Highly-Efficient, Regulated Dual-Output, Ambient Energy Manager for up to 7-cell solar panels with optional primary battery

Features

Ultra-low power start-up:
- Cold start from 380 mV input voltage and 3 μW input power (typical)

Ultra-low power boost regulator:
- Open-circuit voltage sensing for MPPT every 5 s
- Configurable MPPT with 2-pin programming
- Selectable Voc ratios of 70, 75, 85 or 90 %
- Input voltage operation range from 50 mV to 5 V
- MPPT voltage operation range from 50 mV to 5 V

Integrated 1.2/1.8 V LDO regulator:
- Up to 20 mA load current
- Power gated dynamically by external control
- Selectable output voltage

Integrated 1.8 V-4.1 V LDO regulator:
- Up to 80 mA load current with 300 mV drop-out
- Power gated dynamically by external control
- Selectable or adjustable output voltage

Flexible energy storage management:
- Selectable overcharge and overdischarge protection
- For any type of rechargeable battery or (super)capacitor
- Fast supercapacitor charging
- Warns the load when battery is running low
- Warns when output voltage regulators are available

Smallest footprint, smallest BOM:
- Only seven passive external components

Optional primary battery:
- Automatically switches to the primary battery when the secondary battery is exhausted

Integrated balun for dual-cell supercapacitor

Applications

- PV cell harvesting
- Industrial monitoring
- Geolocation
- Home automation
- E-health monitoring
- Wireless Sensor Nodes

Description

The AEM10941 is an integrated energy management circuit that extracts DC power from up to 7-cell solar panels to simultaneously store energy in a rechargeable element and supply the system with two independent regulated voltages. The AEM10941 allows to extend battery lifetime and ultimately eliminates the primary energy storage element in a large range of wireless applications, such as industrial monitoring, geolocation, home automation, e-health monitoring and wireless sensor nodes.

The AEM10941 harvests the available input current up to 110 mA. It integrates an ultra-low power boost converter to charge a storage element, such as a Li-ion battery, a thin film battery, a supercapacitor or a conventional capacitor. The boost converter operates with input voltages in a range from 50 mV to 5 V. With its unique cold-start circuit, it can start operating with empty storage elements at an input voltage as low as 380 mV and an input power of just 3 μW.

The low-voltage supply typically drives a microcontroller at 1.2 V or 1.8 V. The high-voltage supply may typically drive a radio transceiver at a configurable voltage between 1.8 V and 4.1 V. Both are driven by highly-efficient LDO (Low Drop-Out) regulators for low noise and high stability.

Configuration pins determine various operating modes by setting predefined conditions for the energy storage element (overcharge or overdischarge voltages), and by selecting the voltage of the high-voltage supply and the low-voltage supply. Moreover, special modes can be obtained at the expense of a few configuration resistors.

The chip integrates all the active elements for powering a typical wireless sensor. Five capacitors and two inductors are required, available respectively in the small 0402 and 0603 SMD formats.

With only seven external components , integration is maximum, footprint and BOM are minimum, optimizing the time-to-market and the costs of WSN designs.

