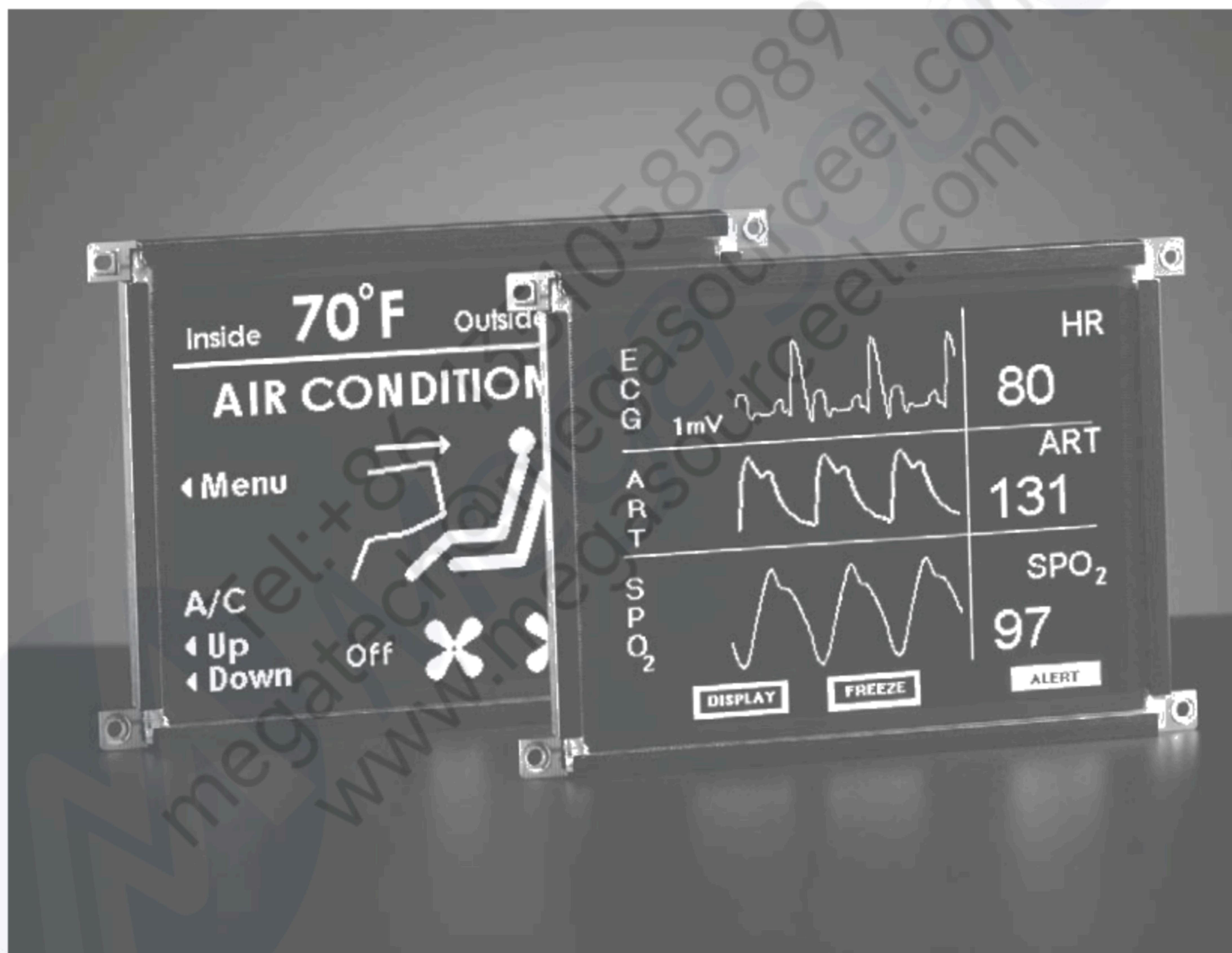


EL320.240.36-HB

ICEBRITE™ QUARTER-VGA
HIGH-BRIGHT SMALL GRAPHICS DISPLAY





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EL320.240.36-HB Quarter-VGA Display

The EL320.240.36-HB thin film electroluminescent (EL) display is a high-performance alternative to quarter-VGA LCDs and is the ideal solution in demanding applications where superior visual performance and environmental ruggedness are critical. The EL320.240.36-HB utilizes Planar's proprietary Integral Contrast Enhancement (ICE™) technology to achieve unparalleled image quality without the use of expensive filters. This small graphics display excels in a wide range of ambient lighting environments while effectively eliminating the blooming common to other high-bright displays.

The display consists of an EL glass panel and control electronics assembled into a space-saving, rugged package for easy mounting. The EL320.240.36-HB is easily interfaced using standard 4-bit LCD control signals. Each of the 76,800 pixels is individually addressable to clearly display high information content graphics and text.

