

# SOLAR BATTERY CHARGER: OVERVIEW

Using a solar cell to charge a battery is a very popular application. However, solar cells also present challenges because of the wide variability of the output voltage, depending on the amount of solar energy directed at the panel, temperature, and the load on the panel. Utilizing the benefits of the ISL81601 buck-boost controller, this design can be used to charge a wide array of battery voltages even if the solar panel is delivering an output voltage much lower than its nominal output. An RL78/G14 MCU is added to ensure that the battery is not overcharged and to monitor the status of the battery. With the addition of MPPT firmware, the RL78/G14 can control the ISL81601 to maximize the efficiency of the solar panels. Depending on the voltage of the solar array used, an optional DC/DC has been added to increase efficiency in higher voltage applications.

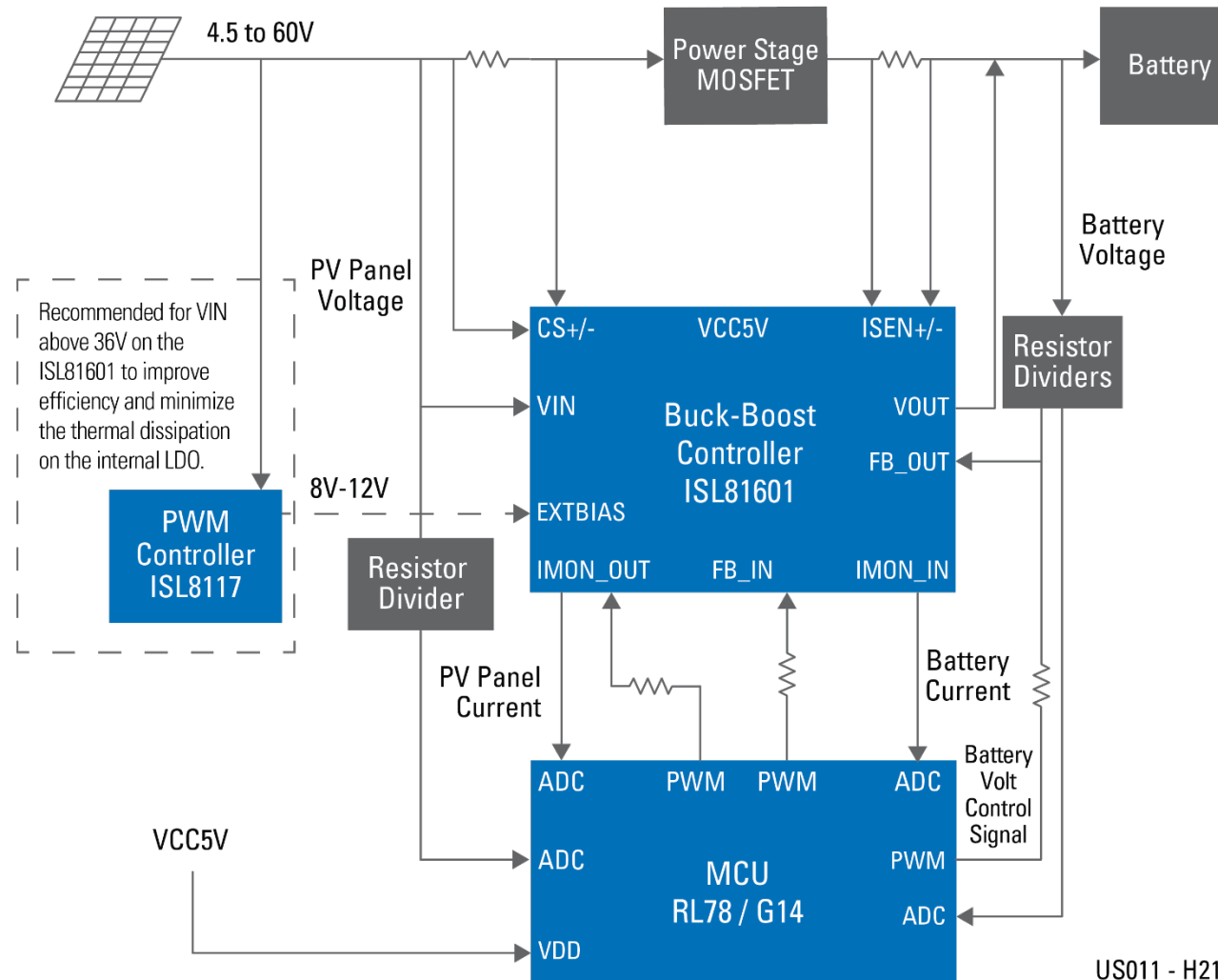
## Key Features:

- Buck-boost architecture charges the battery even when the voltage of the solar panel is below the battery voltage
- Programmable charge rates to support various modes, such as fast-charge and trickle-charge
- Up to 60V input and adjustable output voltage of 0.8V to 60V
- Monitors battery status and protects battery from damage caused by over-charging

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# SOLAR BATTERY CHARGER: BLOCK DIAGRAM



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# ISL81601: HIGH EFFICIENCY, SMOOTH MODE TRANSITION

## 60V Synchronous bidirectional Buck-Boost Controller

### Features

- Wide input voltage range: 4.5V to 60V
- Wide output voltage range: 0.8V to 60V
- Supports pre-biased output with SR soft-start
- Programmable frequency: 100kHz to 600kHz
- Low shut down current: 2.7μA
- Selectable PWM mode operation between PWM/DE/Burst modes
- External sync with clock out or frequency dithering
- Complete protection: OCP, SCP, OVP, OTP, and UVP

### Benefits

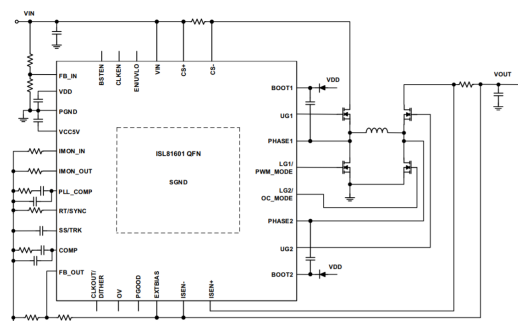
- It provides full protection features such as OVP, UVP, OTP and average and peak current limit on both input and output to ensure high reliability in both unidirectional and bidirectional operation. Proprietary algorithm for smoothest mode transition.
- It has four independent control loops for input and output voltages and current, providing instant current limit in fast transient conditions at either ends and in both directions

### Applications

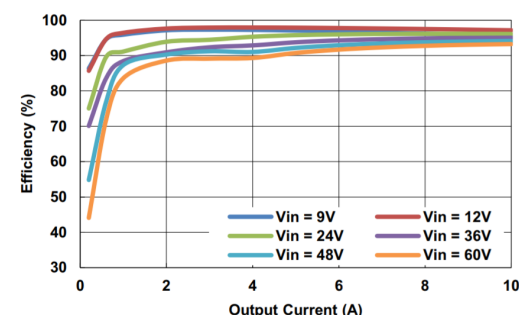
- Battery backup
- UPS/storage systems
- Battery powered industrial applications
- Renewable energy
- Aftermarket automotive
- Redundant power supplies
- Robot and drones
- Medical equipment
- Building and industrial automation
- Security surveillance

## Typical application and key performances

Typical application circuit



Efficiency (VOUT = 12V, DE Mode)

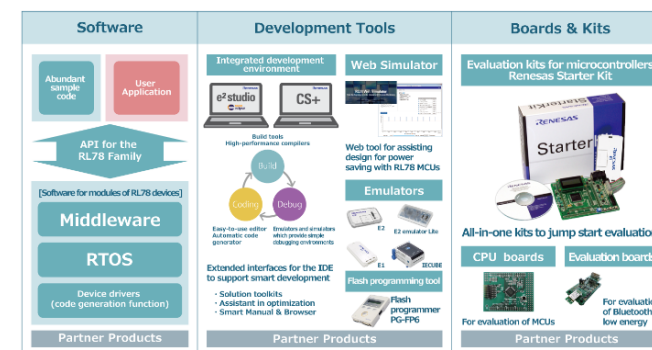
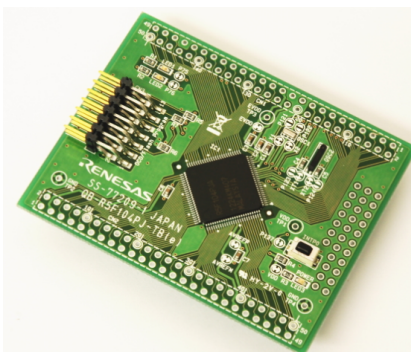
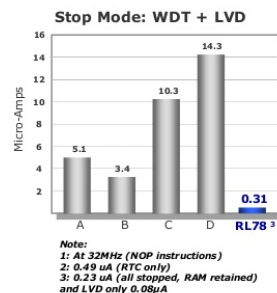
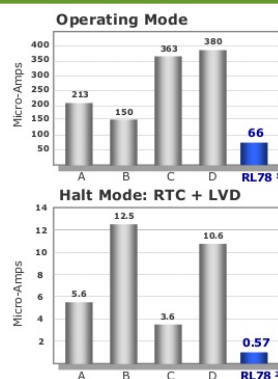


