

KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Jan. 20th, 2014

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

SP14N02L6ALCZ

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ACCEPTED BY: _____

PROPOSED BY: *Ken Chen*

RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL SPECIFICATIONS

(1) Part Name	SP14N02L6ALCZ
(2) Module Size	159.4(W)mm x 101.0(H)mm x 12.0 (D)mm max.
(3) Dot Size	0.47(W)mm x 0.47(H)mm
(4) Dot Pitch	0.50(W)mm x 0.50(H)mm
(5) Number Of Dots	240(W) x 128(H)dots
(6) Duty	1/128
(7) LCD Type	Film type black / white (Negative type) The upper polarizer is anti-glare type. (Hardness.3H) The bottom polarizer is transmissive type.
(8) Viewing Direction	6 O'clock
(9) Backlight	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	20.5	V	
Input Voltage	V_i	-0.3	VDD+0.3	V	
Input Current	I_i	0	1	A	
Static Electricity	-	-	-	-	Note 1

Note 1: 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°C	50°C	-20°C	60°C	Note 2,3
Humidity	Note 1		Note 1		Without Condensation
Vibration	-	4.9m/s ² (0.5G)	-	19.6m/s ² (2G) Note 5	Note 4
Shock	-	29.4m/s ² (3 G)	-	490.0m/s ² (50 G)	XYZ Directions
Corrosive Gas	Not Acceptable		Not Acceptable		

Note 1: $T_a \leq 40^\circ\text{C}$: 85%RH max.

$T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C

Note 2: T_a at -20°C —— < 48h, at 60°C —— < 168h.

Note 3: The maximum rating is defined as above based on the chamber temperature, which might 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°C.
- Operating under high temperature will shorten LED lifetime.

Note 4: 5Hz~100Hz (Except Resonance Frequency)

Note 5: This module should be operated normally after finishing the test.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage For Logic	VDD-VSS	-	4.75	5.0	5.25	V
LC driver Circuit Power Supply Voltage	VEE-VSS	-	-15.5	-15.0	-14.5	V
Input Voltage	VI	H LEVEL	0.8VDD	-	VDD	V
		L LEVEL	0	-	0.2VDD	V
Power Supply Current For Logic Note 1	IDD	VDD-VSS=5.0V	-	11.7	14.0	mA
Power Supply Current For LCD Note 1	IEE	VDD-VSS=5.0V	-	2.5	4.0	mA
Recommended LC Driving Voltage Note 2	VDD-V0	Ta= 0°C , $\phi = 0^\circ$	-	16.9	-	V
		Ta=25°C , $\phi = 0^\circ$	-	15.8	-	V
		Ta=50°C , $\phi = 0^\circ$	-	15.2	-	V

Note 1: VDD-V0=15.8V , Ta=25°C

Note 2: Recommended LC driving voltage may fluctuate about $\pm 1.0V$ by each module.
Test pattern is all "Q".

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	-	144	-	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 144 mA.

Note 2: The estimated lifetime is specified as the time to reduce 50% brightness by applying 144 mA at 25°C.

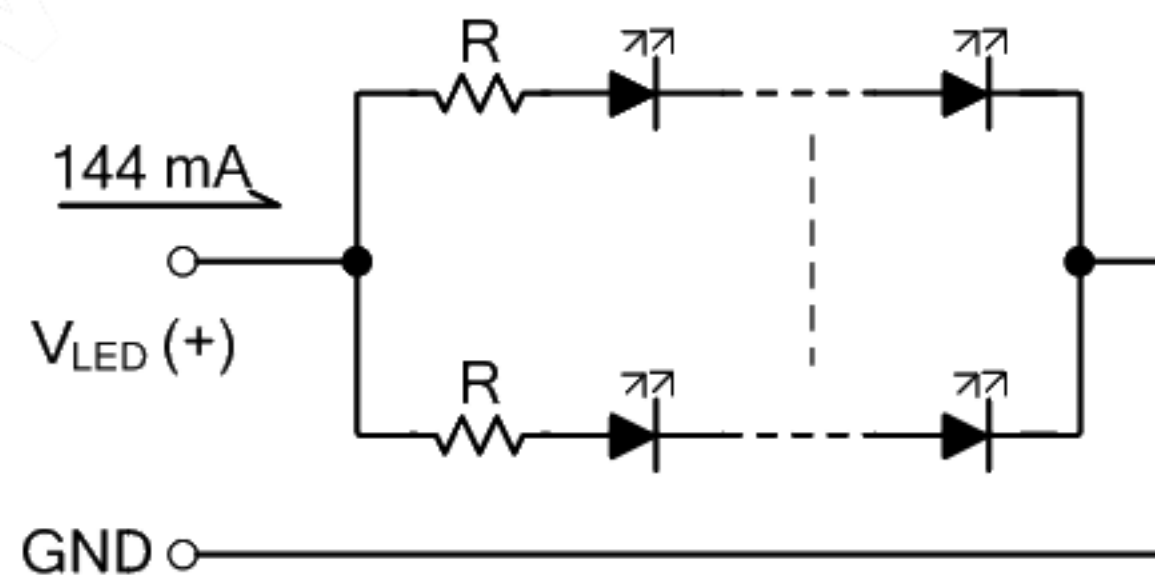


Fig 5.1

6. OPTICAL CHARACTERISTICS

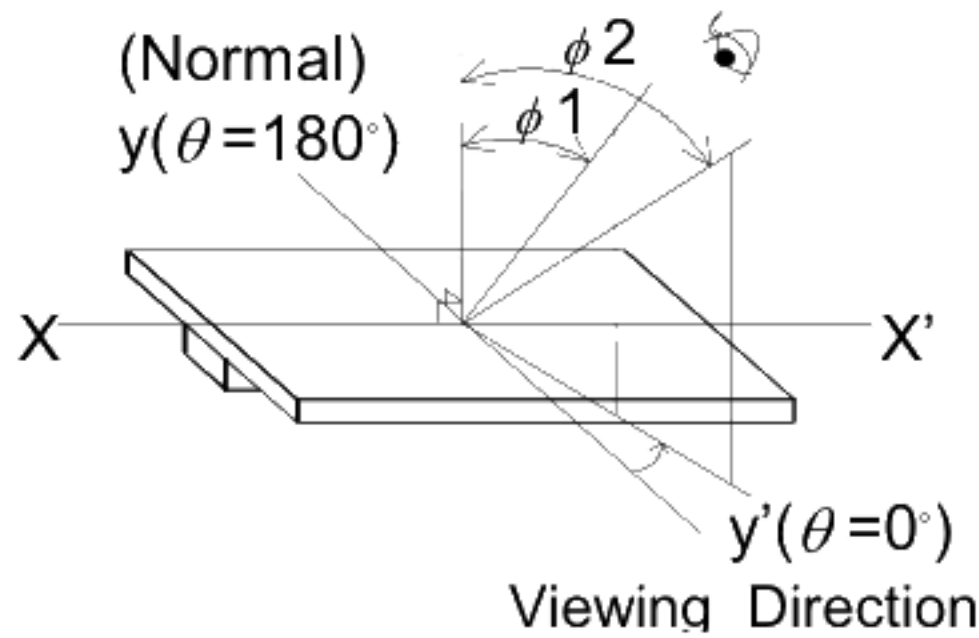
6.1 OPTICAL CHARACTERISTICS

Ta=25°C (Backlight on)

ITEM	SYMBOL	CONDITIONAL	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing Area	$\phi 2-\phi 1$	$K \geq 2.0$	30	40	-	deg	1,2
Contrast Ratio	K	$\phi = 0^\circ, \theta = 0^\circ$	-	20	-	-	3
Response Time (Rise)	tr	$\phi = 0^\circ, \theta = 0^\circ$	-	160	-	ms	4
Response Time (Fall)	tf	$\phi = 0^\circ, \theta = 0^\circ$	-	110	-	ms	4

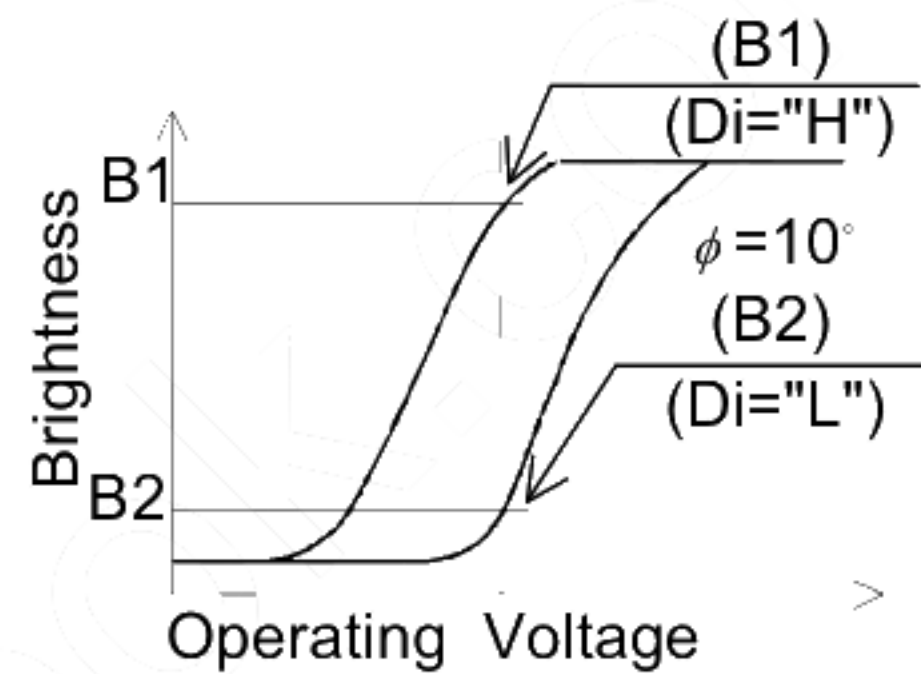
(Measure condition by KOE)

Note 1: Definition of θ and ϕ

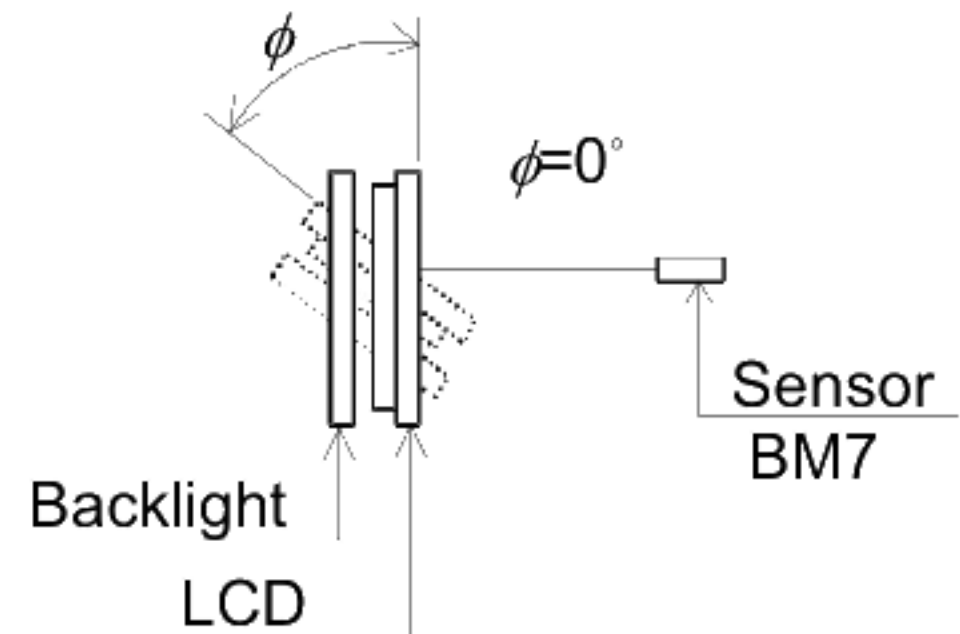
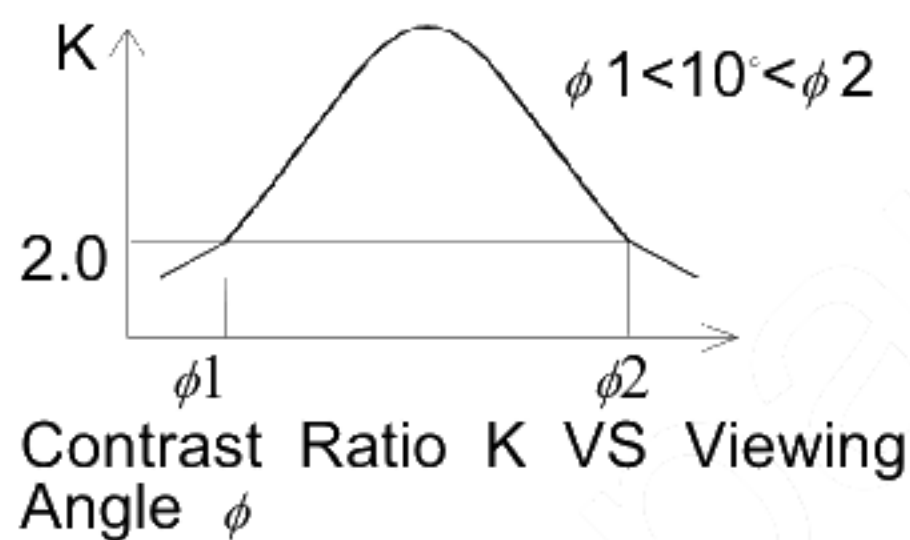


Note 3: Definition of contrast "K"

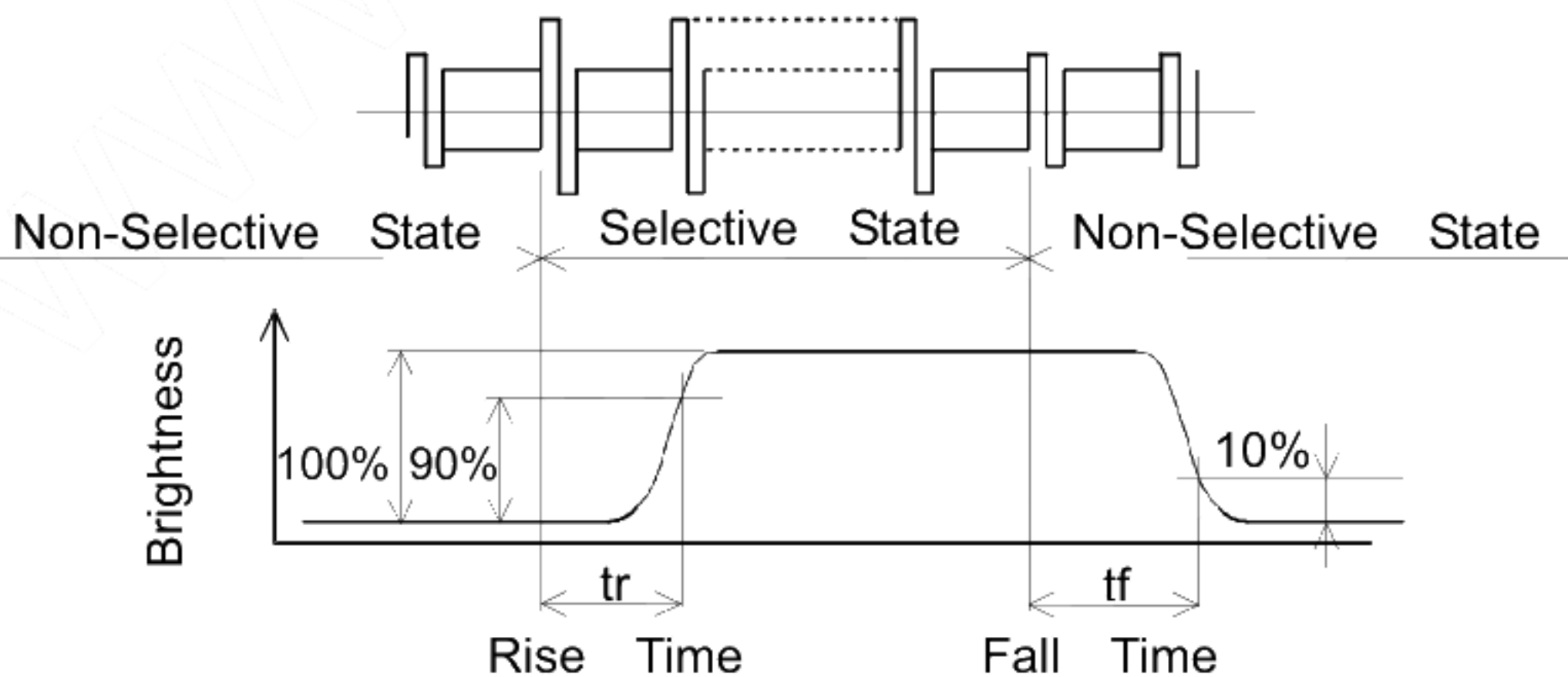
$$K = \frac{\text{Brightness on selected dot (B1)}}{\text{Brightness on non-selected dot (B2)}}$$



Note 2: Definition of viewing angle $\phi 1$ and $\phi 2$.



Note 4: Definition of optical response



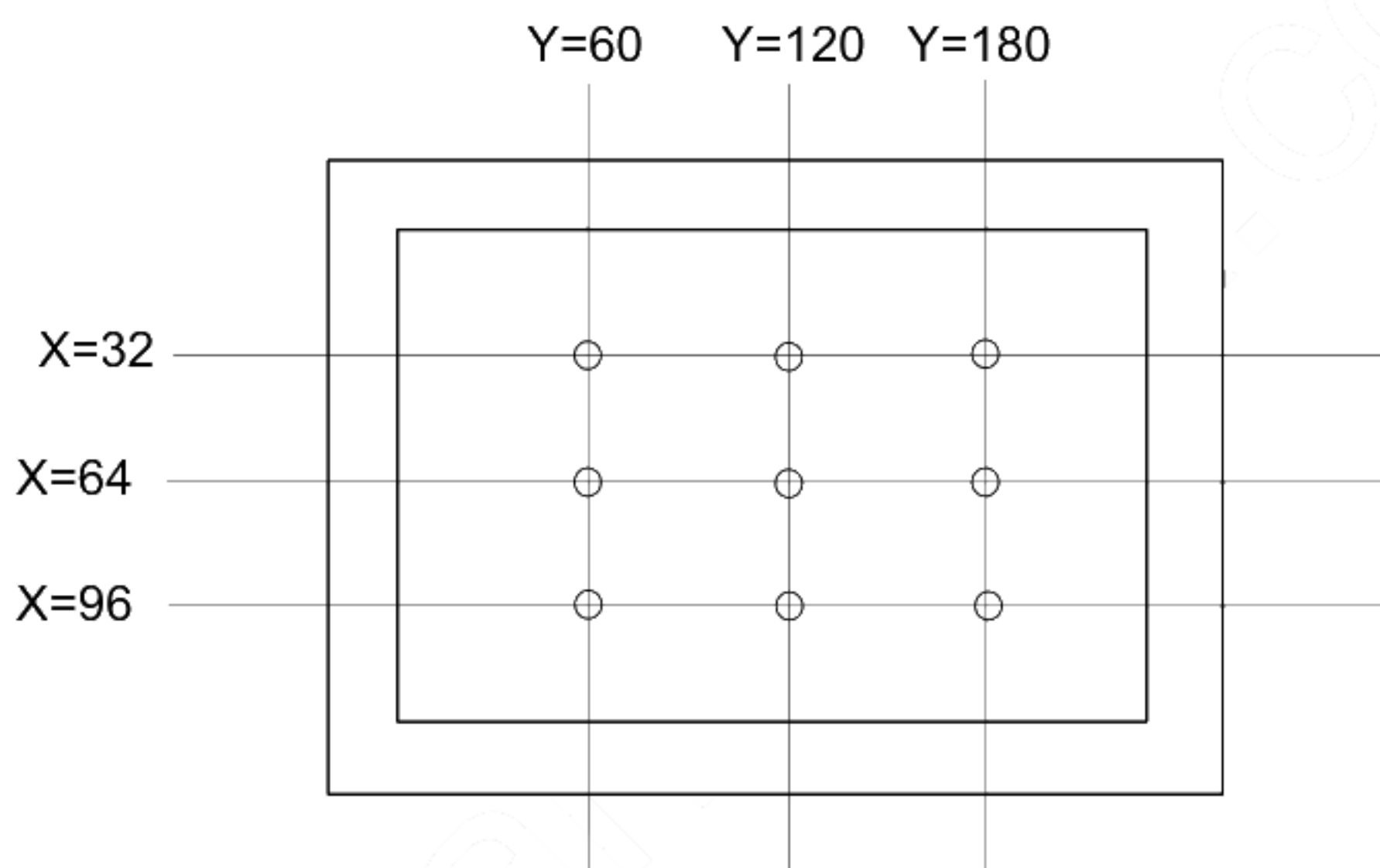
6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

ITEM	MIN.	TYP.	MAX.	UNIT	REMARKS
Brightness	120	150	-	cd/m ²	Note1,2
Brightness Uniformity	-	-	±30	%	Note1,3

Note 1: Measurement after 10 minutes of LED operating.

Note 2: Brightness control : 100%. The LED current is 144 mA when applying 5V (VLED).

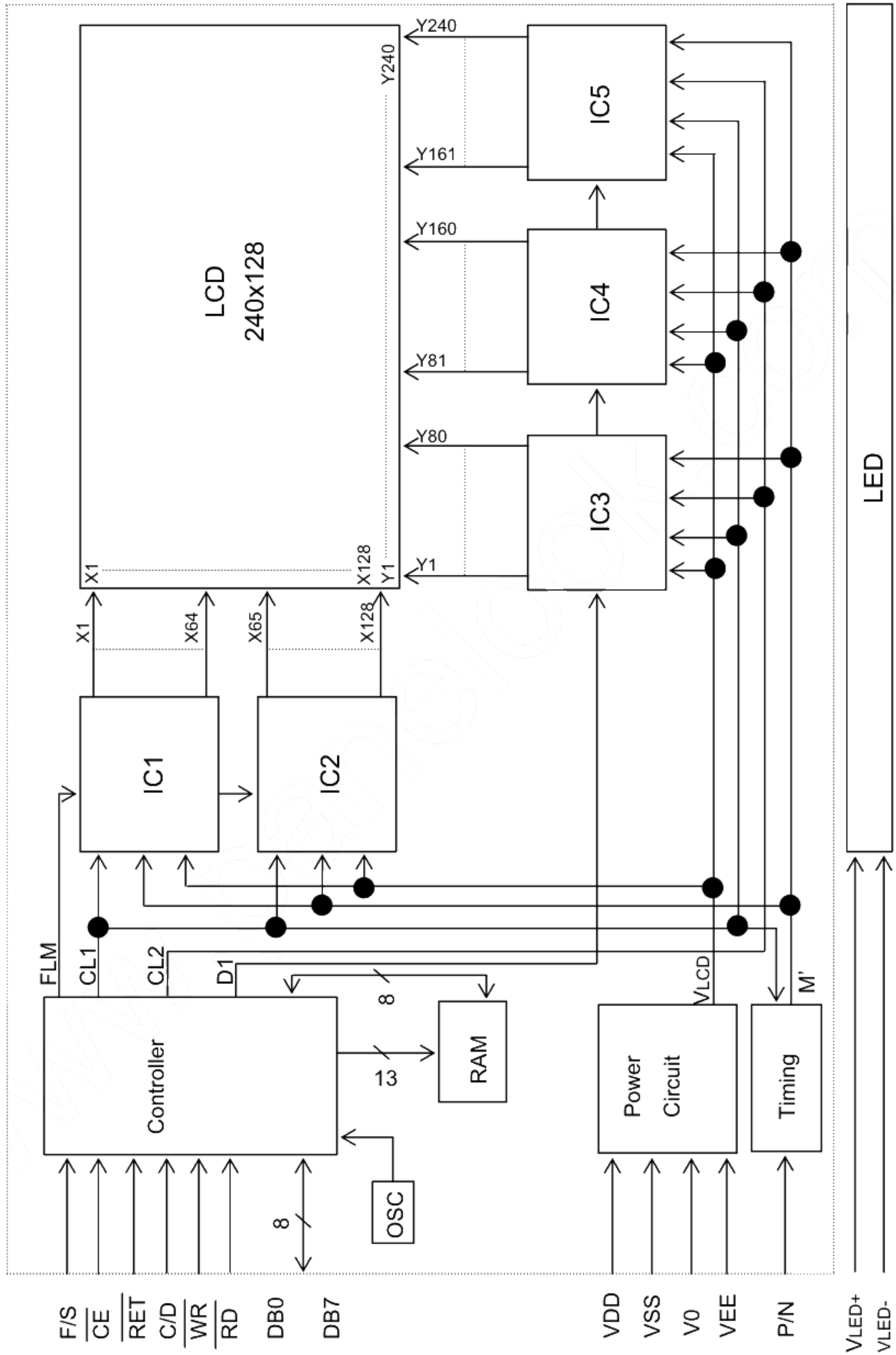
Note 3: Measure of the following 9 places on the display.



Definition of the brightness tolerance.

$$\left(\frac{\text{max. Brightness or min. Brightness} - \text{Average Brightness}}{\text{Average Brightness}} \right) \times 100\%$$

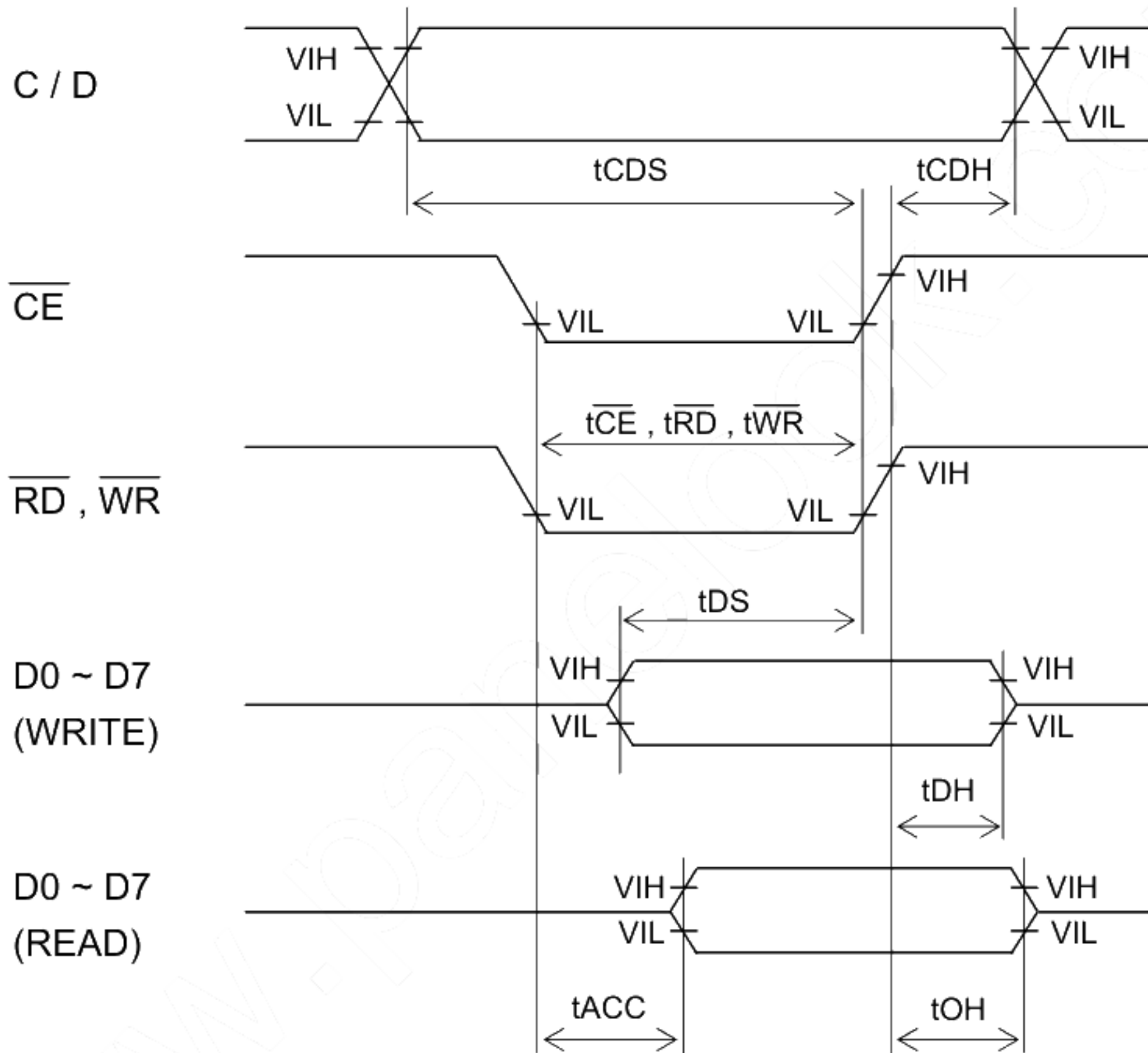
7. BLOCK DIAGRAM



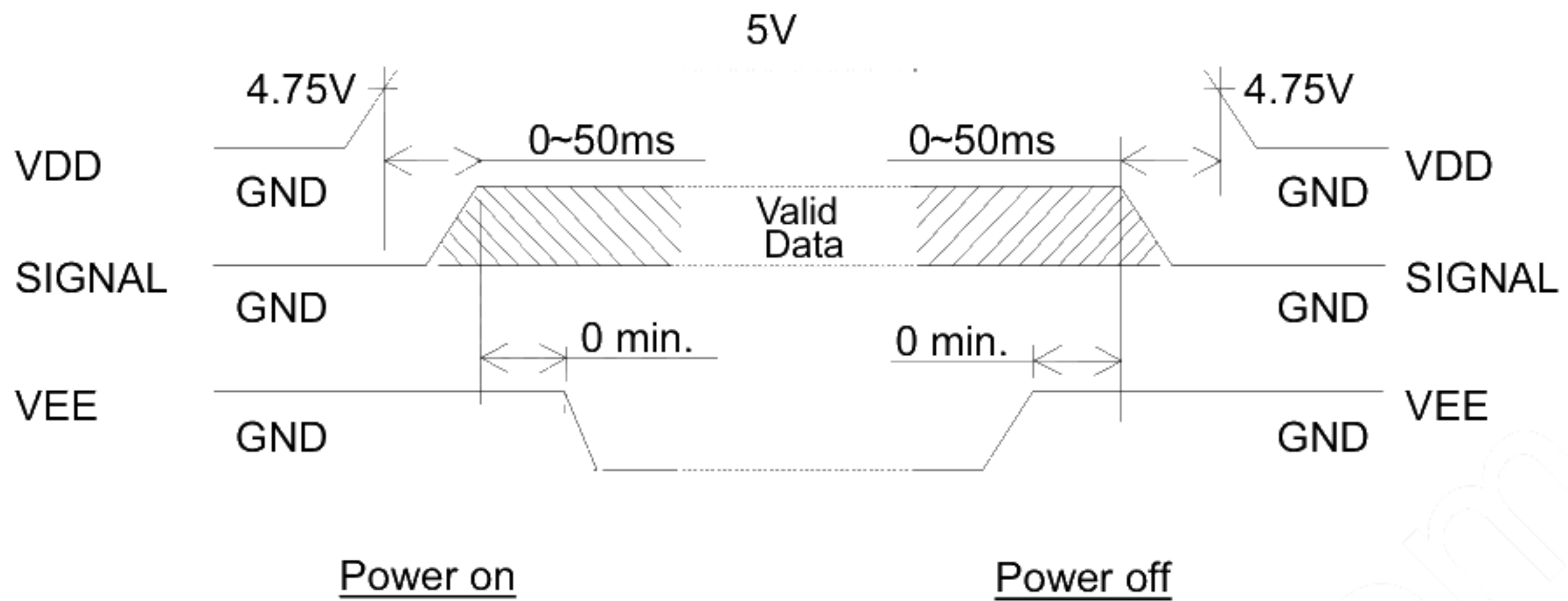
8. INTERFACE TIMING

8.1 INTERFACE TIMING

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
C / D Setup Time	t_{CDS}	100	-	-	ns
C / D Hold Time	t_{CDH}	10	-	-	ns
\overline{CE} , \overline{RD} , \overline{WR} Pulse Width	$\overline{t_{CE}}$, $\overline{t_{RD}}$, $\overline{t_{WR}}$	80	-	-	ns
Data Setup Time	t_{DS}	80	-	-	ns
Data Hold Time	t_{DH}	40	-	-	ns
Access Time	t_{ACC}	-	-	150	ns
Output Hold Time	t_{OH}	10	-	50	ns

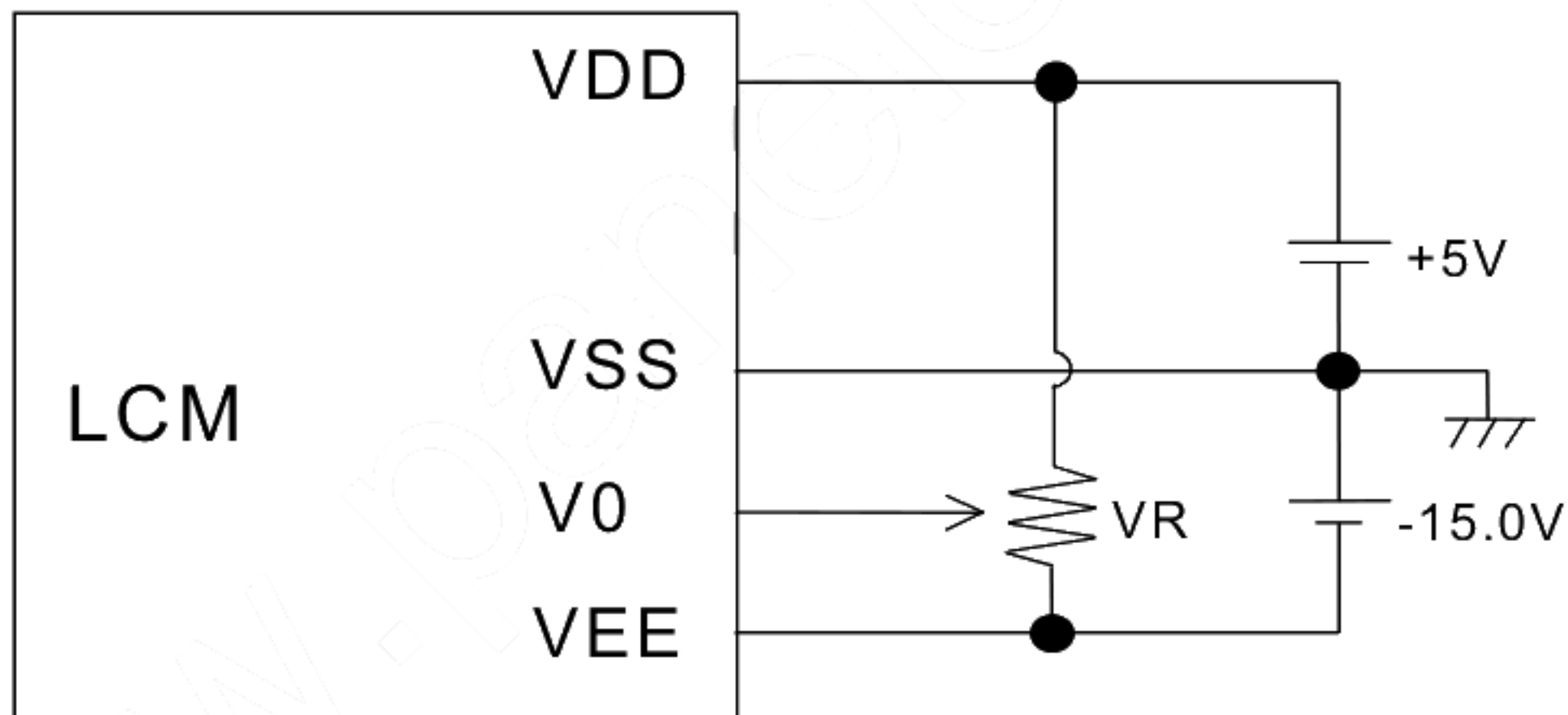


8.2 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL



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

8.3 POWER SUPPLY FOR LCM (EXAMPLE)

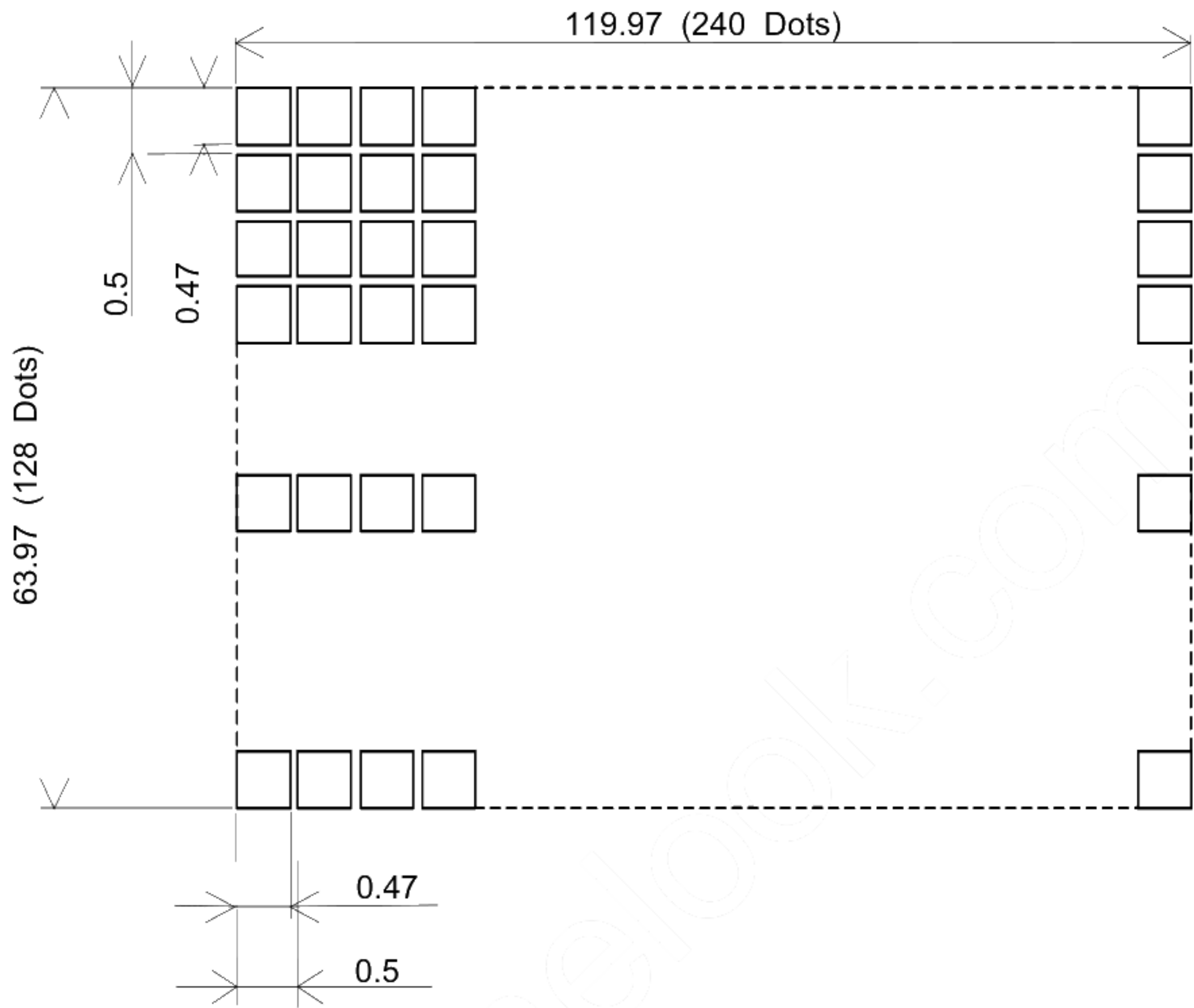


Recommend:

VR: 10~20k Ω

VDD-V0 : LCD driving voltage

9.2 DISPLAY PATTERN



Scale: NTS

Unit : mm

Measurement Tolerance : ± 0.1

9.3 INTERNAL PIN CONNECTION

CN1

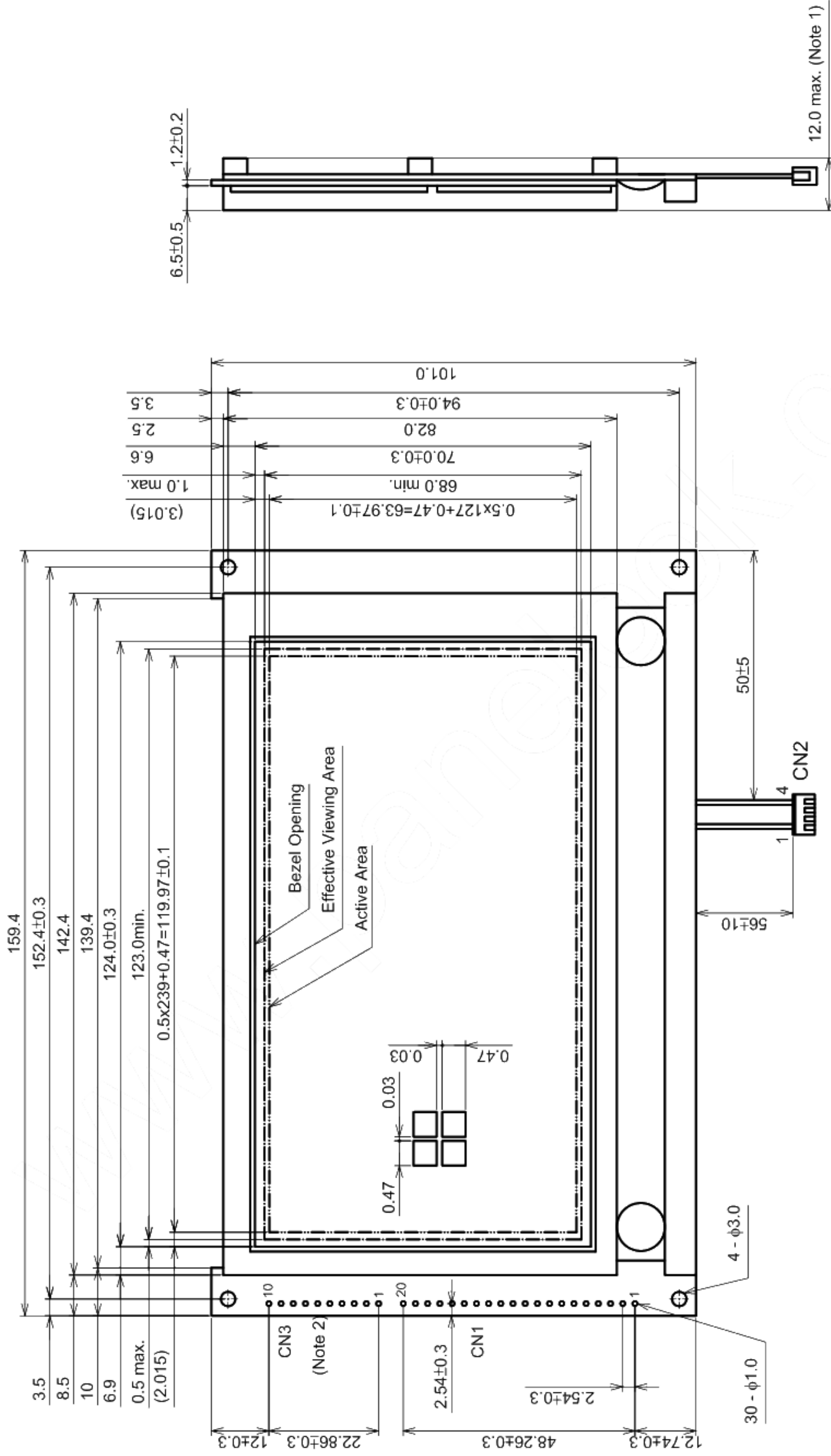
PIN No.	SYMBOL	FUNCTION
A1	VSS(0V)	Ground
A2	VDD(+5V)	Power supply for logic circuit
A3	V0	Power supply for LCD drive
A4	C/D	\overline{WR} ="L" : C/D="H" Command write C/D="L" Data write \overline{RD} ="L" : C/D="H" Status read C/D="L" Data read
A5	\overline{WR}	Data write (Data write at "L")
A6	\overline{RD}	Data read (Read data at "L")
A7~14	DB0~DB7	Data bus
A15	\overline{CE}	Chip enable (\overline{CE} must be "L")
A16	\overline{RET}	Reset
A17	VEE(-15V)	Power supply for LCD drive
A18	$\overline{D.OFF}$	NC/Display , GND/Display off
A19	F/S	Character font select : F/S="H" 6*8Font F/S="L" 8*8Font
A20	P/N	Display mode reverse.

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

9. OUTLINE DIMENSIONS

9.1 OUTLINE DIMENSIONS



Viewing Direction

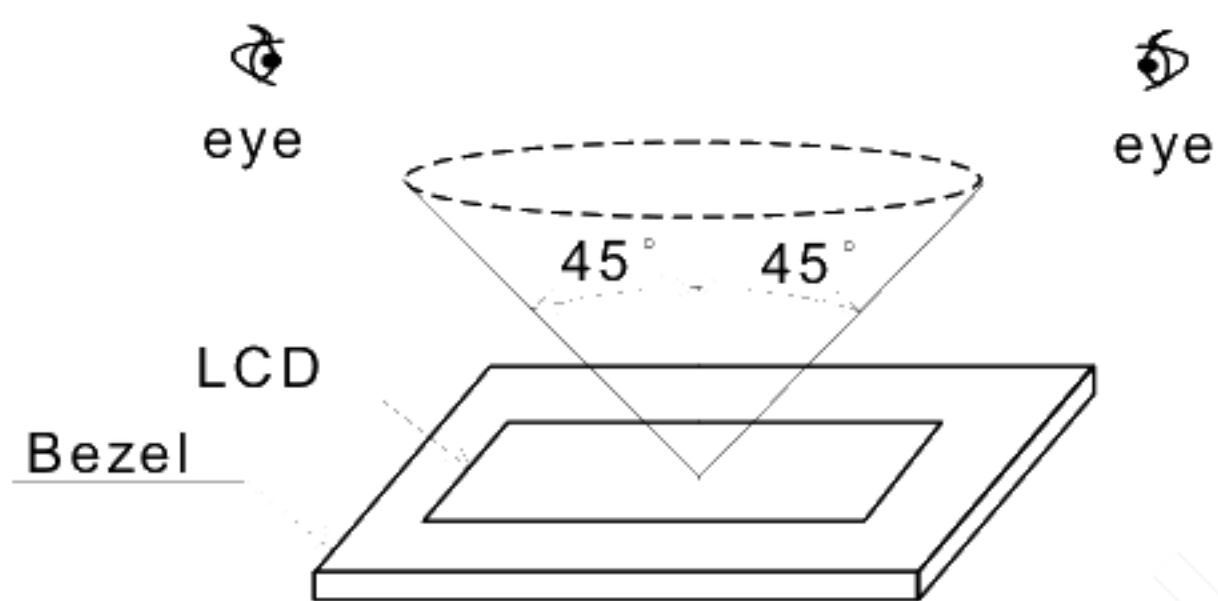
Unit : mm
 Scale : NTS
 Tolerance not specified is ±0.5mm
 Note 1 : Measurement when adding 9.8×10^{-4} Pa
 (1.0kgf/cm²) At the measuring point
 Note 2 : Do not connect any signal to CN3.
 Use CN1 as interface

10. APPEARANCE STANDARD

10.1 APPEARANCE INSPECTION CONDITION

Visual inspection should be done under the following condition.

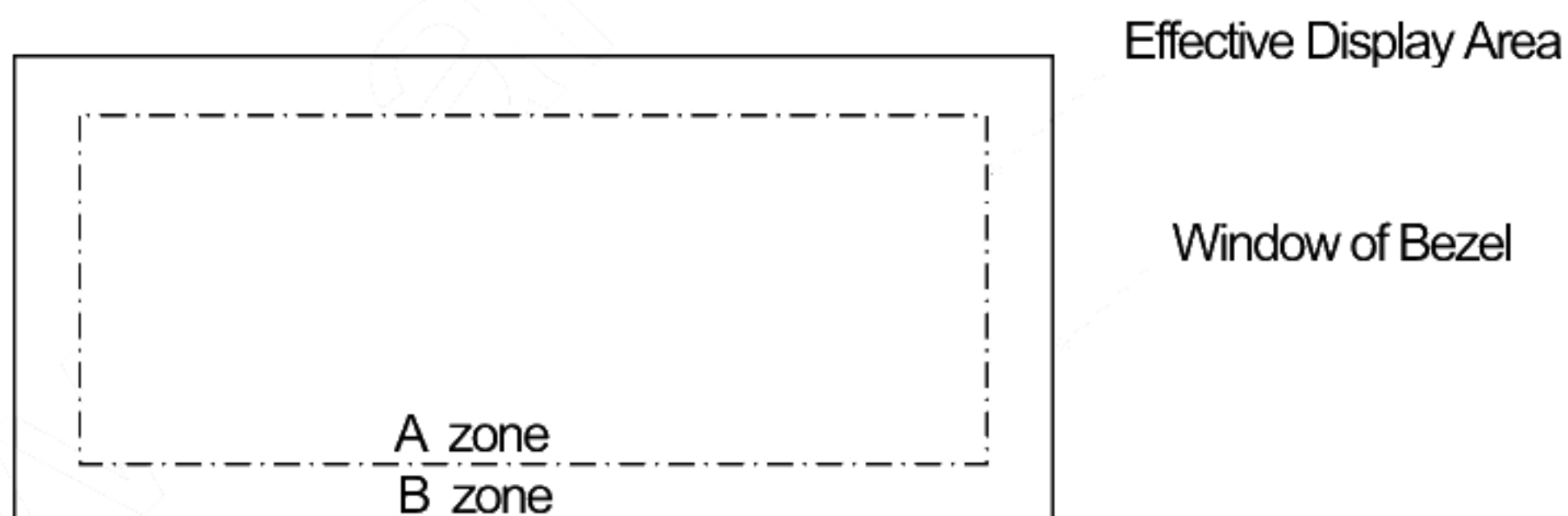
- (1) In the dark room
- (2) With panel lighted with prescribed LED current.
- (3) With eyes 25cm distance from LCM.
- (4) Viewing angle within 45 degrees from the vertical line to the center of LCD.



10.2 DEFINITION OF EACH ZONE

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

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



10.3 APPEARANCE SPECIFICATION

(1) LCD appearance

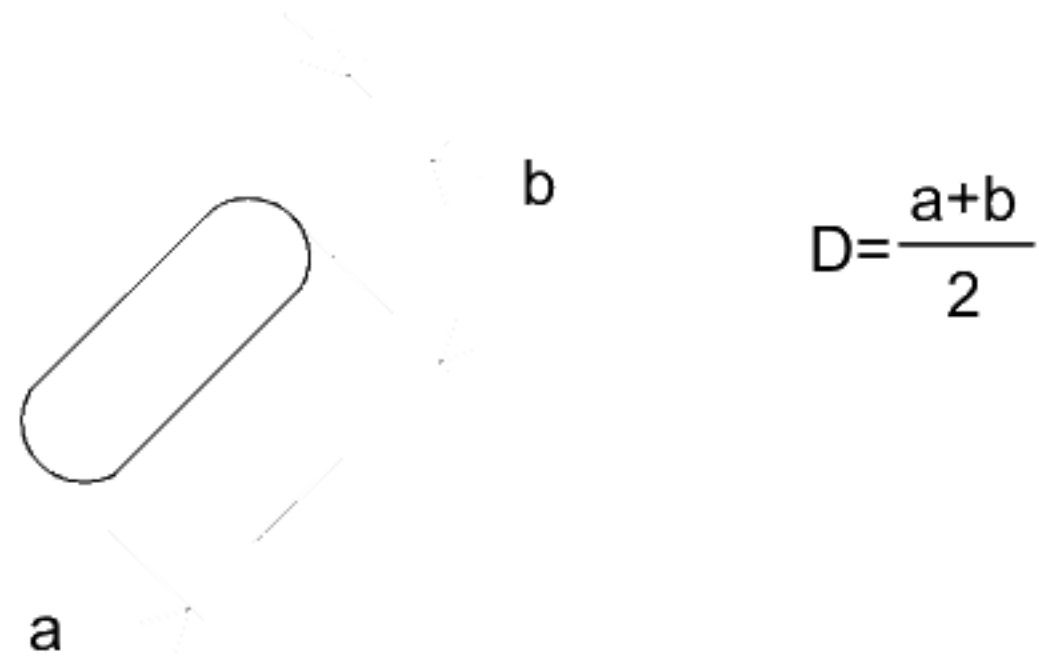
*) If the problem occurs about this item, the responsible person of both party (customer and KOE) will discuss more detail.

No.	ITEM	CRITERIA			A	B	
L C D	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	-	
		$D \leq 0.2$	Ignored				
		$0.2 < D \leq 0.3$	12				
		$0.3 < D \leq 0.5$	3				
		$0.5 < D$	None				
	Stains, Foreign Materials Dark spot	Filamentous			O	*	
		LENGTH L(mm)	Width W(mm)	Maximum Number Acceptable			
		$L \leq 2.0$	$W \leq 0.03$	Ignored			
		$L \leq 3.0$	$0.03 < W \leq 0.05$	6			
		-	$0.05 < W$	None			
		Round			O	*	
		Average Diameter D(mm)	Maximum Number Acceptable	Minimum Space			
		$D < 0.2$	Ignored	-			
		$0.2 \leq D < 0.3$	6	10 mm			
		$0.3 \leq D < 0.4$	4	30 mm			
		$0.4 \leq D$	None	-			
		The whole number		Filamentous + Round = 5			
		Those wiped out easily are acceptable				O	O
Pinhole	$(A+B)/2 \leq 0.15$ Maximum number : Ignored			O	-		
	$0.15 < (A+B)/2 \leq 0.3$ Maximum number : Ignored						
	$C \leq 0.03$ Maximum number : Ignored						

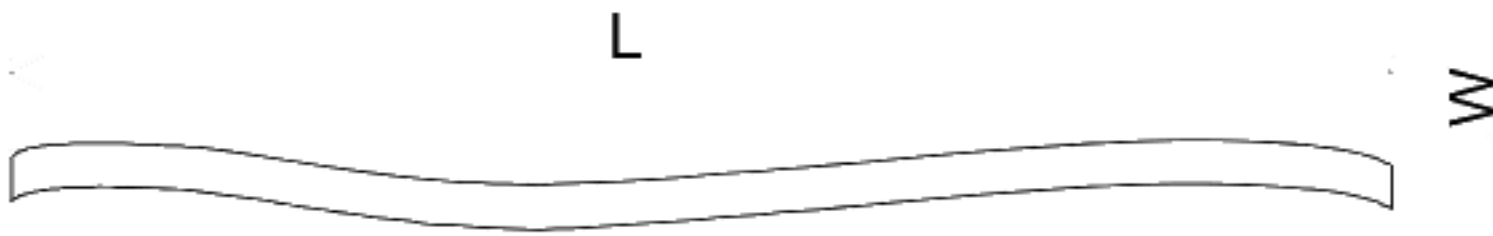
No.	ITEM	CRITERIA				A	B
L	Contrast Irregularity (Spot)	Average Diameter D(mm)	Maximum Number Acceptable	Minimum Space		0	-
		$D \leq 0.25$	Ignored	-			
		$0.25 < D \leq 0.35$	10	20mm			
		$0.35 < D \leq 0.5$	4	20mm			
		$0.5 < D$	None	-			
C D	Contrast Irregularity (A Pair of Scratch)	Width W(mm)	Length L(mm)	Maximum Number Acceptable	Minimum Space	0	-
		$W \leq 0.25$	$L \leq 1.2$	2	20mm		
		$W \leq 0.2$	$L \leq 1.5$	3	20mm		
		$W \leq 0.15$	$L \leq 2.0$	3	20mm		
		$W \leq 0.1$	$L \leq 3.0$	4	20mm		
		The whole number			6		

Note

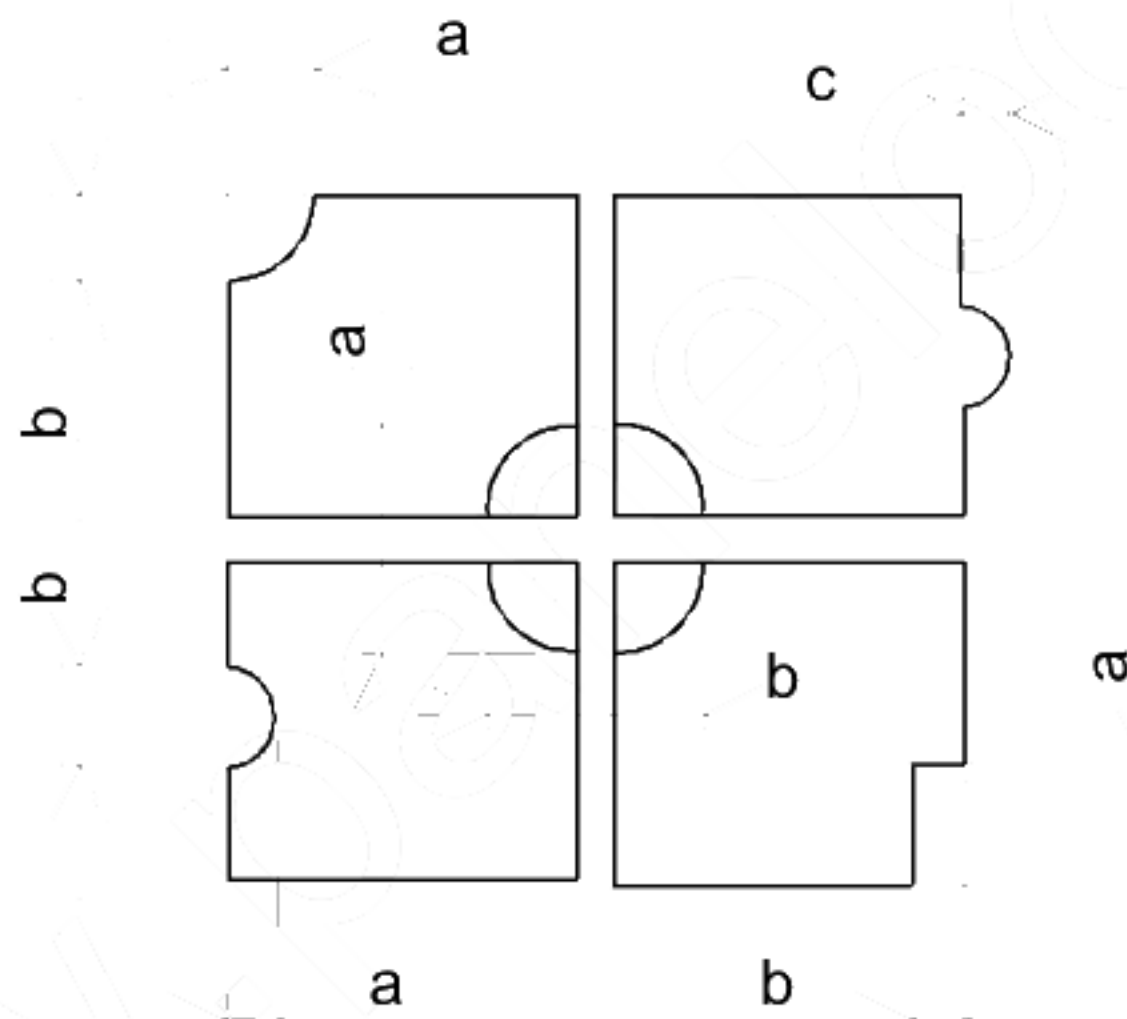
(1) Definition of average diameter D



(2) Definition of length L and width W



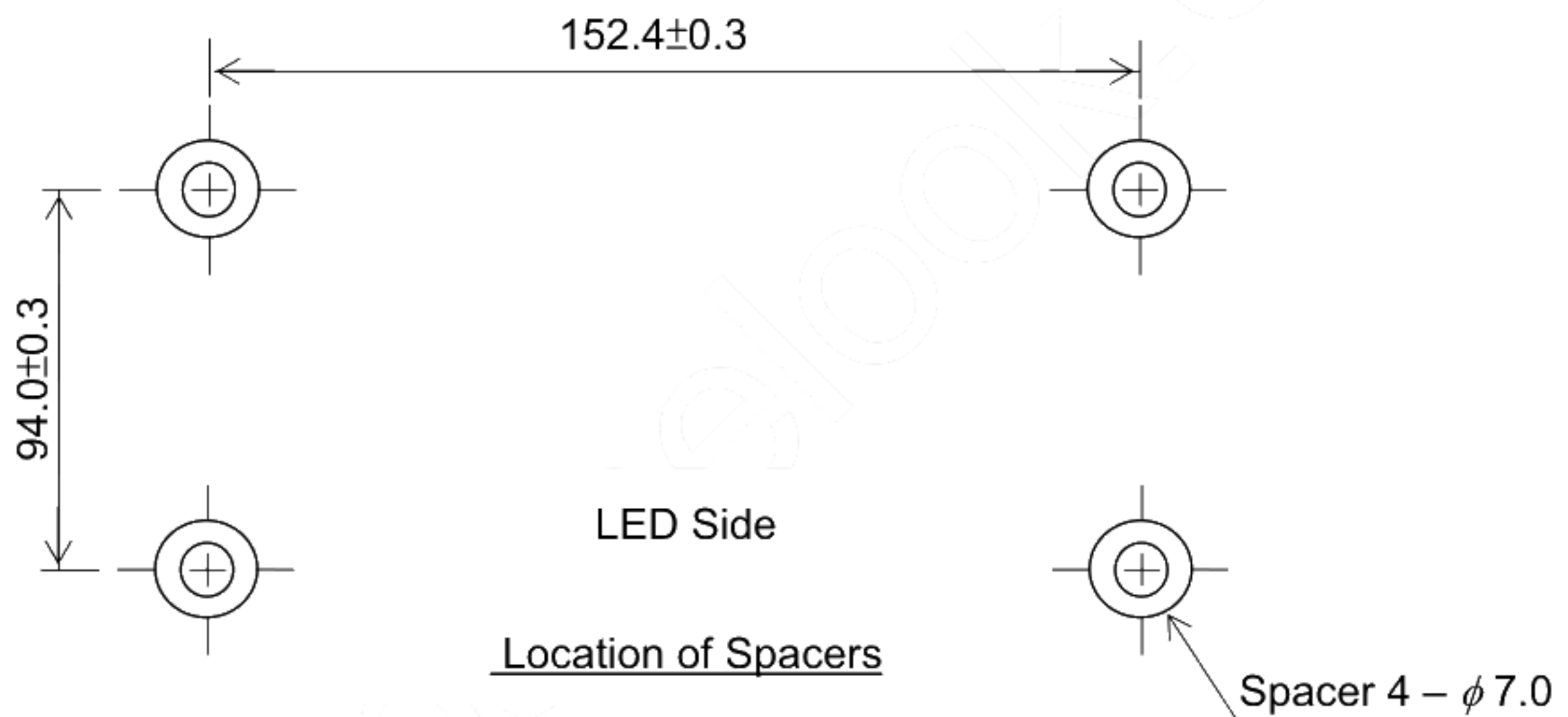
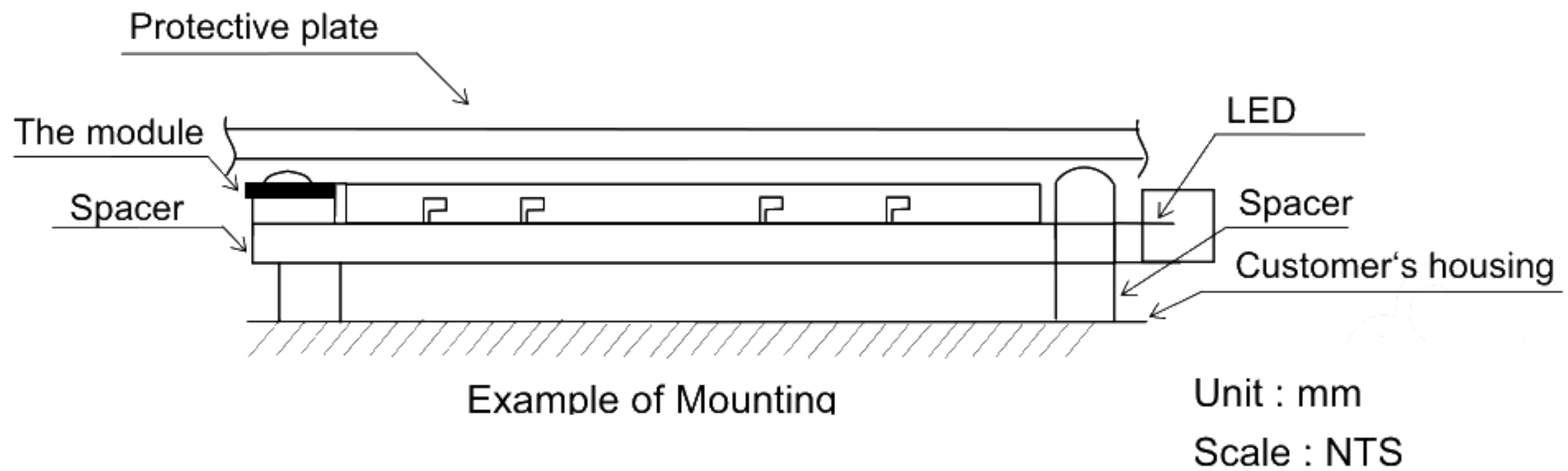
(3) Definition of pinhole



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.



- (1) Use of protective plate, made of an acrylic plate, etc, in order to protect a polarizer and LC cell.
- (2) To prevent the model 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 LCD module from any kind of shock to your set.

11.2 LC driving voltage (V0) and viewing angle range.

Setting V0 out of the recommended condition will be a cause for a change of viewing angle range.

11.3 CAUTION AGAINST STATIC CHARGE

As this module is provided with C-MOS LSI, 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 ($5\pm 0.25V$).

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 $35^{\circ}C$ 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 saliva or water drop attached on the display area because its long period adherence may cause deformation or faded color on the spot.
- (6) Foggy 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, ect.

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°C 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°C to 35°C.
- (3) Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery from us.)

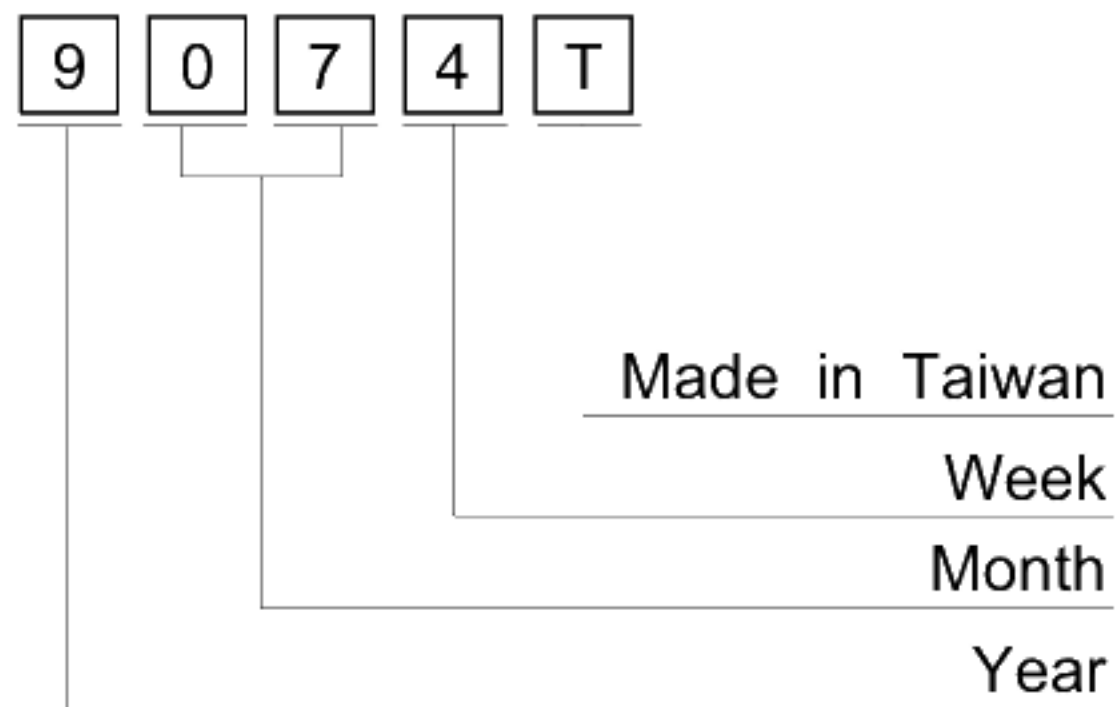
11.8 SAFETY

- (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 cell 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.



YEAR	FIGURE IN LOT MARK
2013	3
2014	4
2015	5
2016	6

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
01~07	1
08~14	2
15~21	3
22~29	4
30~31	5

12.2 LOCATION OF LOT MARK on the back side of LCM

9 0 7 4 T

13. PRECAUTION FOR USE

(1) A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity.

Judgement 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.