SPECIFICATION FOR LCD MODULE

Model No. TM12864DCCW7-1

Prepared by:	**Date:**
Checked by :	**Date:**
Verified by :	**Date:**
Approved by:	**Date:**

TIANMA MICROELECTRONICS CO., LTD

Ver1.0

REVISION RECORD

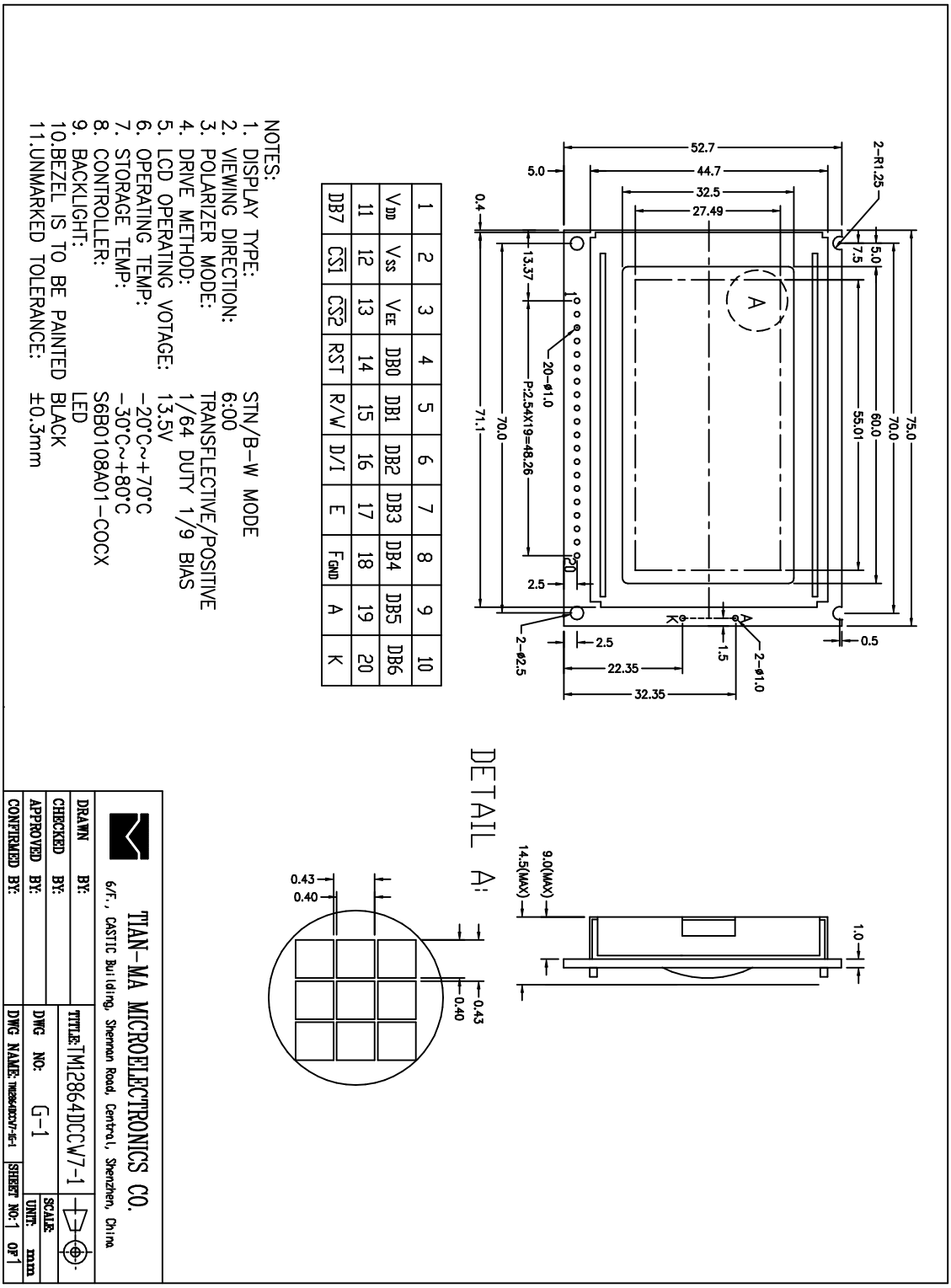
Date	Ver.	Ref. Page	Revision No.	Revision Items
2003-3-4	Ver 1.0			

