

**SPECIFICATION
OF
LCD MODULE**

MODULE NO.: HL24064M02-01WFPTC

Customer Approval:

Accept

Reject

	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

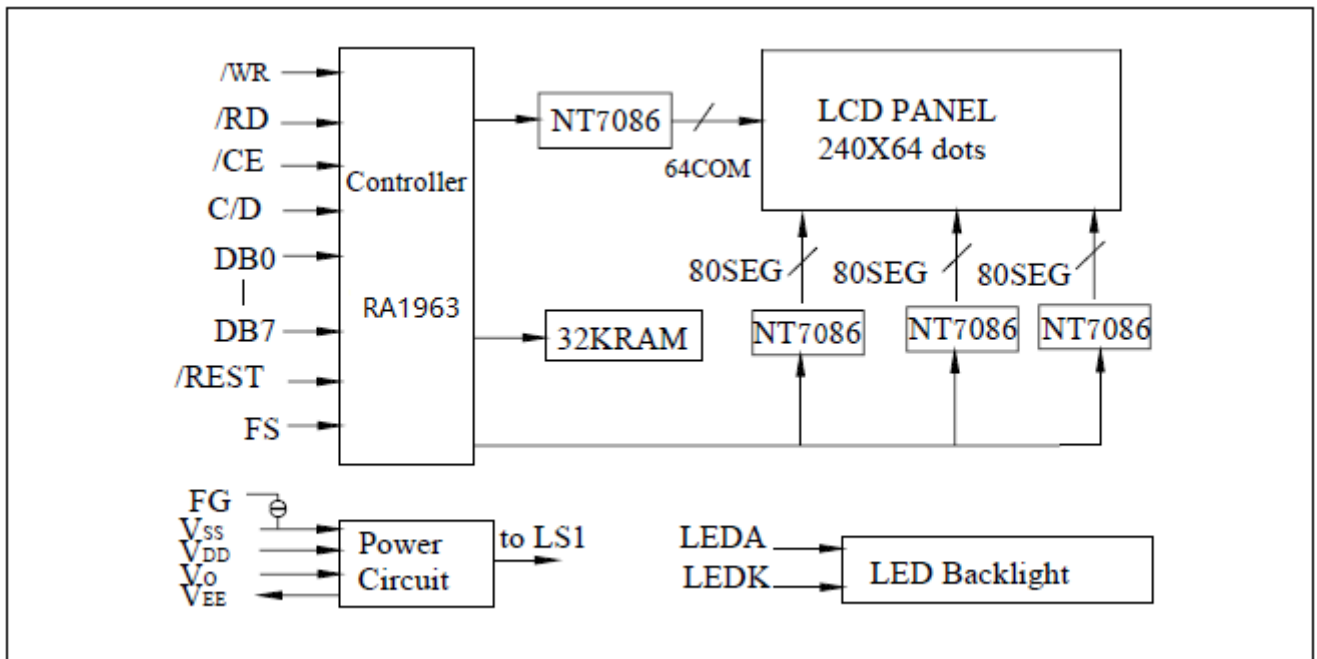
Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKED BY
	A0	2023-04-20	First Release.	
	A1	2023-4-27	Modify pin20, BL parameter Cable length	
	A2	2023-5-8	Modify BL life time	

