SPECIFICATION
FOR
LCM MODULE

MODULE NO.: CBS084A00-TJN
DOC.REVISION: 00

Customer Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		Jun-29-2005
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

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00	Jun-29-2005	First issue	

深圳秋田视佳实业有限公司
SHENZHEN AV-DISPLAY CO., LTD

CONTENTS

1. FUNCTIONS & FEATURES

1.1. Format   :7-segment Characters+ICONS
1.2. LCD mode   : TN / Positive, Reflective Mode
1.3. Viewing direction   : 12 o'clock
1.4. Driving scheme   : 1/4 Duty cycle, 1/3 Bias
1.5. Power supply voltage (V_{DD})   : 4.5 V
1.6. VLCD supply voltage   : 4.0V (adjustable for best contrast)
1.7. Operation temp   : -20~70
1.8. Storage temp   : -30~80
1.9. LCM operation current   : I   1.5mA

2. MECHANICAL SPECIFICATIONS

2.1. Module size   :66.0mm(L)*26.0mm(W)*Max5.0mm (H)
 2.2. Viewing area   :62.0mm(L)*11.0mm(W)
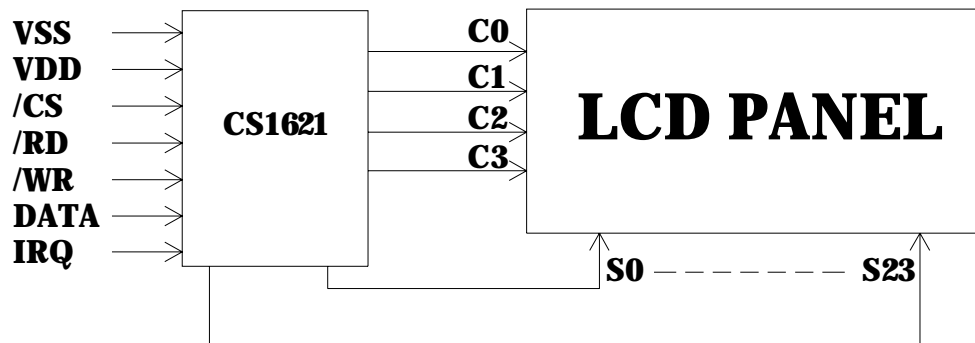2.3. Weight   : Approx.

