

SHARP

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TECHNICAL LITERATURE
FOR
TFT - LCD module

These parts have corresponded with the RoHS directive.

MODEL No. **LQ150X1LW73**

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MOBILE LIQUID CRYSTAL DISPLY GROUP
SHARP CORPORATION

RECORDS OF REVISION

LQ121S7LY11

[illegible]

1. Application

This technical literature applies to the color 15.0 XGA TFT-LCD module LQ150X1LW73.

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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, power supply circuit and a back light unit. Graphics and texts can be displayed on a $1024 \times \text{RGB} \times 768$ dots panel with about 16 million colors by using LVDS (Low Voltage Differential Signaling) and supplying +3.3V DC supply voltages for TFT-LCD panel driving and supply voltage for backlight.

It is a wide viewing-angle-module

(Vertical viewing angle: 170° Horizontal viewing angle: 170° , $\text{CR} \geq 10$).

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

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	38 (Diagonal)	cm
	15.0 (Diagonal)	Inch
Active area	$304.1 \text{ (H)} \times 228.1 \text{ (V)}$	mm
Pixel format	$1024 \text{ (H)} \times 768 \text{ (V)}$	Pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	$0.297 \text{ (H)} \times 0.297 \text{ (V)}$	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit outline dimensions *1	$331.6 \text{ (W)} \times 254.76 \text{ (H)} \times 12.5 \text{ (D)}$	mm
Mass	TBD(MAX)	g
Surface treatment	Anti-glare , LR-coating and hard-coating 2H (Haze value = 42)	

*1.Note: excluding back light cables.

The thickness of module (D) doesn't contain the projection.

Outline dimensions are shown in Fig.1.

4. Input Terminals

4-1. TFT-LCD panel driving

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

Using connectors : DF14H-20P-1.25H (Hirose Electric Co., Ltd.)

Corresponding connectors : DF14-20S-1.25C(Connector)
DF14-2628SCFA(Terminal)

Using LVDS Receiver : Contained in a control IC. [THC63LVDF84A(Thine) compatible]

Corresponding LVDS Transmitter : THC63LVDM83R(Thine) or compatible

Pin No.	Symbol	Function	Remark
1	Vcc	+3.3V Power supply	
2	Vcc	+3.3V Power supply	
3	GND		
4	GND		
5	RXIN0-	Receiver signal (-)	LVDS
6	RXIN0+	Receiver signal (+)	LVDS
7	GND		
8	RXIN1-	Receiver signal (-)	LVDS
9	RXIN1+	Receiver signal (+)	LVDS
10	GND		
11	RXIN2-	Receiver signal (-)	LVDS
12	RXIN2+	Receiver signal (+)	LVDS
13	GND		
14	RXCKIN-	Clock signal (-)	LVDS
15	RXCKIN+	Clock signal (+)	LVDS
16	GND		
17	RXIN3-	Receiver signal (-)	LVDS
18	RXIN3+	Receiver signal (+)	LVDS
19	GND		
20	LVDS_SET	LVDS_SET	【note1】

