KOE
JDI Group

Kaohsiung Opto-Electronics Inc.

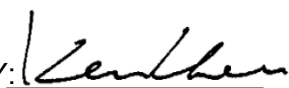FOR MESSRS : _____   DATE : Feb. 20th 2014

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

SP24V01L0ALZZ

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ACCEPTED BY:_____   PROPOSED BY:

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2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY

		SHEET NO.	7B64PS 2702- SP24V01L0ALZZ-1	PAGE	2-1/1
KAOHSIUNG OPTO-ELECTRONICS INC.					

3. MECHANICAL DATA

    (1) Part Name   SP24V01L0ALZZ

    (2) Module Size   257.5(W)mm x 174.0(H)mm x 7.0(D)mm max.

    (3) Dot Size   0.27 (W)mm x 0.27 (H)mm

    (4) Dot Pitch   0.30 (W)mm x 0.30 (H)mm

    (5) Number of Dots   640 (W) x 480 (H)dots

    (6) Duty   1/242 (Display is divided into 2 blocks)

    (7) LCD   Film type black/white (negative type)

                                           the upper polarizer is anti-glare type.

                                         The bottom polarizer is transmissive type.

    (8) Viewing Direction   12 O'clock

    (9) Back Light   Light-Emitting Diode

   (10) LED Lifetime   50k hrs.

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS   VSS=0V : STANDARD

ITEM	SYMBOL	MIN.	MAX.	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	0	6.5	V	
Power Supply for LC Drive	VDD-VEE	0	27.5	V	
Input Voltage	Vi	-0.3	VDD+0.3	V	Note 1
Input Current	Ii	0	1	A	
Static Electricity	-	-	-	-	Note 2

Note 1 $\overline{DOFF}$,FRAME,LOAD,CP,UD0~UD3,LD0~LD3.

Note 2 Make certain you are grounded when handling LCM.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	0℃ Note 6	45℃ Note7	-25℃	60℃	Note 2,3
Humidity	Note 1		Note 1		Without condensation
Vibration	-	9.8m/s^2 (1.0G) Note 5	-	11.76m/s^2 (1.2G) Note 5	Note 4
Shock	-	490m/s^2 (50G) Note 5	-	490m/s^2 (50G) Note 5	3 Times for each direction of ±X ±Y ±Z pulse width 10mS
Corrosive Gas	Not Acceptable		Not Acceptable		

Note 1 Ta≦40℃:85%RH max.

　　　Ta＞40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

Note 2 Ta at -25℃-------＜48h , at 60℃-------＜168h

Note 3 Background color changes slightly depending on ambient temperature. This
　　　phenomenon is reversible.

Note 4 5Hz~500Hz (Except resonance frequency) for each direction of X、Y、Z.
　　　Any failure caused by connector loosened while testing shall be ignored.

Note 5 This module should be operated normally after finish the test.
　　　Any failure caused by connector loosened while testing shall be ignored.

Note 6 Higher LCD driving voltage are needed while operating at 0℃, also the
　　　response time at 0℃, will be slower.

Note 7 There are possibility that color un-uniformity happened while operating at 45℃

Note 8 The maximum rating is defined as above based on chamber temperature, which night
　　　be different from ambient temperature after assembling the panel into the application
　　　Moreover some temperature-related phenomenon as below needed to be noticed:
　　　- Background color, contrast and response time would be different in temperatures other than 25℃.
　　　- Operating under high temperature will shorten LED lifetime.

5. ELECTRICAL CHARACTERISTICS OF LCM

5.1 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage for Logic	VDD-VSS	-	3.0	3.3 / 5.0	5.25	V
Input Voltage	VI	H LEVEL	0.8VDD	-	VDD	V
Note 1		L LEVEL	0	-	0.2VDD	V
Power Supply Circuit for Logic Current Note 2	IDD	VDD-VSS=3.3V	-	22.0	32.0	mA
		VDD-VSS=5.0V		20.0	30.0	
Power Supply Circuit for LC Driving Note 2	IEE	VDD-VSS=3.30V	-	20.0	27.0	mA
		VDD-VSS=5.0V		18.0	25.0	
Recommended LC Driving Voltage Note 3	VDD-VEE	Ta= 0℃ , ϕ=0°	-	23.9	26.5	V
		Ta= 25℃ , ϕ=0°	-	22.7	-	V
		Ta=45℃ , ϕ=0°	18.5	21.6	-	V
Frame Frequency Note4	fFRAME	-	120	130	140	Hz

Note 1 $\overline{DOFF}$,FRAME,LOAD,CP,UD0~UD3, LD0~LD3.

Note 2 fFRAME=140Hz,UD0~UD3=0,1,0,1,….LD0~LD3=1.0,1.0,…

VDD-VEE=22.7V,Ta=25℃

Note 3 Recommended LC driving voltage fluctuates about ±1.0V by each module.

Test pattern is all "Q" .

Note 4 Need to make sure of flickering and rippling of display when setting the frame

frequency in your set.

5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LED Input Voltage	VLED	-	5	5.7	V	Note 1
LED Forward Current	ILED	-	204	-	mA	
LED Lifetime	-	-	50K	-	V	Note 2

Note 1: Fig. 5.1 shows the LED backlight circuit. VLED and ILED is many to one relationship, the above VLED range is defined to obtain 204 mA.

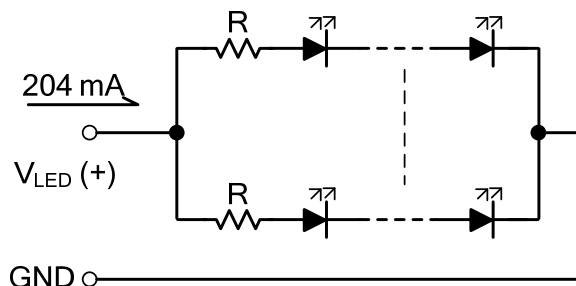Note 2: The estimated lifetime is specified as the time to reduce 50% brightness by applying 204 mA at 25℃ .

