SPECIFICATION FOR LCD MODULE

Model No. TM128128ACCWF

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 Item

1 General Specifications:

1.1 Display type: FSTN

1.2 Display color*:

Display color: Blue-Black

Background: Gray

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Method: 1/128 Duty 1/12 Bias

1.6 Without Backlight

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

1.7 Controller: UC1607-C

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

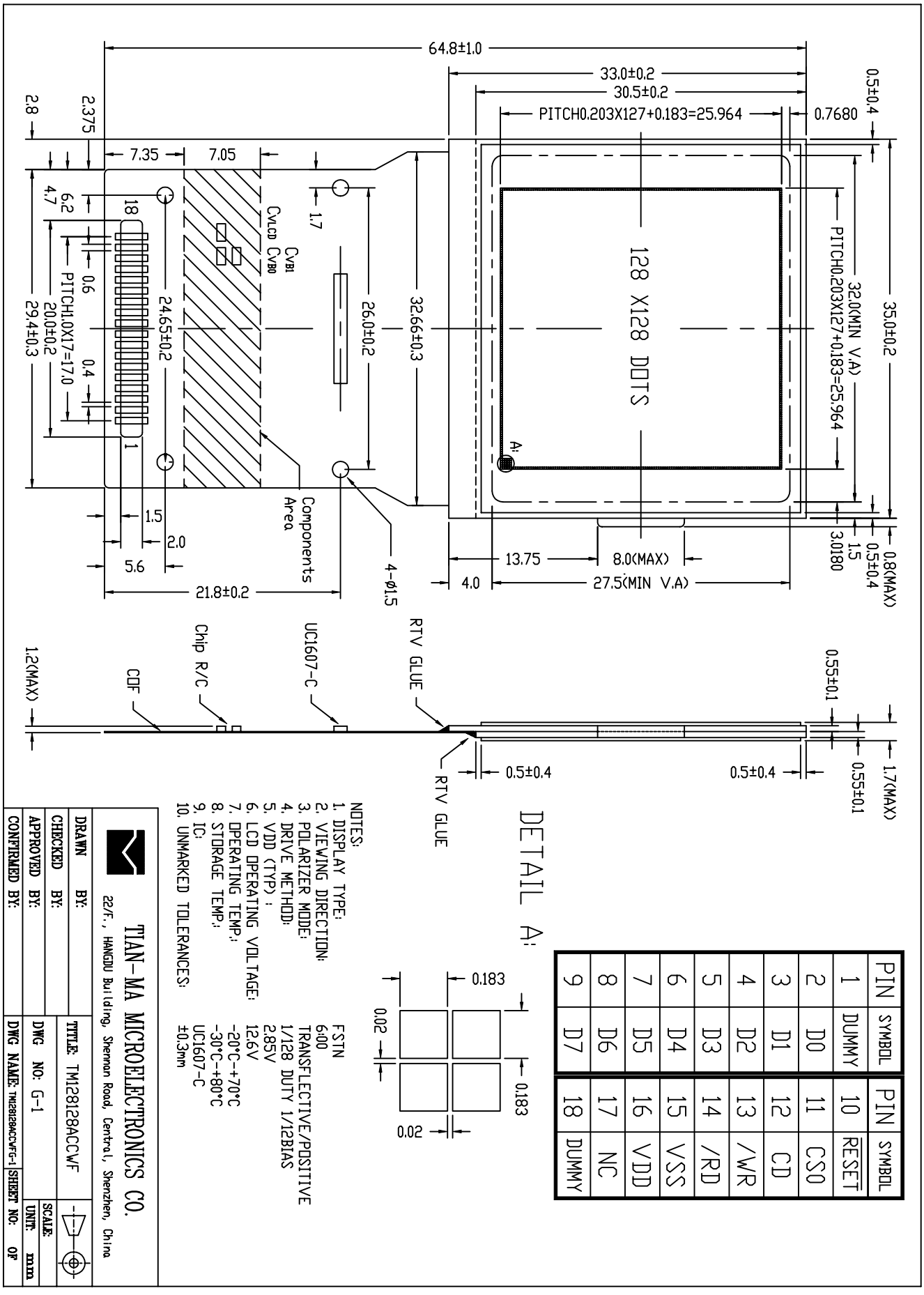
1.11 Dot Matrix: 128X 128 DOTS

1.12 Dot Size: 0.183X0.183 (mm)

1.13 Dot Pitch: 0.203X0.203 (mm)

1.14 Weight: 15g(approx.)

2 Outline Drawing



PIN	SYMBOL	PIN	SYMBOL
1	DUMMY	10	RESET
2	D0	11	CS0
3	D1	12	CD
4	D2	13	/WR
5	D3	14	/RD
6	D4	15	VSS
7	D5	16	VDD
8	D6	17	NC
9	D7	18	DUMMY

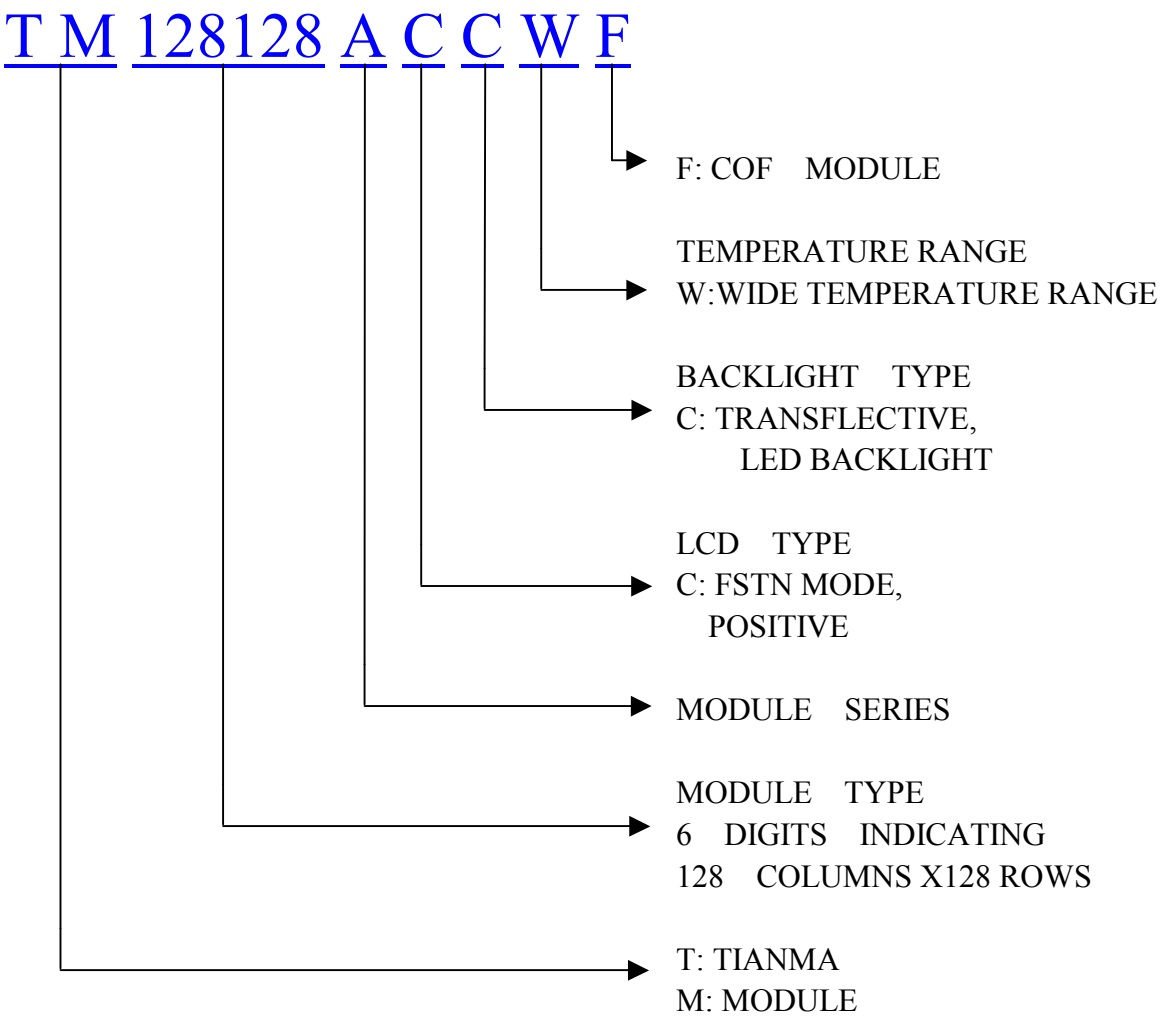
DETAIL A:

NOTES:
1. DISPLAY TYPE: FSTN
2. VIEWING DIRECTION: 6:00
3. POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4. DRIVE METHOD: 1/128 DUTY 1/12BIAS
5. VDD (TYP) : 2.85V
6. LCD OPERATING VOLTAGE: 12.6V
7. OPERATING TEMP.: -20°C~+70°C
8. STORAGE TEMP.: -30°C~+80°C
9. IC: UC1607-C
10. UNMARKED TOLERANCES: ±0.3mm

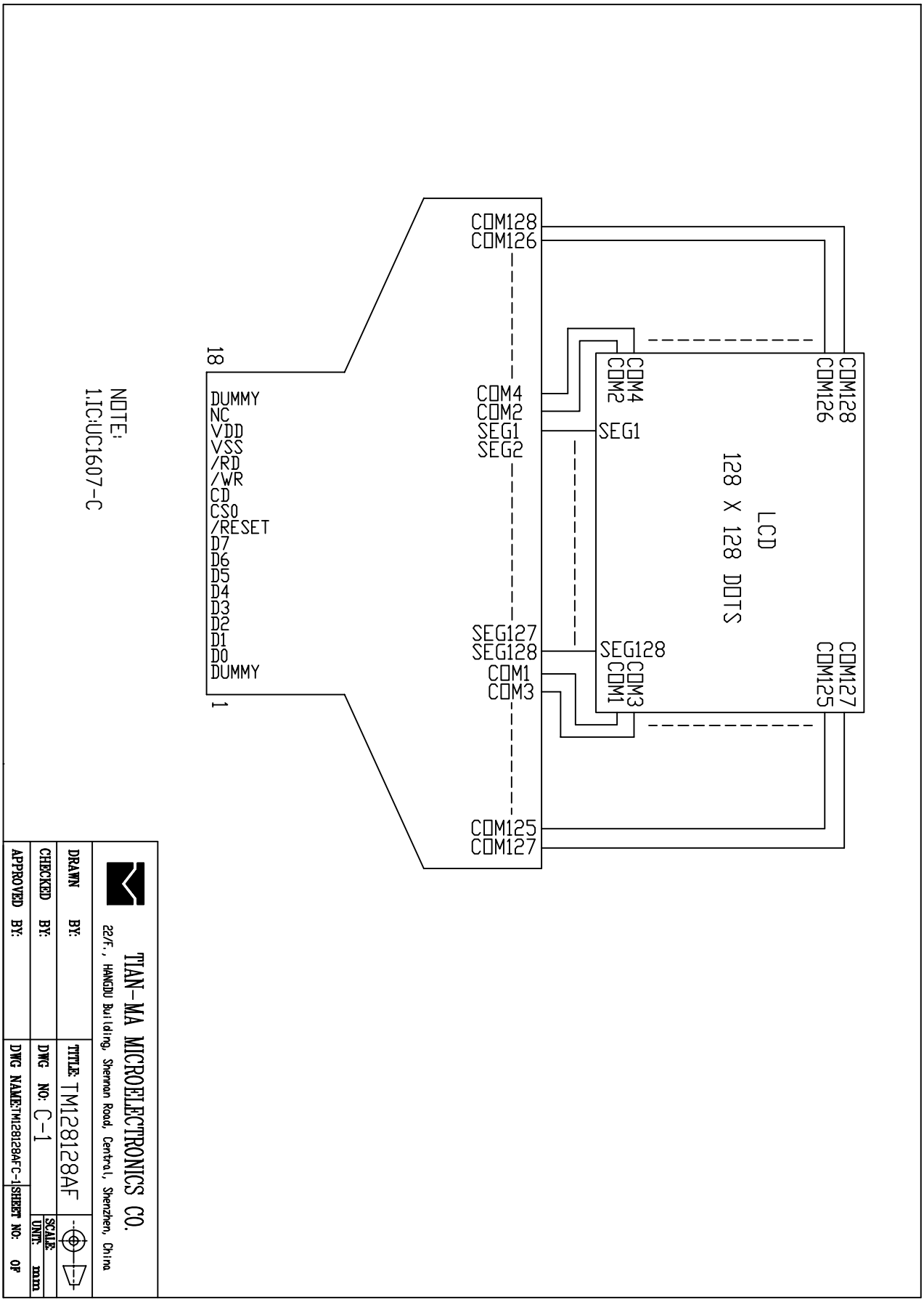
TIAN-MA MICROELECTRONICS CO.
22/F., HANGDU Building, Shennan Road, Central, Shenzhen, China

