SPECIFICATION FOR LCD MODULE

Model No. <u>TM10032ABC</u>

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

TIANMA MICROELECTRONICS CO., LTD

REVISION RECORD

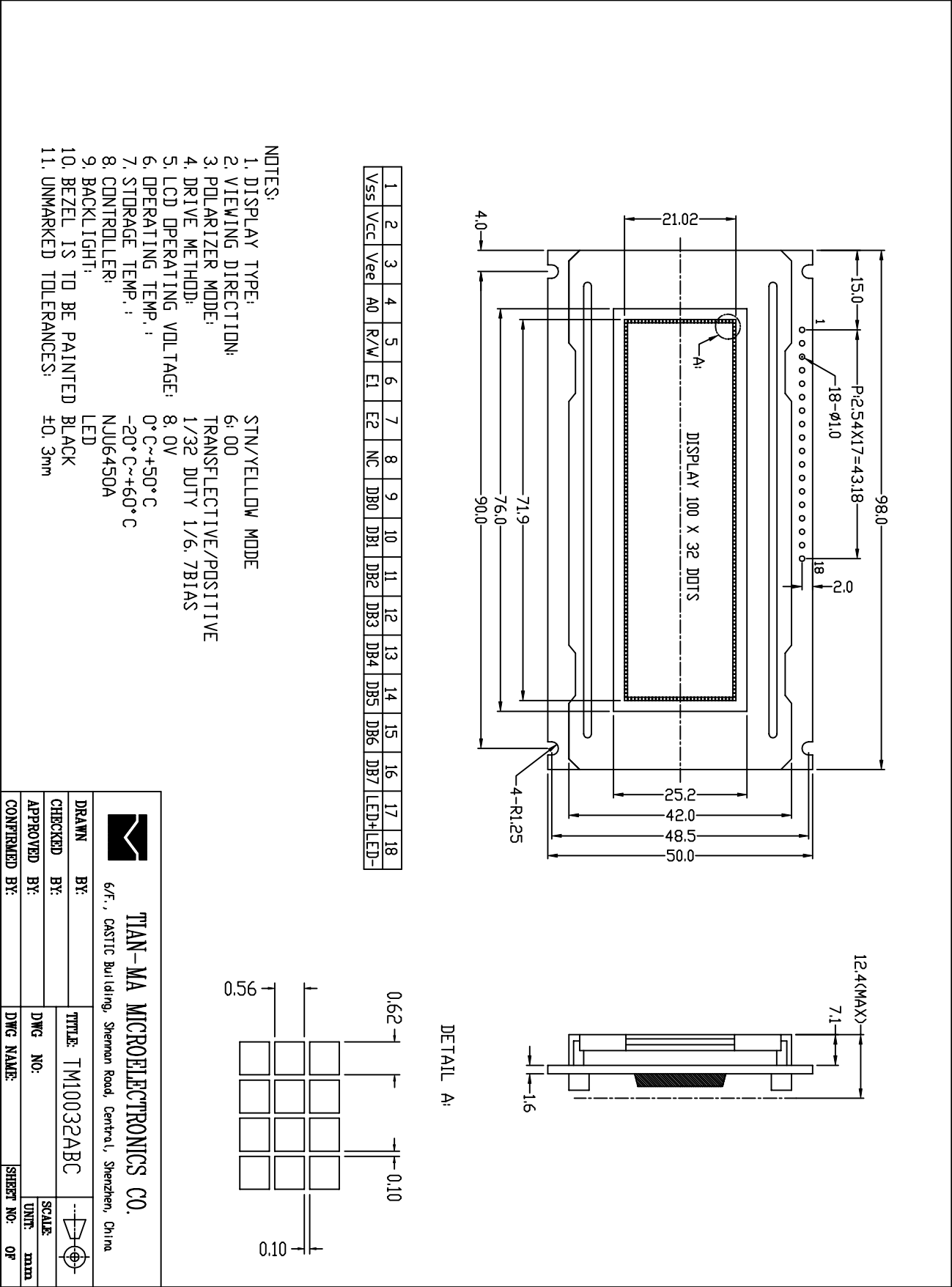| Date	Ref. Page	Revision No.	Revision Items	Check & Approval

1. General Specifications:

1.1 Display type: STN

1.2 Display color*[1]:

      Display color: Blue-Black

      Background*[2]:   Yellow

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Method: 1/32 Duty 1/6.7 Bias

