SPEC No. LD-19406A
ISSUE : Apr.26.2007
PAGE : 24 pages

DEVICE SPECIFICATION

TFT-LCD Module

MODEL

LQ0DZA0115

RECORDS OF REVISION

LQ0DZA0115

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-19406A	Apr.26.2007	-	-	—	1st Issue

1. Application

This specification applies to color TFT-LCD module, LQ0DZA0115.

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 12-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)

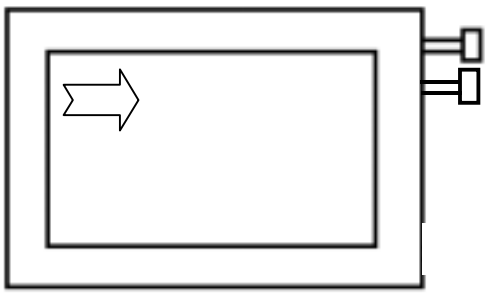
Corresponding connector: DF14-20S-1.25C(Connector) [Hirose electric.,Ltd]

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

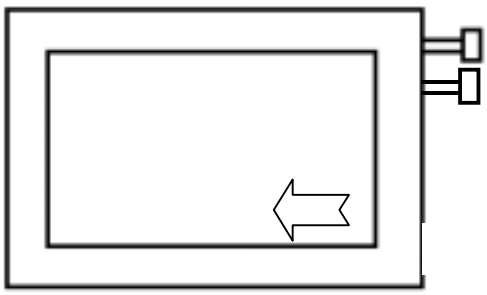
Pin No.	Symbol	Function	Remark
1	V_{CC}	+3.3V power supply	
2	V_{CC}	+3.3V power supply	
3	GND		
4	GND		
5	RXIN0-	Differential data input, CH0 (negative)	LVDS signal
6	RXIN0+	Differential data input, CH0 (positive)	LVDS signal
7	GND		
8	RXIN1-	Differential data input, CH1 (negative)	LVDS signal
9	RXIN1+	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	SELLVDS	Select LVDS	[Note2]

[Note 1]

RL/UD = Low



RL/UD = High



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

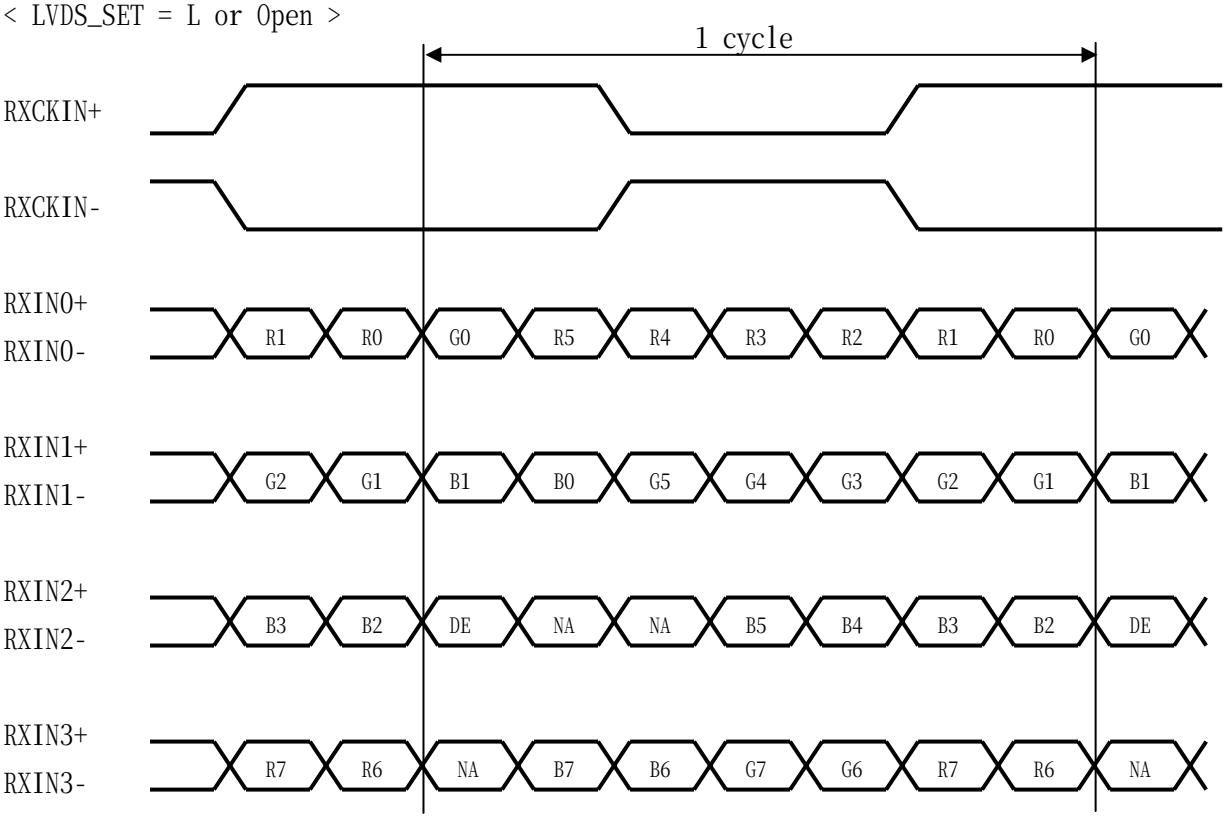
4-2 Data Mapping

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)

