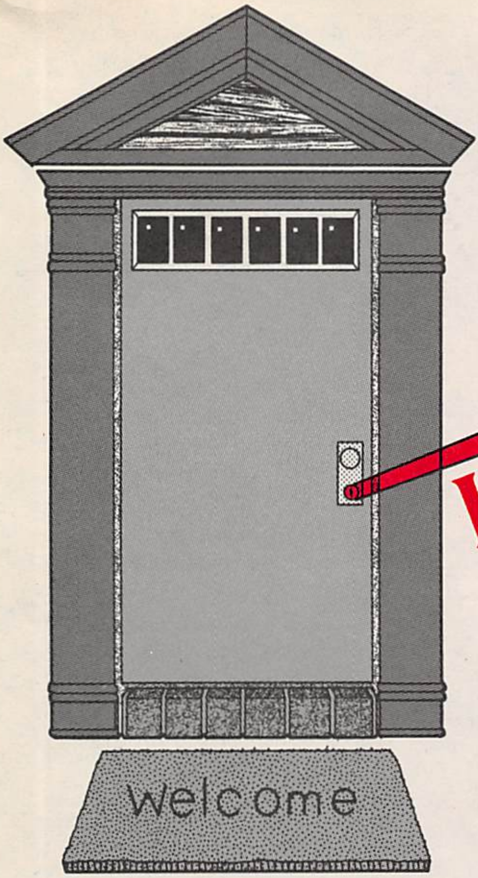
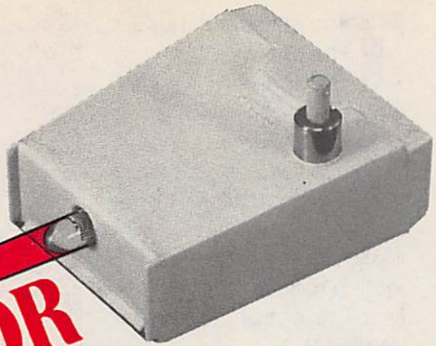


Build a KEYHOLE ILLUMINATOR



BY MARC SPIWAK

Fumbling in the dark with your keys is not only a nuisance, it can be downright dangerous

Have you ever been the first one to come home after dark and find that no one has bothered to leave the porch light on? Well we have, and our block is dark—so dark that it's hard to find the right key, and even harder to get it in the lock! In our neighborhood, it's hardly considered dangerous to fumble in your own doorway, but sadly that's not the case for everyone. And, unfortunately, in today's society women have even more to worry about. Since it's in your best interest to get into your house as quickly as possible, anything that can hasten your entry would be considered a plus.

What's needed is something that can shed some light on a keyhole. It has to be easy to turn on, small enough to be inconspicuous, and be able to turn itself off. In addition, it should be very inexpensive, and take very little time to build. Fortunately for everyone with dark doorways, I found a circuit that fits the bill—the *DoorLite* keyhole illuminator, which can be built for under ten dollars.

The Circuit. The schematic for the DoorLite is shown in Fig. 1. As you can see, there's very little to the circuit, and in addition, the values of all of components are very flexible. With the values shown, LED1 lights and stays lit for about ten seconds after S1 (a miniature, momentary contact, pushbutton switch) is pressed.

Many of you are probably wondering how on Earth can a single LED produce enough light to be of any use; so before we get into how the circuit works, let's address that question. The answer is that LED1 is no ordinary LED. As a matter of fact, LED1 is one of a recent breed of high-intensity LED's, that not only output a lot of light, but also use a focusing lens to create a more intense light beam, rather than a diffusing lens that makes an LED more suitable for use as an indicator.

The normal-size, high-intensity LED can be purchased from Radio Shack (as part number 276-087) for less than two dollars. The high-intensity LED outputs 2000 millicandelas (mcd) of red light; that's over a hundred times the light output of ordinary LED's. And the 2000-mcd LED is hardly the brightest of the high-intensity LED's; Radio Shack also carries a 5000-mcd LED, and Hewlett Packard makes a 15,000-mcd LED (their HLMP-8150).

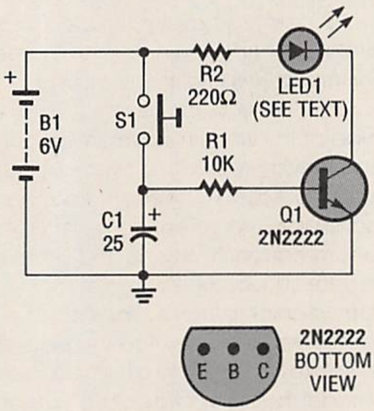


Fig. 1. This circuit will keep the LED illuminated for about ten seconds.

Any of those unit's—as well as a small incandescent lamp—can easily be substituted into our circuit. But because 2000 mcd's is more than enough light to illuminate a door lock, and because the more powerful LED's are much larger in size (the HLMP-8150 is about a half-inch in diameter) and a lot more costly, we went with the 2000-mcd unit. Now let's discuss the circuit.

