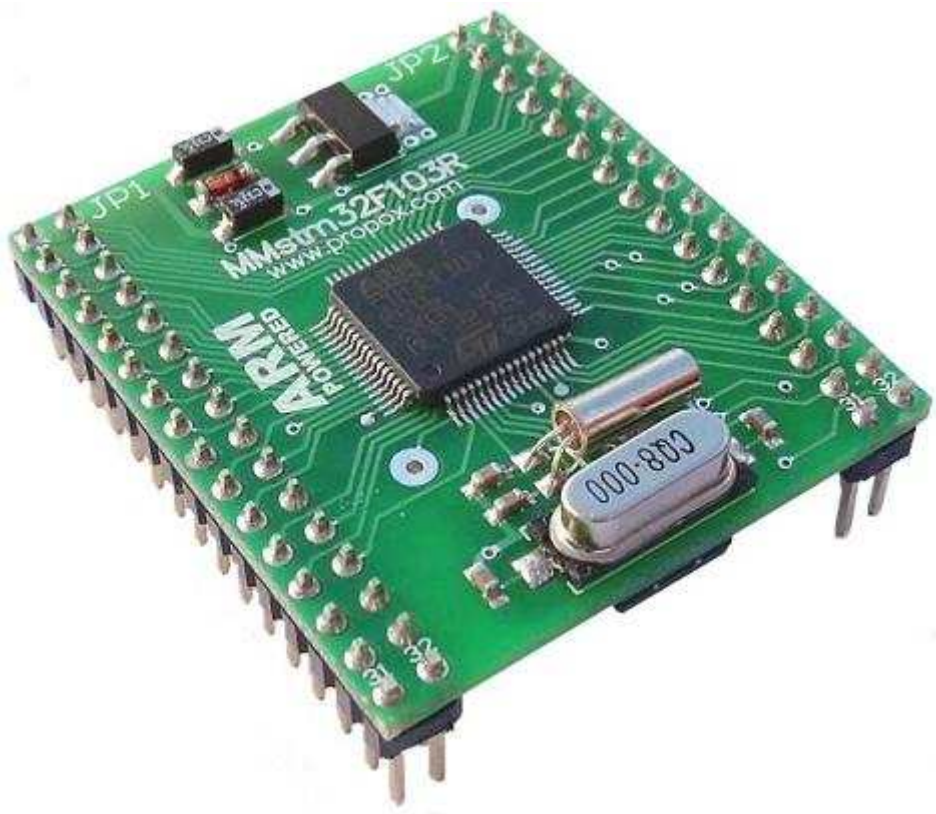


# MMstm32F103R

## User's Manual

REV 1.1

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Many ideas one solution

# CONTENTS

# 1. Introduction

**MMstm32F103R** is universal minimodule for the STM32 Cortex-3 microcontrollers from STMicroelectronics. This microcontroller is available in the TQFP64 case which is difficult to apply to prototype and amateur circuits due to the compactness of pins. We have undertaken an attempt at placing it on a board of 40,5x35,5mm with a layout of leads which matches the commonly available prototype circuit boards. In addition, we have included 3.3V voltage regulator, a Serial Flash memory with a capacity of up to 8MB, a circuit monitoring the supply voltage and clock generator for microcontroller. All ports and signals of the microcontroller are lead out by means of two-row pin connectors with 0.1' pitch. This minimodule is not only an adapter but a complete main board for STM32F103Rx. It needs only a connection to the supply voltage and to the JTAG connector and we can start loading 128kBytes of Flash memory of the microcontroller.
Through integration of the peripherals with the microcontrollers on one board, the application of this module can lead to a shorter design period and facilitate the construction of systems based on ARM microcontrollers, by eliminating the need to design the printed board. The module is supplied with example software.
The **MMstm32F103R** minimodule can be also used in didactic laboratories of informatics colleges and universities, and can be also used to build circuits realizing thesis projects.

