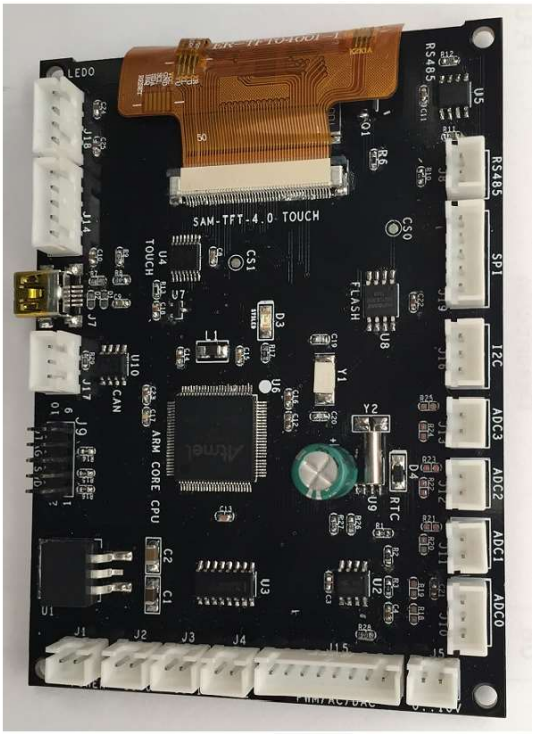
SAM TFT4.0 TOUCH BOARD



Hardware

• Control system based on the ATSAM4E-16C

32 bit Arm with floating point

• East Rising 4.0" 480x800 TFT color display with integrated NT35510 controller from BuyDisplay.com

Controled by parallel interface of 16/18 bits

• Resistive touch screen with AD7843 controller

• External memory of 16 MBytes to store data or images

• Real-time clock with calendar and supercap backup

• 5 analog inputs of 12 bits, 0 ... 2.048V, 0 ... 10V, 4-20 mA

• An analog output 0 ... 10V of 12 bits

• Encoder and buttons connectors

• Three digital outputs 0 / 12V of 500 mA with ULN2003A

• Four PWM outputs

• USB Device 2.0 communication

• CAN BUS communication

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- **Communication Rs485**
- **I2C communication**
- **SPI bus with CS signal available**
- **Does not need a programmer. USB programming with SAM-BA Bootloader**
- **SWD / JTAG connector for programming with Atmel-ICE**
- **12V supply voltage (from 9V to 15V DC)**
- **Maximum consumption current 150 mA**

Software

- **Several examples programs in C 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, which allows to transfer Bitmaps from the PC to the flash memory of the board, through the USB bus. It also allows to take the micro to bootloader mode, for programming with Sam-ba.**

Applications

- **Industrial control systems of different degrees of complexity, guaranteed by the calculation power of the 32-bit micro with mathematical coprocessor, as well as by the versatility of the communications (USB, CANBUS, RS485, etc.)**
- **Control of different types of domestic and industrial equipment.**
- **Temperature control (incubators, refrigerators).**
- **Timers.**
- **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**
- **Etcs.**

The Board has been designed to guarantee high flexibility and comfort in its use. It has the necessary elements for the implementation of different control systems, which require the measurement of unipolar analog magnitudes. It has a 12-bit digital analog converter up to 2 Msps, with an external reference source of high stability Vref = 3.0V. The ADC has five channels enabled, so that five unipolar signals can be measured. Four 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 frequency inverter. The analog output can be used as a wave generator of various shapes and variable frequency.

The Rs485 and CAN Bus allow the expansion of the system, using any of the Ledoelectronics expansion modules or any standard module.

The presence of a color graphic display with a resolution of 480x800, 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, supplied with the board, the images can be transferred from a PC to the Flash memory of the board through the USB bus.

