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Ph. 480-503-4295 | NOPP@FocusLCD.com

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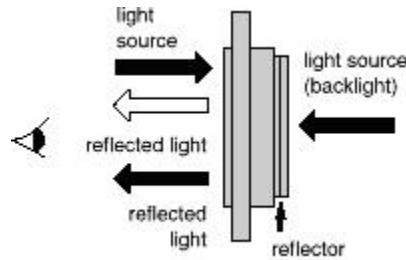
Application Note FAN4207

Transflective Displays

Transflective TFT modules have both transmissive and reflective modes, meaning they both transmit and reflect light. This application note will show the abilities of a transflective TFT display.

Focus LCD's Transflective TFT

Transflective TFT modules have both transmissive and reflective modes, meaning they both transmit and reflect light. Transflective displays are unique in that they can be visible with or without a backlight. This aspect of the transflective display is beneficial for reducing power consumption of the backlight by using the reflected light to create the readable image. Because transflective displays can use reflected light to display its image there is no need to overpower the backlight to compensate for bright ambient light. This makes transflective displays a perfect solution for indoor and outdoor applications, especially in direct sunlight.



Transflective Display

Backlights are often the largest power drain on a display. Using the ambient light to illuminate the display makes transflective displays very energy efficient and are an ideal solution for battery powered devices. For example, a cellphone will increase the brightness of its display when brought into bright ambient lighting. This results in the battery of the device to drain very quickly. Conversely, transflective displays can use this bright ambient lighting to illuminate the display which reduces the power demand of the backlight thus conserving battery life.

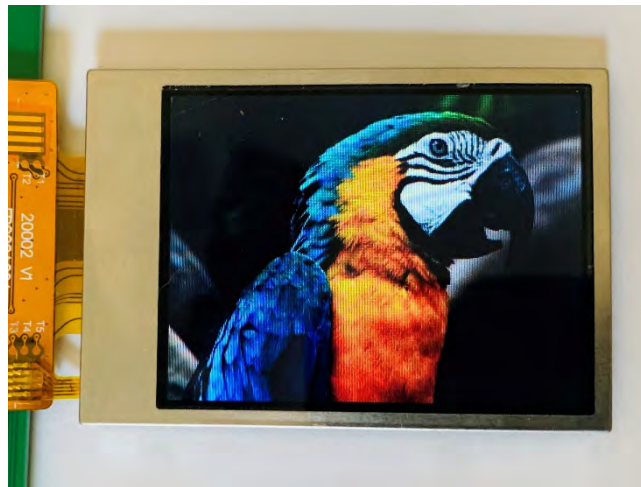
Transflective displays can also utilize the transmissive mode to increase the backlight in darker environments. The display can use a combination of transmissive and reflective modes to maximize power efficiency depending on the environment and ambient light available. An outdoor display could adjust the backlight power depending on how much light is available over the course of the day.



Below is an example of a transfective TFT display at different ambient lighting levels and the corresponding backlight power levels. The display in this example is a 2.0" transfective TFT (display: [E20RB-FW345-N](#)) with a white LED backlight at 345 nits. For more information on this display refer to the [data sheet](#). Some important features of this display are below.

- Low Input Voltage: 3.3V
- Display Colors: 65k/262k
- Resolution: 240x320 pixels
- Brightness: 345 nits
- Display Mode: VA Transfective

The first image is the transfective TFT in the transmissive mode. The transmissive mode of the transfective TFT is using the backlight at 100% brightness. The transmissive TFT is the standard TFT mode and is great for indoor applications.



Focus LCDs Transfective TFT: Transmissive mode

Transfective TFT's can be used all lighting environments, using both display modes, in complete darkness to full sunlight. Below is the transfective TFT in the reflective mode in bright ambient lighting. The transfective TFT below compares the reflective aspect of the display *with* and *without* the use of the backlight LED's. The difference between fully reflective mode at 0% backlight power and 100% backlight power is minimal in direct sunlight, using the backlight in direct sunlight has little effect for the transmissive mode of a TFT.



Focus LCDs Transflective TFT: Reflective mode (no backlight)



Focus LCDs Transflective TFT: Reflective mode (with backlight)

The transflective TFT reflects the bright ambient lighting to illuminate the display. Power is conserved when opting not to use the backlight LEDs which make transflective displays energy efficient and ideal for outdoor applications. It is important to note that displays in very bright environments will appear to have reduced color. In dark environments the image will appear to be more vibrant and colorful. The perceived color variation is due to the contrast in the lighting environment. A transmissive TFT would typically have limited visibility in direct sunlight while the transflective TFT can be visible in any environment. The ambient lighting levels can compensate for the lower power consumption of the backlight without sacrificing image visibility.

A combination of the reflective and transmission modes can be used to optimize the transflective display in any ambient lighting environment. This is especially beneficial for saving power in bright environments where the backlight LEDs can be turned off. This is a small 2.0" TFT at 345 nits that would require 80mA at 3.3V to maintain a constant brightness in the transmissive mode. This power cost becomes much greater for larger TFT's. There is little difference in the TFT appearance at 100% and 0% backlight power in full sunlight when utilizing the full reflective mode of the transflective TFT. Transflective TFT's are a great solution for efficient power use in applications where bright ambient lighting is available.

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