SPECIFICATION FOR LCD MODULE

Model No. _TM0255AKFW_

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

TIANMA MICROELECTRONICS CO., LTD

Ver. 1.0

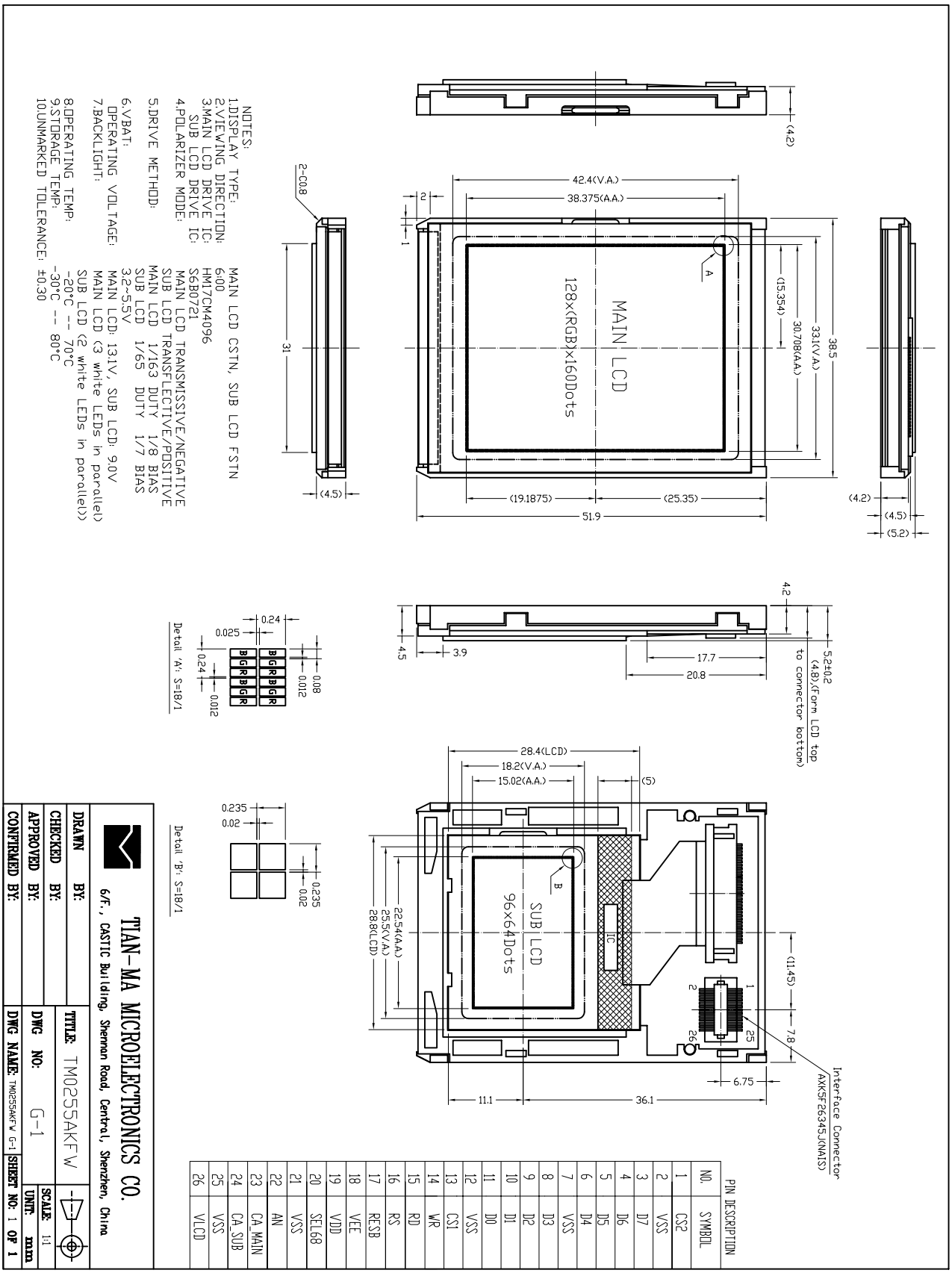
REVISION RECORD

Date	Ver.	Ref. Page	Revision No.	Revision Items

1 General Specifications:

ITEM	CONTENTS		UNIT
	MAIN LCD	SUB LCD	
LCD TYPE	CSTN	FSTN	---
LCD DUTY	1/163	1/65	---
LCD BIAS	1/8	1/7	---
VIEWING DIRECTION	6:00	6:00	O'CLOCK
GLASS AREA(WXH)	36.9X47.85	28.8X28.4	MM
VIEWING AREA(WXH)	33.1X42.4	18.2X25.5	MM
ACTIVE AREA(WXH)	30.708X38.375	22.54X15.02	MM
NUMBER OF DOTS	128(R+G+B)X160	96X64	MM
DOTE SIZE(WXH)	0.264X0.215	0.233X0.233	MM
DOT PITCH(WXH)	0.276X0.24	0.235X0.235	MM
CONTROLLER	HM17CM4096	S6B0721	---
VBAT	3.2~5.5		V
LCD OPERATING VOLTAGE	13.1	9	V
