

LCD MODULE

MODULE NO. :

KSEGB320240C-FWZ-V SERIES**Customer:**

Approved by:

Approved by	Checked by	Prepared by



CONTENTS

1. MODULE CLASSIFICATION INFORMATION 3

2. FUNCTIONS & FEATURES 4

3. MECHANICAL SPECIFICATIONS 4

4. EXTERNAL DIMENSIONS 5

5. BLOCK DIAGRAM6

6. PIN ASSIGNMENT6

7. ABSOLUTE MAXIMUM RATINGS(VSS=0V, TA=25C) 7

8. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS 7

9. ELECTRICAL CHARATERISTICS 8

10. OPERATION TIMING DIAGRAM 11

11. OPTICAL CHARACTERISTICS 12

12. RELIABILITY TEST 14

13. INSPECTION SPECIFICATION15

14. LCD MODULES HANDLING PRECAUTIONS 18

15. OTHERS 18

1. MODULE CLASSIFICATION INFORMATION**KSE G B 320240 C - F W Z - V**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

- ① KSE: KEEN SIDE electronics
- ② C: Character Type, G: Graphic Type
- ③ B: COB, G: COG
- ④ Display Font: 320 * 240
- ⑤ Model serials no. :
- ⑥ LCD Mode: B→ STN-Blue Negative F→ FSTN Positive
 G→ STN Gray Positive Y→ STN Yellow Green Positive
- ⑦ Backlight Type: N→ Without backlight A→ Amber LED backlight
 B→ Blue LED backlight G→ Green LED backlight
 R→ Red LED backlight W→ Withe LED backlight
 Y→ Yellow-Green LED backlight
- ⑧ LCD Polarizer Type/Temperature range/View direction :
 D→ Transflective, W.T, 12:00 E→ Transmissive, W.T, 6:00
 P→ Reflective, W. T, 6:00 Q→ Transmissive, W.T, 12:00
 Z→ Transflective, W.T, 6:00
- ⑨ Special Code: V : Built in negative voltage& Temperature Compensation

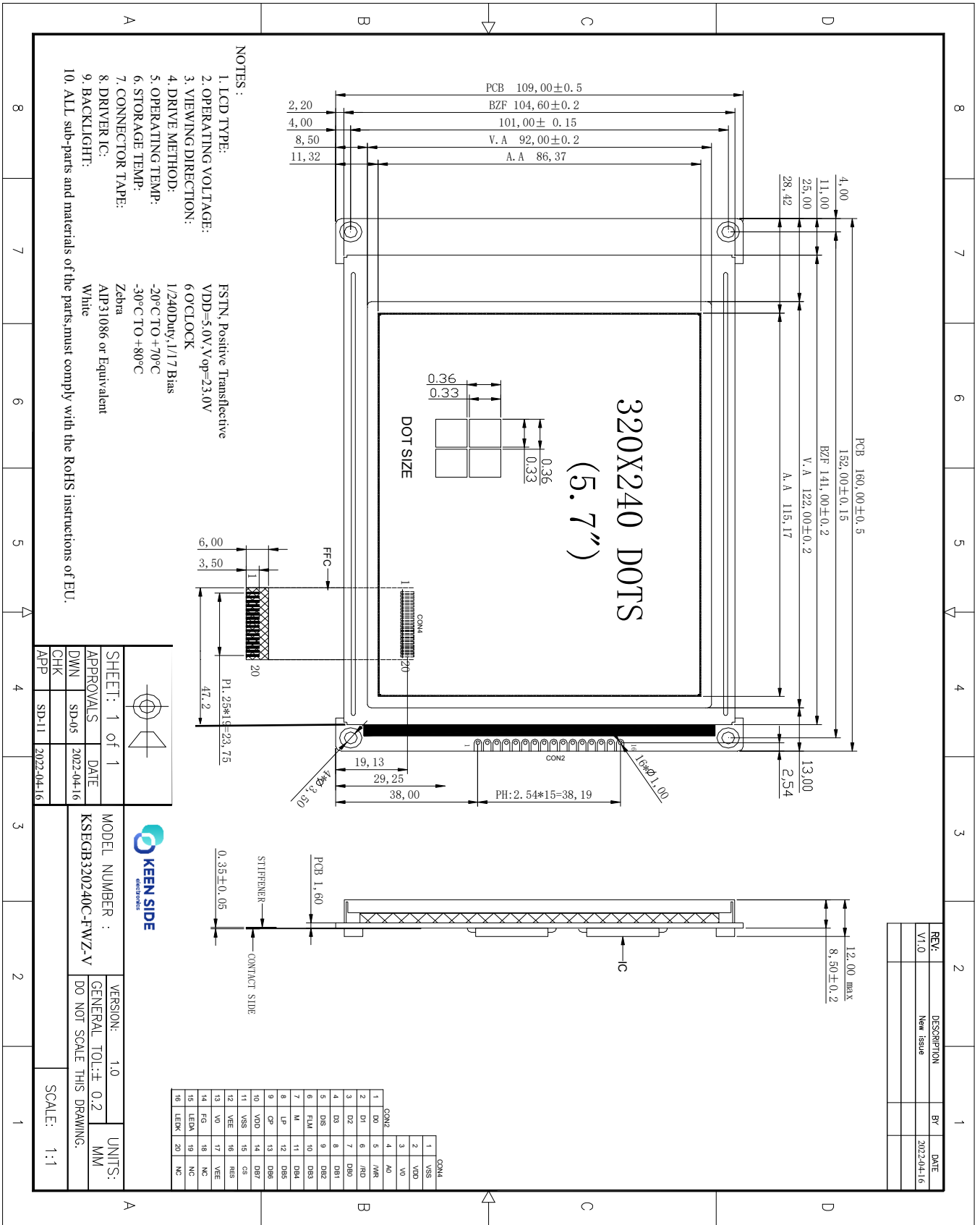
2. FUNCTIONS & FEATURES

- Driving Scheme : 1/240Duty, 1/17 Bias
- Power Supply for logic : 5.0V
- Display Content : 320 x 240 Dots
- V_{LCD} : 23.0V
- Driver IC : AIP31086
- RoHS Conformed