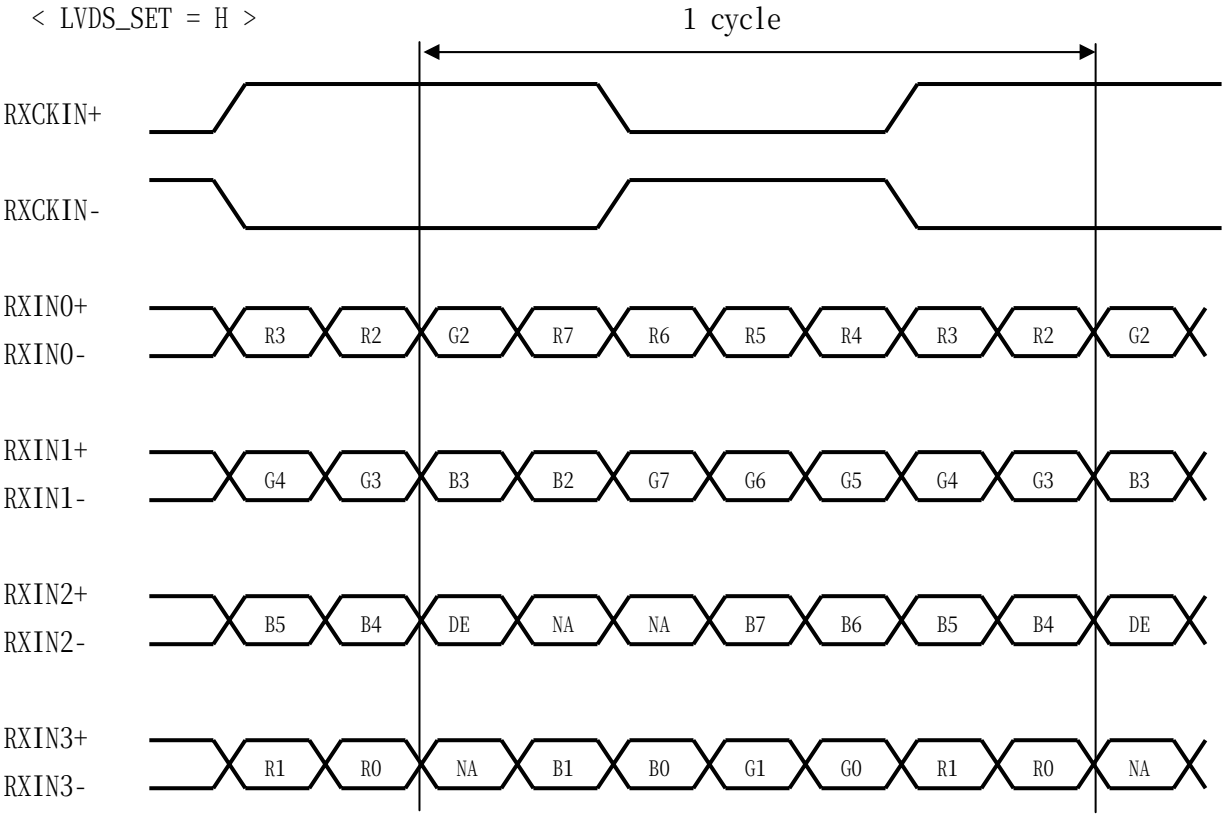
< LVDS_SET = L or Open >



DE: Display Enable

NA: Not Available

< LVDS_SET = H >



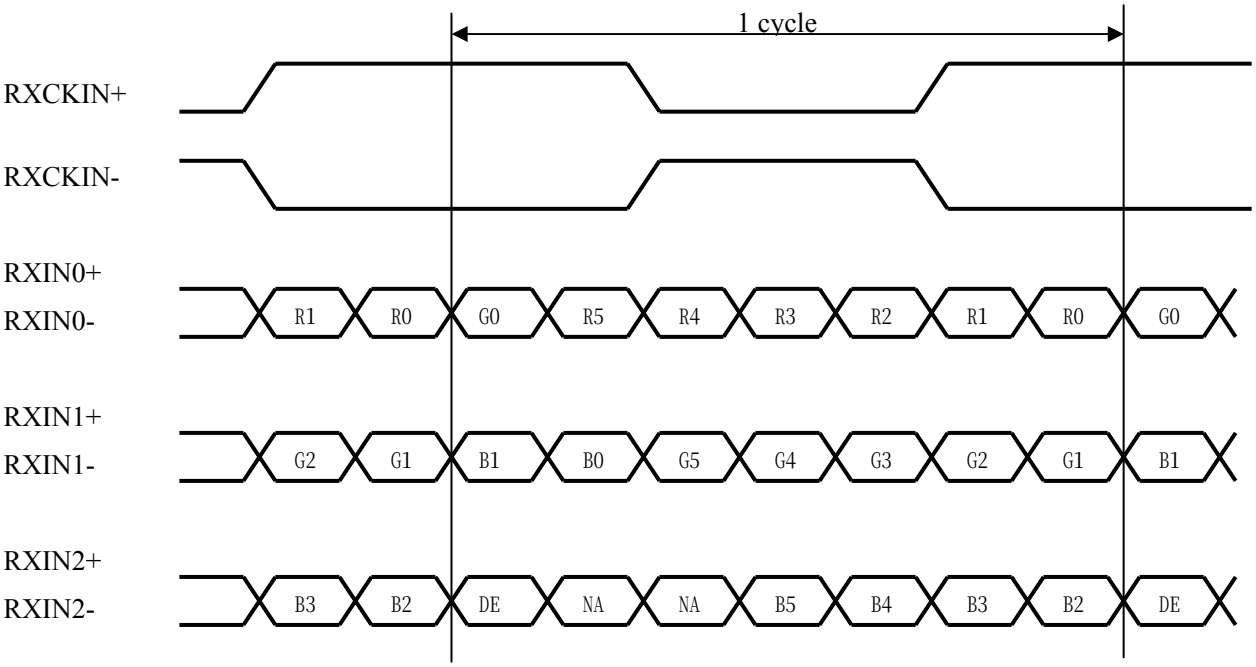
DE: Display Enable

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)

