

SPECIFICATION FOR LCD MODULE

Model No. HM12832(HZD5582)

Prepared by:	Date:
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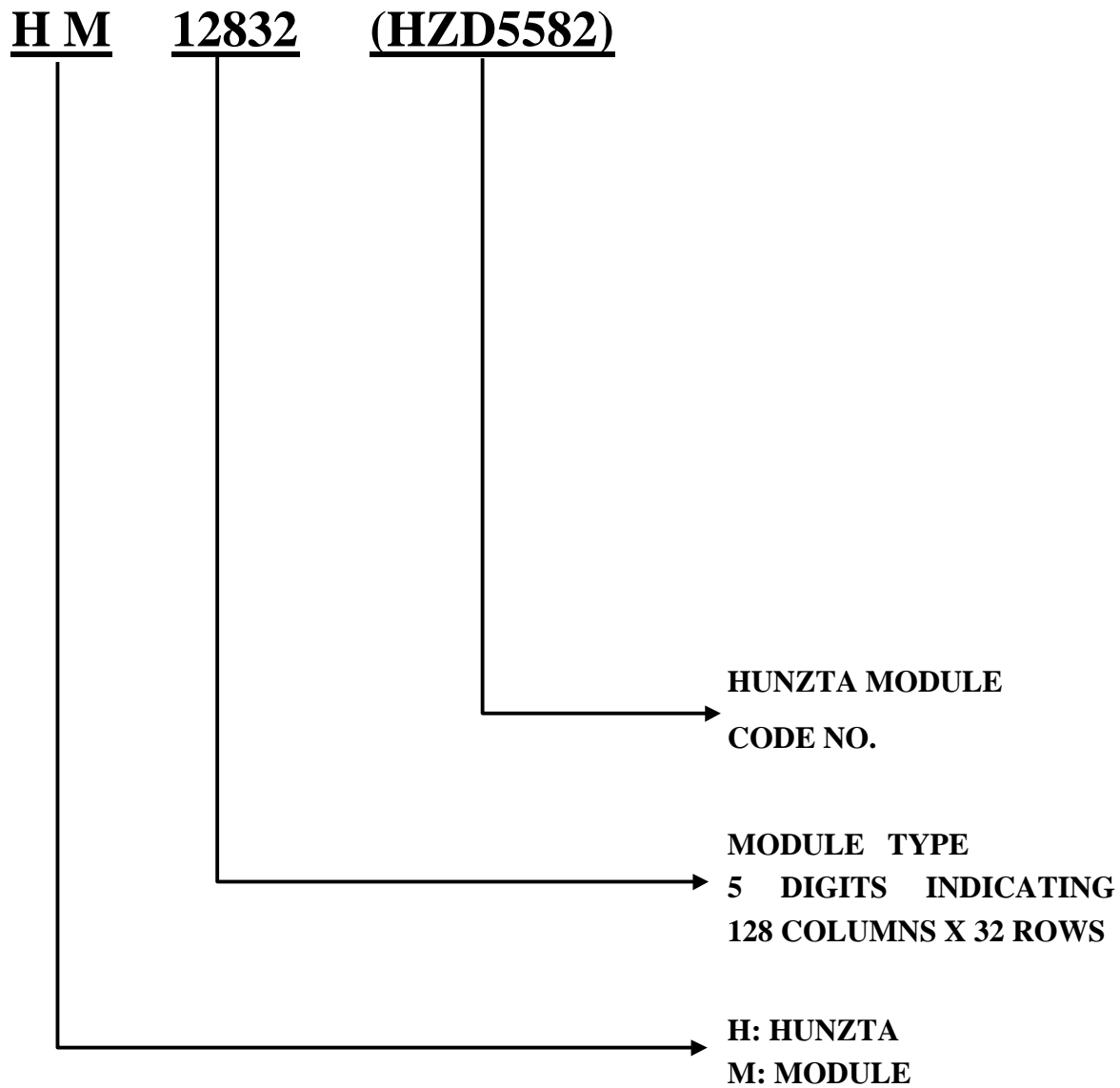
REVISION RECORD

