Osptek Display

LCD MODULE SPECIFICATION

Model No:

HHB88128-990

1. RECORDS OF REVISION

Revision Content	Rev	Date
New Release	A0	2023-5-4

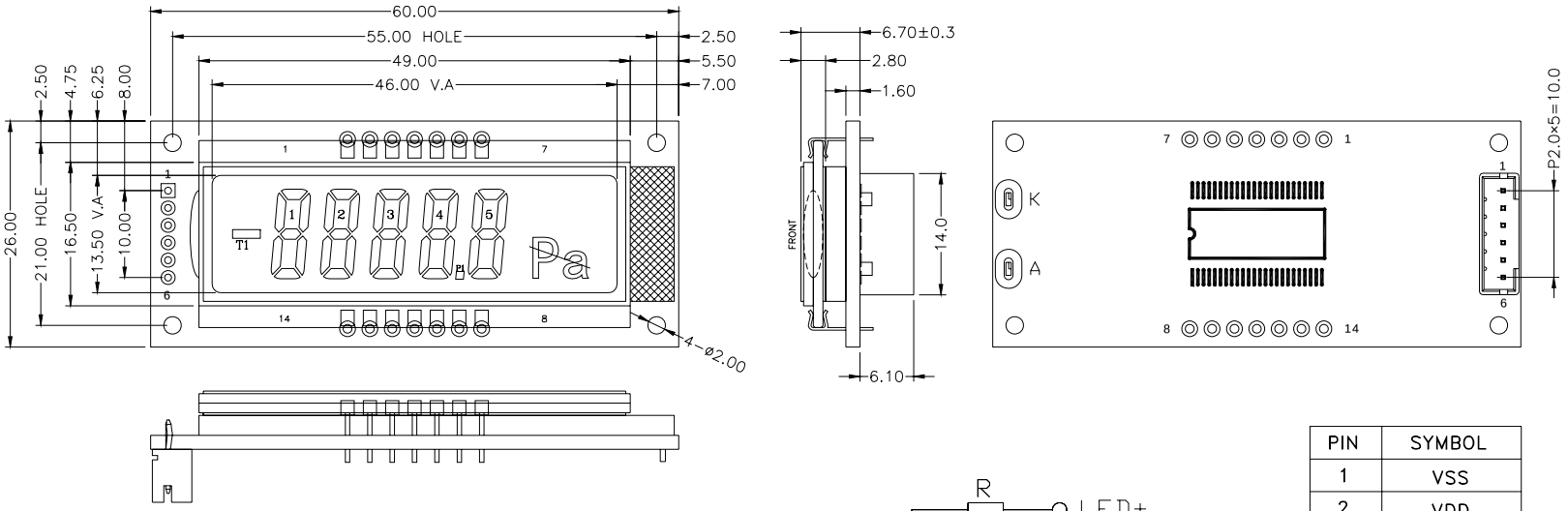
2. CONTENTS

3. GENERAL SPECIFICATIONS

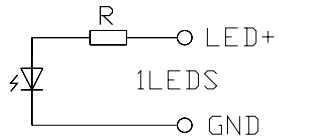
Outline Size(mm)	**60.0(L）×26.0(W)×6.7 (T)**
LCD Type	HTN/Positive/Transflective, 1/4Duty, 1/3Bias
Display Type	Segment (ICON)
View Area(mm)	46.0×13.5
Display Area(mm)	---
Dots Size(mm)	---
Dots Pitch(mm)	---
Character Size(mm)	---
Character Pitch(mm)	---
Controller& Driver	HT1621 (COB)
View Direction	6 O'Clock
Interface Mode	3-Wire Serial Interface
VDD&VOP(Type)	3.0 V & 3.0 V
Backlight(Type)	White, 15mA
Operation Temp.	-20 to +70 ℃
Storage Temp.	-30 to +80 ℃
Weight	---

All Pages Of This Edition Approved			
Signature:		Date:	

REV.	DESCRIPTION	REVISER	DATE
A0	New Release	Liu Gong	2022-10-20



IC	SEG9	SEG8	SEG7	SEG6	SEG5	SEG4	SEG3	SEG2	SEG1	SEG0	COM0	COM1	COM2	COM3
PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14
COM1	T1	1D	/	2D	/	3D	P1	4D	Pa	5D	COM1			
COM2	1E	1C	2E	2C	3E	3C	4E	4C	5E	5C		COM2		
COM3	1G	1B	2G	2B	3G	3B	4G	4B	5G	5B			COM3	
COM4	1F	1A	2F	2A	3F	3A	4F	4A	5F	5A				COM4



