

億力光電股份有限公司

EVERVISION ELECTRONICS CO., LTD.

Product Specification For LCD Module

(KVPF-7B-002-16)

Model NO. : VGG322419-6UFLWA(RoHS)

REVISION : 2

☐ APPROVAL FOR SPECIFICATIONS ONLY

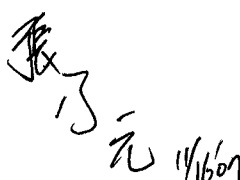
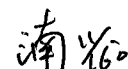
☒ APPROVAL FOR SPECIFICATIONS AND SAMPLE

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STD.

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3. Module Numbering System

V G G 3224 19 – 6 U F L W A

Serial No: A~Z

Backlight Color:

N: Without Backlight;
A: Amber; B: Blue; G: Green;
L: Yellow; O: Orange; R: Red;
W: White; Y: Yellow Green;
X: Others

Backlight Type:

N: Without Backlight; E: EL; F: CCFL;
L: General LED; H: High NTSC LED ;
R: RGB LED; X: Others

LCD Model:

T: TN; H: HTN; G: STN Gray; Y: STN Yellow;
B: STN Blue; W: FSTN Black/White;
C: CSTN; F: TFT; O: OLED; P: PLED;
L: LTPS; N: Others

LCD Type:

R: Reflective/Positive;
S: Reflective/Negative ;
F: Transflective/Positive ;
G: Transflective/Negative ;
U: Transmissive/Positive ;
T: Transmissive/Negative ; N: Others

Temperature Range & View Direction:

General Purpose : 1:6H 2:12H 3:3H 4:9H 5: Others
High Performance: 6:6H 7:12H 8:3H 9:9H 0: Others

STD Product Serial No.: 01~99

Customer Made Serial No.: A1,A2... A9,B1,B2... B9,C1..

Display Function:

Segment Number / Characters Lines / Column and Row Dots
/ Length * Width of Other

Display Type:

C: Character Type; G: Graphic Type; S: Segment Type; O: Other

Package Type:

B: COB; F: COF; G: COG; H: Heat Seal; S: SMT; T: TAB; O: Others

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4. Application

This specification is applied to the 3.5 inch QVGA supported TFT-LCD module, and can display 262k colors. The module is designed for PMP, GPS application and other electronic products which require flat panel display of digital signal interface.

5. Features

- QVGA (320×240 pixels) resolution.
- Display in 262k colors
- Line inversion mode with stripe type.
- On-chip voltage generator
- SYNC mode is supported for digital RGB input data format.

6. General Specifications

Item	Specifications	Unit
Screen Size	3.5 (Diagonal)	inch
Display Format	320RGB(H)×240(V)	dot
Active Area	70.08(H)×52.56(V)	mm
Dot Pitch	0.073(H)×0.219(V)	mm
Pixel Configuration	RGB Vertical Stripe	-
Display Mode	TN Type Transmissive Mode Normally White	-
Surface Treatment	Anti-Glare	-
Viewing Direction	6 O'clock (The Gray Inversion will appear at this direction)	-
Outline Dimension	76.9(W)×63.9(H)×3.3(D)	mm
DC to DC circuit	Build-in	-
Weight	32	g

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7. Absolute Maximum Ratings

7.1 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-30	+80	°C	(1)
Operating Ambient Temperature	T _{OP}	-20	+70	°C	(1)

Note (1) Temperature and relative humidity range are shown in the figure below.

(a) 90%RH Max. ($T_a \leq 40^\circ\text{C}$).

(b) Wet-bulb temperature should be 39°C Max. ($T_a > 40^\circ\text{C}$).

(c) No condensation.

7.2 Electrical Absolute Ratings

7.2.1 TFT-LCD Module

($T_a = 25 \pm 2^\circ\text{C}$, GND = $V_{SS} = 0\text{V}$)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Digital Power Supply Voltage	V _{CC}	$V_{SS} - 0.3$	5.0	V	-

7.2.2 Backlight Unit

($T_a = 25 \pm 2^\circ\text{C}$)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Forward current	I _f	-	(30)	mA	(1)
Reverse voltage	V _R	-	(30)	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

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8. Electrical Characteristics

8.1 TFT-LCD Module

(Ta=25±2°C)

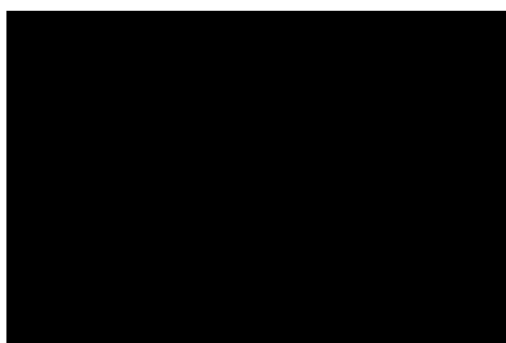
Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Digital Power Supply Voltage	V _{CC}	2.5	3.3	3.6	V	-
Input High Threshold Voltage	V _{IH}	0.8V _{CC}	-	V _{CC}	V	-
Input Low Threshold Voltage	V _{IL}	0	-	0.2V _{CC}	V	-

(GND=VSS=0V)

Parameter	SYMBOL	Condition	Min	Typ	Max	Unit	Remarks
Digital Current	I _{VCC}	V _{CC} = 3.3V	-	15.6	22.0	mA	(1)
Total Power Consumption	PC	V _{CC} = 3.3V	-	51.48	72.6	mW	(1)

Note (1) The specified power consumption is under the conditions at V_{CC}=3.3V,
F_V=60Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern / 0 Gray



