Compact Ultra-Efficient Solar/Light Energy Harvesting Battery Charger

Benefits and Features

Ultra-low power startup:
- Cold start from 250 mV input voltage and 5 µW input power (typical).

Highly efficient energy extraction:
- Periodic open-circuit voltage sensing for Maximum Power Point Tracking (MPPT);
- Configurable MPPT ratios of 35, 50 and from 60 to 90% by 5% steps;
- Constant impedance matching (QFN package only);
- Configurable MPPT sensing timing and period;
- MPPT voltage operation range from 115 mV to 1.5 V.

Flexible energy storage management:
- Selectable overdischarge protection from 2.8 V to 4.0 V;
- Selectable overcharge protection from 3.0 V to 4.8 V;
- For any type of rechargeable battery;
- Battery charge can be disabled, e.g. during transportation.

Configuration and communication:
- Static configurations available through configuration pins (depending on package) or I²C interface;
- I²C interface to set system functionalities and read system information;
- I²C mode up to Fast Mode Plus.

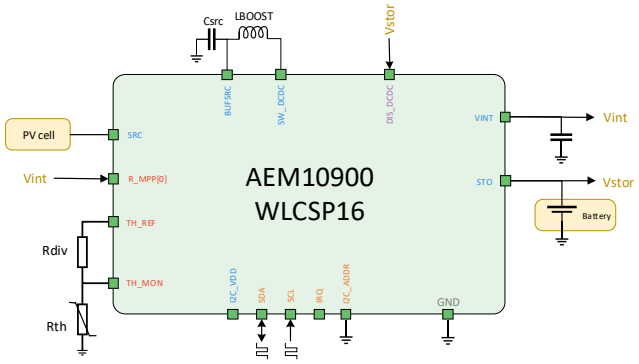
Configurable thermal protection:
- From -40°C to 125°C with accuracy below 1.5°C up to 60°C.

Power meter:
- Energy transfer or pulse counter mode.

Smallest footprint, smallest BOM:
- WLCSP16 2x2 mm or QFN28 4x4 mm;
- Only three passive components.

Applications

Wearable, Fitness	Medical Devices
Asset Tracking	IoT Sensors



Description

The AEM10900 is a fully integrated and compact battery charger circuit that extracts DC power from a solar cell to store energy in a rechargeable battery. This compact and ultra-efficient battery charger allows to extend battery lifetime and eliminates the primary energy storage in a large range of wireless application, such as wearable and medical applications, asset tracking and IoT Sensors.

Thanks to its Maximum Power Point Tracking and its ultra-low power boost converter, the AEM10900 harvests the maximum available input power from a source to charge a storage element, such as a Li-ion battery. The boost converter operates with input voltages in a range from 115 mV to 1.5 V. With its unique cold-start circuit, it can start operating with an input voltage as low as 250 mV and an input power of only 5 µW. The output voltages are in a range of 2.8 V to 4.8 V.

The configurable protection levels determine the storage element voltage protection thresholds to avoid overcharging and overdischarging the storage element and thus damaging it. Those levels are set without requiring any external component. It implements thermal monitoring for battery protection, as well as an average power monitoring system (APM) which allows the application circuit to get a measure of harvested energy.

The AEM10900 internal circuitry can be supplied either from the source or from the battery (“Keep alive” functionality). Being supplied from the battery avoids the need of a cold start after a period with no energy available on the source. On the other hand, when supplied only from the source an always positive power balance is guaranteed even if energy harvesting is not occurring for long periods of time.

It is optimal for wearable applications with its small footprint and small BOM (two capacitors and one inductor). All parameters can be set through an I²C interface, such as thermal shutoff, battery monitoring and MPPT, allowing more flexibility to customer designs.