## Features

### MMstm32F103R minimodule:

- Complete, ready to use microprocessor system
- Fast **ARM Cotex-3** microcontroller STM32F103Rx with up to **90 DMIPS** throughput
- Serial Flash memory 64Mb (8MB)
- Reliable reset circuit
- Built-in system generator 8MHz
- Built-in 32.768kHz crystal resonator for RTC
- Built-in voltage regulator 3.3V 400mA
- Module supply voltage: 3.3V or 3.8 - 9V
- 2 x 32 terminals with 0.1" (2.54mm) pitch fitting every prototype board
- Small dimensions: 40.5mm x 35.5mm
- Available evaluation board and sample applications

# 2. The Module

## Block Diagram

A block diagram of MMstm32F103R minimodule is shown on the image below:

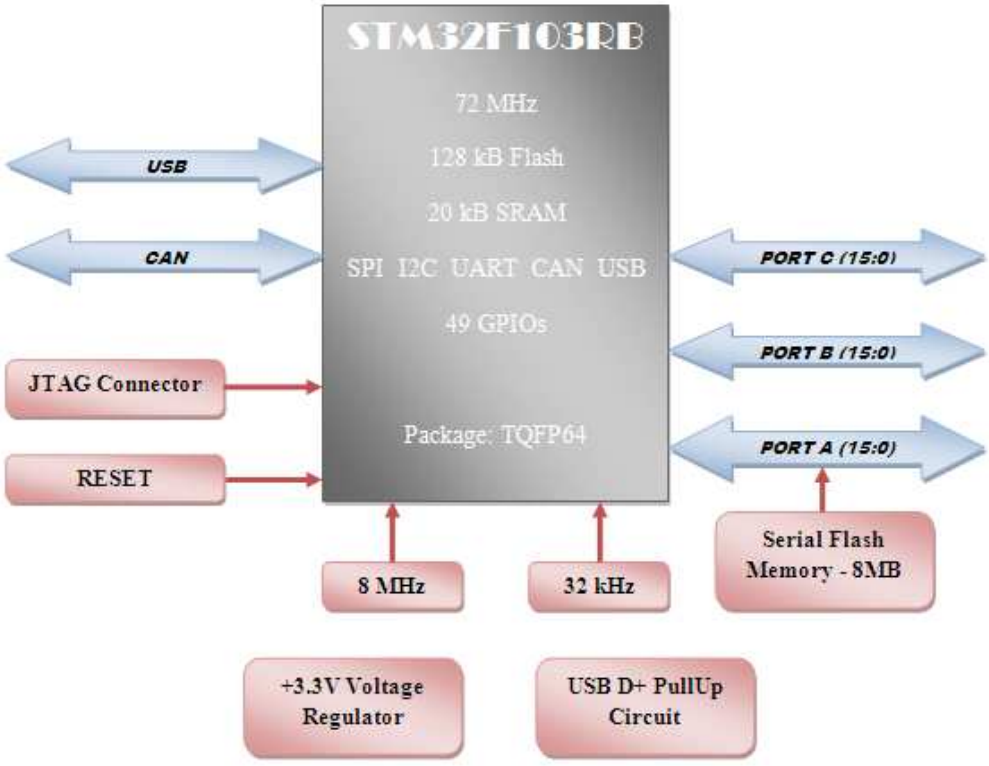



***Figure 1 Block diagram of MMstm32F103R***

Minimodule can be ordered in different configurations with use of selector:

**MMstm32F103R – f – d – b**

*Flash memory size:*
*0 – 32kB*
*1 – 64kB*
*2 – 128kB*

*Serial Flash memory size:*
*0 – not mounted*
*1 – 8MB*

*Battery holder:*
*0 – not mounted*
*1 – mounted*

## Terminals Layout

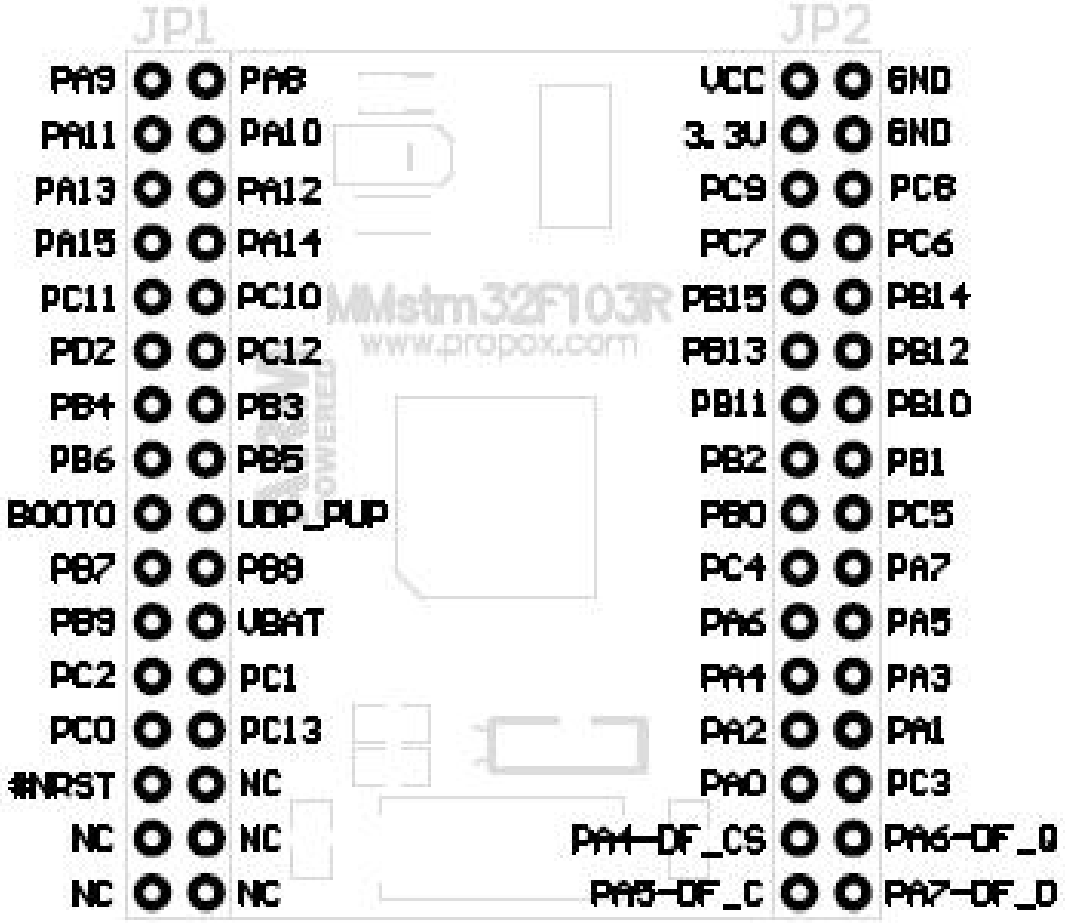



*Figure 2 Terminals Layout – top view*

| J1 | | | J2 | | |
|---|---|---|---|---|---|
| **Pin** | **Main Function** | **Alternate Function** | **Pin** | **Main Function** | **Alternate Function** |
| 1 | PA9 | USART1_TX/TIM1_CH2 | 1 | VCC | |
| 2 | PA8 | USART1_CK/ TIM1_CH1/MCO | 2 | GND | |
| 3 | PA11 | USART1_CTS / CANRX TIM1_CH4 / USBDM | 3 | 3.3V | |
| 4 | PA10 | USART1_RX/TIM1_CH3 | 4 | GND | |
| 5 | JTMS/SWDIO | PA13 | 5 | PC9 | |
| 6 | PA12 | USART1_RTS / CANTX TIM1_ETR / USBDP | 6 | PC8 | |
| 7 | JTDI | PA15 | 7 | PC7 | |
| 8 | JTCK/SWCLK | PA14 | 8 | PC6 | |
| 9 | PC11 | | 9 | PB15 | SPI2_MOSI / TIM1_CH3N |
| 10 | PC10 | | 10 | PB14 | SPI2_MISO/USART3_RTS TIM1_CH2N |
| 11 | PD2 | TIM3_ETR | 11 | PB13 | SPI2_SCK/ USART3_CTS/TIM1_CH1N |
| 12 | PC12 | | 12 | PB12 | SPI2_NSS /I2C2_SMBAI/ USART3_CK/TIM1_BKIN |
| 13 | NTRST | PB4 | 13 | PB11 | I2C2_SDA / USART3_RX |
| 14 | JTDO | PB3/TRACESWO | 14 | PB10 | I2C2_SCL / USART3_TX |
| 15 | PB6 | I2C1_SCL / TIM4_CH1 | 15 | PB2/BOOT1 | |