Device information

Part number	Package	Body size
AEM10941_a	QFN 28-pin	5 mm x 5 mm
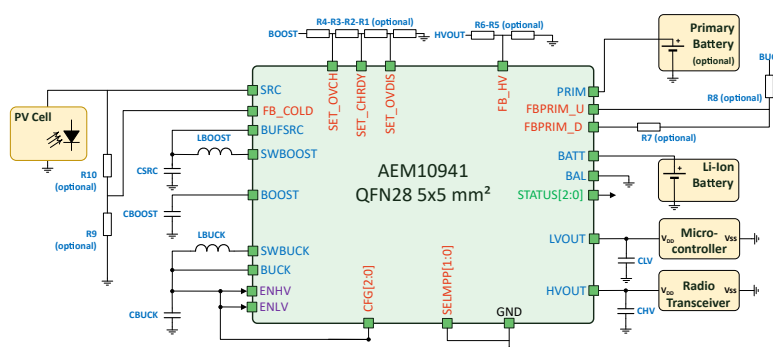
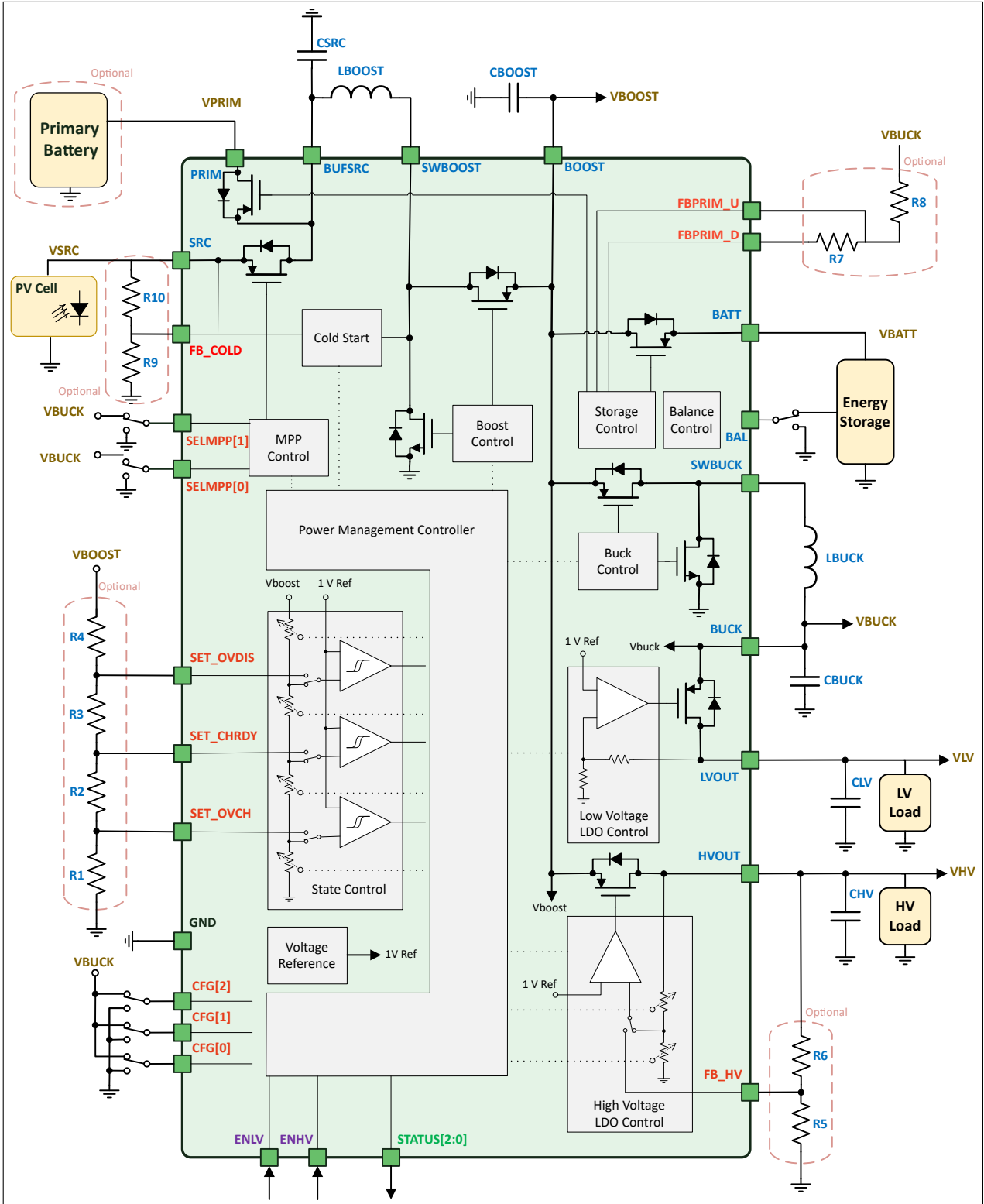# 1 Functional Block Diagram