1. General Specifications:

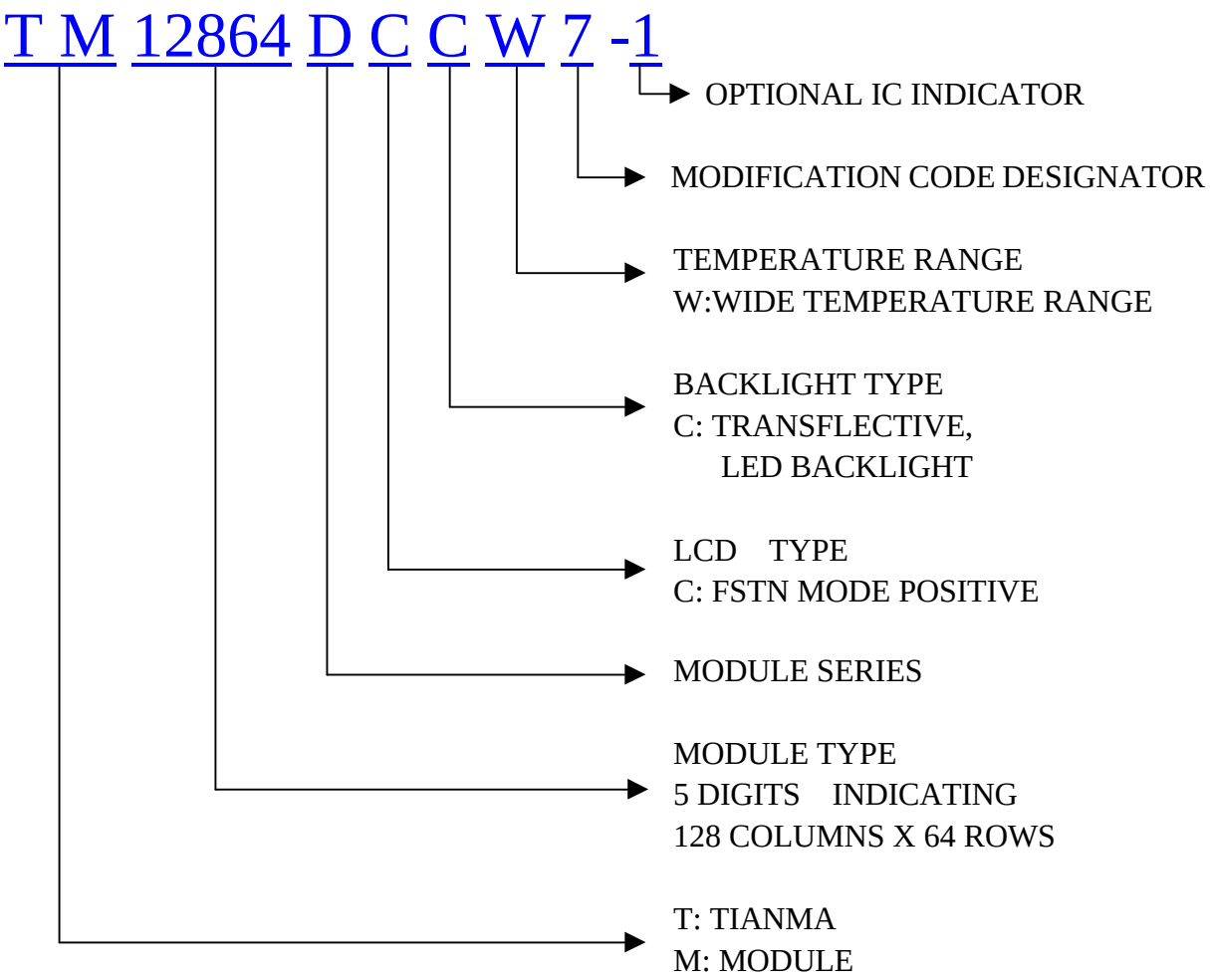
1.1 Display type:	FSTN
1.2 Display color*:	
Display color:	Blue-Black
Background:	White
1.3 Polarizer mode:	Transflective/Positive
1.4 Viewing Angle:	6:00
1.5 Driving Method:	1/64 Duty 1/9 Bias
1.6 Backlight:	LED
1.7 VDD:	5.0V
1.8 LCD OPERATING VOLTAGE:	13.5V
1.7 Controller:	S6B0108A01-C0CX(KS0108BPCC)
1.8 Data Transfer:	8 Bit Parallel
1.9 Operating Temperature:	-20----+70℃
Storage Temperature:	-30----+80℃
1.10 Outline Dimensions:	Refer to outline drawing on next page
1.11 Dot Matrix:	128 X 64 Dots
1.12 Dot Size:	0.40X0.40(mm)
1.13 Dot Pitch:	0.43X0.43 (mm)
1.14 Weight:	Approx. 85g

* Color tone is slightly changed by temperature and driving voltage.

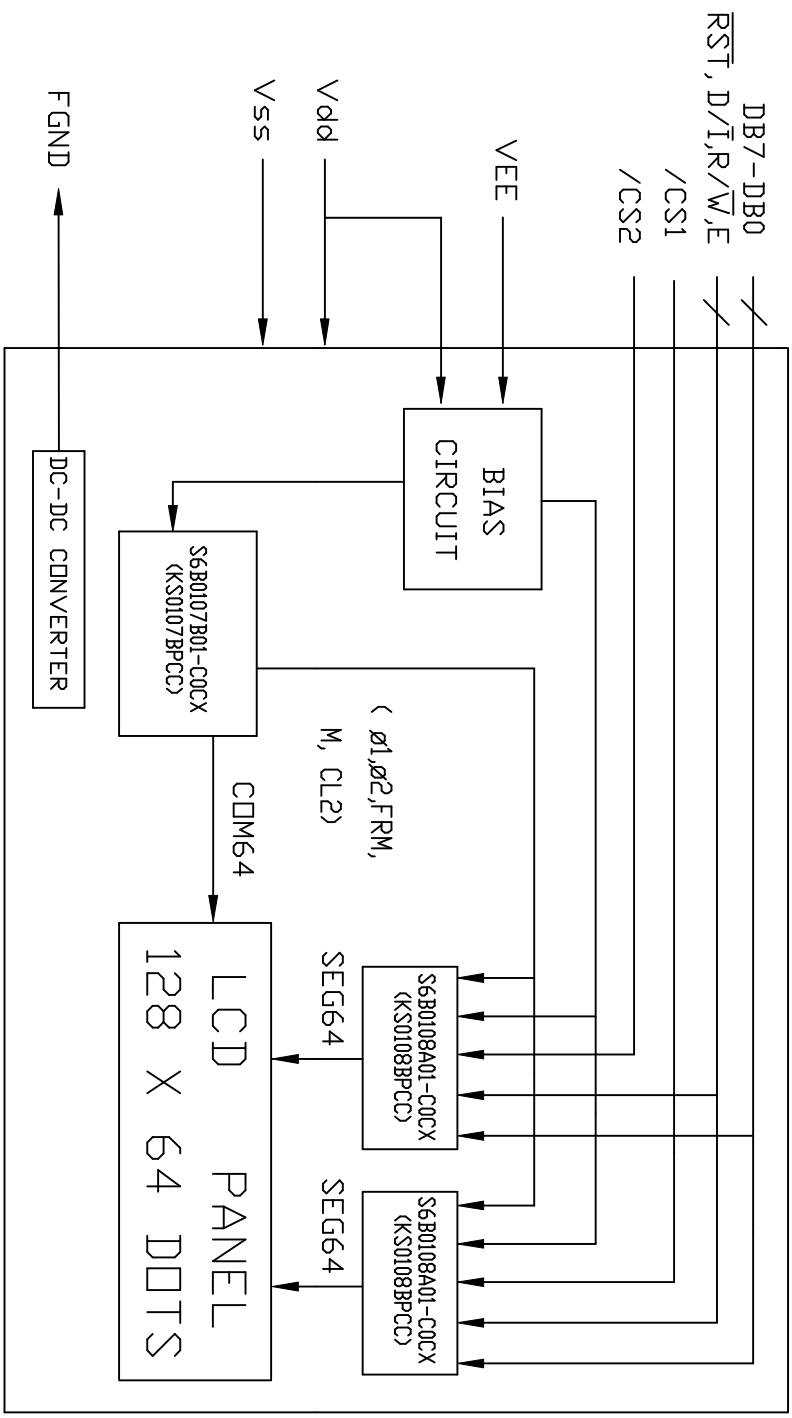
2. Outline Drawing



3. LCD Module Part Numbering System



4. Circuit Block Diagram



5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	6.0	V	
LCD Driving Voltage	V_{LCD}	-	25.0		
Operating Temperature Range	T_{OP}	-20	+70	℃	No Condensation
Storage Temperature Range	T_{ST}	-30	+80		

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics

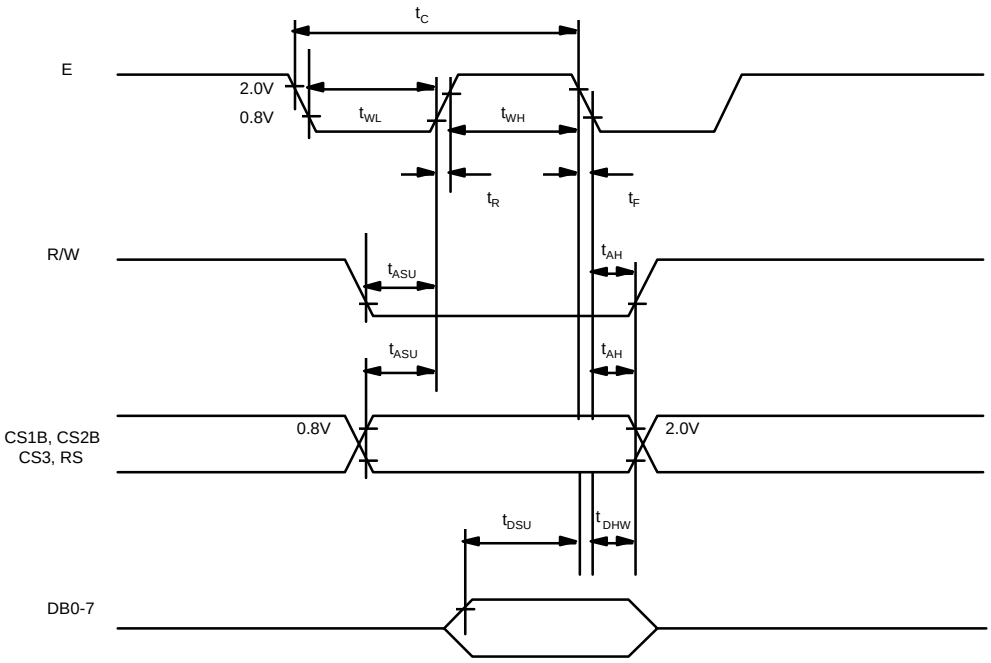
Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	4.75	5.0	5.25	V
Supply Voltage (LCD Drive)		V_{LCD}	-	13.5	-	V
Input Signal Voltage	High	V_{IH} (V_{DD}=5.0)	$0.8V_{DD}$	-	V_{DD}+0.3	V
	Low	V_{IL} (V_{DD}=5.0)	0	-	$0.2V_{DD}$	V
Supply current (Logic)		I_{DD}	-	5.5	-	mA
Supply current (LCD Drive)		I_{EE}	-	1.9	-	mA
Supply current (LED Drive)		I_{LED}	-	-	200	mA

6.2 Interface Signals

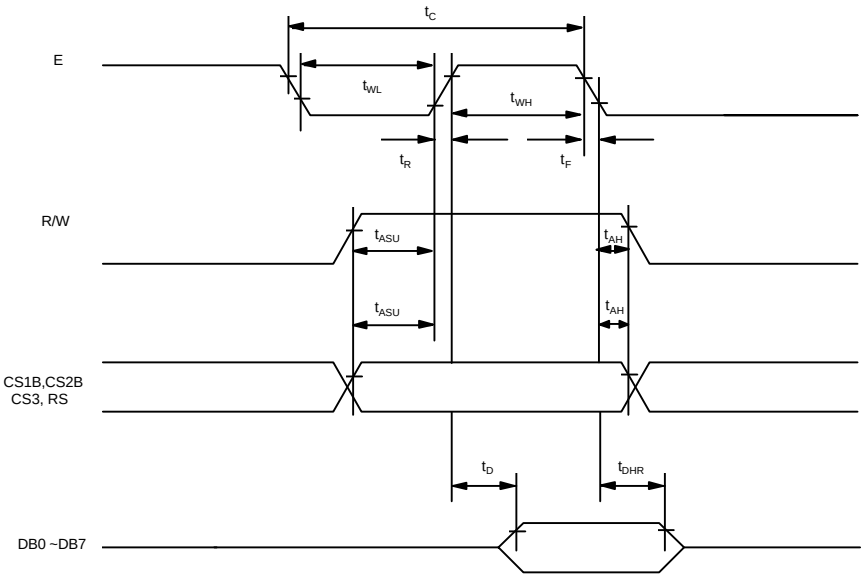
Pin No.	Symbol	Level	Description
1	VDD	5.0V	Power supply voltage for logic and LCD(+)
2	Vss	0V	GND
3	VEE	-8.5V	Power supply voltage for LCD(-)
4	DB0	H/L	Data bit0
5	DB1	H/L	Data bit1
6	DB2	H/L	Data bit2
7	DB3	H/L	Data bit3
8	DB4	H/L	Data bit4
9	DB5	H/L	Data bit5
10	DB6	H/L	Data bit6
11	DB7	H/L	Data bit7
12	/CS1	H/L	When /CS1=1,/CS2=0 select the left half display
13	/CS2	H/L	When /CS1=0,/CS2=1 select the right half display
14	RST	H/L	Reset signal(active at low)
15	R/W	H/L	Select read or write
16	D/I	H/L	Select register
17	E	H/L	Starts data read or write
18	FGND	-10V	Built-in DC-DC output voltage(for V0)
19	A	4.2V	Power supply voltage for LED(+)
20	K	0	Power supply voltage for LED(-)

6.3 Interface Timing Chart

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_C	1000	-	-	ns
E High Level Width	t_{WH}	450	-	-	ns
E Low Level Width	t_{WL}	450	-	-	ns
E Rise Time	t_R	-	-	25	ns
E Fall Time	t_F	-	-	25	ns
Address Set-Up Time	t_{ASU}	140	-	-	ns
Address Hold Time	t_{AH}	10	-	-	ns
Data Set-Up Time	t_{DSU}	200	-	-	ns
Data Delay Time	t_D	-	-	320	ns
Data Hold Time (Write)	t_{DHW}	10	-	-	ns
Data Hold Time (Read)	t_{DHR}	20	-	-	ns



MPU write timing



MPU Read timing

6.4 Instruction Code

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON
Set Address (Y address)	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address at the X address register.
Display Start Line (Z address)	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write Display Data	H	L	Write Data								Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data								Reads data (DB0:7) from display data RAM to the data bus.

