Tear-down: inside a 7W LED light bulb

Margery Conner - March 18, 2010

TESS, a Taiwanese manufacturing company, recently introduced a 7W LED bulb that, at 560 lumens, can serve as a replacement for a typical 500-lumen, 40W incandescent bulb (Figure 1). TESS has received UL (Underwriters Laboratories) approval for the light and can begin selling it in the United States. It expects each light to sell for about $22.

![Figure 1 Glue secures the light's plastic bulblike cover.](image)

TESS obligingly sent me two samples of the light—one 5000K version in cool white and one 2700K version in warm white. The warm-white version produces 450 lumens. These nondimmable bulbs are not direct replacements for 40W incandescent devices.

I put the warm-white bulb to a subjective test by using it in a table lamp that formerly used a 40W CFL (compact-fluorescent-light) bulb. Although the LED has a more directional light, which it casts over a 120° angle, it worked in the lamp. It has a barely noticeable hum that you can hear at 18 in. or closer. The chief charm of the light is that it’s instant-on: There’s no warm-up period that a CFL requires. The specified L70 lifetime of the light is 10,000 hours, whereas the specified lifetime of a CFL is 8000 hours. The CFLs in my house routinely fail after about two years of service.

I was happy with the warm-white LED’s color, so I decided to use the cool-white light as the sacrificial lamb to see what’s inside. The plastic dome is glued onto the finned aluminum base that acts as a heat sink for the LEDs. (The product’s box says the LEDs are from Cree.)

The bulb holds seven LED packages and two empty pads (Figure 2). TESS has announced plans to offer a 9W bulb and will probably use the same PCB (printed-circuit board) by adding two more LEDs on the empty pads. The specks dimly visible in the yellow centers of the LEDs show that each LED is really a package of multiple LED chips (Figure 3). The plastic-looking gray pad around the
PCB’s edges in Figure 2 is a thermal conductive pad for better thermal transfer to the aluminum heat sink.

Figure 2 Not surprisingly for a 7W light, the bulb uses seven 1W LEDs. The gray pad serves as a thermal conductor between the PCB and the heat sink.

Figure 3 The dimly visible dark specks are the tiny LED chips that compose a 1W LED package.

The hollow base of the heat sink encompasses the light’s power-control circuit (Figure 4). A silver-colored clip-on heat sink on the HB-LED-driver IC is an MIP552 that Panasonic introduced in 2007. You can see more gray thermal conductive pad, apparently to protect the two components from mechanical vibrations or shock if they rub together, between the toroidal inductor and clip-on heat sink. The MIP552 is dimmable, but the dimming feature almost doubles the number of necessary surrounding passive components and wouldn’t fit inside the light’s current form factor. The spec sheet lists the LED driver’s switching frequency as 44 kHz.
The light still worked after I took the photos and reassembled it. However, gluing or taping the plastic dome on top didn’t seem like such a good idea for use in an easily accessible table lamp. It now has a home in the laundry room, where it’s one of three lights behind a light fixture and its exposed guts are less of a hazard (Figure 5).

**Figure 5** The exposed light finds a new home in a protected ceiling fixture.

**Figure 6** shows the difference in color temperature between the cool-white, 5000K LED light and the warm-white, 2700K CFLs. Do I like the LED lights? You bet. If price were no object, I would replace all 40W CFLs in the house with LEDs.
**Figure 6** The cool-white light is evident in comparison with the warm-white CFLs. The LED light also comes in a 2700K version.

See this video comparing light patterns and dimming responses for incandescent, CFL, and LED bulbs:

**Also see:**

- [What’s inside the Samsung 40W-replacement-LED light?](#)
- [LED bulbs reveal different design approaches](#)
- [Teardown: What killed this LED bulb?](#)