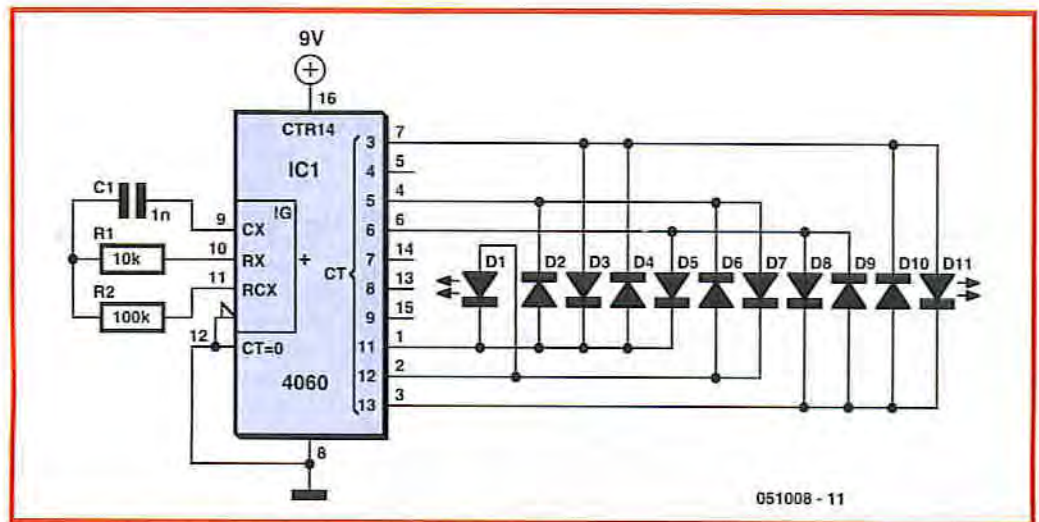


Blinking Christmas decoration

Dieter Folger

Have you already set up a Christmas tree in your house and decorated it with traditional lights? Build a couple of these blinking Christmas decorations to enhance the Christmas mood. The coloured LEDs blink in a seemingly random sequence and rate and create a festive appearance.

The circuit for the blinking Christmas decoration has a very simple design. It is based on a type 4060 digital counter (IC1). This IC has a built-in oscillator with a frequency set by the combination of resistor R1 and capacitor C1. The oscillator frequency is approximately 5 kHz with the component values shown here. The oscillator signal is divided by various factors by the internal digital circuitry of the IC. The division factors are designated by 'CT' in the IC drawing symbol. For instance, the signal on the CT3



output (pin 7) is a square wave with a frequency equal to 5 kHz divided by 2^3 , which means $(5 \text{ kHz} \div 8) = 625 \text{ Hz}$. The oscillator signal is divided by 2^4 (16) on the CT4 output, by 2^5 (32) on the CT5 output, and so on. The signals on each of the outputs thus change at different rates. Eleven LEDs are con-

nected in three groups between six of the counter outputs, with the result that the group of LEDs flash in an apparently random pattern.

To assemble the circuit, first solder the IC socket (mind the polarity), the two resistors, the capacitor, and the battery clip to the

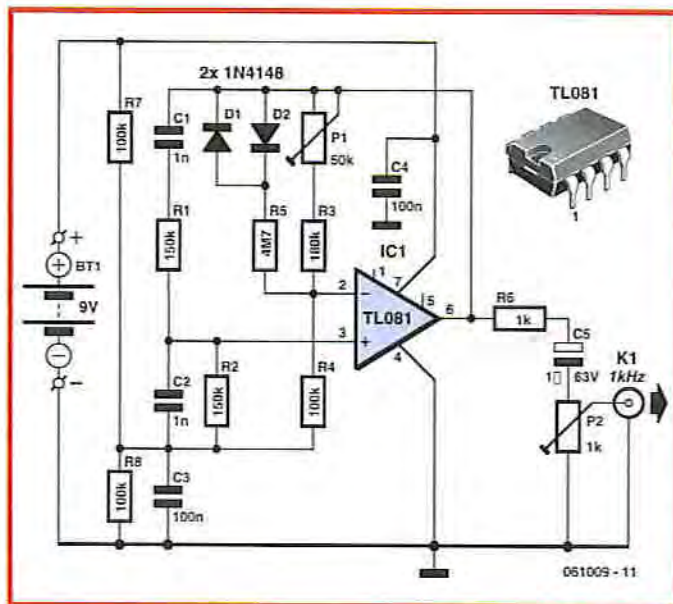
triangular circuit board. Then fit the eleven LEDs. Pay attention to the polarity of the leads: the short lead is the cathode lead. After a final inspection, you can connect a 9-V battery to your Christmas blinker. It should produce a festive blinking pattern!

(I-00051)

Test beeper for your stereo

Ton Giesberts

The test beeper generates a sinusoidal signal with a frequency of 1,000 Hz, a common test frequency for audio amplifiers. It consists of a classical Wien-Bridge oscillator (also known as a Wien-Robinson oscillator). The network that determines the frequency consists here of a series connection of a resistor and capacitor (R1/C1) and a parallel connection (R2/C2), where the values of the resistors and capacitors are equal to each other. This network behaves, at the oscillator frequency (1 kHz in this case), as two pure resistors. The opamp (IC1) ensures that the attenuation of the network (3 times) is compensated for. In principle a gain of 3 times should have been sufficient to sustain the oscillation, but that is in theory. Because of tolerances in the values, the amplification needs to be (automatically) adjusted.



Instead of an intelligent amplitude controller we chose for a somewhat simpler solution. With P1, R3 and R4 you can adjust the gain to the point that oscillation takes place. The range of P1

($\pm 10\%$) is large enough to cover the tolerance range. To sustain the oscillation, a gain of slightly more than 3 times is required, which would, however, cause the amplifier to clip (the 'round-

trip' signal becomes increasingly larger, after all). To prevent this from happening, a resistor in series with two anti-parallel diodes (D1 and D2) are connected in parallel with the feedback (P1 and R3). If the voltage increases to the point that the threshold voltage of the diodes is exceeded, then these will slowly start to conduct. The consequence of this is that the total resistance of the feedback is reduced and with that also the amplitude of the signal. So D1 and D2 provide a stabilising function. The distortion of this simple oscillator, after adjustment of P1 and an output voltage of 100 mV (P2 to maximum) is around 0,1%. You can adjust the amplitude of the output signal with P2 as required for the application. The circuit is powered from a 9-V battery. Because of the low current consumption of only 2 mA the circuit will provide many hours of service.

(I-00255)