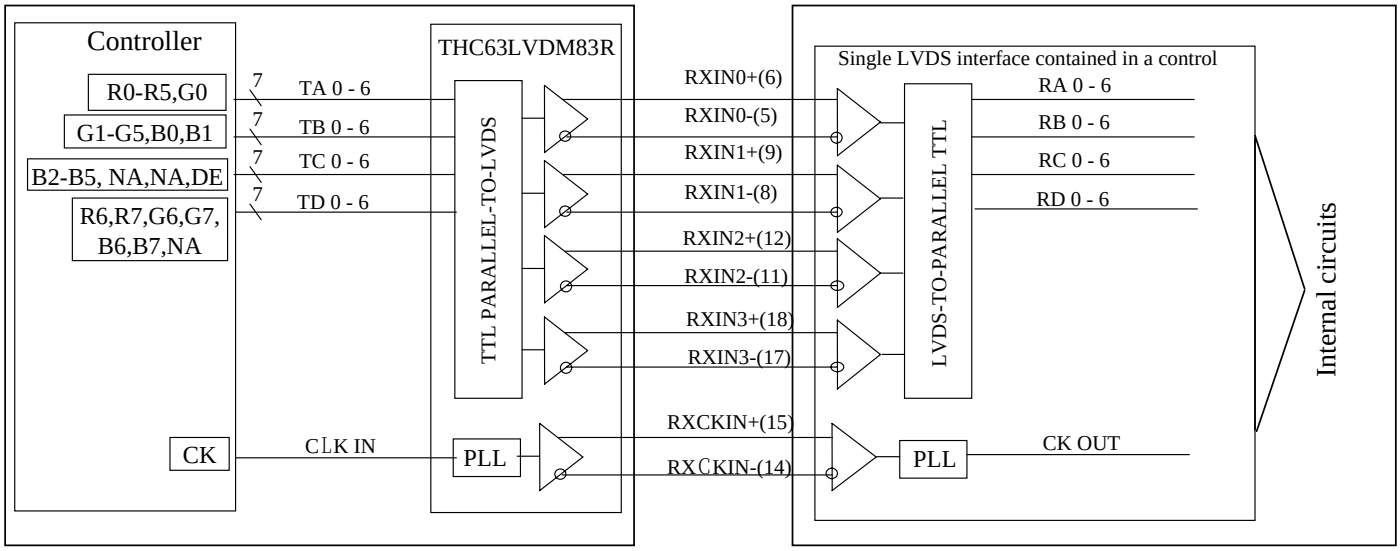


DE: Display Enable

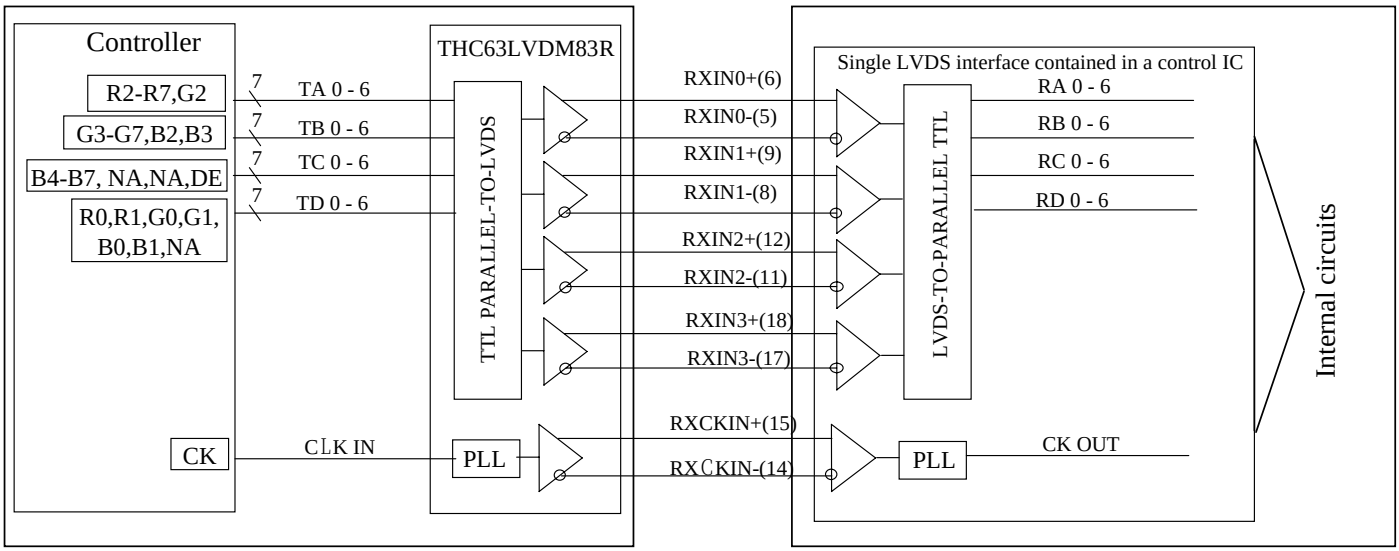
NA: Not Available

(Computer side) (TFT-LCD side)

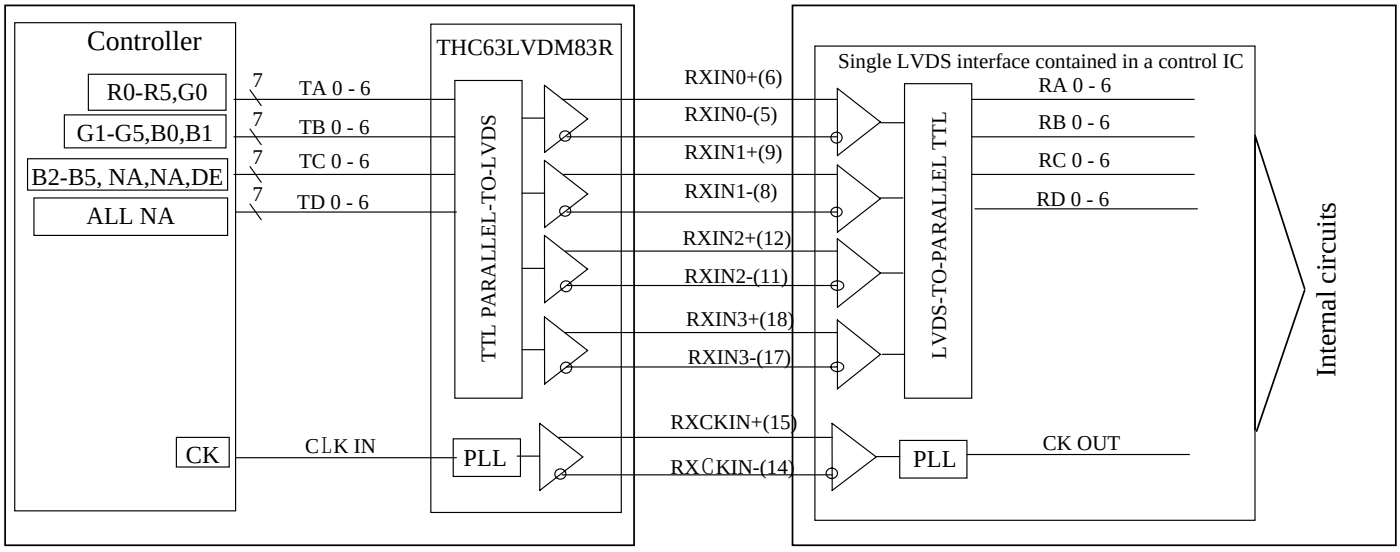
①8Bit Mode
LVDS_SET=L (20 pin=GND or OPEN)



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 °C	Vcc	-0.3 to 4.0	V	[Note1,4]
Input voltage	VI1	Ta=25°C	RXINi-/+(i= 0,1,2,3) RXCLK IN-/+	-0.3 to Vcc+0.3	V	
	VI2	Ta=25°C	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	°C	[Note1]
Operating temperature	Topa	Ambient	-	-10 to +75(panel surface)	°C	[Note1,3]

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

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

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}＜75℃],

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 ºC

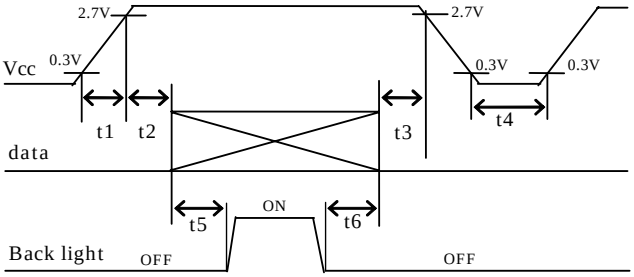
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		Vcc	+3.0	+3.3	+3.6	V	[Note4]
Current dissipation	Vcc=+3.3V	Icc	-	350	450	mA	[Note5]
Input voltage range	LVDS signal	V_L	0	-	2.4	V	[Note3]
Permissive input ripple voltage	Vcc=+3.3V	V_{RP}	-	-	100	mVp-p	
Differential input threshold voltage	High	V_{TH}	-	-	V_{CM} +100	mV	V_{CM}=1.2V [Note1]
	Low	V_{TL}	V_{CM} –100	-	-	mV	
Input voltage	High	V_{IH}	2.1	-	-	V	[Note2]
	Low	V_{IL}	-	-	0.8		
Input current	High	I_{OH}	-	-	400	μA	V_{I2}=+3.3V[Note2]
	Low	I_{OL}	-10.0	-	10.0	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

