



**MULTI-INNO TECHNOLOGY CO., LTD.**

# **LCD MODULE SPECIFICATION**

**Model : MI1602D-G**

Revision	
Engineering	
Date	
Our Reference	



**REVISION RECORD**

Version	Revision Items	Name	Date
0.0	<b>Preliminary</b>		2006.09.20



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1. LCD Module Part Numbering System

MI 16 02 D - G

① ② ③ ④

NO.	Explanation
①	MULTI-INNO module indicating
②	Module type: 3 DIGITS, 16-Character × 2-Line,
③	MULTI-INNO module series (A,B,C,D...)
④	Technology
	G      COG



## 2 Basic specification

Item	Contents			
LCD type	<input type="checkbox"/> TN	<input type="checkbox"/> STN	<input checked="" type="checkbox"/> FSTN	<input type="checkbox"/>
	<input checked="" type="checkbox"/> positive	<input type="checkbox"/> negative		
LCD Duty	<input type="checkbox"/> 64	<input type="checkbox"/> 128	<input type="checkbox"/> 240	<input checked="" type="checkbox"/> 16
LCD Bias	<input type="checkbox"/> 1/9	<input type="checkbox"/> 1/12	<input type="checkbox"/> 1/16	<input checked="" type="checkbox"/> 1/5
Polarizer	<input checked="" type="checkbox"/> reflective	<input type="checkbox"/> transflective	<input type="checkbox"/> transmissive	
LCD background color	<input checked="" type="checkbox"/> grey	<input type="checkbox"/> yellow/green	<input type="checkbox"/> blue-black	
Segment color	<input checked="" type="checkbox"/> black	<input type="checkbox"/> blue-black	<input type="checkbox"/>	
Backlighting	<input type="checkbox"/> LED	<input type="checkbox"/> EL	<input type="checkbox"/> CFL	<input type="checkbox"/>
LED type	<input type="checkbox"/> edge	<input type="checkbox"/> area	<input type="checkbox"/>	<input type="checkbox"/>
Backlighting color	<input type="checkbox"/> white	<input type="checkbox"/> yellow/green	<input type="checkbox"/> blue	<input type="checkbox"/>
View direction	<input checked="" type="checkbox"/> 6:00	<input type="checkbox"/> 12:00	<input type="checkbox"/> 9:00	<input type="checkbox"/> Wide View
Operating temperature	<input type="checkbox"/> 0°C~50°C	<input checked="" type="checkbox"/> -20°C~70°C	<input type="checkbox"/>	
Storage temperature	<input type="checkbox"/> -20°C~60°C	<input type="checkbox"/> -30°C~80°C	<input checked="" type="checkbox"/> -30°C~90°C	
Controller	<input type="checkbox"/> T6963C	<input type="checkbox"/> S1D13305	<input type="checkbox"/> S1D13700	<input checked="" type="checkbox"/> ST7032-0D
Frame	<input type="checkbox"/> SPCC(black)	<input type="checkbox"/> Zinc plated	<input type="checkbox"/> stainless steel	<input type="checkbox"/>
Technology	<input type="checkbox"/> SMT	<input type="checkbox"/> COB	<input checked="" type="checkbox"/> COG	<input type="checkbox"/>
Power supply	<input checked="" type="checkbox"/> single +3.0V	<input type="checkbox"/> single +5.0V	<input type="checkbox"/> dual	<input type="checkbox"/> triplex
Data Transfer	<input checked="" type="checkbox"/> 8 Bit Parallel	<input type="checkbox"/> 4 Bit Parallel	<input type="checkbox"/> Serial	<input type="checkbox"/>

### 2.1 General

The MI1602D-G, Character LCM unit consists of 16-character×2-line dot-matrix(5×7 dot) LCD panel, LCD driver, controller LSI on a glass .Incorporating mask ROM-based character generator and display data RAM in the controller LSI, the unit can efficiently display the desired character under microprocessor control.

### 2.2 Features

- ◆ Wide Operating temperature.
- ◆ Chip on glass.
- ◆ Requirements on environmental protection: RoHS.

Notes:

- Color tone can slightly change with temperature and driving voltage.



### ▪ 3 Mechanical data

Parameter	Standard Value	Unit
Display type	Character module	--
Character size(W×H)	2.95×4.85	mm
Number of dots/characters (W×H)	16×2 (5×7)	--
View area (W×H)	60.20 × 16.60	mm
Active Area (W×H)	56.20 × 10.80	mm
Dot Size (W×H)	0.55 × 0.65	mm
Dot Pitch (W×H)	0.60 × 0.70	mm
Module size(W×H×D)	64.20 × 27.60 × 2.00(MAX)	mm
Module total weight (approx)	6.9	g
Module outline dimensions	Refer to page 6-“Outline drawing”	--

