KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____ DATE : Jun. 19th ,2014

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX09D70VM1CBA

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ACCEPTED BY : _____ PROPOSED BY: _____

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Revised:
<table>
<tr><th rowspan="2">ITEM</th><th colspan="2">OPERATING</th><th colspan="2">STORAGE</th></tr>
<tr><th>Min.</th><th>Max.</th><th>Min.</th><th>Max.</th></tr>
<tr><td>Ambient</td><td>(-20</td><td>(70℃)</td><td>(-30</td><td>(80</td></tr>
</table>
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<table>
<tr><th rowspan="2">ITEM</th><th colspan="2">OPERATING</th><th colspan="2">STORAGE</th></tr>
<tr><th>Min.</th><th>Max.</th><th>Min.</th><th>Max.</th></tr>
<tr><td>Ambient</td><td>-20</td><td>70℃</td><td>-30℃</td><td>80℃</td></tr>
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<tr><td></td><td>7B64PS 2705-TX09D70VM1CBA-2
PAGE 5-1/1</td><td>5.1 ELECTRICAL CHARACTERISTICS
Revised:
<table>
<tr><th>ITEM</th><th>SYMBOL</th><th>TYP.</th></tr>
<tr><td rowspan="4">Power supply Current</td><td>IDD</td><td>0.52</td></tr>
<tr><td>IAVDD</td><td>2.5</td></tr>
<tr><td>IGH</td><td>0.028</td></tr>
<tr><td>IGL</td><td>0.028</td></tr>
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<tr><th>ITEM</th><th>SYMBOL</th><th>TYP.</th></tr>
<tr><td rowspan="4">Power supply Current</td><td>IDD</td><td>0.56</td></tr>
<tr><td>IAVDD</td><td>2.3</td></tr>
<tr><td>IGH</td><td>0.033</td></tr>
<tr><td>IGL</td><td>0.028</td></tr>
</table></td></tr>
<tr><td></td><td>7B64PS 2708-TX09D70VM1CBA-2
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Revised: all of page for Source and Gate Driver setting.</td></tr>
<tr><td></td><td>7B64PS 2708-TX09D70VM1CBA-2
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<tr><td></td><td>7B64PS 2708-TX09D70VM1CBA-2
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Deleted: PCI setting and Note.</td></tr>
<tr><td></td><td>7B64PS 2708-TX09D70VM1CBA-2
PAGE 8-9/10</td><td>8.5 POWER SUPPLY CIRCUIT FOR LED BL
Added: Power Supply Circuit for LED BL</td></tr>
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<tr><th>DATE</th><th>SHEET No.</th><th>SUMMARY</th></tr>
<tr><td rowspan="4">Sep.8,'05</td><td>7B64PS 2705-TX09D70VM1CBA-3
PAGE 6-1/2</td><td>6.1 OPTICAL CHARACTERISTICS OF LCD
Revised:
<table>
<tr><th>ITEM</th><th>SYMBOL</th><th>TYP.</th><th></th><th>TYP.</th></tr>
<tr><td>Brightness</td><td>B</td><td>430</td><td rowspan="5">→</td><td>(400)</td></tr>
<tr><td rowspan="4">Viewing Angle</td><td>θ x</td><td>65</td><td>(70)</td></tr>
<tr><td>θ x'</td><td>65</td><td>(70)</td></tr>
<tr><td>θ y</td><td>80</td><td>(80)</td></tr>
<tr><td>θ y'</td><td>40</td><td>(60)</td></tr>
</table>
Added: the MIN. & MAX. of Color Tone.</td></tr>
<tr><td>7B64PS 2705-TX09D70VM1CBA-3
PAGE 8-5/10</td><td>8.3 POWER OM/OFF SEQUENCE
Added: the timing of DISP.</td></tr>
<tr><td>7B64PS 2705-TX09D70VM1CBA-3
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Removed V4</td></tr>
<tr><td>7B64PS 2705-TX09D70VM1CBA-3
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Revised: the function of PIN2(DISP) & PIN32(V4)
Added: Note1 ~ 3</td></tr>
<tr><td>Oct.13,'05</td><td>7B64PS 2704-TX09D70VM1CBA-4
PAGE 4-1/2</td><td>4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD
Revised:
<table>
<tr><th colspan="2">ITEM</th><th>SYMBOL</th><th>MAX.</th></tr>
<tr><td rowspan="2">LED</td><td>Forward Current</td><td>IF</td><td>25</td></tr>
<tr><td>Pulse Forward Current</td><td>I_{FP}</td><td>80</td></tr>
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<tr><th colspan="2">ITEM</th><th>SYMBOL</th><th>MAX.</th></tr>
<tr><td rowspan="2">LED</td><td>Forward Current</td><td>IF</td><td>35</td></tr>
<tr><td>Pulse Forward Current</td><td>I_{FP}</td><td>100</td></tr>
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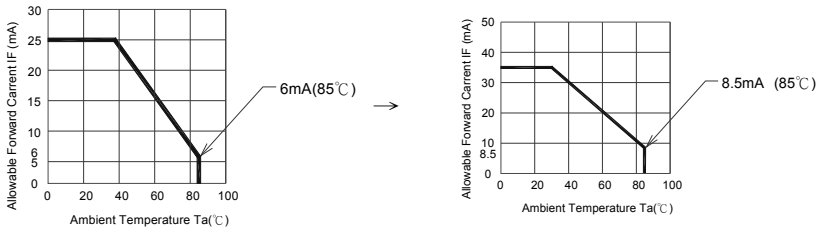
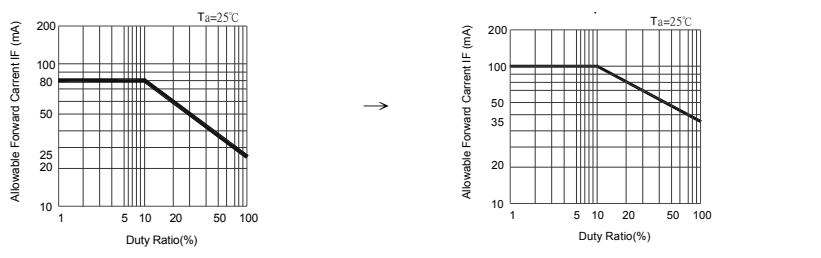
Note 4 :
 

Note 5 :
IFP Conditions : pulse width≦10ms and Duty≦1/10 IFP Conditions : pulse width≦10ms and Duty≦1/10
 
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RECORD OF REVISION

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<tr><td>Oct.13,'05</td><td>7B64PS 2705-
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PAGE 5-1/2</td><td>5.2 ELECTRICAL CHARACTERISTICS OF BACK LIGHT
Revised:
<table>
<tr><th>ITEM</th><th>SYMBOL</th><th>CONDITION</th><th>MAX.</th><th>TYP.</th><th>MAX.</th></tr>
<tr><td>LED
Input Voltage</td><td>VF</td><td>IF=20mA</td><td>-</td><td>3.75</td><td>4.2</td></tr>
<tr><td>LED
Forward
Current</td><td>IF</td><td>-</td><td>-</td><td>20</td><td>20</td></tr>
</table>
↓
<table>
<tr><th>ITEM</th><th>SYMBOL</th><th>CONDITION</th><th>MAX.</th><th>TYP.</th><th>MAX.</th></tr>
<tr><td>LED
Input Voltage</td><td>VF</td><td>IF=20mA</td><td>-</td><td>3.2</td><td>3.5</td></tr>
<tr><td>LED
Forward
Current</td><td>IF</td><td>-</td><td>-</td><td>20</td><td>25</td></tr>
</table></td></tr>
<tr><td></td><td>7B64PS 2706-
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Revised: Brightness and Color Tone of SPEC</td></tr>
<tr><td>May.13,'08</td><td>7B64PS 2712-
TX09D70VM1CBA-5
PAGE 12-1/1</td><td>12.2 Location of lot mark
Lot mark change: Print on FPC → Barcode label</td></tr>
<tr><td>Jan.18,'11</td><td>7B63PS 2709 –
TX09D70VM1CBA-6
Page 9-1/1</td><td>9.OUTLINE DIMENSIONS
The connector on FPC changed.</td></tr>
<tr><td></td><td>7B64PS 2712 –
TX09D70VM1CBA-6
Page 12-1/1</td><td>Added
12.2 REVISION (REV.) CONTROL
<table>
<tr><th>REV No.</th><th>ITEM</th><th>NOTE</th></tr>
<tr><td>A</td><td>-</td><td>-</td></tr>
<tr><td>B</td><td>Connector Changed</td><td>PCN0804</td></tr>
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<tr><td>May 01,'12</td><td>All pages</td><td>Company name changed:
KAOHSIUNG HITACHI ELECTRONICS CO.,LTD.
↓
KAOHSIUNG OPTO-ELECTRONICS INC.</td></tr>
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RECORD OF REVISION

