

# ARCHIMEDE 2000

## Operating Manual



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Ediz./Rev.	Data (gg/mm/aa)	Motivo	Approvato da:
ARC2000-A/00	20/06/2011	First Edition	M.N.
ARC2000-A/00	18/09/2014	Second Edition	M.N.

## Warranty

**Italab** product is guaranteed against defects in materials and workmanship for a period of TWO YEARS from date of shipment. The standard warranty may be extended beyond the two-year period. A record of warranty extensions is listed on sales orders of each product purchased. Standard warranty conditions apply to extended warranty period.

During warranty **Italab** will repair or replace product proved to be faulty prior to authorization. The warranty validation only applies if product is returned to **Italab** after release of Return of Merchandise Authorization and provided that maintenance procedures are followed as listed in the manual. **Warranty does not cover repair resulting from product carelessness, incorrect or improper use.**

### NO OTHER WARRANTY APPLIES

**ITALAB IS NOT LIABLE FOR DAMAGES RESULTING FROM PRODUCT MISUSE  
ITALAB DOES NOT GUARANTEE ERROR-FREE EQUIPMENT, UNINTERRUPTED OPERATION, FIRMWARE OR  
FIRMWARE BUGS.**

If your Equipment needs repairing call **Italab** promptly and ask for customer service department. It is important to contact **Italab** immediately since many problems may be quickly solved over the phone or by e-mail. Please have your Serial Number ready before you contact **Italab** and clearly explain the nature of your problem. Once we acknowledge your Equipment needs service, we will send you an electronic form to fill in with your name, address, phone number, e-mail and an accurate description of problem or failure. We will issue an **RMA** number.

Send the unit with prepaid shipment to the indicated maintenance lab and place the Equipment in the original box or a suitable container to protect product from damage. **Italab** will not be responsible for damage incurred during shipping. Please ensure RMA number is clearly marked onto shipping container. Our standard terms are to fix or repair Equipment within **five working days**. If Equipment requires parts ordering or more than five working days, **Italab** technical service will contact you. We also provide service for Equipment if warranty has expired. Please, follow the same instructions described above, but tick ☒ in the "not in warranty" box. Warranty is valid on condition that proper maintenance procedures have been complied with, as listed in the manual. Damage caused by product misuse is **NOT** covered by warranty.

## Warranty Service

**The Archimede 2000** is a high reliability equipment. Nevertheless, as any equipment which works 24 hours a day for years, some failures are possible. Because the reparation of the modules, inside the Amplifier, is very difficult on the field, we suggest in the event of any failure to contact our service.

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# Safety Instructions

To maximize user safety and ensure the Device to operate correctly , all instructions contained in this section should be read carefully.

## OPERATING CONDITIONS

This Equipment operates with:

- AC 50÷60 Hz power source of between 190-265 V
- temperature range from 0 up to 40°C.
- Maximum altitude of 4000 m

**ATTENTION** : hazardous voltages are present inside the Equipment. **ONLY AUTHORIZED AND QUALIFIED PERSONNEL CAN REMOVE PARTS OF THE EQUIPMENT**

## GROUND THE AMPLIFIER

To minimize shock hazard, the Amplifier chassis must be connected to an electrical ground through the AC power mains cable, with the third wire ( yellow green ) connected to an electrical ground (safety ground) at the power outlet. Any interruption of the grounding conductor will cause a potential shock hazard that could result in personal injury. If the Amplifier is powered by any other source, make sure that the chassis is connected to a separate safety ground

## DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Operation of the Archimede 2000 in presence of flammable gasses or fumes can endanger persons proximate to the site of operation.

## DO NOT REPAIR THE ARCHIMEDE

Component maintenance, replacement and internal adjustments must be made only by ITB qualified service personnel.

## Fuses

In the event of fuses failure, only fuses with the same required current, voltage rating, and specified type should be used. Do not use repaired fuses or short-circuited fuse holders.

## Output Connector

The “7/16” output connector carries dangerously high RF voltages that could cause shock and burn hazards. Never operate the Amplifier without properly connecting the output connector in either an adequately rated load or antenna.

## Electrostatic Discharge (ESD)

A sudden discharge of electrostatic electricity can destroy static-sensitive devices or micro-circuits. Proper grounding techniques are necessary precautions to prevent damage. Always take industry-standard precautions.

## General Safety Rules

- The device must be used in accordance with the instructions for use.
- Electrical installations in the room must correspond to the requirements of safety regulations.
- Take care that there are no cables, especially mains cables, in areas where people could move or work.
- Do not use a mains connection in sockets shared by other power consumers. Do not use an extension cable.
- Only use the mains cable supplied. In the case it is not long enough, only use a cable with the same characteristics as the one provided to assemble a longer one.
- The unit is completely disconnected from the power source only when the power cord is removed from power source. Therefore the power cord and its connectors must always remain easily accessible.
- Do not set up the device in the proximity of heat sources or in a damp location.
- Make sure that the device has adequate ventilation.
- The Amplifier should not be used near water and objects filled with liquids should not be placed on the appliance.
- The Amplifier should be situated so that its location or position does not interfere with its proper ventilation. For example, the device should not be placed in a built-in installation, such as a bookcase or cabinet that may stop the flow of air through the ventilation openings.
- All plugs on the connection cables must be screwed or locked to the chassis housing.
- The device is designed to be used in horizontal position only.
- The device is no longer safe to operate when has visible damage or it hasn't been working for long time.
- In case of technical problems or a few elements of doubt, Italab will help you with the support of qualified technical personnel.
- In case of system failure or visible damage, the device must be shut down.
- Repairs may only be carried out by a person authorized by ITALAB.
- The ARCHIMEDE 2000 must be switched off and the power cord disconnected from the AC source when removing the top cover.

## Climatic Conditions

In order to have the best performance in term of power, life span, etc, the following parameters must be respected:

- the room temperature should be in a range of 25° C and 30°C .
- The humidity shall be less than 70% and non-condensing.

The Equipment will work beyond the parameters specified, but Italab will not guarantee the continuous service and, in any case, with temperatures higher than 50°inside the Equipment, the standby procedure will automatically start. The room must have a good ventilation to ensure that the inside temperature never exceeds the limit of 40 °C. If the Equipment is included in a rack, the rear of this should not be closed. If it is necessary to close the rear of the Device, a forced ventilation and air extraction must be provided.

## SYSTEM OVERVIEW

This document, Archimede 2000 guidebook , provides instructions on how to install, start up and perform controls on the 2000 Watt Archimede FM Broadcast Transmitter (see photo below), an easy-to use and versatile system used in stand-alone mode.

The information on this manual is intended for an experienced system operator with a knowledge of high-performance broadcast transmission systems. The Archimede 2000 is designed to fit a standard 19" rack.



**ARCHIMEDE 2000** is a broadband amplifier operating from 87.5 to 108 MHz. The RF part consists of 2 amplifying units (AMP1000 - FM) that can deliver full power to 2500 watts in continuous service. However, since the philosophy of Italab to allow all components of a product "not to work in stressful conditions," the power of work has been limited to 2000 watts at full speed, this ensures a good reliability without stress.

The Radiofrequency part (including a RF pallet, a low-pass filter and the input / output directional coupler) is inserted in a box and shielded from all other components that complement this Equipment.

The switching power supply, extremely compact and of excellent quality, is oversized for its final use.

The ARCHIMEDE 2000 is run entirely by a powerful microprocessor that in real time controls all the important functions for an efficient work (ventilation, temperatures of the RF part, temperature of incoming and inner air, output power and reflected power).

# TECHNICAL FEATURES

## Technology

- Solid state power MOSFET technology
- Master control by microprocessor with stored program

## RF Specification

Frequency.....	87.5 ÷ 108 MHz
Input Power.....	8 - 10 Watts Max
Output Power.....	0 ÷ 2000 Watts
Harmonics.....	≤ - 70 dBc
Output Connector.....	7/16 "
Input Connector.....	N type

## OTHER

Voltage Input.....	190 ÷ 265 Vac
Current Input .....	14 A & 230Vac
Protections.....	Overload, VSWR and Temperature
Cooling.....	Forced Air
Working Ambient Temperature .....	0 ÷ +40 °C
Storage Temperature .....	-10 ÷ +60 °C
Umidity.....	90 %
Control System.....	2 buttons, 4x20 LCD display
Dimension .....	3 unity rack 19", 530mm
Weigh.....	18 Kg
Box Material .....	Alodyne Aluminium

The user must obtain a license before using the product in the intended country of use. Ensure respective country licensing requirements are complied with. Limitations of use can be applied in respect of operating frequency, transmitter power and/or channel spacing. Italab is not criminally and civilly liable for a not-legally authorized use.

## FRONT PANEL



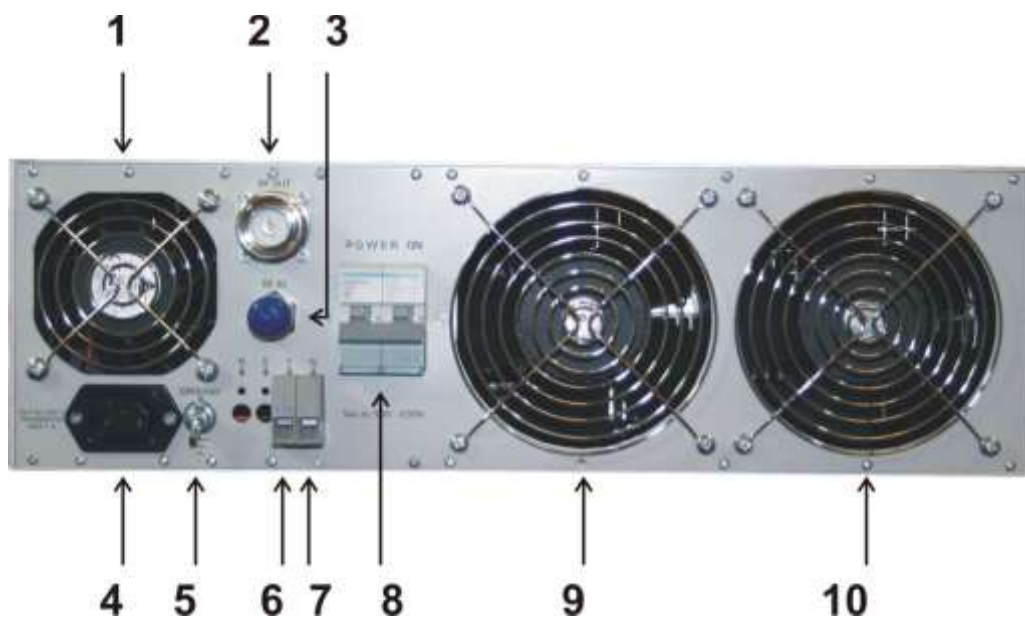
- |    |  |
|----|--|
| 1  | RF TEST (SMA connector output signal test- 60dBc ÷ 3 dB ) option |
| 2  | STOP button                      Stop button                     |
| 3  | START button                      Start button                   |
| 4  | Led ST.BY                      Standby status led                |
| 5  | Led On AIR                      Power broadcast led              |
| 6  | Led BLOCK                      Spy Led block                     |
| 7  | Led TEMP                      Alarm led for overheating          |
| 8  | Led RF OUT                      Spy Led RF out                   |
| 9  | Led REFL                      Spy Led refl                       |
| 10 | DISPLAY                      Operation display                   |

