LEADER TIME SRL

PRODUCT SPECIFICATION

240*64 Graphic COB LCD MODULE
MODEL: LT-24064A1-601 Ver:1.1

< ◇ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED By

Prepared By:

LEADER TIME SRL

VIA MONS. PROSDOCIMI, 27

36042 BREGANZE (VI)

- This specification is subject to change without notice. Please contact LT or it's representative before designing your product based on this specification.

Revision Status

Version	Revise Date	Page	Content	Modified By
Ver. 1.0	2010-5-24		First Issued	
Ver. 1.1	2010-7-3	6,19	Modify the definition of PIN 19	

Table of Contents

1. FEATURES

The features of LCD are as follows

* Display mode : FSTN /Tranflective/Positive
* Controller IC : SAP1024B
* Interface : 8-bit
* Driving Method : 1/64 Duty,1/9 Bias
* Viewing Direction : 6 O'clock
* Backlight : LED/Side (White)
* Sample NO : EG2406C3FSW6B-1.0/20100521

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	180(W)×65(H)×13MAX(T)	mm
Number of Dots	240 x 64Dots	-
View Display Area	132(W)×39(H)	mm
Activity Display Area	127.16(W)×33.88(H)	mm
Dot Size	0.53(W)×0.53 (H)	mm
Dot Pitch	0.49(W)×0.49(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1. ABSOLUTR MAXIMUM RATINGS (Ta=25°C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V_{DD}–V_{SS}	-0.3	-	7.0	V
Supply Voltage For LCD Drive	V_{OP}=V_{DD}–V_{EE}	0	-	30	V
Input Voltage	Vin	-0.3	-	$V_{DD+0.3}$	V
Operating Temp.	Top	-20	-	+70	°C
Storage Temp.	Tst	-30	-	+80	°C

NOTE: The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

3-2. ELECTICAL CHARACTERISTICS(Ta=25°C)

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage		V_{DD}–V_{SS}	V_{DD}=5V ± 10% Ta=25 °C	4.5	5.0	5.5	V
LCD Drive		V_{OP}=V_{DD}–V_{EE}		11.35	11.65	11.95	V
Input Voltage	"H" Level	V_{IH}		V_{DD}-2.2	-	V_{DD}	V
	"L" Level	V_{IL}		0	-	0.8	V
Frame Frequency		f_{FLM}		-	60	-	Hz
Current Consumption		I_{DD}		-	10.9	-	mA

3-3. BACKLIGHT

3-3-1. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Current	IF	Ta=25 °C	-	-	45*2	mA
Reverse Voltage	VR		-	-	5	V
Power Dissipation	PD		-	-	153*2	mW

3-3-2. Electrical-optical Characteristics (Ta=25°C)

Item	Symbol	Condition	Min.		Typ.		Max.		Unit
Forward Voltage	VF	If=45*2mA Ta=25 °C	2.8		3.2		3.4		V
Average Luminous Intensity	Iv		-		200		-		cd/㎡
Colour coordonate	-		x	y	x	y	x	y	-
			0.25	0.25	-	-	0.33	0.33	

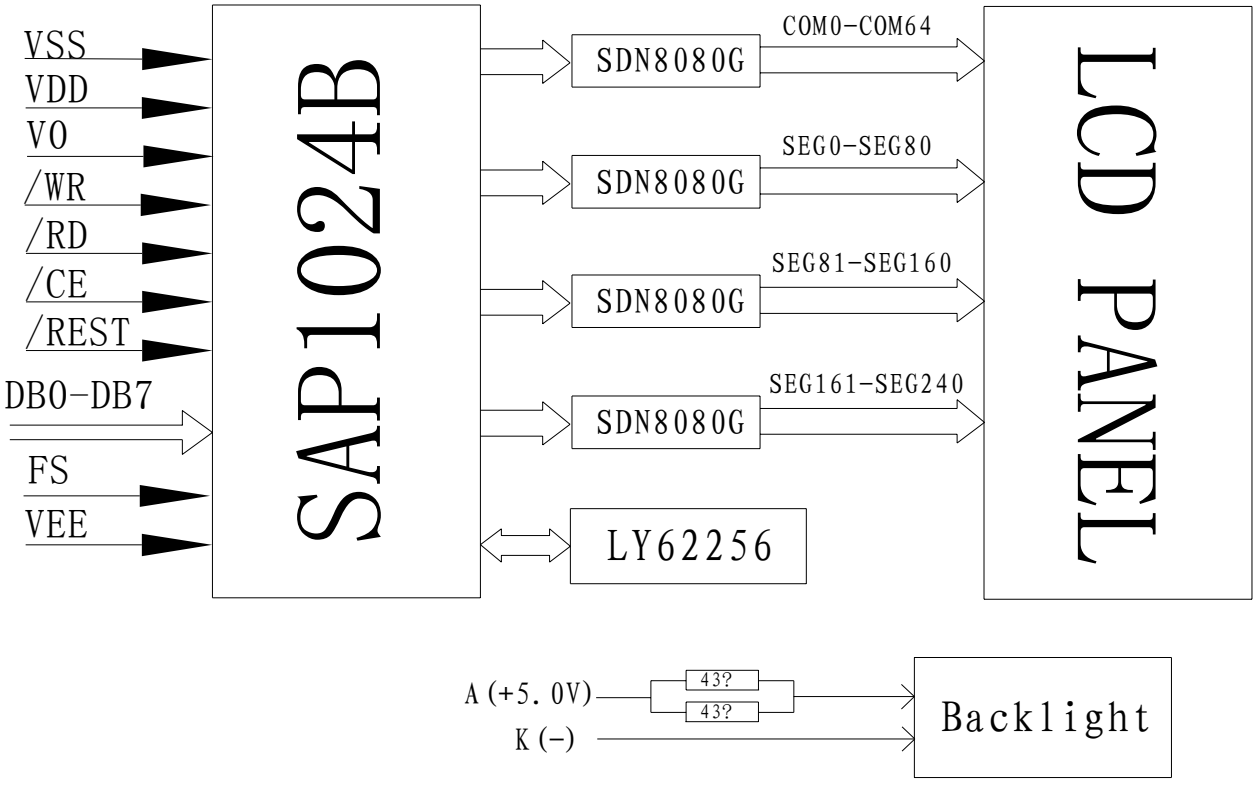
The brightness is measured without LCD panel

