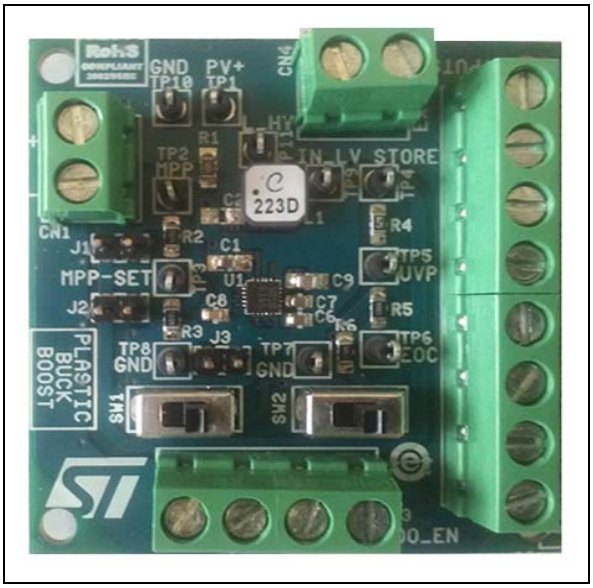
STEVAL-ISV020V1

Evaluation board for SPV1050 ULP energy harvester and battery charger – buck-boost configuration

Data brief



Features

- First startup at Vin = 2.6 V
- Input voltage working range: 150 mV ≤ Vin ≤ 18 V
- End of charge battery voltage: V_{EOC} = 4.25 V
- Battery undervoltage protection: V_{UVP} = 3.7 V

Applications

- Charge any battery chemistry, including lithium based, NiMH, solid state thin film and supercapacitor.
- WSN, HVAC, building and home automation, industrial control, access control, smart lighting, asset and livestock positioning and tracking, surveillance.
- Body area network, sportswear, fitness.

Description

The STEVAL-ISV020V1 is an evaluation board based on the ultralow power energy harvester and battery charger SPV1050. For any detail related to the SPV1050 features and performances please refer to the datasheet.

The evaluation board implements the buck-boost configuration of the DC-DC converter and has the purpose of enhancing the SPV1050 based applications development by testing the silicon performance thanks to many jumpers and test points, and by helping to find out the best system configuration to make the SPV1050 device working at the most of efficiency.

The STEVAL-ISV020V1 board is optimized to:

Harvest energy from PV panels supplying 2.6 V ≤ V_{MP} ≤ 9 V and 10 µA ≤ I_{MP} ≤ 20 mA.

Charge a battery with the 3.7 V undervoltage protection threshold (V_{UVP}) and 4.2 V end of charge voltage threshold (V_{EOC}).

Nevertheless, few easy changes on the application components (input and output resistor partitioning, C_{IN} capacitor) allow to use a different PV panel and source (like TEG), and battery, by setting the V_{MPP_SET}, the V_{UVP} and the V_{EOC} thresholds according to the source and load. More in detail, operating ranges can be extended as follows: V_{MP} from 150 mV up to 18 V, I_{MP} up to 100 mA, V_{UVP} down to 2.2 V and V_{EOC} up to 5.3 V.

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-ISV020V1 product folder on *www.st.com*.