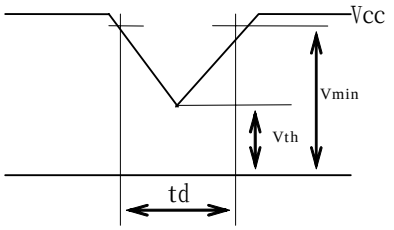


0<t1≦10ms 0<t2≦10ms

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

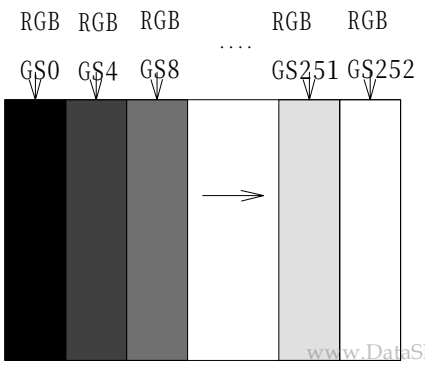
・Please use DE signal by the Lo start.

・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

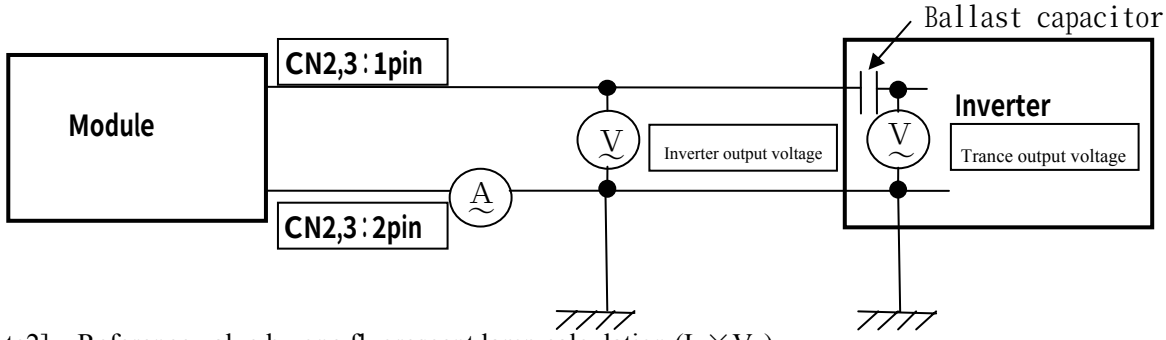


6-2. Backlight driving

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	6.0	7.0	mArms	[Note1]
Lamp voltage	V_L	-	485	560	Vrms	Ta=+25°C,I_L=6.0mArms
Lamp power consumption	P_L	-	2.9	-	W	[Note2]
Lamp frequency	F_L	40	-	70	kHz	[Note3]
Kick-off voltage	Vs	-	-	1100	Vrms	Inverter output voltage, Ta=-10°C
		-	-	(1300)		(Trance output voltage)
Lamp life time	L_L	50000 (Lump unit)	-	-	hour	I_L=6.0mA [Note5]
		15000 (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 = 6.0mArms)

[Note3] 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.

[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=6.0mArms)
① Brightness becomes 50% of the original value under standard condition.
② Kick-off voltage at Ta=-10 ºC exceeds maximum value,1500Vrms.
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.

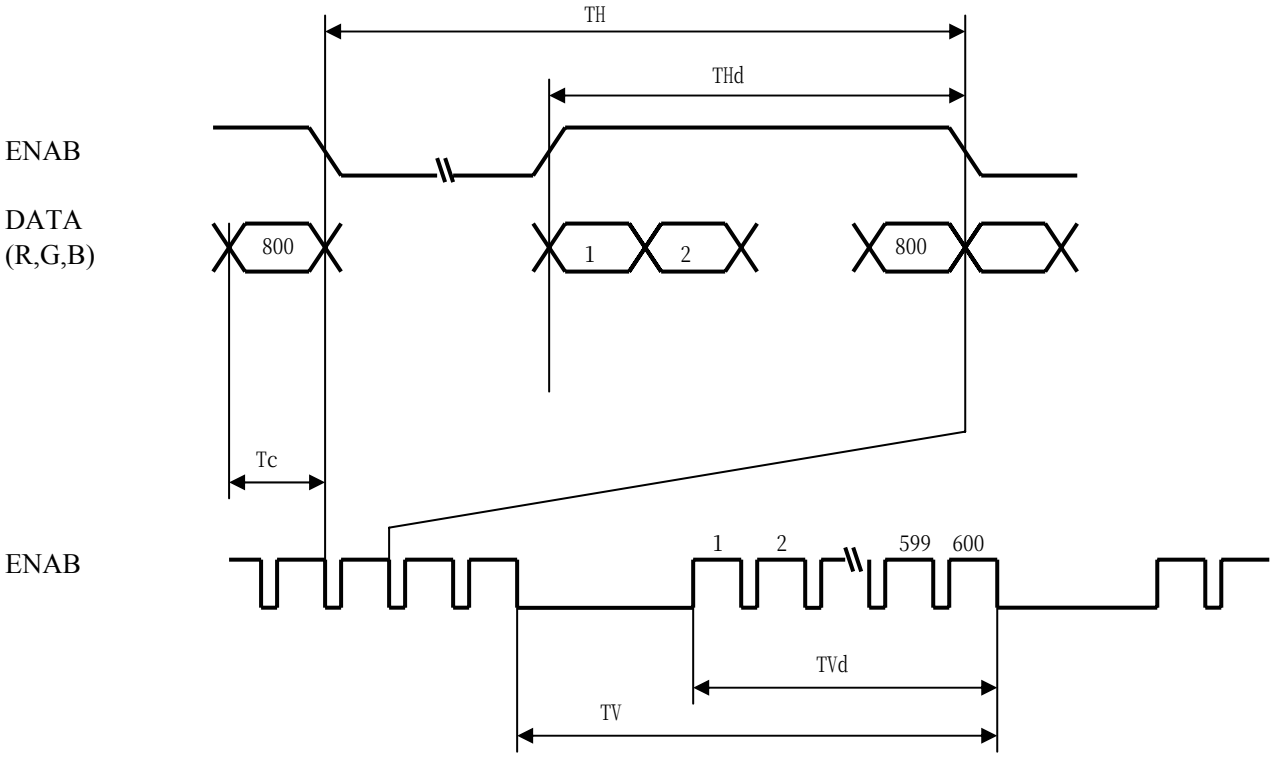
[Note] The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, 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

