



HannStar Display Corp.

Document Title	HSD150PK14-A		
Document No.			

HannStar Product Information

Model : **HSD150PK14**
-AXX

(**AXX:sub model code**)

- Note: 1. The information contained herein is tentative and may be changed without prior notices.
2. Please contact HannStar Display Corp. before designing your product based on this module specification.
3. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.



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Record of Revisions

Rev.	Date	Description of change
1.0	Jan14, 2004	● HSD150PK14-A Tentative specification was first issued.



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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD150PK14-A is a color active matrix thin film transistor (TFT) liquid crystal display(LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 15.0 inch diagonally measured active display area with SXGA + resolution (1050 vertical by 1400 horizontal pixel array) and can display up to 262,144 colors.

1.2 Features

- 15.0 SXGA+ for Notebook PC
- 2-ch LVDS interface system
- Compatible with SPWG style-B standard
- Input timing: DE mode

1.3 Applications

- Notebook PC
- Desktop Monitor
- Display terminals for AV applications
- Display terminals for industrial applications

1.4 General information

Item	Specification	Unit
Outline Dimension	317.3 x 242.0 x 6.3 (Typ.)	mm
Display area	304.5(H) x 228.375(V)	mm
Number of Pixel	1400(H) x1050(V)	pixels
Pixel pitch	0.2175(H) x 0.2175(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display color	6 Bits / 262,144	colors
Display mode	Normally white	
Surface treatment	Antiglare, Hard-Coating(3H)	
Weight	590 (Typ.)	g
Back-light	Single CCFL (Side-Light type)	
Input signal	2-ch LVDS with EDID(following SPWG)	



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1.5 Mechanical Information

	Item	Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	316.8	317.3	317.8	mm
	Vertical(V)	241.5	242.0	242.5	mm
	Depth(D)	—	6.0	6.5	mm
Weight (Without inverter)		—	590	605	g
Torque of customer screw hole		—	—	2.0	Kgf•Cm



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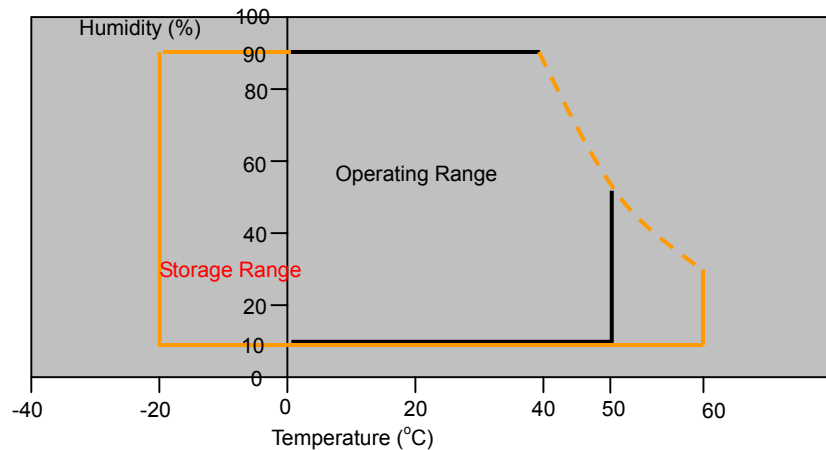
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2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Absolute Rating of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	°C	
Operating temperature	T_{OPR}	0	50	°C	(1)
Vibration(non-operating)	V_{NOP}	—	1.5	G	(2)
Shock(non-operating)	S_{NOP}	180	—	G	(3)
Storage humidity	H_{STG}	10	90	%RH	(3)
Operating humidity	H_{OP}	10	80	%RH	(4)
Low pressure(operating)	P_{LOP}	697	—	hPa	(5)
Low pressure(non-operating)	P_{LNO}	116	—	hPa	(6)

Note (1) Storage / Operating temperature



- (2) 5-500-5Hz sine wave, X,Y,Z each directions, 30min/cycle.
- (3) 2ms, $\pm X$, $\pm Y$, $\pm Z$ direction, one time each. For this shock test, it is necessary to fill the silicon rubber between the shock jig as buffer.
- (4) Max wet bulb temp.=39°C
- (5) 2hrs. (10000 feet)
- (6) 24hrs. (50000 feet)



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2.2 Electrical Absolute Rating

2.2.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.3	4.0	V	(1) (2)
Logic input voltage	V_{IN}	-0.3	VDD+0.3	V	(1) (2)

2.2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_{FL}	0	2500	$V_{(rms)}$	(1) (2)
Lamp current	I_L	0	7.5	mA	(1) (2)
Lamp frequency	f_L	0	80	KHz	(1) (2)

Note (1) Permanent damage may occur to the LCD module if beyond this specification.
Functional operation should be restricted to the conditions described under normal operating conditions.

(2) $T_a = 25 \pm 2^\circ\text{C}$



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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	$\theta=0$ Normal viewing angle	150	250	—		(1)(2)
Response time	Rising	T_R		—	7	12	msec	(1)(3)
	Falling	T_F		—	15	20		
White luminance (Average of 5 points)		Y_L				180	—	cd/m ²
Color chromaticity (CIE1931)	Red	R_x	$\theta=0$ Normal viewing angle	0.570	0.600	0.630		(1)(4)
		R_y		0.312	0.342	0.372		
	Green	G_x		0.271	0.301	0.331		
		G_y		0.507	0.537	0.567		
	Blue	B_x		0.120	0.150	0.180		
		B_y		0.099	0.129	0.159		
	White	W_x		0.280	0.310	0.340		
		W_y		0.300	0.330	0.360		
Viewing angle	Hor.	θ_L	$CR>10$	--	40	—		
		θ_R		--	40	—		
	Ver.	θ_U		--	20	—		
		θ_D		--	40	—		
Brightness uniformity		B_{UNI}	$\theta=0$	60	—	—	%	(6)
Crosstalk		CT(n)		—	—	1.3	%	(7)