3. BLOCK DIAGRAM
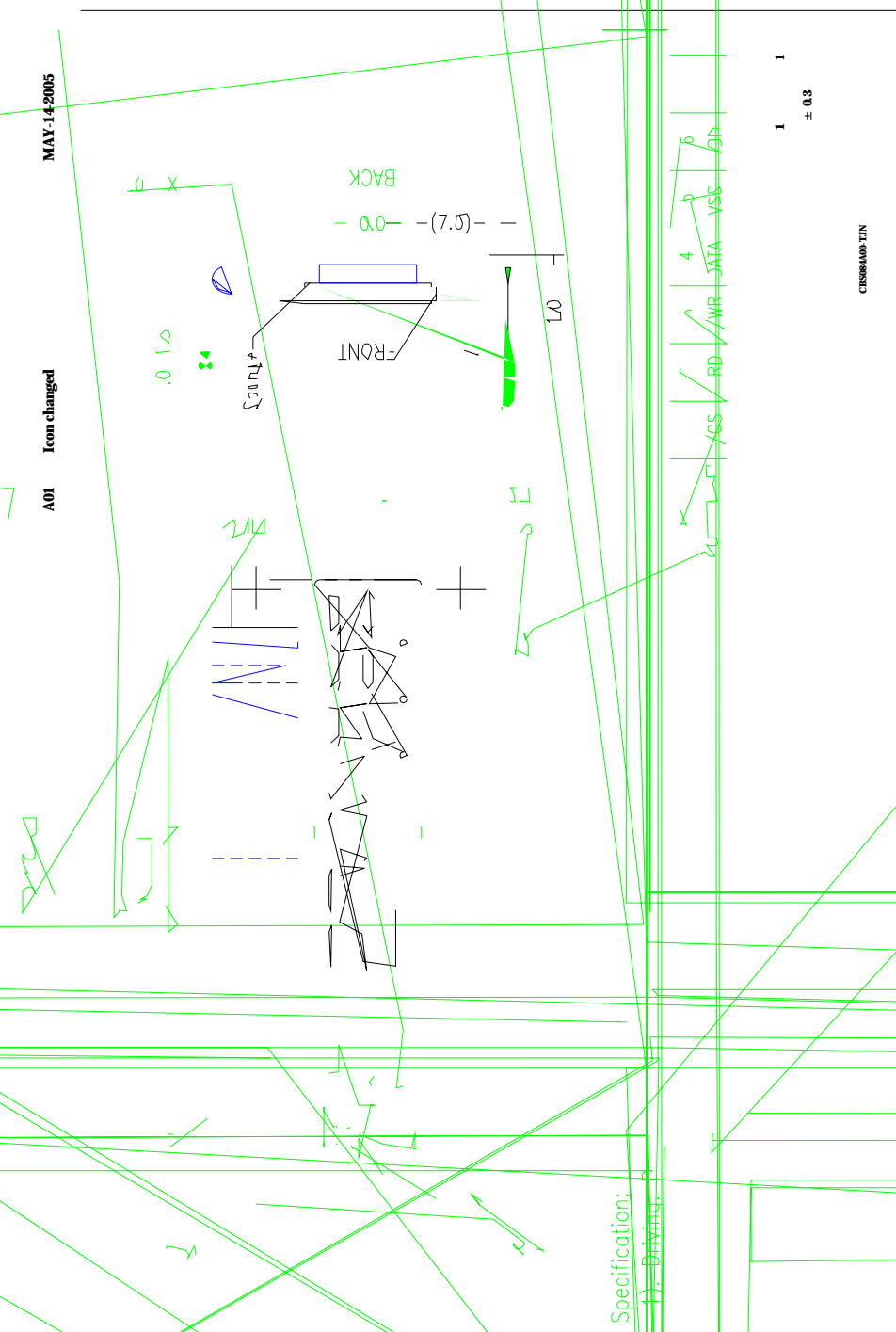
Figure 1. Block diagram

4. DIMENSIONAL OUTLINE

Figure 2. Dimensional Outline

5. PIN DESCRIPTION

INTERFACE:

NO.	ITEM	DESCRIPTION
1	/CS	Chip selection input with pull-high resistor
2	/RD	RADE clock input with pull-high resistor
3	/WR	WRITE clock input with pull-high resistor
4	DATA	Serial data input/output with pull-high resistor
5	VSS	Ground
6	VDD	Positive power supply
7	/IRQ	Time base or WDT over flow flag

6. Display RAM Mapping
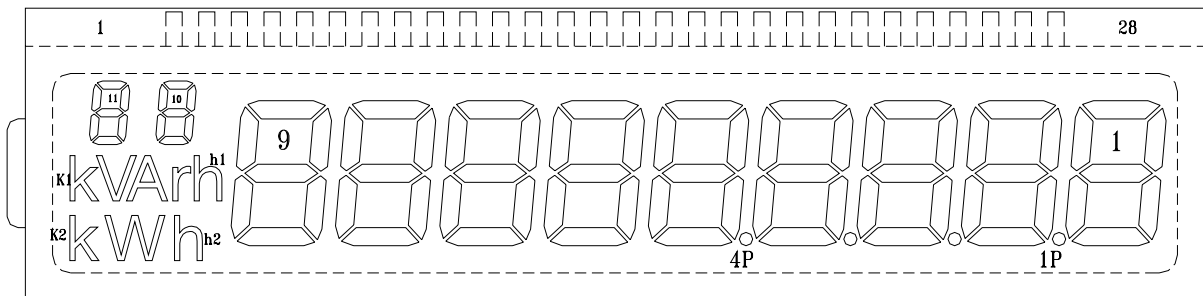
	Com3	Com2	Com1	Com0	
Seg0	K1	H1	A	W	0
Seg1	V	K2	R	H2	1
Seg2	11A	11F	11E	11D	2
Seg3	11B	11G	11C	-----	3
Seg4	10A	10F	10E	10D	4
Seg5	10B	10G	10C	-----	5
Seg6	9A	9F	9E	9D	6
Seg7	9B	9G	9C	-----	7
Seg8	8A	8F	8E	8D	8
Seg9	8B	8G	8C	-----	9
Seg10	7A	7F	7E	7D	10
Seg11	7B	7G	7C	-----	11
Seg12	6A	6F	6E	6D	12
Seg13	6B	6G	6C	-----	13
Seg14	5A	5F	5E	5D	14
Seg15	5B	5G	5C	-----	15
Seg16	4A	4F	4E	4D	16
Seg17	4B	4G	4C	4P	17
Seg18	3A	3F	3E	3D	18
Seg19	3B	3G	3C	3P	19
Seg20	2A	2F	2E	2D	20
Seg21	2B	2G	2C	2P	21
Seg22	1A	1F	1E	1D	22
Seg23	1B	1G	1C	1P	23