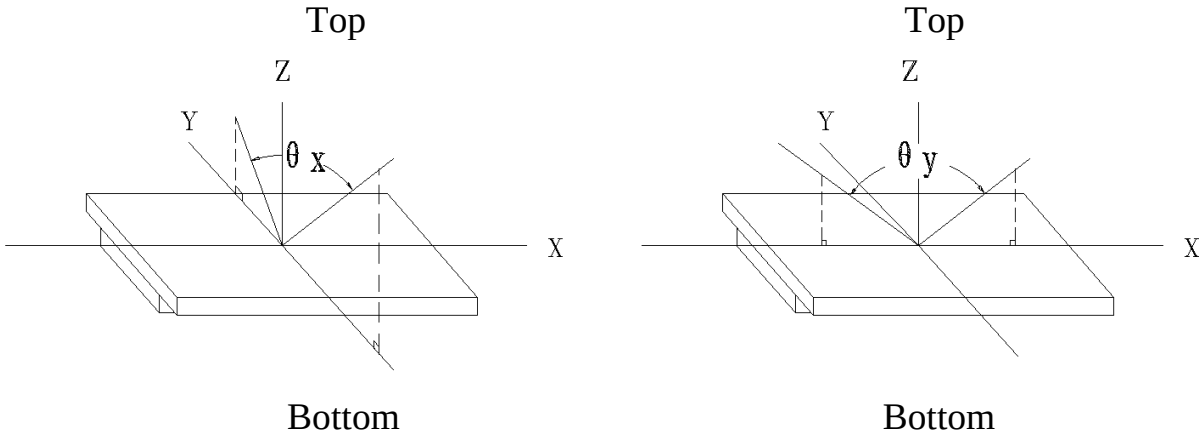
7. Optical Characteristics

7.1 Optical Characteristics Ta=25℃

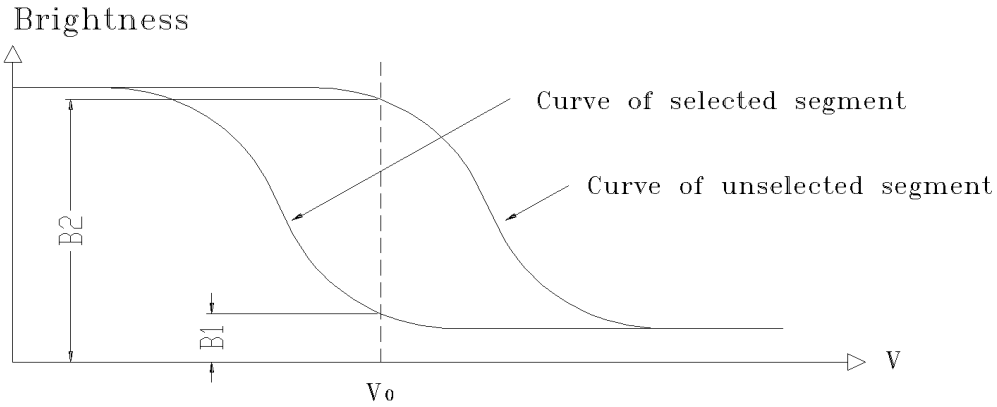
Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		θ_x	C_r=2	θ_y=0 °	-30	--	20	Deg
		θ_y		θ_x=0 °	-30	--	30	
Contrast Ratio		C_r	θ_x=0 ° θ_y=0 °		3.0	-	-	
Response Time	Turn on	T_{on}	θ_x=0 ° θ_y=0 °		-	-	300	ms
	Turn off	T_{off}			-	-	300	

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



7.2.2 Definition of Contrast Ratio

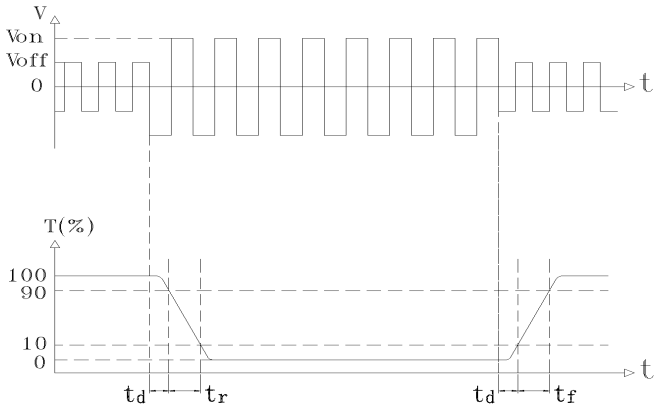


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25℃ ; 2) Frame frequency: 70Hz

