

MINI-MAX/STM32F1-C

Single Board Computer Technical Manual

Date: 7 February, 2013

Document Revision: 1.02



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MINI-MAX/STM32F1-C Single Board Computer Technical Manual. No part of this work may be reproduced in any manner without written permission of BiPOM Electronics.

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WARRANTY:

BiPOM Electronics warrants MINI-MAX/STM32F1-C for a period of 1 year. If the board becomes defective during this period, BiPOM will at its option, replace or repair the board. This warranty is voided if the product is subjected to physical abuse or operated outside stated electrical limits. BiPOM Electronics will not be responsible for damage to any external devices connected to MINI-MINI-MAX/STM32F1-C. BiPOM Electronics disclaims all warranties express or implied warranties of merchantability and fitness for a particular purpose. In no event shall BiPOM Electronics be liable for any indirect, special, incidental or consequential damages in connection with or arising from the use of this product. BiPOM Electronics' liability is limited to the purchase price of this product.

1. Overview

MINI-MAX/STM32F1-C is a general purpose, low-cost, highly-reliable and highly-expandable micro-controller system, based on the STMicroelectronics STM32F103VGT6 ARM® Cortex™-M3 32-bit RISC core operating Microcontroller.

CPU features:

- Current consumption in Active Mode: 68 mA for 72MHz external clock, Standby Mode: 2.5 uA
- 96 KB of on-chip static RAM and 1 MB of on-chip Flash for programs
- 32-bit RISC architecture
- In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software
- Embedded Emulation Module (EEM) supports real-time in-system debugging
- 21 channel, 12-bit 1 μ s Analog to Digital Converter with internal precision reference.
- Up to ten 16-bit timers, each with up to 4 IC/OC/PWM or pulse counter and quadrature (incremental) encoder input, 2 $\times$ 16-bit motor control PWM timers with dead-time generation and emergency stop, 2 $\times$ watchdog timers, SysTick timer: a 24-bit downcounter, 2 $\times$ 16-bit basic timers to drive the DAC
- Low power Real-time clock with independent power and dedicated 32 kHz clock input.
- Up to 2 $\times$ I²C interfaces (SMBus/PMBus), Up to 5 USART's, Up to 3 SPI's (18 Mbit/s), CAN interface (2.0B Active), USB 2.0 full speed interface, SDIO interface.
- Nested vectored interrupt controller able to handle up to 60 maskable interrupt channels and 16 priority levels.
- 80 general purpose I/O pins in a tiny 100-pin LQFP package (58 available on the board). I/O is 5 Volt tolerant.
- Sleep, Stop and Standby modes
- Real-Time Clock/Calendar
- DMA Controller
- Single power supply chip with Power-On Reset and Brown-Out Reset circuits
- CPU operating voltage range of 2.2 V to 3.6 V

MINI-MAX/STM32F1-C board complements these features, providing:

- 8 MHz crystal, with up to 72 MHz internal operation
- Ultra Low Power, USB or Battery operation possible, peripheral shutdown capability
- Holder for MicroSD cards
- Two RS232 Serial Ports with RTS/CTS handshake lines
- USB Device port
- JTAG programming interface
- Keypad connector
- LCD connector (programmable contrast adjustment for the LCD)
- JTAG connector
- Screw terminal block for analog circuits.
- Expansion bus interface to low-cost peripheral boards
- 3.3 Volt on-board regulator

2. Specifications

Dimensions are 2.35 X 2.40 inches (5.97 X 6.10 centimeters).
Mounting holes of 0.125 inches (3 millimeters) on four corners.
-30° - +85°C operating, -40° - +85° C storage temperature range.

