UM0742
User manual

STM8T141-EVAL evaluation kit

Introduction

The STM8T141-EVAL is an evaluation kit which introduces developers to STMicroelectronics STM8T141 touch and proximity capacitive sensor.

It contains an STM8T141 evaluation board, the MB858, plus a set of preconfigured plug-in modules which can evaluate STM8T141 device performances in either touch or proximity detection (depending on the module which has been plugged in).

The evaluation kit features are the following:

- Touch detection with on-board PCB sensing electrode and 1.5 mm dielectric panel
- Easy dielectric adjustment by stacking acrylic panels
- Proximity detection with on-board PCB sensing electrode or plug-in antenna
- Standalone power configuration using an on-board battery
- External power supply through USB interface
- Electrode grounding or shielding configured by jumper

Table 1. STM8T141 main features

Features	STM8T141
Sensing channel	1
Proximity detection range	A few cm
Outputs	1 (Touch or Proximity)
Sampling capacitor	External
Active shield	Yes
V_{DD}	2.0 to 5.5 V
I_{DD} in Normal power mode (typ)	30 µA
I_{DD} in Low power mode	11 µA
Packages	SO8 narrow or UFDFPN8 (2 x 3 mm)

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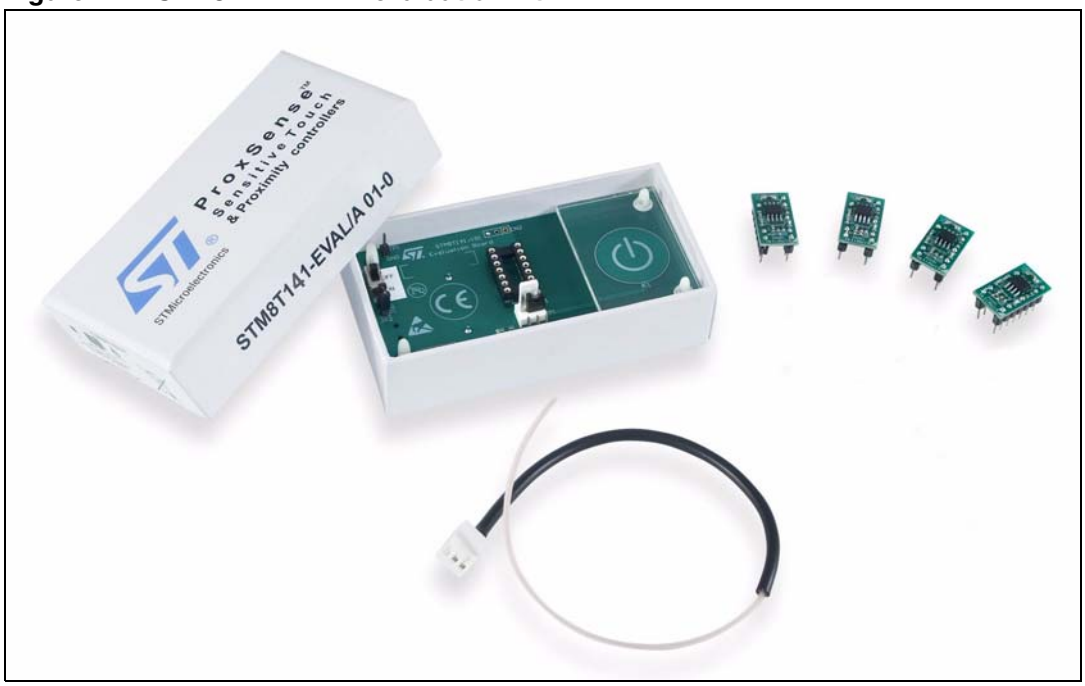
1 Description of the STM8T141-EVAL kit

The STM8T141-EVAL kit (see *Figure 1*) includes:

- 1 STM8T141 evaluation board (MB858)
- 4 STM8T141 preconfigured plug-in modules (MB856)
- 1 antenna shielding cable
- 1 additional 3 mm acrylic panel

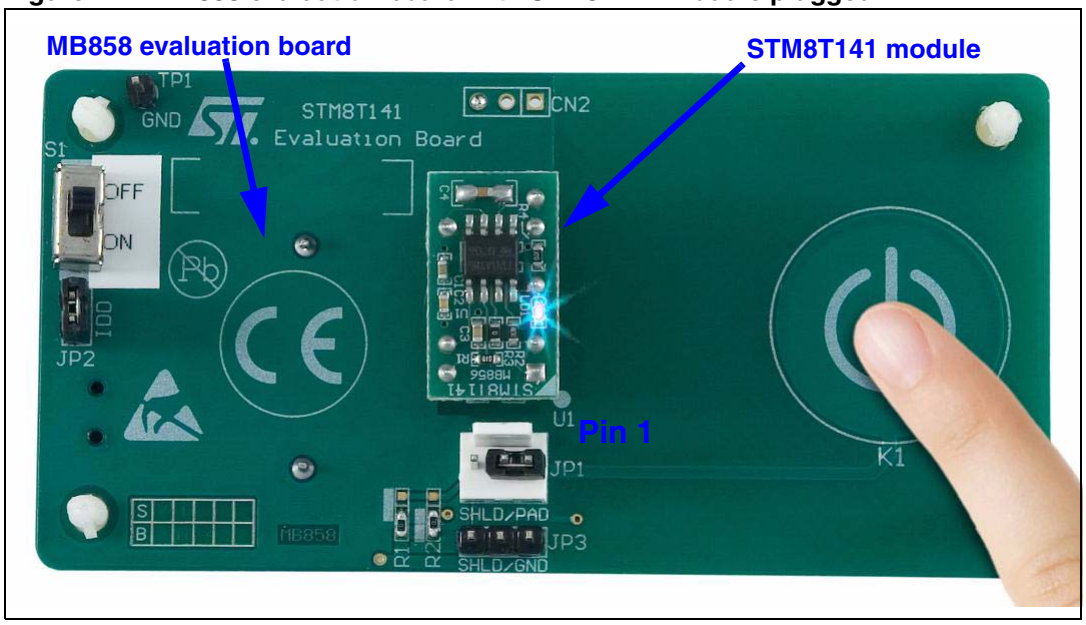
Figure 1. STM8T141-EVAL evaluation kit



1.1 MB858 evaluation board

Figure 2 shows the MB858 evaluation board, while *Figure 3* and *Figure 4* show the board top and bottom layout.

