LIQUID CRYSTAL DISPLAY MODULE

Standard Product Specification

PRODUCT NUMBER	LMR42315

Product Mgr	Engineering	Document Control
		Digitally signed by Ricardo Montes DN: CN = Ricardo Montes, C = US, O = Densitron Displays Reason: I am the author of this document Date: 2007.06.07 15:24:21 -07'00'
Date:	Date:	Date:

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REVISION RECORD

Rev.	Date	Page	Chap.	Comment	ECN no.
A	08/31/06	--	--	Initial DCA Release, ROHS	E3231

1 MAIN FEATURES

ITEM	CONTENTS	REMARK
Display Format	240 dots x 128 dots	
Colour	Monochrome	
Overall Dimensions	144.0 (W) x 104.0 (H) x 18.4 Max. (D)	
Viewing Area	114.0 (W) x 64.0 (H)	
LCD Type	Reference Section 8 – Part Number Description.	See page 18
Mode		
Viewing Angle	6 o'clock	
Duty Ratio	1/128	
Driver IC/Controller	Toshiba T6963	
Backlight Type	Reference Section 8 – Part Number Description.	See page 18
Backlight Colour		
DC/DC Converter	Optional	
Operating Temperature	-20°C ~ +70°C	Note 1
Storage Temperature	-30°C ~ +80°C	Note 2
ROHS Compliant	Yes	

Note 1: Background colour changes slightly depending on ambient temperature. This phenomenon is reversible. Ta≤70 °C: 75% RH max.
Note 2: Ta≤80 °C: 75% RH max.

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

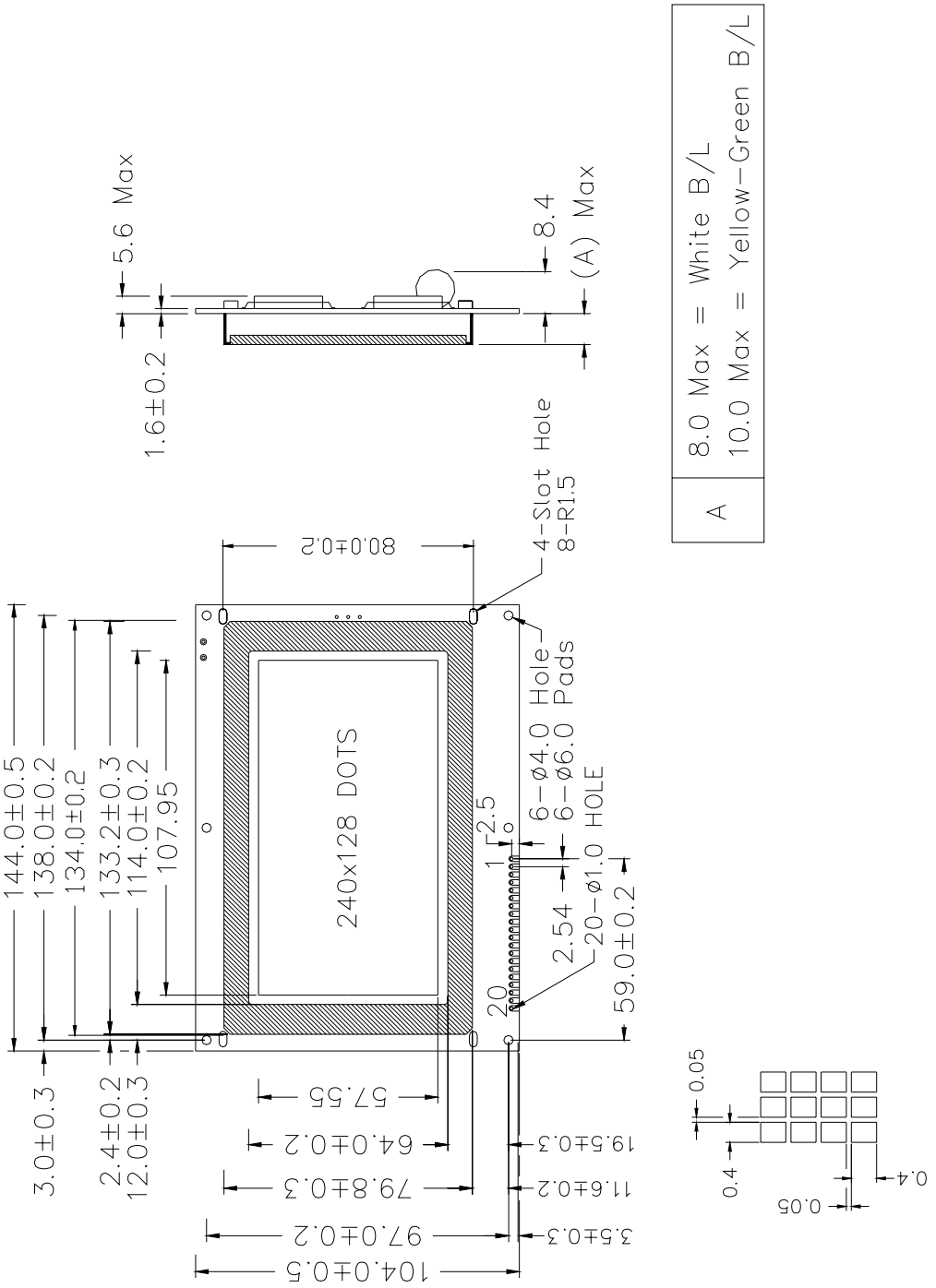
ITEM	CHARACTERISTIC	UNIT
Display Format	240 (W) x 128 (H)	Dots
Overall Dimensions	144.0 (W) x 104.0 (H) x 18.4 Max. (D)	mm
Viewing Area	114.0 (W) x 64.0 (H)	mm
Active Area	107.95 (W) x 57.55 (H)	mm
Dot Size	0.40 (W) x 0.40 (H)	mm
Dot Pitch	0.45 (W) x 0.45 (H)	mm
IC Controller/Driver	Toshiba T6963	