## DESCRIPTION

- LED SWR:**                      **Blinking:** indicates that the output RF power is being limited in order to reduce the reflected power  
**Steady light:** indicates that the reflected power is greater than 12% of the nominal power of the Equipment
- LED PWR:**                      **Blinking:** indicates that the Equipment is limiting the output power in order not to exceed the nominal power.  
**Steady light:** indicates that the output power is greater than the nominal power
- LED TEMP:**                      **Steady light:** indicates that the sensors, placed inside the Equipment, detect a temperature of the apparatus or pallet higher than the safety parameters.
- LED INHIBIT:**                      **Blinking:** indicates that the CPU is reducing the bias voltage to the MOSFET.
- LED ON AIR:**                      **Blinking:** indicates that the Amplifier is operating but there is no output signal over 15% nominal maximum.  
**Steady light:** indicates that the Equipment is deriving the output power
- LED ST. BY**                      **Steady light:** indicates that the Amplifier is in stand-by mode
- STOP BUTTON:**                      Pushing the button the Amplifier will go on standby mode and the output auxiliary power supply will be suspended
- START BUTTON:**                      Pushing the button the pallet will go on operating mode and output auxiliary power supply will be received



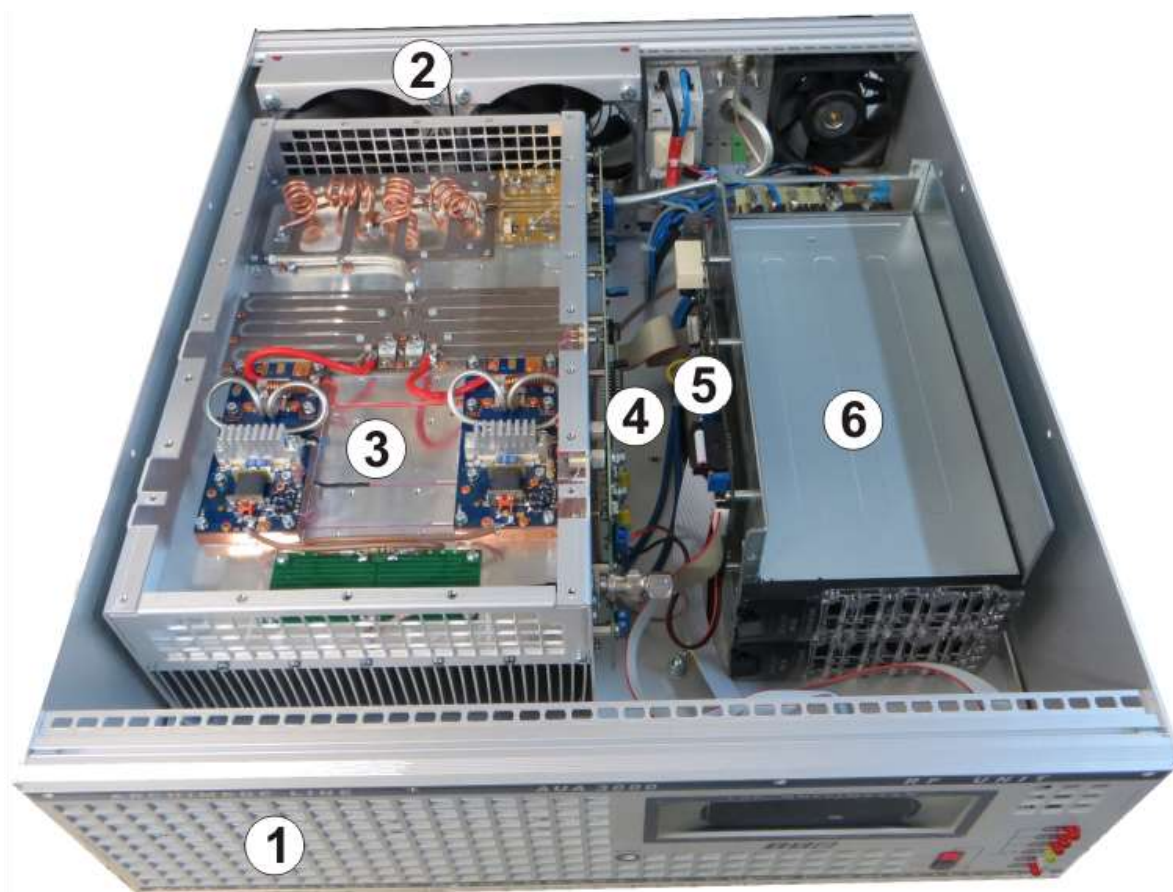
## REAR PANEL OF EQUIPMENT



- 1** Hot air extraction from power supply
- 2** RF Output Connector
- 3** RF Input Connector
- 4** 220 Vac control output for the transmitter ( Max 1 A. )
- 5** Ground connector
- 6** A.C. mains input 220 Volt
- 7** A.C. mains input 220 Volt
- 8** Switch disconnecter
- 9** Extraction of hot air RF section
- 10** Extraction of hot air RF section

option

## INTERNAL OVERVIEW OF EQUIPMENT



- 1** COLD AIR INPUT GRID
- 2** COLD AIR INPUT VANS
- 3** RF BOX
- 4** INTERFACE RF BOX
- 5** CPU
- 6** POWER SUPPLIES ( these may change from model to model)

option

# INSTALLATION TO THE START UP

For any questions or technical problems you may encounter during the installation phase, the ITALAB technical staff will be at your complete disposal to solve the problem. Please do not produce any change that may damage the Device .

Before mounting the Amplifier, check that in the room intended for the installation:

- dust is not excessive
- no deposits of harsh chemicals are present(chlorine, sulphur, etc..)
- any heat source (radiators, hot air ventilation etc.) must be at least 2 meters;
- ensure that the room temperature must not exceed the limits between 0 and +40 ° C with a relative humidity no higher than 90% non-condensing.

After removing the Amplifier out of the packaging, verify that no damages have occurred during shipment.

## Electrical connection


- The connection with main 230 Vac wall outlet must be done through the cable shipped with the Amplifier or with a three conductor cable and minimum conductor section 2.5 mm square.
- For safety is a good rule to have a dedicated cord of 2.5 mm square from main Vac panel to wall outlet with circuit breaker.
- Check that the ON/OFF switch on the rear panel of Amplifier is on OFF position
- Plug the AC power cord into the AC power socket on the rear panel of Amplifier
- Plug the other end of the AC power cord into a wall outlet
- Connect the AC power cord of exciter to the female wall outlet on the rear panel of Amplifier. This is powered only when the Amplifier is in broadcasting mode and the max power absorption allowed is 230W/1A

## RF connection

- Connect the coaxial antenna cable with impedance of 50  $\Omega$  to the RF output connector ( 7/16" ) on the rear panel of Amplifier
- Connect the RF output of exciter to RF input connector of Amplifier with coax cable with impedance of 50  $\Omega$

## Final check for start-up procedure

Before to start the procedure check the following points for security:

	That the Amplifier has the <b>GROUND</b> connection
	That the Vac 230Volt with its circuit breaker is correctly connected to the Amplifier
	That the AC power cord of exciter is correctly connected to the Amplifier
	That the antenna cable is correctly connected at the Amplifier
	That the RF cable from exciter to the Amplifier is correctly connected
	Verify that the input power is not greater than 2 watts. The device will maintain constant the output power even in the presence of a greater power input. <b>Excessive power input will damage the Equipment.</b>

## SYSTEM START UP

When the power switch is turned on, some seconds are necessary before the system starts because the power supply has a long start-up time in order to prevent overloading.

The display will then show the start-up procedure of the Amplifier and this will be ready for transmission.

With the "ON AIR" led blinking, slowly increase the exciter output power until you reach the required transmission power and in any case not greater than 2000 Watts. When the display shows an output of about 150 watts, the ON AIR led stops blinking.

If the output power exceeds 2000 watts, the PWR led will blink and automatically the Mosfet bias voltage is reduced in order to maintain the output power in the safety parameters. It is therefore useless to increase the driving to have more power output.

By keeping on increasing the driving, you can damage the RF power Mosfet which is **no covered by warranty, a part from the warranty of the manufacturer.**

Do not remove the AC power without first having performed the stop procedure, because if the Amplifier is still connected to input power when is removed, this could damage the Equipment.

The installation of the Amplifier is now completed and the correct operation is indicated on the display showing the following values:

- ARCHIMEDE 2000
- OUT POWER up to 2000 Watt
- REF POWER NORM

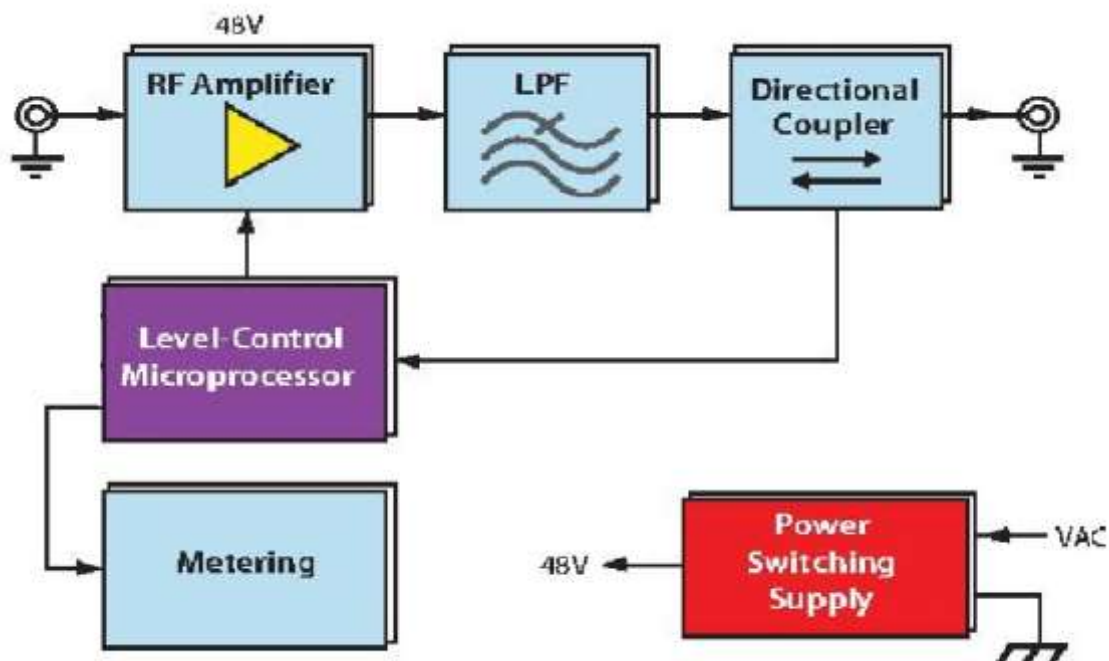
And in the fourth line of the display will be displayed alternately:

- The temperature of the pallets (MAX 85°C) and of the input air ( MAX 45°C)
- Date and time