3.2 Measuring Condition

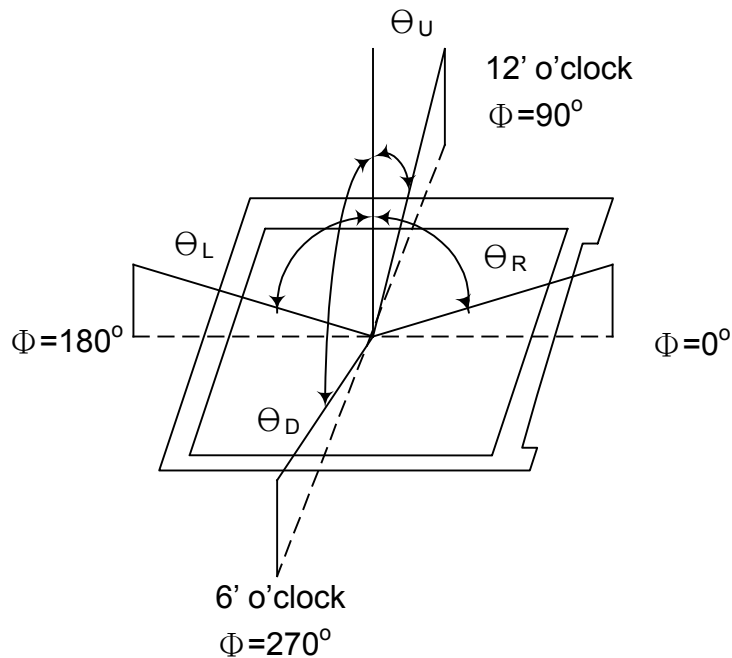
- Measuring surrounding : dark room
- Lamp current I_{FL} : $6.0\pm 0.1mA(rms)$, Lamp freq. $F_L=50KHz$, Inverter : HIU-757-11pF
- $V_{DD}=3.3V\pm 0.05V$
- Ambient temperature : $25\pm 2^\circ C$
- 30min. warm-up time.

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3.3 Measuring Equipment

- Otsuka Electrics Corp., which utilized MCPD-3000 for Chromaticity and BM-5 for other optical characteristics.
- Measuring spot size : 10 ~ 12 mm

Note (1) Definition of Viewing Angle :



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

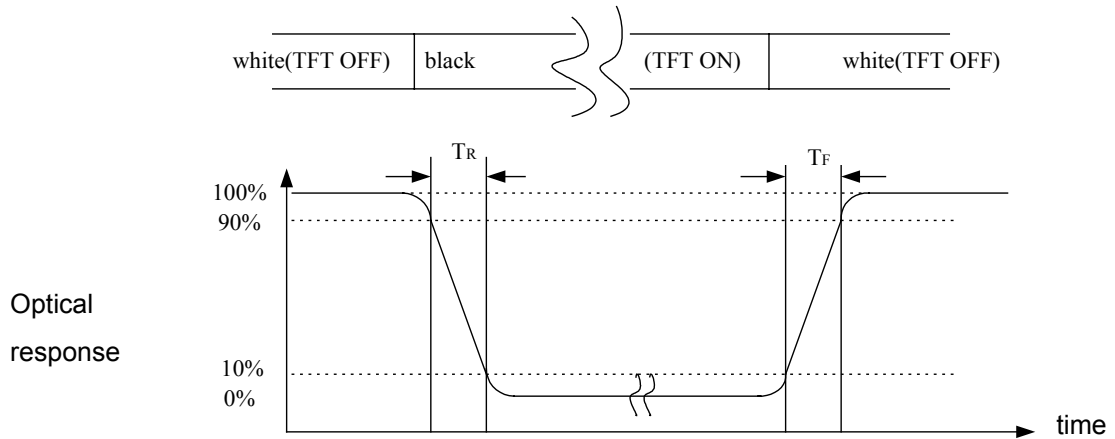
$$CR = \frac{\text{Luminance with all pixels white (L63)}}{\text{Luminance with all pixels black (L0)}}$$



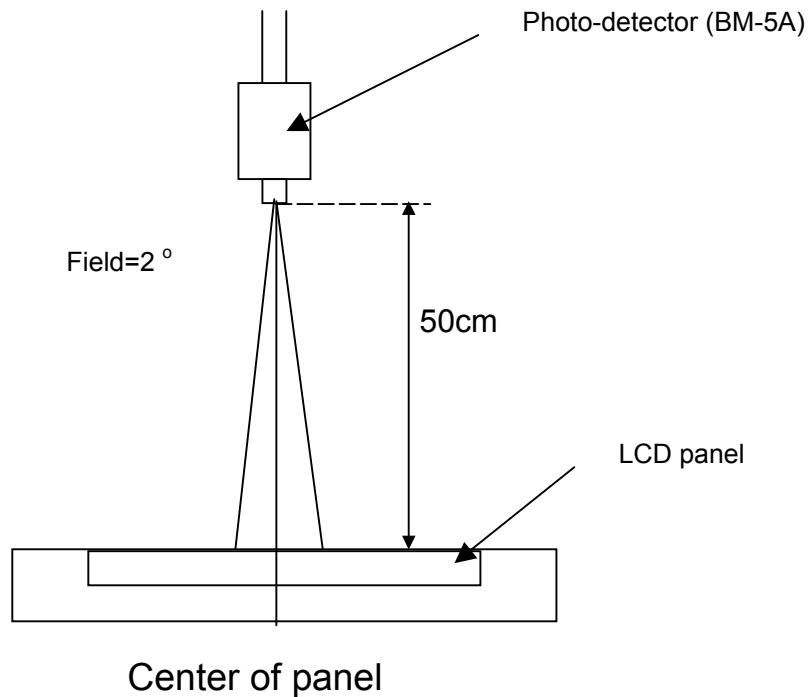
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Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of brightness uniformity



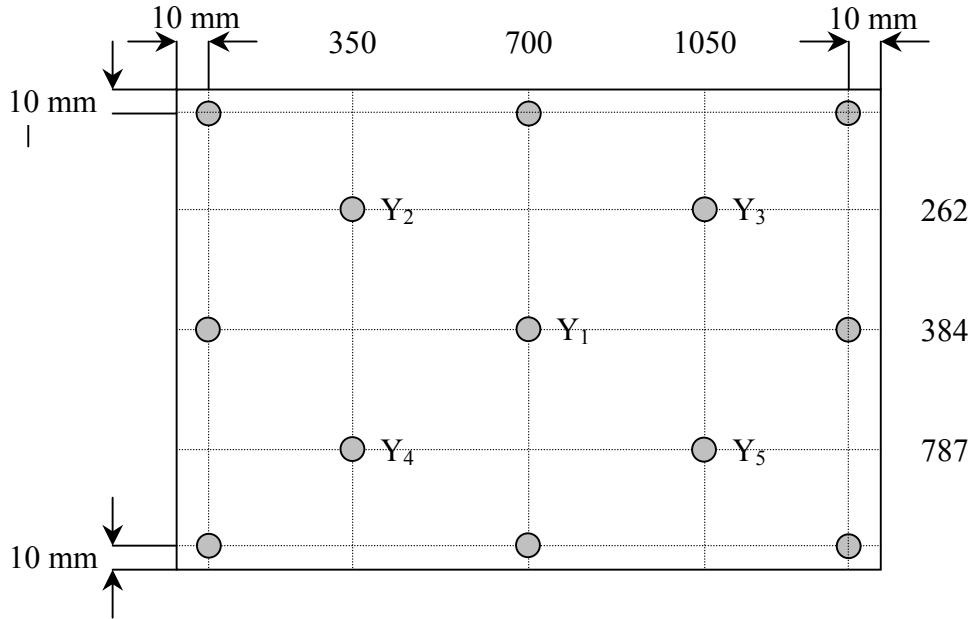


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Note (5) Definition of Average Luminance of White (5 Point)

$$\text{Average Luminance} = \frac{Y_1+Y_2+Y_3+Y_4+Y_5}{5}$$



Note (6) Definition of brightness uniformity

$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 13 points})}{(\text{Max Luminance of 13 points})} \times 100\%$$



