xL865 Global Form Factor Application Note

80000NT11207A Rev.1 – 2014-01-08

Making machines talk.

APPLICABILITY TABLE

PRODUCT
GL865-DUAL V3
GL865-QUAD V3
UL865-EUR
UL865-EUD
UL865-NAR
UL865-NAD
CL865-DUAL

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Contents

1. Introduction

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1.1. Scope

The aim of this document is the description of some hardware solutions useful for developing an application compatible with the products: Telit GL865 V3, Telit UL865, Telit CL865, and to highlight the minor differences between the above mentioned products.

1.2. 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
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'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.

1.3. 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.

1.4. Related Documents

The following is a list of applicable documents downloadable from the Download Zone section of Telit's website http://www.telit.com

- UL865 Hardware User Guide 1VV0301050
- GL865-DUAL/QUAD V3 Hardware User Guide 1VV0301018
- CL865-DUAL Hardware User Guide 1VV0301104

2. Overview

In this document all the basic functions of a mobile phone will be taken into account; for each one of them a proper hardware solution will be suggested and eventually the wrong solutions and common errors to be avoided will be evidenced. Obviously this document cannot embrace the whole hardware solutions and products that may be designed. The wrong solutions to be avoided shall be considered as mandatory, while the suggested hardware configurations shall not be considered mandatory, instead the information given shall be used as a guide and a starting point for properly developing your product with the described modules. For further hardware details that may not be explained in this document refer to the Telit Product Description documents where all the hardware information is reported.

NOTICE:
The integration of the GL865 V3/UL865/CL865 cellular module within user application shall be done according to the design rules described in this manual.

The Unified Form Factor (UFF) is a concept of a products family characterized by the same mechanical and electrical form factor with different radio access technology.

This new approach protects customer's investment by giving you the possibility to migrate with the simple plug-and-play switch of your module with other wireless modules in the Unified Form Factor range without changing your application. In this way Telit offers easy access to different cellular technologies, certifications or bandwidth. For example if you develop applications based on today's mobile operator GSM/GPRS cellular technology if required it might be upgraded in the future to higher data speed capability such as UMTS/HSDPA.

The main advantages are summarized below:

- Increase of the efficiency in the use of the investments assigned to the development of the application (NRE), resulting in higher ROI, thus justifying the business choice of the UFF products;
- Products that are designed to bring technology enhancements to the integrators, such as higher data rates and new wireless standards while maintaining backwards compatibility in form factor and logical interfaces;
- Ease of integration;
- Telit as a single supplier of wireless modems;
- The customer can focus on its core business and application, not the management of operations and procurement required for wireless modems;
- One single application for different markets.

Telit, acknowledging the requirements of the developers, has taken great care to minimize any difference in the interface of the products with the Unified Form Factor; nevertheless some minor differences are still present. This is due to the fact that different technologies have different electrical and mechanical characteristics. However, the application can, with some care, easily accommodate multiple wireless modems.
This document has been created to guide you when developing applications based on Unified Form Factor concept by pointing out module differences.

3. Mechanical Dimensions

The Telit GL865 V3/UL865/CL865 overall dimensions are:

	GL865 V3 [mm]	UL865 [mm]	CL865 [mm]
Length	24.4	24.4	24.4
Width	24.4	24.4	24.4
Thickness	2.6	2.6	2.45

In a common design application which is going to use multiple models, we recommend to consider the highest dimensions as reference.

NOTE:
The 3D drawings/models versions are available separately, and they are provided in IGES format. Please contact the Telit Technical Support to get the models.