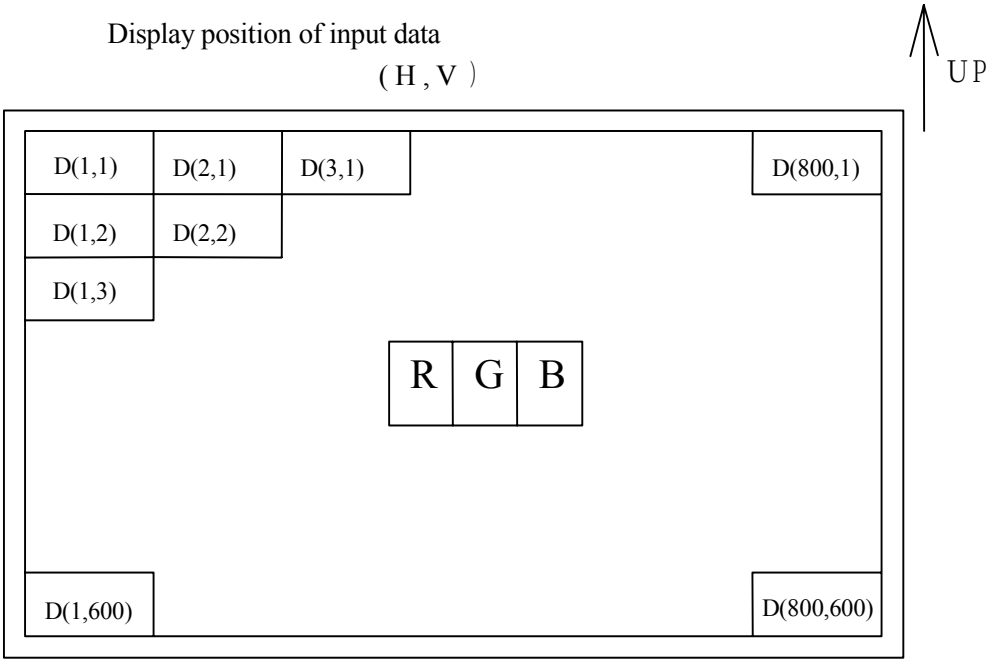
7-1. Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock signal	Frequency	1/Tc	35	40	42	MHz
	Horizontal period	TH	940	1056	1395	clock
ENAB signal			23.5	26.4	39.9	μs
	Horizontal period (High)	THd	800	800	800	clock
	Vertical period	TV	628	666	698	line
			—	16.7	—	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	0z	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

Red color can be displayed in 228 gray scales from 8 bit data signals.

Green color can be displayed in 253 gray scales from 8 bit data signals.

Blue color can be displayed in 253 gray scales from 8 bit data signals.

According to the combination of each color, about 12-million-color display can be achieved on the screen.

Please refer to【Appendix A】of the end for the output Gray scale of each basic color.

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	450	-	-	[Note2,4]
Response time	gray scale	τ		-	10	-	ms	[Note3(Condition 1),4,5]
	black and white	τ d＋τ r		-	35	-	ms	[Note3(Condition 2),4,5]
Chromaticity of White		x		0.283	0.313	0.343	-	
		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	θ =0 °	0.253	0.283	0.313	-	[Note4]
		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		YL		260	330	—	cd/m^2	[Note4] F = 60KHz I_L = 6.0mArms
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.

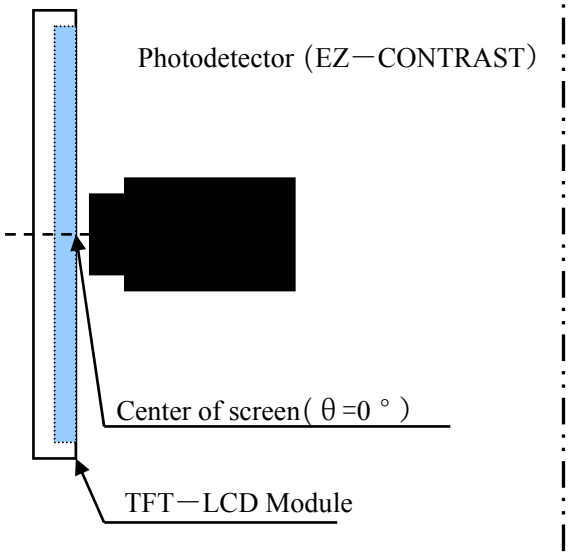


Fig2-1 Viewing angle measurement method

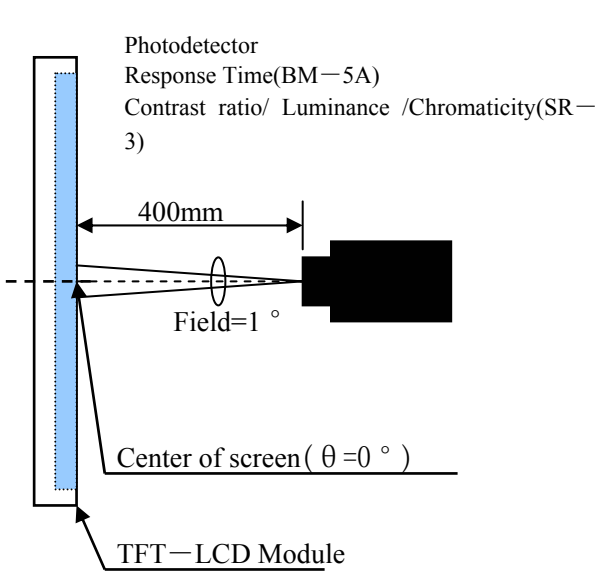
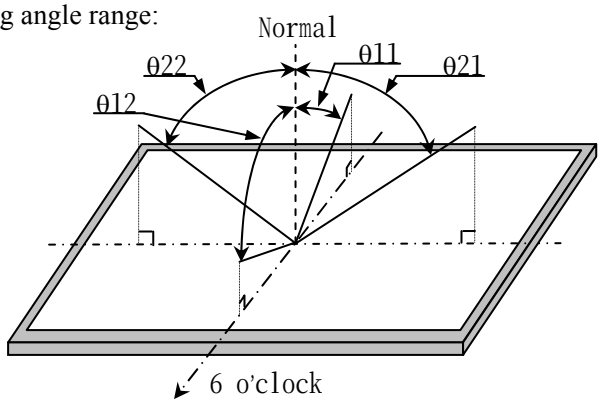


Fig2-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

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:

<Condition 1 : > Definition by gray scal

The response time is defined as the following figure and shall be measured by switching the input signal for nine kinds of gray scales (GS0,32,64,96,128,160,192,224,255) and nine kinds of scales gray signal. (GS0,32,64,96,128,160,192, 224,255)

