NAN YA PLASTICS CORPORATION

LCD Department / Electronic Materials Division
Taipei, Taiwan

Mark Products, LLC

North American Sales & Marketing for Nan Ya Liquid Crystal Displays

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Passive Monochrome Graphics Module Specifications

Product Series: 357
Product Version: 2
Spec Revision: 0

320 x 240 Pixels; 144 mm (5.7 in) Diag. Active Pixel Area
High Contrast STN Fluid; -20 to +70 °C Operating Temp.
Transmissive w/ CCFL Backlight; up to 220 cd/m^2 (typ.) Surface. Lum.
+5.0 VDC Logic Operation, 4 Bit pixel data bus
- 18.2 VDC (nom.) Fluid Operating Voltage @ +25 °C
w/ Attached Flat Flex Cable (14 Cond. x 1.25 mm pitch)

NOTE: All hardware configurations of the LCD module described in this specification sheet are built to order and are subject to minimum order quantities. Some hardware configurations may not be available as standard product and may require additional NRE charges.

PRODUCT No.:
LTBHBT357E2CK, LTBHBT357G2CK, LTBHBT357H2CK

SPEC No.: LM357 - 2 - <0>

EDITED ON: 19-FEB-2000

SALES MANAGER	TECHNICAL APPROVAL	DESIGN MANAGER	DESIGN CHECK	DESIGNER

RECORDS OF REVISION

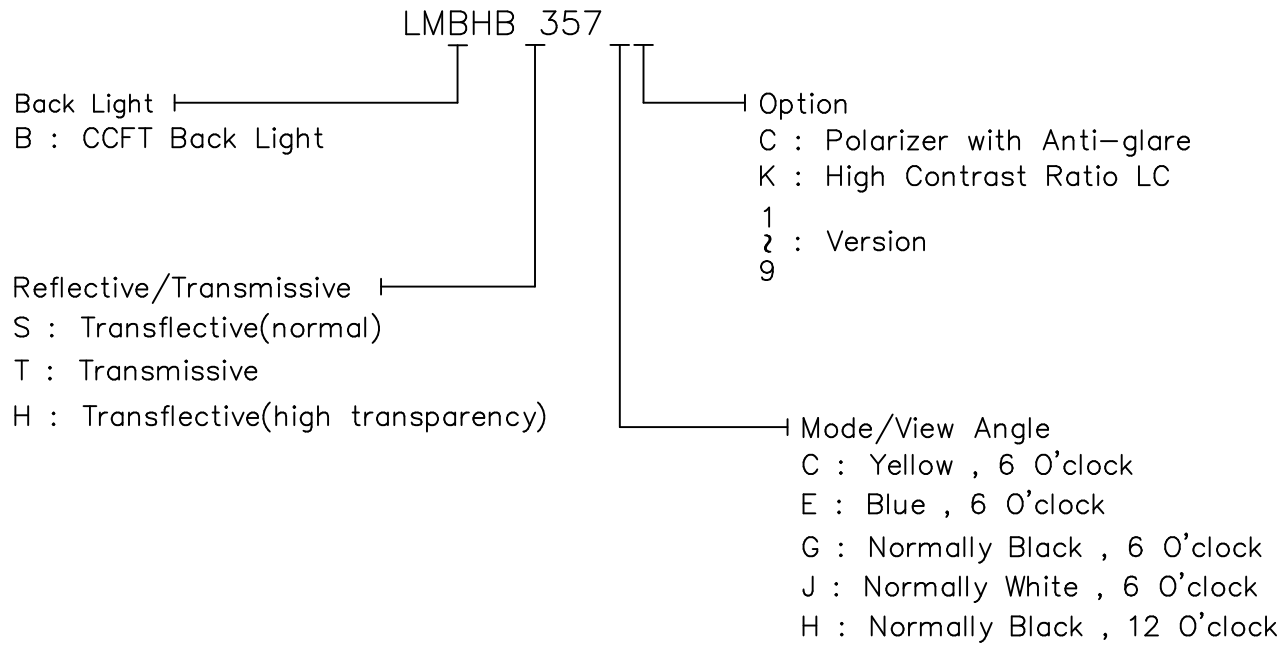
SPEC. NO.: LM357-2

DATE	REVISED NO.	REF. PAGE	SUMMARY	CHECK & APPROVAL
02.18.00'	0	23/23	First Issue	

1. MECHANICAL DATA

(1) Product No.		LTBHB_357_2_
(2) Module Size		168 (W)mm x 111.0 (H)mm x 7.4 (D)mm (CCFT B.L.)
(3) Dot Size		0.33 (W)mm x 0.33 (H)mm
(4) Dot Pitch		0.36 (W)mm x 0.36 (H)mm
(5) Number of Dots		320 (W) x 240 (H)Dots
(6) Duty		1/240
(7) LCD Display Mode	STN:	□ Gray □ Yellow □ Blue
	FSTN:	□ Black and White(Normal Black/Negative Image) □ Black and White(Normal White/Positive Image)
	Rear Polarizer:	□ Reflective □ Transflective □ Transmission
(8) Viewing Direction		□ 6 O'clock □ 12 O'clock
(9) Backlight		CCFT
(10) Controller		Excluded
(11) DC/DC Converter		Excluded
(12) Weight		185 g(APPROX)

Note :



2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V STANDARD

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	7.0	V	
Power Supply for LCM	VDD−VEE	0	30.0	V	
Input Voltage	VI	−0.3	VDD	V	
CCFL Driving Voltage	VFL	500	−	Vrms	
CCFL Input Current	IFL	−	7.0	mArms	
Static Electricity	−	−	−	−	Note 1

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	−20	70	−30	80
Humidity(Without Condensation)	Note 2,3,5		Note 2,4	

Note 1 LCM should be grounded during handling LCM.