| | | | | | |
|---|---|---|---|---|---|
| 16 | PB5 | I2C1_SMBAI | 16 | PB1 | ADC_IN9 / TIM3_CH4 |
| 17 | BOOT0 | | 17 | PB0 | ADC_IN8 / TIM3_CH3 |
| 18 | UDP_PUP | | 18 | PC5 | ADC_IN15 |
| 19 | PB7 | I2C1_SDA / TIM4_CH2 | 19 | PC4 | ADC_IN14 |
| 20 | PB8 | TIM4_CH3 | 20 | PA7 | SPI1_MOSI/ ADC_IN7 / TIM3_CH2 |
| 21 | PB9 | TIM4_CH4 | 21 | PA6 | SPI1_MISO/ ADC_IN6 / TIM3_CH1 |
| 22 | VBAT | | 22 | PA5 | SPI1_SCK / ADC_IN5 |
| 23 | PC2 | ADC_IN12 | 23 | PA4 | SPI1_NSS/ USART2_CK / ADC_IN4 |
| 24 | PC1 | ADC_IN11 | 24 | PA3 | USART2_RX/ ADC_IN3 / TIM2_CH4 |
| 25 | PC0 | ADC_IN10 | 25 | PA2 | USART2_TX/ ADC_IN2 / TIM2_CH3 |
| 26 | PC13 | ANTI_TAMP | 26 | PA1 | USART2_RTS/ ADC_IN1 / TIM2_CH2 |
| 27 | #NRST | | 27 | PA0 | WKUP/USART2_CTS/AD C_IN0 / TIM2_CH1_ETR |
| 28 | NC | | 28 | PC3 | ADC_IN13 |
| 29 | NC | | 29 | PA4-DF_CS | |
| 30 | NC | | 30 | PA6-DF_Q | |
| 31 | NC | | 31 | PA5-DF_C | |
| 32 | NC | | 32 | PA7-DF_D | |

## STM32F103Rx Microcontroller

- ***32-bit Cortex-M3 core***
- ***72 MHz**, 90 DMIPS with **1.25 DMIPS/MHz***
- *From 32 to 128kB in system programmable flash memory*
- *From 10 to 20kB SRAM memory*
- *Up to three 16-bit timers, each with up to 44 UART interfaces IC/OC/PWM or pulse counter*
- *16-bit, 6-channel advanced control timer*
- *2 x 16-bit watchdog timers*
- *Up to 2 x I2C interfaces (SMBus/PMBus)*
- *2 SPI interfaces*
- *Up to 3 USARTs (ISO 7816 interface, LIN, IrDA capability, modem control)*
- *Up to 2 SPIs (18 Mbit/s)*
- ***USB 2.0** full speed interface*
- ***CAN** interface (2.0B Active)*
- *RTC clock*
- *2 x 12-bit, 1 us A/D converters (16-channel)*
- *49 5 V-tolerant I/Os*
- *Nested interrupt controller with 43 maskable interrupt channels*
- *Sleep, Stop and Standby modes*
- *4-to-16 MHz quartz oscillator*
- *Internal 8 MHz factory-trimmed RC*
- *Internal 32 kHz RC*
- *PLL for CPU clock*
- *2.0 to 3.6V application supply*
- *Serial wire debug (SWD) & JTAG interfaces*

## Serial Flash Memory

The minimodule can be equipped with Serial Flash memory **M25P64** (**8MB** capacities). The memory is connected to a fast SPI bus with up to **18MBit/s** transmission speed.

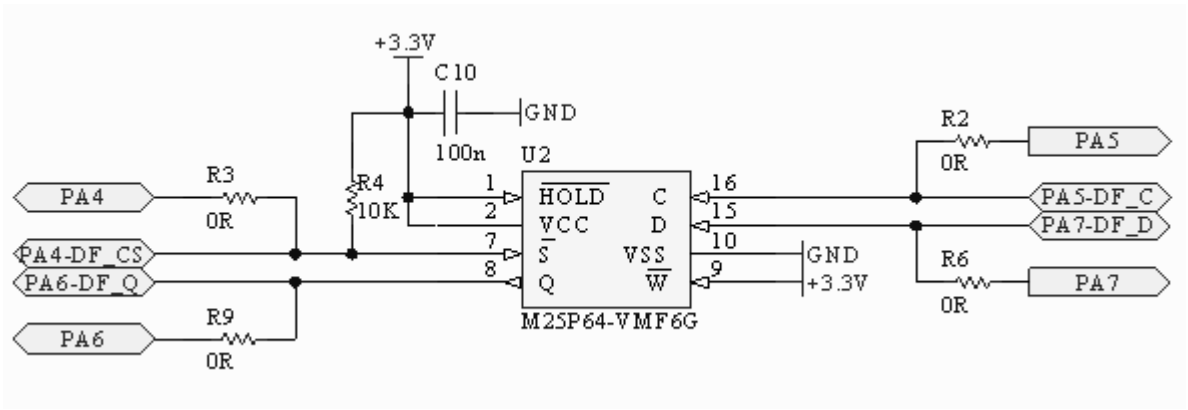



***Figure 3 Serial Flash memory connection***

Memory is available directly on minimodule pins:

| | |
|---|---|
| PA4 – DF_CS | Chip Select |
| PA5 – DF_C | Clock Input |
| PA6 – DF_Q | Data Output |
| PA7 – DF_D | Data Input |

It is also connect to microcontroller ports by 0Ω resistors and it can by directly use without outside connections.

