No.	CM-W-E-0002
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SPECIFICATION

FOR

TFT - LCD module

MODEL No. FU-13-002

【受领印栏】

副事业部长

营业部	第一生产部	生产技术部

WUXI SHARP ELECTRONIC COMPONENTS CO.,LTD.

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1. Application

This technical literature applies to a color TFT-LCD module, FU-13-002.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 1280×3×800 dots panel with 262,144 colors by using LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

In this TFT-LCD panel , low reflection / color filters of excellent color performance and backlights of high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

Optimum viewing direction is 6 o'clock.

Backlight-driving DC/AC inverter is not built in this module.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	33.7(13.3") Diagonal	cm
Active area	286.1 (H)×178.8 (V)	mm
Pixel format	1280 (H)×800 (V)	pixel
	(1 pixel = R+G+B dots)	
Aspect ratio	16 : 10	
Pixel pitch	0.2235 (H)×0.2235 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Surface treatment	Glare and hard-coating 2H	

Parameter		Min.	Typ.	Max.	Unit
Unit outline dimensions [Note 1]	Width	298.7	299.0	299.3	mm
	Height	194.7	195.0	195.3	mm
	Depth	–	–	5.5	mm
Mass		–	375	390	g

[Note 1] excluding backlight cables.

Outline dimensions is shown in Fig.1 (Page 15).

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (LVDS signals and +3.3V DC power supply)

Pin No.	Symbol	Function	Remark
1	GND		
2	Vcc	+3.3V power supply	
3	Vcc	+3.3V power supply	
4	NC		[Note 3]
5	NC		[Note 3]
6	NC		[Note 3]
7	NC		[Note 3]
8	RxIN0-	Receiver signal of LVDS CH0 (-)	[Note 1]
9	RxIN0+	Receiver signal of LVDS CH0 (+)	[Note 1]
10	GND		
11	RxIN1-	Receiver signal of LVDS CH1 (-)	[Note 1]
12	RxIN1+	Receiver signal of LVDS CH1 (+)	[Note 1]
13	GND		
14	RxIN2-	Receiver signal of LVDS CH2 (-)	[Note 1]
15	RxIN2+	Receiver signal of LVDS CH2 (+)	[Note 1]
16	GND		
17	CK IN-	Receiver signal of LVDS CLK (-)	[Note 1]
18	CK IN+	Receiver signal of LVDS CLK (+)	[Note 1]
19	GND		
20	GND		

[Note 1] Relation between RxINi(i=0,1,2) and actual data is shown in following section (4-2)(7-2).

[Note 2] The shielding case is connected with signal GND.

[Note 3] Please use NC by OPEN or GND. NC terminal is not connected with the internal circuit.

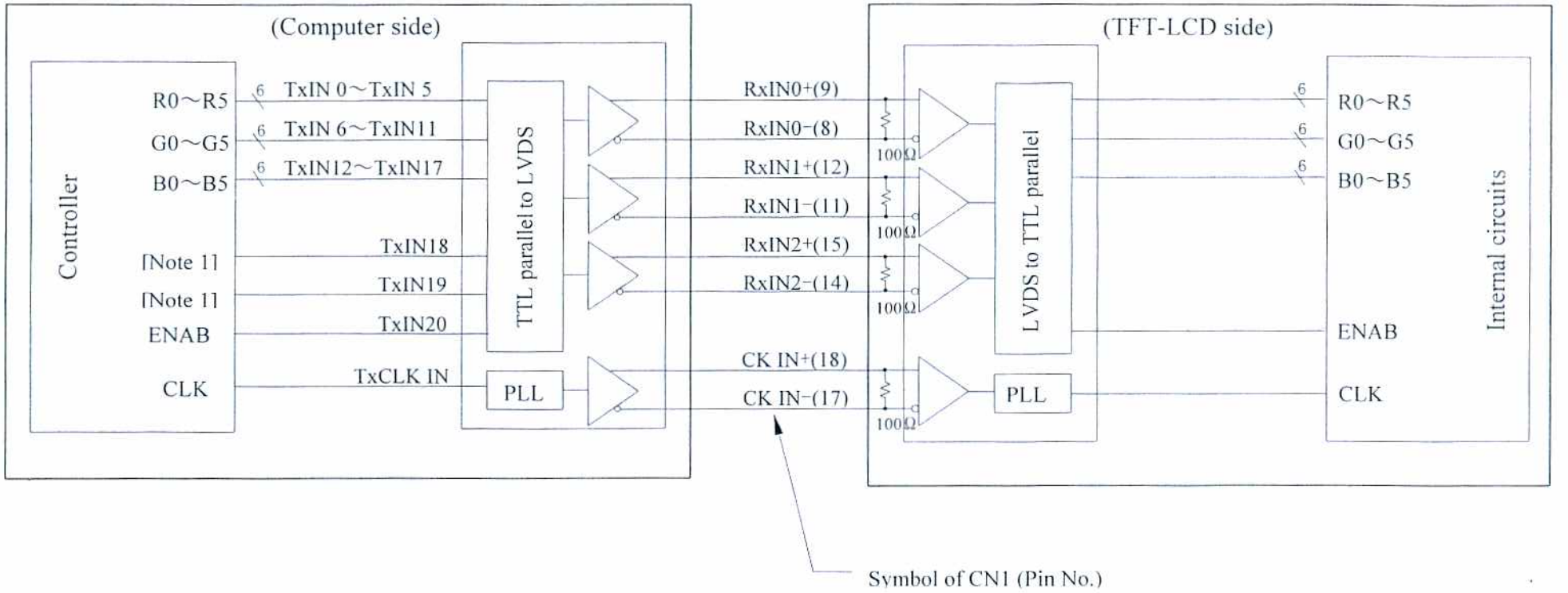
Using connector : DF19KR-20P-1H (Hirose) or equivalent.