1. MECHANICAL SPECIFICATIONS:

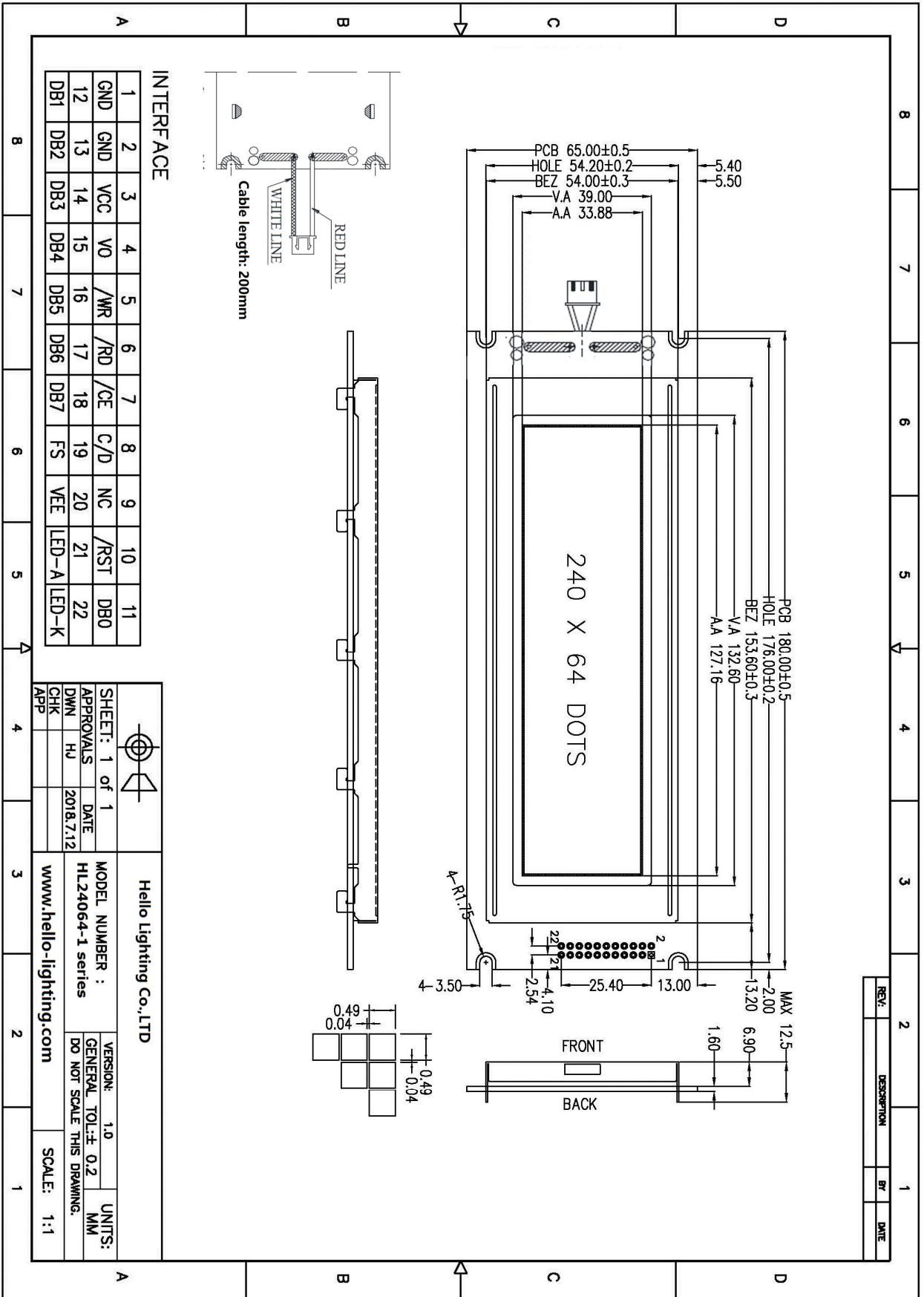
ITEM	SPECIFICATION	UNIT
OUTLINE DIMENSIONS	180 (W) X65(H) X12.5(D)	mm
VIEWING AREA	132X39	mm
ACTIVE AREA	127.16X33.88	mm
DOT PITCH	0.53X0.53	mm
DISPLAY MODE	FSTN Positive Transflective	mm
NUMBER OF DOTS	240x64	-
DRIVER IC	RA1963C or equ	-
DRIVING METHOD	1/128 Duty, 1/12bias	-
BACKLIGHT TYPE	LED WHITE	-
VIEWING DIRECTION	6 O'clock	-

***See attached drawing for details.**

2.BLOCK DIAGRAM:



3.DIMENSIONAL



REV.	DESCRIPTION	BY	DATE
1			

4. PIN DESCRIPTION:

NO.	PIN NAME	I/O	Description
1	FG	-	Frame ground
2	Vss	P	Power ground
3	Vdd	P	Power supply
4	V0	I	Negative voltage input for LCD
5	/WR	I	Write signal
6	/RD	I	Read signal
7	/CE		Chip enable signal
8	C/D		L:data, H: instruction code
9	NC		No connection
10	/RESET		Reset signal, active "L"
11	DB0	IO	Data bus
12	DB1	IO	
13	DB2	IO	
14	DB3	IO	
15	DB4	IO	
16	DB5	IO	
17	DB6	IO	
18	DB7	IO	
19	FS		Font selection:L:8x8 H:6x8
20	VEE		VLCD OUT
21	A	P	Power supply BL(+)
22	K	P	Power supply BL(-)

5. MAXIMUM ABSOLUTE LIMIT:

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	-0.3~7	V
LCD supply voltage	V_{lcd}	0 - 15	V
Operating temperature	T_{opr}	-20 to 70	°C
Storage temperature	T_{stg}	-30 to 80	°C

Note: Absolute maximum rating is the limit value beyond which the IC maybe broken.
They do not assure operations.

