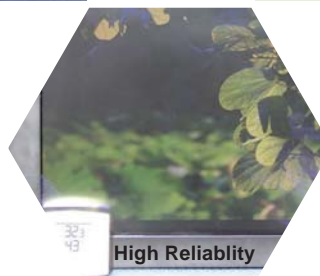
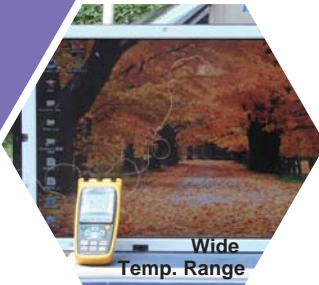




Portwell

EBL-Enhanced BackLight

Wide Temperature Range · Cold Start · Long Service Life · High Reliability



As a professional industrial PC platform

provider since 1993, after moving to new headquarters base - Portwell Engine in 2010, besides original design & manufacturing service (DMS), Portwell starts incubating the concept of new business model as an affordable technology service provider. The EBL (enhanced backlight) series which can enhance and enrich your product lineup of Monitor or Panel PC are introduced.

In current backlight technologies, the ordinary approach to enhance brightness is to increase the number of CCFL tubes or increase the quantity and driving current of LED. However, such approaches will face several critical challenges:

- Modify backlight to high brightness will result in more complex light, electrical, and mechanical interaction of troublesome issues. It will be difficult to assure the LCD panel reliability as well.
- The outdoor high and low ambient thermal shock will drive LCD backlight brightness and its life time to decay rapidly.
- The outdoor sunshine will keep generating heat from radiation to the LCD panel thus making the TFT cell failed.

1. High stability and reliability LCD panel specially designed for outdoor use.

Solution 1: high stability and reliability

Portwell LCD panels with FFL backlight are specifically designed for outdoor applications, not only simple in mechanical design, but also specially designed for extreme high and low ambient thermal shock to ensure long-term use.

2. Ultra-durable backlight technology with 100,000 hours long service life.

Solution 2: Ultra-durable Backlight

Compare to the physic limitations of CCFL backlight with low tolerance to low temperature and LED backlight with low tolerance to high temperature, Portwell LCD panels with FFL can operated from -40°C to 90°C with over 90% of light-emitting efficiency, in addition, the FFL with as long as 100,000 hours service life is the best solution for outdoor applications.

3. The challenge of direct sunlight by introducing high efficient thermal solution to easily dissipate heat from sunlight and backlight.

Solution 3: the challenge of direct sunlight

Outdoor sunshine is a key challenge to LCD application because the sunshine will carry heat at $900\text{W}/\text{m}^2$ to the LCD surface and will be absorbed by the cell, thus giving rise to the failed blackout LCD due to overheat.



EBL gets better Gray Level

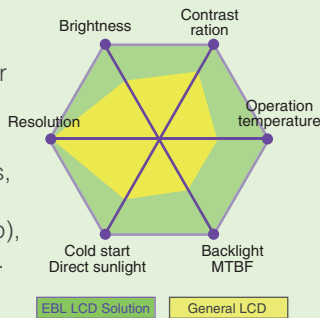


EBL gets better Contrast Ratio

Features of EBL in

general

- Optimized LCD panel for wide application range
 - Through different backlight technologies, include FFL (Mercury-free flat lamp), LED and robust CCFL.
 - Customizable brightness from display size of 7.0" up to 46".
- High Brightness & Sunlight Readable
- Wide Operation Temperature
- Long Service Life and High Reliability
- High Performance Image Quality to draw attention



Specially customized LCD solutions:

- Panel size: 7" ~ 46"
- Brightness: 500 ~ 1200 nits
- Contrast ratio enhanced
 - Gamut correction for High Brightness (HB) image
 - Impulse Backlight

- Wide operation temperature
 - -30°C ~ 60°C ambient temperature
- Cold start & Direct Sunlight
- Long Service Life: Backlight MTBF 100,000 hours (FFL)



