RAYGEN

Approval Sheet
for
TFT-LCD module

MODEL No. S43CDW01

Issued By RAYGEN		

Approved by Customer		

RECORDS OF REVISION

MODEL No : S43CDW01

SPEC No.	Date	No.	Page	SUMMARY	NOTE
RGL-A-001	10.Aug.2006	–	–	–	1 st Issue

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Contents

1. Applicable Scope

This approval sheet is applicable to TFT-LCD Module “S43CDW01” only

2. General Description

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 IC s, Input FPC and a back light unit. Graphics and texts can be displayed on a 480 X 3 X 272 dots panel with about 16million colors by supplying 24bit data signals (8bit X RGB), Four timing signals, logic (typ. +2.5V), analog (typ. +5V) supply voltages for TFT-LCD panel driving and supply voltages for back light.

3. Mechanical (Physical) Specifications

Item	Specification	Unit
Screen size	10.9 (4.3” type) diagonal	c m
Active area	95.04(H) X 53.856(V)	m m
Pixel format	480 X 272	Pixel
	1Pixel = R+G+B dots	
Pixel pitch	0.198(H) X 0.198(V)	m m
Pixel configuration	R,G,B vertical stripes	
Display mode	Normally black	
Unit outline dimensions	105.5(W) X 67.2(H) X 3.95(D)	m m
Mass	50	g
Polarizer Surface treatment	Clear hard coat	

※ The above-mentioned table indicates module sizes without some projections and FPC.

4. Input Terminal Names and Functions

4-1. TFT LCD Panel Driving (Reference Connector :

Hirose Electric CO., LTD. Product No.: FH12A-40S-0.5SH(55) Top contact type)

※ Bottom contact type connectors are also prepared. Ex: FH12-40S-0.5H(55)

※ The FPCs of this LCD module are gold plated, so the connector contacts should be also gold plated.

Terminal No.	Terminal name	Function	Remarks
1	GND	GND(0V)	
2	GND	GND(0V)	
3	VCC	+2.5V power source	
4	VCC	+2.5V power source	
5	R0	RED Data Signal (LSB)	
6~11	R1~R6	RED Data Signal	
12	R7	RED Data Signal (MSB)	
13	G0	GREEN Data Signal (LSB)	
14~19	G1~G6	GREEN Data Signal	
20	G7	GREEN Data Signal (MSB)	
21	B0	BLUE Data Signal (LSB)	
22~27	B1~B6	BLUE Data Signal	
28	B7	BLUE Data Signal (MSB)	
29	GND	GND(0V)	
30	CK	Clock signal to sample each data	
31	DISP	Display ON/OFF Signal	
32	Hsync	Horizontal synchronizing signal	
33	Vsync	Vertical synchronizing signal	
34	NC	NC	Note1
35	AVDD	+5V Analog power source	
36	AVDD	+5v Analog power source	
37	NC	NC	Note1
38	TEST1	TEST1	Note2
39	TEST2	TEST2	Note3
40	TEST3	TEST3	Note3

Note 1) They have been open within FPC.
Note 2) Please be sure to set 38 pins (TEST1) to open.
Note 3) Please be sure to connect 39 pin (TEST2), 40 pin (TEST3) with GND

4-2. Backlight

0.5mmP 4Pin FPC

※ Top contact type connectors are prepared

※ The FPCs of this LCD module are gold plated, so the connector contacts should be also gold plated.

Terminal No.	Signal	Function
1	V_{LED-}	LED Power source Input terminal (Cathode side)
2	NC	No Connection
3	NC	No Connection
4	V_{LED+}	LED Power source Input terminal (Anode side)

