

SPECIFICATION FOR LCD MODULE

Model No. TM128128ACCWF

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

TIANMA MICROELECTRONICS CO., LTD

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°C

Storage Temperature: -30-----+80°C

1.10 Outline Dimensions: Refer to outline drawing on next page

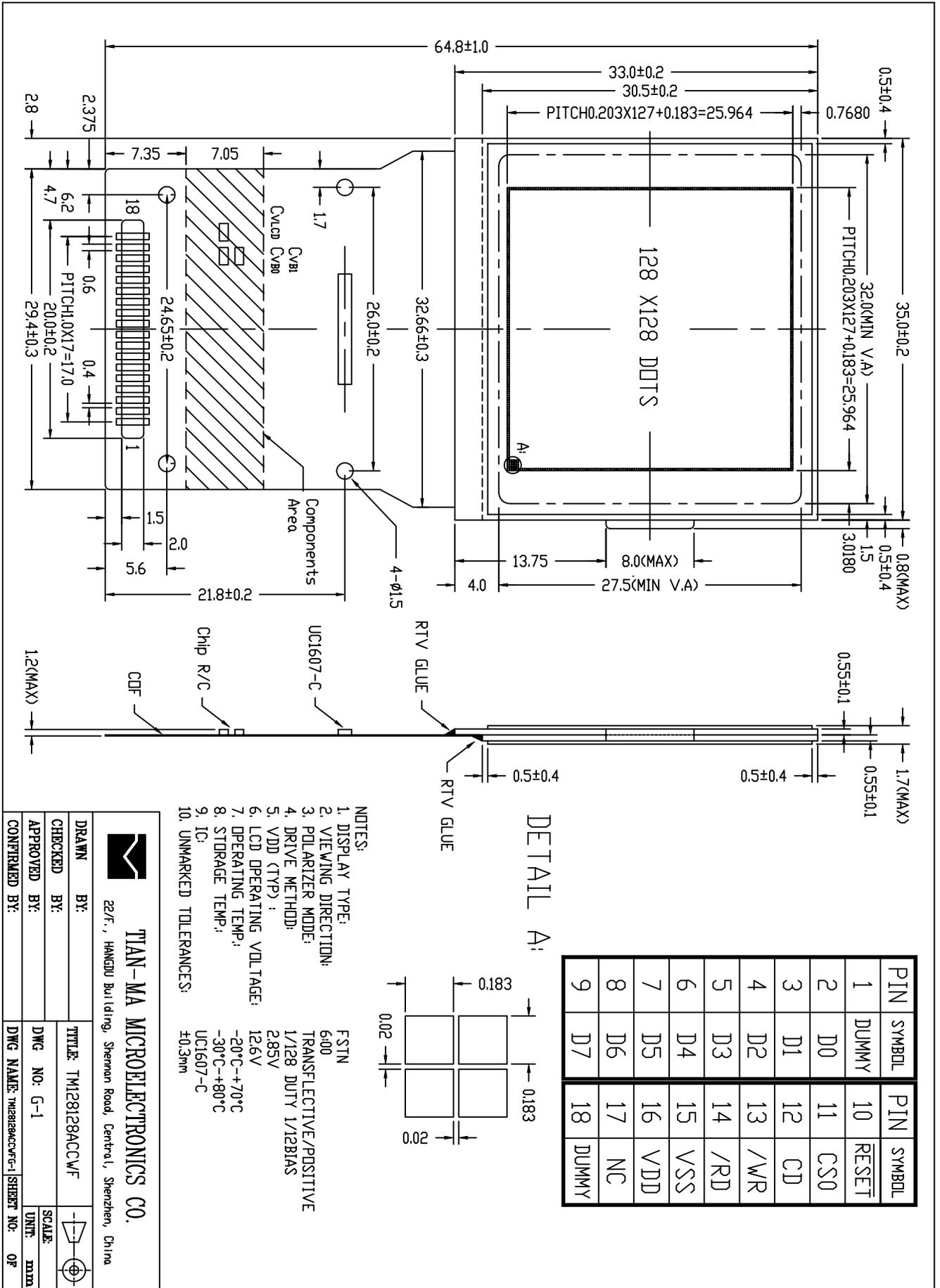
1.11 Dot Matrix: 128X 128 DOTS

1.12 Dot Size: 0.183X0.183 (mm)

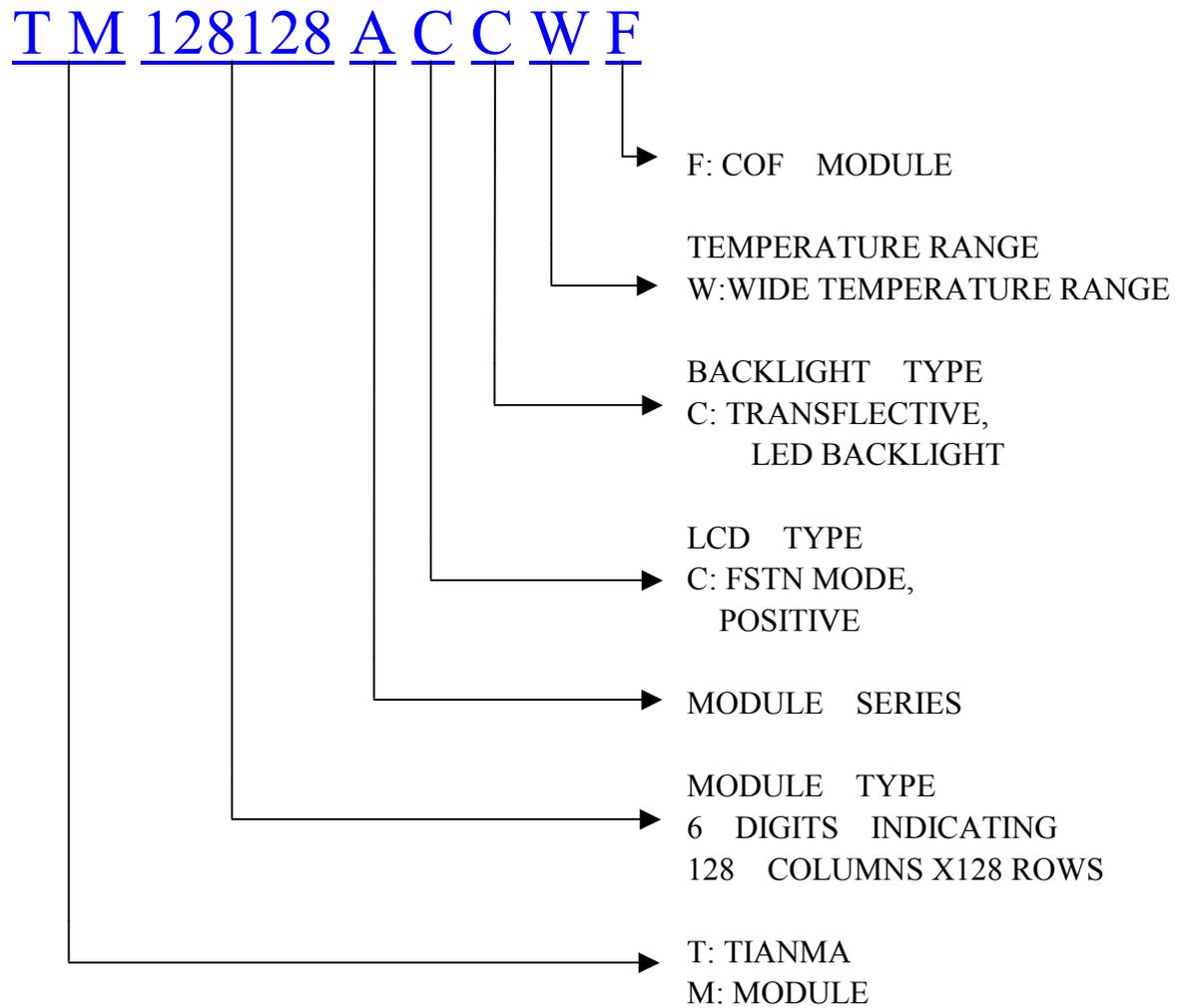
1.13 Dot Pitch: 0.203X0.203 (mm)

