

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

Data brief



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 $2.6\text{ V} \leq V_{MP} \leq 9\text{ V}$ and $10\text{ }\mu\text{A} \leq I_{MP} \leq 20\text{ mA}$.

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.

Features

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

Applications

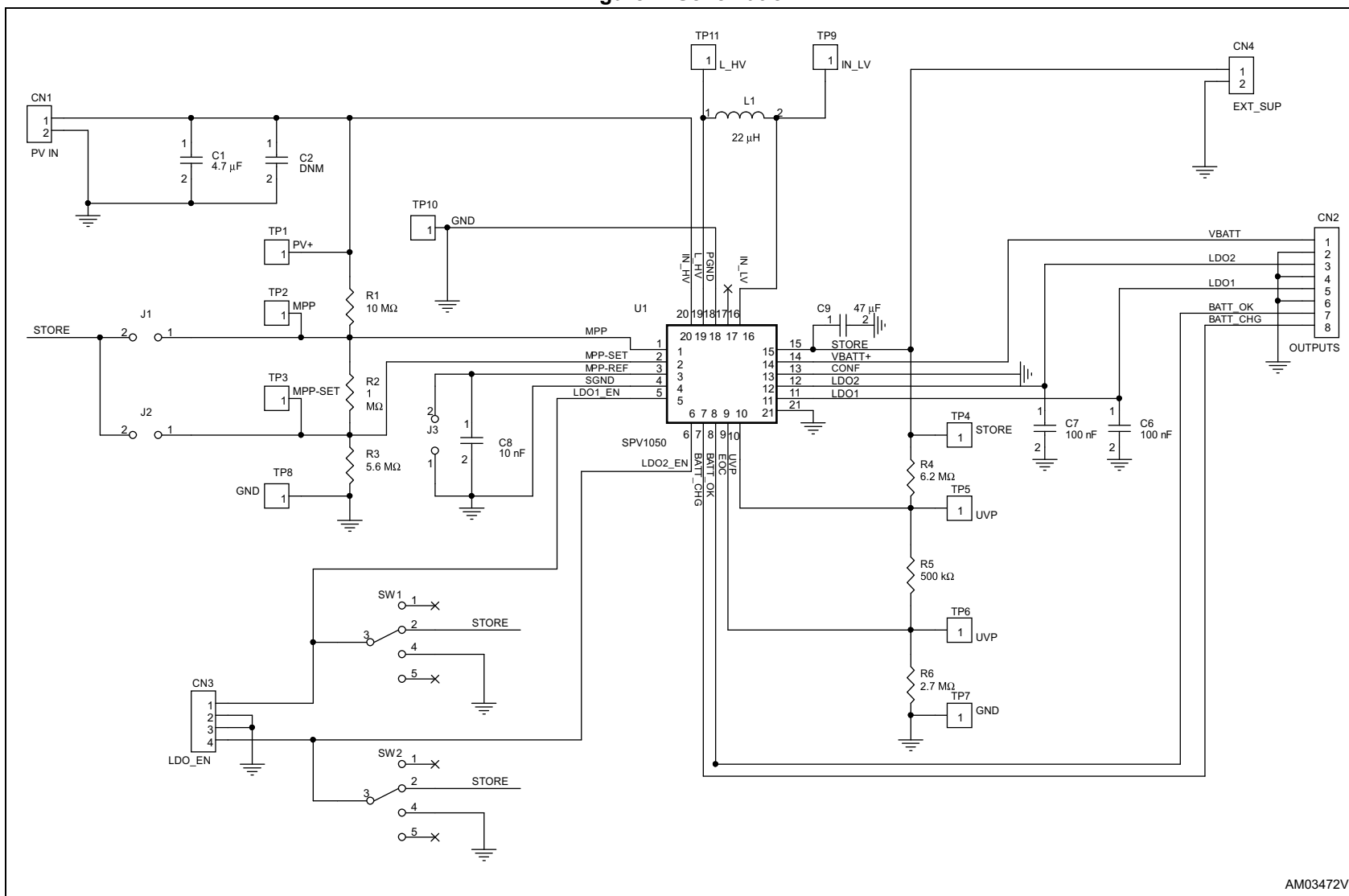
- Charge any battery chemistry, including lithium based, NiMH, solid state thin film and supercapacitor.
- WSN, HVAC, building and home automation, industrial control, access control, smart lighting, asset and livestock positioning and tracking, surveillance.
- Body area network, sportswear, fitness.

