Highly Versatile, Regulated Single-Output, Buck-Boost Ambient Energy Manager For AC/DC Sources with Optional Primary Battery

Features

Ultra-low power start-up
- Cold start from 275 mV input voltage and 3 µW input power (typical)

Very efficient energy extraction
- Open-circuit voltage sensing for Maximum Power Point Tracking (MPPT)
- Selectable open-circuit voltage ratios from 35% to 80% or fixed impedance
- Programmable MPPT sensing period
- MPPT voltage operation range from 100 mV to 4.5 V

Adaptive and smart energy management with optional primary battery
- Switches automatically between boost, buck-boost and buck operation, to maximize energy transfer from its input to the output
- Automatically selects between the source, storage element and an optional primary battery
- Automatically select the output between the internal supply, the load and the storage element
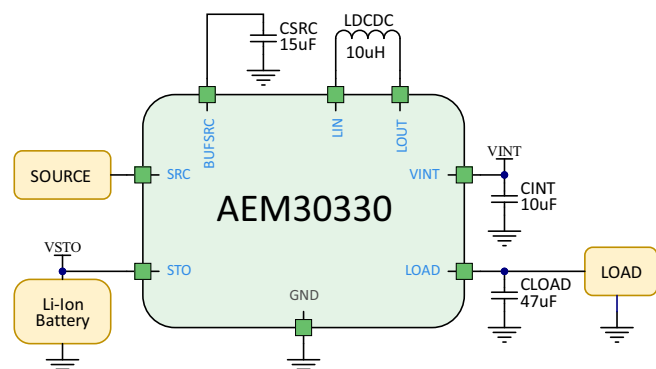
Load supply voltage
- Current drive capability: 30 mA in low power mode, 60 mA in high power mode
- Selectable load voltage from 1.2 V to 3.3 V

Battery protection features
- Selectable over-charge and over-discharge protection for any type of rechargeable battery or (super-)capacitor
- Fast super-capacitor charging
- Dual cell super-capacitor balancing circuit

Smallest footprint, smallest BOM
- Only four external components are required
- One 10 µH inductor
- Three capacitors: one 10 µF, one 15 µF, one at least 40 µF

Description

The AEM30330 is an integrated energy management circuit that extracts DC power from an ambient energy harvesting source to simultaneously supply an application and store energy in a storage element. The AEM30330 allows to extend battery lifetime and ultimately eliminates the primary energy storage element in a large range of applications.

Thanks to its Maximum Power Point Tracking system, the AEM30330 extracts the maximum energy available from the source. It integrates an ultra-low power DCDC converter which operates with input voltages ranging from 100 mV to 4.5 V.

Two different storage elements can be connected: one for storing energy and another one for coupling the load output voltage. At start-up, user can choose to charge the storage element first or the load capacitor first.

With its unique cold start circuit, the AEM30330 can start harvesting with an input voltage as low as 275 mV and from an input power of 3 µW. The preset protection levels determine the storage element voltages protection thresholds to avoid over-charging and over-discharging the storage element and thus avoiding damaging it. Those are set through configuration pins. Moreover, special modes can be obtained at the expense of a few configuration resistors.

The load voltage can be selected to cover most application needs, with a maximum available load current of 60 mA.

The chip integrates all active elements for powering a typical wireless sensor. Only three capacitors and one inductor are required.

Applications

- Asset Tracking/Monitoring
- Retail ESL/ Smart sensors
- Smart home/building
- Industrial applications
- Aftermarket automotive