Fig 5.1
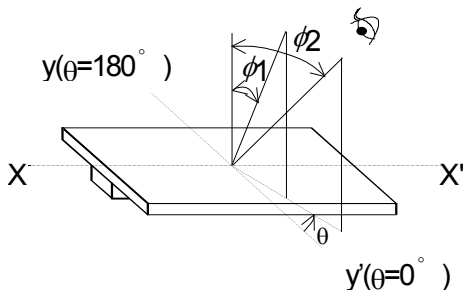
6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS

Ta=25℃ (Backlight ON)

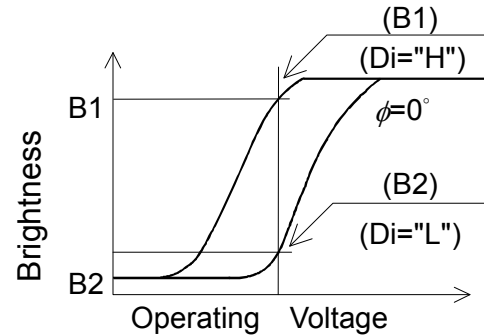| ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing Area	$\phi2-\phi1$	K≧2.0	30	40	-	deg	1,2
Contrast Ratio	K	$\phi=0°$ $\theta=0°$	-	(20)	-	-	3
Response Time (Rise)	tr	$\phi=0°$ $\theta=0°$	-	160	210	ms	4
Response Time (Fall)	tf	$\phi=0°$ $\theta=0°$	-	110	-	ms	4

(Measure condition by KOE)
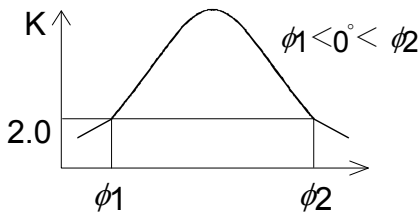
Note 1 Definition of θ and ϕ
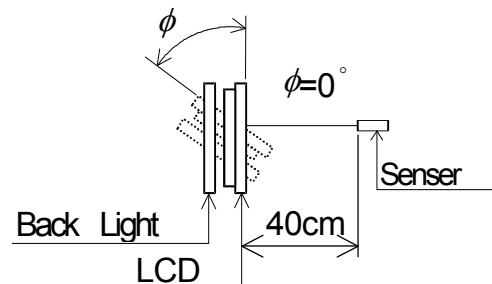Z (Normal)

Note 3 Definition of contrast "K"

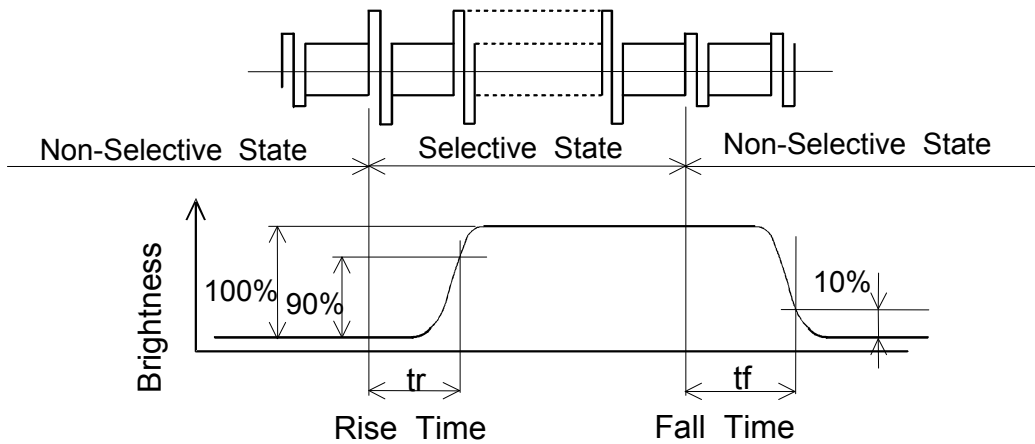$$K= \frac{\text{Brightness on Selected Dot (B1)}}{\text{Brightness on Non-Selected Dot (B2)}}$$

Note 2 Definition of viewing angle $\phi1$ and $\phi2$

$\phi1 < 0° < \phi2$

2.0

Contrast ratio K VS viewing angle ϕ

Note 4 Definition of optical response

Non-Selective State   Selective State   Non-Selective State

100% 90%   10%

tr   tf
Rise Time   Fall Time

6.2 OPTICAL CHARACTERISTICS BACKLIGHT

(LCM, Backlight ON, Ta=25℃)

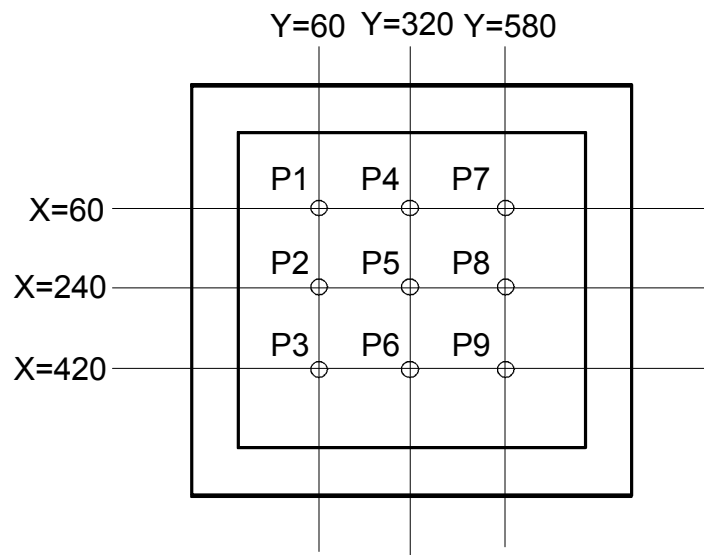| ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness	-	110	-	cd/m^2	Note 1,2
Brightness Uniformity	-	-	±30	%	Note 1,3

Display data should be all "ON"

Note 1 Measurement after 10 minutes of LED operating.

