Desk Microphone Power-On and PTT Indicators

Know when power is applied to your microphone, and when the PTT is engaged.

Don Dorward, VA3DDN

Often one cannot tell just by looking at a powered desk microphone whether it is connected to dc power, or if the push-to-talk (PTT) is engaged. You also can't tell if the PTT switch actually works, or worse, if it has been accidently locked in transmit, unless you are looking at the radio or the RF output power meter. I decided to add telltale LED indicators to my Icom SM-20 microphone that would glow in one color when power is provided to the microphone, and glow in a second color whenever the PTT switch is engaged.

Guidelines

Don't risk ruining the value of your microphone — modifications should look professionally done. Don't risk shortening the life of the PTT switch by running LED current through it. Microphone PTT switches are often just small tactile switches rated at less than 20 mA. Don't overload the radio microphone power source; it is typically rated +5 or 8 V dc at 25 mA maximum. Finally, I kept my circuit small and simple for anyone to build and install.

The Circuit

I built versions of my circuits using either a two-lead bi-color LED, shown in Figure 1, or two individual reverse-connected LEDs with colors of your choice (see the sidebar "Color Blindness in Radio Amateurs"). I chose green for the normal power-on condition, and red to indicate that the PTT is engaged. This circuit requires a microphone with a PTT switch that connects to radio ground for transmitting.

Transistors Q1 and Q2 do the polarity reversal. R1 and R3 set the individual LED forward currents. Normally Q2 is ON and Q1 is OFF. When the cathode of diode D1 is grounded via the microphone PTT switch, Q2 turns OFF and Q1 is ON. Connect the green LED cathode to the collector of Q2 (point Kg), and the red LED cathode to the collector of Q1 (point Kr).

R5 sets the LED forward current for the level of brightness you prefer. Icom radios provide +8 V to the SM-20 microphone, so I set R5 to 100 Ω to supply a nominal 10 mA of LED forward current. R5 can be replaced with a wire jumper for radios that supply only 5 V.

Building the Circuit

The choice of components is not critical. You can build the circuit on a piece perfboard or on a PCB like I did (Figure 2). There is limited space inside the SM-20 microphone. My PCB measures 1.2 by 0.73 inches and fits nicely into a corner (right side of Figure 3) of the microphone base.

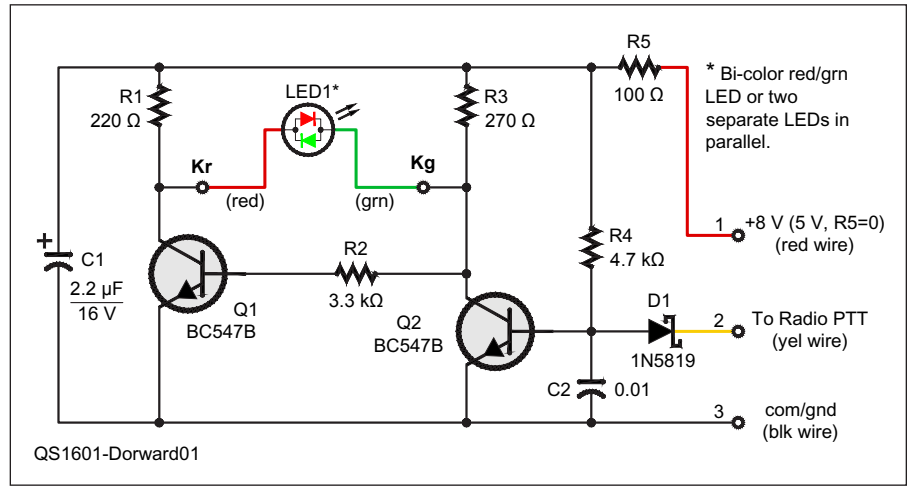


Figure 1 — Schematic diagram for the microphone PTT indicator. LED1 is external to the printed circuit board and may be either a single bi-color red/green LED, or two separate cross-connected LEDs. Connect the cathode for the red LED to Kr, and the cathode for the green LED to Kg.

