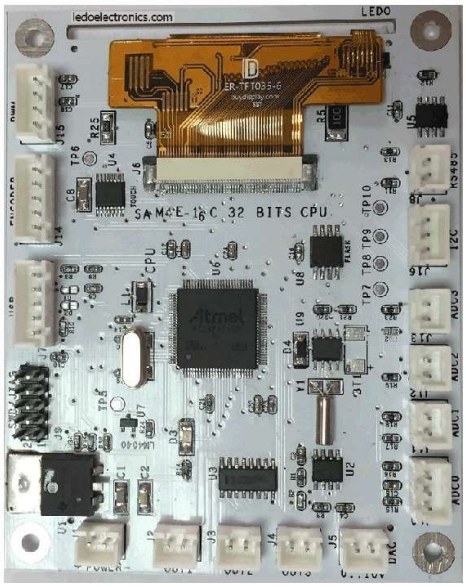
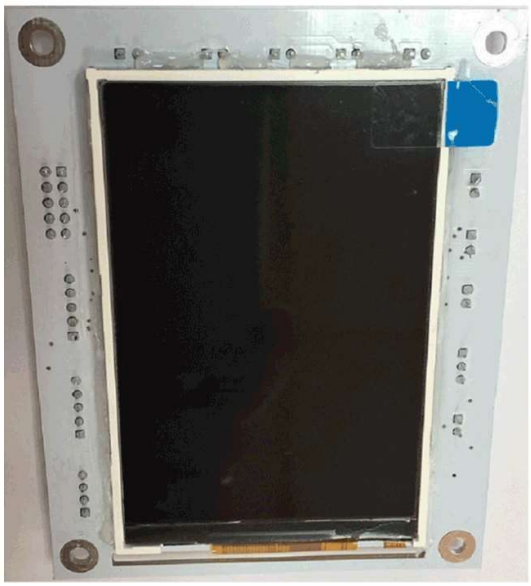
SAM TFT3.5 TOUCH BOARD





Hardware

- **Control system based on the ATSAM4E-16C**

32 bit arm with floating point

- **East Rising 3.5" 320x480 TFT color display with integrated ILI9488 controller from BuyDisplay.com**

Control by parallel interface of 16 bits

- **Resistive touch screen with AD7843 controller**
- **Flash memory of 16 MB to store data or images**
- **Real-time clock with calendar and supercap backup**
- **4 analog inputs of 12 bits, 0 ... 2.048V, 0 ... 10V, 4-20 mA**
- **An analog output 0 ... 10V of 12 bits**
- **Encoder and push-button connectors**
- **Three digital outputs 0 / 12V of 500 mA with ULN2003A**
- **Two PWM outputs**
- **USB Device 2.0 communication**
- **Communication Rs485**
- **I2C communication**

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- **Sam-BA downloading**
- **SWD / JTAG connector for programming in system**
- **12V supply voltage (from 9V to 15V DC)**
- **Maximum consumption current 120 mA**
- **Compact design. 100 mm x 80 mm**

Software

- **Several C and C ++ sample programs with separate classes for the treatment of each of the hardware modules.**
- **All projects compiled with the free IDE Atmel Studio 7**
- **Graphic library for representation of characters and images on the Display with great simplicity.**
- **Geometric graphic library (Lines, Triangles, Rectangles, Pixels, etc.).**
- **Windows application to transfer Bitmaps from the PC to the flash memory of the board, through the USB bus.**

Applications

- **Automatic pumping.**
- **Automatic irrigation.**
- **Automation control.**
- **Sequencer.**
- **Ventilation system.**
- **Dosage.**
- **Generator of waves of different shapes, up to a frequency of 1 MHz.**
- **MODBUS master / slave.**
- **Display / Remote keyboard.**
- **Remote sensor.**
- **Stepper motor control (optional, requires expansion module).**
- **PWM control.**
- **PID control.**
- **Pulse counter**
- **Training kit for students**
- **Etc.**

The board has been designed to guarantee high flexibility and comfort in its use. It has the necessary elements for the implementation of small control systems that require the measurement of unipolar analog magnitudes. It has a 12-bit digital analog converter up to 2 Msps, with high stability external voltage reference source. The ADC has four channels enabled, so that four unipolar signals can be measured. Three of the channels have voltage dividers, to adapt to the levels required by the application.
The presence of the real time clock with calendar, and the Flash memory of 16 MBytes allow the implementation of a Real Time Data Recorder. The USB bus allows data to be collected on a PC.
The analog output from 0 to 10V, as well as the three power outputs for the control of conventional relays or solid state, facilitate the implementation of a PID for the control of temperature, humidity, pressure, etc. or the speed regulation of a motor by means of a Inverter. The analog output can be used as a wave generator of various shapes and variable frequency.
The Rs485 bus allows the expansion of the system, using any of the Ledoelectronics expansion modules or any standard module; it can be configured in Master or Slave mode.
The presence of a color graphic display with a resolution of 320x480, with built-in touch screen, increases the versatility of the board. The libraries supplied with the module make the difficult simple, and allow the representation of characters, images and figures by simple commands with drawBitmap (..), printChar (..), printString (...), drawLine (..), drawRect (..), drawCircle (..), etc.
Using a Windows application, the images can be transferred from a PC to the Flash memory of the board through the USB bus.

