ORIENT DISPLAY

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SPECIFICATION
FOR
LCD MODULE

MODULE NO: AFD1280800B0L-10.1INTM-CU
VERSION NO.: V1.0

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

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RECORD OF REVISION

Version	Revised Date	Page	Content
V1.0	2014/11/03	--	First Issued

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1. GENERAL DESCRIPTION

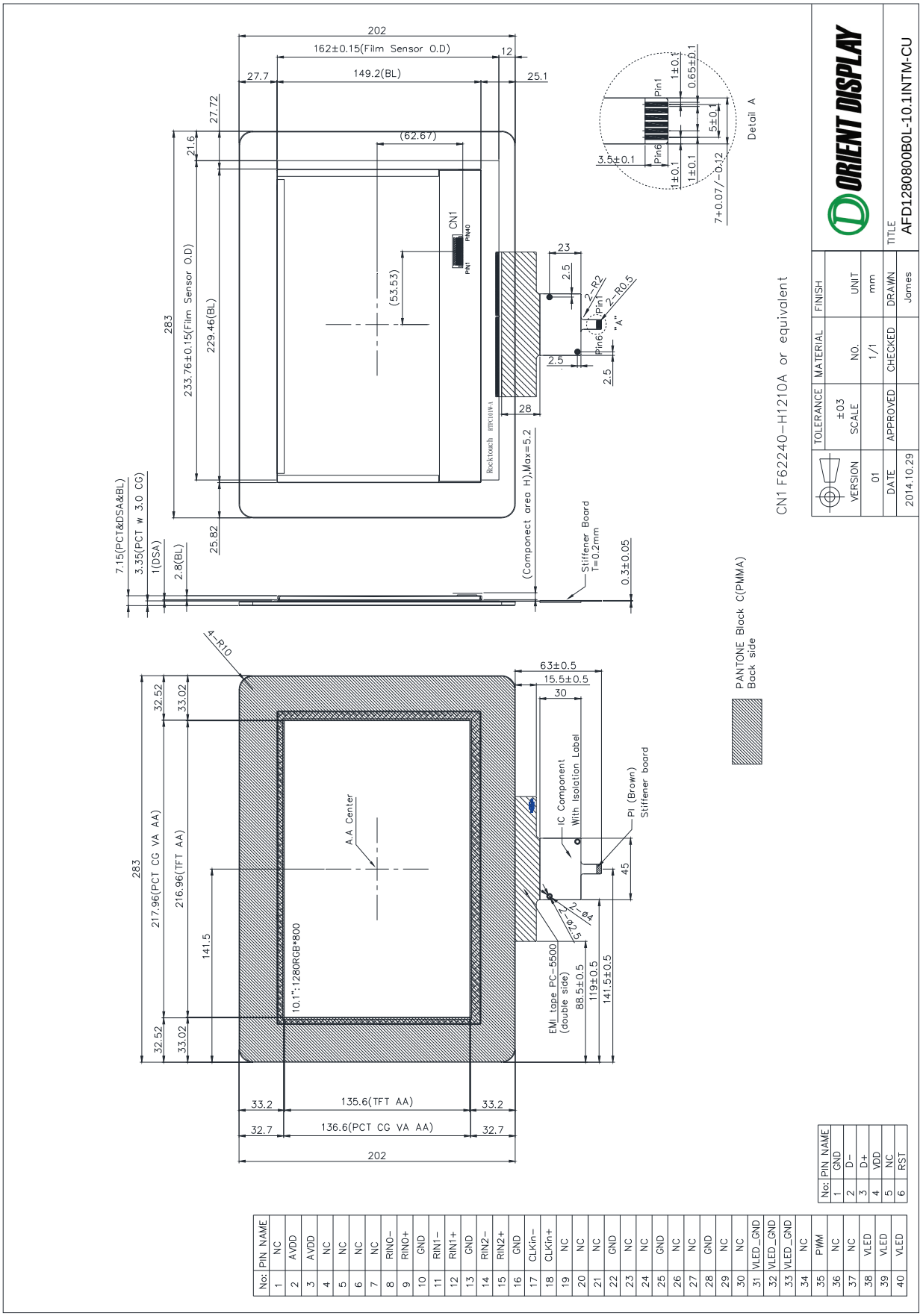
1.1 Description

The specifications is model AFD1280800B0L-10.1INTM-CU is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, a back light system and a projected capacitive touch panel. This TFT LCD has a 10.1 (16:10) inch diagonally measured active display area with WXGA (1280 horizontal by 800 vertical pixels) resolution.

1.2 Features:

No.	Item	Specification	Unit
1	Panel Size	10.1”	Inch
2	Number of Pixels	1280 (W) x RGB x 800 (H)	Pixels
3	Active Area	216.96 (W) × 135.6 (H)	mm
4	Pixel Pitch	0.1695 (W) x 0.1695 (H)	mm
5	Outline Dimension	283 (W) × 202 (H) × 7.15 (T)	mm
6	Number of Colors	262K	- -
7	Display Mode	IPS/Normally Black / Transmissive	- -
8	View Direction	Free of direction	- -
9	Display Format	RGB vertical stripe	- -
10	Surface Treatment	Clear (7H)	- -
11	Contrast Ratio	800 (Typ.)	- -
12	Luminance (cd/m^2)	250 (Typ.)	cd/m2
13	Interface	LVDS 6 bit Interface	- -
14	Backlight	White LED	- -
15	Driver IC	--	- -
16	Operation Temperature	0 ~ 50	°C
17	Storage Temperature	-20 ~ 60	°C
18	Weight	(TBD)	g

