Evaluation Board User Guide
UG-474

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Demo Platform for Energy Harvesting

FEATURES

Plug and Play Energy Harvesting Platform
Compatible with ADI Wireless Sensor Network (WSN) platform
Solar Panel Harvester Included
RoHS compliant

GENERAL DESCRIPTION

The ADP5090 demo platform is a plug-and-play evaluation board for energy harvesting. It includes the PV panel, and all of the power management to enable devices to be powered using energy harvesting. It is based on the Sumoncle SC-5528 PV cell, and the ADP5090 Energy Harvesting Power Management IC.

The demo platform coverts light energy to electrical energy. The PV panel converts the light to 2.1 electrical energy. The ADP5090 boosts this from 2.1V to 3.5V, and stores the energy in a Supercapacitor. The user can easily connect this to power their load.
There is also an LDO on board that can be used to power loads at lower voltage rails than the 3.5V stored in the supercap.
The SC-5528 is a light harvesting dye-sensitized photovoltaic cell. It is optimized for indoor environments, where lux levels of 200 to 1000 lux are typical.

The ADP5090 is an ultra-low power, synchronous, boost dc-to-dc regulator. The ADP5090 runs from input voltages of 0.38 V and provides a high efficiency solution with integrated power switch, synchronous rectifier, and battery management. The demo platform provides an easy way to evaluate the device. Complete information about the ADP5090 is available in the ADP5090 data sheet.

The system also plugs directly into the ADI Wireless Sensor Network (WSN) Demo platform.

This user guide describes how to quickly set up the board to use for powering loads.

SYSTEM BLOCK DIAGRAM

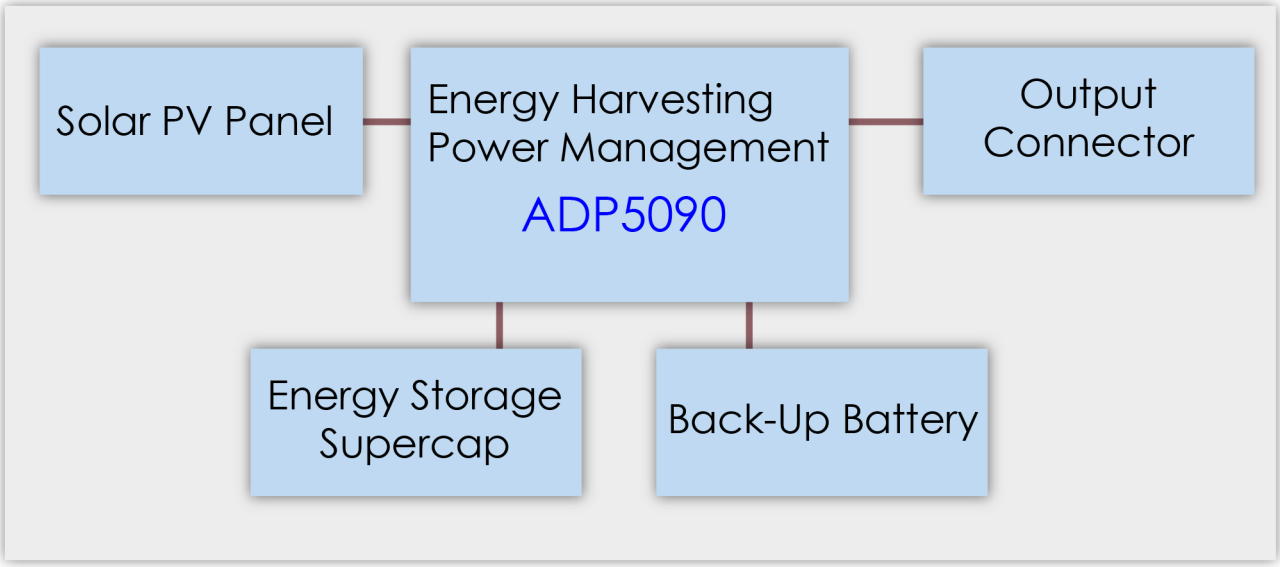

Figure 1. System Block Diagram

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REVISION HISTORY

9/12—Revision 0: Initial Version

QUICK START GUIDE

This section explains how to connect everything together to get the network up and running.