Date	Ver.	Ref.Page	Revision No.	Revision Item

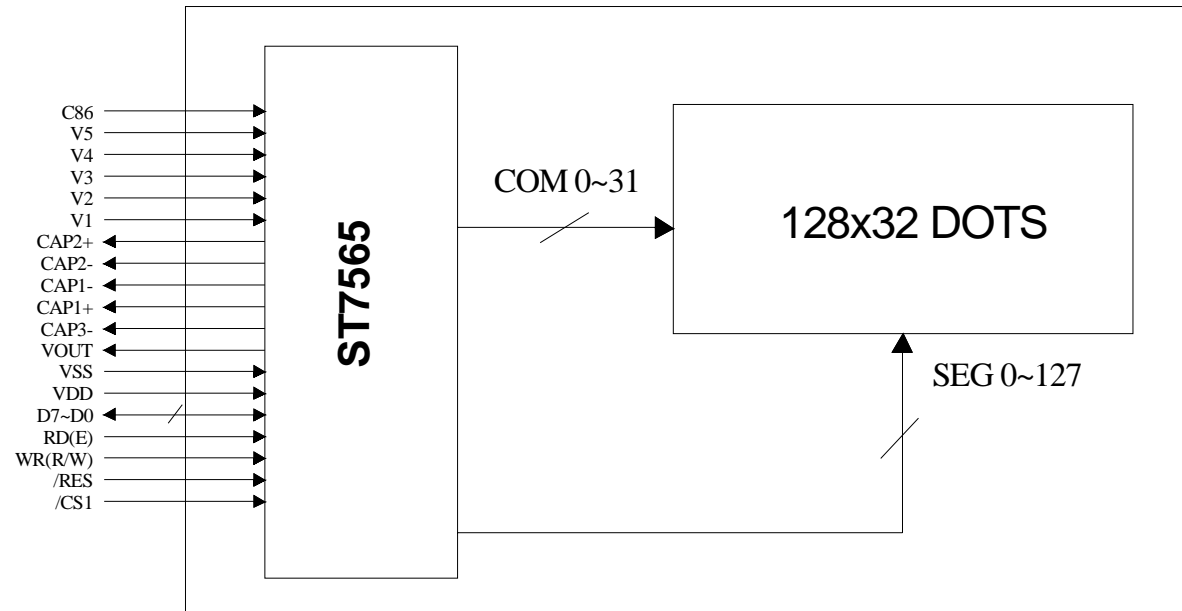
1 General Specifications:

1.1 Display type:	FSTN
1.2 Polarizer mode:	Transflective/Positive
1.3 Viewing Angle:	6:00
1.4 Driving Method:	1/33 Duty 1/6 Bias
1.5 Lcd operation voltage:	5V VDD:3.0V
1.6 Controller:	ST7565S
1.7 Data Transfer:	8bit parallel
1.8 Operating Temperature:	-10°C ~ 60°C
Storage Temperature:	-20°C ~ 70°C
1.9 Outline Dimensions:	Refer to outline drawing on next page
1.10 Dot Matrix:	128 X 32 DOTS
1.11 Dot Size:	0.19 X 0.21 (mm)
1.12 Dot Pitch:	0.22 X 0.24 (mm)
1.13 Weight:	TBD

3 LCD Module part Numbering System



4 Circuit Block Diagram



5 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	0.3	5.0	V	
LCD Driving Voltage	V_{LCD}	0.3	18.0		
Operating Temperature Range	T_{OP}	-10	60	°C	NO Condensation
Storage Temperature Range	T_{ST}	-20	70		

