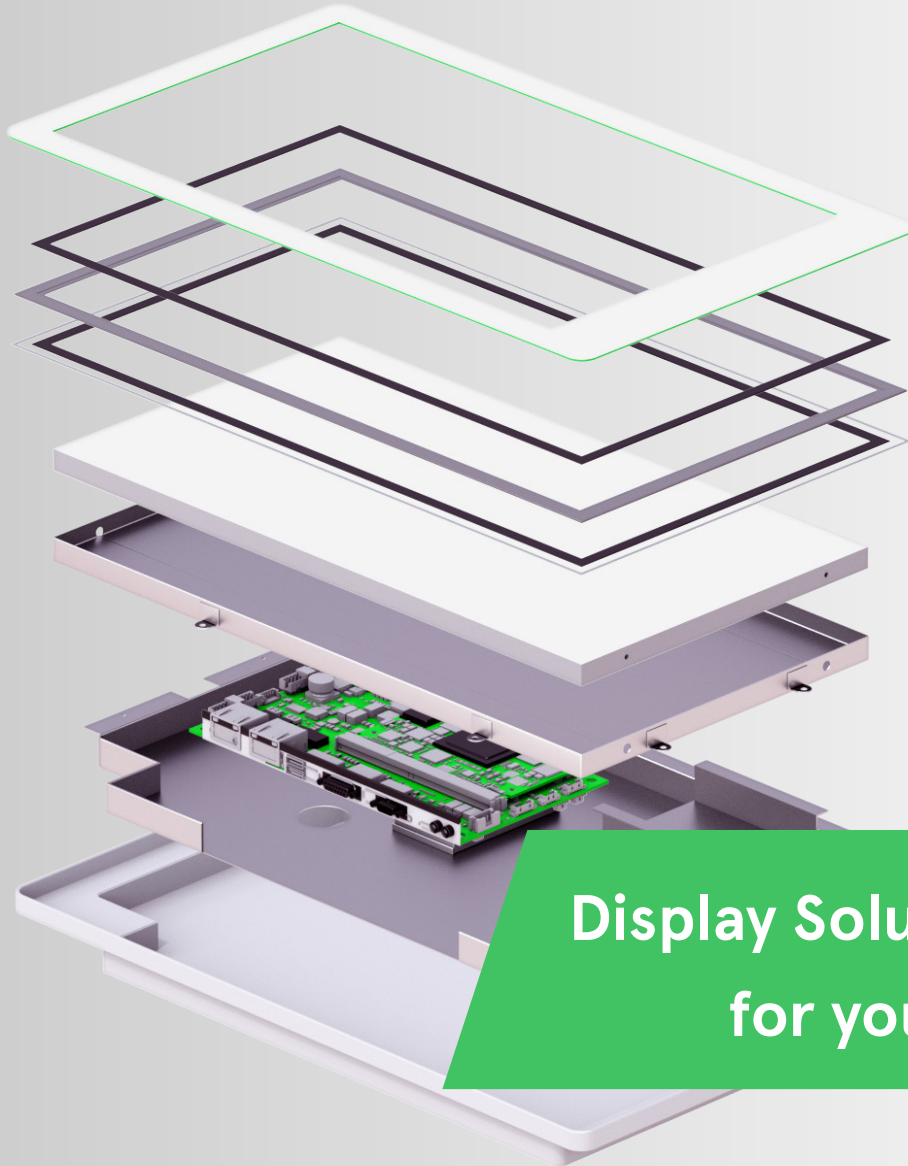




Display Solutions tailored
for your Application

DATASHEET

TX16D206VM0BAA



Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Jul. 17th, 2020

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX16D206VM0BAA

Contents

No.	ITEM	SHEET No.	PAGE
1	COVER	7B64PS 2701-TX16D206VM0BAA-2	1-1/1
2	RECORD OF REVISION	7B64PS 2702-TX16D206VM0BAA-2	2-1/1
3	GENERAL DATA	7B64PS 2703-TX16D206VM0BAA-2	3-1/1
4	ABSOLUTE MAXIMUM RATINGS	7B64PS 2704-TX16D206VM0BAA-2	4-1/1
5	ELECTRICAL CHARACTERISTICS	7B64PS 2705-TX16D206VM0BAA-2	5-1/1
6	OPTICAL CHARACTERISTICS	7B64PS 2706-TX16D206VM0BAA-2	6-1/2~2/2
7	BLOCK DIAGRAM	7B64PS 2707-TX16D206VM0BAA-2	7-1/1
8	RELIABILITY TESTS	7B64PS 2708-TX16D206VM0BAA-2	8-1/1
9	LCD INTERFACE	7B64PS 2709-TX16D206VM0BAA-2	9-1/6~6/6
10	OUTLINE DIMENSIONS	7B64PS 2710-TX16D206VM0BAA-2	10-1/2~2/2
11	APPEARANCE STANDARD	7B64PS 2711-TX16D206VM0BAA-2	11-1/3~3/3
12	PRECAUTIONS	7B64PS 2712-TX16D206VM0BAA-2	12-1/2~2/2
13	DESIGNATION OF LOT MARK	7B64PS 2713-TX16D206VM0BAA-2	13-1/1

ACCEPTED BY: _____

PROPOSED BY: Oblack Tsai

KAOHSIUNG OPTO-ELECTRONICS INC.	SHEET NO.	7B64PS 2701-TX16D206VM0BAA-2	PAGE	1-1/1
---------------------------------	-----------	------------------------------	------	-------

