LIQUID CRYSTAL DISPLAY MODULE

Product Specification

DENSITRON	STANDARD LCD MODULE	
PRODUCT NUMBER	LWX320240D-SERIES	
DEFINITION	320*240 dots	Date 2010/04/01

INTERNAL APPROVALS				
Quality Mgr	Product Mgr	Project Leader	Mech. Eng	Electr. Eng
Date:	Date:	Date:	Date:	Date:

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
0	2010/04/01			Initial Specification	
1	2019/11/18			COG Construction	
2	2019/11/21			Combine 3.3V and 5V VDD characteristics	

1 PART NUMBERING SYSTEM

$$\underline{\textbf{LWX}} \qquad \underline{\textbf{320240B}} - \underline{\textbf{BW}} - \underline{\textbf{WNF}} \;\; *$$

Densitron module   ①   ②   ③   ④ ⑤ ⑥

① Characters x Row format

② <u>Model serials number</u>

③ <u>Display mode and backlight type :</u>

    A = Reflective (without backlight) =

    B* = Transflective positive LEDS array type backlight (BG, BA, BW, BR...)

    B*(E) = Transflective LEDS edge type backlight (BGE, BAE, BWE, BR…)

    B = Transflective CFL

    C* = Transflective positive EL backlight (CB, CW)

    D* = Transmissive negative EL backlight (DB, DW)

    E = CFL

    E* = Transmissive negative LEDS array type backlight (EG, EA, EW, ER…)

    E*(E) = Transmissive negative LEDS edge type backlight (EGE, EAE, EWE, ERE…)

    (* color LED or EL backlight = G/ yellow-green, A/ amber, W/ white, R/ red, B/blue, ...)

④ <u>Temperature range and power supply</u>

    D = Standard temperature range; negative supply voltage required (0°C~+50°C)

    S = Standard temperature range; on board negative voltage generator (0°C~+50°C)

    H= Wide temperature range; negative supply voltage required (-20°C ~+70°C)

    W= Wide temperature range; on board negative voltage generator (-20°C ~+70°C)

⑤ <u>Fluid type and compensation circuit option</u>

    NY = STN yellow-green glass, without temperature compensation circuit

    CY = STN yellow green glass, with temperature compensation circuit on board

    NG = STN gray glass without temperature compensation circuit

    CG = STN gray glass with temperature compensation circuit

    NB = STN blue glass, without temperature compensation circuit

    CB = STN blue glass with temperature compensation circuit

    NF = FSTN black and white glass without temperature compensation circuit

    CF = FSTN black and white glass with temperature circuit on board

ⓖ   Special code for customized features
Please refer to our commercial office

Remarks and definitions :

1°) Display mode and backlight type :

- Reflective polarizer, no backlight, usable only in good ambient light conditions.
- Transflective polarizer uses a background backlight and a mirror reflector, usable in all lighting conditions.
- Transmissive polarizer needs the backlight switched on continuously, usable mostly in low ambient light conditions
- EL (electro-luminescent), uniform brightness, short life time (8000 hours max), needs EL inverter, low current consumption, low thickness.
- LED (light emitting diode), uniform brightness, long lifetime (100 000 hours), doesn't need inverter, reliable in vibration and shock environment, different colors available.

Array version is a direct lighting type, available in standard form, uniform and good brightness on all the active area.

Edge version is an edge lighting type providing a low consumption backlight, has a low thickness and brightness.

- Positive mode has dark pixels on a light background
- Negative mode has light pixels in a dark background and is normally used only with a transmissive polarizer as it needs a backlight on to be visible.

