LIQUID CRYSTAL DISPLAY MODULE

Standard Product Specification

PRODUCT NUMBER	LR2434

INTERNAL APPROVALS		
Product Manager	Engineering	Document Control
Date:	Date:	Date:

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REVISION RECORD

Rev.	Date	Page	Chap.	Comment	ECN no.
A	12/30/09	--	--	Initial DCA Release, ROHS	E4232
B	4/9/12	7	--	LCD drive voltage updated	E4623

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1 MAIN FEATURES

ITEM		CONTENTS	REMARK
Display Format		4 Line x 20 Characters	
Colour		Monochrome	
Overall Dimensions		98.8 (W) x 60.2 (H) x 11.3 Max. (D)	
Viewing Area		76.0 (W) x 25.5 (H)	
LCD Type		STN	
Mode		Transflective / Positive Reflective / Positive	
Viewing Angle		6 o'clock	
Duty Ratio		1/16, ¼ Bias Drive	
Driver IC/Controller		ST7066	
Backlight Type		LED	
Backlight Colour		Yellow-Green	
DC/DC Converter		Built-In	
Operating Temperature	Normal	0°C ~ +50°C	Note 1
	Wide	-20°C ~ +70°C	
Storage Temperature	Normal	-20°C ~ +70°C	Note 2
	Wide	-30°C ~ +80°C	
ROHS Compliant		Yes	

Note 1: Background colour changes slightly depending on ambient temperature. This phenomenon is reversible.
Ta≤70°C: 75% RH max.
Ta>70°C: absolute humidity must be lower than the humidity of 75%RH at 70°C
Note 2: Ta -30°C will be <48hrs, at 80°C will be <120hrs.

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2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

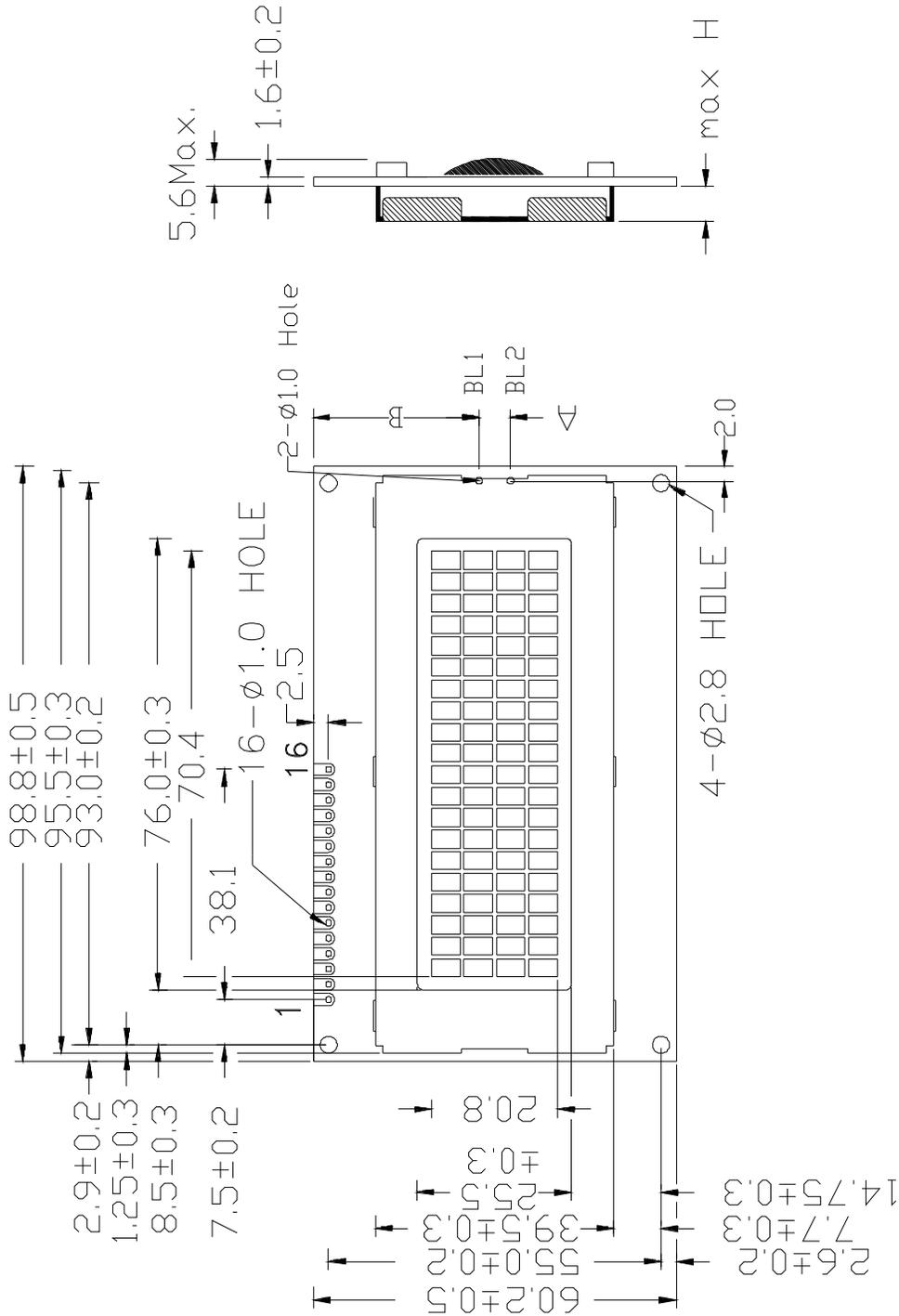| ITEM	CHARACTERISTIC	UNIT
Display Format	4 Line x 20 Characters	--
Character Font Format	5 (W) x 7 (H) with attached cursor	--
Overall Dimensions	98.8 (W) x 60.2 (H) x 11.3 Max. (D)	mm
Viewing Area	76.0 (W) x 25.5 (H)	mm
Active Area	70.4 (W) x 20.8 (H)	mm
Dot Size	0.55 (W) x 0.55 (H)	mm
Dot Pitch	0.60 (W) x 0.60 (H)	mm
IC Controller/Driver	ST7066	

