Bi-stable LCD

September 12, 2013

ORIENT DISPLAY

What is Bistable

- Bi-stable can retain an image without power. The crystals may exist in one of two stable orientations and power is only required to change the image. Bi-stable LCD can change colors, and keep that color even when power is cut off.

Bi-stable Advantages

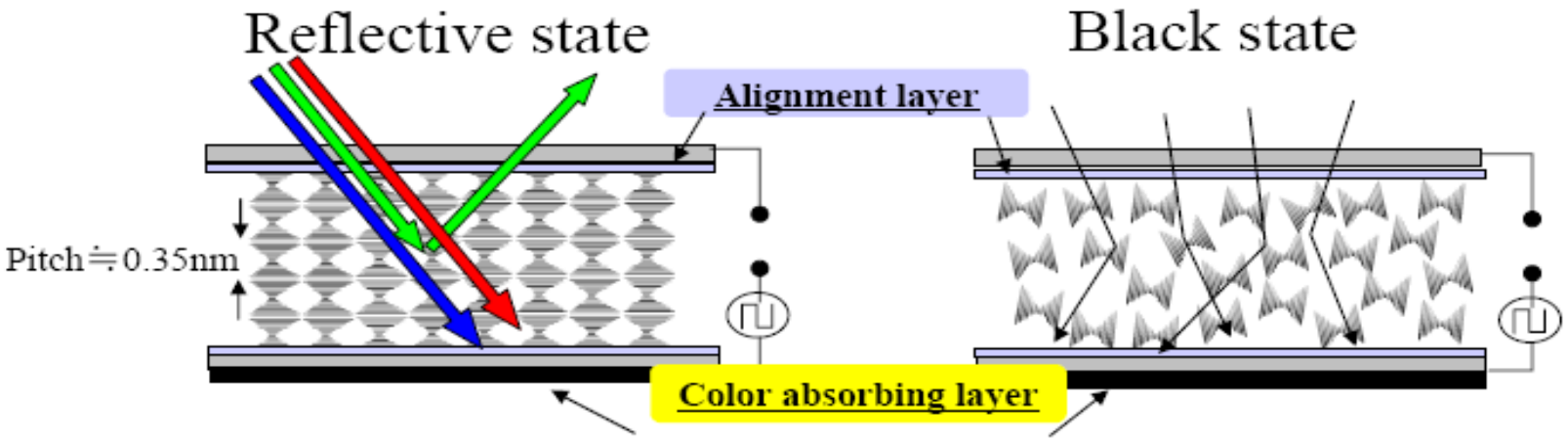
- No flicking: eyes not get tied easily.
- Low power: no power is needed to maintain the image. Made into e-book, 20,000 pages can be read with 2 AAA batteries of 3V.
- Possible high resolution which can achieve 200 dpi. Can achieve 256 gray scale.
- Possible low cost and a green display: no polarizer, color filter and backlight are needed.
- High contrast and wide viewing angle: The monochromatic bi-stable LCD's contrast ratio is as high as 25:1,viewing angle about 80 degree in all directions.

Bi-stable LCD Colors

	Reflective color of Bi-stable LC	Color absorbing layer	Character color	Background color
Single layer	Green※	Black	**Green** ※	**Black**
	Yellow	Blue	**White**	**Blue**
Double layer	Yellow Blue	Black	**White**, **Yellow**, **Blue**, **Black**	
Triple layer	Red Green Blue	Black	**Full Color**	

How Bi-stable LCD Works

✓(Bragg refraction : $2d\sin\theta = n\lambda$)



Planar Texture

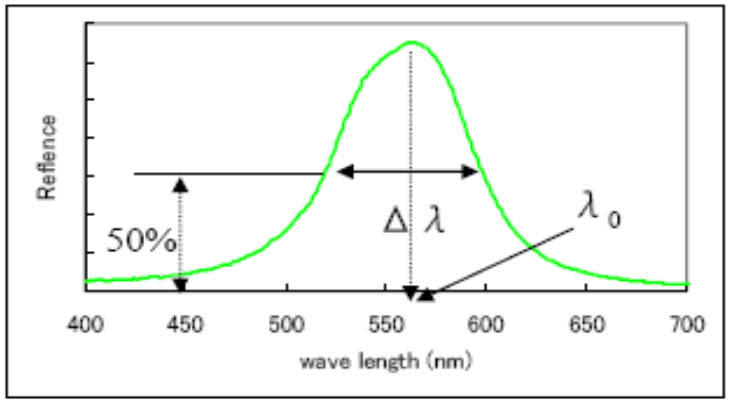
Helical axis is perpendicular to substrates.

Selective reflection

Focal Conic Texture

Helical axis is (approximately)parallel to substrates.