Electronic diagrams of SAM Tft4.0 Touch module

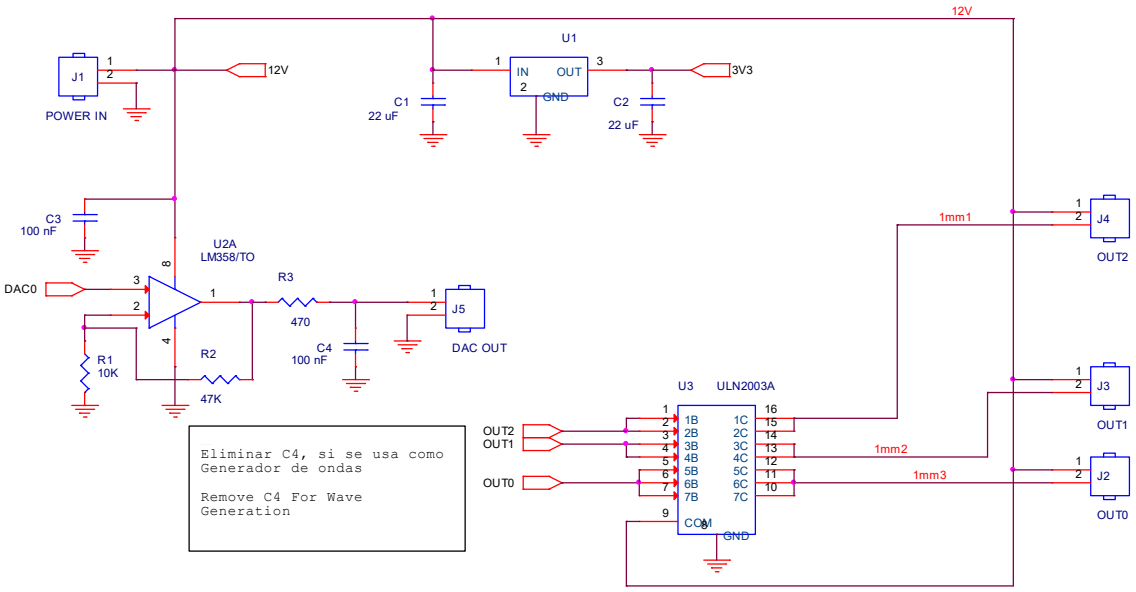

Fig.1. Power supply and Outputs.

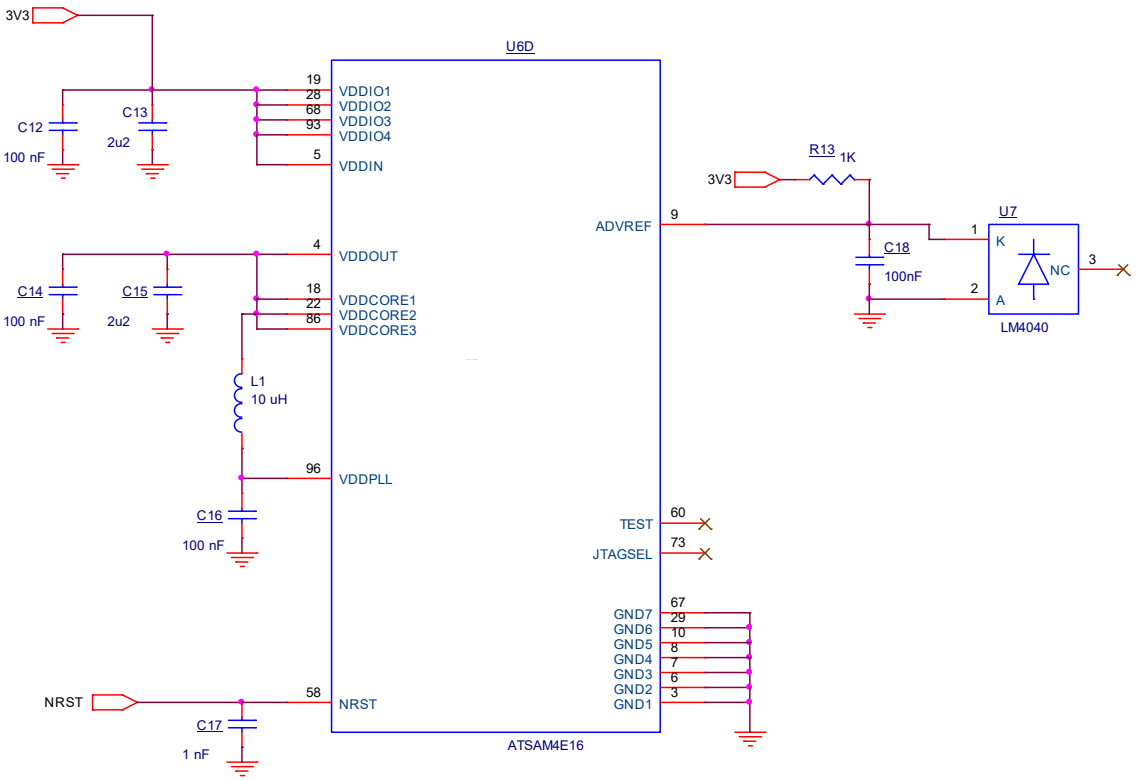

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Fig.2. CPU Core.

