



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.
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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) x 1050(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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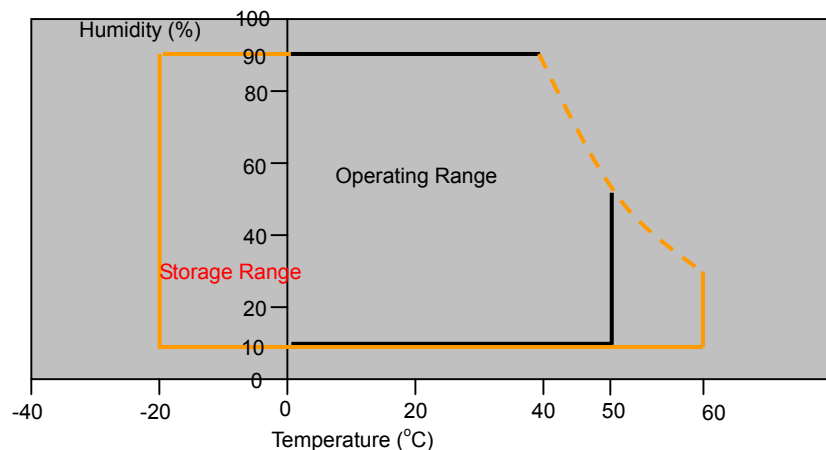
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2.0 ABSOLUTE MAXIMUM RATINGS

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 _{LNOP}	116	—	hPa	(6)

Note (1) Storage / Operating temperature



- (2) 5-500-5Hz sine wave, X,Y,Z each directions, 30min/cycle.
- (3) 2ms, ±X, ±Y, ±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	$V_{DD}+0.3$	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	(1)(4)(5) (I _L =6.0mA)
Color chromaticity (CIE1931)	Red	R _x		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}	Θ=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.



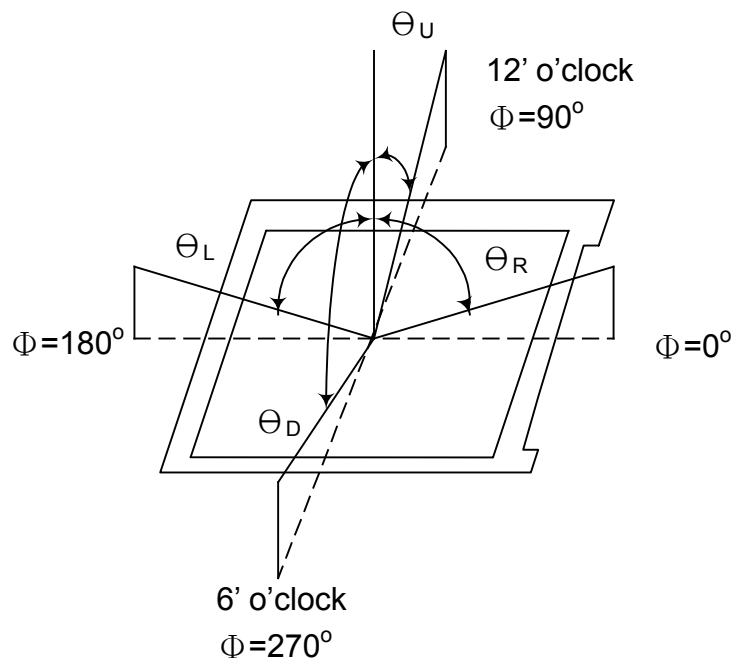
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3.3 Measuring Equipment

- 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 :

