xE70-868 RF Module User Guide

1vv0301037 rev.5 – 2015-08-18

Making machines talk.

APPLICABILITY TABLE

PRODUCT
LE70-868
NE70-868

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Contents

1. Introduction

1.1. Scope

Scope of this document is to present the features and the application of the Telit xE70-868 radio modules.

1.2. xE70-868 Product Description

The xE70-868 module is a multi-channel radio board, delivering up to 500mW in the 868 MHz ISM band (unlicensed frequency band).

It is delivered with preloaded protocol stack:

"x"	Product name	Stack functionality
L	LE70-868	Star Network
N	NE70-868	Low Power Mesh

xE70-868 is pin-to-pin compatible with LE, NE and ME modules working at different frequencies, in particular xE50-868.

xE70-868 is also pin-to-pin compatible with Telit ZE Family (ZigBee 2007 and ZigBee PRO stack).

1.3. Audience

This document is intended for developers using Telit xE70-868 radio modules.

1.4. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-SRD@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

- [1] EN 300 220-2 v2.4.1, ETSI Standards for SRD , May 2012
- [2] ERC Rec 70-03, ERC Recommendation for SRD, October 2012
- [3] 2002/95/EC, Directive of the European Parliament and of the Council, 27 January 2003
- [4] SR Tool User Guide, 1vv0300899
- [5] 2006/771/EC, Harmonization of the radio spectrum for use by short-range devices
- [6] 2009/381/EC, Amending Decision 2006/771/EC on harmonization of the radio spectrum for use by short-range devices
- [7] Star Network Protocol Stack User Guide, 1vv0300873
- [8] Low Power Mesh Protocol Stack User Guide, 1vv0300944

2. Regulatory Conformance Information

2.1. Operational Frequency Bands

The module radio transmitter operations must be compliant with some regulatory requirements in terms of frequency bands and emitted power, as detailed below.

2.1.1. 868 MHz band Requirements

The "ERC recommendation 70-03 Annex 1" describes the 868 MHz license free band for non-specific short range devices in terms of bandwidth, maximum power, duty cycle and channel spacing. It gives the following limitations:

ERC recommendation 70-03				
Band	***Frequency band (MHz)***	***Maximum radiated power (mW)***	***Channel spacing***	***Maximum Duty cycle (%)***
g3	869.400 – 869.650	500	25 kHz or the whole band	10

These bands are free to use but the module and the user must respect some limitations. Most of these restrictions are integrated in the conception of the module, except the duty cycle. This means that each module is limited to a total transmit time of 6 minutes per hour. It is the responsibility of the user to respect the duty cycle

National Restrictions for non-specific short range devices Annex 1 band g3:

Country	**Restriction**	**Reason/Remark**
Band g3		
Georgia	Not implemented	
Russian Federation	Not implemented	
Ukraine	Not implemented	

2.1.2. 865 - 867 MHz Band Requirements

In India it is allowed to operate devices in the 865 – 867 MHz frequency band subject to the following maximum limits:

- Transmitter power: 1 W
- Effective radiated power: 4 W
- Carrier bandwidth; 200 kHz

2.2. Other Regulatory Requirements

Furthermore, the module complies with the ETSI 300-220-2 v2.4.1 standards (specific for SRD) which main requirements are described in Appendix 1.

Finally, the module complies with the new European Directive 2002/95/EC concerning the Restrictive Usage of Hazardous Substances (RoHS).

3. General Features

3.1. Main Functionalities

The xE70-868 module is a complete solution from serial interface to RF interface. The xE70-868 module has a digital part and a RF part. The radio link is a Half-Duplex bi-directional link.

The digital part has the following functionalities:

- Communication interface
- I/O management
- Micro controller with embedded Telit Software Stack

The RF part has the following functionalities:

- Frequency synthesis
- Front-end
- Low noise reception
- Power amplification
- Packet handling

3.2. Software

The xE70-868 module is provided pre-flashed with Telit in-house stack.

Please refer to Protocol Stack User Guides [7][8] for detailed information.

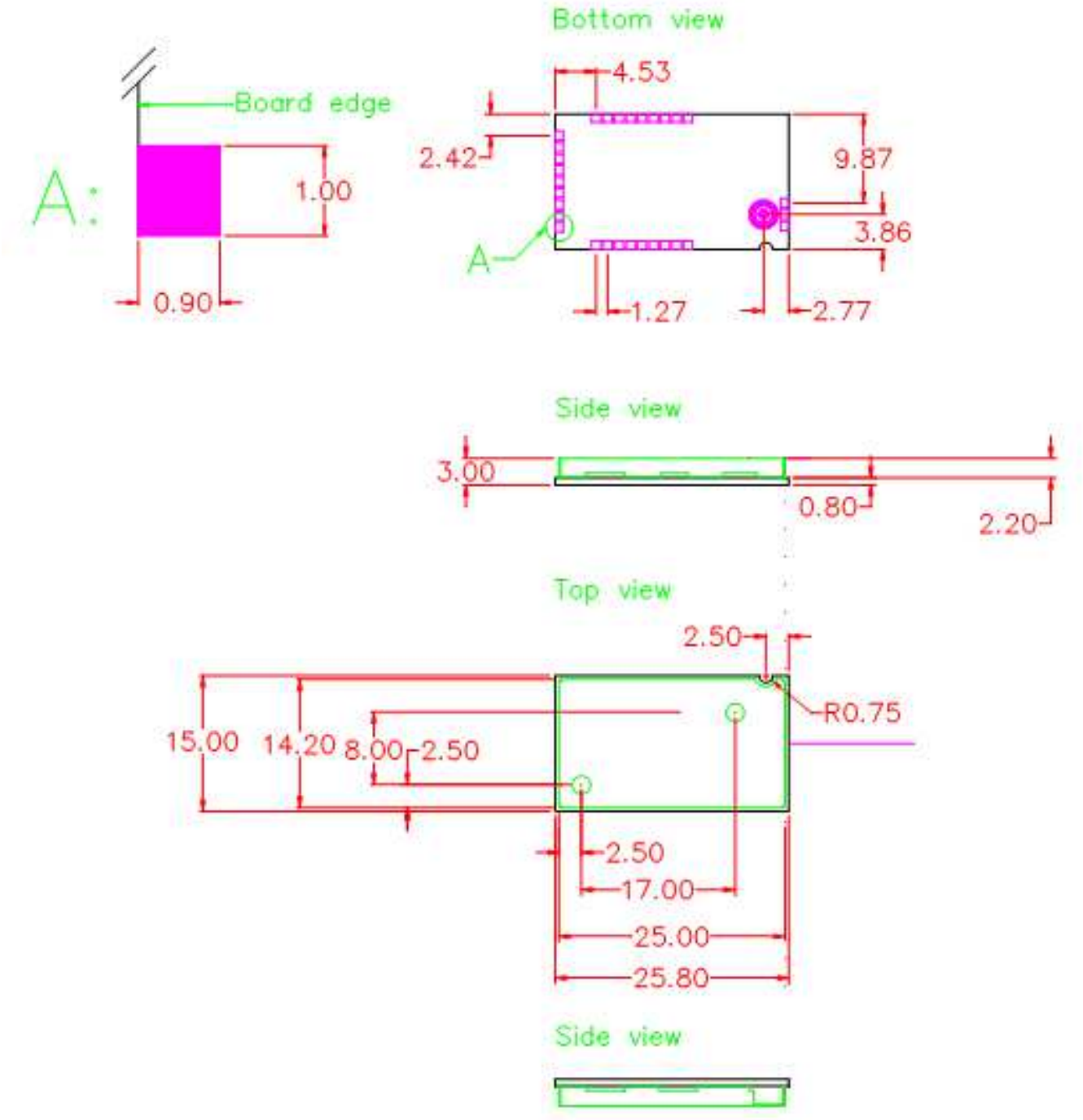
3.3. Temperature Operating Range

	Minimum	*Typical*	*Maximum*	*Unit*
Operating				
Temperature	- 40	25	+ 85	°C
Relative humidity @ 25°C	20		75	%
Storage				
Temperature	- 40	25	+ 85	°C

3.4. Mechanical Specifications

Size	Rectangular 25.8 x 15 mm
Height	3 mm
Weight	1.7 g
PCB thickness	0.8 mm
Cover	Mounted above SMD components for EMI reduction and automatic placement • Dimensions : 25 x 14.2 x 2.2mm • Thickness : 200µm
Components	All SMD components, on one side of the PCB.
Mounting	Suitable for RoHS reflow process • SMD • LGA on the 4 external sides
Number of pins	30

3.4.1. Mechanical drawing



3.5. DC Specifications

Measured on DIP interface with T = 25°C, under 50 ohm impedance connected to RF port and default power register setting if nothing else stated.

