Displaytech
a seacomp company

LCD Module

Product Specification

64128K FC BW-RGB

128 x 64 DOTS Monochrome Display with RGB Backlight

June 8, 2018

Displaytech Ltd.
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Revision Record

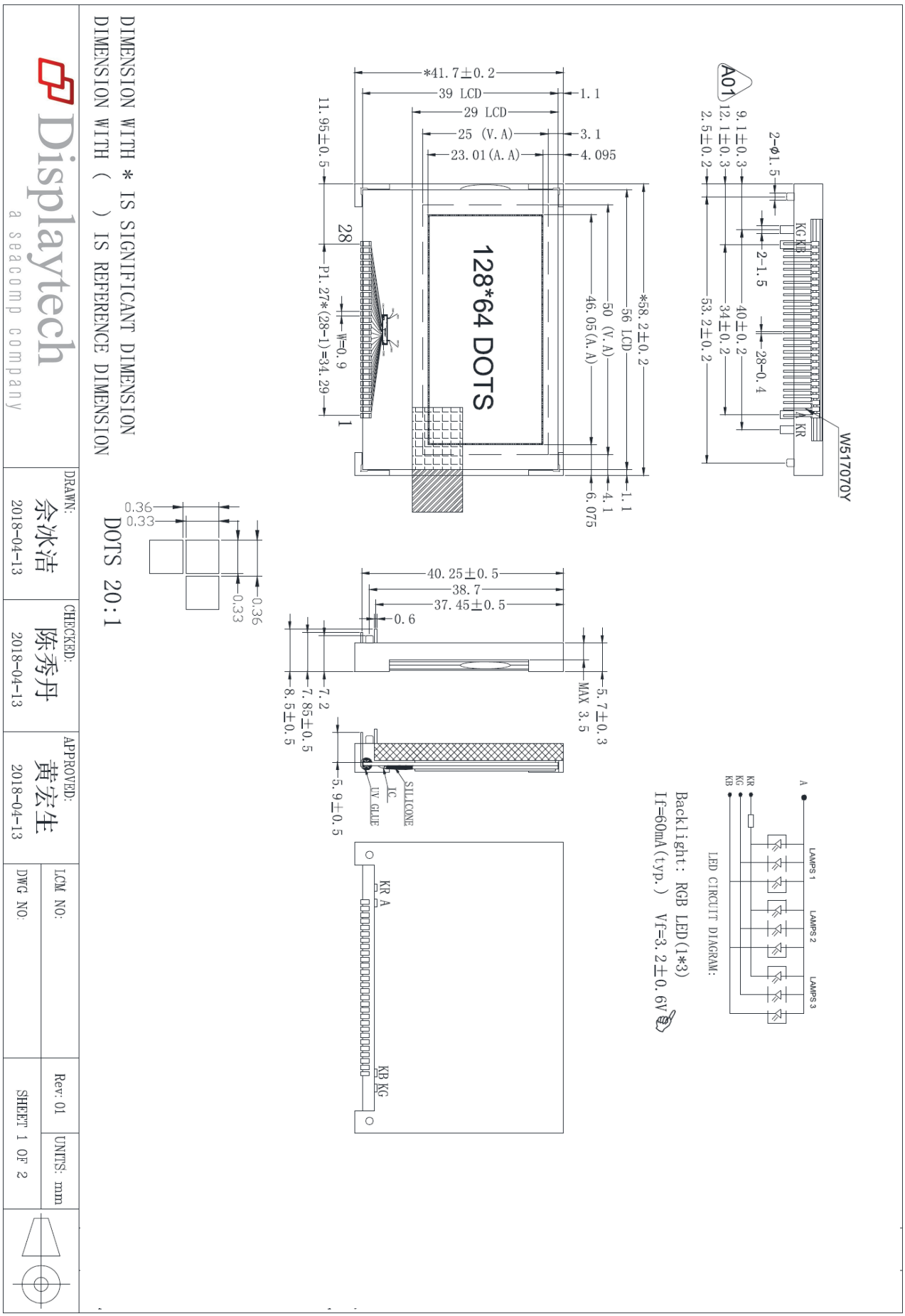
REV	CHANGES	DATE
A0 (Ref. A00 20170407)	First release	Apr 7, 2017
A1 (Ref. A01 20180529)	Updated backlight pins location tolerance in section 2. Mechanical Drawing.	Jun 8, 2018

Table of Content

1. General Specifications

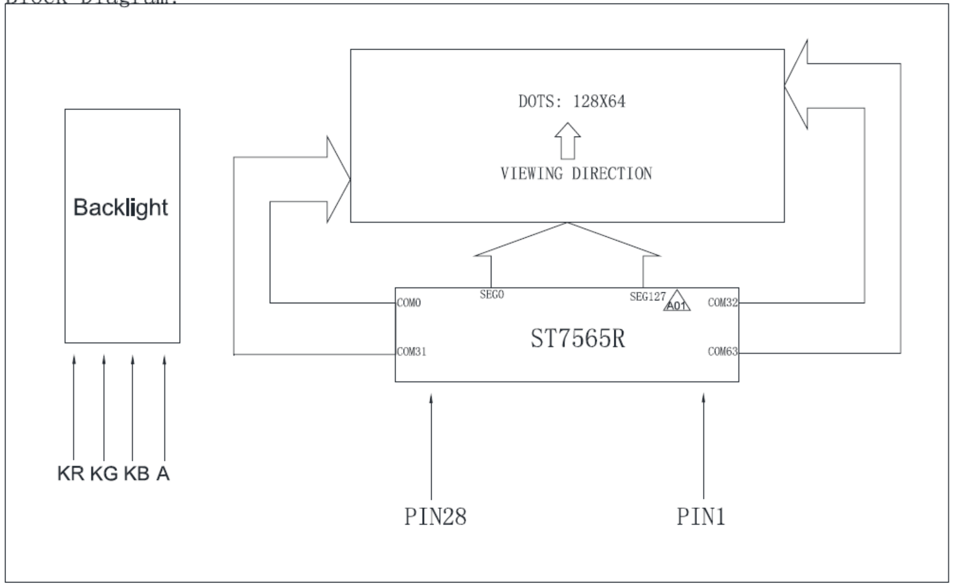
Item	Standard Value	Unit
Display Pattern	Graphic	
Color	Mono	
Resolution	128 x 64	DOTS
Module Dimension (W x H x T)	58.2 x 41.7 x 5.7	mm
Viewing Area (W x H)	50 x 25	mm
Active Area (W x H)	46.05 x 23.01	mm
DOT Size (W x H)	0.33 x 0.33	mm
DOT Pitch (W x H)	0.36 x 0.36	mm
LCD Type	FSTN, Positive	
Polarizer Type	Transflective	
View Direction	6 H	
LCD Controller & Driver	ST7565R	
LCD Driving Method	1/65 duty,1/9 bias	
Interface Type	4-line SPI; Parallel 6800, 8080	
Backlight Type	LED	
Backlight Color	RGB	
DC-DC Converter	Build-in	
Operation Temperature	-20 ~ +70	°C
Storage Temperature	-30 ~ +80	°C

2. Mechanical Drawing



3. Interface I/O Terminal

Block Diagram:



Pin Description:

PIN	Symbol	PIN	Symbol
1	CS1	15	VSS
2	/RES	16	VOUT
3	A0	17	CAP3P
4	/WR	18	CAP1N
5	/RD	19	CAP1P
6	D0	20	CAP2P
7	D1	21	CAP2N
8	D2	22	V4
9	D3	23	V3
10	D4	24	V2
11	D5	25	V1
12	D6	26	V0
13	D7	27	C86
14	VDD	28	P/S