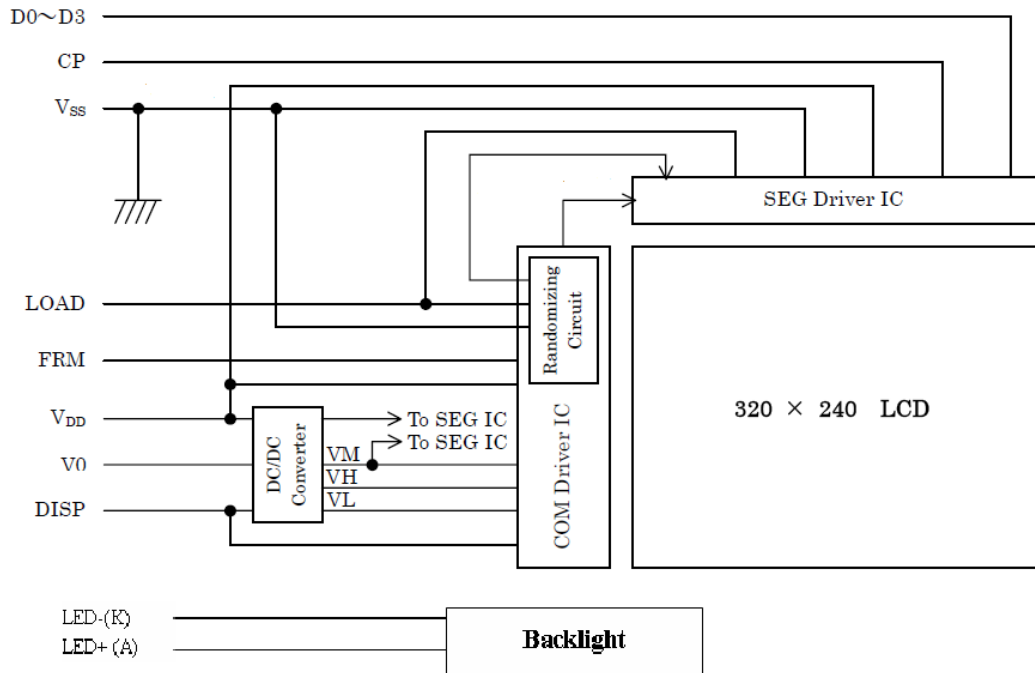
3. MECHANICAL SPECIFICATIONS

- Module Size : 160.00(L) x 109.00(W) x 12.00(H)MAX mm
- Viewing Area : 122.00(L)mm x 92.00 (W)mm
- Active Area : 115.17(L)mm x 86.38 (W)mm
- Dot Pitch : 0.36 (W)mm x 0.36 (H)mm
- Dot Size : 0.34 (W)mm x 0.34 (H)mm
- Dot Gap : 0.02 mm

4. EXTERNAL DIMENSIONS



5. BLOCK DIAGRAM



6. PIN ASSIGNMENT

CON2

NO.	SYMBOL	FUNCTION
1	D0	Data input/output
2	D1	
3	D2	
4	D3	
5	DIS	Display control signal
6	FLM	Synchronous signal for driving scanning line
7	M	AC signal for LCD driver output or NC(There's a connection inside the module)
8	LP	Data signal latch clock
9	CP	Data signal shift clock
10	VDD	Power Supply(+5V)
11	GND	Ground (0V)
12	VEE	Contrast voltage for LCD
13	V0	
14	FG	Frame Ground
15	LED+(A)	Anode of LED backlight
16	LED-(K)	Cathode of LED backlight

CON4

Pin No.	Symbol	Level	Description
1	V _{SS}	0V	Ground
2	V _{DD}	5.0V	Power supply for Logic
3	V _O	(Variable)	Driving voltage for LCD
4	A0	H/L	RD=L WR=H ,A0=L :Data Read AO=H :Status read RD=H WR=L ,A0=L :Data Write AO=H :Command write
5	$\overline{\text{WR}}$	H/L	8080 family: Write signal, 6800 family: R/W signal
6	$\overline{\text{RD}}$	H/L	8080 family: Read signal, 6800 family: Enable clock
7~14	DB0~DB7	H/L	Data bus
15	$\overline{\text{CS}}$	H/L	Chip select ,Active L
16	$\overline{\text{RES}}$	H/L	Controller reset signal, Active L
17	V _{EE}	-25V	Negative voltage output (Optional)
18	NC		NC (8080 series MPU interface option)
19	NC		NC (Frame Ground option)
20	NC		No connection

7. ABSOLUTE MAXIMUM RATINGS(V_{ss}=0V, T_a=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage (Logic)	V _{DD}	-0.3 to 7.0	V
Input voltage	V _{IN}	-0.3 to V _{DD} +0.3	V
Driver Supply Voltage	V _{LCD}	0 to 30	V
Operating Temperature	T _{OPR}	-20 to 70-	°C
Storage Temperature	T _{STG}	30 to 80	°C

8. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Forward Voltage	V _f	4.8	5.0	5.2	V	If=15*10 mA
Forward Current	I _f		150		mA	
Reverse Current	I _r		30			V _r =5.0V
Luminance	L _v		260		Cd/m ²	If=15*10 mA
Operating life time			75,000		h	If=15*10 mA

9. ELECTRICAL CHARACTERISTICS

9.1 DC Characteristics

9.1.1 Segment Driver Application

(V_{SS} = 0V, Ta = - 30 ~ +85°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Operating Voltage 1	V _{DD}	-	2.7	-	5.5	V	
	V _{LCD}	V _{IN} =V _{DD} -V _{EE}	6	-	28		
Input voltage (1)	V _{IH}	-	0.8V _{DD}	-	V _{DD}	V	
	V _{IL}	-	0	-	0.2V _{DD}		
Output voltage (2)	V _{OH}	I _{OH} =-0.4mA	V _{DD} -0.4	-	-	V	
	V _{OL}	I _{OL} =0.4mA	-	-	0.4		
Input leakage current 1 (1)	I _{IL1}	V _{IN} =V _{DD} to V _{SS}	-10	-	10	μA	
Input leakage current 2 (3)	I _{IL2}	V _{IN} =V _{DD} to V _{EE}	-25	-	25		
On resistance(4)	R _{ON}	I _{ON} =100 μA	-	2	4	kΩ	
Supply current(5)	I _{STBY}	f _{CL1} =32kHz, M=V _{SS}	V _{SS} PIN	-	-	100	μA
	I _{DD}	f _{CL1} =32kHz F _M =80HZ	V _{DD} =5V	-	-	5	mA
			V _{DD} =3V	-	-	2	
I _{EE}		V _{DD} =5V	-	-	500	μA	

9.1.2 Common Driver Application

(V_{SS} = 0V, Ta = - 30 ~ +85°C)

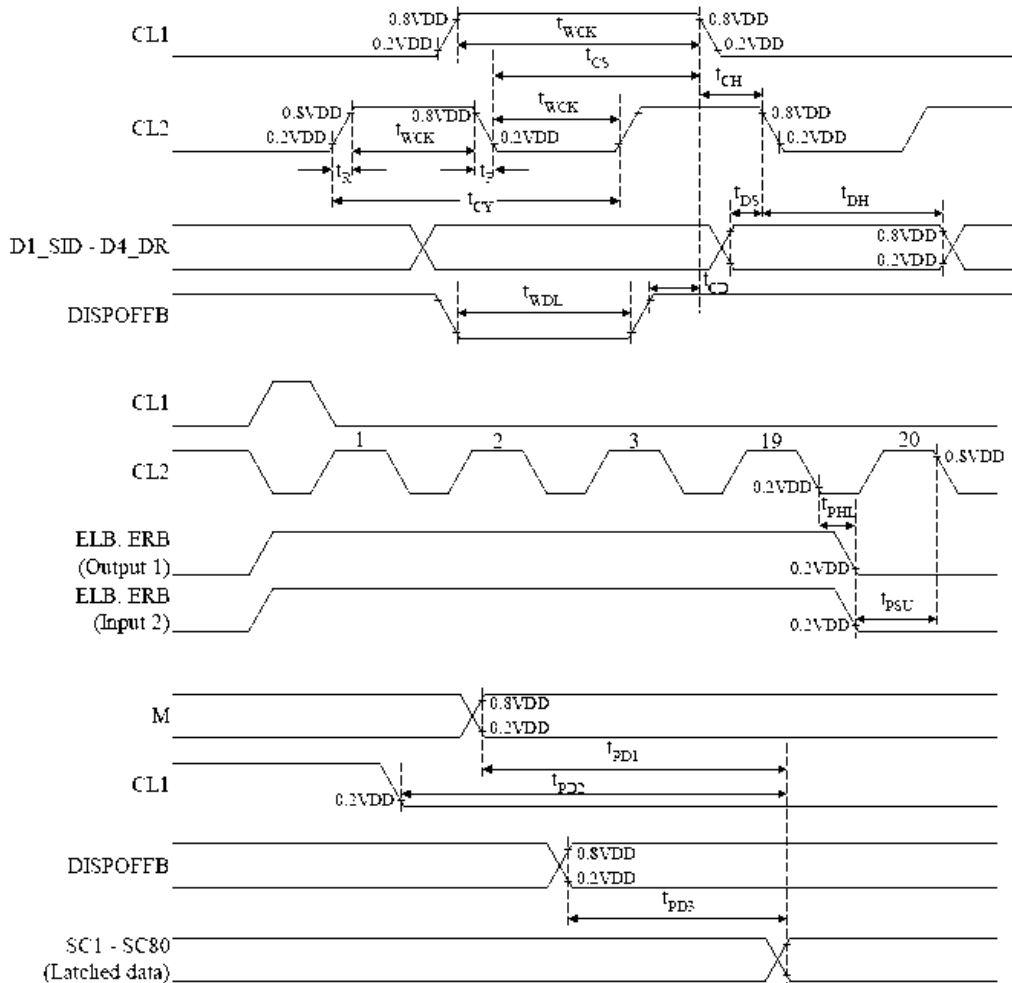
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Operating Voltage 1	V _{DD}	-	2.7	-	5.5	V	
	V _{LCD}	V _{IN} =V _{DD} -V _{EE}	6	-	28		
Input voltage (1)	V _{IH}	-	0.8V _{DD}	-	V _{DD}	V	
	V _{IL}	-	0	-	0.2V _{DD}		
Output voltage (3)	V _{OH}	I _{OH} =-0.4mA	V _{DD} -0.4	-	-	V	
	V _{OL}	I _{OL} =0.4mA	-	-	0.4		
Input leakage current 1 (1)	I _{IL1}	V _{IN} =V _{DD} to V _{SS}	-10	-	10	μA	
Input leakage current 2 (2)	I _{IL2}	V _{IN} =0V, V _{DD} =5V(Pull up)	-50	-125	-250		
Input leakage current 3 (4)	I _{IL3}	V _{IN} =V _{DD} to V _{EE}	-25	-	25		
On resistance(5)	R _{ON}	I _{ON} =100 μA	-	2	4	kΩ	
Supply current(6)	I _{STBY}	f _{CL1} =32kHz, M=V _{SS}	V _{SS} PIN	-	-	100	μA
	I _{DD}	f _{CL1} =32kHz F _M =80HZ	V _{DD} =5V	-	-	200	
			V _{DD} =3V	-	-	120	
			V _{DD} =5V	-	-	150	
I _{EE}		V _{DD} =5V	-	-	150		

