SHARP

TECHNICAL   LITERATURE

FOR

TFT - LCD   module

MODEL   No.

MOBILE LIQUID CRYSTAL DISPLAY GROUP

SHARP   CORPORATION

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1.　Application
This specification applies to color TFT-LCD module, LQ 8 S3 G .

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 powersupply circuit and a backlight unit. Graphics and texts can be displayed on a 800× 3× 600 dots panel with 262,144 colors by supplying 18 bit data signal (6bit/color), two timing signals, +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. 12 o'clock direction is also available by the function to flip the screen horizontally or vertically)
This module is the type of wide viewing angle and high brightness(3 0cd/㎡).
Backlight-driving DC/AC inverter is not built in this module.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size　Diagonal	21.3 (8.4" type)	cm
Active Display area	170.4(H)× 127.8(V)	mm
Pixel format	800(H)× 600(V)	pixel
	(1 pixel　R　G　B dots)	
Pixel pitch	0.213(H)× 0.213(V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Dimension　*1	199.5(W)× 149.5(H)× 11.6 (D)	mm
Mass	TBD (MAX.)	g

*1. Protrusions not included　　Refer to Fig.1 TFT-LCD Module Structure Diagram for details.

4. Input Terminals

4-1. TFT-LCD Panel driving section

CN1   Used connector:DF19G-30P-1H (HROSE ELECTRIC CO.,LTD)

Table 4-1

Pin No.	Symbol	Function	Remarks
1	GND		
2	Vcc	3.3V power supply	
3	Vcc	3.3V power supply	
4	GND		
5	ENAB	ompound synchronization signal	
6	B5	BLUE data signal(MSB)	
7	B4	BLUE data signal	
8	B3	BLUE data signal	
9	B2	BLUE data signal	
10	B1	BLUE data signal	
11	B0	BLUE data signal(LSB)	
12	GND		
13	G	GREEN data signal(MSB)	
14	G	GREEN data signal	
15	G	GREEN data signal	
16	G	GREEN data signal	
17	G	GREEN data signal	
18	G	GREEN data signal(LSB)	
19	GND		
20	R	RED data signal(MSB)	
21	R4	RED data signal	
22	R3	RED data signal	
23	R2	RED data signal	
24	R1	RED data signal	
25	R0	RED data signal(LSB)	
26	GND		
27	NC		
28	NC		
29	CK	Clock signal for sampling each data signal	
30	GND		

4-2. Backlight fluorescent tube driving section

Used connector : BHR-04VS-1(JST)

CNA,CNB   Corresponding connector :SM0 (.0)B-BHS(JST)

Pin no.	Symbol	Function
1	V_{HIGH}	Power supply for lamp (High voltage side)
2	V_{HIGH}	Power supply for lamp (High voltage side)
3	NC	This is electrically opened.
	V_{LOW}	Power supply for lamp (Low voltage side)

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
Input voltage	V_I	Ta=25	0.3 Vcc 0.3		V	Note1
+3.3V supply voltage	Vcc	Ta=25	0	5.5	V	
Storage temperature	Tstg		25	70		Note2,3
Operating temperature (Panel surface)	Topp		10	65		Note2,3,4,5

Note1 CK, R0 R5, G0 G5, B0 B5,ENAB

Note2 No parameter is allowed to exceed the range.

Note3 Humidity 95%RH Max. at Ta 40 .

　　　　Maximum wet-bulb temperature at 39   or less at Ta>40 . No condensation.

Note4 The Panel surface, When backlight is on.(Reference)

Note5 Only operation is guarantied at operating temperature. Contrast, response time, another

　　　　display quality are evaluated at +25 .