DISPLAY TYPE: FSTN, Transflective, Positive
VIEWING DIRECTION: 6H
DRIVER IC: ST7565R
LOGIC VOLTAGE: 3.0±0.3V
LCD DRIVE VOLTAGE(V1cd): 9.0V
DRIVING METHOD: 1/65 DUTY, 1/9 BIAS
OPERATING TEMPERATURE: -20° ~ +70° C
STORAGE TEMPERATURE: -30° ~ +80° C
INTERFACE CONNECTOR: PIN
All UNMARKED TOLERANCE: ±0.2mm
( ) REFERENCE DIMENSION
PLEASE KINDLY CONFIRM

A01:Update LED-PCB pin tolerance
A00: Original Edition
Revision History:

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DRAWN:	CHECKED:	APPROVED:	LCM NO:	Rev: 01	UNITS: mm
陈维江	王彦涵	黄宏生	DWG NO:	SHEET 2 OF 2	
2018-04-13	2018-04-13	2018-04-13			

3.1 Pin Description

Pin	Symbol	Function Description
1	CS1	Chip select (Active low)
2	/RES	Reset input (Active low)
3	A0	Command/data select
4	/WR	Write execution control pin
5	/RD	Read execution control pin
6	D0	Bi-directional data
7	D1	Bi-directional data
8	D2	Bi-directional data
9	D3	Bi-directional data
10	D4	Bi-directional data
11	D5	Bi-directional data
12	D6	Bi-directional data
13	D7	Bi-directional data
14	VDD	Power supply
15	VSS	Power ground
16	VOUT	DC/DC voltage converter
17	CAP3P	DC/DC voltage converter
18	CAP1N	DC/DC voltage converter
19	CAP1P	DC/DC voltage converter
20	CAP2P	DC/DC voltage converter
21	CAP2N	DC/DC voltage converter
22	V4	Power supply for LCD
23	V3	Power supply for LCD
24	V2	Power supply for LCD
25	V1	Power supply for LCD
26	V0	Power supply for LCD
27	C86	MPU interface select
28	P/S	Parallel mode/serial mode select

4. Electro-Optical Specifications

4.1 Absolute Maximum Ratings

No	Item	Symbol	Min	Max	Unit
1	Power Supply Voltage	VDD	-0.3	3.6	V
2	Power Supply Voltage (VDD standard)	V0, VOUT	-0.3	13.5	V
3	Power Supply Voltage (VDD standard)	V1, V2, V3, V4	-0.3	V0	V

Note: Operating Temperature and Storage Temperature can be found in *1.General Specifications*.

4.2 Optical Characteristics

No	Item		Symbol	Condition	Min	Typ	Max	Unit
1	Contrast Ratio		Cr	Ta=23±3°C VLCD = Typ. (2)	-	4.3	-	-
2	Response Time		Tr	Ta=23±3°C	-	150	230	ms
			Tf		-	230	315	ms
3	Viewing Angle	3H		Cr = 2 Ta=23±3°C	22	28	-	Deg
		9H			43	42	-	Deg
		6H			37	40	-	Deg
		12H			38	40	-	Deg
4	R Brightness		Lv	Ta=23±3°C ILED = Typ.	-	55	-	cd/m²
	G Brightness				-	130	-	cd/m²
	B Brightness				-	22	-	cd/m²
5	Luminance Uniformity		△Lv		75	-	-	%

Note:
(1) See Appendix Definition of Optical Characteristics for detail.
(2) VLCD can be found in 4.3 Electrical Characteristics.

4.3 Electrical Characteristics

No	Item	Symbol	Condition	Min	Typ	Max	Unit
1	Power Supply Voltage	VDD	-	2.7	3.0	3.3	V
2	Power Supply Voltage (LCD drive voltage)	V0 (V_{LCD})	Ta=23±3°C	8.6	8.8	9.0	V
3	Current consumption for LCD	Idd	-	-	0.5	1.5	mA
4	Input High-level Voltage	V_IH	-	0.8*VDD		VDD	V
5	Input Low-level Voltage	V_{IL}	-	VSS		0.7*VDD	V
6	Output High-level Voltage	V_{OH}	-	0.8*VDD		VDD	V
7	Output Low-level Voltage	V_{OL}	-	VSS		0.2*VDD	V
8	Forward Current of Backlight	If	Ta=23±3°C		60		mA
9	Forward Voltage of Backlight	Vf	If= Typ. Ta=23±3°C	2.6	3.2	3.8	V
10	Luminous Uniformity of Backlight	△Lv		75	-	-	%
11	Emission Wavelength	R		620		635	-
		G		510		535	-
		B		460		480	-

4.4 Timing Characteristics

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

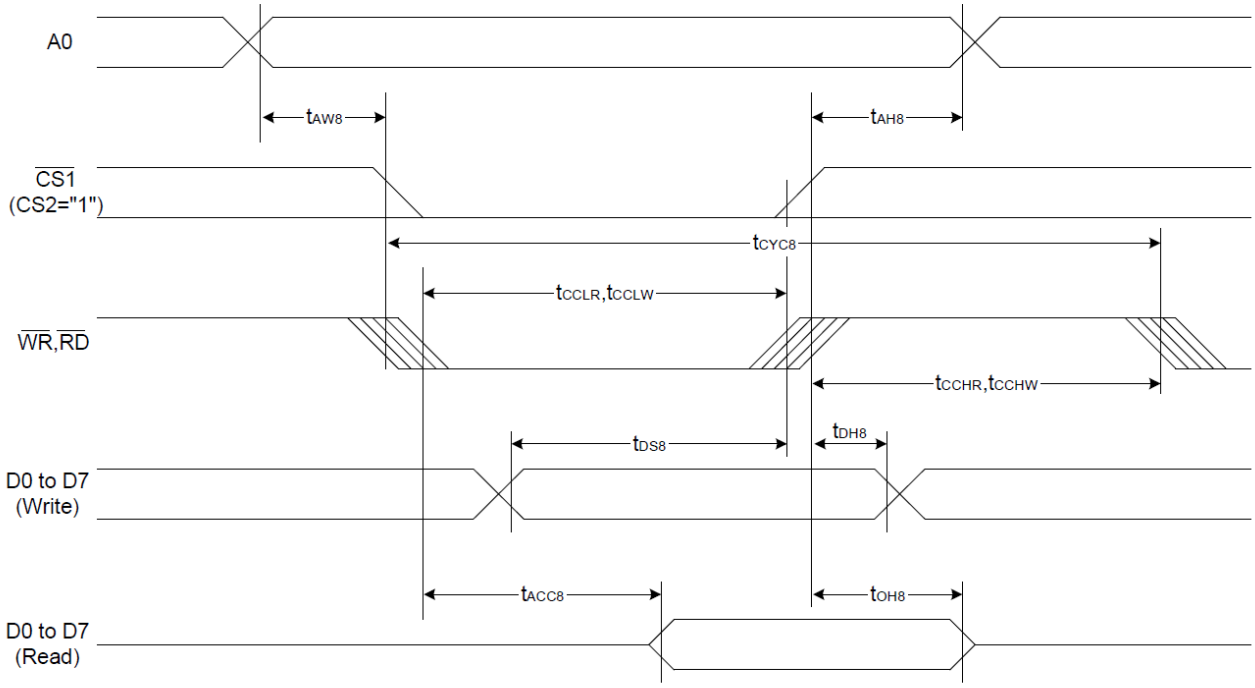


Figure 37

Table 24

(V_{DD} = 3.3V, Ta = –30 to 85℃)

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 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 100 pF	5	50	

Table 25

(V_{DD} = 2.7V, Ta = –30 to 85℃)

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}		400	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		220	—	
Enable H pulse width (WRITE)		t_{CCHW}		180	—	
Enable L pulse width (READ)	RD	t_{CCLR}		220	—	
Enable H pulse width (READ)		t_{CCHR}		180	—	
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 pF	—	140	
READ Output disable time		t_{OH8}	C_L = 100 pF	10	100	

*1 The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast, ($t_r + t_f$) ≦ ($t_{CYC8} – t_{CCLW} – t_{CCHW}$) for ($t_r + t_f$) ≦ ($t_{CYC8} – t_{CCLR} – t_{CCHR}$) are specified.
*2 All timing is specified using 20% and 80% of V_{DD} as the reference.
*3 t_{CCLW} and t_{CCLR} are specified as the overlap between /CS1 being “L” (CS2 = “H”) and /WR and /RD being at the “L” level.