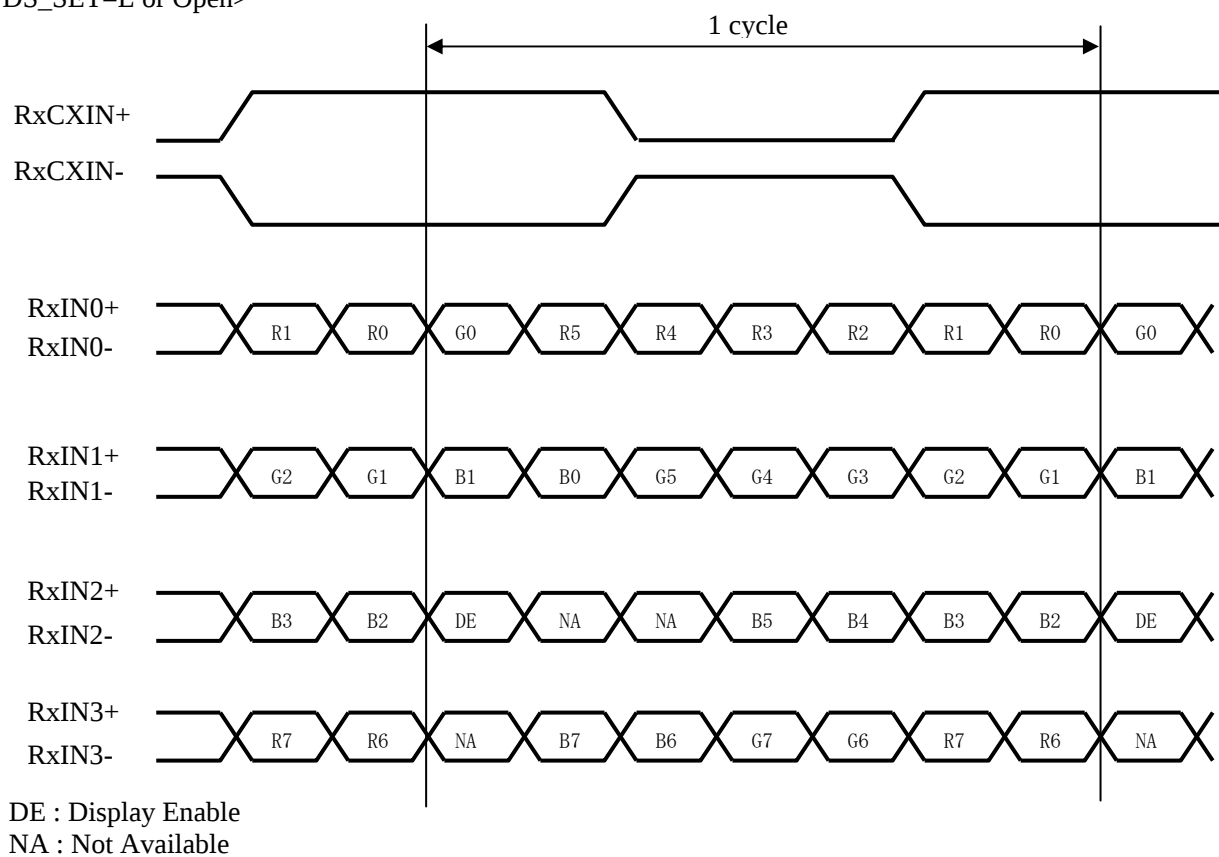
4-2 Data Mapping

1) 8 bit input

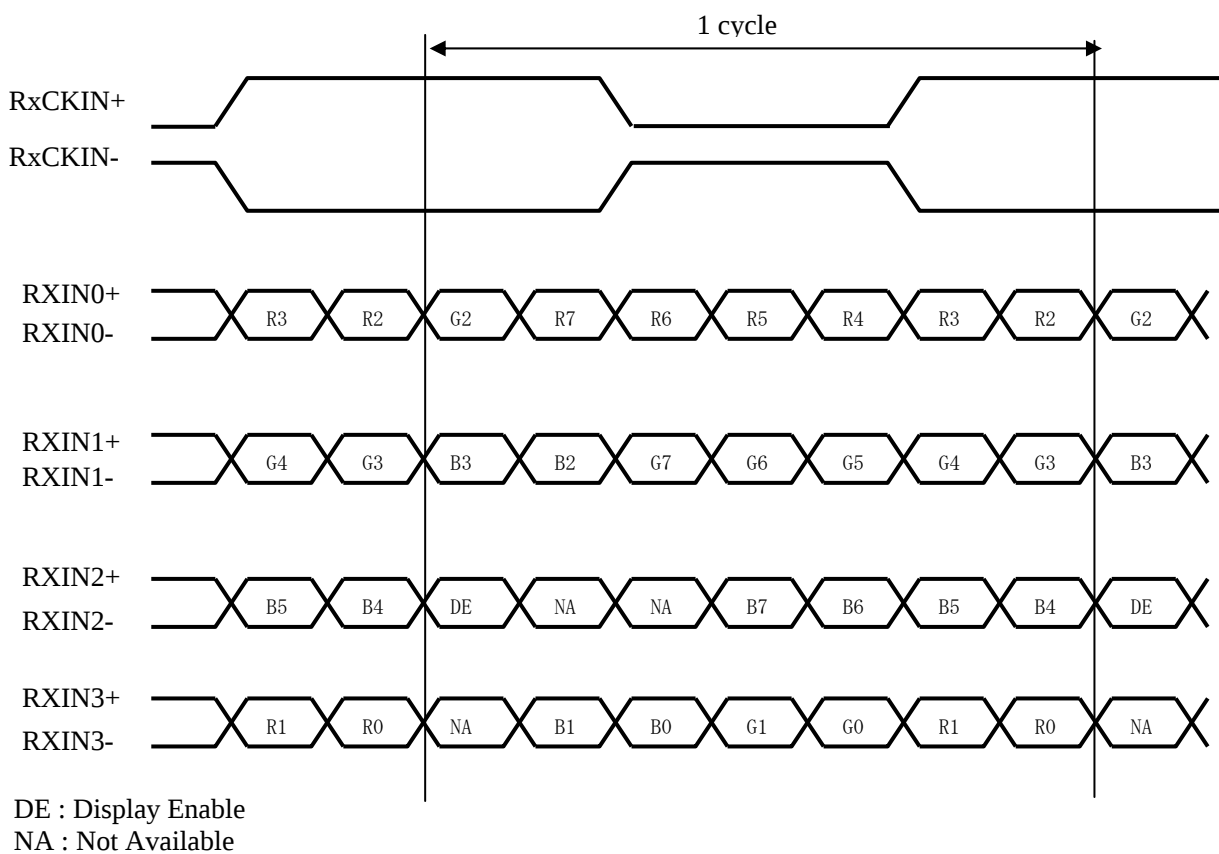
【note1】 pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