7.2.3 Definition of Response time



Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_f$

Measuring Condition:

1) Operating Voltage: 13.5V 2) Frame frequency: 70Hz

8. Reliability

8.1 Content of Reliability Test Ta=25℃

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	80℃ 240H RESTORE:4H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30℃ 240H RESTORE:4H
3	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60℃ 95%RH 240H RESTORE:4H
4	Temperature Cycle	Endurance test applying the low and high temperature cycle -30℃←→25℃←→80℃←→25℃ 30min 5min 30min 5min ←——————————→ 1 cycle	-30℃/80℃ 10 cycles RESTORE:4H
5	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~500Hz, 100m/s^2, 120min
6	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s^2, 18ms
7	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H RESTORE:2H

8.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	v	v	v	v	v	v	v	v	v	Out of the basic Specification
Electrical specification	v	v	v	v	v					Out of the electrical specification
Mechanical Specification							v	v		Out of the mechanical specification
Optical Characteristic	v	v	v	v	v	v			v	Out of the optical specification
Note	For test item refer to 8.1									
Remark	Basic specification = Optical specification + Mechanical specification									

9. QUALITY LEVEL

Examination or Test	At T_a=25℃ (unless otherwise stated)	Inspection				
		Min.	Max.	Unit	IL	AQL
External Visual Inspection	Under normal illumi-nation and eyesight condition, the dis-tance between eyes and LCD is 25cm.	See Appendix A			II	Major 1.0 Minor 2.5
Display Defects	Under normal illumi-nation and eyesight condition, display on inspection.	See Appendix B			II	Major 1.0 Minor 2.5
Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828						

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃

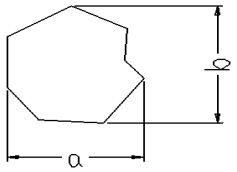
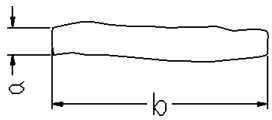
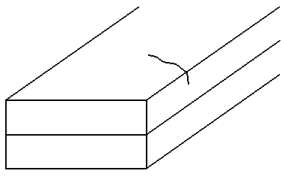
Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

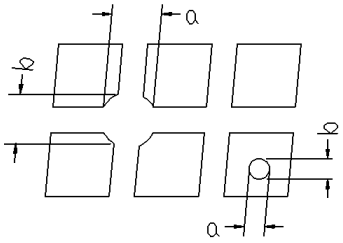
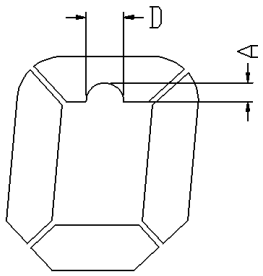
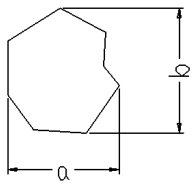
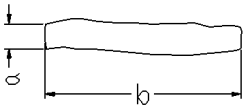
Appendix A

Inspection items and criteria for appearance defects

<table>
<tr><td>Items</td><td>Contents</td><td colspan="4">Criteria</td></tr>
<tr><td>Leakage</td><td></td><td colspan="4">Not permitted</td></tr>
<tr><td>Rainbow</td><td></td><td colspan="4">According to the limit specimen</td></tr>
<tr><td rowspan="4">Polarizer</td><td>Wrong polarizer attachment</td><td colspan="4">Not permitted</td></tr>
<tr><td rowspan="2">Bubble between polarizer and glass</td><td colspan="2">Not counted</td><td colspan="2">Max. 3 defects allowed</td></tr>
<tr><td colspan="2">ϕ<0.3mm</td><td colspan="2">0.3mm≤ϕ≤0.5mm</td></tr>
<tr><td>Scratches of polarizer</td><td colspan="4">According to the limit specimen</td></tr>
<tr><td rowspan="3">Black spot (in viewing area)</td><td rowspan="3">  </td><td>Not counted</td><td>Max. 3 spots allowed</td><td rowspan="4">Max. 3 spots (lines) allowed</td></tr>
<tr><td>X<0.2mm</td><td>0.2mm≤X≤0.5mm</td></tr>
<tr><td colspan="2">X=(a+b)/2</td></tr>
<tr><td rowspan="2">Black line (in viewing area)</td><td rowspan="2">  </td><td>Not counted</td><td>Max. 3 lines allowed</td></tr>
<tr><td>a<0.02mm</td><td>0.02mm≤a≤0.05mm
b≤2.0mm</td></tr>
<tr><td>Progressive cracks</td><td>  </td><td colspan="4">Not permitted</td></tr>
</table>

