

# GE863 Family Hardware User Guide

For GE863-PY, GE863-QUAD, GE863-SIM and GE863-GPS  
1w0300783 Rev.4 – 2009-12-16



## APPLICABILITY TABLE

PRODUCT
GE863-PY
GE863-QUAD
GE863-SIM
GE863-GPS




---

**NOTE:**

This document substitutes the following specifications:

1wv0300715 GE863-QUAD/PY Hardware User Guide

1wv0300714 GE863-GPS Hardware User Guide

---



## Disclaimer

The information contained in this document is the proprietary information of Telit Communications S.p.A. and its affiliates (“TELIT”).

The contents are confidential and any disclosure to persons other than the officers, employees, agents or subcontractors of the owner or licensee of this document, without the prior written consent of Telit, is strictly prohibited.

Telit makes every effort to ensure the quality of the information it makes available. Notwithstanding the foregoing, Telit does not make any warranty as to the information contained herein, and does not accept any liability for any injury, loss or damage of any kind incurred by use of or reliance upon the information.

Telit disclaims any and all responsibility for the application of the devices characterized in this document, and notes that the application of the device must comply with the safety standards of the applicable country, and where applicable, with the relevant wiring rules.

Telit reserves the right to make modifications, additions and deletions to this document due to typographical errors, inaccurate information, or improvements to programs and/or equipment at any time and without notice.

Such changes will, nevertheless be incorporated into new editions of this document.

Copyright: Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights are reserved.

Copyright © Telit Communications SpA 2009.©



# Contents

- 1. INTRODUCTION..... 7**
  - 1.1. SCOPE..... 7
  - 1.2. AUDIENCE..... 7
  - 1.3. CONTACT INFORMATION, SUPPORT..... 7
  - 1.4. DOCUMENT ORGANIZATION..... 8
  - 1.5. TEXT CONVENTIONS..... 9
  - 1.6. RELATED DOCUMENTS..... 9
  - 1.7. DOCUMENT HISTORY..... 10
- 2. OVERVIEW..... 11**
- 3. GE863 MECHANICAL DIMENSIONS ..... 12**
- 4. GE863 MODULE CONNECTIONS ..... 13**
  - 4.1. PIN-OUT..... 13
  - 4.2. PINS LAYOUT ..... 17
- 5. HARDWARE COMMANDS..... 18**
  - 5.1. TURNING ON THE GE863 ..... 18
  - 5.2. TURNING OFF THE GE863..... 20
  - 5.3. RESETTING THE GE863..... 21
    - 5.3.1. *Hardware Unconditional Shutdown (for GE863-GPS only)*..... 21
    - 5.3.2. *Hardware Unconditional restart (GE863-QUAD/PY/SIM only)* ..... 24
  - 6.1. POWER SUPPLY REQUIREMENTS ..... 26
  - 6.2. EMBODIED BATTERY CHARGER ..... 29
  - 6.3. GENERAL DESIGN RULES ..... 30
    - 6.3.1. *Electrical Design Guidelines*..... 30
    - 6.3.2. *Thermal Design Guidelines*..... 36
    - 6.3.3. *Power Supply PCB Layout Guidelines*..... 37
    - 6.3.4. *Parameters for ATEX Application* ..... 38
- 7. ANTENNA ..... 39**
  - 7.1. GSM ANTENNA REQUIREMENTS ..... 39
  - 7.2. GSM ANTENNA - PCB LINE GUIDELINES ..... 40
  - 7.3. GSM ANTENNA - INSTALLATION GUIDELINES..... 40
  - 7.4. GPS ANTENNA REQUIREMENTS..... 41
    - 7.4.1. *Combined GPS Antenna* ..... 41
    - 7.4.2. *Linear and Patch GPS Antenna*..... 41
    - 7.4.3. *LNA and Front End Design Considerations*..... 41
  - 7.5. GPS ANTENNA - PCB LINE GUIDELINES..... 42
  - 7.6. GPS ANTENNA - INSTALLATION GUIDELINES ..... 43
  - 7.7. LOGIC LEVEL SPECIFICATIONS ..... 44
    - 7.7.1. *Reset Signal* ..... 45
- 8. SERIAL PORTS ..... 46**
  - 8.1. GE863-GPS SERIAL PORTS ..... 46



8.2.	GE863-QUAD/PY/SIM SERIAL PORTS .....	46
8.3.	MODEM SERIAL PORT .....	47
8.4.	GE863-GPS SECONDARY PORTS .....	49
8.4.1.	<i>Modem Serial Port 2 (GPS Control)</i> .....	49
8.4.2.	<i>GPS Serial Port A (SIRF Binary)</i> .....	49
8.4.3.	<i>GPS Serial Port B (NMEA)</i> .....	49
8.5.	GE863-QUAD/PY/SIM SECONDARY PORT .....	50
8.5.1.	<i>Modem Serial Port 2 (Python Debug)</i> .....	50
8.6.	RS232 LEVEL TRANSLATION .....	50
8.7.	5V UART LEVEL TRANSLATION .....	53
<b>9.</b>	<b>AUDIO SECTION OVERVIEW .....</b>	<b>55</b>
9.1.	SELECTION MODE .....	55
9.2.	ELECTRICAL CHARACTERISTICS.....	57
9.2.1.	<i>Input Lines Characteristics</i> .....	57
9.2.2.	<i>Output Lines Characteristics</i> .....	58
<b>10.</b>	<b>GENERAL PURPOSE I/O .....</b>	<b>60</b>
10.1.	GPIO LOGIC LEVELS.....	62
10.2.	USING A GPIO PAD AS INPUT .....	63
10.3.	USING A GPIO PAD AS OUTPUT .....	63
10.4.	USING THE RF TRANSMISSION CONTROL GPIO4.....	63
10.5.	USING THE RFTXMON OUTPUT GPIO5 .....	63
10.6.	USING THE ALARM OUTPUT GPIO6 .....	64
10.7.	USING THE BUZZER OUTPUT GPIO7 .....	65
10.8.	MAGNETIC BUZZER CONCEPTS .....	66
10.8.1.	<i>Short Description</i> .....	66
10.8.2.	<i>Frequency Behavior</i> .....	67
10.8.3.	<i>Power Supply Influence</i> .....	67
10.8.4.	<i>Working Current Influence</i> .....	67
10.9.	USING THE TEMPERATURE MONITOR FUNCTION .....	68
10.9.1.	<i>Short Description</i> .....	68
10.9.2.	<i>Allowed GPIO</i> .....	68
10.10.	INDICATION OF NETWORK SERVICE AVAILABILITY .....	70
<b>11.</b>	<b>RTC AND AUXILIARY SUPPLY .....</b>	<b>71</b>
11.1.	RTC BYPASS OUT .....	71
11.2.	VAUX1 POWER OUTPUT .....	71
<b>12.</b>	<b>PPS GPS OUTPUT (GE863-GPS ONLY) .....</b>	<b>72</b>
12.1.	DESCRIPTION.....	72
12.2.	PULSE CHARACTERISTICS .....	72
<b>13.</b>	<b>DAC AND ADC SECTION .....</b>	<b>73</b>
13.1.	DAC CONVERTER.....	73
13.1.1.	<i>Description</i> .....	73
13.1.2.	<i>Enabling DAC</i> .....	73
13.1.3.	<i>Low Pass Filter Example</i> .....	74



13.2.	ADC CONVERTER.....	74
13.2.1.	<i>Description</i> .....	74
13.2.2.	<i>Using ADC Converter</i> .....	75
<b>14.</b>	<b>MOUNTING THE GE863 ON THE APPLICATION BOARD.....</b>	<b>76</b>
14.1.	GENERAL.....	76
14.1.1.	<i>Module Finishing &amp; Dimensions</i> .....	76
14.1.2.	<i>Recommended Foot Print for the Application</i> .....	77
14.1.3.	<i>Suggested Inhibit Area</i> .....	78
14.1.4.	<i>Debug of the GE863 in Production</i> .....	79
14.1.5.	<i>Stencil</i> .....	79
14.1.6.	<i>PCB Pad Design</i> .....	80
14.1.7.	<i>Solder Paste</i> .....	81
14.1.8.	<i>GE863 Solder Reflow</i> .....	82
<b>15.</b>	<b>PACKING SYSTEM .....</b>	<b>84</b>
15.1.1.	<i>Moisture Sensibility</i> .....	86
<b>16.</b>	<b>CONFORMITY ASSESSMENT ISSUES .....</b>	<b>87</b>
<b>17.</b>	<b>SAFETY RECOMMENDATIONS .....</b>	<b>89</b>



## 1. Introduction

### 1.1. Scope

The aim of this document is the description of some hardware solutions useful for developing a product with the Telit GE863-GPS / QUAD / PY / SIM modules.

### 1.2. Audience

This document is intended for Telit customers, who are integrators, about to implement their applications using our modules of the GE863 Family.

### 1.3. Contact Information, Support

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

[TS-EMEA@telit.com](mailto:TS-EMEA@telit.com)  
[TS-NORTHAMERICA@telit.com](mailto:TS-NORTHAMERICA@telit.com)  
[TS-LATINAMERICA@telit.com](mailto:TS-LATINAMERICA@telit.com)  
[TS-APAC@telit.com](mailto: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's 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.



## 1.4. Document Organization

This document contains the following chapters:

Chapter 1: “Introduction” provides a scope for this document, target audience, contact and support information, and text conventions.

Chapter 2: “Overview” provides an overview of the document.

Chapter 3: “GE863 Mechanical Dimensions”

Chapter 4: “GE863 Module Connections” deals with the pin out configuration and layout.

Chapter 5: “Hardware Commands” How to operate on the module via hardware.

Chapter 6: “Power supply” Power supply requirements and general design rules.

Chapter 7: “Antenna” The antenna connection and board layout design are the most important parts in the full product design

Chapter 8: “Serial ports” The serial port on the Telit GE863 is the core of the interface between the module and OEM hardware

Chapter 9: “Audio Section overview” Refers to the audio blocks of the Base Band Chip of the GE863 Telit Modules

Chapter 10: “General Purpose I/O” How the general purpose I/O pads can be configured.

Chapter 11: “RTC and Auxiliary Supply”

Chapter 12: “PPS GPS Output (GE863-GPS only)”

Chapter 13 “DAC and ADC Section” Deals with these two kind of converters.

Chapter 14: “Mounting the GE863 on the application board” Recommendations and specifics on how to mount the module on the user’s board.



## 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

- Telit GSM/GPRS Family Software User Guide, 1w0300784
- GE863 Product Description, 80278ST10016a
- Audio Settings Application Note , 80000NT10007a
- Digital voice Interface Application Note, 80000NT10004a
- AT Commands Reference Guide, 80000ST10025a
- Telit EVK2 User Guide, 1w0300704



## 1.7. Document History

Revision	Date	Changes
ISSUE #0	2008-06-10	First release
ISSUE #1	2009-02-03	updated P/N List §4: Updated turn on, turn off and reset procedure Added OFF current Updated operating voltage Added ATEX parameters §8 : Updated IO Levels Table
ISSUE#2	2009-03-25	Added new disclaimer Updated § 12.2 Modules with single label, orientation on the tray §4 Added clarification on Turn ON / Turn OFF pulse duration
ISSUE#3	2009-08-31	Applied new layout + minor editing Added DVI info in the pin-out section + notice Added DVI App note in the related documents list Added embodied battery charger description Noted in the pin-out section about RTS in need of being connected to ground and DTR should be pulled up if not used. Updated chapter 9 Audio Section Updated schematic drawings
ISSUE #4	2009-12-16	Updated hardware command section Updated power consumption section



## 2. Overview



---

### NOTICE:

The integration of the GSM/GPRS GE863-GPS/QUAD/PY/SIM cellular module within user application must be done according to the design rules described in this manual.

---

In this document all the basic functions of a mobile phone are taken into account; for each one of them a proper hardware solution is suggested and eventually the wrong solutions and common errors to be avoided will be evidenced. This document is not intended to embrace the whole hardware solutions and products that may be designed. Wrong solutions to be avoided must be considered as mandatory, while hardware configurations are only suggested. This document can be regarded as a guide and a starting point to properly develop your product with the Telit GE863-GPS / QUAD / PY / SIM modules. For further hardware details that may not be explained in this document refer to the Telit GE863 Product Description document where all the hardware information is reported.

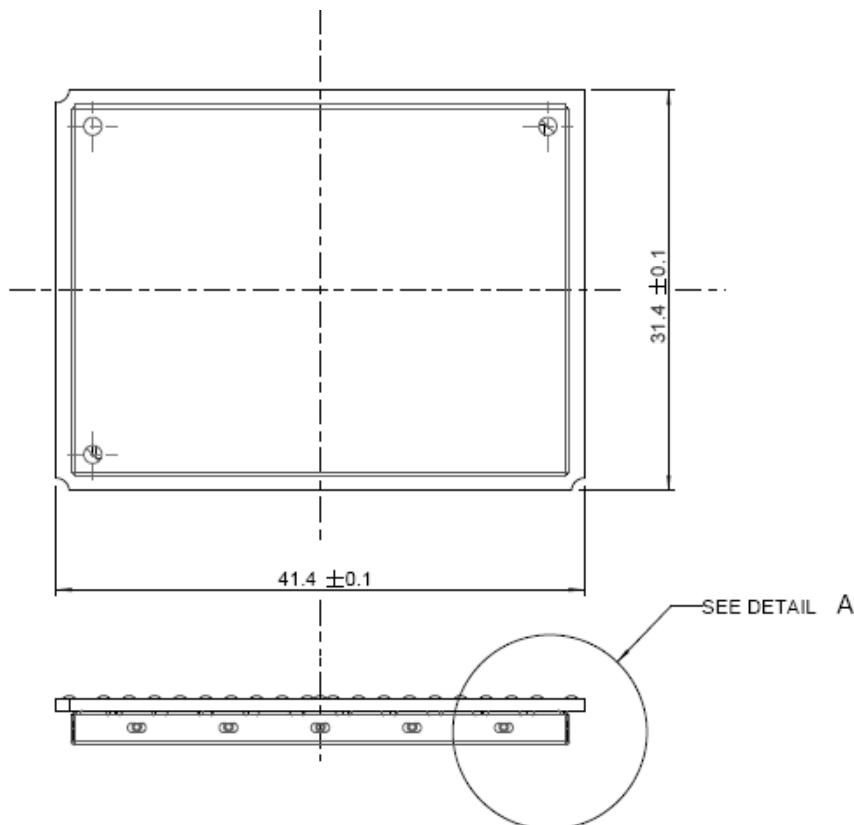
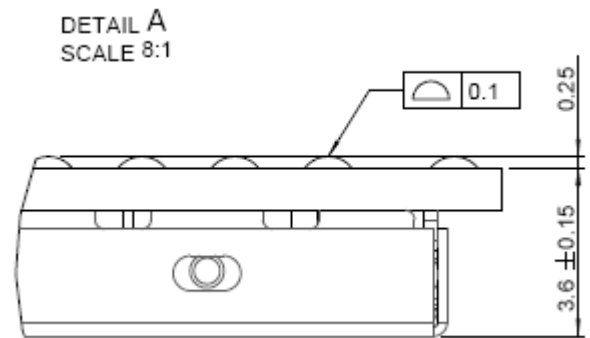
The information presented in this document is believed to be accurate and reliable. However, no responsibility is assumed by Telit Communications S.p.A. for its use, nor any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent rights of Telit Communications S.p.A. other than for circuitry embodied in Telit products. This document is subject to change without notice.