BackLight Circuit

PIN	SYMBOL
1	VSS
2	VDD
3	CS
4	WR
5	DATA
6	LED+

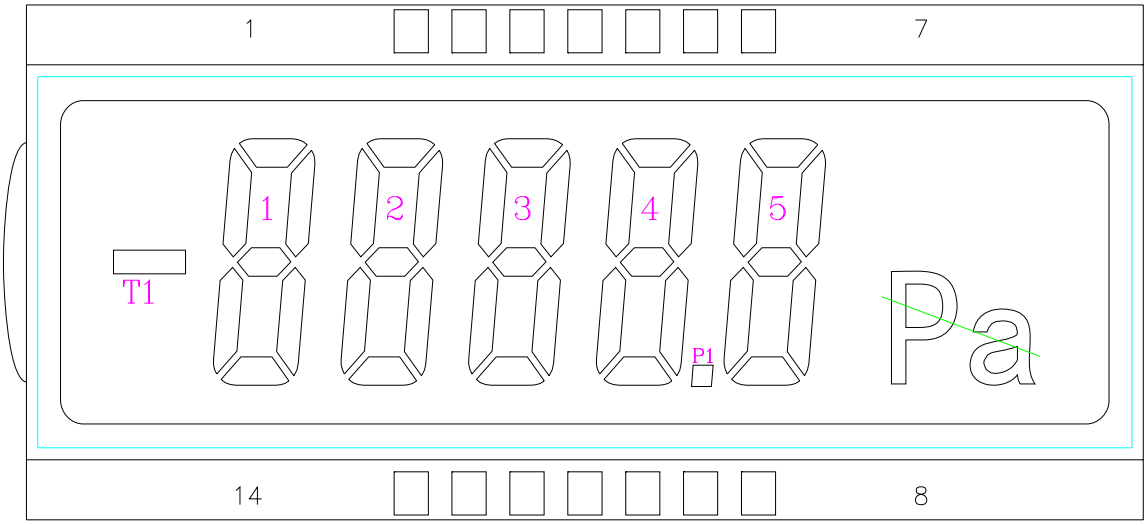
Specifications:

1. Display Mode: HTN/Positive/Transflective.
2. Viewing Angle: 6 O'clock.
3. Drive Method: 1/4Duty, 1/3Bias, VLCD=3.0±0.2V, VDD=3.0V.
4. Backlight Type: White, 3.0±0.2V, 15mA, 1pcs.
5. Operating Temp: −20°C~+70°C.
6. Storage Temp: −30°C~+80°C.
7. Connector: PIN
8. Drive IC: HT1621(SSOP-48)
9. Customer P/N: --
10. Unmarked Tolerance: ±0.2mm
11. Requirements On Environmentall Protection: RoHS

深圳市鱼鹰光电科技有限公司

	NAME:	DATE:	MODEL NUMBER :		SHEET:	1 OF 1
DESIGN BY:	Liu Gong	2022-10-20	HHB88128-990			
CHECKED BY:					NAME:	LCM
APPROVED BY:			DEFAULT UNITS: mm	PROJECTION		

5. LCD DISPLAY LOGIC



IC	SEG9	SEG8	SEG7	SEG6	SEG5	SEG4	SEG3	SEG2	SEG1	SEG0	COM0	COM1	COM2	COM3
PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14
COM1	T1	1D	/	2D	/	3D	P1	4D	Pa	5D	COM1			
COM2	1E	1C	2E	2C	3E	3C	4E	4C	5E	5C		COM2		
COM3	1G	1B	2G	2B	3G	3B	4G	4B	5G	5B			COM3	
COM4	1F	1A	2F	2A	3F	3A	4F	4A	5F	5A				COM4

6. ABSOLUTE MAXIMUN RATING

ELECTRICAL ABSOLUTE MAXIMUMRATINGS

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
POWER SUPPLY FOR LOGIC	**VDD-VSS**	**-0.3**	**5.5**	**V**	
POWER SUPPLY FOR LCD DRIVE	**VSS-VLCD**	**-0.3**	**5.5**	**V**	
INPUT VOLTAGE	**VI**	**VSS**	**VDD**	**V**	
POWER SUPPLY FOR LED	**BLA-VSS**	**0**	**3.2**	**V**	

ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN	MAX	MIN	MAX	
AMBIENT TEMPERATURE(℃)	-20	70	-30	+80	
VIBRATION (M/S^2)	/	/			SEE “ITEMS OF RELIABILITY”
TEMPERATURE CYCLING TEST	/	/			SEE “ITEMS OF RELIABILITY”
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