SAM Tft3.5 Touch Board Schematics

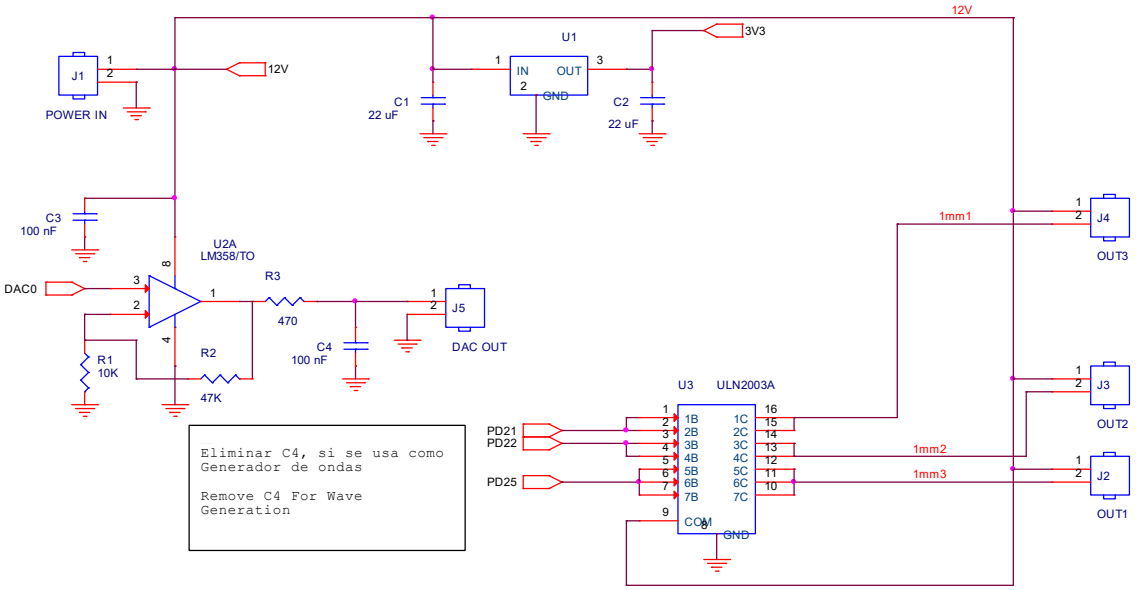


Fig.1. Power supply and outputs.

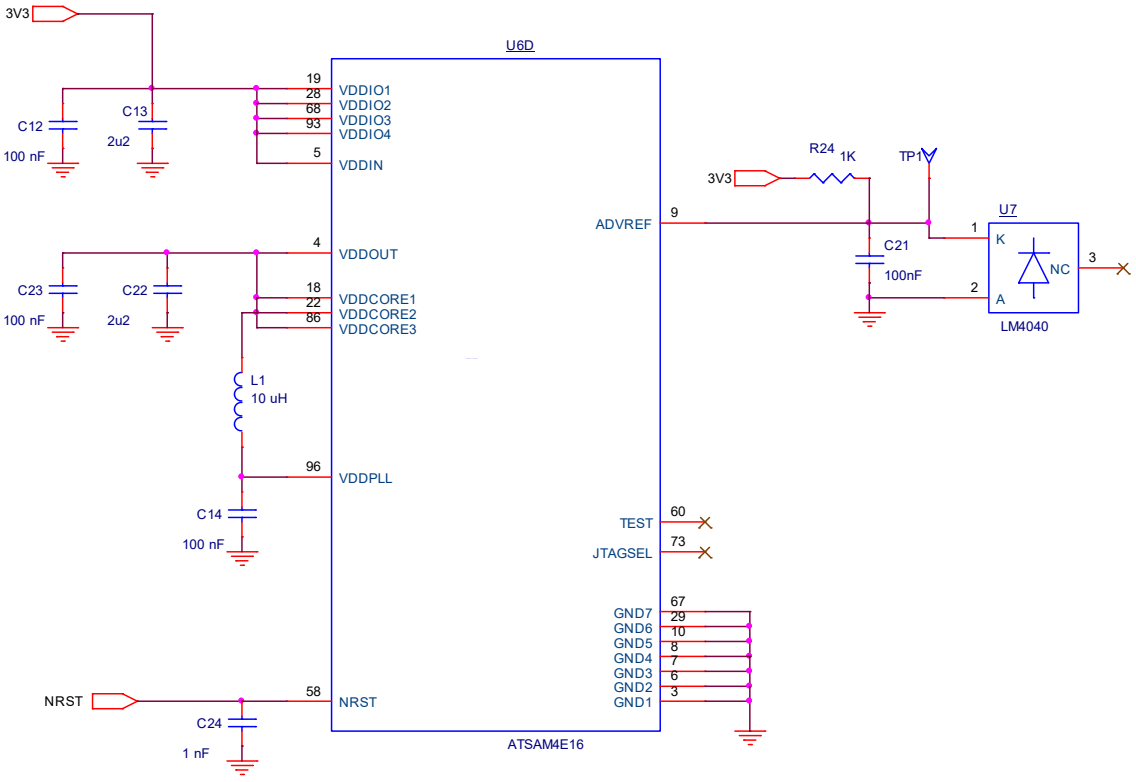


Fig.2. CPU Core.