2. MECHANICAL SPECIFICATION



3. PIN DESCRIPTION

3.1 TFT LCD Module

Pin	Symbol	I/O	Function	Remark
1	NC	-	NO Connect	
2	VDD	P	Power Supply	
3	VDD	P	Power Supply	
4	NC	-	NO Connect	
5	NC	-	NO Connect	
6	NC	-	NO Connect	
7	NC	-	NO Connect	
8	RXIN0-	I	Negative LVDS differential data input	R0~R5,G0
9	RXIN0+	I	Positive LVDS differential data input	
10	GND	P	Ground	
11	RXIN1-	I	Negative LVDS differential data input	G1~G5,B0,B1
12	RXIN1+	I	Positive LVDS differential data input	
13	GND	P	Ground	
14	RXIN2-	I	Negative LVDS differential data input	B2~B5,HS,VS,DE
15	RXIN2+	I	Positive LVDS differential data input	
16	GND	P	Ground	
17	RXCLK-	I	Negative LVDS differential clock input	LVDS CLK
18	RXCLK+	I	Positive LVDS differential clock input	
19	NC	-	NO Connect	
20	NC	-	NO Connect	
21	NC	-	NO Connect	
22	GND	P	Ground	
23	NC	-	NO Connect	
24	NC	-	NO Connect	
25	GND	P	Ground	
26	NC	-	NO Connect	
27	NC	-	NO Connect	
28	GND	P	Ground	
29	NC	-	NO Connect	
30	NC	-	NO Connect	
31	VLED_GND	P	LED Ground	

32	VLED_GND	P	LED Ground	
33	VLED_GND	P	LED Ground	
34	NC	-	NO Connect	
35	PWM	-	PWM Signal for LED dimming control	
36	NC	-	NO Connect	
37	NC	-	NO Connect	
38	VLED	P	LED Power Supply(4.5~5.5V)	
39	VLED	P	LED Power Supply(4.5~5.5V)	
40	VLED	P	LED Power Supply(4.5~5.5V)	

NOTE: The Brightness of LCD Panel could be changed by adjusting PWM

4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Rating

4.1.1 TFT LCD Module

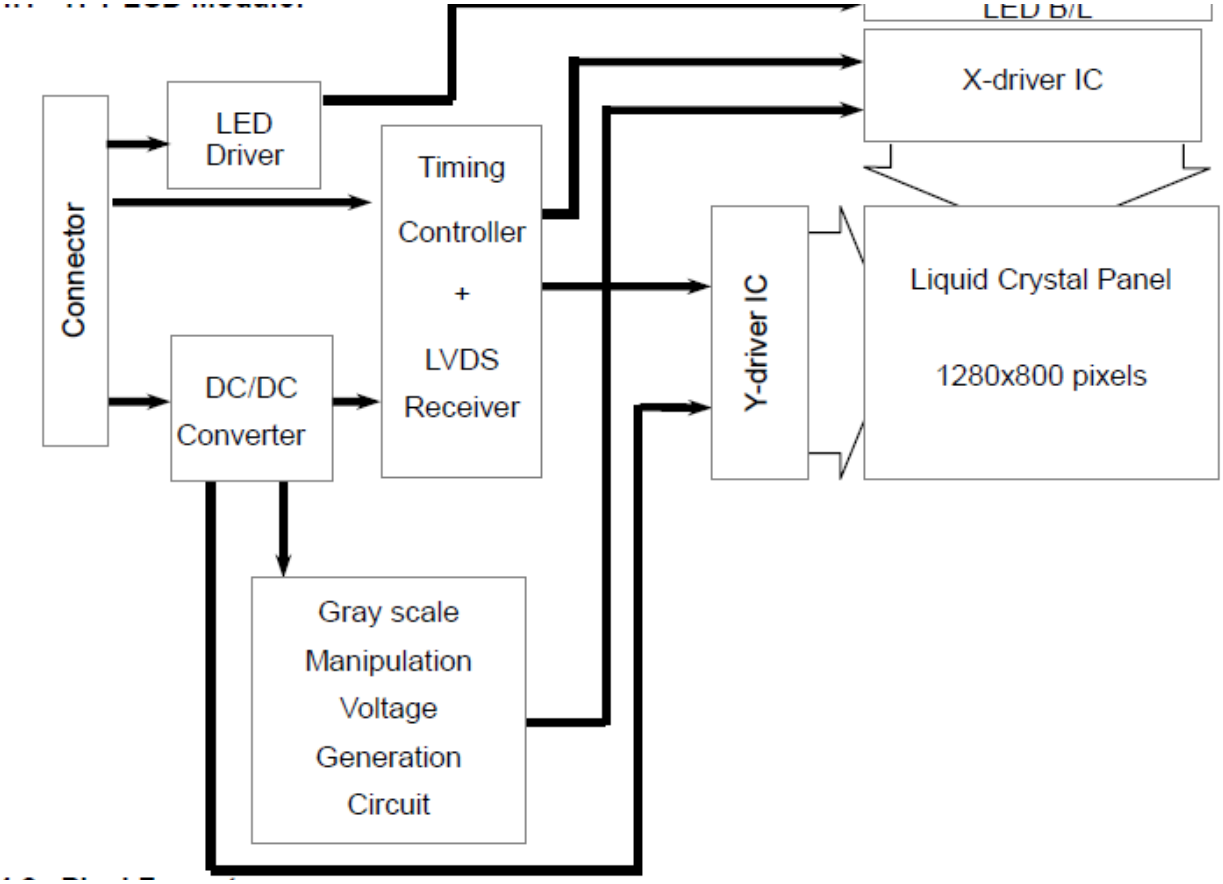
Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VDD	-0.3	4.0	V	