6 Electrical Specifications and Instruction Code

6.1 Electrical characteristics

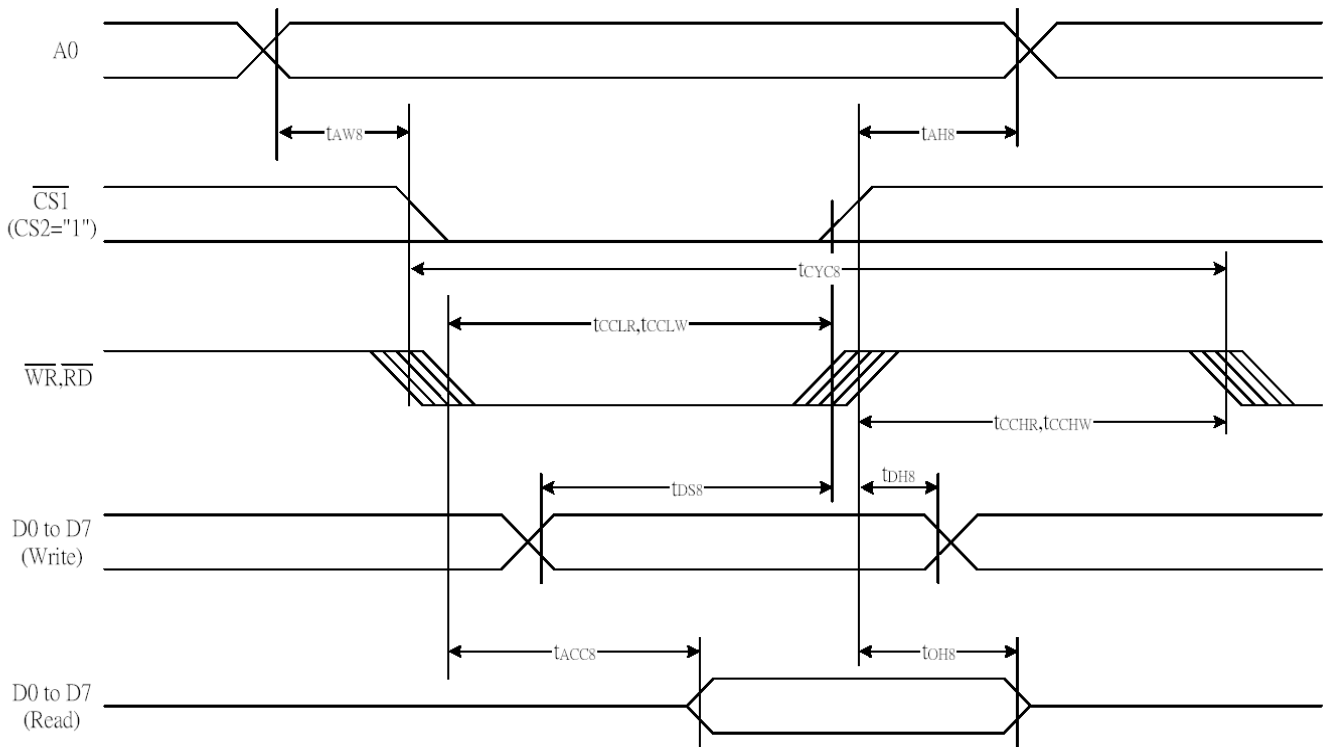
Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	-	3.0	-	V	
Supply Voltage (LCD Drive)	V_{LCD}	-	5.0	-	V	
Input Signal Voltage	High	V_{IH}	$0.8V_{DD}$	-	V_{DD}	V
	Low	V_{IL}	V_{SS}	-	$0.2V_{DD}$	V
Supply current (Logic)	I_{DD} ($V_{DD}-V_{SS}=3.0V$)	-	-	-	uA	

6.2 Interface Signal

Pin No.	Symbol	Level	Description
1	VDD	3.0V	Power supply voltage for logic
2	C86	I	This is the MPU interface switch terminal. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 MPU interface.
3,15	VSS	0V	Ground
4	V5	-	Power supply voltage for LCD
5	V4	-	Power supply voltage for LCD
6	V3	-	Power supply voltage for LCD
7	V2	-	Power supply voltage for LCD
8	V1	-	Power supply voltage for LCD
9	CAP2+	O	Capacitor pin for voltage converter
10	CAP2-	O	Capacitor pin for voltage converter
11	CAP1-	O	Capacitor pin for voltage converter
12	CAP1+	O	Capacitor pin for voltage converter
13	CAP3-	O	Capacitor pin for voltage converter
14	VOUT	O	DC/DC voltage converter output
16~23	D7~D0	I/O	Date bus
24	RD(E)	I	When connected to an 8080 MPU, it is active LOW This pad is connected to the RD signal of the 8080MPU, and the ST7565 data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH, this is used as an enable clock input of the 6800 series MPU.
25	WR(R/W)	I	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read When R/W = "L": Write
26	A0	I	Register selection input pin
27	/RES	I	Reset signal
28	/CS1	I	Chip select signal

