LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER		
PRODUCT NUMBER	**LM40336BW90G240SF**	
CUSTOMER APPROVAL		**Date**

INTERNAL APPROVALS			
Quality Mgr	Product Mgr	Mech. Eng	Electr. Eng
		Pat Chang	Eric
Date:	Date:	Date:Mar.21.06'	Date:Mar.21.06'

☐ **Approval for Specification only**

☑ **Approval for Specification and Sample**

Sample no.: Date: 21-Mar-2006 ISIR no.:

TABLE OF CONTENTS

REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	30-May-05’			Production Release	
B	07-June-05’			Amend PCB and FFC	
C	20-June-05’	9		Change Pin 19 & Pin 20 Define.	
D	21-Mar-06’	7	3.2	Change Power Supply for Logic Voltage	

1 MAIN FEATURES

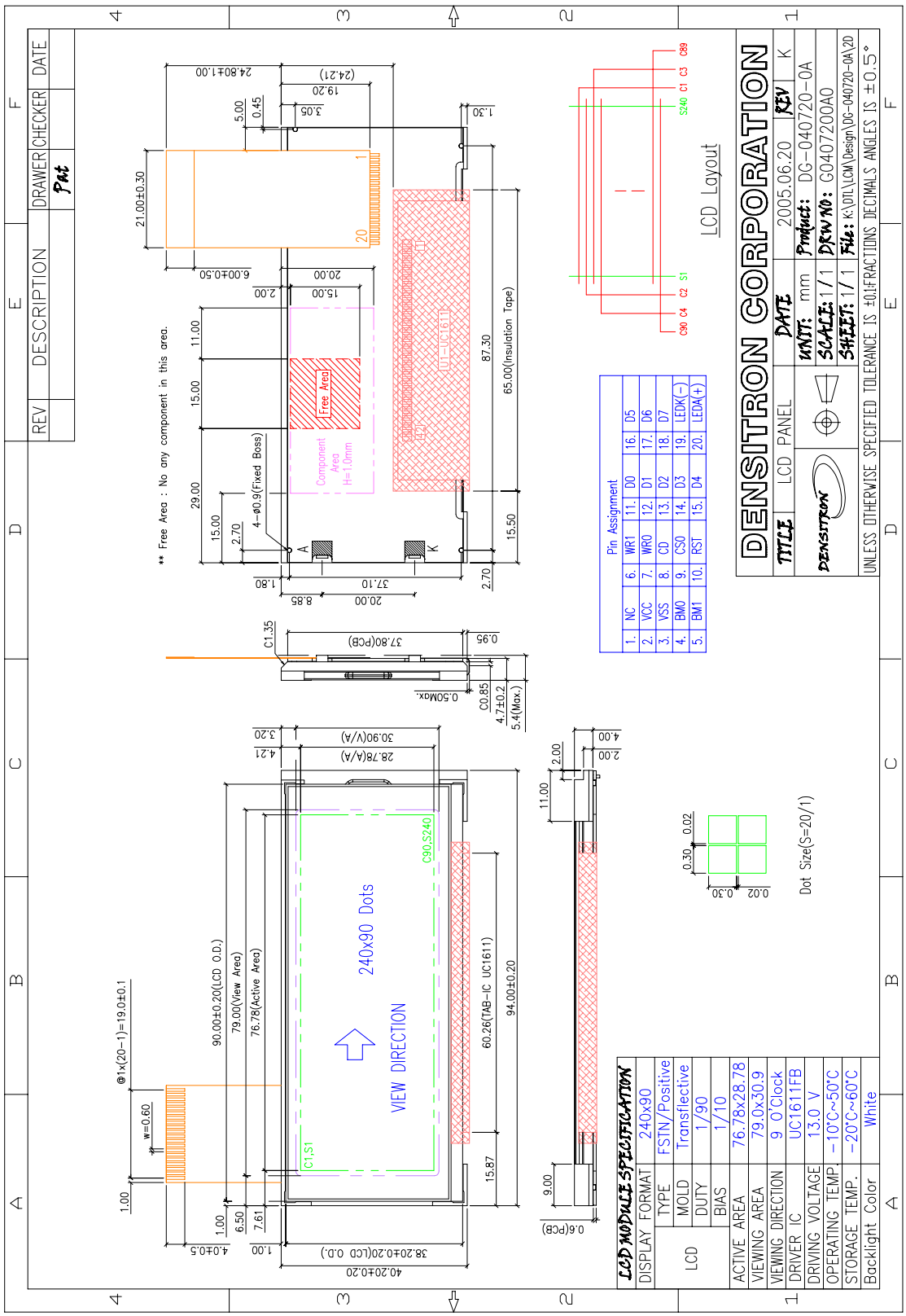
ITEM	CONTENTS
Display Format	240 (W) x 90 (H) Dots
Overall Dimensions	94.0 x 40.2 x 5.4 mm
Viewing Area	79.0 x 30.9 mm
LCD type	FSTN / Positive
Mode	Transflective
Viewing Angle	9 O'clock
Duty ratio	1 / 90
Driver IC	UC1611FB
Backlight Colour	White
DC/DC Converter	Build-In
Operating temperature	-10℃ ~ +50℃
Storage temperature	-20℃ ~ +60℃

