

APPLICATION NOTE 1783

Two AA Cells Power Dual-Supply μ P

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.

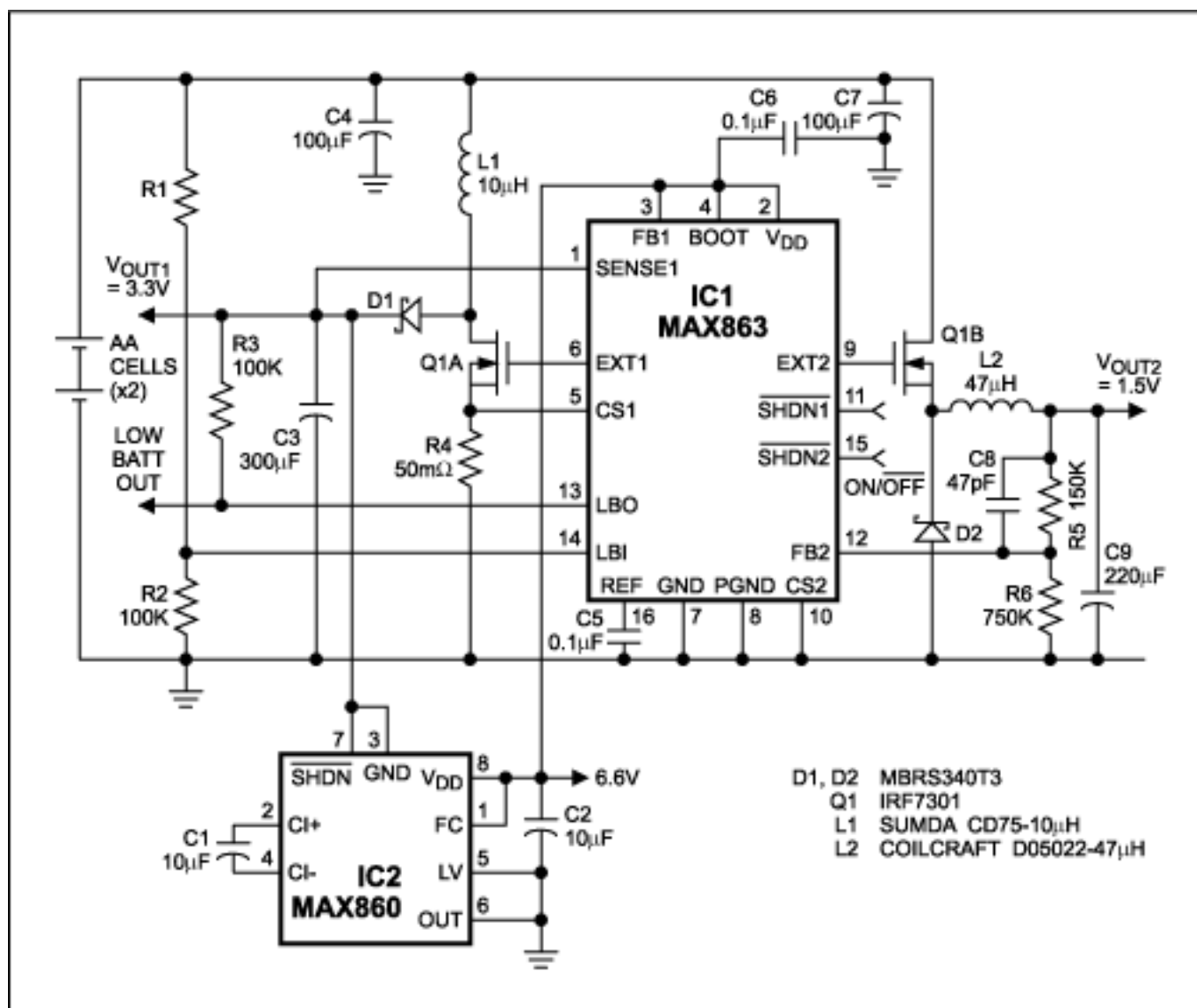


Figure 1. Powered by two AA cells, this circuit generates dual supply rails for a portable μ P system.

