MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0800LT-1

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2010-12-13
Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2010/12/13	First Release	

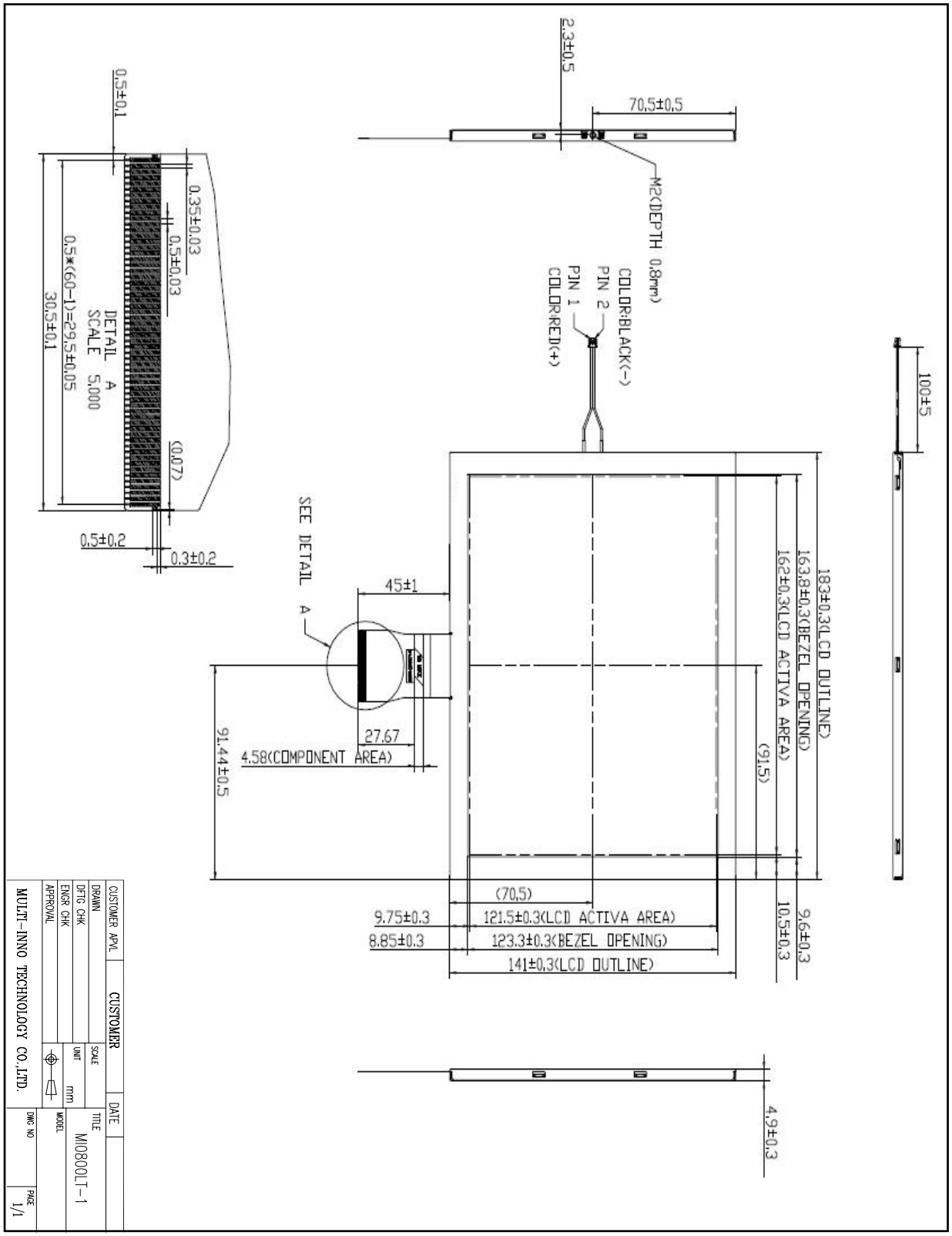
CONTENTS

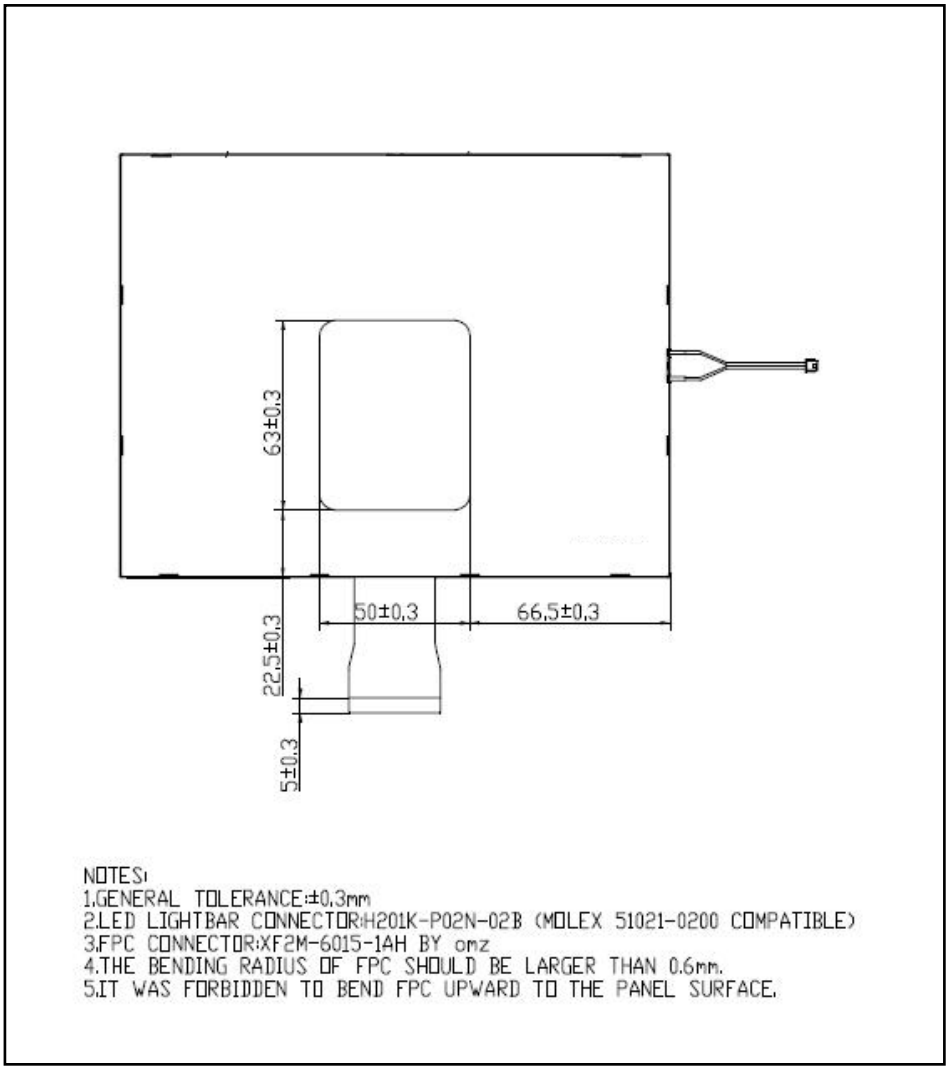
■ GENERAL INFORMATION

Item of general information	Contents	Unit
LCD size	8.0 (diagonal)	inch
LCD type	TFT/Normally White	/
Viewing direction	12:00	O' Clock
Gray scale inversion direction	6:00	O' Clock
Module area (W × H×T)	183.0×141.0×4.9	mm^3
Active area (W×H)	162.0×121.5	mm^2
Number of Dots	800×RGB×600	/
Pixel pitch (W × H)	0.2025×0.2025	mm^2
Color depth	16.2M	/
Interface Type	24 bit RGB+SPI	/
Color configuration	Tri-Gate	/
Panel surface treatment	Anti-Glare,3H	/
Input voltage	3.3	V
Panel power consumption	189	mw
Backlight power consumption	1.58	W
Backlight Type	18 LEDs	/
With/Without TSP	Without TSP	/
Weight	225	g

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.
Note 2 : RoHS compliant;
Note 3: LCM weight tolerance: ± 10%.