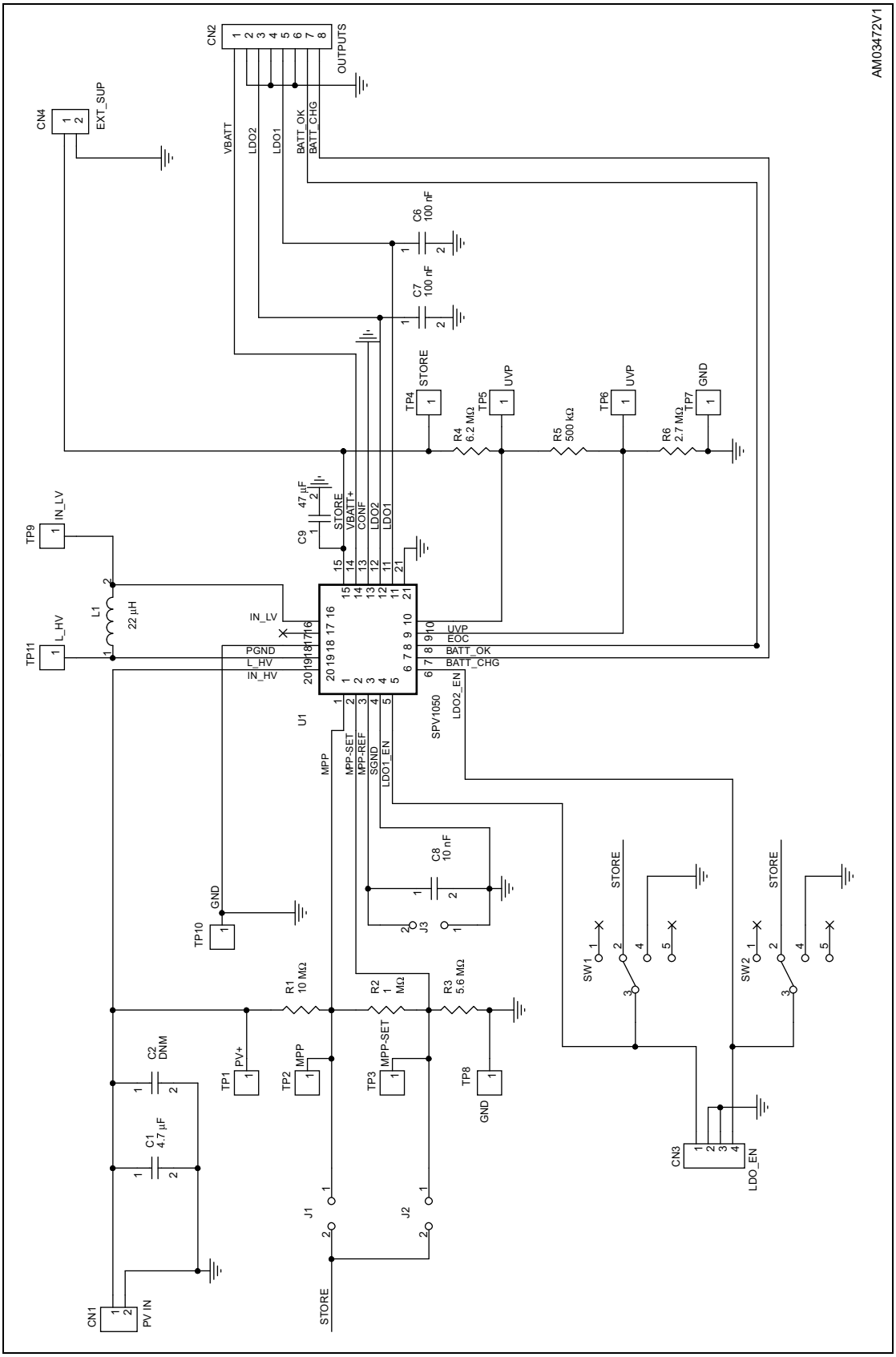


Figure 1. Schematic

Table 1. Bill of material

Sect.	Item	Quan-tity	Reference	Part / value	Tolerance %	Voltage current	Watt	Technol. info.	Package	Manufacturer	Manufacturer code	More information
DC-DC input section	1	1	U1	SPV1050					VFQFPN 3 x 3 x 1 20L (code A0BR)	ST	SPV1050	Plastic socket
	2	1	CN1	2-way screw connector						TE Connectivity	282834-2	Input connector for PV panel or TEG
	3	1	C1	4.7 µF	15%	25 V			0805	Murata	GCM21BR71C475KA73L	Input capacitance
	4	0	C2 (DNM)	4.7 µF	15%	25 V			0805	Murata	GCM21BR71C475KA73L	
	5	3	J1, J2, J3	Jumper				Pitch 2.54 mm	TH			Enable/disable MPPT
	8	1	R1	10 MΩ	1%				0805	YAGEO	RC0805FR-0710ML	Resistor partitioning for MPP track/setting
	9	1	R2	1 MΩ	1%				0805	TE Connectivity	CRG0805F1M0	
	10	1	R3	5.6 MΩ	1%				0805	VISHAY	CRCW08055M60FKEA	
	11	1	L1	22 µH	20%					Coilcraft	LPS4018-223ML_	DC-DC inductor
	12	1	C8	10 nF	15%	16 V		X7R	0603	Murata	GRM188R71C103KA01D	Voltage sampling time constant capacitance