Features and Benefits

- ◆ Excellent visual performance:
 - High brightness and contrast
 - Wide viewing angle $> 160^\circ$
- ◆ Rapid display response < 1 ms
- ◆ Frame buffer
- ◆ Space efficient mechanical package
- ◆ Low EMI emissions
- ◆ Extremely rugged and durable
- ◆ Reliable, long operating life
- ◆ 4-bit LCD-type interface

Installation and Handling

Do not drop, bend, or flex the display. Do not allow objects to strike the surface of the display.

CAUTION: The display uses CMOS and power MOSFET devices. These components are electrostatic sensitive. Unpack, assemble, and examine this assembly in a static-controlled area only. When shipping, use packing materials designed for protection of electrostatic-sensitive components.

Mounting EL Displays

Properly mounted, EL displays can withstand high shock loads as well as severe vibration found in demanding applications. However the glass panel used in an EL display will break if subjected to bending stresses, high impact, or excessive loads.

Avoid bending the display. Stresses are often introduced when a display is mounted into a product. Ideally, the mounting tabs of the display should be the only point of contact with the system. Use a spacer or boss for support; failure to do so will bend the display and cause the glass to break. The instrument enclosure or frame should not flex or distort in such a way that during use the bending loads might be transferred to the display. The EL320.240.36-HB mounting tabs were designed for a 3 mm screw. Mounting surfaces should be flat to within ± 0.6 mm ($\pm 0.025"$). Use all the mounting holes provided. Failure to do so will impair the shock and vibration resistance of the final installation.

CAUTION: To prevent injury in the event of glass breakage, a protective overlay should be used on the viewer side of the display.

WARNING: These products generate voltages capable of causing personal injury (high voltage up to 235 V_{AC}). Do not touch the display electronics during operation.

Cable Length

A maximum cable length of 0.6 m (24 in.) is recommended. Longer cables may cause data transfer problems between the data transmitted and the display input connector. Excessive cable lengths can pick up unwanted EMI. There are third party products which allow this maximum cable length to be exceeded. Contact Planar Application Engineering for more information.

Cleaning

As with any glass or coated surface, care should be taken to minimize scratching. Clean the display glass with mild, water-based detergents only. Apply the cleaner sparingly to a soft cloth, then wipe the display. Disposable cleaning cloths are recommended to minimize the risk of inadvertently scratching the display with particles embedded in a re-used cloth. Particular care should be taken when cleaning displays with anti-glare and anti-reflective films.

Avoiding Burn-In

As with other light emitting displays, use a screen saver or image inversion to avoid causing burn-in on the display. Displaying fixed patterns on the screen can cause burn-in, where luminance variations can be noticed.

Specifications

Performance characteristics are guaranteed when measured at 25°C with rated input voltage unless otherwise specified.

Control Basics

The EL panel is a matrix structure with column and row electrodes arranged in an X-Y formation. Light is emitted when an AC voltage of sufficient amplitude is applied at a row-column intersection. The display operation is based on the symmetric, line-at-a-time data addressing scheme.

Power

The supply voltages are shown in Table 1. All internal high voltages are generated from the display supply voltage (V_H). The logic supply voltage (V_L) should be present whenever video input signals or V_H is applied. The minimum and maximum specifications in this manual should be met, without exception, to ensure the long-term reliability of the display. Planar does not recommend operation of the display outside these specifications.

Table 1. DC Input Voltage Requirements

Parameter	Symbol	Min	Typ	Max	Absolute Max
Logic supply voltage	V_L	4.75 V	5 V	5.25 V	6 V
Logic supply current at +5 V	I_L			0.10 A	
Display supply voltage	V_H	8 V	12 V	18 V	19V
Supply current at +12 V	I_H		0.4 A	0.9 A	
Power consumption @ maximum frame rate			5.5 W	11 W	
Power consumption @ 120 Hz			3.5 W		

CAUTION: Absolute maximum ratings are those values beyond which damage to the device may occur.

Table 2. Video Input Requirements

Description	Min	Max	Units	Notes
Absolute Input Voltage Range	-0.3	5.5	V	$V_L = 5.0$ V
Video logic high voltage	2.2	5.0	V	All input thresholds are TTL
Video logic low voltage	0	0.8	V	
Video logic input current	–	± 0.25	mA	± 0.75 mA max Selftest
Input capacitance	–	15	pF	

There is no overcurrent protection on either the V_H or V_L inputs to protect against catastrophic faults. Planar recommends the use of a series fuse on the 12 volt supply(V_H). A general guideline is to rate the fuse at 1.8 to 2 times the display maximum current rating.

Connector

The display uses the Samtec EHT-110-01-S-D or equivalent locking connector. The mating connector is in the Samtec TCSD family of cable strips. The proper connector, user-specified cable length and connector configuration is supplied as a single unit. Consult your Samtec representative (1-800-SAMTEC9) for the cable/connector options. Compatibility with non-Samtec equivalents should be verified before use.

