SPEC No. LD-19X11A

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PAGE : 23 pages

DEVICE SPECIFICATION

TFT-LCD Module

MODEL

LQ0DZA0126

RECORDS OF REVISION

LQ0DZA0126

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-19X11A	Nov.19.2007	-	-	—	1st Issue

1. Application

This specification applies to color TFT-LCD module, LQ0DZA0126.

The device listed in these specification sheets was designed and manufactured for use in general electronic equipment.

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.

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 800×3×600 dots panel with about 16-million-color by using LVDS (Low Voltage Differential Signaling) system for interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.
The TFT-LCD panel used for this module is a low-reflection and higher-color-saturation type.
Therefore, this module is also suitable for the multimedia use. Viewing angle is 6 o'clock direction.
Backlight-driving DC/AC inverter is not built in this module.

3. Outline Specifications

Parameter	Specifications	Unit
Display size	31 (12.1") Diagonal	cm
Active area	246.0 (H) × 184.5 (V)	mm
Pixel format	800 (H) × 600 (V)	pixel
	(1 pixel=R+G+B dots)	
Aspect ratio	4：3	
Pixel pitch	0.3075 (H) × 0.3075 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions *1	276.0(W) ×209.0(H) ×Max.11.0 (D) *Outline dimensions is shown in Fig.1	mm
Mass	MAX. 660	g
Surface treatment	Anti-glare and hard-coating 3H	

[*1 Note] excluding backlight cables.

4. Input Terminals

4-1. TFT-LCD panel driving

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

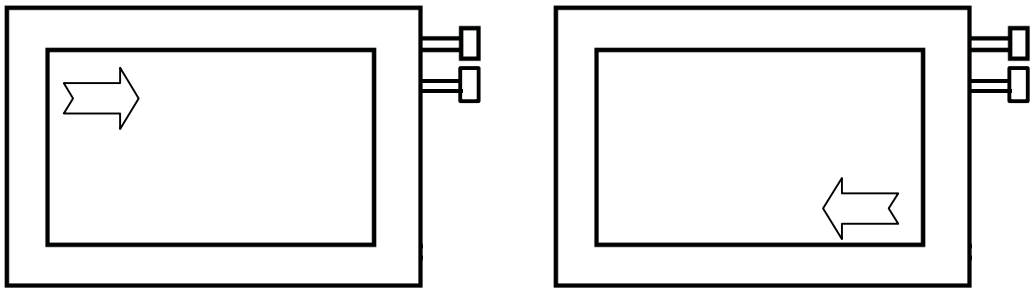
Corresponding connector: DF14-20S-1.25C (Connector) [Hirose electric.,Ltd]

DF14-2628SCF (Terminal) [Hirose electric.,Ltd]

Pin No.	Symbol	Function	Remark
1	V_{CC}	+3.3V power supply	
2	V_{CC}	+3.3V power supply	
3	GND		
4	GND		
5	RXIN0-	Differential data input, CH0 (negative)	LVDS signal
6	RXIN0+	Differential data input, CH0 (positive)	LVDS signal
7	GND		
8	RXIN1-	Differential data input, CH1 (negative)	LVDS signal
9	RXIN1+	Differential data input, CH1 (positive)	LVDS signal
10	GND		
11	RXIN2-	Differential data input, CH2 (negative)	LVDS signal
12	RXIN2+	Differential data input, CH2 (positive)	LVDS signal
13	GND		
14	RXCLK IN-	Differential clock input (negative)	LVDS signal
15	RXCLK IN+	Differential clock input (positive)	LVDS signal
16	GND		
17	RXIN3-	Differential data input, CH3 (negative)	LVDS signal
18	RXIN3+	Differential data input, CH3 (positive)	LVDS signal
19	RL/UD	Horizontal/Vertical display mode select signal	[Note1]
20	LVDS_SET	LVDS_SET	[Note2]

[Note 1]

RL/UD = Low RL/UD = High



[Note 2] Relation between LVDS signals and actual data shows below section (4-2)