2.2 LABELLING & MARKING

Reference Section 8 – Part Number Description: Page 18

DENSITRON
LMR42315
TAIWAN YYMM

2.3 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}	0	7	V	
Power Supply for LCD	V_{DD}-V_O	0	25	V	
Static Electricity	Be sure that you are grounded when handling displays.				

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	4.75	5.0	5.25	V
Input Voltage	V_{IL}	Ta = 25°C	--	2.2	--	V
	V_{IH}	Ta = 25°C	--	0.8	--	V
Current Consumption	* I_{DD}	V_{DD} =5.0 V ±0.25V	--	12	--	mA
	I_{EE}	V_{DD} =5.0 V ±0.25V	--	21.5	--	mA

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

3.3 RECOMMENDED LC DRIVE VOLTAGE

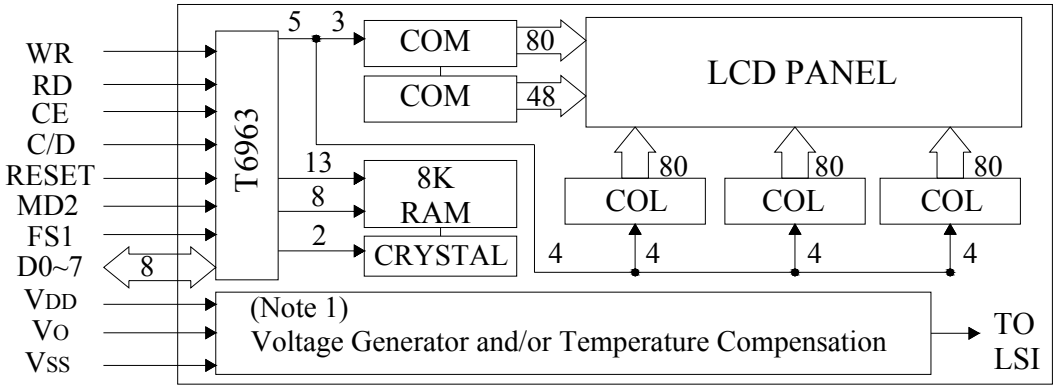
	Temperature	FSTN Temperature		STN Temperature	
		Normal	Wide	Normal	Wide
LCD Driving Voltage	Ta= -20°C	N/A	16.8	N/A	16
	Ta= 0°C	16.3	16.3	15.8	15.8
	Ta= 25°C	16.1	16.1	15.6	15.6
	Ta= 50°C	15.7	15.7	15.2	15.2
	Ta= 70°C	N/A	15.1	N/A	14.8

