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1 Overview

Thank you for choosing the TD1204 evaluation board from Telecom Design!

This document provides a User's Guide for the Telecom Design TD1204 evaluation board (EVB).

As an overview, this chapter gives the scope of this document and lists the board's features.

The document's organization is then detailed.

1.1 Scope

The TD1204 Evaluation Board provides a development and demonstration platform for Telecom Design TD1204 SIGFOX™ gateway modules and software tools.

This guide focuses on the TD1204 evaluation board as a development platform for the TD1204 SIGFOX™ Gateway Module.

1.2 Features

The TD1204 evaluation board provides a rich development platform for the Telecom Design TD1204 SIGFOX™ Gateway module.

The board's main features are:

■ TD1204 SIGFOX™ Gateway module in LGA41 package

SIGFOX Ready™ Gateway and RF transceiver

- Frequency range = ISM 868 MHz
- Receive sensitivity = -126 dBm
- Modulation
 - (G)FSK, 4(G)FSK, GMSK
 - OOK
- Max output power
 - +14 dBm
- Low active radio power consumption
 - 20µA RX (windowed mode)
 - 37 mA TX @ +10 dBm

Multi-GNSS GPS Receiver

- Multi-GNSS support
 - GPS/GLONASS
 - SBAS augmentation services
- Ultra-low power consumption
 - 16 mA Tracking
 - 12 µA Backup
- High Sensitivity
 - 56-channel engine
 - -162 dBm Tracking
 - -148 dBm Cold start

Ultra-low power 3D Accelerometer

- Up to ±16g full scale

TD1204 EVB

- 6-pin R/A header for connecting a standard TTL-232R-3V3 FTDI USB to Serial Cable (3.3V)-1.8m
- 1x7 pin header (not mounted) for ISP (In-Situ Programming) connection
- 2x7 pin header (not mounted) for TD1204 signal breakout
- 1xSMA R/A antenna connector with ESD protection device
- 1xSuper Blue SMT LED on TD1204 module TIM2 pin
- 1xremovable current measurement strap

1.3 Organization

Each section in this document covers a separate topic, organized as follow:

- Section 1 is an overview of the board usage and features
- Section 2 provides a guide for quickly setting up the board
- Section 3 gives a hardware description of the TD1204 EVB evaluation board
- Section 4 contains the Telecom Design TD1204 EVB evaluation board schematic
- Section 5 is a detailed explanation of the power supply

1.4 Relevant Documents

This document provides a hardware overview for the TD1204 Evaluation Board (EVB) system. Additional information on the TD1204 SIGFOX™ gateway module can be found in the following documents available on the Telecom Design Web site developer's area (<https://developers.insgroup.fr/cloud-on-chip/td1204/index.html>):

- TD1204 Datasheet
- TD1204 Reference Manual

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1 Overview.....	3
1.1 Scope	3
1.2 Features	3
1.3 Organization	4
1.4 Relevant Documents	4
2 Setting Up the TD1204 EVB	6
2.1 Electrostatic Warning.....	6
2.2 Packing List.....	6
2.3 Requirements	6
2.4 Powering Up the Board	7
2.5 Getting Started	7
2.6 Upgrading the Firmware	9
2.6.1 Local Firmware Upgrade.....	9
2.6.2 Remote Firmware Update.....	10
2.7 SIGFOX™ Transmission Test.....	10
2.8 Cloud-on-Chip™ Transmission Test	11
2.9 GPS Test	12
3 TD1204 EVB Overview.....	14
3.1 Layout	14
3.2 Block Diagram.....	15
3.3 Hardware Description.....	15
3.3.1 FTDI USB to Serial Cable Connector	15
3.3.2 3.3 V Low Drop Out Voltage Regulator	15
3.3.3 Current Measurement Jumper	15
3.3.4 TD1204 SIGFOX™ Gateway Module.....	15
3.3.5 Super-Blue LED	16
3.3.6 SMA SigFox Antenna Connector.....	16
3.3.7 U.FL GPS Antenna Connector	16
3.3.8 ISP Header	16
3.3.9 Breakout Header.....	17
4 TD1204 EVB Schematics.....	20

2 Setting Up the TD1204 EVB

This section helps you set up the TD1204 EVB evaluation board 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 TD1204 EVB evaluation board 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 TD1204 EVB is delivered in a box containing:

- A TTL-232R-3V3 FTDI USB to TTL Serial Cable (3.3V)-1.8m
- The TD1204 EVB Evaluation Board itself
- An active GPS Antenna
- A 20 cm 868 MHz-Band Swivel Antenna