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	240 x 90 Dots	
Overall Dimensions	94.0 x 40.2 x 5.4	mm
Viewing Area	79.0 x 30.9	mm
Active Area	76.78 x 28.78	mm
Dot Size	0.30 x 0.30	mm
Dot Pitch	0.42 x 0.42	mm
Weight	29	g
IC Controller/Driver	UC1611FB	

2.2 MECHANICAL DRAWING



3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	V_{DD}-V_{SS}	2.5	3.3	V	
Power Supply for LCD	V_{LCD}	6.5	16.5	V	
Operating Temperature	Top	-10	50	°C	Note 1
Storage Temperature	Tst	-20	60	°C	Note 2
Static Electricity	Be sure that you are grounded when handling displays.				

Note 1: Background colour changes slightly depending on ambient temperature. This phenomenon is reversible. Ta≤70 °C: 75% RH max

Note 2: Ta≤70 °C: 75% RH max

3.2 ELECTRICAL CHARACTERISTICS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply for Logic	V_{DD}-V_{SS}	Ta = 25 °C	2.5	3.0	3.3	V
	V_{LED}	IF=70mA	-	3.3	-	
Input Voltage	V_{IH}	Ta = 25 °C	0.85V_{DD}	-	V_{DD}	V
	V_{IL}	Ta = 25 °C	V_{SS}	-	0.15V_{DD}	V
Output Voltage	V_{OH}	I_{OH}=0.5mA	0.8V_{DD}	-	V_{DD}	V
	V_{OL}	I_{OL}=0.5mA	V_{SS}	-	0.2V_{DD}	V
LCD Module Driving Voltage	V_{DD}-V_O	Ta = 25 °C	-	-	-	V
Current Consumption	* I_{DD}	V_{DD} = 3.3V	-	-	6	mA
Frame Frequency	FLM		32	64	128	Hz