5. Absolute Maximum Ratings

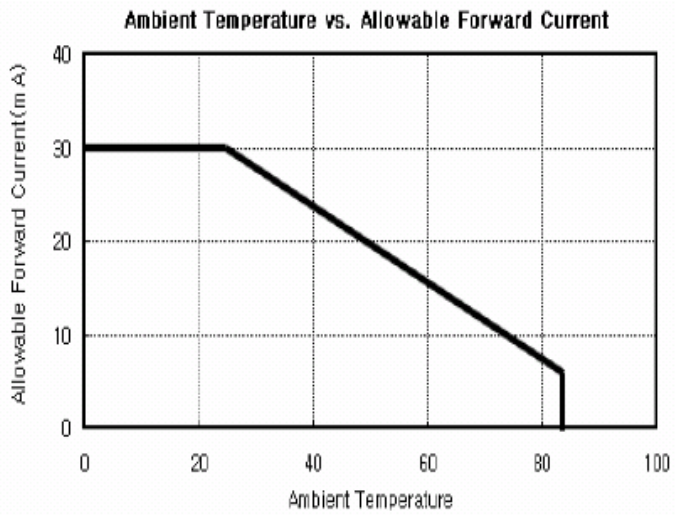
Item	Symbol	Conditions	Rated value	Unit	Remarks
Input voltage	V_I	Ta=25℃	-0.3 ~ VCC+0.3	V	[Note1]
2.5V Power supply voltage	VCC	Ta=25℃	0 ~ +4.5	V	
5V Power supply voltage	AVDD	Ta=25℃	0 ~ +6.0	V	
Temperature for storage	Tstg	-	-25 ~ +60	℃	[Note2]
Temperature for operation	Topa	-	-10 ~ +50	℃	[Note3]
LED Input electric current	ILED	Ta=25℃	30	mA	[Note4]
LED electricity consumption	PLED	Ta=25℃	110	mW	[Note4]

[Note1] CK, R0~R7, G0~G7, B0~B7, Hsync, Vsync, DISP

[Note2] Humidity : 80%RHMax. (Ta≤40℃)
Maximum bulb temperature under 39℃ (Ta>40℃) See to it that no dew will be condensed.

[Note3] Panel surface temperature prescribes.
(Reliability is examined at ambient temperature of 50℃.)

[Note4] Power consumption of one LED (Ta=25℃) (use LED LMSTWH502 7pieces)
Ambient temperature and the maximum input are fulfilling the following operating conditions.



6. Electrical Characteristics

6-1. TFT LCD Panel Driving

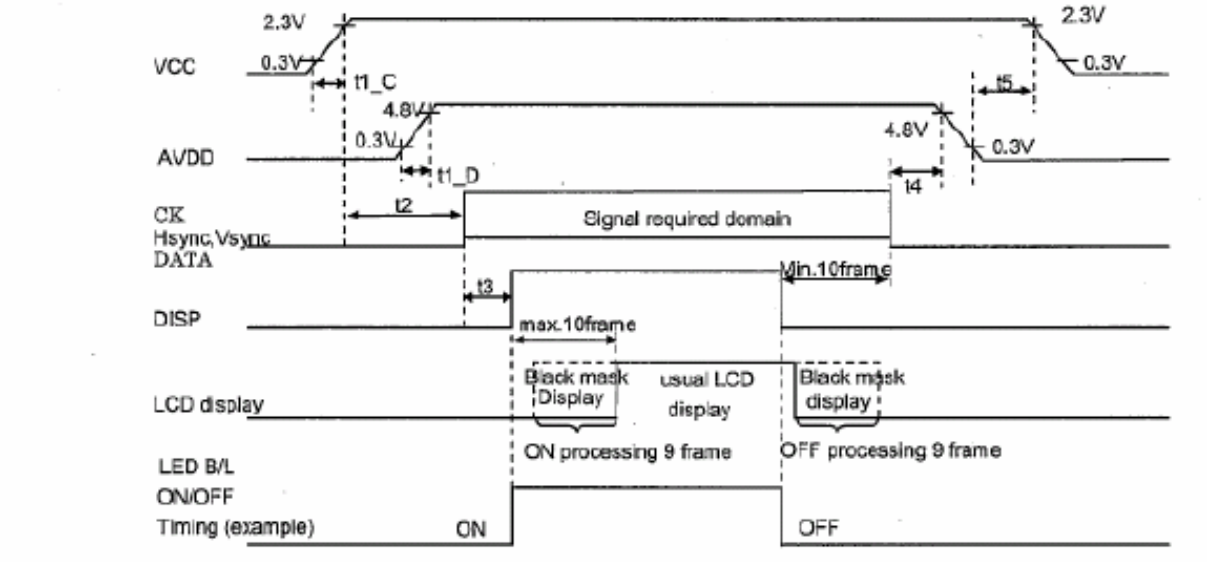
Ta=25 ℃

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
+2.5V power supply	DC voltage	VCC	+2.3	+2.5	+3.3	V	[Note1]
	DC Current	Icc		1.2	3	mA	[Note2]
+5V power supply	DC voltage	AVDD	+4.8	+5.0	+5.2	V	[Note1]
	DC Current	IAVDD		10	18	mA	[Note2]
Permissive Input ripple voltage		VRFVCC			100	mVp-p	Vcc=+2.5V
		VRFVCC			100	mVp-p	Vcc=+2.5V
Input voltage (Low)		VIL			0.2Vcc	V	[Note3]
Input voltage (High)		VIH	0.8Vcc			V	
Input current (Low)		IOL			4.0	μA	VI=0V [Note1]
Input current (High)		IOH			4.0	μA	VI=2.5V [Note1]

