

Highly-Efficient Regulated Dual-Output, Ambient Energy Manager for High-Frequency RF input with optional primary battery

Features

Ultra-low power start-up:

- RF input power from -18.5 dBm up to 10 dBm (typical)
- Cold start from the RF input or from the storage device

Ultra-low power boost regulator:

- Open-circuit voltage sensing for MPPT every 0.33 s
- Configurable MPPT with 2-pin programming
- Selectable Voc ratios of 60, 65 or 70 %
- Input voltage operation range from 50 mV to 2.5 V
- MPPT voltage operation range from 50 mV to 2.5 V
- Constant impedance matching (ZMPPT)

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-3.3 V LDO regulator:

- Up to 80 mA load current with 300 mV drop-out
- Power gated dynamically by external control
- Selectable 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

- RF harvesting
- Industrial monitoring
- Indoor geolocation
- Home automation
- E-health monitoring
- Wireless sensor nodes

Description

The AEM40940 is an integrated energy management subsystem that extracts AC power from high-frequency RF inputs to simultaneously store energy in a rechargeable element and supply the system with two independent regulated voltages. The AEM40940 allows to extend battery lifetime and ultimately eliminates the primary energy storage element in a large range of wireless applications, such as industrial monitoring, indoor geolocation, home automation, e-health monitoring and wireless sensor nodes.

The AEM40940 harvests the available input power up to 10dBm. It integrates an ultra-low power rectifier combined with a boost converter to charge a storage element, such as a Li-ion battery, a thin film battery, a supercapacitor or a conventional capacitor. With its unique cold-start circuit, it can start operating with empty storage elements at an input power as low as -18.5dBm.

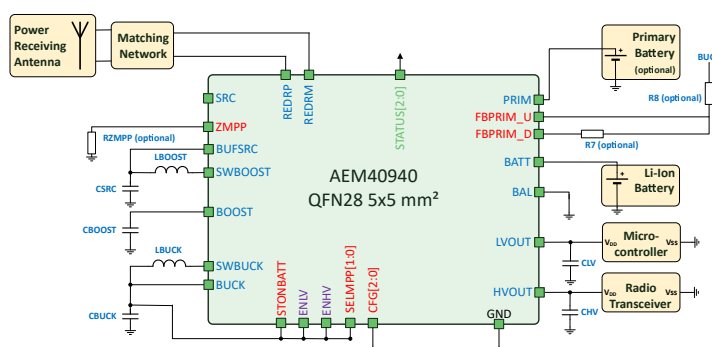
The low-voltage supply typically drives a microcontroller at 1.2 V or 1.8 V. The high-voltage supply may typically drive a radio transceiver at a configurable voltage between 1.8 V and 3.3 V. Both are driven by highly-efficient LDO (Low Drop-Out) regulators for low noise and high stability.

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. 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 excluding the matching network, 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
AEM40940_a	QFN 28-pin	5 mm x 5 mm