Table 1. Bill of material (continued)

Sect.	Item	Quan-tity	Reference	Part / value	Tolerance %	Voltage current	Watt	Technol. info.	Package	Manufacturer	Manufacturer code	More information
Battery section	13	1	CN4	2-way screw connector						TE Connectivity	282834-2	Connector for external supply of pin STORE
	14	1	C9	47 µF	20%	10 V			0805	TDK	C2012X5R1A476M125AC	
	15	1	R4	6.2 MΩ	5%				0805	RS	RS-0805-6m2-5%-0.125W	Resistor Partitioning for UVP, EOC, protection setting
	16	1	R5	499 kΩ	1%				0805	VISHAY	CRCW0805499KFKEA	
	17	1	R6	2.7 MΩ	1%				0805	VISHAY	CRCW08052M70FKEA	
	18	1	CN2	8-way screw connector						TE Connectivity	282836-8	Connector for battery and battery status signals
LDOs section	19	2	C6, C7	100 nF	10%			X7R	0603	KEMET	C0603C104K4RAC	Tank capacitor for LDOs
	21	2	SW1, SW2	5-pin male Stripline				Pitch 2.54 mm	TH			Close 2 - 3: LDO disabled Close 1 - 2: LDO enabled Floating: external control through CN3
	23	1	CN3	4-way screw connector						TE Connectivity	282836-4	Connector for LDOs load connection

Table 1. Bill of material (continued)

Sect.	Item	Quan-tity	Reference	Part / value	Tolerance %	Voltage current	Watt	Technol. info.	Package	Manufacturer	Manufacturer code	More information
List of test points	24	1	TP1					True hole				PV+ pin sensing and soldering
	25	1	TP2					True hole				MPP pin sensing and soldering
	26	1	TP3					True hole				MPP-SET pin sensing and soldering
	27	1	TP4					True hole				STORE pin sensing and soldering
	28	1	TP5					True hole				ULP pin sensing and soldering
	29	1	TP6					True hole				EOC pin sensing and soldering
	30	1	TP7					True hole				GND pin sensing and soldering
	31	1	TP8					True hole				GND pin sensing and soldering
	32	1	TP9					True hole				IN_LV pin sense (for probe scope)
	33	1	TP10					True hole				GND pin sensing (for probe scope)
	34	1	TP11					True hole				L_HV pin sensing (for probe scope)

2 Layout

Figure 2 to *Figure 4* show the components placement and the layout (top and bottom views) of the STEVAL-ISV020V1.

