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DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No. LQ065Y9RA01

CUSTOMER'S APPROVAL

DATE ____________________

BY ____________________

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TFT－LCD MODULE

LQ065Y9RA01

DEVICE SPECIFICATION

CONTENTS

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(1) Summary

This TFT-LCD module is a color active matrix LCD module incorporating amorphous silicon TFT.

An outline of the module is given in Table 4-1.

(2) Features

・SHARP SM-LCD panel and LED Backlight is adopted in this module.

・6bit RSDSTM *(Reduced Swing Differential Signaling) interface is adopted in this module.

・Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.

・The 6.5 screen produces a high resolution image that is composed of 384,000 pixels elements in a stripe arrangement.

・Graphics and texts can be displayed on a 800×3×480 dots panel with 262,144 colors by supplying 18 bit data signals(6 bit/color).

・This module features both transmissive and reflective display technology.

・Wide viewing field angle technology is employed.(The most suitable viewing angle is in the All directions.)

・Viewing angle control technology is employed.

・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 AG(antiglare)AR(antireflection) top polarizer.

・By COG method, realized a slim, lightweight, and compact module.

・Transparent intensity is raised by adoption of the rate LCD panel of a high aperture, a high transparently color filter, and a high transparently polarizing plate.

・An inverted video display in the vertical and horizontal directions is possible.

* RSDSTM is a trademark of National Semiconductor Corporation.

(3) Structure and Outline dimensions

Outline dimensions of the module are given in Fig.1.

Structure of the TFT-LCD module is given in Fig.2.

This TFT-LCD module is composed of the color TFT-LCD panel, driver ICs, FPC, frame, shielding front case, shielding back case and LED backlight unit.(LED circuit to drive the backlight is not built into this module.)

(4) Mechanical specifications

Table4-1

Parameter	Specifications	Units	Remarks
Screen size (Diagonal)	16.4 [6.5″]	cm	
Active area	143.4(W) × 79.32(H)	mm	
Display format	800 × RGB(W) × 480(H)	dots	
Dot pitch	0.05975(W) × 0.16525(H)	mm	
Pixel configuration	R,G,B Stripe configuration		
Display mode	Normally black		
Outline dimension	161.8(W) × 94.7(H) × 11.5(D)	mm	【Note4-1】
Mass	Max 215	g	

【Note4-1】Typical values are shown.

For detailed measurements and tolerances, please refer to Fig.1.

(Projection portions, Backlight harness, FPC are excepted.)

(5) I/O terminal name and functions

5-1) TFT-LCD panel driving part

Table5-1 Recommended connector : 502790 6091 (Molex)

Pin No.	Symbol	i/o	Description	Remarks
1	CS	—	CS Signal input	
2	CS	—	CS Signal input	
3	COM	—	COM Signal input	
4	COM	—	COM Signal input	
5	GND	—	Ground	
6	TH	o	Internal thermistor signal output	
7	VH	i	Gamma reference power supply	[Note5-3]
8	VL	i	Gamma reference power supply	[Note5-3]
9	VP1	i	Power supply of gray image(L15)	
10	VP2	i	Power supply of gray image(L31)	
11	VP3	i	Power supply of gray image(L47)	
12	VN1	i	Power supply of gray image(L15)	
13	VN2	i	Power supply of gray image(L31)	
14	VN3	i	Power supply of gray image(L47)	
15	VSHA	—	Power Supply of Source part	
16	VSHA	—	Power supply of Source part	
17	GND	—	Ground	
18	VDD	—	LCD Power Supply of Gate part	
19	GND	—	Ground	
20	VEE	—	LCD Power Supply of Gate part	
21	GND	—	Ground	
22	GSPOI	i/o	Gate start pulse signal	[Note5-2]
23	GCK	i	Gate clock pulse signal input	
24	GOE	i	Gate output enable signal input	
25	GSPIO	i/o	Gate Start Pulse Signal	[Note5-2]
26	R/L	i	Setting signal of vertical display position	[Note5-2]
27	VCCG	—	Power supply of gate part	[Note5-1]
28	GND	—	Ground	
29	VCCS	—	Power supply of source part	[Note5-1]
30	VCCS	—	Power supply of source part	[Note5-1]
31	SPOI	i/o	Source start pulse signal	[Note5-2]
32	LP	i	Source data transfer signal input	
33	REV	i	Polarity reversing signal of LCD output	
34	LBR	i	Setting signal of horizontal display position	[Note5-2]
35	SPIO	i/o	Source start pulse signal	[Note5-2]
36	GND	—	Ground	
37	X0P	i	Data Input signal(X0P)	[Note5-4]
38	X0N	i	Data Input signal(X0N)	[Note5-4]
39	X1P	i	Data Input signal(X1P)	[Note5-4]
40	X1N	i	Data Input signal(X1N)	[Note5-4]

Table5-1 (sequel)

Pin No.	Symbol	i/o	Description	Remarks
41	X2P	i	Data Input signal(X2P)	[Note5-4]
42	X2N	i	Data Input signal(X2N)	[Note5-4]
43	GND	—	Ground	
44	CKP	i	Source clock signal(CKP)	
45	CKN	i	Source clock signal(CKN)	
46	GND	—	Ground	
47	Y0P	i	Data Input signal(Y0P)	[Note5-4]
48	Y0N	i	Data Input signal(Y0N)	[Note5-4]
49	Y1P	i	Data Input signal(Y1P)	[Note5-4]
50	Y1N	i	Data Input signal(Y1N)	[Note5-4]
51	Y2P	i	Data Input signal(Y2P)	[Note5-4]
52	Y2N	i	Data Input signal(Y2N)	[Note5-4]
53	GND	—	Ground	
54	Z0P	i	Data Input signal(Z0P)	[Note5-4]
55	Z0N	i	Data Input signal(Z0N)	[Note5-4]
56	Z1P	i	Data Input signal(Z1P)	[Note5-4]
57	Z1N	i	Data Input signal(Z1N)	[Note5-4]
58	Z2P	i	Data Input signal(Z2P)	[Note5-4]
59	Z2N	i	Data Input signal(Z2N)	[Note5-4]
60	GND	—	Ground	

[Note5-1] VCCS and VCCG can input same level voltage.

[Note5-2] Setting signal of horizontal and vertical display position

	LBR	R/L	SPOI	SPIO	GSPOI	GSPIO
Normal displayed	Hi	Lo	Input	Output	Input	Output
Right/Left reverse mode	Lo	Lo	Output	Input	Input	Output
Up/Down reverse mode	Hi	Hi	Input	Output	Output	Input
Right/Left & Up/Down reverse mode	Lo	Hi	Output	Input	Output	Input

Caution) Hi=VCCS , Lo=GND(0V)

[Note5-3] Please set the following.

VH = VSHA, VL = GND (0V)

[Note5-4] Refer to (8), Table8-1, Fig8-1.

5-2）LED Backlight system driving part

Table5-2 Recommended connector : Hirose FH28-10S-0.5SH(10)

Pin No.	Symbol	Description	Remarks
1	TH	Internal thermistor signal output	Open（N.U.）
2	GND	Internal thermistor GND	Open（N.U.）
3	N.C.	OPEN	
4	N.C.	OPEN	
5	C3	LED power supply input 3 (－)	Cathode side 3
6	C2	LED power supply input 2 (－)	Cathode side 2
7	C1	LED power supply input 1 (－)	Cathode side 1
8	N.C.	OPEN	
9	A2	LED power supply input (＋)	Anode side
10	A1	LED power supply input (＋)	Anode side

[Note5-5] Don’t input the voltage to the N.C terminal.

(6) Absolute maximum ratings

Teble6-1 GND=0V

Parameter		Symbol	MIN	MAX	Unit	Remark
Power supply of source part	Analog	VSHA	−0.3	+6.0	V	Ta=25 °C
	Digital	VCCS	−0.3	+4.3	V	〃
Power supply of gate part		VDD	−0.3	+38.0	V	〃
		VCCG	−0.3	+6.0	V	〃
		VEE	−23.0	+0.3	V	〃
		VDD−VEE	−0.3	+38.0	V	〃
Input signal	Digital	VID	−0.3	VCCS(G)+0.3	V	〃,[Note6-1]
	Analog	VIA	−0.3	VSHA+0.3	V	〃,[Note6-2]
Common electrodedriving signal		COM,CS	−20	+35.0	V	〃,COM <35Vp-p
Power supply of LED Back Light		ILED	−	90	mA	〃,1line
Storage temperature		Tstg	−40	+95	°C	[Note6-3,4,7]
Operating temperature (LCD panel surface)		Topr1	−40	+85	°C	[Note6-3,4,5,7]
Operating temperature (Ambient temperature)		Topr2	−40	+85	°C	[Note6-6]

[Note6-1] SPOI,SPIO,X0P~X2P,X0N~X2N,Y0P~Y2P,Y0N~Y2N,Z0P~Z2P,Z0N~Z2N,LP,CKP,CKN,REV, LBR,GSPIO,GSPOI,GCK,R/L

[Note6-2] VH,VL,VP1,VN1,VP2,VN2,VP3,VN3

[Note6-3] This rating applies to all parts of the module and should not be exceeded.
Operating temp: -40 to -31 °C, does not provide a correct image on the LCD, but no damage of the display function will occur.

[Note6-4] Maximum wet-bulb temperature is 49 °C . Avoid dew condensation on the module.
Otherwise electrical current leaks will occur , and it cannot meet the specifications.

[Note6-5] The operating temperature guarantees only operation of the circuit. For contrast, speed of response, and other factors related to display quality are determined in the circumstances with Ta=＋25 °C.

[Note6-6] Ambient temperature when the backlight is lit (reference value).
At a temperature specified by the application LED current must be reduced in order to keep the agreed panel operating temperature of +85°C(max)

[Note6-7] Refer to Table 15-1.

(7) Electrical characteristics

7-1) TFT-LCD panel driving section

Table7-1 Recommended operating conditions GND=0V , Ta=25 °C

Parameter			Symbol	MIN	TYP	MAX	Unit	Remarks
Power supply of source driver	Analog		VSHA	+5.6	+5.7	+5.8	V	
	Digital		VCCS	+3.0	+3.3	+3.6	V	[Note7-1]
Power supply of gate driver	TFT driving	Hi	VDD	+14.5	+15.0	+15.5	V	
		Lo	VEEDC	−11.5	−12.0	−12.5	V	VEEDC Bias
			VEEAC		COM AC		Vp-p	[Note7-2]
	Logic	Hi	VCCG	+3.0	+3.3	+3.6	V	[Note7-1]
			VDD-VEE	−	−	+38V	V	
Power supply of gray image			VH,VL VP1,VN1 VP2,VN2 VP3,VN3	0	−	VSHA	V	[Note7-3]

[Note7-1] VCCS and VCCG can input same level voltage.

[Note7-2] VEE AC must be the same phase and amplitude as common electrode driving signal.

