

HITACHI

May.30 , 2007

No. 7B64LTD -2269-1

TENTATIVE

LIQUID CRYSTAL DISPLAY MODULE TECHNICAL DATA

TX09D41VM3CPA

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RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3.GENERAL DATA

The specifications are applied to the following TFT-LCD (Transmissive with micro reflectance) module with Back-light unit.

Note : Driving circuit for LED and power unit is not built in this module.

(1) Part Name	TX09D41VM3CPA
(2) Module Dimensions	64.0(W)mm x 86.0(H)mm x 4.0(D)mm typ. (Except FPC Area)
(3) Effective Display Area	53.64(W)mm x 71.52(H)mm (Diagonal:9cm)
(4) Dot Pitch	0.0745mm x 3(R,G,B)(W) x 0.2235(H)mm
(5) Resolution	240 x 3(R,G,B)(W) x 320 (H) dots
(6) Color Pixel Arrangement	R,G,B Vertical Stripe
(7) LCD Type	Transmissive Color TFT LCD (Normally White)
(8) Display Type	Active Matrix
(9) Number of Colors	262 ^K Colors (R,G,B 6 Bit Digital each)
(10) Backlight	Light Emitting Diode (LED) x 6
(11) Weight	44g
(12) Interface	50 pin C-MOS
(13) Viewing Direction	3 O'clock (The direction it's hard to be discolored)
(14) Touch Panel	Resistance type. The surface is anti-glare.

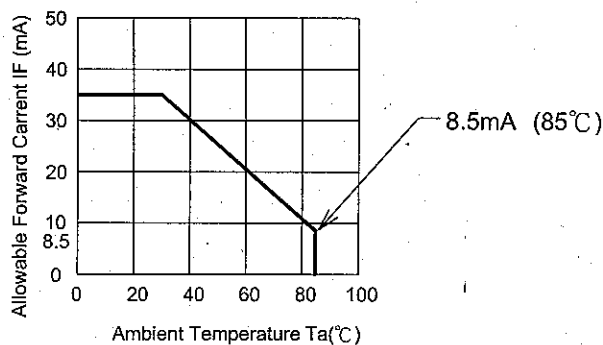
4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

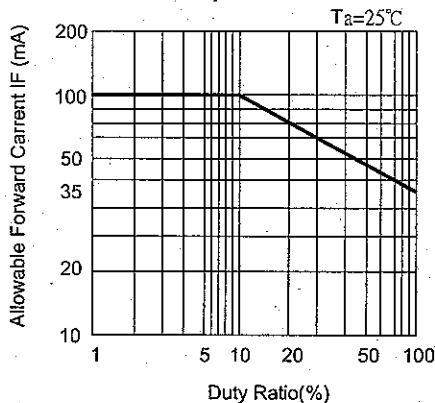
ITEM		SYMBOL	MIN.	MAX.	UNIT	REMARKS
Power Supply for Logic		VCC	-0.3	3.6	V	
Power Supply Voltage for Source Driver and Vcom		VDH	-0.3	6.0	V	
Input Voltage		V _I	0	VCC	V	(1)
Gate	Power Supply for Gate	High	V _{GH}	-0.3	V _{GL} +20	V
		Low	V _{GL}	-9	0.3	V
LED	Forward Current		I _F	-	35	mA (2)
	Pulse Forward Current		I _{FP}	-	100	mA (3)
	Reverse Voltage		V _R	-	5	V
Static Electricity		-	-	±15	kV	(4) (5)

Note (1) Hsync, Vsync, DCLK, R0~R5, G0~G5, B0~B5

(2)



(3) I_{FP} Conditions : pulse width ≤ 10 ms and Duty $\leq 1/10$



(4) Make certain you are grounded when handling LCM.

(5) Testing condition : 200pF - 0 Ω , 25° C - 70%RH.

4.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF TOUCH PANEL

ITEM	SPECIFICATION	UNIT	CONDITION	REMARKS
Supply Voltage	7.0	V	DC	
Endurance Voltage	25	V	DC	(Note 1)

Note 1 : Waiting 1 minute.

4.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		REMARKS
	Min.	Max.	Min.	Max.	
Ambient Temperature	-20°C	70°C	-30°C	80°C	(Note 2,3,6,7,9,10)
Humidity	(Note 1)		(Note 1)		Without condensation
Vibration	-	2.45m/s ² (0.25G)	-	11.76m/s ² (1.2G)	(Note 4,5)
Shock	-	29.4m/s ² (3G)	-	490m/s ² (50G)	(Note 5,8)
Corrosive Gas	Not Acceptable		Not Acceptable		

Note 1 : $T_a \leq 40^\circ\text{C}$: 85%RH max.

$T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C .

Note 2 : For storage condition T_a at $-30^\circ\text{C} < 48\text{h}$, at $80^\circ\text{C} < 100\text{h}$.

For operating condition T_a at $-20^\circ\text{C} < 100\text{h}$

Note 3 : Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Note 4 : 5Hz~100Hz(Except resonance frequency)

Note 5 : This LCM will resume normal operation after finishing the test.

Note 6 : The response time will be slower as low temperature.

Note 7 : Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at $+25^\circ\text{C}$.

Note 8 : Pulse Width : 10ms

Note 9 : This is panel surface temperature , not ambient temperature.

Note 10 : If LED is drive by high current , the life time of LED will be reduced , also high temperature and high humidity.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS OF LCD

Ta=25°C, VSS=0V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for logic	VCC	-	2.5	3.0	3.3	V
Power Supply Voltage for Source Driver and Vcom	VDH	-	8.3	8.45	8.7	
Input voltage for logic (Note 1)	Vi	"H" level	0.8VCC	-	VCC	V
		"L" level	VSS	-	0.2VCC	
Power Supply for LCD	VGH	-	16.2	16.5	17.0	V
	VGL		-8.35	-8.05	-8.0	
	VCOM		VCOM-VSS	-	2.4	
Power Supply Current (Note 2)	ICC	VCC-VSS=3.0V	-	0.22	-	mA
	IDH	VDH-VSS=8.45V	-	3.3	-	
	IGH	VGH-VSS=16.5V	-	0.23	-	
	IGL	VGL-VSS=-8.05V	-	0.17	-	
Vsync Frequency	fV	-	54	60	68	Hz
Hsync Frequency	fH	-	18.57	20.77	22.73	kHz
DCLK Frequency	fCLK	-	5.0	5.6	6.5	MHz

Note 1 : DCLK, RD0~RD5, GD0~GD5, BD0~BD5.

Note 2 : fV=(60)Hz, Ta=25°C, Pattern used as display pattern : Black.

Note 3 : Need to made sure of flickering and rippling of display when setting the frame frequency in your set.