Note 2 Brightness control : 100%.The LED current is 204 mA when applying 5V (VLED).
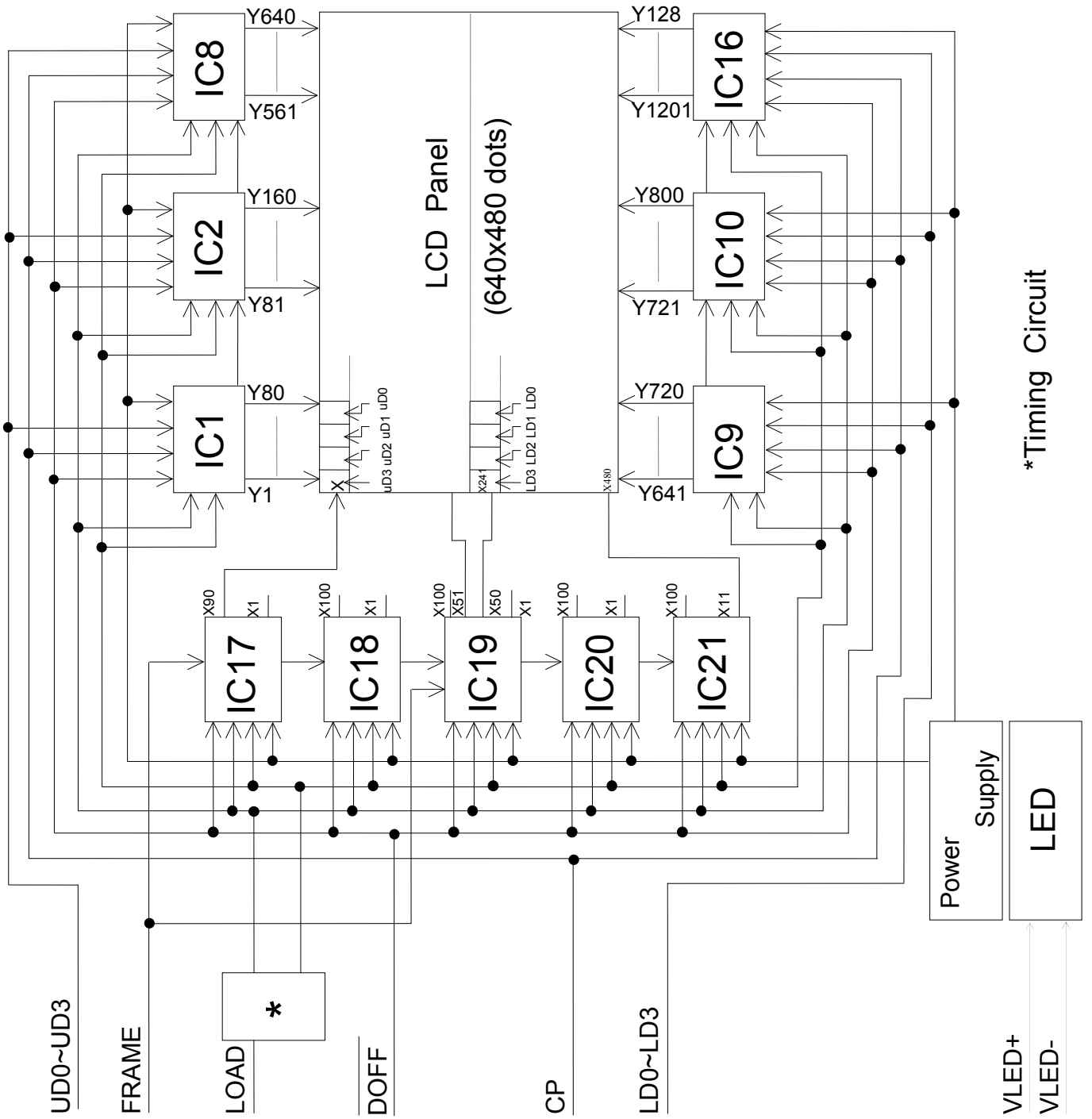
Note 3 Measurement of the following 9 places on the display.
Definition of the brightness tolerance.

Y=60 Y=320 Y=580

X=60

P1 P4 P7

X=240

P2 P5 P8

X=420

P3 P6 P9

$$\left(\frac{\text{Max. Brightness or Min. Brightness - Average Brightness}}{\text{Average Brightness}} \right) \times 100\%$$
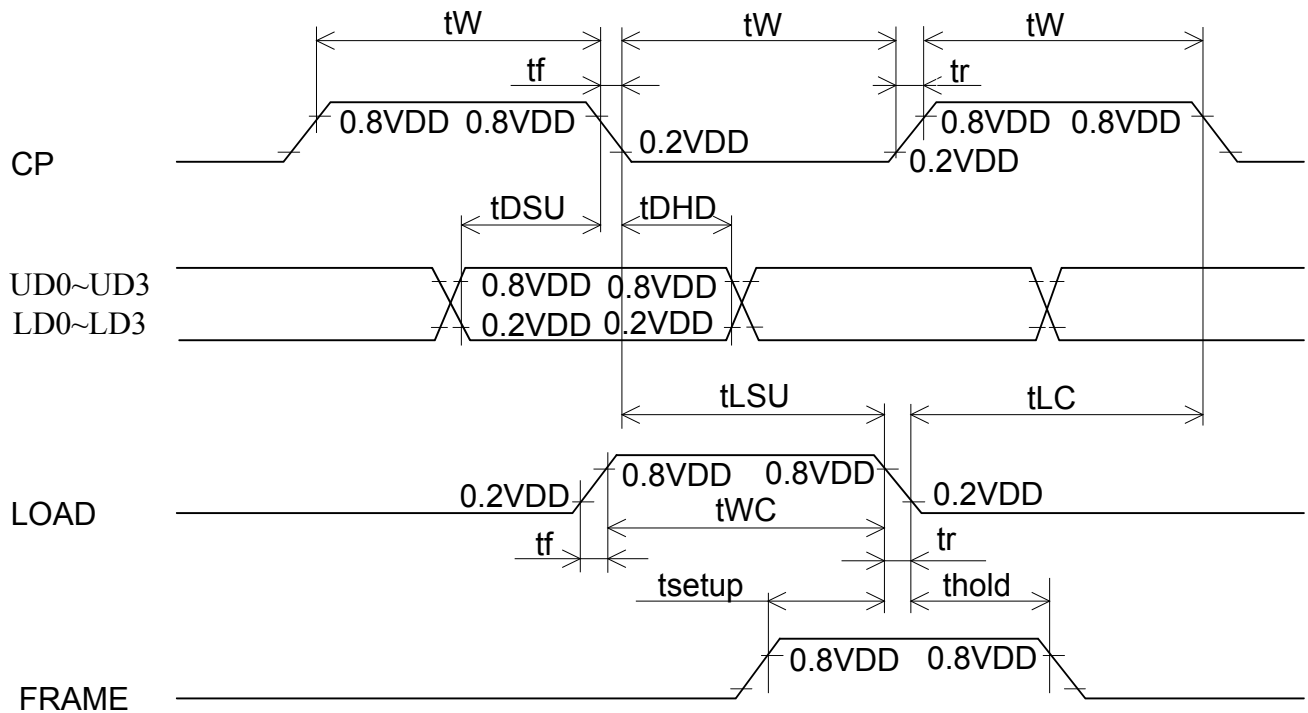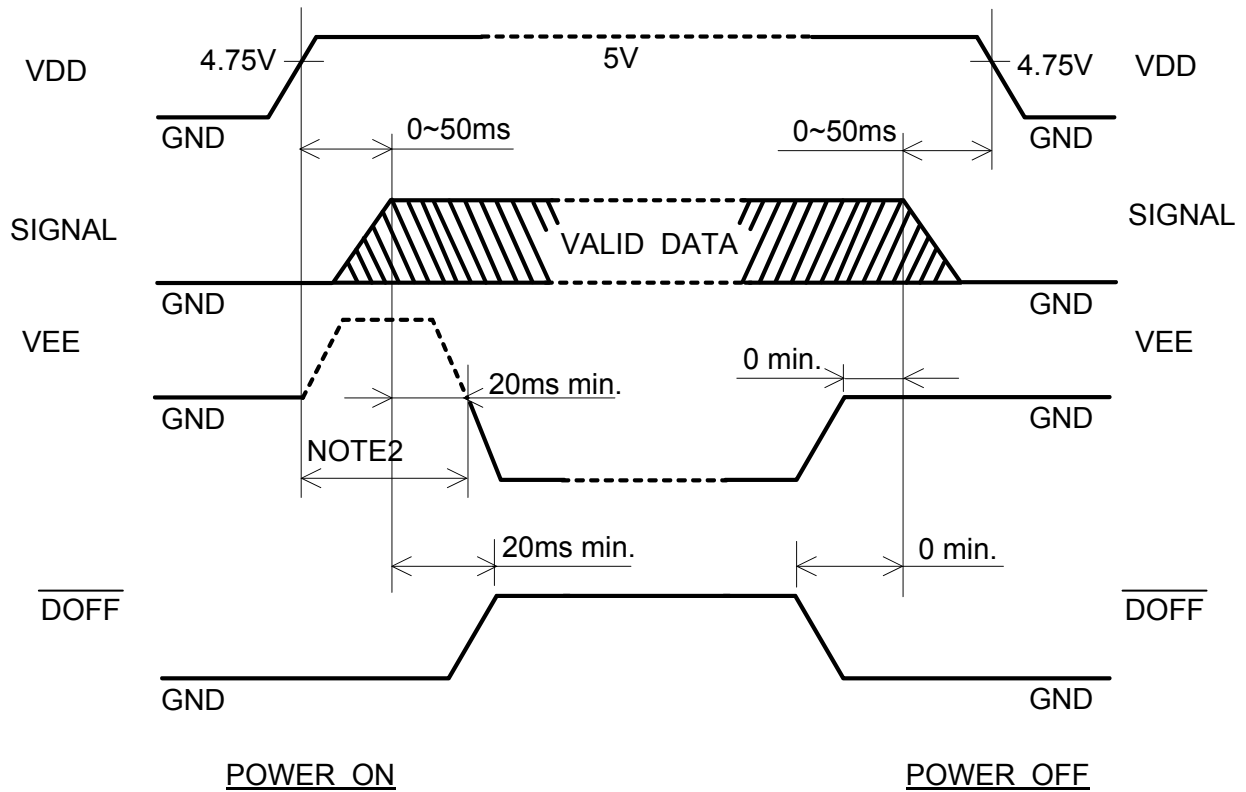
7. BLOCK DIAGRAM