6. Electrical characteristics

6-1. TFT-LCD Panel driving   Ta 25

Parameter		Symbol	Min	Typ	Max	Unit	Remarks
+3.3V	Supply voltage	Vcc	+3.0	+3.3	+3.6	V	Note1
	Current dissipation	Icc		TBD	TBD	mA	Note2
Permissive input ripple voltage		V_{RF}			100	mVp-p	Vcc=+3.3V
Input voltage (Low)		V_{IL}	0		0.3Vcc	V	
Input voltage (High)		V_{IH}	0.7Vcc		Vcc	V	Note3
Input current (low)		I_{OL1}			1.0	μA	V_I=0V Note4
		I_{OL2}			3.0	μA	V_I=0V Note5
Input current (High)		I_{OH1}			1.0	μA	V_I=Vcc Note6
		I_{OH2}	10		100	μA	V_I=Vcc Note7

Note1
   Vcc-turn-on conditions
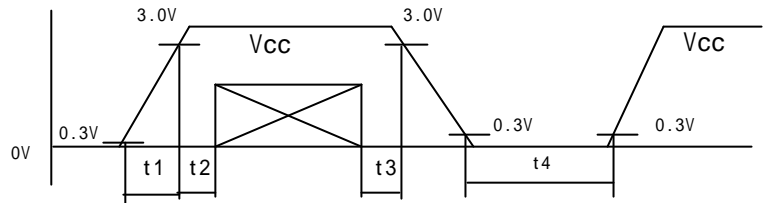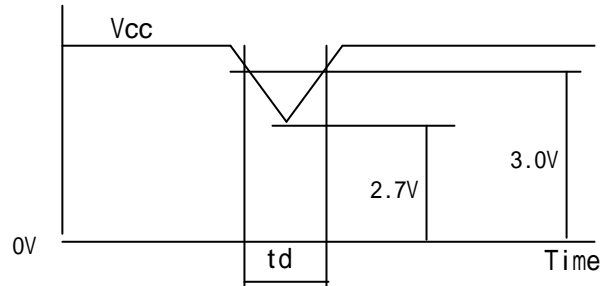
   Vcc-dip conditions
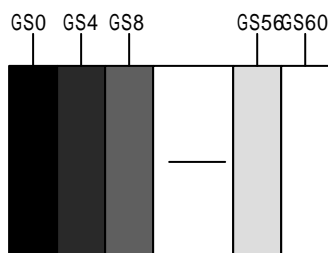

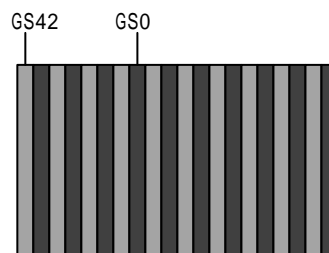   Vcc-dip conditions should also follow the Vcc-turn-on conditions

Note2 Vcc=+3.3V

   Typical current situation   : 16-gray-bar pattern.   Timing : Typical signal
   Maximum current situation : Vertical stripe pattern by GS0 and GS42 signal on every other

   Typical current situation   Maximum current situation

Note3 CK,R0 R5, G0 G5,B0 B5,ENAB

Note4 CK,R0 R5,G0 G5,B0 B5   Note5 ENAB

Note6 CK,R0 R5,G0 G5,B0 B5   Note7 ENAB

6-2. Backlight Driving Section

The backlight system is an edge-lighting type with double CCFT (Cold CathodeFluorescent Tube).

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

Ta=25

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Lamp current	IL	3.0*2	-	6.0*2	mArms	Note1
Lamp power consumption	PL		TBD		W	Note2
Lamp frequency	FL	45	-	100	KHz	
Kick-off voltage	Vs			TBD	Vrms	Ta=25
				TBD		Ta= 10 Note3
Lamp life time	LL	10,000	TBD		hour	Note4

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

Note2 At the condition of Y_L = 350 cd/m².

