LINEAR TECHNOLOGY

DESIGN NOTES

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Applications for a New Micropower, Low Charge Injection Analog Switch

Guy Hoover, William Rempfer, Jim Williams

With greater accuracy for both charge and voltage switching, the LTC201A is a superior replacement for the industry standard DG201A. In addition, the micropower LTC201A operates from a single 5V supply, and has lower on-resistance and faster switching speed. These improvements are critical to the operation of the following three circuits.

Micropower V-F Converter

Figure 1 shows a 100Hz to 1MHz voltage-to-frequency converter. This V-to-F operates from a single supply and draws only 90μA quiescent current, rising to 360μA at 1MHz. Linearity is 0.02% over a 100Hz to 1MHz range.

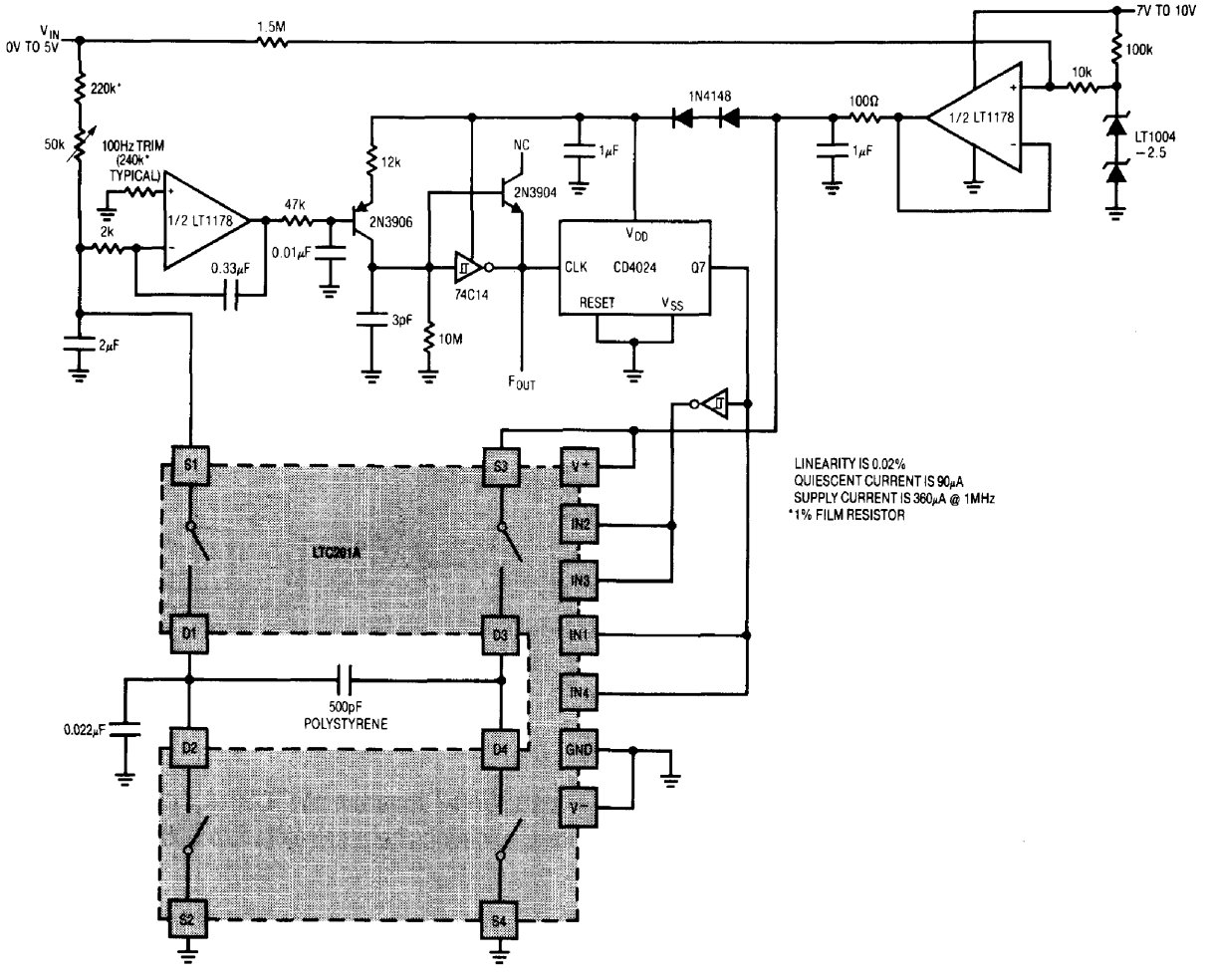

Figure 1. Micropower 100Hz to 1MHz V-to-F Converter

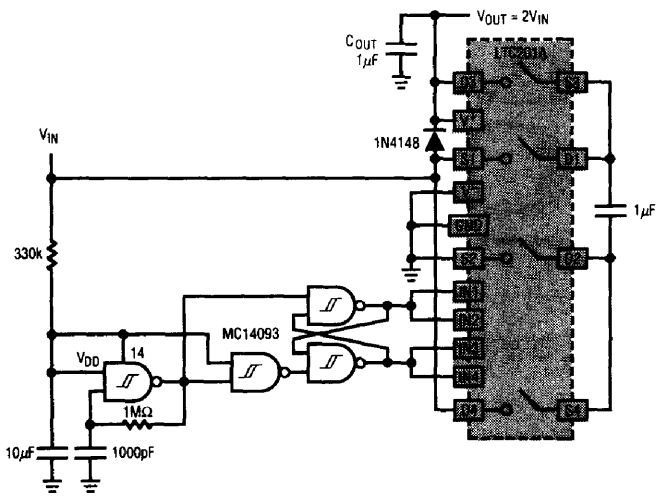

Figure 2. Micropower, 4.5V-15V Input, Voltage Doubler

The circuit consists of an oscillator, a servo amplifier and a charge pump. The oscillator's divided down output is expressed as current (charge per time) by the LTC201A-500pF combination. The input voltage is converted to current by the 220k trimmer pair. The amplifier controls the oscillator frequency to force the net value of the current into A1's summing point to zero.

The 1.5MΩ resistor between V_{IN} and the reference buffer amplifier sums a small input related voltage to the reference, improving linearity. The 0.022µF capacitor prevents excessive negative transitions at LTC201A D1-D2 pins. The series diodes in the oscillator divider supply line lower supply voltage, decreasing current consumption. The 10MΩ resistor at Q8's collector dominates node leakages ensuring low frequency operation by forcing Q8 to always source current.