3. Functional Blocks

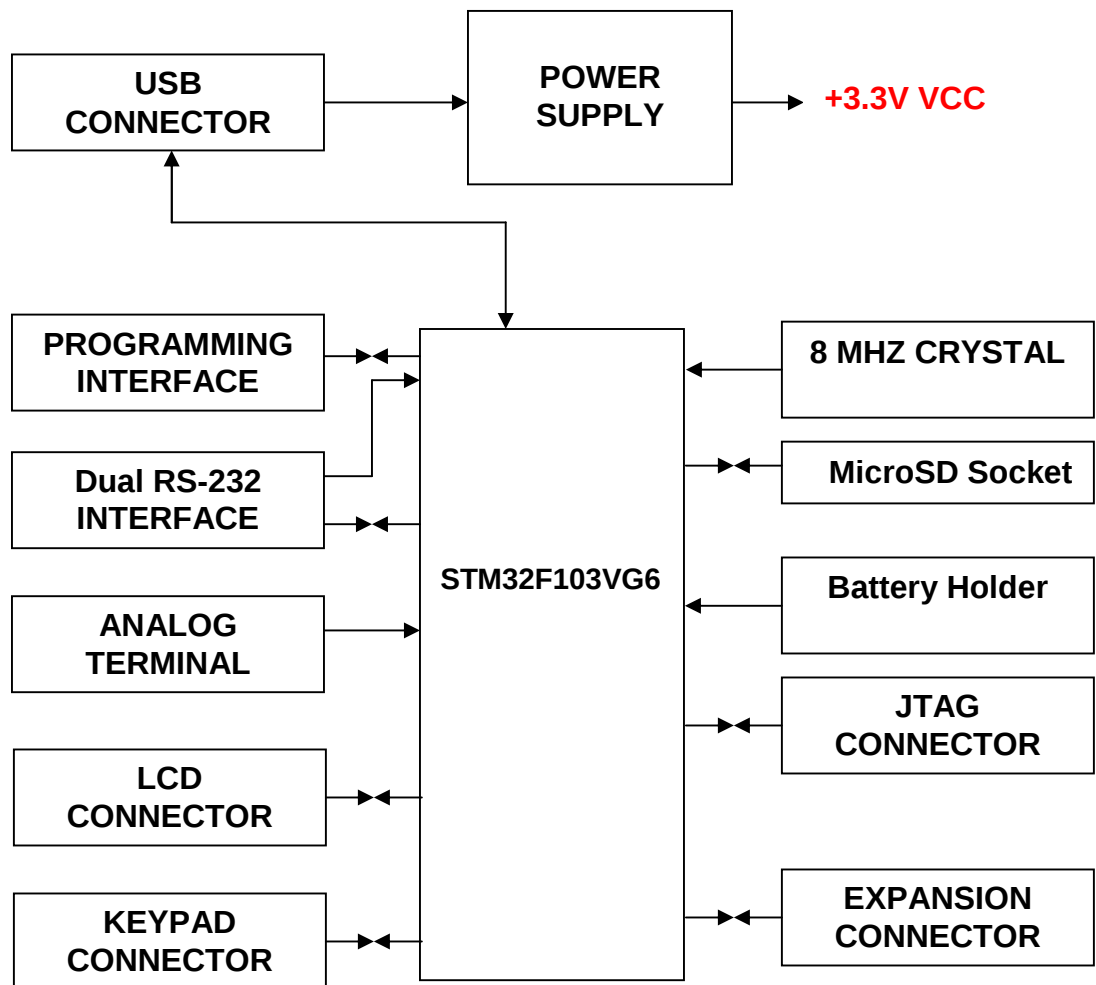


Figure1. Block diagram of the MINI-MAX/STM32F1-C system.

Micro-controller

The STM32F103xG performance line family incorporates the high performance ARM® Cortex™-M3 32-bit RISC core operating at a 72 MHz frequency, high speed embedded memories (Flash memory up to 1 Mbyte and SRAM up to 96 Kbytes), and an extensive range of enhanced I/Os and peripherals connected to two APB buses. All devices offer three 12-bit ADCs, ten general-purpose 16-bit timers plus two PWM timers, as well as standard and advanced communication interfaces: up to two I2Cs, three SPIs, two I2Ss, one SDIO, five USARTs, an USB and a CAN.

For more information:

<http://www.st.com/internet/mcu/product/247492.jsp>

MicroSD Holder

MicroSD is a format for removable flash memory cards. SD is an acronym for Secure Digital. It is the smallest memory card available commercially; at 15 mm×11 mm×1 mm (about the size of a fingernail), it is about a quarter the size of an SD card. MicroSD cards are now available in sizes of many Gigabytes. MINI-MAX/STM32F1-C has a push-push type ejector connector (H1) for accepting standard MicroSD cards. This allows creating low-power data loggers with huge storage capacities.

In-System Programming & Debugging

MINI-MAX/STM32F1-C can be re-programmed using either the RS232 or JTAG interface. STM32F103VGT6 comes with a built-in boot loader. The in-circuit programming feature simplifies program development on the board since downloading programs from a host PC takes only few seconds. User programs can also be downloaded and debugged through the JTAG port (X6).

STM32 Development System based on Micro-IDE Integrated Development Environment from BiPOM Electronics fully supports In-System Programming on the MINI-MAX/STM32F1-C using the serial port.

USB Connector

X9 is a 5-pin Mini USB connector (extra pins on the schematics indicate chassis of the connector).

The USB port on MINI-MAX/STM32F1-C is a Device port that is used for both powering the board and for communications with a USB Host such as a PC or BiPOM's ARM9 series boards with host USB, such as [GadgetPC](#).

JTAG Connector

X6 JTAG connector is a dual row, 20-pin header and interfaces with standard JTAG debuggers.

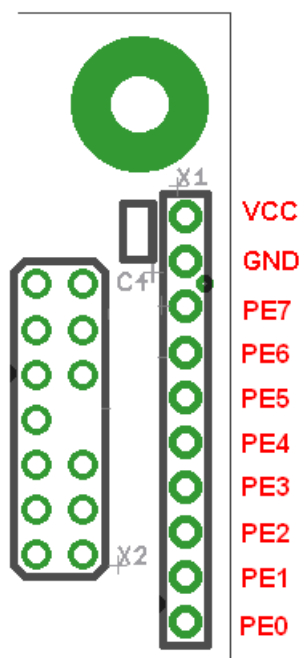
Keypad connector

Keypad connector can be used to scan various types of keypads, such as 3 by 5 or 4 by 4. Keypad connector contains 5 Volt power and ground lines and the 8 port lines of the micro-controller. The lines can also be used as general-purpose inputs/outputs.