SS4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

4-1. INTERFACE PIN FUNCTION DESCRIPTION

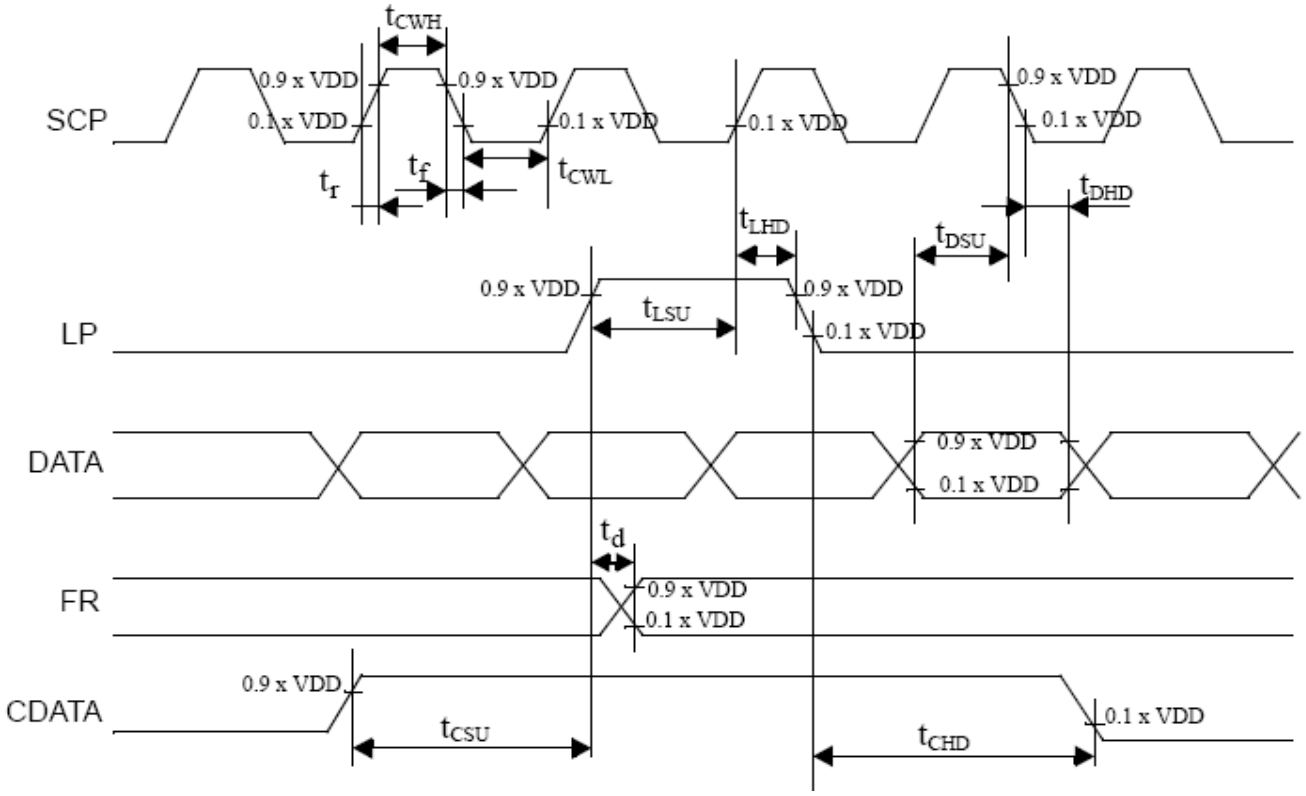
No.	Symbol	Function
1	FG	Frame GND
2	VSS	Ground(0V)
3	VDD	Power supply for the logic (+5V)
4	V0	Power supply for the LCD drive
5	/WR	Write signal
6	/RD	Read signal
7	/CE	Chip enable signal
8	C/D	Instruction(C/D=H) or Data(C/D=L) select signal
9	NC	No Connection
10	/REST	Reset signal
11-18	DB0~DB7	Data bus lines
19	FS	Font selection terminal
20	VEE	Negative voltage output
21	A	Blacklight(+)5.0V
22	K	Blacklight(-)0V