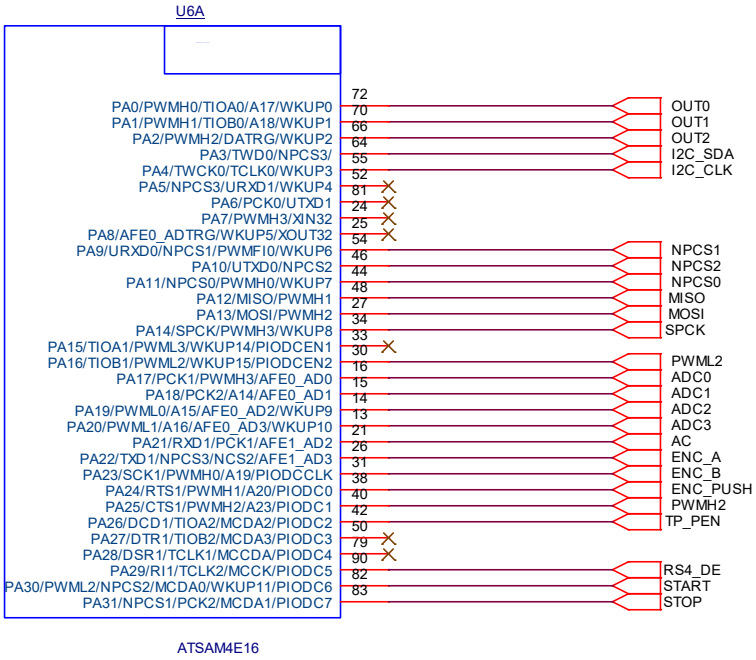
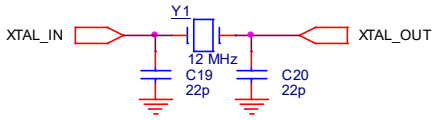