4PIN is V_{LOW}
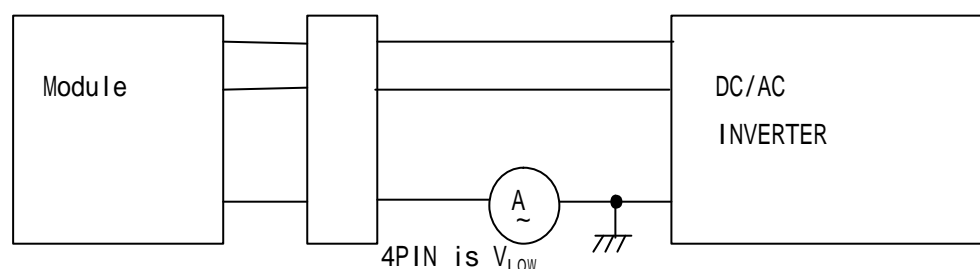
Note3 The open output voltage of the inverter shall be maintained for more than 1sec; otherwise the lamp may not be turned on.

Note4   a) Lamp life time is defined that it applied either   or   under this condition.

(Continuous turning on at Ta=25   , IL=6mArms*2)

Bight ness becomes 50% of the original value under standard condition.

Kick-off voltage at Ta= 10   exceeds maximum value, TBD Vrms.

) In case of operating under lower temp. environment, the lamp exhaustion is accelerated and the brightness becomes lower.

(Continuous operating 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 lampexchange is recommended.

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.
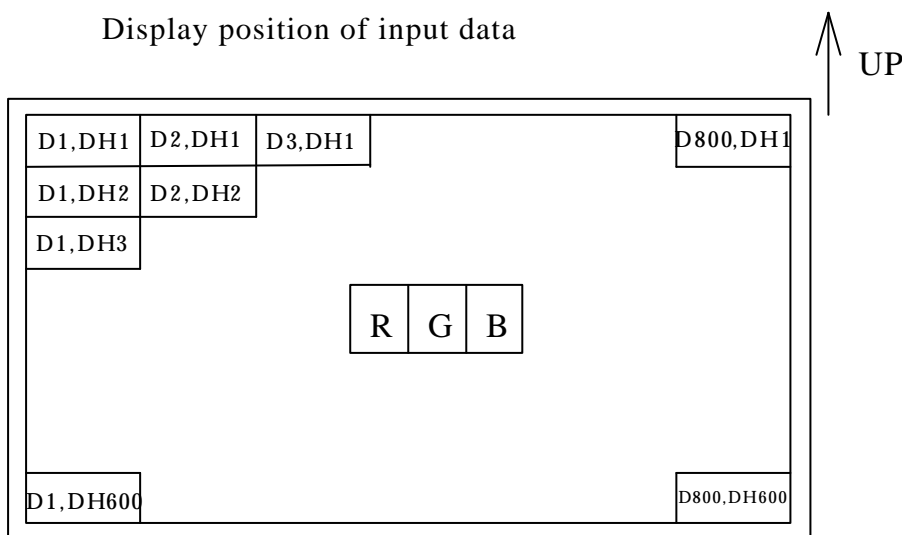
7. Timing Characteristics of Input Signals

Timing diagrams of input signal are shown in Fig. 2.

7-1. Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc		40	42	MHz
			23.8	25	-	ns
	High time	Tch	TBD			ns
	Low time	Tcl	TBD			ns
		TCH TCL	40 60	50 50	60 40	
Data	Setup time	Tds	TBD			ns
	Hold time	Tdh	TBD			ns
ENAB	Setup time		TBD			ns
	One line scanning time	TH	944*	1056*Tc	1064*Tc	
			26.3	26.4	-	μs
	Horizontal Pulse width	THp	2	800	TH-10	clock
	Frame period	TV	60 *TH	628*TH	677*TH	-
			-	16.58	17.85	
Horizontal display period		THd	800	800	800	clock
display period		THc	600	600	600	Line