5.2 ELECTRICAL CHARACTERISTICS OF BACK LIGHT

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARKS
LED Input Voltage	VF	IF=20mA	-	3.2	3.5	V	LED / Part
LED Forward Current	IF	-	-	20	25	mA	LED / Part
LED Reverse Current	IR	VR=5V	-	-	50	μA	LED / Part

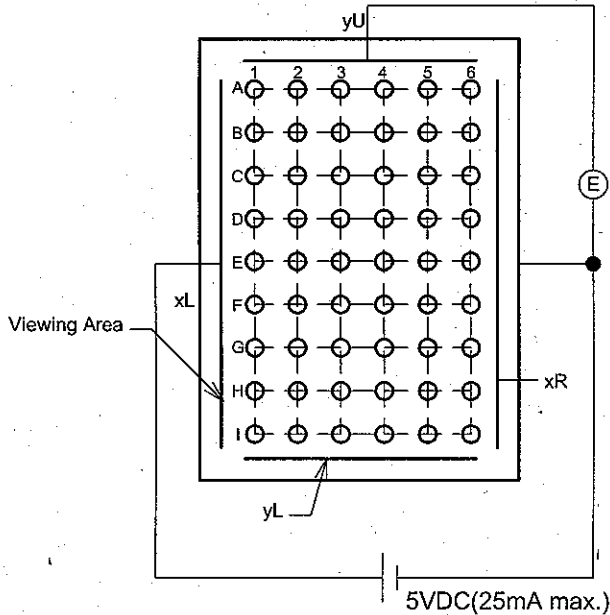
5.3 ELECTRICAL CHARACTERISTICS OF TOUCH PANEL

ITEM		SPECIFICATION	UNIT
Resistance between Terminal	xR - xL	200 - 650	ohm
	yU - yL	250 - 500	ohm
Insulance Resistance (Note 1)	x - y	10M min.	ohm
Linearity (Note 2,3)	x	1.5 max.	%
	y	1.5 max.	%
Chattering		10 max.	ms

Note 1 : Operating Voltage 25V DC.

Note 2 : Test Condition.

(a) Y axis linearity testing method (with tip radius 0.8, polaycetal pen). $V_{xL-xR}=5V$, $V_{OUT}=V_{yU}$.

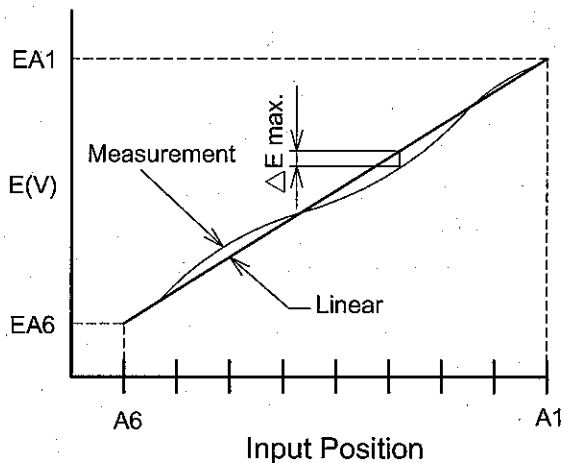


(b) X axis linearity method $V_{yU-yL}=5V$, $V_{OUT}=V_{xL}$.

Note 3 : Calculation

(a) Y axis linearity

$$\text{Linearity} = \frac{\Delta E \text{ max.}}{EA1 - EA6} \times 100(\%)$$



5.4 MECHANICAL CHARACTERISTICS OF TOUCH PANEL

ITEM	SPECIFICATION	UNIT	REMARKS
Pen Input Pressure	0.1 - 1.3	N	R0.8mm Polyacetal pen
Surface Hardness	3H min.	-	JIS K 5400

6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS OF LCD (BACK LIGHT ON)

Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE	
Brightness	B	$\phi=0^\circ \theta=0^\circ$	160	200	-	cd/m ²	(1)	
Uniformity	-	$\phi=0^\circ \theta=0^\circ$	70	-	-	%	(2),(3),(4)	
Viewing Angle	θx	$\phi=0^\circ, K \geq 5.0$	-	50	-	deg	(5),(6)	
	$\theta x'$	$\phi=180^\circ, K \geq 5.0$	-	80	-			
	θy	$\phi=90^\circ, K \geq 5.0$	-	80	-			
	$\theta y'$	$\phi=270^\circ, K \geq 5.0$	-	80	-			
Contrast Ratio	K	$\phi=0^\circ \theta=0^\circ$	180	300	-	-	(4)	
Response Time (rise-fall)	tr+tf	$\phi=0^\circ \theta=0^\circ$	-	(30)	-	ms	(8)	
Color Tone (Primary Color)	Red	x	$\phi=0^\circ \theta=0^\circ$	0.54	0.59	0.64	-	(4)
		y		0.29	0.34	0.39	-	
	Green	x		0.31	0.36	0.41	-	
		y		0.51	0.56	0.61	-	
	Blue	x		0.10	0.15	0.20	-	
		y		0.08	0.13	0.18	-	
	White	x		0.28	0.33	0.38	-	
		y		0.29	0.34	0.39	-	

(Measurement condition : HITACHI standard)

Note (4)~(7) : See page 6-2/2

Note 1 : Active area center

Note 2 : Driving Condition

Display Pattern : White Raster

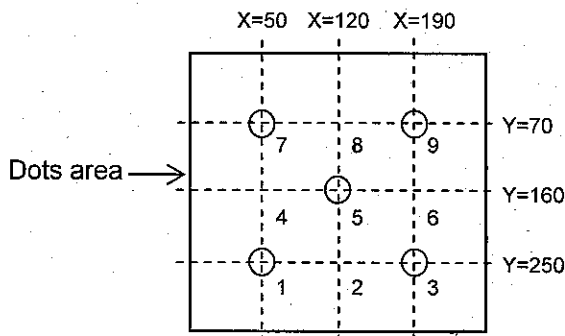
LED Current : 20mA / Part

Measurement of the following

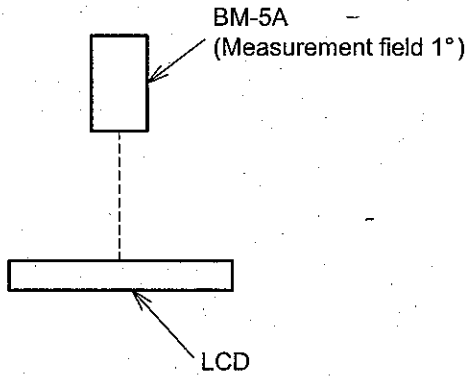
5 places on the display.