### 3. GE863 Mechanical Dimensions

The Telit GE863 module's overall dimensions are:

- Length: 41,4 mm
- Width: 31,4 mm
- Thickness: 3,6 Mm



## 4. GE863 Module Connections

### 4.1. PIN-OUT

BGA Ball	Signal	I/O	Function	Internal Pull up	Type
1	GPIO13	I/O	GPIO13		CMOS 2.8V
2	GPIO12	I/O	GPIO12	47KΩ	CMOS 2.8V
3	GPIO11	I/O	GPIO11	4.7KΩ	CMOS 2.8V
4	GPIO10	I/O	GPIO10		CMOS 2.8V
5	GPIO9	I/O	GPIO9		CMOS 2.8V
6	GPIO8	I/O	GPIO8		CMOS 2.8V
7	RESERVED	-	RESERVED		-
8	GND	-	Ground		Power
9	EAR_MT-	A0	Handset earphone signal output, phase -		Audio
10	EAR_MT+	A0	Handset earphone signal output, phase +		Audio
11	EAR_HF+	A0	Handsfree ear output, phase +		Audio
12	EAR_HF-	A0	Handsfree ear output, phase -		Audio
13	MIC_MT+	AI	Handset microphone signal input; phase+		Audio
14	MIC_MT-	AI	Handset microphone signal input; phase-		Audio
15	MIC_HF+	AI	Handsfree microphone input; phase +		Audio
16	MIC_HF-	AI	Handsfree microphone input; phase -		Audio
17	GND	-	Ground		Power
18	SIMCLK	O	External SIM signal - Clock		1.8/3V ONLY
19	SIMRST	O	External SIM signal - Reset		1.8/3V ONLY
20	SIMIO	I/O	External SIM signal - Data I/O		1.8/3V ONLY
21	SIMIN	I/O	External SIM signal - Presence (active low)	47KΩ	CMOS 2.8V
22	SIMVCC	-	External SIM signal - Power		1.8/3V ONLY
23	ADC_IN1	AI	Analog /Digital converter input		A/D
24	VRTC	A0	VRTC Backup capacitor		Power
25	TX_TRACE		TX data for GPS control (TX data for Debug in case of GE863-QUAD/PY/SIM)		CMOS 2.8V
26	RX_TRACE		RX data for GPS control (RX data for Debug in case of GE863-QUAD/PY/SIM)		CMOS 2.8V
27	VBATT	-	Main power supply		Power
28	GND	-	Ground		Power
29	STAT_LED	O	Status indicator led		CMOS 1.8V
30	AXE	I	Handsfree switching	100KΩ	CMOS 2.8V
31	VAUX1	-	Power output for external accessories		-
32	GPIO4	I/O	GPIO4 Configurable general purpose I/O pin/	4.7KΩ	CMOS 2.8V





BGA Ball	Signal	I/O	Function	Internal Pull up	Type
57	RESERVED	-	RESERVED		-
58	CLK	I/O	Python Debug (CLK) <sup>3</sup>		CMOS 2.8V
59	GPI017	I/O	GPI017 Configurable general purpose I/O pin/ DVI2_WA (Digital Voice Interface)		CMOS 2.8V
60	GPI014	I/O	GPIO		-
61	MRST	I/O	Python Debug (MRST) <sup>3</sup>		-
62	RESERVED	-	RESERVED		-
63	DAC_OUT	0	DAC out		
64	GPI016	I/O	GPIO		CMOS 2.8V
65	RESERVED	-	RESERVED		-
66	MTSR	I/O	Python Debug (MTSR) <sup>3</sup>		-
67	GND	-	Ground		Power
68	TX_GPS	-	GPS serial Port (TX) <sup>3</sup>		-
69	GND	-	Ground		Power
70	RESERVED	-	RESERVED		-
71	GPI015	I/O	GPIO		-
72	GND	-	Ground		Power
73	RX_GPS	-	GPS serial Port (RX) <sup>3</sup>		-
74	RESERVED	-	RESERVED		-
75	PPS	0	1 Pulse per Second signal <sup>3</sup>	100K $\Omega$ pull down	CMOS 2.8V
76	GPI018	I/O	GPI018 Configurable general purpose I/O pin/ DVI2_RX (Digital Voice Interface)		CMOS 2.8V
77	GND	-	Ground		Power
78	RX_GPS_BI N	-	GPS serial Port (RX) - SIRF BINARY <sup>3</sup>		CMOS 2.8V
79	GND	-	Ground		Power
80	TX_GPS_BI N	-	GPS serial Port (TX) - SIRF BINARY <sup>3</sup>		CMOS 2.8V
81	RESERVED	-	RESERVED		-
82	GND	-	Ground		Power
83	GPS_ANT	-	GPS ANTENNA <sup>3</sup>		
84	GND_GPS	-	GPS_ANTENNA GND <sup>3</sup>		Power

<sup>3</sup> Available only on GE863-GPS (in case of GE863-QUAD/PY/SIM it has to be considered RESERVED)





---

**NOTE:**

The GE863 family Wireless Modules (GE863-GPS, GE863-PY, GE863-SIM and GE863-QUAD) has one DVI port present on the system interface. For the GE863 Wireless Modules, the DVI port can only be set to 2 if the digital audio functionality is to be used. This is due to physical interface restrictions.

---





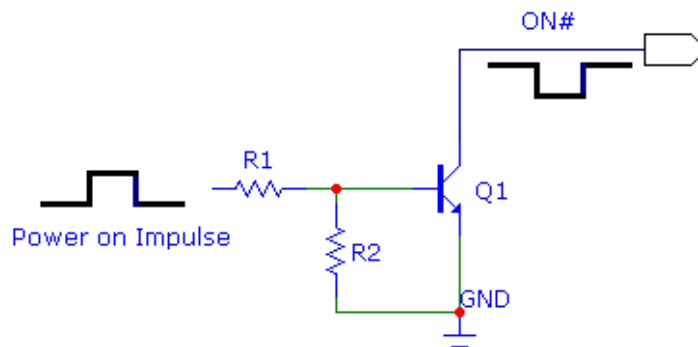
## 5. Hardware Commands

### 5.1. Turning ON the GE863

To turn the GE863 on, the pad ON# must be tied low for at least 1 second and then released. A pulse duration less than 1 second should also start the power on procedure, but this is not guaranteed.

The maximum current that can be drained from the ON# pad is 0,1 mA.

A simple circuit to do it is:



#### NOTE:

Do not use any pull up resistor on the ON# line, since it is internally pulled up. Using pull up resistor may cause latch up problems on the GE863 power regulator and improper power on/off of the module. The line ON# must be connected only in open collector configuration.

In this document all the lines that are inverted, having active low signals, are labeled with a name that ends with a "#" or with a bar over the name.

The GE863 turns fully on by supplying power to the Charge pad as well (as in a module equipped with a battery on the VBATT pads).



#### TIP:

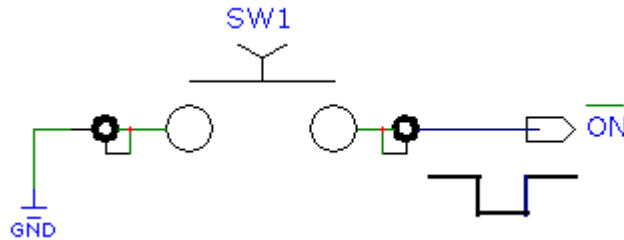
Monitor the hardware line PWRMON to check if the device has been powered on. The device should be considered powered on 900ms after the line raised up.

PWRMON line rises up also when supplying power to the Charge pad.

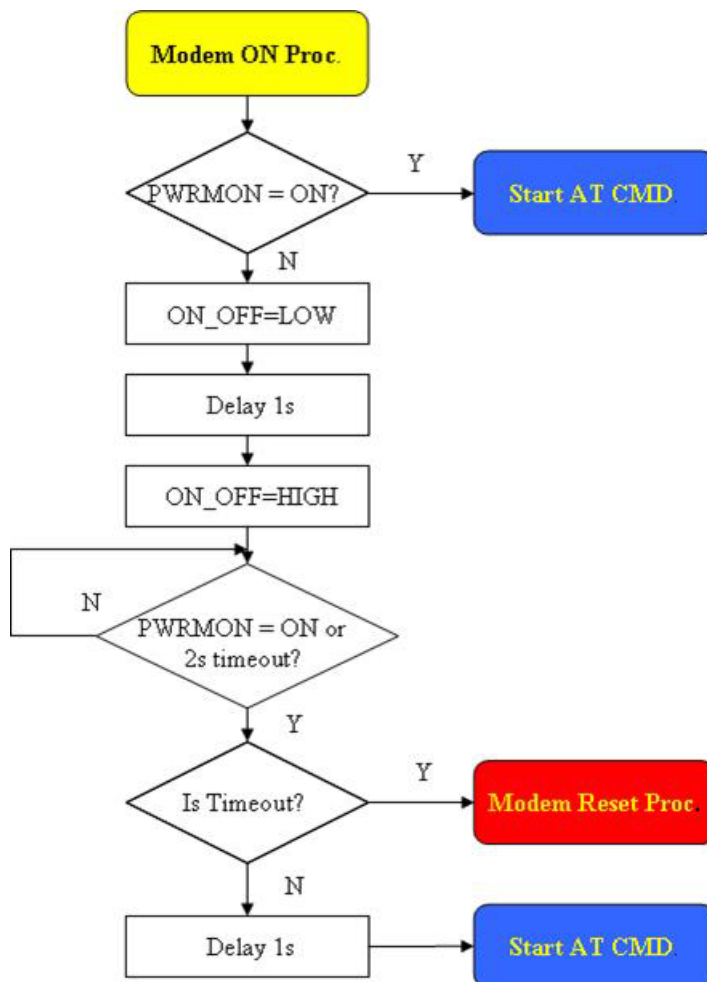


For example:

- 1- Let us assume you need to drive the ON# pad with a totem pole output of a +3/5 V microcontroller (uP\_OUT1):
- 2- Let us assume you need to drive the ON# pad directly with an ON/OFF button:



A flow chart with proper turn on procedure is detailed below:



## 5.2. Turning OFF the GE863

Turning off of the device can be done in two ways:

- via AT command (see GE863 Software User Guide, AT#SHDN)
- by tying low pin ON#

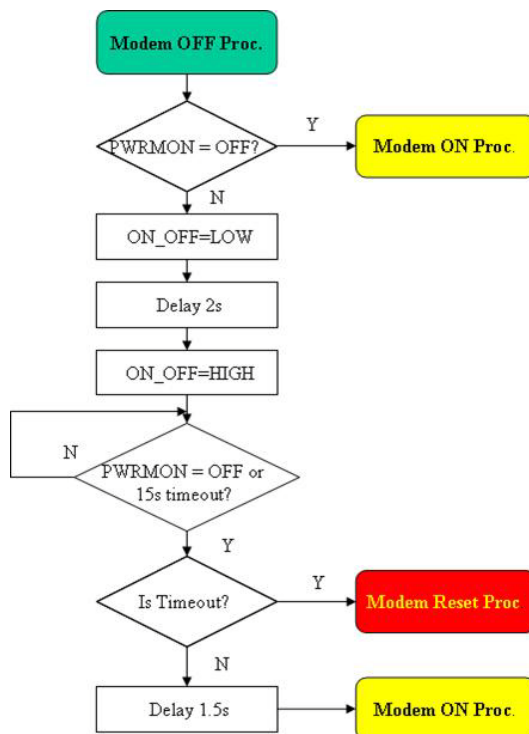
Either ways, the device issues a detach request to network informing that the device will not be reachable any more.

To turn OFF the GE863 the pad ON# must be tied low for at least 2 seconds and then released.

The same circuitry and timing for the power on must be used.

The device shuts down after the release of the ON# pad.

The following flow chart shows the proper turnoff procedure:





**TIP:**

To check if the device has been powered off, the hardware line PWRMON must be monitored. The device is powered off when PWRMON goes low.

### 5.3. Resetting the GE863



**NOTE:**

The concept of resetting the module differs from versions of the GE863. On GE863-QUAD/PY/SIM modules, operating on the RESET# pin as described next will actually reboot the module, giving place to what we'll call an Hardware Unconditional Restart(par 5.3.2), while on GE863-GPS it will shut the module down generating an Hardware Unconditional Shutdown (par 5.3.1).

#### 5.3.1. Hardware Unconditional Shutdown (for GE863-GPS only)



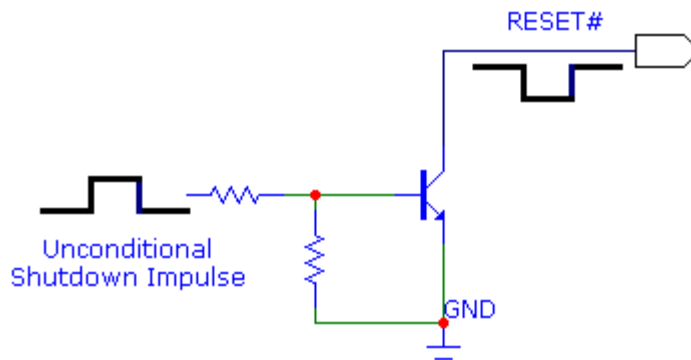
**WARNING:**

The hardware unconditional shutdown must not be used during normal operation of the device since it does not detach the device from the network. It shall be kept as an emergency exit procedure to be done in the rare case that the device gets stacked waiting for some network or SIM responses.

To unconditionally shut down the GE863-GPS, the pad RESET# must be tied low for at least 200 milliseconds and then released.

The maximum current that can be drained from the RESET# pad is 0,15 mA.

A simple circuit to do it is:





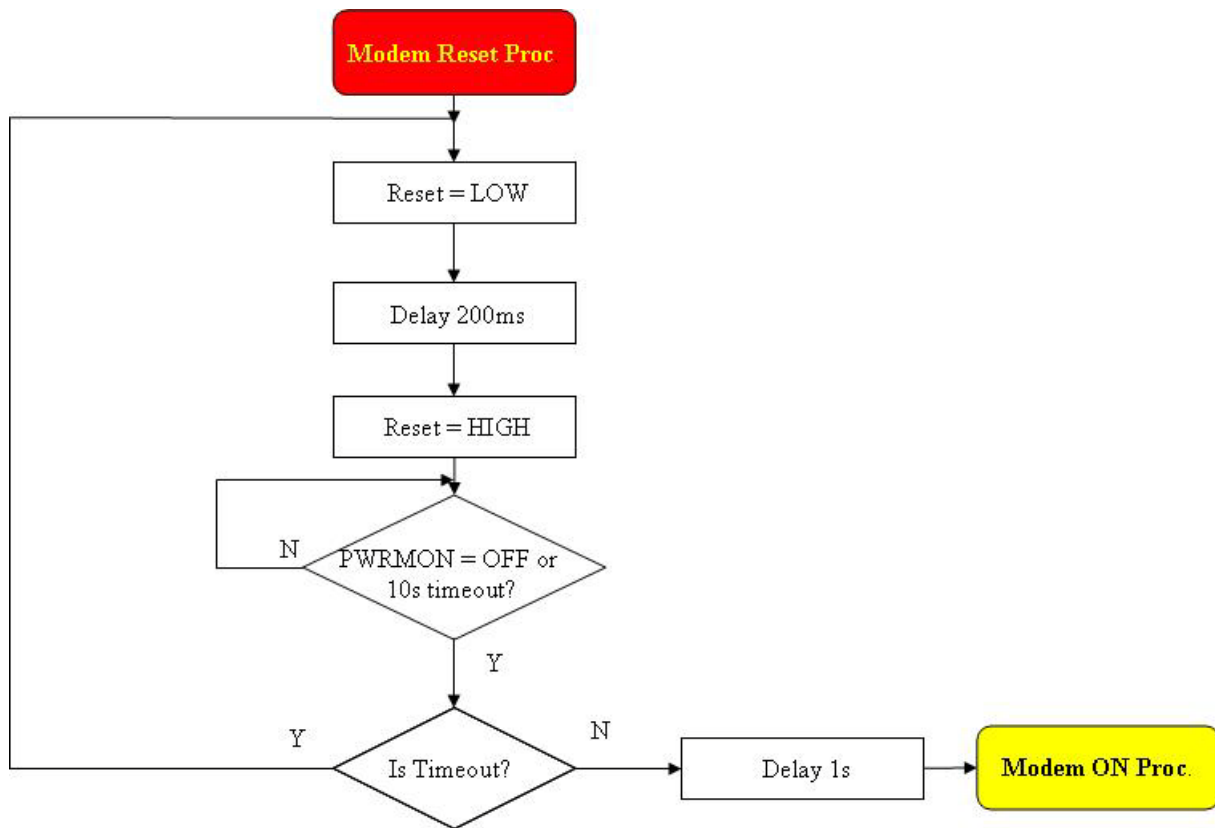
**NOTE:**

Do not use any pull up resistor on the RESET\* line nor any totem pole digital output. Using pull up resistor may cause latch up problems on the GE863-GPS power regulator and improper functioning of the module. The RESET\* line must be connected in open collector configuration only.

