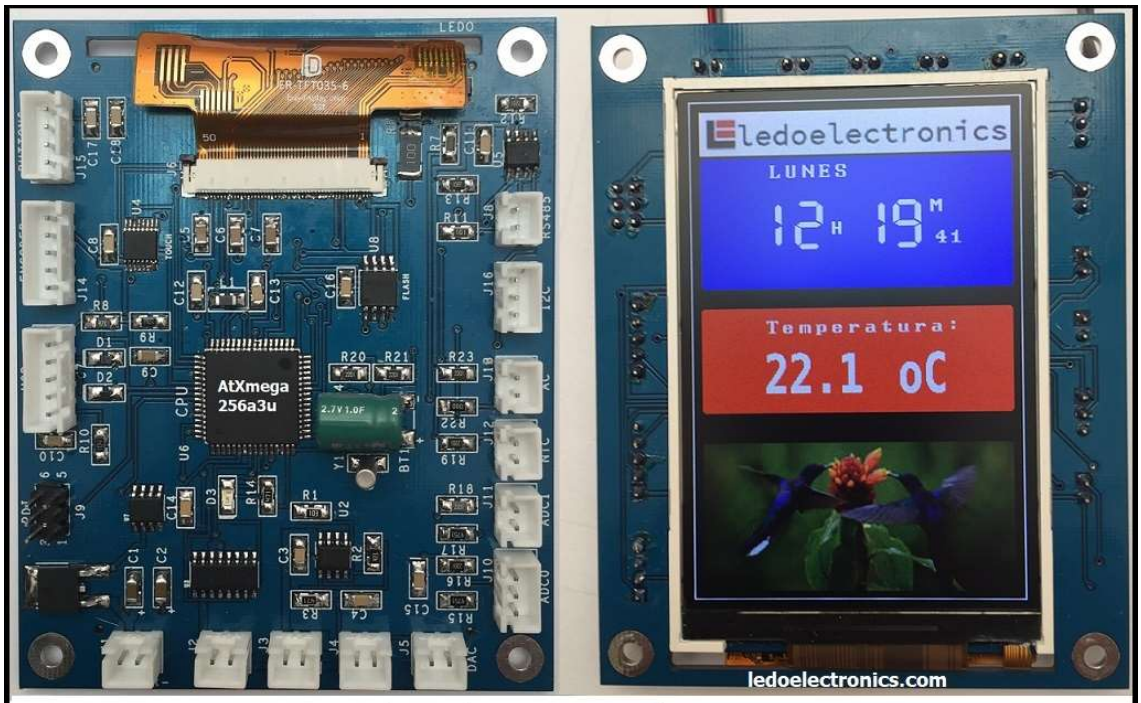
XMEGA256A3U TFT3.5 TOUCH BOARD



For those who program in C / C ++

AVR Xmega Control System. Compact and powerful, with sample applications.

Hardware

- **Control system based on the Xmega256a3u**

Flash: 256 KB RAM: 16 KB, EEPROM 4 KB, etc.

- **East Rising 3.5" 320x480 TFT color display with integrated ILI9488 controller from BuyDisplay.com**
- **Resistive touch screen with AD7843 controller**
- **16 MBytes flash memory to store data or images**
- **Real time clock with calendar and backup supercap**
- **Two 12-bit analog inputs, 0... 2.048V, 0... 10V, 4-20 mA**
- **One 12-bit analog input 0... 2.048V or analog comparator**
- **A 12-bit analog input for Ntc / Ptc Thermistor**
- **An analog 0... 10V 12-bit output**
- **Between five and 11 digital 3.3V inputs / outputs**
- **Encoder connectors and push buttons**
- **Three digital outputs 0 / 12V 500 mA with ULN2003A**

Ing. José Emilio Ledo Galano

- **USB Device 2.0 communication**
- **Rs485 communication**
- **I2C communication**
- **You don't need a programmer. Resident bootloader allows programming with USB cable**
- **PDI connector for programming in system**
- **12V supply voltage (from 9V to 15V DC)**
- **Maximum consumption current 120 mA**
- **Compact design. 100mm x 80mm**

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 to represent 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**
- **It can be programmed with Atmel Flip (without programmer), or with any programmer compatible with Atmel Studio.**