Figure 2. MB858 evaluation board with STM8T141 module plugged-in



1. This photo is not contractual.
2. Pin 1 identifies the first pin of the module (refer to *Table 4*).

Figure 3. MB858 evaluation board top layout

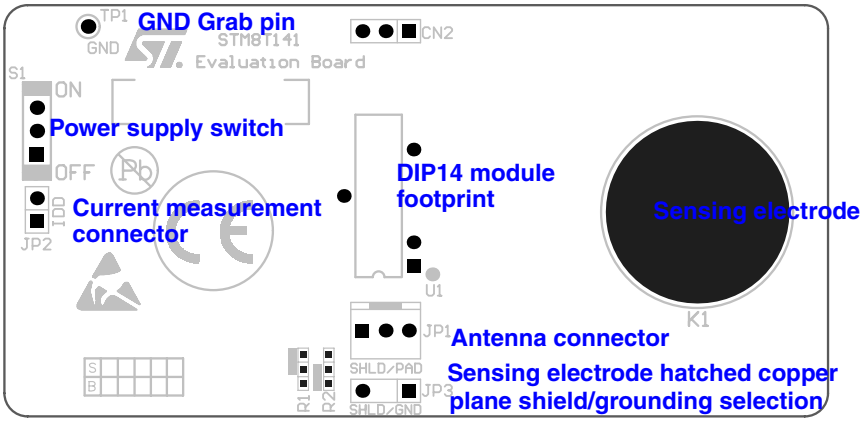
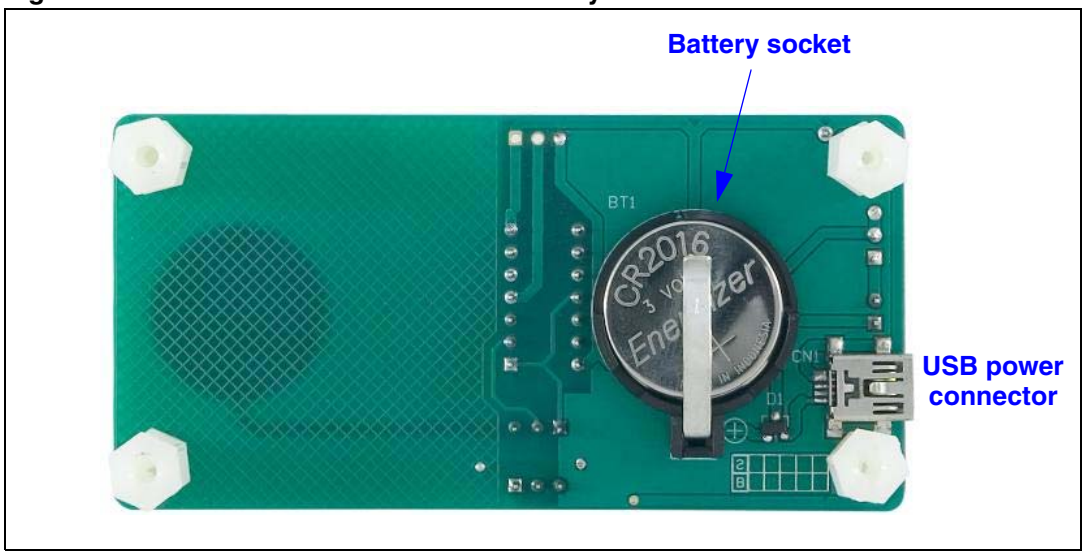


Figure 4. MB858 evaluation board bottom layout



1.1.1 Module socket

The MB858 evaluation board features an SDIP14 socket to connect the STM8T141 module (see *Figure 3*).

1.1.2 Power supply

The evaluation board can be powered by two different sources:

- A 6 V DC battery supply unit composed of two 3 V CR2016 batteries.
- A 5 V DC power supply delivered by the J1 USB connector (cable not provided) (see *Figure 4*).

A dual-anode protection diode (D1) prevents power supply current injection.

I_{DD} current can be monitored by connecting an ammeter to JP2 connector (see *Figure 3*).

Caution: Switch S1 power switch off to preserve batteries when the evaluation board is stored with a module plugged into it.

1.1.3 On-board sensing electrode

A copper sensing plate deposited on the PCB is used as a sensing electrode for touch and proximity detection *(refer to Figure 3)*.

1.1.4 Antenna connector

JP1 connector allows to connect an external antenna instead of the on-board sensing electrode.

1.1.5 Copper planes

Two copper planes (CP1, CP2) and one hatched copper plane (HCP) were laid out onto the PCB (see *Figure 5*).

Figure 5. MB858 evaluation board top copper plane

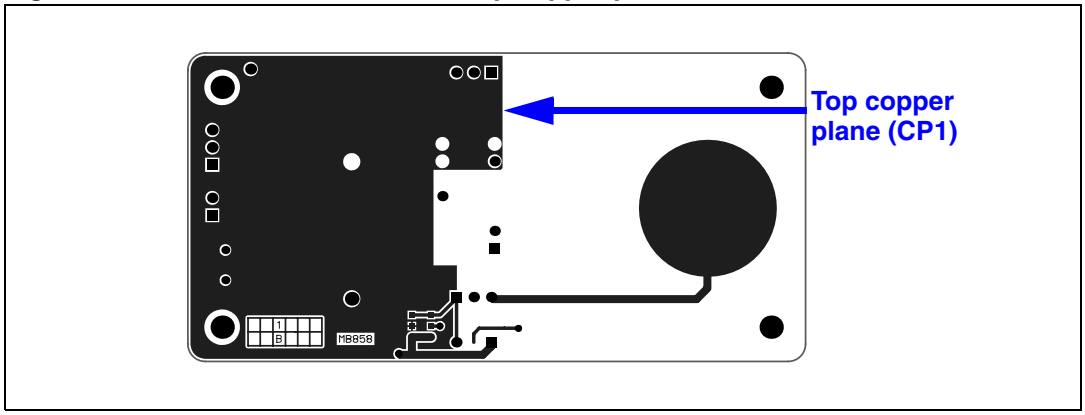
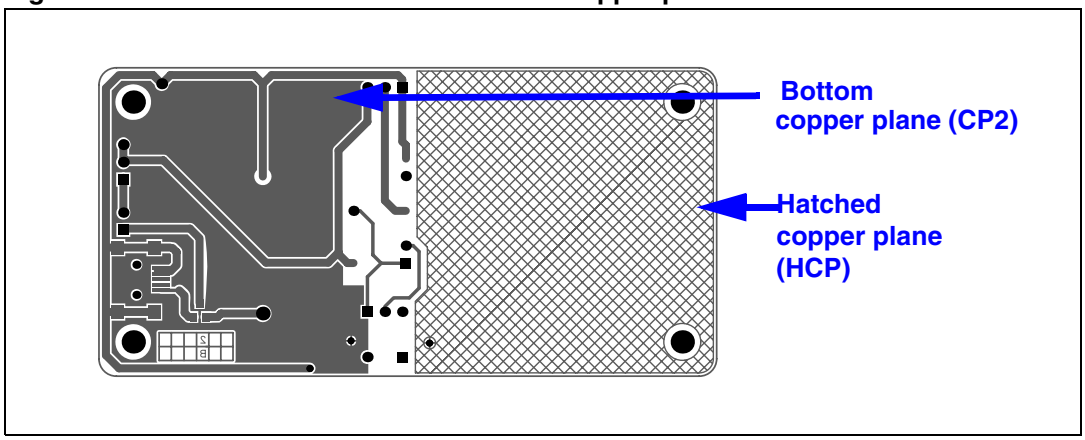


Figure 6. MB858 evaluation board bottom copper plane



1.2 STM8T141 plug-in modules

The STM8T141-EVAL includes a set of plug-in modules (see *Section 1.1*). They allow a quick and simple evaluation of the STM8T141 main features and performances for different option byte configurations:

- 3 modules configured in proximity mode / no marking
- 1 module configured in sensitive touch mode / white marking

The modules incorporate one LED. To allow quick identification of the module configuration (touch or proximity) when the demonstration is running, the following color codes are used:

- Blue LED corresponds to the proximity configuration
- Red LED corresponds to the touch configuration

Refer to *Section 5* for information on programming tools.

The STM8T141 plug-in module PCB is green.

The STM8T141 touch/proximity output (TOUT/POUT) is connected to an LED which is turned on when a touch or proximity detection occurs. The LED color depends on the STM8T141 module configuration (refer to *Table 2* and *Figure 7*). Refer to *Table 4* for the description of STM8T141 module pins.

Table 2. STM8T141 configuration color coding and marking

PCB color	Module configuration	PCB marking	LED color
Green	Proximity detection	No marking	Blue
	Sensitive Touch detection	White dot ink marking	Red

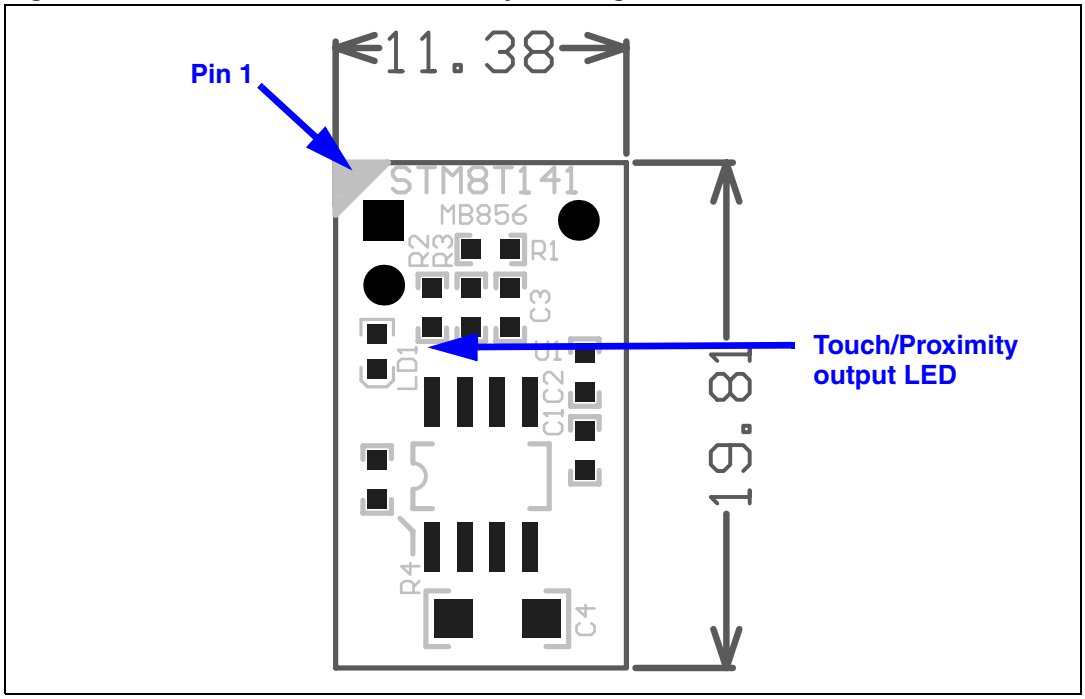
Table 3. Option bytes

Mode	Sensitive touch description	Standard proximity description
Power mode	Low power mode with zoom	Low power mode with zoom
Sensitivity threshold	Sensitive touch	Standard proximity
Recalibration timeout	15 seconds	15 seconds
TOUT/POUT output mode	Active	Active
Sampling conversion period	20 ms	20 ms
Charge transfer frequency	125 kHz	125 kHz

Table 4. STM8T141 module pin description

Pin number	Pin name	Description
1	SHOUT	Shield output
2	ELEC	Electrode
3	NC	Not connected
4	TOUT/POUT	Touch/Proximity output
5	NC	Not connected
6	CS	Capacitive sensing channel pin to external sampling capacitance C_S
7	VSS	Ground
8	NC	Not connected
9	CX	Capacitive sensing channel pin to R_X (C_X serial resistor)
10	NC	Not connected
11	NC	Not connected
12	NC	Not connected
13	VREG	Internal voltage regulator output
14	NC	Not connected

Figure 7. STM8T141 module assembly drawing



2 Getting started with the MB858 evaluation board

To run the board:

1. Place the board on a plane surface.
2. Plug a module in the board according to the device and configuration you intend to evaluate. Make sure that the module is correctly plugged into the socket.
3. Switch on the board.
4. Move your finger or hand close to the touch/proximity electrode:
   - The blue LED switches on to indicate a proximity detection.
   - The red LED switches on to indicate a touch detection.

Note: To improve sensitivity, connect the MB858 board to your PC through a USB cable. The board is then ground and powered through the USB interface.

2.1 Using the on-board sensing electrode

A 1.5 mm acrylic panel mounted on the MB858 is used as sensing electrode. To demonstrate the detection through various dielectric thicknesses, an additional 3 mm panel, included in the STM8T141-EVAL kit, can be stacked on as shown on *Figure 8*.

To use the on-board sensing electrode, a jumper must be installed on the JP1 connector as shown on *Figure 9.*

Figure 8. On-board sensing electrode

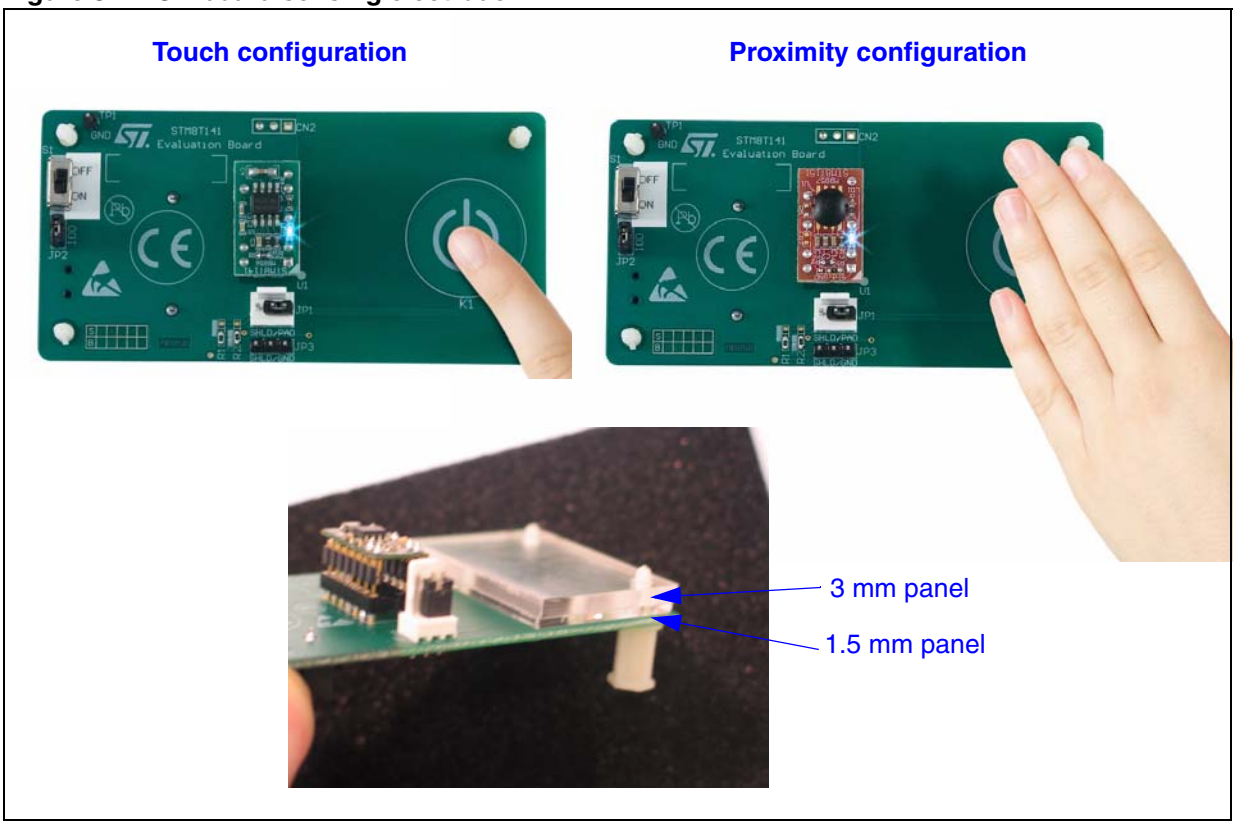
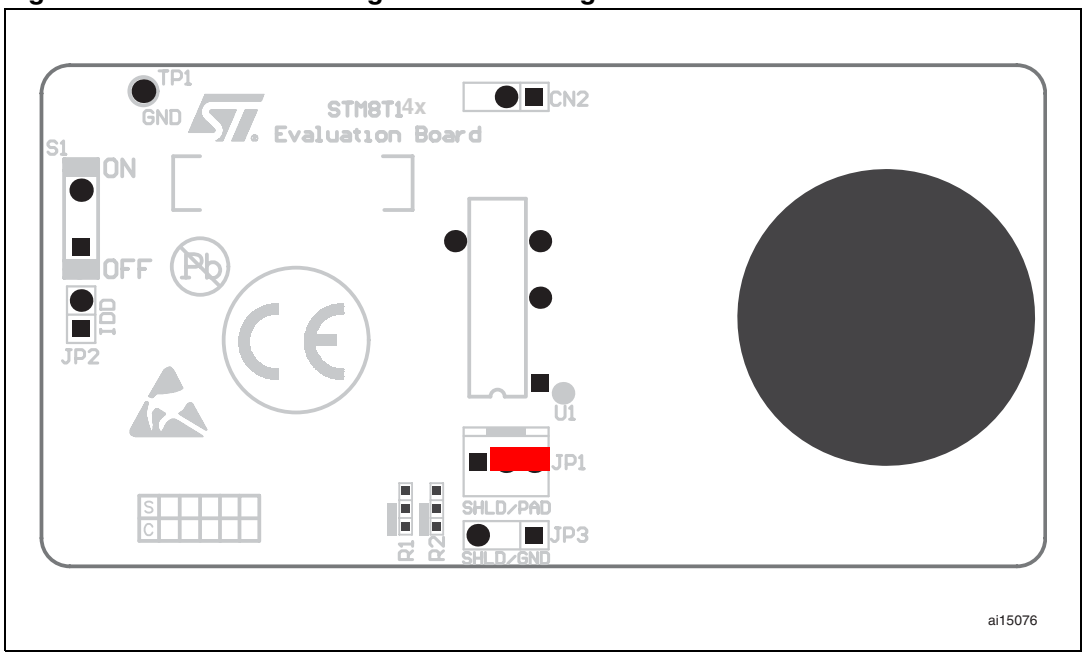


Figure 9. On-board sensing electrode configuration

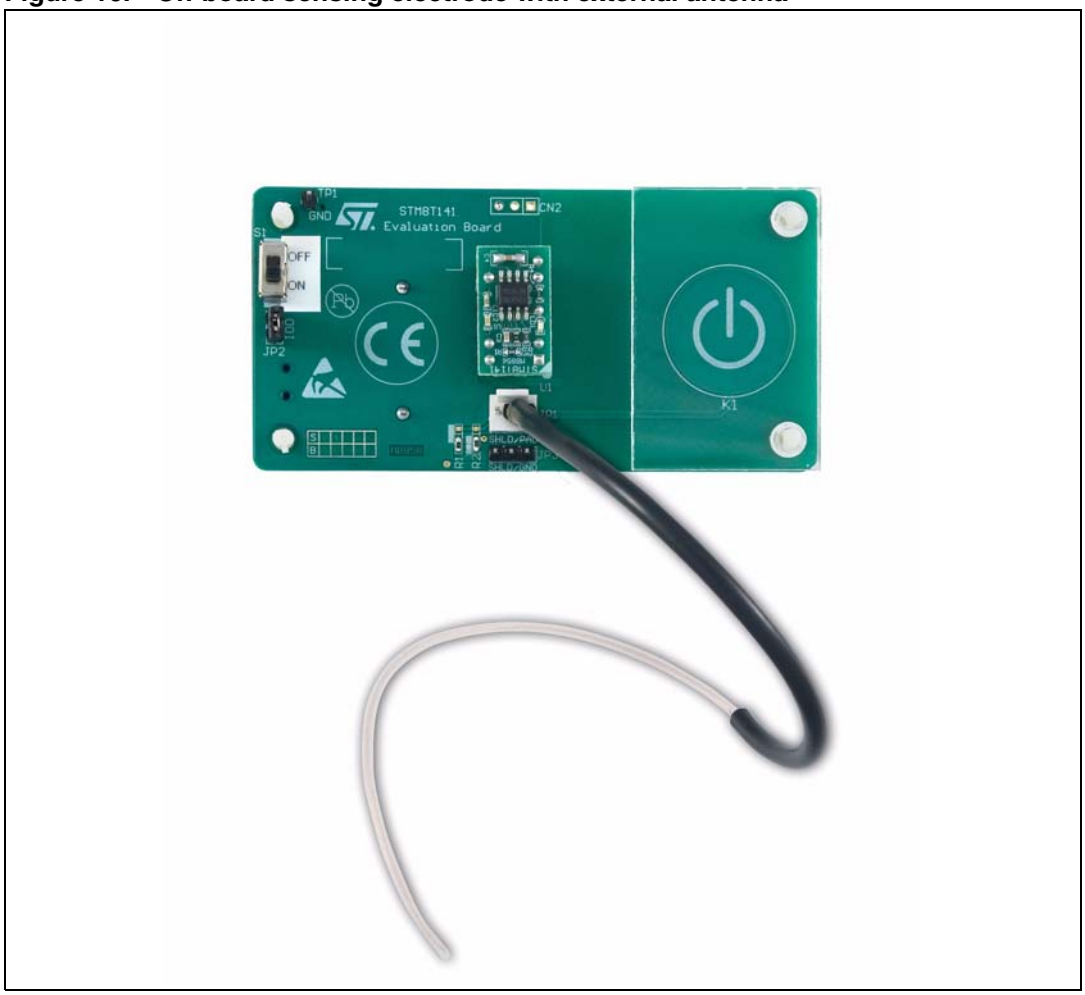


2.2 Installing an external shielded antenna

The on-board sensing electrode can be replaced by an external antenna. The user can use either the antenna provided with the kit, or any other sensing electrode.

To install an external antenna, remove the jumper on JP1, and plug in the antenna.

Figure 10. On-board sensing electrode with external antenna



Caution: Grabbing the external shield antenna might result in incorrect system behavior.

2.3 Shielding and grounding configuration

The MB858 evaluation board features 3 different independent copper planes (refer to *Section 1.1.5*). According to the environment and the application, the overall system performance and stability can be improved by connecting copper planes to ground or to the board shield (see *Figure 5.*).

CP1 and CP2 copper planes can be configured through R1 and R2 resistors, while HCP is configured through JP3 jumper. The board is delivered with R1 and R2 connected to ground, and JP3 to the shield.

Table 5 shows how to configure the board jumpers for each copper plane.

Table 5. Copper plane configuration

Copper plane	Description
CP1	Shield connection 
	Ground connection 
CP2	Shield connection 
	Ground connection 
HCP	Shield connection 
	Ground connection 

3 Performance

The touch and proximity sensing technology is highly dependent on the environment. The application behavior consequently varies when it is moved from a wooden to a metallic table. In addition, if the application is moved quickly from one place to another, the board may detect the environment change and consider it as a touch or proximity detection.

To avoid such behavior, turn off the board when you move it. This will force a recalibration.

Table 6 and *Table 7* show the MB858 evaluation board performance in typical operating conditions.

Table 6. STM8T141 board in standalone mode

Device	Configuration	Description	Performance
STM8T141	– Sensitive touch – Low power mode with zoom – Battery supply – JP3 connected to shield (SHLD)	Touch configuration using on-board electrode	Touch detection over 7.5 mm acrylic panel
	– Proximity – Low power mode with zoom – Battery supply – JP3 connected to shield (SHLD)	Proximity configuration using on-board electrode	Proximity detection in the range of 3 cm

Table 7. STM8T141 board powered through USB supply with earth connection

Device	Configuration	Description	Performance
STM8T141	– Proximity – Low power mode with zoom – USB supply – JP3 connected to shield (SHLD)	Proximity/touch configuration using on-board electrode	Proximity detection in the range of 5 cm
	– Proximity – Low power mode with zoom – USB supply	Proximity/touch configuration using external antenna	Proximity detection in the range of 12 cm

4 Troubleshooting

Table 8 provides the answers to the most common questions related to unexpected behavior or unspecified operating conditions.

Table 8. Troubleshooting

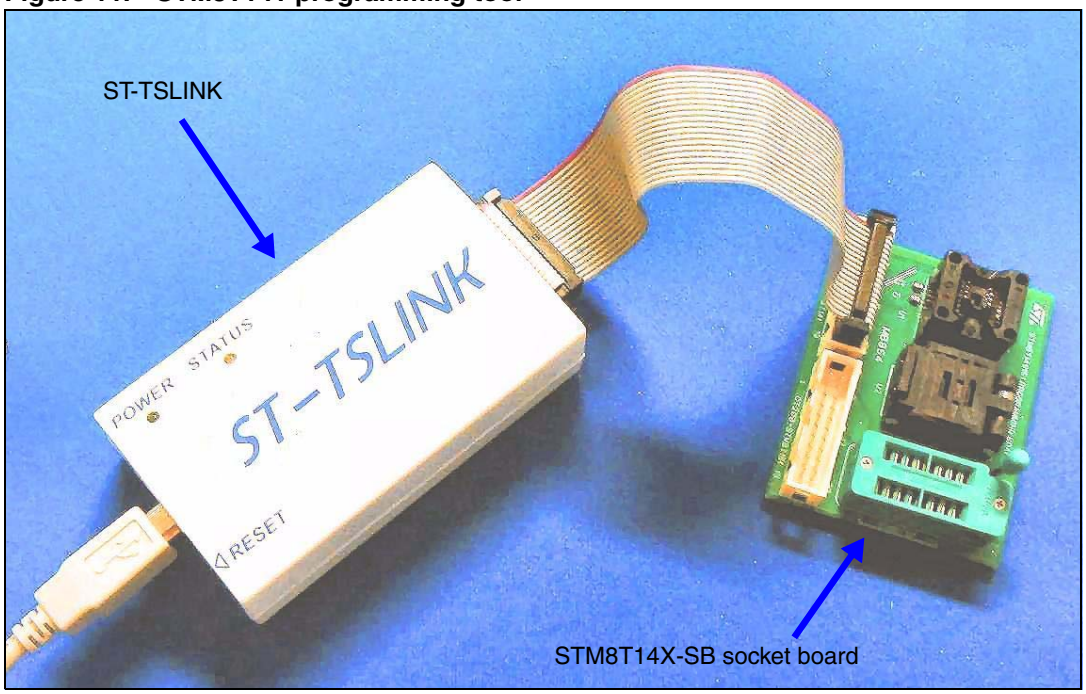
Problem	Probable cause	Remedy
The LED is switched on when holding or touching the board	No system protection preventing the user from touching the PCB.	Use a casing to protect the PCB
	Poor system grounding	Connect board ground to earth by connecting the USB cable to a HUB supplied with an earth outlet.
In proximity detection, the LED is switched on when moving the hand close to some PCB areas	Wrong shielding configuration	Use the shield output to protect the corresponding area from detection. A typical case is electrode back side detection: to cancel the detection, configure the electrode back side copper plane to shield by connecting JP3 to SHLD.
The LED is switched on when moving the board	The surrounding environment changes very quickly when moving the board. As a consequence, the earth reference changes. This can be interpreted as a detection.	Connect the ground of the board to earth by connecting the USB cable to a HUB supplied with an earth outlet.
The LED is permanently switched on after a detection occurs in proximity configuration	If the battery charge or quality is not adequate, the application supply may decrease upon a detection due to the current sunk into the LED when it is switched on. This changes the detection threshold and may lock the device on.	– Replace the battery with a new, fully charged one. – Use a higher grade battery with better current stability. – Use the USB power supply with the battery removed.

5 Programming tools

The capacitive sensing devices can be configured through option bytes. Refer to the STM8T141 datasheet for a detailed description of the option bytes.

The STM8T141 modules can be programmed using the ST-TSLINK programming dongle and STVP (Visual Programmer) and the STM8T14X-SB socket board (see *Figure 11* and refer to the STM8T14X-SB data brief). For more information on the STM8T141-EVAL programming tools, visit STMicroelectronics microcontroller support site at http://www.st.com/mcu.

Figure 11. STM8T141 programming tool



6 Ordering information

Table 9 gives the list of the order codes.

Table 9. Order codes(1)

Part number	Order codes	Description
STM8T141-EVAL	STM8T141-EVAL	STM8T141 evaluation kit (described in this user manual)
STM8T-MOD	STM8T141AM-MOD	Box containing 10 MB856 blank modules based on STM8T141AM61T (OTP device in SO8 package) (see *Figure 12*)(2)
ST-TSLINK	ST-TSLINK	Programming dongle for STM8T141 devices and STM8T14X-SB socket boards.
STM8T14X-SB	STM8T14X-SB	Socket board for STM8T141 devices.

1. The ST-TSLINK dongle and the STM8T14X-SB socket board are not part of the STM8T141-EVAL evaluation kit, and must consequently be ordered separately.
2. In addition to the STM8T141-EVAL evaluation kit, additional STM8T141 “blank” modules (STM8T141AM-MOD) can be ordered separately, with the device option bytes left unprogrammed.

Figure 12. STM8T141 blank module box

7 Schematics

This section shows the design schematics for the STM8T141-EVAL kit:

- MB858 evaluation board (see *Figure 13*)
- STM8T141 module (see *Figure 14*)

Figure 13. STM8T141 evaluation board (MB858)

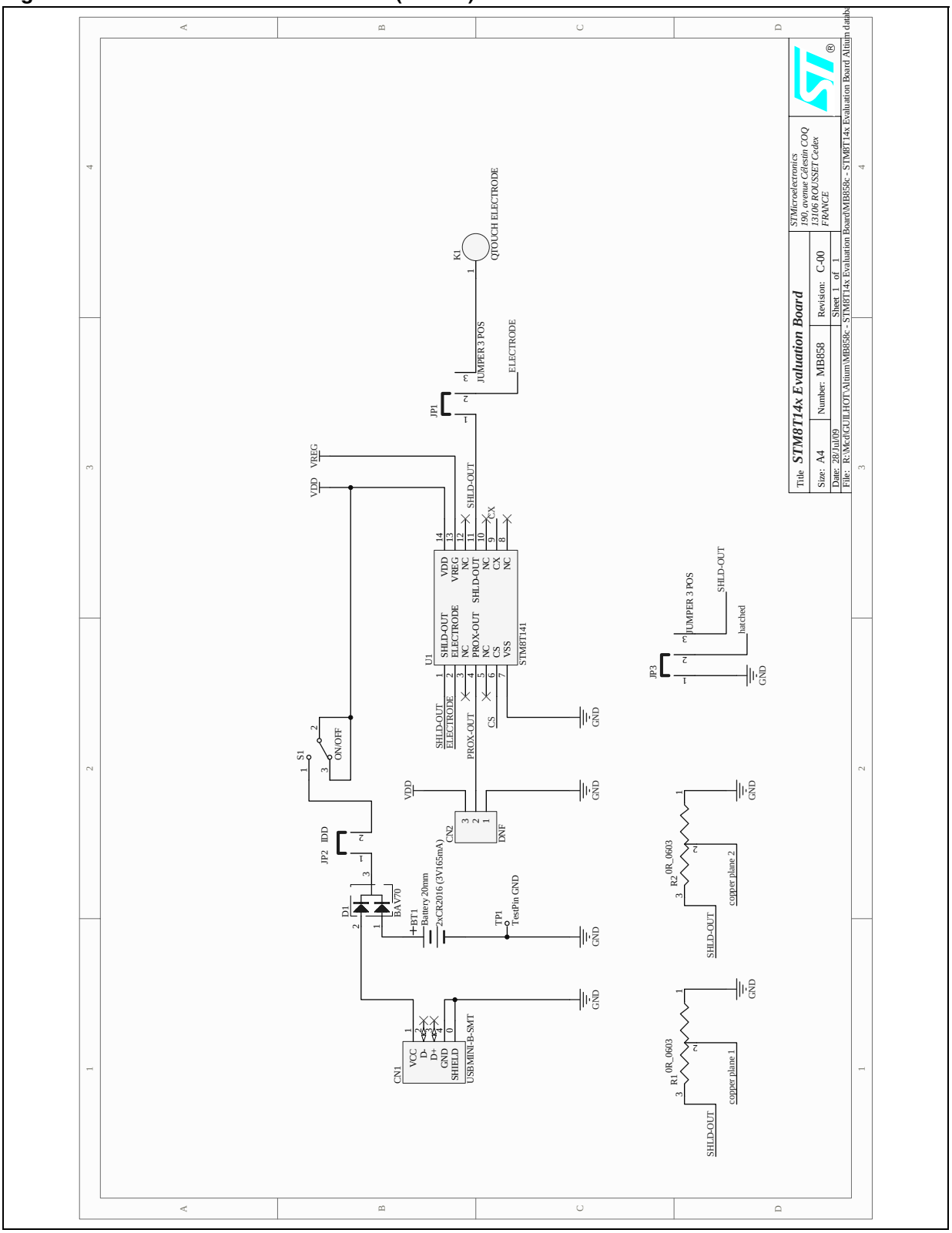
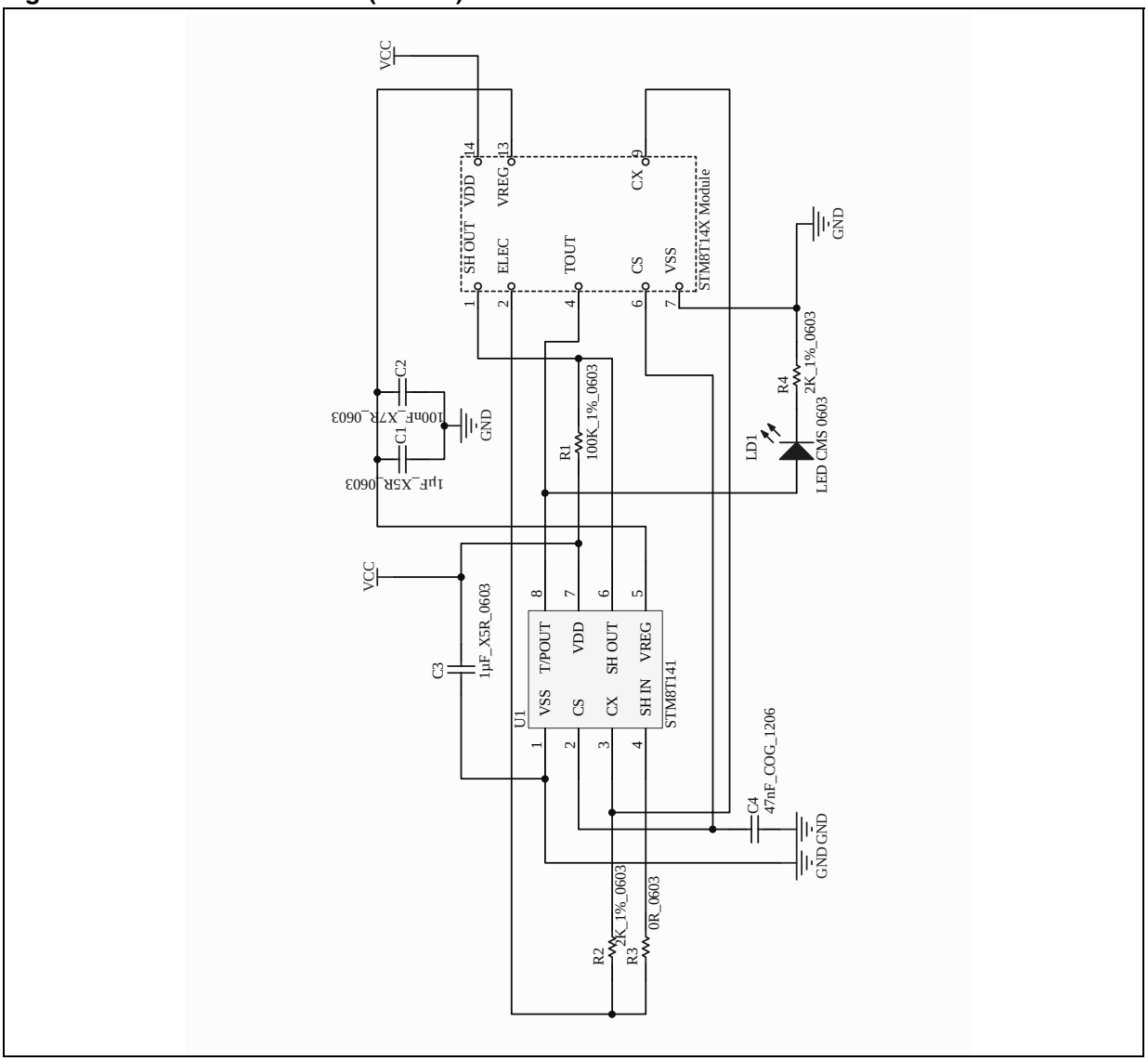


Figure 14. STM8T141 module (MB856)



8 Reference documents

- STM8T141 datasheet
- STM8T14X-SB data brief

9 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-Sep-2009	1	Initial release
20-Nov-2009	2	Minor modification to *Section 1.2*.
08-Feb-2010	3	*Table 8*: updated with an additional problem, cause and remedy.
15-Oct-2010	4	Changed STM8T14X-EVAL to STM8T141-EVAL. Modified V_{DD} voltage range in *Table 1.*

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