AN2726
Application note

Evaluation board user guidelines for the STw4102 single Li-Ion cell battery charger including gas gauge

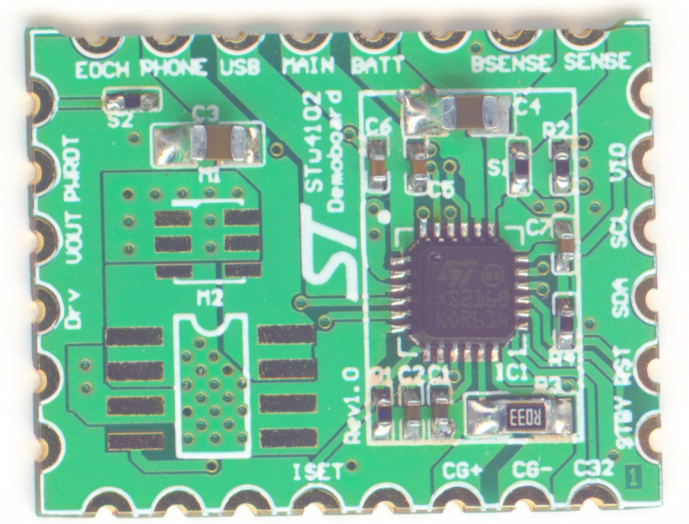
1 Introduction

This application note describes the STEVAL-ISB006V1, an evaluation board specifically designed for the STw4102 battery management integrated circuit.

This document provides:

- a brief description of the STw4102
- a description of the evaluation board
- a detailed bill of materials of the evaluation board
- the layout of the evaluation board.

Figure 1. STw4102 evaluation board



2 About the STw4102

The STw4102 is a standalone constant-current, constant-voltage (CCCV) linear charger dedicated to Li-Ion batteries. The device has a dual charging capability that uses the main input adaptor (wall or car adapter) or a USB cable with no external component.

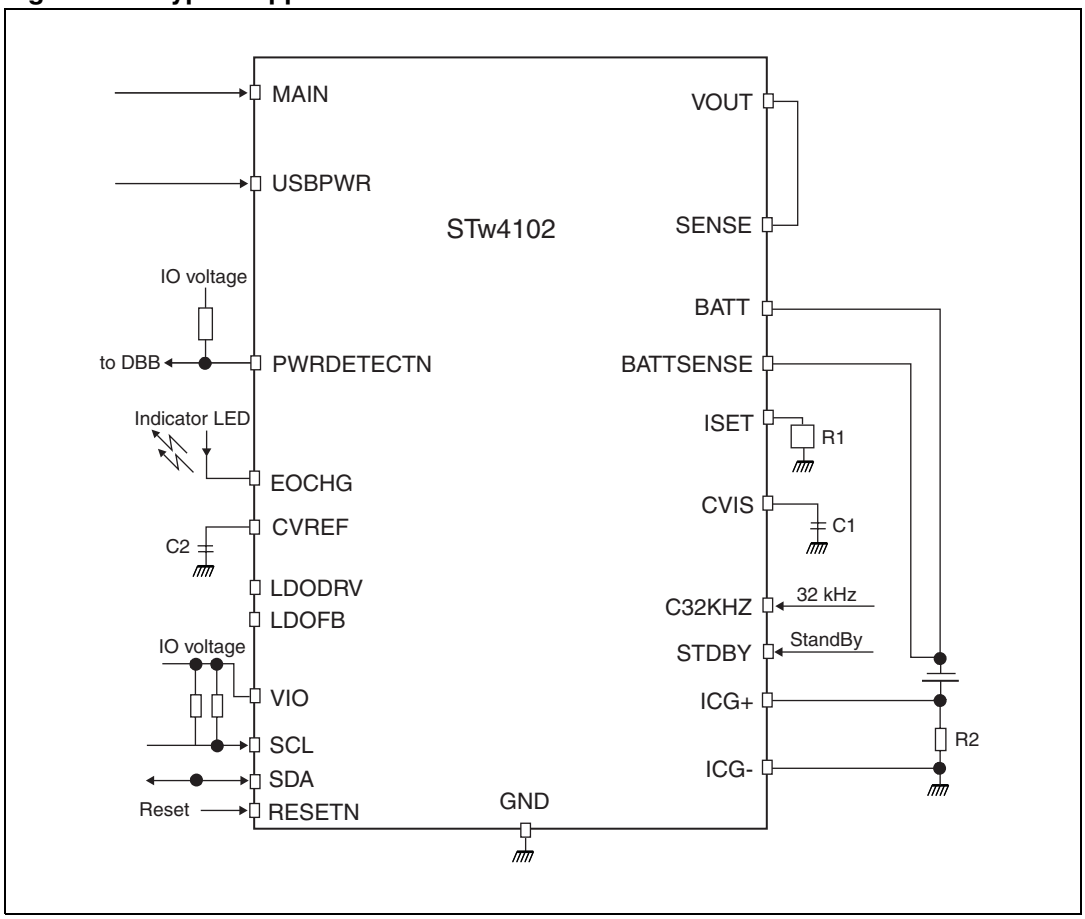
The STw4102 offers a programmable fast-charge current using an external resistor. The thermal regulation circuitry limits the charge current so that the die junction temperature never exceeds the maximum specified value. An end-of-charge output pin indicates the charge termination when the fast charge current drops below 10% of the programmed current value.The STw4102 contains an accurate gas-gauge based on a 13-bit AD converter. An external resistor is used between the battery and ground pin to sense a charge/discharge current. With a typical 30 mΩ resistor, the current can be up to 2.5 A and the 24-bit accumulator system provides a capacity of up to 914 mA.h.

The STw4102 has the following key features.

- Constant-current constant-voltage (CCCV) linear charger.
- Common or separate USB/wall adapter inputs.
- Fast-charge current control up to 1 A for wall adapters and up to 500 mA for USB.
- Support for currents higher than 1 A using external components.
- Programmable charge voltage (4.1 V, 4.2 V, 4.3 V, 4.35 V) with 1% accuracy.
- Thermal regulation.
- Trickle-charge mode at low battery voltage.
- Wall adapter voltage up to 13 V.
- Battery over-voltage protection at 4.7 V.
- Gas gauge with 13-bit AD converter.
- Battery voltage monitor with 7- to 12-bit AD converter.
- I²C interface for device monitoring and control.
- Charge status output pin.
- Power detection output pin.
- Programmable watchdog security timer.
- 4.7 V LDO regulator (with external power MOSFET).

Figure 2 describes the application schematics, with the typical connections and peripheral components surrounding the charger IC.

Figure 2. Typical application for the STw4102



Refer to the datasheet for more detailed information on the STw4102.

3 Description of the demonstration board

The STEVAL-ISB006V1 is a demonstration board designed to help you evaluate the performances of the STw4102.

This section explains how to evaluate the battery charger and the current gauge in a typical application configuration.

Figure 3. Demonstration board schematic diagram

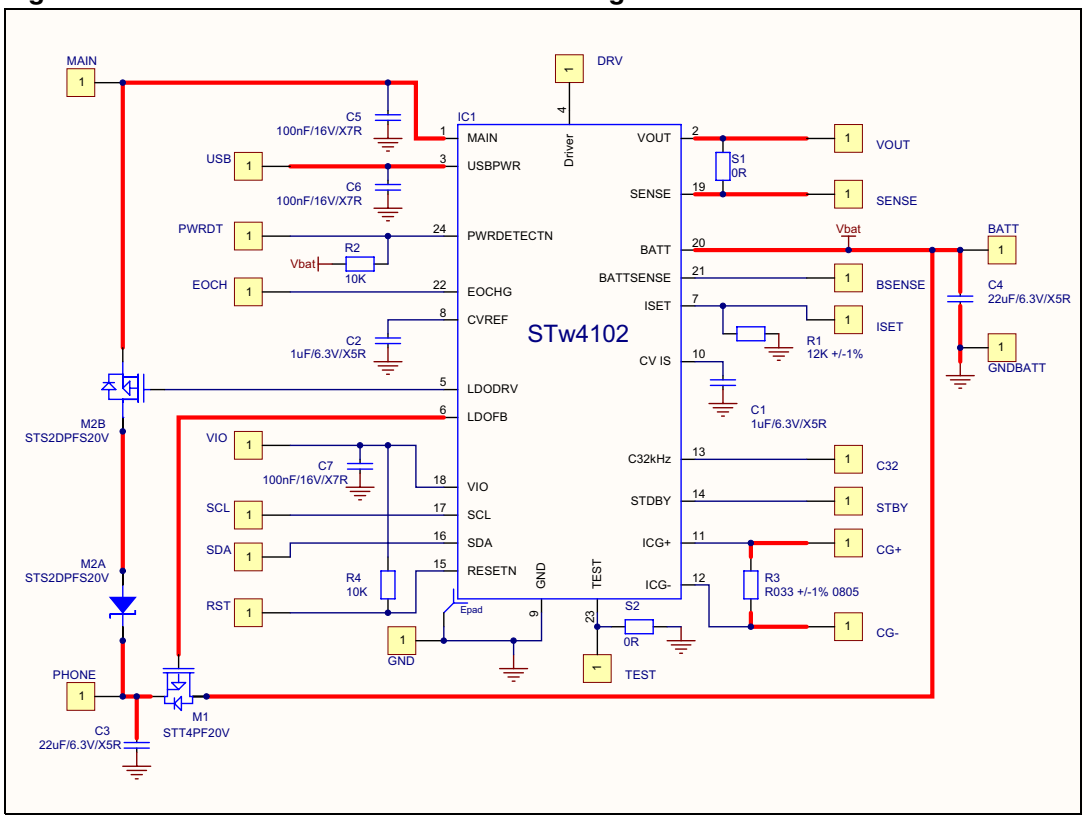


Table 1. Evaluation board bill of materials

Component	Part type	Footprint	Description	Manufacturer	Reference
IC1	STw4102	QFN24	Dual-source Li-Ion charger with gas gauge	STMicroelectronics	STw4102
C1	1µF/6.3V/X5R	0402	Internal supply decoupling capacitor	Taiyo Yuden	JMK105BJ105KV
C2	1µF/6.3V/X5R	0402	Voltage reference decoupling capacitor	Taiyo Yuden	JMK105BJ105KV
C3	22µF/6.3V/X5R	0805	Phone supply decoupling capacitor	Taiyo Yuden	JMK212BJ226KG
C4	22µF/6.3V/X5R	0805	Battery decoupling capacitor	Taiyo Yuden	JMK212BJ226KG
C5	100nF/16V/X7R	0402	Main supply decoupling capacitor	Taiyo Yuden	EMK105BJ104KV
C6	100nF/16V/X7R	0402	USB supply decoupling capacitor	Taiyo Yuden	EMK105BJ104KV
C7	100nF/16V/X7R	0402	Digital supply decoupling capacitor	Taiyo Yuden	EMK105BJ104KV
M1	STT4PF20V	SOT23-6	External LDO P-Mosfet	STMicroelectronics	STT4PF20V
M2	STS2DPFS20V	SO8	External LDO P-Mosfet and Schottky diode	STMicroelectronics	STS2DPFS20V
R1	12K ±1%	0402	Rset resistor for fast charge current setting		
R2	10K ±1%	0402	PWRDETECTN pull-up resistor		
R3	R033 ±1%	0805	Gas gauge shunt resistor	Phycomp	235051117330
R4	10K ±1%	0402	RESETN pull-up resistor		
S1	0R	0402	Strap		
S2	0R	0402	Strap		

Note: The M1 and M2 components (two external P-Mosfets plus a Schottky diode) are not mounted on the standard configuration of the demoboard. They can be added at a later stage to test the external LDO feature.

4 Evaluation board layout

The evaluation board's printed circuit board has the following characteristics.

- Board dimensions: 22.7 mm x 17 mm.

STw4102 and peripheral components PCB area: 12.4 mm x 7.5 mm (0.93 cm^2 or 0.14 $inch^2$):

- 4-layer PCB, FR4 material
- PCB thickness: 0.8 mm, copper thickness: 18 µm

These standards are similar to the ones used by portable equipment manufacturers.

Figure 4. Demonstration board (top view)

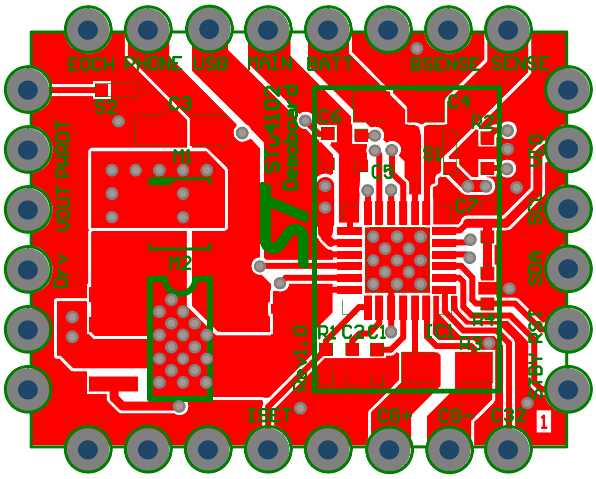


Figure 5. Demonstration board (bottom view)

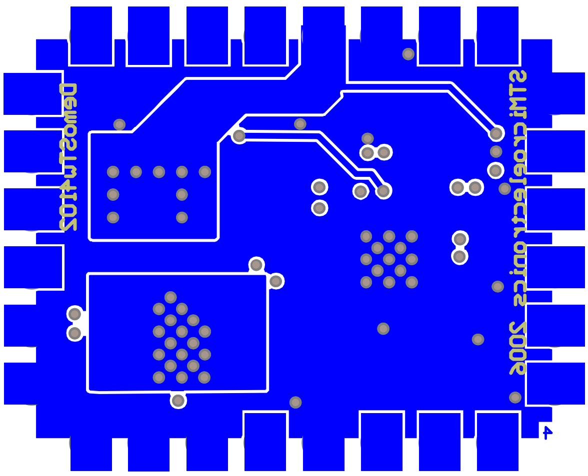


Figure 6. Internal layers of the demonstration board

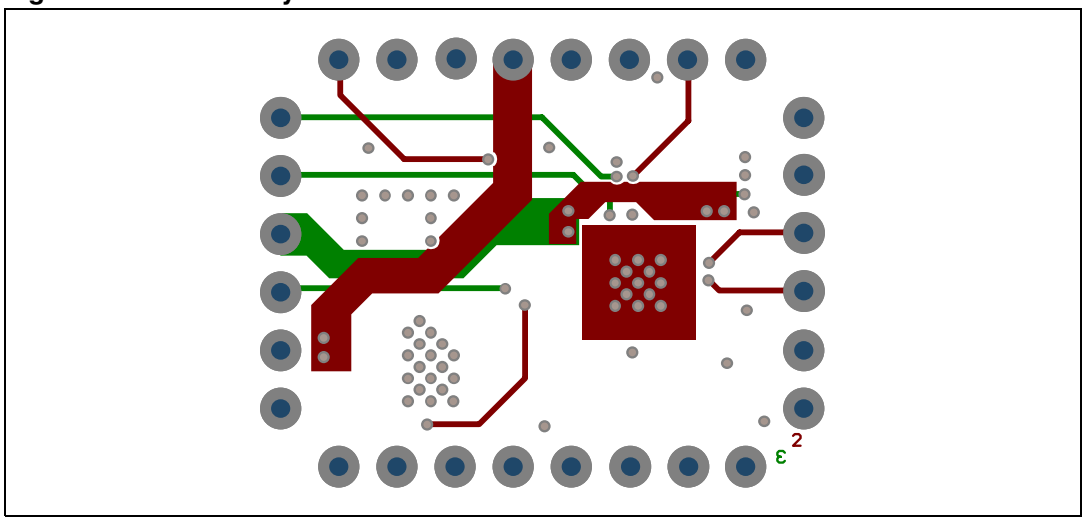