Max limits apply over the entire operating range, T=-40°C to +85°C, V_{DD} =2.3V to 3.6V and all channels.

Characteristics xE70-868	Min.	Typ.	Max.	Unit
Power Supply (V_{DD})	+2.3	+3.6	+3.6	V
Consumption at 3.6V				
Maximum output power 500mW (+27dBm)		335	< 400	mA
Reception		25	30	mA
Stand-by (32.768 khz On)		< 2	< 3	µA
I/O low level	GND	-	0.2x V_{DD}	V
I/O high level	0.8x V_{DD}	-	V_{DD}	V

3.6. Radio Specifications

Measured on DIP interface at T = 25°C, V_{DD} = 3.6V, 50 ohm impedance and default power register setting if nothing else stated.

ERC Rec 70-03 Frequency Band	**Band g3: 869.400 MHz - 869.650 MHz**						
RF data rate	**1.2 kbps**	**2.4 kbps**	**4.8 kbps**	**9.6 kbps**	**19.2 kbps**	**38.4 kbps**	**57.6 kbps**
Numbers of channels	1						
Channel width	250 kHz						
Channel 0	869.525 MHz						
Total Bandwidth	250 kHz						
Transmission							
Duty cycle	≤ 10%						
Modulation Format	2GFSK						
Deviation	± 0.6 kHz	± 1.2 kHz	± 7 kHz	± 7 kHz	± 10 kHz	± 20 kHz	± 30 kHz
Frequency tolerance at 25°C	+/- 2.5 kHz						
RF Output Power at 3.6V	Selectable by software (see Protocol Stack User Guide [7][8])						
	From +7dBm to +27dBm						
Reception							
Rx filter BW	20 kHz	20 kHz	20 kHz	27 kHz	44 kHz	81 kHz	122 kHz
Sensitivity [dBm] for PER < 0,8 (*)	-119	-119	-117	-115	-113	-110	-108.5

(*) 20 bytes Data Packet not including preamble length

ERC Rec 70-03 Frequency Band	**Band g3: 869.400 MHz - 869.650 MHz (channelized operation)**
RF data rate	**4.8 kbps**
Numbers of channels	10
Channel width	25 kHz
Channel 0	869.4125 MHz
Total Bandwidth	250 kHz
Transmission	
Duty cycle	≤ 10%
Modulation Format	2GFSK
Deviation	± 2.4 kHz
Frequency tolerance at 25°C	+/- 2.5 kHz
RF Output Power at 3.6V	Selectable by software (see Protocol Stack User Guides [7][8])
	From +7 dBm to +23dBm
Reception	
Rx filter BW	15 kHz
Sensitivity [dBm] for PER < 0,8 Ch1 – Ch5 – Ch10	-116.5 ; -116.5; -116.5

	Indian Frequency Band: 865 MHz - 867 MHz			
RF data rate	**4.8 kbps**	**9.6 kbps**	**19.2 kbps**	**38.4 kbps**
Numbers of channels	10			
Channel width	200 kHz			
Channel 0	865.1 MHz			
Total Bandwidth	2 MHz			
Transmission				
Modulation Format	2GFSK			
Deviation	± 7 kHz	± 7 kHz	± 10 kHz	± 20 kHz
Frequency tolerance at 25°C	+/- 2.5 kHz			
RF Output Power at 3.6V	Selectable by software (see Protocol Stack User Guide [7][8]) From +7 dBm to +27dBm			
Reception				
Rx filter BW	20 kHz	27 kHz	44 kHz	81 kHz
Sensitivity [dBm] for PER < 0,8	-116.5	-114.5	-113	-110

<table>
<tr><th colspan="5">Limits allowed by ETSI standard [1]</th></tr>
<tr><th colspan="5">Transmission</th></tr>
<tr><td>Frequency error</td><td colspan="4">+/- 12.5 kHz @ 25 kHz channelization
+/- 87 kHz (+/-100 ppm) > 25 kHz channelization</td></tr>
<tr><td>ACP for channels ≤ 25 kHz</td><td colspan="4">- 37 dBm in 16 kHz “receiver” filter BW under normal test conditions
- 32 dBm in 16 kHz “receiver” filter BW under extreme test conditions</td></tr>
<tr><td>Modulation bandwidth</td><td colspan="4"><table>
<tr><th>Reference Bandwidth (RBW)</th><th>Limit</th><th>Lower envelope point Minimum frequency</th><th>Upper envelope point maximum frequency</th></tr>
<tr><td>1 kHz</td><td>- 30 dBm (1 µW)</td><td>$f_{e,\ lower}$</td><td>$f_{e,\ upper}$</td></tr>
<tr><td>1 kHz</td><td>- 36 dBm (250 nW)</td><td>($f_{e,\ lower}$ – 200 kHz)</td><td>($f_{e,\ upper}$ + 200 kHz)</td></tr>
<tr><td>10 kHz</td><td>- 36 dBm (250 nW)</td><td>($f_{e,\ lower}$ – 400 kHz)</td><td>($f_{e,\ upper}$ + 400 kHz)</td></tr>
<tr><td>100 kHz</td><td>- 36 dBm (250 nW)</td><td>($f_{e,\ lower}$ – 1 MHz)</td><td>($f_{e,\ upper}$ + 1 MHz)</td></tr>
</table></td></tr>
<tr><td rowspan="3">Unwanted emissions in the spurious domain</td><td>Frequency
State</td><td>47 MHz to 74 MHz
7,5 MHz to 118 MHz
174 MHz to 230 MHz
470 MHz to 862 MHz</td><td>Other frequencies below 1 000 MHz</td><td>Frequencies above 1 000 MHz</td></tr>
<tr><td>Operating</td><td>- 54 dBm (4 nW)</td><td>- 36 dBm (250 nW)</td><td>- 30 dBm (1 µW)</td></tr>
<tr><td>Standby</td><td>- 57 dBm (2 nW)</td><td>- 57 dBm (2 nW)</td><td>- 47 dBm (20 nW)</td></tr>
<tr><th colspan="5">Reception</th></tr>
<tr><td rowspan="8">Blocking for class 2 equipments</td><td>Frequency offset of the unwanted signal</td><td colspan="2">Receiver bandwidth</td><td>Minimum offset between wanted and unwanted signals</td></tr>
<tr><td rowspan="4">+/-2 MHz</td><td colspan="2">15 kHz</td><td>≥ 35 dB</td></tr>
<tr><td colspan="2">25 kHz</td><td>≥ 33 dB</td></tr>
<tr><td colspan="2">81 kHz</td><td>≥ 28 dB</td></tr>
<tr><td colspan="2">122 kHz</td><td>≥ 26 dB</td></tr>
<tr><td rowspan="4">+/-10 MHz</td><td colspan="2">15 kHz</td><td>≥ 60 dB</td></tr>
<tr><td colspan="2">25 kHz</td><td>≥ 58 dB</td></tr>
<tr><td colspan="2">81 kHz</td><td>≥ 53 dB</td></tr>
<tr><td colspan="2">122 kHz</td><td>≥ 51 dB</td></tr>
<tr><td rowspan="2">Spurious radiation</td><td colspan="2">Below 1000 MHz</td><td colspan="2">Above 1000 MHz</td></tr>
<tr><td colspan="2">- 57 dBm (2 nW)</td><td colspan="2">- 47 dBm (20 nW)</td></tr>
</table>

3.7. Digital Specifications

Function	Characteristics
µC	• 128 kB + 8 kB in system programmable flash • 8 kB RAM • 2 kB E^2PROM
Serial link	• RS232 TTL Full Duplex • 1200 to 115200 bps • 7 or 8 bits • Parity management • Flow control o Hardware (RTS/CTS)