4. Module connections

4.1. Common PIN-OUT

Pin	Signal	I/O	Function	Internal Pull up (PU) or Pull down (PD)			Type
				GL865 V3	UL865	CL865	
Power Supply							
38	VBATT	-	Main power supply (Baseband)				Power
37	VBATT_PA	-	Main power supply (Radio PA)				Power
23	AGND	-	Ground				Power
32	GND	-	Ground				Power
33	GND	-	Ground				Power
35	GND	-	Ground				Power
36	GND	-	Ground				Power
46	GND	-	Ground				Power
SIM Card Interface							
9	SIMVCC	-	External SIM signal – Power supply for the SIM				1.8 / 3V
10	SIMRST	O	External SIM signal – Reset				1.8 / 3V
11	SIMCLK	O	External SIM signal – Clock				1.8 / 3V
12	SIMIO	I/O	External SIM signal - Data I/O	4.7KΩ PU	4.7KΩ PU	4.7KΩ PU	1.8 / 3V
Trace							
44	RXD_AUX	I	RX Data for debug monitor	12KΩ PU	10KΩ PU	50KΩ PU	CMOS 1.8V
45	TXD_AUX	O	TX Data for debug monitor				CMOS 1.8V
Prog. / Data + Hw Flow Control							
1	C109/DCD	O	Output for Data carrier detect signal (DCD) to DTE				CMOS 1.8V
2	C125/RING	O	Output for Ring indicator signal (RI) to DTE				CMOS 1.8V
3	C107/DSR	O	Output for Data set ready signal (DSR) to DTE				CMOS 1.8V
4	C108/DTR	I	Input for Data terminal ready signal (DTR) from DTE	30KΩ PU	12KΩ PU	50KΩ PU	CMOS 1.8V
5	C105/RTS	I	Input for Request to send signal (RTS) from DTE	30KΩ PU	12KΩ PU	50KΩ PU	CMOS 1.8V
6	C106/CTS	O	Output for Clear to send signal (CTS) to DTE				CMOS 1.8V
7	C103/TXD	I	Serial data input (TXD) from DTE	12KΩ PU	12KΩ PU	50KΩ PU	CMOS 1.8V
8	C104/RXD	O	Serial data output to DTE				CMOS 1.8V
Miscellaneous Functions							
43	VAUX/PWRMON	O	Supply Output for external accessories	See chapter 16			CMOS1.8V
47	RESET*	I	HW unconditional shutdown (Active Low)	2KΩ PU	4.7KΩ PU	57KΩ PU	Open collector
30	VRTC [1)]	AO	VRTC Backup capacitor				Power

Pin	Signal	I/O	Function	Internal Pull up (PU) or Pull down (PD)			Type
				GL865 V3	UL865	CL865	
Telit GPIOs							
42	GPIO_01 / DVI_WA0	I/O	Telit GPIO_01 Configurable GPIO/ Digital Audio Interface (WA0)	80KΩ-110KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
41	GPIO_02 / JDR / DVI_RX	I/O	Telit GPIO_02 Configurable GPIO/ / Jammer Detect Report / Digital Audio Interface (RX)	18KΩ-25KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
40	GPIO_03 / DVI_TX	I/O	Telit GPIO_03 Configurable GPIO/ Digital Audio Interface (TX)	80KΩ-110KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
39	GPIO_04/ TX Disable / DVI_CLK	I/O	Telit GPIO_04 Configurable GPIO/ TX Disable input / Digital Audio Interface (CLK)	18KΩ-25KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
29	GPIO_05 / RFTXMON	I/O	Telit GPIO_05 Configurable GPIO/ Transmitter ON monitor	28KΩ-40KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
28	GPIO_06 / ALARM	I/O	Telit GPIO_06 Configurable GPIO/ ALARM	28KΩ-40KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
27	GPIO_07 / BUZZER	I/O	Telit GPIO_07 Configurable GPIO/ Buzzer	28KΩ-40KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
26	GPIO_08/ STAT_LED	I/O	Telit GPIO_08 Configurable GPIO/ Status Led	28KΩ-40KΩ PD	Hi Z	42KΩ PD	CMOS 1.8V
RF SECTION							
34	ANTENNA	I/O	GSM/EDGE/UMTS Antenna (50 ohm)				RF
RESERVED							
19, 31, 48							

WARNING:
RESERVED pins reported above must not be connected.

Unlike other Telit's products the RTC feature of CL865 cannot be operated with VRTC only and the external RTC backup capacitor will be also useless. VBATT must be connected to support RTC feature for CL865.

NOTE:

The internal GPIO's pull up/pull down could be set to the preferred status for the application using the AT#GPIO command.

Please refer for the AT Commands User Guide for the detailed command Syntax.