2.2 LABELLING & MARKING

DENSITRON
LR2434
TAIWAN YYMM

2.3 MECHANICAL DRAWING

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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	6	V	
Input voltage	Vin	0	Vdd	V	
LCD driving Voltage	Vdd-Vo	4	10	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	4.5	5.0	5.5	V
Input Voltage	V_{IH}	Ta = 25°C	2.4	--	V_{DD}	V
	V_{IL}	Ta = 25°C	--	--	1.0	V
Current Consumption	* I_{DD}	V_{DD} =5.0V	--	3	--	mA

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

3.3 RECOMMENDED LC DRIVE VOLTAGE

Vdd – Vss = 5.0V

			STN TEMPERATURE	
			NORMAL	WIDE
Supply Current , (Idd) Typ. ,mA			3	3
Supply Current , (Iee) Typ. ,mA			N/A	N/A
Supply voltage(Vee) Max.			N/A	N/A
Recommend lcd drive voltage				
Lcd driving voltage (Vo – Vss)	Ta = -20 C		N/A	4.5
	Ta = 0 C		4.4	4.4
	Ta = 25 C		4.4	4.4
	Ta = 50 C		4.4	4.4
	Ta = 70 C		N/A	4.3

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3.4 INTERFACE PIN ASSIGNMENT

Pin No.	Symbol	Level	Description
1	V_{SS}	--	Ground (0V)
2	V_{DD}	--	Logic Supply Voltage (+5V)
3	V_O	--	LC Drive voltage for contrast adjustment
4	RS	I	Register Select 0: Instruction Register 1: Data Register
5	R/W	I	Read / Write 0: Data Write (Module ← MPU) 1: Data Read (Module → MPU)
6	E	I	Enable Signal Active High (H→L)
7	DB0	I/O	Bi-directional data bus line 0
8	DB1	I/O	Bi-directional data bus line 1
9	DB2	I/O	Bi-directional data bus line 2
10	DB3	I/O	Bi-directional data bus line 3
11	DB4	I/O	Bi-directional data bus line 4
12	DB5	I/O	Bi-directional data bus line 5
13	DB6	I/O	Bi-directional data bus line 6
14	DB7	I/O	Bi-directional data bus line 7
15	N/A	--	No connection
16	N/A	--	No connection
BL1	EL	--	EL Backlight
BL2	EL	--	EL Backlight