8. INTERFACE TIMING CHART

8.1 TIMING CHART

$29.5\,\mu s \leqq T \leqq 34.4\,\mu S$

LOAD

CP

Dummy Data   X1   X2

UD3   Y1 Y5   Y637

UD2   Y2 Y6   Y638

UD1   Y3 Y7   Y639

UD0   Y4 Y8   Y640

Dummy Data   X241   X242

LD3   Y641 Y645   Y1277

LD2   Y642 Y646   Y1278

LD1   Y643 Y647   Y1279

LD0   Y644 Y648   Y1280

$1.4\,\mu s$ min

FRAME
(REDUCTION)

LOAD

242xT

FRAME

UD0~UD3   X1 X2   X239 X240 Dummy Data

LD0~LD3   X241 X242   X479 X480 Dummy Data

Note 1 Dummy data : "H" level.
Note 2 Do not input over 242 pulses to load.

8.2 TIMING CHARACTERISTICS

0℃ ≦ Ta ≦ 50℃

VDD=3.3V ±0.3V,5V ±0.25V

ITEM	SYMBOL		MIN.	TYP.	MAX.	UNIT
Clock Frequency	fCP		-	-	6.5	MHz
Clock Pulse Width	tW		63	-	-	ns
Clock Pise , Fall Time	tr,tf		-	-	20	ns
Data Set Up Time	tDSU		50	-	-	ns
Data Hold Time	tDHD		50	-	-	ns
Load Set Up Time	tLSU		80	-	-	ns
Load→Clock Time	tLC	VDD=3.3V	120	-	-	ns
		VDD=5V	80	-	-	
"Frame" Set Up Time	tsetup		100	-	-	ns
"Frame" Hold Time	thold		100	-	-	ns
"Load" Pulse Width	twc		125	-	-	ns

8.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL

VDD   4.75V   5V   4.75V   VDD

GND   0~50ms   0~50ms   GND

SIGNAL   VALID DATA   SIGNAL

GND   GND

VEE   0 min.   VEE

GND   20ms min.   GND

NOTE2

20ms min.   0 min.

$\overline{\text{DOFF}}$ $\overline{\text{DOFF}}$
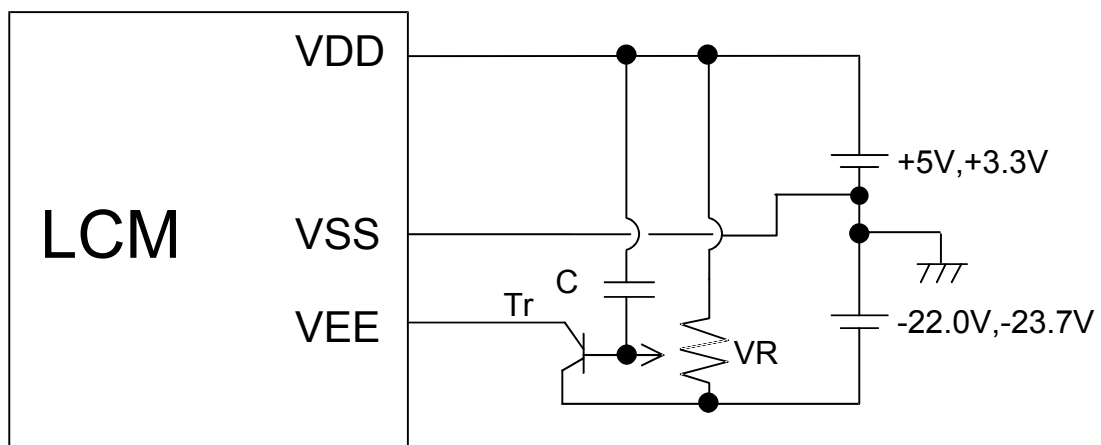
GND   GND

POWER ON   POWER OFF

Note 1 The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

Note 2 In case of not using $\overline{\text{DOFF}}$ controlling, VEE should be at VDD level or open in this time period.

