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| SPEC.NO. | TQ3C-8EACO-E1CUP15-00 |
| DATE | July 31, 2002 |

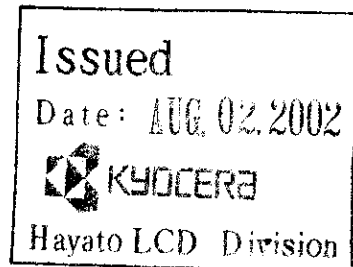
S P E C

FOR : _____

TYPE : KCG057QV1DB-G00

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KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

This specification is subject to change without notice.
Consult Kyocera before ordering.

| | | | | | |
|---------------|---------------------------------|--------------------|----------------|-------------------------|-------------------|
| Original | Designed by : Engineering Dept. | | | Confirmed by : QA Dept. | |
| Issue Data | Prepared | Checked | Approved | Checked | Approved |
| July 31, 2002 | <i>J. Yamazaki</i> | <i>M. Fujitani</i> | <i>H. OHNO</i> | <i>O. Hayashi</i> | <i>y. yoshida</i> |

Caution

1. This Kyocera LCD module has been specifically designed for use only in electronic devices in the areas of audio control, office automation, industrial control, home appliances, etc. The modules should not be used in medical applications where module failure could result in physical harm or loss of life, and Kyocera expressly disclaims any and all liability relating in any way to the use of the module in such medical applications.
2. Customer agrees to indemnify, defend and hold Kyocera harmless from and against any and all actions, claims, losses, damages, liabilities, awards, costs, and expenses, including legal fees, resulting from or arising out of Customer's use, or sale for use, of Kyocera modules in medical applications.
3. Kyocera shall have the right, which Customer hereby acknowledges, to immediately scrap or destroy tooling for Kyocera modules for which no Purchase Orders have been received from the Customer in a two-year period.

Revision Record

| Date | Designed by: Engineering Dept. | | | Confirmed by: QA Dept. | |
|----------|--------------------------------|---------|--------------|------------------------|----------|
| | Prepared | Checked | Approved | Checked | Approved |
| | | | | | |
| Rev. No. | Date | Page | Descriptions | | |
| | | | | | |

1. Application

This data sheet defines the specification for a $(320 \times R.G.B) \times 240$ dot, STN Transmissive color dot matrix type Liquid Crystal Display with CFL backlight.

2. Construction and Outline

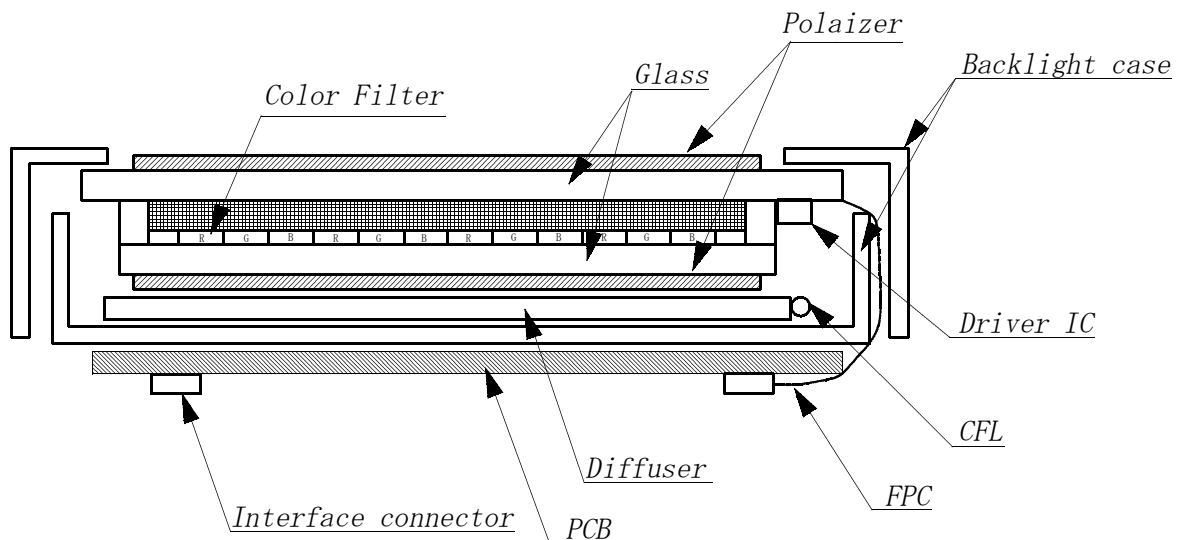
$(320 \times R.G.B) \times 240$ dots, COG type LCD with CFL backlight.

Backlight system : CFL (1 tube).

Inverter : Option
Recommended Inverter : PH-BLC08-K2 (HITACHI MEDIA ELECTRONICS)
PH-BLC08-K3 (" ")
or equivalent.

Polarizer : Glare treatment.

Additional circuit : Bias voltage circuit, Randomizing circuit, DC/DC Converter



This drawing is showing conception only.

3. Mechanical Specifications

| ITEM | SPECIFICATION | UNIT |
|------------------------|----------------------------------|------|
| Outline dimensions | 144.0 (W) × 104.8 (H) × 12.7 (D) | mm |
| Effective viewing area | 117.2 (W) × 88.4 (H) | mm |
| Dot number | (320×R. G. B) (W) × 240 (H) | Dots |
| Dot size | 0.10 (W) × 0.34 (H) | mm |
| Dot pitch | 0.12 (W) × 0.36 (H) | mm |
| Display color *1 | White *2 | — |
| Base color *1 | Black *2 | — |
| Mass | 175 | g |

*1 Due to the characteristics of the LC material, the color vary with environmental temperature.

*2 Negative-type display

Display data "H" :R. G. B Dots ON : White

Display data "L" :R. G. B Dots OFF : Black

4. Absolute Maximum Ratings

4-1. Electrical absolute maximum ratings

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|--------------------------------|--------|------|------|------|
| Supply voltage for logic | VDD | 0 | 6.0 | V |
| Supply voltage for LCD driving | VCONT | 0 | VDD | V |
| Input signal voltage *1 | Vin | 0 | VDD | V |
| FRM frequency | fFRM | — | 150 | Hz |

*1 Input signal : CP, LOAD, FRM, DISP, D0~D7

4-2. Environmental absolute maximum ratings

| ITEM | SYMBOL | MIN | MAX | UNIT |
|--------------------------|------------------|-----|-----|------|
| Operating temperature *1 | Top | 0 | 60 | °C |
| Storage temperature *2 | T _{STO} | -20 | 60 | °C |
| Operating humidity *3 | H _{op} | 10 | *4 | %RH |
| Storage humidity *3 | H _{STO} | 10 | *4 | %RH |
| Vibration | — | *5 | *5 | — |
| Shock | — | *6 | *6 | — |

*1 LCD's display quality shall not be guaranteed at the temperature range of :
below 0°C and upper 40°C.

*2 Temp. = -20°C < 48 h , Temp = 60°C < 168 h
Store LCD panel at normal temperature/humidity.
Keep it free from vibration and shock.
LCD panel that is kept at low or high temperature for a long time can be defective due to
the other conditions, even if the temperature satisfies standard.

*3 Non-condensation.

*4 Temp. ≤ 40°C, 85% RH Max.
Temp. > 40°C, Absolute Humidity shall be less than 85%RH at 40°C.

