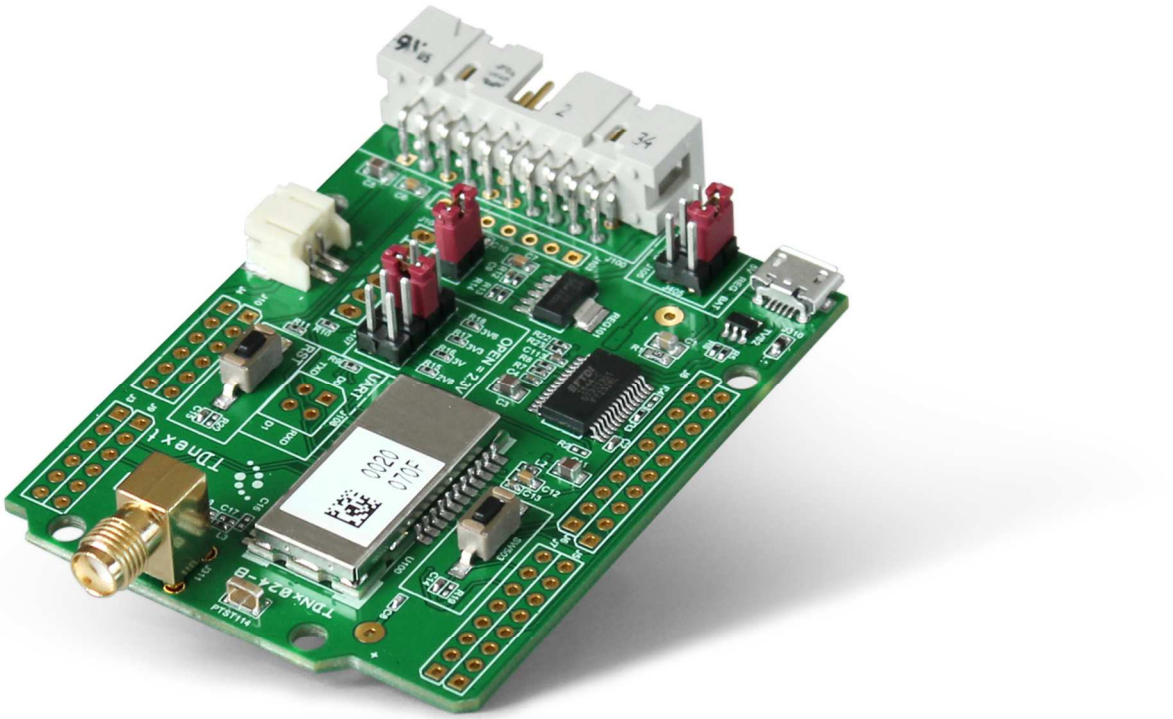

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TABLE OF CONTENTS

1 Overview

This document provides a User's Guide for the Telecom Design LGA25 Modules evaluation board (**LGA25 EVB**) dedicated. As an overview, this chapter gives the scope of this document and lists the board's features. The document's organization is then detailed. **This EVB is available for these following modules**:

Table 1. TDnext LGA25 Modules compatible with LGA25 EVB

Part Number	Description
TD1207R	**ISM SIGFOX™ gateway module** 128K Flash/ 16K RAM / TCXO, with fixed AT command set
TD1208R	**ISM SIGFOX™ gateway module** 128K Flash/ 16K RAM / TCXO, with fixed AT command set, user customizable firmware
TD1508	**US ISM SIGFOX™ gateway module** 128K Flash/32KRAM TCXO

1.1 Scope

The LGA25 EVB provides a development and demonstration platform for LGA25 TDnext modules and software tools. This guide focuses on the LGA25 evaluation board as a development platform for the TDnext LGA25 Modules.

1.2 Features

The board's main features are:

- TDnext module in LGA25 package
- Breakout of all module interfaces
- 4 x power supply input options (2 x connectors for external battery, 1 x USB power supply, 1 x JTAG power supply)
- Adjustable Low Drop-Out (LDO) voltage regulator
- Micro USB connector with on-board FTR232RL for UART communication
- 2 x hardware buttons
- 2 x 10 pin connector compatible with ARM™ JTAG (SWD) & SiliconLabs's Tiny Gecko EVK board
- 1×7 pin header (not mounted) for ISP (In-Situ Programming) connection
- 1 x 6 pin header (not mounted) for FTDI connector
- 1 × SMA R/A antenna connector with ESD protection device (TVS)
- 1× SMT LED on TDnext LGA25 module TIM2 pin
- 1 × removable current measurement strap
- 1 x GND test point

1.3 Relevant Documents

This document provides a hardware overview for the LGA25 EVB system. Additional information on the TDnext LGA25 modules can be found in the following documents available on the Telecom Design Web site developer's area (http://rfmodules.td-next.com/):

2 Setting Up the LGA25 EVB

This section helps you set up the LGA25 for the first time.
Please consider first the electrostatic warning to avoid damaging the board, then discover the hardware and software required to operate the board.
The procedure to power up the board is given, and a description of the default board behavior is detailed.

2.1 Electrostatic Warning

The LGA25 EVB is shipped in a protective anti-static package.
Although the antenna connector is equipped with a proper ESD protection device and that the onboard components offer protection against ESD hazards, the board should not be exposed to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other metallic element.