7. Functional Description

7.1 Display memory -- RAM

The static display memory (RAM) is organized into 32x4 bits and stores the displayed data. The contents of the RAM are directly mapped to the contents of the LCD driver. Data in the RAM can be accessed by the READ, WRITE, and READ-MODIFY-WRITE commands. The following is a mapping from the RAM to the LCD pattern:
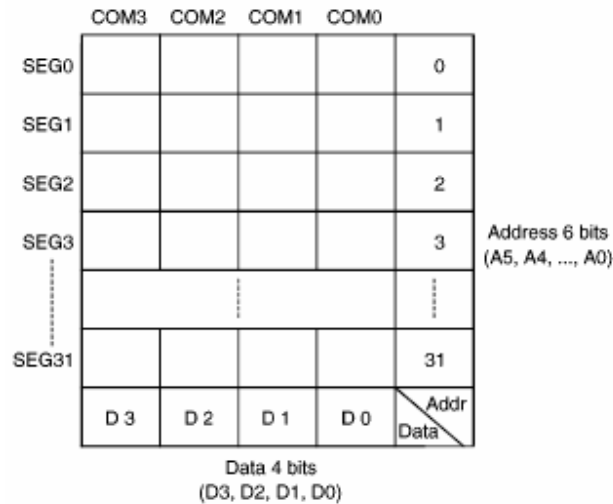
7.2 Command Format

The CS1621 can be configured by the S/W setting. There are two mode commands to configure the CS1621 resources and to transfer the LCD display data. The configuration mode of the CS1621 is called command mode, and its command mode ID is 100. The command mode consists of a system configuration command, system frequency selection command, a LCD configuration command, a tone frequency selection command, a timer/WDT setting command, and an operating command. The data mode, on the other hand, includes READ, WRITE, and READ-MODIFY-WRITE operations. The following are the data mode IDs and the command mode ID:

Operation	Mode	ID
READ	Data	1 1 0
WRITE	Data	1 0 1
READ-MODIFY-WRITE	Data	1 0 1
COMMAND	Command	1 0 0

The mode command should be issued before the data or command is transferred. If successive commands have been issued, the command mode ID, namely 100, can be omitted. While the system is operating in the non-successive command or the non-successive address data mode, the CS pin should be set to "1" and previous operation mode will be reset also. Once the CS pin returns to "0" a new operation mode ID should be issued first.

8. MAXIMUM ABSOUTE LIMIT

Supply Voltage .... −0.3V~5.5V   Storage Temperature.................... −50°C~125°C

Input Voltage....................V_{SS}−0.3V~V_{DD}+0.3V   Operating Temperature.................. −25°C~75°C

*Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

9. ELECTRICAL CHARACTERISTICS

D.C. Characteristics   Ta=25

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, $\overline{WR}$, $\overline{CS}$, $\overline{RD}$	40	80	150	kΩ
		5V		30	60	100	kΩ

Figure 3. DC Characteristics

2. A.C. Characteristics   Ta=25

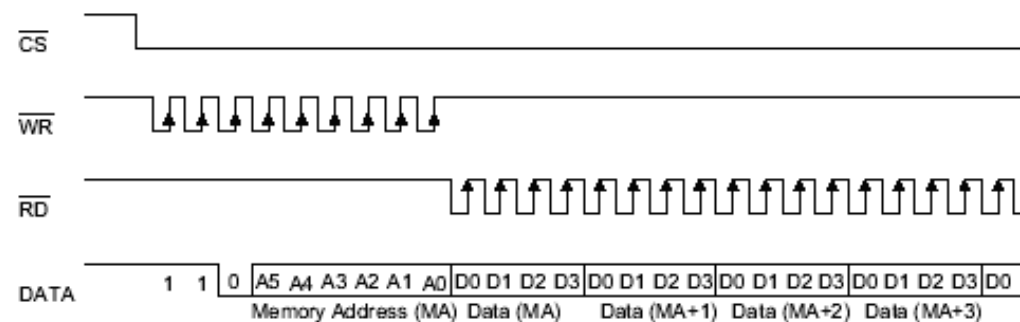| Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
f_{SYS1}	System Clock	3V	On-chip RC oscillator	—	256	—	kHz
		5V		—	256	—	kHz
f_{SYS2}	System Clock	3V	Crystal oscillator	—	32.768	—	kHz
		5V		—	32.768	—	kHz
f_{SYS3}	System Clock	3V	External clock source	—	256	—	kHz
		5V		—	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%	—	—	150	kHz
		5V		—	—	300	kHz
f_{CLK2}	Serial Data Clock ($\overline{RD}$ pin)	3V	Duty cycle 50%	—	—	75	kHz
		5V		—	—	150	kHz
f_{TONE}	Tone Frequency	—	On-chip RC oscillator	—	2.0 or 4.0	—	kHz
t_{CS}	Serial Interface Reset Pulse Width (Figure 3)	—	$\overline{CS}$	—	250	—	ns
t_{CLK}	$\overline{WR}$, $\overline{RD}$ Input Pulse Width (Figure 1)	3V	Write mode	3.34	—	—	μs
			Read mode	6.67	—	—	
		5V	Write mode	1.67	—	—	μs
			Read mode	3.34	—	—	
t_R, t_F	Rise/Fall Time Serial Data Clock Width (Figure 1)	3V	—	—	120	—	ns
		5V					
t_{su}	Setup Time for DATA to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 2)	3V	—	—	120	—	ns
		5V					
t_h	Hold Time for DATA to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 2)	3V	—	—	120	—	ns
		5V					
t_{su1}	Setup Time for $\overline{CS}$ to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 3)	3V	—	—	100	—	ns
		5V					
t_{h1}	Hold Time for $\overline{CS}$ to $\overline{WR}$, $\overline{RD}$ Clock Width (Figure 3)	3V	—	—	100	—	ns
		5V					
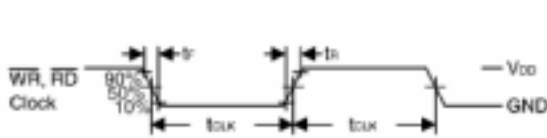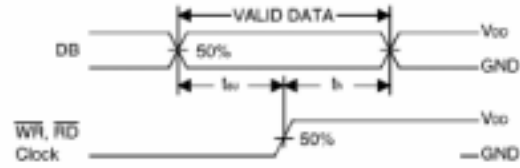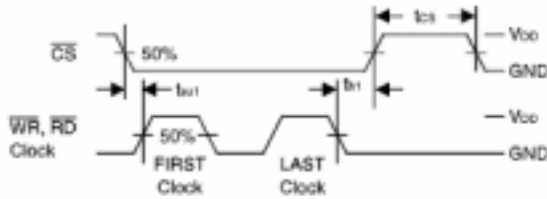
Figure 1