Note 3 Operation of VDD-VSS changing (3.3←→5.0V) should be done after power off.

8.4 POWER SUPPLY FOR LCM (EXAMPLE)

LCM

VDD

VSS

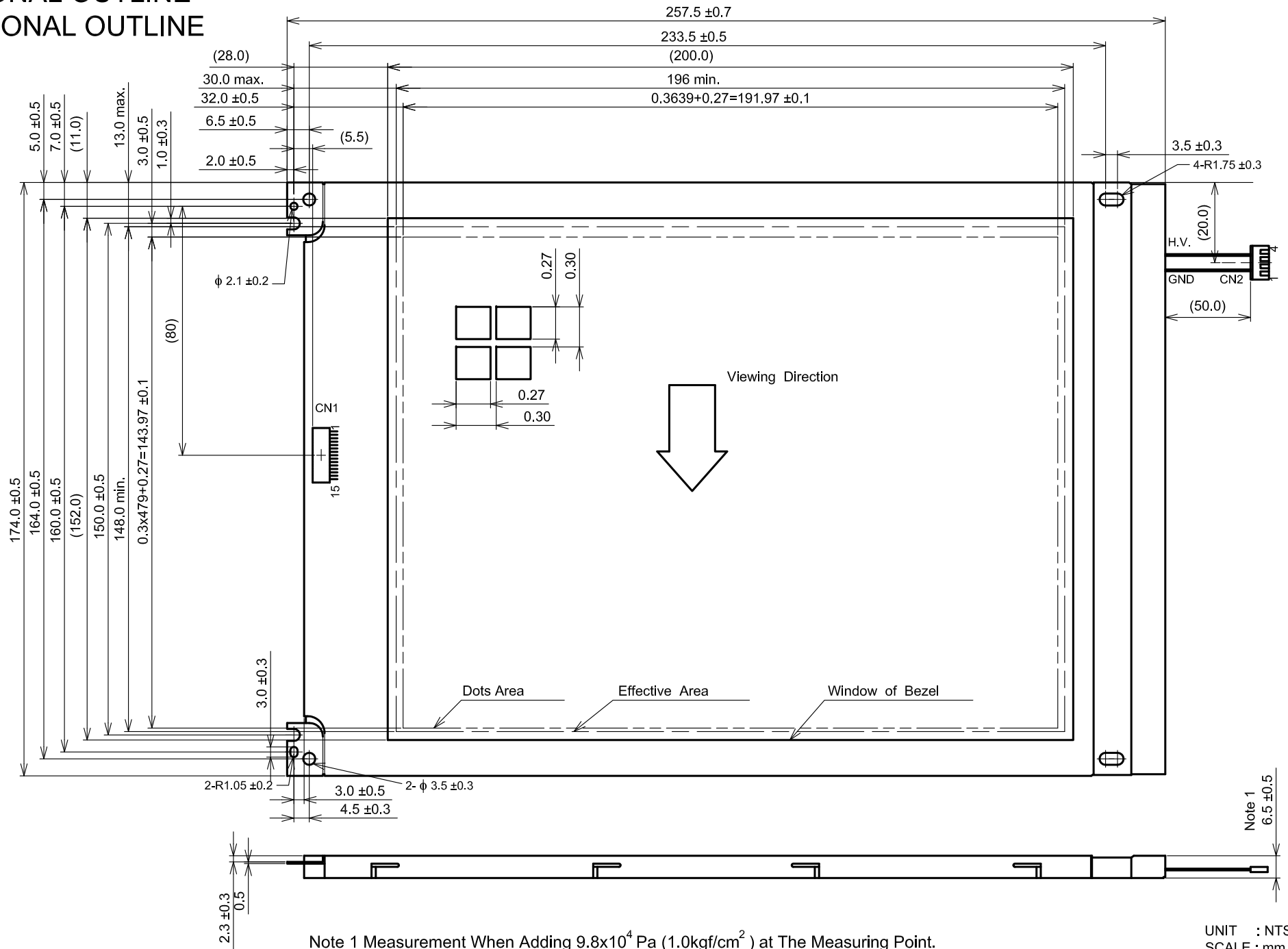VEE

+5V,+3.3V

-22.0V,-23.7V

Tr   C   VR

C1,C2 : 3.3μF(Aluminium electrolytic capacitor)

VR : 10~20kΩ

Tr : 2SA673APKC (HFE=100,IC=500mA)or equivalent Tr.

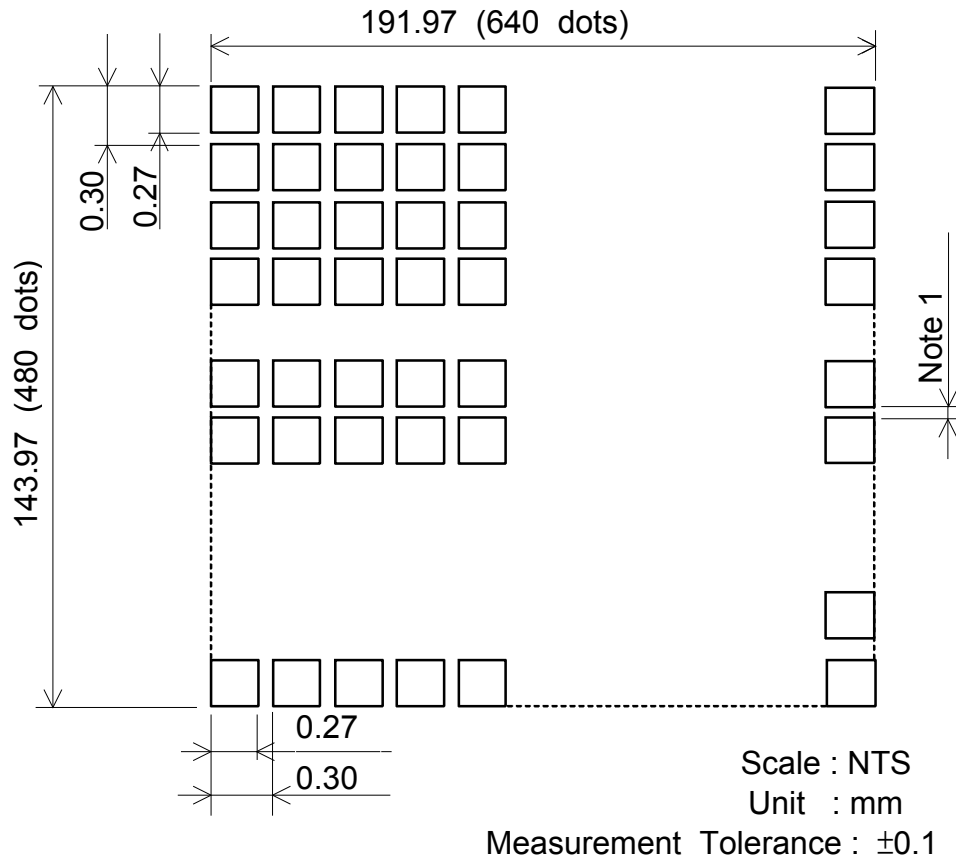| KAOHSIUNG OPTO-ELECTRONICS INC.	SHEET NO.	7B64PS 2708- SP24V01L0ALZZ-1	PAGE	8-3/3