■ EXTERNAL DIMENSIONS





■ ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Power supply voltage	VDDIO	-0.5	5	V
	VDPA	-0.5	5.9	V
	VDNA	-5.9	0.5	V
	VGH	VDPA	-	V
	VGL	-	VDNA	V
	VGH-VGL	-	32.0	V
Input supply voltage	Vi	-0.3	VDDIO+0.3	V
	VCOM	-3.5	0	V
	V1-V5	0	VDPA-0.2	V
	V6-V10	VDNA+0.2	0	V
Operating temperature	Top	-10	60	°C
Storage temperature	TST	-30	70	°C
Humidity	RH	-	90%(Max60 °C)	RH

Note 1: DE, Digital Data.

Note 2: Functional operation should be restricted under ambient temperature (25℃).

Note 3: Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics chapter.

■ ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

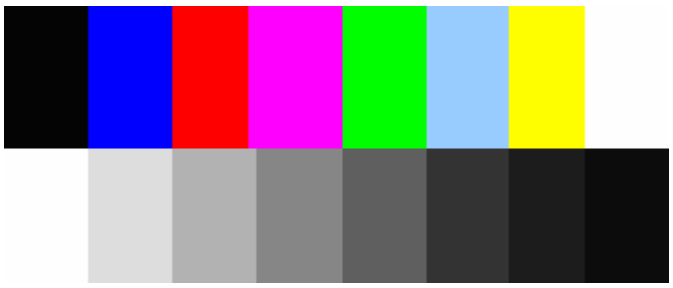
Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Power voltage	VDDIO	3.0	3.3	3.6	V
	VDPA	-	5	5.5	V
	VDNA	-5.5	-5.0	-	V
	VGH	-	14	-	V
	VGL	-	-14	-	V
VCOM	VCOM	-1.6	-1.9	2.2	V
Pull-up/down impedance	Rin	-	800	-	k
Input level of V1-V5	Vx	GND	-	VDPA-0.2	V
Input level of V6-V10	Vx	VDNA+0.2	-	GND	V
Input voltage 'H' level	VIH	0.7VDDIO	-	VDDIO	V
Input voltage 'L' level	VIL	0	-	0. 3VDDIO	V

Note 1: DE, Digital Data
Note 2 : VDPA > V1 > V2 > V3 > V4 > V5 > V6 > V7 > V8 > V9 > V10 > VDNA

CURRENT CONSUMPTION(AGND=GND=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Input current for VDDIO	IVDDIO	VDDIO=3.3V	-	6.45	7	mA	Note 1
Input current forVDPA	IVDPA	VDPA=5V	-	5.58	12.9	mA	Note 1
Input current for VDNA	IVDNA	VDNA=-5V	-	-5.68	-13.4	mA	Note 1
Input current for VGH	IVGH	VGH=14V	-	3.96	5	mA	Note 1
Inpur current for VGL	IVGL	VGL=-14V	-	-4.04	-5	mA	Note 1
Input Leakage Current	Iin	Digital input pins	-	-	±1	uA	Note 2

Note 1: The test pattern use the following pattern.

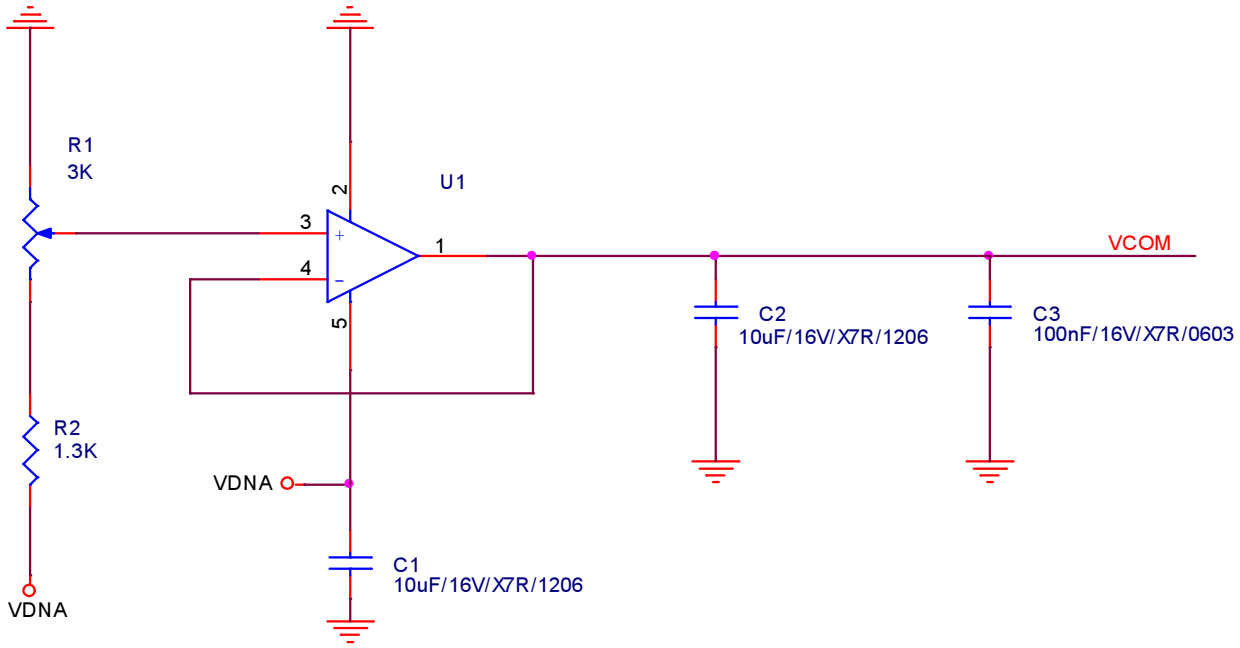


Note 2: except for pull-up, pull-down pins.

GAMMA VOLTAGE SUGGESTED CIRCUIT IS AS FOLLOWS

V1	4.296V
V2	2.929V
V3	2.358V
V4	2.012V
V5	1.003V
V6	-1V
V7	-1.958V
V8	-2.35V
V9	-2.853V
V10	-4.3V

Vcom BUFFER SUGGESTED CIRCUIT IS AS FOLLOWS

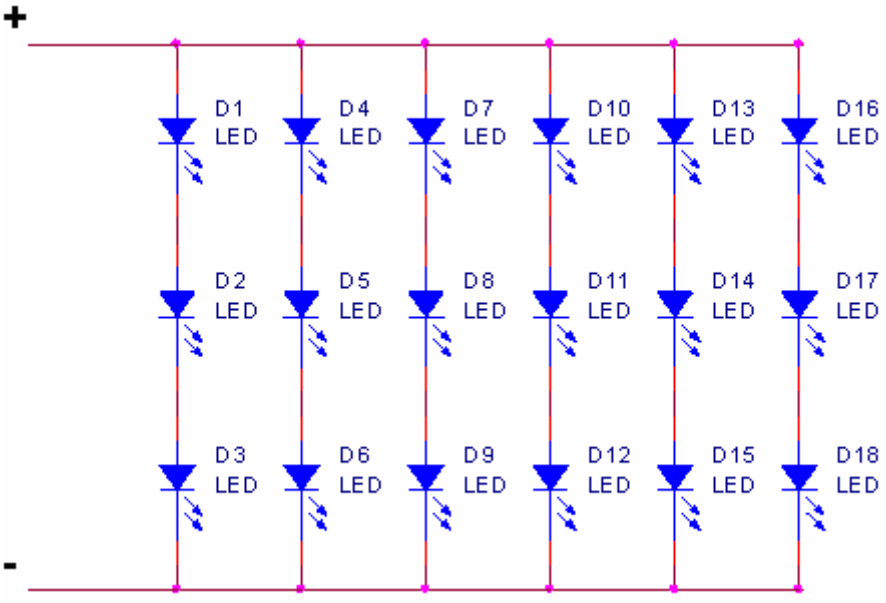


■ BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Condition
LED lightbar current	I	-	150	-	mA	If=150mA
Power consumption	P	-	1.58	1.68	W	Ta=25℃
LED life time	-	10000	-	-	Hr	

Note 1: LED backlight is LED lightbar type(18 pcs of LED).

