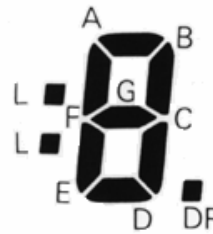
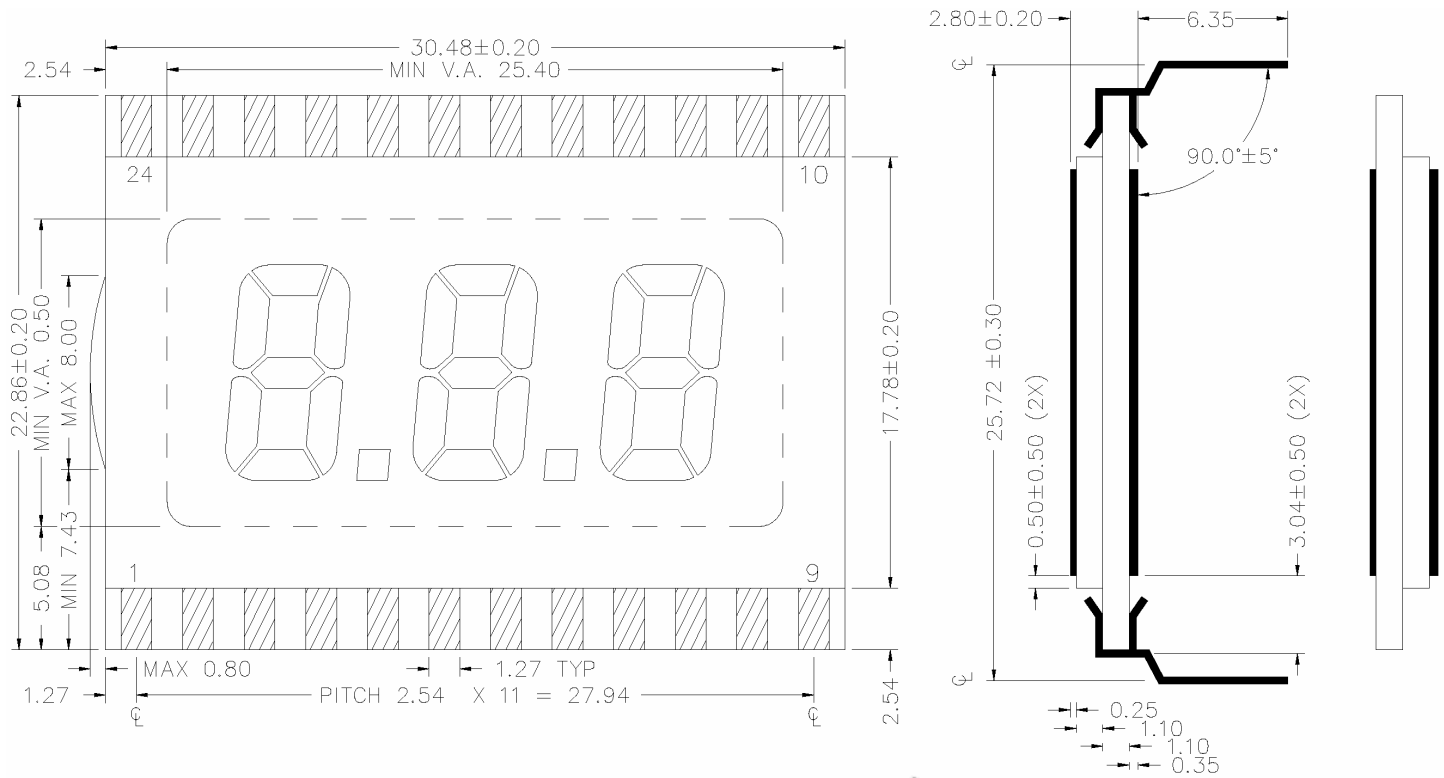


**PD-321 Specifications:**

**Static 3 Digit Liquid Crystal Display**



-DP

-2

**DIGIT HEIGHT 8.89mm (0.35")**

**Pin Definitions:**

(Digit number starts from right to left)

Pin No.	Segment	Pin No.	Segment
1	3E	13	1A
2	3D	14	1F
3	3C	15	1G
4	3DP	16	2B
5	2E	17	2A
6	2D	18	2F
7	2C	19	2G
8	2DP	20	3B
9	1E	21	3A
10	1D	22	3F
11	1C	23	3G
12	1B	24	COM