C1 — capacitor, 2.2 µF 16 V tantalum
C2 — capacitor, 0.01 µF 50 V ceramic
D1 — Schottky diode, 1N5819
LED1 — (see text), bi-color 3mm LED Jameco #94553 or Digikey #160-1058-ND
Q1, Q2 — NPN transistor, BC547B, 2N2222, 2N440, 2N3904, or similar
R1 — resistor, 220 Ω 5% ¼ W
R2 — resistor, 3.3 kΩ 5% ¼ W
R3 — resistor, 270 Ω 5% ¼ W
R4 — resistor, 4.7 kΩ 5% ¼ W
R5 — resistor, 100 Ω 5% ¼ W

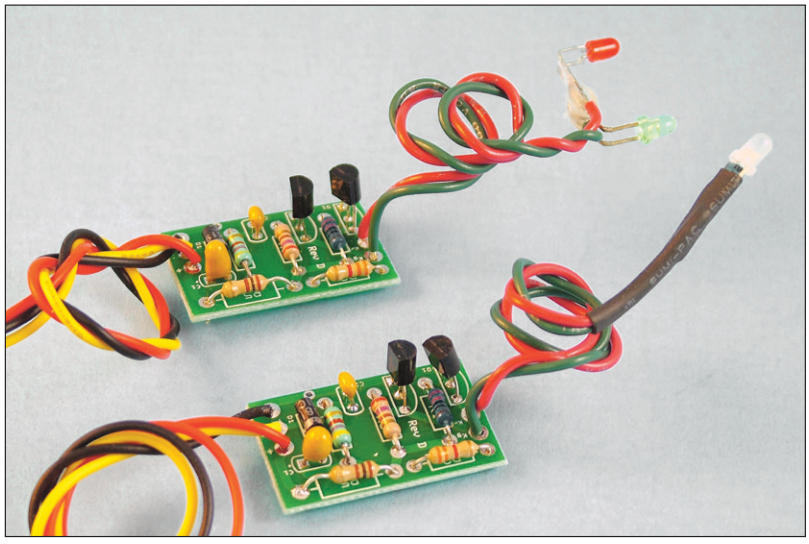


Figure 2 — PCBs for a pair of colored LEDs (top) and a single bi-color LED (bottom) connect to the microphone by the red (+8 V), yellow (PTT), and black (ground) wires.

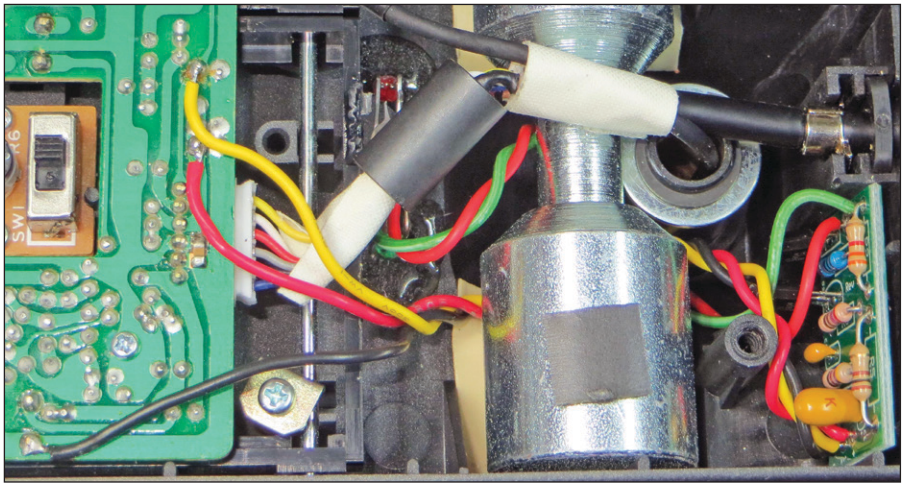


Figure 3 — The PCB fits into the right side of the microphone base. Note the connections of the red, yellow, and black leads.

Color Blindness in Radio Amateurs

I was proudly showing off my single red/green LED PTT indicator to a fellow ham, who pointed out to me that the single LED changing colors would be quite useless to him, as either state would look the same! He is color blind. I was quite surprised, and after a bit of research I learned that:

(1) up to 8% of males may suffer from red-green color blindness,

(2) color blindness to blue or yellow is less prevalent.

There are presently about 730,000 licensed Amateur Radio operators in the US.

If we assume that 75% of them are males, then there may be up to 44,000 hams out there who would not appreciate this bi-color LED PTT indicator!