[Note7-3] VH>VP3>VP2>VP1>VL , VH>VN1>VN2>VN3>VL

Table7-2 Electric characteristic Ta=-40 °C ~+85 °C

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Input voltage of source part	Hi input	VIHS	0.7×VCCS	−	VCCS	V	[Note7-4]
	Lo input	VILS	GND	−	0.3×VCCS	V	
	Hi input	VIHRSDS	70	100	−	mV	[Note7-5]
	Lo input	VILRSDS	−	-100	-70	mV	
	RSDS standard voltage range	VCOM RSDS	GND+0.1	1.2	VCCS-1.2	V	
Input current of source part	Hi input	IIHS1	-60	−	−	μA	[Note7-6]
		IIHS2	-10	−	−	μA	[Note7-7]
	Lo input	IILS1	−	−	60	μA	[Note7-6]
		IILS2	−	−	10	μA	[Note7-7]
Input voltage of gate part	Hi input	VIHG	0.7×VCCG	−	VCCG	V	[Note7-8]
	Lo input	VILG	GND	−	0.3×VCCG	V	
Input current of gate part	Hi input	IIHG1	−	−	10	μA	VI=VCCG,[Note7-8]
		IIHG2	−	−	40	μA	VI=VCCG,[Note7-9]
	Lo input	IILG	−	−	10	μA	VI=GND,[Note7-8,9]
Common electrode driving signal	AC component	COM AC	−	±4.0	±5.0	V	
	DC component	COM DC	+0.5	−	+2.5	V	[Note7-10]
CS driving signal	AC component	CS AC	−	COM AC	−	V	[Note7-11]
	DC component	CS DC	−	COM DC	−	V	

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

[caution] Notes when power supply is turned on.

Please do a power supply on and the power-off in the following order.

Turn on VCCS, VCCG → VEE, Logic signal → VDD, VSHA, VH, VL, VP*, VN*

Turn off VSHA, VH, VL, VP* ,VN*, VDD → Logic signal, VEE → VCCS,VCCG

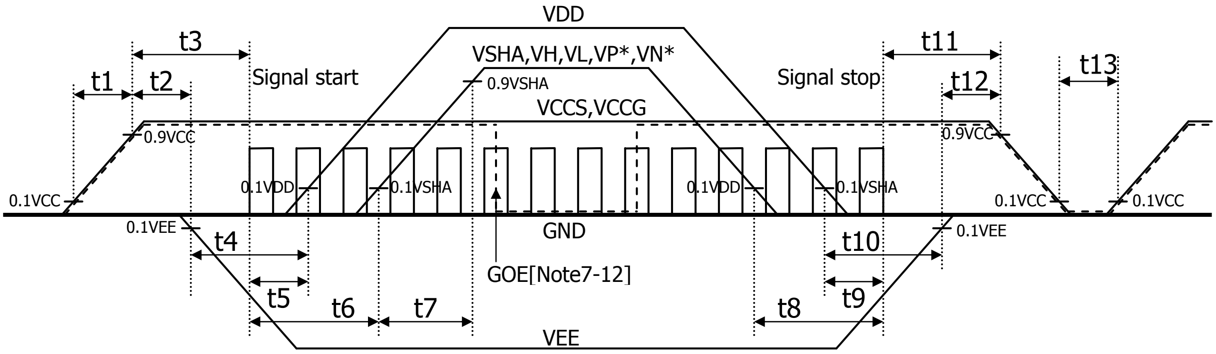


Table7-3　On-off conditions for supply voltage

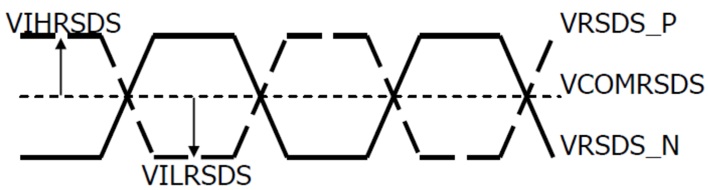
symbol	MIN	MAX	UNIT	symbol	MIN	MAX	UNIT
t1	0	10	ms	t8	0	－	ms
t2	10	－	us	t9	0	－	ms
t3	0	－	ms	t10	0	－	ms
t4	0	－	ms	t11	0	－	ms
t5	0	－	ms	t12	0	－	ms
t6	0	－	ms	t13	35	－	us
t7	0	50	ms				

[Note7-4] SPIO,SPOI,LP,LBR,REV

[Note7-5] X0P~X2N,Y0P~Y2N,Z0P~Z2N,CKP,CKN

Please refer to the following for VIHRSDS, VILRSDS, and VCOMRSDS.

RSDS Single end wave form



VRSDS_P:Wave form on P side of single end
VRSDS_N:Wave form on N side of single end

[Note7-6] LP, LBR, REV, X0P~X2N,Y0P~Y2N,Z0P~Z2N,CKP,CKN

[Note7-7] SPIO, SPOI

[Note7-8] GCK, GSPOI, GSPIO, GOE

[Note7-9] R/L

[Note7-10] Please switch polarity of COM AC for every one level scan and every one vertical scan. Moreover, please adjust COM DC so that contrast becomes the maximum and a flicker becomes the minimum for every module.

[Note7-11] CS AC must be the same phase and amplitude as common electrode driving signal.

[Note7-12] As for the power sequence for GOE, it is recommended to keep it at high voltage until after all power supplies rise in power on sequence, and before all power supplies start to fall off and more than 1 frame after displaying black screen in power off sequence.
Otherwise display image may get disturbed, although no harm to the module itself.

7-2) LED backlight unit driving section

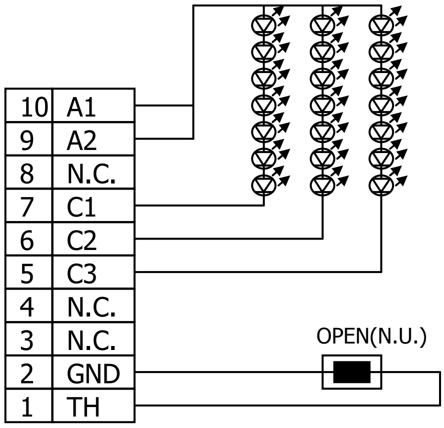
The backlight system is edge-lighting type with 21 White-LED(White Light Emitting Diode).

Table7-4 Ta=25°C

Parameter	symbol	MIN	TYP	MAX	UNIT	Remark
Input Voltage	VLED	18.5	20.5	23.0	V	iLED=60mA (1Line)
Current consumption	ILED	-	0.18	0.27	A	Total current value
Power consumption	WLED	-	3.69	-	W	
Variation of VLED	-	18.0	-	24.5	V	Tp=-30-+85℃/ILED=60mA
Number of circuit strings	—	—	3	—	—	[Note7-13]
Specification of LED-Type	white LED					

[Note7-13] The LED backlight is composed by 3 strings from which 7 LED is connected with the series.

The figure below shows the circuit chart of each string.



7-3) Temperature monitoring interface

Temperature Sensor Thermister Type : TH11-3T223GT made by MITSUBISHI MATERIALS CORPORATION

Table7-5 (Reference data)

Temperature °C	R-Thermistor kΩ (AVE)	Remark	Temperature (C	R-Thermistor k. (AVE)	Remark
–	–	[Note7-14]	40	11.93	[Note7-14]
-40	568.60		50	8.165	
-30	326.60		60	5.71	
-20	193.90		70	4.07	
-10	115.10		80	2.96	
0	69.41		90	2.19	
10	42.97		100	1.65	
20	27.32		110	1.26	
30	17.83		120	0.97	

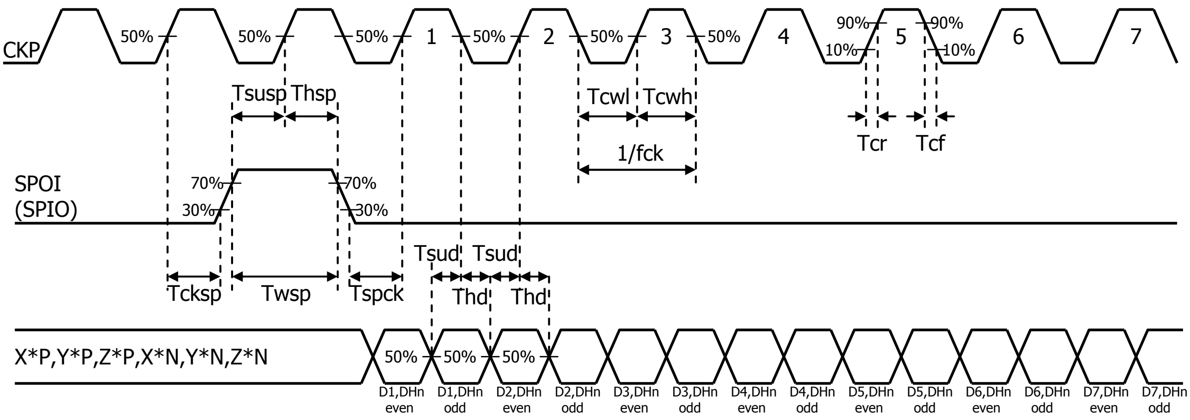
[Note7-14] The above-mentioned value is a characteristic value of the thermally sensitive resistor unit at LED backlight off. Please confirm the characteristic in the state of the product when using it.

7-4) AC characteristics of input signals

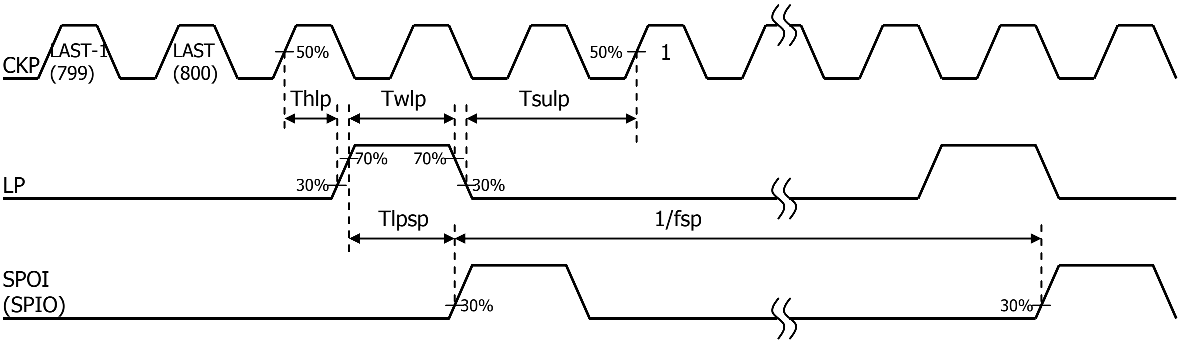
Table7-6 VCCS、VCCG=3.3V,VSHA=5.7V,GND=0V,Ta=25℃