Corresponding connector : DF19G-20S-1C (Hirose) or equivalent.

4-2 LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC

Corresponding Transmitter : THC63LVDM63A (THINE) or equivalent



[Note 1] Do not use at high-impedance TxIN 18 - 19.

4-3. Backlight driving

CN2 Using connector:BHSR-02VS-1(JST)

Corresponding connector : SM02B-BHSS-1-TB(JST)

Connector No.	Pin No.	Symbol	Function	FL cable color
CN2	1	V_{High}	Power supply for lamp (High voltage side)	Pink
	2	V_{Low}	Power supply for lamp (Low voltage side)	White

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
Input voltage	V_I	Ta=25℃	-0.3	Vcc+0.3	V	[Note 1]
+3.3V supply voltage	Vcc	Ta=25℃	0	+4.0	V	
Storage temperature	Tstg	—	-25	+60	℃	[Note 2]
Operating temperature (Ambient)	Topa	—	0	+50	℃	

[Note 1] LVDS signals

[Note 2] Humidity : 95%RH Max. at Ta≦+40℃.

Maximum wet-bulb temperature at +39℃ or less at Ta>+40℃.

No condensation.

6. Electrical Characteristics

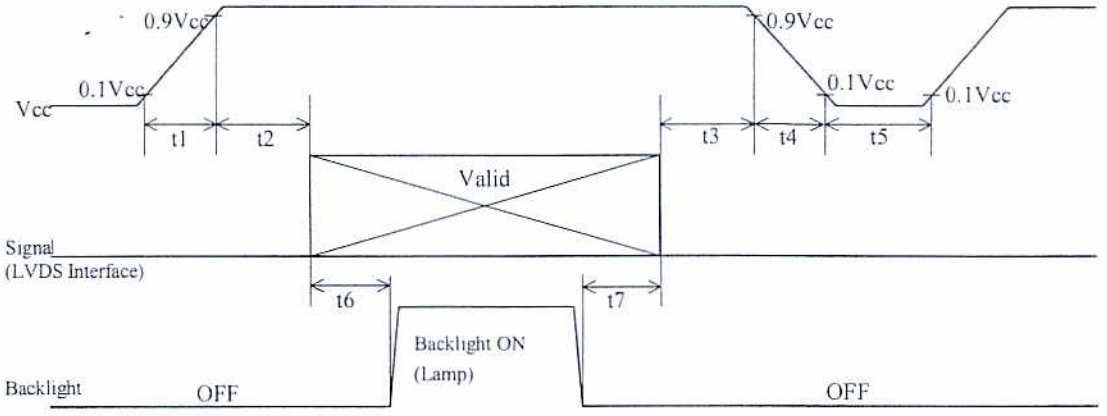
6-1.TFT-LCD panel driving Ta=+25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		Vcc	+3.0	+3.3	+3.6	V	[Note 2]
Current dissipation		Icc	—	290	430	mA	[Note 3]
Permissive input ripple voltage		V_{RP}	—	—	100	mV_{P-P}	Vcc = +3.3V
Input voltage range		V_I	0		2.4	V	LVDS signals
Differential input threshold voltage	High	V_{TH}	—	—	+100	mV	V_{CM} = +1.2V [Note 1]
	Low	V_{TL}	-100	—	—	mV	
Input current (High)		I_{OH}	—	—	±10	μA	V_I = +2.4V Vcc = +3.6V
Input current (Low)		I_{OL}	—	—	±10	μA	V_I = 0V Vcc = 3.6V
Terminal resistor		R_T	—	100	—	Ω	Differential input

[Note 1] V_{CM} : Common mode voltage of LVDS driver.