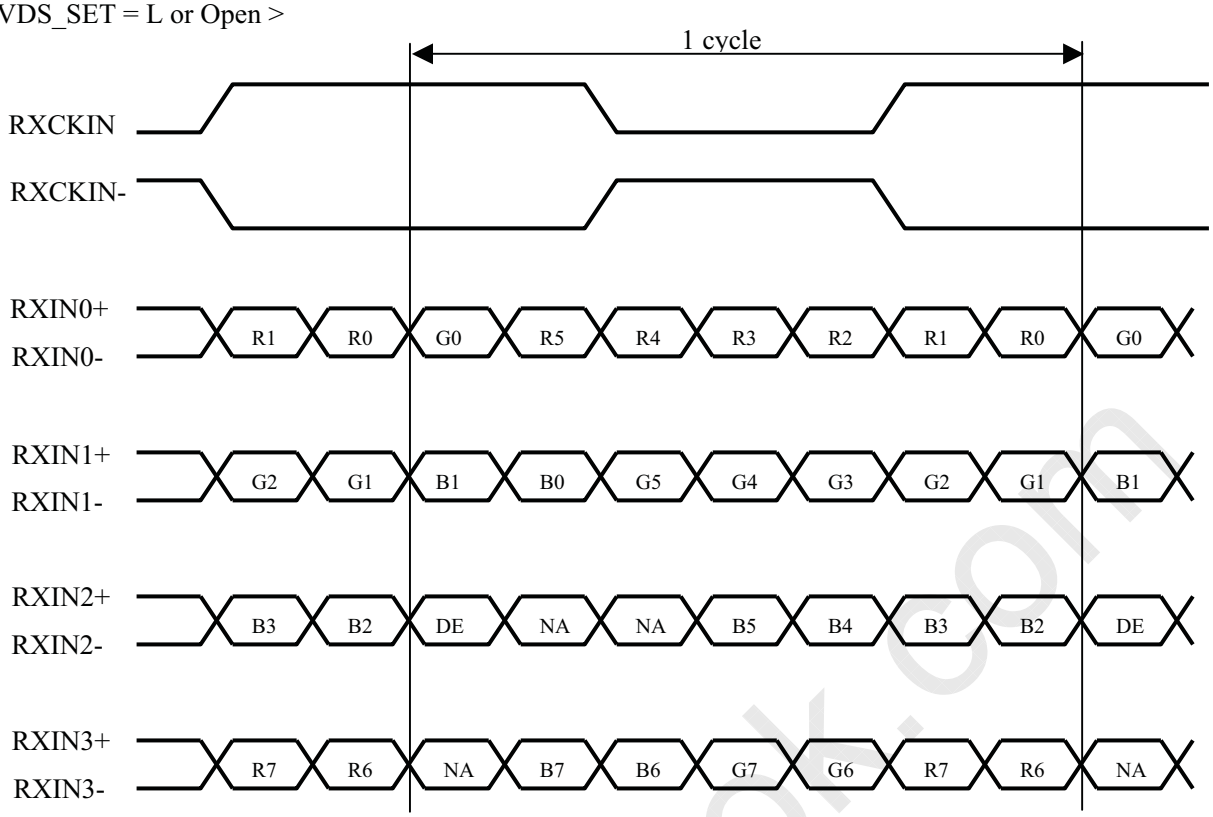
4-2 Data Mapping

1) 8 bit input

【note2】pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

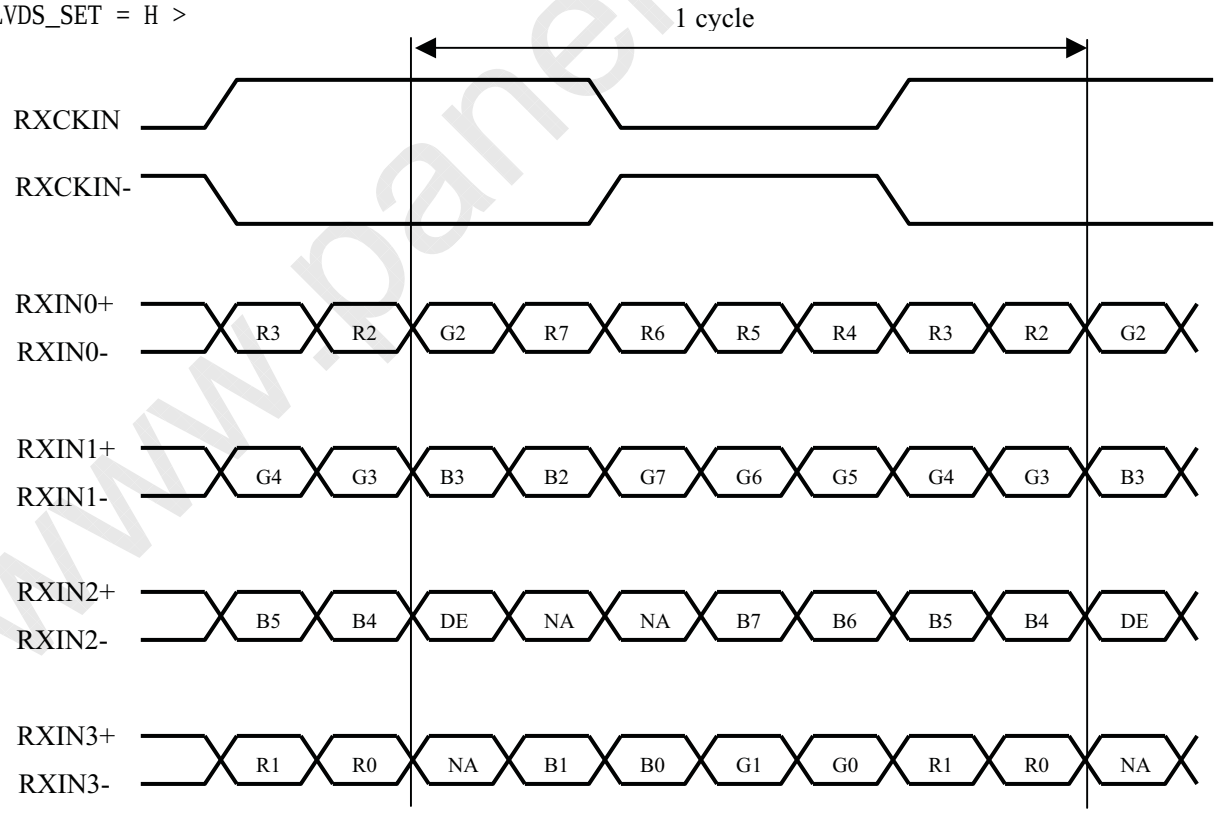
Transmitter		20pin LVDS_SET	
Pin No	Data	=L (GND) or Open	=H (3.3V)
51	TA0	R0 (LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7 (MSB)
4	TA6	G0 (LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7 (MSB)
15	TB5	B0 (LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7 (MSB)
27	TC4	(NA)	(NA)
28	TC5	(NA)	(NA)
30	TC6	DE	DE
50	TD0	R6	R0 (LSB)
2	TD1	R7 (MSB)	R1
8	TD2	G6	G0 (LSB)
10	TD3	G7 (MSB)	G1
16	TD4	B6	B0 (LSB)
18	TD5	B7 (MSB)	B1
25	TD6	(NA)	(NA)

< LVDS_SET = L or Open >



DE: Display Enable
NA: Not Available

< LVDS_SET = H >

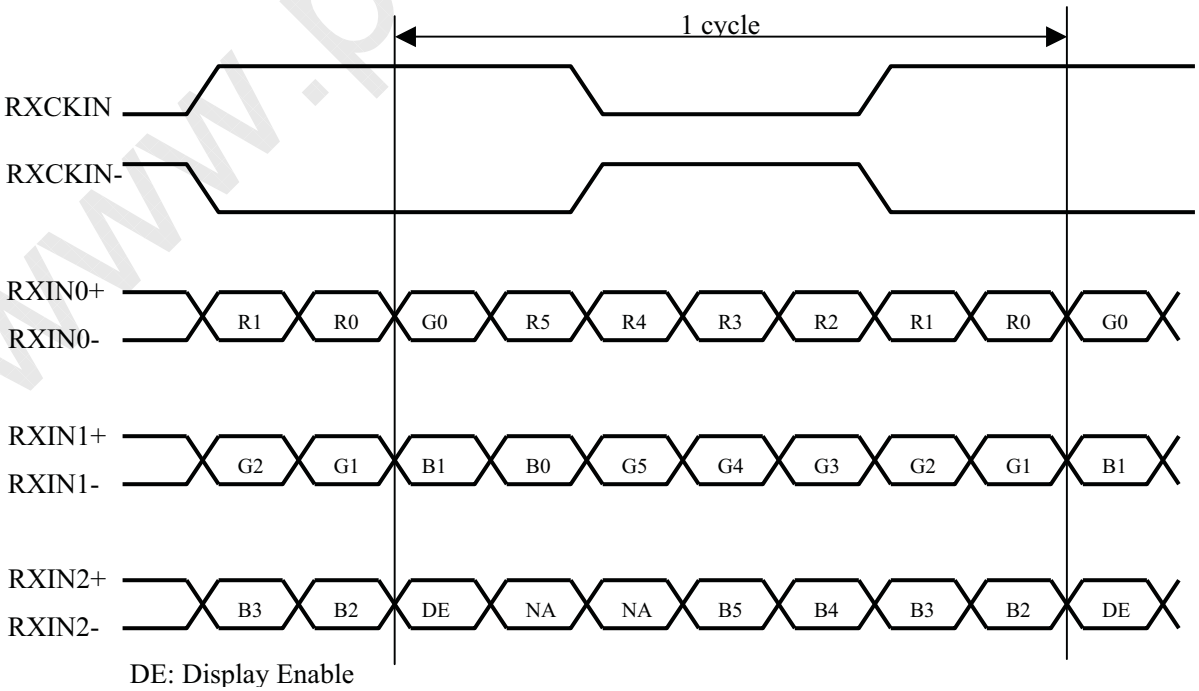


DE: Display Enable
NA: Not Available

2) 6 bit input

【note2】pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

Transmitter		20pin LVDS_SET	
Pin No	Data	=L (GND) or Open	=H (3.3V)
51	TA0	—	R0 (LSB)
52	TA1	—	R1
54	TA2	—	R2
55	TA3	—	R3
56	TA4	—	R4
3	TA5	—	R5 (MSB)
4	TA6	—	G0 (LSB)
6	TB0	—	G1
7	TB1	—	G2
11	TB2	—	G3
12	TB3	—	G4
14	TB4	—	G5 (MSB)
15	TB5	—	B0 (LSB)
19	TB6	—	B1
20	TC0	—	B2
22	TC1	—	B3
23	TC2	—	B4
24	TC3	—	B5 (MSB)
27	TC4	—	(NA)
28	TC5	—	(NA)
30	TC6	—	DE
50	TD0	—	GND
2	TD1	—	GND
8	TD2	—	GND
10	TD3	—	GND
16	TD4	—	GND
18	TD5	—	GND
25	TD6	—	(NA)