It should be kept in mind that if Serial Flash memory is installed, the just outlined port terminals cannot be used externally to the module. Of course the SPI bus can be used for communication with external peripherals, under the condition that they will have circuit selection inputs (CS).

A detailed description of Serial Flash circuits is on the STMicroelectronics page: www.st.com.

## RESET circuit

The MMstm32F103R has a built-in voltage monitoring circuit built around the DS1818 integrated circuit. The circuit generates a RESET signal in case when the supply voltage value is lower than 3V. This takes place when the supply voltage is switched on or off, when the VCC voltage changes its value from 0 to 3.3 V. The guard circuit detects also momentary VCC voltage drops. A short duration drop of VCC below 3V causes the generation of a resetting signal of 100 ms duration. This signal is applied directly to the resetting input of the microcontroller and is led out to a module connector and it can be used as the zeroing output resetting external circuits and as the input for resetting the module, e.g. by means of the RESET button. In such a case the RESET button can short the RESET line directly to ground. An implementation of the reset circuit is presented in the diagram below.

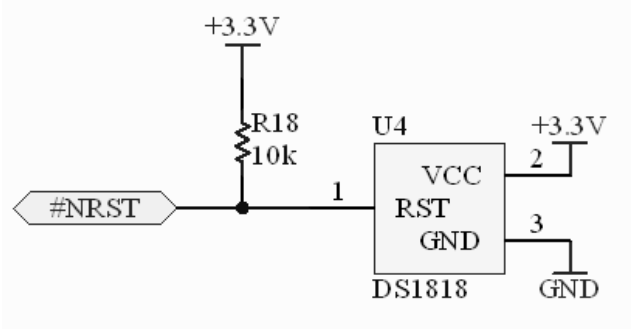



***Figure 4 RESET circuit implementation***

## Voltage Regulator

Minimodule has built-in 3.3V voltage regulator. Thanks to it can be powered with 3.3V voltage supplied to J2 3 pin (+3.3V) or with voltage between 3.8 – 9V, supplied to J2 1 pin (VCC). When power is supplied to VCC pin, then 3.3V voltage is produced on the module by U3 regulator. In this case 3.3V voltage can be also used outside the module, if current draw will not exceed 300mA.

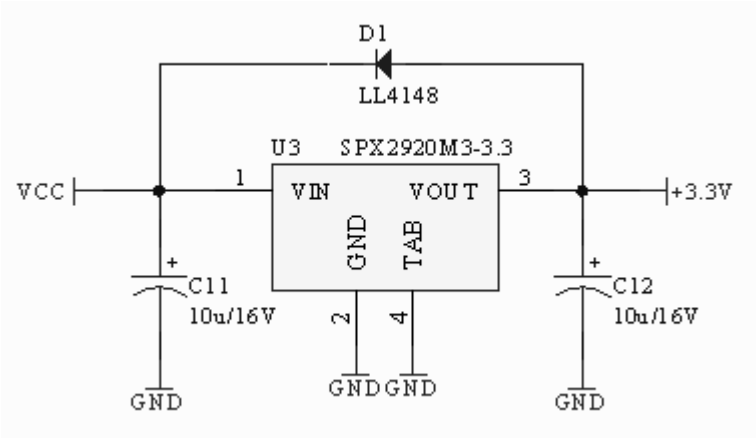



***Figure 5 3.3V Voltage Regulator***

## USB D+ Pull-Up Circuit

USB host recognize presence of device on the bus by sensing pull-up on D+ line. MMstm32F103R has built-in pull-up circuit, shown on drawing below.