Note 2: Definition of “LED Lifetime”: brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25℃ and LED lightbar current= 150mA



Note 3: The value is only for reference.

Note 4: If it operates with LED lightbar voltage more than 150mA, it maybe decreases LED lifetime.

■ ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	θ=0° ∅=0° Ta=25℃	-	30	60	ms	FIG 1.	4
Contrast ratio	Cr		400	500	-	--	FIG 2.	1
Luminance uniformity	δ WHITE		70	75	-	%	FIG 2.	3
Surface Luminance	Lv		200	250	-	cd/m^2	FIG 2.	2
Viewing angle range	θ	∅ = 90°	40	60	-	deg	FIG 3.	6
		∅ = 270°	50	65	-	deg	FIG 3.	
		∅ = 0°	60	70	-	deg	FIG 3.	
		∅ = 180°	60	70	-	deg	FIG 3.	
NTSC ratio	---	---	-	50	-	%	-	-
CIE (x, y) chromaticity	Red x	θ=0° ∅=0° Ta=25℃	0.560	0.610	0.660	-	FIG 2.	5
	Red y		0.300	0.350	0.40	-		
	Green x		0.270	0.320	0.370	-		
	Green y		0.510	0.560	0.610	-		
	Blue x		0.100	0.150	0.200	-		
	Blue y		0.070	0.120	0.170	-		
	White x		0.260	0.310	0.360	-		
	White y		0.280	0.330	0.380	-		

Note1. Contrast Ratio(CR) is defined mathematically by the following formula. For more information see FIG 2.:

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P 1,P2, P 3,P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P 3,P4, P5)}}$$

Note2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

Lv = Average Surface Luminance with all white pixels (P1, P2, P 3,P4, P5)

Note3. The uniformity in surface luminance（δ WHITE）is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta\ \mathbf{WHITE} = \frac{\textbf{Minimum Surface Luminance with all white pixels } \mathbf{(P_1, P_2, P_3, P_4, P_5)}}{\textbf{Maximum Surface Luminance with all white pixels } \mathbf{(P_1, P_2, P_3, P_4, P_5)}}$$

Note4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1..

Note5. CIE (x, y) chromaticity ,The x,y value is determined by screen active area position 5. For more information see FIG 2.

Note6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the conrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note7. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity and CIE， the testing data is base on TOPCON's BM-5 photo detector.

Note8. For TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle.

FIG.1. The definition of Response Time

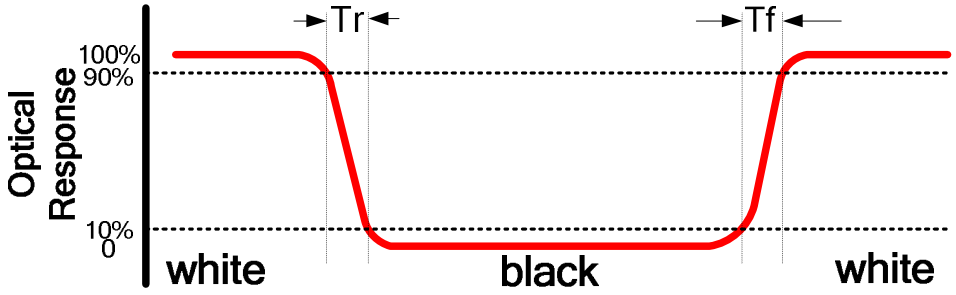


FIG.2. Measuring method for Contrast ratio,surface luminance, Luminance uniformity,CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=5mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

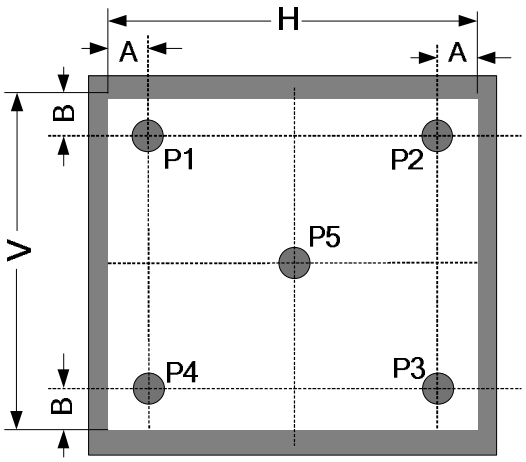
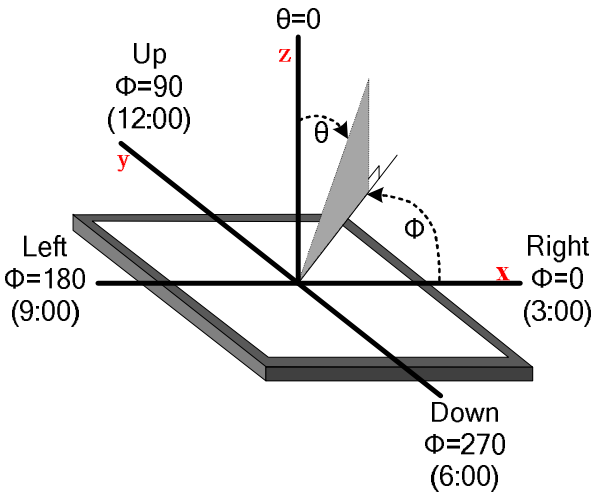


FIG.3. The definition of viewing angle



■ INTERFACE DESCRIPTION

NO.	Symbol	I/O	Description	Remark
1	VCOM	I	Common electrode driving voltage	
2	VGL	P	Negative power supply voltage for Gate driver	
3	VGH	P	Positive power supply voltage for Gate driver	
4	VGH	P	Positive power supply voltage for Gate driver	
5	VDPA	P	Positive power supply voltage for analog power	
6	VDNA	P	Negative power supply voltage for analog power	
7	GND	P	Ground	
8	DRV_BLU	O	CABC PWM_SIGNAL output via an output buffer	
9	CABC_EN	I	CABC function enable	
10	U/D	I	Up/Down selection.	Note2
11	R/L	I	Left/Right selection	Note2
12	GRB	I	H/W global reset	Note1
13	V10	I	Gamma correction voltage reference	
14	V9	I	Gamma correction voltage reference	
15	V8	I	Gamma correction voltage reference	
16	V7	I	Gamma correction voltage reference	
17	V6	I	Gamma correction voltage reference	
18	V5	I	Gamma correction voltage reference	
19	V4	I	Gamma correction voltage reference	
20	V3	I	Gamma correction voltage reference	
21	V2	I	Gamma correction voltage reference	
22	V1	I	Gamma correction voltage reference	
23	VDDIO	P	Digital interface supply voltage of digital	
24	VDDIO	P	Digital interface supply voltage of digital	
25	CS	I	Chip select (Low active) of SPI	
26	SDA	I/O	Data input/output of SPI	
27	SCL	I	Clock input of SPI	
28	GND	P	Ground	
29	DCLK	I	Data clock input	
30	GND	P	Ground	
31	DE	I	Data enable Input (High active)	
32	GND	P	Ground	
33	DB7	I	Blue data Input (MSB)	
34	DB6	I	Blue data Input	

35	DB5	I	Blue data Input	
36	DB4	I	Blue data Input	
37	DB3	I	Blue data Input	
38	DB2	I	Blue data Input	
39	DB1	I	Blue data Input	
40	DB0	I	Blue data Input (LSB)	
41	GND	P	Ground	
42	DG7	I	Green data Input (MSB)	
43	DG6	I	Green data Input	
44	DG5	I	Green data Input	
45	DG4	I	Green data Input	
46	DG3	I	Green data Input	
47	DG2	I	Green data Input	
48	DG1	I	Green data Input	
49	DG0	I	Green data Input (LSB)	
50	GND	P	Ground	
51	DR7	I	Red data Input (MSB)	
52	DR6	I	Red data Input	
53	DR5	I	Red data Input	
54	DR4	I	Red data Input	
55	DR3	I	Red data Input	
56	DR2	I	Red data Input	
57	DR1	I	Red data Input	
58	DR0	I	Red data Input (LSB)	
59	GND	P	Ground	
60	VCOM	I	Common electrode driving voltage	

Note1: Global reset, normally pulled high. Suggest to connecting with an RC (R=10K ohm, C=1uF)reset circuit for stability. Normally pull high.