Note 3 : Definition of the brightness uniformity

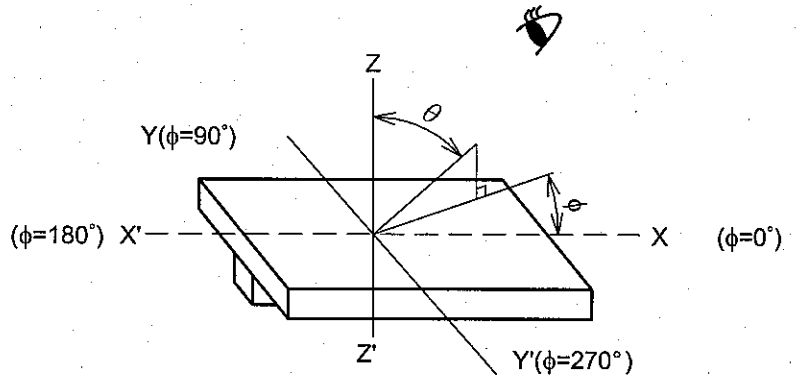
$$\left(\frac{\text{Min. brightness}}{\text{Max. brightness}} \right) \times 100$$



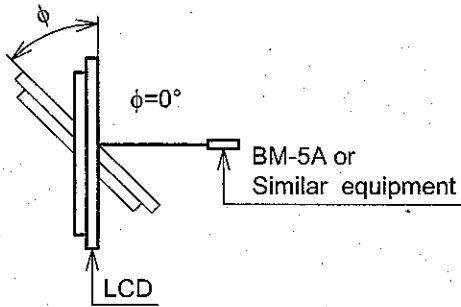
Note 4 : Measurement Condition



Note 5 : Definition of θ and ϕ (Normal)
Viewing direction



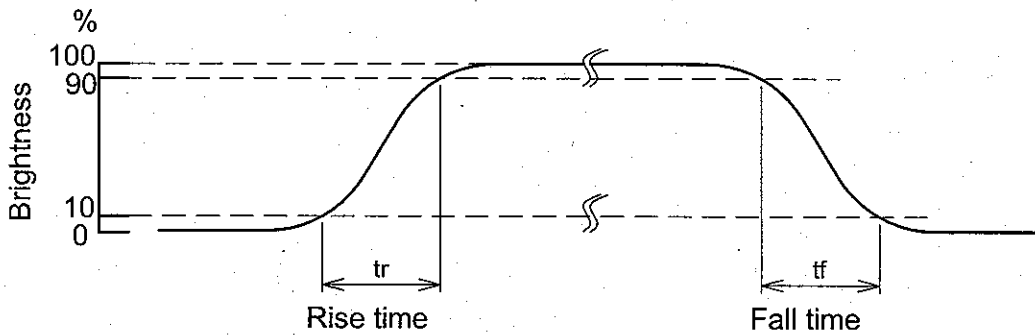
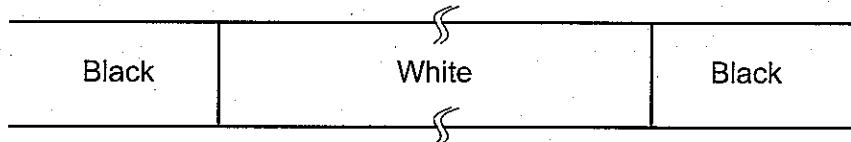
Note 6 : Definition of Viewing angle



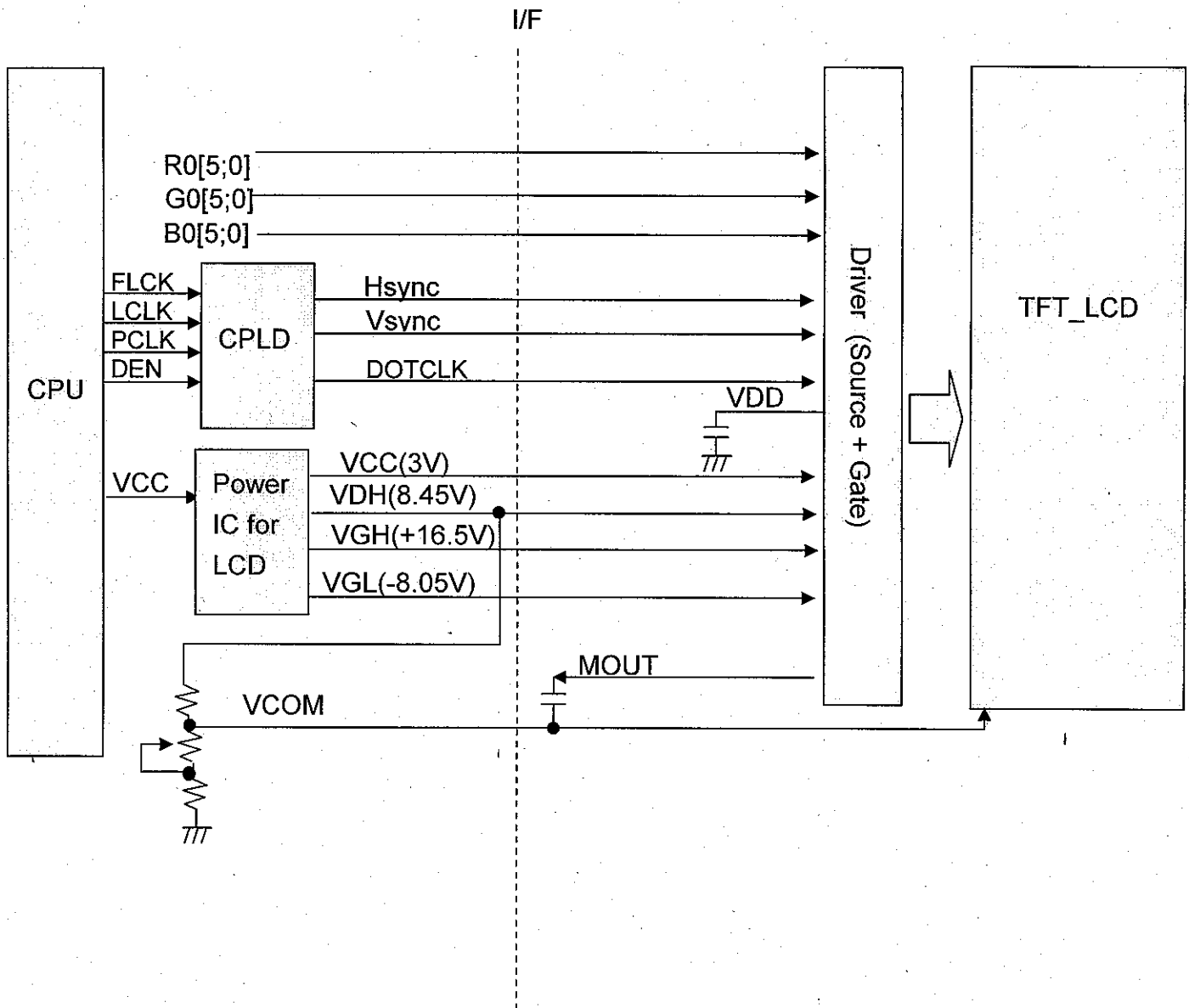
Note 7 : Definition of contrast "K"