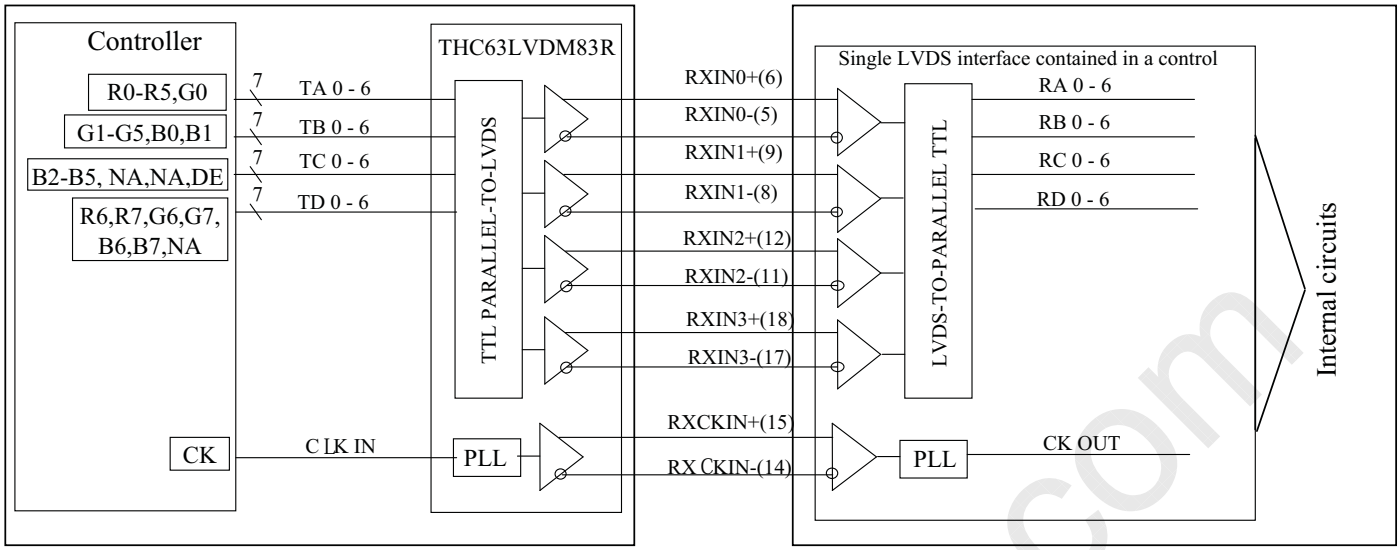
DE: Display Enable

NA: Not Available

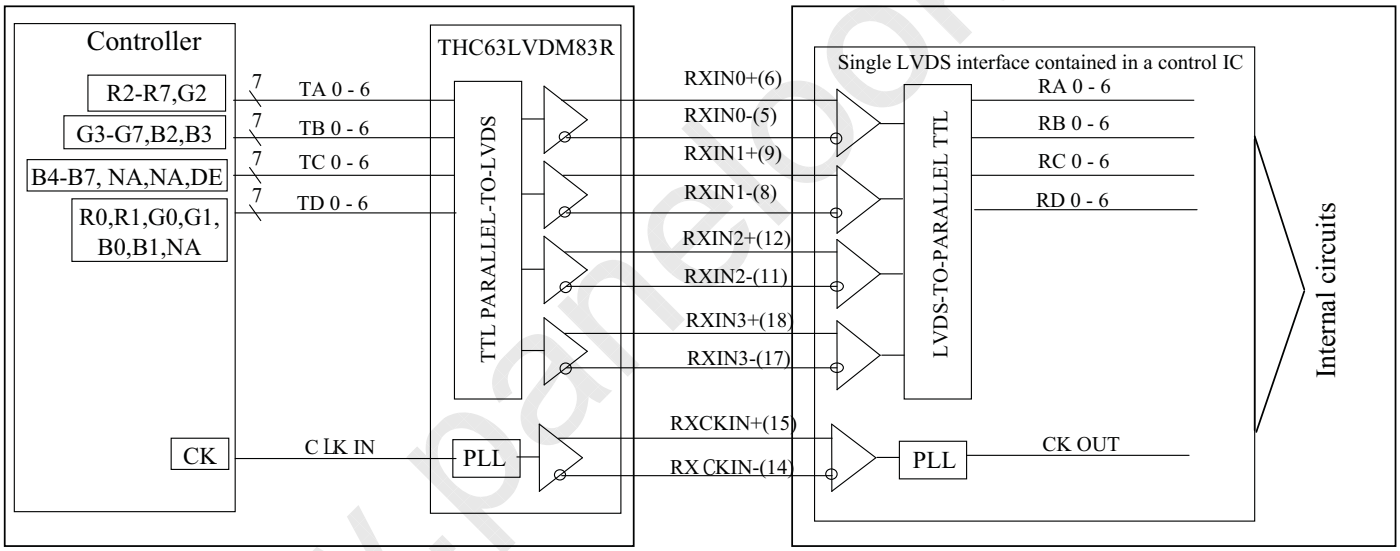
4-3 Interface block diagram

(Computer side) (TFT-LCD side)