9.2 AC Characteristics

9.2.1 Segment Driver Application

(V_{SS} = 0V, Ta = - 30 ~ +85°C)

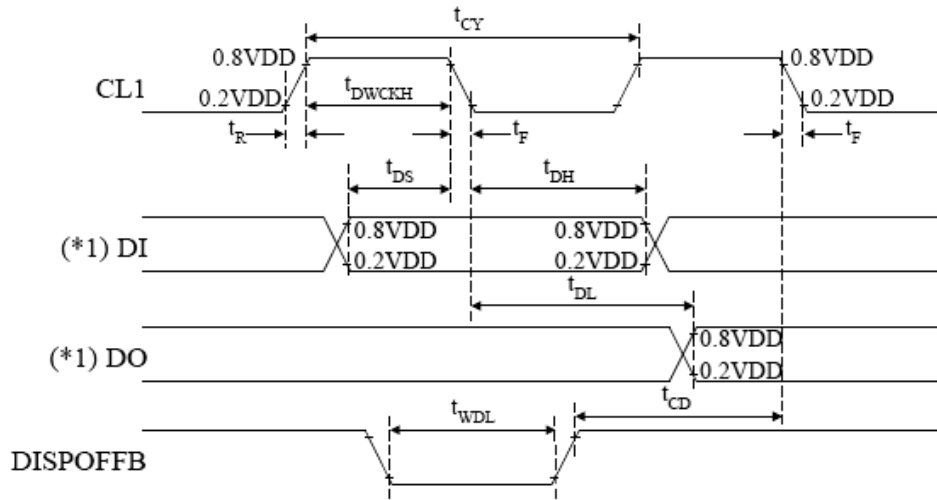
Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t _{CY}	Duty=50%	125	-	-	250	-	-	ns
Clock pulse width	t _{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t _R / t _F	-	-	-	30	-	-	30	
Data set-up time	t _{DS}	-	30	-	-	65	-	-	
Data hold time	t _{DH}	-	30	-	-	65	-	-	
Clock set-up time	t _{CS}	-	80	-	-	120	-	-	
Clock hold time	t _{CH}	-	80	-	-	120	-	-	
Propagation delay time	t _{PHL}	ELB output	-	-	60	-	-	125	
		ERB output	-	-	60	-	-	125	
ELB,ERB set-up time	t _{PSU}	ELB input	30	-	-	65	-	-	
		ERB input	30	-	-	65	-	-	
DISPOFFB low pulse width	t _{WDL}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t _{CD}	-	100	-	-	100	-	-	ns
M – OUT propagation delay time	t _{PD1}	C _L =15pF	-	-	1.0	-	-	1.2	μs
CL1 – OUT propagation delay time	t _{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t _{PD3}		-	-	1.0	-	-	1.2	



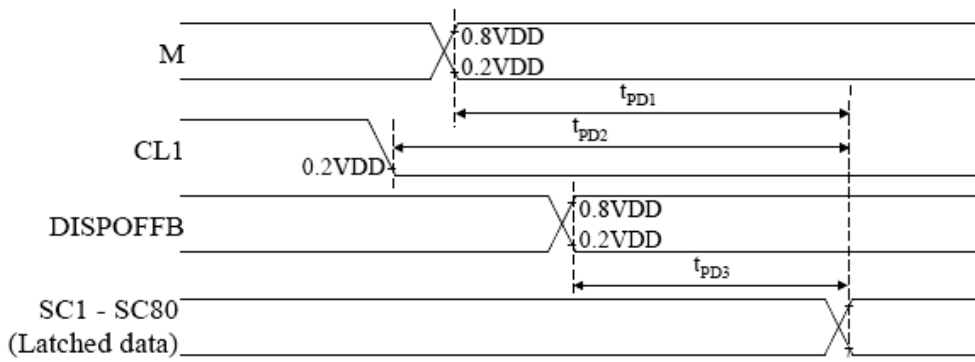
9.2.2 Common Driver Application

(V_{SS} = 0V, T_a = -30 ~ +85°C)

Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t _{CY}	Duty=50%	250	-	-	500	-	-	ns
Clock pulse width	t _{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t _R / t _F	-	-	-	50	-	-	50	
Data set-up time	t _{DS}	-	30	-	-	65	-	-	
Data hold time	T _{DH}	-	30	-	-	65	-	-	
DISPOFFB low pulse width	t _{WDL}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t _{CD}	-	100	-	-	100	-	-	ns
Output delay time	t _{DL}	-	-	-	200	-	-	250	
M - OUT propagation delay time	t _{PD1}	C _L =15pF	-	-	1.0	-	-	1.2	μs
CL1 - OUT propagation delay time	t _{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB - OUT propagation delay time	t _{PD3}		-	-	1.0	-	-	1.2	



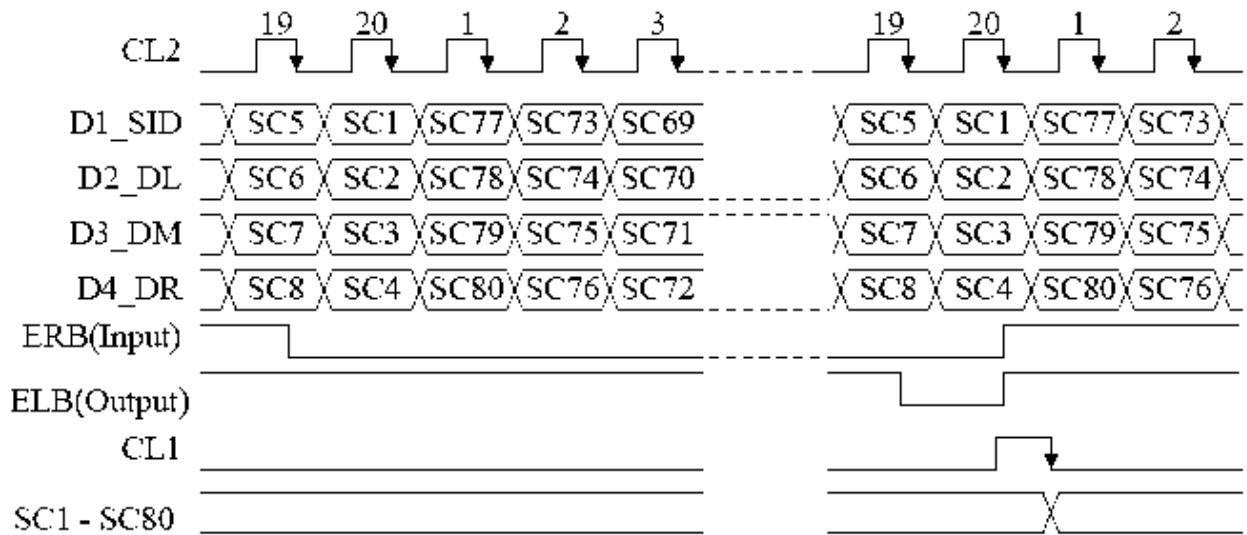
(*1) When in single-type interface mode
 DI=>DDL(SHL=L), D4_DR(SHL=H)
 DO=>D4_DR(SHL=L), D2_DL(SHL=H)
 When in dual-type interface mode
 DI=>D2_DL and D3_DM(SHL=L), D4_DR and D3_DM(SHL=H)
 DO=>D4_DR(SHL=L), D2_DL(SHL=H)



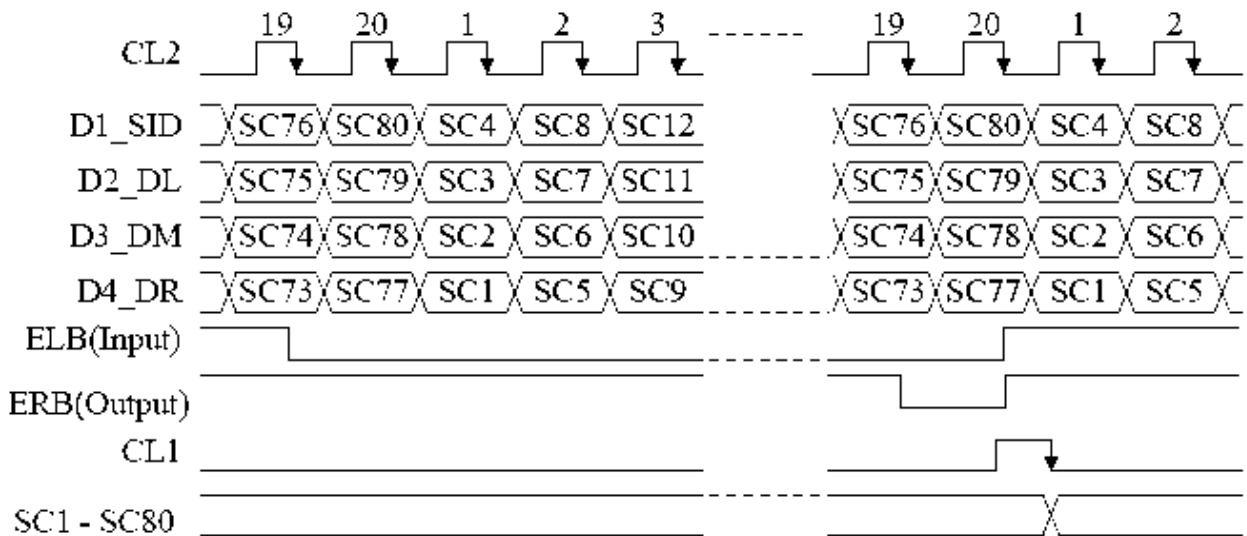
10. OPERATION TIMING DIAGRAM

4-bit parallel mode interface segment driver

When SHL= "Low"