Embedded software functionality	• Flexibility:
	  o Pre flashed
	  o Customization capability
	  o Embedded bootloader for firmware download through serial link or over the air

3.8. Absolute Maximum Ratings

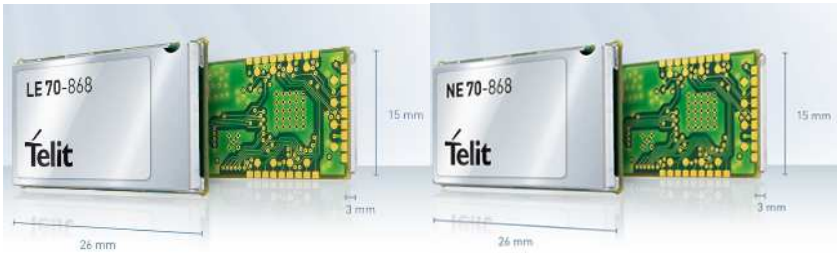
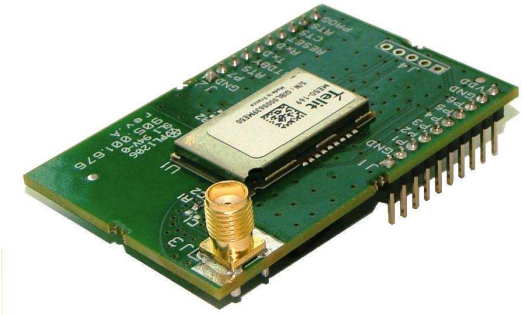
Voltage applied to Vcc, V_{DD} :	-0.3V to +3.6V
Voltage applied to "TTL" Input :	-0.3V to V_{DD}+0.3V

3.9. Ordering Information

The following equipments can be ordered (x = L or N):

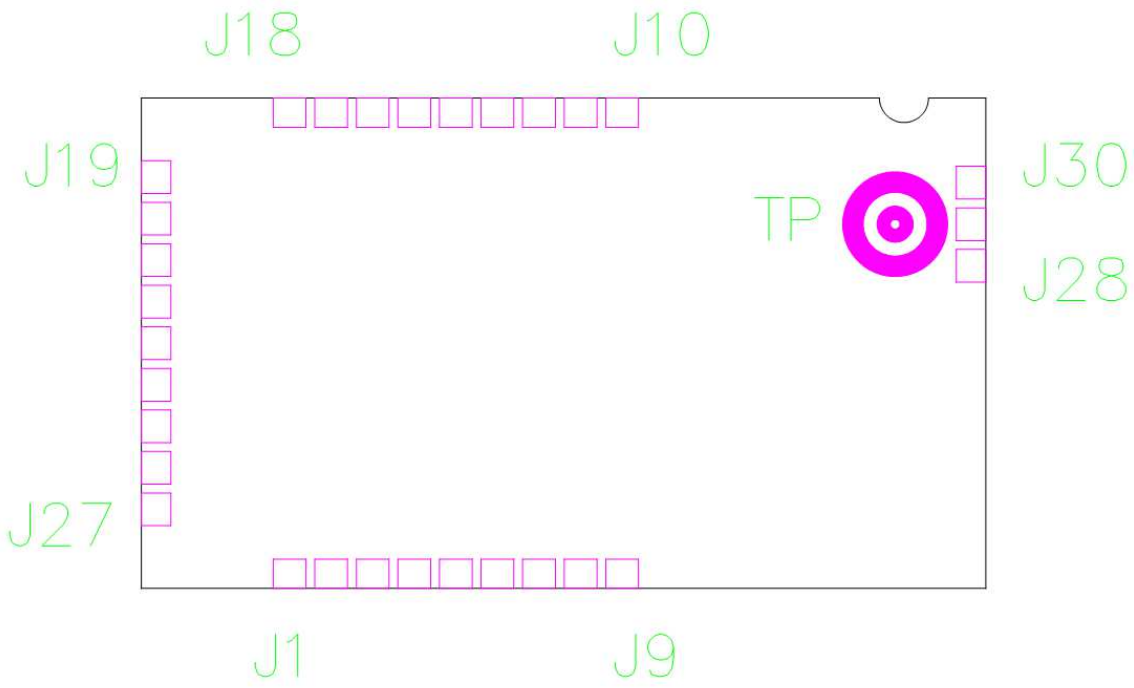
- The SMD version (xE70-868).
- The DIP interface version (xE70-868).
- The Demo Kit LE70-868 composed by n.2 EVK board, n.2 DIP interface boards, n.2 RF antennas, n.2 USB cables, n.2 batteries 9V.
- The Demo Case NE70-868 composed by n.4 EVK board, n.4 DIP interface boards, n.4 RF antennas, n.4 USB cables, n.2 report I/O interface, n.2 batteries 9V.

The versions below are considered standard and should be readily available. For other versions, please contact Telit. Please make sure to give the complete part number when ordering.

Equipment x= L or N
SMD Version
B xE70-868/SMD

DIP Version
B xE70-868/DIP

Demo Kit
LE70-868 Demo Kit/NE70-868 Demo Case


4. Pin-out and signals description

4.1. Module Pin OUT (Top View)



CAUTION: reserved pins must not be connected

CAUTION: In case you want to use in the same application Telit ZE51 or ZE61 modules J9 and J8 should not be connected, since reserved on these modules (see foot notes on Pin-Out tables.