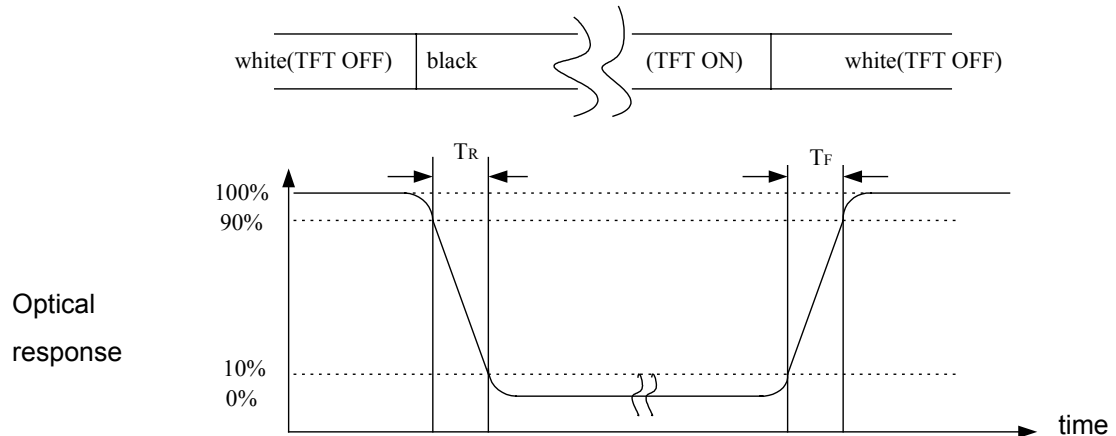


Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

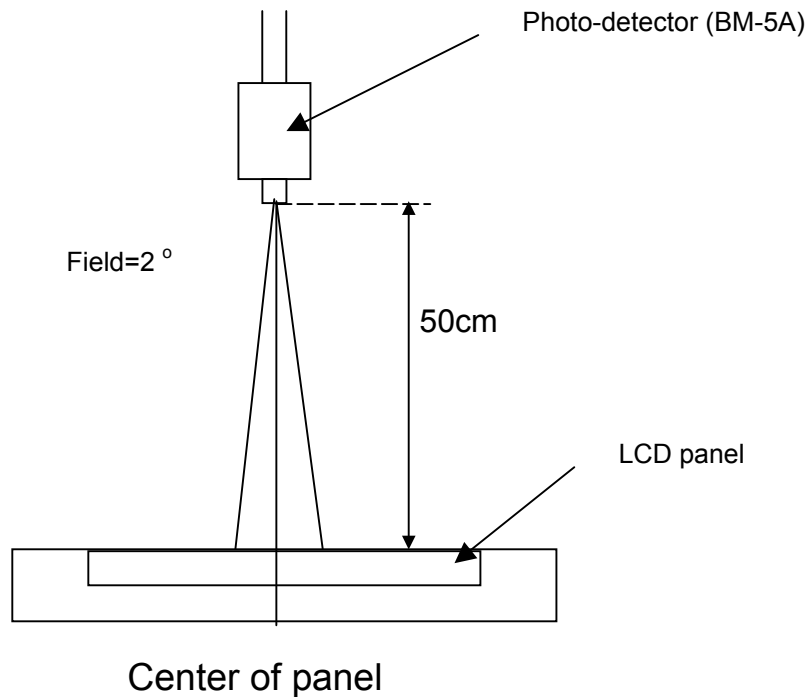
$$CR = \frac{\text{Luminance with all pixels white (L63)}}{\text{Luminance with all pixels black (L0)}}$$

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



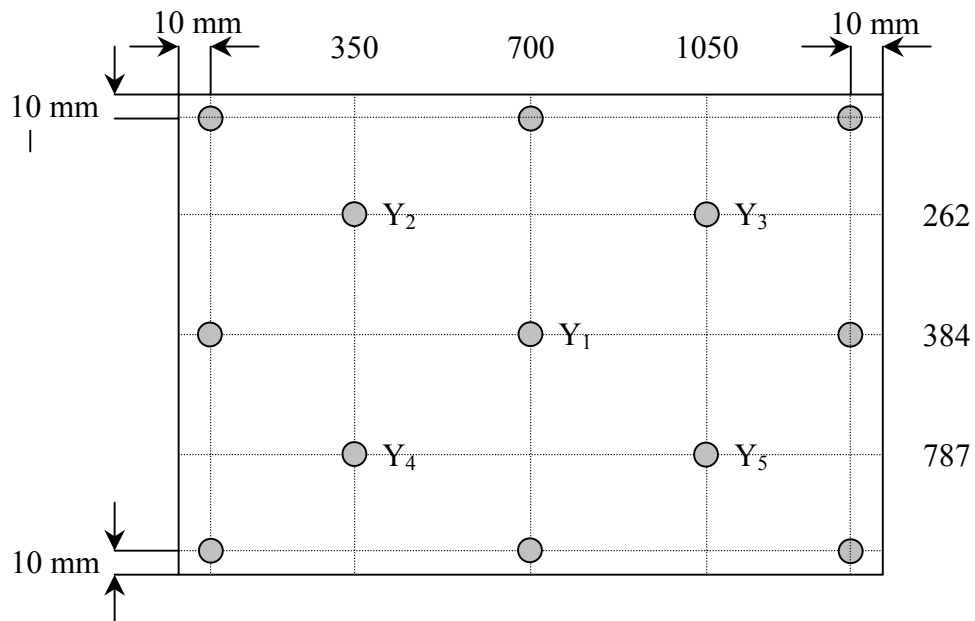
Note (4) Definition of brightness uniformity



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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)

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

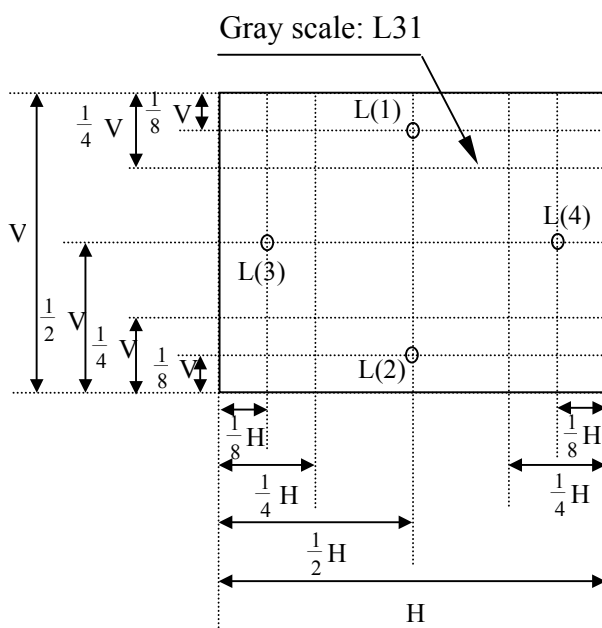
Where $L(n)$ = Luminance of point "n" at pattern A (cd/m^2), $n=1 \sim 4$