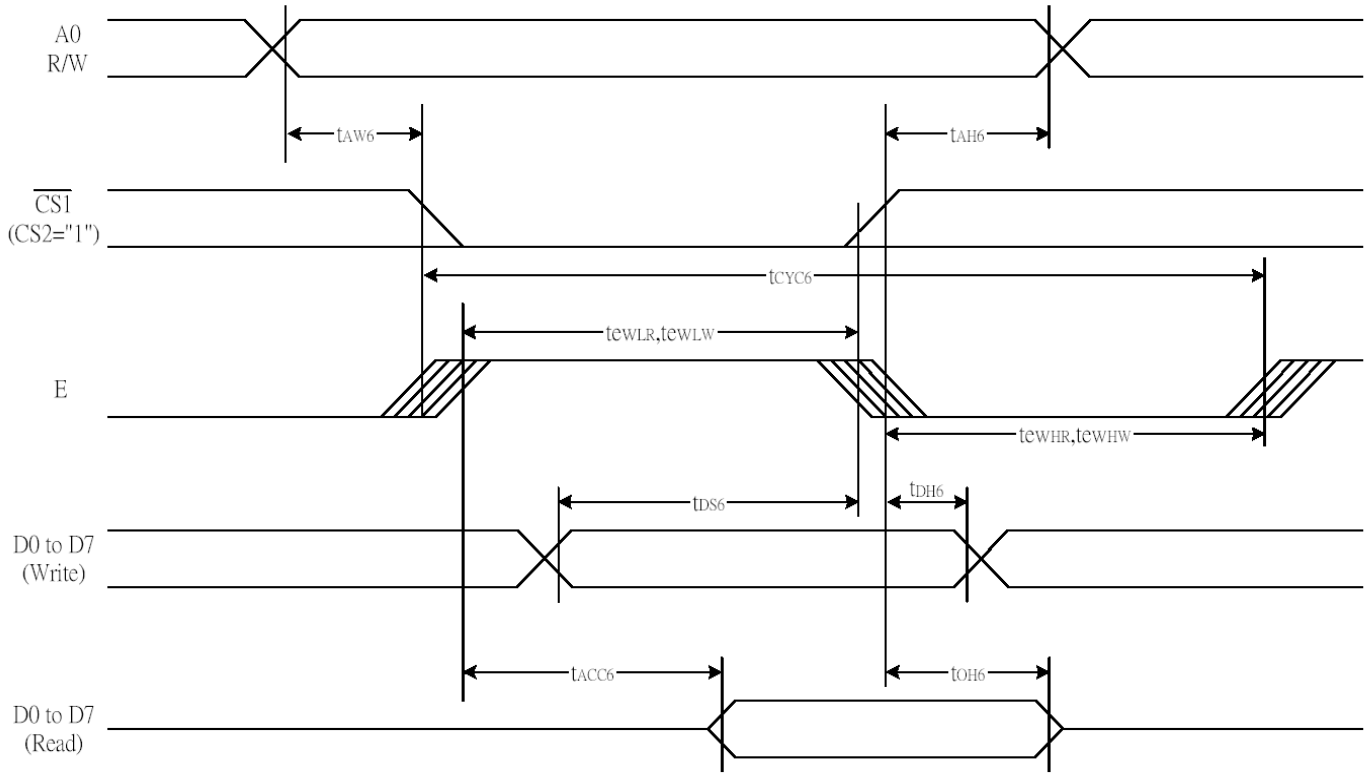
6.3 Interface Timing Chart

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



($V_{DD} = 3.3V$, $T_a = 25^\circ C$)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		80	—	
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH8}	$C_L = 100 \text{ pF}$	5	50	