Fig.3. CPU PIOA



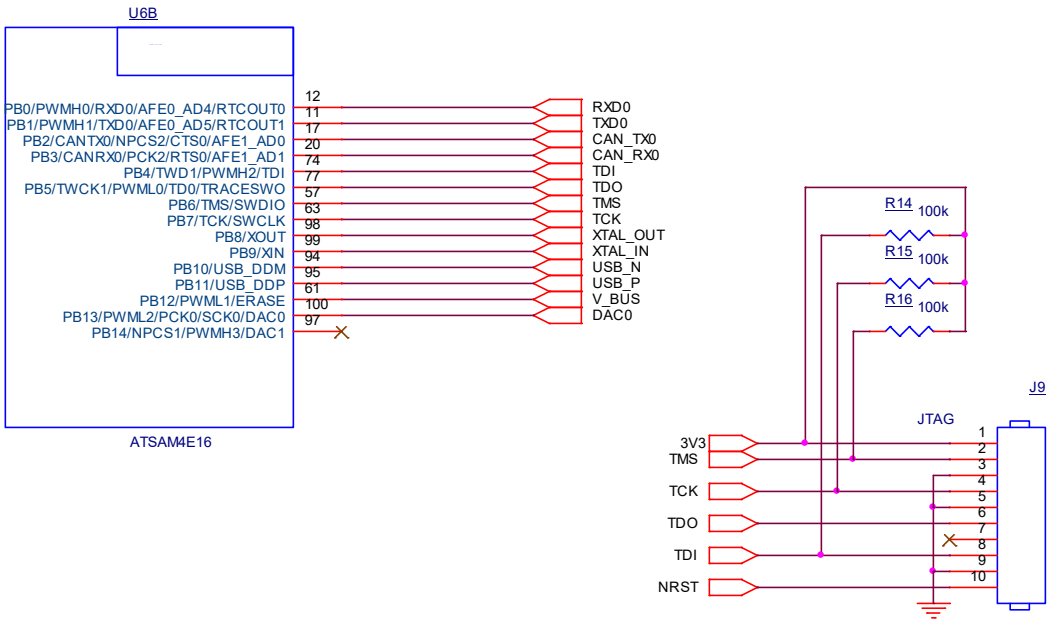


Fig.4. CPU PIOB

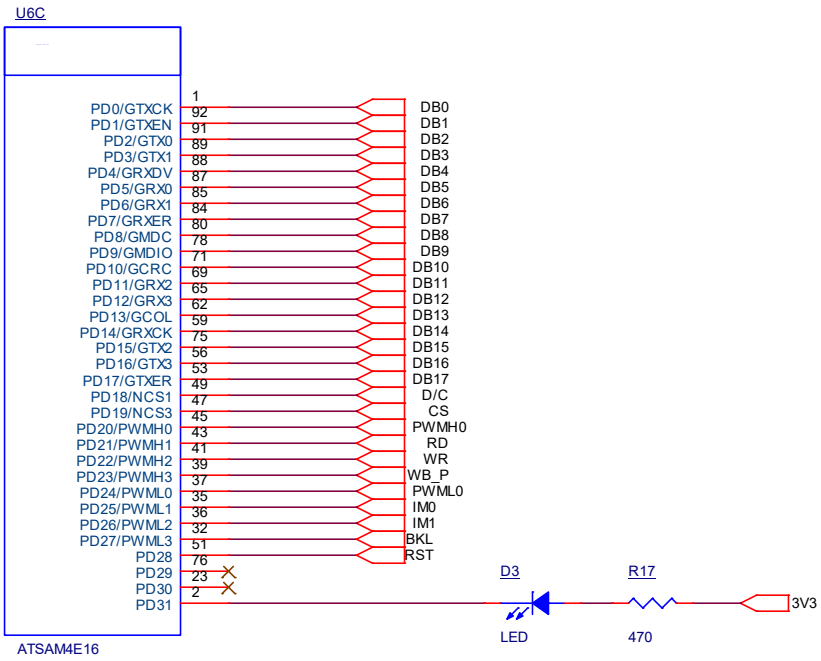


Fig.5. CPU PIOD

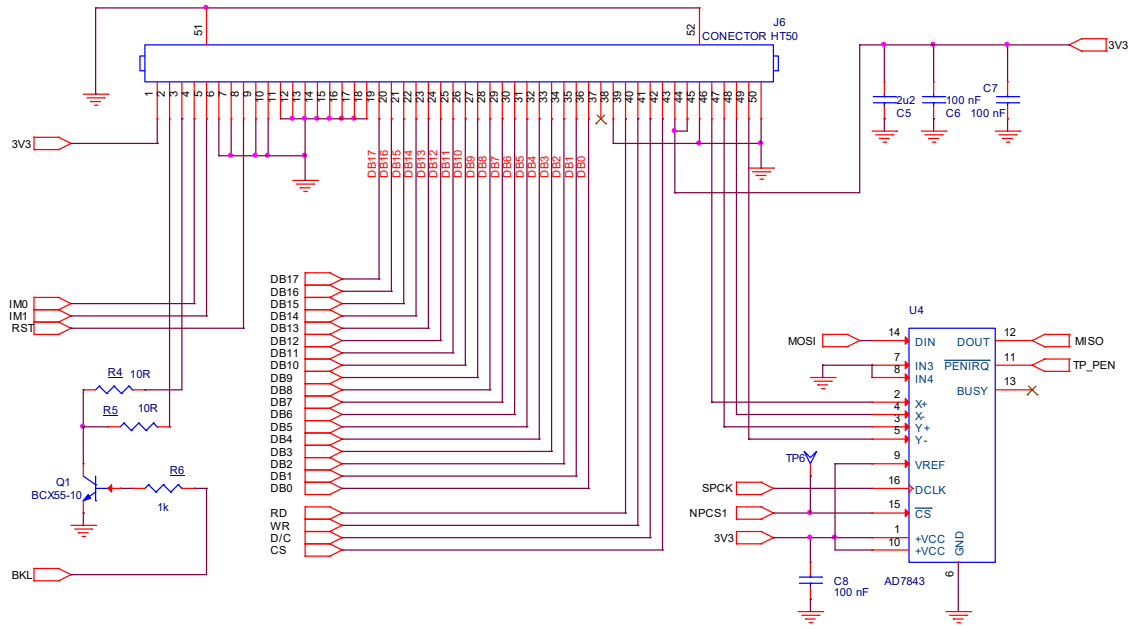


Fig.6. TFT and Touch Panel Controller.