[Note 2]

On-off conditions for supply voltage



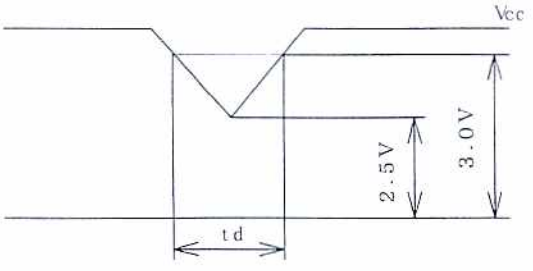
Symbol	Min.	Max.	Unit	Remark
t1	0	10	ms	
t2	0	1	s	
t3	0	1	s	
t4	0	400	ms	
t5	200	—	ms	
t6	180	—	ms	*1
t7	5	—	ms	*1

*1 : As for the power sequence for backlight, it is recommended to apply above mentioned input timing. If the backlight is lit on and off at a timing other than shown above, displaying image may get disturbed. This is due to variation of output signal from timing generator when LVDS signal is changed from on to off or vice versa, but has no harm to the module itself.

[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

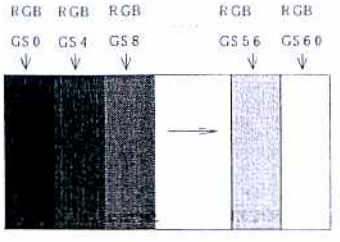
Vcc-dip conditions

1) 2.5 V≦Vcc＜3.0 V
   td≦10 ms
   Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.
2) Vcc＜2.5 V
   Vcc-dip conditions should also follow the On-off conditions for supply voltage



[Note 3] Typical current situation : 16-gray-bar pattern.
Vcc=+3.3V

Maximum current situation : Vcc=+3.0V



6-2. Backlight driving

The backlight system is edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

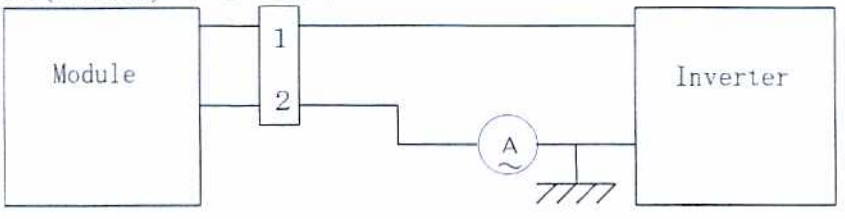
The characteristics of one lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp current range	I_L	3.0	6.0	6.5	mArms	[Note 1]	
Lamp voltage	V_L	–	625	–	Vrms		
Lamp power consumption	P_L	–	3.75	–	W	[Note 2]	
Lamp frequency	F_L	45	58	80	kHz	[Note 3]	
Kick-off voltage	V_S	–	–	1350	Vrms	Ta=25℃	[Note 4]
		–	–	1540	Vrms	Ta=0℃	
Lamp life time	L_L	12000	–	–	Hour	[Note 5]	

[Note 1] The lamp current range, which can be turned on, is shown.

Lamp current measures by connecting the ammeter for high frequency to the V_{Low} side in the circuit of the following figure.

- Lamp frequency : 45~80kHz
- Temperature (Ambient) : 0~+50℃



* 2pin is V_{LOW}

In addition, please check lighting starting nature and lighting stability after mounting a module and an inverter on the occasion of use in a low current region.

[Note 2] Calculated value for reference ($I_L \times V_L$)

[Note 3] Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

[Note 4] It is defined at 22pF for the ballast capacitor of a DC/AC inverter.

The voltage above this value should be applied to the lamp for more than 1 second to start-up. Otherwise the lamp may not be turned on.

[Note 5] Above value is applicable when the long side of LCD module is placed horizontally.(Landscape position)

(Lamp lifetime may vary if LCD module is in portrait position due to the change of mercury density inside the lamp)

Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of Ta = 25℃ and I_L = 6.5 mArms.

① Brightness becomes 50 % of the original value under standard condition.

② Kick-off voltage at Ta = 0℃ exceeds maximum value, 1540 V rms.

[Note] The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp.

When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur.

When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

[Note] Insulate the high voltage area in order to prevent direct contacts to the area. As countermeasures for excessive heat or exothermic fire, use protection elements such as fuses to cut the circuit.