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>



<LVDS_SET =H>

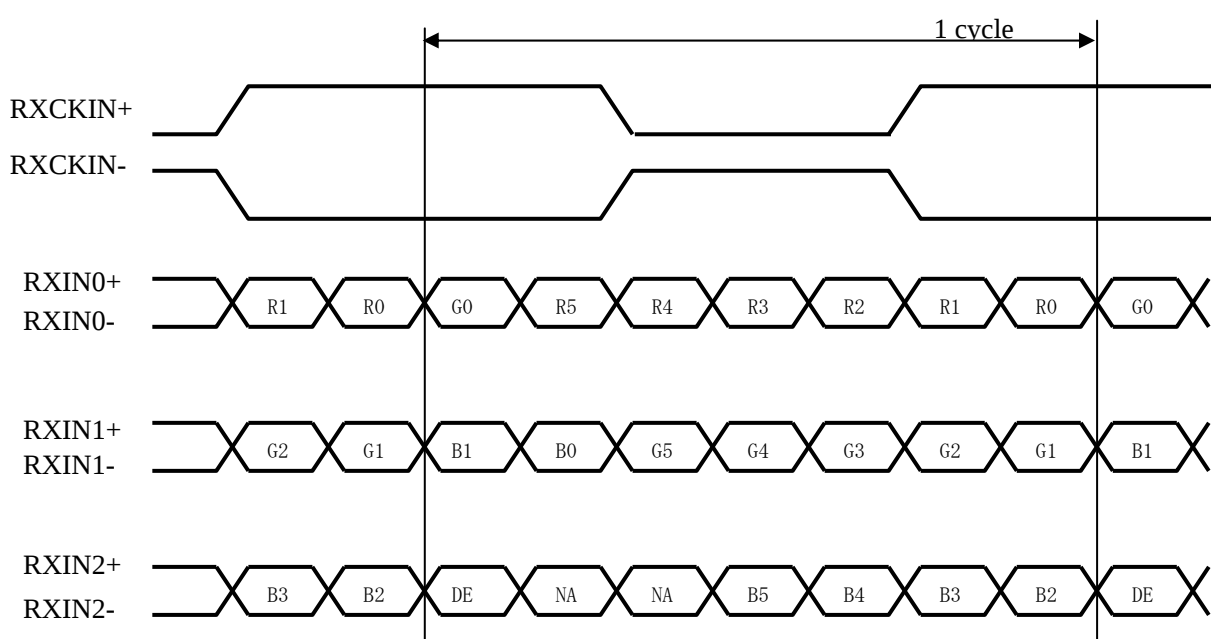


4-3 Data Mapping

2) 6 bit input

【note1】 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

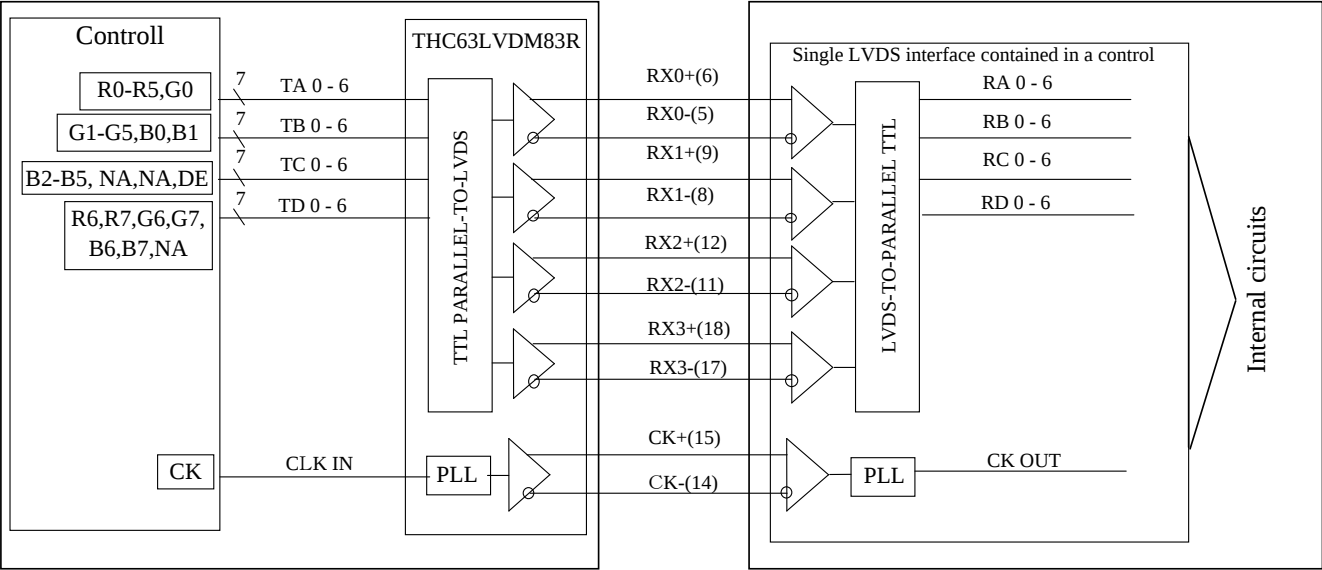
NA : Not Available

(Computer Side)

(TFT-LCD side)

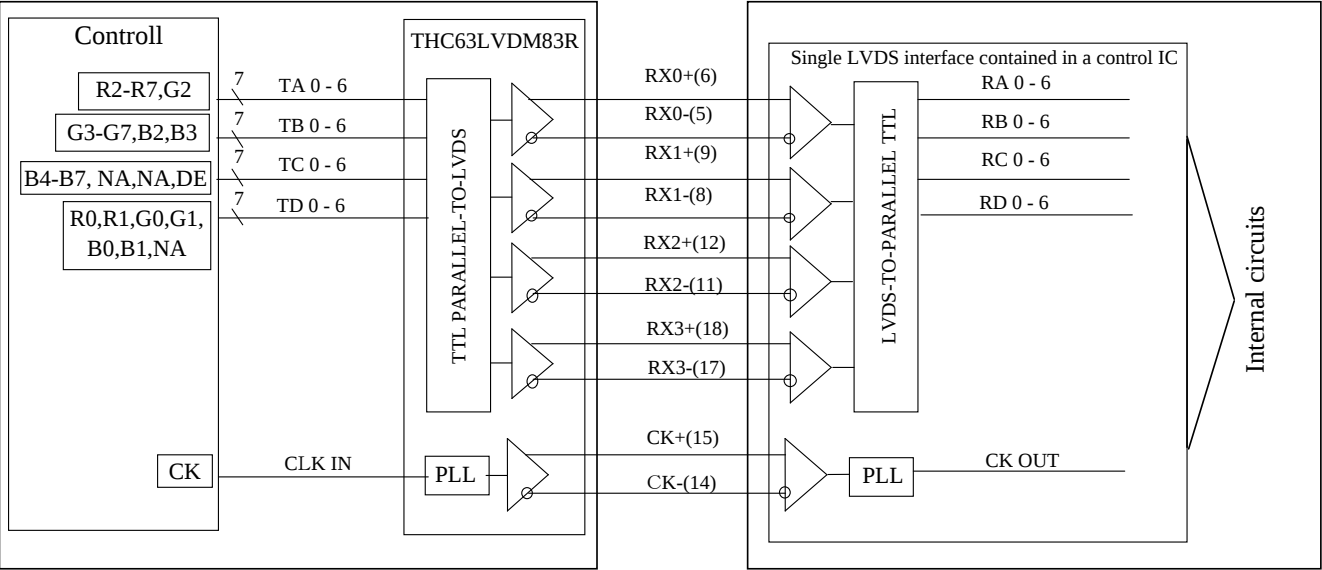
①8Bit Mode

LVDS_SET=L (20 pin=GND or OPEN)