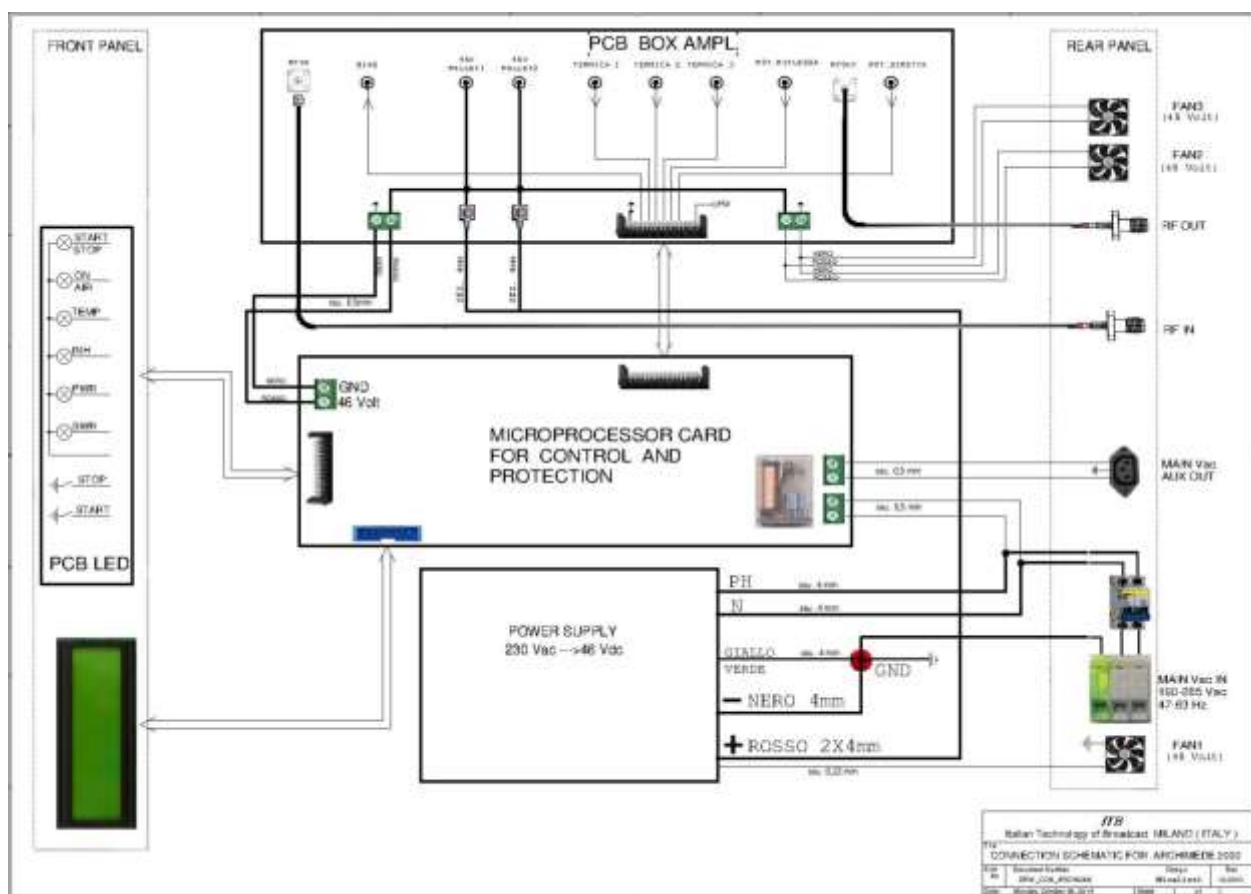
It is mandatory to provide adequate ventilation to the Equipment to maintain its internal temperature as low as possible, in a recommended range of 5÷35° C. Even if the Equipment may work until 40°C his life expectancy will be impaired by excessive temperature.

Vents in the walls and any other opening shall be fitted with a metal grating to keep away rodents and other animals. Proper air filtering avoid dust and insects to be conveyed in the internal Equipment causing over temperature alarm. Make absolutely certain that the floor cannot be flooded during heavy rainfall. Even moisture and/or dust may cause condensation build-up in the Amplifier. This can trigger destructive electric arcs during the switch on/off system and thus cause damage that **is not covered by the warranty.**

## SYSTEM BLOCK DIAGRAM

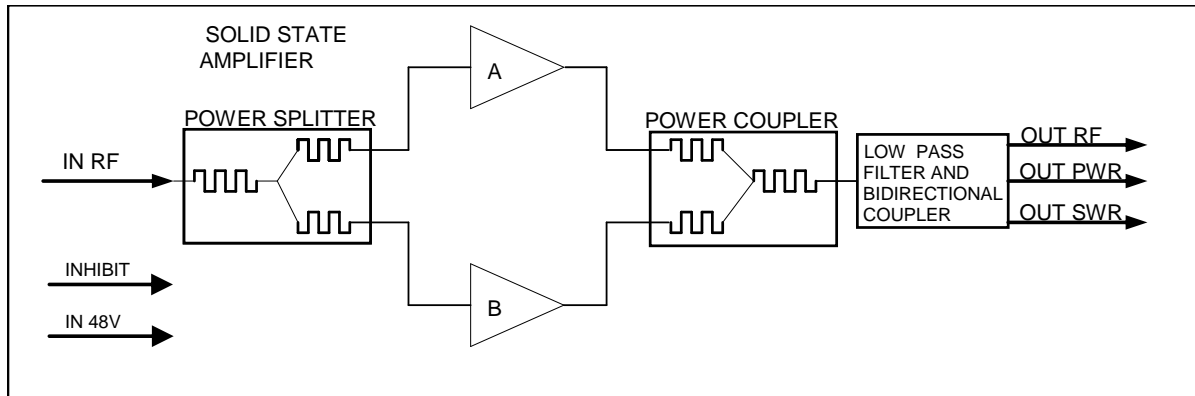


## INTERNAL WIRING



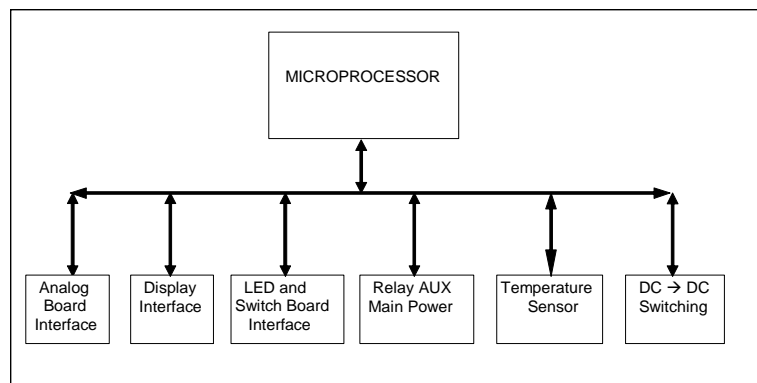
# CIRCUIT DESCRIPTION

## 1 RF AMPLIFIER BOX



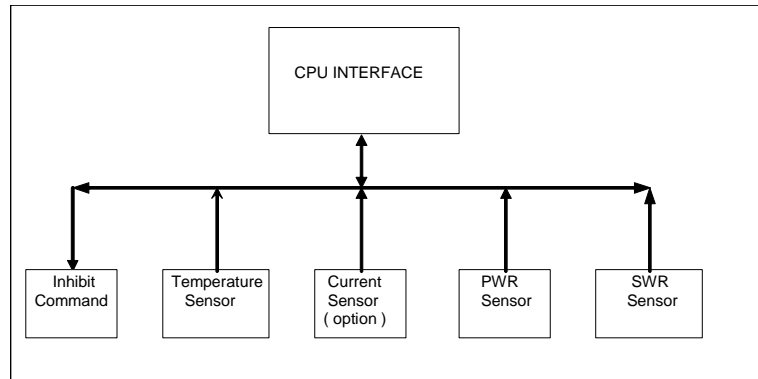
The RF section consists of one 2000 W (2 x AMP1000-FM) amplifier modules and the Low Pass filter to reduce the harmonics. In the Low Pass filter output, a bidirectional coupler measures AC/DC power showing the parameters on the display and sending the signals to the microprocessor which manages the operation and alarm functions. The circuits are all fully planar designed to allow an immediate access and inspection to all internal modules. All these parts are completely screened by a Alodyne Aluminium box to comply with EMI requirements.

## 2 CPU BOARD



The CPU board is the heart of the Amplifier. The board contains an ST microcontroller with internally stored the software for management and control of the Equipment. The software can only be modified locally by qualified technicians. The CPU is connected to all other boards by flat cables to read the status ( PWR; SWR, Temperature, ..... ) and to assure the normal operation. Inside the board there are two DC/DC switching to deliver the low voltage power from main 48V for all analogue and digital circuits.

### 3 ANALOG BOARD



The analog board is the interface between the RF box and CPU board. This adjust the level signal from RF box to CPU and from CPU to RF box.

### 4 LED BOARD

On this board are placed some led for warning alarm, status machine and two push buttons mainly used to start/stop the Equipment and as second function to read/change the Equipment parameter.

### 5 LCD DISPLAY

The front panel LCD display allows the monitoring of the Amplifier parameters ( PWR, SWR, temperature,...)

### 6 POWER SUPPLY

This module performs an efficient regulation of the AC input 230 Vac to a lower DC 48Vac for RF pallet and log/analog boards. Being its efficiency very high, very little heat is produced in the regulation process.

## LCD DISPLAY SCREENS

To assure a very good vision the Archimede uses a big display of 4 lines and includes 20 characters in each.

### POWER ON

Turning on the Amplifier( placed in "stop" mode), after the setup stage, the display will show the written below. On the fourth line of the will be displayed the Equipment data.

					P	u	s	h		S	T	A	R	T					
					t	o		s	t	a	r	t		T	X				
								h	h	:	m	m							

### START of TRANSMISSION

After pushing the start button or turning on the Amplifier (placed on "start" ), after the setup stage, the display will show the written

			A	R	C	H	I	M	E	D	E		2	0	0	0			
	W	a	i	t		S	y	s	t	e	m		S	e	t	u	p		

After the setup phase the display will show the written

			A	R	C	H	I	M	E	D	E		3	0	0	0			
O	U	T		P	O	W	E	R			.	.	.	.		W	A	T	T
R	E	F	.	P	O	W	E	R								N	O	R	M
R	a	d			x	x	°	C			l	n	g			x	x	°	C

On the fourth line of the display will be displayed alternately for some seconds the date and time

During the broadcast it is possible to see sequentially on the display, by pressing the start button, the parameters of the Amplifier and the Equipment data.



## STOP SEQUENCE

During the broadcast by pressing the stop button will activate the standby procedure.

The display will show the written

			S	T	O	P		s	e	q	u	e	n	c	e				

at the same time will be disconnected the AC power from aux main plug located on the rear panel and the voltage polarization on the pallet.