Keypad Connector (X1)

Signal	Pin
PE0 (KEY0)	1
PE1 (KEY1)	2
PE2 (KEY2)	3
PE3 (KEY3)	4
PE4 (KEY4)	5
PE5 (KEY5)	6
PE6 (KEY6)	7
PE7 (KEY7)	8
Ground (GND)	9
VCC (+5V)	10

Table 1



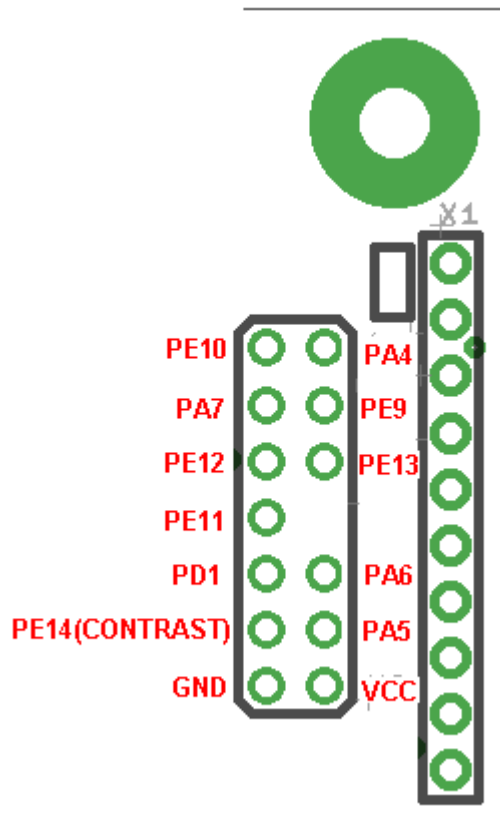
LCD Connector

LCD connector serves various types of character and graphic LCD modules. Alternatively LCD port can be used as a 10-bit general purpose I/O. Contrast is a 16-bit analog PWM output to adjust the contrast of the LCD display under software control. Alternatively it can be used as a general purpose analog output.

LCD Connector (X2)

Signal	Pin	Pin	Signal
Ground (GND)	1	2	VCC (+5V)
PE14 Contrast (VEE)	3	4	PA5 (CTRL)
PD1 (READ)	5	6	PA6 (STROBE)
PE11 (LD4)	7	8	Not Connected
PE12 (LD6)	9	10	PE13 (LD7)
PA7 (LD0)	11	12	PE9(LD1)
PE10 (LD2)	13	14	PA4 (LD3)

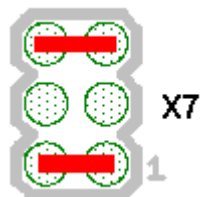
Table 2



RS232 Serial Ports

Two RS232 serial ports are available on the MINI-MAX/STM32F1-C. IC10 converts micro-controller's RXD and TXD pins to/from RS232 levels. IC10 has an internal circuit that generates +/-6 Volts for RS232 logic levels. First RS232 port is wired to a 10-pin header (X5). Second RS232 port is wired to a 6-pin header (X7).

The default configuration is to have two RS232 ports with RX/TX lines only. This configuration does not have any handshake lines. If a single RS232 port with handshake lines (RTS/CTS) is needed, the two RS232 ports can be combined into one on X6. For this purpose, 2 jumpers must be set between pins 5, 6 and 1, 2 of X7 as shown below:



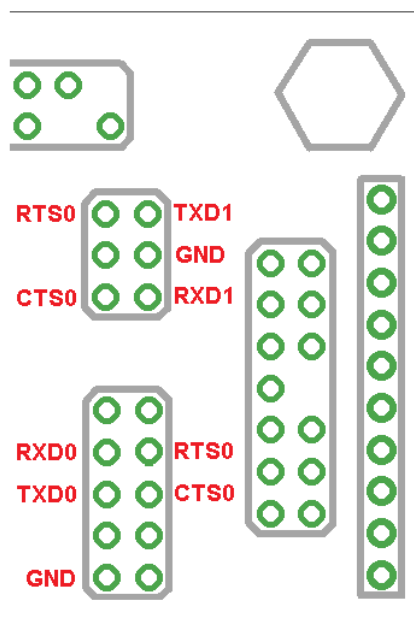
First RS232 Serial Port (X5)

Signal	Pin	Pin	Signal
NC (Not Connected)	1	2	DSR_0(DSR0 input)
RXD_0 (RX0 input)	3	4	RTS_0* (RTS0 output)
TXD_0 (TX0 output)	5	6	CTS_0* (CTS0 input)
NC (Not Connected)	7	8	NC (Not Connected)
Ground (GND)	9	10	NC (Not Connected)

Second RS232 Serial Port (X7)