1.6 Backlight: LED

1.7 Controller: NJU6450A

1.8 Data Transfer: 8 Bit Parallel

1.9 Operating Temperature: $0----+50℃$

    Storage Temperature: $-20----+60℃$

1.10 Outline Dimensions: Refer to outline drawing on next page

1.11 Dot Matrix: 100 X 32 Dots

1.12 Dot Size: 0.62 X 0.56(mm)

1.13 Dot Pitch: 0.72 X 0.66 (mm)
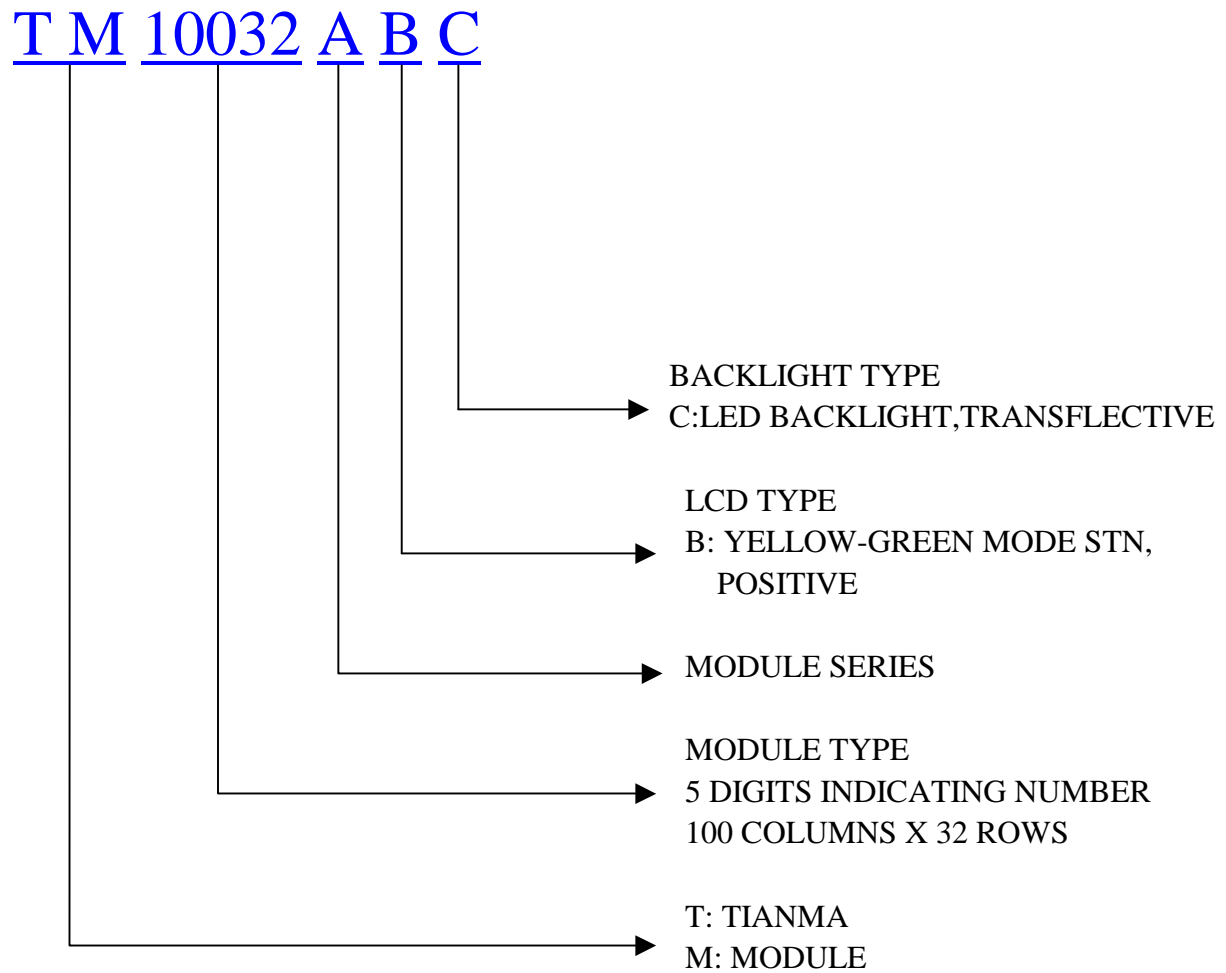
1.14 Weight: 65g(Approx.)

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

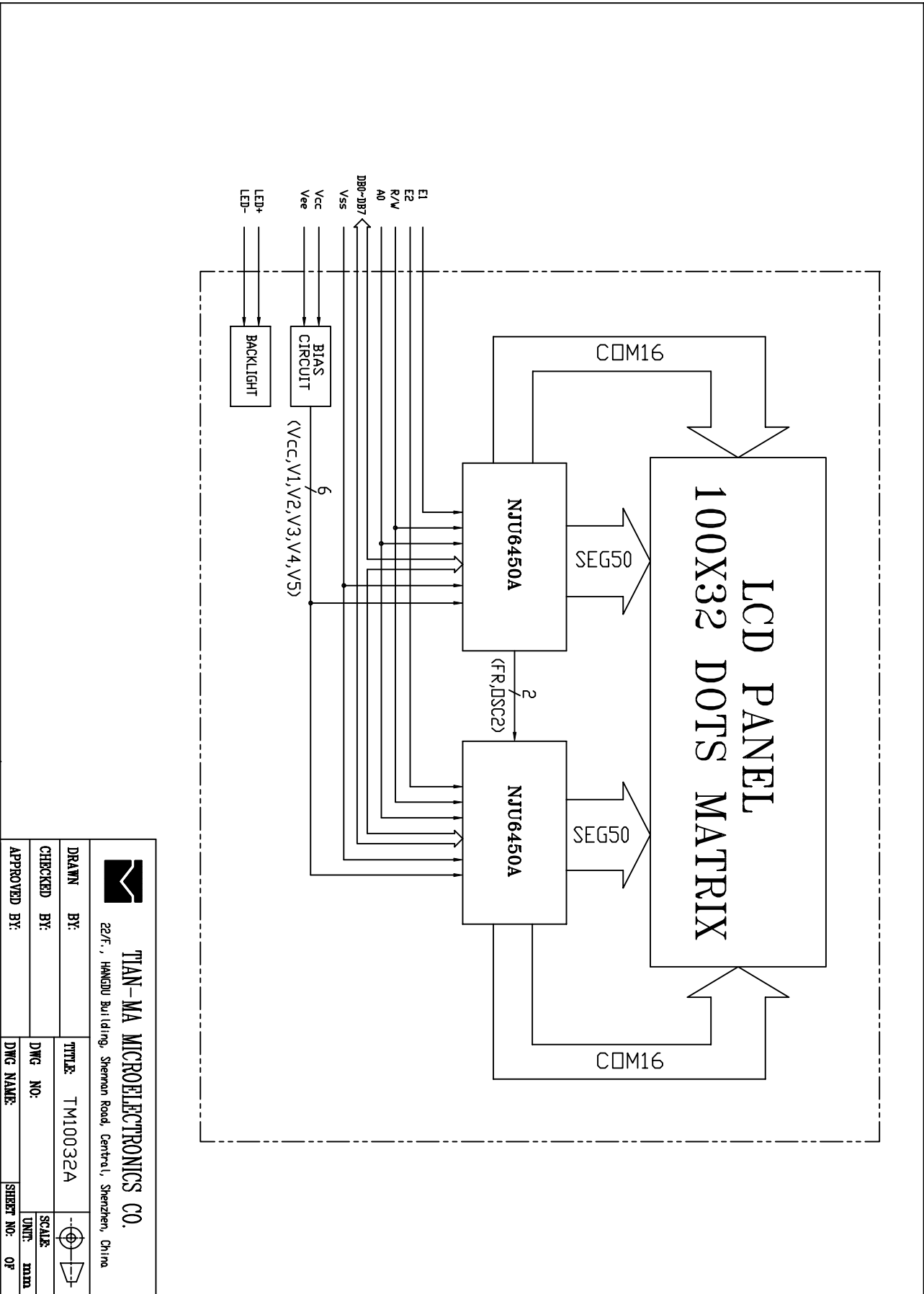   *[2] Color tone will be changed by backlight.