$LB(n)$ = Luminance of point "n" at pattern B (cd/m^2), $n=1 \sim 4$

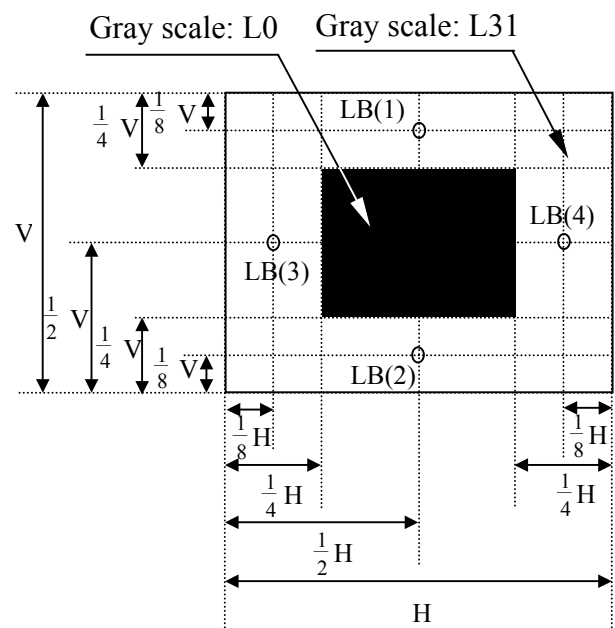
The location measured will be exactly the same in both patterns.