**TIP:**

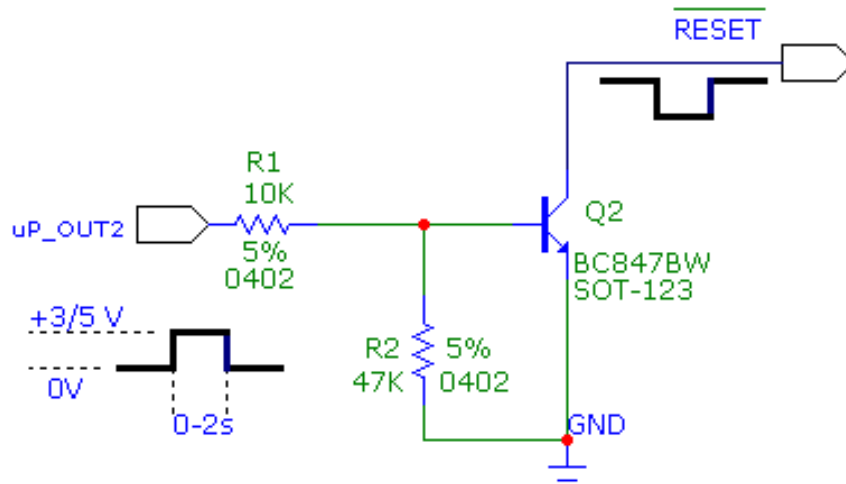
The unconditional hardware shutdown must be always implemented on the boards and the software must use it as an emergency exit procedure.

A flow chart for this is detailed below:



For example:

Let us assume you need to drive the RESET# pad with a totem pole output of a +3/5 V microcontroller (uP\_OUT2):



### 5.3.2. Hardware Unconditional restart (GE863-QUAD/PY/SIM only)



**WARNING:**

The hardware unconditional Restart must not be used during normal operation of the device since it does not detach the device from the network. It shall be kept as an emergency exit procedure to be done in the rare case that the device gets stacked waiting for some network or SIM responses.

To unconditionally reboot the GE863-QUAD/PY/SIM, the pad RESET# must be tied low for at least 200 milliseconds and then released.

The maximum current that can be drained from the RESET# pad is 0,15 mA.



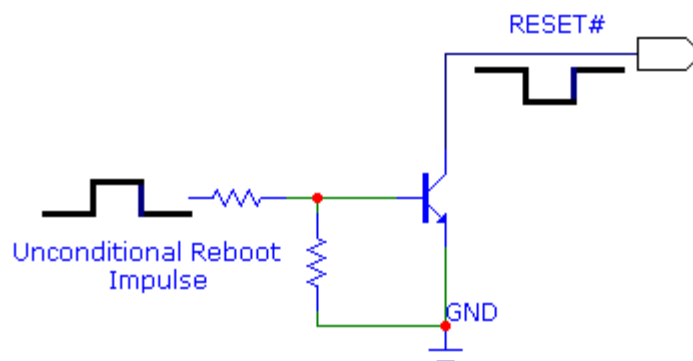
**NOTE:**

Do not use any pull up resistor on the RESET\* line nor any totem pole digital output. Using pull up resistor may bring to latch up problems on the GE863-QUAD/PY/SIM power regulator and improper functioning of the module. The line RESET\* must be connected only in open collector configuration.

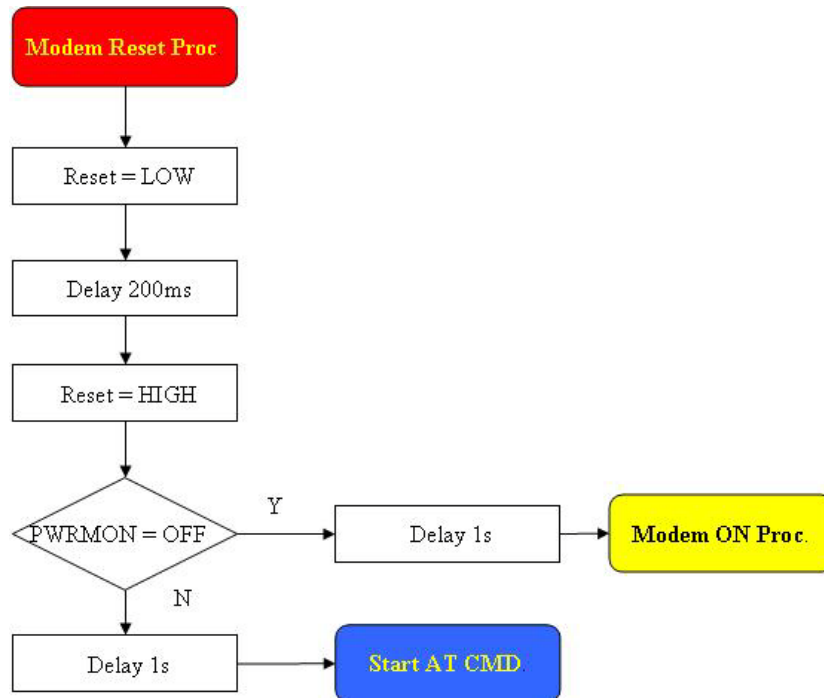
**TIP:**

The unconditional hardware restart must always be implemented on the boards and the software must use it as an emergency exit procedure.

A simple circuit to do it is:

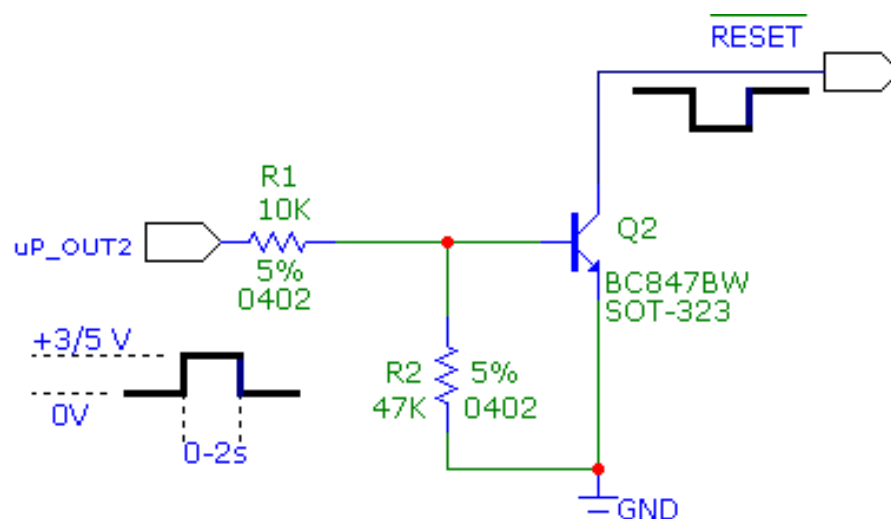


In the following flow chart is detailed the proper restart procedure:



For example:

Let us assume you need to drive the RESET# pad with a totem pole output of a +3/5 V microcontroller (uP\_OUT2):



## 6. Power Supply

The power supply circuitry and board layout are a very important part in the full product design and they strongly reflect on the product overall performances, hence read carefully the requirements and the guidelines that will follow for a proper design.

### 6.1. Power Supply Requirements

POWER SUPPLY (SW release 7.02.xx4 or older)	
Nominal Supply Voltage	3.8 V
Normal Operating Voltage Range	3.4 V ÷ 4.20 V

POWER SUPPLY (SW release 7.03.x00 or newer)	
Nominal Supply Voltage	3.8 V
Normal Operating Voltage Range	3.4 V ÷ 4.20 V
Extended Operating Voltage Range	3.22 V ÷ 4.50 V



**NOTE:**

The Operating Voltage Range MUST never be exceeded; care must be taken in order to fulfil min/max voltage requirement.



**NOTE:**

Overshoot voltage (regarding MAX Extended Operating Voltage) and drop in voltage (regarding MIN Extended Operating Voltage) MUST never be exceeded;

The “Extended Operating Voltage Range” can be used only with completely assumption and application of the HW User guide suggestions.



The following table is describing the power consumptions of the module:

GE863-QUAD/PY		
Mode	Average (mA)	Mode description
<b>SWITCHED OFF</b>		Module supplied but Switched Off
Switched Off	<26 uA	
<b>IDLE mode</b>		
AT+CFUN=1	19.0	Normal mode: full functionality of the module
AT+CFUN=4	18.2	Disabled TX and RX; module is not registered on the network
AT+CFUN=0 or =5	6.6	Paging Multiframe 2
	4.5	Paging Multiframe 4
	3.3	Paging Multiframe 6
	3.2	Paging Multiframe 8
	2.5	Paging Multiframe 9
<b>CSD TX and RX mode</b>		
GSM900 CSD PL5	237.3	GSM VOICE CALL
DCS1800 CSD PL0	223.8	
<b>GPRS (class 10) 1TX</b>		
GSM900 PL5	264,0	GPRS Sending data mode
DCS1800 PL0	176,0	
<b>GPRS (class 10) 2TX</b>		
GSM900 PL5	473,8	GPRS Sending data mode
DCS1800 PL0	307,8	



The following table is describing the power consumptions of the module in case of the GE863-GPS:

GE863-GPS		
Mode	Average (mA)	Mode description
<b>SWITCHED OFF</b>		Module supplied but Switched Off
Switched Off	<30 uA	
<b>IDLE mode (GPSP=0)</b>		
AT+CFUN=1	19.0	Normal mode: full functionality of the module
AT+CFUN=4	18.2	Disabled TX and RX; module is not registered on the network
AT+CFUN=0 or =5	6.6	Paging Multiframe 2
	4.5	Paging Multiframe 4
	3.3	Paging Multiframe 6
	3.2	Paging Multiframe 8
	3.3	Paging Multiframe 9
<b>IDLE mode (GPSP=1)</b>		
AT+CFUN=1	79.4	Normal mode: full functionality of the module
AT+CFUN=4	79.0	Disabled TX and RX; module is not registered on the network
AT+CFUN=0 or =5	70.3	Paging Multiframe 2
	68.6	Paging Multiframe 4
	67.8	Paging Multiframe 6
	63.4	Paging Multiframe 8
	63.0	Paging Multiframe 9
<b>IDLE mode (GPSPS=2,1800)</b>		
AT+CFUN=0 or =5	11.5	Paging Multiframe 2
	10.0	Paging Multiframe 9
<b>CSD TX and RX mode</b>		
GSM900 CSD PL5	325.0	GSM VOICE CALL + GPS receiver active
DCS1800 CSD PL0	302.2	
<b>GPRS (class 10) 1TX</b>		
GSM900 PL5	264,0	GPRS Sending data mode
DCS1800 PL0	176,0	
<b>GPRS (class 10) 2TX</b>		
GSM900 PL5	473,8	GPRS Sending data mode
DCS1800 PL0	307,8	

RF transmission in GSM systems is not continuous, being packed into bursts at a base frequency of about 216 Hz. The relative current peaks can be as high as about 2A. The power supply has to be designed in order to withstand these current peaks without big voltage drops; this means that both the electrical design and the board layout must be designed for this current flow.





**TIP:**

The power supply electrical design must forecast a peak current output of at least 2A.

If the layout of the PCB is not properly designed, then a strong noise floor is generated on the ground and the supply; this reflects on all the audio paths producing an audible and annoying noise at 216 Hz; if the voltage drops, the overwhelming peak current absorption might cause the device to even shutdown, as a consequence of the supply voltage drop.

## 6.2. Embodied Battery Charger

The battery charger is suited for 3.7V Li-Ion rechargeable battery (suggested capacity 500-1000mAH). The Charger needs only a CURRENT LIMITED power source input and charges the battery directly through VBATT connector pins.

Battery charger input pin	CHARGE
Battery pins	VBATT, GND
Battery charger input voltage min	5.0 V
Battery charger input voltage typ	5.5 V
Battery charger input voltage max	7.0 V
Battery charger input current max	400mA
Battery type	Li-Ion rechargeable



**NOTE:**

If embodied battery charger is used, then a LOW ESR capacitor of at least 100µF must be mounted in parallel to VBATT pin.

**NOTE:**

When power is supplied to the CHARGE pin, a battery must always be connected to the VBATT pin of the GE863.



## 6.3. General Design Rules

The principal guidelines for the Power Supply Design embrace three different design steps:

- the electrical design
- the thermal design
- the PCB layout

### 6.3.1. Electrical Design Guidelines

The electrical design of the power supply depends strongly on the power sources where this power is drained. We distinguish them into three categories:

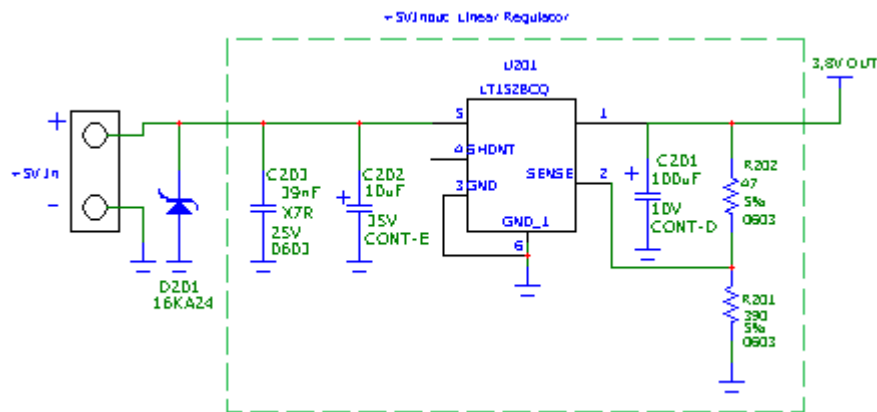
- +5V input (typically PC internal regulator output)
- +12V input (typically automotive)
- battery

#### 6.3.1.1. + 5V Input Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, hence there is not a big difference between the input source and the desired output, and a linear regulator can be used. A switching power supply is not suited because of the low drop out requirements.
- Using a linear regulator, a proper heat sink must be provided in order to dissipate the power generated.
- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks close to the GE863. a 100 $\mu$ F tantalum capacitor is usually suited.
- Make sure the low ESR capacitor on the power supply output (usually a tantalum one) is rated at least 10V.
- A protection diode must be inserted close to the power input, in order to save the GE863 from power polarity inversion.