Note2:

U/D	Direction	**L/R**	Direction
H	D → U	H	R → L
L	U→ D	L	L → R

Backlight Pin Assignment

Recommended connector : H201K-P02N-02B (MOLEX 51021-0200 COMPATIBLE)

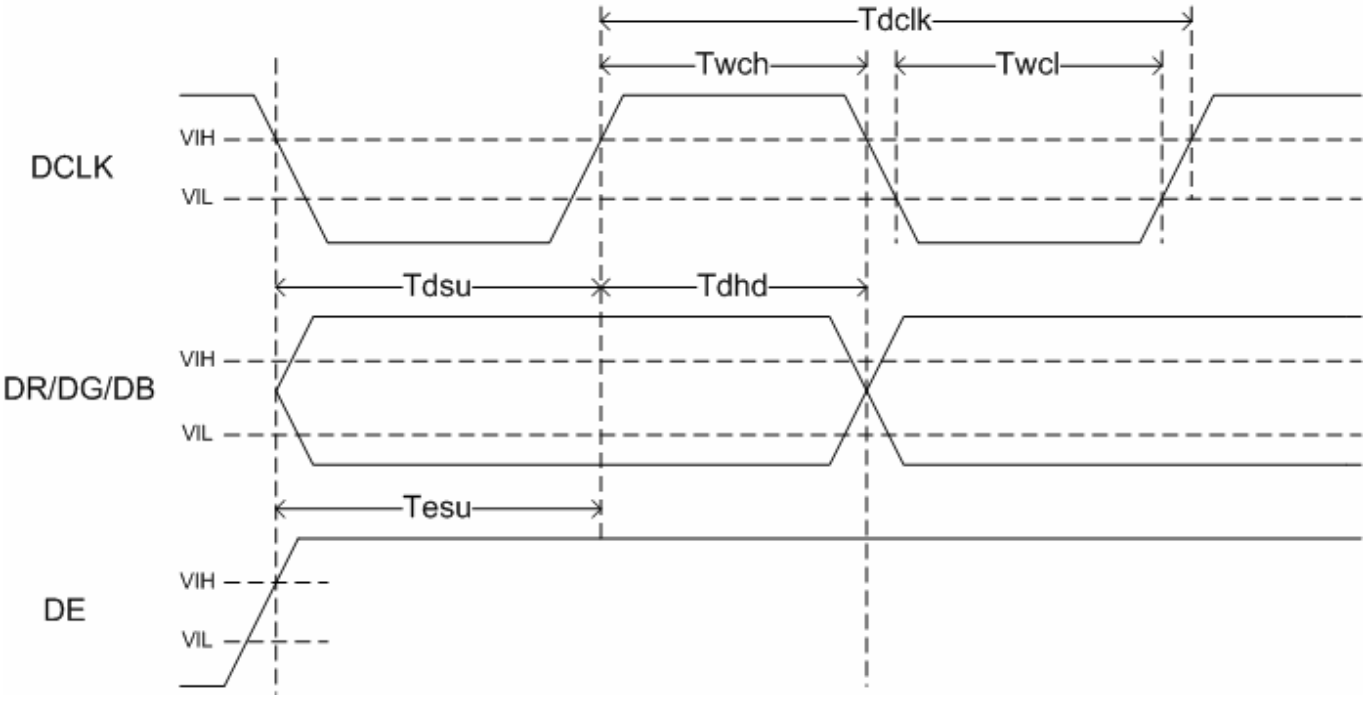
NO.	Symbol	I/O	Description	Remark
1	HI	I	Power supply for backlight unit (High voltage)	
2	GND	-	Ground for backlight unit	

■ REFERENCE APPLICATION NOTES

1. Electrical AC Characteristics

a. Signal AC Characteristics

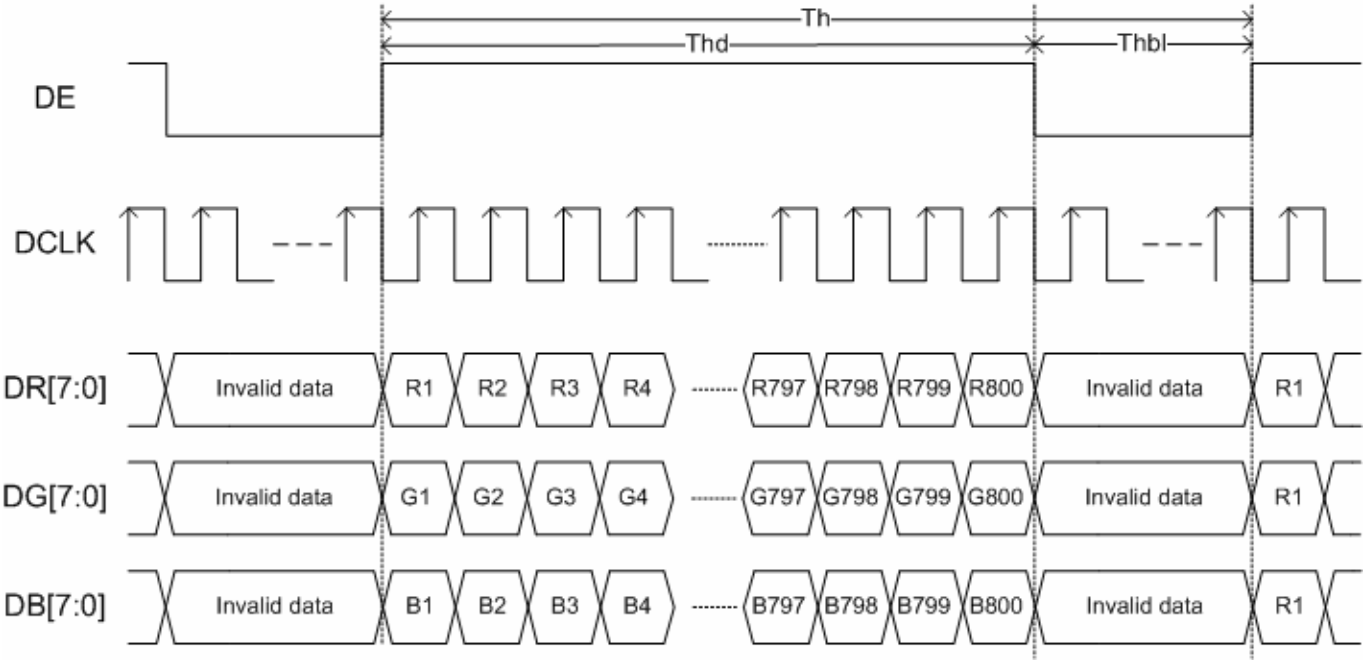
Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Clock High time	Twcl	8	--	--	ns	
Clock Low time	Twch	8	--	--	ns	
Data setup time	Tdsu	5	--	--	ns	
Data hold time	Tdhd	10	--	--	ns	
Data enable set-up time	Tesu	4	--	--	ns	



b. Input Timing Setting

Horizontal timing:

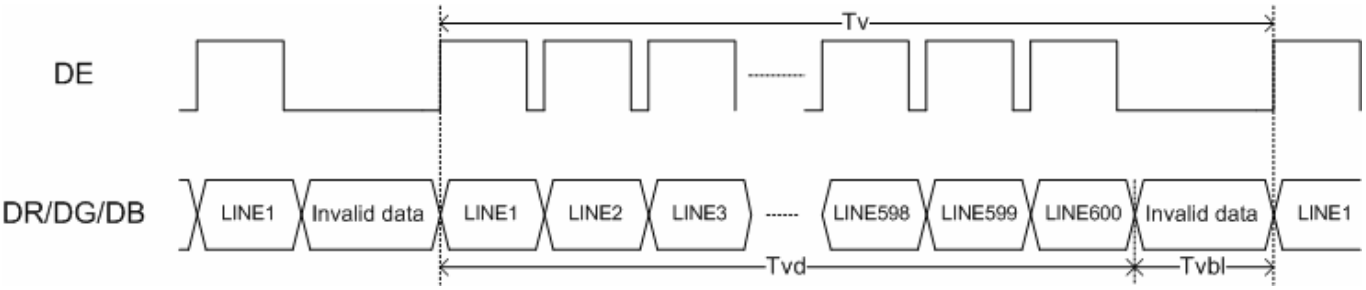
Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK frequency	Fdclk	36.7	40	45.1	MHz	
DCLK period	Tdclk	22	25	27	ns	
Hsync period (= Thd + Thbl)	Th	986	1056	1183	DCLK	
Active Area	Thd	--	800	--	DCLK	
Horizontal blanking	Thbl	186	256	383	DCLK	



Horizontal input timing

Vertical timing:

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Vsync period (= Tvd + Tvbl)	Tv	620	628	635	Th	
Active lines	Tvd	--	600	--	Th	
Vertical blanking	Tvbl	20	28	35	Th	

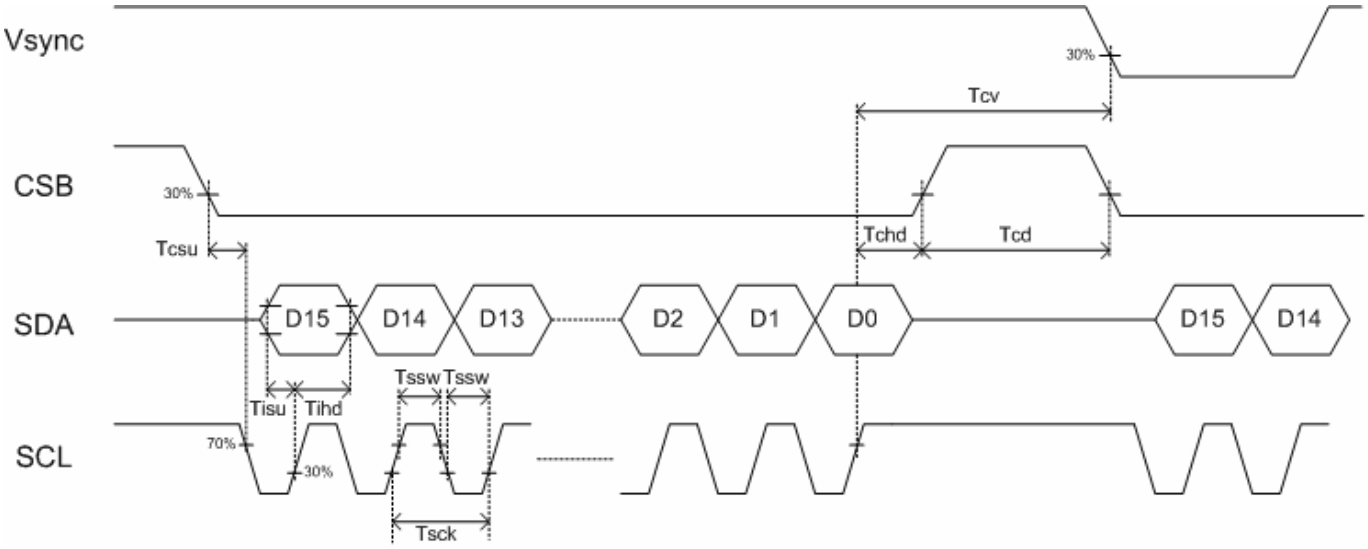


Vertical timing

2. Serial Interface Charateristics

a. Serial Control Interface AC Characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Serial clock	Tsck	320	--	--	ns	
SCL pulse duty	Tscw	40%	50%	60%	Tsck	
Serial data setup time	Tisu	120	--	--	ns	
Serial data hold time	Tihd	120	--	--	ns	
Serial clock high/low	Tssw	120	--	--	ns	
CSB setup time	Tcsu	120	--	--	ns	
CSB hold time	Tchd	120	--	--	ns	
Delay from CSB to VSYNC	Tcv	1	--	--	us	
Chip select distinguish	Tcd	1	--	--	us	



AC serial interface write mode timings

b. Register Bank

A totally 16-bit register includeing 7-bit address D[15:9], 1-bit Read bit D[8], and 8-bit data D[7:0] can be set via 3-wire serial peripheral interface. Beflow figure is for a detail description of the parameters.

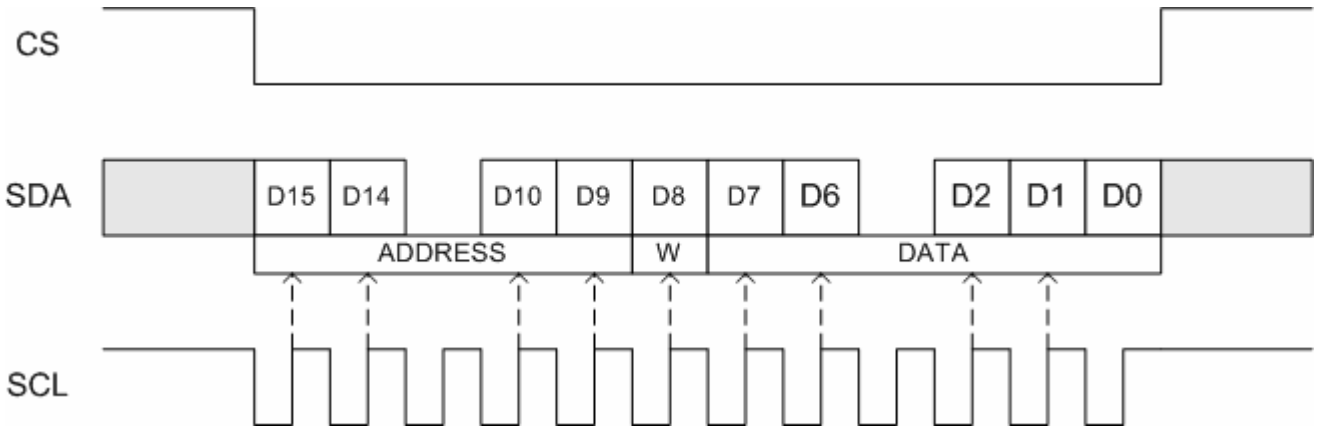


Figure. Serial interface read sequence

(1) Each serial command consists of 16bits of data which is loaded one bit a time at the rising edge of serial slock SCL.

(2) Command loading operation starts from the falling edge of CS and is completed at the next rising edge of CS.

(3) The serial control block is operational after power on reset, but commands are established by the following rising edge of End Frame. If command is transferred multiple times for the same resgister, the last command before the following rising edge of the End Frame is valid, except for some special registers (ex. GRB, etc.).

(3) If less the 16 bits of SCL are input while CS is low, the transferred data is ignored. The read operation interrupt.

(4) If 16 bits or more of SCL are input while CS is low, the first 16 bits of transferred data in the duration of CS="L" are valid data.

(5) Serial block operates with the SCL clock

(6) Serial data can be accepted in the standy(power save) mode.

(7) It is suggested that DE, DCLK always exists in the same time.

(8) When GRB is activated through the serial interface, all register are cleared, except the GRB value.

(9) The register setting values are rewritten by the influence of static electricity, a noise, etc. to unsuitable value, incorrect operating may occur. It is suggested that the SPI interface will setup as frequently as possible.

c. Serial Interface Setting Table.