3.4 INTERFACE PIN ASSIGNMENT

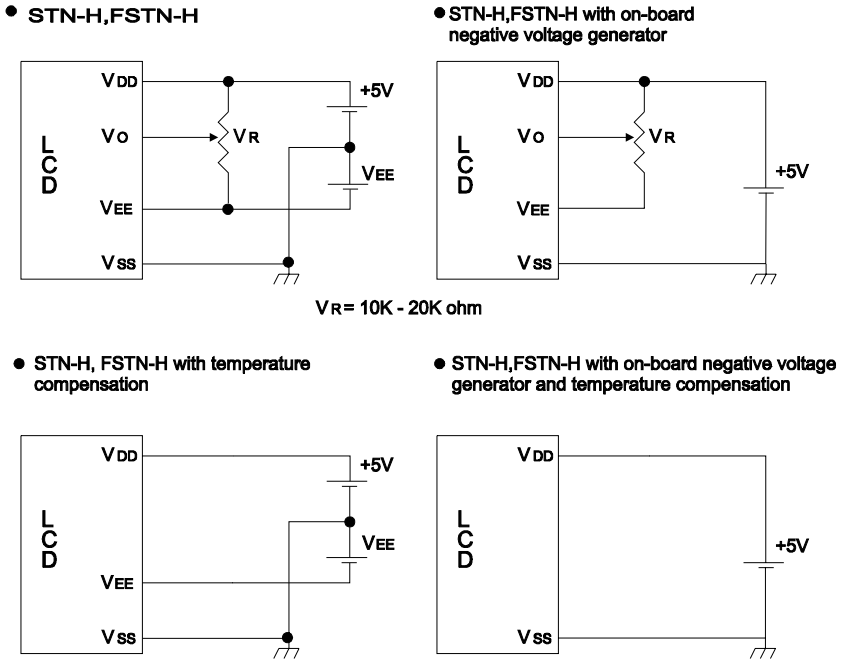
1	Vss	Ground LED- for White backlight
2	Vdd	Power supply for logic circuit (+5V)
3	Vo	Operating voltage for LC drive
4	C/D	WR="L"…C/D="H": Command write C/D="L": Data write RD="L"…C/D="H": Status read C/D="L": Data read
5	RD	Data Read Active Low
6	WR	Data Write Active low
7	DB0	Bi-directional data bus line 0
8	DB1	Bi-directional data bus line 1
9	DB2	Bi-directional data bus line 2
10	DB3	Bi-directional data bus line 3
11	DB4	Bi-directional data bus line 4
12	DB5	Bi-directional data bus line 5
13	DB6	Bi-directional data bus line 6
14	DB7	Bi-directional data bus line 7
15	CE	Chip enable Active low
16	RESET	Chip reset Active low
17	V_{EE}	Negative voltage input for LC drive (Negative voltage output for models with on-board negative voltage generator)
18	MD2	Mode Selection
19	FS1	Font size selection
20	V_{LED}+	Anode (+): Backlight input voltage White
BL1	V_{LED}+	Anode (+): Backlight input voltage for Yellow-Green
BL2	V_{LED}-	Cathode (-): Backlight input voltage for Yellow-Green
BL3	N/C	No Connection
BL4	V_{LED}+	Anode (+): Backlight input voltage White backlight
BL5	V_{LED}-	Cathode (-): Backlight input voltage White backlight

MD2	H	L		FS1	H	L
Columns	32	40		Font	6X8	8X8

3.5 BLOCK DIAGRAM



3.6 POWER SUPPLY CIRCUIT



3.7 TIMING CHARACTERISTICS

Please reference the manufacture's specifications for the Toshiba T6963 controller.

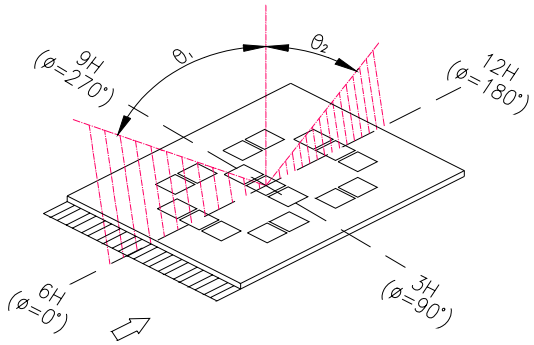
4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

