

SPECIFICATION FOR LCD MODULE

Model No. TM0255AKFW

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

TIANMA MICROELECTRONICS CO., LTD

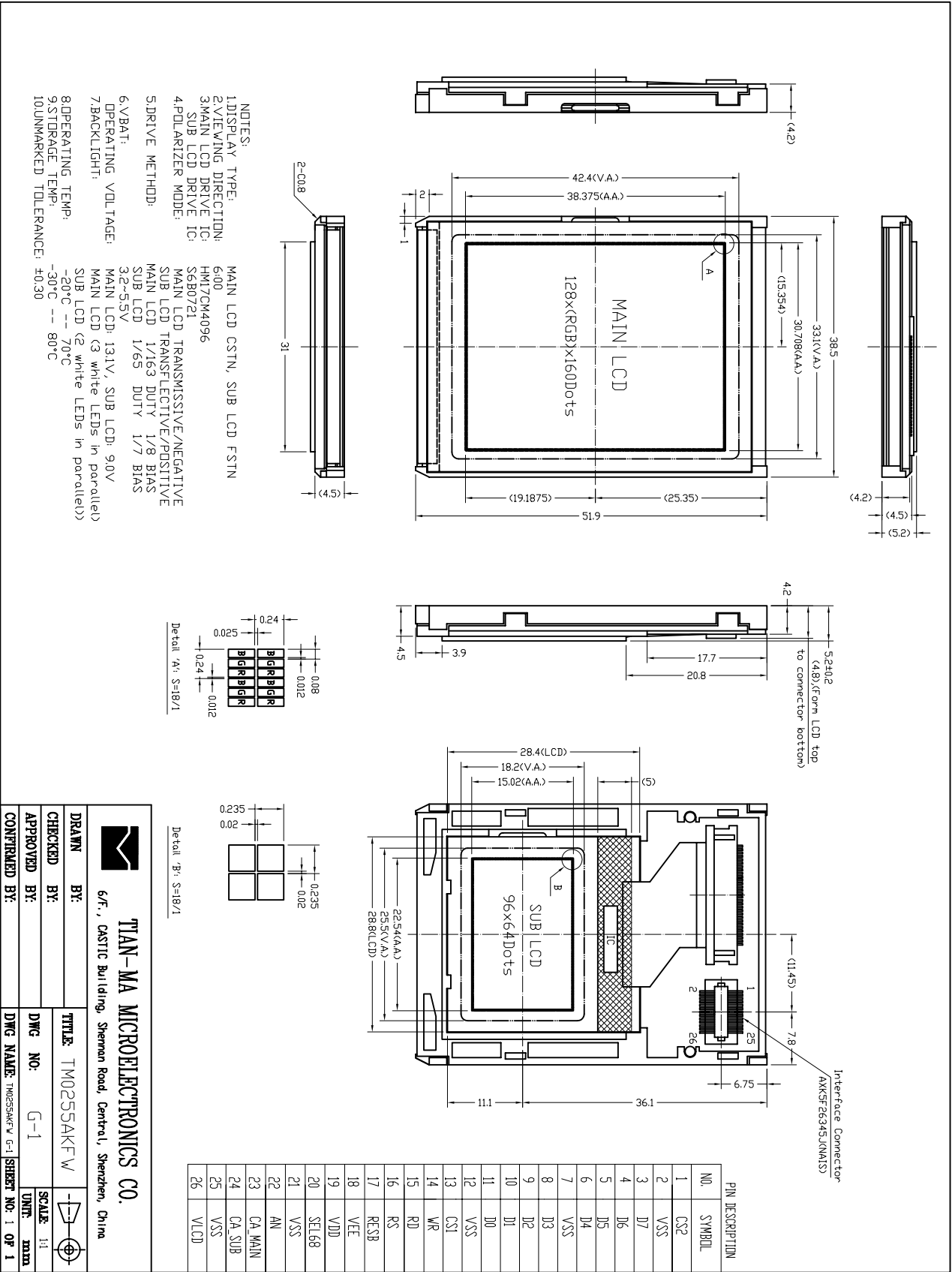
REVISION RECORD

Date	Ver.	Ref. Page	Revision No.	Revision Items

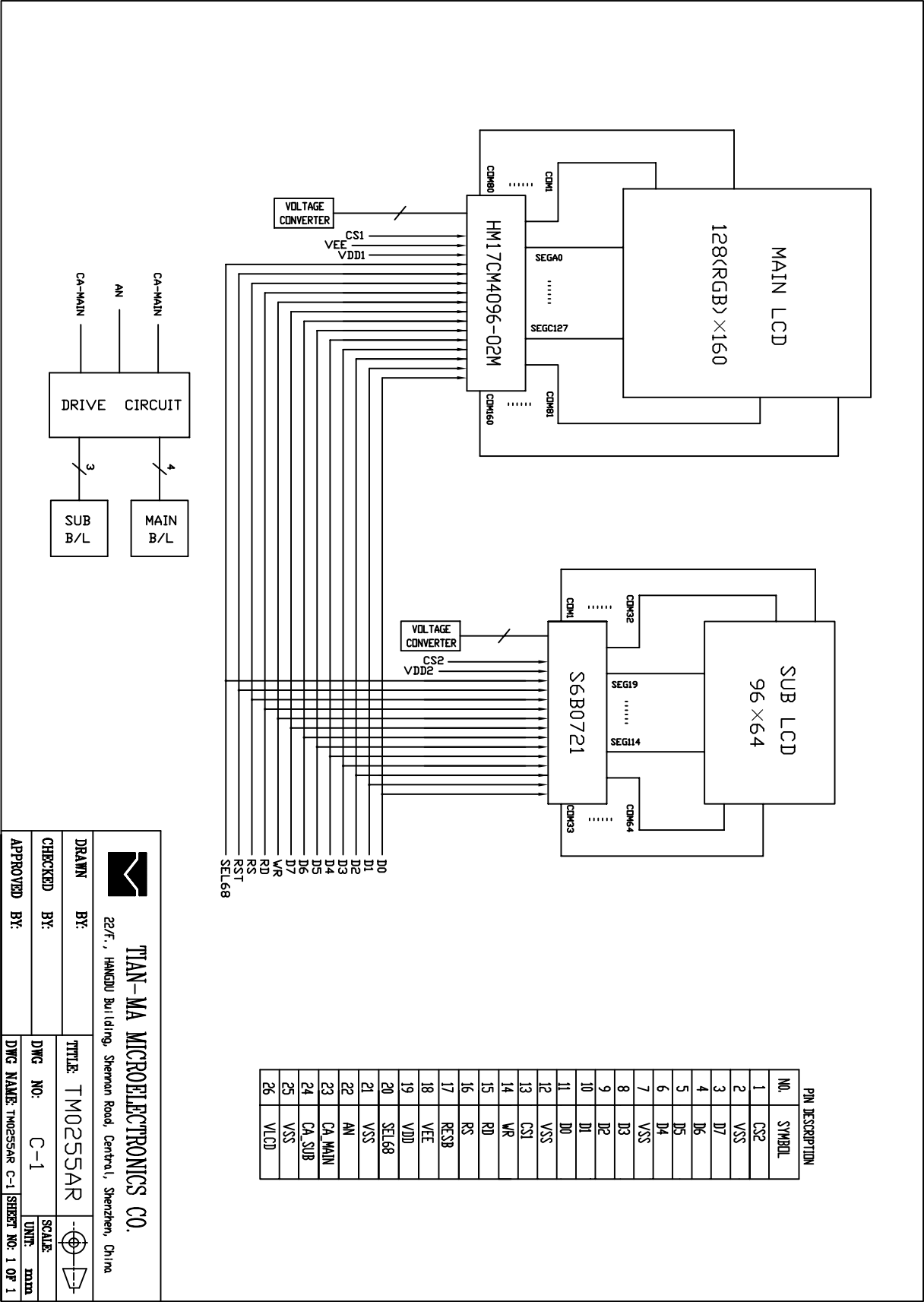
1 General Specifications:

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
DOPE 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



3. Circuit Block Diagram



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	
Storage temperature	Tst	-30	+80	

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently 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 (V_{SS}=0V, T_a=25 °C)