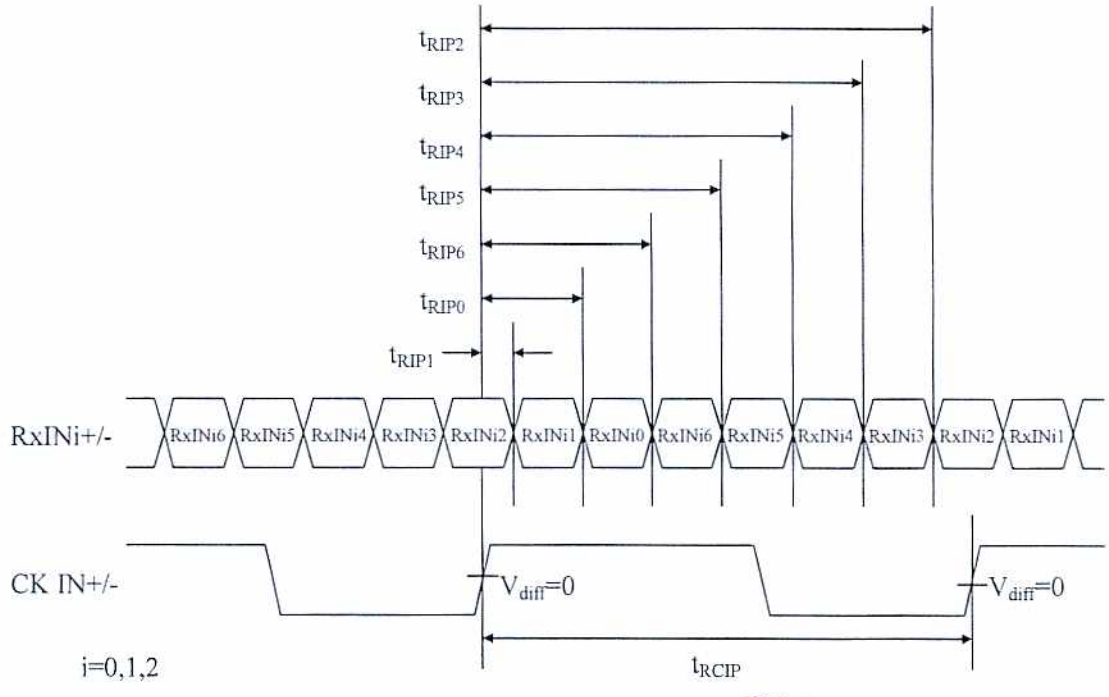
Use burn-resistant (or noncombustible) material for board or resin.

6-3. LVDS input specification

6.3.1. AC characteristics Vcc=+3.0V～+3.6V, Ta=0℃～+50℃

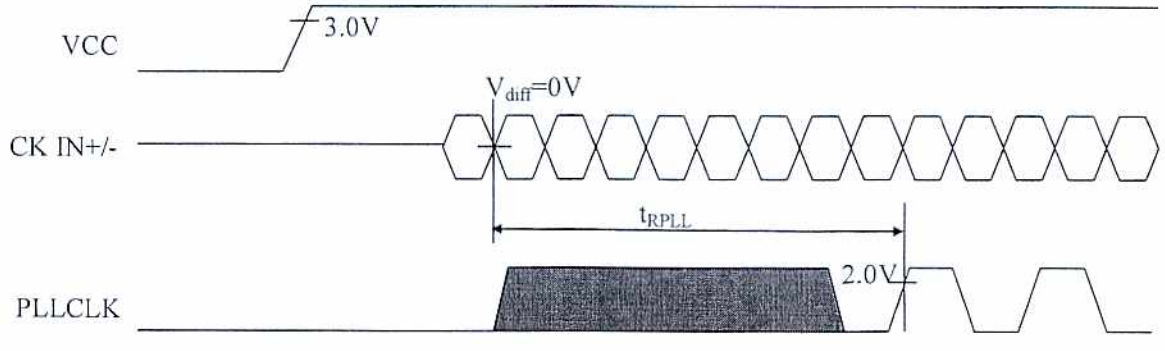
Parameter	Symbol	Min	Typ.	Max.	Unit
Input Data Position 0 (tRCIP=14.08ns)	t_{RIP1}	-0.25	0.0	+0.25	ns
Input Data Position 1 (tRCIP=14.08ns)	t_{RIP0}	t_{RCIP}/7-0.25	t_{RCIP}/7	t_{RCIP}/7+0.25	ns
Input Data Position 2 (tRCIP=14.08ns)	t_{RIP6}	2 t_{RCIP}/7-0.25	2 t_{RCIP}/7	2 t_{RCIP}/7+0.25	ns
Input Data Position 3 (tRCIP=14.08ns)	t_{RIP5}	3 t_{RCIP}/7-0.25	3 t_{RCIP}/7	3 t_{RCIP}/7+0.25	ns
Input Data Position 4 (tRCIP=14.08ns)	t_{RIP4}	4 t_{RCIP}/7-0.25	4 t_{RCIP}/7	4 t_{RCIP}/7+0.25	ns
Input Data Position 5 (tRCIP=14.08ns)	t_{RIP3}	5 t_{RCIP}/7-0.25	5 t_{RCIP}/7	5 t_{RCIP}/7+0.25	ns
Input Data Position 6 (tRCIP=14.08ns)	t_{RIP2}	6 t_{RCIP}/7-0.25	6 t_{RCIP}/7	6 t_{RCIP}/7+0.25	ns
Phase Lock Loop Set	t_{RPLL}	—	—	10	ms
Input Clock Period	t_{RCIP}	13.3	14.1	16.7	ns

