KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS:_____ DATE: May 1st ,2012

# CUSTOMER'S ACCEPTANCE SPECIFICATIONS

# SP14Q005

Contents



ACCEPTED BY:_____ PROPOSED BY:

# RECORD OF REVISION

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# RECORD OF REVISION

| DATE | SHEET No. | SUMMARY |
|---|---|---|
| Jun.04,'04 | 7B64PS 2705-SP14Q005-5 Page 5-2/2 | 5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT Canceled<br>Note 5:When ICFL is used over 5.5 mA ,it may cause uneven contrast near CFL location ,due to heart dispersion from CFL. |
| | 7B64PS 2706-SP14Q005-5 Page 6-1/3 | 6.1 OPTICAL CHARACTERISTICS OF LCD<br>Revised Viewing Area $\phi$ 40→80<br>Revised $\phi = \phi a = \phi b$ → $\phi = \phi a + \phi b$ |
| | 7B64PS 2706-SP14Q005-5 Page 6-3/3 | 6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT<br>Added The LCD driving voltage should be adjusted at the voltage where the peak contrast is obtained. |
| | 7B64PS 2710-SP14Q005-5 Page 10-1/3 | 10.1 APPEARANCE INSPECTION CONDITION<br>Revised 45°→25° |
| Feb.13,'07 | 7B64PS 2712-SP14Q005-6 Page 12 - 1/1 | 12. DESIGNATION OF LOT MARK<br>Added : REVISION<br>REV No. \| ITEM<br>A \| Brightness Cone Extend |
| Mar.06,'09 | 7B64PS 2712-SP14Q005-7 Page 12 - 1/1 | 12. DESIGNATION OF LOT MARK<br>Revised reversion from REV. A to REV.B |
| May 01,'12 | All pages | Company name changed:<br>KAOHSIUNG HITACHI ELECTRONICS CO.,LTD.<br>↓<br>KAOHSIUNG OPTO-ELECTRONICS INC. |
| | | |

# 3. GENERAL SPECIFICATIONS

| | | |
|---|---|---|
| (1) | Part Name | SP14Q005 |
| (2) | Outer Dimensions | 167.0(W)mm×109.0(H)mm×10.0 (D)mm(max.) |
| (3) | Effective Area | 120(W)mm min. × 89(H)mm min. |
| (4) | Dot Size | 0.345(W)min. × 0.345(H)min. |
| (5) | Dot Pitch | 0.360(W)mm × 0.360(H)mm |
| (6) | Dot Number (Resolution) | 320 (W) × 240 (H) dots |
| (7) | Duty Ratio | 1/240 |
| (8) | LCD Type | Transmissive type F-STN<br>With anti-glare type upper polarizer |
| (9) | Viewing Direction | 6 O'clock |
| (10) | Viewing Angle | Viewing Angle in Rear - Front<br>(12:00) (6:00)<br>R-F=90 ° (typ.) |
| (11) | BackLight Type | Cold cathode fluorescent lamp.<br>CFL life time : 50,000h(average)<br>Note : CFL life time = life time for half of CFL brightness. |

# 4. ABSOLUTE MAXIMUM RATINGS

## 4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

VSS=0V : STANDARD

| ITEM | SYMBOL | MIN. | MAX. | UNIT | REMARKS |
|---|---|---|---|---|---|
| Power Supply for Logic | VDD-VSS | 0 | 6.0 | V | |
| Power Supply for LC Driving | VDD-VEE | 0 | 27.5 | V | |
| Input Signal Voltage | Vi | -0.3 | VDD+0.3 | V | Note1 |
| Input Signal Current | Ii | 0 | 1 | A | |
| Static Electricity | VESD0 | - | ±100 | V | Note2,3,4 |
| | VESD1 | - | ±10 | kV | Note2,3,5 |

Note 1: $\overline{\text{DOFF}}$ , FRAME , LOAD , CP , D0~D3.
Note 2: Make certain you are grounded when handling LCM.
Note 3: Energy storage capacitance 200pF , discharge resistance 250Ω Ta=25℃ , 60%RH.
Note 4: Contact discharge to I/F connector pins.
Note 5: Contact discharge to front metal bezel.

## 4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | OPERATING | | STORAGE | | REMARKS |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| Ambient Temperature | -20℃ | 70℃ | -30℃ | 80℃ | Note2,3,7 |
| Humidity | Note1 | | Note1 | | Without Condensation |
| Vibration | - | 2.45m/s$^2$<br>0.25G | - | 11.76m/s$^2$<br>1.2G<br>Note5 | Note4<br>1h max. |
| Shock | - | 29.4m/s$^2$<br>3 G | - | 490.0m/s$^2$<br>50 G<br>Note5 | X、Y、Z Directions |
| 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 -30℃ ＜ 48h , at 80℃ ＜ 168h.
Note 3: Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.
Note 4: 5Hz~100Hz (Except resonance frequency)
Note 5: This module should be operated normally after finish the test.
Note 6: When LCM will be operated at 0℃ , the life time of CFL will be reduced.
Please make sure that the characteristics of the inverter meet the CFL specification.
Note 7: Operation temp not include CFL & Touch Panel.

# 5. ELECTRICAL CHARACTERISTICS

## 5.1 ELECTRICAL CHARACTERISTICS

| I T E M | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Power Supply Voltage for Logic | VDD-VSS | - | 4.75 | 5.0 | 5.25 | V |
| | | | 3.2 | 3.3 | 3.4 | |
| Power Supply Voltage for LC Driving | VEE-VSS | - | -23.1 | -22.0 | -20.9 | V |
| Input Signal Voltage Note1 | Vi | H LEVEL | 0.8VDD | - | VDD | V |
| | | L LEVEL | 0 | - | 0.2VDD | V |
| Power Supply Current for Logic Note2 | IDD | VDD-VSS=5.0V VEE-VSS= -22.0V | - | 6.0 | - | mA |
| Power Supply Current for LC Driving Note2 | IEE | VDD-VSS=5.0V VEE-VSS= -22.0V | - | 5.0 | - | mA |
| Recommended LC Driving Voltage Note3 | VDD-V0 | Ta= 0℃ , $\phi$= 0° | 21.0 | 22.0 | 23.0 | V |
| | | Ta=25℃ , $\phi$= 0° | 20.0 | 21.0 | 22.0 | V |
| | | Ta=50℃ , $\phi$= 0° | 19.0 | 20.0 | 21.0 | V |
| FRAME Frequency Note4 | fFRAME | - | 70 | 75 | 80 | Hz |

Note 1: $\overline{\text{DOFF}}$ , FRAME , LOAD , CP , D0~D3.