An example of linear regulator with 5V input is:



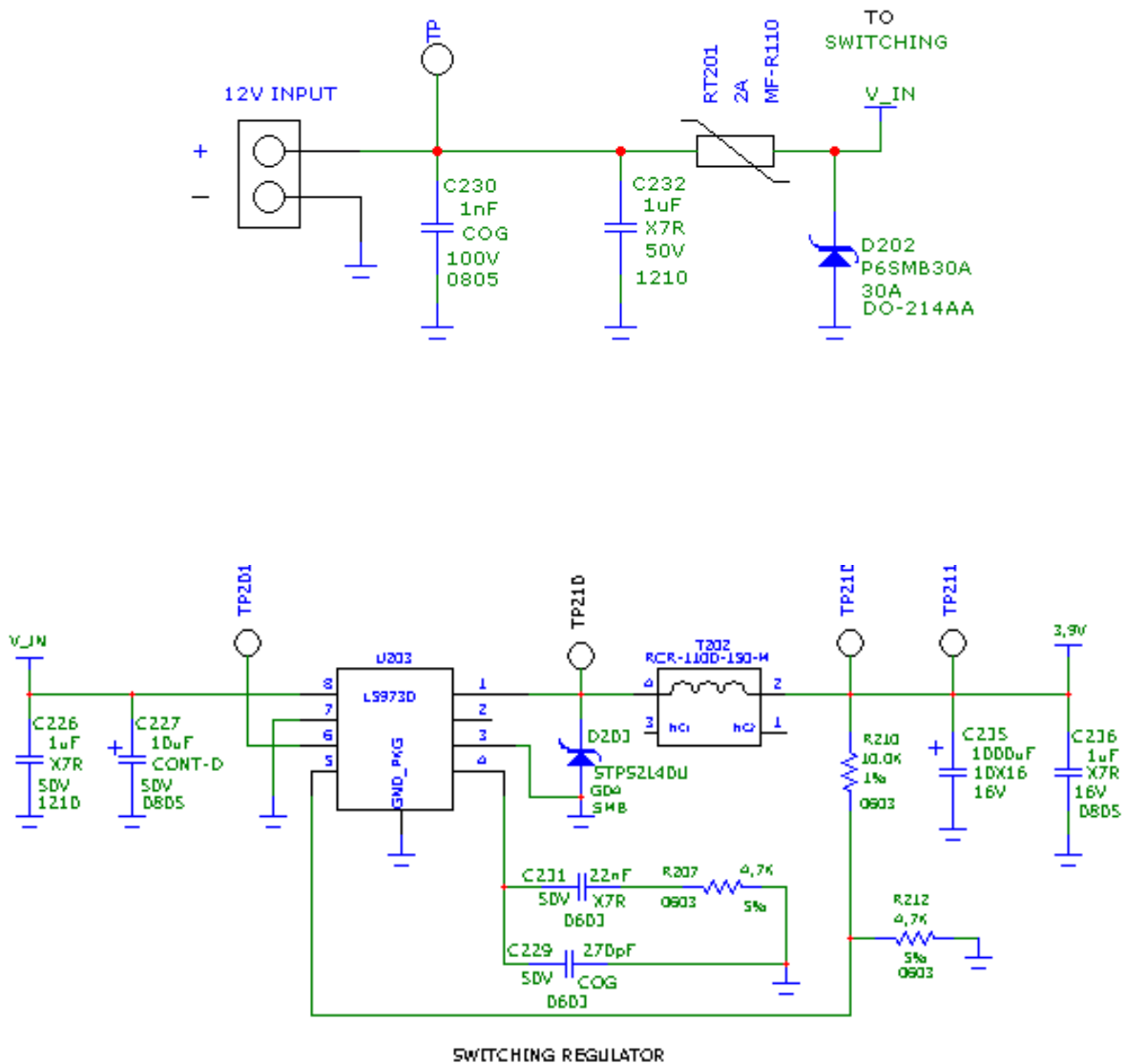


### 6.3.1.2. + 12V Input Source Power Supply Design Guidelines

- The desired output for the power supply is 3.8V, due to the big difference between the input source and the desired output; a linear regulator is not suited and must not be used. A switching power supply is preferable because of better efficiency especially with the 2A peak current load represented by the GE863.
- When using a switching regulator, a 500 kHz (or more) switching frequency regulator is preferable because of its smaller inductor size and its faster transient response. This allows the regulator to respond quickly to the current peaks absorption.
- In any case the frequency and Switching design selection is related to the application to be developed, cause the switching frequency could also generate EMC interferences.
- As far as PB batteries (as inside cars), the input voltage can rise up to 15,8V and this must be kept in mind when choosing components: all components in the power supply must withstand this voltage.
- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks, a 100µF tantalum capacitor is usually suited.
- Make sure the low ESR capacitor on the power supply output (usually a tantalum one) is rated at least 10V.
- For Car applications a spike protection diode must be inserted close to the power input, in order to clean the supply from spikes.
- A protection diode must be inserted close to the power input, in order to save the GE863 from power polarity inversion. This can be the same diode as for spike protection.



An example of switching regulator with 12V input is in the below schematic (it is split in 2 parts):



### 6.3.1.3. Battery Source Power Supply Design Guidelines

The desired nominal output for the power supply is 3.8V and the maximum voltage allowed is 4.2V (4.5 V if using SW release 7.03.x00 or newer), hence a single 3.7V Li-Ion cell battery type is suited for supplying the power to the Telit GE863 module.




---

#### WARNING:

Do not use any Ni-Cd, Ni-MH, and Pb battery types directly connected with GE863. Their use can lead to overvoltage on the GE863 and damage it. USE ONLY Li-Ion battery types.

---

The three cells Ni/Cd or Ni/MH 3,6 V Nom. battery types or 4V PB types MUST NOT BE USED DIRECTLY since their maximum voltage can rise over the absolute maximum voltage for the GE863-GPS and damage it.

- A Bypass low ESR capacitor of adequate capacity must be provided in order to cut the current absorption peaks. A 100µF tantalum capacitor is usually suited.
- Make sure the low ESR capacitor (usually a tantalum one) is rated at least 10V.
- A protection diode must be inserted close to the power input, in order to save the GE863 from power polarity inversion. Otherwise the battery connector must be done in a way to avoid polarity inversions when connecting the battery.
- The battery capacity must be at least 500mAh in order to withstand the current peaks of 2A; the suggested capacity is from 500mAh to 1000mAh.



#### 6.3.1.4. Battery Charge Control Circuitry Design Guidelines

The charging process for Li-Ion Batteries can be divided into 4 phases:

- qualification and trickle charging
- fast charge 1 - constant current
- final charge - constant voltage or pulsed charging
- maintenance charge

The qualification process consists of a battery voltage measure, indicating roughly its charge status. If the battery is deeply discharged, meaning its voltage is lower than the trickle charging threshold, then charging must start slowly, possibly with a current limited to the pre-charging process. The current must be kept very low with respect to the fast charge value.

During trickle charging the voltage across the battery terminals rises; when it reaches the fast charge threshold level the charging process goes into a fast charge phase.

During the fast charge phase the process proceeds with a current limited for charging; this current limit depends on the required time for completing the charge and on battery pack capacity. During this phase the voltage across the battery terminals still raises but at a lower rate. Once the battery voltage reaches its maximum voltage the process goes into its third state: Final charging. The voltage measure to change the process status into final charge is very important. It must be ensured that the maximum battery voltage is never exceeded, otherwise the battery may be damaged and even explode.

Moreover, for constant final chargers, the voltage phase (final charge) must not start before the battery voltage has reached its maximum value, otherwise the battery capacity will be slightly reduced.

The final charge can be of two different types: constant voltage or pulsed. GE863 uses constant voltage.

The constant voltage charge proceeds with a fixed voltage regulator (very accurately set to the maximum battery voltage) and the current decreases while the battery is becoming charged. When the charging current falls below a certain fraction of the fast charge current value, then the battery is considered fully charged, the final charge stops and eventually starts the maintenance.

The pulsed charge process has no voltage regulation, instead charge continues with pulses. Usually the pulse charge works in the following manner: the charge is stopped for some time, let us say few hundreds of ms, then the battery voltage will be measured and when it drops below its maximum value a fixed time length charging pulse is issued. As the battery approaches its full charge, the off time becomes longer and the duty-cycle of the pulses decreases. The battery is







For these reasons, the thermal design is rarely a concern and the simple ground plane where the power supply chip is placed can be enough to ensure a good thermal condition and avoid overheating.

Let's consider the heat of the module during the transmission of 1W max during CSD/VOICE calls and 2W max during class10 GPRS upload.

This generated heat will be mostly conducted to the ground plane under the GE863; you must ensure that your application can dissipate it.

### 6.3.3. Power Supply PCB Layout Guidelines

As seen on the electrical design guidelines the power supply must have a low ESR capacitor on the output to cut the current peaks and a protection diode on the input to protect the supply from spikes and polarity inversion. The placement of these components is crucial for the correct working of the circuitry. A misplaced component can be useless or can even decrease power supply performances.

- The Bypass low ESR capacitor must be placed close to the Telit GE863 power input pads or in the case the power supply is a switching. It can be placed close to the inductor to cut the ripple provided by the PCB trace from the capacitor. The GE863 is wide enough to ensure a dropless connection even during 2A current peaks.
- The protection diode must be placed close to the input connector where the power source is drained.
- The PCB traces from the input connector to the power regulator IC must be wide enough to ensure no voltage drops occur when the 2A current peaks are absorbed. Note that this is not made especially in order to save power, but to avoid the voltage drops on the power line at the current peaks frequency of 216 Hz. that the 216 Hz reflects on all the components connected to that supply, introducing the noise floor at the burst base frequency. For this reason, while a voltage drop of 300-400 mV may be acceptable from the power loss point of view, the same voltage drop may not be acceptable from the noise point of view. If your application does not have audio interface but only uses the data feature of the Telit GE863, then this noise is not so disturbing and the power supply layout design can be more forgiving.
- The PCB traces to the GE863 and the Bypass capacitor must be wide enough to ensure no significant voltage drops to occur when the 2A current peaks are absorbed. This is for the same reason as previous point. Try to keep this trace as short as possible.
- The PCB traces connecting the Switching output to the inductor and the switching diode must be kept as short as possible by placing the inductor and the diode very close to the power switching IC (only for switching



power supply). This is done in order to reduce the radiated field (noise) at the switching frequency (100-500 kHz usually).

- The use of a good common ground plane is suggested.
- The placement of the power supply on the board must be done in such a way to guarantee that the high current return paths in the ground plane are not overlapped to any noise sensitive circuitry as the microphone amplifier/buffer or earphone amplifier.
- The power supply input cables must be kept separate from noise sensitive lines such as microphone/earphone cables.

#### **6.3.4. Parameters for ATEX Application**

In order to integrate the Telit's GE863 module into an ATEX application, the appropriate reference standard IEC EN xx and integrations must be followed.

Below are listed parameters and useful information to integrate the module in your application:

- GE863-QUAD & GE 863-PY
  - Total capacity: 78.394  $\mu$ F
  - Total inductance: 10.163  $\mu$ H
- GE863-GPS
  - Total capacity: 83.167  $\mu$ F
  - Total inductance: 10.264  $\mu$ H
- No voltage upper than supply voltage is present in the module.
- No step-up converters are present in the module.
- In abnormal conditions, the maximum RF output power is up 34 dBm max for few seconds.

For this particular application, we recommend the customer to involve TTSC (Telit Technical Support Center) in the design phase of the application.



## 7. Antenna

The antenna connection and board layout design are the most important parts in the full product design and they strongly reflect on the overall product performances. Read carefully and follow the requirements and the guidelines for a proper design.

### 7.1. GSM Antenna Requirements

As suggested on the Product Description the antenna and antenna line on PCB for a Telit GE863 device must fulfill the following requirements:

Antenna Requirements	
Frequency range	Depending by frequency band(s) provided by the network operator, the customer must use the most suitable antenna for that/those band(s)
Bandwidth	70 MHz in GSM850, 80 MHz in GSM900, 170 MHz in DCS & 140 MHz PCS band
Gain	Gain < 3dBi
Impedance	50 $\Omega$
Input power	> 2 W peak power
VSWR absolute max	$\leq$ 10:1
VSWR recommended	$\geq$ 2:1

When using the Telit GE863, since there is no antenna connector on the module, the antenna must be connected to the GE863 through the PCB with the antenna pad.

In the case the antenna is not directly developed on the same PCB or directly connected at the antenna pad of the GE863, a PCB line is needed in order to connect with it or with its connector.

This line of transmission must fulfill the following requirements:

Antenna Line on PCB Requirements	
Impedance	50 $\Omega$
Max Attenuation	0,3 dB
No coupling with other signals allowed	
Cold End (Ground Plane) of antenna must be equipotential to the GE863 ground pins	

Furthermore if the device is developed for the US market and/or Canada market, it must comply to the FCC and/or IC approval requirements:

This device is to be used only for mobile and fixed application. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any



other antenna or transmitter. End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance. OEM integrators must ensure that the end user has no manual instructions to remove or install the GE863 module.

Antennas used for this OEM module must not exceed 3dBi gain for mobile and fixed operating configurations.

## 7.2. GSM Antenna - PCB Line Guidelines

- Ensure that the antenna line impedance is 50  $\Omega$ .
- Keep the antenna line on the PCB as short as possible, since the antenna line loss must be less than 0,3 dB.
- Antenna line must have uniform characteristics, constant cross section, avoid meanders and abrupt curves.
- Keep, if possible, one layer of the PCB used only for the Ground plane;
- Surround (on the sides, over and under) the antenna line on PCB with Ground, avoid having other signal tracks facing directly the antenna line track.
- The ground around the antenna line on PCB has to be strictly connected to the Ground Plane by placing vias once per 2mm at least.
- Place EM noisy devices as far as possible from GE863 antenna line.
- Keep the antenna line far away from the GE863 power supply lines.
- If you have EM noisy devices around the PCB hosting the GE863, such as fast switching ICs, take care of the shielding of the antenna line by burying it inside the layers of PCB and surround it with Ground planes, or shield it with a metal frame cover.
- If you do not have EM noisy devices around the PCB of GE863, by using a strip-line on the superficial copper layer for the antenna line, the line attenuation will be lower than a buried one.

## 7.3. GSM Antenna - Installation Guidelines

- Install the antenna in a place covered by the GSM signal.
- The Antenna must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
- Antenna must not be installed inside metal cases.



- Antenna must be installed also according Antenna manufacturer instructions.

## 7.4. GPS Antenna Requirements

The GE863-GPS module is not provided with an internal LNA amplifier. The use of an active antenna is important to achieve a good performance.

The module is provided of an Antenna supply circuit with the following characteristics:

- supply voltage referred to VBATT (Must accept values from 3.4 to 4.2 V DC)
- supply enable controlled internally by the BB
- current measurement circuit (readable also with AT commands)
- voltage measurement circuit (readable also with AT commands)
- HW Protection for antenna short circuit (if consumption exceeds 40mA)

### 7.4.1. Combined GPS Antenna

The use of combined GPS antennas is NOT recommended; this solution could generate an extremely poor GPS reception and also the combination antenna requires additional diplexer and adds a loss in the RF route.

### 7.4.2. Linear and Patch GPS Antenna

Using this type of antenna introduces at least 3 dB of loss if compared to a circularly polarized (CP) antenna. Having a spherical gain response instead of a hemispherical gain response could aggravate the multipath behaviour & create poor position accuracy.

### 7.4.3. LNA and Front End Design Considerations

LNA gain must be between 12 dB and 26 dB (assumes a patch antenna). - This assumes the patch used has >3 dBic of gain.

Linear antenna implementation must consider a minimum of ~14.5 dB of LNA gain.

Excessive LNA gain (>27 dB) can introduce jamming spurs, degrade 3IP, and saturate the receiver.

The supply voltage must accept the range between 3.4 to 4.2 V DC

In highly integrated environments rich with potential interference, SiRF suggests design implementations with PRE filters.

The module's GPS input is already provided of a SAW filter.



As suggested on the Product Description the external active antenna for a Telit GE863-GPS device must fulfill the following requirements:

Antenna Requirements	
Frequency range	1575.42 MHz (GPS L1)
Bandwidth	± 1.023 MHz
Gain	1.5 dBi < Gain < 4.5 dBi
Impedance	50Ω
Amplification	Typical 25dB (max 27dB)
Supply voltage	Must accept from 3 to 5 V DC
Current consumption	Typical 20mA (40 mA max)

When using the Telit GE863-GPS, since there is no antenna connector on the module, the antenna must be connected to the GE863-GPS through the PCB with the antenna pad.

In the case that the antenna is not directly developed on the same PCB, hence directly connected at the antenna pad of the GE863-GPS, then a PCB line is needed in order to connect with it or with its connector.