Device Information

Part Number	Package	Body size [mm]
10AEM30330J0000	QFN 40-pin	5x5mm

Evaluation Board

Part Number
2AAEM30330J0010

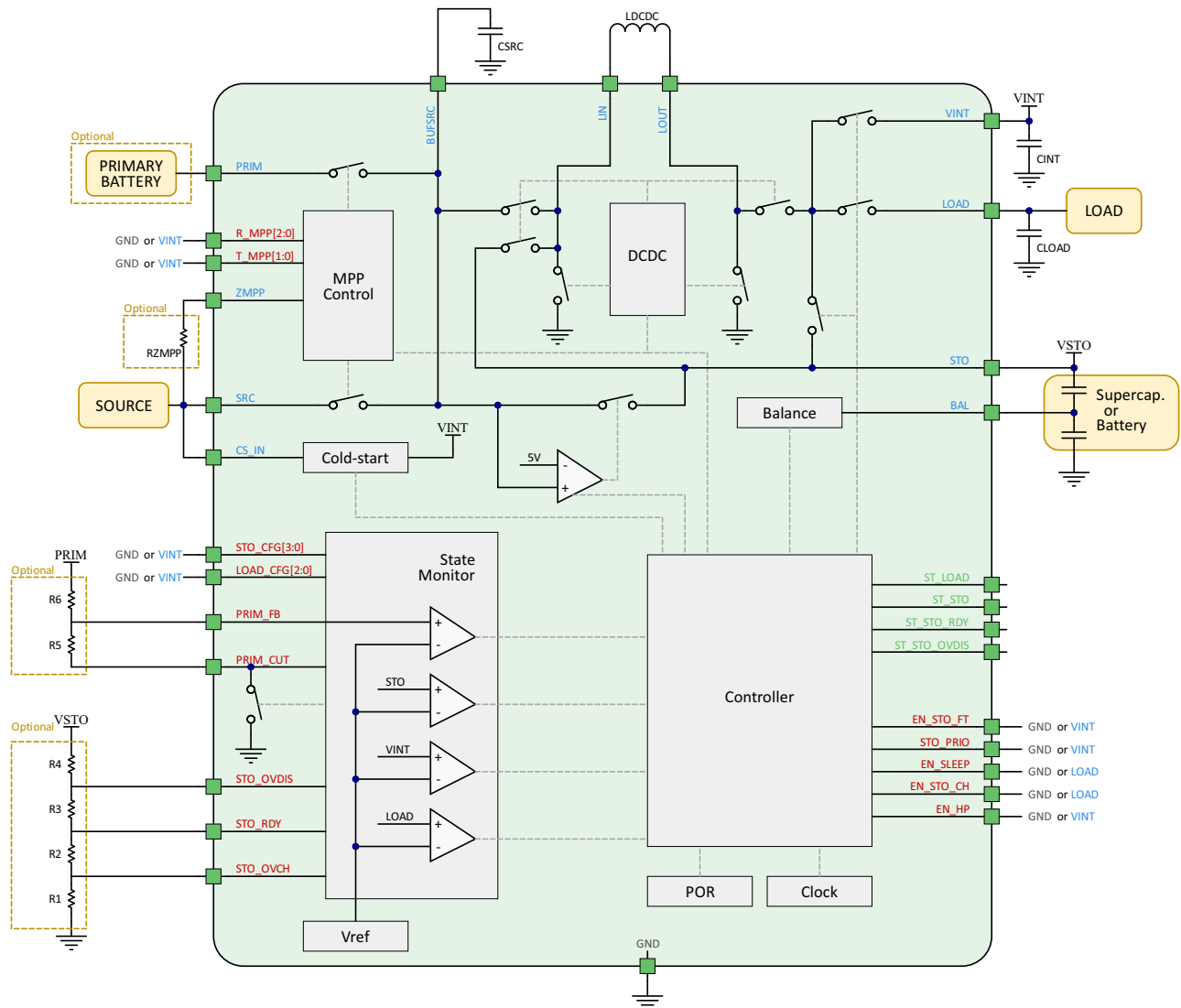# 1. Functional Block Diagram

Figure 1: Functional Block Diagram

2. Performance Data

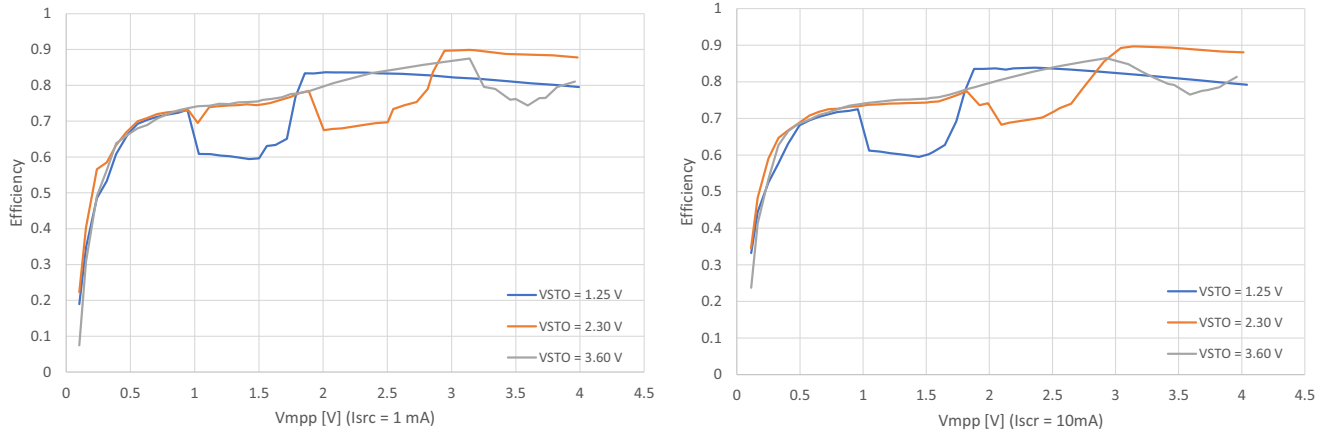## 2.1. DCDC Conversion Efficiency From SRC to STO in Low Power Mode