### 4 Absolute maximum ratings

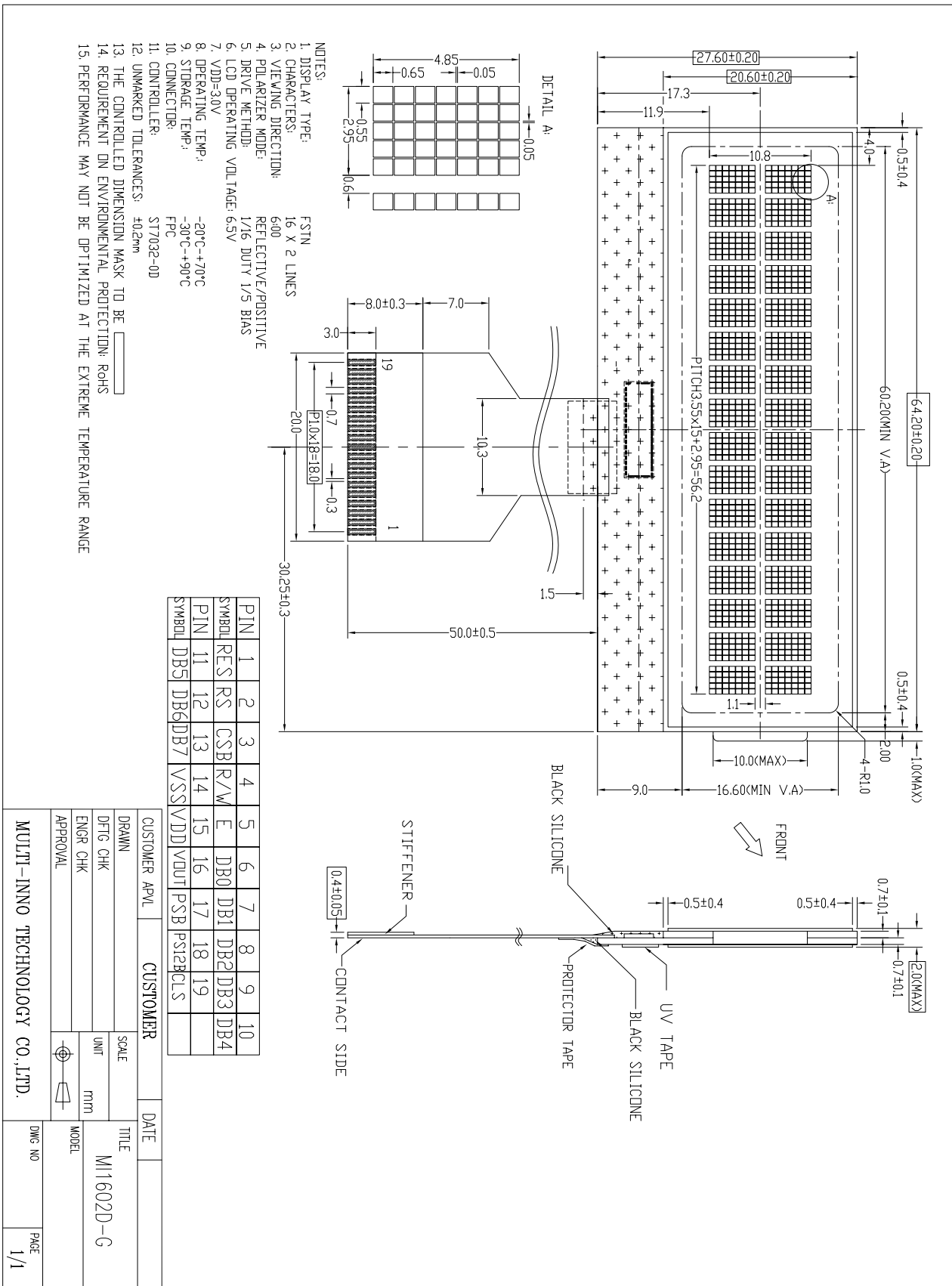
(Without LED backlighting ,Ta=25℃)

Parameter	Symbol	Min	Max	Unit	Remark
Logic circuit supply voltage	V <sub>CC</sub>	-0.3	+7.0	V	
LCD driving voltage	V <sub>LCD</sub>	-0.3	+7.0	V	
Operating temperature range	Top	-20	+70	℃	No Condensation
Storage temperature range	T <sub>st</sub>	-30	+90	℃	

