WINTEK

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	STD
MODEL	WD-C1602Q-1YLYa VER. 1
CUSTOMER APPROVED	

APPROVED BY	CHECKED BY	ORGANIZED BY
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■ **APPROVAL FOR SPECIFICATIONS ONLY**

☐ **APPROVAL FOR SPECIFICATIONS AND SAMPLE**

History of Version

Version	Contents	Date	Note
a1	New Version	27.Sep.2005	SPEC.

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(1) Electronic Units

1.1 Absolute Maximum Ratings

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
OPERATING TEMPERATURE	T_{OP}	0	-	+50	$^\circ$C
STORAGE TEMPERATURE	T_{ST}	-20	-	+70	$^\circ$C
INPUT VOLTAGE	V_I	V_{SS}	-	V_{DD}	V
SUPPLY VOLTAGE FOR LOGIC	V_{DD}-V_{SS}	-0.3	-	6.5	V
SUPPLY VOLTAGE FOR LCD	V_{DD}-V_0	-0.3	-	6.5	V
STATIC ELECTRICITY	Be sure that you are grounded when handing LCM.				

1.2 Electrical Characteristics

(Ta=25°C, V_{DD} =4.5V)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	V_{DD}-V_{SS}	-	4.75	5.0	5.25	V
SUPPLY VOLTAGE FOR LCD	V_{DD}-V_0 (V_{OP})	Ta = 25 $^\circ$C	-	4.5	-	V
INPUT HIGH VOL.	V_{IH}	-	2.2	-	V_{DD}	V
INPUT LOW VOL.	V_{IL}	-	0	-	0.6	V
OUTPUT HIGH VOL.	V_{OH}	-	2.4	-	-	V
OUTPUT LOW VOL.	V_{OL}	-	-	-	0.4	V
SUPPLY CURRENT	* I_{DD}	V_{DD} = 5V	-	2.0	3.0	mA

* IDD Measurment condition is for all "Q" pattern on display.
※To avoid image residual, the same picture could not display to exceed one hour.

1.3 Interface Pin Function

CN1：

| NO	SYMBOL	I / O	FUNCTION
1	V_{SS}	-	GND（0V）
2	V_{DD}	-	VCC（+5V ±5%）
3	V_O	-	CONTRAST ADJUSTMENT
4	RS	H/L	REGISTER SELECT SIGNAL
5	R/W	H/L	READ / WRITE SELECTION
6	E	H,H→L	ENABLE SIGNAL
7	DB0	H/L	DATA BIT 0
8	DB1	H/L	DATA BIT 1
9	DB2	H/L	DATA BIT 2
10	DB3	H/L	DATA BIT 3
11	DB4	H/L	DATA BIT 4
12	DB5	H/L	DATA BIT 5
13	DB6	H/L	DATA BIT 6
14	DB7	H/L	DATA BIT 7
15	NC	-	-
16	NC	-	-

JP2:

1	A	-	LED (+)
4	K	-	LED (—)

1.4 Power Supply for LCD Module
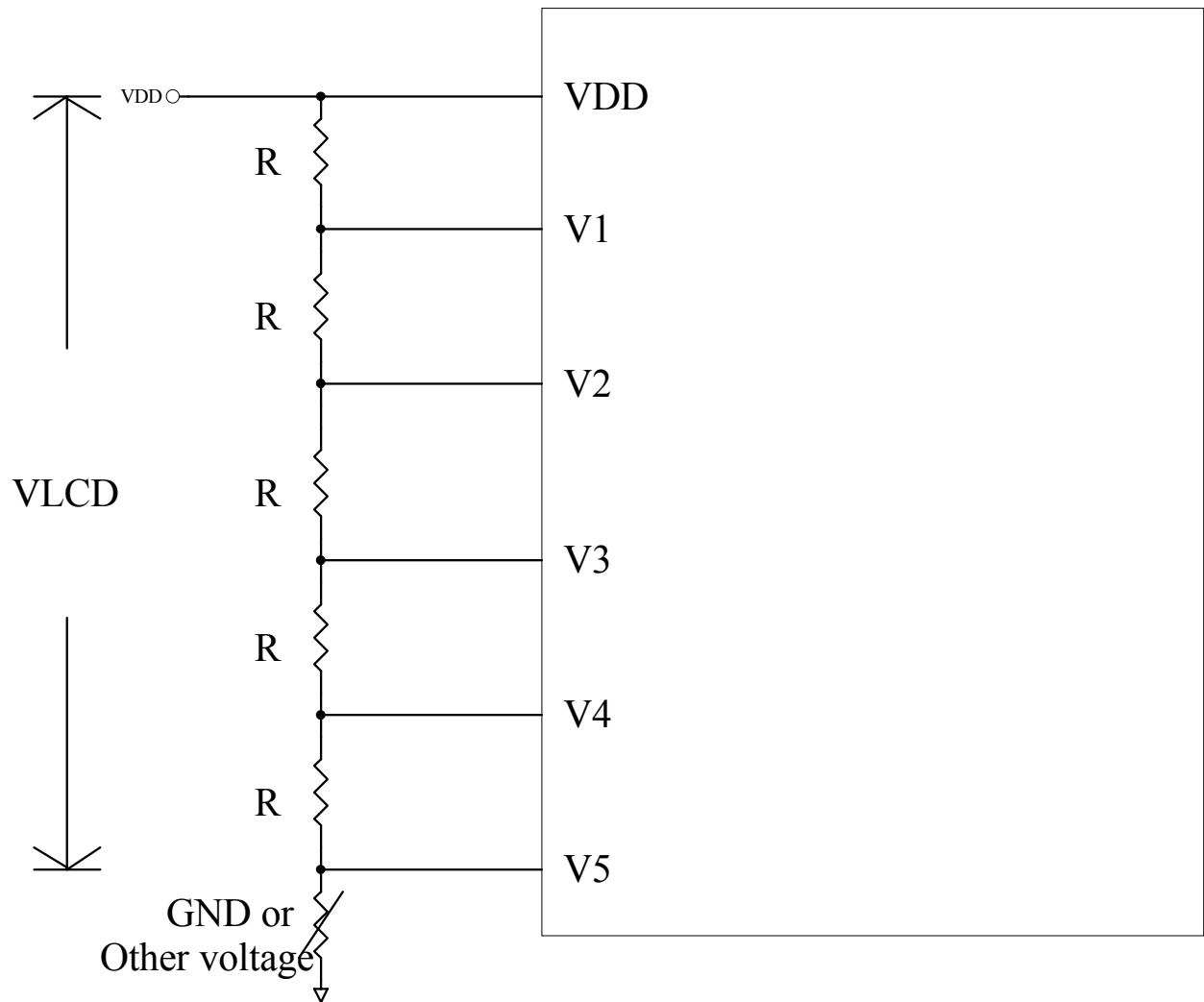
1.5 Block Diagram with Display Ram Address and Initialization Table

