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Main components	
LD39080	Ultra low drop BICMOS voltage regulator
L6920DB, L6920DC	Synchronous rectifier step up converter

## Specification

- Input voltage 2.5V
- Output voltage 3.3V @ 0.5A
- Output noise <2mV and better

## Circuit description

A highly efficient and compact low-noise DC-DC converter using a very low-dropout linear regulator as a noise filter is described

Switching regulators are noisy and the more economical or popular types operate at frequencies in the 100 KHz to 300KHz range, which necessitates large or costly components for noise and ripple reduction. Despite the careful selection of an inductor and output capacitor, only a finite ripple reduction can be achieved. The residual ripple from a typical buck converter can be from 20 to 50mV pk-pk, depending on layout and quality of the passives components.

Clean power is needed for sensitive analog or measuring instrument front end circuits that can be extremely sensitive to 20mV of power supply ripple, rendering its performance degraded or unacceptable. Some sensitive products use batteries as a source of extremely 'clean' DC power despite their cost. Other sensitive products use a standard linear regulator despite its inefficiency. Another alternative, the passive LC filter, can be used, but it is a large and costly addition and also dissipates energy.

The L6920 is a popular boost converter for low voltage/low power applications. The PFM (pulse frequency modulation) architecture is more efficient and operates down to less than 1 Volt, but intrinsically noisier than some other switching implementations. This circuit provides a way to use the high efficiency L6920 while reducing the output noise to the very low levels required in sensitive applications.

With the availability of extremely low dropout linear regulators, it is possible to follow a DC-DC converter with a very low dropout linear regulator to obtain a DC voltage that is free from most noise. The combination is very efficient due to the low dropout, and the low dissipation across the linear regulator means that any additional PCB area for cooling is not required. This technique is not limited to use with the L6920, but can be used wherever noise must be efficiently removed.

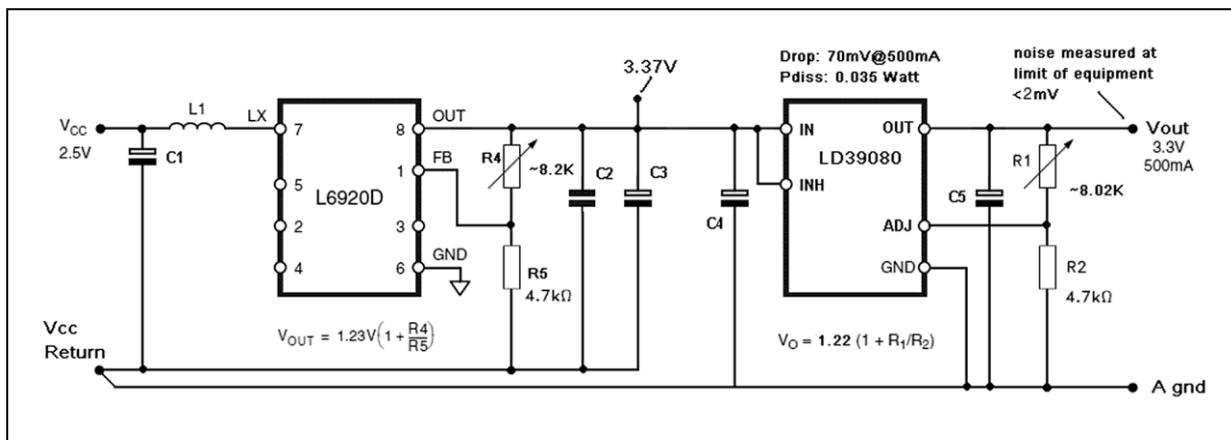
Figure 1 illustrates a method of adding a very low dropout regulator such as the STLD39080 after a DC-DC converter to provide an ultra-quiet power source for sensitive applications. In the example, the linear regulator dissipates 35mW, passing about 98% of the energy to the load. Table 1 provides the list of materials used in this circuit.

To receive the best advantage, it is important to observe good PCB layout practices. Isolate the ground returns so that the clean DC power ground and the switching regulator ground are separated, except at the main common GND point. Current from the DC-DC converter's ground must not flow in series with the ground circuit of the linear section.

**Table 1. Bill of materials for a Boost topology test circuit:**

Ref	Description	PN or Comment
L6920D	IC, L6920	ST L6920D
LD39080	IC, LD39080	ST LD39080PT-R
L1	Inductor, 10uH	Panasonic ELL6RH100M
C1, C3	Capacitor, 47uF	EEFCDJ470R
C2	Capacitor, 0.1uF	Ceramic (see datasheet)
C4, C5	Capacitor, 100uF	Ceramic (see datasheet)
R1	8020 Ohms	20K 10 turn pot
R2, R5	4.7K Ohms	
R3	See text	
R4	8200 Ohms	20K 10 turn pot