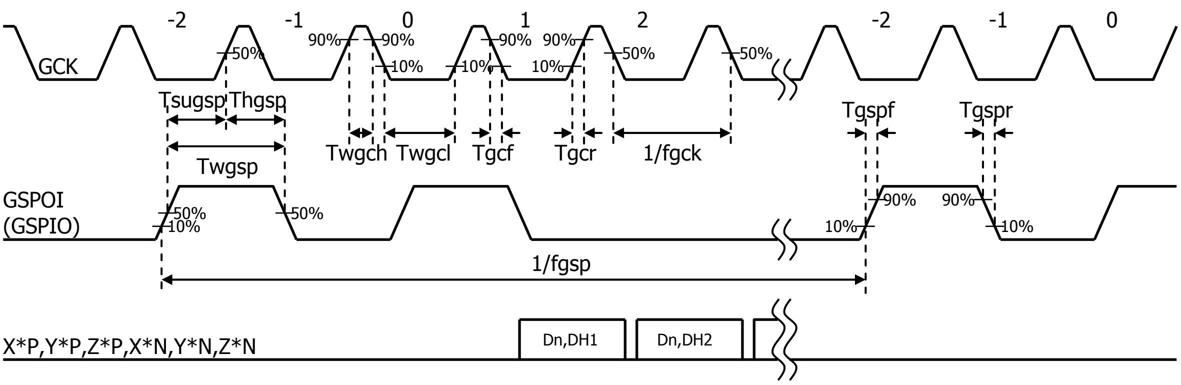
Parameter		Symbol	MIN	TYP	MAX	Unit	Terminal
Source part	Operating Clock frequency	fck	—	26.2	60	MHz	CKP CKN
	High level clock width	Tcwh	6	—	—	ns	
	Low level clock width	Tcwl	6	—	—	ns	
	Clock rise time	Tcr	—	—	5	ns	
	Clock fall time	Tcf	—	—	5	ns	
	Start pulse frequency	fsp		30	200	kHz	SPOI ,SPIO [Note7-15]
	Start pulse set up time	Tsusp	1	—	—	ns	
	Start pulse hold time	Thsp	2	—	—	ns	
	CKP rise time → Start pulse rise time	Tcksp	6	—	—	ns	
	Start pulse fall time → CKP rise time	Tspck	3	—	—	ns	
	Start pulse H width	Twsp	1	—	2	Tcwh(l)	
	Latch pulse set up time	Tsulp	5	—	—	ns	LP
	Latch pulse hold time	Thlp	6	—	—	ns	
	Latch pulse H width	Twlp	1/fck	—	—	ns	
	Latch pulse Start pulse set up time	Tlpsp	1/fck	—	—	ns	
	Data set up time	Tsud	3	—	—	ns	X0P~X2N,Y0P~Y2N ,Z0P~Z2N
	Data hold time	Thd	2	—	—	ns	
Gate part	Operating Gate clock frequency	fgck	—	30	200	kHz	GCK
	Gate clock pulse L width	Twgcl	25	—	—	μs	
	Gate clock pulse H width	Twgch	1	—	—	μs	
	Gate clock rise time	Tgcr	—	—	100	ns	
	Gate clock fall time	Tgcf	—	—	100	ns	
	Gate start pulse frequency	fgsp	—	60	65	Hz	GSPIO GSPOI
	Gate start pulse set up time	Tsugsp	100	—	—	ns	
	Gate start pulse hold time	Thgsp	100	—	—	ns	
	Gate start pulse width	Twgsp	200	—	—	ns	
	Gate start pulse rise time	Tgspr	—	—	100	ns	
	Gate start pulse fall time	Tgspf	—	—	100	ns	
GCK rise → COM change time		Tgckcom	2.5	—	—	μs	GCK COM,CS,VEE REV LP
COM change→ Reverse change time		Tcomrev	0	—	—	μs	
COM signal rise time		Tcomr	—	—	2	μs	
COM signal fall time		Tcomf	—	—	2	μs	
Reverse change→ Latch pulse rise time		Trevlp	300	—	—	ns	

[Note7-15] The rising pulse in CKP is existed only 1 time during Hi period (Twsp) on start pulse.

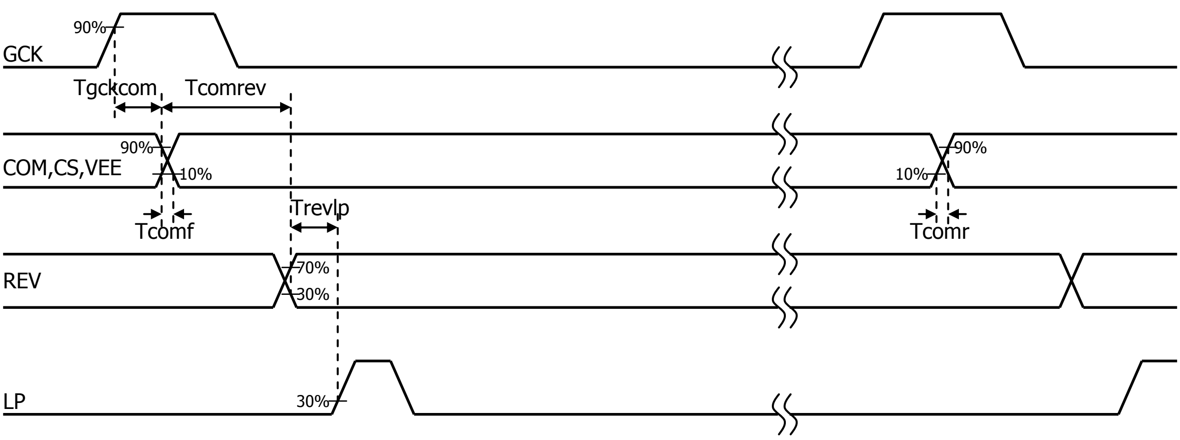


Begin the uptake of data with the rise of the 1st CKP after having taken in the high voltage of SPOI(SPIO) by a rise of CKP。 Refer to Fig8-1,8-2,8-3,8-4



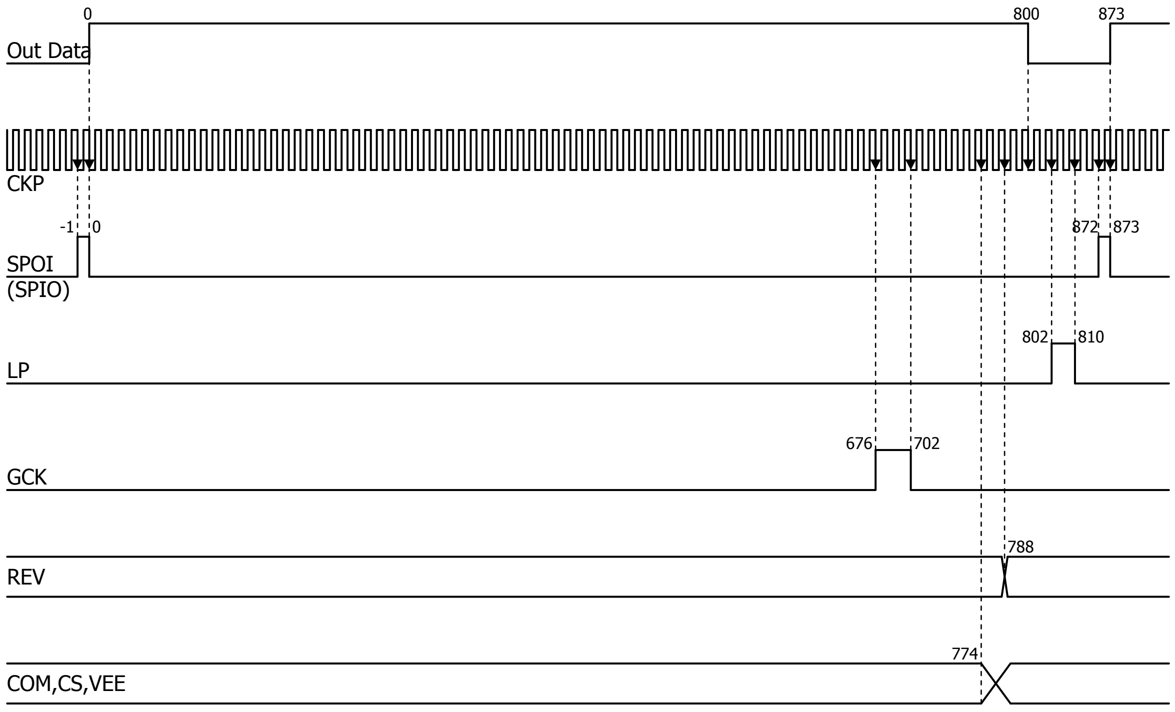


Please input GSPOI(GSPIO) in skip 2pluse like an upper figure.

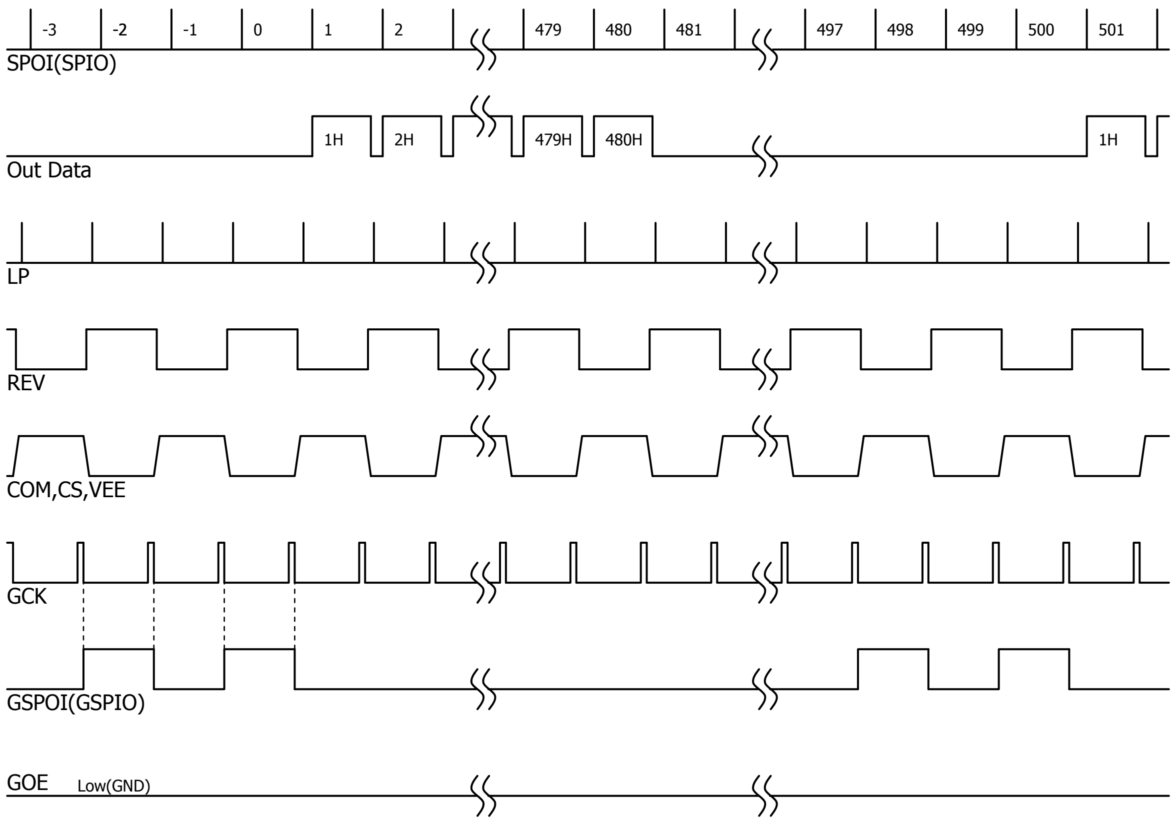


The example of the timing chart

Horizontal timing chart



Vertical timing chart



7-5）Electric power consumption

Table7-7 Ta = 25°C

Parameter		symbol	Voltage conditions	Min	Typ	Max	Unit
Current for source driver	Analog	ISHA	VSHA=+5.7V	—	20	30	mA
	Digital	ICCS	VCCS,VCCG=+3.3V	—	20	30	mA
Current for gate driver	Hi	IDD	VDD=+15.0V	—	0.3	1	mA
	Lo	$IEE_{(RMS)}$	VEE DC=－12.0V	—	35	50	mA
	Logic	ICCG	VEE AC=8.0Vp-p	—	0.2	0.5	mA
Panel		$ICOM_{(RMS)}$	COM AC=8.0Vp-p	—	10	15	mA
		$ICS_{(RMS)}$	CS AC=8.0Vp-p		40	60	mA