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

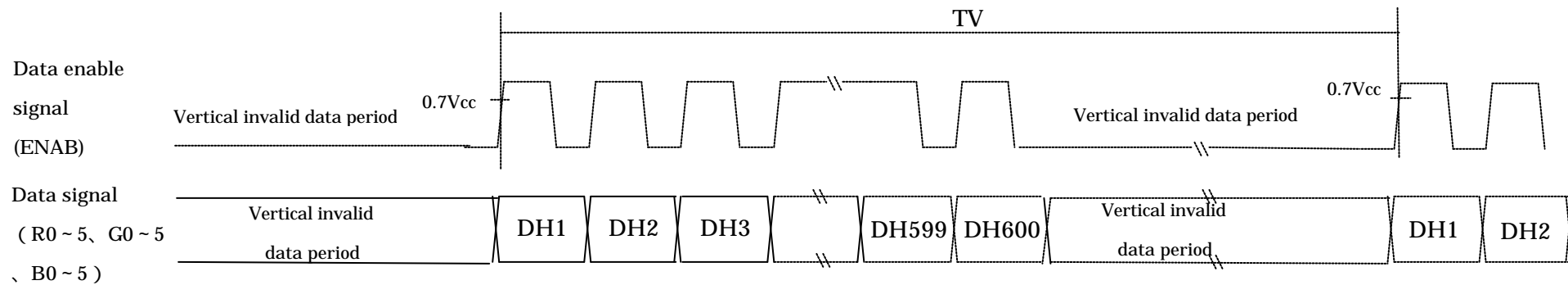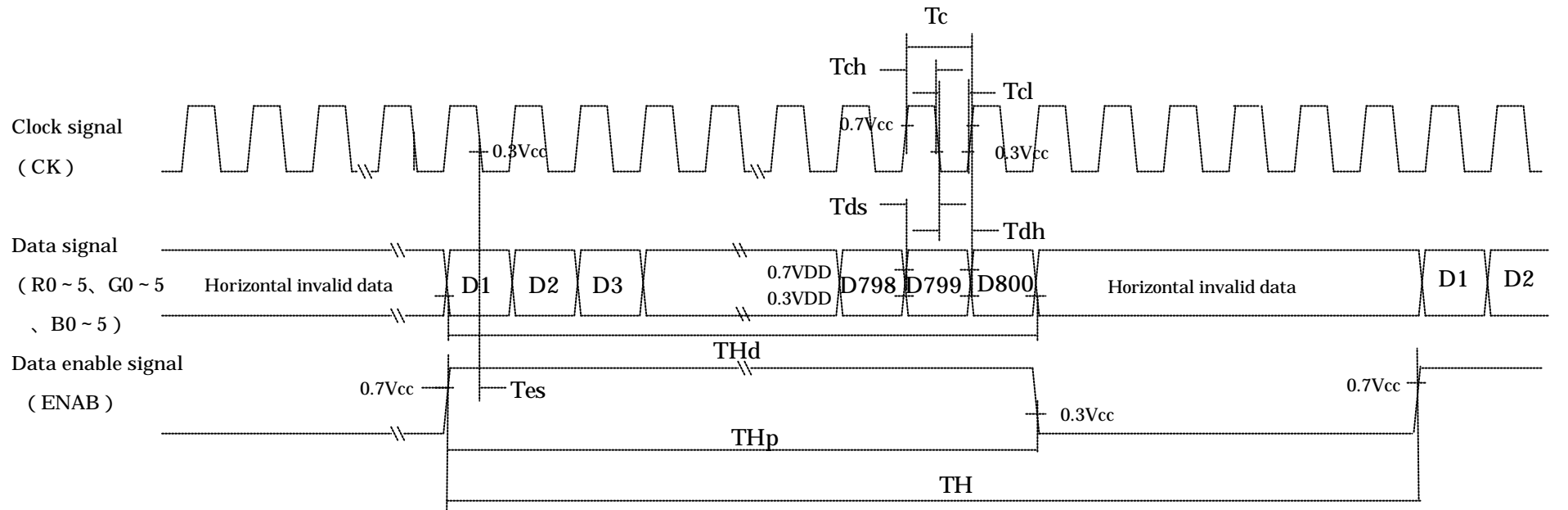### 7-2. Input Data Signals and Display Position on the screen