<table>
<tr><th>DATE</th><th>SHEET No.</th><th>SUMMARY</th></tr>
<tr><td>Jun.18,’14</td><td>7B64PS 2706 –
TX09D70VM1CBA-8
Page 6-1/2</td><td>6.1 OPTICAL CHARACTERISTICS OF LCD (BACK LIGHT ON)
Revised:
<table>
<tr><th colspan="2">ITEM</th><th>MIN.</th><th>TYP.</th><th>MAX.</th></tr>
<tr><td rowspan="8">Color chromaticity</td><td rowspan="2">Red</td><td>0.55</td><td>0.60</td><td>0.65</td></tr>
<tr><td>0.29</td><td>0.34</td><td>0.39</td></tr>
<tr><td rowspan="2">Green</td><td>0.28</td><td>0.33</td><td>0.38</td></tr>
<tr><td>0.54</td><td>0.59</td><td>0.64</td></tr>
<tr><td rowspan="2">Blue</td><td>0.09</td><td>0.14</td><td>0.19</td></tr>
<tr><td>0.07</td><td>0.12</td><td>0.17</td></tr>
<tr><td rowspan="2">White</td><td>0.27</td><td>0.32</td><td>0.37</td></tr>
<tr><td>0.29</td><td>0.34</td><td>0.39</td></tr>
</table>
↓
<table>
<tr><th colspan="2">ITEM</th><th>MIN.</th><th>TYP.</th><th>MAX.</th></tr>
<tr><td rowspan="8">Color chromaticity</td><td rowspan="2">Red</td><td>0.58</td><td>0.63</td><td>0.68</td></tr>
<tr><td>0.28</td><td>0.33</td><td>0.38</td></tr>
<tr><td rowspan="2">Green</td><td>0.29</td><td>0.34</td><td>0.39</td></tr>
<tr><td>0.54</td><td>0.59</td><td>0.64</td></tr>
<tr><td rowspan="2">Blue</td><td>0.10</td><td>0.15</td><td>0.20</td></tr>
<tr><td>0.06</td><td>0.11</td><td>0.16</td></tr>
<tr><td rowspan="2">White</td><td>0.25</td><td>0.30</td><td>0.35</td></tr>
<tr><td>0.27</td><td>0.32</td><td>0.37</td></tr>
</table></td></tr>
<tr><td></td><td>7B64PS 2713 –
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Page 13-1/1</td><td>13.2 REVISON (REV.) CONTROL
Added:
<table>
<tr><th>REV No.</th><th>ITEM</th><th>NOTE</th></tr>
<tr><td>C</td><td>LCD Production Line Changed.</td><td>PCN0883</td></tr>
</table></td></tr>
</table>

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 3.5” QVGA TFT with 3 by 4 format, which is composed of amorphous silicon. Each sub-pixel (dot) on the LCD is vertical stripe type arranged as R (red), G (green), B (blue) color sequentially. The bounding technology, COG (chip on glass), and LED backlight design have been applied on this display RoHS compliant.

Part Name	TX09D70VM1CBA
Module Dimensions	64.0(W) mm x 86.0(H) mm x 3.12(D) mm (Expect FPC Area)
LCD Active Area	53.64(W) mm x 71.52(H) mm
Pixel Pitch	0.2235(W) mm x 0.2235(H) mm
Resolution	240 x 3(RGB)(W) x 320(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Color TFT; Normally White
Display Type	Active Matrix
Number of Colors	262k Colors (6-bit RGB)
Backlight	Light Emitting Diode (LED)
Weight	36g
Interface	C-MOS; 50 pins
Power Supply Voltage	3.3V (Including LCD ,Timing Controller and Backlight)
Viewing Direction	6 O’clock (without image inversion and least brightness change) 12 O’clock (contrast peak located at)

4. ABSOLUTE MAXIMUM RATINGS

Item			Symbol	Min.	Max.	Unit	Remarks
Power Supply for Logic			DVDD	-0.3	4.6	V	-
Source	Power Supply for LCD		AVDD	-0.3	11.0		Note 1
	Input Voltage	High	V_{IH}	-0.3	AVDD+0.3		Note 2
		Low	V_{IL}	-0.3	DVDD+0.3		-
Gate	Power Supply for Gate	High	V_{GH}	-0.3	V_{GL}+35		-
		Low	V_{GL}	-10	+0.3		-
	Input Voltage		V_{IG}	-0.3	DVDD+0.3		Note 3
Operating Temperature			Top	-20	70	˚C	Note 4
Storage Temperature			Tst	-30	80		
LED Backlight	Forward Current		I_F	-	35	mA	Note 5
	Pulse Forward Current		I_{FP}	-	100		Note 6
	Reverse Voltage		V_R	-	5	V	-

Note 1: AVDD-0.2≧V0, V9≧GND+0.2

Note 2: LOAD(CL1), CL2, M, POL, STH, RGB data bus.

Note 3: CL3, DISP, STV

Note 4: 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 from 25˚C.
- Operating under high temperature will shorten LED lifetime.

Note 5: Fig. 4.1 shows the maximum rating of forward current based on different temperature for LED unit.

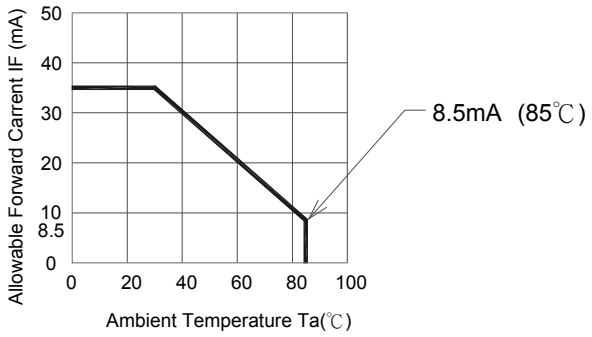


Fig. 4.1

Note 6: Fig. 4.2 shows the LED characteristics of the relationship between I_{FP} v.s. duty ratio, which is related to dimming control of LED backlight.

I_{FP} condition :
pulse width $\leqq$ 10ms
duty $\leqq$ 1/10

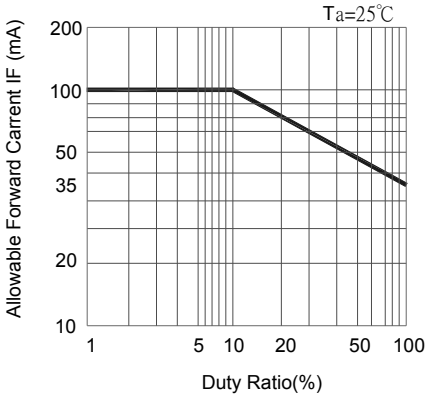


Fig. 4.2

5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

$T_a = 25\ ^\circ C$, Vss = 0V

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply for Logic		DVDD	-	2.3	3.3	3.6	V	-
Power Supply for LCD	Source	AVDD	-	7.5	8.48	9.5		
	Gate	V_{GH}	-	13.0	15.0	17.0		
		V_{GL}	-	-8.0	-5.0	-2.0		
Power Supply Current		I_{DD}	16 Vertical Gray Scale	-	0.56	2.0	mA	Note 1
		I_{AVDD}		-	2.3	4.0		
		I_{GH}		-	0.033	0.06		
		I_{GL}		-	0.028	0.06		
Frame Frequency		f_{Frame}	-	52	60	68	Hz	-

Note 1: An all black check pattern is used when measuring current. f_{Frame} is set to 60Hz.

5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25\ ^\circ C$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_F	I_F=20mA	-	3.2	3.5	V	LED/Part
LED Forward Current	I_F	-	-	20	25	mA	LED/Part
LED Reverse Current	I_R	V_R=5V	-	-	50	μ A	LED/Part

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 after 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.

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

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		B	ϕ=0°, θ=0° 20 mA/per LED	320	400	-	cd/m^2	Note 1
Brightness Uniformity		-		70	-	-	%	Note 2
Contrast Ratio		CR		180	300	-	-	Note 3
Response Time		Tr+Tf	ϕ=0°, θ=0	-	30	-	ms	Note 4
Viewing Angle		θ=X	ϕ=0°,CR≧10	-	70	-	Degree	Note 5
		θ=X'	ϕ=180°,CR≧10	-	70	-		
		θ=Y	ϕ=90°,CR≧10	-	80	-		
		θ=Y'	ϕ=270°,CR≧10	-	60	-		
Color Chromaticity	Red	X	ϕ=0°, θ=0	0.58	0.63	0.68	-	Note 6
		Y		0.28	0.33	0.38		
	Green	X		0.29	0.34	0.39		
		Y		0.54	0.59	0.64		
	Blue	X		0.10	0.15	0.20		
		Y		0.06	0.11	0.16		
	White	X		0.25	0.30	0.35		
		Y		0.27	0.32	0.37		

Note 1: The brightness is measured from the 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-5 as shown in Fig. 6.2.