7. ELECTRICAL CHARACTERISTICS(Vss=0V)

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	V_{DD}-V_{SS}	Ta=0~+50℃	2.8	3.0	3.2	Volt	
Input Voltage	V_{IL}	Vdd=5V±5%	V_{SS}		0.3	Volt	
	V_{IH}		-	-	V_{DD}	Volt	
Output Voltage	Vo_L	Vdd=5V±5%	-	-	0.3	Volt	
	Vo_H		-	-	-	Volt	
LCD driveVoltage(recommended Voltage)	V_{SS} –V_{LCD}	T_a＝0℃	-	-	-	Volt	
		T_a＝25℃	2.8	3.0	3.2		
		T_a＝50℃	-	-	-		
Power Supply Current for LCM	I_{DD}	V_{DD} =5.0V T_a=25℃	-	-	2	mA	-
	Iled	Vin= 3.0	-	15	20		

8. BACKLGHT CHARACTERISTICS

1. Standard Backlight Styles (Edge Lighting Type):
   The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption.
2. The main advantage of the LED Backlight can simply be adjusted, by a resistor or potentiometer.

Item	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Unit**	**Note**
Supply Voltage	V	If=15 mA	--	3.0	3.2	V	
Supply Current	I	V=3.0 V	--	15	20	mA	
Reverse Voltage	Vr	--	--	--	--	V	
Luminous Intensity for LCM (Include lcd)	Iv	If=15 mA	--	20	--	cd/m^2	2
Uniformity for LCM	--	If=15 mA	70			%	3
Life Time	--	If=15 mA	50000	--	--	hrs	4
Spectral Range	x	If=15 mA	0.26	0.29	0.32		
	y	If=15 mA	0.26	0.29	0.32		

Note :1. Backlight Only.
2. Average luminous intensity of points 1-5.
3. Brightness uniformity=(MAX-MIN)/MAX × 100.
4. LED lifetime defined as follows :The final brightness is at 50% of original brightness.

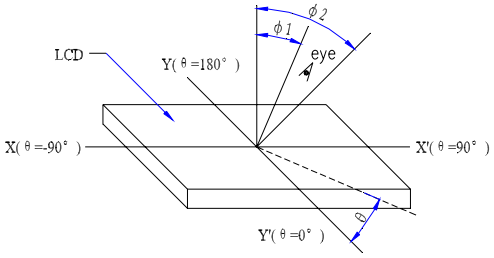
9. PIN CONNECTIONS

Pin No.	Pin Out	Description
1	VSS	Ground.
2	VDD	Logic supply voltage (3.0V) .
3	/CS	Chip selection input with pull-high resistor When the CS is logic high, the data and command read from or written to the HT1621 are disabled. The serial interface circuit is also reset. But if CS is at logic low level and is input to the CS pad, the data and command transmission between the host controller and the HT1621 are all enabled.
4	/WR	WRITE clock input with pull-high resistor. Data on the DATA line are latched into the HT1621 on the rising edge of the WR signal.
5	DATA	Serial data input/output with pull-high resistor.
6	LED+	LED Backlight A

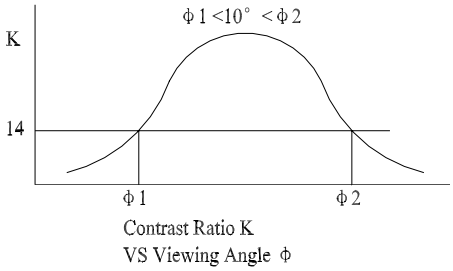
10. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle range	Θ2-Θ1	T_a=25℃	20	-	-	Deg	K=1.4 A,B
	Φ		-	-	-		
Rise Time	T_r	T_a=25℃	-	150	300	ms	Φ=10 Θ=0 C
Fall Time	T_f	T_a=25℃	-	200	300		
Contrast	Cr	T_a=25℃	-	5	-	-	Φ=10 Θ=0 D