Applications

- **Temperature control (Incubators, Refrigerators).**
- **Data recording in real time.**
- **Timers.**
- **Automatic pumping.**
- **Automation control.**
- **Sequencer.**
- **Ventilation system.**
- **Dosage.**
- **Wave generator of different shapes, up to a frequency of 20 kHz.**
- **MODBUS master / slave.**
- **Remote display / keyboard.**
- **Remote sensor.**
- **Stepper motor control (optional, requires expansion module).**
- **PWM control.**
- **PID control.**
- **Pulse counter**
- **Student training kit**
- **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 signals. It has a 12-bit digital analog converter up to 2 Msps, with a highly stable external reference source Vref = 2.048V. The ADC has four channels enabled, so four signals can be measured simultaneously. The first two channels have voltage dividers, to adapt to the levels required by the application.

The presence of the real-time clock with calendar, and the 16 MByte flash memory allow the implementation of a real-time data logger. The USB bus enables 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 or solid-state relays, facilitate the implementation of a PID for the control of temperature, humidity, pressure, etc. or the speed regulation of a motor using frequency 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 graphic color display with a resolution of 320x480, with a 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 using simple commands such as drawBitmap (..), printChar (..), printString (…), drawLine (..), drawRect (..), drawCircle (..), etc.

Using a Windows application, images can be transferred from a PC to the flash memory of the board through the Usb bus.

Xmega Tft3.5 Touch module Schematics

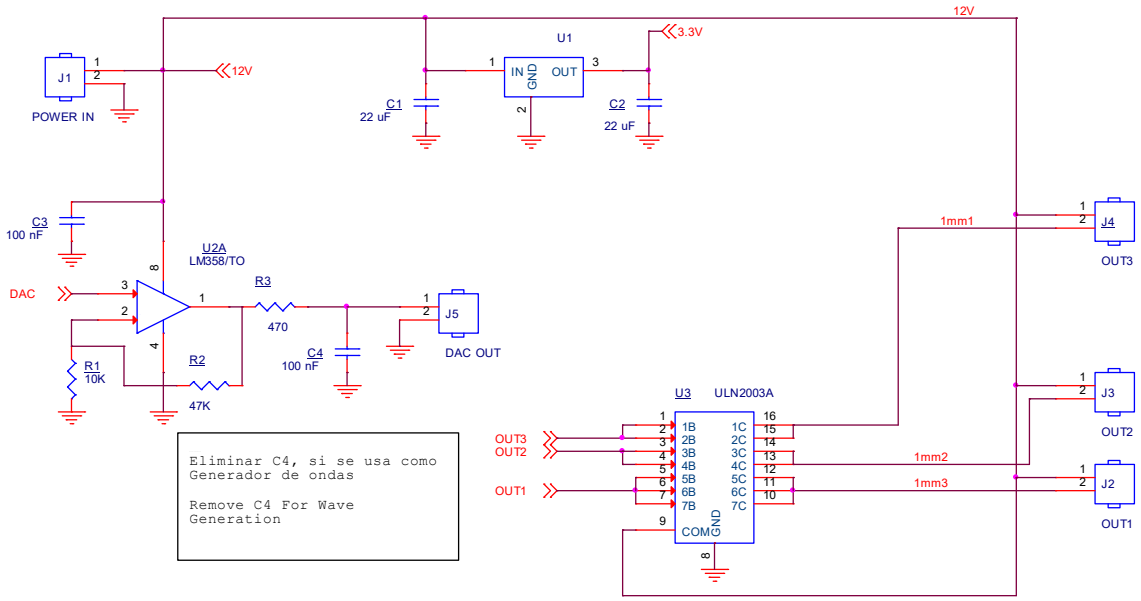


Fig.1. Power supply and Outputs.

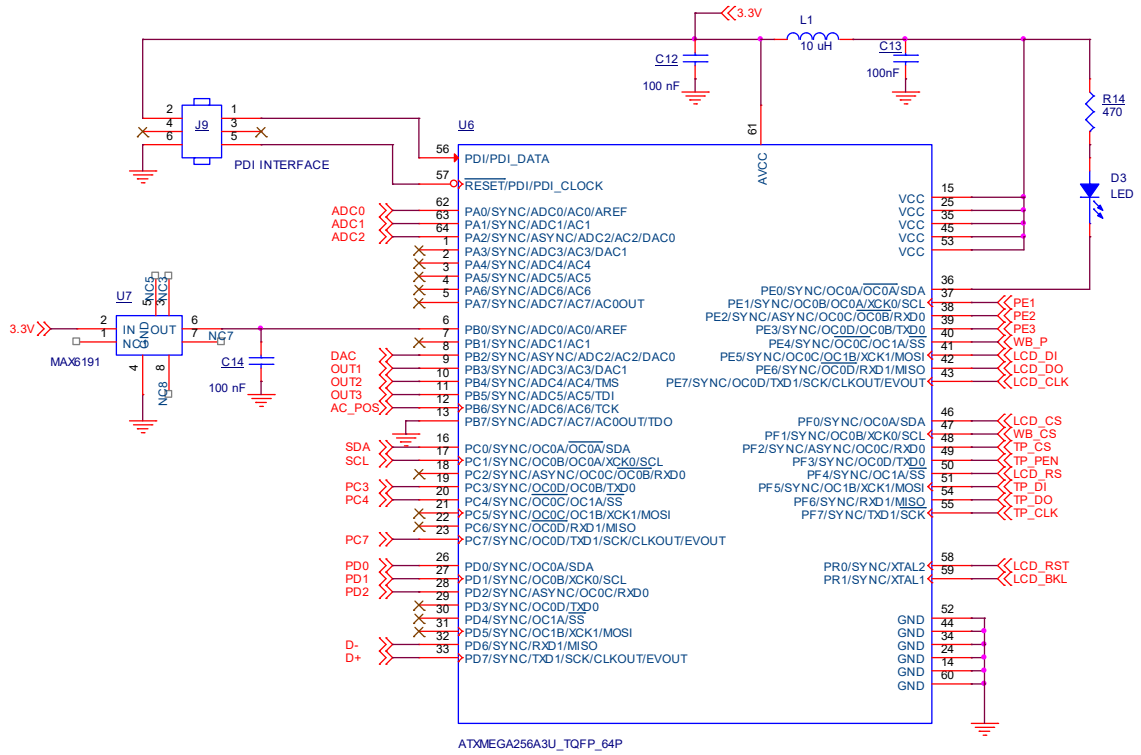


Fig.2. CPU

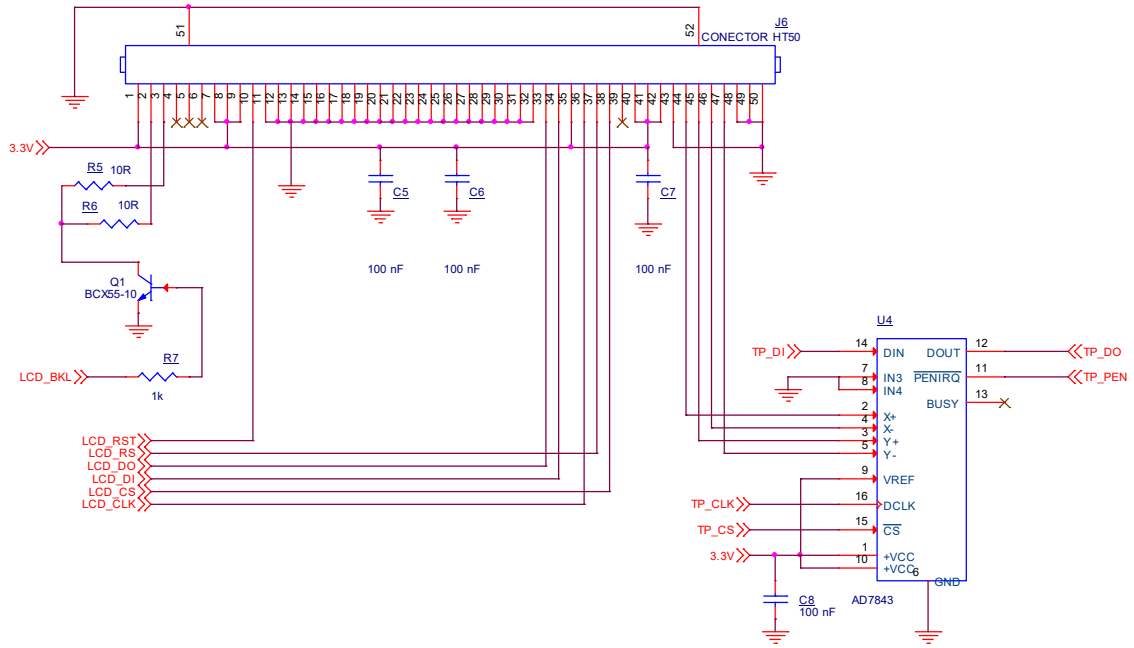


Fig.3. TFT and Touch Screen.