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Note (7) Definition of crosstalk CT(1) ~ CT(4)

$$CT(n) = \frac{|L(n) - LB(n)|}{L(n)} \times 100\%, n = 1 \sim 4$$

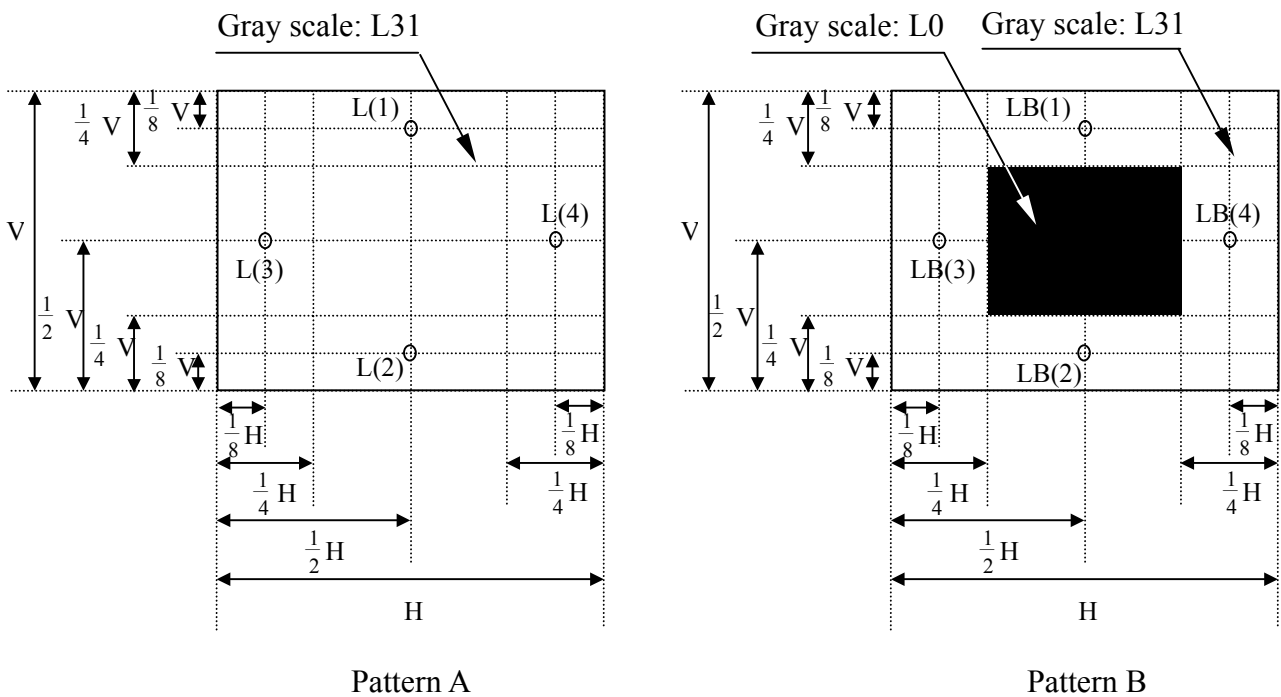
Where L(n) = Luminance of point "n" at pattern A (cd/m²), n=1~4

LB(n) = Luminance of point "n" at pattern B (cd/m²), n=1~4

The location measured will be exactly the same in both patterns.