*5

| | | |
|-----------------|----------------------|---|
| Frequency | 10~55 Hz | Converted to acceleration value : (0.3~9 m/s ²) |
| Vibration width | 0.15 mm | |
| Interval | 10-55-10 Hz 1 minute | |

2 hours in each direction X/Y/Z (6 hours as total)
EIAJ ED-2531

*6 Acceleration: 490m/s²
Pulse width : 11 ms
3 times in each direction : ±X/±Y/±Z.
EIAJ ED-2531

5. Electrical Characteristics

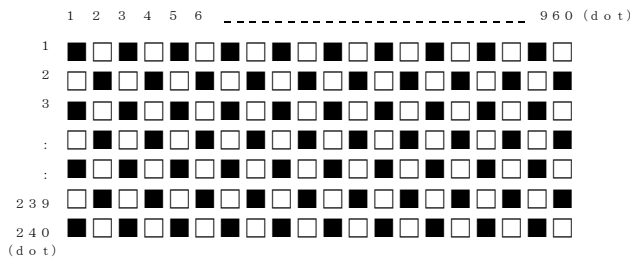
Temp. = 25°C, VDD = +5.0V ± 5%

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---------------|---------------------------|------------------|--------|--------|------|
| Supply voltage for logic | VDD | — | 4.75 | 5.00 | 5.25 | V |
| LCD driving voltage *1 | Vop= VCONT | 0 °C | (1.20) | — | — | V |
| | | 25 °C | (1.30) | (1.80) | (2.30) | V |
| | | 60 °C | — | — | (2.40) | V |
| Input voltage (FRM, LOAD, CP, DISP, D0~D7) | Vin | "H" level | 0.8VDD | — | VDD | V |
| | | "L" level | 0 | — | 0.2VDD | V |
| Input current | Iin | Input signal | (-100) | — | (100) | μA |
| Rush current for logic | Irush | When rush current happens | 3.0A(Peak) × 1ms | | | |
| Clock frequency | fcp | — | 2.02 | 2.16 | 7.14 | MHz |
| Frame frequency *2 | fFRM | — | 70 | 75 | 150 | Hz |
| Current consumption for logic | IDD | *3 | — | 27.0 | 40.5 | mA |
| Power consumption | Pdisp | | — | 135.0 | 202.5 | mW |

*1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (Vop= VCONT) for driving LCD.

*2 In consideration of display quality, it is recommended that frame frequency is set in the range of 70-80Hz. When you have to use higher frame and clock frequencies, confirm the LCD's performance and quality prior to finalizing the frequency values:
Generally, as frame and clock frequencies become higher current consumption will get bigger and display quality will be degraded.

*3 Display high frequency pattern, (see below).
VDD = 5.0V , Vop = VCONT , fFRM = 75 Hz , fcp = 2.16MHz, Temp = 25°C
Pattern:



6. Optical Characteristics

Temp. = 25°C

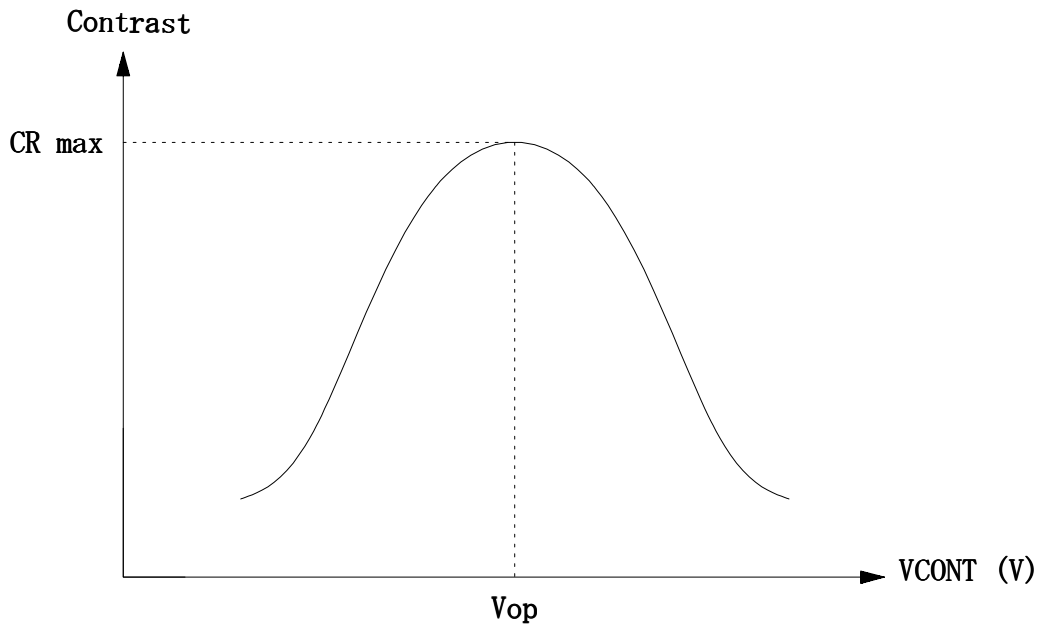
| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|-------|----------|---------------------------|--------------------|-------|------|-------------------|------|
| Response time | Rise | Tr | $\theta = \phi = 0^\circ$ | — | 190 | 290 | ms | |
| | Down | Td | $\theta = \phi = 0^\circ$ | — | 170 | 270 | ms | |
| Viewing angle range | | θ | CR \geq 2 | $\phi = 0^\circ$ | -35 | — | 20 | deg. |
| | | ϕ | | $\theta = 0^\circ$ | -50 | — | 50 | deg. |
| Contrast ratio | | CR | $\theta = \phi = 0^\circ$ | (30) | (55) | — | — | |
| Brightness (IL=5.0mA) | | L | — | (110) | (160) | — | cd/m ² | |
| Chromaticity coordinates | Red | x | $\theta = \phi = 0^\circ$ | 0.49 | 0.54 | 0.59 | — | |
| | | y | | 0.28 | 0.33 | 0.38 | | |
| | Green | x | $\theta = \phi = 0^\circ$ | 0.24 | 0.29 | 0.34 | | |
| | | y | | 0.46 | 0.51 | 0.56 | | |
| | Blue | x | $\theta = \phi = 0^\circ$ | 0.10 | 0.15 | 0.20 | | |
| | | y | | 0.07 | 0.12 | 0.17 | | |
| | White | x | $\theta = \phi = 0^\circ$ | 0.25 | 0.30 | 0.35 | | |
| | | y | | 0.25 | 0.30 | 0.35 | | |

Optimum contrast is obtained by adjusting the LCD driving voltage(Vop) while at the viewing angle of $\theta = \phi = 0^\circ$.

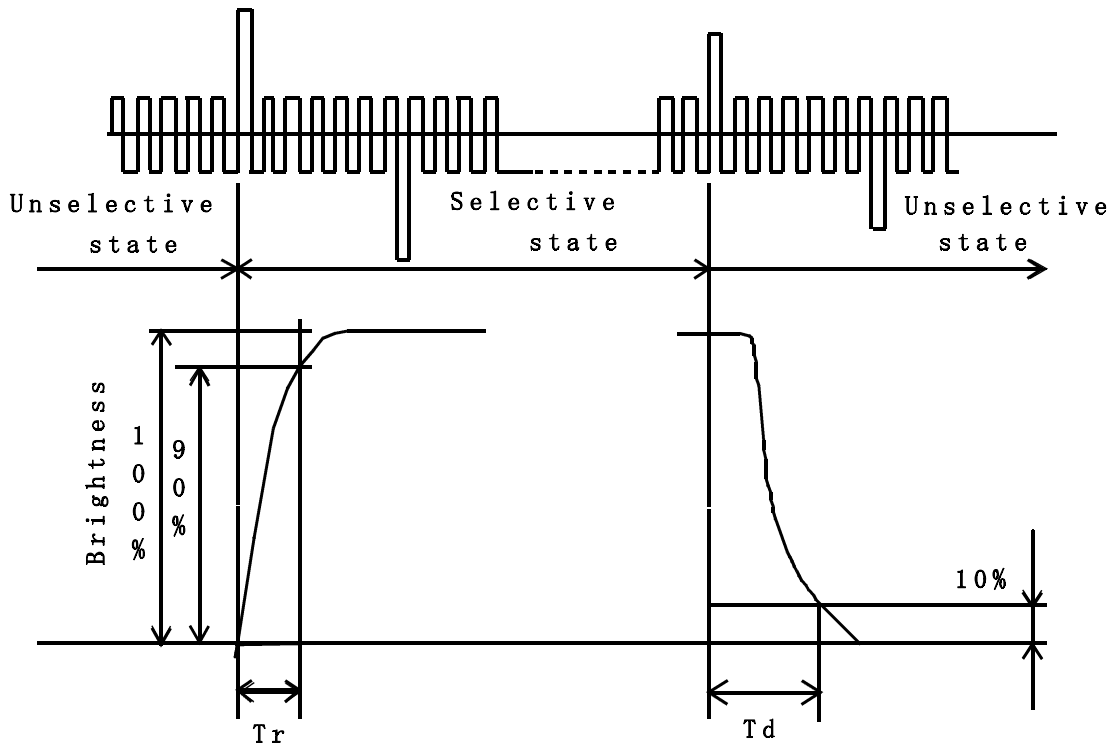
6-1. Contrast ratio is defined as follows:

$$CR = \frac{\text{Brightness at all pixels "White"}}{\text{Brightness at all pixels "Black"}}$$