$L0$: Luminance with all pixels black

$L63$: Luminance with all pixels white



Pattern A



Pattern B

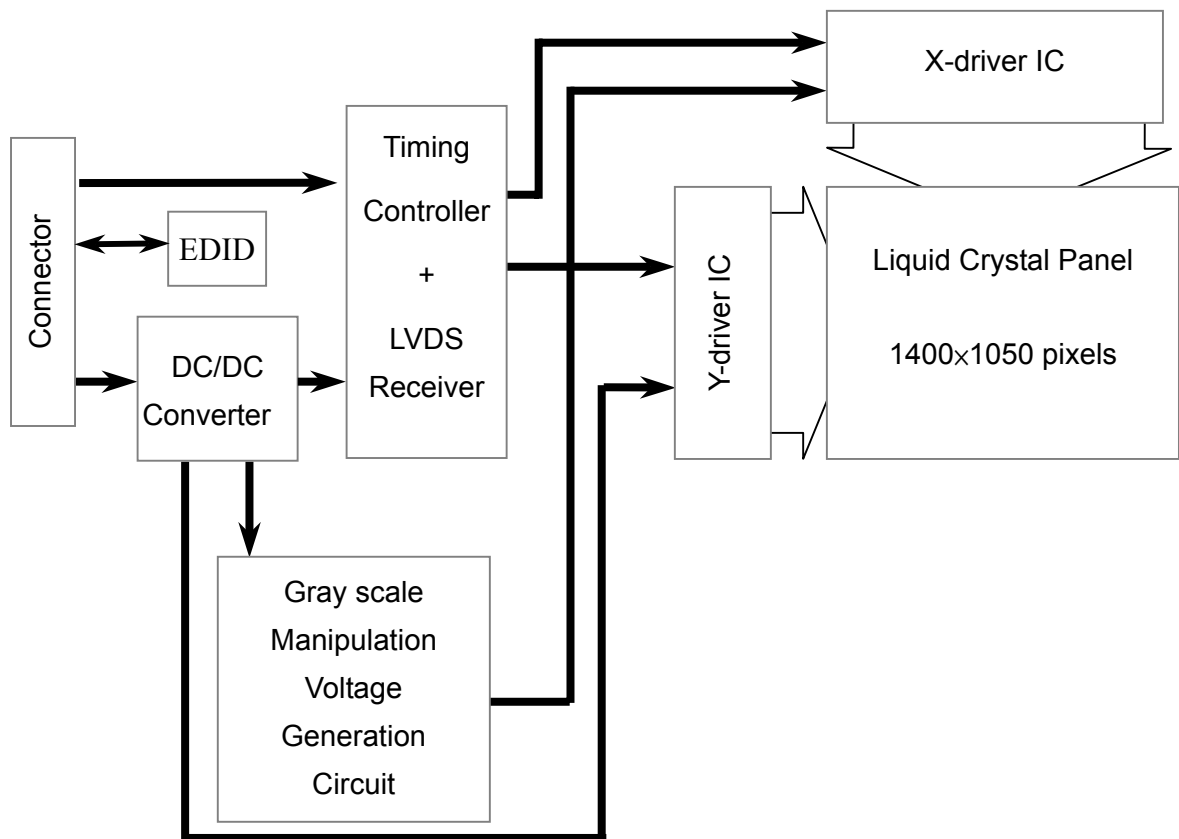


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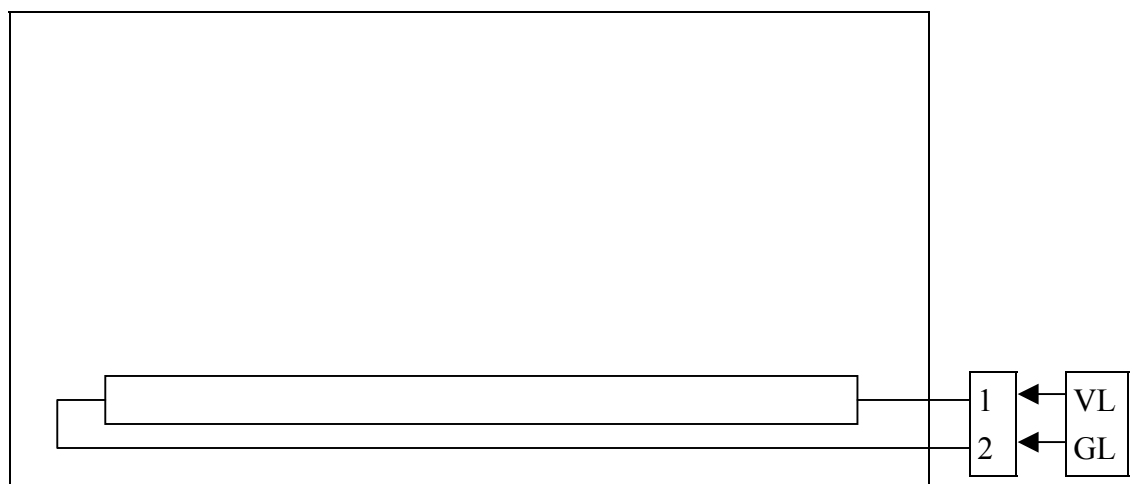
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4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Back Light Unit

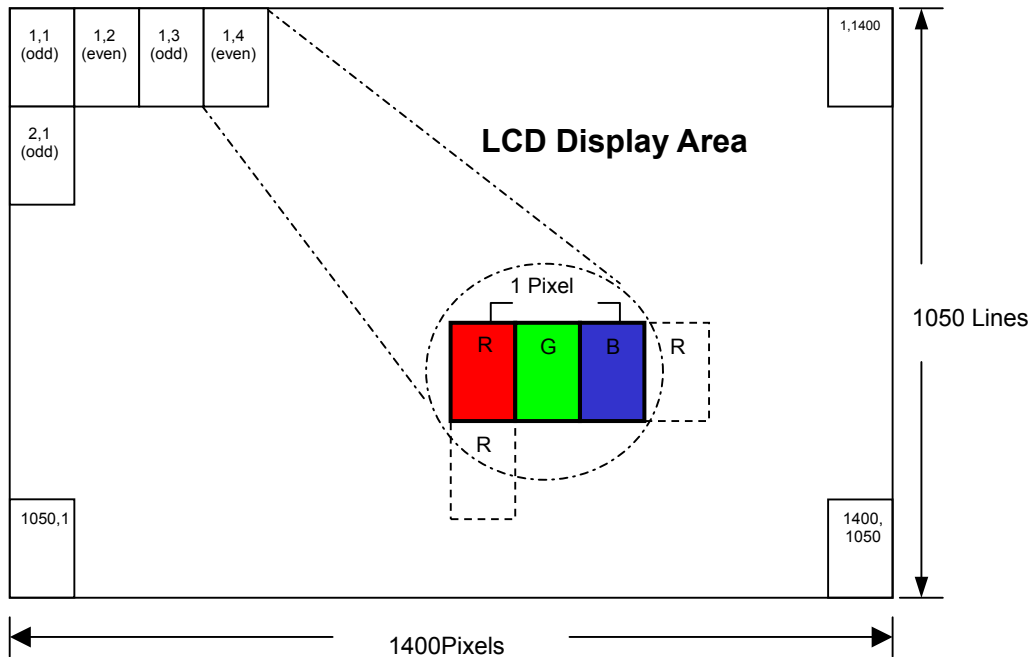




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4.3 Pixel Format





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4.4 Relationship Between Displayed Color and Input

		MSB						LSB						MSB						LSB						Gray scale level
	Display	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	H	H	H	H	H	H	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	H	L	L	L	L	L	L	L	L	L	L	L	-						
	Purple	H	H	H	H	H	H	H	L	L	L	L	L	L	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	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	L0						
	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	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	L0						
	Dark ↕ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	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	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	L0						
	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	H	L	L	L	L	L	H	L	L	L2						
		⋮						⋮						⋮						L3...L60						
		H	H	H	H	L	H	H	H	H	L	H	H	H	H	H	L	H	L	L61						
		H	H	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	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	ClkEDID	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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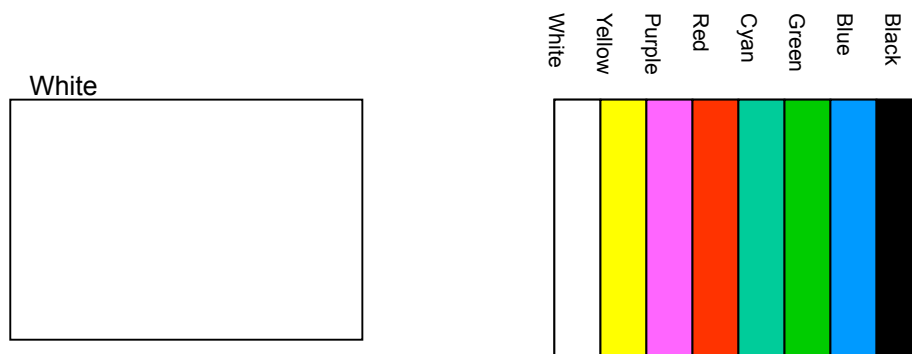
6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

