SHARP

No.	LD – 22551A
DATE	May. 26. 2010

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ101K1LY02

The technical literature is subject to change without notice.
So, please contact Sharp or its representative before designing your product based on this literature.

ENGINEERING DEPARTMENT I
LIQUID CRYSTAL DISPLAY DIVISION III
LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

RECORDS OF REVISION

LQ101K1LY02

SPEC No.	DATE	REVISED No.	SUMMARY PAGE	SUMMARY	NOTE
LD-22551A	Mar. 26. 2010				1st Issue

In case of using the device for applications such as control and safety equipment for transportation(aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment(trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device, which does not comply with the instructions, and the precautions specified in these technical literature sheets.

Contact and consult with a SHARP sales representative for any questions about this device.

Table of contents

Fig1. Outline dimension

1. Application

This technical literature applies to a color TFT-LCD module, LQ101K1LY02.

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, a control circuit and power supply circuit, and a backlight unit. Graphics and texts can be displayed on a 1280×3×800 dots panel with (16,777,216) 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, 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 viewings are all directions.

Backlight-driving LED controller is not built in this module.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	25.6 (10.07") Diagonal	cm
Active area	217.0 (H)×135.6 (V)	mm
Pixel format	1280 (H)×800 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.170 (H)×0.170 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally black	
Surface treatment	Glare + LR	

Parameter		Min.	Typ.	Max.	Unit
Unit outline dimensions [Note 1]	Width	(229.2)	(229.5)	(229.8)	mm
	Height	(148.8)	(149.1)	(149.4)	mm
	Depth	—	(4.88)	(5.08)	mm
Mass		—	(175)	(190)	g

[Note 1] Outline dimensions is shown in Fig.1

4. Input Terminals

4 - 1. Symbol

CN1 (LVDS signals, +3.3V DC power supply, and B/L power supply)

Pin No.	Symbol	Function	Remark
1	NC		[Note2]
2	VDD	+3.3V power supply	
3	VDD	+3.3V power supply	
4	NC		[Note2]
5	SCLK	I2C Serial Input Clock	[Note3]
6	SDAT	I2C Serial DATA/IO	[Note3]
7	NC		[Note2]
8	RIN0-	Receiver signal of LVDS CH0(-)	[Note1]
9	RIN0+	Receiver signal of LVDS CH0(+)	[Note1]
10	GND	GND	
11	RIN1-	Receiver signal of LVDS CH1(-)	[Note1]
12	RIN1+	Receiver signal of LVDS CH1(+)	[Note1]
13	GND	GND	
14	RIN2-	Receiver signal of LVDS CH2(-)	[Note1]
15	RIN2+	Receiver signal of LVDS CH2(+)	[Note1]
16	GND	GND	
17	RCLK-	Receiver signal of LVDS CLK(-)	[Note1]
18	RCLK+	Receiver signal of LVDS CLK(+)	[Note1]
19	GND	GND	
20	RIN3-	Receiver signal of LVDS CH3(-)	[Note1]
21	RIN3+	Receiver signal of LVDS CH3(+)	[Note1]
22	GND	GND	
23	NC		[Note2]
24	NC		[Note2]
25	GND	GND	
26	NC		[Note2]
27	COLOR_EN	Color Management Selection	[Note3]
28	CABC_EN	CABC ON/OFF Terminal	[Note3]
29	PWMI	Input PWM Dimming signal of CABC	[Note3]
30	PWMO	Output PWM Dimming signal of CABC	[Note3]
31	NC		[Note2]
32	LED_C1	LED_Cathode1	
33	LED_C2	LED_Cathode2	
34	LED_C3	LED_Cathode3	
35	LED_C4	LED_Cathode4	
36	LED_C5	LED_Cathode5	
37	LED_C6	LED_Cathode6	
38	NC		[Note2]
39	LED_A	LED_Anode	
40	LED_A	LED_Anode	

[Note 1] Relation between RINi(i=0,1,2,3) and actual data is shown in following section (4-2)(6-2).

[Note 2] Don't input any signals or any powers into a NC pin. Keep the NC pin open.

[Note 3] Timing controller function is following section (6-4).

[Note 4] The shielding case is connected with signal GND.

