SPECIFICATION FOR LCD MODULE

Model No. _TM0276ANFWG_

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

TIANMA MICROELECTRONICS CO., LTD

Ver. 1.0

REVISION RECORD

Date	Ver.	Ref. Page	Revision No.	Revision Items

1. General Specifications:

1.1 Display type: TFT

1.2 Display color:

Display color*[1]: 262K(max) COLOR

Background*[2]: Black (Red, Green, Blue dots are off state)

1.3 Polarizer mode: Transmissive/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Method: 1/224 Duty 1/7 Bias

1.6 Backlight Type: LED (4 CHIPS)

Backlight Color: WHITE

1.7 Controller: HD667B89

1.8 Data Transfer: 8 Bit Parallel

1.9 Operating Temperature: -20----+70℃

Storage Temperature: -30----+80℃

1.10 Power Supply Voltage: VDD=3.0V

1.11 LCD Operating Voltage: VLCD=20.0V

1.12 Outline Dimensions: Refer to outline drawing on next page

1.13 Dot Matrix: 176 X 3 (RGB) X 220 Dots

1.14 Pixel Pitch: 0.066mmX0.198mm

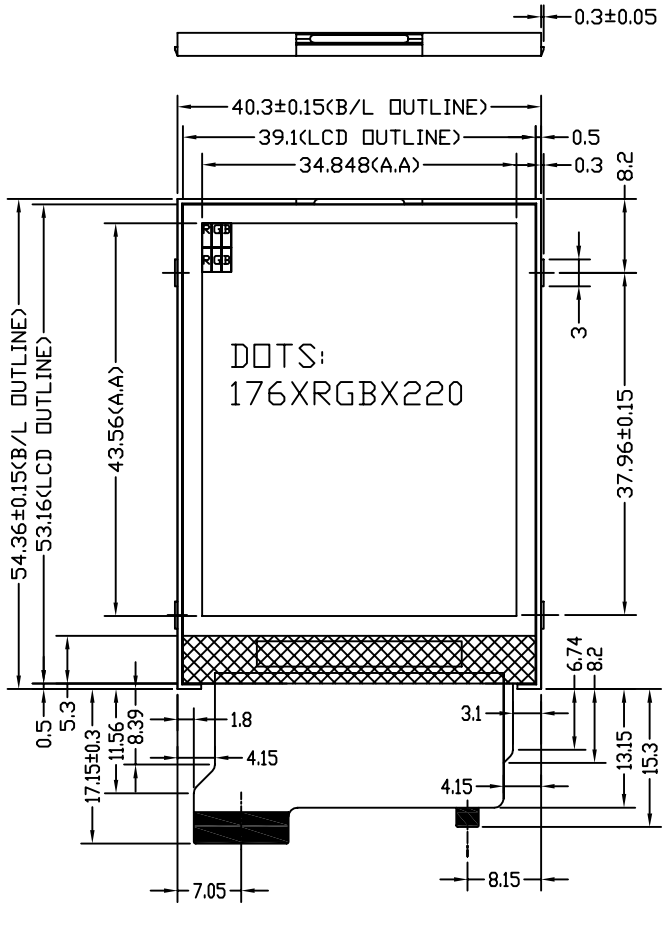
1.15 Weight: TBD*[3]

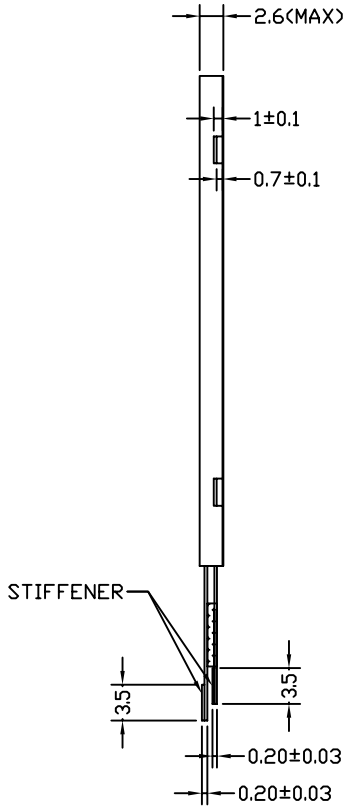
*[1] Color tone is slightly changed by temperature and driving voltage.

