

Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 1280242A VM-PW-N

15,0“ TFT

Product Specification

Version: 0

26.12.2024

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*** Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 15' TFT-LCD contains 1280X242 pixels, and can display up to 16.7M colors.

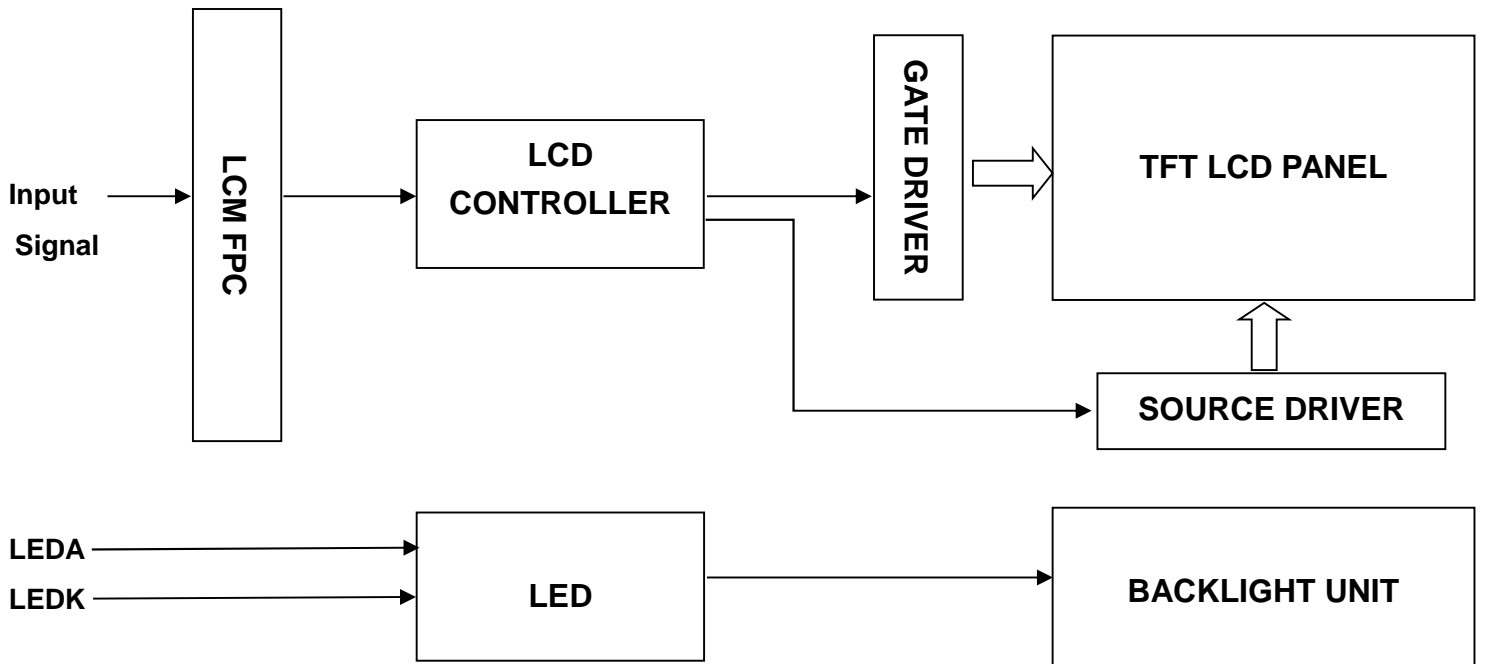
*** Features**

General Information	Items	Specification	Unit	Note
		Main Panel		
	Display area(AA)	374.784(H) *70.86(V) (15 inch)	mm	-
	Driver element	TFT active matrix	-	-
	Display colors	16.7M	colors	-
	Number of pixels	1280*(RGB)*242	dots	-
	TFT Pixel arrangement	RGB vertical stripe	-	-
	Pixel pitch	0.2928(H) x 0.2928(V)	mm	-
	Viewing angle	FREE	o'clock	-
	LCM Interface	DUAL CHANNEL LVDS		
	Display mode	Transmissive/Normally Black	-	-
	Operating temperature	0~+50	°C	-
	Storage temperature	-20~+60	°C	-

*** Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	403.3	-	mm	-
	Vertical(V)	-	98.1	-	mm	-
	Depth(D)	-	14	-	mm	-
Weight		-	638	-	g	-

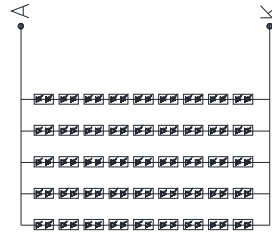
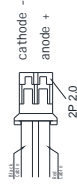
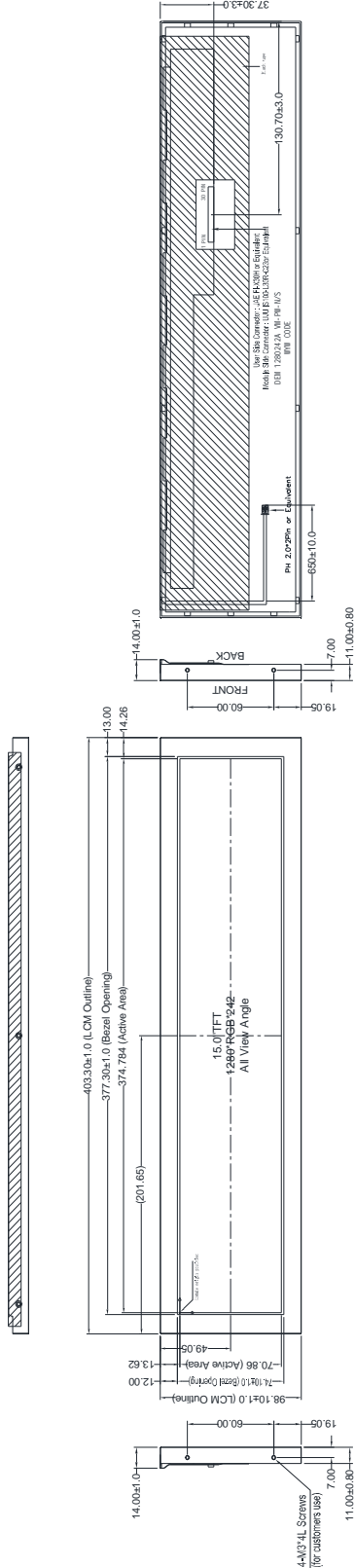
1. Block Diagram



2. Outline dimension

LCM PIN:

Pin	Name
1	RX01NO-
2	RX01NO+
3	RX01NI-
4	RX01NI+
5	RX01N2-
6	RX01N2+
7	GND
8	RX0CLKI-
9	RX0CLKI+
10	RX01N3-
11	RX01N3+
12	RXE1NO-
13	RXE1NO+
14	GND
15	RXE1NI-
16	RXE1NI+
17	GND
18	RXE1N2-
19	RXE1N2+
20	RXECLKI-
21	RXECLKI+
22	RXE1N3-
23	RXE1N3+
24	GND
25	NC
26	NC
27	NC
28	VDD
29	VDD
30	VDD



LED Numbers: 9X5=45EA
LED(B/L) CIRCUIT

- NOTE:
1. DISPLAY TYPE: 15.0" , TFT-LCD, 16.7M COLORS
 2. DISPLAY MODE: NORMALLY BLACK/IPS
 3. VIEWING DIRECTION: ALL
 4. LCM Interface: Dual Channel LVDS
 5. VDD: +5V(TYP.)
 6. OPERATING TEMP: 0° C TO 50° C
STORAGE TEMP: -20° C TO 60° C
 7. BACK LIGHT: LED WHITE, 45 Chip LED, 150mA, 48. 6-57. 6V
 8. LCM Brightness: 500cd/m2(Typ.)
 9. ROHS COMPLIANT.

3. Input terminal Pin Assignment

3.1 Electrical Interface Connection

User Side Connector : JAE FI-X30H or Equivalent

Module Side Connector : IS100-L30R-C23(UJU) or equivalent

NO.	SYMBOL	DISCRIPTION	I/O
1	RXOIN0-	Negative Transmission data of Pixel 0 (ODD)	I
2	RXOIN0+	Positive Transmission data of Pixel 0 (ODD)	I
3	RXOIN1-	Negative Transmission data of Pixel 1 (ODD)	I
4	RXOIN1+	Positive Transmission data of Pixel 1 (ODD)	I
5	RXOIN2-	Negative Transmission data of Pixel 2 (ODD)	I
6	RXOIN2+	Positive Transmission data of Pixel 2 (ODD)	I
7	GND	Ground.	P
8	RXOCLKIN-	Negative Transmission Clock (ODD)	I
9	RXOCLKIN+	Positive Transmission Clock (ODD)	I
10	RXOIN3-	Negative Transmission data of Pixel 3 (ODD)	I
11	RXOIN+	Positive Transmission data of Pixel 3 (ODD)	I
12	RXEIN0-	Negative Transmission data of Pixel 0 (EVEN)	I
13	RXEIN0+	Positive Transmission data of Pixel 0 (EVEN)	I
14	GND	Ground.	P
15	RXEIN1-	Negative Transmission data of Pixel 1 (EVEN)	I
16	RXEIN+	Positive Transmission data of Pixel 1 (EVEN)	I
17	GND	Ground.	P
18	RXEIN2-	Negative Transmission data of Pixel 2 (EVEN)	I
19	RXEIN2+	Positive Transmission data of Pixel 2 (EVEN)	I
20	RXECLKIN-	Negative Transmission Clock (EVEN)	I
21	RXECLKIN+	Positive Transmission Clock (EVEN)	I
22	RXEIN3-	Negative Transmission data of Pixel 3 (EVEN)	I
23	RXEIN3+	Positive Transmission data of Pixel 3 (EVEN)	I
24	GND	Ground.	P
25	NC	Not connection	--

26	NC	Not connection	--
27	NC	Not connection	--
28	VDD	Power Supply: +5V	P
29	VDD	Power Supply: +5V	P
30	VDD	Power Supply: +5V	P

3.2 Back-light Interface Connection

-LED connector: PH 2.0*2PIN or Equivalent

NO.	SYMBOL	DISCRIPTION	I/O
1	Cathode -	Cathode pin of backlight (Black-)	P
3	Anode +	Anode pin of backlight (Red+)	P

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$	700	1000	--		(1)(2)
Response time	Rising	T_{R+T_F}	Normal viewing angle	--	14	20	msec	(1)(3)
	Falling							
Color gamut		S(%)		60	66	--	%	
Color Filter Chromaticity	White	W_X	Normal viewing angle	-0.04	0.315	+0.04		(1)(4) CA-310
		W_Y			0.378			
	Red	R_X			0.639			
		R_Y			0.352			
	Green	G_X			0.314			
		G_Y			0.601			
	Blue	B_X			0.151			
		B_Y			0.080			
Viewing angle	Hor.	Θ_L	CR>10	85	89	--		(1)(4)
		Θ_R		85	89	--		
	Ver.	Θ_U		85	89	--		
		Θ_D		85	89	--		
Option View Direction		ALL						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

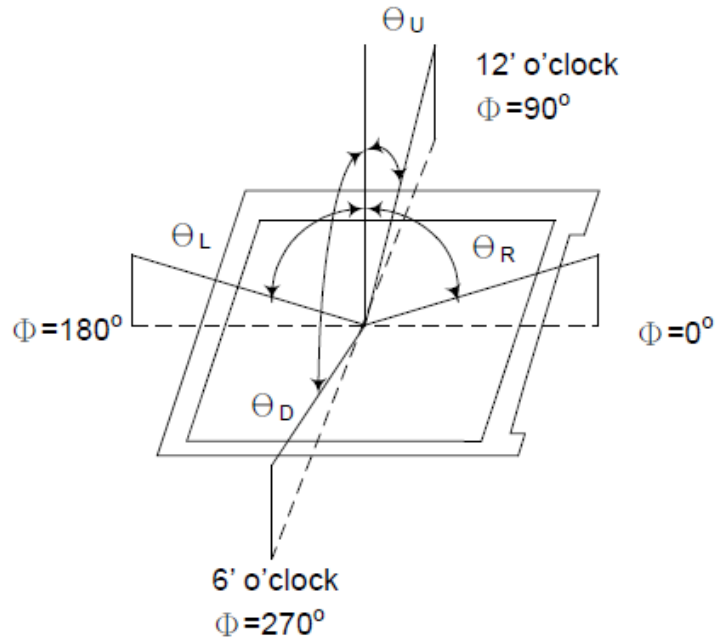
Ambient temperature : $25\pm 2^\circ\text{C}$

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.

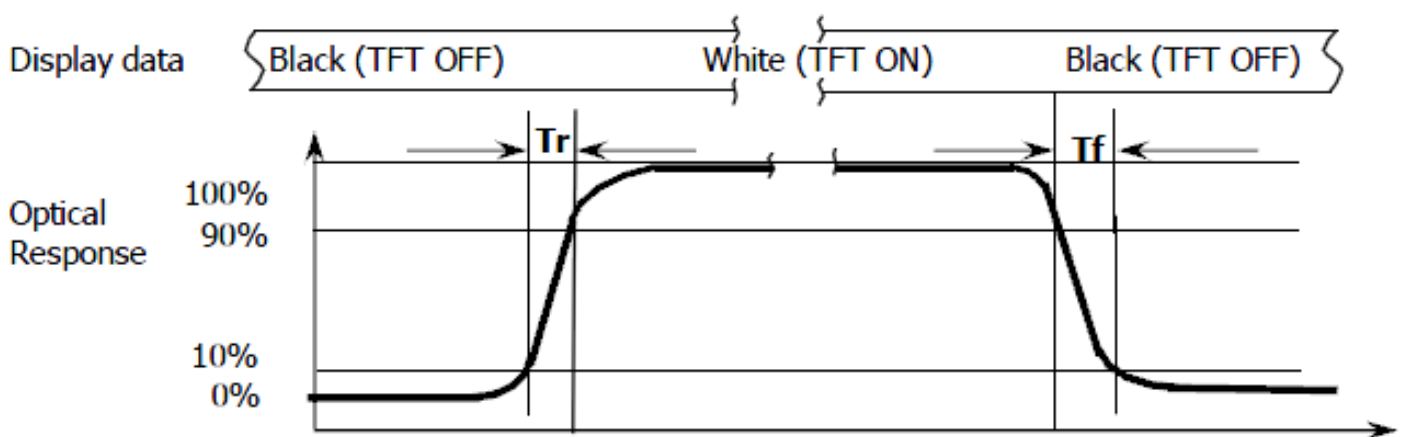
Note (1): Definition of Viewing Angle :



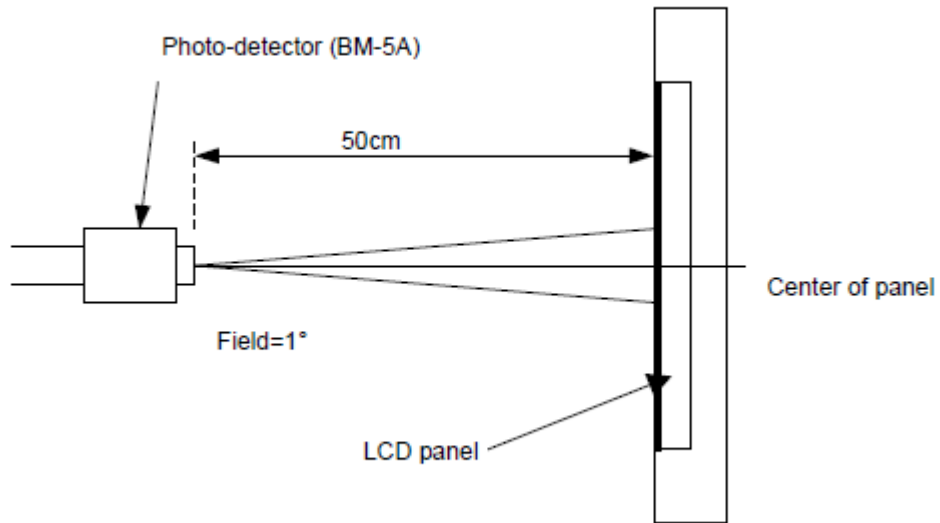
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	DVDD	-0.3	6.0	V
Operating temperature	T _{OP}	0	+50	°C
Storage temperature	T _{ST}	-20	+60	°C

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

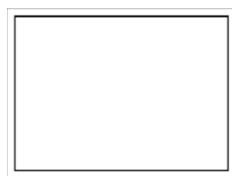
5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	4.5	5.0	5.5	V	
Power Supply Current	I _{DD}	-	600	1100	mA	Note 1
In-Rush Current	I _{RUSH}	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	300	mV	Note 4
High Level Differential Input	V _{IH}	-	-	+100	mV	
Low Level Differential Input	V _{IL}	-100	-	-	mV	
Differential input voltage	V _{ID}	200	-	600	mV	
Differential input common mode voltage	V _{cm}	1.0	1.2	1.5		V _{IH} =100mV
Power Consumption	P _D	-	3	5.5		

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
 The current draw and power consumption specified is for VDD=5.0V, Frame rate=75Hz
 Clock frequency = 67.5 MHz. Test Pattern of power supply current
 a) Typ : Color Test
 b) Max : Vertical Subline255



Notes : 2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs +/-20 %
 Notes : 3. Permissible Input ripple Voltage should be measured under VDD =5.0V, 25°C, fV(frame frequency)=MAX condition(@ Gray level 255 Gray level 0) and At that time, we recommend the bandwidth configuration of oscilloscope is to be under 20Mhz. Ripple Voltage should be covered by Input voltage Spec.



Gray level 255



Gray level 0

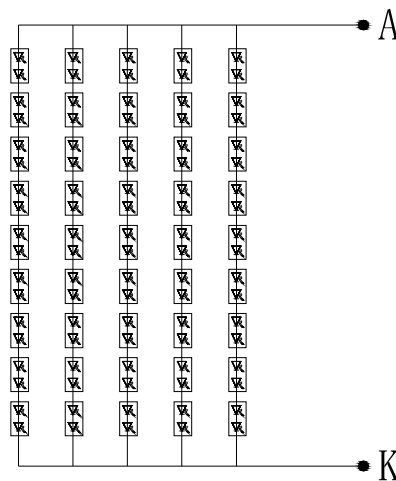
5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 45 DUAL CHIP White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	--	150	--	mA	Constant currents
Forward Voltage	V_F	48.6	49.7	57.6	V	
LCM Luminance	L_v	800	1000	--	cd/m ²	Note3
LED life time	Hr	30000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

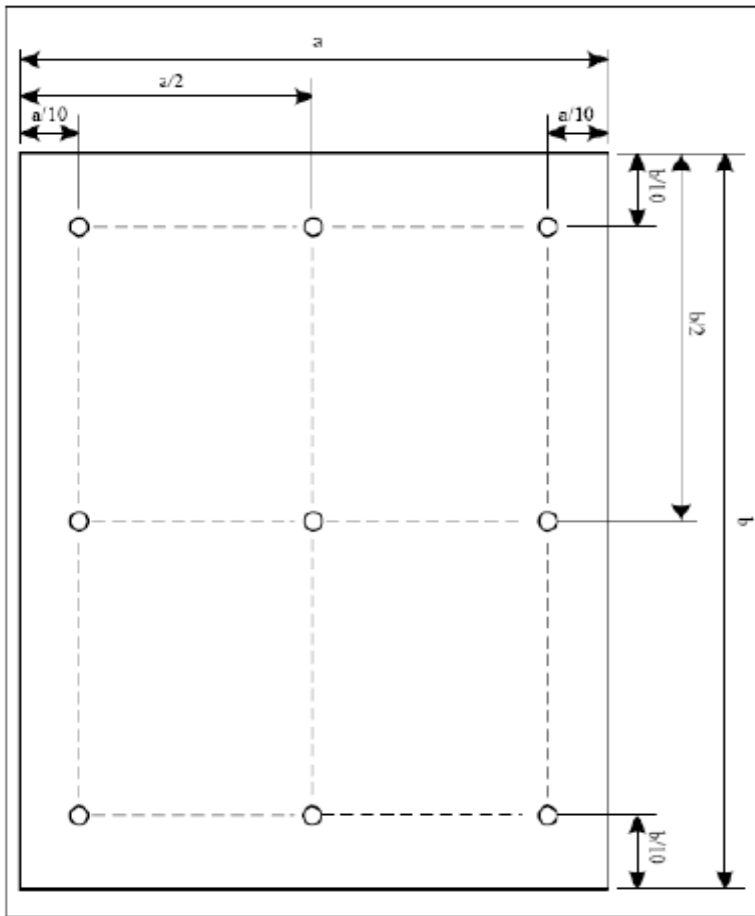
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm3\text{ }^\circ\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25\text{ }^\circ\text{C}$ and $I_L=150\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 150mA. The constant current driving method is suggested.



LED Numbers: 9X5=45EA
LED(B/L) CIRCUIT

NOTE 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. AC Characteristic

6.1 LVDS interface

	Input Signal	Transmitter		Interface		Remark (CN11)	Other
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
LVDS	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3	
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15					
	OB1	19					
	OB2	20	42 41	OUT2- OUT2+	RXO2- RXO2+	5	
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27					
	Vsync	28					
	DE	30					
	MCLK	31	40 39	CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	OR6	50	38 37	OUT3- OUT3+	RXO3- RXO3+	10	
	OR7	2					
	OG6	8					
OG7	10						
OB6	16						
OB7	18						
RSVD	25						

Note: The order of even data is same with odd data.

6.2 SIGNAL TIMING SPECIFICATION

The KD150HDFLA008 is operated by the DE only

Characteristics	Symbol		Min.	Typ.	Max.	Unit	Note
DCLK	Period	tCLK	14.81	18.52	22.22	ns	
	Frequency	-	45	54	67.5	MHz	
Hsync	Period	tHP	704	844	960	tCLK	
	Horizontal Valid	tHV	640	640	640	tCLK	
	Horizontal Blank	tHB	64	204	320	tCLK	
	Frequency	fH	53	63.96	80	MHz	
Vsync	Period	tVP	1036	1066	1150	tHP	
	Vertical Valid	tVV	242	242	242	tHP	
	Vertical Blank	tVB	12	42	72	tHP	
	Frequency	fV	50	60	75	MHz	
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%	

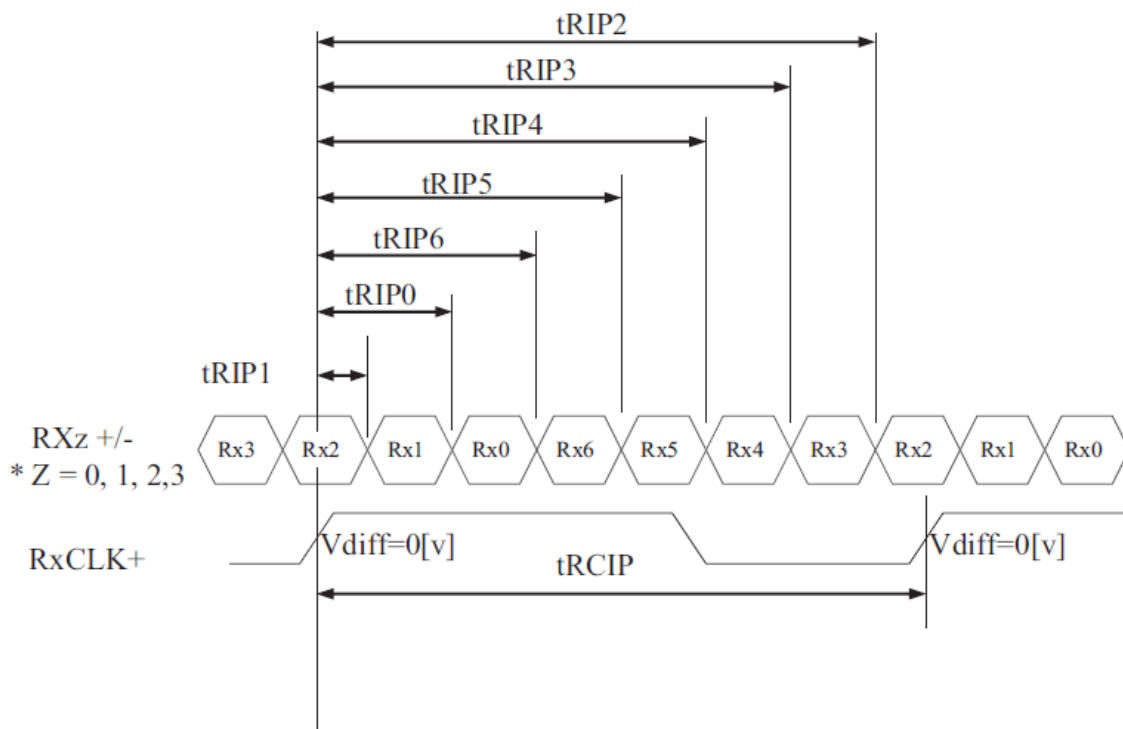
Note : The DCLK range at last line of V-blanking should be set in 0-H-active/2

LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table

<LVDS Rx Interface Timing Specification>

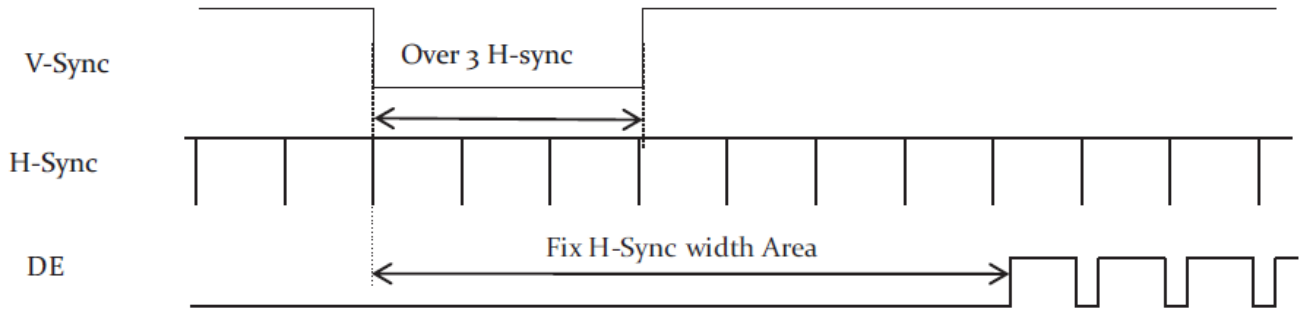
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	14.81	18.52	22.22	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	



* Vdiff = (RXz+) - (RXz-), ..., (RXCLK+) - (RXCLK-)

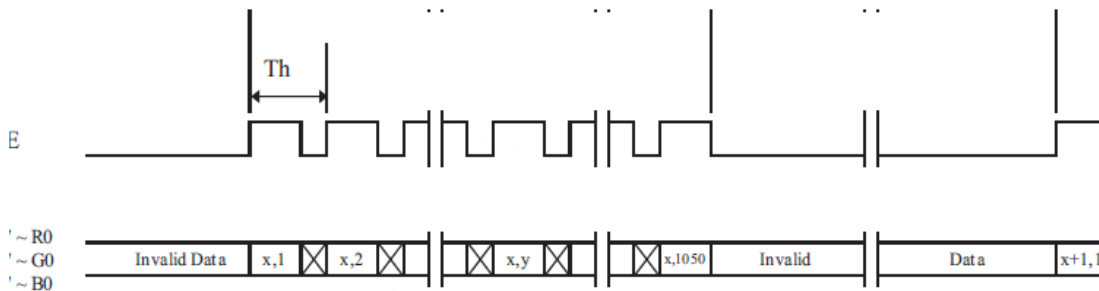
SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

Sync Timing Waveforms

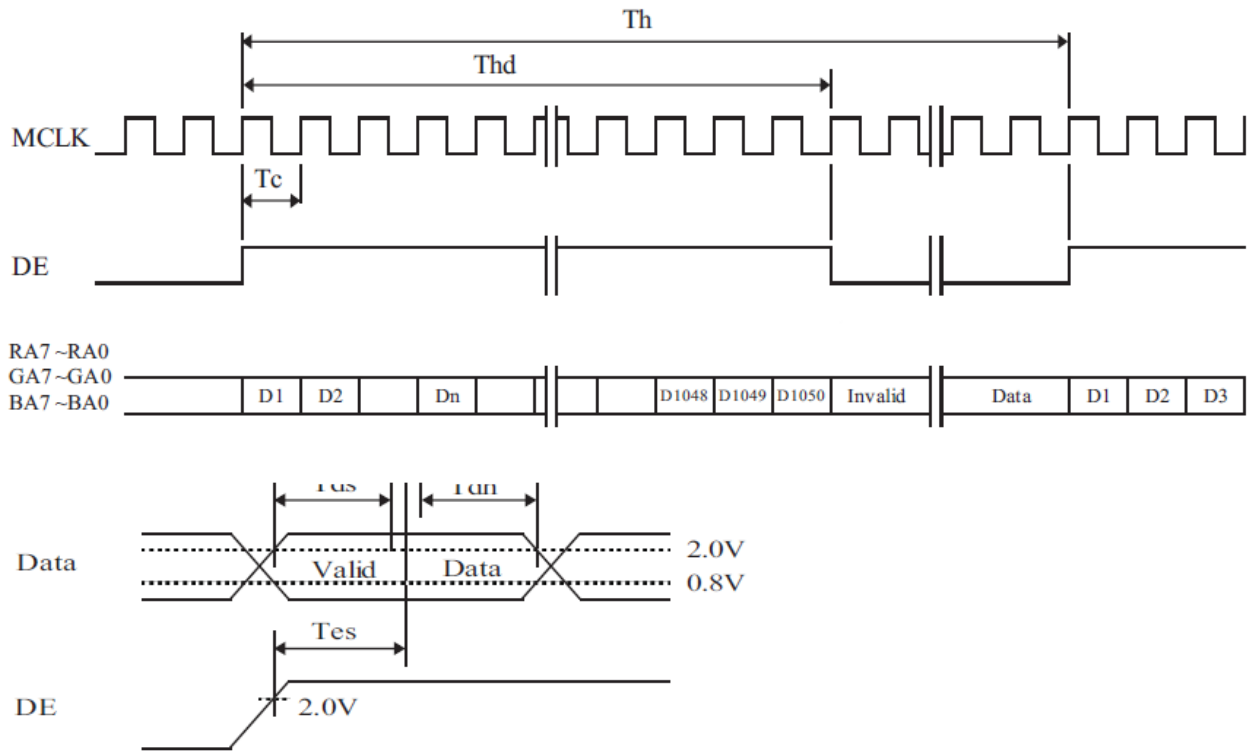


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

Vertical Timing Waveforms



Horizontal Timing Waveforms



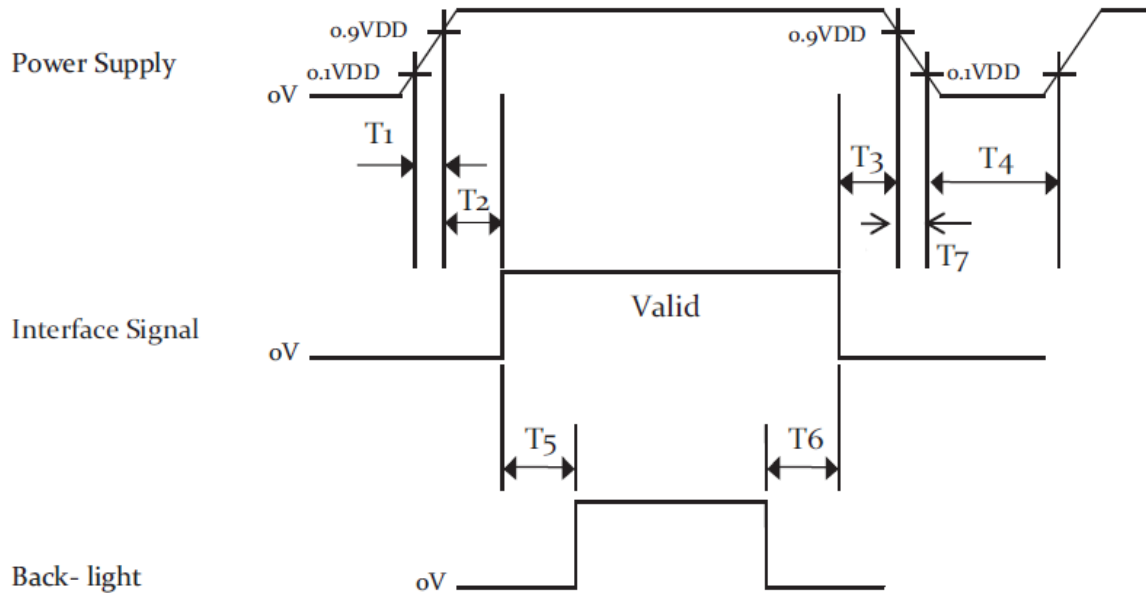
6.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 10. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
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
	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
	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
	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
	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
	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	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	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	△																								
	▽																								
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	▽	1	1	1	1	1	1	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	
Gray Scale of Green	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	△																								
	▽																								
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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	0	0	0	0	0	0	0	0	
Gray Scale of Blue	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	△																								
	▽																								
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
Gray Scale of White	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	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	
	△																								
	▽																								
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	
	▽	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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	

6.4 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- $0.5\text{ ms} \leq T1 \leq 10\text{ ms}$
- $0 \leq T2 \leq 50\text{ ms}$
- $0 \leq T3 \leq 50\text{ ms}$
- $1\text{ sec} \leq T4$
- $200\text{ ms} \leq T5$
- $200\text{ ms} \leq T6$

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

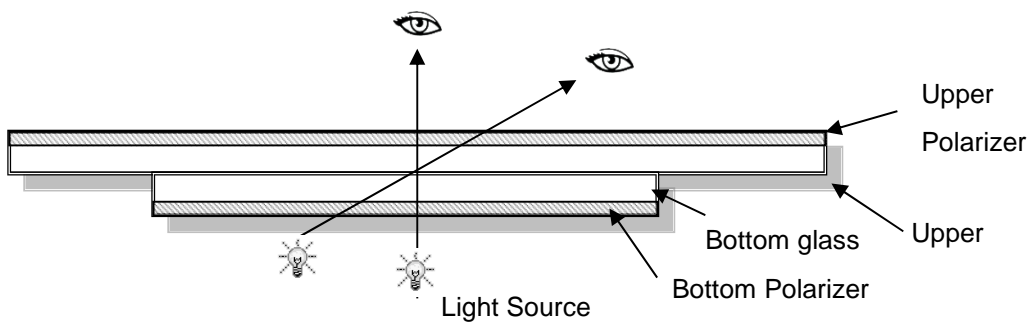
Temperature : $25\pm 5^{\circ}\text{C}$

Humidity : $65\%\pm 10\%\text{RH}$

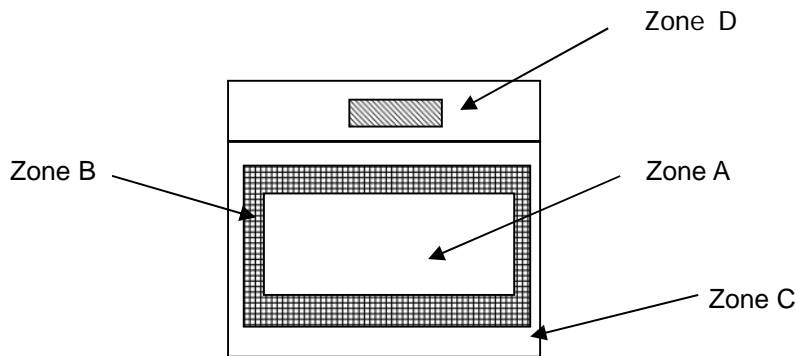
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

Major defect	Minor defect
0.65	1.5

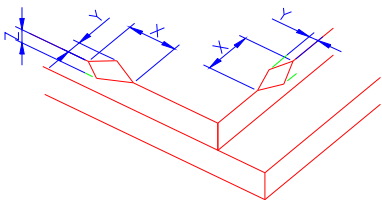
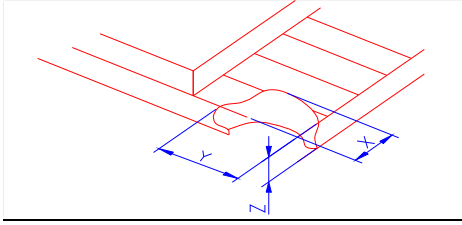
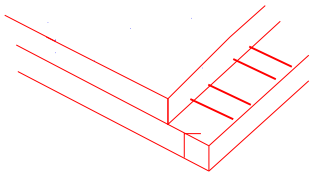
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc...	Major
2	Missing	Missing components and etc...	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc...	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc...	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc...	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

Note1: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

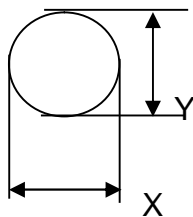
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table border="1" data-bbox="753 611 1453 759"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	 <table border="1" data-bbox="831 1068 1372 1167"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 <p style="text-align: center;">Crack Not allowed</p>							

2.0

Spot defect



$$\Phi = (X + Y) / 2$$

① light dot (black/white spot , pinhole, stain, etc.)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3(distance ≥ 10 mm)		
$0.25 < \Phi \leq 0.4$	2(distance ≥ 10 mm)		
$\Phi > 0.4$	0		

② Dim spot (light leakage, dent, dark spot, etc)


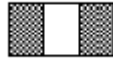
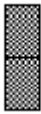
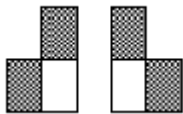
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3(distance ≥ 10 mm)		
$0.25 < \Phi \leq 0.4$	2(distance ≥ 10 mm)		
$\Phi > 0.4$	0		


③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.5$	2(distance ≥ 10 mm)		
$\Phi > 0.5$	0		

④ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.4$	2(distance ≥ 10 mm)		
$0.4 < \Phi \leq 0.5$	1		
$\Phi > 0.5$	0		

3.0	LCD Pixel defect	<p>Pixel bad points</p> <table border="1" data-bbox="534 248 1497 1003"> <thead> <tr> <th data-bbox="534 248 730 304">Item</th> <th data-bbox="730 248 1241 304">Zone A</th> <th data-bbox="1241 248 1497 304">Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="534 304 730 465" rowspan="3">Bright dot</td> <td data-bbox="730 304 1241 360">Random</td> <td data-bbox="1241 304 1497 360">N≤2</td> </tr> <tr> <td data-bbox="730 360 1241 416">2 dots adjacent</td> <td data-bbox="1241 360 1497 416">N≤0</td> </tr> <tr> <td data-bbox="730 416 1241 465">3 dots adjacent</td> <td data-bbox="1241 416 1497 465">N≤0</td> </tr> <tr> <td data-bbox="534 465 730 633" rowspan="3">Dark dot</td> <td data-bbox="730 465 1241 521">Random</td> <td data-bbox="1241 465 1497 521">N≤3</td> </tr> <tr> <td data-bbox="730 521 1241 577">2 dots adjacent</td> <td data-bbox="1241 521 1497 577">N≤0</td> </tr> <tr> <td data-bbox="730 577 1241 633">3 dots adjacent</td> <td data-bbox="1241 577 1497 633">N≤0</td> </tr> <tr> <td data-bbox="534 633 730 943">Distance</td> <td data-bbox="730 633 1241 943"> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td> <td data-bbox="1241 633 1497 943">5mm</td> </tr> <tr> <td colspan="2" data-bbox="534 943 1241 1003">Total bright and dark dot</td> <td data-bbox="1241 943 1497 1003">N≤4</td> </tr> </tbody> </table> <p data-bbox="534 1010 614 1043">Note:</p> <p data-bbox="534 1066 1476 1155">A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p data-bbox="534 1171 1428 1261">B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p data-bbox="534 1317 1029 1350">C) 2 dot adjacent = 1 pair = 2 dots</p> <p data-bbox="534 1368 646 1402">Picture:</p> <div data-bbox="662 1451 742 1514" style="display: inline-block; text-align: center;">  </div> <div data-bbox="582 1559 790 1592" style="display: inline-block; text-align: center;">2 dot adjacent</div> <div data-bbox="1069 1451 1181 1514" style="display: inline-block; text-align: center;">  </div> <div data-bbox="1021 1559 1228 1592" style="display: inline-block; text-align: center;">2 dot adjacent</div> <div data-bbox="670 1619 710 1731" style="display: inline-block; text-align: center;">  </div> <div data-bbox="534 1749 869 1783" style="display: inline-block; text-align: center;">2 dot adjacent (vertical)</div> <div data-bbox="1077 1619 1260 1731" style="display: inline-block; text-align: center;">  </div> <div data-bbox="1013 1749 1316 1783" style="display: inline-block; text-align: center;">2 dot adjacent (slant)</div>	Item	Zone A	Acceptable Qty	Bright dot	Random	N≤2	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Dark dot	Random	N≤3	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	Total bright and dark dot		N≤4
Item	Zone A	Acceptable Qty																							
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	2 dots adjacent	N≤0																							
	3 dots adjacent	N≤0																							
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm																							
Total bright and dark dot		N≤4																							

4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.05$</td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.05 < W \leq 0.06$</td> <td>$L \leq 5.0$</td> <td colspan="3">$N \leq 3$</td> </tr> <tr> <td>$0.06 < W \leq 0.08$</td> <td>$L \leq 4.0$</td> <td colspan="3">$N \leq 2$</td> </tr> <tr> <td>$W > 0.08$</td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(m m)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$			$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$			$W > 0.08$	Define as spot defect			
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$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$																												
$W > 0.08$	Define as spot defect																													
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																												
6.0	Display color & Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.																												
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																												

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

8. Reliability Test Result

Remark:

Item	Condition	Inspection after test
High Temperature Operating	50°C,96HR	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	0°C, 96HR	
High Temperature Storage	60°C, 96HR	
Low Temperature Storage	-20°C, 96HR	
High Temperature & High Humidity Operating	+50°C, 90% RH ,96 hours.	
Thermal Shock (Non- operation)	0°C,30 min ↔ 50°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) 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, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.