#### Notes:

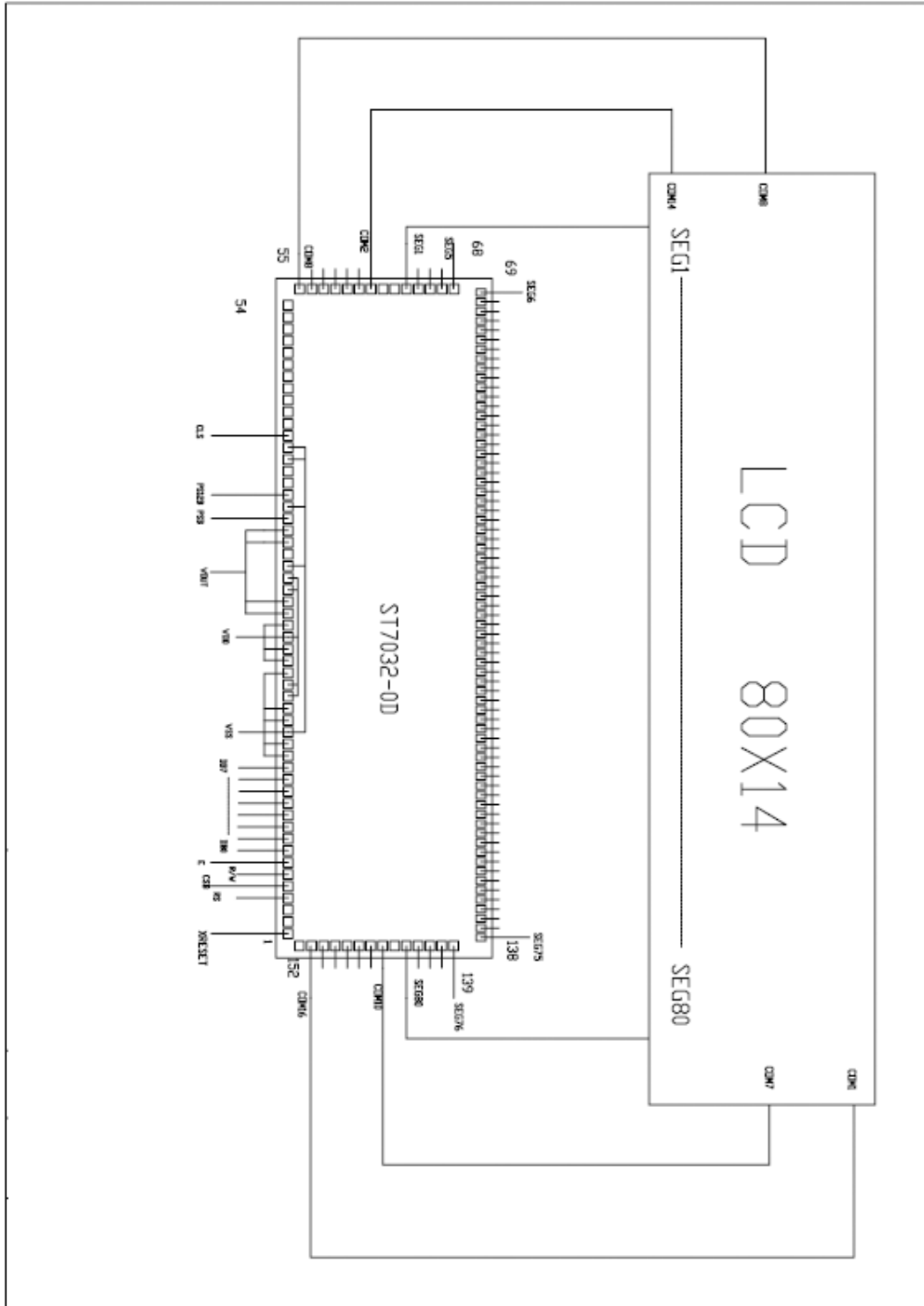
- LCD operating voltage  $V_{LCD}=V_0 - V_{SS}$ ,  $V_0(=V_{OUT})$  is the external voltage and the module uses a built-in voltage follower circuit.  $V_{SS}$  is the analog ground.
- If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability, and its service life will reduce.
- $V_{CC} > V_{SS}$  must be maintained.

5. Outline Drawing



## 6. Circuit

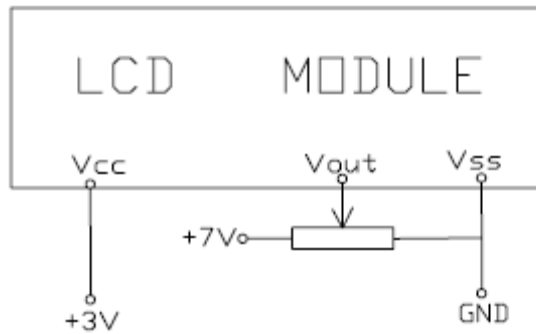
### 6.1 Block Diagram





**6.2 Recommend power supply circuit**

Only for reference.



**7 Pin connections**

Pin No.	Symbol	Level	Description
1	RES	H/L	External reset signal
2	RS	3.0V	Selects registers (H: Data L: Instruction)
3	CSB	0.8V	Chip select
4	R/W	H/L	Selects read or write
5	E	H/L	Data read/write enable signal
6	DB0	H/L	Data bit0
7	DB1	H/L	Data bit1
8	DB2	H/L	Data bit2
9	DB3	H/L	Data bit3
10	DB4	H/L	Data bit4
11	DB5	H/L	Data bit5
12	DB6	H/L	Data bit6
13	DB7	H/L	Data bit7
14	VSS	H/L	Ground and power supply voltage for LCD(-)
15	VDD	4.2V	Power supply voltage for logic
16	VOUT	0V	Power supply voltage for LCD(+)
17	PSB		Interface selection
18	PS12B		ITO option
19	CLS		Internal/external oscillation select



## 8 Instruction Code & Timing characteristics

### 8.1 COMMAND

(when "EXT" option pin connect to Vss, the instruction set follow below table)

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC=380KHz	OSC=540kHz	OSC=700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us

Note \* : this bit is for test command , and must always set to "0"

Instruction table 0(IS=0)														
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us