L0 : Luminance with all pixels black

L63 : Luminance with all pixels white



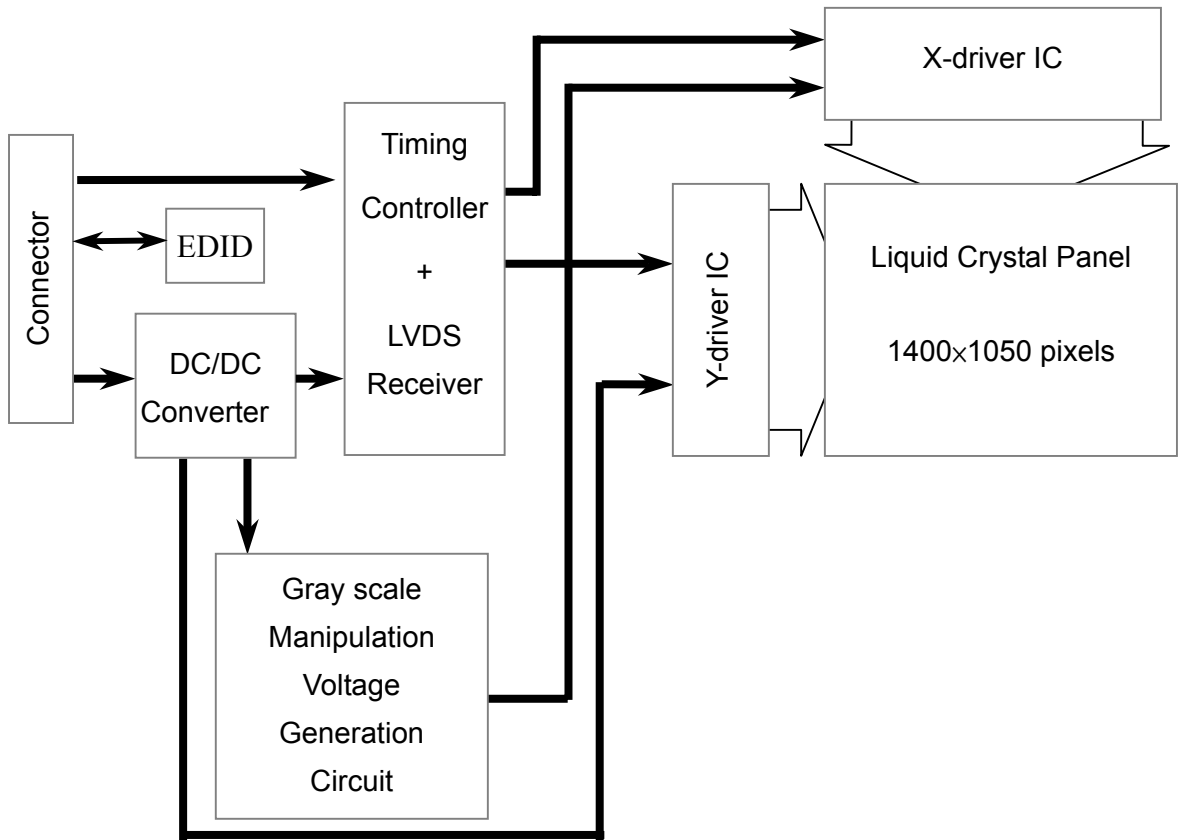


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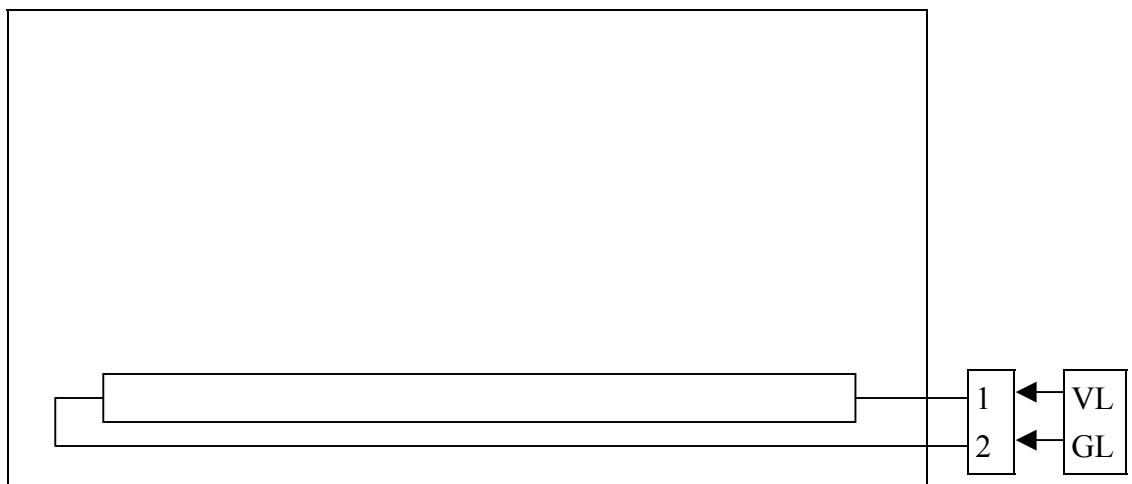
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4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Back Light Unit

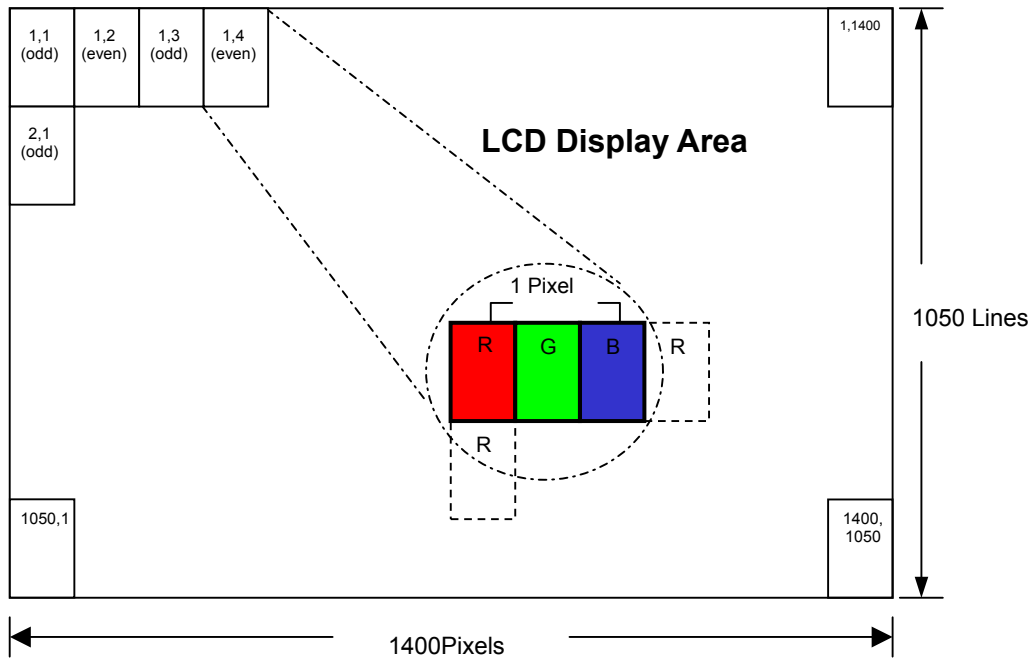




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4.3 Pixel Format





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4.4 Relationship Between Displayed Color and Input

	Display	MSB						LSB						Gray scale level						
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0		B5	B4	B3	B2	B1	B0
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑ ↓ Light	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L60
	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L61	
	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L62	
	Red	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	Red L63
	Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Dark ↑ ↓ Light		L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L60
L		L	L	L	L	L	H	H	H	H	L	H	L	L	L	L	L	L	L61	
L		L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L62	
Green		L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	Green L63
Gray scale of Blue		Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Dark ↑ ↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L60
	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	L	H	L61	
	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L62	
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	Blue L63
	Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Dark ↑ ↓ Light		L	L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L1
		L	L	L	L	H	L	L	L	L	L	H	L	L	L	L	L	H	L	L2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	L3...L60
H		H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	H	L61	
H		H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	L62	
White		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L63



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5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

CN1 (INPUT SIGNAL): FI-XB30S-HF10 (JAE)

MATING CONNECTOR: FI-X30M,FI-X30MR

Terminal no.	Symbol	Function	Note
1	GND	Ground	
2	VDD	Power Supply : +3.3V	
3	VDD	Power Supply : +3.3V	
4	VEDID	DDC 3.3V power	
5	NC	Reserved for supplier test point	
6	CIKEDID	DDC clock	
7	DataEDID	DDC data	
8	Odd_Rin0-	- LVDS differential data input (R0-R5, G0)	(2)
9	Odd_Rin0+	+ LVDS differential data input (R0-R5, G0)	(2)
10	GND	Ground	
11	Odd_Rin1-	- LVDS differential data input (G1-G5, B0-B1)	(2)
12	Odd_Rin1+	+ LVDS differential data input (G1-G5, B0-B1)	(2)
13	GND	Ground	
14	Odd_Rin2-	- LVDS differential data input (B2-B5,NC,NC,DE)	(2)
15	Odd_Rin2+	+ LVDS differential data input (B2-B5,NC,NC,DE)	(2)
16	GND	Ground	
17	Odd_ClkIN-	- LVDS differential clock input	(2)
18	Odd_ClkIN+	+ LVDS differential clock input	(2)
19	GND	Ground	
20	Even_Rin0-	- LVDS differential data input (R0-R5, G0)	
21	Even_Rin0+	+ LVDS differential data input (R0-R5, G0)	
22	GND	Ground	
23	Even_Rin1-	- LVDS differential data input (G1-G5, B0-B1)	
24	Even_Rin1+	+ LVDS differential data input (G1-G5, B0-B1)	
25	GND	Ground	
26	Even_Rin2-	- LVDS differential data input (B2-B5,NC,NC,DE)	
27	Even_Rin2+	+ LVDS differential data input (B2-B5, NC, NC, DE)	
28	GND	Ground	
29	Even_ClkIN-	- LVDS differential clock input	
30	Even_ClkIN+	+ LVDS differential clock input	

Note (1) Please connects NC pin to nothing. Don't connect it to ground nor to other signal input.
(NC pin should be open.)