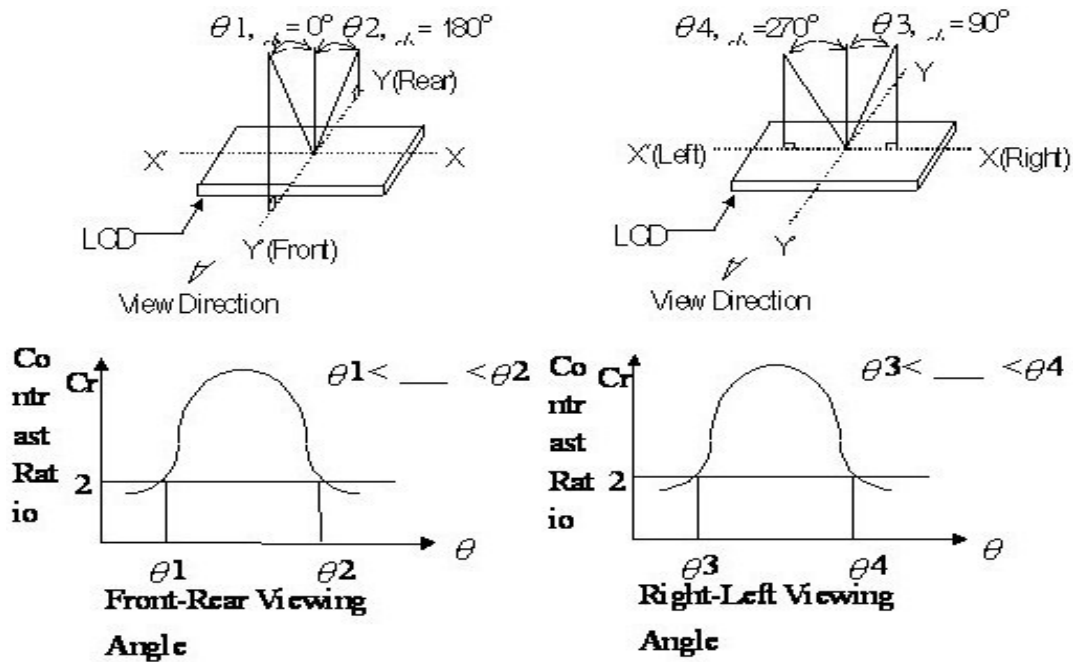


When SHL= "High"