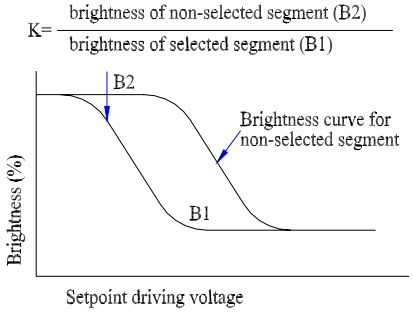
10.1 Definition of angle θ and φ



10.2 Definition of viewing angle $\varphi 1$ and $\varphi 2$

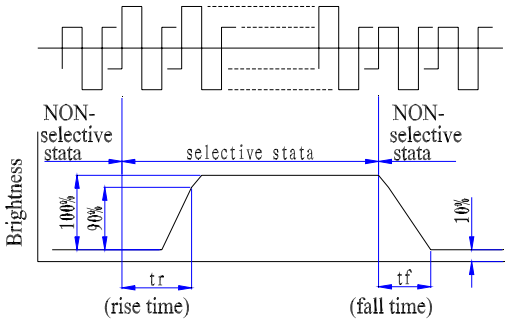


10.3 Definition of contrast "K"



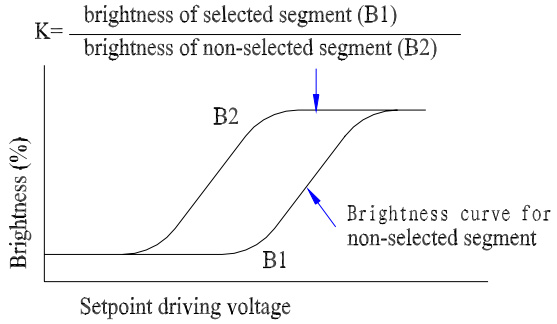
POSITIVE TYPE 正性显示

10.4 Definition of optical response



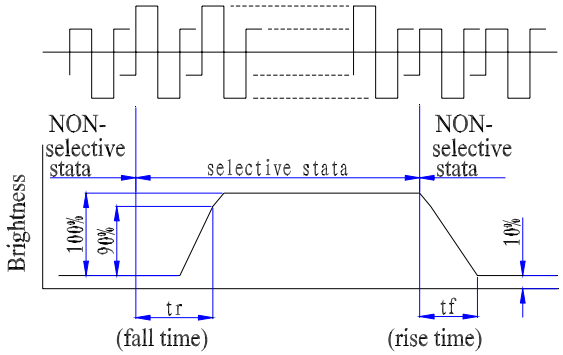
POSITIVE TYPE 正性显示

10.5 Definition of contrast “K”



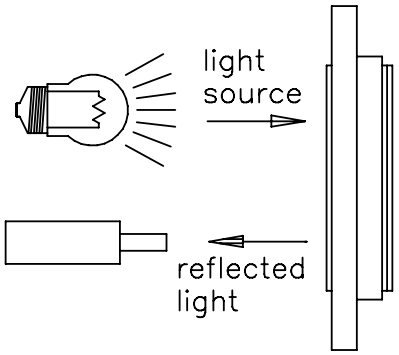
NEGATIVE TYPE 负性显示

10.6 Definition of optical response

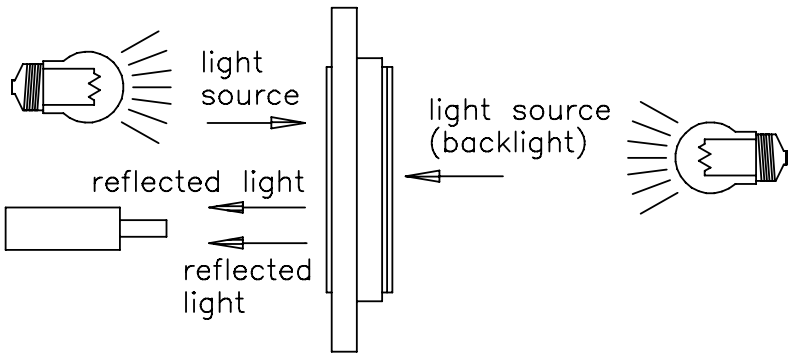


NEGATIVE TYPE 负性显示

10.7 DESCRIPTION OF MEASURING EQUIPMENT



Reflective type



Transflective type

11. ELECTRICAL CHARACTERISTICS

D.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.4	—	5.2	V
I_{DD1}	Operating Current	3V	No load/LCD ON On-chip RC oscillator	—	150	300	μA
		5V		—	300	600	μA
I_{DD2}	Operating Current	3V	No load/LCD ON Crystal oscillator	—	60	120	μA
		5V		—	120	240	μA
I_{DD3}	Operating Current	3V	No load/LCD ON External clock source	—	100	200	μA
		5V		—	200	400	μA
I_{STB}	Standby Current	3V	No load, Power down mode	—	0.1	5	μA
		5V		—	0.3	10	μA
V_{IL}	Input Low Voltage	3V	DATA, $\overline{WR}$, $\overline{CS}$, $\overline{RD}$	0	—	0.6	V
		5V		0	—	1.0	V
V_{IH}	Input High Voltage	3V	DATA, $\overline{WR}$, $\overline{CS}$, $\overline{RD}$	2.4	—	3.0	V
		5V		4.0	—	5.0	V
I_{OL1}	DATA, BZ, $\overline{BZ}$, $\overline{IRQ}$	3V	V_{OL}=0.3V	0.5	1.2	—	mA
		5V	V_{OL}=0.5V	1.3	2.6	—	mA
I_{OH1}	DATA, BZ, $\overline{BZ}$	3V	V_{OH}=2.7V	–0.4	–0.8	—	mA
		5V	V_{OH}=4.5V	–0.9	–1.8	—	mA
I_{OL2}	LCD Common Sink Current	3V	V_{OL}=0.3V	80	150	—	μA
		5V	V_{OL}=0.5V	150	250	—	μA
I_{OH2}	LCD Common Source Current	3V	V_{OH}=2.7V	–80	–120	—	μA
		5V	V_{OH}=4.5V	–120	–200	—	μA
I_{OL3}	LCD Segment Sink Current	3V	V_{OL}=0.3V	60	120	—	μA
		5V	V_{OL}=0.5V	120	200	—	μA
I_{OH3}	LCD Segment Source Current	3V	V_{OH}=2.7V	–40	–70	—	μA
		5V	V_{OH}=4.5V	–70	–100	—	μA
R_{PH}	Pull-high Resistor	3V	DATA, $\overline{WR}$, $\overline{CS}$, $\overline{RD}$	60	120	200	kΩ
		5V		30	60	100	kΩ