Figure 1- Packing List

2.3 Requirements

In order to set up the TD1204 EVB evaluation board, 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 (VCP) which is appropriate for your machine (<http://www.ftdichip.com/Drivers/VCP.htm>)
- The Telecom-Design “**TDLoader.exe**” utility program in order to reflash the TD1204 module firmware (<https://developers.insgroup.fr/cloud-on-chip/TD1204/download.html>)
- The Ublox u-center software can also be used in order to visualize GPS performance (<http://www.u-blox.com/en/evaluation-tools-a-software/u-center/u-center.html>)

2.4 Powering Up the Board

The TD1204 EVB evaluation board is self-powered by the USB port, by using an external 5 V power supply attached to the corresponding pins on the FTDI onboard header, or by opening the current consumption measurement strap and applying a 2.3 V to 3.3 V power supply unit attached to the correct pins on either the ISP or breakout header (see schematic for details).

The board has no power switch; just plug/unplug the power/USB cable to/from the board to cycle power.

2.5 Getting Started

The TD1204 SIGFOX™ Gateway module on the TD1204 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 swivel antenna to the TD1204 onboard SMA socket and rotate the antenna so that it stands up, perpendicular to the TD1204 EVB board top surface
- Plug the small U.FL connector to the TD1204 module then connect the external active. For best performance place the antenna horizontally with black side on top. Also make sure to place it on the outside or at least near a window.
- Make sure that the current measurement strap is placed across the 2-pin header on the TD1204 EVB board
- Connect the FTDI cable 0.1” Female Molex connector into the onboard R/A 6-pin header, so that the FTDI black wire is aligned with the label on the TD1204 EVB board

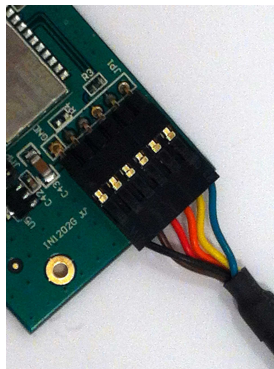


Figure 2- FTDI Cable Connection

- Connect the FTDI cable USB A plug into an available USB host port on the PC

TD1204 EVB

The onboard “Super Blue” 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 3- 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 Windows’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 (COMx)”** entry corresponding to the newly attached TD1204 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 **“COMx”** 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”
- LVTTTL electrical level
- 9600 bps
- 8 data bits
- No parity
- 1 stop bit
- No hardware/software flow control

You should then be able to type in the following command (note: there may be no character echo by default):

```
AT&V<CR>
```

Where **“<CR>”** represent a press on the “Carriage Return” key.

You should get a result similar to:

```
Telecom Design TD1204
Hardware Version: 0F
Software Version: SOFTXXXX
S/N: YYYYYYYY
ACTIVE PROFILE
E0 V1 Q1 X1 S300:24 S301:2 S302:14 S303:1
```

2.6 Upgrading the Firmware

Your TD1204 module is always evolving and so is our Web portal. To be able to use your TD1204 module please always perform a firmware upgrade using the latest available firmware.

The TD1204 SIGFOX™ Gateway 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 TD1204 SIGFOX™ Gateway module, as only the Telecom Design provided “**TDLoader.exe**” utility is required.

This utility can be obtained from <https://developers.insgroup.fr/cloud-on-chip/td1204/download.html>.

Launch the “TDLoader.exe” utility and then select TD1204 EVB. This will result in a dialog window similar to this:

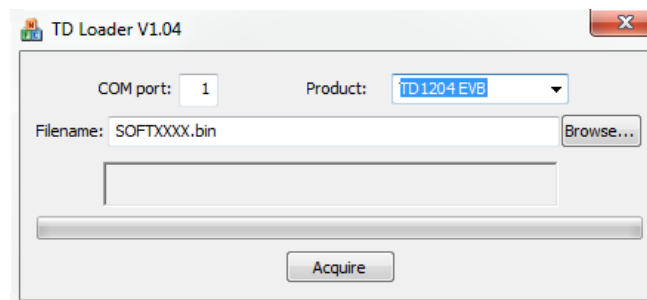


Figure 4- TD1204 Loader Dialog

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 TD1204 EVB board to the FTDI USB cable, you should see:

TD1204 EVB

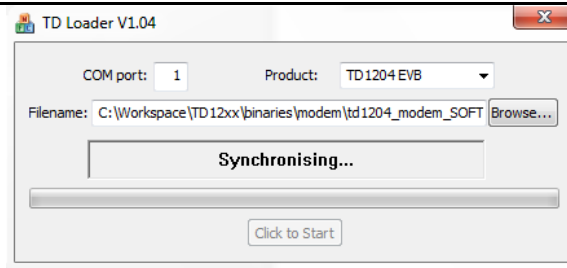


Figure 5- TD Loader Synchronizing

- If the Loader cannot get synchronized with the TD1204 EVB, try to unplug/replug the board on the FTDI cable 0.1" Female Molex connector side and retry. You should then get:

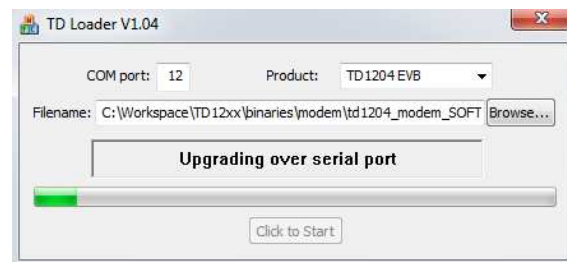


Figure 6- TD Loader Upgrading

- For a firmware < SOFT1278, during the upgrade process, the TD1204 EVB onboard blue LED should turn on, and eventually, it should turn off and you should get:

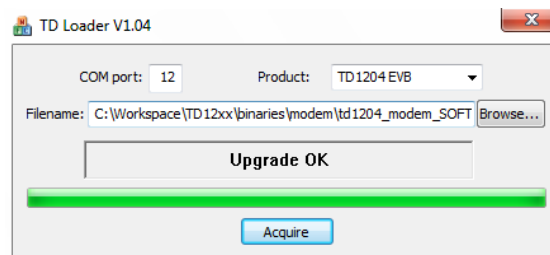


Figure 7- TD Loader Finished

- For a firmware \geq SOFT1278, during the upgrade process, the TD1204 EVB onboard blue LED should turn on and shortly turn off during Flash writes. It will eventually turn off and you should get the same dialog box as above

2.6.2 Remote Firmware Update

Within a controlled RF manufacturing environment, the TD1204 module firmware can also be upgraded remotely by radio.

Please contact Telecom Design to obtain more information on the required procedure.

2.7 SIGFOX™ Transmission Test

Beside the basic purpose of controlling that the board is operational, the default firmware is able to send RF messages to the SIGFOX™ network, which can be monitored using the SIGFOX™ backend Web portal in real-time.

In order to perform a SIGFOX™ transmission test, please point your Web browser to the address <http://backend.sigfox.com>. Use the login and password information supplied by SIGFOX™ to access the platform.

Then, turn on temporarily character echo (so you can see what you are actually typing), enable verbose answer display, and send a message containing the 2 hexadecimal byte values 0x54 and 0x44:

```
ATE1<CR>ATQ0<CR>
OK
AT$SS=54 44<CR>
OK
```

You should see a raw message containing the 2-byte value appearing promptly in the SIGFOX™ backend Web portal display.

2.8 Cloud-on-Chip™ Transmission Test

The default firmware is also able to send RF - Sensor formatted - messages through the SIGFOX™ network, which can be monitored on the SENSOR™ Web portal in real-time.

In order to access the SENSOR™ Web portal and to your module's dashboard, you will need first to register your TD1204 module on the SENSOR™ platform.

To do so, please turn on temporarily character echo (so you can see what you are actually typing), enable verbose answer display, and make sure your TD1204 module is configured as a Transmitter.

```
ATE1<CR>ATQ0<CR>
OK
ATS500=2<CR>
OK
AT&W
OK
ATZ
OK
```

Please wait a few seconds for the module to reboot before sending a registration frame:

```
AT$REG<CR>
OK
```

You should now be able to access the SENSOR™ Web portal and your module's dashboard by pointing your Web browser to the address <https://developers.insgroup.fr/dashboards/device.html> and entering the registration information supplied on the TD1204 EVB sticker.

You can try to send a raw message:

```
AT$RAW=54 44<CR>
OK
```

You should see a raw message containing the 2-byte value appearing promptly in your dashboard.

TD1204 EVB

2.9 GPS Test

In order to make use of the GPS inside the TD1204 you need to plug the GPS antenna via the U.FL connector as below:

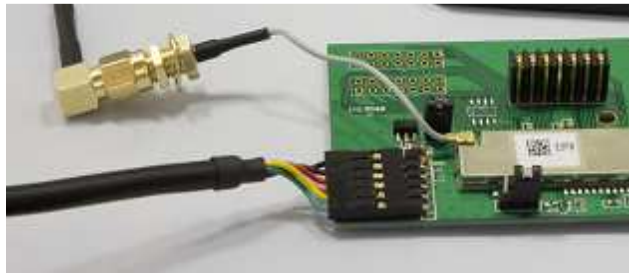


Figure 8 – GPS Antenna via U.FL connector

Then start the GPS to display all NMEA thanks to the following AT command

```
AT$GPS=1,16,0,0xFFFF,1,1<CR>  
OK
```

You should then get NMEA frames outputted on your terminal. In order to decode the NMEA output we recommend to make use of the Ublox “u-center” software which can be downloaded at the following address:

<https://www.u-blox.com/en/evaluation-tools-a-software/u-center/u-center.html>

Once installed select the appropriated COM port (you will need to disconnect from your terminal):

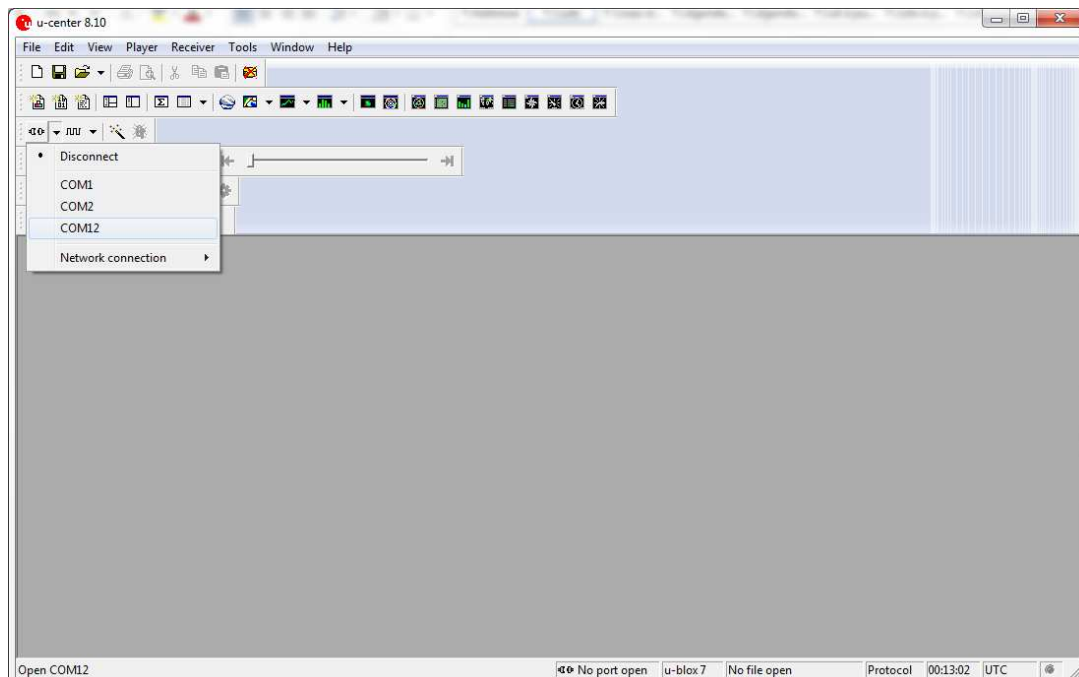


Figure 9 – u-center Port COM selection

Then you will be able to display all decoded information such as position and satellites level in order to fully qualify the solution:

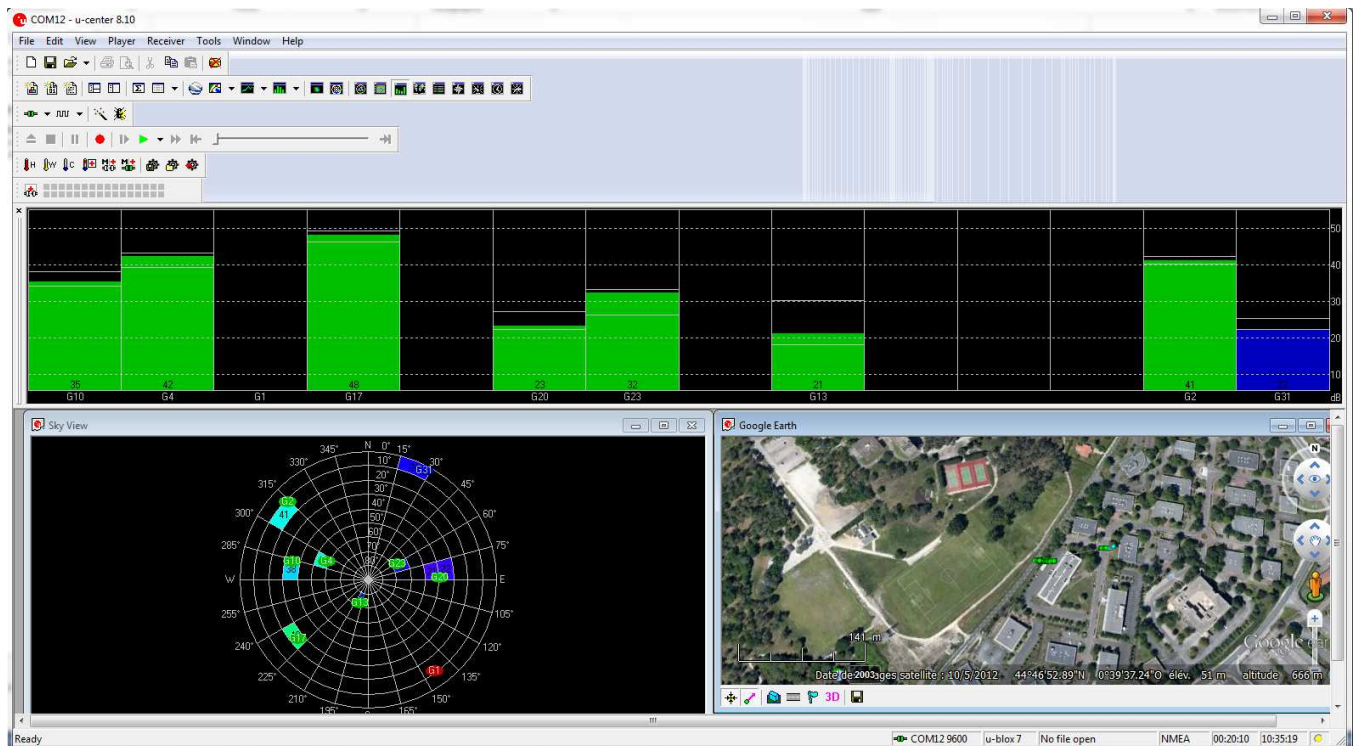


Figure 10 – u-center Satellites and Position Display

TD1204 EVB

3 TD1204 EVB Overview

The TD1204 Evaluation Board (EVB) provides access to the different TD1204 SIGFOX™ gateway module interfaces, USB connectivity using a standard FTDI LVTTL RS232 ↔ USB cable, and development flashing/debugging facility using the standard ARM™ SWD debug interface, as well as an integrated regulated power supply.

The TD1204 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 TD1204 module.

