SPECIFICATION FOR LCD MODULE

Model No. __**TM162JCAWG1**__

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:　　White

1.3 Polarizer mode:　　Reflective/Positive

1.4 Viewing Angle:　　6:00

1.5 Driving Method:　　1/16 Duty　1/5 Bias

1.6 LCD Operating Voltage: 3.3V

1.7 Logic Voltage:　　　3.3V

1.8 Without Backlight

1.9 Controller:　　　S6A0032X01-B0CY

1.10 Display Fonts:　　5 × 8 dots (1 Character)

1.11 Data Transfer:　　8 Bits Parallel

1.12 Operating Temperature:　-20----+60

　　Storage Temperature:　-30----+70

1.13 Outline Dimensions:　Refer to outline drawing on next page

1.14 Dot Matrix:　　　16 Characters X 2 Lines

1.15 Dot Size:　　　0.55X0.60(mm)

1.16 Dot Pitch:　　　0.60X0.65(mm)

1.17 Weight:　　　　20g (Approx)

　　* Color tone is slightly changed by temperature and driving voltage.
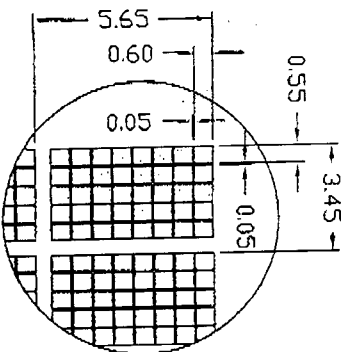
DETAIL A:

FRONT

BLACK SILICONE

UV TAPE

27.70±0.20
19.70±0.20
10.80
4.45
PITCH1.8X13=23.4
0.9
0.9
PITCH3.45X16-0.50=54.70
61.00(MIN V.A)
66.00±0.20
5.65
27.5±0.2
10.0(MAX)
4-R1.0
2.50
15.70(MIN V.A)
10.0
1.0(MAX)
2.00(MAX)
0.70±0.10
0.70±0.10
0.3
9.45±0.50