（Panel surface temperature ： 40℃）

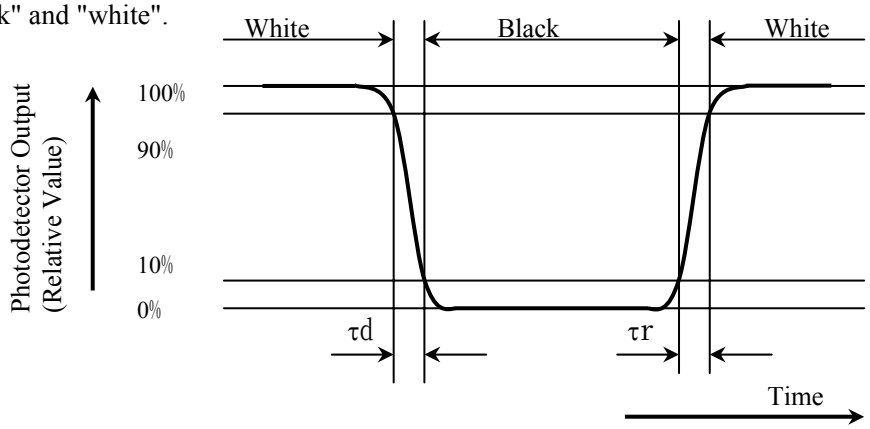
	GS0	GS32	GS64	GS96	GS128	GS160	GS192	GS224	GS255
GS0		τ r:0-32	τ r:0-64	τ r:0-96	τ r:0-128	τ r:0-160	τ r:0-192	τ r:0-224	τ r:0-255
GS32	τ d:32-0		τ r:32-64	τ r:32-96	τ r:32-128	τ r:32-160	τ r:32-192	τ r:32-224	τ r:32-255
GS64	τ d:64-0	τ d:64-32		τ r:64-96	τ r:64-128	τ r:64-160	τ r:64-192	τ r:64-224	τ r:64-255
GS96	τ d:96-0	τ d:96-32	τ d:96-64		τ r:96-128	τ r:96-160	τ r:96-192	τ r:96-224	τ r:96-255
GS128	τ d:128-0	τ d:128-32	τ d:128-64	τ d:128-96		τ r:128-160	τ r:128-192	τ r:128-224	τ r:128-255
GS160	τ d:160-0	τ d:160-32	τ d:160-64	τ d:160-96	τ d:160-128		τ r:160-192	τ r:160-224	τ r:160-255
GS192	τ d:192-0	τ d:192-32	τ d:196-64	τ d:196-96	τ d:196-128	τ d:196-160		τ r:192-224	τ r:192-255
GS224	τ d:224-0	τ d:224-32	τ d:224-64	τ d:224-96	τ d:224-128	τ d:224-160	τ d:224-192		τ r:224-255
GS255	τ d:255-0	τ d:255-32	τ d:255-64	τ d:255-96	τ d:255-128	τ d:255-160	τ d:255-192	τ d:255-224	

τ *:x-y… Switching time from a option gray scale (x) to other option gray scale (y)

$$\tau = \{\Sigma\ (\tau\ r{:}x\text{-}y) + \Sigma\ (\tau\ d{:}x\text{-}y)\} / 72$$

<Condition 2 : > Definition by black and white

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

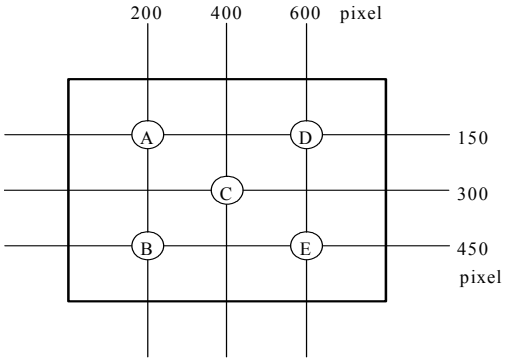


[Note4] This shall be measured at center of the screen.

[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. 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) 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)”.

12. 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

13. Reliability test items

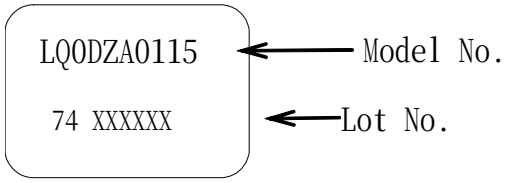
No.	Test item	Conditions	Remark
1	High temperature storage test	Ta=75°C 240h	
2	Low temperature storage test	Ta= -30°C 240h	
3	High temperature & high humidity operation test	Ta=40°C ; 95%RH 240h (No condensation)	
4	High temperature operation test	T=75°C (panel surface) 240h	
5	Low temperature operation test	Ta= -10°C 240h	
6	Vibration test (non- operating)	Frequency: 10～57Hz/Vibration width (one side):0.075mm : 58～500Hz/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]

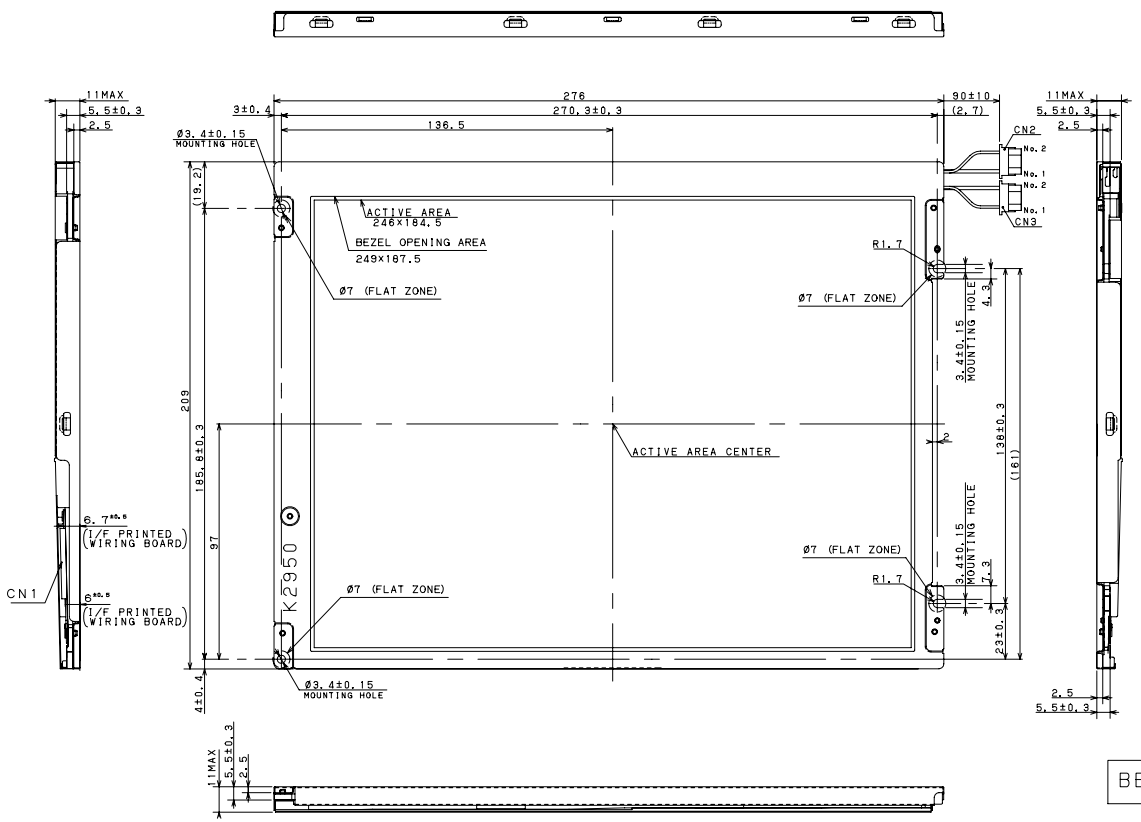
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state：Temperature:15～35°C, Humidity:45～75%, Atmospheric pressure:86～106kpa)