LVDS input timing

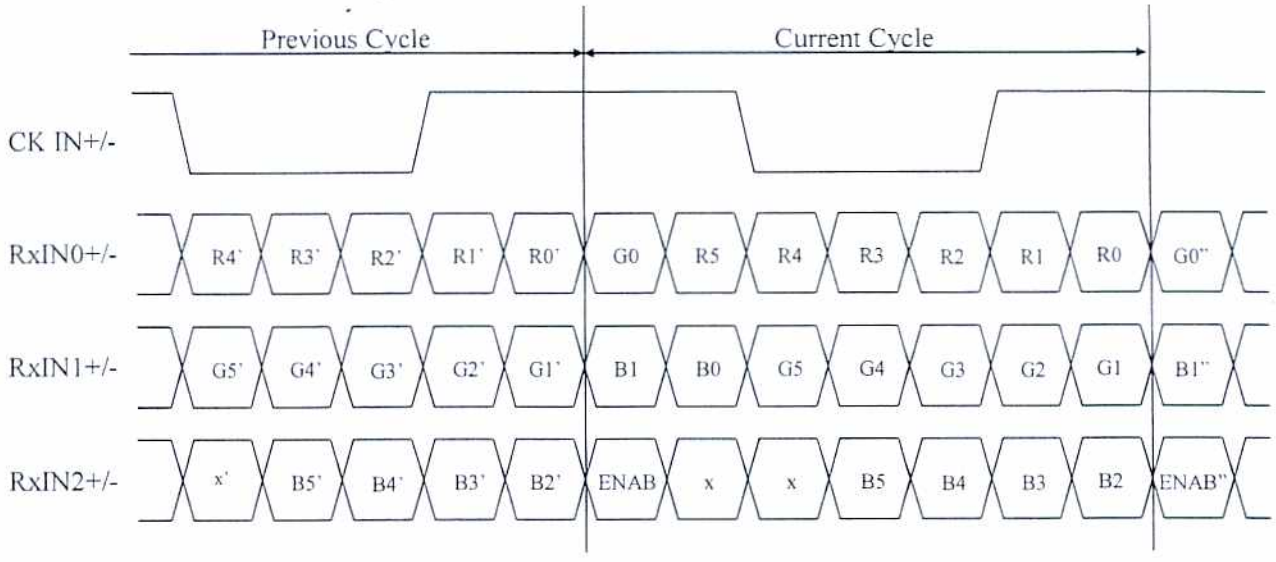


※Note
Vdiff=(RxINi+)-(RxINi-), (CK IN+)-(CK IN-)