※ The rush current will flows when power supply is turned on, so please design the power supply circuit referring to [Note4].
(The rush current changes according to the condition of the supply voltage value, rising time and so on.)

【Note 1】

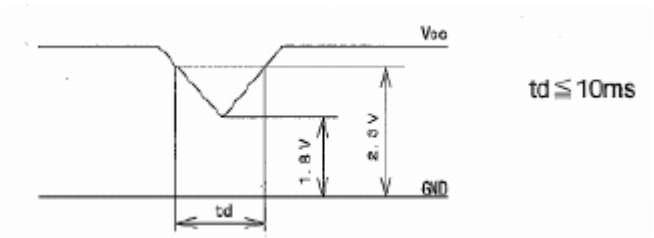
Sequences of supply voltage and signals



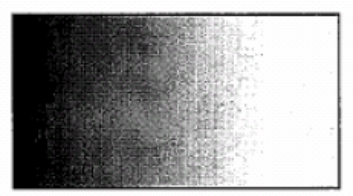
◎ Please do not supply AVDD before VCC
◎ It discharges and boost up voltage for TFT module on the basis of a DISP-signal
It drives Max-10 flames (about 0.2seconds) from change of DISP-signals by reasons that It takes time for 9 flames while each processing operation.
Therefore, the display start is delayed for 10 flames and Ten or more frames needs to be voltage maintained at the time of a display end.
◎ It is not problem to set up DISP=L, ANDD=GND when VCC voltage is supplied
◎ Please don't set various signals to Hi-Z when VCC-voltage is supplied
in reason that those signals are CMOS input.
◎ Don't change DISP signal into the state of H level When AVDD voltage is in the state of GND.
◎ The ON/OFF timing of LED Back Light is an example.

	MIN	TYP	MAX	unit
t1_C	0	-	10	ms
t1_D	0.5	-	10	ms
t2	50	-	-	ms
t3	0	-	-	ms
t4	0	-	-	ms
t5	0	-	-	ms

Dip Conditions for supply voltage



[Note2]
Typical current situation:256-gray-bar pattern VCC=2.5V AVDD=5.0V



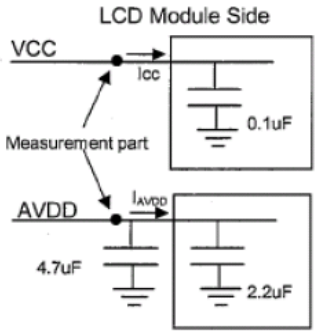
[Note3] CK, R0~R7, G0~G7, B0~B7, Hsync, Vsync, DISP

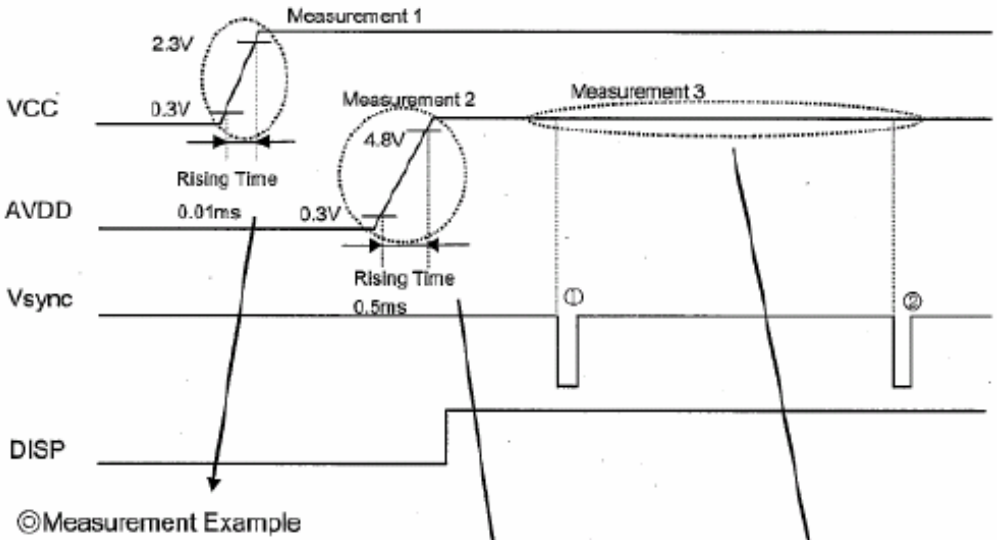
[Note4]