4.1.2 Environment Absolute Rating

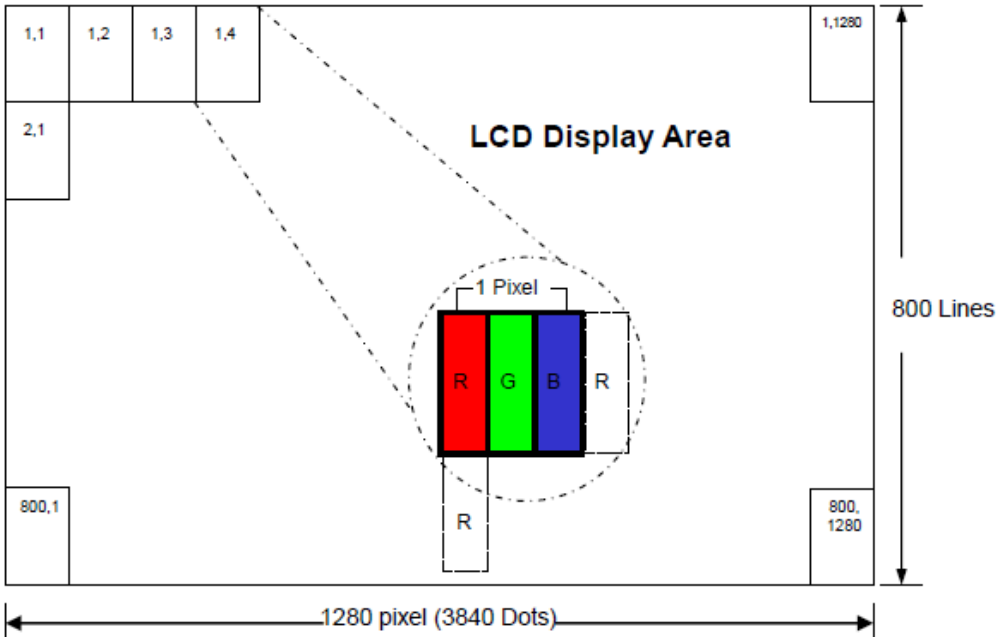
Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Topa	0		50	°C	Ambient temperature
Storage Temperature	Tstg	-20		60	°C	

5. BLOCK DIAGRAM

5.1 TFT LCD Module



Pixel Format



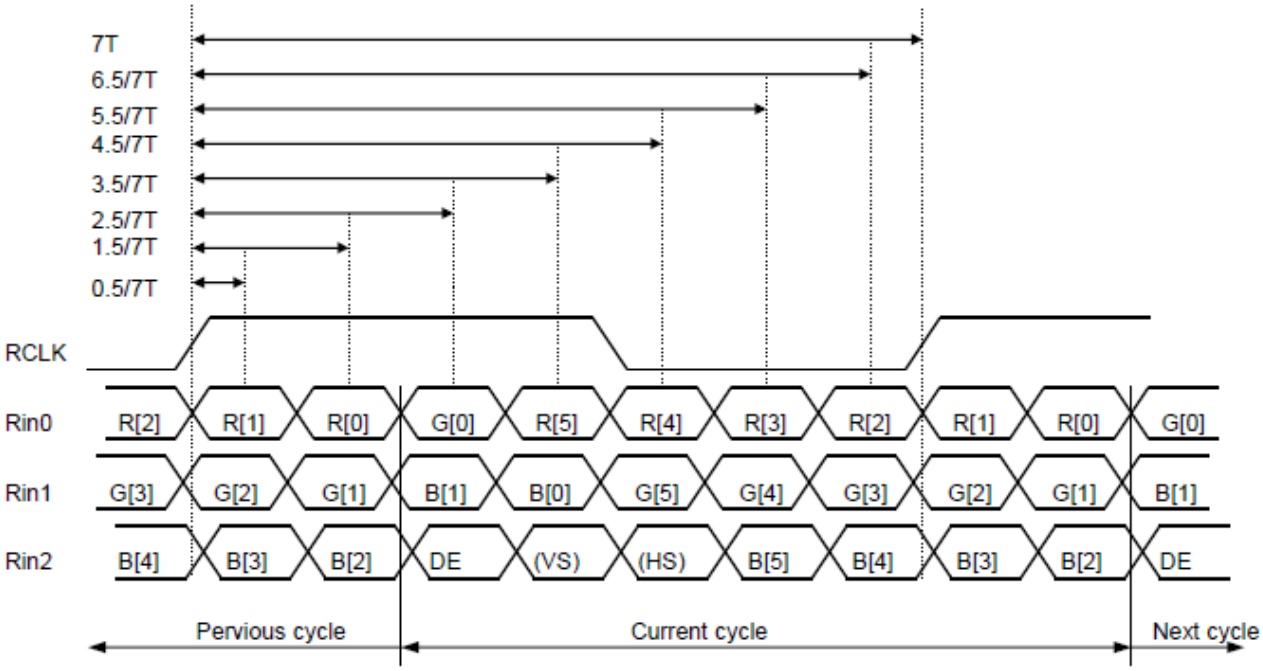
6. Relationship Between Displayed Color and Input

6.1 6 bit

	Display	MSB R5	R4	R3	R2	R1	LSB R0	MSB G5	G4	G3	G2	G1	LSB G0	MSB B5	B4	B3	B2	B1	LSB B0	Gray scale level
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		⋮						⋮						⋮						L3…L60
		H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L61
		H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L62
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	Red L63
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L2
		⋮						⋮						⋮						L3…L60
		L	L	L	L	L	L	H	H	H	H	L	H	L	L	L	L	L	L	L61
		L	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L62
	Green	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	Green L63
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
		⋮						⋮						⋮						L3…L60
		L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	L	H	L61
		L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L62
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	Blue L63
Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L1
		L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L	L2
		⋮						⋮						⋮						L3…L60
		H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	H	L61
		H	H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	L62
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L63