1. Connect the solar panel's 10 pin connector to the J2 10 pin connector on the ADP5090 board as shown in Figure 2.

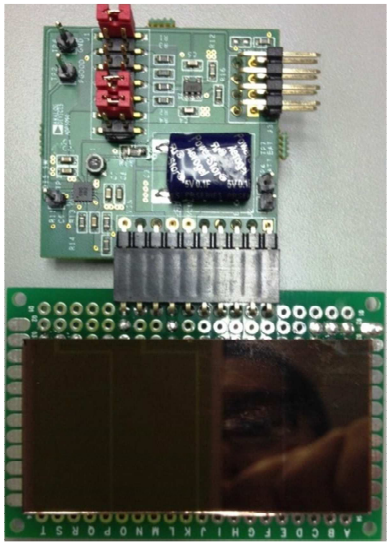


Figure 2. Hardware Setup

2. Connect J1_1 and J1_2, J1_9 and J1_10, J1_11 and J1_12 on the ADP5090 board.
3. Place the system in a bright environment. Monitor the voltage on the SuperCap using the test points TP4 (BATT) and TP6 (GND).
4. The output is available on J3_1 on the ADP5090 board

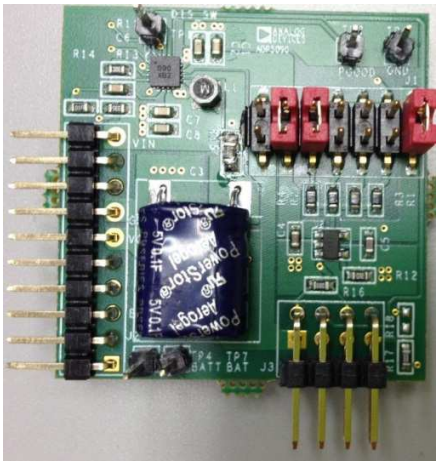


Figure 3. Jumper Setup