However, by using two LED indicators slightly spaced apart, one green and one red, or one blue and one yellow, color blind hams can still make sense out of it, the same way they do with traffic signals while driving, that is, by position or location of the illuminated LED.

LED Preparation

The LEDs are connected to the PCB with flexible #24 or #26 AWG insulated wires (Figure 2). Keep track of the bi-color LED leads to be certain which you should connect then to get the colors right. If you get it wrong, just reverse the leads. I shortened the LED leads to about a half inch, then slipped ⅛-inch shrink tubing over the individual red and green connection leads, and finished with larger shrink tubing over both wires.

If you opt for two separate LEDs, bend the leads at right angles about 0.2 inches from the LED body, as seen in Figure 2. Next, position both LEDs with their leads pointing at each other in a soft-jawed vise at the desired distance apart. I used 0.75 inches. Tack the leads together with a drop of solder, then position and solder the color-coded red and green wires to the respective cathodes. Use a drop of hot-melt glue to cover and secure the solder joints. See the *QST* in Depth web page for additional details.[1]

LED Mounting

I strongly recommend using the small and unobtrusive 3 mm LEDs. They can be mounted with just the dome showing. Make sure the area beneath is clear, and drill a small LED mounting hole (7⁄64 inches) in a location of your choice. Carefully enlarge the hole with a small reamer or round file for a snug fit on the LED. Then use a drop of hot-melt glue from the underside to secure it in place. This is the only mechanical modification needed to the microphone.

Connections to the Microphone

I color-coded the wires between my PCB (Figure 3) and the microphone. The Icom SM-20 microphone uses Pin 2 for +8 V (red wire), Pin 5 for PTT (yellow), and Pin 6 (black) for chassis ground. This may vary according to your microphone and radio combination. Use an ohmmeter to verify continuity from the eight-pin round plug to the solder lands on the microphone internal PCB.

Printed Circuit Board

My printed circuit board layout and additional construction details are available on the *QST* in Depth web page. I will make

[1]www.arrl.org/qst-in-depth

the Gerber files available at no cost to anyone who would like them. There are also a limited number of finished PCBs available at my cost plus postage. Contact me by e-mail for details.

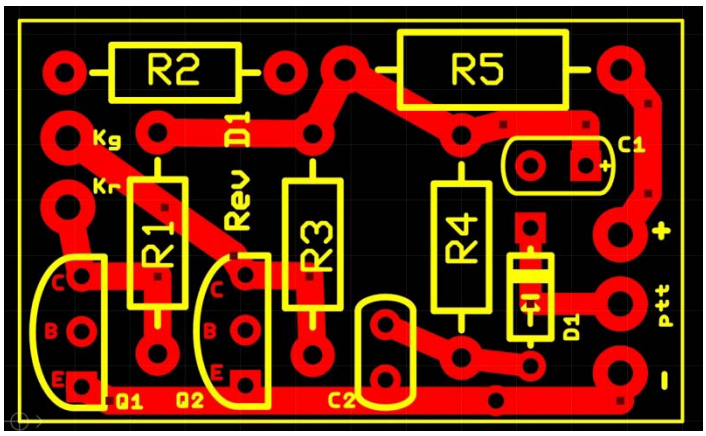
Photos by the author.

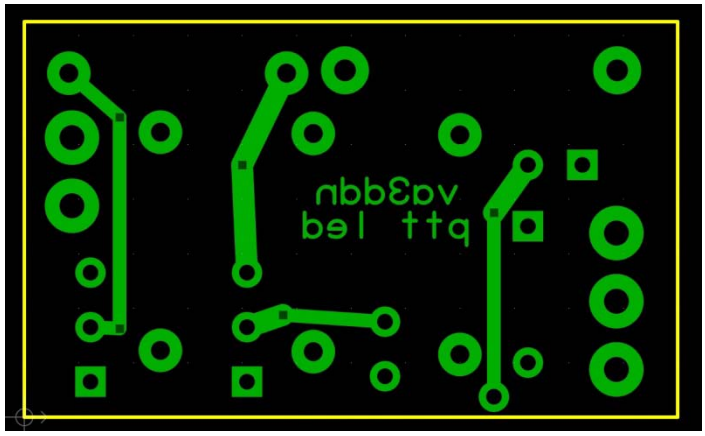
ARRL member Don Dorward, VA3DDN, has been a licensed Amateur Radio operator since 2002, with basic and advanced certification. He graduated Ryerson Electronics Technology in 1963. His career positions included management of R & D, ISO9001, and ISO13485 Quality Systems, Regulatory Affairs, in the areas of technical support for electronic components and materials, environmental testing and instrument calibration, automotive electronics product development, switch mode power supply development, medical electronics, UL/CSA and EU product safety testing and certification, and EMI compliance. Don developed programs for accelerated life testing methods such as HALT and HASS, in-house training for Quality Systems, ESD prevention, and IPC Workmanship Standards for the Acceptability of electronic equipment. He is the inventor on two patents, and retired in 2006. Don is a Life Member of IEEE, Radio Amateurs of Canada, and Ten-Ten International. You can reach him at **va3ddn@arrl.net**.