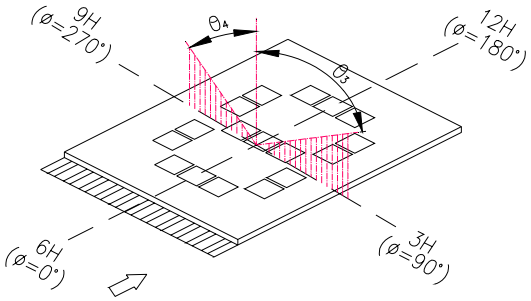
Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	θ1	CR≥2	30	35	--	deg	1
	θ2	CR≥2	20	25	--	deg	1
	θ3	CR≥2	30	35	--	deg	2
	θ4	CR≥2	30	35	--	deg	2
Contrast Ratio	CR	Ta = 25°C	--	5	--	-	3
Response Time	Tr	Ta = 25°C	--	200	300	ms	4
	Tf	Ta = 25°C	--	150	200		
Driving Method	Duty	1/128					
Viewing Direction	6 o'clock						

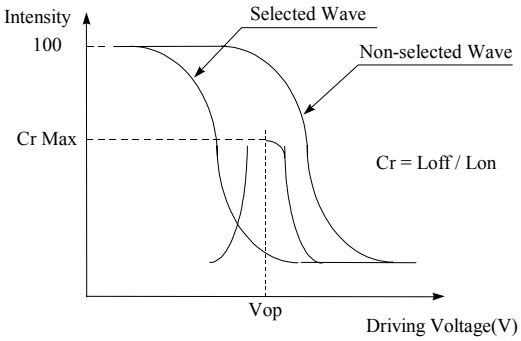
Note 1: definition of viewing angle θ1 & θ2



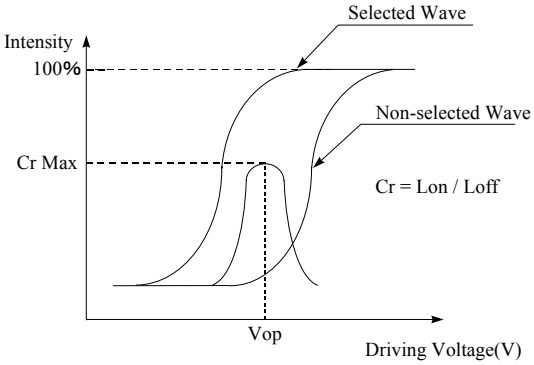
Note 2: definition of viewing angle θ3 & θ4



Note 3: definition of contrast ratio (CR)

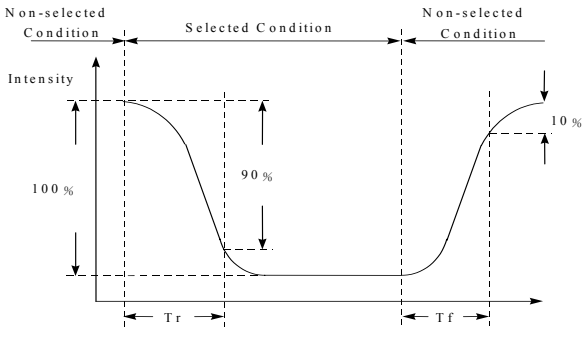


[positive type]

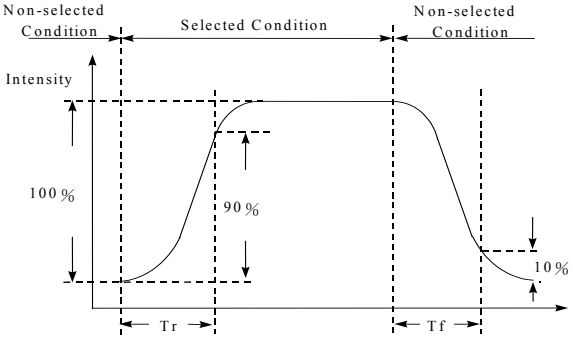


[Negative type]

Note 4: definition of response time



[positive type]



[Negative type]

5 BACKLIGHT SPECIFICATION

5.1 BACKLIGHT CHARACTERISTICS

Led Array

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Current	I		660	-	680	mA	
Current Limit Resistor	R2 = 1.7 Ohms 2W on customer board						
Colour	Yellow-Green						

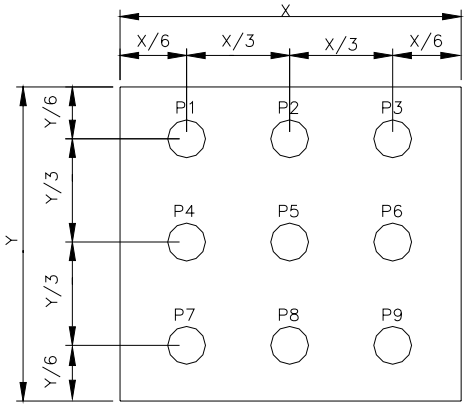
Led Edge (White)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Current	I		140	-	160	mA	
Current Limit Resistor	N/A						
Colour	White						

Note:

1. Average luminous intensity of 9 points
2. Brightness uniformity = MIN / MAX x 100
3. Half of the original brightness

Measure Method: (X*Y: Light Area)



6 QUALITY ASSURANCE SPECIFICATION

6.1 CONFORMITY

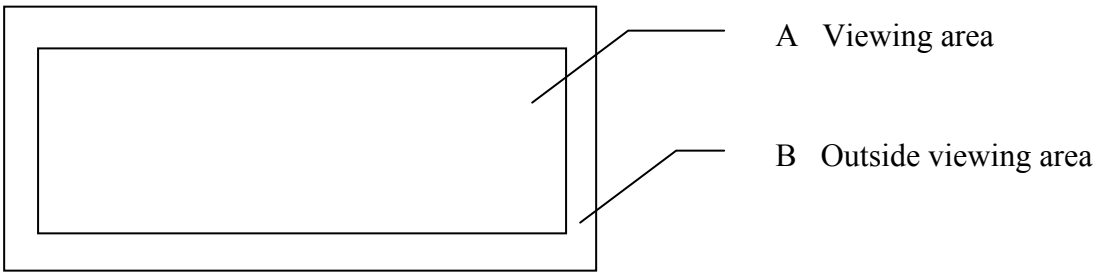
The performance, function and reliability of the shipped products conform to the Product Specification.

6.2 DELIVERY ASSURANCE

6.2.1 Delivery inspection standards

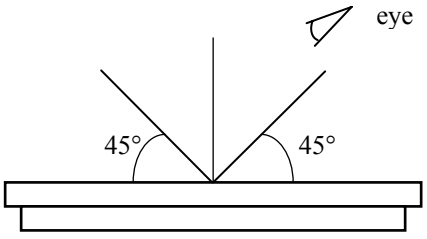
- IPC-AA610, class 2 electronic assemblies standard

6.2.2 Zone definition



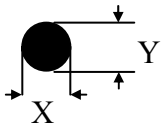
6.2.3 Visual inspection

- 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>Class</th><th>Item</th><th colspan="4">Criteria</th></tr>
<tr><td>Minor</td><td rowspan="2">Packing & Label</td><td>Outside & inside package</td><td colspan="3">Presence of product no., lot no., quantity</td></tr>
<tr><td>Critical</td><td colspan="4">Product must not be mixed with others and quantity must not be different from that indicated on the label</td></tr>
<tr><td>Major</td><td>Dimension</td><td colspan="4">Product dimensions must be according to specification and drawing</td></tr>
<tr><td>Major</td><td>Electrical</td><td colspan="4">Product electrical characteristics must be according to specification</td></tr>
<tr><td>Critical</td><td>LCD Display</td><td colspan="4">Missing lines or wrong patterns on LCD display are not allowed</td></tr>
<tr><td>Minor</td><td>Black spot, white spot, dust</td><td colspan="4">Round type: as per following drawing
∅ = (X+Y)/2
 

<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><th>Size</th><th>Zone A</th><th>Zone B</th></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>
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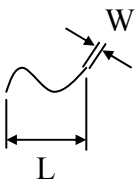
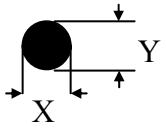
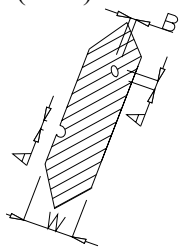
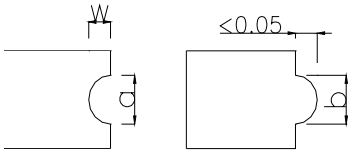
Line type: as per following drawing
 

<table>
<tr><th colspan="4">Acceptable quantity</th></tr>
<tr><th>Length</th><th>Width</th><th>Zone A</th><th>Zone B</th></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>Minor</td><td>Polariser scratch</td><td colspan="4">Scratch on protective film is permitted
Scratch on polariser: same as No. 1</td></tr>
<tr><td>Minor</td><td>Polariser bubble</td><td colspan="4">∅ = (X+Y)/2
 

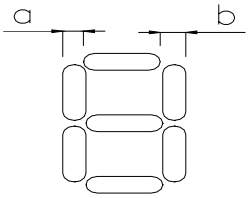
<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr>
<tr><td>∅<0.2</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>0.2<∅<0.5</td><td>2</td></tr>
<tr><td>0.5<∅<1.0</td><td>1</td></tr>
<tr><td>1.0<∅</td><td>0</td></tr>
</table>
Total acceptable quantity: 3</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Segment deformation</td><td>1.a. Pin hole on segmented display

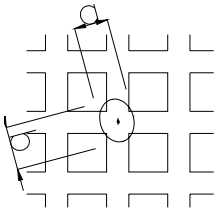
W: segment width
∅ = (A+B)/2
 

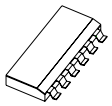
<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Width</td><td>∅</td></tr>
<tr><td>W≤0.4</td><td>∅≤0.2 and ∅≤1/2W</td></tr>
<tr><td>W>0.4</td><td>∅≤0.25 and ∅≤1/3W</td></tr>
</table>
Total acceptable quantity: 1 defect per segment
Pin holes with ∅ under 0.10 mm are acceptable</td></tr>
<tr><td>Minor</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>Minor</td><td>Colour uniformity</td><td>Level of sample for approval set as limit sample</td></tr>
<tr><td>Critical</td><td rowspan="3">Backlight</td><td>The backlight colour should correspond to the product specification</td></tr>
<tr><td>Critical</td><td>Flashing and or unlit backlight is not allowed</td></tr>
<tr><td>Minor</td><td>Dust larger than 0.25 mm is not allowed</td></tr>
<tr><td>Major</td><td rowspan="3">COB</td><td>Exposed wire bond pad is not allowed</td></tr>
<tr><td>Major</td><td>Insufficient covering with resin is not allowed (wire bond line exposed)</td></tr>
<tr><td>Minor</td><td>Dust or bubble on the resin are not allowed</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Major</td><td rowspan="4">PCB
  </td><td>No unmelted solder paste should be present on PCB</td></tr>
<tr><td>Critical</td><td>Cold solder joints, missing solder connections, or oxidation are not allowed</td></tr>
<tr><td>Minor</td><td>No residue or solder balls on PCB are allowed</td></tr>
<tr><td>Critical</td><td>Short circuits on components are not allowed</td></tr>
<tr><td>Minor</td><td>Tray particles</td><td>
<table>
<tr><th></th><th>Size</th><th>Quantity</th></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>

7 RELIABILITY SPECIFICATION

7.1 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
Operation at High Temperature and Humidity	40°C±2°C 90% RH for 240 hours	No abnormalities in function* and appearance**
High Temperature Operation	70°C±2°C for 240 hours	No abnormalities in function* and appearance**
Low Temperature Operation	-20°C±2°C for 240 hours	No abnormalities in function* and appearance**
High Temperature Storage	80°C±2°C for 240 hours	No abnormalities in function* and appearance**
Low Temperature Storage	-30°C±2°C for 240 hours	No abnormalities in function* and appearance**
Heat Shock	-30°C (30 min)→ 25°C (5 min)→ +80 (30min) 10 cycles	No abnormalities in function* and appearance**
Vibration	Sweep for 1 minute at 10Hz, 55Hz, 10Hz, amplitude 1.5mm for 15 minutes in the X, Y and Z directions.	No abnormalities in function* and appearance**
Drop Shock	One angle, three edges and six sides. 75cm above ground (no weight difference).	No abnormalities in function* and appearance**

* Current consumption < 2 times initial value
** Contrast > ½ initial value

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.

8 PART NUMBER DESCRIPTIONS FOR AVAILABLE OPTIONS

LMR42315①②128G240③④⑤

① **POLARIZER TYPE**
B = Transflective: light background with LED backlight
E = Transmissive: dark background with LED backlight

② **BACKLIGHT COLOR**
G = Yellow-Green (Standard)
W = White

③ **FLUID TYPE AND POWER SUPPLY**
D = STN with +5VDC and external negative voltage operation
S = STN with +5VDC operation (on-board negative voltage generation)
H =Wide temperature range with +5VDC external negative voltage operation
W = Wide temperature range: on-board negative voltage generator

④ **FLUID TYPE**
F = FSTN (Film Supertwisted Nematic)
N = STN, STN-H

⑤ **COLOR FOR STN FLUID**
B = Blue background (available for E polarizer type only)
G = Gray background (available for B polarizers types only)
Y = Yellow background (available for B polarizers types only)

9 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).