Display position of input data

UP

D1,DH1	D2,DH1	D3,DH1		D800,DH1
D1,DH2	D2,DH2			
D1,DH3				

R | G | B

D1,DH600 | | | | D800,DH600

fig1. Input signal timing

LCY03029-8

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

Colors & Gray scale		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	1	1	1	1
	⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

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

9. Optical Specification

Ta=25 , Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21	(CR≧10)	50	55		Deg.	Note1,4
		θ22		50	55		Deg.	
	Vertical	θ11		25	30		Deg.	
		θ12		60	65		Deg.	
Contrast ratio		CR	θ=0°	60				Note2,4
			Best viewing					
Response time	Rise	τr	θ=0°		20		ms	Note3,4
	Decay	τd			40		ms	
Chromaticity of white		X		0.263	0.313	0.363		Note4
		Y		0.279	0.329	0.379		
Luminance		YL		260	350		cd/m²	
Direction of panel viewing angle					6		o'clock	Note5

Measuremed 30 minutes after turning on.　　　　　(typical condition:IL=6mArms)

The optical specification must measured in a dark room or equivalent state with the method shown in Fig.3 below.

Photodetector (BM-5A: TOPCON)

TFT LCD module

LCD panel

Center of the screen
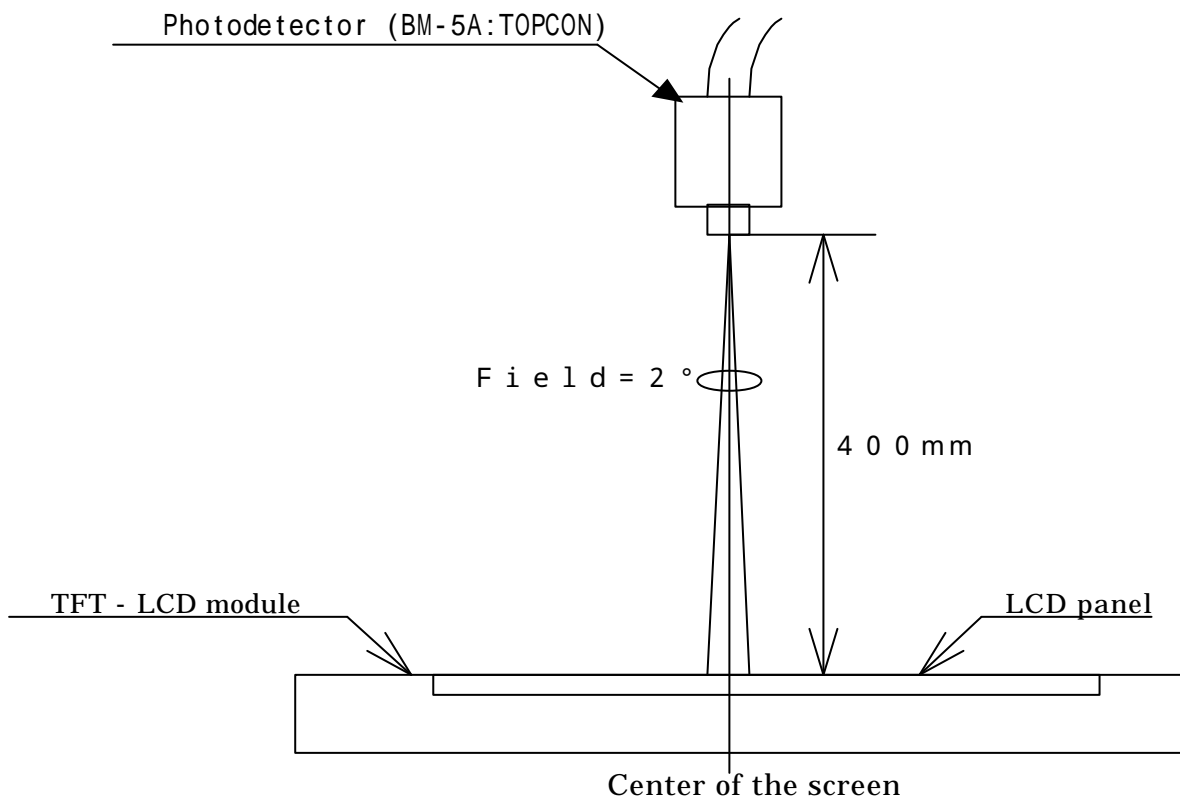
Fig.3 Optical characteristics measurement method