2.2 Packing List

The LGA25 EVB is delivered in a box containing:

- The LGA25 EVB Evaluation Board itself
- 1x USB A to Micro USB Type B standard cable
- 1x 20-pin FPC JTAG cable
- 1x ISM 869~915 MHz half-wave swivel antenna

Figure 1. Packing List

2.3 Requirements

In order to set up the LGA25 EVB, the following items are required:

- A PC running Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7 or Windows Server 2008 R2 operating system (this is only required for being able to flash the device using the provided utility

program, for a simple connection to the module, any operating system for which FTDI devices are supported should work)

- A Web browser running on the PC with access to the Internet
- A serial terminal emulation program running on the PC, such as:
  - HyperTerminal (included in Windows 9x/2000/XP)
  - PuTTY (http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html)
  - RealTerm (http://realterm.sourceforge.net/)
- The FTDI Virtual COM Port Driver (VCD) which is appropriate for your machine (http://www.ftdichip.com/Drivers/VCP.htm)
- The TDnext "**TDLoader.exe**" utility program in order to reflash the TDnext LGA25 module firmware (http://rfmodules.td-next.com/)

2.4 Power Supply Selection

The LGA25 EVB evaluation board is powered from the Micro USB connector (recommended power supply), by using an external 5 V power source. Several other power supply options are possible (see section 3.3.1 for more details).

When starting the EVB for the first time, it is recommended to connect jumpers as described in Figure 2.

1) Place a jumper on the **J405** header between the **5V** pin and the **REG** pin (5V power supply option)
2) Place a jumper on the **J107** header in the **3V3** position (3.3V module power supply voltage level)
3) Place jumper on the **J406** header (current measurement strap shorted)

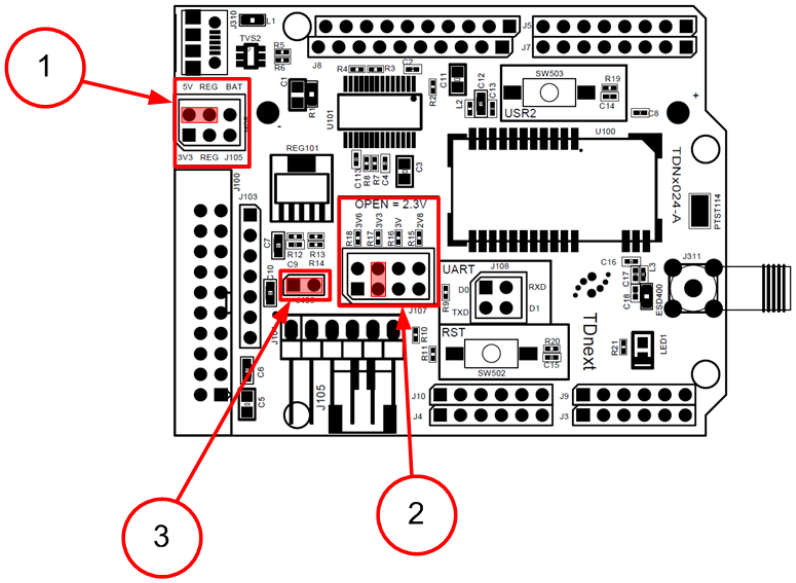


Figure 2. Powering start-up configuration

2.5 Getting Started

The TDnext LGA25 Modules on the LGA25 EVB evaluation board is pre-installed with a firmware allowing an easy set up.

- This firmware contains a Hayes-compatible "AT" command interpreter that also understand the SIGFOX compatible commands, making it easy to type in control commands and getting the corresponding answers using a simple serial terminal emulator.

In order to verify that the device is functional, please:

- Connect the SMA antenna to the LGA25 onboard SMA socket and rotate the antenna so that it stands up, perpendicular to the LGA25 EVB board top surface

- Make sure that the recommended power configuration from section 2.4 is respected
- Connect the Micro USB cable to the USB host port on the PC and on the LGA25 EVB board

Figure 3. Micro USB cable Connection

The onboard "LED" should flash briefly upon connection, indicating a Power-On Reset (POR) condition. If this is not the case, please try to unplug / replug the USB cable after controlling the connections described above.

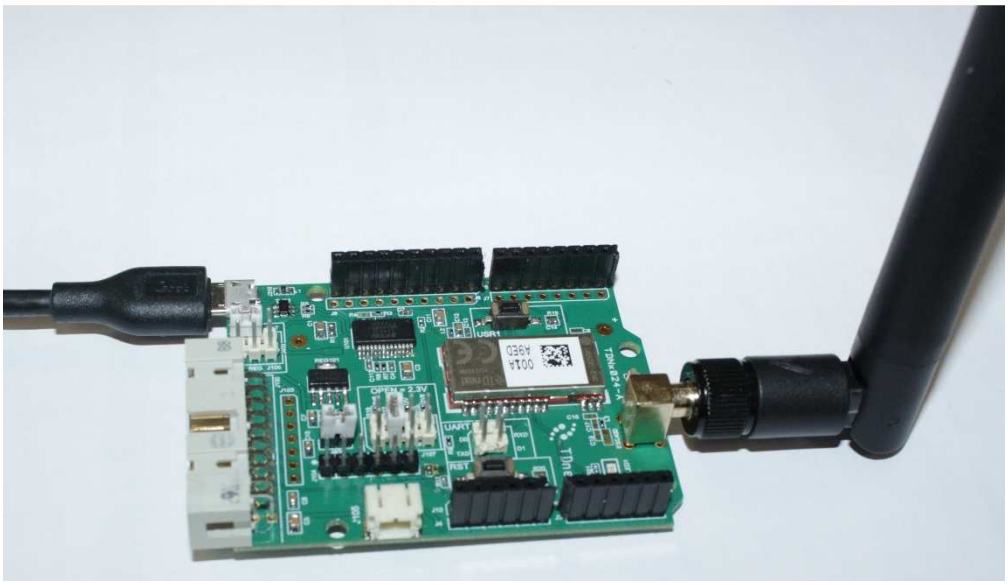


Figure 4. Getting Started

As the serial terminal emulation software will require the (virtual) port corresponding to the newly attached device, the best way to get it is to use Window's "**Device Manager**" from the Control Panel, by clicking on the "**System**" icon and selecting the "**Hardware**" tab and pressing the "**Device Manager…**" button. Please locate and unfold the "**Ports (COM & LPT)**" entry into the device tree list: you should see an "**USB Serial Port (COM*x*)**" entry corresponding to the newly attached LGA25 EVB device. If unsure, you can safely unplug/replug the USB cable to observe the changes into the "**Device Manager**" window. Please write down this "**COM*x***" information, so you can provide it later to the serial terminal emulation software.
You can then close Windows's "**Device Manager**" window and launch your selected serial terminal emulation software, with the following serial parameters:

- Port as obtained from Window's "Device manager"
- LVTTL electrical level
- 9600 bps or 115200 bps (according to module used)

- 8 data bits
- No parity
- 1 stop bit
- No hardware/software flow control

All available AT commands are presented in the '*TDnext RF Module Reference Manual revx.x.pdf*' document.