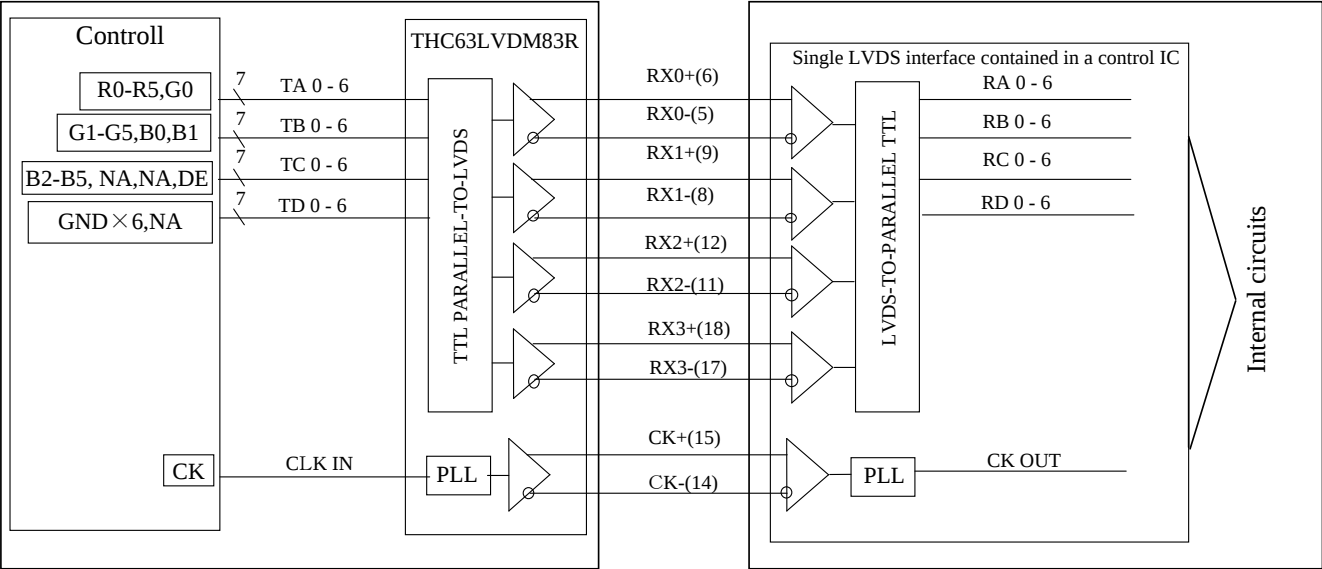
②8Bit Mode

LVDS_SET=H (20 pin=3.3[V])



③6Bit Mode

LVDS_SET=H (20 pin=3.3[V])

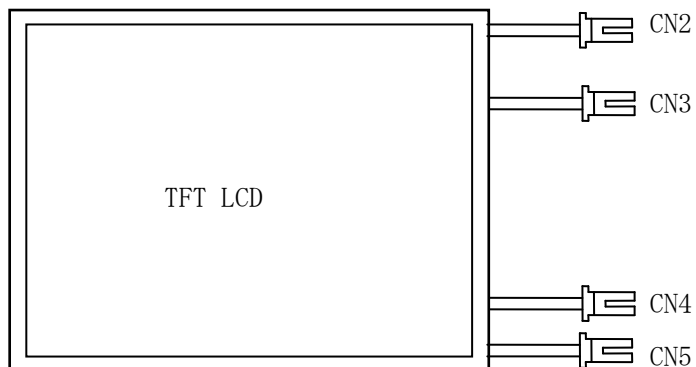


4-4. Backlight

CN 2, 3, 4, 5

The module-side connector : BHSR-02VS-1(N)(JST)

Pin no.	symbol	Function
1	V_H	Power supply for lamp (High voltage side)
2	GND	Ground



5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Supply voltage	V_{CC}	$T_a=25^{\circ}\text{C}$	$0 \sim +4.0$	V	
Storage temperature	T_{STG}	—	$-25 \sim +60$	$^{\circ}\text{C}$	【Note1】
Operating temperature	T_{OPA}	Panel surface	$0 \sim +60$	$^{\circ}\text{C}$	

【Note1】 Humidity : 95%RH Max. ($T_a \leq 40^{\circ}\text{C}$)Maximum wet-bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$)

No condensation.

6. Electrical Characteristics

6-1. TFT-LCD panel driving

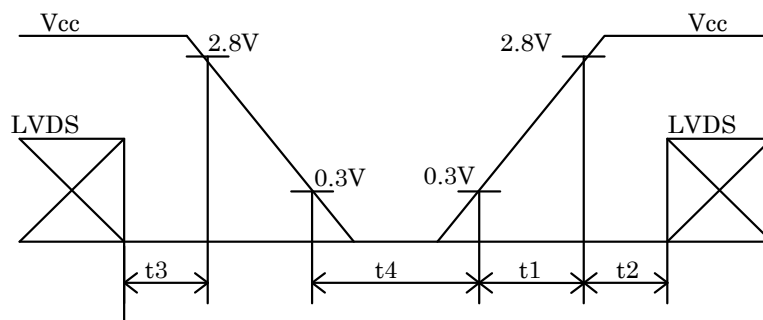
Ta=25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply	Supply voltage	V _{CC}	+3.0	+3.3	+3.6	V	【Note1】
	Current dissipation	I _{CC}	—	TBD	TBD	mA	【Note2】
Permissible input ripple voltage		V _{RF}	—	—	100	mVp-p	V _{CC} =+3.3V
Terminate Resister		R _T		100		Ω	
Input voltage (High)		V _{IH}			100	mA	
Input voltage (Low)		V _{IL}	-100			mA	