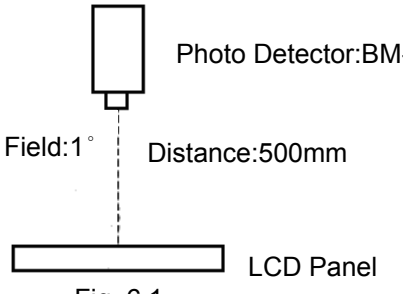


Fig. 6.1

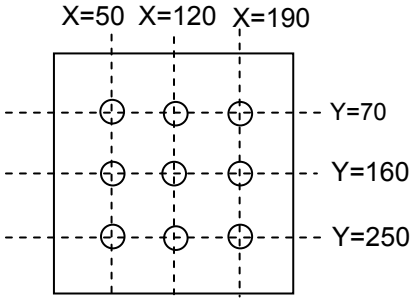


Fig. 6.2

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. Rising time is the period from 90% brightness down to 10% brightness when the data is from white turning to black. Oppositely, Falling time is the period from 10% brightness rising to 90% brightness.

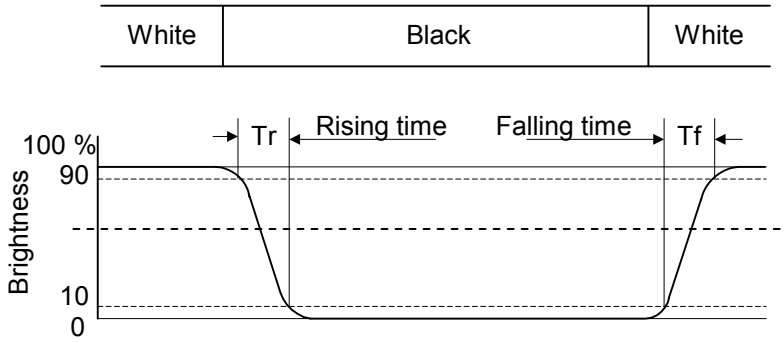


Fig . 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, 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 6 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 contrast peak would be located at 12 o'clock.

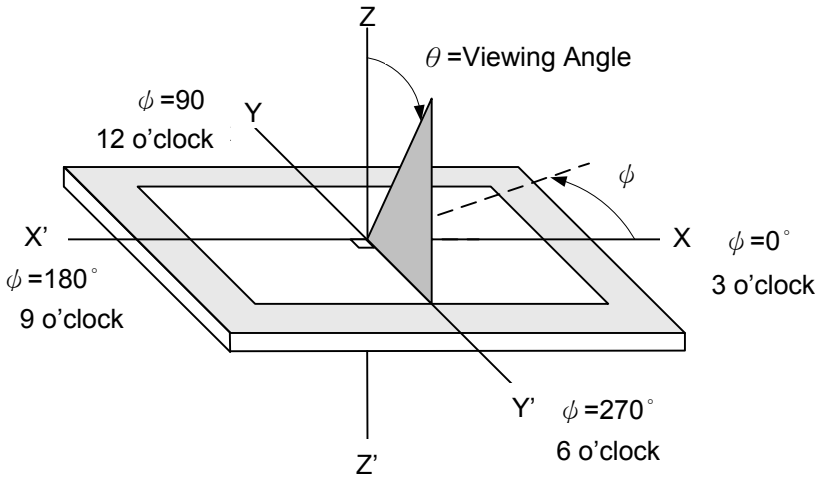
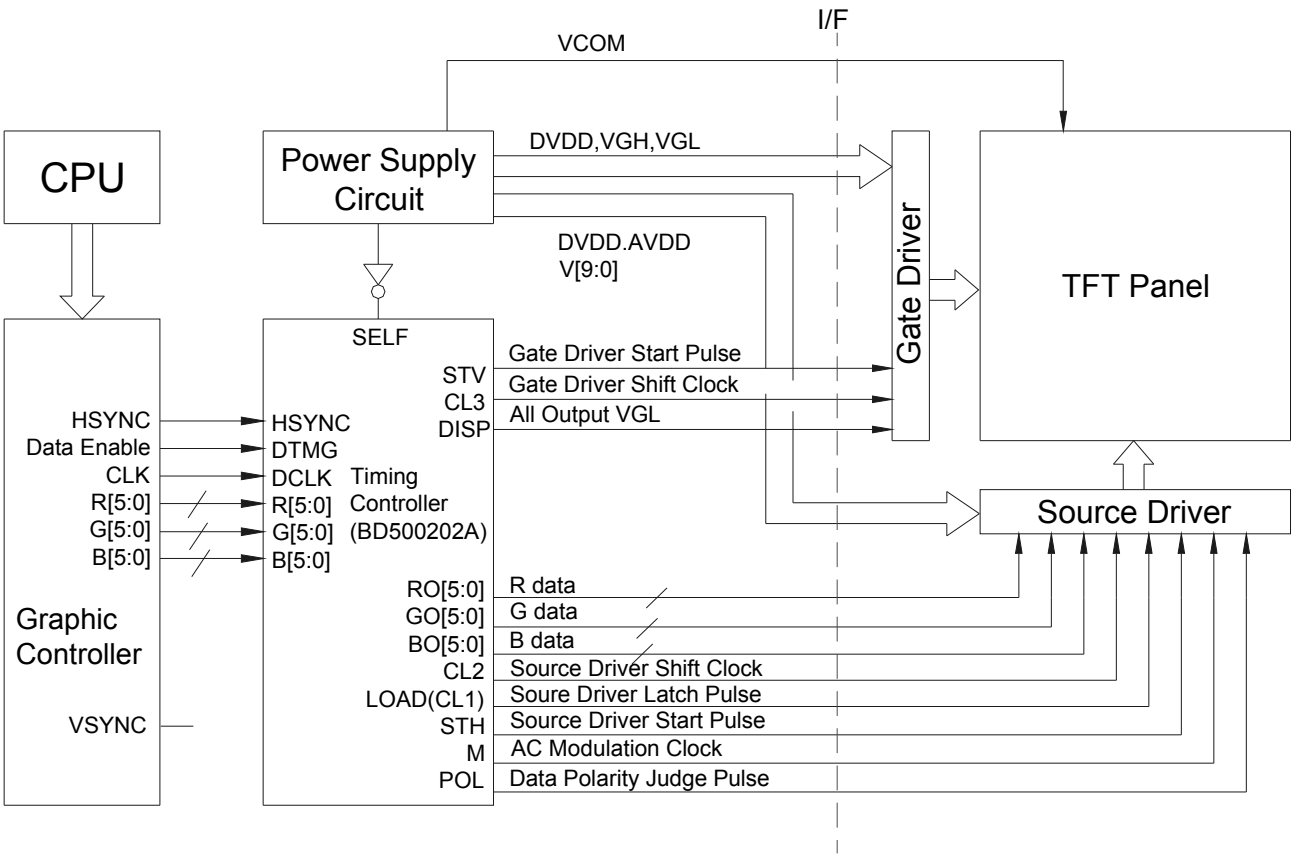