Figure 2

Figure 3

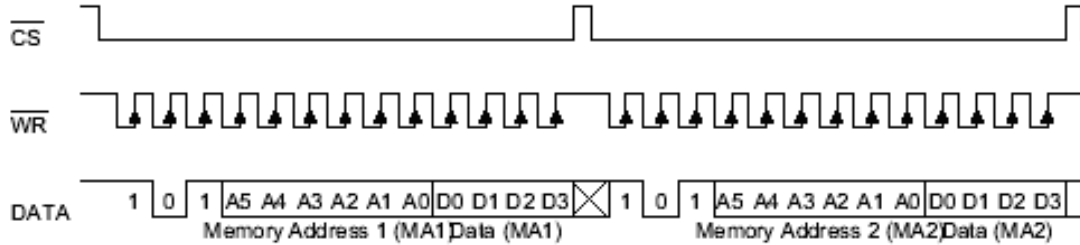# 10. TIMING CHARACTERISTICS

READ mode (command code : 1 1 0)
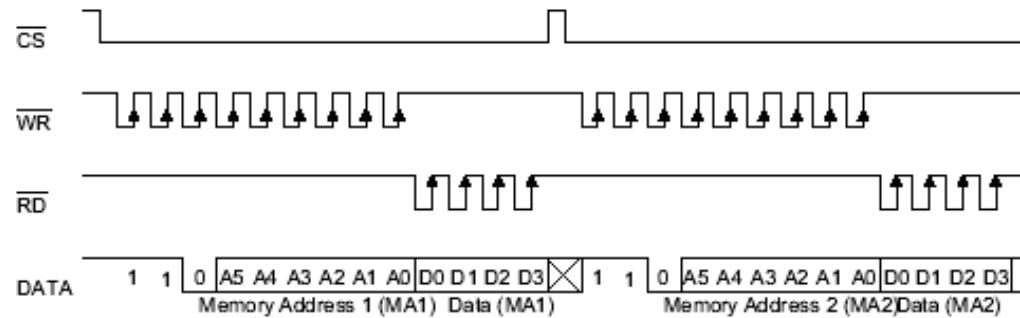
READ mode (successive address reading)

Command mode (command code : 1 0 0)
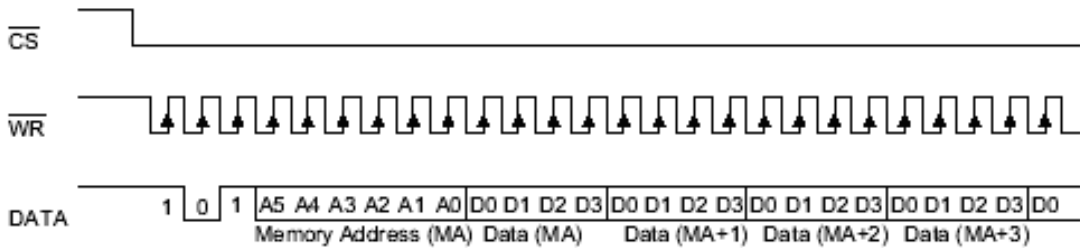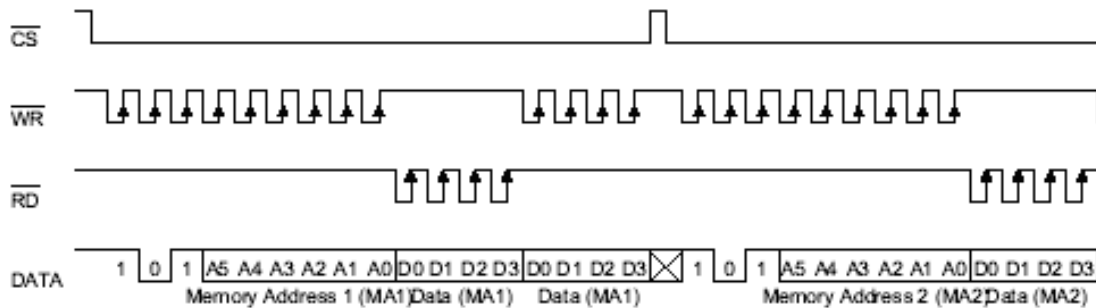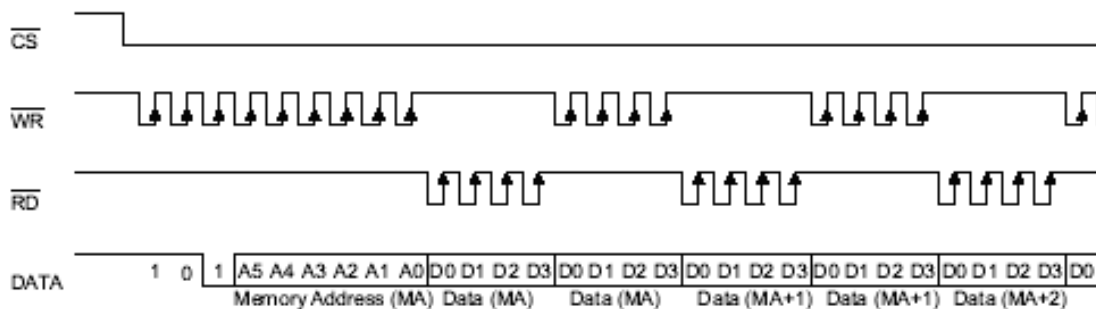
WRITE mode (command code : 1 0 1)

CS

WR

DATA | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 | ✕ | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 |

Memory Address 1 (MA1) Data (MA1)   Memory Address 2 (MA2) Data (MA2)

WRITE mode (successive address writing)

CS

WR

DATA | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 |

Memory Address (MA) Data (MA)   Data (MA+1)   Data (MA+2)   Data (MA+3)

Note: It is recommended that the host controller should read in the data from the DATA line
between the rising edge of the RD line and the falling edge of the next RD line.