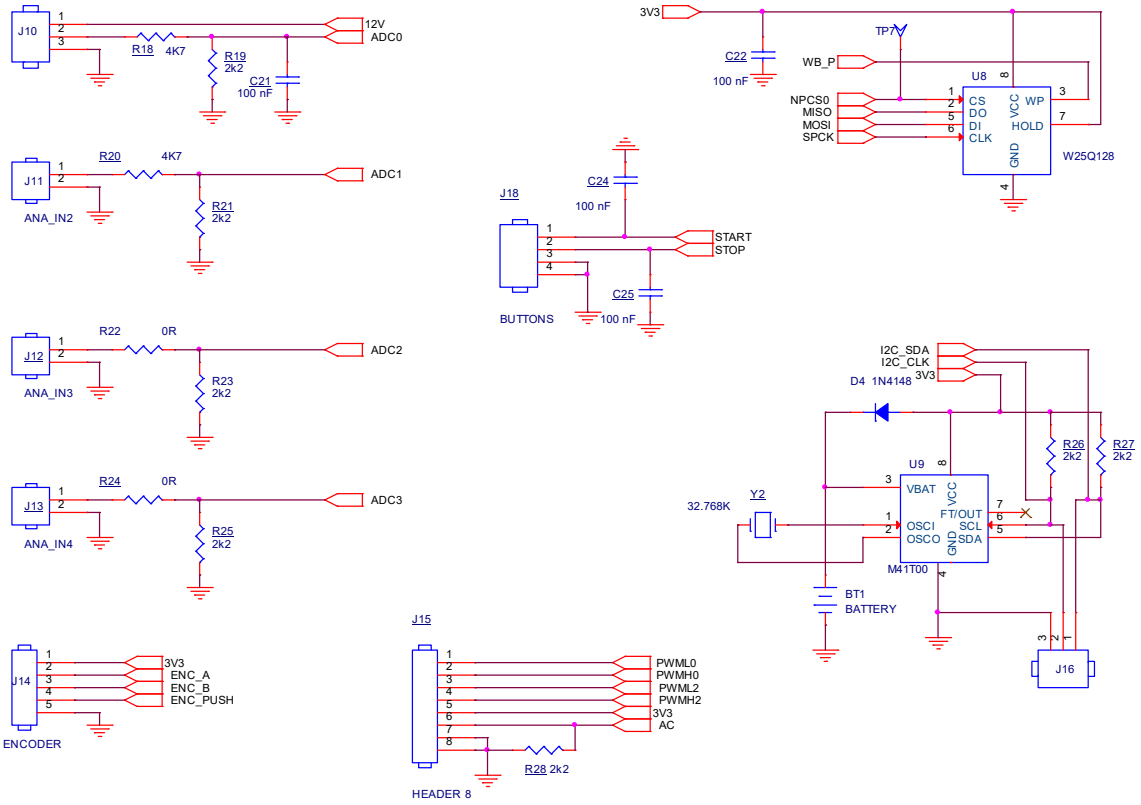


Fig.7. Connectors, RTC and External Flash.