【Note1】 △3

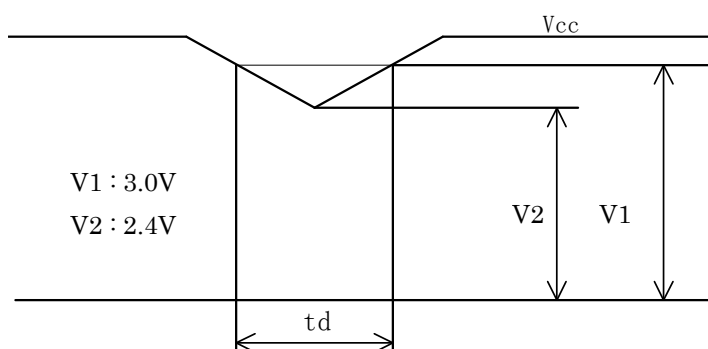
1) On-off sequences of V_{CC} and data

$$\begin{aligned}
 0 < t_1 &\leq 60\text{ms} \\
 0 < t_2 &\leq 50\text{ms} \\
 0 \leq t_3 &\leq 50\text{ms} \\
 t_4 &\geq 100\text{ms}
 \end{aligned}$$



2) Dip conditions for supply voltage

- 1) $V_2 \leq V_{CC} < V_1$
 $t_d \leq 10\text{ms}$
- 2) $V_{CC} < V_2$
V_{CC}-dip conditions should also follow the on-off conditions.



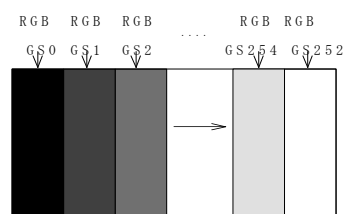
【Note2】 Typical current situation : 253-gray-bar pattern

V_{CC}=+3.3V, CK=65MHz

Gray scale : GS(n)

n=0~252

The explanation of each gray scale, GS(n), is described below section 8.



6-2. Backlight

The back light system is an edge-lighting type with 4 CCFTs (Cold Cathode Fluorescent Tube).

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

The value mentioned below is at the case of one CCFT.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp current range	I_L	3.5	6.5	7.5	mArms	【Note1】
Lamp voltage	V_L	—	(615)	(700)	Vrms	$T_a=25^{\circ}\text{C}$, $I_L=6.5\text{mArms}$
Lamp power consumption	P_L	—	(4.0)	(4.55)	W	【Note2】 , $I_L=6.5\text{mArms}$
Lamp frequency	F_L	(40)	(60)	(70)	KHz	【Note3】
Kick-off voltage	V_s	—	—	(1080)	Vrms	$T_a=25^{\circ}\text{C}$ 【Note4】
		—	—	(1480)	Vrms	$T_a=0^{\circ}\text{C}$ 【Note4】
Lamp life time	T_L	50,000	—	—	Hour	$I_L=6.5\text{mArms}$ 【Note5】

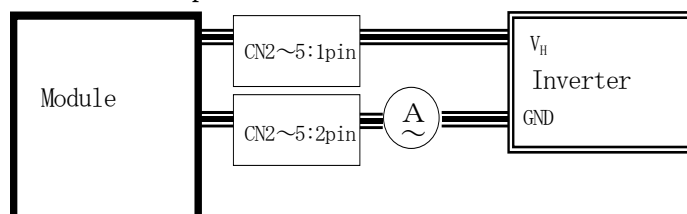
【Note1】 A lamp can be light in the range of lamp current shown above.

Maximum rating for current is measured by high frequency current measurement equipment connected to V_{LOW} at circuit showed below.

(Note : To keep enough kick-off voltage and necessary steady voltage for CCFT.)

Lamp frequency : 40~70kHz

Ambient temperature : 0~50°C



【Note2】 Referential data per one CCFT by calculation ($I_L \times V_L$).

The data does not include loss at inverter .

【Note3】 Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, adjust lamp frequency, and keep inverter as far as from module or use electronic shielding between inverter and module to avoid interference.

【Note4】 Kick-off voltage value is described as the index in the state of lamp only.

The kick-off voltage is estimated to be risen up as approx. +200V in the state of module only, and the further rise up can be seen according to the assembling status of user cabinet. Please set the kick-off voltage of inverter to avoid the lighting failures in the state of operation. Please design the inverter so that its open output voltage can be connected for more than 1 second to startup. Otherwise, the lamp may not be turned on. But, please set as 100ms when the ambient luminance around the lamp is more than 1lux.

【Note5】 Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of $T_a=25^{\circ}\text{C}$ and the lamp current value indicated to the Remark .

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

② Kick-off voltage at $T_a=0^{\circ}\text{C}$ exceeds maximum value, 1480Vrms .

【Note6】

The performance of the backlight, for example lifetime 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 occurs. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Use the lamp inverter power source incorporating such safeguard as overvoltage / overcurrent protective circuit or lamp voltage waveform detection circuit, which should have individual control of each lamp.

In case one circuit without such individual control is connected to more than two lamps, excessive current may flow into one lamp when the other one is not in operation.