1.14 Weight: 15g(approx.)

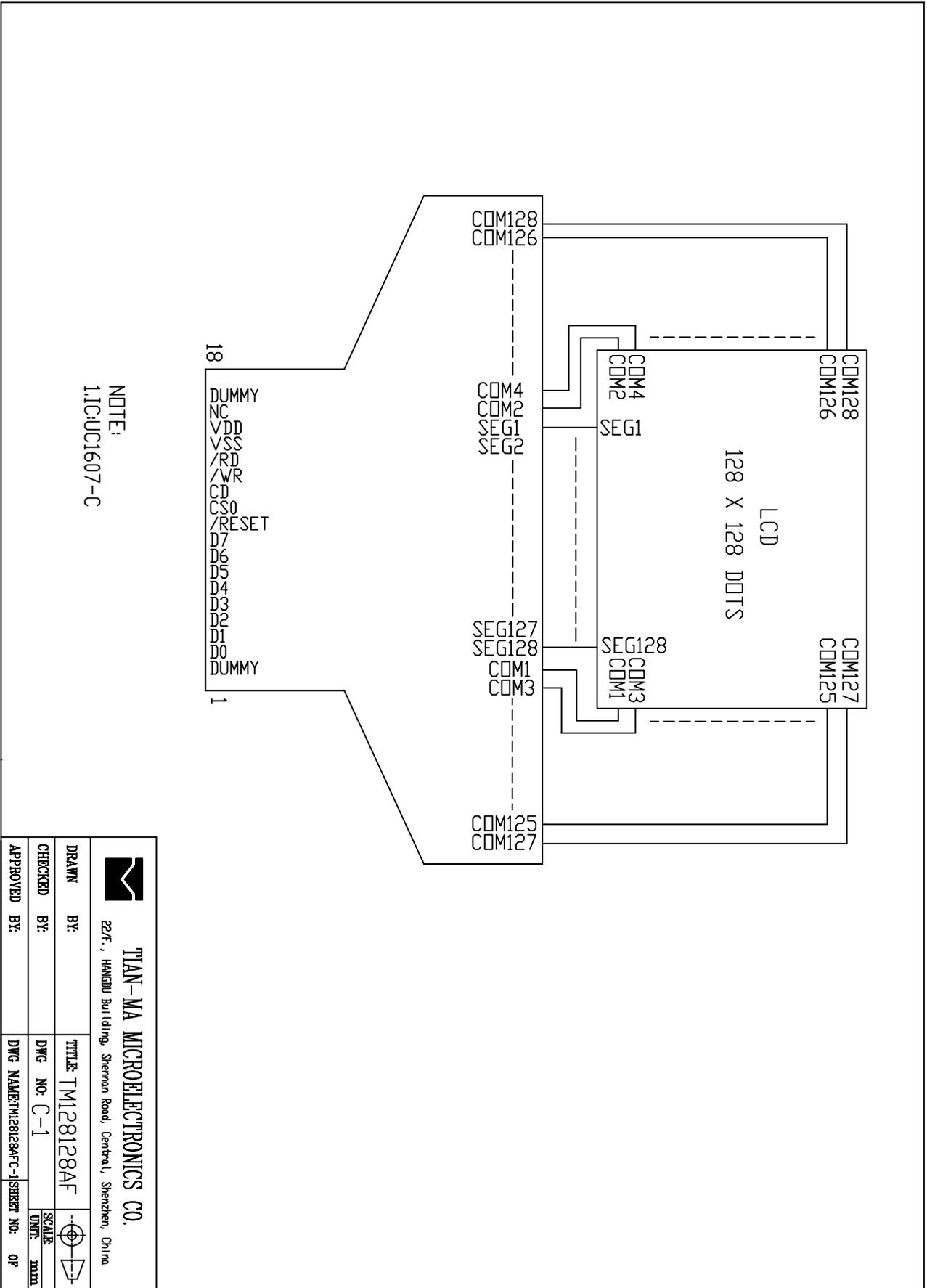
2 Outline Drawing



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	°C	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	<u>RESET</u>	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

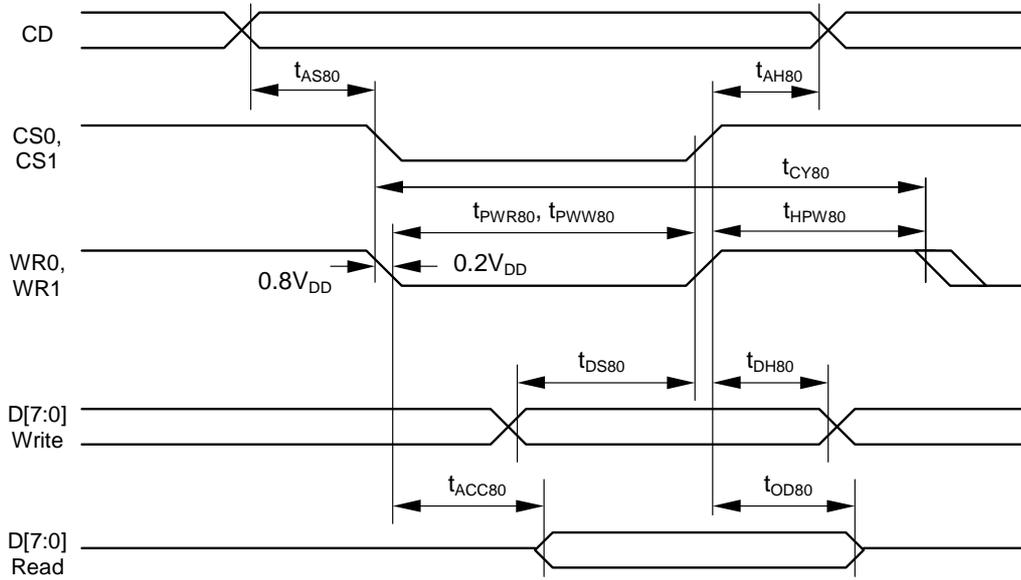


Figure 21: Parallel Bus Timing Characteristics (for 8080 MCU)

(VDD=2.4V to 3.0V, Ta= -30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS80}	CD	Address setup time		20	–	ns
t _{AH80}	CD	Address hold time		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}	D0~D7	Data setup time		30	–	ns
t _{DH80}	D0~D7	Data hold time		10	–	ns
t _{ACC80}		Read access time	C _L = 100pF	–	50	ns
t _{OD80}		Output disable time		10	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	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	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	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	1	1	1	0	0	1	TT		For testing only. Do not use.
	0	0	#	#	#	#	#	#	#	#	

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

7 Optical Characteristics

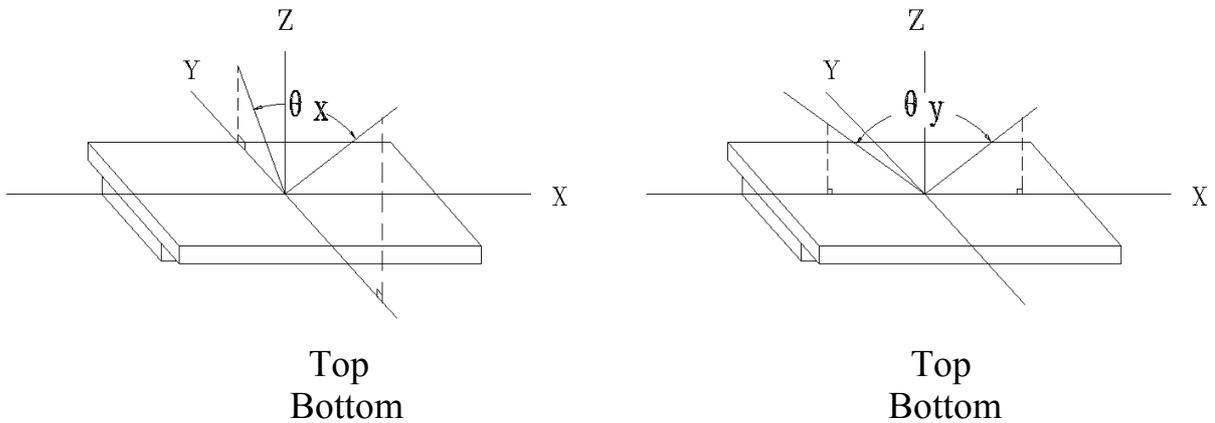
7.1 Optical Characteristics

Ta=25°C

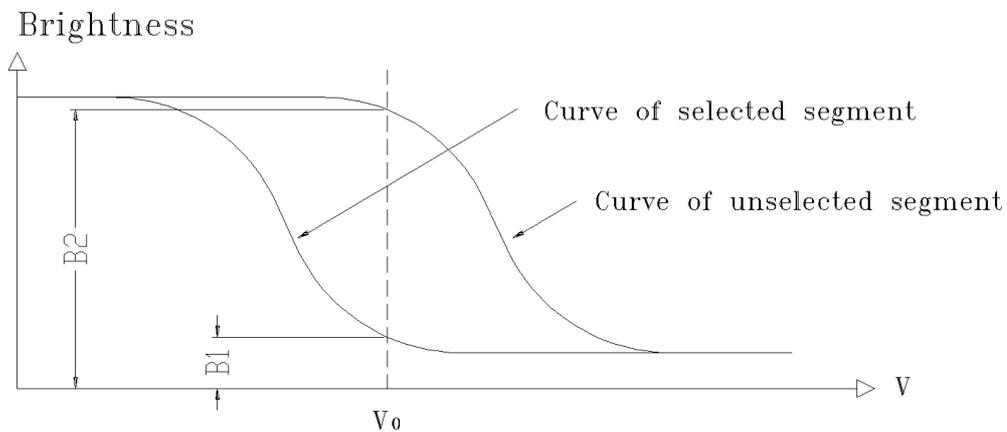
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle	θ_x	$C_r \geq 2$			-30 -- 20	Deg
	θ_y					
Contrast Ratio	C_r	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	3	-	-	
Response Time	Turn on	T_{on}	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$		300	ms
	Turn off	T_{off}				

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



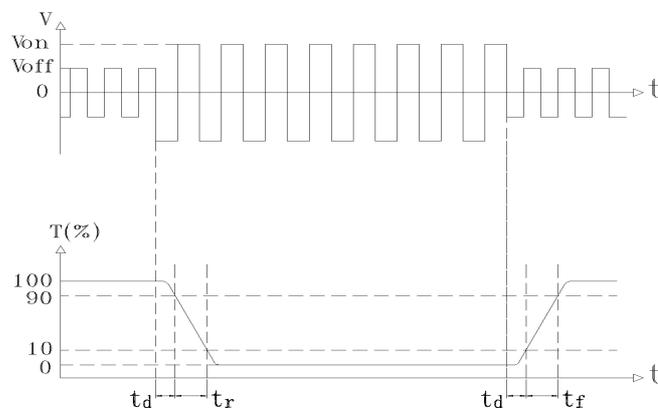
7.2.2 Definition of Contrast Ratio



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

Measuring Conditions:

- 1) Ambient Temperature: 25°C
- 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

8.2 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 $T_{amb}=25^{\circ}C$ (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 : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

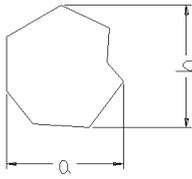
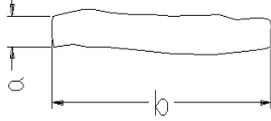
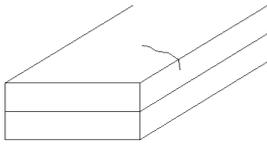
Relatively humidity: $\leq 80\%$

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.

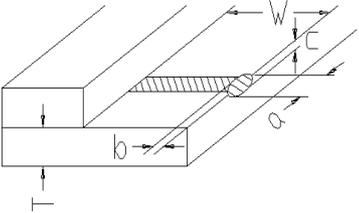
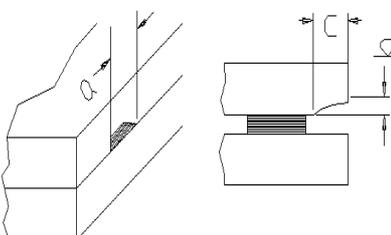
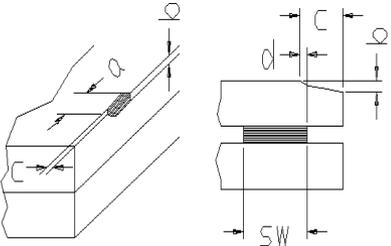
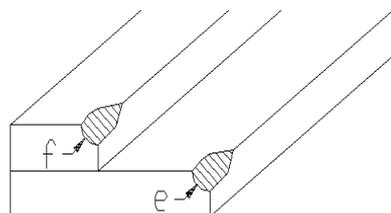
Appendix A

Inspection items and criteria for appearance defects

Items	Contents	Criteria		
Protective Glue		No clear defects		
Cover Tape		Covering all of the chip and no clear crimple		
Leakage		Not permitted		
Rainbow		According to the limit specimen		
Polarizer	Wrong polarizer attachment	Not permitted		
	Bubble between polarizer and glass	Not counted	Max. 3 defects allowed	
		$\phi < 0.3\text{mm}$	$0.3\text{mm} \leq \phi \leq 0.5\text{mm}$	
	Scratches of polarizer	According to the limit specimen		
Black spot (in viewing area)		Not counted	Max. 3 spots allowed	Max. 3 spots (lines) allowed
		$X < 0.20\text{mm}$	$0.20\text{mm} \leq X \leq 0.5\text{mm}$	
		$X = (a+b)/2$		
Black line (in viewing area)		Not counted	Max. 3 lines allowed	
		$a < 0.02\text{mm}$	$0.02\text{mm} \leq a \leq 0.05\text{mm}$ $b \leq 2.0\text{mm}$	
Progressive cracks		Not permitted		

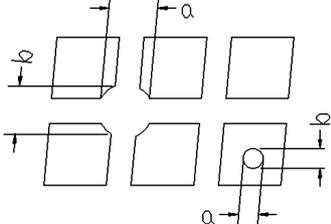
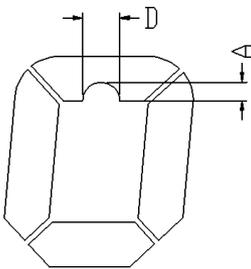
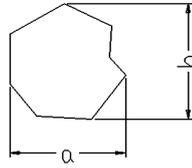
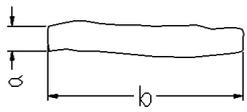
Appendix A

Inspection item and criteria for appearance defects (continued)

Items	Contents	Criteria							
Glass Cracks	Cracks on pads 	a	b	c	Max. 2 Cracks allowed	Max. 5 cracks allowed			
		$\leq 3\text{mm}$	$\leq W/5$	$\leq T/2$					
		$\leq 2\text{mm}$	$\leq W/5$	$T/2 < C < T$					
	Cracks on contact side 	a	b		Max. 2 cracks allowed				
		$\leq 3\text{mm}$	$\leq T/2$						
		$\leq 2\text{mm}$	$T/2 < b < T$						
		C shall be not reach the seal area							
	Cracks on non-contact side 	a	b		Max. 2 cracks allowed				
		$\leq 3\text{mm}$	$\leq T/2$						
		$\leq 2\text{mm}$	$T/2 < b < T$						
	$C \leq 0.5\text{mm}$								
	$d \leq SW/3$								
Corner cracks 	$e < 2.0\text{mm}^2$ $f < 2.0\text{mm}^2$			Max. 3 cracks allowed					

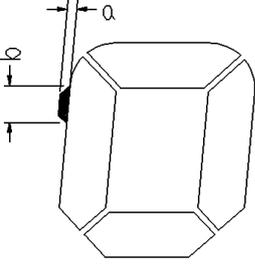
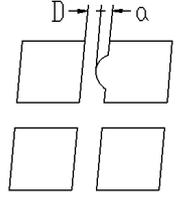
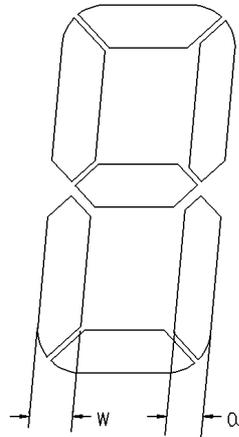
Appendix B

Inspection items and criteria for display defects

Items	Contents	Criteria		
Open segment or open common		Not permitted		
Short		Not permitted		
Wrong viewing angle		Not permitted		
Contrast ratio uneven		According to the limit specimen		
Crosstalk		According to the limit specimen		
Pin holes and cracks in segment (DOT)		Not counted	Max.3 dots allowed	Max.3 dots allowed
		$X < 0.1\text{mm}$	$0.1\text{mm} \leq X \leq 0.2\text{mm}$	
		$X = (a+b)/2$		
		Not counted	Max.2 dots allowed	
$A < 0.1\text{mm}$		$0.1\text{mm} \leq A \leq 0.2\text{mm}$ $D < 0.25\text{mm}$		
Black spot (in viewing area)		Not counted	Max.3 spots allowed	Max.3 spots (lines) allowed
		$X < 0.1\text{mm}$	$0.1\text{mm} \leq X \leq 0.2\text{mm}$	
		$X = (a+b)/2$		
Black line (in viewing area)		Not counted	Max.3 lines allowed	Max.3 lines allowed
		$a < 0.02\text{mm}$	$0.02\text{mm} \leq a \leq 0.05\text{mm}$	

Appendix B

Inspection items and criteria for display defects (continued)

Items	Content	Criteria				
Transformation of segment		Not counted	Max. 2 defects allowed	Max.3 defects allowed		
		$x < 0.1\text{mm}$	$0.1\text{mm} \leq x \leq 0.2\text{mm}$			
		$x = (a+b)/2$				
		Not counted	Max. 1 defects allowed			
		$a < 0.1\text{mm}$	$0.1\text{mm} \leq a \leq 0.2\text{mm}$ $D > 0$			
		Max.2 defects allowed $0.8W \leq a \leq 1.2W$ $a = \text{measured value of width}$ $W = \text{nominal value of width}$				