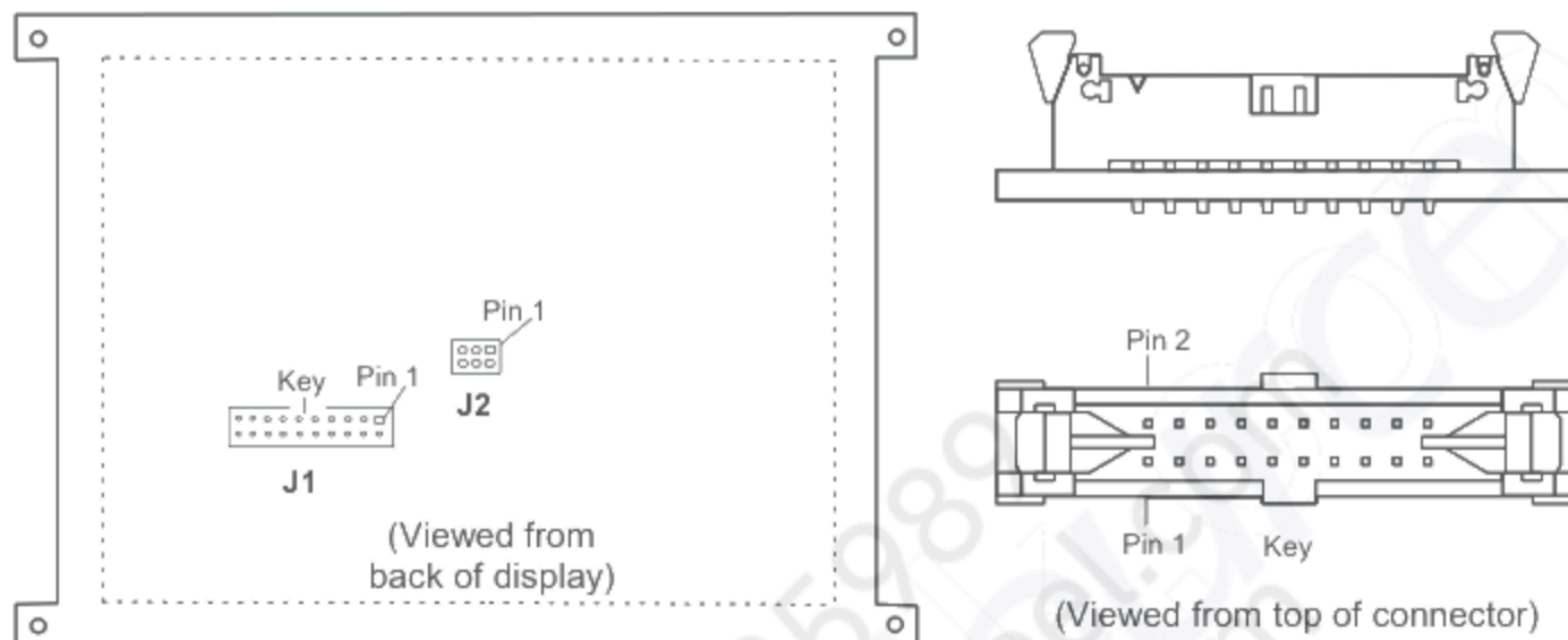


Figure 1. Data/Power Connector

Table 3. J1 Connector Pinouts

Pin	Signal	Description	Pin	Signal	Description
1	V _{DD}	+12 V Power	2	V _{DD}	+12 V Power
3	Selftest	* Selftest Input	4	SCAN	Scan rate control
5	V _L	+5 V Power	6	GND	Ground
7	VS	Vertical Sync	8	GND	Ground
9	HS	Horizontal Sync	10	GND	Ground
11	VCLK	Video Clock	12	GND	Ground
13	VID ₀	Video Data	14	GND	Ground
15	VID ₁	Video Data	16	GND	Ground
17	VID ₂	Video Data	18	GND	Ground
19	VID ₃	Video Data	20	GND	Ground