2. Outline Drawing

NOTES:
1. DISPLAY TYPE: STN/YELLOW MODE
2. VIEWING DIRECTION: 6:00
3. POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4. DRIVE METHOD: 1/32 DUTY 1/6.7BIAS
5. LCD OPERATING VOLTAGE: 8.0V
6. OPERATING TEMP.: 0°C~+50°C
7. STORAGE TEMP.: -20°C~+60°C
8. CONTROLLER: NJU6450A
9. BACKLIGHT: LED
10. BEZEL IS TO BE PAINTED BLACK
11. UNMARKED TOLERANCES: ±0.3mm

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Vss	Vcc	Vee	A0	R/W	E1	E2	NC	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-

DISPLAY 100 X 32 DOTS

A:

P:2.54X17=43.18
18-φ1.0

4.0
15.0
90.0
76.0
71.9
21.02
25.2
42.0
48.5
50.0
98.0
2.0
4-R1.25

DETAIL A:

0.56
0.62
0.10
0.10

12.4(MAX)
7.1
1.6

TIAN-MA MICROELECTRONICS CO.
6/F., CASTIC Building, Shennan Road, Central, Shenzhen, China

DRAWN	BY:
CHECKED	BY:
APPROVED	BY:
CONFIRMED BY:	

TITLE: TM10032ABC
DWG NO:
DWG NAME:
SHEET NO: OF
SCALE:
UNIT: mm

3. LCD Module Part Numbering System

T M 10032 A B C

BACKLIGHT TYPE
C:LED BACKLIGHT,TRANSFLECTIVE

LCD TYPE
B: YELLOW-GREEN MODE STN,
POSITIVE

MODULE SERIES

MODULE TYPE
5 DIGITS INDICATING NUMBER
100 COLUMNS X 32 ROWS

T: TIANMA
M: MODULE

4. Circuit Block Diagram

LED+
LED−
Vcc
Vee
Vss
DB0-DB7
A0
R/W
E2
E1

BACKLIGHT

BIAS CIRCUIT

(Vcc,V1,V2,V3,V4,V5)

6

NJU6450A

NJU6450A

SEG50

SEG50

(FR,OSC2)

2

COM16

COM16

LCD PANEL 100X32 DOTS MATRIX

TIAN-MA MICROELECTRONICS CO.

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

DRAWN	BY:	TITLE:	TM10032A	
CHECKED	BY:	DWG NO:		SCALE:
APPROVED	BY:	DWG NAME:		UNIT: mm
				SHEET NO: OF

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	7.0	V	
LCD Driving Voltage	V_{LCD}	-0.3	13.0		
Operating Temperature Range	T_{OP}	0	+50	℃	No Condensation
Storage Temperature Range	T_{ST}	-20	+60		

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	4.5	5.0	5.5	V
Supply Voltage (LCD Drive)		V_{LCD}	-	8.0	-	V
Input Signal Voltage	High	V_{IH} （V_{DD}=5.0）	$0.7V_{DD}$	-	V_{DD}+0.3	V
	Low	V_{IL} （V_{DD}=5.0）	-0.3	-	$0.2V_{DD}$	V
Supply current (Logic)		I_{DD} （V_{DD}-V_{SS} =5.0）	-	-	5.0	mA
Supply current (LCD Drive)		I_{EE}	-	-	1.0	mA
Supply current (LED)		I_{LED}	-	-	366.4	mA

6.2 Interface Signals

Pin No.	Symbol	Level	Description
1	Vss	0V	Ground
2	Vcc	5.0V	Power supply voltage for logic and LCD(+)
3	Vee	-3.0V	Power supply voltage for LCD(-)
4	A0	H/L	H: Display Data L: Instructions
5	R/W	H/L	Read/Write Select Signal (H: Read, L: Write)
6	E1	H/L	Read/Write enable Signal for IC1 (Active at "H")
7	E2	H/L	Read/Write enable Signal for IC2 (Active at "H")
8	NC	-	No signal
9	DB0	H/L	Data Bus Line
10	DB1	H/L	Data Bus Line
11	DB2	H/L	Data Bus Line
12	DB3	H/L	Data Bus Line
13	DB4	H/L	Data Bus Line
14	DB5	H/L	Data Bus Line
15	DB6	H/L	Data Bus Line
16	DB7	H/L	Data Bus Line
17	LED+	4.2V	Power supply voltage for LED(+)
18	LED-	0	Power supply voltage for LED(-)

6.3 Interface Timing Chart

AC Characteristics(V_{DD}=4.5V~5.5V,Ta=-20~+75℃)

○ **System bus read/write I (80 family MPU)**
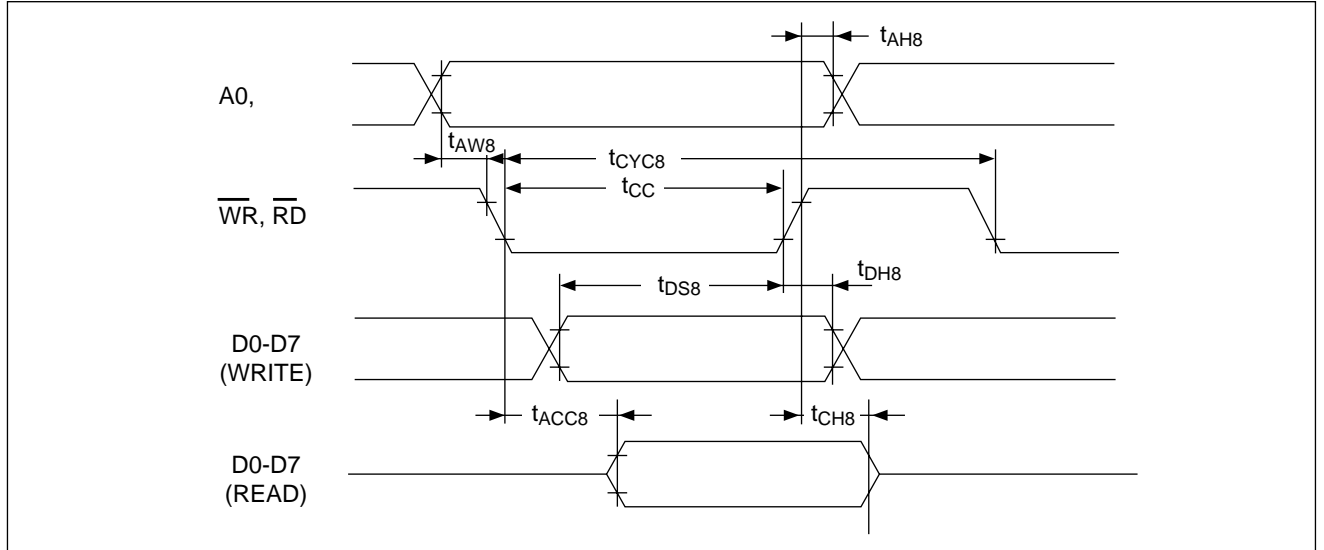
Characteristic	Signal	Symbol	Condition	Min.	Max.	Unit
Address hold time	A0,	t_{AH8}		10	—	ns
Address setup time		t_{AW8}		20	—	ns
System cycle time	$\overline{WR}, \overline{RD}$	t_{CYC8}		1000	—	ns
Control pulse width		t_{CC}		200	—	ns
Data setup time		t_{DS8}		80	—	ns
Data hold time	D0 to D7	t_{DH8}		10	—	ns
RD access time		t_{ACC8}	C_L=100pF	—	90	ns
Output disable time		t_{CH8}		10	60	ns

*1 The rise or fall time of input signals should be less than 15ns.