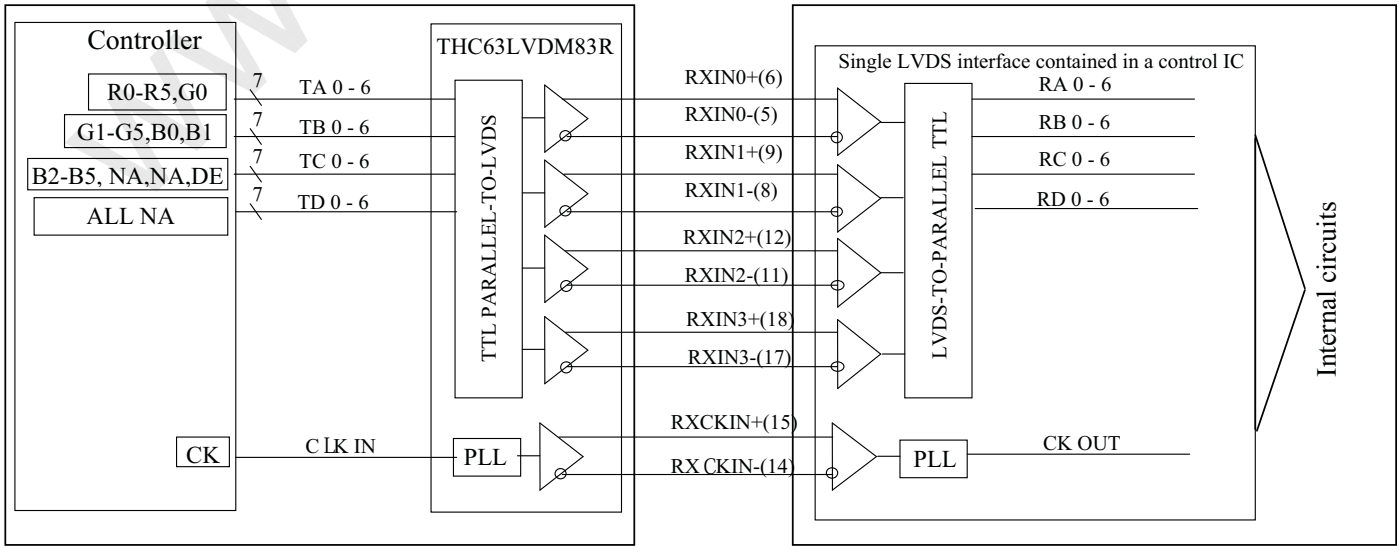
①8Bit Mode
LVDS_SET=L (20 pin=GND or OPEN)



②8Bit Mode
LVDS_SET=H (20 pin=3.3[V])



③6Bit Mode
LVDS_SET=H (20 pin=3.3[V])



4-4. Backlight driving

CN2 ,CN3

Used connector: BHR-02 (8.0) VS-1N (JST)

Corresponding connector: SM02 (8.0) B-BHS-1R-TB (JST)

SM02 (8.0) B-BHS-1-TB (JST)

Connector No.	Pin No.	Symbol	function	FL Cable color	
				CN2	CN3
CN2,3	1	V_{HIGH}	Power supply for lamp (High voltage side)	White	Pink
	2	V_{LOW}	Power supply for lamp (Low voltage side)	Gray	White

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Pin name	Ratings	Unit	Remark
supply voltage	Vcc	Ta=25 ºC	Vcc	-0.3 to 4.0	V	[Note1,4]
Input voltage	VI1	Ta=25ºC	RXINi-/+(i= 0,1,2,3) RXCLK IN-/+	-0.3 to Vcc+0.3	V	
	VI2	Ta=25ºC	RL/UD, SELLVDS	-0.3 to Vcc+0.3	V	
Lump input voltage	V_{HIGH}	-	V_{HIGH} (CN2,CN3)	0 to +2000	Vrms	[Note1,2]
Storage temperature	Tstg	-	-	-30 to +75	ºC	[Note1]
Operating temperature	Topa	panel surface	-	0 to +70	ºC	[Note1,3]

[Note1] Humidity: 95%RH Max. at Ta=<40ºC.

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

No condensation.

[Note2] A high voltage should be not able to be continued when the lamp doesn't light

[Note3] When used on condition of Operating temperature [65℃≦T_{OPA}＜70℃],

degradation of display grace, such as screen stain etc, may be caused.

[Note4] Please use the one of 2A or more in current capacity about the power-supply voltage.

6. Electrical Characteristics

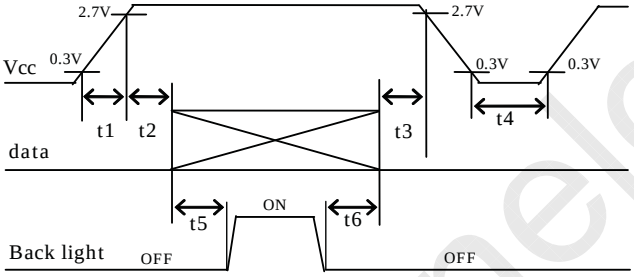
6-1.TFT-LCD panel driving Ta=+25 °C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		Vcc	+3.0	+3.3	+3.6	V	[Note4]
Current dissipation	Vcc=+3.3V	Icc	-	290	380	mA	[Note5]
Input voltage range	LVDS signal	V_L	0	-	2.4	V	[Note3]
Permissive input ripple voltage	Vcc=+3.3V	V_{RP}	-	-	100	mVp-p	Vcc=+3.3V
Differential input threshold voltage	High	V_{TH}	-	-	V_{CM} +100	mV	V_{CM}=1.2V
	Low	V_{TL}	V_{CM} –100	-	-	mV	[Note1]
Input voltage	High	V_{IH}	2.1	-	-	V	[Note2]
	Low	V_{IL}	-	-	0.8		
Input current	High	I_{OH}	-	-	500	μA	V_{I2}=+3.3V[Note2]
	Low	I_{OL}	-10	-	10	μA	V_{I2}=0V[Note2]
Input impedance (Differential input)		R_T	-	100	-	Ω	

[Note1] V_{CM} : Common mode voltage of LVDS driver [Note2]RL/UD,SELLVDS

[Note3]LVDS signals

[Note4]On-off conditions for supply voltage

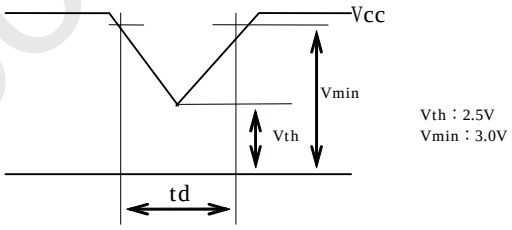


0<t1≦10ms 0<t2≦10ms

0<t3≦1s 1s≦t4

300ms≦t5 200ms≦t6

Vcc-dip conditions



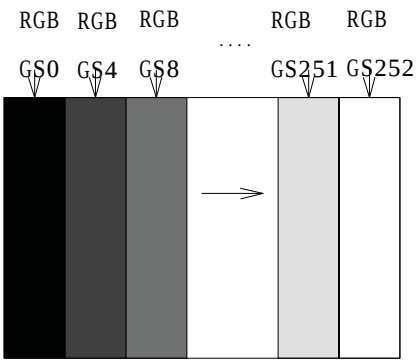
1) Vth ≦ Vcc ＜ Vmin
td ≦ 10ms
2) Vcc<Vth

Vcc-dip conditions should also follow the On-off conditions for supply voltage

- Please use DE signal by the Lo start.
- Please do not input Vsync/Hsync to this module,it is recommend to be used by the pull-down
- It is recommended to consider some timing difference between LVDS input and Backlight input as shown above.