Device Information

Package	Body size [mm]
WLCSP16	2x2
QFN28	4x4

Evaluation Board

Part number
2AAEM10900C0011

6. Functional Block Diagram

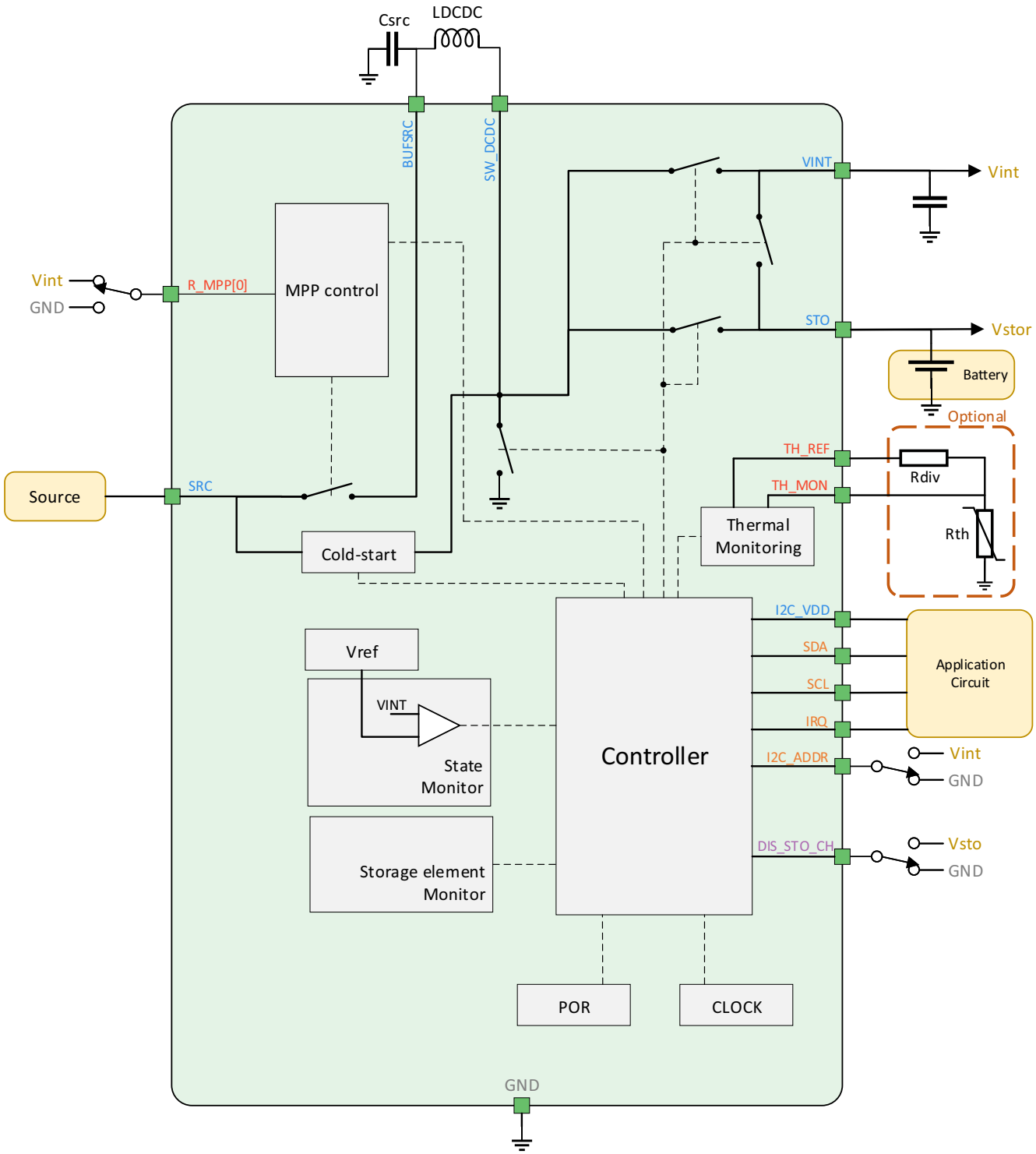


Figure 4: Functional block diagram (WLCSP16 package)