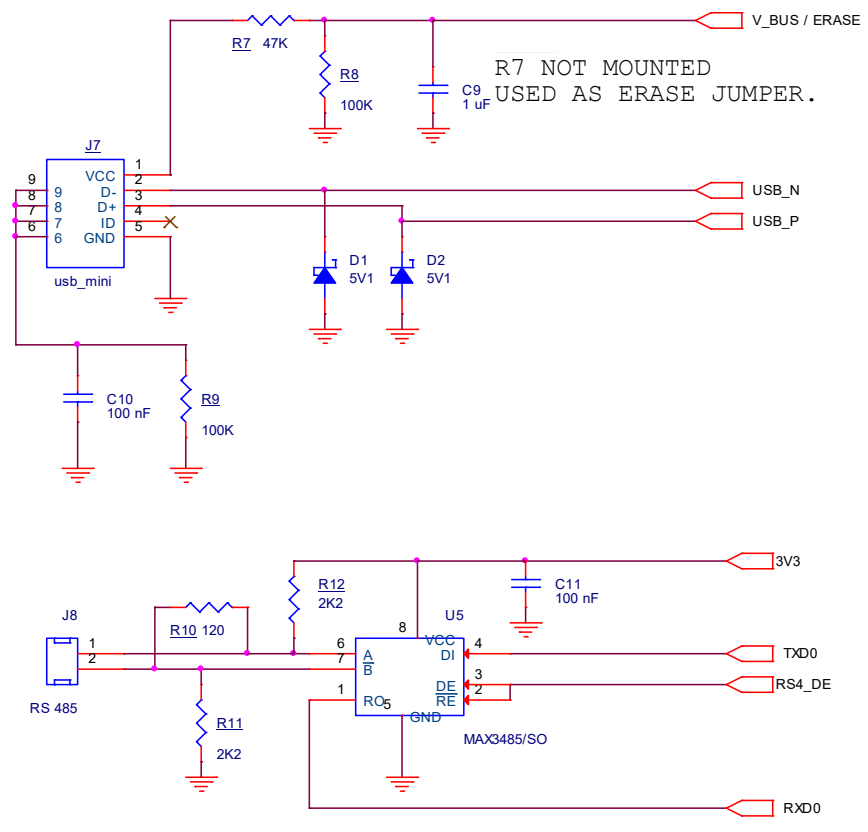


Fig.8. USB and Rs485 Communications.

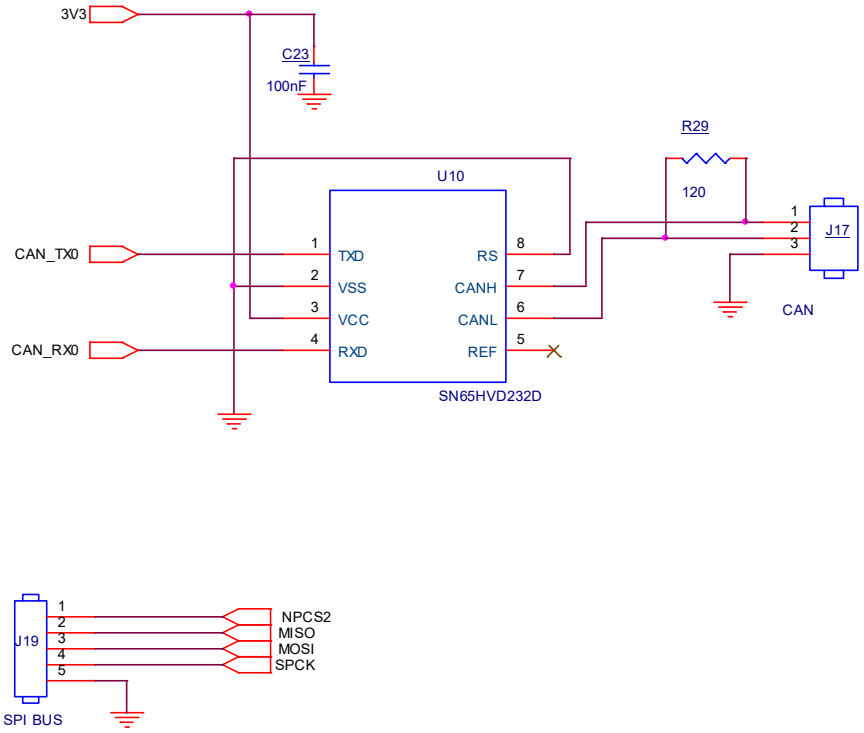


Fig.10. SPI Interface Connector.

Programming

The Program, compiled in the free IDE Atmel Studio 6xx - 7xx, or any other IDE can be transferred to the microcontroller, without the need of any programmer. Through the free utility SAM-BA Bootloader, downloadable from the Microchip website, only a mini USB cable is required to connect it to the PC.

The board is also compatible with Atmel programmers, such as the Atmel-ICE, through the 10-pin J9 JTAG / SW connector.

The SAM4E-16C can be brought into Bootloader mode, hardware (Erase jumper) and software, using Ledoelectronics utility Sam_tft_flash_prog.exe.

Expansion modules

The following expansion modules are available, compatible with the SAM_TFT4.0_TOUCH control system:

- Stepper motor control module (RS485).
- Control Module stepper motor (CAN Bus).

• Module with three temperature PID controllers (CAN Bus).
• CAN_IO Board inputs / outputs expander. 16 inputs and 18 digital outputs 0 / 24V DC.