An example of rush current measurement

◎ Measurement conditions

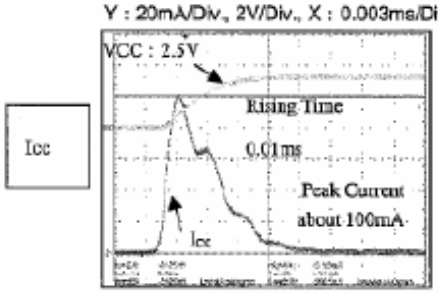
. Power supply voltage VCC : 2.5V AVDD : 5.0V
. Disp signal : OFF ⇒ ON
. Other input signals : GND
. Measurement system : refer to right Fig.
. Rush current measurement timing : refer to following Fig.





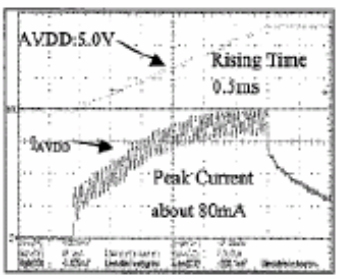
◎Measurement Example

Measurement 1
Y : 20mA/Div., 2V/Div., X : 0.003ms/Div.

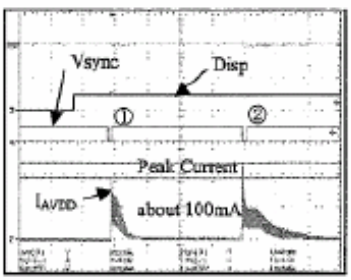


Icc

Measurement 2
Y : 20mA/Div., 2V/Div., X : 0.08ms/Div.



Measurement 3
Y : 50mA/Div., 5V/Div., X : 4ms/Div.



IAVDD

These rush current won't flow stationary,

these will flow at the timing shown in Measurement 3.

6-2. Back light driving

The back light system has seven LEDs

[LMSTWH502]

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Rated Voltage	VBL	-	-	22.4	V	
Rated Current	IL	-	20	28	mA	Ta=25℃

7. Timing characteristics of input signals

An input signal timing waveform is shown in Fig. 2.

7-1 Timing characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	7.83	9.00	9.26	MHZ	
	Duty ratio	Th/T	40	50	60	%	
Data	Set up time	Tds	25	-	-	ns	
	Hold time	Tdh	25	-	-	ns	
Horizontal Synchronizing	Period	TH	-	525	-	Clock	
	Pulse width	THp	-	41	-	Clock	
	Horizontal Period	THd	-	480	-	Clock	
	Back porch	THb	-	2	-	Clock	
	Front porch	THf	-	2	-	Clock	
Vertical Synchronizing	Period	TV	-	286	-	Line	
	Pulse width	TVp	-	10	-	Line	
	Vertical Period	TVd	-	272	-	Clock	
	Back porch	TVb	-	2	-	Line	
	Front porch	TVf	-	2	-	Line	

[Note] . In case of using the slow frequency, the deterioration of display, flicker etc may occur.
. The timing characteristics are basically fixed as above.