READ-MODIFY-WRITE mode (command code : 1 0 1)

CS

WR

RD

DATA | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 | D0 D1 D2 D3 | ✕ | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 |

Memory Address 1 (MA1) Data (MA1)   Data (MA1)   Memory Address 2 (MA2) Data (MA2)

READ-MODIFY-WRITE mode (successive address accessing)

CS

WR

RD

DATA | 1 | 0 | 1 | A5 A4 A3 A2 A1 A0 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 D1 D2 D3 | D0 |

Memory Address (MA) Data (MA)   Data (MA)   Data (MA+1)   Data (MA+1)   Data (MA+2)

11. CONTROL AND DISPLAY INSTRUCTION

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
EXT 256K	1 0 0	0001-11XX-X	C	System clock source, external clock source	
BIAS 1/2	1 0 0	0010-abX0-X	C	LCD 1/2 bias option ab=00: 2 commons option ab=01: 3 commons option ab=10: 4 commons option	
BIAS 1/3	1 0 0	0010-abX1-X	C	LCD 1/3 bias option ab=00: 2 commons option ab=01: 3 commons option ab=10: 4 commons option	
TONE 4K	1 0 0	010X-XXXX-X	C	Tone frequency, 4kHz	
TONE 2K	1 0 0	011X-XXXX-X	C	Tone frequency, 2kHz	
$\overline{\text{IRQ}}$ DIS	1 0 0	100X-0XXX-X	C	Disable $\overline{\text{IRQ}}$ output	Yes

Name	ID	Command Code	D/C	Function	Def.
$\overline{\text{IRQ}}$ EN	1 0 0	100X-1XXX-X	C	Enable $\overline{\text{IRQ}}$ output	
F1	1 0 0	101X-X000-X	C	Time base/WDT clock output:1Hz The WDT time-out flag after: 4s	
F2	1 0 0	101X-X001-X	C	Time base/WDT clock output:2Hz The WDT time-out flag after: 2s	
F4	1 0 0	101X-X010-X	C	Time base/WDT clock output:4Hz The WDT time-out flag after: 1s	
F8	1 0 0	101X-X011-X	C	Time base/WDT clock output:8Hz The WDT time-out flag after: 1/2 s	
F16	1 0 0	101X-X100-X	C	Time base/WDT clock output:16Hz The WDT time-out flag after: 1/4 s	
F32	1 0 0	101X-X101-X	C	Time base/WDT clock output:32Hz The WDT time-out flag after: 1/8 s	
F64	1 0 0	101X-X110-X	C	Time base/WDT clock output:64Hz The WDT time-out flag after: 1/16 s	
F128	1 0 0	101X-X111-X	C	Time base/WDT clock output:128Hz The WDT time-out flag after: 1/32 s	Yes
TEST	1 0 0	1110-0000-X	C	Test mode, user don't use.	
NORMAL	1 0 0	1110-0011-X	C	Normal mode	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 256kHz RC oscillator, a 32.768kHz crystal oscillator, or an external 256kHz 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 the HT1621.

12. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = -20°C	4.3	4.5	4.7	V
		Ta = 25°C	3.8	4.0	4.2	
		Ta = 70°C	3.3	3.5	3.7	
Response time	Tr	Ta = 25°C	---	185	---	ms
	Tf		---	200	---	ms
Contrast	Cr	Ta = 25°C	---	4	---	---
Viewing angle range	θ	Cr ≥ 2	-20	---	+20	deg
			-20	---	+20	deg
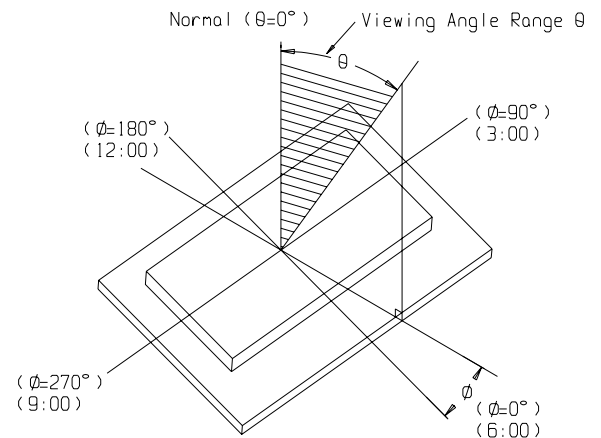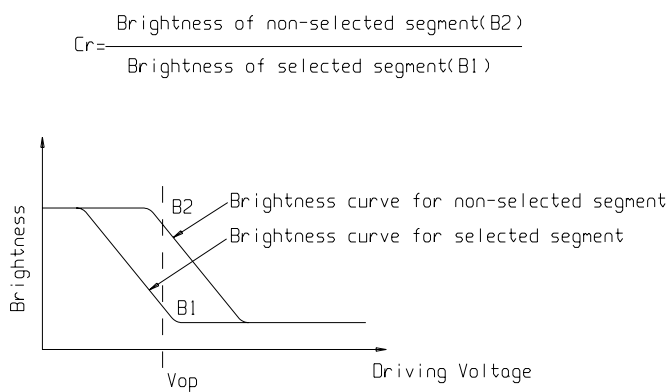
13.QUALITY SPECIFICATIONS

13.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.

Fluorescent
Lamps

30cm ₘᵢₙ

100cm ₘᵢₙ

45° 45°

LCM
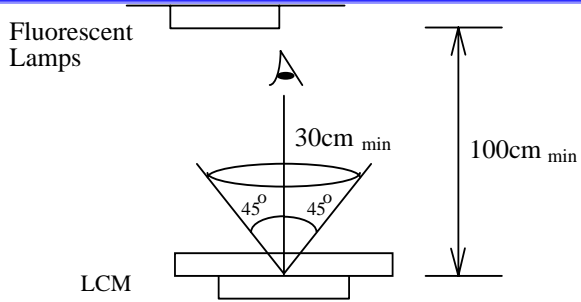
Definition of zone:
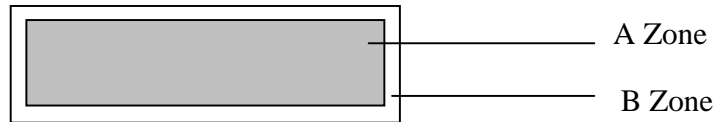
A Zone

B Zone

A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

13.2 Specification of quality assurance

AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling
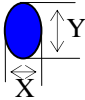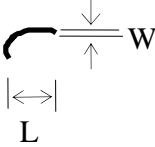
Defect classification (Note: * is not including)
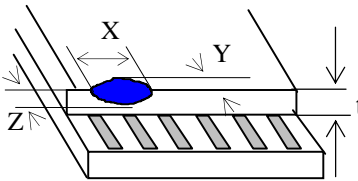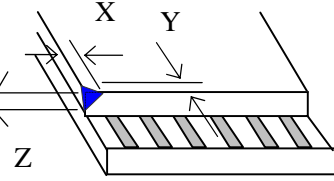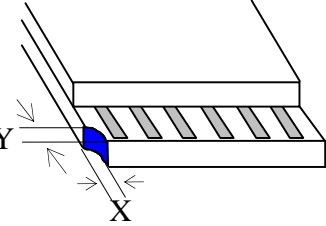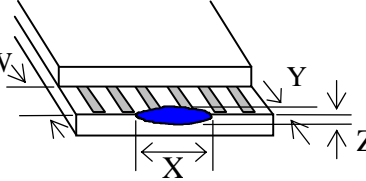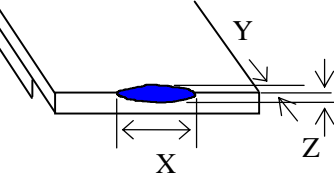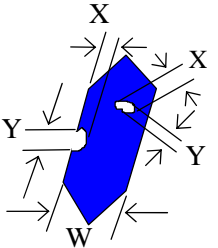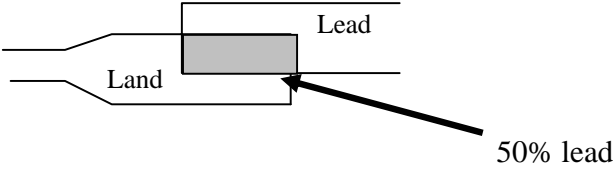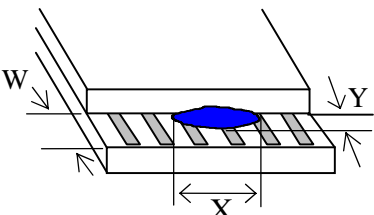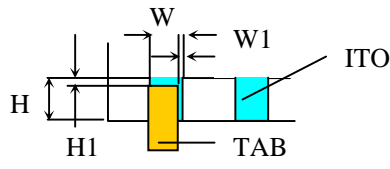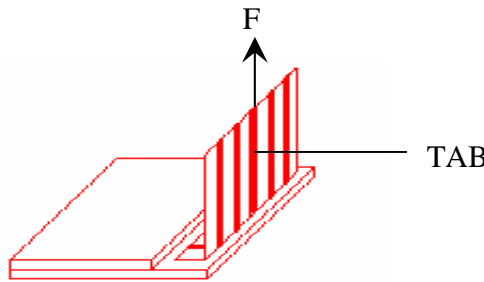
Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Flat cable or pin reverse	10	
	Non-display	Wrong or missing component	11	
		Black spot and dust	3	
Minor	Display state	Line defect, Scratch	4	1.0
		Rainbow	5	
		Chip	6	
		Pin hole	7	
		Protruded	12	
		Bubble and foreign material	3	
		Poor connection	9	
	Polarizer	Poor connection	10	
	Soldering	Position, Bonding strength	13	
	Wire			
	TAB			