A.C. Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
f_{SYS1}	System Clock	3V	On-chip RC oscillator	192	256	320	kHz
f_{SYS2}	System Clock	—	Crystal oscillator	—	32768	—	Hz
f_{SYS3}	System Clock	—	External clock source	—	256	—	kHz
f_{LCD}	LCD Clock	—	On-chip RC oscillator	—	$f_{SYS1}/1024$	—	Hz
		—	Crystal oscillator	—	$f_{SYS2}/128$	—	Hz
		—	External clock source	—	$f_{SYS3}/1024$	—	Hz
t_{COM}	LCD Common Period	—	n: Number of COM	—	n/f_{LCD}	—	s
f_{CLK1}	Serial Data Clock ($\overline{WR}$ pin)	3V	Duty cycle 50%	4	—	150	kHz
		5V		4	—	300	kHz
f_{CLK2}	Serial Data Clock ($\overline{RD}$ pin)	3V	Duty cycle 50%	—	—	75	kHz
		5V		—	—	150	kHz
f_{TONE}	Tone Frequency (2kHz)	3V	On-chip RC oscillator	1.5	2.0	2.5	kHz
	Tone Frequency (4kHz)			3.0	4.0	5.0	kHz
t_{CS}	Serial Interface Reset Pulse Width (Figure 3)	—	$\overline{CS}$	250	300	—	ns
t_{CLK}	$\overline{WR}$, $\overline{RD}$ Input Pulse Width (Figure 1)	3V	Write mode	3.34	—	125	µs
			Read mode	6.67	—	—	
		5V	Write mode	1.67	—	125	µs
			Read mode	3.34	—	—	
t_r, t_f	Rise/Fall Time Serial Data Clock Width (Figure 1)	—	—	—	120	160	ns
t_{su}	Setup Time for DATA to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 2)	—	—	60	120	—	ns
t_h	Hold Time for DATA to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 2)	—	—	250	300	—	ns
t_{su1}	Setup Time for $\overline{CS}$ to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 3)	—	—	500	600	—	ns
t_{h1}	Hold Time for $\overline{CS}$ to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 3)	—	—	250	300	—	ns
t_{OFF}	V_{DD} OFF Times (Figure 4)	—	V_{DD} drop down to 0V	20	—	—	ms
t_{SR}	V_{DD} Rising Slew Rate (Figure 4)	—	—	0.05	—	—	V/ms
t_{RSTD}	Delay Time after Reset (Figure 4)	—	—	1	—	—	ms

Note: 1. If the conditions of Power-on Reset timing are not satisfied in power On/Off sequence, the internal Power-on Reset (POR) circuit will not operate normally.

2. If the VDD drops below the minimum voltage of operating voltage spec. during operating, the conditions of Power-on Reset timing must be satisfied also. That is, the VDD must drop to 0V and keep at 0V for 20ms (min.) before rising to the normal operating voltage.