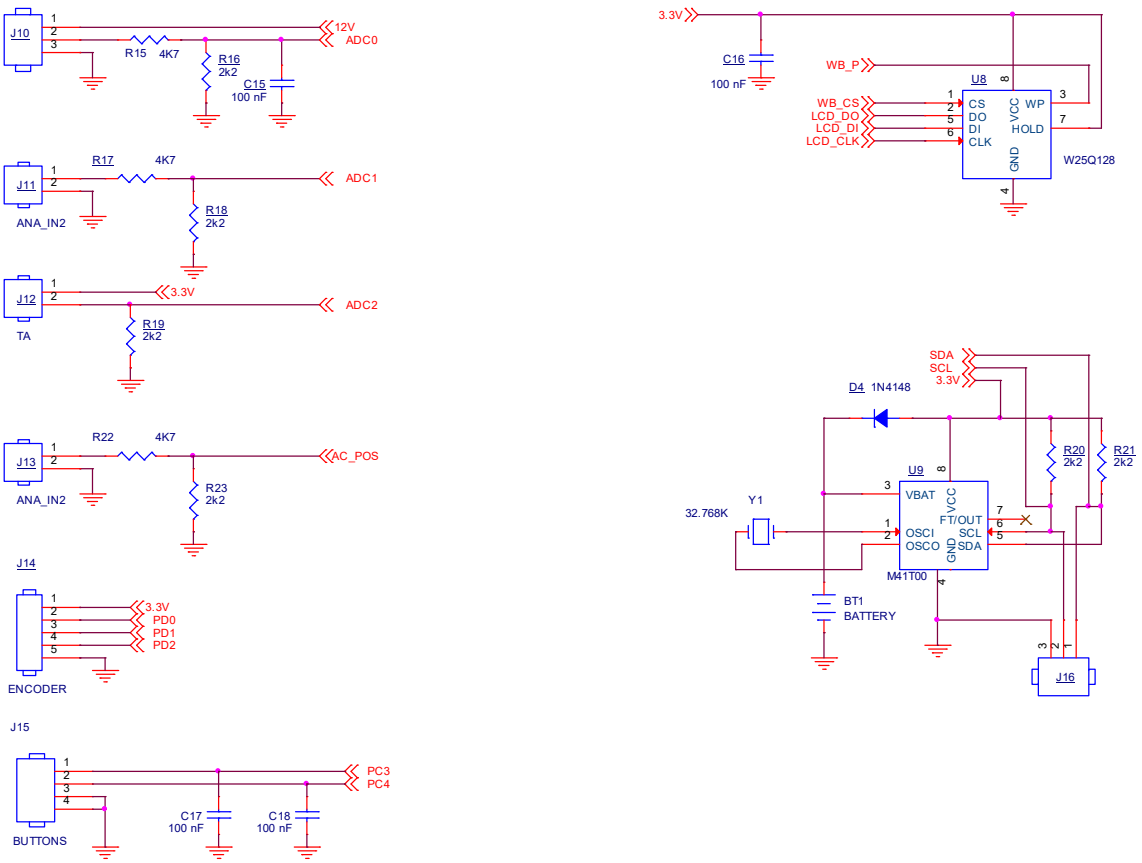


Fig.4. Connectors. RTC and external Flash.