2.6 Upgrading the Firmware

Your TDnext LGA25 module is always evolving and so is our Web portal. To be able to use your module please always perform a firmware upgrade using the latest available firmware.

The TDnext LGA25 modules contain a built-in bootloader able to perform a full firmware upgrade locally while connected to a Windows PC computer over its UART/USB interface.

There is no need to have a full toolchain set up to upgrade at TDnext LGA25 module, as only the TDnext provided "**TDLoader.exe**" utility is required.

This utility can be obtained from http://rfmodules.td-next.com/.

Launch the "TDLoader.exe" utility. This will open a dialog window similar to this:

Figure 5: TD Loader Dialog

2.6.1 Local Firmware Upgrade

In order to perform a local firmware upgrade, please:

- Make sure the FTDI cable is connected on the PC end
- Provide the COM port number, as obtained from the "**Device Manager**" in section 2.5 "Getting Started" above
- Paste the firmware file absolute file name or browse to it using the "**Browse…**" button
- Press the "**Acquire**" button to start the upgrade process
- If not already connected, please connect the LGA25 EVB board to the FTDI USB cable, you should see:

Figure 6: TD Loader Synchronizing

- If the Loader cannot get synchronized with the LGA25 EVB, try to unplug/replug the board on the FTDI cable 0.1" Female Molex connector side and retry. You should then get:

Figure 7: TD Loader Upgrading

- During the upgrade process, the LGA25 EVB onboard green LED should turn on and shortly turn off during Flash writes. It will eventually turn off and you should get:

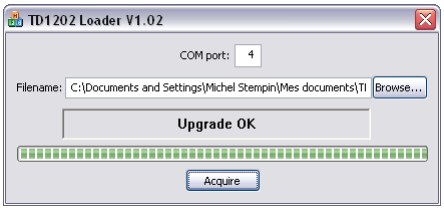


Figure 8: TD Loader Finished

2.6.2 Remote Firmware Update

Within a controlled RF manufacturing environment, the TDnext LGA25 module firmware can also be upgraded remotely by radio.

Please contact TDnext to obtain more information on the required procedure.

3 LGA25 EVB Overview

The LGA25 EVB provides:

- access to the different TDnext LGA25 module interfaces
- USB connectivity using a standard Micro USB cable
- development flashing/debugging facility using the standard ARM™ SWD debug interface or an ad-hoc ISP connector
- an integrated regulated power supply.

The LGA25 EVB can be powered from USB or from the dedicated power pins on the available headers, with the capability to measure the current consumption of the target TDnext LGA25 module.