This line of transmission must fulfill the following requirements:

Antenna Line on PCB Requirements	
Impedance	50Ω
No coupling with other signals allowed	
Cold End (Ground Plane) of antenna must be equipotential to the GE863-GPS ground pins	

Furthermore if the device is developed for the US and/or Canada market, it must comply with the FCC and/or IC approval requirements:

This device is to be used only for mobile and fixed application.

## 7.5. GPS Antenna - PCB Line Guidelines

- Ensure that the antenna line impedance is 50Ω.
- Keep the antenna line on the PCB as short as possible to reduce the loss.
- Antenna line must have uniform characteristics, constant cross section, avoid meanders and abrupt curves.
- Keep one layer of the PCB used only for the Ground plane, if possible.
- Surround (on the sides, over and under) the antenna line on PCB with Ground, avoid having other signal tracks facing directly the antenna line of track.



- The ground around the antenna line on PCB has to be strictly connected to the Ground Plane by placing vias once per 2mm at least.
- Place EM noisy devices as far as possible from GE863-GPS antenna line.
- Keep the antenna line far away from the GE863-GPS power supply lines.
- Keep the antenna line far away from the GE863-GPS GSM RF lines.
- If you have EM noisy devices around the PCB hosting the GE863-GPS, such as fast switching ICs, take care of the shielding of the antenna line by burying it inside the layers of PCB and surround it with Ground planes, or shield it with a metal frame cover.
- If you do not have EM noisy devices around the PCB of GE863-GPS, use a strip-line on the superficial copper layer for the antenna line. The line attenuation will be lower than a buried one.

## 7.6. GPS Antenna - Installation Guidelines

- The GE863-GPS due to its characteristics of sensitivity is capable to perform a Fix inside the buildings. (In any case the sensitivity could be affected by the building characteristics i.e. shielding).
- The Antenna must not be co-located or operating in conjunction with any other antenna or transmitter.
- Antenna must not be installed inside metal cases.
- Antenna must be installed also according Antenna manufacturer instructions.



## 7.7. Logic Level Specifications

Where not specifically stated, all the interface circuits work at 2.8V CMOS logic levels. The following table shows the logic level specifications used in the Telit GE863 interface circuits:

### Absolute Maximum Ratings - Not Functional

Parameter	Min	Max
Input level on any digital pin when on	-0.3V	+3.6V
Input voltage on analog pins when on	-0.3V	+3.0 V

### Operating Range - Interface Levels (2.8V CMOS)

Level	Min	Max
Input high level	2.1V	3.3V
Input low level	0V	0.5V
Output high level	2.2V	3.0V
Output low level	0V	0.35V

For 1,8V signals:

### Operating Range - Interface Levels (1.8V CMOS)

Level	Min	Max
Input high level	1.6V	2.2V
Input low level	0V	0.4V
Output high level	1,65V	2.2V
Output low level	0V	0.35V

### Current Characteristics

Level	Typical
Output Current	1mA
Input Current	1 $\mu$ A



### 7.7.1. Reset Signal

Signal	Function	I/O	BGA Ball
RESET	Phone reset	I	47

RESET is used to reset the GE863 modules. Whenever this signal is pulled low, the GE863 is reset. When the device is reset it stops any operation in progress. After the release of the reset, GE863-GPS is unconditionally shut down (in case of GE863-QUAD/PY/SIM the reset line perform an unconditional restart), without doing any detach operation from the network where it is registered. This behavior is not a proper shut down because GSM devices are requested to issue a detach request on turn off. For this reason the Reset signal must not be used to normally, shutting down the device, but only as an emergency exit in the rare case the device remains stuck waiting for some network response.



**NOTE:**

Do not use this signal to power off the GE863. Use the ON/OFF signal to perform this function or the AT#SHDN command.

The RESET is internally controlled at start-up to achieve always a proper power-on reset sequence. There is no need to control this pin at start-up; it may only be used to reset a device if it is not responding to any command.

#### Reset Signal Operating Levels:

Signal	Min	Max
RESET Input high	2.0V*	2.2V
RESET Input low	0V	0.2V

\* this signal is internally pulled up so the pin can be left floating if not used.

If unused, this signal may be left unconnected. If used, then it must always be connected with an open collector transistor to permit to the internal circuitry the power on reset and under voltage lockout functions.



## 8. Serial Ports

### 8.1. GE863-GPS Serial Ports

The serial port on the Telit GE863-GPS is the core of the interface between the module and OEM hardware. 4 serial ports are available on the module:

- MODEM SERIAL PORT
- MODEM SERIAL PORT 2 (GPS CONTROL PORT)
- GPS SERIAL PORT A (SIRF BINARY)
- GPS SERIAL PORT B (NMEA)

### 8.2. GE863-QUAD/PY/SIM Serial Ports

Several configurations can be designed for the serial port on the OEM hardware, but the most common are:

- RS232 PC com port
- microcontroller UART @ 2.8V - 3V (Universal Asynchronous Receive Transmit)
- microcontroller UART@ 5V or other voltages different from 2.8V



### 8.3. Modem Serial Port

Several configurations can be designed for the serial port on the OEM hardware, but the most common are:

- RS232 PC com port
- microcontroller UART @ 2.8V - 3V (Universal Asynchronous Receive Transmit)
- microcontroller UART@ 5V or other voltages different from 2.8V

Depending from the type of serial port on the OEM hardware a level translator circuit may be needed to make the system work. The only configuration that does not need a level translation is the 2.8V UART.

The serial port on the GE863 is a +2.8V UART with all the 7 RS232 signals. It differs from the PC-RS232 in the signal polarity (RS232 is reversed) and levels. The levels for the GE863 UART are the CMOS levels:

#### Absolute Maximum Ratings -Not Functional

Parameter	Min	Max
Input level on any digital pad when on	-0.3V	+3.6V
Input voltage on analog pads when on	-0.3V	+3.0 V

#### Operating Range - Interface Levels (2.8V CMOS)

Level	Min	Max
Input high level $V_{IH}$	2.1V	3.3V
Input low level $V_{IL}$	0V	0.5V
Output high level $V_{OH}$	2.2V	3.0V
Output low level $V_{OL}$	0V	0.35V



The signals of the GE863 serial port are:

RS232 Pin Number	Signal	GE863 Pad Number	Name	Usage
1	DCD - dcd_uart	42	Data Carrier Detect	Output from the GE863 that indicates the carrier presence
2	RXD - tx_uart	38	Transmit line *see Note	Output transmit line of GE863 UART
3	TXD - rx_uart	37	Receive line *see Note	Input receive of the GE863 UART
4	DTR - dtr_uart	39	Data Terminal Ready	Input to the GE863 that controls the DTE READY condition
5	GND	8-17-28-36-45-48-50-56	Ground	ground
6	DSR - dsr_uart	43	Data Set Ready	Output from the GE863 that indicates the module is ready
7	RTS - rts_uart	40	Request to Send	Input to the GE863 that controls the Hardware flow control
8	CTS - cts_uart	41	Clear to Send	Output from the GE863 that controls the Hardware flow control
9	RI - ri_uart	44	Ring Indicator	Output from the GE863 that indicates the incoming call condition



**NOTE:**

According to V.24, RX/TX signal names are referred to the application side, therefore on the GE863 side these signal are on the opposite direction: TXD on the application side will be connected to the receive line (here named TXD/ rx\_uart ) of the GE863 serial port and vice versa for RX.

**TIP:**

For a minimum implementation, only the TXD and RXD lines can be connected, the other lines can be left open provided a software flow control is implemented.

**TIP:**

In order to avoid noise or interferences on the RXD lines it is suggested to add a pull up resistor (100KΩ to 2.8V)



## 8.4. GE863-GPS Secondary Ports

### 8.4.1. Modem Serial Port 2 (GPS Control)

This port is used to control the GPS part by the GSM part.

It is available on the following pins:

PIN #	NAME	DESCRIPTION	TYPE
25	TX_TRACE	TX Data for GPS control	CMOS 2.8V
26	RX_TRACE	RX Data for GPS control	CMOS 2.8V

The typical integration requires connecting these pins to GPS serial port A:

PIN #	NAME		NAME	PIN#
25	TX_TRACE	↔	RX_GPS_BIN	78
26	RX_TRACE	↔	TX_GPS_BIN	80

### 8.4.2. GPS Serial Port A (SIRF Binary)

This port is carrying out the GPS navigation data in SIRF BINARY format. The default configuration is 57600 bps, 8, n, 1

It is available on the following pins:

PIN #	NAME	DESCRIPTION	TYPE
78	RX_GPS_BIN	GPS RX Data (Sarf Binary)	CMOS 2.8V
80	TX_GPS_BIN	GPS TX Data (Sarf Binary)	CMOS 2.8V

The typical integration requires connecting these pins to MODEM serial port 2.

### 8.4.3. GPS Serial Port B (NMEA)

This port is carrying out the GPS navigation data in NMEA 0183 format. The default configuration is 4800 bps, 8, n, 1

It is available on the following pins:

PIN #	NAME	DESCRIPTION	TYPE
68	TX_GPS	GPS TX Data (NMEA)	CMOS 2.8V
73	RX_GPS	GPS RX Data (NMEA)	CMOS 2.8V

GPS RX Lines and TX lines may need a dual supply isolation buffer like an FXLP34 to avoid CMOS high states while in POWER SAVING.



## 8.5. GE863-QUAD/PY/SIM Secondary Port

### 8.5.1. Modem Serial Port 2 (Python Debug)

It is available on the following pins:

PIN #	NAME	DESCRIPTION	TYPE
25	TX_TRACE	TX Data	CMOS 2.8V
26	RX_TRACE	RX Data	CMOS 2.8V

## 8.6. RS232 Level Translation

In order to interface the Telit GE863 with a PC COM port or a RS232 (EIA/TIA-232) application a level translator is required. This level translator must

- invert the electrical signal in both directions
- change the level from 0/3V to +15/-15V

Actually, the RS232 UART 16450, 16550, 16650 & 16750 chipsets accept signals with lower levels on the RS232 side (EIA/TIA-562), allowing for a lower voltage-multiplying ratio on the level translator. Note that the negative signal voltage must be less than 0V and hence some sort of level translation is always required.

The simplest way to translate the levels and invert the signal is by using a single chip level translator. There are a multitude of them, differing in the number of drivers and receivers and the levels (be sure to get a true RS232 level translator not a RS485 or other standards).

By convention the driver is the level translator from the 0-3V UART level to the RS232 level, while the receiver is the translator from RS232 level to 0-3V UART.

In order to translate the whole set of control lines of the UART you will need:

- 5 driver
- 3 receiver



#### NOTE:

The digital input lines working at 2.8VCMOS have an absolute maximum input voltage of 3,75V; therefore the level translator IC must not be powered by the +3.8V supply of the module. Instead it must be powered from a +2.8V / +3.0V (dedicated) power supply.

This is because this way the level translator IC outputs on the module side (i.e. GE863 inputs) will work at +3.8V interface levels, stressing the module inputs at its maximum input voltage.

This can be acceptable for evaluation purposes, but not on production devices.





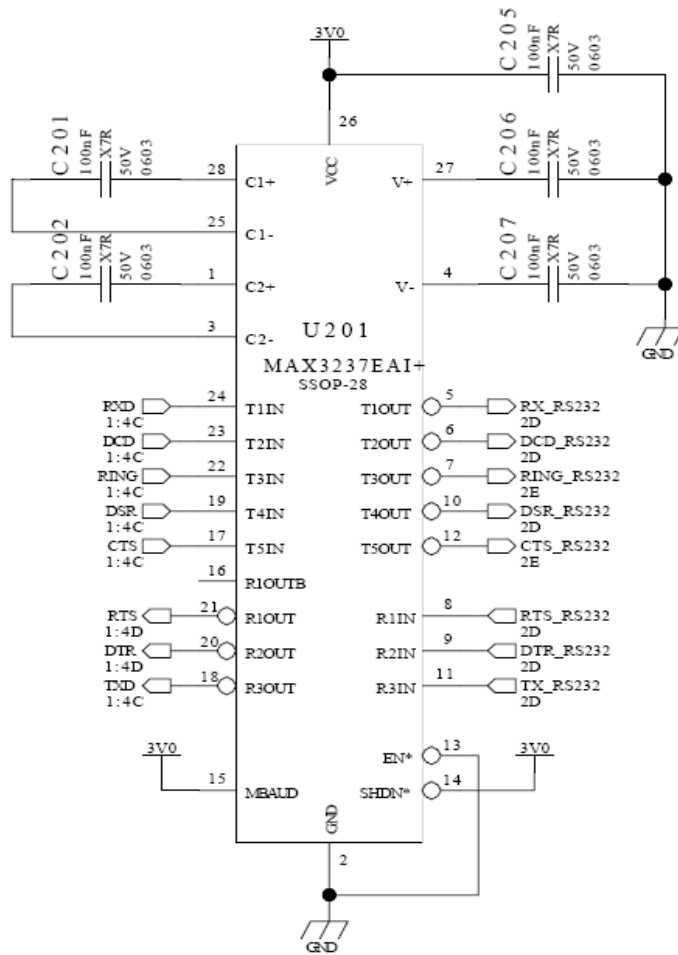
**NOTE:**

In order to be able to do in circuit reprogramming of the GE863 firmware, the serial port on the Telit GE863 must be available for translation into RS232 and either it is controlling device must be placed into tristate, disconnected or as a gateway for the serial data when module reprogramming occurs.

Only RXD, TXD, GND and the on/off module turn on pad are required to the reprogramming of the module, the other lines are unused.

All applicators must include in their design a way reprogramming the GE863.

An example of level translation circuitry of this kind is:



**RS232 LEVEL TRSANSLATOR**



The RS232 serial port lines are usually connected to a DB9 connector with the following layout:



## 8.7. 5V UART Level Translation

If the OEM application uses a microcontroller with a serial port (UART) that works at a voltage different from 2.8 - 3V, then a circuitry has to be provided to adapt the different levels of the two set of signals. As for the RS232 translation, there are a multitude of single chip translators. For example a possible translator circuit for a 5V TRANSMITTER/RECEIVER can be:

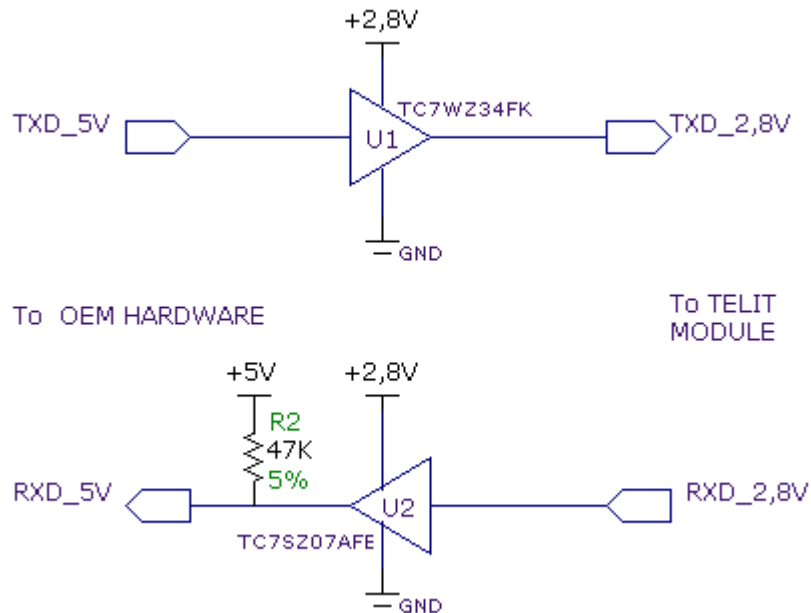


### TIP:

This logic IC for the level translator and 2.8V pull-ups (not the 5V one) can be powered directly from VAUX line of the GE863. Note that the TC7SZ07AE has open drain output, therefore the resistor R2 is mandatory.

### NOTE:

The UART input line TXD (rx\_uart) of the GE863 is NOT internally pulled up with a resistor, so there may be the need to place an external 47KΩ pull-up resistor. Either the DTR (dtr\_uart) or RTS (rts\_uart) input lines are not pulled up internally, so an external pull-up resistor of 47KΩ may be required.