2°) Fluid type :

- STN yellow green or gray LCD has a yellow green or gray background with dark blue pixels and offers a good contrast.
- FSTN LCD is to produce very high contrast with black and white pixels using a film polarizer
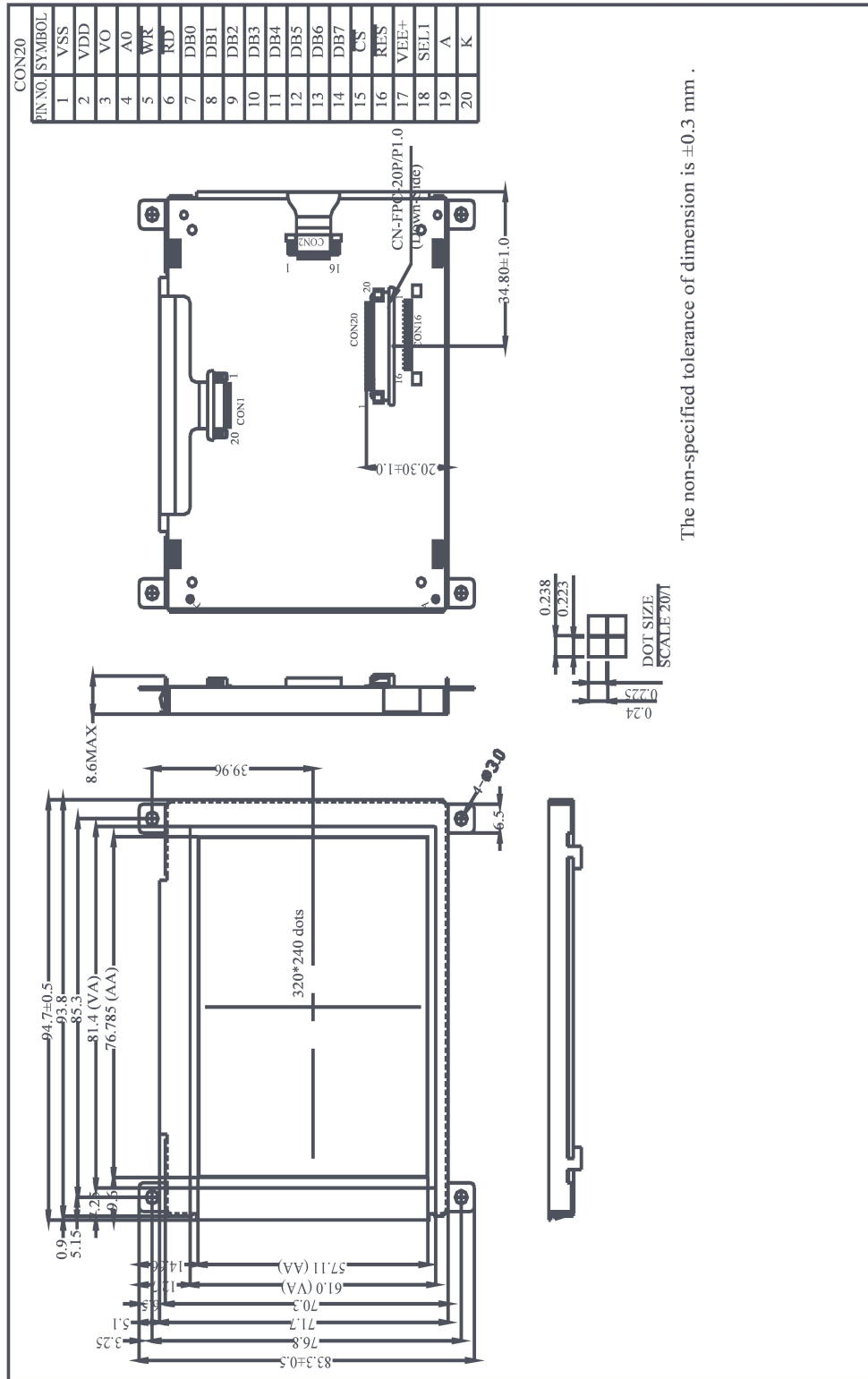
2 MAIN FEATURES

ITEM	STANDARD VALUE	UNIT
Number of dots	320x240	–
Outline dimension	94.7 x 83.3 x 8.6max	mm
View area	81.4 x 61.0	mm
Active area	76.785 x 57.11	mm
Dot size	0.223 x 0.225	mm
Dot pitch	0.238 x 0.24	mm
LCD type	FSTN Positive Transflective (In LCD production, It will occur slightly color difference. We can only guarantee the same color in the same batch.)	
Duty	1/240	
View direction	6 o'clock	
Backlight	LED, White, other available on request	
IC	RA8835	