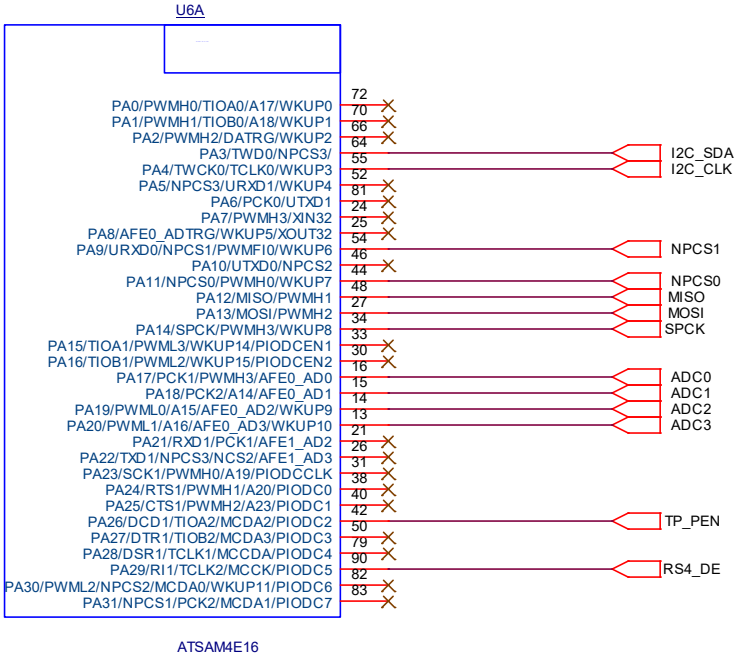


Fig.3. CPU PIOA

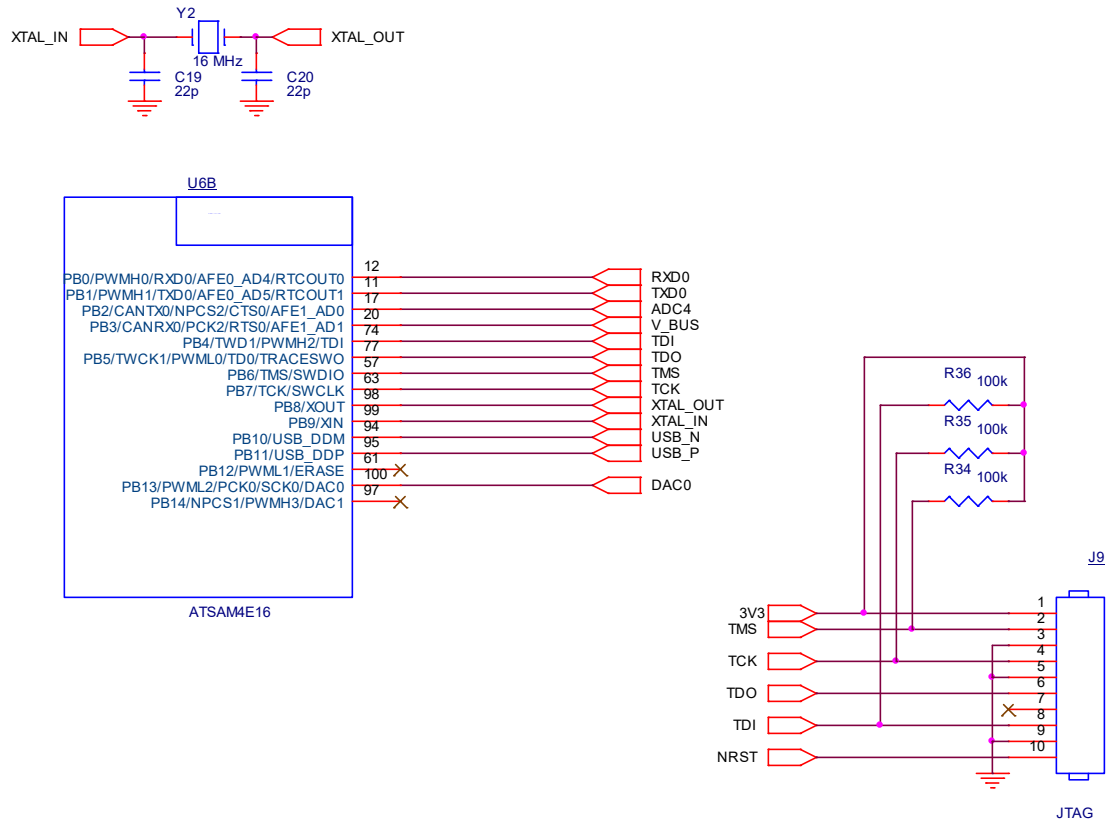


Fig.4. CPU PIOB