7-2 Timing details

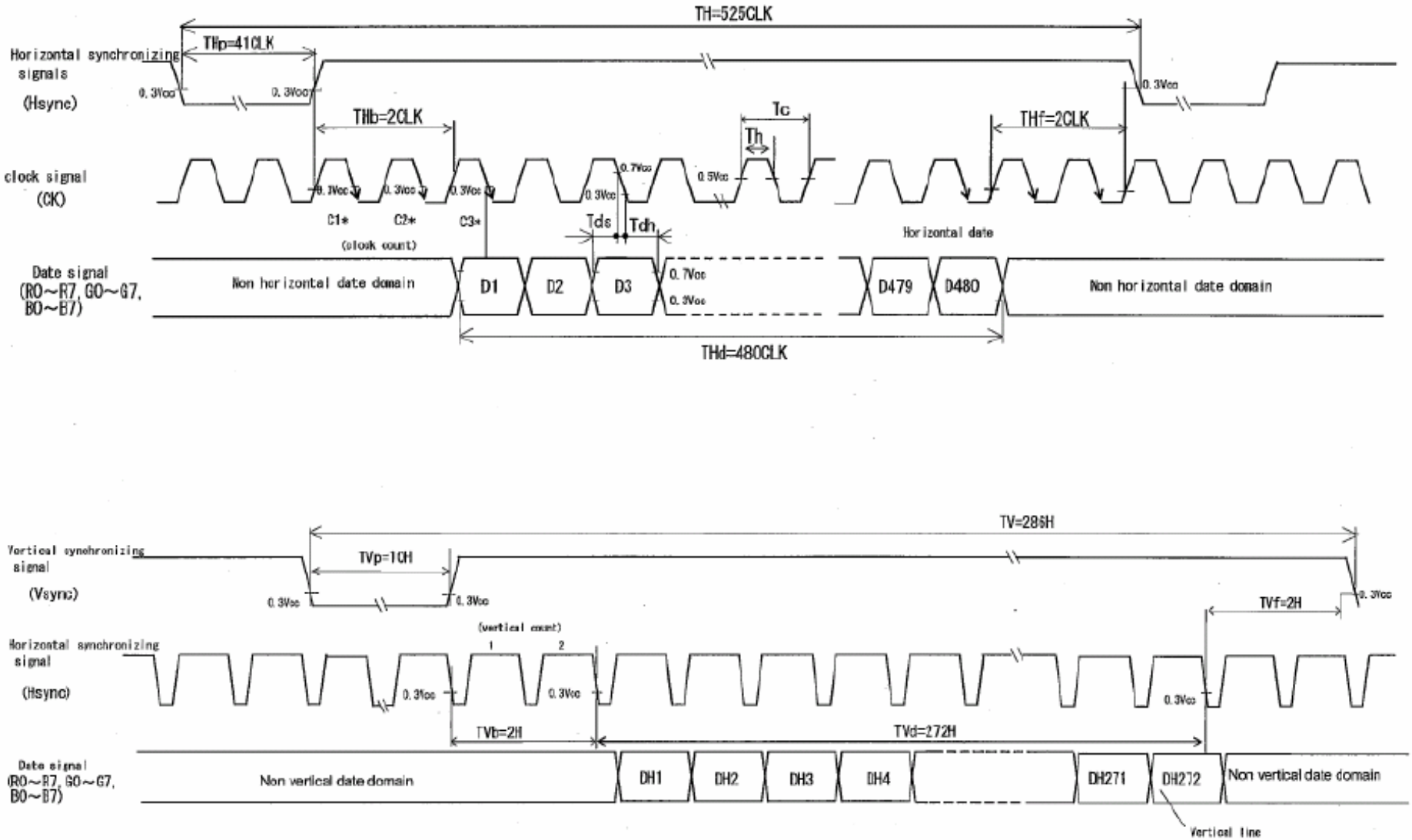
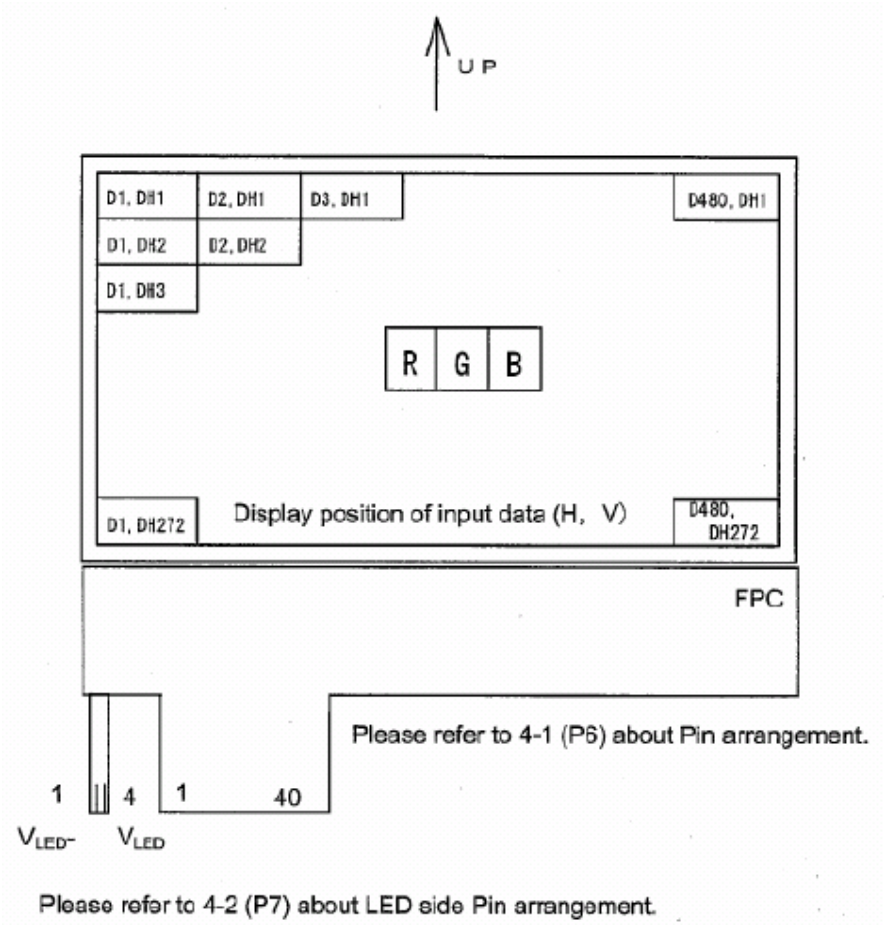