5.1 Electrical characteristics

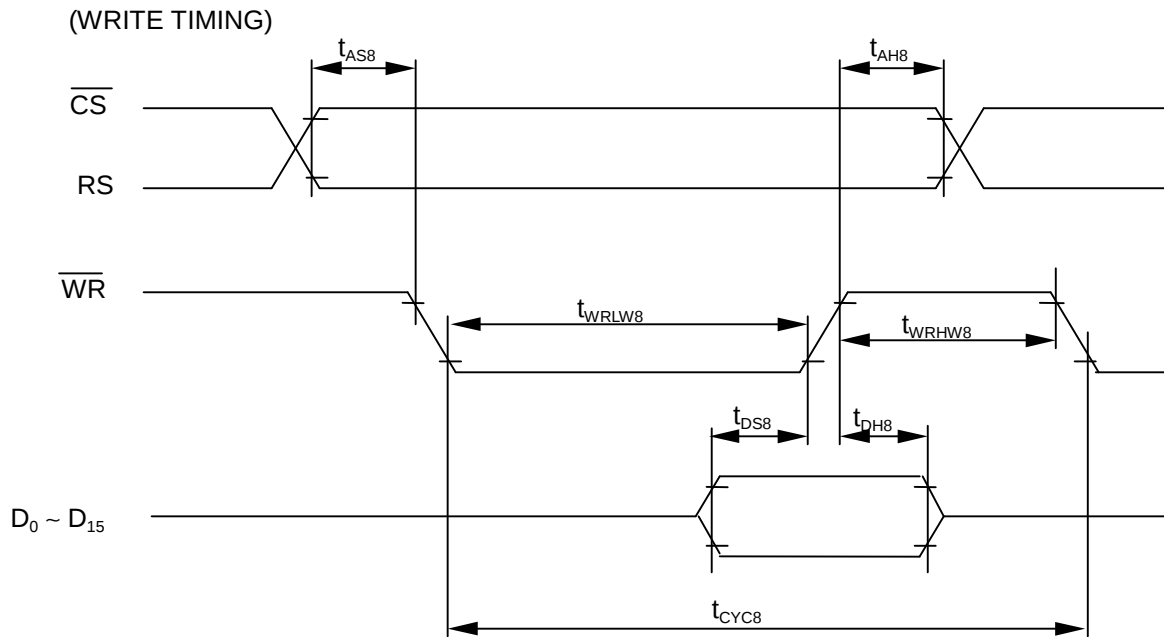
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for logic	VBATT	---	3.2	3.8	5.5	V
Operation voltage for main LCD	VLCD1	25	2.4	3.0	3.3	V
Operation voltage for SUB LCD	VLCD2	25	2.4	3.0	3.3	V
Input voltage'H' Level	V _{IH}	LCD_VCC=3.0V	0.8VDD	---	LCD_VCC	V
Input voltage'L' Level	V _{IL}	LCD_VCC=3.0V	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)



($V_{DD}=2.5\sim 3.3V$, $T_a=-30\sim +85^{\circ}C$)

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

($V_{DD}=2.2\sim 2.5V$, $T_a=-30\sim +85^{\circ}C$)

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

($V_{DD}=1.7\sim 2.2V$, $T_a=-30\sim +85^{\circ}C$)

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

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

Interface Timing Chart for Sub LCD

Read / Write Characteristics (8080-series MPU)

