Clock Pulse Generator

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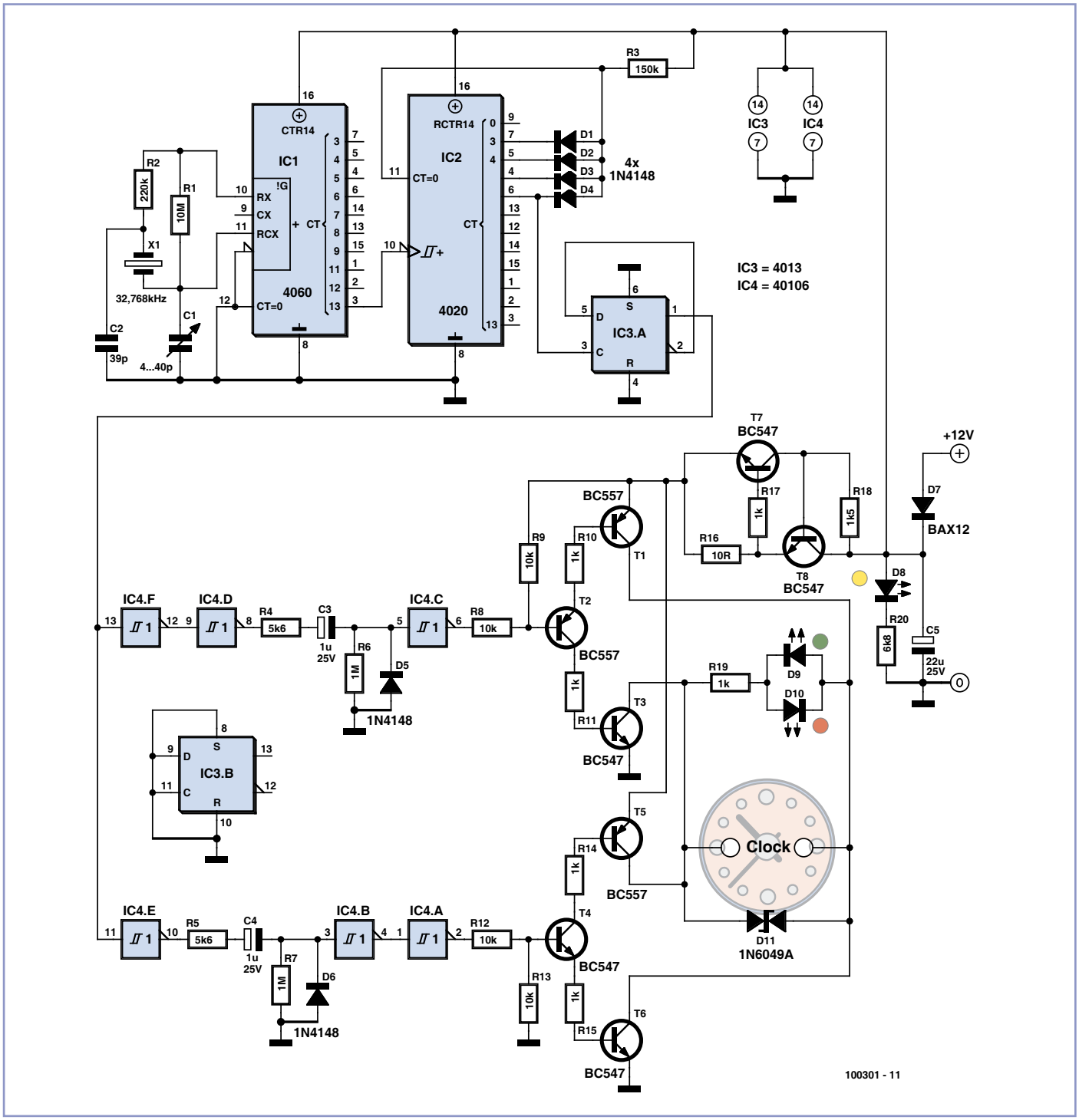
For many years the author has been approached by people who have managed to lay hands on an 'antique' electric clock and need an alternating polarity pulse driver. This is immediately followed by the question whether an affordable circuit for this is available. The design described here has been working very nicely for years in three of the author's clocks. To keep the circuit simple and thus inexpensive, the author dispensed with automatic adjustment for summer and winter time.

A 32.768 kHz oscillator is built around IC1. X1 is a crystal of the type that can be found in almost every digital watch, especially the cheaper ones. The frequency can be adjusted with trimmer C1 if necessary.
The clock signal is divided by IC1 and IC2 to obtain a signal on CT=6 (pin 6) of IC2 with a frequency of one pulse per minute. IC3.A is wired as a divide-by-2 circuit to maintain a constant signal during each 1-minute period. IC4.E and IC4.F buffer this signal, and IC4.D inverts the output of IC4.F.
When CT=6 of IC2 goes high, IC3.A receives a clock pulse and its Q output goes High. IC4.F and IC4.D then charge C3 via R6 (1 MΩ), and the output of IC4.C remains low for approxi-



mately 1 second. This drives T2 into conduction, and with it T1 and T3. The resulting current through the clock coil causes the green LED to light up. When CT=6 of IC2 goes high again after 1 minute, IC3.A receives a new clock pulse and its Q output goes Low. Now C4 is charged by IC4.E via R7 and the output of IC4.B is low for approximately 1 second, so the output of IC4.A is logic High. This drives T4 into conduction, and with it T5 and T6. The resulting current through the clock coil causes the red LED to light up. In this way the clock is driven by pulses with alternating polarity.

Diode D7 protects the circuit against reverse-polarity connection of the supply voltage. Diode D8 is lit constantly when the supply voltage is present. Transistors T7 and T8 provide current limiting if a short circuit occurs in the clock mechanism. The peak pulse current can be increased by reducing the value of R16 (minimum value 2.2 Ω). Diode D11 is a dual suppressor diode that clips any voltage spikes that may occur. This diode is fairly expensive, so it was omitted in the circuits actually built. This has not led to any problems up to now, but it may be advisable with heavy-duty clocks or multi-pulse clocks.

Note: this circuit is only suitable for pulse-driven clocks that operate at 12 V. The circuit must be modified for models that operate at 24, 48 or 60 V. As these models are less common, or in many cases can be converted to 12 V operation, this option is not described here.

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