6.2 Data Mapping

Bit Mapping & Interface Definition



LVDS Receiver Input Timing Definition
for 6bits LVDS input

7. ELECTRICAL CHARACTERISTICS

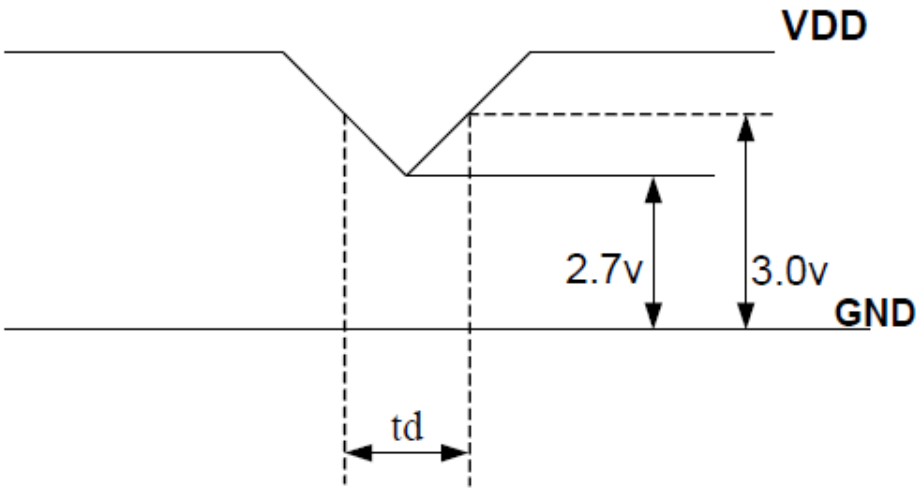
7.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	**Note (2)**
Current of power supply	IDD	-	0.27	-	A	V_{DD} =3.3V、White pattern (L63)
VDD Power	PDD	-	-	1.0	W	V_{DD} =3.3V、White pattern (L63)
Inrush current	I_{RUSH}	-	-	1.50	A	Note (2)

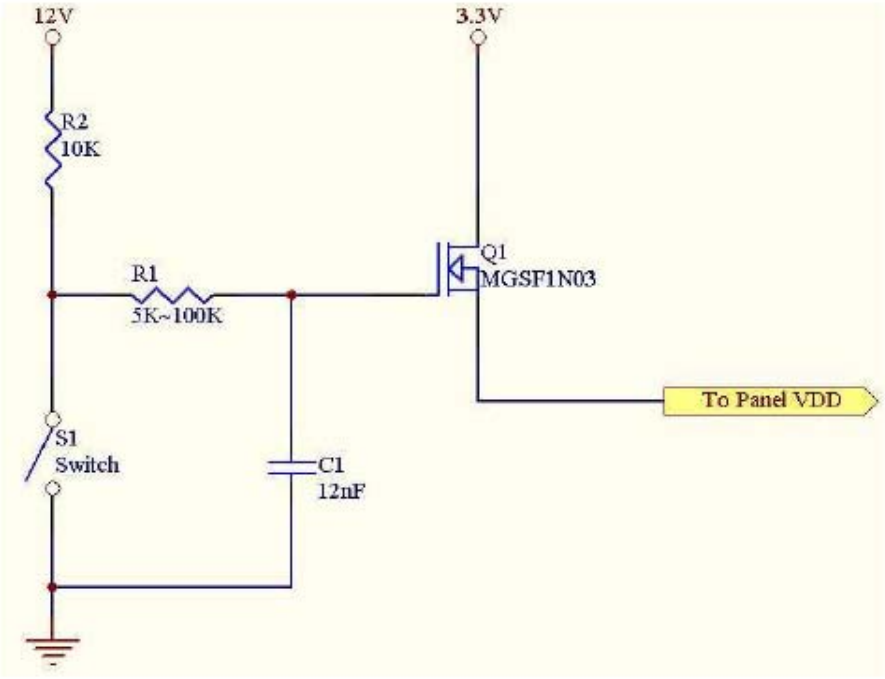
Note (1): V_{DD}-dip condition:

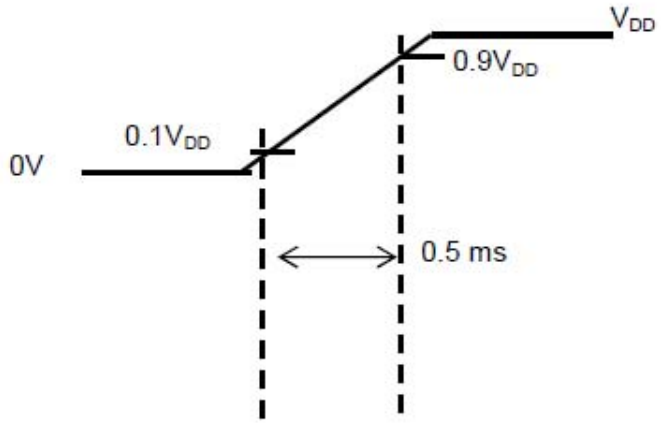
When VDD operating within 2.7V≦VDD<3.0V，td≦10ms , the display may momentarily become abnormal.

VDD<2.7V , VDD dip condition should also follow the Power On/Off conditions for supply voltage.