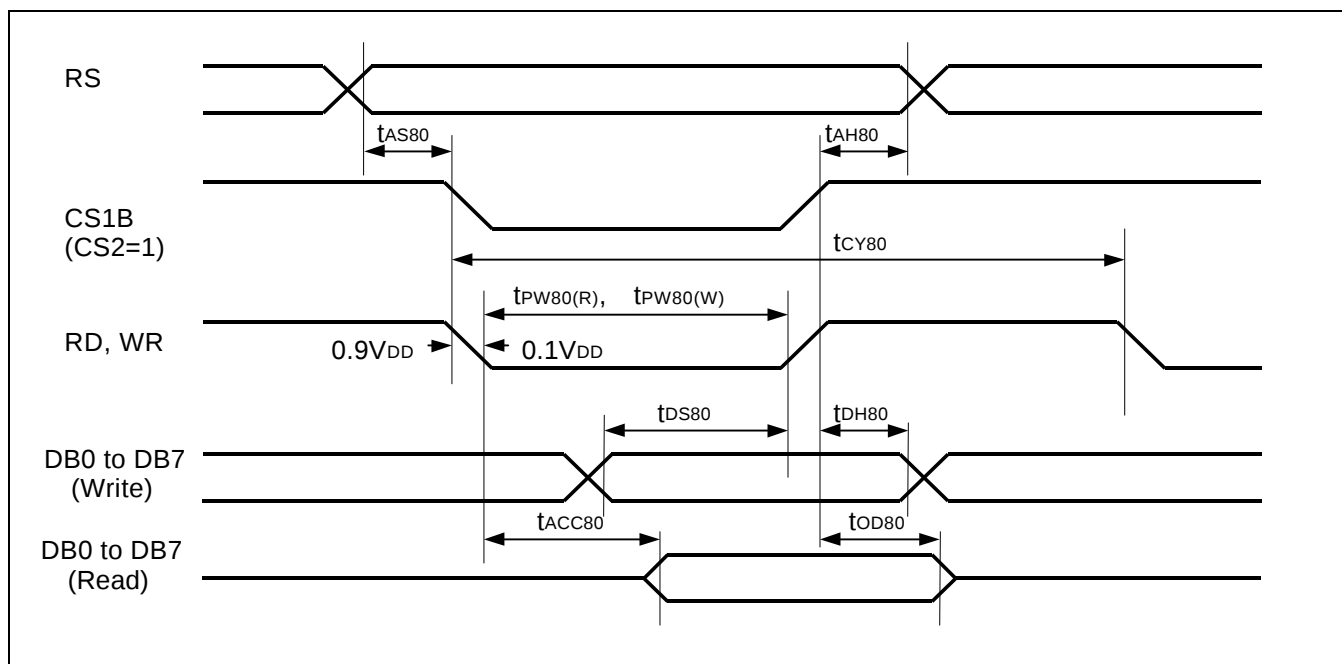


Figure 34. Read / Write Characteristics (8080-series MPU)

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

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time	RS	tAS80	13	-	-	ns	
Address hold time	RS	tAH80	17	-	-	ns	
System cycle time	RS	tCY80	400	-	-	ns	
Pulse width (WR)	RW_WR	tPW80 (W)	55	-	-	ns	
Pulse width (RD)	E_RD	tPW80 (R)	125	-	-	ns	
Data setup time	DB7 to DB0	tDS80	35	-	-	ns	
Data hold time		tDH80	13	-	-	ns	
Read access time		tACC80	-	-	125	ns	C _L = 100 pF
Output disable time		tOD80	10	-	90	ns	

Command Chart for Main LCD

INSTRUCTION TABLE (1)

INSTRUCTION	CODE (80 series I/F)							code								function
	CS	RS	RD	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	SHI FT	MO N	ALL ON	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	RE V	NL IN	SW AP	RE F	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	AMP ON	HA LT	DC ON	AC L	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	ON/OFF	RESET	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	×	×	×	×	<u>Don't use this instruction.</u>