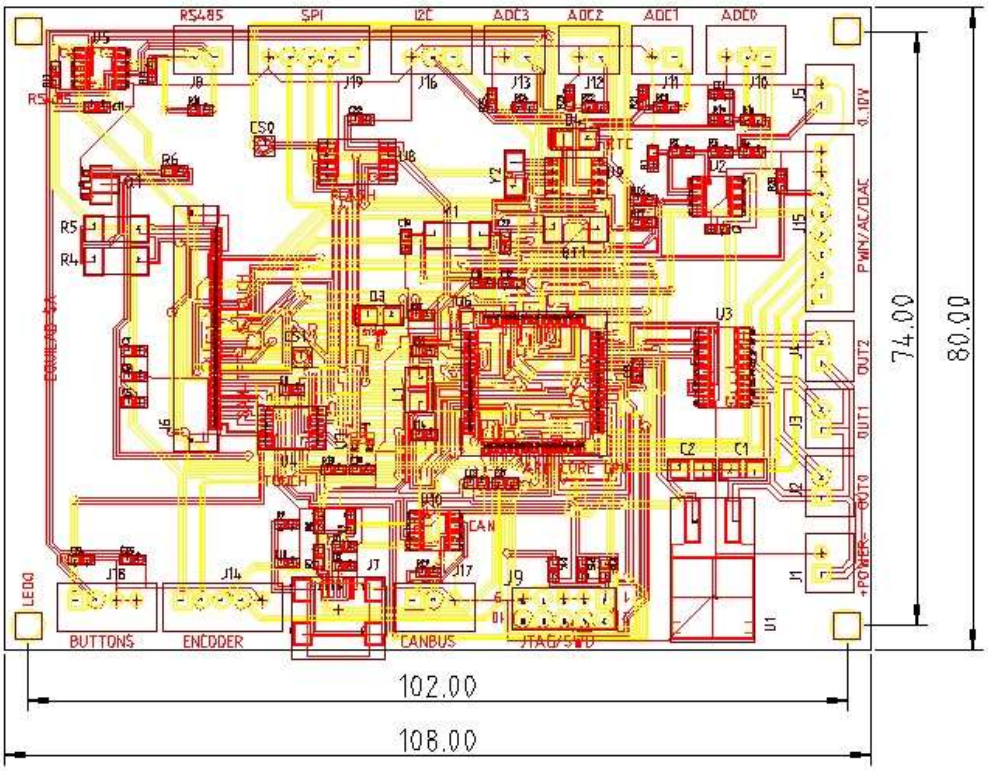
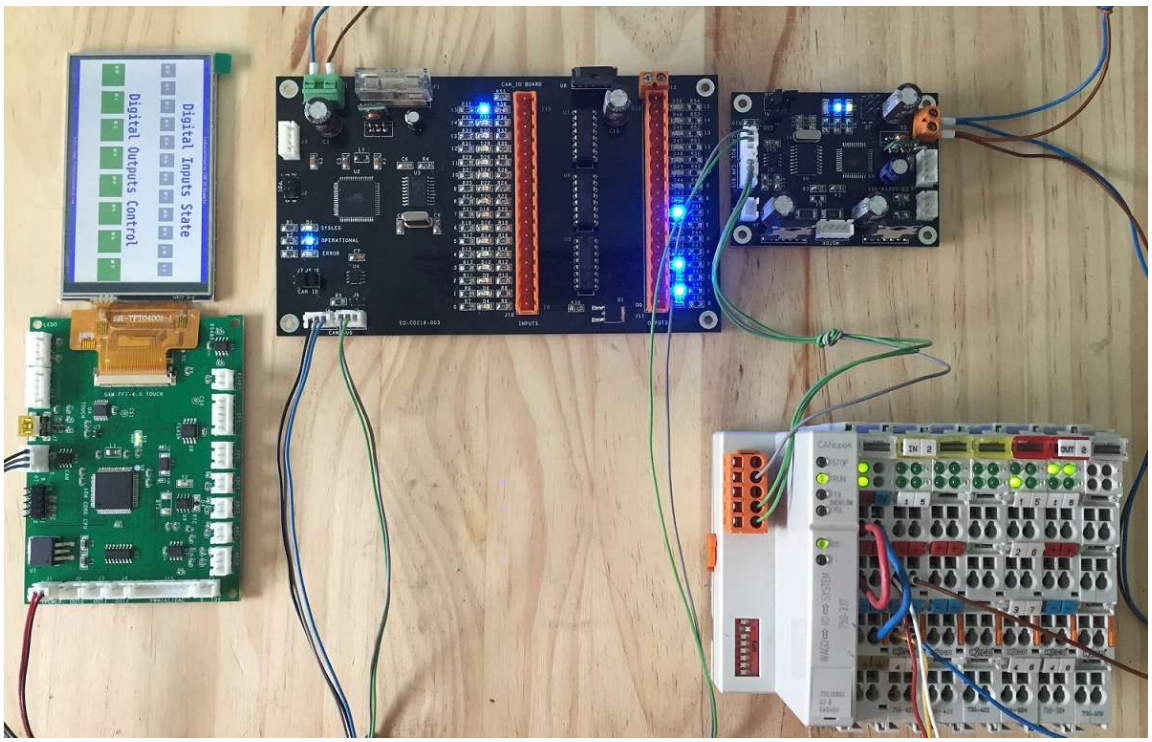


Fig.6. Board outline.