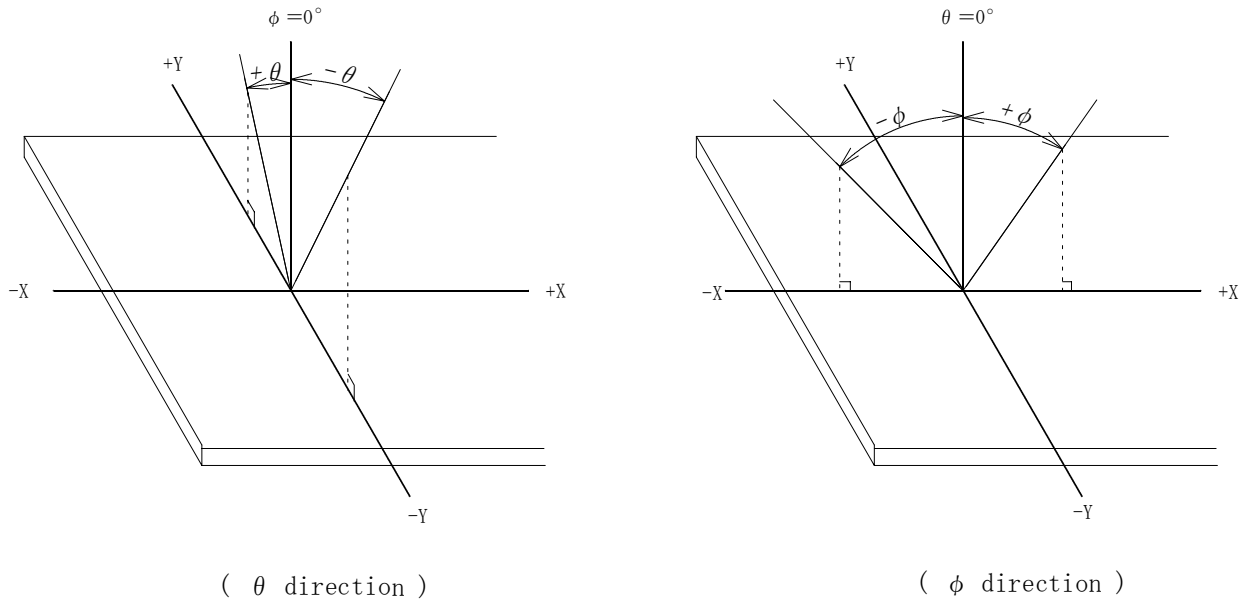
6-2. Definition of Vop



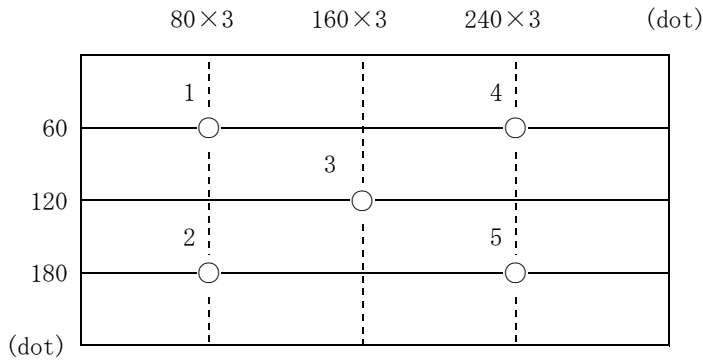
6-3. Definition of response time



6-4. Definition of viewing angle

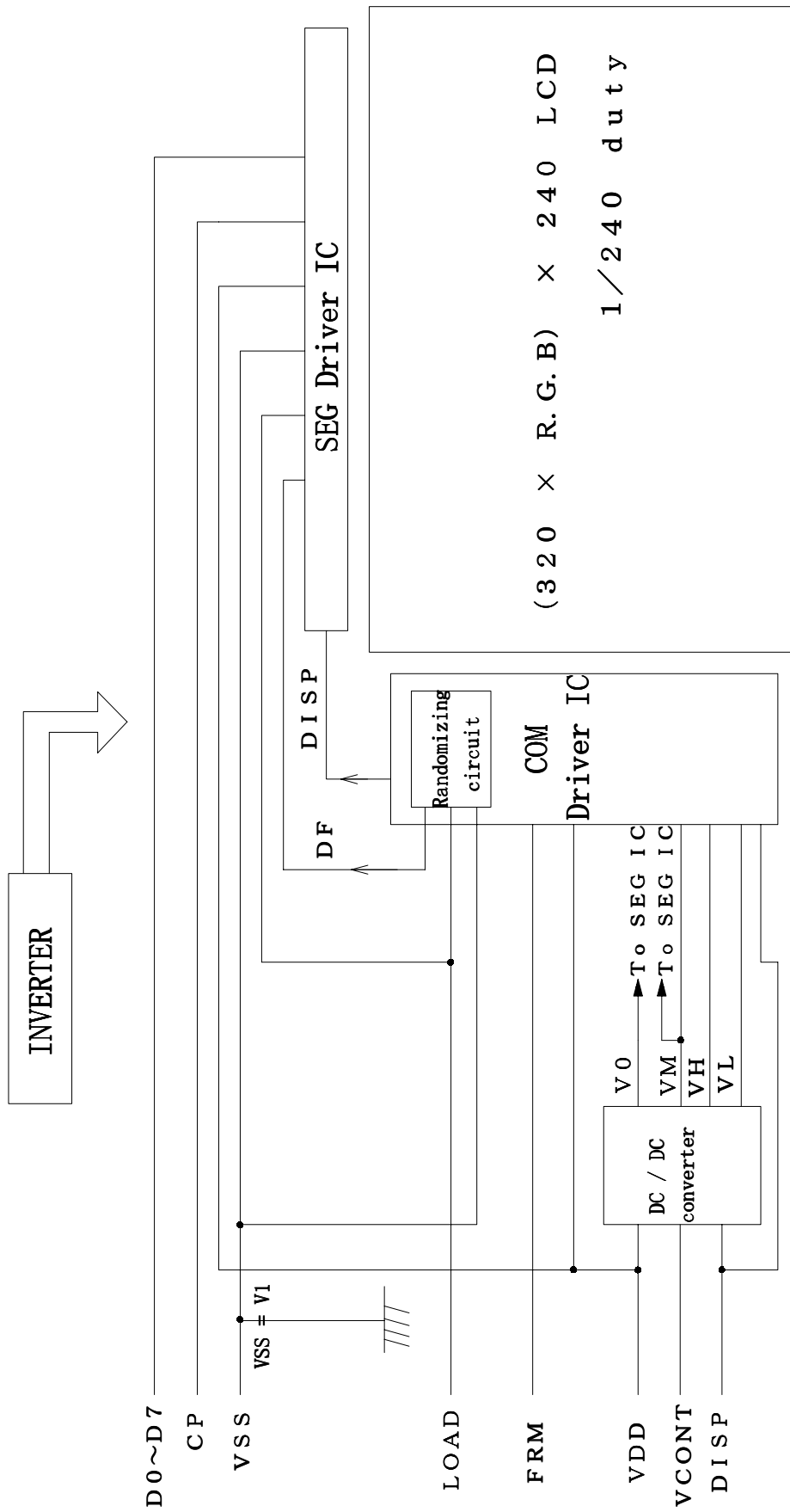


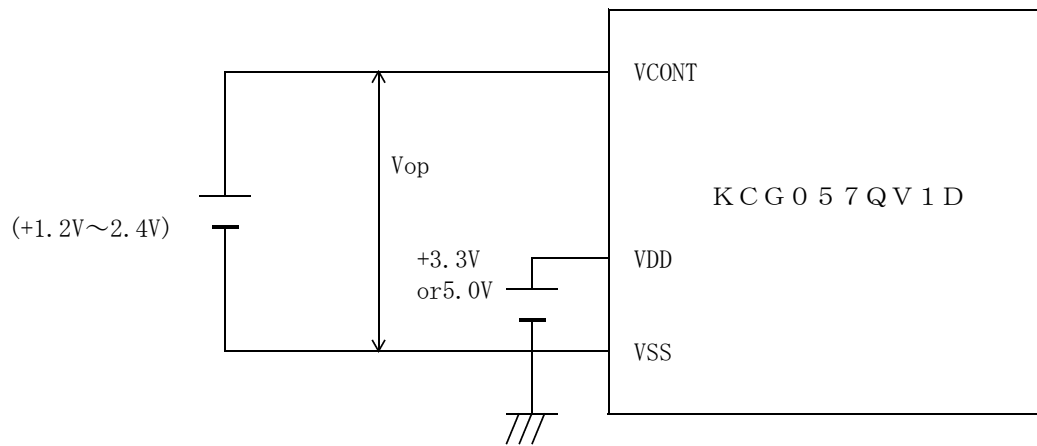
6-5. Measuring points



- 1) Rating is defined as the average brightness inside the viewing area.
- 2) 30 minutes after CFL is turned on. (Ambient Temp. = 25°C)
- 3) The inverter should meet the eccentric conditions;
 - Sine, symmetric waveform without spike in positive and negative.

7. Circuit Block Diagram





8-1. LCD

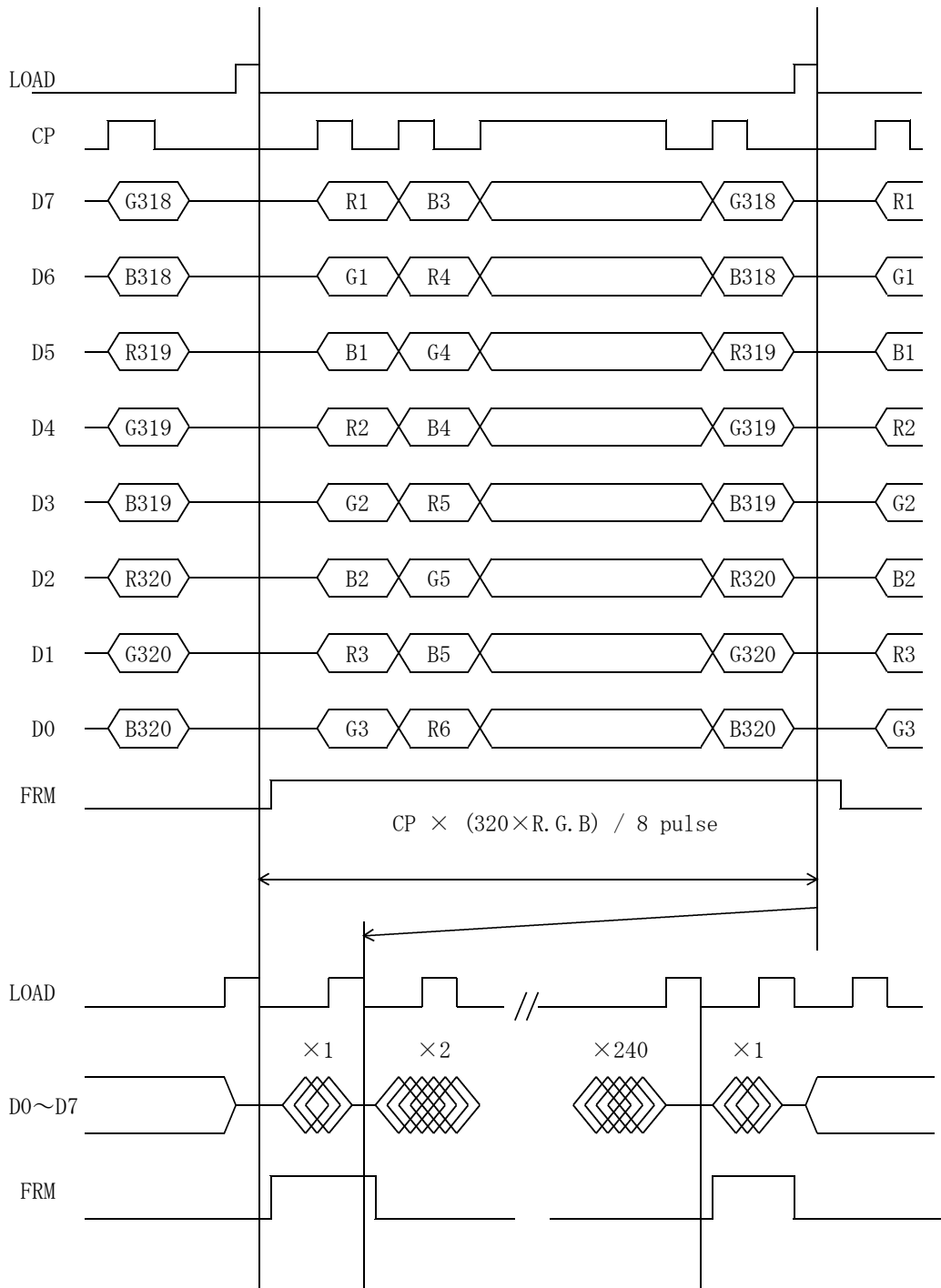
| PIN NO. | SYMBOL | DESCRIPTION | LEVEL |
|---------|--------|--|---------------|
| 1 | FRM | Synchronous signal for driving scanning line | H |
| 2 | LOAD | Data signal latch clock | H → L |
| 3 | CP | Data signal shift clock | H → L |
| 4 | DISP | Display control signal | H(ON), L(OFF) |
| 5 | VDD | Power supply for logic | — |
| 6 | VSS | GND | — |
| 7 | VCONT | LCD adjust voltage | — |
| 8 | D7 | Display data | H(ON), L(OFF) |
| 9 | D6 | | |
| 10 | D5 | | |
| 11 | D4 | | |
| 12 | D3 | | |
| 13 | D2 | | |
| 14 | D1 | | |
| 15 | D0 | | |
| 16 | VDD | Power supply for logic | — |
| 17 | VDD | | |
| 18 | VSS | GND | — |
| 19 | VSS | | |
| 20 | VSS | | |

LCD connector : 08-6210-020-340-800 (ELCO)
Recommended matching connector : 0.5mm pitch FFC or FPC

8-2. CFL

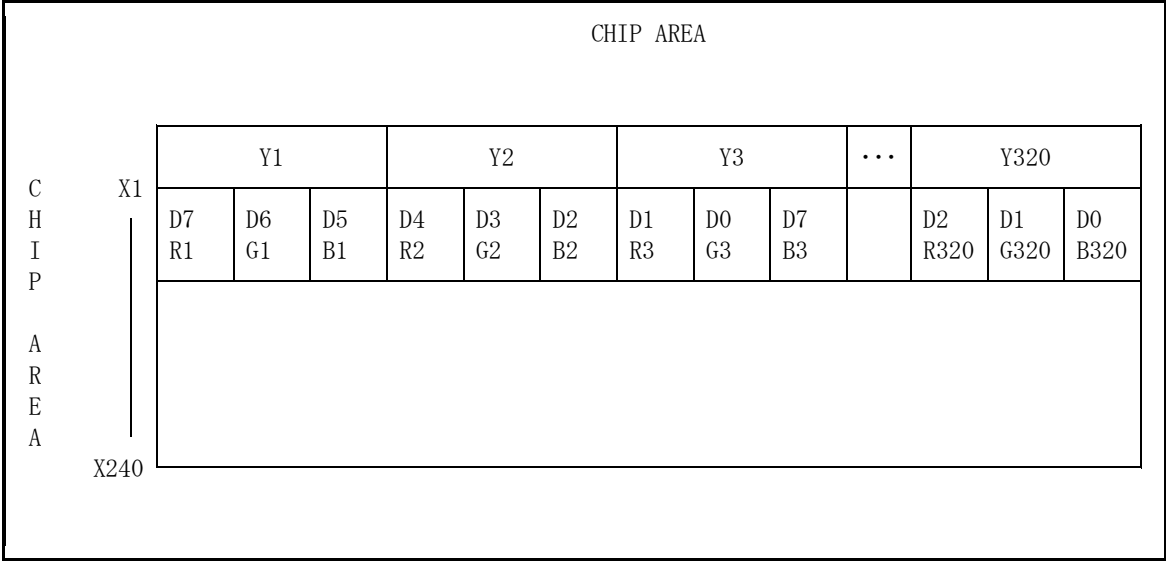
| PIN No | SYMBOL | DESCRIPTION | LEVEL |
|--------|--------|----------------------------|-------|
| 1 | HV | Power supply for CFL | AC |
| 2 | NC | — | — |
| 3 | GND | Ground line(from inverter) | — |

LCD side connector : BHR-03VS-1 (JST)
Recommended matching connector : SM02-(8.0)B-BHS-1 (JST)

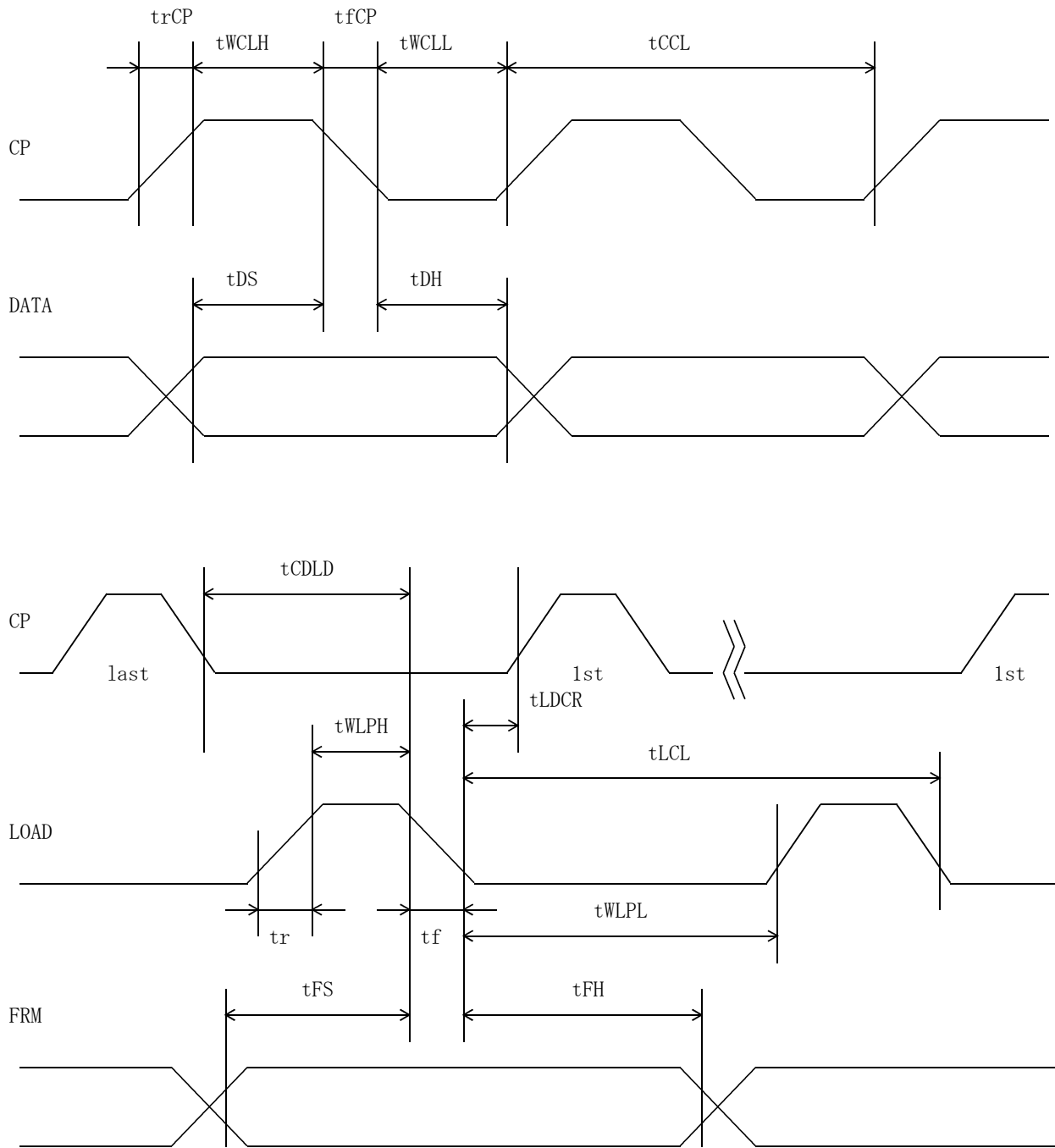


* The cycle of load signal should be stable and continuously applied without interruption.

* The above-mentioned timing chart shows a reference to set up a LCD module, not an electrical rating.



1.1. Input Timing Characteristics



11-1. Switching characteristics

Input Characteristics ; VDD = +5.0V \pm 5%, Temp. = 25 $^{\circ}$ C

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|---------------------------------|--------|------|------|------|
| CP Cycle *1, *2 | tCCL | 140 | — | ns |
| CP "H" Pulse Width *2 | tWCLH | 60 | — | ns |
| CP "L" Pulse Width *2 | tWCLL | 60 | — | ns |
| CP Rise Up Time *2 | trCP | — | 15 | ns |
| CP Fall Down Time *2 | tfCP | — | 15 | ns |
| Data Set Up Time | tDS | 30 | — | ns |
| Data Hold Time | tDH | 30 | — | ns |
| LOAD "H" Pulse Width | tWLPH | 60 | — | ns |
| LOAD "L" Pulse Width | tWLPL | 400 | — | ns |
| LOAD Cycle *3 | tLCL | 500 | — | ns |
| CP Down→LOAD Down Delay Time | tCDLD | 100 | — | ns |
| LOAD Down→CP Rise Delay Time *4 | tLDCR | 100 | — | ns |
| Input Signal Rise Up Time | tr | — | 20 | ns |
| Input Signal Fall Down Time | tf | — | 20 | ns |
| FRM Data Set Up Time | tFS | 120 | — | ns |
| FRM Data Hold Time | tFH | 30 | — | ns |

*1 CP Cycle is adjust so that FRM signal is 75Hz.

*2 The formula of condition

$$\textcircled{1} \text{ trCP} + \text{tfCP} < \text{tCCL} - (\text{tWCLH} + \text{tWCLL})$$

$$\textcircled{2} \text{ trCP}, \text{tfCP} \leq 15 \text{ ns}$$

Please use on condition that $\textcircled{1}$, $\textcircled{2}$ are filled.

*3 LOAD Cycle is const.