Reg	ADDRESS							R	DATA							
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
R0	0	0	0	0	0	0	0	0	--	--	--	--	--	--	0	1
R1	0	0	0	0	0	0	1	0	--	--	--	--	00		00	

d. Register Description

R0 setting

Address	Bit	Discription		Default
000000	7 - 2	-	Internal use	000111
	1	STB	Standby mode setting	0
	0	GRB	S/W global reset	1

Bit 1	STB
0	Nomal operation **(default)**
1	Standby mode. Register data are kept.

Bit 0	GRB
0	S/W global reset. Reset all register to default value. H/W GRB has higher priority.
1	Normal operation. **(default)**

R1 Settings

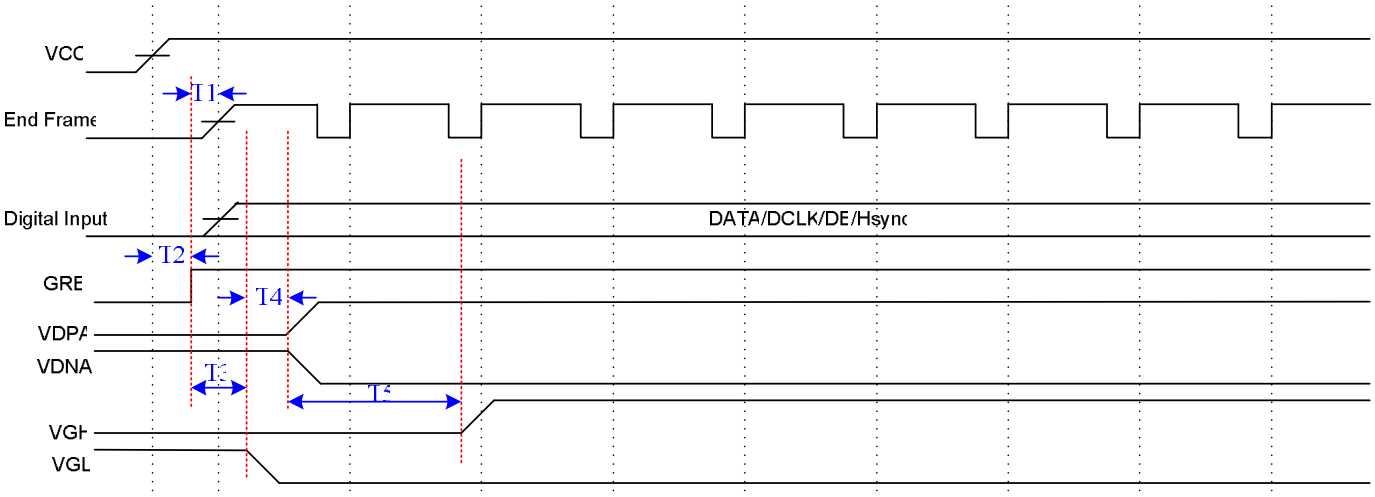
Address	Bit	Discription		Default
000001	7 - 4	-	Internal use	0000
	3 - 2	CHUD	Vertical scan direction setting	00
	1 - 0	CHLR	Horizontal scan direction setting	00

Bit 3 - 2	CHUD
0x	Accoring to H/W pin U/D setting. **(default)**
10	Vertical scan direction is from up to down.
11	Vertical scan direction is from down to up.

Bit 1 - 0	CHLR
0x	Accoring to H/W pin L/R setting. **(default)**
10	Horizontal scan direction is from left to right.
11	Horizontal scan direction is from right to left.

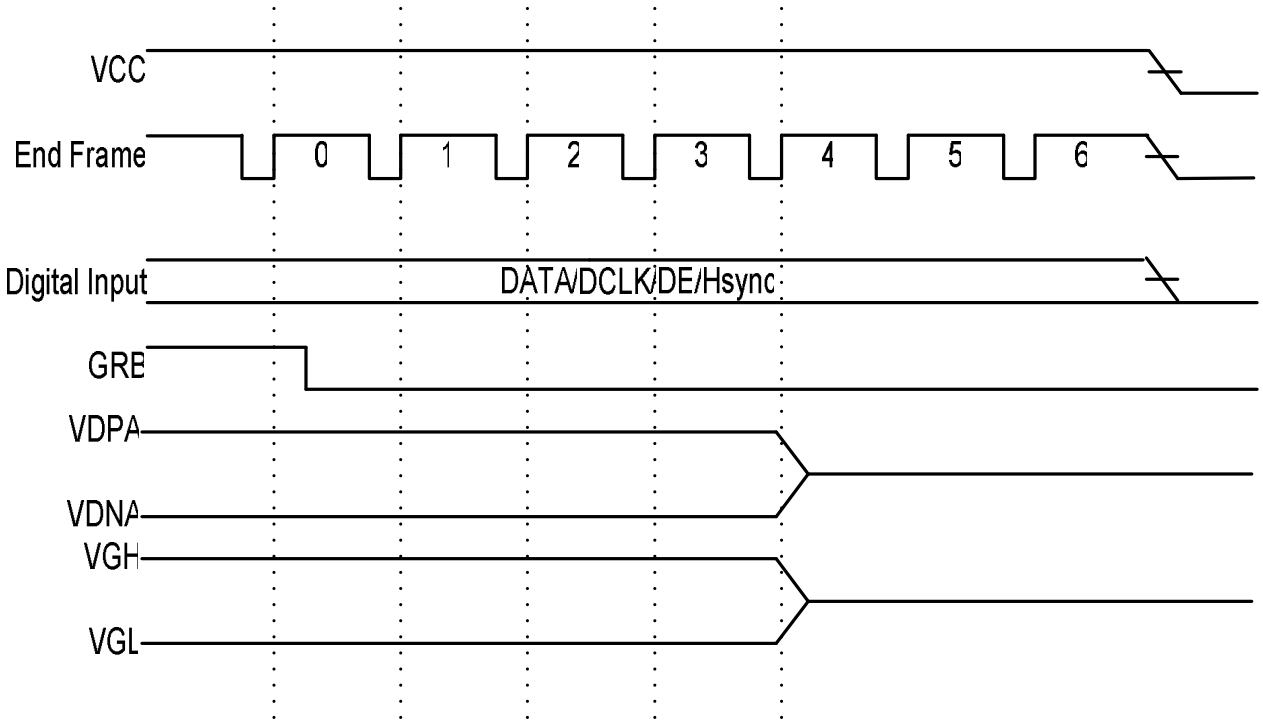
3. Power On/Off Characteristics

a. Recommended Power On Sequence



T1 > 0us; T2 ≧ 10us ; T3 ≧ 0us ; T4 > 0us ; T5 > 0us

b. Power Off Sequence



■ RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	70±2℃/240 hours	
2	Low Temperature Storage	-30±2℃/240 hours	
3	High Temperature Operating	60±2℃/240 hours	
4	Low Temperature Operating	-10±2℃/240 hours	
5	Temperature Cycle	-10±2℃~25~60±2℃×100cycles	Non-operation
6	Damp Proof Test	50℃±5℃×80%RH/240 hours	Operation
7	Image Sticking	25℃,4hrs	
8	Cold Start Test	-30℃/1 Hr (min.), power on/off per 5 minutes, repeat 5 times	Note 2
9	Vibration	Frequency range :10~55Hz,Stoke: 1.5mm Sweep:10~55 ~10Hz,2 hours for each direction of X,Y,Z(6 hours for total)	Non-operation JIS C7021, A-10 condition A:15 minutes
10	Mechanical Shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction	Non-operation JIS C7021,A-7 condition C
11	ESD test	Contact = ± 4 kV, class B Air = ± 8 kV, class B	
12	Vibration (With Carton)	Random vibration: 0.015G2/Hz from 5~200Hz -6dB/Octave from 200~500Hz	IEC 68-34
13	Drop (With Carton)	Height:60cm 1 corner, 3 edges, 6 surfaces	

Note 1: Ta: Ambient Temperature. Tp: Panel Surface Temperature

Note 2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

Note 3: All the cosmetic specification is judged before the reliability stress.