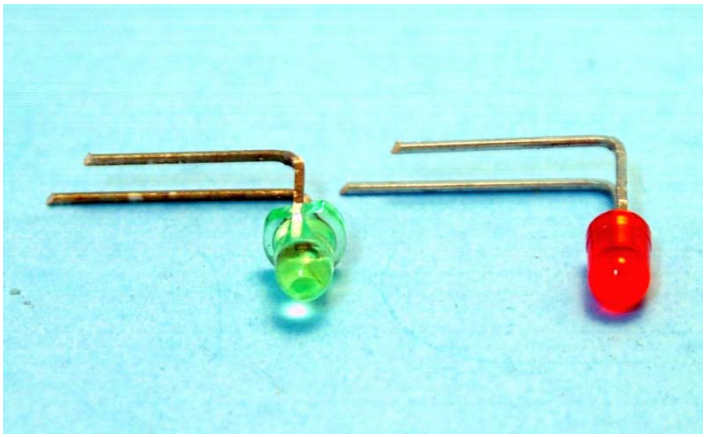
For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

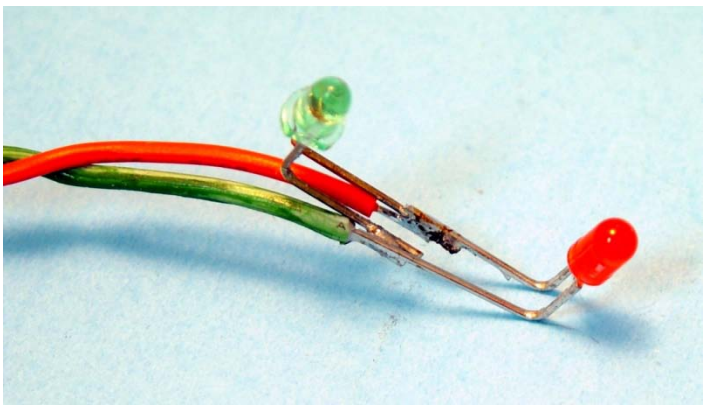
Additional Information

Note: Pin-out outline of Q1,Q2, as shown on pcb matches 2N4401 & 2N3904.
BC547B & 2N2222 may require mounting 180 deg.
Please verify pin-out of the transistors you have per manufacturer data-sheet.









