Application Report
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TPS6116x With Separate Power Stage and IC Input Voltages

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ABSTRACT

This application report shows how to operate the TPS6116x integrated circuits (IC) with two separate input power rails, one for the boost power stage and one to power the IC itself. In this example, an input as low as 1.8 V from discharged dual-alkaline batteries supplies power to the boost stage, whereas a separate 3.3-V supply powers the IC.

The TPS6116x is a white LED driver with an integrated switch FET and an input voltage range of 2.7 V to 18 V. The IC does not require its VIN pin to be powered from the same rail as the boost power stage. So, it can be used in applications where the input supply drains below 2.7 V. For example, consider a portable application using two series alkaline batteries with each providing 1.5 V nominally, but discharging down to 0.9 V. The input supply varies from 3 V down to 1.8 V, which is below the TPS6116x minimum input voltage. In most applications, an additional 3.3-V or higher voltage rail having low current capability is being generated by a separate dc/dc converter to power other circuitry. This rail can be used to power the TPS6116x IC while the power stage is powered directly from the battery.

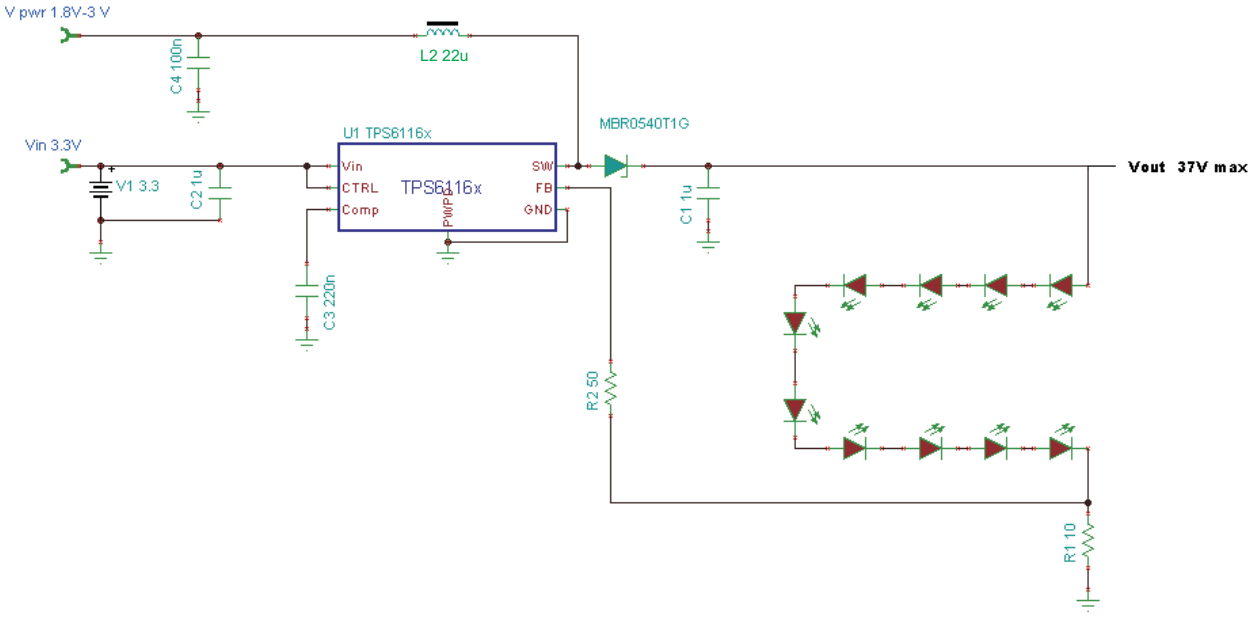

Figure 1. Test Circuit

The test circuit in Figure 1 shows the TPS6116x being powered from a 3.3-V rail (V_{IN}) and the power stage being powered from a 1.8-V supply (V_{PWR}), representing the discharged dual alkaline batteries. The input current out of the V_{IN} supply is typically less than 1 mA. The graph shown in Figure 2 shows the efficiency at V_{PWR} = 1.8 V and 3 V.

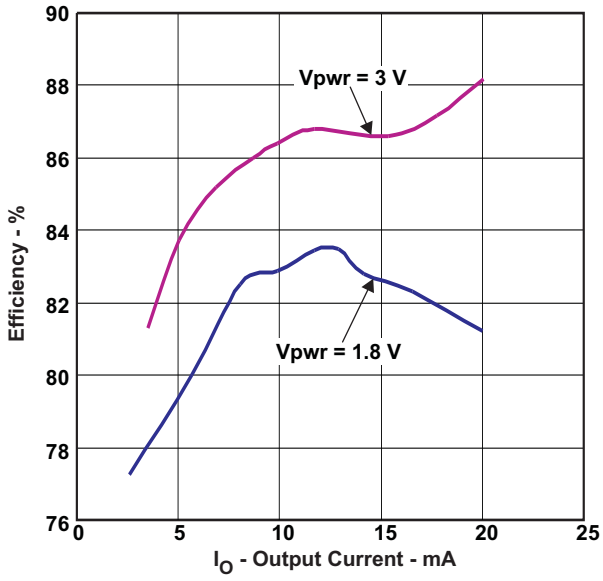

Figure 2. Efficiency

Also, with the 0.22-µF compensation capacitor, the control loop is stable as shown by the loop response in Figure 3. The loop response was taken with V_{PWR} = 1.8 V, V_{IN} = 3.3 V, and I_{LED} = 20 mA.

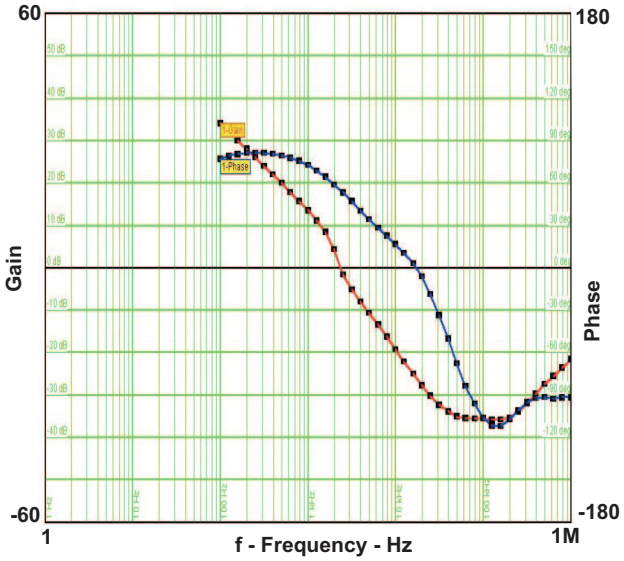

Figure 3. Loop Response

To summarize, the TPS61161 can be configured to operate from input voltages less than 2.7 V. Operating from lower input voltages extends the operating range of the IC, thereby allowing it to be used in alkaline-battery-powered applications.

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