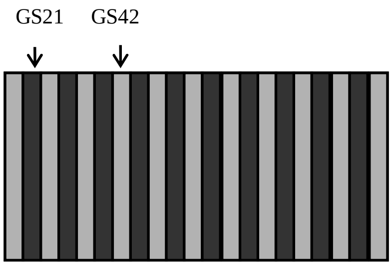
*Conditions

Driving conditions:

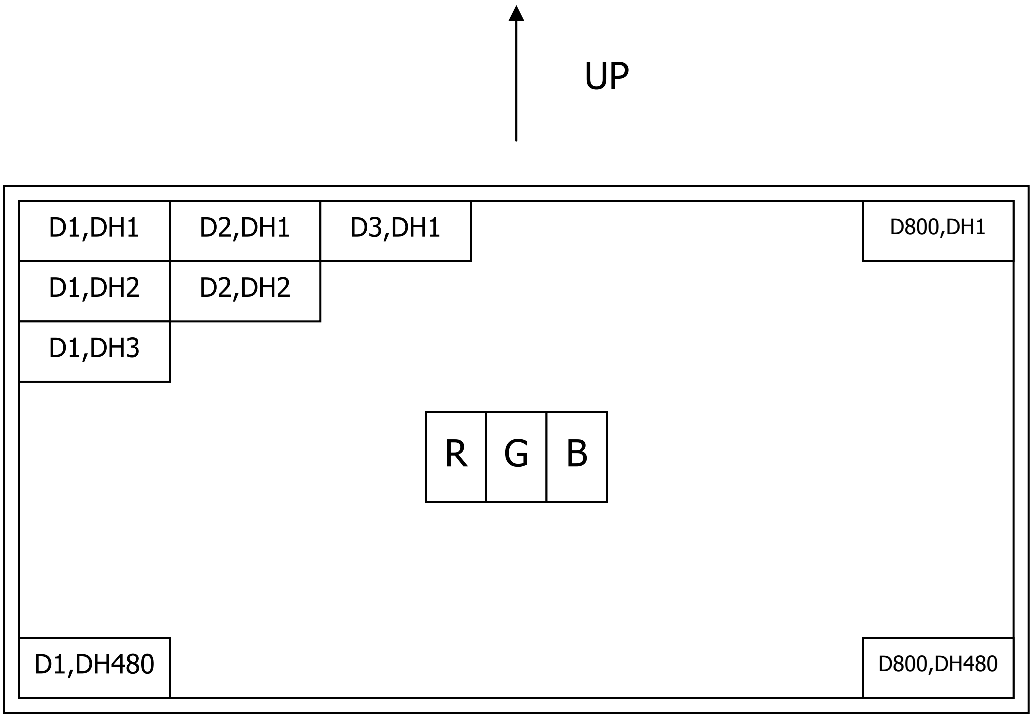
fck=26.2MHz , fgck=30kHz , fgsp=60Hz , Normal displayed

Display pattern:

Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot.



7-6）Input Data Signals and Display Position on the screen



(8) Input signals, basic display color and gray scale of each color

Table8-1

	Colors & Gray scale	Data signal 0 : **P = Low level voltage, **N = High level voltage 1 : **P = High level voltage, **N = Low level voltage																		
		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

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.

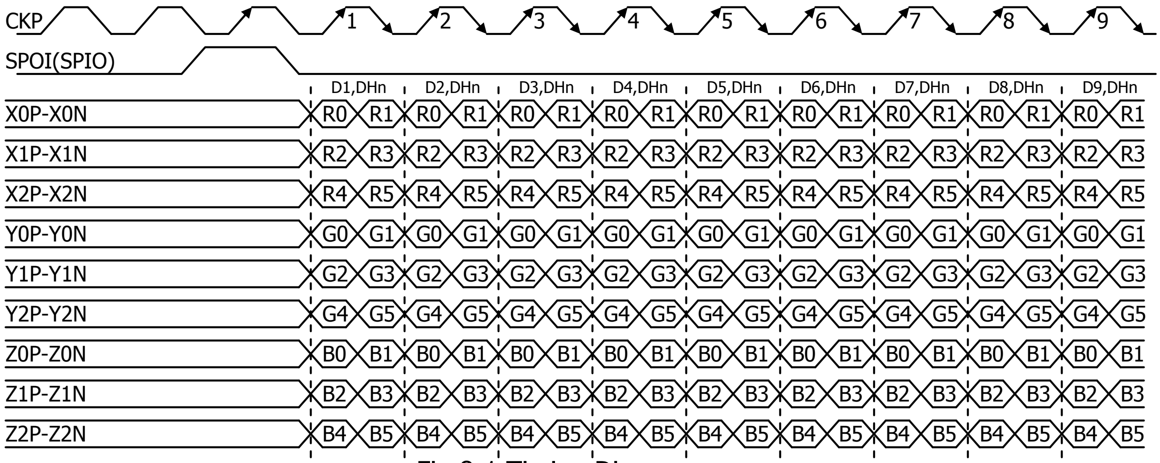


Fig.8-1 Timing Diagram

It is necessary to leave space more than two clocks like Fig.8-4 when you decide the SPOI(SPIO) to the second pulse. Otherwise, whether the state is Fig.8-2 or Fig.8-3 is not decided.

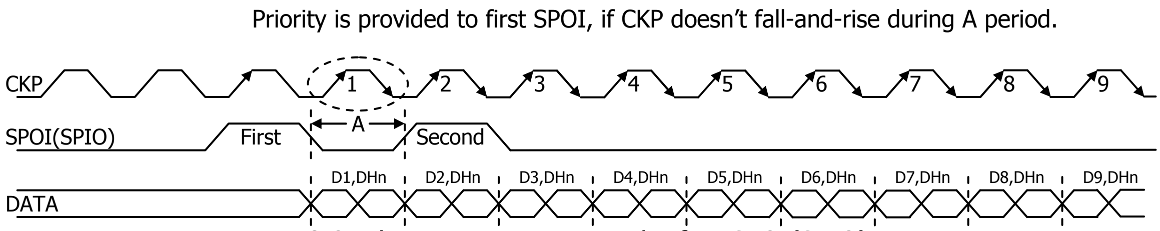


Fig.8-2 When giving priority to the first SPOI(SPIO)

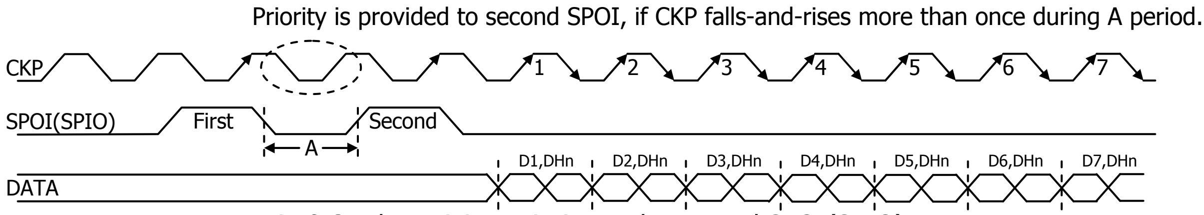


Fig.8-3 When giving priority to the second SPOI(SPIO)

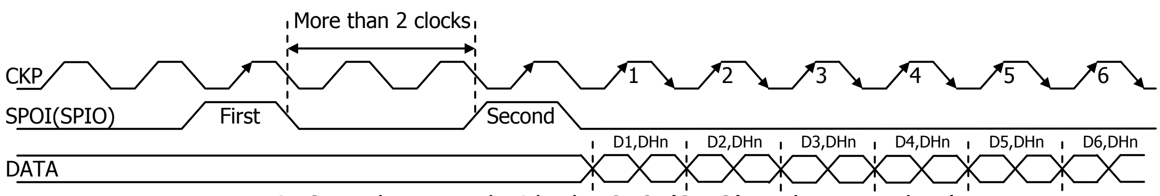


Fig.8-4 When you decide the SPOI(SPIO) to the second pulse

(9) Optical characteristics<initial value>

Table9-1 Ta=25°C

Parameter			Symbol	Condition	MIN	TYP	MAX	Unit	Remarks
Transmissive mode	Contrast ratio 1		θ11,θ12	20degree	150	250	—		[Note9-1,2]
			θ21, θ22	60degree	20	60	—		
			CRmax	Optimal(Ta=25℃)	800	1200	—		[Note9-2,12]
	Contrast ratio 2		-	θ=0°,Ta=80℃	—	-25	—	%	[Note9-2,3]
			-	θ=0°,Ta=60℃	—	-15	—	%	[Note9-2,3]
			-	θ=0°,Ta=-10℃	—	-15	—	%	[Note9-2,3]
			-	θ=0°,Ta=-30℃	—	-30	—	%	[Note9-2,3]
	Response Time	Ta=70℃	τr_{70}	θ=0°,B→W	—	5	7	ms	[Note9-4]
			τr_{70} (B-L8)	θ=0°, L0→L8	—	25	40	ms	[Note9-4]
			τd_{70}	θ=0°,W→B	—	2	5	ms	[Note9-4]
			τd_{70} (L16-L8)	θ=0°,L16→L8	—	10	15	ms	[Note9-4]
		Ta=25℃	τ r	θ=0°,B→W	—	12	20	ms	[Note9-4]
			τ r(B-L8)	θ=0°, L0→L8	—	63	80	ms	[Note9-4]
			τ d	θ=0°,W→B	—	4	8	ms	[Note9-4]
			τ d(L16-L8)	θ=0°,L16→L8	—	27	40	ms	[Note9-4]
		Ta=0℃	τr_{0}	θ=0°,B→W	—	15	25	ms	[Note9-4]
			τr_{0}(B-L8)	θ=0°, L0→L8	—	161	210	ms	[Note9-4]
			τd_{0}	θ=0°,W→B	—	12	25	ms	[Note9-4]
			τd_{0}(L16-L8)	θ=0°,L16→L8	—	65	90	ms	[Note9-4]
		Ta=-20℃	τr_{-20}	θ=0°,B→W	—	54	90	ms	[Note9-4]
			τr_{-20}(B-L8)	θ=0°, L0→L8	—	545	700	ms	[Note9-4]
			τd_{-20}	θ=0°,W→B	—	70	100	ms	[Note9-4]
			τd_{-20}(L16-L8)	θ=0°,L16→L8	—	250	350	ms	[Note9-4]
		Ta=-30℃	τr_{-30}	θ=0°,B→W	—	124	200	ms	[Note9-4]
			τr_{-30}(B-L8)	θ=0°, L0→L8	—	1440	1850	ms	[Note9-4]
			τd_{-30}	θ=0°,W→B	—	160	200	ms	[Note9-4]
			τd_{-30}(L16-L8)	θ=0°,L16→L8	—	600	840	ms	[Note9-4]
	White luminance		Lw	θ=0°	225	300	450	cd/m^2	[Note9-5,6]
	Black luminance		Lb	θ=0°	—	—	0.7	cd/m^2	[Note9-5,6]
	Uniformity of luminance		-	θ=0°	75	83	-	%	[Note9-5,6,7]
	Gamma		-	Value at L31	1.83	-	2.55		[Note9-11]
	White chromaticity		x	θ=0°	0.271	0.301	0.331		[Note9-5,6]
			y	θ=0°	0.300	0.330	0.360		[Note9-5,6]
	Red chromaticity		x	θ=0°	0.566	0.596	0.626		[Note9-5,6]
			y	θ=0°	0.284	0.314	0.344		[Note9-5,6]
	Green chromaticity		x	θ=0°	0.301	0.331	0.361		[Note9-5,6]
			y	θ=0°	0.575	0.605	0.635		[Note9-5,6]
	Blue chromaticity		x	θ=0°	0.119	0.149	0.179		[Note9-5,6]
			y	θ=0°	0.064	0.094	0.124		[Note9-5,6]
	BLACK chromaticity		x	θ=0°	0.233	0.303	0.373		[Note9-5,6]
			y	θ=0°	0.240	0.310	0.380		[Note9-5,6]
	NTSC ratio		-	θ=0°	55	60	-	%	