The circuit should be powered from at least 3-volts DC, but 5 is probably better. We used a 6-volt camera battery, because of its small size (about the size of an N-cell), and because one only cost about four dollars. Switch S1 is a simple momentary-contact pushbutton that we had in our junkbox; we used it, too, because of its small size.

With S1 normally open, there is no charge on C1, Q1 is off, and the LED is dark. When S1 is pressed, a bias voltage is applied to the base of Q1 via R1, causing it to immediately turn on. Turning on Q1 completes LED1's

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KEYHOLE ILLUMINATOR
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ground path, causing it to light. While that is happening, C1 charges toward the positive supply rail. When S1 is released, the charge on C1 maintains Q1's base bias, keeping it and LED1 turned on.

Because resistor R1 is a 10k unit, the charge on capacitor C1 takes about ten seconds to discharge through R1 and the base of transistor Q1. Actually it takes a bit longer than ten seconds for C1 to completely discharge, but after ten seconds, the bias on Q1 is no longer sufficient for that transistor to pass enough current for LED1 to produce a useful light.

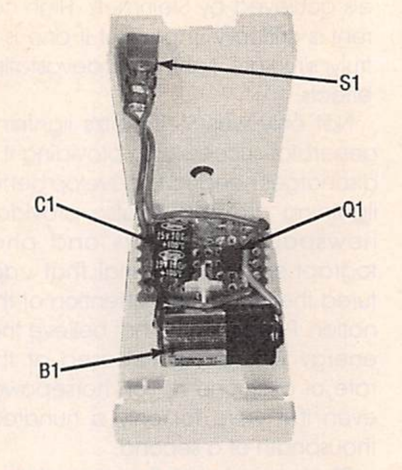
PARTS LIST FOR THE DOORLITE KEYHOLE ILLUMINATOR

- Q1—2N2222, 2N3904, or similar general-purpose NPN silicon transistor
- LED1—High-intensity LED (Radio Shack part number 276-087, or substitute, see text)
- R1—10,000-ohm, ¼-watt, 5% resistor
- R2—220-ohm, ¼-watt, 5% resistor
- C1—25-µF, 10-WVDC, electrolytic capacitor
- B1—6-volt camera battery (see text)
- S1—Miniature, normally open, momentary-contact, pushbutton switch

ADDITIONAL PARTS AND MATERIALS

Perfboard materials, enclosure, wire, solder, hardware, etc.

For most people, ten seconds should be plenty of time to get a key in the lock. But, for those who may need more time (for instance, those suffering from arthritis or some other debilitating joint condition), the time can increased by increasing the value of C1. On the other hand, the LED's on time can be decreased by decreasing the value of C1. The same effect can be achieved by varying the value of R1, but it's possible to increase the value of R1 to the point where Q1 will no longer turn on. So, to vary the time that the LED stays on, it's best to vary the value of C1.



With some carefully chosen parts, the DoorLite fits neatly into an old dental-floss case.

Resistor R2 is included in the circuit only to limit the current flow through LED1. At the specified value (220 ohms), it's enough to effectively limit current through LED1, while still allowing the LED to glow brightly. The lower R2's resistance, the brighter LED1 will be, and the higher the resistance, the dimmer LED1 will be.

We've specified a 2N2222 NPN transistor for Q1 because that's perhaps the most common transistor in the industry. However, we actually used a 2N4410—another NPN transistor—in our prototype because that's what we had on hand. The point we're trying to get across here is that the DoorLite circuit is so non-critical that nearly any NPN transistor that you happen to have on hand should work properly.

Construction. Once we had a simple circuit down on paper and had successfully breadboarded it, the next thing was to find a suitable enclosure for the project. Size was definitely a consideration, since we didn't want to install a large, unsightly device at our front door. Store-bought cases don't really come in sizes as small as we wanted, but fortunately the perfect case—at least for this project—was right in our medicine cabinet: a dental-floss container.

True, it sounds silly, but the finished design looks good and certainly is small. And the floss case seemed to be specially designed to accommodate the parts that we had chosen. We simply opened the case, removed the spool of floss (we saved it in an old film canister), and started our measuring, fitting, and drilling to create the enclosure.

The N-cell battery fit perfectly in a place already molded in the case, the switch also fit perfectly. We cut a piece of perfboard to fit in the case to mount the rest of the components on. Naturally, all wiring was done point-to-point, as there were only a few connections to make. Some double-sided tape can be applied to the back of the case to make it easy to mount the device wherever it is needed. However, the finished unit is so small that you might want to forget the double-sided tape, and suspend it from a keychain.

The floss case was the perfect choice for this project—in our opinion anyway. But if size is not a consideration to you, then you can use any size case, battery, or LED you like. The circuit will work just the same.

That's all there is to it. The DoorLite is a simple, yet useful project that anyone could use. Why not build one today! ■