Figure 2: DCDC Efficiency from SRC to STO for 1 mA and 10 mA in Low Power Mode

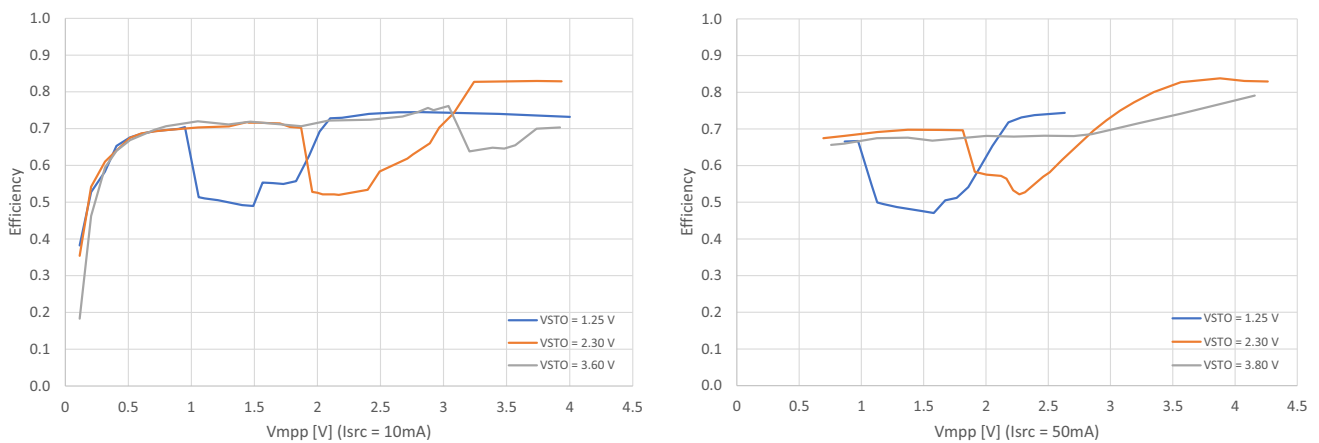## 2.2. DCDC Conversion Efficiency From SRC to STO in High Power Mode