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY																																																																																																					
Jul.17,'20	7B64PS 2703 - TX16D206VM0BAA-2 Page 3-1/1	3. GENERAL DATA Revised : Power Consumption 1.68W → 1.008W																																																																																																					
	7B64PS 2705 - TX16D206VM0BAA-2 Page 5-1/1	5.2 BACKLIGHT CHARACTERISTICS Revised : <table><tr><td>Item</td><td>Condition</td><td>Typ.</td><td>Max.</td></tr><tr><td>LED Forward Current</td><td>Backlight Unit</td><td>140</td><td>-</td></tr><tr><td>LED Lifetime</td><td>140 mA</td><td>50K</td><td>-</td></tr></table> ↓ <table><tr><td>Item</td><td>Condition</td><td>Typ.</td><td>Max.</td></tr><tr><td>LED Forward Current</td><td>Backlight Unit</td><td>84</td><td>95</td></tr><tr><td>LED Lifetime</td><td>84 mA</td><td>50K</td><td>-</td></tr></table> Note 1 & Note 2 : 140mA → 84mA	Item	Condition	Typ.	Max.	LED Forward Current	Backlight Unit	140	-	LED Lifetime	140 mA	50K	-	Item	Condition	Typ.	Max.	LED Forward Current	Backlight Unit	84	95	LED Lifetime	84 mA	50K	-																																																																													
	Item	Condition	Typ.	Max.																																																																																																			
LED Forward Current	Backlight Unit	140	-																																																																																																				
LED Lifetime	140 mA	50K	-																																																																																																				
Item	Condition	Typ.	Max.																																																																																																				
LED Forward Current	Backlight Unit	84	95																																																																																																				
LED Lifetime	84 mA	50K	-																																																																																																				
7B64PS 2706 - TX16D206VM0BAA-2 Page 6-1/2	6. OPTICAL CHARACTERISTICS Revised : <table><tr><td>Item</td><td>Condition</td><td>Min.</td><td>Typ.</td></tr><tr><td>Brightness of White</td><td>I_{LED}= 140mA</td><td>640</td><td>800</td></tr></table> ↓ <table><tr><td>Item</td><td>Condition</td><td>Min.</td><td>Typ.</td></tr><tr><td>Brightness of White</td><td>I_{LED}= 84mA</td><td>320</td><td>400</td></tr></table> <table><tr><td colspan="2">Item</td><td>Symbol</td><td>Min.</td><td>Typ.</td><td>Max.</td></tr><tr><td rowspan="8">Color Chromaticity</td><td rowspan="2">Red</td><td>X</td><td>0.57</td><td>0.62</td><td>0.67</td></tr><tr><td>Y</td><td>0.29</td><td>0.34</td><td>0.39</td></tr><tr><td rowspan="2">Green</td><td>X</td><td>0.30</td><td>0.35</td><td>0.40</td></tr><tr><td>Y</td><td>0.55</td><td>0.60</td><td>0.65</td></tr><tr><td rowspan="2">Blue</td><td>X</td><td>0.09</td><td>0.14</td><td>0.19</td></tr><tr><td>Y</td><td>0.04</td><td>0.09</td><td>0.14</td></tr><tr><td rowspan="2">White</td><td>X</td><td>0.24</td><td>0.29</td><td>0.34</td></tr><tr><td>Y</td><td>0.26</td><td>0.31</td><td>0.36</td></tr></table> ↓ <table><tr><td colspan="2">Item</td><td>Symbol</td><td>Min.</td><td>Typ.</td><td>Max.</td></tr><tr><td rowspan="8">Color Chromaticity</td><td rowspan="2">Red</td><td>X</td><td>0.58</td><td>0.63</td><td>0.68</td></tr><tr><td>Y</td><td>0.31</td><td>0.36</td><td>0.41</td></tr><tr><td rowspan="2">Green</td><td>X</td><td>0.31</td><td>0.36</td><td>0.41</td></tr><tr><td>Y</td><td>0.55</td><td>0.60</td><td>0.65</td></tr><tr><td rowspan="2">Blue</td><td>X</td><td>0.10</td><td>0.15</td><td>0.20</td></tr><tr><td>Y</td><td>0.02</td><td>0.07</td><td>0.12</td></tr><tr><td rowspan="2">White</td><td>X</td><td>0.26</td><td>0.31</td><td>0.36</td></tr><tr><td>Y</td><td>0.27</td><td>0.32</td><td>0.37</td></tr></table>	Item	Condition	Min.	Typ.	Brightness of White	I _{LED} = 140mA	640	800	Item	Condition	Min.	Typ.	Brightness of White	I _{LED} = 84mA	320	400	Item		Symbol	Min.	Typ.	Max.	Color Chromaticity	Red	X	0.57	0.62	0.67	Y	0.29	0.34	0.39	Green	X	0.30	0.35	0.40	Y	0.55	0.60	0.65	Blue	X	0.09	0.14	0.19	Y	0.04	0.09	0.14	White	X	0.24	0.29	0.34	Y	0.26	0.31	0.36	Item		Symbol	Min.	Typ.	Max.	Color Chromaticity	Red	X	0.58	0.63	0.68	Y	0.31	0.36	0.41	Green	X	0.31	0.36	0.41	Y	0.55	0.60	0.65	Blue	X	0.10	0.15	0.20	Y	0.02	0.07	0.12	White	X	0.26	0.31	0.36	Y	0.27	0.32	0.37
Item	Condition	Min.	Typ.																																																																																																				
Brightness of White	I _{LED} = 140mA	640	800																																																																																																				
Item	Condition	Min.	Typ.																																																																																																				
Brightness of White	I _{LED} = 84mA	320	400																																																																																																				
Item		Symbol	Min.	Typ.	Max.																																																																																																		
Color Chromaticity	Red	X	0.57	0.62	0.67																																																																																																		
		Y	0.29	0.34	0.39																																																																																																		
	Green	X	0.30	0.35	0.40																																																																																																		
		Y	0.55	0.60	0.65																																																																																																		
	Blue	X	0.09	0.14	0.19																																																																																																		
		Y	0.04	0.09	0.14																																																																																																		
	White	X	0.24	0.29	0.34																																																																																																		
		Y	0.26	0.31	0.36																																																																																																		
Item		Symbol	Min.	Typ.	Max.																																																																																																		
Color Chromaticity	Red	X	0.58	0.63	0.68																																																																																																		
		Y	0.31	0.36	0.41																																																																																																		
	Green	X	0.31	0.36	0.41																																																																																																		
		Y	0.55	0.60	0.65																																																																																																		
	Blue	X	0.10	0.15	0.20																																																																																																		
		Y	0.02	0.07	0.12																																																																																																		
	White	X	0.26	0.31	0.36																																																																																																		
		Y	0.27	0.32	0.37																																																																																																		

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 6.2" HVGA of 8:3 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, COG (chip on glass) technology and LED backlight are applied on this display.

Part Name	TX16D206M0BAA
Module Dimensions	173.0(W) mm x 70.0(H) mm x 7.0 (D) mm max.
LCD Active Area	148.8(W) mm x 53.76(H) mm
Dot Pitch	0.0775(W) mm x 3 (R.G.B) (W) X0.224 (H) mm
Resolution	640 x 3(RGB)(W) x 240(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Color TFT; Normally Black
Polarizer Surface	Anti-glare
Display Type	Active Matrix
Number of Colors	262k Colors
Backlight	Light Emitting Diode (LED)
Weight	110g (typ.)
Interface	C-MOS; 18-bit RGB; 40 pins
Power Supply Voltage	3.3V for LCD; 12V for Backlight
Power Consumption	0.59 W for LCD; 1.008W for Backlight
Viewing Direction	Super Wide Version (In-Plane Switching)

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V _{DD}	-0.3	5	V	-
Input Voltage of Logic	V _I	-0.3	V _{DD} +0.3	V	Note 1
Operating Temperature	T _{op}	-20	70	°C	Note 2
Storage Temperature	T _{st}	-30	80	°C	Note 2
Backlight Input Voltage	V _{LED}	-	15	V	-

Note 1: The rating is defined for the signal voltages of the interface such as DCLK, DE, 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.