Instruction table 1(IS=1)														
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab2	Rab1	Rab0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us

Note:

Be sure the ST7032 is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7032. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

**8.2 Interface Timing characteristics**

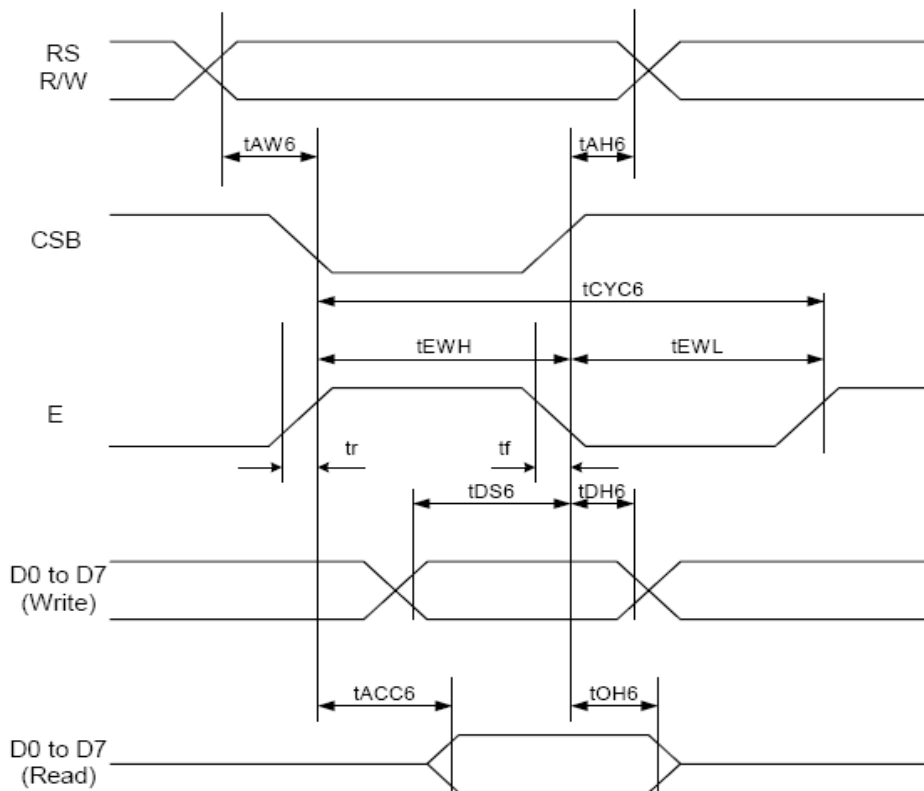
Note: Please refer to IC:       ST7032       data sheet for more details.

- 68 Interface

( Ta = -30°C to 85°C )

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
Address hold time	RS	t <sub>AH6</sub>	—	20	-	20	-	ns
Address setup time	RS	t <sub>AW6</sub>		20	-	20	-	
System cycle time	RS	t <sub>CYC6</sub>	—	400	-	280	-	ns
Data setup time	D0 to D7	t <sub>DS6</sub>	—	100	-	80	-	ns
Data hold time	D0 to D7	t <sub>DH6</sub>		40	-	20	-	
Access time	D0 to D7	t <sub>ACC6</sub>	C <sub>L</sub> = 100 pF	-	500	-	400	ns
Output disable time	D0 to D7	t <sub>OH6</sub>		300	-	150	-	
Enable Rise/Fall time	E	t <sub>r,tf</sub>	—	-	20	-	20	ns
Enable H pulse time	E	t <sub>EWH</sub>	—	200	-	120	-	ns
Enable L pulse time	E	t <sub>EWL</sub>	—	150	-	130	-	ns

Note: All timing is specified using 20% and 80% of V<sub>DD</sub> as the reference.



**Figure 1. Data Transferring Timing Diagram**



8.3 character generator code map

ST7032-0D (ITO option OPR1=1, OPR2=1)

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0001	J	k	l	M	N	O	P	Q	R	S	T	U	V	W	X	Y
0010	z	[	\	^	_	0	1	2	3	4	5	6	7	8	9	*
0011	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
0100	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
0101	↑	↓	↔	↕	↖	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢
0110	↓	↖	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥
0111	↦	↧	↨	↩	↪	↫	↬	↭	↮	↯	↰	↱	↲	↳	↴	↵
1000	←	→	↔	↕	↖	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢
1001	↖	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦
1010	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧
1011	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧	↨
1100	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧	↨	↩
1101	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧	↨	↩	↪
1110	↛	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧	↨	↩	↪	↫
1111	↜	↝	↞	↠	↡	↢	↣	↤	↥	↦	↧	↨	↩	↪	↫	↬



## 9 Electrical characteristics

( TA = -30°C to 85°C, VDD = 2.7 V – 4.5 V )