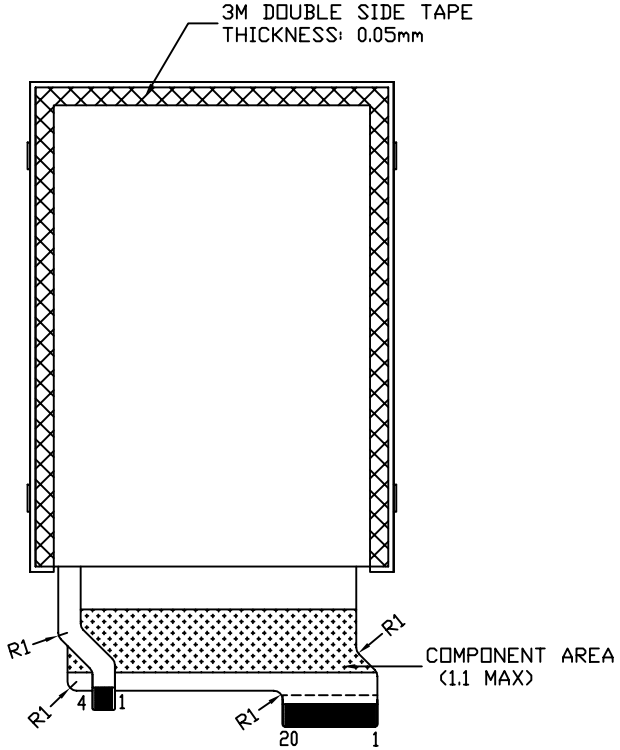
*[2] Color tone will be changed by backlight.

*[3] TBD: To Be Determined.

2. Outline Drawing





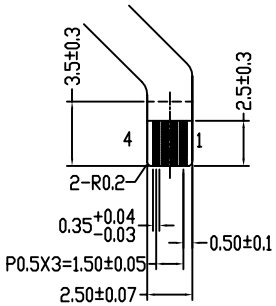


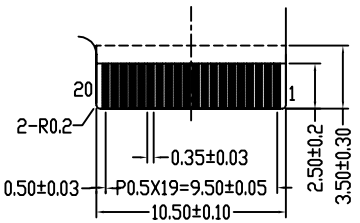
CN1

1	NC
2	GND
3	GND
4	GND
5	CS
6	RS
7	WR
8	RD
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7

CN2

1	CATHODE	17	RESET
2	CATHODE	18	VCC
3	ANODE	19	VCC
4	ANODE	20	NC





NOTES:

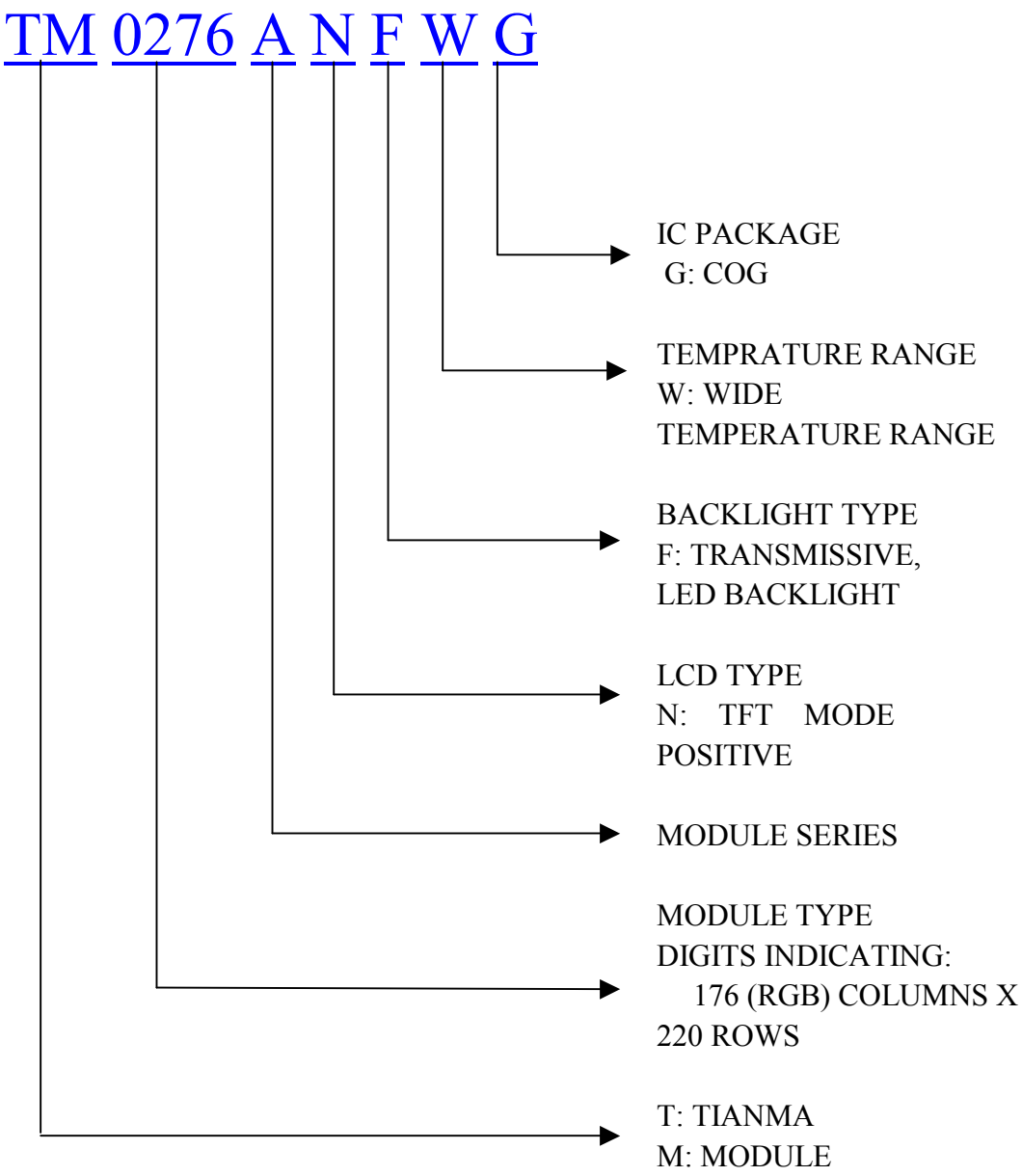
1.DISPLAY TYPE:	TFT(262144-COLOR)
2.VIEING DIRECTION:	6:00
3 LCD DRIVE IC:	HD667B89
4.POLARIZER MODE:	TRANSMISSIVE/POSITIVE
5.DRIVE METHOD:	1/224 DUTY 1/7 BIAS
6.VBAT:	2.6~3.2V
7.BACKLIGHT:	4CHIP-WHITE LED
8.OPERATING TEMP:	-20°C -- 70°C
9.STORAGE TEMP:	-30°C -- 80°C
10.UNMARKED TOLERANCE:	±0.30