Input Characteristics ; VDD = +3.3V ± 0.3V, Temp. = 25 °C

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|---------------------------------|--------|------|------|------|
| CP Cycle *1, *2 | tCCL | 170 | — | ns |
| CP "H" Pulse Width *2 | tWCLH | 80 | — | ns |
| CP "L" Pulse Width *2 | tWCLL | 80 | — | ns |
| CP Rise Up Time *2 | trCP | — | 20 | ns |
| CP Fall Down Time *2 | tfCP | — | 20 | ns |
| Data Set Up Time | tDS | 60 | — | ns |
| Data Hold Time | tDH | 60 | — | ns |
| LOAD "H" Pulse Width | tWLPH | 80 | — | ns |
| LOAD "L" Pulse Width | tWLPL | 400 | — | ns |
| LOAD Cycle *3 | tLCL | 500 | — | ns |
| CP Down→LOAD Down Delay Time | tCDLD | 100 | — | ns |
| LOAD Down→CP Rise Delay Time *4 | tLDCR | 100 | — | ns |
| Input Signal Rise Up Time | tr | — | 20 | ns |
| Input Signal Fall Down Time | tf | — | 20 | ns |
| FRM Data Set Up Time | tFS | 120 | — | ns |
| FRM Data Hold Time | tfH | 30 | — | ns |

*1 CP Cycle is adjust so that FRM signal is 75Hz.

*2 The formula of condition

$$\textcircled{1} \text{ trCP} + \text{tfCP} < \text{tCCL} - (\text{tWCLH} + \text{tWCLL})$$

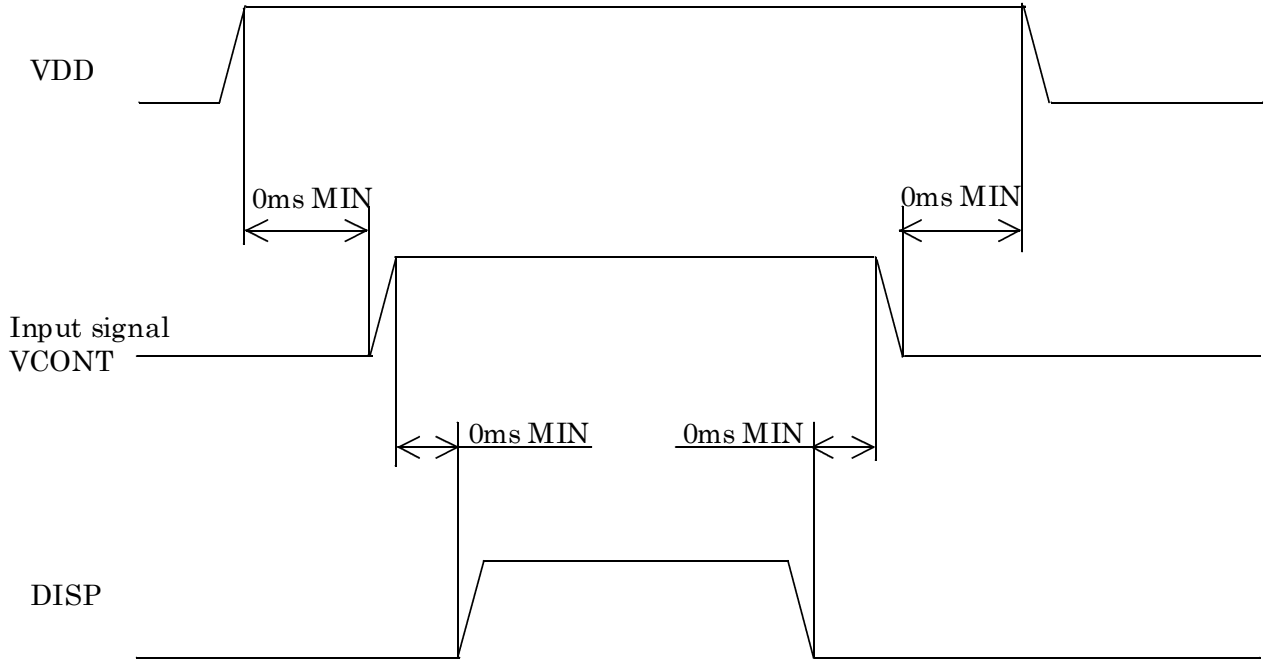
$$\textcircled{2} \text{ trCP}, \text{tfCP} \leq 20 \text{ ns}$$

Please use on condition that $\textcircled{1}$, $\textcircled{2}$ are filled.

*3 LOAD Cycle is const.

1 2. Supply Voltage Sequence Condition

DO NOT apply DC voltage to the LCD panel. DC voltage induce irreversible electrochemical reactions and reduce LCD life. Always follow the power supply ON/OFF sequence of VDD first, input signal second, VCONT third and finally DISP. This will prevent DC driving of the LCD or CMOS LSI latch up as shown below.



* Input signal : CP, LOAD, FRM, VCONT, D0~D7

* The above sequence should be designed as to keep each normal figure on condition that liquid crystal module is loaded on your system.

* Control the input signal and VCONT to the above ON - OFF timing when you switch ON/OFF the display during VDD and DISP are on.
And design the circuit as VCONT's OFF level become GND level at the same time.

1 3. Backlight Characteristics

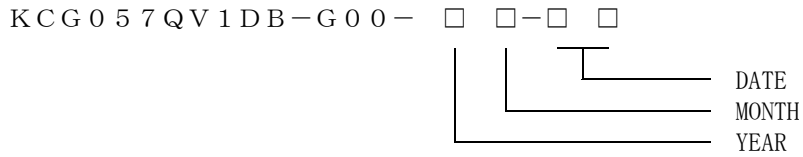
Temp. = 25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | NOTE |
|-----------------------------------|--------|------------|-------------|-------------|-------|
| Starting discharge Voltage *1 | VS | — | — | (795) Vrms. | 0 °C |
| | | — | — | (530) Vrms. | 25 °C |
| Discharging tube current *2, *3 | IL | 3.0 mArms. | 5.0 mArms. | 6.0 mArms. | — |
| Discharging tube voltage | VL | — | (320) Vrms. | — | — |
| Operating life (IL=5.0 mArms.) *4 | T | 36,000 h | 54,000 h | — | — |
| Operating frequency | F | (40) kHz | — | (100) kHz | — |

- *1 The Non-load output voltage (VS) of the inverter should be designed to have some margin, because VS may increase due to the leak current which may be caused by wiring of CFL cables. (Reference value: (1035) Vrms MIN.)
- *2 We recommend that you should set the discharging tube current at lower than typical value so as to prevent the heat accumulation of CFL tube from deteriorating a performance of the LCD.
- *3 Do not apply more than 6.0mA discharge tube current. Because CFL maybe broken due to over current.
- *4 When the illuminance or quantity of light has decreased to 50 % of the initial value. Average life time of CFL will be decreased when LCD is operating at lower and Higher temperature.

1 4. Lot Number Identification

The lot number shall be indicated on the back of the backlight case of each LCD.



| | | | | | | |
|------|------|------|------|------|------|------|
| YEAR | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| CODE | 2 | 3 | 4 | 5 | 6 | 7 |

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|-------|------|------|------|------|-----|------|
| MONTH | JAN. | FEB. | MAR. | APR. | MAY | JUN. |
| CODE | 1 | 2 | 3 | 4 | 5 | 6 |

| | | | | | | |
|-------|------|------|------|------|------|------|
| MONTH | JUL. | AUG. | SEP. | OCT. | NOV. | DEC. |
| CODE | 7 | 8 | 9 | X | Y | Z |

1 5. Warranty

15-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

15-2. Production Warranty

Kyocera warrants its LCDs for a period of 12 months after receipt by the purchaser, and within the limits specified. Kyocera shall, by mutual agreement, replace or rework defective LCDs that are shown to be Kyocera's responsibility.

16. Precautions for use

16-1. Installation of the LCD

1. Please ground the mounting (screw) holes of an LCD module, in order to stabilize brightness and display quality.
2. A transparent protection plate shall be added to protect the LCD and its polarizers.
3. The LCD shall be installed so that there is no pressure on the LSI chips.
4. The LCD shall be installed flat, without twisting or bending.
5. The display window size should be the same as the effective viewing area.
6. In case you use outside frame of effective viewing area as outward appearance of your product, unevenness of its outward appearance is out of guarantee.
7. Do not pull the CFL lead wires and do not bend the root of the wires.
Housing should be designed to protect CFL lead wires from external stress.

