NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LDC65H591CDS

SPEC. NO.: LM591-0A-△0

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
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EDITED ON : May. 08. 2006

Q.C. DEPT.	DESIGN MANAGER	DESIGN CHECK	DESIGNER
			W.R.HSU

RECORDS OF REVISION

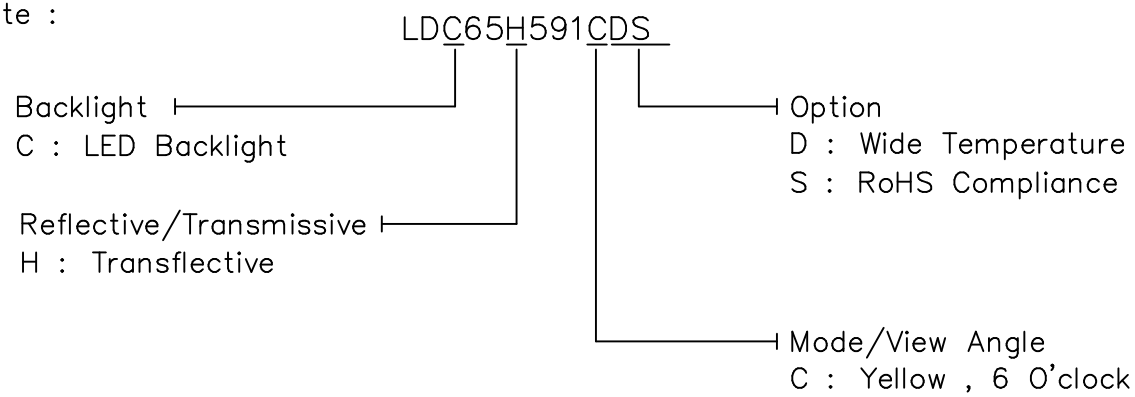
SPEC. NO.: LM591-0A

DATE	REVISED NO.	REF. PAGE	SUMMARY	DESIGN	CHECK
05.08.06'	0	1~23/23	First Issue	W.R.HSU	

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	LDC65H591CDS	–
2	Module Size	69.0 (W) x 58.5 (H) x 5.8 (D)	mm
3	Dot Size	0.41 (W) x 0.57 (H)	mm
4	Dot Pitch	0.44 (W) x 0.60 (H)	mm
5	Number of Dots	128 (W) x 64 (H)	Dot
6	Duty	1/65	–
7	LCD Display Mode	STN, Yellow Mode	–
8	Rear Polarizer	Transflective Type	–
9	Viewing Direction	6	O'clock
10	Backlight	LED	–
11	Controller	S1D15605D00B000 or Compatible	–
12	Touch Panel	Excluded	–
13	Weight	28 (Approx.)	g

Note :



RoHS Compliance.

Nan Ya guarantees that this project doesn't include any materials (6 materials) or includes less than specified quantities which are regulated by RoHS Compliance.

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

	SYMBOL	MIN.	MAX.	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	5.5	V	
Input Voltage	VI	−0.3	VDD	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	−20	70	−40	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	

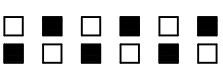
Note 2 Ta ≦ 70°C : 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature. That phenomenon is reversible.

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-VSS	-		4.5	5.0	5.5	V
Input Voltage	VIH	H level		0.8VDD	-	VDD	V
	VIL	L level		0	-	0.2VDD	
Recommended LC Driving Voltage	VDD-V5 (Vop)	*Note	-20°C	9.0	9.3	9.6	V
			0°C	8.4	8.7	9.0	
			25°C	8.1	8.4	8.7	
			50°C	7.9	8.2	8.5	
			70°C	7.7	8.0	8.3	
Power Supply Current	IDD	VDD-VSS=5.0V VDD-V5=8.4V Ta=25°C Pattern: 		-	0.5	0.7	mA
Surface Luminance of LCM	L	IAK = 40mA Pattern: Dots All ON		-	4	8	cd/m²
		IAK = 40mA Pattern: Dots All OFF		4	8	-	

*Note :

(1)Duty=1/65, Bias=1/9

(2)Internal Resistance Ratio Register : (1,1,0)Binary

(3)Electronic Volumn Value : (11)Decimal

(4)Thermal Gradient : -0.05 %/°C

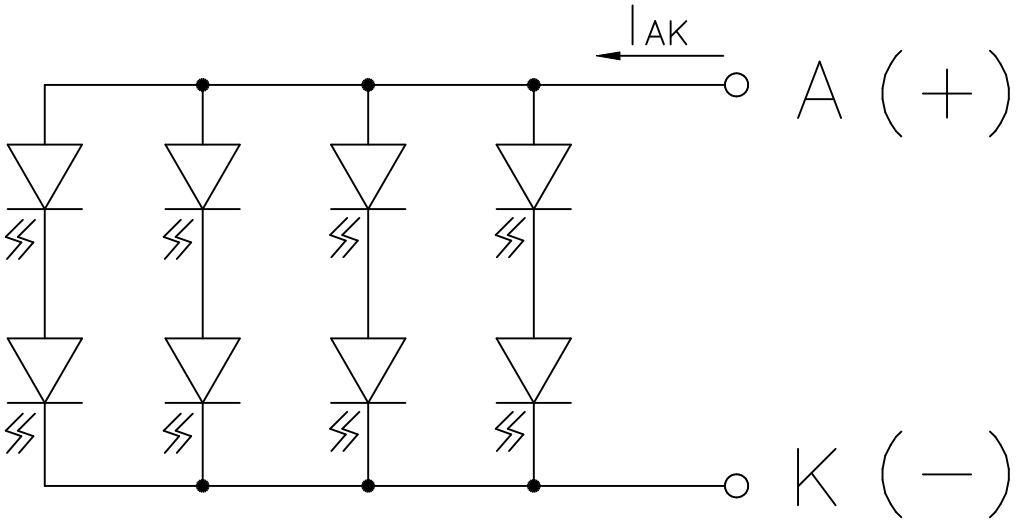
(5)Range of Electronic Volumn Control : (11±3)Decimal

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating (Constant Current Driving) Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I_P	–	–	120	mA	–
Maximum reverse voltage	V_R	–	–	–10	V	–
Applied forward current	I_{AK}	–	40	–	mA	–
Applied forward voltage	V_{AK}	3.8	4.2	4.6	V	–
LED power consumption	P_F	0.15	0.16	0.17	W	–
LED life time	L_L	–	40000	–	hrs	at I_{AK} = 40 mA (*1)

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness.