3 MECHANICAL SPECIFICATION

3.1 MECHANICAL CHARACTERISTICS

ITEM	STANDARD VALUE	UNIT
Number of dots	320x240	–
Outline dimension	94.7 x 83.3 x 8.6max	mm
View area	81.4 x 61.0	mm
Active area	76.785 x 57.11	mm
Dot size	0.223 x 0.225	mm
Dot pitch	0.238 x 0.24	mm

3.2 MECHANICAL DRAWING

CON20		
PIN NO.	SYMBOL	
1	VSS	
2	VDD	
3	VO	
4	A0	
5	WR	
6	RD	
7	DB0	
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	CS	
16	RES	
17	VEE+	
18	SEL.1	
19	A	
20	K	

The non-specified tolerance of dimension is ±0.3 mm .

CN-FPC-20P/P1.0 (Down side)

34.80±1.0

20.30±1.0

320*240 dots

94.7±0.5
93.8
85.3
81.4 (VA)
76.785 (AA)

39.96

8.6MAX

4-Ø3.0
6.5

57.11 (AA)
61.0 (VA)
70.3
71.7
76.8
83.3±0.5

0.9
5.15
3.25
5.1

DOT SIZE
SCALE 20/1
0.238
0.223
0.24
0.225

4 ELECTRICAL SPECIFICATION

4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	—	+70	℃
Storage Temperature	T_{ST}	-30	—	+80	℃
Input Voltage	V_{IN}	-0.3	—	$V_{DD+0.3}$	V
Supply Voltage For Logic	V_{DD}-V_{SS}	-0.3	—	7.0	V
Supply Voltage For LCD	V_{DD} -V_0	0	—	32	V

Note 1: Background colour changes slightly depending on ambient temperature.

4.2 ELECTRICAL CHARACTERISTICS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	V_{DD}-V_{SS}	—	3.0	3.3	3.6	V
	V_{DD}-V_{SS}	—	4.7	5.0	5.3	V
Supply Voltage For LCD	V_{OP}	Ta=-20℃	—	—	23.3	V
		Ta=25℃	—	23.0	—	V
		Ta=70℃	22.7	—	—	V
Input High Volt.	V_{IH}	—	$0.5V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	$0.2V_{DD}$	V
Output High Volt.	V_{OH}	—	V_{DD}-0.4	—	—	V
Output Low Volt.	V_{OL}	—	—	—	V_{SS}+0.4	V
Supply Current	I_{DD}	V_{DD}=3.3V	—	63.5	100.0	mA
	I_{DD}	V_{DD}=5.0V	—	52.0	80.0	mA

4.3 INTERFACE PIN ASSIGNMENT

Pin No.	Symbol	Level	Description
1	V_{SS}		Ground
2	V_{DD}		Power supply for Logic (3.3V or 5V)
3	V_O	(Variable)	Operation voltage LCD driving
4	A_0	H/L	H:Data L:Instruction
5	$\overline{WR}$	H	8080 family: Write signal, 6800 family: R/W signal
6	$\overline{RD}$	L	8080 family: Read signal, 6800 family: Enable clock
7-14	DB0-DB7	H/L	DB0 Data bus line
15	CS	H/L	Chip Enable
16	RES	H/L	Reset
17	VEE		Positive voltage output
18	SEL1	H/L	8080 OR 6800 Family Interface Select ; H:68xx , L:80xx
19	A		Power supply for B/L+
20	K		Power supply for B/L-