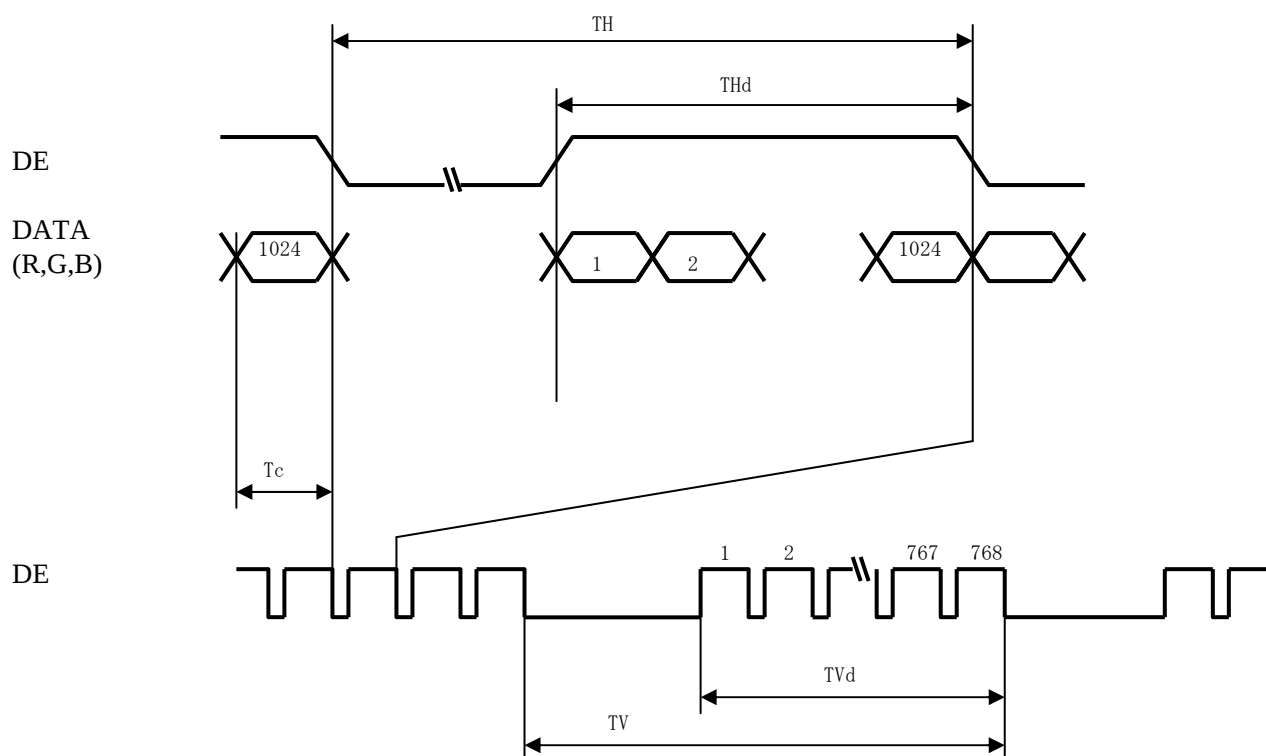
【Note7】 Under the environment of 10lx or less, miss-lighting delay may occur.

7. Timing characteristics of input signals

7-1. Timing characteristics

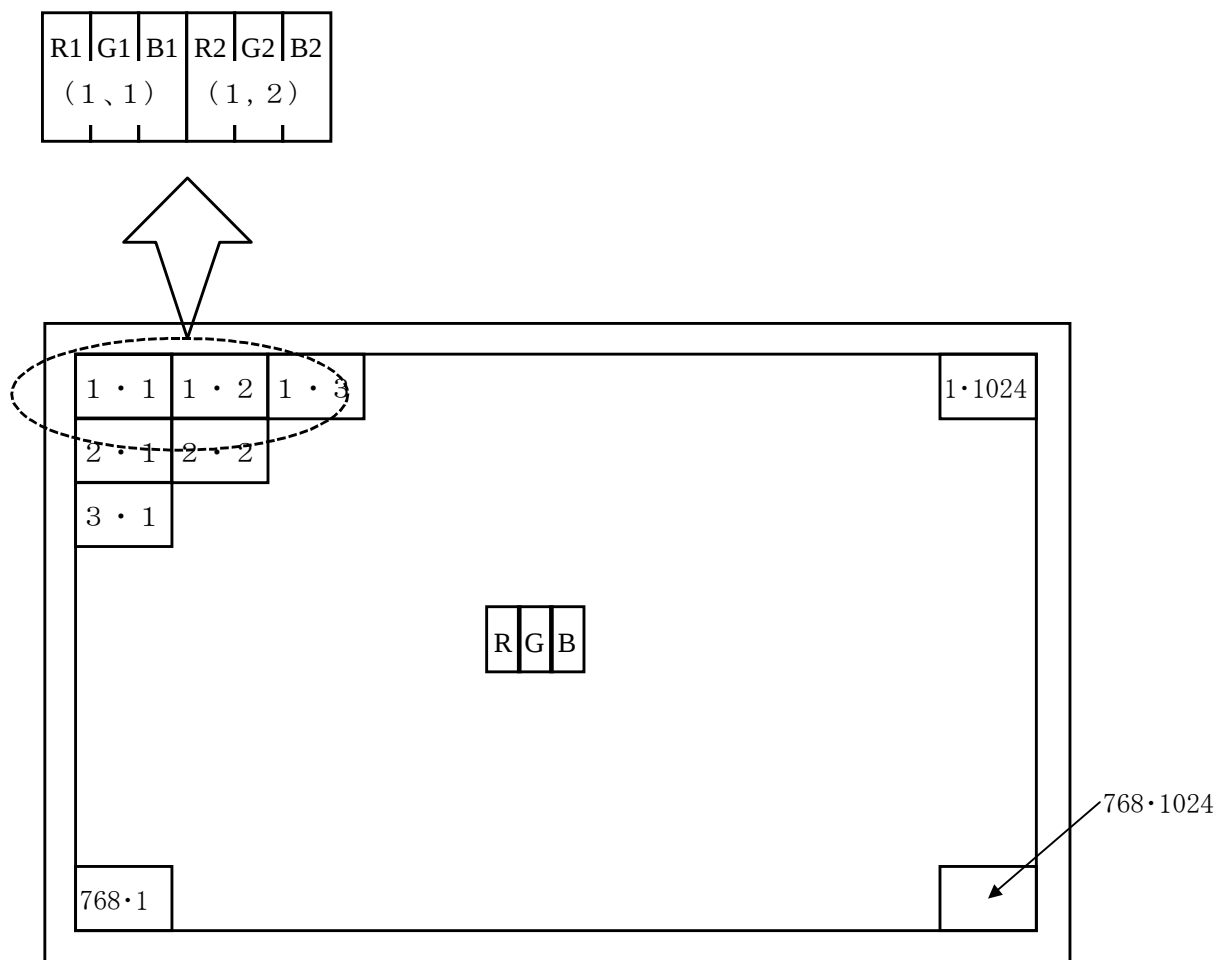
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Frequency	1/Tc	60	65	85	MHz	
Horizontal period	TH	1056	1344	1720	clock	
		16.0	20.7	23.4	μs	
Horizontal period (High)	THd	1024		1024	clock	
Vertical period	TV	773	806	1008	line	【Note】
		13.3	16.7	18.1	ms	
Vertical period (High)	TVd	768		768	line	

【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

Graphics and texts can be displayed on a $1024 \times \text{RGB} \times 768$ dots panel with 16M colors by supplying 24 bit data signal (8bit/color [253 gray scales] $\times 3$).