4. OPTICAL CHARACTERISTICS

WIDE TEMPERATURE MODE

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)										θ(Viewing Angle)		φ(Viewing Angle)	
		−20°C		0°C		25°C		50°C		70°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
H	C	2.5	4	3	4.5	3.5	5	2.5	4	2	3	−	F: 35 R: 30	−	L: 30 R: 30
NOTE		NOTE 6										NOTE 5			

NOTE :

H : Transflective

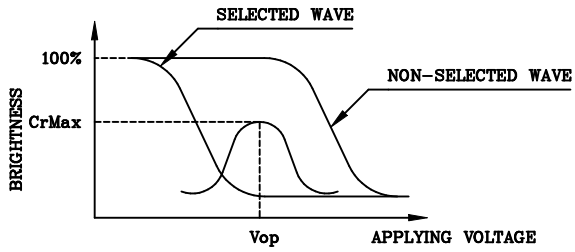
C : Yellow, 6 O'clock

AT $\phi=0°$ $\theta=0°$

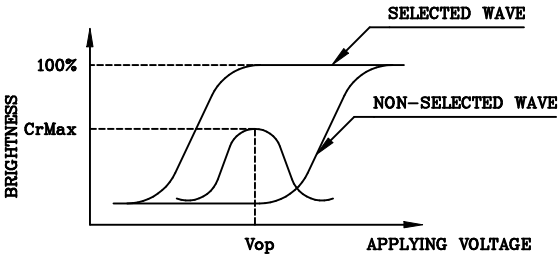
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	−20℃	3200	4000	6000	ms	NOTE 2
		0℃	680	850	1270		
		25℃	160	200	300		
		50℃	95	120	180		
		70℃	45	60	90		
Response Time (fall)	Tf	−20℃	1900	2400	3600	ms	NOTE 2
		0℃	400	500	600		
		25℃	95	120	180		
		50℃	40	50	75		
		70℃	30	40	60		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



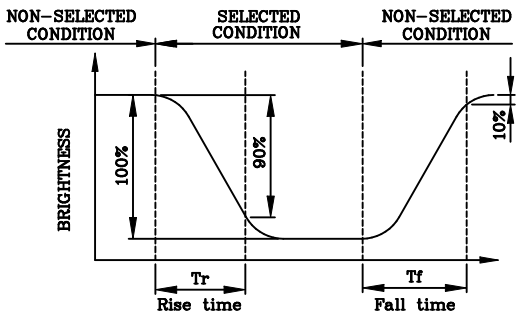
(negative type)

*Conditions

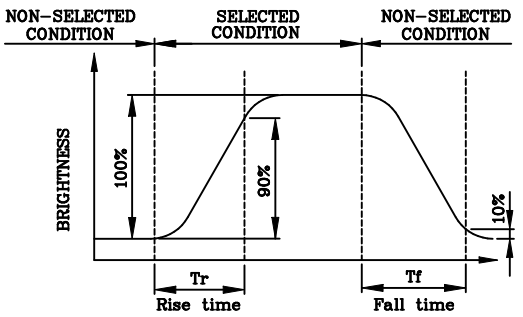
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



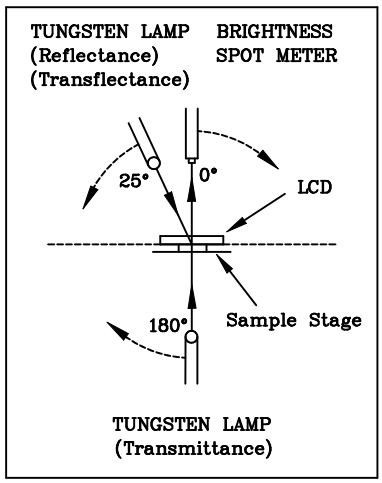
(negative type)

*Conditions

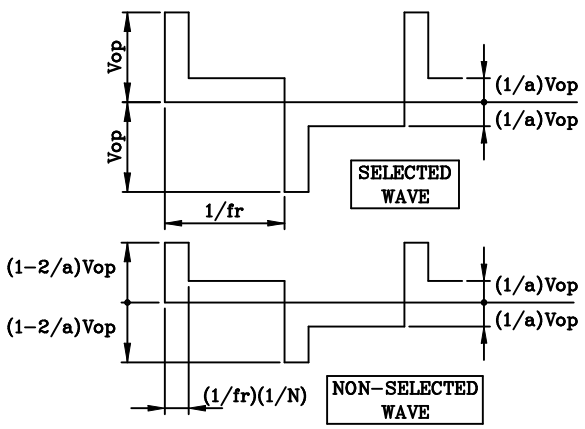
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

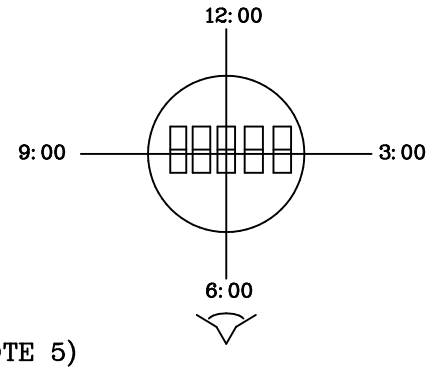


Multiplex Driving (1/N duty 1/a bias)



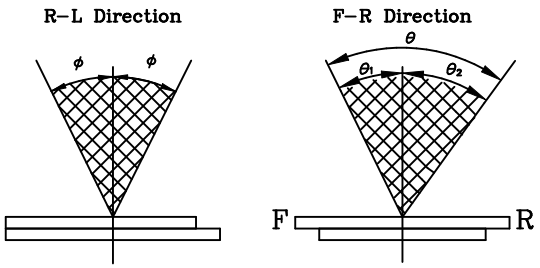
(NOTE 4)

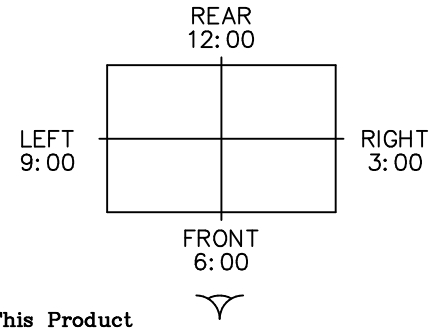
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So $\theta_1 > \theta_2$

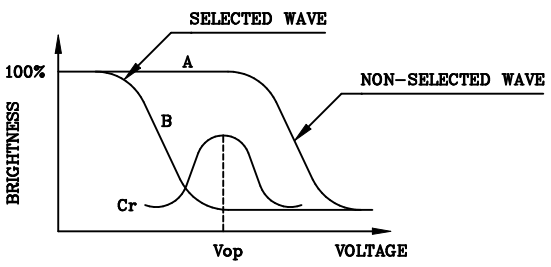
$\theta = \theta_1 + \theta_2$

*Conditions

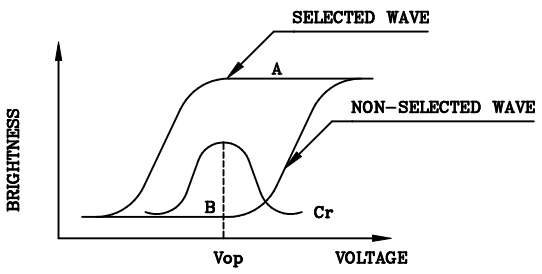
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



