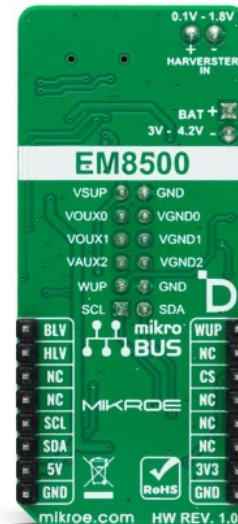
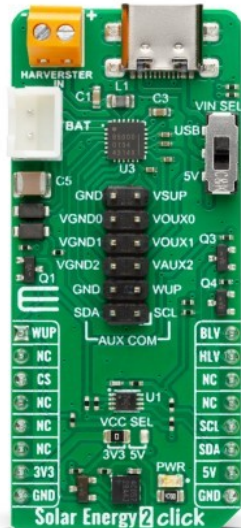


Solar Energy 2 Click



PID: MIKROE-5594

Solar Energy 2 Click is a compact add-on board that can recharge a battery by harvesting the solar power of the Sun or by other means. This board features the [EM8500](#), a power management controller with an energy harvesting interface from EM Microelectronic. The controller is specifically designed for efficient harvesting over various DC sources such as photovoltaic (solar) or thermal electric generators (TEG). It can recharge the connected LiPo battery or supercapacitor (or even a conventional capacitor). In addition, the EM8500 can use the same battery as a power source for powering the connected system. This Click board™ makes the perfect solution for powering wireless sensor networks, environmental monitoring devices, portable and wearable health monitoring devices, battery operating platforms, and similar low-power self-sustained devices.

Solar Energy 2 Click is supported by a [mikroSDK](#) compliant library, which includes functions that simplify software development. This [Click board™](#) comes as a fully tested product, ready to be used on a system equipped with the [mikroBUS™](#) socket.

How does it work?

Solar Energy 2 Click is based on the EM8500, a power management controller with an energy harvesting interface from EM Microelectronic. The EM8500 is flexible in operation and can use different energy banks such as primary cell batteries, gold capacitors, and supercapacitors. It can work in harvesting sources in μW to mW range thanks to an ultra-low power DC-DC boost converter with very high efficiency. The EM8500 uses short-term storage (STS) element (100 μF capacitor) to speed up system start-up. Besides fast start-up time over battery power, the LTS element (long-term storage) controls the minimum and maximum voltages, thus preventing damage to the battery. The onboard PMU with a built-in mechanism will extend the battery life

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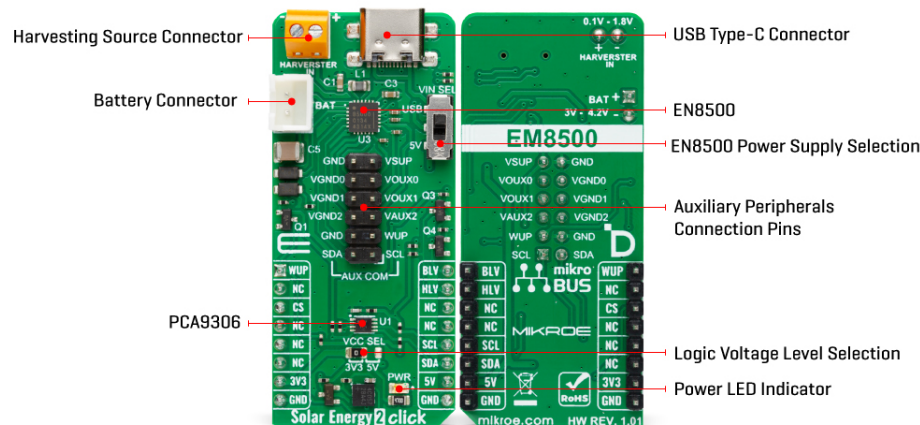


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if using a non-rechargeable battery.



The Solar Energy 2 Click can supply the external application through the VSUP and VAUX0-2 pins and correspondent GNDs of the 12-pin AUX COM header. On the VSUP pin, which is the main supply output, the wake-up function allows the automatic enabling of the supply after a given time. The AUX (auxiliary) output pins can output regulated voltages from 1.2 to 2.6V. Onboard EEPROM stores device configuration data, such as minimum and maximum voltage monitors, which will stop the DC-DC convertor, thus limiting the power loss. On EEPROM can be stored data for the VAUX0-2 and VGND0-2 pins, which besides the voltage output, can be used to store data for disconnecting any of these pins.

There are three modes in which Solar Energy 2 Click can operate. In Normal mode, the battery is connected and is in operating range. The LTS Protection mode is activated when the LTS voltage drops below minimum battery operation. In this mode is activated under-voltage protection. Finally, there is a Sleep mode where the VSUP is not supplied, and the communication with the host MCU is off. Sleep mode exit can be activated over the wake-up pin or by an internal timer.

The EN8500 also comes with several features, such as under-voltage, over-voltage, min/max voltage warning, USB connected status, lux-meter, and more. The lux-meter can run in three modes: Fully Automatic mode, Automatic Range Selection, and Fully Manual mode. The lux-meter determines current ranges by the harvesting element in 1 μ A steps. On Solar Energy 2 Click, a VIN SEL switch allows the EN8500 to use the 5V rail from the mikroBUS™ socket or the 5V from the onboard USB Type-C connector as its supply. The EN8500 can detect the power on this line but can't determine if it is from the USB C or the 5V rail of the mikroBUS™ socket.

Although the EN8500 uses 5V rail only for its power management, the Solar Energy 2 Click can work with 3.3V systems, too. This Click board™ features the PCA9306, a dual bidirectional voltage level translator from Texas Instruments. As a low-voltage-side reference voltage, this translator uses the VSUP from the EN8500, while the high-side is the one selected via the VCC SEL jumper. In the same manner, several MOSFETs are used for other onboard interconnections.

Solar Energy 2 Click uses a standard 2-Wire I2C interface to communicate with the host MCU and supports Standard, Fast, and High-Speed communication. As mentioned, the EN8500 can exit sleep mode via the wake-up functions, which can be the WUP pin of the mikroBUS™ socket or the WUP pin of the AUX COM header. The EN8500 uses two more pins to send statuses to

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the host MCU. The HLV is used as a harvester-energy levels detection status, while the BLV is used for battery voltage levels monitoring.


This Click board™ can operate with either 3.3V or 5V logic voltage levels selected via the VCC SEL jumper. This way, both 3.3V and 5V capable MCUs can use the communication lines properly. However, the Click board™ comes equipped with a library containing easy-to-use functions and an example code that can be used, as a reference, for further development.

Specifications

Type	Battery charger,Solar Charger
Applications	Can be used for powering wireless sensor networks, environmental monitoring devices, portable and wearable health monitoring devices, battery operating platforms, and similar low-power self-sustained devices
On-board modules	EM8500 - power management controller with an energy harvesting interface from EM Microelectronic
Key Features	Variety of DC harvesting sources including thermal electric generators (TEG) or photovoltaic (solar), sources in the μ W to mW range, flexible operation with primary cell battery, gold capacitors, and supercapacitors, auxiliary voltage output, programmable thresholds, onboard EEPROM, and more
Interface	I2C
ClickID	Yes
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V or 5V

Pinout diagram

This table shows how the pinout on Solar Energy 2 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
Wake Up	WUP	1	AN	PWM	16	BLV	Battery Voltage Level Indicator
	NC	2	RST	INT	15	HLV	Harvester Voltage Level Indicator
	NC	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	SCL	I2C Clock
	NC	6	MOSI	SDA	11	SDA	I2C Data

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Power Supply	3.3V	7	3.3V	5V	10	5V	Power Supply
Ground	GND	8	GND	GND	9	GND	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP2	VCC SEL	Left	Logic Level Voltage Selection 3V3/5V: Left position 3V3, Right position 5V
SW1	VIN SEL	Upper	Power Supply Selection USB/5V: Upper position USB, Lower position 5V

Solar Energy 2 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
AUX Output Voltage	1.2	-	2.6	V
DC Harvesting Source Voltage	0.1	0.5	1.8	V

Software Support

We provide a library for the Solar Energy 2 Click as well as a demo application (example), developed using MIKROE [compilers](#). The demo can run on all the main MIKROE [development boards](#).

Package can be downloaded/installed directly from NECTO Studio Package Manager (recommended), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

Library Description

This library contains API for Solar Energy 2 Click driver.

Key functions

- solarenergy2_set_pwr_current_source Solar Energy 2 power source selection function.
- solarenergy2_config_abs_voltage Solar Energy 2 config absolute voltage function.
- solarenergy2_set_mppt_ratio Solar Energy 2 set MPPT ratio function.

Example Description

This library contains API for the Solar Energy 2 Click driver. This driver provides functions to configure the power management controller with an energy harvesting interface.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager (recommended), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

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Other MikroE Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.SolarEnergy2

Additional notes and informations

Depending on the development board you are using, you may need [USB UART click](#), [USB UART 2 Click](#) or [RS232 Click](#) to connect to your PC, for development systems with no UART to USB interface available on the board. UART terminal is available in all MIKROE [compilers](#).

mikroSDK

This Click board™ is supported with [mikroSDK](#) - MIKROE Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the [LibStock](#) and installed for the compiler you are using.

For more information about mikroSDK, visit the [official page](#).

Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click boards™](#)

[ClickID](#)

Downloads

[Solar Energy 2 click example on Libstock](#)

[Solar Energy 2 click schematic](#)

[Solar Energy 2 click 2D and 3D files](#)

[PCA9306 datasheet](#)

[EM8500 datasheet](#)

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