3.1 Board Layout

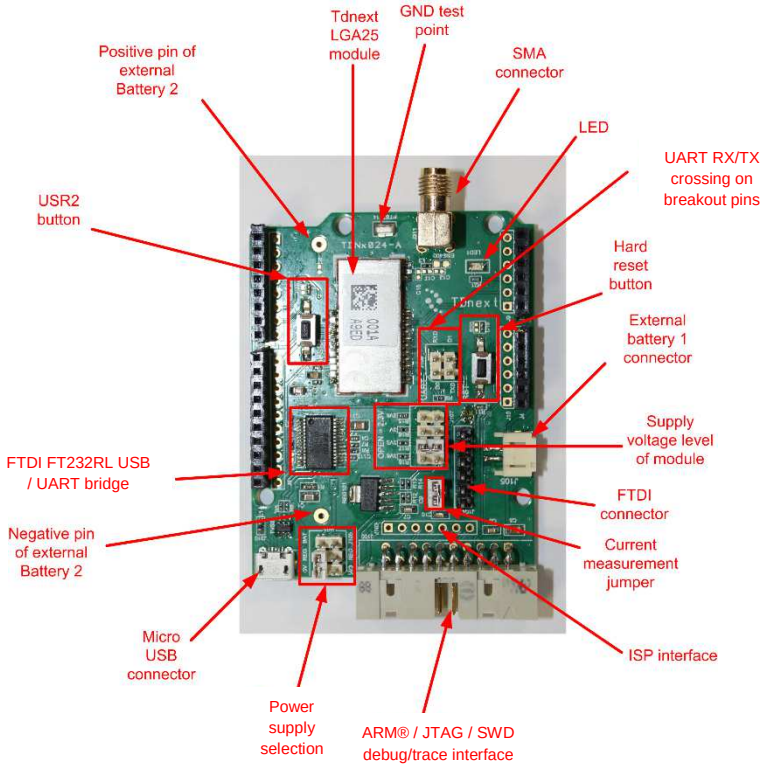


Figure 9: LGA25 EVB Top View

3.2 Block Diagram

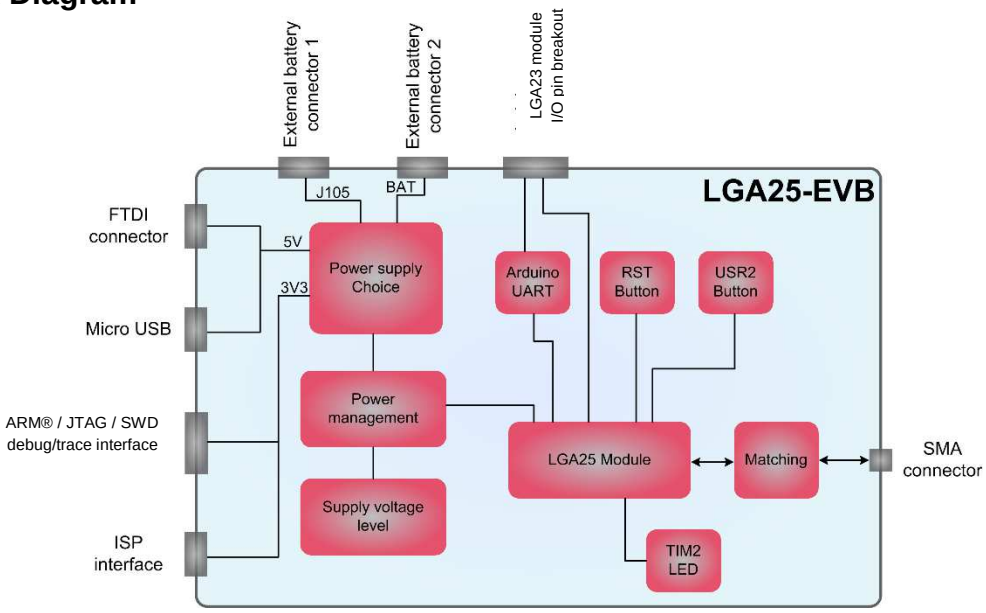


Figure 10: LGA25 EVB Block Diagram

3.3 Hardware Description

3.3.1 Power Supply Selection

The LGA25-EVB features an on-board LDO (Low-Drop Out) voltage regulator that accepts power supply from different sources:

- micro USB connector or FTDI connector (used for sending AT command over UART / USB)
- ARM™ JTAG (SWD) or ad-hoc ISP connectors (used to flash / debug / trace the TDRF module firmware)
- External battery connector
- Soldered battery pads (compatible with the LS17500-2PF battery form factor)

A jumper must set on the **J405** header according to the desired power source (see **Figure 11**) between:

- **5V** and **REG** pins in order to supply power from the Micro USB **J310** or FTDI **J104** connectors
- **3V3** and **REG** pins in order to supply power from the ARM™ JTAG **J100** or ad-hoc ISP **J103** connectors
- **J105** and **REG** pins in order to supply power from the external battery JST2 connector **J105**
- **BAT** and **REG** in order to supply power from the soldered battery pads

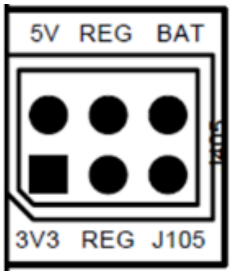


Figure 11. Power Supply Selection

Note: Never connect multiple external supply voltages to the board simultaneously!

3.3.2 Module Supply Voltage Level Selection

The LGA25-EVB features an adjustable LDO voltage regulator to supply the TD RF module. It is thus possible to choose the module's supply voltage level by placing a jumper on header **J107** (see **Figure 12**).

The available voltage levels are: 2.3V, 2.8V, 3V, 3.3V and 3.6V. For example, the picture below shows how to place a jumper to obtain a power supply voltage level of 3.6V. Simply remove the jumper to obtain a 2.3V supply voltage level.

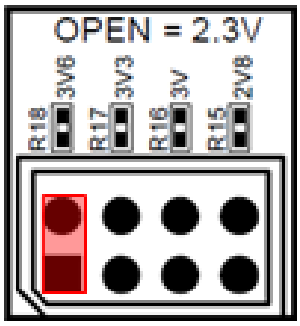


Figure 12. Level of voltage supply

3.3.3 Micro USB to UART interface

Thanks to the integrated FTDI FT232RL USB / UART interface chip, it is possible to send AT commands to the LGA25 module using a simple USB cable with a microUSB plug.

3.3.4 FTDI USB to Serial Cable Connector

The LGA25 EVB provides a 1×6 0.1" pitch R/A header (**J104** - not mounted) compatible with FTDI's TTL-232R-3V3 TTL to USB Serial Converter cable (not provided).

The cable datasheet can be found on FTDI's support website at:
http://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_TTL-232R_CABLES.pdf
Note: This cable must not be used if the FT232RL chip **U101** is mounted.

3.3.5 Current Measurement Jumper

A convenient jumper (labeled "**J406**") is present on the LGA25 EVB board that enables current measurement by replacing it with a micro-ammeter.
This jumper can also be used to isolate the TDnext LGA25 module from the output of the adjustable LDO voltage regulator, thus allowing the module to be power from a separate 2.3 V to 3.6 V external power supply connected to either the ISP or breakout headers.

3.3.6 TDnext LGA25 Module

TDnext LGA25 devices are high performance with low current consumption. The combination of a powerful radio transceiver and a state-of-the-art ARM Cortex M3 baseband processor achieves extremely high performance while maintaining ultra-low active and standby current consumption.
The LVTTL low-energy UART, the I^2C bus, the multiple timers with pulse count input/PWM output capabilities, the 2 high-resolution/high-speed ADCs and single DAC, along with the numerous GPIOs can control any kind of external sensors or activators.
Featuring an AES encryption engine and a DMA controller, the powerful 32-bit ARM Cortex-M3 baseband processor can implement highly complex and secure protocols in an efficient environmental and very low consumption way.
To obtain more information regarding the TDnext LGA25 module, please refer to the Datasheet of the module concerned or to the "*TDxxxx Reference Manual*" documents.