○ System bus read/write II (68 family MPU)
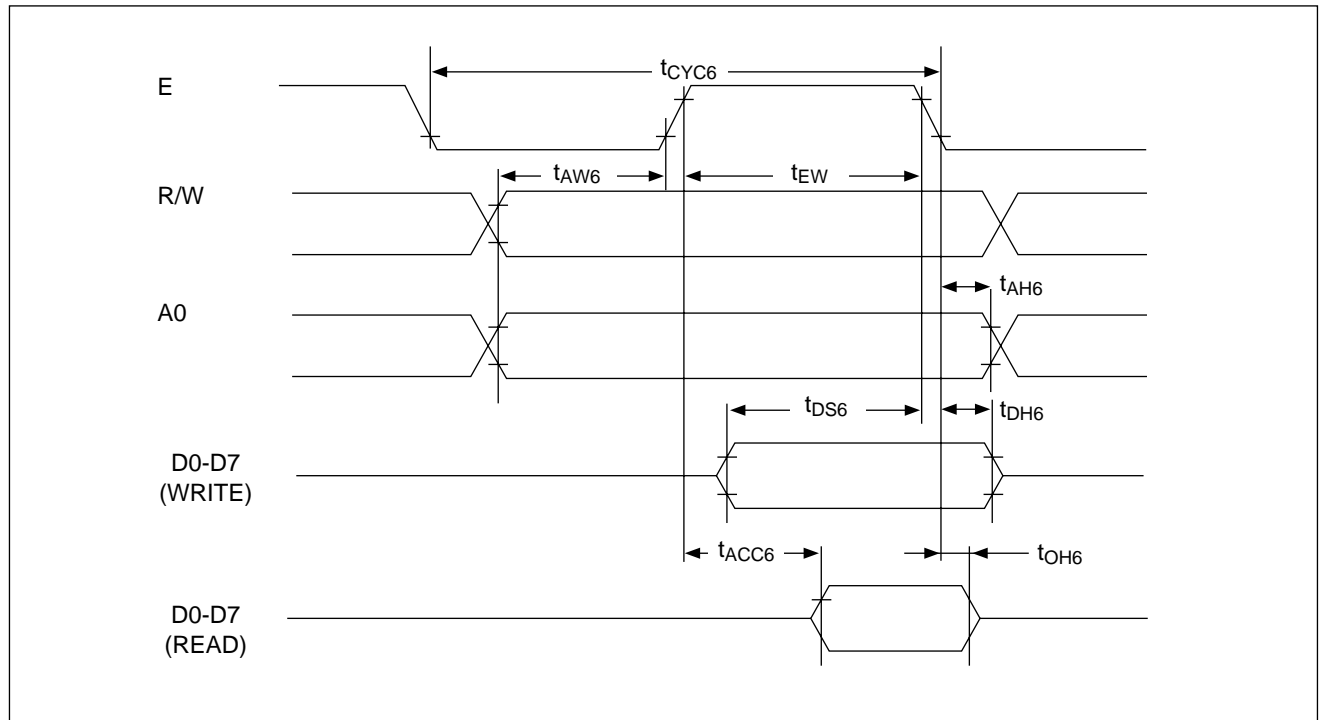
Characteristic		Signal	Symbol	Condition	Min.	Max.	Unit
System cycle time		A0	t_{CYC6}		1000	—	ns
Address setup time		R/W	t_{AW6}		20	—	ns
Address hold time			t_{AH6}		10	—	ns
Data setup time			t_{DS6}		80	—	ns
Data hold time		D0 to D7	t_{DH6}		10	—	ns
Output disable time			t_{OH6}	C_L=100pF	10	60	ns
Access time			t_{ACC6}		—	90	ns
Enable Pulse width	Read	E	t_{EW}		100	—	ns
	Write				80	—	ns

*1 The rise or fall time of input signals should be less than 15ns.

Command	RD̄	W̄R̄	A0	D7	D6	D5	D4	D3	D2	D1	D0	Command description
Display On/Off	1	0	0	1	0	1	0	1	1	1	0/1	Switch the entire display on or off
Display Start Line	1	0	0	1	1	0	Display start line					Determine the line of RAM data to be displayed at the display top line(COM0)
Page Address Set	1	0	0	1	0	1	1	1	0	Page (0-3)		Sets the page of the display RAM in the page address register
Column(SEG) Address Set	1	0	0	0	0	Column Address (0 - 79)						Set the column address of the display RAM in the column address register
Status Read	0	1	0	Busy	ADC	ON/OFF	RESET	0	0	0	0	Read the status
Write Display Data	1	0	1	Write Data								Write Data on the data bus to RAM
Read Display Data	0	1	1	Read Data								Read Data on the data bus to RAM
ADC Select	1	0	0	1	0	1	0	0	0	0	0/1	Used to reverse the correspondence between the display RAM's column addresses and segment driver output ports (0:forwaed 1:reverse)
Static Drive On/Off	1	0	0	1	0	1	0	0	1	0	0/1	Select normal display operation or static all-lit drive display operation (0::normal 1:static drive*)
Duty Select	1	0	0	1	0	1	0	1	0	0	0/1	Select the duty factor for driving LCD cells (0;1/16 1;1/32)
Read Modify Write	1	0	0	1	1	1	0	0	0	0	0	Increment the column address counter by one only when display data is written but not when it is read
End	1	0	0	1	1	1	0	1	1	1	0	Cancel the read modify write mode
Reset	1	0	0	1	1	1	0	0	0	1	0	Reset the display
Power Save (Dual command)	1	0	0	1	0	1	0	1	1	1	0	Set the power save mode by selecting Display off and Static Driving on
	1	0	0	1	0	1	0	0	1	0	1	