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3.5 BLOCK DIAGRAM
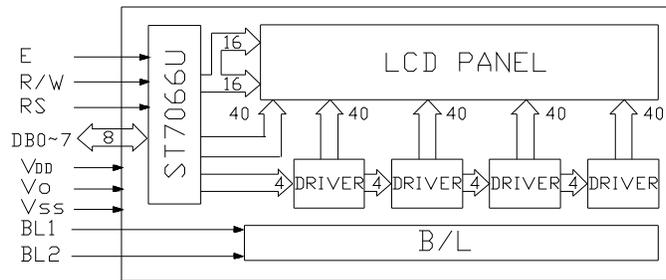
3.6 POWER SUPPLY CIRCUIT
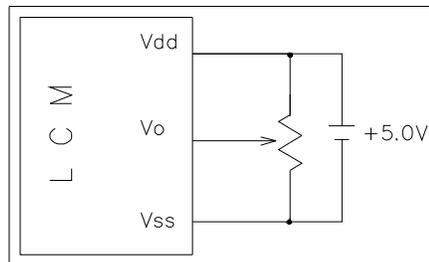
RECOMMENDED VR : 10 K ohm ~ 20 K ohm

3.7 TIMING CHARACTERISTICS

Please reference the manufacture's specifications for the ST7066 controller.
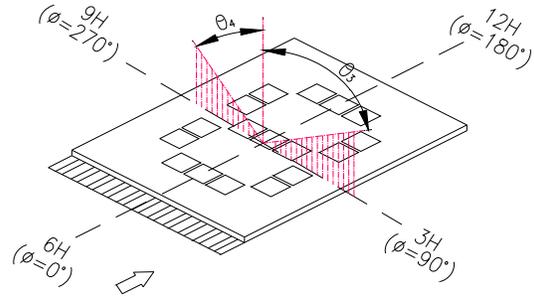
4   OPTICAL SPECIFICATION

4.1   OPTICAL CHARACTERISTICS

Ta = 25 °C

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle		θ1	CR≥2	--	45	--	deg	1
		θ2	CR≥2	--	35	--	deg	1
		θ3	CR≥2	--	35	--	deg	2
		θ4	CR≥2	--	35	--	deg	2
Contrast Ratio	STN	CR	Ta = 25°C	--	7.0	--	--	3
Response Time		Tr	Ta = 25°C	--	60	300	ms	4
		Tf	Ta = 25°C	--	100	300		
Driving Method		Duty	1/16					
Viewing Direction		6 o'clock						

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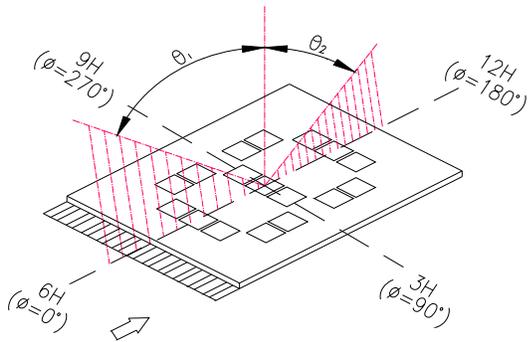
Note 3: definition of contrast ratio (CR)

[positive type]   [Negative type]
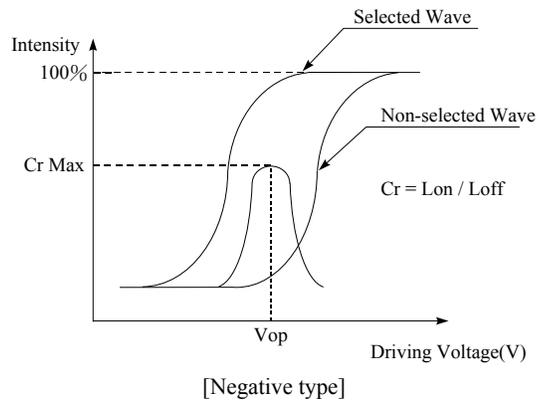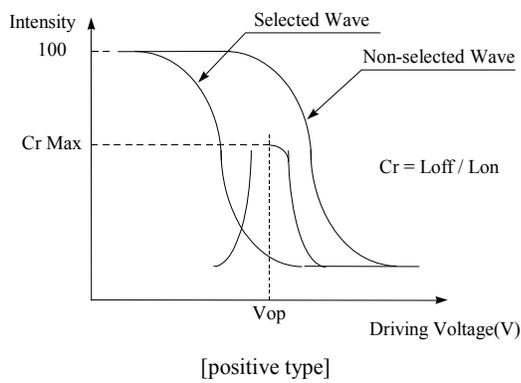
Note 4: definition of response time

[positive type]   [Negative type]