6.ELECTRICAL CHARACTERISTICS

6.1 DC Characteristics ($T_a=25^{\circ}\text{C}$)

Item		Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	Logic	V_{DD}	-	4.5/3.0	5.0/3.3	5.5/3.6	V
LCD Supply Voltage		V_{LCD}	25°C	9	17	25	V
Logic Low Input voltage		V_{IL}	-	V_{SS}	-	$0.3X V_{DD}$	V
Logic High Input voltage		V_{IH}	-	$0.7 V_{DD}$	-	V_{DD}	V
Current Consumption All white	Logic	$I_{DD} + I_{IN}$	$V_{DD} = V_{IN} = 3.3V$	-	-	0.5	mA
	Analog						
Current Consumption All black	Logic	$I_{DD} + I_{IN}$	$V_{DD} = V_{IN} = 3.3V$	-	-	0.5	mA
	Analog						

Note: Voltage greater than above may damage the module.

All voltages are specified relative to $V_{SS}=0V$.

6-2 Backlight Electrical-optical Characteristics

1. Stander Lamp Styles(Edge Lighting Type):

The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:

2. The Main Advantages of the LED Backlight are as following:

2.1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.

3. Data About LED Backlight:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.1	3.5	3.7	V	If=80mA	-
Supply Current	If	-	80	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	10uA	
Power dissipation	Pd	-	336	-	mW	-	
Uniformity for LCM	-	80	-	-	%	If=80mA	3
Life Time	-	-	50000	-	Hr	If=80 mA	-
Backlight Color	White						

NOTE:

1. Average Luminous Intensity of P1-P9

2. Uniformity = Min/Max * 100%

3.LED life time defined as follows: The final brightness is at 70% of original brightness

Measured Method: (X*Y: Light Area)(Left Draft as follow)

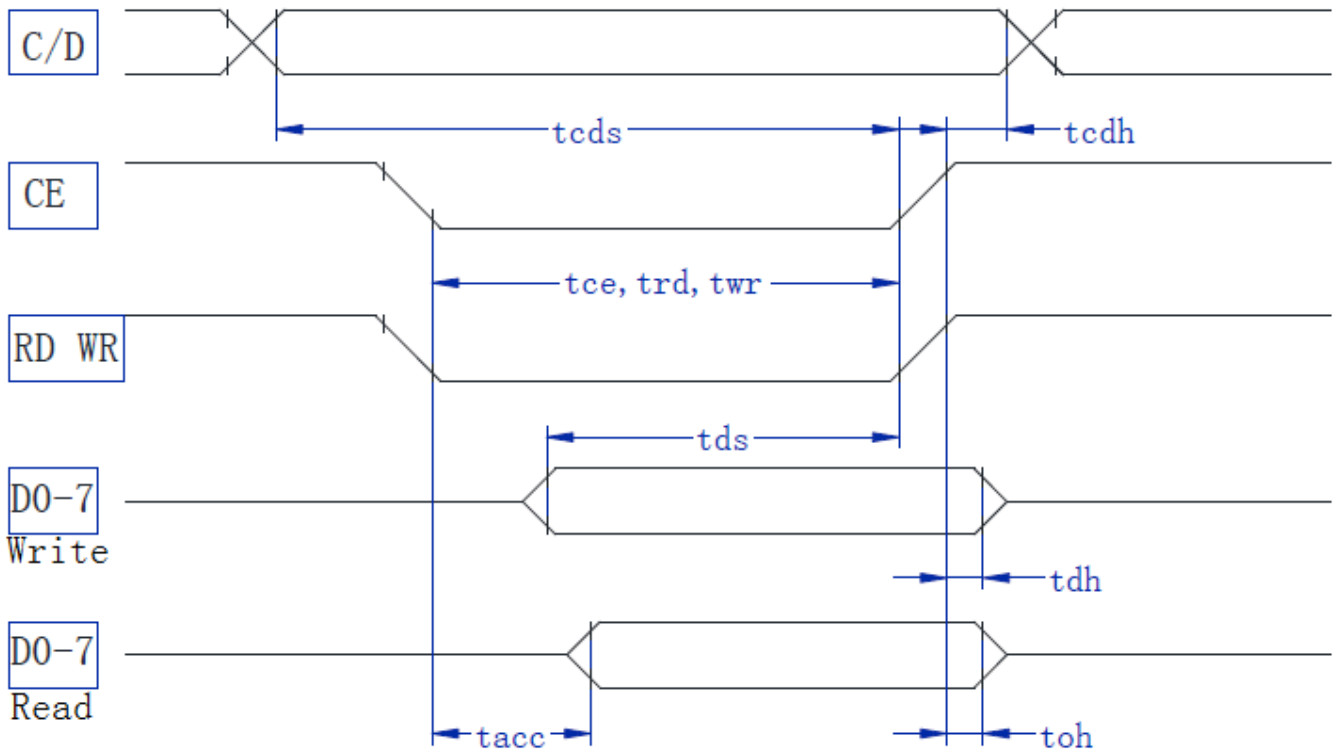
Internal Circuit Diagram(Right Draft as follow)