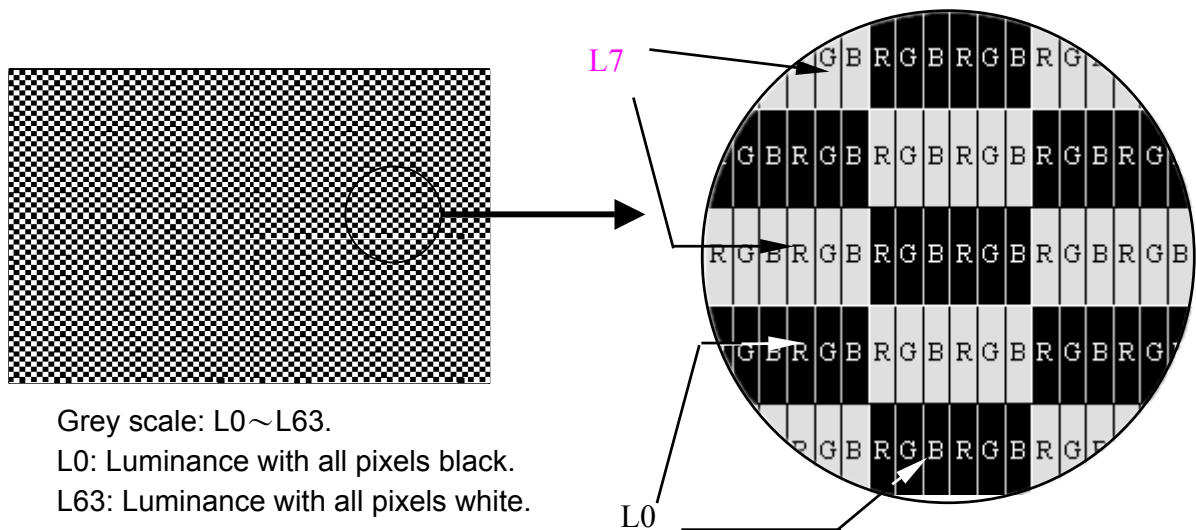
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of power supply		V _{DD}	3.0	3.3	3.6	V	
Current of power supply	White	I _{DD0}	335	410	475	mA	(1)
	V-Color	I _{DD1}	455	520	585	mA	(1)
	Mosaic	I _{DD2}	515	580	645	mA	(1)
Vsync frequency		f _V	—	60	—	Hz	ref 6.7 t1
Hsync frequency		f _H	—	64	—	KHz	ref 6.7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

Note (1)

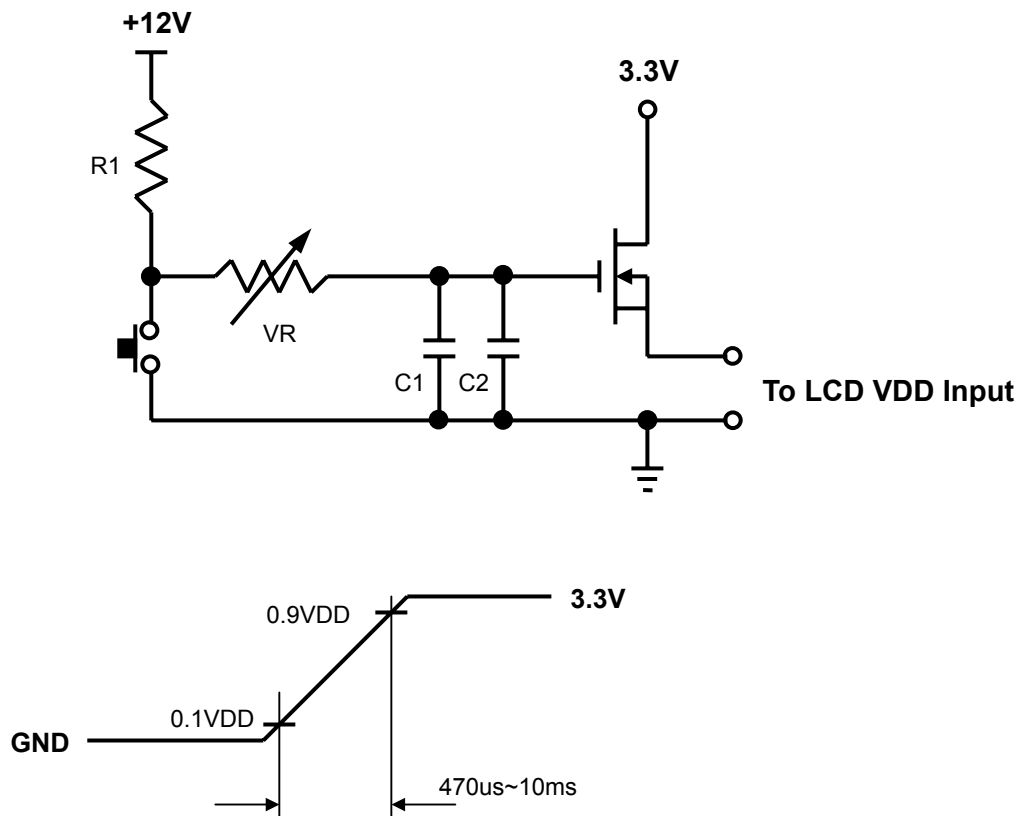
1). White & V-Color :



