



# APPROVAL for GPO LCM

Date: Nov 05,2002

Customer / 客戶名稱 .....

Product No. **GPG320X240-NFNDSCW3 (GM0128)**

Customer's Signature(s): .....

客戶確認簽章：

*We can do it better!*

Prepared	Check-PT	Approval-PT	Check-QA	Final Approval



# GPG320X240- NFNDSCW3 (Vers. B)

Version	Revision Remark	Date
A	New	2002/07/07
B	4. Absolute Maximum Ratings 5.7 Recommend Power Supply Circuit	2002/11/05
C		
D		
E		
F		
G		
H		
I		



## Table of Contents

1. Scope	4
2. Purpose	4
3. Basic Specifications	4
3.1 Display Specifications	
3.2 Mechanical Specifications	
3.3. Block Diagram	
3.4 Terminal Functions	
4. Absolute Maximum Ratings	7
5. Electrical Characteristics	7
5.1 DC Characteristics	
5.2 AC Characteristics	
5.3 Timing Chart	
5.4 Timing Diagram	
5.5 Power ON/OFF Control	
5.6 Relation Between Data and Display	
5.7 Recommend Power Supply Circuit	
6. Optical Characteristics	13
6.1 Optical Characteristics	
6.2 Definition of Optical Characteristics	
6.2.1 Optical Measuring Equipment	
6.2.2 Definition of Viewing Angle	
6.2.3 Definition of Response Time	
6.2.4 Definition of Contrast Ratio	
7. Reliability	16
7.1 MTTF	
7.2 Content of Reliability Test	
7.3 Failure Judgment Criteria	



8. Inspection Criteria	17
8.1 Quality Level	
8.2 Conditions of Visual Inspection	
8.3 Quality Judgment Criteria	
8.3.1 Electrical Characteristics	
8.3.1.1 Electrical Function	
8.3.1.2 Electrical Defects	
8.3.2 Cosmetic Characteristics	
8.4 Provision of Settlement of Disputes	
9. Precautions for Use of LCD Modules	21
9.1 Handling Procedures	
9.2 Storage Precautions	
9.3 Design Precautions	
9.4 Other Considerations	
9.5 Warranty	

- Attachment A:      Out-line Drawing  
Attachment B:      Packing Specifications



**1. Scope**

This approval document defines the product specifications and inspection criteria for the Liquid Crystal Display (LCD) supplied by Grand Pacific Optoelectronics Corporation.

**2. Purpose**

This approval document is only valid when signed by customer representative and by Grand Pacific Optoelectronics Corporation, QA department.

By signing this document, the parties accept to acknowledge and to comply with the product specifications and the quality level as stipulated in this document.

**3. Basic Specifications**

**3.1 Display Specifications**

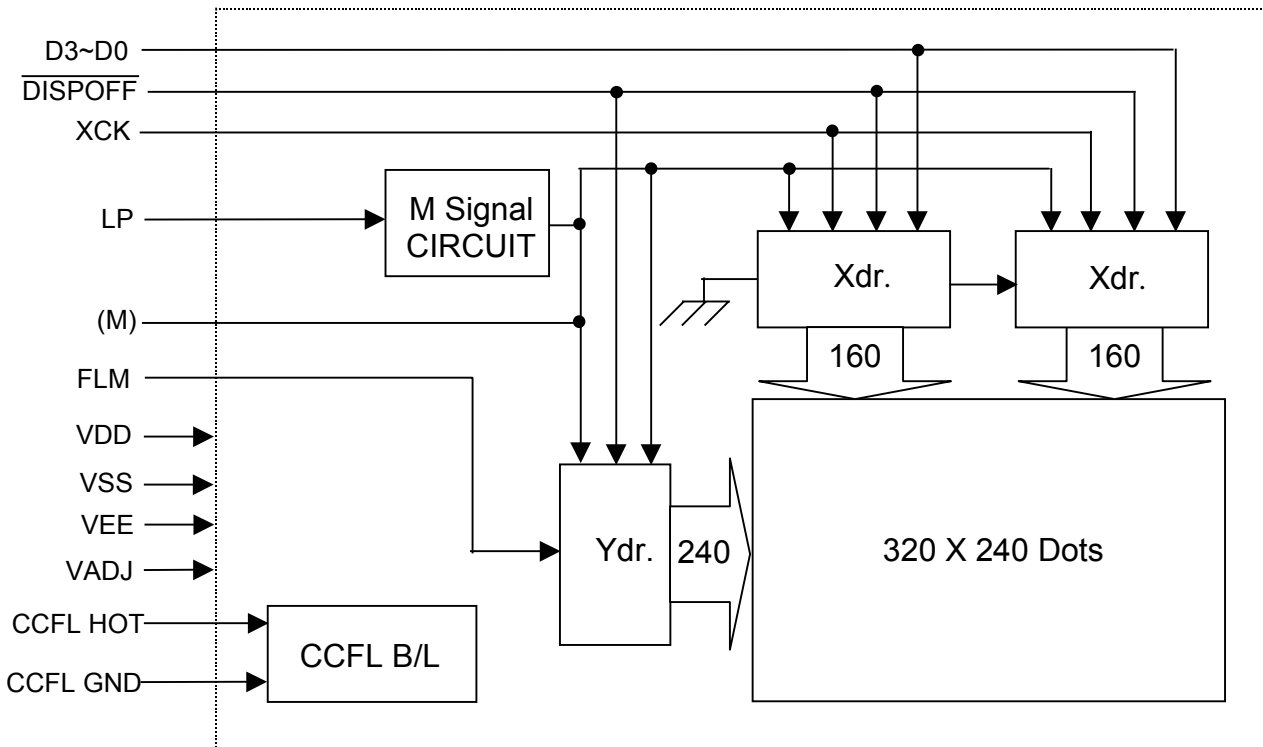
No.	Item	Specifications
1	Display Mode	FSTN , Negative , Transmissive
2	Display Color (*1)	Display Data "1" = White Display Data "0" = Black
3	Viewing Angle	6 O'clock Direction
4	Duty	1/240 Duty
5	Bias	1/16 bias
6	Driver IC	COM:NT7702H-TABF4 · SEG: NT7701H-TABF3 (Novatek)
7	Display Surface	Glare
8	Back Light	CCFL (White)

(R1) Color tone is slightly changed by temperature and driving voltage.

