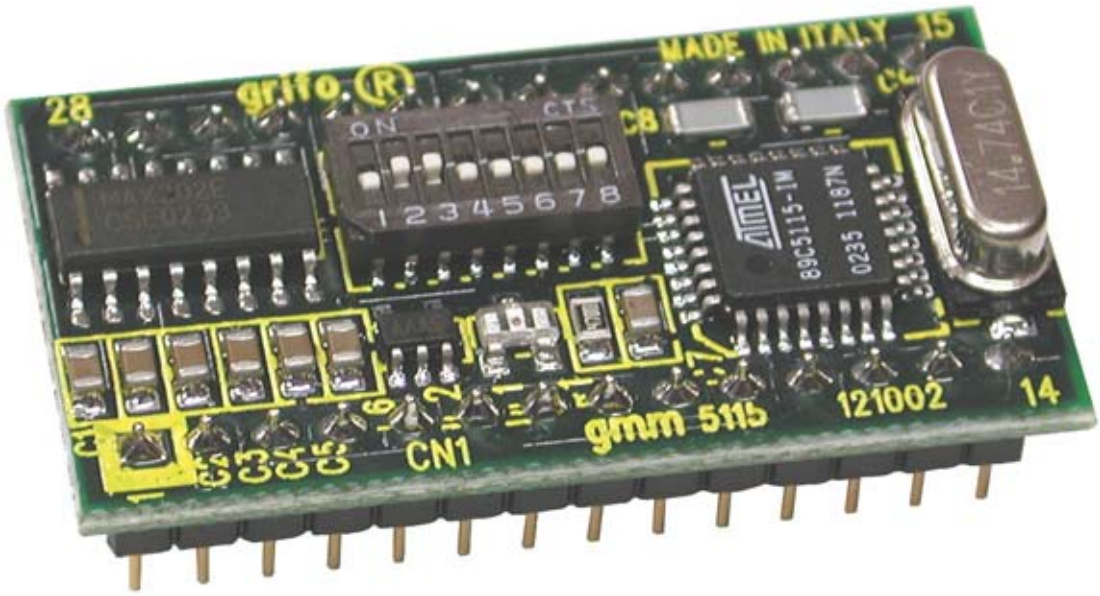
GMM 5115

grifo® MiniModulo T89c5115

TECHNICAL MANUAL



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GMM 5115 Rel. 5.10 *Ed. 11 November 2003*

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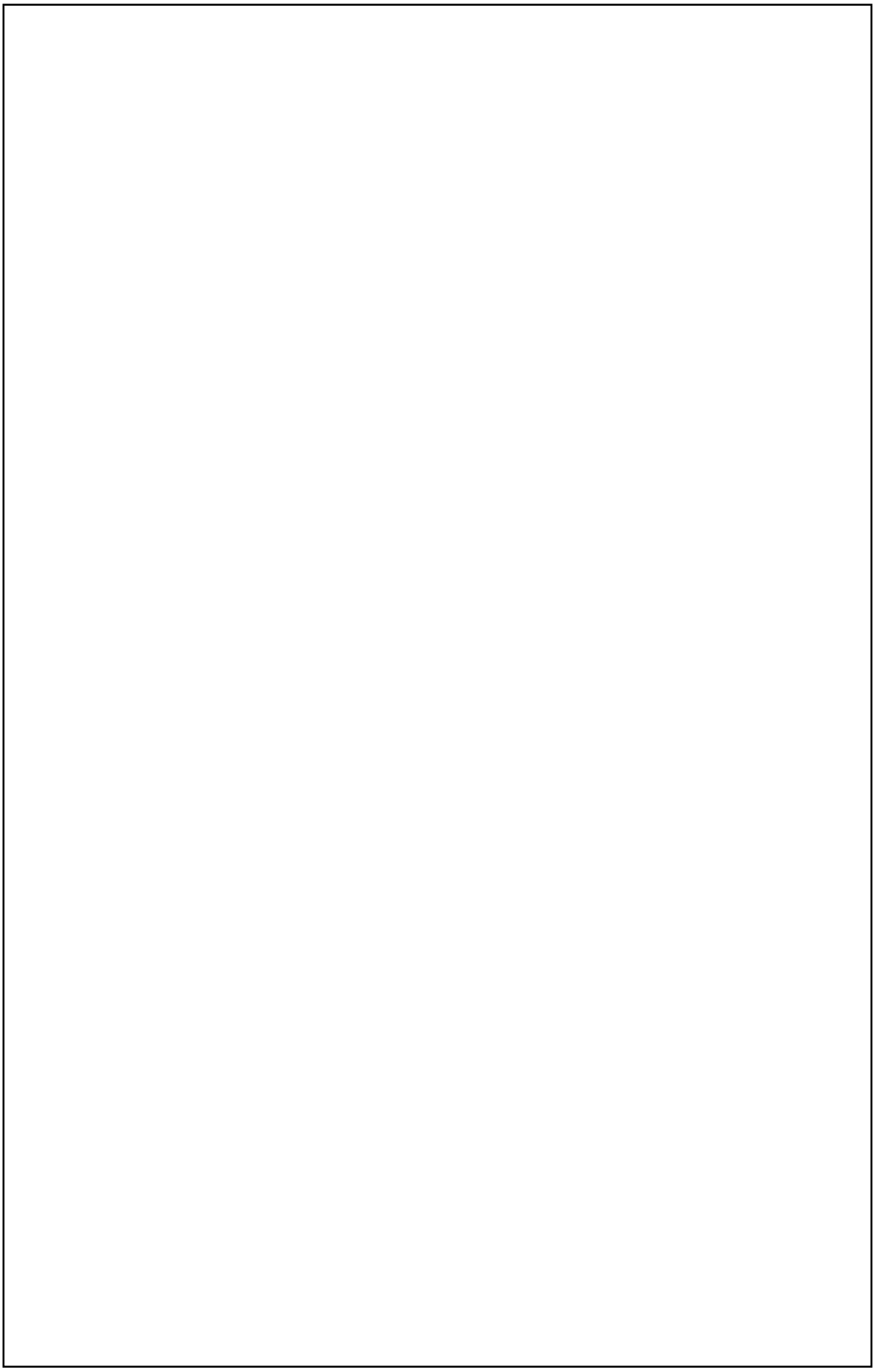

GMM 5115

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TECHNICAL MANUAL

Standard container with **28 pins** male socket, DIL, 100 mils pitch, 600 mils width; **very small dimension**: 20.7 x 38.7 x 12.8 mm; single power supply required **+5Vdc** (the current consumption may vary according to module connections); availability of **idle** mode and **power down mode**; **Atmel T89C5115** microcontroller (8051 code compatibile) with 14.74 Mhz crystal; programmable machine speed at **12 or 6 clock** cycle; **16K FLASH** for code, 2K FLASH for boot loader, 256 bytes RAM for data, **256 bytes ERAM** for data, **2K EEPROM** for data; **7 A/D converter channels** with **10 bits** resolution, **20 µsec** conversion time; 14 **interrupt** sources with **4 priority levels**; **3 Timers Counters** up to 16 bits; **5 PCA channels** up to 16 bits with PWM, watch dog, **compare**, **capture**, etc. functionality; **18 digital I/O lines** available on connector; hardware serial line with Baud Rate up to **115200 Baud**, **RS 232** buffered or at **TTL** level; transceiver MAX202 for RS 232 serial line; **reset** and power supply control circuit based on MAX825; 8 configuration **dip switches**; **LED** to indicate RUN or DEBUG status or managed by software; internal FLASH and EEPROM can be managed through **In System Programming**, or when the module is already mounted, by using the serial communication line; **freeware software** for PC, that supports the ISP programmation to dowload the generated code, inside on board FLASH; wide range of **development tools** as: Assembler (MCA51); C compiler (MCC51, HTC51, SYS51CW, DDS Micro C51); BASIC compiler (BASCOM 8051); PASCAL compiler (SYS51PW); etc.; long list of **demo programs** and use examples supplied under source form, duly remarked, for the available development tools.

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For specific informations on the components mounted on the card, please refer to the Data Book of the builder or second sources.

SYMBOLS DESCRIPTION

In the manual could appear the following symbols:

Attention: Generic danger

Attention: High voltage

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INTRODUCTION

The use of these devices has turned - IN EXCLUSIVE WAY - to specialized personnel.

The purpose of this handbook is to give the necessary information to the cognizant and sure use of the products. They are the result of a continual and systematic elaboration of data and technical tests saved and validated from the manufacturer, related to the inside modes of certainty and quality of the information.

The reported data are destined- IN EXCLUSIVE WAY- to specialized users, that can interact with the devices in safety conditions for the persons, for the machine and for the enviroment, impersonating an elementary diagnostic of breakdowns and of malfunction conditions by performing simple functional verify operations , in the height respect of the actual safety and health norms.

The informations for the installation, the assemblage, the dismantlement, the handling, the adjustment, the reparation and the contingent accessories, devices etc. installation are destined - and then executable - always and in exclusive way from specialized warned and educated personnel, or directly from the TECHNICAL AUTHORIZED ASSISTANCE, in the height respect of the manufacturer recommendations and the actual safety and health norms.

The devices can't be used outside a box. The user must always insert the cards in a container that rispect the actual safety normative. The protection of this container is not threshold to the only atmospheric agents, but specially to mechanic, electric, magnetic, etc. ones.

To be on good terms with the products, is necessary guarantee legibility and conservation of the manual, also for future references. In case of deterioration or more easily for technical updates, consult the AUTHORIZED TECHNICAL ASSISTANCE directly.

To prevent problems during card utilization, it is a good practice to read carefully all the informations of this manual. After this reading, the user can use the general index and the alphabetical index, respectly at the begining and at the end of the manual, to find information in a faster and more easy way.

CARD VERSION

The present handbook is reported to the **GMM 5115** card release **121002** and later. The validity of the bring informations is subordinate to the number of the card release. The user must always verify the correct correspondence among the two denotations. On the card the release number is present in more points both board printed diagram (serigraph) and printed circuit (for example on the left on the component side and on the top left corner on the solder side).