3.3.7 LED

An SMT LED is connected to the TIM2 pin of the TDnext LGA25 module through a series current-limiting resistor.
At module reset, this LED is driven by the TDnext LGA25 module during the bootloader check for approximately 200 ms, to indicate that a firmware update is taking place.
It is strongly recommended that a similar configuration is adopted upon TDnext LGA25 module integration into a custom design, if the firmware upgrade feature is desirable.

Beside its use as a bootloader indicator, this LED can be used for other purposes without any restriction.

3.3.8 Buttons

The LGA25-EVB is equipped with 2 buttons.

- The first button (**SW502**), normally open, is connected to the reset pin of the LGA25 module
- The second button (**SW503**), normally open, is connected using a pull-up resistor to the USR2 pin of the LGA25 module

3.3.9 SMA Antenna Connector

The LGA25 EVB board features a standard right-angle SMA socket to easily connect a 50 Ω impedance matched antenna or cable.
An appropriate 50 Ω antenna is provided with the LGA25 EVB. Other devices, such as a test / measurement equipment can also be connected to this socket using appropriate RF cables.
The antenna connector is protected against ESD (Electro-Static Discharge) hazards by a small SMT RF-class Transient Voltage Suppressor device (TVS) placed closed to the socket base with a good discharge evacuation path to ground.

3.3.10 ARM® JTAG /SWD Interface Connector

J100 is a connector to interface the LGA25-EVB to a standard ARM® JTAG /SWD debug/trace probe, such as the one provided on the EFM32 STK3300 Tiny Gecko EVK. The pinout for this 2x10 pin 2.54mm pitch connector is given in the following figure and table.

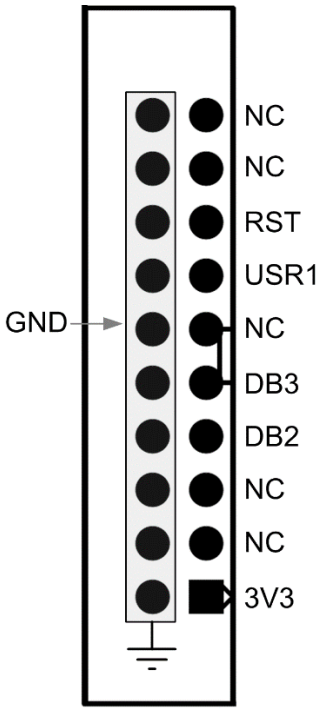


Figure 13. Tiny Gecko connector

Table 2. Tiny Gecko connector pin descriptions

Pin number	Signal Name	Pin Type	Function
1	3.3V	Power	Supply Voltage Input
2	GND	Ground	LGA25-EVB ground
3	NC	NC	Not Connected
4	GND	Ground	LGA25-EVB ground
5	NC	NC	Not Connected
6	GND	Ground	LGA25-EVB ground
7	DB2	I/O	SWDIO (SWD Data I/O) Signal
8	GND	Ground	LGA25-EVB ground
9	DB3	I	SWDCLK (SWD Clock) Signal
10	GND	Ground	LGA25-EVB ground
11	NC	NC	Not Connected
12	GND	Ground	LGA25-EVB ground
13	USR1	I/O	SWO debug signal (connected to USR1 of LGA25 module)
14	GND	Ground	LGA25-EVB ground
15	RST	I	Active Low RESET input signal
16	GND	Ground	LGA25-EVB ground
17	NC	NC	Not Connected
18	GND	Ground	LGA25-EVB ground
19	NC	NC	Not Connected
20	GND	Ground	LGA25-EVB ground

For additional information regarding the EFM32 STK3300 Tiny Gecko EVK, see the relevant EFM32™ Tiny Gecko Starter Kit documentation.

3.3.11 ISP Header

The LGA25 EVB evaluation board contains a single-in-line 7×1 0.1" pitch header (not mounted), as a convenient low pin count ISP (In Situ Programming/Debugging). The connector pinout is detailed in the following figure and table:

Figure 14. ISP Header Pinout

Table 3: ISP Header Pinout

Pin	Pin Name	I/O	Description
1	3.3V	Power	Supply Voltage Input
2	GND	GND	Connect to PCB ground
3	RST	I	Active Low RESET input signal
4	TXD	O	Low-Power UART Data Transmit Signal
5	RXD	I	Low-Power UART Data Receive Signal This signal is internally pulled up by an integrated resistor.
6	DB2	I/O	SWDIO (SWD Data I/O) Signal
7	DB3	I	SWDCLK (SWD Clock) Signal

3.3.12 Breakout Interface

All LGA RF module I/O pins are broken out to convenient connectors on the LGA25-EVB. The pinout of this board is given in the following figure and table.