OUTLINE DIMENSIONS	REFER TO OUTLINE DRAWING ON NEXT PAGE		
BACKLIGHT	LED(WHITE)	LED(BULE)	---
OPERATING TEMPERAT	-20---+70℃	-20---+70℃	---
STORAGE TEMPERATURE	-30---+80℃	-30---+80℃	---
WEIGHT	TBD		---
DATA TRANSFER	8BIT PARALLEL	8 BIT PARALLEL	---
POLARIZER MODE	TRANSMISSIVE /NEGATIVE	TRANSFLECTIVE /POSITIVE	---

2. Outline Drawing



NO.	SYMBOL	PIN DESCRIPTION
1	CS2	
2	VSS	
3	D7	
4	D6	
5	D5	
6	D4	
7	VSS	
8	D3	
9	D2	
10	D1	
11	D0	
12	VSS	
13	CS1	
14	WR	
15	RD	
16	RS	
17	RESB	
18	VEE	
19	VDD	
20	SEL68	
21	VSS	
22	AN	
23	CA_MAIN	
24	CA_SUB	
25	VSS	
26	VLCD	

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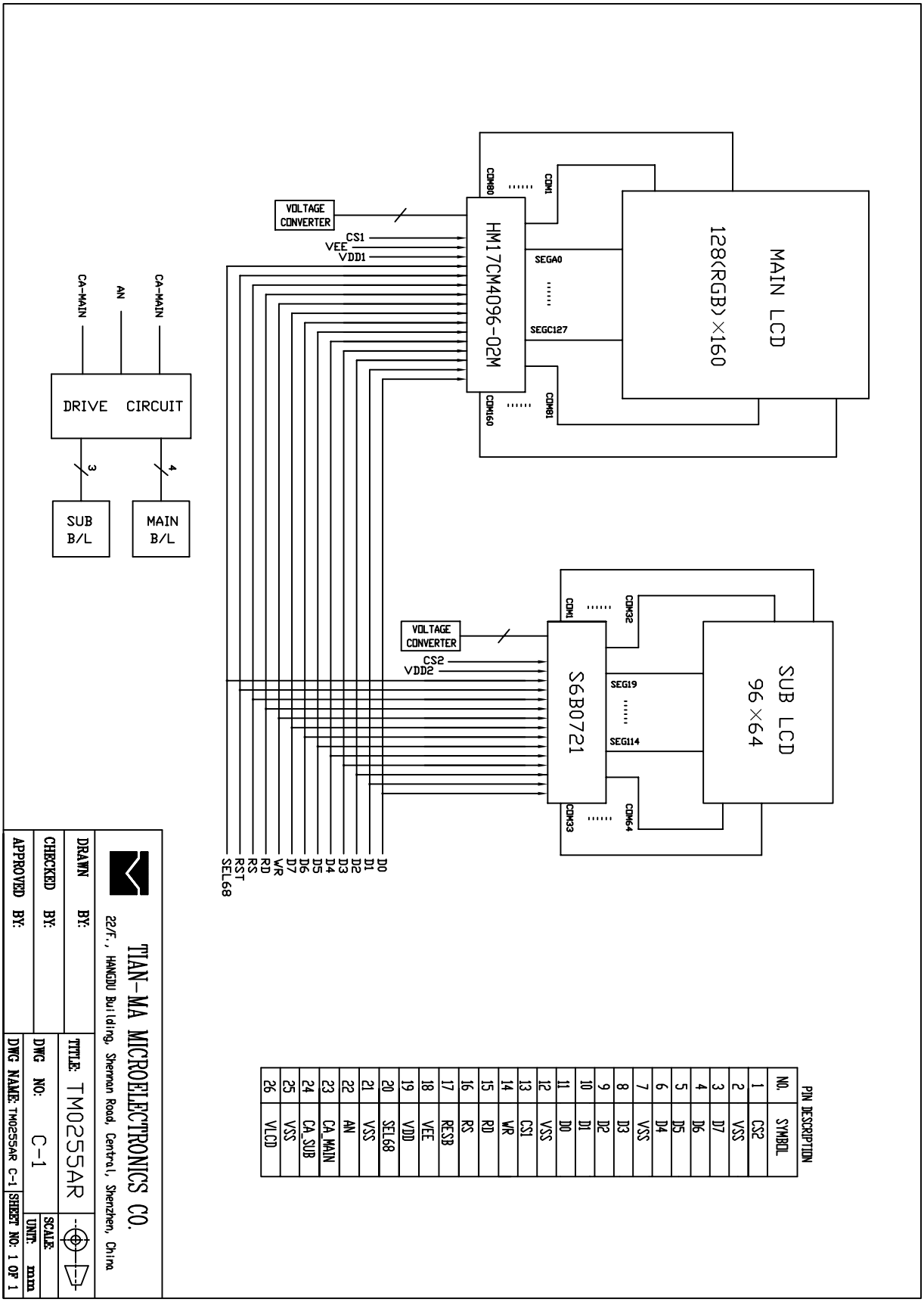
DRAWN BY:	TITLE: TM0255AKFW		
CHECKED BY:			
APPROVED BY:	DWG NO: G-1	SCALE: 1:1	UNIT: mm
CONFIRMED BY:	DWG NAME: TM0255AKFW G-1	SHEET NO: 1 OF 1	