Table9-1 (sequel) Ta=25°C

Parameter		Symbol	Condition	MIN	TYP	MAX	Unit	Remarks
Reflective mode	Contrast ratio	θ11,θ12	20degree	2	4	-		[Note9-1,2]
		θ21, θ22	60degree	1.1	2			
		CR_{ref}	θ＝0°,Optimal	3	4.5	—		[Note9-1,2]
	Response Time	τr_{ref}	B→W	—	15	—	ms	[Note9-4]
		τd_{ref}	W→B	—	4	—	ms	
	Reflection ratio	Rf	θ＝0°	—	3.7	—	%	[Note9-8]
	White chromaticity	X	θ＝0°	0.303	0.353	0.403		[Note9-9]
		Y	θ＝0°	0.334	0.384	0.434		
	Red chromaticity	x	θ＝0°	0.416	0.466	0.516		
		y	θ＝0°	0.245	0.295	0.345		
	Green chromaticity	x	θ＝0°	0.236	0.286	0.336		
		y	θ＝0°	0.414	0.464	0.514		
	Blue chromaticity	x	θ＝0°	0.178	0.228	0.278		
		y	θ＝0°	0.167	0.217	0.267		
	Black chromaticity	x	θ＝0°	0.190	0.240	0.290		
		y	θ＝0°	0.123	0.173	0.223		
	NTSC ratio	-	θ＝0°	-	17	-	%	
Surface reflectance		SRf		-	0.5	0.6	%	[Note9-8]
LED lifetime	+25°C	—	continuation	10000	—	—	Hour	[Note9-10]

*The measurement data of above optical characteristics are measured 30 minutes after lighting the B/L. they are measured in a dark room or an equivalent state by the method shown in the following figure.

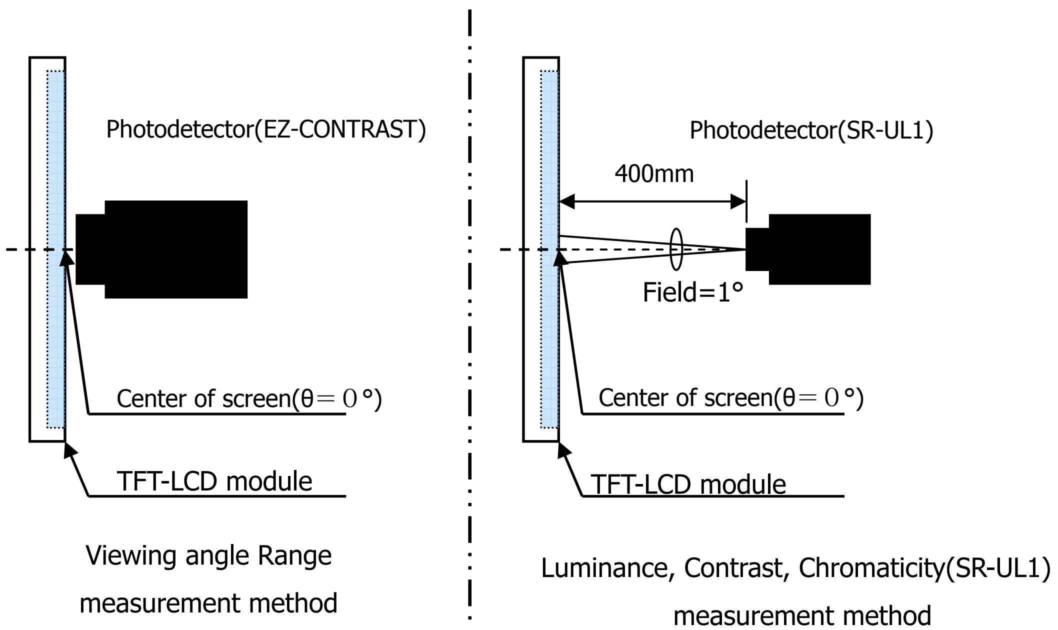
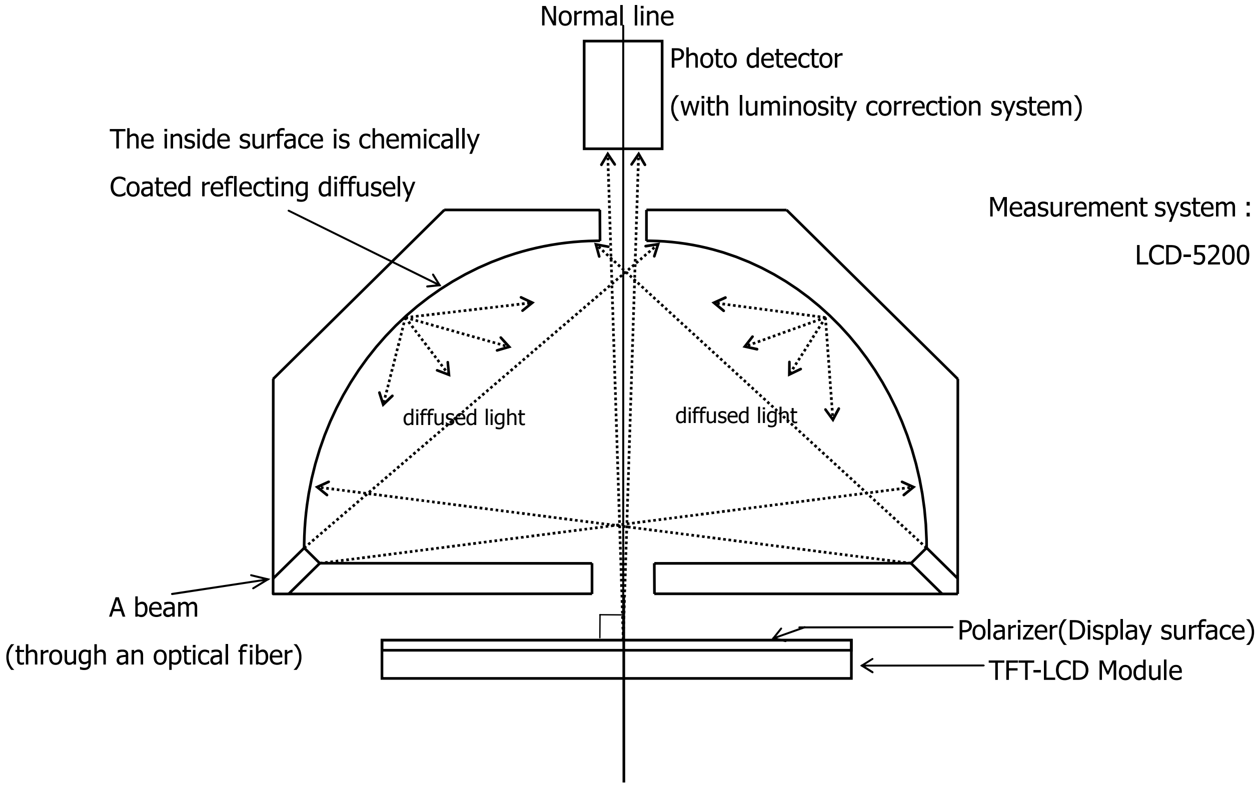


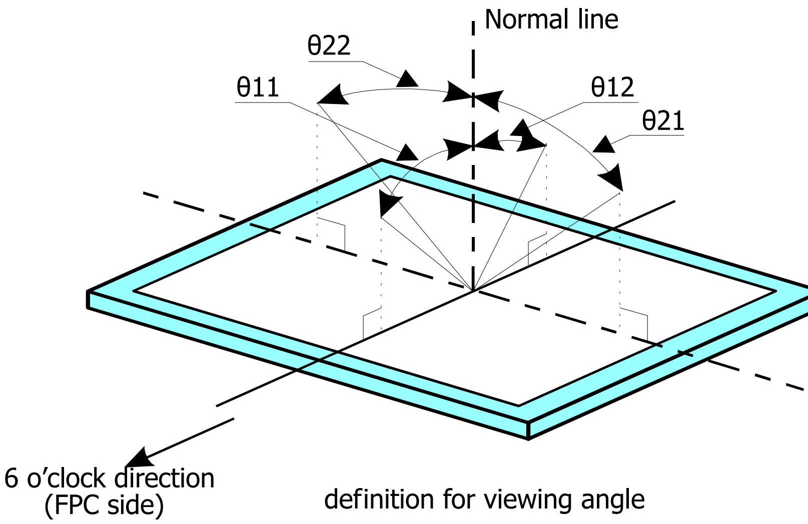
Fig.9-1 Optical characteristics measurement method (Transmissive mode)



Contrast / Viewing angle Range / Response time measurement method

Fig.9-2 Optical characteristics measurement method (Reflective mode)

[Note 9-1] Viewing angle range is defined as follows.



definition for viewing angle

[Note 9-2]　Contrast ratio is defined as follows:

$$\text{Contrast ratio(CR)} = \frac{\text{Photo detector output with LCD being "white(GS63)"}}{\text{Photo detector output with LCD being "black(GS0)"}}$$

