Cellular displays go hi-res

The global adoption of cellular phones has prompted development of small, high-resolution color displays to handle the increasingly stringent audiovisual needs of these devices.

Despite shrinking to less than the size of a deck of playing cards, mobile phones have become fully functional devices that not only make and receive calls but also consider e-mail, a calculator, schedule manager and alarm clock to be basic functions. These phones increasingly can do digital still photography and provide photo transfer, gaming, storing, music playback and Web browsing.

High-resolution color displays are helping phone makers incorporate more visual functions into the mobile handset, since the quality of the image plays a major role in determining the perceived quality of the overall device. Liquid-crystal displays for mobile phones continue to improve. New red, green, blue composite LED backlights produce an increased color gamut and consumer demands for bright, detailed, colorful images and high-content information from their mobile phones.

According to DisplaySearch (Austin, Texas), sales of displays for mobile phones nearly tripled from 2001 to 2003, increasing from 366 million to 975 million units. By 2009, the total will swell to nearly 1.4 billion displays.

Simpler phones can get by with a transflective LCD, which is adequate for simple functions indoors and which performs well in bright outdoor conditions. But audiovisual display is viewed at about half the distance of a computer monitor (19.6 inches vs. 11.8 inches), it still works out that the phone display's apparent pixel density is about twice that of the PC.

One problem with the increased resolution is that the LCD cell aperture ratio is decreased, so a brighter backlight is needed to achieve the same image brightness as with a lower-resolution panel. For example, a 2.2-inch QCIF+ panel has a 60 percent aperture ratio, compared with only 10 percent for a 2.4-inch VGA panel. Today's more-efficient LED backlights may ease that problem.

While consumers want larger, higher-resolution displays on their phones with brighter images, they also want their phones to be thinner and lighter. This means not only that displays must be thin—a typical 2.2-inch QVGA panel is only 2.6 mm thick, including the backlight—but also that their supporting circuitry must be small.

The typical large-scale integration (LSI) driver chips are 2 mm thick, but new designs have halved that dimension. And by mounting them along the bottom of the screen instead of the side, the display can be centered in the phone housing for a pleasingly symmetrical appearance.

Power consumption is another important display design consideration. Brighter backlights and more functions require more power, yet batteries take up more space and add weight as the storage capacity increases. As a result, power savings must be designed into every aspect of the device. The LCD panel of a typical 2.2-inch QVGA display consumes only 12 milliwatts, but the LED backlight draws an additional 216 milliwatts, so the current challenge is to reduce the power consumption of the LED backlight.

Higher levels of integration reduce the phone's parts count, which can lower material costs, reduce assembly costs and increase reliability. A single large-scale integration combining source driver and gate driver functions can reduce costs. Combining a single display with a subdisplay, backlight and digital camera in a single module cuts the parts count.