Signal	Pin	Pin	Signal
RXD_1 (RX input)	1	2	CTS_0* (CTS0 input)
Ground (GND)	3	4	NC (Not Connected)
TXD_1 (TX output)	5	6	RTS_0* (RTS0 output)

Table 3



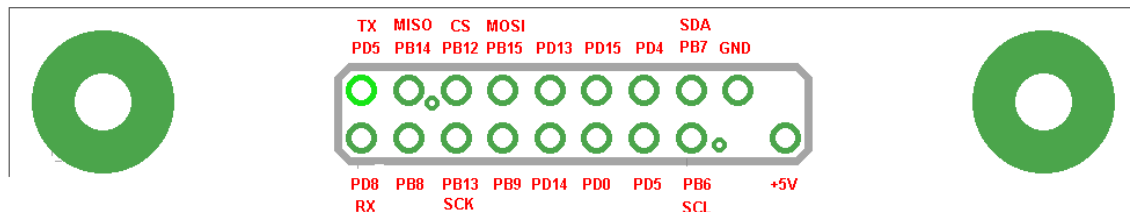
Expansion connector

Expansion connector can be used for interfacing to external circuitry, prototyping boards and peripheral boards. Expansion connector has 16 lines, which can be used as general purpose I/O. Some of these lines have special functions. MINI-MAX/STM32F1-C peripheral boards can be connected either as a piggy-back daughter-board on MINI-MAX/STM32F1-C using standoffs or can be placed up away from MINI-MAX/STM32F1-C using a 20-wire ribbon cable. Peripherals section lists the available expansion boards. Table 4 shows the pin assignments for the MINI-MAX/STM32F1-C Expansion connector.

Expansion connector (X3)

Signal	Pin	Pin	Signal
Ground (GND)	1	2	VCC (+5V)
Ground (GND)	3	4	VCC (+5V)
PB7 (SDA)	5	6	PB6 (SCL)
PD4 (IO4)	7	8	PD5 (IO5)
PD15 (IO2)	9	10	PD0 (IO3)
PD13(IO0)	11	12	PD14 (IO1)
PB15(MOSI)	13	14	PB9 (IO7)
PB12 (CS)	15	16	PB13 (SCK)
PB14 (MISO)	17	18	PB8 (IO6)
PD5 (TX_D)	19	20	PD8 (RX_D)

Table 4



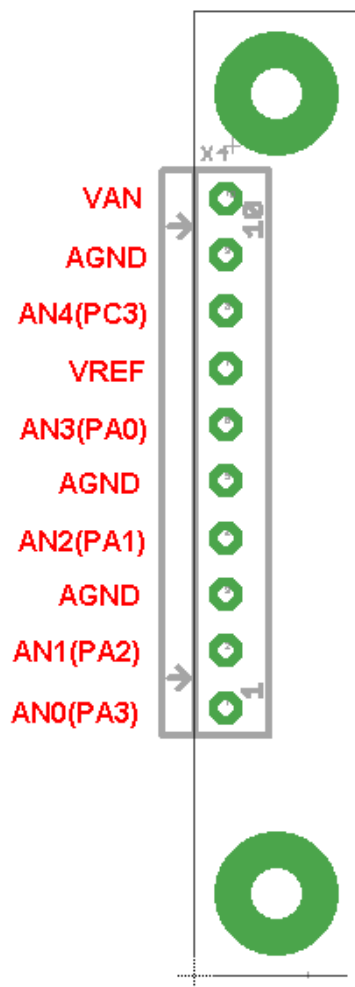
Analog interface

Analog terminal X10 serves for interfacing to various types of analog peripherals, such as strain gages, pressure sensors, thermocouples etc. Five ADC inputs, analog reference VREF, analog power supply VAN and analog ground are wired to X10. Reference is 3.0 Volts.

Analog terminals (X10)

Signal	Pin
PA3 (AN0)	1
PA2 (AN1)	2
Analog Ground (AGND)	3
PA1 (AN2)	4
Analog Ground (AGND)	5
PA0 (AN3)	6
Reference Voltage (VREF, output)	7
PC3 (AN4)	8
Analog Ground (AGND)	9
3.3V Analog Power (VAN, output)	10

Table5



Real Time Clock

The real-time clock (RTC) and the backup registers are powered through an electronic switch that takes power either on VDD supply when present or through the VBAT pin. The backup registers are forty-two 16-bit registers used to store 84 bytes of user application data when VDD power is not present. These are not reset by a system or power reset, and they are not reset when the device wakes up from the Standby mode.

RTC provides a set of continuously running counters that can be used with suitable software to provide a clock calendar function, and provides an alarm interrupt and a periodic interrupt. It is clocked by a 32.768 kHz external crystal, internal low power RC oscillator or the high-speed external clock divided by 128. The internal low-speed RC oscillator has a typical frequency of 40 kHz. RTC can be calibrated using an external 512 Hz output to compensate for any natural quartz deviation. RTC features a 32-bit programmable counter for long term measurement using the Compare register to generate an alarm. A 20-bit prescaler is used for the time base clock and is configured by default to generate a time base of 1 second from a 32.768 kHz clock.