* I_{DD} measurement condition is for all pattern ON

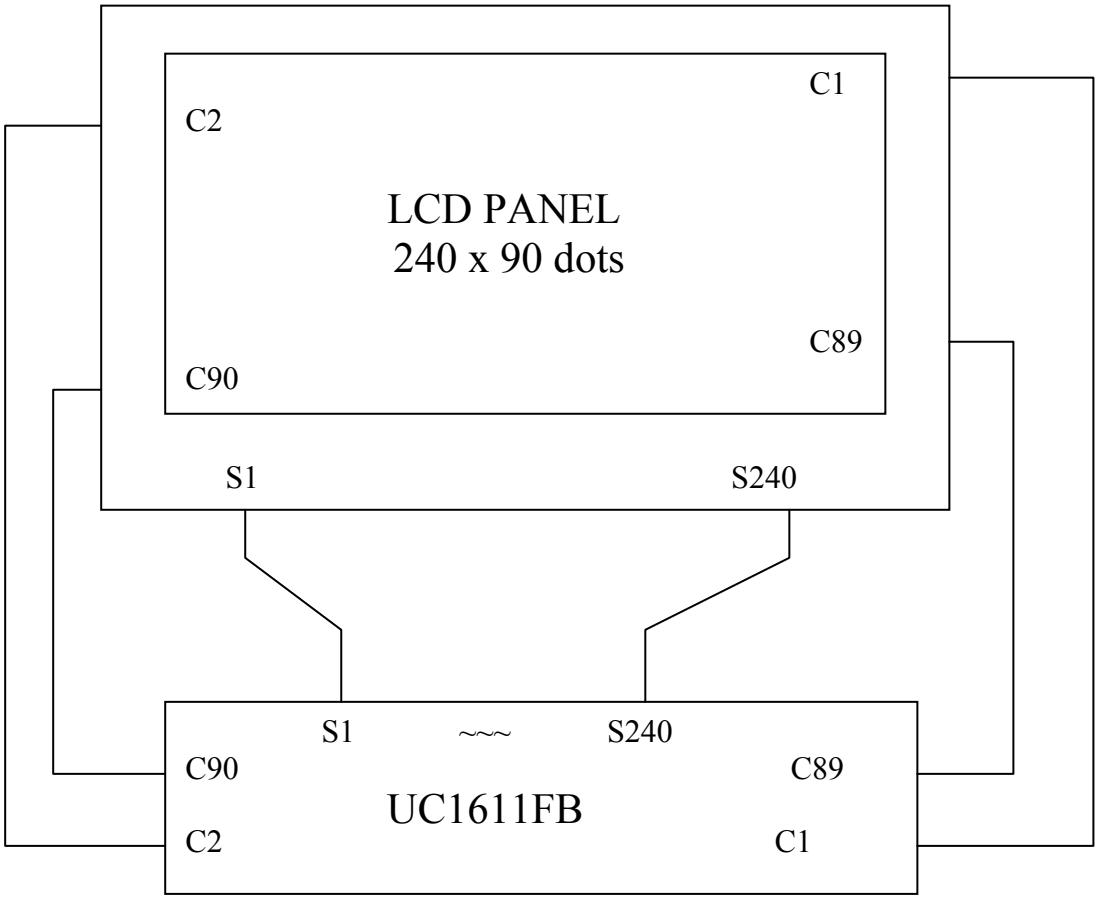
3.3 INTERFACE PIN ASSIGNMENT

<table>
<tr><th>No.</th><th>Symbol</th><th>I/O</th><th>Function</th></tr>
<tr><td>1</td><td>NC</td><td>-</td><td>No command.</td></tr>
<tr><td>2</td><td>VCC</td><td>PWR</td><td>This is the analog power supply and it should be connected to the same power source. V_{CC} is the digital power supply and it should be connected to a voltage source that is no higher than others.</td></tr>
<tr><td>3</td><td>VSS</td><td>GND</td><td>Ground. Connect them to the shared GND pin.</td></tr>
<tr><td>4</td><td>BM0</td><td rowspan="2">I</td><td rowspan="2">Bus Mode: The interface bus mode is detemined by BM[1:0] and D[7] by the following relationship.
<table>
<tr><th>BM[1:0]</th><th>D[7]</th><th>Mode</th></tr>
<tr><td>11</td><td>Date</td><td>6800/8-bit</td></tr>
<tr><td>10</td><td>Date</td><td>8080/8-bit</td></tr>
<tr><td>01</td><td>0</td><td>6800/4-bit</td></tr>
<tr><td>00</td><td>0</td><td>8080/4-bit</td></tr>
<tr><td>01</td><td>1</td><td>3-wire SPI(S9_</td></tr>
<tr><td>00</td><td>1</td><td>4-wire SPI(S8)</td></tr>
</table></td></tr>
<tr><td>5</td><td>BM1</td></tr>
<tr><td>6</td><td>WR1</td><td rowspan="2">I</td><td rowspan="2">WR[1:0] controls the read/write operation of the host interface. See Host Interface section for more detail.