6. Optical Characteristics

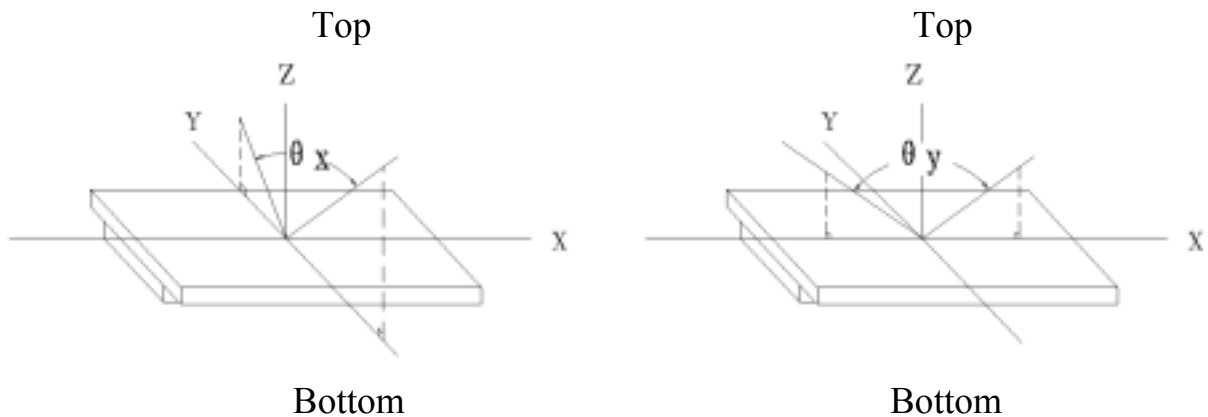
6.1 Optical Characteristics

V_{LCD}=16.8V Ta=25

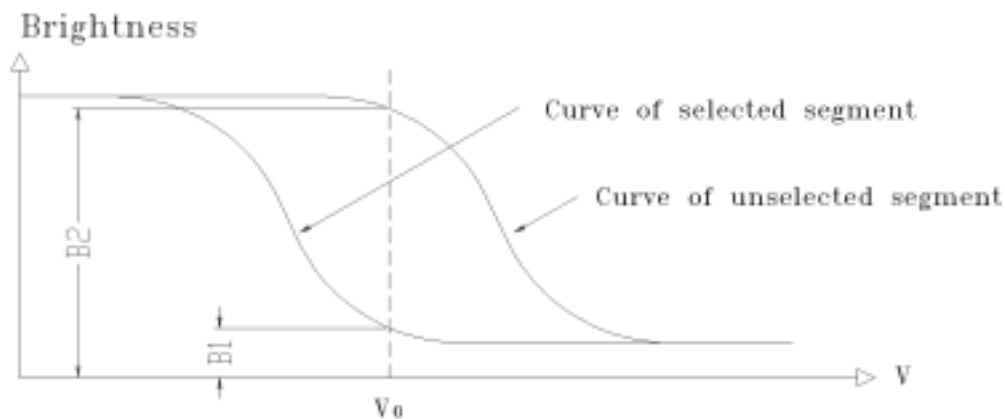
Item		Symbol	Condition			Min.	Typ.	Max.	Unit
Viewing Angle Main LCD		θ_x	$C_r \geq 2$	$\theta_y = 0^\circ$	MAIN	-40--+35			Deg
					SUB	-60--36			
		θ_y		$\theta_x = 0^\circ$	MAIN	-30--+30			
					SUB	-42--40			
Contrast Ratio Main LCD		C_r	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$			30	50	60	--
Response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

6.2 Definition of Optical Characteristics

6.2.1 Definition of Viewing Angle



6.2.2 Definition of Contrast Ratio

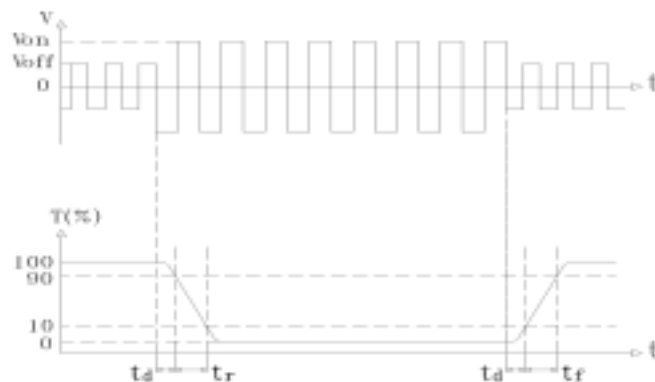


$$\text{Contrast Ratio} = B_2/B_1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

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	100	-	-	cd/m ²
Uniformity	Bp	30-80%RH	-	-	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)
 $Bp = Bp \text{ (Min.)} / Bp \text{ (Max.)} \times 100 \text{ (\%)}$
 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 $-30 \xleftrightarrow{30\text{min}} 25 \xleftrightarrow{5\text{min}} 80 \xleftrightarrow{30\text{min}} 25 \xleftrightarrow{5\text{min}}$ ← ----- 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

Inspection						
Examination or Test	At T _a =25 (unless otherwise stated)	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

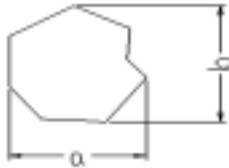
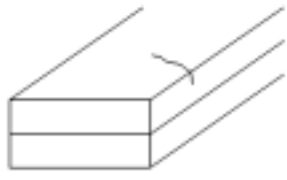
Relatively humidity: ≤ 80%

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.

