Technical Article

Pump It up Quietly

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As you may have read in previous blogs and Greg Lubarsky's white paper, "The Forgotten Converter," using a charge pump DC/DC converter for special supply rails in a system can be very effective from a solution size and cost standpoint, especially by eliminating the need for an inductor.

One challenge with a charge pump solution is that it can be a bit noisier than an inductive DC/DC converter. Some application designers solve this problem by adding a low-dropout regulator (LDO) to the charge pump output to achieve a low-noise solution. This can be particularly troublesome if you need a negative rail, however, as negative-rail LDOs typically come in pretty large packages. For example, the ADP7182 comes in a 3mm-by-3mm package.

With TI's new LM27761 negative-charge pump plus ultra-low-noise LDO, this challenge can be eliminated cost-effectively. The solution includes the newly released LM27761 inverting charge pump and integrates an ultra-low-noise LDO – using similar techniques as TI's popular LP5907.

Using just the charge pump to covert the $+V_{IN}$ to a $-V_{OUT}$ produces a rail that looks like Figure 1. The output ripple is of the order of 16mV.

Figure 1. Charge-pump Output Characteristic

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By integrating the ultra-low-noise LDO, you can make that rail a lot cleaner, as shown in Figure 2. In this plot the ripple is less than 2mV.

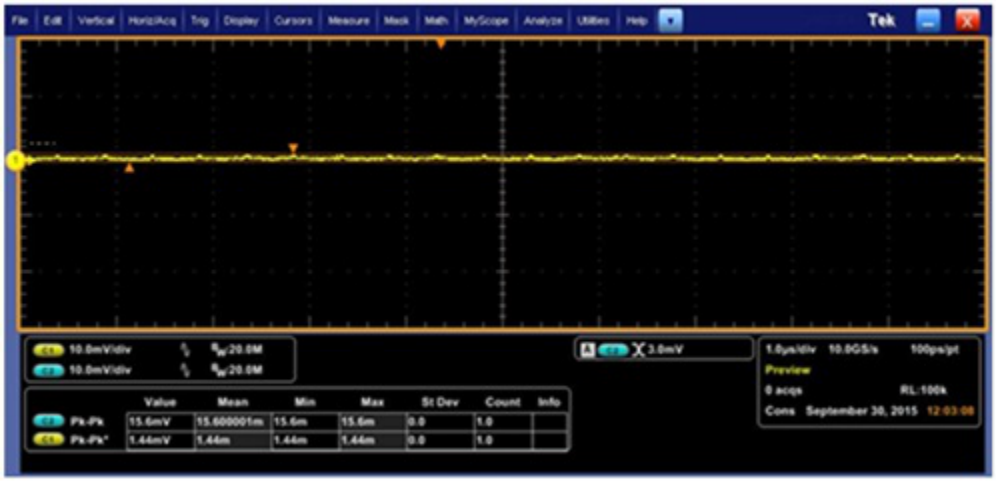

Figure 2. Cleaned LDO Output

The LM27761 comes in a tiny 2mm-by-2mm WSON8 package, which makes for a very compelling footprint and PCB design-friendly 0.5mm pitch pads.

The added benefit of this device is that it has an adjustable output from -5.0 to -1.5V, which makes it very flexible for powering different device types. It has the ability to supply up to 250mA loads, and can support multiple loads if needed.

Quiet negative-rail generation can be very useful in powering high-performance signal-path devices such as data converters, analog front ends and amplifiers. In fact, the LM27761 complements the new OPA1622 operational amplifier, especially for space-constrained professional and portable audio devices that need the highest-performance audio-headphone drive solution available and low power consumption.

Additional Resources:

- Read other blogs on designing with charge pumps, including this one on “pumping it up” with charge pumps.
- Browse charge pump solutions.

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