$$K = \frac{\text{White Brightness}}{\text{Black Brightness}}$$

Note 8 : Definition optical response time



7. BLOCK DIAGRAM



8. INTERFACE TIMING

8.1 INTERFACE TIMING

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
DOTCLK cycle time	tCYCD	100	-	-	ns	1 trans
		50	-	-		3 trans
DOTCLK low level pulse width	PWDL	20	-	-	ns	-
DOTCLK high level pulse width	PWDH	20	-	-	ns	-
VSYNC setup time	tVSYNCS	0	-	1	clock	-
HSYNC setup time	tHSYNCS	0	-	1	clock	-
(ENABLE setup time)	tENS	20	-	-	ns	*
(ENABLE hold time)	tENH	20	-	-	ns	*
RGB data setup time	TPDS	20	-	-	ns	-
RGB data hold time	TPDH	20	-	-	ns	-
DOTCLK/VSYNC/HSYN C rising edge, falling edge times	trgbr / trgbf	-	-	20	ns	-

*for the reference

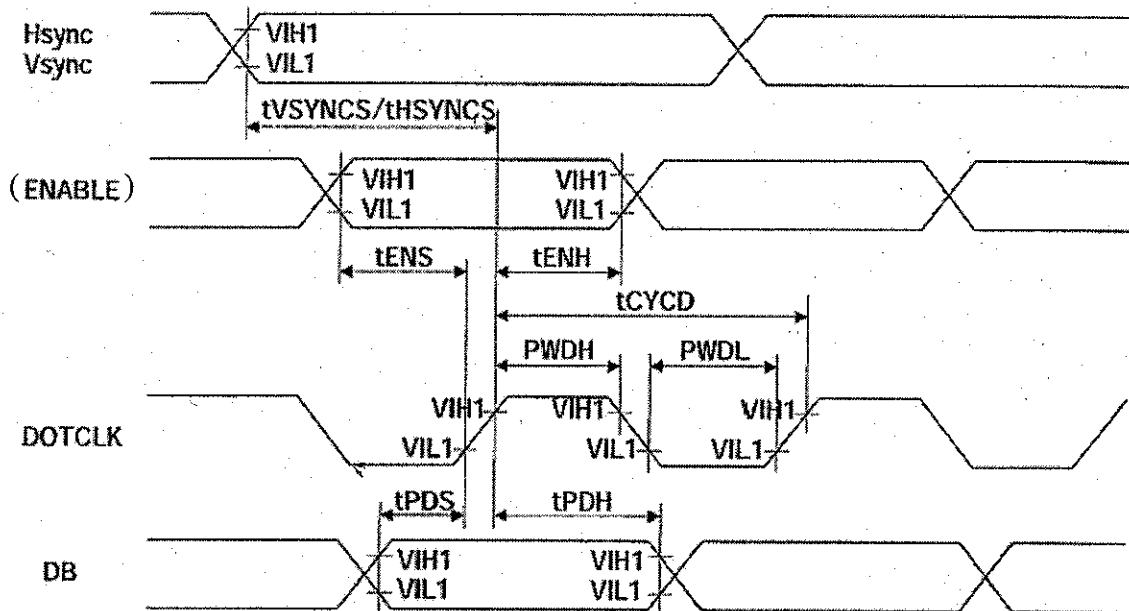


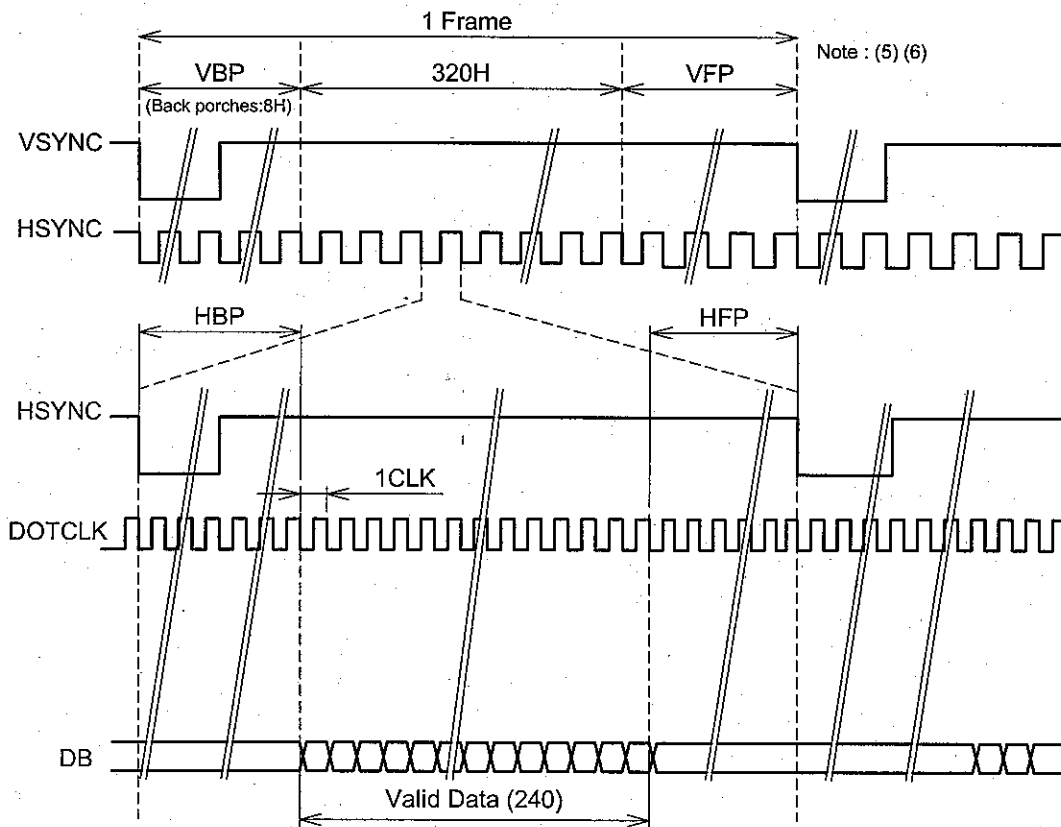
Fig1. RGB Interface timing

8.2 TIMING CHART

	SYMBOL	MIN.	TYP.	MAX.	UNIT
Back porch for Horizontal	HBP	-	12	-	Clock
Front porch for Horizontal	HFP	15	18 Note(1)	21	Clock
Back porch for Vertical	VBP	-	8 Note(3)	-	HSYNC
Front porch for Vertical	VFP	17	(20) Note(2)	22	HSYNC

Note(1) : (DOTCLK total) - ((Valid data period for Horizontal) + (HBP))

(2) : (HSYNC total) - ((Active Area period) + VBP)



(3) Note about VSYNC timing setting

Check the timing chart of VSYNC and HSYNC , If timing setting is not set as fig1, it must be set as fig2 .