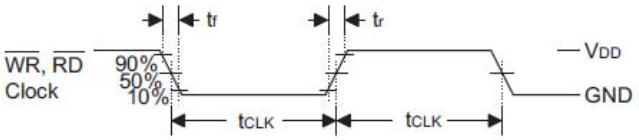


Figure 1

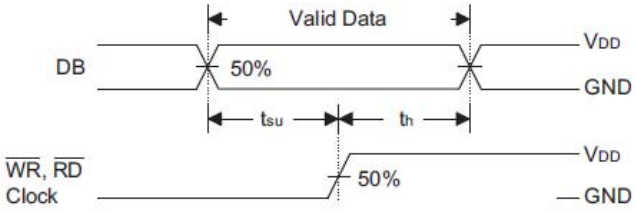


Figure 2

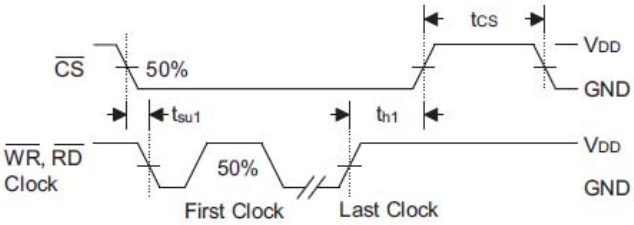


Figure 3

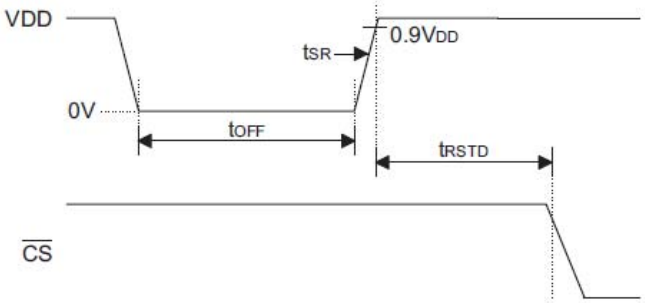
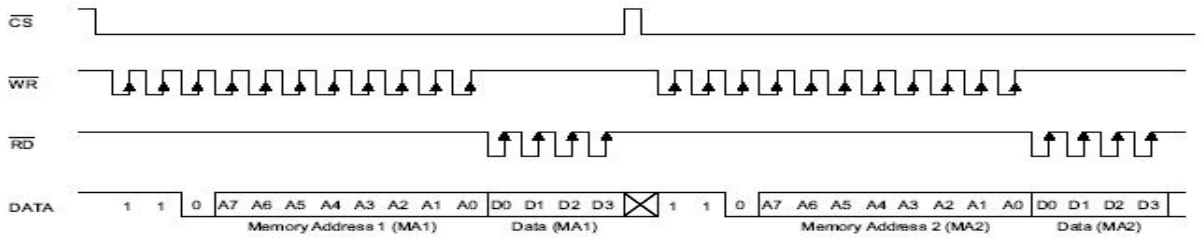


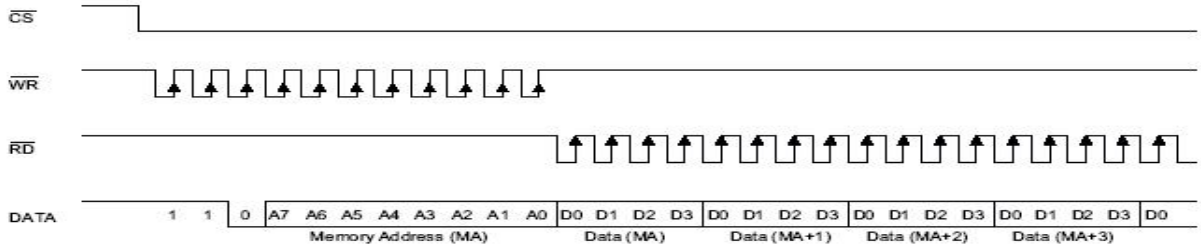
Figure 4 Power-on Reset Timing

12. CONTROL IC TIMING CHARACTERISTICS

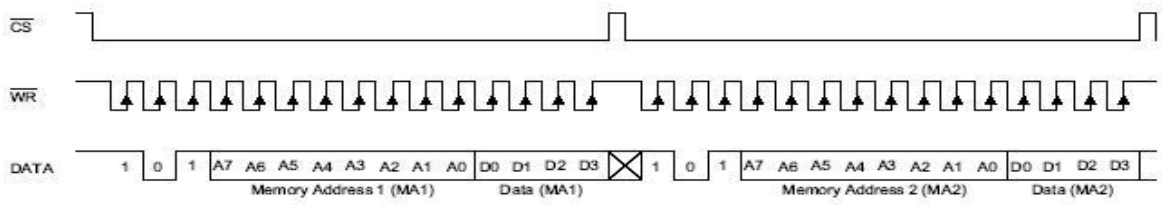
READ mode (command code : 1 1 0)



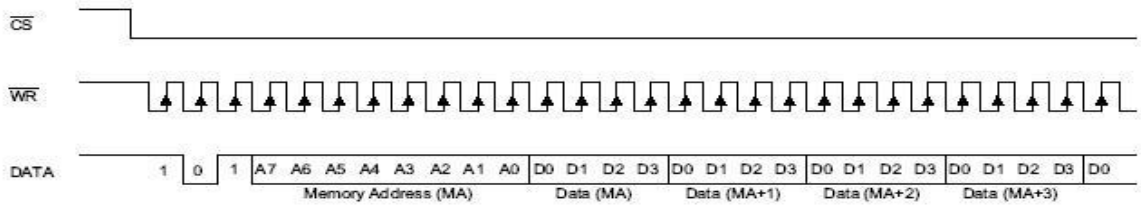
READ mode (successive address reading)



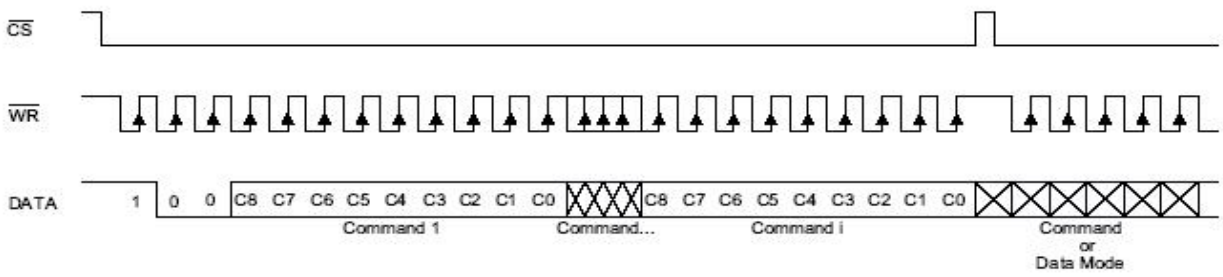
WRITE mode (command code : 1 0 1)



WRITE mode (successive address writing)



Command mode (command code : 1 0 0)



13. DISPLAY COMMAND

Name	ID	Command Code	D/C	Function	Def.
READ	1 1 0	A5A4A3A2A1A0D0 D1D2D3	D	Read data from the RAM	
WRITE	1 0 1	A5A4A3A2A1A0D0 D1D2D3	D	Write data to the RAM	
READ-MODIFY-WRITE	1 0 1	A5A4A3A2A1A0D0 D1D2D3	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	0000-1101-X	C	Clear the contents of time base generator	
CLR WDT	1 0 0	0000-1111-X	C	Clear the contents of WDT stage	
RC 32K	1 0 0	0001-10XX-X	C	System clock source, on chip RC oscillator	Yes
EXT 32K	1 0 0	0001-11XX-X	C	System clock source, external clock source	
TONE 4K	1 0 0	010X-XXXX-X	C	Tone frequency, 4KHz	
TONE 2K	1 0 0	0110-XXXX-X	C	Tone frequency, 2KHz	
IRQ DIS	1 0 0	100X-0XXX-X	C	Disable IRQ output	Yes
IRQ EN	1 0 0	100X-1XXX-X	C	Enable IRQ output	
F1	1 0 0	101X-0000-X	C	Time base/WDT clock output:1Hz ;The WDT time-out flag after: 4s	
F2	1 0 0	101X-0001-X	C	Time base/WDT clock output:2Hz The WDT time-out flag after: 2s	
F4	1 0 0	101X-0010-X	C	Time base/WDT clock output:4Hz;The WDT time-out flag after: 1s	
F8	1 0 0	101X-0011-X	C	Time base/WDT clock Output: 8Hz ;The WDT time-out flag after: 1/2 s	
F16	1 0 0	101X-0100-X	C	Time base/WDT clock output: 16Hz The WDT time-out flag after: 1/4 s	
F32	1 0 0	101X-0101-X	C	Time base/WDT clock output: 32Hz; The WDT time-out flag after: 1/8 s	
F64	1 0 0	101X-0110-X	C	Time base/WDT clock output:64Hz; The WDT time-out flag after: 1/16 s	
F128	1 0 0	101X-0111-X	C	Time base/WDT clock output:128Hz; The WDT time-out flag after: 1/32 s	Yes

Note: X: Don't care
A5~A0: RAM addresses
D3~D0: RAM data
D/C: Data/command mode
Def.: Power on reset default

All the bold forms, namely **1 1 0**, **1 0 1**, and **1 0 0**, are mode commands. Of these, **1 0 0** indicates the command mode ID. If successive commands have been issued, the command mode ID except for the first command will be omitted. The source of the tone frequency and of the time base/WDT clock frequency can be derived from an on-chip 32kHz RC oscillator, a 32.768kHz crystal oscillator, or an external 32kHz clock. Calculation of the frequency is based on the system frequency sources as stated above. It is recommended that the host controller should initialize the HT1621 after power on reset, for power on reset may fail, which in turn leads to the malfunctioning of theHT1621.

14. QUALITY LEVEL

Inspection conditions

ENVIRONMENTAL CONDITIONS

The environmental conditions for inspection shall be as follows: Room temperature:22±3℃;Humidity:50±10%RH

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.