TIAN-MA MICROELECTRONICS CO.

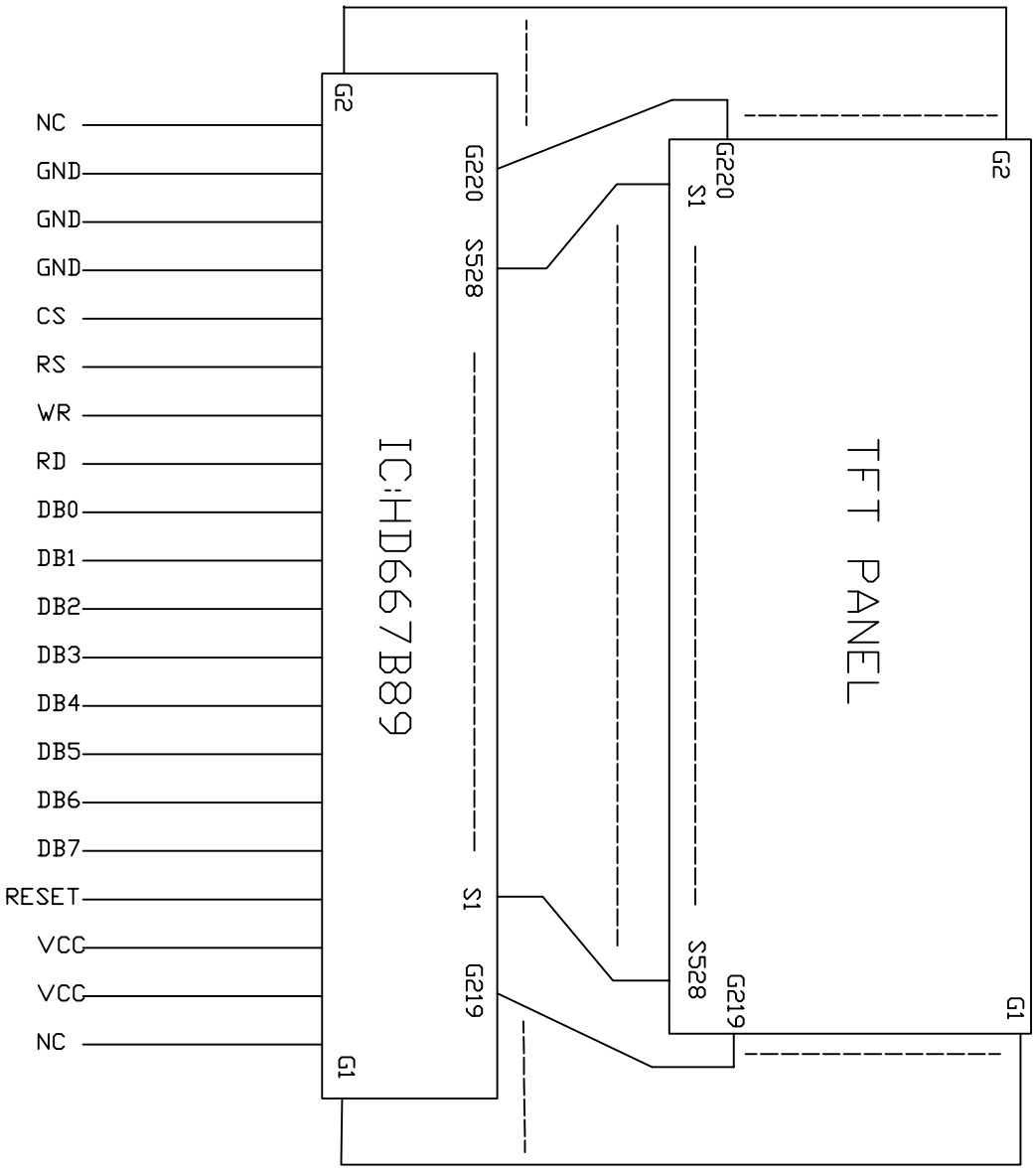
22/F., CASTIC Building, Shennan Road, Central, Shenzhen, China