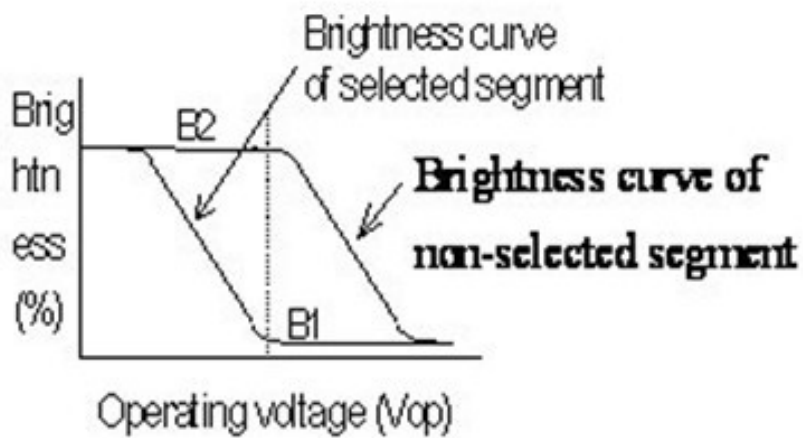
11. OPTICAL CHARACTERISTICS

11.1 Definition of Viewing Angle

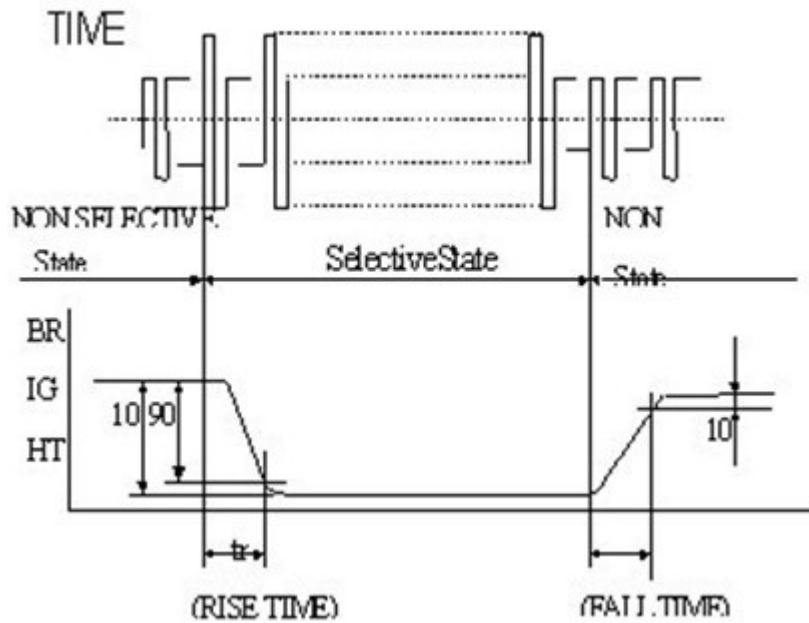


11.2 Definition of Contrast

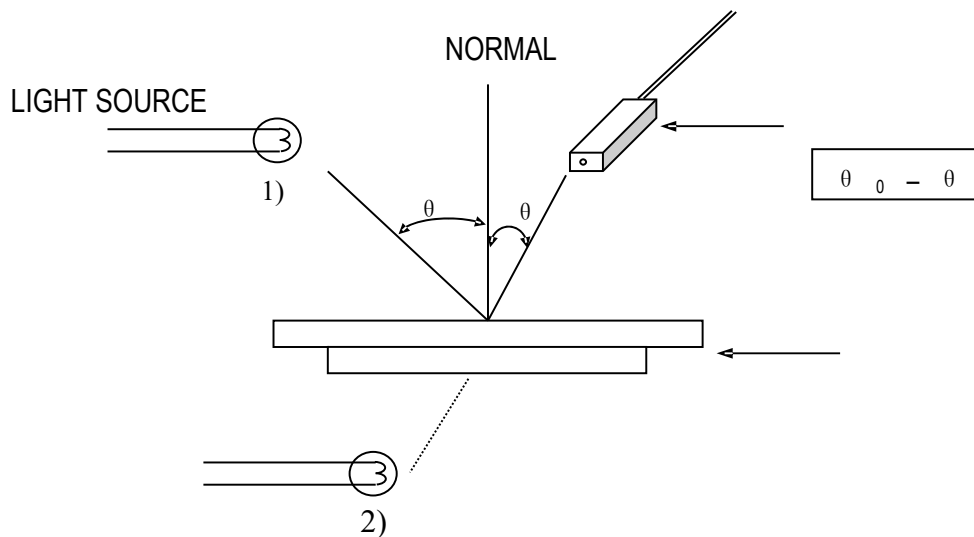
$$C.R = \frac{\text{Brightness of nonselected segment (E2)}}{\text{Brightness of selected segment}}$$



11.3 Definition of Response



11.4 Measuring Instruments For Elector-optical Characteristics



*** Note:**

- 1) Light source position for measuring the reflective type of LCD panel;
- 2) Light source position for measuring the transfective / transmissive types of LCD panel.

12. RELIABILITY TEST

Operating life time: Longer than 75,000 hours

(at room temperature without direct irradiation of sunlight)

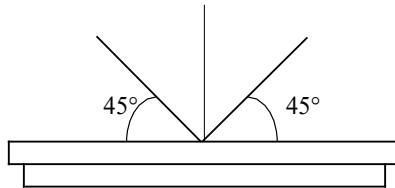
Reliability characteristics shall meet following requirements.

No.	Test Item	Content of Test	Test Condition
1	High Temperature Storage	Endurance test applying the high temperature for a long time storage	+80°C 96H
2	Low Temperature Storage	Endurance test applying the low temperature for a long time storage	-30°C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	+70°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20°C 96H
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $ \begin{array}{ccccccc} -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 70^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} \\ 30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\ \longleftarrow & & & & & & \longrightarrow \\ & & & & & & \text{1 cycle} \end{array} $	-20°C/70°C 5 cycles
7	Vibration Test (Package State)	Endurance test applying the vibration during transportation	10Hz - 55Hz, 50m/s, 15min
8	Shock Test (Package State)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s, 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40 kPa 16 H


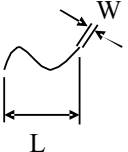
13. Inspection specification

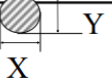
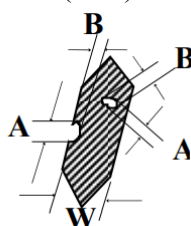
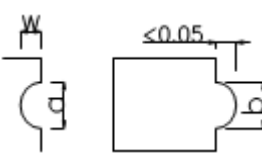
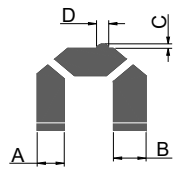
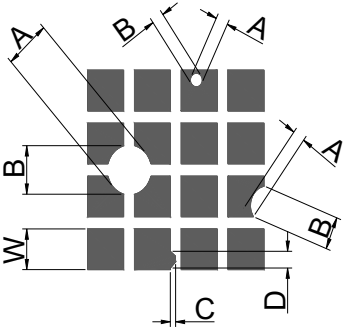
13.1 Visual Inspection

- 1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- 2) Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- 3) Inspect the module at 45° right and left, top and bottom.
- 4) Use the optimum viewing angle during the contrast inspection.



12.2 Standard of Appearance Inspection

No.	Item	Criteria																			
1	Black spot White spot Dust	Round type: as per following drawing $\Phi = (X+Y)/2$  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.1$</td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td>$0.1 < \Phi < 0.2$</td> <td>2</td> </tr> <tr> <td>$0.2 < \Phi < 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Acceptable quantity			Size	Zone A	Zone B	$\Phi < 0.1$	Any number	Any number	$0.1 < \Phi < 0.2$	2	$0.2 < \Phi < 0.25$	1	$0.25 < \Phi$	0				
		Acceptable quantity																			
		Size	Zone A	Zone B																	
		$\Phi < 0.1$	Any number	Any number																	
$0.1 < \Phi < 0.2$	2																				
$0.2 < \Phi < 0.25$	1																				
$0.25 < \Phi$	0																				
Line type: as per following drawing																					
<table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="4">Acceptable quantity</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>—</td> <td>$W \leq 0.02$</td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.02 < W \leq 0.03$</td> <td>2</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.03 < W \leq 0.05$</td> <td>2</td> </tr> <tr> <td>—</td> <td>$0.05 < W$</td> <td>As round type</td> </tr> </tbody> </table>	Acceptable quantity				Length	Width	Zone A	Zone B	—	$W \leq 0.02$	Any number	Any number	$L \leq 3.0$	$0.02 < W \leq 0.03$	2	$L \leq 2.5$	$0.03 < W \leq 0.05$	2	—	$0.05 < W$	As round type
Acceptable quantity																					
Length	Width	Zone A	Zone B																		
—	$W \leq 0.02$	Any number	Any number																		
$L \leq 3.0$	$0.02 < W \leq 0.03$	2																			
$L \leq 2.5$	$0.03 < W \leq 0.05$	2																			
—	$0.05 < W$	As round type																			
																					