Precision Voltage Doubler

The precision micropower voltage doubler of Figure 2 has an input voltage range of 4.5V to 15V. The low supply current of the LTC201A allows it to be powered directly from the input voltage. Total no load supply current of the circuit ranges from 20µA at V_{IN} = 4.5V to 130µA at V_{IN} = 15V. Output impedance is only 1.2kΩ at V_{IN} = 4.5V and reduced to 600Ω at V_{IN} = 15V. The accuracy of this circuit is better than 0.2% over the 4.5V to 15V input range.

The MC14093 is used to form an oscillator with complementary non-overlapping outputs. R1 and C1 determine the frequency of oscillation (roughly 1.2kHz at V_{IN} = 4.5V). The oscillator outputs drive two sets of switches in the LTC201A and ensure that one pair of switches shuts off before the other set turns on. C_{IN} is alternately charged to V_{IN} and then stacked on top of V_{IN} to charge C_{OUT}. R2 reduces the supply voltage to the MC14093 which keeps current drain low. The diode ensures latch-free power-up for any input rise time condition.

Quad 12-Bit Sample and Hold

Figure 3's sample and hold uses the low charge injection of the LTC201A combined with the low offset voltage of the LT1014 to produce a sample to hold offset of only 0.6mV. This makes it accurate enough for 12-bit applications. Acquisition time to 0.6mV is 20µs. Aperture time is 300ns (the off time of the LTC201A). Droop rate is 2mV/ms and is limited by the I_B of the LT1014. The input range is 3.5V to −5V with ±5V supplies.

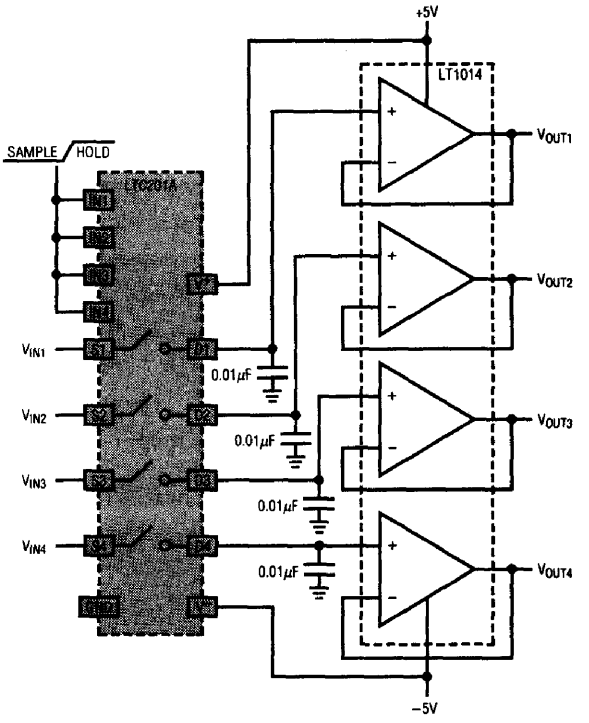

Figure 3. Quad 12-Bit Sample and Hold

For additional literature on LTC201A, call **(800) 637-5545.**
For applications help, call (408) 432-1900, Ext. 445.