GENERAL INFORMATION

GMM 5115 (**grifo® M**ini **M**odule T89c**5115**) is a module based on microcontroller **Atmel T89c5115**, a powerful and complete system-on-a-chip provided with **CPU**, **internal memory** both for data and for code, **A/D converter**, **watch dog**, **interrupts**, TTL digital I/O lines, a hardware serial line, dedicated **timer/counter** with capture/compare capability and the flexible **PCA** section. This section allows to build, with no or few external components, **PWM** outputs, more timer/counter with capture/compare, software serial lines, etc.
In modules's very small area some comoponents that exploit microcontrollers's performance are already mounted. In addition to this, component that completemicro's features are installed, like **power good and reset** generator **MAX 825**.
Possible applications of **GMM 5115** Mini Modules are several.
We remark the employ as **smart intelligent nodes** with local functionalities as PID algorithms for controlling temperatures, motors, valves, etc. or as **decentralized systems** as robots, automation of production line machines, big factory automations. Finally, **teleacquisition** and **telecontrol** on medium and low distances, **home automation** (lights turning ON/OFF, heating and cooling systems control, supervision of electric devices, security and acces control systems).
Last but not least, **didactics**: **GMM 5115** offers a very low cost to learn CAN, we have many starter kits options. For this purpose it is likewise interesting the **GMM TST** support card.
In any case, there is a short time to market: the user can see a prototype or even a ready product in one week.
Overall features are:

- Standard container with **28 pins** male socket, dual in line, 100 mils pitch, 600 mils width.
- **Very small dimension**: 20.7 x 38.7 x 12.8 mm.
- **4 layers** printed circuit to obtain **best** noisy resistance and best **EMI performance**.
- Single power supply required **+5Vdc** (the current consumption can change according with module connections).
- Availability of power saving setting as **idle** mode and **power down mode**.
- **Atmel T89C5115** microcontroller (8051 code compatibile) with 14.74 Mhz crystal.
- Programmable machine speed at **12 or 6 clock** cycle.
- **16K FLASH** for code, 2K FLASH for boot loader, 256 bytes RAM for data, **256K ERAM** for data, **2K EEPROM** for data.
- **7 A/D converter channels** with **10 bits** resolution, **20 µsec** conversion time.
- A/D reference voltage available on connector.
- 14 **interrupt** sources with **4 priority levels**.
- **3 Timers Counters** up to 16 bits
- **5 PCA channels** up to 16 bits with PWM, watch dog, compare, capture, etc. functionality.
- **18 digital I/O lines** available on connector. Some of these lines have multiple functions.
- Hardware serial line with programmable Baud Rate up to **115200 Baud**, **RS 232** buffered or at **TTL** level.
- **Reset** and power supply control circuit based on MAX825.
- 8 configuration **dip switches**, with 3 dips acquired by software.
- **1 status LED** managed by software through a digital I/O line.
- Internal FLASH and EEPROM can be managed through **In System Programming**, or when the module is already mounted, by using the serial communication line.

- **Freeware software** for PC, that supports the ISP programmation to dowload the generated code, inside on board FLASH.
- Wide range of **development tools** as: Assembler (MCA51); C compiler (MCC51, HTC51, SYS51CW, DDS Micro C51); BASIC compiler (BASCOM 8051); PASCAL compiler (SYS51PW); etc.
- Long list of **demo programs** and use examples supplied under source form, duly remarked, for the available development tools.

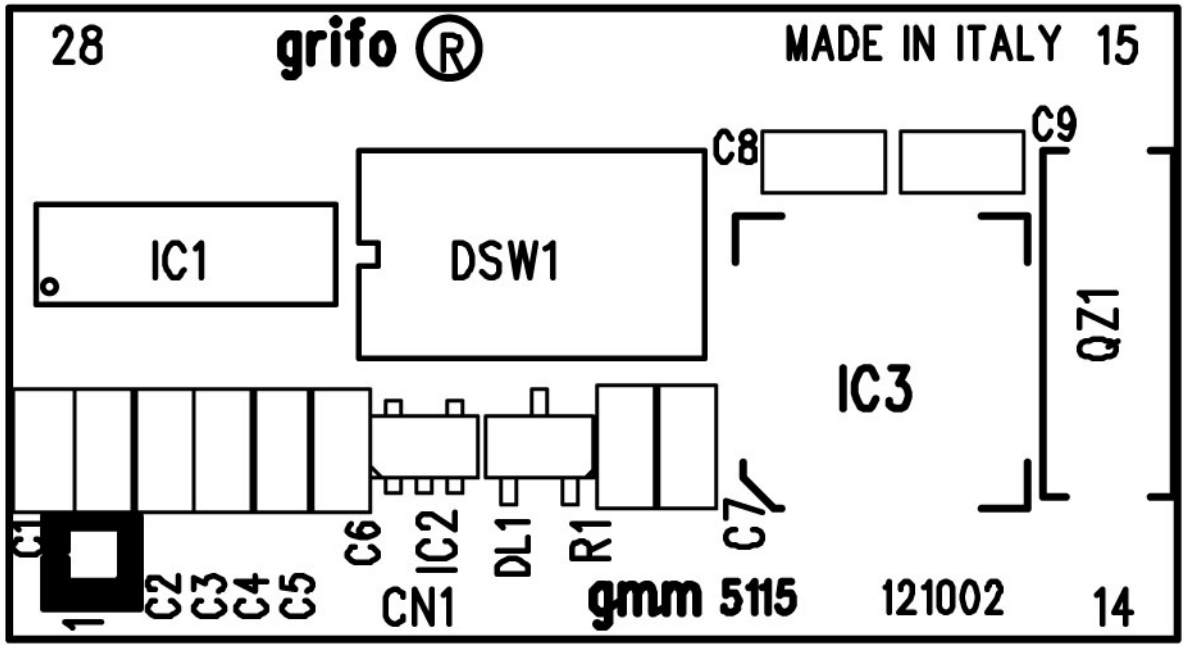


FIGURE 1: COMPONENTS MAP (ABOVE COMPONENTS SIDE AND SOLDER SIDE)

TTL DIGITAL I/O SIGNALS

GMM 5115 Mini Module provides 18 TTL digital I/O signals of microcontroller Atmel T89c5115, that is signals P1.0÷P1.7, P2.0÷P2.1, P3.2÷P3.7 and P4.0÷P4.1.
These signals can be driven programming the specific microprocessor internal registers or using the specific high level commands of programming languages.

A/D CONVERTER ANALOG SIGNALS

GMM 5115 Mini Module provides 8 analog inputs of Atmel T89c5115 internal A/D converter, that is signals AN1÷AN7 multiplexed on signals P1.1÷P1.7.
A/D conversion is made through opportune manipulation of specific microcontroller internal registers. For further information please refer to data sheet of appendix A of this manual or the comments in high level languages example source programs.

DIP SWITCH

GMM 5115 Mini Module is provided with an on board dip switch whose purpose is to set up several electric parameters of module itself and eventually logical parameters of application program.
In fact switch 1 is connected to signal P1.0 and is used at power on or after a reset to determine whether the micro has to run the user application program or the FLASH boot loader, switches 2 to 5 switch between RS 232 or TTL serial signals, switch 6 connects the on board battery and the remaining 2 switches are available to the user program. For further information please see the chapter “DIP SWITCH”.

WATCH DOG

Microcontroller T89c5115 is provided with an internal hardware watch dog capable to reset the CPU if the user program cannot retrigger it in less than the selected intervent time.
Intervent time range is rather wide, it is from about 9 ms to 1 second.

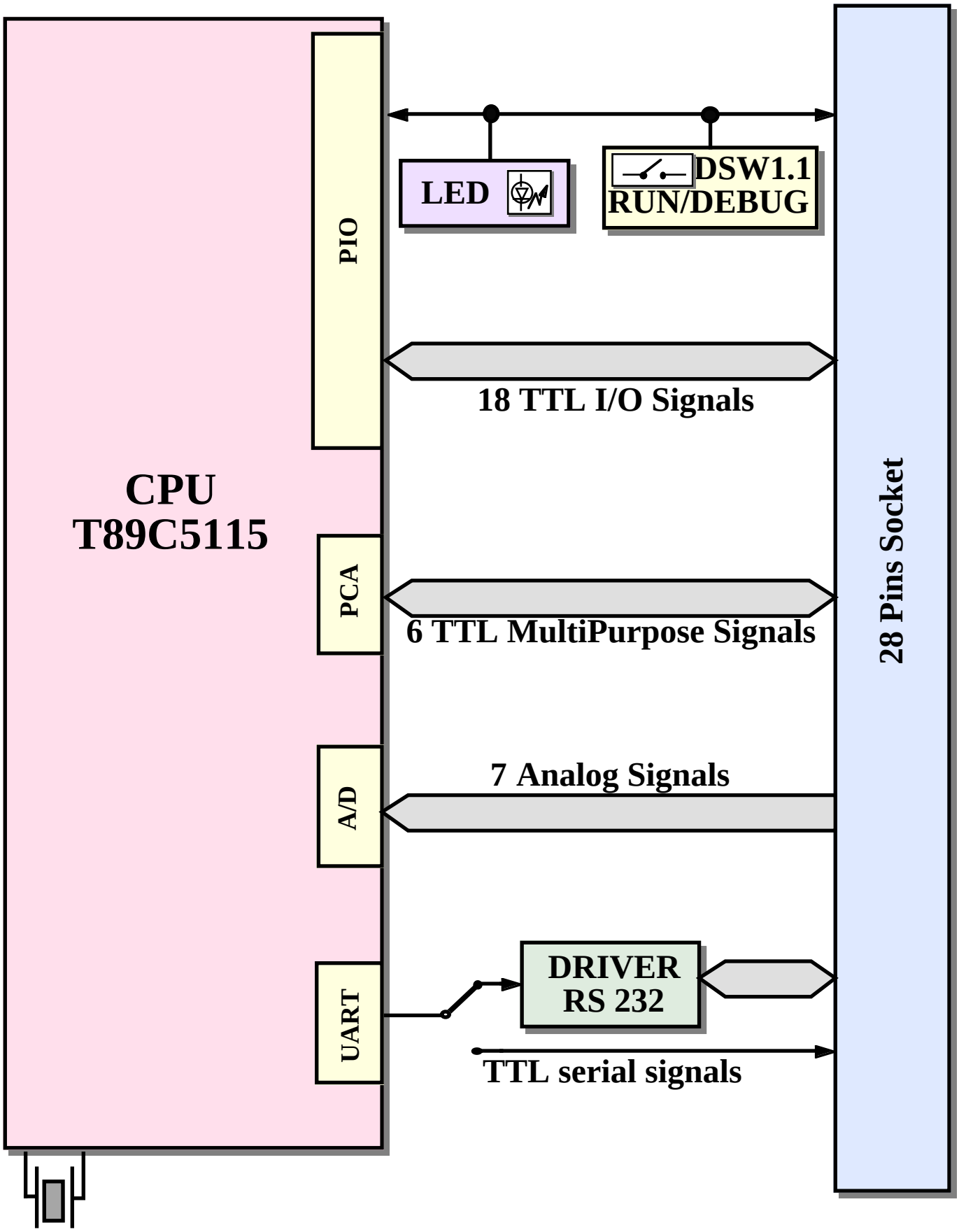


FIGURE 2: BLOCK DIAGRAM

UART RS 232 / TTL

An RS 232 buffer is installed on board of **CAN GM2** Mini Module allows to connect easily the module to any device provided with the same serial interface.
As the UART used is the one internal to the microcontroller, which generates only TTL signals, it is possible to provide directly on the socket these TTL signals instead of RS 232, to let the user connect buffers of different electric protocols like, for example, RS 422, RS 485, current loop, etc.

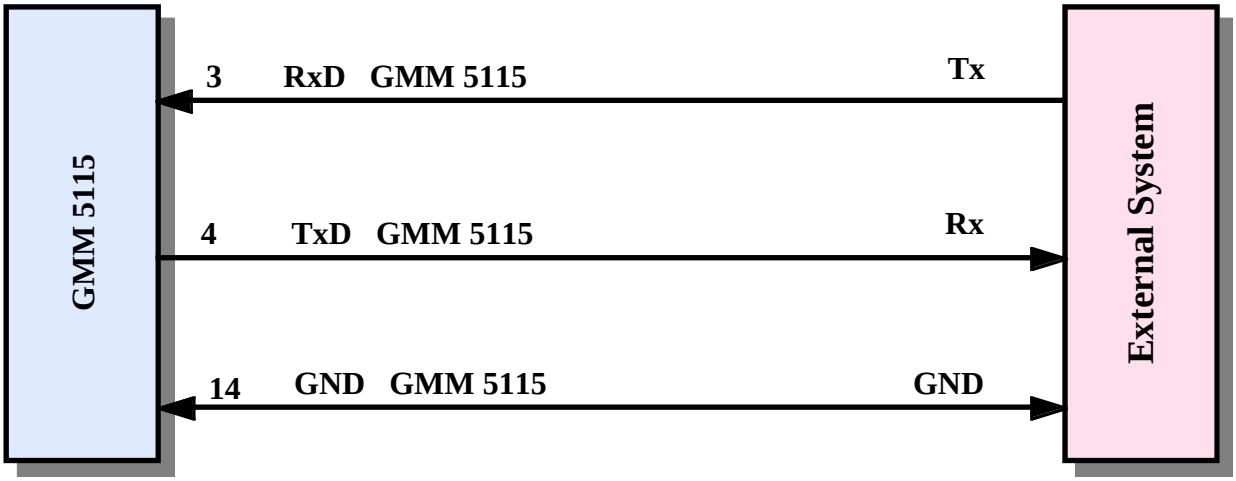


FIGURE 3: RS 232 POINT TO POINT CONNECTION EXAMPLE

In the following diagram the figurea on the right indicate the pins of D type connector available on **CAN GMT** or **GMB HR84**, please refer to further paragraphs “USE WITH BOARD CAN GMT” and “USE WITH MINI BLOCK MODULE GMB HR84”.
Please remember to configure correctly dip switch DSW1 to select between RS 232 and TTL signals (please see paragraph “DIP SWITCH” for further information).

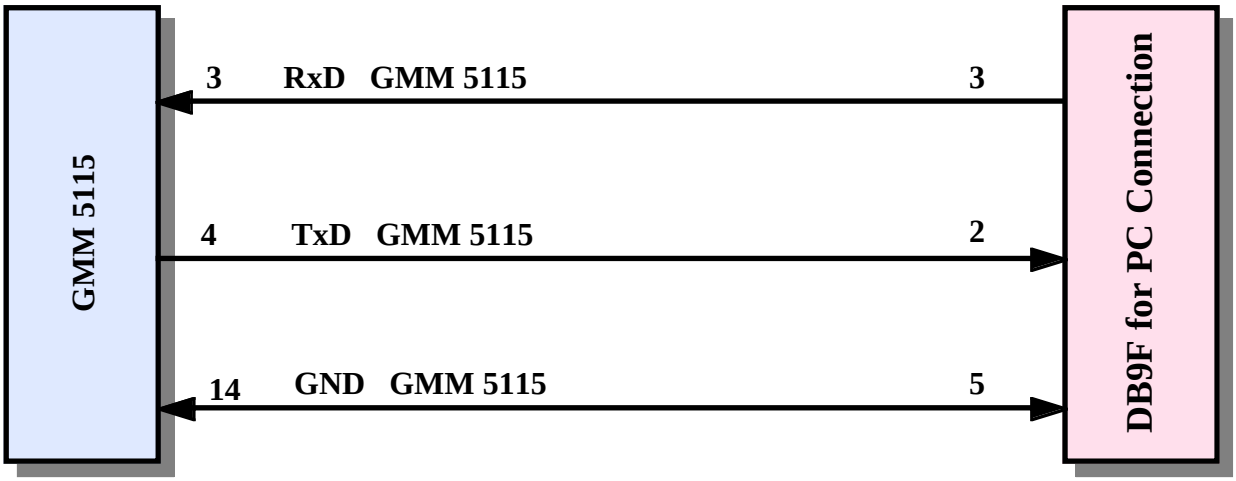


FIGURE 4: RS 232 POINT TO POINT CONNECTION EXAMPLE TO A PC

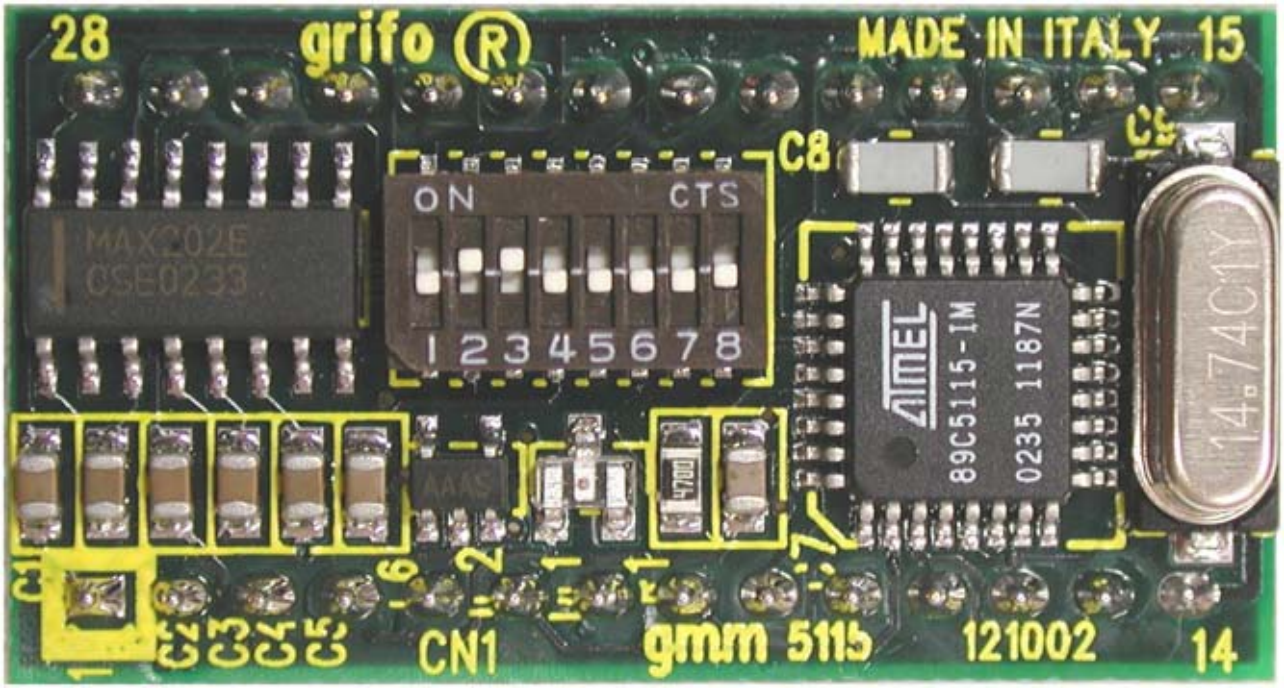


FIGURE 5: PHOTO OF CARD GMM 5115

TECHNICAL FEATURES

GENERAL FEATURES

Devices:	18 digital TTL I/O signals 7 A/D converter analog inputs 6 signals PCA section 1 Watch Dog section 3 Programmable Timer/Counter 14 interrupt sources and 4 interrupt levels 1 reset generator MAX 825 1 RS 232 serial line through MAX 202 1 eight pins dip switch 1 status LED (red)
Memories:	16 Kbyte FLASH user program 2K byte FLASH boot loader 2K EEPROM user data 256 Bytes ERAM user data
CPU:	Atmel T89c5115
Clock frequency:	14.7465 MHz
A/D resolution:	10 bit
A/D conversion time:	20 µsec
External reset duration:	typical 280 msec

PHYSICAL FEATURES

Size:	20.7 x 38.7 x 12.8 mm
Weight:	9.8 g
Connectors:	28 pins male socket DIL
Temperature range:	0÷50 °C
Relative humidity:	20%÷90% (without condense)

ELECTRIC FEATURES

Power supply voltage:	+5 Vdc	
Current consumption:	7 ma	(power down mode)
	13 ma	(normal working mode)
	20 ma	(highest)
Analog inputs impedance:	high	
Power failure theshold:	typical 4.56 Vdc	

INSTALLATION

In this chapter there are the information for a right installation and correct use of the card. The user can find the location and functions of LEDs, ect. and some explanatory diagrams.

USE WITH MINI BLOCK MODULE GMB HR84

Amongst **grifo®** cards, **GMB HR84** module is the one designed specifically to provide optocoupled inputs and relay outputs to **CAN GMx** and **GMM xxx** 28 pins Mini Modules and to install them on omega rails.
Mini block modules are provided with a **plastic container DIN 50022** Modulbox, model M4 HC53.
Sizes: front **90** x **71** mm, height **58** mm.
Can be installed on **omega rail** DIN 46277-1 and DIN 46277-3.

Remarkable features are:
- 1 A/D converter line with full range selectable between **2.5 V** and **10 V**
- 1 TTL **PWM** signal

FIGURE 6: PHOTO OF GMB HR84 WITH CONTAINER

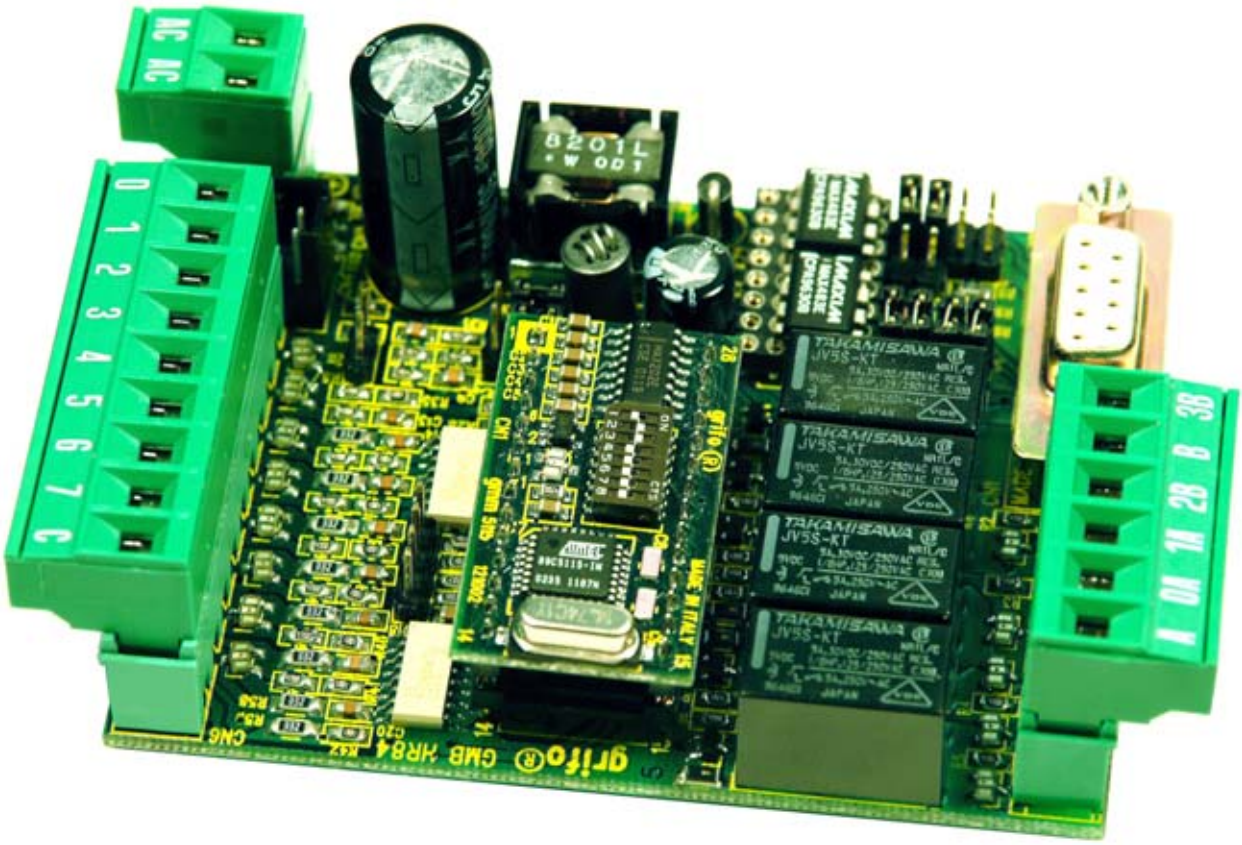


FIGURE 7: PHOTO OF GMM 5115 AND GMB HR84 WITHOUT CONTAINER

GMB HR84 allows easily to:

- to supply the Mini Module through on board power supply
- to have eight TTL I/O signals of microprocessor ports optocoupled NPN and PNP at the same time and visualized through red LEDs; I/O signals are multiplexed with PCA, so developed functions like couters are immediatly available
- to have other four TTL I/O signals of microprocessor ports on bufferd relays driving and visualized through green LEDs; I/O signals are multiplexed with PCA, so developed functions like sqare waves are immediatly available
- to connect I^2C Bus available for external devices on dedicated connector
- to connect immediatly RS 232 - TTL serial line through a comfortable 9 pins D type connector
- to buffer easily TTL UART signals from microprocessor in RS 422, RS 485 or current loop
- to have more I/O signals for A/D converter, PWM functions, etc. on AMP connector

USE WITH GMM TST BOARD

Amongst **grifo®** cards, **GMM TST** is the one designed specifically to be the prototyping board supporting **CAN GMx** and **GMM xxx** Mini Modules.
GMM TST allows easily to:

- to supply the Mini Module through on board power supply
- to have I/O port and A/D converter signals on a comfortable low profile connector compiant to standard **I/O ABACO®**
- to set and visualize the status of up to 2 microcontroller I/O signals through coloured push buttons and LEDs excludible by jumpers
- to generate sound feedback using the autoscillating on board buzzer
- to develop quickly and comfortably user interface application taking advantage of on-board LCD backlit 20x2 display and the 4x4 matrix keyboard

FIGURE 8: PHOTO OF GMM 5115 AND GMM TST

HOW TO START

One of the most important features of **GMM 5115** Mini Module is the possibility to program the microprocessor T89c5115 internal memory with in system programming (ISP) through serial interface.
Below are listed the sequence of operations that must be performed by the user to use this feature:

A) Check serial connection between Mini Module and PC
- A1) Make the connection described on figure 5 or install the Mini Module on a **GMM TST** or a **GMB HR84**, in these cases please refer to respective manual
- A2) Start a terminal emulator on PC, configure it to use the serial port where Mini Module is connected with 19200 baud, 8 data bits, 1 stop bit, no parity
- A3) Supply the Mini Module; each Mini Module is delivered with its demo program already programmed in internal FLASH and configured to make it start when Module is supplied, if you don't see the starting screen of demo on terminal emulator, check serial connection and that switch 1 of DSW 1 is OFF

B) Reprogramming of internal FLASH
- B1) The file containing the demo already programmed in internal FLASH, called pr5115.hex, is available on **grifo®** CD, locate and save to a comfortable position on PC hard drive
- B2) Set switch 1 of DSW1 ON
- B3) Close the terminal emulator
- B4) Power off and then on the card
- B5) Program the microprocessor internal FLASH EPROM by using the specific program supplied by ATMEL: **FLIP**
- B6) Power off the card
- B7) Set switch 1 of DSW1 OFF
- B8) Restart the terminal emulator configured like in A2)
- B9) Power on the card: the programmed application program will start execution from internal ROM

C) Creation of an application program
- C1) The files containing the source code of demo already programmed in internal FLASH, called pr5115.* (extension identifies the language), is available on **grifo®** CD or out web site www.grifo.com, locate and save to a comfortable position on PC hard drive
- C2) Recompile the source code using the compiler you choose, to obtain a file prgmzero.hex like the one already available on **grifo®** CD
- C3) Follow the instructions from B2) above

The ISP reduces the total application cost, in fact it eliminates the requirements of EPROM, EPROM programmer, external FLASH EPROM, etc. For further informations on in system programming please refet to specific technical documentation from ATMEL.

CONNECTIONS

The **GMM 5115** module has one male 28 pins DIL connector that provides +5 Vdc power supply andallows to connect to the external world the signals of on board microcontroller Atmel T89c5115 and the surrounding components.

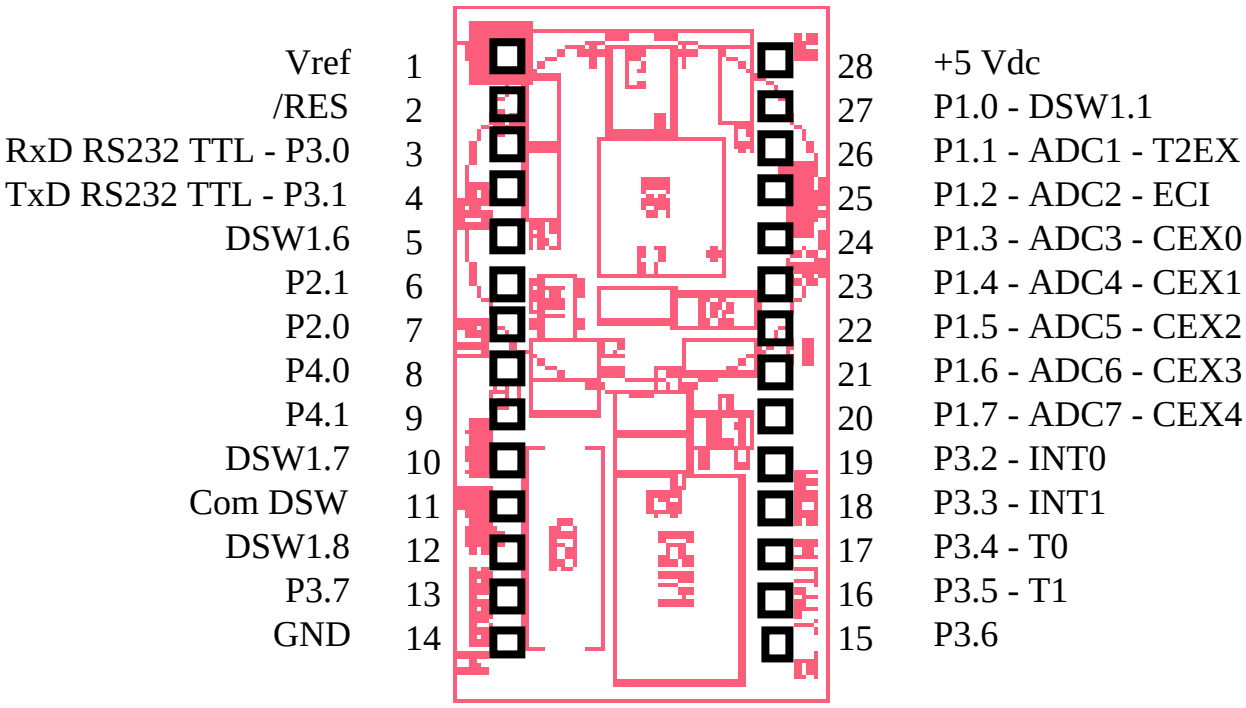


FIGURE 9: PINOUT OF 28 PIN SOCKET (COMPONENTS SIDE)

Signals description:

+5 Vdc	= I	- Power supply +5 Vdc
GND	=	- Ground
RxD RS232 / TTL	= I	- Receive Data in RS 232 or TTL
TxD RS232 / TTL	= O	- Transmit Data in RS 232 or TTL
/INTn	= I	- CPU internal interrupt (/INT0 and /INT1)
Tn	= I	- External inputs for timer 0, 1 and 2 count
T2EX	= I	- Trigger inputs for timer 2
/RES	= I/O	- CPU reset signal
P1.0÷7	= I/O	- CPU TTL I/O digital Port 1 signals (multiplexed)
P2.0÷1	= I/O	- CPU TTL I/O digital Port 2 signals
P3.0÷7	= I/O	- CPU TTL I/O digital Port 3 signals (partially multiplexed)
P4.0÷1	= I/O	- CPU TTL I/O digital Port 4 signals
ADC1÷7	= I	- Analog inputs
CEX.0÷4	= I/O	- Digital inputs or PWM outputs of PCA 0÷4 (multiplexed)
ECI	= I	- External clock digital input of PCA 0÷4 (multiplexed)
Vref	= I	- A/D converter reference voltage

INTERRUPTS MANAGEMENT

One of the most important **GMM 5115** features is the powerful interrupts management. Here is a short description of how the board's hardware interrupt signals can be managed; a more complete description of the hardware interrupts can be found in the microprocessor data sheets or in appendix A of this manual.

- CPU inside devices -> Can generate an internal interrupt. Possible sources of internal interrupt events are: timer 0÷2, PCA, UART, A/D converter, external interrupts.

The microprocessor features a programmable priority structure that manages the case of contemporary interrupts. The addresses of the interrupt response subroutines can be software programmed by the user placing them on the proper code areas while the interrupts priority level and activation are sofware programmable through internal CPU registers. So the user program has always the possibility to react promptly to every external event, deciding also the priority of interrupts.

MEMORY ARCHITECTURE

Memory of Mini Module **GMM 5115** is made by microprocessor internal memory . In detail:

Internal memory

- 16K bytes FLASH of user memory
- 2K bytes FLASH for boot loader
- 2K bytes EEPROM of user memory
- 256 bytes SRAM of user memory

VISUAL FEEDBACK

GMM 5115 Mini Module is provided with one LEDs as described in the following table:

LED	PURPOSE
DL1	If ON, indicates that signal P1.0 (pin 27 of socket) is at low level (zero volt).

FIGURE 10: VISUAL SIGNALATIONS TABLE

DIP SWITCH

An 8 pins dip switch is installed on **GMM 5115** Mini Module. It allows to perform selection regarding the module's working way. Figure 13 shows a list of swithces connection and purpose, in the table * means default connection, that is the configuration of the board after test in our laboratories.
To locate the dip switch, please refer to figure 12.

I/O CONNECTION

To prevent possible connecting problems between **GMM 5115** and the external systems, the user has to read carefully the information of the previous paragraphs and he must follow these instrunctions:

- For RS 232 communication signals the user must follow the standard rules of these protocols.

- For all TTL signals the user must follow the rules of this electric standard. The connected digital signal must be always referred to card digital ground (GND). For TTL signals, the 0 Vdc level corresponds to logic state "0", while 5Vdc level corrisponds to logic state "1".

- The analog inputs (A/D section) must be connected to low impedance signals in the range: 0÷3 Vdc.

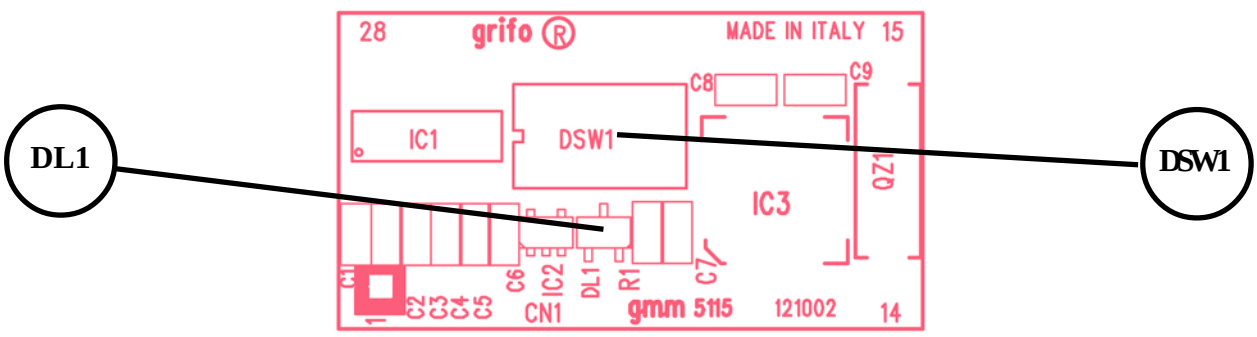


FIGURE 11: DL1 AND DSW1 LOCATION

SWITCH	POSITION	PURPOSE	DEF.
1	ON	Connects signal P1.0 (pin 27 of socket) to the ground (zero volt). If Mini Module is powered or reset in this condition it enters in DEBUG mode and runs the Boot Loader.	
	OFF	Does not connect signal P1.0 (pin 27 of socket). If Mini Module is powered or reset in this condition it enters in RUN mode and runs the user program stored in the microcontroller FLASH memory.	*
2	ON	Connects signal TxD of on board RS 232 serial line to pin 4 of 28-pins socket. Used in conjunction with switches 3, 4 and 5.	*
	OFF	Does not connect signal TxD of on board RS 232 serial line to pin 4 of 40-pins socket.	
3	ON	Connects signal RxD of on board RS 232 serial line. Used in conjunction with switches 2, 4 and 5.	*
	OFF	Does not connect signal RxD of on board RS 232 serial line.	
4	ON	Connects signal TTL TxD of microcontroller to socket. Used in conjunction with switches 2, 3 and 5.	
	OFF	Does not connect signal TTL TxD of microcontroller to socket.	*
5	ON	Connects signal TTL RxD of microcontroller to socket. Used in conjunction with switches 2, 3 and 4.	
	OFF	Does not connect signal TTL RxD of microcontroller to socket.	*
6	ON	Connects pin 5 to pin 11 of 28-pins socket.	
	OFF	Does not connect pin 11 of 28-pins socket.	*
7	ON	Connects pin 10 to pin 11 of 28-pins socket .	
	OFF	Does not connect pin 11 of 28-pins socket.	*
8	ON	Connects pin 12 to pin 11 of 28-pins socket .	
	OFF	Does not connect pin 11 of 28-pins socket.	*

FIGURE 12: DIP SWITCH TABLE

SOFTWARE DESCRIPTION

A wide selection of software development tools can be obtained, allowing use of the module as a system for its own development, both in assembler and in other high level languages; in this way the user can easily develop all the requested application programs in a very short time. Generally all software packages available for the mounted microprocessor, or for the 51 family, can be used.

GET 51: it is a complete program with editor, communication driver and mass memory management for all '51 family cards. This program developed by **grifo®** allows to operate in the best conditions. The program is menu driven and mouse driven. It is designed to run undr MS-DOS but can run also in MACINTOSH environment with VIRTUAL-PC. It is delivered in MS-DOS 3”1/2 floppy disks.

BASCOM 8051: cross compiler for BASIC source program. It is a powerful software tool that includes editor, BASIC compiler and simulator included in an easy to use integrated development environment for Windows. Many memory models, data types and direct use of hardware resource instructions are available.

HI TECH C 51: cross compiler for C source program. It is a powerful software tool that includes editor, C compiler, assembler, optimizer, linker, library, and remote symbolic debugger, in one easy to use integrated development environment.

FORTH: complete software development tools to program the card with FORTH high level language. It needs a P.C. for user interface and it is really interesting for its fast execution and small size, of the generated code.

MCC 51: integer cross compiler for source files in standard ANSI C. It produces a source assembly file compatible with MCA 51 or with Intel macro relocatable assembler MCS 51.

MCA 51: macro cross assembler available for MS-DOS operating system in absolute and relocatable version. In this relocatable version is supplied with a linker and a library manager.

MCS 51: source level debugger and simulator. Allows to simulate microcontrollers of family 51 and to monitor a program's status. It is executed on P.C. without any additional hardware and it allows loading of HEX and SYMBOLIC files, breakpoint setting, instruction execution in trace mode, registers and memory dump, etc.

MCK 51: it is the sum of MCC 51 and MCA 51 and it is a complete C compiler with an output file type compatible with MCS 51.

SYS51CW: cross compiler for C source program. It is a powerful software tool that includes editor, C compiler, assembler, optimizer, linker, library, simulator and remote symbolic debugger, included in an easy to use integrated development environment for Windows.

SYS51PW: cross compiler for PASCAL source program. It is a powerful software tool that includes editor, PASCAL compiler, assembler, optimizer, linker, library, simulator and remote symbolic debugger, included in an easy to use integrated development environment for Windows.

DDS MICRO C 51: low cost ross compiler for C source program. It is a powerful software tool that includes editor, C compiler (integer), assembler, optimizer, linker, library, and remote debugger, in one easy to use integrated development environment. There are also included the library sources and many utilities programs.

µC/51: It is a comfortable, low cost, software package with a colplete IDE that allows to use an editor, and ANSI C compiler, and assembler, a linker and a remote source level debugger user configurable. Souces of main libraries and remote debugger are included, and so severl utility and demo programs.

LADDERWORK: It is a easy to use system to generate automation application using the very famouts contact logic. It features a graphic editor to place and connect components that refer to hardware resources (like digital I.O, counters, A/D, etc.) like on an electric diagram and define their properties, and efficent compiler to create the executable code and an utility to download it. Integrated IDE makes comfortable use of these tools. Delivered in a CD for Windows with user manual and hardware key.

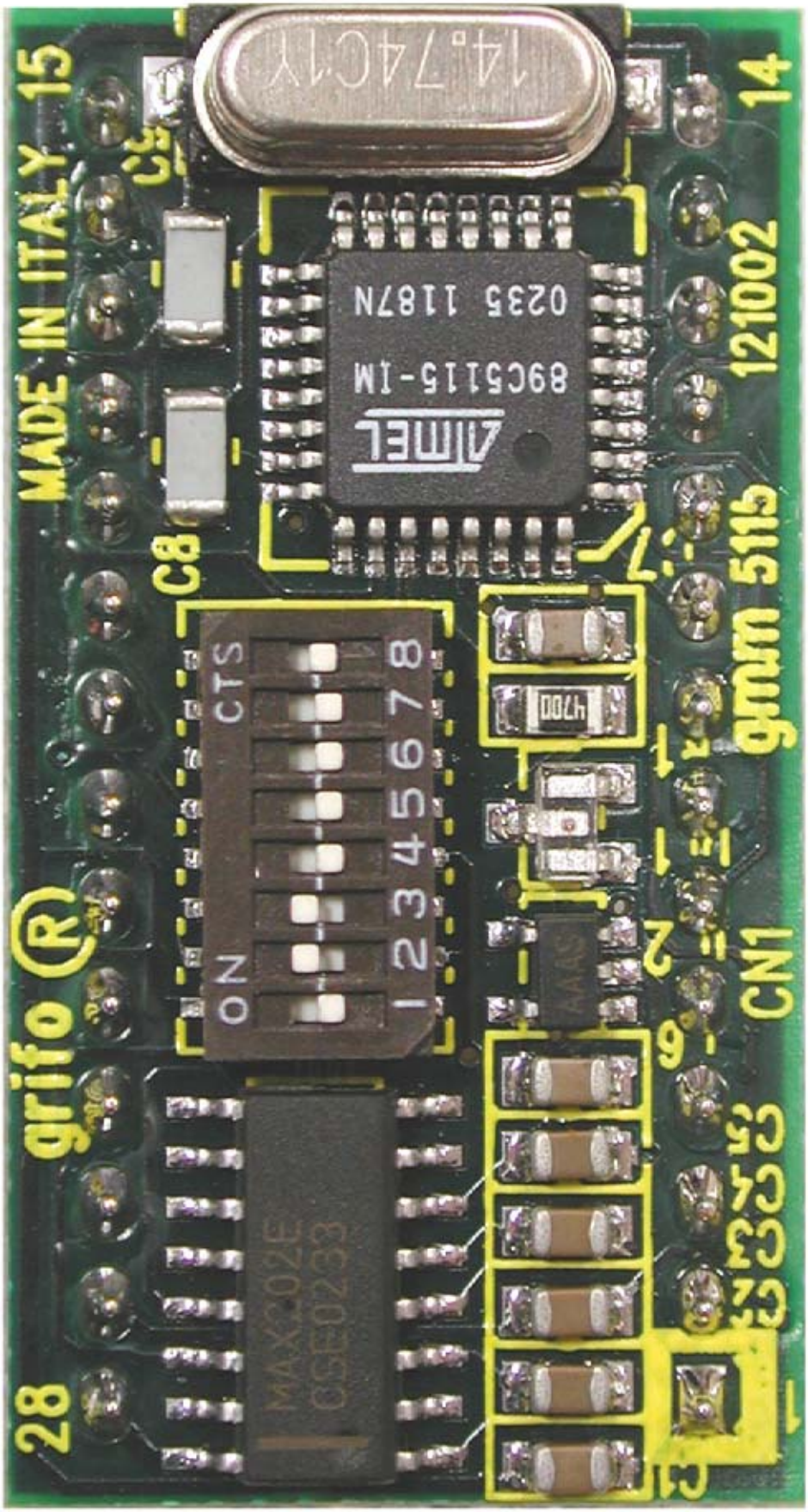


FIGURE 13: PHOTO OF GMM 5115

PERIPHERAL DEVICES SOFTWARE DESCRIPTION

In the previous paragraphes are described the external registers addresses, while in this one there is a specific description of registers meaning and function (please refer to I/O addressing tables, for the registers name and addresses values).
For microprocessor internal peripheral devices, not described in this paragraph, or for further information, please refer to manufacturing company documentation or appendix A of this manual.

DIP SWITCH DSW1 AND RUN/DEBUG

Two switches of the on board DSW1 dip switch status can be obtained by software, through a simple read operation of bit 0 of port 0:

P1.0 -> DSW1.1

Switch 1 is the RUN or DEBUG selector, that is if the switch is ON after a reset or a power on the boot loader is run, otherwise if the switch is OFF the user program in internal FLASH is run.
DSW1 is read in complemented logic, in fact "**ON**" position corresponds to logic level **0** and "**OFF**" position cooresponds to logic level **1**.

STATUS LED

LED DL1 (red) can be software driven and their status can be read by simple read and write operations on port 1:

P1.0 -> DL1

Driving is in complemented logic, in fact LED is **ON** when bit is **0** and LED is **OFF** when the corresponding bit is **1**.

EXTERNAL DEVICES

GMM 5115, through board **GMM TST** and **GMB HR84**, can be connected to a wide range of block modules and operator interface system produced by **grifo®**, or to many system of other companies.The on board resources can be expanded with a simple connection to the numerous peripheral **grifo®** boards,both intelligent and not, thanks to its standard I/O **ABACO®**connector.
Hereunder some of these cards are briefly described; ask the detailed information directly to **grifo®**, if required.

GMB HR84

grifo® Mini Block Housing, 8 opto inputs, 4 relays outputs

8 optocoupled **inputs NPN** or **PNP** visualized through **LEDs**; some inputs can be **counter** or **interrupt** source; **4 relay outputs** up to 5 A visualized through 4 **LEDs**; some outputs can make **PCA** functions for automatic timed commands; **Serial line** RS 232, RS 422, RS 485, current loop or TTL; switching power supply; logic protection trhough **TransZorb™**; **DC** or **AC** power supply from 12 Vdc up to 24 Vac.

GMB HR168

grifo® Mini Block Housing, 16 opto inputs, 8 relays outputs

Plastic container for rails DIN 50022 Modulbox model M6 HC53; front 90 x 106; height 58 mm; 16 optocoupled **inputs NPN** or **PNP** visualized through **LEDs**; some inputs can be **counter** or **interrupt** source; **8 relay outputs** up to 5 A visualized through **LEDs**; some outputs can make **PCA** functions for automatic timed commands; **RTC** with Lithium battery; 1 TTL output driven by RTC and visualized through LED.

GMM TST

grifo® Mini Module Test

Low price card usefull for evaluating and test purpose of 28 or 40 pins **grifo®** Mini Modules type **GMM xxx** and **CAN GMx**. It provides: **D9 connectors** for a direct connections to **RS 232** line; **Buzzer**; **16 Key** buttons; 2 lines **LCD** display; power supply section with standard connector; push buttons and LEDs for digital I/O signals management; etc.

GMM TST2

grifo® Mini Module Test 2

Low price card usefull for evaluating and test purpose of 28 or 40 pins **grifo®** Mini Modules type **GMM 932, GMM AM08 GMM AM32**, etc...It provides: **D9 connectors** for a direct connections to **RS 232** line and **AVR programmer**; **Buzzer**; Connectors 10 pin for a direct connections to AVR ISP; **16 Key** buttons; 2 lines **LCD** display; **power supply** section with standard connector; push buttons and LEDs for digital I/O signals management; etc.

CAN GMT

Controller Area Network - **grifo®** Mini Module Test

Low price card usefull for evaluating and test purpose of 28 pins Mini Modules type **CAN GM1, CAN GM2, GMM 5115**, etc.. It provides: **D9 connectors** for a direct connections to **CAN** line and **RS 232** line; **power supply** section with standard connector; **push buttons** and **LEDs** for digital I/O signals management; prototype area; etc.

CAN GM Zero

grifo® CAN 28 pin Mini Module da based on CPU Atmel T89C51CC03

con 64K FLASH; 256 Bytes RAM;2K ERAM; 2K FLASH for Bootloader; 2K EEPROM; 3 Timer Counter e 5 sezioni di Timer Counter ad alta funzionalita' (PWM, watch dog, comparazione); RTC + 240 Bytes RAM, tamponati con batteria al Litio; I^2C BUS; 17 linee di I/O TTL; 8 A/D 10 bit; RS 232 or TTL; CAN; 2 LEDs di stato; Dip switch di configurazione; ecc.

CAN GM1

grifo® CAN 28 pin Mini Module da based on CPU Atmel T89C51CC01

con 32K FLASH; 256 Bytes RAM; 1024 Bytes ERAM; 2K FLASH for Bootloader; 2K EEPROM; 3 Timer Counter e 2 sezioni di Timer Counter ad alta funzionalita' (PWM, comparazione); RTC + 240 Bytes RAM, tamponati con batteria al Litio; stato; Dip switch di configurazione; ecc.

CAN GM2

grifo® CAN 28 pin Mini Module da based on CPU Atmel T89C51CC02

grifo® Mini Module has a 28 pin connector and it is based on Atmel T89C51CC02 CPU with 16K FLASH; 256 Byte RAM; 256 Bytes ERAM; 2K FLASH for Bootloader; 2K EEPROM; 3 Timer Counter and 2 Programmable Counter Array channels (for PWM, compare, capture); 18 TTL I/O lines; 8 A/D 10 bit: RS 232 or TTL; 1 status LED; configuration dip switch; etc.

GMM AC2

grifo® Mini Module AC2

This **grifo®** Mini Module has a 40 pin connector and it is based on Atmel T89C51AC2 CPU with 32K FLASH; 256 Byte RAM;1K ERAM; 2K FLASH for Bootloader; 2K EEPROM; 3 Timers Counters and 5 Programmable Counter Array channels (for PWM, watch dog, compare, capture); 32 TTL I/O lines; 8 A/D 10 bits; RS 232 or TTL; 2 status LEDs; configuration dip switch; etc.

GMM 932

grifo® Mini Module 932

grifo® Mini Module has a 28 pin connector and it is based on Philips P89LPC932 CPU with 8K FLASH; 768 Byte RAM; 512 Bytes EEPROM; 3 Timer Counter and 2 Programmable Counter Array channels (for PWM, compare, capture); 2 Comparetors; I^2C BUS; 23 TTL I/O lines; RS 232 or TTL; 1 status LED; etc.

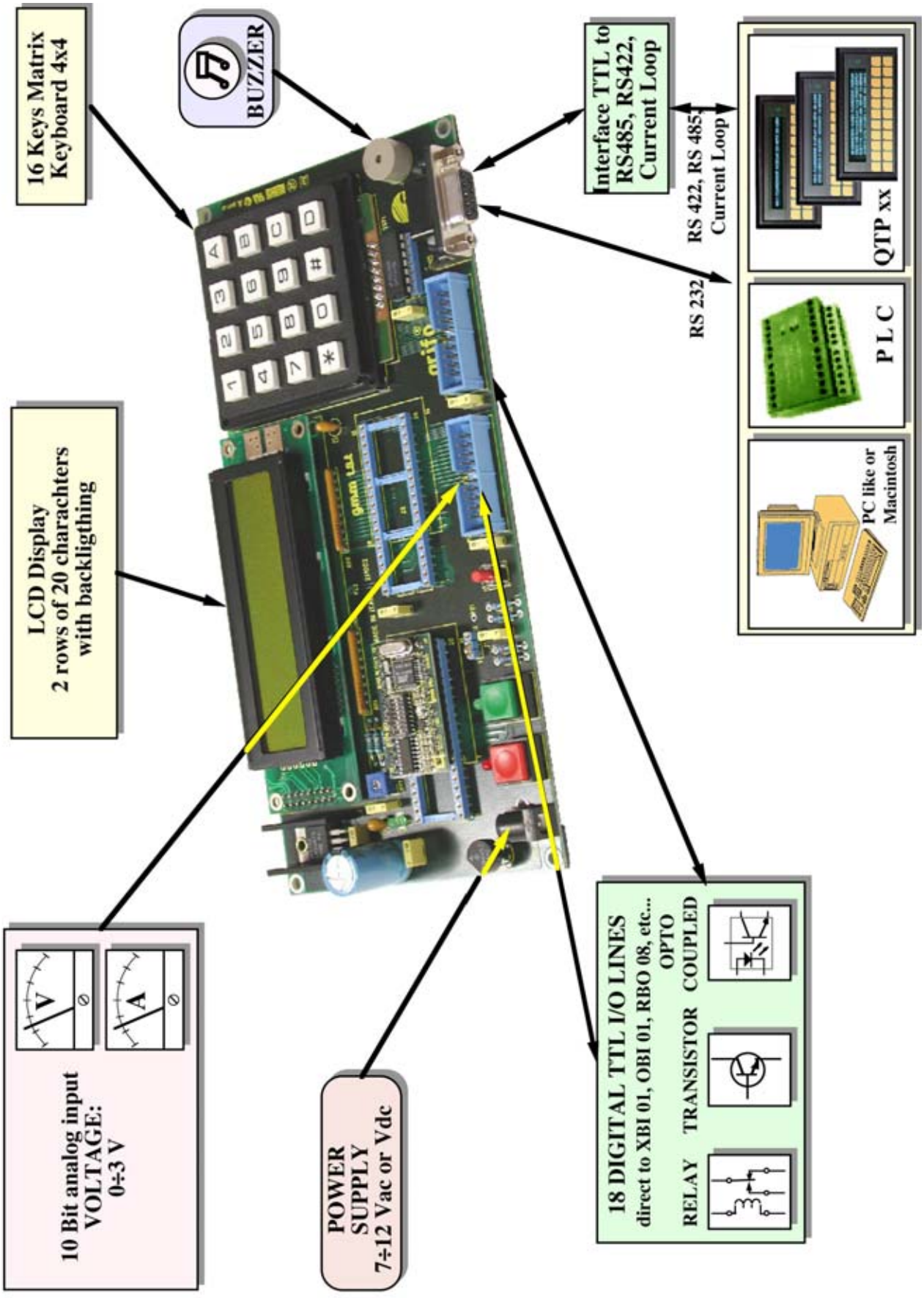


FIGURE 14: CONNECTION EXAMPLES

GMM AM08

grifo® Mini Module ATmega08

grifo® Mini Module has a 28 pin connector and it is based on Atmel ATmega8L CPU with 8K FLASH; 1K SRAM; 512 Byte EEPROM; 3 Timer Counter and 2 Programmable Counter Array channels; 3 PWM; 8 A/D; 1 Comparetor; I^2C BUS; Master/Slave SPI Serial Interface; 23 TTL I/O lines; RS 232 or TTL; 1 status LED; ecc.

GMM AM32

grifo® Mini Module ATmega32

grifo® Mini Module has a 40 pin connector and it is based on Atmel ATmega32L CPU witch 32K FLASH; 2K SRAM; 1K EEPROM; 3 Timer Counter eand 2 Programmable Counter Array channels; 4 PWM; 8 A/D; 1 Comparetor; RTC + 240 Bytes SRAM, backed by Lithium battery; I2C BUS; Master/Slave SPI Serial Interface; JTAG Interface; 32 TTL I/O lines; RS 232 or TTL; 2 status LED; ecc.

BIBLIOGRAPHY

In this chapter there is a complete list of technical books, where the user can find all the necessary documentations on the components mounted on **GMM 5115**.

Manual MAXIM:	*New Releases Data Book - Volume IV*
Manual MAXIM:	*New Releases Data Book - Volume V*
Manual NATIONAL SEMICONDUCTOR:	*Linear Databook - Volume 1*
Manual PHILIPS:	*I^2C bus*
Manual PHILIPS:	*Application notes and development tools for 80C51 microcontrollers*

For further information and upgrades please refer to specific internet web pages of the manufacturing companies.

Data sheet della CPU is available also at our technical documentation service:
http://www.grifo.it/PRESS/DOC/Atmel/T89C5115.pdf

APPENDIX A: DATA SHEET

grifo® provides a completely free technical documentation service to make available data sheets of on board components. Please refer to downloadable documents; the location of ATMEL AT89c5115 is URL http://www.grifo.com/PRESS/DOC/Atmel/AT89C5115.pdf.
To use our technical documentation service just connect to our site www.grifo.com and click its icon.

Features

- 80C51 Core Architecture
- 256 Bytes of On-chip RAM
- 256 Bytes of On-chip ERAM
  - 16-KB of On-chip Flash Memory
  - Data Retention: 10 Years at 85°C
  - Read/Write Cycle: 10K
- 2K Bytes of On-chip Flash for Bootloader
- 2K Bytes of On-chip EEPROM
  - Read/Write Cycle: 100k
- 14-sources 4-level Interrupts
- Three 16-bit Timers/Counters
- Full Duplex UART Compatible 80C51
- Maximum Crystal Frequency 40 MHz
  - In X2 Mode, 20 MHz (CPU core, 40 MHz)
- Three or Four Ports: 16 or 20 Digital I/O Lines
- Two-channel 16-bit PCA with:
  - PWM (8-bit)
  - High-speed Output
  - Timer and Edge Capture
- Double Data Pointer
- 21-bit WatchDog Timer (7 Programmable Bits)
- A 10-bit Resolution Analog to Digital Converter (ADC) with 8 Multiplexed Inputs
- Power Saving Modes:
  - Idle Mode
  - Power-down Mode
- Power Supply: 5V ± 10% (or 3V[1] ± 10%)
- Temperature Range: Industrial (-40° to +85°C)
- Packages: SOIC28, PLCC28, VQFP32

Note: 1. Ask for availability

Description

The T89C5115 is a high performance Flash version of the 80C51 single chip 8-bit microcontrollers. It contains a 16-KB Flash memory block for program and data.

The 16-KB Flash memory can be programmed either in parallel mode or in serial mode with the ISP capability or with software. The programming voltage is internally generated from the standard VCC pin.

The T89C5115 retains all features of the 80C52 with 256 bytes of internal RAM, a 7-source 4-level interrupt controller and three timer/counters. In addition, the T89C5115 has a 10-bit A/D converter, a 2-KB Boot Flash memory, 2-KB EEPROM for data, a Programmable Counter Array, an ERAM of 256 bytes, a Hardware WatchDog Timer and a more versatile serial channel that facilitates multiprocessor communication (EUART). The fully static design of the T89C5115 reduces system power consumption by bringing the clock frequency down to any value, even DC, without loss of data.

The T89C5115 has two software-selectable modes of reduced activity and an 8 bit clock prescaler for further reduction in power consumption. In the idle mode the CPU is frozen while the peripherals and the interrupt system are still operating. In the power-down mode the RAM is saved and all other functions are inoperative.

The added features of the T89C5115 make it more powerful for applications that need A/D conversion, pulse width modulation, high speed I/O and counting capabilities such as industrial control, consumer goods, alarms, motor control, etc. While remaining fully compatible with the 80C52 it offers a superset of this standard microcontroller.

ATMEL

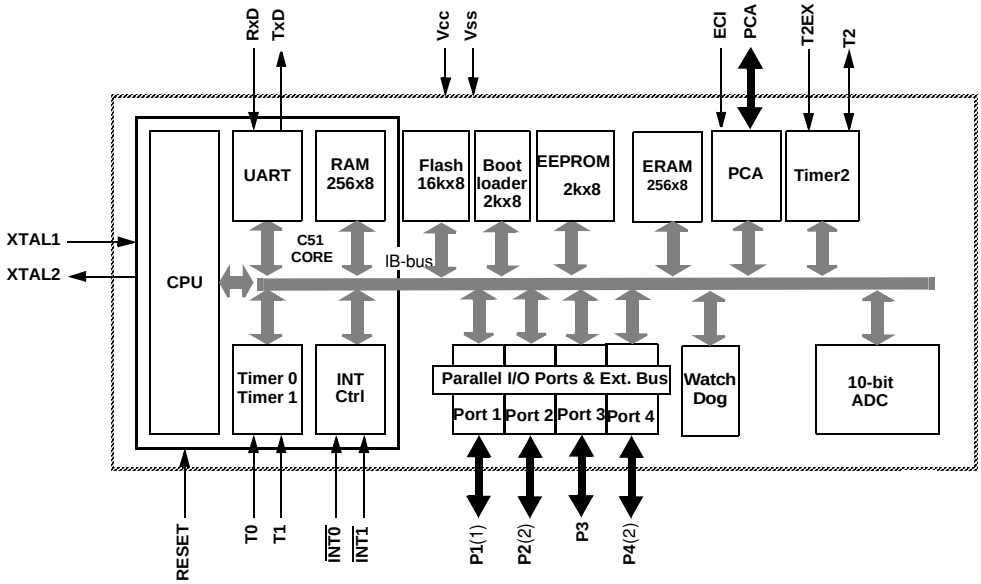
Low Pin Count 8-bit MCU with A/D Converter and 16-Kbytes of Flash Memory

T89C5115

Rev. 4128A–8051–04/02

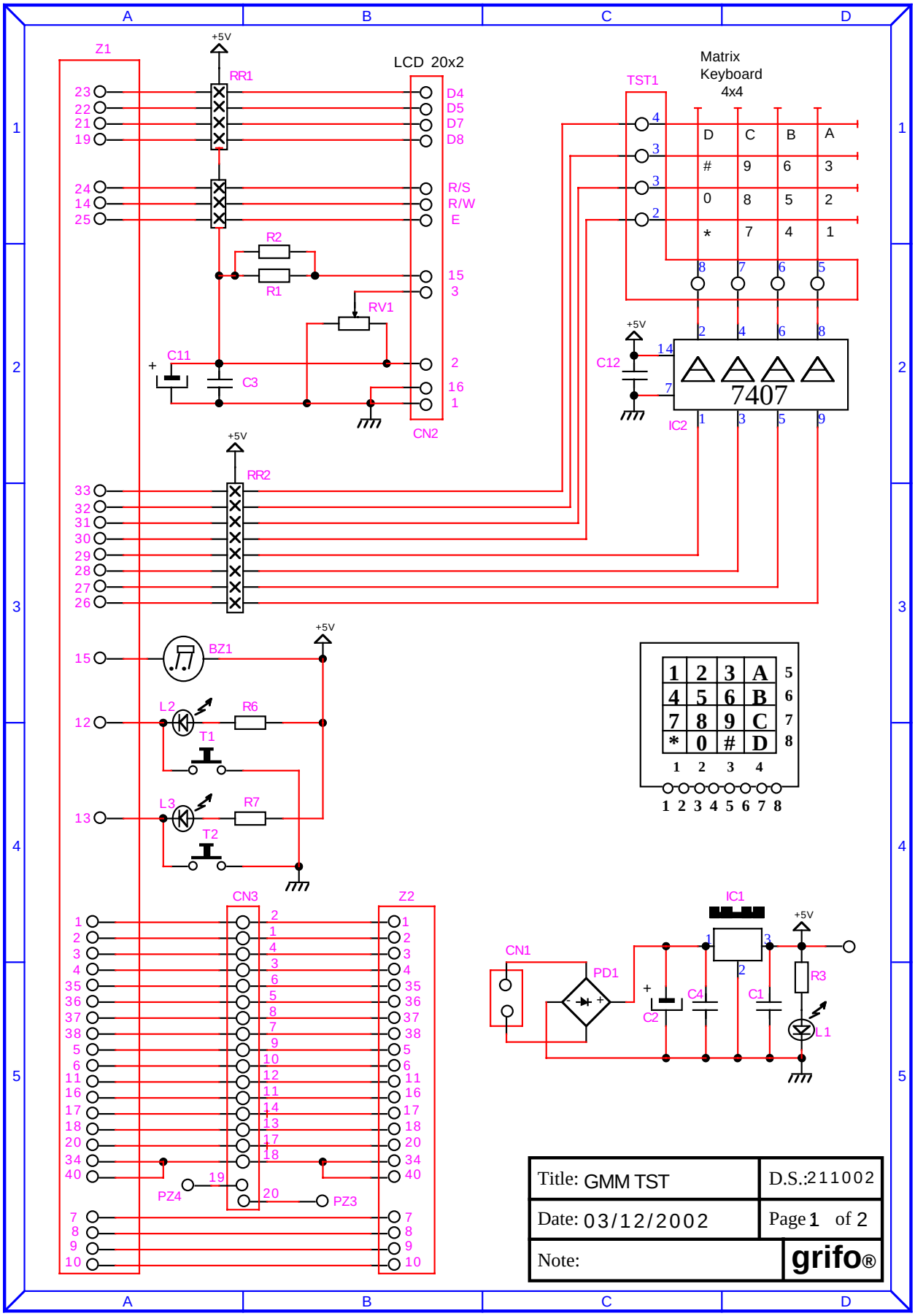
In X2 mode a maximum external clock rate of 20 MHz reaches a 300 ns cycle time.

Block Diagram



Notes: 1. 8 analog Inputs/8 Digital I/O
2. 2-Bit I/O Port

APPENDIX B: GMM TST ELECTRIC DIAGRAM



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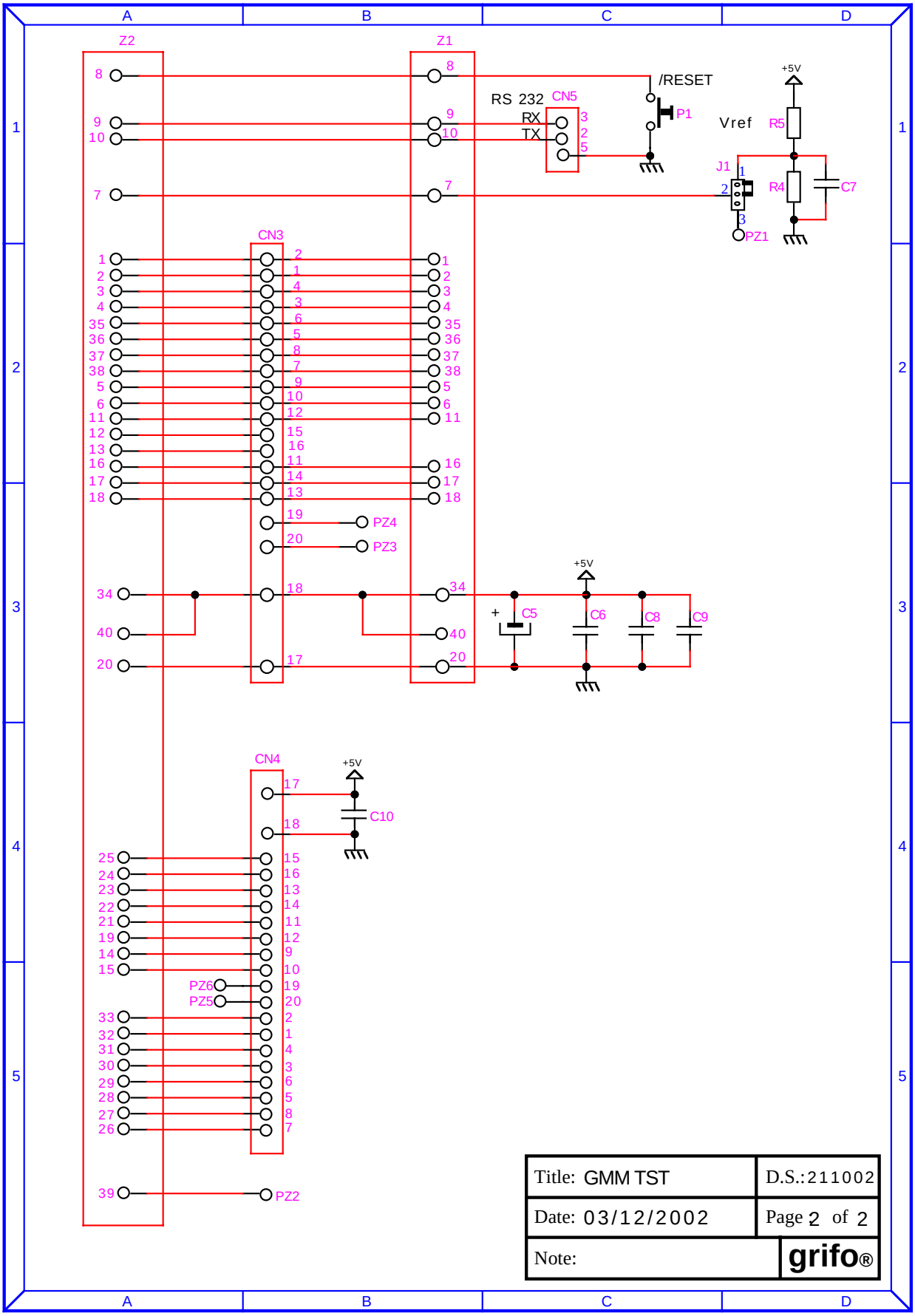
Date: 03/12/2002	Page 1 of 2
Note:	grifo®


A
B
C
D
1
2
3
4
5
Z2
Z1
CN3
CN4
CN5
RS 232
RX
TX
/RESET
P1
Vref
R5
R4
C7
J1
PZ1
+5V
C5
C6
C8
C9
C10
PZ4
PZ3
PZ6
PZ5
PZ2
Title: GMM TST
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Date: 03/12/2002
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Note:
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