Adjustable pulse generator features rate alarm

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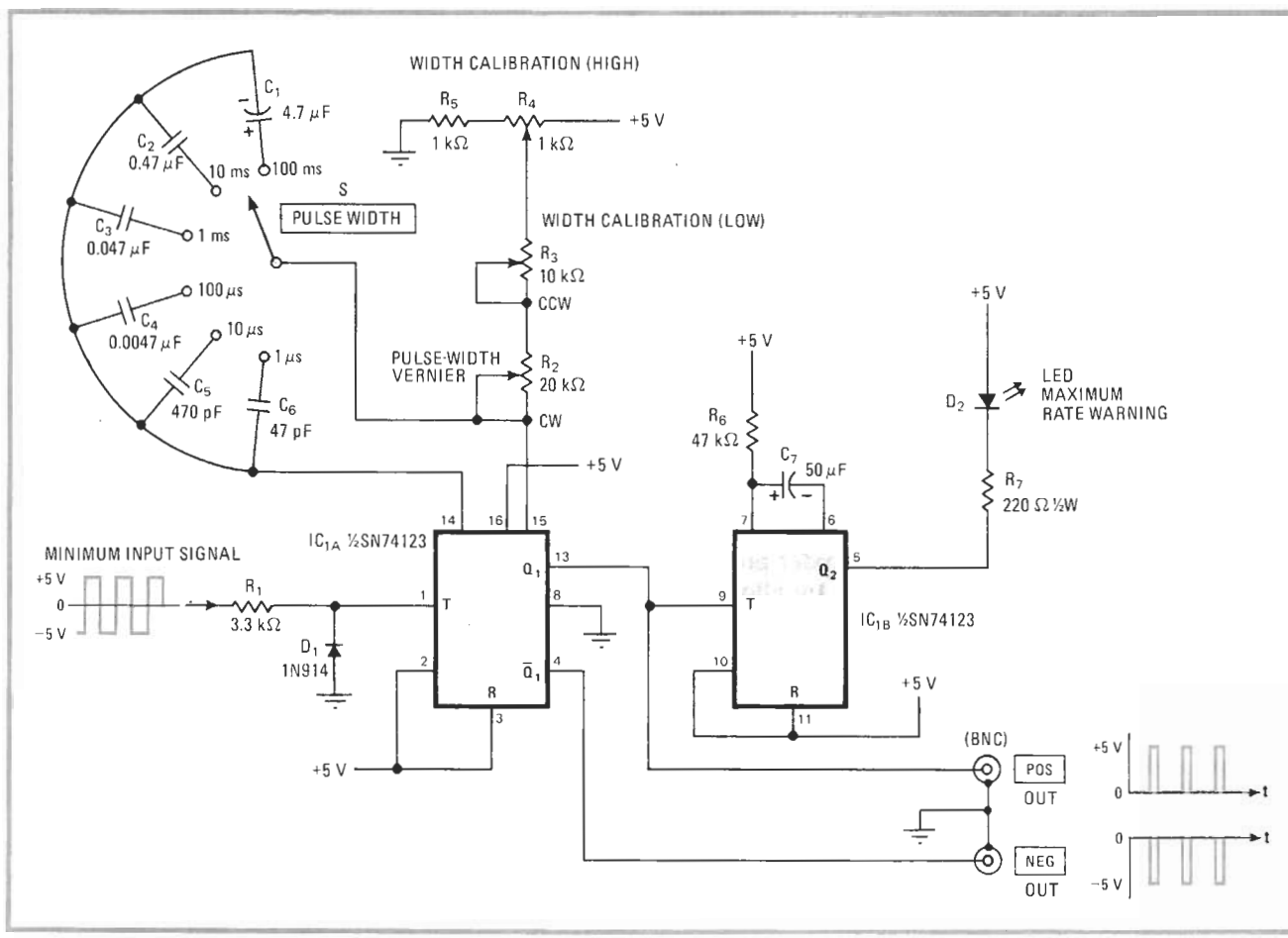
A TTL dual monostable multivibrator integrated circuit driven by a clock emits pulses of either polarity with widths adjustable in six decade ranges from 100 nanoseconds to 100 milliseconds. Output rise and fall times of the pulses are 15 ns or less, and the frequency can be greater than 10 megahertz. The most novel feature of the generator, however, is a maximum-pulse-rate indicator light that switches on if the clock rate is increased so that it is no longer compatible with the pulse width; that is, if the clock period is equal to or less than the pulse width.

Each negative-going transition of the clock signal applied to resistor R_1 causes one pulse to be generated by the one-shot multivibrator, IC_{1A}. Pulse width is determined by the circuit time-constant R_PC_P, where C_P is any capacitor from C_1 to C_6, and R_P is the sum of R_2 through R_5. Positive-going output pulses are available from IC_{1A}'s Q output, and negative-going ones from its $\bar{Q}$ output.

If the rate of the incoming clock signal is so high that its period is less than the desired pulse width, IC_{1A} is retriggered during its pulse-forming time (this type of one-shot multivibrator is retriggerable at any point in its operating cycle). Retriggering keeps the output of IC_{1A}, which is connected to the input of the second one-shot circuit, IC_{1B}, constantly at +5 volts. If IC_{1B} is untriggered for a time equal to its time-out period (approximately 2 seconds for listed values of R_6 and C_7), the output of IC_{1B} switches to ground level at Q_2, and the light-emitting diode lights.

The circuit includes potentiometers for vernier adjustment of pulse width and for calibration. The procedure is as follows:



Fast and narrow. Adjustable-width pulses down to 100 nanoseconds are produced at rates to 10 megahertz by this TTL circuit, based on a single dual-monostable integrated circuit driven by any suitable clock. If the input clock rate is raised so high (or the output pulse width is made so small) that the width exceeds the period, Q_2 goes low and lights the warning LED.

1. Adjust input clock frequency to 500 Hz.
2. Set switch S to 1-ms position.
3. Set R_3 to midrange.
4. Set R_2 to full clockwise (cw) position.
5. Adjust R_4 for 1-ms output-pulse width.
6. Set R_2 to full counter clockwise (ccw) position.
7. Adjust R_3 for 100-microsecond output-pulse width.

Repeat steps 4–7 until the rotation of R_2 from full counterclockwise to full clockwise changes the width of the output pulse from 100 μs to 1 ms.

The warning indicator can be checked by switching switch S to the 10-ms position. The indicator will light until the output pulse width is less than 1 ms.

Any function generator can provide a suitable clock signal. If a bipolar generator is used, diode D_1 eliminates negative pulses. □