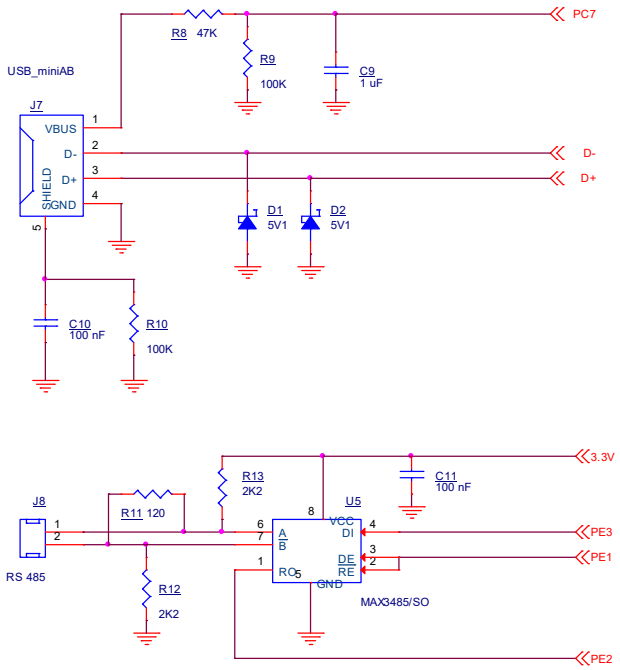


Fig.5. USB and Rs485 Communications.

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 Atmel Flip. 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. Making use of any Atmel programmer, such as **Atmel_ICE**, or **AVRISP-MKii**. For this, the module has the PDI interface.

Fig.6. Board outline.

Accessories

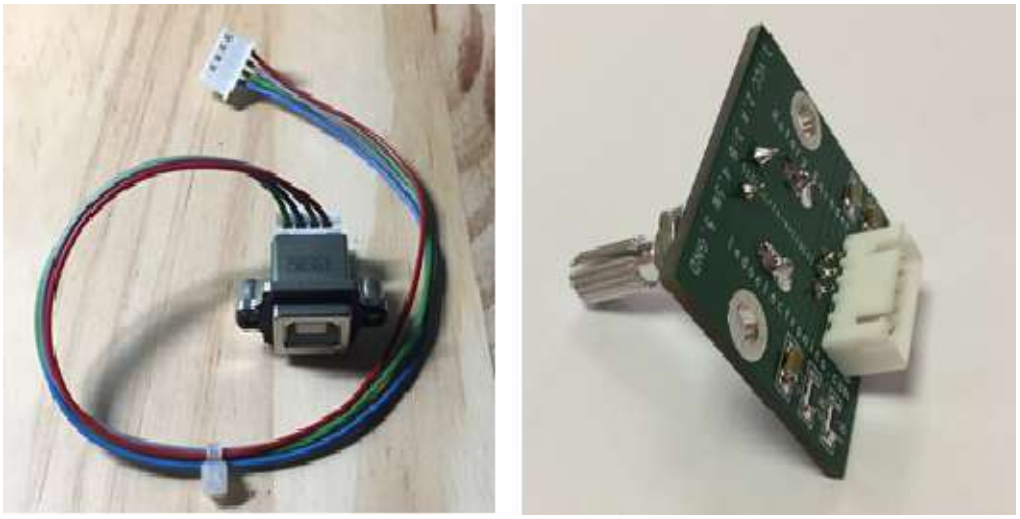


Fig. 7. USB connector and rotary encoder, manufactured by Ledoelectronics.

Limitations

Without a doubt, this module is one of the most attractive on the market, due to its quality / price ratio, resources, connectivity, power and versatility. Its weak point is Screen refresh rate. It is controlled by the 8 MHz SPI serial bus. Each pixel requires about 20 uS. This is not a problem, to update variables, and small areas of the display, but a change of its 153600 pixels takes about three seconds.

For more dynamic graphics applications, we recommend one of the two Ledoelectronics modules, with a 32-bit ARM processor. The **SAM TFT3.5 TOUCH**, or the **SAM TFT4.0 TOUCH**.

These boards are very similar to the **Xmega Tft3.5 Touch**, in terms of resources, but their processor is much more powerful, and the display is controlled by a 16/18-bit parallel bus. The **SAM TFT4.0 TOUCH** has a resolution of 800x480, and also has CAN Bus.

Example projects

Several standard applications are offered below to help familiarize you with the module and to give you an idea of its power and versatility.

All C ++ projects have been compiled by the free Microchip Atmel Studio 7.0 IDE.

The source code of all applications can be downloaded for free from the download area of www.ledoelectronics.com.