1000 nits brightness
(Measured by 20:1 attenuator)

Benefits from cooperation with Portwell:

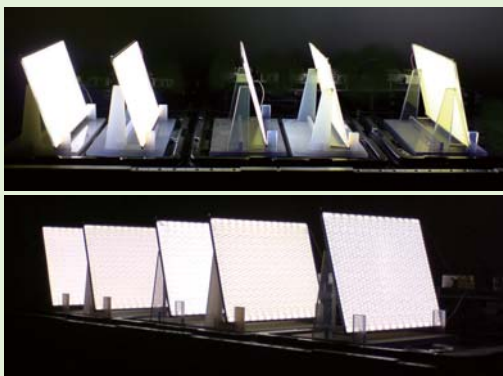
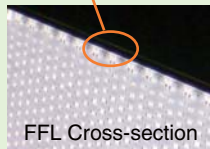
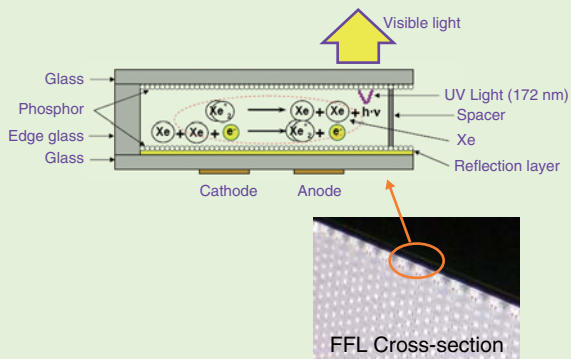
Though the optimization of reliability, performance (brightness), and TCO, Portwell can provide most cost-effective high brightness LCD panels and support you to dig out more business opportunity from the HB niche market.

More on Core Backlight Technologies

FFL

In early 2000's, the backlight technology FFL, a slim and flat light source, was introduced to the market by Delta Optoelectronics Inc. in Taiwan. Its primary advantages are long operating lifetime and design of mercury-free. FFL has longer lifetimes (100,000 hours) and better color reproduction and light uniformity when compared with the conventional CCFL.

The FFL is slim and large enough to cover the entire display area, providing benefits of sufficient heat to warm up the liquid crystal at extremely low temperature and of uniform backlight. Besides, FFL initiate response within 1 sec to produce light by using a pulsed dielectric barrier discharge process. However, FFL requires more power than CCFL to deliver the same measured brightness.



How does FFL Operate?

- By the interaction of Xe (Xenon) atoms, free electrons, and strong electrical field, the unstable bi-atom molecular excimer (Xe₂⁺) is generated.
- Xenon excimer (Xe₂⁺) will emit the UV radiation at 147nm and at 172nm
- UV radiation is converted to visible light by phosphors

Hg (Mercury)-free flat lamp (FFL):

- Xenon gas discharged by di-electric barrier pulse voltage
- High brightness stability
- Long service life at wide operation temperature range

LED

LED backlight technology is the fastest growing one nowadays. The benefits of such backlight source are reasonably good efficiency, wider range of color reproduction and enhanced contrast ratio, low voltage operation, design mercury-free. However, LED backlight source, same as any semiconductor device, has lower tolerance of high system temperature which may cause color shift. In addition, RGB LED backlight has to overcome the uniformity issue of luminance. Now, utilizing White LED technology is most common instead.

EBL Optimizing HB LED operation

- Strictly control LED performance and thermal issue
- Maintain good lifetime at brightness enhanced operation

CCFL

So far, the most commonly used LCD backlight technology is CCFL. CCFL backlight has very good performance properties including good luminous intensity, high density (compact and light weight), good color reproduction, uniformity, vibration & impact resistance, durability, longer lifetime than LED and high efficiency.

