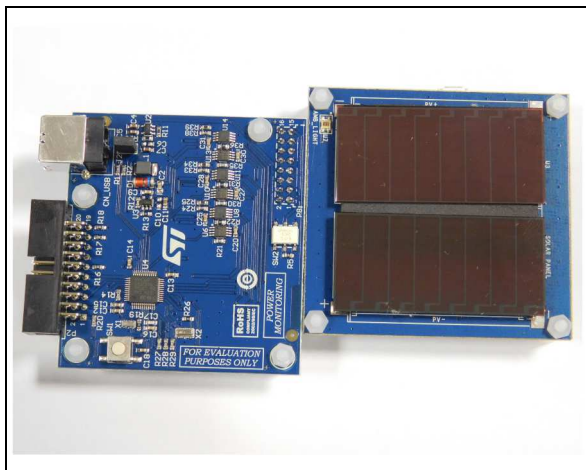


## Energy harvesting demonstration kit based on SPV1050

Data brief



### Features

- SPV1050 based harvesting dongle board
- PV module soldered on the back
- Lithium coin cell battery
- PV module electrical characteristics at 200 lux:
  - $V_{OC\_TYP} = 9.8\text{ V}$ ,  $I_{SC\_TYP} = 20\text{ }\mu\text{A}$
  - $V_{MP\_TYP} = 8\text{ V}$ ,  $I_{MP\_TYP} = 18\text{ }\mu\text{A}$
- Li-Ion battery:
  - $Capacity_{NOM} = 120\text{ mAh}$
  - $V_{NOMINAL} = 3.6\text{ V}$
  - $V_{CHARGE} = 4.2\text{ V}$
  - $V_{END-OF-DISCHARGE} = 2.75\text{ V}$
- Interface to power monitoring board
- PV module voltage and battery monitoring
- Ambient light sensor for irradiance level measurement
- Supported by SW GUI to show MPPT accuracy and conversion efficiency

### Description

The STEVAL-ISV021V1 is a demonstration kit which consists of a complete energy harvesting module based on the SPV1050 ULP energy harvester and battery charger, having the purpose to show the electrical performance of the power converter and many other fundamental electrical quantities related to the overall system.

The power manager is configured as a buck-boost converter, fitting the electrical characteristics of the mounted PV panel and battery.

A power monitoring board along with a software GUI are used to monitor and to graph both of PV panel and battery voltage and current, and system performances like MPPT accuracy and conversion efficiency.

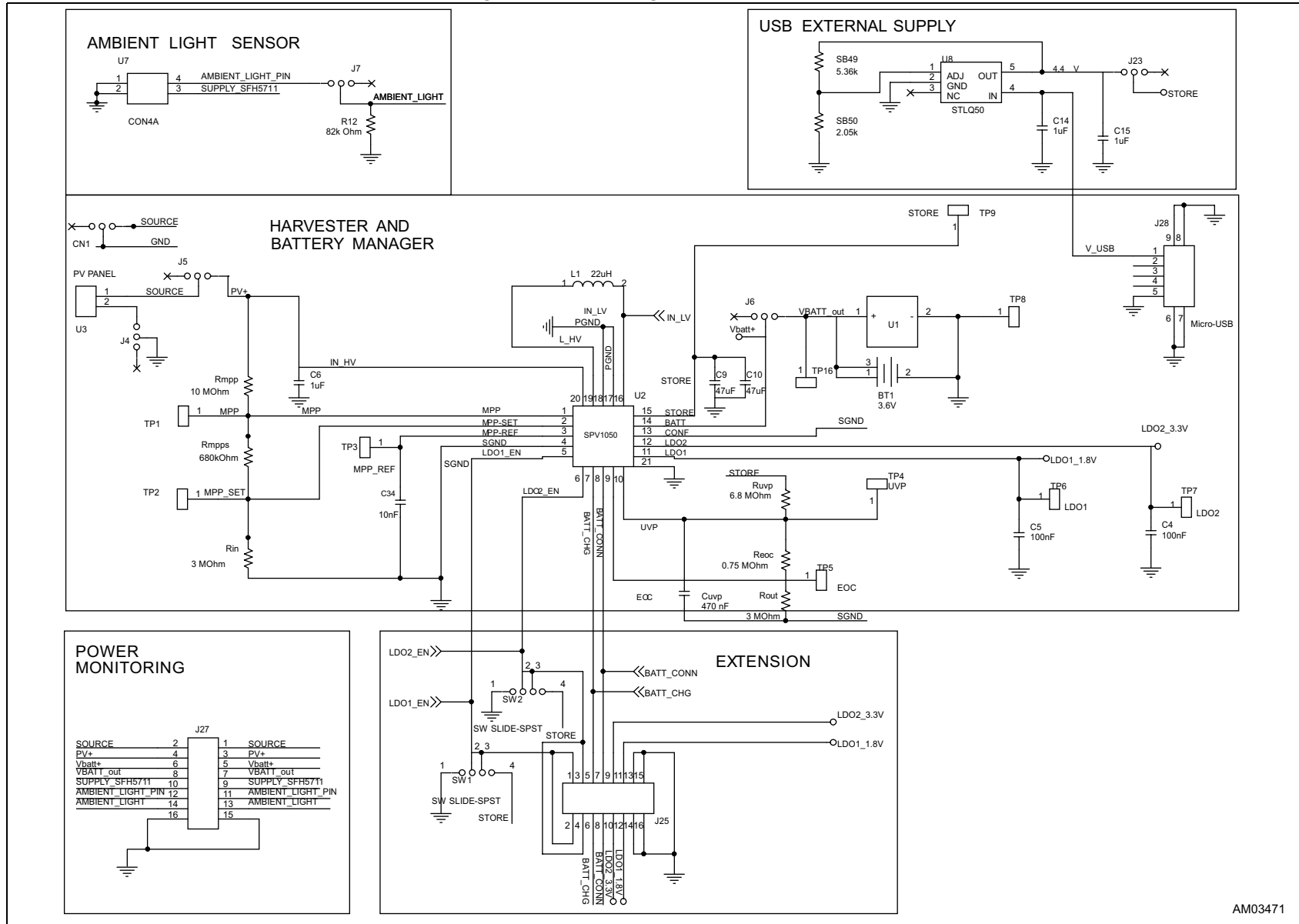
The STEVAL-ISV021V1 represents the standalone harvesting module that can be interfaced with a wireless sensor node to provide the microcontroller, transmitter and sensors with the energy scavenged and stored into the battery.

Furthermore, the STEVAL-ISV021V1 embeds an extension connector to interface and to monitor of some of SPV1050 input and output signals through a microcontroller based board.

# 1 Schematic and bill of material

The schematic, bill of material and gerber files can be downloaded from the Design resources tab of the STEVAL-ISV021V1 product folder on [www.st.com](http://www.st.com).

Figure 1. Harvesting module schematic



AM03471



Table 1. Harvesting module BOM

| Sect.   | Item | Qty. | Ref. | Part/value                 | Tolerance (%) | Voltage current | Watt | Technol. info. | Package | Manufacturer | Manufacturer code | More information                                                                                                    |
|---------|------|------|------|----------------------------|---------------|-----------------|------|----------------|---------|--------------|-------------------|---------------------------------------------------------------------------------------------------------------------|
| Battery | 1    | 1    | BT1  | Support for Li-Ion battery |               |                 |      |                | SMD     | Keystone     | 3008              |                                                                                                                     |
|         | 2    | 1    | J6   | SMD jumper                 |               |                 |      | Pitch 100 mils | SMD     | FCI          | 95293-101-03LF    | This jumper allows the connection of the STORE pin to the voltage regulator U4 in case the external sampling is OFF |
| Supply  | 3    | 2    | U3   | Flexible PV panel          |               |                 |      |                | SMD     | SANYO        | AM-1801           | 2 PV panels connected in series                                                                                     |
|         | 5    | 1    | J4   | SMD jumper                 |               |                 |      | Pitch 100 mils | SMD     | FCI          | 95293-101-03LF    | This jumper disconnects the PV panel U3 in case an alternative supply is required and connected to CN1              |
|         | 6    | 1    | J5   | 3-way switch               |               |                 |      | Pitch 100 mils | SMD     | FCI          | 95293-101-03LF    | This jumper allows the connection of the source to the harvester U1 in case the external sampling is OFF            |
|         | 7    | 1    | CN1  | 2-way conn.                |               |                 |      | Pitch 100 mils | SMD     | FCI          | 95293-101-03LF    | Input connector for external PV panel or TEG                                                                        |

Table 1. Harvesting module BOM (continued)

| Sect.                              | Item         | Qty. | Ref.  | Part/value     | Tolerance (%) | Voltage current | Watt | Technol. info. | Package | Manufacturer    | Manufacturer code                                  | More information                                                                 |
|------------------------------------|--------------|------|-------|----------------|---------------|-----------------|------|----------------|---------|-----------------|----------------------------------------------------|----------------------------------------------------------------------------------|
| Harvester/DC-DC controller section | MPPT section | 8    | U2    | SPV1050        |               |                 |      |                |         | ST              |                                                    | Harvester and thin film battery manager                                          |
|                                    |              | 9    | C6    | 1 $\mu$ F      | 15%           | 25 V            |      | X5R            | 0603    | Murata          | GRM188R61E105KA12D                                 | Input capacitance                                                                |
|                                    |              | 10   | Rmpp  | 10 M $\Omega$  | 1%            |                 | 0.1  |                | 0603    | VISHAY          | CRCW060310M0FKEA                                   | Resistor partitioning for MPP track                                              |
|                                    |              | 11   | Rmpps | 680 k $\Omega$ | 1%            |                 | 0.1  |                | 0603    | TE Connectivity | CRG0603F680K                                       | Resistor partitioning for MPP setting                                            |
|                                    |              | 12   | Rin   | 3 M $\Omega$   | 0.01          |                 |      |                | 0603    | VISHAY          | CRCW06033M00FKEA                                   | Input resistor partitioning                                                      |
|                                    |              | 13   | C34   | 10 nF          | 15%           | 16 V            |      | X7R            | 0603    | Murata          | GRM188R71C103KA01D                                 | Voltage sampling time constant capacitance                                       |
|                                    |              | 14   | L1    | 22 $\mu$ H     | 20%           |                 |      |                |         | Coilcraft       | LPS4018-223ML_<br>LPS5010-223ML_<br>XFL2006-223ME_ | DC-DC inductor                                                                   |
|                                    | LDO1         | 15   | SW1   | 3-way switch   |               |                 |      | Pitch 100 mils | SMD     | FCI             | 95293-101-04LF                                     | Close 1 - 2, LDO1 is disabled<br>Close 2 - 3, LDO1 controlled by external signal |
|                                    |              | 16   | C5    | 100 nF         | 10%           | 6.3 V           |      | X5R            | 0402    | AVX             | 04026D104KAT2A                                     |                                                                                  |
|                                    | LDO2         | 17   | SW2   | 3-way switch   |               |                 |      | Pitch 100 mils | SMD     | FCI             | 95293-101-04LF                                     | Close 1 - 2, LDO2 is disabled<br>Close 2 - 3, LDO2 controlled by external signal |
|                                    |              | 18   | C4    | 100 nF         | 10%           | 6.3 V           |      | X5R            | 0402    | AVX             | 04026D104KAT2A                                     |                                                                                  |



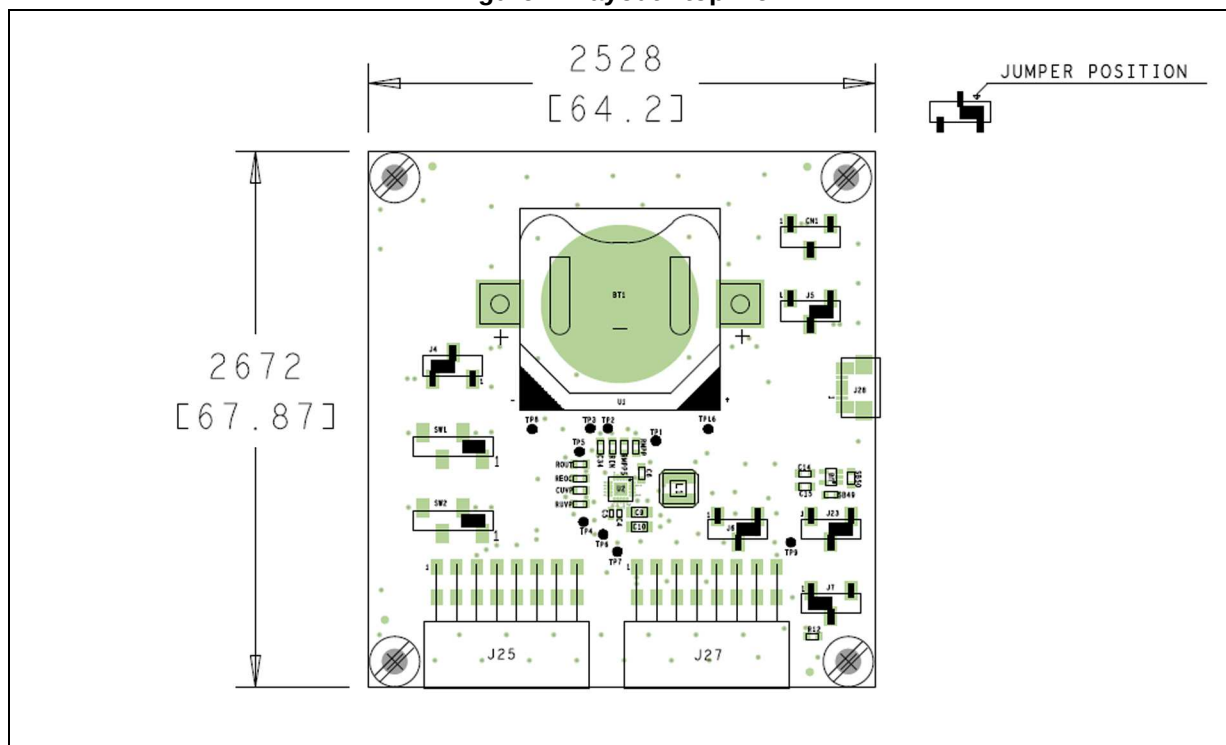
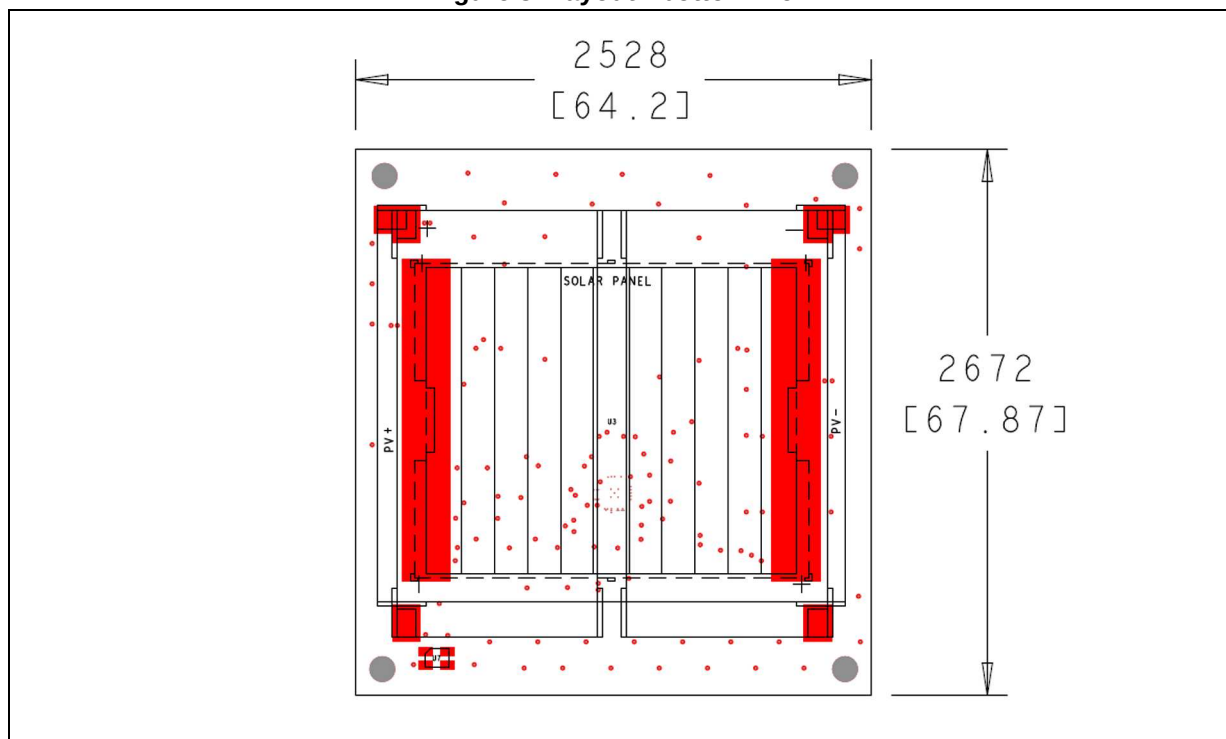
Table 1. Harvesting module BOM (continued)

| Sect.                      | Item | Qty. | Ref.     | Part/value      | Tolerance (%) | Voltage current | Watt | Technol. info. | Package   | Manufacturer | Manufacturer code  | More information                                                            |
|----------------------------|------|------|----------|-----------------|---------------|-----------------|------|----------------|-----------|--------------|--------------------|-----------------------------------------------------------------------------|
| Battery management section | 19   | 2    | C9, C10  | 47 $\mu$ F      | 20%           | 6.3 V           |      | X5R            | 0805      | KEMET        | C0805C476M9PAC7800 | Capacitor on STORE net                                                      |
|                            | 21   | 1    | Cuyp     | 470 nF          | 15%           | 10 V            |      | X5R            | 0603      | Murata       | GRM188R71A474KA61D | UVP voltage sampling delay time constant capacitance                        |
|                            | 22   | 1    | Ruyp     | 6.8 M $\Omega$  | 1%            |                 |      |                | 0603      | VISHAY       | CRCW06036M80FKEA   | VEOC = 4.15 V<br>VUVP = 3.75 V                                              |
|                            | 23   | 1    | Reoc     | 0.75 M $\Omega$ | 1%            |                 |      |                | 0603      | VISHAY       | CRCW0603750KFKEA   |                                                                             |
|                            | 24   | 1    | Rout     | 3 M $\Omega$    | 1%            |                 |      |                | 0603      | VISHAY       | CRCW06033M00FKEA   |                                                                             |
| Ambient light              | 25   | 1    | U7       | SFH5711         |               |                 |      |                | SMD       | OSRAM        | SFH 5711           | Ambient light sensor:<br>place on the same solder side of the PV panel (U3) |
|                            | 26   | 1    | R12      | 80 k $\Omega$   | 1%            |                 | 0.1  |                | 0603      | VISHAY       | CRCW060382K0FKEA   |                                                                             |
|                            | 27   | 1    | J7       | SMD jumper      |               |                 |      | Pitch 100 mils | SMD       | FCI          | 95293-101-03LF     |                                                                             |
| External supply from USB   | 28   | 1    | U8       | STLQ50C-R       |               |                 |      |                | SOT323-5L | ST           | STLQ50C-R          |                                                                             |
|                            | 29   | 1    | SB49     | 5.36 k $\Omega$ |               |                 | 0.1  |                | 0603      | Panasonic    | ERA3AEB5361V       |                                                                             |
|                            | 30   | 1    | SB50     | 2.05 k $\Omega$ | $\pm$ 1%      |                 | 0.1  |                | 0603      | VISHAY       | CRCW06032K05FKEA   |                                                                             |
|                            | 31   | 2    | C14, C15 | 1 $\mu$ F       | 15%           | 25 V            |      | X5R            | 0603      | Murata       | GRM188R61E105KA12D |                                                                             |
|                            | 33   | 1    | J23      | SMD jumper      |               |                 |      | Pitch 100 mils | SMD       | FCI          | 95293-101-03LF     | Disable charging from USB                                                   |

Table 1. Harvesting module BOM (continued)

| Sect.                | Item | Qty. | Ref.          | Part/value   | Tolerance (%) | Voltage current | Watt | Technol. info. | Package | Manufacturer | Manufacturer code   | More information                     |
|----------------------|------|------|---------------|--------------|---------------|-----------------|------|----------------|---------|--------------|---------------------|--------------------------------------|
| External connections | 34   | 1    | J28           | Micro-USB    |               |                 |      |                | SMD     | Molex        | 47346-0001          | External charge from USB             |
|                      | 35   | 1    | J25           | 16-pin conn. |               |                 |      | 2.54 mm        | SDM     | Samtec       | SMH-108-02-G-D      | Connector for future extensions      |
|                      | 36   | 1    | J27           | 16-pin conn. |               |                 |      | 2.54 mm        | SMD     | Samtec       | SMH-108-02-G-D      | Connector for power monitoring board |
| Spacers + nuts       | 37   | 4    | Screw support |              |               |                 |      |                |         | RS           | 325-687 and 525-701 |                                      |

## 2 Layout

**Figure 2. Layout - top view****Figure 3. Layout - bottom view**



### 3 Revision history

**Table 2. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                            |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 28-Nov-2013 | 1        | Initial release.                                                                                                                                                                                                                                                                                                                   |
| 02-May-2014 | 2        | Updated board photography on page 1 (replaced by new photography).<br>Updated Section 1: Schematic and bill of material on page 2 (updated web link).<br>Updated Table 1: Harvesting module BOM on page 4 (updated item numbering, added manufacturer code to "Screw support" item, updated "More information" for several items). |
| 18-Dec-2015 | 3        | Updated board photo on the cover page.                                                                                                                                                                                                                                                                                             |

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