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

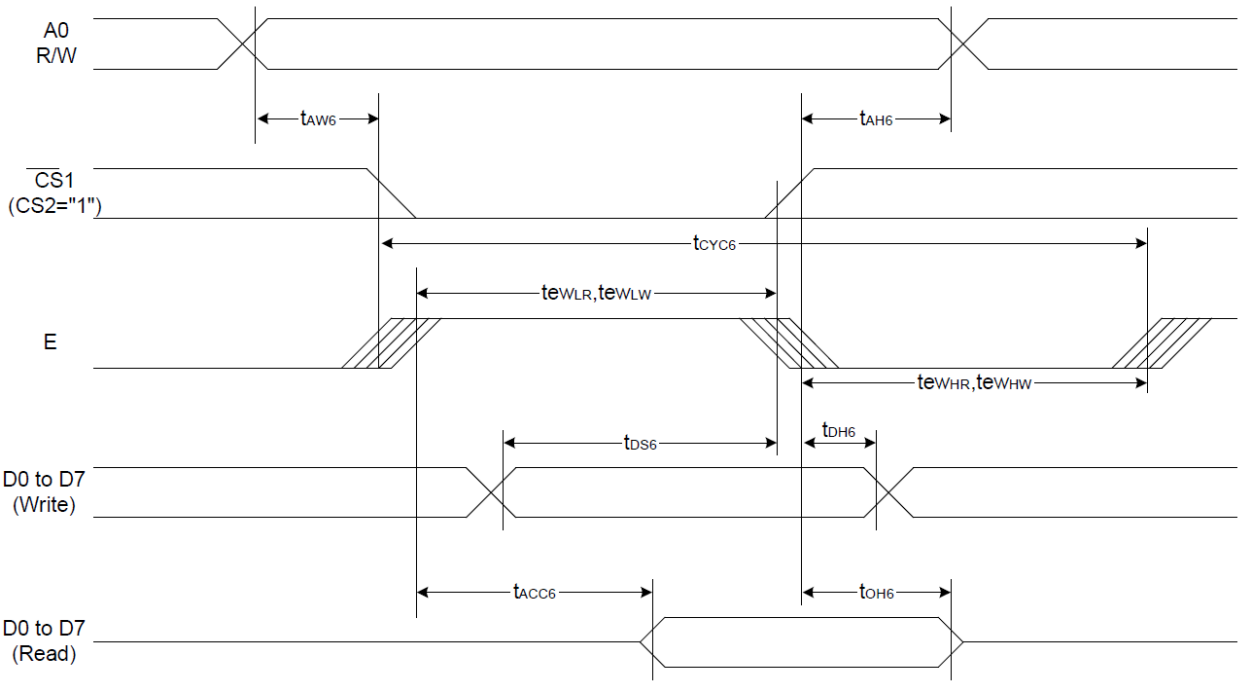


Figure 38

Table 26

(V_{DD} = 3.3V, Ta = –30 to 85℃)

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_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EWHR}		140		
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH6}	C_L = 100 pF	5	50	

Table 27

(V_{DD} = 2.7V, Ta = –30 to 85℃)

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}		400	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		220	—	
Enable H pulse width (WRITE)		t_{EWHW}		180	—	
Enable L pulse width (READ)	RD	t_{EWLR}		220	—	
Enable H pulse width (READ)		t_{EWHR}		180	—	
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	C_L = 100 pF	—	140	
READ Output disable time		t_{OH6}	C_L = 100 pF	10	100	

*1 The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast, ($t_r + t_f$) $\leqq$ ($t_{CYC6} - t_{EWLW} - t_{EWHW}$) for ($t_r + t_f$) $\leqq$ ($t_{CYC6} - t_{EWLR} - t_{EWHR}$) are specified.
*2 All timing is specified using 20% and 80% of V_{DD} as the reference.
*3 t_{EWLW} and t_{EWLR} are specified as the overlap between $\overline{CS1}$ being “L” (CS2 = “H”) and E.

The 4-line SPI Interface

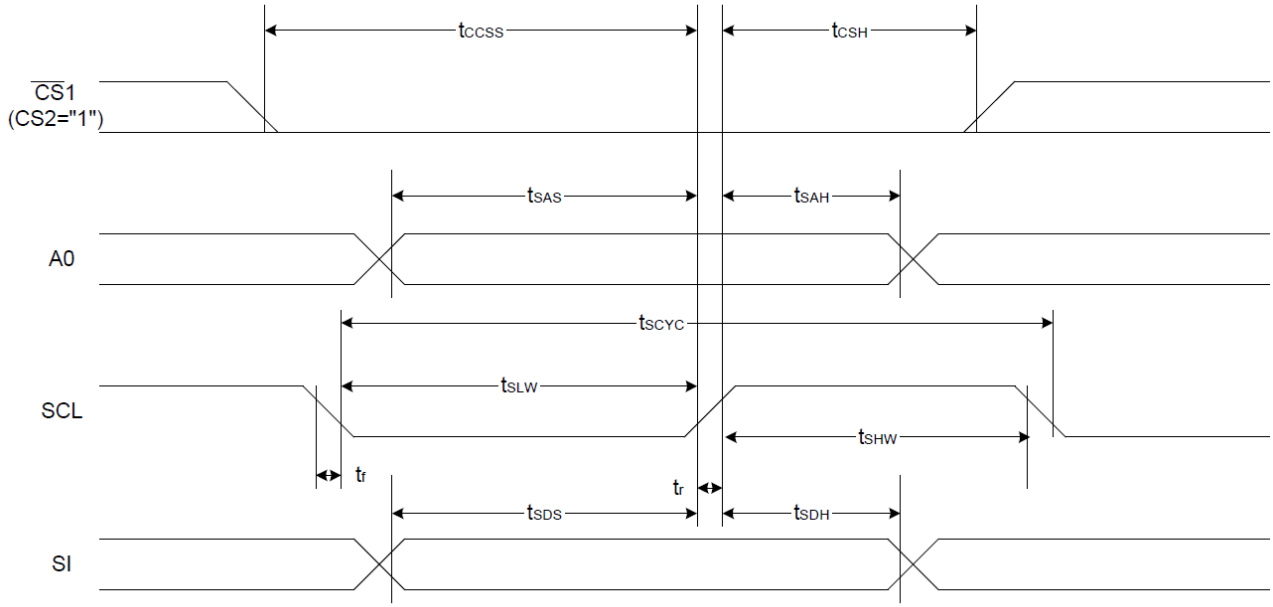


Figure 39

Table 28

(VDD = 3.3V,Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	Tscyc		50	—	ns
SCL “H” pulse width		Tshw		25	—	
SCL “L” pulse width		TSLW		25	—	
Address setup time	A0	TSAS		20	—	
Address hold time		Tsah		10	—	
Data setup time	SI	Tsds		20	—	
Data hold time		TSDH		10	—	
CS-SCL time	CS	Tcss		20	—	
CS-SCL time		Tcsh		40	—	

Table 29

(VDD = 2.7V,Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	Tscyc		100	—	ns
SCL “H” pulse width		TSHW		50	—	
SCL “L” pulse width		TSLW		50	—	
Address setup time	A0	TSAS		30	—	
Address hold time		TSAH		20	—	
Data setup time	SI	TSDS		30	—	
Data hold time		TSDH		20	—	
CS-SCL time	CS	TCSS		30	—	
CS-SCL time		TCSH		60	—	

*1 The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
*2 All timing is specified using 20% and 80% of VDD as the standard.