3. Circuit Block Diagram



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8	D3
9	D2
10	D1
11	D0
12	VSS
13	CS1
14	WR
15	RD
16	RS
17	RESB
18	VEE
19	VDD
20	SEL68
21	VSS
22	AN
23	CA_MAIN
24	CA_SUB
25	VSS
26	VLCD

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DRAWN BY:	TITLE: TM0255AR		
CHECKED BY:	DWG NO: C-1	SCALE:	
APPROVED BY:	DWG NAME: TM0255AR C-1	UNIT: mm	SHEET NO: 1 OF 1

4 Absolute Maximum Ratings(Ta=25℃)

Item	Symbol	Min.	Max.	Unit
Power Supply Voltage(1)	VBAT	3.2	5.5	V
Power Supply Voltage(2)	LCD_VCC	-0.3	4.0	V
Power Supply Voltage for Main LCD	VLCD_GND	-0.3	16	V
Logic signal Input voltage	Vt	-0.3	LCD_VCC+0.3	V
Operating temperature	Topr	-20	+70	℃
Storge temperature	Tst	-30	+80	℃

Notes:

1. If the module is above these absolute maximum ratings.It may become permanenthly damaged.Using the module within the following electrical characteristic conditions are also exceeded,the module will malfunction and cause poor reliability.
2. LCD_VCC>GND must be maintained.

5. Electrical Specifications and Instruction Code (Vss=0v, Ta=25℃)

5.1 Electrical characteristics

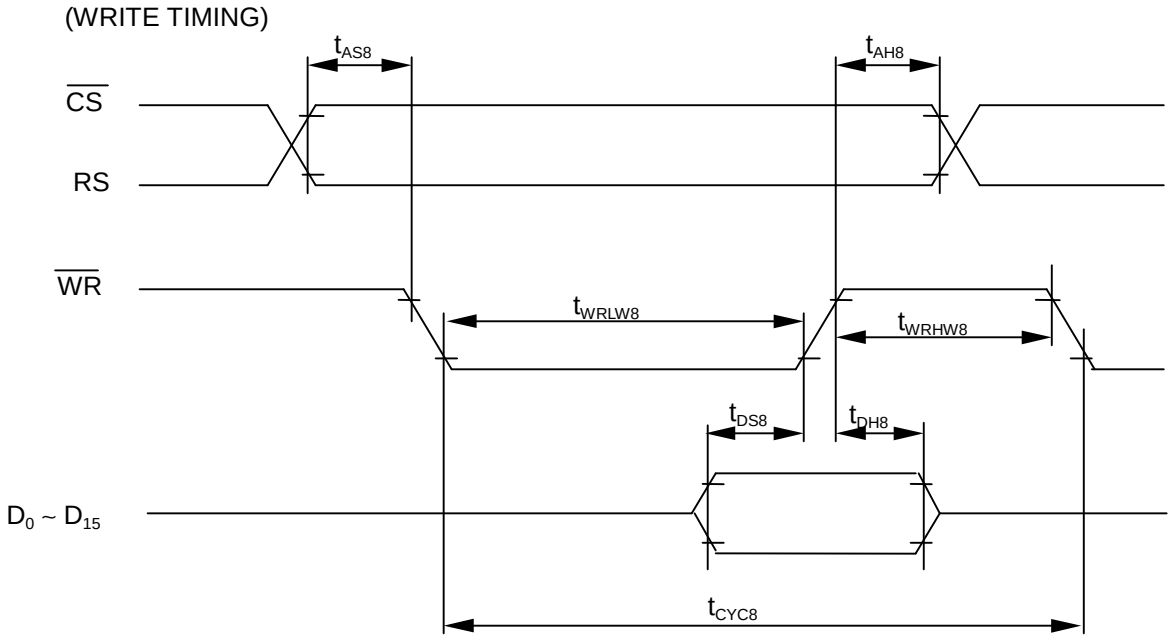
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for logic	VBATT	---	3.2	3.8	5.5	V
Operation voltage for main LCD	VLCD1	25	2.4	3.0	3.3	V
Operation voltage for SUB LCD	VLCD2	25	2.4	3.0	3.3	V
Input voltage'H' Level	V_{IH}	LCD_VCC=3.0V	0.8VDD	---	LCD_VCC	V
Input voltage'L' Level	V_{IL}	LCD_VCC=3.0V	0	---	0.2VDD	V
Output voltage'H'level	V_{OH}	VDD=3.0V VDD=2.75V	0.8LCD_VCC	---	LCD_VCC	V
Output voltage'L'level	V_{OL}	---	0	---	0.2LCD_VCC	V
Current consumption for MAIN LCD normal operation	IDD1	LCD-VCC-GND=3.0V 1/160DUTY	---	1.8	3.0	mA
Current consumption for SUB LCD normal operation	IDD2	LCD-VCC-GND=3.0V 1/64DUTY	---	0.15	0.35	mA
Supply Voltage (LED)	V_{LED}	---	---	10.0	---	V
Supply current (WHITE LED)	I_{LED}	---	---	17	20	mA
Supply current (BLUE LED)	I_{LED}	---	---	5	7	mA
Supply current (LCM)	I_{LCM}	---	---	70	80	mA