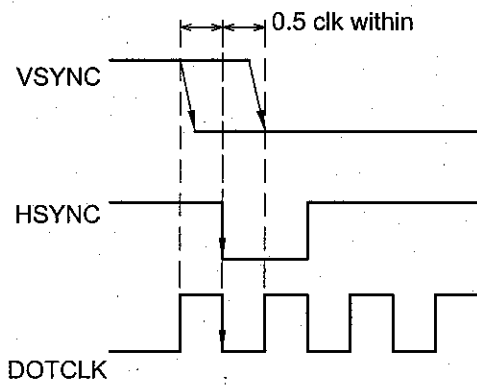


fig1. VSYNC timing

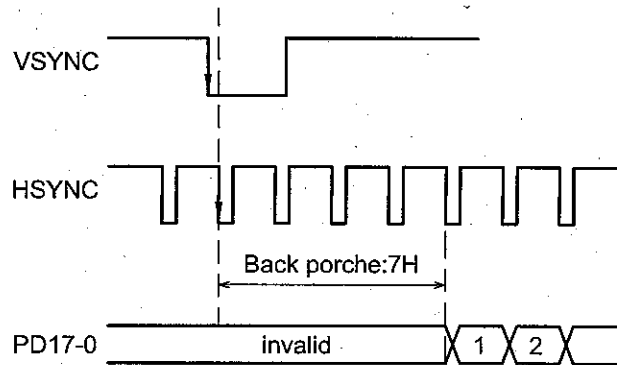
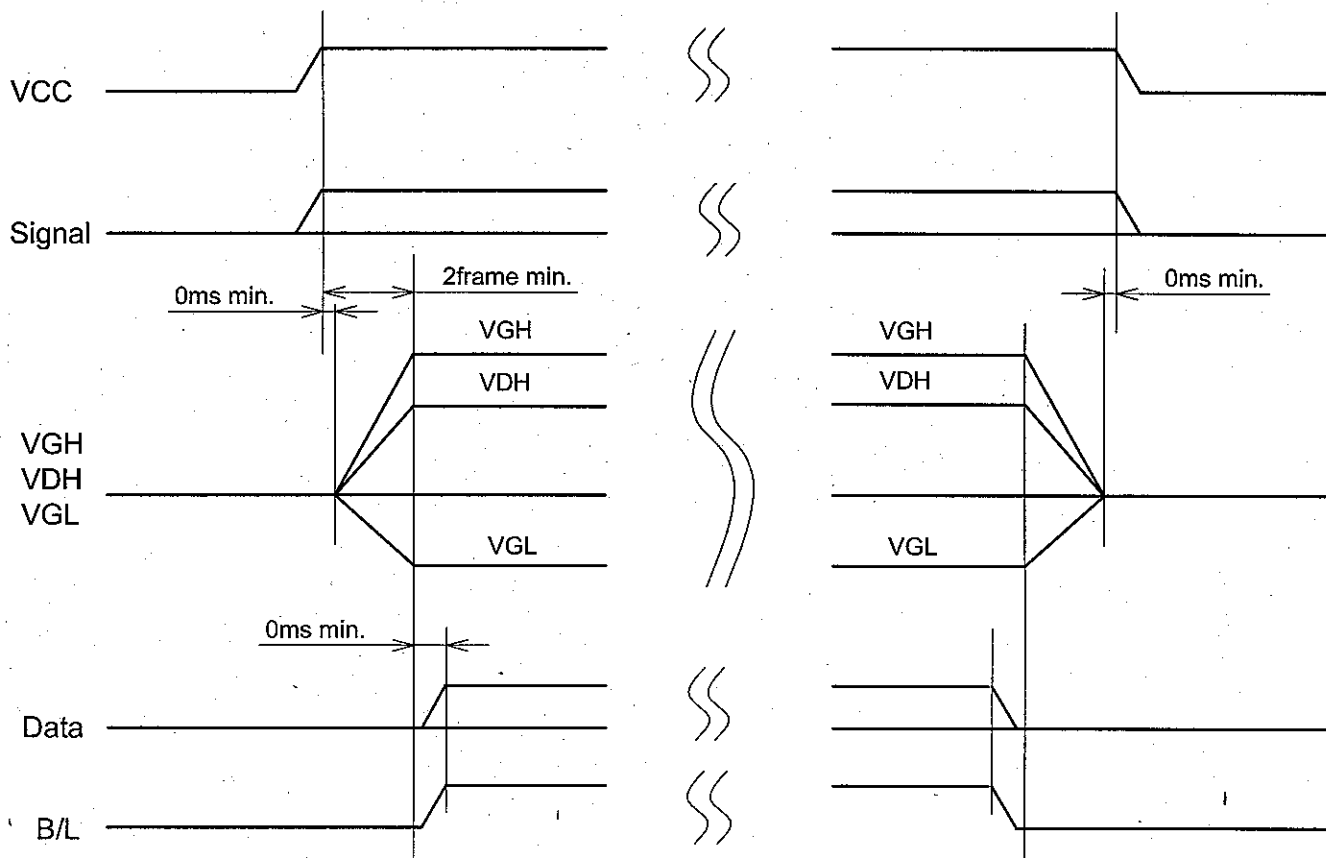


fig2. Vertical back porch regulation

- (4) The DOTCLK signal must be supplied consecutively.
- (5) Front and back porches (VBP , VFP) must be set before and after the display operation period.
- (6) The front porch period continues until the next input of VSYNC signal.