5.65
0.60
0.55
0.05
3.45
0.05

NOTES:
1. DISPLAY TYPE: FSTN MODE
2. VIEWING DIRECTION: 6:00
3. POLARIZER MODE: REFLECTIVE/POSITIVE
4. OPERATING TEMP: -20°C--+60°C
5. STORAGE TEMP: -30°C--+70°C
6. VDD: 3.3V
7. LCD OPERATING VOLTAGE: 3.3V
8. DRIVE METHOD: DUTY 1/16 BIAS 1/5
9. CONTROLLER: S6A0032X01-B0CY
10. PIN CONNECTOR
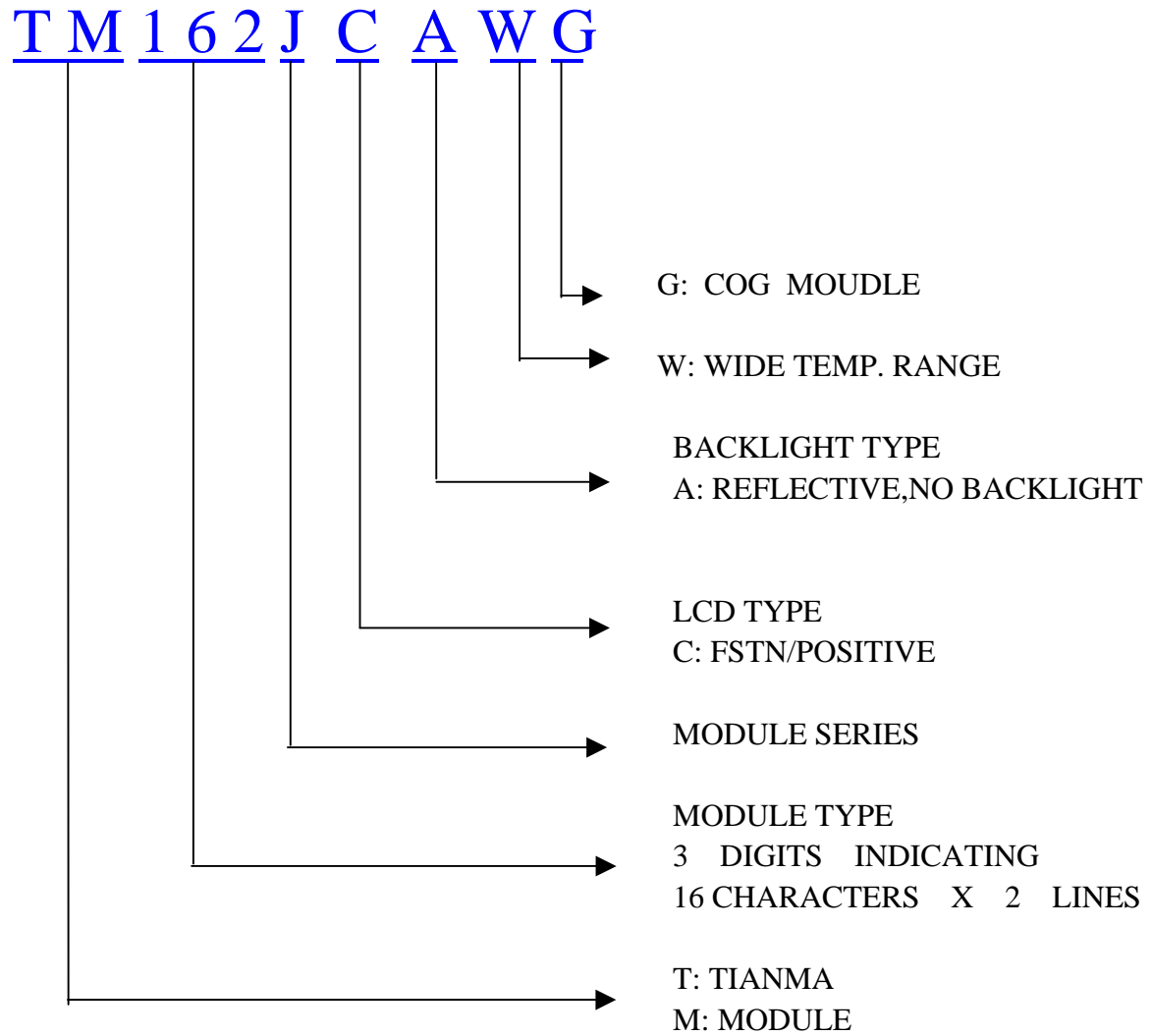11. LCD NO.: TJCGS-083F
12. ALL UNMARKED TOLERANCES: ±0.3mm