Fig. 6.4

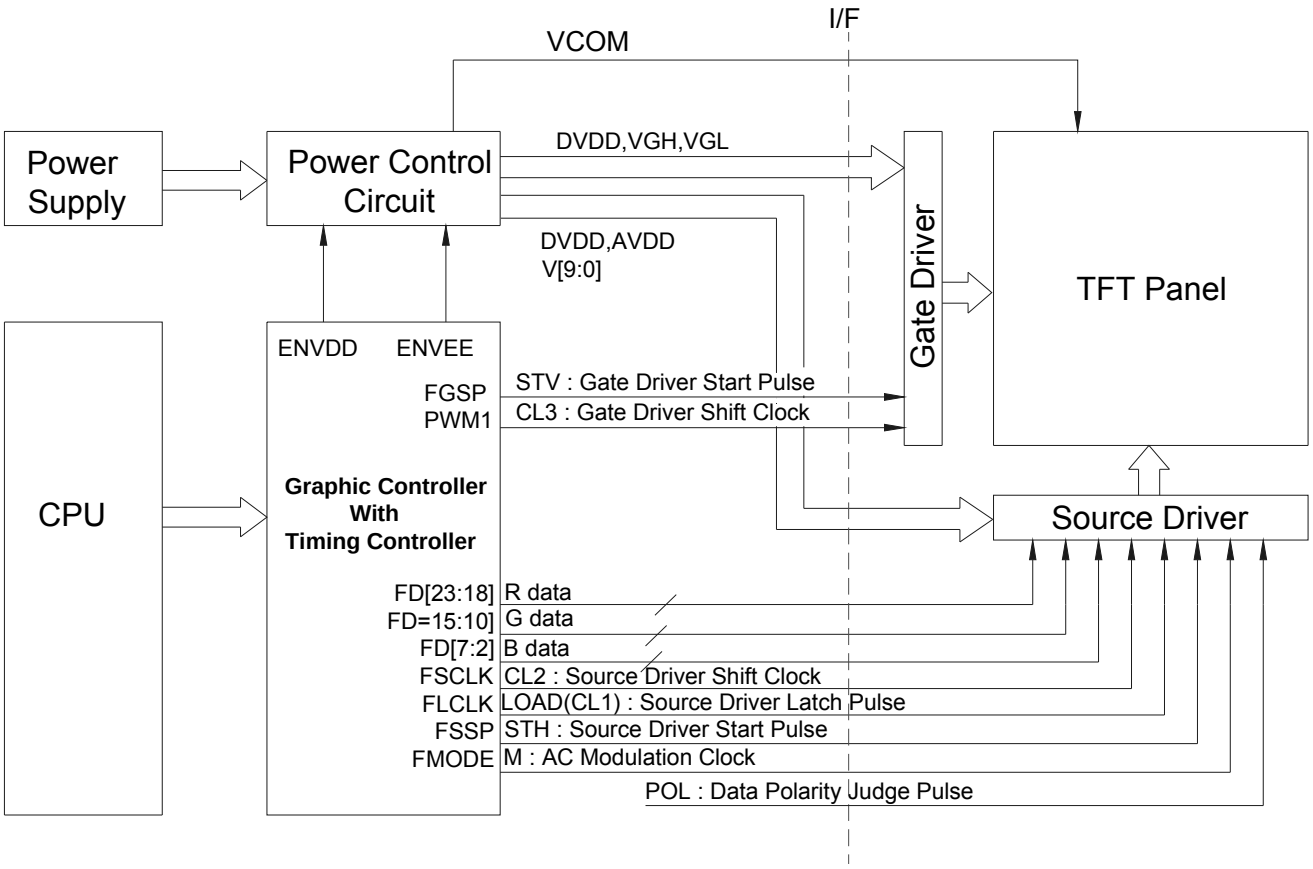
Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM

Example 1



Example 2


I/F
VCOM
Power Supply
Power Control Circuit
DVDD,VGH,VGL
DVDD,AVDD
V[9:0]
Gate Driver
TFT Panel
CPU
ENVDD
ENVEE
FGSP
PWM1
STV : Gate Driver Start Pulse
CL3 : Gate Driver Shift Clock
Graphic Controller With Timing Controller
Source Driver
FD[23:18] R data
FD=15:10] G data
FD[7:2] B data
FSCLK CL2 : Source Driver Shift Clock
FLCLK LOAD(CL1) : Source Driver Latch Pulse
FSSP STH : Source Driver Start Pulse
FMODE M : AC Modulation Clock
POL : Data Polarity Judge Pulse

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 (Note 3)
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, 330Ω 3) Air discharge for glass: ± 8KV 4) Contact discharge for metal frame: ± 8KV	1) Glass: 9 points 2) Metal frame: 8 points (Note4)

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

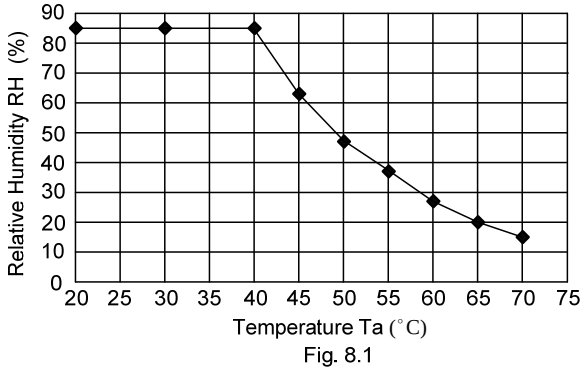


Fig. 8.1

Note 4: All pins of LCD interface(CN1) have been tested by ± 100V contact discharge of ESD under non-operating condition.

9. LCD INTERFACE

9.1 INTERFACE PIN CONNECTIONS

The suitable connector of display interface is FH12-50S-0.5P made by JAE.

Pin assignment of LCD interface is as below:

Pin No.	Signal	Function	Pin No.	Signal	Function
1	V_{GH}	Power Supply for Gate Driver (High)	26	B5	Blue Data
2	DISP	Display on/off (Note1.)	27	POL	Data Polarity Judge pulse (Note2)
3	CL3	Gate Driver Shift Clock	28	M	AC Modulation Clock
4	STV	Gate Driver Start Pulse	29	LOAD (CL1)	Source Driver Latch Pulse
5	V_{SS}	GND	30	CL2	Source Driver Shift Clock
6	V_{GL}	Power Supply for Gate Driver (Low)	31	V0	Gray Scale Voltage
7	V_{SS}	GND	32	V4	No Connection (Note3.)
8	STH	Source Driver Start Pulse	33	AVDD	Power Supply for Source Driver
9	R0	Red Data	34	AVDD	
10	R1		35	V5	Gray Scale Voltage
11	R2		36	V9	Gray Scale Voltage
12	R3		37	DVDD	Power Supply for Logic
13	R4		38	DVDD	
14	R5		39	VCOM	Common Voltage
15	G0	Green Data	40	VCOM	
16	G1		41	V_{SS}	GND
17	G2		42	Anode R	LED Power Supply (+)
18	G3		43	Cathode R	LED Power Supply (-)
19	G4		44	Anode L	LED Power Supply (+)
20	G5		45	Cathode L	LED Power Supply (-)
21	B0	Blue Data	46	V_{SS}	GND
22	B1		47	NC	No Connection
23	B2		48	NC	
24	B3		49	NC	
25	B4		50	NC	

Note 1 : If you don't use Tcon IC, please follow page 9-5/9 to set the DISP's timing.

Note 2 : If you don't use Tcon IC, the POL must be connected to GND.

Note 3 : Keep open electrically, please follow the page 9-8/9.

9.2 TIMING CHART

(Data is latched negative edge trigger of DCLK)

