Features

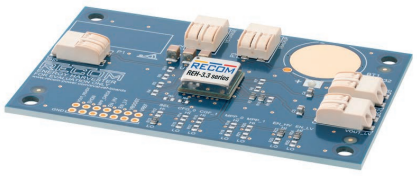
Evaluation Module

- Evaluation platform for REH-3.31.8 energy harvester module
- Supports rechargeable Li-Ion battery or supercapacitor as energy storage
- Backup coin cell battery holder footprint and input for uninterruptable operation
- Easy setup and evaluation

RECOM
Evaluation Module

REH-3.31.8-EVM-1

Description



The REH-3.31.8-EVM-1 allows a quick evaluation of the REH-3.31.8 energy harvester module. It contains all the necessary easy-plug-in connectors to connect the energy source, energy storage element, twin output voltages and an external backup battery (if used). The PCB footprint includes pads for a space-saving CR2032 battery holder to serve as an on-board backup battery, if required. If a primary cell back-up battery (1.5VDC to 4.5VDC) is fitted, the REH-Module will automatically switch over to the back-up supply if the energy harvesting input fails to maintain an uninterrupted output.

With the REH-3.31.8-EVM-1 evaluation board, it is possible to configure all of the features of the REH-3.31.8 module such as selection of the type of the storage element (rechargeable battery or supercapacitor), set the backup battery switch-over threshold voltage and to independently enable either or both outputs. All input and output signals of the module are easily accessible for test probes.

Selection Guide

Part Number	Input Voltage Range (1) [VDC]	Output Voltage 1 [VDC]	Output Current 1 max. [mA]	Output Voltage 2 [VDC]	Output Current 2 max. [mA]
REH-3.31.8-EVM-1	0.05 - 5	3.3	80	1.8	20

Notes:

Note1: Cold start operation from 0.38VDC

Quick Start Guide

Warning: Do not operate the harvester without a storage element (supercapacitor or battery) attached unless you have a stable source of energy on the PV input. In that case the on-board capacity of 3 x 47uF (C_1, C_2, C_3) is sufficient for safe operation.

1. Set storage element type:
   -populate 0Ω resistor R_{13} for rechargeable 4.2VDC Li-Ion battery (default)
   -remove R_{13} and populate 0Ω resistor R_{12} for 5VDC supercapacitor

2. Connect selected storage element to P_2. Observe correct polarity!
   Important: Do not plug in the PV input before the storage element is connected.
   The storage element can be pre-charged for a faster start-up. The voltage cannot exceed 4.5VDC.

3. Backup battery:
   -if not used, populate R_2 and R_{10} with 0Ω resistors and leave R_1 open (default)
   -if a battery backup is used, remove R_2 and R_{10} and populate R_1 and R_2 with resistor values from the graph below based on the desired minimum battery backup voltage. For example, a 3VDC lithium coin cell has a minimum voltage of 2.2VDC.
   Fit either an external battery to P_3 or a coin cell holder for an on-board solution (e.g. DigiKey BK-915-CT-ND).

4. Connect energy harvesting source (PV panel, etc.) to the PV connector. Observe the correct polarity!
   Maximum open voltage of the PV input shall not exceed 5VDC. Any DC source up to 5VDC can be used on this input if a quick charge of the storage element is needed (for example, USB or bench power supply).

Specifications (measured @ Ta= 25°C, full load and after warm-up unless otherwise stated)

5. EN_HV/EN_LV enable:
   -populate 0Ω resistors R_{22} and R_{24} to VREF to permanently enable the outputs (default)
   -to disable the high voltage output, remove R_{22} and populate 0Ω resistor R_{23}.
   -to disable the low voltage output, remove R_{24} and populate 0Ω resistor R_{25}.
   Do not solder or remove the resistors during operation!