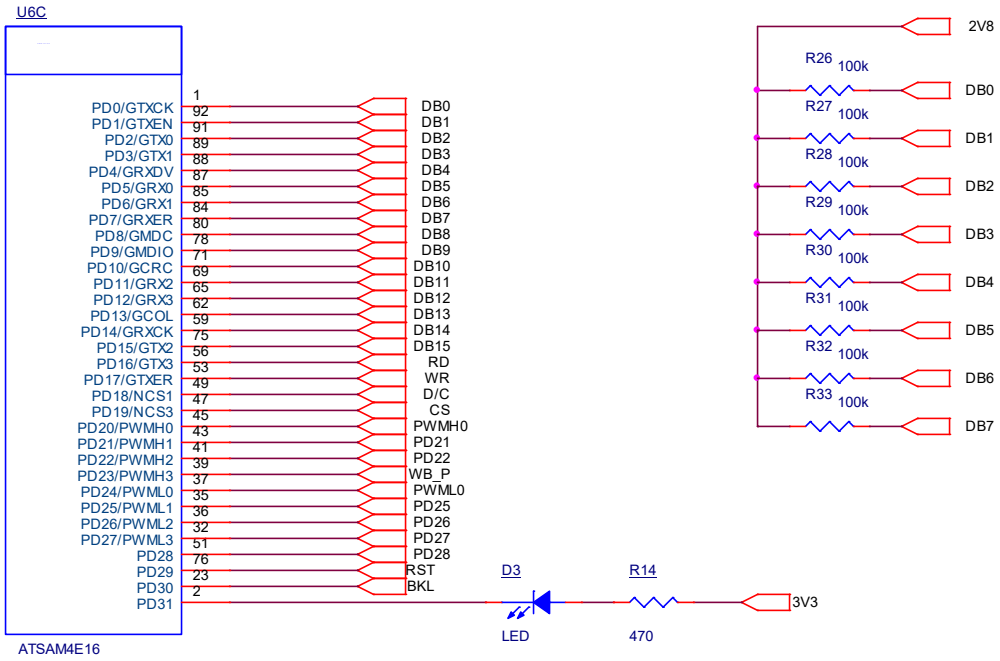


Fig.5. CPU PIOD

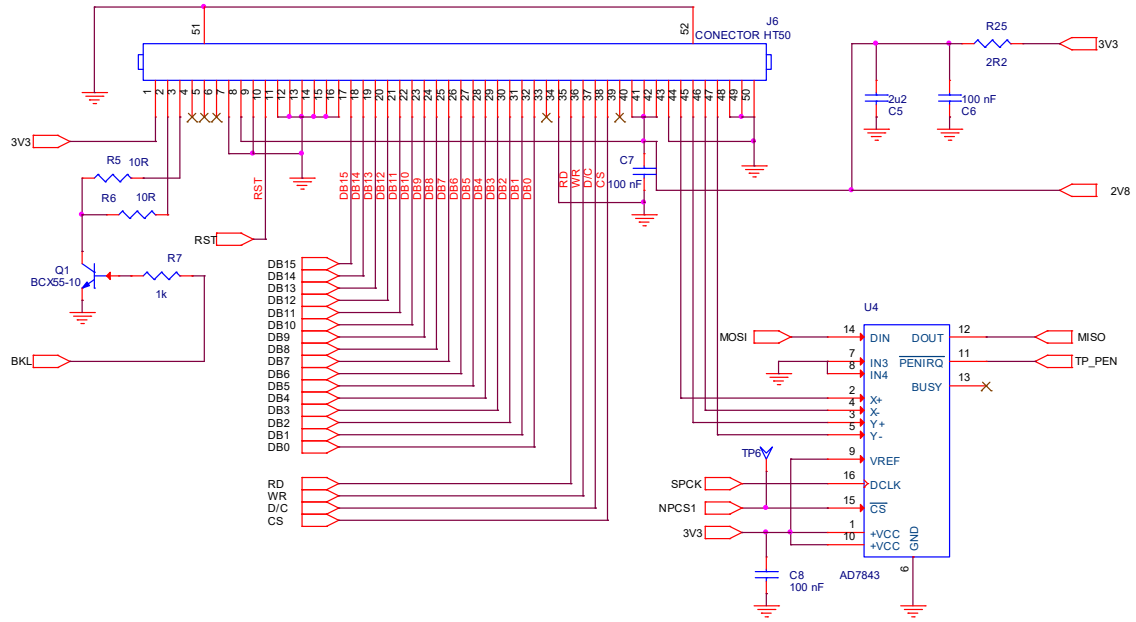


Fig.3. TFT and touch screen.