**Typical Electro-Optical Characteristics for Twist Nematic (TN) Display (1)**

LC Fluid Type				TN COMMERCIAL (S)		TN EXTENDED (W)
Drive Method				Static (LV)	Static (HV)	Static (HV) (4)
Operating Temperature			°C	-10~+60		-40~+80
Storage Temperature			°C	-20~+60		-40~+80
Typical Operating Voltage (2)		-10°C	V	--	--	--
		0°C		--	--	--
		25°C		3.0	5.0	5.0
		50°C		--	--	--
Typical Switching Time(4)		TOFF	0°C	250		100
			25°C	80		40
		TON	0°C	200		100
			25°C	60		50
Typical Temperature Coefficient (0~40°C)			mV/°C	--		--
Operating Frequency Range (3)			Hz	30~300		30~300
Max. Contrast Ratio		25°C	CRMAX	30		30
Viewing Angle @ CR>=25		25°C	qy	-65°~+25°		-65°~+25°
			qx	-70°~+70°		-70°~+70°

**Notes:**

- (1) -- The following table presents typical values only for positive TN displays and these values are subject to change without notice. Please consult with a Pacific Display Devices applications engineer for the exact values of your display.
- (2) -- Maximum allowable DC voltage is 50mV.
- (3) -- Display could flicker but consumes less current at lower operating frequency.
- (4) -- (W-LV) version is available with special order

**Standard LCD Glass Part Numbering Notation:**

<b>Example: PD 321 - DP - RC - S - LV - 6 - x</b>	
<b><u>Notation</u></b>	<b><u>Descriptions</u></b>
<b>PD</b>	Pacific Display Devices Prefix
<b>321</b>	MODEL NUMBER
<b>-DP</b>	CONNECTOR TYPES <ul style="list-style-type: none"> <li>• <b>-2</b>: Elastomeric (Zebra) type</li> <li>• <b>-DP</b>: DIL pins (6.35mm Std)</li> </ul>
<b>-RC</b>	POLARIZER GRADE <ul style="list-style-type: none"> <li>• <b>-RC</b>: Commercial Reflective</li> <li>• <b>-FC</b>: Commercial Transflective</li> <li>• <b>-TC</b>: Commercial Transmissive</li> <li>• <b>-RH</b>: Reflective, high stability</li> <li>• <b>-FH</b>: Transflective, high stability</li> <li>• <b>-TH</b>: Transmissive, high stability</li> </ul>
<b>-S</b>	FLUID OPERATING TEMPERATURE <ul style="list-style-type: none"> <li>• <b>-S</b>: Standard</li> <li>• <b>-W</b>: Wide temperature</li> </ul>
<b>-LV</b>	DRIVE VOLTAGE <ul style="list-style-type: none"> <li>• <b>-LV</b>: Low Voltage Operation</li> <li>• <b>-HV</b>: High Voltage</li> </ul>
<b>-6</b>	VIEWING DIRECTION <ul style="list-style-type: none"> <li>• <b>-6</b>: 6 o'clock (Standard)</li> <li>• <b>-12</b>: 12 o'clock</li> </ul>
<b>-X</b>	REMARKS or SPECIAL OPTIONS <ul style="list-style-type: none"> <li>• <b>Blank</b>: Standard</li> </ul>

**LCD Service Life**

The rated MTBF for the LCD Glass products are 100,000 hours minimum at 25° C ±10% in an environment meeting the specifications outlined in this document, and a minimal amount of Ultraviolet Light impacting the LCD surface. Usage in an outdoor / direct sunlight (high UV) environment will reduce the MTBF to 50,000 hrs.

**Definition of Acceptable LCD service life**

- Contrast of LCD maintains 30% of initial value
- Current consumption of LCD will not exceed 300% of initial
- There may be noticeable alignment deterioration in LCD cell layer

## **USING LCD GLASS**

### **Installing LCD Glass**

- 1) Do not apply pressure to the LCD Viewing Area since it could permanently damage the LC cells ability to operate.
- 2) There is a protective plastic film installed on the LCD Viewing Area to protect the top LCD polarizer and underlying glass for being scratched or marred during manufacturing or transit. The protective plastic layer must be removed carefully without damaging the rigid plastic polarizer it is covering.
- 3) The LCD is made up of thin glass and plastic materials, and will break under harsh conditions. Care should be taken to isolate the LCD from undue stress by the manufacturing process, shipping requirements, and end product usage.