8.3 POWER ON/OFF SEQUENCE

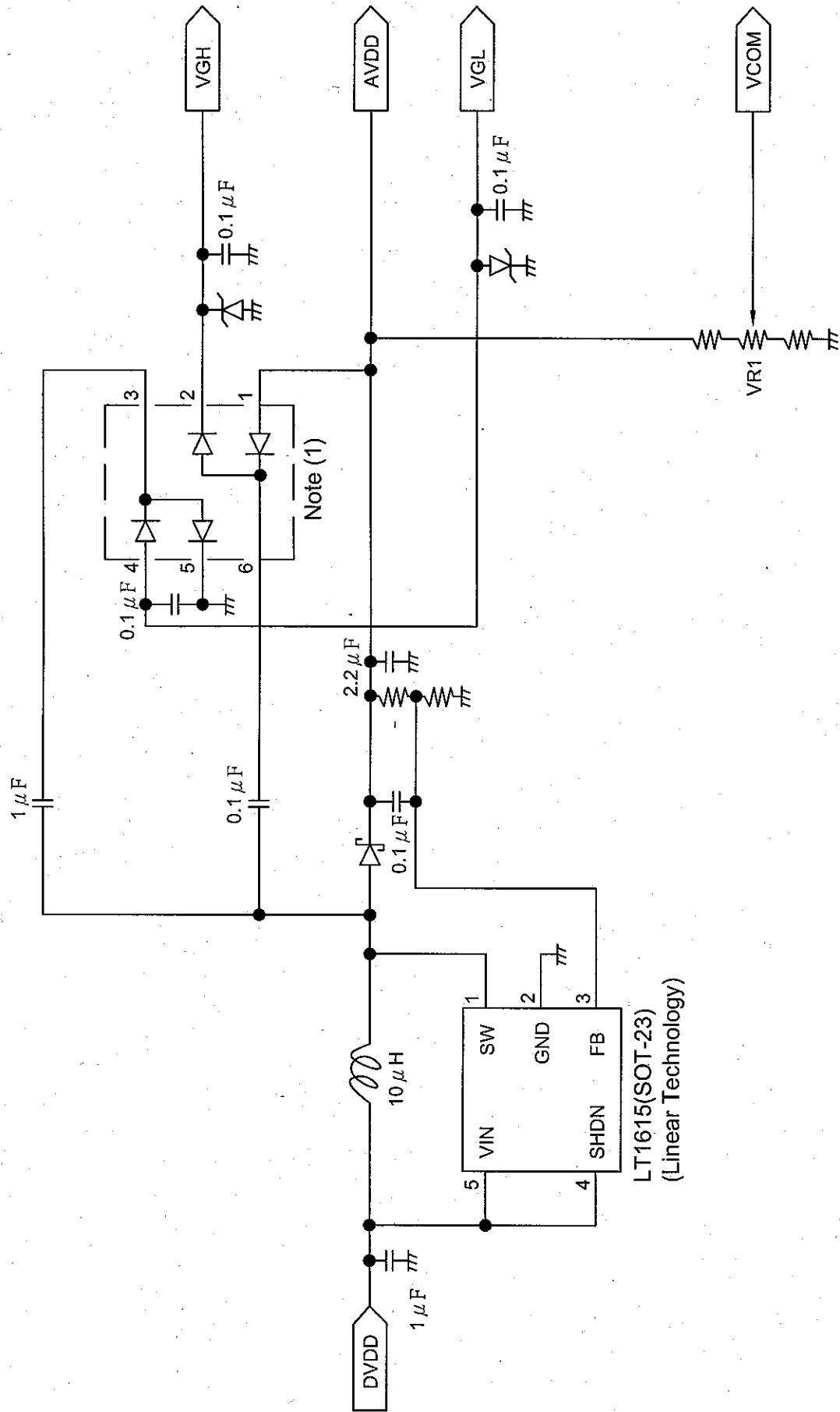


8.4 RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT DATA

8.4.1 Display Colors

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(0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(0)	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(62)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(61)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(2)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(0)	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(62)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(61)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(2)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(0)	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(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

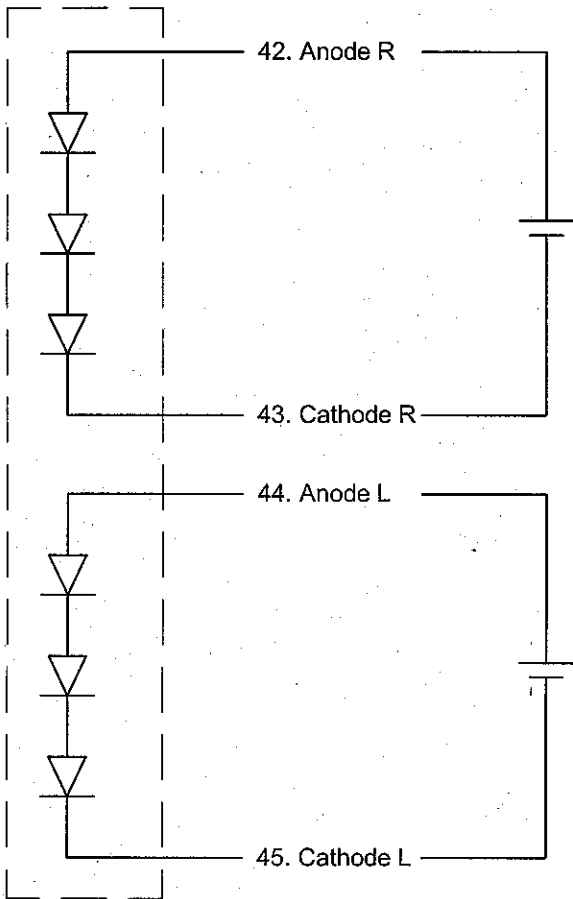
8.5 POWER SUPPLY CIRCUIT FOR LCD (REFERENCE ONLY)



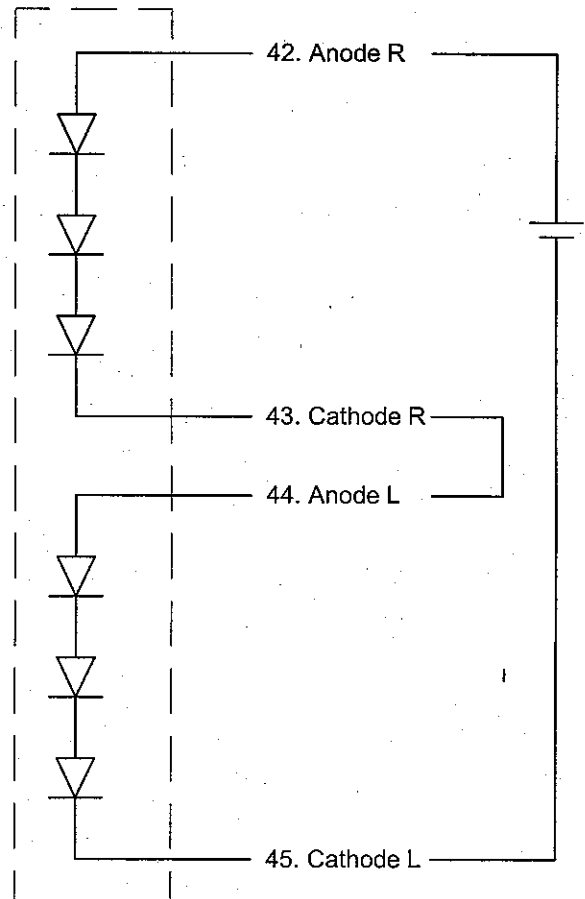
Note 1 : Must use shottky barrier diode, and forward voltage is 0.4V (typ.)