In parallel mode, WR[1:0] meaning depends on whether the interface is in 6800 mode or 8080 mode. In serial interface modes, these two pins are not used. Connect them to Vss.</td></tr>
<tr><td>7</td><td>WR0</td></tr>
<tr><td>8</td><td>CD</td><td>I</td><td>Control data or Display data Selection for read/write operation. In S9 modes, CD pin is not used, connect CD pin to Vss. “L”: Control data “H”: Display data</td></tr>
<tr><td>9</td><td>CS0</td><td>I</td><td>Chip selection. Chip is selected when CS1=”H” and CS0=”L”. When the chip is not selected, D[7:0] will be high impedance.</td></tr>
<tr><td>10</td><td>RST</td><td>I</td><td>When RET=”L”, all control registers are re-initialized by their default states. Since UC1611 has built-in Power-ON Reset and a software Reset command, RST pin is not required for general chip operation.
When RST pin is used, insert a ~ 10KO resistor to improve noise filtering (a small filter capacitor is provided on-chip.). When RST is not used, connect the pin to V_{DD}.</td></tr>
</table>

<table>
<tr><td>11</td><td>D0</td><td rowspan="8">I/O</td><td rowspan="9">Bi-directional bus for both serial and parallel host interfaces.
In serial mode, connect D[0] to SCK, D[3] to SDA, and D[7] to V_{DD} or Vss. When BM[1:0]=”LL”, the bus mode is defined by D[7].
<table><tr><td></td><td>BM=1x (Parallel)</td><td>BM=0x (Serial)</td></tr><tr><td>D0</td><td>D0</td><td>SCK</td></tr><tr><td>D1</td><td>D1</td><td>-</td></tr><tr><td>D2</td><td>D2</td><td>-</td></tr><tr><td>D3</td><td>D3</td><td>SDA</td></tr><tr><td>D4</td><td>D4</td><td>-</td></tr><tr><td>D5</td><td>D5</td><td>-</td></tr><tr><td>D6</td><td>D6</td><td>-</td></tr><tr><td>D7</td><td>D7</td><td>S8/S9</td></tr></table>
Connect unused pins to Vss.</td></tr>
<tr><td>12</td><td>D1</td></tr>
<tr><td>13</td><td>D2</td></tr>
<tr><td>14</td><td>D3</td></tr>
<tr><td>15</td><td>D4</td></tr>
<tr><td>16</td><td>D5</td></tr>
<tr><td>17</td><td>D6</td></tr>
<tr><td>18</td><td>D7</td></tr>
<tr><td>19</td><td>LEDK(-)</td><td>-</td><td>LED Cathode</td></tr>
<tr><td>20</td><td>LEDA(+)</td><td>-</td><td>LED Anode</td></tr>
</table>

3.4 BLOCK DIAGRAM



3.5 Timing Characteristics

Please refer to IC manufacturer specification p/n UC1611FB

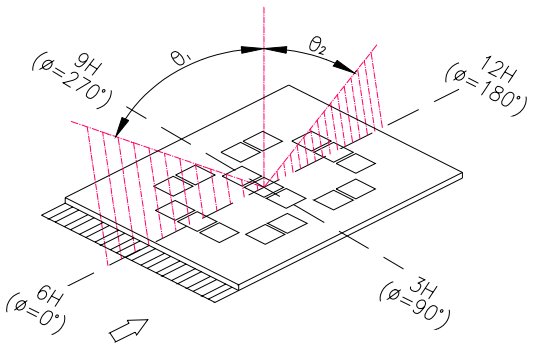
4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

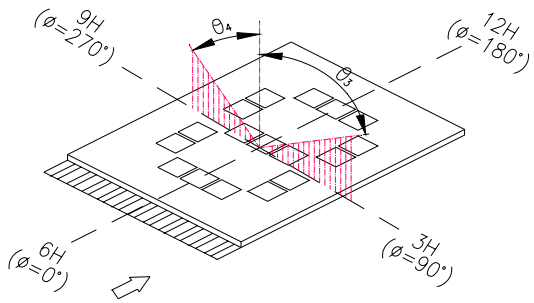
Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	θ1	CR≥2	-	25	-	deg	1
	θ2	CR≥2	-	25	-	deg	1
	θ3	CR≥2	-	25	-	deg	2
	θ4	CR≥2	-	30	-	deg	2
Contrast Ratio	CR	Ta = 25 °C	5	7	-	-	3
Response Time	Tr	Ta = 25 °C	-	125	220	ms	4
	Tf	Ta = 25 °C	-	210	-		
Driving Method	Duty	1/90					
	Bias	1/10					
LCD Type	FSTN – Positive / Transflective						
Viewing Direction	9 O'CLOCK						

