Frequency Doubling Through Full-Wave Rectification to 150MHz

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Diode bridges are commonly utilized in full-wave rectification circuitry. However, they are incapable of handling small input signals or high frequencies. When precision and speed are desired, one must design with active devices.

Circuit Description

The circuit in Figure 1 utilizes the speed of a current feedback amplifier (EL2186) and the precision of a differential amplifier (EL2142) to provide full-wave rectification. The input signal is fed through the current feedback amplifier where only one of the two feedback paths is engaged each half-cycle. When the output is positive, current flows through D1 while D2 isolates the other feedback path. Conversely, when the output is negative, current can only flow through D2. Schottky diodes (HP 5082-2835) have been selected as D1 and D2 for their speed and low capacitance.

Each of these half-wave rectified signals is passed selectively into the high impedance differential amplifier, the positive half-cycles at its non-inverting input and the negative half-cycles at its inverting input. Since only one of the signals is active at any given time, the differential amplifier basically combines the signals. Full-wave rectification or frequency doubling is the result.

This circuit has been designed for unity gain. If more gain is desired, the gain setting resistor of the EL2186, Rgain, may be adjusted. The feedback ratio of the EL2142 could also be adjusted; but since its inherent bandwidth is smaller than the EL2186, this is not recommended for the highest operating speeds. For smaller signal inputs at midband frequencies, the gain could be split between the two stages. However, remember to limit the gain of the first stage so that it does not exceed the input voltage range of the second stage.

Conclusion

An option for full-wave rectification is presented that surpasses the limitations of standard diode bridges. High-speed active devices enable this high-frequency doubler to handle input voltages as small as 300mV and output frequencies up to 150MHz.

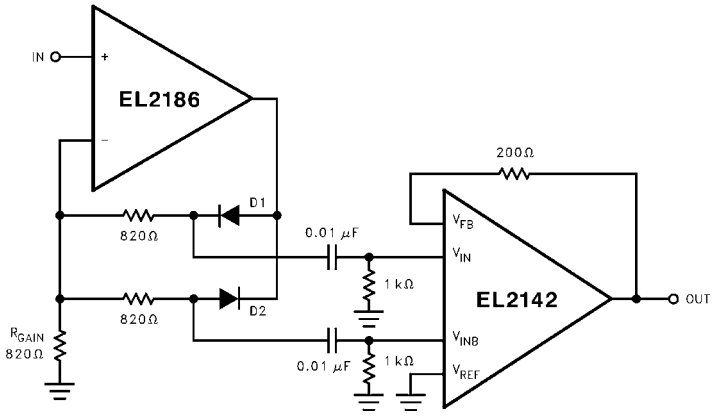

FIGURE 1.