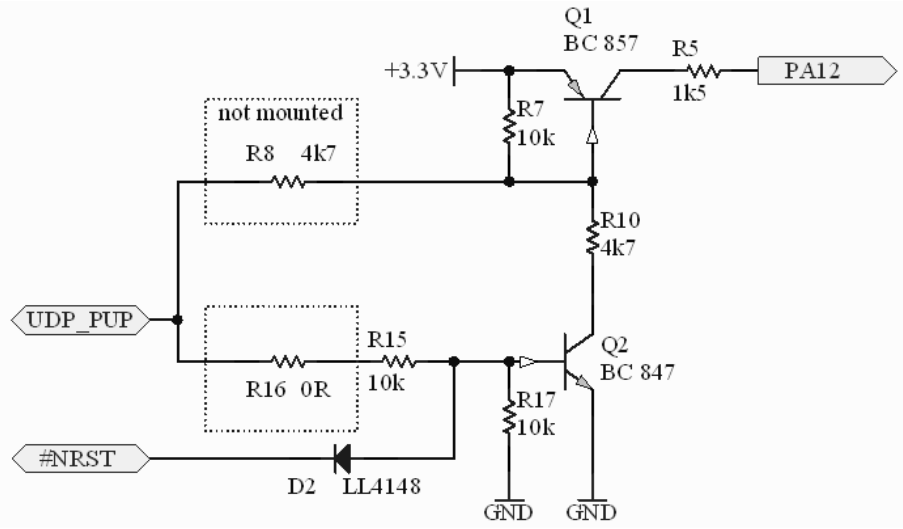



*Figure 6 USB D+ Pull-Up circuit implementation*

Pull-up is by default turned off by R7 resistor. Active reset signal or low level on UDP_PUP (R16 mounted) line turns on pull-up, what is interpreted by USB host as connection of USB device.

## JTAG Connection

JTAG is a four-lead interface permitting the takeover of control over the processor's core. The possibilities offered by this interface are, among others: step operation, full-speed operation, hardware and software breakpoints, inspection and modification of contents of registers and data memories. The method of connecting the JTAG connector to the minimodule is shown in the drawing:

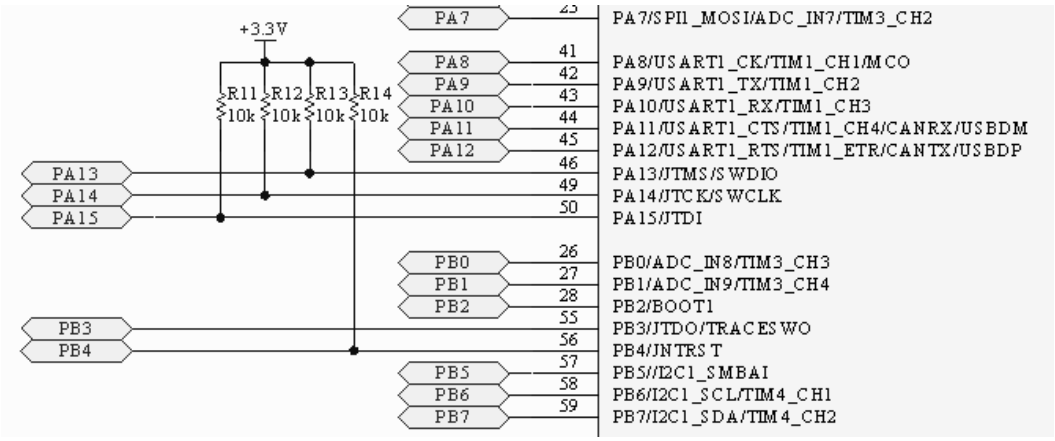
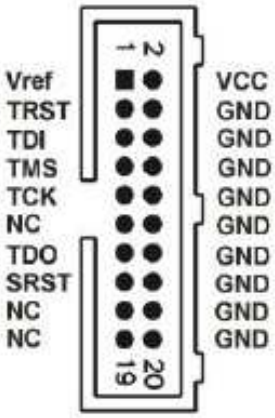



*Figure 7 JTAG connection on module*




| Pin description | |
|---|---|
| VCC | Supply voltage to the emulator |
| Vref | Target voltage sense |
| TRST | Tap RESET, RESET signal for JTAG chain |
| TDI | Test Data Input, data signal from debugger to target |
| TMS | Test Mode Select, mode select signal from emulator to target |
| TCK | Test Clock, clock signal from emulator to target |
| TDO | Test Data Output, data signal from target to debugger. |
| SRST | Target RESET signal |
| GND | Ground |

JTAG programmer/debugger may be found on page:
ARM cable I [http://www.propox.com/products/t_122.html](http://www.propox.com/products/t_122.html)