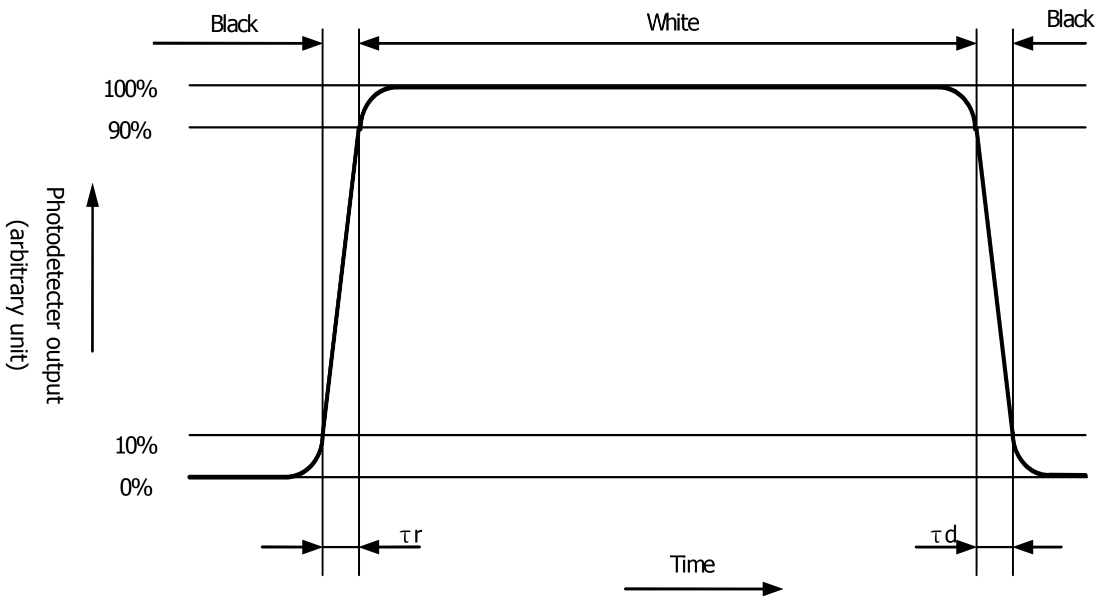
[Note 9-3] The change rate by the ambient temperature of the contrast is defined as follows.

It is a change rate against the CR value of 25℃ in ambient temperature of the module.

[Note 9-4] Response time is defined as follows:

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".

Measurement system:LCD-5200(Transmissive mode/ Reflective mode)

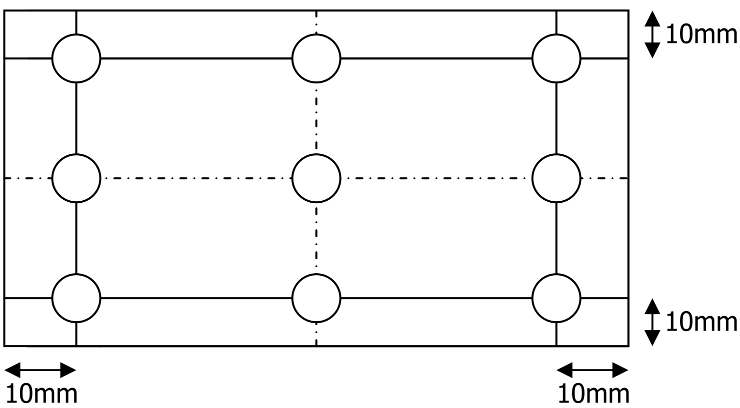


[Note 9-5] LED driving condition is refer to Table7-4.

[Note 9-6] Measured on the center area of the panel at a viewing cone 1-degree by TOPCON luminance meter SR-UL1.(After 30 minutes operation)

[Note 9-7] Uniformity of luminance is measured in the measurement part shown in the figure below.

The measurement part is "○" symbol it shown.



$$\text{Uniformity of luminance} \Rightarrow \frac{\text{Minimum luminance}}{\text{Maximum luminance}} \times 100\%$$

[Note 9-8] Reflectance is defined as follows

$$\text{Reflection ratio} = \frac{\text{Light detected level of the reflection by the LCD}}{\text{Light detected level of the reflection by the standard}} \times 100$$

[Note 9-9] It is assumed that chromaticity of the light source is (x=0.313,y=0.329).
The measuring system is CM-2002(with the unit reflecting diffusely) made by MINOLTA co.,ltd.

[Note 9-10] LED life is the time when the Brightness level of the panel surface doesn't become equal or less than 80% of the brightness of the initial value on the following conditions.
* LED driving condition is refer to Table7-4. PWM dimming 100%~5%(Ta=25°C)

[Note 9-11] When you adjust the power supply voltage level and signal voltage level to the following set value .
VSHA=VH=5.7V , VL=0V , COM AC=8.0Vp-p ,
VP1=2.11V , VP2=2.52V , VP3=3.16V ,
VN1=3.43V , VN2=3.01V , VN3=2.33V

[Note 9-12] Minimum contrast value is defined as below conditions.
* Contrast value is defined as the average of 9 point contrast values. Please refer to Note 9-7 for the position of 9 points.
* This minimum value of contrast can't be guaranteed based on Cpk.
* In case customer's measurement result of contrast at panel center position is under '800', we will exchange new LCD module for free of which the contrast at panel center position is more than '800', but it is not counted as the LCD module failure. And if after mass production there are many LCD modules in mass production which are under '800' at customer's measurement but are more than '800' at SHARP 9 point measurement, it's necessary for customer and SHARP to discuss the handling of the LCD modules.

(10) Mechanical characteristics

10-1) External appearance
No significant defects permitted. (See Fig. 1)

10-2) Panel toughness
The panel should not be broken, when press to the center of the panel by (30N) power using smooth surface with 15mm diameter.
Caution: If the pressure is added on the active area of the panel over the long time, even if the pressure is very small weight , the functional damage might occur in the panel.

10-3) I/O connector performance
A) Input/output connectors to control the LCD module
1) Applicable Connector : 502790-6091(MOLEX)
2) FPC flexibility :
Slit on the film cover lay coat part of one side printing

If it had been tested bending under radius nothingness and bending angle 180degrees, the FPC should not be cut.

(It should be bend by hand and only at once).

B) Input/output connector of LED backlight driving circuit

1) Applicable Connector : FH28-10S-0.5SH(10) (Hirose)

2) FPC flexibility :

Slit on the film cover lay coat part of one side printing

If it had been tested bending under radius nothingness and bending angle 180degrees, the FPC should not be cut.

(It should be bend by hand and only at once).

(11) Display quality

The display quality of the color TFT-LCD module is controlled by the Incoming Inspection Standard.

(12) Handling instruction of TFT-LCD module

12-1) Handling of FPC

①FPC can be bent only in the input part straight wiring part.

②Please do not hang the LCD module from the FPC or do not apply excessive force to FPC.

③Please do not impact on the part equipped with parts of FPC.

12-2) Installation of TFT-LCD module

①When assembling the TFT-LCD module, ensure module is fixed in its natural flat plane, and avoid stressing the module causing it to twist or wrap.

Do not apply pressure to the module from the user application (user push-buttons etc.) since this may distort the display images.

②Remove all electrical power before connecting or disconnecting the module FPCs.

③Be sure to connect the metallic shielding cases of the LCD module and the GND of your component surely.

12-3) Precautions in mounting

①Polarizer adhesion the surface of the LCD is made of a soft material and should be handled carefully to avoid damage. Protection sheet is applied on the LCD top surface to safeguard the polarizer against scratches and dirt. It is recommended to remove the protection sheet immediately before use, taking care to avoid static electric charges.

②Precautions in removing the protection sheet

A) Work environment

When the protection sheet is removed 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 form 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 air of discharging blower in downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within optimum length of discharging blower.

b) Pull the tag of protection sheet and remove it slowly to your side.

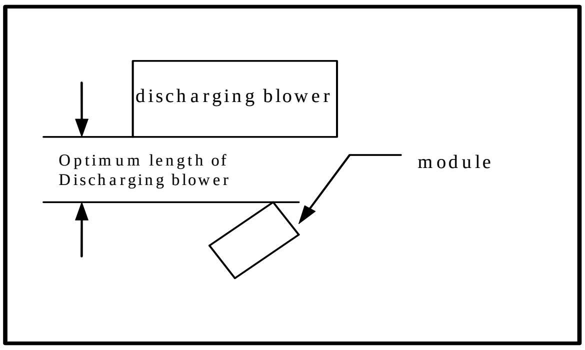
c) On removing off the protection sheet, pass the module to the next work process to prevent the module to get dust.

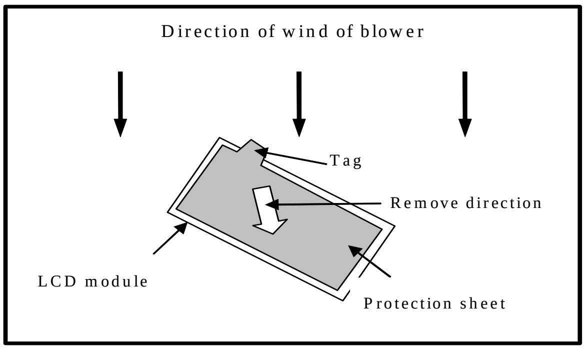
d) Method of removing dust from polarizer

・Blow off dust with N2 blower for which static electricity preventive measure has been taken.

・Since polarizer is vulnerable, wiping should be avoided if necessary.

However, please wipe it carefully with the cloth for a lens wipe when it is necessary to wipe the surface.





③When metal part of the TFT-LCD module (shielding case) soiled, wipe it with soft dry cloth.

④The LCD used in the module is made of glass. If drop the module or bump it on hard surface, the LCD should be broken.Please handle with care.

⑤Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling the module.

12-4) Caution of product design

①Protect the LCD module from water/salt-water by the waterproof cover, etc.

12-5) Other

①Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours. Liquid crystal is deteriorated by ultraviolet rays.

②Store 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.

③If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is hazardous, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.

④Be sure to adjust DC bias voltage of common electrode driving signal(COM DC) in the state of the last product. When not adjusted, it becomes the cause of a deterioration of display quality.

⑤Observe all precautionary requirements of general electronic components.

(13) Packing form

13-1) Package form (Refer to Fig.3)

a) Maximum number of cartons for stacking	: 7
b) Package quantity in one carton	: 25
c) carton size (mm)	: 624 (W) ×419 (H) ×196 (D)
d) Total mass of one carton (kg)	: 7.1

13-2) Carton keeping conditions

Environments

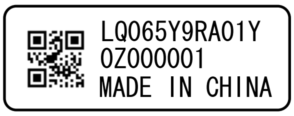
Temperature	:	0～40°C
Humidity	:	60%RH or less(at 40 °C) No dew condensation at low temperature and high humidity.
Atmosphere	:	Harmful gas such as acid or alkaline that corrodes electronic components or wires, must not be avoided.
Storage periods	:	Max of approx 3 months
Opening of the package	:	In order to prevent the LCD module from breakdown by electrostatic charges, please control the humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

(14) Other

14-1) Indication of the lot number

The lot number is shown on a label. Attached location is shown in Fig.1 (Outline Dimensions).