LVDS phase lock loop set



6.3.2.LVDS data



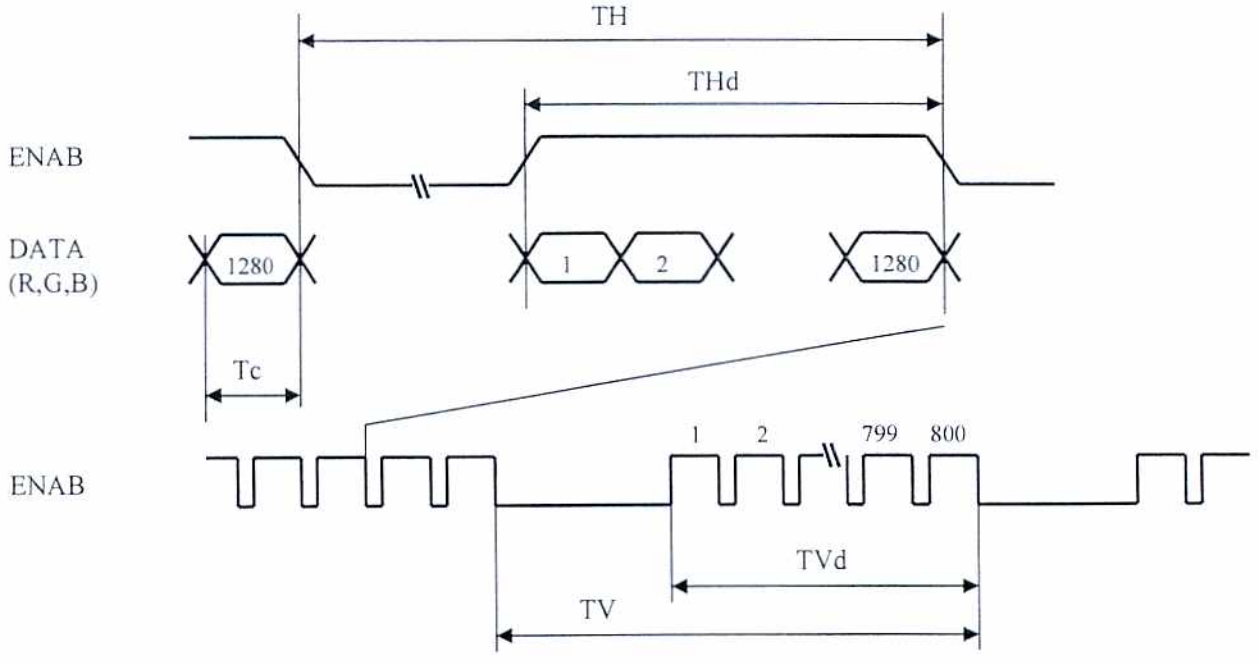
7. Timing Characteristics of Input Signals

7-1. Timing characteristics

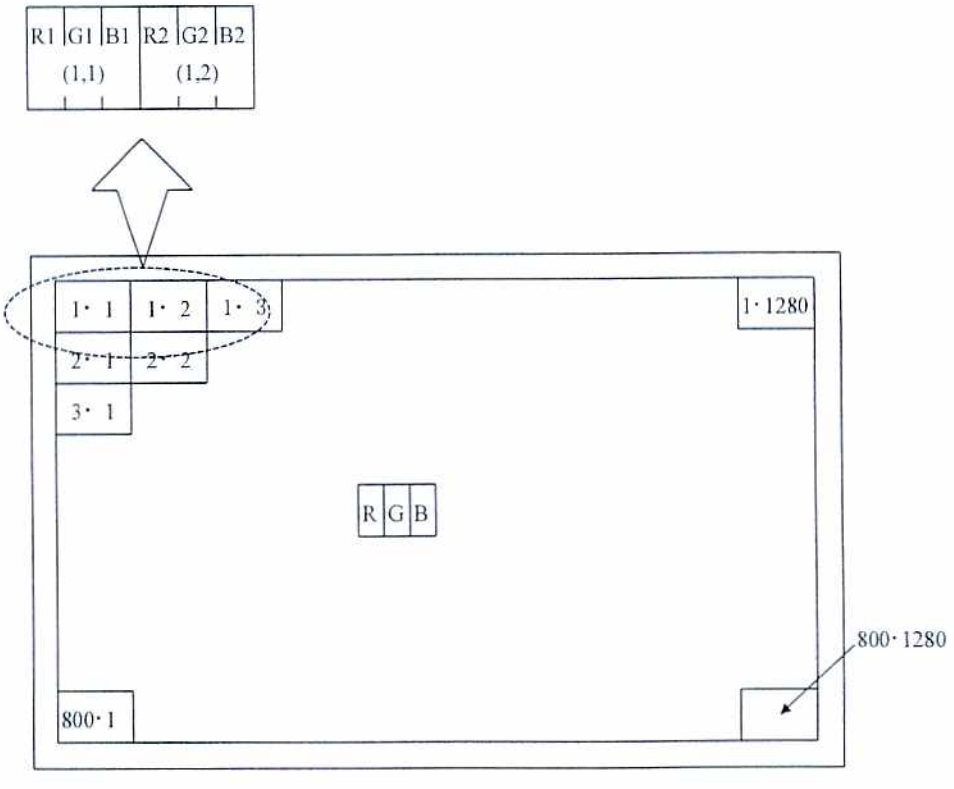
Vcc=+3.0V～+3.6V, Ta=0℃～+50℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	60	71	85	MHz	[Note 1]
Data enable Signal	Horizontal period	TH	1400	1440	1680	clock	
			19.71	20.28	—	μs	
	Horizontal period (High)	THd	1280	1280	1280	clock	
	Vertical period	TV	803	823	900	Line	
			15.83	16.69	—	ms	
	Vertical period (High)	TVd	800	800	800	line	

[Note 1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.