Note : **(2)** Power on Inrush current test circuit





V_{in} rising time

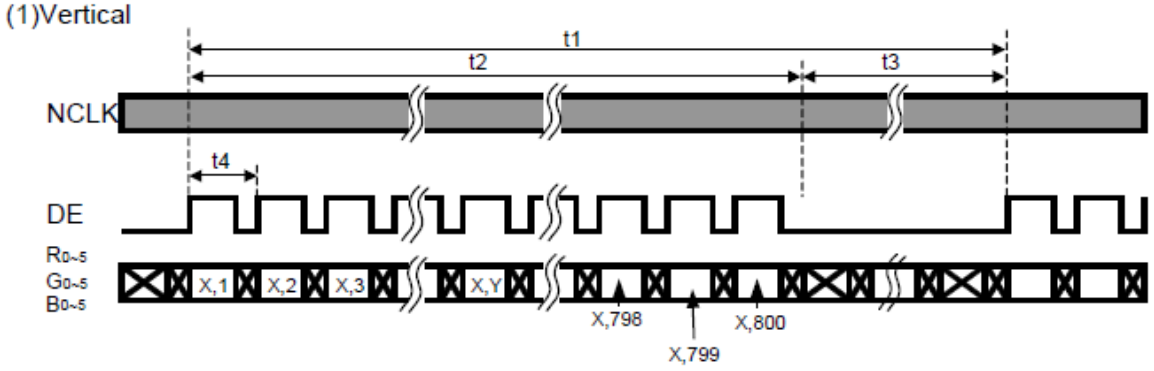
7.2 INTERFACE SPECIFICATIONS

7.2.1 Timing

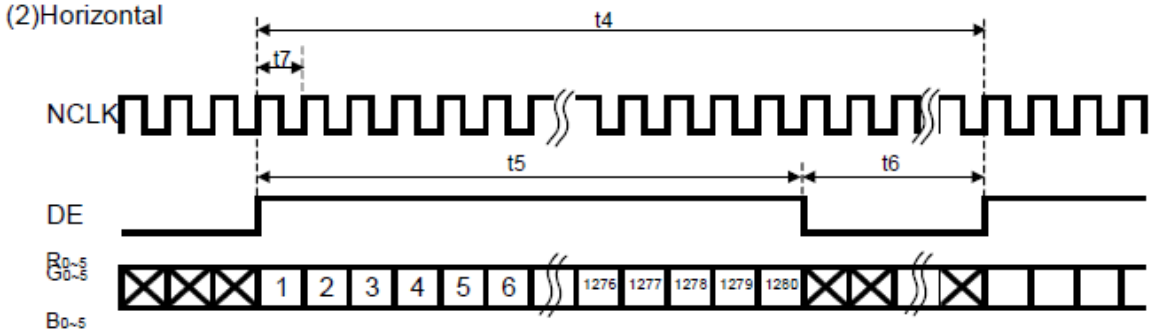
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	55	60	65	Hz
Frame Period	t1	803	823	1023	line
Vertical Display Time	t2	800	800	800	line
Vertical Blanking Time	t3	3	23	223	line
1 Line Scanning Time	t4	1334	1440	1961	clock
Horizontal Display Time	t5	1280	1280	1280	clock
Horizontal Blanking Time	t6	54	160	681	clock
Clock Rate	t7	64.3	71.1	85	MHz

Timing Diagram of Interface Signal (DE mode)

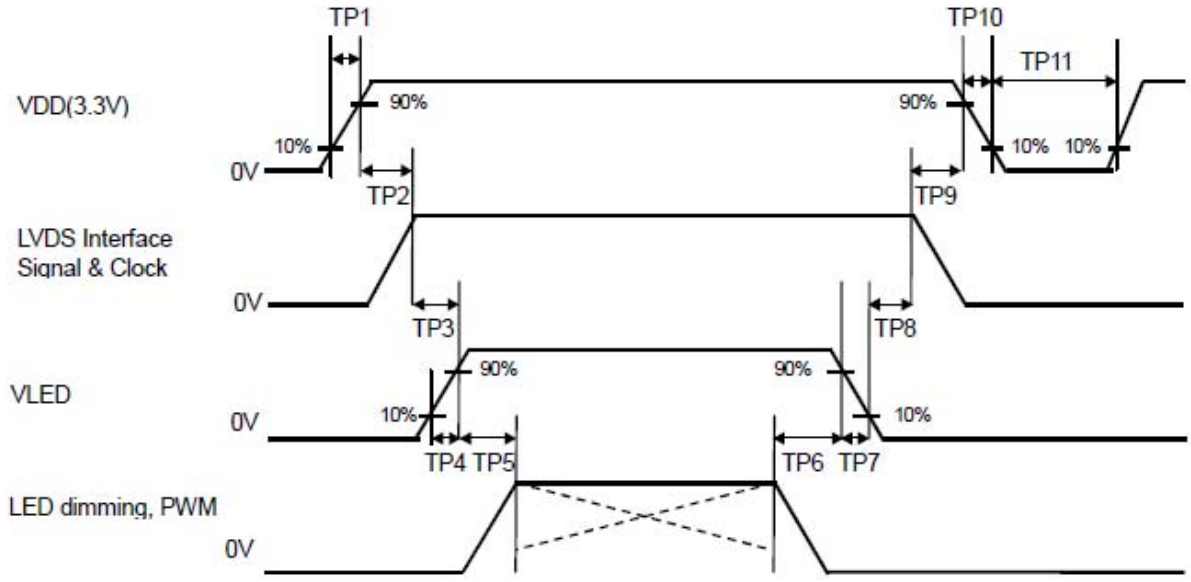
(1)Vertical



(2)Horizontal



7.3 Power On / Off Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	200	--	--	msec	
TP4	0.5	--	10	msec	
TP5	10	--	--	msec	
TP6	10	--	--	msec	
TP7	0	--	10	msec	
TP8	200	--	--	msec	
TP9	0	--	50	msec	
TP10	1	--	10	msec	
TP11	1000	--	--	msec	

Note：(1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.

(2) Apply the lamp volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP13 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

(6) The duty of LED dimming signal should be more than 20% in TP6 and TP14

(7) PWM can adjust brightness to control Pin. Pulse duty the bigger the brighter

7.4 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
Backlight Power consumption (Include LED driver efficiency)	P_{LED}	--	--	2.91	Watt	Ta=25℃ VLED=5V PWM duty 100% Note (1)
LED Life-Time	N/A	10,000	--	--	Hour	Ta=25℃ I_F=23mA Note (2)

Note (1): The LED lifetime defines as the estimated time to 50% degradation of final luminous.