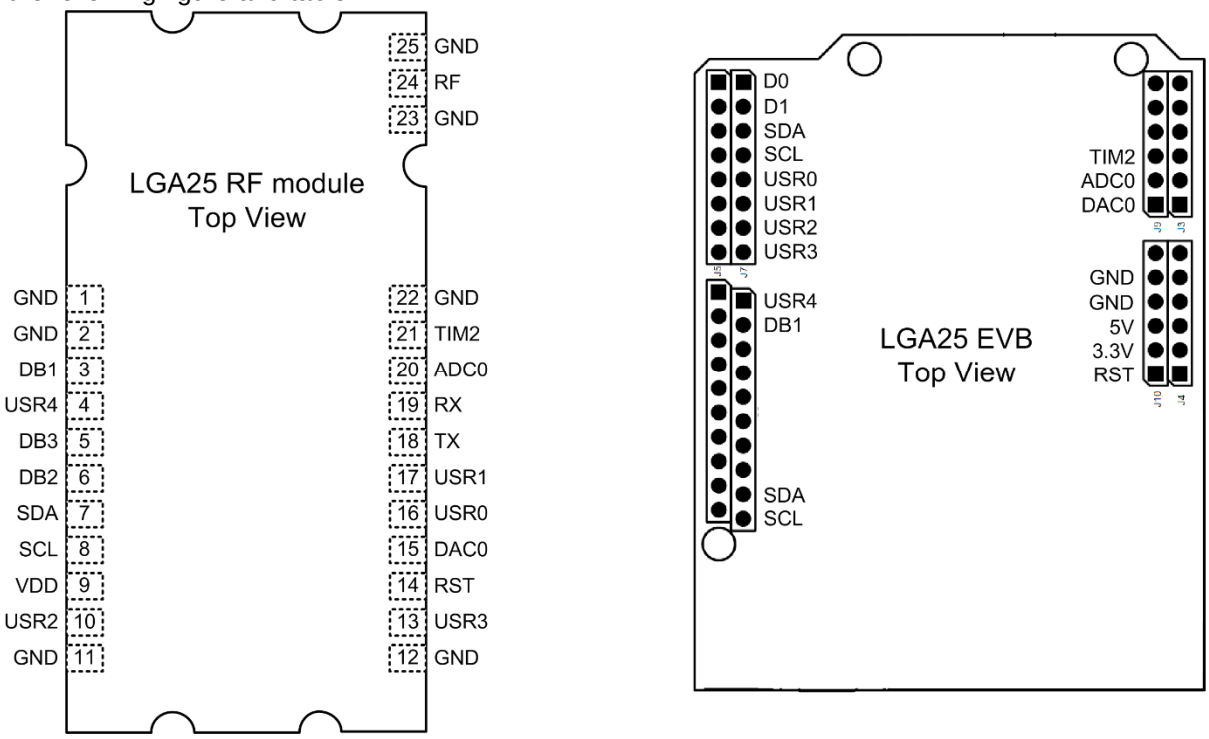


Figure 15. Breakout Interface

Table 4- Breakout Interface Pinout

Pin Name	I/O	Description	Note
D0	I/O	Low-Power UART Data Transmit/Receive data	See section (**Erreur ! Source du renvoi introuvable.**)
D1	I/O	Low-Power UART Data Transmit/Receive data	See section (**Erreur ! Source du renvoi introuvable.**)
SDA	I/O	I/O with Master / Slave I²C serial data function	
SCL	I/O	I/O with Master / Slave I²C serial clock function	
USR0	I/O	General Purpose I/O 0	
USR1	I/O	General Purpose I/O 1	
USR2	I/O	General Purpose I/O 2	
USR3	I/O	General Purpose I/O 3	
USR4	I/O	General Purpose I/O 3	
DB1		Reserved	
TIM2	I/O	I/O with Timer compare function	
ADC0	I/O	I/O with ADC analog input function	
DAC0	I/O	I/O with DAC analog output function	
GND	GND	LGA25-EVB Ground	
5V	Power	+5V supply voltage	See section (3.3.1)
3.3V	Power	+3.3V supply voltage	See section (3.3.1)
RST	I	Active Low RESET input signal	

3.3.13 RXD / TXD Direction Selection

The LGA25-EVB RXD / TXD UART interface pin direction can be selected by placing 2 jumpers on the **J108** connector (see **Figure 16**).

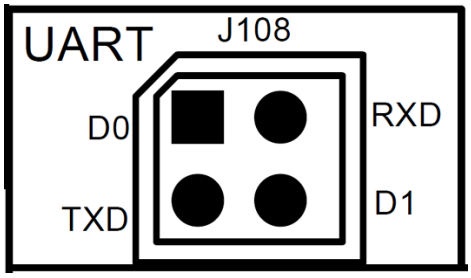


Figure 16. RXD / TXD Direction Selection

3.3.14 RF matching

The LGA25-EVB offers the possibility to add a matching / filtering network between the RF module and the antenna. By default, a 0 Ω shunt resistor is mounted (**L3**). It is thus possible to use a specific matching /filtering in order to test a different external antenna.