5.2 Interface Signals

PinNo.	Symbo l	Level	Description
1	CS2	H/L	Chip select for sub lcd
2	VSS	L	Ground
3	D7	L	Data bus bit7
4	D6	H/L	Data bus bit6
5	D5	H/L	Data bus bit5
6	D4	H/L	Data bus bit4
7	VSS	H/L	Ground
8	D3	H/L	Data bus bit3
9	D2	H/L	Data bus bit2
10	D1	H/L	Data bus bit1
11	D0	H/L	Data bus bit0
12	VSS	H/L	Ground
13	CS1	H/L	Chip select for main lcd
14	WR	H/L	Write operation(8080 system)
15	RD	H/L	Read operation(8080 system)
16	RS	H/L	Index select/Data command select
17	RESB	H/L	Reset pin
18	VEE	H/L	Power for sub lcd
19	VDD	H/L	POWER supplu for logic
20	SEL68	H/L	CPU interface select pin
21	VSS	H/L	GROUND
22	AN	H/L	+4.2V
23	CA_MAIN	H/L	MAIN LED control pin
24	CA_SUB	H/L	SUB LED control pin
25	VSS	L	GROUND
26	VLCD	L	LCD driver supply voltage

5.3 Interface Timing Chart for Main LCD

SYSTEM BUS READ / WRITE TIMING (80 series CPU interface)



(V_{DD}=2.5~3.3V, Ta=-30~+85°C)

ITEM	SYMBOL	CONDITION	MIN.	MAX.	UNIT	PORT
Address hold timing Address setup timing	t_{AH8} t_{AS8}		0 0		ns ns	$\overline{CS}$ RS
System cycle timing Write "L" pulse width Write "H" pulse width	t_{CYC8} t_{WRLW8} t_{WRHW8}		90 35 35		ns ns ns	$\overline{WR}$
Data setup timing Data hold timing	t_{DS8} t_{DH8}		30 5		ns ns	$D_0 \sim D_{15}$

(V_{DD}=2.2~2.5V, Ta=-30~+85°C)

ITEM	SYMBOL	CONDITION	MIN.	MAX.	UNIT	PORT
Address hold timing Address setup timing	t_{AH8} t_{AS8}		0 0		ns ns	$\overline{CS}$ RS
System cycle timing Write "L" pulse width Write "H" pulse width	t_{CYC8} t_{WRLW8} t_{WRHW8}		160 70 70		ns ns ns	$\overline{WR}$
Data setup timing Data hold timing	t_{DS8} t_{DH8}		40 5		ns ns	$D_0 \sim D_{15}$

(V_{DD}=1.7~2.2V, Ta=-30~+85°C)

ITEM	SYMBOL	CONDITION	MIN.	MAX.	UNIT	PORT
Address hold timing Address setup timing	t_{AH8} t_{AS8}		0 0		ns ns	$\overline{CS}$ RS
System cycle timing Write "L" pulse width Write "H" pulse width	t_{CYC8} t_{WRLW8} t_{WRHW8}		180 80 80		ns ns ns	$\overline{WR}$
Data setup timing Data hold timing	t_{DS8} t_{DH8}		70 10		ns ns	$D_0 \sim D_{15}$

notice) All timing reference is 20% and 80% of V_{DD} and 80%.