**3.2 Mechanical Specifications**

No.	Item	Specifications	Unit
1	Outline Dimensions	Refer to attachment A (Out-line Dimensions)	
2	Dot Format	320 x 240	Dots
3	Dot Size	0.345 x 0.345	mm
4	Dot Pitch	0.360 x 0.360	mm
5	Weight	Approx. 150	g

**3.3 Block Diagram**





**3.4 Terminal Functions**

**3.4.1 LCD Terminal**

Connector: 1.25 mm Pitch 14 Pins FFC

No.	Symbol	I/O	Function
1	D0	I	Data Bus Lines
2	D1	I	Data Bus Lines
3	D2	I	Data Bus Lines
4	D3	I	Data Bus Lines
5	$\overline{\text{DISPOFF}}$	I	Display Off Control Signal
6	FLM	I	Start Scan Line
7	NC(M)	-	No Connection
8	LP(CL1)	I	Data Latch Signal
9	XCK(CL2)	I	Data Shift Signal
10	VDD	I	Power Supply for Logic
11	VSS	I	Power Supply for Logic (GND)
12	VEE	I	Power Supply for LCD Driver
13	VADJ	I	Contrast Adjustment
14	FG	I	Frame Ground

**3.4.2 . CCFL Back Light Terminal**

No.	Symbol	I/O	Function
C1	CCFL HOT	I	Power Supply for CCFL(HOT)
C2	NC	-	No Connection
C3	NC	-	No Connection
C4	CCFL GND	I	Power Supply for CCFL(GND)



**4. Absolute Maximum Ratings <sup>ΔB</sup>**

Items	Symbols	Standard Value		Unit	Conditions
		Min.	Max.		
Power Supply Voltage	VDD-VSS	-0.3	+7.0	V	VDD
	VLCD-VSS	-0.3	+30.0	V	VEE,VADJ
Input Voltage	VIN	-0.3	VDD+0.3	V	D0~D3,DISPOFF,FLM,XCK,LP
CCFL B/L Starting Voltage	Vs	-	590	Vrms	T=0°C
		-	480	Vrms	T=25°C
CCFL B/L Operating Frequency	Fop	30	50	KHz	
Operating temperature	Top	0	50	°C	
Storage temperature	Tst	-20	70	°C	

**5. Electrical Characteristics**

**5.1 DC Characteristics**

Items	Symbol	Standard Value			Unit	Terminal
		Min.	Typ.	Max.		
	VDD-VSS	2.5	3.3	5.5	V	VDD
Power Supply Voltage	VLCD	20	-	28	V	VEE,VADJ
“0” Input Voltage	VIL	-0.3	-	0.2VDD	V	D0~D3, LP, XCK ,FLM, DISPOFF
“1” Input Voltage	VIH	0.8VDD	-	VDD	V	
I/O Leak Current	ILI	-	-	10	μA	
Power Supply Current(*1)	IDD	-	55	85	μA	
Power Supply Current (*1)	ILCD	-	2.2	4.0	mA	VEE
Power Supply Voltage for CCFL B/L	VL	-	280	-	Vrms	CCFL HOT CCFL GND
Power Supply Current for CCFL B/L (*2)	IL	-	5.0	5.5	mArms	CCFL HOT CCFL GND

(\*1) Measuring Conditions: T = 25°C

(Typ.)

VDD = 3.3 V, VLCD = Getting maximum contrast, f (FR) = 70Hz, Text Pattern

(Max.)

VDD = 3.3 V, VLCD = Getting maximum contrast, f (FR) = 70Hz, Checker Pattern

(\*2) Measuring Conditions: T = 25°C

VCCFL HOT-VCCFL GND = 280 Vrms,Freq=40 KHz



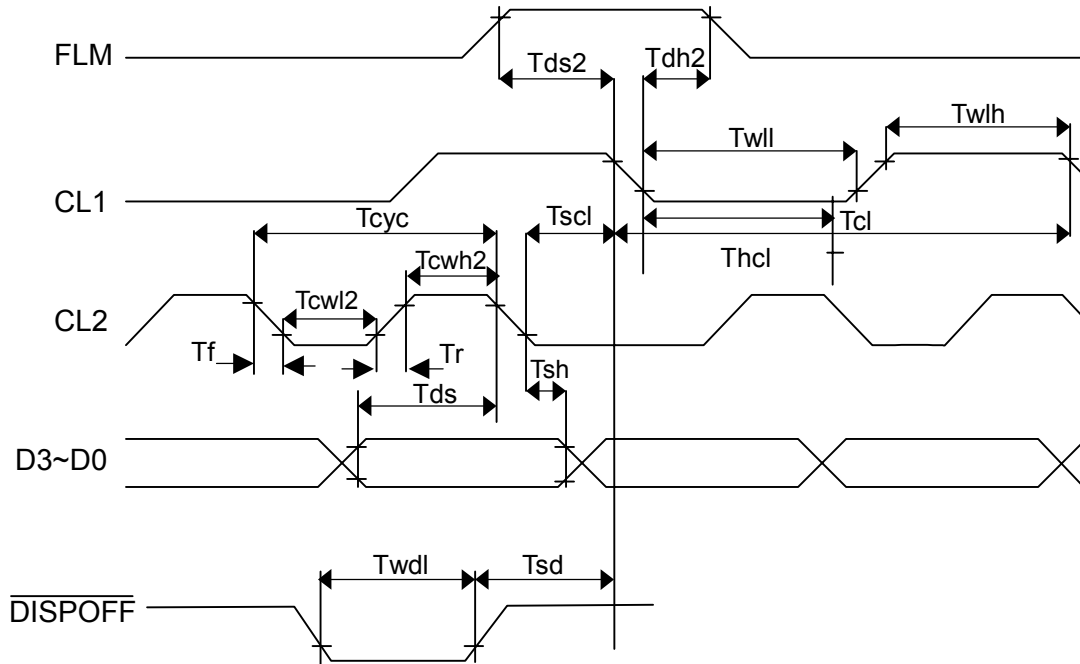
5.2 AC Characteristics

Ta= 0~50°C, VDD=2.5~5.5V

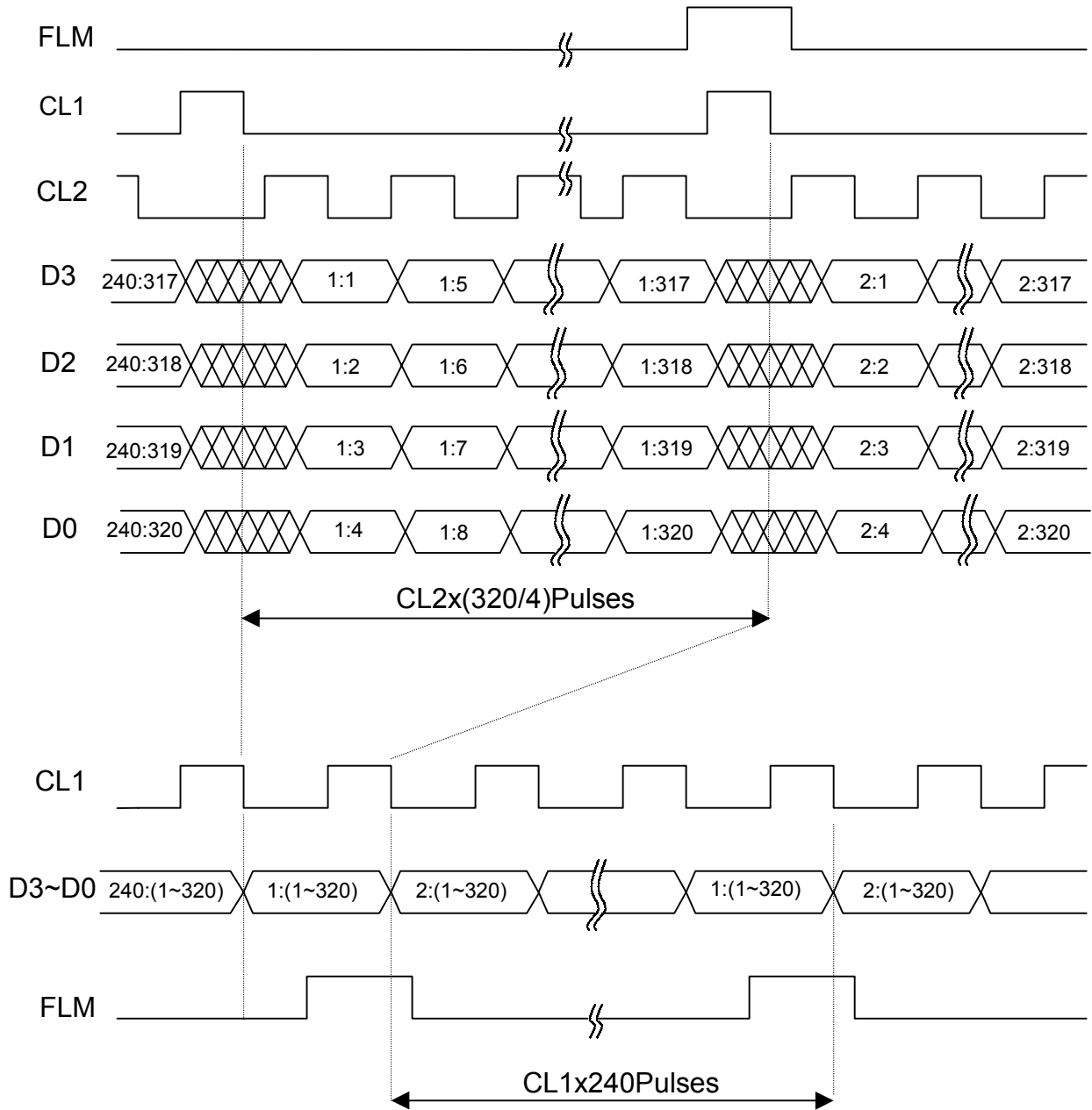
Item	Symbol	Standard Value			Unit	Conditions
		Min.	Typ.	Max.		
CL1 Cycle Time	Tcl	330	-	-	ns	
CL1 Pulse Width "H"	Twlh	51	-	-	ns	
CL1 Pulse Width "L"	Twll	320	-	-	ns	
CL2 Cycle Time	Tcyc	125	-	-	ns	Tr,Tf ≤ 11 ns
CL2 Pulse Width "H"	Tcwh2	51	-	-	ns	
CL2 Pulse Width "L"	Tcwl2	51	-	-	ns	
CL1→CL2 Fall Time	Thcl	51	-	-	ns	
CL2→CL1 Fall Time	Tscl	51	-	-	ns	
Data Setup Time	Tds	30	-	-	ns	
Data Hold Time	Tsh	40	-	-	ns	
FR Setup time	Tds2	30	-	-	ns	
FR Hold time	Tdh2	50	-	-	ns	
DISPOFF removal time	Tsd	100	-	-	ns	
DISPOFF "L" pulse width	Twdl	1.2	-	-	μs	
Input Wave Form Rise/Fall Time	Tr	-	-	50	ns	(R1)
	Tf	-	-	50	ns	(R1)

(R1) Tr, Tf < (Tcyc-Tcwh2-Tcwl2)/2, Tr, Tf ≤ 50ns

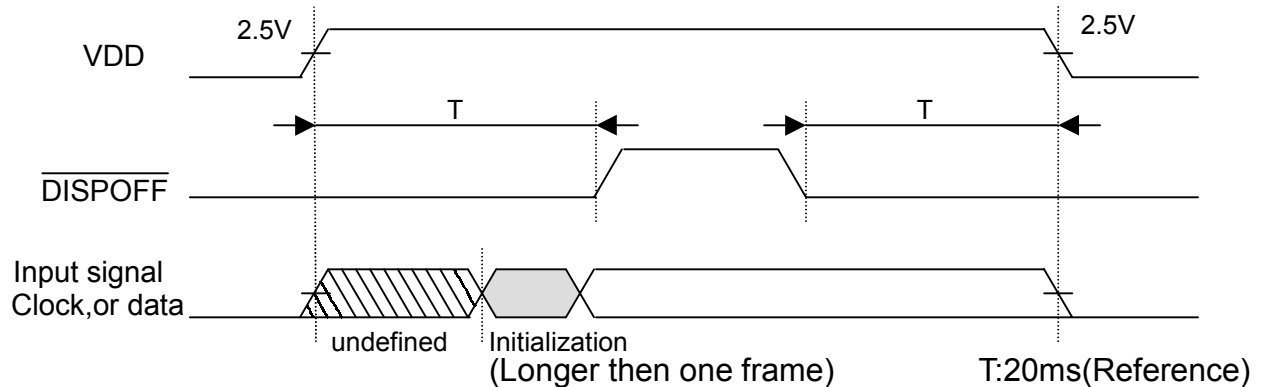
5.3 Timing Chart



**5.4 Timing Diagram**



### 5.5. Power ON/OFF Control



#### Power on:

- 1) Input VSS to the  $\overline{\text{DISPOFF}}$  pin when turn on the power VDD.
- 2) The LCD level forcibly outputs the VM level by the  $\overline{\text{DISPOFF}}$  function.
- 3) The  $\overline{\text{DISPOFF}}$  function has a priority even if input signal distortion occurs immediately after VDD input.
- 4) Then input the predetermined signals to initialize the driver registers. In this case, assure a period for more than one frame.
- 5) Preparation for normal display is thus completed. Cancel the  $\overline{\text{DISPOFF}}$  function by setting the  $\overline{\text{DISPOFF}}$  pin to VDD.

#### Shut down:

As a rule, shut down should be in the opposite order that is used for power on.