Weakly scattering



$\lambda_0 = n \cdot P$ 〔 $n = (n_{\parallel} + n_{\perp})/2$ 〕

$\Delta\lambda = \Delta n \cdot P$

- For Cholesteric materials with positive dielectric anisotropy, the molecules in the planar structure will easily realign parallel to an applied electric field, generating the reflective layered structure. To break up the helical layered structure is to apply voltage around 6V to 30V. In order to switch from focal conic state back to planar state, even higher voltage is needed (35V). The exact voltage required for switching depends on cell gap as well as dielectric anisotropy of liquid crystals. The focal state is less stable than the planar state.

Precautious of Using Bi-stable LCD

- Bi-stable Liquid Crystal materials require protection from UV light.A UV blocking material with a minimum 98% cut of at 380nm and lower spectral components is required.
- The finished product design should incorporate a transparent cover such as acrylic, polycarbonate etc,to protect the viewing area of the display. Place the protective cover as close to the display module as possible. The protective cover should be sufficient thickness to resist bending.
- Adding an anti-glare and or anti-reflective surface film or finish to the viewing side of the protection cover may improve the optical performance.
- Bi-stable LCDs requires the use of a voltage booster . Designing into some environments needs to be cautious, examples: explosive gas.
- Bi-stable LCDs are limited to one color of character and one color of background.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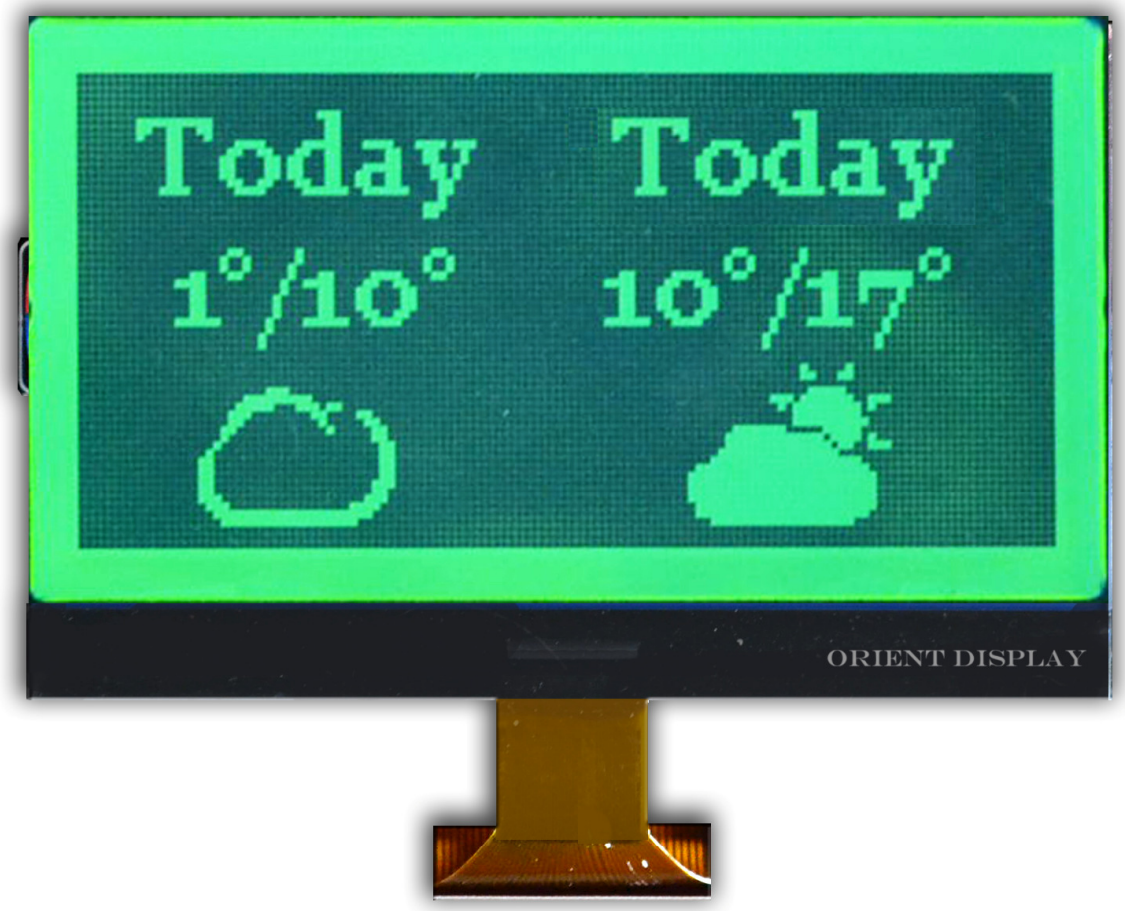
Today
1°/10°
Today
10°/17°
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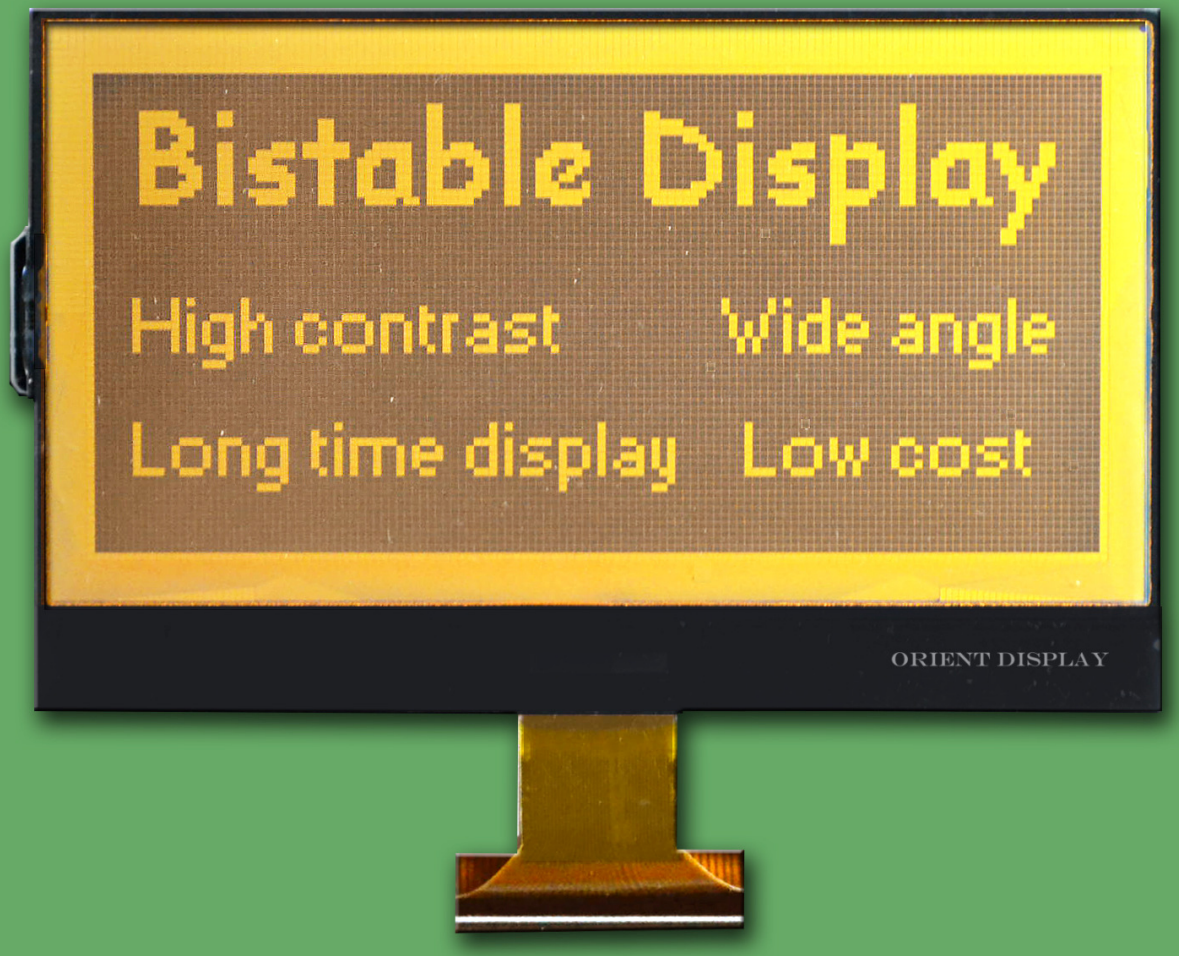
Bistable Display
High contrast
Wide angle
Long time display
Low cost
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HaoShi chocolate
ShangHai
7.80
RMB
45g
ORIENT DISPLAY

Black/White Bistable

- Bistable Technology Limitation
  - Refresh rate is slow: 2-3 seconds
  - Between each screen refreshing, the screen has to be refreshed with a dark screen.
  - The power used for screen refreshing is pretty high. So, it will not worthwhile for a application if the screen has to be refreshed more than 20 to 50 times depending on the battery used. Bistable technology has been used for shelf label and E-reader.

- Standard Product Info:
- http://www.orientdisplay.com/bistable-lcd-modules.html
- Custom made Bi-stable:
  - Any type of monochrome and multicolor LCDs including digit, character and graphic bi-stable LCDs can be custom made.

Competitive Technology: E-ink