Active Area

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8.2 Backlight Unit

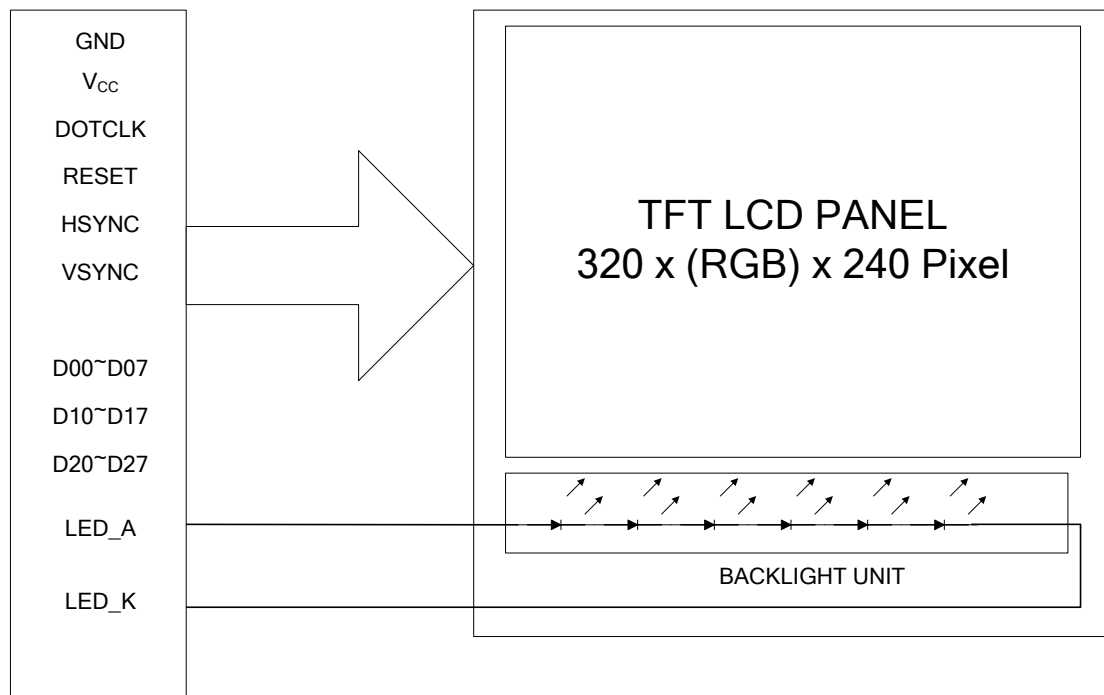
(Ta=25±2°C)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Voltage	VL	-	(18.6)	-	V	(1)
LED Current	IL	-	(20)	-	mA	(1)
Power Consumption	P _{BL}	-	(372)	-	mW	(1)

Note (1) The driving design of backlight unit is dependent on serial consideration of six LEDs.

9. Block Diagram

TFT-LCD Module with Backlight Unit



10. Input / Output Terminals Pin Assignment

10.1 TFT-LCD Module

Pin No.	Symbol	I/O	Description
1	LED_K	I	LED_cathode
2	LED_K	I	LED_cathode
3	LED_A	I	LED_anode
4	LED_A	I	LED_anode
5	NC	I	No connection
6	NC	I	No connection
7	NC	I	No connection
8	RESET	I	Reset
9	NC	I	No connection
10	NC	I	No connection
11	NC	I	No connection
12	D20	I	Blue data(LSB)
13	D21	I	Blue data
14	D22	I	Blue data
15	D23	I	Blue data
16	D24	I	Blue data
17	D25	I	Blue data
18	D26	I	Blue data
19	D27	I	Blue data(MSB)
20	D10	I	Green data(LSB)
21	D11	I	Green data
22	D12	I	Green data
23	D13	I	Green data
24	D14	I	Green data
25	D15	I	Green data
26	D16	I	Green data
27	D17	I	Green data(MSB)
28	D00	I	Red data(LSB)
29	D01	I	Red data
30	D02	I	Red data

Pin No.	Symbol	I/O	Description
31	D03	I	Red data
32	D04	I	Red data
33	D05	I	Red data
34	D06	I	Red data
35	D07	I	Red data(MSB)
36	HSYNC	I	Line synchronization signal.
37	VSYNC	I	Frame synchronization signal.
38	DOTCLK	I	Dot Colck signal
39	NC	I	No connection
40	NC	I	No connection
41	VCC	I	For system power supply.
42	VCC	I	For system power supply.
43	NC	I	No connection
44	NC	I	No connection
45	NC	I	No connection
46	NC	I	No connection
47	NC	I	No connection
48	NC	I	No connection
49	NC	I	No connection
50	NC	I	No connection
51	NC	I	No connection
52	NC	I	No connection
53	GND	I	Ground
54	GND	I	Ground

10.2 Color Data Input Assignment

The brightness of each primary color(red, green and blue) is based on the 8 bit gray scale data input for the color. The higher the binary input, the brighter the color. The table provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		D07	D06	D05	D04	D03	D02	D01	D00	D17	D16	D15	D14	D13	D12	D11	D10	D27	D26	D25	D24	D23	D22	D21	D20
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of RED	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1

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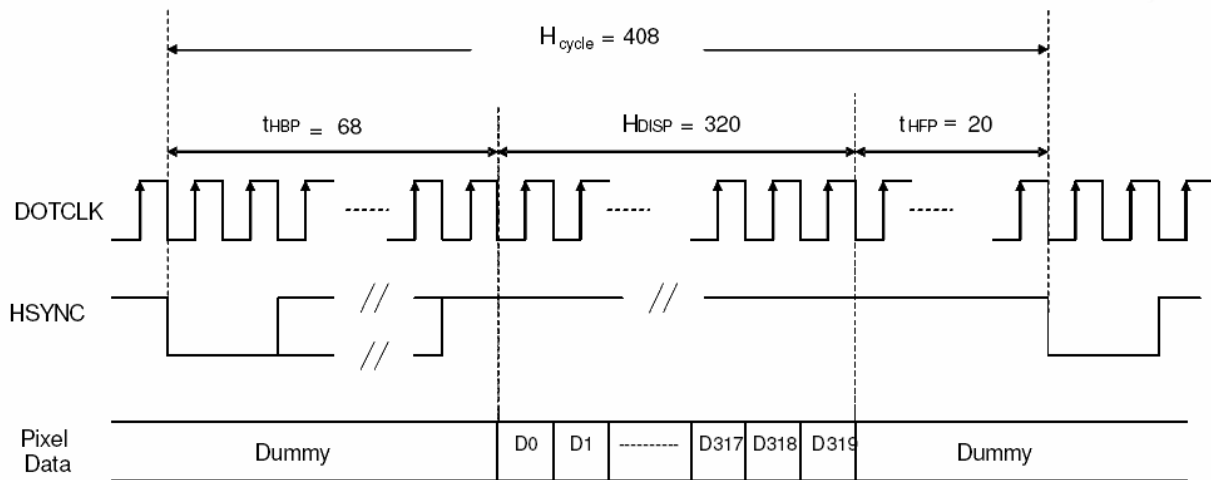
11. Interface Timing

11.1 Input Signal Characteristics

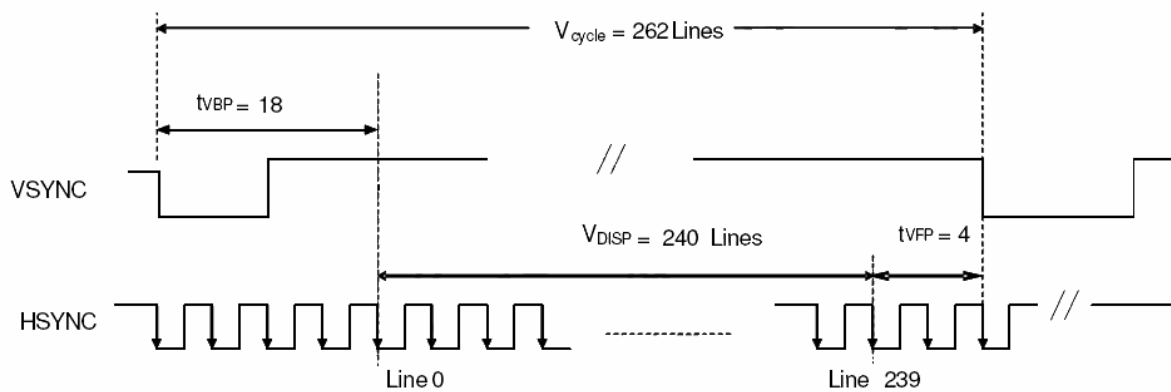
11.1.1 Digital Parallel RGB Interface (960×240 resolution)

Characteristics		Symbol	Min.	Typ.	Max.	Unit
			24 bit	24 bit	24 bit	
DOTCLK Frequency		fDOTCLK	-	6.5	10	MHz
DOTCLK Period		tDOTCLK	100	154	-	ns
Horizontal Frequency (Line)		fH	-	14.9	22.35	KHz
Vertical Frequency (Refresh)		fV	-	60	90	Hz
Horizontal Back Porch		tHBP	-	68	-	tDOTCLK
Horizontal Front Porch		tHFP	-	20	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	68	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	88	-	tDOTCLK
Horizontal Display Area		HDISP	-	320	-	tDOTCLK
Horizontal Cycle		Hcycle	-	408	450	tDOTCLK
Vertical Back Porch		tVBP	-	18	-	Lines
Vertical Front Porch		tVFP	-	4	-	Lines
Vertical Data Start Point		tVBP	-	18	-	Lines
Vertical Blanking Period		tVBP + tVFP	-	22	-	Lines
Vertical Display Area	NTSC	VDISP	-	240	-	Lines
	PAL			280(PALM=0)		
				288(PALM=1)		
Vertical Cycle	NTSC	Vcycle	-	262	350	Lines
	PAL			313		

11.2 Waveform



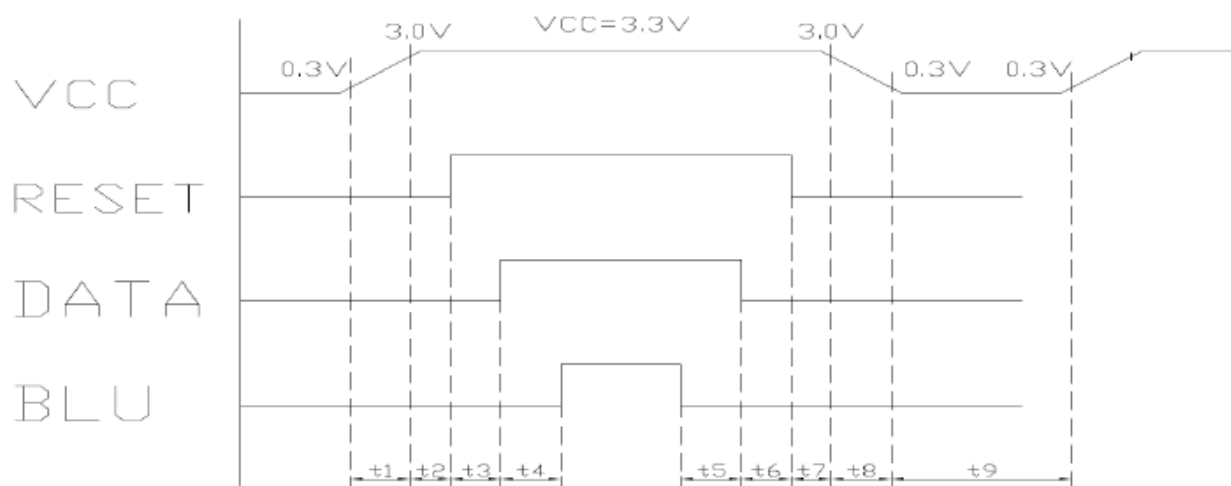
Horizontal Data Transaction Timing



Vertical Data Transaction Timing

Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

11.3 Power On / Off Sequence



$$T1 \leq 10\text{ms}$$

$$200\text{ms} \leq T5$$

$$1\text{ sec} \leq T9$$

$$10\mu\text{s} \leq T2$$

$$50\text{ms} \leq T6$$

$$50\text{ms} \leq T3$$

$$10\mu\text{s} \leq T7$$

$$200\text{ms} \leq T4$$

$$T8 \leq 10\text{ms}$$

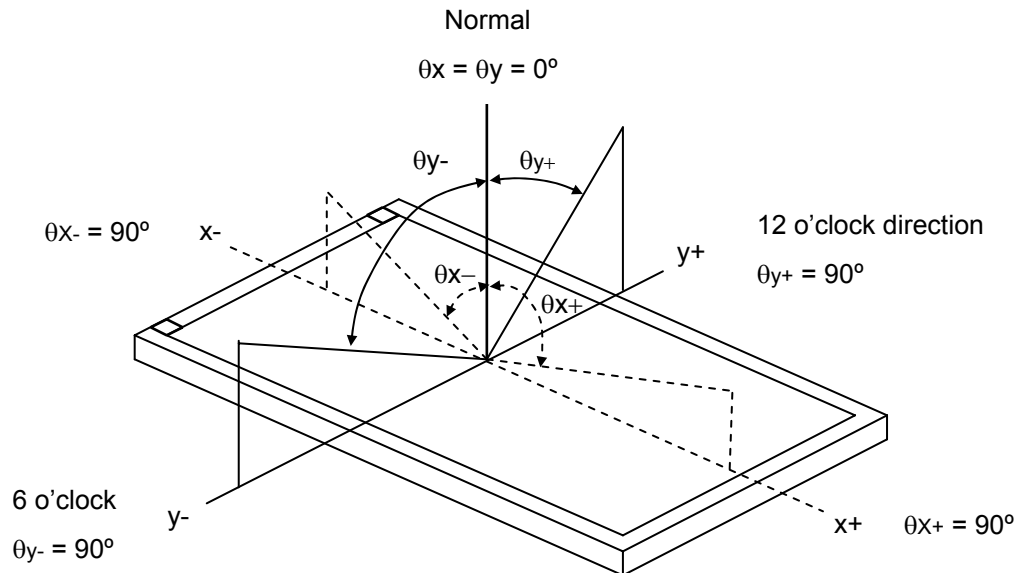
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12. Optical Characteristics

The optical characteristics should be measured in a dark environment (≤ 1 lux) or equivalent state with the methods shown in Note (4).

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle	300	450	-	-	(2)
Response Time		T_{R+T_F}		-	50	-	ms	(3)
Luminance(Center)		Y		300	350	-	cd/m ²	(4)
Brightness uniformity		BUNI		80	-	-	%	(5)
Color Chromaticity	Red	Rx		0.510	(0.560)	0.610	-	(1),(4)
		Ry		0.370	(0.420)	0.470	-	
	Green	Gx		0.220	(0.270)	0.320	-	
		Gy		0.620	(0.670)	0.720	-	
	Blue	Bx		0.090	(0.140)	0.190	-	
		By		0.030	(0.080)	0.130	-	
	White	Wx		0.210	(0.260)	0.310	-	
		Wy		0.300	(0.350)	0.400	-	
Viewing Angle	Horizontal	θ_{x+}	CR $\geq$ 10	55	70	-	deg.	
		θ_{x-}		55	70	-		
	Vertical	θ_{y+}		40	65	-		
		θ_{y-}		50	70	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

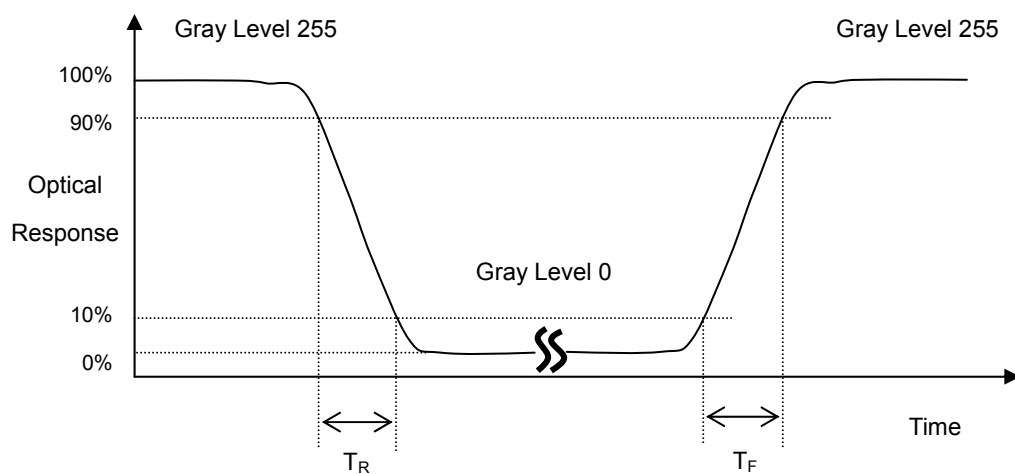
Measured at the center point of panel

Contrast Ratio (CR) = L_{255} / L_0

L_{255} : Luminance of gray level 255

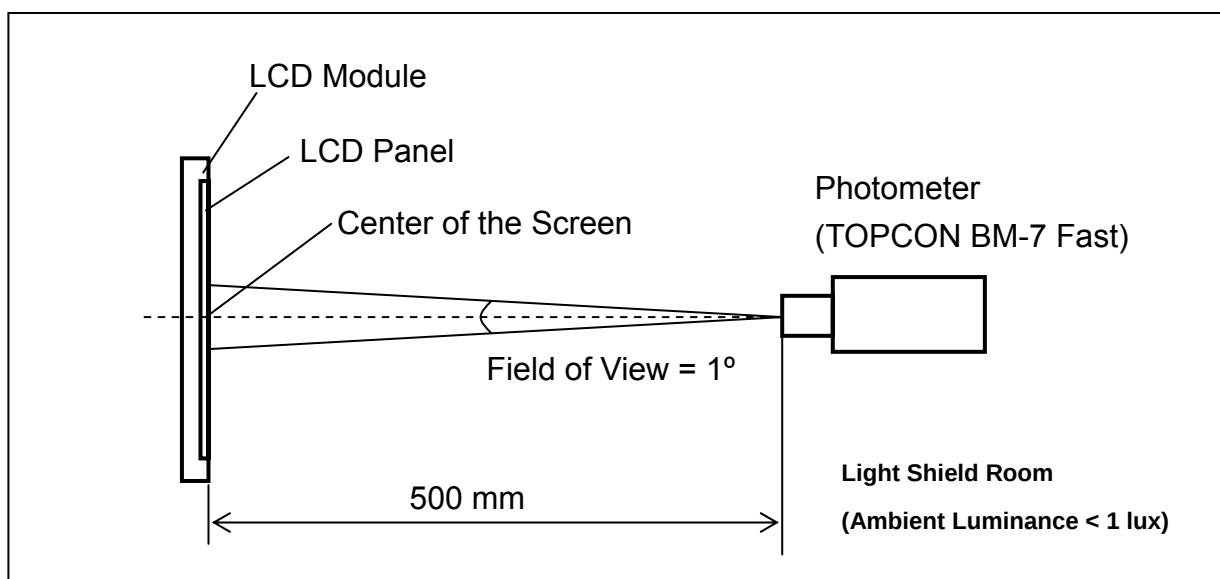
L_0 : Luminance of gray level 0.

Note (3) Definition of Response Time (T_R , T_F):

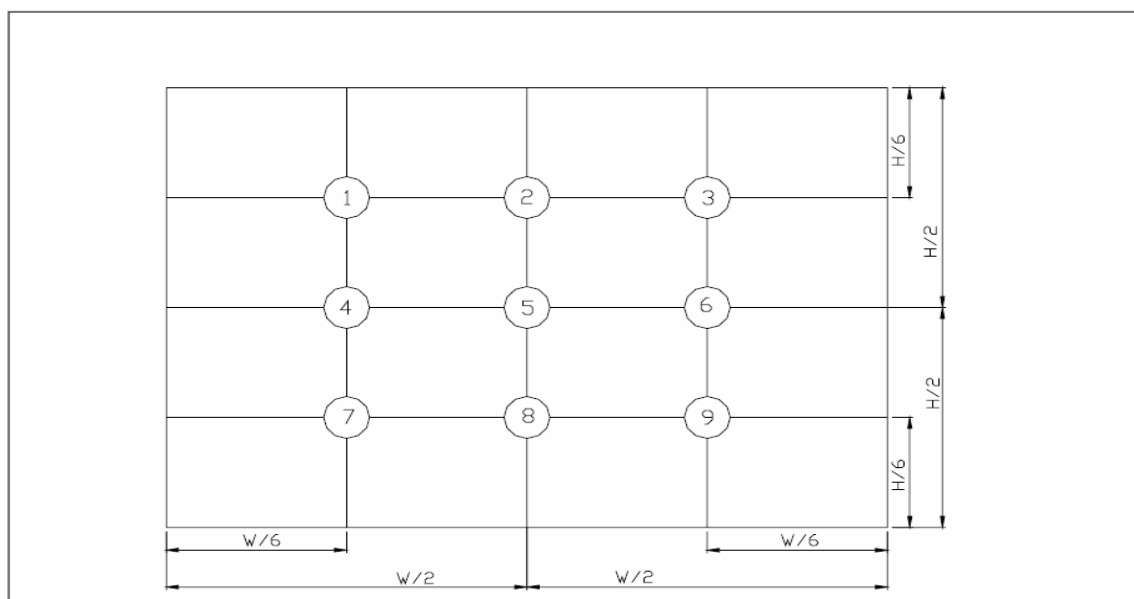


Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.

**Note (5) Definition of brightness uniformity**

Brightness uniformity = (Min Luminance of 9 points) / (Max Luminance of 9 points) × 100%



(單位 : mm)

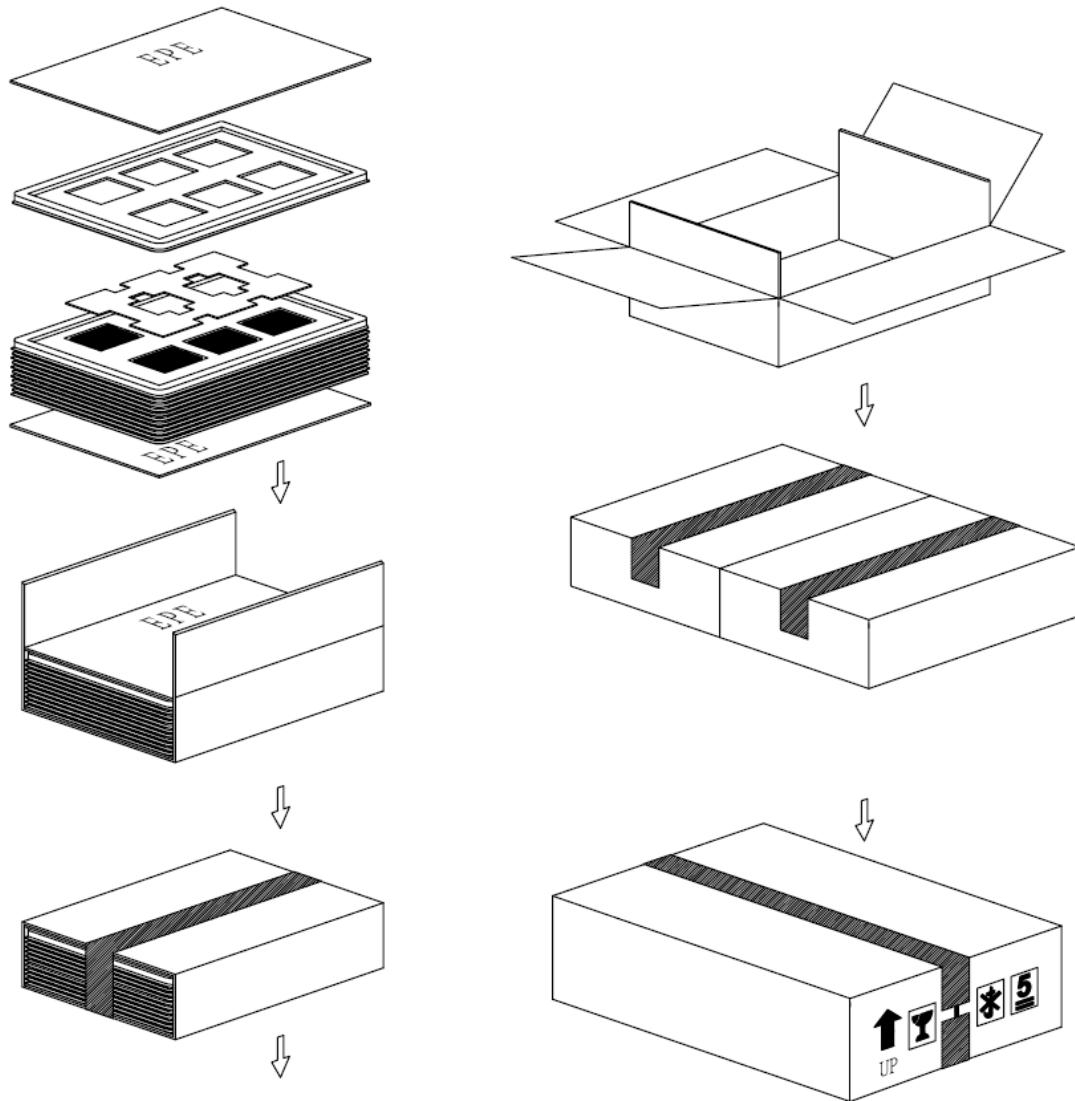
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13. Reliability Test

No.	Test Items	Test Condition	Remark
1	High Temperature Storage Test	T _a = 80℃ 240 hours	-
2	Low Temperature Storage Test	T _a = -30℃ 240 hours	-
3	High Temperature Operation Test	T _a = 70℃ 240 hours	-
4	Low Temperature Operation Test	T _a = -20℃ 240 hours	-
5	High Temperature and High Humidity Operation Test	T _a =60℃ 90%RH 240 hours	-
6	Electro Static Discharge Test (non-operating)	-Panel Surface/Top Case : 150pF, 330Ω Air: ±15kV, Contact: ±8kV	-
7	Mechanical Shock Test (non-operating)	Half sine wave, 80G, 11ms 3 times shock of each six surfaces	-
8	Vibration Test (non-operating)	Sine wave, 10 ~ 55 ~ 10Hz, 3 axis, 2 hours/axis	-
9	Thermal Shock Test (non-operating)	-20℃ (30min) ~ 70℃ (30min), 100 cycles	-
10	Drop Test(with Carton)	Height: 80cm 1 corner, 3 edges, 6 surfaces	-

14. Packaging

Packing Method



	PARTS LIST				
	ITEM	SIZE(LxWxH) unit:mm	MATERIAL	Q.T.Y	NOTE
1	TRAY	372.0x262.0x16.0	PET	28	
2	CARD BOARD(P01)	816.0x375.0x3.5	CARTON	2	
3	CARD BOARD(P02)	945.0x275.0x3.5	CARTON	2	
4	CARD BOARD(P03)	375.0x265.0x3.5	CARTON	4	
5	INTERNAL BOX(S01)	400.0x290.0x150.0	CARTON	2	
6	EXTERNAL BOX(L02)	600.0x420.0x170.0	CARTON	1	
7	EPE Form	285.0x197.0x2.0	EPE	26	
8	PRODUCT	76.9x63.9x3.3		156	

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15. Precautions

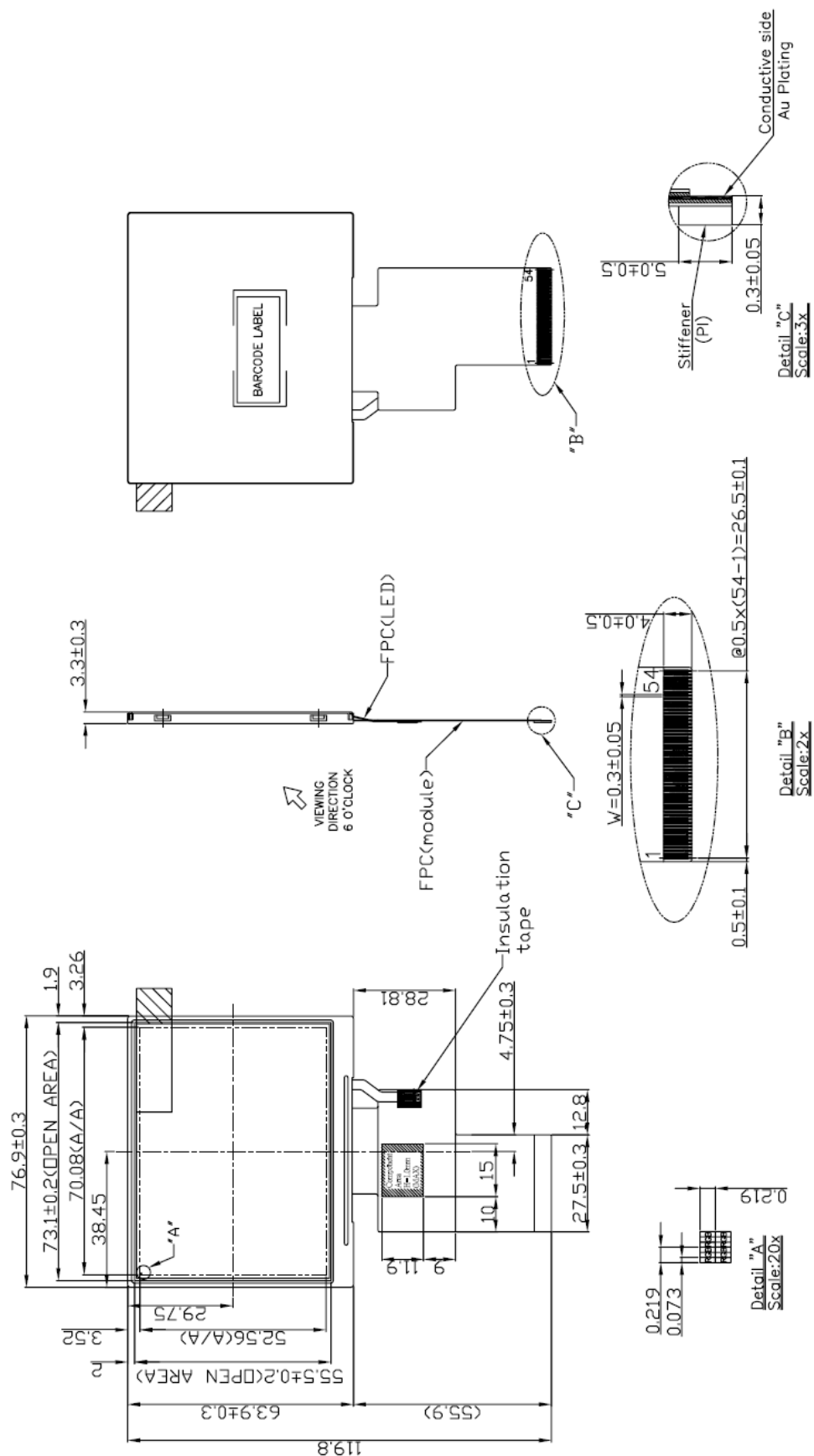
15.1 Assembly and Handling Precautions

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It's recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Don't apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD module in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow.

15.2 Safety Precautions

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

16.Outline Drawing



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17. Definition of Labels

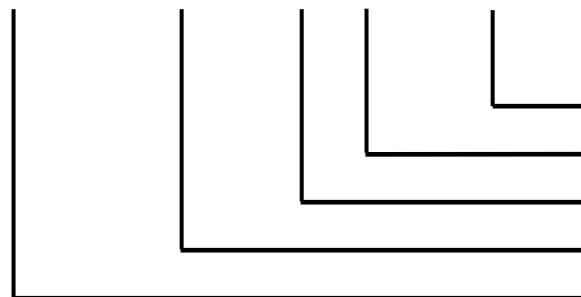
The bar code nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Module Name: VGG322419-6UFLWA

(b) Serial ID:

A B C D E F G H I J K L M



Serial No.
Revision Code
Factory Code
Manufactured Date
Screen Size

Serial ID includes the information as below:

(a) Screen size (Diagonal): Inch Code (ABCD)

3.5" → 0350

10.4" → 1040

(b) Manufactured Date: Year, Month, Day (EFG)

Year (E)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mark	0	1	2	3	4	5	6	7	8	9

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Month (F)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

Day (G)

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mark	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G
Day	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Mark	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	

(c) Factory Code (H):

For EVERVISION internal use.

(d) Revision Code (I):

Cover all the change, for example: 1: Rev.1, 2: Rev.2, 3: Rev.3...etc.

(e) Serial No. (JKLM):

Manufacturing sequence of product, for example: 0001~9999.

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18. Incoming Inspection Standards

18.1 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature $25 \pm 5^{\circ}\text{C}$
- (2) Humidity: $60 \pm 5\%$ RH
- (3) Viewing distance is approximately 35 ~ 40 cm
- (4) Viewing angle is normal to the LCD panel as Fig _1(10°)
- (5) Ambient Illumination: 300 ~ 500 Lux for external appearance inspection

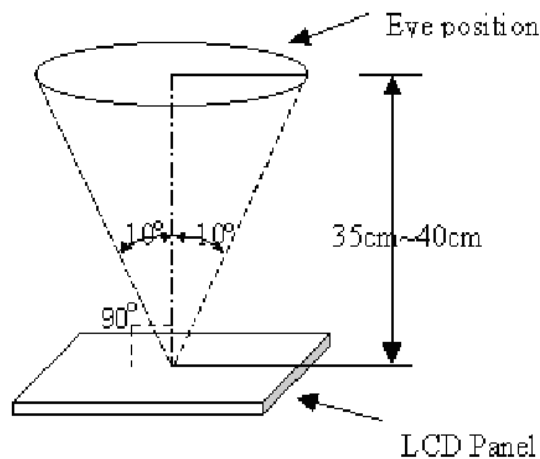


Fig _ 1

18.2 The defects classify of AQL as following:

Class of defects	AQL	Definition
Major	0.65%	It is defect that is likely to result in failure or to reduce materially the usability of the intended function.
Minor	1.5%	It is a defect that will not result in functioning problem with deviation classified.

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18.3 Inspection Parameters

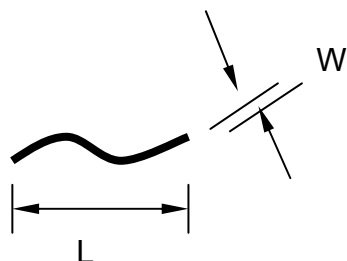
Item		Specification/Description				Note												
Display	Function	No Display				-												
		Malfunction				-												
Operating	Contrast ratio	Out of Spec				Note: 3												
	Line defect	No obvious Vertical and Horizontal line defect in bright , dark and colored.				-												
	Point Defect (red,green,blue,dark)	Item	Acceptable number			Note: 1 、 2 、 5 、 6 、 7												
			A	B	Total													
		BRIGHT DOT	N≤0	N≤2	N≤6													
		DARK DOT	N≤2	N≤4														
		TOTAL DOT	N≤2	N≤4														
		TWO ADJACENT DOT	NOT ALLOWED															
		THREE OR MORE ADJACENT DOT	NOT ALLOWED															
External Inspection (non-operating)	Scratch on the polarizer	<table><tr><td>L(mm)</td><td>W(mm)</td><td colspan="2">Acceptable number</td></tr><tr><td>L≤2.5</td><td>W≤0.1</td><td colspan="2">3</td></tr><tr><td>L>2.5</td><td>W>0.1</td><td colspan="2">0</td></tr></table>				L(mm)	W(mm)	Acceptable number		L≤2.5	W≤0.1	3		L>2.5	W>0.1	0		Note:3
		L(mm)	W(mm)	Acceptable number														
		L≤2.5	W≤0.1	3														
		L>2.5	W>0.1	0														
	Dent or bubble on the polarizer	Dimension(mm)		Acceptable number														
		D≤0.3		3														
		D≤0.1		Disregard														
Foreign material on the polarizer	<table><tr><td>Dimension(mm)</td><td colspan="3">Acceptable number</td></tr><tr><td>D≤0.5</td><td colspan="3">2</td></tr><tr><td>D≤0.1</td><td colspan="3">Disregard</td></tr></table>				Dimension(mm)	Acceptable number			D≤0.5	2			D≤0.1	Disregard			Note:4	
	Dimension(mm)	Acceptable number																
	D≤0.5	2																
D≤0.1	Disregard																	

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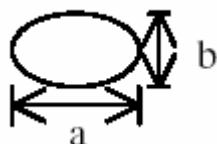
Note1. Distance between point defect distance should be large than 5 mm.

Note2. The definition of dot defect : The dot defect was judged after repair and the size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

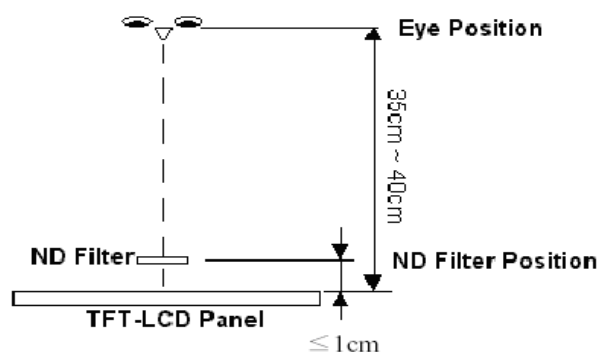
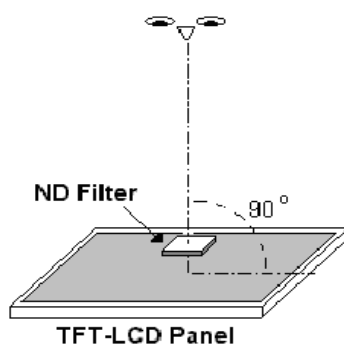
Note3.



Note4. D : Diameter $D=(a+b)/2$



Note5. Bright dot is defined through 6% transmission ND Filter as following.

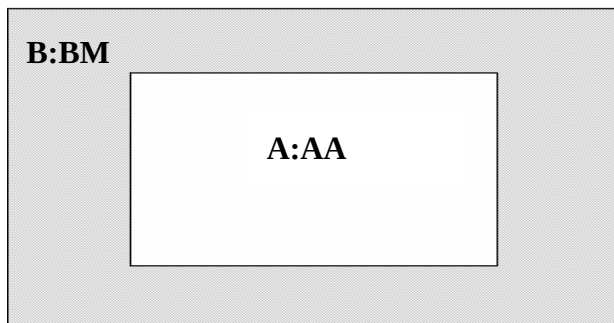


Note6. ADJACENT DOT



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Note7.



18.4. Handling of LCM

- (1)Don't give external shock.
- (2)Don't apply excessive force on the surface.
- (3)Liquid in LCD is hazardous substance. Must not lick and swallow. when the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
- (4)Don't operate it above the absolute maximum rating.
- (5)Don't disassemble the LCM.