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



AM03472V1



Table 1. Bill of material

Sect.	Item	Quantity	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 μ F	15%	25 V			0805	Murata	GCM21BR71C 475KA73L	Input capacitance
	4	0	C2 (DNM)	4.7 μ F	15%	25 V			0805	Murata	GCM21BR71C 475KA73L	
	5	3	J1, J2, J3	Jumper				Pitch 2.54 mm	TH			Enable/disable MPPT
	8	1	R1	10 M Ω	1%				0805	YAGEO	RC0805FR- 0710ML	Resistor partitioning for MPP track/setting
	9	1	R2	1 M Ω	1%				0805	TE Connectivity	CRG0805F1M0	
	10	1	R3	5.6 M Ω	1%				0805	VISHAY	CRCW08055M 60FKEA	
	11	1	L1	22 μ H	20%					Coilcraft	LPS4018- 223ML_	DC-DC inductor
	12	1	C8	10 nF	15%	16 V		X7R	0603	Murata	GRM188R71C1 03KA01D	Voltage sampling time constant capacitance

Table 1. Bill of material (continued)

Sect.	Item	Quantity	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 μ F	20%	10 V			0805	TDK	C2012X5R1A476M125AC	
	15	1	R4	6.2 M Ω	5%				0805	RS	RS-0805-6m2-5%-0.125W	Resistor Partitioning for UVP, EOC, protection setting
	16	1	R5	499 k Ω	1%				0805	VISHAY	CRCW0805499KFKEA	
	17	1	R6	2.7 M Ω	1%				0805	VISHAY	CRCW08052M70FKEA	
	18	1	CN2	8-way screw connector							TE Connectivity	282836-8
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	Quantity	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