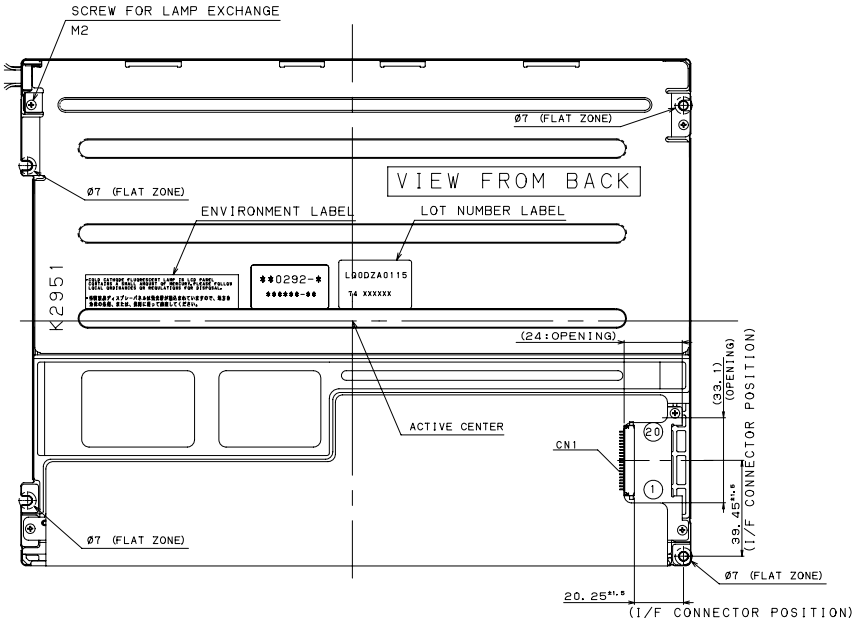
14.Others

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.





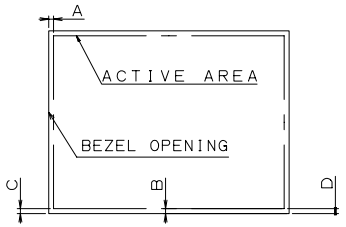
INTERFACE CONNECTOR

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	V_{HIGH}	WHITE	PINK
2	V_{LOW}	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

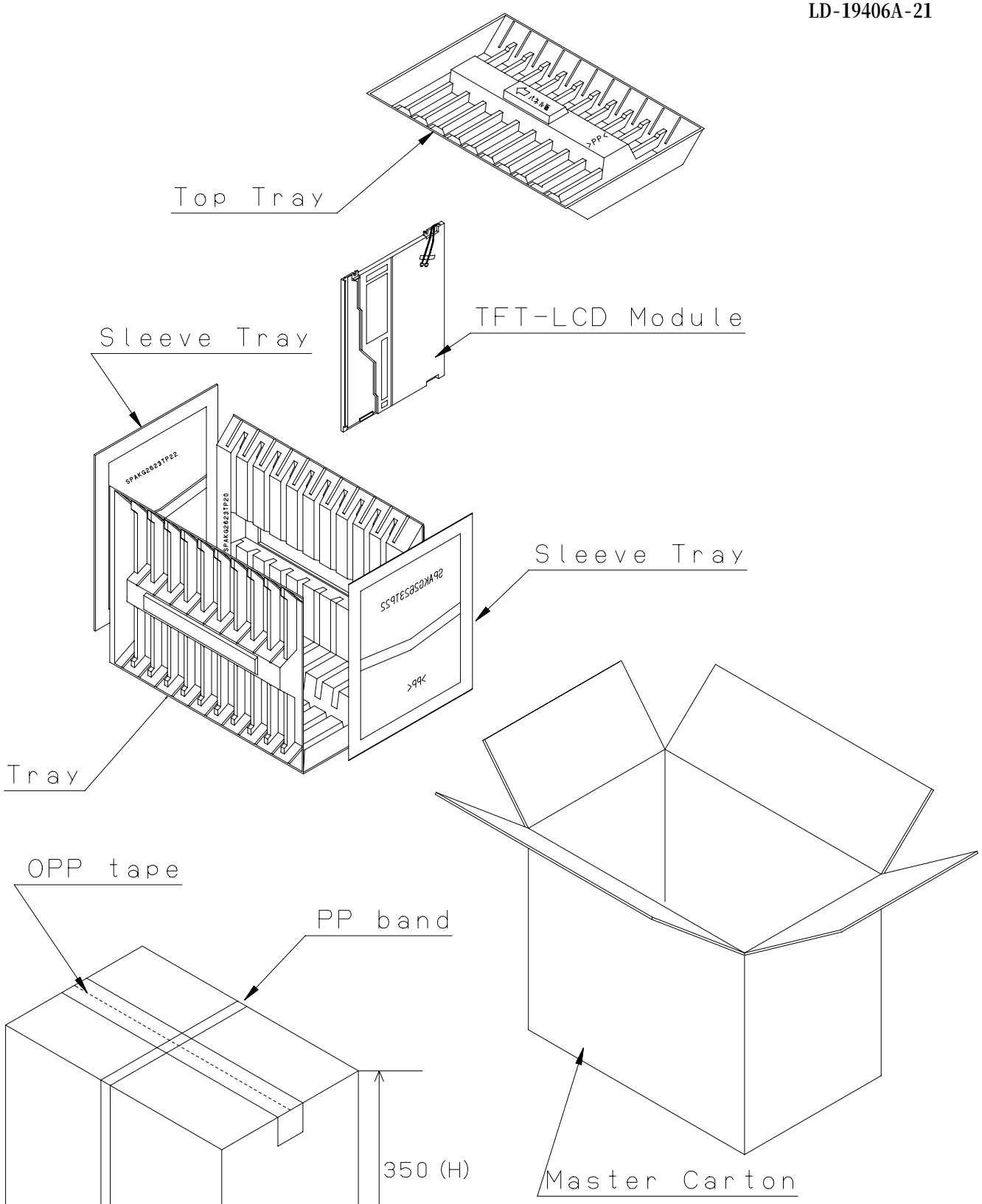


Fig3:Packing Form

[Apendix A]