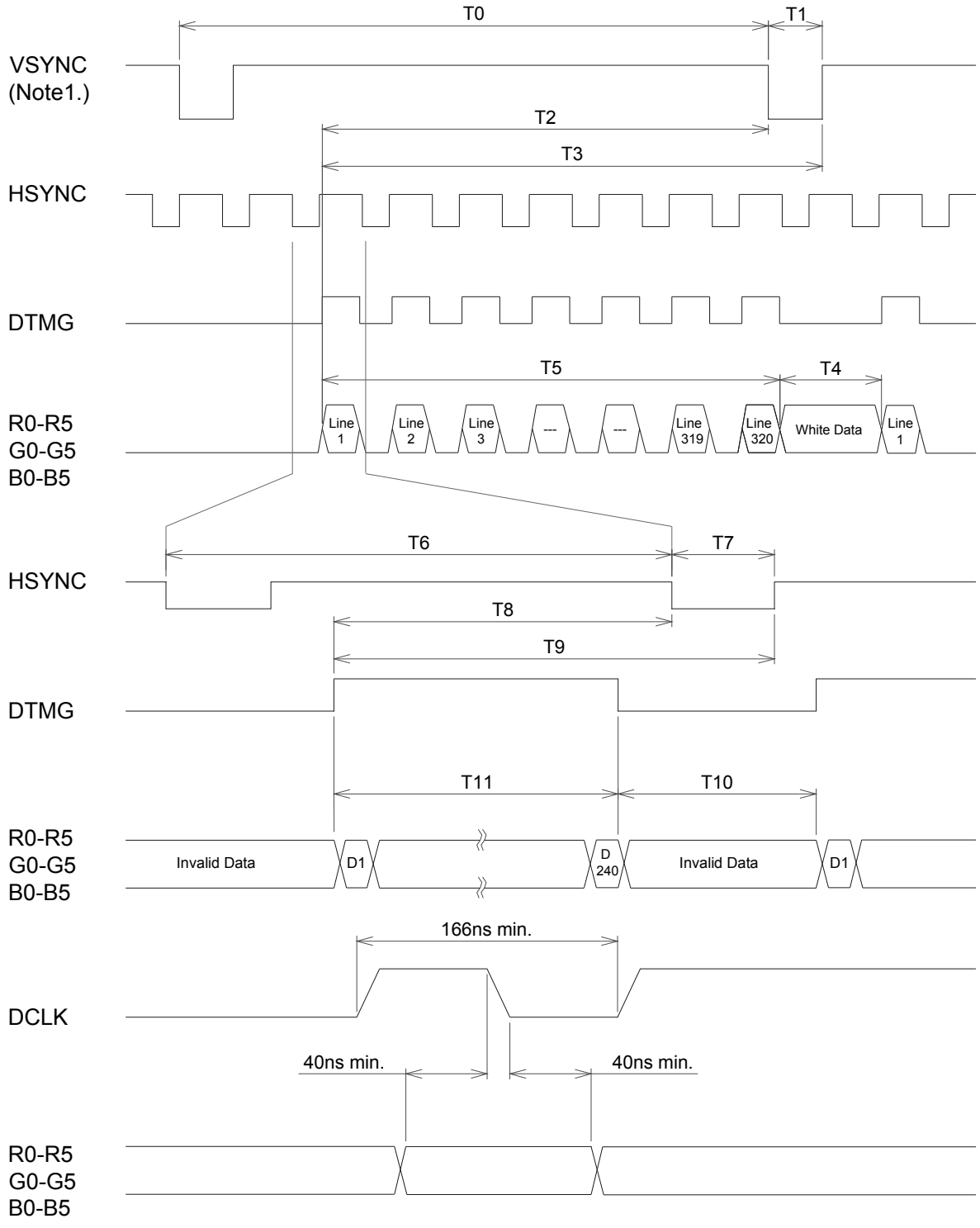


Fig.9.1 Timing sequence for Graphic controller

Note 1: VSYNC is generated by Tcon IC.

