KOE
JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS: _____

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX11D06VM2AAA

Contents

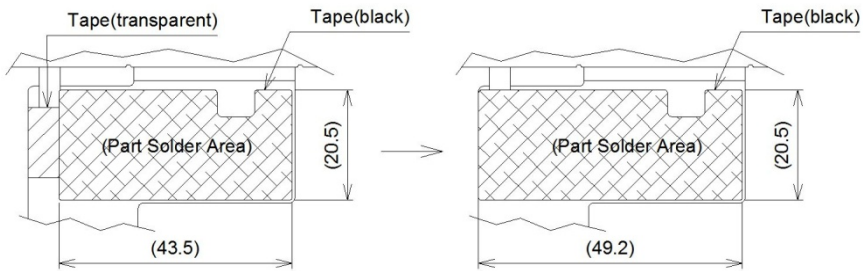ACCEPTED BY: _____

PROPOSED BY: *Jim Fang*

RECORD OF REVISION

DATE	SHEET No.	SUMMARY
May 01,'12	All pages	Company name changed: 　KAOHSIUNG HITACHI ELECTRONICS CO.,LTD. 　　　　　↓ 　KAOHSIUNG OPTO-ELECTRONICS INC.
	7B64PS-2704- TX11D06VM2AAA-2 Page 4-1/1	4. ABSOLUTE MAXIMUM RATINGS 　Revised: Note2.
Feb 22,'13	7B64PS-2710- TX11D06VM2AAA-3 　Page 10-1/1	FPC Tape Changed:
	7B64PS-2713- TX11D06VM2AAA-3 　Page 13-1/1	Added: 5) REVISION (REV.) CONTROL

Rev No.	ITEM	NOTE
A	-	-
B	FPC Tape changed	PCN0857

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 4.3"(for Touch panel) WQVGA of 16:9 format amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R(red), G(green), B(blue) sequentially. This display is RoHS compliant, and COG (chip on glass) technology and LED backlight are applied on this display.

Part Name	TX11D06VM2AAA
Module Dimensions	105.5(W) mm x 67.2(H) mm x 2.9(D) mm typ.
LCD Active Area	95.04(W) mm x 53.856(H) mm
Dot Pitch	0.066(W) mm x 3(R, G, B)(W) x 0.198(H) mm
Resolution	480 x 3(RGB)(W) x 272(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Color TFT; Normally White
Display Type	Active Matrix
Number of Colors	16.7M Color
Backlight	9 LEDs serial
Weight	(45) g (typ.)
Interface	C-MOS; 24-bit RGB; 40 pins
Power Supply Voltage	3.3V for LCD; (27.9)V for Backlight
Power Consumption	56 mW for LCD; 558mW for backlight
Viewing Direction	12 O'clock (The direction without image inversion and least brightness change)

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V_{DD}	-0.5	5.0	V	-
Input Voltage of Logic	V_I	-0.5	V_{DD}	V	Note 1
Operating Temperature	Top	-20	70	°C	Note 2
Storage Temperature	Tst	-30	80	°C	Note 2
LED Forward Current	IF	-	25	mA	Note 3

Note 1: The rating is defined for the signal voltages of the interface such as DE, CLK and RGB data bus.

Note 2: The maximum rating is defined as above based on the chamber temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.

- Operating under high temperature will shorten LED lifetime.

Note 3: Fig. 4.1 shows the maximum rating of LED forward current against temperature. The backlight unit in this display has been set to 20 mA per LED. This is within the range when operating the display between -20~70°C.
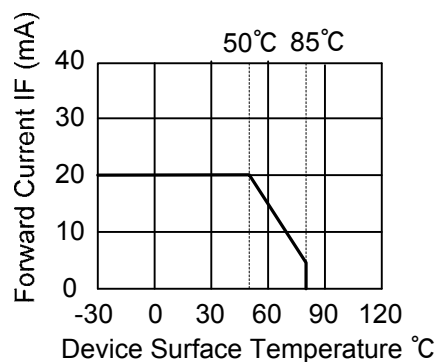
Fig 4.1

5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

Ta = 25ºC, V_{SS}=0V

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-	3.1	3.3	3.5	V	-
Input Voltage of Logic	V_{IH}	"H" level	$0.8xV_{DD}$	-	V_{DD}	V	Note 1
	V_{IL}	"L" level	V_{SS}	-	$0.2xV_{DD}$		
Power Supply Current	I_{DD}	-	-	17	25	mA	Note 2

Note 1: The rating is defined for the signal voltages of the interface such as DE, CLK and RGB data bus.

Note 2: Test condifions : V_{DD} 3.3V

5.2 BACKLIGHT CHARACTERISTICS

Ta = 25ºC

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	Backlight Unit	-	27.9	-	V	Note1
LED Forward Current	I_{LED}	Backlight Unit	18	20	22	mA	-
LED Lifetime	-	I_{LED} = 20 mA	10K	20K	-	Hrs	Note 2

Note 1: Fig. 5.1 shows the LED backlight circuit. The circuit has 9 LEDs in total.

Note 2: The estimated lifetime is specified as the time to reduce 50% brightness by applying 20 mA at 25°C.