At the end of the standby cycle on the display will show the written

					P	u	s	h		S	T	A	R	T					
					t	o		s	t	a	r	t		T	X				
								h	h	:	m	m							

## LCD DISPLAY ALARM SCREENS

### FORWARD ALARM (PWR)

When the “PWR” is above 105% of rated power the “PWR” led on the led board starts blinking and the CPU will start to reduce the bias voltage to the MOSFET to bring the output power back to the nominal level. If the “PWR” does not return within normal ranges, but will exceed the threshold of 110%, the “CPU” will begin the standby process and the display will show the written

							A	I	a	r	m								
			P	W	R		I	i	m	i	t	a	t	i	o	n			

After some seconds the “CPU” will restart the start up sequence. If at the end of the sequence the “PWR” is inside the limit the transmission will continue ,otherwise it will fall back into the alarm cycle.

**Warning:** If the alarm cycle is repeated for 5 times in a few hours the Amplifier will stop. To restart the Amplifier turn off for some seconds the main power supply 230 Volt and then turn it on.

### REFLECTED ALARM (SWR)

When the SWR is above 7% of rated power the SWR led starts blinking and the third line “ REF. POWER ALARM” will appear on the display

			A	R	C	H	I	M	E	D	E		2	0	0	0				
O	U	T		P	O	W	E	R			.	.	.	.		W	A	T	T	
R	E	F		P	O	W	E	R								A	L	A	R	M
H	S				x	x	°	C			I	n				x	x	°	C	

If the “SWR exceeds the threshold of 10%, the “CPU” will begin to reduce the mosfet bias voltage in order to reduce the “SWR”. If it does not return within normal ranges, the “CPU” will begin the process of standby and the display will show the written

							A	I	a	r	m									
			S	W	R		I	i	m	i	t	a	t	i	o	n				

After some seconds the “CPU” will start the sequence of start up. If at the end of the sequence the “SWR” shall be within the limit the transmission will continue otherwise it will fall back into the alarm cycle.

**Warning:** If the alarm cycle is repeated for 5 times in a few hours the Amplifier will stop. To restart the Amplifier turn off for some seconds the main power supply 230 Volt and then turn it on.

Please check if the output impedance is 50 Ohm

## TEMPERATURE ALARM

When the CPU detects that a temperature sensor provides a value above the scheduled threshold, the standby process begins and on the display will be shown the flashing written

		T	e	m	p	e	r	a	t	u	r	e		S	T	O	P		

The Equipment will stay in alarm until the temperature will come back within normal ranges.

**Warning:** If the alarm cycle is repeated for 5 times in a few hours the Amplifier will stop.

To restart the Amplifier turn off for some seconds the main power supply 230 Volt and then turn it on.

## USER PROGRAMMING

The end user can change clock, language and the name that appears on the display when the Equipment is on standby mode. To do this you must follow the following procedure. Press the **stop** button and wait until the display will show the written:

					P	a	s	s	w	o	r	d	:						

At this point insert the password as follows:

- push for 3 times the **stop** button
- push for 3 times the **start** button

Whenever you press a button the display will show the symbol “\*” to confirm keying in.  
If the sequence will be wrong the display will show the written

					P	a	s	s	w	o	r	d	:						
				--	>		W	R	O	N	G		<	--					

After a few seconds on the display will appear the written to input the password, and then repeat the sequence.  
When you enter the correct password the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
					C	U	S	T	O	M	E	R							
				P	u	s	h		S	T	A	R	T						

## PROGRAMMING CLOCK

By pressing the **start** button the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
							C	L	O	C	K								

In this situation by pressing the **stop** button you switch to the following menu (*programming language*) while by pressing the **start** button you enter the *programming clock* menu and the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
							C	L	O	C	K								
	h	h	:	m	m				g	g	.	m	m	.	a	a	a	a	

By pressing the **stop** button you increase the time; when you reach the correct time press the **start** button to confirm.

Do the same operation to edit all other data.

At the end the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
							C	L	O	C	K								

In this situation by pressing the **start** button you go back to previous menu *programming clock* while by pressing the **stop** button it switches at next menu *programming language*

## PROGRAMMING LANGUAGE

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							

In this situation, by pressing the **stop** button, you go to the following menu *programming name* while by pressing the **start** button you go to the *programming language* menu and the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							
					E	N	G	L	I	S	H								

By pressing the **stop** button the languages supported (English, French, Spanish, Italian) are displayed in sequence. When the preferred language is displayed, press the **start** button to confirm the selection. By this time the writing will be on display in the selected language

For the French language

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							
					F	R	A	N	C	A	I	S							

For the Spanish language

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							
						E	S	P	A	N	O	L							

For the Italian language

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							
						I	T	A	L	I	A	N	O						

After choosing the language by pressing the **start** button, on the display will show the written in the selected language

				P	r	o	g	r	a	m	m	i	n	g					
					L	A	N	G	U	A	G	E							

In this situation by pressing the **start** button you go back to menu *programming language* while by pressing the **stop** button it switches at menu *programming name*

## PROGRAMMING NAME

				P	r	o	g	r	a	m	m	i	n	g					
								N	A	M	E								

In this situation, by pressing the **stop** button, it switches to *programming exit* menu while by pressing the **start** button you go to *programming name* menu in order to modify the Amplifier's name and the display will show the written

			P	r	o	g	r	a	m	m	i	n	g						
								N	A	M	E								
			C	u	s	t	o	m	e	r		n	a	m	e				

The third line shows the current name of the Amplifier.

By pressing the **stop** button the alphabet letters will be displayed in sequence, while pressing the **start** button you confirm this indication in each cell and it will pass automatically to the next cell.

Do the same operation for all 20 characters in the line.

At the end of the operation the display will show the written

				P	r	o	g	r	a	m	m	i	n	g					
								N	A	M	E								

In this situation by pressing the **start** button, it switches back to menu *programming name* while by pressing the **stop** button it switches at menu *programming exit*

## PROGRAMMING EXIT

				P	r	o	g	r	a	m	m	i	n	g					
		P	R	O	G	R	A	M	M	I	N	G		E	X	I	T		

In this situation by pressing the **start** button it switches to *programming clock* menu while by pressing the **stop** button you enter the *programming exit* menu and on the display will be shown the written

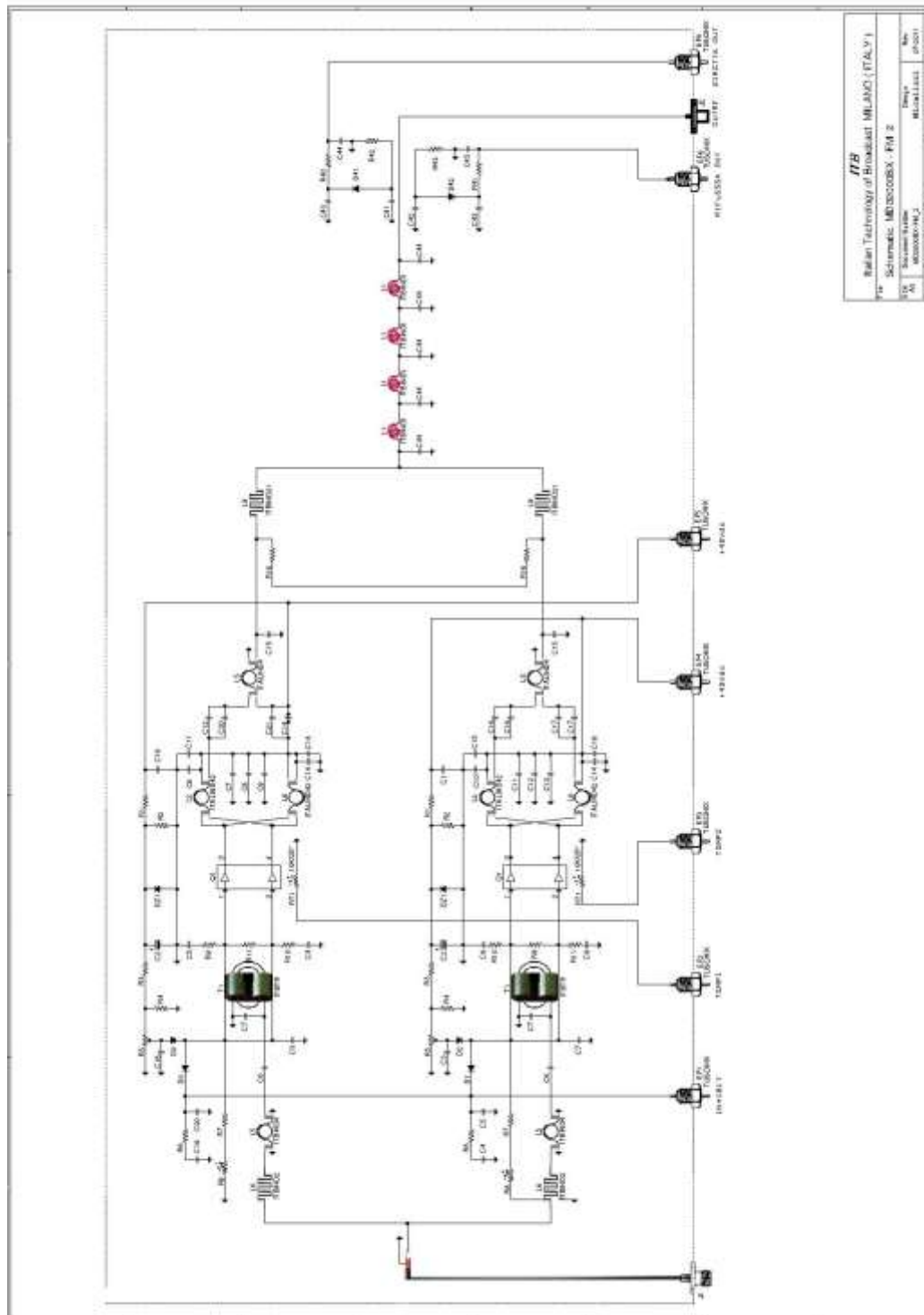


				P	r	o	g	r	a	m	m	i	n	g					
		P	R	O	G	R	A	M	M	I	N	G		E	X	I	T		
					P	U	S	H		S	T	A	R	T					