1 Functional Block Diagram

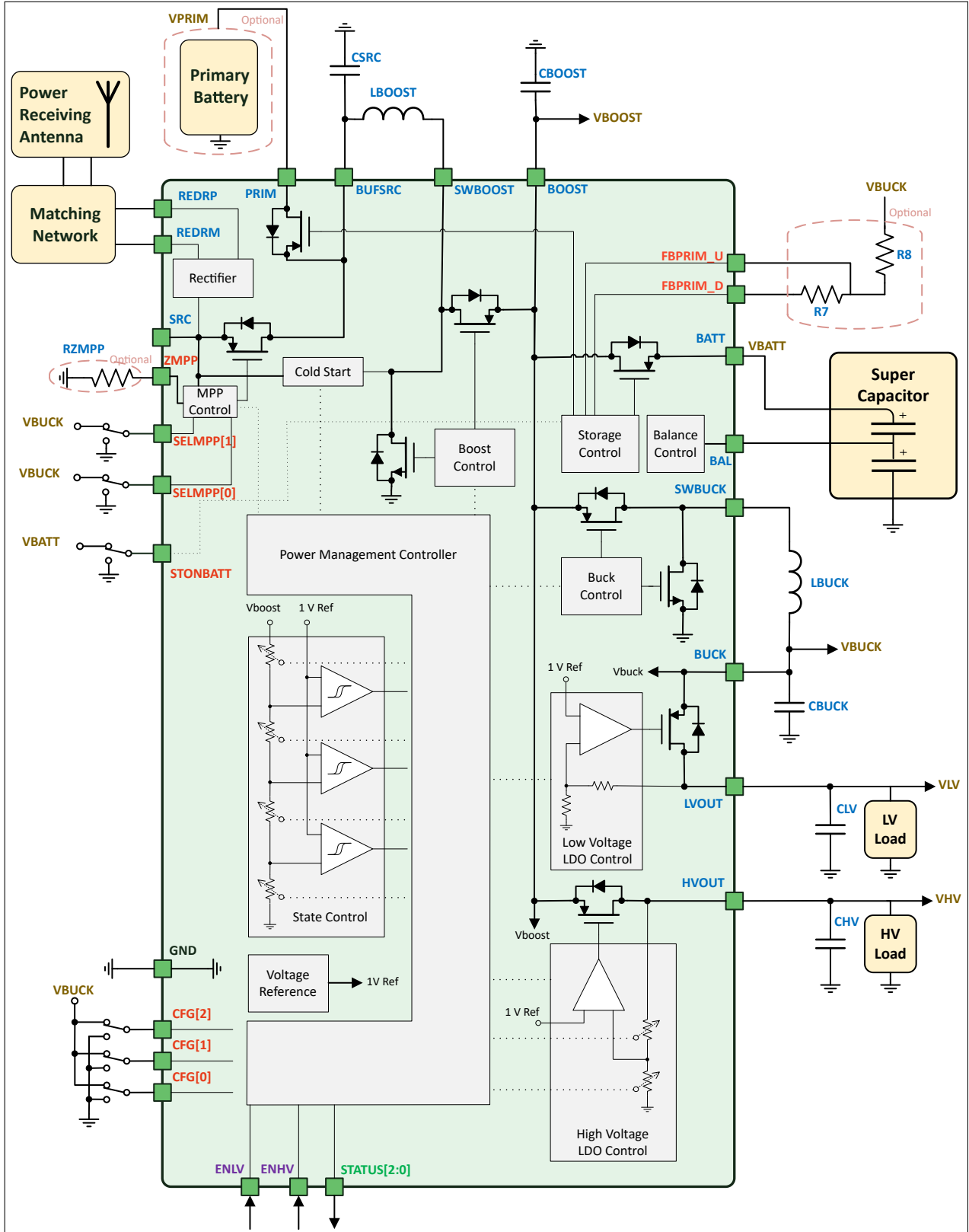


Figure 1: Functional block diagram

2 Performance Data

2.1 BOOST conversion efficiency