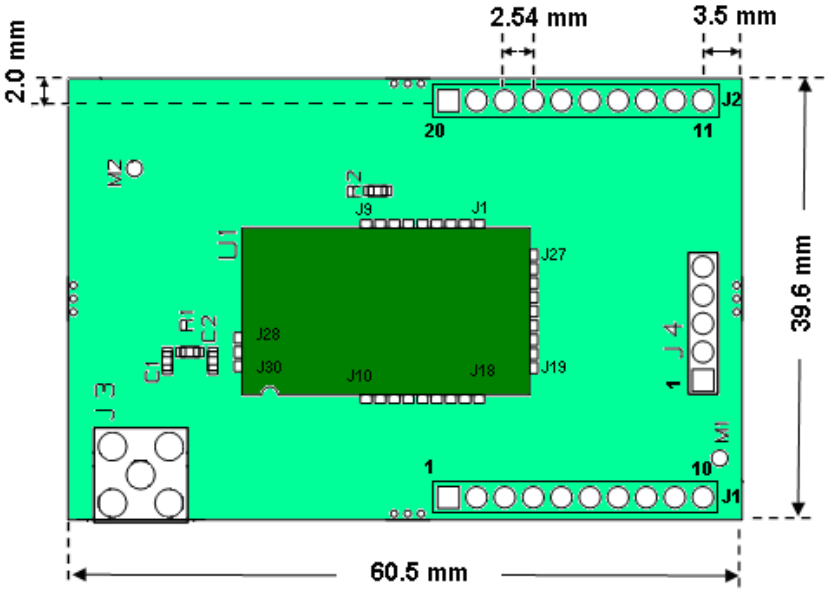
4.2. Module Pin-out table

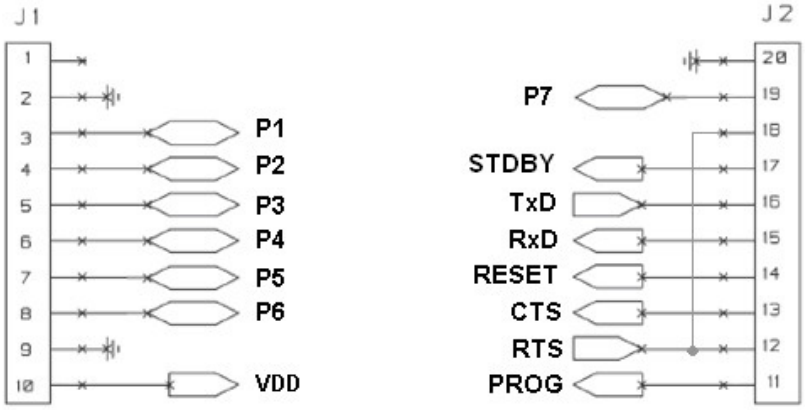
Pin	*Pin name*	*Pin type*	*Signal level*	*Function*
J30	GND	Gnd		RF Ground connection for external antenna
J29	Ext_Antenna	RF		RF I/O connection to external antenna
J28	GND	Gnd		RF Ground connection for external antenna
J27	GND	Gnd		Ground
J26	GND	Gnd		Ground
J25	VDD	Power		Digital and Radio part power supply pin
J24	CTS	I	TTL	Clear To Send
J23	RESET	I	TTL	µC reset (Active low with internal pull-up)
J22	RTS	O	TTL	Request To Send
J21	RXD	I	TTL	RxD UART – Serial Data Reception
J20	GND	Gnd		Ground
J19	TXD	O	TTL	TxD UART – Serial Data Transmission
J18	STAND_BY	I	TTL	Standby (Active high with internal pull-down: when set to 1 the module is put in stand-by)
J17	GND	Gnd		Ground
J16	PROG	I	TTL	Signal for serial µC flashing (Active high with internal pull-down)
J15	GND	Gnd		Ground
J14	PDI_DATA	I/O	TTL	Program and Debug Interface DATA
J13	GND	Gnd		Ground
J12	GND	Gnd		Ground
J11	GND	Gnd		Ground
J10	PDI_CLK	I	TTL	Program and Debug Interface CLOCK
J9	IO9[1]	I/O	TTL	Digital I/O N°9 with interrupt
	Status TX/RX	O	TTL	See reference document **[7] Star Network Protocol Stack User Guide**
J8	IO8_AD_DA[2]	I/O	analog	A to D and D to A I/O N°8 with interrupt (Logic I/O capability)
	ACK TX	O	TTL	See reference document **[7] Star Network Protocol Stack User Guide**
J7	IO7_A	I/O	analog	Analog Input N°7 (Logic I/O capability)
J6	IO6_A	I/O	analog	Analog Input N°6 (Logic I/O capability)
J5	IO5_A	I/O	analog	Analog Input N°5 (Logic I/O capability)
J4	IO4_A	I/O	analog	Analog Input N°4 (Logic I/O capability)

[1, 2] In case you want to use in the same application Telit ZE51 or ZE61 modules J9 and J8 should not be connected, since reserved on these modules.

J3	IO3_A	I/O	analog	Analog Input N°3 (Logic I/O capability)
J2	IO2_P	I/O	TTL	Logic I/O N°2 with interrupt
	RX LED	O	TTL	See reference document **[7] Star Network Protocol Stack User Guide**
J1	IO1_P	I/O	TTL	Logic I/O N°1 with interrupt
	TX LED	O	TTL	See reference document **[7] Star Network Protocol Stack User Guide**

4.3. Pin-out of the Module DIP





4.4. Dip-Module Pin-out correspondence table

Pin-Out correspondence between xE70-868/DIP and xE70-868/SMD

xE70-868/DIP			xE70-868/SMD		Comments
Connector	Pin	Name	Pin	Name	
J1	1				Reserved Pin
	2	GND		GND	
	3	P1	J5	IO5_A	
	4	P2	J9	Status TX/RX	
	5	P3	J2	RX LED	
	6	P4	J1	TX LED	
	7	P5	J4	IO4_A	
	8	P6	J3	IO3_A	
	9	GND		GND	
	10	VDD	J25	VDD	
J2	11	PROG	J16	PROG	
	12	RTS	J22	RTS	
	13	CTS	J24	CTS	
	14	RESET	J23	RESET	
	15	RxD	J21	RxD	
	16	TxD	J19	TxD	
	17	STDBY	J18	STAND_BY	
	18	RTS	J22	RTS	
	19	P7	J6	IO6_A	
	20	GND		GND	
J4	1		J14	PDI_DATA	J4 Connector for debugging and flashing
	2		J10	PDI_CLK	
	3		J23	RESET	
	4		J25	VDD	
	5			GND	
			J7	IO7_A	Reserved Pin
			J8	IO8_AD_DA	
J3	SMA connector		J29	Ext_Antenna (Unbalanced RF)	A 50 Ohm coplanar wave guide and a 0 ohm resistor are used to connect J29 to J3

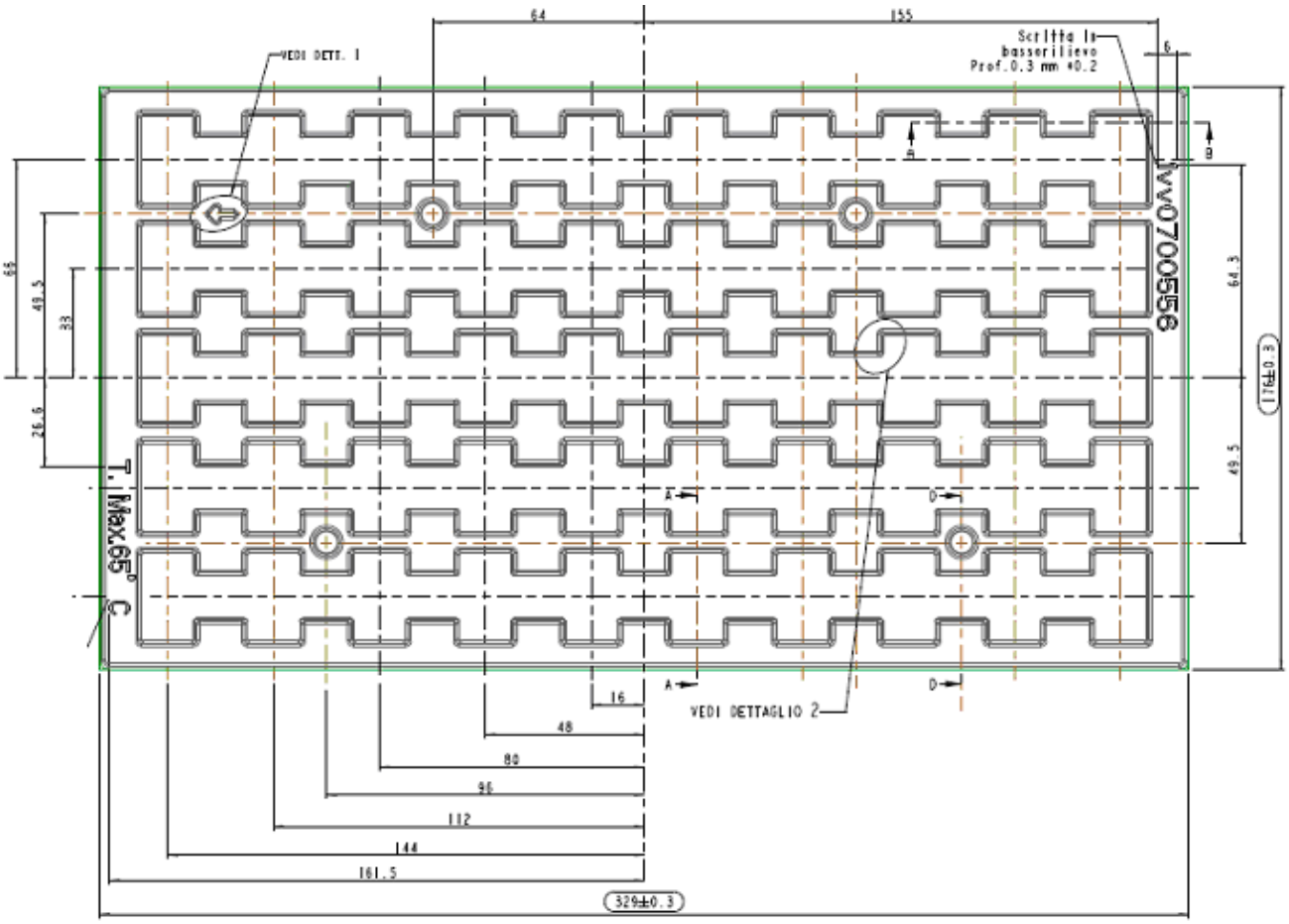
4.5. Signals description

Signals	Description
Reset	External hardware reset of the radio module. Active on low state.
TXD, RXD	Serial link signals, format NRZ/TTL: TXD is for outgoing data. RXD is for incoming data. The '1' is represented by a high state.
CTS	Incoming signal. Indicates whether the module can send serial data to user (Active, on low state) or not (inactive, on high state).
RTS	Outgoing signal. Indicates whether the user can transmit serial data (active, on low state) or not (inactive, on high state).
IO	I/O, configurable as input or as output. See reference document **[7]** for LE70-868.
STANDBY	Input signal which indicates to the module to switch to pre-selected low-power mode. See reference document **[7]** for LE70-868
TX LED	Output signal set to VCC during radio transmission and set to GND the rest of the time
RX LED	Output signal set to VCC as soon as a radio frame is detected with correct synchronization word. The signal returns to GND as soon as the frame reception is finished
ACK TX	In Addressed Secured mode, this signal rises to VCC when an ACK hasn't been received after frame transmission and repetition. This is the hardware version of "ERROR" serial message. It stays at VCC until next success addressed secured transmission
STATUS TX/RX	Output signal which indicates the status of the serial port. When serial port is transmitting, Status RX/TX signal goes VCC until the end of serial transmission. The signal stays to GND the rest of the time