Figure 1: Functional block diagram

AEM10941

2 Performance Data
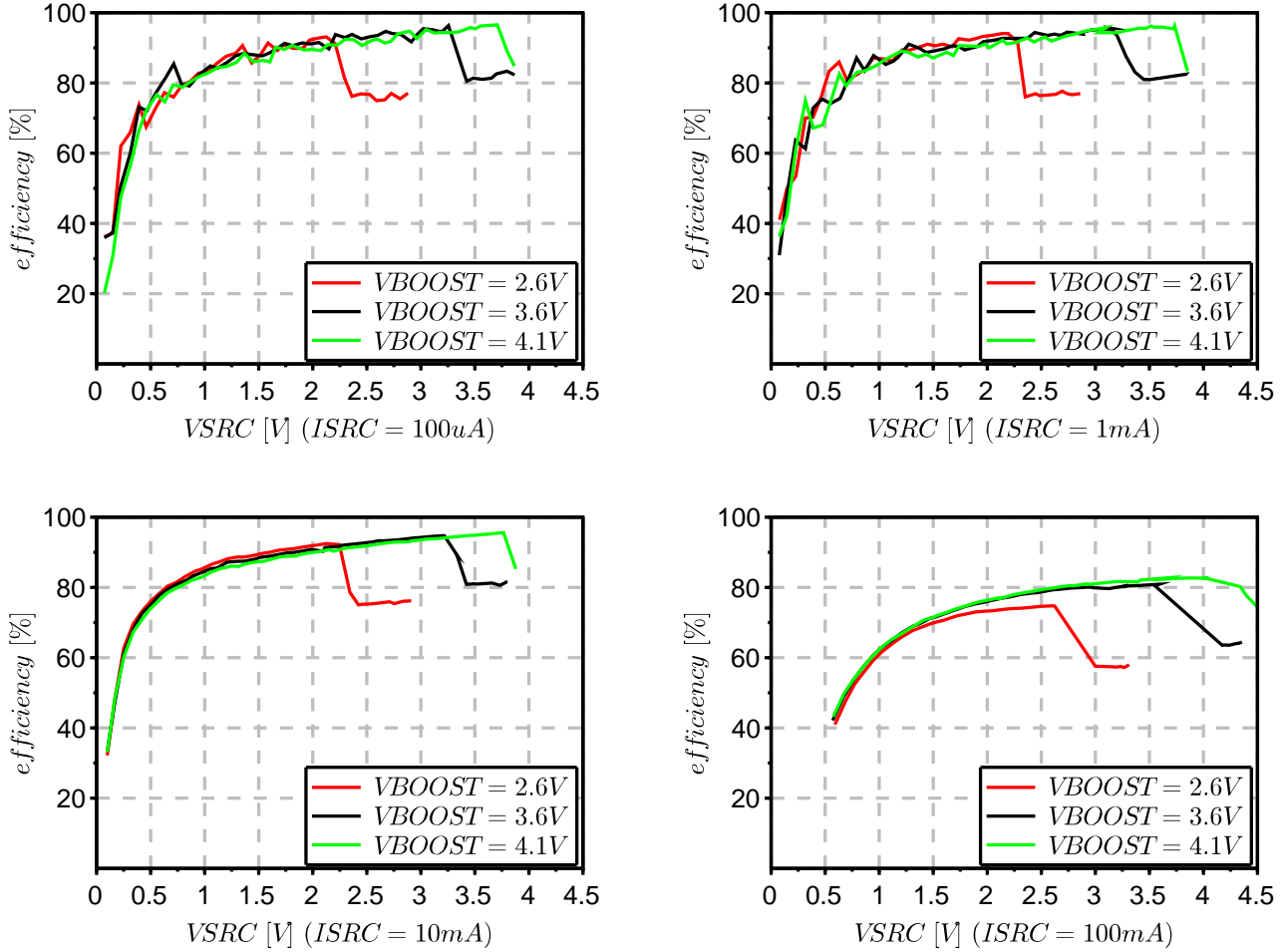
2.1 BOOST conversion efficiency

Figure 2: Boost efficiency for Isrc at 100 µA, 1 mA, 10 mA and 100 mA

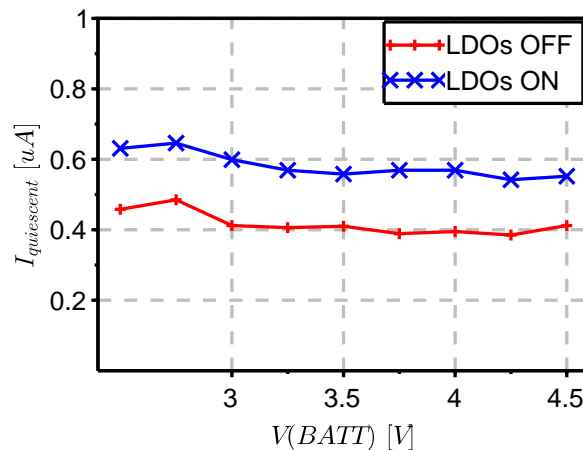### 2.2 Quiescent current