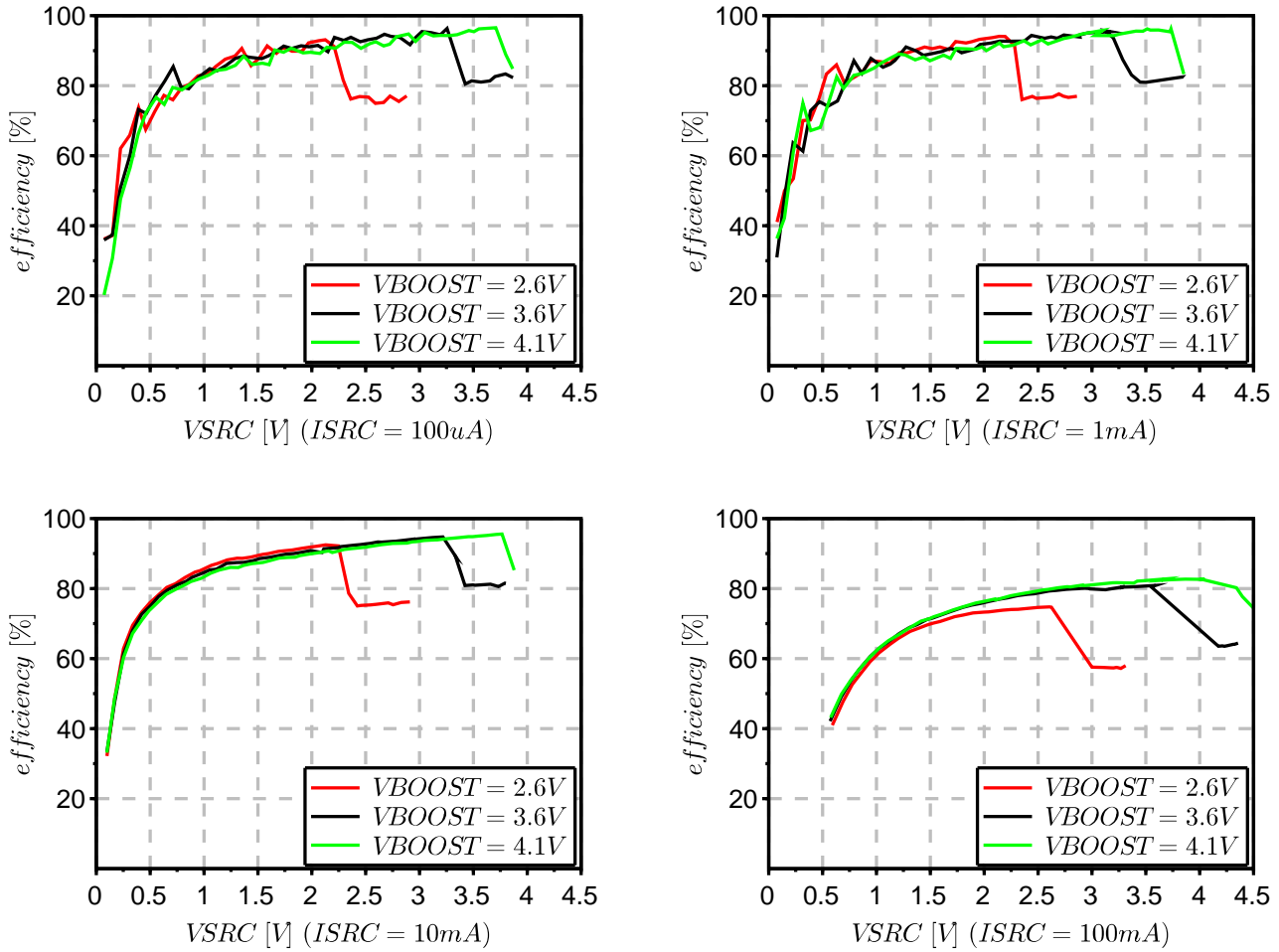


Figure 2: Boost efficiency for current delivered by the rectifier at 100 μ A, 1 mA, 10 mA and 100 mA