7-2. Input data signals and display position on the screen



Display position of input data(V· H)

8. Input Signals, Basic Display Colors and Gray Scale of Each Color

	Colors & Gray scale	Gray Scale	Data signal																	
			R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	—	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	—	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	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
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	↓	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	↓	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

9. Optical Characteristics

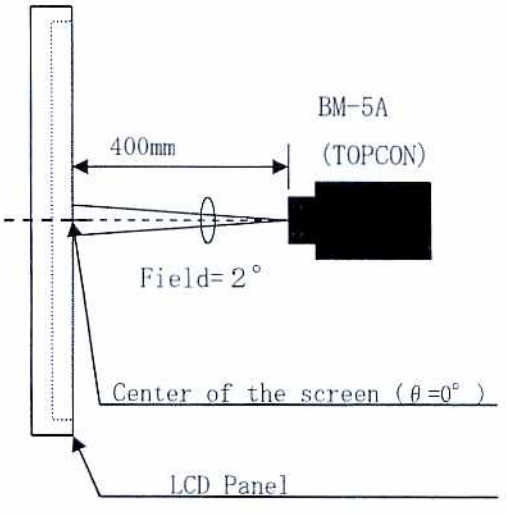
Ta=+25℃, Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21, θ 22	CR>10	45	—	—	Deg.	[Note 1,3,6]
	Vertical	θ 11		10	—	—	Deg.	
		θ 12		30	—	—	Deg.	
Contrast ratio		CRn	θ =0°	150	—	—		[Note 1,4,6]
		CRo	Optimum viewing angle	150	300	—		
Response time		τ r+ τ d	θ =0°	—	30	40	ms	[Note 1,5,6]
Chromaticity of white		x		0.292	0.322	0.352		[Note 1,6]
		y		0.302	0.332	0.362		
Luminance of white		Y_{LI}		190	240	—	cd/m^2	[Note 1,7] I_L=6.0mArms F_L=58kHz
White Uniformity		δ w		—	1.10	1.30		[Note 1,8]

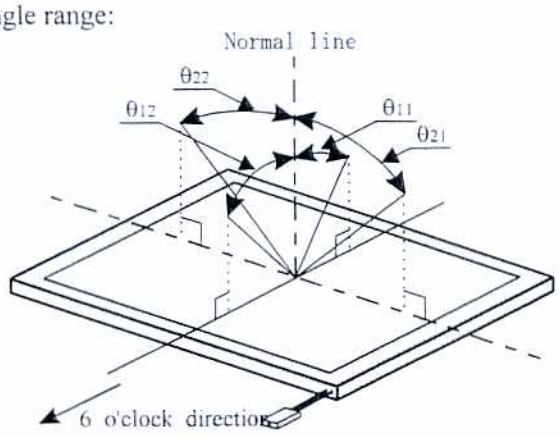
The measurement shall be executed 30 minutes after lighting at rating. Condition : (I_L=6.0mArms)

The optical characteristics shall be measured in a dark room or equivalent.

[Note 1] Optical Characteristics Measurements



[Note 3] Definitions of viewing angle range:



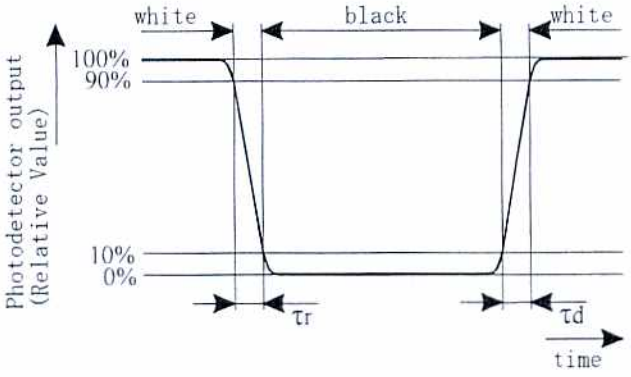
[Note 4] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 5] Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



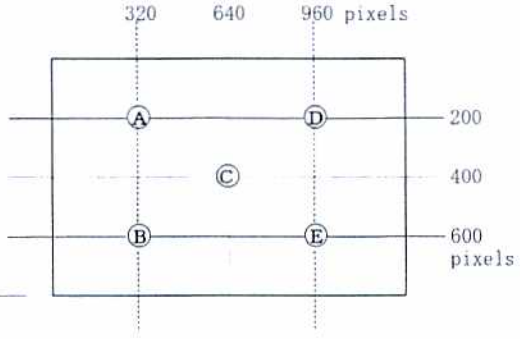
[Note 6] This shall be measured at center of the screen.