Reset Timing

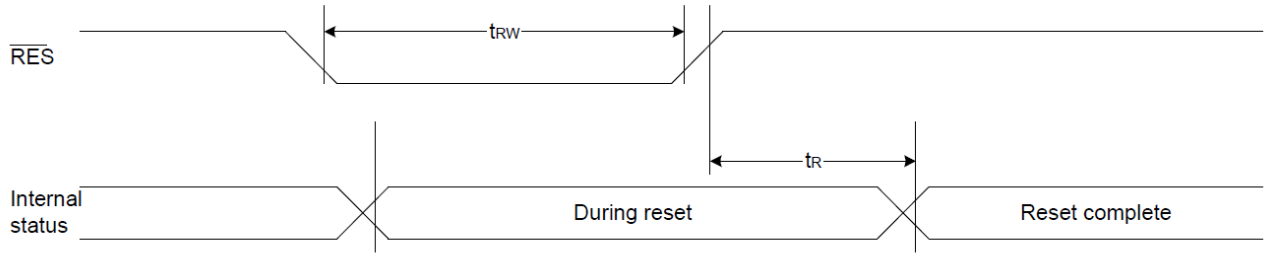


Figure 41

Table 30

(V_{DD} = 3.3V, Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_R		—	—	1.0	us
Reset "L" pulse width	/RES	t_{RW}		1.0	—	—	us

Table 31

(V_{DD} = 2.7V, Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_R		—	—	2.0	us
Reset "L" pulse width	/RES	t_{RW}		2.0	—	—	us

*1 All timing is specified with 20% and 80% of V_{DD} as the standard.

5. Programming

5.1 Instruction Table

Table 16: Table of ST7565R Commands (Note) *: ignored data

Command	Command Code											Function
	A0	/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 Column address set lower bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
				0	0	0	0	Least significant 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 (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	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	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	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) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
				0	0	Electronic volume value						
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0 1	0: Sleep mode, 1: Normal mode
				*	*	*	*	*	*	0	0	
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Note: See Datasheet of LCD Driver for detail.

5.2 Display Data RAM

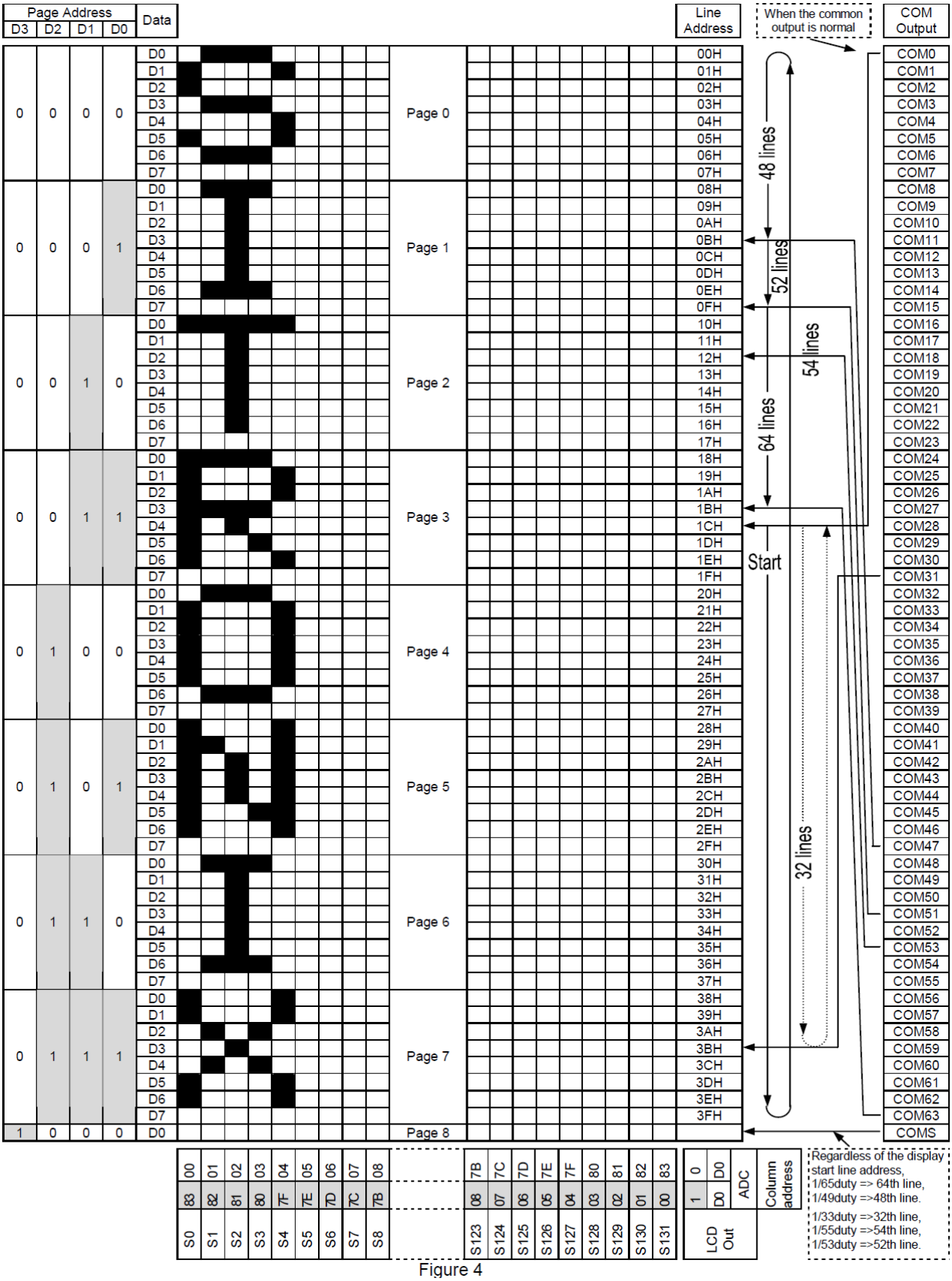
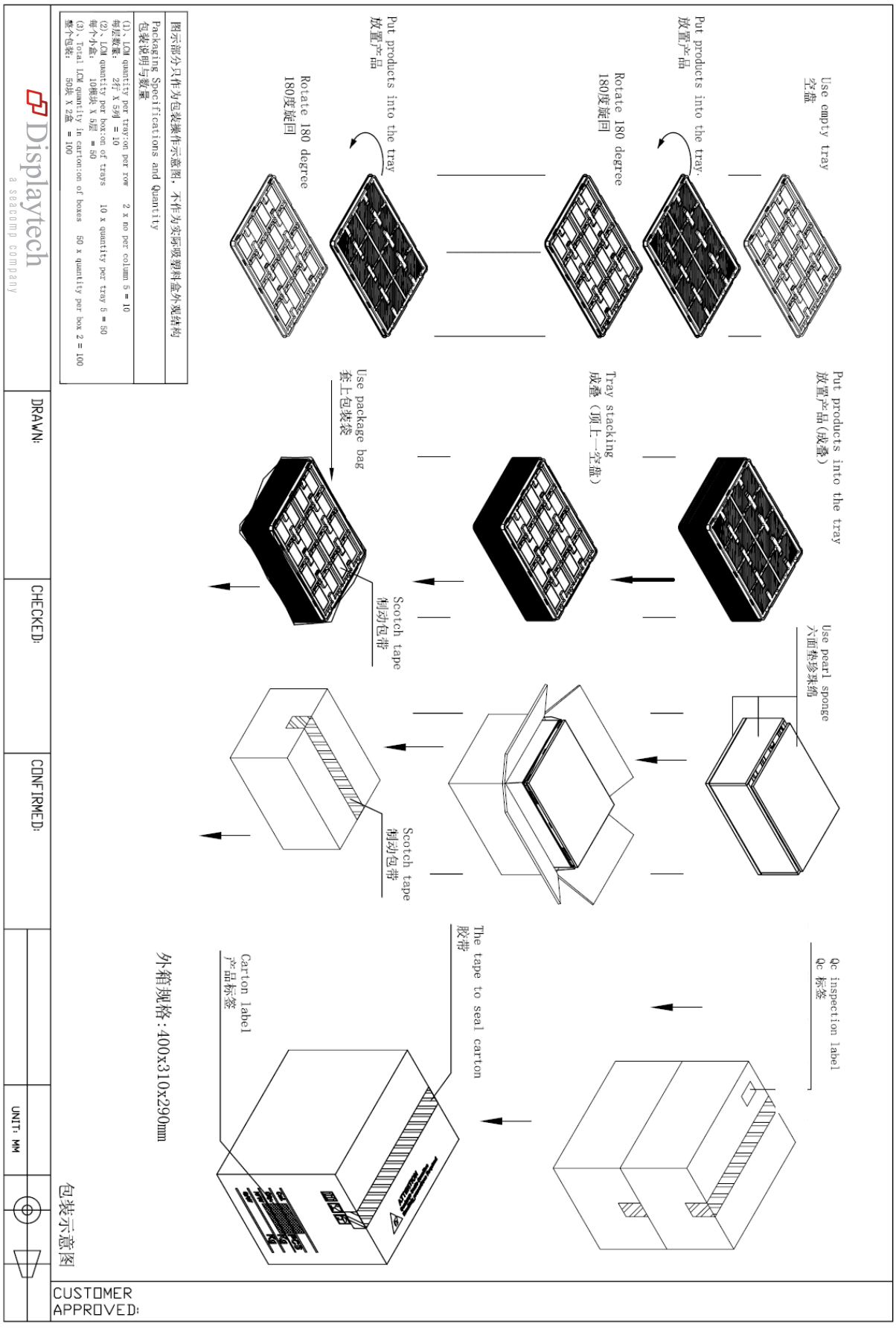


Figure 4

Appendix A

A.1 Packing Method

A.1.1 Flowchart



Note: Detail refer to goods label in mass production

A.1.2 Carton Label

Carton label is printed with A4 paper.

PART NO: 64128K FC BW-RGB
QTY: 100 PCS
P/O NO: XXXXXXXXX
CARTON: TBD

DISPLAYTECH
UNIT E, 31/F, BILLION PLAZA 2
10 CHEUNG YUE STREET
CHEUNG SHA WAN, KLN, HONG KONG
TEL: +852 2311 2080
FAX: +852 2722 6998
MADE IN CHINA

Remark:
1) PART NO = Displaytech part number
2) QTY = Quantity of products inside the box
3) P/O NO = Customer PO number
4) CARTON = Carton number

A.2 Part Number Definition

64128K F C B W-RGB

- W-RGB → Backlight Color: RGB
- W → Temperature Range: C: Commercial, 0 to 50°C; W: Wide, -20 to 70°C
- B → Viewing Angle (B: 6 o'clock; T: 12 o'clock)
- C → Backlight (A: none; B: EL; C: LED; D: CCFL)
- F → LCD Mode: (A: TN; B: STN Yellow/Green; C: STN Blue; D: STN Grey; F: FSTN; G: FSTN Negative; H: HTN)
- 64128K → Model No.

A.3 Definitions of Optical Characteristic

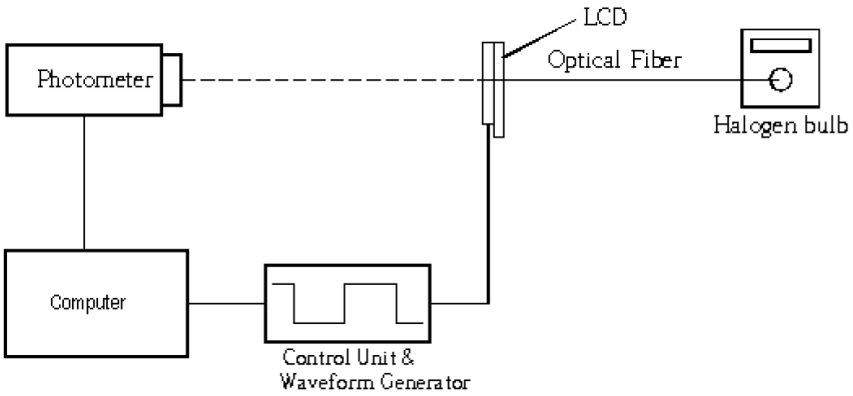
A.3.1 Contrast Ratio Test

A) Contrast ratio is calculated by the following formula when the output voltage is obtained from the electro-optical test system.
B) Test Condition: Accord to the LCD's driving method and operating voltage (VLCD).
C) Formula:

$$\text{Contrast Ratio (Positive type)} = \frac{\text{Photometer output voltage when non-select waveform is applying}}{\text{Photometer output voltage when select waveform is applying}}$$

$$\text{Contrast Ratio (Negative type)} = \frac{\text{Photometer output voltage when select waveform is applying}}{\text{Photometer output voltage when non-select waveform is applying}}$$

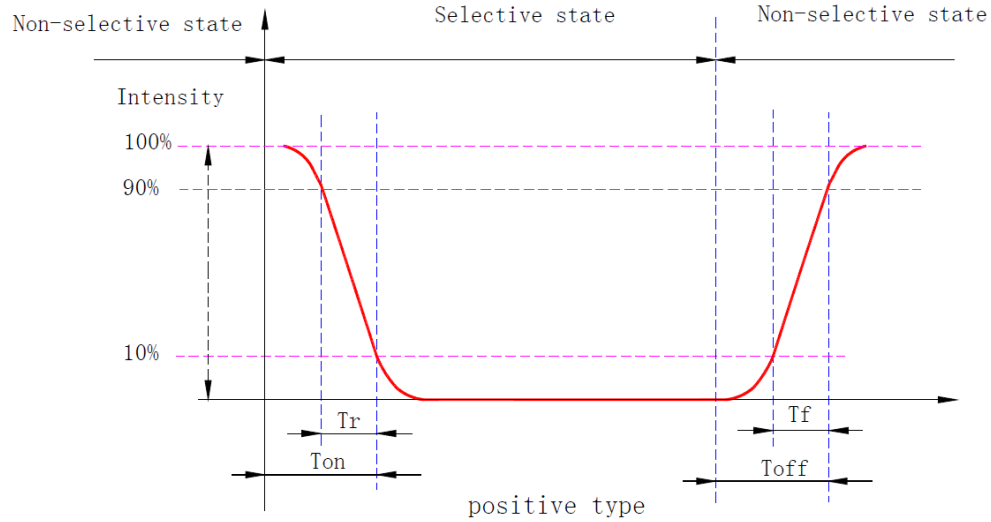
D) Test system:



A.3.2 Response time

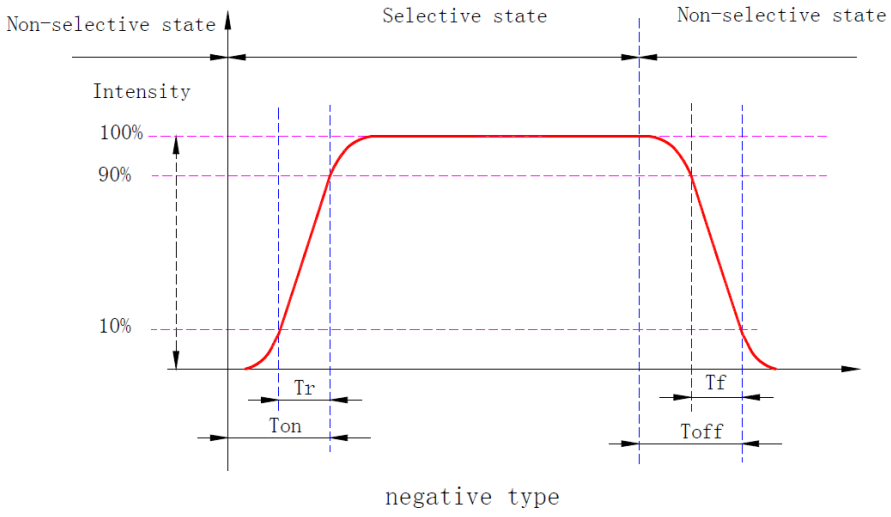
A.3.2.1 Positive type

A) Rise time is defined as the time required for the transmission to change from 90% to 10%.
B) Fall time is defined as the time required for the transmission to change from 10% to 90%.
C) On time is defined as the time required for the transmission to change from 100% to 10%.
D) Off time is defined as the time required for the transmission to change from 0% to 90%.



A.3.2.2 Negative type

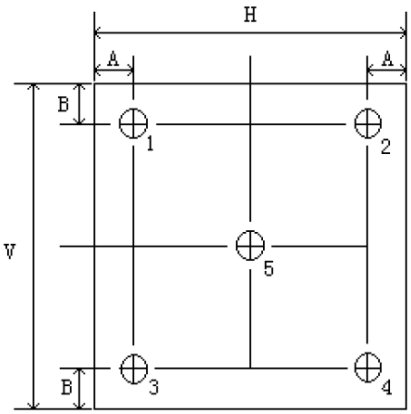
A) Rise time is defined as the time required for the transmission to change from 10% to 90%.
B) Fall time is defined as the time required for the transmission to change from 90% to 10%.
C) On time is defined as the time required for the transmission to change from 0% to 90%.
D) Off time is defined as the time required for the transmission to change from 100% to 10%.



A.3.3 Luminance Measurement

Luminance is a cd/m^2 (nits) measurement of the display's white color (white screen).
All measurements are performed in a dark ambient.
Display luminance is defined as the average value of five (5) white screen measurements. The location of these 5 measurement points is shown in the drawing below.

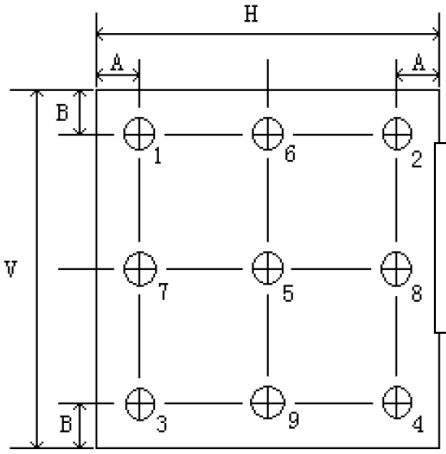
$$\text{Display Luminance} = \frac{\text{Surface Luminance of all white screen (1+2+3+4+5)}}{5}$$



Screen Luminance Measurement Points (5)
- A: 5mm
- B: 5mm
- H / V: Active Area
- Measuring Equipment: DMS505
- Measurement point diameter: 3mm

A.3.4 White Uniformity Measurement

White luminance uniformity is a cd/m^2 (nits) measurement of the display's white color across the display screen.
All measurements are performed in a dark ambient.
Display luminance uniformity is defined as the percent (%) of luminance value variation over nine (9) white screen measurements. The location of these 9 measurement points is shown in the drawing below.

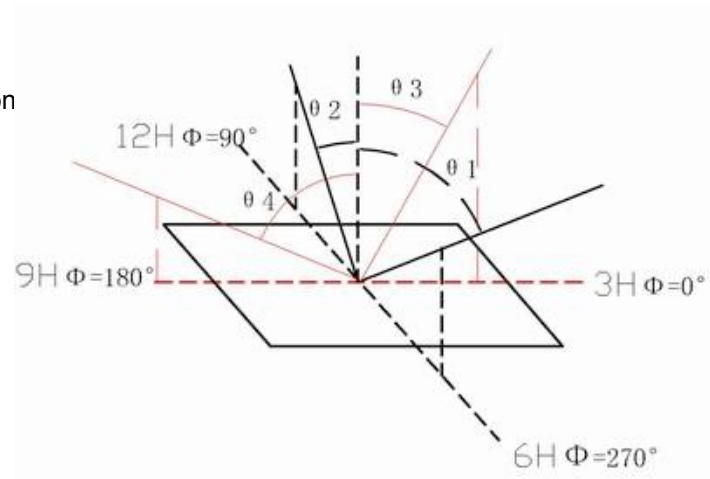


- A: 5mm
- B: 5mm
- H / V: Active Area
- Measuring Equipment: DMS505
- Measurement point diameter: 3mm

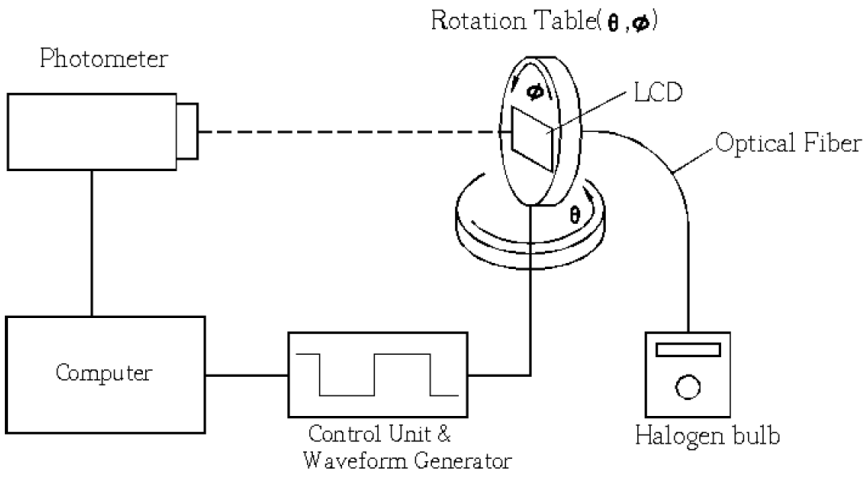
$$\text{Luminance Uniformity} = \frac{\text{Min Luminance (9 Pts.1- 9)}}{\text{Max Luminance (9 Pts.1- 9)}} \times 100\%$$

A.3.5 Viewing Angle

A) Viewing angle is definition



B) System Block Diagram



Appendix B

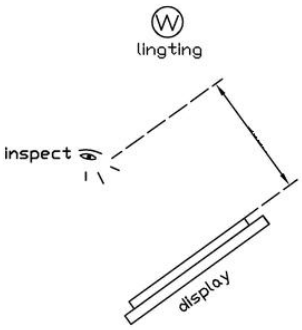
B.1 Quality Units

B.1.1 Purpose & Scope

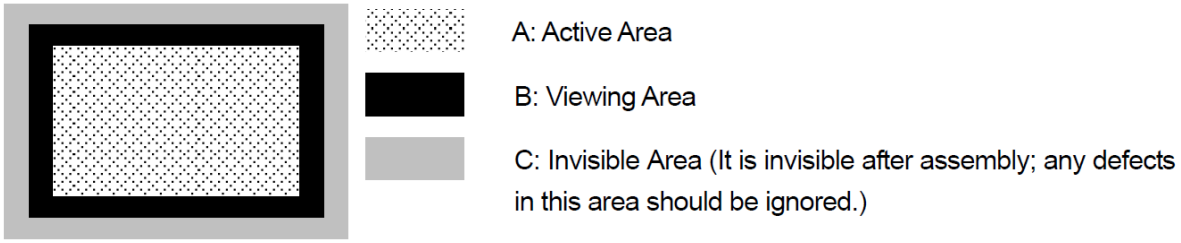
a. This standard is applicable for mono STN products which were produced by our company. All mono STN products of our company should be subject to this standard;
b. If some defect item was not defined exactly in this standard, there must be a negotiation between customer and our company;
c. If customer had special requirements, there also must be a negotiation between customer and our company.

B.1.2 Inspection Conditions

a. Inspection direction should be perpendicular to LCD surface;
b. Inspection should be performed under the condition of 20~40W fluorescent lamp;
c. The distance between inspector's eyes & product surface should be 30cm~50cm when inspection.



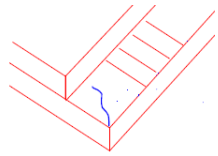
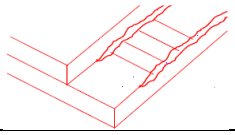
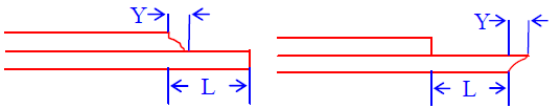
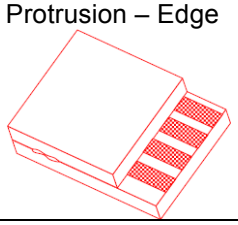
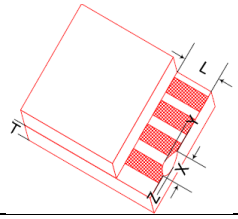
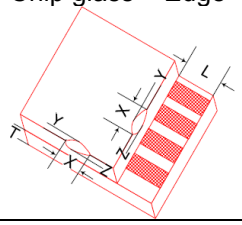
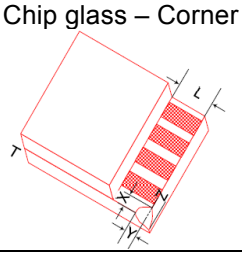
B.1.3 Definition of LCD area



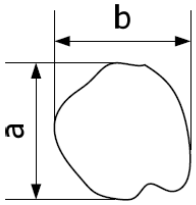
B..4 Sampling Plan

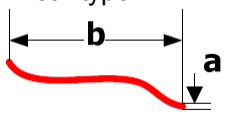
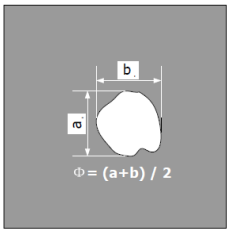
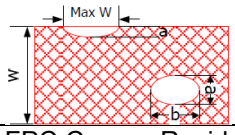
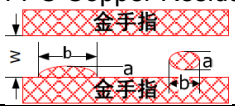
a. Sampling Method
According to GB2828.1-2003 (Equivalent to MIL-STD-105/E) General inspection level II.
b. AQL Definition
Major: AQL=0.65 (Please refer to the definition in “B.1.5 & B.1.6 Inspection Criteria”)
Minor: AQL=1.0 (Please refer to the definition in “B.1.5 & B.1.6 Inspection Criteria”)

B.1.5 Inspection Criteria (Not energized)

<table>
<tr><th>No</th><th>Defect Name & Illustration</th><th>Criteria</th><th>Class</th></tr>
<tr><td>1.5.1</td><td>Light Leakage</td><td>Not allowed</td><td>Major</td></tr>
<tr><td>1.5.2</td><td>Vacuum Bubble</td><td>Not allowed</td><td>Major</td></tr>
<tr><td>1.5.3</td><td>Rainbow</td><td>According to limit sample</td><td>Minor</td></tr>
<tr><td>1.5.4</td><td>Glass Crack
  </td><td>Not allowed</td><td>Minor</td></tr>
<tr><td>1.5.5</td><td>Protrusion - ITO lead
  </td><td> 
Y≤L/3, allowed quantity:2</td><td>Minor</td></tr>
<tr><td>1.5.6</td><td>Protrusion – Edge
  </td><td>Allowed if protrusion didn’t affect dimension.</td><td>Minor</td></tr>
<tr><td>1.5.7</td><td>Chip glass - ITO Lead
  </td><td>Unit: mm
<table>
<tr><th>S (cm²)</th><th>X</th><th>Y</th><th>Z</th><th>Allowed Qty</th></tr>
<tr><td>50<S</td><td>≤6.0</td><td>≤L/3</td><td>≤T</td><td>3</td></tr>
<tr><td>12<S≤50</td><td>≤5.0</td><td>≤L/3</td><td>≤T</td><td>3</td></tr>
<tr><td>S≤12</td><td>≤4.0</td><td>≤L/3</td><td>≤T</td><td>3</td></tr>
<tr><td>S random</td><td>Random</td><td>≤0.5, if L/3>0.5</td><td>≤T/2</td><td>NC (1)</td></tr>
</table>
Remark: S was the outline area (big glass area).</td><td>Minor</td></tr>
<tr><td>1.5.8</td><td>Chip glass – Edge
  </td><td>Unit: mm
<table>
<tr><th>S (cm2)</th><th>X</th><th>Y*</th><th>Z</th><th>Extend width of seal line</th><th>Allowed Qty</th></tr>
<tr><td>50<S</td><td>≤6.0</td><td>≤2.0</td><td>≤T</td><td>≤1/2</td><td>NC</td></tr>
<tr><td>12<S≤50</td><td>≤5.0</td><td>≤1.5</td><td>≤T</td><td>≤1/2</td><td>NC</td></tr>
<tr><td>S≤12</td><td>≤4.0</td><td>≤1.0</td><td>≤T</td><td>≤1/3</td><td>NC</td></tr>
<tr><td>S random</td><td>Random</td><td>≤0.5</td><td>≤T/2</td><td>-</td><td>NC</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>1.5.9</td><td>Chip glass – Corner
  </td><td>Unit: mm
<table>
<tr><th>S (cm²)</th><th>X</th><th>Y</th><th>Z</th><th>Allowed Qty</th></tr>
<tr><td>50<S</td><td>≤6.0</td><td>≤L</td><td>≤T</td><td>2</td></tr>
<tr><td>12<S≤50</td><td>≤5.0</td><td>≤L</td><td>≤T</td><td>2</td></tr>
<tr><td>S≤12</td><td>≤4.0</td><td>≤L</td><td>≤T</td><td>2</td></tr>
</table>
Remark: If X reach ITO lead, according to the criteria of “1.5.7”.</td><td>Minor</td></tr>
</table>

Note (1): NC = Not Count

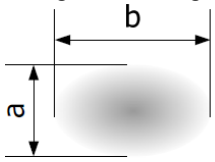
<table>
<tr><th>No</th><th>Defect Name & Illustration</th><th>Criteria</th><th>Class</th></tr>
<tr><td>1.5.10</td><td>Circular type
 

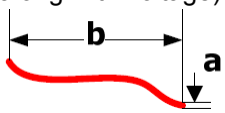
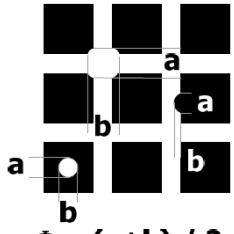
Φ= (a+b) / 2</td><td>Suppose S (2)= The area of A, the criteria in A&B is as below,
<table><tr><th>S (cm²)
Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>Φ≤0.10</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.10<Φ≤0.20</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.20<Φ≤0.30</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.30</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Bubble, dirt spot, concavo-convex spot & stab spot should be regarded as circular defect.
Maximum defect number in 1cm² is 1.
Please refer to footmark for the conversion between S & Diagonal.</td><td>Minor</td></tr>
<tr><td>1.5.11</td><td>Linear type
 
</td><td>Suppose S= The area of A, the criteria in a&b is as below,
<table><tr><th>S (cm²)
a&b Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>a≤0.03</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.03<a≤0.05, b≤3</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>a>0.05</td><td colspan="5">According to the criteria of <1.5.10></td></tr></table>Remark: Linear scratch, dirt line should be regarded as linear defect.
Maximum defect number in 1cm² is 1.</td><td>Minor</td></tr>
<tr><td>1.5.12</td><td>Polar bubble / Dent
 
</td><td>Suppose S= The area of A, the criteria in A&B is as below,
<table><tr><th>S (cm²)
Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>Φ≤0.15</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.15<Φ≤0.25</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.25<Φ≤0.35</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.35</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Maximum defect number in 1cm² is 1.
Ignore the dent if it can't be seen in positive angle.</td><td>Minor</td></tr>
<tr><td>1.5.13</td><td>Polarizer Stab</td><td>According to the criteria of <1.5.10></td><td>Minor</td></tr>
<tr><td>1.5.14</td><td>Polarizer Scratch</td><td>According to the criteria of <1.5.11></td><td>Minor</td></tr>
<tr><td>1.5.15</td><td>FPC Pinhole
 
</td><td><table><tr><th>a</th><th>b</th><th>Allowed Qty</th></tr><tr><td>≤W/3</td><td>≤W</td><td>NC</td></tr><tr><td>>W/3</td><td>>W</td><td>Not allowed</td></tr></table></td><td>Minor</td></tr>
<tr><td>1.5.16</td><td>FPC Copper Residue
 
</td><td><table><tr><th>a</th><th>b</th><th>Allowed Qty</th></tr><tr><td>≤W/3</td><td>≤W</td><td>NC</td></tr><tr><td>>W/3</td><td>>W</td><td>Not allowed</td></tr></table></td><td>Minor</td></tr>
<tr><td>1.5.17</td><td>FPC Impress / Crease</td><td><table><tr><th>Shape</th><th>Allowed Qty</th></tr><tr><td>Moulage / Impress</td><td>NC</td></tr><tr><td>Crease with a sharp angle</td><td>Note allowed</td></tr></table></td><td>Minor</td></tr>
<tr><td>1.5.18</td><td>Soldering defect</td><td>According to the criteria of IPC-A-610C</td><td>Minor</td></tr>
</table>

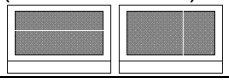
Note (2): Suppose Length:Width = 4:3, The conversion between S & diagonal length is as below table,

S (cm²)	Diagonal Length (Inch)
4	1.13
12	1.95
50	3.99
150	6.91

B.1.6 Inspection Criteria (Energized)

<table>
<tr><th>No</th><th>Defect Name & Illustration</th><th>Criteria</th><th>Class</th></tr>
<tr><td>1.6.1</td><td>Circular type when display (Not change along with voltage)</td><td>According to the criteria of <1.5.10></td><td>Minor</td></tr>
<tr><td>1.6.2</td><td>Circular type when display (Change along with voltage)
 

Φ = (a+b) / 2</td><td>Suppose S= The area of A, the criteria in a&b is as below,
<table><tr><th>S (cm²)
Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>Φ≤0.30</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.30<Φ≤0.50</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.50<Φ≤0.80</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.80</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Maximum defect number in 1cm² is 1.</td><td>Minor</td></tr>
<tr><td>1.6.3</td><td>Linear type when display (Not change along with voltage)</td><td>According to the criteria of <5.1.11></td><td>Minor</td></tr>
<tr><td>1.6.4</td><td>Linear type when display (Change along with voltage)
 
</td><td>Suppose S= The area of A, the criteria in a&b is as below,
<table><tr><th>S (cm²)
a&b Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>a≤0.05</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.05<a≤0.10, b≤5</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>a>0.10</td><td colspan="5">According to the criteria of <1.6.2></td></tr></table>Remark: Maximum defect number in 1cm² is 1.</td><td>Minor</td></tr>
<tr><td>1.6.5</td><td>Pinhole
 

Φ = (a+b) / 2</td><td>Suppose S= The area of A, the criteria in a&b is as below,
<table><tr><th>S (cm²)
Φ (mm)</th><th>S≤4</th><th>4<S≤12</th><th>12<S≤50</th><th>50<S≤150</th><th>S>150</th></tr><tr><td>Φ≤0.10</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.10<Φ≤0.15</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.15<Φ≤0.25</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.25</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Maximum defect number in 1cm² is 1.</td><td>Major</td></tr>
<tr><td>1.6.6</td><td>Segment Distortion</td><td>More than 1/5 size in spec is not allowed.</td><td>Major</td></tr>
<tr><td>1.6.7</td><td>Missing Segment (Row or column)
  </td><td>Not allowed.</td><td>Major</td></tr>
<tr><td>1.6.8</td><td>Abnormal Display</td><td>Not allowed.</td><td>Major</td></tr>
<tr><td>1.6.9</td><td>Display inhomogeneity / CR inhomogeneity</td><td>According to the approved sample by both sides</td><td>Minor</td></tr>
<tr><td>1.6.10</td><td>Too much current</td><td>Not allowed.</td><td>Major</td></tr>
<tr><td>1.6.11</td><td>No display</td><td>Not allowed.</td><td>Major</td></tr>
<tr><td>1.6.12</td><td>No backlight / flicking</td><td>Not allowed.</td><td>Major</td></tr>
</table>

B.2 Reliability Test

B.2.1 Standard Specifications for Reliability

B.2.1.1Test method

There should be no existing conspicuous failure of functions and appearance in LCD after the following tests.

No	Item	Description
1	Low Temperature Operating	The sample should be allowed to stand at (-20±2)℃ for 96 Hours under driving condition.
2	High Temperature Operating	The sample should be allowed to stand at (70±2)℃ for 96 Hours under driving condition.
3	Low Temperature Storage	The sample should be allowed to stand at (-30±3)℃ for 96 Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
4	High Temperature Storage	The sample should be allowed to stand at (80±2)℃ for 96Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
5	Moisture resistance	The sample should be allowed to stand at (40±2)℃, (95±2)%RH for 96Hours under no-load condition excluding the polarizer, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours
6	Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: T_{STL} * for 30 minutes -> normal temperature for 5 minutes -> T_{STH} * for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours

Note:

- T_{STL}: Lowest Storage Temperature.
- T_{STH}: Highest Storage Temperature.

B.2.1.2 Testing Conditions and Inspection Criteria:

For the final test, the testing sample must be stored at room temperature for 24 hours, after the tests listed above; Standard specifications for Reliability have been executed in order to ensure stability.

No	Item	Description
1	Current Consumption	The current consumption should be under double of initial test.
2	Contrast	The contrast must be larger than half of initial test.
3	Appearance	Appearance defects should not happen.

B.2.2 Life Time

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10°C), normal humidity (45±20%RH), and in area not exposed to direct sunlight.

B.3 Caution for Using

1. Recommended storage condition: 50~60%RH, 25+/-5℃;
2. Avoid direct sunlight. Avoid operating or storage under the temperature which exceeds the standard for a long time;
3. Avoid driving LCD with DC (Direct Current);
4. LCD was made of glass, please avoid any impact or pressure on surface;
5. If the skin contact with liquid crystal incautiously, wash with water for more than 15 minutes. If you feel uncomfortable, please see the doctor immediately;
6. It is prohibited to clean polarizer by ethanol or acetone. Clean polarizer by pure water is recommended;

7. The products should be used within 6 month. Otherwise, the ITO pad and FPC pad maybe be oxidized and cause poor contact, etc.;
8. ESD: TFT module or COG module is sensitive to ESD, effective action should be taken before you touch the products;
9. Avoid contacting the ITO pad by hand and pressing the surface of the LCD. Please take the both sides when you fetch the LCD.

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