REAL TIME CLOCK

Xmega TFT3.5 Touch Board Application Example

- **Real time clock with non-volatile and adjustable date and time**
- **Measurement of ambient temperature**
- **Atmel Studio 7.0 C ++ Project**

Ing. José Emilio Ledo Galano

This application uses some of the resources of the Xmega TFT3.5 Touch board from Ledoelectronics, to implement a clock with calendar, and measurement of the ambient temperature.

Setting the date and time is very simple. It is done using a rotary encoder, in this case we have used the PEC11R from Ledoelectronics, which is compatible pin-to-pin with the J14 connector on the board. The encoder button is used to navigate between the parameters, and the wheel is used to modify their values.

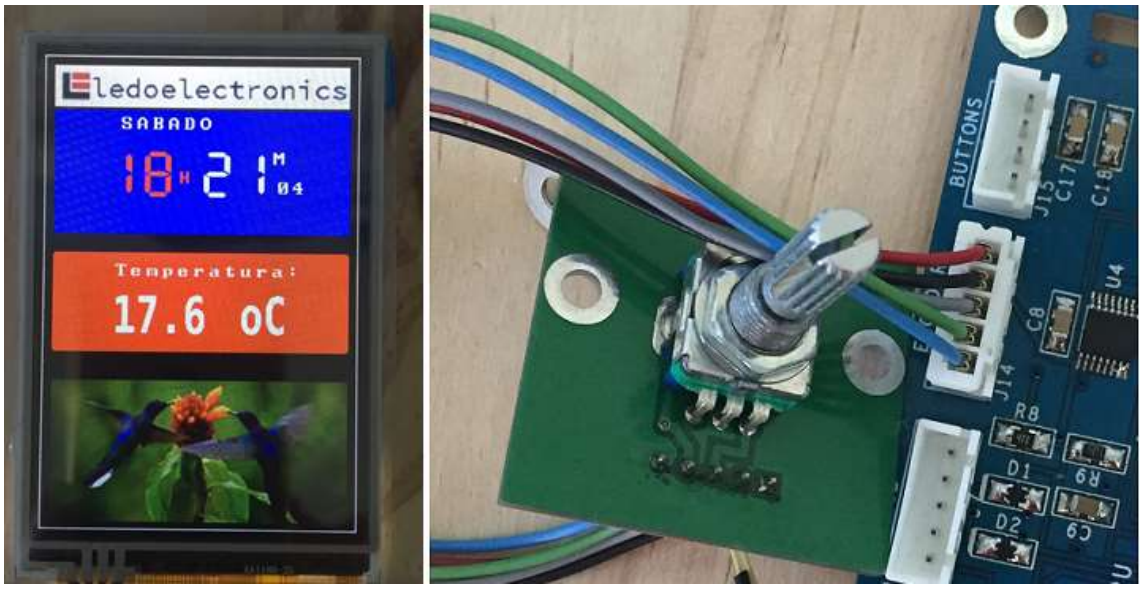


Fig. 1. Modifying the hours.

The setting is independent for each of the following parameters:

1 day

2. Hours

3 minutes

4. Seconds

Board resources used in the application

1. RTC M41T00S with backup supercap

2. ADC Converter and NTC Input

3. TFT display for data output, as 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.

8. Rotary Encoder.

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 **Atmel Flip**. 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**, or **AVRISP-MKii**. For this, the module has the PDI interface.

Conclusions:

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

It has been designed for educational purposes, to show the operation of the real time clock present in the module.

PID REGULATOR

Xmega TFT3.5 Touch Board Application Example

- **Temperature regulator with PID algorithm**
- **Fully configurable from touch screen**
- **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 **Xmega TFT3.5 Touch** board from Ledoelectronics, to implement a PID temperature regulator, capable of working in heating or cooling modes.

Fig.1. User Interface.

All the configuration parameters are modified by means of the touch screen and the numerical keyboard, as we can see in fig. 1.

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. CPU timers for PWM modulation

2. CPU calculation potential

3. ADC converter and NTC input

4. OUT1 digital output

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

6. USB interface. Only for bitmap transfer from PC to Flash on the board

7. 16 MB external flash memory. Image storage.

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

9. Ports, SPI Interface. Communication between chips.

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 **Atmel Flip**. 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.

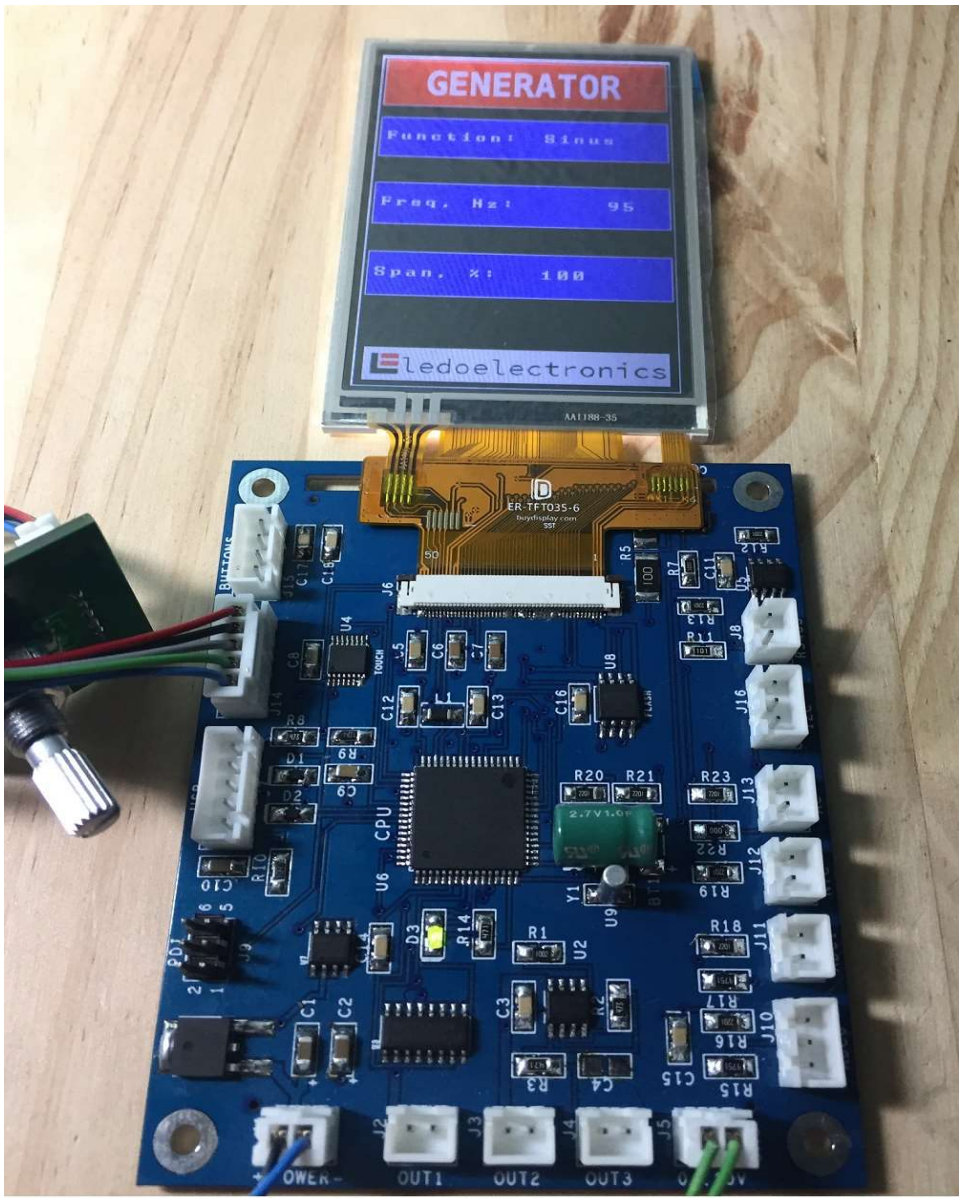
2. Using any Atmel programmer, such **as Atmel_ICE**, or **AVRISP-MKii**. For this, the module has the PDI interface.

Conclusions:

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

This temperature regulator, in combination with a solid state relay, or with any of the Ledoelectronics power boards, can be used for temperature control in domestic and industrial applications.