8.6 POWER SUPPLY CIRCUIT FOR LED BL (REFERENCE ONLY)

Example 1.
LED B/L



Example 2.
LED B/L



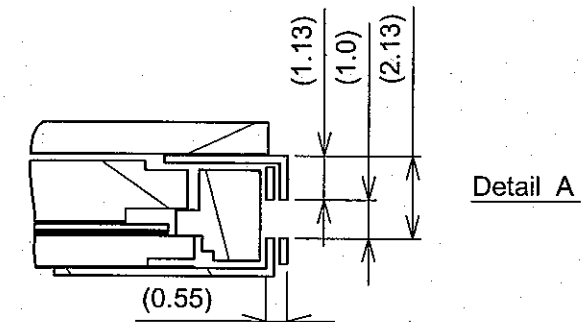
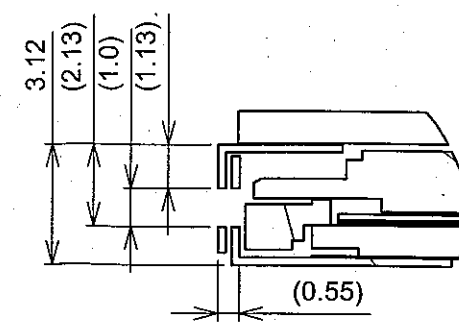
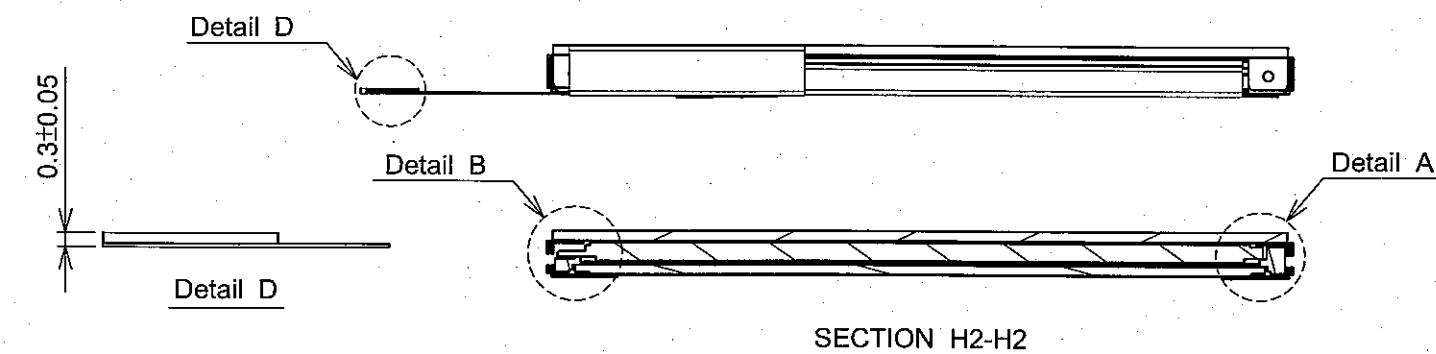
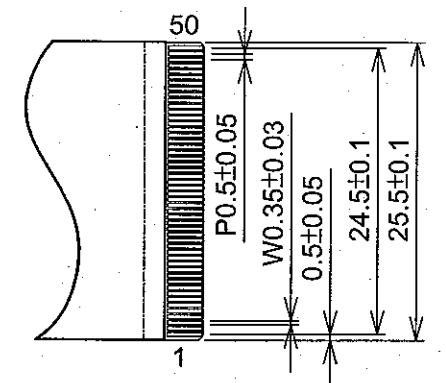
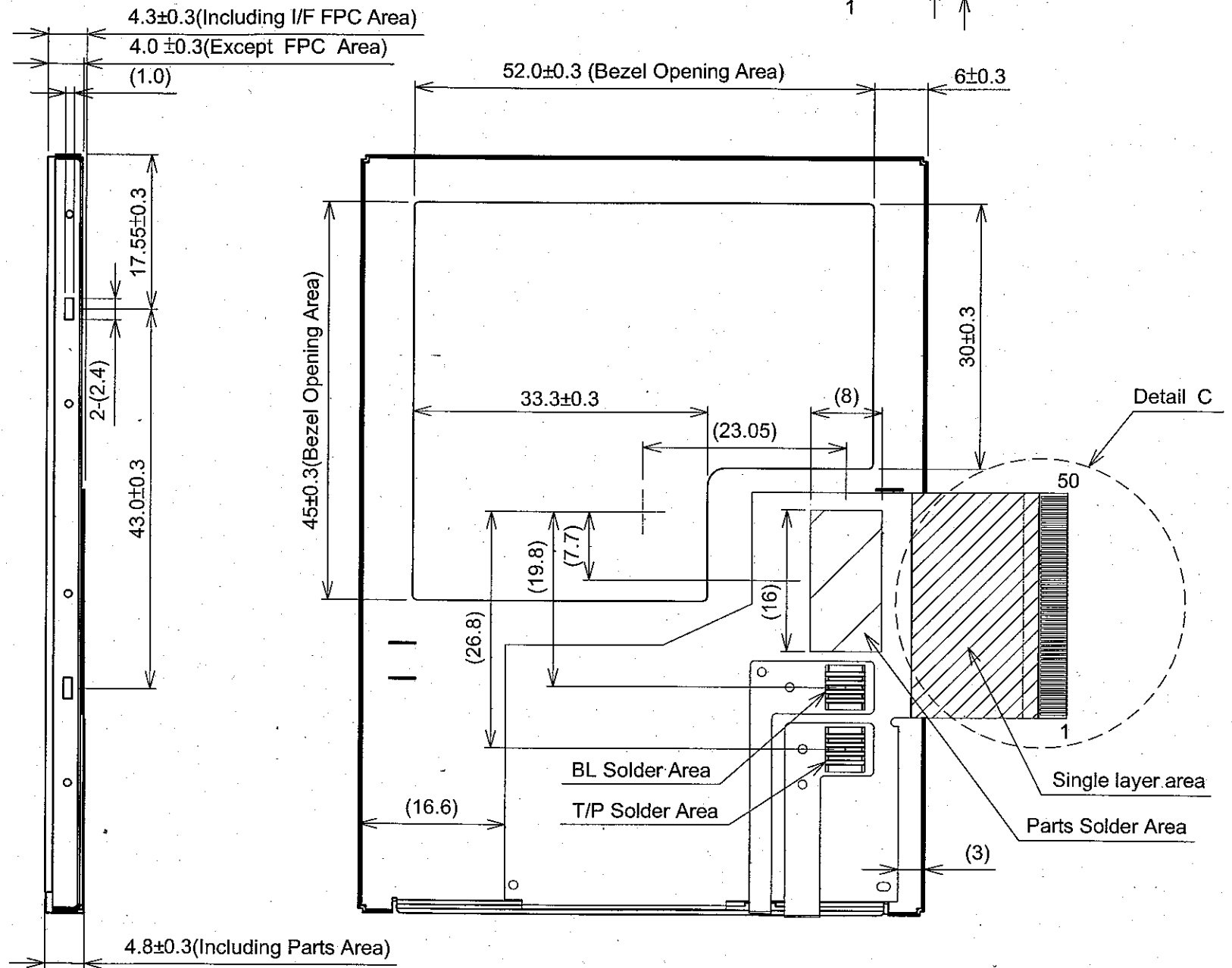
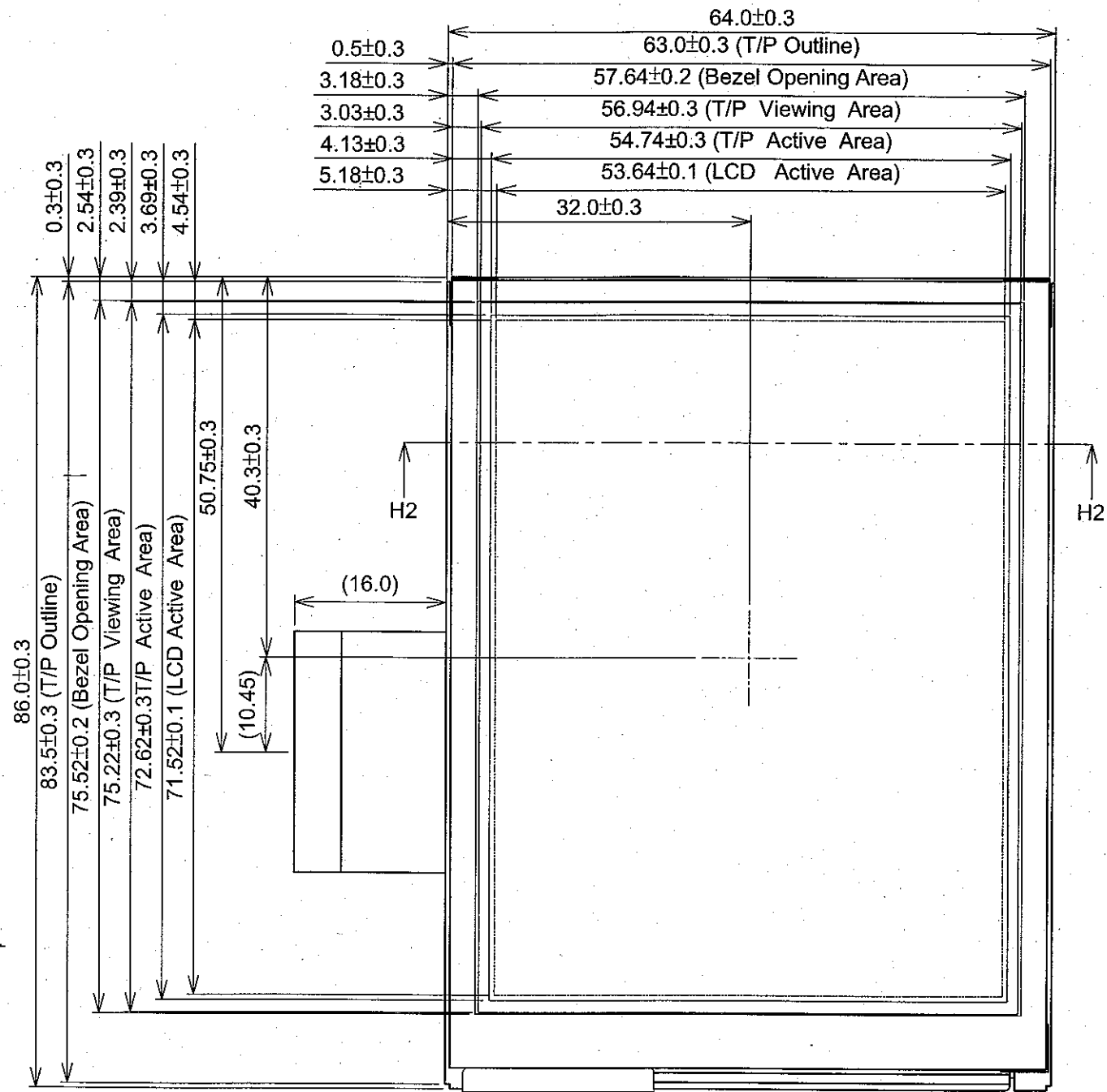
8.7 INTERNAL PIN CONNECTION