3.1 Layout

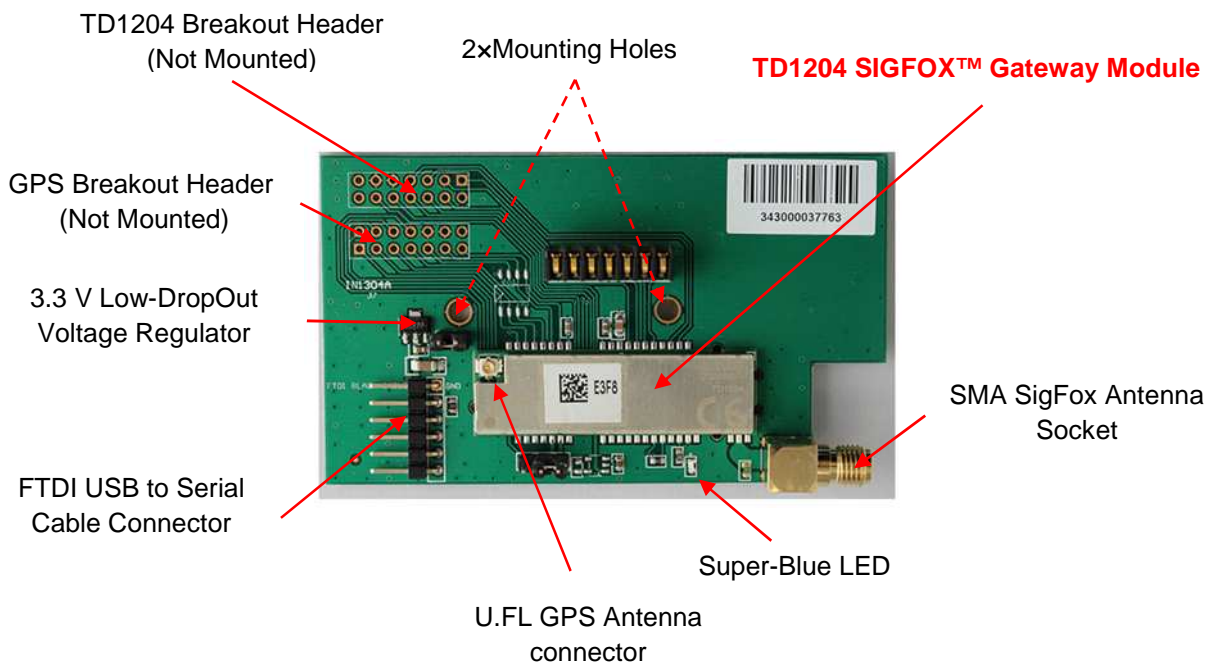


Figure 8- TD1204 EVB Top View

3.2 Block Diagram

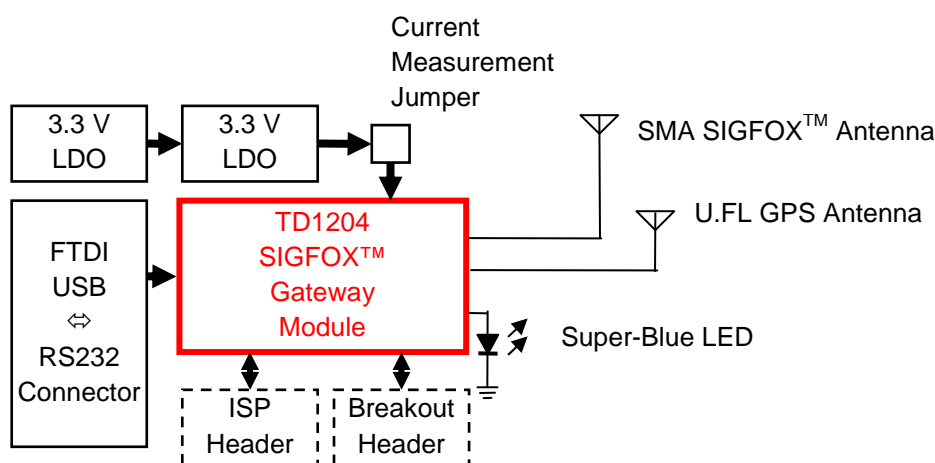


Figure 9- TD1204 EVB Block Diagram

3.3 Hardware Description

3.3.1 FTDI USB to Serial Cable Connector

The TD1204 EVB evaluation board is equipped with a 1×6 0.1" pitch R/A header compatible with FTDI's TTL-232R-3V3 TTL to USB Serial Converter cable. One such cable is included within the TD1204 EVB.

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 has no orientation key, so there is a chance that it can be plugged in the wrong way. The cable crimps should be visible on the upper side of the black Molex connector, see Figure 2- FTDI Cable Connection.

The TD1204 EVB board is protected against accidental cable reverse connections by series current-limiting resistors on RXD and CTS signals.

3.3.2 3.3 V Low Drop Out Voltage Regulator

The TD1204 EVB board contains a 3.3 V low drop out voltage regulator with proper decoupling for delivering power supply to the TD1204 module.

This voltage regulator is sufficient for powering the TD1204 module itself, but it is not suitable for powering other high power loads that may be connected to it.

3.3.3 Current Measurement Jumper

A convenient jumper (labeled "**JMP**") is present on the TD1204 EVB board that enables current measurement by replacing it with a micro-ammeter.

This jumper can also be used to isolate the TD1204 module from the output of the 3.3V LDO voltage regulator, thus allowing the module to be powered by a separate 2.3 V to 3.3 V external power supply connected to either the ISP or breakout headers.

3.3.4 TD1204 SIGFOX™ Gateway Module

Telecom Design's TD1204 devices are high performance, low current SIGFOX™ gateways. 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.

TD1204 EVB

The TD1204 device offers an outstanding RF sensitivity of -126 dBm while providing an exceptional output power of up to $+14$ dBm with unmatched TX efficiency.

The TD1204 device versatility provides the gateway function from a local Narrow Band ISM network to the long-distance Ultra Narrow Band SIGFOX™ network at no additional cost.

The broad range of analog and digital interfaces available in the TD1204 module allows any application to interconnect easily to the SIGFOX™ network.

The LVTTL low-energy UART, the I2C 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 TD1204 SIGFOX™ Gateway module, please refer to the “*TD1204 Datasheet*” or to the “*TD1204 Reference Manual*” documents.

3.3.5 Super-Blue LED

An SMT Super-Blue LED is connected to the TIM2 pin of the TD1204 SIGFOX™ Gateway module through a series current-limiting resistor.

At module reset, this LED is driven by the TD1204 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 TD1204 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.

3.3.6 SMA SigFox Antenna Connector

The TD1204 EVB board features a common right-angle SMA socket to easily connect a $50\ \Omega$ impedance matched antenna or cable.

An appropriate $50\ \Omega$ / 20 cm swivel antenna is provided with the TD1204 EVB. Other devices, such as test / measurement equipments can also be connected to this socket using the correct RF cables.

The antenna connector is protected against ESD (Electro-Static Discharge) hazards by a small SMT RF-class ESD protection device placed closed to the socket base with a good discharge evacuation path to ground.

3.3.7 U.FL GPS Antenna Connector

The TD1204 features a U.FL socket to easily connect a $50\ \Omega$ impedance matched GPS antenna or cable. An appropriate active GPS antenna is provided with the TD1204 EVB.