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
VDD	Operating Voltage	-	2.7	-	4.5	V
V <sub>LCD</sub>	LCD Voltage	V <sub>0</sub> -V <sub>SS</sub>	2.7	-	7.0	V
I <sub>CC</sub>	Power Supply Current	VDD=3.0V (Use internal booster/follower circuit)	-	160	230	uA
V <sub>IH1</sub>	Input High Voltage (Except OSC1)	-	1.9	-	VDD	V
V <sub>IL1</sub>	Input Low Voltage (Except OSC1)	-	- 0.3	-	0.8	V
V <sub>IH2</sub>	Input High Voltage (OSC1)	-	0.7 VDD	-	VDD	V
V <sub>IL2</sub>	Input Low Voltage (OSC1)	-	-	-	0.2 VDD	V
V <sub>OH1</sub>	Output High Voltage (DB0 - DB7)	I <sub>OH</sub> = -1.0mA	0.75 VDD	-	-	V
V <sub>OL1</sub>	Output Low Voltage (DB0 - DB7)	I <sub>OL</sub> = 1.0mA	-	-	0.8	V
V <sub>OH2</sub>	Output High Voltage (Except DB0 - DB7)	I <sub>OH</sub> = -0.04mA	0.8 VDD	-	VDD	V
V <sub>OL2</sub>	Output Low Voltage (Except DB0 - DB7)	I <sub>OL</sub> = 0.04mA	-	-	0.2 VDD	V
R <sub>COM</sub>	Common Resistance	V <sub>LCD</sub> = 4V, I <sub>d</sub> = 0.05mA	-	2	20	KΩ
R <sub>SEG</sub>	Segment Resistance	V <sub>LCD</sub> = 4V, I <sub>d</sub> = 0.05mA	-	2	30	KΩ
I <sub>LEAK</sub>	Input Leakage Current	V <sub>IN</sub> = 0V to VDD	-1	-	1	μA
I <sub>PUP</sub>	Pull Up MOS Current	VDD = 3V	20	30	40	μA
f <sub>OSC</sub>	Oscillation frequency	VDD = 3V, 1/17duty	350	540	1100	KHz