9.DIMENSIONAL OUTLINE
9.1 DIMENIONAL OUTLINE

257.5 ±0.7
233.5 ±0.5
(200.0)
(28.0)
30.0 max.
196 min.
32.0 ±0.5
0.3639+0.27=191.97 ±0.1
6.5 ±0.5
(5.5)
2.0 ±0.5

5.0 ±0.5
7.0 ±0.5
(11.0)
13.0 max.
3.0 ±0.5
1.0 ±0.3

3.5 ±0.3
4-R1.75 ±0.3

(20.0)
H.V.
GND   CN2
(50.0)

φ 2.1 ±0.2

0.27
0.30

0.27
0.30

Viewing Direction

CN1

(80)

15

174.0 ±0.5
164.0 ±0.5
160.0 ±0.5
(152.0)
150.0 ±0.5
148.0 min.
0.3x479+0.27=143.97 ±0.1

3.0 ±0.3

Dots Area   Effective Area   Window of Bezel

2-R1.05 ±0.2
3.0 ±0.5
2- φ 3.5 ±0.3
4.5 ±0.3

Note 1
6.5 ±0.5

2.3 ±0.3
0.5

Note 1 Measurement When Adding 9.8x10^4 Pa (1.0kgf/cm^2) at The Measuring Point.

UNIT : NTS
SCALE : mm

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9.2 DISPLAY PATTERN

191.97 (640 dots)

143.97 (480 dots)

0.30

0.27

0.27

0.30

Note 1

Scale : NTS
Unit : mm
Measurement Tolerance : ±0.1

Note 1 Center-gap 60μm max.

9.3 INTERNAL PIN CONNECTION

INTERFACE		PIN NO.	SIGNAL	LEVEL	FUNCTION
LCM	I/F1	1	FRAME	H	First Line Marker
		2	LOAD	H→L	Data Latch
		3	CP	H→L	Data Shift
		4	$\overline{\text{DOFF}}$	H/L	H : ON / L : OFF
		5	VDD	-	Power Supply for Logic
		6	VSS	-	Gnd
		7	VEE	-	Power Supply for LC
		8	UD0	H/L	Display Data (Upper Half)
		9	UD1		
		10	UD2		
		11	UD3		
		12	LD0	H/L	Display Data (Lower Half)
		13	LD1		
		14	LD2		
		15	LD3		

I/F1 : MOLEX / 53261-1510
(SUITABLE CONNECTOR : MOLEX / 51021-1500)

LED I/F : JAE IL-G-4S-S3C2-SA

PIN No.	SYMBOL	Function
1	VSS	GND
2	NC	No Connect
3	NC	No Connect
4	VLED(+5V)	Power Supply for LED

10. APPEARANCE STANDARD

10.1 APPEARANCE INSPECTION CONDITION

Visual inspection should be done under the following condition.

(1) In the dark room.

(2) With panel lighted with prescribed LED inverter circuit.

(3) With eyes 25cm distance from LCM.

(4) Viewing angle within 45 degrees from the vertical line to the center of LCD.
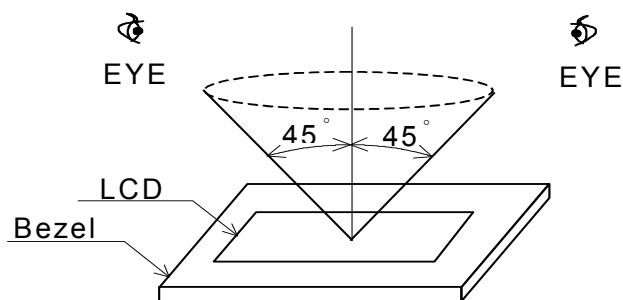
10.2 DEFINITION OF EACH ZONE

A zone : Within the effective area specified at page 9-1/3 of this document.

B zone : Area between the window of bezel line and the effective area line
specified at page 9-1/3 of this document.
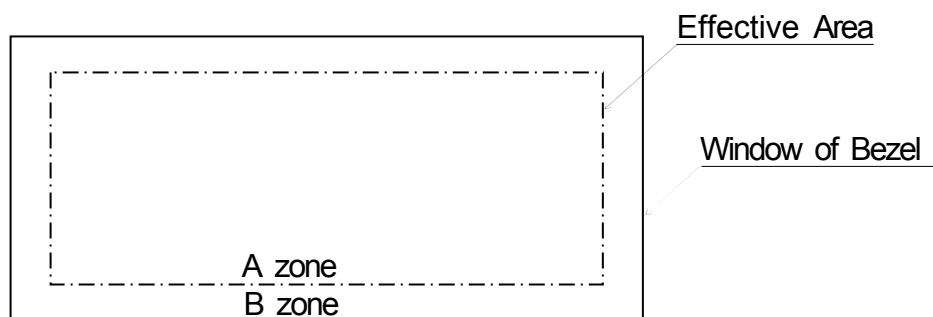
10.3 APPEAREACE SPECIFICATION

(1) LCD APPEARANCE

*) If the problem occures about this item, the responsible person of both party
(customer and KOE) will discuss more detail.