Note (2) The module used a 100ohm resistor between positive and negative data lines of each receiver input.

5.2 Back-Light Unit

CN2 CCFL Power Source (**BHSR-02VS-1**) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Mating Connector: (**SBHT-002T-P0.5**) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Terminal no.	Symbol	Function
1	VL	CCFL power supply (high voltage)
2	GL	CCFL power supply (low voltage)



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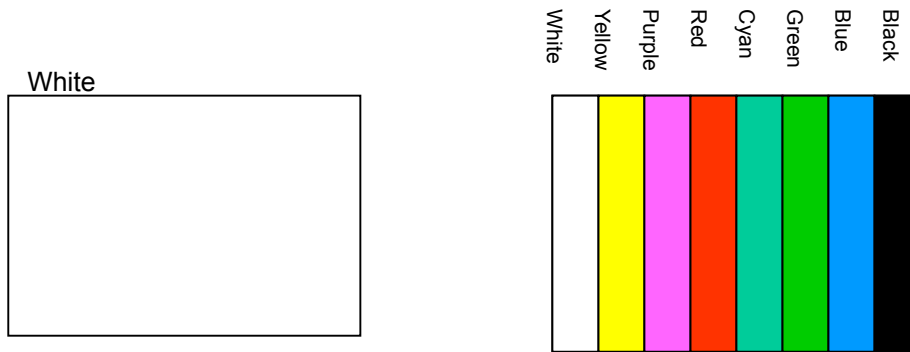
6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

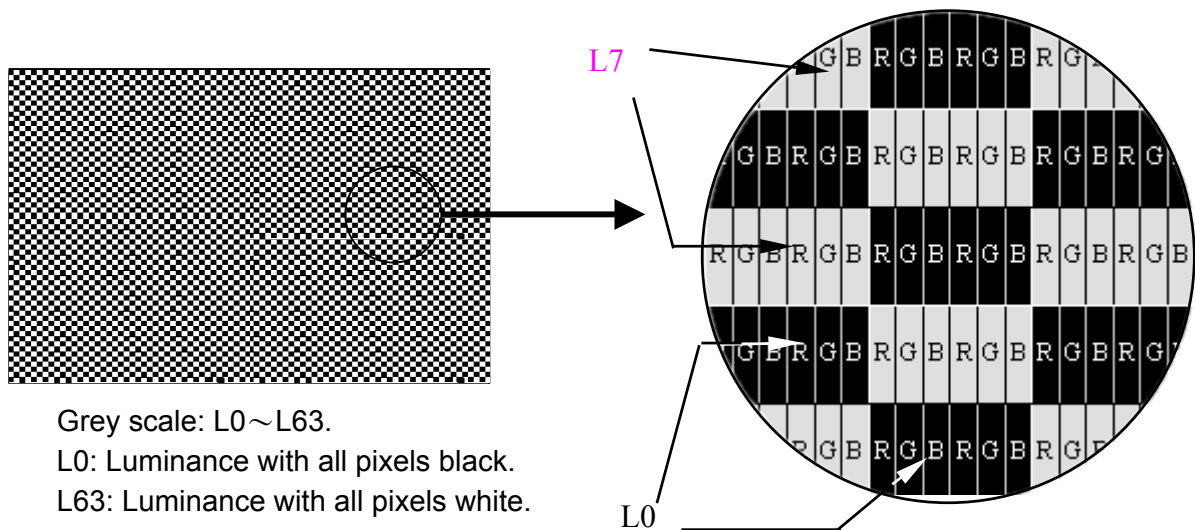
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Voltage of power supply	V_{DD}	3.0	3.3	3.6	V		
Current of power supply	White	I_{DD0}	335	410	475	mA	(1)
	V-Color	I_{DD1}	455	520	585	mA	(1)
	Mosaic	I_{DD2}	515	580	645	mA	(1)
Vsync frequency	f_V	—	60	—	Hz	ref 6.7 t1	
Hsync frequency	f_H	—	64	—	KHz	ref 6.7 t2	
Frequency	f_{DCLK}	—	54	—	MHz	ref 6.7 t4	
Input rush current	I_{Rush}	—	—	1.5	A	(2)	

Note (1)

1). White & V-Color :



2). Mosaic : Dot checker image

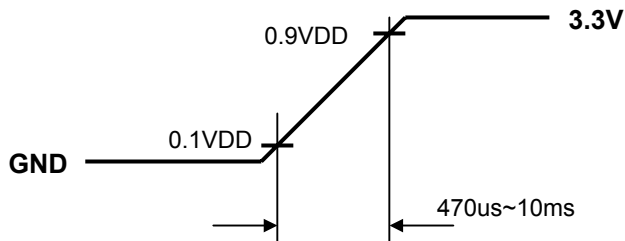
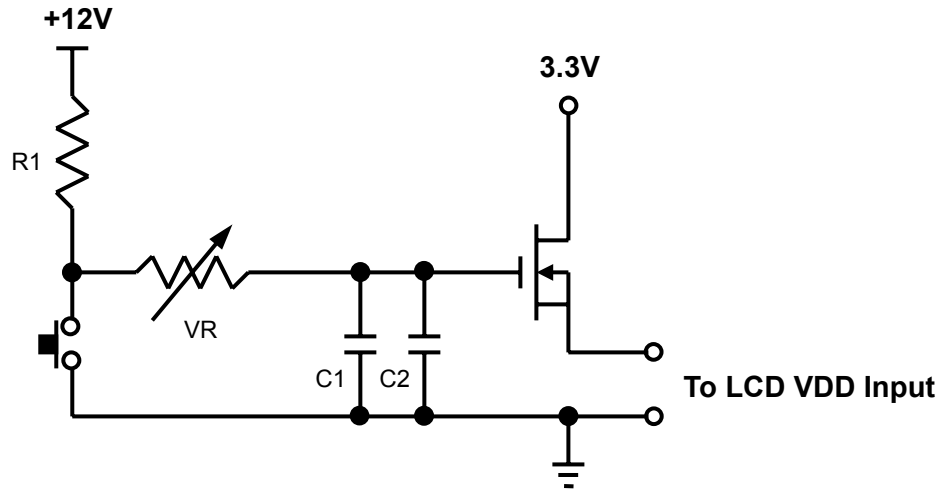