Figure 3: Quiescent current with LDO on and off

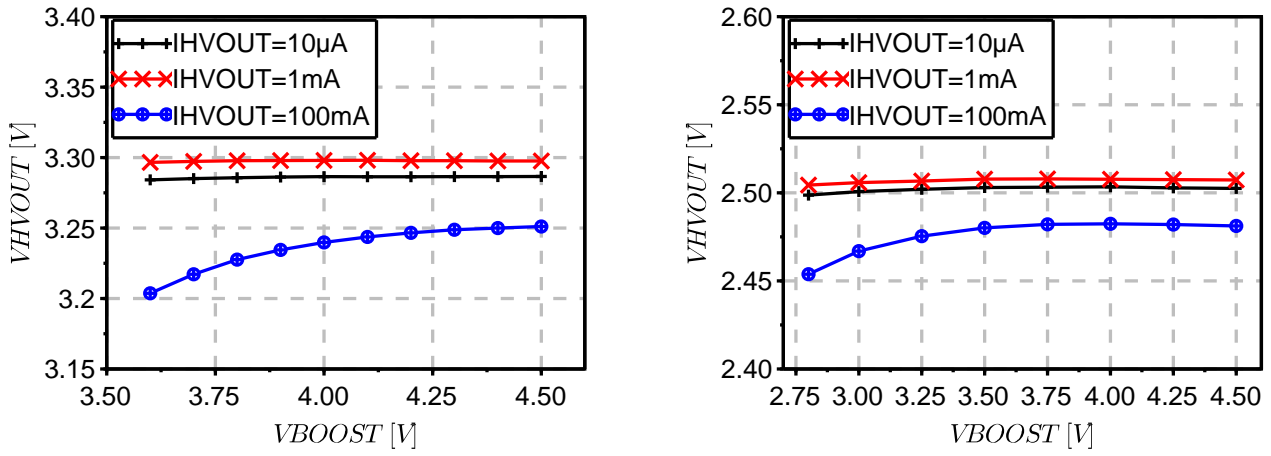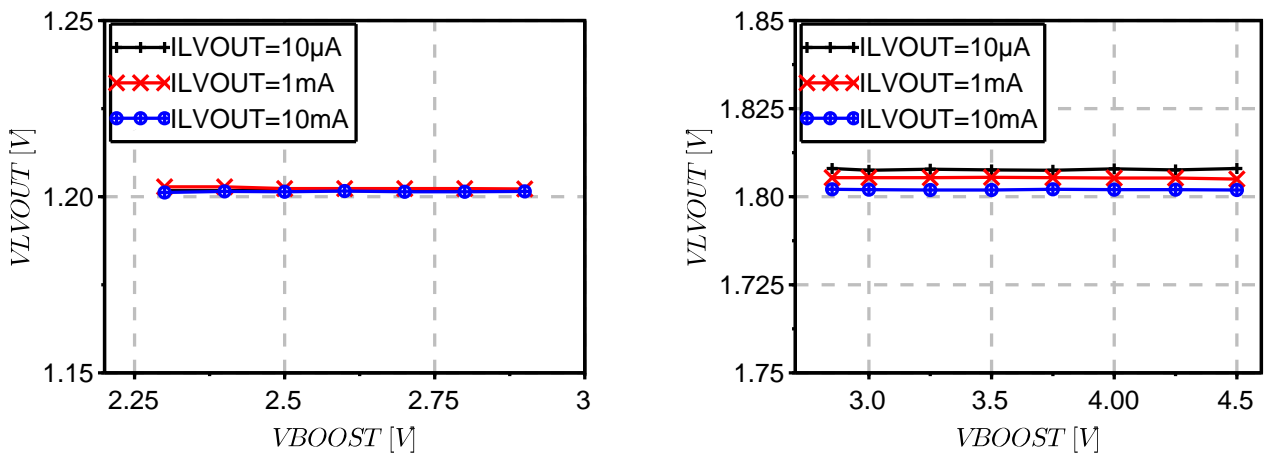## 2.3 High-voltage LDO regulation

Figure 4: HVOUT at 2.5 V and 3.3 V

2.4 Low-voltage LDO regulation

Figure 5: LVOUT at 1.2 V and 1.8 V