However, the disadvantages of CCFL are with a slight amount (approx. 4mg Hg per lamp) of mercury vapor (Hg) inside and its low tolerance at low ambient temperature.

EBL Robust CCFL Backlight with MTBF extension

- CCFL lamp surface temperature control
- Lifetime extension under high brightness operation

■ Specification of FFL HB



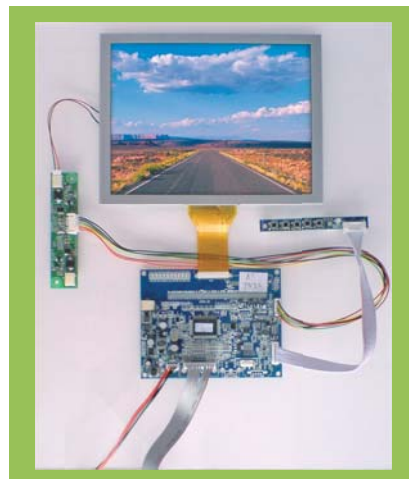
| Open Fram Model Name | | EBL-150OA | EBL-170OB | EBL-190OB |
|-------------------------|---------------------|------------------|--------------------|--------------------|
| Display Diagonal | | 15" | 17" | 19" |
| Aspect Ratio | | 4:3 | 4:3 | 4:3 |
| Brightness (nits) | | 1,000 | 900 | 700 |
| Display Spec. | Resolution | 1024 x 768 / XGA | 1280 x 1024 / SXGA | 1280 x 1024 / SXGA |
| | Pixel Pitch (um) | 297 x 297 | 264 x 264 | 294 x 294 |
| | Contrast Ratio | 1000:1 | 800:1 | 1000:1 |
| | Viewing Angle (H/V) | 140 / 130 | 160 / 160 | 160 / 160 |
| Operation Condition | Operation Temp. | -30 ~ 60°C | -30 ~ 60°C | -30 ~ 60°C |
| | Cold Start Temp. | -30°C | -30°C | -30°C |
| | Direct Sunlight | Yes | Yes | Yes |
| | Humidity | 10% ~ 95% | 10% ~ 95% | 10% ~ 95% |
| | Backlight MTBF | 100,000 hours | 100,000 hours | 100,000 hours |
| Connectivity | Video Inputs | VGA, DVI | VGA, DVI | VGA, DVI |
| | Power Supply | AC 90 ~ 240V | AC 90 ~ 240V | AC 90 ~ 240V |
| Power | Max. Consumption | 100W | 120W | 135W |
| | Mechanical | Mounting | Panel / VESA | Panel / VESA |
| Touch Screen (Optional) | | TBD | TBD | TBD |

| Open Fram Model Name | | EBL-185OB | EBL-215OB | EBL-240OB | EBL-315OA |
|-------------------------|---------------------|-----------------|-------------------|-------------------|-------------------|
| Display Diagonal | | 18.5" | 21.5" | 24" | 31.5" |
| Aspect Ratio | | 16:9 | 16:9 | 16:9 | 16:9 |
| Brightness (nits) | | 700 | 650 | 900 | 1,000 |
| Display Spec. | Resolution | 1366 x 768 / HD | 1920 x 1080 / FHD | 1920 x 1080 / FHD | 1920 x 1080 / FHD |
| | Pixel Pitch (um) | 300 x 300 | 248 x 248 | 277 x 277 | 363 x 363 |
| | Contrast Ratio | 1000:1 | 1000:1 | 1000:1 | 4000:1 |
| | Viewing Angle (H/V) | 170 / 160 | 170 / 160 | 170 / 160 | 176 / 176 |
| Operation Condition | Operation Temp. | -30 ~ 60°C | -30 ~ 60°C | -30 ~ 60°C | -30 ~ 60°C |
| | Cold Start Temp. | -30°C | -30°C | -30°C | -30°C |
| | Direct Sunlight | Yes | Yes | Yes | Yes |
| | Humidity | 10% ~ 95% | 10% ~ 95% | 10% ~ 95% | 10% ~ 95% |
| | Backlight MTBF | 100,000 hours | 100,000 hours | 100,000 hours | 100,000 hours |
| Connectivity | Video Inputs | VGA, DVI | VGA, DVI | VGA, DVI | VGA, DVI |
| | Power Supply | AC 90 ~ 240V | AC 90 ~ 240V | AC 90 ~ 240V | AC 90 ~ 240V |
| Power | Max. Consumption | 125W | 140W | 180W | 350W |
| | Mechanical | Mounting | Panel / VESA | Panel / VESA | Panel / VESA |
| Touch Screen (Optional) | | TBD | TBD | TBD | TBD |