4.4 Interface Block Diagram
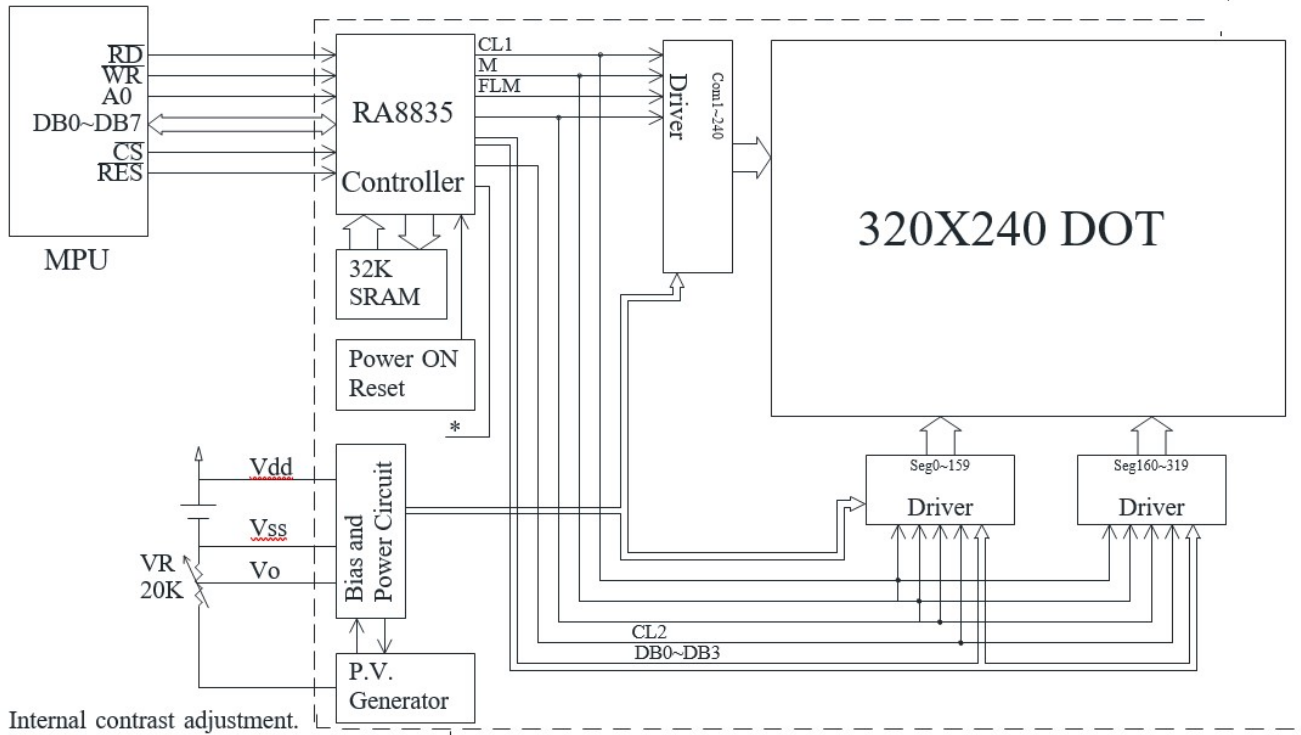
*:6800 family or 8080family interface selectable.

4.5 DISPLAY CONTROL INSTRUCTION

Please refer to RA8835 specification

5 OPTICAL SPECIFICATION

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	CR≧2	0	—	30	ψ = 180°
	θ	CR≧2	0	—	60	ψ = 0°
	θ	CR≧2	0	—	45	ψ = 90°
	θ	CR≧2	0	—	45	ψ = 270°
Contrast Ratio	CR	—	—	5	—	—
Response Time	T rise	—	—	200	300	ms
	T fall	—	—	250	350	ms

Note 1: definition of viewing angle θ1 & θ2   Note 2: definition of viewing angle θ3 & θ4
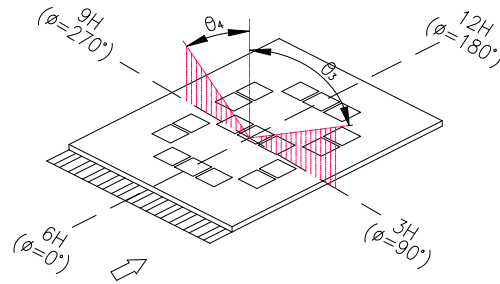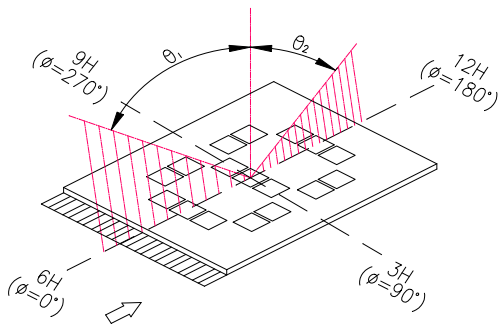
Note 3: definition of contrast ratio (CR)

