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Keywords: Two AA Cells Power Dual-Supply µP

APPLICATION NOTE 1783

Two AA Cells Power Dual-Supply µP

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Certain of the new, high-power microprocessors for portable applications (Strong ARM and others) require dual power-supply voltages for operation. As an example, these voltages can be 3.3V for the I/O circuitry and 1.5V for the processor core. A battery of two AA cells, rechargeable or primary (available at most corner shops), is popular for these applications because it offers very high power density.

A compact circuit for this application (**Figure 1**) is based on a dual DC-DC boost controller (IC1). Output 1, configured as in a standard application, provides the 3.3V rail and delivers output currents up to 1A. If necessary, the output voltage can be adjusted by adding external feedback to the FB1 terminal.
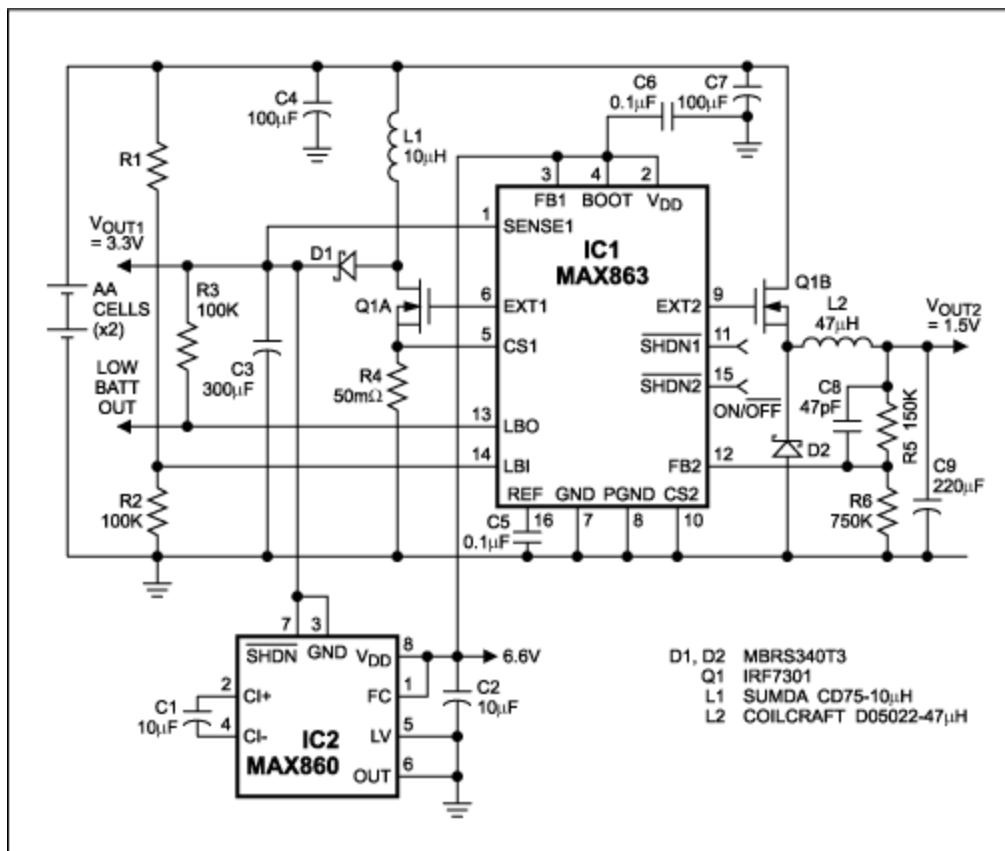

Figure 1. Powered by two AA cells, this circuit generates dual supply rails for a portable µP system.

IC1 is powered by a charge-pump doubler (IC2) that generates 6.6V from the 3.3V rail. (You can omit this device if your application includes a suitable bias voltage.) Connecting IC2's FC pin to V_{CC} sets the chip to run at its lowest operating frequency (6kHz), for which the quiescent current is minimum (~70µA at 3V supply). Locate the C6 bypass capacitor very close to IC1's V_{DD} pin.

Output 2 is configured as a step-down switcher instead of as a boost, which is the standard topology for both Output 1 and Output 2. The IC's internal MOSFET driver turns on the external, high-side MOSFET (Q1B) by pulling its gate to 6.6V. With its source connected to the battery, Q1B's V_{GS} ranges from 3.6V (battery fresh) to 4.6V (battery end-of-life). Connecting CS2 to ground disables current sensing for controller 2, and the inductor's value (47µH) ensures discontinuous conduction without saturation. Feedback to the FB2 terminal via R5 and R6 sets the output-voltage level:

$V_{OUT} = V_{REF}R6/(R5+R6)$, where V_{REF} = 1.25V.