Figure 2. Layout - silkscreen view

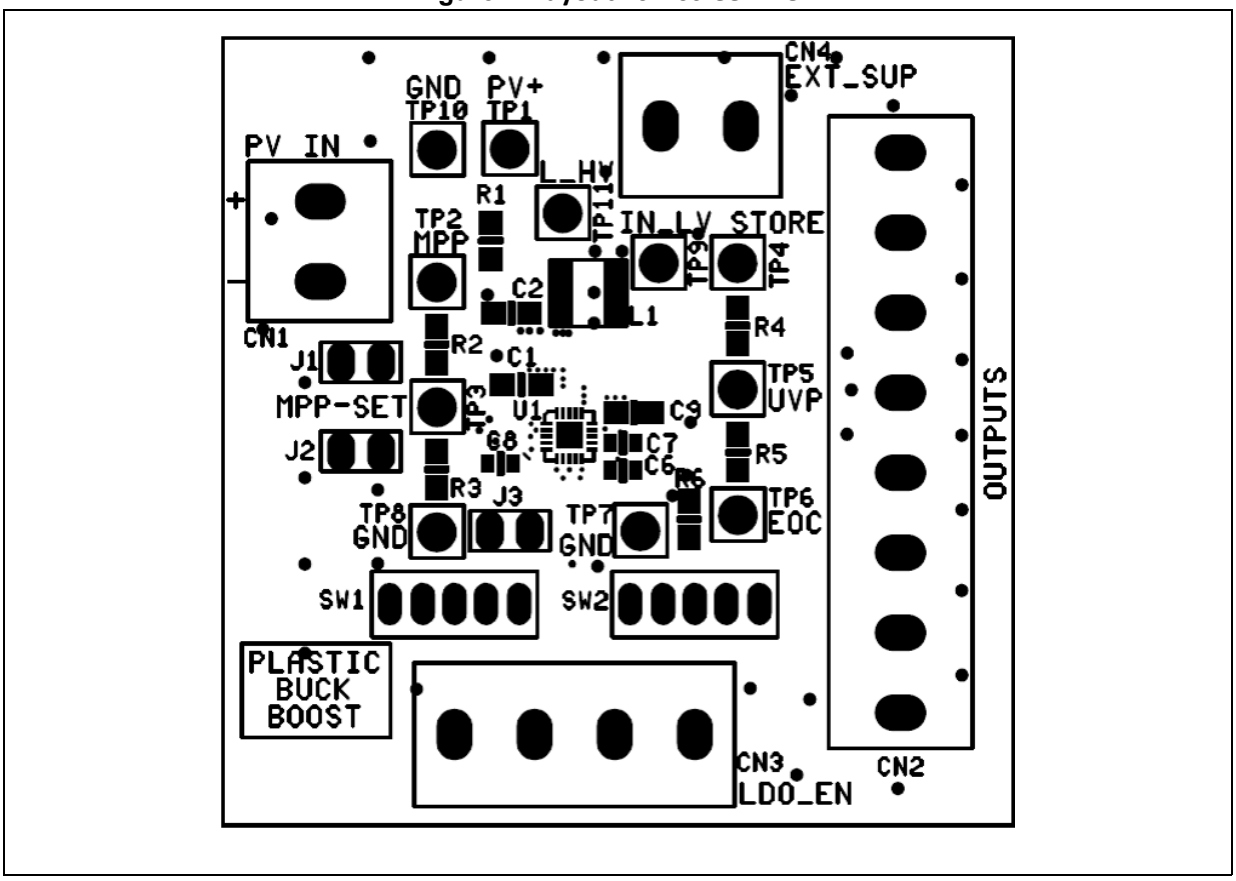


Figure 3. Layout - top view

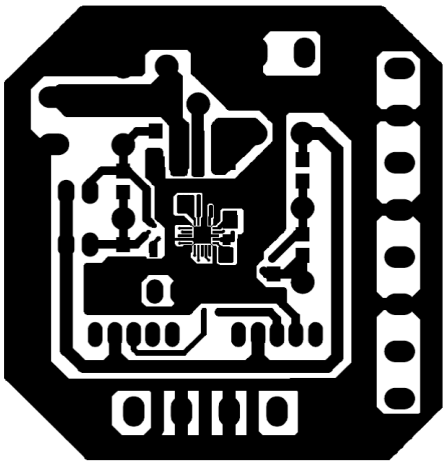
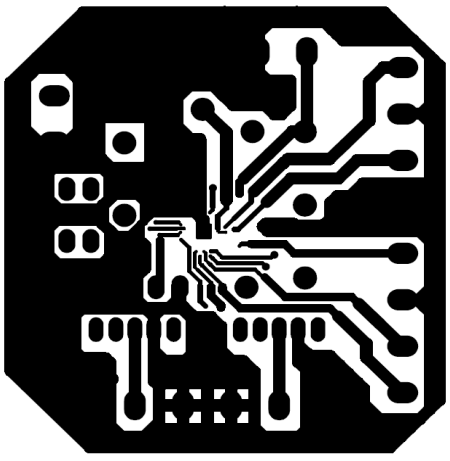


Figure 4. Layout - bottom view



3 Revision history

Table 2. Document revision history

Date	Revision	Changes
28-Nov-2013	1	Initial release.
05-May-2014	2	Updated *Section : Features on page 1* (updated values of “First startup at Vin” and “Input voltage working range”). Updated *Section : Description on page 1* (updated values of “Harvest energy from PV panels supplying”, added extended operating ranges). Updated *Section 1: Schematic and bill of material on page 2* (updated web link). Updated *Figure 1: Schematic on page 3* (updated value of C9 capacitor, minor modifications). Updated *Table 1: Bill of material on page 4* (removed “PV panel” item, updated numbering and quantity of several items, updated “Technol. info.” of J1, J2, J3 jumper, updated values and manufacturer information of C9 capacitor, updated “More information” for several items). Minor modifications throughout document.

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