Display Position of Data (V, H)

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

8-1 8bit input

		Data signal																											
	Colors & Gray scale	Gray Scale	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	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	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	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	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	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	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	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	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	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	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	0		
	↑	↓	↓								↓								↓										
	↓	↓	↓								↓								↓										
	Brighter	GS250	0	1	0	1	1	1	1	1	0	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	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	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	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	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	0		
	↑	↓	↓								↓								↓										
	↓	↓	↓								↓								↓										
	Brighter	GS250	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	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	0		
	Green	GS252	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	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	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	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	0		
	↑	↓	↓								↓								↓										
	↓	↓	↓								↓								↓										
	Brighter	GS250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1		
	↓	GS251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	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	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	Data signal																		
		Gray Scale	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	0	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

$T_a=25^{\circ}\text{C}$, $V_{cc}=+3.3\text{V}$

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing angle range	Vertical	θ 11	$CR \geq 10$	70	85	—	Deg.	【Note1,4】	
		θ 12		70	85	—	Deg.		
	Horizontal	θ 21, θ 22		70	85	—	Deg.		
Contrast ratio		C R	$\theta = 0^{\circ}$	400	600	—		【Note2,4】	
Response Time		Td+Tr		—	25	55	ms	【Note3,4】	
Chromaticity of White		Wx		0.283	0.313	0.343	—	【Note4】	
		Wy		0.299	0.329	0.359	—		
Chromaticity of Red		Rx		TBD	TBD	TBD	—		
		Ry		TBD	TBD	TBD	—		
Chromaticity of Green		Gx		TBD	TBD	TBD	—		
		Gy		TBD	TBD	TBD	—		
Chromaticity of Blue		Bx		TBD	TBD	TBD	—		
		By		TBD	TBD	TBD	—		
Luminance of white		YL	280	350	—	cd/m ²	IL=6.5mA rms	FL= 60kHz 【Note4】	
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.

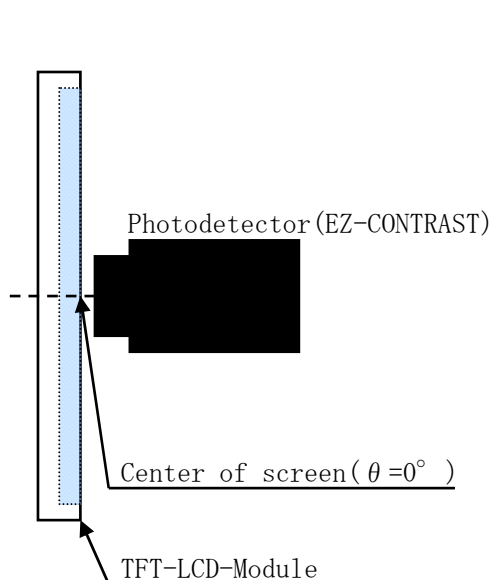


Fig2-1 Viewing angle measurement method

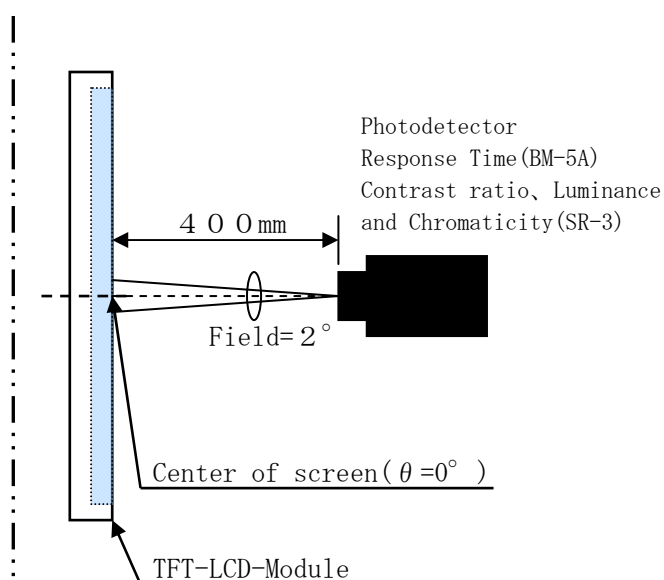
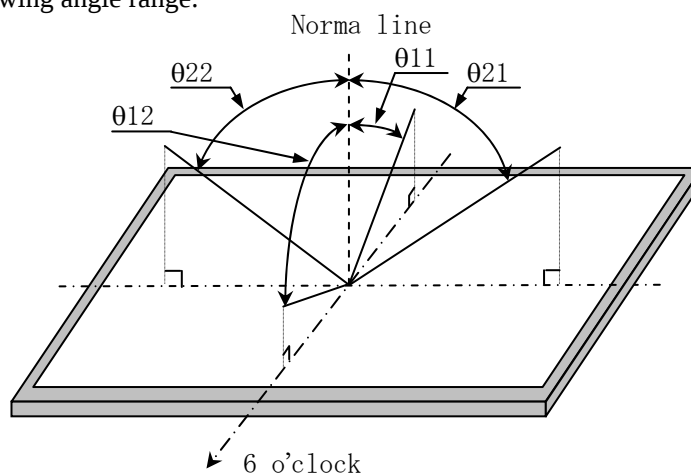