Fig 2 Input signal timing

7-3. Input Data Signals and Display Position on the screen



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

	Colors & Gray Scale	Gray Scale	Date signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			LSB							MSB	LSB							MSB	LSB							MSB
Basic Color	Black	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓					↓								↓								↓			
	⇩	↓					↓								↓								↓			
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage 1 : High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of 24 bit data signals, the 16-million-color can be achieved on the screen.

9. Optical Characteristics

Module characteristics

Ta=25℃, VCC=+2.5V, AVDD=5.0V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizonal	Θ21, Θ22	CR>10	-	80	-	Deg.	[Note1,4]
	Vertical	Θ11		-	80	-	Deg.	
		Θ12		-	80	-	Deg.	
Contrast ratio		CR	Θ=0°	100	400	-		[Note2,4]
Response Time	Rise	Tr	Θ=0°	-	30	45	ms	[Note3,4]
	Decay	Td		-	30	45	ms	
Chromaticity of White		x		0.246	0.296	0.346		[Note4]
		y		0.293	0.343	0.393		
Luminance of white		XL1	ILED=20mA ILED=28mA	-	280 370	-	cd/㎡	[Note4] [Note4]

※ The optical characteristics measurements are operated under a stable luminescence and a dark condition. (refer to Fig.3)

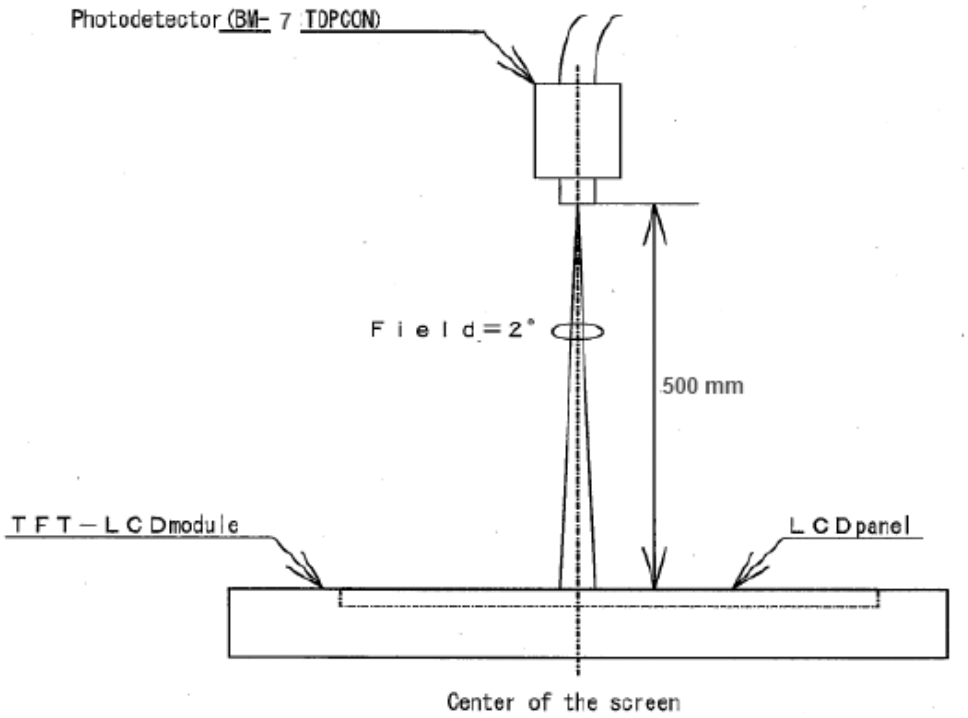
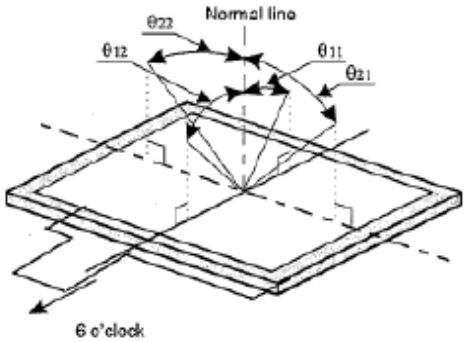


Fig.3 Optical characteristics measurement method

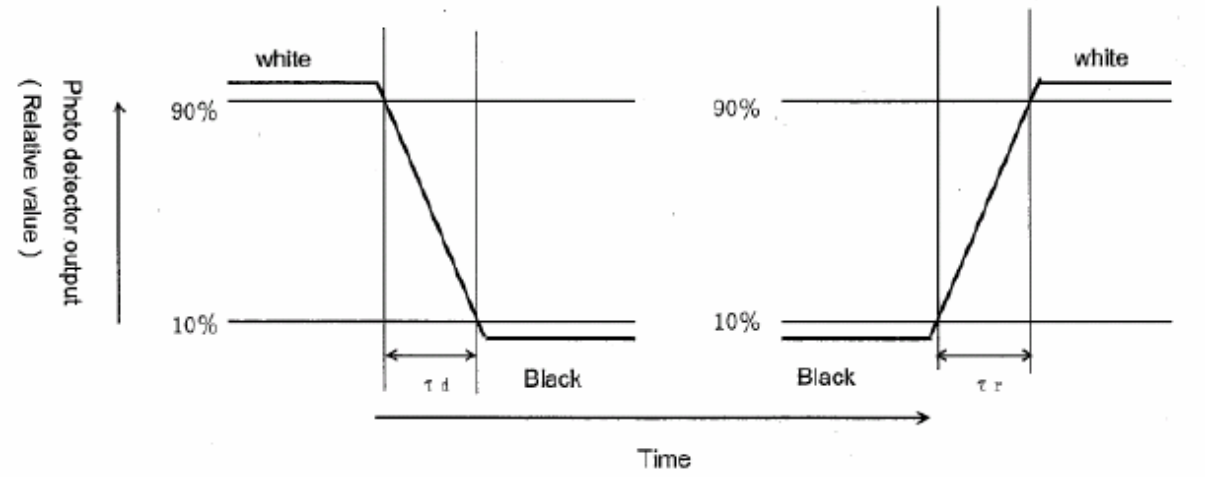
[Note1] Definitions of viewing angle range



[Note2] Definition of contrast ratio
The contrast ratio is defined as the following

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

[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.

10. Handling of modules

10-1. Inserting the FPC into its connector and pulling it out

① Be sure to turn off the power supply and the signals when inserting or disconnecting the cable.

② Please insert for too much stress not to join FPC in the case insertion of FPC.

10-2 About handling of FPC

① The bending radius of the FPC should be more than 1.4mm, and it should be bent evenly.

② Do not dangle the LCD module by holding the FPC, or do not give any stress to it.

10-3 Mounting of the module

① The module should be held on to the plain surface. Do not give any warping or twisting stress to the module.

② Please consider that GND can ground a modular metal portion etc. so that static electricity is not changed to a module.

10-4 Cautions in assembly / Handling pre cautions.

As the polarizer can be easily scratched, be most careful in handling it.

① Work environments in assembly.