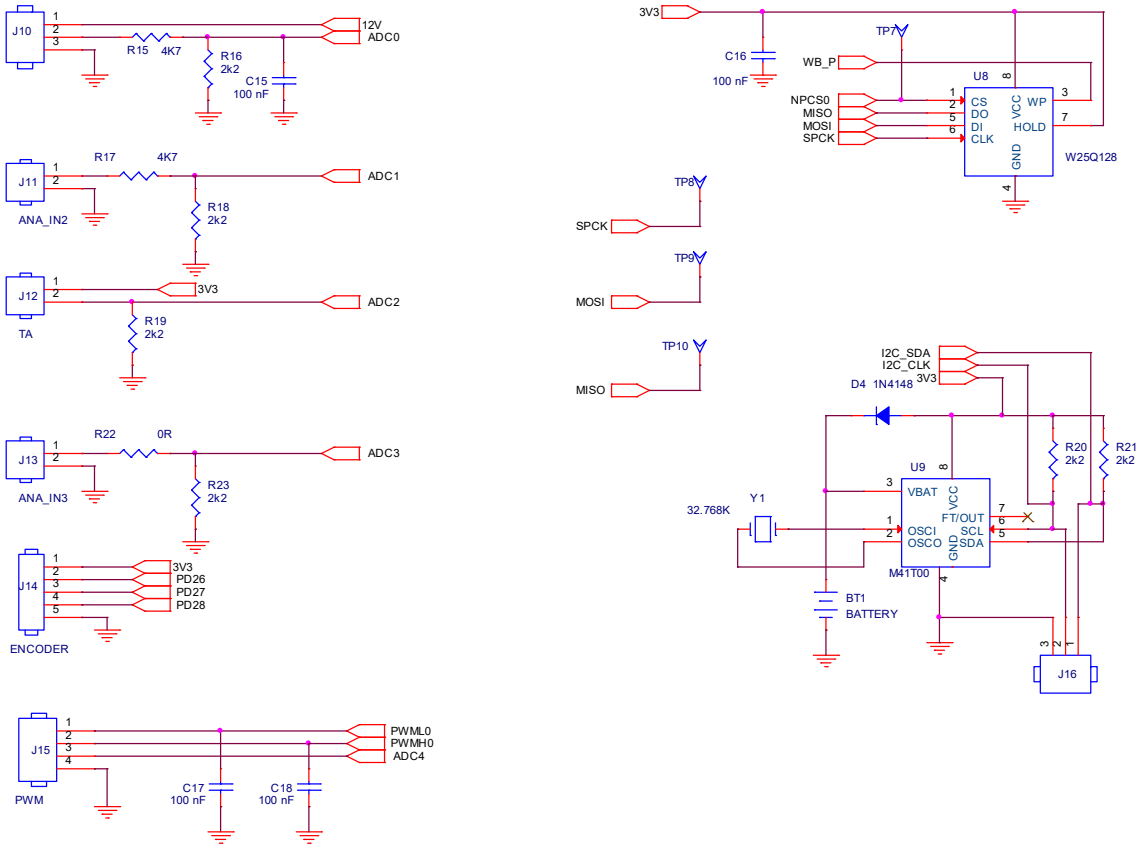


Fig.4. Connectors. RTC y Flash

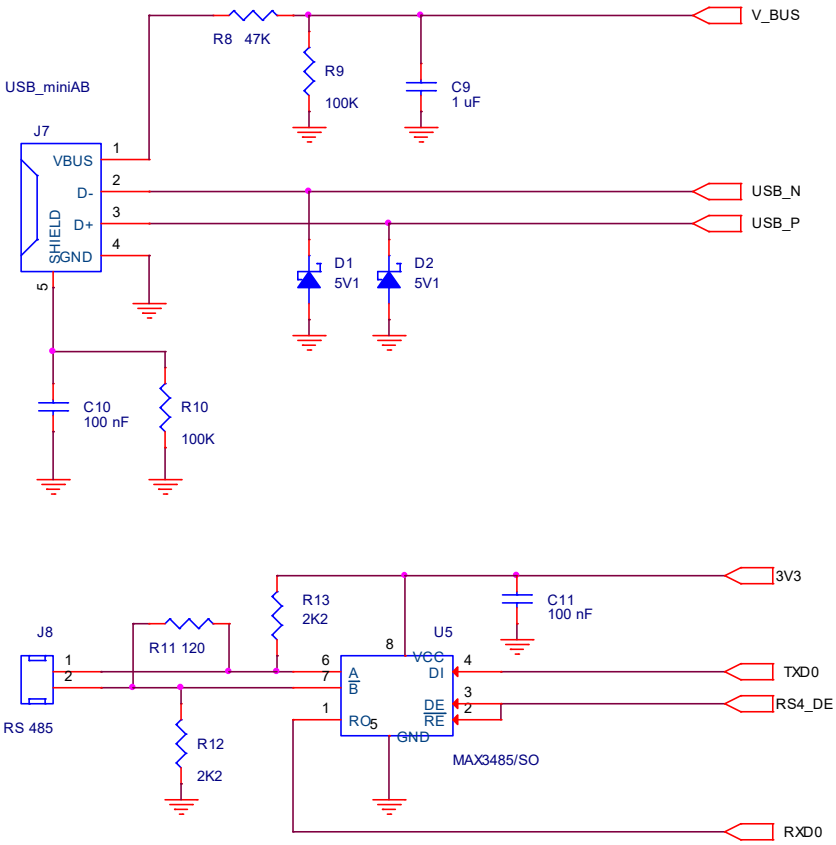


Fig.5. USB and Rs485 Communications.