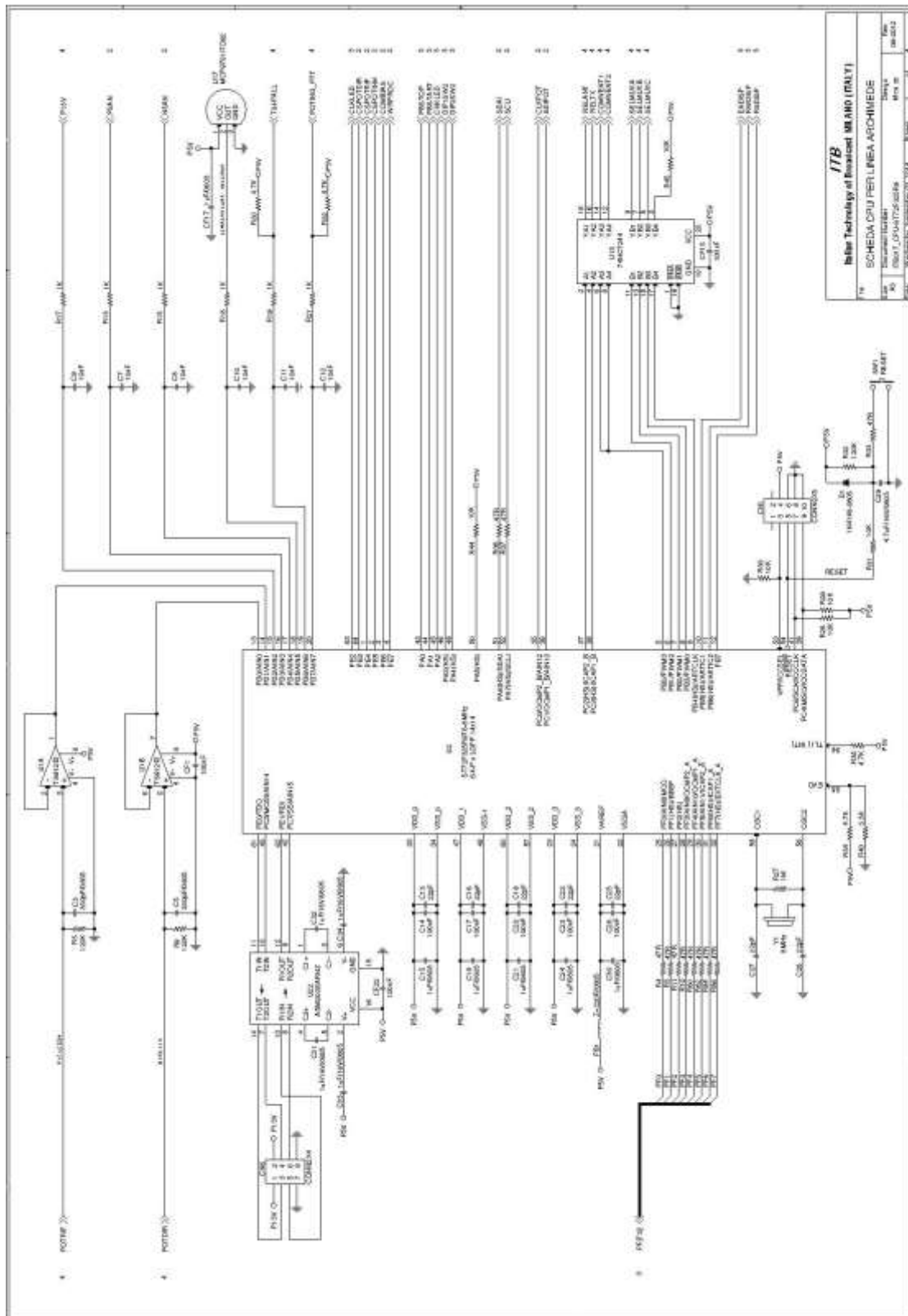
In this situation by pressing the **start** button it switches to previous menu while by pressing the **stop** button you enter the *programming exit* menu