[positive type]

Intensity
100

Selected Wave

Non-selected Wave

Cr Max

$Cr = Loff / Lon$

Vop

Driving Voltage(V)

[Negative type]

Intensity
100%

Selected Wave

Non-selected Wave

Cr Max

$Cr = Lon / Loff$

Vop

Driving Voltage(V)
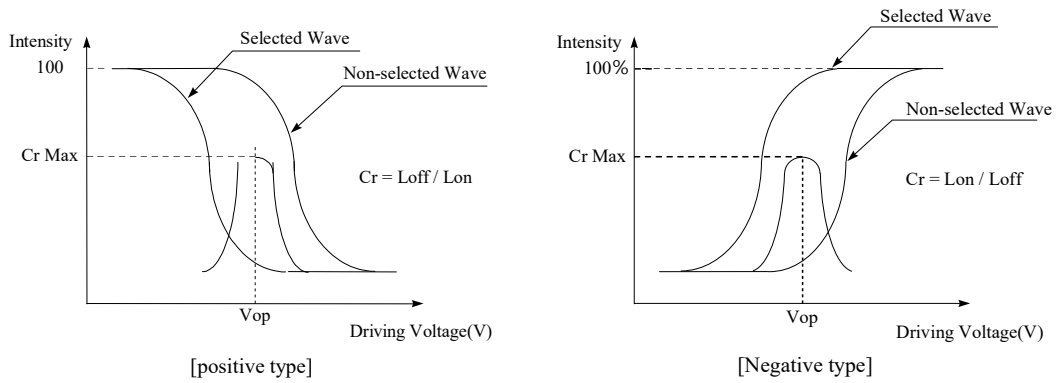
Note 4: definition of response time

[positive type]

Non-selected Condition — Selected Condition — Non-selected Condition

Intensity

100 %

90 %

10 %

Tr — Tf

[Negative type]

Non-selected Condition — Selected Condition — Non-selected Condition

Intensity

100 %

90 %

10 %

Tr — Tf
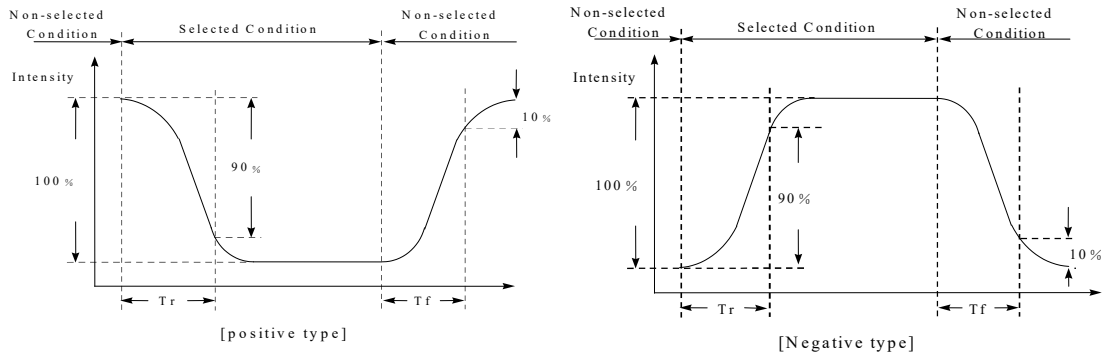
6 TOUCH SCREEN SPECIFICATION

Under Development/evaluation

7 BACKLIGHT SPECIFICATION

Specification

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION
Supply Current	ILED	72	82	120	mA	V=3.5V
Supply Voltage	V	-	3.5	-	V	-
Reverse Voltage	VR	-	-	5	V	-
Chromaticity	X	0.26	0.29	0.32	-	-
Coordinates	Y	0.26	0.29	0.32	-	-
Luminance (Without LCD)	IV	560	700	-	CD/M^2	ILED=82mA
LED Life Time (For Reference only)	-	-	50K	-	Hr.	ILED=82mA 25℃,50-60%RH, (Note 1)
Color	White					

Note: The LED of B/L is drive by current only, drive voltage is for reference only. drive
   voltage can make driving current under safety area (current between minimum and
   maximum).