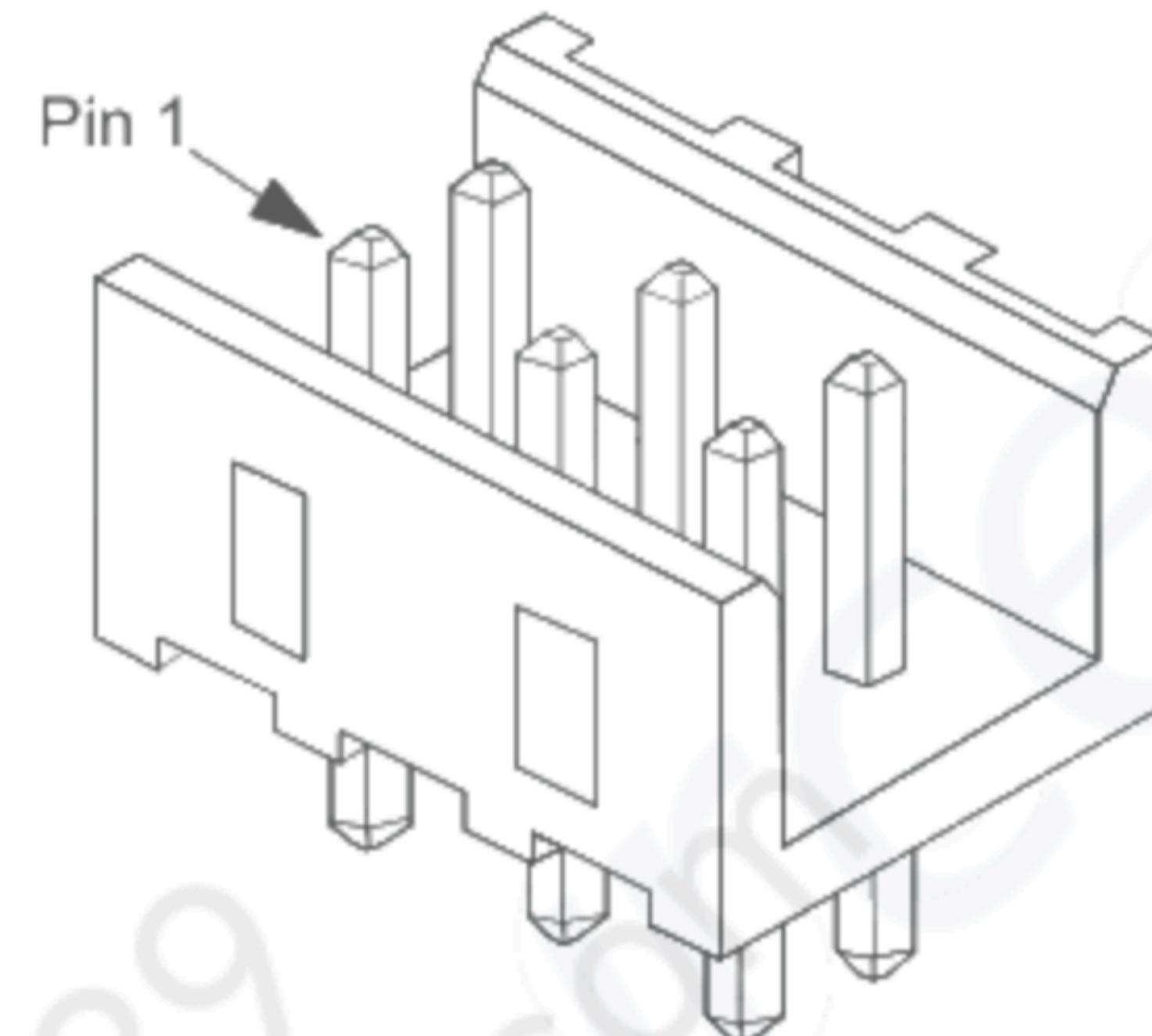
* Connect pin 3 to ground for normal display operation.

Dimming Connector J2

The J2 analog dimming connector is a Berg six-pin, dual in-line header, part number 95615-106. The mating connector is the Berg 89947-706 (IDC) or a combination of the Berg 77138-001 (discrete crimp-to-wire receptacle) and the Berg 90311-006 (housing). Refer to “Dimming” on page 9 for more information.

The pin assignments are:

Pin	Symbol	Description
1	LUMA	Luminance A
2	GND	Ground
3	RESERVED	Reserved
4	LUMC	Luminance C
5	GND	Ground
6	LUMD	Luminance D



Interface Information

Planar EL Small Graphics Displays (SGD) incorporate an interface that is similar to many LCD interfaces. This interface is supported by a variety of off-the-shelf chip sets which take care of all display control functionality, freeing the system processor for other tasks. Designers should select the chip set that best suits their particular architecture and price point.

Video Input Signals

The end of the top line of a frame is marked by **VS**, vertical sync signal as shown in Figure 2. The end of each row of data is marked by **HS**. Depending on the input frame rate, a continuous low state of the **VS** input signal will shut the display scan after one frame period.