■ INSPECTION CRITERION

This specification is made to be used as the standard acceptance/rejection criteria for Normal LCM Product.

1 Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

Major defect: AQL 0.65

Minor defect: AQL 1.5

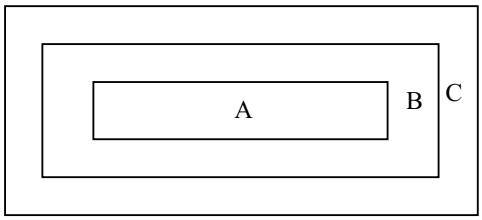
2. Inspection condition

●Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45°against perpendicular line. (Normal temperature 20~25°C and normal humidity 60±15%RH).

● Driving voltage

The Vop value from which the most optimal contrast can be obtained near the specified Vop in the specification (Within ±0.5V of the typical value at 25°C.).

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

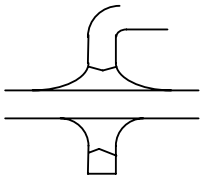
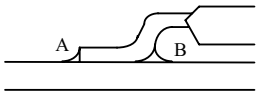
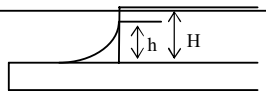
4.Inspection Standard

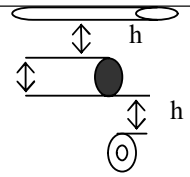
4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical，horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	

4.2 Cosmetic Defect

4.2.1 Module Cosmetic Criteria

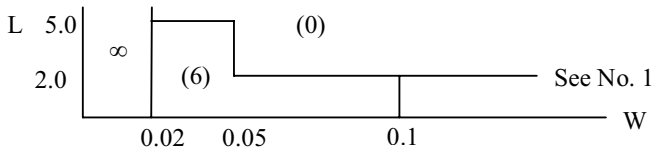
No.	Item	Judgement Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on Printed Circuit Boards	visible copper foil (∅0.5mm or more) on substrate pattern	Minor
5	Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed ∅0.2mm)	Minor Minor
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate discoloring	No plate fading, rusting and discoloring	Minor
8	Solder amount 1. Lead parts	a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly. (too much) b. Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB. 	Minor
	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder. 	Minor
	3. Chips	(3/2) H ≥ h ≥ (1/2) H 	Minor

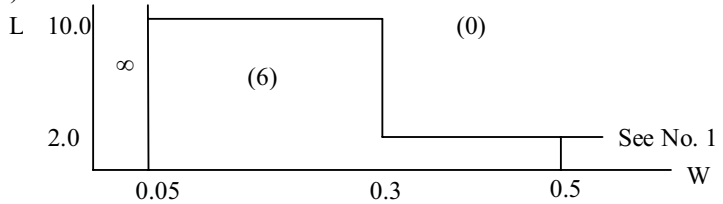
9	Solder ball/Solder splash	a. The spacing between solder ball and the conductor or solder pad h ≥0.13mm The diameter of solder ball d ≤0.15mm.  b. The quantity of solder balls or solder Splashes isn't beyond 5 in 600 mm^2 . c. Solder balls/Solder splashes do not violate minimum electrical clearance. d. Solder balls/Solder splashes must be entrapped/encapsulated Or attached to the metal surface . NOTE: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	Minor Minor Major Minor

4.2.2Cosmetic Criteria (Non-Operating)

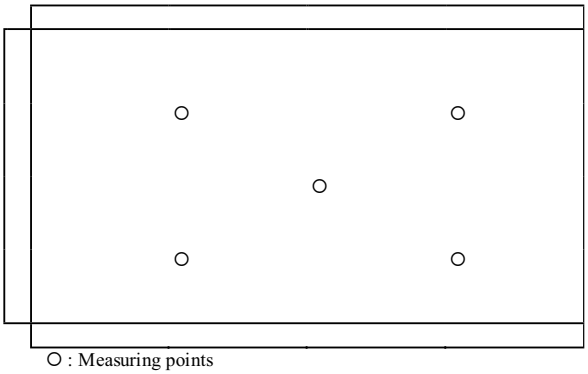
No.	Defect	Judgment Criterion	Partition
1	Spots	In accordance with *Screen Cosmetic Criteria (Operating) No.1*.	Minor
2	Lines	In accordance with *Screen Cosmetic Criteria (Operating) No.2*.	Minor
3	Bubbles in polarizer	Size : d mm / Acceptable Qty in active area d ≤ 0.3 : Disregard 0.3 < d ≤ 1.0 : 3 1.0 < d ≤ 1.5 : 1 1.5 < d : 0	Minor
4	Scratch	In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
5	Allowable density	Above defects should be separated more than 30mm each other.	Minor
6	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.	Minor
7	Contamination	Not to be noticeable.	Minor

4.2.3 Cosmetic Criteria (Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgment Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>A) Clear
<table>
<tr><th>Lcd size</th><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr>
<tr><td rowspan="4">Lcd size≤8.0'</td><td>d≤0.1</td><td>Disregard</td></tr>
<tr><td>0.1＜d≤0.2</td><td>6</td></tr>
<tr><td>0.2＜d≤0.3</td><td>2</td></tr>
<tr><td>0.3 < d</td><td>0</td></tr>
<tr><td rowspan="4">Lcd size＞8.0'</td><td>d ≤0.1</td><td>Disregard</td></tr>
<tr><td>0.1＜d≤0.3</td><td>10</td></tr>
<tr><td>0.3＜d≤0.5</td><td>5</td></tr>
<tr><td>0.5 < d</td><td>0</td></tr>
</table>
Note : Including pin holes and defective dots which must be within one pixel size; Total defective point shall not exceed 6 pcs no more than 8 inch LCD and 10PCS for more than 8 inch LCD.
B) Unclear
<table>
<tr><th>Lcd size</th><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr>
<tr><td rowspan="4">Lcd size≤ 8.0'</td><td>d≤0.2</td><td>Disregard</td></tr>
<tr><td>0.2＜d≤0.5</td><td>6</td></tr>
<tr><td>0.5＜d≤0.7</td><td>2</td></tr>
<tr><td>0.7＜d</td><td>0</td></tr>
<tr><td rowspan="5">Lcd size ＞8.0'</td><td>d≤0.2</td><td>Disregard</td></tr>
<tr><td>0.2＜d≤0.5</td><td>10</td></tr>
<tr><td>0.5＜d≤0.7</td><td>3</td></tr>
<tr><td>0.7＜d≤1.0</td><td>1</td></tr>
<tr><td>1.0< d</td><td>0</td></tr>
</table>
Note : Total defective point shall not exceed 6 pcs for no more than 8 inch LCD and 10PCS for more than 8 inch LCD.</td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>A) Clear


Note : ( ) - Acceptable Qty in active area
L - Length (mm)
W - Width (mm)
∞ - Disregard
B) Unclear


‘Clear’ = the shade and size of the line or dot are not changed with the LCD operation voltage changing .the defect looks very apparent.
‘Unclear’ = the shade and size of the line or dot are changed with the LCD operation voltage changing ,the defect looks not so apparent</td><td>Minor</td></tr>
</table>

3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'Spot'. (see *Screen Cosmetic Criteria (Operating) No.1*)	Minor
7	Uneven brightness (only back-lit type module)	Uneven brightness must be BMAX / BMIN ≤ 2 - BMAX : Max. value by measure in 5 points - BMIN : Min. value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure.  ○ : Measuring points	Minor

Note :

(1) Size : d = (long length + short length) / 2

(2) The limit samples for each item have priority.

(3) Complex defects are defined item by item, but if the numbers of defects are defined in above table, the total number should not exceed 10.

(4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.

- 7 or over defects in circle of ∅5mm.
- 10 or over defects in circle of ∅10mm.
- 20 or over defects in circle of ∅20mm.

■ PRECAUTIONS FOR USING LCD MODULES

1 Handing Precautions

1.1 The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

1.2 If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.

1.5 If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

1.6 Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contact with oil and fats.