4.2. PIN-OUT differences

Pin	Module	Signal	I/O	Function
16	UL865	USB_VBUS	AI	Power sense for the internal USB transceiver.
	GL865	RESERVED	-	-
	CL865	USB_VBUS	AI	Power for the internal USB transceiver.
17	UL865	USB_D-	I/O	USB differential Data (-)
	GL865	RESERVED	-	-
	CL865	USB_D-	I/O	USB differential Data (-)
18	UL865	USB_D+	I/O	USB differential Data (+)
	GL865	RESERVED	-	-
	CL865	USB_D+	I/O	USB differential Data (+)
20	UL865	RESERVED	-	-
	GL865	EAR-	AO	Earphone signal output, phase -
	CL865	EAR-	AO	Earphone signal output, phase -
21	UL865	RESERVED	-	-
	GL865	EAR+	AO	Earphone signal output, phase +
	CL865	EAR+	AO	Earphone signal output, phase +
22	UL865	RESERVED	-	-
	GL865	Mic-	AI	Mic. signal input; phase-
	CL865	Mic-	AI	Mic. signal input; phase-
24	UL865	RESERVED	-	-
	GL865	Mic+	AI	Mic. signal input; phase+
	CL865	Mic+	AI	Mic. signal input; phase+
25	UL865	SPI_CLK	I/O	SPI_CLK
	GL865	RESERVED	-	-
	CL865	RESERVED	-	-

NOTE:

In a common design UL865/GL865 V3/CL865 the RESERVED pins in the table above may be connected.

5. Logic level specifications

The following tables show the logic level specifications for GL865 V3, UL865 and CL865:

Absolute Maximum Ratings -Not Functional

	GL865 V3		UL865		CL865	
Parameter	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Input level on any digital pin (CMOS 1.8) with respect to ground	-0.3V	2.1V	-0.3V	2.3V	-0.3V	2.3V

Operating Range - Interface levels (1.8V CMOS)

	GL865 V3		UL865		CL865	
Parameter	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Input high level	1.3V	1.9V	1.5V	1.9V	1.5V	2.1V
Input low level	0.0V	0.35V	0.0V	0.35V	0.0V	0.35V
Output high level	1.6V	1.9V	1.6V	1.9V	1.35V	1.8V
Output low level	0.0V	0.2V	0.0V	0.2V	0.0V	0.45V

Current characteristics (Preliminary values)

	GL865 V3	UL865	CL865
Parameter	**Typical**	**Typical**	**Typical**
Output Current	1mA	1mA	2mA
Input Current	1µA	1µA	30µA

6. USB Port

The UL865 and CL865 includes an integrated universal serial bus (USB) transceiver, compliant with USB 2.0 specifications and supporting the USB Full-Speed (12Mb/s) mode. The UL865 supports also High-Speed (480Mb/s) mode. For this reason the signal traces should be routed carefully: trace lengths, number of vias and capacitive loading should be minimized and the characteristic impedance value should be as close as possible to 90 Ohms differential.

The impedance value of USB_DPLUS and USB_DMINUS signals for CL865 should be as close as possible to 100 Ohms differential.

Pins 16, 17 and 18 are internally unconnected on GL865 V3 so in a common design the USB port can be routed to the MCU in order to have the possibility to use it in case UL865 and CL865 are mounted.

If not used we suggest routing pins 16, 17 and 18 of xL865 to test points (or better to a mini USB connector not mounted).

7. SPI port

The UL865 module is provided by one 3 wire SPI interface. The AP has the master role i.e. it supplies the clock. The following table is listing the available signals:

PAD	Model	Signal	I/O	Function	COMMENT
45	UL865	SPI_MOSI/ TX_AUX	I/O	SPI MOSI	Shared with TX_AUX
	GL865	TX_AUX	O	Auxiliary UART (TX Data to DTE)	
	CL865	TX_AUX	O	Auxiliary UART (TX Data to DTE)	
44	UL865	SPI_MISO/RX_AUX	I/O	SPI MISO	Shared with RX_AUX
	GL865	RX_AUX	I	Auxiliary UART (RX Data from DTE)	
	CL865	RX_AUX	I	Auxiliary UART (RX Data from DTE)	
25	UL865	SPI_CLK	I	SPI CLK	
	GL865	RESERVED	-	-	-
	CL865	RESERVED	-	RESERVED	

NOTE:

Due to the shared functions, when the SPI port is used, it is not possible to use the AUX_UART port.

WARNING:
In a common design xL865 the SPI port should not be used.

8. Audio Section Overview

8.1. Analog

On UL865 the analog audio interface is not present; in an xL865 common design you should use the digital audio interface.

9. Document History

Revision	Date	Changes
Rev. 0	2013-10-07	Initial release
Rev. 1	2014-01-08	Added CL865