DRAWN BY:	TITLE: TM0276ANFWG		
CHECKED BY:			
APPROVED BY:	DWG NO: G-1	SCALE:	
CONFIRMED BY:		UNIT: mm	
	DWG NAME: TM0276AMFWGG-1	SHEET NO: 1 OF 1	

3. LCD Module Part Numbering System



4. Circuit Block Diagram



TIAN-MA MICROELECTRONICS CO.

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DRAWN BY:	TITLE: TM0276ATG	
CHECKED BY:	DWG NO: C-1	SCALE:
APPROVED BY:	DWG NAME: TM0276ATGC-1	UNIT: mm
		SHEET NO: 1 OF 1

5. Absolute Maximum Ratings

Ta=25℃

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	+4.6	V	
LCD Driving Voltage	V_{LCD}	-	+20.0		
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 Vss=0V, Ta=25℃

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		V_{DD}-Vss	+2.6	+3.0	+3.2	V
Supply Voltage (LCD Drive)		V_{LCD}	-	-	20.0	V
Input Signal Voltage	High	V_{IH} (V_{DD}=3.0)	0.8V_{DD}	-	V_{DD}	V
	Low	V_{IL} (V_{DD}=3.0)	0	-	0.2 V_{DD}	V
Supply current (Logic)		I_{DD} (V_{DD}- V_{SS}=3.0V)	-	-	300	uA
Oscillator frequency range		f_{osc}	244	305	366	kHz
Supply Voltage (LED)		V_{LED}	-	14.0	-	V
Supply current (LED)		I_{LED}	-	15.0	-	mA
LCD CURRENT		I_{LCD}	-	-	5	mA

6.2 Interface Signals

6.2.1 CN1

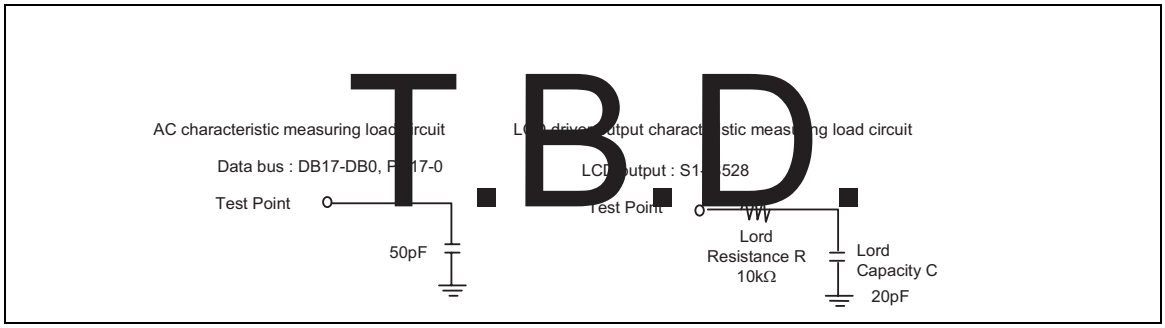
Pin No.	Symbol	Level	Description
1	NC	-	
2	GND	0V	GROUND
3	GND	0V	GROUND
4	GND	0V	GROUND
5	CS	H/L	CHIP SELECT
6	RS	H/L	REGISTER SELECTS
7	WR	H/L	WRITE SINGAL
8	RD	H/L	READ SINGAL
9	DB0	H/L	Data bus bit 0
10	DB1	H/L	Data bus bit 1
11	DB2	H/L	Data bus bit 2
12	DB3	H/L	Data bus bit 3
13	DB4	H/L	Data bus bit 4
14	DB5	H/L	Data bus bit 5
15	DB6	H/L	Data bus bit 6
16	DB7	H/L	Data bus bit 7
17	RESET	H/L	RESET
18	VCC	3V	SUPPLY POWER
19	VCC	3V	SUPPLY POWER
20	NC	-	