DRAWN BY:		TITLE: TM128128ACCWF	
CHECKED BY:			SCALE:
APPROVED BY:		DWG NO: G-1	UNIT: mm
CONFIRMED BY:		DWG NAME: TM128128ACCWFG-1	SHEET NO: 0F

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)		$V_{DD}-V_{SS}$	1.8	3.0	3.3	V
Supply Voltage (LCD Drive)		V_{LCD}	6.5	12.6	14	V
Input Signal Voltage	High	V_{IH} (V_{DD}=3.0)	0.8V_{DD}	-	V_{DD}+0.3	V
	Low	V_{IL} (V_{DD}=3.0)	0	-	0.2 V_{DD}	V
Supply current (Logic)		I_{DD} ($V_{DD}-V_{SS}$ =3.0)	-	-	100	uA
Supply current (LED Backlight)		I_{BL}	-			mA

6.2 Interface Signals

Pin No.	Symbol	Level	Description
1	DUMMY	-	No Connection
2	D0	H/L	Data bit0
3	D1	H/L	Data bit1
4	D2	H/L	Data bit2
5	D3	H/L	Data bit3
6	D4	H/L	Data bit4
7	D5	H/L	Data bit5
8	D6	H/L	Data bit6
9	D7	H/L	Data bit7
10	$\overline{\text{RESET}}$	L	Reset signal input
11	CS0	L	Chip select input
12	CD	H/L	Selects registers, L:Control data, H:Display data
13	/WR	L	Write Signal
14	/RD	L	Read Signal
15	VSS	0V	Ground
16	VDD	3.0V	Power supply voltage for logic
17	NC	-	No Connection
18	DUMMY	-	No Connection

6.3 Interface Timing Chart

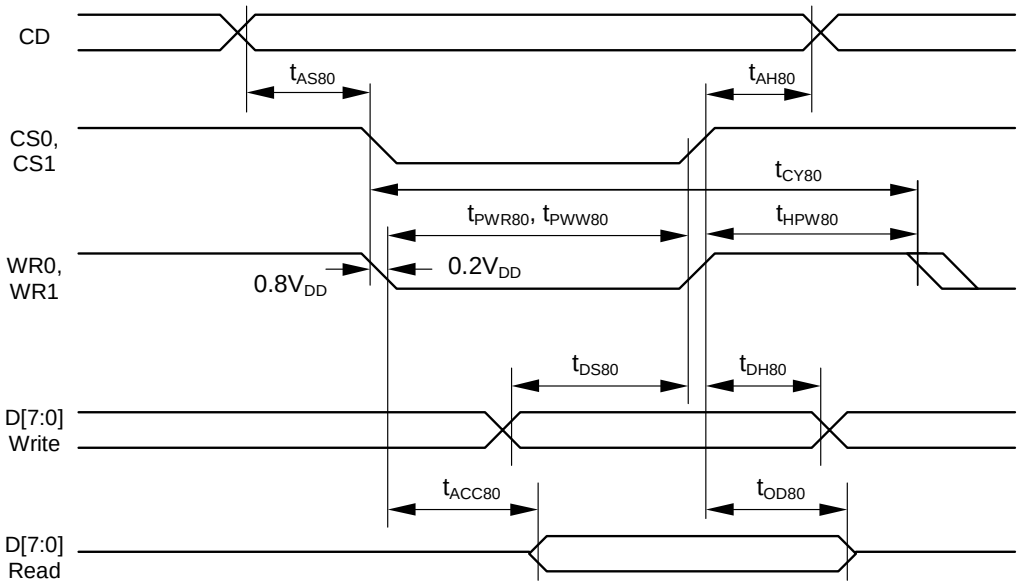


Figure 21: Parallel Bus Timing Characteristics (for 8080 MCU)