System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)

(V_{DD} = 3.3 V, T_a = 25°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t _{AH6}		0	—	ns
Address setup time		t _{AW6}		0	—	
System cycle time		t _{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t _{EHLW}		80	—	
Enable H pulse width (WRITE)		t _{EHW}		80	—	
Enable L pulse width (READ)	RD	t _{EHLR}		80	—	
Enable H pulse width (READ)		t _{EHR}		140	—	
WRITE Data setup time	D0 to D7	t _{DS6}		40	—	
WRITE Address hold time		t _{DH6}		0	—	
READ access time		t _{ACC6}	CL = 100 pF	—	70	
READ Output disable time		t _{OH6}	CL = 100 pF	5	50	

(Note) *: disabled data

Command											Function		
	AO	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address	
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address	
Column address set lower bit				0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address	
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data	
(6) Display data write	1	1	0	Write data								Writes to the display RAM	
(7) Display data read	1	0	1	Read data								Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	1	Sets the display RAM address SEG output correspondence 0: normal, 1:reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	1	Sets the LCD display normal/reverse 0: normal, 1:reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1:1/7 bias(ST7565)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	1	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode	
(17) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra)model	
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	1	Set the V5 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value							
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	1	0: OFF, 1:ON
Static indicator register set				0	0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x.3x.4x 01: 5x 11: 6x
(21) Power saver													Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	*	Command for IC test. Do not use this command

7 Optical Characteristics

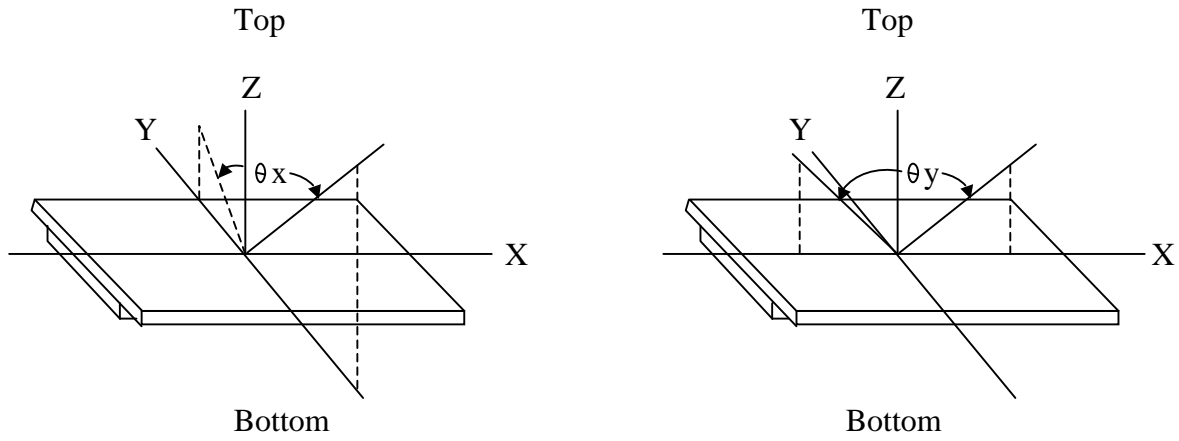
7.1 Optical Characteristics

Ta=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Viewing Angle	θ_x	$C_r \geq 2$	$\theta_y = 0^\circ$	-	-	20	Deg
	θ_y						
Contrast Ratio	C_r	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	3.0	-	-		
Response Time	Turn on	T_{on}	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	-	-	300	ms
	Turn off	T_{off}				-	

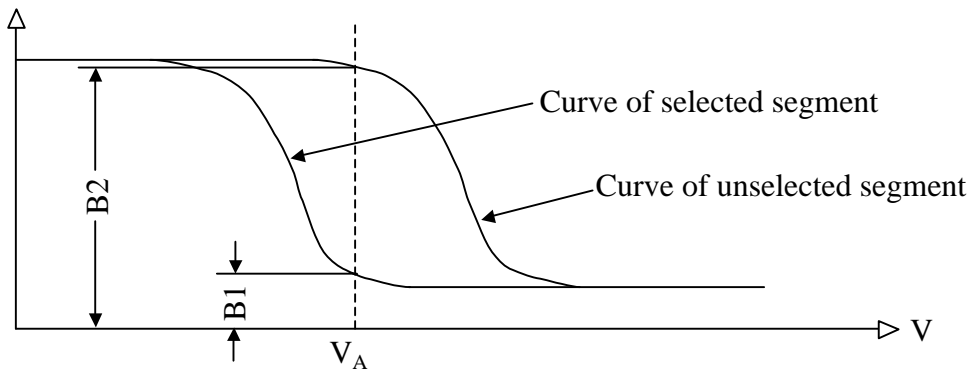
7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



7.2.2 Definition of Contrast Ratio

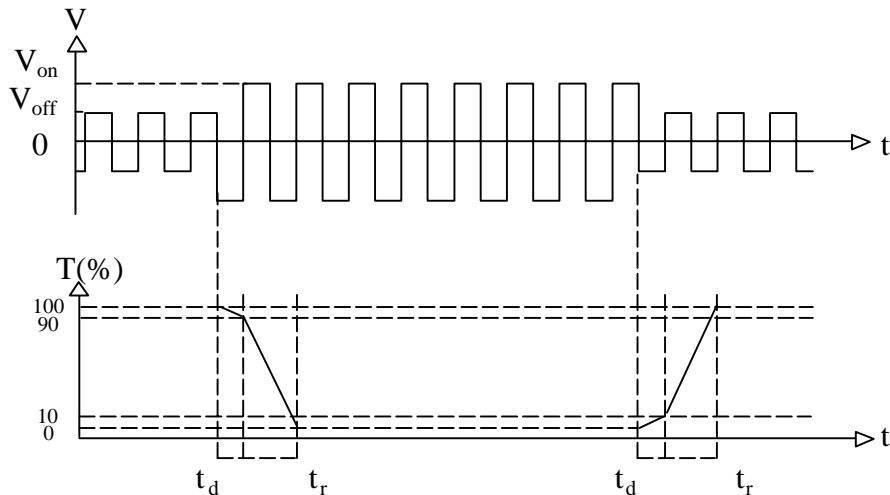
Brightness



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

Measuring Conditions:

- 1) Ambient Temperature: 25°C
- 2) Frame frequency: 70.0Hz



7.2.3 Definition of Response time

Turn on time: $t_{on} = t_d + t_r$

Turn off time: $t_{off} = t_d + t_r$

Measuring Condition:

- 1) Operating Voltage: 6.5V
- 2) Frame frequency: 70.0Hz

8.2 Failure Judgment Criterion

Criterion Item	Test Item No.							Failure Judgement Criterion
	1	2	3	4	5	6	7	
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 $T_{amb}=25^{\circ}C$ (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
<p>Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828</p>						

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 alcoholSolvents 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 string 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 °C ~ 40 °C

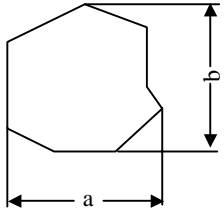
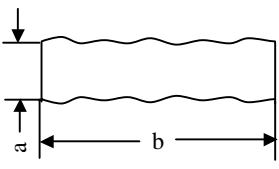
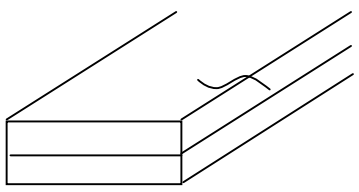
Relatively humidity: ≤ 80%

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.

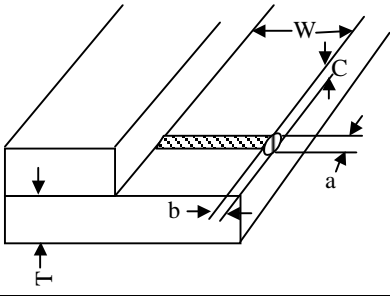
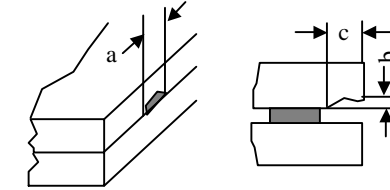
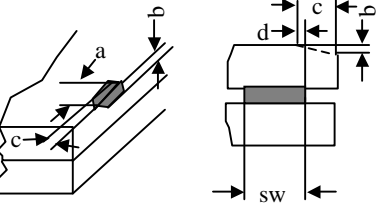
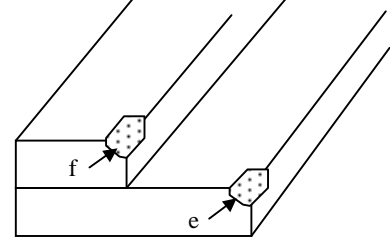
Appendix A

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 permitted	Max. 3 defects allowed		
		$\phi < 0.3 \text{ mm}$	$0.33 \phi \leq 0.5 \text{ mm}$		
	Scratches of Polarizer	According to the limit specimen			
Black spot (in viewing area)		Not counted	Max. 3 spots allowed		
		$X \leq 0.20 \text{ mm}$	$0.20 \text{ mm} \leq X \leq 0.5 \text{ mm}$		
		$X = (a+b)/2$			Max.3 spots (lines) allowed
Black spot (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			

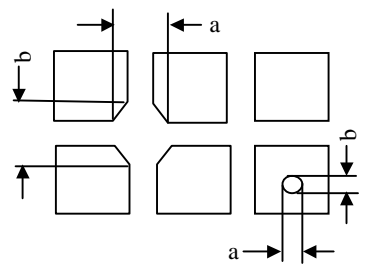
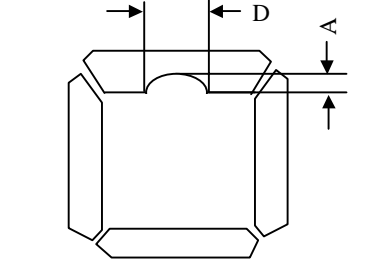
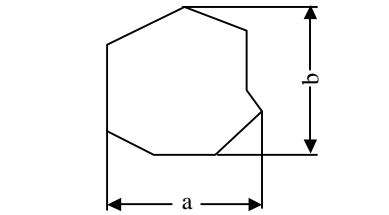
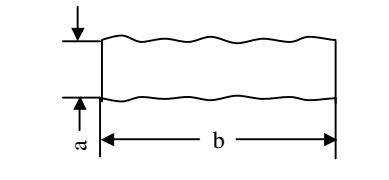
Appendix A

Inspection items and criteria for appearance defects (continued)

Items	Contents	Criteria						
Glass Cracks	<p>Cracks on pads</p> 	a	b	c	Max.2 Cracks allowed	Max.5 cracks allowed		
	$\leq 3\text{mm}$	$\leq W/5$	$\leq T/2$					
	$\leq 2\text{mm}$	$\leq W/5$	$T/2 < C < T$					
	<p>Cracks on contact side</p> 	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							
	<p>Cracks on non-contact side</p> 	a	b		Max.2 Cracks allowed			
	$\leq 3\text{mm}$	$\leq T/2$						
	$\leq 2\text{mm}$	$T/2 < b < T$						
$C \leq 0.5\text{mm}$								
$d \leq SW/3$								
<p>Corner cracks</p> 	$e < 2.0\text{mm}^2$ $f < 2.0\text{mm}^2$			Max.2 Cracks allowed				

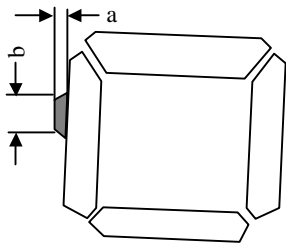

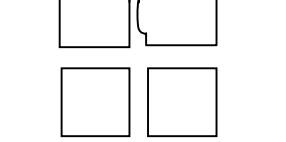


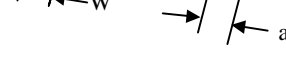
Appendix B

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

Inspection items and criteria for display defects (continued)

Items	Contents	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			