16-2. Static Electricity

1. Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required. Operation should wear ground straps.

16-3. LCD Operation

1. The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
2. Vop must be adjusted to optimize viewing angle and contrast.
3. Operation of the LCD at temperature below the limit specified may cause image degradation and/or bubbles.

It may also change the characteristics of the liquid crystal.

This phenomenon may not recover. The LCD shall be operated within the temperature limits specified.

16-4. Storage

1. The LCD shall be stored within the temperature and humidity limits specified.
Store in a dark area, and protected the LCD from direct sunlight or fluorescent light.
2. The LCD should be packaged to prevent damage.

16-5. Screen Surface

1. DO NOT store in a high humidity environment for extended periods.
Image degradation, bubbles, and/or peeling off of polarizer may result.
2. The front polarizer is easily scratched or damaged.
Prevent touching it with any hard material, and from being pushed or rubbed.
3. The LCD screen may be cleaned with a soft cloth or cotton pad.
Methanol, or Isopropyl Alcohol may be used, but insure that all solvent residue is removed.
4. Water may cause damage or discoloration of the polarizer.
Clean any condensation or moisture from any source immediately.
5. Always keep the LCD free from condensation during testing.
Condensation may permanently spot or stain the polarizers.

1 7. Reliability Data / Environmental Test

| TEST ITEM | TEST CONDITION | TEST TIME | RESULT |
|--------------------------------|--|-----------|---|
| High Temp. Atmosphere | 60°C | 240 h | Display Quality : No defect Display Function : No defect Current Consumption : No defect |
| Low Temp. Atmosphere | -20°C | 240 h | Low Temp. Bubble : None Solid Crystallization of Liquid Crystal : None Display Quality : No defect Display Function : No defect Current Consumption : No defect |
| High Temp. Humidity Atmosphere | 40°C 90%RH | 240 h | Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Current Consumption : No defect |
| Temp. Cycle | -20°C 0.5 h R. T. 0.5 h 60°C 0.5 h | 10 cycles | Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Bubble on Cell : None |
| High Temp. Operation | 60°C Vop | 500 h | Display Quality : No defect Current Consumption : No defect |

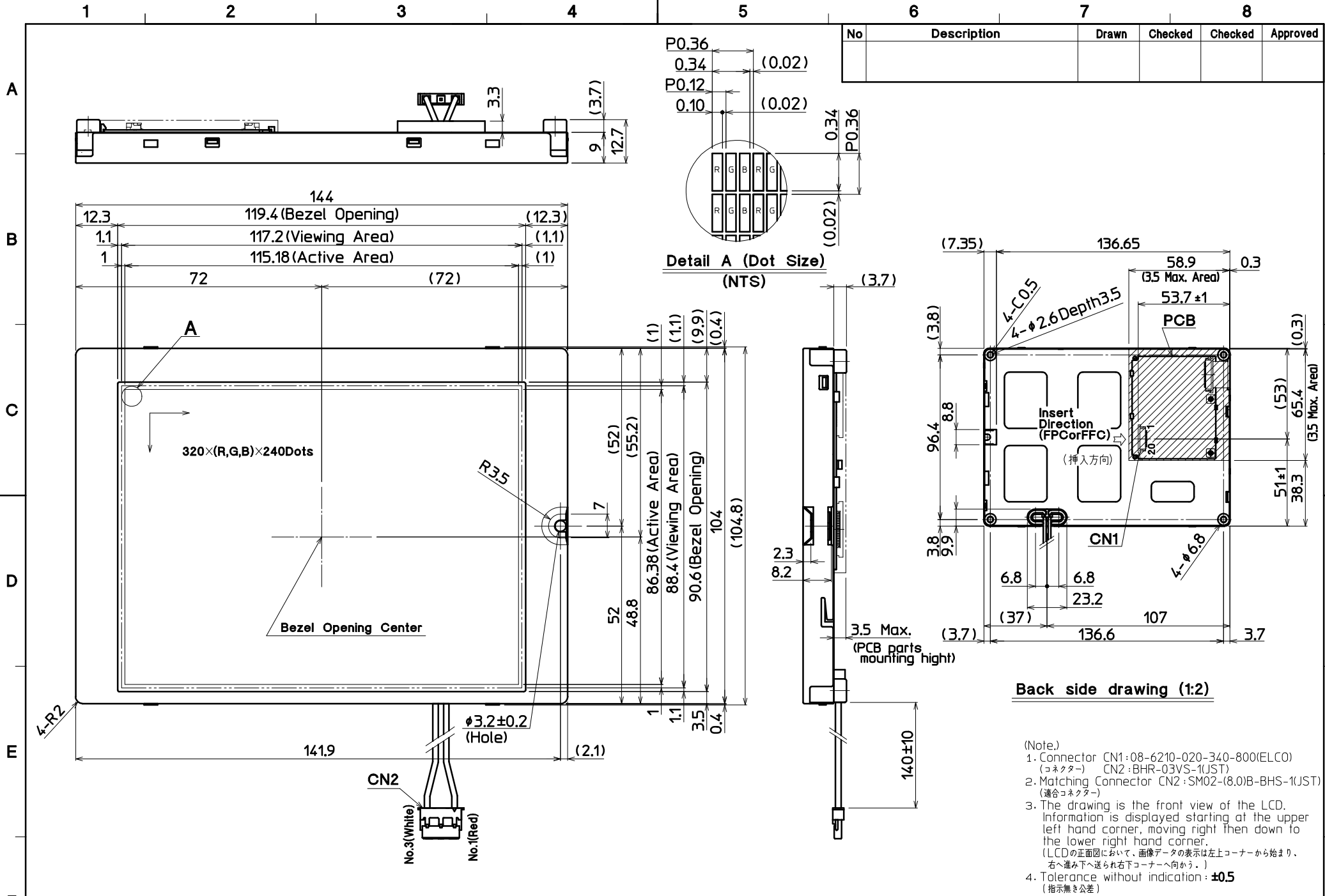
* Each test item uses a test LCD only once. The tested LCD is not used in any other tests.

* The LCD is tested in circumstances in which there is no condensation.

* The tested LCD is inspected after 24 hours of storage at room temperature and room humidity after each test is finished.

* The reliability test is not an out-going inspection.

* The result of the reliability test are for your reference purpose only.
The reliability test is conducted only to examine the LCD's capability.



| No | Description | Drawn | Checked | Checked | Approved |
|----|-------------|-------|---------|---------|----------|
| | | | | | |

Back side drawing (1:2)

- (Note.)
- Connector CN1: 08-6210-020-340-800(ELCO) (コネクタ) CN2: BHR-03VS-1(JST) (コネクタ)
 - Matching Connector CN2: SM02-(8.0)B-BHS-1(JST) (適合コネクタ)
 - The drawing is the front view of the LCD. Information is displayed starting at the upper left hand corner, moving right then down to the lower right hand corner. (LCDの正面図において、画像データの表示は左上コーナーから始まり、右へ進み下へ送られ右下コーナーへ向かう。)
 - Tolerance without indication: ± 0.5 (指示無き公差)

| | | | | | | | | | | |
|-----------------|--------------------|-----------------------|---------|----------------------|-------------|-----------------------|--|-----------------------------|-----------------------------|-----------|
| Material 材質 | Treatment 処理 | Approved '02.07.26 | Checked | Checked '02.07.26 | Drawn 倉元 | Scale 1:1(1:2,NTS) | Title KCG057QV1DB Outline Dimensions | Drawing No. 121A5018300 | Year-Month-Day '02.07.26 | Size 3 |
| Quantity 製作数 | Description; 備考 | 阿部 | | 今村 | | | | | | |

| | |
|----------|-----------------------|
| SPEC.NO. | TQ3C-8EACO-E2CUP15-00 |
| DATE | July 31, 2002 |

FOR : _____

KYOCERA INSPECTION STANDARD

TYPE : KCG057QV1DB-G00

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

| | | | | | |
|---------------|--------------------------------|--------------------|----------------|------------------------|-------------------|
| Original | Designed by :Engineering Dept. | | | Confirmed by :QA Dept. | |
| Issue Data | Prepared | Checked | Approved | Checked | Approved |
| July 31, 2002 | <i>F. Yamagaki</i> | <i>M. Fujitani</i> | <i>H. OHNO</i> | <i>S. Hayashi</i> | <i>Y. Yoshida</i> |