(Effective spatial Distribution)

Hole Diameter \varnothing 3mm ; 1 to 9 per Position Measured Luminous:

7.AC TIMING

7.1 write operation



Item	Symbol	Test conditions	MIN	MAX	UNIT
C/D setup time	t_{CDS}		100	-	ns
C/D hold time	t_{CDH}		10	-	ns
CE,RD,WR pulse width	t_{CE} t_{RD} t_{WR}		80	-	ns
Data set-up time	t_{DS}		80	-	ns
Data hold time	t_{DH}		40	-	ns
Access time	t_{ACC}		-	150	ns
Output hold time	t_{OH}		10	10	ns

8. OPTICAL CHARACTERISTICS:

Driving the backlight

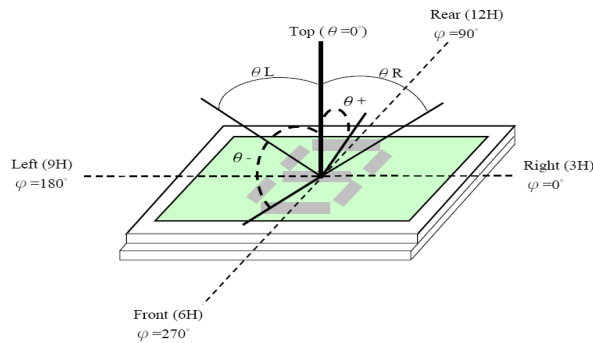
No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tr	25°C	-	150	200	Ms	(1)(2)
			Tf	25°C	-	150	200		
2	Contrast Rate		Cr	$\theta=0$, Normal viewing angle	-	3	-	-	(1)(3)
3	Viewing Angle	Hor.	Θ	CR>10	-50	-	50	Deg	-
		Ver.	Θ		-50	-	50		

Measure Conditions:

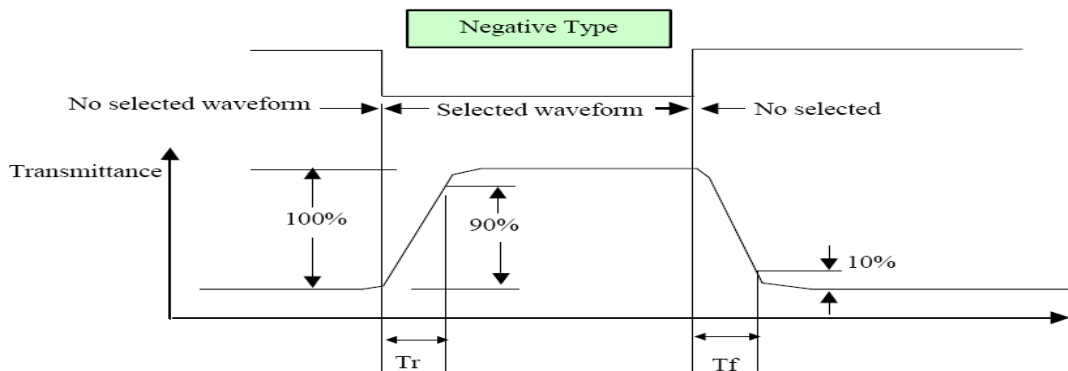
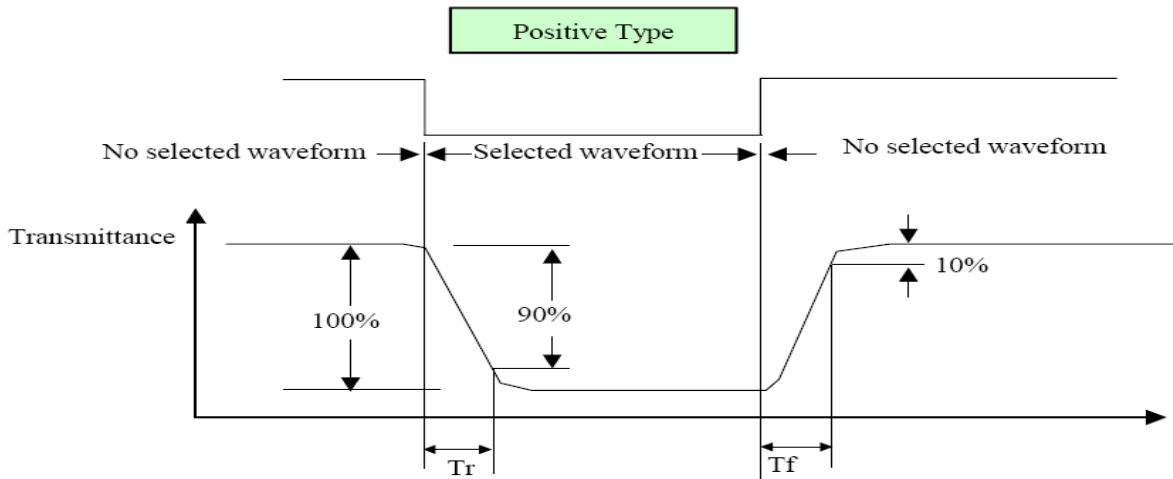
1. Measure surrounding : dark room;
2. Ambient temperature: $25\pm 2^\circ\text{C}$;
3. 30min.warm-up time.