7.5 LED Dr

7.5.1 **Absolute Maximum Ratings**

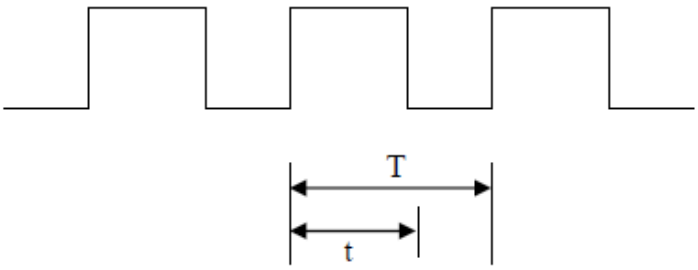
Item	Symbol	Min.	Max.	Unit	Note
LED Power Supply voltage	V_{LED}	-0.3	5.5	Volt	
LED_EN, PWM pin Voltage	V_{PWM}	--	V_{LED}	Volt	

7.5.2 **DC Electrical Characteristics**

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply Voltage	V_{LED}	4.5	--	5.5	Volt	
PWM High Threshold	V_{PWMH}	2.0	--	V_{LED}	Volt	
PWM Low Threshold	V_{PWML}	--	--	0.8	Volt	
PWM Frequency	F_{PWM}	225	--	1k	Hz	
PWM Frequency	F_{PWM}	14K		20k	Hz	Note(1)
PWM Duty Cycle	T_D	20	--	100	%	Note(2)

Note (1): PWM Frequency have noise problems during 1K~13K Hz.

Note (2): PWM Duty Cycle



Duty Cycle = (t / T) *100%

8. PROJECTED CAPACITIVE TOUCH PANEL SPECIFICATIONS

8.1 Main Feature

Item	Specification	Unit
Screen Size	10.1 inches	Diagonal
Type	Transparent Type Projected Capacitive Touch Panel	--
Input Mode	Human's Finger	--
View Area	217.96(H)(typ.) X 136.6 (V)(typ.)	mm
Module Outline	283 (H)(typ.) X 202 (V)(typ.)	mm
Resolution	2048(H) X 2048(V)	--
Interface	USB	--
Operating system OS	WIN7/Android	
Touch number	Two points	
Cover glass pencil-hardness	7H(min) by JIS K-5600-5-4	--
Response time	35	ms
Report Rate	75	Points/sec
Digital Power Supply	2.7V(min)~3.3V DC (typ.)	V
Power Consumption	EXC7200 Active: Max.50mA EXC7200 idle : 8 mA EX5404 Active: Max.10mA	mA
IC solution	IC : EETI_ EX5404 MCU : EETI_EXC7200	

8.2 Pin Assignments and Definitions

Item	Name	I/O	Unit
1	GND	P	Ground
2	D-	I/O	D-
3	D+	I/O	D+
4	VDD	P	Power supply
5	NC	-	NO connect
6	RST	I	Reset signal

9. PTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness		--	Note1, Note 3, ($\theta = 0^\circ$, Normal Viewing Angle)	200	250	--	cd/m2
Uniformity		B-uni		70	75	-	%
Contrast Ratio		CR		600	800	--	--
Response Time		Tr+Tf		--	25	35	ms
Color Chromaticity	White	Wx		0.283	0.313	0.343	--
		Wy		0.299	0.329	0.359	--
View angle	Horizontal	θ x+	Center CR≥10	80	89	--	
		θ x-		80	89	--	
	Vertical	θ Y+		80	89	--	
		θ Y-		80	89	--	

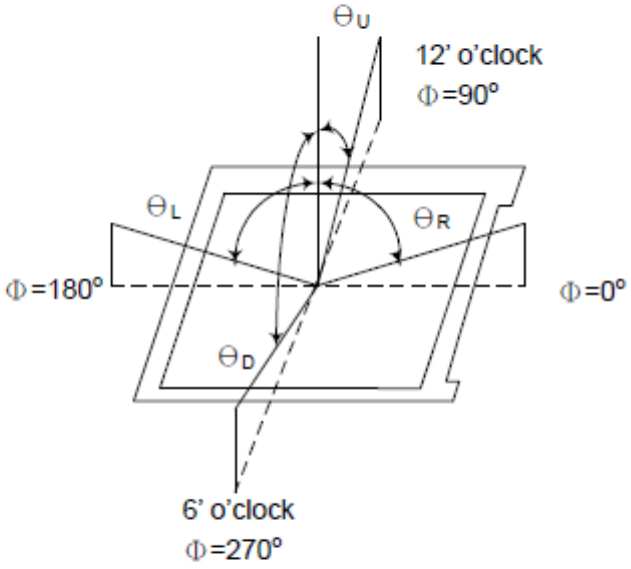
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 20 ~ 21 mm

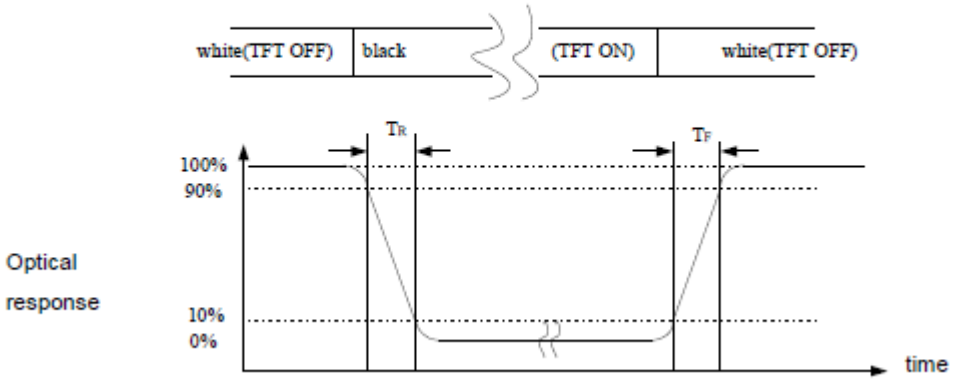
Note (1) Definition of Viewing Angle:



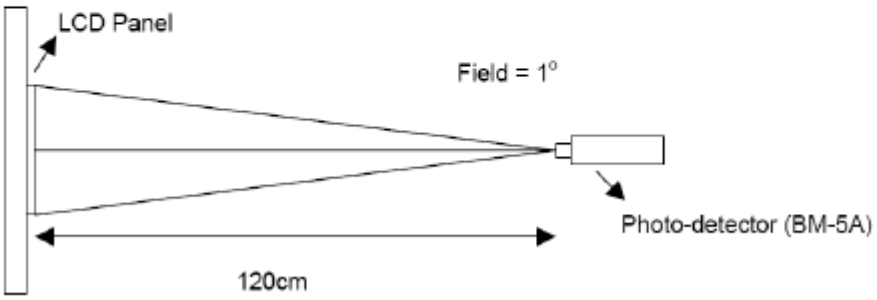
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time : Sum of T_R and T_F

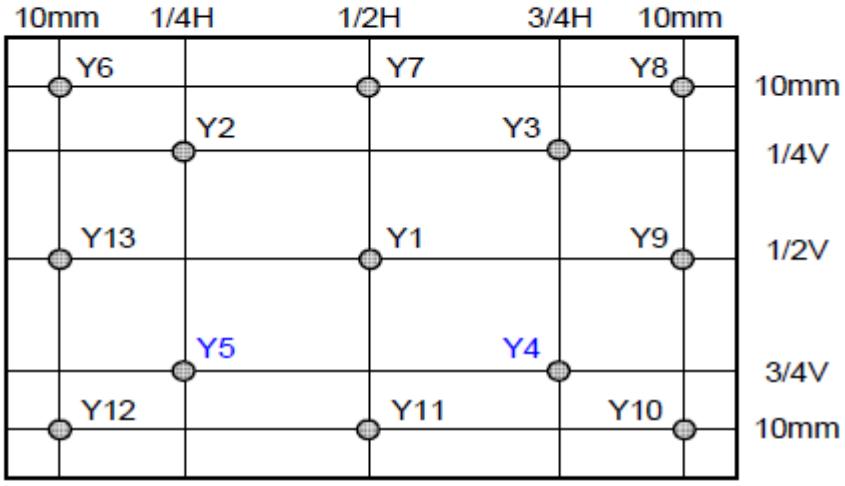


Note (4) Definition of optical measurement setup



Note (5) Definition of Average Luminance Uniformity of White (5 Point)

$$\text{Average Luminance Uniformity} = \frac{Y_1+Y_2+Y_3+Y_4+Y_5}{5}$$



Note (6) Definition of brightness uniformity

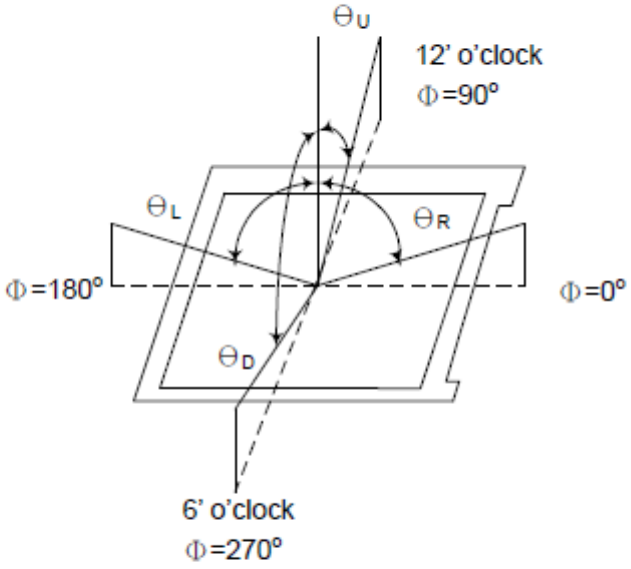
$$\text{Luminance uniformity(5 points)} = \frac{\text{(Max Luminance of 5 points)}}{\text{(Min Luminance of 5 points)}}$$

$$\text{Luminance uniformity(13points)} = \frac{\text{(Max Luminance of 13 points)}}{\text{(Min Luminance of 13 points)}}$$

Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 20 ~ 21 mm

Note (1) Definition of Viewing Angle:



Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

10. RELIABILITY

10.1 Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

10.2 TESTS

No.	ITEM	CONDITION CRITERION
1	High Temperature Storage	60°C, 240 hrs
2	Low Temperature Storage	-20°C, 240 hrs
3	High Temperature Operating	50°C, 240 hrs
4	Low Temperature Operating	0°C, 240 hrs
5	High Temperature/Humidity Non-Operating	60°C, 90%RH, 240 hrs
6	Temperature Shock Non-Operating	-20°C ←→ 60°C (0.5hr each), 100 cycles
7	Vibration Test Non-Operating	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z

Note1: The test sample have recovery time for 24 hours at room temperature before the function check. In the standard conditions, there is no any touch panel function NG issue occurred.

10.3 JUDGMENT STANDARD

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

10.4 INCOMING INSPECTION STANDARDS

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Operating</td><td>Display function: No Display malfunction (Major)
Contrast ratio (Black, White):
Does not meet specified range in the spec. (Major) (Note:3)
Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)
Point Defect : Active area ≤ 5 dots (Minor) (Note:1)
<table>
<tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr>
<tr><th>Active Area</th></tr>
<tr><td>Bright</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark</td><td>4</td></tr>
</table>
Non-uniformity: Visible through 5%ND filter. (Minor)
Foreign material in Black or White spots shape (W>1/4L)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D> 0.5</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.3 < D ≤ 0.5</td><td>5</td></tr>
<tr><td>D ≤ 0.3</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard
Foreign Material in Line or spiral shape (W≤1/4L) (Note: 4)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>L >5</td><td>W>0.1</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.5 < L ≤ 5</td><td>0.03 < W≤0.1</td><td>5</td></tr>
<tr><td>L ≤0.5</td><td>W≤0.03</td><td>*</td></tr>
</table>
L : Length W : Width ＊ : Disregard</td></tr>
<tr><td>2</td><td>External Inspection (non-operating)</td><td>Dimension: Outline (Major)
Bezel appearance: uneven (Minor)
Scratch on the polarize: (Note:2)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>--</td><td>W>0.1</td><td>0</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>L ≤ 3</td><td>W≤0.1</td><td>3</td></tr>
</table>
L : Length W : Width ＊ : Disregard
Dent or bubble on the polarize (Note:2)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D≤0.3</td><td>*</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>D≤0.5</td><td>3</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard</td></tr>
</table>

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

Note1:

(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively

(b)Dark point defect is defined as visible in full white pattern.

(c)Definition of distribution of point defect is as follows:

-minimum separation between dark point defects should be larger than 5mm.

-minimum separation between bright point defects should be larger than 5mm.

(d)Definition of joined bright point defect and joined dark point defect are as follows:

-Two or more joined bright point defects must be nil.

-Three joined dark point defects must be nil.

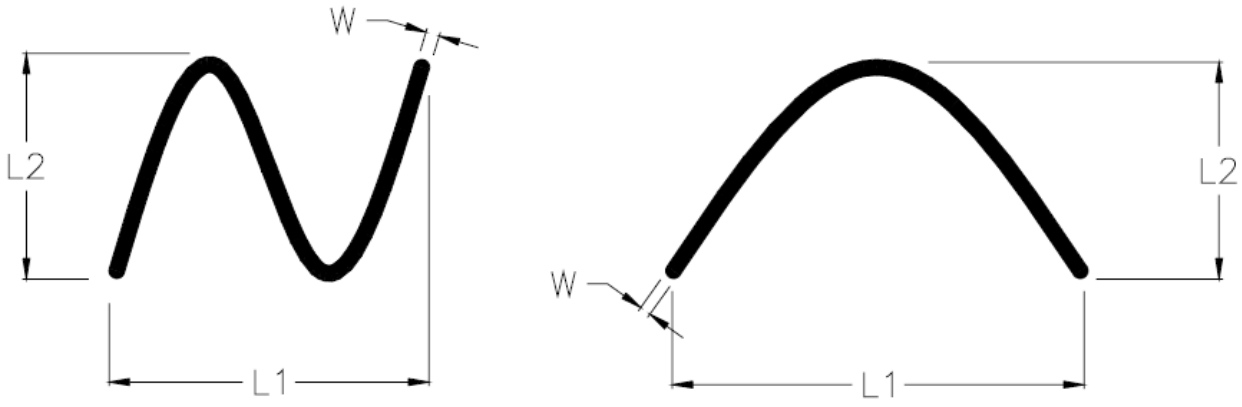
-Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maximum.

-Two Joined dark point is counted as two dark points with 2 pair maximum.

Note2: The external inspection should be conducted at the distance 30± 5cm between the eyes of inspector and the panel.

Note3: Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note4: W-Width in mm , L-length of Max.(L1,L2) in mm.



10.5 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

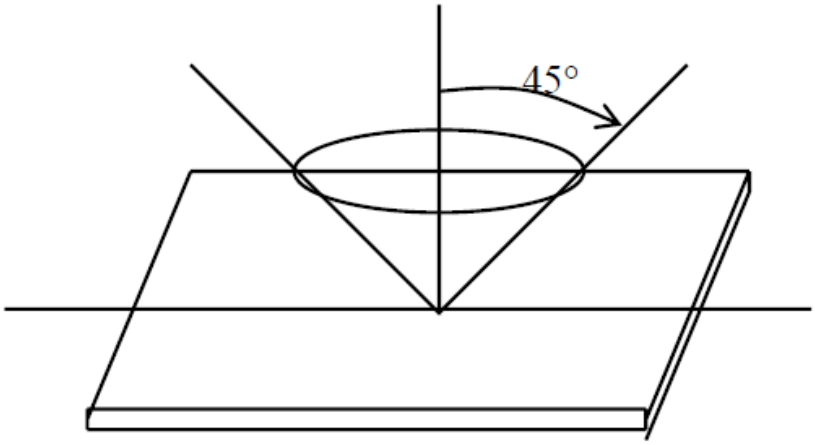
Inspection level: Level II

10.6 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.

$\theta \leq 45^{\circ}$ inspection under non-operating condition.

$\theta \leq 5^{\circ}$ inspection under operating condition



11. PRECAUTION RELATING PRODUCT HANDLING

11.1 SAFETY

11.1.1 **If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.**

11.1.2 **If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.**

11.2 HANDLING

11.2.1 **Avoid any strong mechanical shock which can break the glass.**

11.2.2 **Avoid static electricity which can damage the CMOS LSI—When working with the module, be sure to ground your body and any electrical equipment you may be using.**

11.2.3 **Do not remove the panel or frame from the module.**

11.2.4 **The polarizing plate of the display is very fragile. So , please handle it very carefully, Do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)**

11.2.5 **Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.**

11.2.6 **Do not touch the display area with bare hands , this will stain the display area.**

11.2.7 **Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.**

11.2.8 **To control temperature and time of soldering is 280 ± 10°C and 3-5 sec.**

11.2.9 **To avoid liquid (include organic solvent) stained on LCM.**

11.3 STORAGE

11.3.1 **Store the panel or module in a dark place where the temperature is 25°C ± 5°C and the humidity is below 65% RH.**

11.3.2 **Do not place the module near organics solvents or corrosive gases.**

11.3.3 **Do not crush, shake, or jolt the module.**