10 Optical Characteristics

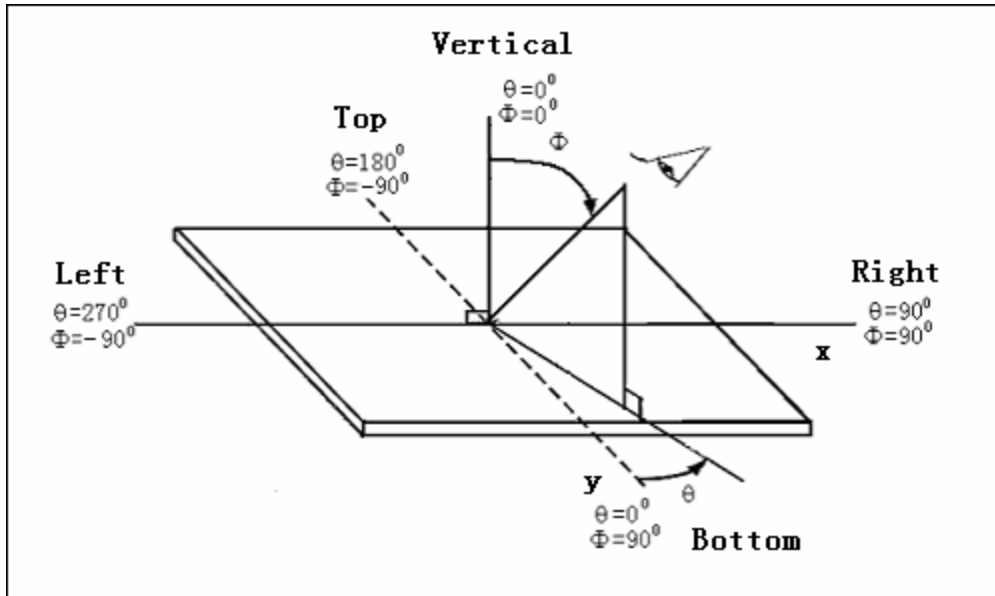
10.1 Optical Characteristics

Ta=25°C

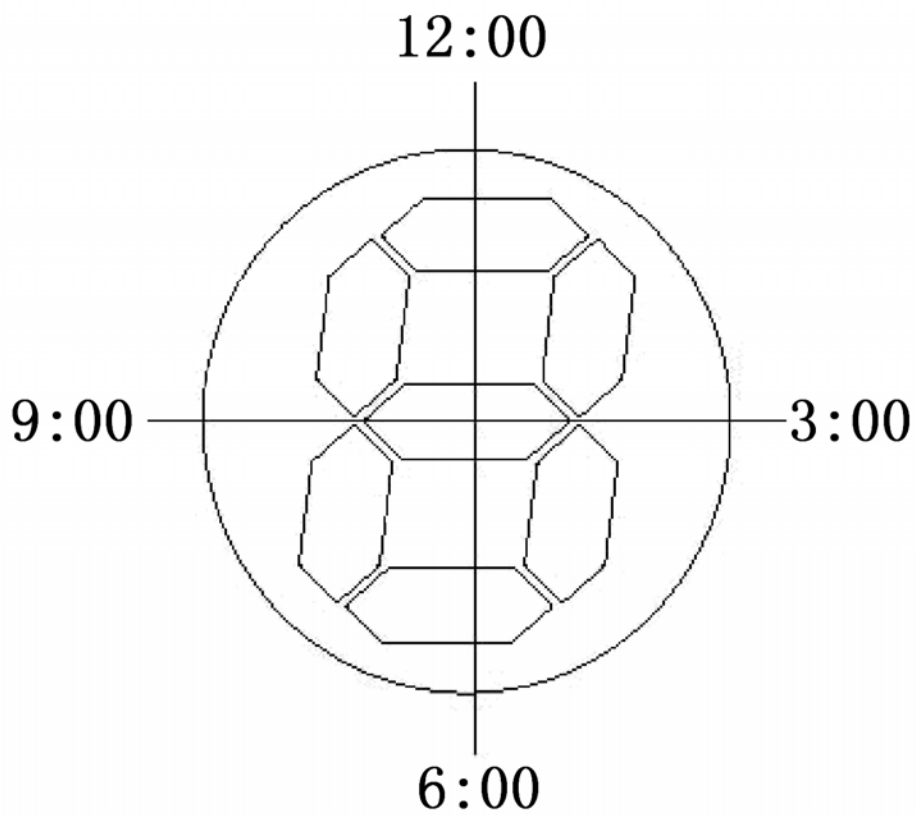
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	
Viewing Angle	$\theta_x$	Cr $\geq$ 2	$\theta_y = 0^\circ$	-45 -- 60			Deg	
	$\theta_y$		$\theta_x = 0^\circ$	-30 -- 30				
Viewing Angle	$\theta_x$	Cr $\geq$ 5	$\theta_y = 0^\circ$	--			Deg	
	$\theta_y$		$\theta_x = 0^\circ$	--				
Contrast Ratio		Cr	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	--	10.0	--		
Response Time	Turn on	Ton	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$ A wave, f=70Hz	Tamb= +22°C	--	--	250	ms
				0°C	--	--	--	
				-10°C	--	--	--	
				-20°C	--	--	--	
	Turn off	Toff			--	--	200	
					--	--	--	
					--	--	--	
					--	--	--	

