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	DISPLAY DEVICE BUSINESS GROUP SHARP CORPORATION **TECHNICAL LITERATURE**	APPLICABLE GROUP DISPLAY DEVICE BUSINESS GROUP

TECHNICAL LITERATURE FOR

TFT-LCD module

MODEL No. LS037V7DW05

These parts have corresponded with the RoHS directive.

CUSTOMER'S APPROVAL

DATE

BY

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RECORDS OF REVISION

ＭＯＤＥＬ　Ｎｏ：LS037V7DW05

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	NO.	PAGE	SUMMARY	NOTE
2011.09.05	-	-	-	1st Issue
2012.01.27	B	3	ADD：Mass	2nd Issue
		18	CHANGE：Outline Figure	
2012.02.08	C	6	ADD：LED life time(section 6.2)	3rd Issue
		14	ADD：Reflection ratio(Table 9-1)	
		15	ADD：Note9-7 Definition of reflection ratio	

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Table of contents

1 Applicable TFT-LCD module

This technical literature applies to the color TFT-LCD module, LS037V7DW05.

2 Overview

This module is a color transflective and active matrix LCD module incorporating CG-Silicon TFT (Continuous Grain-Silicon Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs (with control Function), a FPC (with DC-DC Converter), a back light, a back sealed casing and a Touch Panel.

This module has control circuit. Graphics and texts can be displayed on a 480×3×640 dots panel with 16,777,216 colors by supplying.

This LCD module has multi colors functions. A Color mode is selective in 262,144 colors (18bit RGB) or 16,777,216 colors (24bit RGB).

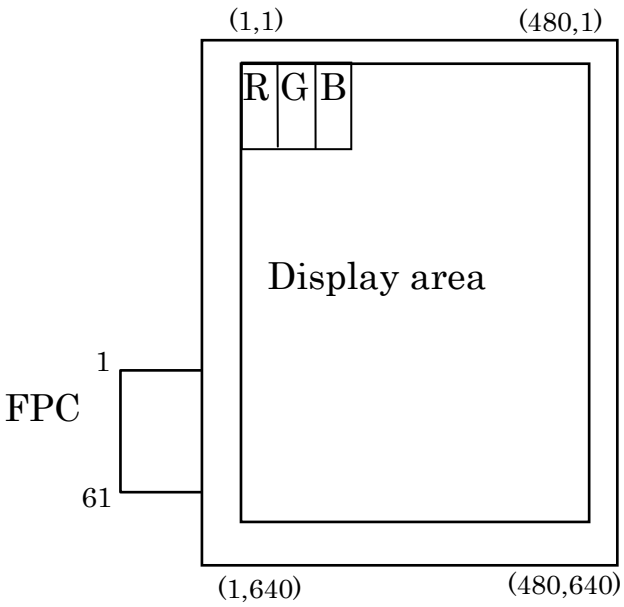
It has a wide viewing-angle-mode (Vertical viewing angle :(±80°) Horizontal viewing angle: (±80°) ,CR≥5).

3 Mechanical Specifications

Table 3.1

Items	Specifications	Unit
Display size (Diagonal)	9.4 (3.7")	cm
Active display area	56.16(H) x 74.88 (V)	mm
Pixel format	480(H) x RGB x 640(V) (1 pixel=R+G+B dots)	dot
Aspect ratio	3:4	
Pixel pitch	0.039[H] x 0.117[V]	mm
Pixel configuration	R,G,B vertical stripe	-
LCD mode	Normally Black	-
Dimension[Note3-1]	65.0(W) x 89.2(H) x 4.4(D)	mm
Mass (typical)	48	g

[Note3-1] Fig.5 shows dimensions of the module.



4 Input Signal Assignment

4-1. TFT-LCD Panel and Back Light driving section

Corresponding connector : FH23-61S-0.3SHAW(05) (HIROSE ELECTRIC CO., LTD.)

Table 4.1

Pin No.	Symbol	I/O	Function	Remark
1	GND	-	GND	
2	NC	-		
3	LED+	-	LED power supply (Hign Voltage)	
4	NC	-		
5	LED-	-	LED power supply (Low Voltage)	
6	NC	-		
7	T4	O	Touch Panel (right side)	
8	T3	O	Touch Panel (6 o'clock side)	
9	T2	O	Touch Panel (Left side)	
10	T1	O	Touch Panel (12 o'clock side)	
11	GND	-	GND	
12	NC	-		
13	VDD5	-	Power Supply (+5.5V)	
14	VDD5	-	Power Supply (+5.5V)	
15	NC	-		
16	VCI	-	Power Supply (+1.8V)	
17	NC	-		
18	GND	-	GND	
19	RESB	I	Reset signal	
20	GND	-	GND	
21	NC	-		
22	SCL	O/Z	I2C clock signal	
23	NC	-		
24	SDA	I/O/Z	I2C data signal	
25	NC	-		
26	GND	-	GND	
27	B7	I	BLUE data signal(MSB)	
28	B6	I	BLUE data signal	
29	B5	I	BLUE data signal	
30	B4	I	BLUE data signal	
31	B3	I	BLUE data signal	
32	B2	I	BLUE data signal	
33	B1	I	BLUE data signal	
34	B0	I	BLUE data signal(LSB)	
35	GND	-	GND	
36	G7	I	GREEN data signal(MSB)	
37	G6	I	GREEN data signal	
38	G5	I	GREEN data signal	
39	G4	I	GREEN data signal	
40	G3	I	GREEN data signal	
41	G2	I	GREEN data signal	
42	G1	I	GREEN data signal	
43	G0	I	GREEN data signal(LSB)	
44	GND	-	GND	
45	R7	I	RED data signal(MSB)	
46	R6	I	RED data signal	
47	R5	I	RED data signal	
48	R4	I	RED data signal	
49	R3	I	RED data signal	
50	R2	I	RED data signal	
51	R1	I	RED data signal	
52	R0	I	RED data signal(LSB)	
53	GND	-	GND	
54	DE	I	Data enable signal (signal to settle the horizontal display position)	Positive
55	GND	-	GND	
56	DOTCLK	I	Dot-clock signal	
57	GND	-	GND	
58	HSYNC	I	Horizontal synchronous signal	Negative
59	GND	-	GND	
60	VSYNC	I	Vertical synchronous signal	Negative
61	GND	-	GND	

5 Absolute maximum ratings

Table 5-1

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
+5.5V supply voltage	VDD5	Ta=25℃	-0.3	+7.25	V	
+1.8V supply voltage	VCI	Ta=25℃	-0.3	+4.6	V	
Input voltage	V_{IN1}	Ta=25℃	-0.3	VCI+0.3	V	[Note 5-1]
Storage temperature	Tstg	—	-30	+80	℃	[Note5-3,4,5]
Operating temperature (Panel surface)	Topp	—	-20	+70	℃	
LED Current	ILED	Ta=25℃	—	35	mA	[Note5-6]

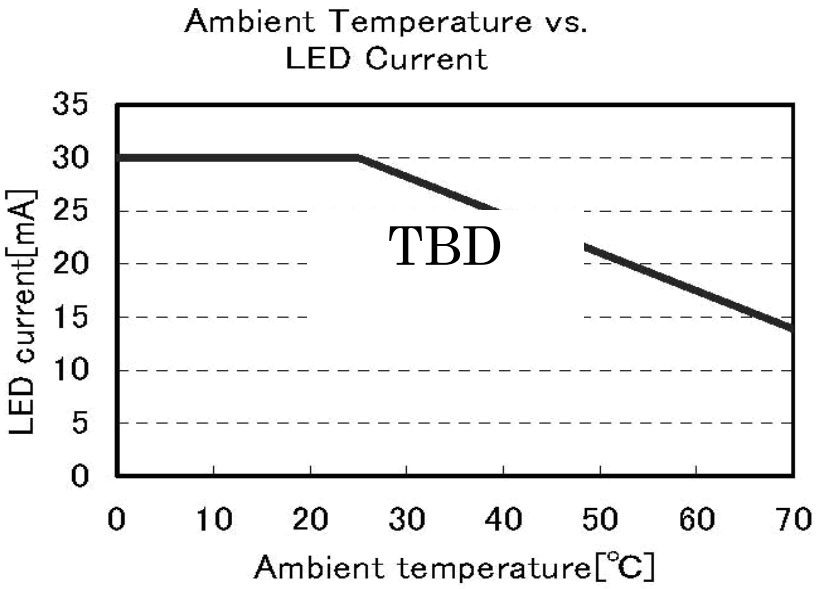
[Note5-1] RESB, SCL, SDA, R0～R7, G0～G7, B0～B7, DE, DOTCLK, HSYNC, VSYNC

[Note5-3] Maximum wet-bulb temperature is less than 39℃. Dew condensation must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note5-4] The operating temperature guarantees only operation of the circuit. For contrast, response time and other factors related to display quality, judgment is done using the ambient temperature Ta =＋25℃.

[Note5-5] Take care not to overrun ratings above.

[Note5-6] (Provisional plan,The figure below is just an example) LED current should be as per below figure.



6 Electrical characteristics

6-1. TFT-LCD Panel driving section

Ta=25℃

Table 6-1

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	VDD5	+5.2	+5.5	+5.8	V	
Supply voltage (Logic)	VCI	+1.65	+1.8	+1.95		
Permissive input ripple	V_{pp}	—	—	TBD	mVp-p	VDD5=+5.5V
Input voltage (“Low” state)	V_{IL}	0	-	0.3×VCI	V	[Note6-1]
Input voltage (“High” state)	V_{IH}	0.7×VCI	-	VCI	V	
Input leakage current(High)	I_{OH1}	—	—	TBD	μA	VI=1.8V [Note6-1]
Input leakage current(low)	I_{OL1}	—	—	TBD	μA	VI=0V [Note6-1]
IO leakage current	ILi	TBD	—	TBD	μA	Vin to VCI

[Note 6-1] RESB, SCL, SDA, R0～R7, G0～G7, B0～B7, DE, DOTCLK, HSYNC, VSYNC
[Note 6-2] Every Signal is CMOS Input, Hi-Z is prohibited when VCI is on level.

6-2 Backlight driving section

The backlight system is an edge-lighting type with white-LED.
(It is usually required to measure under the following condition.
condition: Ta=25℃±2℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED voltage	VL	—	18.0	19.8	V	[Note 6-3]
LED current	IL	—	17	TBD	mA	
Power consumption	WL	—	(306)	TBD	V	[Note 6-4]
LED life time	LL	—	(10000)	—	Hour	[Note 6-5]

[Note 6-3] VL(3.0V/pcs*6pcs=18.0V) at IL(17mA).
[Note 6-4] Calculated reference value. WL= (VL×IL)
[Note 6-5] The life time is determined as the time at which luminance of the LED becomes 50% of the initial brightness or not normal lighting at the typical LED current on condition of continuous operating at 25±2°C.

7 Timing Characteristics of input signals

7-1. Timing characteristics

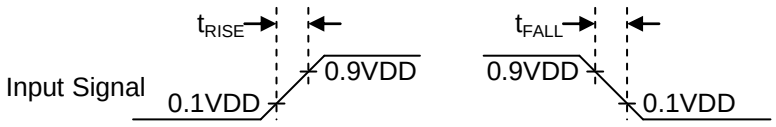
Table 7-1

Parameter	Symbol	MODE	Min.	Typ.	Max.	Unit	Note
DOTCLK Period	t_{CLK}	VGA QVGA	38 152	39.7 158.8	41.7 167	ns	DOTCLK [Note 7-1]
DOTCLK Low Width	t_{CLKL}		15	-	-	ns	
DOTCLK High Width	t_{CLKH}		15	-	-	ns	
Data setup time	t_{DS}		10	-	-	ns	R0～R7, G0～G7, B0～B7
Data hold time	t_{DH}		10	-	-	ns	
Pulse width of DEN	t_{HHW}	VGA QVGA	-	480 240	-		
Period of HSYNC	t_{HS}	VGA QVGA	-	648 324	-	CLK	HSYNC
Pulse width of HSYNC	t_{hsw}		-	2	-	CLK	
HSYNC setup time	t_{HSYS}		6	-	-	ns	
HSYNC hold time	t_{HSYH}		6	-	-	ns	
Horizontal Back Porch	t_{HBP}	VGA QVGA	28 14	78 38	166 82	CLK	
Horizontal Front Porch	t_{HFP}	VGA QVGA	14 14	88 44	138 68	CLK	
Period of VSYNC	t_{VS}		57	59.94	63	Hz	VSYNC
Period of VSYNC	t_{VS}	VGA QVGA	- -	648 326	-	HCYC	
Pulse width of VSYNC	t_{vsw}		-	1	-	HCYC	
VSYNC setup time	t_{VSYS}		6	-	-	ns	
VSYNC hold time	t_{VSYH}		6	-	-	ns	
VSYNC-HSYNC phase difference	t_{VHD}		0		HCYC-2	CLK	[Note 7-2]
Input Signal Rising Time	t_{RISE}		-	-	8	ns	[Note 7-3]
Input Signal Falling Time	t_{FALL}		-	-	8	ns	[Note 7-3]
Reset Pulse Width	t_{RESW}		20	-	-	μs	[Note 7-4]

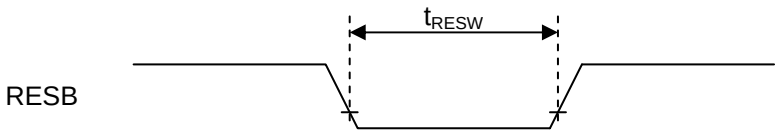
[Note 7-1] In case of lower frequency, the deterioration of display quality, flicker etc., may occur.

[Note 7-2] HCYC = HSYNC Period(VGA:Typ.648CLK, QVGA:Typ.324CLK)

[Note 7-3] VSYNC,HSYNC,DOTCLK,R0～R7,G0～G7,B0～B7,DEN,RESB terminals are applied.



[Note 7-4] Reset Signal Timing chart



[Note7-5] Timing diagrams of input signal are shown in Fig.1 and Fig.2

7-2. Vertical display position

The Vertical display start position is fixed 2 line.

[Portrait VGA Mode Timing Chart]

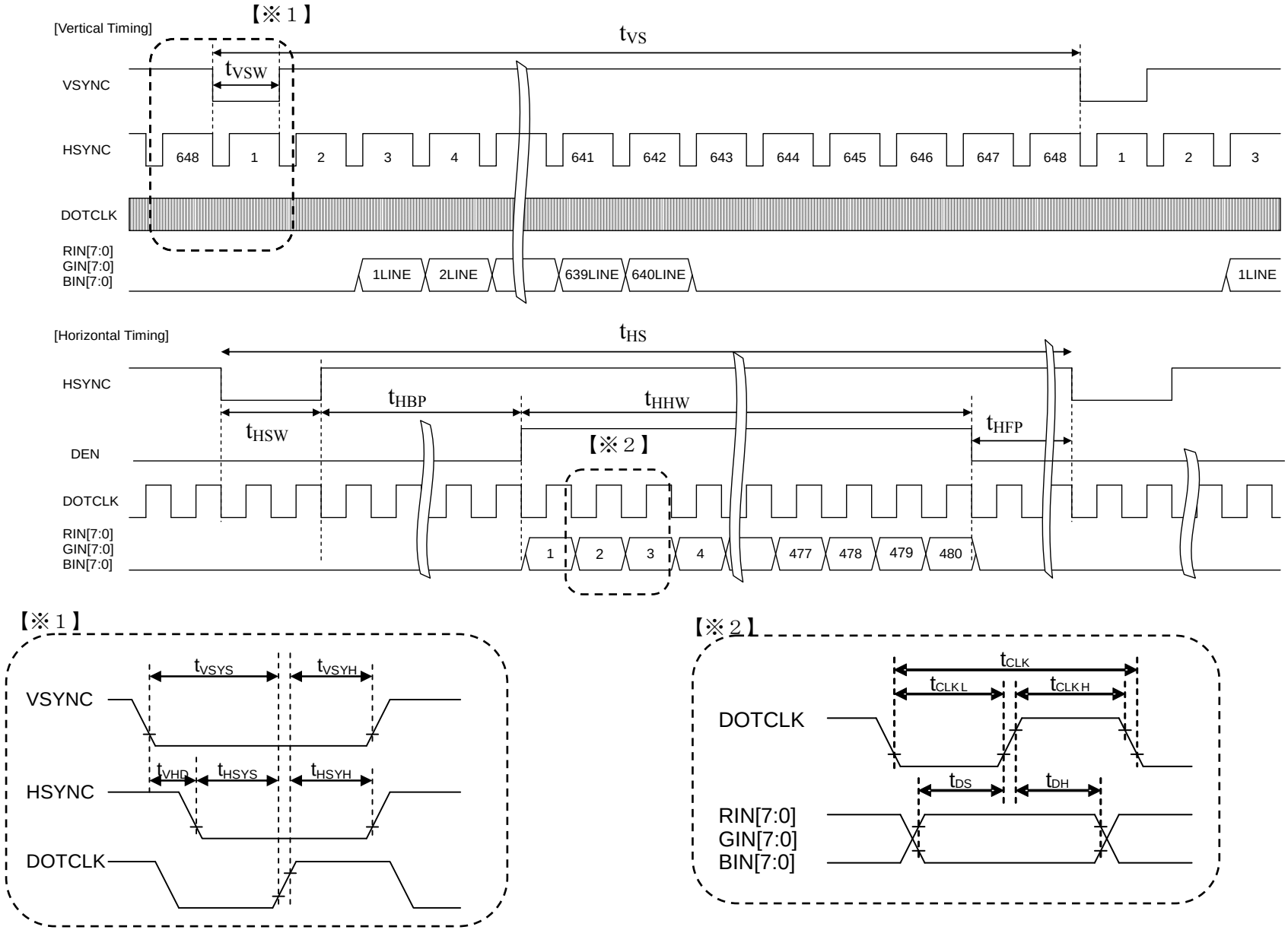


Fig.1 LCDIF signal timing in Portrait VGA mode

[Portrait QVGA Mode Timing Chart]

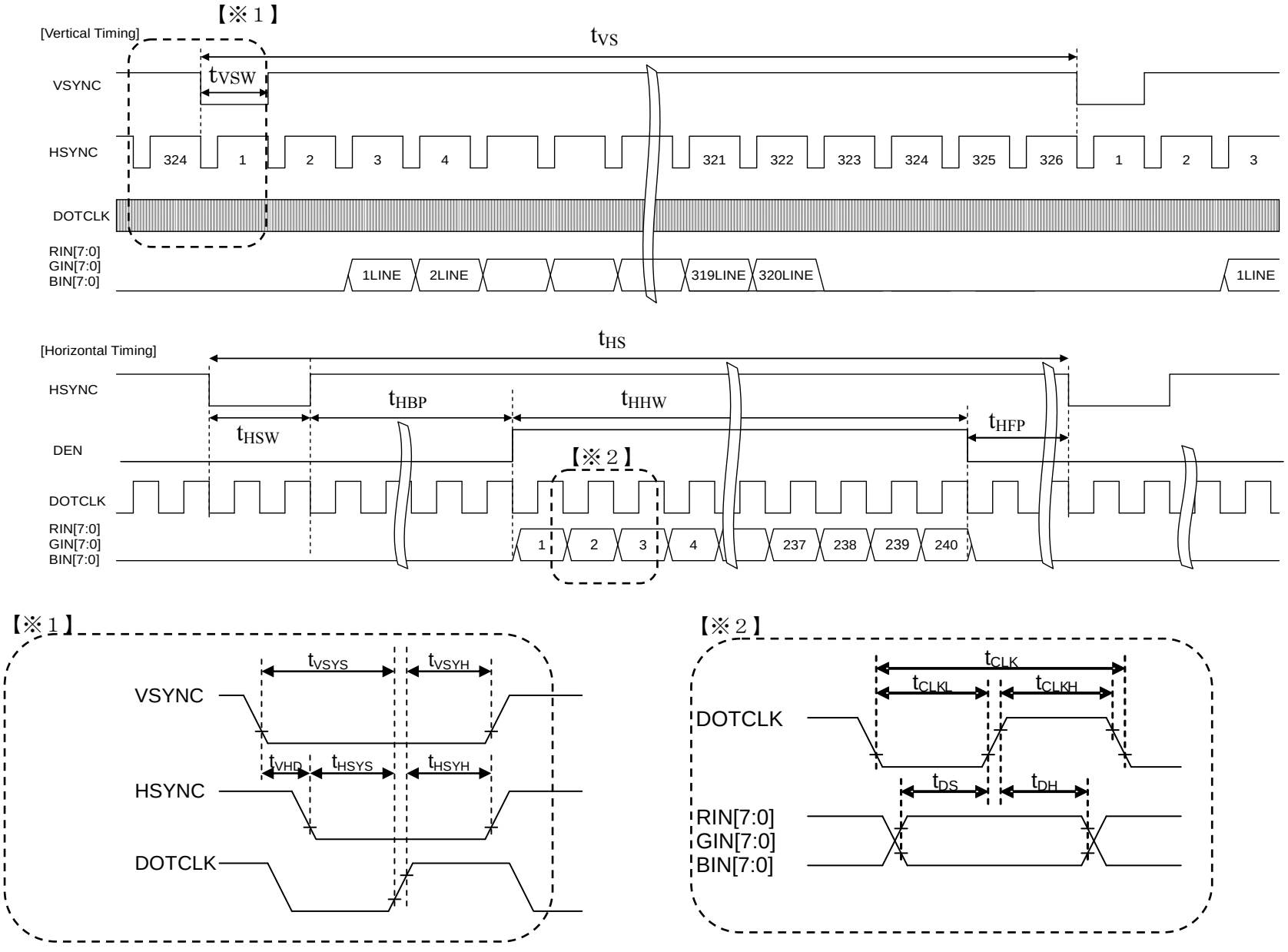
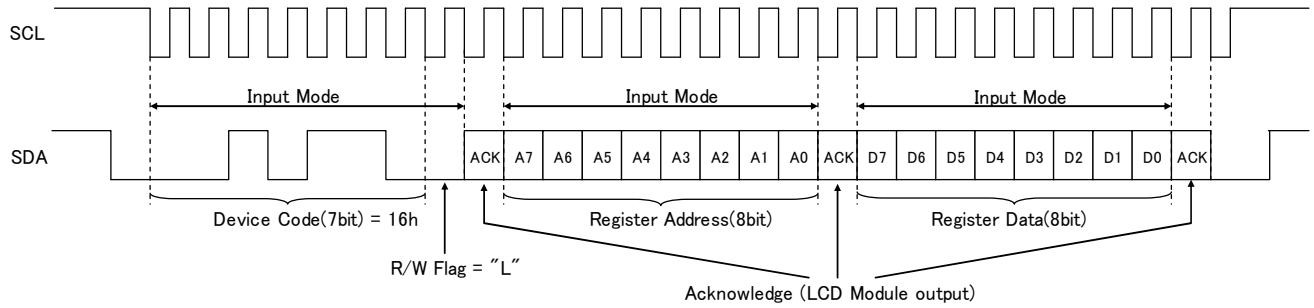


Fig.2 LCDIF signal timing in Portrait QVGA mode

7-3. I2C interface protocol

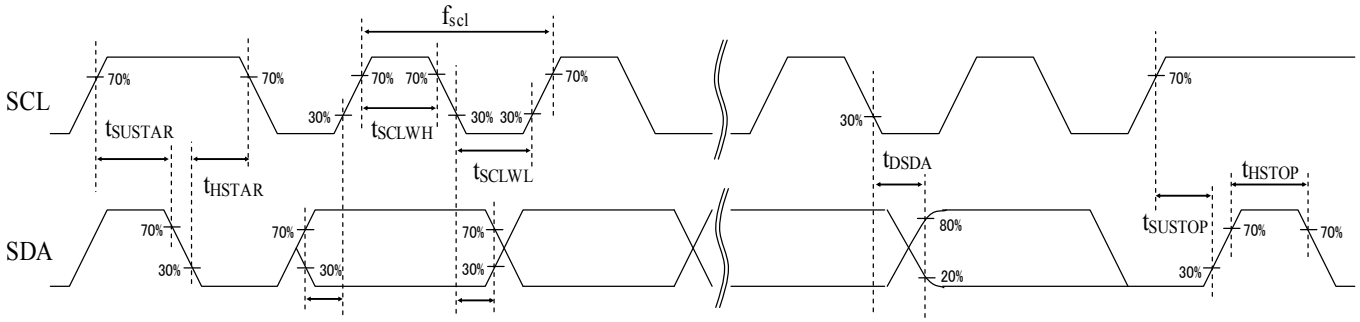
Register write access protocol is as shown in the following timing.
Device code is 16hex (7bit).



7-4. I2C interface AC timing

Table 7-2

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
SCL Frequency	fscl	CL=100pF			3.4	MHz
SCL pulse "H" width	t_{SCLWH}		60			ns
SCL pulse "L" width	t_{SCLWL}		160			ns
SDA set up time	t_{SUSDA}		10			ns
SDA hold time	t_{HSDA}		0			ns
Start condition set up time	t_{SUSTAR}		160			ns
Start condition hold time	t_{HSTAR}		160			ns
Stop condition set up time	t_{SUSTOP}		160			ns
Interval between Stop condition and Start condition	t_{HSTOP}		160			ns
SDA output delay time	t_{DSDA}		0			ns



7-5. Power ON/OFF Sequence

(1) Power ON sequence

	Item	Address or Data	Write Data(hex)	Remark
1	RESB = L			
2	VCI Power ON			
3	VDD5 Power ON			
4	Wait > 10ms			
5	RESB = H			
6	Wait > 1us			
7	Signal(DOTCLK, VSYNC, HSYNC, RGB Data) input			
8	Wait > 6ms			
9	SLEEP OUT	Address	11h	
		Data	00h	
10	Wait > 100ms			
11	DISP ON	Address	29h	The display starts synchronizing with VSYNC pulse after writing DISP ON regisnter.
		Data	00h	

(2) Power OFF sequence

	Item	Address or Data	Write Data(hex)	Remark
1	DISP OFF	Address	28h	
		Data	00h	
2	Wait 1V			
3	SLEEP IN	Address	10h	
		Data	00h	
4	Wait > 100ms			
5	Signal(CK, VSYNC, HSYNC, RGB Data) stop			
6	RESB = L			
7	WAIT > 1ms			
8	VDD5 Power OFF			
9	VCI Power OFF			

7-6. Resolution Select

It is necessary to write in three registers in the following sequence.
The resolution is changed synchronizing with VSYNC pulse after writing the third register.
The register access interval is wait more than 160ns.

(1) VGA to QVGA

	Item	Address or Data	Write Data(hex)	Remark
1	VGA Display			
2	Bank1	Address	B0h	
		Data	01h	
3	Zoom	Address	DEh	
		Data	01h	
4	VALGO	Address	96h	
		Data	01h	
5	QVGA timing input			The resolution is changed synchronizing with VSYNC pulse after writing VALGO regisnter.

(2) QVGA to VGA

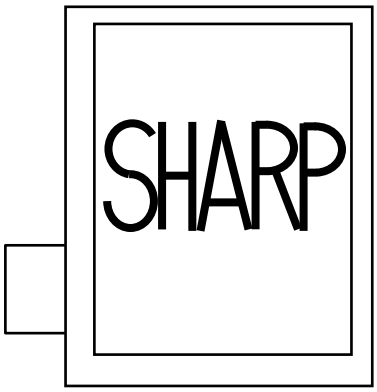
	Item	Address or Data	Write Data(hex)	Remark
1	QVGA Display			
2	Bank1	Address	B0h	
		Data	01h	
3	Zoom	Address	DEh	
		Data	00h	
4	VALGO	Address	96h	
		Data	01h	
5	VGA timing input			The resolution is changed synchronizing with VSYNC pulse after writing VALGO regisnter.

7-7. Horizontal and Vertical Scanning Direction

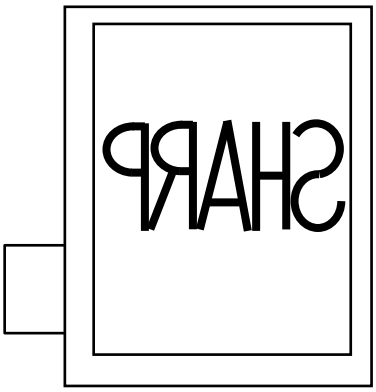
The Horizontal and vertical scanning direction can be selected by writing in the two registers in the following sequence.

	Item	Address or Data	Write Data(hex)	Remark
1	VGA Display			
2	Bank1	Address	B0h	
		Data	01h	
3	HV Scan	Address	DCh	
		Data	**h	Please refer to the following figures for the writing data. Default value is 80h.

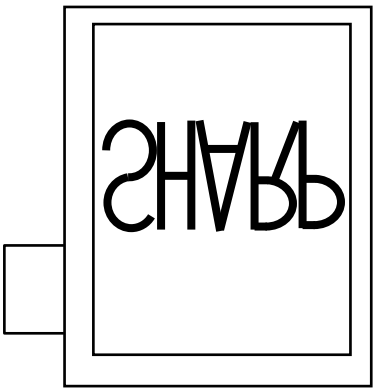
(1) Address = DCh , Data = 80h



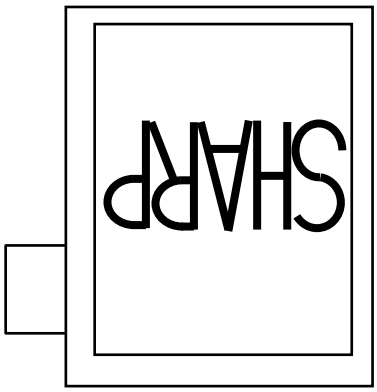
(2) Address = DCh , Data = A0h



(3) Address = DCh , Data = 90h



(4) Address = DCh , Data = B0h



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

Table 8-1

	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	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 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	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 total 24 bit data signals, the 16.7-million-color color display can be achieved on the screen.

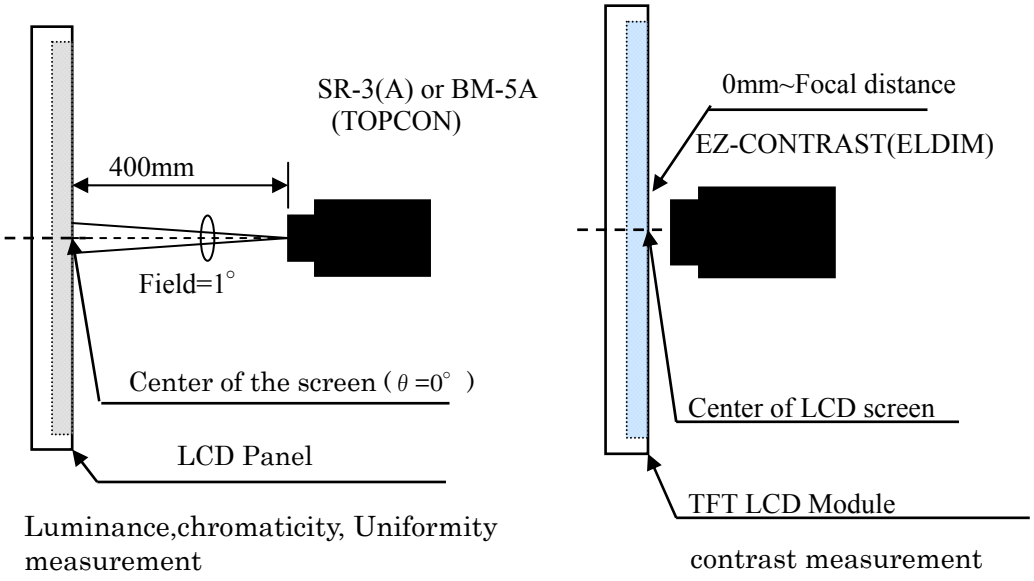
9 Optical Specification

Table 9-1 Ta=25°C, Vcc=3.3V

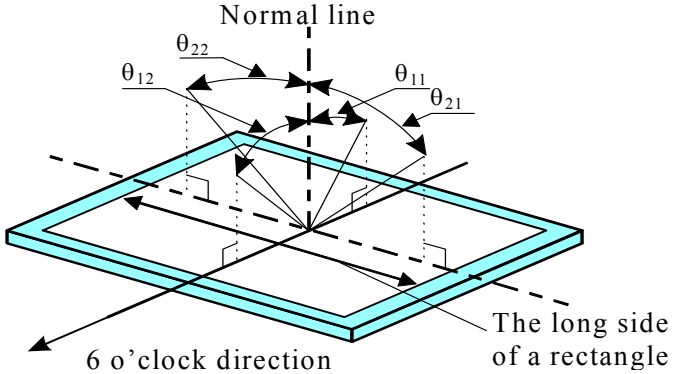
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle Range	Horizontal	θ21, θ22	CR≧5	TBD	(80)	-	degree	[Note9-1,2]
	Vertical	θ11, θ12		TBD	(80)	-	degree	
Contrast ratio		CR max	Best viewing angle	TBD	450	-	-	[Note9-1,3,6]
Response	Rise+Fall	Tr +Td	θ = 0°	—	TBD	-	ms	[Note9-1,4,6]
Chromaticity of white		x	θ = 0°	(0.263)	(0.313)	(0.363)	-	[Note9-1,6]
		y		(0.279)	(0.329)	(0.379)	-	
Luminance of white		Y_{L1}	θ = 0°	(190)	(240)	-	cd/m²	[Note9-1,6]
NTSC ratio			θ = 0°	TBD	(50)	-	%	
Uniformity			θ = 0°	(60)	-	-	%	[Note9-5,6]
Reflection ratio		R	θ = 0°	(2)	(4)	-	%	[Note9-7]

※ The measurement shall be executed 30 minutes after lighting at rating. Condition : IL=17mA
The optical characteristics shall be measured in a dark room or equivalent.

[Note 9-1] Optical Characteristics Measurements



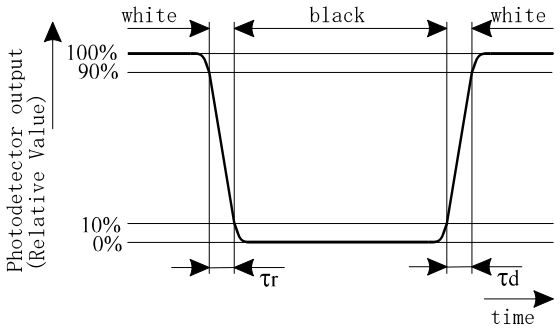
[Note9-2] Definitions of viewing angle range:



[Note9-3] Definition of contrast ratio:
The contrast ratio is defined as the following.

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

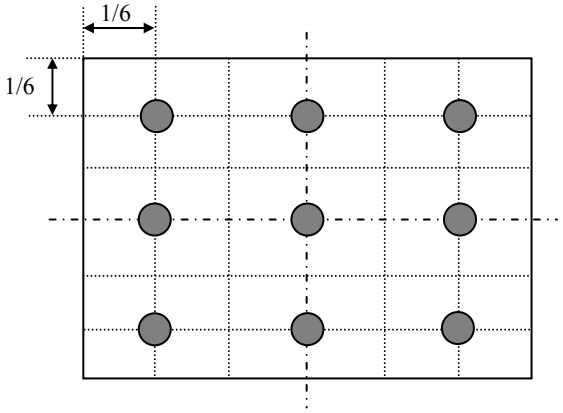
[Note9-4] Definition of response time:
The response time is defined as the following figure and shall be measured by switching the input signal between "black" and "white" alternatively.



[Note9-5] Definition of Uniformity

$$\text{Uniformity(\%)} = \frac{\text{Minimum Breightness}}{\text{Maximum Brightness}} \times 100$$

The brightness should be measured on the 9-points as shown in the right figure.

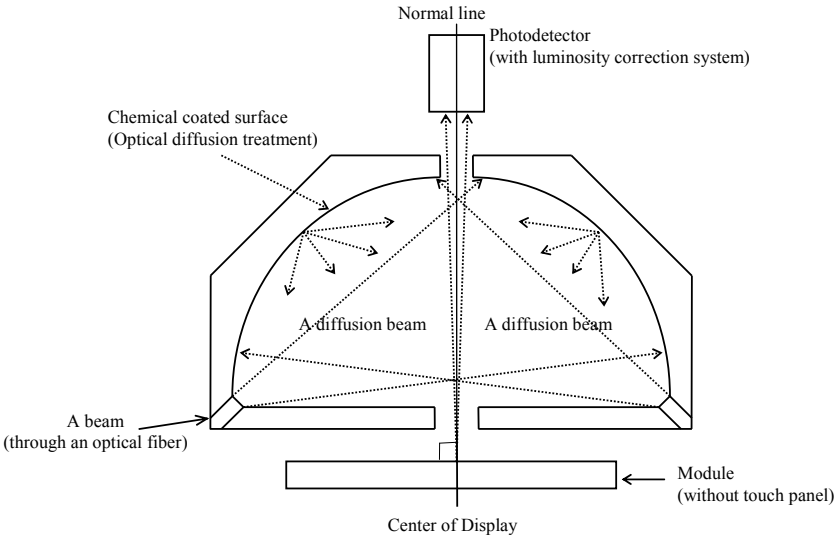


[Note9-6] This parameter should be measured at the center of the screen and 30 minutes after turn-on.

[Note9-7] Definition of reflection ratio

$$\text{Contrast Ratio(CR)} = \frac{\text{Light detected level of the reflection by the LCD module}}{\text{Light detected level of the reflection by the standard white board}}$$

A measurement device is Otsuka luminance meter LCD-5200. (With the diffusion reflection unit)



10 Display Qualities

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standards TFT-LCD.

11 Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.
Please insert for too much stress not to join FPC in the case of insertion of FPC.

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 LCD surface 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 ensure the human earth when handling. Observe all other precautionary requirements in handling components.

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

i) Protect sheet(Laminate film) is attached to the module surface to prevent it from being scratched. Peel the sheet off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the LCD surface by using an ionized nitrogen gun, etc.
Working under the following environments is desirable.
- All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.
- Use Ionized blower for electrostatic removal, and peel of the protect sheet with a constant speed. (Peeling of it at over 2 seconds)

j) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.

k) 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.

l) 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.

m) Disassembling the module can cause permanent damage and should be strictly avoided.
Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.
(Except for protection film of the panel.)

n) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)

o) 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.

p) 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.

q) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series),
tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film.
Be sure to confirm the component of them.

r) Do not use polychloroprene. If you use it, there is some possibility of generating Cl_2 gas that influences the reliability of the connection between LCD panel and driver IC.

s) Do not put a laminate film on LCD module, after peeling of the original one. If you put on it, it may cause discoloration or spots because of the occurrence of air gaps between the polarizer and the film.

12 Reliability Test Items.

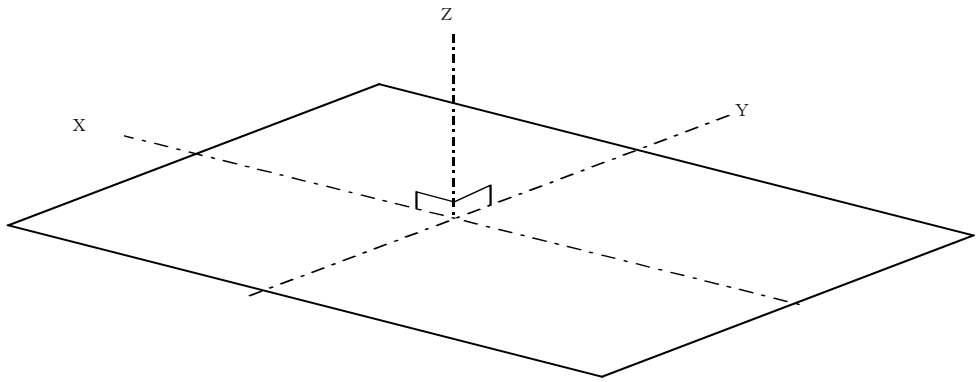
No.	Test parameter	Conditions
1	High temperature storage test	Leaves the module at Ta=80°C for 240h
2	Low temperature storage test	Leaves the module at Ta=-30°C for 240h
3	High temperature & high humidity operation test	Operates the module at Ta=40°C; 95%RH for 240h (No condensation)
4	High temperature operation test	Operates the module with +70°C at panel surface for 240h
5	Low temperature operation test	Operates the module at Ta=-20°C for 240h
6	Strength against ESD	±200V・200pF(0Ω)　1 time for each terminals
7	Shock test (non- operating)	Max. acceleration : 490m/s^2 Pulse width : 11ms, half sine wave Direction : ±X,±Y,±Z once for each direction.
8	Vibration test (non- operating)	Frequency : 5 ~57Hz/Vibration width (one side):0.076 mm : 57~500Hz/ acceleration:9.8m/s^2 Sweep time : 11 minutes Test period :1 hour for each direction of X,Y,Z (total 3 hours)
9	Thermal shock test	-30°C ~ +80°C /5 cycle [1h] [1h]

[Result Evaluation Criteria]

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

[Note12-1] Ta = Ambient temperature

[Note 12-2] The directions of X, Y, Z are defined as below:



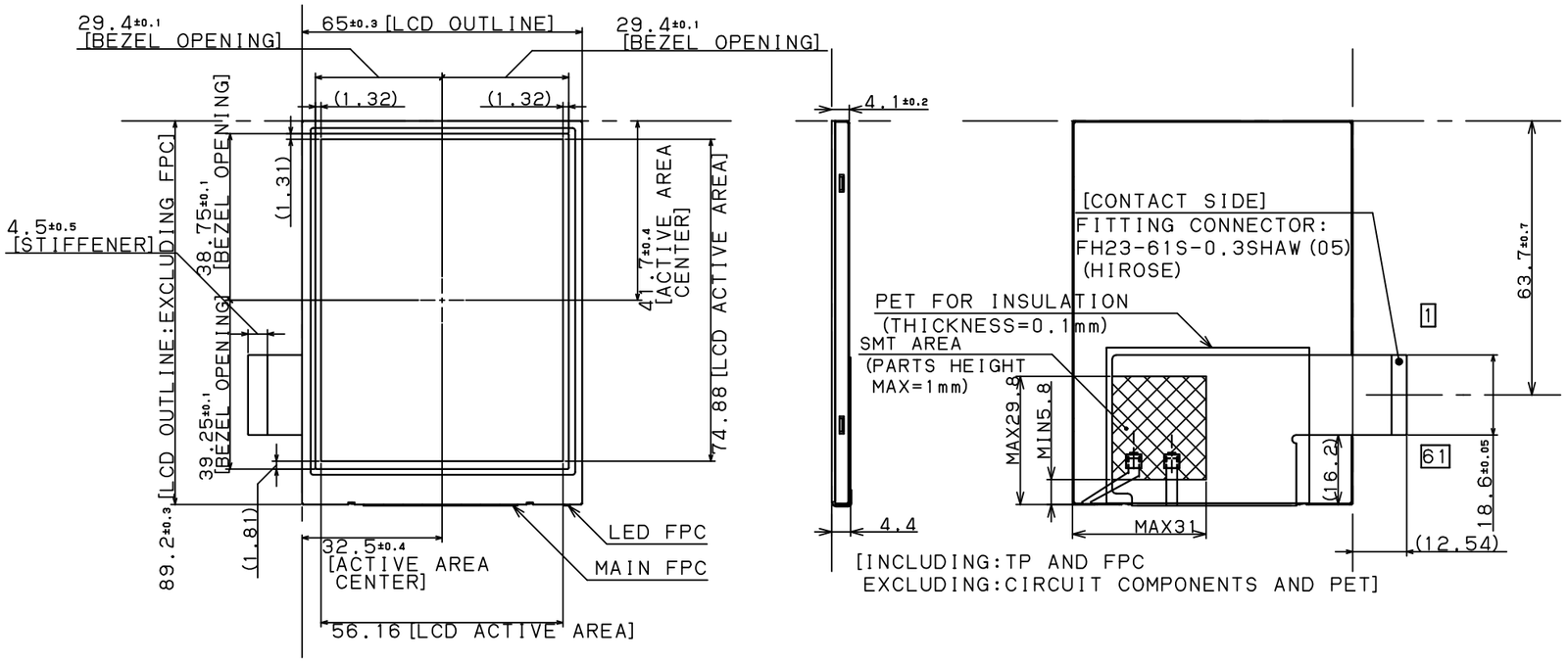
13 Packing Form

packaging form. T.B.D

Carton stock conditions T.B.D

14 Marking of product name

Serial No. indication.　T.B.D



REMARK
1. GENERAL TOLERANCE IS ±0.5mm.
2. BENDING RADIUS OF FPC SHOULD BE GREATER THAN 0.6mm.
3. GUARANTEED-AREA-OF-APEARANCE IS LCD ACTIVE AREA.
4. GUARANTEED-AREA-OF-TP-KEY-AREA IS LCD ACTIVE AREA.
   IF THE POINTING STRESS IS IMPOSED ON THE OUTSIDE OF THAT AREA, IT MAY DAMEGE THE ELECTRIC CHARACTERISTICS OF TP.
5. TAKE CARE IN SET DESIGN TO HIDE THE SCRATCHES AND BUBBLES AND LEAKED LIGHT FROM BACKLIGHT WHICH APPEARS ON THE OUTSIDE OF GUARANTEED-AREA-OF-APPERARNCE.
6. TOLERANCE OF MODULE WIDTH ARE EXCLUDING WARP OF THE MODULE.
7. CUSHION MATERIALS SHOULD BE LIMITED WITHIN THE CUSHION AREA. IF CAB-CUSHION IS POSITIONED OUTSIDE OF THAT AREA, IT MAY DAMEGE THE ELECTRIC CHARACTERISTICS OF TP.

Fig.3 Outline Dimensions