Working under the following environments is desirable:

a) Implement more than 1MΩ conductive treatment (by placing a conductive mat or applying Conductive paint) on the floor or tiles.

b) No dusts come in to the working room. Please an adhesive, anti-dust mat at the entrance of the room.

c) Humidity of 50~70% and temperature of 15~27℃ are desirable.

d) All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.

e) Use a blower for electrostatic removal. Set it in a direction slightly tilt downward so that each module can be well subjected to its wind. Set the blower at an optimum distance between the blower and the module.

② How the remove dust on the polarizer

a) Blow out dust by the use of an N2 blower with antistatic measures taken. Use of an ionized air gun is recommendable.

b) When the panel surface is soiled, wipe it with soft cloth.

③ In the case of the module's metal part (shield case) is stained, wipe it with a piece of dry, soft cloth. If rather difficult, give a breath on the metal part to clean better.

④ If a water dropped, etc. remains stuck on the polarizer for a long time, it is apt to get discolored or cause stains. Wipe it immediately.

⑤ As a glass substrate is used for the TFT-LCD panel, if it is dropped on the floor or hit by something hard, it may be broken or chipped off.

⑥ Since CMOS LSI is used in this module, take care of static electricity and taken the human earth into consideration when handling.

10-5 Others

① Regarding storage of LCD modules, avoid storing them at direct sunlight-situation.
You are requested to store under the following conditions:
(Environmental conditions of temperature/humidity for storage)

(1) Temperature: 0~40℃

(2) Relative humidity: 95% or less

. As average values of environments (temperature and humidity) for storing, use the following control guidelines:
Summer season: 20~35℃, 85% or less Winter season: 5~15℃, 85% or less

. If stored under the conditions of 40℃ and 95% RH, cumulative time of storage must be less than 240 hours.

② If stored at temperature below the rated values, the inner liquid crystal may freeze, causing cell destruction. At temperatures exceeding the rated values for storage, the liquid crystal may become isotropic liquid, marking it no longer possible to come back to its original state in some cases.

③ If the LCD is broken, do not drink liquid crystal in the mouth. If the liquid crystal adheres to a hand or foot or to clothes, immediately cleanse it with soap.

④ If a water drop or dust adheres to the polarizer, it is apt to cause deterioration. Wipe it immediately.

⑤ Be sure to observe other caution items for ordinary electronic parts and components.

11. Reliability test items

No	Test item	condition
1	High temperature storage test	Ta=60 ℃ 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=50 ℃ 240h (The panel temp. must be less than 50 ℃)
5	Low temperature operation test	Ta=-10 ℃ 240h
6	Vibration test (non-operating)	Frequency : 10~55Hz/Vibration width (one side) : 1.5mm Sweep time : 1minutes Test period : (2 hours for each direction of X,Y, Z)
7	Shock test	Direction : ±X, ±Y, ±Z, Time : Third for each direction. Impact value : 10G Action time 6ms
8	Thermal shock test	Ta=-25 ℃~60 ℃ /10cycles (30min) (30min)

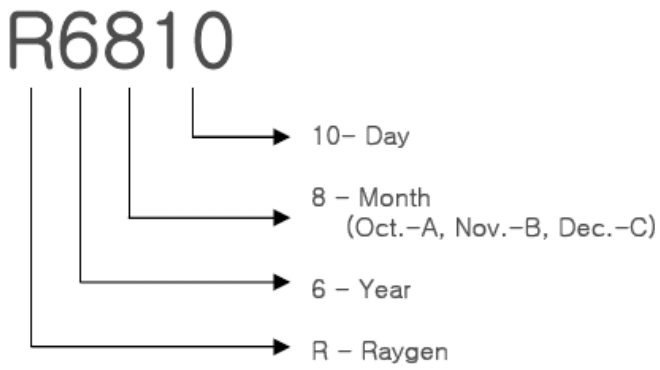
[Result Evaluation Criteria]
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

12. Display Grade

The standard regarding the grade of color LCD displaying modules should be based on the delivery inspection standard.

13. Lot no. marking

The lot no. will be indicated on individual labels. The location is as shown



14. Others

1 Disassembling the module can cause permanent damage and you should be strictly avoided
2 Please be careful that you don't keep the screen displayed fixed pattern image for a long time, since retention may occur.
3 If you pressed down a liquid crystal display screen with you finger and so on, the alignment disorder of liquid crystal will occur. And then it will become display fault.
Therefore, Be careful not to touch the screen directly, and to consider not stressing to it.
4 In the circuit parts on FPC, We don't change LCD module parts without announces.