**Figure 1. Circuit diagram**



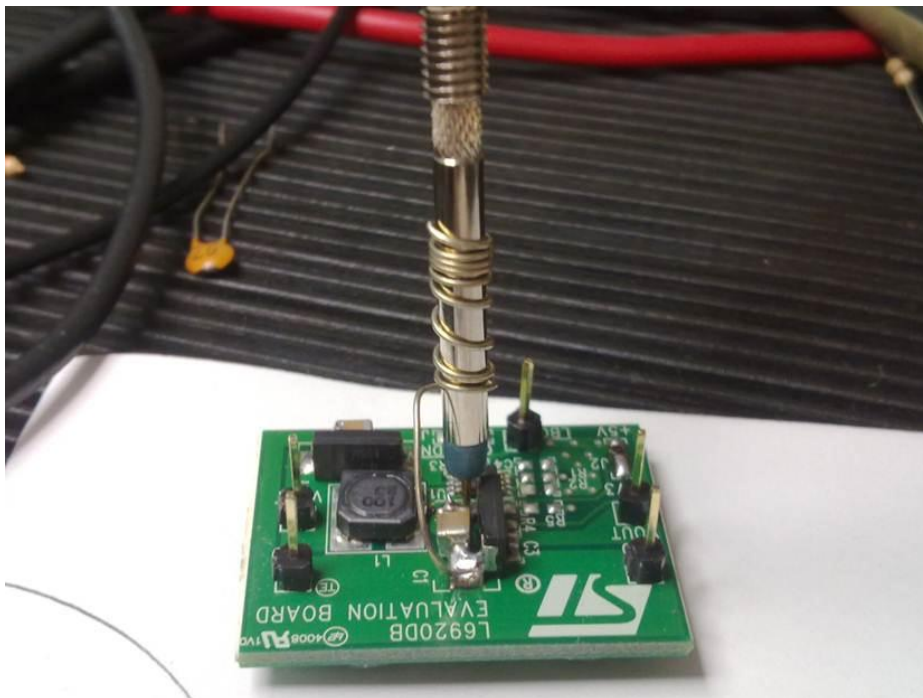
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## Measurement results

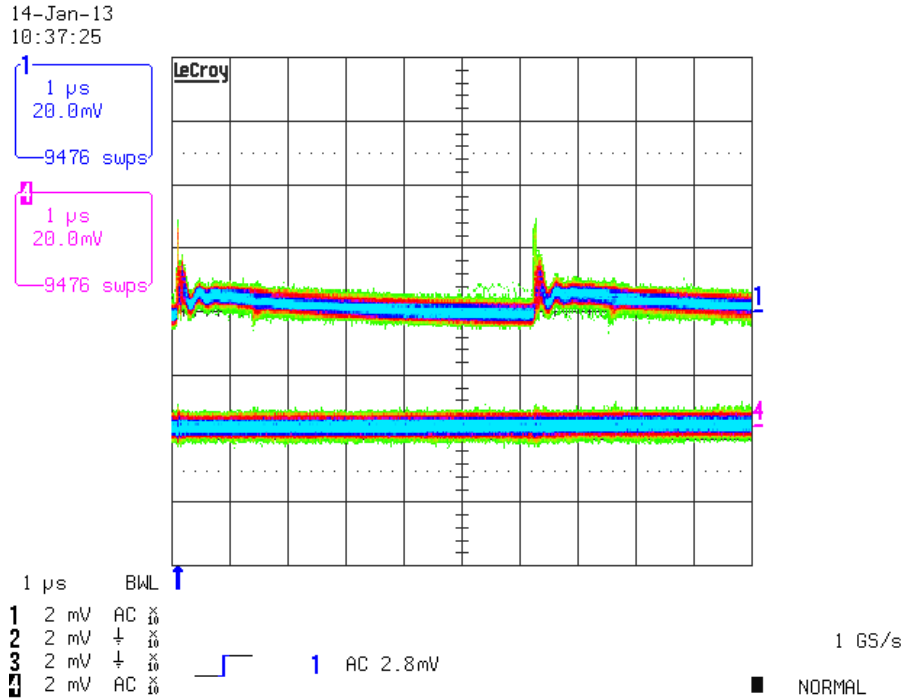
For this evaluation, the LD39080 was mounted on a prototyping board and connected in very close proximity to the output on the L6920 evaluation board.

An oscilloscope was used to observe the noise present at the output of the DC to DC converter. In order to obtain a true measurement without interference from probe ground leads and similar factors, the probe arrangement similar to that shown in Figure 2 was used. This attaches the probe tip shield directly to the (-) side of the output capacitor and the (+) side directly to the tip. The scope bandwidth was limited to 20MHz, not because there is any real noise above 20MHz, but because some digital scopes “look noisy” when in full bandwidth mode and the scope’s noise would have been similar to the small amounts we wished to finally observe. The noise seen at the output of the linear regulator section was so low that it was difficult to measure it precisely, but it was less than 2mV peak to peak. Figure 3 shows the results of the filtering action of the LD39080. Channel 1 is the L6920 output and Channel 4 is the final output from the LD39080.

**Figure 2. Probing for noise methodology**



**Figure 3. Comparison of noise**



## Variations

The LD29080, having a slightly higher voltage drop at a given current, may also be used especially where load current is smaller or voltage drop is not as critical.

## Support material

Related design support material	
<a href="#">STEVAL-ISA077V1</a>	High efficiency synchronous rectifier step-up converter demonstration board based on the L6920DB
<a href="#">STEVAL-ISA077V2</a>	High efficiency synchronous rectifier step-up converter demonstration board based on the L6920D
Documentation	
Datasheet LD39080: Ultra low drop BICMOS voltage regulator	
Datasheet L6920DC: Synchronous rectifier step up converter	
Datasheet L6920DB: Synchronous rectifier step up converter	

## Revision history

Date	Version	Changes
30-APR-2013	1	Initial release

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