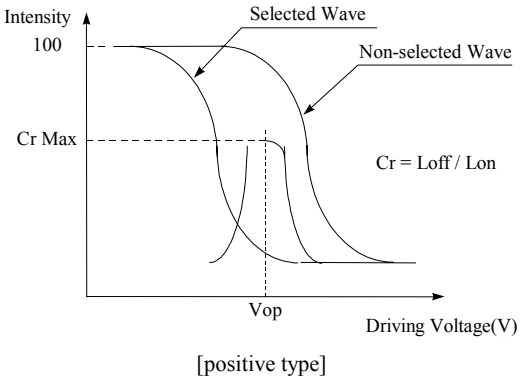
Note 1: definition of viewing angle θ1 & θ2



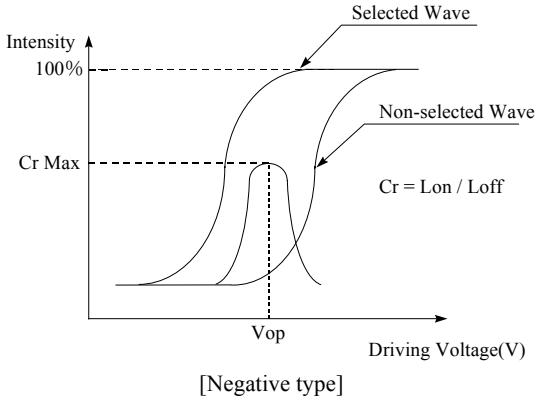
Note 2: definition of viewing angle θ3 & θ4



Note 3: definition of contrast ratio (CR)

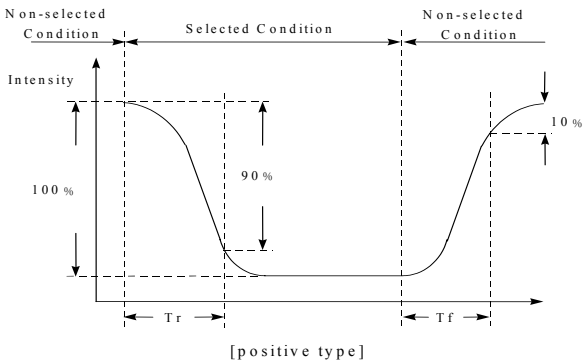


[positive type]

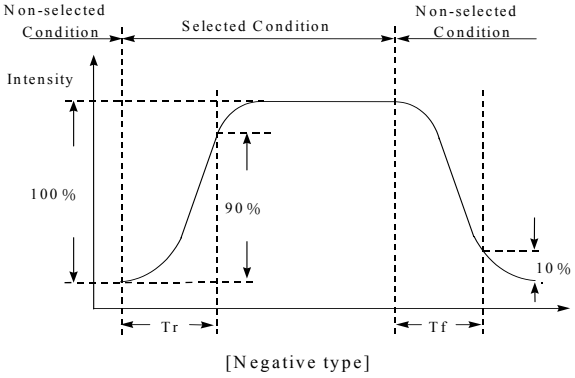


[Negative type]

Note 4: definition of response time



[positive type]



[Negative type]

5 PACKAGING AND LABELLING SPECIFICATION

5.1 PACKAGING

5.1.1 Material

	Item	Part code	Dimensions (mm)	Unit weight (kg)	Quantity
1	Module	DG-040720-0A	94.0*40.2*5.4	0.029	-
2	Tray	*****	-	-	-
3	Inner box	*****	-	-	-
4	Carton	*****	-	-	-
5	Inner box bag	*****	-	-	-
6	Total weight	Kg		± 5%	

5.1.2 Specification and quantity

Modules x tray	Quantity per row	0	x	Quantity per column	0	=	**0**
Modules per box	Quantity per tray	0	x	Quantity of trays	0	=	**0**
Total no. of modules	Quantity per box	0	x	Quantity of boxes	0	=	**0**