Note 2 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 3 Ta ≦ 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 4 Ta at −30°C will be < 48hrs, at 80°C will be < 120hrs

Note 5 Operation temp not include CCFL Lamp

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

ITEM			SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic			VDD−VSS	−		4.75	5.0	5.25	V
Recommended LC Driving Voltage (Wide Temp. LCM)			VDD−VO	Duty=1/240 Bias=1/12.5	−20°C	24.6	25.0	25.4	V
					0°C	23.6	24.0	24.4	
					25°C	22.8	23.2	23.6	
					50°C	21.7	22.1	22.5	
					70°C	20.8	21.2	21.6	
Input Voltage			VIH	H level		0.7VDD	−	VDD	V
			VIL	L level		0	−	0.3VDD	V
Power Supply Current			IDD	FLM = 70 Hz VDD = 5.0 V VEE = −24.0 V VDD−VO = 23.2 V PATTERN :		−	7.8	11.7	mA
			IEE			−	7.6	11.4	mA
CCFT	Open Voltage		V_{Open}	Lamp Current = 5 mArms Frequency = 35 KHz		−	420	−	Vrms
	Lamp Voltage		V_L			−	260	−	Vrms
LCM	Surface Luminance	CCFL	T357G2CK	VDD=5.0V VDD−VO=23.2V	PATTERN: (Dots All Off)	−	8	−	cd/m²
			T357E2CK			−	45	−	
			T357H2CK			−	12	−	
			T357G2CK		PATTERN: (Dots All ON)	−	180	−	cd/m²
			T357E2CK			−	220	−	
			T357H2CK			−	196	−	

4. OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)						ϕ(Viewing Angle)		ϕ(Viewing Angle)	
		0℃		25℃		50℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	H	–	10.0	–	10.0	–	8.0	–	86	–	55
T	E	–	6.0	–	5.0	–	4.5	–	60	–	50
T	G	–	10.0	–	10.0	–	8.0	–	86	–	55
note		NOTE 6						NOTE 5			

note: T: TRANSMISSIVE

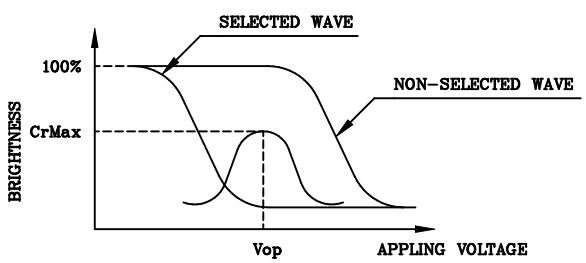
H: NORMALLY BLACK
G: NORMALLY BLACK
E: BLUE

AT $\phi=0°$ $\theta=0°$

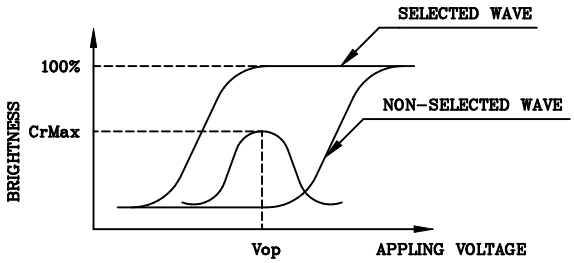
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	–	2700	4100	ms	NOTE 2
		0℃	–	500	800		
		25℃	–	150	250		
		50℃	–	80	120		
		70℃	–	60	90		
Response Time (fall)	Tf	-20℃	–	3500	5300	ms	NOTE 2
		0℃	–	800	1000		
		25℃	–	250	400		
		50℃	–	120	180		
		70℃	–	80	120		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



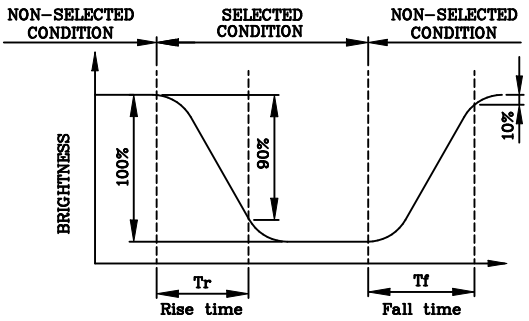
(negative type)

*Conditions

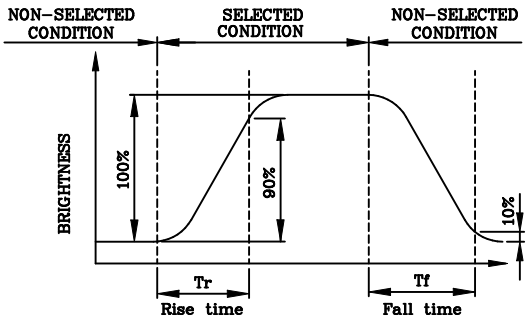
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



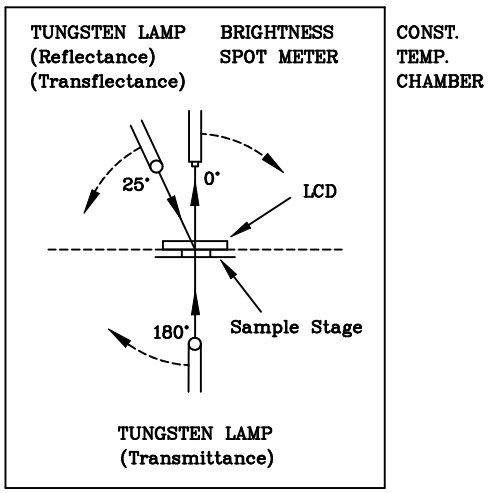
(negative type)

*Conditions

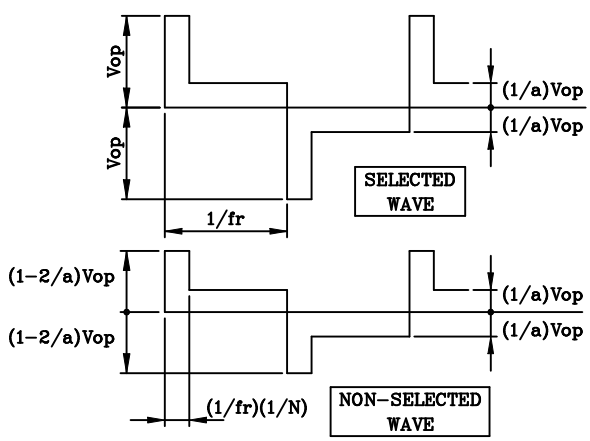
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

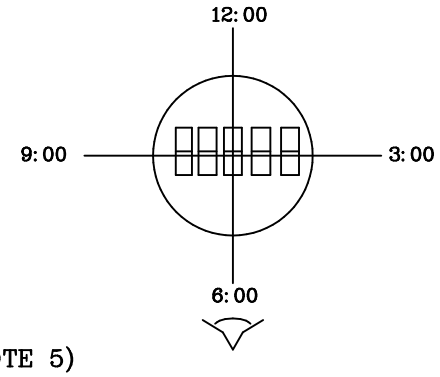


Multiplex Driving (I/N duty 1/a bias)



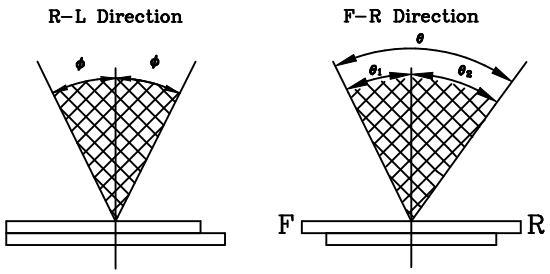
(NOTE 4)

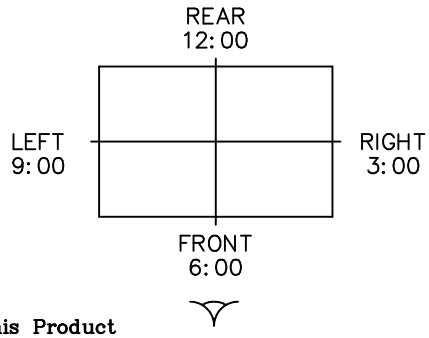
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So $\theta 1 > \theta 2$

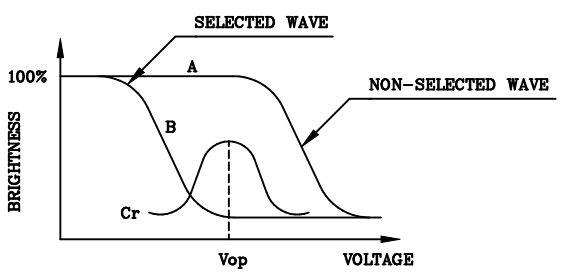
$$\theta = \theta_1 + \theta_2$$

*Conditions

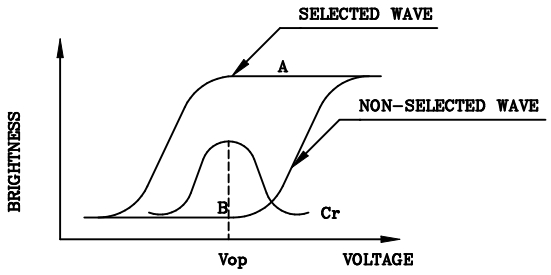
Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



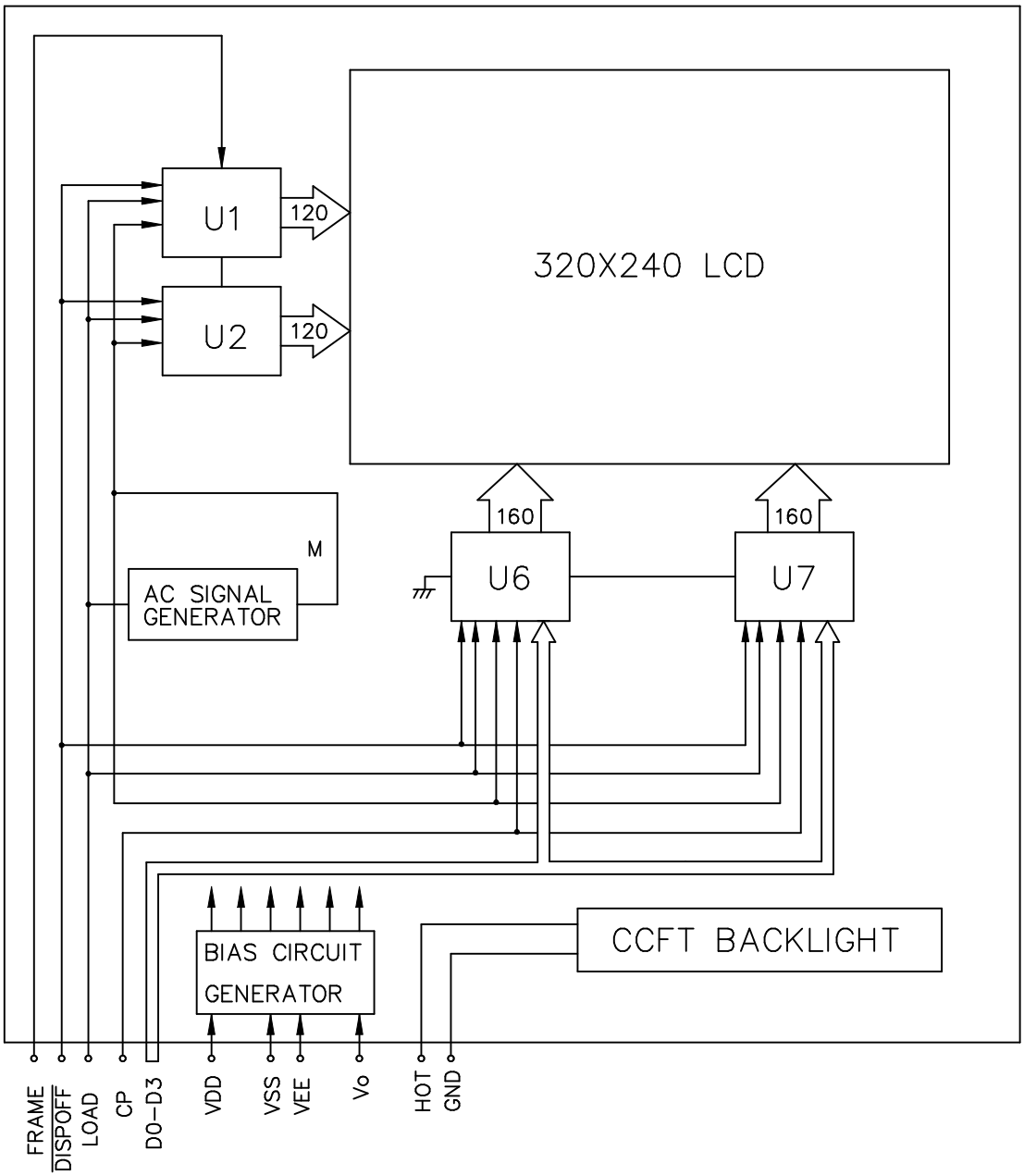
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias

5. BLOCK DIAGRAM



* AC SIGNAL SETTING

J1	J2	J3	J4	J5	J6	J7	J8
L	H	L	L	H	L	L	L

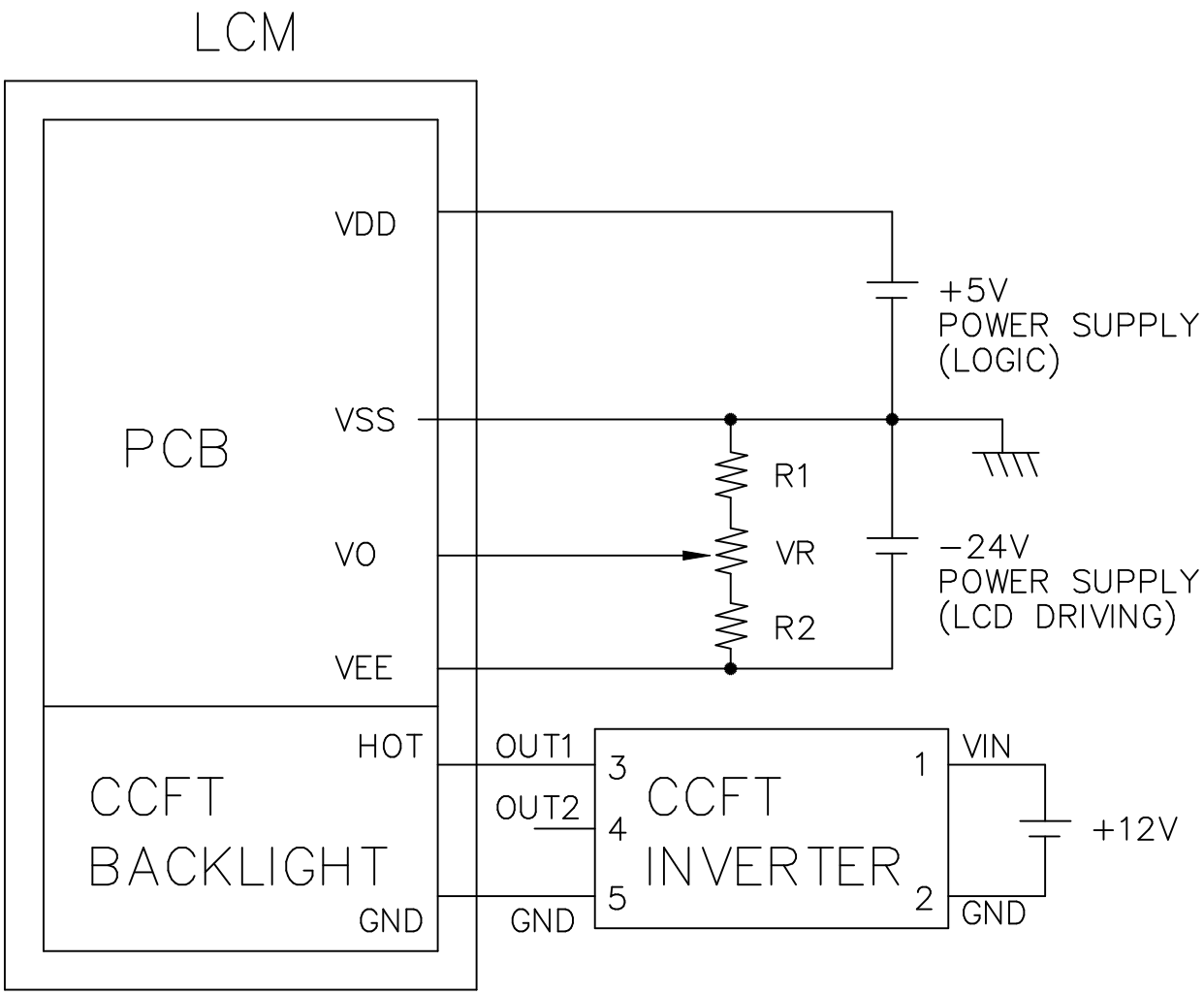
6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	D0	H/L	DISPLAY DATA SIGNAL
2	D1		
3	D2		
4	D3		
5	$\overline{\text{DISPOFF}}$	H/L	H: ON/L: OFF
6	FRAME	H	SCAN START-UP SIGNAL
7	NC	–	NO CONNECTION
8	LOAD	H→L	INPUT DATA LATCH SIGNAL
9	CP	H→L	DATA INPUT CLOCK SIGNAL
10	VDD	–	POWER SUPPLY FOR LOGIC(+5V)
11	VSS	–	SIGNAL GROUND(0V)
12	VEE	–	POWER SUPPLY FOR LCD
13	VO	–	LCD CONTRAST ADJUST VOLTAGE
14	FGND	–	FRONT PANEL GROUND

CCFL CONNECTOR : IL-G-4S-S3C2(JAE)

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	HOT	–	POWER SUPPLY FOR CCFT (HOT)
2	NC	–	NO CONNECTION
3	NC	–	NO CONNECTION
4	GND	–	POWER SUPPLY FOR CCFT (GND)

7.POWER SUPPLY



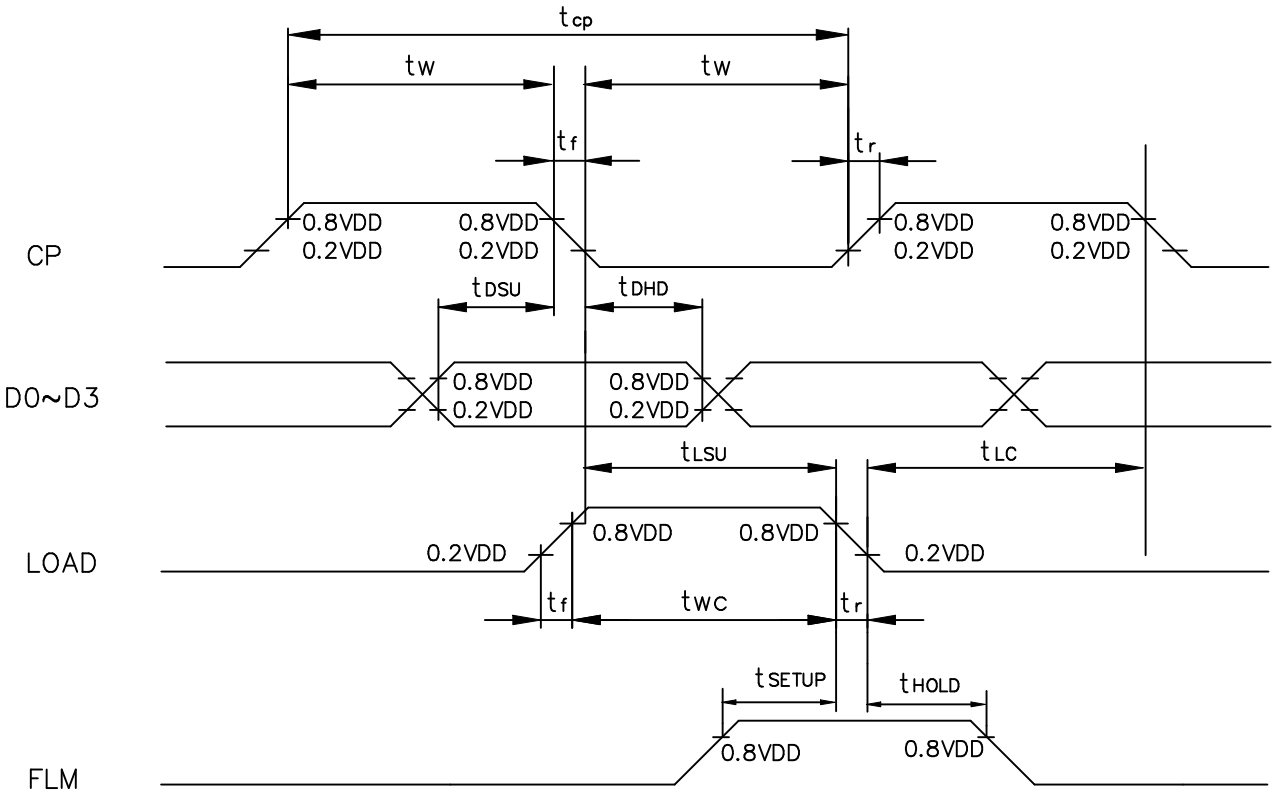
1.R1+VR+R2=10K~20KΩ

2.RECOMMENDED CCFT INVERTER : CXA-L10L-L(TDK)

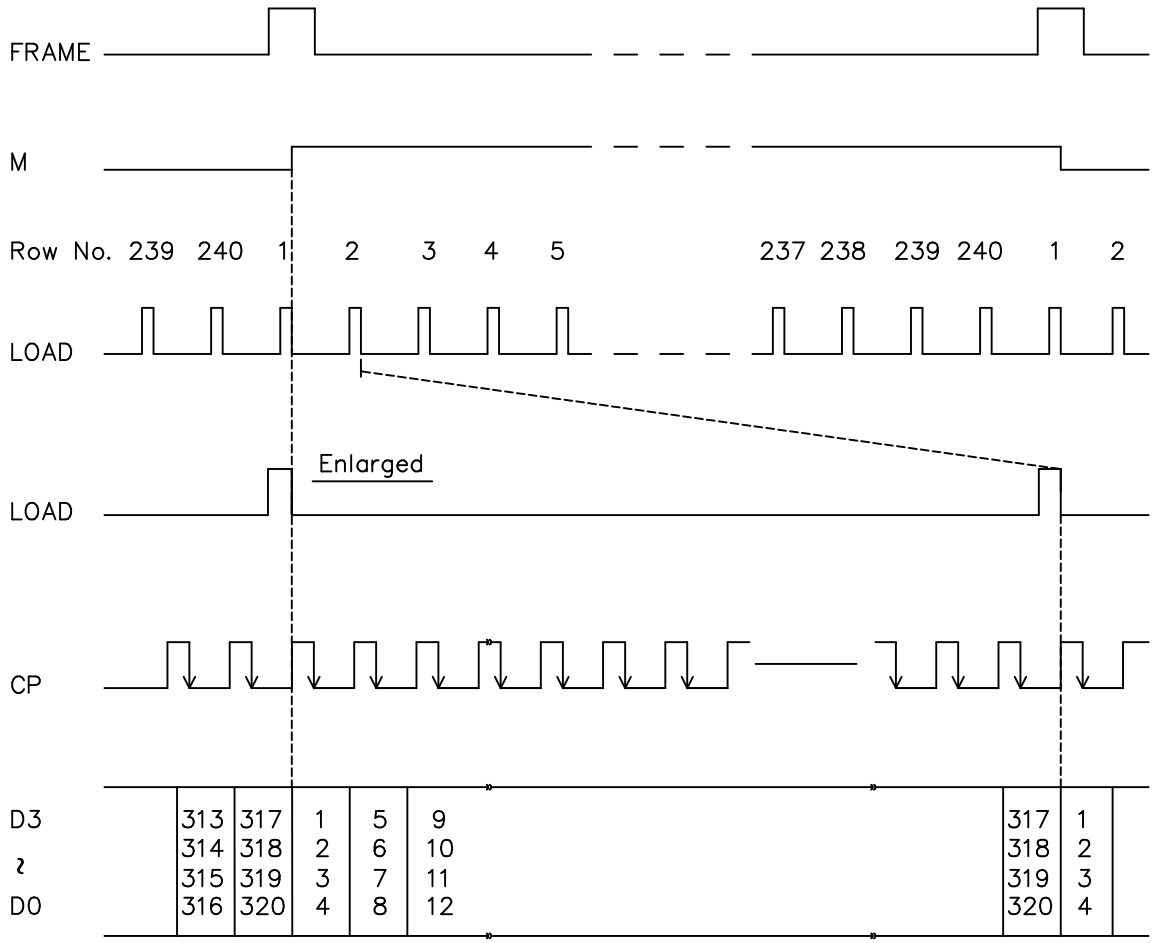
8.1TIMING CHARACTERISTICS

@VDD=4.5~5.5V

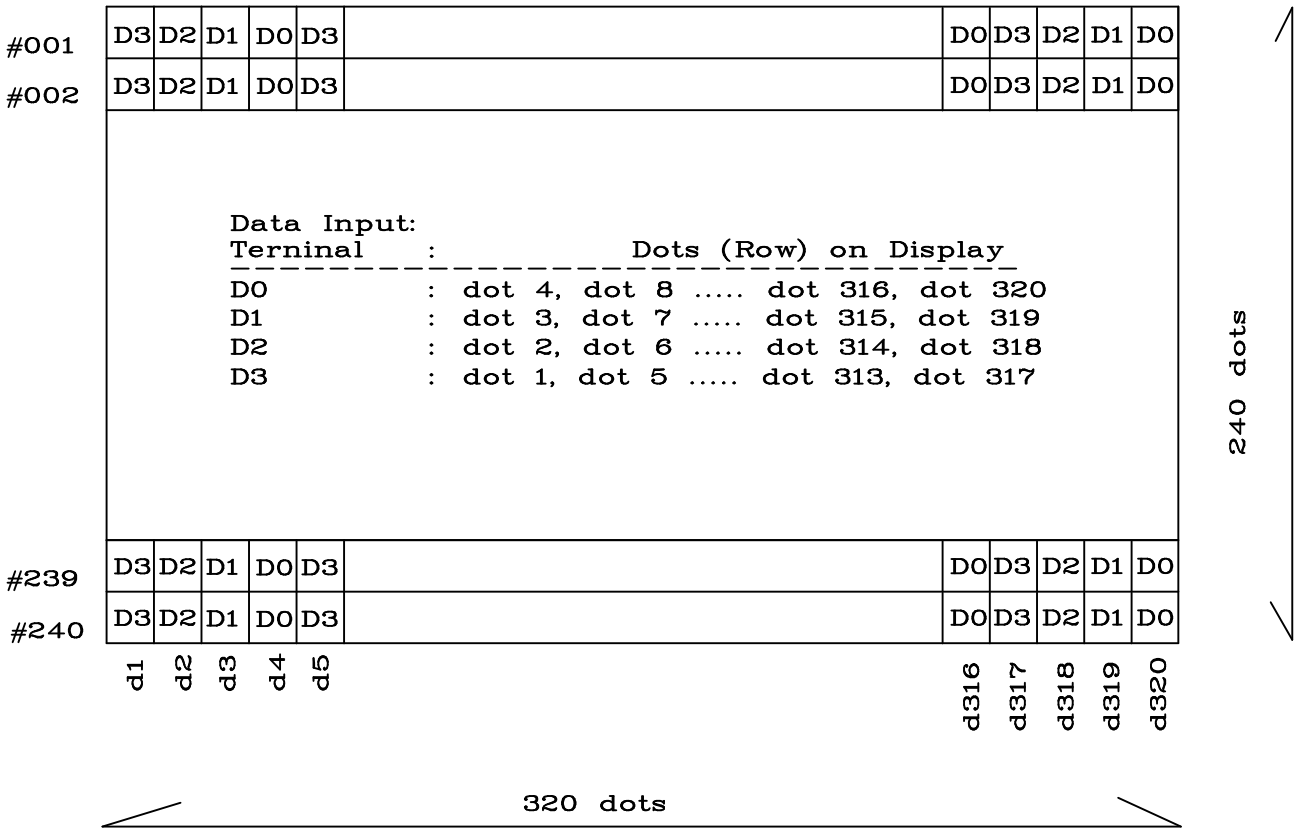
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Shift Clock Period	t_{cp}	153	–	–	ns	(DUTY=50%.VDD=4.5V)
CLOCK PULSE WIDTH	t_W	56	–	–	ns	
CLOCK RISE, FALL TIME	t_r , t_f	–	–	20	ns	
DATA SETUP TIME	t_{DSU}	50	–	–	ns	
DATA HOLD TIME	t_{DHD}	40	–	–	ns	
"CP" →"LOAD" FALL TIME	t_{LSU}	65	–	–	ns	
"LOAD" →"CP" FALL TIME	t_{LC}	65	–	–	ns	
FLM SETUP TIME	t_{SETUP}	100	–	–	ns	
FLM HOLD TIME	t_{HOLD}	100	–	–	ns	
LOAD PULSE WIDTH	t_{WC}	70	–	–	ns	



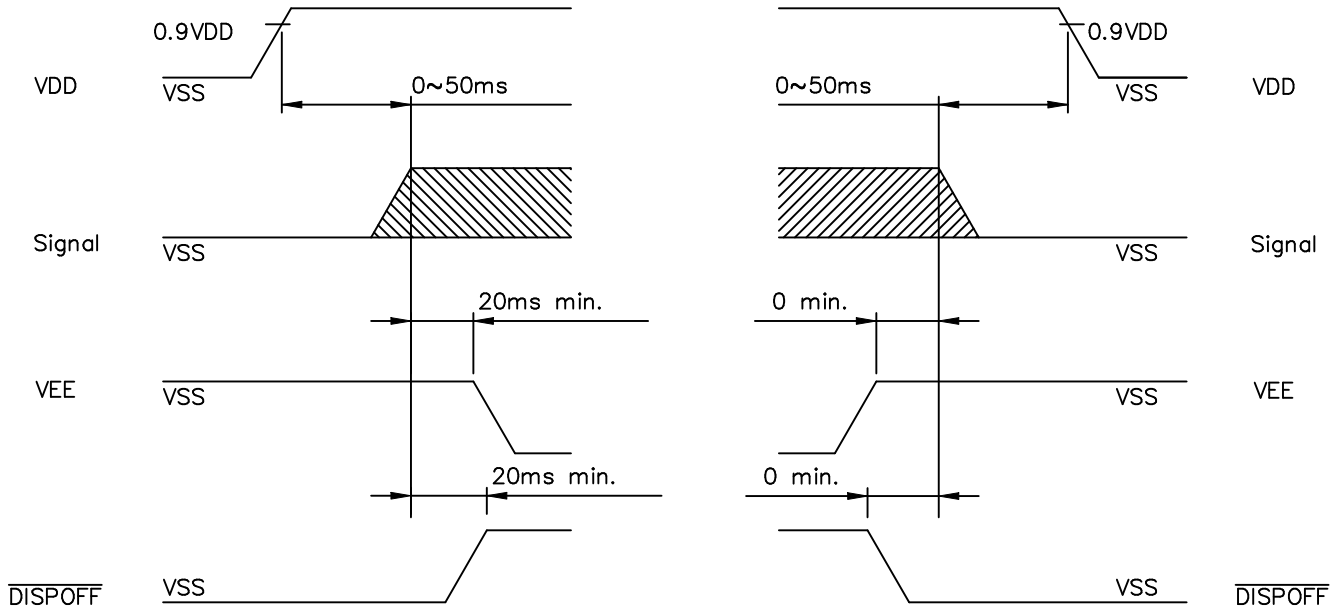
8.2TIMING CHART OF INPUT SIGNALS



8.3DISPLAY PATTERN



8.4POWER ON/OFF TIMING



POWER ON

POWER OFF

The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C	120HR		Appearance without defect	
2	Low Temp. Storage	−20°C	120HR		Appearance without defect	
3	High Temp. & High Humi. Storage	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	−20°C, 30min → 25°C.5min → 70°C, 30min → 25°C.5min (1cycle)			Appearance without defect	5 cycles

Inspection Provision

1.Purpose

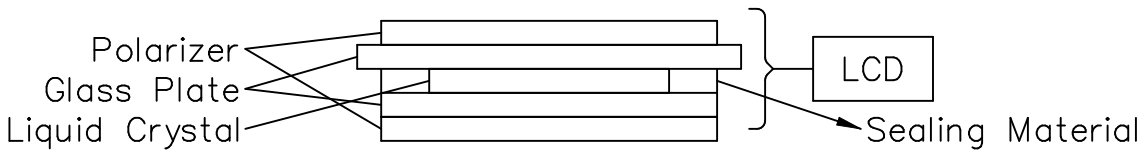
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

2.Applicable Scope

The NAN YA inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.

3.Technical Terms

3-1 NAN YA Technical Terms



4.Outgoing Inspection Provision

Outgoing inspection is according to the product inspection manual. (Per 1-1, 1-2 & 1-3)

4-1 Inspection Method

MIL-STD-105D Level Ⅱ Regular inspection

4-2 Inspection Standard

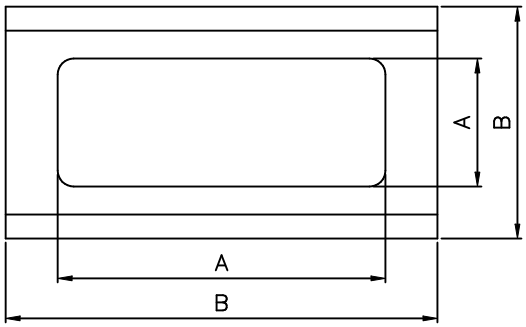
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	faults which substantially lower the practicality and the initial purpose difficult to achieve.
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		

	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	faults which appear to pose almost no obstacle to the practicality, effective use, and operation.
	Polarizing plate	Scratches, foreign Matter, air bubbles, and peeling		
	Dots	Pinhole, deformation		
	Color tone	Color unevenness		
	Solder appearance	Cold solder Solder projections		

4-3 Inspection Provisions

*Viewing Area Definition

Fig. 1



A : Zone Viewing Area
B : Zone Glass Plate Out Line

*Inspection place to be 500 to 1000 lux illuminance uniformly without glaring.
The distance between luminous source(daylight fluorescent lamp and cool white fluorescent lamp) and a sample to be 30cm to 50cm.

*Test and measurement are performed under the following conditions, unless otherwise specified.

Temperature	20± 15°C
Humidity	65± 20%R.H..
Pressure	860~1060hPa(mmbar)

In case of doubtful judgment, it is performed under the following conditions.

Temperature	20± 2°C
Humidity	65± 5%R.H..
Pressure	860~1060hPa(mmbar)

5. Specification for quality check

5-1 Electrical characteristics

NO.	Item	Criterion
1.	Non operational	Fail
2.	Miss operating	Fail
3.	Missing dot	Fail
4.	Contrast irregular	Not allowable
5.	Response time	Within Specified value
6.	EL backlight turn on/off	Within Specified value

5-2 External Appearance Defect

<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1.</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>(1)-1-Spots(At non lighting condition)

<table>
<tr><th>Average Diameter(mm): D</th><th>Number of pieces permitted</th></tr>
<tr><td>D≦0.1</td><td>Ignore</td></tr>
<tr><td>0.1<D≦0.2</td><td>5</td></tr>
<tr><td>0.2<D≦0.3</td><td>2</td></tr>
<tr><td>0.3<D</td><td>0</td></tr>
</table>
Number of total pieces is set to within 5 pieces.

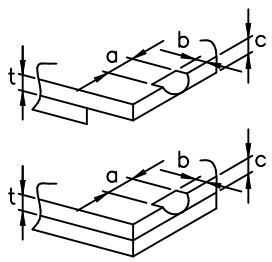
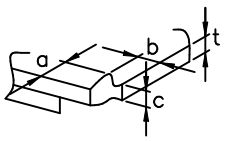
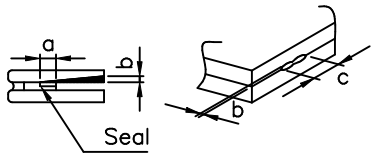
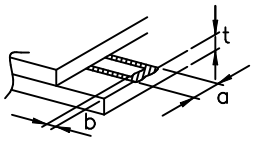
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2

(1)-2-Spots(At lighting condition)

<table>
<tr><th>Average Diameter(mm): D</th><th>Number of pieces permitted</th></tr>
<tr><td>D≦0.3</td><td>Ignore</td></tr>
<tr><td>0.3<D≦0.75</td><td>5</td></tr>
<tr><td>0.75<D</td><td>0</td></tr>
</table>
Number of total pieces is set to within 5 pieces.

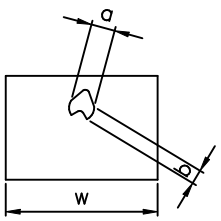
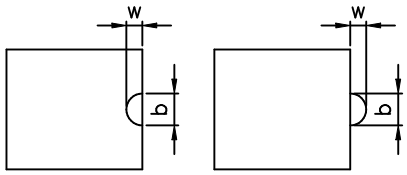
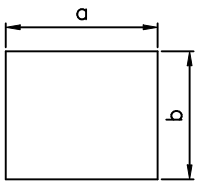
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2</td></tr>
</table>

<table>
<tr><td>1.</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>(1)−1 Spots(At non lighting condition)
<table><tr><th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr><tr><td>W≦0.03</td><td>Ignore</td><td>Ignore</td></tr><tr><td>0.03<W≦0.08</td><td>L≦4</td><td>2</td></tr><tr><td>0.08<W≦0.1</td><td>L≦1</td><td>1</td></tr></table>Object exceeding 0.1mm follow the standards of the spots form.
Note that when there are 2 pieces or more, they are not to be concentrated.
(1)−2 Spots(At lighting condition)
<table><tr><th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr><tr><td>W≦0.03</td><td>Ignore</td><td>Ignore</td></tr><tr><td>0.03<W≦0.08</td><td>L≦3</td><td>6</td></tr><tr><td>0.08<W</td><td>3<L</td><td>None</td></tr></table>Object exceeding 0.1mm follow the standards of the spots form.
Note that when there are 2 pieces or more, they are not to be concentrated.</td></tr>
<tr><td>2.</td><td>Scratches(Glass, reflection plates, and polarizing plates)</td><td>In accordance with black spots.
(At non lighting condition)</td></tr>
<tr><td>3.</td><td>Color irregular</td><td>Not remarkable color irregular.</td></tr>
</table>

<table>
<tr><td>4.</td><td>Air bubbles polarizing plates, and reflection plates</td><td colspan="2">
<table>
<tr><th>Average Diameter (mm): D</th><th>Number of pieces permitted</th></tr>
<tr><td>D≦0.3</td><td>Ignore</td></tr>
<tr><td>0.3<D</td><td>0</td></tr>
</table>
Average diameter = (Long diameter + Short diameter)/2
Note that when there are 4 pieces or more, they are not to be concentrated.
</td></tr>
<tr><td rowspan="5">5.</td><td rowspan="5">Cracks</td><td>(1)General crack
 
</td><td>a≦5
b≦2
c≦t
Where, a and b are ignored when less that or equal 0.5. The numbers of pieces are set at up to 5 pieces.</td></tr>
<tr><td>(2)Corner crack
 
</td><td>a≦2.5
b≦2.5
c≦t
a+b≦4</td></tr>
<tr><td>(3)Seal portion crack
 
</td><td>a≦The seal width x1/3
b≦t x2/3
c≦5
The numbers of pieces are set at up to 5 pieces.</td></tr>
<tr><td>(4)ITO Pin crack
 
</td><td>a≦5
b≦1/3 pin length
c≦t</td></tr>
<tr><td>(5)Progressive cracks</td><td>All taken to be unacceptable.</td></tr>
</table>

6.	Outer dimensions	Should be with in the tolerance.
7.	Newton ring	Orbicular of interference fringes. To be non. In case of doubtful judgenemt, agreement shall be reachment.
8.	Soldering	Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mouting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1.	Plinhole	 Dot display a and b are each ≦0.2mm The overall total is taken be with in 10 units. Note that they are not to be concentrated.
2.	Missing	 Dot display a and b are each ≦0.2mm The overall total is taken to be with in 10 units.
3.	Thick and thin display	 Taken to be within±1.5% of display character width(a) and height(b).

NOTICE:

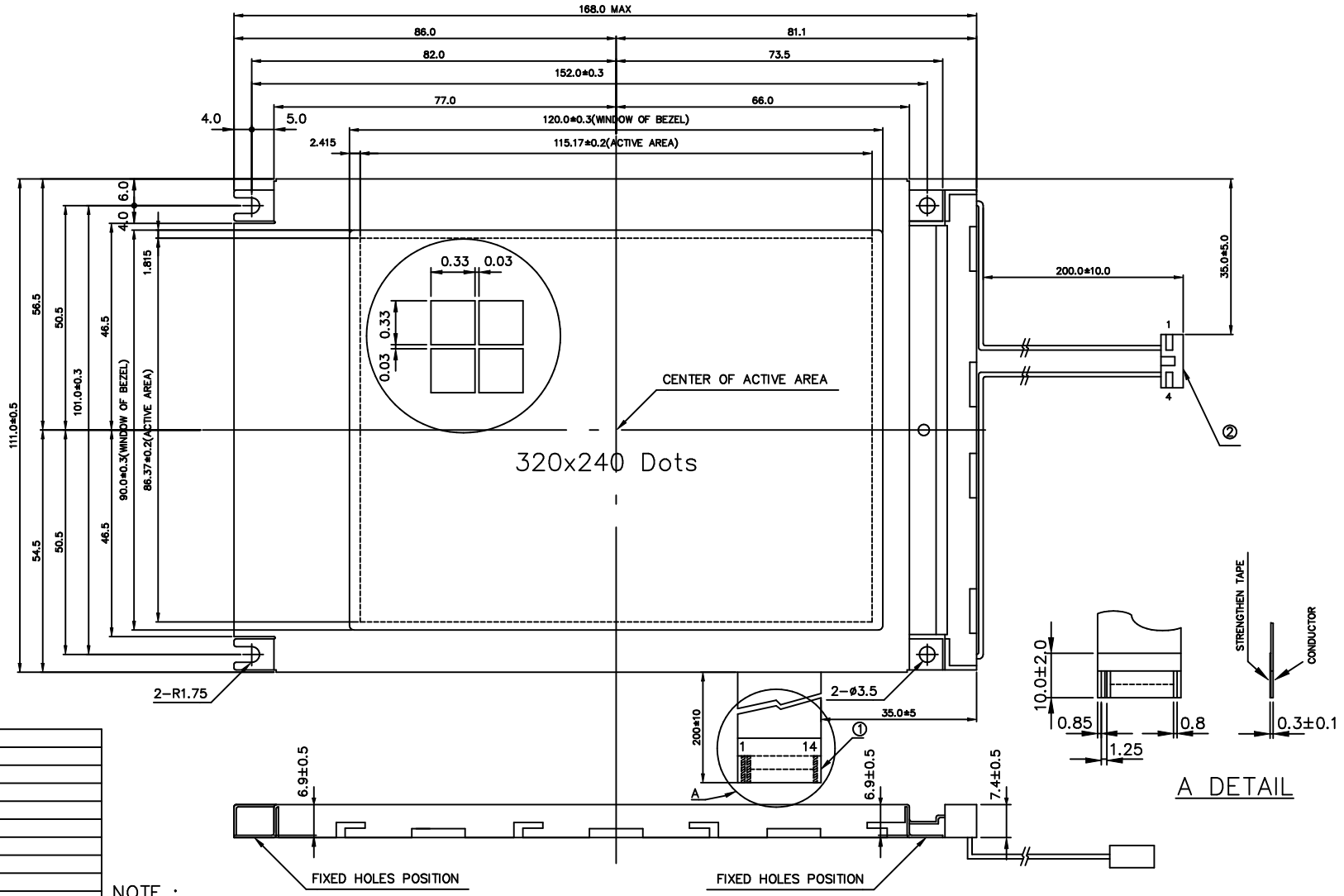
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
  5. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

- TERMS OF WARRANT
  1. Acceptance inspection period
     The period is within one month after the arrival of contracted commodity at the buyer's factory site.
  2. Applicable warrant period
     The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT
  CCFL : 20,000hrs for lamp-current 5mA, 35KHz, 25°C(Average)
  (Operating life time is defined as follows : The final brightness is at 50% of original brightness.)



PIN ASSIGNMENT OF I/O CONNECTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	D0	H/L	Display Data
2	D1	H/L	Display Data
3	D2	H/L	Display Data
4	D3	H/L	Display Data
5	$\overline{\text{DISPOFF}}$	H/L	H: ON/L: OFF
6	FRAME	H	FIRST LINE MARKER
7	NC	–	NO CONNECTION
8	LOAD	H/L	DATA LATCH
9	CP	H/L	DATA SHIFT
10	VDD	–	POWER SUPPLY FOR LOGIC
11	VSS	–	GND
12	VEE	–	POWER SUPPLY FOR LC
13	VO	–	OPERATING VOLTAGE LC DRIVING
14	FGND	–	FRONT PANEL GROUND

PIN ASSIGNMENT OF CCFL CONNECTION

Pin No.	SYMBOL	LEVEL	FUNCTION
1	HOT	–	Power Supply for CCFL(HOT)
2	NC	–	No Connection
3	NC	–	No Connection
4	GND	–	Power Supply for CFL(GND)

NOTE :

1. RESOLUTION : 320 X 240 DOTS
2. CONTROLLER : EXCLUDED
3. DC/DC CONVERTER : EXCLUDED
4. ① INTERFACE CONNECTOR
   FFC, N14 P1.25mm
   ② CCFT CONNECTOR
   J.A.E./IL-G-4S-S3C2
5. TOLERANCE NO SPECIFIED : ±0.5mm

REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE
5					
4					
3					
2					
1					

南亞塑膠工業股份有限公司
NAN YA PLASTICS CORPORATION

製品圖

LTBHB_357_2CK

	NAME	DATE	THIRD ANGLE P.
APPROVE			
CHECK			
DESIGN	J.Y.LIN	89.02.19	SCALE: 1/1
DRAWN	PING PING	89.02.19	UNIT: mm

DWG NO. M357-D2A /0