- 1) Set the  $\overline{\text{DISPOFF}}$  pin to VSS.
- 2) Set VDD and the input signal to VSS.

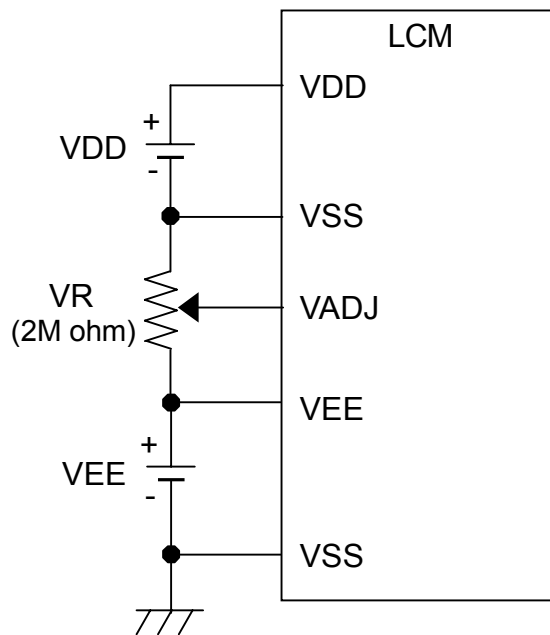
Since the  $\overline{\text{DISPOFF}}$  function is inactivated when the VDD level drops to VSS, the LCD output may output a level other than VM. Therefore, an incorrect display may appear at shut down or power on.

**5.6 Relation Between Data and Display**

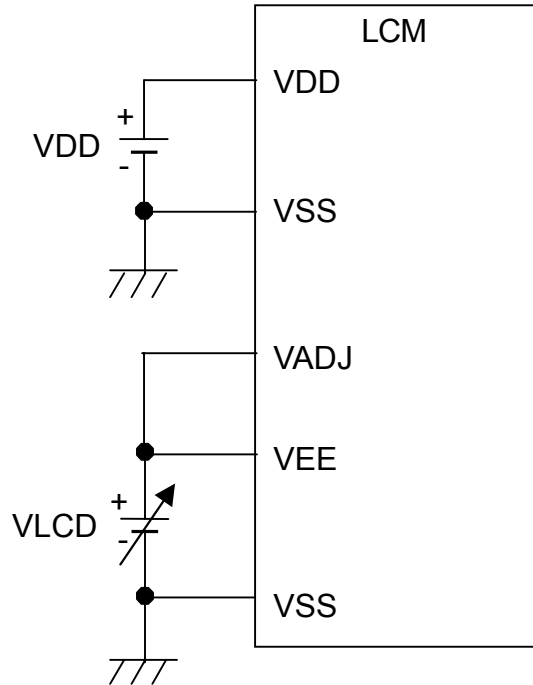
1:1	1:2	1:3	1:4		1:317	1:318	1:319	1:320
2:1	2:2	2:3				2:318	2:319	2:320
3:1	3:2						3:319	3:320
4:1								4:320
237:1								237:320
238:1	238:2						238:319	238:320
239:1	239:2	239:3				239:318	239:319	239:320
240:1	240:2	240:3	240:4		240:317	240:318	240:319	240:320

**5.7 Recommend Power Supply Circuit<sup>ΔB</sup>**

Recommend Circuit 1:



**Recommend Circuit 2:**



## 6. Optical Characteristics

### 6.1 Optical Characteristics

(Transmissive mode)

Item	Symbol	Temp °C	Standard Value			Unit	Conditions	
			Min	Typ	Max			
Vop	VLCD-VSS	0	23.4	24.7	25.9	V		
		25	22.8	24.1	25.3	V		
		50	21.9	23.1	24.3	V		
Response Time	Tr	0	-	530	800	ms		
		25	-	200	300	ms		
	Tf	0	-	350	530	ms		
		25	-	100	150	ms		
Contrast Ratio	K	25	10	21	-			
Viewing angle	Φ	25	-	50	-	deg.	θ = 0°	CR ≥ 2.0
			-	50	-	deg.	θ = 90°	
			-	30	-	deg.	θ = 180°	
			-	40	-	deg.	θ = 270°	
Initial Brightness	B	25	-	90	-	cd/m <sup>2</sup>	(*1)	

- Panel only characteristics

- 1/240 duty, 1/16 bias

(\*1) Measuring Conditions:

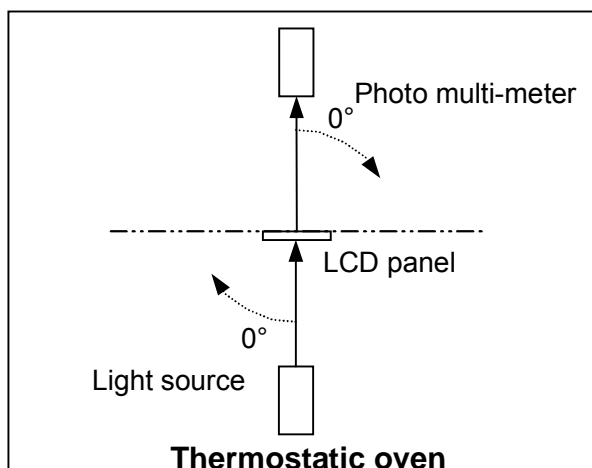
Test point: Φ15.0mm, Tester: TOPCON BM-7

CCFL Input Voltage(  $V_{CCFL\ HOT}-V_{CCFL\ GND}$  ): 280 Vrms,5 mArms,40 KHz

Display pattern:all display data="1"

### 6.2 Definition of Optical Characteristics

#### 6.2.1 Optical Measuring Equipment

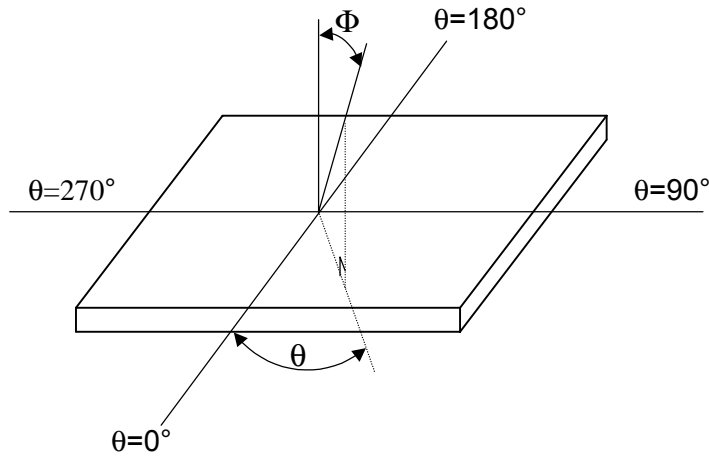


Specification Measuring Conditions

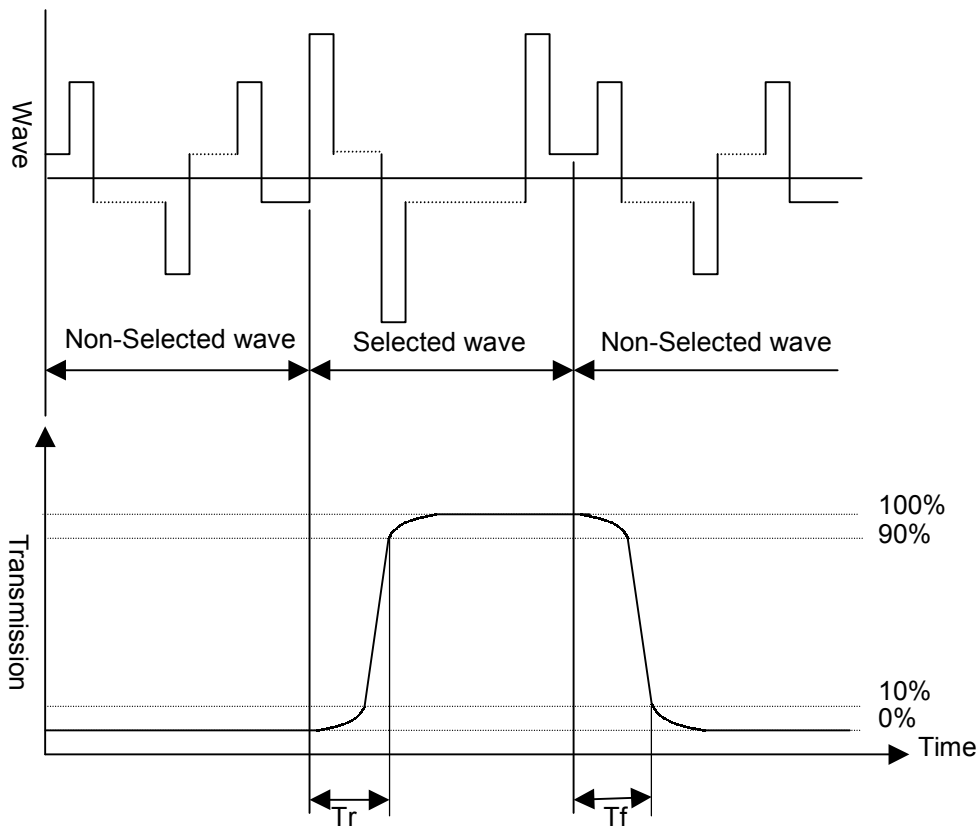
Luxmeter: LCD-5100 (OTSUKA ELECTRONICS)

Brightness Measuring Spot Diameter: Φ = 3.0mm

**6.2.2 Definition of Viewing Angle**

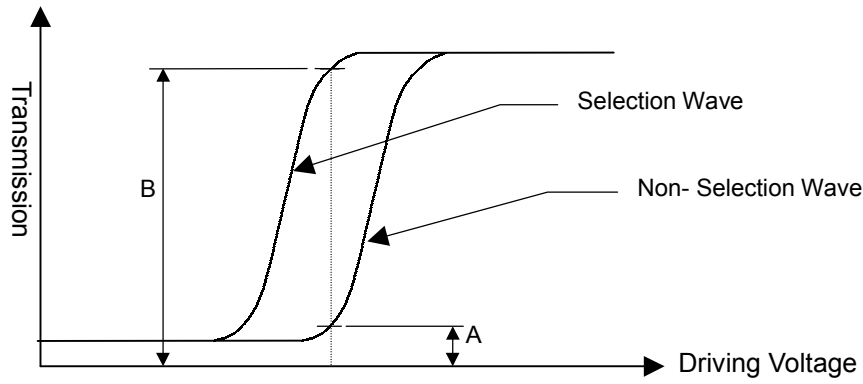


**6.2.3 Definition of Response Time**



[Measuring Conditions]  
 VLCD-VSS = Operating Voltage  
 $\theta_X = \theta_Y = 0^\circ$

**6.2.4 Definition of Contrast Ratio**



$$\text{Contrast Ratio} = \frac{\text{Transmission A of Non Selection DOT}}{\text{Transmission B of Selection DOT}}$$

VLCD-VSS = Operating Voltage

$\theta X = \theta Y = 0^\circ$





**7. Reliability**

**7.1 MTTF (Mean-Time-To-Fail)**

The LCD is designed to meet the MTTF by 60,000 hours under normal room conditions (25 °C, 65% RH, without sun-shine)

**7.2 Content of Reliability Test**

Categories	No	Item	Conditions	Duration
Initial	1	Initial measurement	1. Out-line dimensions 2. Cosmetic inspection 3. Power consumption	
Environmental Reliability	1	High Temp / Storage	70°C	240 hrs
	2	High Temp / Operation	50°C	120 hrs
	3	Low Temp / Storage	-20°C	240 hrs
	4	Low Temp / Operation	0°C	120 hrs
	5	High Temp. & High Humidity / Storage	50°C / 95% R.H.	240 hrs
	6	High Temp. & High Humidity / Operation	50°C / 95% R.H.	120 hrs
	7	Thermal Shock	-20°C / 0.5 hr => 70°C / 0.5 hr	50 Cycles
Mechanical effects (package state)	1	Vibration	Sinusoidal vibration: 9~200 Hz 2.0mm p-p 2.0 Gmax Random vibration: 10~200 Hz 0.02 g/Hz 200~500 Hz 0.0004 g/Hz	1 hr, 3 axis each
	2	Free Fall	1. Height: 80cm 2. 1 corner / 3 lines / 6 surfaces	

- 1) During the Reliability Test the LCD Module is without package except for mechanical effects
- 2) Vibration & Free Fall is the endurance test applying vibration & shock that might occur during transportation. The testing unit is one packing carton.
- 3) No condensation may occur during the test.

**7.3 Failure judgment criteria**

After the above-mentioned test:

1. The current consumption must be below or equal to the initial value.
2. There should be no abnormal function.
3. No cosmetic failures are allowed.

## 8. Inspection Criteria

### 8.1 Quality level

Defect	Classification of Defects		AQL (%)	References
Major Defect	Electrical Characteristic	Electrical Function	<b>0.25</b>	A major defect refers to a defect that may substantially degrade the usability of product applications
		Electrical Defect	<b>0.40</b>	
Minor Defect	Appearance	Glass Chip / Crack	<b>0.65</b>	A minor defect refers to a defect that is not considered to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the products or it's operation.
		Polarizer / Reflector (Scratch / Particle / Bubble / Peeling)		

Sampling planning is following MIL-STD-105E Normal Inspection Level II , single sampling.

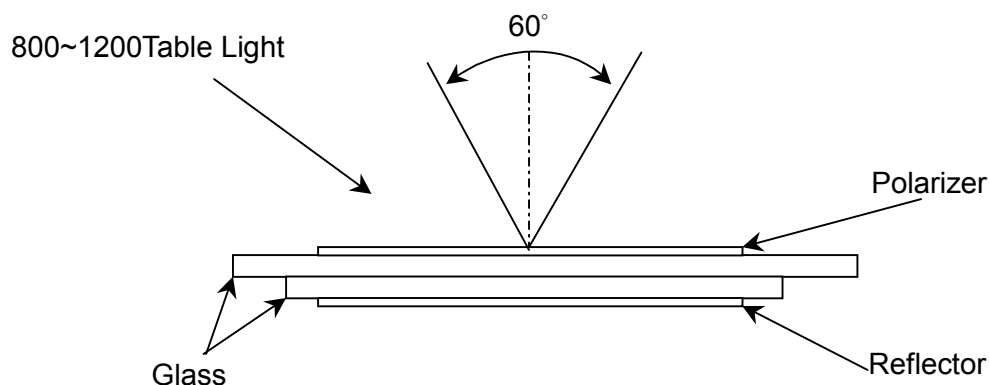
### 8.2 Conditions for Visual Inspection

Visual Inspection shall be carried out at a distance of more than 30 cm from the naked eye to the display surface, and under a light source of 800~1200 LUX table light.

The inspection shall be performed within an angle of 30° from Z-axis to X and Y.

Visual Inspection is only for the Viewing Area. Refer to attachment A (Out-line drawing)

Vertical Direction





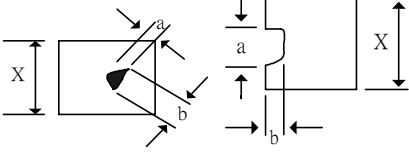
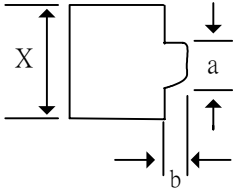
### 8.3 Quality Judgment Criteria

#### 8.3.1 Electric Characteristics

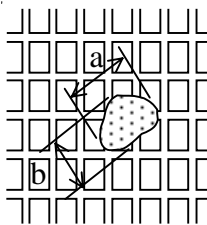
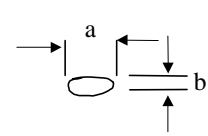
##### 8.3.1.1 Electric Function

No	Item	Judgment Criteria
1	Abnormal Light On	Not allowed
2	Miss Operation	Not allowed
3	Open, Short	Not allowed
4	Cross Short Line	Not allowed
5	Half Tone	Not allowed
6	Response Time	Same time in whole active area

8.3.1.2 Electric Defects

No	Item	Judgment Criteria																														
1	Electrical Defect	<div style="text-align: center;">  </div> <p>( I ) Circle Spots</p> <table border="1" data-bbox="635 633 1198 936"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Neglect</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \Phi \leq 0.30</math></td> <td>1</td> </tr> <tr> <td><math>0.30 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>( II ) Defect Line</p> <table border="1" data-bbox="635 1010 1430 1312"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Length (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.03</math></td> <td>—</td> <td>Neglect</td> </tr> <tr> <td><math>0.03 &lt; \Phi \leq 0.05</math></td> <td><math>1.0 &lt; L \leq 4.0</math></td> <td>2</td> </tr> <tr> <td><math>0.05 &lt; \Phi \leq 0.08</math></td> <td><math>1.0 &lt; L \leq 3.0</math></td> <td>1</td> </tr> <tr> <td><math>0.08 &lt; \Phi</math></td> <td><math>1.0 &lt; L \leq 2.0</math></td> <td>1</td> </tr> <tr> <td><math>0.08 &lt; \Phi</math></td> <td>—</td> <td>0</td> </tr> </tbody> </table> <p>© When the width is over 0.08 mm, according to the ( I ) Circle Spots.</p> <p>( III ) <math>a \leq X/2</math> and <math>b \leq X/2</math>, but not be allowed short.</p> <div style="text-align: center;">  </div> <p>© Follow the above defect quantity <math>\leq 4</math> Defects.</p>	$\Phi$ Grain Size (mm)	Tolerance Dots	$\Phi \leq 0.10$	Neglect	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.25$	1	$0.25 < \Phi \leq 0.30$	1	$0.30 < \Phi$	0	$\Phi$ Grain Size (mm)	Length (mm)	Tolerance Dots	$\Phi \leq 0.03$	—	Neglect	$0.03 < \Phi \leq 0.05$	$1.0 < L \leq 4.0$	2	$0.05 < \Phi \leq 0.08$	$1.0 < L \leq 3.0$	1	$0.08 < \Phi$	$1.0 < L \leq 2.0$	1	$0.08 < \Phi$	—	0
		$\Phi$ Grain Size (mm)	Tolerance Dots																													
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$0.08 < \Phi$	$1.0 < L \leq 2.0$	1																														
$0.08 < \Phi$	—	0																														

8.3.2 Cosmetic Characteristics

No	Item	Judgment Criteria																									
1	Bubble (Polarizer, Reflector)	<table border="1"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td>Neglect</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.30</math></td> <td>2</td> </tr> <tr> <td><math>0.30 &lt; \Phi \leq 0.35</math></td> <td>2</td> </tr> <tr> <td><math>0.35 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>( I ) <math>\Phi</math> Grain Size = Average Diameter            ( II ) Allowed Dots: 4 Dots</p>	$\Phi$ Grain Size (mm)	Tolerance Dots	$\Phi \leq 0.15$	Neglect	$0.15 < \Phi \leq 0.30$	2	$0.30 < \Phi \leq 0.35$	2	$0.35 < \Phi$	0															
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$0.30 < \Phi \leq 0.35$	2																										
$0.35 < \Phi$	0																										
2	Aligning Defect	<table border="1"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 1.5</math></td> <td>Neglect</td> </tr> <tr> <td><math>1.5 &lt; \Phi \leq 2.0</math></td> <td>2</td> </tr> <tr> <td><math>2.0 &lt; \Phi \leq 2.5</math></td> <td>1</td> </tr> <tr> <td><math>2.5 &lt; \Phi \leq 3.0</math></td> <td>1</td> </tr> </tbody> </table>  <p>( I ) <math>\Phi</math> Grain Size showed by <math>(a+b)/2</math>            ( II ) Allowed Dots: 4 Dots</p>	$\Phi$ Grain Size (mm)	Tolerance Dots	$\Phi \leq 1.5$	Neglect	$1.5 < \Phi \leq 2.0$	2	$2.0 < \Phi \leq 2.5$	1	$2.5 < \Phi \leq 3.0$	1															
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$2.5 < \Phi \leq 3.0$	1																										
3	Panel (Including Polarizer, Reflector) Black Spots, White Spots, Fiber, Scratch	<p>( I ) Circle Spots            Definition: <math>\Phi</math> Grain size is <math>(a + b)/2</math></p>  <table border="1"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Neglect</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> <p>( II ) Defect Line</p> <table border="1"> <thead> <tr> <th><math>\Phi</math> Grain Size (mm)</th> <th>Length (mm)</th> <th>Tolerance Dots</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.03</math></td> <td>—</td> <td>Neglect</td> </tr> <tr> <td><math>0.03 &lt; \Phi \leq 0.05</math></td> <td><math>1.0 &lt; L \leq 5.0</math></td> <td>2</td> </tr> <tr> <td><math>0.05 &lt; \Phi \leq 0.08</math></td> <td><math>1.0 &lt; L \leq 3.0</math></td> <td>2</td> </tr> <tr> <td><math>0.08 &lt; \Phi</math></td> <td>—</td> <td>0</td> </tr> </tbody> </table> <p>© When the width is over 0.08 mm, according to the ( I ) Circle Spots.            Follow the above defect quantity <math>\leq 4</math> Defects.</p>	$\Phi$ Grain Size (mm)	Tolerance Dots	$\Phi \leq 0.10$	Neglect	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.25$	2	$0.25 < \Phi$	0	$\Phi$ Grain Size (mm)	Length (mm)	Tolerance Dots	$\Phi \leq 0.03$	—	Neglect	$0.03 < \Phi \leq 0.05$	$1.0 < L \leq 5.0$	2	$0.05 < \Phi \leq 0.08$	$1.0 < L \leq 3.0$	2	$0.08 < \Phi$	—	0
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## 8.4 Provision for Settlement of Disputes

In case of any inconsistency in above criteria, the Contract duly signed by both parties takes priority over the Approval Document.

Limit-sample: Some inspection criteria cannot be shown in this document, so the parties might agree on limit sample, which will then be basis for the approval of the actual product.

## 9. Precautions for use of LCD Modules

### 9.1. Handling procedures

- A) The display panel is made of glass. Do not subject it to a mechanical shock.
- B) If the display panel is damaged, the liquid crystal substance inside may leak out. Avoid contact with the mouth. If the substance comes into contact with the your skin or clothes, promptly wash the area thoroughly using soap and water.
- C) Do not touch or apply excessive force on the surface of the display or the adjoining area of the LCD module since this may cause the color tone/contrast ratio to vary.
- D) Under the protective film the polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully and keep in a dust free environment.
- E) If the display surface of the LCD module becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of following solvents, either Isopropyl or Ethyl Alcohol  
Solvents other than those mentioned above may damage the polarizer.  
Do not use water, acetone, and aromatic solvents.
- F) When positioning the LCD module, ensure that it is free of twisting, warping, and tension. Strain has a great influence upon display quality. Also, ensure that enough room is left for possible shifting of the outer case/housing.
- G) When installing the LCD module, do not forcibly pull or bend the I/O cable.
- H) Do not touch the IC of the LCD module, as this may cause abnormal readings that cannot be corrected.
- I) Do not attempt to disassemble or modify the LCD module.
- J) No Connection terminals should be left open. Do not connect anything.
- K) If the logic circuit power is off, do not try to apply input signals.
- L) To prevent damage to the various components of the display from static electricity, normal anti static techniques must be used.  
Tools required for assembly, such as soldering irons, must be properly earthed to minimize the amount of static electricity generated. Try to avoid assembly and other work under very dry conditions.  
The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- M) Avoid handling the LCD glass, as the edges are sharp.



### 9.2 Storage precautions

- A) Exercise care to minimize possible corrosion or contamination of the electrical contacts. Moisture condensation or a current flow in a high humidity environment accelerates corrosion of the contacts.
- B) When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the LCD module in bags designed to prevent static electricity build up under low ambient temperature/normal humidity conditions.  
Avoid high temperature /high humidity and low temperatures, below 0 °C.  
Whenever possible, the LCD module should be stored in the same packaging in which they were shipped from our company.

### 9.3 Design precautions

- A) The absolute maximum ratings represent the rated value beyond which the LCD module must not be used. If the LCD module is used in excess of the rated values, their operation characteristics may be adversely affected permanently.
- B) To prevent the occurrence of erroneous or poor operation caused by electromagnetic noise, attention must be paid to the VIL, VIH specification values, including taking the precaution of using short signal cables whenever possible.
- C) The liquid crystal display characteristics are temperature dependent. Viewing clarity of the display becomes poorer when the LCD is used outside its designated operating temperature range. It is therefore recommended that the LCD be used within this range.
- D) We recommend that power supply lines (VDD or Vcc) have over-current protection precautions. (Fuse etc.)
- E) To minimize Electro Magnetic Interference, designs using LCD Modules should recognize the effect of components elsewhere, especially from adjacent peripheral devices.
- F) The Tape Carrier Package fixes the LCD module, consisting of a glass panel, inside the housing. If the PCB is fixed, it could be disconnected when subjected to stress.

### 9.4. Other considerations

- A) Liquid crystal material solidifies at low temperatures (below the storage temperature range) leading to defective orientation of the liquid crystal or the generation of air bubbles.  
Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.
- B) If the LCD module has been operating for a long time showing the same display patterns, there may be retention of the display pattern on the screen as ghost images and a slight contrast irregularity may also appear. Normal operating status can be regained by suspending use for some time to rest the display if possible. It should be noted that this phenomenon does not adversely affect the performance reliability.
- C) To minimize performance reduction of the LCD modules resulting from the adverse effects of static electricity, avoid touching the following areas when handling the modules:
  - Terminal connections
  - Parts of pattern wiring on TCP
- D) Although these modules have a built-in protection terminal against static electricity for all pins, this may not be sufficient if higher levels of static electricity are encountered, possibly leading to a short circuit. Therefore, care in anti static handling is very important, including using earthen straps for the operators



- E) Generally, irradiating it with a strong light will change the characteristics of a semiconductor device. This may adversely affect the operational characteristics of the IC in the modules. We recommend whenever possible that:

Handling, preparation, assembly, and testing involving LCD are carried out in the lowest possible lighting conditions, consistent with Operator comfort.

#### **9.5. Warranty**

A) **Acceptance Inspection Period**

The period is one month after the arrival of contracted commodity at the customer's factory site.

B) **General Warranty Period**

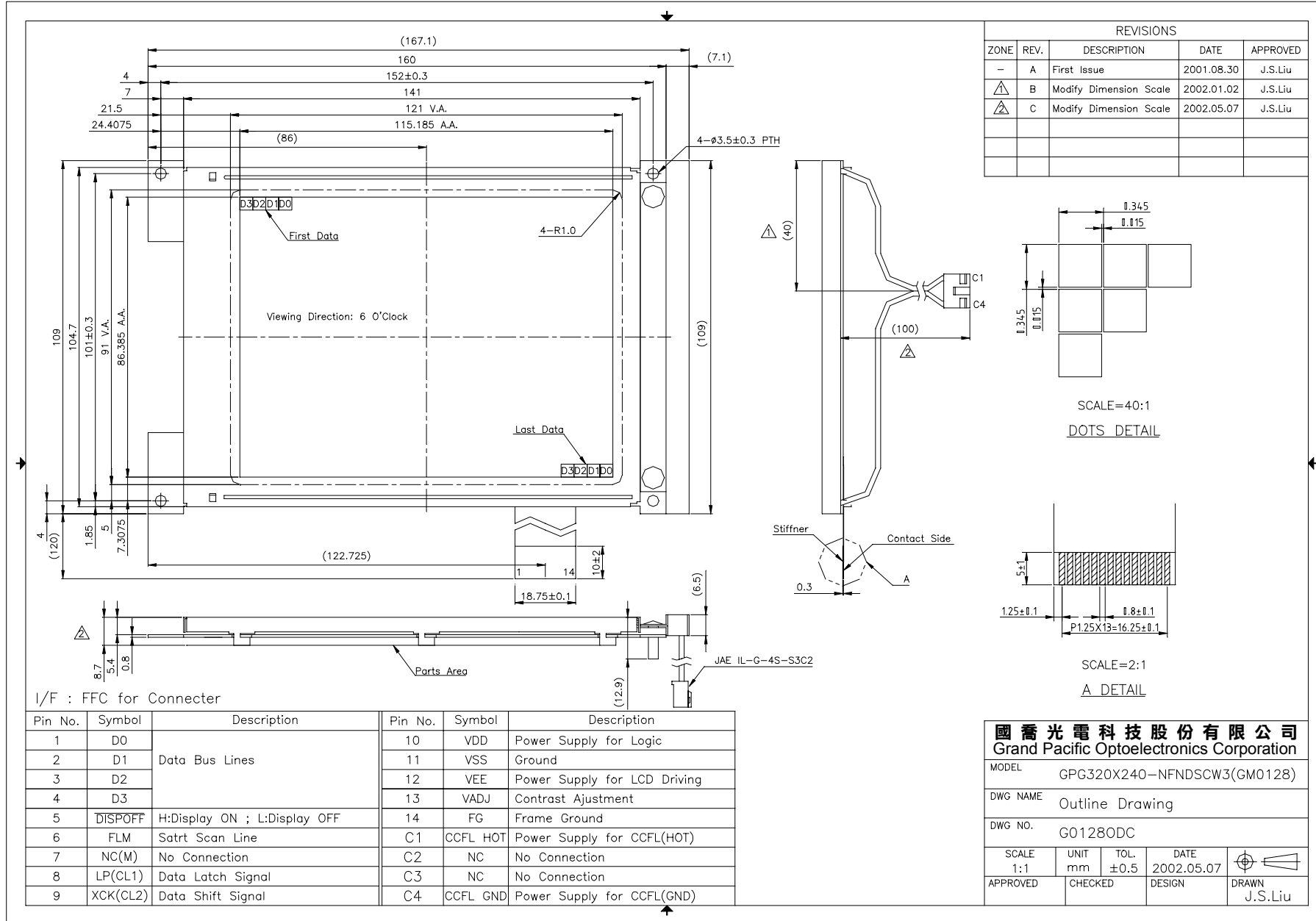
The General Warranty period is one year from the date when the product was shipped out from Grand Pacific Optoelectronics Corp. However, the warranty is applicable only when the product has been handled and/or stored under normal conditions that at no time violate above-mentioned precautions.

- C) The warranty liability of Grand Pacific Optoelectronics Corp. is limited to repair and/or replacement.

The disregard of any one of above precautions invalidates the warranty in its entirety.

- D) Grand Pacific Optoelectronics Corp. is not to be held responsible for any subsequent or consequential events.



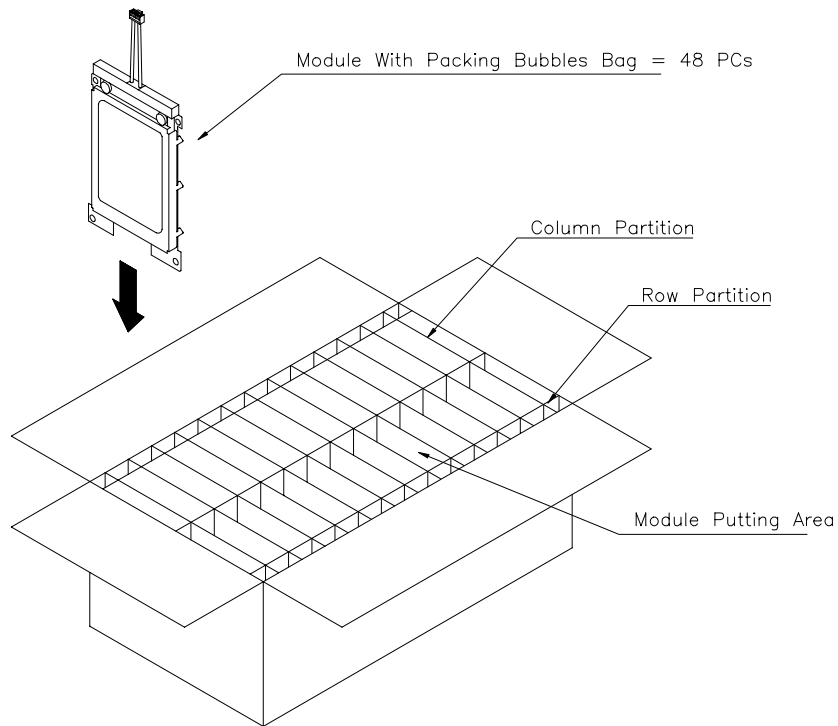


## PACKING METHOD

### (1) Specifications

ITEM	MATERIAL	SIZE ( mm )	QUANTITY
Module	-	-	48
Column Partition	BF Paper Box	315 X 225	13
Row Partition	BF Paper Box	499 X 225	3
Carton	ABF Paper Box	510 X 325 X 275	1

### (2) Packing of Carton



\* The Label of Carton :

客户 (Customer)		
客户料号 (Part No.)		
订单编号 (P. O.)		
製品名 (Product No.)		
数量 (Quantity)		檢驗章
Shipping Lot No.		