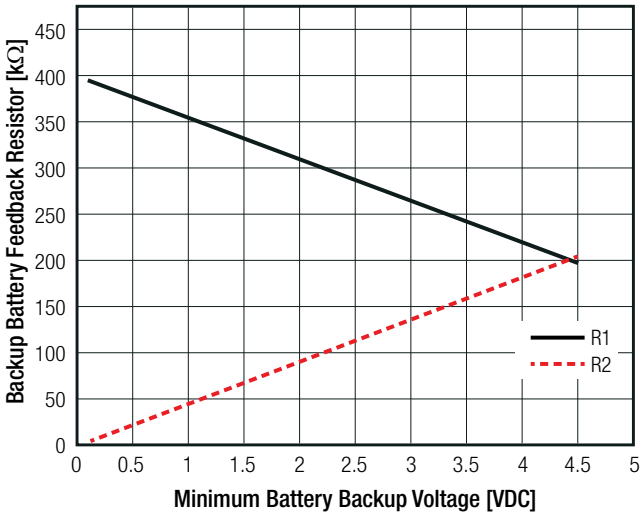
   -to allow external control of the HV or LV output, replace R_{22} and/or R_{24} with 1MΩ resistors and use an open-collector control signal (0VDC = disabled, open or Vref = enabled)

   Note the output voltages will not be active (internally disabled) until the voltage on storage element exceeds the minimum storage device threshold levels (3.7VDC or 3.9VDC)

6. For disassembly, always disconnect the PV source and disable the outputs before removing the storage element.

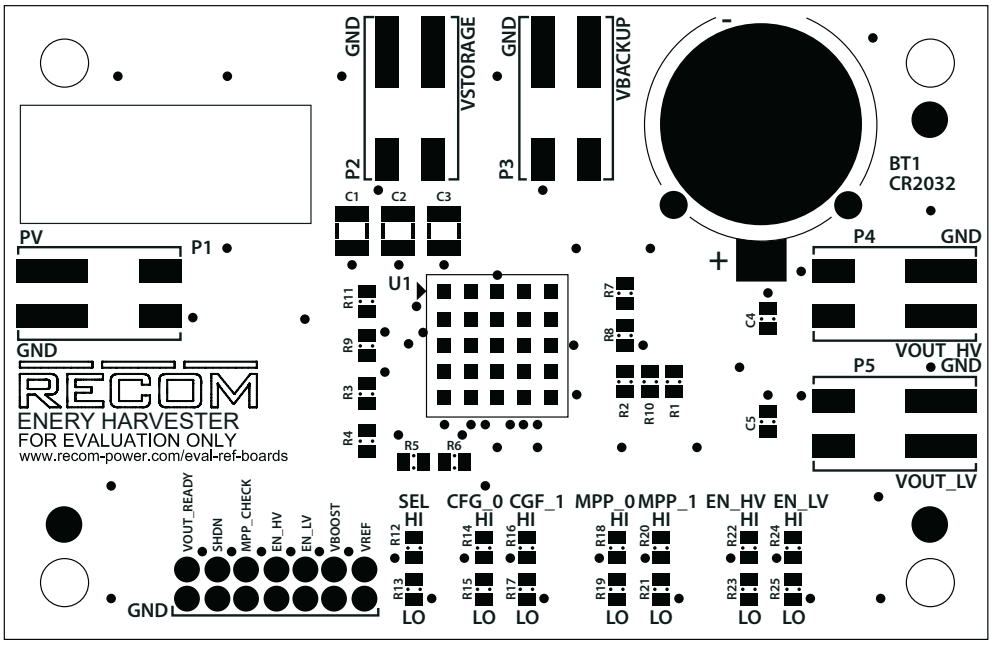
Minimal V_{BACKUP} Battery Voltage vs. FBV_{BACKUP} resistor

The calculated value for trim resistor in below example are according to standard E96 value; therefore, the specified voltage may slightly vary.



Example:
To set up V_{BACKUP} at ~2.2VDC
R_1= 301kΩ
R_2= 100kΩ

Component Placement



Specifications (measured @ Ta= 25°C, full load and after warm-up unless otherwise stated)

Connector Description

P1

Pin	Name	Description
1-2	PV	Harvester energy source (e.g. PV); 5VDC max voltage
3-4	GND	Common GND

P2

Pin	Name	Description
1-2	$V_{STORAGE}$	Storage element connection (supercapacitor or battery)
2	NC	No Connection

P3

Pin	Name	Description
1-2	V_{BACKUP}	Backup battery input positive terminal
3-4	GND	Common GND, battery negative terminal

P4

Pin	Name	Description
1-2	HV_{OUT}	3.3VDC High Voltage output
3-4	GND	Common GND

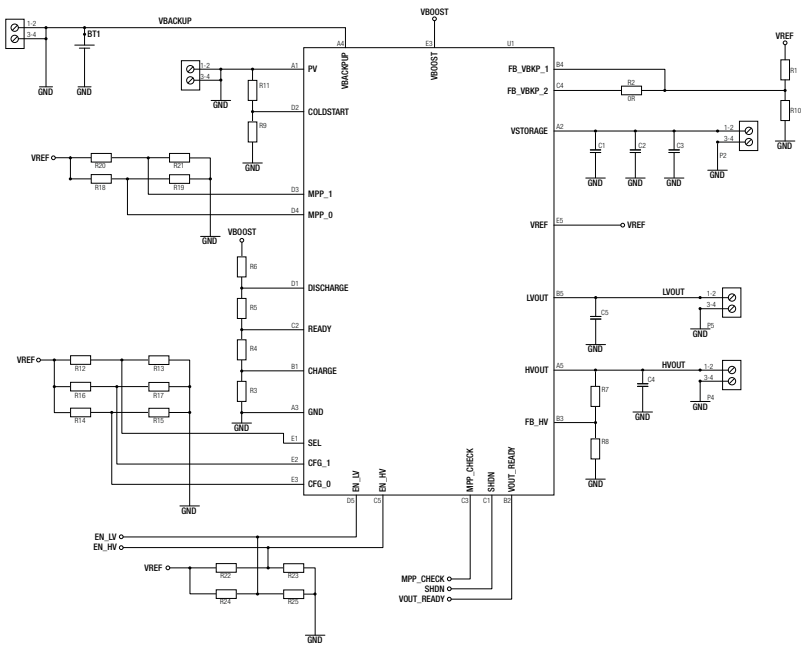
P5

Pin	Name	Description
1-2	LV_{OUT}	1.8VDC Low Voltage output
3-4	GND	Common GND

Pads Direct Connection

Name	Description
VOUT_READY	N/A with the REH-3.31.8 module
SHDN	Status logic output Asserted HIGH when $V_{STORAGE}$ falls below 3.6VDC and warns the system of imminent shutdown. Both outputs (HV_{OUT} and LV_{OUT}) are disabled after 600ms if the $V_{STORAGE}$ is not restored above 3.6VDC. Asserted HIGH when V_{BACKUP} is in use. LOW during normal operational state.
MPP_CHECK	N/A with the REH-3.31.8 module
EN_HV	High Voltage output enable (ENABLE: tie to VREF, DISABLE: tie to GND)
EN_LV	Low Voltage output enable (ENABLE: tie to VREF, DISABLE :tie to GND)
GND	Negative Input Voltage (GND)
VBOOST	N/A with the REH-3.31.8 module
VREF	reference voltage of the REH-3.31.8 module (typically 2.2VDC)

Schematic



Specifications (measured @ Ta= 25°C, full load and after warm-up unless otherwise stated)

Schematic Description

U_1: REH-3.31.8 energy harvester module

P_1: PV input of the harvester module. Allows connection to the energy source, e.g. a PV panel or other source with an open voltage not exceeding 5VDC.

P_3, BT_1: Backup voltage input with the possibility of using CR2032 coin cell battery (BT_1 footprint available). Non-rechargeable battery must be used.

R_9, R_{11}: Voltage divider for setting the minimum cold-start input voltage. Not populated. Function not supported by REH-3.31.8.

R_{18}, R_{19}, R_{20}, R_{21}: Setting resistors for Maximum Power Point Tracking setting. Not populated. Function not supported by REH-3.31.8.

R_3, R_4, R_5, R_6: Setting resistors for programming the threshold voltage levels of the storage element. Not populated. Function not supported by REH-3.31.8.

R_{12}, R_{13}: Setting resistors for the configuration of the storage element.

Reference	Configuration with the Battery	Configuration with the Supercapacitor
R_{12}	open	0Ω populated
R_{13}	0Ω populated	open

R_{14}, R_{15}: Setting resistors for future configurations. Not populated. Function not supported by REH-3.31.8.

R_{16}, R_{17}: Setting resistors for future configurations. Not populated. Function not supported by REH-3.31.8.

R_{22}, R_{23}: HV_{OUT} enable/disable setting resistors

Reference	HV_{OUT} enable	HV_{OUT} disable
R_{22}	0Ω populated	open
R_{23}	open	0Ω populated

R_{24}, R_{25}: LV_{OUT} enable/disable setting resistors

Reference	HV_{OUT} enable	HV_{OUT} disable
R_{24}	0Ω populated	open
R_{25}	open	0Ω populated

R_1, R_2, R_{10}: Setting resistors for the minimum battery backup voltage threshold. The input will switch to the backup battery if the PV input fails to supply sufficient voltage (e.g. no sun). The energy in the backup battery can be used only if the cell voltage is above the minimum battery backup voltage. Use the Graph above to set the required values. When V_{BACKUP} is not used (default), both pins (FB_VBKP_1, FB_VBKP_2) have to be connected to GND (R_1 open; R_2 and R_{10} populated with 0Ω resistor).

P_2, C_1, C_2, C_3: On-board capacitors create the minimum required storage capacitance (140µF) for stable harvesting operation. P_2 allows connection for the external storage element - either a supercapacitor or rechargeable battery defined by the SEL pin.

P_5, C_5: Low voltage output (typically 1.8VDC) and 10µF output filtering capacitor.

P_4, C_4: High voltage output (typically 3.3VDC) and 10µF output filtering capacitor.

R_7, R_8: High voltage output feedback resistors. Not populated. Function not supported by REH-3.31.8.

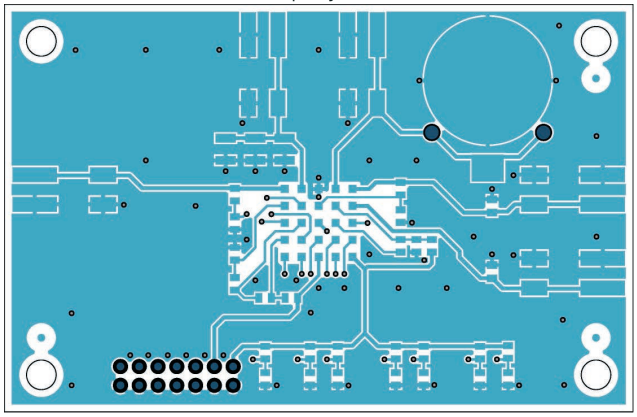
Specifications (measured @ Ta= 25°C, full load and after warm-up unless otherwise stated)

DIMENSION AND PHYSICAL CHARACTERISTICS

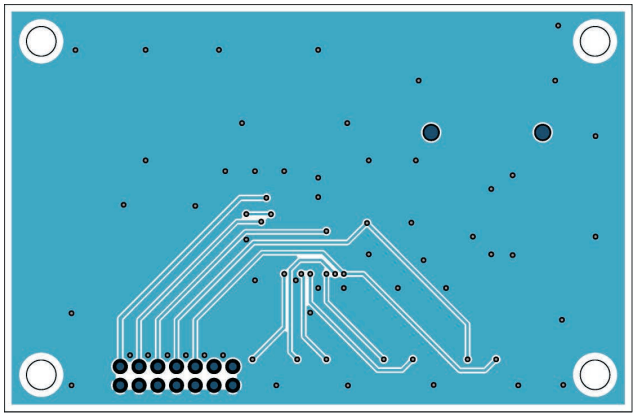
Parameter	Type	Value
Dimension (LxWxH)		85.0 x 55.0 x 5.9mm
Weight		21g typ.

Layout

Top Layer



Bottom Layer



Notes:

Note3: Visit www.recom-power.com/eval-ref-boards to download the Gerber files

BOM

Comp.	Description	Manufacturer Part Number	Manufacturer	Remarks
BT1	CR2032 Battery Holder	(pinout compatible with MPD 20mm cell holder BK-915-TR)		not fitted
C1, C2, C3	47uF 6.3V X7R 1210	GCM32ER70J476KE19L	MURATA	
C4, C5	10uF 10V X7R 0805	CL21B106KPQNNNG	SAMSUNG ELECTRO-MECHANICS	
P1, P2, P3, P4, P5	CONNECTOR	2060-452_998-404	WAGO	
R1, R3-R9, R11, R12, R14-R21, R23, R25	RES 0805			not mounted
R2, R10, R13, R22, R24	0Ω 0.125W 0805	RC0805JR-070RL	YAGEO	
U1	REH-3.31.8 MODULE	REH-3.31.8	RECOM	

PACKAGING INFORMATION (SAME AS RPMH-1.5-EVM-1 BOARD)

Parameter	Type	Value
Packaging Dimension (LxWxH)		114.0 x 60.0 x 28.0mm
Packaging Quantity		1pc

Contents

- RPMH-1.5-EVM-1 Evaluation Module
- Terms and Conditions