



ASI-T-650MA5AN/W REV 1

No	Item	Specification	Remark
1	Type	Transmissive	--
2	Display Mode	Normally White	--
3	Pixel Element	a-Si TFT	--
4	Screen Size	7.0inch	--
5	Resolution	800(RGB) x480	--
6	Color Number	16.7M	--
7	Active Area	143.4 (W) x 76.704(L) (mm)	--
8	Pixel Size	0.17925 x 0.1598 (mm)	--
9	Color Arrangement	RGB-stripe	--
10	Assembly Type	COG	--
11	Back Light	LED	--
12	Good Viewing Direction	12 o'clock	--
13	Gray Scale Inversion Direction	6 o'clock	--
14	Weight	T.B.D.	g
15	Module Dimension	155.2(W) x 89.4 (L) x 5.5(H) mm	--



RECORD OF REVISION

DATE	REV.	PAGE	SUMMARY
2020/06/22	1 (1)	P.14	11.Modified schematic diagram of data clock signal (DCLK), latching data at falling edge instead of rising edge. Please refer (1)

3. General specifications

3.1 General specifications

It is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses the amorphous silicon TFT as a switching devices. This model is composed of a Transmissive type TFT-LCD Panel, a driver circuit and a back-light unit.

3.2 Features

- High image quality a-Si TFT LCD module.
- 16.7M color number.
- Support (RGB) input mode
- High contrast.
- Low power consumption.

4. Mechanical data

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5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

(1) TFT-LCD Panel Absolute Maximum Ratings

Ta=25°C

Item	Symbol	Condition	Standard Value		Unit	Remark
			Min.	Max.		
Power supply voltage	DVDD	GND=0V	-0.5	5.0	V	--
	VIN	GND=0V	-0.3	DVDD+0.3	V	--
	AVDD	GND=0V	-0.5	13.5	V	--
	VGH	GND=0V	-0.3	42.0	V	--
	VGL	GND=0V	VGH-42	0.3	V	--

- If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

(2) Back-Light Unit

Ta=25°C

Item	Symbol	Min.	Max.	Unit	Remark
Current	ILED	--	350	mA	--

5.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit	Remark
Operation temperature range	Top	-20	70	°C	Ambient
Storage temperature range	Tst	-30	80	°C	Ambient

- (1) Corrosive gas environment is not acceptable.
- (2) TFT-LCD color will change slightly depending on environment temperature.
This phenomenon is reversible.

6. Electrical characteristics

(1)TFT-LCD Module

Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply	DVDD	3.0	3.3	3.6	V	--
Analog Supply Voltage	AVDD	--	10.3	--	V	--
Gate ON Voltage	VGH	16.5	17.0	17.5	V	--
Gate OFF Voltage	VGL	-7.5	-7.0	-6.5	V	--
Common Electrode Driving Signal	VCOM	3.18	3.68	4.18	V	--
Hight level input voltage	VIH	0.7VDD	--	VDD	V	--
Low level input voltage	VIL	0	--	0.3VDD	V	

NOTE(1) : Typical VCOM is only a reference value, it must be optimized according to each LCM.

(2) Back-Light Unit

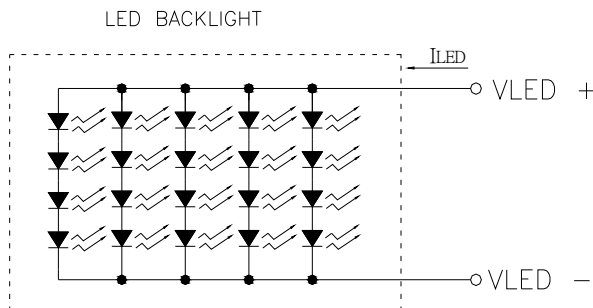
Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	VLED	10.8	12.4	13.6	V	--
Forward current	ILED	--	300	--	mA	--
LED Life Time	Lf	20000	--	--	hrs	NOTE (1)

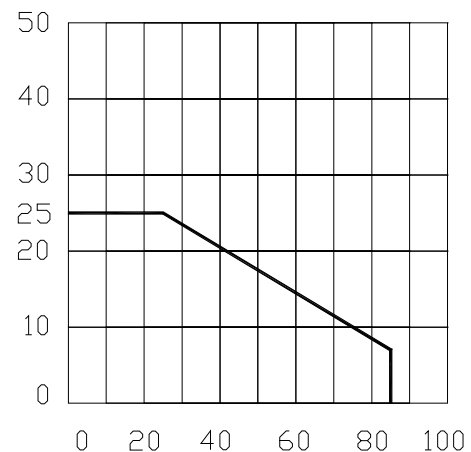
NOTE (1) : The “LED life time” is defined as the module brightness decreases to 50% of original brightness.

NOTE (2) : Current reduction rate of Single LED is according to the graph indicated below:

NOTE (3) : Back light circuit.



Allowable Forwade Current



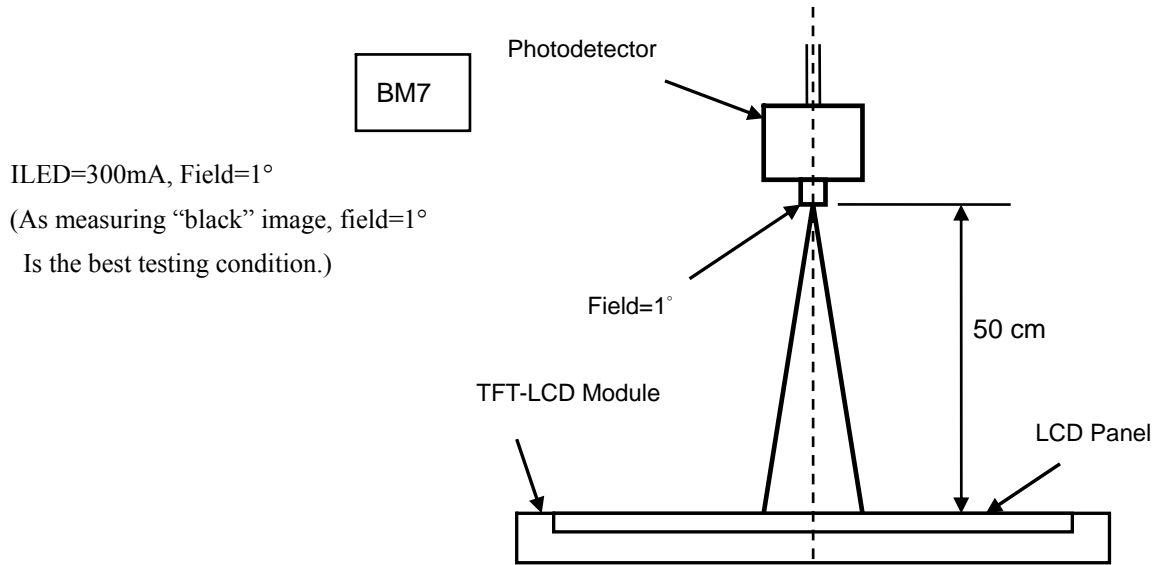
Ambitent Temperature Ta(°C)

7. Optical characteristics

Ta=25°C, ILED=300mA

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	B	$\theta=0^\circ$ Normal viewing angle At the center of panel	400	500	--	cd/m ²	(1)	
Contrast Ratio	C/R		400	500	--	--	(2)	
Response Time	Tr+Tf		--	25	50	ms	(3)	
Color chromaticity	White		Wx	(0.291)	(0.321)	(0.351)	--	--
			Wy	(0.317)	(0.347)	(0.377)	--	--
	Red		Rx	(0.558)	(0.588)	(0.618)	--	--
			Ry	(0.283)	(0.313)	(0.343)	--	--
	Green		Gx	(0.279)	(0.309)	(0.339)	--	--
			Gy	(0.531)	(0.561)	(0.591)	--	--
	Blue		Bx	(0.106)	(0.137)	(0.166)	--	--
		By	(0.096)	(0.126)	(0.156)	--	--	
Viewing Angle	Top	$\Phi=180^\circ$	$C/R \geq 10$ Backlight On	40	50	--	Deg. Good Viewing Direction(12H) (4)	
	Bottom	$\Phi=0^\circ$		60	70	--		Gray Scale Inversion Direction(6H) (4)
	Left	$\Phi=270^\circ$		60	70	--		(4)
	Right	$\Phi=90^\circ$		60	70	--		(4)
Uniformity	Un	$\theta=0^\circ$ Normal viewing angle	70	--	--	%	(5)	

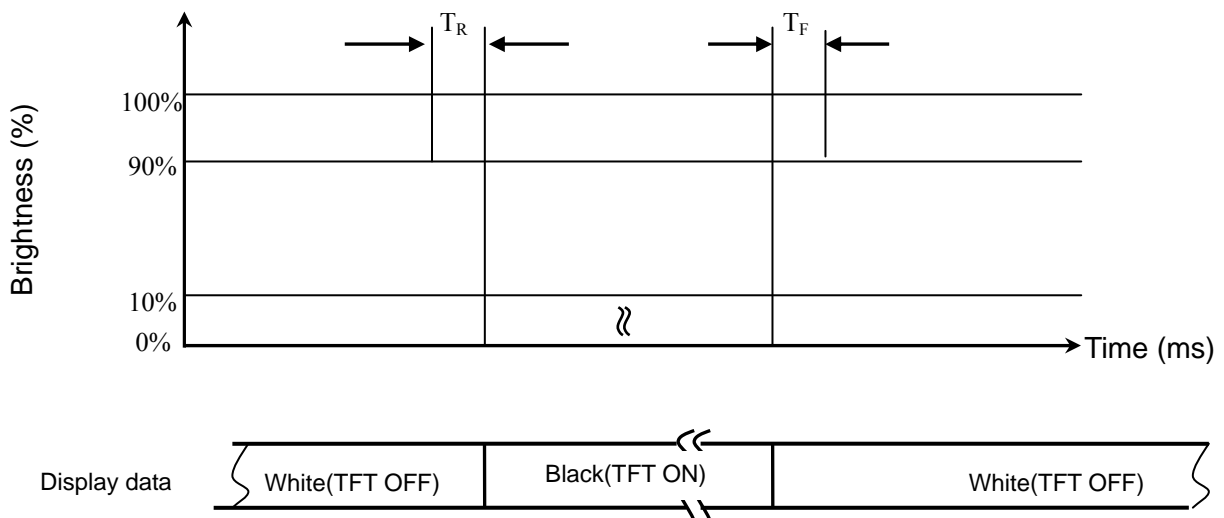
Note 1: The brightness test equipment setup



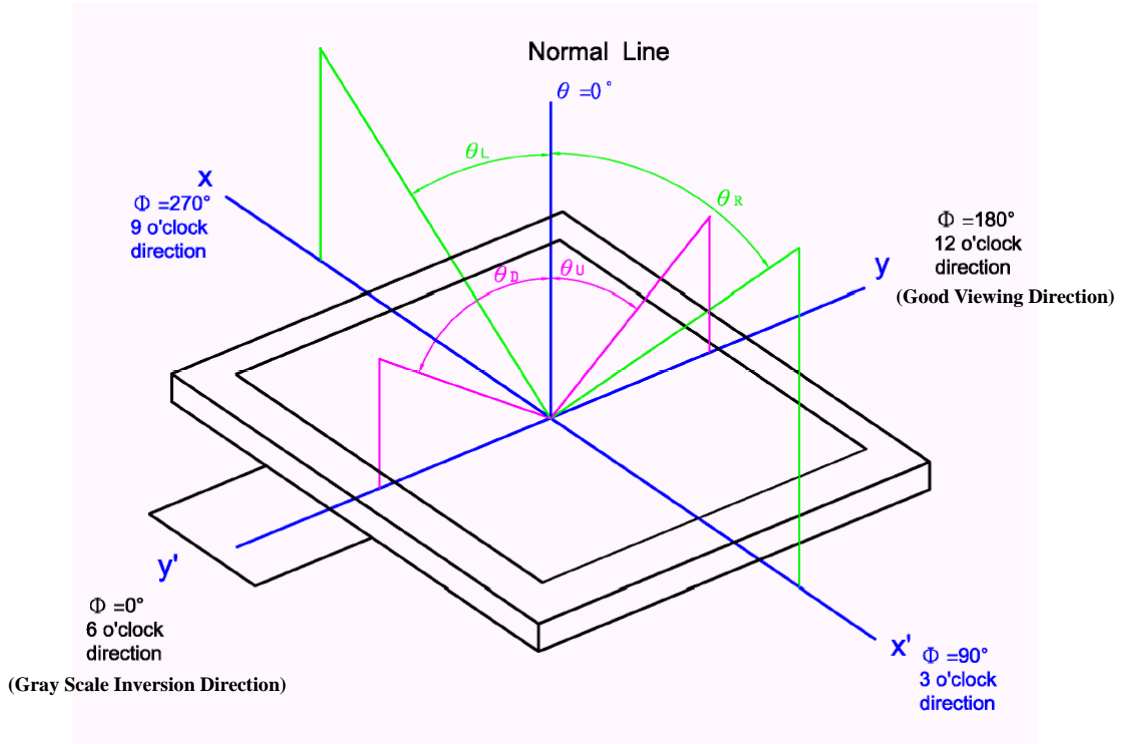
Note 2: Definition of contrast Ratio (C/R)

$$C/R = \frac{\text{Brightness When LCD is at "White" State}}{\text{Brightness When LCD is at "Black" State}}$$

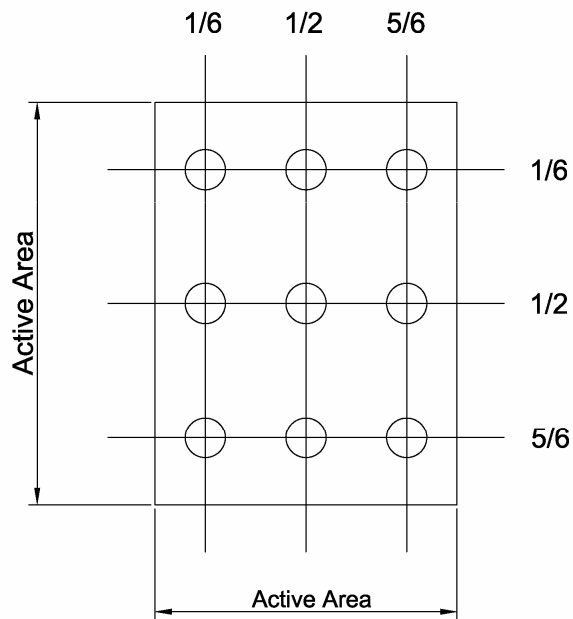
Note 3: Definition of response time



Note 4: Definition of viewing angle

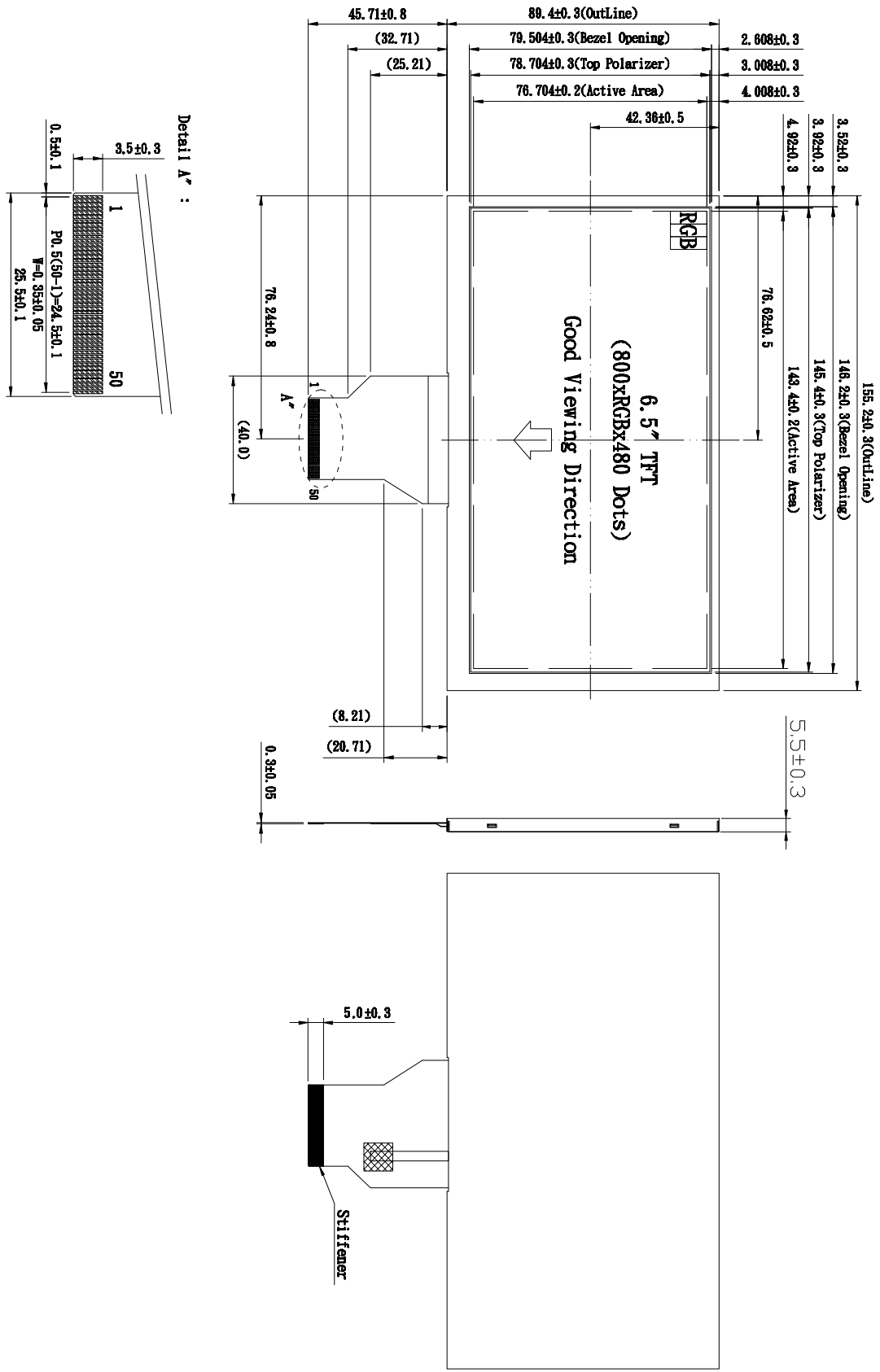


Note 5: Definition of uniformity (U_n)



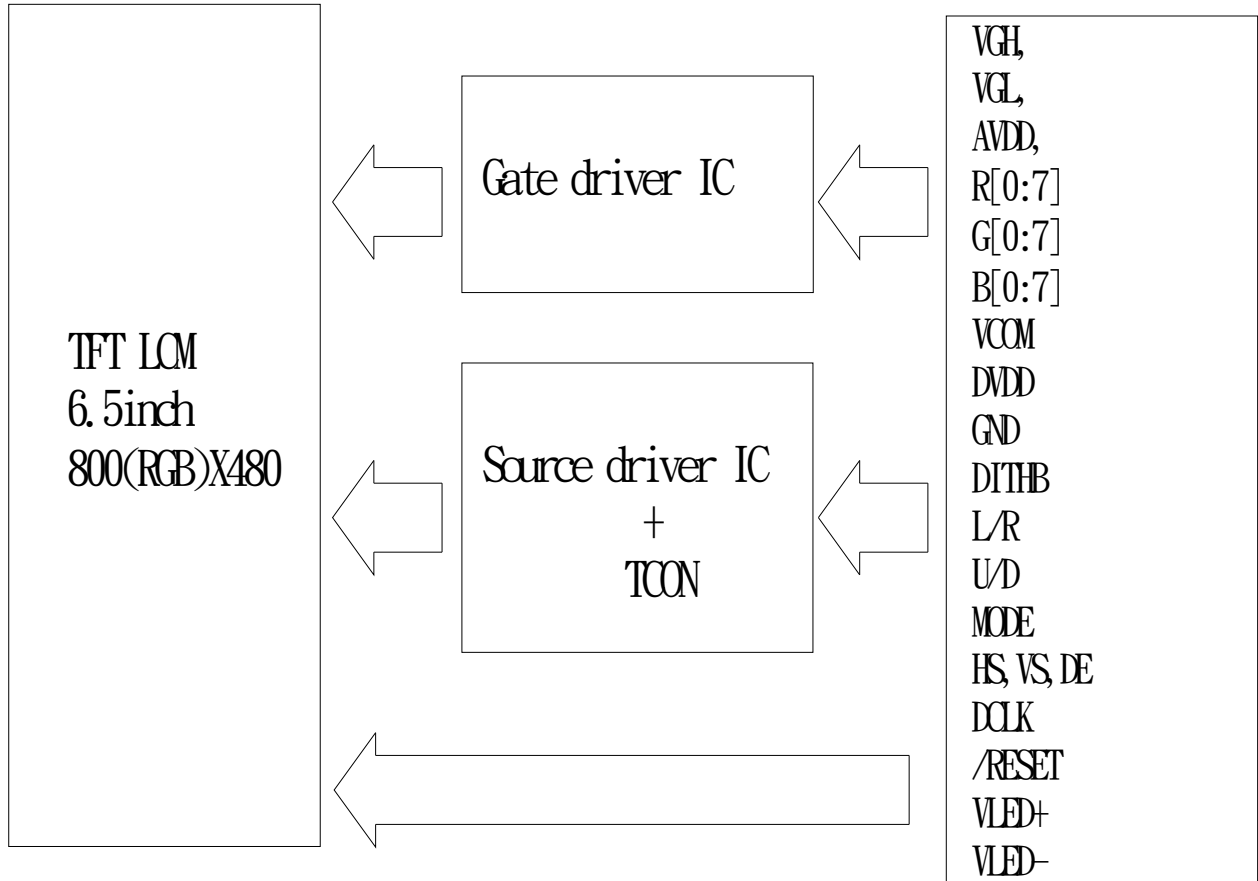
$$U_n = \frac{B_{min}}{B_{max}} \times 100\%$$

8. Outline dimension



9. Block diagram

9.1 TFT-LCD Module (Interface System Structure)



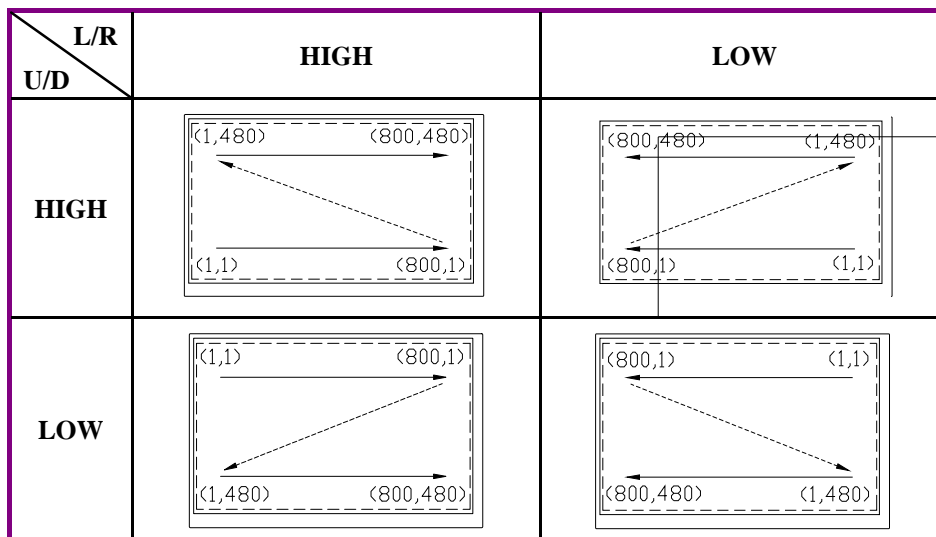
10. Input Terminal Pin Assignment

10.1 Input Signal & Power for TFT-LCD Module

Pin No	Symbol	Description	Remark
1	VLED+	LED_Anode	-
2	VLED+	LED_Anode	-
3	VLED-	LED_Cathode	-
4	VLED-	LED_Cathode	-
5	GND	Power Ground	-
6	VCOM	Internal reference Voltage	-
7	DVDD	Power Supply for Digital Circuit	-
8	MODE	DE or SYNC mode select	-
9	DE	Data Enable	-
10	VS	Vertical synchronizing signal in RGB interface	-
11	HS	Horizontal synchronizing signal in RGB interface	-
12	B7	Blue data bit 7	-
13	B6	Blue data bit 6	-
14	B5	Blue data bit 5	-
15	B4	Blue data bit 4	-
16	B3	Blue data bit 3	-
17	B2	Blue data bit 2	-
18	B1	Blue data bit 1	-
19	B0	Blue data bit 0	-
20	G7	Green data bit 7	-
21	G6	Green data bit 6	-
22	G5	Green data bit 5	-
23	G4	Green data bit 4	-
24	G3	Green data bit 3	-
25	G2	Green data bit 2	-
26	G1	Green data bit 1	-
27	G0	Green data bit 0	-
28	R7	Red data bit 7	-
29	R6	Red data bit 6	-
30	R5	Red data bit 5	-
31	R4	Red data bit 4	-
32	R3	Red data bit 3	-
33	R2	Red data bit 2	-

Pin No	Symbol	Description	Remark
34	R1	Red data bit 1	-
35	R0	Red data bit 0	-
36	GND	Power Ground	-
37	DCLK	Clock signal ; Latch data at Falling Edge	-
38	GND	Power Ground	-
39	L/R	Source shift direction control	NOTE(1)
40	U/D	Gate scan direction control	NOTE(1)
41	VGH	TFT Gate On Voltage	-
42	VGL	TFT Gate Off Voltage	-
43	AVDD	Power supply for analog block.	-
44	/RESET	Hardware global reset and low active	-
45	NC	No connection	-
46	VCOM	Internal reference Voltage	-
47	DITHB	Dithering function enable control	-
48	GND	Power Ground	-
49	NC	No connection	-
50	NC	No connection	-

NOTE(1):SCAN DIRECTION

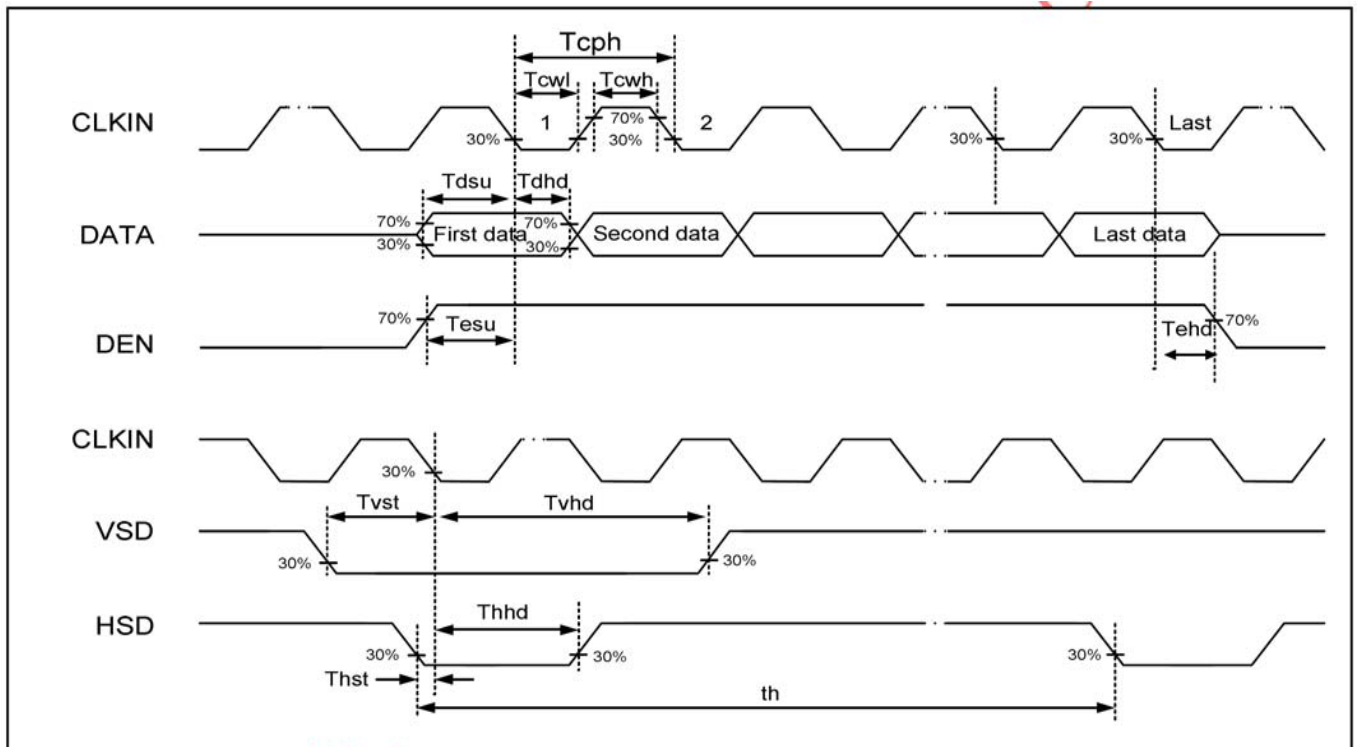


11. Timing Characteristics

11.1 AC Electrical Characteristics Timing Conditions

Parameter	Symbol	Rating			Unit
		Min.	Typ.	Max.	
VDD Power On Slew rate	TPOR			20	ms
RESET pulse width	Trst	10			us
CLKIN cycle time	Tcph	20			ns
CLKIN pulse duty	Tcwh	40	50	60	%
VSD setup time	Tvst	8			ns
VSD hold time	Tvhd	8			ns
HSD setup time	Thst	8			ns
HSD hold time	Thhd	8			ns
Data set-up time	Tdsu	8			ns
Data hold time	Tdhd	8			ns
DE setup time	Tesu	8			ns
DE hold time	Tehd	8			ns
Output stable time	Tsst			6	us

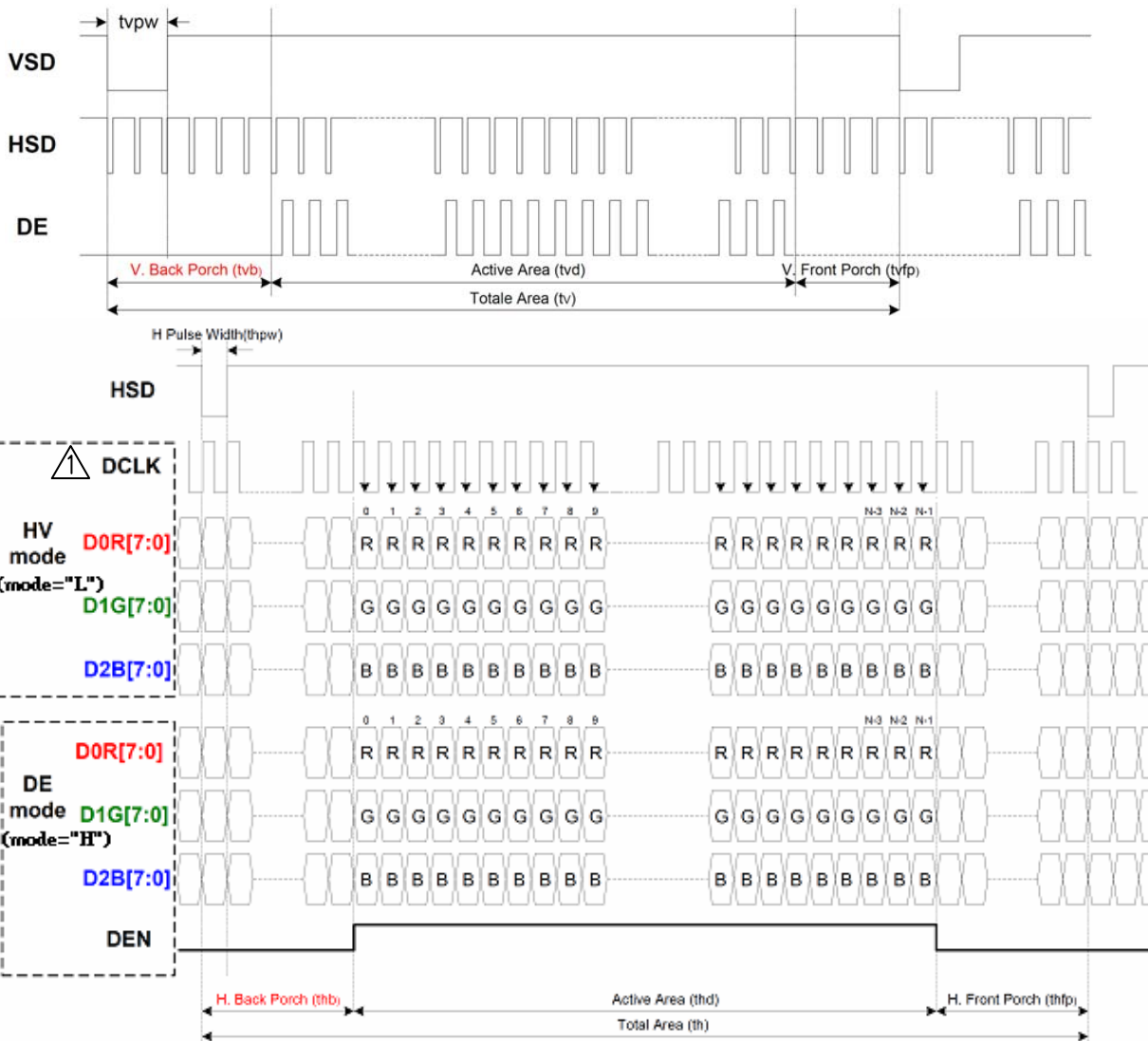
11.2 Timing Controller Timing Chart



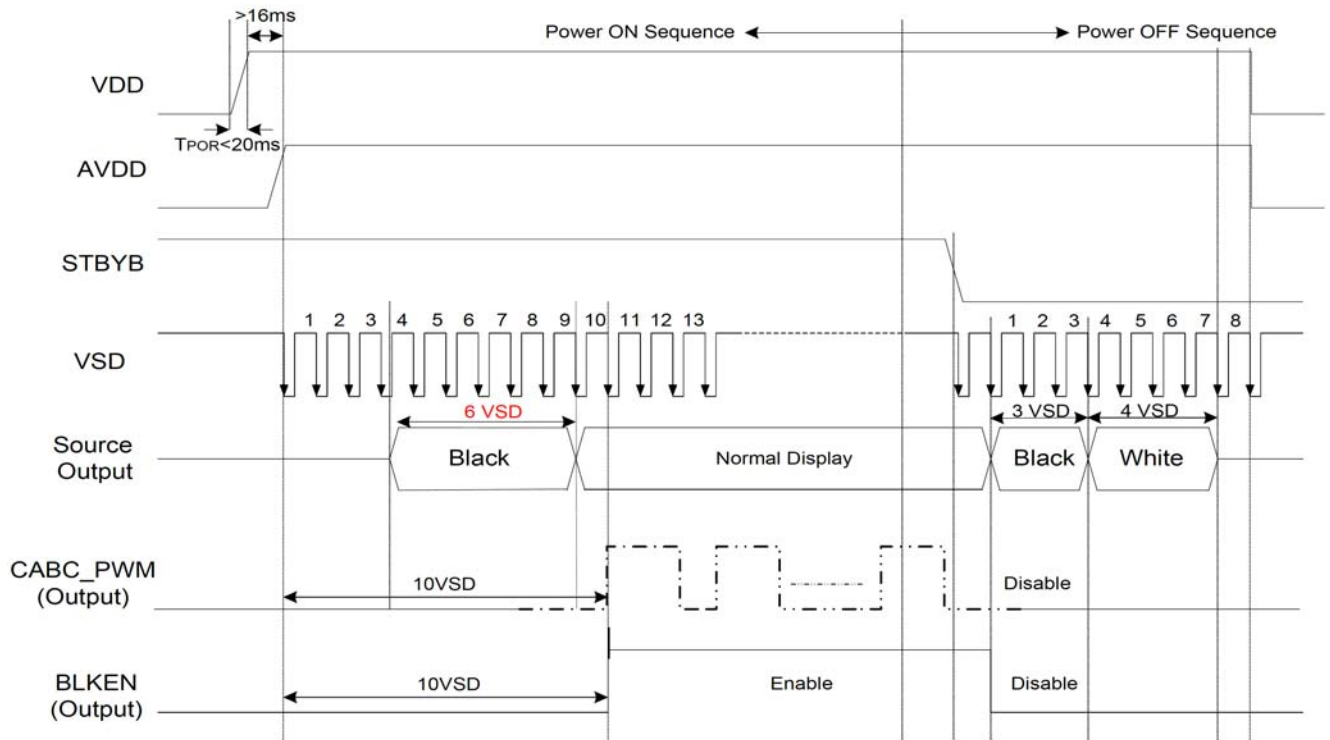
11.3 Data input format

Horizontal Input Timing						
Parameter	Symbol	Value			Unit	
		Min.	Typ.	Max.		
Horizontal display area	t_{HD}	--	800	--	CLKIN	
CLKIN frequency	f_{CLK}	--	33.3	50	MHz	
1 Horizontal line period	t_H	862	1056	1200	CLKIN	
HSD pulse width	Min.	--	1	--	CLKIN	
	Typ.	--	--	--	CLKIN	
	Max.	--	40	--	CLKIN	
HSD back porch	SYNC	t_{HBP}	46	46	46	CLKIN
HSD front porch	SYNC	t_{HFP}	16	210	354	CLKIN

Vertical Input Timing					
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	t_{VD}	--	480	--	HSD
VSD period time	t_V	510	525	650	HSD
VSD pulse width	t_{VPW}	1	--	20	HSD
VSD back porch	t_{VBP}	23	23	23	HSD
VSD front porch	t_{VFP}	7	22	147	HSD



11.4 Power on/off Sequence



12. Reliability Test Items

No.	Test items	Conditions	Remark
1	High temperature operation	70°C , 240hours	--
2	Low temperature operation	-20°C , 240hours	--
3	High temperature storage	80°C , 240hours	
4	Low temperature storage	-30°C , 240hours	
5	High temperature & high humidity storage	60°C , 80% RH , 240hours	--
6	Thermal Shock storage	-20°C , 30min. ~ 70°C , 30min. , 100 Cycles	--
7	Vibration test	Freq.:10~500~10 Hz, 1.5G , 0.37oct/min 1 hours for each direction of X, Y, Z	Non-operation
8	Electrostatic discharge	150F / 330Ω , ±8KV(contact) / ±15KV(Air) 5 points/panel; 5 times/point	Non-operation
<p>Criterion: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.</p>			

13. General Precautions

Please pay attentions to the followings as using the LCD module.

13.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the polarizer permanently. The recommended solvents are water and Isopropyl alcohol.
- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.

13.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

13.3 Operation

- (a) When mounting or dismantling the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms should always be obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

13.4 Others

- (a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- (b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- (c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.

14. Quality and reliability

14.1 Test condition

Test should be conducted under the following conditions:

- (a) Ambient temperature: $25 \pm 5^{\circ}\text{C}$
- (b) Humidity: $55 \pm 10\% \text{ RH}$

14.2 Sampling plan

Sampling method shall be in accordance with MIL-STD-105D, inspection level II, normal inspection, and single sampling plan tables for normal tightened and reduced inspection.

14.3 Acceptable quality level

A major defect is a defect that could result in failure or materially reduce that the usability of the unit of product for its intended purpose.

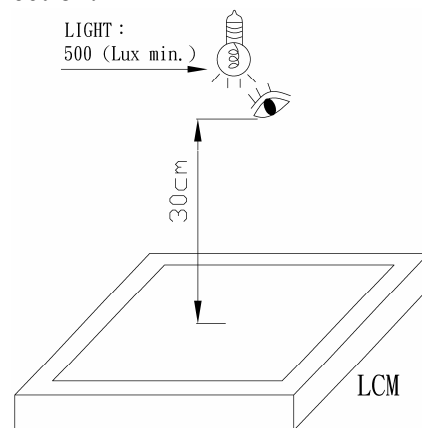
A minor defect is one that does not materially reduce the usability of the unit of product for its intended purpose or is a departure from established standards having no significant bearing on the effective use or operation of the unit.

14.4 Appearance

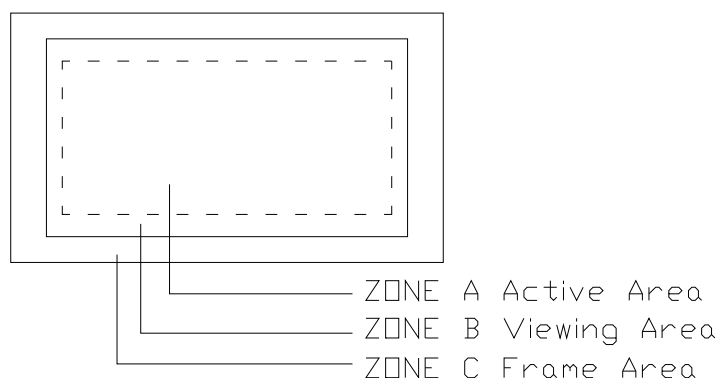
Appearance test is to be conducted by human eyes at approximately 30cm distance from LCD module under the single fluorescent light without reflection.

Condition:

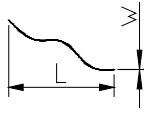
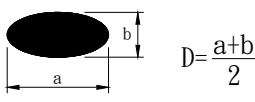
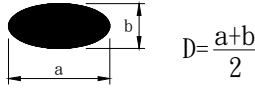
- (a) Illumination: 500 Lux min
- (b) Inspect determination: 30cm
- (c) Inspect direction: above the LCM
- (d) View angle: $\pm 30^{\circ}$



The inspection area of LCD panel shall be within the range of following limits.



14.5 Inspection quality criteria for TFT LCM

ITEM	DESCRIPTION OF DEFECTS	Zone	Acceptable level (%)																					
DIMENSION	Refer to individual acceptance specification	A,B,C	2.5																					
LINE DEFECT ON SURFACE (SCRATCHES, BLACK/WHITE LINE)	(a) $L \leq 2\text{mm} \ \& \ W \leq 0.03\text{mm}$, disregard (b) $L \leq 3\text{mm} \ \& \ 0.03\text{mm} < W \leq 0.05\text{mm}$, $N \leq 3$ (c) $L \leq 2.5\text{mm} \ \& \ 0.05\text{mm} \leq W \leq 0.1\text{mm}$, $N \leq 1$ (d) $W > 0.1\text{mm}$, as SPOT DEFECT ON SURFACE 	A	2.5																					
SPOT DEFECT ON SURFACE (BLACK/WHITE SPOT)	Average diameter, D (a) $D \leq 0.2\text{mm}$, disregard (b) $0.2\text{mm} < D \leq 0.5\text{mm}$, $N \leq 6$.ACC (c) $D > 0.5\text{mm}$, REJ (d) Distance between 2 spots $\geq 10\text{mm}$ 	A	2.5																					
PROTRUDE DOT/ DENT ON SURFACE	Average diameter D (a) $D \leq 0.2\text{mm}$, disregard (b) $0.2\text{mm} < D \leq 0.3\text{mm}$, $N \leq 3$.ACC (c) $0.3\text{mm} < D \leq 0.5\text{mm}$, $N \leq 1$.ACC (d) $D > 0.5\text{mm}$, REJ 	A	2.5																					
POLARIZER EDGE	BUBBLES · DENTS · RESIDUAL GLUE · DECKLE EDGE : Active Area outside area don't care.	A,B	2.5																					
BRIGHT/ DARK POINT	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Item</th> <th>Allow number in Area A</th> </tr> </thead> <tbody> <tr> <td rowspan="4">(a) Bright point</td> <td>Single point</td> <td>2</td> </tr> <tr> <td>Two adjacent point</td> <td>0</td> </tr> <tr> <td>Three adjacent point</td> <td>0</td> </tr> <tr> <td>Total point</td> <td>2</td> </tr> <tr> <td rowspan="4">(b) Dark point</td> <td>Single point</td> <td>3</td> </tr> <tr> <td>Two adjacent point</td> <td>0</td> </tr> <tr> <td>Three adjacent point</td> <td>0</td> </tr> <tr> <td>Total point</td> <td>3</td> </tr> </tbody> </table> <p>※ Point : A sub pixel 1R or 1G or 1B ※ The distance of bright or dark point > 5mm</p>	Item		Allow number in Area A	(a) Bright point	Single point	2	Two adjacent point	0	Three adjacent point	0	Total point	2	(b) Dark point	Single point	3	Two adjacent point	0	Three adjacent point	0	Total point	3	A	2.5
Item		Allow number in Area A																						
(a) Bright point	Single point	2																						
	Two adjacent point	0																						
	Three adjacent point	0																						
	Total point	2																						
(b) Dark point	Single point	3																						
	Two adjacent point	0																						
	Three adjacent point	0																						
	Total point	3																						
CHROMA MURA	Mura and leak are defined through transmission ND 5% filter	A	2.5																					
DISPLAY ABNORMAL	(a) Non display (b) Line defect (c) Response time, contrast ratio, brightness or viewing angle abnormal (d) Water ripple (e) Flicker	A	0.65																					

NOTE : (1) ACC : Accept (2) REJ : Reject