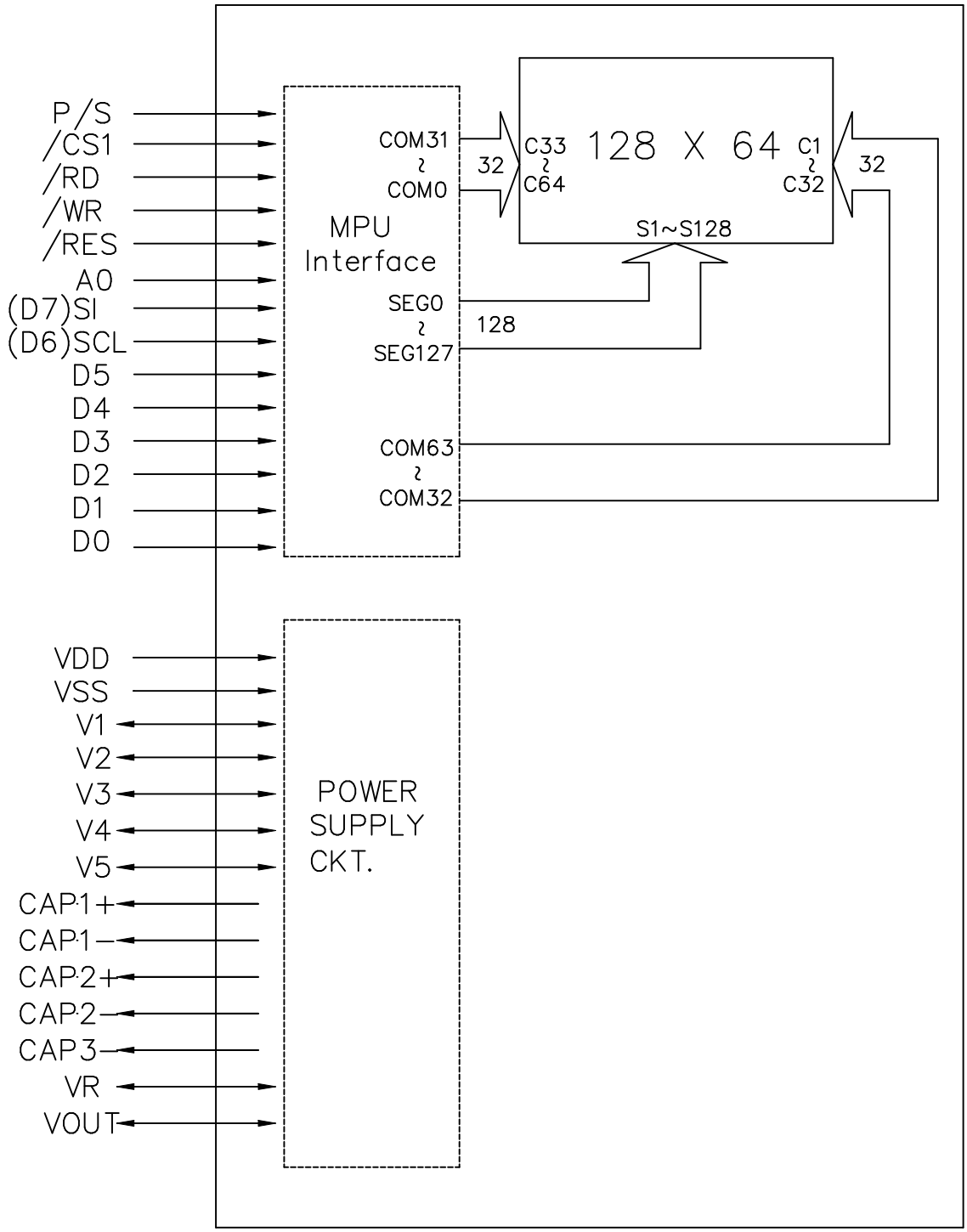
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

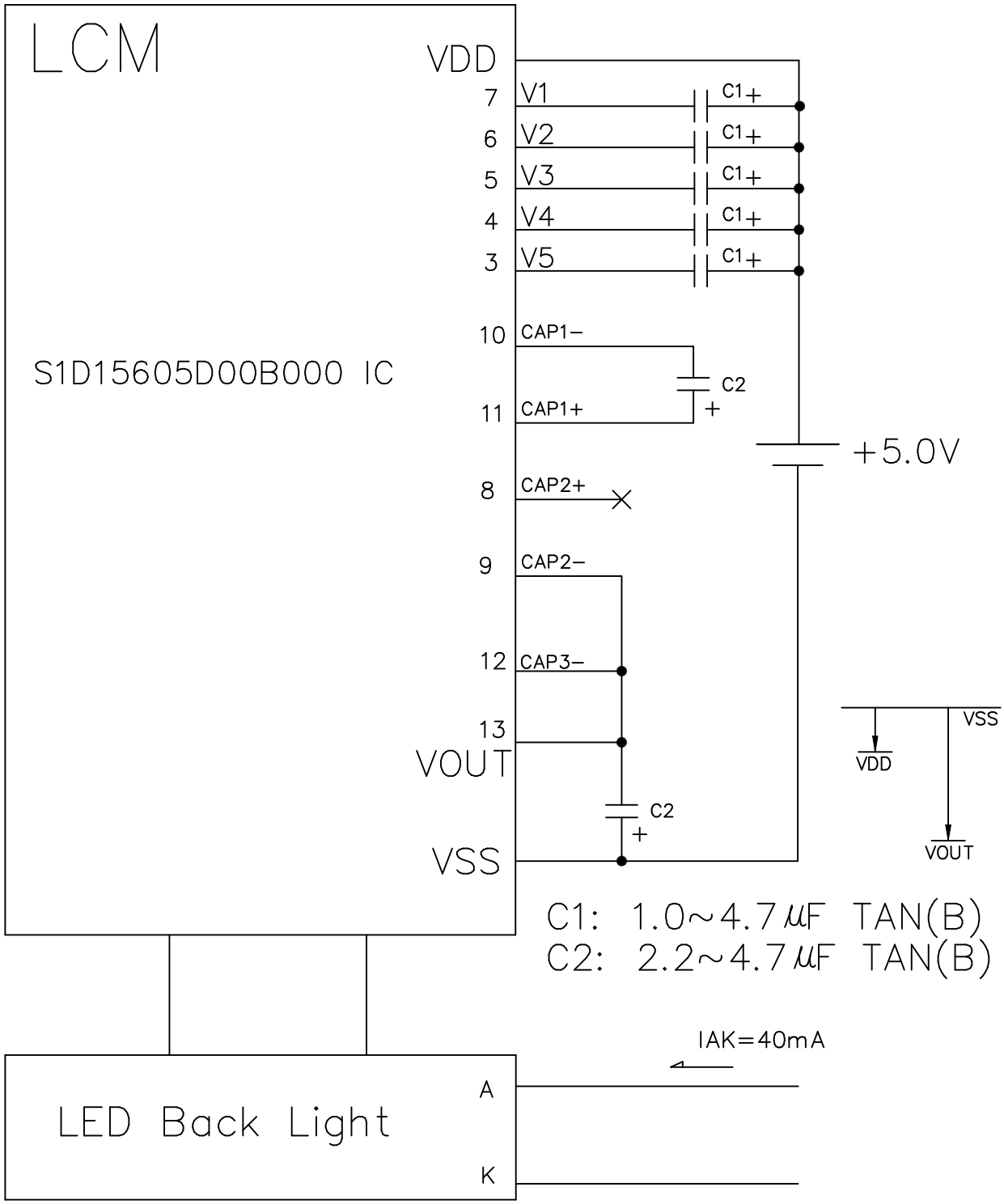
CN1. LCD INTERFACE (FPC, PITCH 1.0)

PIN NO	SYMBOL	FUNCTION
1	P/S	HIGH: Parallel ; LOW: Serial data input
2	V_R	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider
3	V5	This is a multi-level power supply for the liquid crystal drive
4	V4	
5	V3	
6	V2	
7	V1	
8	CAP2+	DC/DC Voltage converter
9	CAP2−	
10	CAP1−	
11	CAP1+	
12	CAP3−	
13	Vout	
14	Vss	This is a 0V terminal connected to the system GND
15	VDD	Shared with the MPU power supply terminal VCC(+5V)
16	D7(SI)	Serial data input
17	D6(SCL)	Serial clock input
18	D5	
19	D4	Parallel data input
20	D3	
21	D2	
22	D1	
23	D0	
24	$\overline{RD}$	Fixed to either "H" or to "L"
25	$\overline{WR}$	Fixed to either "H" or to "L"
26	A0	"H" = Display data , "L" = Control data
27	/RES	Reset signal
28	/CS1	Chip select signal

CN2. LED CONNECTOR, PHR-2 (JST) OR COMPATIBLE

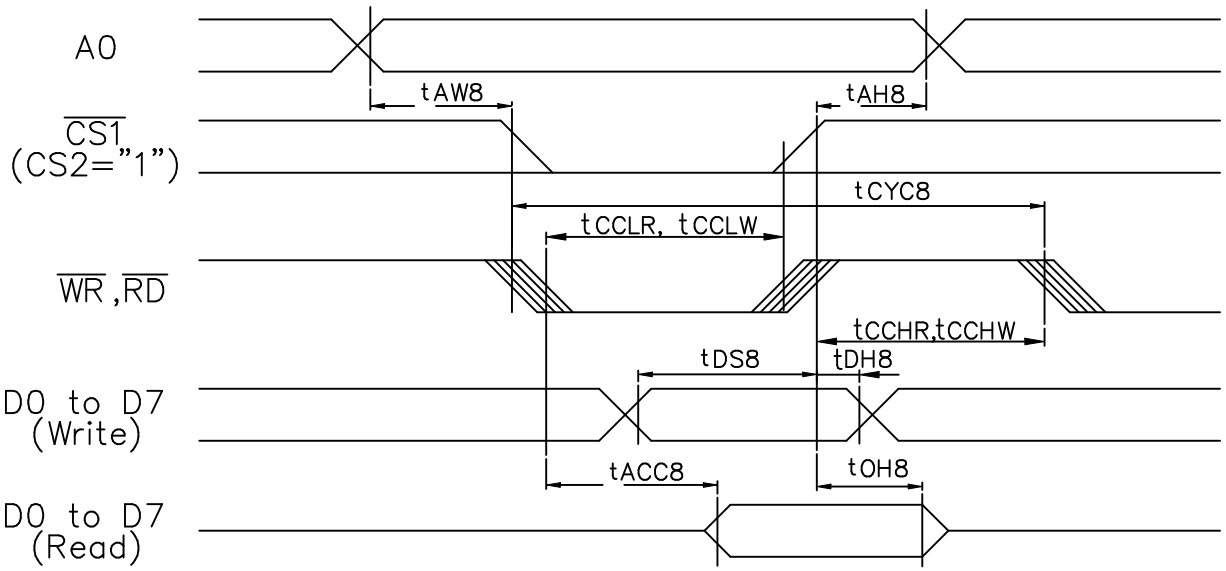
PIN NO	SYMBOL	FUNCTION
1	A	Power Supply Voltage LED Backlight (4.2V)
2	K	GND

7.POWER SUPPLY



8. TIMING CHARACTERISTICS

8-1 For 8080 Series MPU



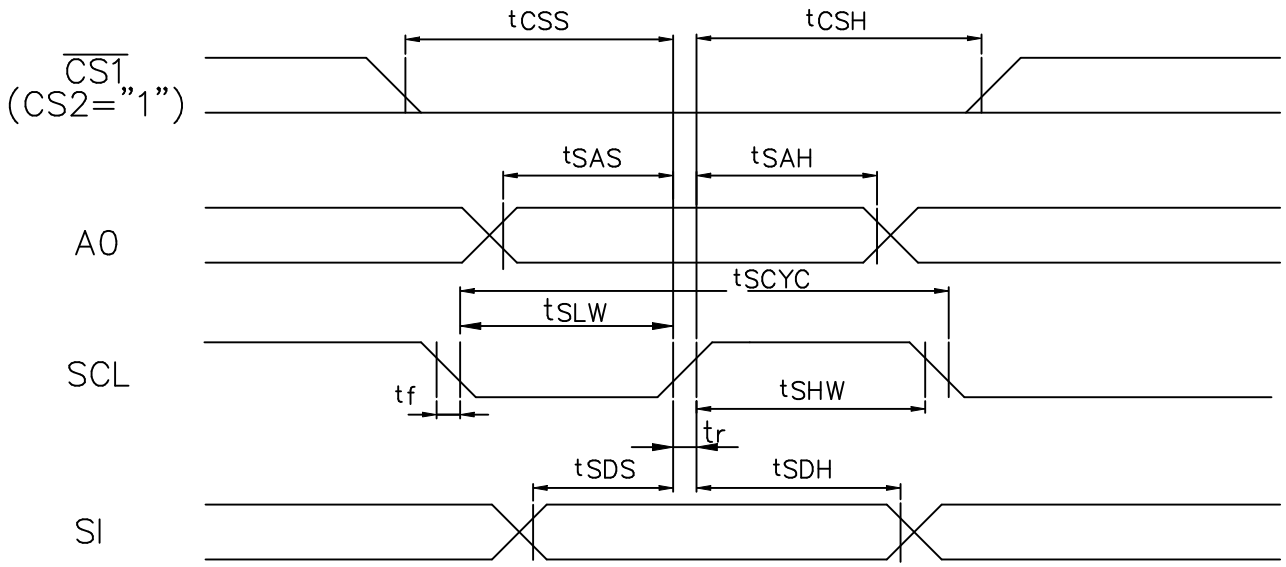
VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating Min	Rating Max	Unites
Address hold time	A0	tAH8		0	-	ns
Address setup time		tAW8		0	-	ns
System cycle time	A0	tCYC8		166	-	ns
Control L pulse width	$\overline{WR}$	tCCLW		30	-	ns
Control L pulse width	$\overline{RD}$	tCCLR		70	-	ns
Control H pulse width	$\overline{WR}$	tCCHW		30	-	ns
Control H pulse width	$\overline{RD}$	tCCHR		30	-	ns
Data setup time	D0 to D7	tDS8		30	-	ns
Data hold time		tDH8		10	-	ns
$\overline{RD}$ access time		tACC8	CL=100pF	-	70	ns
Output disable time		tOH8		5	50	ns

VDD=2.7~4.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating Min	Rating Max	Unites
Address hold time	A0	tAH8		0	-	ns
Address setup time		tAW8		0	-	ns
System cycle time	A0	tCYC8		300	-	ns
Control L pulse width	$\overline{WR}$	tCCLW		60	-	ns
Control L pulse width	$\overline{RD}$	tCCLR		120	-	ns
Control H pulse width	$\overline{WR}$	tCCHW		60	-	ns
Control H pulse width	$\overline{RD}$	tCCHR		60	-	ns
Data setup time	D0 to D7	tDS8		40	-	ns
Data hold time		tDH8		15	-	ns
$\overline{RD}$ access time		tACC8	CL=100pF	-	140	ns
Output disable time		tOH8		10	100	ns

8-2 For Series Interface



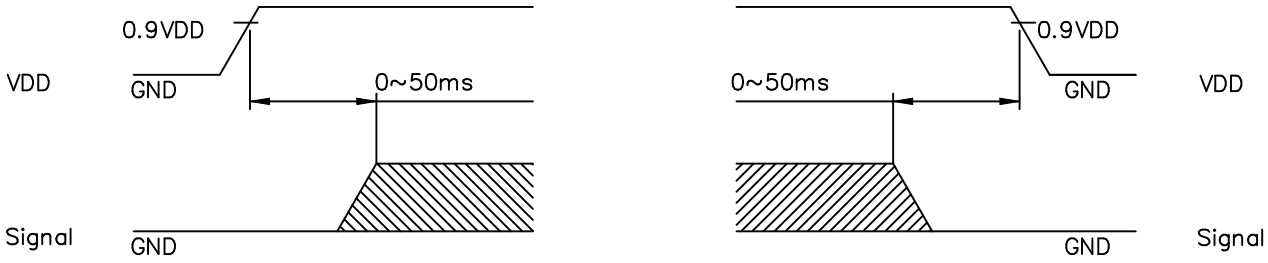
VDD=4.5~5.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Serial Clock Period	SCL	tSCYC		200	-	ns
SCL "H" pulse width		tSHW		75	-	ns
SCL "L" pulse width		tSLW		75	-	ns
Address setup time	A0	tSAS		50	-	ns
Address hold time		tSAH		100	-	ns
Data setup time	SI	tSDS		50	-	ns
Data hold time		tSDH		50	-	ns
CS-SCL time	CS	tCSS		100	-	ns
		tCSH		100	-	ns

VDD=2.7~4.5V, Ta=-40~85°C

Item	Signal	Symbol	Condition	Rating		Unites
				Min	Max	
Serial Clock Period	SCL	tSCYC		250	-	ns
SCL "H" pulse width		tSHW		100	-	ns
SCL "L" pulse width		tSLW		100	-	ns
Address setup time	A0	tSAS		150	-	ns
Address hold time		tSAH		150	-	ns
Data setup time	SI	tSDS		100	-	ns
Data hold time		tSDH		100	-	ns
CS-SCL time	CS	tCSS		150	-	ns
		tCSH		150	-	ns

8-3. POWER 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

WIDE TEMPERATURE RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80°C	120Hrs		Appearance without defect	
2	Low Temp. Storage	−40°C	120Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60°C 90%RH	120Hrs		Appearance without defect	
4	High Temp. Operating Display	70°C	120Hrs		Appearance without defect	
5	Low Temp. Operating Display	−20°C	120Hrs		Appearance without defect	
6	Thermal Shock	−20°C,30min → 70°C,30min ↑ (1cycle)			Appearance without defect	10 cycles

Inspection Provision

1.Purpose

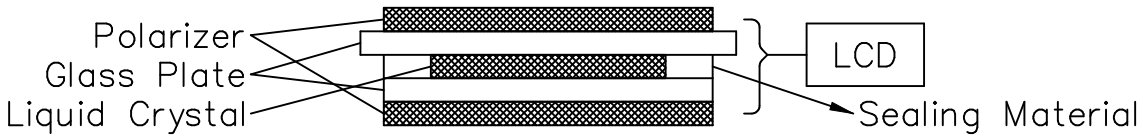
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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

4-1 Inspection Method

MIL-STD-105E Level Ⅱ Regular inspection

4-2 Inspection Standard

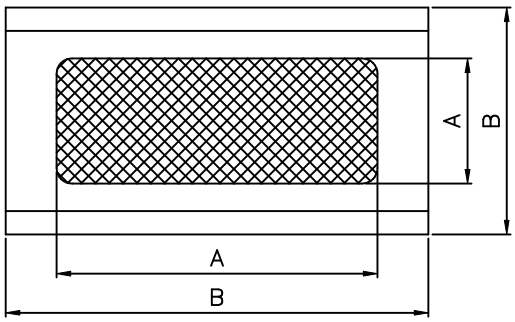
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	faults which substantially lower the practicality and the initial purpose difficult to achieve.
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		

	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 Outline

*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 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

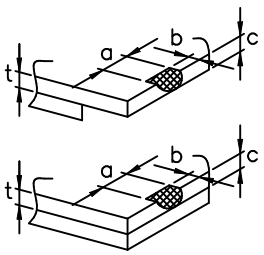
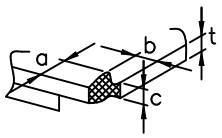
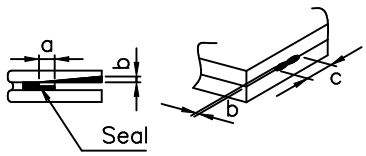
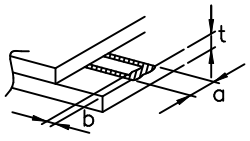
5-1 Electrical characteristics

NO.	Item	Criterion
1	Non operational	Fail
2	Miss operating	Fail
3	Missing dot	Fail
4	Contrast irregular	Fail
5	Response time	Within Specified value
6	Backlight turn on/off	Within Specified value

5-2 External Appearance Defect

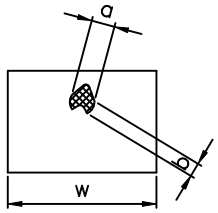
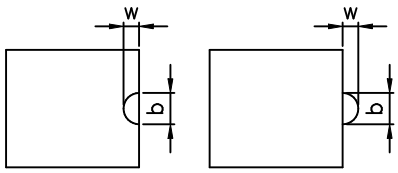
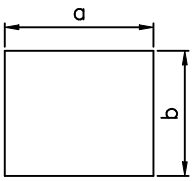
<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>(1)-1-Spots
<table><tr><th>Average Diameter(mm): D</th><th>Number of pieces permitted</th></tr><tr><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-Blurred 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>Line</td><td>(1)-1-Lines
<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-Blurred Lines(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 than or equal to 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 widthx1/3
b≦tx2/3
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 within the tolerance.
7	Newton ring(touch panel)	Orbicular of interference fringes is not allowed in the optimum contrast within the active area under viewing angle.
8	Soldering	Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mounting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1	Pinhole	 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).

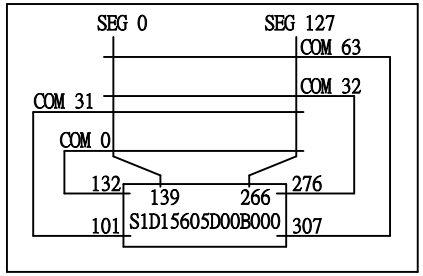
NOTICE:

- 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.

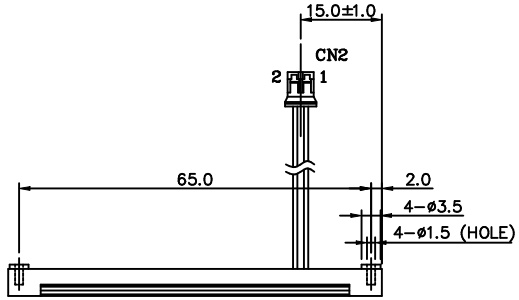
- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch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

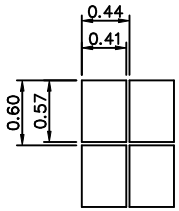
- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

- 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.

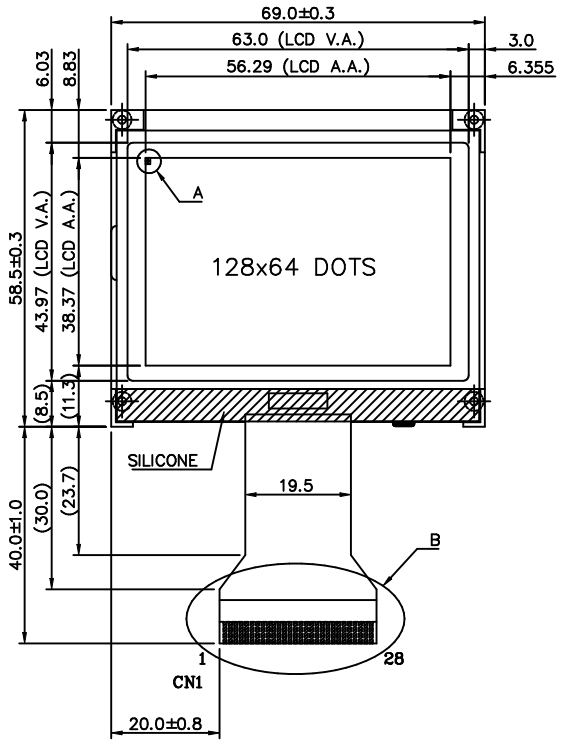


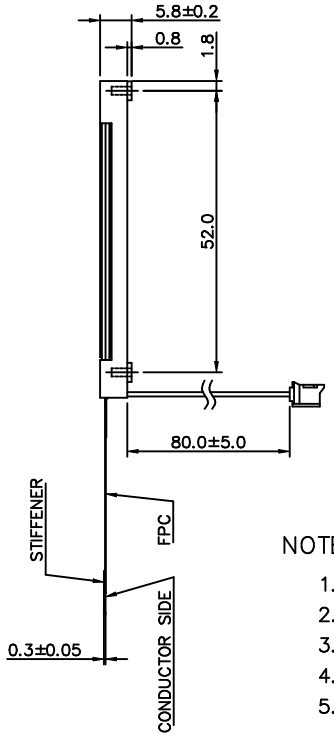
LAYOUT DIAGRAM

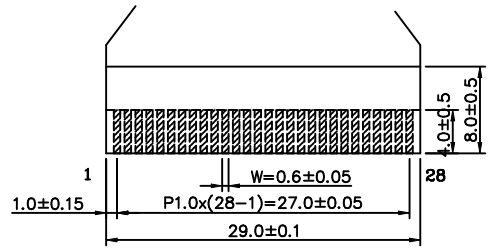




DETAIL A
(S=20:1)







DETAIL B
(S=2:1)

CN1. LCD INTERFACE (FPC, PITCH 1.0)

PIN NO	SYMBOL	FUNCTION
1	P/S	HIGH: Parallel ; LOW: Serial data input
2	V_R	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider
3	V5	This is a multi-level power supply for the liquid crystal drive
4	V4	
5	V3	
6	V2	
7	V1	
8	CAP2+	DC/DC Voltage converter
9	CAP2−	
10	CAP1−	
11	CAP1+	
12	CAP3−	
13	Vout	
14	Vss	This is a 0V terminal connected to the system GND
15	VDD	Shared with the MPU power supply terminal VCC(+5V)
16	D7(SI)	Serial data input
17	D6(SCL)	Serial clock input
18	D5	Parallel data input
19	D4	
20	D3	
21	D2	
22	D1	
23	D0	
24	$\overline{RD}$	Fixed to either "H" or to "L"
25	$\overline{WR}$	Fixed to either "H" or to "L"
26	A0	"H" = Display data , "L" = Control data
27	/RES	Reset signal
28	/CS1	Chip select signal

CN2. LED CONNECTOR, PHR-2 (JST) OR COMPATIBLE

PIN NO	SYMBOL	FUNCTION
1	A	Power Supply Voltage LED Backlight (4.2V)
2	K	GND

VIEW DIRECTION

NOTES:

1.RESOLUTION: 128X64 DOTS
2.BACKLIGHT: LED (YELLOW-GREEN)
3.DRIVER IC: S1D15605D00B000 or Compatible
4.GLASS THICKNESS: 0.7 mm
5.LED CONNECTOR: PHR-2 (JST) or Compatible

DIMENSION	TOLERANCE
L ≦ 6	±0.25 (mm)
6 < L ≦ 18	±0.3 (mm)
18 < L ≦ 50	±0.4 (mm)
50 < L ≦ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

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

LDC65H591CDS

	NAME	DATE	THIRD ANGLE P.
APPROVE			
CHECK			
DESIGN	C. B. LAN	95.02.13	SCALE: 1/1
DRAWN	C. B. LAN	95.02.13	UNIT: mm

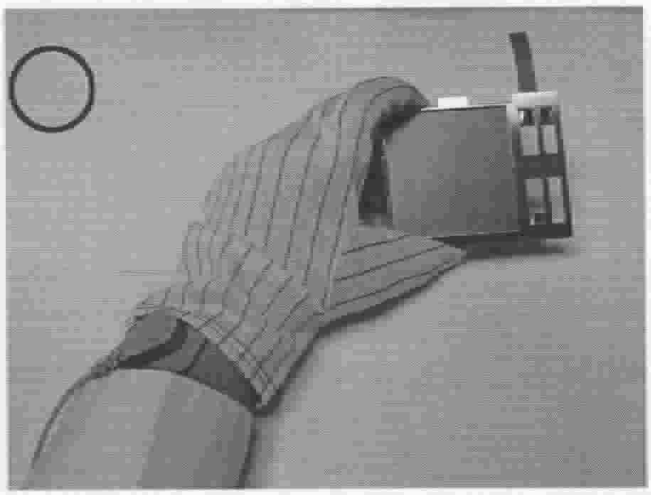
DWG NO. M591AD0A 0

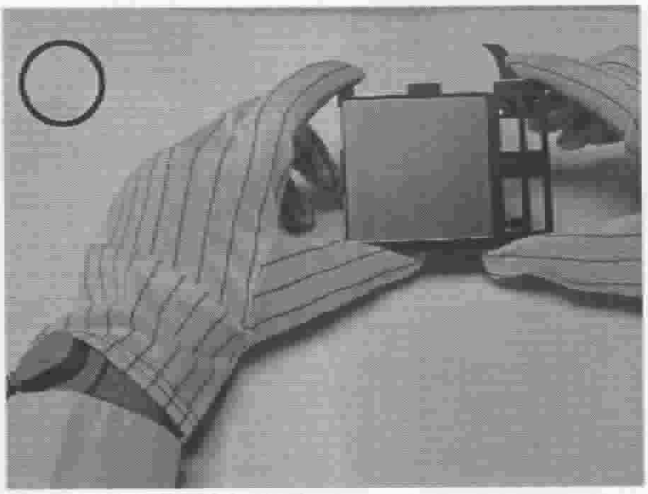
THE NOTES OF LCM USING

LCM is easy to damage.

Please follow the notes as bellows, and be careful of handling!

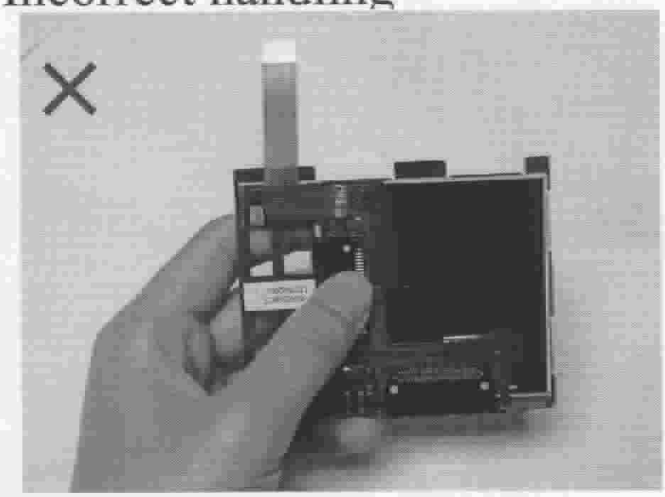
Correct handling



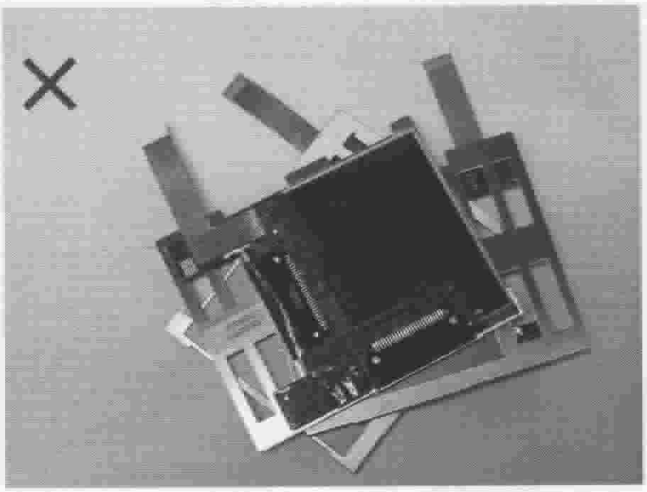


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

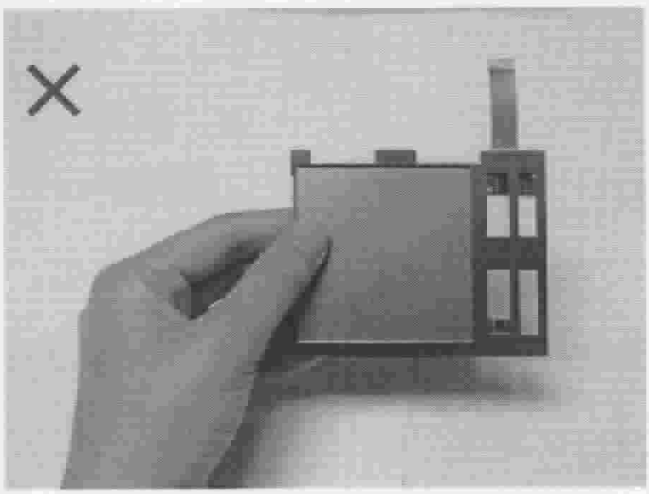
Incorrect handling



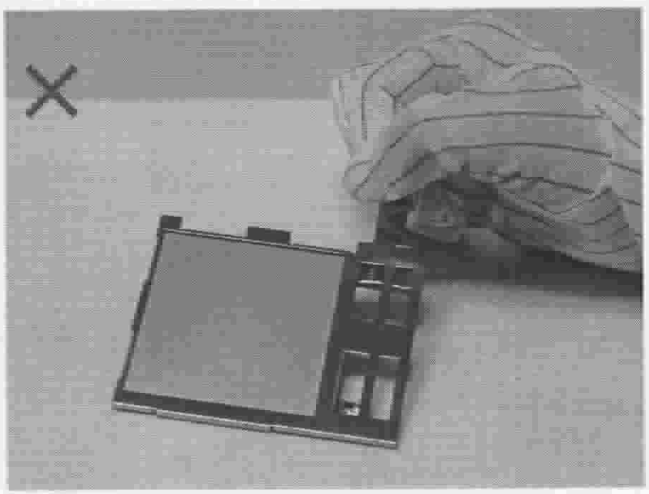
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.