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Note (2) Input Rush Current measurement condition



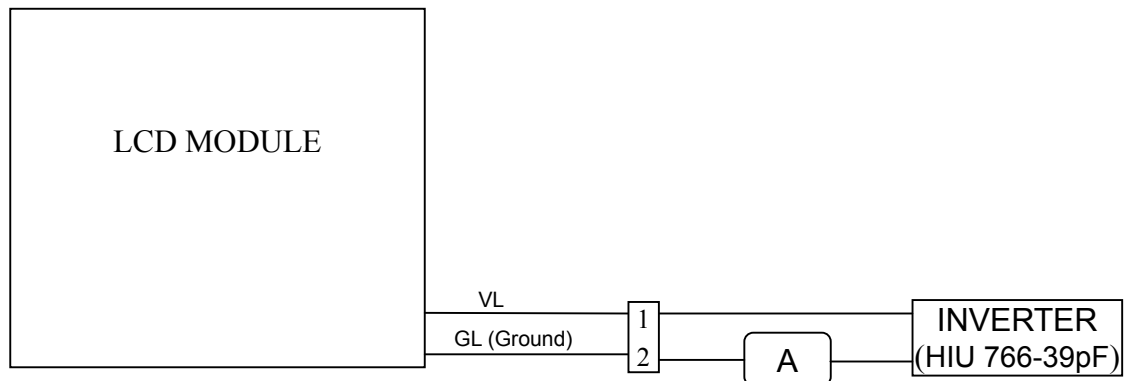
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6.2 Back-Light Unit

The back-light system is an edge-lighting type with 1 CCFL(Cold Cathode Fluorescent Lamp). The characteristics of the lamp is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL	2.0	6.0	7.5	mA(rms)	(1)
Lamp voltage	VL	576	640	704	V(rms)	$I_L=6.0\text{mA}$
Frequency	fL	20	50	80	KHz	(2)
Operating lamp life time	Hr	10,000	—	—	Hour	(3)
Startup voltage	Vs	1250	—	—	V(rms)	at 25°C
		1600				at 0°C

Note (1) Lamp current is measured with current meter for high frequency as shown below. Specified valued are for a lamp.



Note (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause ripple noise on the display. Therefore lamp frequency shall be kept away from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

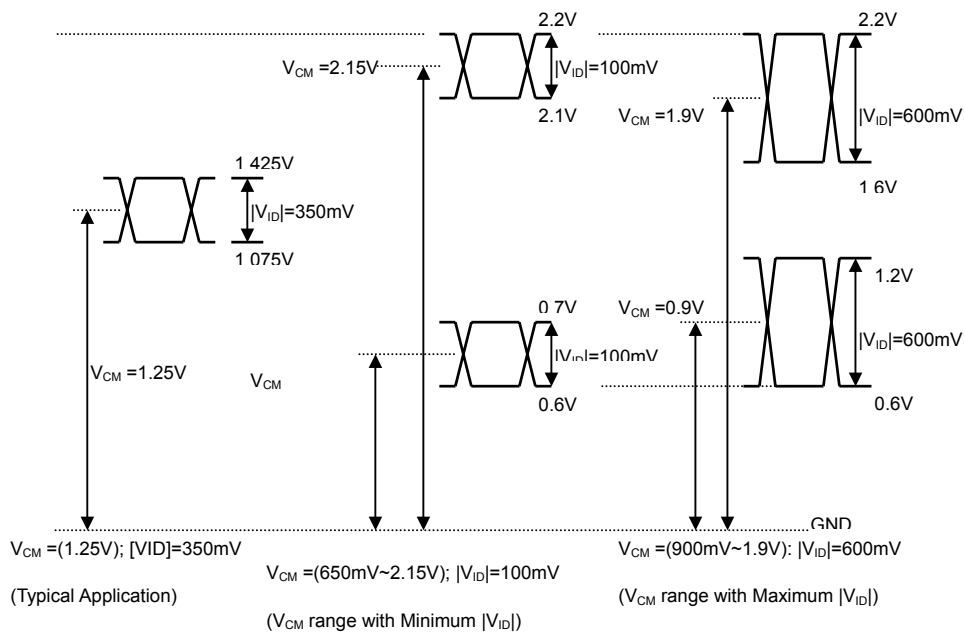
Note (3) Lamp life time (Hr) can be defined as the time in which it continues to operate under the condition : $T_a=25\pm 3^\circ\text{C}$, $I_L=6.5\text{mA(rms)}$ and $f_L=50\text{kHz}$ until the brightness becomes less than 50%



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6.3 Switching Characteristics for LVDS Receiver

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V _{th}	—	—	100	mV	V _{CM} =1.2V
Differential Input Low Threshold	V _{tl}	-100	—	—	mV	
Input Current	I _{IN}	—	—	±10	uA	V _{IN} =2.2V, V _{DD} =3.6V
		—	—	±10	uA	V _{IN} =0.6V, V _{DD} =3.6V
Input Voltage Range(Signal ended)	V _{IN}	0.6	—	2.2	V	
Differential input Voltage	V _{ID}	0.100	—	0.600	V	
Common Mode Voltage Offset	V _{CM}	0.6+ V _{ID} /2	—	2.2- V _{ID} /2	V	
Clock Frequency	f _c	51	54	57	MHz	