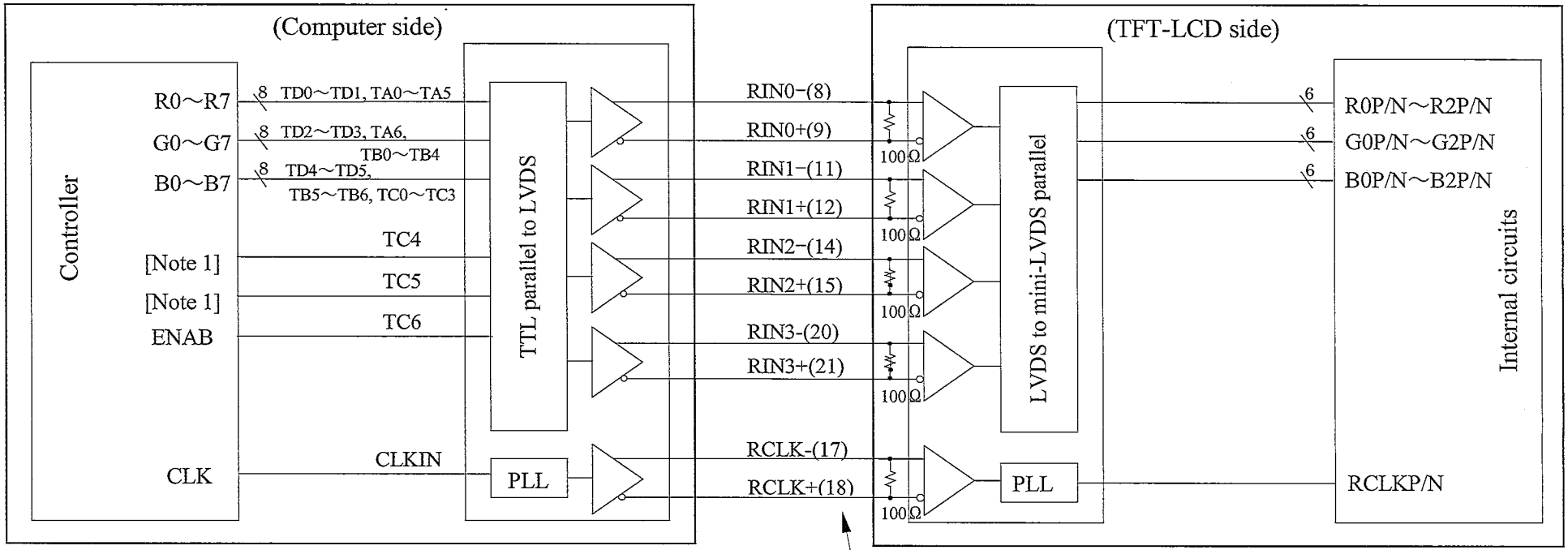
- Using connector : (20455-040E-12 (I-PEX))
- Corresponding connector : (20453-040T-01 (I-PEX))

  (Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

4 - 2. LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC

Corresponding Transmitter : THC63LVDM83D (THINE) or equivalent



[Note 1] Do not use at high-impedance TC4, TC5.

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
Input voltage	VI	Ta=25℃	-0.3	VDD	V	[Note 1]
+3.3V supply voltage	VDD	Ta=25℃	-0.3	+5.0	V	
Storage temperature (ambient)	Tstg	—	-20	+70	℃	[Note 2]
Operating temperature (ambient)	Topa	—	-10	+60	℃	
LED input electric current	I_{LED}	Ta=25℃	—	35	mA	[Note3]
LED electricity consumption	P_{LED}	Ta=25℃	—	119	mW	

[Note 1] LVDS signals

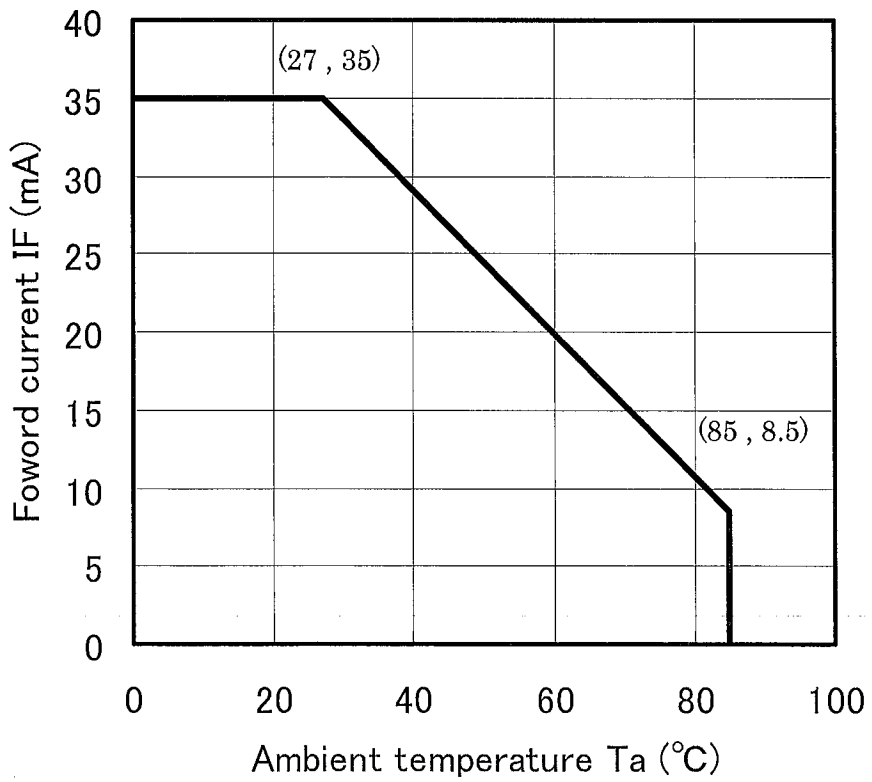
[Note 2] Humidity : 95%RH Max. at Ta≦+40℃.

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

No condensation.

[Note 3] Power consumption of one LED (Ta = 25°C). (use 42 pieces LED)

Ambient temperature and the maximum input are fulfilling the following operating conditions.