Note on defect classification

No.	Item	Criterion
1	Short or open circuit LC leakage Flickering No display Wrong viewing direction Wrong Back-light	Not allow
2	Contrast defect Background color deviation	Refer to approval sample

No.	Item	Criterion		
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$		Point Size	Acceptable Qty.	
			$\phi \le 0.10$	Disregard
			$0.10 < \phi \quad 0.20$	3
			$0.20 < \phi \quad 0.25$	2
			$0.25 < \phi \quad 0.30$	1
			$\phi > 0.30$	0
		Unit mm		

No.	Item	Criterion		
4	Line defect, Scratch		Line		Acceptable Qty.
		L	W	
		---	0.015 W	Disregard
		3.0 L	0.03 W	2
		2.0 L	0.05 W	
		1.0 L	0.1 W	1
		---	0.05<W	Applied as point defect
		Unit: mm		

No.	Item	Criterion
5	Rainbow	Not more than two color changes across the viewing area.

No	Item	Criterion
6	Chip Remark: 　X: Length direction 　Y: Short direction 　Z: Thickness direction 　t: Glass thickness 　W: Terminal Width	 Acceptable criterion | X	Y	Z | |---|---|---| | 2 | 0.5mm | t/2 | Acceptable criterion | X | Y | Z | |---|---|---| | 2 | 0.5mm | t | Acceptable criterion | X | Y | Z | |---|---|---| | 3 | 2 | t | | shall not reach to ITO | | | Acceptable criterion | X | Y | Z | |---|---|---| | Disregard | 0.2 | t | Acceptable criterion | X | Y | Z | |---|---|---| | 5 | 2 | t/3 |

No.	Item	Criterion
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10$mm is acceptable. <table><tr><td>Point Size</td><td>Acceptable Qty</td></tr><tr><td>ϕ ≦ 1/4W</td><td>Disregard</td></tr><tr><td>1/4W< ϕ ≦ 1/2W</td><td>1</td></tr><tr><td>ϕ ≧ 1/2W</td><td>0</td></tr></table> Unit: mm
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. Lead Land 50% lead
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 0.4$
13	TAB	1. Position 2 TAB bonding strength test P (=F/TAB bonding width) 650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

13.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	No abnormalities
Low temp. Operating	-20°C	48	in functions
Humidity	40°C/ 90%RH	48	and appearance
Temp. Cycle	0°C ← 25°C →50°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

13.4 Precaution for using LCD/LCM
LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with is oproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting AV.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.

7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280°C \pm 10°C$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

AV LCDs and modules are not consumer products, but may be incorporated by AV's customers into consumer products or components thereof, AV does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of AV is limited to repair or replacement on the terms set forth below. AV will not be responsible for any subsequent or consequential events or injury or damage to any personnel

or user including third party personnel and/or user. Unless otherwise agreed in writing between AV and the customer, AV will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with AV general LCD inspection standard . (Copies available on request)

2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.