No.	ITEM	CRITERIA			A	B
	Scratches	Serious one is not allowed			*	-
	Dent	Serious one is not allowed			*	-
	Wrinkles in Polarizer	Serious one is not allowed			*	-
	Bubbles	Average diameter D(mm)		Maximum number Acceptable	O	-
		D≦0.2		Ignored		
		0.2＜D≦0.3		12		
		0.3＜D≦0.5		3		
		0.5＜D		None		
L C D	Stains, Foreign Materials Dark Spot	Filamentous			O	*
		Length L(mm)	Width W(mm)	Maximum number Acceptable		
		L≦2.0	W≦0.03	Ignored		
		L≦3.0	0.03＜W≦0.05	6		
		-	0.05＜W	None		
		Round			O	*
		Average diameter D(mm)	Maximum number Acceptable	Minimum Space		
		D＜0.2	Ignored	-		
		0.2≦D＜0.3	6	10 mm		
		0.3≦D＜0.4	4	30 mm		
		0.4≦D	None	-		
		The whole Number	Filamentous + Round = 10			
		Those wiped out easily are acceptable			O	O
	Pinhole	(A+B) / 2≦0.15 Maximum number : Ignored			O	-
		0.15＜(A+B) / 2≦0.3 Maximum number : 10				
		C≦0.03 Maximum number : Ignored				

No.	ITEM	CRITERIA				A	B
L C D	Contrast Irregularity (Spot)	Average diameter D(mm)	Maximum number Acceptable		Minimum Space	O	-
		D≦0.3	Ignored		-		
		0.3＜D≦0.45	15		20mm		
		0.45＜D≦0.6	5		20mm		
		0.6＜D≦0.8	3		50mm		
		0.8＜D	None		-		
	Contrast Irregularity (Line) (A pair of Scratch)	Width W(mm)	Length L(mm)	Maximum number Acceptable	Minimum Space	O	-
		W≦0.25	L≦1.2	2	20mm		
		W≦0.2	L≦1.5	3	20mm		
		W≦0.15	L≦2.0	3	20mm		
		W≦0.1	L≦3.0	4	20mm		
		The whole number		6			

Note

(1) Definition of average diameter D
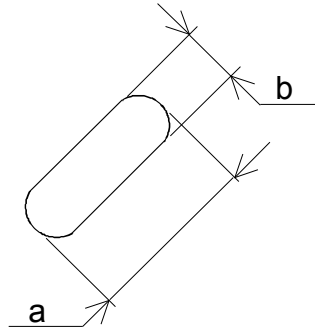
$$D = \frac{a+b}{2}$$

(2) Definition of length L and width W
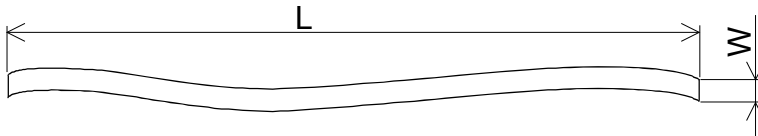
(3) Definition of pinhole
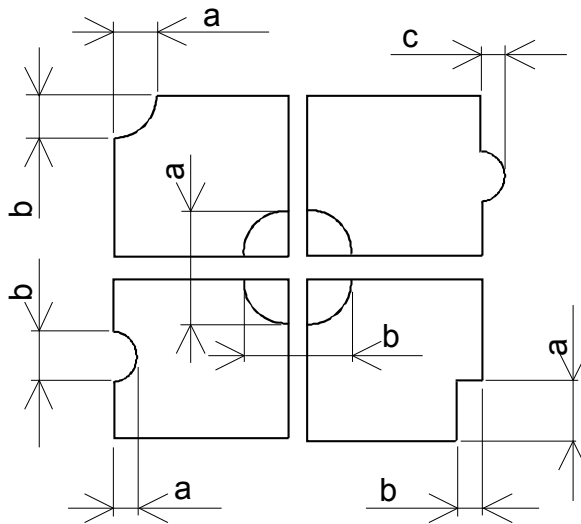
C : Salience

11. PRECAUTION IN DESIGN

11.1 MOUNTING METHOD

Since the module is so constructed as to be fixed by utilizing fitting holes in the module as shown below, it is necessary to take consideration the following items on attachment to a frame.

Protective Plate

LED

The Module

Spacer

Customer's Housing

Spacer

Protective Spacer

Example of Mounting

238.0 ± 0.3

119.0 ± 0.3

30 ± 0.3

197.0 ± 0.3

71.0 ±0.3

164.0 ±0.3

LED Side

150.0 ±0.3

90 ±0.3

Spacer 4-φ7.0
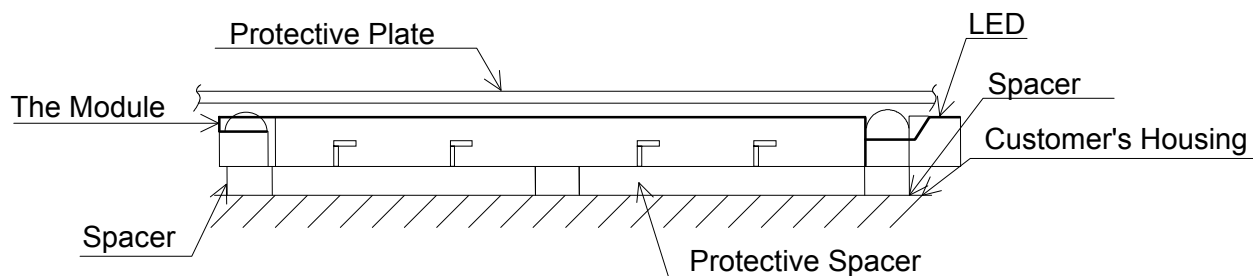
Protective Spacer 4-φ5.0
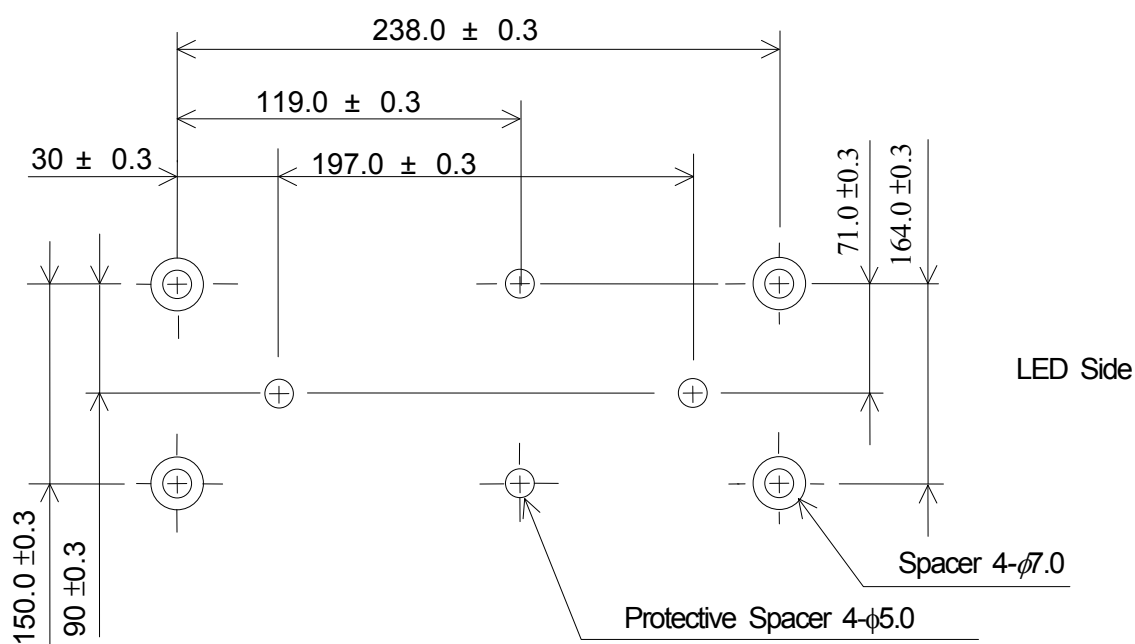
Location of Spacers

Unit:mm
Scale:NTS

(1) Use of protective plate, made of an acrylic plate, etc, in order to protect a polarizer and LC cell.