EVALUATION BOARD SCHEMATIC

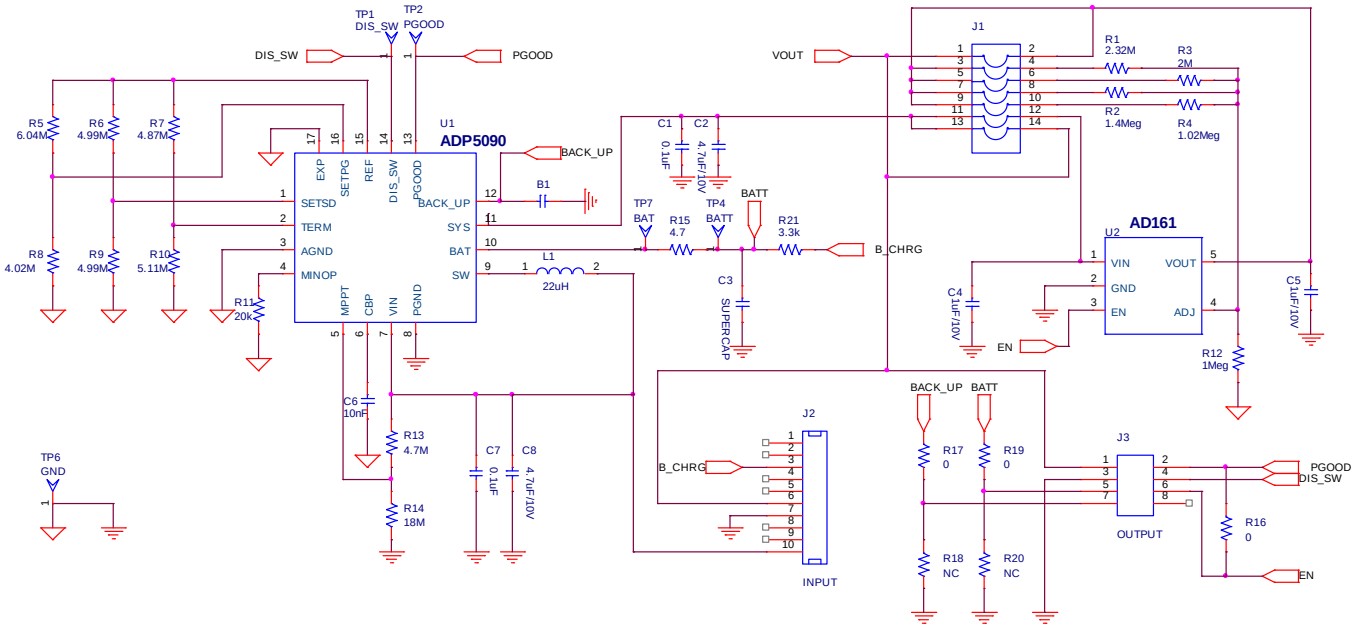


Figure 4. Schematic

EVALUATION BOARD LAYOUT

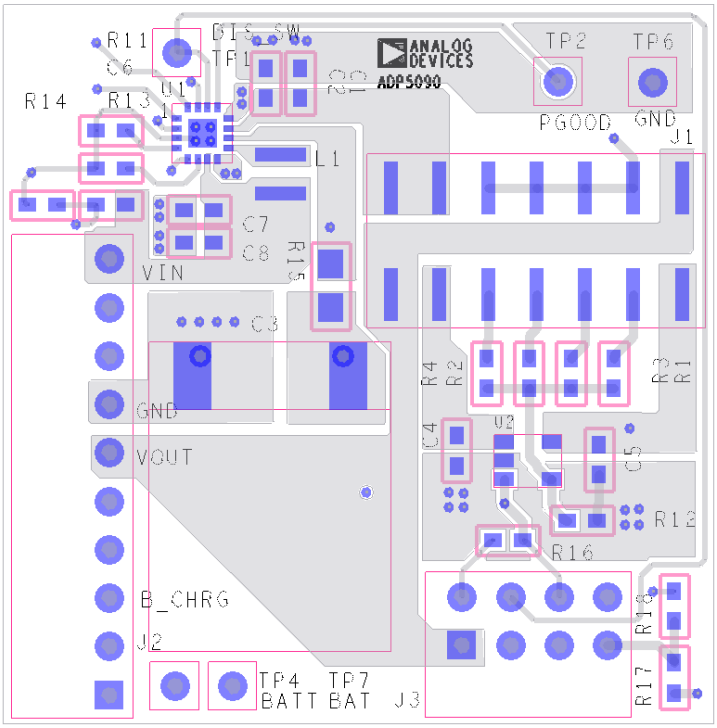


Figure 5. Top Assembly

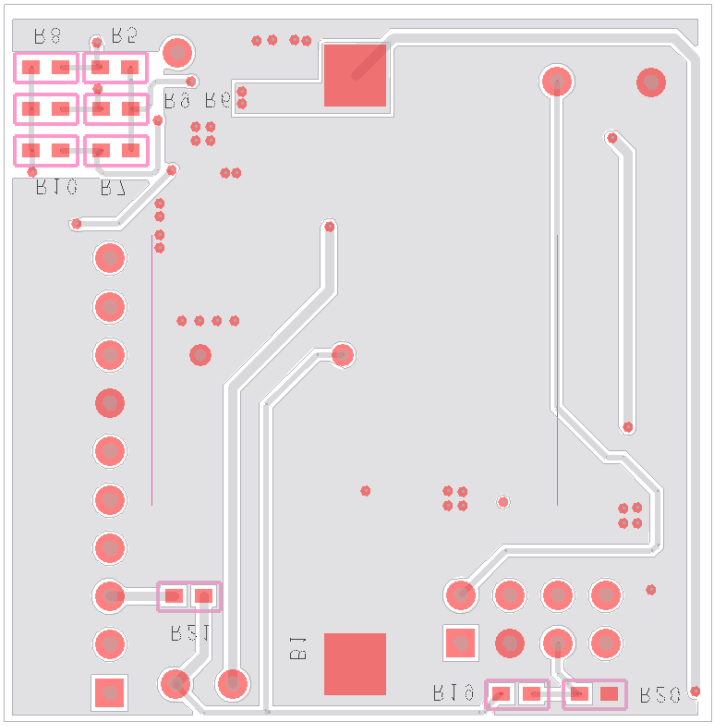


Figure 5. Bottom Assembly

EVALUATION BOARD HARDWARE

LDO: POWER MANAGEMENT OF THE OUTPUT

An LDO (ADP161) is included on the demo board. This can be used to realize different output voltages. This table shows the jumper connections, and the corresponding output voltage. See schematics for more details.