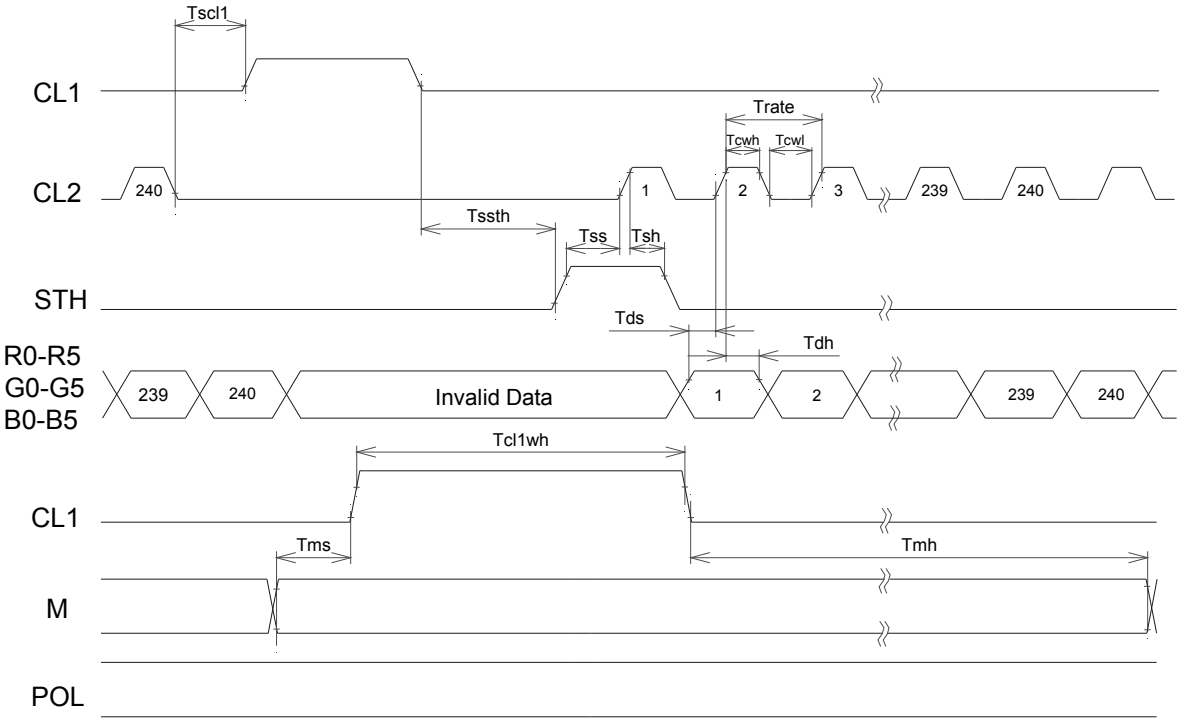


Fig.9.2 Horizontal Timing Sequence for non Tcon

Note: 0.8xDVDD, 0.2xDVDD

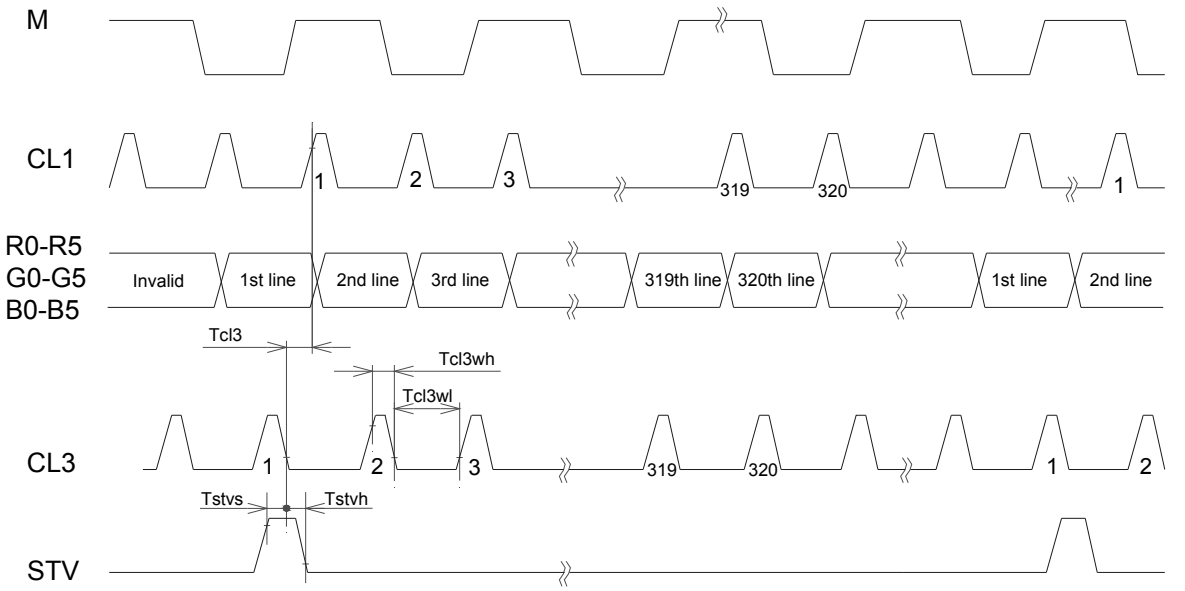


Fig.9.3 Vertical Timing Sequence for non Tcon

Note: 0.8xDVDD, 0.2xDVDD

9.3 INTERFACE TIMING SPECIFICATIONS

9.3.1 INTERFACE TIMING

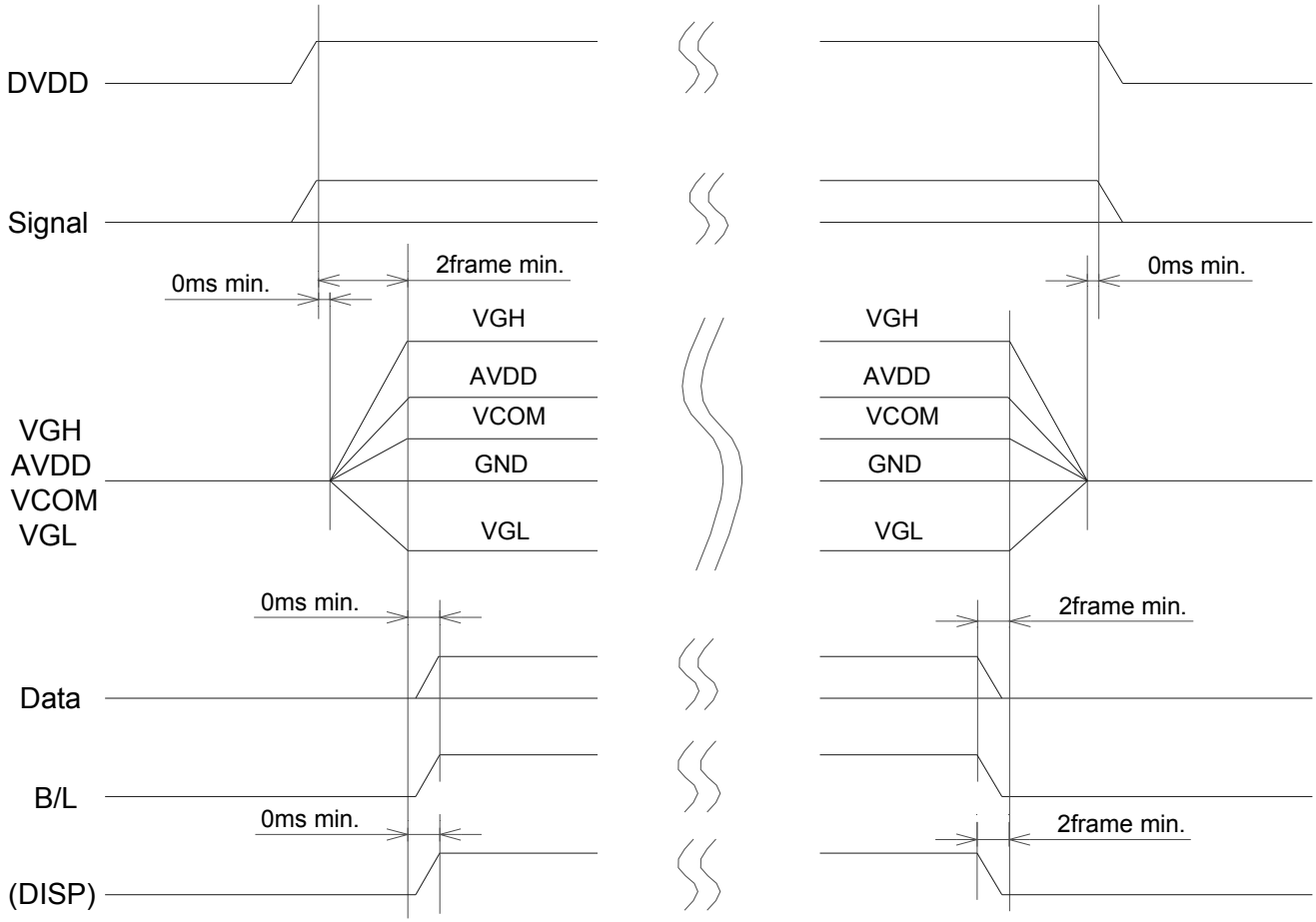
ITEM	MIN.	TYP.	MAX.	UNIT	SYMBOL
Vertical Total	-	327	-	Line	T0
Vertical Sync Width	1	1	-	Line	T1
Vertical Sync Start	-	322	-	Line	T2
Vertical Sync End	-	323	-	Line	T3
Vertical Blank Time	5	7	-	Line	T4
Vertical Display End	-	320	-	Line	T5
Horizontal Total	265	273	509	Pixel Clock	T6
Horizontal Sync Width	4	5	10	Pixel Clock	T7
Horizontal Sync Start	244	251	307	Pixel Clock	T8
Horizontal Sync End	248	256	317	Pixel Clock	T9
Horizontal Blank Time	25	33	269	Pixel Clock	T10
Horizontal Display End	-	240	-	Pixel Clock	T11

Note: Vertical total should be set to odd.

9.3.2 INTERFACE TIMING

	Item	Symbol	Min.	Typ.	Max.	Unit.	Remark
Source Driver	Clock cycle time	Trate	100	-	-	ns	-
	Clock low level width	Tcwl	35	-	-	ns	-
	Clock high level width	Tcwh	35	-	-	ns	-
	Data set up time	Tds	25	-	-	ns	-
	Data hold time	Tdh	25	-	-	ns	-
	Start pulse set up time	Tss	25	-	-	ns	-
	Start pulse hold time	Tsh	25	-	-	ns	-
	CL1 high level width	Tcl1wh	10	-	-	us	-
	CL1 start pulse	Tscl1	100	-	-	ns	-
	STH start pulse	Tssth	100	-	-	ns	-
	M set up time	Tms	50	-	-	ns	-
	M hold time	Tmh	50	-	-	ns	-
Gate Driver	CL3 cycle time	Tcl3	2	3	-	us	-
	CL3 high level width	Tcl3wh	2	-	-	us	-
	CL3 low level width	Tcl3wl	2	-	-	us	-
	STV set up time	Tstvs	250	-	-	ns	-
	STV hold time	Tstvh	250	-	-	ns	-

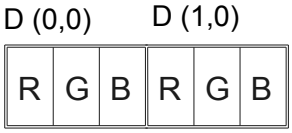
9.4 POWER SEQUENCE

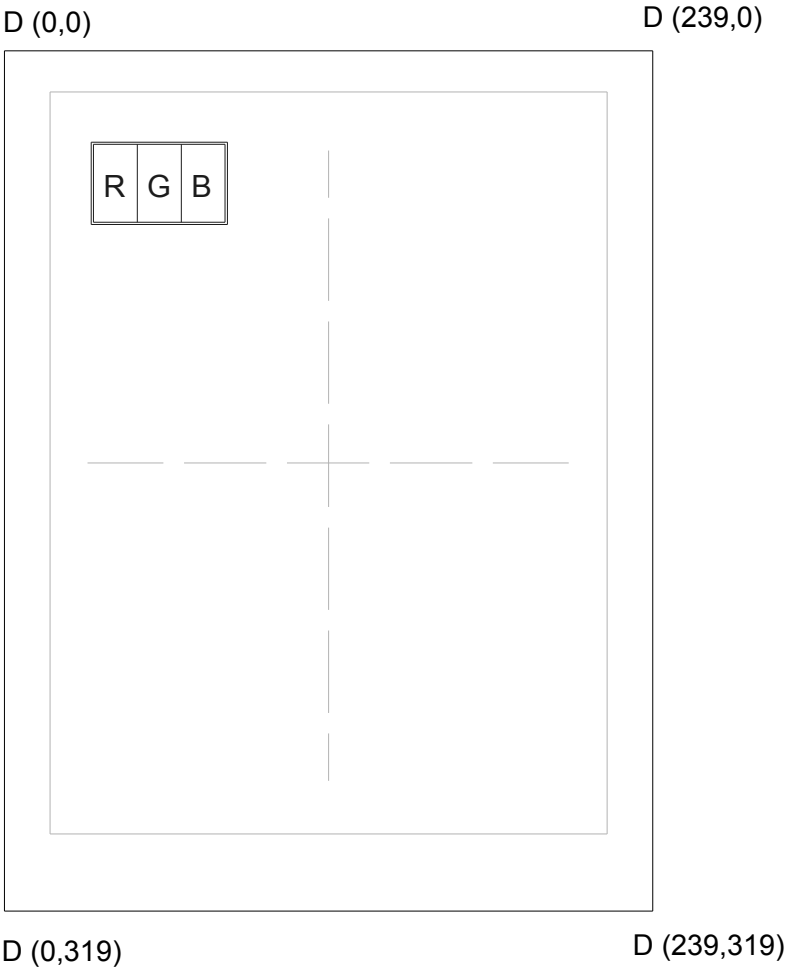


9.5 DATA INPUT for DISPLAY COLOR

Input color		Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	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