(VDD=2.4V to 3.0V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{AS80} t_{AH80}	CD	Address setup time Address hold time		20 40	–	ns
t_{CY80}		System cycle time		100	–	ns
t_{PWR80}	WR1	Pulse width (read)		45	–	ns
t_{PWW80}	WR0	Pulse width (write)		45	–	ns
t_{HPW80}	WR0, WR1	High pulse width		40	–	ns
t_{DS80} t_{DH80}	D0~D7	Data setup time Data hold time		30 10	–	ns
t_{ACC80} t_{OD80}		Read access time Output disable time	C_L = 100pF	– 10	50 50	ns

6.4 Instruction Code

The following is a list of host commands support by UC1607

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle

\# Useful Data bits
– Don't Care

Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action
Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte @ PA/CA
Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte @ PA/CA
Get Status	0	1	BZ	MX	DE	RS	WA	GN1	GN0	1	Get Status Summary
Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]=D[3:0]
Set Column Address MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4] =D[3:0]
Set Mux rate.	0	0	0	0	1	0	0	0	#	#	Set MR[1:0]=D[1:0]
Set Temp. Compensation.	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]=D[1:0]
Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]=D[1:0]
Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[3:2]=D[1:0]
Set Adv. Program Control (double byte command)	0 0	0 0	0 #	0 #	1 #	1 #	0 #	0 #	0 #	R #	Set APC[R][7:0]=D[7:0], where R = 0, or 1
Set Max CA (double byte command)	0 0	0 0	0 -	0 #	1 #	1 #	0 #	0 #	1 #	0 #	Set MC = D[6:0]
Set Start Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]=D[3:0]
Set Start Line MSB	0	0	0	1	0	1	#	#	#	#	Set SL[7:4]=D[3:0]
Set Page Address LSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]=D[3:0]
Set Page Address MSB	0	0	0	1	1	1	#	#	#	#	Set PA[7:4]=D[3:0]
Set V_{REF} potential meter (double-byte command)	0 0	0 0	1 #	0 #	0 #	0 #	0 #	0 #	0 #	1 #	Set PM[5:0]=D[5:0] Set GN[1:0]=D[7:6]
Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]=D[2:0]
Set Frame Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]=D[1:0]
Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]=D0
Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]=D0
Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]=D[2:0]
Set LCD Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]=D[2:0]
Set LCD Gray Shade	0	0	1	1	0	1	-	-	#	#	Set LC[6:5]=D[1:0]
System Reset	0	0	1	1	1	0	0	0	1	0	System Reset sequence
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]= D[1:0]
Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	Set AC[3]=0, CA=CR;
Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	Set AC[3]=1, CR=CA;
Set Test Control (double byte command)	0 0	0 0	1 #	1 #	1 #	0 #	0 #	1 #	TT #	 #	For testing only. Do not use.

* Other than commands listed above, all other bit patterns result in NOP (No Operation).

7 Optical Characteristics

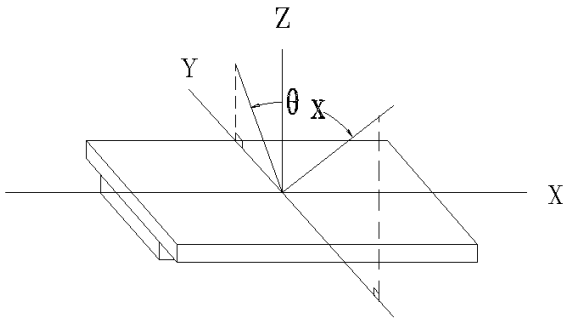
7.1 Optical Characteristics

Ta=25℃

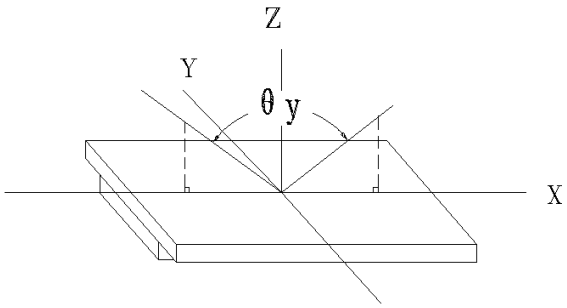
Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		θ_x	$C_r \geq 2$	$\theta_y=0°$	-30 -- 20			Deg
		θ_y		$\theta_x=0°$	-30 -- 30			
Contrast Ratio		C_r	$\theta_x=0°$ $\theta_y=0°$		3	-	-	
Response Time	Turn on	T_{on}	$\theta_x=0°$ $\theta_y=0°$		-	-	300	ms
	Turn off	T_{off}			-	-	300	

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle

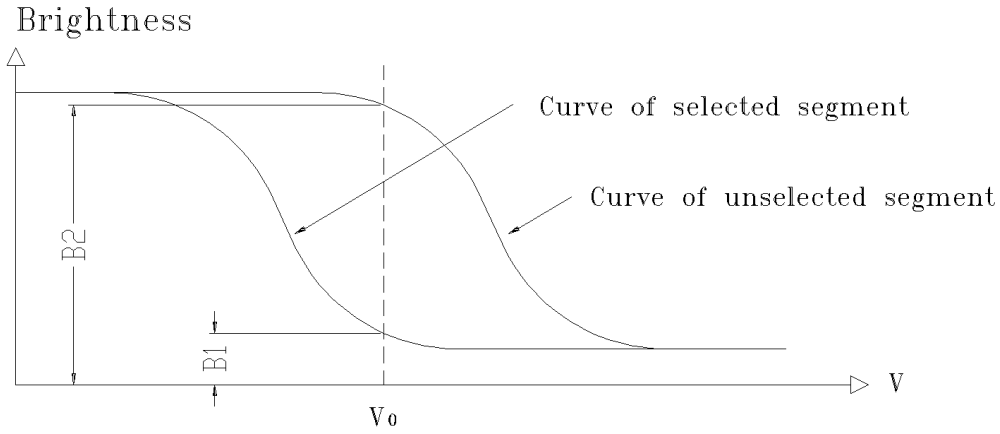


Top
Bottom



Top
Bottom

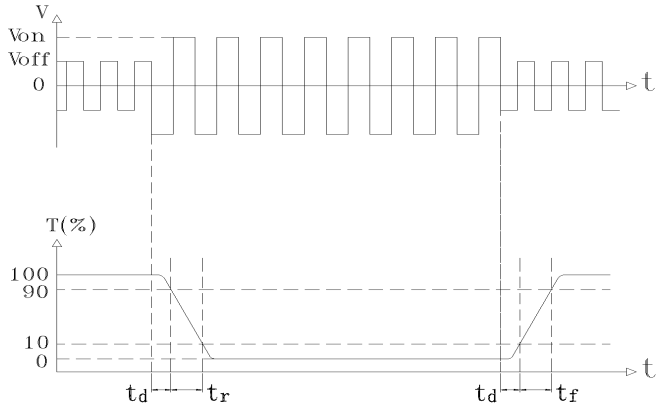
7.2.2 Definition of Contrast Ratio



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

Measuring Conditions:

1) Ambient Temperature: 25℃ 2) Frame frequency: 85.0Hz



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:12.6V 2) Frame frequency: 85.0Hz

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	60℃ 95%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~500Hz, 100m/s^2, 120min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 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_{amb}=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 annex A			II	Major 1.0 Minor 2.5
Display Defects	Under normal illumination and eyesight condition, display on inspection.	See annex 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℃

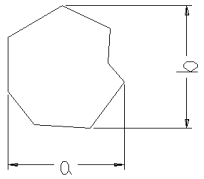
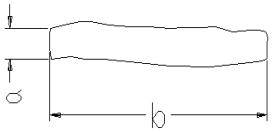
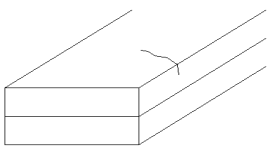
Relatively humidity: ≤80%

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.

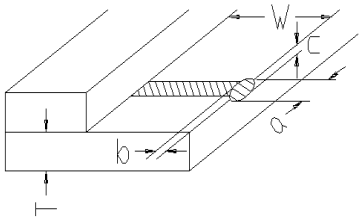
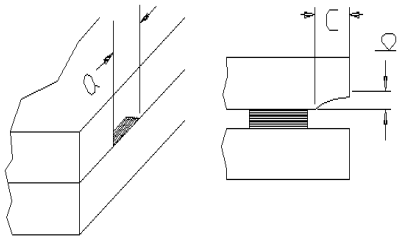
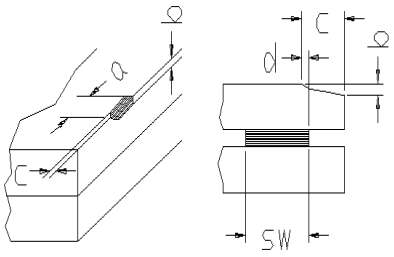
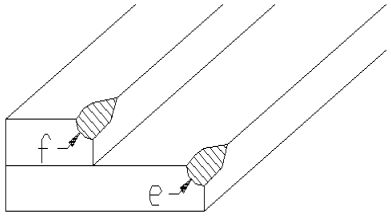
Appendix A

Inspection items and criteria for appearance defects

<table>
<tr><th>Items</th><th>Contents</th><th colspan="4">Criteria</th></tr>
<tr><td colspan="2">Protective Glue</td><td colspan="4">No clear defects</td></tr>
<tr><td colspan="2">Cover Tape</td><td colspan="4">Covering all of the chip and no clear crimple</td></tr>
<tr><td colspan="2">Leakage</td><td colspan="4">Not permitted</td></tr>
<tr><td colspan="2">Rainbow</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<0.20mm</td><td>0.20mm≤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="3">Not permitted</td><td></td></tr>
</table>

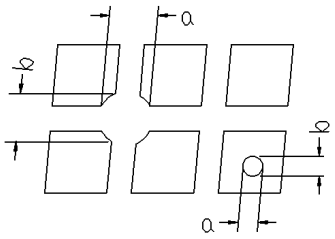
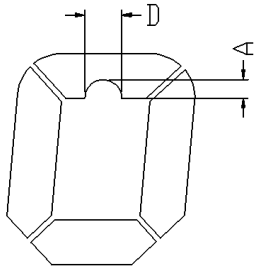
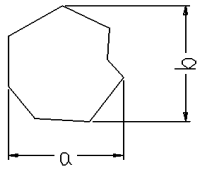
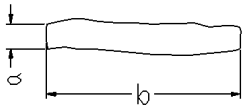
Appendix A

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>

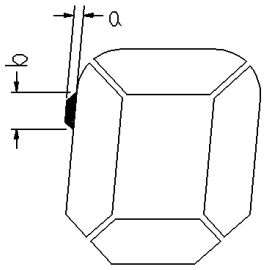
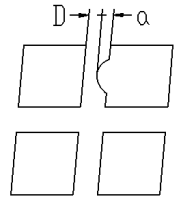
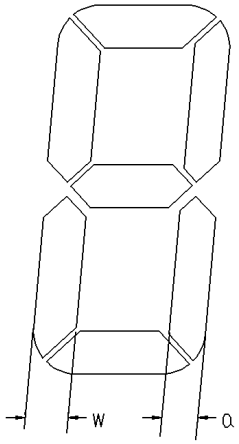
Appendix B

Inspection items and criteria for display defects

<table>
<tr><td colspan="2">Items</td><td>Contents</td><td colspan="3">Critera</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="5">Pin holes and cracks in segment (DOT)</td><td rowspan="3"> 
</td><td>Not counted</td><td>Max.3 dots allowed</td><td rowspan="5">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</td></tr>
</table>

Appendix B

Inspection items and criteria for display defects (continued)

<table>
<tr><th>Items</th><th>Content</th><th colspan="3">Critera</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 rowspan="2">  </td><td>Not counted</td><td>Max. 1 defects allowed</td><td rowspan="2">0.1mm≦a≦0.2mm
D>0</td></tr>
<tr><td>a＜0.1mm</td><td></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>