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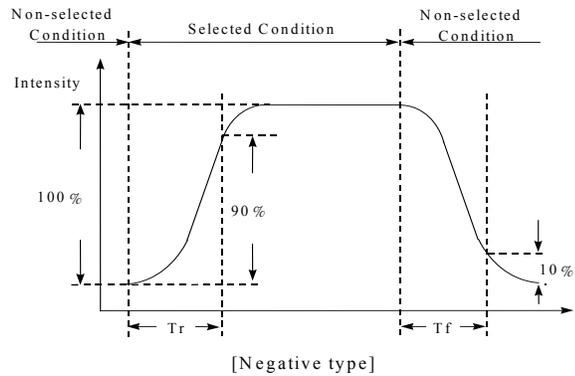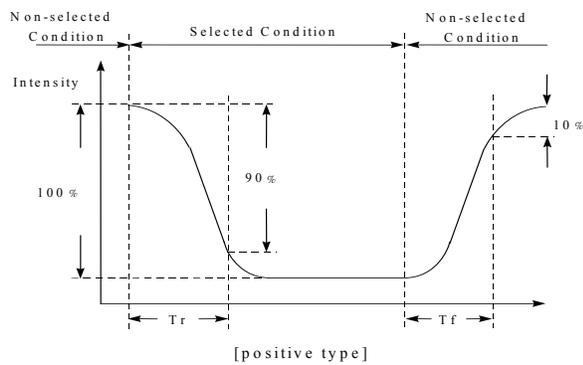
5 BACKLIGHT SPECIFICATION

5.1 BACKLIGHT CHARACTERISTICS

EL B/L operating range (Vin=5V)

Item	Conditions	Standard			Unit
		Min.	Typ.	Max.	
Input voltage	Ta = 25 C	---	100	---	Vrms
Current consumption	Ta = 25 C		3.5		mA
Average brightness (B/L only) (Ta = 25 C, I = 3.5 mA)	Test when connecting after 3 min. Ta = 25 C (max. contrast)				cd/m2 (Note 2)
		---	50	---	
Lamp life	Ta = 25 C , I = 3.5 mA Humidity : 30%RH ~ 85%RH	---	3,000	---	Hrs (Note 4)
Operating Temp.	Humidity : 30%RH ~ 85%RH	-20	---	70	C
Storage Temp.	Humidity : 30%RH ~ 85%RH	-30	---	80	C

Note 2: Average brightness of 3 point when B/L is used at the beginning.
Note 4: Brightness uniformity = (MIN/MAX) x 100%

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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

A   Viewing area
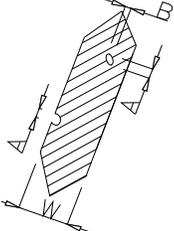
B   Outside viewing area
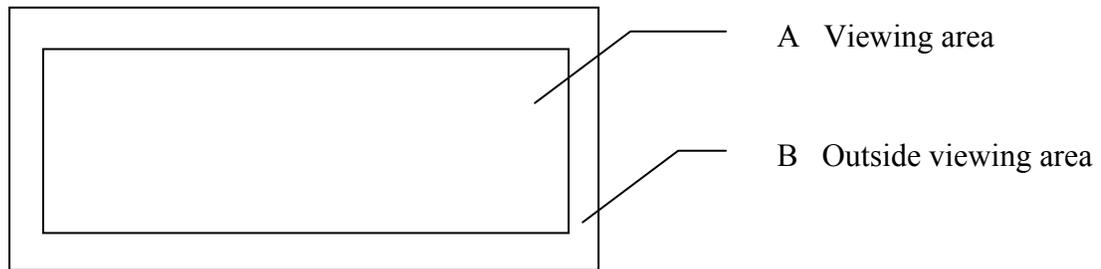
6.2.3 Visual inspection

- 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.

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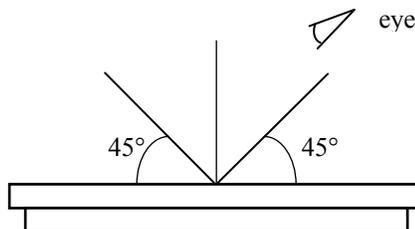
6.2.3.1 Standard of appearance inspection

Units: mm

Class	Item	Criteria	
Minor	Packing & Label	Outside & inside package	Presence of product no., lot no., quantity
Critical		Product must not be mixed with others and quantity must not be different from that indicated on the label	
Major	Dimension	Product dimensions must be according to specification and drawing	
Major	Electrical	Product electrical characteristics must be according to specification	
Critical	LCD Display	Missing lines or wrong patterns on LCD display are not allowed	
Minor	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	
Minor	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1	
Minor	Polariser bubble	$\varnothing = (X+Y)/2$ Total acceptable quantity: 3	

Round type table:
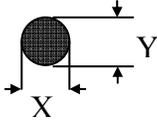
Acceptable quantity		
Size	Zone A	Zone B
$\varnothing<0.1$	Any number	Any number
$0.1<\varnothing<0.2$	2	
$0.2<\varnothing<0.25$	1	
$0.25<\varnothing$	0	

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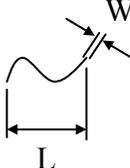
Acceptable quantity			
Length	Width	Zone A	Zone B
- -	$W\leq0.02$	Any number	Any number
$L\leq3.0$	$0.02<W\leq0.03$	2	
$L\leq2.5$	$0.03<W\leq0.05$		
- -	$0.05<W$	As round type	

Polariser bubble table:
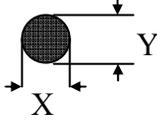
Acceptable quantity		
Size	Zone A	Zone B
$\varnothing<0.2$	Any number	Any number
$0.2<\varnothing<0.5$	2	
$0.5<\varnothing<1.0$	1	
$1.0<\varnothing$	0	

Class	Item	Criteria
Minor	Segment deformation	1.a. Pin hole on segmented display W: segment width $\varnothing = (A+B)/2$ <table><tr><td colspan="2">Acceptable quantity</td></tr><tr><td>Width</td><td>$\varnothing$</td></tr><tr><td>W≤0.4</td><td>$\varnothing$≤0.2 and $\varnothing$≤1/2W</td></tr><tr><td>W>0.4</td><td>$\varnothing$≤0.25 and $\varnothing$≤1/3W</td></tr></table>Total acceptable quantity: 1 defect per segment Pin holes with $\varnothing$ under 0.10 mm are acceptable
Minor	Segment deformation	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<$\varnothing$<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 $\varnothing = (a+b)/2$ <table><tr><td colspan="2">Acceptable quantity</td></tr><tr><td>Size</td><td></td></tr><tr><td>$\varnothing$≤0.4</td><td>Any number</td></tr><tr><td>0.4<$\varnothing$≤1.0</td><td>5</td></tr><tr><td>1.0<$\varnothing$≤1.5</td><td>3</td></tr><tr><td>1.5<$\varnothing$≤2.0</td><td>2</td></tr></table>Total acceptable quantity: 7
Minor	Colour uniformity	Level of sample for approval set as limit sample
Critical	Backlight	The backlight colour should correspond to the product specification
Critical		Flashing and or unlit backlight is not allowed
Minor		Dust larger than 0.25 mm is not allowed
Major	COB	Exposed wire bond pad is not allowed
Major		Insufficient covering with resin is not allowed (wire bond line exposed)
Minor		Dust or bubble on the resin are not allowed
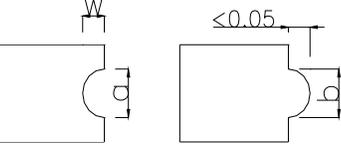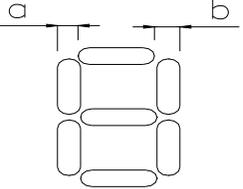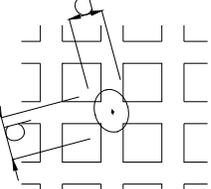
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Class	Item	Criteria			
Major	PCB	No unmelted solder paste should be present on PCB			
Critical		Cold solder joints, missing solder connections, or oxidation are not allowed			
Minor		No residue or solder balls on PCB are allowed			
Critical		Short circuits on components are not allowed			
Minor	Tray particles			Size	Quantity
			On tray	$\varnothing<0.2$	Any number
				$\varnothing>0.25$	4
			On display	$\varnothing\geq0.25$	2
				L = 3	1

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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 (5min)→ +80 (30min)→ 25°C (5 min) 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

ALPHANUMERIC PART NUMBERING DESCRIPTION
LR2434 ①②4C20③④⑤

Model Number 4/5 Digits

① POLARISER OPTIONS

B = Transflective: light background, with backlight.
   (Blue-Green EL B/L).
A= Reflective: light background, without backlight.

② LED BACKLIGHT COLOR

N/A

FORMAT: (4C20=4X20 module format)

③ FLUID TYPE AND POWER SUPPLY

D = STN/NTN with +5VDC or ± 5VDC operation.
S = STN/NTN with +5VDC operation
H = Extended temp with +5VDC operation

④ FLUID TYPE AND TN VIEWING ANGLE

N = STN/NTN

⑤ TN TEMPERATURE RANGE OR STN/NTN
BACKGROUND COLOUR

Y = Yellow mode STN/NTN (with B polarisers)
G = Grey mode STN/NTN (with B polarisers)

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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).

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