5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

$T_a = 25\text{ }^{\circ}\text{C}$, $V_{SS} = 0\text{V}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-	3.0	3.3	3.6	V	-
Input Voltage of Logic	V_I	"H" level	2.0	-	V_{DD}	V	Note 1
		"L" level	V_{SS}	-	0.8		
Power Supply Current	I_{DD} for HVGA	$V_{DD}-V_{SS}$ $\approx 3.3\text{V}$	-	180	250	mA	Note 2
	I_{DD} for VGA		-	200	280		
Vsync Frequency	f_v	-	50	60	68	Hz	-
Hsync Frequency	f_H for HVGA	-	15	15.6	16.2	KHz	-
	f_H for VGA	-	29.4	30	30.6		
DCLK Frequency	f_{CLK} for HVGA	-	9.6	12.5	15.2	MHz	-
	f_{CLK} for VGA	-	18.4	24	28.8		

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

Note 2: An all white check pattern is used when measuring I_{DD} . f_v is set to 60 Hz.

Note 3: 0.5A fuse is applied in the module for I_{DD} . For display activation and protection purpose, power supply is recommended larger than 1.0A to start the display and break fuse once any short circuit occurred.

5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25\text{ }^{\circ}\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	Backlight Unit	11.5	12.0	12.5	V	Note1
LED Forward Current	I_{LED}	Backlight Unit	-	84	95	mA	-
LED Lifetime	-	84 mA	-	50K	-	hrs	Note 2

Note 1: Fig. 5.1 shows the LED backlight circuit. V_{LED} and I_{LED} is many-to-one relationship, the above V_{LED} range is defined to obtain 84mA.

Note 2: The estimated lifetime is specified as the time to reduce 50% brightness by applying 84mA at $25\text{ }^{\circ}\text{C}$.

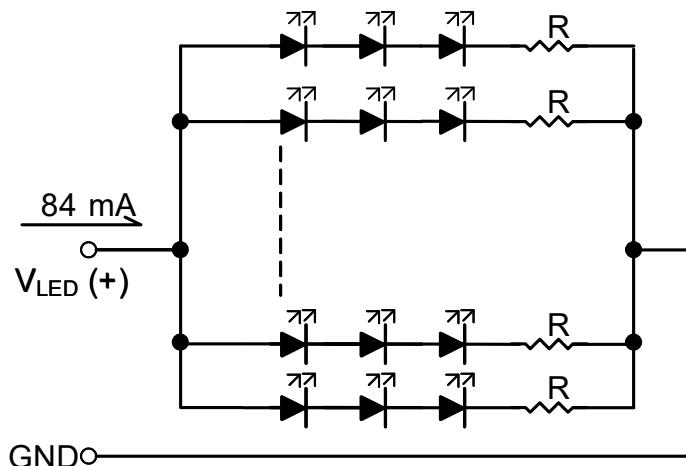


Fig. 5.1

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 less than 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$$T_a = 25\text{ }^{\circ}\text{C}, f_v = 60\text{ Hz}, V_{DD} = 3.3\text{V}$$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$, $I_{LED} = 84mA$	320	400	-	cd/m ²	Note 1
Brightness Uniformity		-		75	-	-	%	Note 2
Contrast Ratio		CR		600	1200	-	-	Note 3
Response Time		Rise + Fall	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	40	-	ms	Note 4
NTSC Ratio		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	60	-	%	-
Viewing Angle		θ x	$\phi = 0^{\circ}, CR \geq 10$	70	85	-	Degree	Note 5
		θ x'	$\phi = 180^{\circ}, CR \geq 10$	70	85	-		
		θ y	$\phi = 90^{\circ}, CR \geq 10$	70	85	-		
		θ y'	$\phi = 270^{\circ}, CR \geq 10$	70	85	-		
Color Chromaticity	Red	X	$\phi = 0^{\circ}, \theta = 0^{\circ}$	0.58	0.63	0.68	-	Note 6
		Y		0.31	0.36	0.41		
	Green	X		0.31	0.36	0.41		
		Y		0.55	0.60	0.65		
	Blue	X		0.10	0.15	0.20		
		Y		0.02	0.07	0.12		
	White	X		0.26	0.31	0.36		
		Y		0.27	0.32	0.37		

Note 1: The brightness is measured from 9 point average value of the panel, P1~P9 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-5 as shown in Fig. 6.2.

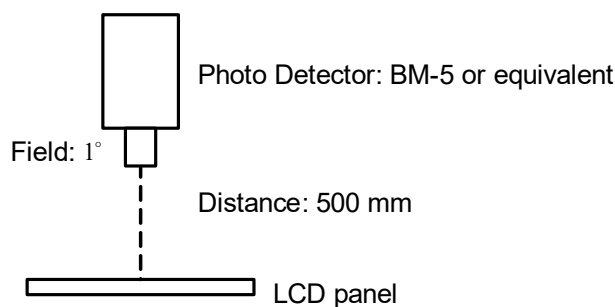


Fig. 6.1

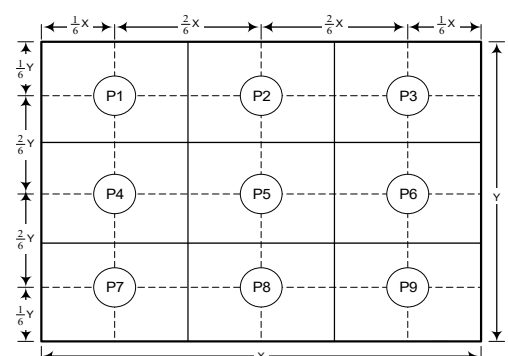


Fig. 6.2

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 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness falling to 10% brightness.

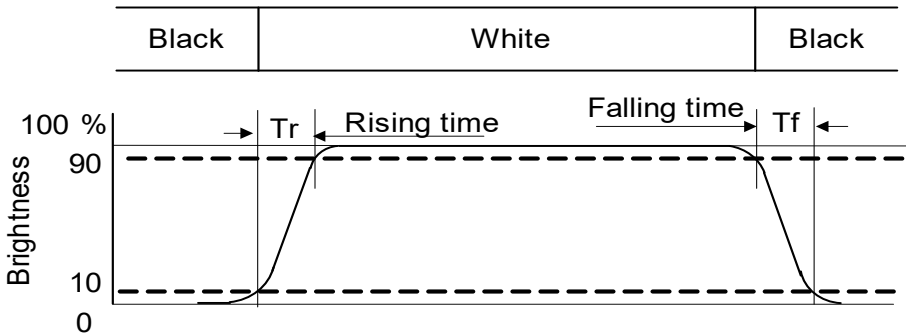


Fig. 6.3

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

The display is super wide viewing angle version, so that the best optical performance can be obtained from every viewing direction.