Classification of defects

A major defect

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

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 normal inspection Single sample inspection	1.0
Minor defect	MIL-STD-105D Inspection level1 normal inspection Single sample inspection	2.5

Life time

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

ITEMS OF RELIABILITY

ITEM	CONDITIONS	CRITERION
High temperature operation test	+70℃ \ 120 hours	**1.** It judged at room temperature after 2 hours to be good as appearance and electrical test is normal after the experiment. **2.** Current consumption should within the specification of Approval sheet Electro-optical characteristics
Low temperature operation test	-20℃ \ 120 hours	5-10pcs
High temperature/humidity storage test	+80℃,80%±10%RH \ 120 hours	

High temperature storage test	+80℃ \ 120 hours	
Low temperature storage test	-30℃ \ 120 hours	
Temperature cycling test	-20℃ (30 min) ↓ ↑ 25℃ (5 min) ↓ ↑ 70℃ (30 min) CYCLES: 10	
Vibration	Random Wave: 10 ~ 50 Hz Each Direction (x, y, z): 30MIN.	

Cosmetic criteria of LCD screen

DEFECT	JUDGEMENT CRITERION		
Spots	**Size d (mm)**		**Acceptable quantity in active area**
	d≤0.1 0.1<d≤0.2 0.2<d≤0.3 d>0.3		Disregard 6 2 0
	Note: d = (Length + Width)/2		
Polarizer Bubbles	**Size d (mm)**		**Acceptable quantity in active area**
	d≤0.3 0.3<d≤1.0 1.0<d≤1.5 d>1.5		Disregard 3 1 0
	Note: d = (Length + Width)/2		
Lines	**Width W (mm) Length L (mm)**		**Acceptable quantity in active area**
	W ≤ 0.02		Disregard
	0.02< W≤0.05	L ≤ 5.0	6
		L > 5.0	0
	0.05<W≤0.1	L ≤ 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			

15. PRECAUTIONS

Static charge

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

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

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℃, it is required that the relative humidity is 50% or less.

Long-time storage

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

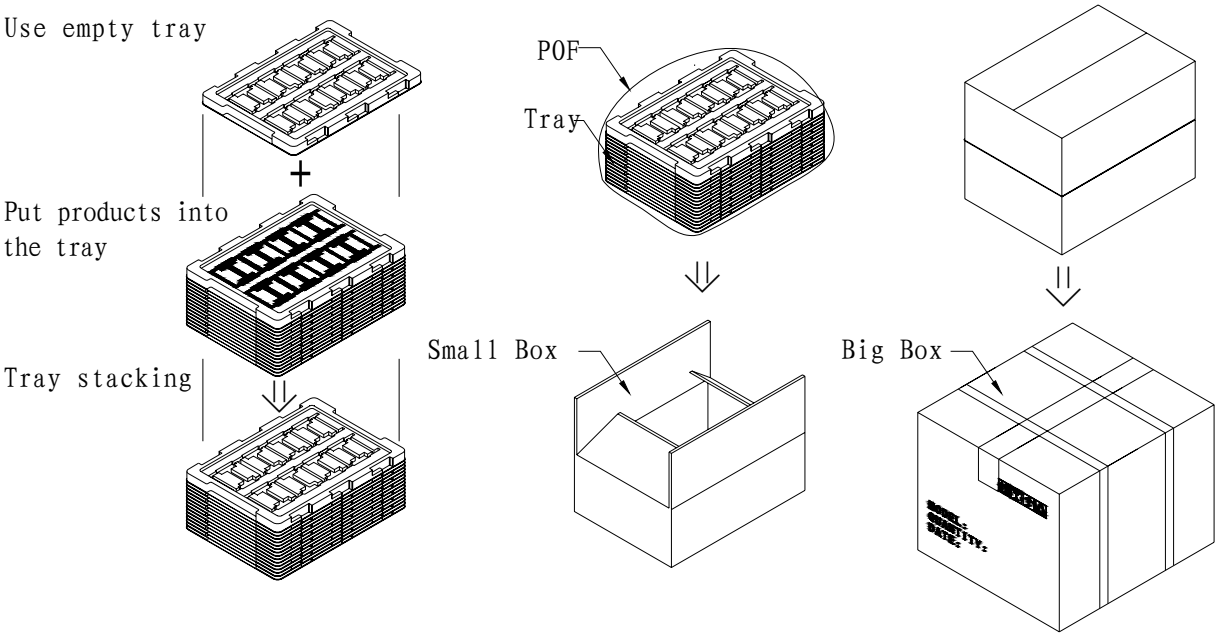
1. Store the product in a polyethylene bag with a sealed opening to prevent fresh air entering from the outside. Placing it with a desiccant is not necessary.
2. Store the product in a dark place, with the temperature in the range from -10℃ to 60℃.
3. Keep the sensitive polarizer surface of the LCD panels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

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.

16. PACKAGE INFORMATION

Packaging Material				
No.	Item	Model	Dimensions (mm)	Quantity
1	LCM	-	-	--
2	POF	-	-	--
3	TRAY	-	-	--
4	SMALL BOX	-	385.0×315.0×200.0	2
5	BIG BOX	-	398.0×331.0×430.0	1



OR