Suitable connector : FH12-50S-0.5P

No	SYMBOL	FUNCTION
1	VGH	Power Supply for Gate Driver (High)
2	NC	No Connection by FPC Side
3	NC	No Connection by FPC Side
4	NC	No Connection by FPC Side
5	GND	Ground
6	VGL	Power Supply for Gate Driver (Low)
7	VSS	Ground
8	Hsync	Horizontal Sync Signal
9	R0	Red Data (LSB)
10	R1	Red Data
11	R2	Red Data
12	R3	Red Data
13	R4	Red Data
14	R5	Red Data (MSB)
15	G0	Green Data (LSB)
16	G1	Green Data
17	G2	Green Data
18	G3	Green Data
19	G4	Green Data
20	G5	Green Data (MSB)
21	B0	Blue Data (LSB)
22	B1	Blue Data
23	B2	Blue Data
24	B3	Blue Data
25	B4	Blue Data

No	SYMBOL	FUNCTION
26	B5	Blue Data (MSB)
27	NC	No Connection by FPC Side
28	Vsync	Vertical Sync Signal
29	NC	No Connection by FPC Side
30	DOTCLK	Dot Clock Signal
31	NC	No Connection by FPC Side
32	NC	No Connection by FPC Side
33	VDH	Power Supply for Source Driver
34	VDH	Power Supply for Source Driver
35	NC	No Connection by FPC Side
36	NC	No Connection by FPC Side
37	VCC	Power Supply for Logic
38	VCC	Power Supply for Logic
39	VCOM	Common Voltage
40	VCOM	Common Voltage
41	VSS	Ground
42	Anode R	LED Power Supply (+)
43	Cathode R	LED Power Supply (-)
44	Anode L	LED Power Supply (+)
45	Cathode L	LED Power Supply (-)
46	VSS	Ground
47	xR	Touch Panel Right Side
48	yL	Touch Panel Lower Side
49	xL	Touch Panel Left Side
50	yU	Touch Panel Upper Side

9.DIMENSIONAL OUTLINE



Scale : NTS
Unit : mm