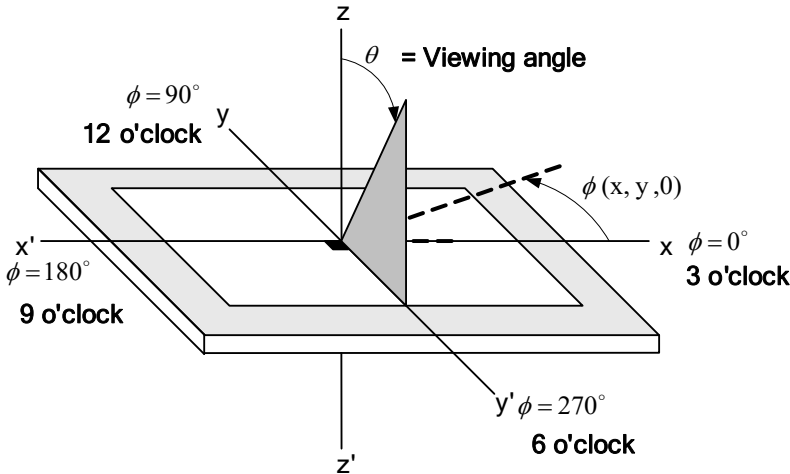
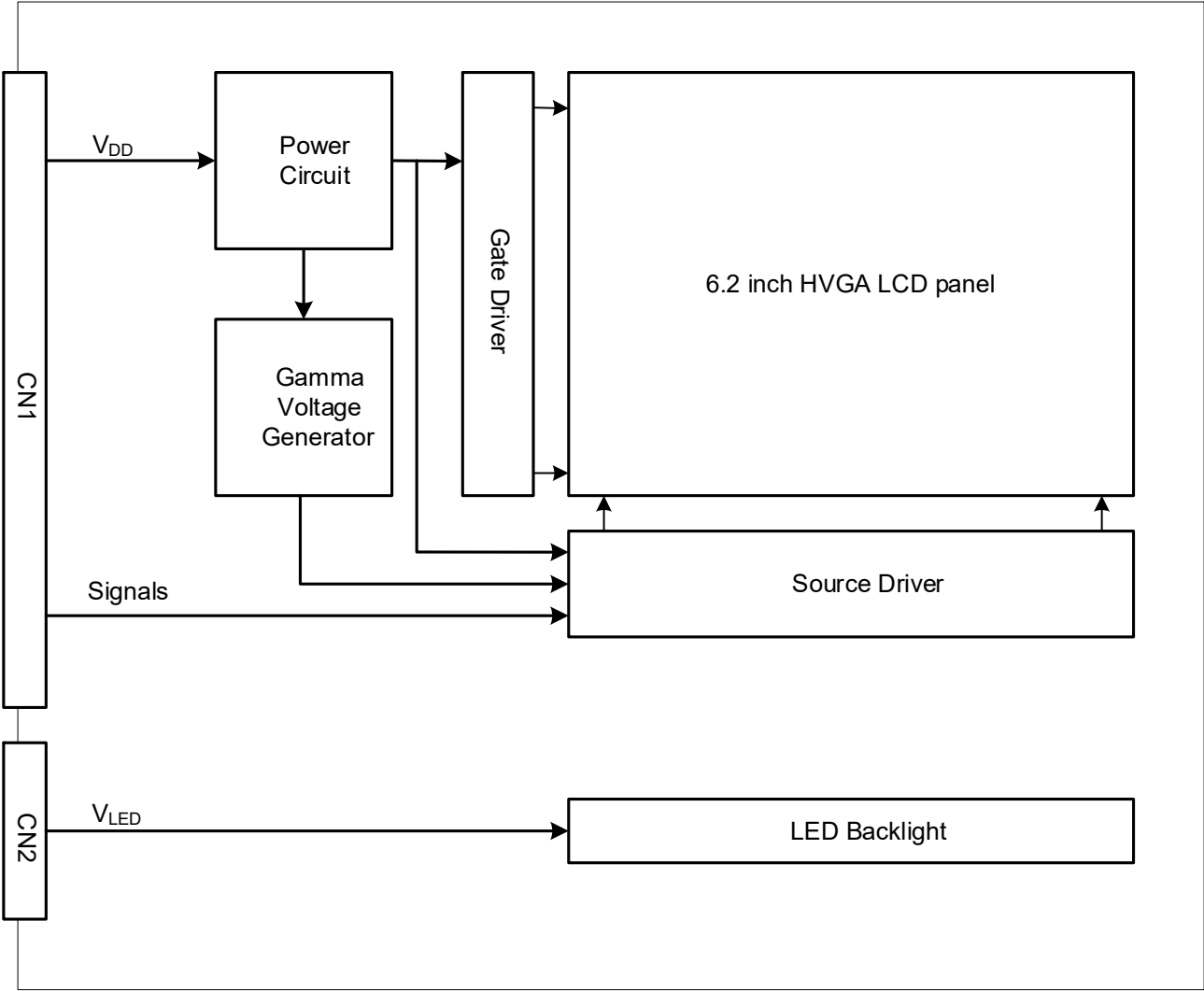


Fig. 6.4

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

7. BLOCK DIAGRAM



Note 1: Signals are DCLK, DE, and RGB data bus.

8. RELIABILITY TESTS

Test Item	Condition	
High Temperature	1) Operating 2) 70 °C	240 hrs
Low Temperature	1) Operating 2) -20 °C	240 hrs
High Temperature	1) Storage 2) 80 °C	240 hrs
Low Temperature	1) Storage 2) -30 °C	240 hrs
Heat Cycle	1) Operating 2) -20 °C ~70 °C 3) 3hrs~1hr~3hrs	240 hrs
Thermal Shock	1) Non-Operating 2) -35 °C ↔ 85 °C 3) 0.5 hr ↔ 0.5 hr	240 hrs
High Temperature & Humidity	1) Operating 2) 40 °C & 85%RH 3) Without condensation	240 hrs (Note4)
Vibration	1) Non-Operating 2) 20~200 Hz 3) 2G 4) X, Y, and Z directions	1 hr for each direction
Mechanical Shock	1) Non-Operating 2) 10 ms 3) 50G 4) ±X, ±Y and ±Z directions	Once for each direction
ESD	1) Operating 2) Tip: 150 pF, 330 Ω 3) Air discharge for glass: ± 8KV 4) Contact discharge for metal frame: ± 8KV	1) Glass: 9 points 2) Metal frame: 8 points (Note3)

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 pins of LCD interface (CN1) have been tested by ± 100V contact discharge of ESD under non-operating condition.

Note 4: Under the condition of high temperature & humidity, if the temperature is higher than 40°C, the humidity needs to be reduced as Fig. 8.1 shown.