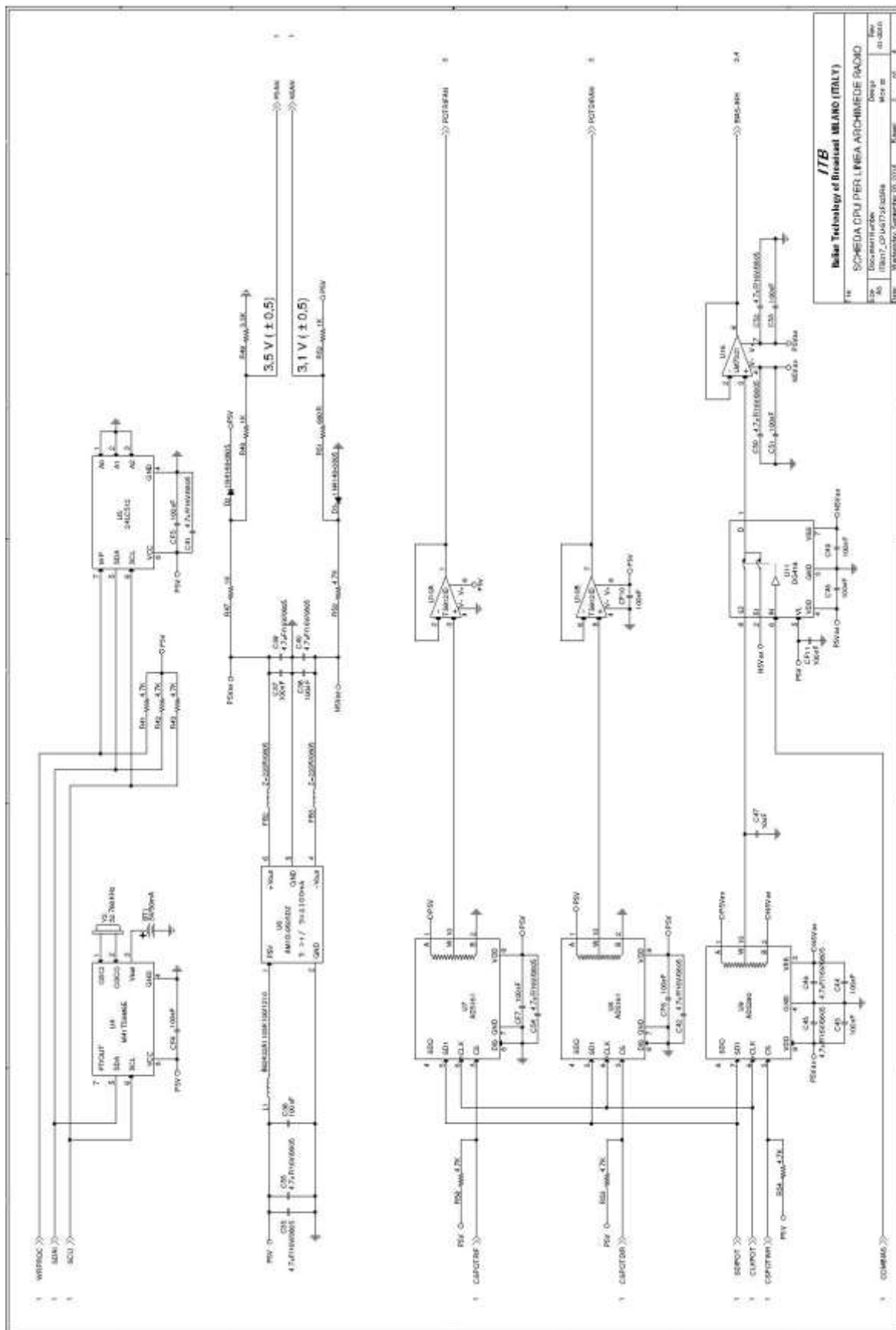
# SCHEMATICS DRAWINGS AND BOM

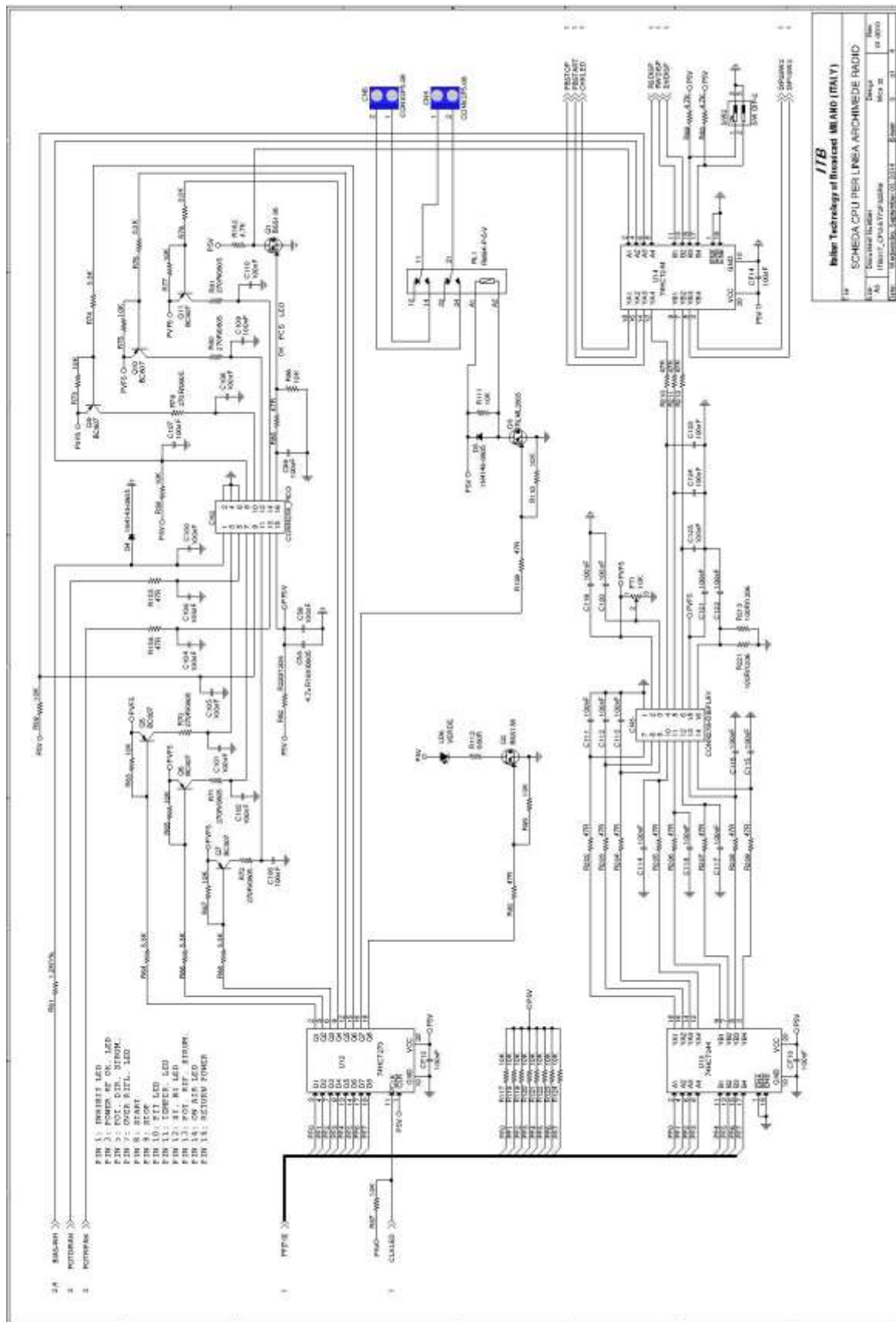
## RF BOX

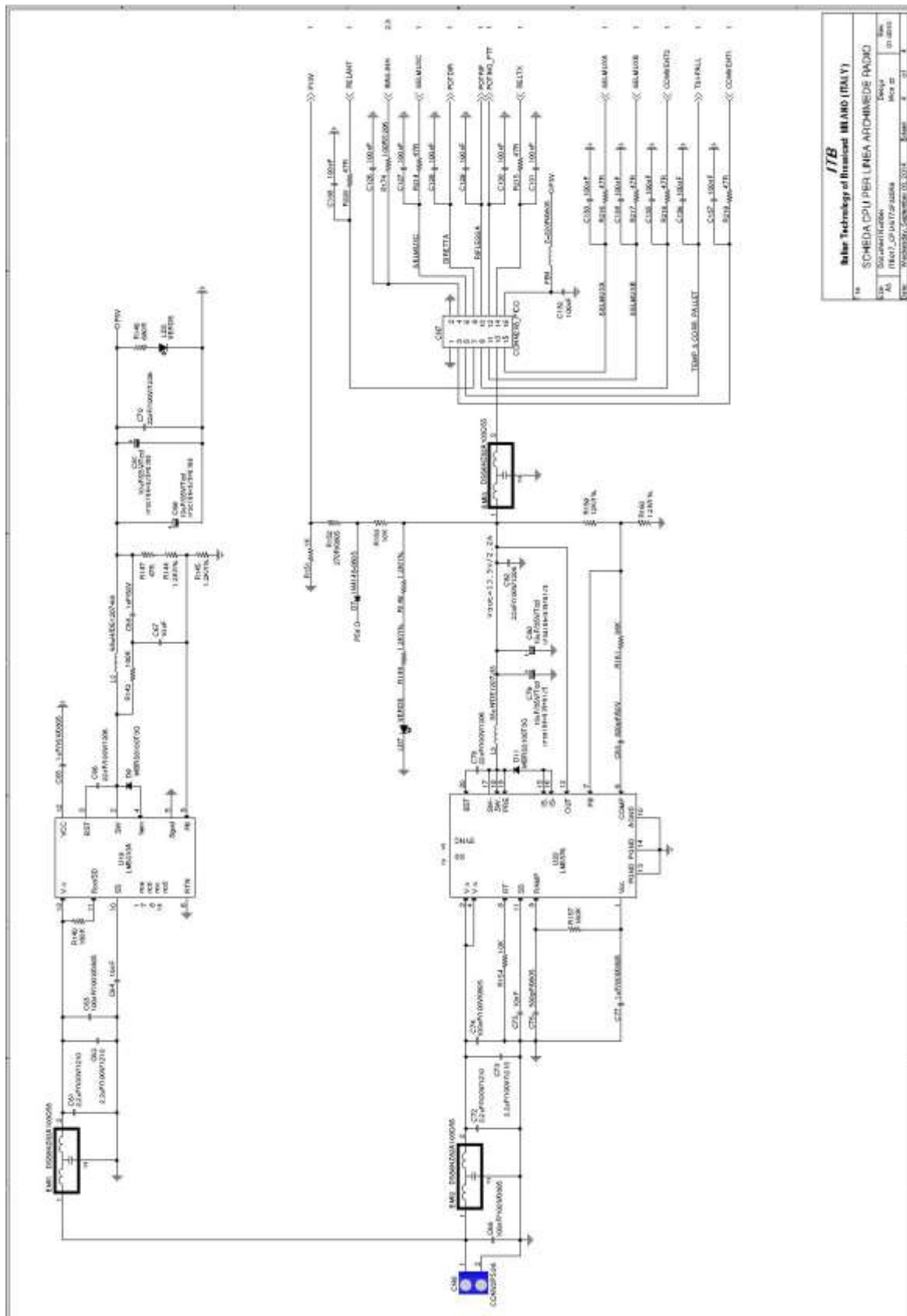


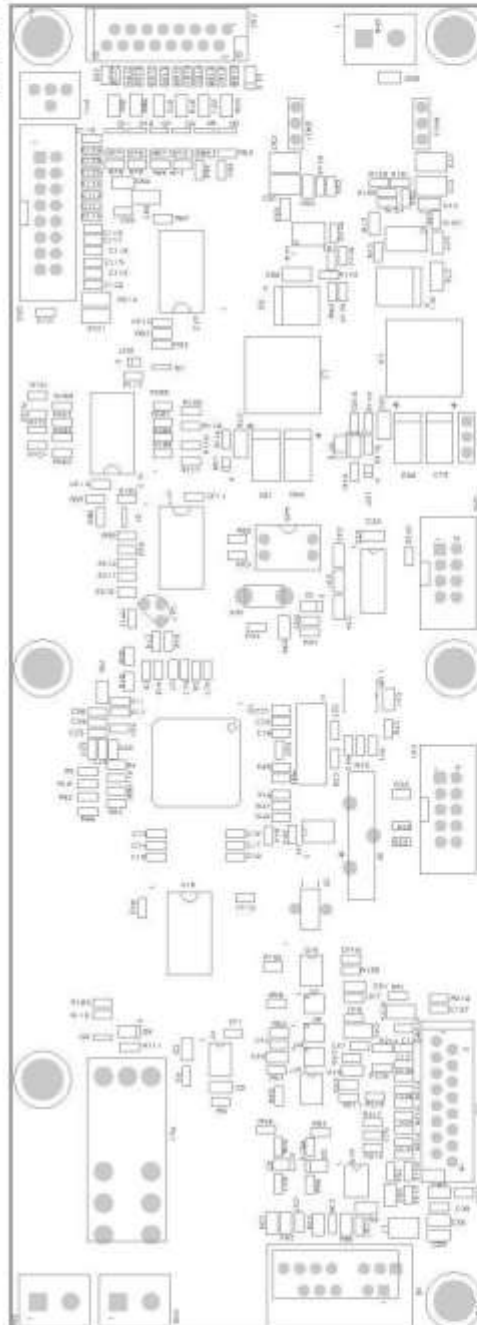
# CPU











ITB MILANO  
 ITB817 REV. 01-2012  
 AMCS - GPL  
 VASSA-DE-MONTANIS S.A.L. (ITB)



SCHEDA CPU UNIVERSALE CON SERALE E MICRO ST72F325R9 REV 09-2012							Date: 10/09/2012	23
4	ITB CODE	Description	Q.ty	Manuf.	Mfr Code	Size		
25	ITB017	SCHEDA CPU CON MICRO ST72F325R9 CON SERIALE	1	0	0	4 STR. 1,6x27,5x75mm	23	
52	110A022-050	CAPACITOR, 22pF, 50V, 5% CERAMIC, COGNIPQ, SM0603	7	KEMET	C0603C220K5GAC	0603	181	
59	110A820-050	CAPACITOR, 820 pF, 50V, 10% CERAMIC, X7R SM0603	1	MURATA	GRM188R71H021K001D	0603	23	
60	110B001-050	CAPACITOR, 1 nF, 50V, 10% CERAMIC, X7R SM0603	1	KEMET	C0603C102K5PAC	0603	23	
67	110B010-050	CAPACITOR, 10 nF, 50V, 10% CERAMIC, X7R SM0603	10	KEMET	C0603C103K5PAC	0603	230	
72	110B100-018	CAPACITOR, 100 nF, 18V, 10%, CERAMIC, X7R, SM 0803	67	AVX	0803YC104KAT2A	0803	1.541	
78	110C001-010	CAPACITOR, 1 uF, 10V, 10%, CERAMIC, X5R, SM 0603	6	AVX	0603ZD106KAT2A	0603	138	
81	111A470-050	CAPACITOR, 330pF, 50V, 5% CERAMIC, COGNIPQ, SM0605	3	KEMET	C0805C331J1GAC	0805	69	
107	111B100-100	CAPACITOR, 100 nF, 100V, 10% CERAMIC, X7R SM0605	3	KEMET	C0805C104K1PAC	0805	69	
111	111C001-010	CAPACITOR, 1uF, 16V, 10%, CERAMIC, X7R, SM 0605	6	KEMET	C0805C105K4R	0805	138	
115	111CAV7-010	CAPACITOR, 4,7uF, 10V, 10%, CERAMIC, X5R, SM 0605	13	MURATA	GRM21B961A475K	0605	299	
128	112B022-100	CAPACITOR, 22 nF, 100V, 10%, CERAMIC, X7R SM1206	4	KEMET	C1206C103K1PAC	1206	92	
142	113C2V2-100	CAPACITOR, 2.2uF, 100V, 20%, CERAMIC, X7R 1210	4	TDK	C3225X7R2A25M	1210	92	
164	120C010-025	CAPACITOR, 10uF, 25V, 20%, TANTALUM, LOW ESR 300 mOhm, SERIE TPSC106K025F0300	2	AVX	TPSC106K025F0300	C	46	
165	120C010-034	CAPACITOR, 10uF, 35V, 10%, TANTALUM LOW ESR 125 mOhm, SERIE TPSC106K035F0125	2	AVX	TPSC106K035F0125	D	46	
254	130D000-500	DIODE RECTIFYING 75V 0.5A, 1N4148-0805	6	PHILIPS	1N4148-0805	0805	136	
282	130D173-098	DIODE SCHOTTKY MBR53100T3G, 5A 100V, 125A PULSE SMT	2	ONSEMI	MBR53100T3G	SMC	46	
326	139D001-000	SMD LED GREEN VERTICAL, 35mcd@1F 20mA, V <sub>F</sub> 2.4 V, 0805 (02 21 0000)	3	LITEON	LTST-C171KGKT	0805	69	
340	140R020-221	SMC FILTER, FERRITE BEADS, Z=220 & Rdc 0.05 Ohm, 1500 mA	4	MURATA	BLM21P0221SN1D	0805	92	
345	140F210-000	Lead EMFIL Capacitor Type 10nF +/-30%, BA, 100V 10nF, -25+85°C	3	MURATA	DS96N282A103C55B	0	69	
379	141F001-A008	CONNETTORE PER FLAT DA CS MASCHIO A OTTO POLI (2X4) POLARIZZATO	1	AMPHENOL	T821108A1S100CEU	RETTANG. 11x8,3	23	
380	141F001-M10	CONNETTORE PER FLAT DA CS MASCHIO A DIECI POLI (2X5) POLARIZZATO	1	MOLEX	0039285101	RETTANG. 18x6,3	23	
382	141F001-M16	CONNETTORE PER FLAT DA CS MASCHIO A SEDICI POLI (2X8) POLARIZZATO	1	MOLEX	0039285161	RETTANG. 26x6,3	23	
411	143C501-F02	MORSETTIERA A VITE DA CS INGRESSO VERTICALE, FILA SINGOLA 2PIN, P-5.08mm GREY	3	TME	DG901-5.0-2P11	RETT. 25x6	46	
434	143P210-000	SWITCH TACT 3.5x6mm SPST-NO H=5mm 1.8N, 50mA, 12V, TACT-35N	1	NINGI	TACT-35N	PTH 3.5x6	23	
435	143P300-002	DIL SWITCHES STANDARD, SINGLE POLE TWO POSITIONS, 50 mA@24Vdc, DIP-4	1	TME	DS-02	DIP-4	23	
461	148N204-000	N-CHANNEL MOSFET, V <sub>DS</sub> =50V, 200 mA, R <sub>DS(on)</sub> =8.0Ω @ V <sub>GS</sub> =4.5 V, SOT-23, BSS138	2	FAIRCHILD	BSS138	SOT-23	46	
463	148N208-000	N-CHANNEL MOSFET, V <sub>DS</sub> =30V, ID 800 mA, R <sub>DS(on)</sub> =0.4Ω @ V <sub>GS</sub> =4.5 V, SOT-23, IRLML2803	1	INTERN. RECT.	IRLML2803	SOT-23	23	
476	148P502-000	TRANSISTOR PNP 500MA 45V SOT23 BC0807	6	ONSEMI	BC0807	SOT-23	138	
487	190R007-000	RELE DPDT REL.POL. SERIE RM94, 5 V, 8 A/230Vac, R <sub>load</sub> 60 Ohm	1	REL.POL.	RM94-P-5V	28x13x16	23	

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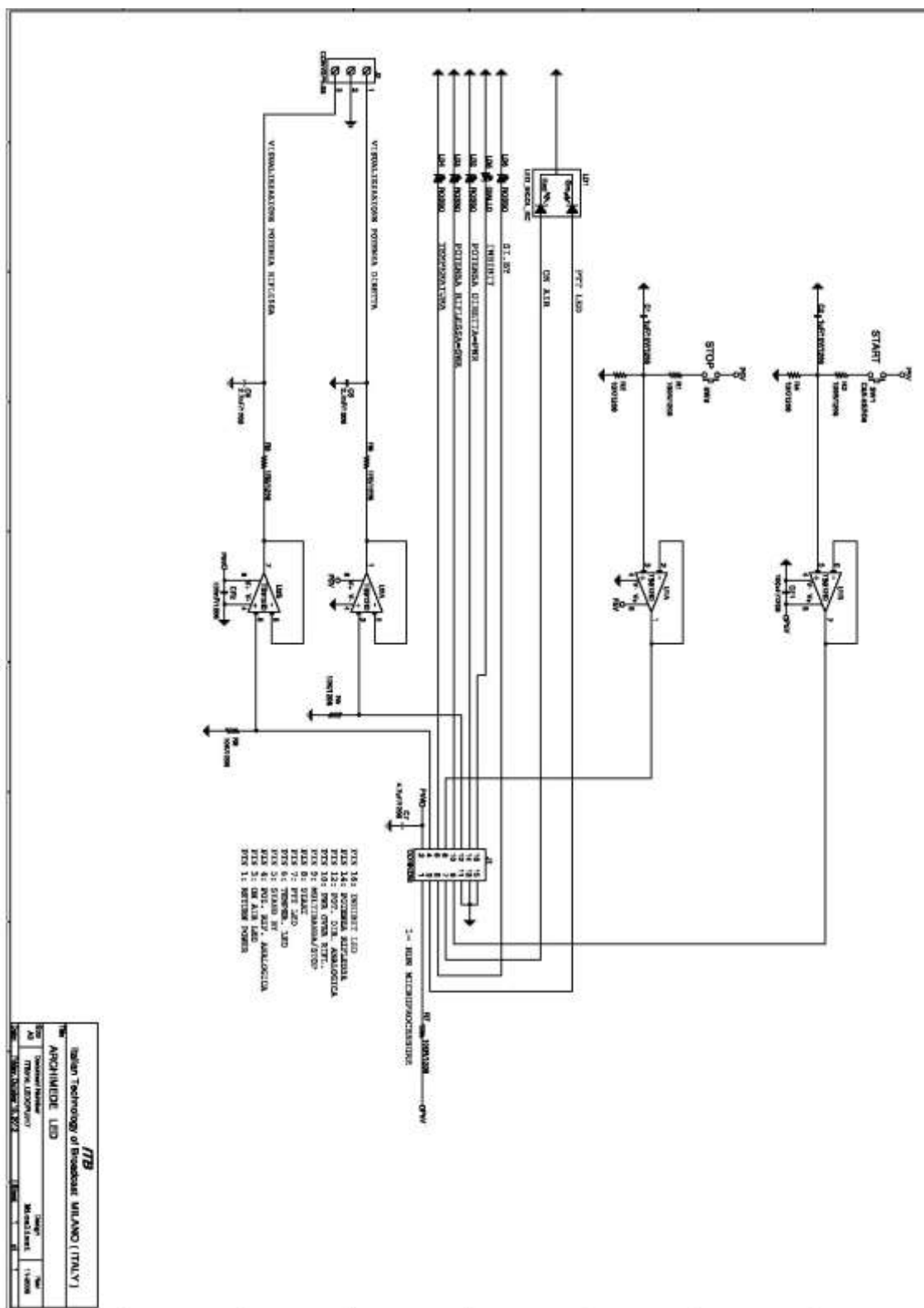
SCHEDA CPU UNIVERSALE CON SERIALE E MICRO ST72F325R9 REV 09-2012							Date: 10/09/2012	
4	ITB CODE	Description	Qty	Manuf.	Mfr Code	Size		
537	201B001-200	RESISTOR 1.2 KOhm, 1/10W, 1%, 0603	8	PANASONIC	ERJ	0603		138
564	201B012-000	RESISTOR 12 KOhm, 1/10W, 1%, 0603	1	PANASONIC	ERJ	0603		23
562	201L047-000	RESISTOR 47 Ohm, 1/10W, 5%, 0603	35	PANASONIC	ERJ	0603		805
595	201L690-000	RESISTOR 690 Ohm, 1/10W, 5%, 0603	3	PANASONIC	ERJ	0603		69
597	201M001-000	RESISTOR 1 KOhm, 1/10W, 5%, 0603	10	PANASONIC	ERJ	0603		230
500	201M003-500	RESISTOR 3.3 KOhm, 1/10W, 5%, 0603	8	PANASONIC	ERJ	0603		184
601	201M004-700	RESISTOR 4.7 KOhm, 1/10W, 5%, 0603	14	PANASONIC	ERJ	0603		322
603	201M010-000	RESISTOR 10 KOhm, 1/10W, 5%, 0603	29	PANASONIC	ERJ	0603		667
606	201M036-000	RESISTOR 36 KOhm, 1/10W, 5%, 0603	1	PANASONIC	ERJ	0603		23
610	201M120-000	RESISTOR 120 KOhm, 1/10W, 5%, 0603	3	PANASONIC	ERJ	0603		69
611	201M180-000	RESISTOR 180 KOhm, 1/10W, 5%, 0603	3	PANASONIC	ERJ	0603		69
615	201N001-000	RESISTOR 1 MOhm, 1/10W, 5%, 0805	1	PANASONIC	ERJ	0805		23
682	202L270-000	RESISTOR 270 Ohm, 1/8W, 5%, 0805	7	PANASONIC	ERJ	0805		161
682	203A000-220	RESISTOR 0.22 Ohm, 1/4W, 1%, 1206	1	PANASONIC	ERJ	1206		23
726	203L100-000	RESISTOR 100 Ohm, 1/4W, 5%, 1206	3	PANASONIC	ERJ	1206		69
800	217PDK-010	POTENZIOMETRO DIGITALE, 3-WIRE SPI, +/- 15 Volt, 256 Step Volatile DA 10 KOhm ADE290	1	ANAL. DEV.	AD290YFMAZ10	MSOP-10		23
801	217PDK-205	POTENZIOMETRO DIGITALE, 3-WIRE SPI, 2.7-5.5 Volt, 256 Step Volatile DA 5 KOhm ADE161	2	ANAL. DEV.	AD5161BRAZ5	MSOP-10		46
811	217PTTV-010	TRIMMER MULTIFREQUENZA DI POLICE, 10 KOhm 28 GIRI PTH A REGOL. ORIZZ.	1	TIME	T910K-10K	PTH 10x5x10		23
824	298010-0V1	CHIP INDUCTORS, 10uH, 1.6 Ohm, 180mA, Q=2562, SMT, 25MHz	1	EPCOS	BR2422A1103K100	1210		23
834	298103-3V8	SHIELDED POWER INDUCTOR 33uH, 3.9A, 0.053 Ohm, SMT	1	TIME	DE1207-33	12x12x10		23
837	2981047-1V7	SHIELDED POWER INDUCTOR 47uH, 1.75A, 0.132 Ohm, SMT	1	BOURNS	SRU1048-470Y	10x10x4		23
884	300R005-005	DC/DC CONVERTER, 1W, Vin=5 Volt, Vout +/-5 V, I=100 mA, AM1D-0505DZ, SIP7	1	AIMTEC	AM1D-0505DZ	SIP7		23
884	300R082-000	HIGH VOLT. 1A STEP-DOWN SWITCHING REG. FREQ. UP 1 Mhz, LM5010A TSSOP14	1	NATIONAL	LM5010A	TSSOP-14EP		23
889	300R125-000	SAMPLE SWITCH-EP875V, 3A Step-Down Switching Regulator LM5578	1	NATIONAL	LM5578MH	Exp Pad TSSOP-20		23
921	300S124-000	IC, REAL TIME CLOCK, 512 Bit (64b x8) Serial Access, TIMEKEEPER8 SPROM, M41T56MEE	1	ST	M41T56MEE	SOIC-8		23
927	300S172-000	IC, TRANSCEIVERS FOR RS232 AND V.28, ADM202, SOIC 16	1	ANALOG DEVICES	ADM202PEARNZ	SOIC-16		23
939	301M071-084	MICROCONTROLLER, 8-BIT MCU, 16K FLASH, 512 RAM, ST72F325R9T8, TOFP84	1	ST	ST72F325R9T8	TOFP84		23
949	301M500-512	512K 2C™ CMOS Serial EEPROM 2.7-5.5 Volt, 24LC012T-ISM (ISM)	1	MICROCHIP	24LC012T-ISM	SOIC-8 (SOIC-8)		23
968	312L244-000	IC, BUFFER W/3-STATE OUTPUTS, 74VHC244, SM, SOIC-20	3	TEXAS INSTR.	74VHC244	SOIC-20		69
969	312L273-000	IC, Octal D-type flip-flop with reset, 74VHC273, SOIC-20	1	TEXAS INSTR.	CD74VHC273DW	SOIC-20		23
991	350A051-000	HIGH POWER SINGLE OP AMP, RAIL TO RAIL IN/OUT, +/-15 Volt, LM7321, SOIC-8	1	NATIONAL	LM7321MA	SOIC-8		23
994	350B061-000	DUAL OP AMP, RAIL TO RAIL IN AND OUT TSB120D, 2.7-16 Volt, SOIC-8	2	ST	TSB120D	SOIC-8		46
1000	351AS01-000	PRECISION CMOS ANALOG SWITCH, 44 Volt, DG419, SOIC8	1	VISHAY	DG419DY	SOIC-8		23
1006	351T503-000	ANALOG TEMPERATURE SENSOR, 3.1 TO 5.5 V, 18.5 mV/C, TO92, MCP9701	1	MICROCHIP	MCP9701-ETO	TO92		23
1021	400C008-327	CRYSTAL, 32.768KHz, 12.5pF, 20 PPM, SMT CILINDRICO 2x7mm CFPX-56R	1	IOD FREQ. PROD.	32.768KCFPX-56R	CIL 2x7 mm		23
1028	400C008-500	CRYSTAL, 8 MHz, 20 pF, 50 PPM, 100R-ESR,	1	ECOS Inc	ECOS90-20-SPX	HC49-US		23
1040	511B033-230	Lithium Battery 3 Volt 230mAh, Coin Vertical Type CR2032V	1	TIME	BAT-CR2032V	PTH 20x2 mm		23