Indicated contents of the label :



← Model name + Distribution code(X or Y or Z)
← Lot number

Label size: 27mm x 10mm

QR code size: 5.3mm x 5.3mm

contents of lot No.	the 1st figure	production year (ex. 2010 : 0、2011: 1 ･･･)
	the 2nd figure	production month 1,2,3,…,9,X,Y,Z
	the 3rd～8th figure	serial No. 000001～
	the 9th figure	revision marks A,B,C…

Contents of QR code : LQ065Y9RA01Y0Z000001

(LQ065Y9RA01Y: Model name + Distribution code; 0Z000001: Lot number)

14-2) Maximum number of trays for stacking

Maximum number of trays for stacking : 5

14-3) RoHS

This TFT-LCD module is RoHS compliant products.

14-4) Instructions for disposing of LCD modules.

Please dispose in accordance to regulations for this module.

14-5) The country of origin of the TFT-LCD module

P.R.China

14-6) The manufacturing site of TFT-LCD

SHARP CORPORATION

1177-1, GOSANA, TAKI-CHO, TAKI-GUNN MIE

MOBILE LIOUID CRYSTAL DISPLAY GROUP 3 MIE PLANT 1

14-7) The manufacturing site of TFT-LCD module

WUSI SHARP ELECTRONIC COMPONENTS CO.,LTD

No.54 Area, Wuxi National High & New Tech Industrial Development Zone,

Wuxi, Jiangsu, 214028 P.R. China

14-8) When any question or issue occurs, it shall be solved by mutual discussion.

(15) Reliability test contents

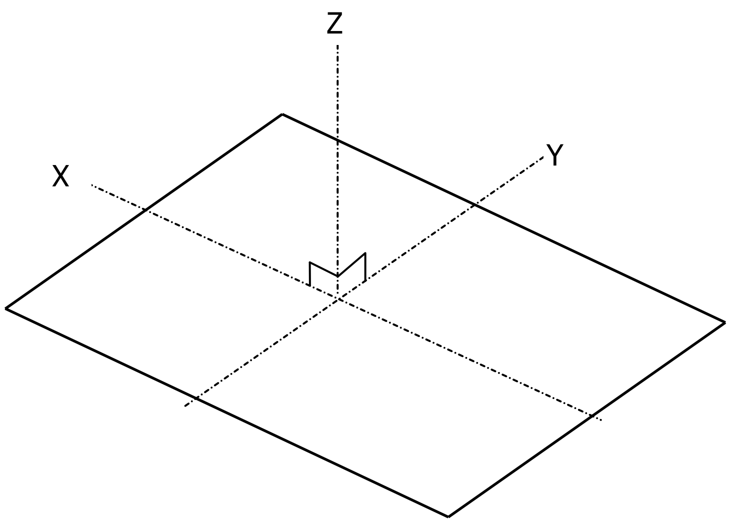
Table 15-1　Temperature condition is based on operating temperature condition

No.	Test items	Test condition
1	High temperature storage test	Ta = +85 °C　　240h
2	High temperature storage test	Ta = +95 °C　　120h
3	Low temperature storage test	Ta =－40 °C　　240h
4	High temperature and high humidity operation test	Tp = +50 °C , 95%RH　　240h
5	Hi temperature operating test	Tp = +85 °C　　240h
6	Low temperature operating test	Ta =－40 °C　　240h
7	Electro static discharge test	±200V・200pF(0Ω) 1 time for each terminals ±2KV・150pF(330Ω) 3 time for each terminals ±15KV・150pF(330Ω) 3 time for the display center
8	Shock test	$980 m/s^2$・6ms,　±X ; ±Y ; ±Z　3 times for each direction （JIS C0041, A-7 Condition C）【caution】
9	Vibration test	Frequency : 8～33.3Hz , Stroke : 1.3mm Frequency : 33.3Hz～400Hz,Acceleration : $29.4 m/s^2$ Cycle　: 15 minutes X,Z 2 hours for each directions，4 hours for Y direction (total 8 hours)　【caution】（JIS D1601）
10	Heat shock test(Storage)	Ta=－30 °C　～　+85 °C / 200 cycles (0.5h)　　(0.5h)

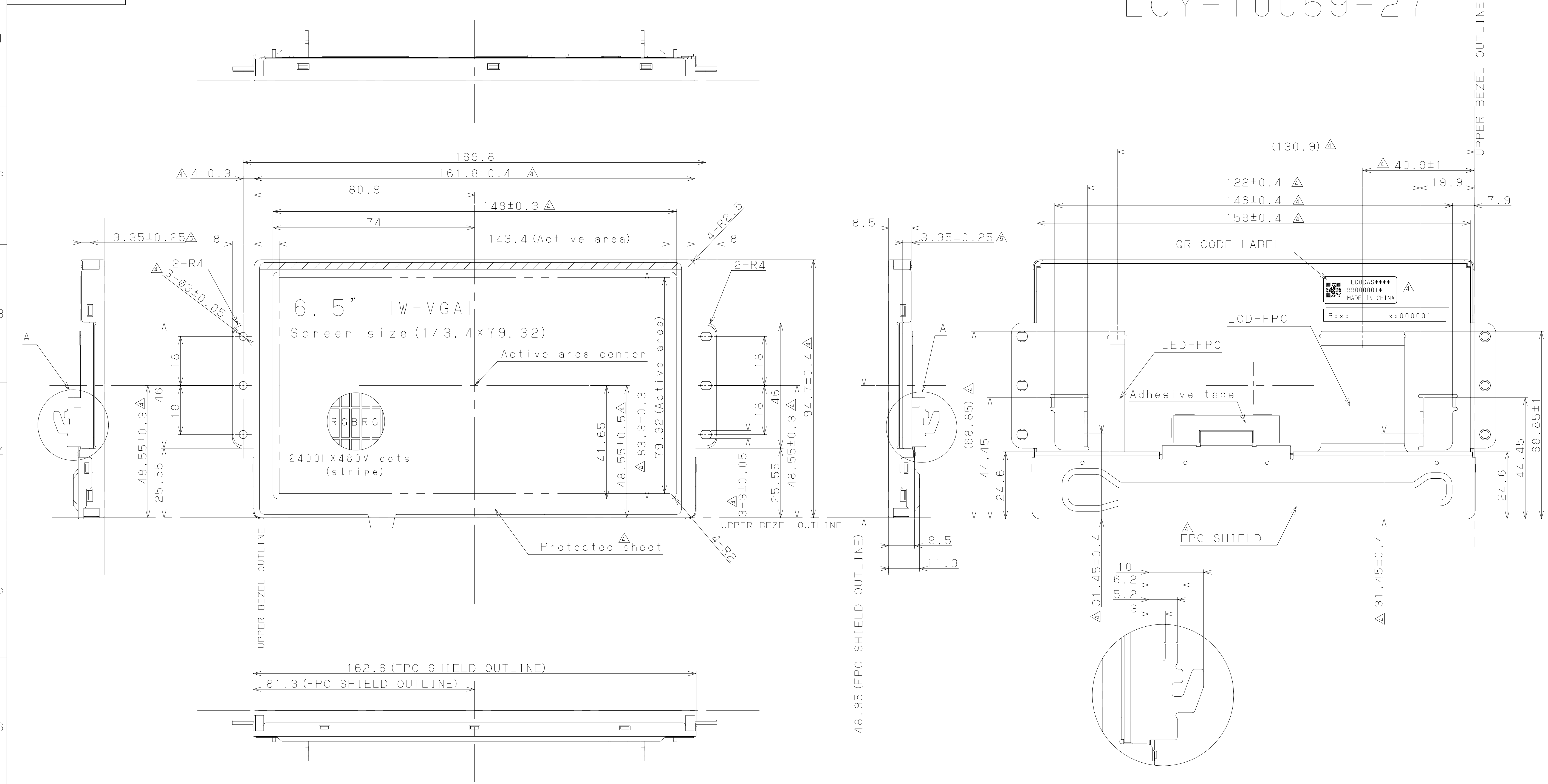
【Note】　Ta = Ambient temperature, Tp = Panel temperature

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

【caution】　Definition of X, Y, Z direction is shown as follows



LCY-10059-27



A part Detailed drawing
(Scale: 2/1)

Take care in set design to hide the scratches and bubbles appeared on the polarizer or other frame area which is located outside of active area.

LED-FPC connector: FH28-10S-0.5SH(10)

LCD-FPC connector: ~~FH28-60S-0.5SH(05) (HRS)~~ 4
502790-6091 (molex)

unit: mm
General tolerance is ±0.50

Please do not copy this material and do not disclose this to third party.

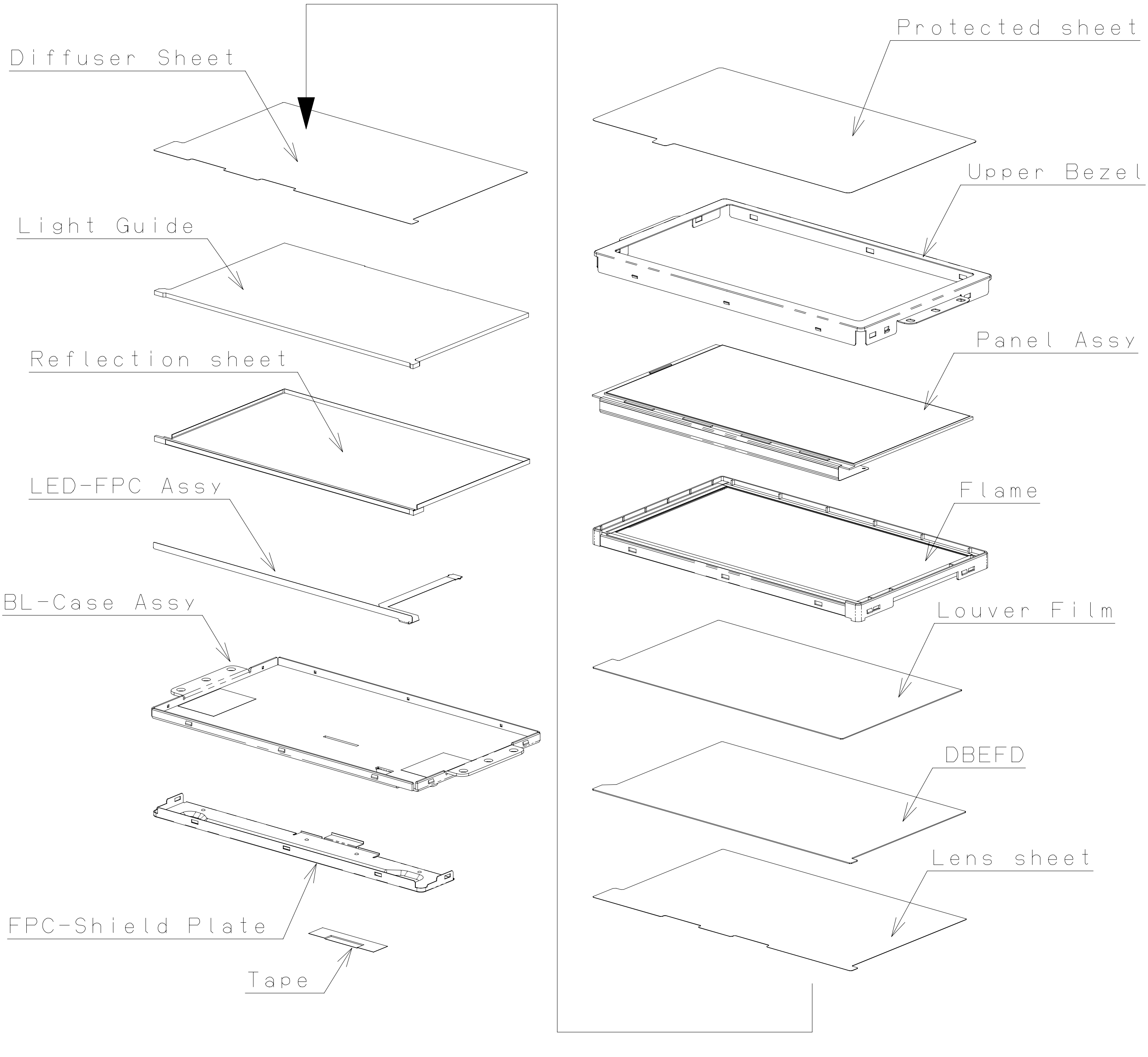
No.	DATE	REVISION	Sign.
5	10.08.07	Addition of dimensions.	K. Yonemura
4	09.07.06	Size allowance change. Protected seat is added. etc	R. sugiyama
3	09.06.24	It the overall revises it by the shape change. LCD FPC connecter is changed.	R. sugiyama
2	09.03.12	Dimensions change of the FPC SHIELD. Addition of adhesive tape and screw depth (4MAX). etc	R. sugiyama
1	09.02.12	Dimensions change of the stud.	J. seto

DATE	2009.02.05
MODEL	LQ065Y9RA01
DRAWING NO	LCM-08504E
size	A2
SCALE	1/1

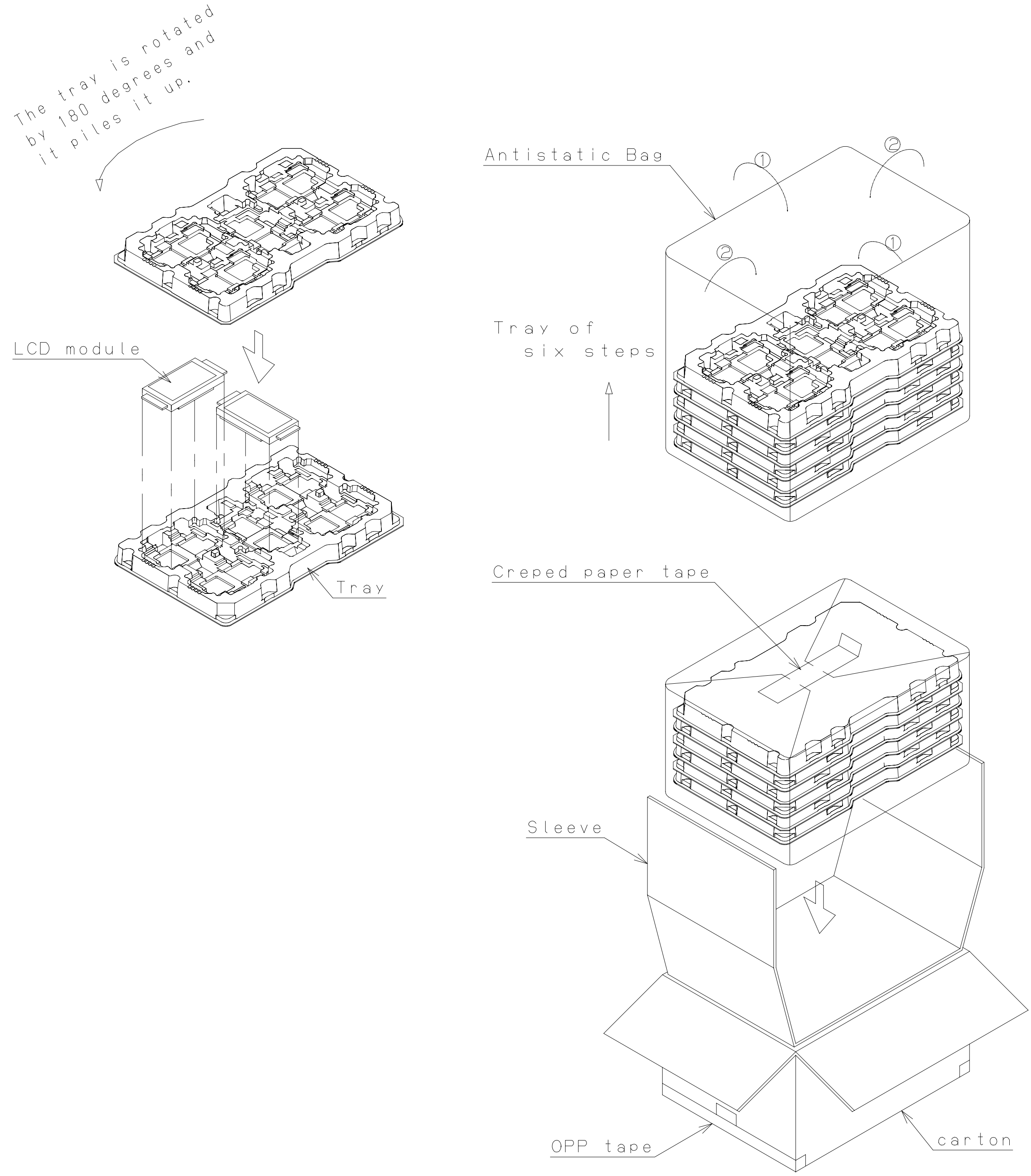
SHARP CORPORATION Engineering Dept. II Mobile LCD Division. II Mobile LCD Group

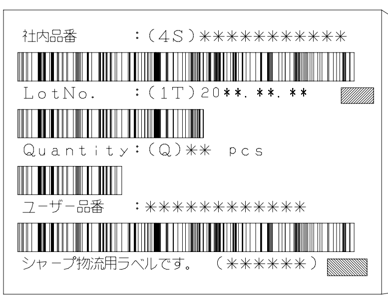
Fig-1

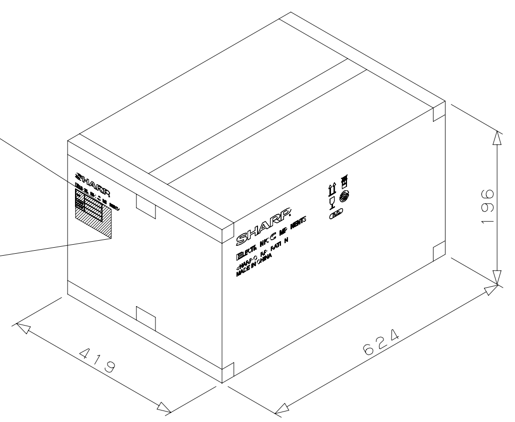
LCY-10059-28



- Fig.2 -







*The carton:Up to 7steps.
*Carton size:624×419×196(H)
*Max 25module in each carton

Fig-3

（Appendix）

Adjusting method of optimum DC bias voltage of common electrode driving signal

Photoelectric devices are very effective to obtain optimum DC bias voltage of common electrode driving signal accurately, and the accuracy is with 0.1V. (In visual examination method, the accuracy is about 0.5V because of the difference among individuals.)

Adjusting method of DC bias voltage using the photoelectric devices is as follows

Measurement of flicker

Adjust the DC baias voltage so as to minimize flicker at NTSC : 60Hz(30Hz) / PAL : 50Hz(25Hz).

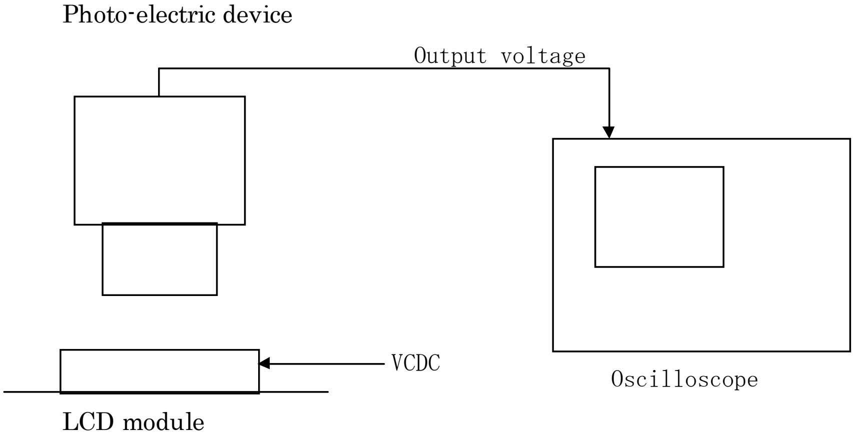


Fig. A　Measurement system

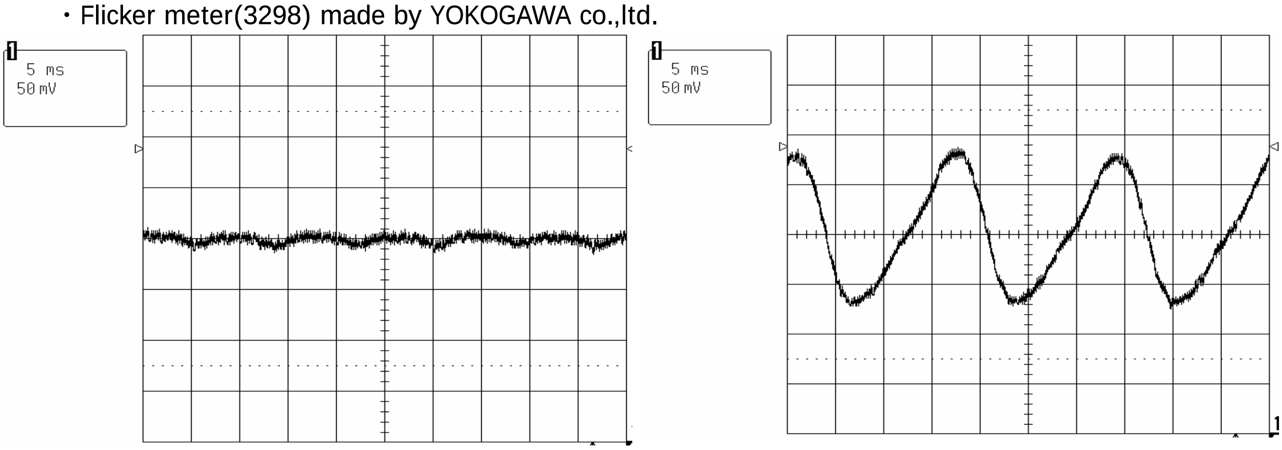
Adjusting method of DC bias voltage

Measure the output voltage from Photoelectric device using the oscilloscope at the measurement system of Fig. A.

Then, change the DC bias voltage in small steps, and adjust it so as to minimize the flicker(target:max5%) at NTSC 60Hz(30Hz) / PAL : 50Hz(25Hz). (Fig.B)

・Measured on the center area of the panel(1 point) by flicker meter. Display pattern is flicker pattern(Horizontal stripe pattern alternating 31 gray scale(GS31) with 0 black(GS0) every 1 dot.).

・Flicker meter(3298) made by YOKOGAWA co.,ltd.



DC bias : Optimum　　　　DC bias : Optimum + 1

Fig. B　Waveforms of flicker