Power Supply Unit

MINI-MAX/STM32F1-C board comes with a Mini USB cable to power the board from a computer or from a 5 Volt regulated power supply.

MINI-MAX/STM32F1-C has an on-board voltage regulator. IC4 generates +3.3V for digital circuits and IC2 generates +3.0V for analog reference.

4. Peripherals

A peripheral board can either be stacked on top of MINI-MAX/STM32F1-C using stand-offs or connected in a chain configuration using flat ribbon cable. Figure 2 shows how any peripheral board can be connected to a micro-computer board in a stacked fashion. Figure 3 shows the chain connection.

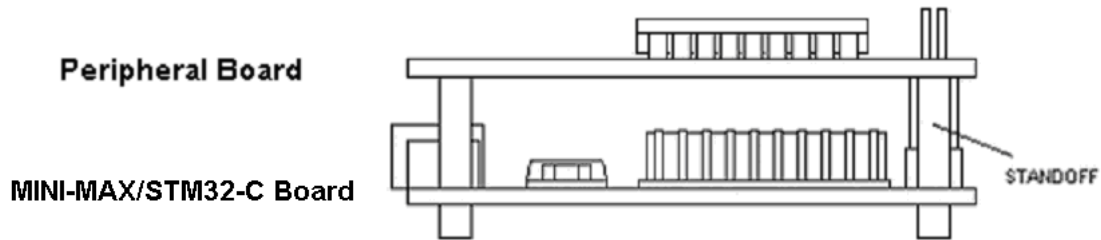


Figure 2

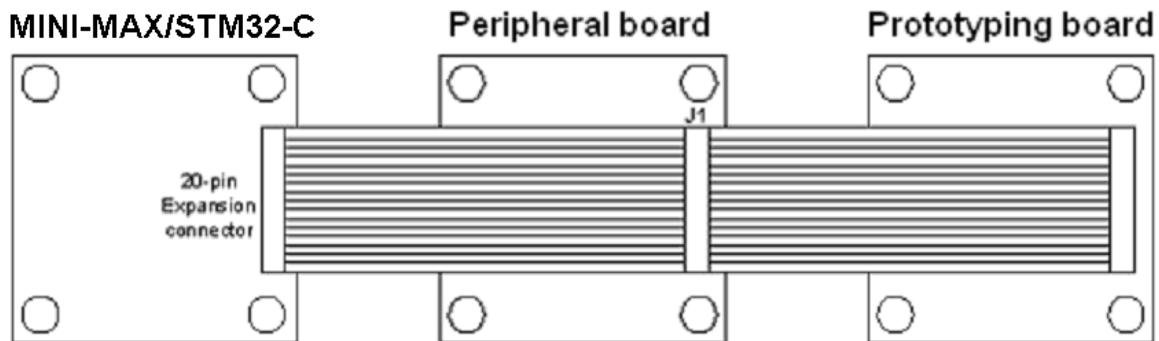


Figure 3

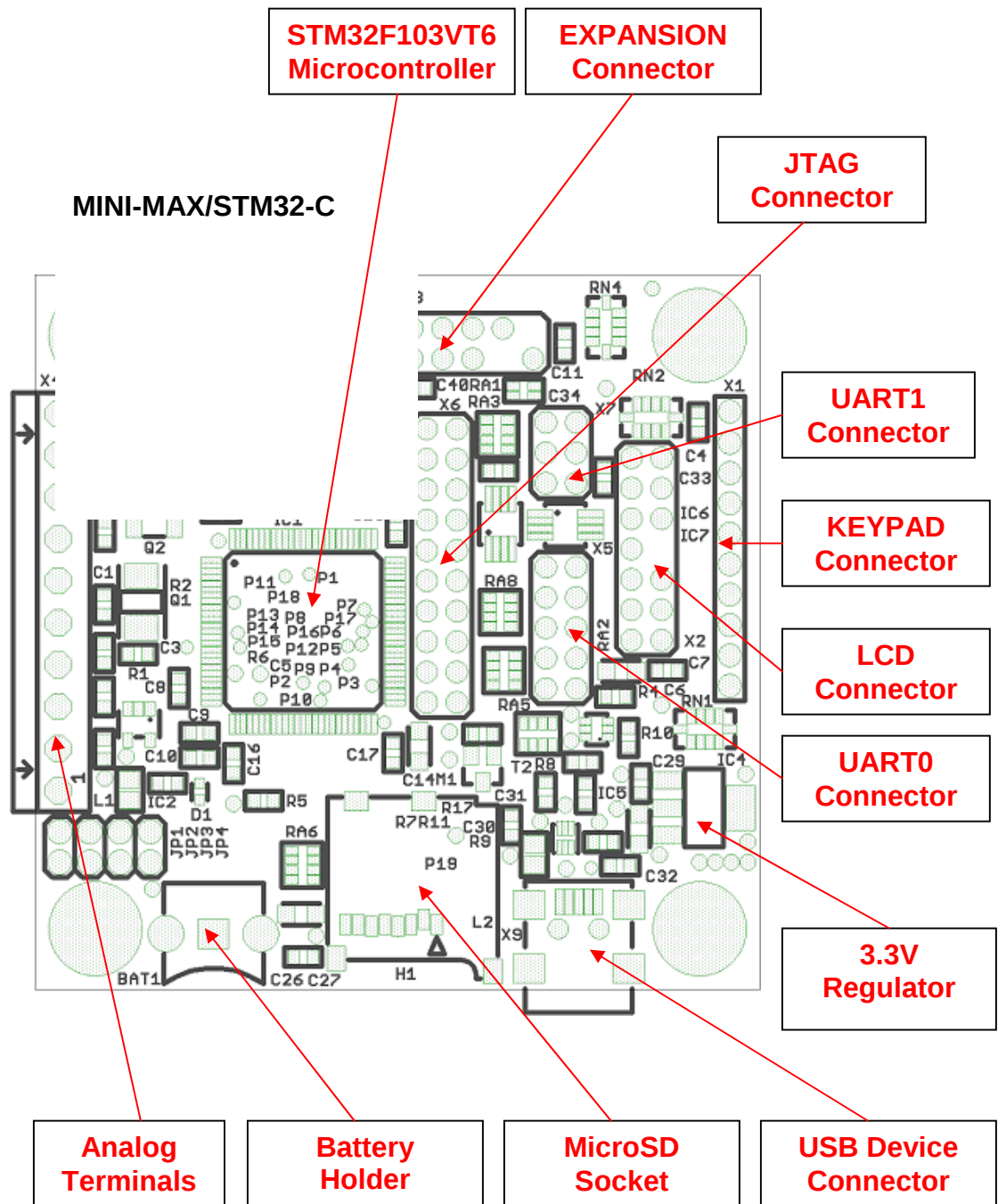
More details regarding BiPOM Peripheral boards are available from the link below:
www.bipom.com/periph_boards.php

5. Software

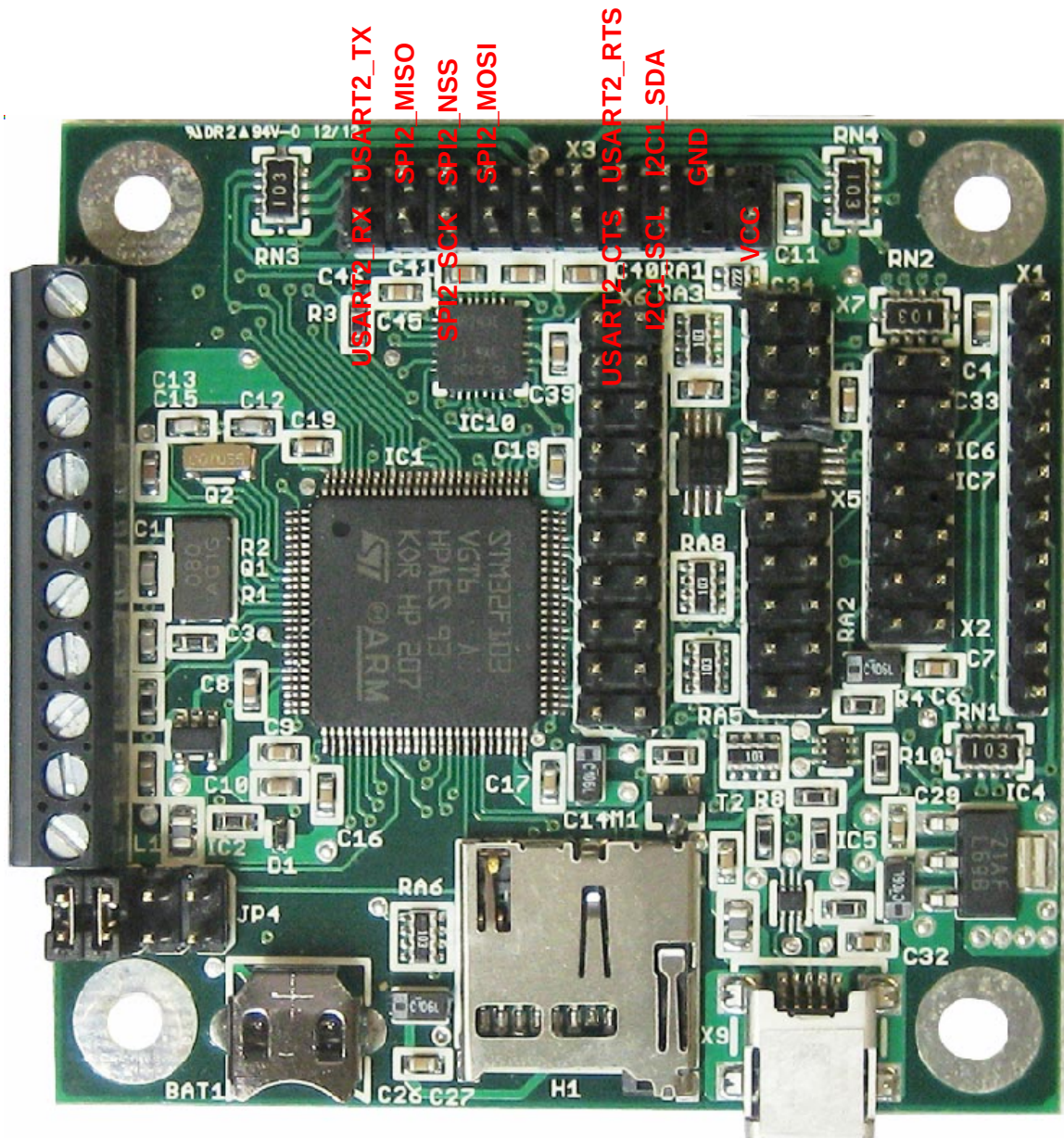
Please visit <http://www.bipom.com/forum/index.php/board,21.0.html> and read FAQ's