## 9. Audio Section Overview

The Baseband chip was developed for the cellular phones, which needed two separated amplifiers both in RX and in TX section.

A couple of amplifiers had to be used with internal audio transducers while the other couple of amplifiers had to be used with external audio transducers.

To distinguish the schematic signals and the Software identifiers, two different definitions were introduced, with the following meaning:

- internal audio transducers → *HS/MT* (from HandSet or MicroTelephone )
- external audio transducers → *HF* (from HandsFree )

Actually the acronyms have not the original importance.

In other words this distinction is not necessary, being the performances between the two blocks like the same.

Only if the customer needs higher output power to the speaker , he has a constraint. Otherwise the choice could be done in order to overcome the PCB design difficulties.

For these reasons we have not changed the HS and HF acronyms, keeping them in the Software and on the schematics.

The Base Band Chip of the GE863 Telit Module maintains the same architecture.

For more information refer to Telit document :

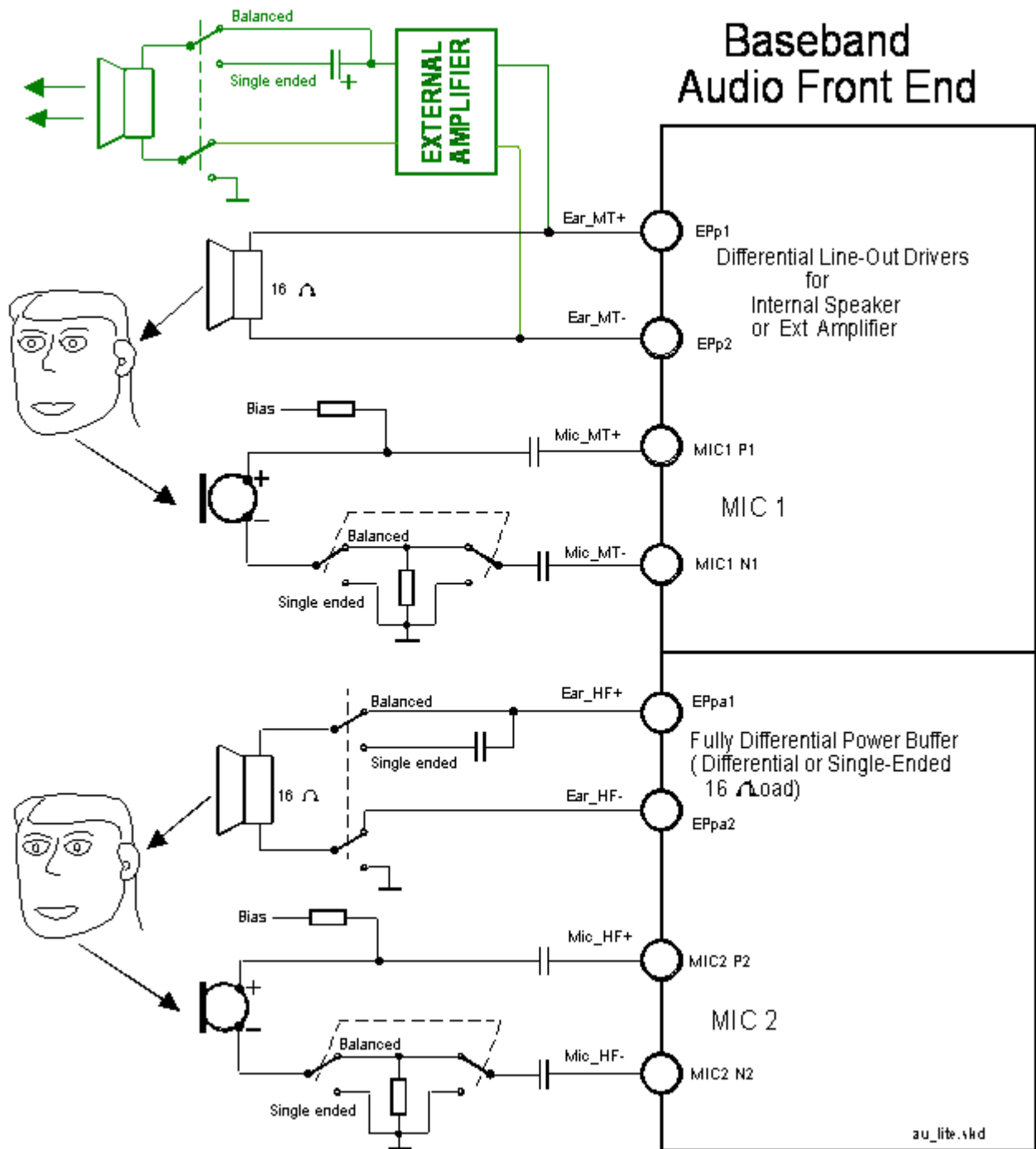
*“80000NT10007a Audio Settings Application Note“.*

### 9.1. Selection mode

Only one block can be active at a time , and the activation of the requested audio path is done via hardware by *AXE* line or via software by *AT#CAP* command .

Moreover the Sidetone functionality could be implemented by the amplifier fitted between the transmit path and the receive path, enabled at request in both modes.





Audio Section Block Diagram



## 9.2. Electrical Characteristics



**TIP:** Being the microphone circuitry the more noise sensitive, its design and layout must be done with particular care. Both microphone paths are balanced and the OEM circuitry must be balanced designed to reduce the common mode noise typically generated on the ground plane. However the customer can use the unbalanced circuitry for particular application.

### 9.2.1. Input Lines Characteristics

"MIC_MT" and "MIC_HF" differential microphone paths	
Line Coupling	AC*
Line Type	Balanced
Coupling capacitor	$\geq 100\text{nF}$
Differential input resistance	$50\text{K}\Omega$
Differential input voltage	$\leq 1,03\text{V}_{\text{pp}}$ @ $\text{MicG}=0\text{dB}$



**(\*) WARNING :** AC means that the signals from the microphone have to be connected to input lines of the module through capacitors which value has to be  $\geq 100\text{nf}$ . not respecting this constraint, the input stages will be damaged.

**WARNING:** when particular OEM application needs a *Single Ended Input* configuration, it is forbidden connecting the unused input directly to Ground, but only through a  $100\text{nF}$  capacitor. Don't forget that in Single Ended configuration the useful input signal will be halved.



## 9.2.2. Output Lines Characteristics



### TIP:

We suggest driving the load differentially from both output drivers, thus the output swing will double and the need for the output coupling capacitor avoided. However if particular OEM application needs also a Single Ended circuitry can be implemented, but the output power will be reduced four times.

The OEM circuitry shall be designed to reduce the common mode noise typically generated on the ground plane and to get the maximum power output from the device (low resistance tracks).



### WARNING:

The loads are directly connected to the amplifier outputs when in *Differential* configuration, through a capacitor when in *Single Ended* configuration. Using Single Ended configuration, the unused output line must be left open. Not respecting this constraint, the output stage will be damaged.



### TIP :

Remember that there are slightly different electrical performances between the two internal audio amplifiers:

- the "*Ear\_MT*" lines can directly drive a **16 Ω load** at -12dBFS (\*\*) in *Differential* configuration
- the "*Ear\_HF*" lines can directly drive a **16Ω load** in *Differential* or *Single Ended* configurations
- There is no difference if the amplifiers drive an external amplifier

(\*\*) *0dBFS* is the normalized overall Analog Gain for each Output channel equal to  $3,7V_{pp}$  differential



"EAR_MT" Output Lines	
line coupling	AC single-ended DC differential
output load resistance	$\geq 14 \Omega$
internal output resistance	$4 \Omega$ ( <i>typical</i> )
signal bandwidth	150 - 4000 Hz @ -3 dB
max. differential output voltage	$1.31 V_{rms}$ ( <i>typical, open circuit</i> )
differential output voltage	$328mV_{rms} / 16 \Omega / @ -12dBFS$
volume increment	2 dB per step
volume steps	10

"EAR_HF" Output Lines	
line coupling:	AC single-ended DC differential
output load resistance :	$\geq 14 \Omega$
internal output resistance:	$4 \Omega (>1,7 \Omega)$
signal bandwidth:	150 - 4000 Hz @ -3 dB
max. differential output voltage	$1.31 V_{rms}$ ( <i>typical, open circuit</i> )
max. S.E. output voltage	$656 mV_{rms}$ ( <i>typical, open circuit</i> )
volume increment	2 dB per step
volume steps	10



## 10. General Purpose I/O

The general purpose I/O pads can be configured to act in three different ways:

- input
- output
- alternate function (internally controlled)

The following GPIO are available on the GE863:

Ball	Signal	I/O	Function	Type	Input / Output Current	Default State	ON_OFF state	State During Reset	Note
34	GPI01	I/O	GPI001 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
33	GPI02	I/O	GPI002 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		Alternate function (JDR)
55	GPI03	I/O	GPI003 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	1	1	47K Pull Up
32	GPI04	I/O	GPI004 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	1	1	4.7K Pull Up Alternate function (RF Transmission Control)
53	GPI05	I/O	GPI005 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		Alternate function (RFTXMON)
54	GPI06	I/O	GPI006 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	fig. 01	HIGH	Alternate function (ALARM)
51	GPI07	I/O	GPI007 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		Alternate function (BUZZER)
6	GPI08	I/O	GPI008 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
5	GPI09	I/O	GPI009 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
4	GPI010	I/O	GPI010 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
3	GPI011	I/O	GPI011 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	1	1	4.7K Pull Up
2	GPI012	I/O	GPI012 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	1	1	47K Pull Up
1	GPI013	I/O	GPI013 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
60	GPI014	I/O	GPI014 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
71	GPI015	I/O	GPI015 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		



Ball	Signal	I/O	Function	Type	Input / Output Current	Default State	ON_OFF state	State During Reset	Note
64	GPIO16	I/O	GPIO16 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
59	GPIO17	I/O	GPIO17 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		
76	GPIO18	I/O	GPIO18 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	INPUT	0		

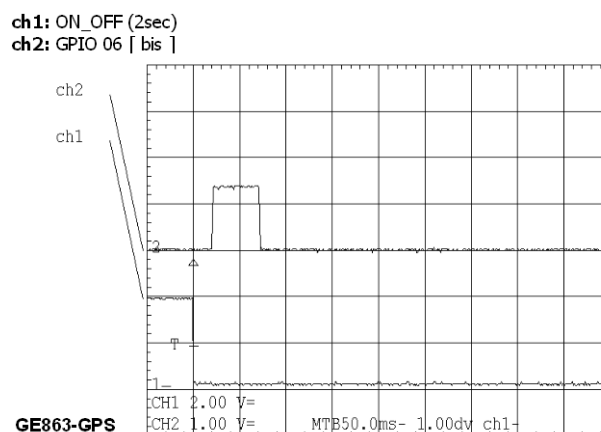
Input pads can only be read and report the digital value (high or low) present on the pad at the read time; output pads can only be written or queried and set the value of the pad output; an alternate function pad is internally controlled by the GE863 firmware and acts depending on the function implemented.

Not all GPIO pads support all these three modes:

- GPIO1, GPIO3, GPIO8 to GPIO18 support both input and output mode but not Alternate function.
- GPIO2 supports all three modes and can be input, output, Jamming Detect Output (Alternate function)
- GPIO4 supports all three modes and can be input, output, RF Transmission Control (Alternate function)
- GPIO5 supports all three modes and can be input, output, RFTX monitor output (Alternate function)
- GPIO6 supports all three modes and can be input, output, alarm output (Alternate function)
- GPIO7 supports all three modes and can be input, output, buzzer output (Alternate function)

All GPIO pads are 2.8V CMOS signals and their interface levels are the same specified in the paragraph 6.

Figure 01



## 10.1. GPIO Logic Levels

Where not specifically stated, all the interface circuits work at 2.8V CMOS logic levels. The following table shows the logic level specifications used in the GE863 interface circuits:

### Absolute Maximum Ratings - Not Functional

Parameter	Min	Max
Input level on any digital pin when on	-0.3V	+3.6V
Input voltage on analog pins when on	-0.3V	+3.0 V

### Operating Range - Interface Levels (2.8V CMOS)

Level	Min	Max
Input high level	2.1V	3.3V
Input low level	0V	0.5V
Output high level	2.2V	3.0V
Output low level	0V	0.35V

For 1.8V signals:

### Operating Range - Interface Levels (1.8V CMOS)

Level	Min	Max
Input high level	1.6V	2.2V
Input low level	0V	0.4V
Output high level	1,65V	2.2V
Output low level	0V	0.35V





The line rises up 300ms before first TX burst and becomes LOW again from 500ms to 1sec after last TX burst.

## 10.6. Using the Alarm Output GPIO6

The GPIO6 pad, when configured as Alarm Output, is controlled by the GE863 module and will rise when the alarm starts and fall after the issue of a dedicated AT command.

This output can be used to power up the GE863 controlling microcontroller or application at the alarm time, giving you the possibility to program a timely system wake-up to achieve some periodic actions and completely turn off either the application, or the GE863 during sleep periods, dramatically reducing the sleep consumption to few  $\mu\text{A}$ .



---

### NOTE:

During RESET the line is set to HIGH logic level.

---

In battery-powered devices this feature will greatly improve the autonomy of the device.



## 10.7. Using the Buzzer Output GPIO7

As Alternate Function, the GPIO7 is controlled by the firmware that depends on the function implemented internally.

This setup always places the GPIO7 pin in OUTPUT direction and the corresponding function must be activated properly by AT#SRP command (refer to AT commands specification).

In this case, the dummy value for the pin state can also be both “0” or “1”.

- send the command **AT#GPIO=7, 1, 2<cr>**:
- wait for response **OK**
- send the command **AT#SRP=3**

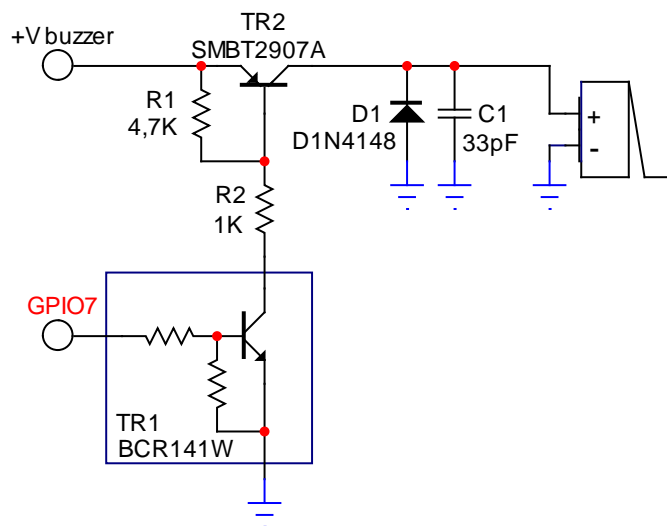
The GPIO7 pin will be set as Alternate Function pin with its dummy logic status set to HIGH value.

The “Alternate function” permits your application to easily implement Buzzer feature with some small hardware extension of your application as shown in the next sample figure.



### NOTE:

To correctly drive a buzzer, a driver must be provided; its characteristics depend on the Buzzer and to get these pieces of info, contact your buzzer vendor.



Example of Buzzer’s driving circuit.



### 10.8.2. Frequency Behavior

The frequency behavior represents the effectiveness of the reproduction of the applied signals. Because performance is related to a square driving waveform (whose amplitude varies from 0V to  $V_{pp}$ ), if you modify the waveform (e.g. from square to sinus) the frequency response will change.

### 10.8.3. Power Supply Influence

Applying a signal whose amplitude is different from that suggested by the manufacturer, the performance change following the rule “*if resonance frequency  $f_0$  increases, amplitude decreases*”.

Because resonance frequency depends on acoustic design, by lowering the amplitude of the driving signal the response bandwidth tends to become narrow, and vice versa.