1.5.1 Block Diagram
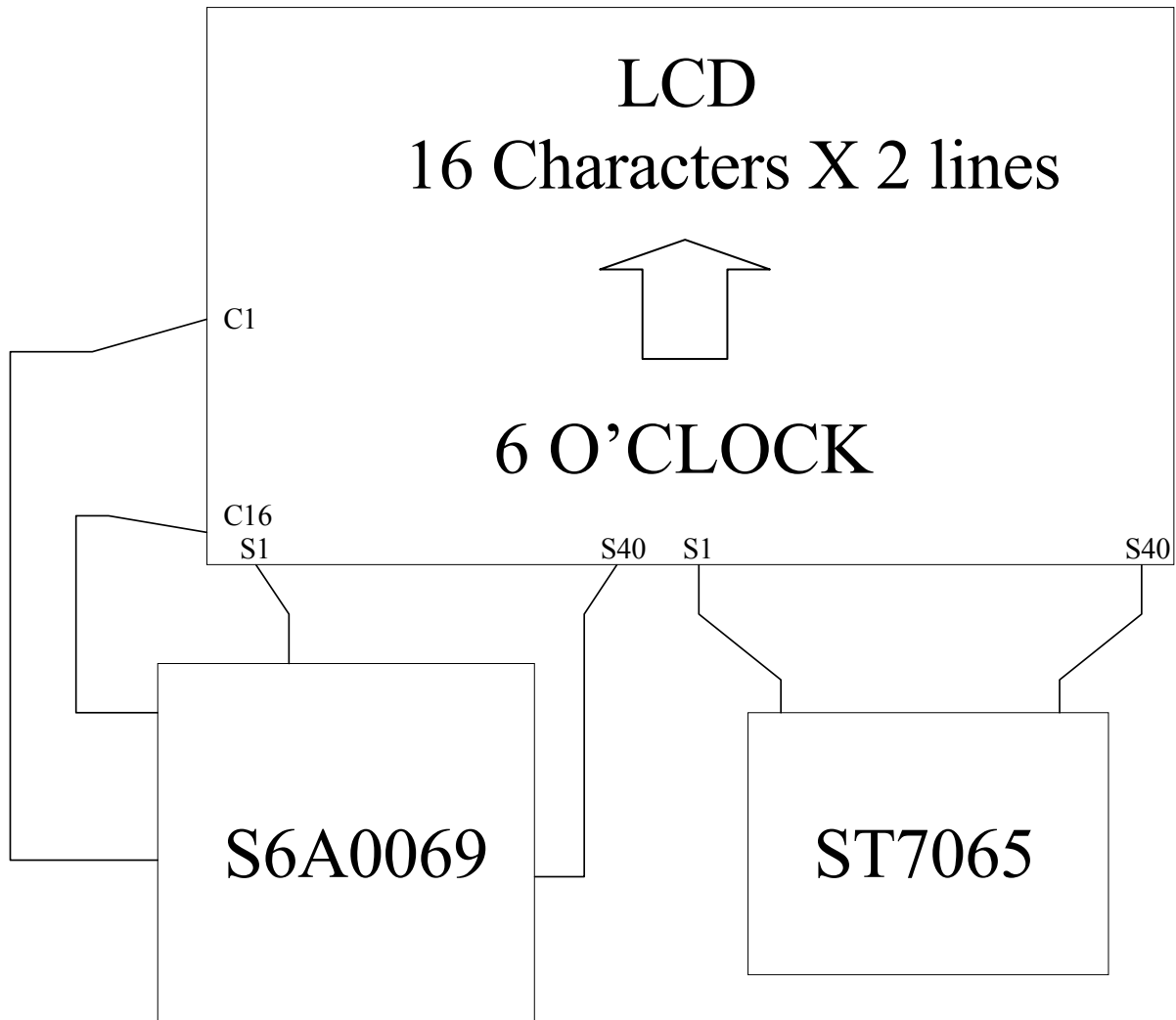
1.5.2 Display Ram Address

Relationship between Character Code (DDRAM) and Character Pattern (CGRAM)

Character Code (DDRAM data)								CGRAM Address						CGRAM Data								Pattern number
D7	D6	D5	D4	D3	D2	D1	D0	A5	A4	A3	A2	A1	A0	P7	P6	P5	P4	P3	P2	P1	P0	
0	0	0	0	×	0	0	0	0	0	0	0	0	0	×	×	×	0	1	1	1	0	pattern 1
											0	0	1				1	0	0	0	1	
											0	1	0				1	0	0	0	1	
											0	1	1				1	1	1	1	1	
											1	0	0				1	0	0	0	1	
											1	0	1				1	0	0	0	1	
											1	1	0				1	0	0	0	1	
											1	1	1				0	0	0	0	0	
:								:						:								:
0	0	0	0	×	1	1	1	0	0	0	0	0	0	×	×	×	1	0	0	0	1	pattern 8
											0	0	1				1	0	0	0	1	
											0	1	0				1	0	0	0	1	
											0	1	1				1	1	1	1	1	
											1	0	0				1	0	0	0	1	
											1	0	1				1	0	0	0	1	
											1	1	0				1	0	0	0	1	
											1	1	1				0	0	0	0	0	

1.5.3 Initialization Table:

	Instruction	Code	Description
1.	Function set	**38H**	Function set: DL=1:it means 8-bit bus mode with MPU. N=1:2-line display is set. F=0:5×8 dot format display mode is set.
2.	Display on/off control	**0CH**	Display on: D=1:entire display is turned on. C=0:cursor is disappeared in current display, but I/D register preserves its data. B=0:blink is off.
3.	Entry mode set	**06H**	Entry set: I/D=1:cursor/blink moves to right and DDRAM address is increased by 1. SH=0:shifting of entire display is not performed.
4.	Return home	**02H**	Return home
5.	Clear display	**01H**	Clear display

1.6 Timing Characteristic
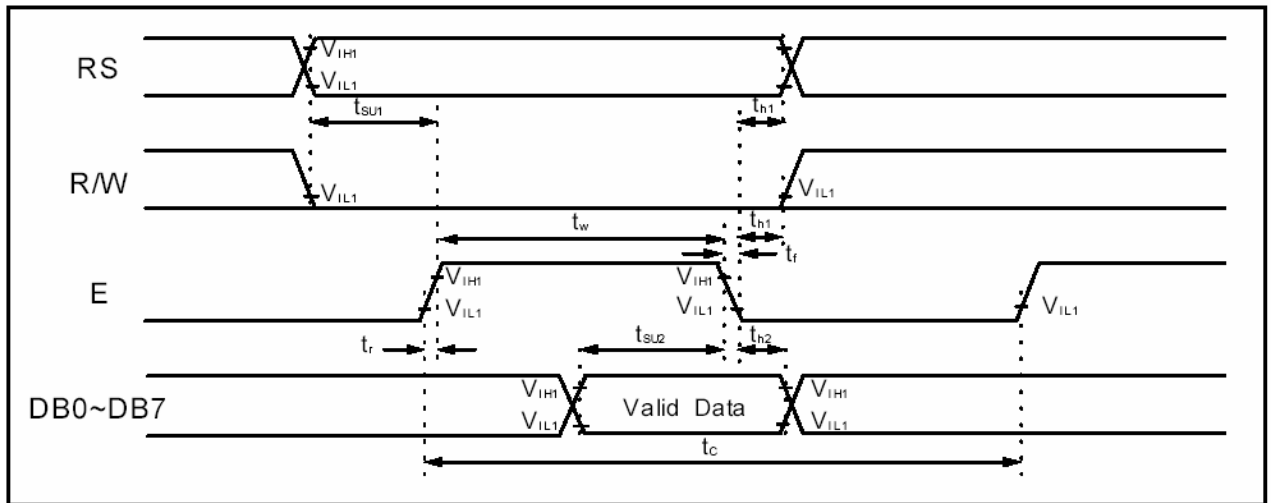
Write Mode Timing Diagram
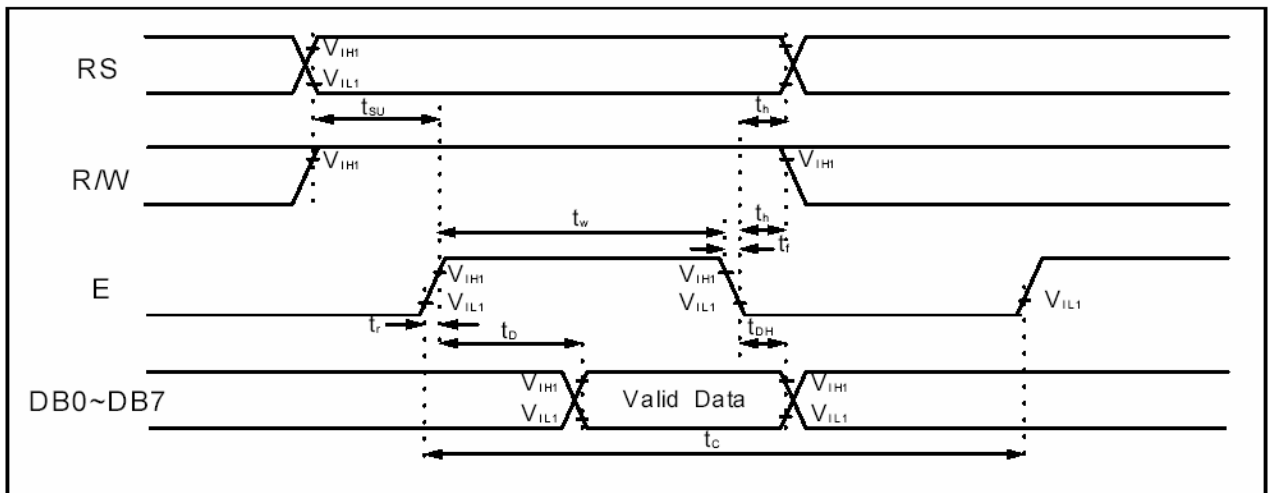
Read Mode Timing Diagram
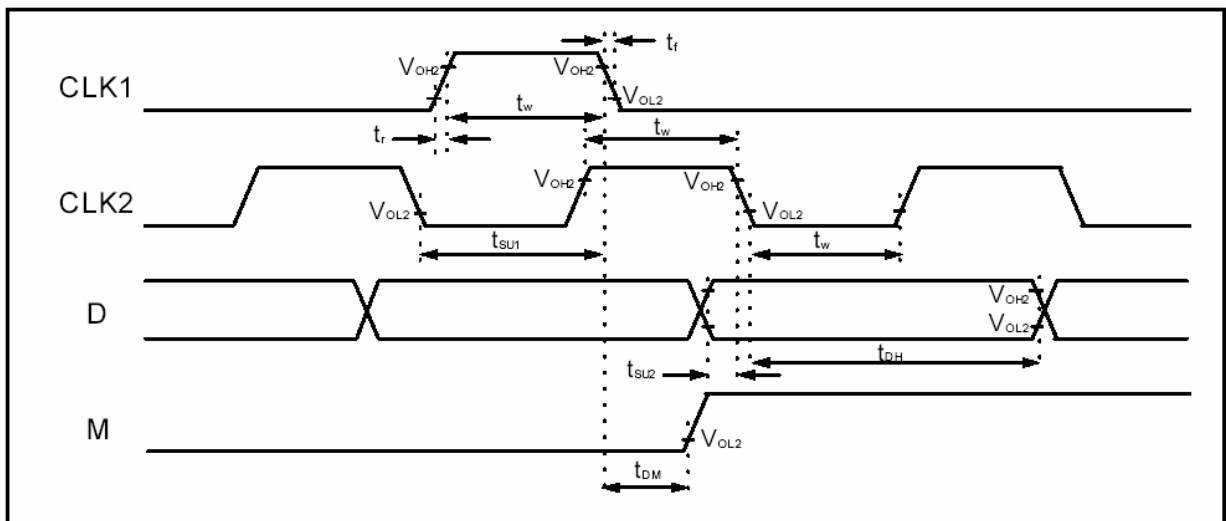
Interface Mode With Extension Driver Timing Diagram

1.7 Power ON/OFF SEQUENCE

1.7.1 Power ON Sequence

```
                    ┌──────────────┐
                    │   Power ON    │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │  Wait 100ms   │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │    RESET      │
                    └──────┬───────┘
                           │
            ┌──────────────▼──────────────────┐
            │   Waiting for releasing Reset     │
            └──────────────┬──────────────────┘
                           │
   ┌───────────────────────▼────────────────────────────┐
   │  write_i(0x0c);                 /*Display on*/        │
   └─────────────────────────────────────────────────────┘
```
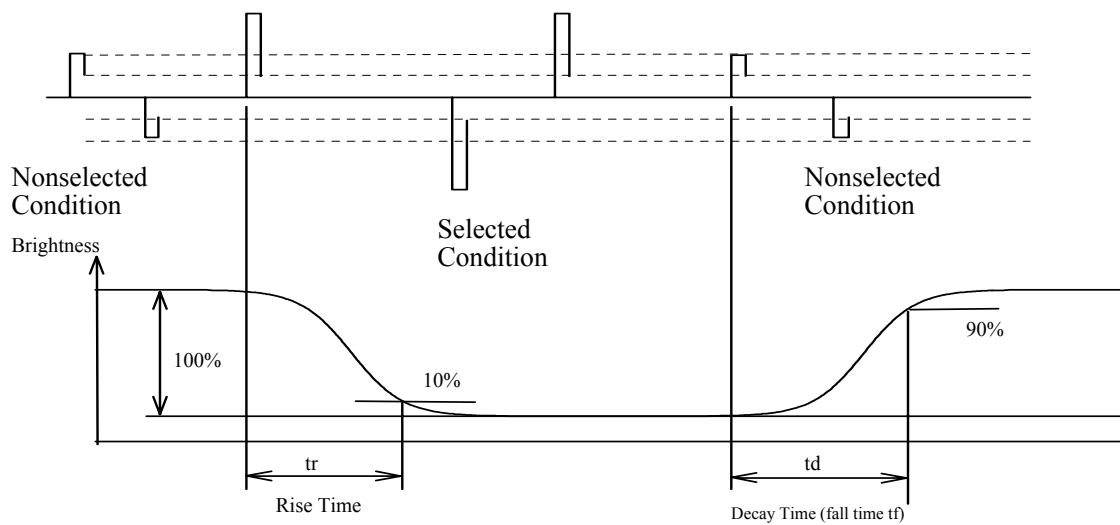
1.7.2 Power OFF Sequence

```
   ┌─────────────────────────────────────────────────────┐
   │  write_i(0x08);                 /* Display off*/      │
   └───────────────────────┬────────────────────────────┘
                           │
            ┌──────────────▼──────────────────┐
            │          DISPLAY OFF             │
            └──────────────┬──────────────────┘
                           │
            ┌──────────────▼──────────────────┐
            │   WAITING FOR DISCHARGE           │
            │           100ms                   │
            └──────────────┬──────────────────┘
                           │
            ┌──────────────▼──────────────────┐
            │          POWER OFF               │
            └──────────────────────────────────┘
```
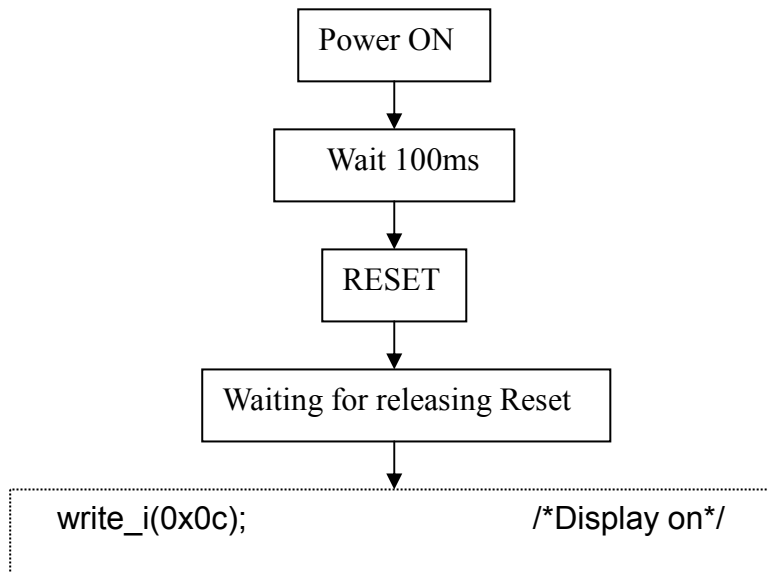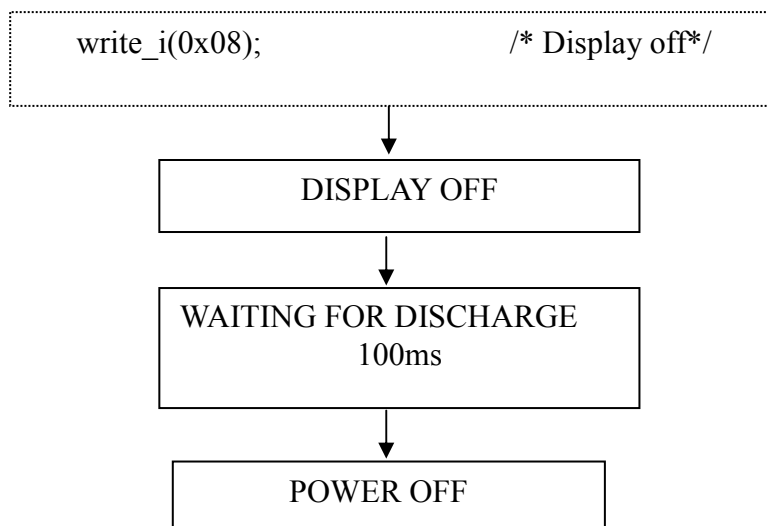
(2) Electro-optical Units

2.1 Electro-optical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VIEW ANGLE (V)	θ	CR≧2	-40	-	40	deg.
VIEW ANGLE (H)	ϕ	CR≧2	-40	-	40	deg.
CONTRAST RATIO	CR	Transmissive(Ta=25℃)	-	5	-	-
RESPONSE TIME	tr	Ta=25℃	-	200	400	ms
RESPONSE TIME	td	Ta=25℃	-	200	400	ms
DRIVE METHOD	DUTY					
	BIAS					
LCD TYPE		STN(Transflective Type)				
VIEWING DIRECTION		6 O'CLOCK				

2.2 Optical Definitions

Nonselected Condition

Selected Condition

Nonselected Condition

Brightness

100%

10%

90%

tr

Rise Time

td

Decay Time (fall time tf)

Response Time

12:00

9:00   **3:00**

6:00

y (back)   Eye
                θ
(left) x'   x (right)
                    φ
            y' (front)

View Direction

View Angle

Brightness   Brightness cure of selected segment

                                    B $_2$

                            Brightness curve of
                            nonselected segment

                                    B $_1$
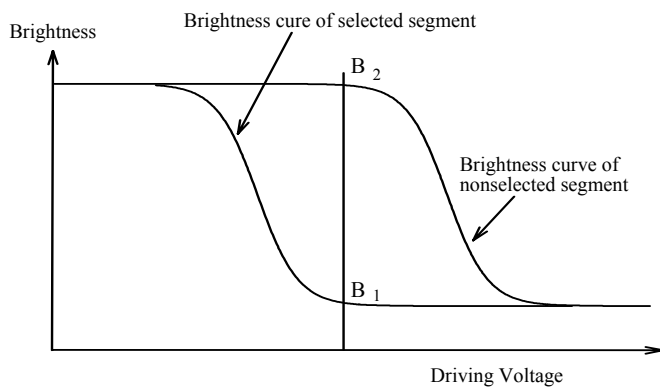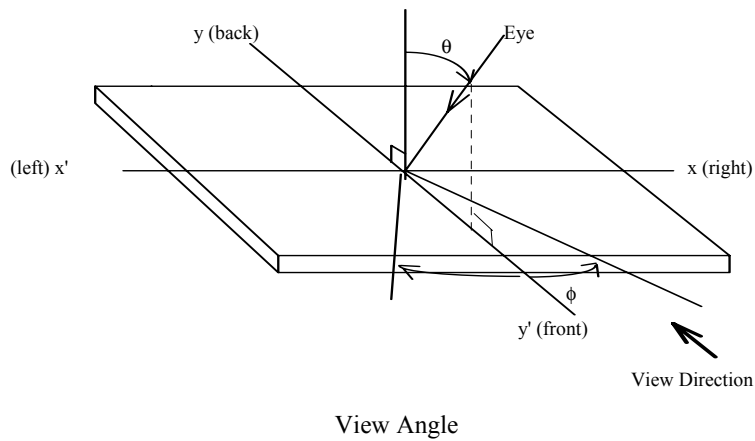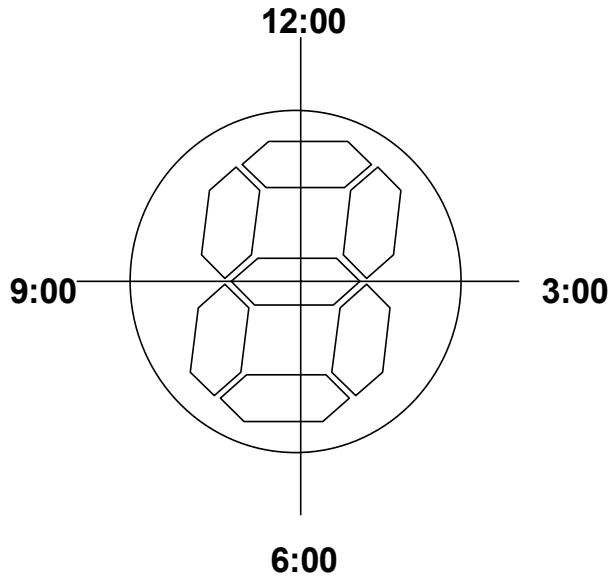
            Driving Voltage   Perpendicular line (θ=90°)

$$\text{Contrast ratio} = \frac{\text{Brightness at nonselected segment (B2)}}{\text{Brightness at selected segment (B1)}}$$

Contrast ratio (CR)

(3) Mechanical Units

3.1 Mechanical Specification

ITEM	STANDARD VALUE	UNIT
NUMBER OF CHARACTER	16 CHARACTERS × 2 LINE	dots
CHARACTER FORMAT	5 × 7 DOTS with CURSOR	mm
MODULE DIMENSION	122.0 (W) × 44.0 (H) × 14.5 (T)	
VIEWING AREA	99.0 (W) × 24.0 (H)	mm
ACTIVE AREA	94.84 (W) × 20.0 (H)	mm
CHARACTER SIZE	4.84 (W) × 9.66 (H)	
CHARACTER PITCH	6.00 (W) × 10.34 (H)	
DOT SIZE	0.92 (W) × 1.10 (H)	mm
DOT PITCH	0.98 (W) × 1.16 (H)	mm
APPROX. WEIGHT	50	g
BACK LIGHT	LED (Yellow – Green)	