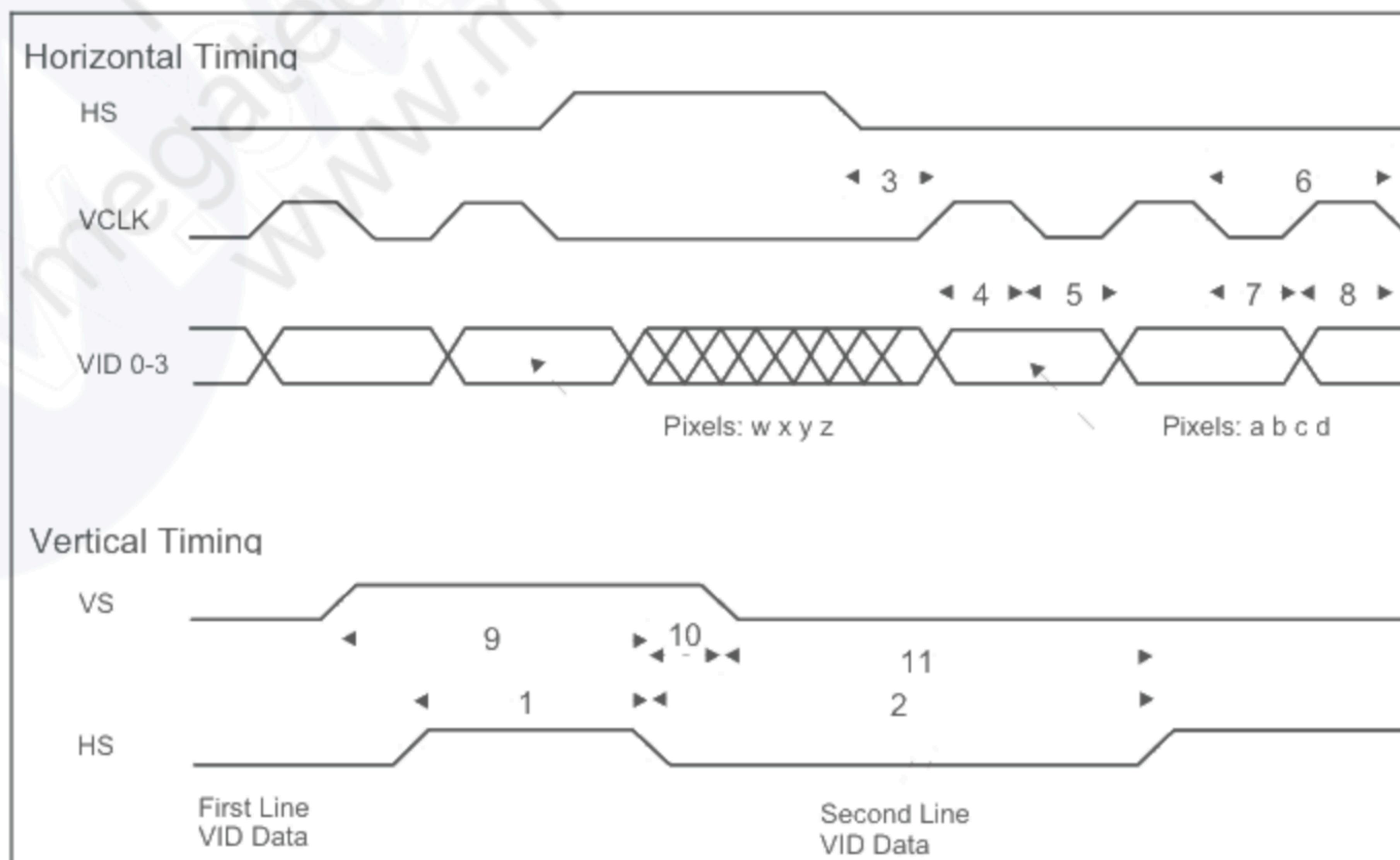


Figure 2. Video Input Timing Diagram

Timing is compatible with many LCD graphics controllers.

Table 4. Video Input Descriptions

Num	Description	Symbol	Min.	Typ.	Max.	Units
1	HS high time	tHS _h	100			nsec
2	HS low time	tHS _l	80			tVCLK
3	HS to VCLK rising edge	tHS _{su}	95			nsec
4	VID setup to VCLK	tVID _{su}	50			nsec
5	VID hold from VCLK	tVID _{hd}	50			nsec
6	Video clock period	tVCLK	140			nsec
	VCLK rise, fall time	tVCLK _{rf}		10	15	nsec
7	VCLK low width	tVCLK _l	30			nsec
8	VCLK high width	tVCLK _h	30			nsec
9	VS high setup to HS low	tVSh _{su}	140			nsec
10	VS hold after HS	tVSh _{hd}	140			nsec
11	VS low setup to HS high	tVSl _{su}	140			nsec
12	HS period	tHS	34			μsec
	VS period	tVS	240			tHS
	Frame Rate	fVS	1		120	Hz

Input signals **VID₀** through **VID₃** contain the video data for the screen. Pixel information is supplied from left to right and from top to bottom four pixels at a time. Video data for one row is latched on the fall of **HS**.

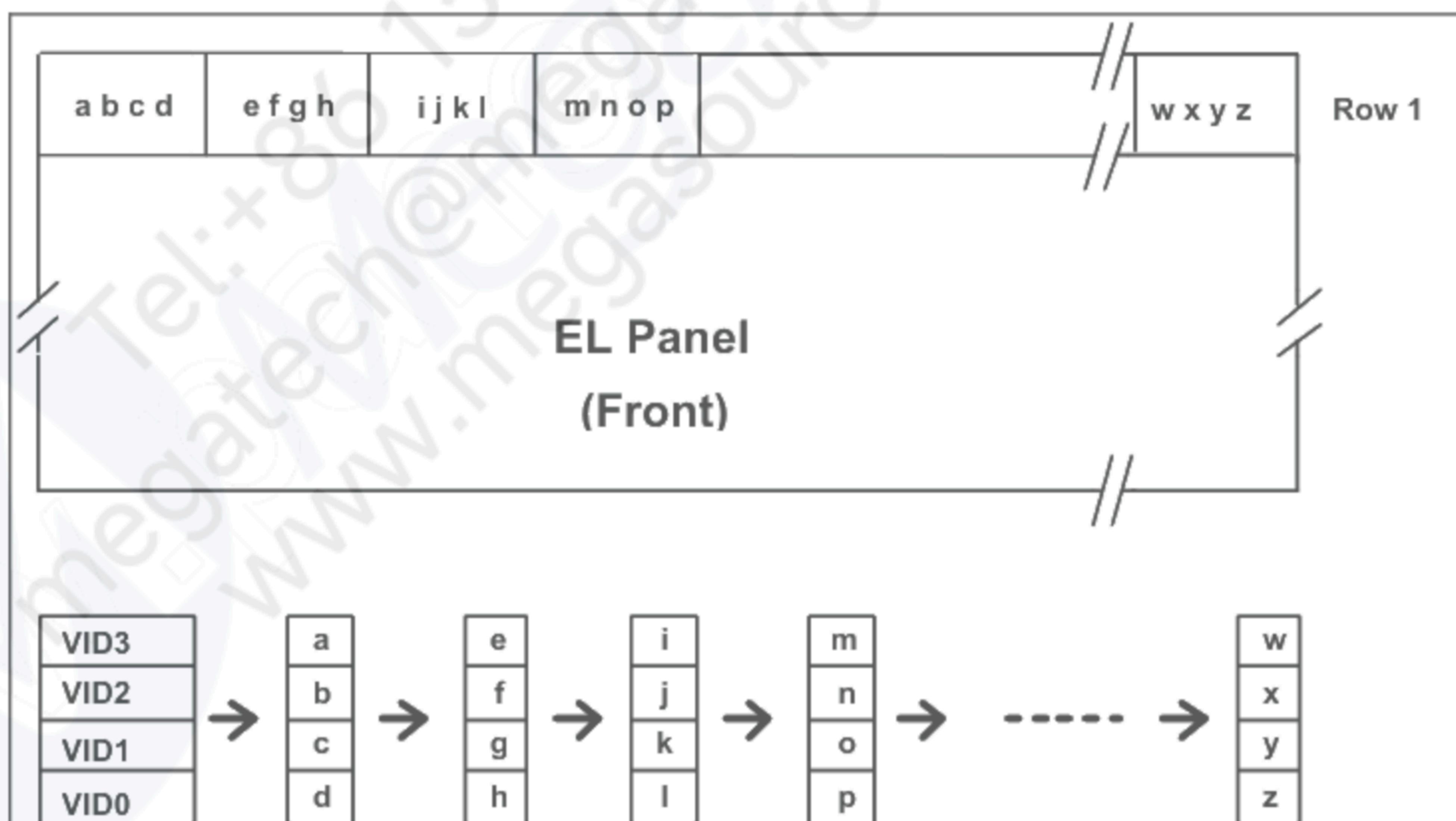


Figure 3. Pixel Location versus Sequence of Data.

Internal Frame Buffer

This display includes an internal frame buffer. The display frame rate and the display brightness are independent of user-supplied input data timing. The display frame rate can be controlled through the digital dimming feature as described below.

CAUTION: The display includes an internal frame buffer. In order to blank the display image in the event of system malfunction, pull down the VS signal.

Dimming

There are two standard methods for dimming the EL320.240.36-HB display. Analog dimming using the J2 dimming connector described on page 7 of this manual allows for manual dimming from 100% to approximately 5% of the full brightness. To perform analog dimming, connect a 50 k ohm variable resistor between LUMA and GND. Alternatively, an external voltage or current mode D/A converter may be used to facilitate dimming by sinking a maximum of 250 μ A (for maximum dimming) from LUMA to GND on the input connector. Open circuit voltage is 4 V nominal.

The internal scan frequency can be controlled via the LUMC and LUMD inputs. When LUMC and LUMD are left open, the scan rate is determined by the SCAN signal (pin 4) on the data input connector. With the combination of LUMC and LUMD, the following luminance levels are obtained:

Table 5. Luminance Control

Approx. Relative luminance	100%	75%	50%	30%	100%	50%
LUMD (internal pull up)	High	High	Low	Low	Open	Open
LUMC (internal pull up)	High	Low	High	Low	Open	Open
SCAN (J1 pin 4)	Open	Open	Open	Open	High	Low

Self-Test Mode

The display incorporates a self-test mode composed of two patterns displayed at maximum frame rate for approximately 30 seconds each, and then repeated. The patterns are as follows: *50/50 Checkerboard* and *Full On*. The self-test mode is entered by leaving pin 3 on J1 unconnected or pulled high. This pin has an internal pull-up. Connect pin 3 on J1 to Ground for normal display operation.