■ Specification of LED HB



| Model Name | EBL-080LA | EBL-084LA | EBL-150LC | EBL-156LC |
|--|---------------------|---------------------|----------------------|---------------------|
| Backlight | LED | LED | LED | LED |
| Display Diagonal | 8.0" | 8.4" | 15" | 15.6" |
| Aspect Ratio | 4:3 | 4:3 | 4:3 | 16:9 |
| Brightness (nit or cd/m ²) | 1000 | 1000 | 500 | 420 |
| Display Resolution WxH (dot) | 800 x 600 | 800 x 600 | 1024 x 768 | 1920 x 1080 |
| Contrast Ratio | 500:1 | 600:1 | 600:1 | 400:1 |
| Viewing Angle (U/D/L/R) | 50 / 70 / 70 / 70 | 75 / 75 / 75 / 75 | 65 / 60 / 70 / 70 | 60 / 60 / 70 / 70 |
| Dot Pitch WxH(mm) | 0.203 ² | 0.213 ² | 0.297 ² | 0.215 ² |
| Operation Temp. (°C)(LCD surface) | 70 / -20 | 85 / -30 | 55 / -20 | 50 / 0 |
| Storage Temp. | 80 / -30 | 85 / -30 | 60 / -20 | 60 / -20 |
| Backlight lifetime (hrs) min. | 20,000 (typ) | 50,000 | 30,000 | 20,000 (typ) |
| Interface | TTL | 1-channel LVDS | 1-channel LVDS | 2-channel LVDS |
| Video signal Voltage (V) | 3.3 | 3.3 | 3.3 | 3.3 |
| Dimensions WxHxD (mm) | 183.0 x 141.0 x 6.3 | 203.0 x 145.2 x 8.0 | 326.5 x 253.5 x 11.1 | 359.3 x 209.5 x 5.7 |



■ Specification of CCFL HB



| Model Name | EBL-121LC | EBL-150LB | EBL-190LC1 |
|--|----------------------|----------------------|----------------------|
| Backlight | CCFL | CCFL | CCFL |
| Display Diagonal | 12.1" | 15" | 19" |
| Aspect Ratio | 4:3 | 4:3 | 4:3 |
| Brightness (nit or cd/m ²) | 550 | 700 | 550 |
| Display Resolution WxH (dot) | 800 x 600 / SVGA | 1024 x 768 / XGA | 1280 x 1024 / SXGA |
| Contrast Ratio | 600 | 700 | 1000 |
| Viewing Angle (U/D/L/R) | 140 / 110 | 140 / 135 | 170 / 160 |
| Dot Pitch WxH(mm) | 0.3075 ² | 0.297 ² | 0.294 ² |
| Display Colors | 16.2M | 16.2M | 16.7M |
| Dimension (WxHxD)mm | 279.0 x 209.0 x 11.0 | 326.5 x 253.5 x 14.4 | 396.0 x 324.0 x 18.0 |
| Operation Temp. (LCD surface) | -30 ~ 85°C | -30 ~ 85°C | -0 ~ 50°C |
| Storage Temp. | -30 ~ 85°C | -30 ~ 85°C | -20 ~ 60°C |
| Backlight lifetime (hours) | 50,000 | 50,000 | 50,000 |

| Model Name | EBL-185LB | EBL-190LC2 | EBL-215LC | EBL-216LB |
|--|----------------------|----------------------|----------------------|----------------------|
| Backlight | CCFL | CCFL | CCFL | CCFL |
| Display Diagonal | 18.5" | 19" | 21.5" | 21.6" |
| Aspect Ratio | 16:9 | 16:10 | 16:9 | 16:9 |
| Brightness (nit or cd/m ²) | 650 | 450 | 550 | 700 |
| Display Resolution WxH (dot) | 1366 x 768 / HD | 1440 x 900 / WXGA+ | 1920 x 1080 / FHD | 1366 x 768 / HD |
| Contrast Ratio | 1000 | 1000 | 1000 | 800 |
| Viewing Angle (U/D/L/R) | 170 / 160 | 170 / 160 | 170 / 160 | 170 / 160 |
| Dot Pitch WxH(mm) | 0.30 ² | 0.2835 ² | 0.2482 ² | 0.3495 ² |
| Display Colors | 16.7M | 16.7M | 16.7M | 16.7M |
| Dimension (WxHxD)mm | 438.0 x 255.0 x 16.5 | 428.0 x 278.0 x 16.5 | 495.6 x 292.2 x 16.4 | 501.0 x 297.0 x 17.3 |
| Operation Temp. (LCD surface) | 0 ~ 50°C | 0 ~ 50°C | -0 ~ 50°C | -0 ~ 50°C |
| Storage Temp. | -20 ~ 60°C | -20 ~ 60°C | -20 ~ 60°C | -20 ~ 60°C |
| Backlight lifetime (hours) | 50,000 | 50,000 | 50,000 | 50,000 |

■ R-CCFL

- Robust CCFL designed for large size LCD Panel, 31.5" & 46"
- Custom-made CCFL with thicker diameter and consideration of heat dissipation design for better thermal management

| Model Name | EBL-315LA1 | EBL-315LA2 | EBL-460LA |
|--|----------------------|----------------------|-----------------------|
| Backlight | R-CCFL | R-CCFL | R-CCFL |
| Display Diagonal | 31.5" | 31.5" | 46" |
| Aspect Ratio | 16:9 | 16:9 | 16:9 |
| Brightness (nit or cd/m ²) | 1200 | 1200 | 1200 |
| Display Resolution WxH (dot) | 1366 x 768 / HD | 1920 x 1080 / FHD | 1920 x 1080 / FHD |
| Contrast Ratio | 3000 | 4000 | 4000 |
| Viewing Angle (U/D/L/R) | 178 / 178 | 178 / 178 | 178 / 178 |
| Dot Pitch WxH(mm) | 0.5107 ² | 0.3637 ² | 0.5302 ² |
| Display Colors | 16.7M | 16.7M | 16.7M |
| Dimension (WxHxD)mm | 760.0 x 450.0 x 60.2 | 760.0 x 450.0 x 60.2 | 1083.0 x 627.0 x 69.0 |
| Operation Temp. (LCD surface) | 0 ~ 50°C | 0 ~ 50°C | 0 ~ 50°C |
| Storage Temp. | -20 ~ 60°C | -20 ~ 60°C | -20 ~ 60°C |
| Backlight lifetime (hours) | 50,000 | 50,000 | 50,000 |

■ High Brightness Applications

- Outdoor Kiosk
- Outdoor Digital Signage
- Semi-outdoor Kiosk
- Window Display
- Window Signage
- Display for Totem Display
- Display for High Image Quality DOOH
- Display for Transportation Vehicles or Stations
- Display for Gas Pump Station
- QSR or Drive-Thru Kiosk
- ATM (Auto-Teller Machine)
- Ticket Machine
- Self-service Stop



Cold Start



Wide Temp. Range



High Reliability



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