[Note 7] Average of five point.(A~E)

[Note 8] Definition of white uniformity:

White uniformity is defined as the following with five measurements (A～E).

$$\delta w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$



10. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the front polarizer is easily damaged, pay attention not to scratch it.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

h) This module has its circuitry PCBs on the rear side and should be handled carefully in order not to be stressed.

i) Protect sheet is attached to the module surface to prevent it from being scratched. Peel the sheet off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc..

j) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.

k) Connect GND of mounting holes to stabilize against EMI and external noise.

l) There are high voltage portions on the backlight and very dangerous. Careless touch may lead to electrical shock. When exchange lamps or service, turn off the power without tail.

m) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

n) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.

o) Be careful not to pull the back light lead cable with an excessive strength, when connecting to the inverter or handling the cables.

p) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the technical literature may not be satisfied.

q) Disassembling the module can cause permanent damage and should be strictly avoided.

r) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

s)Please handle carefully not to charge excessive stress onto the back of the module.Excessive stress may cause unrepairable damage to the module.

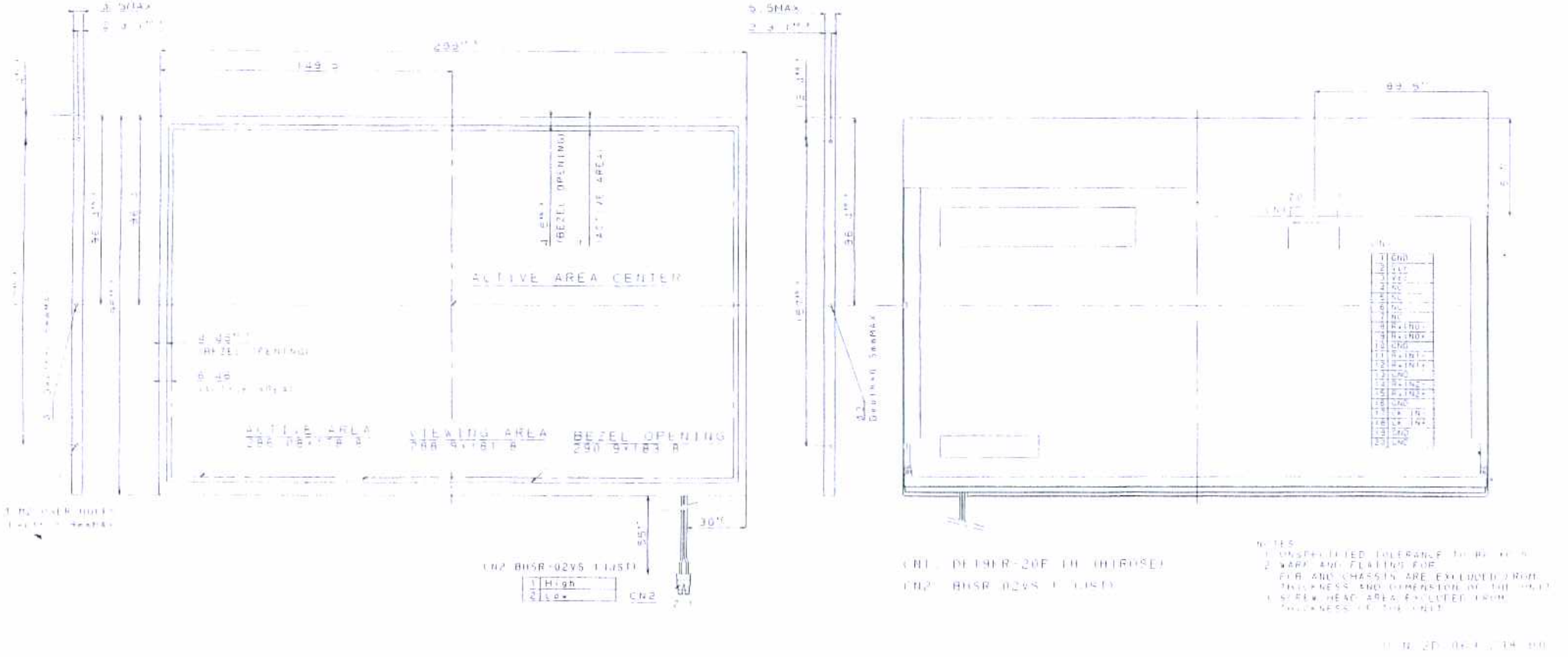


Fig1. FU-13-002 Outline Dimensions