Output Gray scale table to input data of each basic color (R,G,B)

	R	G	B
Number of Gray scale	228	232	225

Input Gray scale	Output Gray scale		
	R	G	B
GS0	0	0	0
GS1	0	0	0
GS2	1	1	1
GS3	2	2	2
GS4	3	3	2
GS5	4	4	3
GS6	5	4	3
GS7	5	5	4
GS8	6	6	5
GS9	7	7	5
GS10	8	7	6
GS11	9	8	7
GS12	9	9	7
GS13	10	10	8
GS14	11	11	8
GS15	12	11	9
GS16	13	12	10
GS17	14	13	10
GS18	14	14	11
GS19	15	15	12
GS20	16	15	12
GS21	17	16	13
GS22	18	17	13
GS23	18	18	14
GS24	19	18	15
GS25	20	19	15
GS26	21	20	16
GS27	22	21	17
GS28	22	22	17
GS29	23	22	18
GS30	24	23	18
GS31	25	24	19
GS32	26	25	20
GS33	27	26	20
GS34	27	26	21
GS35	28	27	22
GS36	29	28	22
GS37	30	29	23
GS38	31	29	24
GS39	31	30	24
GS40	32	31	25
GS41	33	32	25
GS42	34	33	26
GS43	35	33	27
GS44	36	34	27
GS45	36	35	28
GS46	37	36	29
GS47	38	37	29
GS48	39	37	30
GS49	40	38	30
GS50	40	39	31
GS51	41	40	32
GS52	42	40	32
GS53	43	41	33
GS54	44	42	34
GS55	45	43	34
GS56	45	44	35
GS57	46	44	35
GS58	47	45	36
GS59	48	46	37
GS60	49	47	37
GS61	49	48	38
GS62	50	48	39
GS63	51	49	39
GS64	52	50	40
GS65	53	51	41
GS66	54	52	41
GS67	55	53	42
GS68	56	54	43
GS69	57	55	44
GS70	58	56	45
GS71	59	57	46
GS72	60	58	46
GS73	62	59	47
GS74	63	60	48
GS75	64	61	49
GS76	65	62	50
GS77	66	63	51
GS78	67	64	51
GS79	68	65	52
GS80	70	66	53
GS81	71	68	54
GS82	72	69	55
GS83	73	70	56
GS84	74	71	57
GS85	75	72	58

Input Gray scale	Output Gray scale		
	R	G	B
GS86	77	73	58
GS87	78	74	59
GS88	79	75	60
GS89	80	77	61
GS90	82	78	62
GS91	83	79	63
GS92	84	80	64
GS93	85	81	65
GS94	86	82	66
GS95	88	83	67
GS96	89	85	68
GS97	90	86	69
GS98	91	87	70
GS99	93	88	71
GS100	94	89	72
GS101	95	91	73
GS102	96	92	74
GS103	98	93	75
GS104	99	94	76
GS105	100	95	77
GS106	101	97	78
GS107	103	98	79
GS108	104	99	80
GS109	105	100	81
GS110	106	102	82
GS111	108	103	83
GS112	109	104	84
GS113	110	105	85
GS114	112	107	86
GS115	113	108	87
GS116	114	109	88
GS117	115	111	89
GS118	117	112	90
GS119	118	113	91
GS120	119	114	92
GS121	121	116	93
GS122	122	117	94
GS123	123	118	96
GS124	125	120	97
GS125	126	121	98
GS126	127	122	99
GS127	129	124	100
GS128	130	125	101
GS129	131	126	102
GS130	133	128	103
GS131	134	129	104
GS132	135	130	106
GS133	137	132	107
GS134	138	133	108
GS135	139	134	109
GS136	141	135	110
GS137	142	137	111
GS138	143	138	112
GS139	145	139	113
GS140	146	141	115
GS141	147	142	116
GS142	149	143	117
GS143	150	145	118
GS144	151	146	119
GS145	153	147	120
GS146	154	149	122
GS147	155	150	123
GS148	157	151	124
GS149	158	153	125
GS150	160	154	126
GS151	161	155	127
GS152	162	157	129
GS153	164	158	130
GS154	165	159	131
GS155	166	161	132
GS156	168	162	133
GS157	169	163	135
GS158	170	165	136
GS159	172	166	137
GS160	173	167	138
GS161	174	168	139
GS162	176	170	140
GS163	177	171	142
GS164	178	172	143
GS165	179	173	144
GS166	180	174	145
GS167	181	175	146
GS168	182	176	147
GS169	183	177	148
GS170	184	179	149
GS171	186	180	150

Input Gray scale	Output Gray scale		
	R	G	B
GS172	187	181	151
GS173	188	182	152
GS174	189	183	154
GS175	190	184	155
GS176	191	185	156
GS177	192	186	157
GS178	193	187	158
GS179	194	188	159
GS180	195	189	160
GS181	196	190	161
GS182	197	191	162
GS183	197	192	163
GS184	198	193	164
GS185	199	194	165
GS186	200	195	166
GS187	201	196	167
GS188	202	197	168
GS189	203	198	169
GS190	204	199	170
GS191	205	199	171
GS192	205	200	172
GS193	206	201	173
GS194	207	202	175
GS195	208	203	176
GS196	209	204	177
GS197	210	205	178
GS198	211	206	179
GS199	212	207	180
GS200	213	208	181
GS201	214	209	182
GS202	215	210	184
GS203	216	211	185
GS204	217	212	186
GS205	217	213	187
GS206	218	214	188
GS207	219	215	189
GS208	220	216	190
GS209	221	217	192
GS210	222	218	193
GS211	223	219	194
GS212	224	220	195
GS213	225	221	196
GS214	225	222	197
GS215	226	223	198
GS216	227	224	200
GS217	228	225	201
GS218	229	226	202
GS219	230	227	203
GS220	231	228	204
GS221	231	229	205
GS222	232	230	207
GS223	233	231	208
GS224	234	232	209
GS225	235	233	210
GS226	236	234	211
GS227	236	235	213
GS228	237	236	214
GS229	238	237	215
GS230	239	238	216
GS231	240	239	217
GS232	241	240	219
GS233	241	240	220
GS234	242	241	221
GS235	243	242	223
GS236	243	243	224
GS237	244	243	226
GS238	245	244	227
GS239	246	245	229
GS240	246	246	231
GS241	247	246	232
GS242	248	247	234
GS243	248	248	235
GS244	249	249	237
GS245	250	249	239
GS246	250	250	240
GS247	251	251	242
GS248	251	251	244
GS249	252	252	245
GS250	253	253	247
GS251	253	253	249
GS252	254	254	250