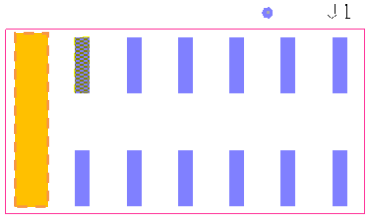
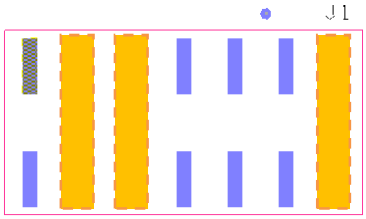
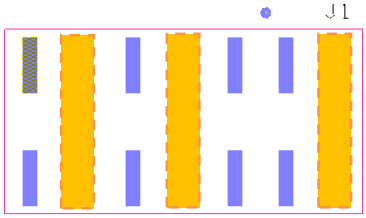
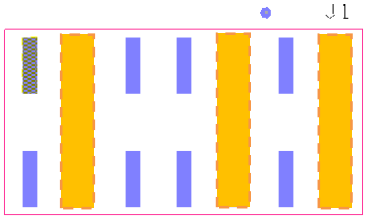
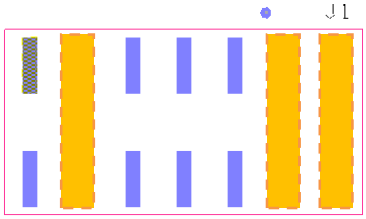
Setting	V_{OUT}	Jumper Position	Jumper Position on demo board
1	3.5 V (LDO bypassed)	J1_13 & J1_14	
2	2 V	J1_1 & J1_2 J1_ 9 & J1_10 J1_11 & J1_12	
3	2.4 V	J1_1 & J1_2 J1_ 7 & J1_8 J1_11 & J1_12	
4	3 V	J1_1 & J1_2 J1_ 5 & J1_6 J1_11 & J1_12	
5	3.3 V	J1_1 & J1_2 J1_ 3 & J1_4 J1_11 & J1_12	

Table 1. Power Management of Sensor Nodes

J3 - OUTPUT CONNECTOR

The J3 output connector is used to connect the demo board to the user's load. As well as providing power, it also has some other interface connections that allow more interaction between the demo board and the host MCU on the load. It is directly compatible with ADI's Wireless Sensor Network (WSN) demo boards. Table 2 shows the pinout of this connector, and a brief description on the pin functions.

Pin #	Pin Name	Description
1	SYS	Output voltage supply from the demo board to the load
2	PGOOD	PGOOD output signal from the ADP5090
3	GND	Ground
4	DIS_SW	DIS_SW input signal to the ADP5090
5	BATT	Supercap voltage (for battery monitoring)
6	EN	Enable LDO
7	BACK_UP	Back Up voltage (for battery monitoring)
8	NC	No Connect

Table 2. Output Connector

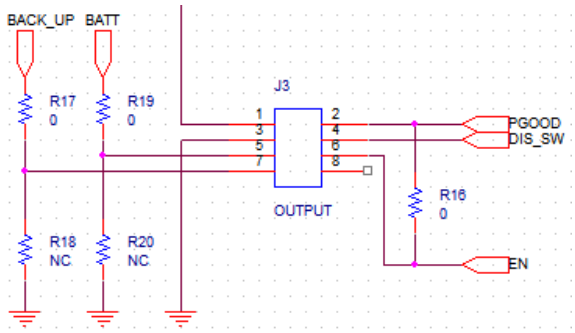


Figure 6. Output Connector

Pin 1 (SYS): This is the output voltage that the demo board delivers to the load.

Pin 2 (PGOOD): The ADP5090 has a programmable PGOOD signal. Once the PGOOD threshold has been reached, the ADP5090 sets this pin high. It can be connected to the user's host MCU GPIO input. See the ADP5090 datasheet for more detailed information on this function.

Pin 3 (GND): This is the ground connection for the ADP5090 board.

Pin 4 (DIS_SW): This can be connected to the user's host MCU GPIO output. If the host MCU requires the ADP5090 to temporarily halt the switching regulator function, then the user would set this pin high. See the ADP5090 datasheet for more detailed information on this function.

Pin 5 (BATT): This can be connected to an analog input of the user's host MCU. This allows the user to monitor the voltage on the supercap of the ADP5090 demo board. Populating R1 and R2 gives a resistor divider for cases where the host MCU's analog input range is lower than the supercap voltage.

Pin 6 (ENABLE): This is the enable control signal for the ADP161 LDO on the ADP5090 demo board. The user could connect this to the host MCU GPIO output to enable and disable the ADP161.

Pin 7 (BACK_UP): This can be connected to an analog input of the user's host MCU. This allows the user to monitor the voltage on the supercap of the ADP5090 demo board. Populating R3 and R4 gives a resistor divider for cases where the host MCU's analog input range is lower than the supercap voltage.

Pin 8 (NC): No connect. This pin is not used.

BILL OF MATERIALS

Quantity	Reference	Part	Part Number	Package	Vendor
1	B1	CR2032 Holder	BC2032-F1	CR2032_holder	Memory Protection Devices
2	C1,C7	0.1uF	GRM188R71H104KA93	C0603	Murata
2	C2,C8	4.7uF/10V	GRM21BR61A475KA73	C0603	Murata
1	C3	SUPERCAP	PB-5R0H104-R	SuperCAP_12x12	Cooper Bussmann
2	C4,C5	1uF/10V	GRM185R61A105KE36	C0603	Murata
1	C6	10nF	GRM188R71H103KA01	C0603	Murata
1	J1	Jumper	TSM-107-04-T-DV	SIP14_dual	SAMTEC
1	J2	INPUT	TSW-110-08-T-S-RA	sip10_BtoB	SAMTEC
1	J3	OUTPUT	9-103324-0	SIP8_2rows	TE Connectivity
1	L1	22uH	EPL3015-223ML	inductor_3x3	Coilcraft
1	R1	2.32M	CRCW06032M320FKEA	R0603	Vishay Dale
1	R2	1.4Meg	CRCW06031M40FKEA	R0603	Vishay Dale
1	R3	2M	CRCW06032M00FKEA	R0603	Vishay Dale
1	R4	1.02Meg	CRCW06031M02FKEA	R0603	Vishay Dale
1	R5	6.04M	CRCW06036M04FKEA	R0603	Vishay Dale
2	R6,R9	4.99M	CRCW06034M99FKEA	R0603	Vishay Dale
1	R7	4.87M	CRCW06034M87FKEA	R0603	Vishay Dale
1	R8	4.02M	CRCW06034M02FKEA	R0603	Vishay Dale
1	R10	5.11M	CRCW06035M11FKEA	R0603	Vishay Dale
1	R11	20k	CRCW060320K0FKEA	R0603	Vishay Dale
1	R12	1Meg	CRCW06031M00FKEA	R0603	Vishay Dale
1	R13	4.7M	CRCW06034M70FKEA	R0603	Vishay Dale
1	R14	18M	RK73B1JTTD186J	R0603	KOA
1	R15	4.7	CRCW08054R70JNEAIF	R0805	Vishay Dale
3	R16,R17,R19	0	CRCW06030000FKEA	R0603	Vishay Dale
2	R18,R20	NC		R0603	Vishay Dale
1	R21	3.3k	CRCW06033K3FKEA	R0603	Vishay Dale
1	TP1	DIS_SW	5001	SIP1	Keystone Electronics
1	TP2	PGOOD	5001	SIP1	Keystone Electronics
1	TP4	BATT	5001	SIP1	Keystone Electronics
1	TP6	GND	5001	SIP1	Keystone Electronics
1	TP7	BAT	5001	SIP1	Keystone Electronics
1	U1	ADP5090	ADP5090ACPZ-1-R7	LFCSP16-3x3PL	Analog Devices
1	U2	AD161	ADP161AUJZ-R7	sot23-5	Analog Devices

RELATED LINKS

Table 1.

Resource	Description
ADP5090	Product Page, ADP5090 Energy Harvesting Boost Converter.
ADP161	Product Page, ADP161 LDO
Sumoncle SC-5528	

NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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