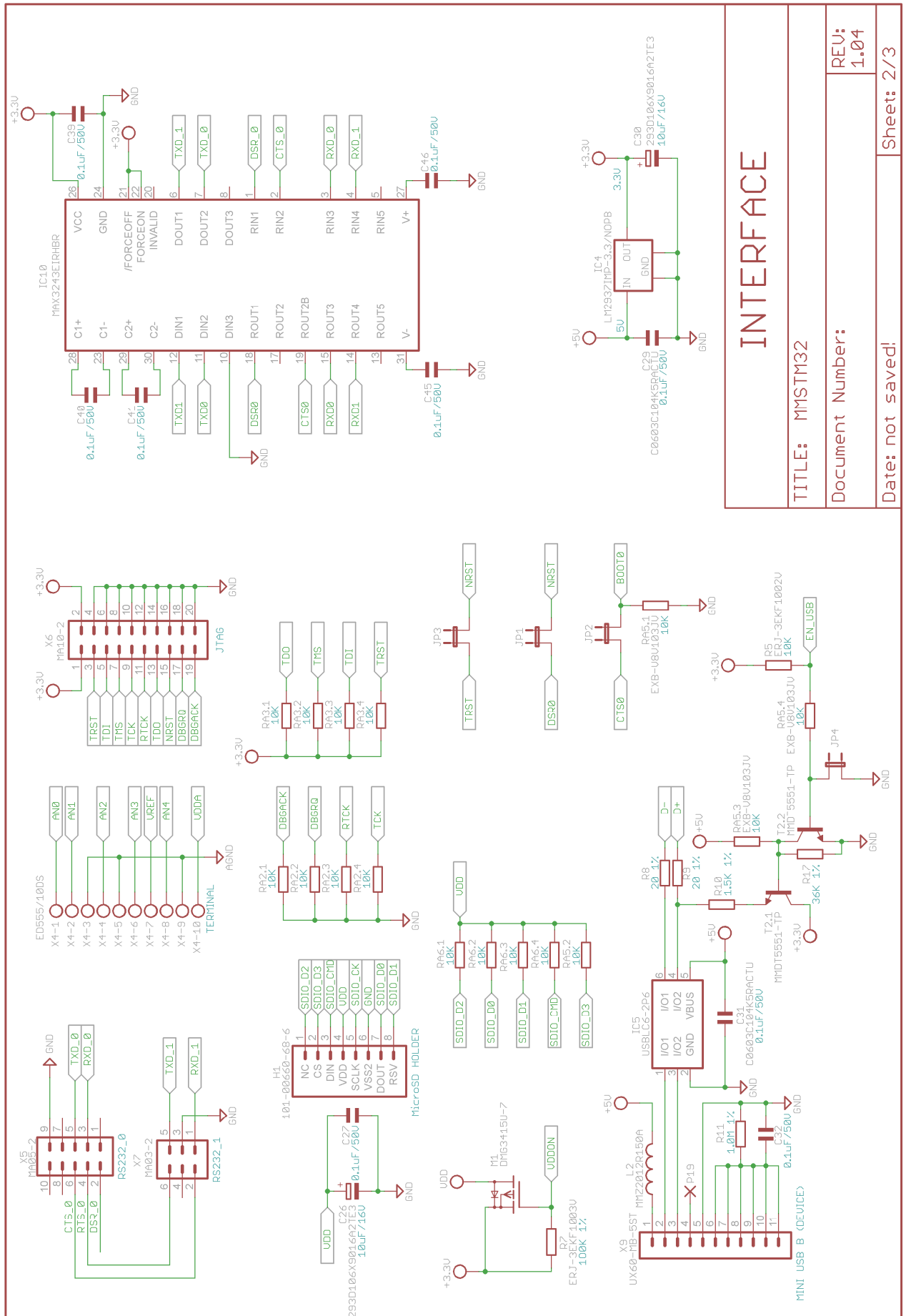
Please visit <http://www.bipom.com/products/us/4377910.html> and download the STM32 Development System.