MULTIWAVE SIGNAL GENERATOR



Xmega TFT3.5 Touch Board Application Example

- **Sinus, Sawtooth, Triangle and PWM waves Generation**
- **Adjustable Frequency, Amplitude and Duty cycle**
- **1 Hz to 10000 Hz Frequency Output**
- **Atmel Studio 7.0 C++ Project**

Ing. José Emilio Ledo Galano

This application uses some of the resources of the Ledoelectronics Xmega 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 TCE0. Set the sampling frequency, to make up the generator output wave.

2. Event System Controller. DAC conversion begins.

3. DMA Controller. Access data without CPU intervention.

4. Channel 0 of the DACB 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.

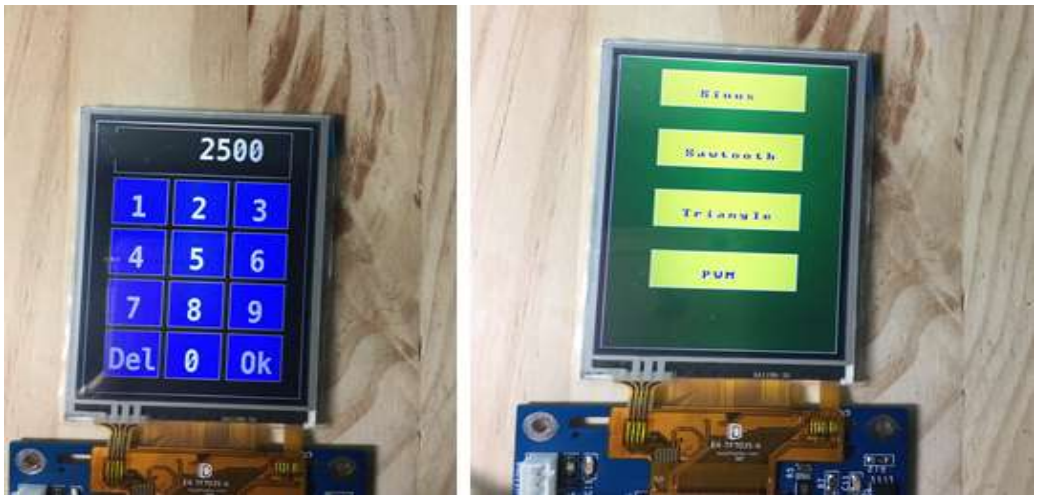


Fig.2. Touch Pannel data entry.

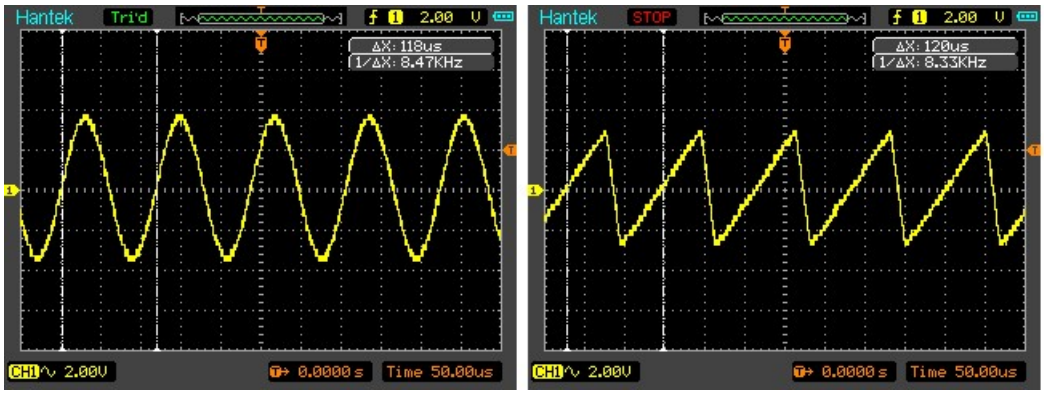


Fig.3. oscillograms of generated signals.

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 **Atmel Flip**. 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**, or **AVRISP-MKii**. For this, the module has the PDI interface.

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 20 kHz. For practical use, it is recommended to use the similar Ledoelectronics SAM TFT3.5 Touch module, which features a 32-bit ARM CPU.

REAL TIME TIMER

Xmega 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 Xmega 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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2. Using any Atmel programmer, such **as Atmel_ICE**, or **AVRISP-MKii**. For this, the module has the PDI interface.

Conclusions:

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

The timer, in combination with the Le-SR240V-5A board, is being used successfully to control the lighting of a fish tank.