Optical

Table 6. Optical Characteristics

Luminance		
L_{on} (areal), min	120 cd/m ²	screen center, maximum frame rate
L_{on} (areal), typ	150 cd/m ²	screen center, maximum frame rate
L_{off} (areal), max	0.3 cd/m ²	5 points: center plus four corners measured 1.0 ±0.25" from adjacent bezel edges, @ 120 Hz
Non-uniformity		
All pixels fully lit	35%	Maximum difference two of five points, using the formula: $BNU\%=[1 - (\min_lum/\max_lum)] \times 100\%$
Luminance Variation (Temperature)		
Maximum	±25%	Across operating temperature range
Luminance Variation (Time)		
Maximum	< 20%	10,000 hours at 25°C ambient
Viewing Angle		
Minimum	>160° in all directions; no contrast or luminance change	
Contrast Ratio (typical)		
	90:1	@ 500 lux ambient, maximum frame rate
	8:1	@ 10,000 lux ambient, maximum frame rate

Environmental

Table 7. Environmental Characteristics

Temperature*		
Operating	-40 °C to +85 °C	
Operating Survival	-40 °C to +95 °C	
Storage	-40 °C to +105 °C	
Humidity		
Non-condensing, operating	93% RH max at +40 °C, per IEC 68-2-3	
Condensing, non-operating	95% RH max at +55 °C, per IEC 68-2-30	
Altitude		
Operating/non-operating	0 to 18 km (58k ft) per IEC 68-2-13	
Vibration		
Random	0.02 g ² /Hz, ASD level, 5-500 Hz	
Operating/non-operating	per IEC 68-2-36, test Fdb.	
Shock		
Operating/non-operating	100 g, 6 ms, half sine wave per IEC 68-2-27, test Ea.	

* Temperature sensor is built in to provide power cut-off in case of over heating.
Note: Power cut-off is not operative in Selftest.

Reliability

The display MTBF is greater than 50,000 hours at the maximum frame rate with a 90% confidence level at 25 °C.

Safety and EMI Performance

The display will not inhibit the end product from obtaining these certifications: IEC 950, IEC 601-1-1, UL2601, CSA 22.2 #601-M89, FCC Docket, Part 15, Subpart J, Class B; CISPR22, Class B; and VDE 871/VFG243 Class B.

Optional Features

Conformal coating and anti-glare filters are available as an option.