2). Mosaic : Dot checker image



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Note (2) Input Rush Current measurement condition



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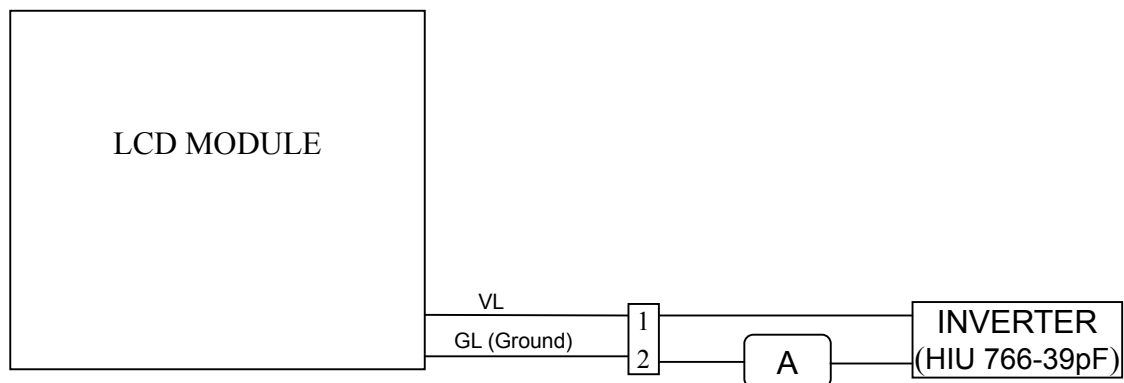
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6.2 Back-Light Unit

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 : $T_a=25\pm3\text{ }^\circ\text{C}$, $I_L=6.5\text{mA(rms)}$ and $f_L=50\text{kHz}$ until the brightness becomes less than 50%

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	

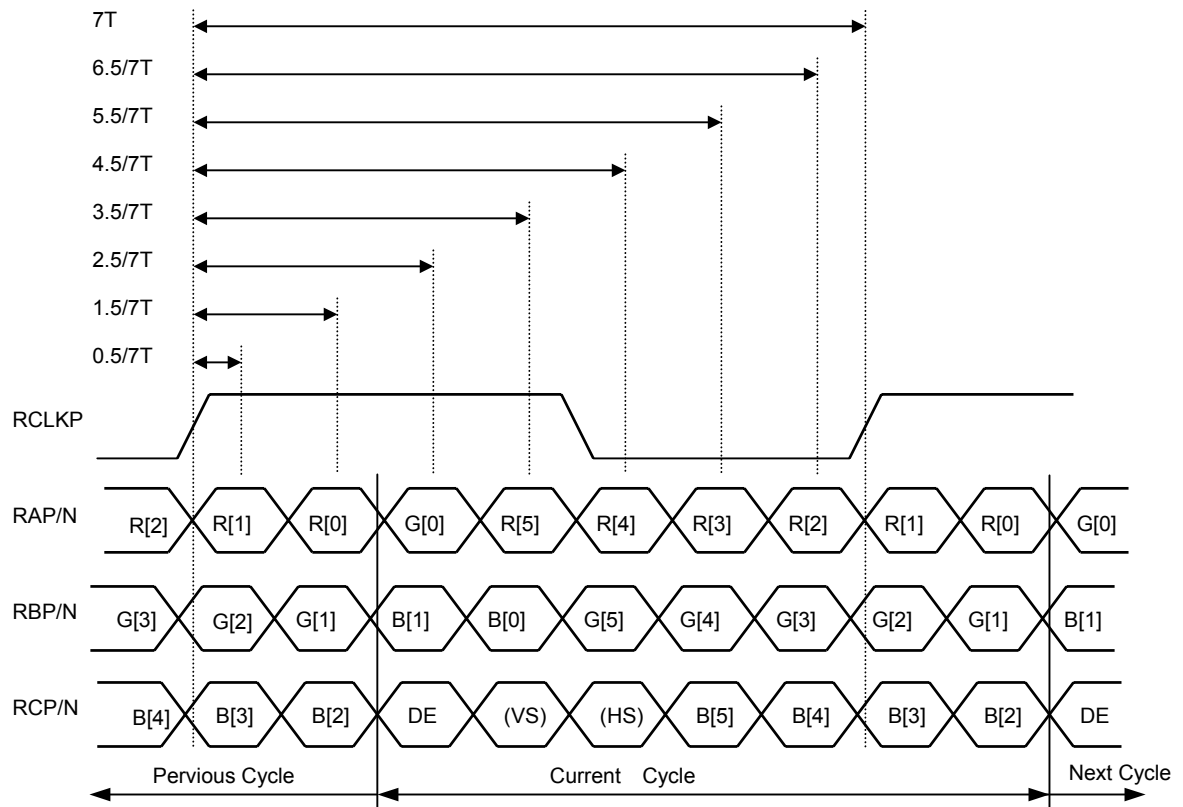




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6.4 Bit Mapping & Interface Definition