6.2.2 CN2

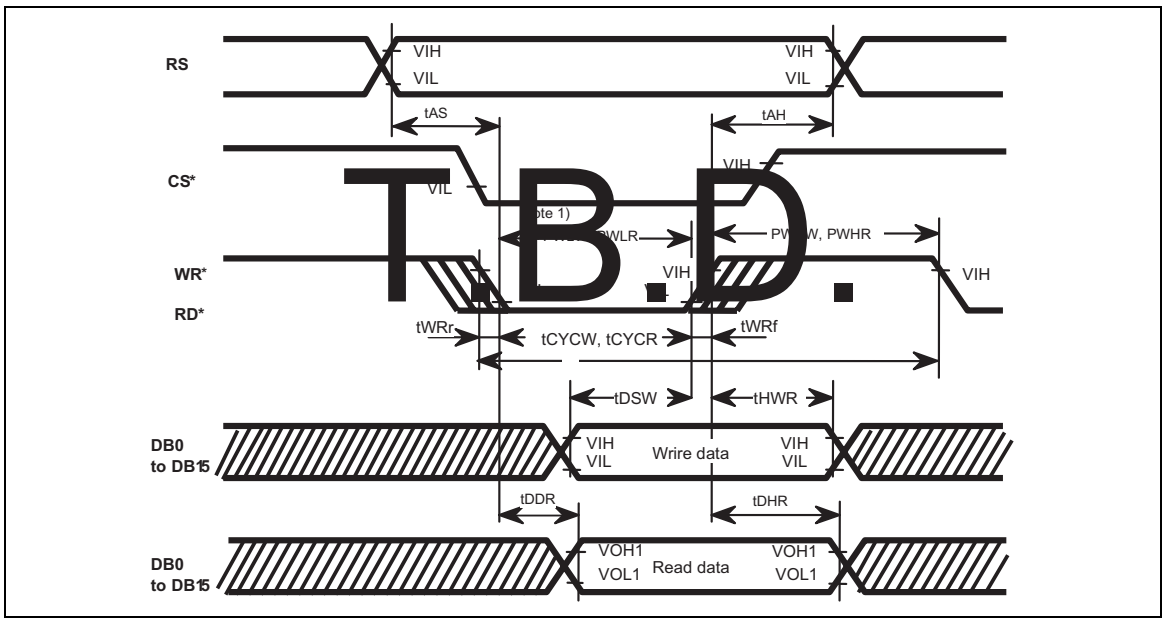
Pin No.	Symbol	Level	Description
1	CATHODE		LED CATHODE
2	CATHODE		LED CATHODE
3	ANODE		LED ANODE
4	ANODE		LED ANODE

6.3 Interface Timing Chart

Load circuits for measuring AC characteristics



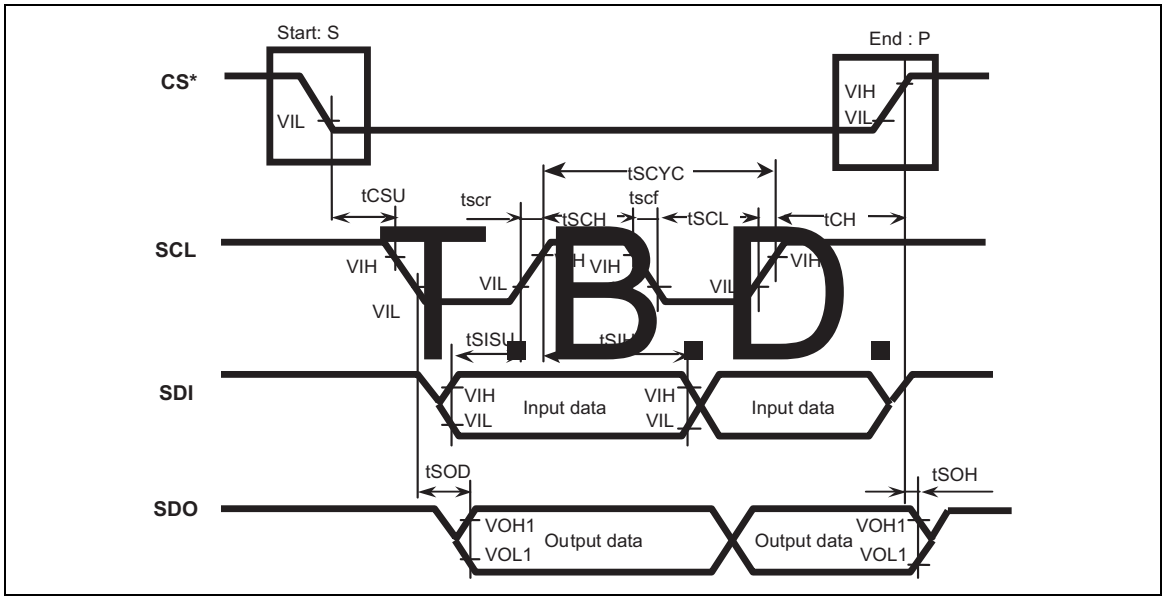
80-system Bus Operation



Note 1) PWLW and PWLR is specified in the overlapped period when CS* is low and WR* or RD* is low.