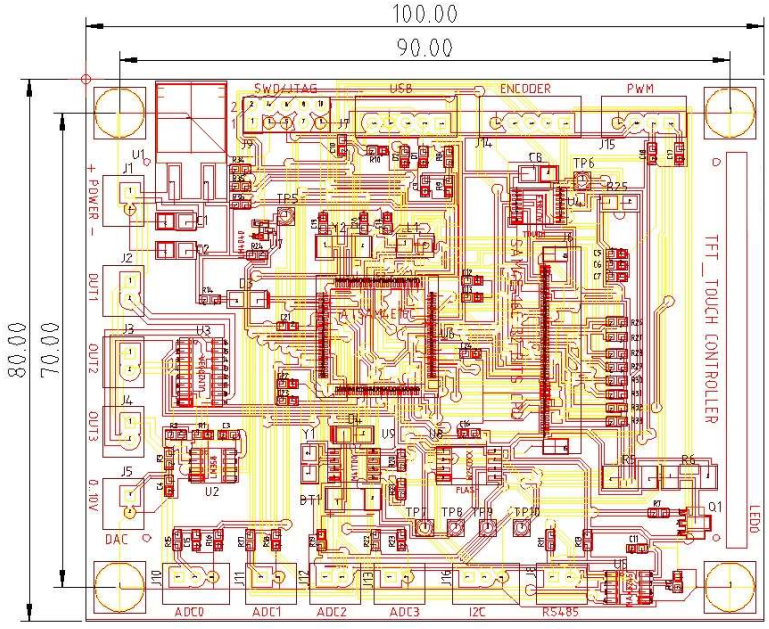
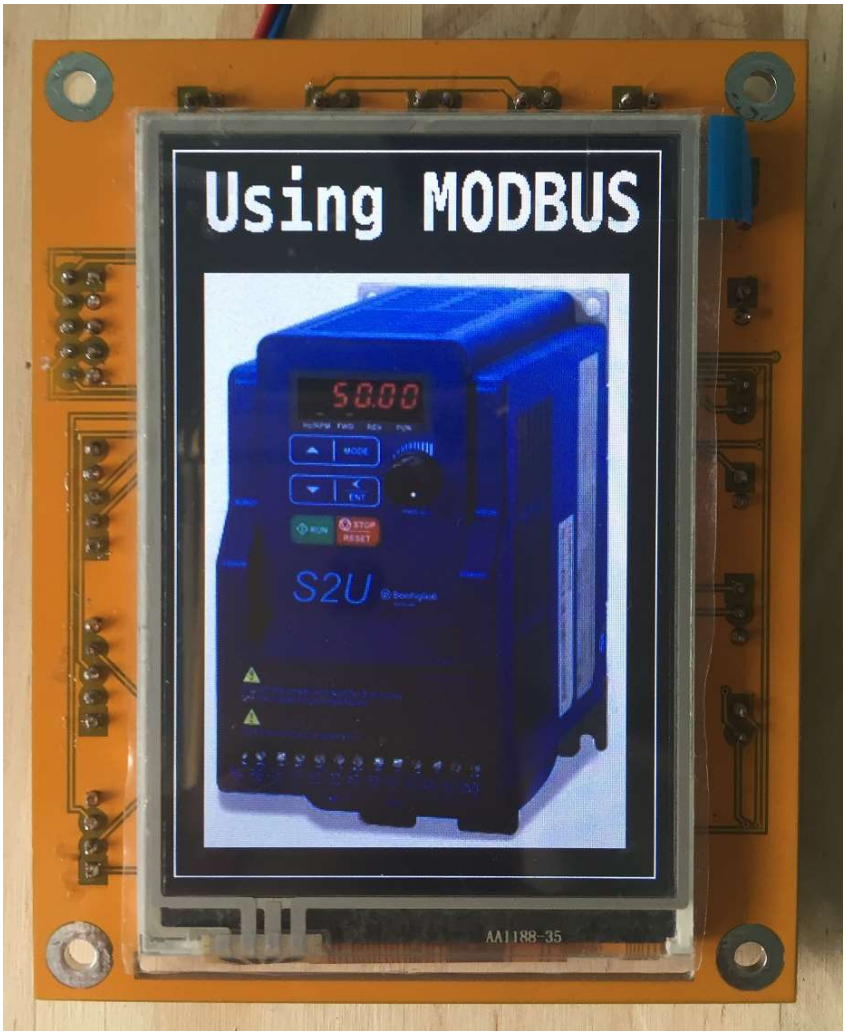


Fig.6. Board outline.

MODBUS RS485 EXAMPLE PROJECT



SAM TFT3.5 TOUCH Board Sample Application

The example shows the control of the Bonfiglioli S2U drive, through the Rs485 bus, using the Modbus Rtu protocol.

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A simple application that shows the communication functionalities of the module

SAM TFT3.5 TOUCH from Ledoelectronics. It allows you to send commands to the drive, and read its status.

Fig.1. Display and Keyboard

Board resources used in the application

1. Timer TC0.

2. Timer TC1.

3. USART0 and Rs485 transceiver.

4. TFT display and touch screen. They are used for data input and output, as a user interface.

5. USB interface. Only for bitmap transfer from the PC to the Flash of the board.

6. 16 MB external flash memory. Image storage.

7. Real Time Controller of the CPU (RTC). Used as a time base.

8. Ports, SPI interface. Communication between chips.

El código fuente del proyecto puede ser bajado de la zona de descargas de la web www.ledoelectronics.com

Programming

The project can be compiled in any commonly used IDE: Atmel Studio, IAR Compiler, Codevision AVR etc.

The application can be transferred to the micro in two ways:

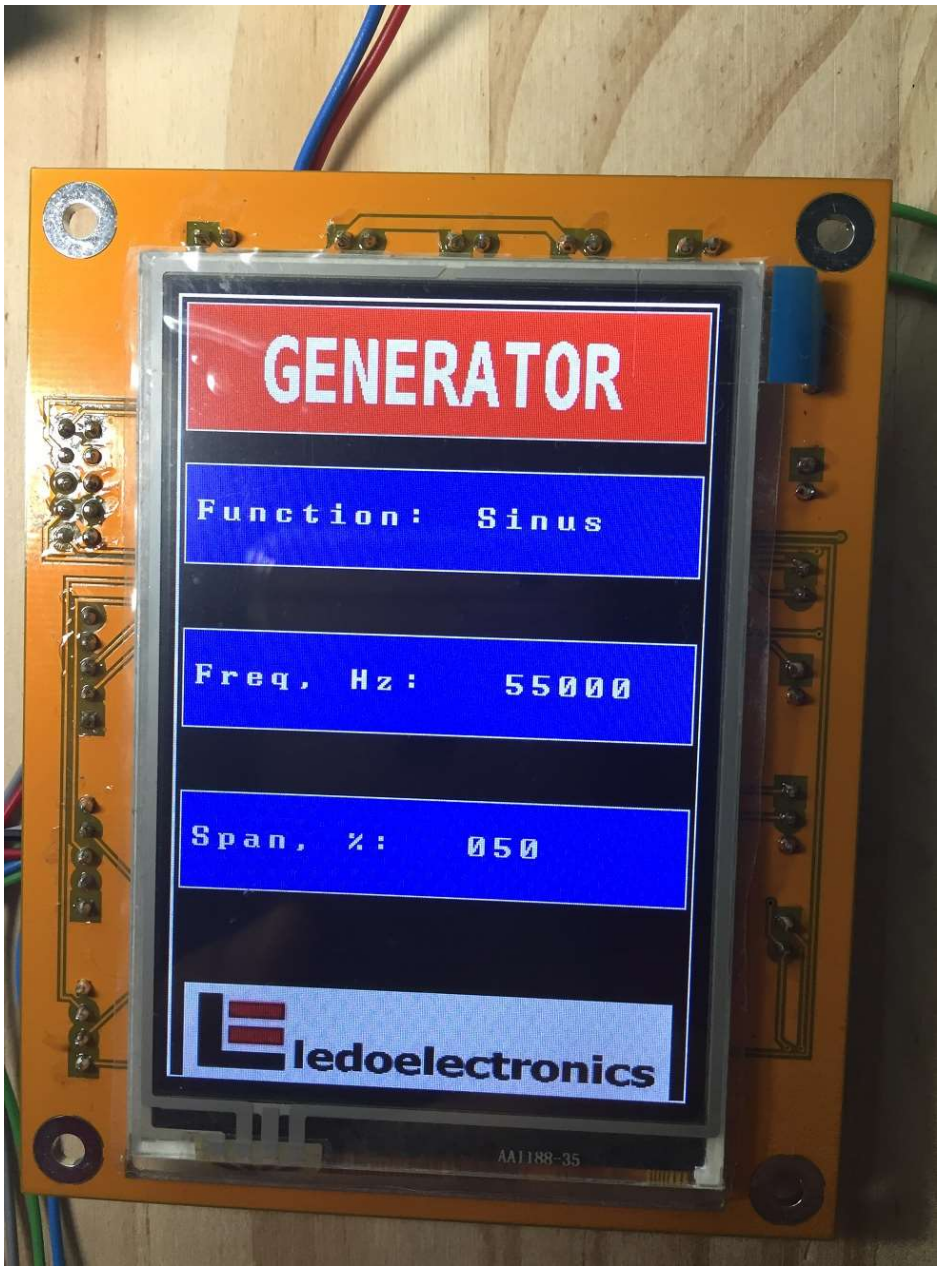
1. Without the need to use any external programmer, through SamBa. To do this, the board is put into bootloader mode by short-circuiting pins 2 and 3 of connector J16 (I2C) during startup. In this case, only a USB cable is required between the PC and the board.

2. Using any Atmel programmer, such as Atmel_ICE.

Conclusions:

The code was successfully tested with a real S2U drive. Parameter read and write, motor start and stop operations, as well as speed adjustment were performed.

MULTIWAVE SIGNAL GENERATOR



SAM TFT3.5 TOUCH Board Application Example

- **Sinus, Sawtooth, Triangle and PWM waves Generation**
- **Adjustable Frequency, Amplitude and Duty cycle**
- **1 Hz to 58000 Hz Frequency Output**
- **Atmel Studio 7.0 C++ Project**

Ing. José Emilio Ledo Galano

This application uses some of the resources of the Ledoelectronics **SAM TFT3.5 TOUCH** board to implement a signal generator, which can be used for educational purposes, or as a non-professional instrument, in an Electronics workshop.

The type of curve, and its parameters such as amplitude, frequency and duty cycle, can be adjusted from zero to maximum, in a very easily accessible way. They can be entered directly from the touch keyboard, or through an encoder inserted in connector J14.

The Encoder allows you to gradually modify both the frequency and the duty cycle throughout its range, something very comfortable, for testing electronic circuits.

Fig.1. Main Screen.

Board resources used in this application

1. Timer TC1. Set the sampling frequency, to make up the generator output wave.

2. TC1 TIO Signal. DAC conversion begins.

3. PDM Controller. Access data without CPU intervention.

4. Channel 0 of the DAC Converter. Generate the analog wave.

5. Analog output 0… 10V (connector J5). DAC amplified signal, constitutes the physical output of the generator.

6. TFT display and touch screen. They are used for data input and output, as a user interface.

7. Rotary encoder. Data entry, user interface.

8. USB interface. Only for bitmap transfer from the PC to the Flash of the board.

9. 16 MB external flash memory. Image storage.