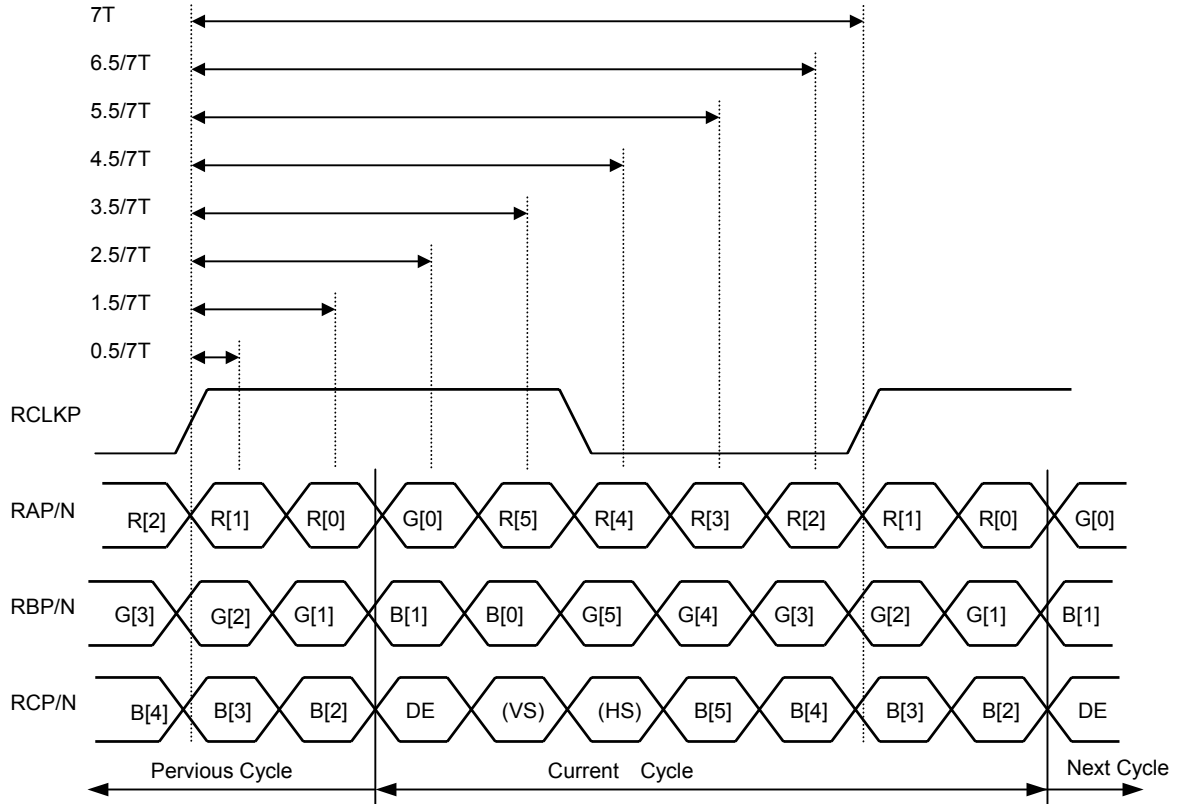
Receiver |V_{ID}| and V_{CM} Allowable Operation Range



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6.4 Bit Mapping & Interface Definition



Bit Mapping & Timing Definition(Even/Odd)



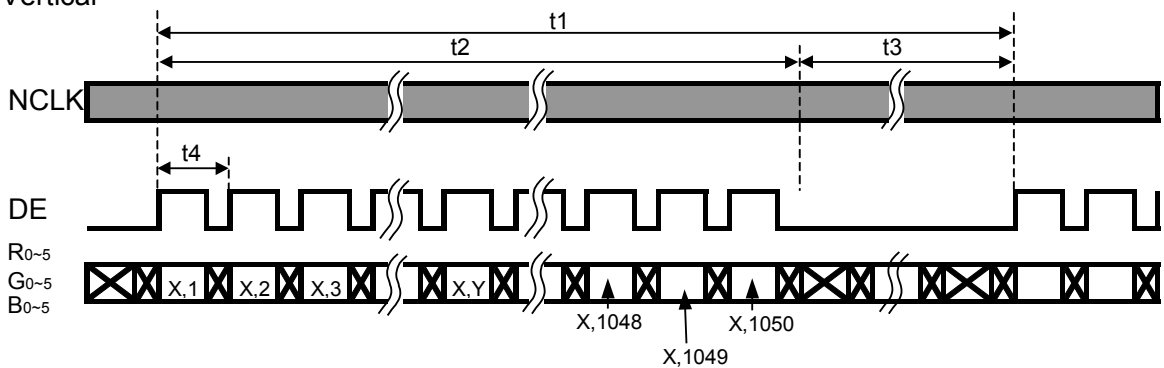
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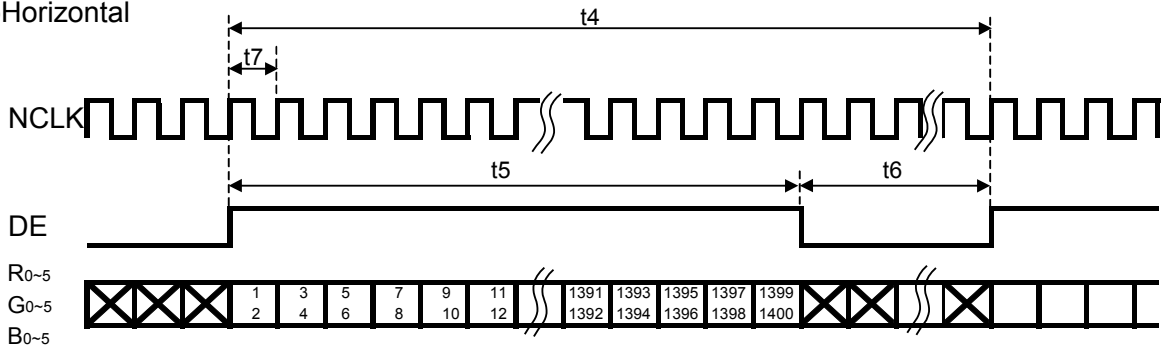
6.5 Interface Timing (DE mode) ¹⁾²⁾³⁾⁴⁾⁵⁾⁶⁾

Item	Symbol	Min.	Typ.	Max.	Unit
Frame Period	t1	1058 × t4	1066 × t4	1074 × t4	—
		16.67	16.67	16.67	ms
Vertical Display Time	t2	1050 × t4	1050 × t4	1050 × t4	—
Vertical Blanking Time	t3	2 × t4	—	—	—
1 Line Scanning Time	t4	803 × t7	844 × t7	884 × t7	—
		15.52	15.63	15.75	us
Horizontal Display Time	t5	700 × t7	700 × t7	700 × t7	—
Horizontal Blanking Time	t6	120 × t7	—	—	—
Clock Period	t7	17.55	18.519	19.62	ns