		Total acceptable quantity: 3																			
2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1																			
3	Polariser bubble	$\Phi = (X+Y)/2$																			

		 <table border="1"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.2$</td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td>$0.2 < \Phi < 0.5$</td> <td>2</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td>1</td> </tr> <tr> <td>$1.0 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Total acceptable quantity: 3</p>	Acceptable quantity			Size	Zone A	Zone B	$\Phi < 0.2$	Any number	Any number	$0.2 < \Phi < 0.5$	2	$0.5 < \Phi < 1.0$	1	$1.0 < \Phi$	0																					
Acceptable quantity																																						
Size	Zone A	Zone B																																				
$\Phi < 0.2$	Any number	Any number																																				
$0.2 < \Phi < 0.5$	2																																					
$0.5 < \Phi < 1.0$	1																																					
$1.0 < \Phi$	0																																					
4	Segment deformation	<p>4.1 Pin hole on segmented display W: segment width $\Phi = (A+B)/2$</p>  <table border="1"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Width</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.4$</td> <td>$\Phi \leq 0.2$ and $\Phi \leq 1/2W$</td> </tr> <tr> <td>$W > 0.4$</td> <td>$\Phi \leq 0.25$ and $\Phi \leq 1/3W$</td> </tr> </tbody> </table> <p>Total acceptable quantity: 1 defect per segment Pin holes with Φ under 0.10 mm are acceptable</p> <p>4.2 Pin hole on dot matrix display</p>  <table border="1"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>$a, b < 0.1$</td> <td>Any number</td> </tr> <tr> <td>$(a+b)/2 \leq 0.1$</td> <td>Any number</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td>3</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p> <p>4.3 Segments / dots with different width</p>  <table border="1"> <thead> <tr> <th colspan="2">Acceptable</th> </tr> </thead> <tbody> <tr> <td>$a \geq b$</td> <td>$a/b \leq 4/3$</td> </tr> <tr> <td>$a < b$</td> <td>$a/b > 4/3$</td> </tr> </tbody> </table> <p>4.4 Alignment layer defect $\Phi = (A+B)/2$</p>  <table border="1"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.4$</td> <td>Any number</td> </tr> <tr> <td>$0.4 < \Phi \leq 1.0$</td> <td>5</td> </tr> <tr> <td>$1.0 < \Phi \leq 1.5$</td> <td>3</td> </tr> <tr> <td>$1.5 < \Phi \leq 2.0$</td> <td>2</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p>	Acceptable quantity		Width	Quantity	$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq 1/2W$	$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$	Acceptable quantity		Size	Quantity	$a, b < 0.1$	Any number	$(a+b)/2 \leq 0.1$	Any number	$0.5 < \Phi < 1.0$	3	Acceptable		$a \geq b$	$a/b \leq 4/3$	$a < b$	$a/b > 4/3$	Acceptable quantity		Size	Quantity	$\Phi \leq 0.4$	Any number	$0.4 < \Phi \leq 1.0$	5	$1.0 < \Phi \leq 1.5$	3	$1.5 < \Phi \leq 2.0$	2
Acceptable quantity																																						
Width	Quantity																																					
$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq 1/2W$																																					
$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$																																					
Acceptable quantity																																						
Size	Quantity																																					
$a, b < 0.1$	Any number																																					
$(a+b)/2 \leq 0.1$	Any number																																					
$0.5 < \Phi < 1.0$	3																																					
Acceptable																																						
$a \geq b$	$a/b \leq 4/3$																																					
$a < b$	$a/b > 4/3$																																					
Acceptable quantity																																						
Size	Quantity																																					
$\Phi \leq 0.4$	Any number																																					
$0.4 < \Phi \leq 1.0$	5																																					
$1.0 < \Phi \leq 1.5$	3																																					
$1.5 < \Phi \leq 2.0$	2																																					
5	Colour	Level of sample for approval set as limit sample																																				

uniformity				
6	Backlight	The backlight colour should correspond to the product specification Flashing and or unlit backlight is not allowed Dust larger than 0.25 mm is not allowed		
7	COB	Exposed wire bond pad is not allowed Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed		
8	PCB	No unmelted solder paste should be present on PCB Cold solder joints, missing solder connections, or oxidation are not allowed No residue or solder balls on PCB are allowed Short circuits on components are not allowed		
9	Tray particles	Acceptable quantity		
			Size	Quantity
		On tray	$\Phi < 0.2$	Any number
			$\Phi > 0.25$	4
On display	$\Phi \geq 0.25$	2		
	L = 3	1		

14. LCD MODULES HANDLING PRECAUTIONS

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

15. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections