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# SPECIFICATION FOR LCD MODULE

**Model No.**  
**PC-6749-AA**

**Approved by:** \_\_\_\_\_

**Date:** \_\_\_\_\_

REV.	DESCRIPTIONS	RELEASE DATE
1.0	Primary release	2004-7-20

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**Taiwan**

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### 1. Basic specification

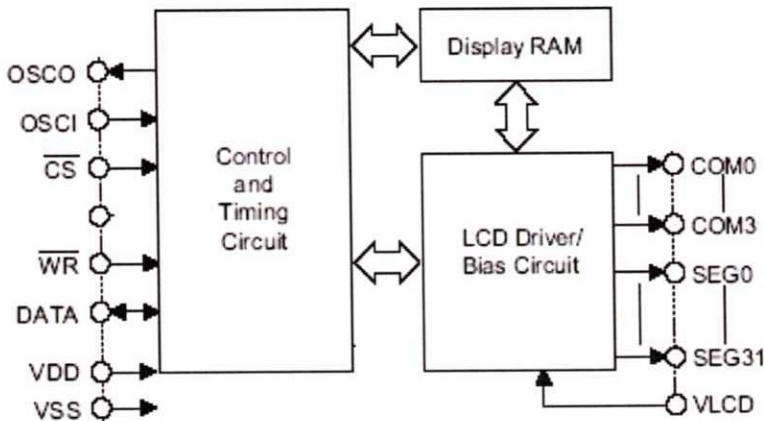
## 1.1 Basic composition

LCD Display type	: HTN, TRANSFLECTIVE / POSITIVE
Driving method	: 1/4DUTY 1/3 BIAS
View direction	: 6 O'clock
Driver IC	: HT1621
Backlight	: LED Backlight, with color side type
Operating Temperature	: 0-----70°C
Storage Temperature	: -20-----80°C

## 1.2 Mechanical specification

ITEM	STANDARD VALUES	UNIT
Module size	27.4(W)x21.9(H)x5.50(T) (MAX)	mm
View area	22.20(W)x18.00(H)	mm
Active area	17.49(w)x7.00(h)	mm

## 2. Application circuit



## 3. Interface pin description

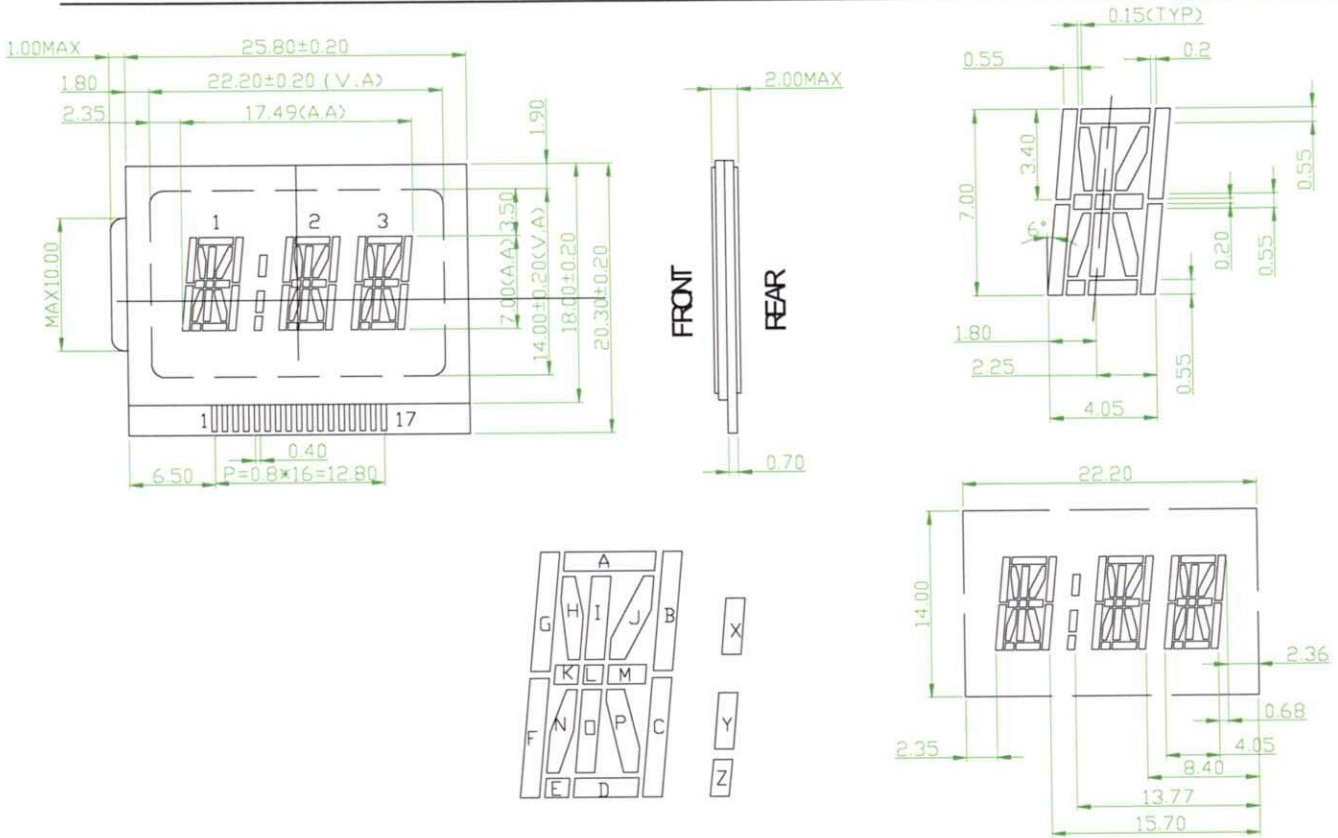
PIN NO.	SYMBOL	I/O	FUNCTION
1	VSS	POWER	Logic ground
2	VDD	POWER	Power supply
3	/WR	I	Write on the fellow edge of /WR signal
4	DATA	I/O	Input or Output data
5	/CS	I	Chip Select
6	BL-C	I	Backlight on or off select
7	BL-GND	POWER	Ground
8	NC	--	--

## 4. Mechanical outline drawing

### 4.1 Module size







## 5. Electrical characteristics

### 5.1 DC characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating voltage	$V_{DD}$	-	4.5	5.0	5.5	V
Operating current	$I_{DD}$	$V_{DD}=5.0V,$	-	6.0	8.0	mA
LCD driving voltage	$V_{LCD}$	---	-	4.5	-	V

## 5.2

### A.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
f <sub>SYS1</sub>	System Clock	3V	On-chip RC oscillator	—	256	—	kHz
		5V		—	256	—	kHz
f <sub>SYS2</sub>	System Clock	3V	Crystal oscillator	—	32.768	—	kHz
		5V		—	32.768	—	kHz
f <sub>SYS3</sub>	System Clock	3V	External clock source	—	256	—	kHz
		5V		—	256	—	kHz
f <sub>LCD</sub>	LCD Clock	—	On-chip RC oscillator	—	f <sub>SYS1</sub> /1024	—	Hz
		—	Crystal oscillator	—	f <sub>SYS2</sub> /128	—	Hz
		—	External clock source	—	f <sub>SYS3</sub> /1024	—	Hz
t <sub>COM</sub>	LCD Common Period	—	n: Number of COM	—	n/f <sub>LCD</sub>	—	s
f <sub>CLK1</sub>	Serial Data Clock ( $\overline{\text{WR}}$ pin)	3V	Duty cycle 50%	—	—	150	kHz
		5V		—	—	300	kHz
f <sub>CLK2</sub>	Serial Data Clock ( $\overline{\text{RD}}$ pin)	3V	Duty cycle 50%	—	—	75	kHz
		5V		—	—	150	kHz
f <sub>TONE</sub>	Tone Frequency	—	On-chip RC oscillator	—	2.0 or 4.0	—	kHz
t <sub>CS</sub>	Serial Interface Reset Pulse Width (Figure 3)	—	$\overline{\text{CS}}$	—	250	—	ns
t <sub>CLK</sub>	$\overline{\text{WR}}$ , $\overline{\text{RD}}$ Input Pulse Width (Figure 1)	3V	Write mode	3.34	—	—	$\mu\text{s}$
			Read mode	6.67	—	—	
		5V	Write mode	1.67	—	—	$\mu\text{s}$
			Read mode	3.34	—	—	