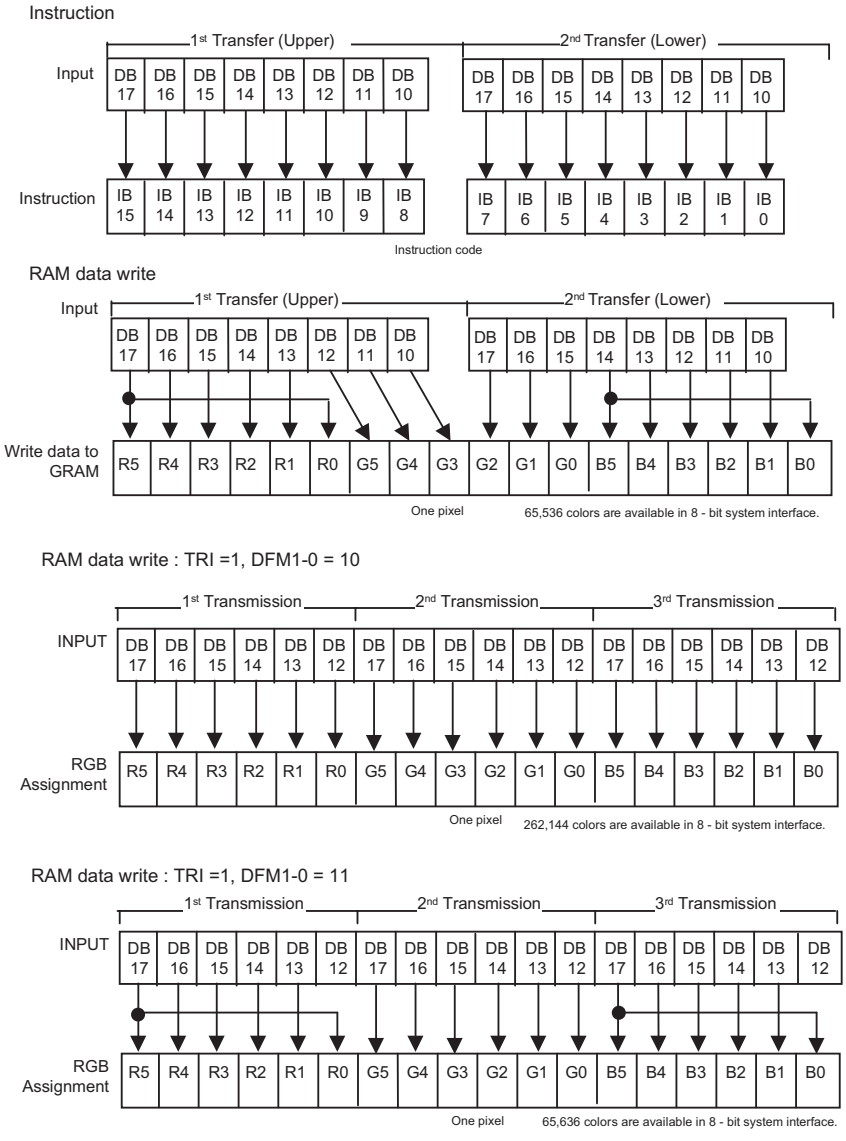
Note 2) Parallel data transfer is enabled on the DB15-8 pins when the 8-bit bus interface is used. Fix the DB7-0 pins to Vcc or GND.