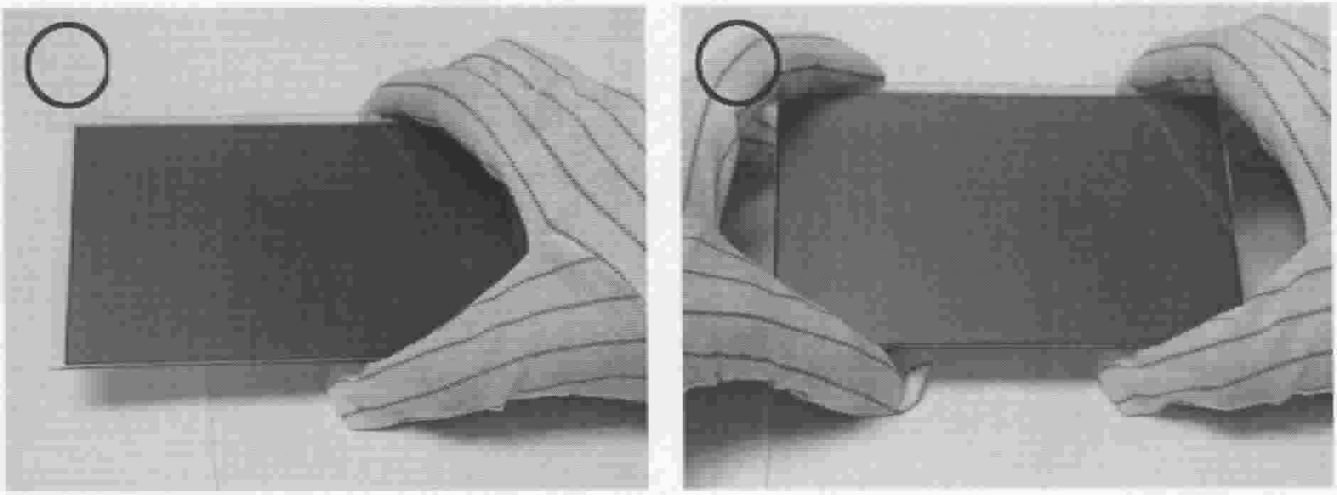


Please don't stretch interface of output.

THE NOTES OF LCD USING

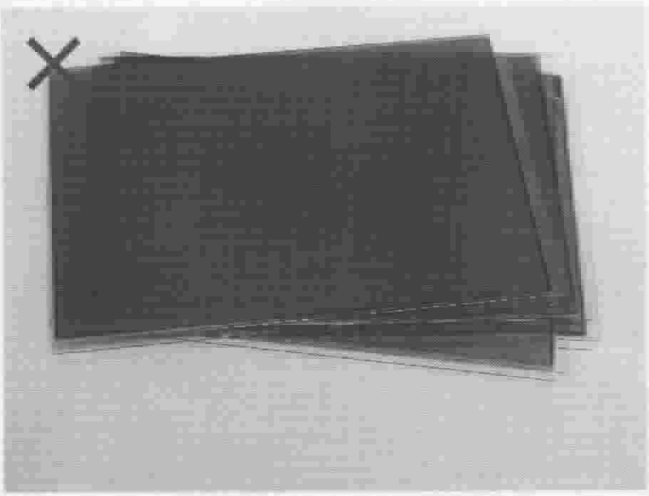
LCD is easy damage.
Please follow notes as bellows, and be careful of handling!

Correct handling

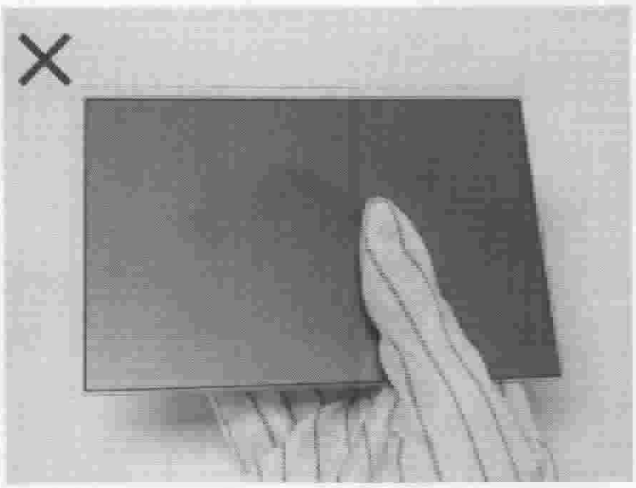


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

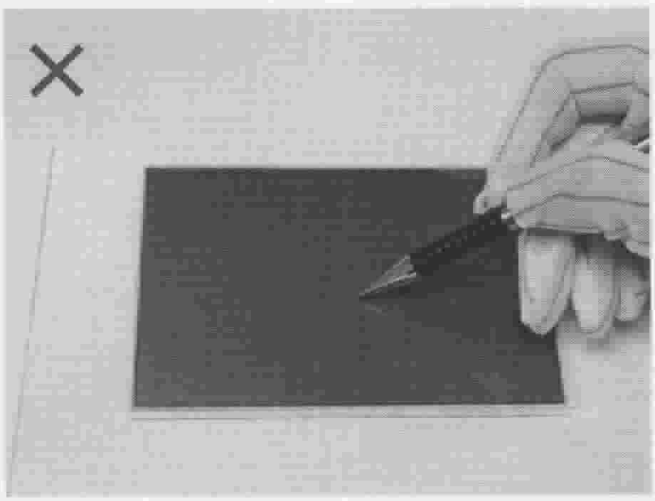
Incorrect handling



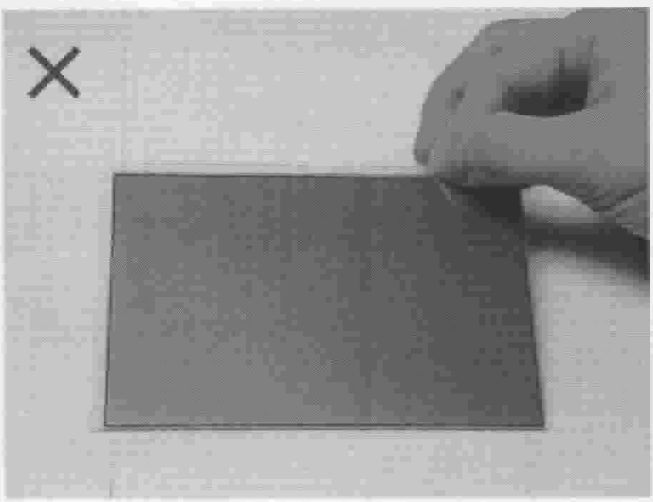
Please don't put one on another LCD.



Please don't hold the surface of LCD.



Please don't operate with sharp stick such as sharp pencil.



Please don't touch ITO glass without anti-static gloves.