6. Electrical Characteristics

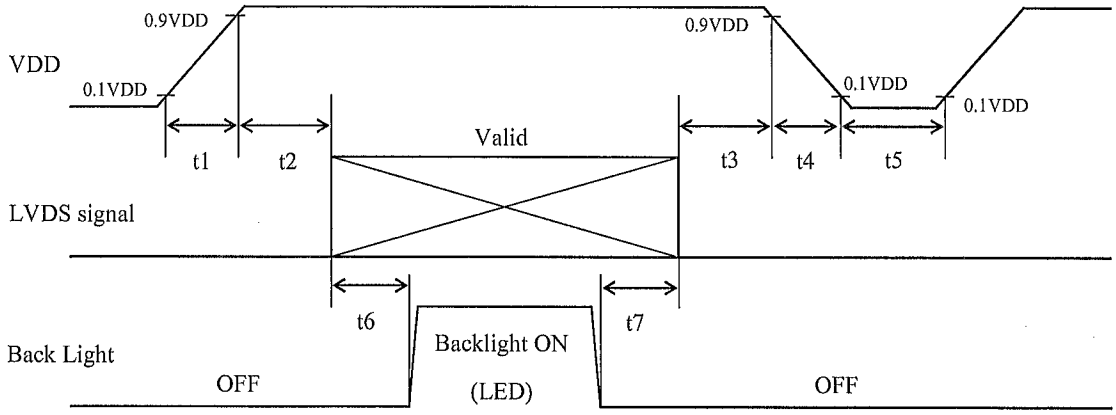
6 - 1. TFT-LCD panel driving

Ta＝+25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		VDD	+3.0	+3.3	+3.6	V	[Note 2]
Current dissipation		IDD	—	(300)	(550)	mA	[Note 3]
Permissive input ripple voltage		V_{RP}	—	—	100	mV_{P-P}	VDD = +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	VI= +2.4V VDD = +3.6V
Input current (Low)		I_{OL}	—	—	±10	μA	VI = 0V VDD = 3.6V
Termination 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



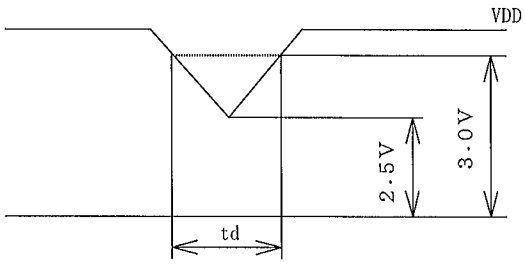
Symbol	Min	Max	Unit	Note
t1	0	10	ms	
t2	0	1	s	
t3	0	1	s	
t4	0	400	ms	
t5	200	—	ms	
t6	180	—	ms	*1
t7	5	—	ms	*1

*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.