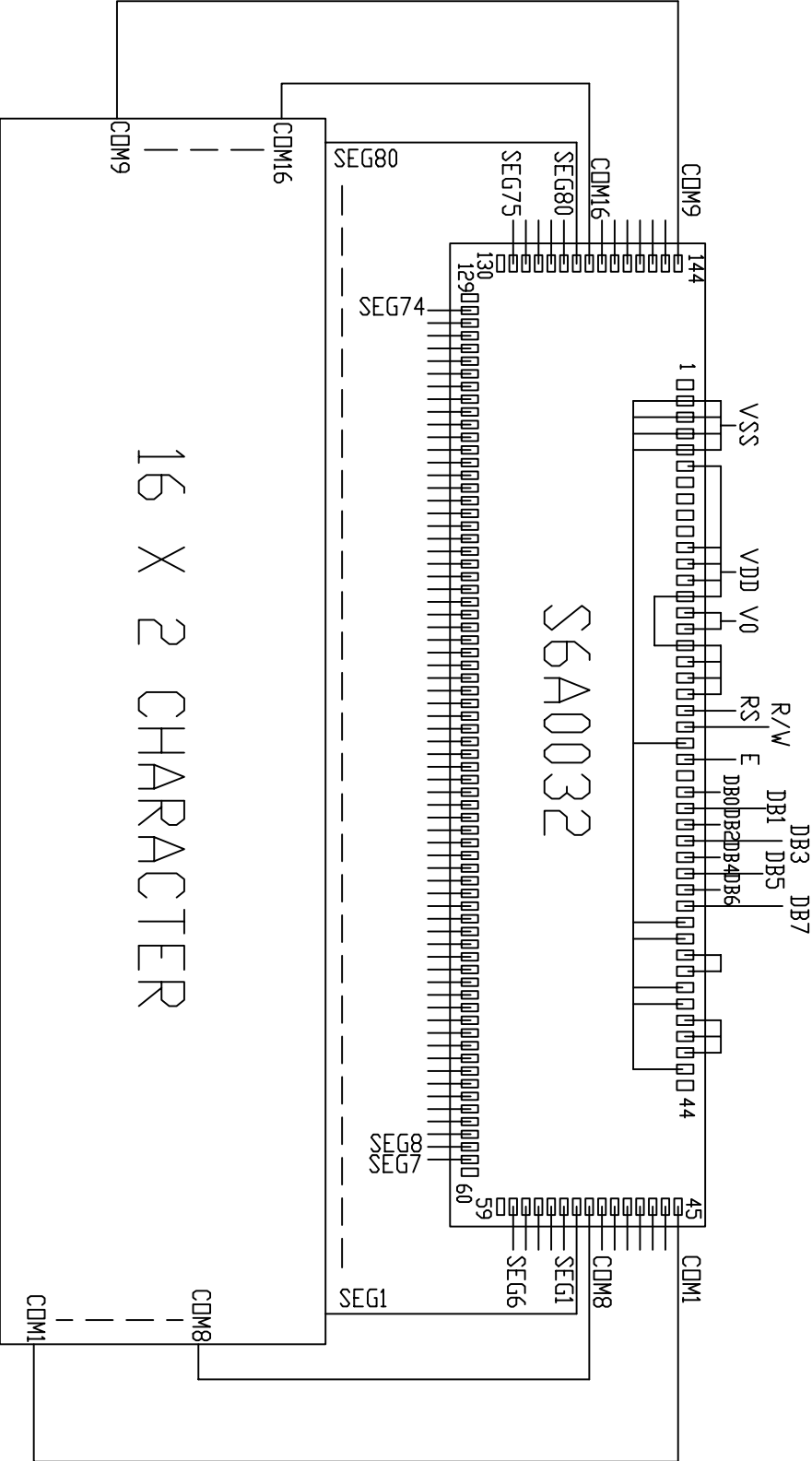| 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Vss	Vdd	Vo	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7

3. LCD Module Part Numbering System

T M 1 6 2 J C A W G

G: COG MOUDLE

W: WIDE TEMP. RANGE

BACKLIGHT TYPE
A: REFLECTIVE,NO BACKLIGHT

LCD TYPE
C: FSTN/POSITIVE

MODULE SERIES

MODULE TYPE
3 DIGITS INDICATING
16 CHARACTERS X 2 LINES

T: TIANMA
M: MODULE

Ver 1.0

4. Circuit Block Diagram

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	8.0		
Operating Temperature Range	T_{OP}	-20	+60		No Condensation
Storage Temperature Range	T_{ST}	-30	+70		

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		V_{DD} V_{SS}	3.0	3.3	3.6	V
Supply Voltage (LCD Drive)		V_{LCD}		3.3		V
Input Signal Voltage	High	V_{IH} $V_{DD}=3.0$	$0.7V_{DD}$	-	V_{DD}	V
	Low	V_{IL} $V_{DD}=3.0$	V_{SS}	-	$0.3V_{DD}$	V
Supply current (Logic)		I_{DD} V_{DD} $V_{SS}=3.3$	50	-	150	μA

6.2 Interface Signals

| Pin No.	Symbol	Level	Description
1	V_{SS}	0V	Ground
2	V_{DD}	3.3V	Power supply voltage
3	V_O	3.3V	Power supply voltage for LCD
4	RS	H/L	Selects registers (H: Data, L: Instruction)
5	R/W	H/L	Selects read or write (H: Read, L: Write)
6	E	H/L	Read/write enable signal
7	DB0	H/L	Data bit0
8	DB1	H/L	Data bit1
9	DB2	H/L	Data bit2
10	DB3	H/L	Data bit3
11	DB4	H/L	Data bit4
12	DB5	H/L	Data bit5
13	DB6	H/L	Data bit6
14	DB7	H/L	Data bit7

6.3 Interface Timing Chart

AC Characteristics(V_{DD}=2.4V~5.5V,Ta=-30~+85℃)

6800-series MPU Interface & Write Instruction

AC Characteristics (6800-series Write Instruction)

| Condition	Characteristic	Symbol	Min.	Typ.	Max.	Unit
V_{DD} = 2.4V to 3.6V, Ta = -30 to +85 ^{o}C	E cycle time	t_C	650		-	ns
	Pulse rise / fall time	t_R, t_F	-	-	25	
	E pulse width high	t_{WH}	450	-	-	
	E pulse width low	t_{WL}	150	-	-	
	RS and CSB setup time	t_{SU1}	60	-	-	
	RS and CSB hold time	t_{H1}	30	-	-	
	DB setup time	t_{SU2}	100	-	-	
	DB hold time	t_{H2}	50	-	-	
V_{DD} = 3.6V to 5.5V, Ta = -30 to +85 ^{o}C	E cycle time	t_C	350		-	ns
	Pulse rise / fall time	t_R, t_F	-	-	25	
	E pulse width high	t_{WH}	250	-	-	
	E pulse width low	t_{WL}	100	-	-	
	RS and CSB setup time	t_{SU1}	40	-	-	
	RS and CSB hold time	t_{H1}	10	-	-	
	DB setup time	t_{SU2}	40	-	-	
	DB hold time	t_{H2}	10	-	-	
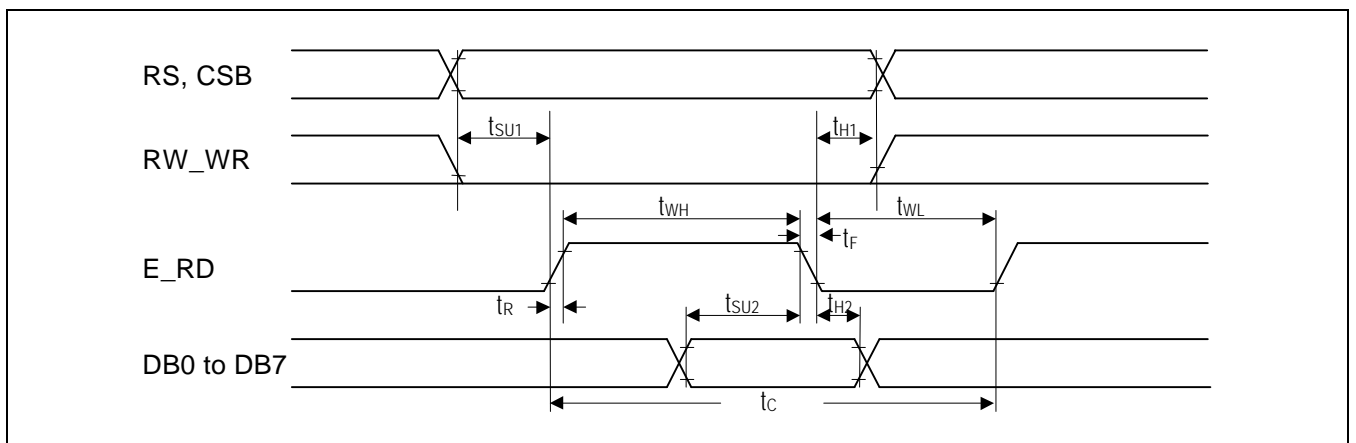
Write Bus Mode Timing (6800-series MPU Interface)

6800-series MPU Interface & Read Instruction

AC Characteristics (6800-series Read Instruction)

Condition	Characteristic	Symbol	Min.	Typ.	Max.	Unit
V_{DD} = 2.4V to 3.6V, Ta = -30 to +85 °C	E cycle time	t_C	650		-	ns
	Pulse rise / fall time	t_R, t_F	-	-	25	
	E pulse width high	t_{WH}	450	-	-	
	E pulse width low	t_{WL}	150	-	-	
	RS and CSB setup time	t_{SU}	60	-	-	
	RS and CSB hold time	t_H	30	-	-	
	DB output delay time	t_D	-	-	360	
	DB output hold time	t_{DH}	20	-	-	
V_{DD} = 3.6V to 5.5V, Ta = -30 to +85 °C	E cycle time	t_C	350		-	ns
	Pulse rise / fall time	t_R, t_F	-	-	25	
	E pulse width high	t_{WH}	250	-	-	
	E pulse width low	t_{WL}	100	-	-	
	RS and CSB setup time	t_{SU}	40	-	-	
	RS and CSB hold time	t_H	10	-	-	
	DB output delay time	t_D	-	-	120	
	DB output hold time	t_{DH}	10	-	-	
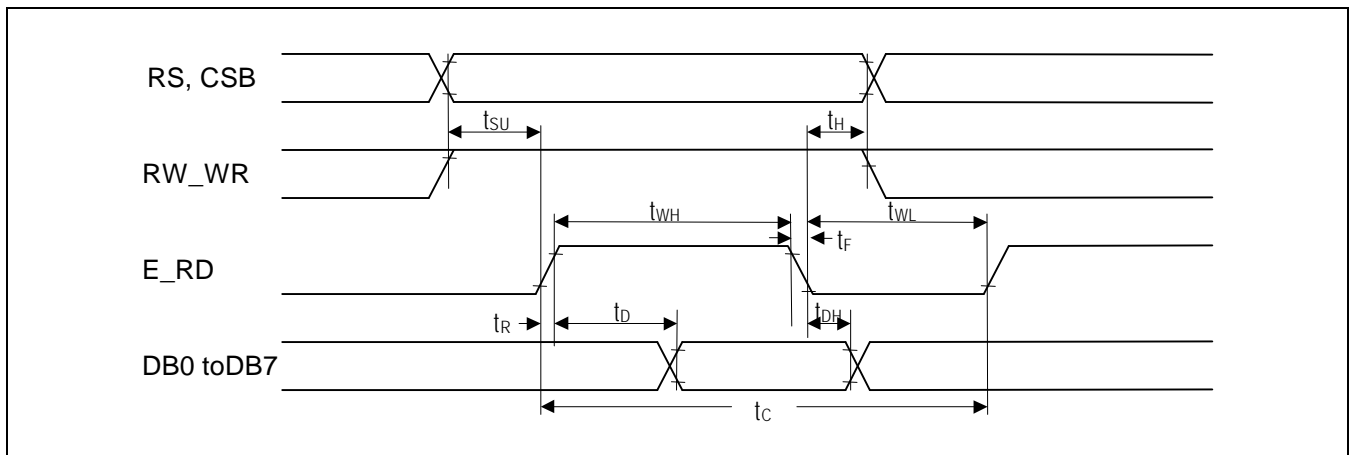
Read Bus Mode Timing (6800-series MPU Interface)

6.4 Instruction Code

INSTRUCTION DESCRIPTION

Instruction Table

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
*Clear display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC
Return home	0	0	0	0	0	0	0	0	1	-	DDRAM address is set to 00h from AC and the cursor returns to 00h position. The contents of DDRAM are not changed.
Entry mode set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display
Display ON / OFF control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and blinking of cursor (B) ON / OFF control
Cursor or display shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data
Function set	0	0	0	0	1	DL	-	-	-	-	Set interface data length (DL: 4-bit / 8-bit) instruction
CGRAM address set	0	0	0	1	0	0	A3	A2	A1	A0	Set CGRAM address in address counter.
DDRAM address set	0	0	1	A6	A5	A4	A3	A2	A1	A0	Set DDRAM address in address counter.
Read busy flag and address	0	1	BF	A6	A5	A4	A3	A2	A1	A0	Whether in internal operation or not can be known by reading BF, The contents of address counter can also be read
Write data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into DDRAM / CGRAM
Read data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from DDRAM / CGRAM

("-": Don't care)

NOTES:
1. Instruction execution time depends on the internal process time of KS0032, therefore it is necessary to provide a time larger than one MPU interface cycle time (tc) between execution of two successive instructions.
2. "Clear Display" instruction has 850μs execution time (when fosc = 40.0kHz), so check the Busy flag or wait for more than 850μs after using "Clear Display" instruction.

6.5 Character generator ROM(S6A0032)

CHARACTER GENERATOR ROM (CGROM)

CGROM has 5 x 8-dot 254 characters. The CGROM character code 00h and 01h are CGRAM character data area.

CGROM Character Code (00)

7. Optical Characteristics

7.1 Optical Characteristics   Ta=25

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

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle
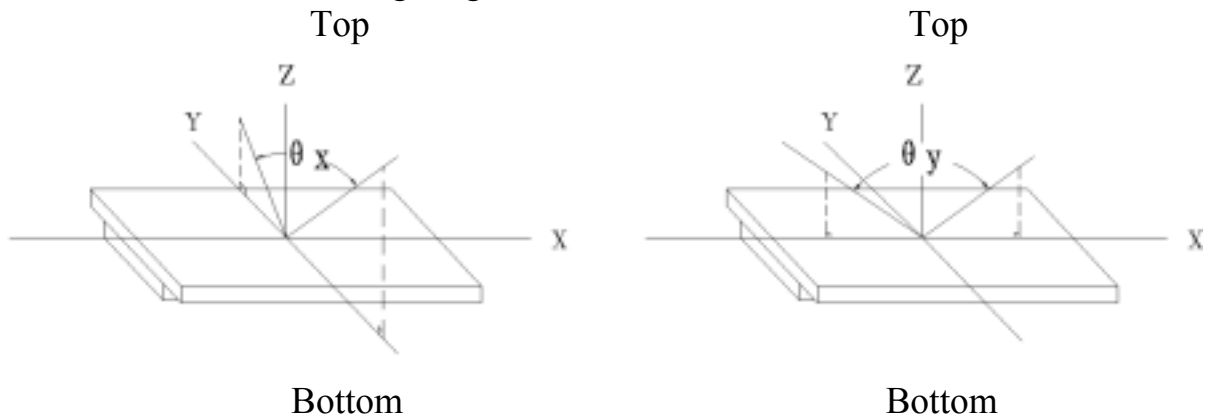
7.2.2 Definition of Contrast Ratio
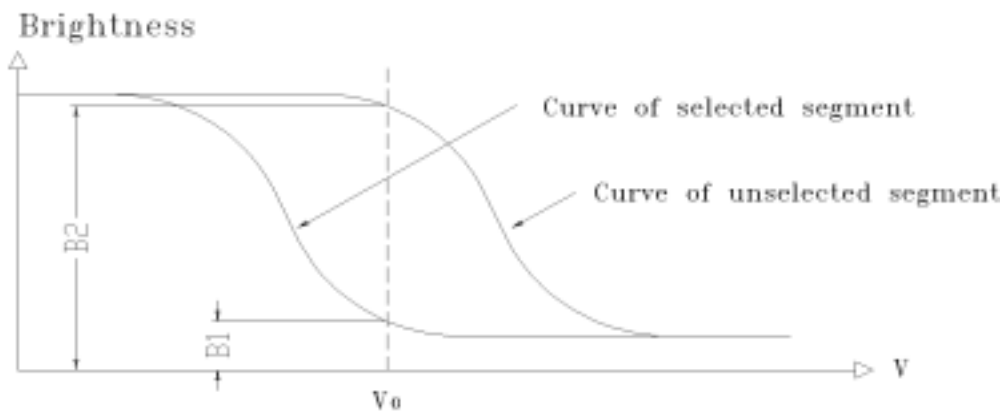
$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25 ; 2) Frame frequency: 78Hz

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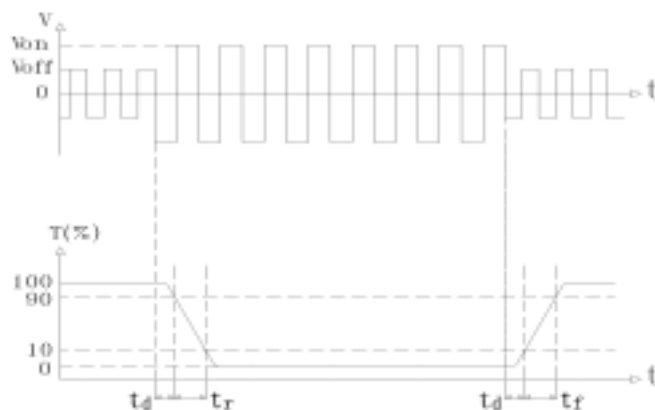
Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_f$

Measuring Condition:

1) Operating Voltage: 3.3V   2) Frame frequency: 78Hz

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	70 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage　current) and the thermal stress to the element for a long time	60 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20 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 -30　　25　　70　　25 30min　5min　30min　5min 1 cycle	-30　/70 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- sine wave, 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 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 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 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:

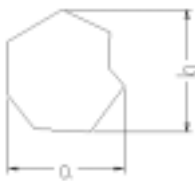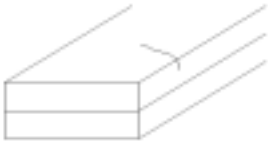   Temperature :   0   40
    Relatively humidity: 80%

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.
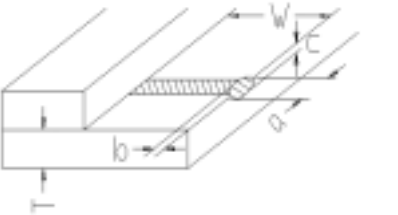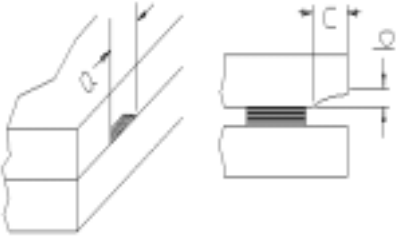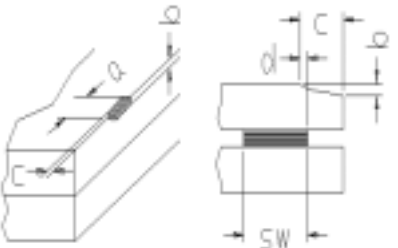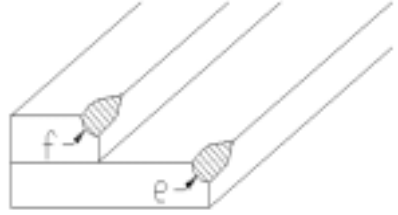
Appendix A

Inspection items and criteria for appearance defects

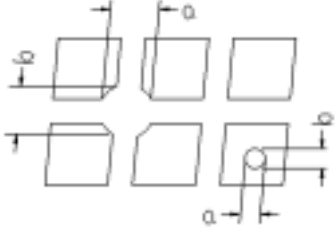| Items	Contents	Criteria		
Protective Glue		No clear defects		
Cover Tape		Covering all of the chip and no clear crimple		
Leakage		Not permitted		
Rainbow		According to the limit specimen		
Polarizer	Wrong polarizer attachment	Not permitted		
	Bubble between polarizer and glass	Not counted	Max. 3 defects allowed	
		$\phi<0.3$mm	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		
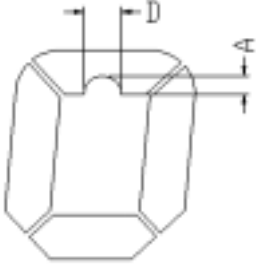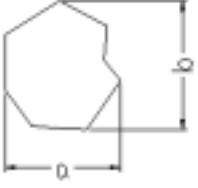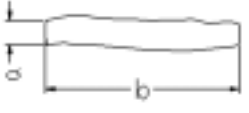
Appendix A

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
		3mm	W/5	T/2		
		2mm	W/5	T/2<C<T		
	Cracks on contact side	a		b	Max. 2 cracks allowed	
		3mm		T/2		
		2mm		T/2<b<T		
		C shall be not reach the seal area				
	Cracks on non-contact side	a		b		
		3mm		T/2		
		2mm		T/2<b<T		
		C 0.5mm				
		d SW/3				
	Corner cracks	$e<2.0mm^2$ $f<2.0mm^2$			Max. 3 cracks allowed	
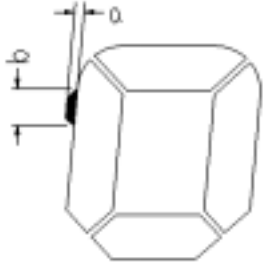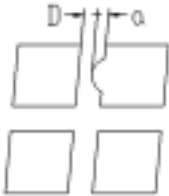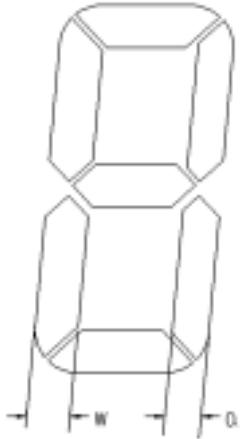
Appendix B

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. 02m 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 x 0.2mm	
		x=(a+b)/2		
		Not counted	Max. 1 defects allowed	
		a 0.1mm	0.1mm a 0.2mm D>0	
		Max.2 defects allowed 0.8W a 1.2W a=measured value of width W=nominal value of width		

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