Two comparator ICs yield a fast, linear VFC

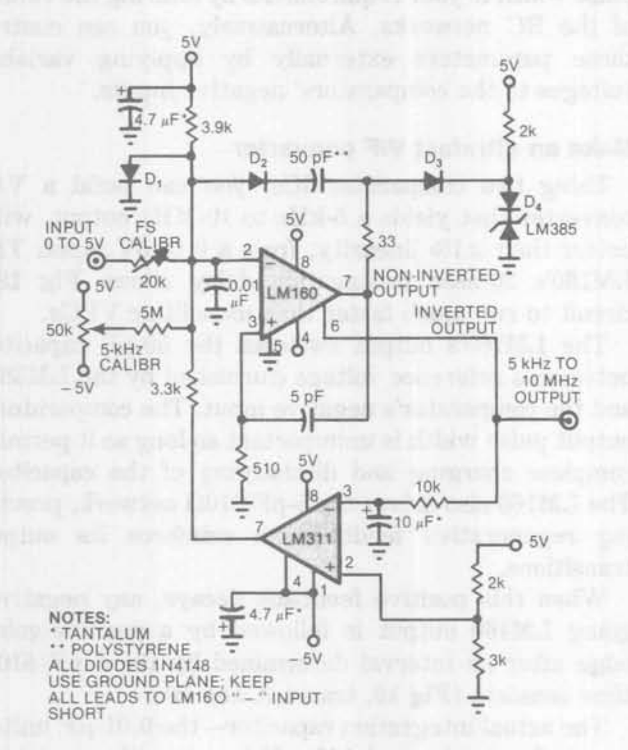
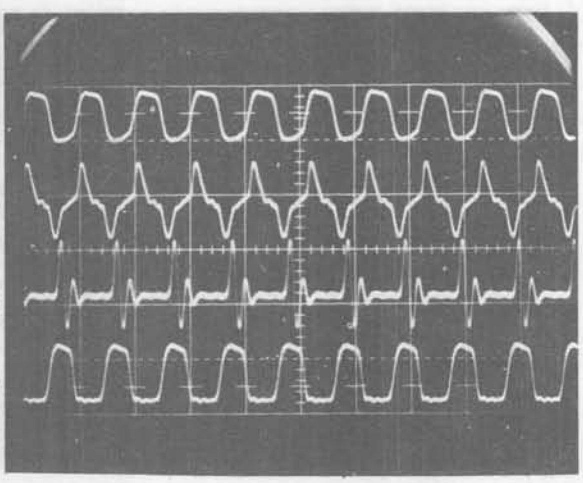


Fig 18—Producing 5-kHz to 10-MHz output, *this V/F-converter circuit uses two comparator ICs and features ±1% linearity. The LM160 is the heart of the converter; the LM311 prevents lockup.*



TRACE	VERTICAL	HORIZONTAL
A	5V/DIV	100 µSEC/DIV
B	0.5V/DIV	100 µSEC/DIV
C	10 mA/DIV	100 µSEC/DIV
D	5V/DIV	100 µSEC/DIV

Fig 19—A clean 10-MHz output *(trace D) results from an LM160's action in* **Fig 18**'s *V/F converter. Trace C shows the charge-dispensing current from* **Fig 18**'s *50-pF capacitor.*

the 0.01-µF capacitor, resulting in a lower voltage.

The LM160's negative-going output also produces a short negative pulse—via the 5-pF/510Ω feedback—at its positive input. When this negative pulse decays to a point where the positive input is just higher than the negative input, the 50-pF capacitor again receives a charge, and the entire cycle repeats. Diodes D_1 and D_2 compensate for diodes D_3 and D_4, minimizing temperature drift.

The LM160's inverted output (**Fig 19**, trace D) serves as circuit output and also drives the LM311 comparator circuit to prevent LM160 lockup. Without it, any condition (such as startup and input overdrive) that allows the 0.01-µF capacitor to charge beyond its normal operating point could cause the LM160's output to go to the −5V rail and stay there.

The LM311 prevents lockup by pulling the LM160's negative input toward −5V. The 10-µF/10-kΩ network determines when the LM311 switches on. When the VFC runs normally, the 10-µF capacitor charges to a negligibly small voltage, holding the LM311 off. The LM160's inverted output stays HIGH if the VFC stops running (if lockup occurs), forcing the LM311 to turn on and restarting the circuit.

To calibrate the circuit, apply a 5V input and adjust the 20-kΩ potentiometer for a 10-MHz output. Then apply 2.5 mV and adjust the 50-kΩ potentiometer for a 5-kHz output. When building this circuit, use a ground plane and good grounding techniques and locate the components associated with the LM160 inputs as close as possible to the inputs. **EDN**

Author's biography

Jim Williams, now a consultant, was applications manager in National Semiconductor's Linear Applications Group (Santa Clara, CA), specializing in analog-circuit and instrumentation development, when this article was written. Before joining the firm, he served as a consultant at Arthur D Little Inc and directed the Instrumentation Development Lab at the Massachusetts Institute of Technology. A former student of psychology at Wayne State University, Jim enjoys tennis, art and collecting antique scientific instruments in his spare time.