(1)Vertical



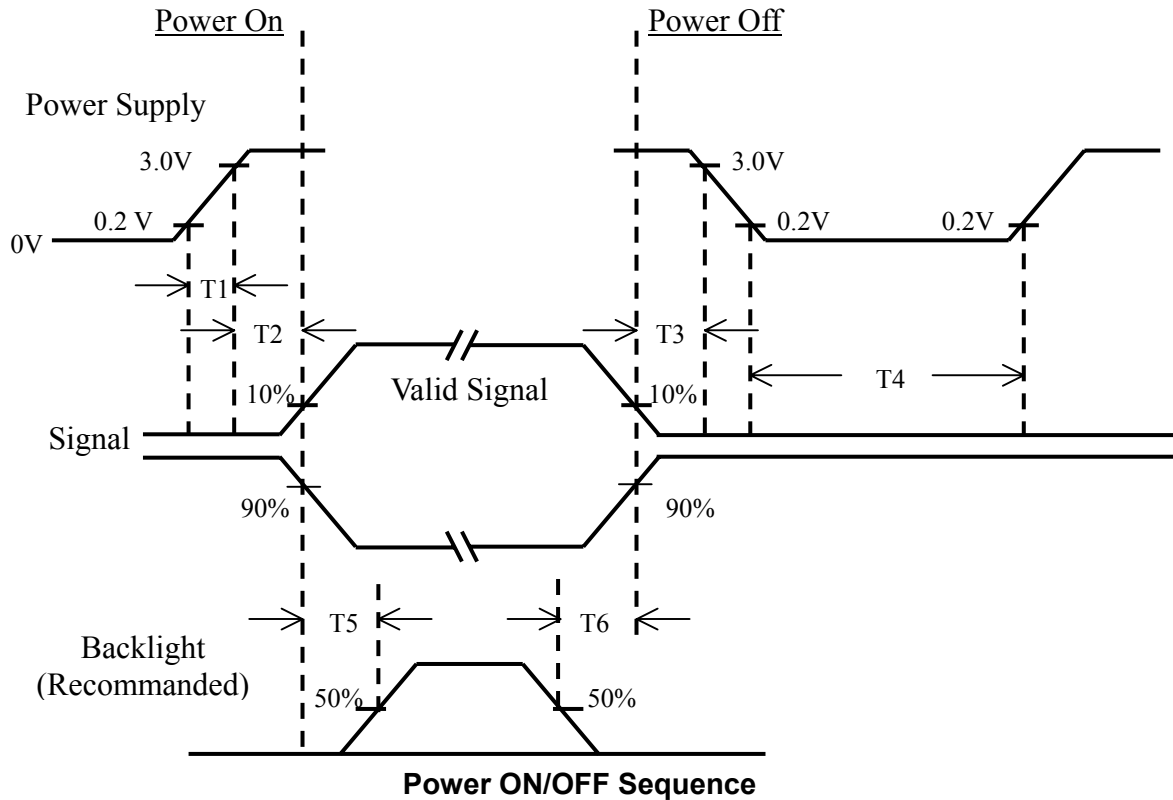
(2)Horizontal



Timing Diagram of Interface Signal (DE mode)

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6.6 Power ON/OFF Sequence



$$470 \text{ usec} < T1 \leq 10 \text{ msec}$$

$$0 < T2 \leq 50 \text{ msec}$$

$$0 < T3 \leq 50 \text{ msec}$$

$$400 \text{ ms} \leq T4$$

Back-light:

$$200 \text{ ms} \leq T5$$

$$200 \text{ msec} < T6$$

- Note (1) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (2) In case of $V_{DD} = \text{off level}$, please keep the level of input signal on 0 voltage.
- (3) T4 should be measured after the module has been fully discharged between power off and on period.



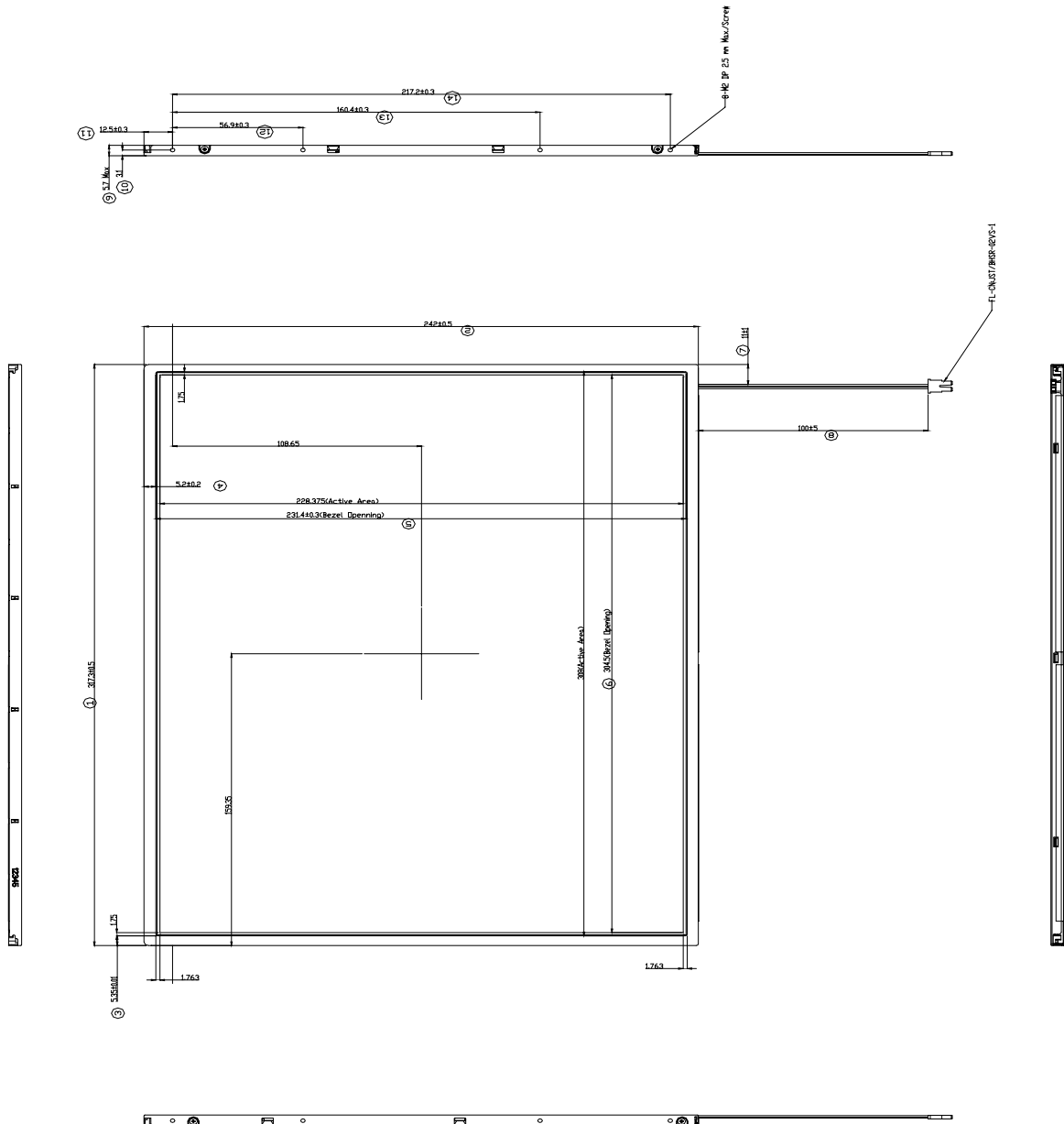
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7.0 OUTLINE DIMENSION

7.1 Front View Outline Dimension

Unit : mm





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7.2 Back View Outline Dimension