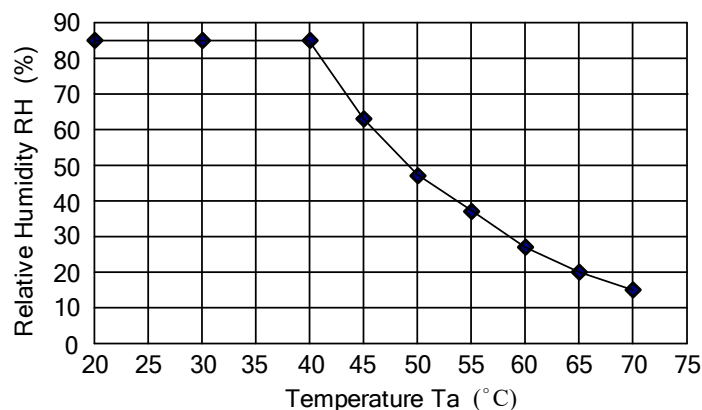


Fig. 8.1

9. LCD INTERFACE

9.1 INTERFACE PIN CONNECTIONS

The display interface connector is FA5B040HP1R3000 made by JAE (Thickness: $0.3 \pm 0.05\text{mm}$; Pitch: $0.5 \pm 0.05\text{mm}$) 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 _{DD}	Power Supply for Logic	21	G4	Green Data
2	V _{DD}		22	G3	
3	V _{DD}		23	V _{SS}	GND
4	V _{DD}		24	G2	Green Data
5	NC	No Connection	25	G1	
6	DE	Data Enable	26	G0	
7	V _{SS}	GND	27	V _{SS}	GND
8	DCLK	Dot Clock	28	R5	Red Data
9	V _{SS}	GND	29	R4	
10	NC	No Connection	30	R3	
11	V _{SS}	GND	31	V _{SS}	GND
12	B5	Blue Data	32	R2	Red Data
13	B4		33	R1	
14	B3		34	R0	
15	V _{SS}	GND	35	Vcom	Common Voltage (Generated by LCM)
16	B2	Blue Data	36	V _{SS}	GND
17	B1		37	NC	No Connection
18	B0		38	NC	No Connection
19	V _{SS}	GND	39	NC	No Connection
20	G5	Green Data	40	NC	No Connection

The backlight interface connector is BHR-03VS-1 made by JST, and pin assignment of backlight is as below:

Pin No.	Signal	Level	Function
1	V _{LED+}	-	Power Supply for LED
2	NC	-	No connection
3	V _{LED-}	-	GND

9.2 TIMING CHART

9.2.1 HVGA MODE

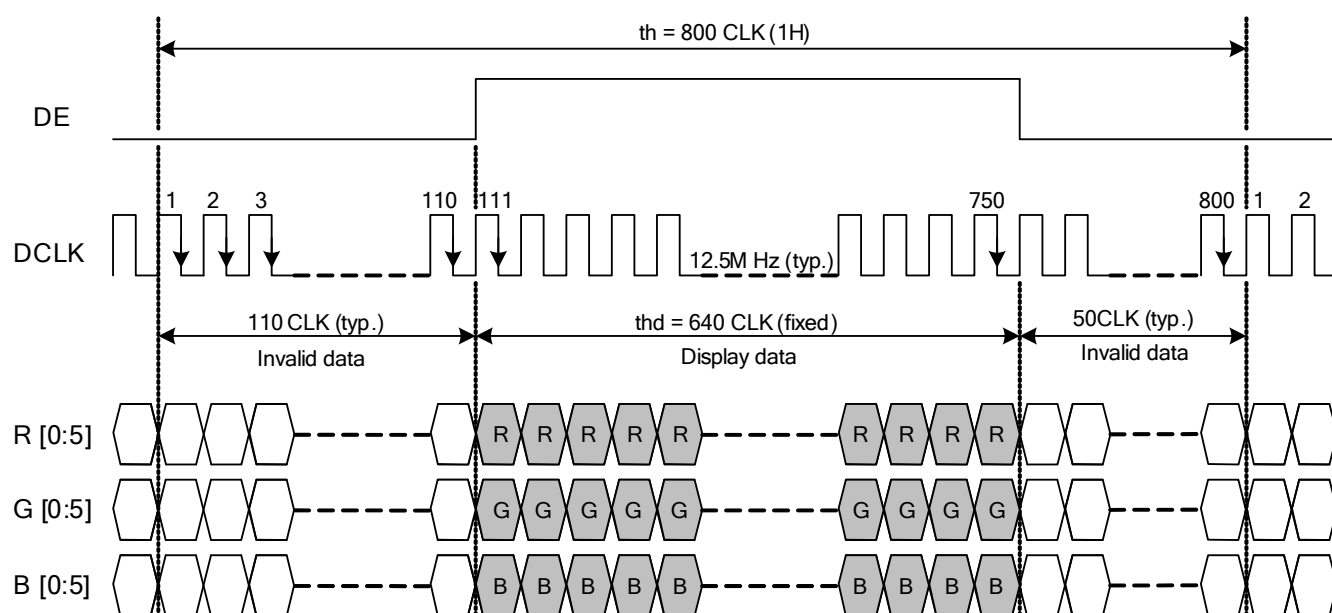


Fig. 9.1 Horizontal Timing of HVGA Mode

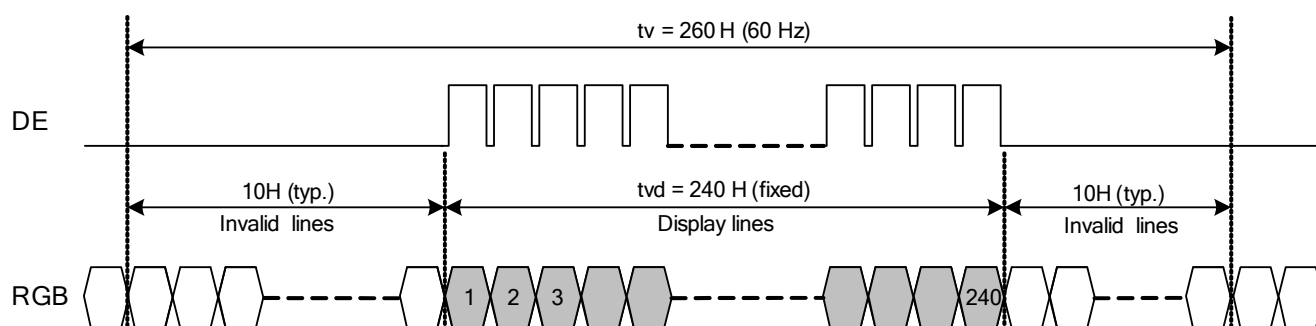


Fig. 9.2 Vertical Timing of HVGA Mode

9.2.2 VGA MODE

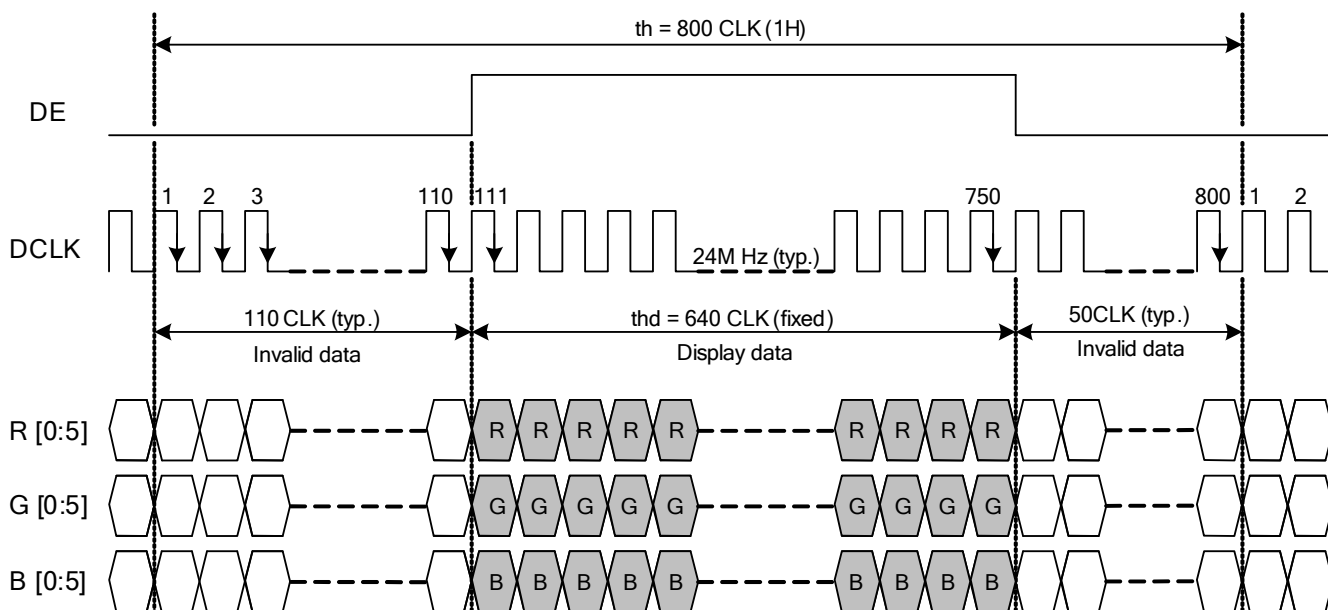


Fig. 9.3 Horizontal Timing of VGA Mode

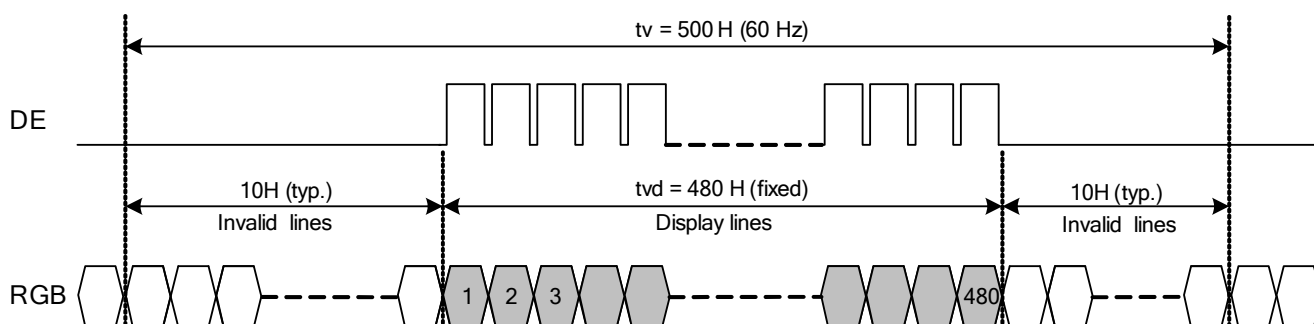


Fig. 9.4 Vertical Timing of VGA Mode

9.2.3 CLOCK AND DATA INPUT TIMING

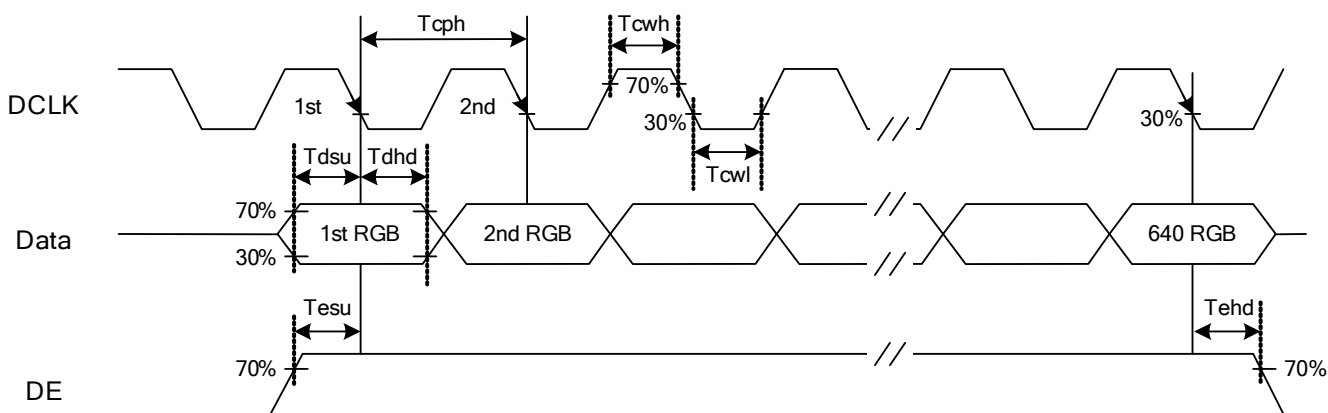


Fig. 9.5 Setup & Hold Time of Data and DE signal.

9.3 TIME TABLE

A. HVGA MODE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vsync Frequency	f_V	-	50	60	68	Hz
DCLK Frequency	f_{CLK}	-	9.6	12.5	15.2	MHz
DE	Horizontal Cycle	t _H	766	800	830	CLK
	Horizontal Valid Data Width	t _{HD}	640			
	Horizontal Porch Width	t _{HB}	126	160	190	
	Vertical Cycle	t _V	250	260	270	H
	Vertical Valid Data Width	t _{VD}	240			
	Vertical Porch Width	t _{VB}	10	20	30	

B. VGA MODE

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vsync Frequency	f_V	-	50	60	68	Hz
DCLK Frequency	f_{CLK}	-	18.4	24	28.8	MHz
DE	Horizontal Cycle	t _H	750	800	830	CLK
	Horizontal Valid Data Width	t _{HD}	640			
	Horizontal Porch Width	t _{HB}	110	160	190	
	Vertical Cycle	t _V	490	500	510	H
	Vertical Valid Data Width	t _{VD}	480			
	Vertical Porch Width	t _{VB}	10	20	30	

C. CLOCK AND DATA INPUT TIMING

Item		Symbol	Min.	Typ.	Max.	Unit
Data	Setup Time	Tdsu	8	-	-	ns
	Hold Time	Tdhd	8	-	-	
DE	Setup Time	Tesu	8	-	-	
	Hold Time	Tehd	8	-	-	

9.4 POWER SEQUENCE

The diagram illustrates the power sequence for a device. It shows three signals over time: V_{DD} , Signals, and Backlight.
1. V_{DD} starts at 0, rises to $0.1V_{DD}$ (labeled Note 3), then to $0.7V_{DD}$, and finally to $0.9V_{DD}$. It remains at $0.9V_{DD}$ until the Signals are removed, then falls back to $0.7V_{DD}$ and finally to 0.
2. Signals start at 0, rise to $0.3V_{DD}$ when V_{DD} reaches $0.9V_{DD}$, and remain at $0.3V_{DD}$ until V_{DD} falls to $0.7V_{DD}$.
3. Backlight starts at 0, rises to $0.3V_{LED}$ after a delay (labeled Note 2) from the start of Signals, and falls back to 0 before the Signals are removed (labeled Note 2).
Note 1 indicates the time period when V_{DD} is at $0.9V_{DD}$ and Signals are at $0.3V_{DD}$.