Note Definition:

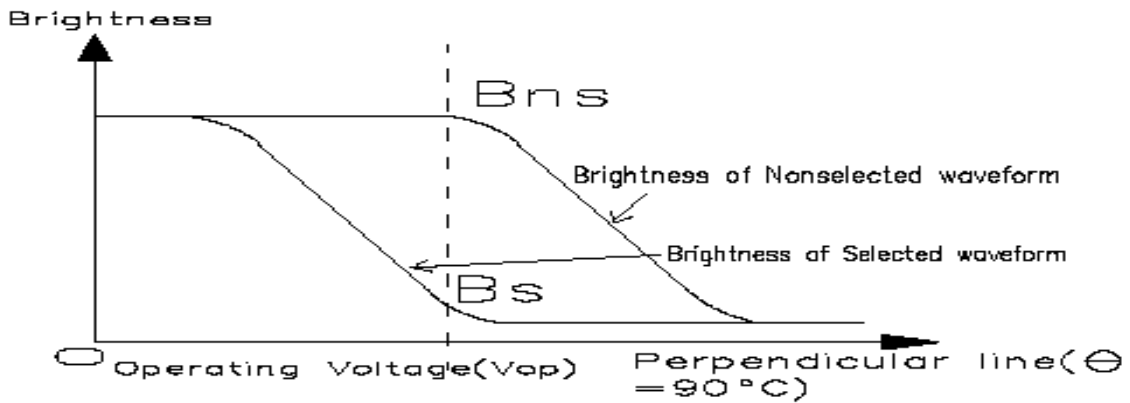
Note(1)Viewing angle range:



Note (2)Response Time:



Note(3) Contrast Ratio Definition:

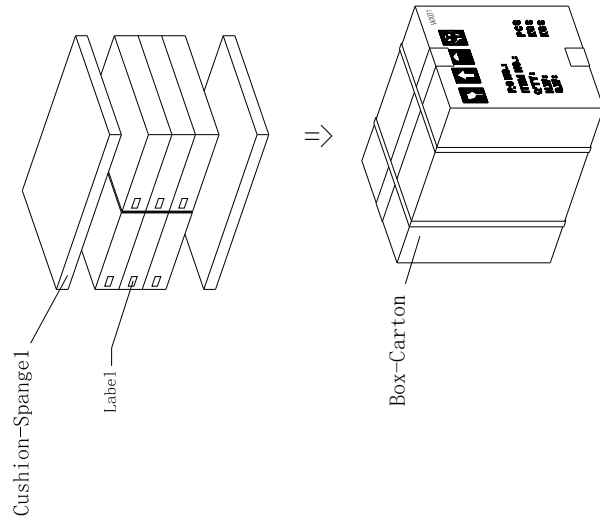
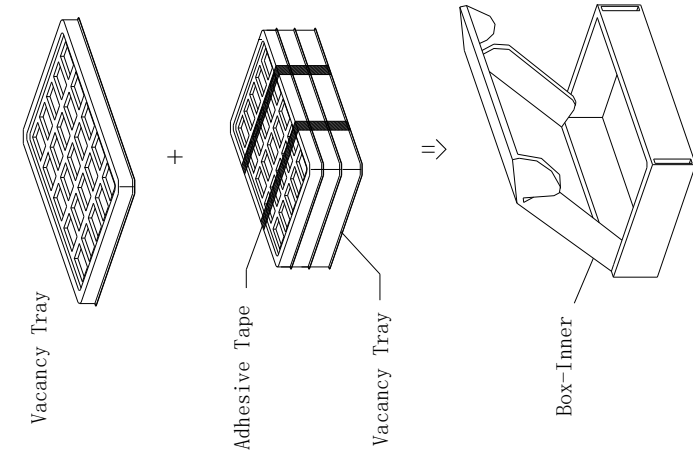
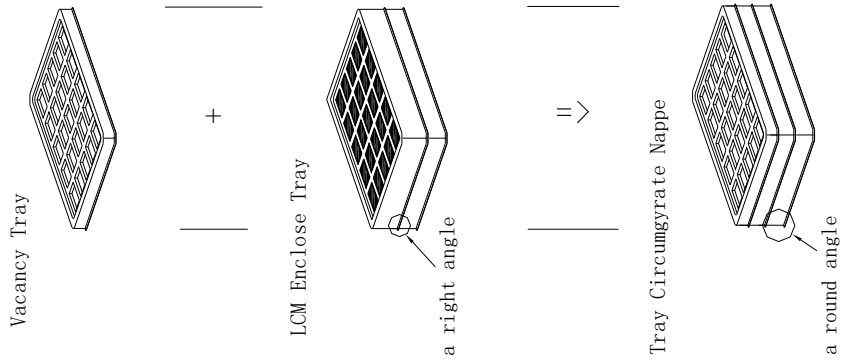