3.3.8 ISP Header

The TD1204 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) interface, and consisting in:

- 3.3 V power supply and ground
- 2-wire UART RXD/TXD signals
- RESET input signal
- 2-wire ARM® SWD (Single Wire Debug) DB3 (SWDCLK) and DB2 (SWDIO) signals

The connector pinout is given in the following figure and table:

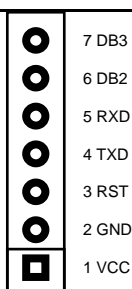


Figure 10- ISP Header Pin-out

Pin	Pin Name	I/O	Description
1	VCC	VCC	+2.3 to +3.3 V Supply Voltage Input The recommended VCC supply voltage is +3.0V.
2	GND	GND	Connect to PCB ground
3	RST	I	Active Low RESET input signal This signal resets the TD1204 module to its initial state. If not used, this signal can be left floating, as it is internally pulled up by an integrated resistor.
4	TXD	O	Low-Power UART Data Transmit Signal This signal provides the UART data going from the TD1204 module out to the host application processor. This signal is internally pulled up by an integrated resistor.
5	RXD	I	Low-Power UART Data Receive Signal This signal provides the UART data coming from the host application processor going to the TD1204 module. This signal is internally pulled up by an integrated resistor.
6	DB2	I/O	SWDIO (SWD Data I/O) Signal This signal provides the SWD programming/debugging signal interface to the integrated TD1204 ARM® CPU. This pin may be configured to perform various functions.
7	DB3	I	SWDCLK (SWD Clock) Signal This signal provides the SWD clock signal to the integrated TD1204 ARM® CPU. This pin may be configured to perform various functions.

Table 1: ISP Header Pinout

Note: Pin 1 is outlined on the TD1204 EVB PCB top silkscreen J2 footprint as a square mark.

3.3.9 Breakout Header

The TD1204 EVB board features a 2×7 0.1" pitch header (not mounted) that provides access to all the available TD1204 module interface pins, and consisting in:

- 2 × 3.3 V power supply and ground
- 2 × I²C bus SDA and SCL signals
- 1 × timer input capture / output compare pins
- 1 × RESET input signal
- 1 × ADC analog input signals
- 1 × DAC analog output signal
- 5 × GPIO digital signals
- 1 × Reserved signal

TD1204 EVB

The TD1204 connector pin-out is given in the following figure and table:

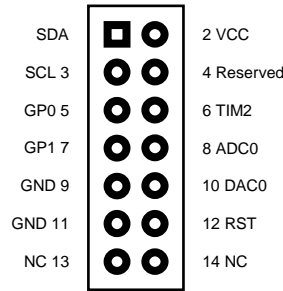


Figure 11- TD1204 Break-out Header Pin-out

Pin	Pin Name	I/O	Description
1	SDA	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions, including the I ² C DATA (SDA) function.
2	VCC	PWR	Connected to 3.3 V power supply line
3	SCL	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions, including the I ² C clock (SCL) function.
4	Reserved	I/O	Reserved pin – Do not connect
5	GP0	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions.
6	TIM2	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions, including the timer input capture / output compare #2 function.
7	GP1	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions.
8	ADC0	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions, including the ADC analog input #0 function.
9	GND	GND	Connected to PCB ground
10	DAC0	I/O	General Purpose Low-Power Digital I/O This pin may be configured to perform various functions, including the DAC analog output #0 function.
11	GND	GND	Connected to PCB ground
12	RST	I	Active Low RESET input signal This signal resets the TD1204 module to its initial state. If not used, this signal can be left floating, as it is internally pulled up by an integrated resistor.
13	NC	I/O	Not connected
14	NC	I/O	Not connected

Table 2: TD1204 Pin-out Description

The GPS connector pin-out is given in the following figure and table:

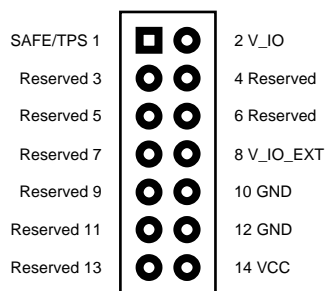


Figure 12- GPS Break-out Header Pin-out

Pin	Pin Name	I/O	Description
1	SAFE/TPS	O	Timepulse This pin can provide accurate clock pulses with configurable duration and frequency from the GPS.
2	V_IO	O	GPS IO supply Voltage This pin provides a 3.3V power output which is used to power the GPS IO including an external active antenna if used.
3	Reserved	I/O	Reserved pin – Do not connect
4	Reserved	I/O	Reserved pin – Do not connect
5	Reserved	I/O	Reserved pin – Do not connect
6	Reserved	I/O	Reserved pin – Do not connect
7	Reserved	I/O	Reserved pin – Do not connect
8	V_IO_EXT	I	External Supply Voltage GPS IO alternative external supply voltage. Connect to a 1.65V to 3.6V power supply if needed. This power supplied should be provided instead of V_IO in case an external flash which cannot handle a 3.3V supply voltage is used.
9	Reserved	I/O	Reserved pin – Do not connect
10	GND	GND	Connected to PCB ground
11	Reserved	I/O	Reserved pin – Do not connect
12	GND	GND	Connected to PCB ground
13	Reserved	I/O	Reserved pin – Do not connect
14	VCC	PWR	Connected to 3.3 V power supply line