Fig2-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

Fig2 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



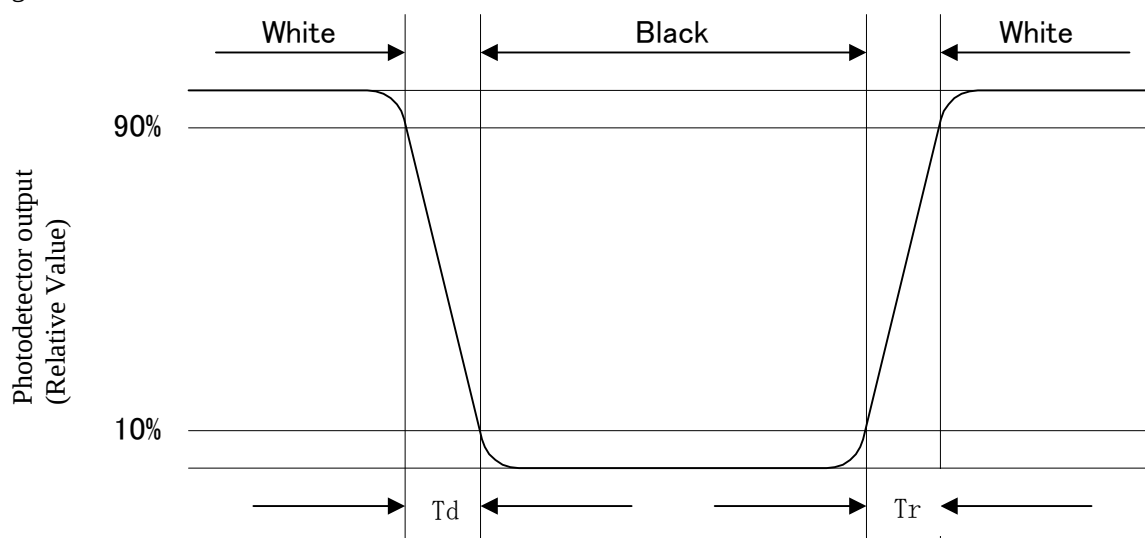
【Note2】 Definition of contrast ratio:

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".

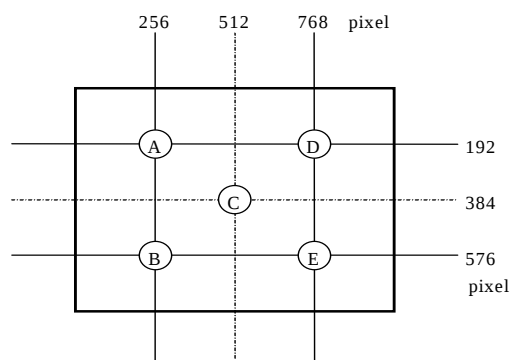


【Note4】 This shall be measured at center of the screen.

【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.
Blow away dust on the polarizer with antistatic N₂ blow. It is undesirable to wipe off because a polarizer is sensitive.
It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer. When unavoidable, wipe off carefully with a cloth for wiping lenses.
- d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- 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 take the human earth into consideration when handling.
- h) Make sure the four mounting holes of the module are grounded sufficiently. Take electro-magnetic interference (EMI) into consideration.
- i) The module has some printed circuit boards (PCBs) on the back side. Take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
- j) Observe all other precautionary requirements in handling components.
- k) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.
- l) 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.
- m) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
- n) 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.
- o) 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.
- p) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.
- q) 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 fail.
- r) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.

- s) 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.
- t) Never dismantle the module , because it will cause failure.
- u) 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.
- v) The lamp used for this product is very sensitive to the temperature.
Luminance decreases rapidly when it is used for a long time or repeatedly under the environment of the low temperature or the module is being cooled.
Please avoid the continuous or repeating use of it under such an environment.
It may decrease up to 50% of the initial luminance in about one month under the low temperature environment. Please consult our company when it is used under the environment like the above mentioned.

11. Packing form

T B D

12. Reliability test items

No.	Test item	Conditions
1	High temperature storage test	Ta = 60°C 240h
2	Low temperature storage test	Ta = -25°C 240h
3	High temperature & high humidity operation test	Ta = 40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Tp = 60°C (panel surface) 240h
5	Low temperature operation test	Ta = 0°C 240H
6	Vibration test (non- operating)	Frequency : 10~57Hz/Vibration width (one side) : 0.075mm : 57~500Hz/Gravity : 9.8m/s ² Wave form : sin wave Sweep time : 11minutes 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.

【Result Evaluation Criteria】

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

13. Others

1) Lot No. and indication Bar Code Label:

T B D

2) Packing Label

T B D

3) 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.

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

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

6) The chemical compound which causes the destruction of ozone layer is not being used.

7) Material information of LPG (Light Pipe Guide) are labeled on the back of the module.

MATERIAL INFORMATION
>PLASTIC LIGHT GUIDE:PMMA<

8) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury, Please follow local ordinances or regulations for disposal. (put on the back of the module.)

COLD CATHODE FLUORESCENT LAMP IN LCD PANEL
 CONTAINS A SMALL AMOUNT OF MERCURY, PLEASE FOLLOW
 LOCAL ORDINANCES OR REGULATIONS FOR DISPOSAL
 当該液晶ディスプレイパネルは蛍光管が組込まれていますので、地方自治体の条例、または、規制に従って廃棄して下さい。

9) When any question or issue occurs, it shall be solved by mutual discussion.

◎ Carton storage condition

Temperature	0°C to 40°C
Humidity	95%RH or less
Reference condition :	20°C to 35°C , 85%RH or less (summer) : 5°C to 15°C , 85%RH or less (winter) ・ the total storage time (40°C,95%RH) : 240H or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.
Notes	Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment
Storage period	1 year