### **Precaution for Handling LCD Glass**

Since the LCD glass is fragile and has been assembled with a high degree of precision, avoid applying excessive shocks or making any alterations to it.

- 1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
- 2) Do not alter, modify or change the shape of the glass, or interconnecting pins or cables.
- 3) Do not drop, bend or twist LCM.
- 4) The glass can easily cracked or chipped with rough handling, especially at corners or edges.

### **Precaution for Hand Soldering the LCD to a PCB**

The LCD glass and fluid are pretty durable, but the front and rear polarizers are specially made plastic sheets that reorient the alignment of the light waves going through the LCD glass. Since they are plastic, they are very sensitive to heat and typically cannot exceed 85 deg C without taking permanent damage. (Note: Specialty temperature range TN Glass can take up to 110 degrees on special order). Hand Soldering guidelines:

- 1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
- 2) Observe the following when soldering lead wire, connector cable and etc. to the LCD.
  - a) Soldering iron temperature : 280°C ± 10°C.
  - b) Soldering time : 4 sec Max.
  - c) Please note at no time can the LCD glass rise above 80°C.
- 3) Solder : Eutectic solder.
- 4) The front and rear polarizers on the LCD glass are plastic. Their temperature cannot exceed 85 deg C, EVER, or the polarizers will melt and take permanent damage.
- 5) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters. DO NOT get any of the cleaning fluid on the LCD polarizers since permanent damage can occur. Please read the section below on the proper method and materials are acceptable to use on a LCD.

NOTE: Soldering wires directly to the LCD pins or conductive pads is not recommended and will void the warranty of the part.

### **Wave soldering the LCD**

The wave soldering of LCD glass is *not recommended* and we do not warranty any parts put through that process, but if you can keep to the requirements of the specs above it may work acceptably for you. Please do careful evaluation of any wave soldered LCD components for full operation, and that the LCD polarizers have an additional protective covering during this process.

### **Precautions for Operation**

- 1) Viewing angle varies with the change of liquid crystal driving voltage. Adjust the drive voltage to show the best contrast at your optimum viewing angle.
- 2) Driving the LCD in the voltage above the limit shortens its life.
- 3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- 4) The LCD will continue to operate up to its full rated storage temperature (Tst), but none of the optical viewing characteristics are guaranteed beyond the rated operating temperature (Top).
- 5) If the display area is pushed hard during operation or installation, the display may become abnormal. This condition should be corrected by cycling the power to the LCD; but it is not guaranteed and permanent damage may have occurred.
- 6) Condensation at terminals may cause an electrical malfunction and possible electro-chemical reactions. The Relative Humidity of the environment should therefore be kept below the condensation point (which is dependant on temperature), but can typically be considered at 65%.

### Handling

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD is soft and easily scratched. Handle this polarizer carefully.
- If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with petroleum benzene. Solvents other than petroleum benzene may damage the polarizer
- Exercise care to minimize corrosion of the LCD electrical interconnection points. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- Do not attempt to disassemble the LCD glass or seals.
- To prevent damage of the LCD elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD glass assy.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under excessively dry conditions.
  - The LCD Viewing Area is coated with a plastic film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

### Storage

- When storing the LCD, avoid exposure to direct sunlight or to the light of fluorescent lamps
- Store the LCD in a dark place where the temperature is  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  and the humidity below 65% RH.
- Do not store the LCD near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the LCD Glass.

### Cleaning

- DO NOT wipe the dry polarizing plate with a dry cloth, as it may scratch the surface.
- DO NOT use chemicals such as Ketonic solvents (Ketone and Acetone) or Aromatic solvents (Toluene and Xylene), Ethanol or Isopropyl Alcohol as they will damage the polarizers. Avoid oil and fat. Avoid lacquer and epoxy which might contain solvents and hardeners that erode the electrodes. Some solvents such as Freon or Trichloroethylene will also seep into the epoxy covering the DIL pins and thereby cause corrosion of the electrical and mechanical connections in a high humidity or condensing environment.
- WIPE OFF saliva or water drops immediately. Contact with water over long periods of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of the ITO electrodes.
- Wipe the LCD Viewing Area gently with soft cloth soaked with a petroleum benzene.

### Others:

- Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD is subject to a low temperature.
- If the LCD has been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

### Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water. The toxicity is extremely low, but caution should be exercised at all times.