

# Pulse generator has independent phase control

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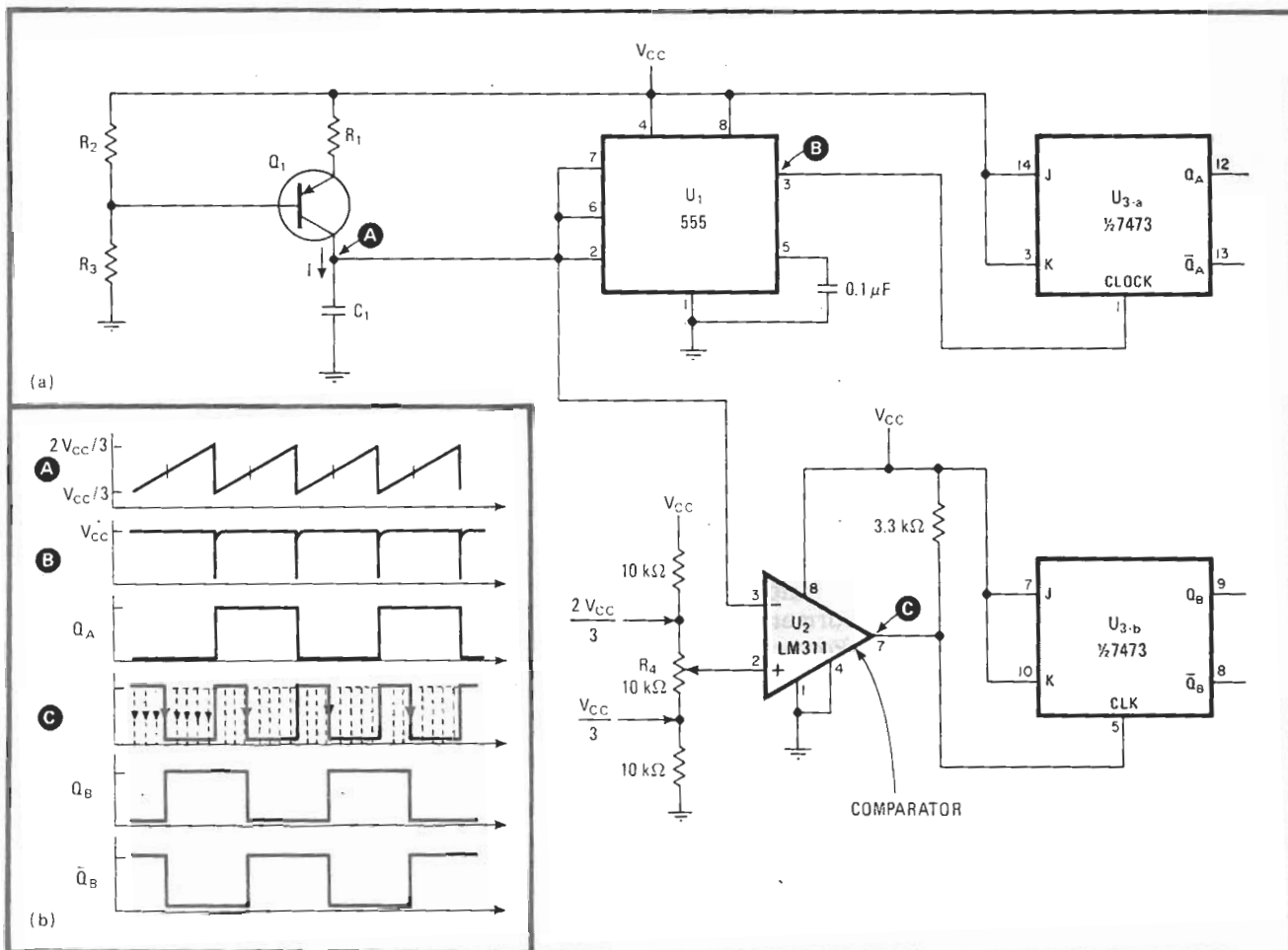
Many phase-locked-loop applications need a circuit to generate signals whose phase can be controlled independent of their other characteristics. Using a 555 timer and a few discrete components, this design provides a pulser with independent phase control between  $0^\circ$  to  $180^\circ$ . In addition, the phase is continuously adjustable.

Timer  $U_1$  (a) together with transistor  $Q_1$  and capacitor  $C_1$  generates a sawtooth signal whose amplitude is be-

tween  $V_{cc}/2$  and  $2V_{cc}/3$  (b). For every cycle of this sawtooth wave, a short pulse is produced at the output of  $U_1$ . This pulse clocks flip-flop  $U_{3,a}$  to generate reference signal  $Q_A$ . By comparing the sawtooth signal with a reference voltage provided by potentiometer  $R_4$ , the comparator output clocks flip-flop  $U_{3,b}$  to generate pulse  $Q_B$  that is phase-shifted with respect to the reference.

Because this phase difference bears a linear relationship to the reference voltage at the noninverting terminal of  $U_2$ ,  $R_4$  is calibrated in terms of the phase control, with  $V_{cc}/3$  corresponding to  $0^\circ$  and  $2V_{cc}/3$  to  $180^\circ$ . Since both  $Q_B$  and  $\bar{Q}_B$  are available from the output flip-flop, the circuit provides both phase-advance and phase-lag versions of the reference signal. □

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**Adjusting phase.** Using a 555 timer and a few components, this design (a) provides a pulse generator with independent phase control. The output can be either delayed or advanced with respect to the reference at  $Q_A$ .  $R_4$  is calibrated in terms of the phase difference, with  $V_{cc}/3$  corresponding to  $0^\circ$  and  $2V_{cc}/3$  corresponding to  $180^\circ$ . The timing diagram (b) depicts the phase relationship between the reference and the outputs.