4-2. BLOCK DIAGRAM



5. TIMING CHARACTERISTICS

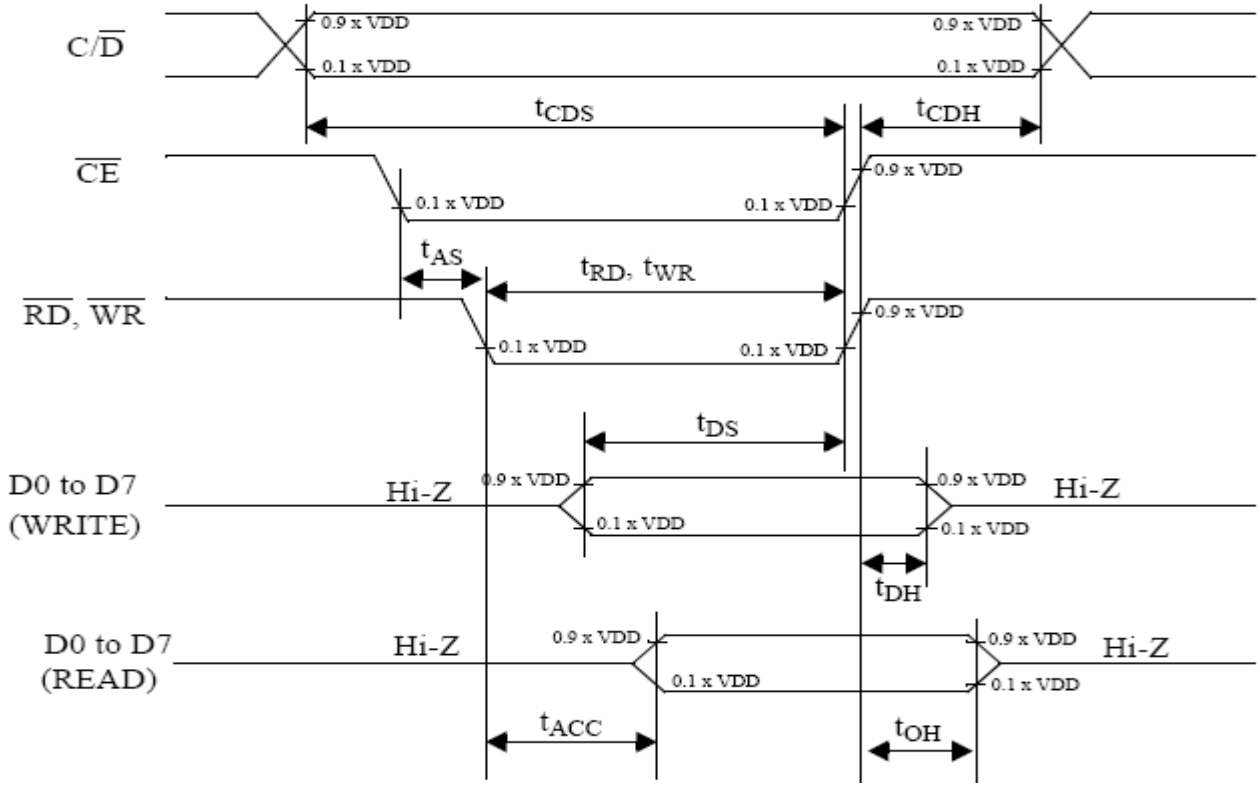
5-1.Driver clock characteristics



V_{DD} = 5 V ±10%; V_{SS} = 0 V; all voltages with respect to V_{SS} unless otherwise specified; T_{amb} = –20 to +70 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f_{SCP}	Operating frequency	T_{amb} = –10 to +70 °C		2.75	MHz
T_{CWH}, T_{CWL}	SCP pulse width		150		ns
T_r, T_f	SCP Rise/Fall time			30	ns
t_{LSU}	LP set-up time		150	290	ns
t_{LHD}	LP hold time		5	40	ns
t_{DSU}	Data set-up time		170		ns
t_{DHD}	Data hold time		80		ns
t_d	Frame delay time			90	ns
t_{CSU}	CDATA set-up time		450	850	ns
t_{CHD}	CDATA hold time		450	950	ns

5-2.Microcontroller bus interface timing



V_{DD} = 5 V ±10%; V_{SS} = 0 V; T_{amb} = -20 °C to +70°C.

symbol	parameter	MIN.	MAX.	test conditons	Unit
t_{CDS}	C/$\overline{D}$ set-up time	100			ns
t_{CDH}	C/$\overline{D}$ hold time	10			ns
t_{RD}, t_{WR}	$\overline{RD}$, $\overline{WR}$ pulse width	80			ns
t_{AS}	Address set-up time	0			ns
t_{AH}	Address hold time	0			ns
t_{DS}	Data set-up time	80			ns
t_{DH}	Data hold time	40		Note	ns
t_{ACC}	Access time		150	Note	ns
t_{OH}	Output hold time	10	50	Note	ns

6. COMMAND LIST

6-1. command table

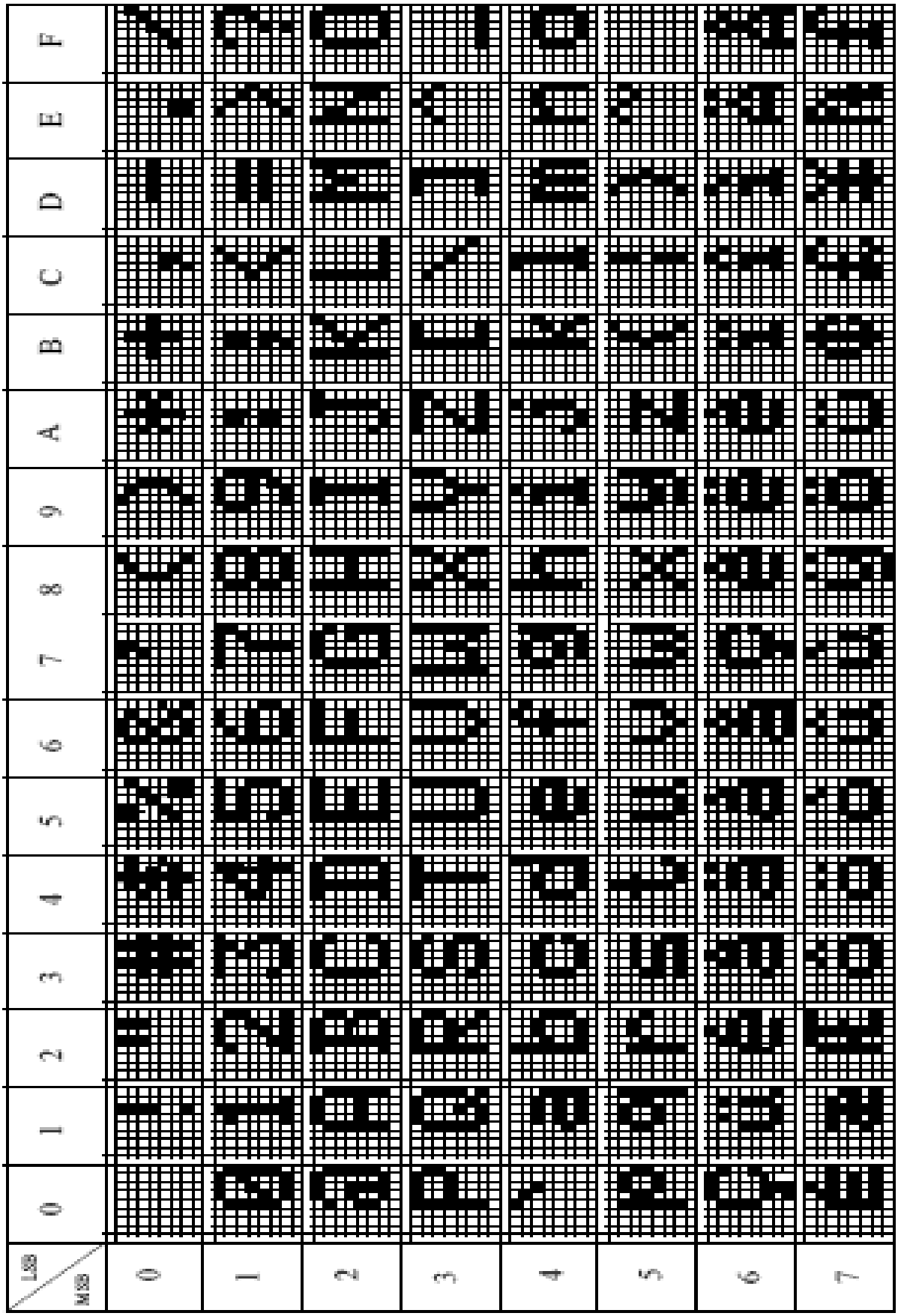
COMMAND	CODE	OPERAND 1	OPERAND 2	FUNCTION
Register Setting	0010 0001	X address	Y address	Set cursor pointer
	0010 0010	Data	00H	Set offset register
	0010 0100	Low address	High address	Set address pointer
Set Control Word	0100 0000	Low address	High address	Set text home address
	0100 0001	Columns	00H	Set text area
	0100 0010	Low address	High address	Set graphic home address
	0100 0011	Columns	00H	Set graphic area
Mode Set	1000 x000			OR mode
	1000 x001			EXOR mode
	1000 x011			AND mode
	1000 x100			Text Attribute mode
	1000 0xxx			Internal CG ROM mode
	1000 1xxx			External CG RAM mode
Display mode	1001 0000			Display OFF.
	1001 xx10			Cursor ON, blink OFF.
	1001 xx11			Cursor ON, blink ON.
	1001 01xx			Text ON, graphic OFF.
	1001 10xx			Text OFF, graphic ON.
	1001 11xx			Text ON, graphic ON.
Cursor Pattern Select	1010 0000			Selec one-line cursor.
	1010 0001			Select two-line cursor.
	1010 0010			Select three-line cursor.
	1010 0011			Select four-line cursor.
	1010 0100			Select five-line cursor.
	1010 0101			Select six-line cursor.
	1010 0110			Selec seven-line cursor.
	1010 0111			Select eight-line cursor.
Data Auto Read/Write	1011 0000			Select Data Auto Write
	1011 0001			Select Data Auto Read
	1011 0010			Reset Auto Read/Write
Data READ / WRITE	1100 0000	Data		Data Write and increment Address Pointer
	1100 0001			Data Read and increment Address Pointer
	1100 0010	Data		Data Write and decrement Address Pointer.
	1100 0011			Data Read and decrement Address Pointer
	1100 0100	Data		Data Write and Keep Address Pointer
	1100 0101			Data Read and Keep Address Pointer
Screen Peek	1110 0000			Screen peek
Screen Copy	1110 1000			Screen copy
Bit Set/Reset	1111 0xxxx			Bit Reset
	1111 1xxxx			Bit Set
	1111 x000			Bit 0
	1111 x001			Bit 1
	1111 x010			Bit 2
	1111 x011			Bit 3
	1111 x100			Bit 4
	1111 x101			Bit 5
	1111 x110			Bit 6
	1111 x111			Bit 7

7. CHARACHER GENERATOR ROM

7-1. CG ROM code 0101

Character Code Map

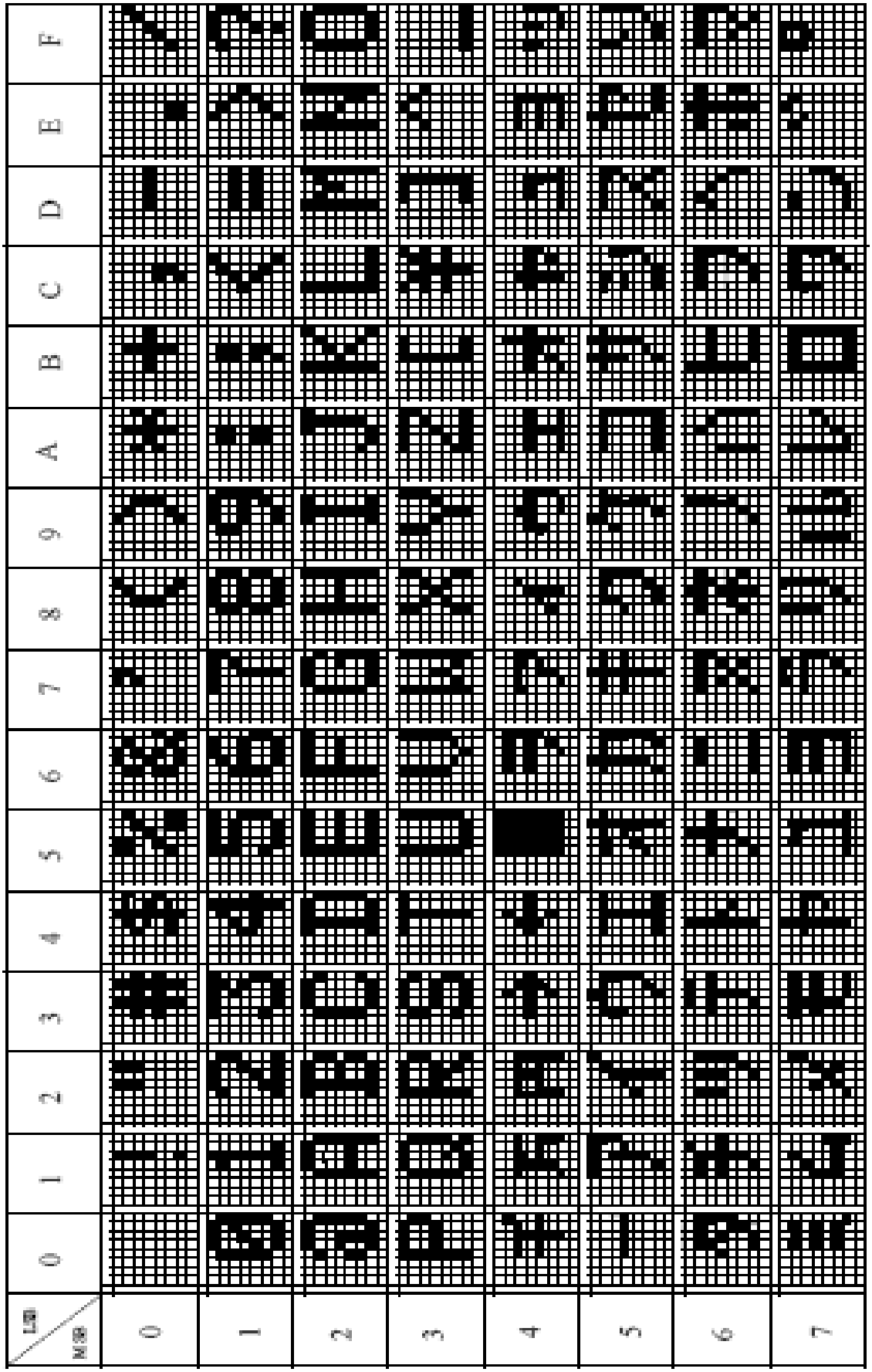
The relation between character codes and character pattern (CG ROM TYPE 0101)



7-2. CG ROM code 0201

Character Code Map

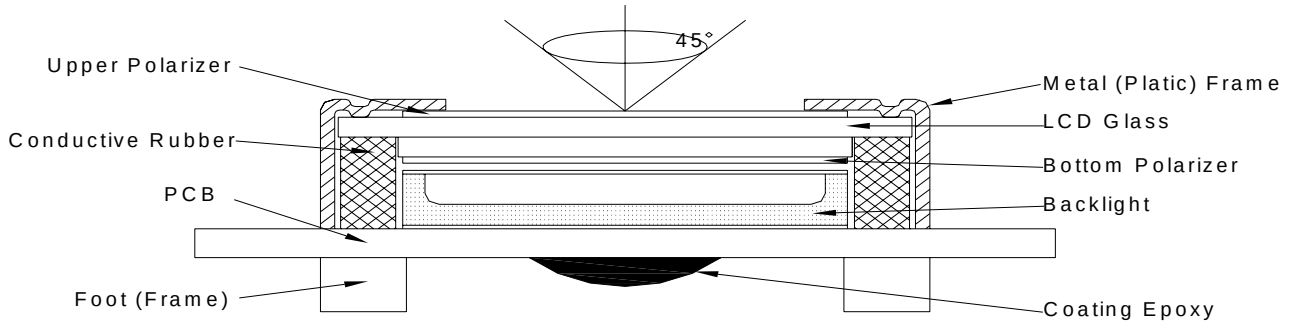
The relation between character codes and character pattern (CG ROM TYPE 0201)



8. QUALITY SPECIFICATIONS

8-1. LCM Appearance and Electric inspection Condition

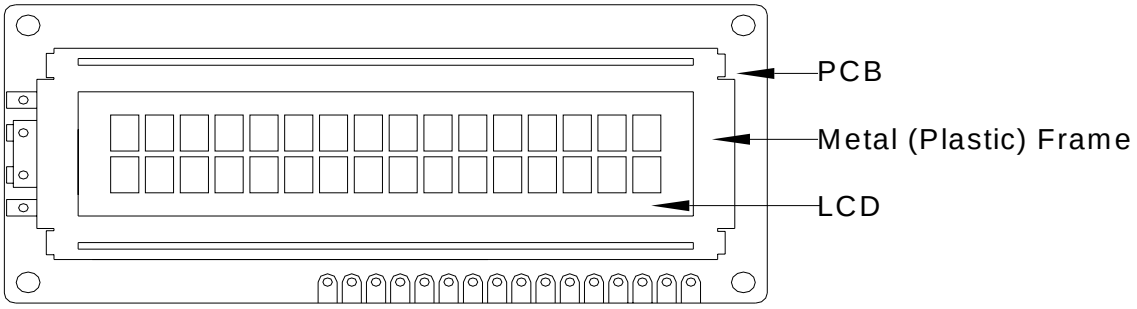
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



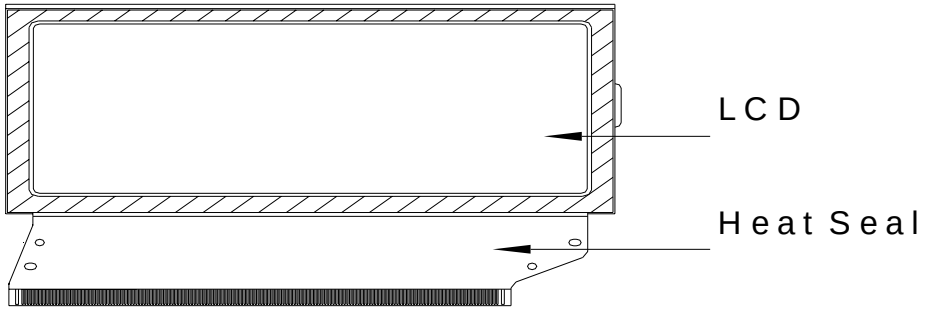
2. View Angle: with in 45˚around perpendicular line.

8-2. Definition

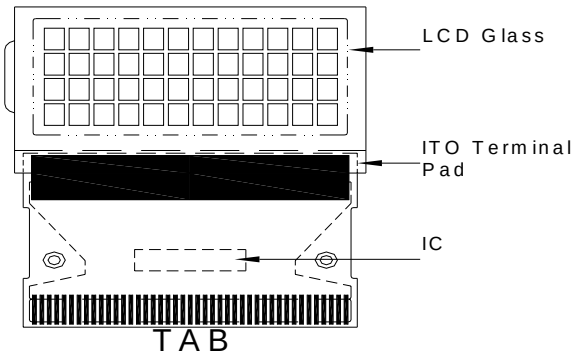
1. COB

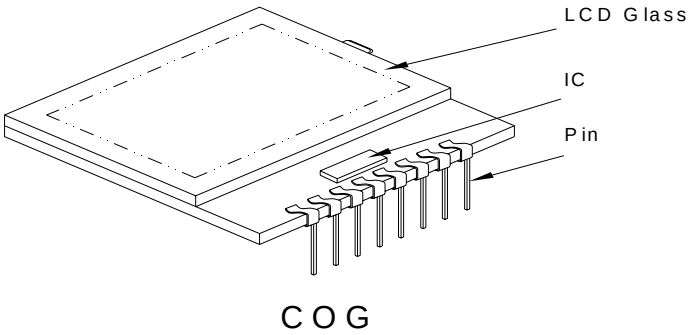


2. Heat Seal



3. TAB and COG





8-3. Sampling Plan and Acceptance

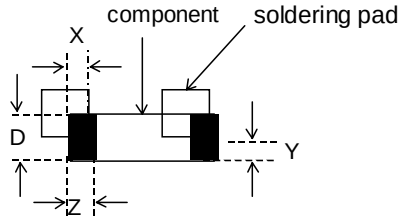
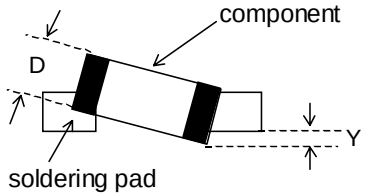
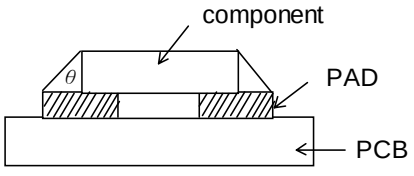
1. Sampling Plan
   MIL - STD - 105E (‖) ordinary single inspection is used.
2. Acceptance
   Major defect: AQL = 0.25%
   Minor defect: AQL = 0.65%

8-4. Criteria

1. COB

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm^2	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

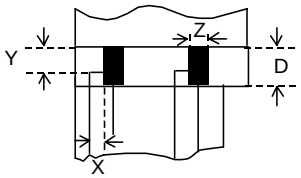
2. SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation		Reject
Minor	Component position shift 	X < 3/4Z Y > 1/3D	Reject Reject
Minor	Component tilt 	Y > 1/3D	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	Reject

3. Metal (Plastic) Frame

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1≤w<0.2mm	L≤5.0mm	2
		0.2≤w<0.3mm	L≤3.0mm	1
		w≥0.3mm	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L+W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0$mm		2
		$1.0 < \Phi \leq 1.5$mm		1
		$1.5\text{mm} < \Phi$		0
		Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored		
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

