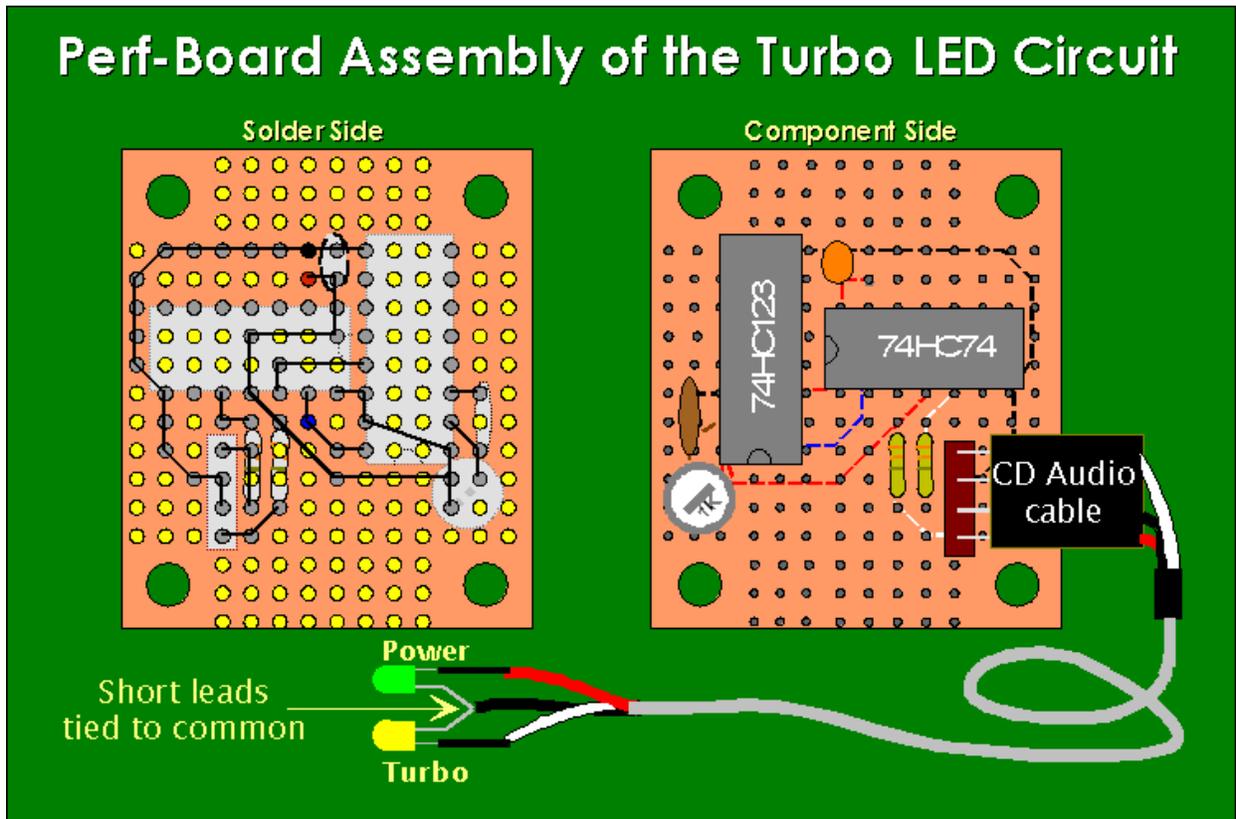# Color Computer Turbo Light

High speed indicator

Want to know when your CoCo is running at 2MHz? Not only a good reminder about disk I/O and possible I/O issues, some of us just like to know when programs are using it. And if you've repacked your CoCo into a PC case like I have, it's really cool to have a *functional* turbo LED!

It works great on CoCo3's... I have yet to test it on my CoCo1. Will update this spot when done.

Special thanks to Richard Lorbieski, who gave me his permission to share this article, which originally appeared in The Rainbow, May '91 (correction appeared in August). Thanks also to Robert Sherwood for the excellent scans (with corrections no less!), Bruce Calkins for pointing me to the article in the first place and of course to The Rainbow, without which all of our CoCo's would surely have been less

fun!

Perf-Board Assembly of the Turbo LED Circuit

Solder Side

Component Side

74HC123

74HC74

CD Audio cable

Short leads tied to common

Power

Turbo

A bright idea for monitoring clock speed on the CoCo 3

Turbo Light

by Richard Lorbieski

Have you ever wondered at which clock speed your CoCo 3 is operating? The only way to tell whether the computer is in the high- or low-speed mode is with BASIC. If you type POKE 65497,0 (the high-speed poke) after power up, you'll notice the cursor blinks faster. This means the computer is in the high-speed mode, but this is a crude way of checking the clock speed. Furthermore, if you're in a program or using OS-9, it's impossible to tell at which speed the CoCo is running. Unfortunately, Tandy did not include a "turbo" indicator light for the CoCo 3. I have designed a circuit that indicates when it is running at 0.89 MHz and when it is set to 1.78 MHz.

The turbo board is a great first project. It is simple and compact. There are no traces to cut on the main board, and no software modifications are necessary. The project requires only a handful of components and can be built in one evening. Most of the parts can be purchased at Radio Shack or at a local electronics supply house. However, the 74HC74 might not be an in-stock item at the local supply store. Therefore, you may have to order one. The reason I decided to

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use a 74HC74 was that it does not require transistor drivers for the LEDs. I wanted to keep the circuit simple and compact. If you
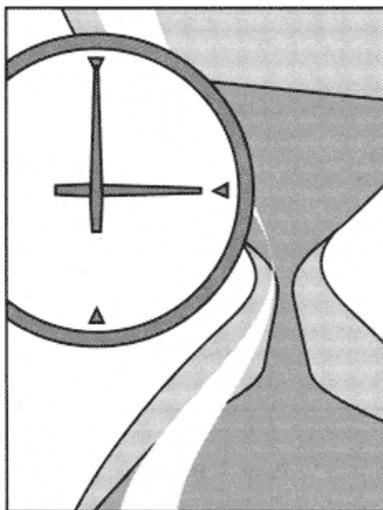
are unable to locate a 74HC74, try Jameco Computer Products (1355 Shoreway Road, Belmont, CA 94002, 415-592-8097) or JDR Microdevices (2233 Branham Lane, San Jose, CA 95124, 800-538-5001). Or contact me and I'll try to help you find one.

Theory of Operation

The E clock from the Color Computer is fed into Pin 1 of the 74LS123 (U1) and Pin 2 of the 74HC74(U2). The trigger timer is set by the input to pins 14 and 15 of U1. The duration of the trigger is controlled by R1 and C1. The trigger output on Pin 4 of U1 is

designed to last between 560ns and 1020ns. Figure 1 shows how U2 operates. When the output of U1 is "timed-out" in the 0.89-MHz mode of the CoCo 3, Pin 6 of U2 is enabled and goes High, thus lighting the red LED. However, when U1 is timed-out in the 1.78-MHz mode, Pin 5 of U2 goes High activating the green LED.

Building the Project

This project is designed for newcomers as well as hardware gurus. But for newcomers to building electronic projects, it is highly recommended that someone with experience help you build this circuit to avoid the possibility of an improper connection destroying your Color Computer. All the components can be mounted on a small printed circuit board.

Figure 2 is the parts list for this project. Not shown in the schematic (Figure 3) are the power connections for the ICs. Vcc is the +5 volt line. The pins on U1 and U2 for +5 volts and Ground are as follows:

IC	Ground	+5 Volts
U1	8	16
U2	7	14

Decoupling capacitors (0.1 µF) are used to filter any noise in the +5 volt line and one should be mounted close to each IC. One lead of each capacitor is connected to the +5-volt line and the other lead goes to Ground. I recommend you use sockets for the IC so, in case of malfunction, they can be replaced without desoldering the chip from the board. Another tip is to mount a connector to the

1120 ns.

CLK Low

0.89 MHz Clock
(Slow Speed)

Ground

Area where 74LS123 can time out.

560 ns.

CLK High

1.78 MHz Clock
(Fast Speed)

Ground

Output Pin 4 of U1

TRIGGER

LOAD 74HC74

The 74LS123 triggers on the negative edge of the clock and loads the 74HC74 with the clock data on the positive edge of the signal on Pin 4 of U1.
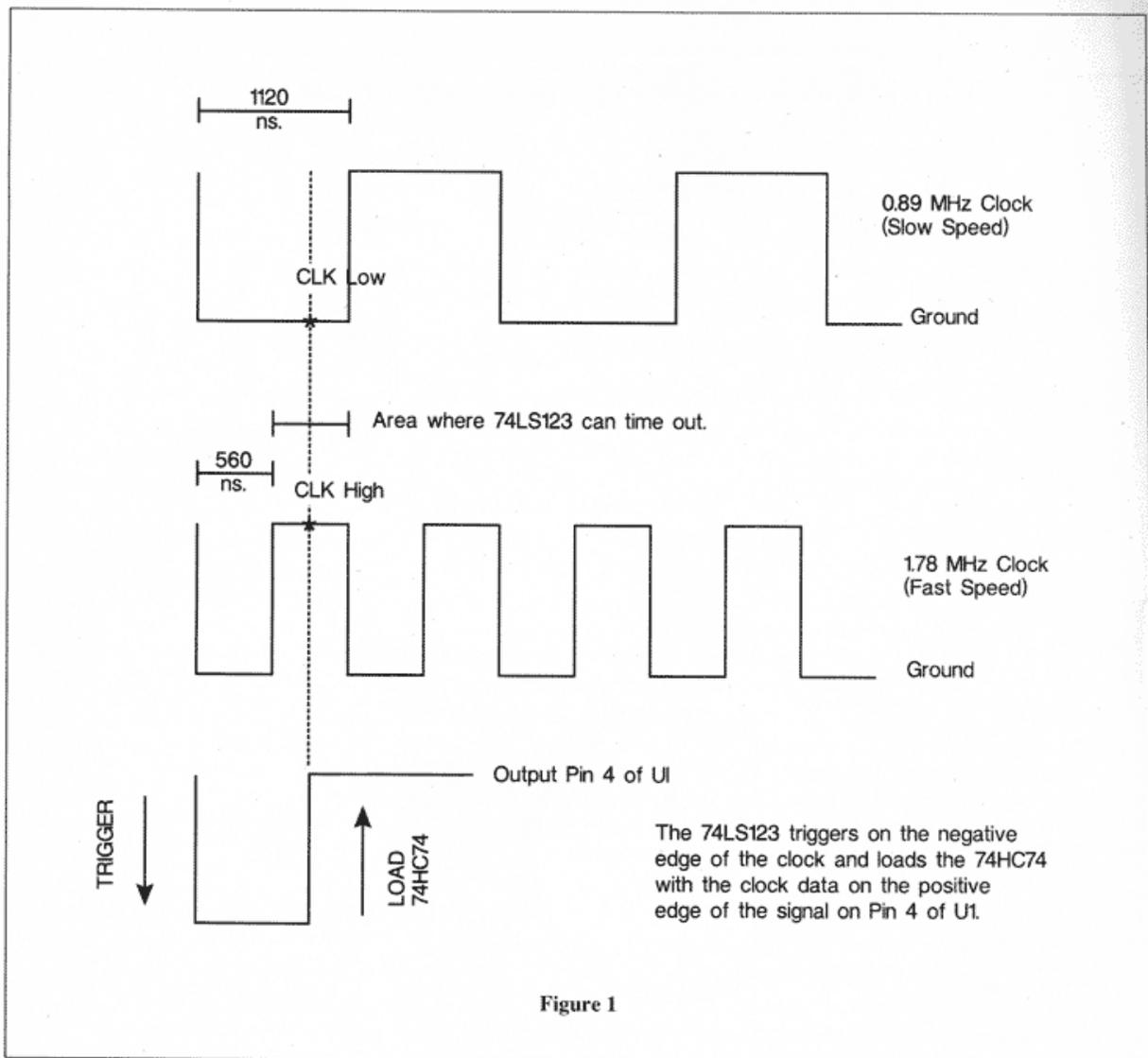
Figure 1

project board and use a cable with a connector that matches the board connector. This makes it unnecessary to desolder wires on the project board to open the computer case.

The best place to connect the cable wires is to the 68B09E microprocessor (labeled IC1 on the main board). Solder the wires on the bottom side of the main board and route them to the top. This avoids putting excessive heat on the CPU when soldering. Solder the Ground wire to Pin 1, the +5-volt wire to Pin 7, and the E-clock wire to Pin 34. Before going any further, double check your work.

Installation and Testing

The best place to mount the board is on the underside of the top of the case. Mount it 2 to 3 inches from the ROM cartridge port

Part	Description
U1	74LS123
U2	74HC74
R1	620-ohm resistor
R2,R3	330-ohm resistor
C1	.001-µf capacitor

Misc.   0.1-µF capacitors (2) for the ICs, one red and one green LED, IC sockets, and one small project board.

Figure 2: Parts List

and 2 to 3 inches from the back of the CoCo. Before mounting the board, test the circuit.

On power up, the red LED should immediately light. Next, enter POKE 65497,0 (high-speed poke) and the green LED should light. If the green LED fails to operate, recheck your connections. If they are correct, change the value of R1. Use a resistor between 500 to 700 ohms. It is better to start with a lower value and increase it until the unit functions properly. To restore the CoCo to normal, enter POKE 65496,0 (low-speed poke). If everything works, install the turbo board inside the CoCo 3.

At this time I do not have access to a CoCo 1 or 2. Therefore, I cannot guarantee the board works using the undocumented high-speed pokes on those computers. Perhaps in the future I can try it on an older CoCo. If so, I'll report my findings on Delphi. I hope the turbo board helps you. ❑
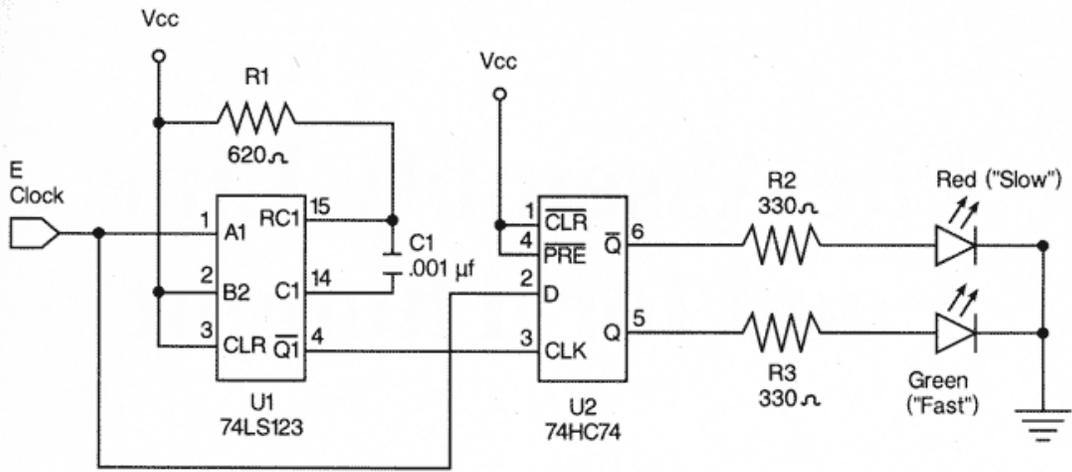
Figure 3