10. Performance Data

10.1. DCDC Conversion Efficiency

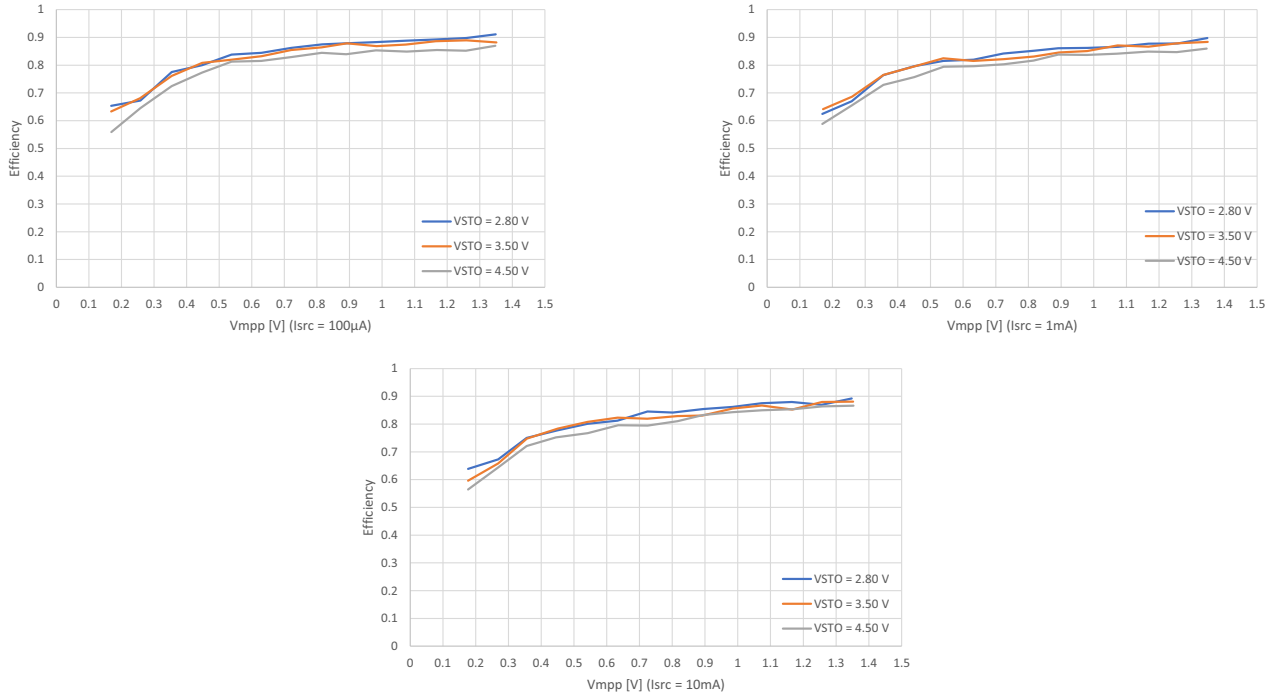


Figure 17: DCDC Conversion Efficiency (LDCDC: VLS252012HBX-4R7M-1)

10.2. Quiescent Current

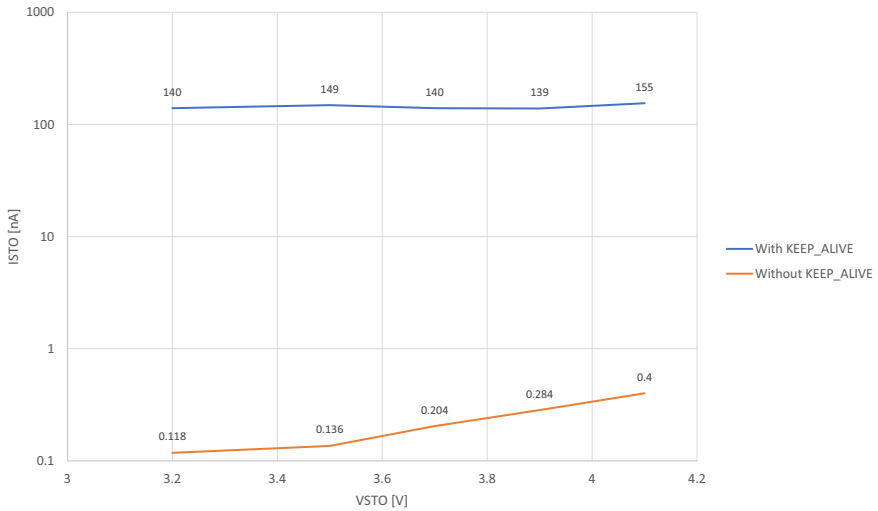


Figure 18: Quiescent Current