# RL78/G14: HIGH FUNCTION GENERAL PURPOSE MCU

## Low power MCU series within the RL78 Family

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>• True Low Power 16bit 32MHz uC</li> <li>• Broad Scalability w/ pin/FLASH/RAM options</li> <li>• High Performance w/ 1.6V to 5.5V operation</li> <li>• High Integration including oscillators, power-on-reset, low voltage detection, watchdog, real time clocks and analog functions</li> <li>• Comprehensive Tools and Support                             <ul style="list-style-type: none"> <li>– Advanced Tools, 3<sup>rd</sup> Party, Online resources and training</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• RL78 provide many options in-order to scale power based on application requirements by using combination of the clock selection and advanced power modes.</li> <li>• RL78 offer scalability via &gt; 600 devices with wide pin count, packages, I/O peripheral mapping and large memory options</li> <li>• Integration options allow for many of the functions necessary to make the solution smaller, more reliable and lower cost</li> </ul>	<ul style="list-style-type: none"> <li>• HVAC Systems</li> <li>• Climate control systems</li> <li>• Smart Thermostats</li> <li>• Bathroom fans</li> <li>• Kitchen exhaust hoods</li> <li>• Smart outlets &amp; receptacles</li> <li>• Home appliance</li> <li>• Weather stations</li> <li>• Industrial automation</li> </ul>

## Typical application and key performances



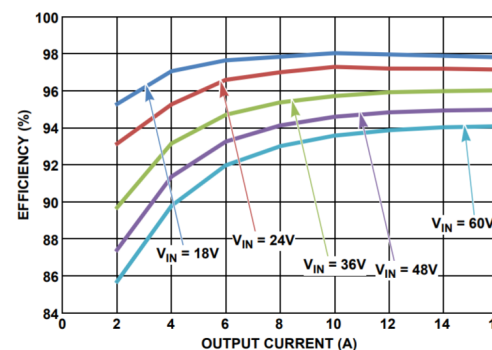
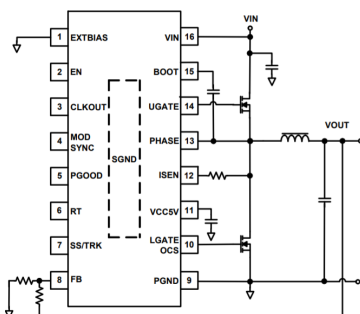
# ISL8117/A: DEFAULT SETTINGS, LOW COMPONENT COUNT

## 60V Synchronous Step-Down PWM Controller with wide $V_{in}$ – $V_{out}$ range

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>Wide input voltage range: 4.5V to 60V</li> <li>Wide output voltage range: 0.6V to 54V</li> <li>Light-load efficiency enhancement</li> <li>Programmable soft-start</li> <li>Programmable frequency: 100kHz to 2MHz</li> <li>Adaptive shoot-through protection</li> <li>No external current sense resistor</li> <li>Complete protection</li> </ul>	<ul style="list-style-type: none"> <li>It uses the valley current modulation technique to bring hassle-free power supply design with a minimal number of components and complete protection from unwanted events.</li> <li>Low pin count, fewer external components, and default internal values makes the ISL8117 an ideal solution for quick to market simple power supply designs.</li> <li>The unique DEM/Skipping mode at light-load dramatically lowers standby power consumption with consistent output ripple over different load levels.</li> </ul>	<ul style="list-style-type: none"> <li>PLC and factory automation</li> <li>Amusement machines</li> <li>Security surveillance</li> <li>Servers and data centers</li> <li>Switchers and routers</li> <li>Telecom and datacom</li> <li>LED panels</li> </ul>

## Typical application and key performances

Typical application circuit



# SOLAR BATTERY CHARGER

- **System benefits**

- Wide 4.5V to 60V input and 0.8V to 60V output voltage range
- Low power MCU, RL78/G14, with high integration for low system parts count
- Programmable charge profiles and constant current/constant voltage modes safely support various charge states

Device Category	P/N	Key Features
MCU	RL78/G14	RL78 Core, Low Power, High-Integration, General Purpose MCU
Power	ISL81601	60V Synchronous Bi-directional Buck-Boost Controller
Power	ISL8117	Single Output Buck Controller, 4.5 to 60 V <sub>IN</sub>