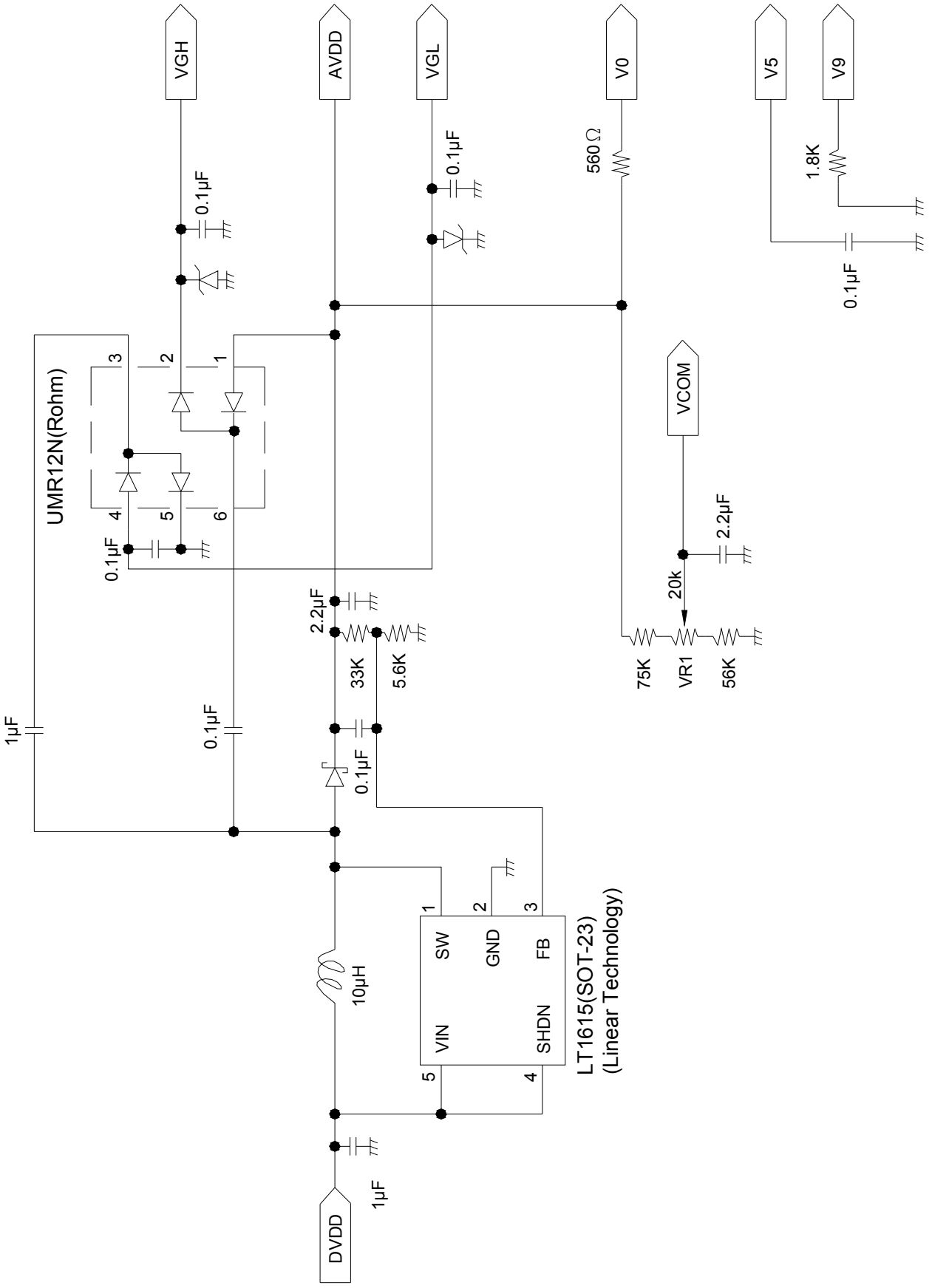
9.6 DATA ADDRESS





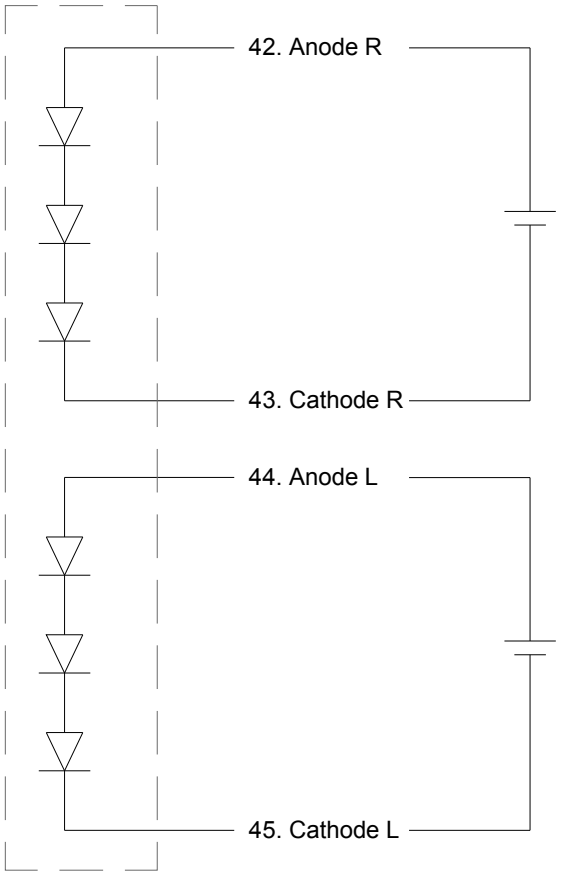
Top View

9.7 POWER SUPPLY CIRCUIT FOR LCD (REFERENCE ONLY)

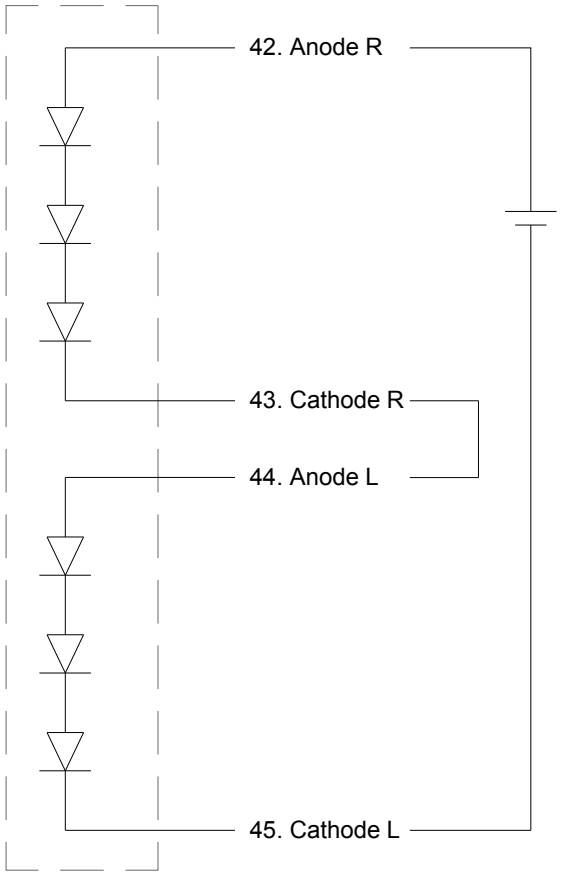


9.8 POWER SUPPLY CIRCUIT FOR LED BL (REFERENCE ONLY)

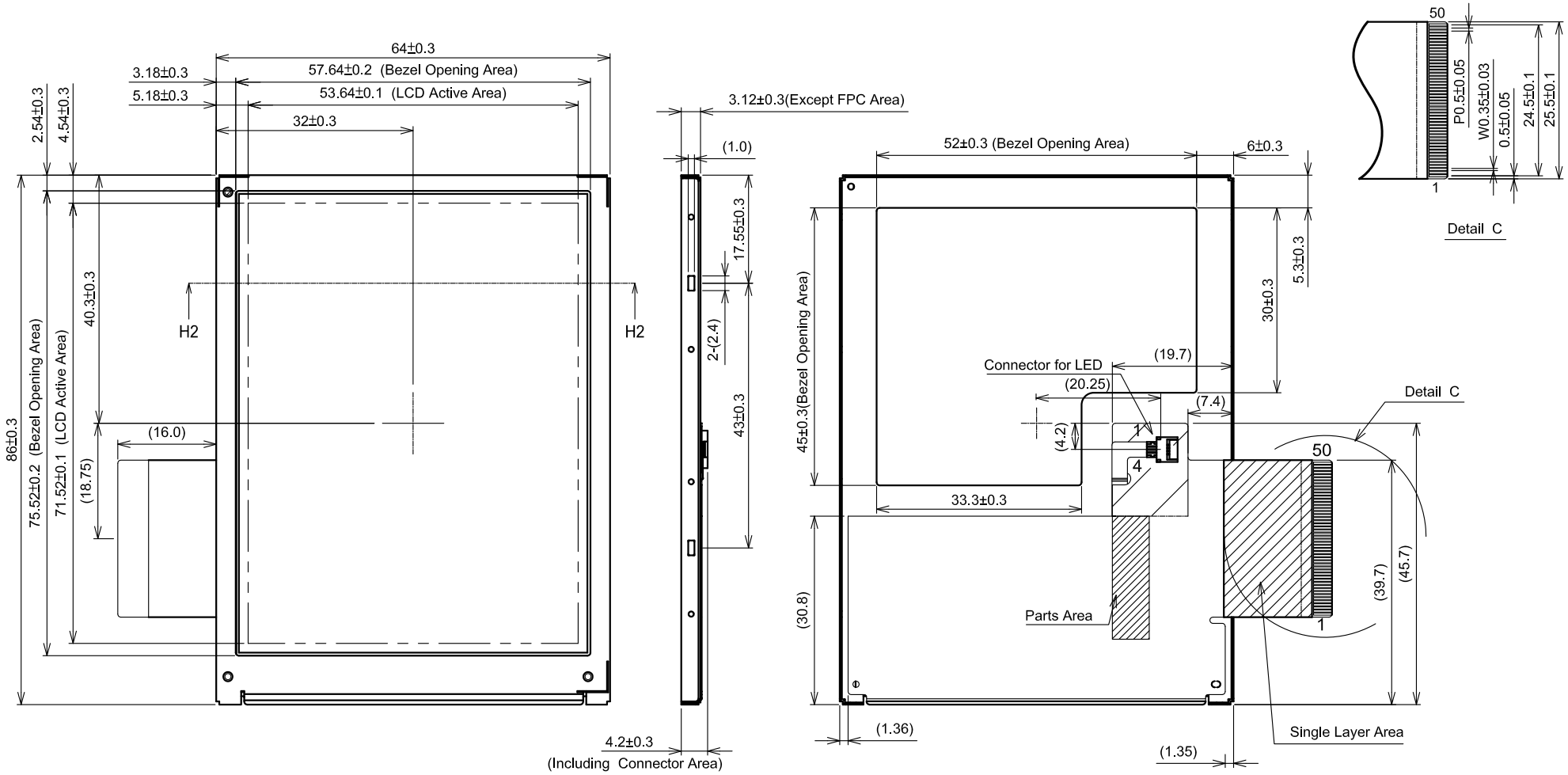
Example 1.
LED B/L



Example 2.
LED B/L



10. OUTLINE DIMENSIONS



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11. APPEARANCE STANDARD

The appearance inspection is performed in a 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.

