Keywords: analog switches, low voltage, charge pump, voltage regulator, power supply, switching time, transition time, analog switch, power supplies

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APPLICATION NOTE 130

Analog Switches Operate With 3V or 5V Supplies

Abstract: By adding a voltage doubler and voltage inverter, a single 3V or 5V power supply can produce the voltages necessary to improve the performance on a dual voltage analog switch. With the higher power supplies and wider range, the on resistance and timing performance are enhanced.

By adding a single component to a 3V-only or 5V-only board, you can operate conventional CMOS analog switches with performance approaching that specified with ±15V supplies. This means fast switching, low on-resistance, CMOS/TTL compatibility, low power consumption, and a signal range ($\pm V_{CC}$) that exceeds the input supply range (V_{CC} to ground).

Simply add a charge-pump voltage converter (IC1), which produces $\pm 2V_{CC}$ outputs from a V_{CC} input. These unregulated voltages ensure reliable switch operation for V_{CC} levels as low as 3V. Logic thresholds for the switch remain unaffected.

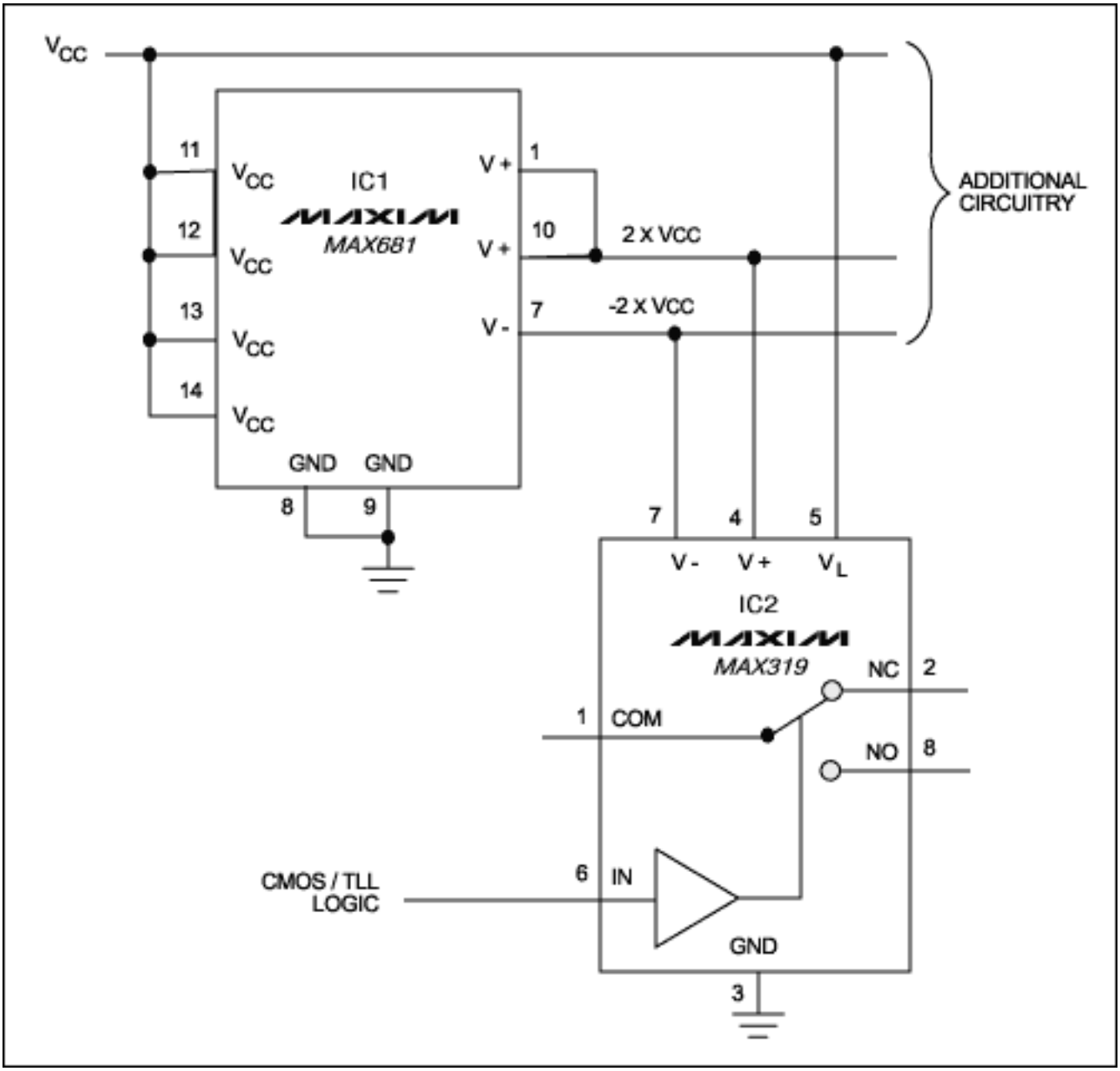

Figure 1. The charge pump (IC1) provides a local bipolar power supply for the CMOS analog switch (IC2).

A V_{CC} of 3V (for instance) produces ±6V rails for the switch (IC2), resulting in on-resistance <30Ω $_W$, switching times <200ns, leakage <0.1nA, and I_{CC} current <0.5mA. Raising V_{CC} to 5V produces ±10V rails, resulting in on-resistance <20Ω $_W$, switching times <150ns, leakage <0.4nA, and I_{CC} current <1.3mA.

IC1 can easily power additional switches and/or low-power op amps, but more than a few milliamps of load current degrades performance by lowering the unregulated supply rails.

Application Note 130: http://www.maxim-ic.com/an130

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AN130, AN 130, APP130, Appnote130, Appnote 130