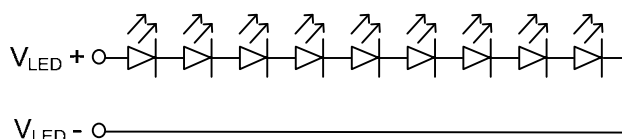Fig. 5.1

6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.

- The backlight unit needs to be turned on for 30 minutes.

- The ambient temperature is 25°C.

- In the dark room around 300~700 lx, the equipment has been set for the measurements as shown in Fig 6.1.

Ta=25° C, V_{DD}=3.3V

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$, I_{LED}= 20 mA	400	500	-	cd/m^2	Note 1
Brightness Uniformity		-		70	75	-	%	Note 2
Contrast Ratio		CR		400	500	-	-	Note 3
Response Time (Rising + Falling)		$T_r + T_f$	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	25	-	ms	Note 4
Viewing Angle		θ x	$\phi = 0^{\circ}, CR \geq 10$	60	70	-	Degree	Note 5
		θ x'	$\phi = 180^{\circ}, CR \geq 10$	60	70	-		
		θ y	$\phi = 90^{\circ}, CR \geq 10$	40	50	-		
		θ y'	$\phi = 270^{\circ}, CR \geq 10$	60	70	-		
Color Chromaticity	White	x	$\phi = 0^{\circ}, \theta = 0^{\circ}$	0.26	0.31	0.36	-	Note 6
		y		0.28	0.33	0.38		

Note 1: The brightness is measured from center point of the panel, P5 in Fig. 6.2, for the typical value.

Note 2: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

, which is based on the brightness values of the 9 points measured by BM-7 as shown in Fig. 6.2.
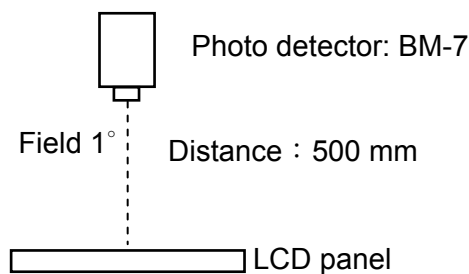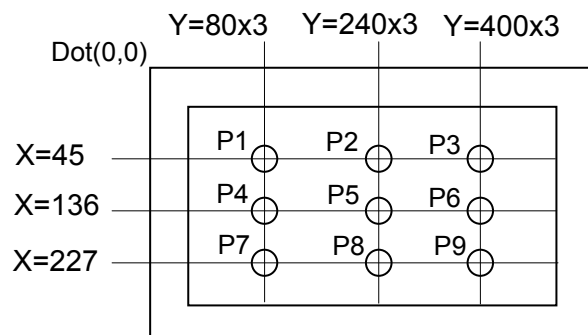

Fig. 6.1

Fig. 6.2

Note 3: The Contrast ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 4: The definition of response time is shown in Fig. 6.3. The rising time is the period from 90% brightness to 10% brightness when the data is from white to black. Oppositely, falling time is the period from 10% brightness rising to 90% brightness.

White	Black	White
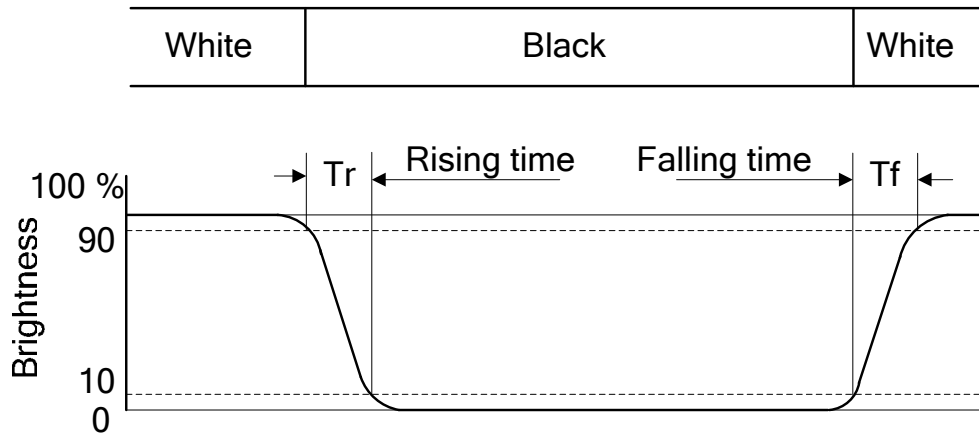
Fig 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, ϕ =270° means 6 o'clock, and ϕ =0° means 3 o'clock. Moreover, angle θ is used to represent viewing angles from axis Z toward plane XY.

The viewing direction of this display is 12 o'clock, which means that a photograph with gray scale would not be reversed in color and the brightness change would be less from this direction. However, the best contrast peak would be located at 6 o'clock.

Fig 6.4

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM
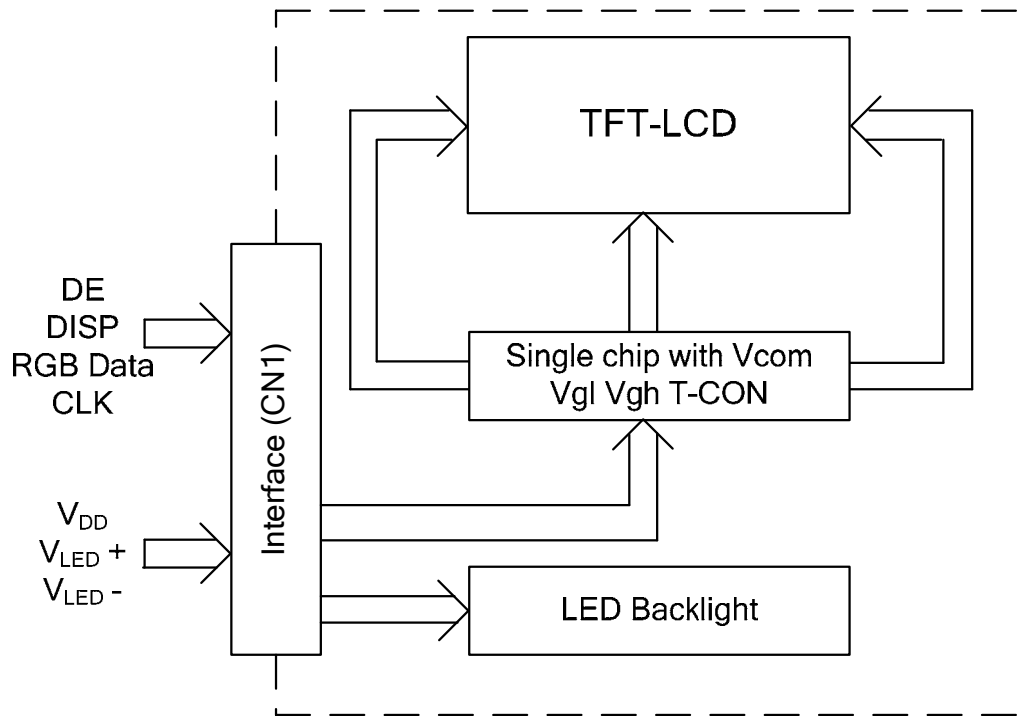
8. RELIABILITY TESTS

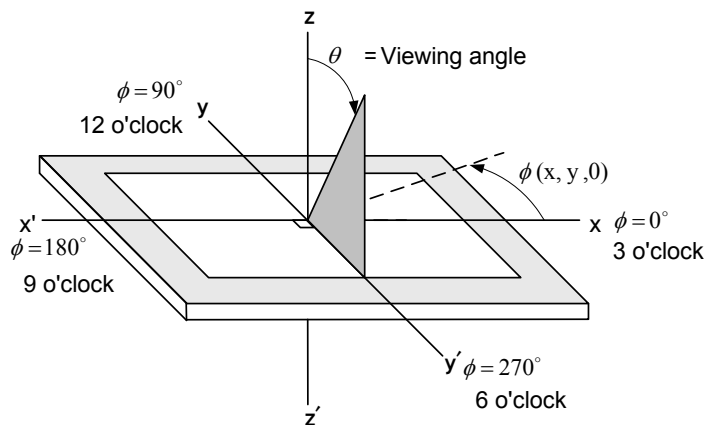| Test Item	Condition	
High Temperature	1) Operating 2) 70°C (temperature of panel`s surface)	240 hrs
Low Temperature	1) Operating 2) -20°C (ambient temperature)	240 hrs
High Temperature	1) Storage 2) 80°C (ambient temperature)	240 hrs
Low Temperature	1) Storage 2) -30°C (ambient temperature)	240 hrs
Thermal Shock	1) Non-Operating 2) -30°C ↔ 80°C 3) 0.5 hr ↔ 0.5 hr	100 cycles
High Temperature & Humidity	1) Operating 2) 60°C & 90%RH 3) Without condensation 4) Note 4	240 hrs
Vibration	1) Non-Operating 2) Frequency range: 10～55Hz 3) Stroke: 1.5mm 4) Sweep: 10Hz～55Hz～10Hz 5) X, Y and Z directions	2 hr for each direction (6 hours for total)
Mechanical Shock	1) Non-Operating 2) 6 ms 3) 100G 4) ±X, ±Y and ±Z directions	3 times for each direction
ESD	1) Non-Operating 2) Tip: 100 pF, 1500 Ω 3) ±2KV, Human Body Mode	-

Note 1: Display functionalities are inspected under the conditions defined in the specification after the reliability tests.

Note 2: The display is not guaranteed for use in corrosive gas environments.

Note 3: All the appearance specifications are judged before the reliability tests.

Note 4: Under the condition of high temperature & humidity, if the temperature is higher than 60°C, the humidity needs to be reduced as Fig. 8.1 shown.

Fig. 8.1

9. LCD INTERFACE

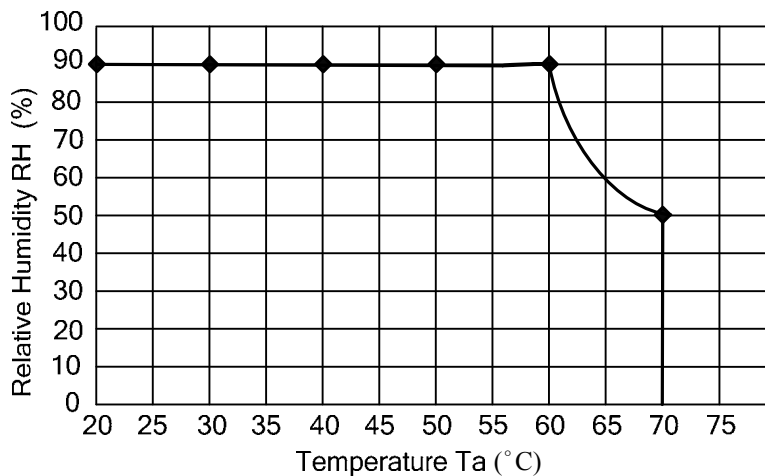## 9.1 INTERFACE PIN CONNECTIONS

The display interface connector (CN1) is FH19SC-40S-0.53H manufactured by Hirose (Thickness: 0.3±0.05mm; Pitch: 0.5mm) and more details of the connector are shown in the section of outline dimension.

Pin assignment of LCD interface is as below:

Pin No.	Signal	Function	Pin No.	Signal	Function
1	V_{LED}-	LED Ground	21	B0	Blue Data Bit0 (LSB)
2	V_{LED}+	LED Power	22	B1	Blue Data Bit1
3	V_{SS}	Ground	23	B2	Blue Data Bit2
4	V_{DD}	Power Supply for Logic	24	B3	Blue Data Bit3
5	R0	Red Data Bit0 (LSB)	25	B4	Blue Data Bit4
6	R1	Red Data Bit1	26	B5	Blue Data Bit5
7	R2	Red Data Bit2	27	B6	Blue Data Bit6
8	R3	Red Data Bit3	28	B7	Blue Data Bit7 (MSB)
9	R4	Red Data Bit4	29	V_{SS}	Ground
10	R5	Red Data Bit5	30	CLK	Dot Data Clock
11	R6	Red Data Bit6	31	DISP	Display on/off
12	R7	Red Data Bit7 (MSB)	32	NC	No Connection
13	G0	Green Data Bit0 (LSB)	33	NC	No Connection I
14	G1	Green Data Bit1	34	DE	Display Timing Signal
15	G2	Green Data Bit2	35	NC	No Connection
16	G3	Green Data Bit3	36	V_{SS}	Ground
17	G4	Green Data Bit4	37	NC	No Connection
18	G5	Green Data Bit5	38	NC	No Connection
19	G6	Green Data Bit6	39	NC	No Connection
20	G7	Green Data Bit7 (MSB)	40	NC	No Connection

9.2 TIMING CHART
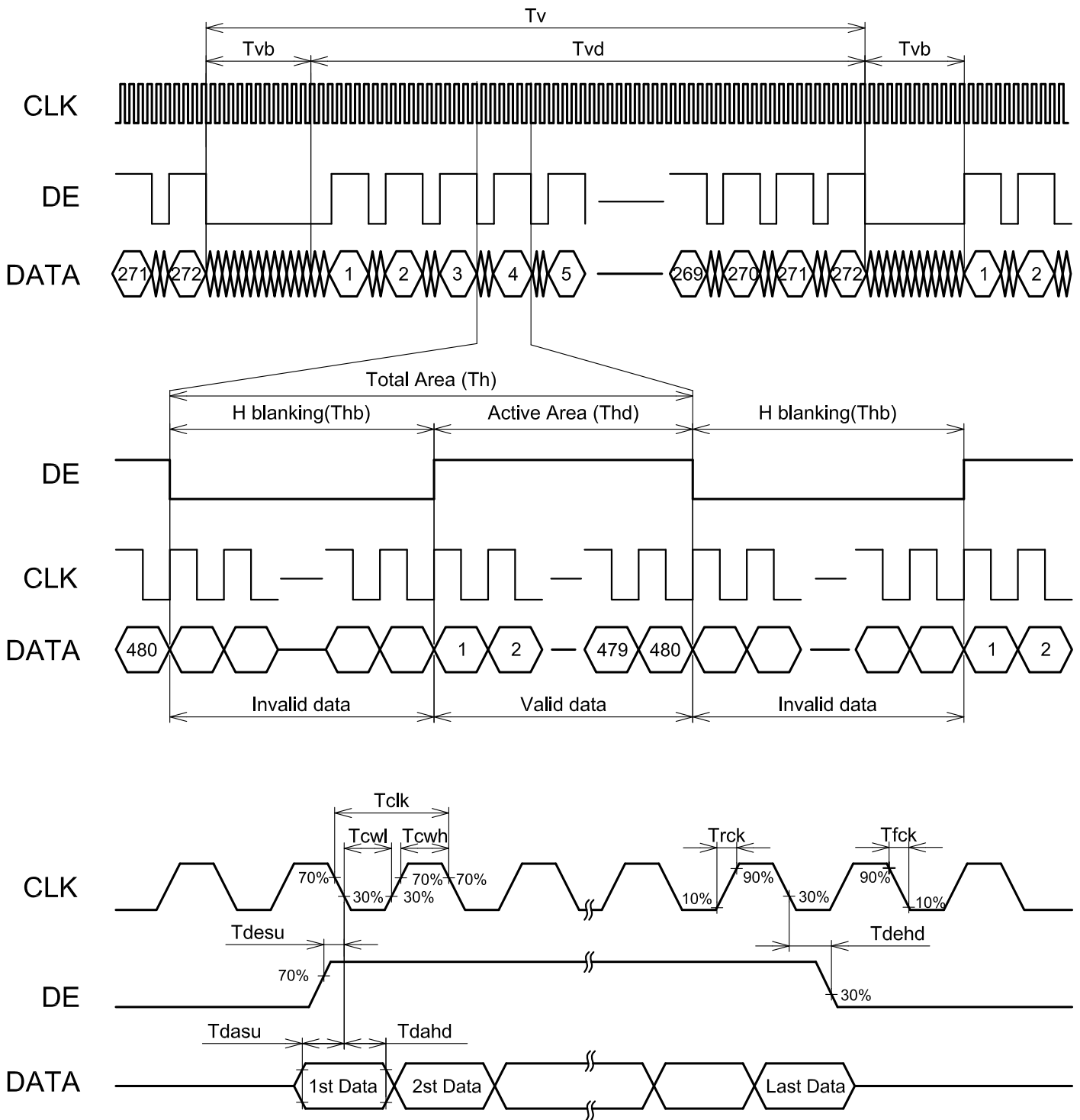
Note 1: Data is latched by falling edge of CLK

9.3 INTERFACE TIMING SPECIFICATIONS

Item	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	fclk	7	9	12	MHz
DEV period time	Tv	277	288	400	H
DEV display area	Tvd		272		H
DEV blanking	Tvb	5	16	128	H
DEH period time	Th	520	525	800	CLK
DEH display area	Thd		480		CLK
DEH blanking	Thb	40	45	320	CLK
CLK cycle time	Tclk	83	110	143	ns
Clock width of high level	Tcwh	40	50	60	%
Clock width of low level	Tcwl	40	50	60	%
Clock rising time	t_{rck}	-	-	9	ns
Clock falling time	t_{fck}	-	-	9	ns
Data Setup Time	t_{desu}	10	-	-	ns
Data Hold Time	t_{dahd}	10	-	-	ns
DE Setup Time	t_{desu}	10	-	-	ns
DE Hold Time	t_{dehd}	10	-	-	ns

9.4 POWER SEQUENCE

POWER SUPPLY
V_{DD}

INTERFACE
SIGNAL

Display ON/OFF
SIGNAL

Power supply
For LED unit

T1

$0.9V_{DD}$

$0.1V_{DD}$

T2

T3

T4

T6

$0.9V_{DD}$

$0.1V_{DD}$

$0.1V_{DD}$

T2

T3

T5
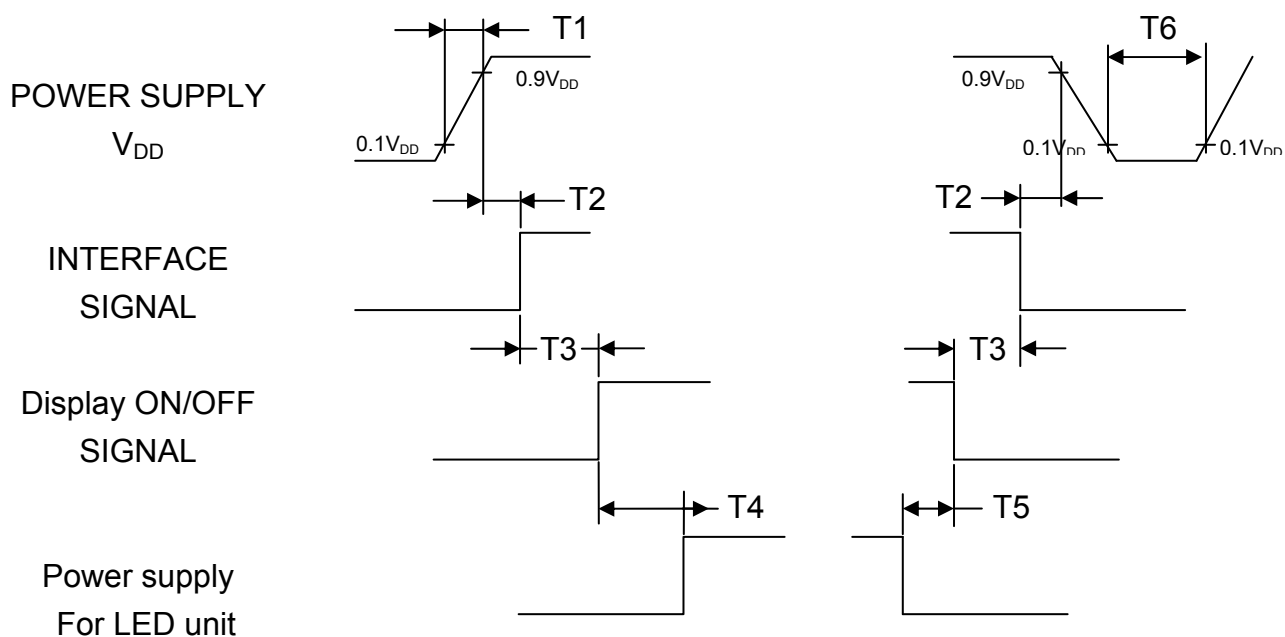
Symbol	Specification	Symbol	Specification
T1	$0 \le T1 \le 10$ msec	T4	160 msec $\le T4$
T2	$0 \le T2 \le 100$ msec	T5	160 msec $\le T5$
T3	$0 \le T3 \le 200$ msec	T6	1 sec $\le T6$

9.5 DATA INPUT for DISPLAY COLOR

Input color		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
		MSB							LSB	MSB							LSB	MSB							LSB
Basic Color	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(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
	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
	Blue(255)	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
Red	Red(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
	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
Green	Green(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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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
Blue	Blue(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
	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	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

10. OUTLINE DIMENSIONS

105.5±0.2

98.7(Window Bezel)

95.04±0.05(Active Area)

3.4

5.23

(52.75)

2.41

4.23

R G B

Display Center

Tape(black)

67.2±0.2

57.5(Window Bezel)

53.856±0.05(Active Area)

(36.05)

(44.05)

(Part Solder Area)

(20.5)

25.2±1

(49.2)

(28.85)

See Detail A

2.9±0.2

Component High=1.4MAX.

0.3±0.05

(15)

Barcode label

(4)

49.7

5±0.5

3.5±0.3

1   40

0.15±0.03   0.5

Width=0.35±0.03

P0.5*(40-1)=19.5±0.07

20.5±0.1

Detail A
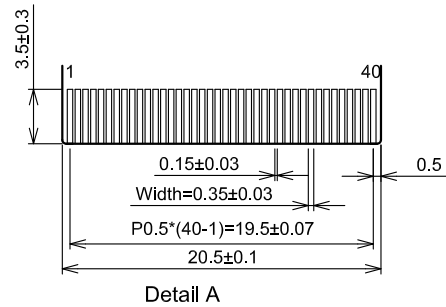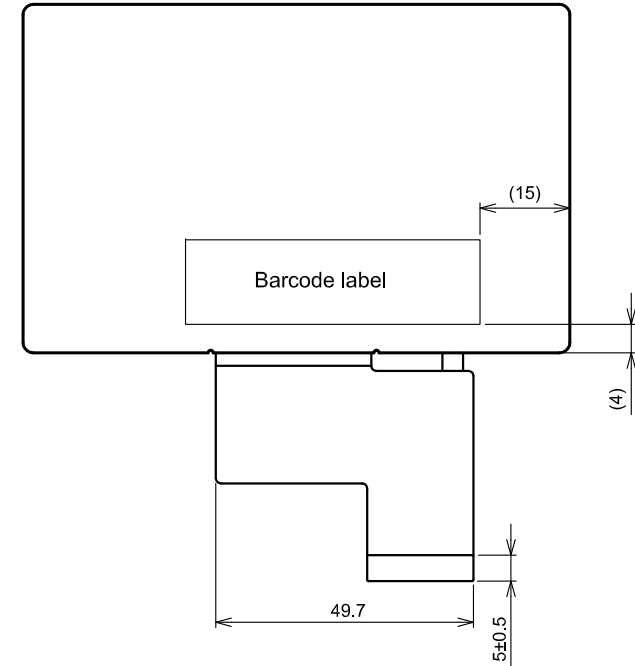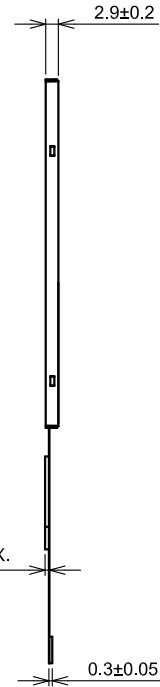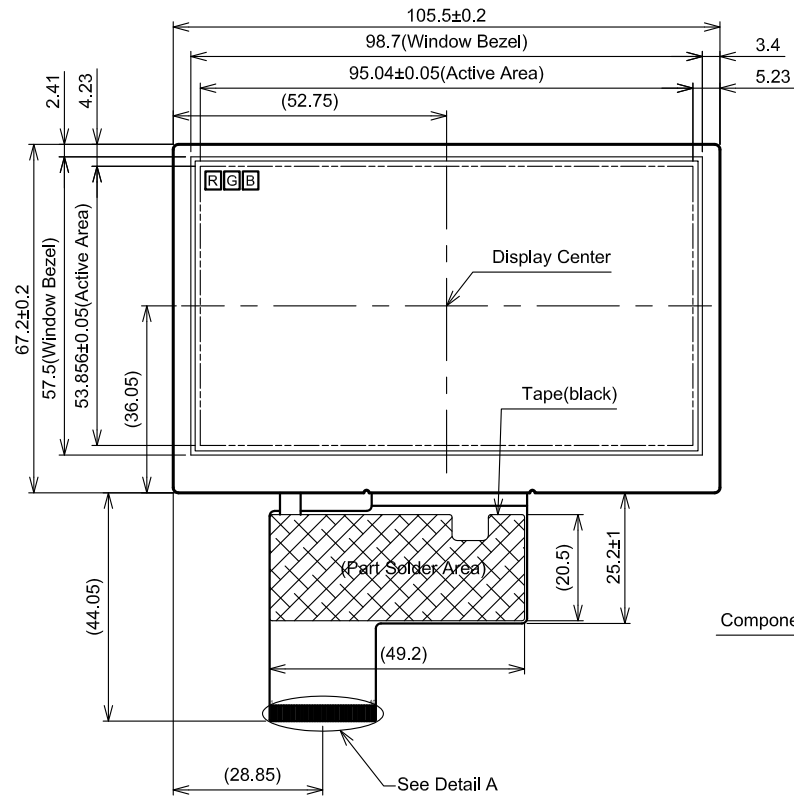
Note:
1.General Tolerance ±0.3mm

Scale : NTS
Unit : mm

| KAOHSIUNG OPTO-ELECTRONICS INC. | SHEET No. | 7B64PS 2710-TX11D06VM2AAA-3 | PAGE | 10-1/1 |

11. APPEARANCE STANDARD

The appearance inspection is performed in a dark room around 300~700 lx based on the conditions as below:

- The distance between inspector's eyes and display is 35 cm.

- The viewing zone is defined with angle θ shown in Fig. 11.1 The inspection should be performed within 45° when display is shut down. The inspection should be performed within 5° when display is power on.
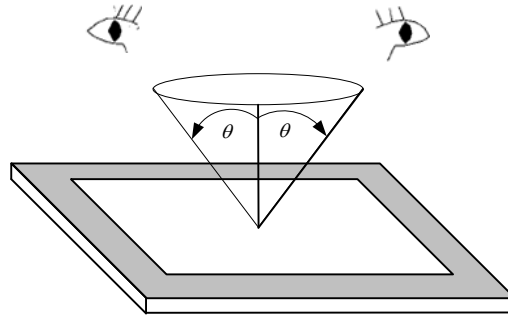
Fig. 11.1

11.1 THE DEFINITION OF LCD ZONE

LCD panel is divided into 3 areas as shown in Fig.11.2 for appearance specification in next section. A zone is the LCD active area (dot area); B zone is the area, which extended 1 mm out from LCD active area; C zone is the area between B zone and metal frame.

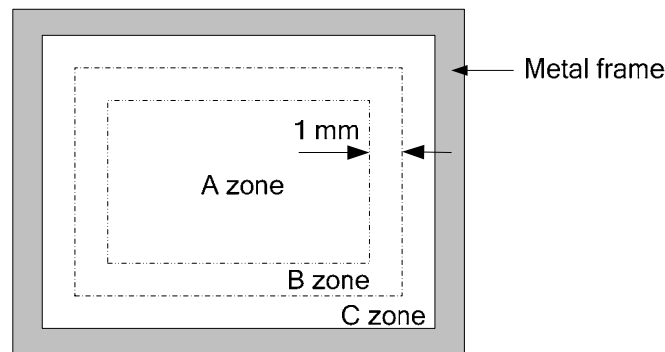In terms of housing design, B zone is the recommended window area customers' housing should be located in.

Fig. 11.2

11.2 LCD APPEARANCE SPECIFICATION

The specification as below is defined as the amount of unexpected phenomenon or material in different zones of LCD panel. The definitions of length, width and average diameter using in the table are shown in Fig. 11.3 and Fig. 11.4.

| Defect Type		Specification Size (mm)	Maximum number	Applied zone
Dot Shape (Particle、Scratch and Bubbles) (Fig. 11.4)		$D \leqq 0.1$	Ignored	A
		$0.1 < D \leqq 0.4$	2	
		$0.4 < D$	0	
Line Shape (Particle、Scratch、Line and Bubbles) (Fig. 11.3)		$W \leqq 0.01$	Ignored	A
		$0.01 < W \leqq 0.05$ and $L \leqq 3$	3	
		$0.05 < W$ or $3 < L$	0	
Bezel	Scratch	No harm		B,C
	Dirt	No harm		
	Wrap	No harm		
	Sunken	No harm		
Dot-Defect (Note 1)	Bright dot-defect	$N \leqq 1$		A
	Dark dot-defect	$N \leqq 2$		
	Total Bright and Dark dots	$N \leqq 2$		
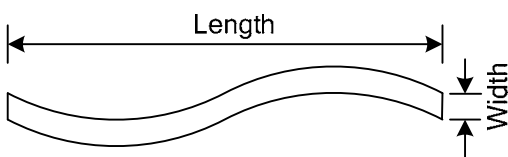
Fig. 11.3
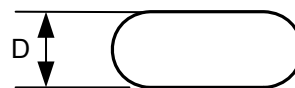
Fig. 11.4

Note 1: The definitions of dot defect are as below:

- The defect area of the dot must be bigger than half of a dot.

- For bright dot-defect, the dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. The bright dot defect must be visible through 2% ND filter.

- For dark dot-defect, the dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

- The definition of 1-dot-defect is the defect-dot, which is isolated and no adjacent defect-dot.

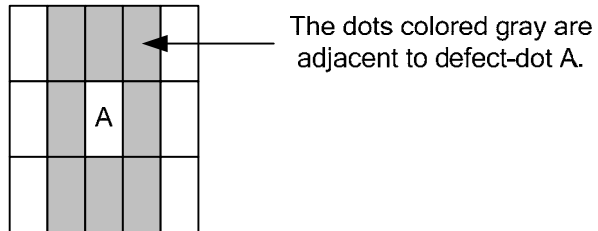- The definition of adjacent dot is shown as Fig. 11.5.

The dots colored gray are adjacent to defect-dot A.

Fig. 11.5

12. PRECAUTIONS

12.1 PRECAUTIONS of ESD

1) Before handling the display, please ensure your body has been connected to ground to avoid any damages by ESD. Also, do not touch display's interface directly when assembling.

2) Please remove the protection film very slowly before turning on the display to avoid generating ESD.

12.2 PRECAUTIONS of HANDLING

1) In order to keep the appearance of display in good condition, please do not rub any surfaces of the displays by using sharp tools harder than 3H, especially touch panel, metal frame and polarizer.

2) Please do not stack the displays as this may damage the surface. In order to avoid any injuries, please avoid touching the edge of the glass or metal frame and wore gloves during handling.

3) Touching the polarizer or terminal pins with bare hand should be avoided to prevent staining and poor electrical contact.

4) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean display's surfaces.

5) Please use soft cloth or absorbent cotton with ethanol to clean the display by gently wiping. Moreover, when wiping the display, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the display's surface, especially polarizer.

6) Please wipe any unknown liquids immediately such as saliva, water or dew on the display to avoid color fading or any permanent damages.

7) Maximum pressure to the surface of the display must be less than 1.96×10^4 Pa. If the area of applied pressure is less than $1 cm^2$, the maximum pressure must be less than 1.96N.

12.3 PRECAUTIONS OF OPERATING

1) Please input signals and voltages to the displays according to the values defined in the section of electrical characteristics to obtain the best performance. Any voltages over than absolute maximum rating will cause permanent damages to this display. Also, any timing of the signals out of this specification would cause unexpected performance.

2) When the display is operating at significant low temperature, the response time will be slower than it at 25°C. In high temperature, the color will be slightly dark and blue compared to original pattern. However, these are temperature-related phenomenon of LCD and it will not cause permanent damages to the display when used within the operating temperature.

3) The use of screen saver or sleep mode is recommended when static images are likely for long periods of time. This is to avoid the possibility of image sticking.

4) Spike noise can cause malfunction of the circuit. The recommended limitation of spike noise is no bigger than ±100 mV.

12.4 PRECAUTIONS of STORAGE

If the displays are going to be stored for years, please be aware the following notices.

1) Please store the displays in a dark room to avoid any damages from sunlight and other sources of UV light.

2) The recommended long term storage temperature is between 15°C ~35°C and 65% humidity or less to avoid causing bubbles between polarizer and LCD glasses, and polarizer peeling from LCD glasses.

3) It would be better to keep the displays in the container, which is shipped from KOE, and do not unpack it.

4) Please do not stick any labels on the display surface for a long time, especially on the polarizer.

13 DESIGNATION OF LOT MARK

1) The lot mark is showing in Fig.13.1. First 4 digits are used to represent production lot, and the last 6 digits are the serial number.
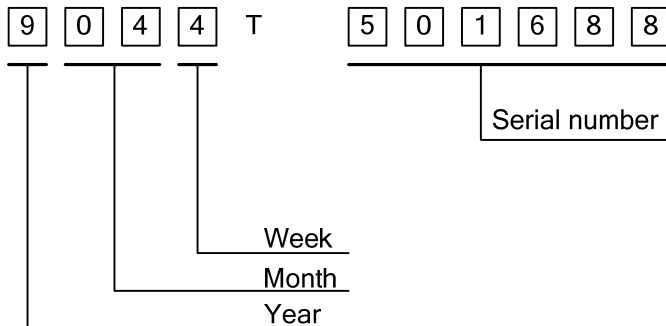
| 9 | 0 | 4 | 4 | T | | 5 | 0 | 1 | 6 | 8 | 8 |

Serial number

Week
Month
Year

Fig. 13.1

2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

Year	Lot Mark
2012	2
2013	3
2014	4
2015	5
2016	6

Month	Lot Mark	Month	Lot Mark
Jan.	01	Jul.	07
Feb.	02	Aug.	08
Mar.	03	Sep.	09
Apr.	04	Oct.	10
May	05	Nov.	11
Jun.	06	Dec.	12

Week	Lot Mark
1~7 days	1
8~14 days	2
15~21 days	3
22~28 days	4
29~31 days	5

3) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

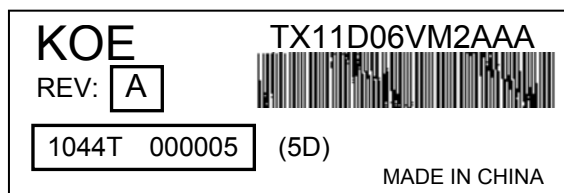4) The location of the lot mark is on the back of the display shown in Fig. 13.2.

KOE
REV: A
TX11D06VM2AAA

1044T   000005   (5D)
MADE IN CHINA

Fig. 13.2

5) Rev. is the column for manufacturing convenience A-Z except I and O maybe written on this column.

Rev. No	ITEM	NOTE
A	-	-
B	FPC Tape changed	PCN0857