Summarizing:  $V_{pp} \uparrow \rightarrow f_0 \downarrow$      $V_{pp} \downarrow \rightarrow f_0 \uparrow$




---

#### WARNING:

It is very important to respect the sense of the applied voltage: never apply to the “-” pin a voltage more positive than the “+” pin: if this happens, the diaphragm vibrates in the opposite direction with a high probability to be expelled from its physical position. This damages the device permanently.

---

The risk is that the  $f_0$  could easily fall outside of new bandwidth; consequently the SPL could be much lower than the expected.

### 10.8.4. Working Current Influence

In the component data sheet you will find the value of MAX CURRENT: this represents the maximum average current that can flow at nominal voltage without current limitation. In other words it is not the peak current, which could be twice or three times higher. If driving circuitry does not support these peak values, the SPL will never reach the declared level or the oscillations will stop.



## 10.9. Using the Temperature Monitor Function

### 10.9.1. Short Description

The Temperature Monitor is a function of the module that permits to control its internal temperature and if properly set (see the #TEMPMON command on AT Interface guide) it raises to High Logic level a GPIO when the maximum temperature is reached.

### 10.9.2. Allowed GPIO

The AT#TEMPMON set command could be used with one of the following GPIO:

Ball	Signal	Function	Type	Input / Output Current	Note
34	GPIO 01	GPIO01 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
6	GPIO 08	GPIO08 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
5	GPIO 09	GPIO09 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
4	GPIO 10	GPIO10 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
1	GPIO 13	GPIO13 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
60	GPIO 14	GPIO14 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
71	GPIO 15	GPIO15 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
64	GPIO 16	GPIO16 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
59	GPIO 17	GPIO17 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	
76	GPIO 18	GPIO18 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	



The set command could be used also with one of the following GPIO but in that case the alternate function is not usable:

Ball	Signal	Function	Type	Input / Output Current	Note
33	GPIO 02	GPIO02 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	Alternate function (JDR)
53	GPIO 05	GPIO05 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	Alternate function (RFTXMON)
51	GPIO 07	GPIO07 Configurable GPIO	CMOS 2.8V	1 $\mu$ A / 1mA	Alternate function (BUZZER)

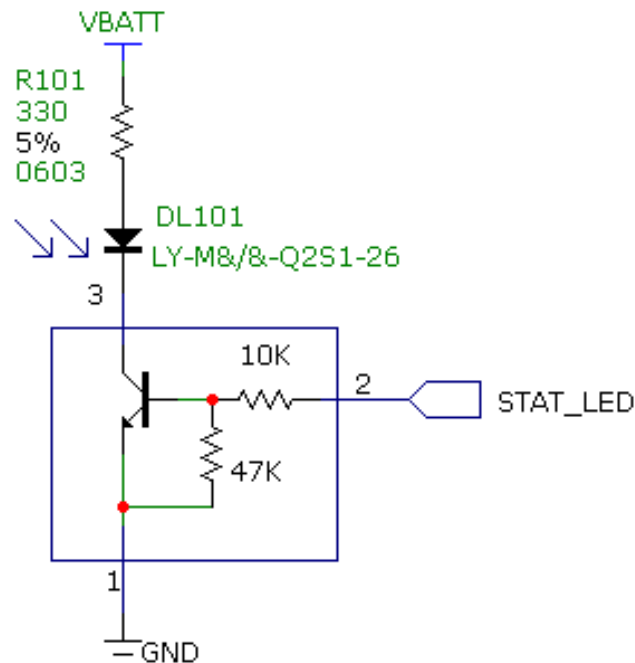


## 10.10. Indication of Network Service Availability

The STAT\_LED pin status shows information on the network service availability and Call status. In the GE863 modules, the STAT\_LED needs an external transistor to drive an external LED. Because of the above, the status indicated in the following table is reversed with respect to the pin status.

LED status	Device Status
Permanently off	Device off
Fast blinking (Period 1s, Ton 0,5s)	Net search / Not registered / turning off
Slow blinking (Period 3s, Ton 0,3s)	Registered full service
Permanently on	a call is active

A schematic example could be:



## 11. RTC and Auxiliary Supply

### 11.1. RTC Bypass Out

The VRTC pin brings out the Real Time Clock supply, which is separate from the rest of the digital part, allowing only RTC going on when all the other parts of the device are off. A backup capacitor can be added to this power output in order to increase the RTC autonomy during power off of the battery. NO Devices must be powered from this pin.

### 11.2. VAUX1 Power Output

A regulated power supply output is provided in order to supply small devices from the module. This output is active when the module is ON and goes OFF when the module is shut down. The operating range characteristics of the supply are:

Operating Range - VAUX1 power supply - GE863-GPS

	Min	Typical	Max
Output voltage	2.75V	2.85V	2.95V
Output current			50mA
Output bypass capacitor (inside the module)			2.2 $\mu$ F

Operating Range - VAUX1 power supply - GE863-QUAD/PY/SIM

	Min	Typical	Max
Output voltage	2.75V	2.85V	2.95V
Output current			100mA
Output bypass capacitor (inside the module)			2.2 $\mu$ F



## 12. PPS GPS Output (GE863-GPS only)

### 12.1. Description

The Time Mark output 1PPS provides a one pulse-per-second signal to the user specific application. The 1PPS pulse is available at any time as soon as a fix is done. This signal is a positive logic, CMOS level output pulse that transitions from logic 'low' condition to logic 'high' at a 1 Hz rate.

### 12.2. Pulse Characteristics

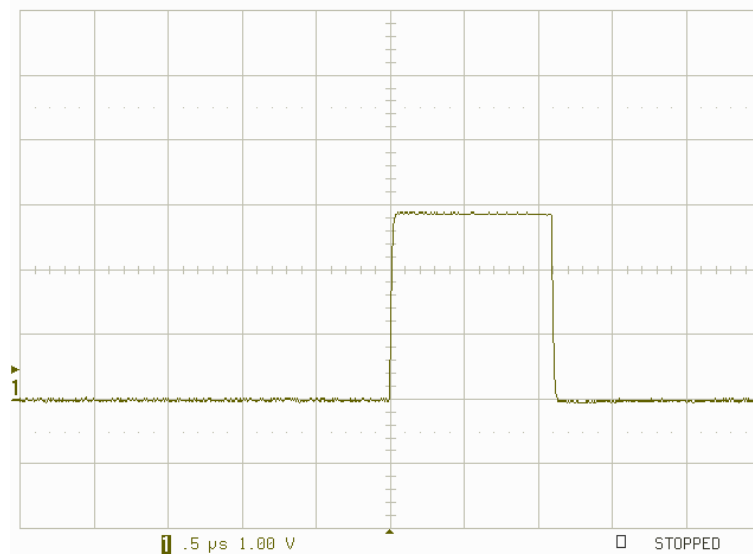
The signal is available on BGA Ball # 75 on GE863-GPS and on pin 26 of PL104 on EVK2 Adapter board (CS1151).

Type:	Output CMOS 2.8V
Duration:	Typically 1us
Pull up/ down:	Internal 100KΩ Pull down



#### NOTE:

The signal is available only when the receiver provides a valid Navigation solution.







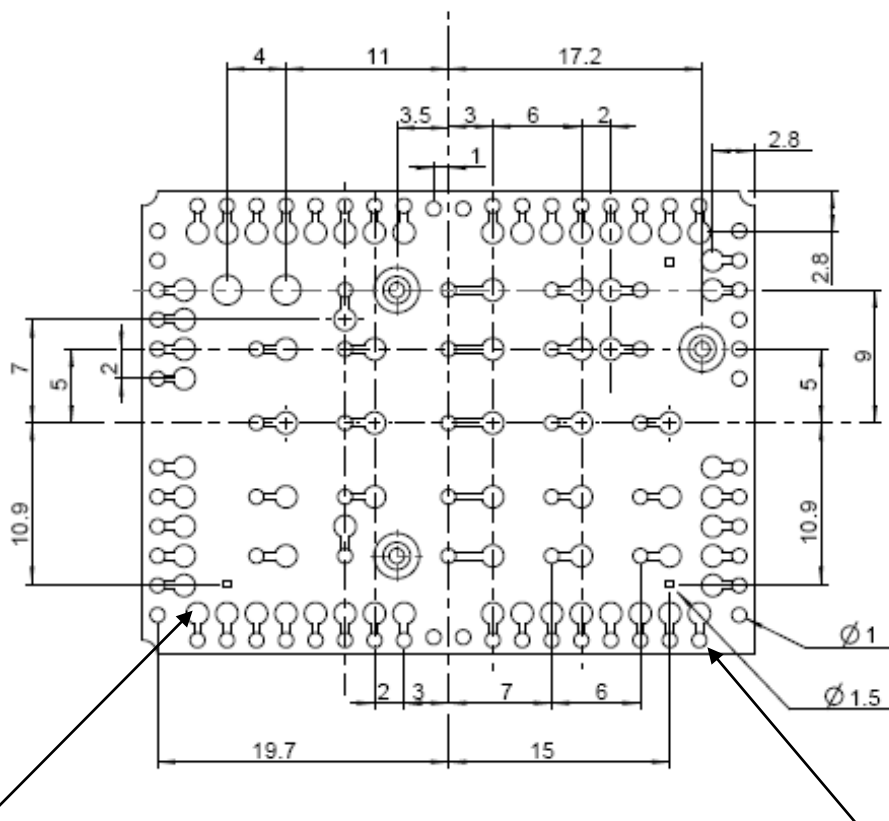


## 14. Mounting the GE863 on the Application Board

### 14.1. General

The Telit GE863 modules have been designed in order to be compliant with a standard lead-free SMT process.

#### 14.1.1. Module Finishing & Dimensions

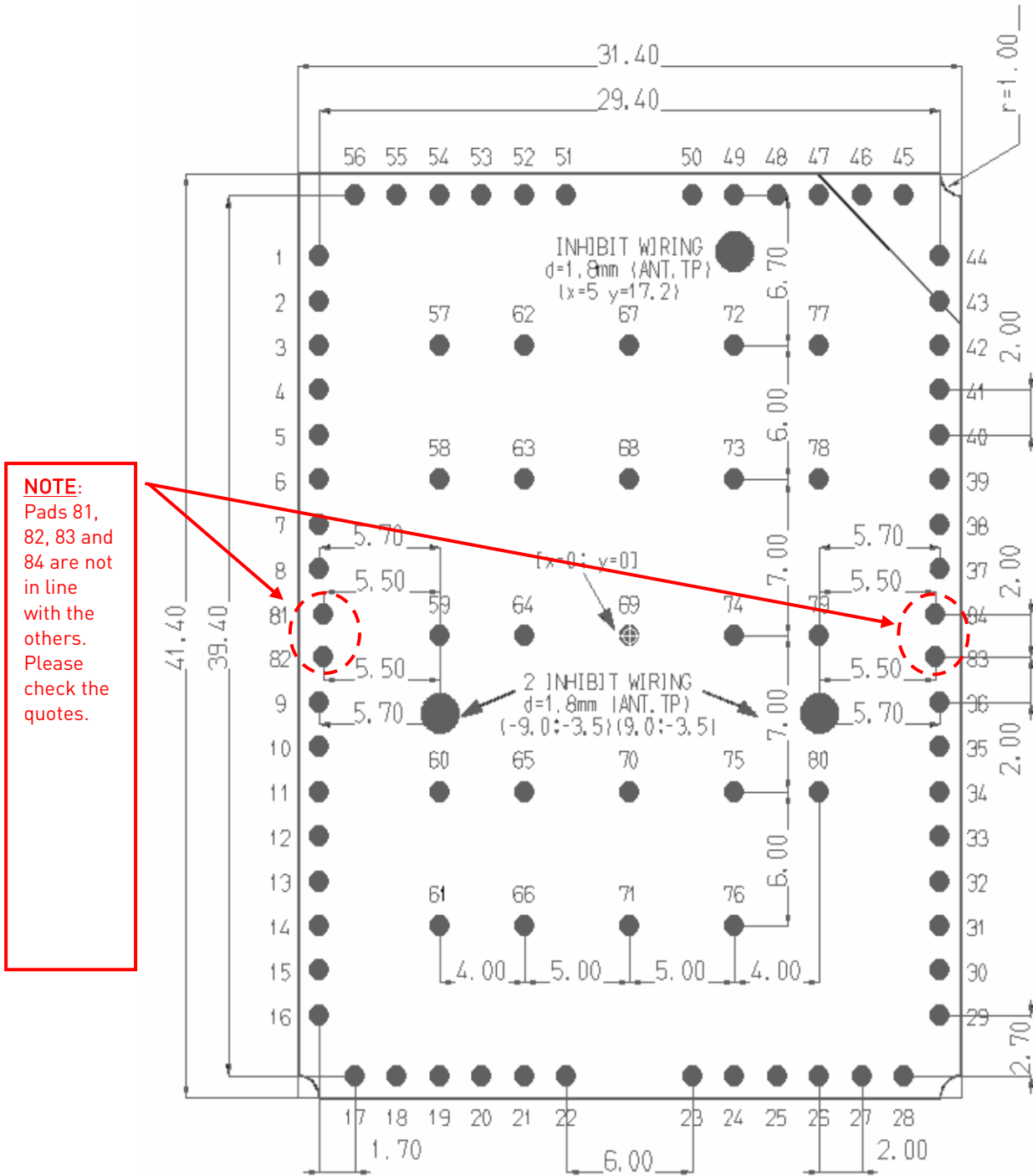


Surface finishing Ni/Au for all test pads

**Lead-free Alloy:**  
Surface finishing Sn/Ag/Cu for all solder pads

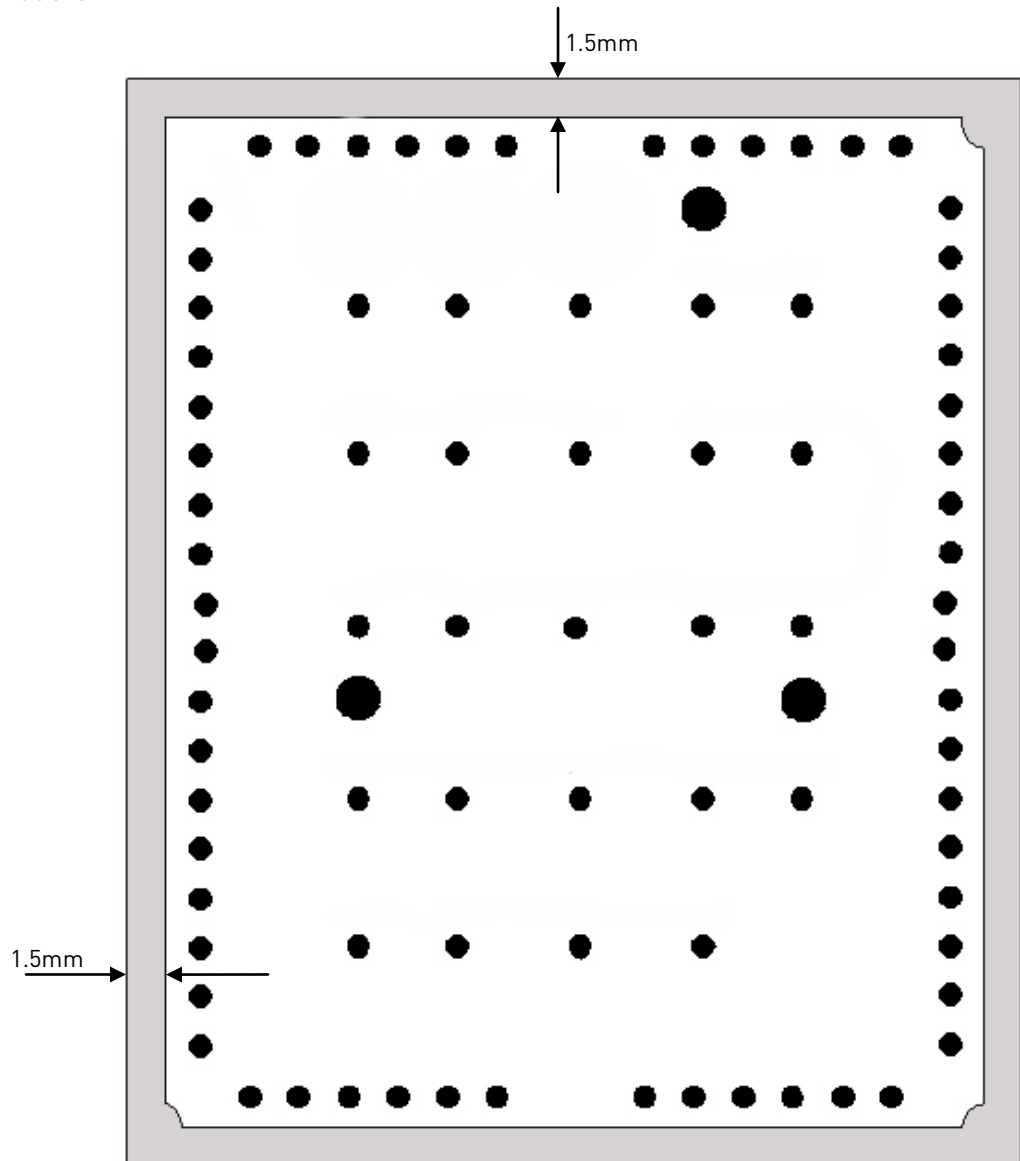


### 14.1.2. Recommended Foot Print for the Application



### 14.1.3. Suggested Inhibit Area

In order to easily rework the GE863 it is suggested to consider on the application of a 1.5mm Inhibit area around the module.