10. Real Time Controller of the CPU (RTC). Used as a time base.

11. Ports, SPI Interface. Communication between chips.

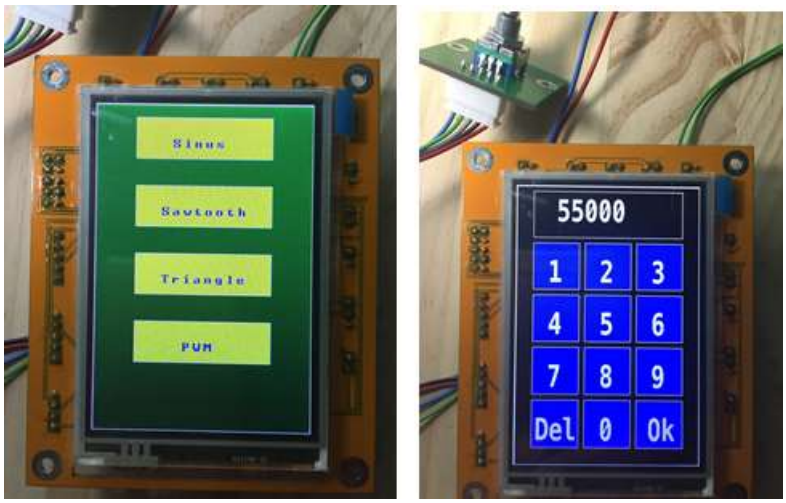


Fig.2. Touch Pannel data entry.

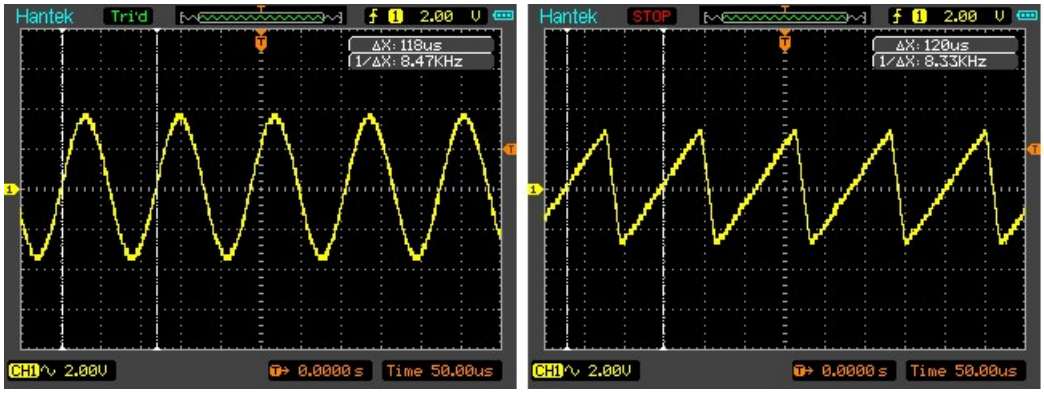


Fig.3. oscillograms of generated signals.

The Project source code can be downloaded from the download area of the web www.ledoelectronics.com

Programming

The project can be compiled in any commonly used IDE: **Atmel Studio**, **IAR Compiler**, **Codevision AVR** etc.

The application can be transferred to the micro in two ways:

1. Without the need to use any external programmer, using **SamBa**. To do this, the board is put into bootloader mode by shorting pins 2 and 3 of connector J16 (I2C)

during startup. In this case, only a USB cable is required between the PC and the board.

2. Using any Atmel programmer, such **as Atmel_ICE**.

Conclusions:

This is one of the various applications of the Xmega TFT3.5 Touch module. Although it may be useful on a practical level, its main purpose is educational, since the frequency of the output signal does not exceed 60 kHz. The sine wave has 32 points per period.

REAL TIME TIMER

SAM TFT3.5 TOUCH Board Application Example

- **Real time clock with non-volatile and adjustable date and time**
- **Adjustable on and off times up to the second**
- **Output compatible with all solid state relays, and Ledoelectronics power boards**
- **Atmel Studio 7.0 C ++ Project**

Ing. José Emilio Ledo Galano

This application uses some of the resources of the SAM TFT3.5 TOUCH board from Ledoelectronics, to implement a Timer, capable of activating and deactivating a load at the scheduled time and day of the week.

Fig.1. User interface.

Setting the date and time, as well as the ON and OFF times, is very simple. You just have to hold down the area of the screen, where the variable you want to modify is located.

The setting is independent for each of the following parameters:

1. day
2. Time
3. minutes
4. Seconds
5. Enable / Disable

To enable or disable the timer, you need to click on the left half of the yellow stripe on the main screen. If you click on the right half, then the configuration screen for the ON and OFF times appears.

Can be combined with a Solid State Relay (SSR), or with any of the Ledoelectronics power boards, to control loads up to 90 A.

Board resources used in the application

1. RTC M41T00S with backup supercap

2. OUT1 digital output.

3. TFT display and touch screen. They are used for data input and output, as a user interface.

4. USB interface. Only for bitmap transfer from the PC to the Flash of the board.

5. 16 MB external flash memory. Image storage.

6. Real Time Controller of the CPU (RTC). Used as a time base.

7. Ports, SPI Interface. Communication between chips.

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Programming

The project can be compiled in any commonly used IDE: **Atmel Studio**, **IAR Compiler**, **Codevision AVR** etc.

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2. Using any Atmel programmer, such **as Atmel_ICE**.

Conclusions:

This is one of the various applications of the Xmega TFT3.5 Touch module.

The code has been successfully tested.