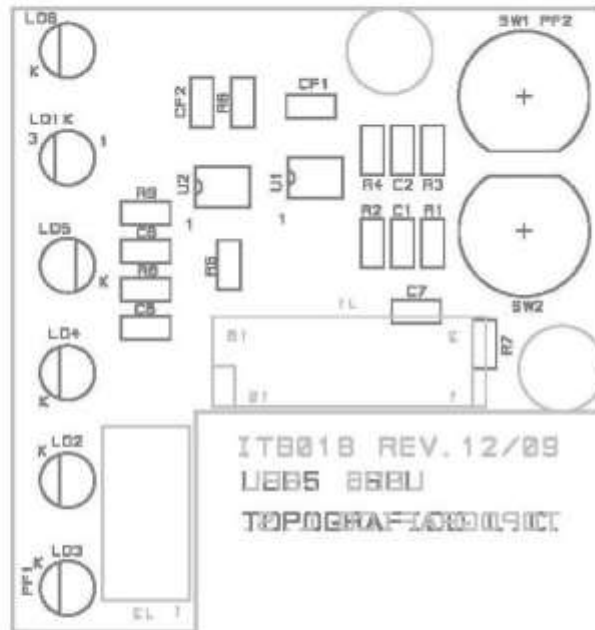
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ITB017-CPU-ST72F325R9

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## LED





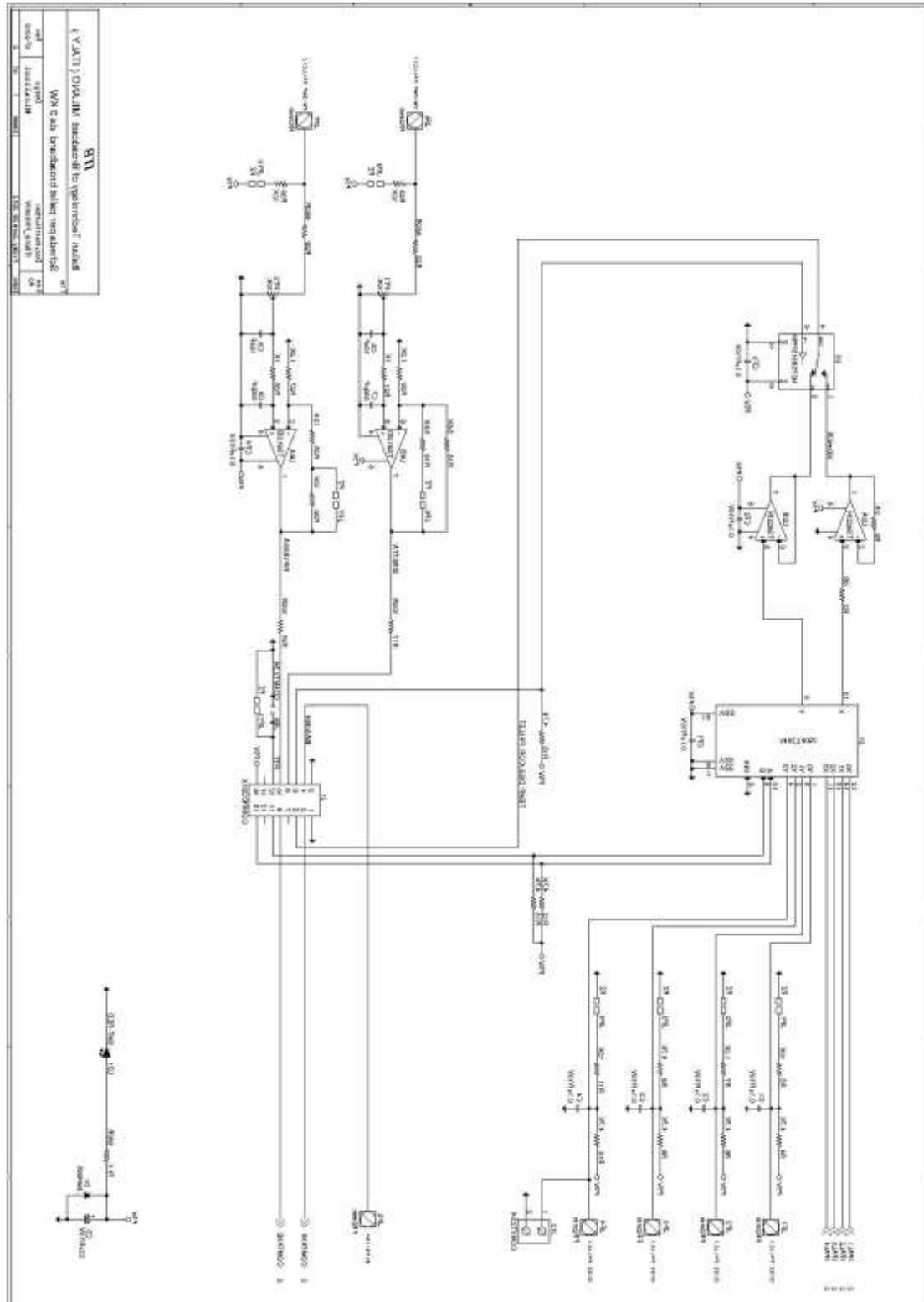
**SCHEDA LED PER CPU ITB017 REV 09-2012**
**Data: 10/09/2012**

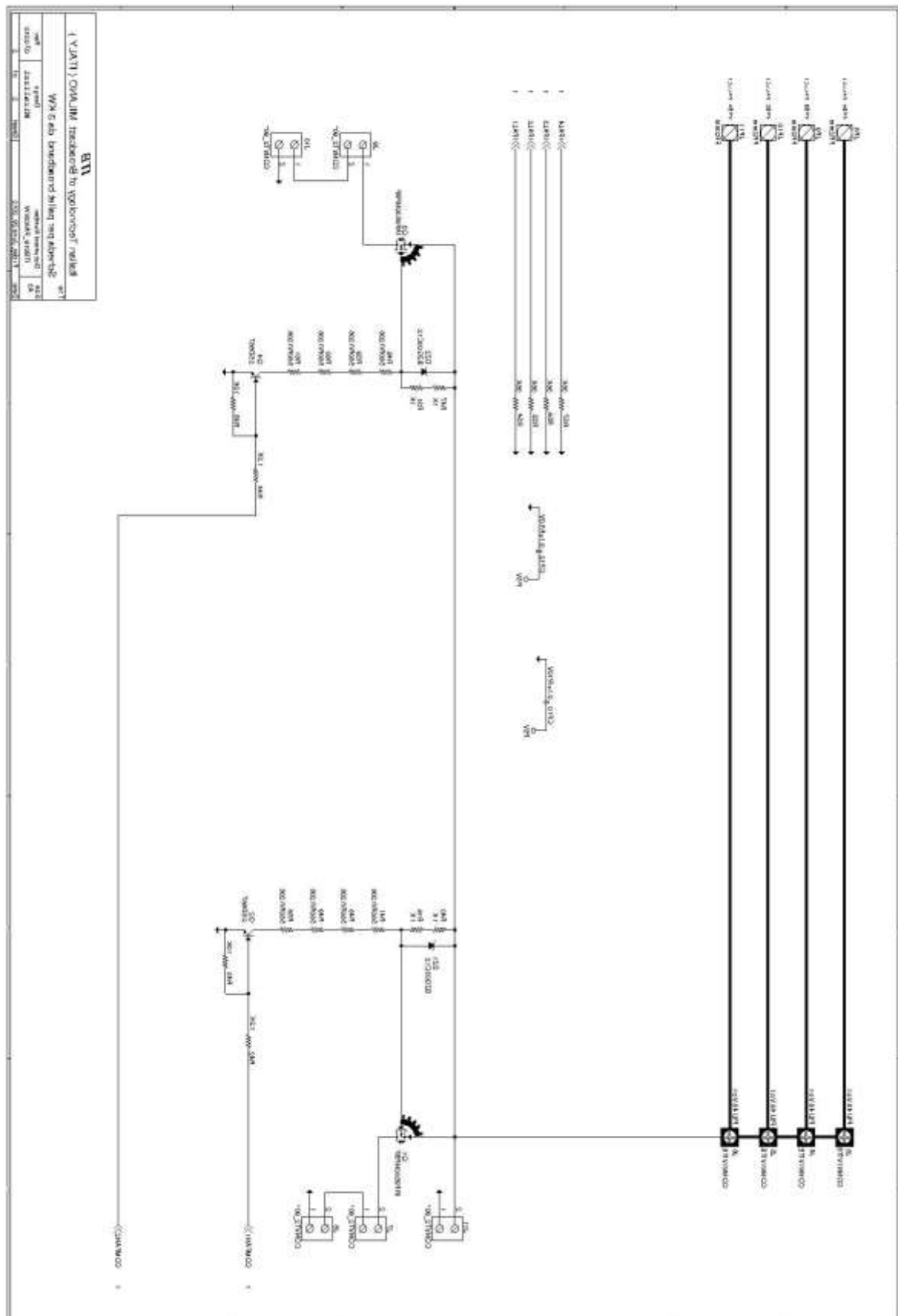
4	ITB CODE	Description	Design reference	Manuf.	Mfr Code
25	119016	SCHEDA LED PER CPU ITB017 REV.1208		0	0
128	112827-050	CAPACITOR 2,7 nF 50V, 10% CERAMIC,X7R SMT206	CS,C6	MURATA	GRM32C70727M50
138	1128100-050	CAPACITOR 100 nF 50V, 10% CERAMIC, X7R, SMT206	CS,C7	KEMET	C1206C100K50RAC
139	1128001-025	CAPACITOR 1uF 25V, 10%, CERAMIC,X7R,1206	C1,C2	KEMET	C1206C100K50ACTU
139	1128047-025	CAPACITOR 4,7uF 25V, 10%, CERAMIC,X0R,1206	C7	KEMET	C1206C47M50ACTU
304	1360401-000	PTH LED RED VERTICAL, H=4,8mm, D=5mm, P 2,54mm IF 10mA	L02,L03,L04,L04	KINORIGHT	L-SMD
306	1360402-000	PTH LED YELLOW VERTICAL, H=4,8mm, D=5mm, P 2,54mm IF 10mA	L06	KINORIGHT	L-SMD
308	1360400-000	PTH LED BICOLOR COMMON CATHODE GREEN-RED VERTICAL, H=4,8mm, D=5mm, F 20mA	L01	KINORIGHT	L-SMD
382	1411901-M16	CONNETTORE PICOFLEX RF-50 PER FLAT DA CS MASCHIO A SEDICI POLI	L1	MOLEX	90025-0016
417	1421501-F03	INCORRETTORIA A VITE DA CS INGRESSO VERTICALE, FILA SINGOLA A TRE POLI, P-5	L2	TME	TR-3-P-3P/0V
429	1439002-000	DE SPST MOMENTARY SWITCHES VERTICAL, DBC09-F1 LFS, COLOR BLUE	SW1	CAK	DB0260 F1 LFS
430	1439003-000	DE SPST MOMENTARY SWITCHES VERTICAL, DBC04-F1 LFS, COLOR RED	SW2	CAK	DB0240 F1 LFS
708	203A100-000	RESISTOR 100 Ohm, 1/4W, 1%, 1206	RI,RS,R10	PANASONIC	ERJ
728	203B010-000	RESISTOR 10 KOhm, 1/4W, 1%, 1206	RE,RI,R5,R16	PANASONIC	ERJ
737	203L001-500	RESISTOR 1,5 Ohm, 1/4W, 0%, 1206	RL,R9	PANASONIC	ERJ
1002	3550A060-000	SINGLE OP AMP, RAIL TO RAIL IN AND OUT TS1981-ID, 2.5-5.5 Vol, SOTIC-8	U1,U2	ST	TS19811AID

RESERVATO

ITB018-LED

## ANALOG







[illegible]