

Fig. 3. The solder side of the Analyzer PC board is shown here.

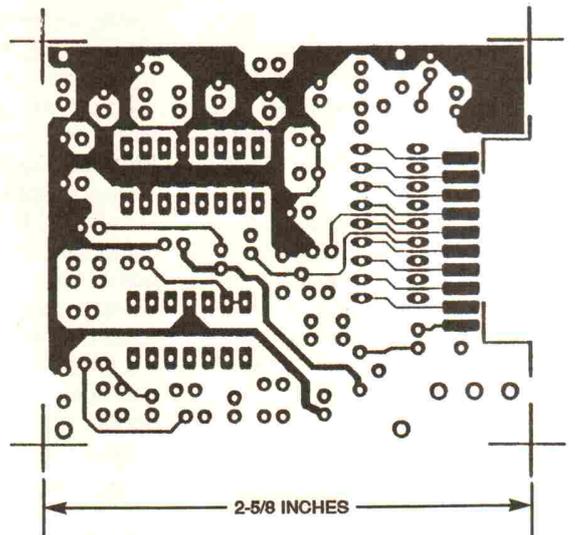


Fig. 4. Here's the component side of the board.

ence of IC4 to reduce power consumption. The transistor supplies a regulated voltage to U1 and the high end of the voltage divider that makes up the internal reference voltages for the comparators inside IC4. The low end of that voltage-divider string is referenced by IC2, an LM336Z, at +2.5 volts. That gives the bar graph a 2.5-volt, full-scale display.

Op-amps IC3-a, IC3-b, and IC3-d are biased from a voltage-divider string made up of R7 and R8. Resistor R7 biases the "quiet" operating point of those op-amps above the voltage level of the first bar-graph comparator so that the first bar will always be lit for a zero input. Because stress is inversely related to the percentage modulation, the first bar must remain lit for zero input to indicate maximum stress state. As stress is reduced and the percentage modulation increases, the signal drives DISP1 into the normal level. Even if the percentage modulation is unusually high, any level above the design value will still only light the tenth bar without going off range.

A swing of 0.3 volt on the RSSI signal will drive DISP1 to full scale. Because the slope of IC1's RSSI line is 0.414-volt/10-dB with a 5-volt supply, the full-scale display requires about a 7-dB swing, which corresponds to a 65% modulation. That value is approximately consistent with the example shown in Fig. 1, where a 25% modulation yields about a 200-mV peak-to-peak swing on the RSSI line. With the

### PARTS LIST FOR THE VOICE-STRESS ANALYZER

#### SEMICONDUCTORS

IC1—NE614 IF amplifier, integrated circuit  
 IC2—LM336Z 2.5-volt reference diode, integrated circuit  
 IC3—LM324M quad op-amp, integrated circuit  
 IC4—LM3914 linear bar-graph driver, integrated circuit  
 Q1, Q2—2N5089 NPN transistor  
 DI—D5—1N4148 silicon diode  
 DISP1—Ten-LED bar-graph display

#### RESISTORS

(All resistors are 1/4-watt, 5% units.)  
 R1, R3—6800-ohm  
 R2—3000-ohm  
 R4—1600-ohm  
 R5—2700-ohm  
 R6, R18—100,000-ohm  
 R7—1200-ohm  
 R8, R11, R19—10,000-ohm  
 R9—2400-ohm  
 R10—7500-ohm  
 R12, R14, R16—68,000-ohm  
 R13—270,000-ohm  
 R15—24,000-ohm  
 R17—12,000-ohm

#### CAPACITORS

C1, C4, C7—C9, C12—100- $\mu$ F, 10-WVDC, electrolytic  
 C2, C14, C15—0.1- $\mu$ F, polyester  
 C3—0.02- $\mu$ F, polyester  
 C5—0.015- $\mu$ F, polyester  
 C6, C10—0.047- $\mu$ F, polyester  
 C11, C13, C16—10- $\mu$ F, 16-WVDC, electrolytic

#### ADDITIONAL PARTS AND MATERIALS

MIC1—Electret condenser element (Digi-Key part no. P9970-ND or equivalent)  
 S1—SPDT switch  
 B1—9-volt battery  
 Printed circuit materials, project enclosure, battery snap with leads, IC sockets, wire, solder, hardware, etc.

**Note:** The following items are available from Vista (P.O. Box 1425, Bolingbrook, IL 60440; Tel. 708-378-5534): NE614 IF amplifier—\$4.50 (plus \$3.00 shipping and handling); pre-etched PC board (TREMOLLO-BRD)—\$10.00 (plus \$3.00 shipping and handling); kit of all parts including prepunched case with silk screen and battery (TREMOLLO-KIT)—\$48.00 (plus \$5.00 shipping and handling); fully assembled version is available with battery (TREMOLLO-ASSEM)—\$59.00 (plus \$5.00 shipping and handling). Illinois residents please add 7.5% sales tax. Check, money order, and credit cards are accepted. For fast check verification, please provide street address (no P.O. boxes), telephone number, and driver's-license number and state of issue.

ten-bar display used in the project, each bar represents about 6- or 7-percent AM modulation.

**Construction.** The author's prototype was built on a double-sided printed-circuit board. If you would like