Top View

It is also suggested, as common rule for an SMT component, to avoid having a mechanical part of the application in direct contact with the module.



#### 14.1.4. Debug of the GE863 in Production

To test and debug mounting of the GE863, we strongly recommend to foresee test pads on the host PCB, in order to check the connection between the GE863 itself and the application and to test the performance of the module connecting it with an external computer. Depending by the customer application, these pads include, but are not limited to, the following signals:

- TXD
- RXD
- ON/OFF
- RESET
- GND
- VBATT
- TX\_TRACE
- RX\_TRACE
- PWRMON

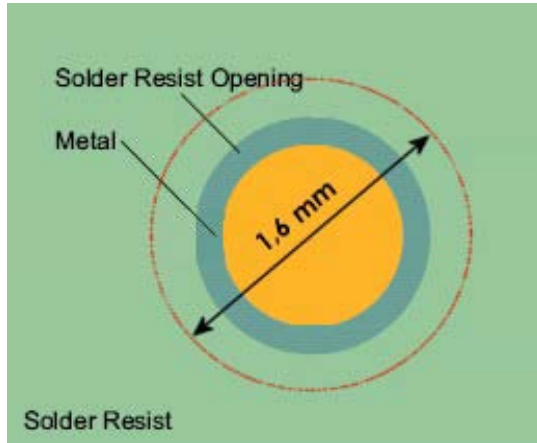
#### 14.1.5. Stencil

Stencil's apertures layout can be the same of the recommended footprint (1:1), we suggest a thickness of stencil foil  $\geq 120\mu\text{m}$ .





Placement of microvias not covered by solder resist is not recommended, unless the microvia carries the same signal of the pad itself.



Holes in pad are allowed only for blind holes and not for through holes.

Recommendations for PCB pad surfaces:

Finish	Layer thickness [μm]	Properties
Electro-less Ni / Immersion Au	3 -7 / 0.05 - 0.15	Good solder ability protection, high shear force values

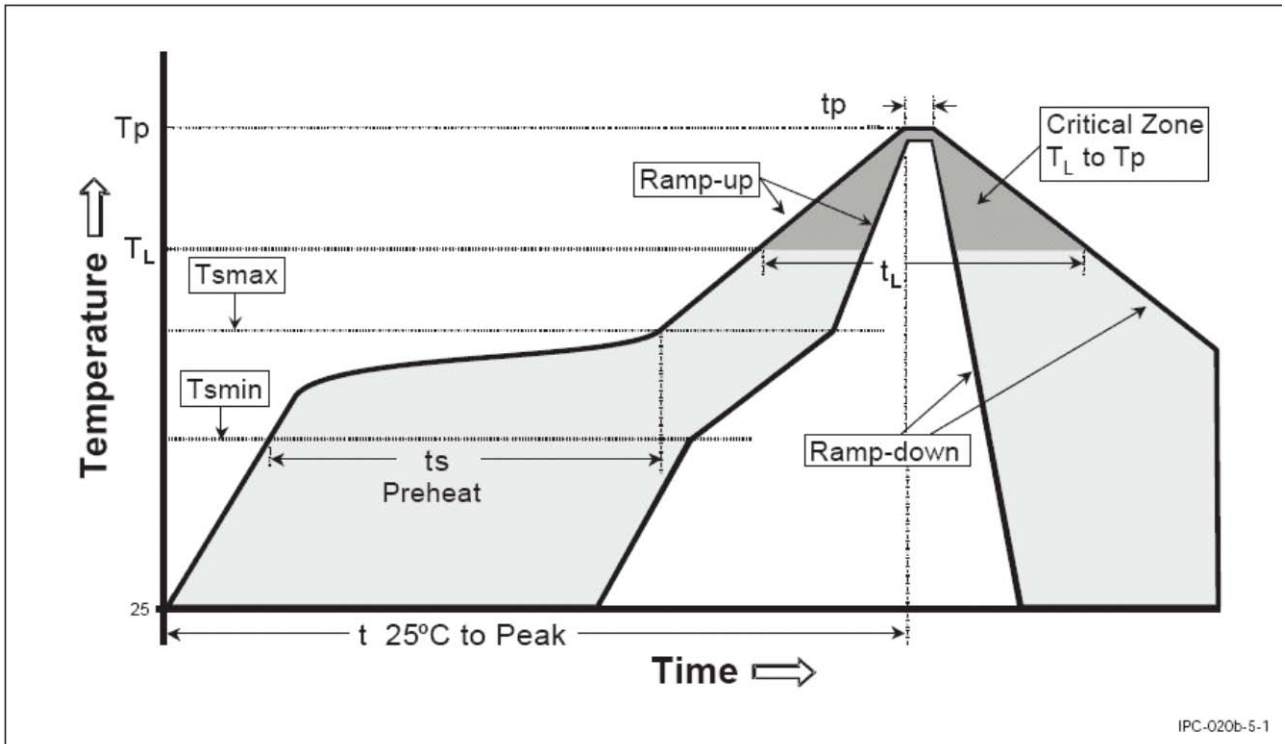
The PCB must be able to resist higher temperatures occurring at the lead-free process. This issue must be discussed with the PCB-supplier. Generally, the wet-ability of tin-lead solder paste on the described surface plating is better, compared to lead-free solder paste.

### 14.1.7. Solder Paste

	Lead free
Solder paste	Sn/Ag/Cu



### 14.1.8. GE863 Solder Reflow



IPC-020b-5-1

Profile Feature	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max
Preheat: - Temperature Min ( $T_{smin}$ ) - Temperature Max ( $T_{smax}$ ) - Time (min to max) ( $t_s$ )	150°C 200°C 60-180 seconds
$T_{smax}$ to $T_L$ : - Ramp-up Rate	3°C/second max
Time maintained above: - Temperature ( $T_L$ ) - Time ( $t_L$ )	217°C 60-150 seconds
Peak Temperature ( $T_P$ ):	245 +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	8 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.



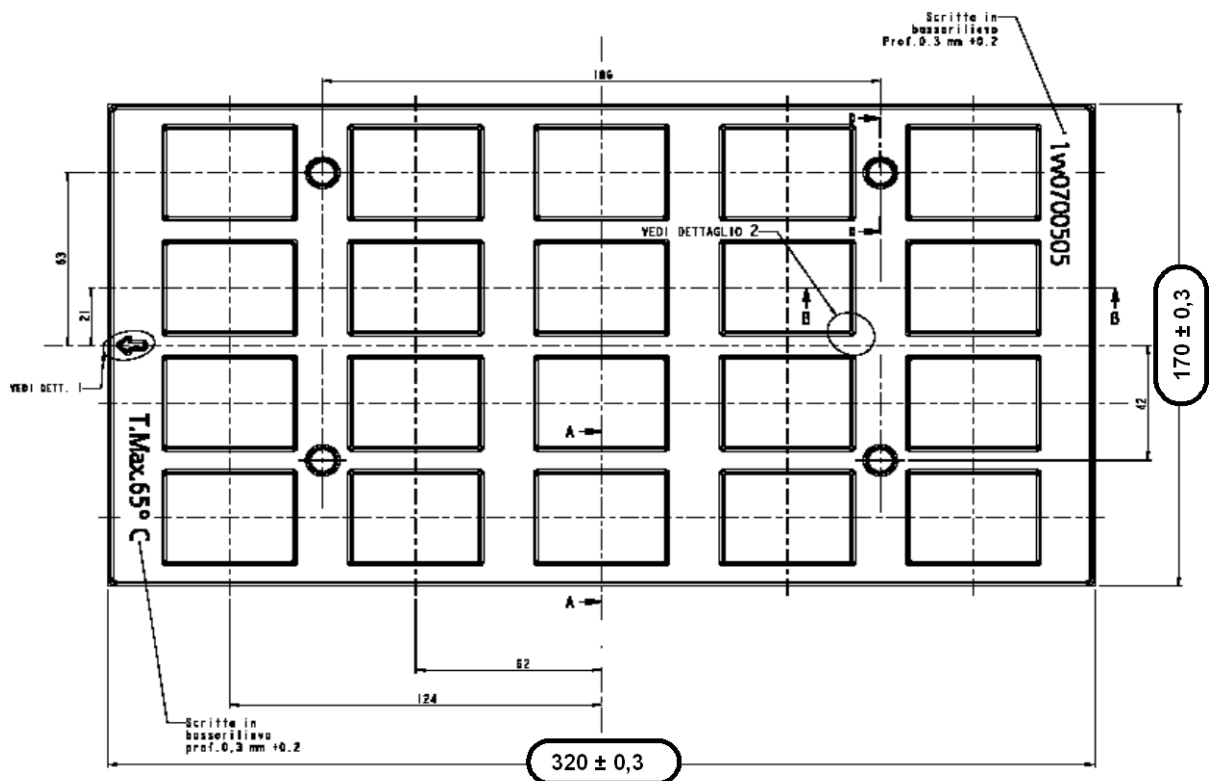
**WARNING:**

The GE863 module can accept only one reflow process.



## 15. Packing System

According to SMT processes, for picking & placing movement requirements, Telit GE863 modules are packaged on trays. Each tray contains 20 pieces with the following dimensions:



All quotes are in mm. general tolerance  $\pm 0.1$

Section A-A

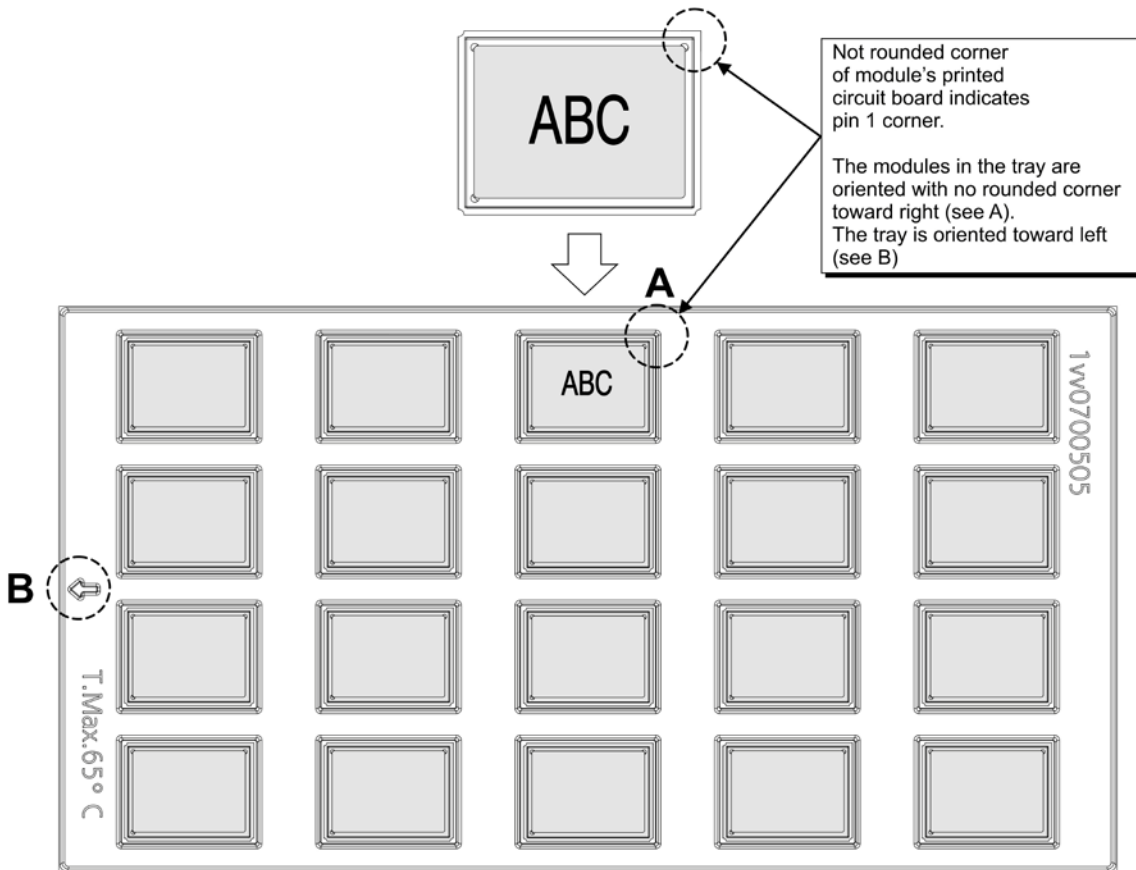


6.1

Note that trays can withstand a maximum temperature of 65° C.



Modules orientation on tray:



### **15.1.1. Moisture Sensibility**

The level of moisture sensibility of Telit GE863 modules is “3”, according with standard IPC/JEDEC J-STD-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 GE863 inside of the dry bag must be 12 months from the bag seal date, when stored in a non-condensing atmospheric environment of <math><40^{\circ}\text{C}</math> / 90% RH
- b) Environmental condition during the production:  $\leq 30^{\circ}\text{C}$  / 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



## 16. Conformity Assessment Issues

The Telit GE863-GPS/PY/QUAD/SIM has been assessed in order to satisfy the essential requirements of the R&TTE Directive 1999/05/EC (Radio Equipment & Telecommunications Terminal Equipments) to demonstrate the conformity against the harmonized standards with the final involvement of a Notified Body.

# CE0168

If the module is installed in conformance to the Telit installation manuals, no further evaluation under **Article 3.2** of the R&TTE Directive and do not require further involvement of a R&TTE Directive Notified Body for the final product.

In all other cases, or if the manufacturer of the final product is in doubt, then the equipment integrating the radio module must be assessed against **Article 3.2** of the R&TTE Directive.

In all cases the assessment of the final product must be made against the Essential requirements of the R&TTE Directive **Articles 3.1(a)** and **(b)**, Safety and EMC respectively, and any relevant Article 3.3 requirements.

This Product Description, the Hardware User Guide and Software User Guide contain all the information you may need for developing a product meeting the R&TTE Directive.

Furthermore the GE863-GPS/PY/QUAD/SIM module is FCC Approved as module to be installed in other devices. This device is to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, a new application and FCC is required.

The GE863-GPS/PY/QUAD/SIM is conforming to the following US Directives:

- Use of RF Spectrum. Standards: FCC 47 Part 24 (GSM 1900)
- EMC (Electromagnetic Compatibility). Standards: FCC47 Part 15







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/>