# 3. Evaluation Board

## EVBmm™

# 4. Specifications

| | |
|---|---|
| **Microcontroller** | STM32F103Rx |
| **Program Memory** | up to 128kB |
| **SRAM Memory** | up to 20kB |
| **Serial Flash Memory** | 8MB |
| **Digital in/out** | up to 49 |
| **Analog inputs** | up to 15 |
| **Power Supply** | 3.3V or 3.8 – 9V |
| **Dimensions** | 40,5x35,5mm |
| **Weight** | about 80g |
| **Temperature range** | 0 – 70ºC |
| | |
| **Connectors** | Two gold-pin connectors - 2x32 |

# 5. Technical Assistance

In order to obtain technical assistance please contact support@propox.com . In the request please include the following information:

- a detailed description of the problem

# 6. Guarantee

The MMstm32F103R minimodule is covered by a six-month guarantee. All faults and defects not caused by the user will be removed at the Producer's cost. Transportation costs are borne by the buyer.
The Producer takes no responsibility for any damage and defects caused in the course of using the MMstm32F103R module.

# 7. Assembly Drawings




*Figure 8 TOP*




*Figure 9 Bottom*

# 8. Dimensions

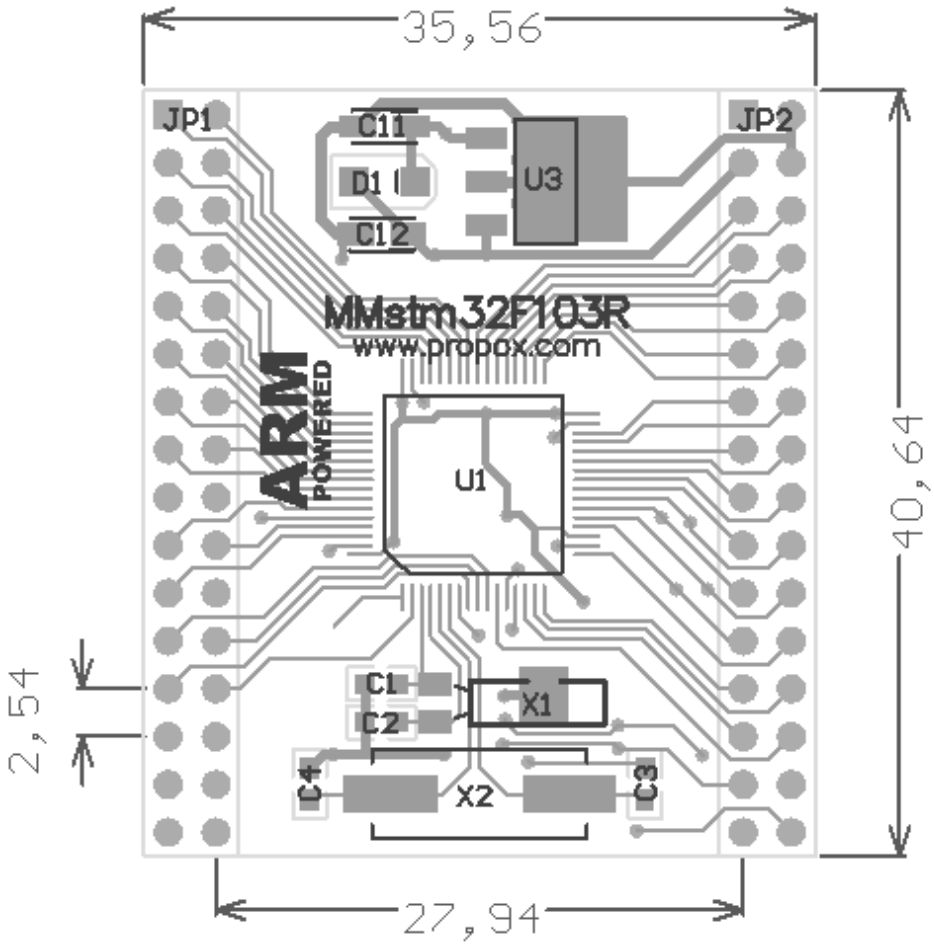
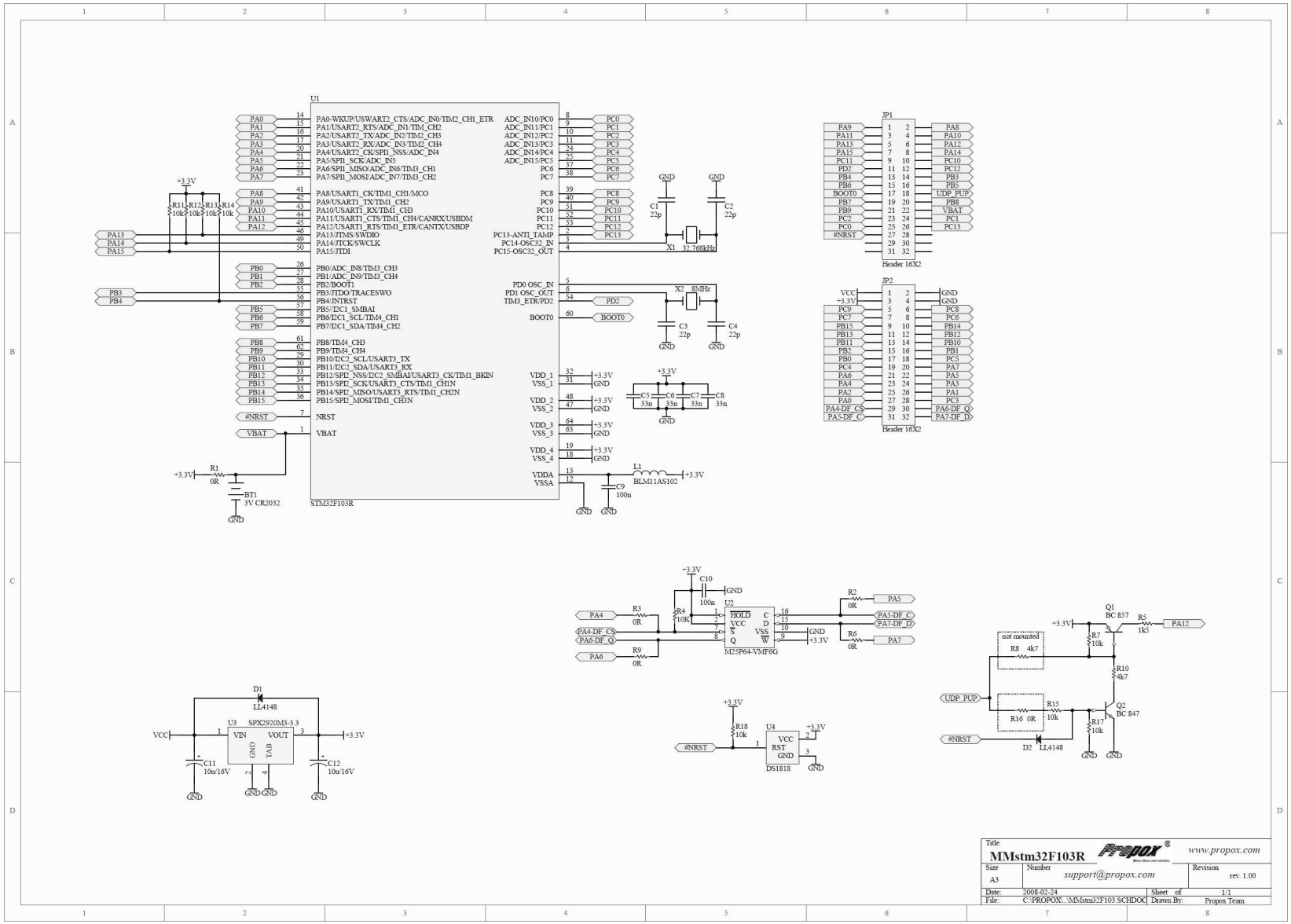



*Figure 10 Top View*


*Figure 11 Side View*

# 9. Schematic


U1
STM32F103R
JP1
Header 16X2
JP2
Header 16X2
X1 32.768kHz
X2 8MHz
BT1 3V CR2032
U2 M25P64-VMF6G
U3 SPX2920M3-3.3
U4 DS1818
D1 LL4148
D2 LL4148
Q1 BC 857
Q2 BC 847
L1 BLM11AS102
not mounted
R8 4k7
R16 0R
Title
MMstm32F103R
www.propox.com
support@propox.com
Size A3
Number
Revision rev. 1.00
Date: 2008-02-24
Sheet of 1/1
File: C:\PROPOX...\MMstm32F103.SCHDOC
Drawn By: Propox Team