Tiny, Fast and Efficient Comparator Regenerates Clock Signals up to 3MHz

by Jim Sousae

What is it?

The LTC6702 is a tiny dual comparator that is designed to bridge the gap between relatively slow ultralow power comparators and very fast high power comparators. The LTC6702 combines speed, low voltage operation and micropower operation, making it ideal in battery powered circuits that require high performance. Additional features such as built-in hysteresis (to ensure stable operation) and CMOS inputs simplify designs and allow the use of large source impedances. Offered in the tiny 2mm × 2mm DFN package, the LTC6702 is the smallest dual comparator currently available, with a footprint nearly 40% smaller than that of a SOT-23.

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What's So Special?

Guaranteed Speed

The two main benchmarks of a comparator are propagation delay and supply current. Most comparators only list a typical value for propagation delay. The LTC6702 goes one step further, fully testing and guaranteeing a propagation delay of 500ns maximum from –40°C to 125°C. It manages to do this while drawing only 30µA maximum supply current per comparator. Guaranteed operation with a supply voltage as low as 1.7V optimizes battery life.

Excellent Output Swing

The LTC6702 uses patented break-before-make circuitry in its output stage to minimize shoot-through current when the output changes states (typically problematic in CMOS output stages). The result is an output stage with three times better swing than the typical bipolar output stage and much lower shoot-through current than the typical CMOS output stage, allowing the LTC6702 to maintain its efficient operation, even at high toggle rates. The push-pull output stage topology provides rail-to-rail operation without the need of a pull-up resistor.

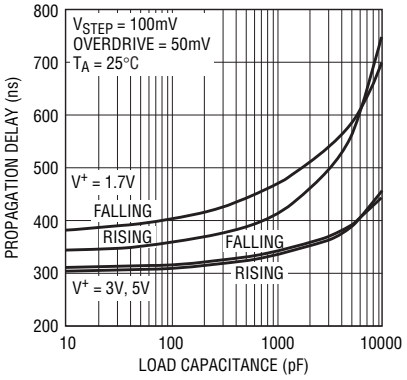

Figure 1. Speed is maintained with high capacitive loads

Capacitive Load Handling

The LTC6702 has the ability to drive large capacitive loads due to its high output drive current, unusual in such a small, low quiescent current device. The output current is specified at ±15mA from –40°C to 125°C and has a typical short circuit current of ±250mA. Competing products show capacitive load handling to 400pF due to the degradation of their rise/fall times and propagation delay with higher capacitive loads. Figure 1 shows the LTC6702's ability to drive up to 10,000pF with significantly less degradation to these parameters. The high output drive current also allows the LTC6702 to drive low current relays directly.

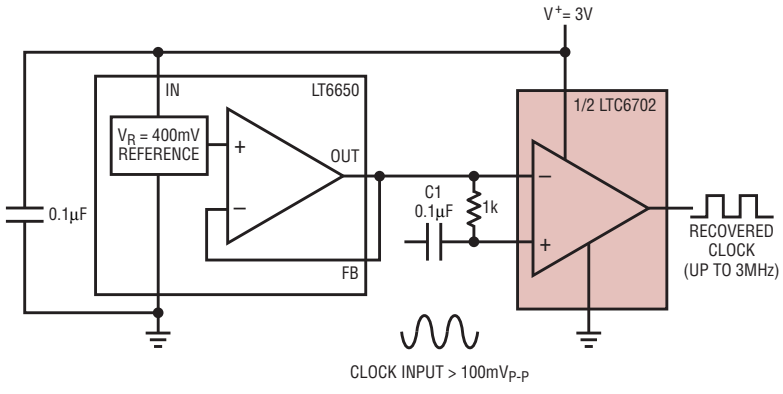

Figure 2. Clock recovery circuit efficiently recovers clock signals up to 3MHz

Inputs Operate Above V+

Most comparators protect their inputs from ESD strikes by diode clamping the inputs to supply. Instead, the LTC6702 uses a ground referenced ESD device on each input pin, thus allowing the inputs to operate above the positive supply without additional input current or damage to the device. As long as one input is within the allowed common-mode range, the other input can go as high as the absolute maximum rating of 6V, regardless of the supply voltage.

What's It Good For?

Clock Regeneration

The high toggle rate and efficiency of the LTC6702 is ideal for clock regeneration in battery powered circuits. It is no longer necessary to waste milliamps of supply current powering an ultrafast comparator when ultrafast speeds are not required. The simple circuit in Figure 2 can recover clock signals with frequencies up to 3MHz while burning only 225µA of supply current.

Level Translation

The LTC6702's push-pull output stage and its ability to operate with either input above the positive supply rail simplifies logic level translation. Many comparators use an open collector or open drain type output stage to enable level translation and require a pull-up resistor and separate supply to set the output logic level. The circuits in Figure 3 show how the LTC6702 can perform both high-to-low and low-to-high level translation without the need of an additional pull-up resistor, thus reducing component count and saving board space.

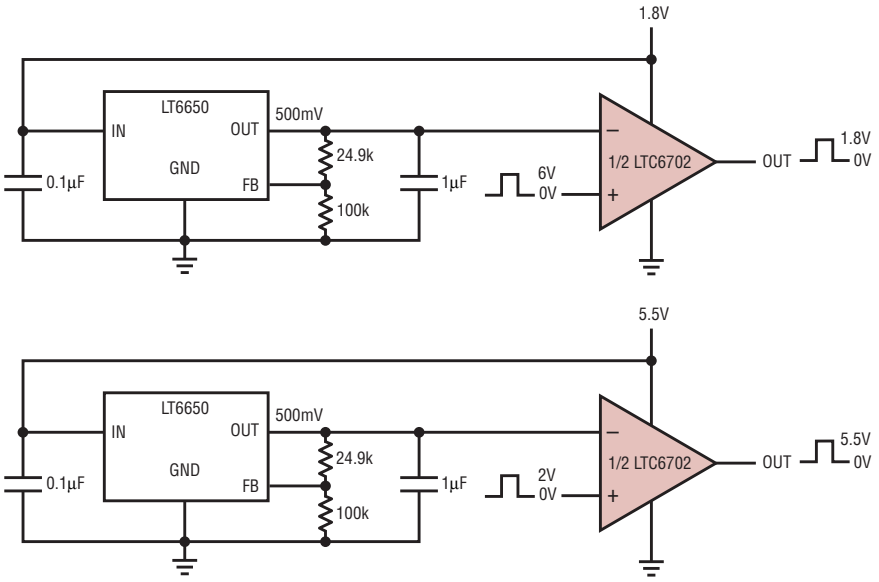

Figure 3. Level translation without the need of an additional supply or pull-up resistor

Current Sense Alarm

A typical swing of 300mV from either rail with ±60mA output drive allows the LTC6702 to directly drive an LED or relay for alarm annunciation or load protection switching. Figure 4 shows a dual load current sense alarm circuit that provides resistor programmable thresholds, turns on an LED when an overload condition is detected and has a quiescent current of only 31µA.

Conclusion

The unique feature set of the LTC6702 makes it a very versatile dual comparator. Its tiny footprint and rail-to-rail output capability allow the designer to conserve board space, while it's high speed to power ratio and low voltage operation enable efficient clock regeneration and maximize battery life.

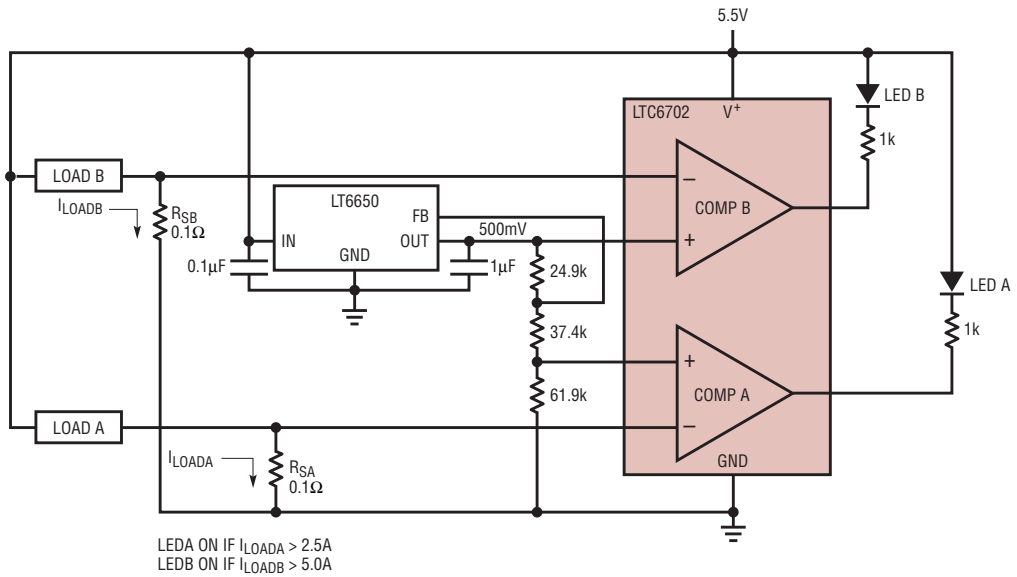

Figure 4. This micropower dual low side current sense alarm can drive an LED or relay