Bit Mapping & Timing Definition(Even/Odd)



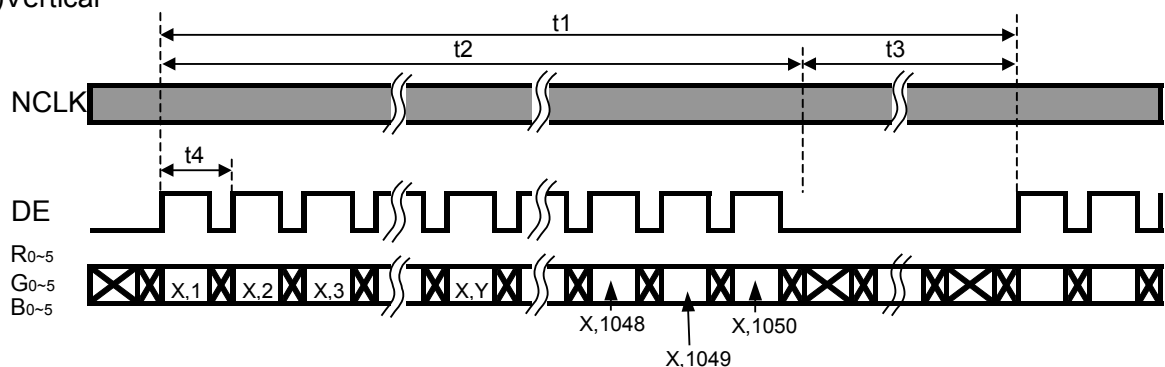
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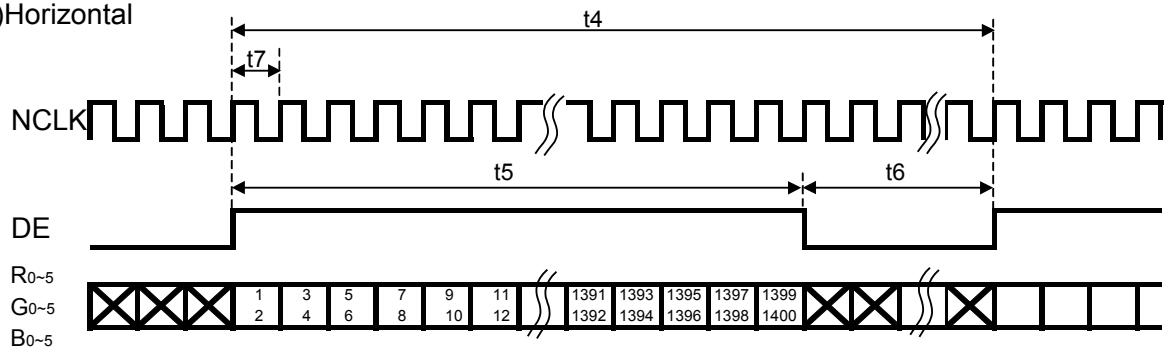
6.5 Interface Timing (DE mode) ¹⁾²⁾³⁾⁴⁾⁵⁾⁶⁾

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



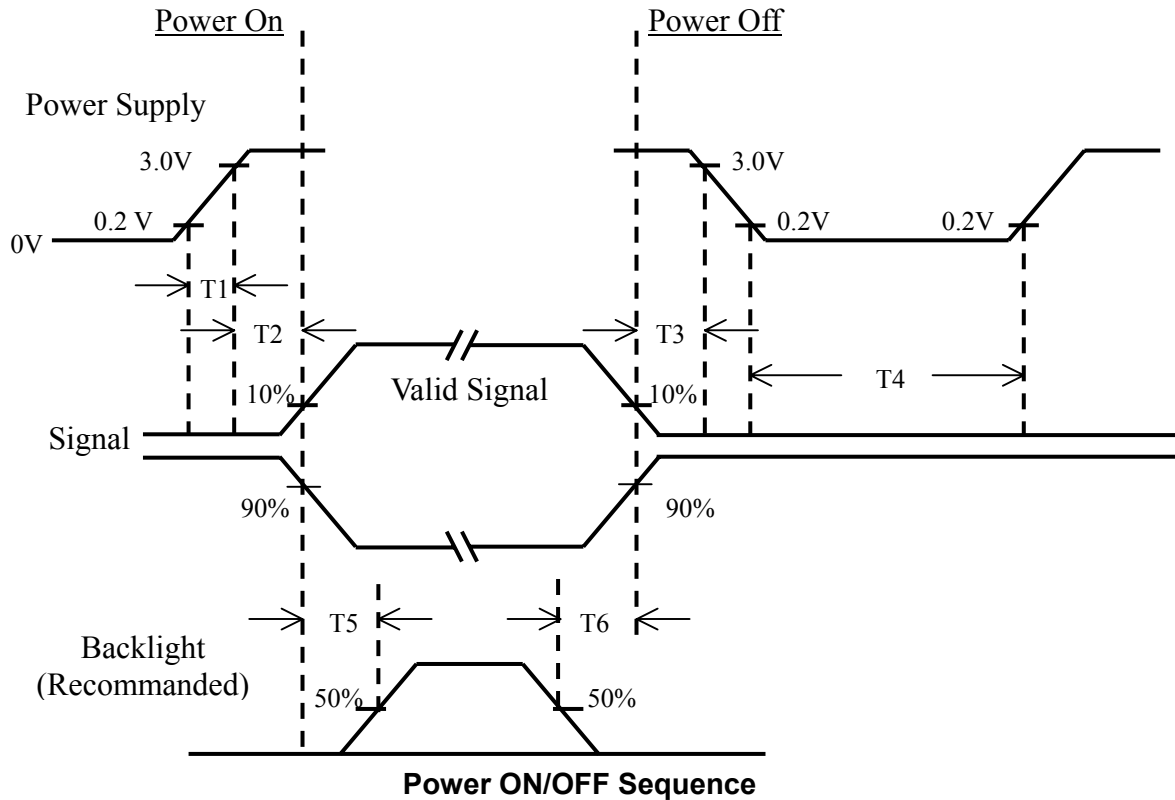
Timing Diagram of Interface Signal (DE mode)



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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:

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

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

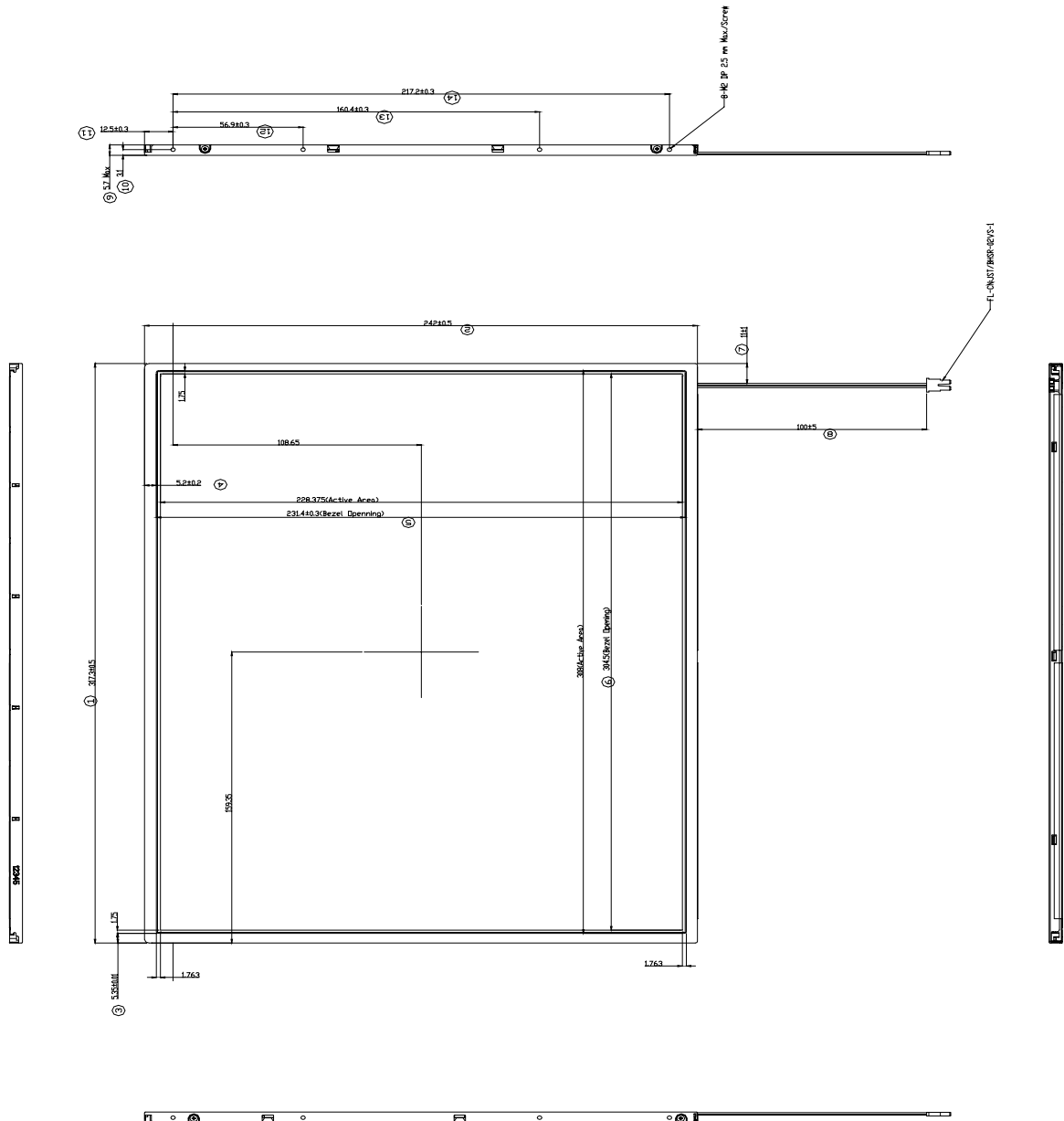
- Note (1) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (2) In case of V_{DD} = off level, please keep the level of input signal on 0 voltage.
- (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

Unit : mm

7.1 Front View Outline Dimension



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7.2 Back View Outline Dimension