Read / Write Characteristics (8080-series MPU)

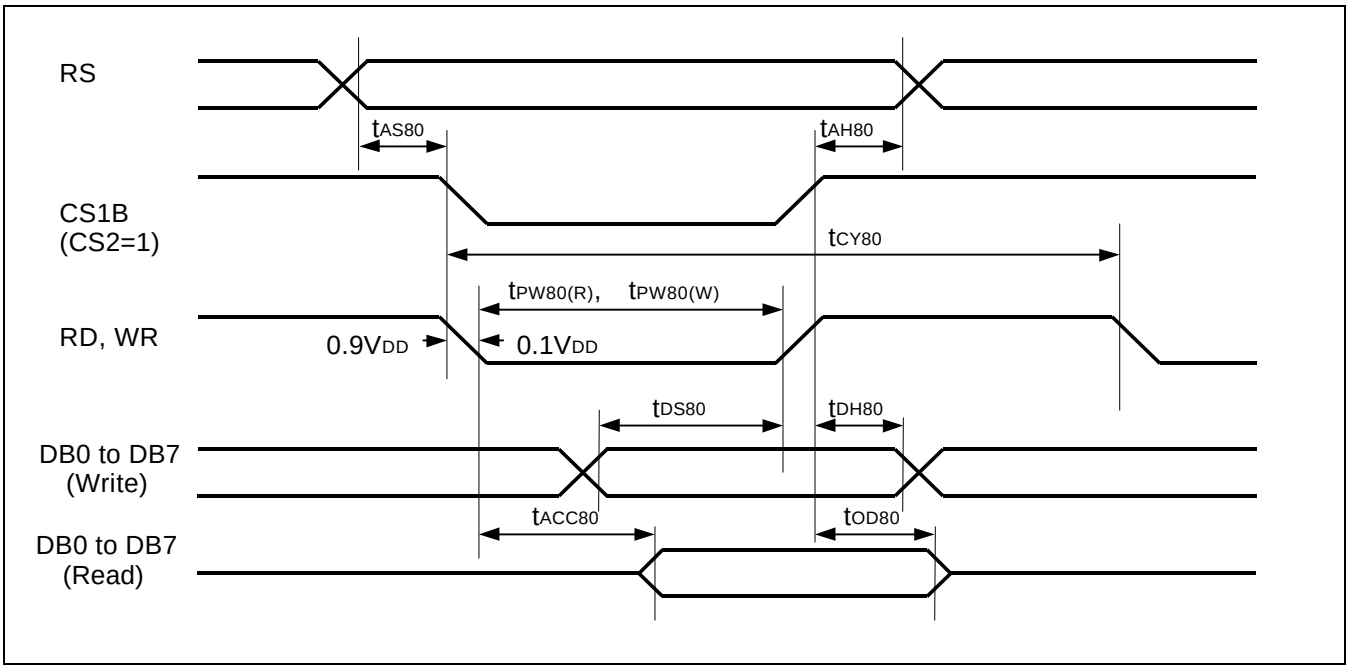


Figure 34. Read / Write Characteristics (8080-series MPU)

(V_{DD} = 2.4 to 3.6V, Ta = -40 to +85°C)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	RS	t_{AS80} t_{AH80}	13 17	-	-	ns	
System cycle time	RS	t_{CY80}	400	-	-	ns	
Pulse width (WR)	RW_WR	$t_{PW80\ (W)}$	55	-	-	ns	
Pulse width (RD)	E_RD	$t_{PW80\ (R)}$	125	-	-	ns	
Data setup time Data hold time	DB7 to DB0	t_{DS80} t_{DH80}	35 13	-	-	ns	
Read access time Output disable time		t_{ACC80} t_{OD80}	- 10	-	125 90	ns	C_L = 100 pF

Command Chart for Main LCD

INSTRUCTION TABLE (1)

INSTRUCTION	CODE (80 series I/F)							code								function
	$\overline{CS}$	RS	$\overline{RD}$	$\overline{WR}$	RE_2	RE_1	RE_0	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	
Display data write in	0	0	1	0	0/1	0/1	0/1	Write Data								Write in to display RAM
Display data read out	0	0	0	1	0/1	0/1	0/1	Read Data								Read out from display RAM
X address (lower) [0_H]	0	1	1	0	0	0	0	0	0	0	0	AX_3	AX_2	AX_1	AX_0	X address setting of display RAM.
X address (upper) [1_H]	0	1	1	0	0	0	0	0	0	0	1	AX_7	AX_6	AX_5	AX_4	X address setting of display RAM.
Y address (lower) [2_H]	0	1	1	0	0	0	0	0	0	1	0	AY_3	AY_2	AY_1	AY_0	Y address setting of display RAM.
Y address (upper) [3_H]	0	1	1	0	0	0	0	0	0	1	1	AY_7	AY_6	AY_5	AY_4	Y address setting of display RAM.
Display start line set (lower) [4_H]	0	1	1	0	0	0	0	0	1	0	0	LA_3	LA_2	LA_1	LA_0	RAM Y address setting corresponds to scan start line of common driver.
Display start line set (upper) [5_H]	0	1	1	0	0	0	0	0	1	0	1	LA_7	LA_6	LA_5	LA_4	RAM Y address setting corresponds to scan start line of common driver.
N line inversion set (lower) [6_H]	0	1	1	0	0	0	0	0	1	1	0	N_3	N_2	N_1	N_0	quantity setting of line inversion
N line inversion set (upper) [7_H]	0	1	1	0	0	0	0	0	1	1	1	N_7	N_6	N_5	N_4	quantity setting of line inversion
Display control(1) [8_H]	0	1	1	0	0	0	0	1	0	0	0	SHIFT	MON	ALLON	ON/OFF	SHIFT: common shift direction set, MON: BW/gradation display, ALLON: all on , ON/OFF: display ON/OFF control
Display control(2) [9_H]	0	1	1	0	0	0	0	1	0	0	1	REV	NLIN	SWAP	REF	REV: display positive / negative, NLIN: n line inversion ON/OFF, SWAP: display data swap, REF: segment positive / negative
Increment control [A_H]	0	1	1	0	0	0	0	1	0	1	0	WIN	AIM	AYI	AXI	WIN: window selection, AIM: increment timing selection, AYI:Y increment, AXI:X increment
Power control [B_H]	0	1	1	0	0	0	0	1	0	1	1	AMPON	HALT	DCON	ACL	AMPON: internal OP Amp. ON, HALT: power save DCON: boosting circuit ON, ACL: reset
LCD duty set [C_H]	0	1	1	0	0	0	0	1	1	0	0	DS_3	DS_2	DS_1	DS_0	LCD driver duty ratio set
Boosting coefficient set [D_H]	0	1	1	0	0	0	0	1	1	0	1	*	VU_2	VU_1	VU_0	Boosting times set
bias ratio set [E_H]	0	1	1	0	0	0	0	1	1	1	0	*	B_2	B_1	B_0	LCD drive bias set
RE register set [F_H]	0	1	1	0	0/1	0/1	0/1	1	1	1	1	TST_0	RE_2	RE_1	RE_0	RE flag set

*notice 1) * mark is Don't Care*
notice 2) The contents in [ ] mark are the address for reading the internal register.

Command Chart for Sub LCD

× : Don't care

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Read display data	1	1	Read data								Read data from DDRAM
Write display data	1	0	Write data								Write data into DDRAM
Read status	0	1	BUSY	ADC	ONOFF	RESETB	0	0	0	0	Read the internal status
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn on/off LCD panel When DON = 0: display OFF When DON = 1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM1
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage Mode
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC = 0: normal direction (SEG1→SEG132) When ADC = 1: reverse direction (SEG132→SEG1)
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Select normal / reverse display When REV = 0: normal display When REV = 1: reverse display
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Select normal / entire display ON When EON = 0: normal display. When EON = 1: entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	BIAS	Select LCD bias
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	Release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	×	×	×	Select COM output direction When SHL = 0: normal direction (COM1→COM64) When SHL = 1: reverse direction (COM64→COM1)
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound instruction of display OFF and entire display ON
Test instruction	0	0	1	1	1	1	×	×	×	×	***Don't use this instruction.***

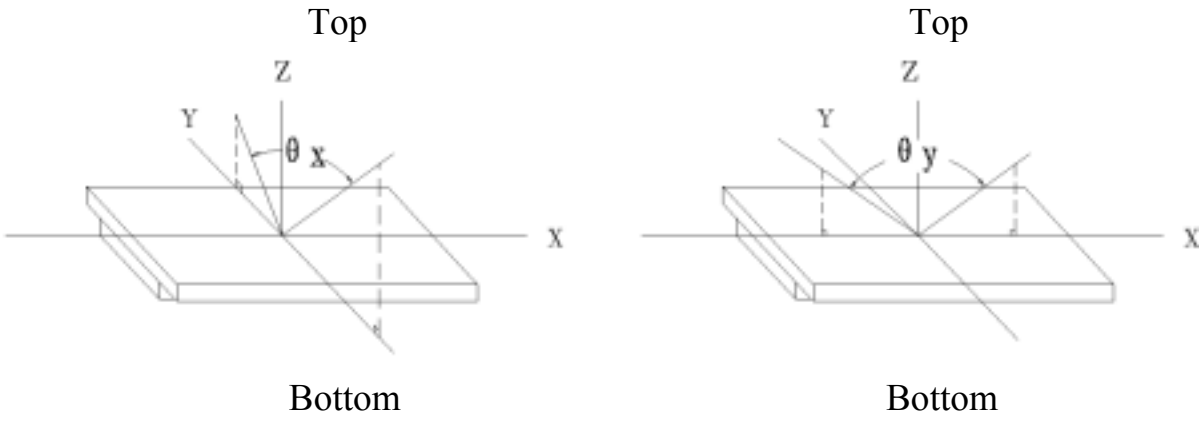
6. Optical Characteristics

6.1 Optical Characteristics V_{LCD}=16.8V Ta=25℃

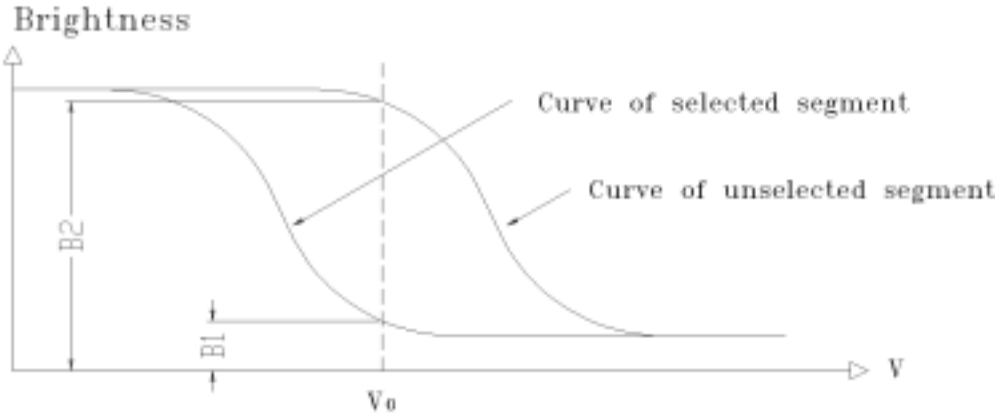
Item		Symbol	Condition			Min.	Typ.	Max.	Unit
Viewing Angle Main LCD		θ_x	Cr≥2	θ_y=0 °	MAIN	-40--+35			Deg
					SUB	-60--36			
		θ_y		θ_x=0 °	MAIN	-30--+30			
					SUB	-42--40			
Contrast Ratio Main LCD		Cr	θ_x=0 ° θ_y=0 °			30	50	60	--
Response Time	Turn on	T_{on}	θ_x=0 ° θ_y=0 °			-	-	150	ms
	Turn off	T_{off}				-	-	100	
Color Of CIE Coord-Inate	Red	x	θ_x=0 ° θ_y=0 °			-	TBD	-	-
		y				-	TBD	-	-
	Green	x	θ_x=0 ° θ_y=0 °			-	TBD	-	-
		y				-	TBD	-	-
	Blue	x	θ_x=0 ° θ_y=0 °			-	TBD	-	-
		y				-	TBD	-	-

6.2 Definition of Optical Characteristics

6.2.1 Definition of Viewing Angle



6.2.2 Definition of Contrast Ratio

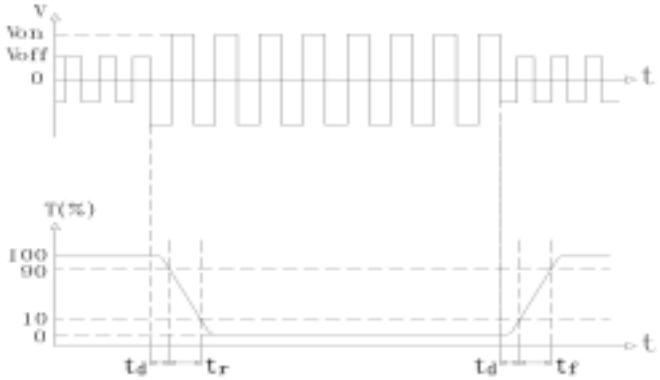


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25℃ ; 2) Frame frequency: 70.0Hz

6.2.3 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:MAIN-LCD 13.1V SUB-LCD 9V

2) Frame frequency: 70.0Hz

6.3 Brightness Characteristic(main)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness	Bp	Ta=25℃±3℃ 30-80%RH	100	-	-	cd/m^2
Uniformity	△Bp		-	-	80	%

Note:

1. The data is measured after CCFLs are turned on for 5 minutes.
2. Testing conditions LED: V_{LED} =10.0V (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

7. Reliability

7.1 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℃±2℃ 240H Restore 4H at 25℃
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30℃±2℃ 240H Restore 4H at 25℃
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	80℃±2℃ 240H Restore 4H at 25℃
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-30℃±2℃ 240H Restore 4H at 25℃
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	70℃±2℃ 90%RH 240H Restore 4H at 25℃
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 Restore 4H at 25℃
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 Restore 2H

7.2 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									

8. 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						

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

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

9.1.2 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.

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

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

9.1.5 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

9.1.6 Do not attempt to disassemble the LCD Module.

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

9.1.8 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.

9.2 Storage precautions

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

9.2.2 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℃

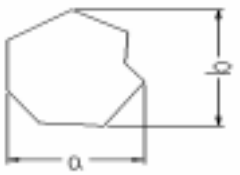
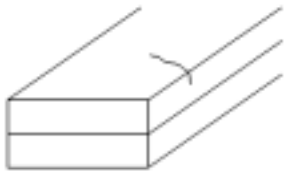
Relatively humidity: ≤80%

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

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

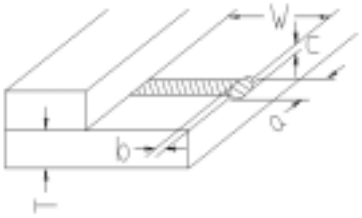
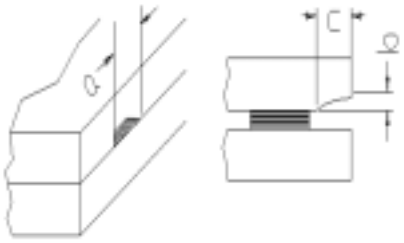
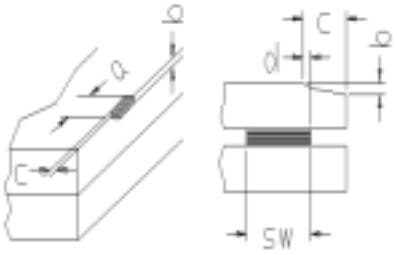
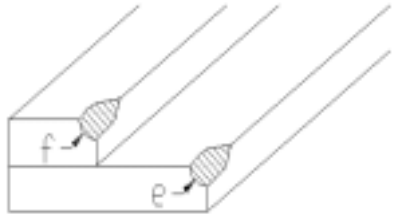
Appendix A

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>

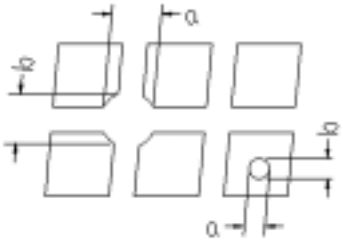
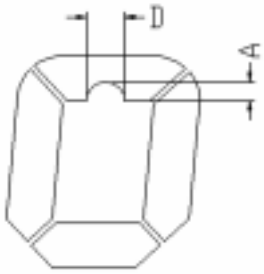
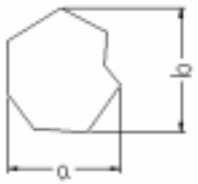
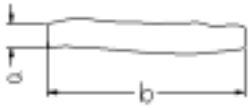
Appendix A

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>

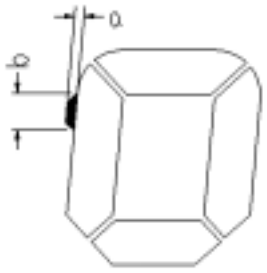
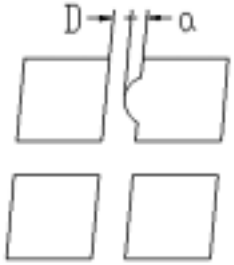
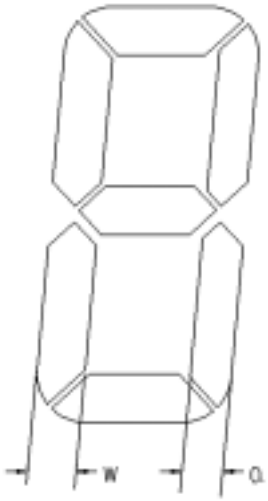
Appendix B

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="3">  </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>  </td><td>Not counted</td><td>Max.2 dots allowed</td></tr>
<tr><td colspan="2">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="4">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><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>