5.2 LABELLING & MARKING

DENSITRON
LM40336BW90G240SF
TW YYMM

6 QUALITY ASSURANCE SPECIFICATION

6.1 CONFORMITY

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

6.2 DELIVERY ASSURANCE

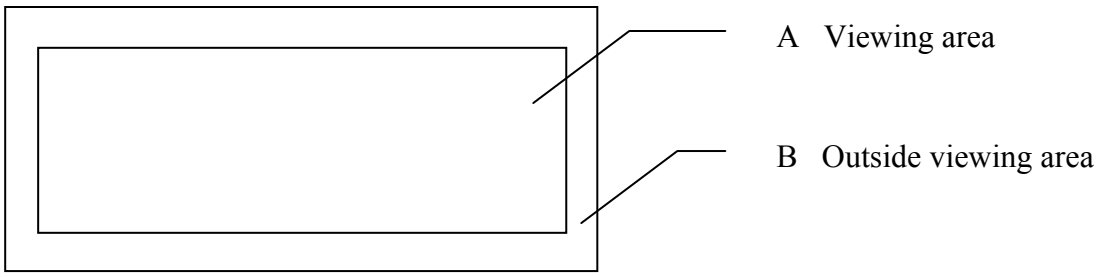
6.2.1 Delivery inspection standards

- 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:

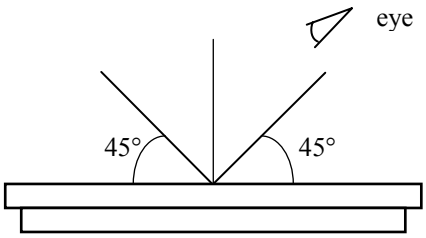
Rank	Item Inspected	Defect type	AQL	Remark
Major defect	Display	Non display	0.25%	Fit/Function defect
		Over current		
		Missing segment		
		Wrong viewing direction		
		Incorrect operating		
		Backlight OFF		
		Backlight flashing		
	Dimension	PCB and bezel out of specification		
Minor defect	LCD	Black and white spot	1.0%	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		
	Tray	Particles	Every tray	
		Total	1.0%	

6.2.2 Zone definition



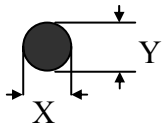
6.2.3 Visual inspection

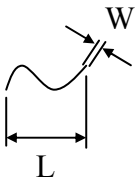
- Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk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

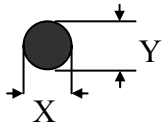


6.2.3.1 Standard of appearance inspection

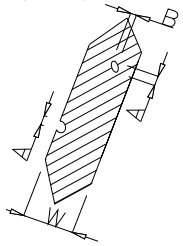
Units: mm

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black spot, white spot, dust</td><td>
Round type: as per following drawing
∅ = (X+Y)/2


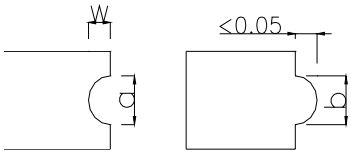
<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>∅<0.1</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>0.1<∅<0.2</td><td>2</td></tr>
<tr><td>0.2<∅<0.25</td><td>1</td></tr>
<tr><td>0.25<∅</td><td>0</td></tr>
</table>
Line type: as per following drawing


<table>
<tr><th colspan="4">Acceptable quantity</th></tr>
<tr><td>Length</td><td>Width</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>- -</td><td>W≤0.02</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>L≤3.0</td><td>0.02<W≤0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≤2.5</td><td>0.03<W≤0.05</td></tr>
<tr><td>- -</td><td>0.05<W</td><td>As round type</td></tr>
</table>
Total acceptable quantity: 3
</td></tr>
<tr><td>2</td><td>Polariser scratch</td><td>Scratch on protective film is permitted
Scratch on polariser: same as No. 1</td></tr>
<tr><td>3</td><td>Polariser bubble</td><td>
∅ = (X+Y)/2


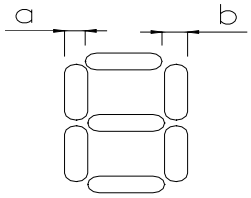
<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>∅<0.2</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>0.2<∅<0.5</td><td>2</td></tr>
<tr><td>0.5<∅<1.0</td><td>1</td></tr>
<tr><td>1.0<∅</td><td>0</td></tr>
</table>
Total acceptable quantity: 3
</td></tr>
<tr><td>4</td><td>Segment deformation</td><td>
1.a. Pin hole on segmented display

W: segment width
∅ = (A+B)/2


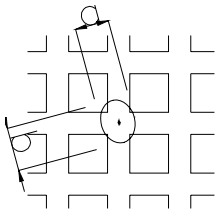
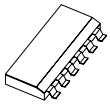
<table>
<tr><th colspan="2">Acceptable quantity</th></tr>
<tr><td>Width</td><td>∅</td></tr>
<tr><td>W≤0.4</td><td>∅≤0.2 and ∅≤1/2W</td></tr>
<tr><td>W>0.4</td><td>∅≤0.25 and ∅≤1/3W</td></tr>
</table>
Total acceptable quantity: 1 defect per segment
Pin holes with ∅ under 0.10 mm are acceptable
</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th></tr>
<tr><td>4</td><td>Segment deformation</td><td>
1b. Pin hole on dot matrix display


<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>a,b<0.1</td><td>Any number</td></tr>
<tr><td>(a+b)/2≤0.1</td><td>Any number</td></tr>
<tr><td>0.5<∅<1.0</td><td>3</td></tr>
</table>
Total acceptable quantity: 7

2. Segments / dots with different width


<table>
<tr><td colspan="2">Acceptable</td></tr>
<tr><td>a≥b</td><td>a/b≤4/3</td></tr>
<tr><td>a<b</td><td>a/b>4/3</td></tr>
</table>

3. Alignment layer defect
∅ = (a+b)/2

<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>∅≤0.4</td><td>Any number</td></tr>
<tr><td>0.4<∅≤1.0</td><td>5</td></tr>
<tr><td>1.0<∅≤1.5</td><td>3</td></tr>
<tr><td>1.5<∅≤2.0</td><td>2</td></tr>
</table>
Total acceptable quantity: 7
</td></tr>
<tr><td>5</td><td>Colour uniformity</td><td>Level of sample for approval set as limit sample</td></tr>
<tr><td>6</td><td>Backlight</td><td>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</td></tr>
<tr><td>7</td><td>COB</td><td>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</td></tr>
<tr><td>8</td><td>PCB
  </td><td>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</td></tr>
<tr><td>9</td><td>Tray particles</td><td>
<table>
<tr><td></td><td>Size</td><td>Quantity</td></tr>
<tr><td rowspan="2">On tray</td><td>∅<0.2</td><td>Any number</td></tr>
<tr><td>∅>0.25</td><td>4</td></tr>
<tr><td rowspan="2">On display</td><td>∅≥0.25</td><td>2</td></tr>
<tr><td>L = 3</td><td>1</td></tr>
</table>
</td></tr>
</table>

6.3 DEALING WITH CUSTOMER COMPLAINTS

6.3.1 Non-conforming analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.
After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

6.3.2 Handling of non-conforming displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

7 RELIABILITY SPECIFICATION

7.1 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	50°C±2, 240 hours	No abnormalities in function and appearance
Low Temperature Operation	-10°C±2, 240 hours	No abnormalities in function and appearance
High Temperature Storage	60°C±2, 240 hours	No abnormalities in function and appearance
Low Temperature Storage	-20°C±2, 240 hours	No abnormalities in function and appearance
High Temperature & High Humidity Storage	40°C±2, 90%RH, 240 hours	No abnormalities in function and appearance
Thermal Shock Storage	1 cycle of -10°C 30 min, R.T. 5 min, 50°C 30 min	No abnormalities in function and appearance
Vibration	Frequency: 10 to 55 Hz Acceleration: 5g 1 cycle time: 1 min Time: 15 min (each direction)	No abnormalities in function and appearance
Drop Shock	Height: 60 cm 1 corner , 3 Edges 6 Surfaces Each one : Test once.	No abnormalities in function and appearance

7.2 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions of room temperature (25±10 °C), normal humidity (45±20% RH), and in area not exposed to direct sunlight.
2	Function, performance, appearance, etc. shall be free from remarkable deterioration within 5,000 hours under ordinary operating and storage conditions of 70 °C temperature, normal humidity (45±20% RH), and in area not exposed to direct sunlight.

8 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).