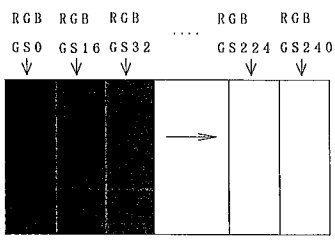
VDD-dip conditions

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



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

Maximum current situation : VDD=+3.0V



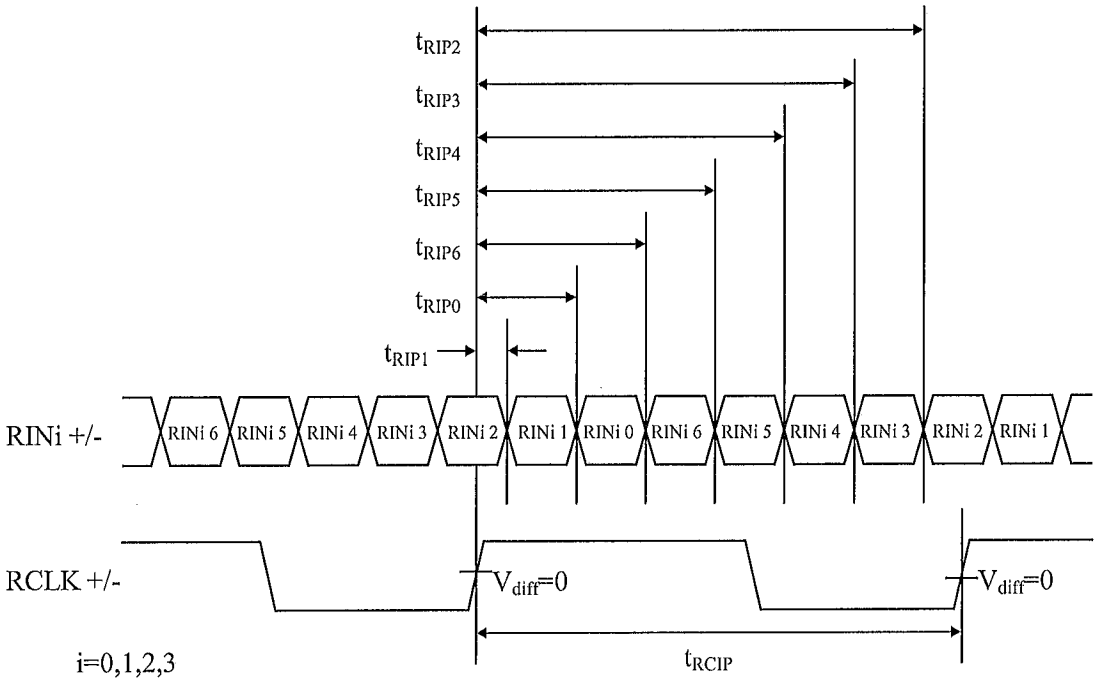
6 - 2. LVDS input specification

6 - 2 - 1. AC characteristics

VDD=+3.0V～+3.6V, Ta=-10℃～+60℃

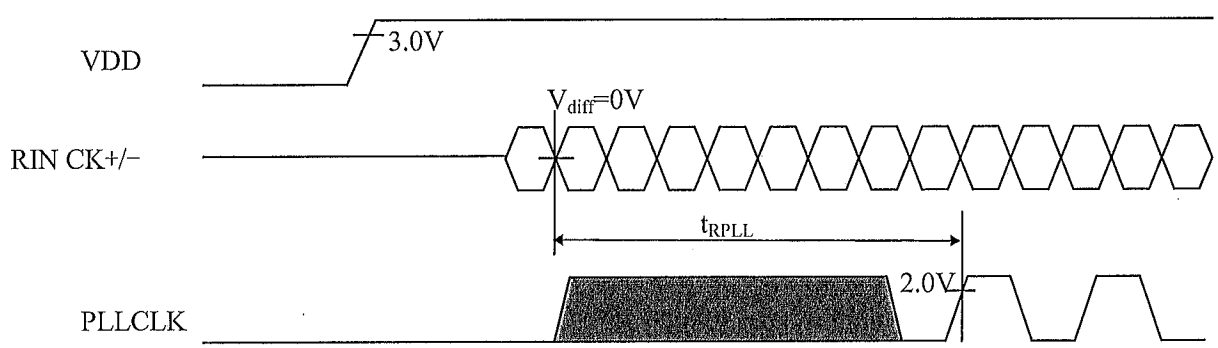
Parameter	Symbol	Min	Typ.	Max.	Unit
Input Data Position 0 (tRCIP=15.38ns)	t_{RIP1}	-0.25	0.0	+0.25	ns
Input Data Position 1 (tRCIP=15.38ns)	t_{RIP0}	t_{RCIP}/7-0.25	t_{RCIP}/7	t_{RCIP}/7+0.25	ns
Input Data Position 2 (tRCIP=15.38ns)	t_{RIP6}	2 t_{RCIP}/7-0.25	2 t_{RCIP}/7	2 t_{RCIP}/7+0.25	ns
Input Data Position 3 (tRCIP=15.38ns)	t_{RIP5}	3 t_{RCIP}/7-0.25	3 t_{RCIP}/7	3 t_{RCIP}/7+0.25	ns
Input Data Position 4 (tRCIP=15.38ns)	t_{RIP4}	4 t_{RCIP}/7-0.25	4 t_{RCIP}/7	4 t_{RCIP}/7+0.25	ns
Input Data Position 5 (tRCIP=15.38ns)	t_{RIP3}	5 t_{RCIP}/7-0.25	5 t_{RCIP}/7	5 t_{RCIP}/7+0.25	ns
Input Data Position 6 (tRCIP=15.38ns)	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}	TBD	15.43	TBD	ns

LVDS input timing

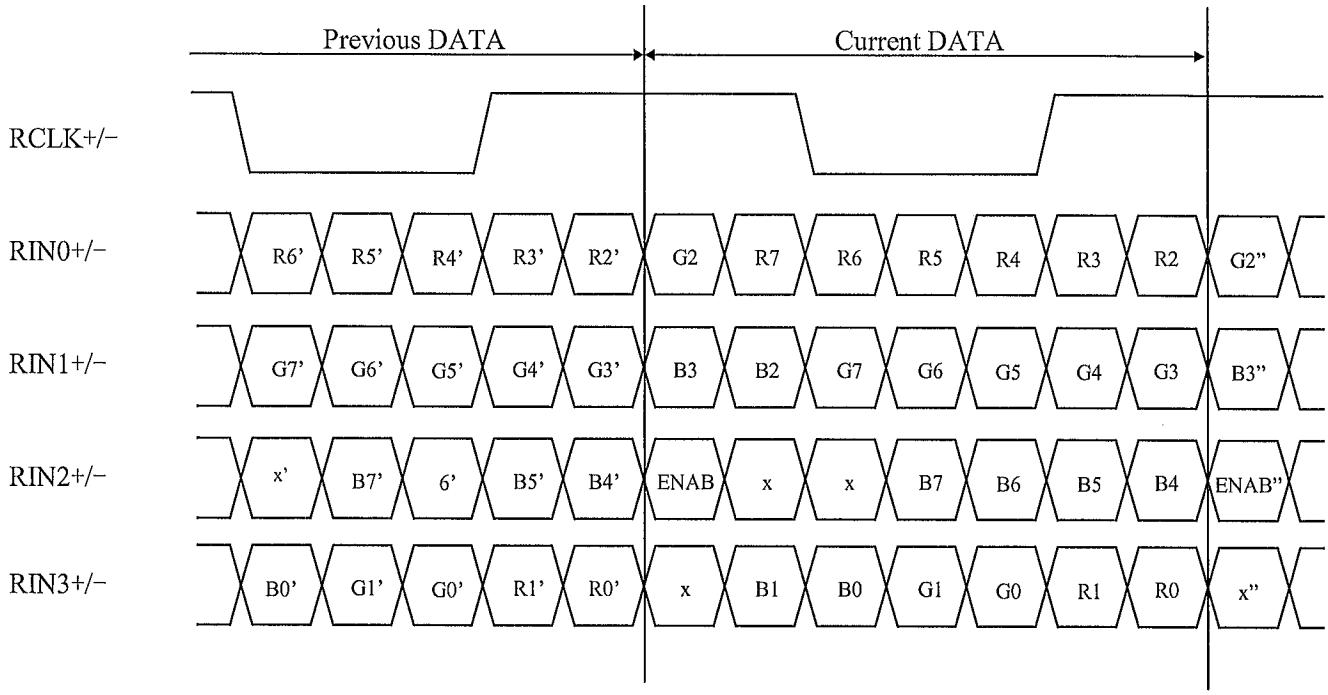


※Note
Vdiff=(RINi+)-(RINi-), (RCLK+)-(RCLK-)

LVDS phase lock loop set



6 - 2 - 2. LVDS data



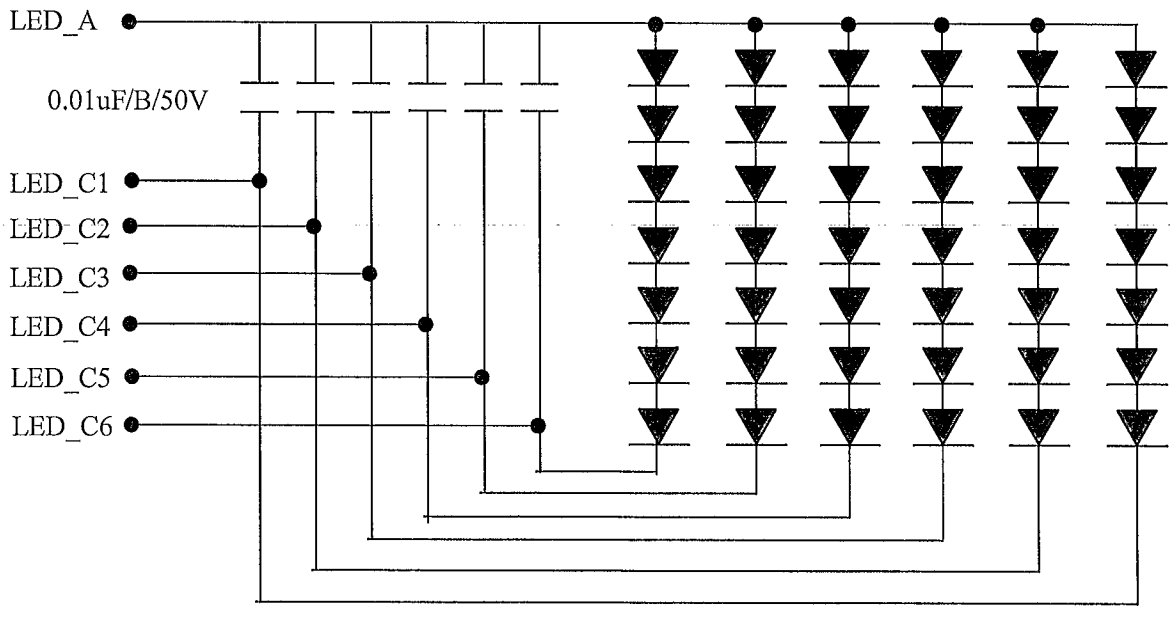
6 - 3. Backlight driving

The backlight system has 42 pieces LED (6 strings of 7 LEDs each)

· Normal operation (400cd / m^2)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Rated Voltage	V_{BL}	-	(21.0)	(24.5)	V	For 1 strings
Rated Current	I_L	-	(15.5)	-	mA	Ta=25°C
Power consumption	W_L	-	(1.95)	-	W	For 6 strings

[LED circuit]



6 - 4. Timing Controller function

・CABC function

CABC_EN	CABC	PWMI	PWMO
"H"	ON	PWM signal	Input PWM duty × CABC Dimming duty
"L"	OFF	PWM signal	PWM signal pass through

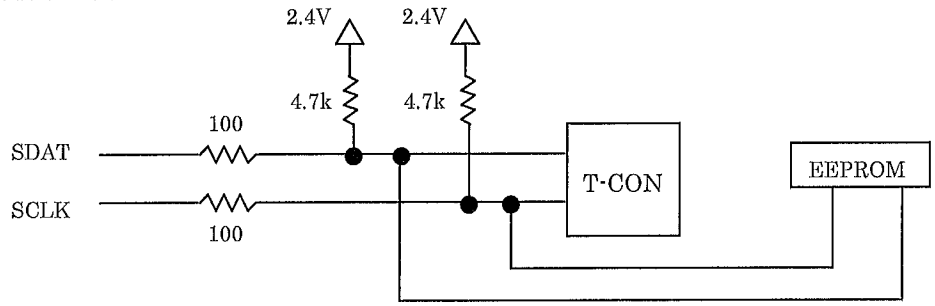
・Color Management function

COLOR_EN	Color Management
"H"	ON
"L"	OFF

DC Characteristic

Parameter		Symbol	Min	Typ	Max	Unit
PWMI signal	High	V_{IH}	0.7VDD	VDD	5	V
	Low	V_{IL}	0		0.3VDD	V
PWMO signal	High	V_{OH}	2	2.4	2.5	V
	Low	V_{OL}	0		0.5	V
CABC_EN	High	V_{IH}	0.7VDD	VDD	5	V
	Low	V_{IL}	0		0.3VDD	V
COLOR_EN	High	V_{IH}	0.7VDD	VDD	5	V
	Low	V_{IL}	0		0.3VDD	V

I^2C bus circuit



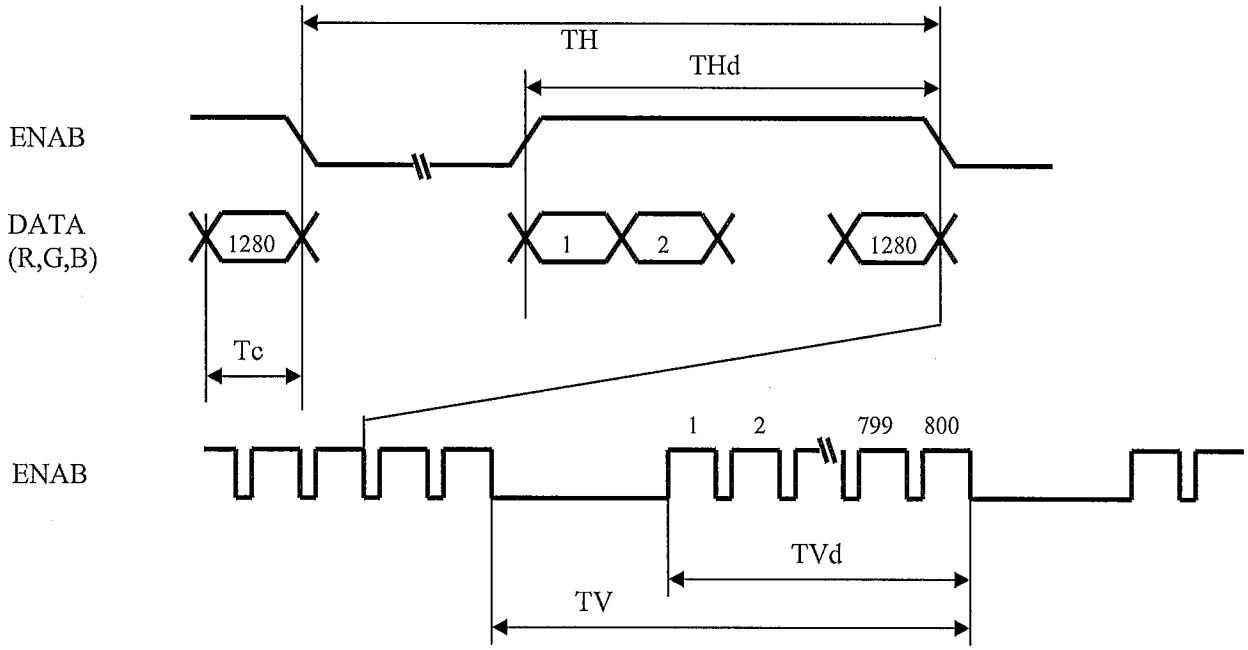
7. Timing Characteristics of Input Signals

7 - 1. Timing characteristics

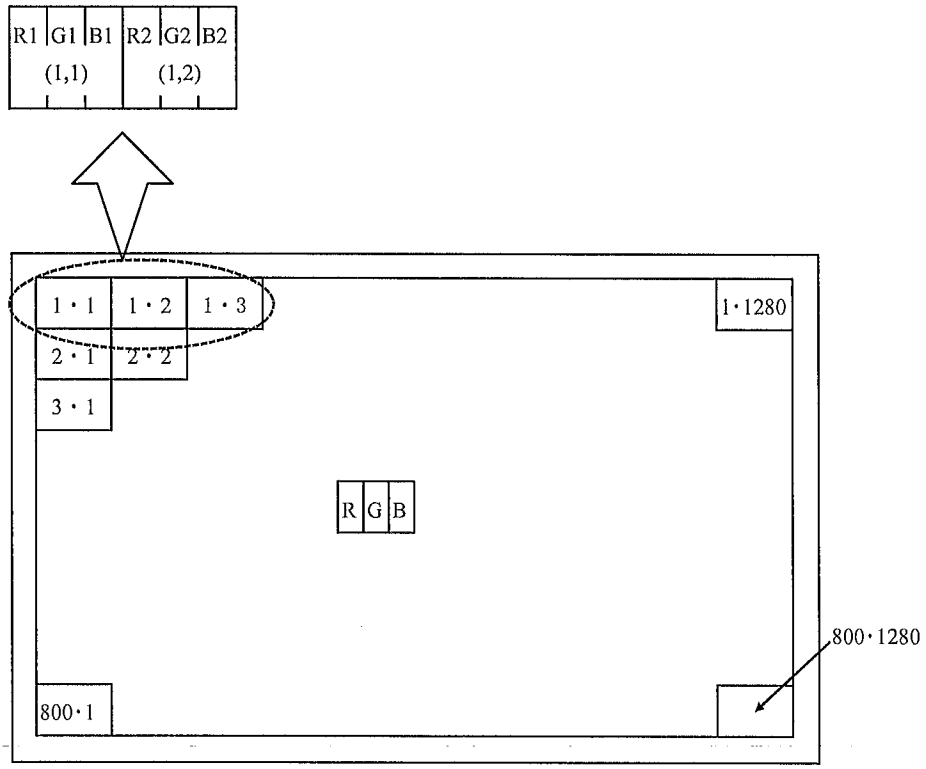
VDD=+3.0V～+3.6V, Ta=-10℃～+60℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	TBD	65	TBD	MHz	[Note 1]
Data enable Signal	Horizontal period	TH	—	1330	—	clock	
			—	20.5	—	μs	
	Horizontal period (High)	THd	—	1280	—	clock	
	Vertical period	TV	—	812	—	Line	
			—	16.67	—	ms	
	Vertical period (High)	TVd	—	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	Date signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			LSB							MSB	LSB							MSB	LSB							MSB
Basic Color	Black	–	0	0	0	0	0	0	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	0	0	0	0	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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	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	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals.

According to the combination of 24 bit data signals, the 16.7M color display can be achieved on the screen.

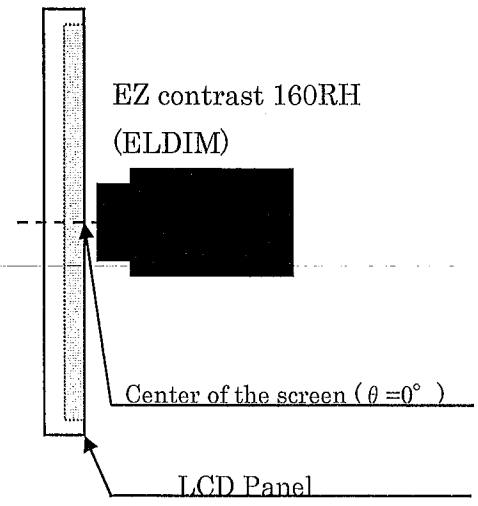
9. Optical Characteristics

Ta=+25℃, VDD=+3.3V

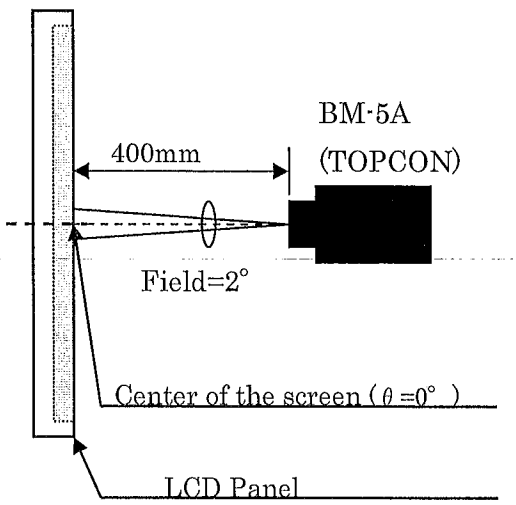
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21, θ 22	CR>10	(70)	(80)	—	deg.	[Note 1,3,4,6]
	Vertical	θ 11		(70)	(80)	—	deg.	
		θ 12		(70)	(80)	—	deg	
Contrast ratio		CR	θ =0°	(600)	(800)	—		[Note 2,4,6]
Response time		τ r+ τ d	θ =0°	—	(25)	—	ms	[Note 2,5,6]
Chromaticity of white		x		(0.273)	(0.303)	(0.333)		[Note 2,6]
		y		(0.281)	(0.311)	(0.341)		
Chromaticity of red		x		(0.538)	(0.568)	(0.598)		
		y		(0.304)	(0.334)	(0.364)		
Chromaticity of green		x		(0.307)	(0.337)	(0.367)		
		y		(0.549)	(0.579)	(0.609)		
Chromaticity of blue		x		(0.120)	(0.150)	(0.180)		
		y		(0.079)	(0.109)	(0.139)		
NTSC ratio					(48.9)		%	
Luminance of white [Note 2,6]		Y_{LI}		(300)	(400)	—	cd/m^2	Normal operation (I_L = 15.5mA)
White Uniformity		δ w		—	(1.25)	(1.43)		[Note 2,7]

※ The measurement shall be executed 30 minutes after lighting at rating. Condition : I_L = 15.5mA.
The optical characteristics shall be measured in a dark room or equivalent.

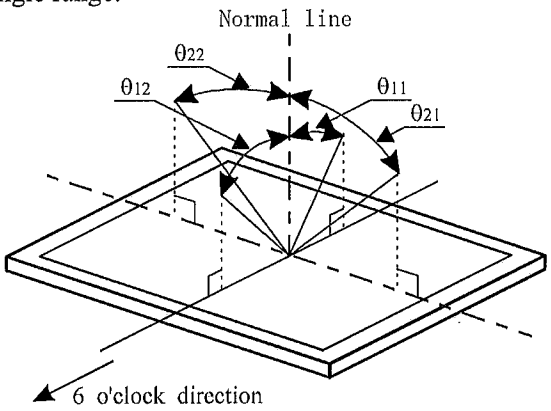
[Note 1] Measuring Viewing Angle Range



[Note 2] Other Measurements



[Note 3] Definitions of viewing angle range:



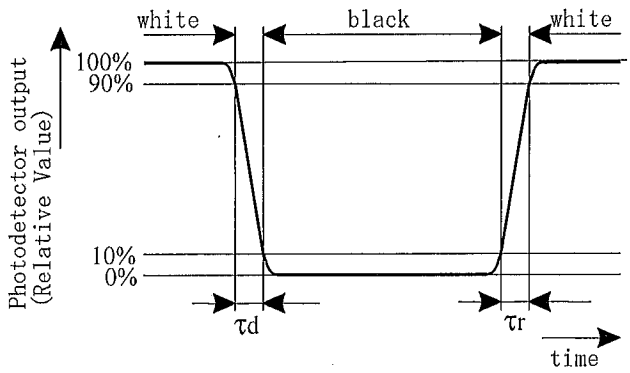
[Note 4] Definition of contrast ratio:

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" .

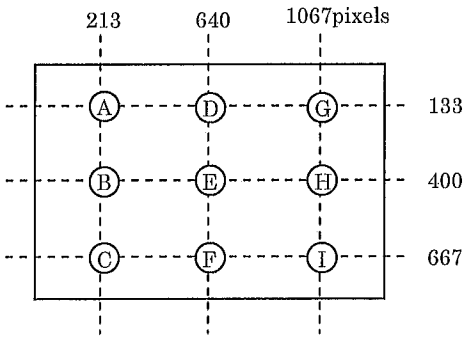


[Note 6] This shall be measured at center of the screen.

[Note 7] Definition of white uniformity:

White uniformity is defined as the following with nine measurements (A~I).

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



10. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

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

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

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

f) 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.

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

h) 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..

i) 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.

j) Connect GND of module bezel to stabilize against EMI and external noise.

k) 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.

l) Adjusting volume has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

m) Disassembling the module can cause permanent damage and should be strictly avoided.
Do not peel off the tapes, and do not remove an internal connector.

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

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

p) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

12. Packing Form

Piling number of cartons	TBD
Package quantity in one carton	TBD
Carton size	TBD(W)×TBD(D)×TBD(H)
Total mass of one carton filled with full modules	TBD
Packing form	TBD

13. RoHS Regulations

This product corresponds to the RoHS Regulations.