## 6. Instructions

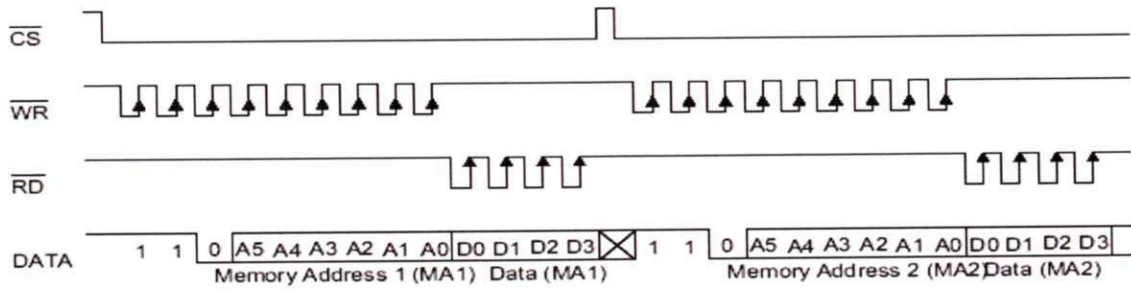
## Command Summary

Name	ID	Command Code	D/C	Function	Def.
READ	1 1 0	A5A4A3A2A1A0D0D1D2D3	D	Read data from the RAM	
WRITE	1 0 1	A5A4A3A2A1A0D0D1D2D3	D	Write data to the RAM	
READ-MODIFY-WRITE	1 0 1	A5A4A3A2A1A0D0D1D2D3	D	READ and WRITE to the RAM	
SYS DIS	1 0 0	0000-0000-X	C	Turn off both system oscillator and LCD bias generator	Yes
SYS EN	1 0 0	0000-0001-X	C	Turn on system oscillator	
LCD OFF	1 0 0	0000-0010-X	C	Turn off LCD bias generator	Yes
LCD ON	1 0 0	0000-0011-X	C	Turn on LCD bias generator	
TIMER DIS	1 0 0	0000-0100-X	C	Disable time base output	
WDT DIS	1 0 0	0000-0101-X	C	Disable WDT time-out flag output	
TIMER EN	1 0 0	0000-0110-X	C	Enable time base output	
WDT EN	1 0 0	0000-0111-X	C	Enable WDT time-out flag output	
TONE OFF	1 0 0	0000-1000-X	C	Turn off tone outputs	Yes
TONE ON	1 0 0	0000-1001-X	C	Turn on tone outputs	
CLR TIMER	1 0 0	0000-11XX-X	C	Clear the contents of time base generator	
CLR WDT	1 0 0	0000-111X-X	C	Clear the contents of WDT stage	
XTAL 32K	1 0 0	0001-01XX-X	C	System clock source, crystal oscillator	
RC 256K	1 0 0	0001-10XX-X	C	System clock source, on-chip RC oscillator	Yes