3.2 Mechanical Diagram
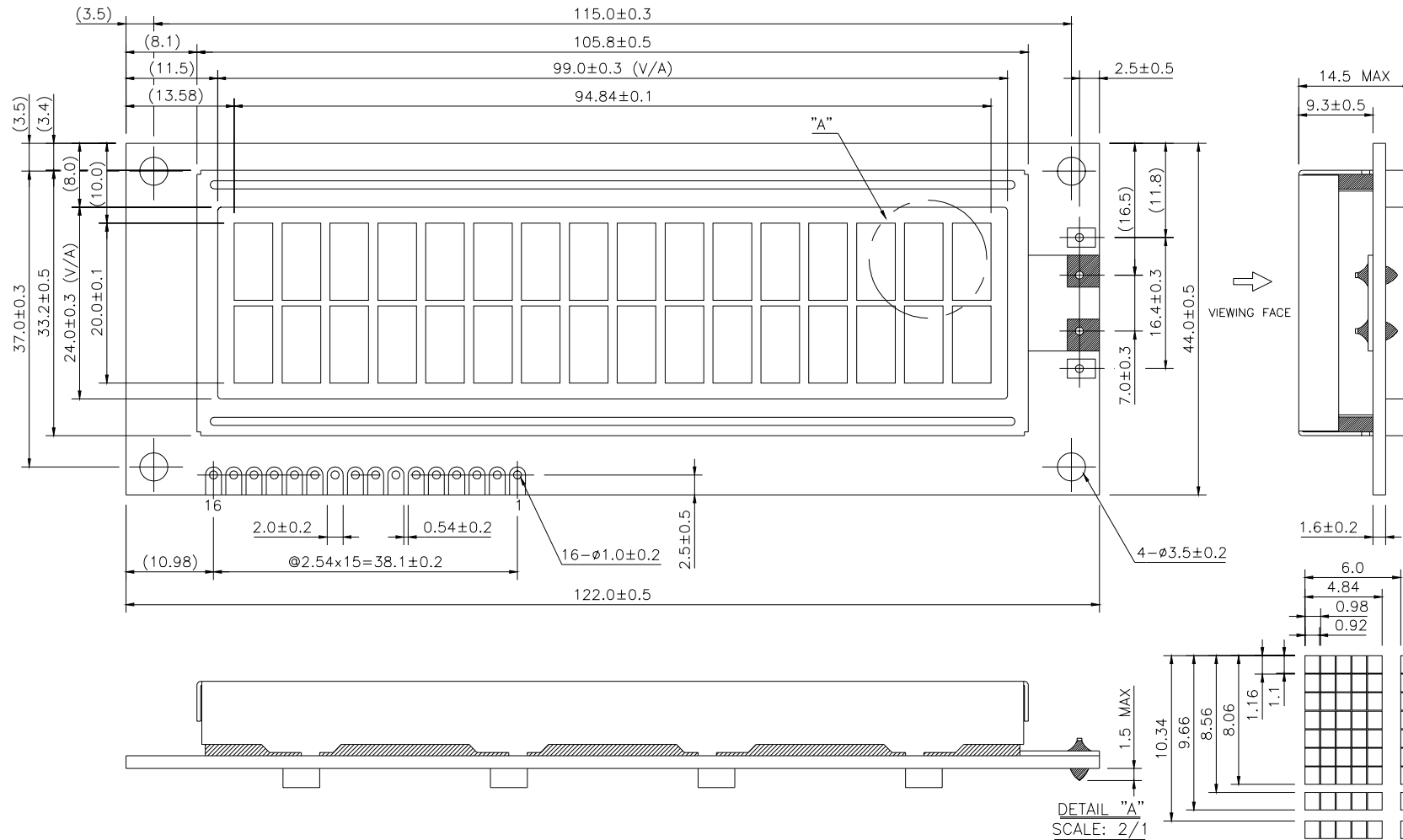
3.3 Back-light Specification

LED Backlight Styles:

The LED chips are distributed over the whole light area of the illumination unit, which gives the most uniform light.

1. Data About LED Backlight

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Supply Current	I	-	390	550	mA	V = 4.2 V	-
Forward Voltage	V_{AK}	-	4.2	4.6	V	-	-
Reverse Voltage (Single chip)	V_R	-	-	10	V	-	-
Luminous Intensity	I_V	70	-	-	cd/m^2	V = 4.2 V	1 (With LCD)
Luminous Intensity Ratio	-	-	-	2	-	V = 4.2 V	2
Peak Emission Wavelength	λ_P	-	572	-	nm	V = 4.2 V	
Life Time		-	50000	-	Hr.	V $\leqq$ 4.6 V	

NOTE：1.Average Luminous Intensity Of P1 – P5

2. Luminous Intensity Ratio = MAX./ MIN.

2. Internal Circuit Diagram

$$V_{AK}=4.2V$$
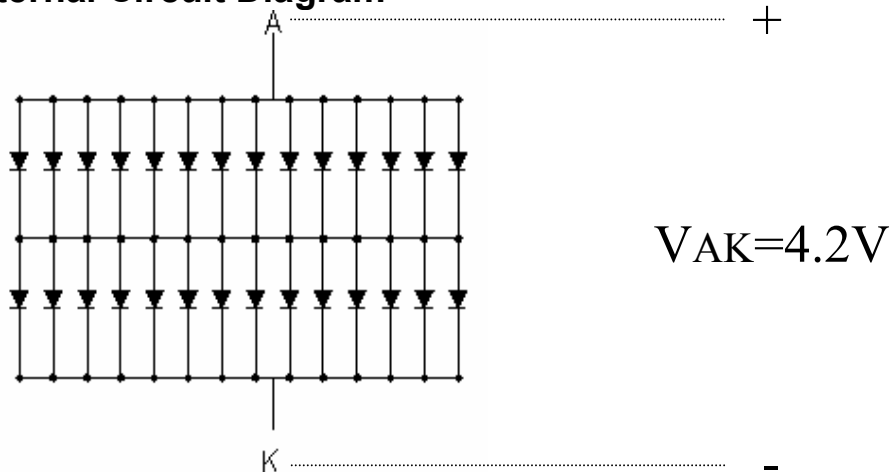
3. MEASURED METHOD (X*Y: Light Area)
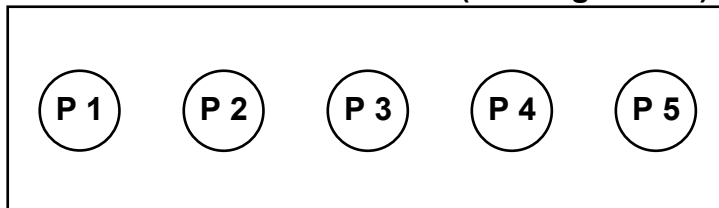
(Effective spatial Distribution)

Hole Diameter $\pm 1 \, \varphi$ mm;1 to 5 per Position Measured Luminous Intensity
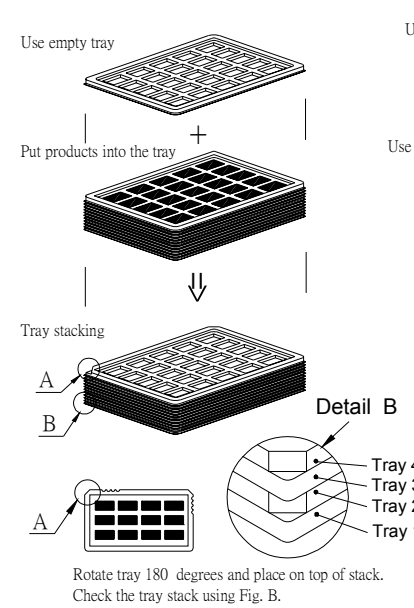
3.4 Packing Method

1. Packaging Material : (per carton)

NO.	Item	Model		Dimensions (mm)	Unit Weight (Kg)	Quantity
1	LCM Module	WD-C1602Q-1YLYa		122.0*44.0	0.0631	180
2	Tray	V127	PETA	320*217*21*0.6	0.06	40
3	Product Box	C01		320*219*70	0.131	10
4	Carton	C61		475*345*389	1.208	1
5	Package Bag	C5		467*321*0.08	0.023	10
6	Total Weight	16.5		Kg± 5%		

2. Packaging Specifications and Quantity :

(1) LCM quantity per tray : quantity per row   3   x quantity per column   2   =   6

(2) LCM quantity per box : quantity per tray   6   x quantity of trays   3   =   18

(3) Total LCM quantity in carton : quantity per box   18   x quantity of boxes   10   =   180

Use empty tray
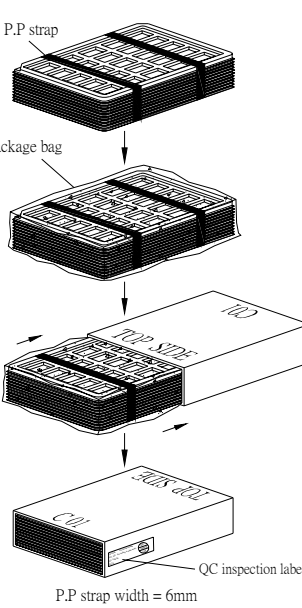
Put products into the tray