Note1　Definitions of viewing angle range:
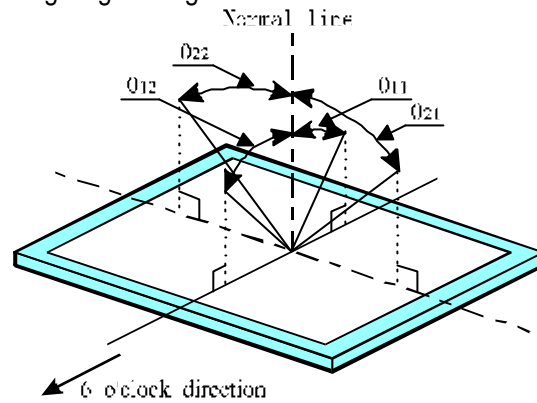
Note2　Definition of contrast ratio:

　　　The contrast ratio is defined as the following.

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

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" .
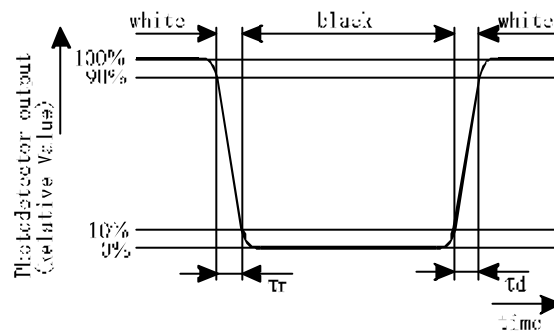
Note4　This shall be measured at center of the screen.

Note5　In the direction of 6 o'clock, Gray scale reverse occurs.

10. Display Quality

The criteria for the display quality of the color LCD module depends on Delivery Inspection Standard.

11 Handling Precautions

a) Be sure to turn off the power and signals for module before pluging/upplubing cable to/from the connector.

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 to avoid rubbing with something hard or sharp.

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 and refined wires and components, it may break, crack or internal wire breaking 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.

h) Observe all other precautionary requirements in handling components.

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

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 interference fringe etc. Which degrades display quality.

k) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.

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

m) Be sure not to apply tensile stress to the lamp lead cable.

12. Packing Form

a) Piling number of cartons: MAX.

b) Package quantity in one carton: pcs

c) Carton size :   (W)×   (D)×   (H)mm

d) Total mass of 1 carton filled with full modules: kg

13 Reliability Test Items

No.	Test item	Conditions
1	High temperature storage test	Ta= 75 240h
2	Low temperature storage test	Ta= 25 240h
3	High temperature & high humidity operation test	Ta= 40 ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta= 65 240h
5	Low temperature operation test	Ta= 10 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.

Result Evaluation Criteria

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

14 Others

1) Lot No. Label:

```
LQ084S3DG01      *********
```
Model No.   Serial No.
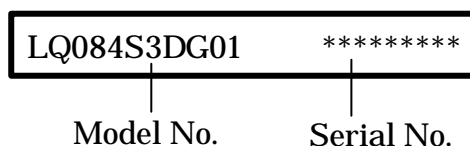
2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

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.

5) If any problem occurs in relation to the description of this specification , it shall be resolved through discussion with spirit of cooperation.

6) Do not use LCD module in the atmosphere of corrosive gases, such as sulfide gas or chlorine gases. Polarizer may be deteriorated or cause chemical reaction that can lead to short circuits at the terminal points. Do not use the material, which compounds contain sulfide or chlorine articles in the vicinity of LCD module. At high temperature, these compounds produce corrosive gases.

Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays.