

PREPARED BY: <i>H. Yabuuchi</i>	DATE: 22 July 2015	SHARP DISPLAY DEVICE BUSINESS DIVISION 2 SHARP CORPORATION SPECIFICATION	SPEC No. LCY-14005E
APPROVED BY: <i>H. Yabuuchi</i>	DATE: 22 July 2015		FILE No.
			ISSUE: 21, July, 2015
			PAGE : 27 pages

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ123B5RW01

PART No. 8 928 554 145

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY *H. Yabuuchi*
 H.Yabuuchi
 Department general manager
 Development Department II
 Display Device unit IV
 Display Device Business Division II
 SHARP CORPORATION

RECORDS OF REVISION

MODEL No : LQ123B5RW01

SPEC No.	Date	NO.	PAGE	SUMMARY	NOTE
LCY-14005	19,June.2014	-	-	Revised form LCY-12038I	1 st Issue
			5	Table 6 Add the V1~V14 to Symbol	
			7,19	Table 7-2 Change value V6:2.2->2.07,V7:1.65->1.81, V8:-1.55->-1.71,V9:-2.1->-1.97 Delete the phrase "gamma2.2"	
			11	Rephrase "Begin the~" -> "Data sampling~"	
			15	12. Change the total number of color 16,581,375 -> 16,777,216	
			20	16-2) Change (Torque (1.0)Nm->1.5Nm)	
			21	B)-b),c),d) Rephrase	
			21	16-4) Add one caution of production design	
			25	Fig4.Change	
			30	4,4-1 Update the reference data	
			-	Appendix 5. Add CR, Luminance and color at higher and lower temp.(reference data)	
LCY-14005A	1,Aug.2014	A	7	Table7-1 Change value Tpon 700ms -> 10ms Note 7-2 Add the content	2 nd Issue
			17	Table 13 Revise Gamma spec.	
			25	Fig.4 Add fixation tape for protection film	
			-	Appendix 4. Deleted the reference measurement results 4-1. Change to the relative values 6. Add the resistor value	
LCY-14005B	5,Nov.2014	B	Cover	Change part number	3 rd Issue
			17	Table13. Revise Gamma spec.	
			19	Note13-3. Fixed error ($\tau d \Leftrightarrow \tau r$)	
			23	Label & Data matrix code Change user number	
			25	Update Fig.4 Outline Dimensions	
LCY-14005C	1,Apr.2015	C	5	Table 6 Revise AVDDM Max -0.3 -> +0.3	4 th Issue
			24,28	Add MAT label	
			25,26	Table 21-1; UV stability test Move from Table21-1 to Table22	
			27	Fig 4.Outline Dimensions Update to a reference dimension of the stud height	
LCY-14005D	13,May.2015	D	24	18-2 MAT label Add recommended reader	5 th Issue
			-	Table 22. Reference test Move from Table 22 to Appendix	

NOTICE

This publication is the proprietary of SHARP and is copyrighted, with all rights reserved. Under the copyright laws, no part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical for any purpose, in whole or in part, without the express written permission of SHARP. Express written permission is also required before any use of this publication may be made by a third party.

The application circuit examples in this publication are provided to explain the representative applications of SHARP's devices and are not intended to guarantee any circuit design or permit any industrial property right or other rights to be executed. SHARP takes no responsibility for any problems related to any industrial property right or a third party resulting from the use of SHARP's devices, except for those resulting directly from device manufacturing processes.

In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP's devices, shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP's device.

Observe the following points when using any device in this publication. SHARP takes no responsibility for damage caused by improper use of the devices.

The devices in this publication are designed for use in general electronic equipment designs , such as:

- Audio visual equipment
- Car navigation system for aftermarket

The appropriate design measures should be taken to ensure reliability and safety when SHARP's devices are used for equipment such as:

- Transportation control and safety equipment(i.e.,aircraft,trains,automobiles,etc.)
- Traffic signals
- Gas leakage sensor breakers
- Alarm equipment
- Various safety devices etc.

SHARP's devices shall not be used for equipment that requires extremely high level of reliability, such as:

- Military and space applications
- Nuclear power control equipment
- Medical equipment for life support

Contact a SHARP representative, in advance, when intending to use SHARP's devices for any "specific" applications other than those recommended by SHARP.

Contact and consult with a SHARP representative if there are any questions about the contents of this publication.

1. Application

The SHARP Color TFT-LCD module is an active matrix LCD (Liquid Crystal Display) produced by making the most of Sharp's expertise in liquid-crystal and semiconductor technologies. The active device is amorphous silicon TFT (Thin Film Transistor).

2. Summary and Features

- 8bit RSDS™ *(Reduced Swing Differential Signaling) interface is adopted in this module.
- Utilizes a panel with a 8:3 aspect ratio, which makes the module suitable for use in wide-screen systems.
- The 12.3 screen produces a high resolution image that is composed of 777,600 pixels elements in a stripe arrangement.
- Graphics and texts can be displayed on a 1440×RGB×540 dots panel with 16,777,216 colors by supplying 24 bit data signals(8 bit/color).
- By adopting an active matrix drive, a picture with high contrast is realized.
- Reduced reflection as a result of low reflection black matrix and an antiglare (AG) polarizer being adopted. The polarizer haze value is 41.5% typical.(*absorption axis of polarizer : horizontal)
- By COG method, realized a slim, lightweight, and compact module.
- Through the use of ASV –normally black mode, an image with highly natural color reproduction is realized.
- The LED backlight has excellent performance even at low temperatures.

*RSDS™ is a trademark of National Semiconductor Corporation.

3. Construction and Outline

The module consists of a TFT-LCD panel, drivers, FPC, PWB, backlight unit, shielding cases.

4. Mechanical specifications

Table 4-1

Parameter	Specifications	Units	Remarks
Screen size (Diagonal)	31.24[12.3"]	cm	
Active area	291.6 (W) × 109.35 (H)	mm	
Display format	777,600	pixels	
	1440 × RGB × 540	dots	
Dot pitch	0.0675(H) × 0.2025 (V)	mm	
Pixel configuration	R,G,B stripe configuration		
Display mode	Normally black		
Outline dimension	311.4 (W) × 130.2(H) × 19.2(D)	mm	[Note4-1]
Mass	720(MAX)	g	

[Note4-1] Please refer to Fig.4 "Outline Dimensions"

5. Input terminal

Pin arrangement, name and description of the module are shown in Table 5-1 , Table 5-2.

Table 5-1 : Pin arrangement / Name / Description.

Input connector : 04 6288 064 000 846+(KYOCERA)

Pin No.	Symbol	Description	Remarks
1	GND	Ground	
2	CKP	RSDS Clock (Positive polarity)	[Note5-1]
3	CKN	RSDS Clock (Negative polarity)	[Note5-1]
4	GND	Ground	
5	D00P	RSDS Data (Positive polarity of R1, R0)	[Note5-1]
6	D00N	RSDS Data (Negative polarity of R1, R0)	[Note5-1]
7	D01P	RSDS Data (Positive polarity of R3, R2)	[Note5-1]
8	D01N	RSDS Data (Negative polarity of R3, R2)	[Note5-1]
9	D02P	RSDS Data (Positive polarity of R5, R4)	[Note5-1]
10	D02N	RSDS Data (Negative polarity of R5, R4)	[Note5-1]
11	D03P	RSDS Data (Positive polarity of R7, R6)	[Note5-1]
12	D03N	RSDS Data (Negative polarity of R7, R6)	[Note5-1]
13	GND	Ground	
14	D10P	RSDS Data (Positive polarity of G1, G0)	[Note5-1]
15	D10N	RSDS Data (Negative polarity of G1, G0)	[Note5-1]
16	D11P	RSDS Data (Positive polarity of G3, G2)	[Note5-1]
17	D11N	RSDS Data (Negative polarity of G3, G2)	[Note5-1]
18	D12P	RSDS Data (Positive polarity of G5, G4)	[Note5-1]
19	D12N	RSDS Data (Negative polarity of G5, G4)	[Note5-1]
20	D13P	RSDS Data (Positive polarity of G7, G6)	[Note5-1]
21	D13N	RSDS Data (Negative polarity of G7, G6)	[Note5-1]
22	GND	Ground	
23	D20P	RSDS Data (Positive polarity of B1, B0)	[Note5-1]
24	D20N	RSDS Data (Negative polarity of B1, B0)	[Note5-1]
25	D21P	RSDS Data (Positive polarity of B3, B2)	[Note5-1]
26	D21N	RSDS Data (Negative polarity of B3, B2)	[Note5-1]
27	D22P	RSDS Data (Positive polarity of B5, B4)	[Note5-1]
28	D22N	RSDS Data (Negative polarity of B5, B4)	[Note5-1]
29	D23P	RSDS Data (Positive polarity of B7, B6)	[Note5-1]
30	D23N	RSDS Data (Negative polarity of B7, B6)	[Note5-1]
31	GND	Ground	
32	SP	Start pulse for source driver	
33	LD	Data transfer signal input for source driver	
34	POL	Polarity reversing signal of LCD output	
35	GSP	Start pulse for gate driver	
36	GCK	Gate clock pulse for gate driver	
37	GOE	Gate output enable signal	
38	VDD	Power supply voltage	
39	VDD	Power supply voltage	
40	GND	Ground	
41	GND	Ground	
42	AVDDP	Power supply for source driver (+6.37V)	
43	V1	Power supply for grey image (L255)	
44	V2	Power supply for grey image (L223)	
45	V3	Power supply for grey image (L175)	
46	V4	Power supply for grey image (L127)	
47	V5	Power supply for grey image (L79)	
48	V6	Power supply for grey image (L3)	
49	V7	Power supply for grey image (L0)	
50	V8	Power supply for grey image (L0)	

Pin No.	Symbol	Description	Remarks
51	V9	Power supply for grey image (L3)	
52	V10	Power supply for grey image (L79)	
53	V11	Power supply for grey image (L127)	
54	V12	Power supply for grey image (L175)	
55	V13	Power supply for grey image (L223)	
56	V14	Power supply for grey image (L255)	
57	AVDDM	Power supply for source driver (-6.37V)	
58	GND	Ground	
59	VCOM	VCOM voltage input	
60	N.C.	Open	
61	VGL	Power supply for gate driver (-14.5V)	
62	N.C.	Open	
63	VGH	Power supply for gate driver(+17.5V)	
64	N.C.	Open	

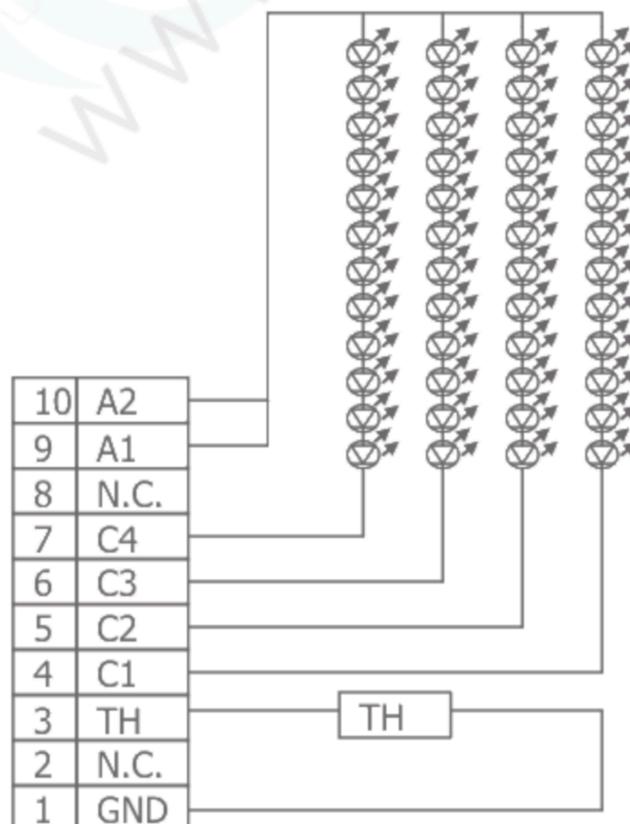
[Note5-1] Refer to Chapter 12, Table8-1, Fig8-1

Table 5-2 : Pin arrangement of backlight.

Recommended connector : Hirose FH28-10S-0.5SH(10)

No.	Symbol	function	Remarks
1	GND	GND reference for 3	
2	N.C.	This is open terminal	
3	RTh	Thermistor	Note) NSS4103F39F(10kΩ)
4	VLC4	LED Power supply input 1(-)	Cathode side 1
5	VLC3	LED Power supply input 2(-)	Cathode side 2
6	VLC2	LED Power supply input 3(-)	Cathode side 3
7	VLC1	LED Power supply input 4(-)	Cathode side 4
8	N.C.	This is open terminal	
9	VLA	LED Power supply input (+)	Anode side
10	VLA	LED Power supply input (+)	Anode side

The figure below shows the circuit chart of each string.



6. Absolute maximum ratings

Absolute maximum ratings of the module are shown in Table 6.

Table 6

GND=0V

Item	Symbol	MIN	MAX	Unit	Remarks
Power supply of source part	AVDDM	-7.3	+0.3	V	Ta=25°C
	V8~V14				
	AVDDP	-0.3	+7.3	V	"
	V1~V7				
	VDD	-0.3	+4.6	V	" , [Note6-1]
Power supply of gate part	VGH	-0.3	VGL+42.0	V	"
	VGL	-25.0	+0.3	V	"
Common electrode driving signal	VCOM	-7.3	+0.3	V	"
Power supply of LED Back Light	If	-	90	mA	" ,1line
Storage temperature	Tstg	-40	+90	°C	[Note6-2,3]
Operating temperature (LCD panel surface)	Topr1	-30	+85	°C	[Note6-4,6,7,8]
Operating temperature (Ambient temperature)	Topr2	-30	+60	°C	[Note6-5,7]

【Note 6-1】 GSP,GCK,GOE,D00P~D03P,D00N~D03N,D10P~D13P,D10N~D13N,D20P~D23P,CKP,CKN,SP,LD,POL

【Note 6-2】 This rating applies to all parts of the module and should not be exceeded.

Operating temp:-40°C to -30°C, does not provide a correct image on the LCD, but no damage of the display function will occur.

【Note 6-3】 Maximum wet-bulb temperature is 57°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 6-4】 The operating temperature is a temperature at which the module is assured to operate. Display quality criteria such as contrast and response speed are evaluated when Ta = +25°C.

【Note 6-5】 Ambient temperature when the backlight is lit at 100% PWM ratio.(reference value).

【Note 6-6】 Panel temperature is defined as the peak temperature on both the front and rear surfaces of the panel.

【Note 6-7】 LED current must be lower than the line in the figure 6-1.

【Note 6-8】 The operating temperature guarantees only operation of the circuit. For contrast, response time, and other factors related to display quality are determined in the circumstances with Ta=+25°C

Dimming shall operate at $T_a \geq 60 \text{ }^\circ\text{C}$.

Countermeasures for heat generation from LCD module are required at customer's system.

Fig. 6-1 : Ambient temperature -LED current

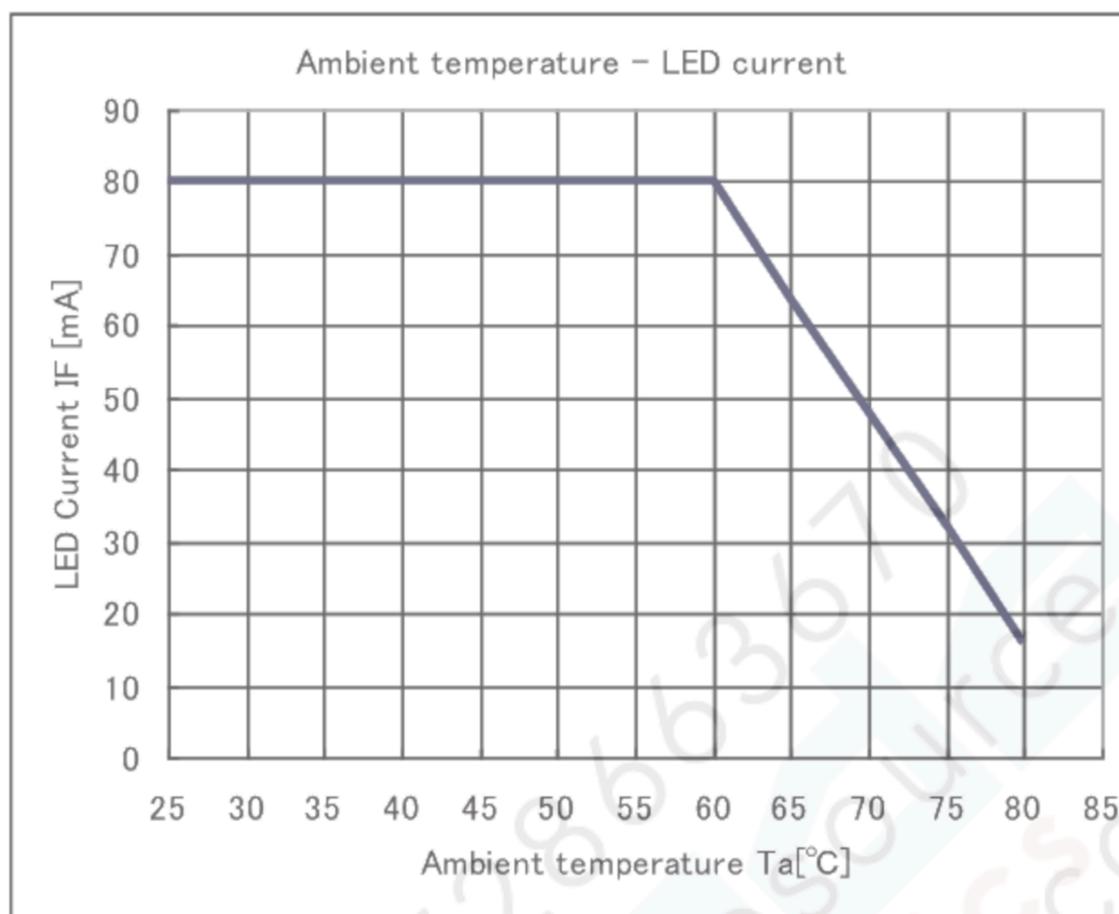
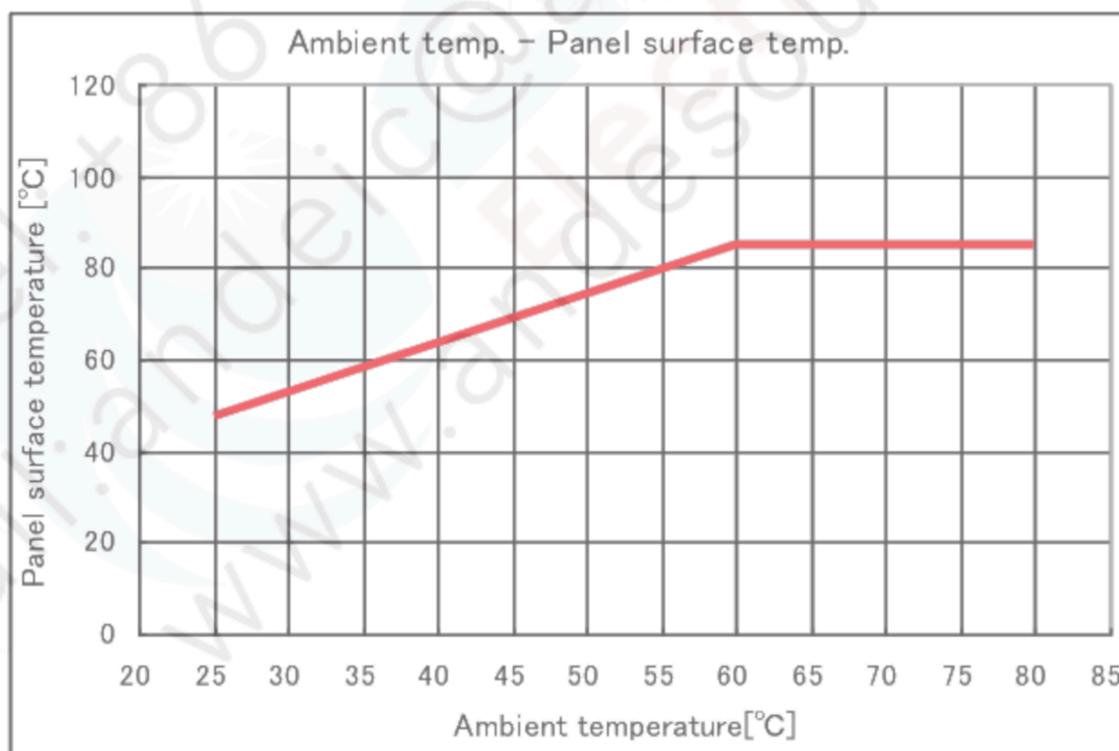


Fig.6-2 : Ambient temperature - Panel surface temperature



Note) Fig.6-2 is a result when it drives by Fig6-1

7. Electrical characteristics

7-1) TFT-LCD panel driving section

Table7-1 Recommended conditions

GND=0V, Ta=25 °C

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks	
Power supply of source part	Analog	AVDDM	-6.50	-6.37	-6.24	V		
		AVDDP	+6.24	+6.37	+6.50	V		
	Digital	VDD	+3.0	+3.3	+3.6	V		
	Rise time	Trise	-	-	10	ms	[Note7-1]	
	Voltage drop	VTH	2.5	-	-	V	[Note7-1]	
	Voltage drop time	Tvth	-	-	10	ms	[Note7-1]	
	Resupply voltage	Voff	0	-	0.1×VDD	V	[Note7-2]	
	Time of re-power supply	Tpon	10	-	-	ms	[Note7-2]	
Power supply of gate driver	TFT driving	Hi	VGH	+17.0	+17.5	+18.0	V	
		Lo	VGL	-15.0	-14.5	-14.0	V	
			VGH-VGL	-	-	+40.0		
	Logic	Hi	VDD	+3.0	+3.3	+3.6	V	
Power supply of grey image		V1~V14	-6.3	-	+6.3	V	[Note7-3]	
VCOM voltage		VCOM	-1.5	-0.85	0	V	[Note7-4]	

【Note7-1】 Please refer to Fig.7-1

【Note7-2】 When VDD was less than VTH, re-power supply is necessary.(Please refer to Fig7-2)
Please follow the Power OFF sequence.(Fig.9-1)

【Note7-3】 AVDDP>V1>V2>V3>V4>V5>V6>V7>GND>V8>V9>V10>V11>V12>V13>V14>AVDDM

【Note7-4】 please adjust VCOM so that contrast becomes the maximum and a flicker becomes the minimum for every module.
(please refer to page25 for VCOM adjustment method.)

Table7-2 Recommended grey scale voltage

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Grey scale voltage	V1	-	+ 6.30	-	V	
	V2	-	+ 4.74	-	V	
	V3	-	+ 3.96	-	V	
	V4	-	+ 3.50	-	V	
	V5	-	+ 3.15	-	V	
	V6	-	+ 2.07	-	V	
	V7	-	+ 1.81	-	V	
	V8	-	-1.71	-	V	
	V9	-	-1.97	-	V	
	V10	-	-3.05	-	V	
	V11	-	-3.4	-	V	
	V12	-	-3.86	-	V	
	V13	-	-4.74	-	V	
	V14	-	-6.30	-	V	

Table7-3 Electric characteristic

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Input voltage of source part	Hi input	VIHS	0.7×VDD	—	VDD	V
	Lo input	VILS	GND	—	0.3×VDD	V
	RSDS	VID	100	200	600	mV
	RSDS standard voltage range	VCM	0.5	1.2	VDD-1.1-VID/2	V
Input current of source part	Hi input	IIHS	—	—	150	μA
	Lo input	IILS	—	—	150	μA
Input voltage of gate part	Hi input	VIHG	0.7×VDD	—	VDD	V
	Lo input	VILG	GND	—	0.3×VDD	V
Input current of gate part	Hi input	IIHG	—	—	1	μA
	Lo input	IILG	—	—	1	μA

* The supply voltage condition is a range in Table 7-1.

* Please refer to Fig.7-1 “Power ON/OFF sequence”

Fig. 7-1: VDD waveforms

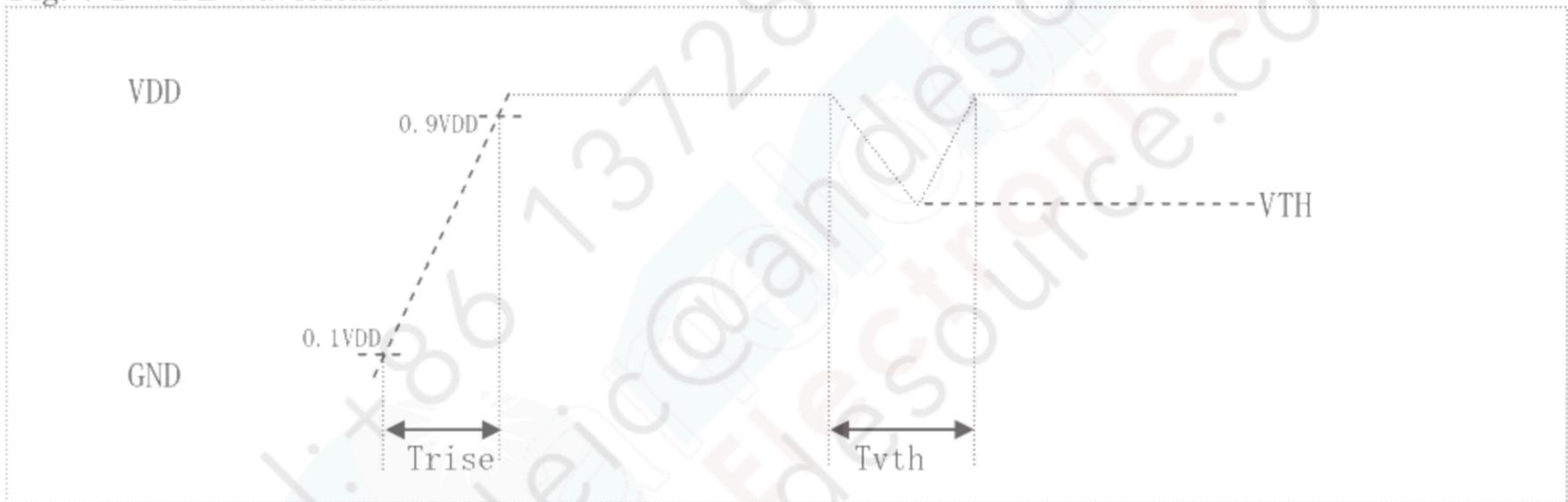
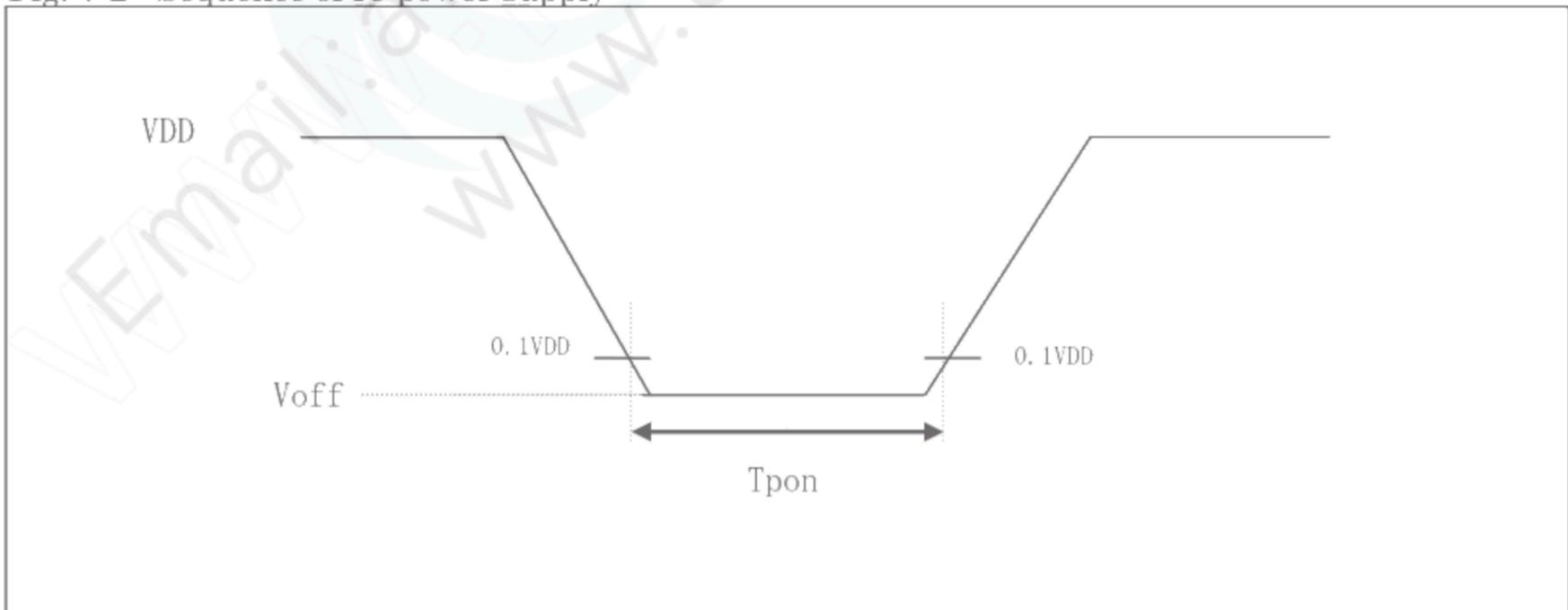
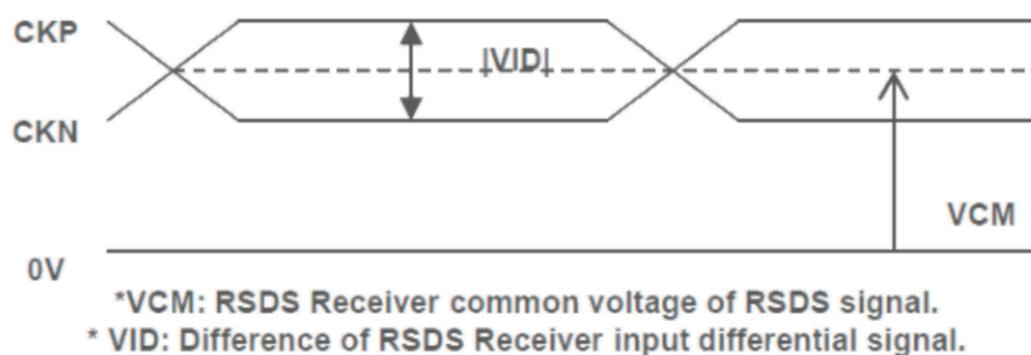


Fig. 7-2 : Sequence of re-power supply



【Note7-5】 SPLD,POL

【Note7-6】 D00P~D03P,D00N~D03N,D10P~D13P,D10N~D13N,D20P~D23P,D20P~D23N,CKP,CKN
Please refer to the following for VID and VCM.



【Note7-7】SP,LD,POL,D00P~D03P,D00N~D03N,D10P~D13P,D10N~D13N,D20P~D23P,D20P~D23N,CKP,CKN

【Note7-8】 GCK,GSP,GOE

7-2)Backlight driving section

Table 7-4 Recommended condition

Ta = +25°C

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Input voltage	Vf	31.4	36.5	42.6	V	Ta = +25°C [Note7-9,13]
	Vf-30	—	—	46.0	V	Ta = -30°C [Note7-10]
	Vf+85	30.3	—	—	—	Ta = +85°C [Note7-10]
Current consumption	If	—	80	90	mA	one line [Note7-11]
Power consumption	Wf	—	11.68	—	W	[Note7-12]

[Note7-9] In this case heat is balanced If=80mA by one line (twelve series).
(Reference value based on LED specifications)

[Note7-10] In this case If=80mA power supply ON by one line (twelve series).
(Reference value based on LED specifications)

[Note7-11] Please use the LED current within Fig 6-1.

[Note7-12] Reference, Wf = Vf x If x parallel qty.

[Note7-13] Only one Vf rank of LEDs will be used in one display.

8 Timing characteristics

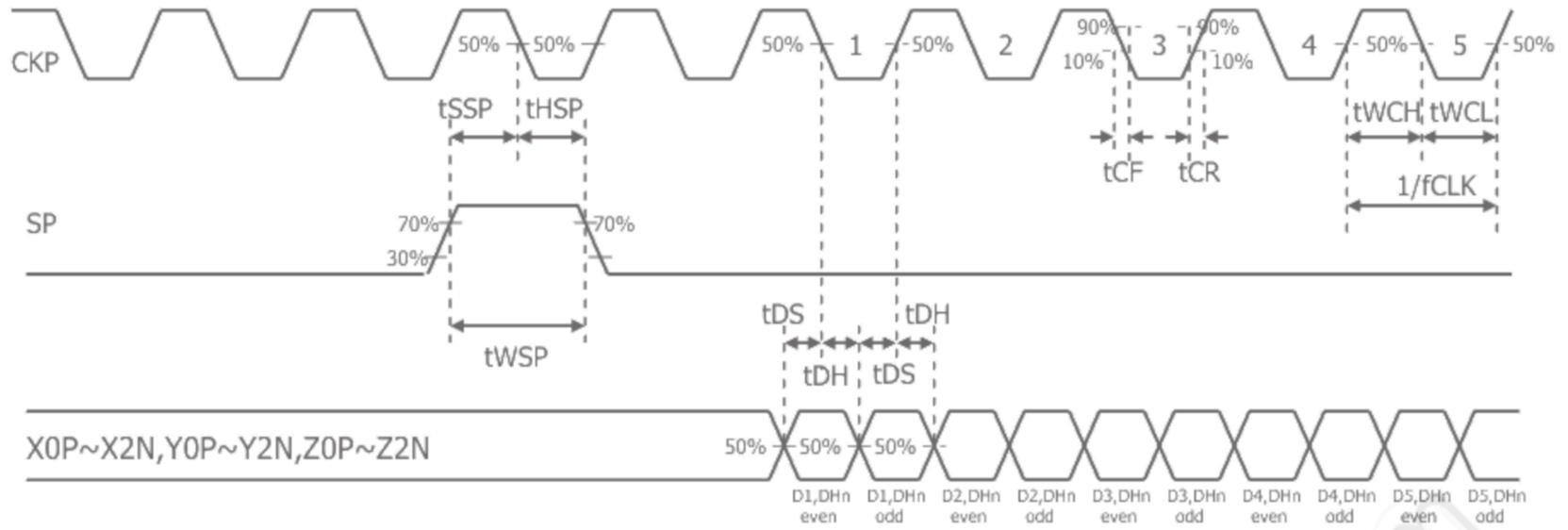
Timing diagrams of input signal are shown in Table 8.

Table 8 : Input signal timing

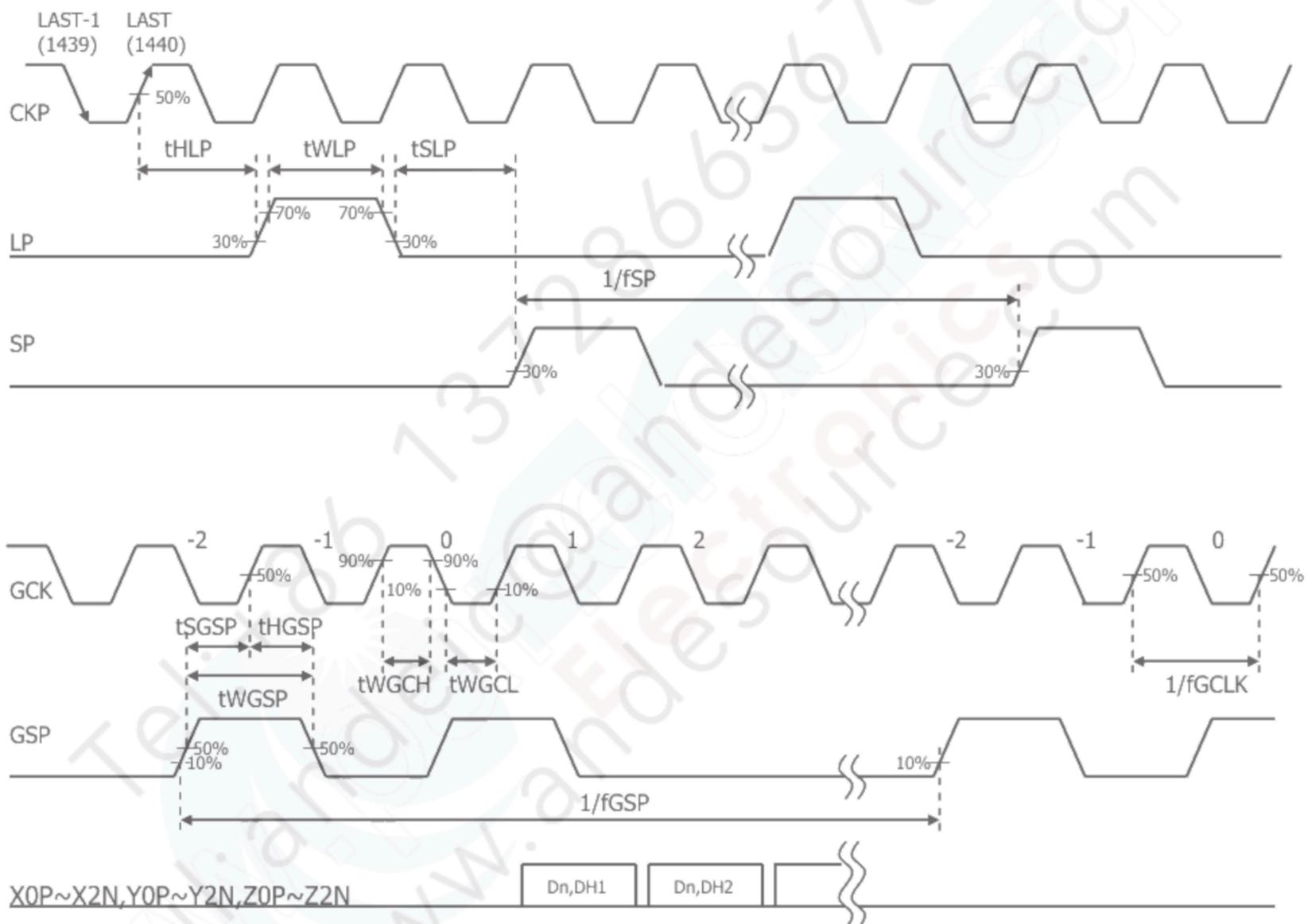
Ta = +25°C

【Note8-1】 The falling pulse in CKP is existed only 1 time during Hi period (tWSP) on start pulse.

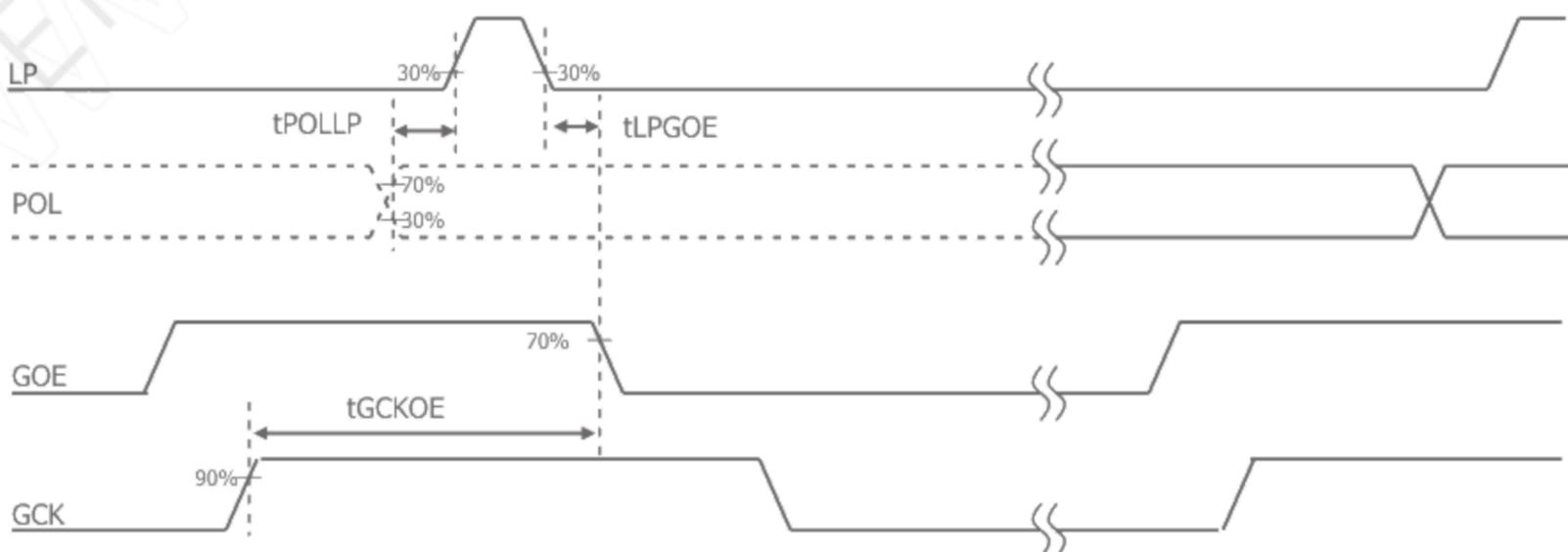
	Parameter	Symbol	MIN	TYP	MAX	Unit	Terminal
Source part	Operating Clock frequency	fCLK	44.58	54.15	59.37	MHz	CKP CKN
	High level clock width	tWCH	7	—	—	ns	
	Low level clock width	tWCL	7	—	—	ns	
	Clock rise time	tCR	—	—	3	ns	
	Clock fall time	tCF	—	—	3	ns	
	Start pulse frequency	fSP	27.5	33.3	36.4	kHz	SP [Note8-1]
	Start pulse set up time	tSSP	3	—	—	ns	
	Stat pulse hold time	tHSP	3	—	—	ns	
	Start pulse H width	tWSP	1	1	1	clk	
	Latch pulse fall → Stat pulse rise time	tSLP	1	—	—	clk	LP
	Last data → Latch Pulse rise time	tHLP	58	—	—	clk	
	Latch pulse H width	tWLP	2	—	—	μs	
	Data set up time	tDS	3	—	—	ns	
	Data hold time	tDH	3	—	—	ns	
Reverse change → Latch pulse rise time	tPOLLP	1	68	90	clk	POL	
Gate part	Operating Gate clock frequency	fGCLK	27.5	33.3	36.4	kHz	GCK
	Gate clock pulse L width	tWGCL	5	—	—	μs	
	Gate clock pulse H width	tWGCH	5	—	—	μs	
	Gate start pulse frequency	fGSP	50	60	65	Hz	GSP
	Gate start pulse set up time	tSGSP	1	—	—	us	
	Gate start pulse hold time	tHGSP	1	—	—	us	
	Gate start pulse width	tWGSP	200	—	—	ns	
	Latch pulse fall→GOE fall time	tLPGOE	-1	0	1	clk	GOE
	GCK rise→GOE fall time	tGCKOE	1	203	210	clk	



Data sampling would begin from the second falling edge of CKP after SP is sampled.



Please input GSP in skip 2pluse like an upper figure.

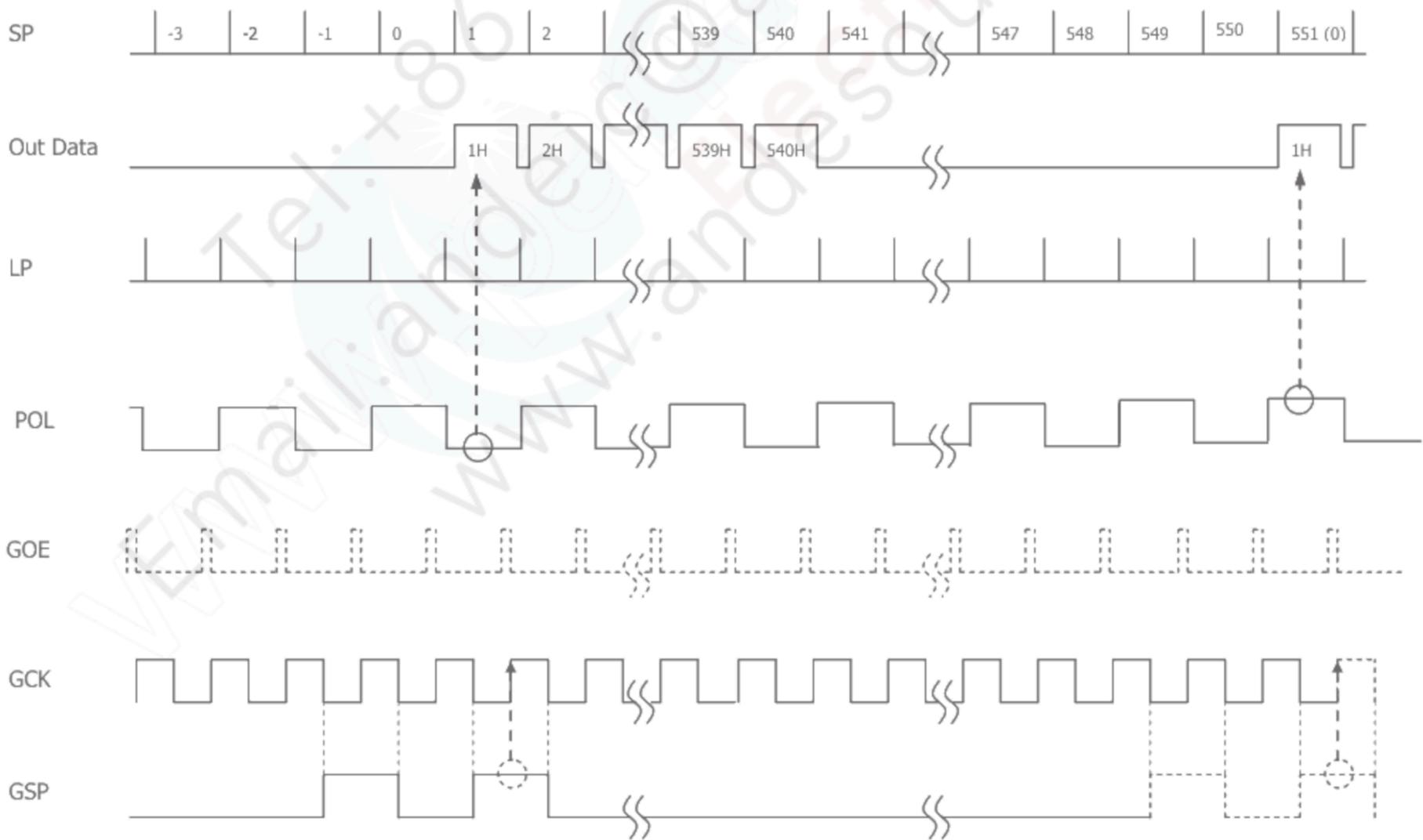


The example of the timing chart

Horizontal timing chart



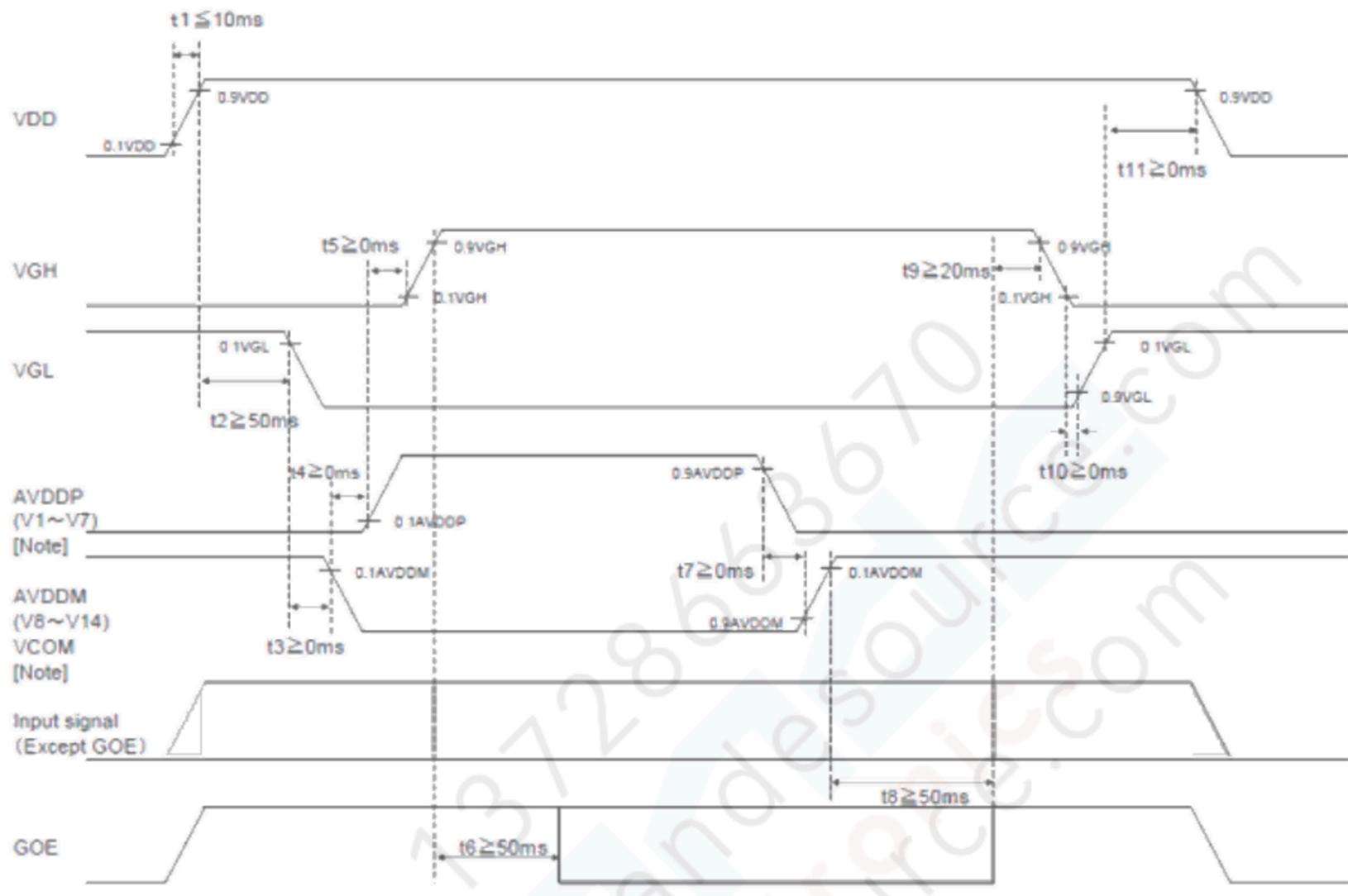
Vertical timing chart



9 Power ON/OFF sequence

Fig.9 -1.:Power ON/OFF sequence

Power ON/OFF sequence must be done by the following sequence.



[Note] AVDDP>V1>V2>V3>V4>V5>V6>V7>GND
GND>V8>V9>V10>V11>V12>V13>V14>AVDDM

10. Current consumption

A rule about the Current consumption is shown in Table10.

Table10

Ta = 25°C

Parameter		symbol	Voltage conditions	Min	Typ	Max	Unit
Current for source driver	Analog	IDDM	AVDDM=-6.37V	-	36	50	mA
		IDDP	AVDDP=+6.37V	-	34	50	mA
	Digital	IDD	VDD=+3.3V	15	34	50	mA
Current for gate driver	Hi	IGH	VGH=+17.5V	-	0.7	1	mA
	Lo	IGL	VGL=-14.5V	-	0.7	1	mA
Panel		ICOM	VCOM=-0.85V	-	0.02	0.1	mA

Note) Max current condition :

Display pattern : White screen (GS255)

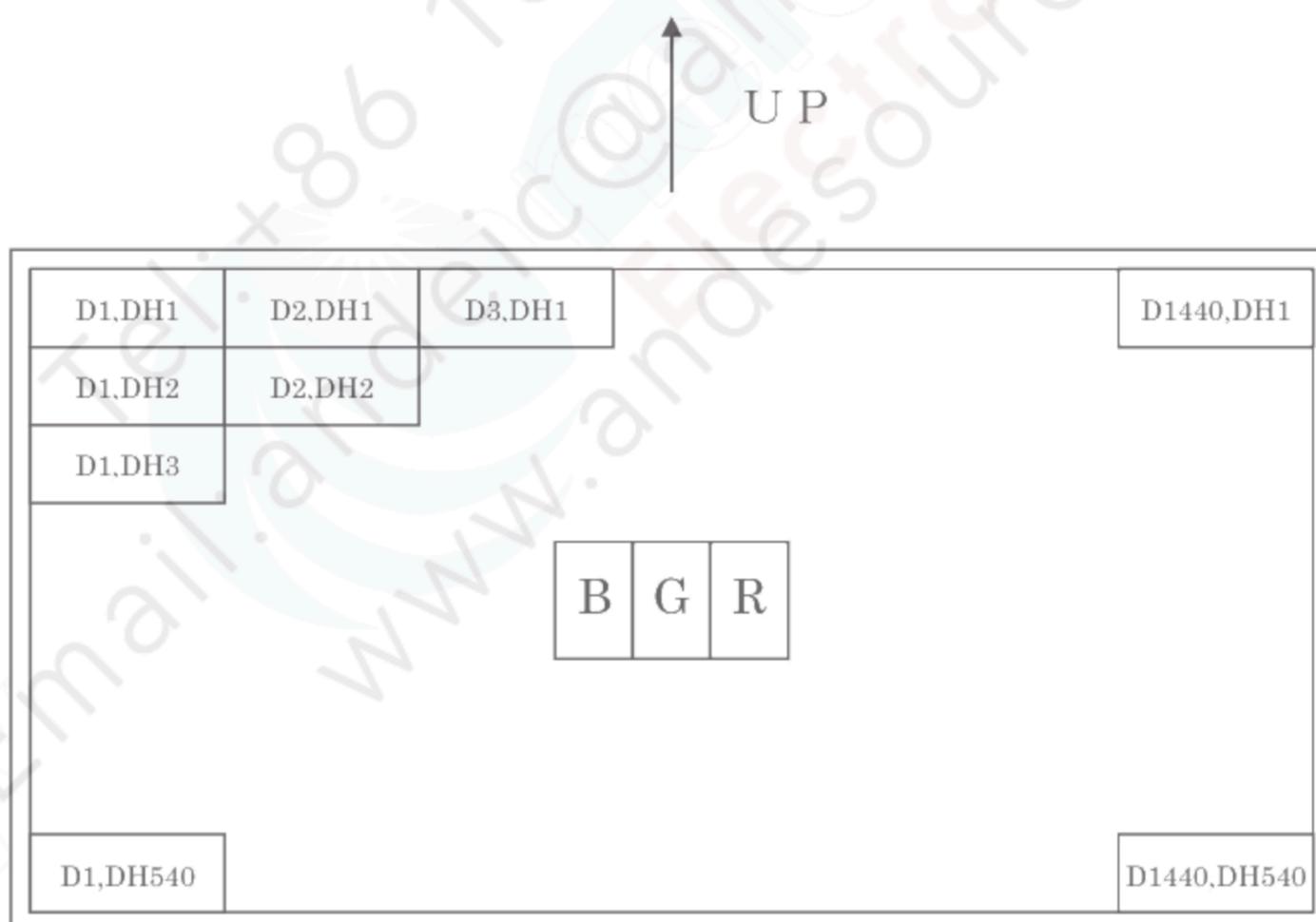
Timing: fCLK=54.15MHz, fH=33.3kHz, fV=60Hz,

In addition, It is defined by follows.

fH : Frequency of Horizontal synchronous signal (Frequency of HSY) $fH=1/tH(t)$

fV : Frequency of Vertical synchronous signal (Frequency of VSY) $fV=1/(tH(t)*tV)$

11. Input Data Signals and Display Position on the screen



Display position of input data (H,V)

12. Input Signals, Basic Display Color and Grey Scale of Each Color

Table12

Colors & Grey scale	Grey 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
Grey 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
Grey 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
Grey 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 255 grey scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.

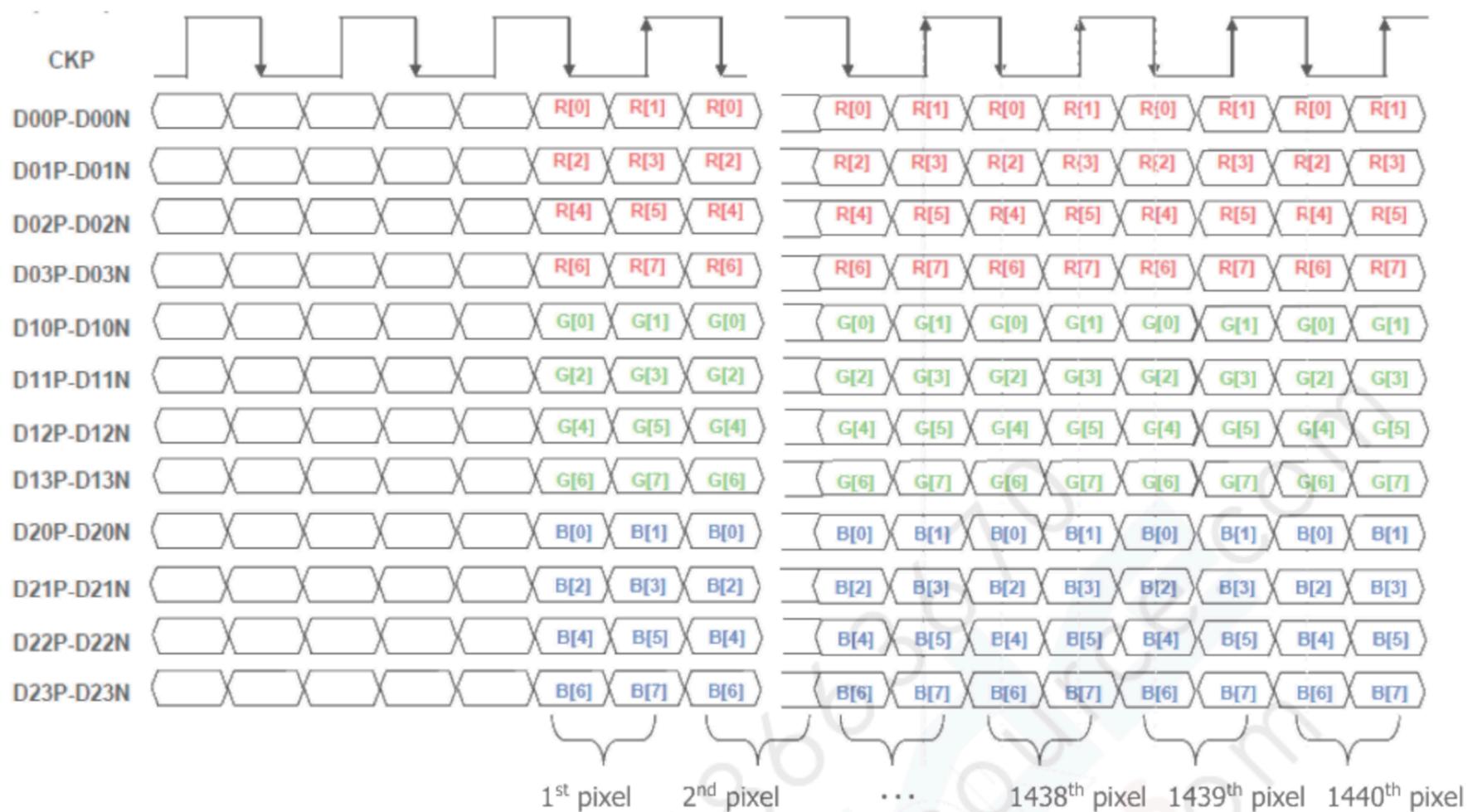


Fig.12-1 Timing Diagram

13. Optical characteristics [initial value]

Table 13

Ta=25°C

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	Notes	
Viewing angle range	θ21,θ22	10 ≤ CR	70	80	—	°(degree)	【Note 13-1,2,8】	
	θ11, θ12		70	80	—	°(degree)		
	θ21, θ22, θ11, θ12	200 ≤ CR	20	—	—	°(degree)		
Contrast ratio	CR	Perpendicular	500	1700	—		【Note 13-2,8】	
Response time	Ta= +25°C	τ r+ τ d	θ = 0°	—	15	40	ms	【Nte 13-3,8】
		τ G2G		—	80	120	ms	
	Ta= -30°C	τ r+ τ d	θ = 0°	—	380	720	ms	
		τ G2G		—	2000	3300	ms	
Luminance uniformity (White)	Lmin/Lmax	θ = 0° 9point	75	85	—	%	【Note 13-7,8】	
Gamma (At each gray scale)	γ 191	θ = 0° 【Note 13-8】	1.90	2.30	2.70		Gray scale 191	
	γ 127		1.90	2.20	2.50		Gray scale 127	
	γ 63		2.05	2.40	2.75		Gray scale 63	
	γ 31		2.65	3.00	3.35		Gray scale 31	
	γ 16		2.45	2.80	3.15		Gray scale 16	
	γ 8		2.10	2.45	2.80		Gray scale 8	
	γ 4		1.85	2.20	2.55		Gray scale 4	
White Luminance	Y		550	690	—	cd/m ²	【Note 13-4,8】	
Chromaticity	White	x	0.263	0.303	0.343		【Note 13-4,6,8】	
		y	0.293	0.333	0.373			
	Red	x	0.613	0.643	0.673		【Note 13-4, 8】	
		y	0.303	0.333	0.363			
	Green	x	0.269	0.299	0.329			
		y	0.575	0.605	0.635			
	Blue	x	0.117	0.147	0.177			
		y	0.031	0.061	0.091			
NTSC ratio	-		—	72	—	%		【Note 13-4,8】
Angular Colour shift threshold	θ21 (40°)	If=80mA (per one line)		0.015		Δi'v'		reference value
	θ22 (-40°)			0.015				
	θ12 (30°)			0.009				
	θ11 (-25°)			0.006				
LED Life Time	-	continuation	10,000	—	—	hour	【Note 13-5,8】	

*Measuring after 30minutes operation. The measurement of the optical character is measured by using the method of fig.13-1 and fig.13-2 under the condition which is equal to the darkroom or the darkroom.

*After LED power on, luminance reaches 50% or above in 0.5sec, and 90% or above in 3sec.

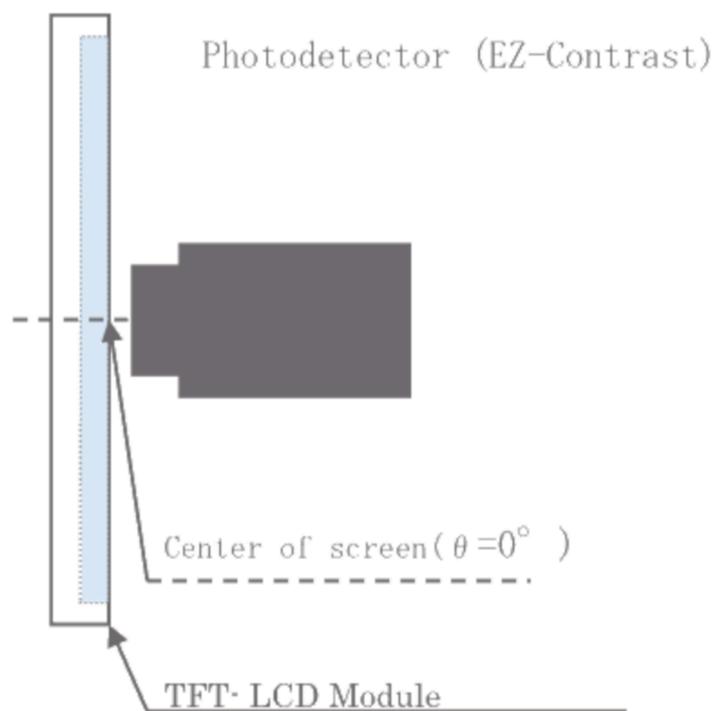


Fig13-1 Viewing angle / Range measurement method

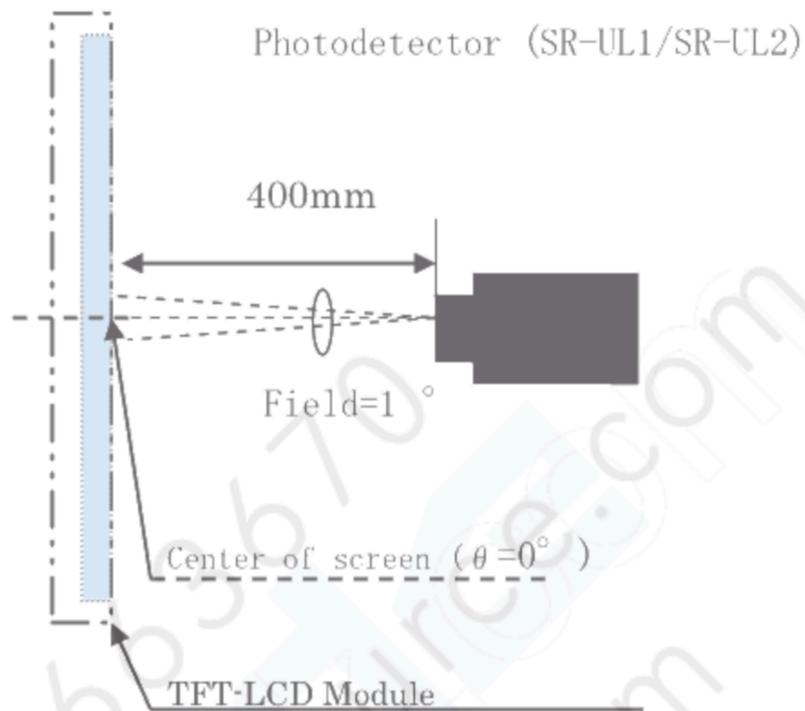
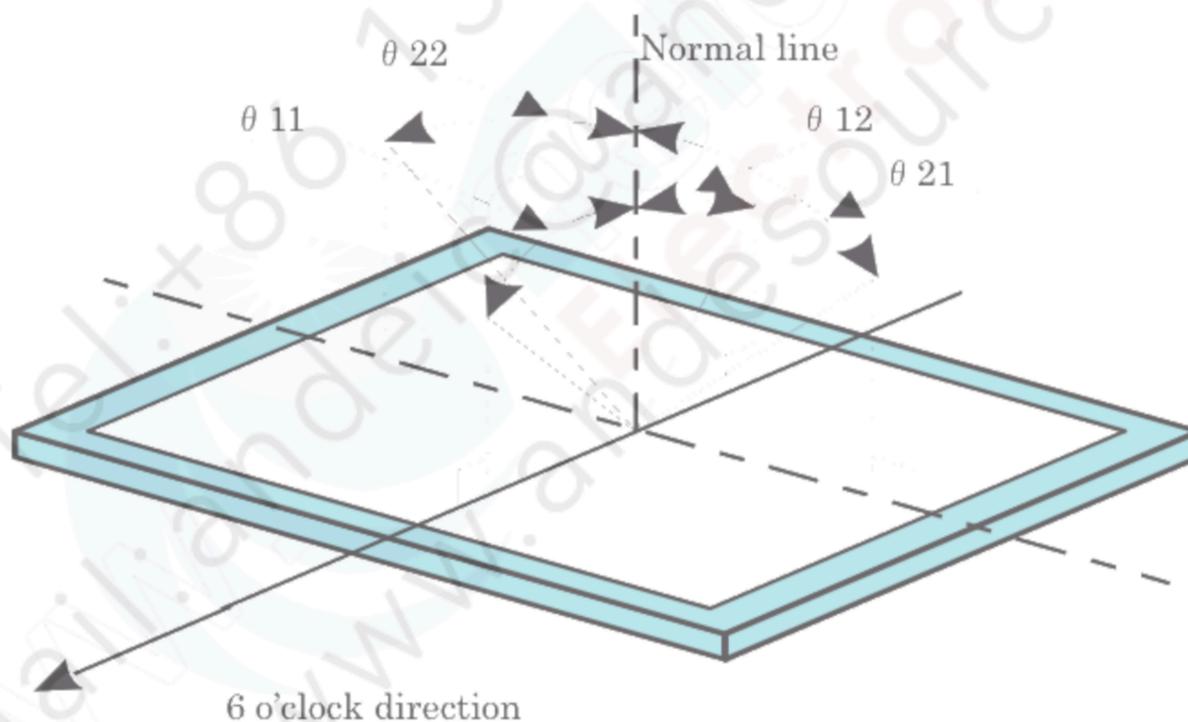


Fig13-2 Luminance / Chromaticity / Contrast measurement method

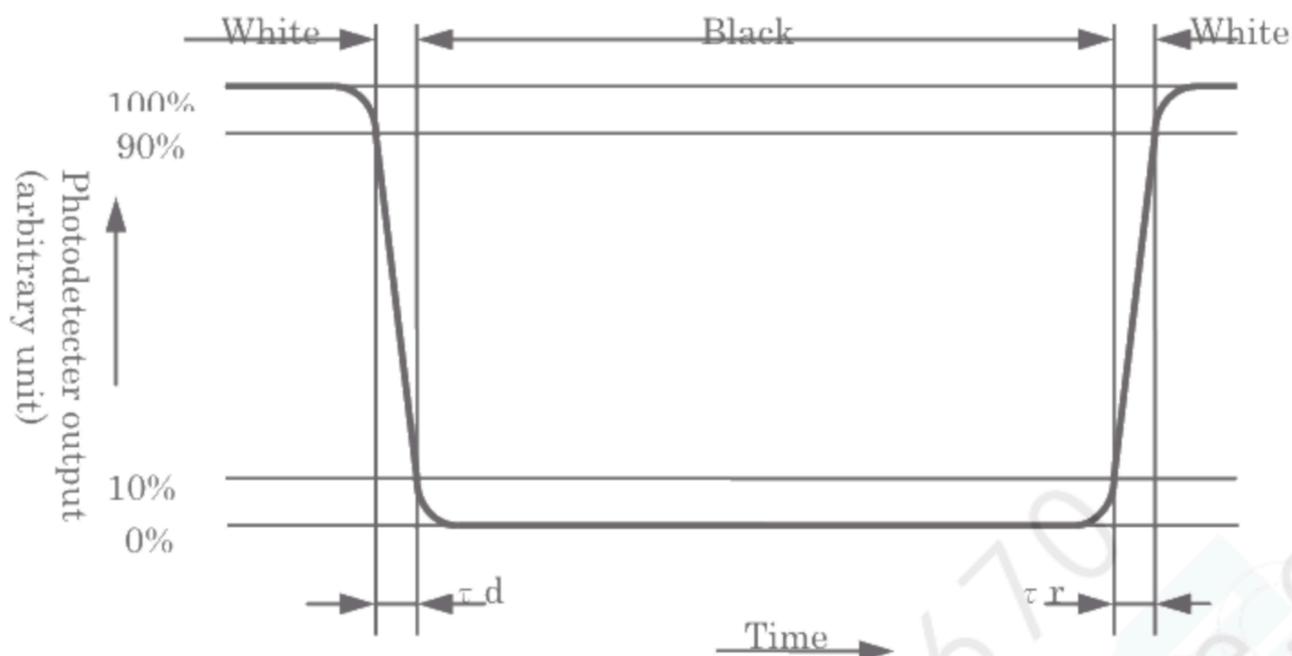
【Note 13-1】 Viewing angle range is defined as follows.



【Note 13-2】 Contrast ratio of transmission is defined as follows:

$$\text{Contrast ratio(CR)} = \frac{\text{Photo detector output with LCD being "white"(GS255)}}{\text{Photo detector output with LCD being "black"(GS0)}}$$

【Note 13-3】 Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".

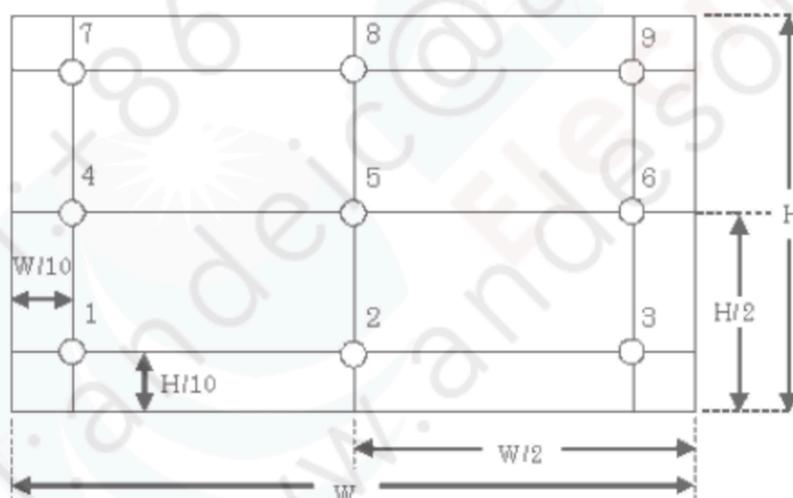


【Note 13-4】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter SR-UL1/SR-UL2.(After 30 minutes operation)

【Note 13-5】 LED life time is defined as the time when the brightness of the panel not to become less than 50% of the original value in the continuous operation under the following condition.

- ① LED current $I_f=80\text{mA}$ and PWM dimming 100%~5%.
- ② $T_a=25^\circ\text{C}$ for 95% of test time, $T_a=60^\circ\text{C}$ for 5% of test time.

【Note 13-7】 Luminance uniformity is defined as follows



The measurement of Luminance measures nine points of the above figure.

The maximum and minimum luminance is chosen as a result.

$$\text{Luminance uniformity} = \text{Minimum Luminance} / \text{Maximum Luminance} (\%)$$

【Note 13-8】 Adjust the power supply voltage level to the following value.

$$AVDDP=6.37, AVDDM=-6.37$$

$$V1=6.30, V2=4.74, V3=3.96, V4=3.50, V5=3.15, V6=2.07, V7=1.81,$$

$$V8=-1.71, V9=-1.97, V10=-3.05, V11=-3.4, V12=-3.86, V13=-4.74, V14=-6.30$$

14. Display quality

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

15. Mechanical characteristics

15-1) External appearance

The appearance security domain becomes the active area. (See Fig.4)

15-2) Panel: Surface Compression Strength

- Panel Fracture: The panel must not break at 19N pressure on the center applied by a smooth surface of 15mm diameter.

(Note) No matter how little its weight is, it may interfere with the function if any pressure is applied for a long time on the viewing area.

- Surface treatment of Polarizer is Anti-glare(AG). And the surface hardness of polarizer is 3H.

11-3) Input connector performance:

A) FPC for TFT panel driving parts

- (1) Applied Connector: 04 6288 064 000 846+(KYOCERA)

16. Handling instructions

16-1) Handling of LED-FPC

- ① Please do not hang the LCD module by the LED-FPC or apply excessive force on the LED-FPC.
- ② Please do not fold the LED-FPC. Please follow Sharp's FPC handling recommendations for bending the LED-FPC and under all circumstances ensure the minimum bend radius guideline of 0.5mm is observed.

16-2) Mounting of module

- ① The TFT-LCD module is designed to be mounted on equipment using the mounting tabs at the rear side.

On mounting the module, as the M3 screw is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.

(fastening torque is Max 1.5 N·m as design target, screw number is "1 030 052 670".)

Don't allow the pressure from the touch switched besides the display module (if any) to impact the module directly. Such external stress can cause image distortion.

- ② Be sure to turn off the power supply when inserting or disconnecting the cable.
- ③ Please ensure that the LCD metal case is grounded in the system design.

16-3) Precautions in mounting

Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

Protective sheet is applied on the surface to protect it against scratches and dirties.

It is recommended to peel off the protective sheet immediately before the use, taking care of static electricity Precautions in peeling off protective sheet.

A) Working environment

When the protective sheet is peeled off, static electricity may cause dust to stick to the polarizer surface.

To avoid this, the following working environment is desirable.

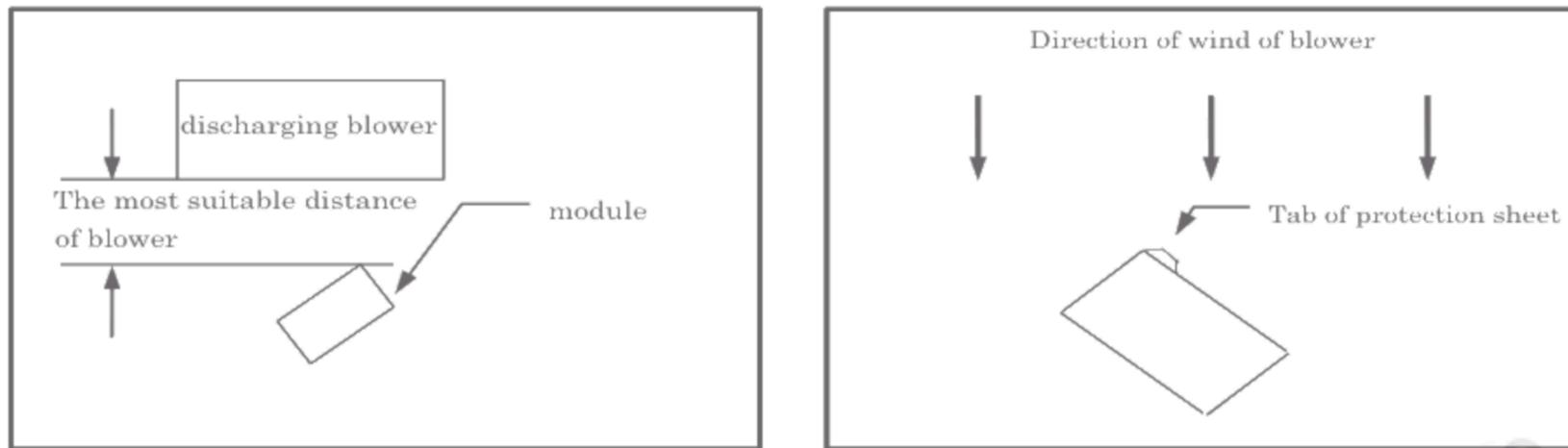
- a) Floor: Conductive treatment of 1MΩ or more on the tile.
(conductive mat or conductive paint on the tile)

- b) Clean room free from dust and with an adhesive mat on the doorway.

- c) Advisable humidity: 50%~70% Advisable temperature: 15°C~27°C

- d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

B) Working procedures



- a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently.
Please set the distance between module and discharging blower the most suitable distance of blower.
- b) Peel off protective sheet, pulling tab of protection sheet slowly to your side.
- c) On peeling off the protective sheet, pass the module to the next work process to prevent the module to get dust.
- d) Method of removing dust from polarizer
 - Blow off dust with ionized air blower for which static electricity preventive measure has been taken.
 - Since polarizer is vulnerable, wiping should be avoided.
But when the panel has stain or grease, we recommend to use soft cloth like SAVINA MX or equivalent any cloth can be used.

When metal part of the TFT-LCD module (shielding case and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirties, wipe the part, breathing on it.

Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.

TFT-LCD module and Touch panel uses glass which breaks or cracks easily if dropped or bumped on hard surface.

Handle with care. Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

16-4) Caution of product design

Please following items strictly when the product is designed by using this module.

- The LCD module shall be protected against water salt-water by the waterproof cover..
- Please take measures to ensure electromagnetic radiation from module does not cause interfere to operation of surrounding appliances.
- About the FPC/FFC design of the LCD panel drive input part, please refer to recommended FPC/FFC dimensions of input connector which 04 6288 064 000 846+(KYOCERA). In addition, we recommend the terminals of FFC/FPC be of gold or gold plated, because the contact points of the connector are gold plated.
- Customer mechanics should be designed to avoid possible reflection from the cutting surface of front case.

16-5) Others

- ① Do not expose the module to direct sunlight or intensive ultraviolet rays for several hours; liquid crystal is deteriorated by ultraviolet rays.
- ① Store the module at a temperature near the room temperature. At lower than the rated storage temperature, liquid crystal solidifies, causing the panel to be damaged. At higher than the rated storage temperature, liquid crystal turns into isotropic liquid and may not recover.

- ② If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is injurious, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.
- ③ Observe all other precautionary requirements in handling general electronic components.
- ④ When handling LCD modules and assembling them into cabinets, please avoid that long-terms 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 modules. Do not use the LCD module under such environment.
- ⑤ Be sure to adjust DC bias voltage of common electrode driving signal(VCOM) in the state of the last product. When not adjusted, it becomes the cause of a deterioration of display quality.
- ⑥ Please design the system ensuring that no load is applies directly to the display module. External load when applied directly on the display module can cause display distortion like pooling.
- ⑦ When carrying out PWM Dimming, a display noise may occur depending on Dimming frequency. Please fully inquire in the case of a products design.
Recommendation Dimming frequency : frequency multiplying of Frame rate or high-frequency(over 1k Hz)

17. Packing form

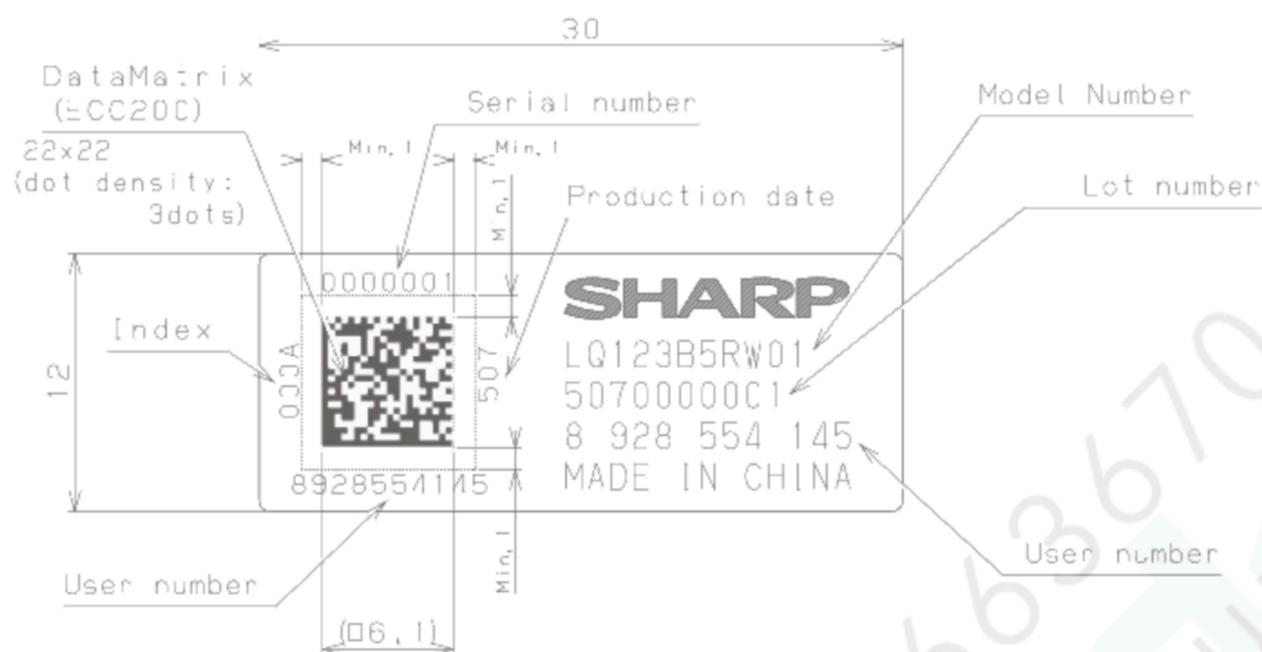
Please refer to Fig.17 "Packing form"

- a) Piling number of cartons : MAX 7
- b) Package quantity in one carton 8pcs
- c) Carton size: 574mm×389mm×223mm
- d) Total mass of one carton filled with full modules: 8.5Kg
- e) Recommended warehouse storage conditions
 - Environment
 - ①Temperature : 0~40℃
 - ②Humidity : 60%RH or less (at 40℃)
No dew condensation at low temperature and high humidity.
 - ③Atmosphere :Harmful gas, such as acid or alkali which corrodes electronic components and/or wires, must not be detected.
 - ④Period : about 3 months
 - ⑤Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

18.Indication of lot number label and MAT label

18-1.Lot number label

- ① Attached location of the label Please refer to Fig.4 (Outline dimensions)
- ② Indicated contents of the label



Data Matrix code

Production date	Serial number	User number	Index	Model number
3	7	10	4	19
5 0 7	0 0 0 0 0 0 1	8 9 2 8 5 5 4 1 4 5	0 0 0 A	L Q 1 2 3 B 5 R W 0 1

Contents of Lot number

- 1st figure: Production year (ex.2014→4)
- 2nd, 3rd figure: Production month (01,02,03...,09,10,11,12)
- 4th~10th figure: Sharp serial number

Note) Recommended reader is DS6708-SR20007ZZR(SYMBOL) and Reader's version is ECC200.

18-2.MAT label

- ① Attached location of the label Please refer to Fig.17 (Packing Form)
- ② Indicated contents of the label



No.	Data Field	2D-Code Data Matrix		1D-Barcode Code128		Printed Text		
		yes/no	Data Identifier	Contents	yes/no	Contents	yes/no	Contents
1	Label Version	yes	12S	0002	no		no	
2	Customer Part Number	yes	P	8928554145	no		yes	8928554145
3	Manufacturer Part Number	yes	1P	LQ123B5RW01X/Z	no		yes	LQ123B5RW01X/Z
4	Ordering Code	yes	31P	LQ123B5RW01	no		yes	LQ123B5RW01
5	Part Description (Part Name)	no			no		yes	12.3inch TFT-LCD
6	Manufacturer Number	yes	12V	690536925	no		no	
7	Manufacturer Location	yes	10V	JPN-OSAKA	no		yes	JPN-OSAKA
8	Revision Level/Index	yes	2P	000A	no		yes	000A
9	Additional Part Information	yes	20P		no		yes	
10	Date of Manufacturing	yes	6D	20150721	no		yes	20150721
11	Expiration Date	yes	14D	20180721	no		yes	20180721
12	RoHS	yes	30P	Y	no		Logo	
13	MS-Level	yes	Z	N	no		yes	N
14	Purchase Order Number	yes	K		no		yes	
15	Shipping Note Number	yes	16K	0	no		yes	0
16	Supplier Name	no			no		yes	SHARP CORPORATION
17	Supplier-ID	yes	V	59429	no		yes	59429
18	Package-ID	yes	3S	S014515721001	no		yes	S014515721001
19	Quantity	yes	Q	8NAR000	no		yes	8
20	Batch-Counter	yes	20T	1	no		no	
21	Batch-No. #1	yes	1T	20150721	no		yes	20150721
22	Batch-No. #2	yes	2T		no		yes	
23	Supplier Data	yes	1Z		no		no	
24	Partnumber@Vendor	no			yes	P8928554145@V0000059429	yes	P8928554145@V0000059429
25	Charge@Quantity	no			yes	H000000000020150721@Q00008	yes	H000000000020150721@Q00008

Date of Manufacturing and Batch-No.#1 packaging day (YYYYMMDD)
 Package-ID
 unique number for every box.

Data Matrix code

Prefix	DI	Label Version	DI	Customer Part Number	DI	Manufacturer Part Number	DI
[] > @ 0 6 : @ 1 2 S 0 : 0 0 2 @ P 8 9 2 8 5 5 4 1 4 5 @ 1 P L Q 1 2 3 B 5 R W 0 1 X / Y @							
DI	Ordering Code	DI	Manufacturer Number	DI	Manufacturer Location	DI	
3 1	P L Q 1 2 3 B 5 R W 0 1 @	1 2 V 6	9 0 5 3 6 9 2 5 @	1 0 V J P N - O S A K A @			
DI	Index	DI	Date of Manufacturing	DI	Expiration Date	DI	RoHS
2	P 0 0 0 A @	2 0 P @	6 D 2 0 1 5 0 7 2 1 @	1 4 D	2 0 1 8 0 7 2 1 @	3 0 P Y @	Z N @
DI	Supplier-ID	DI	Package-ID	DI		DI	
K @	1 6 K 0 @	V 5 9 4 2 9 @	3 S S 0 1 4 5 1 5 7 2 1 0 0 1 @				
DI	Quantity	DI	BC	DI	Batch-No. #1	DI	Suffix
Q	8 N A R 0 0 0 @	2 0 T 1 @	1 T	2 0 1 5 0 7 2 1 @	2 T @	1 Z @ @	

Note) Recommended reader is DS6708-SR20007ZZR(SYMBOL) and Reader's version is ECC200.

19.Fab locations

Panel production : Sharp (Mie factory) – Mie tech
 LCD assembly : WSEC(China)

20.About RoHS

This TFT-LCD module is RoHS complaint.

21.Disposal of module

Please take care to observe appropriate laws and regulations when disposing of this TFT-LCD product for any reason.

22. Reliability test condition

Table 21-1 Reliability test

No.	Test items	Test condition
1	High temperature storage test	Ta = +85°C 240h
2	Low temperature storage test	Ta = -40°C 240h
3	High temperature and high humidity operation test	Tp = +60°C, 90%RH 240h
4	Hi temperature operating test	Tp = +85°C 240h
5	Low temperature operating test	Ta = -30°C 240h
6	Electro static discharge test	±200V · 200pF(0Ω) 1 time for each terminals
7	Shock test	980m/s ² · 6ms, ±X ; ±Y ; ±Z 3 times for each direction
8	Vibration test	Frequency : 8~33.3Hz , Stroke : 1.3mm Frequency : 33.3Hz~400Hz,Acceleration : 29.4m/s ² Cycle : 15 minutes X,Z 2 hours for each directions, 4 hours for Y direction (total 8 hours)
9	Heat shock test	-30°C ~ +85°C , 200 cycles (0.5h) (0.5h)

Ta = Ambient temperature, Tp = Panel temperature

【Check items】

In the standard condition, there shall be no practical problems that may affect the display function.

【Note】

Definition of X, Y, Z direction is shown as follows

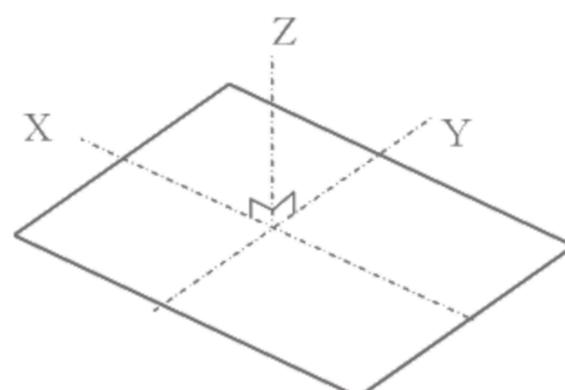


Fig.22 Definition of X, Y, Z

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



LEED 51003

11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



1000000

1000000

1000000

Rev	Description	Date	By	Appr
1	Initial Release	10/10/00	J. Smith	M. Jones
2	Minor Changes	11/10/00	J. Smith	M. Jones
3	Major Changes	12/10/00	J. Smith	M. Jones
4	Final Release	01/10/01	J. Smith	M. Jones

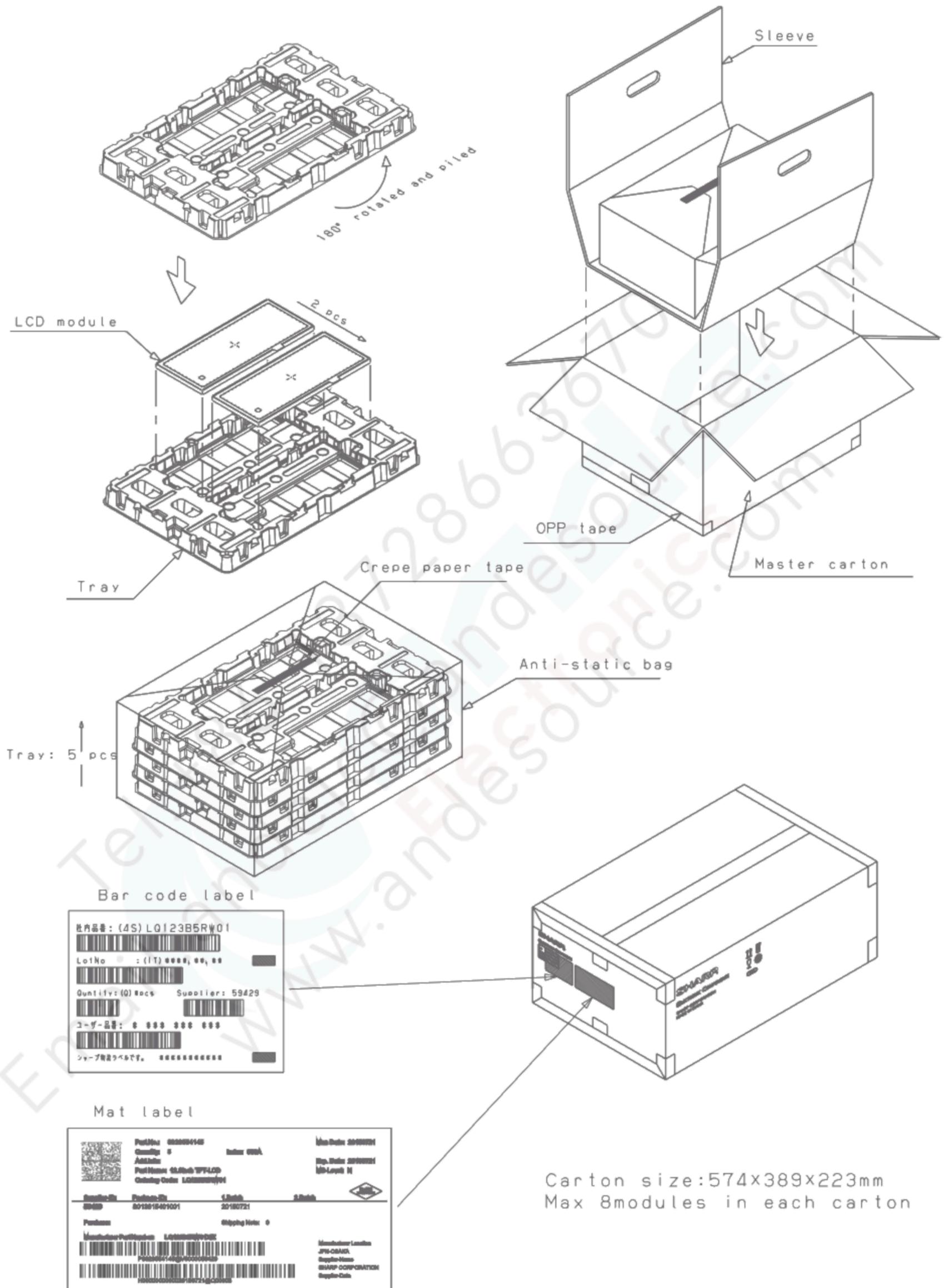


Fig17. Packing Form