5. Process Information

5.1. Delivery

xE70-868 modules are delivered in plastic tray packaging, each tray including 50 units. The dimensions of the tray are the following: 329 mm x 176 mm x 5.6 mm. Each unit is placed in a 26.6 mm x 16 mm location. An empty tray weights 45 g and a loaded tray weights around 130 g.



5.2. Storage

The optimal storage environment for XE70-868 modules should be dust free, dry and the temperature should be included between -40°C and +85°C.

5.3. Moisture sensibility

The level of moisture sensibility of the Product is "3" according with standard IPC/JEDEC JSTD-020, take care of all the relative requirements for using this kind of components.
Moreover, the customer has to take care of the following conditions:

a) The shelf life of the Product inside of the dry bag must be 12 months from the bag seal date,
b) when stored in a non-condensing atmospheric environment of <= 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5
c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition b) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected
d) Baking is required if conditions b) or c) are not respected
e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more.

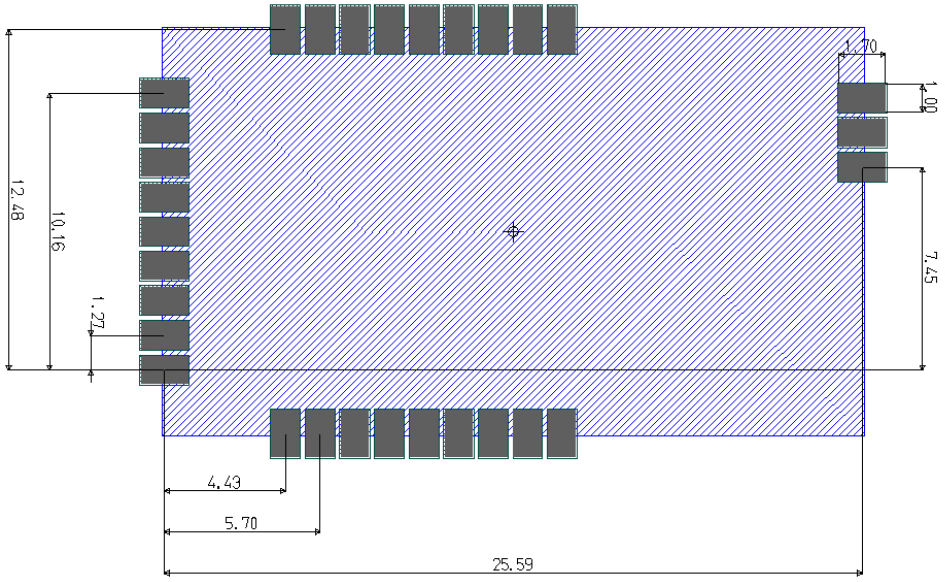
5.4. Additional Precautions

Also, it must be noted that due to some components, XE70-868 modules are ESD sensitive device. Therefore, ESD handling precautions should be carefully observed.

5.5. Soldering pad pattern

The surface finished on the printed circuit board pads should be made of Nickel/Gold surface.

The recommended soldering pad layout on the host board for the xE70-868 module is shown in the diagram below:



All dimensions in mm

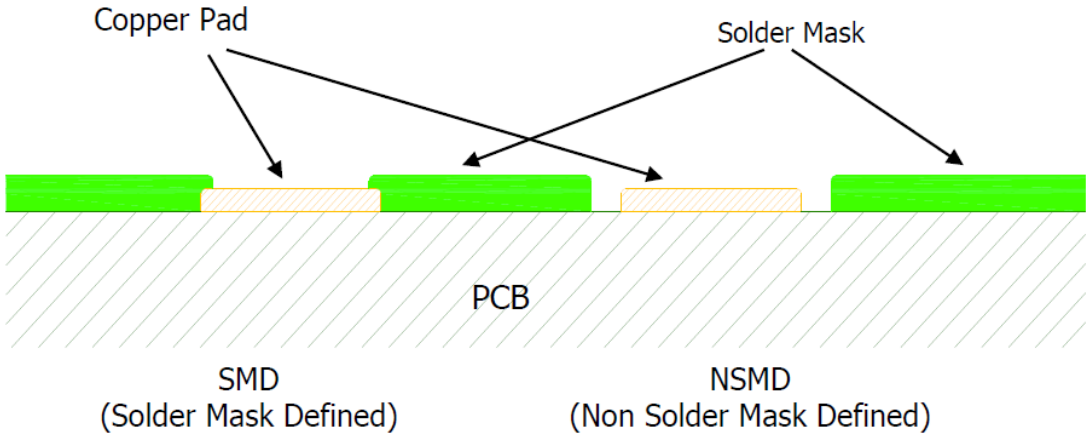
Neither via-holes nor wires are allowed on the PCB upper layer in area occupied by the module.

5.6. Solder paste

xE70-868 module is designed for surface mounting using half-moon solder joints (see diagram below). For proper module assembly, solder paste must be printed on the target surface of the host board. Stencil apertures layout can have the same dimensions as the copper pads.
The solder paste should be eutectic and made of 95.5% of SN, 4% of Ag and 0.5% of Cu. The recommended solder paste height is 180 µm .
The following diagram shows mounting characteristics for ME integration on host PCB.

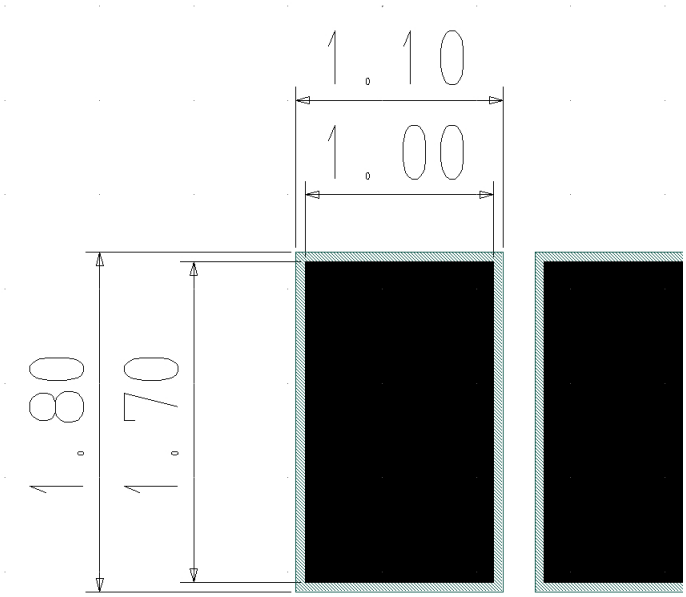
5.7. PCB pad design

Non-Solder Mask Defined (NSMD) type is recommended for the solder pads on the host pcb:



5.8. PCB pad dimensions

The recommended PCB pad dimensions are described in the following picture: as can be seen, solder mask apertures are 0.1mm larger than the copper pad:



5.9. Placement

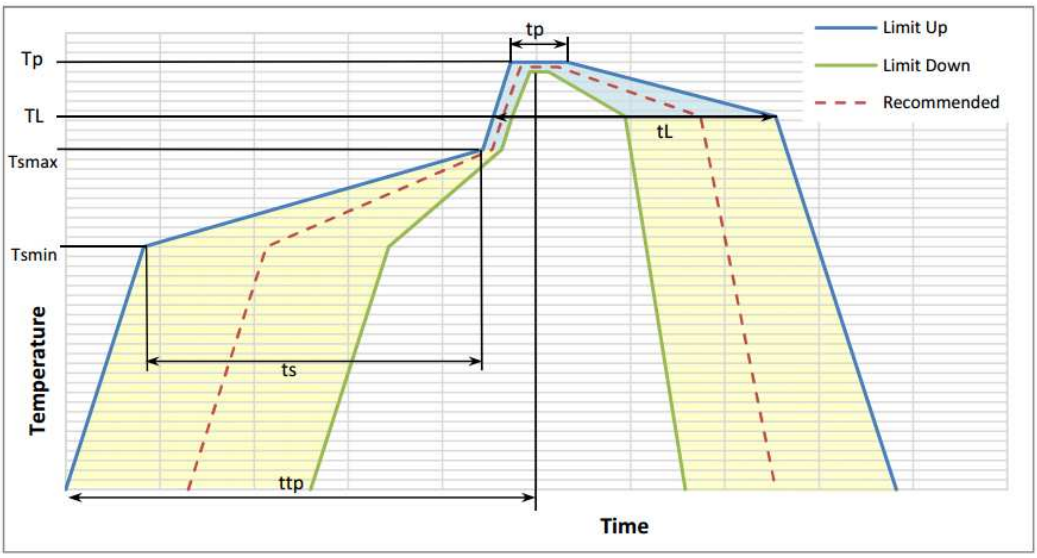
The xE70-868 module can be automatically placed on host boards by pick-and-place machines like any integrated circuit.

5.10. Soldering Profile (RoHS Process)

It must be noted that xE70-868 module should not be allowed to be hanging upside down during the reflow operation. This means that the module has to be assembled on the side of the printed circuit board that is soldered last.

The recommendation for lead-free solder reflow in IPC/JEDEC J-STD-020D Standard should be followed.

Profile Feature	Pb-Free Assembly
Average ramp-up rate (TL to Tp)	3°C/seccond max
Preheat	
- Temperature Min (Tsmin)	150°C
- Temperature Max (Tsmax)	200°C
- Time (Tsmin to Tsmax) ts	60-180 seconds
Tsmax to TL	
- Ramp-up rate	3°C/seccond max
Time maintained above:	
- Temperature (TL)	217°C
- Time (tL)	60-150 seconds
Peak Temperature (Tp)	245°C +0/-5 °C
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds
Ramp-down Rate	6°C/second max
Time 25°C to Peak Temperature Tp (ttp)	8 minutes max



The barcode label located on the module shield is able to withstand the reflow temperature.

CAUTION - It must also be noted that if the host board is submitted to a wave soldering after the reflow operation, a solder mask must be used in order to protect the xE70-868 radio module's metal shield from being in contact with the solder wave.

6. Board Mounting Recommendation

6.1. Electrical environment

The best performances of the xE70-868 module are obtained in a "noise free" environment. Some basic recommendations must be followed:

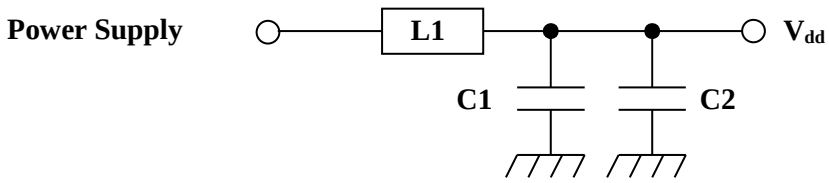
- Noisy electronic components (serial RS232, DC-DC Converter, Display, Ram, bus,...) must be placed as far as possible from the xE70-868 module.

CAUTION – A particular attention must be put on power supply DC-DC converter, due to switching frequency that generates spurious into the receiver band. It can strongly decrease module performances. It is then recommended to put a metallic shield covering DC conversion function.

- Switching components circuits (especially RS-232/TTL interface circuit power supply) must be decoupled with a 100 µF low ESR tantalum capacitor. And the decoupling capacitor must be as close as possible to the noisy chip.

6.2. Power supply decoupling on xE70-868 module

The power supply of xE70-868 module must be nearby decoupled. A LC filter is strongly recommended in case of DC-DC conversion. It must be placed as close as possible to the radio module power supply pin, VDD.



For example:

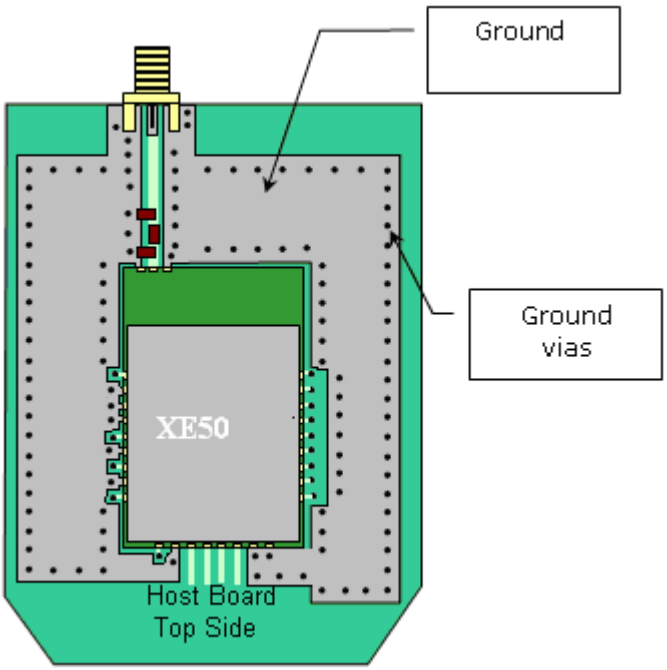
Symbols	Reference	Value	Manufacturer
L1	LQH32CN1R0M33	1µH	Murata
C1	GRM31CF51A226ZE01	22µF	Murata
C2	Ceramic CMS 25V	100nF	Multiple

L1 must be chosen carefully with very low serial resistance (ESR) in order to limit voltage drop.

6.3. RF layout considerations

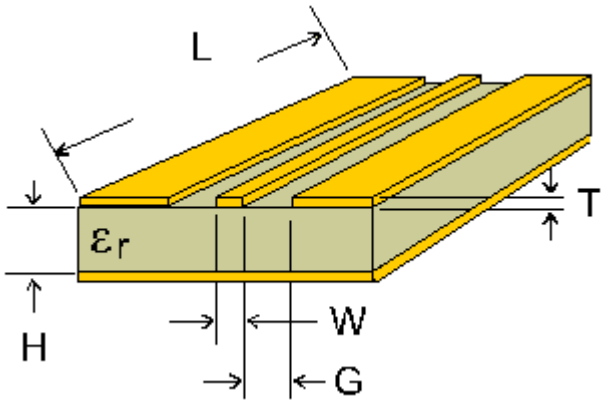
Basic recommendations must be followed to achieve a good RF layout:

- It is recommended to fill all unused PCB area around the module with ground plane
- The radio module ground pin must be connected to solid ground plane.
- If the ground plane is on the bottom side, a via (Metal hole) must be used in front of each ground pad. Especially J28 and J30 (RF Gnd) pins should be grounded via several holes to be located right next to the pins thus minimizing inductance and preventing mismatch and losses.



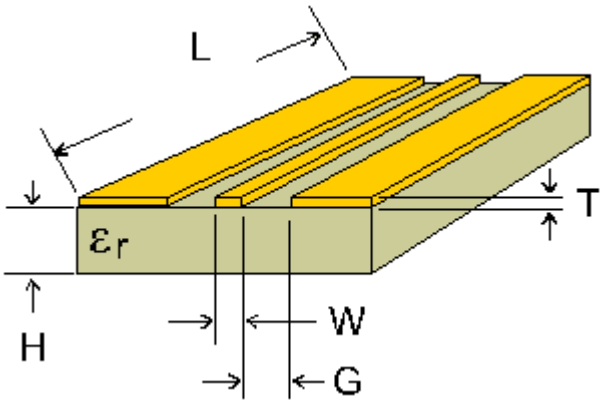
6.4. Antenna connections on printed circuit boards

Special care must be taken when connecting an antenna or a connector to the module. The RF output impedance is 50 ohms, so the strip between the pad and the antenna or connector must be 50 ohms following the tables below. Ground lines should be connected to the ground plane with as many vias as possible, but not too close to the signal line.



PCB material	PCB thickness H (mm)	Coplanar line W (mm)	Coplanar line G (mm)
FR4	0.8	1	0.3
	1.6	1	0.2

Table 1: Values for double face PCB with ground plane around and under coplanar wave guide (recommended)

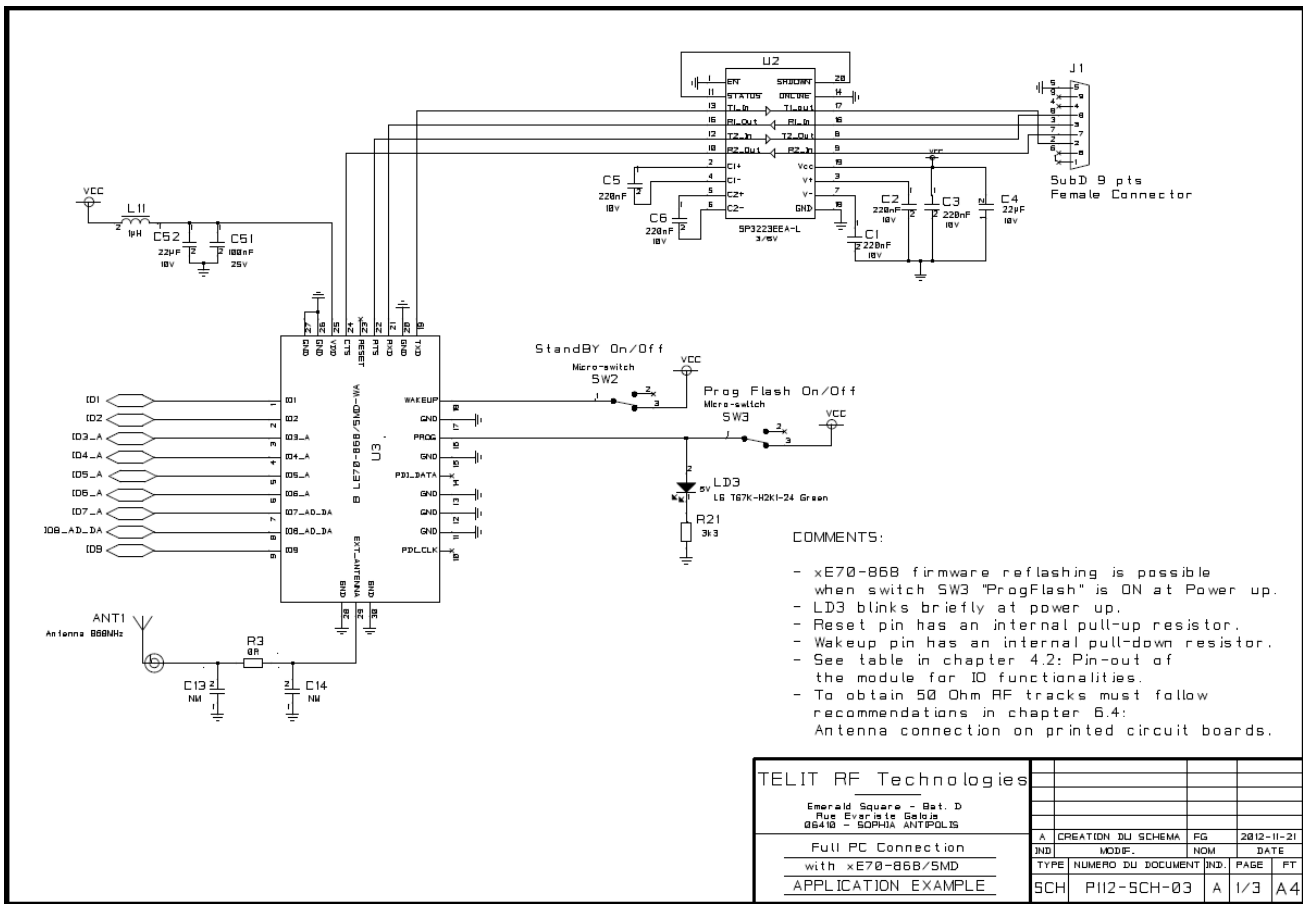


PCB material	PCB thickness H (mm)	Coplanar line W (mm)	Coplanar line G (mm)
FR4	0.8	1	0.22
	1.6	1	0.23

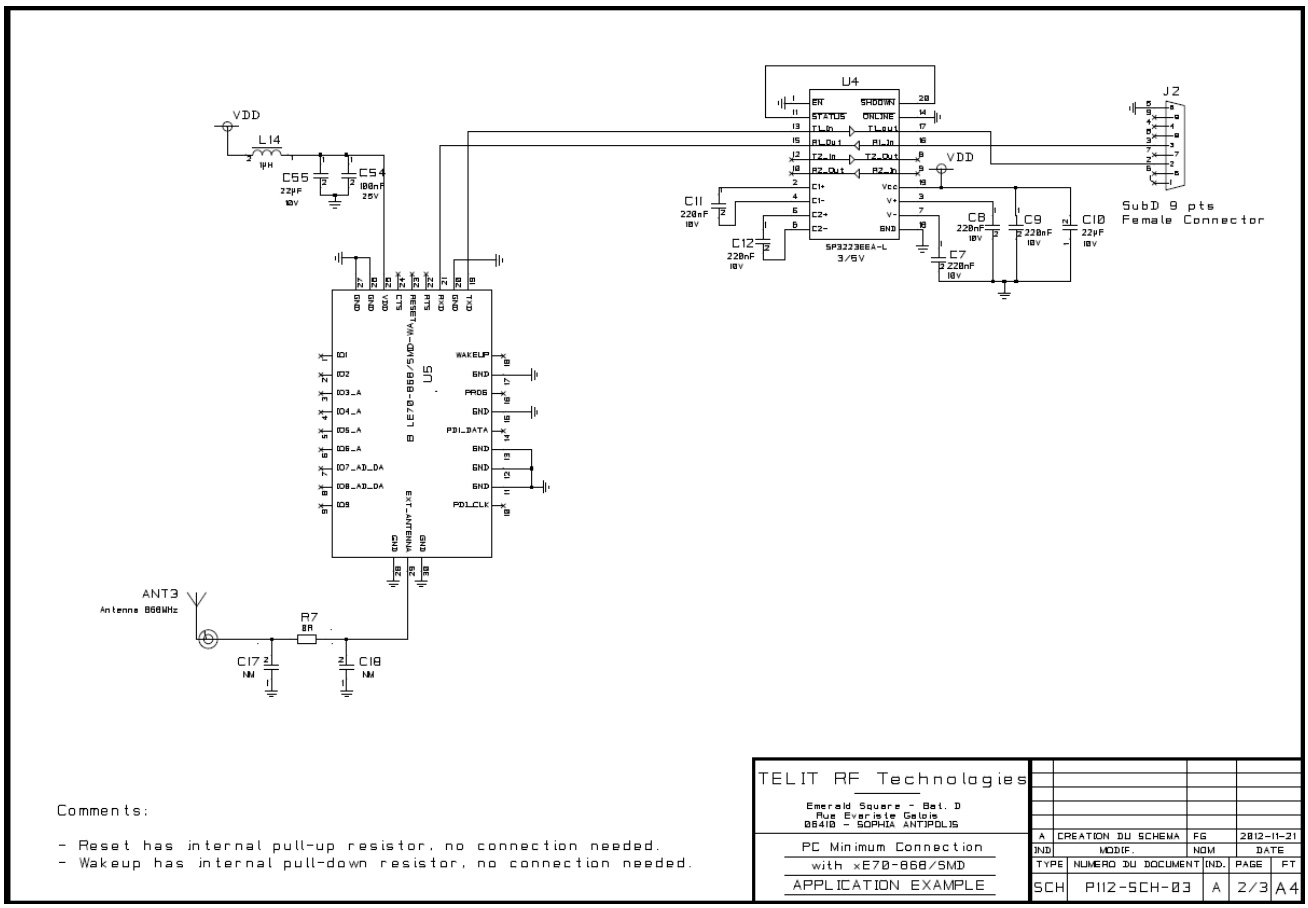
Table 2: Values for simple face PCB with ground plane around coplanar wave guide (not recommended)

6.5. xE70-868 Interfacing

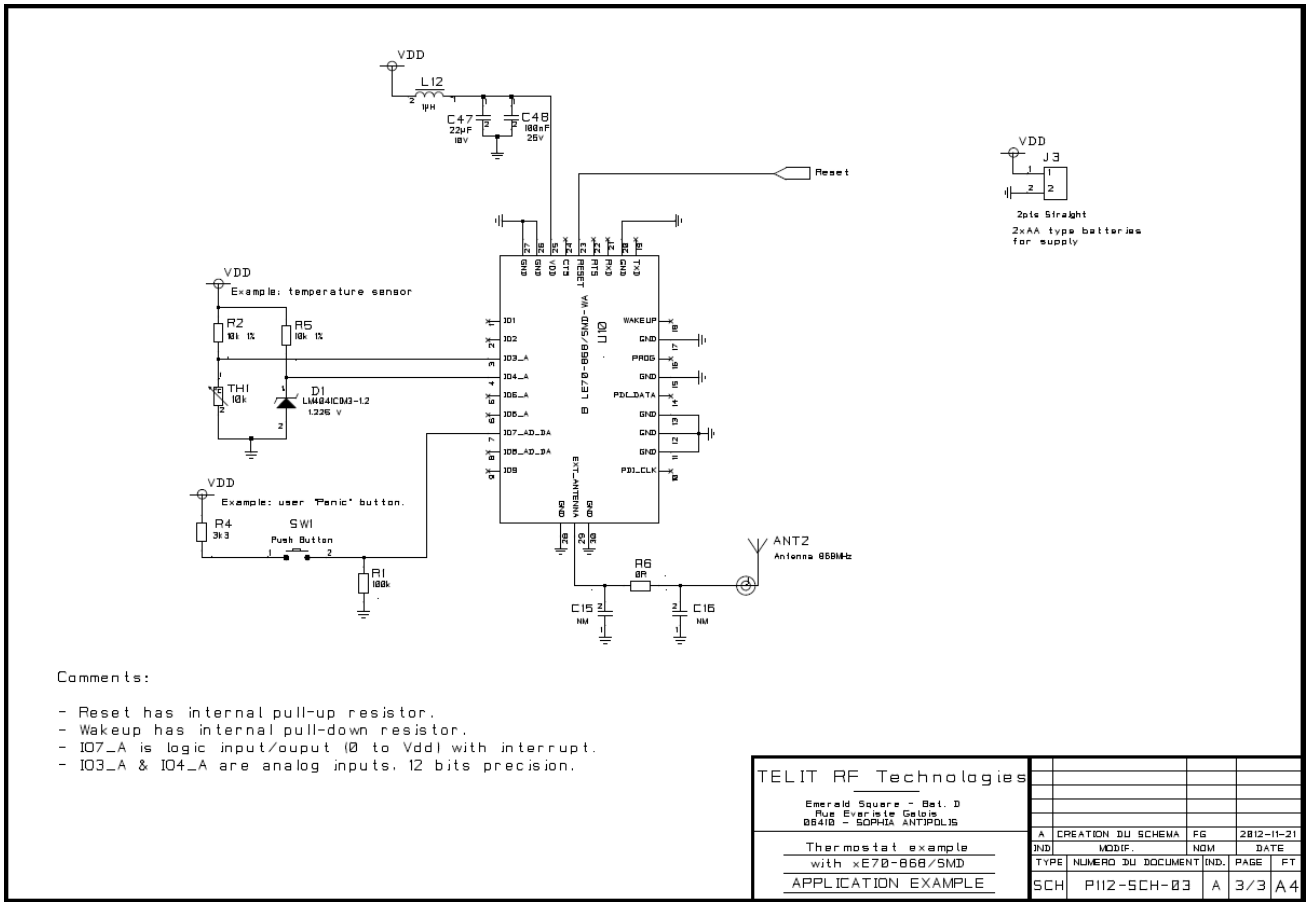
Example of a full RS-232 connection between a PC or an Automat (PLC) and xE70-868



Example of minimum connections for communication between a PC and xE70-868



Example for sensor connection with xE70-868



7. Declaration Of Conformity

EC DECLARATION OF CONFORMITY

1. LE70-868, ME70-868, NE70-868 (product name)
2. Telit Communications S.p.A -Ico. Sa Illetta, S.S. 195, Km 2.300, 09122 Cagliari- ITALY (manufacturer)
3. This declaration of conformity is issued under the sole responsibility of the manufacturer
4. Radio Module for Application in 868 MHz band

5. The object of the declaration described above is in conformity with the relevant Community harmonisation: European Directive 1999/05/EC (R&TTE)
6. The conformity with the essential requirements of the 1999/05/EC has been demonstrated against the following harmonized standards:

EN 60950-1:2006	For article 3.1 (a): Health and Safety of the User
EN 301 489-1 V1.8.2 EN 301 489-3 V1.4.1	For article 3.1 (b): Electromagnetic Compatibility
EN 300 220-2 V2.4.1	For article 3.2: Effective use of radio spectrum

7. The conformity assessment procedure referred to in Article 10 and detailed in Annex V of Directive 1999/05/EC has been followed with the involvement of the following Notified Body:
   CETECOM ICT Services GmbH Untertürkheimer Straße 6-10, D-66117 Saarbrucken, Germany.
   Notified Body Number: 0682

   Thus, CE 0682 is placed on the product

8. The Technical Construction File (TCF) relevant to the product described above and which support this Declaration of Conformity, is held at: Telit Communications S.p.A Via Stazione di Prosecco, 5/b 34010 Sgonico (TRIESTE) ITALY

Signed for and on behalf of Telit Communications S.p.A

Trieste, **2013-10-08**

Quality Director
Guido Walcher

R&D Manager
Gianpiero Pilu

Technical Construction File: [illegible]

Mod 0211 2012-11 Rev.2 (758/2008/EC)

8. Safety Recommendations

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc. It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The European Community provides some Directives for the electronic equipments introduced on the market. All the relevant information's are available on the European Community website:

http://ec.europa.eu/enterprise/sectors/rtte/documents/

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:

http://ec.europa.eu/enterprise/sectors/electrical/

9. Glossary

ACP	Adjacent Channel Power
AFA	Adaptive Frequency Agility
bps	Bits per second
BW	Bandwidth
dB	Decibel
dBm	Power level in decibel milliwatt (10 log (P/1mW))
E^2PROM	Electrically Erasable Programmable Read Only Memory
e.r.p	Effective radiated power
ETSI	European Telecommunication Standard Institute
GFSK	Gaussian Frequency Shift Keying
I	Input
ISM	Industrial, Scientific and Medical
kB	KiloByte
kbps	Kilobits per second
kcps	Kilochips per second
kHz	Kilo Hertz
LBT	Listen Before Talk
LGA	Land Grid Array
MHz	Mega Hertz
mW	milliwatt
O	Output
PER	Packet Error Rate
ppm	Parts per million
RAM	Random Access Memory
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RxD	Receive Data
SMD	Surface Mounted Device
SRD	Short Range Device
TxD	Transmit Data
UART	Universal Asynchronous Receiver Transmitter
µC	microcontroller

10. Document History

Revision	Date	Changes
0	2012-11-21	First Release
1	2014-01-30	Inserted NE70-868 module and DoC
2	2014-04-01	Updated Demo Kit/Case content
3	2014-07-18	Updated Radio Specifications table
4	2014-07-22	Corrected partname for L1 on page 32
5	2015-08-18	Updated mounting process information, chapter 5