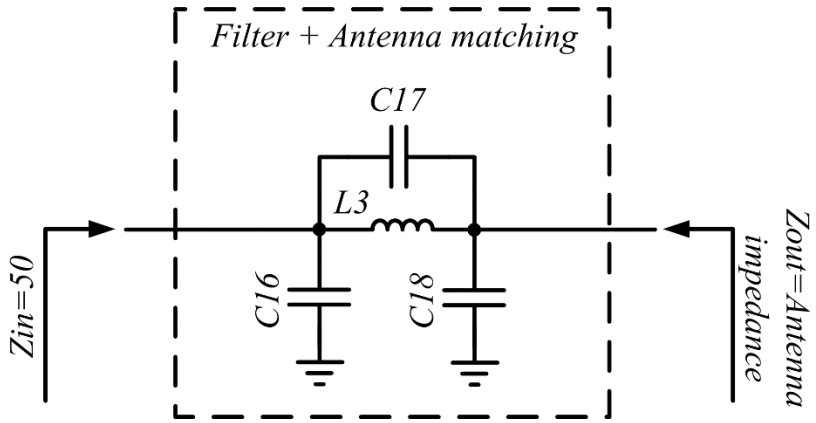
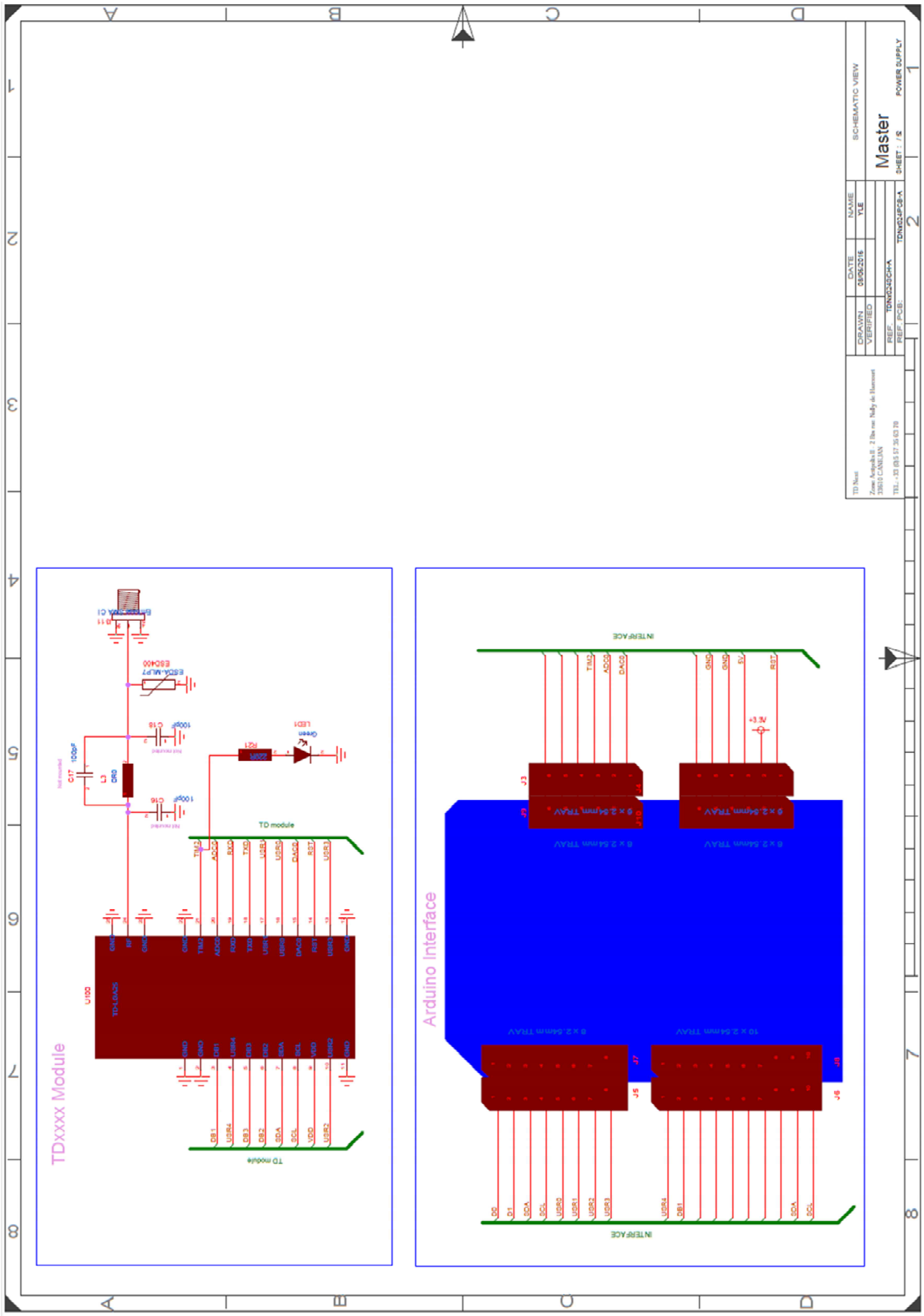
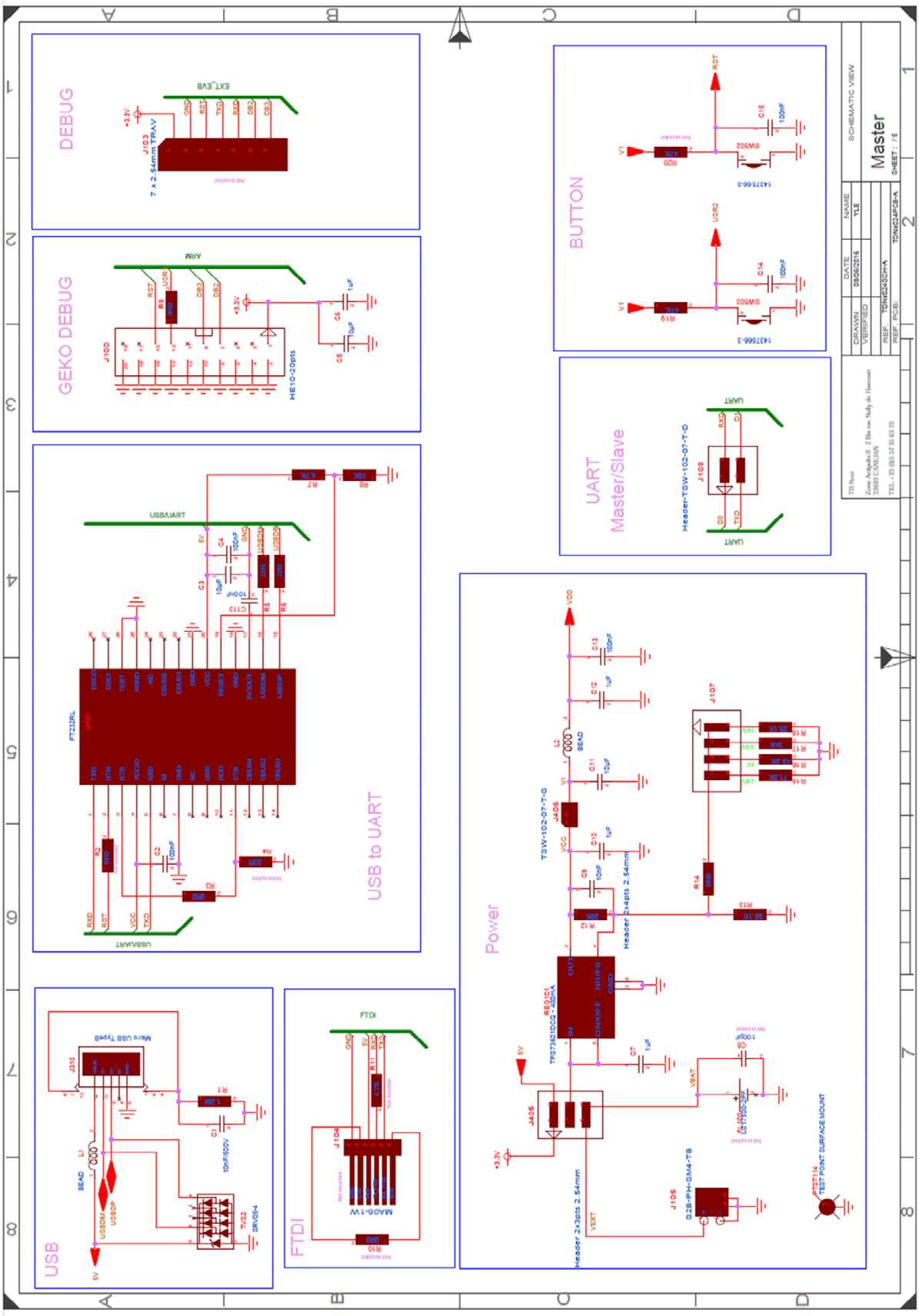