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 (~70 μ A 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 (47 μ H) ensures discontinuous conduction without saturation. Feedback to the FB2 terminal via R5 and R6 sets the output-voltage level:

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

Quiescent current for the circuit is 465 μ A with a 2V battery and 280 μ A 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 (V_{TH}) for low-battery detection:

$$V_{TH} = V_{REF}R2/(R1+R2), \text{ where } V_{REF} = 1.25V.$$

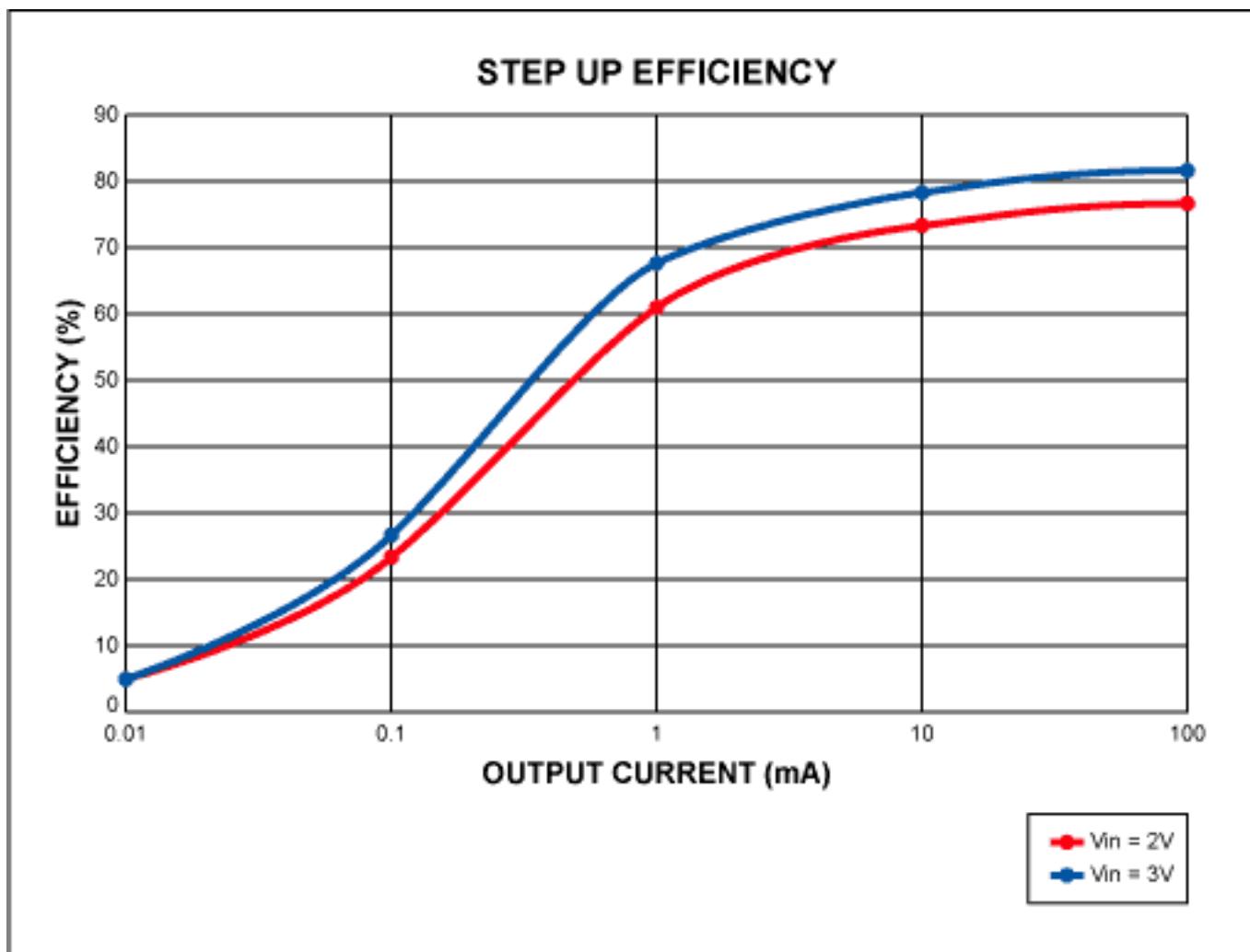


Figure 2. Efficiency for Figure 1's step-up output (3.3V) varies with input voltage and output current.

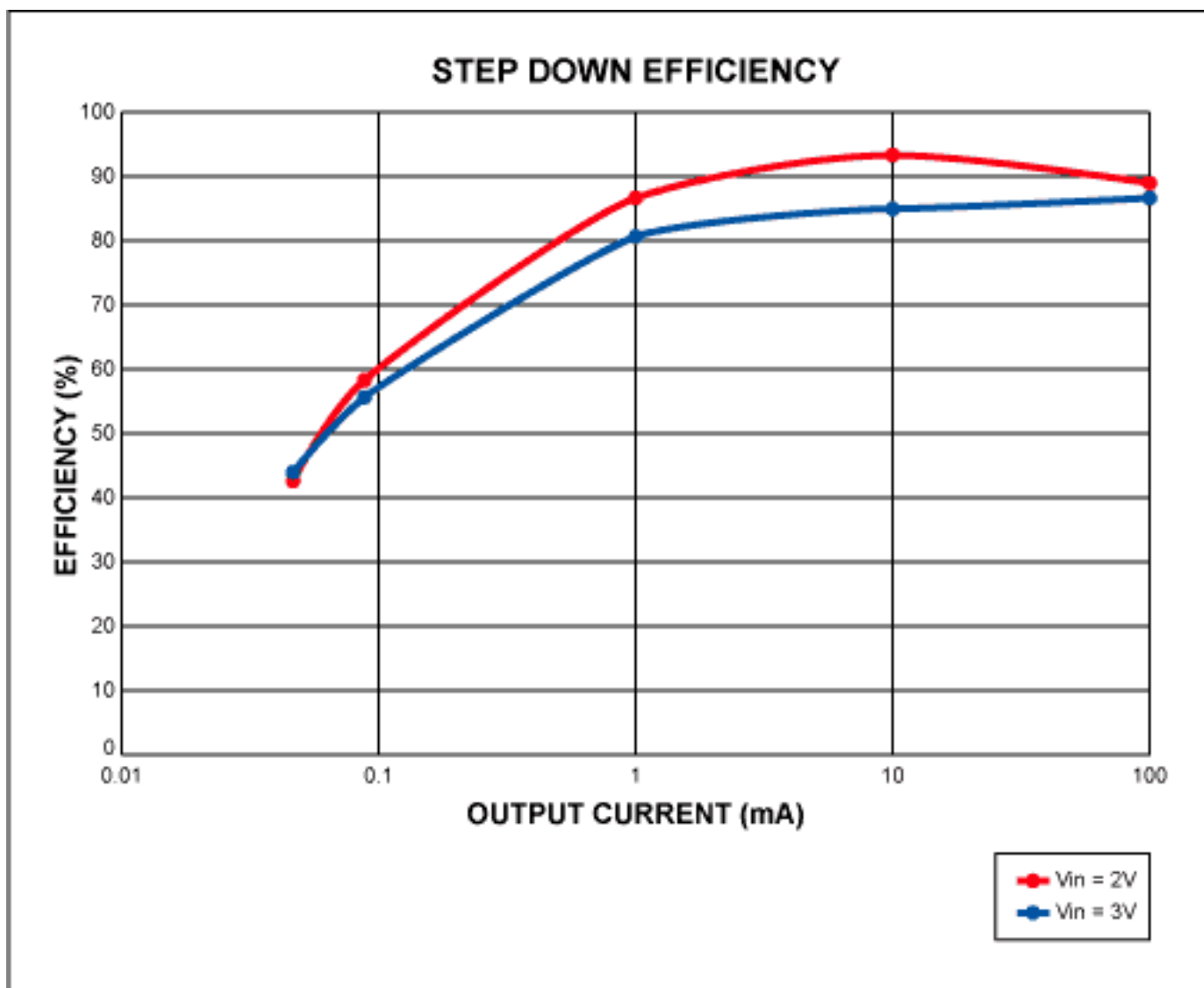


Figure 3. Efficiency for Figure 1's step-down output (1.5V) also varies with input voltage and output current.

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