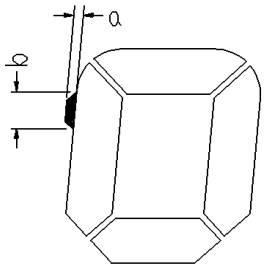
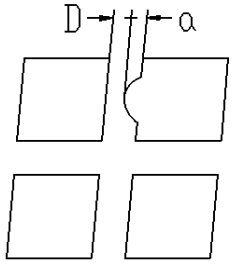
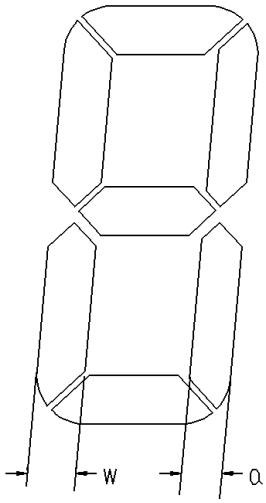
Appendix B

Inspection items and criteria for display defects

<table>
<tr><td colspan="2">Items</td><td>Contents</td><td colspan="3">Criteria</td></tr>
<tr><td colspan="3">Open segment or open common</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Short</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Wrong viewing angle</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Contrast radio uneven</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td colspan="3">Crosstalk</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td rowspan="4">Pin holes and cracks in segment (DOT)</td><td rowspan="2">  </td><td>Not counted</td><td>Max.3 dots allowed</td><td rowspan="4">Max.3 dots allowed</td></tr>
<tr><td>X<0.1mm</td><td>0.1mm≤X≤0.2mm</td></tr>
<tr><td colspan="2">X=(a+b)/2</td></tr>
<tr><td rowspan="2">  </td><td>Not counted</td><td>Max.2 dots allowed</td></tr>
<tr><td>A<0.1mm</td><td>0.1mm≤A≤0.2mm
D<0.25mm</td></tr>
<tr><td rowspan="3">Black spot (in viewing area)</td><td rowspan="3">  </td><td>Not counted</td><td>Max.3 spots allowed</td><td rowspan="4">Max.3 spots (lines) allowed</td></tr>
<tr><td>X<0.1mm</td><td>0.1mm≤X≤0.2mm</td></tr>
<tr><td colspan="2">X=(a+b)/2</td></tr>
<tr><td rowspan="2">Black line (in viewing area)</td><td rowspan="2">  </td><td>Not counted</td><td>Max.3 lines allowed</td></tr>
<tr><td>a<0.02mm</td><td>0.02mm≤a≤0.05mm
b≤0.5mm</td></tr>
</table>

Appendix B

Inspection items and criteria for display defects (continued)

<table>
<tr><th>Items</th><th>Content</th><th colspan="3">Criteria</th></tr>
<tr><td rowspan="3">Transfor-
mation
of segment</td><td rowspan="2">  </td><td>Not counted</td><td>Max. 2 defects allowed</td><td rowspan="3">Max.3
defects
allowed</td></tr>
<tr><td>x＜0.1mm</td><td>0.1mm≦x≦0.2mm</td></tr>
<tr><td colspan="2">x=(a+b)/2</td></tr>
<tr><td>  </td><td>Not counted</td><td>Max. 1 defects allowed</td><td rowspan="2">a＜0.1mm</td><td rowspan="2">0.1mm≦a≦0.2mm
D>0</td></tr>
<tr><td>  </td><td colspan="3">Max.2 defects allowed
0.8W≦a≦1.2W

a=measured value of width
W=nominal value of width</td></tr>
</table>