Figure 17. LGA25-EVB Matching interface

4 LGA25-EVB Schematics




DEBUG
GEKO DEBUG
BUTTON
UART
Master/Slave
USB to UART
Power
USB
FTDI
Master
SCHEMATIC VIEW

5 Mechanical Drawing

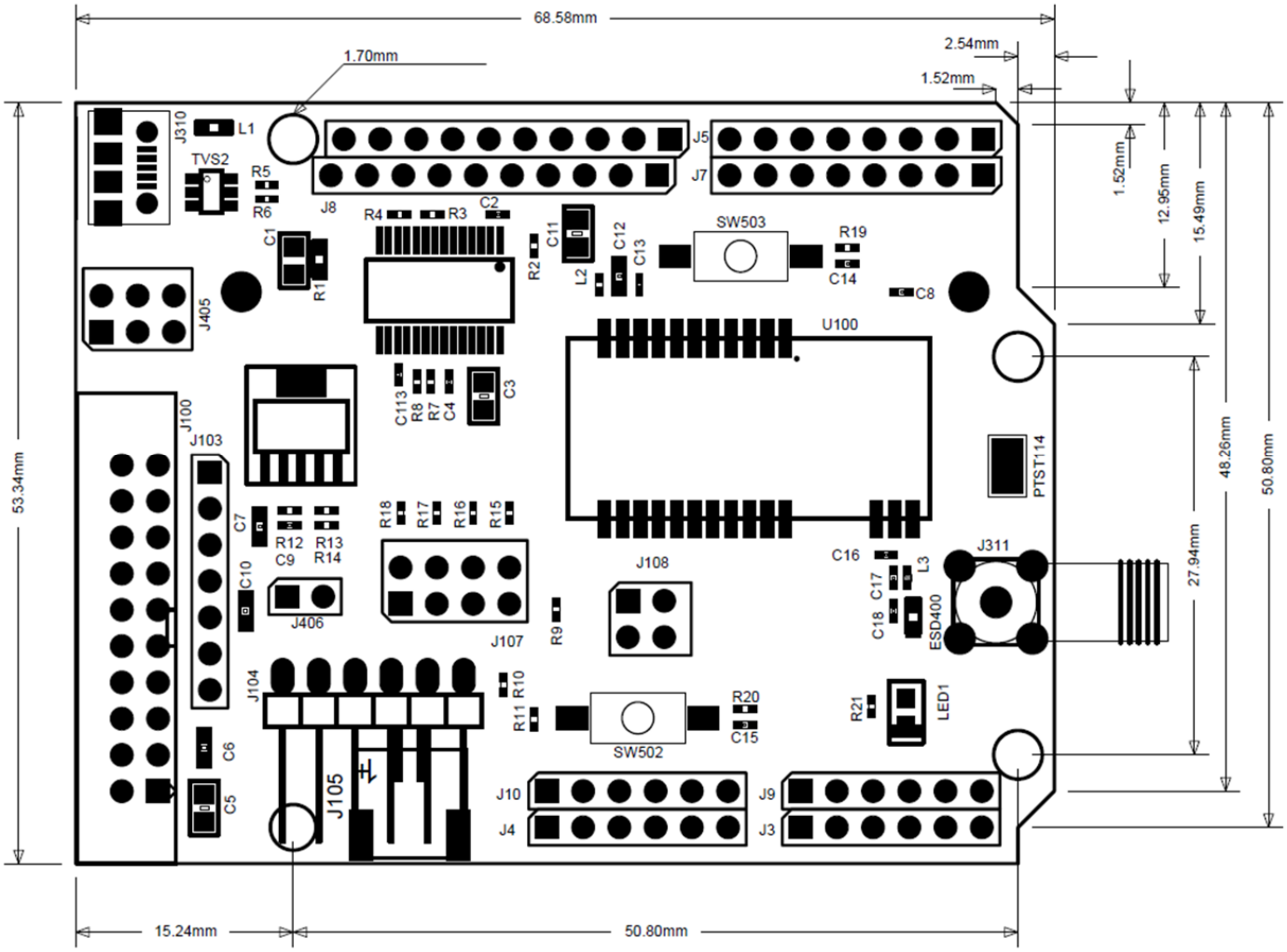


Figure 18: LGA25 EVB Mechanical Drawing

Note:

1. All dimensions are shown in millimeters (mm) unless otherwise specified.

DOCUMENT CHANGE LIST

Revision 1.0

- TD12xx/TD15xx EVB User's Guide

Revision 1.1

- Updated onboard LED color

NOTES

CONTACT INFORMATION

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