1.7 Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

1.8 Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

1.9 Do not attempt to disassemble or process the LCD module.

1.10 NC terminal should be open. Do not connect anything.

1.11 If the logic circuit power is off, do not apply the input signals.

1.12 Electro-Static Discharge Control, Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembling

and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

- 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.

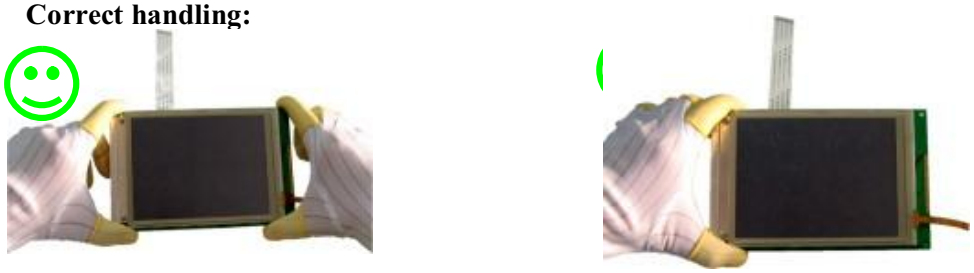
1.13 Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist the LCM.

2 Handling precaution for LCM

2.1 LCM is easy to be damaged. Please note below and be careful for handling.

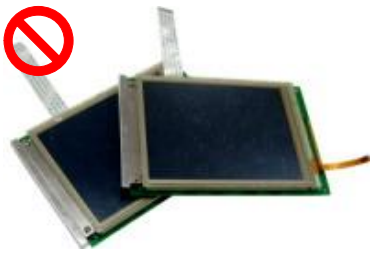
2.2 Correct handling:



As above picture, please handle with anti-static gloves around LCM edges.

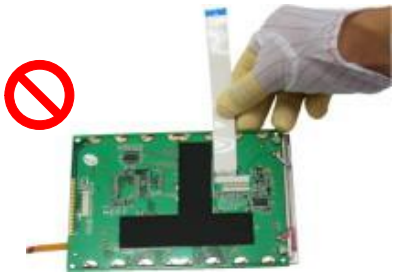
2.3 Incorrect handling:

Please don't touch IC directly.

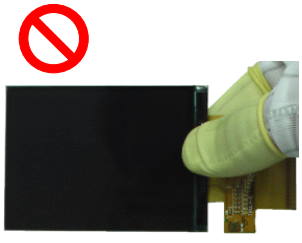


Please don't stack LCM.

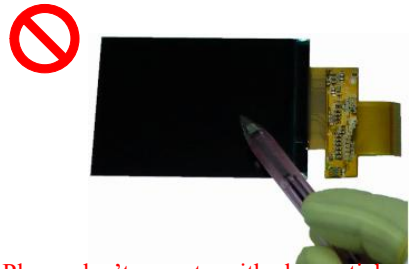
Please don't hold the surface of panel.



Please don't stretch interface of output, such as FPC cable.



Please don't hold the surface of IC.



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

3 Storage Precautions

3.1 When storing the LCD modules, the following precaution are necessary.

3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.

3.1.2 Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.

3.1.3 The polarizer surface should not come in contact with any other objects (We advise you to store them in the anti-static electricity container in which they were shipped).

3.2 Others

3.2.1 Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

3.2.2 If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

3.2.3 To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

3.2.3.1 - Exposed area of the printed circuit board.

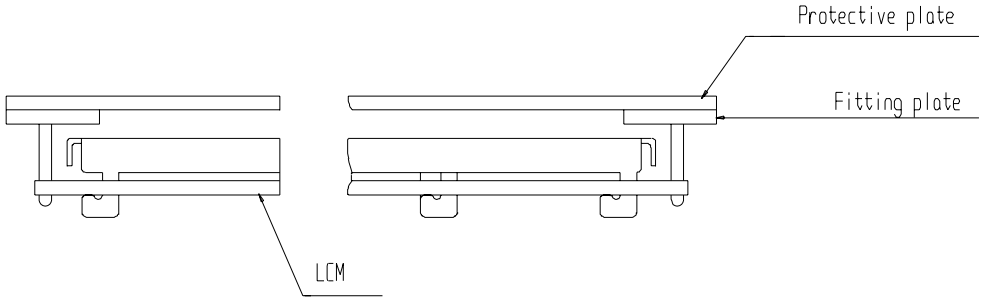
3.2.3.2 -Terminal electrode sections.

4 USING LCD MODULES

4.1 Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

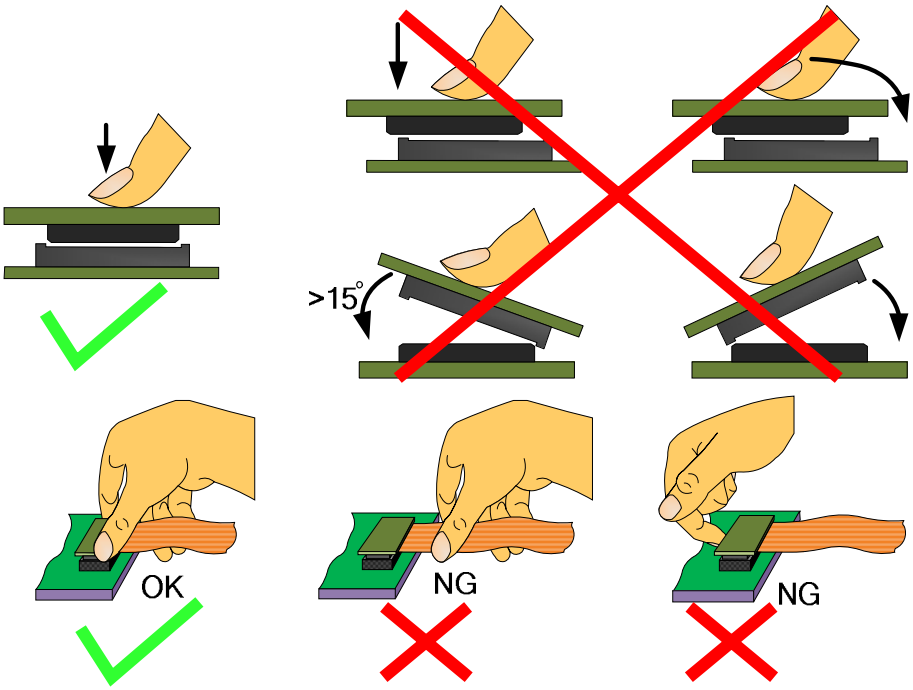
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



4.1.2 When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

4.2 Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows



4.3 Precaution for soldering the LCM

	Manual soldering	Machine drag soldering	Machine press soldering
No RoHS Product	290°C ~350°C. Time : 3-5S.	330°C ~350°C. Speed : 15-17 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Speed : 15-17 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

4.3.1 If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

4.3.2 When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

4.3.3 When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

4.4 Precautions for Operation

4.4.1 Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

4.4.2 It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

4.4.3 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.

4.4.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

4.4.5 A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

4.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

4.4.7 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

4.5 Safety

4.5.1 It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

4.5.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

4. 6 Limited Warranty

Unless agreed between Multi-Inno and the customer, Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Inno within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of Multi-Inno limited to repair and/or replace on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

4.7 Return LCM under warranty

4.7.1 No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

4.7.1.1 - Broken LCD glass.

4.7.1.2 - PCB eyelet is damaged or modified.

4.7.1.3 -PCB conductors damaged.

4.7.1.4 - Circuit modified in any way, including addition of components.

4.7.1.5 - PCB tampered with by grinding, engraving or painting varnish.

4.7.1.6 - Soldering to or modifying the bezel in any manner.

4.7.2 Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

■ PACKING SPECIFICATION

Please consult our technical department for detail information.

■ PRIOR CONSULT MATTER

1 For Multi-Inno standard products, we keep the right to change material, process ... for improving theproduct property without prior notice to our customer.

2 For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.

3 If you have special requirement about reliability condition, please let us know before you start the test on our samples.