

APPLICATION NOTE 1810

## Low-Cost Step-Up/Step-Down Converter Accepts 2V to 16V Inputs

**Abstract:** Step-up/step-down DC-DC converter converts 2V to 16V input to a 9V output at up 500mA. The circuit employs the MAX761 internal-switch boost DC-DC converter and a Zetex FZT749 PNP transistor. The topology is boost followed by LDO.

The circuit shown in **Figure 1** is a low-cost step-up/step-down DC-DC converter. By definition, its input voltage can range above and below the regulated output voltage. The circuit includes a simple switch-mode boost converter (IC1) that contains a comparator, normally used to detect low battery voltage. In this example, the comparator controls an external, low-cost pnp transistor operating as a linear regulator.

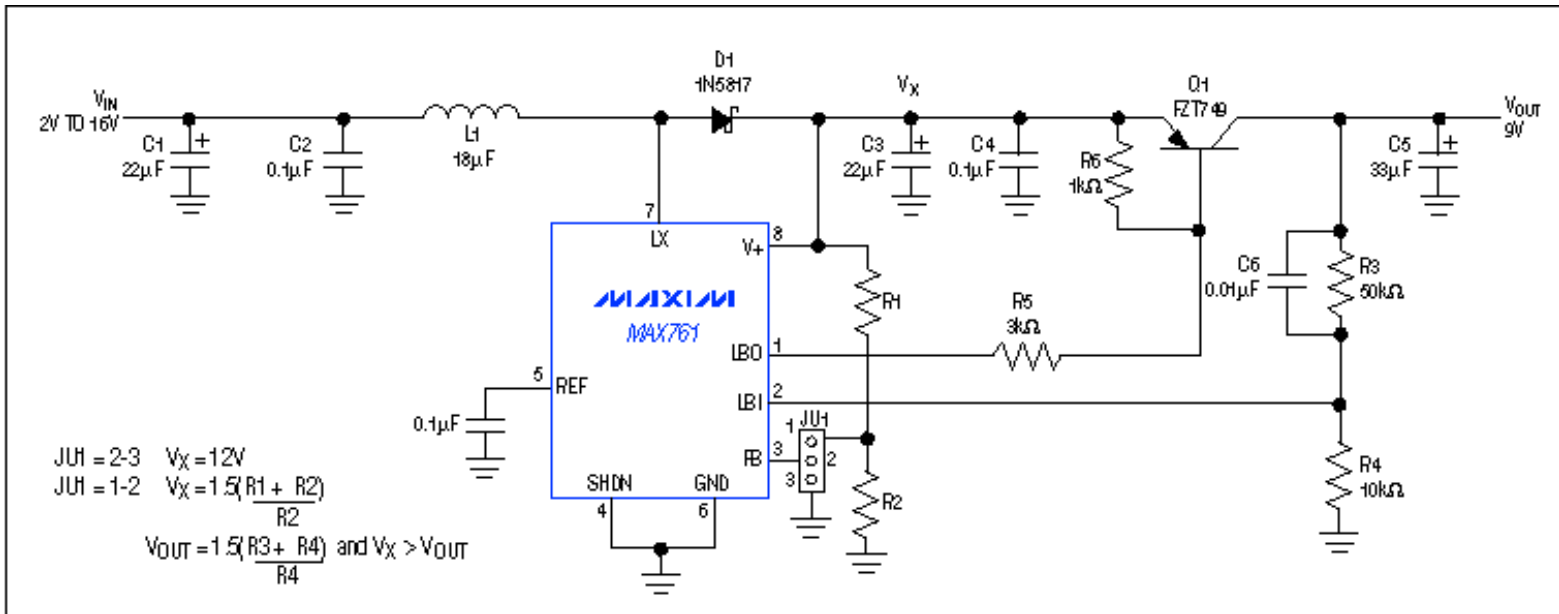


Figure 1. This step-up/step-down converter maintains a regulated output (set to 9V for the R3/R4 values shown) as the input voltage varies between 2V and 16V.

IC1 steps up  $V_{IN}$  (2V min) to the level of  $V_X$  as determined by the jumper block JU1. A 2-3 jumper selects the internal divider, producing  $V_X = 12V$ , and a 2-1 jumper selects feedback resistors R1 and R2, producing  $V_X = 1.5V(R1 + R2)/R2$ .  $V_X$  should be set 1V to 2V above the desired output voltage.

Linear regulator Q1 steps down  $V_X$  to an output level set by R3 and R4:

$$V_{OUT} = 1.5V(R3 + R4)/R4$$

where  $V_X > V_{OUT}$ .

When  $V_{IN} > V_X$ , the switching regulator stops and the linear regulator alone controls  $V_{OUT}$ . C6 reduces output ripple. This circuit allows a wide range of input and output voltages, and delivers output currents up to 500mA (**Figure 2**).

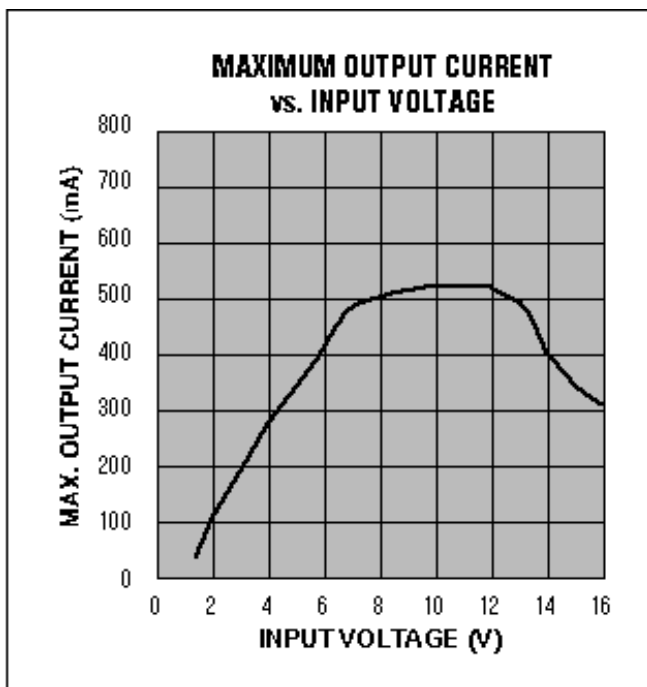


Figure 2. For  $V_{OUT} = 9V$ , the maximum output current in Figure 1 varies with input voltage, as shown.

A similar idea appeared in the 7/16/98 issue of *Electronic Design*.

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Application Note 1810: <http://www.maxim-ic.com/an1810>

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#### Related Parts

MAX761: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)

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