6. Board Layout



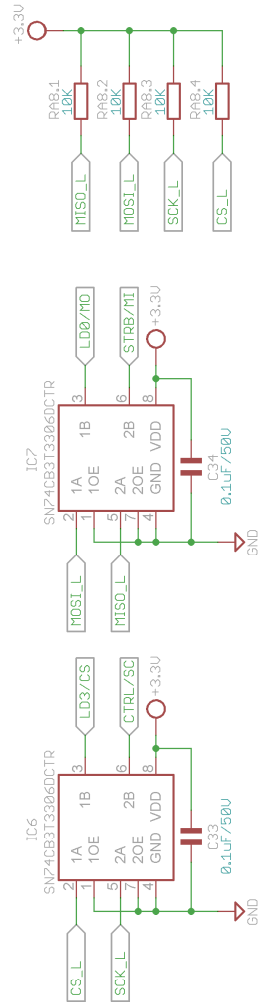
Expansion Connector pinout for alternate I/O functions:



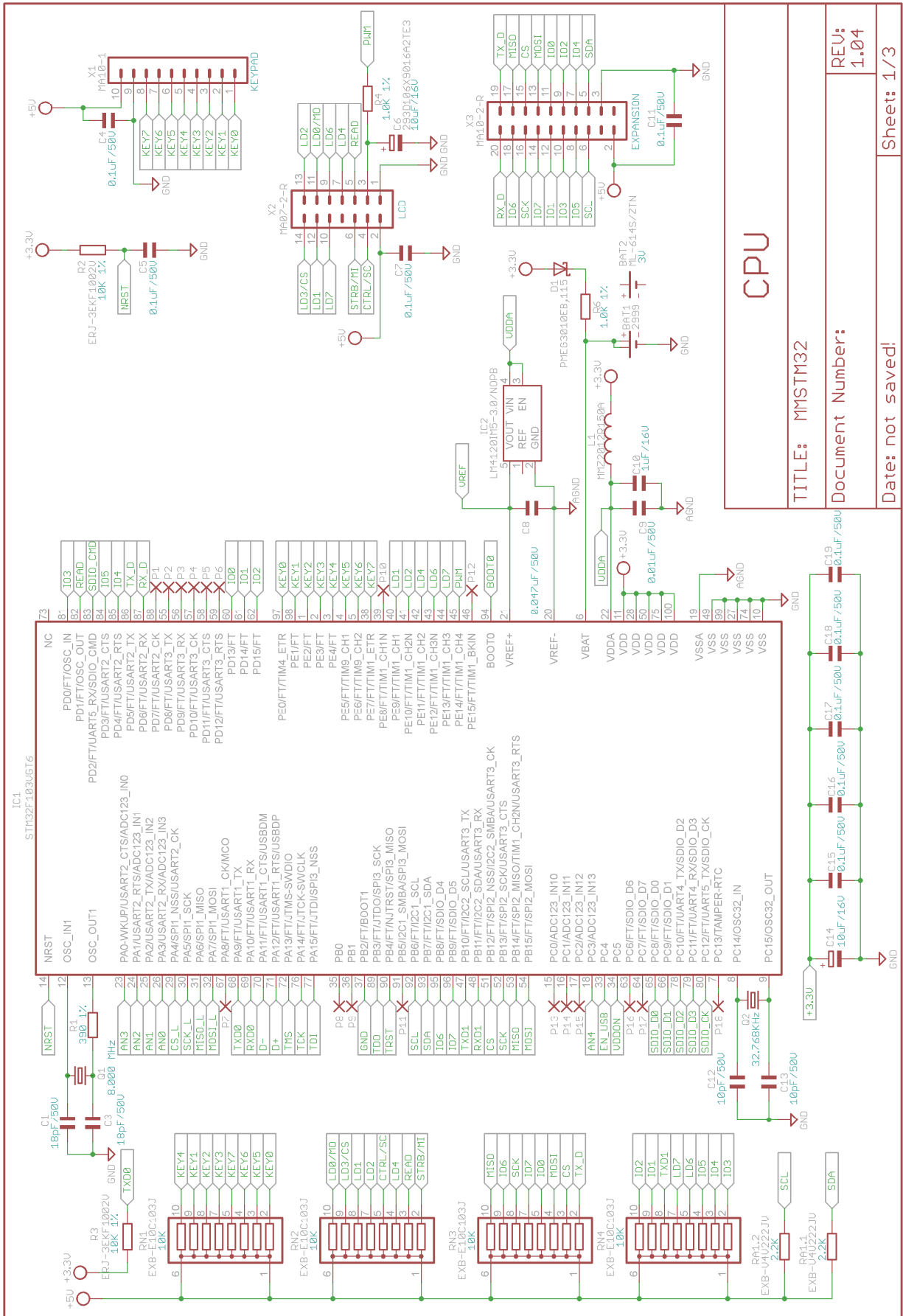


INTERFACE

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LEVEL SHIFTER		
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CPU

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