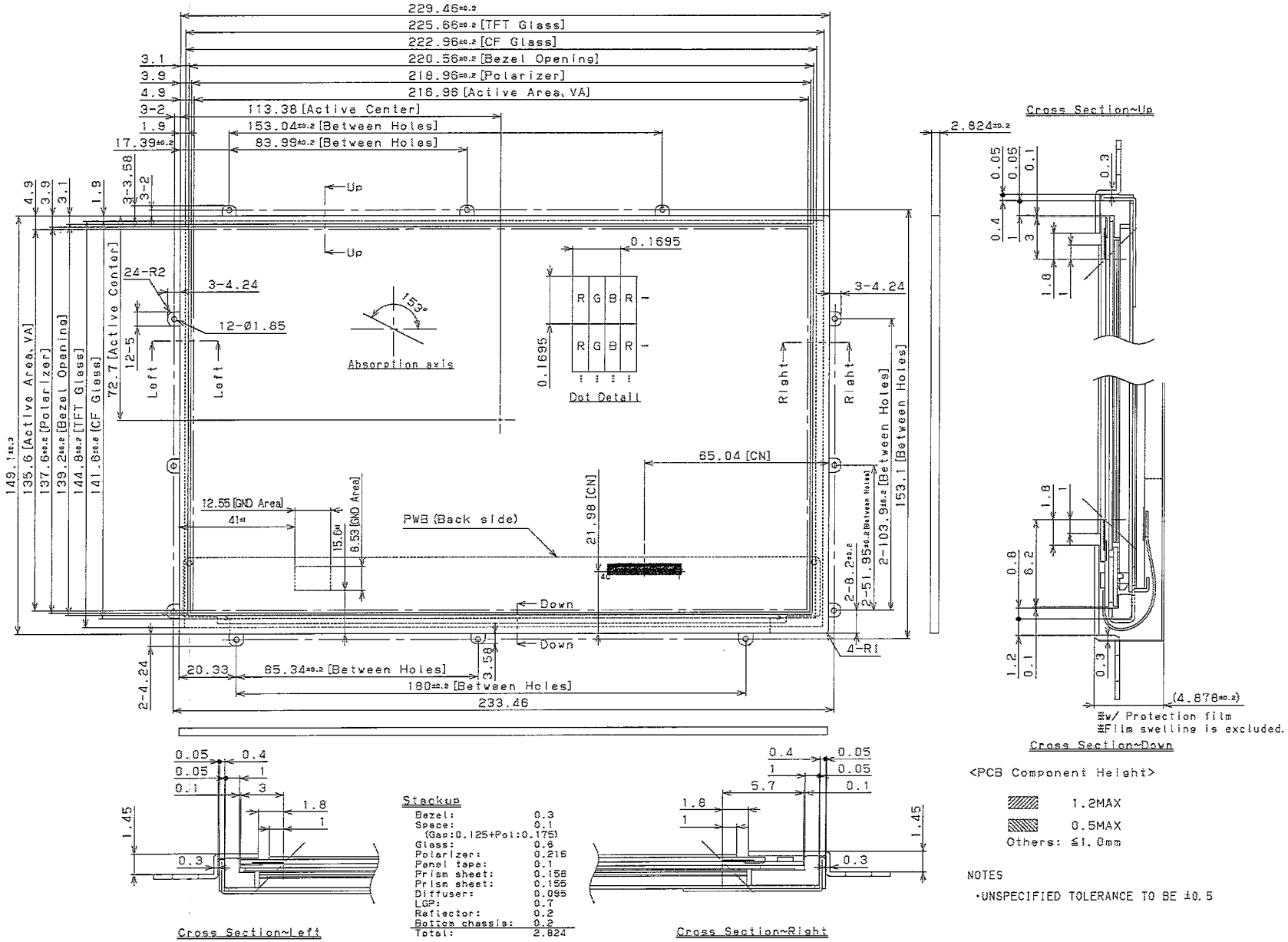
14. Reliability Test Items

No.	Test item	Conditions
1	High temperature storage test	Ta = 70℃ 240h
2	Low temperature storage test	Ta = -20℃ 240h
3	High temperature & high humidity operation test	Ta = 40℃ ; 90%RH 240h (No condensation)
4	High temperature operation test	Ta = 60℃ 240h
5	Low temperature operation test	Ta = -10℃ 240h
6	Thermal Shock Test (non- operating)	+70℃(1hours) ⇔ -25℃(1hours) 2hours per cycle Temperature change time:10℃/minute Tested for 5 cycles
7	Vibration test (non- operating)	Frequency:10~57Hz/Vibration width (one side):0.076mm :57~500Hz/acceleration:9.8m/s^2 Sweep time: 11minutes Test period: 1 hour for each direction of X,Y,Z
8	Shock test (non- operating)	Max. gravity : 490 m/s2 Pulse width : 11 ms, half sine wave Direction : ±X,±Y,±Z once for each direction.
9	ESD	±200V, 200pF(0Ω) 1time/each terminal

[Result Evaluation Criteria] Under the display quality test conditions with normal operation state, these shall be no change, which may affect practical display function.

[Normal operation state] Temperature : +15～+35℃, Humidity : 45～75%, Atmospheric pressure : 86～106kPa

FIG1. Outline dimensions



Cross Section~Up

※w/ Protection film
※Film swelling is excluded.

Cross Section~Down

Cross Section~Left

Stackup

Bezel:	0.3
Space:	0.1
(Gap:0.125+Pol:0.175)	
Glass:	0.6
Polarizer:	0.216
Panel tape:	0.1
Prism sheet:	0.158
Prism sheet:	0.155
Diffuser:	0.095
LGP:	0.7
Reflector:	0.2
Bottom chassis:	0.2
Total:	2.824

Cross Section~Right

<PCB Component Height>

1.2MAX
0.5MAX
Others: ≤1.0mm

NOTES
・UNSPECIFIED TOLERANCE TO BE ±0.5

10.1WXGA Outline Dimensions

2010.05.20
D/N:2D-104-024-03