Tray stacking

Detail B

Tray 4
Tray 3
Tray 2
Tray 1

Rotate tray 180 degrees and place on top of stack.
Check the tray stack using Fig. B.
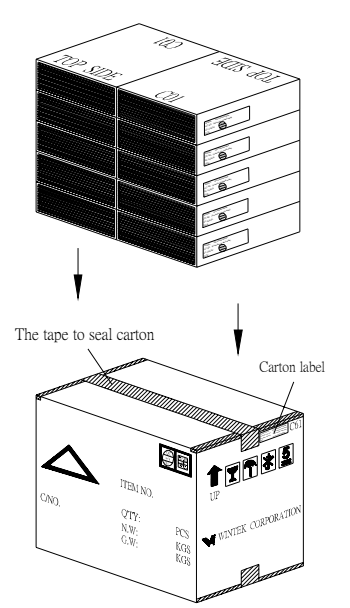
Use P.P strap

Use package bag

TOP SIDE

QC inspection label

P.P strap width = 6mm

The tape to seal carton

Carton label

3. Label Specifications :

(1) QC Inspection Label

MODEL:	WD-C1602Q-1YLYa
LOT NO:	(According to each order)
QC CHECK:	QC DATE OK
DATE:	
Q'ty:	(According to each order)

32.0

90.0

Label Color----Green

(2) Carton Label

Wintek Part No:	WD-C1602Q-1YLYa
Purchase Order No:	(According to each order)
Q'ty:	(According to shipping)

42.4

105.0

Label Color----White

Remark

(4) Quality Units

4.1 Specification of Quality Assurance

4.1-1.Purpose

This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaser by WINTEK CORPORATION (Supplier).

4.1-2.Standard for Quality Test

a. Inspection :

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to **ANSI/ASQC Z1.4-1993.General Inspection Level Ⅱ take a single time.**

(ii) The defects classify of AQL as following:

Major defect: AQL=0.65
Minor defect: AQL=2.5
Total defects: AQL=2.5

4.1-3.Nonconforming Analysis ＆ Deal With Manners

a. Nonconforming analysis:

(i) Purchaser should supply the detail data of non-conforming sample and the non-suitable state.

(ii) After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before two weeks.

b. Disposition of nonconforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

4.1-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides think that it must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

4.1-5. Standard of The Product Appearance Test

a. Manner of appearance test:

(i) The test must be under 20W $\times$ 2 or 40W fluorescent light, and the distance of view must be at 30 cm.

(ii) When test the model of transmissive product must add the reflective plate.

(iii) The test direction is base on about around 45° of vertical line.
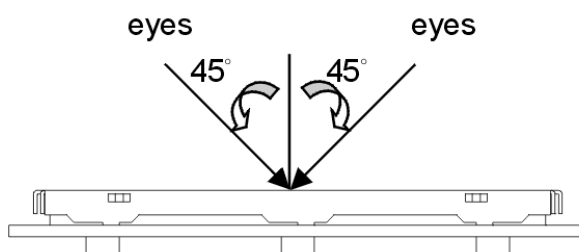
(iv) Definition of area:
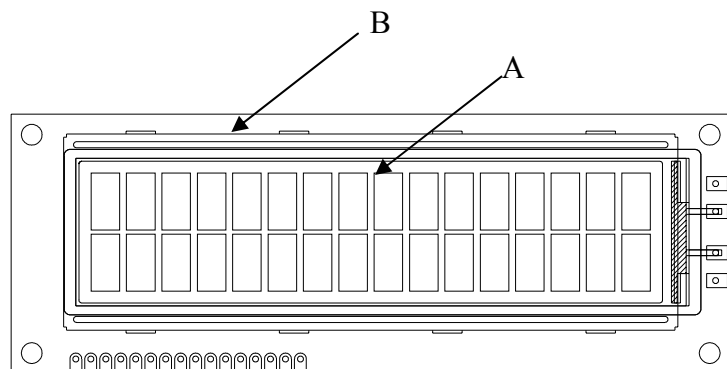
A Area : Viewing area.
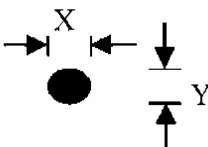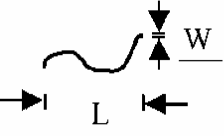
B Area : Out of viewing area.

(Outside viewing area)
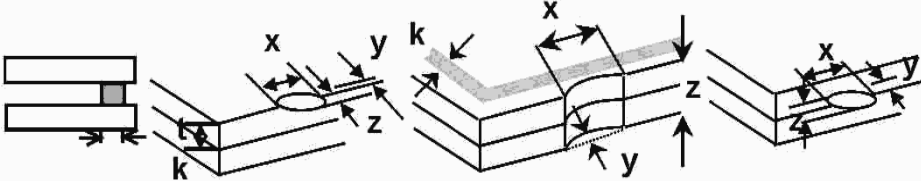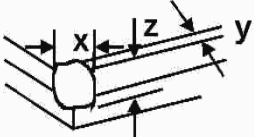
b. Basic principle:
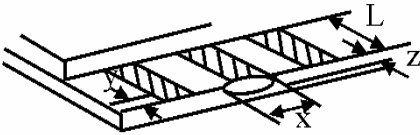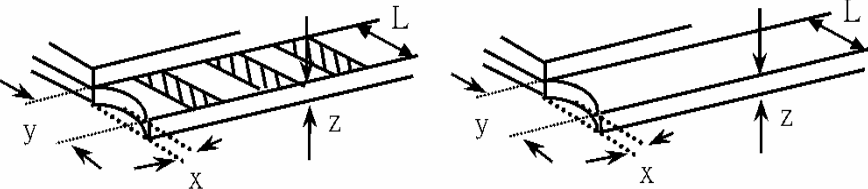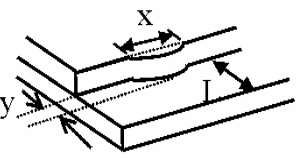
(i) It will accord to the AQL when the standard can not be described.

(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

(iii) Must add new item on time when it is necessary.

c. Standard of inspection:(Unit: mm)

4.1-6. Inspection specification

NO	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character , dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Contrast defect.	0.65
02	Black or white spots on LCD (display only)	2.1 White and black spots on display $\leqq 0.25$mm, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm.	2.5
03	LCD black spots,white spots, contamination (non-display)	3.1 Round type：As following drawing $\phi = (x + y)/2$	2.5

3.1 Round type：As following drawing

$\phi = (x + y)/2$

SIZE	Acceptable Q TY
$\phi \leqq 0.10$	Accept no dense
$0.10 < \phi \leqq 0.20$	2
$0.20 < \phi \leqq 0.25$	1
$0.25 < \phi$	0

3.2 Line type：(As following drawing)

Length	Width	Acceptable Q TY
---	$W \leqq 0.02$	Accept no dense
$L \leqq 3.0$	$0.02 < W \leqq 0.03$	2
$L \leqq 2.5$	$0.03 < W \leqq 0.05$	
---	$0.05 < W$	As round type

NO	Item	Criterion	AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications ,not easy to find, must check in specify direction | Size ϕ	Acceptable Q TY
---	---
$\phi \leqq 0.20$	Accept no dense
$0.20 < \phi \leqq 0.50$	3
$0.50 < \phi \leqq 1.00$	2
$1.00 < \phi$	0
Total Q TY	3		2.5
05	Scratches	Follow NO.3 LCD black spots, white spots, contamination	
06	Chipped glass	Symbols： x：Chip length　　　y：Chip width　　　z：Chip thickness k：Seal width　　　t：Glass thickness　　a：LCD side length L：Electrode pad length 6.1　General glass chip ： 6.1.1Chip on panel surface and crack between panels： | z：Chip thickness	y：Chip width	x：Chip length
---	---	---
Z $\leqq$ 1/2t	Not over viewing area	x $\leqq$ 1/8a
1/2t $<$ z $\leqq$ 2t	Not exceed 1/3k	x $\leqq$ 1/8a | ⊙If there are 2 or more chips, x is the total length of each chip. 6.1.2 Corner crack： | z：Chip thickness	y：Chip width	x：Chip length
---	---	---
Z $\leqq$ 1/2t	Not over viewing area	x $\leqq$ 1/8a
1/2t $<$ z $\leqq$ 2t	Not exceed 1/3k	x $\leqq$ 1/8a | ⊙ If there are 2 or more chips, x is the total length of each chip.	2.5

NO	Item	Criterion	AQL
06	Glass crack	Symbols： x：Chip length y：Chip width z：Chip thickness k：Seal width t：Glass thickness a：LCD side length L：Electrode pad length 6.2 Protrusion over terminal： 6.2.1 Chip on electrode pad： | y：Chip width	x：Chip length	z：Chip thickness
---	---	---
y≦ 0.5 mm	x≦1/8a	$0 < z \leq t$ | 6.2.2 Non-conductive portion： | y：Chip width	x：Chip length	z：Chip thickness
---	---	---
y≦ L	x≦1/8a	$0 < z \leq t$ | ⊙If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. ⊙If the product will be heat sealed by the customer, the alignment mark must not be damaged. 6.2.3 Substrate protuberance and internal crack. 	y： width	x： length
---	---
y≦ 1/3L	x ≦ a		2.5

NO	Item	Criterion	AQL
07	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit. 8.2 Spots or scratches that appear when lit must be judged . using LCD spot, lines and contamination standards. 8.3 Backlight doesn t light or color is wrong.	0.65 2.5 0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination. 9.2 Bezel must comply with job specifications.	2.5 0.65
10	PCB、COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination. 10.2 COB seal surface may not have pinholes through to the IC. 10.3 The height of the COB should not exceed the height indicated in the assembly diagram. 10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places. 10.5 No oxidation or contamination PCB terminals. 10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts. 10.7 The jumper on the PCB should conform to the product characteristic chart. 10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hole pad, make sure it is smoothed down.	2.5 2.5 0.65 2.5 2.5 0.65 0.65 2.5
11	Soldering	11.1 No unmelted solder paste may be present on the PCB. 11.2 No cold solder joints, missing solder connections, oxidation or icicle. 11.3 No residue or solder balls on PCB. 11.4 No short circuits in components on PCB.	2.5 2.5 2.5 0.65

NO	Item	Criterion	AQL
12	General appearance	12.1　No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2　No cracks on interface pin (OLB) of TCP.	0.65
		12.3　No contamination, solder residue or solder balls on product.	2.5
		12.4　The IC on the TCP may not be damaged, circuits.	2.5
		12.5　The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		12.6　The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7　Sealant on top of the ITO circuit has not hardened	2.5
		12.8　Pin type must match type in specification sheet.	0.65
		12.9　LCD pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet .	0.65
		12.12 The appearance of Heat Seal should not admit any dirt and break.	

4.2 Standard Specification for Reliability

4.2-1. Standard Specifications for Reliability of LCD Module

No	Item	Description
01	High temperature operation	The sample should be allowed to stand at 50 ℃ for 240 (-0, +48) hours under driving condition.
02	Low temperature operation	The sample should be allowed to stand at 0 ℃ for 240 (-0, +48) hours under driving condition.
03	High temperature resistance	The sample should be allowed to stand at 70 ℃ for 240 (-0,+48) hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 30 minutes.
04	Low temperature resistance	The sample should be allowed to stand at -20 ℃ for 240 (-0,+48) hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 24 hours.
05	Moisture resistance	The sample should be allowed to stand at 40 ℃, 90 % RH MAX for 240 (-0,+48) hours under no-load condition excluding the polarizer, then taking it out and drying it at normal temperature.
06	Thermal shock resistance	The sample should be allowed to stand the following 10 cycles of operation: -40℃ for 30 minutes → normal temperature for 5 minutes → +80℃ for 30 minutes → normal temperature for 5 minutes , as one cycle.

4.2-2.Testing Conditions and Inspection Criteria

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in Table 4.2,Standard specifications for Reliability have been executed in order to ensure stability.

NO	Item	Test Model	Inspection Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
03	Appearance	Visual inspection	Defect free.

4.2-3.Life Time

Life time	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25 ±10℃), normal humidity (45 ±20% RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

Note: From our experience the life time of high humidity operation and high temperature operation as above mentioned could be achieved.

4.3 Precautions in Use of LCM

4.3-1 Handling of LCM
- Don't give external shock.
- Don't apply excessive force on the surface.
- Liquid in LCD is hazardous substance. Must not lick and swallow. when the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
- Don't operate it above the absolute maximum rating.
- Don't disassemble the LCM.

4.3-2 Storage
- Store in an ambient temperature of 5℃ to 45℃, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.
- Store in anti-static electricity container.
- Store without any physical load.

4.3-3 Soldering
- Use the high quality solder. (60-63% tin mixed with lead)
- Iron: no higher than 260℃ and less than 3-4 sec during soldering.
- Soldering: only to the I/O terminals.
- Rewiring: no more than 3 times.

4.3-4 Assembly
- The front polarizer is covered with a protective foil which should be removed before use.