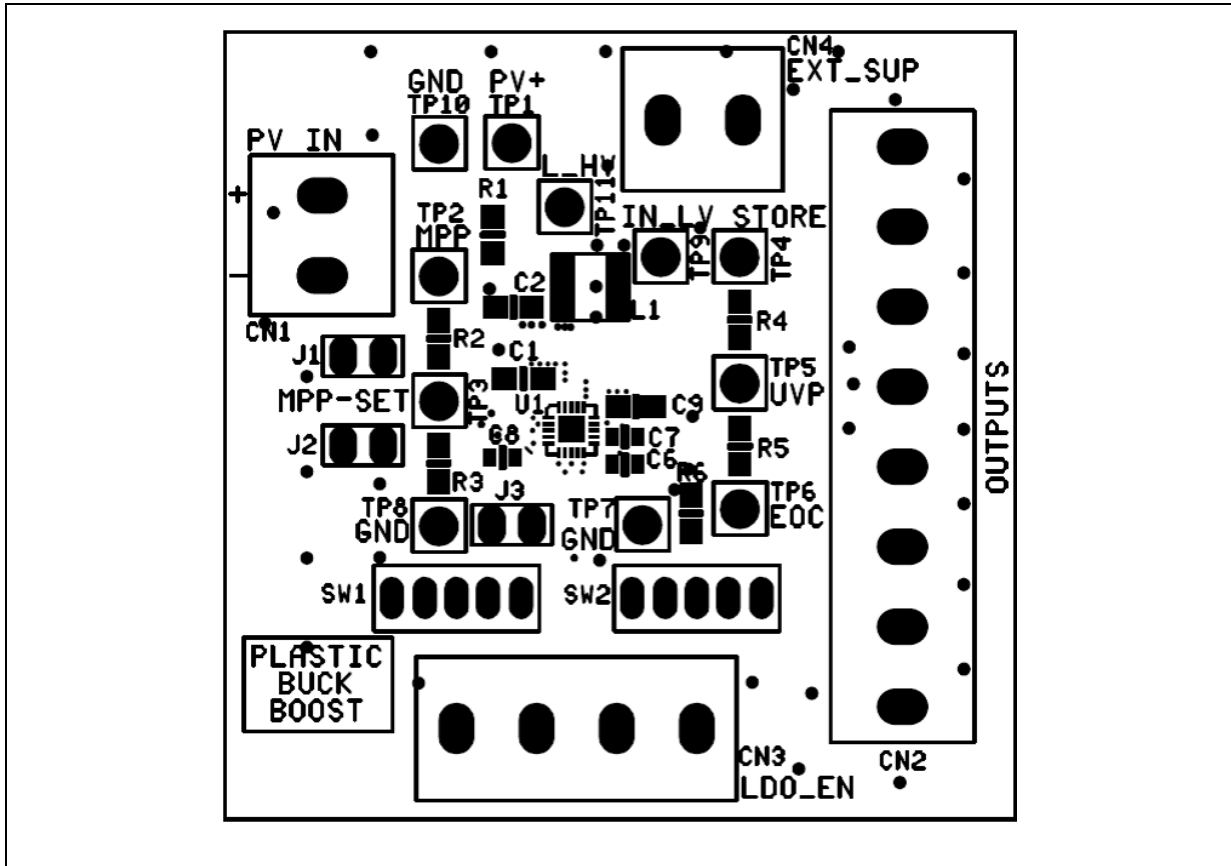


Figure 3. Layout - top view

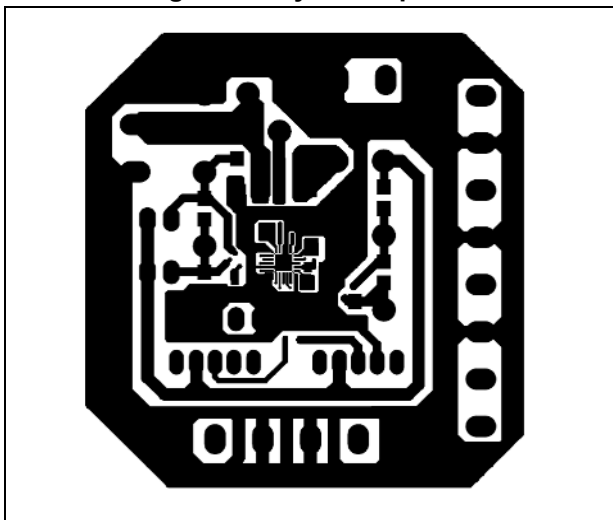
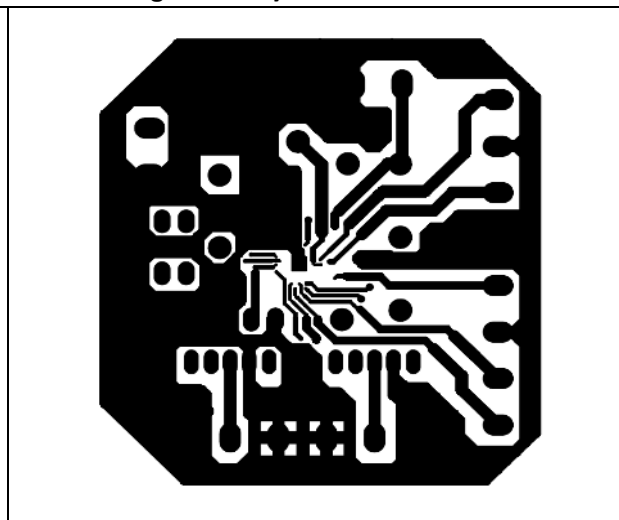


Figure 4. Layout - bottom view



3 Revision history

Table 2. Document revision history

Date	Revision	Changes
28-Nov-2013	1	Initial release.
05-May-2014	2	<p>Updated Section : Features on page 1 (updated values of “First startup at Vin” and “Input voltage working range”).</p> <p>Updated Section : Description on page 1 (updated values of “Harvest energy from PV panels supplying”, added extended operating ranges).</p> <p>Updated Section 1: Schematic and bill of material on page 2 (updated web link).</p> <p>Updated Figure 1: Schematic on page 3 (updated value of C9 capacitor, minor modifications).</p> <p>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).</p> <p>Minor modifications throughout document.</p>

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2014 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