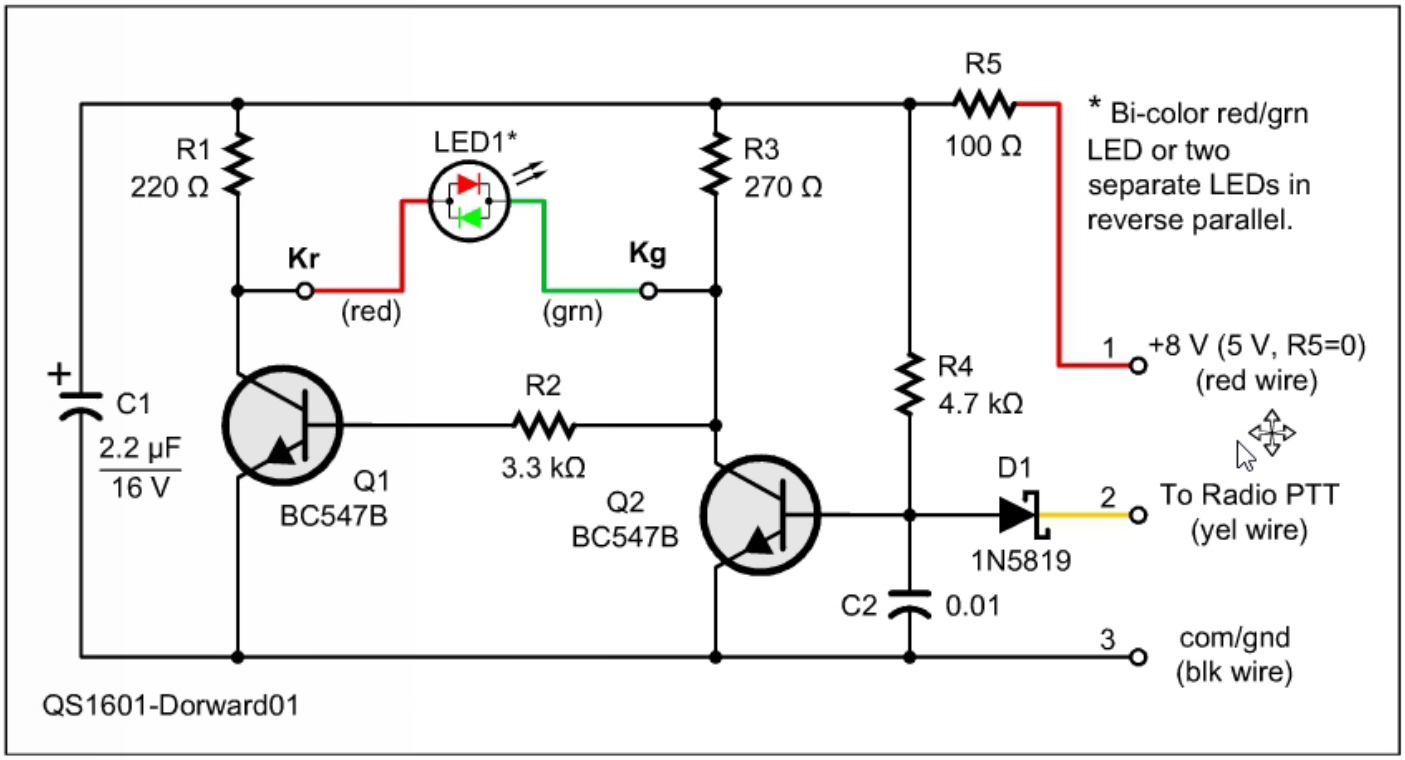
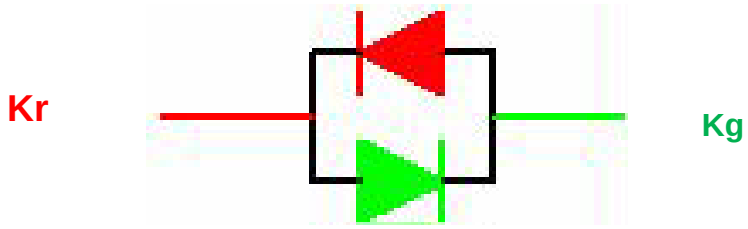


Figure 1 — Schematic diagram for the microphone PTT indicator. LED1 is external to the printed circuit board and may be either a single bi-color red/green LED, or two separate cross-connected LEDs. Connect the cathode for the red LED to Kr, and the cathode for the green LED to Kg.

C1 — capacitor, 2.2 µF 16 V tantalum
C2 — capacitor, 0.01 µF 50 V ceramic
D1 — Schottky diode, 1N5819
LED1 — (*see text), bi-color 3mm LED Jameco #94553 or Digikey #160-1058-ND
Q1, Q2 — NPN transistor, BC547B, 2N2222, 2N4401, 2N3904, or similar

R1 — resistor, 220 Ω 5% ¼ W
R2 — resistor, 3.3 kΩ 5% ¼ W
R3 — resistor, 270 Ω 5% ¼ W
R4 — resistor, 4.7 kΩ 5% ¼ W
R5 — resistor, 100 Ω 5% ¼ W

Please note, the illustration of the bi-color LED in the QST drawn circuit above is incorrect. It should be as shown below:



Revised Jan 23, 2016 VA3DDN