10.2 Definition of Optical Characteristics

10.2.1 Definition of Viewing Angle

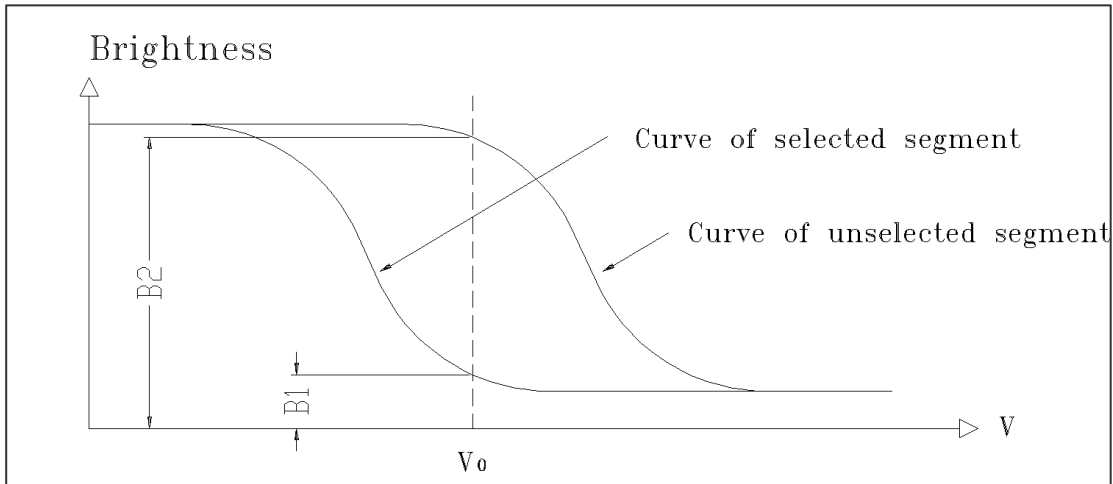


10.2.2 Indication of Viewing Angle





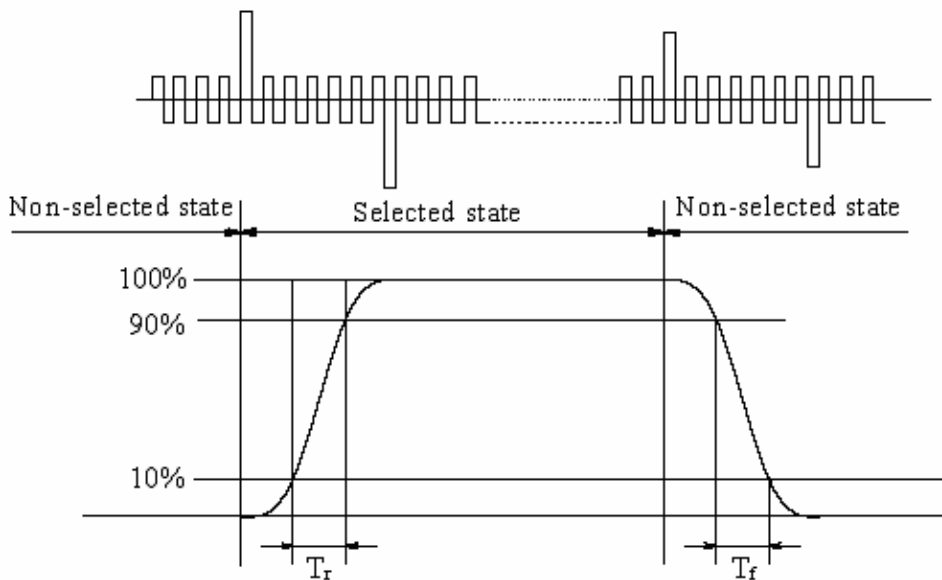
10.2.2 Definition of Contrast Ratio



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

- Measuring Conditions:
- 1) Ambient Temperature: 25°C
  - 2) Frame frequency: 70Hz
  - 3) Operating voltage: Vop=6.5V
  - 4) Applying waveform: 1/16 duty 1/5 bias
  - 5) View angle (θ, φ): (0°, 0°)

10.2.3 Definition of Response time Test ( LCD using TJCGS572)



Turn on time:  $t_{on} = t_r$       Turn off time:  $t_{off} = t_f$

- Measuring Condition:
- 1) Operating Voltage: Vop=6.5V
  - 2) Frame frequency: 70Hz
  - 3) Applying waveform: 1/16 duty 1/5 bias
  - 4) View angle (θ, φ): (0°, 0°)





## 11 Reliability

### 11.1 Content of Reliability Test

Ta=25°C

No.	Test Item	Content of Test	Test condition	Criterion
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	90°C 240H	Remark1 Remark2 Remake3 Remake4
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30°C 240H	
3	High Temperature Operation	Endurance test applying the electric stress (voltage and current) and the thermal stress to the element for a long time	70°C 240H	
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20°C 240H	
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40°C 90%RH 240H	
6	Temperature Cycle	Endurance test applying the low and high temperature cycle <div style="text-align: center;"> <math display="block">-30^{\circ}\text{C} \xleftrightarrow{30\text{min}} -25^{\circ}\text{C} \xleftrightarrow{5\text{min}} 90^{\circ}\text{C} \xleftrightarrow{30\text{min}} 25^{\circ}\text{C} \xleftrightarrow{5\text{min}}</math> <p style="text-align: center;">←----- 1 cycle -----→</p> </div>	-30°C/90°C 10 cycles	
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 100m/s <sup>2</sup> , 120min	Remark1 Remark5 Remark6
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s <sup>2</sup> ,18ms	
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H Restore 2H	

#### Notes:

1. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
2. The test sample is inspected after 2 hours or more storing at room temperature and room humidity after each test item is finished.
3. The criteria refer to 12.2.



**11.2 Inspection of criteria**

Remark NO.	Content
1	Functional test is OK. Missing Segment, shorts, unclear segment, nondisplay, display abnormally, liquid crystal leak are unallowable.
2	After testing, cosmetic defects should not happen, no low temperature bubbles, seal loose and fall, frame rainbow, ACF bubble growing are unallowable in the appearance test.
3	Total current consumption should not be over 10% of initial value.
4	After tests being executed, Contrast must be larger than 70% of its initial value prior to the tests.
5	No glass crack, chipped glass, end seal loose frame crack and so on.
6	No structure loose and fall.

**11.3 LCD module service life**

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 100,000 hours under ordinary operating and storage conditions room temperature (25°C ± 10°C).

**11.4 Definition of module service life**

- Contrast becomes 30% of initial value.
- Current consumption becomes three times higher than initial value.
- Remarkable alignment deterioration occurs in LCD cell layer.
- Unusual operation occurs in display functions



12 Quality level

Examination or Test	At T <sub>a</sub> =25°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
<b>Note: Major defects: Open segment or common, Short, Serious damages, Leakage</b> <b>Minor defects: Others</b> <b>Sampling standard conforms to GB2828</b>						



## **13 Precautions for Use of LCD Modules**

### **13.1 Handling Precautions**

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

13.1.2 Liquid in LCD is hazardous substance, 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, thoroughly and promptly wash it off using soap and water.

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

13.1.4 Don't touch, push or rub the exposed polarizer covering the display surface of the LCD module with anything harder than an HB pencil lead, the polarizer is soft and easily scratched, handle it carefully.

13.1.5 Don't put or attach anything on the display area to avoid leaving any marks on.

13.1.6 If the display surface is contaminated or becomes dusty, breathe on the surface and gently wipe it with a soft dry cloth. do not scrub hard to avoid damage the surface. 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

13.1.7 Do not attempt to disassemble the LCD Module.

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

13.1.9 Avoid using the same display pattern long time ( continuous ON segment).Software must be prepared so that the pattern will be changed

13.1.10 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- a. Be sure to ground the body and electric appliances when handling the LCD Modules. It is preferable to use conductive mat on table and wear cotton clothes or conductive processed fibre. Synthetic fibre is not recommended.
  - 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 careful and slow when peeling off this protective film since static electricity may be generated. It is recommended to use ionic fan or machine when operating. It is recommended to remove the protection foil slowly (> 3 sec.).
  - e. It is preferable to wear gloves etc, to avoid damaging the LCD. Please do not touch electrodes with bare hands or avoid any other contamination.
-



### **13.2 Storage precautions**

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

13.2.2 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 : 5°C ~ 40°C

Relatively humidity: ≤80%

13.2.3 The LCD modules should be stored in a clean environment or room, free from acid, alkali and harmful gas.

13.2.4 Store the module in anti-static electricity container and without any physical load.

### **13.3 Transportation precautions**

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

### **13.4 Soldering**

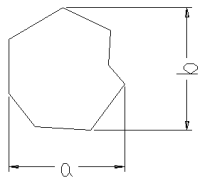
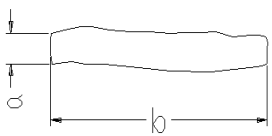
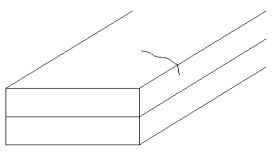
13.4.1 Use the high quality solders, only solder the I/O terminals.

13.4.2 No higher than 280°C and time less than 3-4 second during soldering.

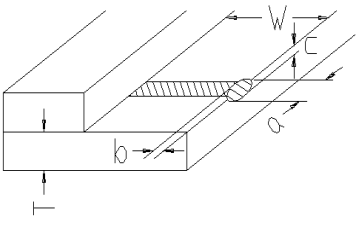
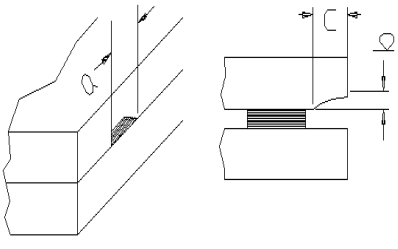
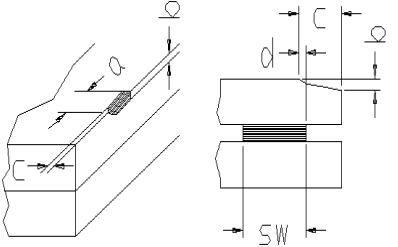
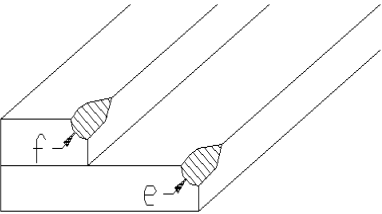
13.4.3 Rewiring: no more than 3 times.

13.4.4 when you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged (or stripped off). It is recommended to use solder suction machine.

**Appendix A**
**Inspection items and criteria for appearance defects**

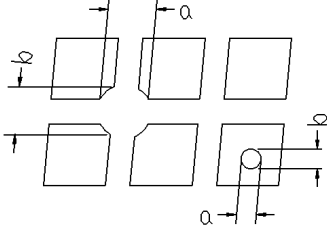
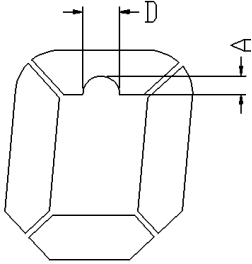
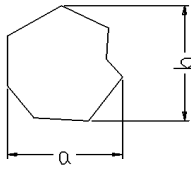
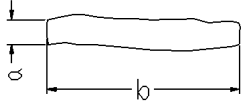
Items	Contents	Criteria		
Protective Glue		No clear defects		
Cover Tape		Covering all of the chip and no clear crimple		
Leakage		Not permitted		
Rainbow		According to the limit specimen		
Polarizer	Wrong polarizer attachment	Not permitted		
	Bubble between polarizer and glass	Not counted	Max. 3 defects 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	
		$X < 0.20\text{mm}$	$0.20\text{mm} \leq X \leq 0.5\text{mm}$	
		$X = (a+b)/2$		
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 (continued)

Item	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	
		$\leq 3\text{mm}$	$\leq T/2$			
		$\leq 2\text{mm}$	$T/2 < b < T$			
	$C \leq 0.5\text{mm}$					
Corner cracks 	$e < 2.0\text{mm}^2$ $f < 2.0\text{mm}^2$			Max. 3 cracks allowed		

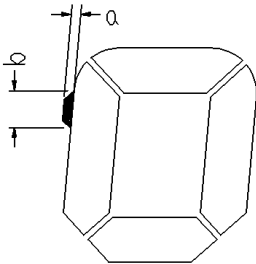
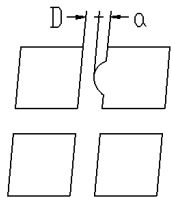
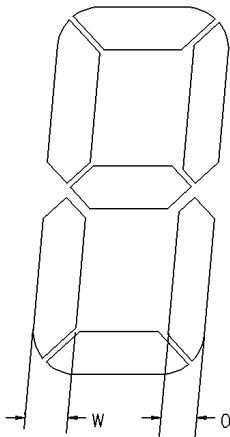
Appendix B

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	
		$a < 0.02\text{mm}$	$0.02\text{mm} \leq a \leq 0.05\text{mm}$ $b \leq 0.5\text{mm}$	



Appendix B (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 $0.8W \leq a \leq 1.2W$  $a = \text{measured value of width}$ $W = \text{nominal value of width}$		