



# ECN

Liquid Crystal Displays

## New Life for Character LCDs?



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**D**ot matrix character liquid crystal displays (LCDs) have been around since the mid-1980s. They are displays that show alphanumeric characters using a limited dot-matrix pattern — usually  $5 \times 8$  dots. This type of display is commonly used in office equipment such as printers, fax machines, business phones and servers, as well as in a variety of other applications including vending machines, credit card verification equipment, instruments, meters, and even telescopes.

Dot matrix character liquid crystal displays are used in these applications because they are inexpensive, readily available in standard formats from a number of manufacturers, simple to design in and integrate and quite capable of displaying the limited text messaging required for these applications. The most popular character formats are  $16 \times 2$ ,  $20 \times 2$ ,  $20 \times 4$ ,  $24 \times 2$ , and  $40 \times 2$ . Now new types of character displays are becoming available with remarkable enhancements that offer advantages in appearance, performance and functionality.

### Performance Enhancements

With incremental performance improvements, dot matrix character displays can continue to be a viable display option for years to come. Display manufacturers have been able to integrate technology enhancements into dot matrix character displays in order to offer performance improvements while retaining the industry standard packages. These enhancements include backlighting advancements, LCD panel front-of-screen performance enhancements and improvements in liquid crystal fluid characteristic improvements and display packaging. High contrast ratios of up to 80:1 are achieved by using black matrix technology in a high contrast film STN (super twisted nematic) LCD panel.

This produces brightly colored pixels on a pure black back-

*State-of-the-art dot matrix character LCDs incorporate an array of performance improvements for today's product designers.*

ground. Dot pixels are produced in attractive green, blue, white or red hues based upon the type of backlighting specified. The choice of colors offers designers the option of matching the data readout color with their product. This offers distinct advantages for some applications. For example, hospital instruments are best served by bright, easy to read green character displays that are visible even when the room lights are switched off. Telescope readouts are best suited to red readouts, which will not interfere with the user's night vision.



**Figure 1.** These C-51505 20-character  $\times$  2-line monochrome displays from Optrex offer improved performance in an industry-standard configuration as well as a striking appearance and a range of color options.

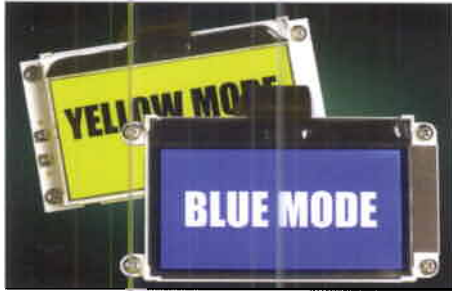
A highly efficient, single-chip LED side light can replace a traditional 12-chip matrix yellow LED backlight and provide superior efficiency for lower power consumption while maintaining excellent luminance (up to  $150 \text{ cd/m}^2$ ). And, it is available in a variety of colors. The use of higher efficiency backlights enables product differentiation while offering lower power consumption and fewer components in the system, making it simpler, more reliable and more energy-efficient.

Liquid crystal fluid technology, originally developed for mobile phone applications, has been deployed in character displays to allow a wider operating temperature range without having to adjust the liquid crystal driving voltage to compensate for changes in temperature. By selecting a fluid with a flat voltage vs. operation temperature characteristic, the display can be operated over the entire operational range of  $-20^\circ$  to  $+70^\circ \text{ C}$  at a constant 5V driving voltage.

### Alternatives to Character Liquid Crystal Displays

VFDs (Vacuum Fluorescent Displays) are commonly used in applications like security access terminals, gaming machines, microwave ovens, home audio equipment, automotive clocks, radios and a range of industrial equipment. VFDs normally have

bright blue-green characters on a dark background and feature wide viewing angles and wide operating temperatures. Drawbacks to this technology include



**Figure 2.** These Optrex F-51553 Series mono-chrome COG (chip-on-glass) LCDs offer a high level of integration, permitting the display of characters and graphics together.

large package size compared to active display area, relatively higher power consumption and poor readability in high ambient light conditions. Also, due to process limitations, it is difficult to make VFDs with very high pixel density or full color display. With these limitations, VFD technology is especially vulnerable to replacement by LCDs and now also by OLEDs (Organic Light Emitting Diodes).

With existing OLED technology, it is technically quite feasible to produce small information displays with single or multiple colors for alphanumeric readouts. These have been found in applications such as car audio systems and mobile phones using small molecule technology. Most recently, polymer type OLEDs have been used for alphanumeric readouts employed in a Norelco electric shaver. Still, OLED displays have quite limited availability and are not

currently available in standard form factors, so for most applications it is still too early to make use of OLED technology.

One other alternative to character-type liquid crystal displays is the use of graphic type liquid crystal displays to represent text messaging by using dot pixels to form character LCD patterns. A typical 128 x 64 - dot graphic LCD, like the Optrex F-51553 series (Figure 2), has about the same active area as a standard 20 x 4 character LCD. (20 x 4 is one of the most popular formats for character displays.)

By using full graphic LCDs instead of 5 x 8 dot matrix character LCDs, designers have more flexibility in pat-

tern representation and can choose or mix font sizes. In addition, they can combine graphic patterns such as logos, graphic icons or bar graphs with the character messaging for a richer display messaging content. Small graphic LCDs normally come with LED backlighting and are available in a variety of color schemes, such as white characters on blue background or black characters on yellow background. Small graphic LCDs are now available with a high level of integration including integrated controller/driver, display data RAM and internal charge pump for LCD driving voltage. They are normally priced at about 20 to 30 percent higher than character displays with the same active area but, considering what they bring to the table, they can be an excellent value for certain applications that want to mix characters with graphics.

Overall, dot-matrix character LCDs are still a very viable option for product designers. Today's state-of-the-art dot matrix character LCDs incorporate a significant array of performance improvements. They're brighter, they're easier to read (even in daylight), they offer a wide palette of color options, they use less power, they cost less and they're readily available off-the-shelf in industry standard form factors.



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