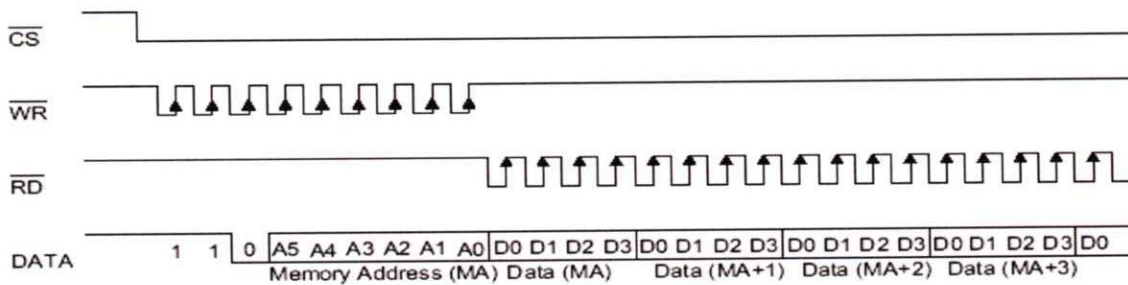
## 7. Electro-optical characteristics



**READ mode (command code : 1 1 0)**

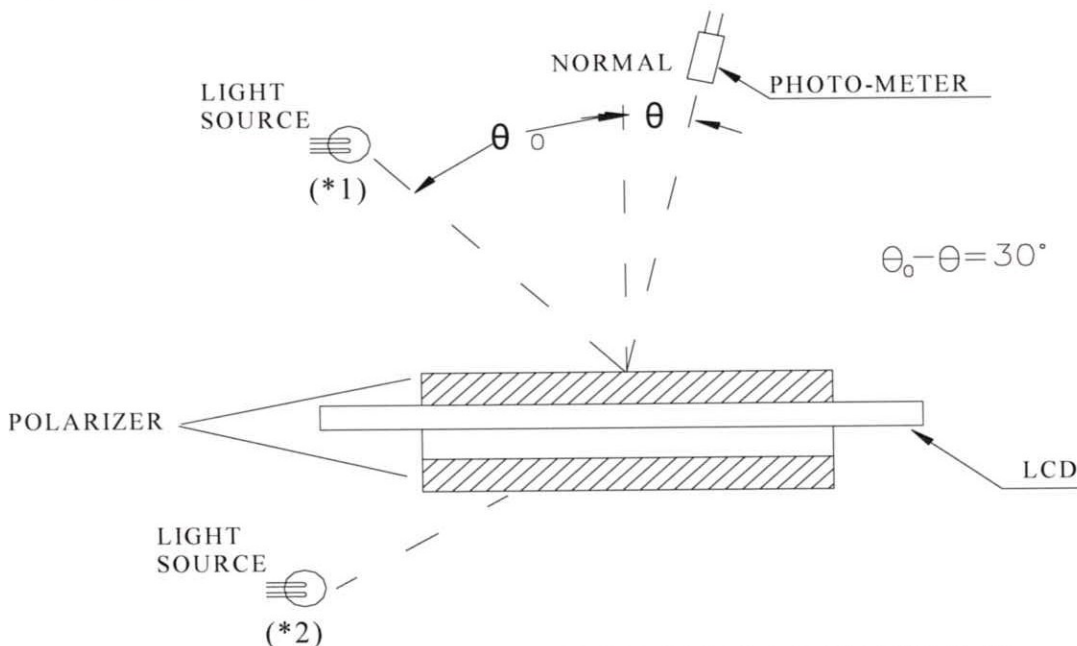


**READ mode (successive address reading)**



## 8. Optical measurement system

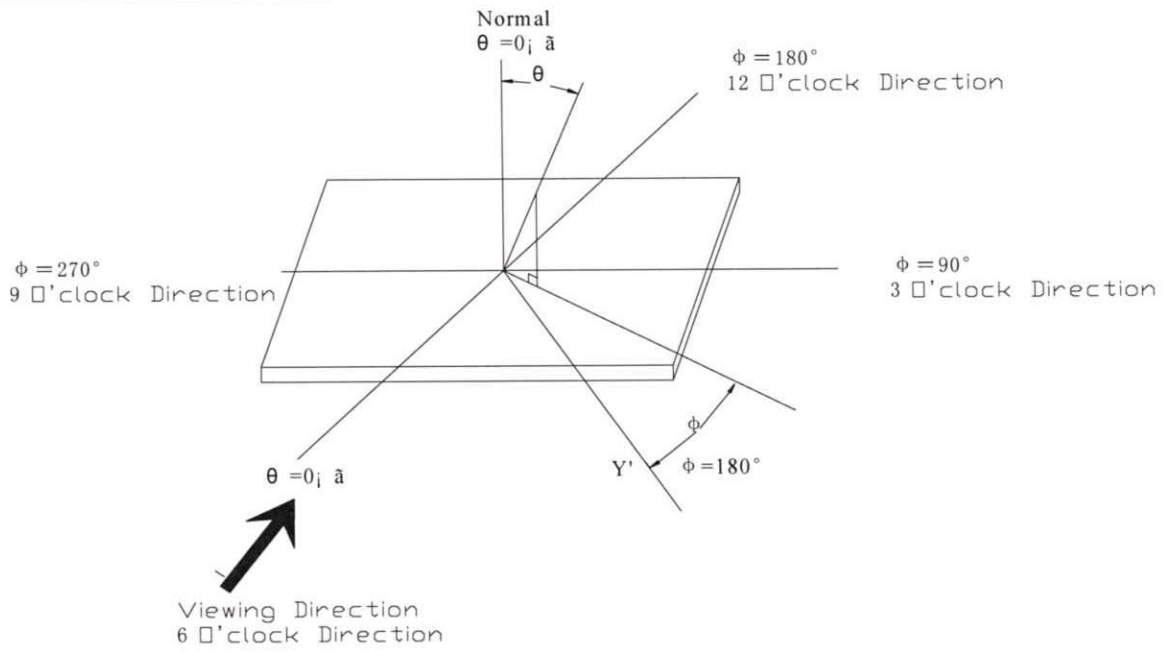
### MEASURING INSTRUMENTS FOR ELECTRO-OPTICAL CHARACTERISTICS



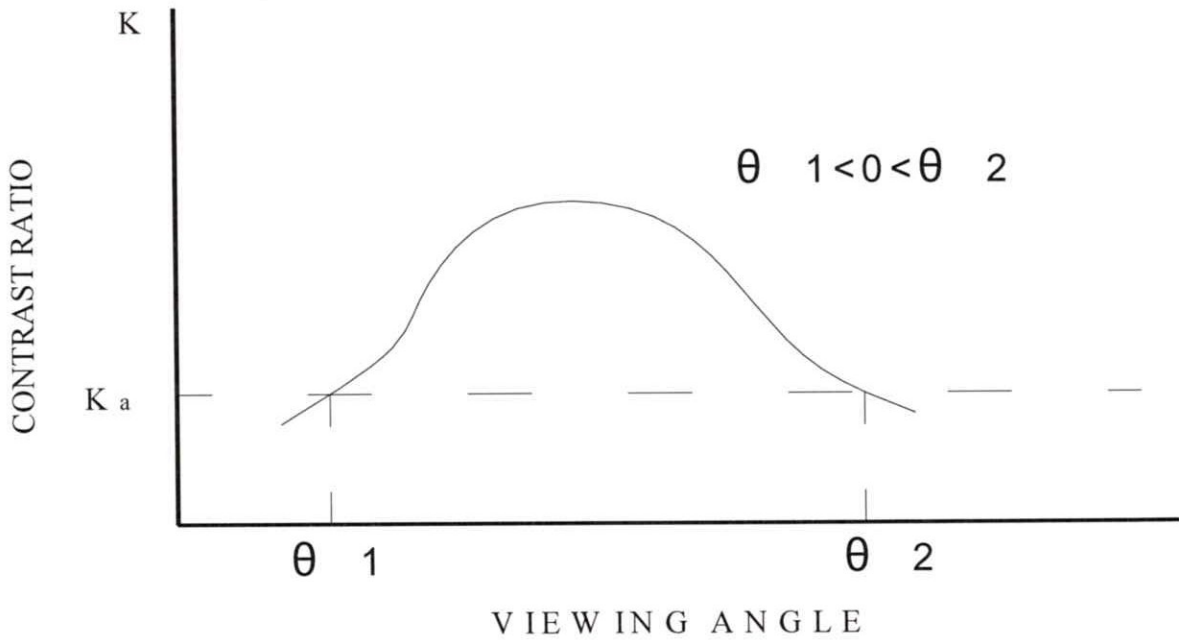
\*1: LIGHT SOURCE POSITION FOR MEASURING OF REFLECTIVE TYPE LCD