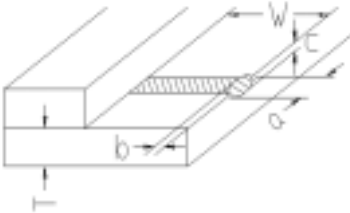
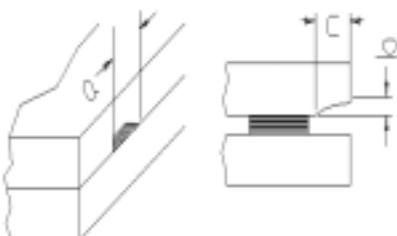
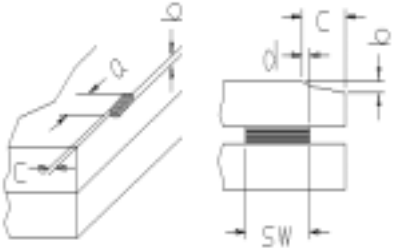
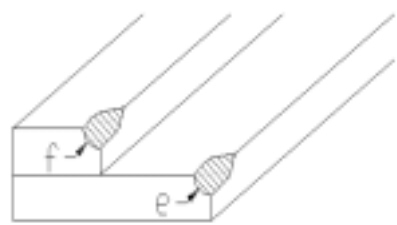
Appendix A

Inspection items and criteria for appearance defects

Items	Contents	Criteria		
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
		$X < 0.2\text{mm}$	$0.2\text{mm} \leq X \leq 0.5\text{mm}$	
		$X = (a+b)/2$		
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		

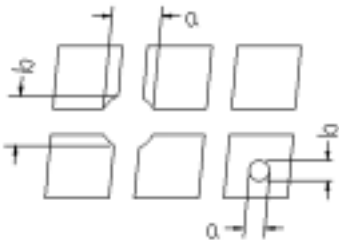
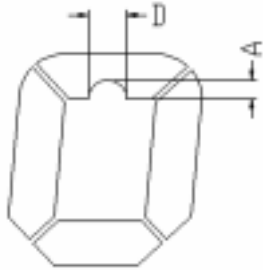
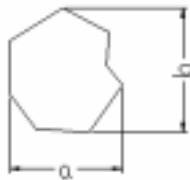
Appendix A

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	

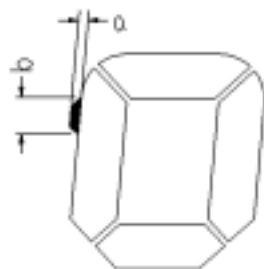
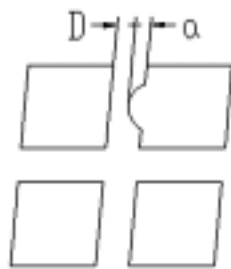
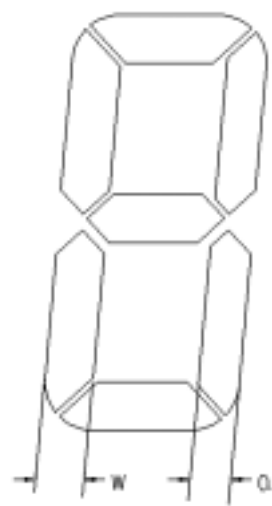
Appendix B

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 radio 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<0.1mm	0.1mm ≤ X ≤ 0.2mm	
		X=(a+b)/2		
		Not counted	Max.2 dots allowed	
		A<0.1mm	0.1mm ≤ A ≤ 0.2mm D<0.25mm	
Black spot (in viewing area)		Not counted	Max.3 spots allowed	Max.3 spots (lines) allowed
		X<0.1mm	0.1mm ≤ X ≤ 0.2mm	
		X=(a+b)/2		
Black line (in viewing area)		Not counted	Max.3 lines allowed	
		a<0.02mm	0.02mm ≤ a ≤ 0.05mm b ≤ 0.5mm	

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=measured value of width W=nominal value of width		