Clock Synchronized Serial Interface Operation



RESET Operation

6.4 Instruction code



Data format for 8-bit interface

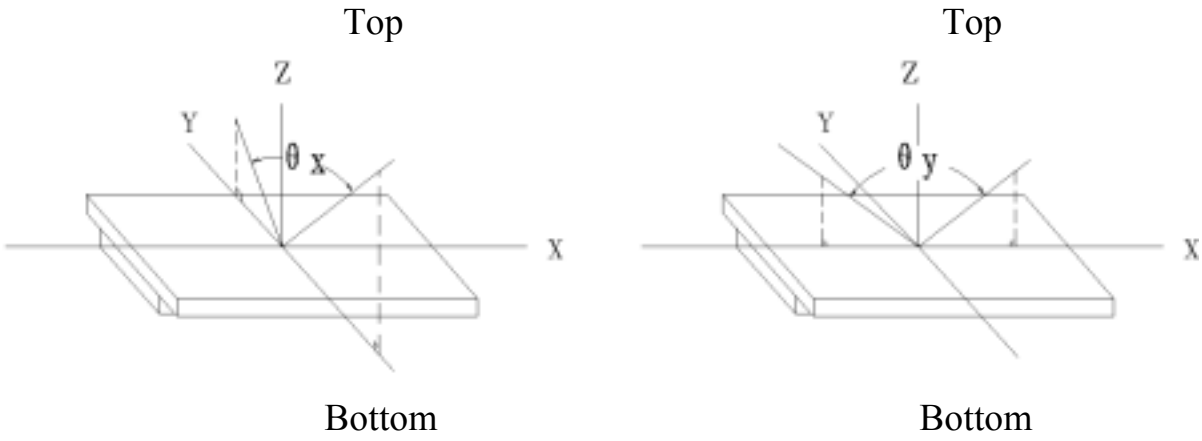
7. Optical Characteristics

7.1 Optical Characteristics V_{LCD}=20.0V Ta=25℃

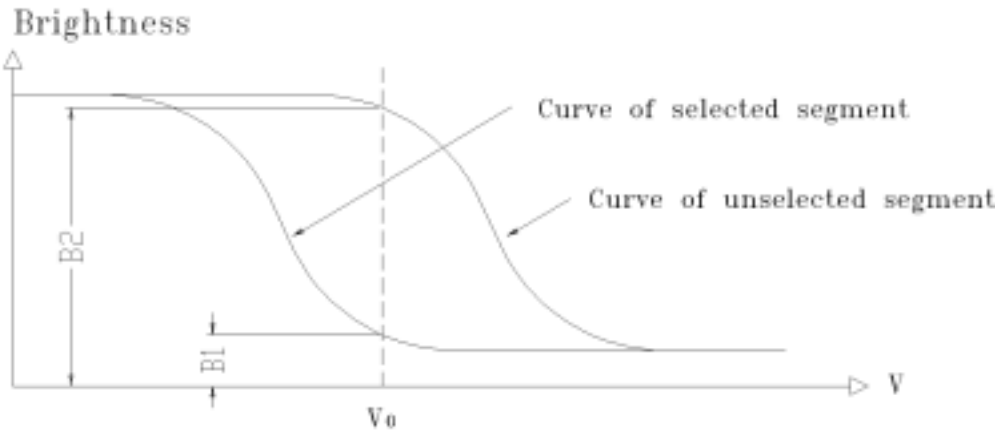
Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		θ_x	$C_r \geq 10$	θ_y=0 °	-35 -- +15			Deg
		θ_y		θ_x=0 °	-45 -- +45			
Contrast Ratio		C_r	θ_x=0 ° θ_y=0 °			150	-	
Response Time					--	25		ms
Color Of CIE Coord-Inate	Red	x	θ_x=0 ° θ_y=0 °		-	0.593	-	
		y			-	0.333	-	
	Green	x	θ_x=0 ° θ_y=0 °		-	0.314	-	
		y			-	0.545	-	
	Blue	x	θ_x=0 ° θ_y=0 °		-	0.138	-	
		y			-	0.160	-	

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



7.2.2 Definition of Contrast Ratio

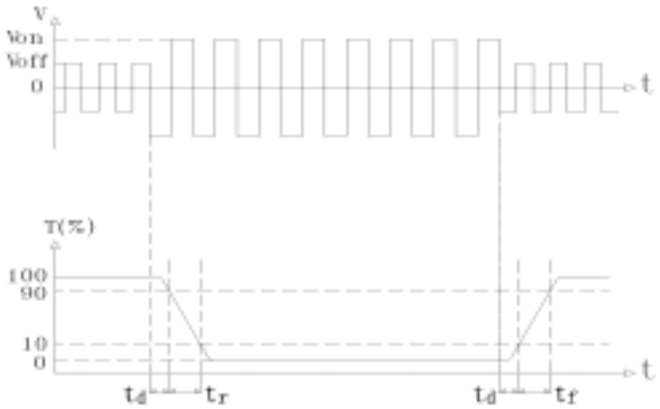


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25℃ ; 2) Frame frequency: 60.0Hz

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:20.0V 2) Frame frequency: 60.0Hz

7.3 Brightness Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness	Bp	Ta=25℃±3℃ 30-80%RH	180	-	-	cd/m^2
Uniformity	△Bp		-	80	-	%

Note:

1. The data is measured after LED are turned on for 5 minutes.
2. Testing conditions LED: V_{LED} = 14.0 V (DC)
   LCD: All dots are on (White color)
3. Brightness in the center of the LCD panel.
4. Definition of Uniformity (△Bp)

△Bp = Bp (Min.) / Bp (Max.) X 100 (%)

Bp (Max.) = Maximum brightness in 9 measurement spots

Bp (Min.) = Minimum brightness in 9 measurement spots

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
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30℃ 240H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	70℃ 240H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20℃ 240H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	65℃ 90%RH 240H
6	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
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 100m/s^2, 120min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s^2, 18ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H

8.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	√	√	√	√	√	√	√	√	√	Out of the basic Specification
Electrical specification	√	√	√	√	√					Out of the electrical specification
Mechanical Specification							√	√		Out of the mechanical specification
Optical Characteristic	√	√	√	√	√	√			√	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 illumination and eyesight condition, the distance between eyes and LCD is 25cm.	See Appendix A			II	Major 1.0 Minor 2.5
Display Defects	Under normal illumination 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℃

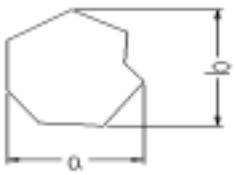
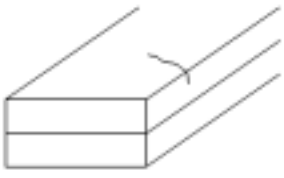
Relatively humidity: ≤80%

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.