Luminance with all pixel white

Contrast Ratio (Cr) = _____

Luminance with all pixel black

9. PACKAGE.



- NOTE:
1. PET Tray Nappe Circumgyrate 180°
 2. LCM Panel Packaging Heads

10. STANDARD SPECIFICATION FOR RELIABILITY:

Item	Condition	Remark	Regulation
High temp. Storage	80±5°C 96Hrs	Dry	Note 2
High temp. Operating	70±5°C 96Hrs	Dry	
Low temp. Storage	-30±5°C 96Hrs	Dry	
Low temp. Operating	-20±5°C 96Hrs	Dry	
Temperature Shock (Non-operation state)	Cycle: 25±5°C 0.5Hrs→-20±5 °C 1Hrs→25±5°C 0.5Hrs→ 70±5°C 1Hrs Total 32 cycles	Dry	Note 2
Humidity (Non-operation state)	40±5°C & 90---95% RH 96Hrs	No Condensation	Note 1 Note 2
Vibration (Non-operation state)	Frequency: 10---55 Hz Total Amplitude: 1.5 mm One cycle 60 seconds to 3 directions of X,Y,Z for each 15 minutes.	3 directions	Note 2
ESD Test	Air: ±6KV, Contact: ±4KV		Note 3

Note 1 : Returned to normal temperature and humidity for 4 hrs.

Note 2 : No change on display and in operation under the test condition.

Note 3 : Only for display area, if display can resume after program was reset, it is OK.

Note 4 : Product cannot sustain at extreme storage conditions for long time.

Test condition:

1) Normal Temperature and Humidity(Ambient Temperature)

Temperature: 25±5°C

Humidity: 65% RH

2) Operation

Unless specified otherwise, test will be conducted under function state.

3) Test Frequency

For destructive tests, such as shock test, will be conducted only once.

11.SPECIFICATION OF QUALITY ASSURANCE:

11.1 Purpose

This standard for Quality Assurance should affirm the quality of LCD Module products to supply.

11.2 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 MIL-STD105E.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

11.3. Nonconforming Analysis & Deal With Manners

a. Nonconforming Analysis:

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

(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.

11.4. 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.

11.5 Standard of The Product Appearance Test

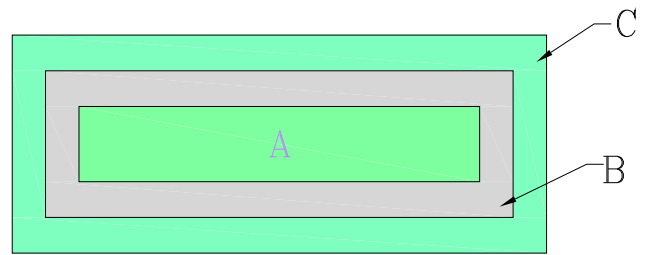
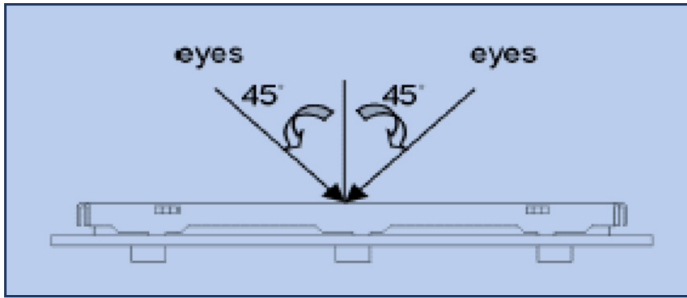
a. Manner of appearance test: This specification should be applied for both light on and off situation.

(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.

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

(iii) The test direction is base on about around 10° of vertical line (Left graph)

(iiii) Temperature: 25±5°C Humidity: 65±10%RH



(iv) Definition of area (Right graph)

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)

Allowable limits defined in follow Dot defect Table should be met for each white, black , R, G, B raster. The limits apply to the entire area. Missing white in 60% or more of typical (one color, R or G or B) pixel aperture is defined as a bright defect, less than 60% is acceptable .Black spot in 60% or more of typical pixel aperture is defined as a dark defect, less than 60% is acceptable.

Dot defect table:

Item		White dot defect	Black dot defect	Total
1	Defect counts	3	3	3
2	Combined defect Counts	No combined dot defect allowed. Two Single dot defect that within 5mm during each dot defect should be counted as combined dot defect.		

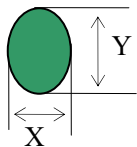
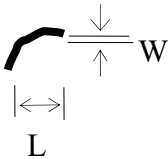
11.6 Inspection specification

AQL inspection standard

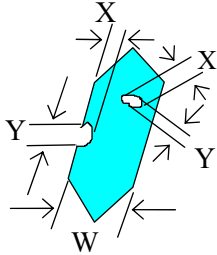
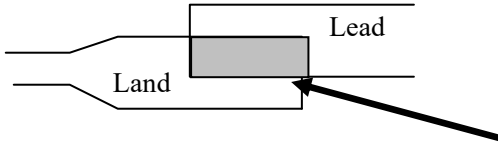
Sampling method: MIL-STD-105E, Level II, single sampling

Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		Contrast defect (dim, ghost)		
		LC leakage		
		Flickering		
		No display		
	Non-display	Wrong viewing direction	2	
		Wrong Back-light	7	
		Flat cable or pin reverse	9	
		Wrong or missing component	10	
Minor	Display state	Background color deviation	2	2.5
		Black spot and dust	3	
		Line defect	4	
		Scratch		
		Rainbow	5	
		Pin hole	6	
	Polarizer	Bubble and foreign material	3	
		Scratch	4	
	PCB,FPC	Scratch	4	
	Soldering	Poor connection	8	
	Wire	Poor connection	9	
	LCD	CHIP OUT	11	

Note on defect classification:

No.	Item	Criterion																				
1	Short or open circuit	Not allow																				
	LC leakage																					
	Flickering																					
	No display																					
	Wrong viewing direction																					
	Wrong Back-light																					
2	Contrast defect	Refer to approval sample																				
	Background color deviation																					
3	Point defect, Black spot, dust (incl. Polarizer) ex.: dirt under polarizer, Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer $\phi = (X+Y)/2$	 <table border="1" data-bbox="901 929 1340 1176"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.20$</td> <td>Disregard</td> </tr> <tr> <td>$0.20 < \phi \leq 0.25$</td> <td>3</td> </tr> <tr> <td>$0.25 < \phi \leq 0.30$</td> <td>2</td> </tr> <tr> <td>$\phi > 0.30$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.20$	Disregard	$0.20 < \phi \leq 0.25$	3	$0.25 < \phi \leq 0.30$	2	$\phi > 0.30$	0										
Point Size	Acceptable Qty.																					
$\phi \leq 0.20$	Disregard																					
$0.20 < \phi \leq 0.25$	3																					
$0.25 < \phi \leq 0.30$	2																					
$\phi > 0.30$	0																					
4	Line defect	 <table border="1" data-bbox="877 1400 1428 1668"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$0.015 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$3.0 \geq L$</td> <td>$0.03 \geq W$</td> <td rowspan="2">2</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.05 \geq W$</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.1 > W$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.05 < W$</td> <td>Applied as point defect</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
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$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area																				

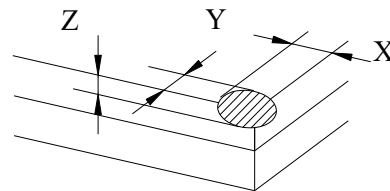
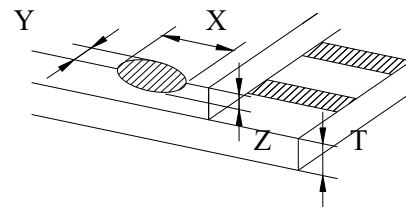
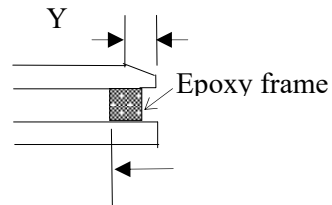
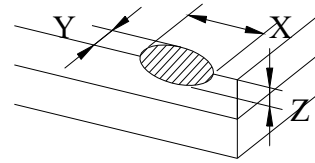
No.	Item	Criterion
-----	------	-----------

6	<p>Segment pattern W = Segment width $\phi = (X+Y)/2$</p>	<p>(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.</p>  <table border="1" data-bbox="970 360 1430 562"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </tbody> </table> <p>Unit: mm</p>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
7	Back-light	<p>(1) The color of backlight should correspond its specification. (2) Not allow flickering</p>								
8	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB or FPC. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.</p> 								
9	Wire	<p>(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.</p>								
10	PCB,FPC	<p>(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.</p>								