Note 2: FLM=75Hz , test pattern is all “Q”.
VDD-V0=21.0V , Ta=25℃

Note 3: Recommended LC driving voltage may fluctuate about ±1.0V by each module.
Test pattern is all “Q”

Note 4: Please set the frame frequency so as to avoid flicker and rippling on the display.

## 5.2 ELECTRICAL CHARACTERISTICS OF BACKLIGHT

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|
| Lamp Voltage | VL | - | 300 | - | Vrms | Ta=25℃ |
| Frequency | fL | - | 70 | 85 | kHz | Ta=25℃ |
| Lamp Current | IL | 4 | 5 | 6 | mArms | Ta=25℃ |
| Starting Discharge Voltage | VS | 1000 | - | - | Vrms | Ta=25℃ |

Note 1: Please make sure that your inverter is designed to meet the above specifications.

Note 2: Starting discharge voltage is increased when LCM is operating at lower temperature , please check the characteristics of your inverter , so as to ensure discharge at low temperature.

Note 3: Average life time of CFL will be decreased when LCM is operating at lower temperature.

Note 4: Lower driving frequency of CFL inverter may cause mechanical noise of the backlight system .
Before designing the inverter , please consider the driving frequency of noise .

# 6. OPTICAL CHARACTERISTICS

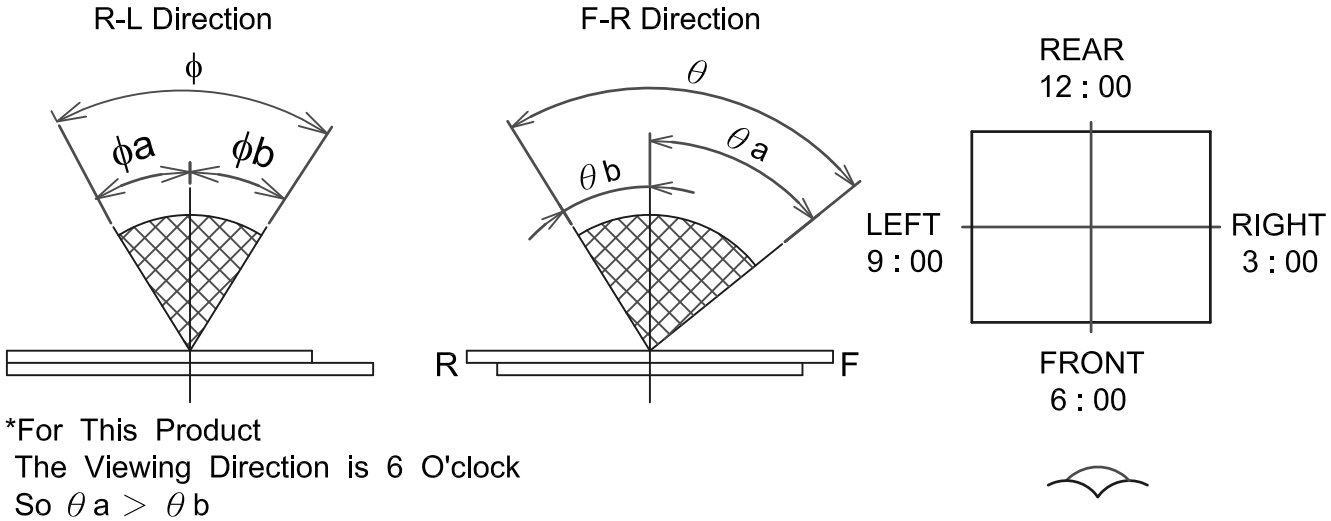
## 6.1 OPTICAL CHARACTERISTICS OF LCD

Ta=25℃(Backlight On)

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | REMARKS |
|---|---|---|---|---|---|---|---|
| Viewing Area | $\theta$ | K≧2.0 | - | 90 | - | deg | Note1 |
| | $\phi$ | | | 80 | | | |
| Contrast Ratio | K | $\phi$=0°, $\theta$=0° | - | 25 | - | - | Note2 |
| Response Time (Rise) | tr | $\phi$=0°, $\theta$=0° | - | 330 | - | ms | Note3 |
| Response Time (Fall) | tf | $\phi$=0°, $\theta$=0° | - | 150 | - | ms | Note3 |

(Measure condition by KOE)

Note 1: Definition of Viewing Angle

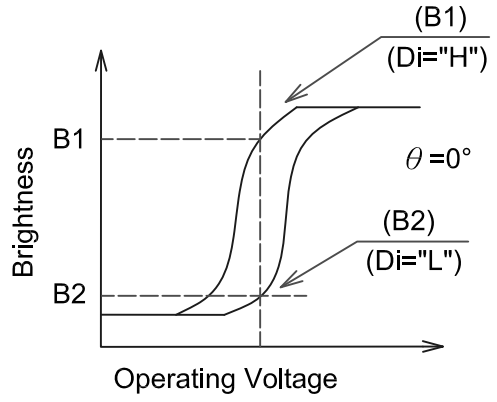


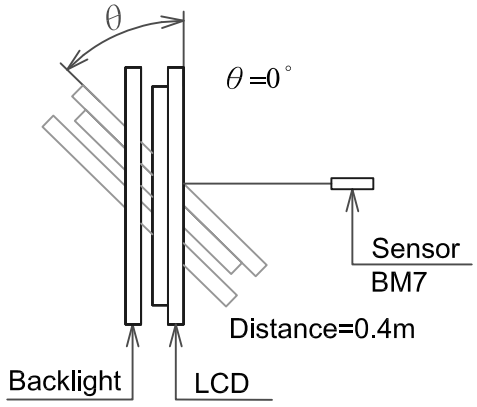

*For This Product
The Viewing Direction is 6 O'clock
So $\theta a > \theta b$

$\theta = \theta a + \theta b$
$\phi = \phi a + \phi b$

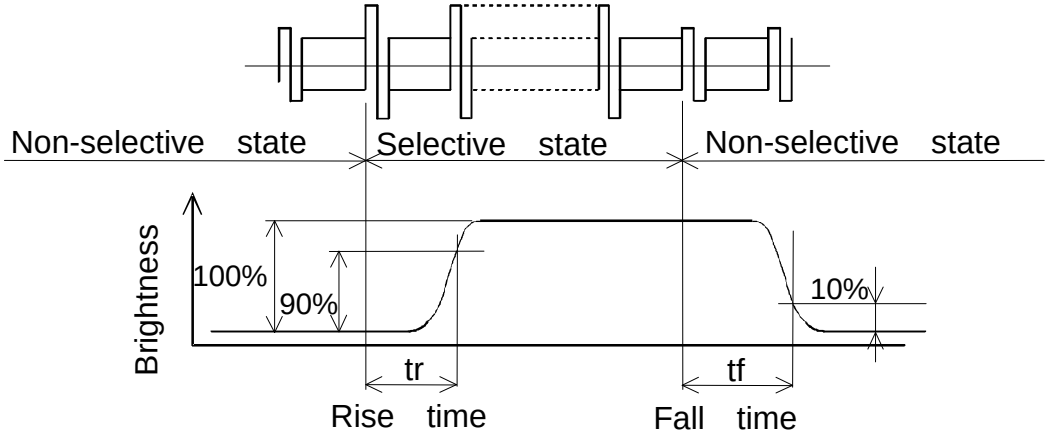
Note 2: Definition of contrast"K"

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



Note 3: Definition of optical response



## 6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

| I T E M | MIN. | TYP. | MAX. | UNIT | REMARKS |
|---|---|---|---|---|---|
| Brightness | - | 220 | - | $cd/m^2$ | ICFL=5mA<br>Note1,2 |
| Rise Time | - | 5 | - | minute | ICFL =5mA<br>Brightness 80% |
| Brightness Uniformity | - | - | ±30 | % | Note1,3 |

CFL : Initial, Ta=25℃,

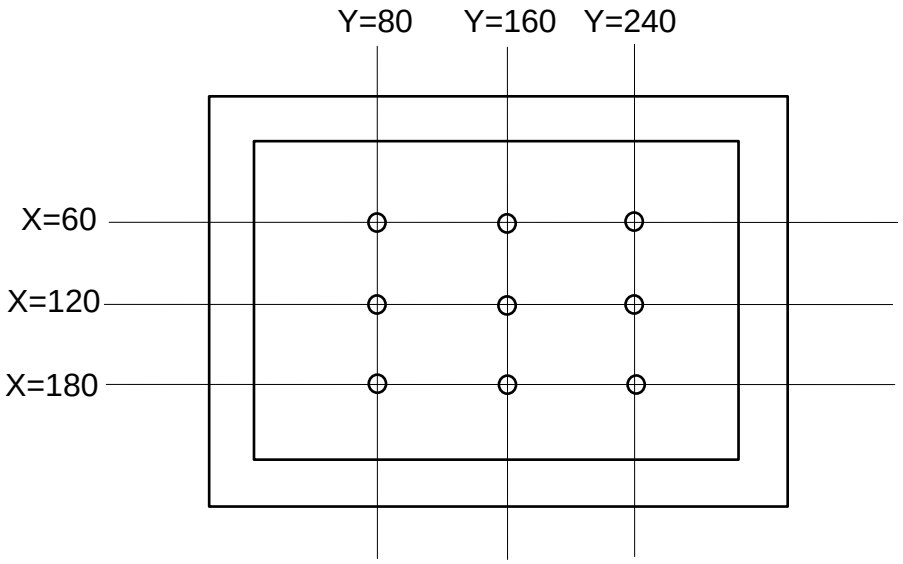
Display data should be all “ON”.

The LCD driving voltage should be adjusted at the voltage where the peak contrast is obtained.

Note 1: Measurement after 10 minutes of CFL operating.

Note 2: Brightness control : 100%

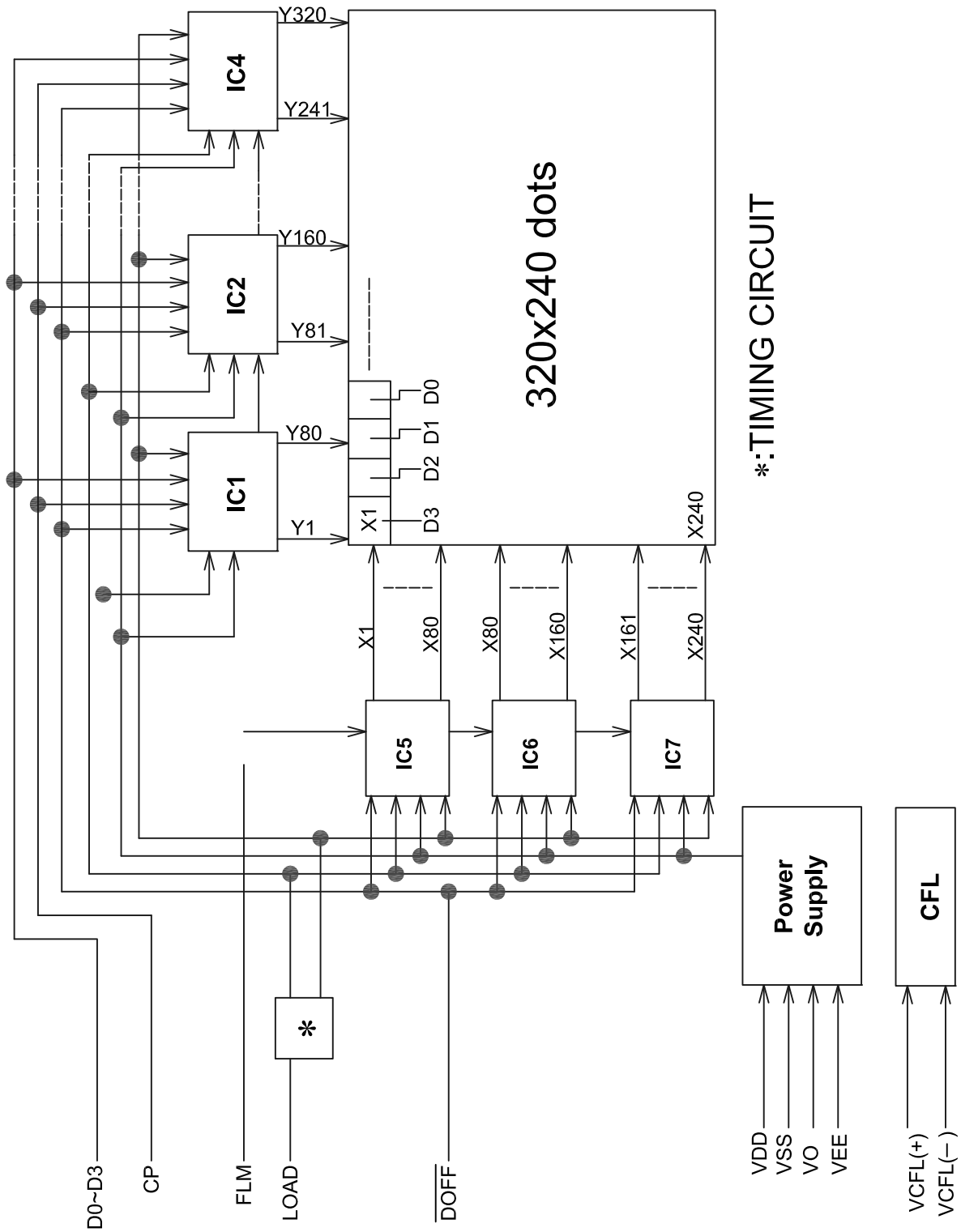
Note 3: Measure of the following 9 places on the display.




Definition of the brightness tolerance.

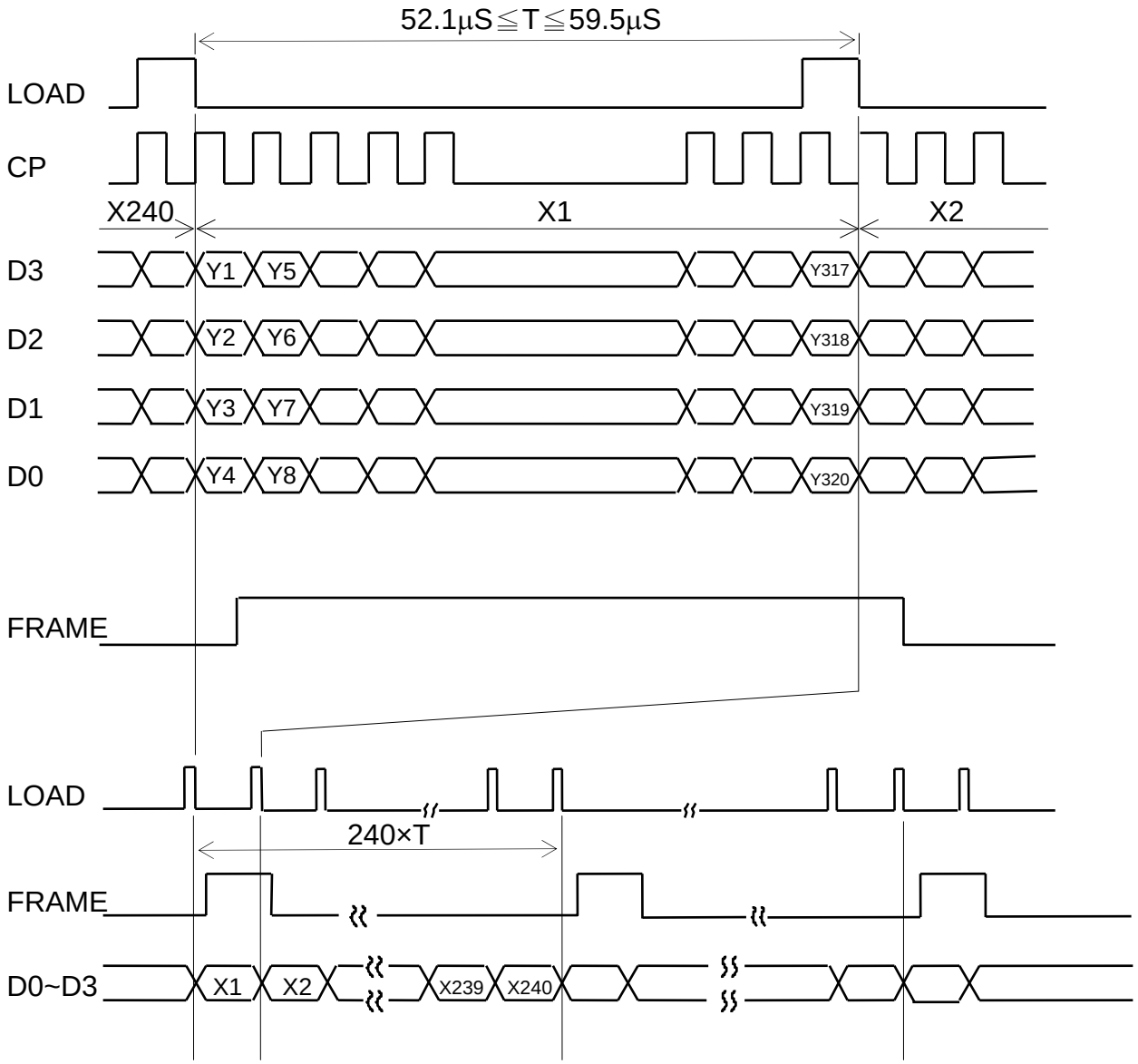
$$\left( \frac{\text{max. or min. Brightness - Average Brightness}}{\text{Average Brightness}} \right) \times 100\%$$

# 7. BLOCK DIAGRAM



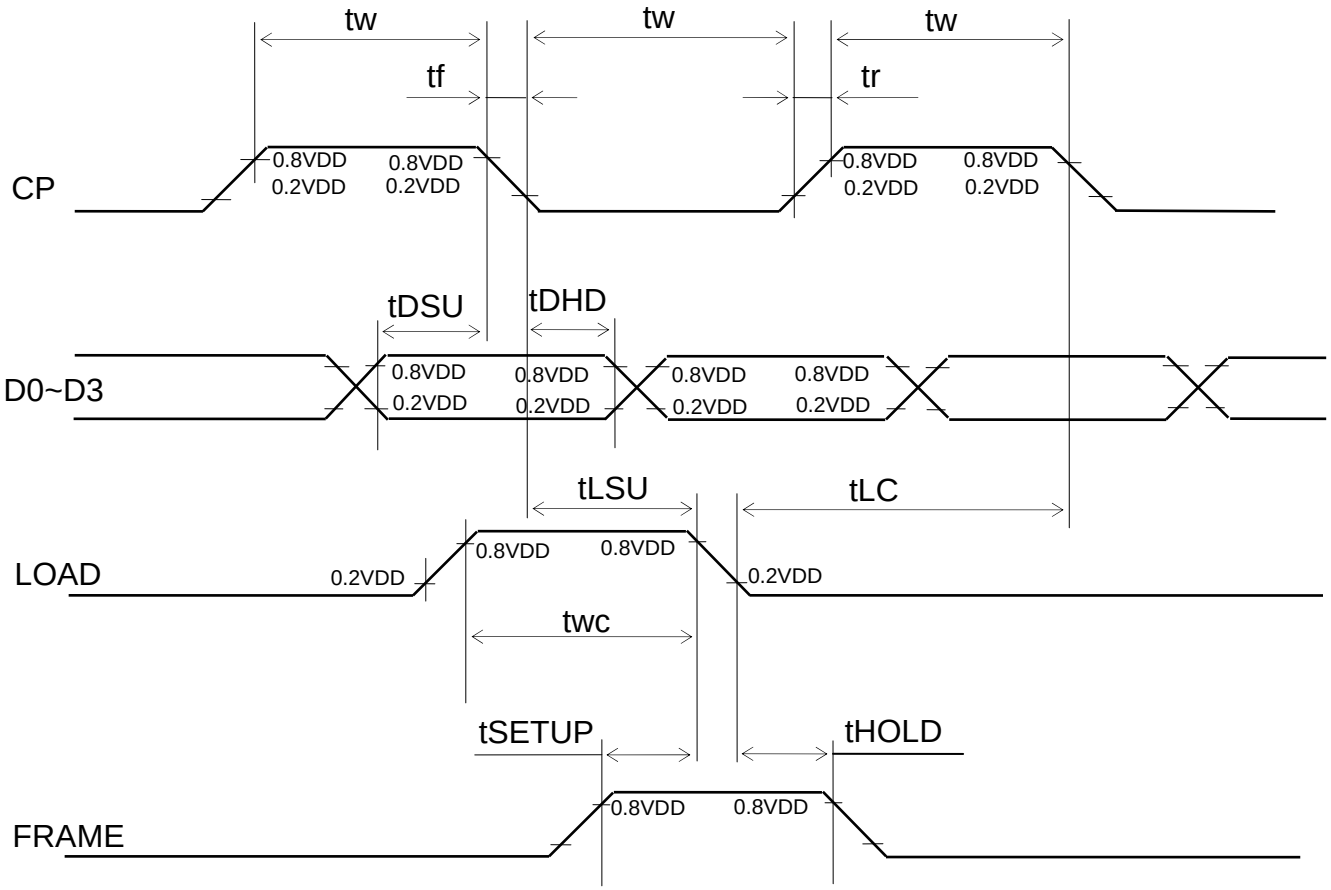
# 8. INTERFACE TIMING CHART

## 8.1 INTERFACE TIMING CHART

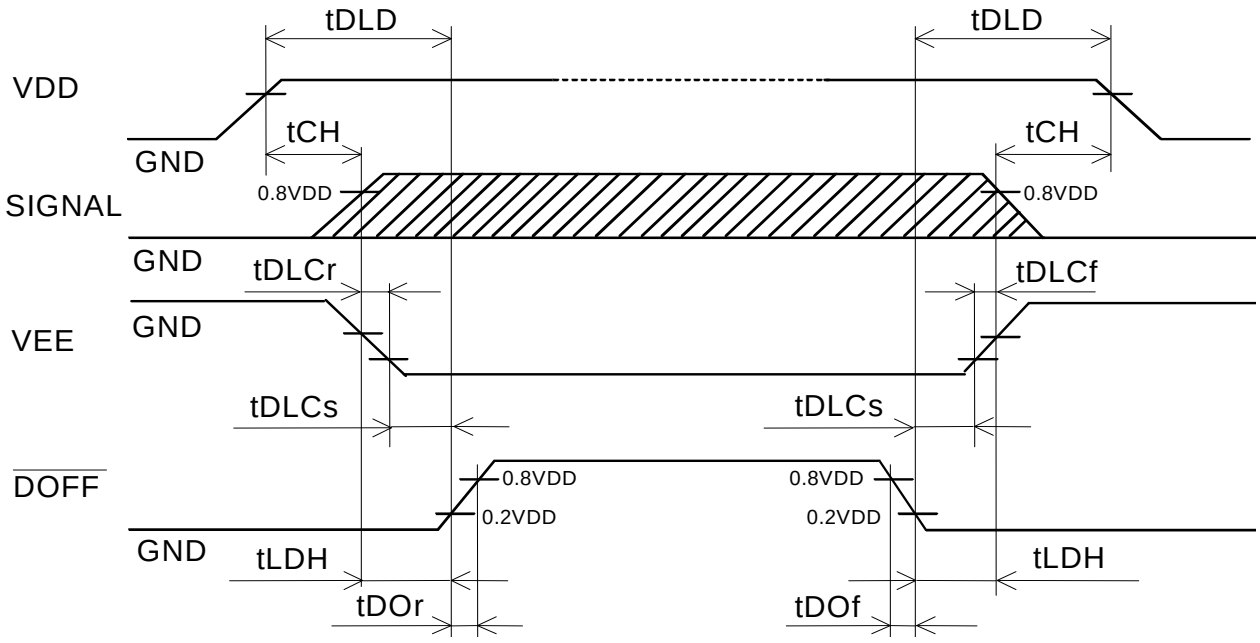


## 8.2 TIMING CHARACTERISTICS

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Clock frequency | fCP | - | - | 6.5 | MHz |
| Clock pulse width | tW | 45 | - | - | ns |
| Clock rise, fall time | tr,tf | - | - | 15 | ns |
| Data set up time | tDSU | 30 | - | - | ns |
| Data hold time | tDHD | 30 | - | - | ns |
| Load set up time | tLSU | 80 | - | - | ns |
| Load clock time | tLC | 120 | - | - | ns |
| “FRAME” set up time | tSETUP | 100 | - | - | ns |
| “FRAME” hold time | tHOLD | 100 | - | - | ns |
| “LOAD” pulse width | tWC | 125 | - | - | ns |



## 8.3 POWER ON/OFF TIMING SEQUENCE

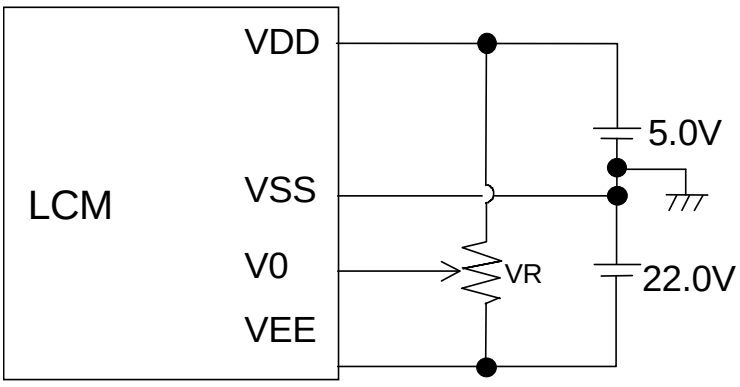



| SYMBOL | MIN. | MAX. | UNIT | REMARKS |
|---|---|---|---|---|
| tDLD | 50 | - | ms | Note1 |
| tCH | 0 | 30 | ms | |
| tLDH | 0 | - | ms | |
| tDOr | - | 100 | ns | Note2 |
| tDOf | - | 100 | ns | |
| tDLCr | 0 | - | ms | |
| tDLCf | 0 | - | ms | |
| tDLCs | 20 | - | ms | |

Note 1: Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.

Note 2: KOE recommends you to use $\overline{\text{DOFF}}$ function. display quality may deteriorate if you don't use $\overline{\text{DOFF}}$ function.

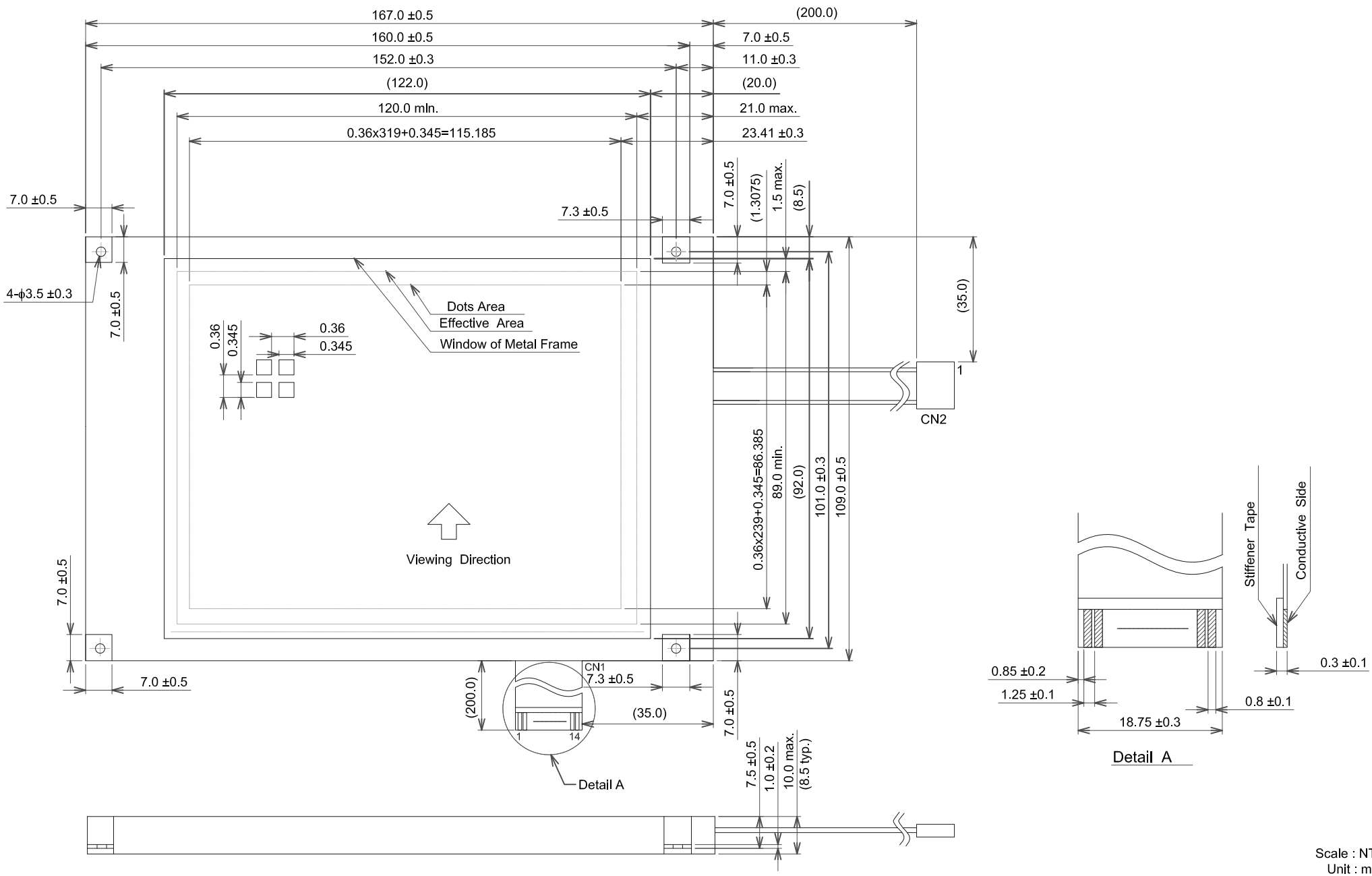
## 8.4 POWER SUPPLY FOR LCM (EXAMPLE)




Note 1: VR : 10kΩ

# 9. DIMENSIONS OUTLINE

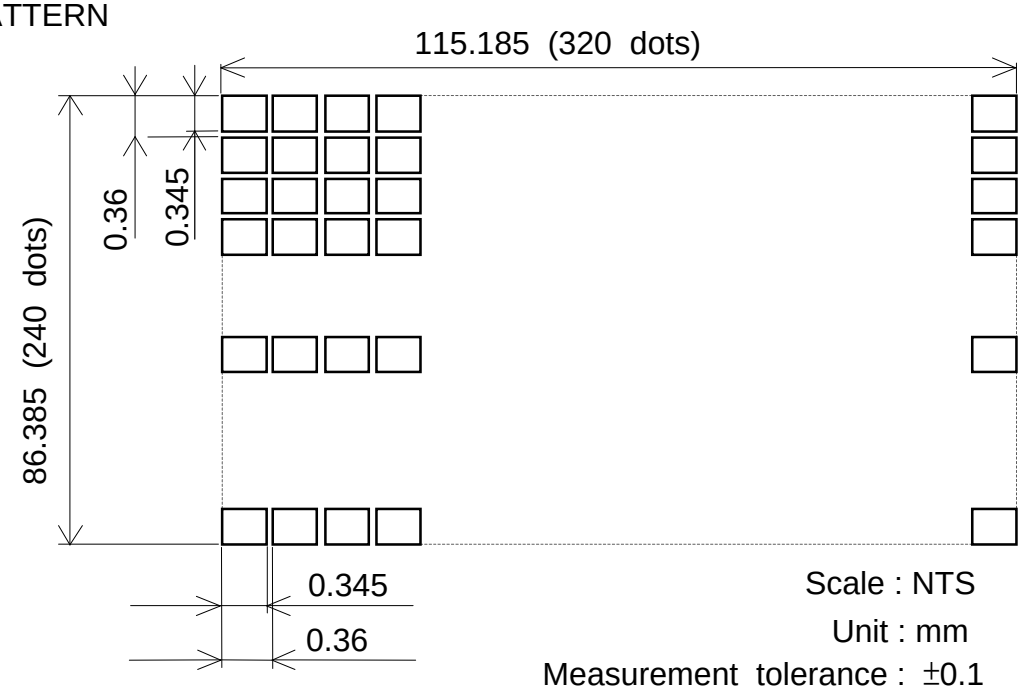
## 9.1 DIMENSIONS OUTLINE




Scale : NTS
Unit : mm

Note 1: Measurement when adding 9.8 x $10^4$ Pa at the measuring point.

## 9.2 DISPLAY PATTERN




Scale : NTS

Unit : mm

Measurement tolerance : ±0.1

## 9.3 INTERFACE PIN CONNECTION

FPC：pitch 1.25mm 14 pins

| INTERFACE | | PIN No. | SIGNAL | LEVEL | FUNCTION |
|---|---|---|---|---|---|
| LCM | CN1 | 1 | D0 | H/L | Display Data |
| | | 2 | D1 | | |
| | | 3 | D2 | | |
| | | 4 | D3 | | |
| | | 5 | $\overline{DOFF}$ | H/L | H : ON / L : OFF |
| | | 6 | FRAME | H | First Line Marker |
| | | 7 | N.C | - | - |
| | | 8 | LOAD | H→L | Data Latch |
| | | 9 | CP | H→L | Data Shift |
| | | 10 | VDD | - | Power Supply for Logic |
| | | 11 | VSS | - | GND |
| | | 12 | VEE | - | Power Supply for LC |
| | | 13 | V0 | - | Operating Voltage LC Driving |
| | | 14 | VSS | - | GND |

| INTERFACE | | PIN No. | SIGNAL | LEVEL | FUNCTION |
|---|---|---|---|---|---|
| LCM | CN2 | 1 | VCFL(+) | - | Power Supply for CFL |
| | | 2 | N.C | - | - |
| | | 3 | N.C | - | - |
| | | 4 | VCFL(-) | - | CFL GND |

CFL I/F : J.A.E./ IL – G – 4S –S3C2

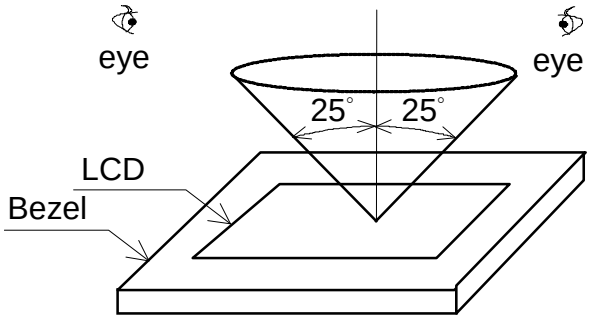
# 10. APPEARANCE STANDARD

## 10.1 APPEARANCE INSPECTION CONDITION

Visual inspection should be done under the following condition.

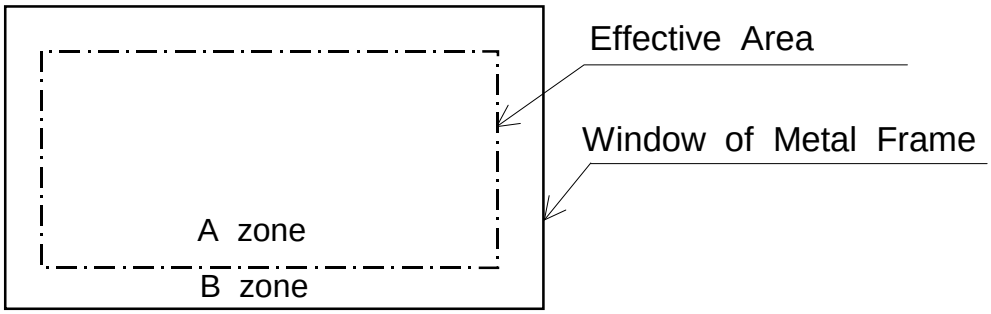
(1) The inspection should be done under in the dark room.
(2) The CFL should be lighted with the prescribed inverter.
(3) The distance between eyes of an inspector and the LCD module is 25cm.
(4) The viewing zone is shown the figure .
Viewing angle $\leqq 25^{\circ}$

.




## 10.2 DEFINITION OF EACH ZONE

A zone : Within the effective area specified at page 9-1/2 of this document.
B zone : Area between the window of metal frame and the effective area line specified at page 9-1/2 of this document.



10.3 APPEARANCE SPECIFICATION

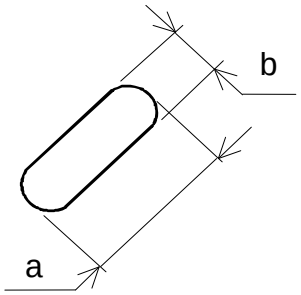
*) If a problem occurs in respect to any of these items , both parties(Customer and KOE) will discuss in more detail.

| 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 | | ○ | - |
| | | D≦0.2 | Ignore | | | |
| | | 0.2＜D≦0.3 | 12 | | | |
| | | 0.3＜D≦0.5 | 3 | | | |
| | | 0.5＜D | None | | | |
| | Stains, Foreign Materials, Dark Spot | Filamentous | | | ○ | - |
| | | Length L(mm) | Width W(mm) | Maximum number acceptable | | |
| | | L≦2.0 | W≦0.03 | Ignore | | |
| | | L≦3.0 | 0.03＜W≦0.05 | 6 | | |
| | | L≦2.5 | 0.05＜W≦0.1 | 1 | | |
| | | Round | | | ○ | - |
| | | Average diameter D(mm) | Maximum number acceptable | Minimum space | | |
| | | D＜0.2 | Ignore | - | | |
| | | 0.2 ≦D＜0.33 | 8 | 10mm | | |
| | | 0.33≦D | None | - | | |
| | | Total | Filamentous + Round = 10 | | | |
| | | Those wiped out easily are acceptable | | | ○ | ○ |
| | Pinhole | Average diameter D(mm) | Maximum number acceptable | | ○ | - |
| | | D≦0.15 | Ignore | | | |
| | | 0.15＜D≦0.3 | 10 | | | |
| | | C≦0.015 | ignore | | | |
| | Contrast Irregularity (Spot) | Average diameter D(mm) | Maximum number acceptable | Minimum space | | |
| | | D≦0.25 | Ignore | - | | |
| | | 0.25＜D≦0.35 | 10 | 20mm | | |
| | | 0.35＜D≦0.5 | 4 | 20mm | | |
| | | 0.5 ＜D | None | - | | |

| No. | ITEM | CRITERIA | | | | A | B |
|---|---|---|---|---|---|---|---|
| LCD | Contrast Irregularity (Line) (Filamentous) | Width D(mm) | Length L(mm) | Maximum number acceptable | Minimum space | ○ | - |
| | | 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 | | |
| | | Total | | 6 | | | |

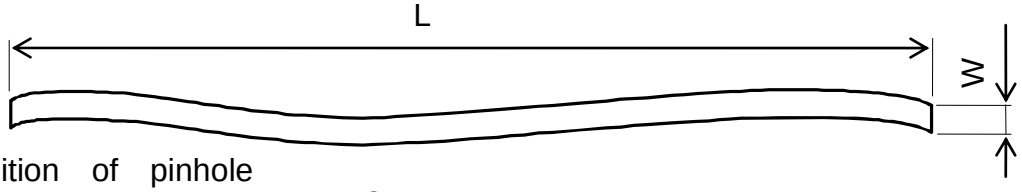
| No. | ITEM | CRITERIA | | |
|---|---|---|---|---|
| CFL B/L | Dark Spots, White Spots Foreign Materials (Spot) | D≦0.4 | | Ignore |
| | | D＞0.4 | | None |
| | Foreign Materials (Line) | W≦0.2 | L＜2.5 | ≦1 |
| | | W≦0.2 | L＞2.5 | None |
| | | W＞0.2 | | None |
| | Scratches | W≦0.1 | | Ignore |
| | | 0.1＜W≦0.2 | L≦11.0 | ≦1 |
| | | 0.1＜W≦0.2 | L≧11.0 | None |
| | | W＜0.2 | | None |

Note 1: Definition of average diameter D

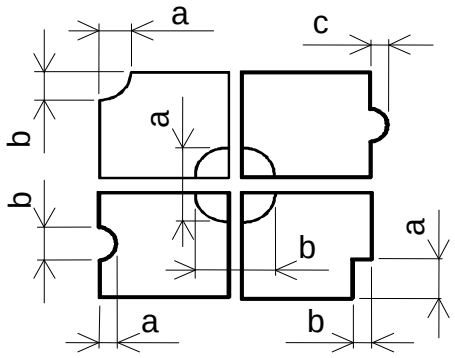



$$D = \frac{a+b}{2}$$

Note 2: Definition of length L and width W




Note 3: Definition of pinhole




c : Salience

# 11. PRECAUTION IN DESIGN

## 11.1 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.

## 111.2 PRECAUTIONS AGAINST STATIC CHARGE

As this module contains C-MOS LSIs , it is not strong against electrostatic discharge. Make certain that the operator's body is connected to the ground through a list band etc. And don't touch I/F pins directly.

## 11.3 POWER ON SEQUENCE

Input signals should not be applied to LCD module before power supply voltage is applied and reaches to specified voltage (VDD).

If above sequence is not kept, C-MOS LSIs of LCD modules may be damaged due to latch up problem.

## 11.4 PACKAGING

(1) No leaving product 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 storage.

(2) Since polarizers tend to be easily damaged, They should be handled full with care so as not to get them touched, pushed or rubbed.

(3) As the adhesives used for adhering polarizers 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.

(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 due to coldness will be caused 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. (Some cosmetics are 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. Be careful not to give it sharp shock caused by dropping down, etc.

11.5 CAUTION FOR OPAERATION

(1) It is an indispensable condition to drive LCDs 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 LCDs 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 LCDs show dark blue color in them. However those phenomena do not mean malfunction or out of order with LCDs 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 or less is required.

11.6 STORAGE

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

(1) Storage in a polyethylene bag with the opening sealed , so the fresh air will not be entered from outside .

(2) Placing in a dark place 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 store them as they have been contained in the inner container at the time of delivery from us.)

11.7 SAFETY

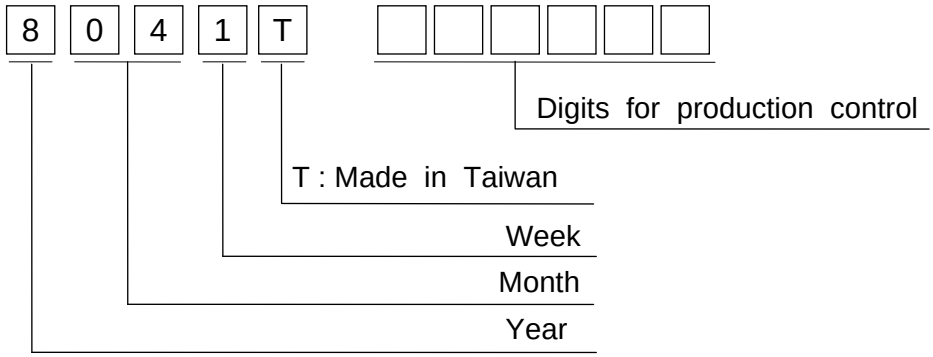
(1) It is recommendable to crash damaged or unnecessary LCDs into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol , which should be burned up later.

(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 5 digits for production lot and 6 digits for production control.




| Year | Figure in lot mark |
|---|---|
| 2012 | 2 |
| 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 |
|---|---|
| 1~ 7 | 1 |
| 8~14 | 2 |
| 15~21 | 3 |
| 22~28 | 4 |
| 29~31 | 5 |

## 12.2 SERIAL No.

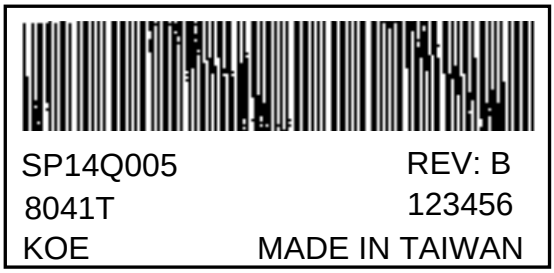
Serial No. is consisted of 6 digits number (000001~999999).

## 12.3 LOCATION OF LOT MARK

Label is bring attached on the back side of module.

## 12.4 REVISION(Rev.) CONTROL

| Rev No. | ITEM |
|---|---|
| A | Brightness Cone Extend<br>Mcount IC:MN73099HED(Panasonic)<br>Transistor:2SA1036K(ROHM) |
| B | Brightness Cone Extend<br>Mcount IC:IT7001M(ITE)<br>Transistor:2SA1576(ROHM) |



# 13. PRECAUTION FOR USE

13.1 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.

13.2 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.

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