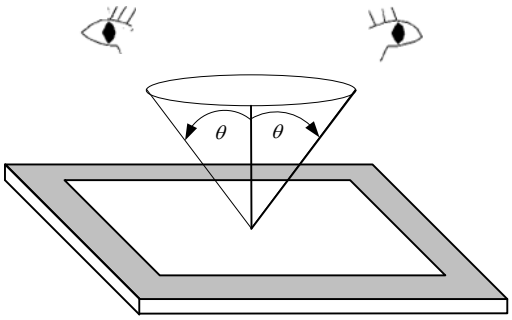


Fig. 11.1

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.

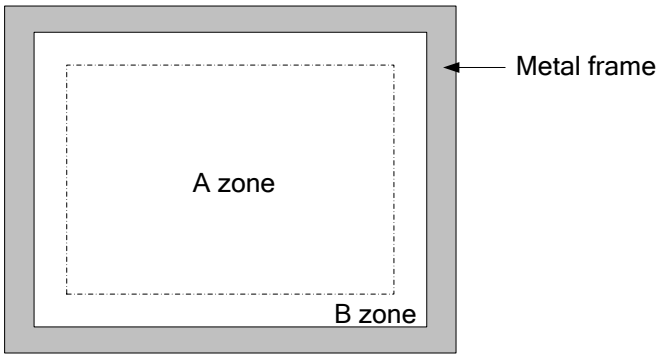


Fig. 11.2

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.

<table>
<tr><th>Item</th><th colspan="3">Criteria</th><th>Applied zone</th></tr>
<tr><td rowspan="4">Scratches</td><td>Length / L(mm)</td><td>Width / W(mm)</td><td>Maximum number Acceptable</td><td rowspan="4">A,B</td></tr>
<tr><td>L≦2.0</td><td>W≦0.03</td><td>Ignored</td></tr>
<tr><td>L≦2.0</td><td>0.03＜W≦0.05</td><td>4</td></tr>
<tr><td>2.0＜L</td><td>0.05＜W</td><td>None</td></tr>
<tr><td>Dent</td><td colspan="3">Serious one is not allowed.</td><td>A</td></tr>
<tr><td>Wrinkles in Polarizer</td><td colspan="3">Serious one is not allowed.</td><td>A</td></tr>
<tr><td rowspan="3">Bubbles on Polarizer</td><td colspan="2">Average diameter / D(mm)</td><td>Maximum number Acceptable</td><td rowspan="3">A</td></tr>
<tr><td colspan="2">D≦0.3</td><td>2</td></tr>
<tr><td colspan="2">0.3＜D</td><td>None</td></tr>
<tr><td rowspan="15">1) Stains
2) Foreign Materials
3) Dark Spot</td><td colspan="3">Filamentous (Line shape)</td><td rowspan="3">A,B</td></tr>
<tr><td>Length / L(mm)</td><td>Width / W(mm)</td><td>Maximum number Acceptable</td></tr>
<tr><td>L＜2.0</td><td>W≦0.05</td><td>4</td></tr>
<tr><td>L≦1.0</td><td>0.05＜W≦0.1</td><td>2</td></tr>
<tr><td colspan="3">Round (Dot shape)</td><td rowspan="6">A,B</td></tr>
<tr><td colspan="2">Average diameter / D(mm)</td><td>Maximum number acceptable</td></tr>
<tr><td colspan="2">D≦0.15</td><td>6</td></tr>
<tr><td colspan="2">0.15＜D≦0.2</td><td>4</td></tr>
<tr><td colspan="2">0.2＜D</td><td>None</td></tr>
<tr><td colspan="2">In total</td><td>Filamentous + Round=9</td></tr>
<tr><td colspan="3">Those wiped out easily are acceptable.</td></tr>
<tr><td rowspan="11">Dot-Defect
(Note 1)</td><td colspan="2">Type</td><td>Maximum number acceptable</td><td rowspan="11">A,B</td></tr>
<tr><td rowspan="3">Sparkle mode</td><td>1 dot</td><td>4</td></tr>
<tr><td>2 dots</td><td>2(sets)</td></tr>
<tr><td>In total</td><td>4</td></tr>
<tr><td rowspan="3">Black mode</td><td>1 dot</td><td>4</td></tr>
<tr><td>2 dots</td><td>2(sets)</td></tr>
<tr><td>In total</td><td>4</td></tr>
<tr><td>Sparkle mode
& Black mode</td><td>2 dots</td><td>2(sets)</td></tr>
<tr><td colspan="2">In total</td><td>6</td></tr>
</table>

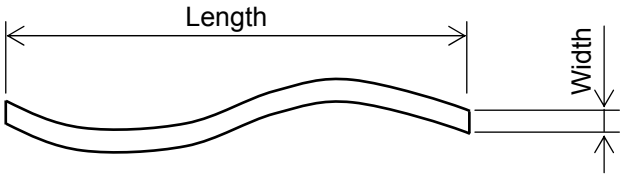
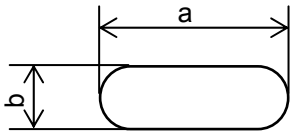


Fig 11.3



Average diameter = $\frac{a+b}{2}$

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, showing black pattern, the dot's brightness must be over 30% brighter than others.
- For dark dot-defect, showing white pattern, the dot's brightness must be under 70% darker than others.
- 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.

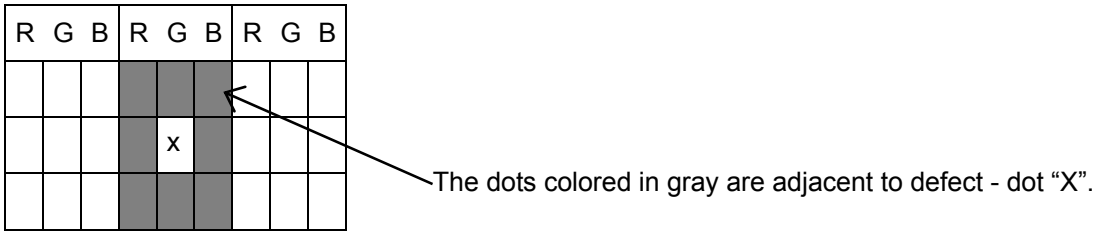


Fig 11.5

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 $1{,}96 \times 10^4$ 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 $\pm$ 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 10℃~35℃ 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.13.1. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 6 digits are the serial number.

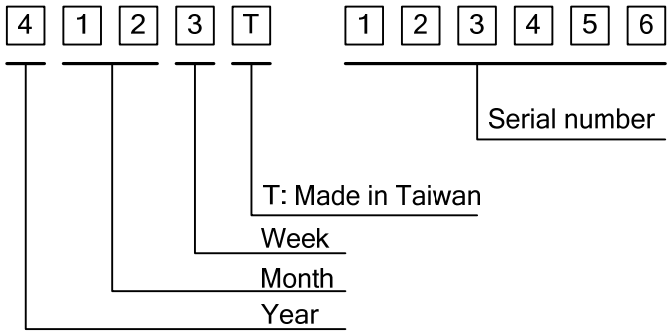


Fig. 14.1

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

Year	Lot Mark
2014	4
2015	5
2016	6
2017	7
2018	8

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.

REV.No	ITEM	REMARKS
A	-	-
B	Connectors Changed	PCN0804
C	LCD Production Line Changed	PCN0883

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

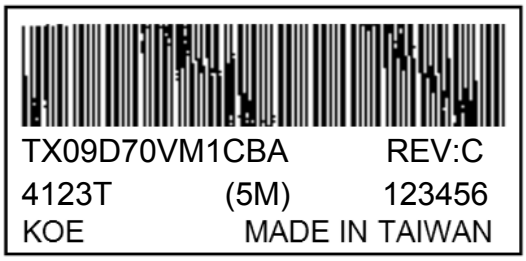


Fig. 13.2