Note 1: In order to avoid any damages, V_{DD} has to be applied before all other signals. The opposite is true for power off where V_{DD} has to be remained on until all other signals have been switch off. The recommended time period is 1 second.

Note 2: In order to avoid showing uncompleted patterns in transient state. It is recommended that switching the backlight on is delayed for 1 second after the signals have been applied. The opposite is true for power off where the backlight has to be switched off 1 second before the signals are removed.

Note 3: In order to avoid high Inrush current, V_{DD} rising time need to set more than 0.5ms.

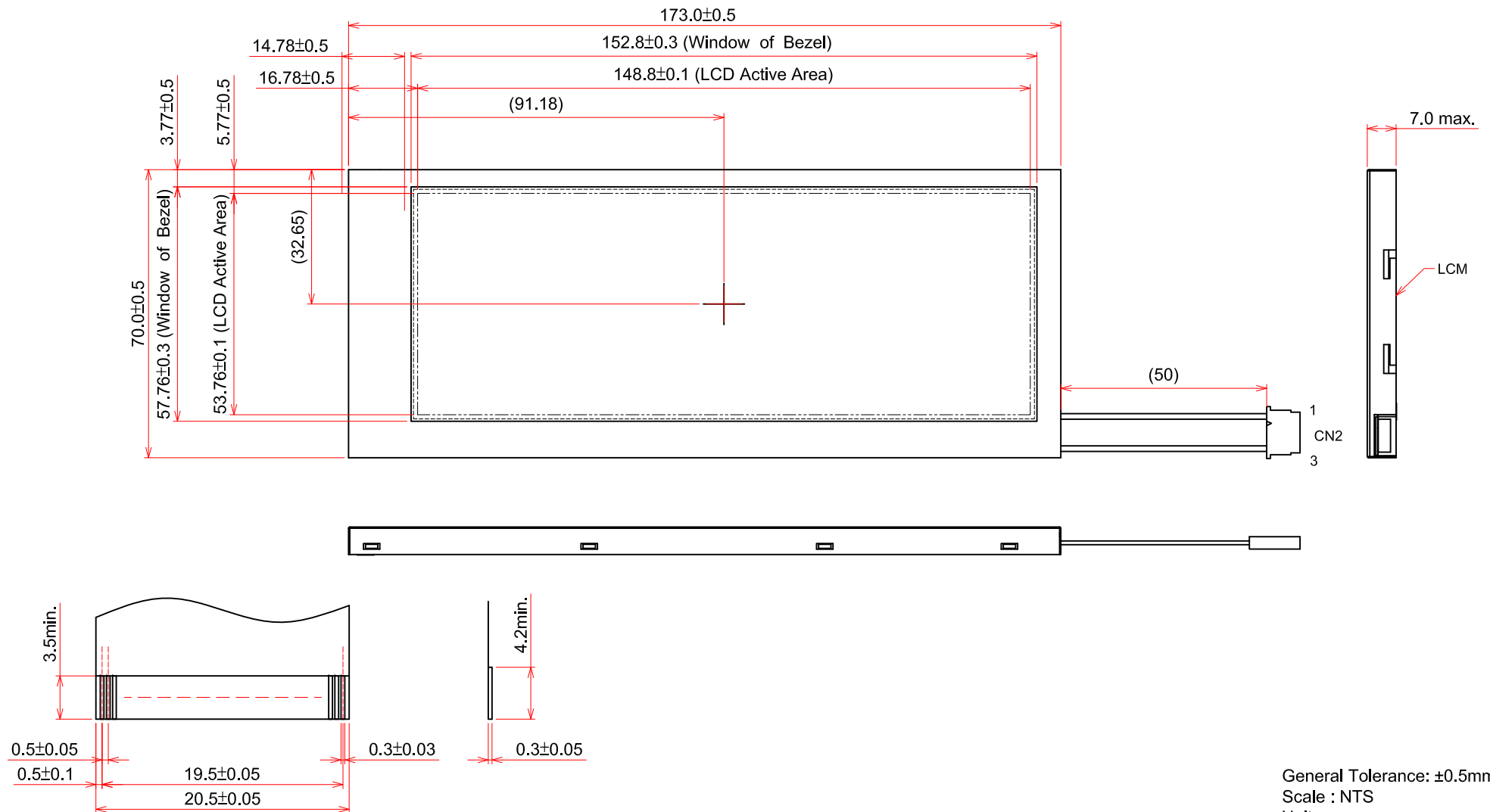
Note 3: In order to avoid high Inrush current, V_{DD} rising time need to set more than 0.5ms.

9.5 DATA INPUT for DISPLAY COLOR

	COLOR & Gray Scale	Data Signal																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Red	Black	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	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	1	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Black	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	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

10. OUTLINE DIMENSIONS

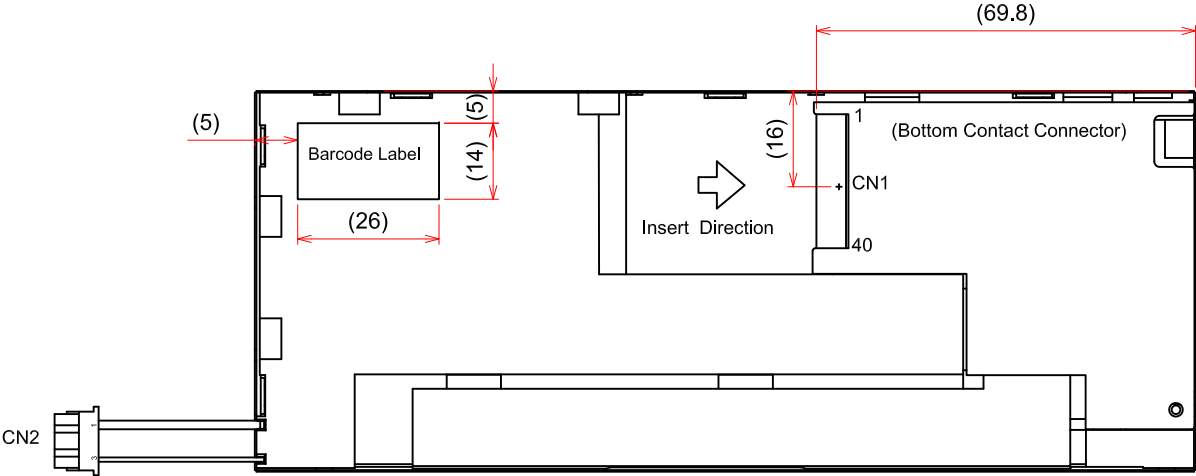
10.1 FRONT VIEW



Recommended design rule for I/F FPC

General Tolerance: $\pm 0.5 \text{ mm}$
 Scale : NTS
 Unit : mm

10.2 REAR VIEW



General Tolerance: ±0.5mm
Scale : NTS
Unit : mm

11. APPEARANCE STANDARD

The appearance inspection is performed in a dark room around 500~1000 lx based on the conditions as below:

- The distance between inspector's eyes and display is 30 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.

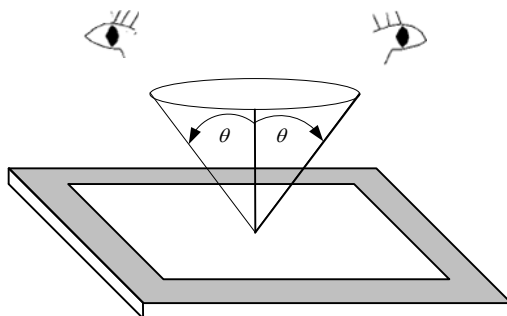


Fig. 11.1

11.1 THE DEFINITION OF LCD ZONE

LCD panel is divided into 2 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 between A zone and metal frame.

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

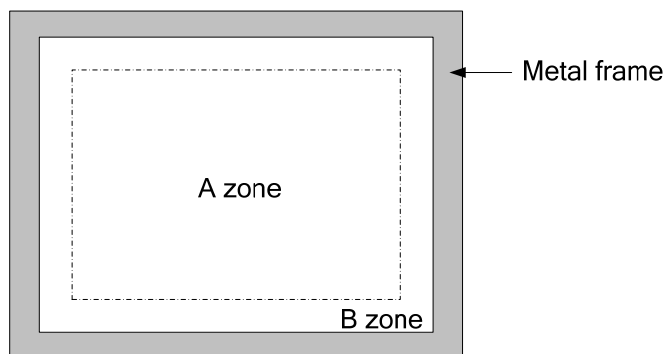


Fig. 11.2

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.

Item	Criteria				Applied zone
Scratches	Length (mm)	Width (mm)	Maximum number	Minimum space	A,B
	Ignored	$W \leq 0.01$	Ignored	-	
	$L \leq 40$	$W \leq 0.02$	10	-	
	$L \leq 20$	$W \leq 0.04$	10	-	
	Round (Dot Shape)				
	Average diameter (mm)	Maximum number	Minimum space		
	$D \leq 0.2$	Ignore	-		
	$D \leq 0.4$	10	-		
Dent	Serious one is not allowed				A,B
Wrinkles in polarizer	Serious one is not allowed				A,B
Bubbles on polarizer	Average diameter (mm)		Maximum number		A,B
	$D \leq 0.3$		Ignored		
	$D \leq 0.5$		10		
	$D \leq 1.0$		5		
1) Stains 2) Foreign Materials 3) Dark Spot	Filamentous (Line shape)				A,B
	Length (mm)	Width (mm)	Maximum number		
	Ignored	$W \leq 0.02$	Ignored		
	$L \leq 2.0$	$W \leq 0.03$	10		
	$L \leq 1.0$	$W \leq 0.06$	10		
	Round (Dot shape)				A,B
	Average diameter (mm)	Maximum number	Minimum Space		
	$D \leq 0.2$	Ignored	-		
	$D \leq 0.3$	5	-		
	$D > 0.3$	0	-		
	In total	Filamentous + Round=10			
	Those wiped out easily are acceptable				
Dot-Defect (Note 1)		Type	Maximum number		A
	Bright dot-defect	1 dot	1		
	Dark dot-defect	1 dot	2		
		2 adjacent dot	0		
	In total			3	

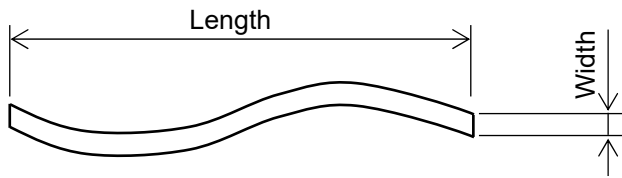


Fig 11.3

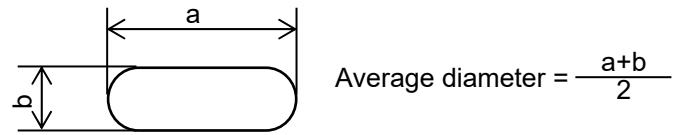


Fig 11.4

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

- For bright dot-defect, showing black pattern, visible with 3% ND filter is defined.
- For dark dot-defect, showing white pattern, defect size over 1/2 dot area is defined.
- 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 Density of dot defect is defined in the area within diameter $\phi = 10\text{mm}$.

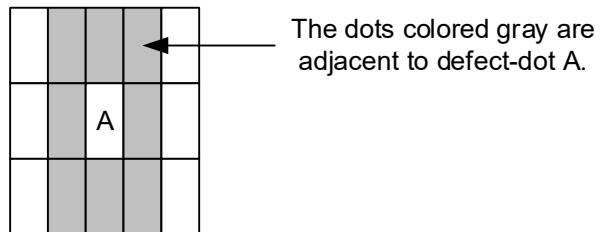


Fig 11.5

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 sharp tools harder than 3H, especially touch panel, metal frame and polarizer.
- 2) Please do not pile the displays in order to avoid any scars leaving on the display. In order to avoid any injuries, please pay more attention for the edges of glasses and metal frame, and wear finger cots to protect yourself and the display before working on it.
- 3) Touching the display area or the terminal pins with bare hand is prohibited. This is because it will stain the display area and cause poor insulation between terminal pins, and might affect display's electrical characteristics furthermore.
- 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 permanently damages.
- 7) Maximum pressure to the surface of the display must be less than 1.96×10^4 Pa. If the area of adding 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 $\pm 100 \text{ mV}$.

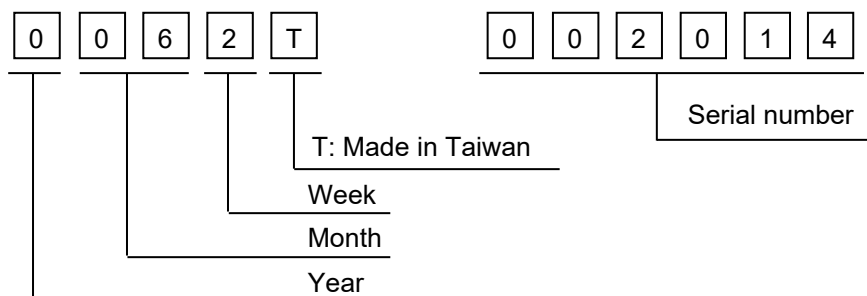
12.4 PRECAUTIONS of STORAGE

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 10 C° ~35 C° and 55%~75% humidity 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.13.3. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 6 digits are the serial number.



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

Year	Mark
2020	0
2021	1
2022	2
2023	3
2024	4

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	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. 13.3.

Label example :



Fig 13.3