Figure 7. Single-connector application typical schematic

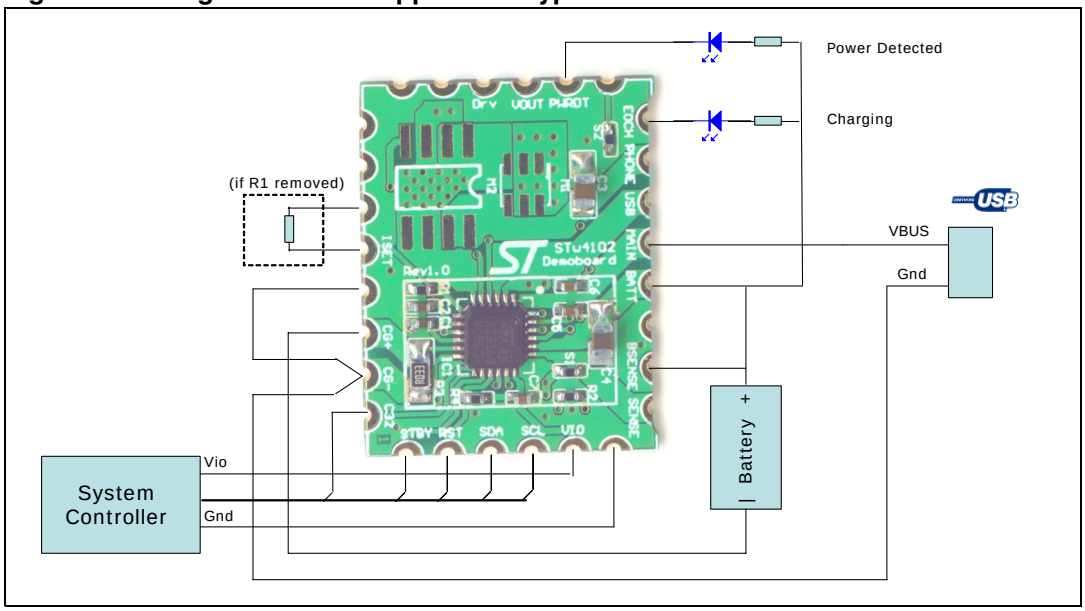
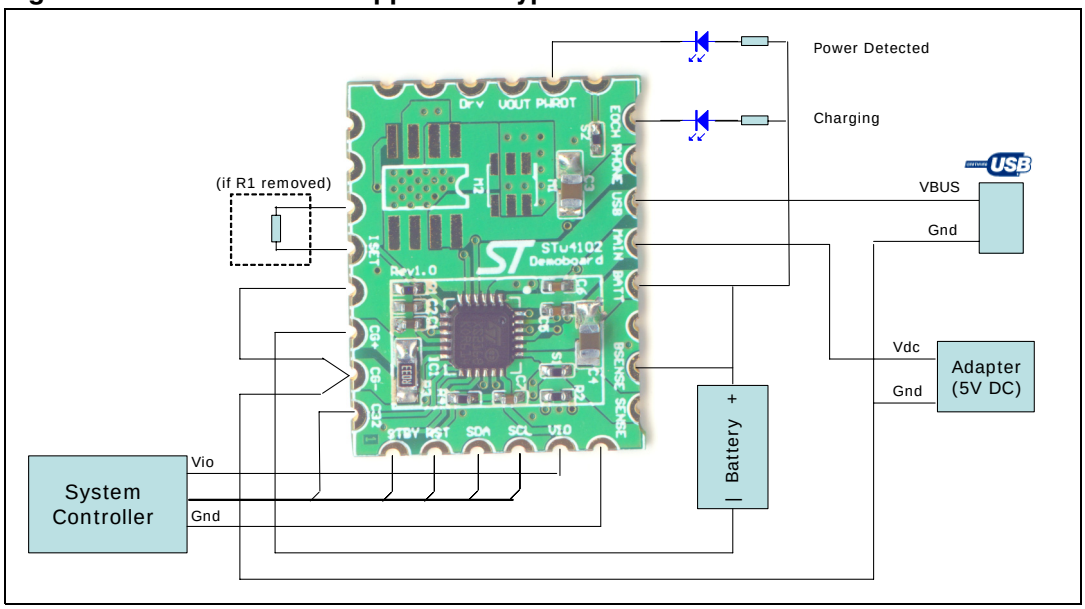


Figure 8. Dual-connector application typical schematic



5 Revision history

Table 2. Document revision history

Date	Revision	Changes
10-Jul-2008	1	Initial release.