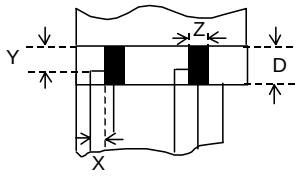
4. Flexible Film Connector (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle +5°	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L+W}{2}$	Expose the conductive line	Reject
		Φ > 1.0mm	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject

5. Screw

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

6. Heatseal 、TCP 、FPC

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L+W}{2}$	Φ> 0.5mm	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject
Major	Conductive line break		Reject

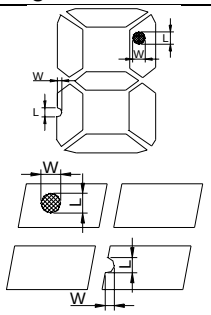
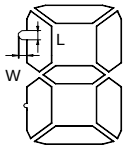
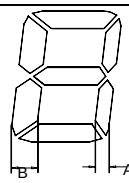
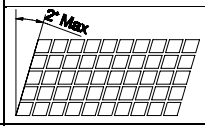
7. LED Backing Protective Film and Others

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq$0.10mm	Ignore
		0.10< $\Phi \leq$0.15mm	2
		0.15< $\Phi \leq$0.2mm	1
		Φ>0.2mm	0
		The distance between any two spots should be $\geq$5mm Any spot/dot/void outside of viewing area is acceptable	
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

8. Electric Inspection

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

9. Inspection Specification of LCD

<table>
<tr><th>Defect</th><th colspan="2">Inspect Item</th><th colspan="6">Inspection Standards</th></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Linear Defect</td><td rowspan="4">∗ Glass Scratch
∗ Polarizer Scratch
∗ Fiber and Linear material</td><td>W</td><td colspan="2">W≤0.03</td><td colspan="2">0.03<W≤0.05</td><td>W>0.05</td></tr>
<tr><td>L</td><td colspan="2">L<5</td><td colspan="2">L<3</td><td>Any</td></tr>
<tr><td>ACC. NO.</td><td colspan="2">1</td><td colspan="2">1</td><td>Reject</td></tr>
<tr><td>Note</td><td colspan="5">L is the length and W is the width of the defect</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Black Spot and Polarizer Pricked</td><td rowspan="3">∗ Foreign material between glass and polarizer or glass and glass
∗ Polarizer hole or protuberance by external force</td><td>Φ</td><td>Φ≤0.1</td><td>0.1<Φ≤0.15</td><td>0.15<Φ≤0.2</td><td>Φ>0.2</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="4">Φ is the average diameter of the defect.
Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">White Spot and Bubble in polarizer</td><td rowspan="3">∗ Unobvious transparant foreign material between glass and glass or glass and polarizer
∗ Air protuberance between polarizer and glass</td><td>Φ</td><td>Φ≤0.3</td><td>0.3<Φ≤0.5</td><td>0.5<Φ</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="3">Φ is the average diameter of the defect.
Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Segment Defect</td><td rowspan="4">  </td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">Note</td><td colspan="3">W is more than 1/2 segment width</td><td>Reject</td></tr>
<tr><td colspan="4">$\Phi = \frac{L + W}{2}$
Distance between two defect is 10mm</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Protuberant Segment</td><td rowspan="3"> 
Φ = (L + W) / 2</td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>W</td><td>Glue</td><td>W≤1/2 Seg
W≤0.2</td><td>W≤1/2 Seg
W≤0.2</td><td>Ignore</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm^2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="5">Minor</td><td rowspan="5">Assembly Mis-alignment</td><td rowspan="3">  </td><td colspan="5">1. Segment</td></tr>
<tr><td>B</td><td>B≤0.4mm</td><td>0.4<B≤1.0mm</td><td>B>1.0mm</td></tr>
<tr><td>B-A</td><td>B-A<1/2B</td><td>B-A<0.2</td><td>B-A<0.25</td></tr>
<tr><td>Judge</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td></tr>
<tr><td>  </td><td colspan="5">2. Dot Matrix</td></tr>
<tr><td colspan="4">Deformation>2°</td><td>Reject</td></tr>
<tr><td>Minor</td><td>Stain on LCD Panel Surface</td><td></td><td colspan="5">Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: “Black spot” and “White Spot”</td></tr>
</table>

9. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	70℃, 96Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	-20℃, 96Hrs	
3	High Humidity	60℃, 90%RH, 96Hrs	
4	High Temperature Storage	80℃, 96Hrs	
5	Low Temperature Storage	-30℃, 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	
7	Thermal Shock	-20℃ to 25℃ to 70℃ (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and –1 ~ –5kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 8kV and –1 ~ -8kV	

Note: 1) Above conditions are suitable for our company standard products.
2) For restrict products, the test conditions listed as above must be revised.

10. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichloro trifloro thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is reequired.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

11. OUTLINE DIMENSION