


PART NO : GG1080N0AUC6A
CUSTOMER : _____

Accepted by : _____

Proposed by : 

Date : 10,07,2003

GG1080N0AUC6A

REV : 3

PAGE : 1

RECORD OF REVISION

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2003/07/31	4 7 15~17 18 19 20	Change page 4 ADD Luminance (White) ADD AC Timing Charts. ADD Note ADD Note Change page 20
2003/10/07	20	ADD Startup Voltage Typ.1350

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1.0 GENERAL DESCRIPTIONS

1.1 Introduction

LCMTSF15X4A1 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switch device.

This model is composed of a TFT LCD panel, the voltage reference, common voltage, DC-DC converter, column, and row driver circuit. This TFT LCD has a 15-inch diagonally measured active display area with XGA resolution (768 vertical by 1024 horizontal pixel array).

1.2 Features

- 15" XGA TFT LCD panel
- 4 CCFLs Backlight system
- Supported XGA (V : 768 lines, H : 1024 pixels) resolution
- Supported to 75HZ refresh rate
- Without LCD Timing Controller
- Supported 16.2M colors
- High brightness wide viewing angle.

1.3 General information

Item	Specification	Unit	Note
Outline dimension	331.5 × 254.6 × 12	mm	
Display area	304.1(H) × 228.1(V) (15.0" diagonal)	mm	1
Number of Pixel	1024(H) × 768(V)	pixels	
Pixel pitch	0.297(H) × 0.297(V)	mm	1
Pixel arrangement	RGB Vertical stripe		
Display color	8-bits driver (6-bits with Frame Rate Control)		
Display mode	Normally white		
Luminance (white)	300 cd/m ² (Typ)		
Surface treatment	Antiglare		
Weight	950 (Typ.)	g	
Back-light	4-CCFLs, Top & bottom edge side		
Power consumption	9.2 Watt (Typ)		
Input signal	Source and Gate Driver control signals		
Optimum viewing direction	6 o' clock		1

1.4 Applications

Desktop monitors
Display terminals for AV applications
Monitors for industrial applications

1.5 Mechanical information

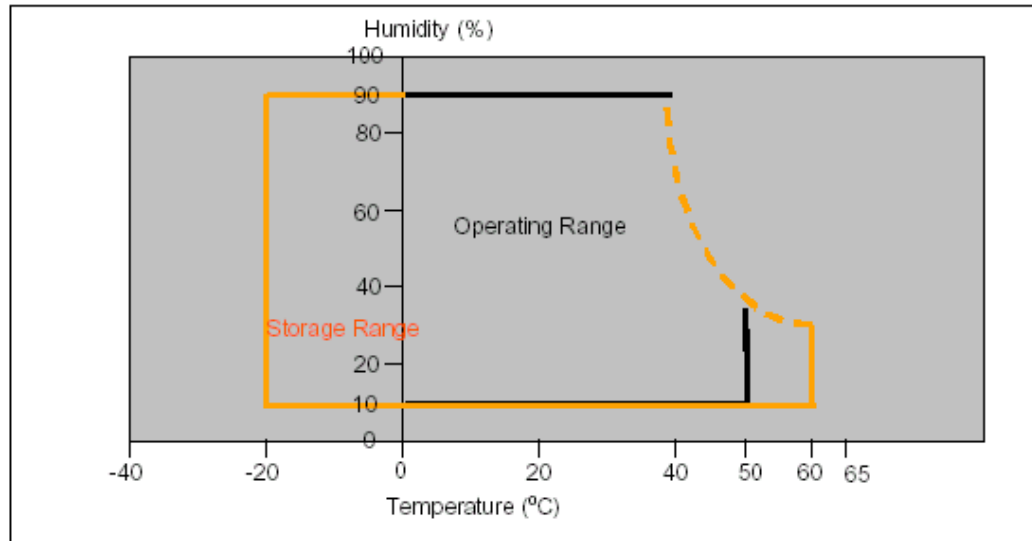
Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	-----	331.5	-----	mm
	Vertical(V)	-----	254.6	-----	mm
	Depth(D)	-----	12	-----	mm
Weight (without inverter)		-----	950	-----	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Absolute Rating of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-20	60	°C	(6)
Operating temperature	T _{OPR}	0	50	°C	(6)
Vibration(non-operating)	V _{NOP}	--	1.5	G	(1)
Shock(non-operating)	S _{NOP}	--	70	G	(2)
Storage humidity	H _{STG}	10	90	%RH	(3),(6)
Operating humidity	H _{OP}	10	80	%RH	(3),(6)
Low pressure(operating)	P _{LOP}	697	--	HPa	(4),(6)
Low pressure(non-operating)	P _{LNOP}	116	--	HPa	(5),(6)

Note (1) 5-500Hz sine wave, X,Y,Z each directions, 30 min/cycle.
(2) 11ms, ±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.
(3) Max wet bulb temp. =39°C
(4) 2 hrs. (10000 feet)
(5) 24hrs. (50000 feet)



2.2 Electrical Absolute Rating:

2.2.1 TFT LCD Module:

Item	Symbol	Condition	Value		Unit
			min.	max.	
Input Power Voltage	V_{DD}	Normal	+3.0	+3.6	V(DC)
Logic Signal input voltage	V_{SIG}	Normal	-0.3	$V_{DD} + 0.3$	V

2.2.2 Back Light Unit:

Item	Symbol	Min.	Max.	Unit	Note
Lamp voltage	V_L	0	2000	V(rms)	(1)
Lamp current	I_L	—	7.0	mA	(1)
Lamp frequency	f_L	0	100	KHz	(1)

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.

3.0 OPTICAL CHARACTERISTICS

3.1 Measuring Condition

Measuring surrounding : dark room

Lamp current I_{BL} : $(6.0) \pm 0.1$ mA, lamp freq. $F_L = 50$ KHz

$V_{DD1} = 3.3$ V, $f_V = 60$ Hz, $f_{DCLK} = 32.5$ MHz

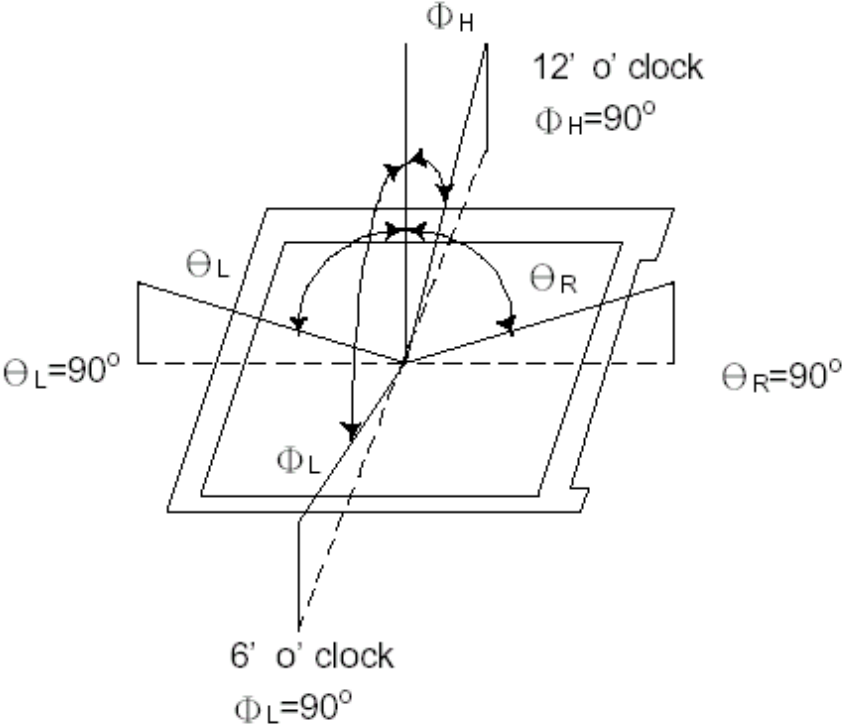
Surrounding temperature : 25 ± 2 °C

30min. Warm-up time.

3.2 Optical specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast	CR		400	500	---		(1),(2),(5)
Luminance (White)	cd/m ²		---	300	---		
Response time	Rising	T_R	---	9	---	msec	(1),(3),(5)
	Falling	T_F	---	25	---		
Color chromaticity (CIE 1931)	Red	R_x	$\theta = 0^\circ$ $\phi = 0^\circ$ Normal viewing angle	---	(0.623)	---	(1),(4),(5)
		R_y		---	(0.335)	---	
	Green	G_x		---	(0.293)	---	
		G_y		---	(0.599)	---	
	Blue	B_x		---	(0.144)	---	
		B_y		---	(0.113)	---	
	White	W_x		---	(0.310)	---	
		W_y		---	(0.330)	---	
Viewing angle	Hor.	θ_L	CR>10	---	65	---	
		θ_R		---	70	---	
	Ver.	θ_H		---	55	---	
		θ_L		---	70	---	

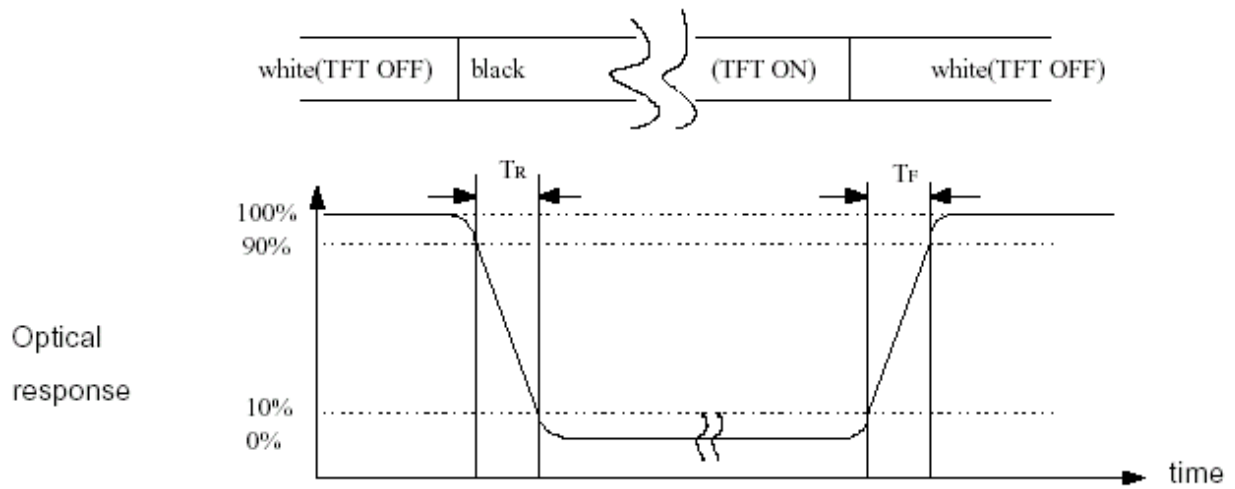
Note (1) Definition of Viewing Angle:



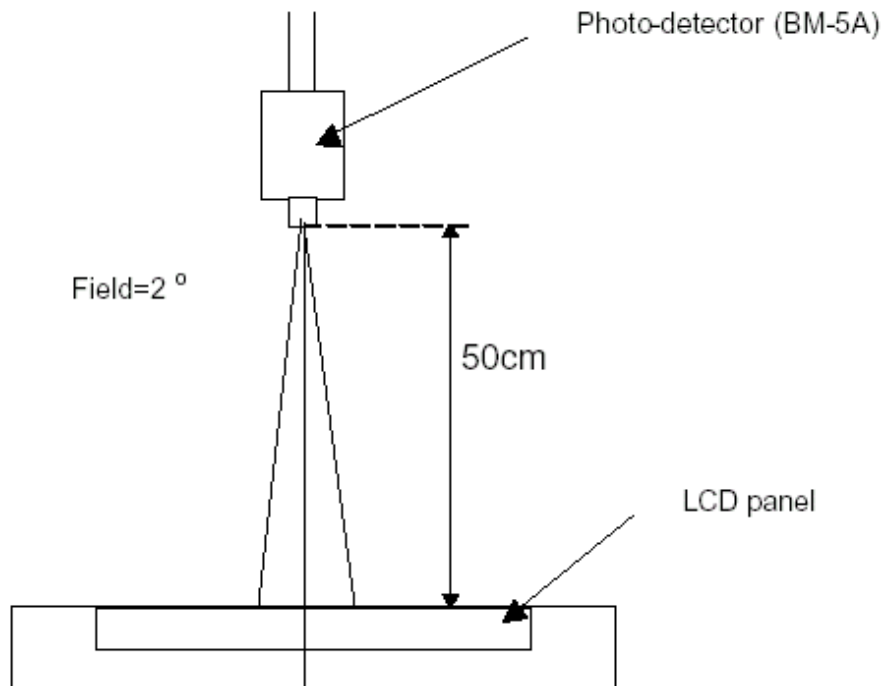
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

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

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

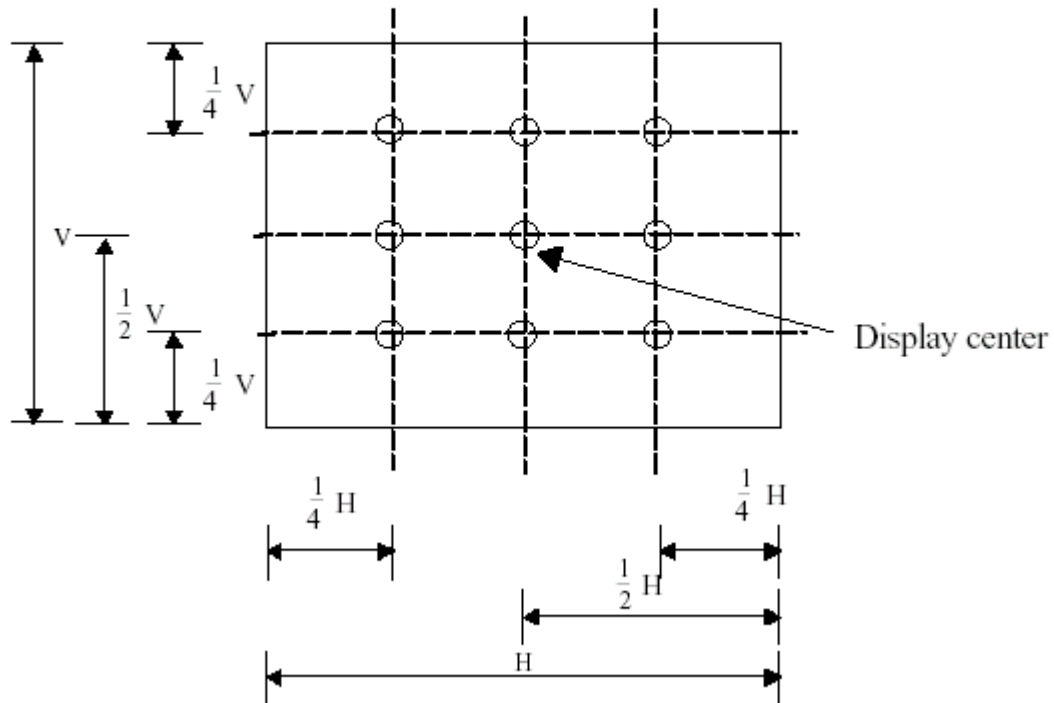


Note (4) Optical characteristic measurement setup



Note (5) Definition of brightness uniformity

Luminance uniformity = (Min Luminance)/(Max Luminance) x 100%



Note (6) Definition of crosstalk CT (1) ~ CT (4)

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

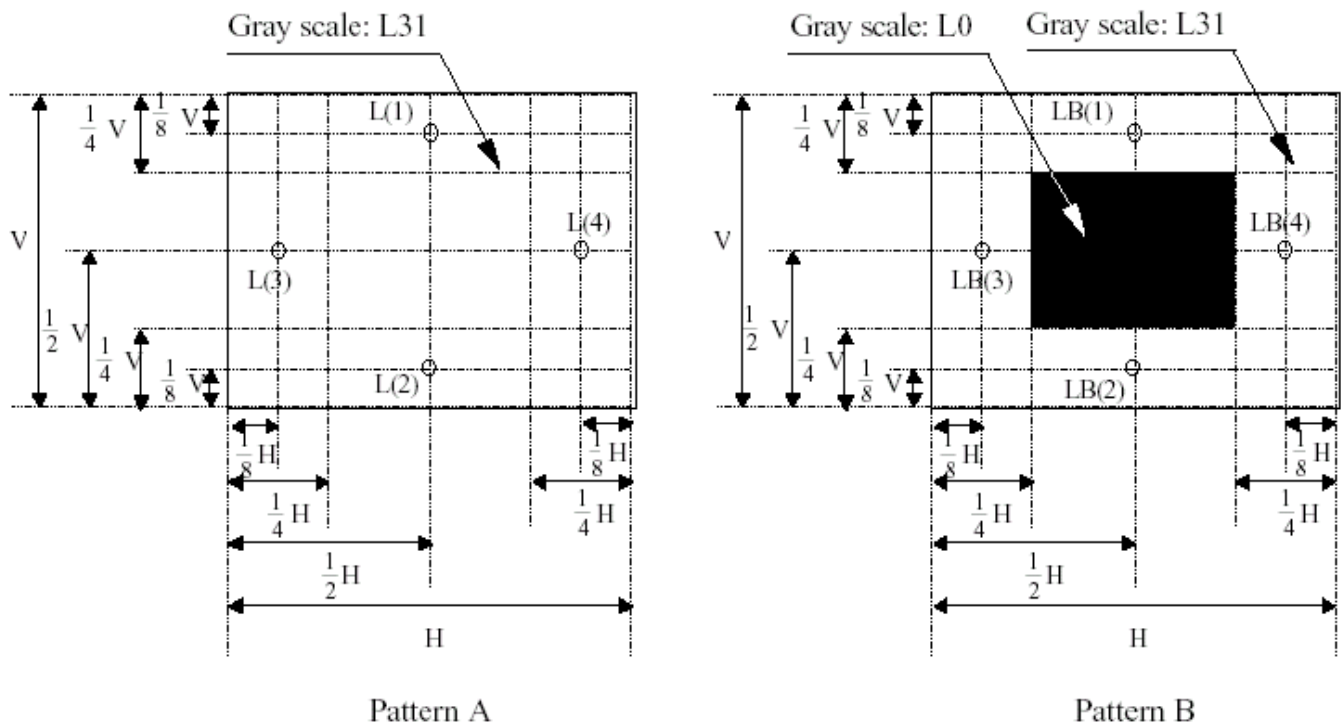
Where $L(n)$ = Luminance of point "n" at pattern A (cd/m^2) , $n=1\sim 4$

$LB(n)$ = 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.

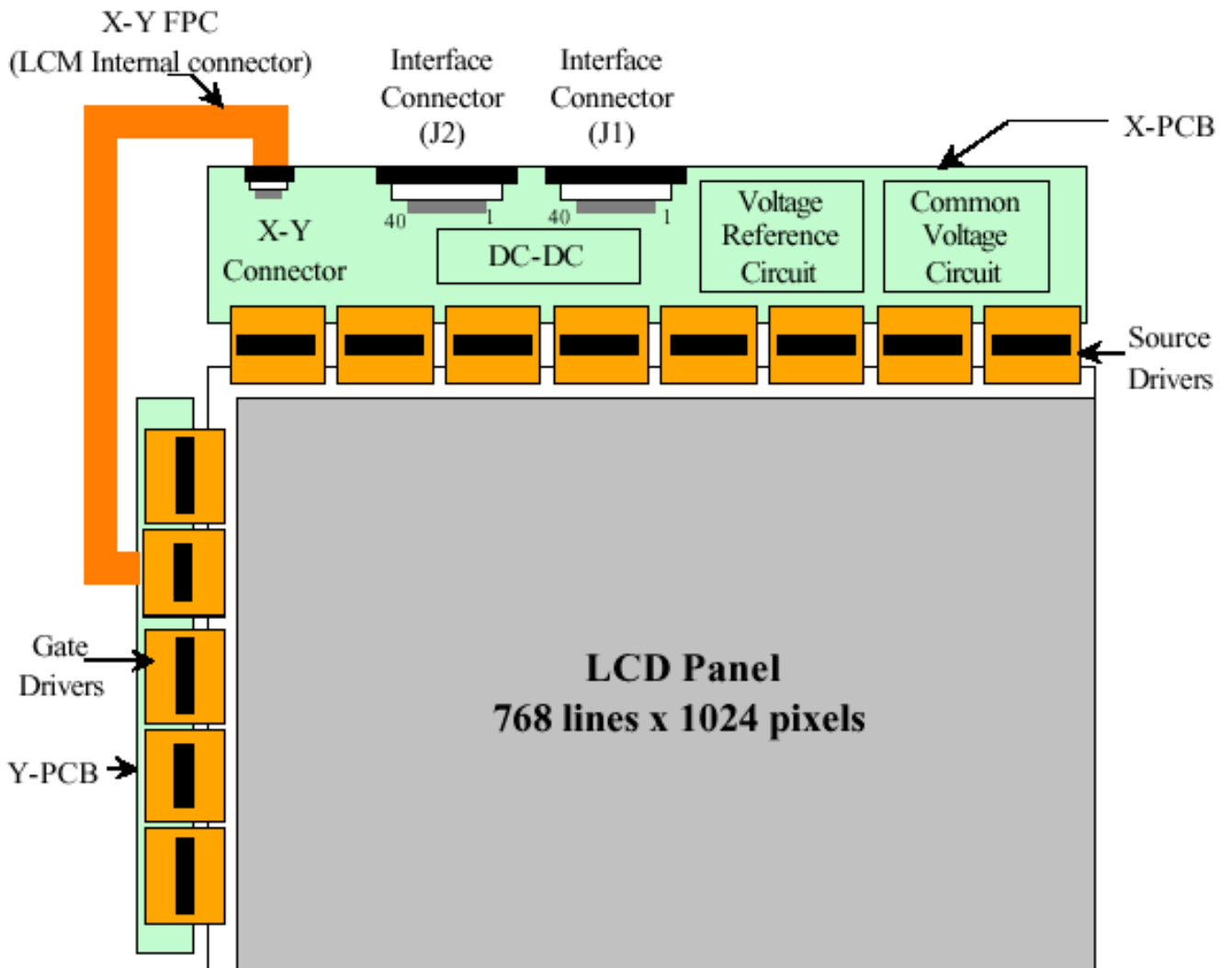
L0: Luminance with all pixels black

L63: Luminance with all pixels white

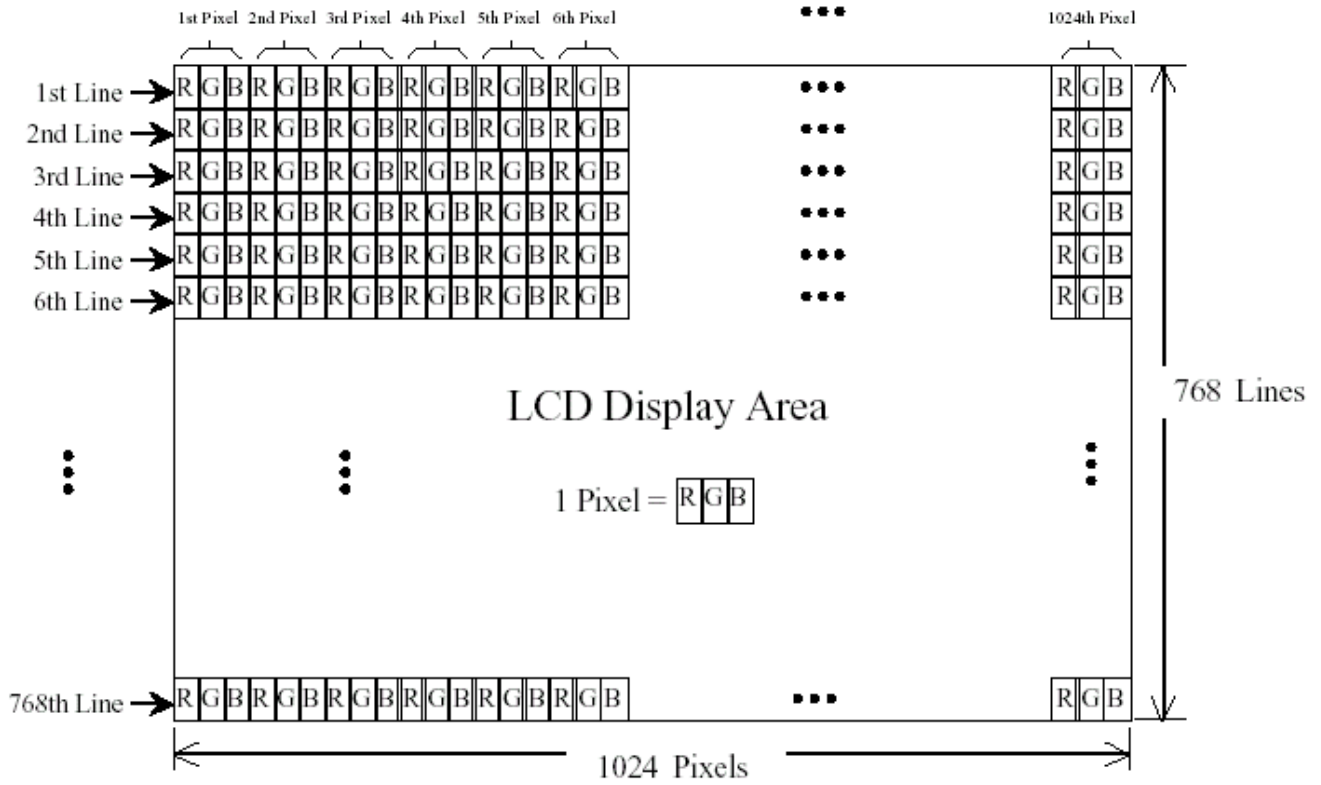


4.0 BLOCK DIAGRAM

4.1 LCD Module Block Diagram:



4.2 Pixel Format

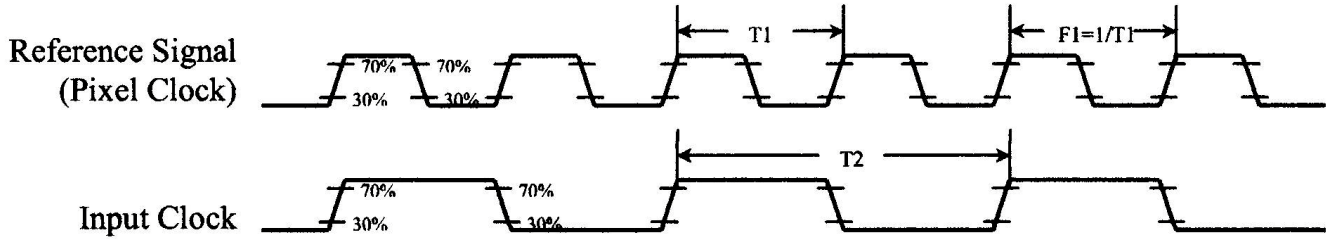


4.3 Relationship between Displayed Color and Input Data

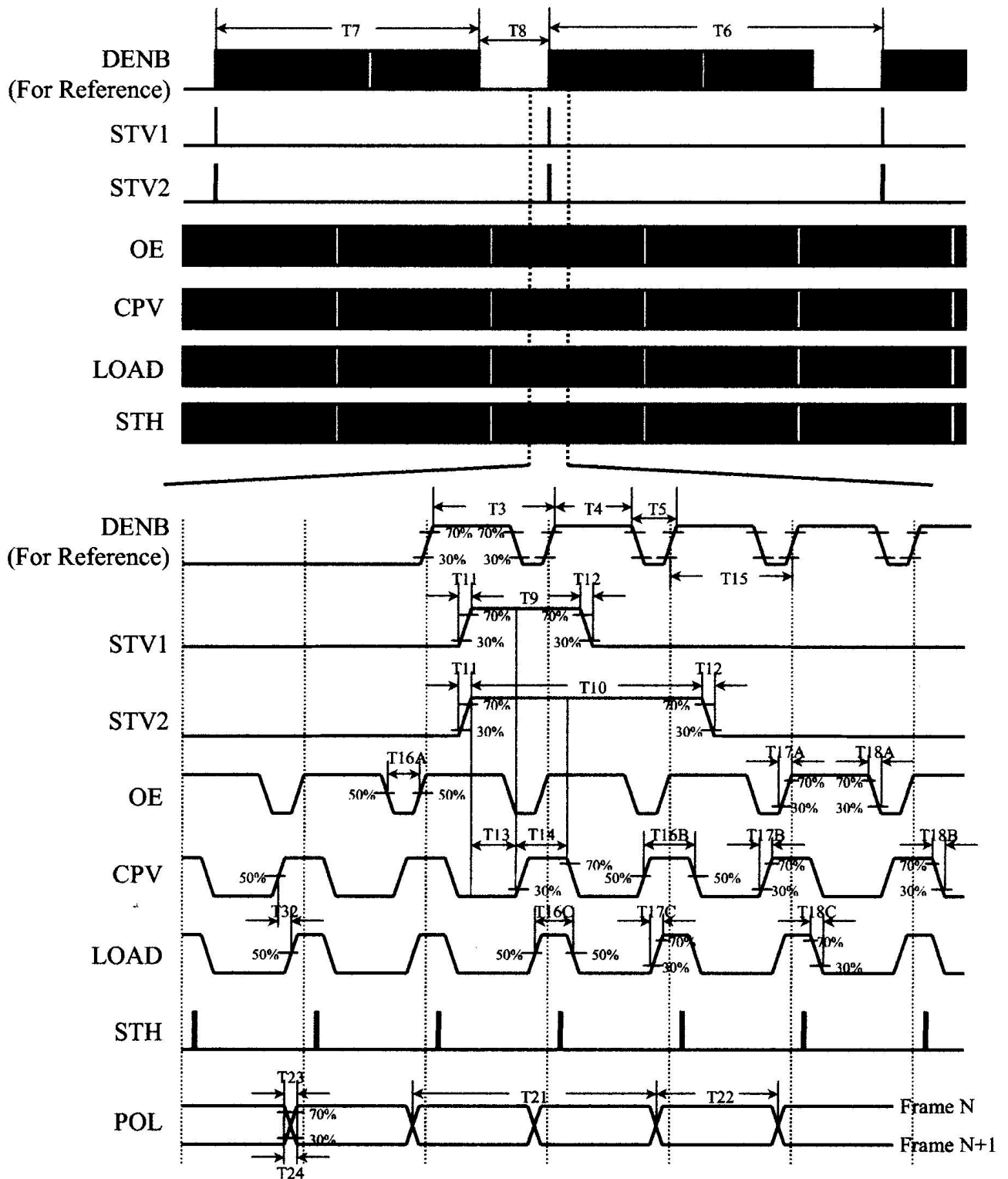
	Display	MSB					LSB					MSB					LSB					Gray scale level
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0			
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-		
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	-		
	Green	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	-		
	Light Blue	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	-		
	Red	H	H	H	H	H	H	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	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		
	Light	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	L0		
	Dark	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		
	Light	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	L0		
	Dark	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		
	Light	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 and Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0		
	Dark	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		
	Light	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		

5.0 AC Timing Charts.

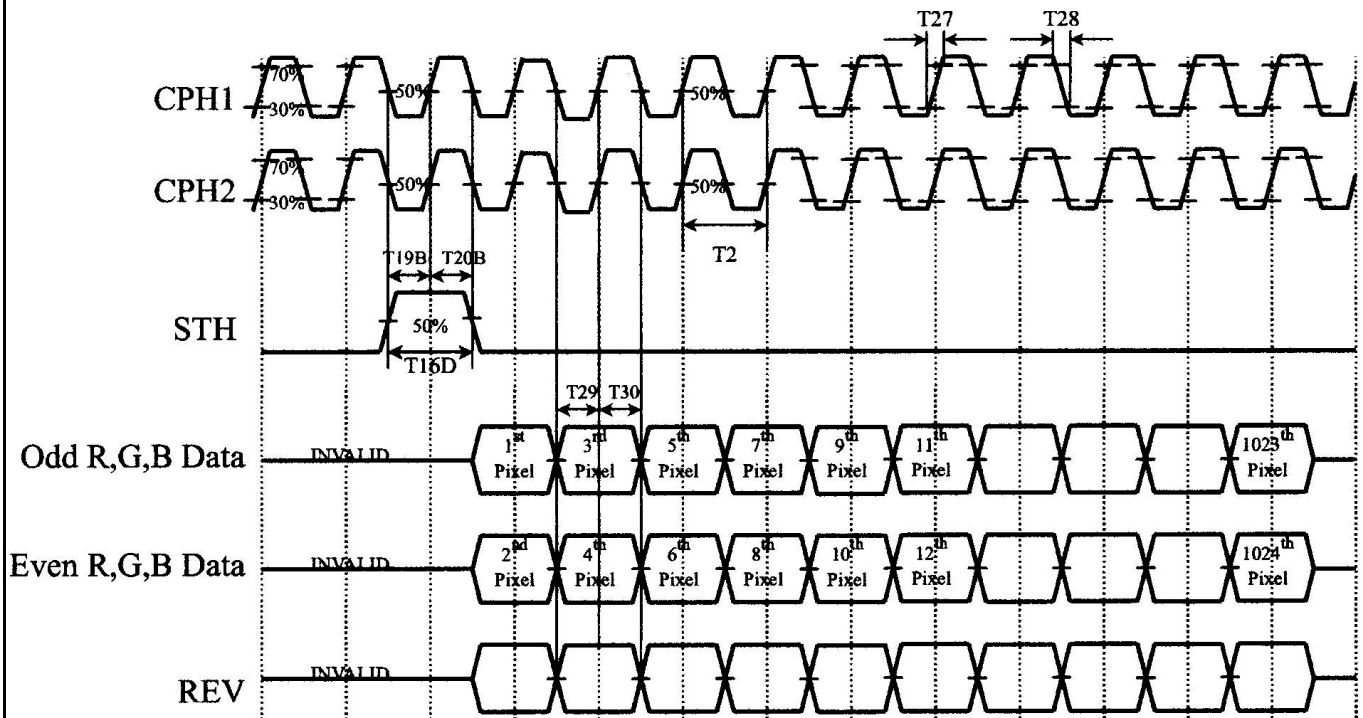
(1). Reference Signal (pixel clock):



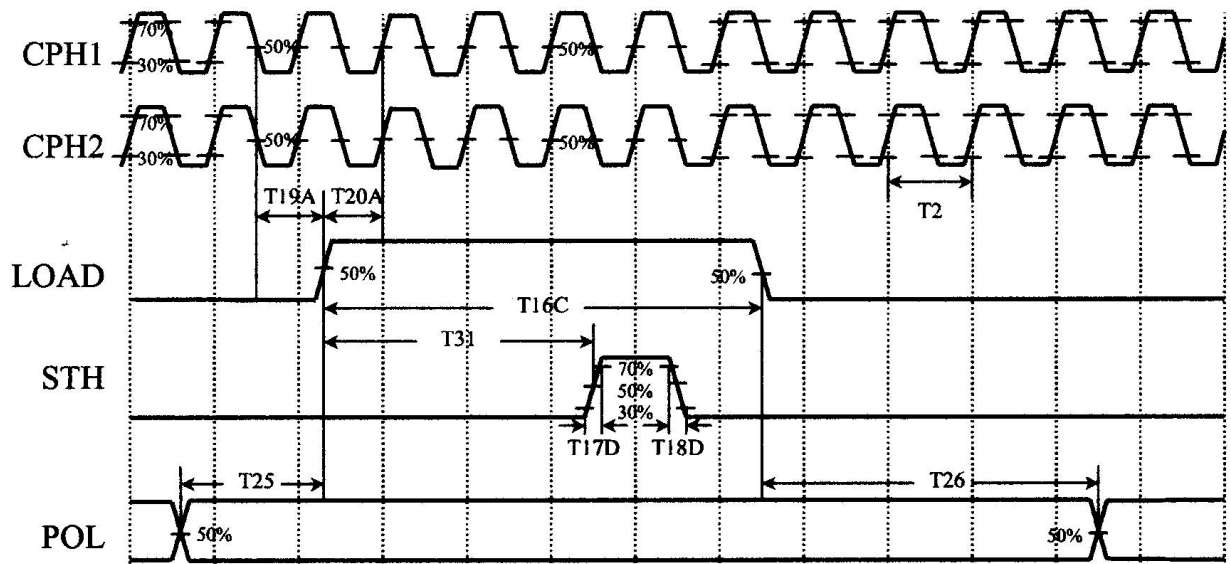
(2). Vertical Periodic (STV1, STV2, OE, CPV):



(3). Horizontal Periodic 1 (STH, CPH, DATA):



(4). Horizontal Periodic 2 (CPH, LOAD, STH, POL):



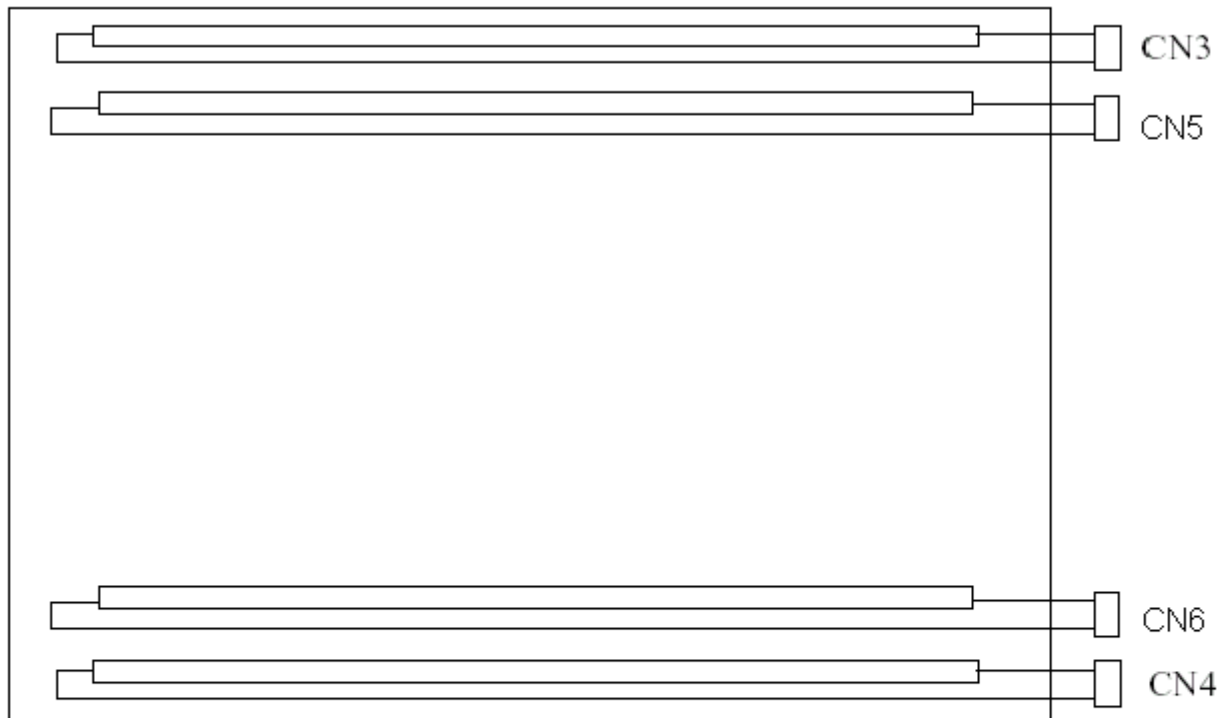
6.0 I/O CONNECTION PIN ASSIGNMENT

6.1 Interface FPC Connector (40-pins x 2)

I/F FRC Connector (J1)			I/F FRC Connector (J2)		
Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	NC	No Connecting	1	VDD	Digital Power Input (DC +3.3V)
2	NC	No Connecting	2	VDD	Digital Power Input (DC +3.3V)
3	GND	Ground	3	GND	Ground
4	GND	Ground	4	GND	Ground
5	EB5	Even-dot Blue Data bit 5 (MSB)	5	OB5	Odd-dot Blue Data bit 5 (MSB)
6	EB4	Even-dot Blue Data bit 4	6	OB4	Odd-dot Blue Data bit 4
7	EB3	Even-dot Blue Data bit 3	7	OB3	Odd-dot Blue Data bit 3
8	EB2	Even-dot Blue Data bit 2	8	OB2	Odd-dot Blue Data bit 2
9	EB1	Even-dot Blue Data bit 1	9	OB1	Odd-dot Blue Data bit 1
10	EB0	Even-dot Blue Data bit 0 (LSB)	10	OB0	Odd-dot Blue Data bit 0 (LSB)
11	GND	Ground	11	GND	Ground
12	EG5	Even-dot Green Data bit 5 (MSB)	12	OG5	Odd-dot Green Data bit 5 (MSB)
13	EG4	Even-dot Green Data bit 4	13	OG4	Odd-dot Green Data bit 4
14	EG3	Even-dot Green Data bit 3	14	OG3	Odd-dot Green Data bit 3
15	EG2	Even-dot Green Data bit 2	15	OG2	Odd-dot Green Data bit 2
16	EG1	Even-dot Green Data bit 1	16	OG1	Odd-dot Green Data bit 1
17	EG0	Even-dot Green Data bit 0 (LSB)	17	OG0	Odd-dot Green Data bit 0 (LSB)
18	GND	Ground	18	GND	Ground
19	ER5	Even-dot Red Data bit 5 (MSB)	19	OR5	Odd-dot Red Data bit 5 (MSB)
20	ER4	Even-dot Red Data bit 4	20	OR4	Odd-dot Red Data bit 4
21	ER3	Even-dot Red Data bit 3	21	OR3	Odd-dot Red Data bit 3
22	ER2	Even-dot Red Data bit 2	22	OR2	Odd-dot Red Data bit 2
23	ER1	Even-dot Red Data bit 1	23	OR1	Odd-dot Red Data bit 1
24	ER0	Even-dot Red Data bit 0 (LSB)	24	OR0	Odd-dot Red Data bit 0 (LSB)
25	GND	Ground	25	GND	Ground
26	CPH1	Pixel Clock Input	26	CPH2	Pixel Clock Input
27	GND	Ground	27	GND	Ground
28	GND	Ground	28	GND	Ground
29	STH	Horizontal Start Pulse	29	NC	No Connecting
30		Source Driver Latch Pulse	30	NC	No Connecting
31	POL	Source Driver Output Polarity control	31	NC	No Connecting
32	REV	Data Reverse Control Signal	32	NC	No Connecting
33	GND	Ground	33	NC	No Connecting
34	GND	Ground	34	NC	No Connecting
35	STV1	Vertical Start Pulse 1	35	NC	No Connecting
36	STV2	Vertical Start Pulse 2	36	NC	No Connecting
37	CPV	Vertical Clock Input	37	NC	No Connecting
38		Gate Driver Output Enable Signal	38	NC	No Connecting
39	GND	Ground	39	GND	Ground
40	GND	Ground	40	GND	Ground

LCD Connector:FH12-40S-0.5SH (Hirose) or equivalent

6.2 Back Light Unit (CCFL) Connectors:



The backlight interface connector is a model BHSR-02VS-1, manufactured by JST, The mating Connector part number is SM02B-BHSS-1-TB or equivalent.

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

7.0 ELECTRICAL CHARACTERISTICS

7.1 Electrical System of LCD Module :

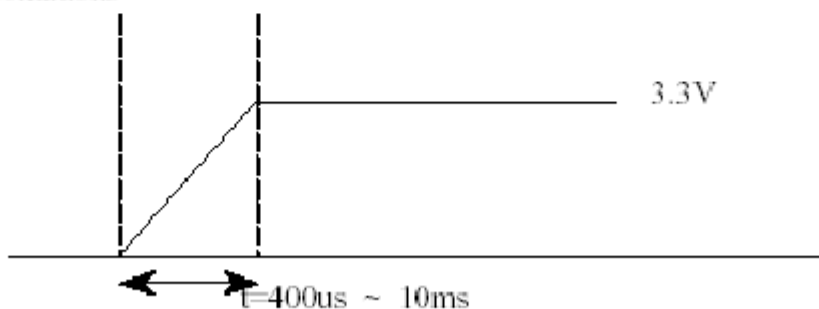
Item	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Input Voltage	V_{DD}		+3.0	+3.3	+3.6	V(DC)
Input Signal voltage	V_{IH}	High Level	$0.7 * V_{DD2}$	-----	$V_{DD}+0.2$	V
	V_{IL}	Low Level	0	-----	$0.3 * V_{DD2}$	V

7.2 Back-Light Unit:

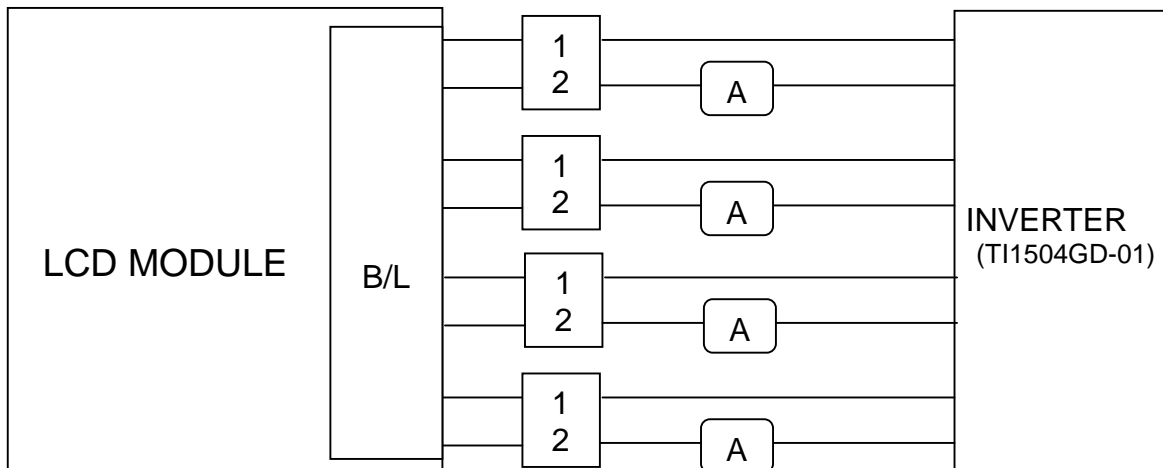
The backlight system is an edge-lighting type with -CCFL (Cold Cathode Fluorescent Lamp). The characteristics of four lamps are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	I_L	4.68	4.70	4.76	mA(rms)	(1)
Lamp voltage	V_L	565	-----	580	V(rms)	$I_L=6.0$ mA
Frequency	f_L	-----	33	-----	KHz	(2)
Operating life time	Hr	-----	50000	-----	Hour	(3)
Startup voltage	V_s	710	-----	728	V(rms)	at 25°C
		-----	1350	-----	V(rms)	at 0°C

* Inrush current conditions



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



- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
- (3) Life time (Hr) can be defined as the time in which it continues to operate under the condition: Temp. = $25 \pm 3^\circ \text{C}$, $I_L = 6.0 \text{mA (rms.)}$ and $f_L = 50 \text{KHz}$ until one of the following event occurs:
1. When the brightness becomes 50%.
 2. When the startup voltage (Vs) at 0°C becomes higher than the maximal value of Vs specified above.

8.0 Outline dimension