If the Backlight lights on before LCD starting, or if the Backlight is kept on after LCD stopping, the screen may look white for a moment or abnormal image may be displayed. This is caused by variation in output signal from timing generator at LVDS input on or off. It does not cause the damage to the LCD module

[Note 5] Typical current situation : 253-gray-bar pattern.
(Vcc=+3.3V,fck=40MHz,Ta=+25℃)
The explanation of each gray scale is described below section 8

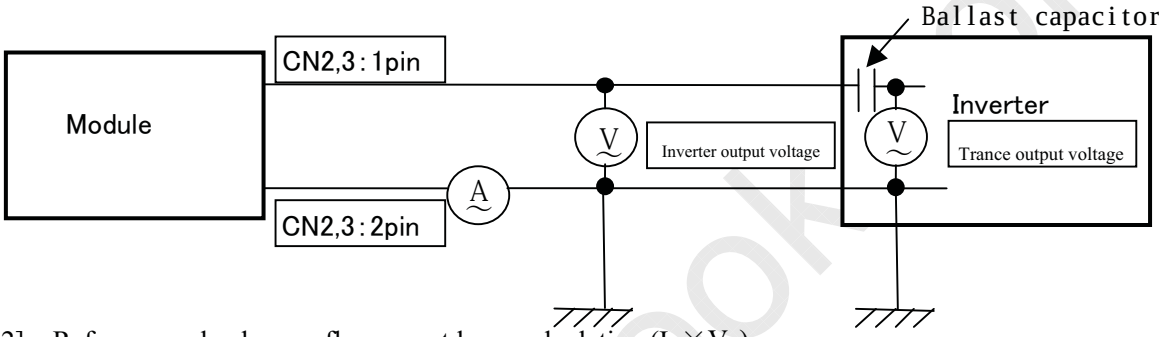


6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).
The characteristics of single lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	3.0	6.5	7.5	mArms	[Note1]
Lamp voltage	V_L	-	465	540	Vrms	Ta=+25℃,I_L=6.5mArms
Lamp power consumption	P_L	-	3.0	-	W	[Note2]
Lamp frequency	F_L	40	-	70	kHz	[Note3]
Kick-off voltage	Vs	-	-	1100	Vrms	Inverter output voltage / Ta=0℃
Lamp life time	L_L	50000 (Lump unit)	-	-	hour	I_L=6.5mA [Note5]
		-	20000 (Module)	-		[Reference]

[Note1] Lamp current is measured with current meter for high frequency as shown below.



[Note2] Reference value by one fluorescent lamp calculation ($I_L \times V_L$)
It is assumed the value that doesn't contain the loss of the inverter. (I_L = 6.5mArms)

[Note3] Lamp frequency may produce interference with horizontal synchronous frequency, andthis 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.

[Note4] The value of the trans output side in the inverter of ballast capacitor 27pF is described.
Lighting beginning voltage might rise according to the state of the user cabinet mounting, and please set the open-circuit voltage of the inverter so as not to generate the lighting failure while real used.
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.

[Note5] Since lamp is consumables, the life time written above is referencial value and it is not guaranteed in this specification.
Lamp life time is defined that it applied either ① or ② under this condition
(Continuous turning on at Ta=25 ºC, IL=6.5mArms)
① Brightness becomes 50% of the original value under standard condition.
② Kick-off voltage at Ta=0 ºC exceeds maximum value,1100Vrms.
In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower. (Continuous operating under for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)
In case of such usage under lower temp environment, periodical lamp exchange is recommended.

[Note] Please synchronize the lighting frequency and the phase of the lamp of the same connector.
There is a possibility to exceed ratings of the connector when not synchronizing.

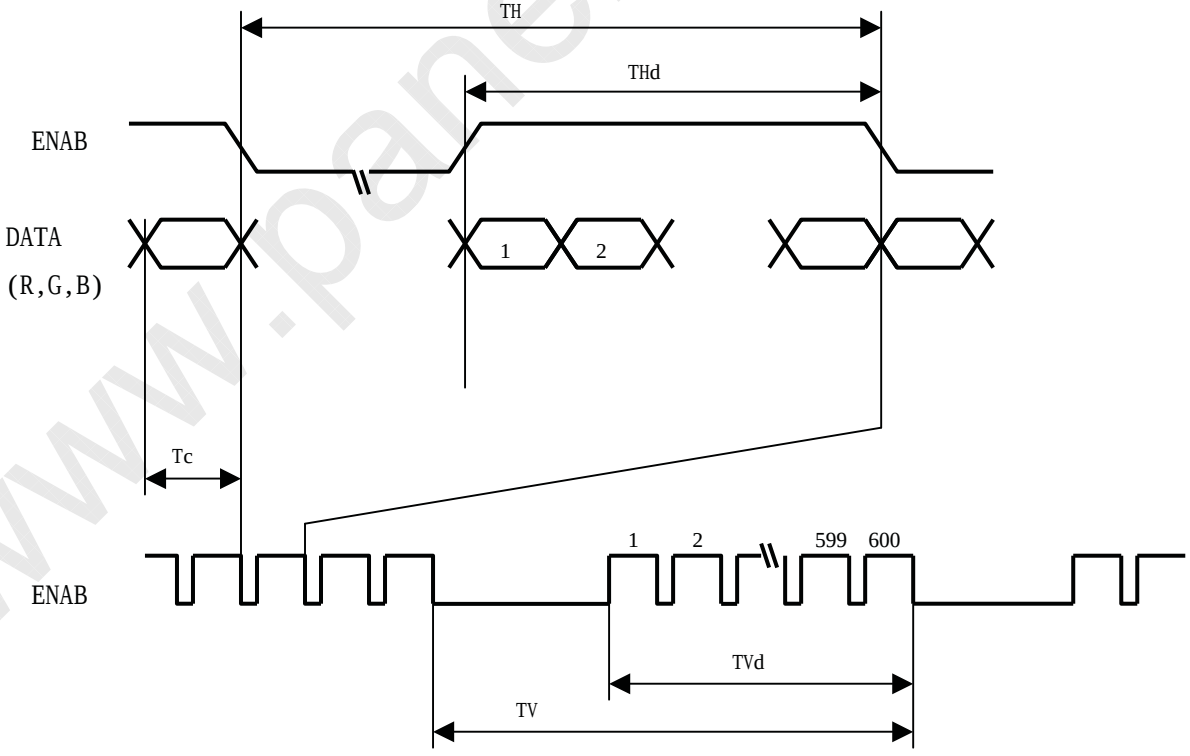
[Note] The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.
Be sure to use a back light power supply with the safety protection circuit such as the detection circuit for the excess voltage, excess current and or electric discharge waveform.
Be sure to use the detect circuit by which one side of the CCFT lamps can be controlled independently. Otherwise, when one side of the CCFT is open, the excess current may possibly be applied to the other side of the lamp.