Figure 3: DCDC Efficiency from SRC to STO for 10 mA and 50 mA in High Power Mode

AEM30330

2.3. DCDC Conversion Efficiency From STO to LOAD in Low Power Mode
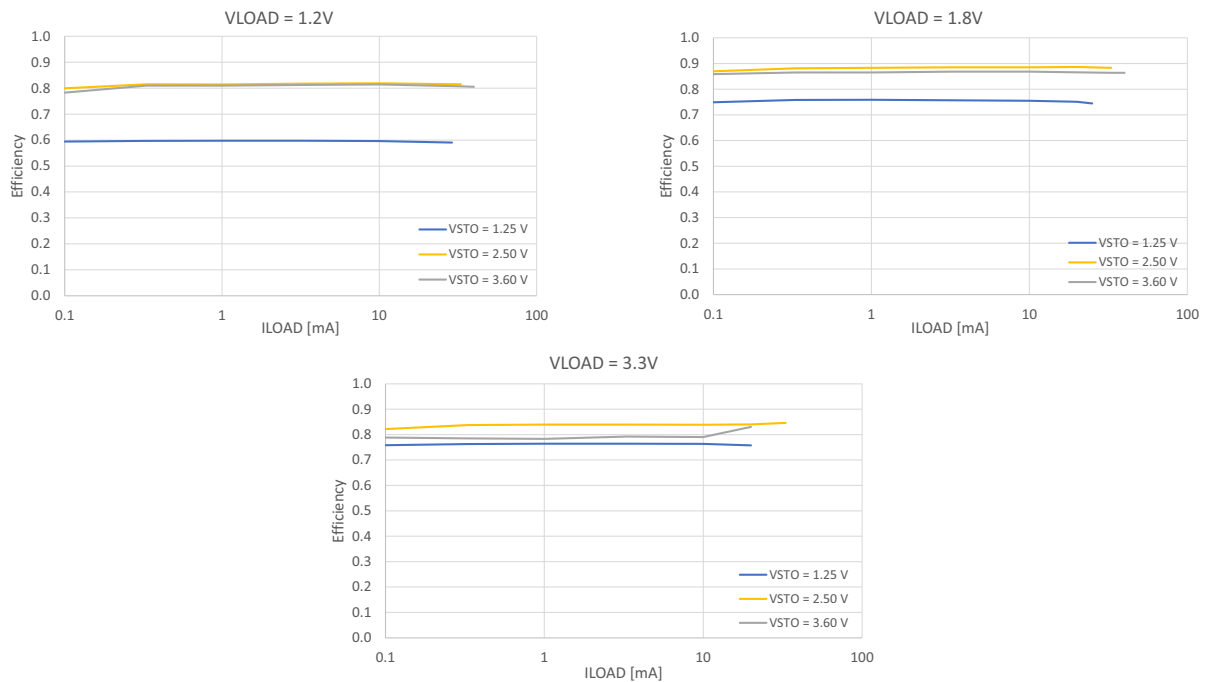

Figure 4: DCDC Efficiency from STO to LOAD in Low Power Mode

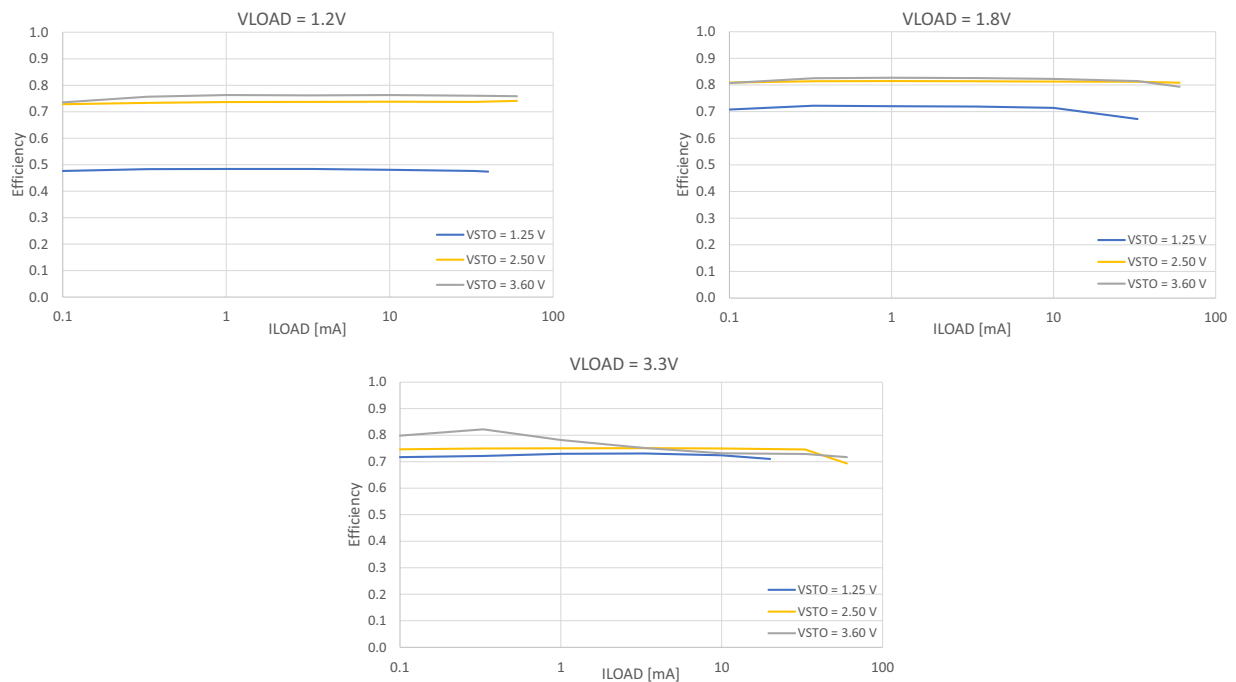## 2.4. DCDC Conversion Efficiency From STO to LOAD in High Power Mode

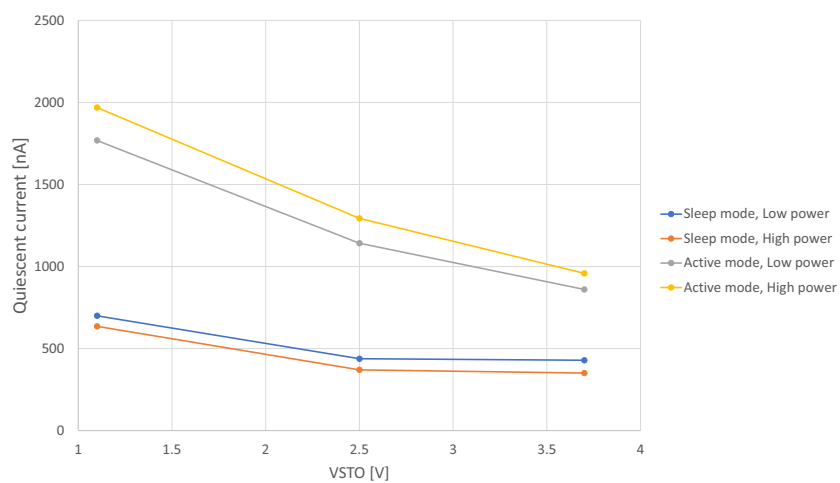*Figure 5: DCDC Efficiency from STO to LOAD in High Power Mode*

2.5. Quiescent Current

Figure 6: Quiescent Current