2.2 Quiescent current

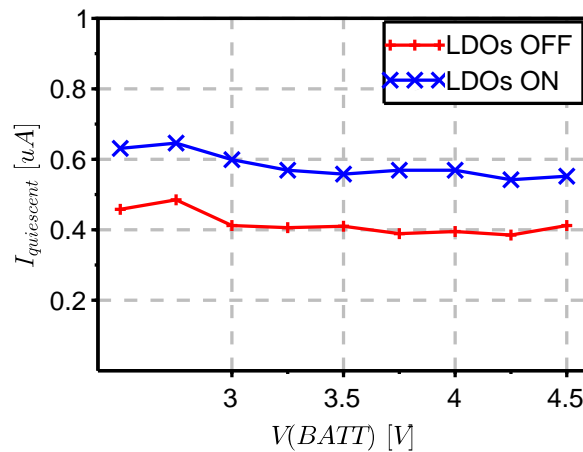


Figure 3: Quiescent current with LDO on and off

2.3 High-voltage LDO regulation

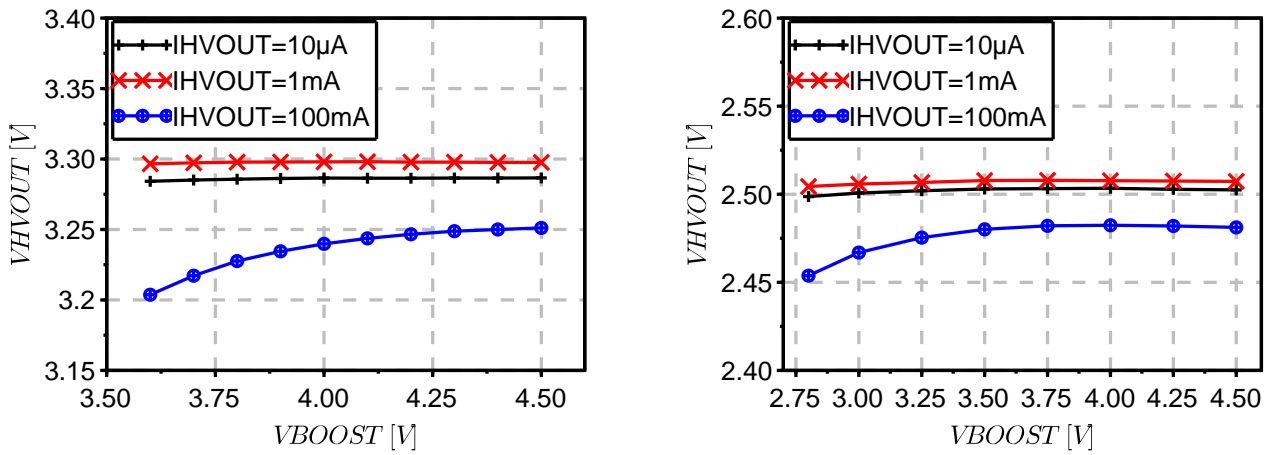


Figure 4: HVOUT at 2.5 V and 3.3 V

2.4 Low-voltage LDO regulation

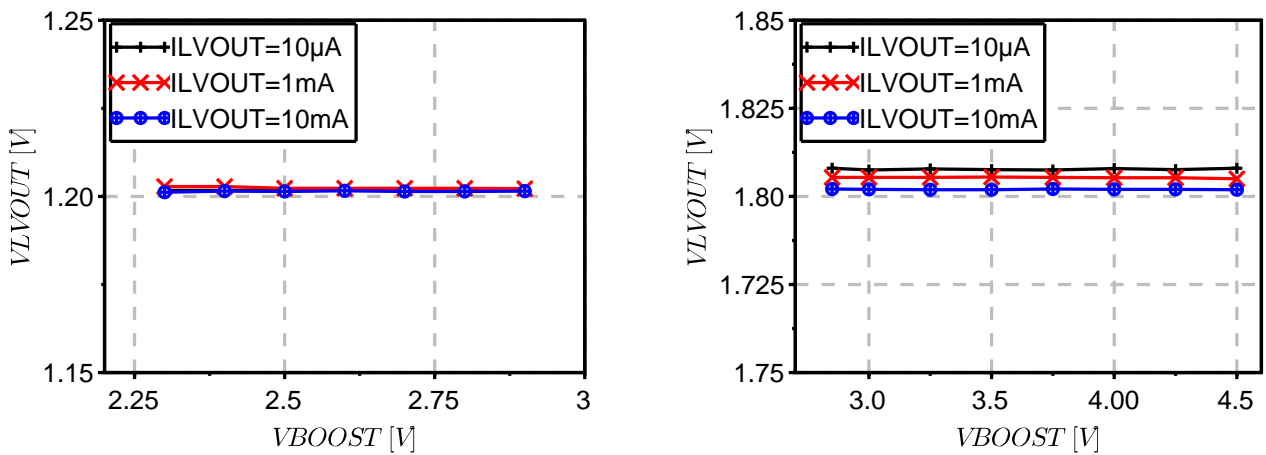


Figure 5: LVOUT at 1.2 V and 1.8 V

2.5 Internal rectifier

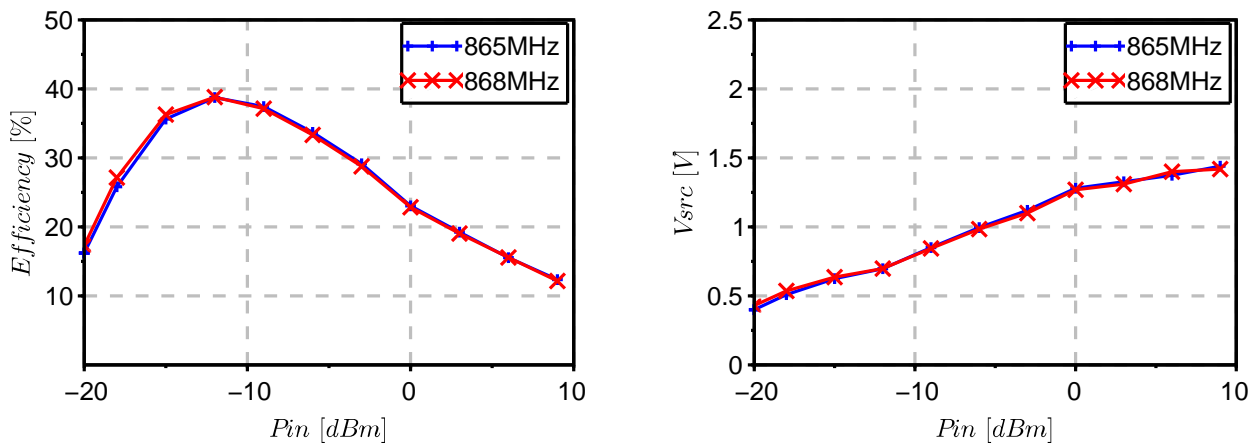


Figure 6: Efficiency and output voltage of the internal rectifier