7. Optical Characteristics

7.1 Optical Characteristics   Ta=25℃

Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		θ_x	$C_r \geq 2$	$\theta_y=0°$	-35	--	20	Deg
		θ_y		$\theta_x=0°$	-30	--	30	
Contrast Ratio		C_r	$\theta_x=0°$ $\theta_y=0°$		4.0	-	-	
Response Time	Turn on	T_{on}	$\theta_x=0°$ $\theta_y=0°$		-	-	250	ms
	Turn off	T_{off}			-	-	250	

7.2 Definition of Optical Characteristics
7.2.1 Definition of Viewing Angle

Top   Top
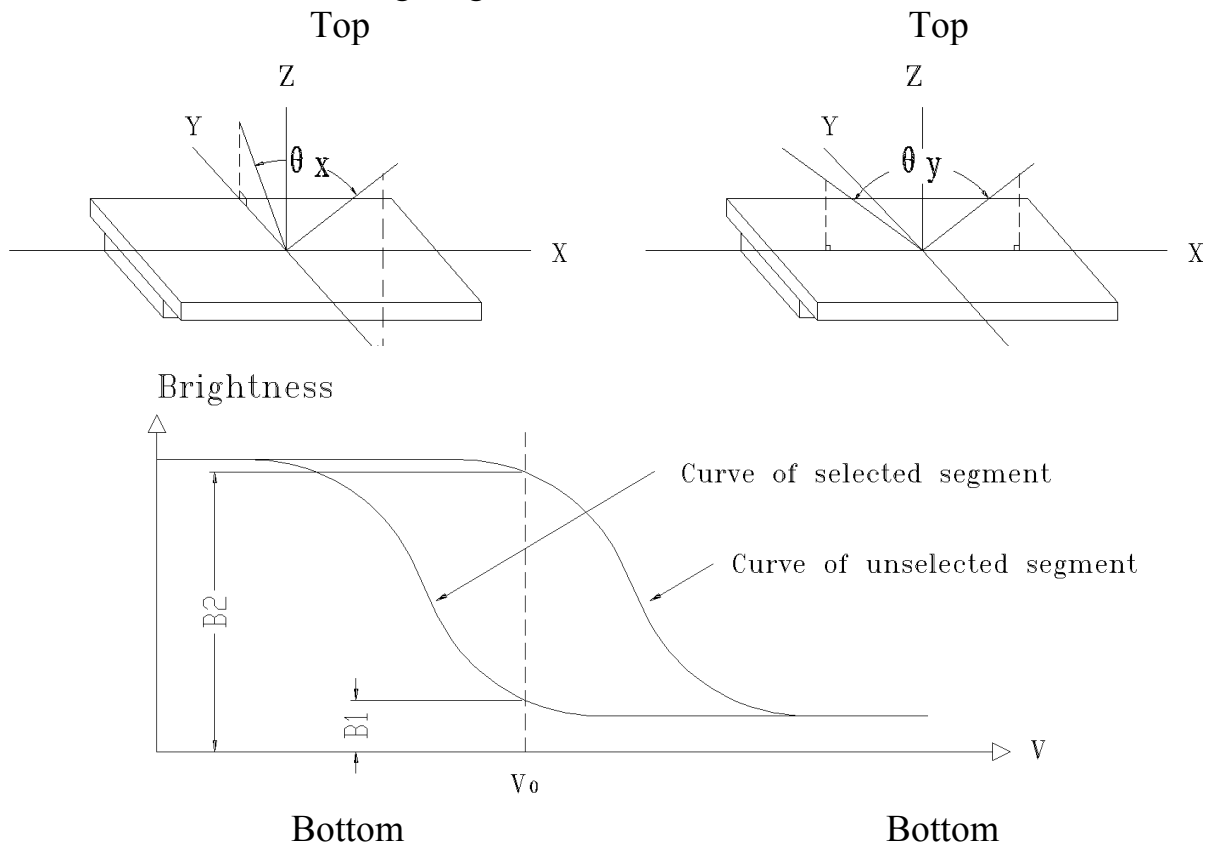
7.2.2 Definition of Contrast Ratio

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

Measuring Conditions:

1) Ambient Temperature: 25℃ ;   2) Frame frequency: 64.0Hz

7.2.3 Definition of Response time
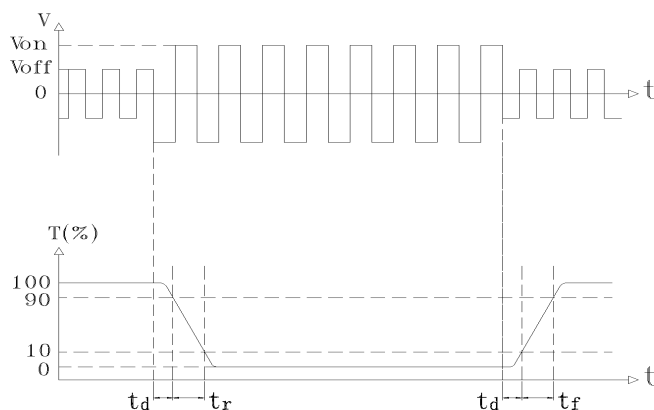
Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_f$

Measuring Condition:

1) Operating Voltage: 8.0V   2) Frame frequency: 64.0Hz

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	60℃ 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20℃ 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	50℃ 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0℃ 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40℃ 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $-20℃\longleftrightarrow25℃\longleftrightarrow60℃\longleftrightarrow25℃$ 30min 5min 30min 5min $\longleftarrow\quad\quad\quad\quad\quad\longrightarrow$ 1 cycle	-20℃/60℃ 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s^2, 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s^2, 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 16H

8.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgment 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 Ta=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 　　　Minor 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:
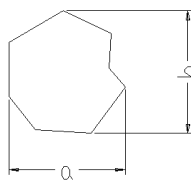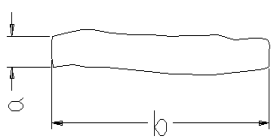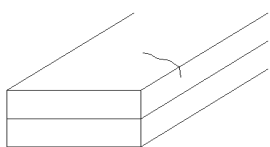
Temperature : 0℃ ～ 40℃

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.
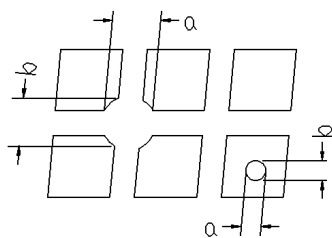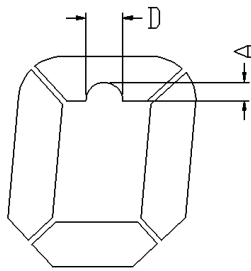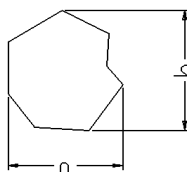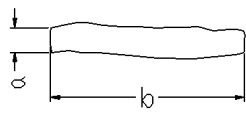
Appendix A

Inspection items and criteria for appearance defects

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	
		φ<0.3mm	0.3mm≤φ≤0.5mm	
	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<0.20mm	0.20mm≤X≤0.5mm	
		X=(a+b)/2		
Black line (in viewing area)		Not counted	Max. 3 lines allowed	
		a<0.02mm	0.02mm≤a≤0.05mm b≤2.0mm	
Progressive cracks		Not permitted		
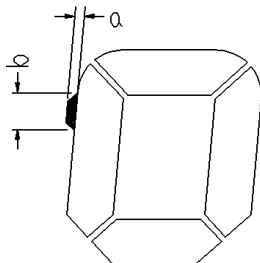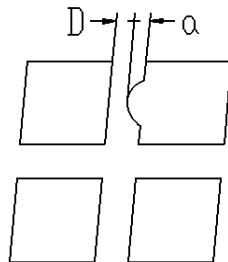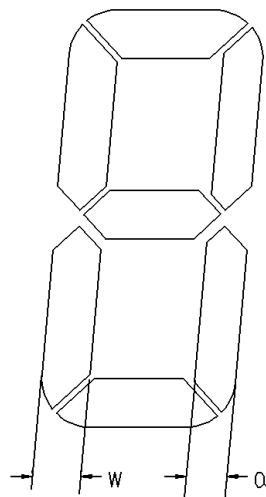
Appendix B
Inspection items and criteria for display defects

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		
Transfor-mation of segment		Not counted	Max. 2 defects allowed	Max.3 defects allowed
		$x<0.1mm$	$0.1mm\leqslant x\leqslant 0.2mm$	
		$x=(a+b)/2$		
		Not counted	Max. 1 defects allowed	
		$a<0.1mm$	$0.1mm\leqslant a\leqslant 0.2mm$ $D>0$	
		Max.2 defects allowed $0.8W\leqslant a\leqslant 1.2W$ a=measured value of width W=nominal value of width		