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LCD

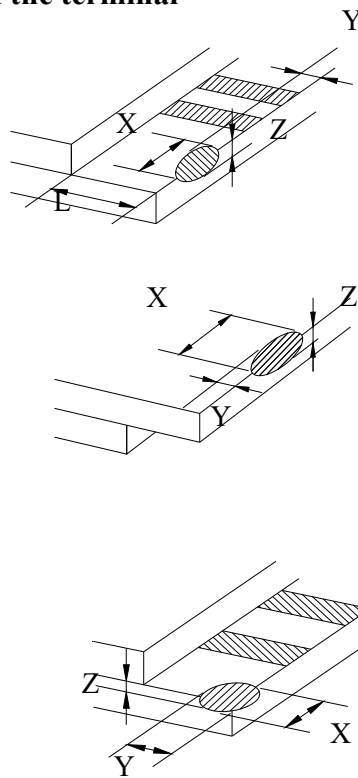
2.1.1 chip on the surface



Note: A:LCD Length

X	Y	Z
$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$
$\leq 1/8A$	Not enter into epoxy frame	$\leq T$
	Not enter into the inner edge of epoxy	$\leq 1/2T$

2.1.2 Chip on the terminal

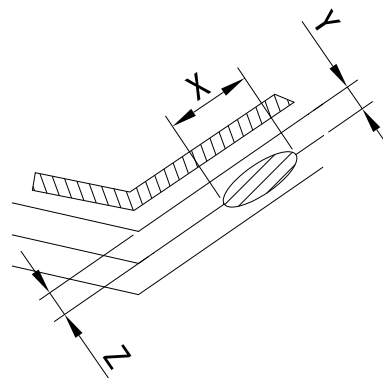


X	Y	Z
$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/2L$	$\leq T$
$\leq 1/8A \& \leq 1\text{mm}$	$\leq L$	$\leq T$
$\leq 1/8A \& \leq 2\text{mm}$	$\leq L$	$\leq 1/2T$

Note: A:LCD Length.

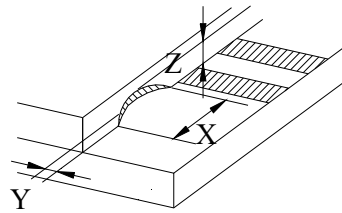
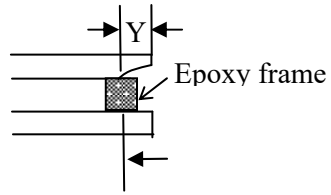
the distance between crack and contact pad must be greater than the width of 1st contact pad.

2.1.3 Chip out on between side



11

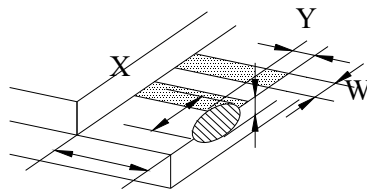
LCD



X	Y	Z
$\leq 1/8A$	Not enter into epoxy frame	$Z \leq 2T$
	Not enter into 1/2 epoxy frame	$Z \leq 1/2T$

Note: A : LCD Length

2.1.4 including corner chip and side chip

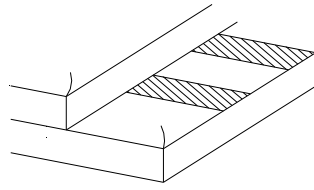


L

Note: A:LCD Length

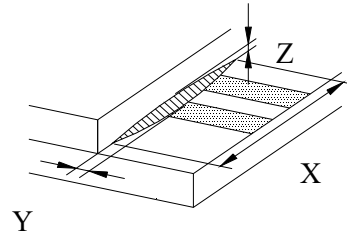
X	Y	Z
$>1/8A$	$\leq 1/6L$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/3L$	
$\leq 1/4W$	$\leq 2/3L$	

2.2 Chip out



- 1) Chip out is that crackles extend to inner edge.
- 2) Crackles round epoxy frame will be rejected.
- 3) Chip out on the terminal will be rejected: $Z=T$ length $>1\text{mm}$ or $Z<T$ length $>2\text{mm}$
- 4) The chip out at ITO will be rejected.

2.3 Poor cutting



X	Y	Z
$>1/8$ A	≤ 0.3	$\leq 1/2T$
$\leq 1/8$ A	According to drawing	$1/2T \leq Z \leq T$

Note : A: LCD Length.

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LCD

12

SMT

According to the <Acceptable of electronic assemblies> IPC-A-610C class 2 stander. Component missing or function defect are Major defect ,the others are Minor defect.

Any one out of the specification will be rejected.

12. GENERAL PRECAUTIONS

(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
- Trichlorotrifluoroethane

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.
- As light 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 required.

(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.

Hello Lighting co., ltd reserves the right to change this specification.

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