CAN BUS EXAMPLE PROJECT



SAM TFT4.0 TOUCH Board Sample Application

The example shows the use of the CAN Bus interface present on the ATSAM4E-16C chip, for communication with three different nodes:

1. **WAGO PLC 750-337**
2. **CAN IO Board from Ledoelectronics**
3. **CAN Motor Board from Ledoelectronics**

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The CAN Bus is extraordinary. It speed is only 1 Mbit / s, and only 8 bytes can be transmitted in each message. Even so, it is the standard of communication between elements of machines; used in almost all vehicles on earth and space.

It is Event driven. Each node can initiate a transaction to be attended when needed. It has an arbitrariness system, which handles possible collisions, based on the priority of the messages.

It is a redundant system by Hardware and Software. It has the highest immunity to noise among all existing communication buses.

It was developed by the German company Robert Bosh GmbH in the mid-1980s.

This application shows the CAN communication functionalities of the module

SAM TFT4.0 TOUCH from Ledoelectronics. It allows interaction with three nodes on a CAN bus.

- With the **Wago 750-337 PLC**
- With the **CAN IO** module from Ledoelectronics
- With the Ledoelectronics **CAN Motor** module

Fig.1. Starting Screen.

It is capable of reading and writing Wago's PLC inputs, using the CAN Open protocol, using SDO and PDO services. It also communicates with the CAN IO and CAN Motor modules from Ledoelectronics. A speed of 500 kbit / s has been chosen.

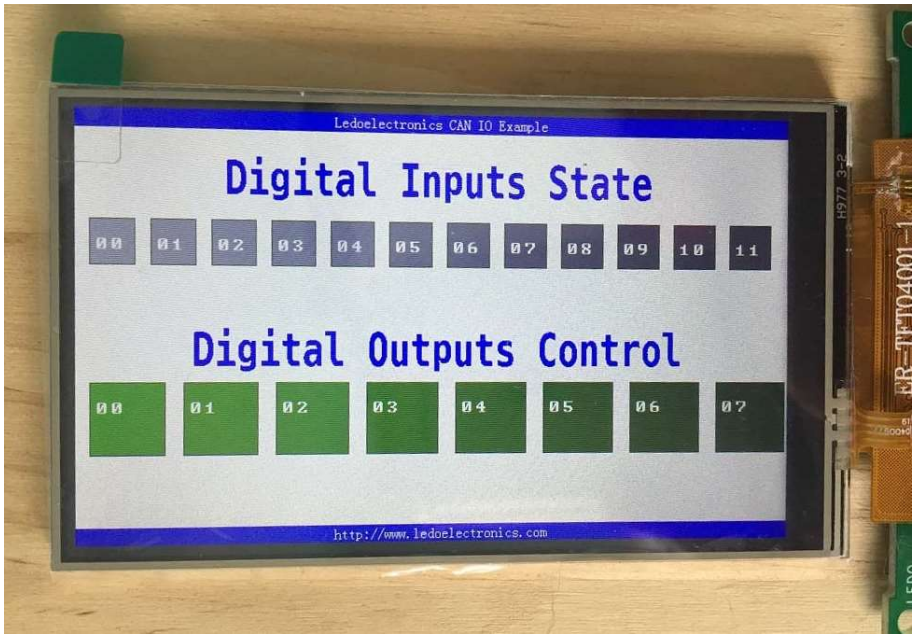

Fig.2. IO Screen.

Fig.3. Motor Screen.

Fig.4. Keyboard.

Board resources used in the application

1. Timer TC0.

2. Timer TC1.

3. CAN0 and CAN Bus 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.

The source code of the project 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, through SamBa. To do this, the board is put into bootloader mode by short-circuiting the "Erase" jumper. In this case, only a USB cable is required between the PC and the board.

2. Using Atmel programmer Atmel_ICE.

Conclusions:

The code was successfully tested with all connected nodes, at a speed of 500 kbit / s. Three of the 8 Mailboxes available with the CAN interface of the ATSAM4E-16C CPU were used to receive the messages.