7. Timing characteristics of input signals

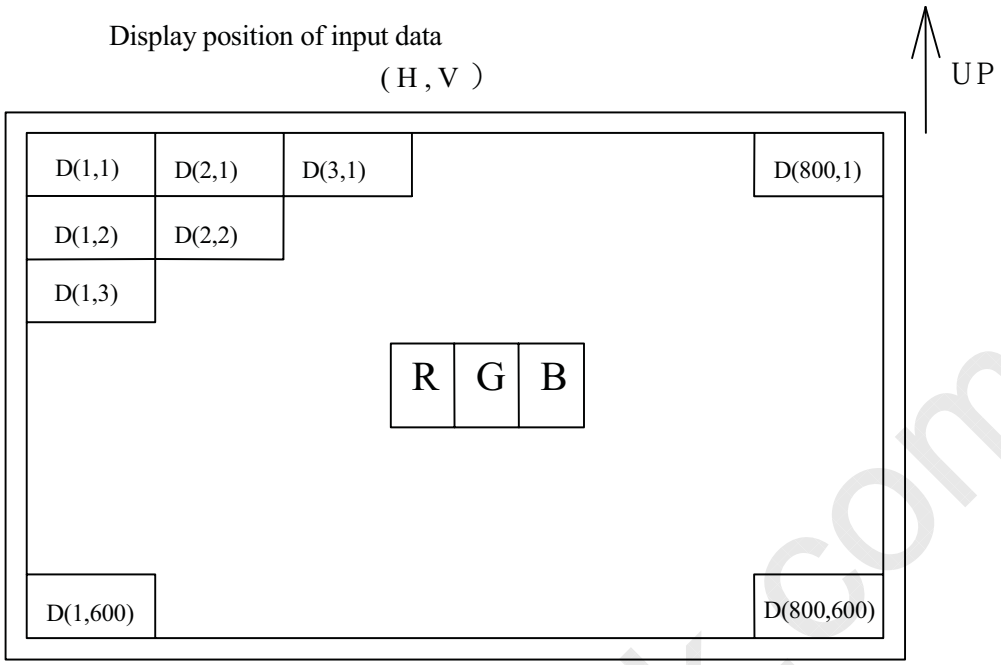
7-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock signal	Frequency	1/Tc	35	40	42	MHz
	Horizontal period	TH	832	1056	1395	clock
ENAB signal	Horizontal period (High)	THd	20.8	26.4	39.9	µs
			800	800	800	clock
	Vertical period	TV	628	666	798	line
			—	17.6	—	ms
	Vertical period (High)	TVd	600	600	600	line

【Note】 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



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

8-1 8bit input

	Colors & Gray scale	Gray scale	Data 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
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	X	X	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1
	Red	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	—	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1
	Yellow	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	—	X	X	1	1	1	1	1	1	X	X	1	1	1	1	1	1	X	X	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	GS250	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS251	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS252	X	X	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	GS250	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS251	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS252	0	0	0	0	0	0	0	0	X	X	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	GS250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1
	⇩	GS251	0	0 z	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
	Blue	GS252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage X : Don't care

Each basic color can be displayed in 253 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.

8-2 6bit input

	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		—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	—	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Blue	—	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Green	—	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Cyan	—	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	—	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Magenta	—	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Yellow	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	White	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	↓				↓						↓						↓		
	⇧	↓				↓						↓						↓		
	⇩	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Brighter	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Red	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Darker	↓				↓						↓						↓		
	⇧	↓				↓						↓						↓		
	⇩	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	Brighter	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	⇩	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Green	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Black	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	⇧	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	Darker	↓				↓						↓						↓		
	⇧	↓				↓						↓						↓		
	⇩	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	Brighter	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	⇩	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 Characteristics9. 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	60	70	-	Deg.	
	Vertical	θ 11		35	50	-	Deg.	
		θ 12		55	60	-	Deg.	
Contrast ratio		C R	Optimum viewing angle	250	400	-	-	[Note2,4]
Response time		τ r	θ =0°	-	10	-	ms	[Note3]
		τ d		-	25	-	ms	[Note3]
Chromaticity of White		x		0.283	0.313	0.343	-	[Note4]
		y		0.299	0.329	0.359	-	
Chromaticity of Red		x		0.618	0.648	0.678	-	
		y		0.306	0.336	0.366	-	
Chromaticity of Green		x		0.253	0.283	0.313	-	
		y		0.582	0.612	0.642	-	
Chromaticity of Blue		x		0.114	0.144	0.174	-	
		y		0.052	0.082	0.112	-	
Luminance of white		Y_L		260	330	—	cd/m^2	[Note4] F = 60KHz I_L = 6.5mArms
White Uniformity		δ w		—	—	1.25	—	[Note5]

※ The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.2 below.

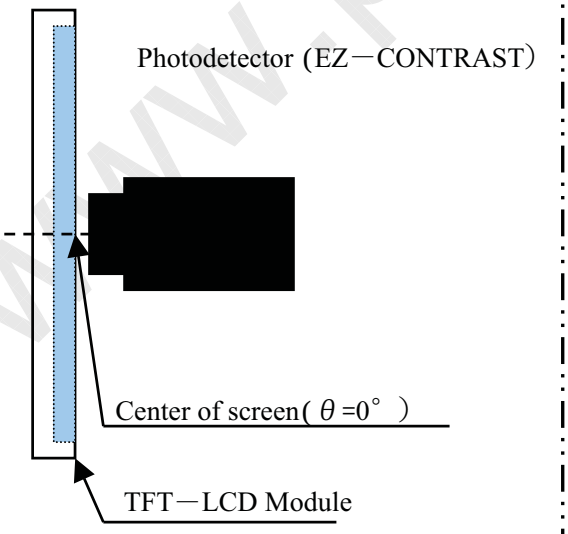


Fig2-1 Viewing angle measurement method

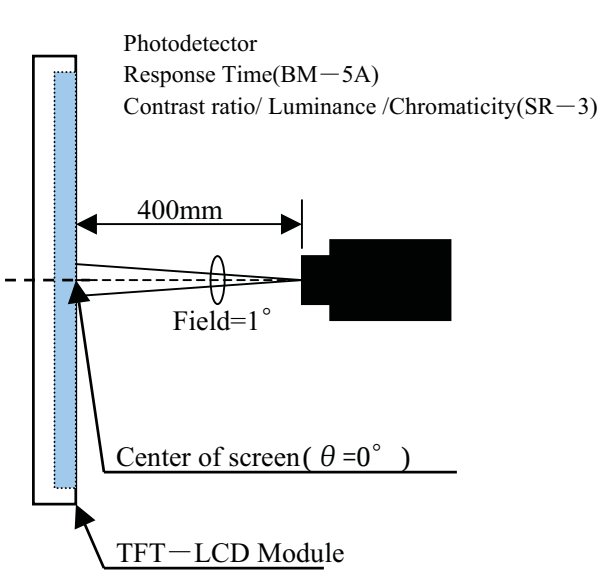
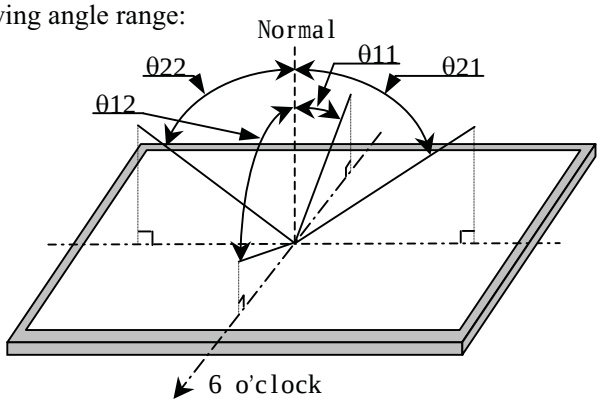


Fig2-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

Fig2 Optical characteristics measurement method

[Note1]Definitions of viewing angle range:



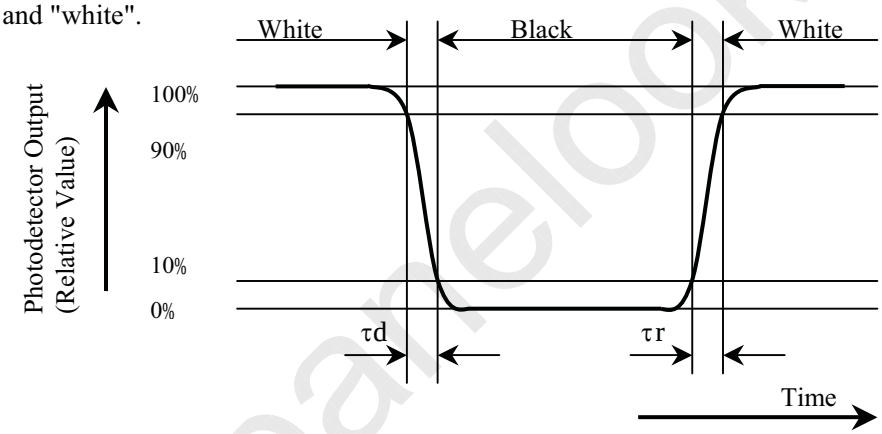
[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note3] 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".

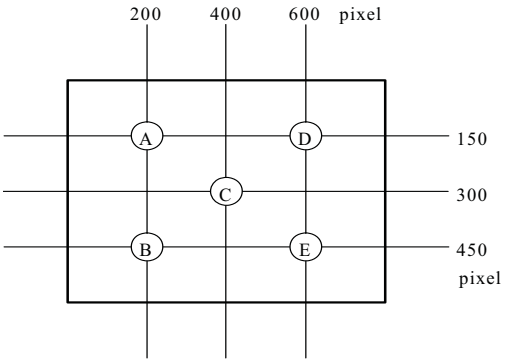


[Note4] This shall be measured at center of the screen.

[Note5] 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) Since there is a circuit board in the module back, stress is not added at the time of a design assembly. Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.
i) Protection film is attached to the module surface to prevent it from being scratched . Peel the film off slowly , just before the use, with strict attention to electrostatic charges. Blow off 'dust' on the polarizer by using an ionized nitrogen.
j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
k) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environmentl
l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.
m) 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.
n) 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.
o) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.
p) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.
q) When install LCD modules in the cabinet, please tighten with “torque=0.294±0.02N•m(3.0±0.2kgf•cm)”.

11. Packing form

Piling number of cartons	MAX. 5
Package quantity in one carton	10pcs
Carton size	395(W)×275(H)×350(D) mm
Total mass of one carton filled with full modules	8000g
Packing form is shown	Fig.3

12. Reliability test items

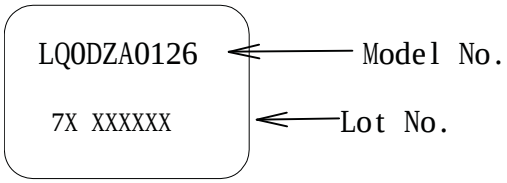
No.	Test item	Conditions	Remark
1	High temperature storage test	Ta=75℃ 240h	
2	Low temperature storage test	Ta= -30℃ 240h	
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)	
4	High temperature operation test	T=70℃ (panel surface) 240h	
5	Low temperature operation test	Ta= 0℃ (panel surface) 240h	
6	Vibration test (non- operating)	Frequency: 10～57Hz/Vibration width (one side):0.075mm : 57～500Hz/Gravity:9.8m/s^2 Sweep time : 11 minutes Test period : 3 hours (1 hour for each direction of X,Y,Z)	
7	Shock test (non- operating)	Max. gravity : 490m/s^2 Pulse width : 11ms, half sine wave Direction : ±X,±Y,±Z once for each direction.	
8	ESD test	Contact discharge (150pF 330Ω) non-operating = ±10kV, operating = ±8kV Atmospheric discharge (150pF 330Ω) non-operating = ±20kV, operating = ±15kV	

[Result Evaluation Criteria]

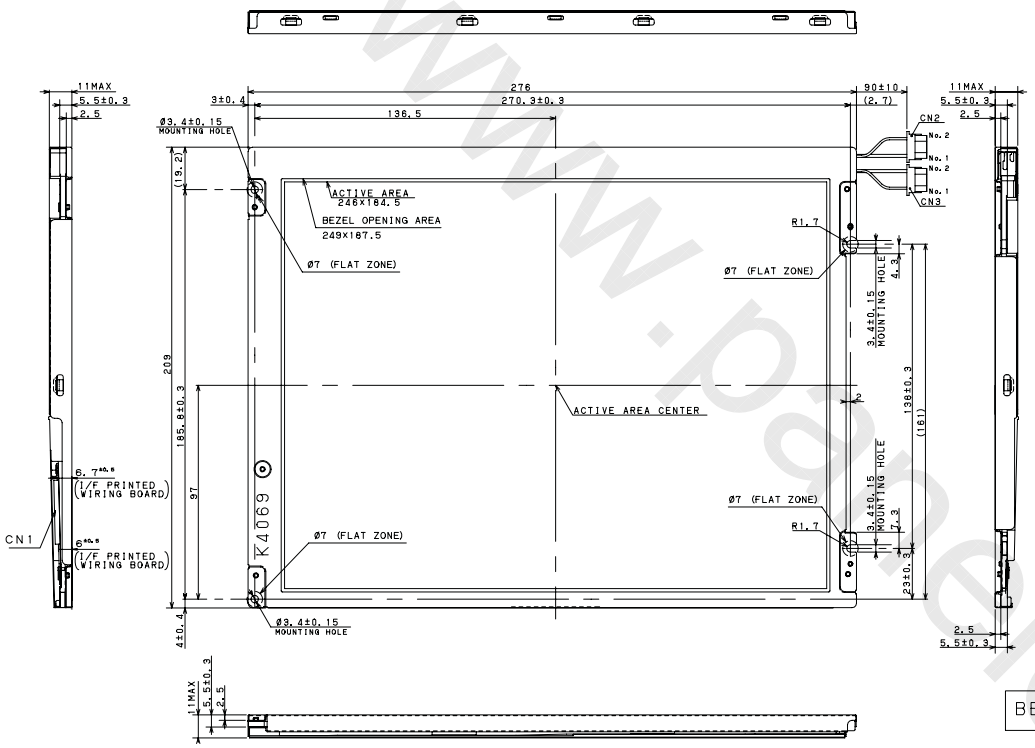
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state：Temperature:15～35℃, Humidity:45～75%, Atmospheric pressure:86～106kpa)

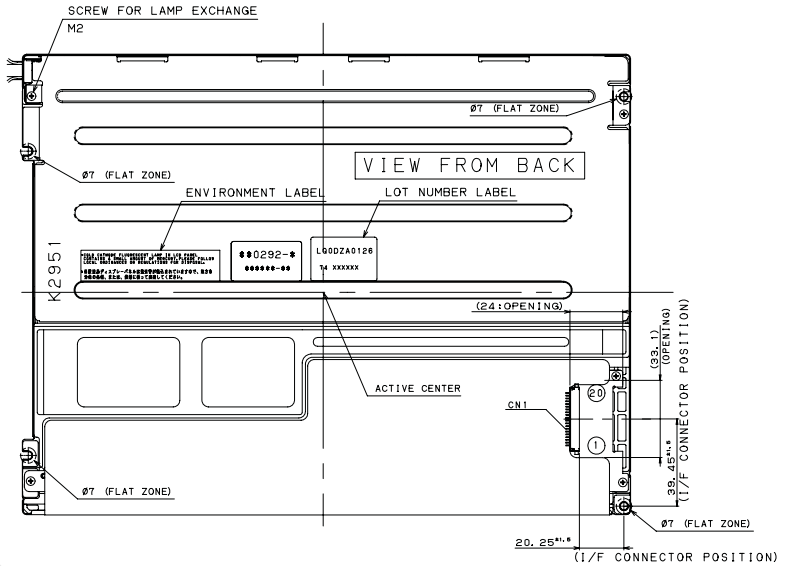
13.Others

1) Lot number Label:



2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.
3) Disassembling the module can cause permanent damage and should be strictly avoided.
4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.





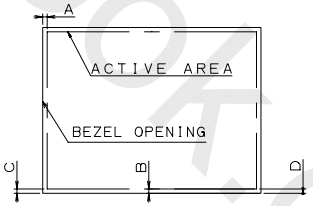
INTERFACE CONNECTOR

CN1:PIN LAYOUT

pin	1	2	3	4	5	6	7
	VCC	VCC	GND	GND	RxIN0-	RxIN0+	GND
8	9	10	11	12	13	14	15
RxIN1-	RxIN1+	GND	RxIN2-	RxIN2+	GND	CK IN-	CK IN+
16	17	18	19	20			
GND	RxIN3-	RxIN3+	RL/UD	SELLVDS			

CORRESPONDING CONNECTOR: [DF14-20S-1.25C(CONNECTOR) (HIROSE ELECTRIC)]
[DF14-2628SCF(TERMINAL) (HIROSE ELECTRIC)]

BEZEL/DISPLAY POSITION



1) TOLERANCE X-DIRECTION A:1.5±0.8
2) TOLERANCE Y-DIRECTION B:1.5±0.8
3) OBLIQUITY OF DISPLAY AREA |C-D|<0.8

CCFT CONNECTOR (JST)
CN2, CN3:
[BHR-02(8.0)VS-1N]

PIN LAYOUT		WIRE COLOR	
		CN2	CN3
1	VHIGH	WHITE	PINK
2	VLOW	GLAY	WHITE

NOTES
1) UNSPECIFIED TOLERANCE TO BE ±0.5
2) WARP AND FLATING FOR PCB AND CHASSIS ARE EXCLUDED FROM THICKNESS AND DIMENSION OF THE UNIT.
3) RECOMMENDED TIGHTEN TORQUE FOR MOUNTING 0.294±0.02N·m (3.0±0.2kgf·cm)

Fig1:OUTLINE DEMENSIONS

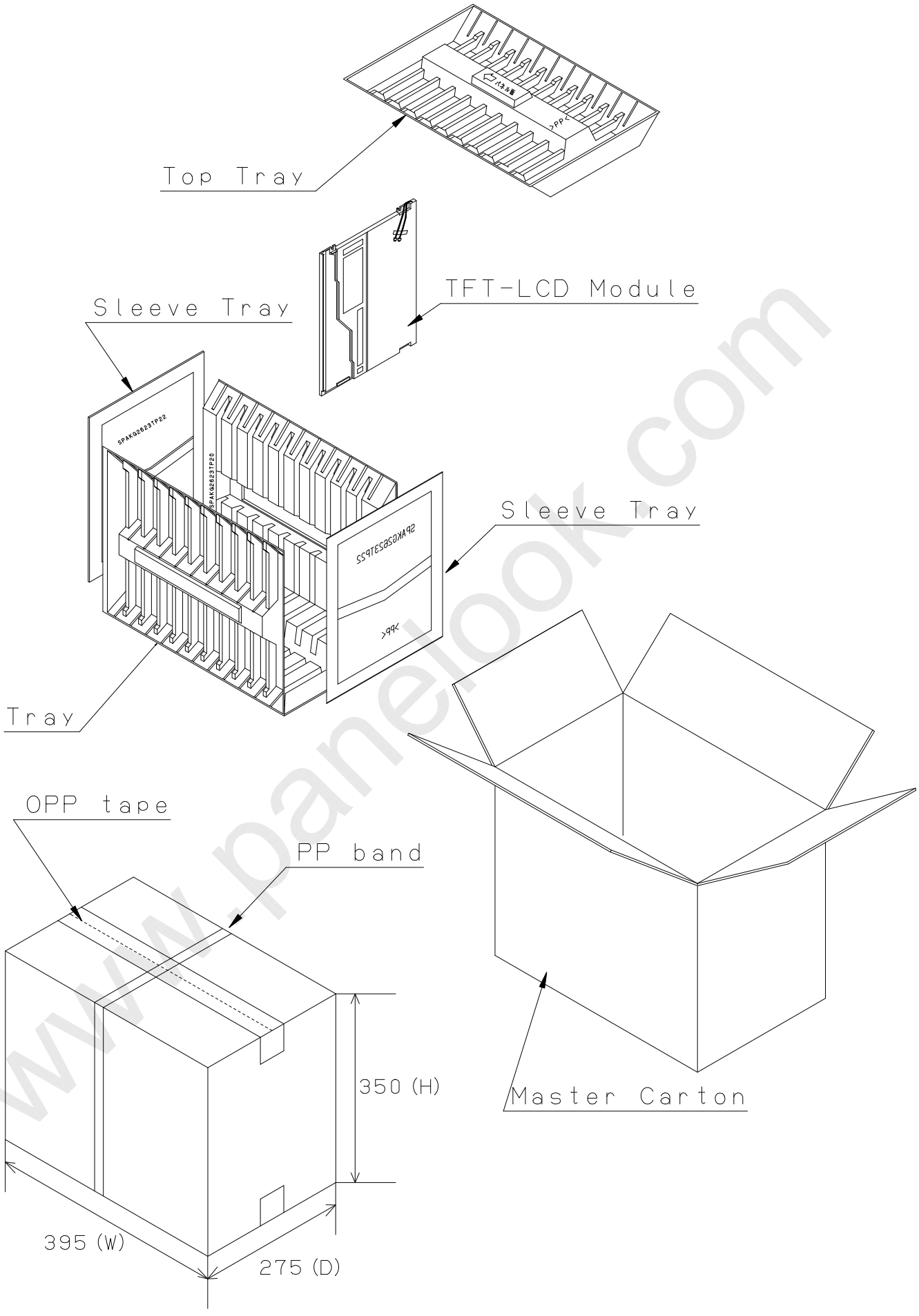


Fig3:Packing Form