Quiescent current for the circuit is 465µA with a 2V battery and 280µA with a 3V battery. Efficiency can exceed 80% for the step-up output (**Figure 2**), and 90% for the step-down output (**Figure 3**). (For each graph, the other output is unloaded.) active-low SHDN1 and active-low SHDN2 provide independent shutdown control for the two outputs, but output 2 (1.5V) will be absent unless output 1 (3.3V) is present. R1 and R2 set the threshold (VTH) for low-battery detection:
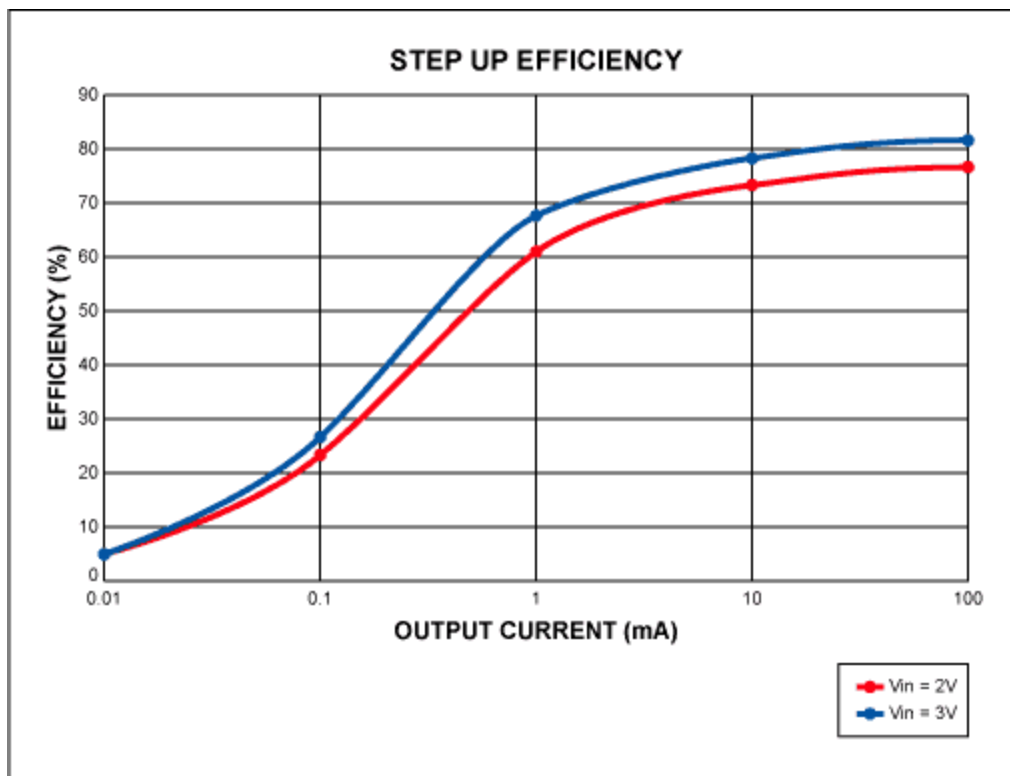
VTH = $V_{REF}R2/(R1+R2)$, where V_{REF} = 1.25V.

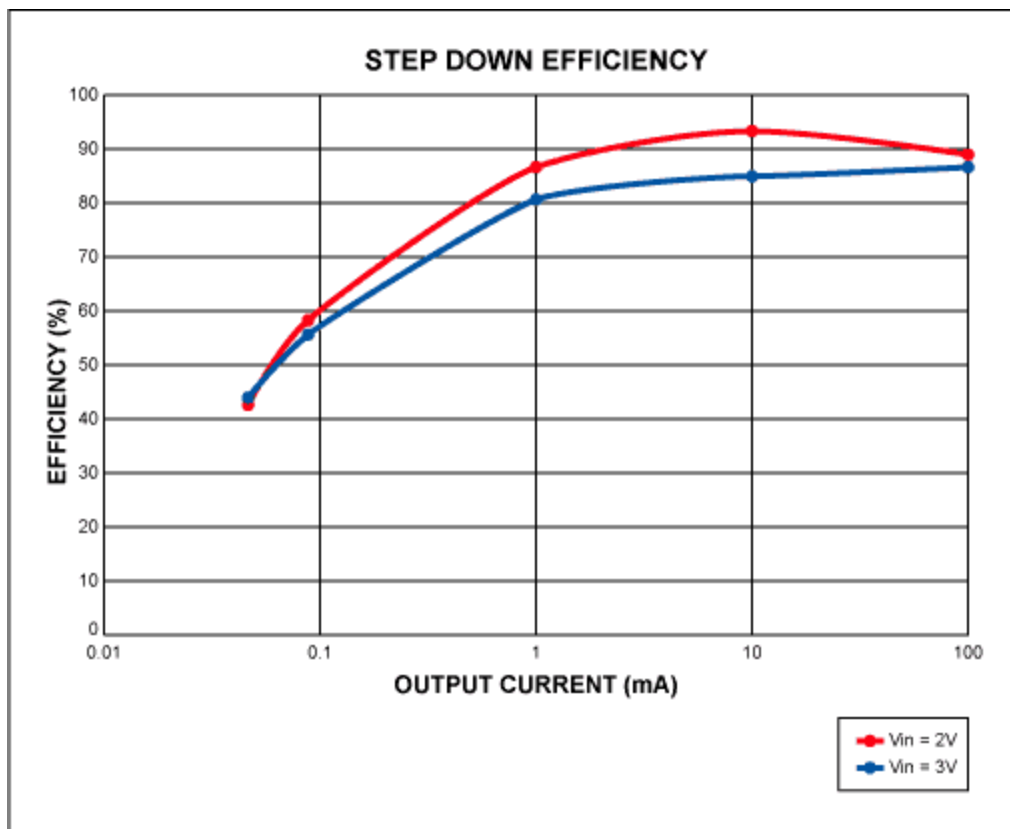Figure 2. Efficiency for Figure 1's step-up output (3.3V) varies with input voltage and output current.

Figure 3. Efficiency for Figure 1's step-down output (1.5V) also varies with input voltage and output current.

Related Parts		
MAX860	50mA, Frequency-Selectable, Switched-Capacitor Voltage Converters	Free Samples
MAX863	Dual, High-Efficiency, PFM, Step-Up DC-DC Controller	Free Samples

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