Mechanical Characteristics

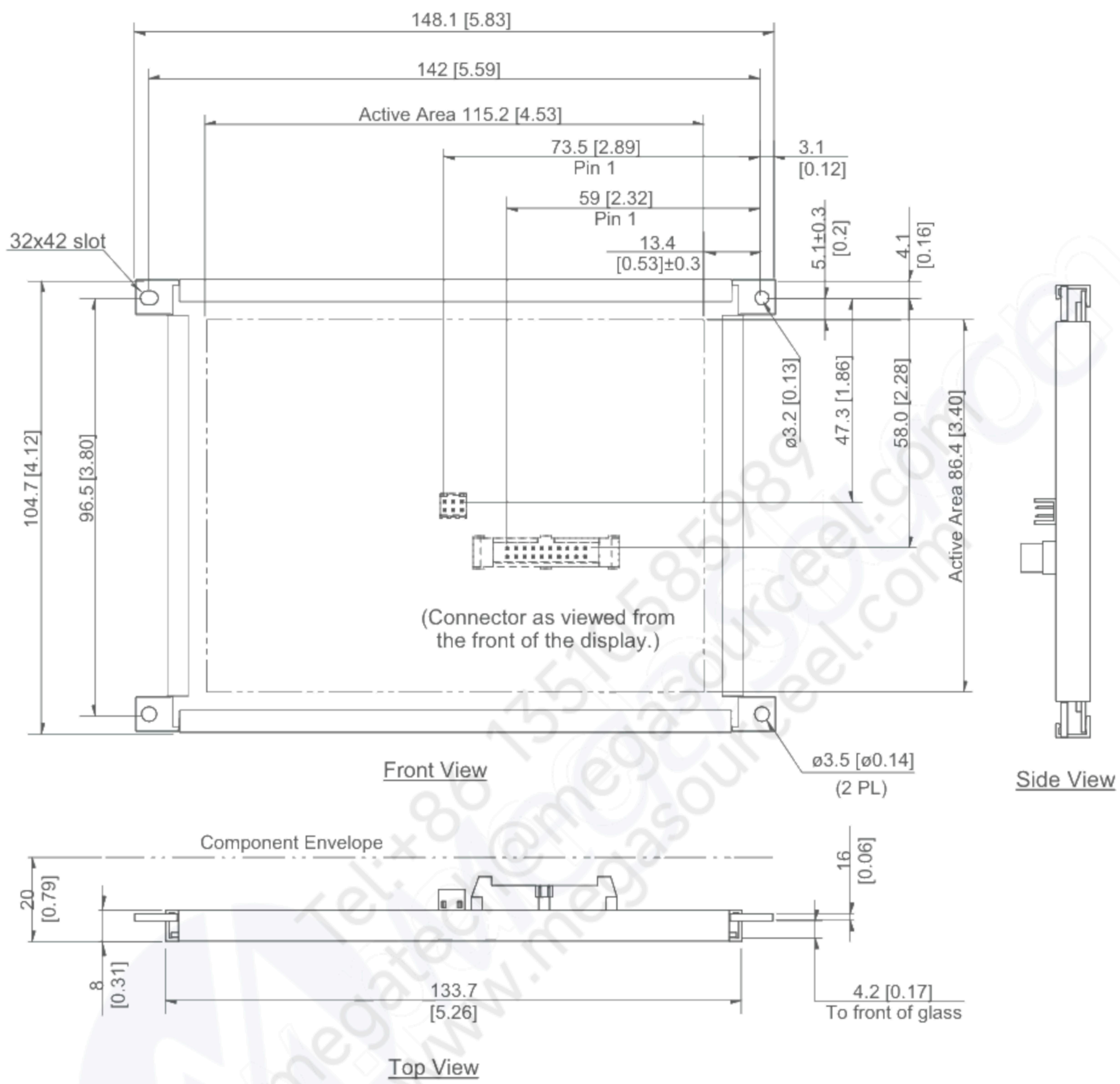
Table 8. Mechanical Characteristics

Display External Dimensions		
millimeters (inches)	width	148.1 (5.83)
	height	104.7 (4.12)
	depth	20 (0.8)
Weight (typical)		180 g (6.3 oz)
Fill Factor		74%
Display Active Area		
millimeters (inches)	width	115.1 (4.53)
	height	86.3 (3.40)
Pixel Size		
millimeters (inches)	width	0.31 (0.012)
	height	0.31 (0.012)
Pixel Pitch		
millimeters (inches)	width	0.36 (0.014)
	height	0.36 (0.014)

Component Envelope

The component envelope shown in Figure 4 illustrates the distance components extend behind the display. Tall components do not necessarily fill this area. Planar reserves the right to relocate components *within* the constraints of the component envelope without prior customer notification. For this reason, Planar advises users to design enclosure components to be outside the component envelope.

Device designers will need to consider their specific system requirements to determine the spacing necessary to maintain the specified ambient temperature. Air flow and surrounding component materials will affect the depth of the air gap.



Dimensions in are millimeters; inches in brackets.

Tolerances unless specified

.x ± 0.50 [0.02]

.xx ± 0.25 [0.01]

Figure 4. Display Dimensions

Note: The dimensions in this drawing are approximate. Please contact Planar Applications Engineering to request an actual drawing prior to beginning your design.

Description of Warranty

This description is not the full warranty, and should not be construed as a substitute for the full warranty. A copy of the full warranty is available upon request.

Planar warrants that the goods it sells will be free of defects in materials and workmanship, and that these goods will substantially conform to the specifications furnished by Planar, and to any drawings or specifications furnished to the Seller by the Buyer if approved by the Seller. This warranty is effective only if Planar receives notice of such defect or non-conformance during the period of warranty, which begins the day of delivery.

The goods Planar sells are warranted for a period of one year unless otherwise agreed to by Planar and the Buyer. The Buyer must return the defective or non-conforming goods, upon request, to Planar not later than 30 days after Planar's receipt of notice of the alleged defect or non-compliance. Buyer shall prepay transportation charges, and Planar shall pay for return of the goods to the Buyer. No goods are to be returned to Planar without prior permission.

The warranty does not apply in cases of improper or inadequate maintenance by the Buyer, unauthorized modification of the goods, operation of the goods outside their environmental specifications, neglect or abuse of the goods, or modification or integration with other goods not covered by a Planar warranty when such modification or integration increases the likelihood of damage of the goods.

Ordering Information

Product	Part Number	Description
EL320.240.36-HB	996-0292-00	5.6" (142 mm) diagonal, quarter VGA high-bright display, -40 to +85 °C operating temperature

Design and specifications are subject to change without notice.

Planar Systems continues to provide optional, and in many cases custom, features to address the specific customer requirements. Consult Planar Sales for pricing, lead time and minimum quantity requirements.

Support and Service

Planar is a U.S. company based in Beaverton, Oregon and Espoo, Finland, with a world-wide sales distribution network. Full application engineering support and service are available to make the integration of Planar displays as simple and quick as possible for our customers.

RMA Procedure: For a *Returned Material Authorization* number, please contact Planar Systems, Inc. with the model number(s) and serial number(s). When returning goods for repair, please include a brief description of the problem, and mark the outside of the shipping container with the RMA number.



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