Note 1:50K hours is only an estimate for reference.
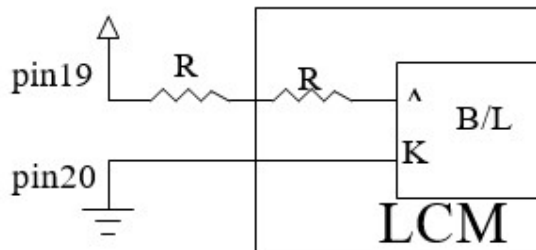
8 QUALITY ASSURANCE SPECIFICATION

8.1CONFORMITY

he performance, function and reliability of the shipped products conform to the Product Specification.

8.2 DELIVERY ASSURANCE

8.2.1 Delivery inspection standards.

- MIL-STD-105E, general inspection level II, single sampling level;
- IPC-AA610 rev. C, class 2 electronic assemblies standard

The quality assurance levels are shown below:

Rank	Item Inspected	Defect type	AQL	Remark
Critical defect	Display	Non display	0.65%	Display malfunction
		Over current		
		Missing segment		
		Wrong viewing direction		
		Backlight OFF		
	Dimension	PCB and bezel out of specification	0.65%	Assembly failure
Major defect	Display	Incorrect operating	1.0%	
	Backlight	Flashing, dust		
		Wrong colour		
Minor defect	LCD	Black and white spot	2.5%	Appearance defect
		Black and white lines		
		Polariser scratch		
		Bubbles in polariser		
		Segment deformation, pin hole		
		Colour uniformity		
		Glass chip		
	COB	Wire bond pad exposed		
		Insufficient covering with resin (wire bond line exposed)		
		Bubble, dust on COB		
	PCB	Dust, solder ball on PCB		
		Pad scratch		
		Total	2.5%	

8.2.2 Zone definition

A   Viewing area

B   Outside viewing area
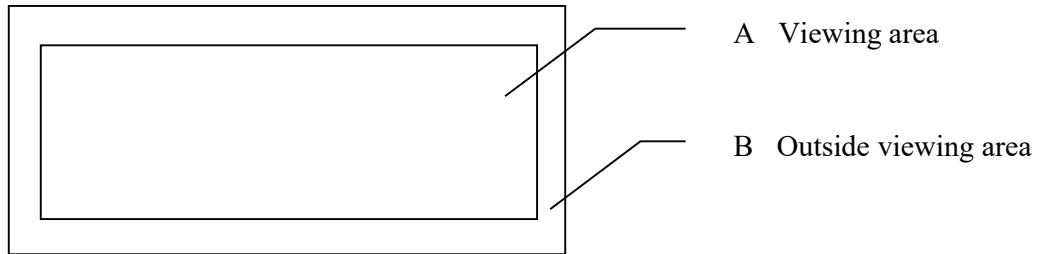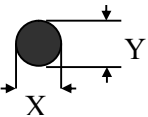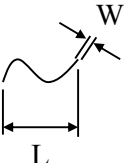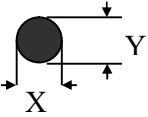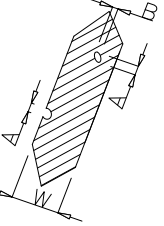
8.2.3 Visual inspection
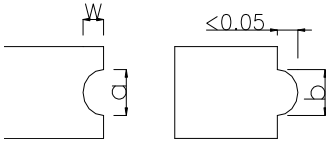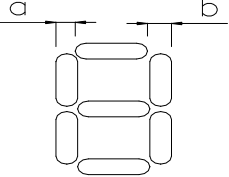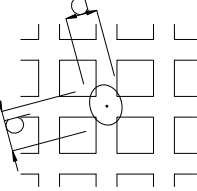
- Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- Inspect the module at 45° right and left, top and bottom.
- Use the optimum viewing angle during the contrast inspection.