(2) To prevent the module cover from being pressed, the spacers between the module and the fitting plates should be longer than 0.5mm.

(3) We recommend you to use protective spacer as figure for protecting the module from any kind of shock to your set.

11.2 LC DRIVING VOLTAGE (VEE) AND VIEWING ANGLE RANGE

Setting VEE out of the recommended condition will be a cause for a change of viewing angle range.

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11.3 CAUTION AGAINST STATIC CHARGE
 As this module is provided with C-MOS LSIs the care to take such a precaution
 as to grounding the operator's body is required when handling it.

11.4 POWER ON SEQUENCE
 Input signals should not be applied to LCD module before power supply voltage
 is applied and reaches to specified voltage (5 ±0.25V).
 If above sequence is not kept, C-MOS LSIs of LCD modules may be damaged
 due to latch up problem.

11.5 PACKAGING
 (1) No. Leaving products is preferable in the place of high humidity for a long
    period of time. For their storage in the place where temperature is 35℃ or
    higher, special care to prevent them from high humidity is required. A
    combination of high temperature and high humidity may cause them
    polarization degradation as well as bubble generation and polarizer peel-off.
    Please keep the temperature and humidity within the specified range for
    use and storing.
 (2) Since upper polarizers and lower aluminum plates tend to be easily damaged,
    they should be handled with full care so as not to get them touched, pushed
    or rubbed by a piece of glass, tweezers and anything else which are harder
    than a pencil lead 3H.
 (3) As the adhesives used for adhering upper/lower polarizers and aluminum
    plates are made of organic substances which will be deteriorated by a
    chemical reaction with such chemicals as acetone, toluene ethanol and
    isopropyl-alcohol. The following solvents are recommended for use:
    Normal Hexane
    Please contact us when it is necessary for you to use chemicals other than
    the above.
 (4) Lightly wipe to clean the dirty surface with absorbent cotton waste or other
    soft material like chamois, soaked in the chemicals recommended without
    scrubbing it hardly. To prevent the display surface from damage and keep the
    appearance in good state, it is sufficient, in general, to wipe it with absorbent cotton.
 (5) Immediately wipe off asliva or water drop attached on the display area
    because its long period adherence may cause deformation or faded color on
    the spot.
 (6) Fogy dew deposited on the surface and contact terminals due to coldness will
    be a cause for polarizer damage, stain and dirt on product. When necessary
    to take out the products from some place at low temperature for test, etc.
    It is required for them to be warmed up in a container once at the
    temperature higher than that of room.

(7) Touching the display area and contact terminals with bare hands and contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched by bare hands. (There are some cosmetics detrimental to polarizers.)

(8) In general the quality of glass is fragile so that it tends to be cracked or chipped in handling, specially on its periphery please be careful not give it sharp shock caused by dropping down, etc.

11.6 CAUTION FOR OPERATION

(1) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current driver should be avoided.

(2) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark blue color in them. However those phenomena do not mean impediment or out of order with LCD's which will come back in the specified operating temperature range.

(3) If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

(4) A slight dew depositing on terminals is a cause for electrochemical reaction resulting in terminal open circuit. Usage under the relative condition of 40℃ 50%RH less is required.

11.7 STORAGE

In case of storing for a long period of time (for instance, for years) for the purpose of replacement use, the following ways are recommended.

(1) Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it, and with no desiccant.

(2) The placing in a dark room where neither exposure to direct sunlight nor light is, keeping temperature in the range from 0℃ to 35℃.

(3) Storing with no touch on polarizer surface by anything else. (It is recommended to stone them as they have been contained in the inner container at the time of delivery from us.)

11.8 SAFETY

(1) It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

(2) When any liquid leaked out of a damaged glass gall comes in contact with your hands, please wash it off well with soap and water.

12. DESIGNATION OF LOT MARK

12.1 LOT MARK

Lot mark is consisted of 4 digits for production.

Lot and 8 digits for production control.

| 4 | 0 | 3 | 1 | | | | | | | | |

DIGITS FOR PRODUCTION CONTROL
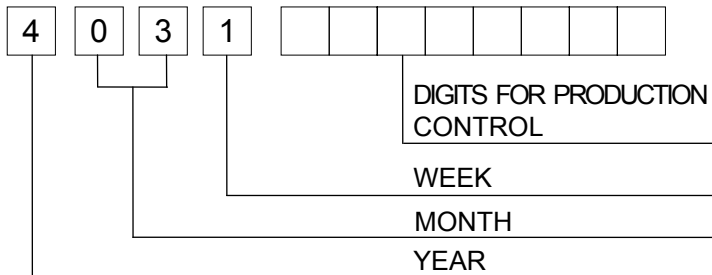
WEEK

MONTH

YEAR

YEAR	FIGURE IN LOT MARK
2014	4
2015	5
2016	6
2017	7
2018	8

MONTH	FIGURE IN LOT MARK	MONTH	FIGURE IN LOT MARK
Jan.	01	Jul.	07
Feb.	02	Aug.	08
Mar.	03	Sep.	09
Apr.	04	Oct.	10
May	05	Nov.	11
Jun.	06	Dec.	12

WEEK (DAY IN CALENDAR	FIGURE IN LOT MARK
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

12.2 LOCATION OF LOT MARK

on the back side of LCM

| 4 0 3 1 * * * * * * * * |

13. PRECAUTIPON FOR USE

(1) A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

(2) On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible persons of the both parties.

   1. When a question is arisen in the specifications.

   2. When a new problem is arisen which is not specified in this specifications.

   3. When an inspection specifications change or operating condition change in customer is reported to KOE, and some problem is arisen in this specification due to the change.

   4. When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

(3) Regarding the treatment for maintenance and repairing, both parties will discuss it in six months later after latest delivery of this product.

The precaution that should be observed when handling LCM have been explained above. If any points are unclear of if you have any requests, please contact KOE.