\*2: LIGHT SOURCE POSITION FOR MEASURING OF TRANSMISSIVE/TRANSFLECTIVE TYPE LCD

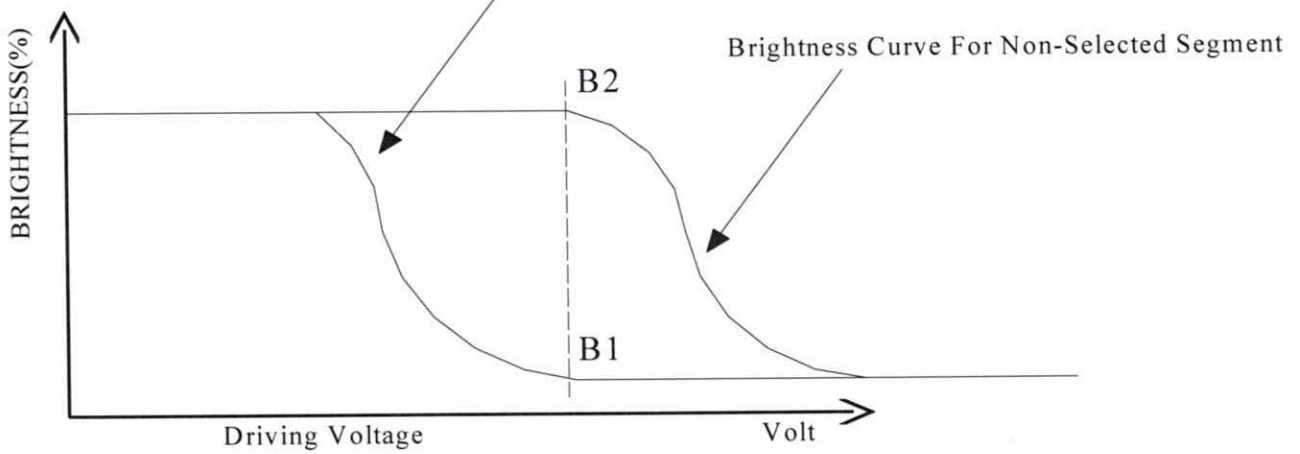




DEFINITION OF VIEWING ANGLE

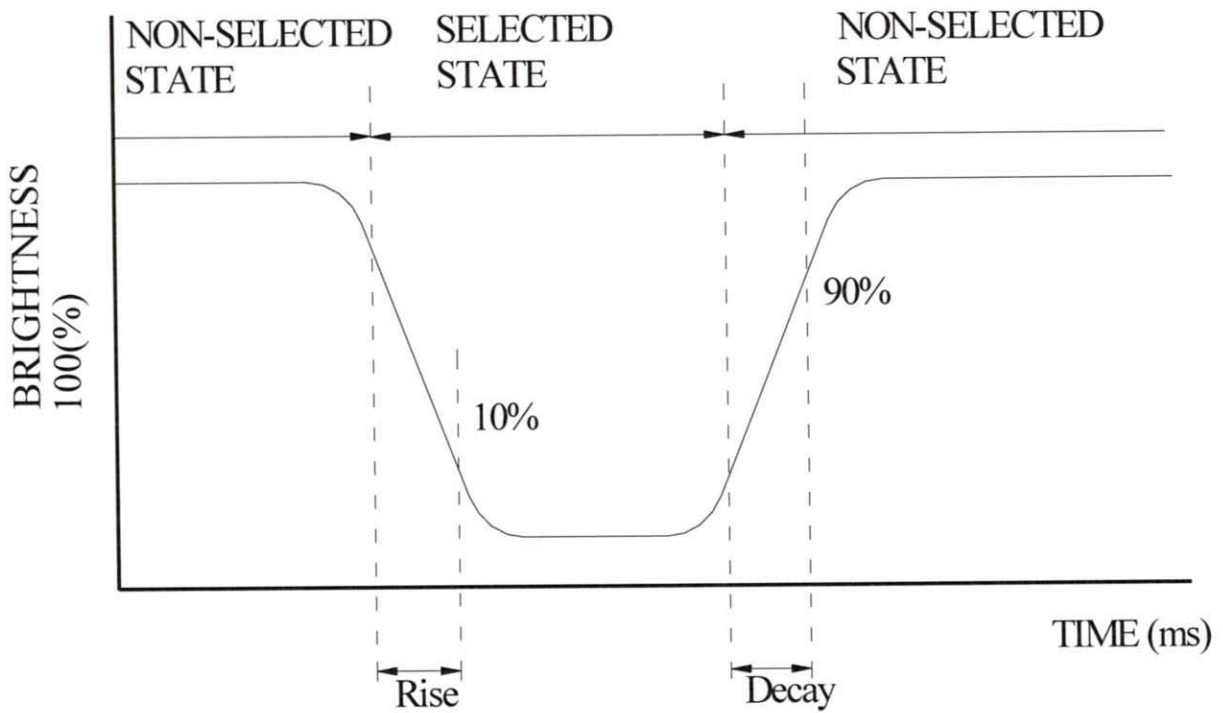


9. Contrast ratio Cr



$$Cr = \frac{\text{Brightness of Non-selected Segment}(B2)}{\text{Brightness of selected Segment}(B1)}$$

### 10. Response times TR and TF



### 11. Quality level

## 11.1 Inspection conditions

### 11.1.1 ENVIRONMENTAL CONDITIONS

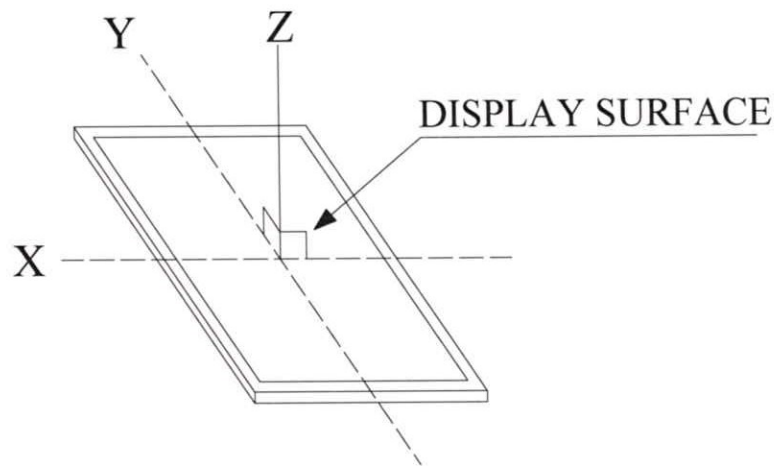
The environmental conditions for inspection shall be as follows

Room temperature:  $20 \pm 3^\circ\text{C}$

Humidity :  $65 \pm 20\% \text{RH}$

### 11.1.2 The external visual inspection

The inspection shall be performed by using a single 20W fluorescent lamp for illumination and the distance from LCD to eyes of the inspector should be 30cm or more.



Fluorescent lamp set perpendicular to the display surface

## 11.2 Classification of defects

### 11.2.1 A major defect

A major defect refers to A defect which may substantially degrade usability for product applications.

### 11.2.2 Minor defect

A Minor defect refers to A defect which is not considered to substantially degrade product application or A defect which deviates from existing standards almost unrelated to the effective use of the product or its operation

Sampling procedures for each items acceptance level table

Defect type	Sampling procedures	AQL
Major defect	MIL-STD-105D Inspection level1	1.0



	normal inspection Single sample inspection	
Minor defect	MIL-STD-105D Inspection level1 normal inspection Single sample inspection	2.5

## 12. Reliability

### 12.1 Life time

50,000Hrs(25°C in the room without ray of sun)

### 12.2 ITEMS OF RELIABILITY

ITEM	CONDITIONS	CRITERION
High temperature operation test	70°C \ 240 hours	<ol style="list-style-type: none"> <li>It judged at room temperature after 2 hours to be good as appearance and electrical test is normal after the experiment.</li> <li>Current consumption should within the specification of Approval sheet Electro-optical characteristics</li> </ol>
Low temperature operation test	0°C \ 240 hours	
High temperature/humidity storage test	80°C,90%±5%RH \ 240 hours	
High temperature storage test	+80°C \ 240 hours	
Low temperature storage test	-20°C \ 240 hours	
Temperature cycling test	0°C (30 min) ↓ ↑ 25°C ( 5 min) ↓ ↑ 70°C ( 30 min)  <b>CYCLES: 10</b>	
Vibration	Random Wave: 40 ~ 50 Hz Acceleration: 5 g Each Direction (x, y, z ): 50 sec	

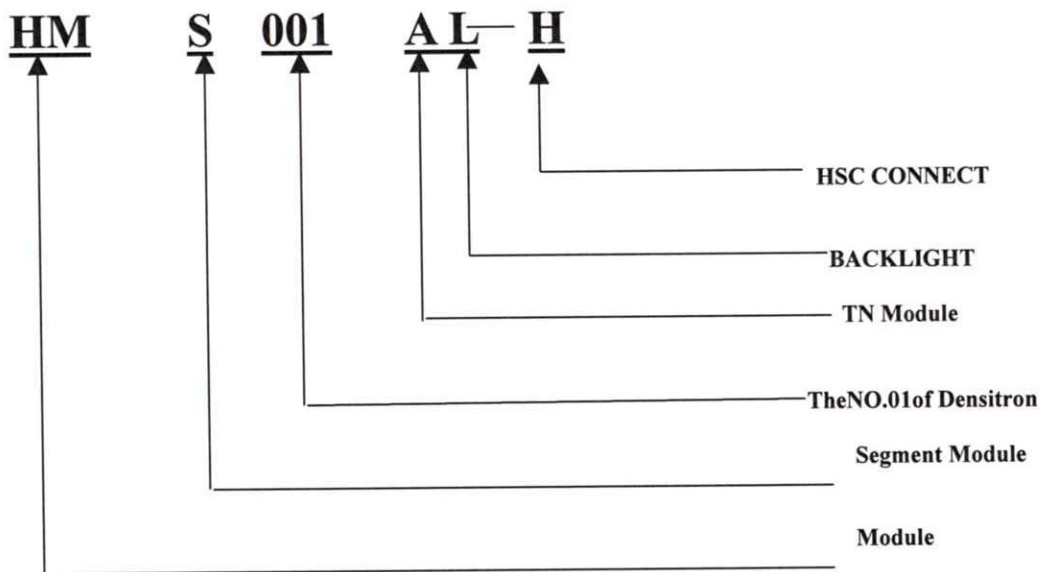
## 13. Cosmetic criteria of LCD screen

DEFECT	JUDGEMENT CRITERION		
	Size d (mm)	Acceptable quantity in active area	
Spots	$d \leq 0.1$	Disregard	
	$0.1 < d \leq 0.2$	6	
	$0.2 < d \leq 0.3$	2	
	$d > 0.3$	0	
Note: $d = (\text{Length} + \text{Width})/2$			
Polarizer Bubbles	$d \leq 0.3$	Disregard	
	$0.3 < d \leq 1.0$	3	
	$1.0 < d \leq 1.5$	1	
	$d > 1.5$	0	
Note: $d = (\text{Length} + \text{Width})/2$			
Lines	Width W (mm) Length L (mm)	Acceptable quantity in active area	
	$W \leq 0.02$	Disregard	
	$0.02 < W \leq 0.05$	$L \leq 5.0$	6
		$L > 5.0$	0
	$0.05 < W \leq 0.1$	$L \leq 2.0$	6
		$L > 2.0$	0
$W > 0.1$	See criteria for spots		

Testing conditions: 20W fluorescent lamp at 30 cm distance at normal viewing angle

### 14. Data-Coding system

INSTRUCTION OF DATA CODE FOR Densitron



### 15.1 Static charge

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Since this LCD module contains CMOS LSIs that are sensitive to static charge, care must be taken when handling it.

## 15.2 Power on sequence

1. Input signals should not be applied to the LCD module before the logic system voltage has reached the specified voltage. If the above sequence is not kept, the LCD module might be permanently damaged.
2. When connecting the power supply, connect the LCD bias voltage after connecting the logic system voltage.
3. When disconnecting the power supply, disconnect the logic system voltage after the LCD bias voltage.
4. It is recommended to connect a serial resistor or fuse to the LCD bias power supply of the system as a current limiter. The value of the resistor depends on the kind of LCD used, but is typically 50~100Ω

## 15.3 Operation

1. It is essential to drive the LCD within the specified voltage limits, since a higher driving voltage than allowed causes a shorter LCD lifetime. Under these circumstances, electrochemical reactions will result in undesirable deterioration of the LCD.
2. The response time of the LC fluid is considerably longer at low temperature than in the normal operating temperature range. On the other hand, the LCD will show a dark blue color at high temperatures. Those phenomena do not indicate a malfunction or defect of the LCD. Back at normal temperatures, the LCD will return to its original behavior.
3. If the display area is pressed hard during operation, some abnormal display patterns might appear. However, the display will resume normal operation after turning the module off and on.
4. Moisture on the terminals could cause an electrochemical reaction resulting in an open terminal connection. If the environmental temperature is higher than 50°C, it is required that the relative humidity is 50% or less.

## 15.4 Packaging

1. Do not leave the product in a place of high humidity for a long period. For storage in a location where the temperature is 60°C or higher, special care to protect the product from high humidity is required. A combination of high temperature and high humidity may cause polarization degradation and damage as well. Please keep the temperature and humidity within the specified range for storing.
2. Since LCD panels tend to be easily damaged, they should be handled with full care. Avoid any contact with materials that have a hardness of more than 2H.
3. Adhesive used for adhering upper/lower polarizers and aluminum plates are made of organic substances that will deteriorate by chemical reactions with for examples chemicals such as acetone, toluene, ethanol and isopropylalcohol. Please prevent the use of these chemicals and contact us when it is necessary for you to use other chemicals.
4. Immediately wipe off saliva or water drops from the display area with an absorbent cotton cloth without scrubbing it. If adhered for a long period, such particles might cause deformation for faded color.
5. Moisture deposited on the display surface and contact terminals due to low temperatures will be a cause for



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polarizer damage, stains and dirt. Before use, such panels should be slowly warmed up to a temperature that is higher than room temperature..

6. Touching the display area and contact terminals with bare hands is harmful to polarizer and may lead to poor insulation at the terminals.
7. The glass is fragile and can be cracked or chipped easily by handling, in particular on near its edge. Please prevent sudden shocks or exposing the glass to other sorts of stress.

### **15.5 Ling-time storage**

For long-term storage the following methods are highly recommended:

1. Store the product in a polyethylene bag with a sealed opening to prevent fresh air entering from the outside. Placing it with a desiccant is not necessary.
2. Store the product in a dark place, with the temperature in the range from -10°C to 60°C.
3. Keep the sensitive polarizer surface of the LCD panels clear of any contact. We recommend using the container that was used by Densitron to deliver the products.

### **15.6 Cleaning of product**

To clean the product make sure to use absorbent cotton cloth or other soft material like chamois. Make sure to rub it gently and do not use chemicals when cleaning.