eye

45°   45°
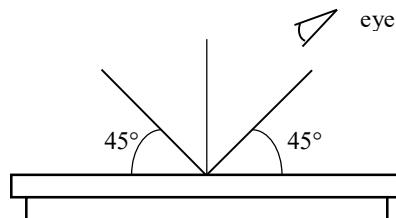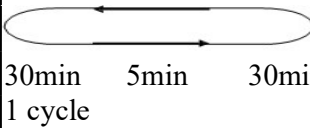
8.2.4 Standard of appearance inspection

Units: mm

No	Item	Criteria
1	Black spot, white spot, dust	Round type: as per following drawing $\varnothing = (X+Y)/2$ Line type: as per following drawing Total acceptable quantity: 3
2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1
3	Polariser bubble	$\varnothing = (X+Y)/2$ Total acceptable quantity: 4
4	Segment deformation	1.a. Pin hole on segmented display W: segment width $\varnothing = (A+B)/2$ Total acceptable quantity: 1 defect per segment Pin holes with $\varnothing$ under 0.10 mm are acceptable

Item 1 — Round type: Acceptable quantity

	Acceptable quantity	
Size	Zone A	Zone B
$\varnothing<0.1$	Any number	Any number
$0.1<\varnothing<0.2$	6	
$0.2<\varnothing<0.3$	2	
$0.3<\varnothing$	0	

Item 1 — Line type: Acceptable quantity

		Acceptable quantity	
Length	Width	Zone A	Zone B
- -	$W\leq0.02$	Any number	Any number
$L\leq3.0$	$0.02<W\leq0.03$	2	
$L\leq2.5$	$0.03<W\leq0.05$		
- -	$0.05<W$	As round type	

Item 3 — Acceptable quantity

	Acceptable quantity	
Size	Zone A	Zone B
$\varnothing<0.3$	Any number	Any number
$0.3<\varnothing<1.0$	3	
$1.0<\varnothing<1.5$	1	
$1.5<\varnothing$	0	

Item 4 — Acceptable quantity

Width	$\varnothing$
$W\leq0.4$	$\varnothing\leq0.2$ and $\varnothing\leq1/2W$
$W>0.4$	$\varnothing\leq0.25$ and $\varnothing\leq1/3W$

No	Item	Criteria
4	Segment deformation	1b. Pin hole on dot matrix display <table> **Acceptable quantity** Size | a,b<0.1 | Any number (a+b)/2≤0.1 | Any number 0.5<∅<1.0 | 3 Total acceptable quantity: 7 </table> 2. Segments / dots with different width <table> **Acceptable** a≥b | a/b≤4/3 a<b | a/b>4/3</table> 3. Alignment layer defect ∅ = (a+b)/2 <table> **Acceptable quantity** Size | ∅≤0.4 | Any number 0.4<∅≤1.0 | 5 1.0<∅≤1.5 | 3 1.5<∅≤2.0 | 2 Total acceptable quantity: 7</table>
5	Colour uniformity	Level of sample for approval set as limit sample
6	Backlight	The backlight colour should correspond to the product specification Flashing and or unlit backlight is not allowed Dust larger than 0.25 mm is not allowed
7	COB	Exposed wire bond pad is not allowed Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed
8	PCB	No unmelted solder paste should be present on PCB Cold solder joints, missing solder connections, or oxidation are not allowed No residue or solder balls on PCB are allowed Short circuits on components are not allowed

9 RELIABILITY SPECIFICATION

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	— —
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity storage	The module should be allowed to stand at 60 ℃,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃ 30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	— —
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	— —

10 HANDLING PRECAUTIONS

Safety
If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes.
If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design
Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.
When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean.
Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning
Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotriflorothane.
Do not wipe the display surface with dry or hard materials that will damage the polariser surface.
Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge
As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on.
Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

Packaging
Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height.
To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

Caution during operation
It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.
Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.
If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once.
Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage
Store the display in a dark place where the temperature is 25°C ± 10°C and the humidity below 50%RH.
Store the display in a clean environment, free from dust, organic solvents and corrosive gases.
Do not crash, shake or jolt the display (including accessories).