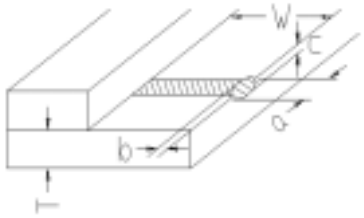
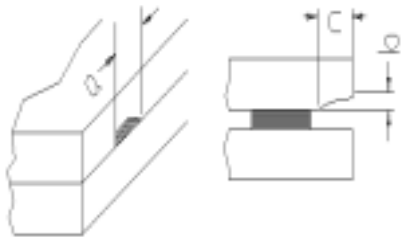
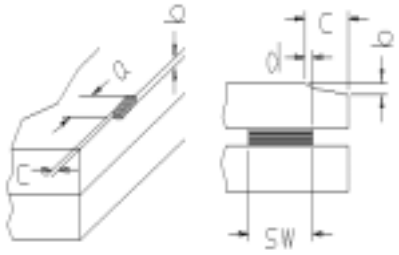
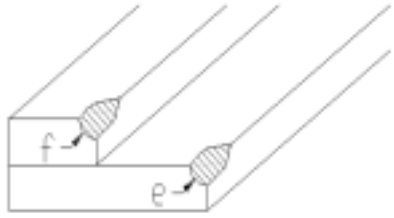
Appendix A

Inspection items and criteria for appearance defects

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

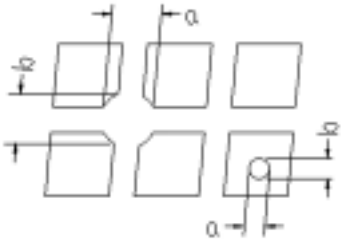
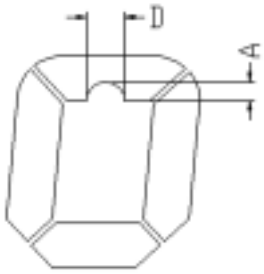
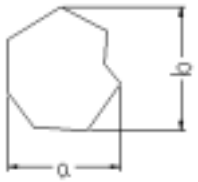
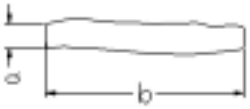
Appendix A

Inspection item and criteria for appearance defects (continued)

<table>
<tr><th>Items</th><th>Contents</th><th colspan="4">Criteria</th></tr>
<tr><td rowspan="4">Glass Cracks</td><td>Cracks on pads
  </td><td>a
≤3mm
≤2mm</td><td>b
≤W/5
≤W/5</td><td>c
≤T/2
T/2<C<T</td><td>Max. 2 cracks allowed</td><td rowspan="4">Max. 5 cracks allowed</td></tr>
<tr><td>Cracks on contact side
  </td><td colspan="2">a
≤3mm
≤2mm
C shall be not reach the seal area</td><td>b
≤T/2
T/2<b<T</td><td rowspan="2">Max. 2 cracks allowed</td></tr>
<tr><td>Cracks on non-contact side
  </td><td colspan="2">a
≤3mm
≤2mm
C≤0.5mm
d≤SW/3</td><td>b
≤T/2
T/2<b<T</td></tr>
<tr><td>Corner cracks
  </td><td colspan="3">e<2.0mm^2
f<2.0mm^2</td><td>Max. 3 cracks allowed</td></tr>
</table>

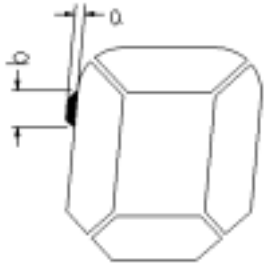
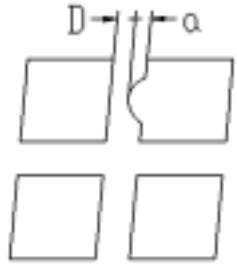
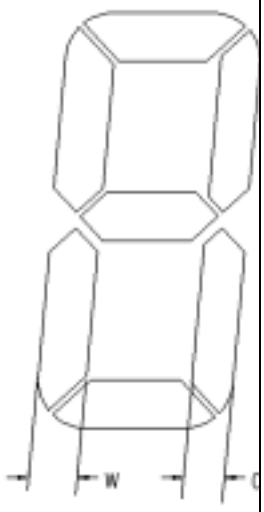
Appendix B

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></tr>
<tr><td>a＜0.1mm</td><td>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>