Table 3: Breakout Header Pin-out

4 TD1204 EVB Schematics

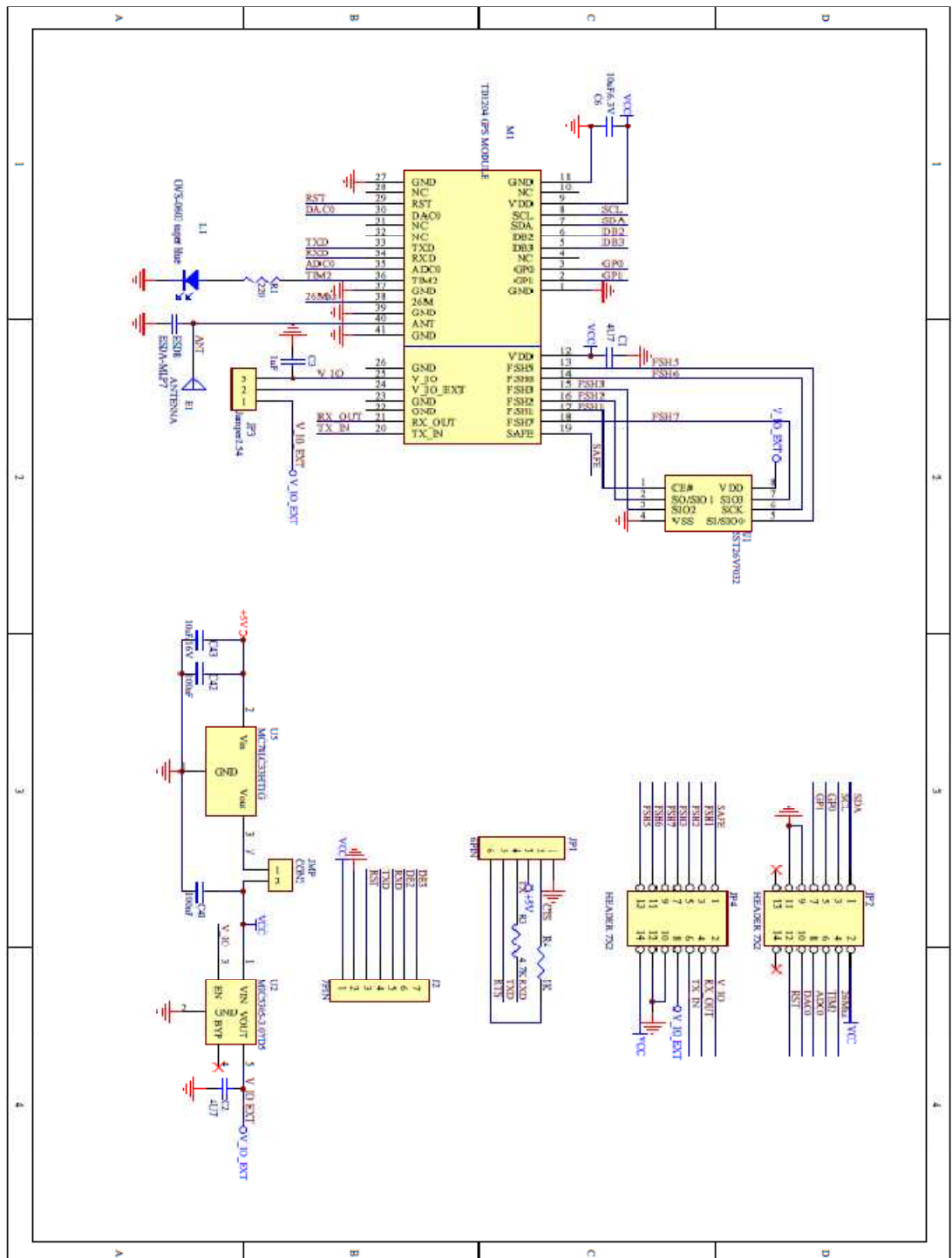


Figure 13- TD1204 EVB Schematic

DOCUMENT CHANGE LIST

Revision 1.0

- First Release

Revision 1.1

- Changed contact information

TD1204 EVB

NOTES:

NOTES:

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