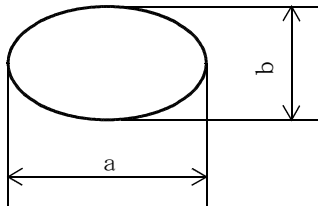
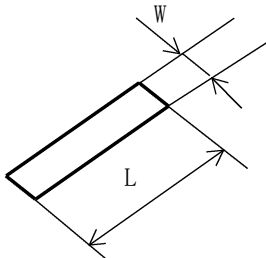
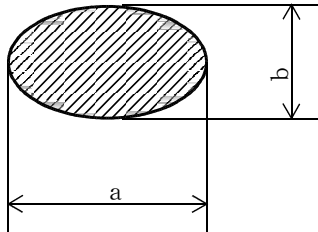
Revision Record

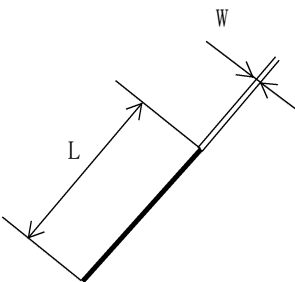
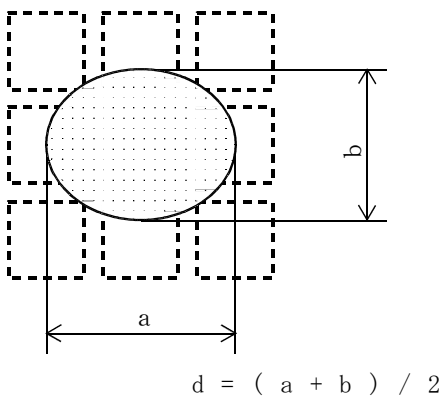
| Date | Designed by: Engineering Dept. | | | Confirmed by: QA Dept. | |
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| | Prepared | Checked | Approved | Checked | Approved |
| | | | | | |
| Rev. No. | Date | Page | Descriptions | | |
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1)Note

| Item | Note |
|-------------------------------|---|
| General | <p>1. When defects specified in this Inspection Standards are inspected, operating voltage(Vop) shall be set at the level where optimized contrast is available. Display quality is applied up to effective viewing area. (Bi-Level INSPECTION)</p> <p>2. This inspection standard about the image quality shall be applied to any defect within the effective viewing area and shall not be applicable to outside of the area.</p> <p>3. Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and Kyocera.</p> <p>4. Inspection conditions</p> <p>Luminance : 500 Lux minimum . Inspection distance : 300 mm (from the sample) Temperature : 25 ± 5 °C Direction : right above</p> |
| Definition of Inspection item | <p>Pinhole, Bright spot Black spot, Scratch Foreign particle</p> <p>The color of a small area is different from the remainder. The phenomenon does not change with voltage.</p> |
| | <p>Contrast variation</p> <p>The color of a small area is different from the remainder. The phenomenon changes with voltage.</p> |
| | <p>Polarizer (Scratch, Bubble, Dent)</p> <p>Scratch, Bubble and Dent in the polarizer which can be observed in on / off state.</p> |

2) Standard

| Inspection item | Judgement standard | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--------------------|-----------------------|-------------------|----------------|--------------|---------------|---|--------------------|---|---------------------|--------------------|-----------|---|--------------------|---|---|-----------|---|---|-----------|---|-----------------------|
| Pinhole, Bright spot Black spot, Foreign particle | <div style="text-align: center;">  $d = (a + b) / 2$ <table border="1" data-bbox="587 566 1393 801"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.2$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.2 < d \leq 0.3$</td> <td>5</td> </tr> <tr> <td>C</td> <td>$0.3 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>D</td> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table> </div> | Category | Size (mm) | Acceptable number | A | $d \leq 0.2$ | neglected | B | $0.2 < d \leq 0.3$ | 5 | C | $0.3 < d \leq 0.5$ | 3 | D | $0.5 < d$ | 0 | | | | | | | |
| Category | Size (mm) | Acceptable number | | | | | | | | | | | | | | | | | | | | | |
| A | $d \leq 0.2$ | neglected | | | | | | | | | | | | | | | | | | | | | |
| B | $0.2 < d \leq 0.3$ | 5 | | | | | | | | | | | | | | | | | | | | | |
| C | $0.3 < d \leq 0.5$ | 3 | | | | | | | | | | | | | | | | | | | | | |
| D | $0.5 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | |
| Scratch, Foreign particle | <div style="text-align: center;">  <table border="1" data-bbox="557 1171 1422 1473"> <thead> <tr> <th></th> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$W \leq 0.03$</td> <td>—</td> <td>neglected</td> </tr> <tr> <td>B</td> <td rowspan="3">$0.03 < W \leq 0.1$</td> <td>$L \leq 2.0$</td> <td>neglected</td> </tr> <tr> <td>C</td> <td>$2.0 < L \leq 4.0$</td> <td>3</td> </tr> <tr> <td>D</td> <td>$4.0 < L$</td> <td>0</td> </tr> <tr> <td>E</td> <td>$0.1 < W$</td> <td>—</td> <td>According to Circular</td> </tr> </tbody> </table> </div> | | Width (mm) | Length (mm) | Acceptable No. | A | $W \leq 0.03$ | — | neglected | B | $0.03 < W \leq 0.1$ | $L \leq 2.0$ | neglected | C | $2.0 < L \leq 4.0$ | 3 | D | $4.0 < L$ | 0 | E | $0.1 < W$ | — | According to Circular |
| | Width (mm) | Length (mm) | Acceptable No. | | | | | | | | | | | | | | | | | | | | |
| A | $W \leq 0.03$ | — | neglected | | | | | | | | | | | | | | | | | | | | |
| B | $0.03 < W \leq 0.1$ | $L \leq 2.0$ | neglected | | | | | | | | | | | | | | | | | | | | |
| C | | $2.0 < L \leq 4.0$ | 3 | | | | | | | | | | | | | | | | | | | | |
| D | | $4.0 < L$ | 0 | | | | | | | | | | | | | | | | | | | | |
| E | $0.1 < W$ | — | According to Circular | | | | | | | | | | | | | | | | | | | | |
| Contrast variation | <div style="text-align: center;">  $d = (a + b) / 2$ <table border="1" data-bbox="587 1821 1393 2007"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.5$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.5 < d \leq 0.7$</td> <td>3</td> </tr> <tr> <td>C</td> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table> </div> | Category | Size (mm) | Acceptable number | A | $d \leq 0.5$ | neglected | B | $0.5 < d \leq 0.7$ | 3 | C | $0.7 < d$ | 0 | | | | | | | | | | |
| Category | Size (mm) | Acceptable number | | | | | | | | | | | | | | | | | | | | | |
| A | $d \leq 0.5$ | neglected | | | | | | | | | | | | | | | | | | | | | |
| B | $0.5 < d \leq 0.7$ | 3 | | | | | | | | | | | | | | | | | | | | | |
| C | $0.7 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | |

| Inspection item | Judgement standard | | | | | | | | | | | | | | | | | | |
|-------------------------------------|---|-------------------|----------------|-------------------|----------------|--------------|--------------|---|--------------------|---|--------------------|--------------------|-----------|---|-----------|---|---|-----------|---|
| Polarizer (Scratch, Bubble, Dent) | <p>(1) Scratch</p>  | | | | | | | | | | | | | | | | | | |
| | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$W \leq 0.1$</td> <td>—</td> <td>neglected</td> </tr> <tr> <td>B</td> <td rowspan="2">$0.1 < W \leq 0.3$</td> <td>$L \leq 5.0$</td> <td>neglected</td> </tr> <tr> <td>C</td> <td>$5.0 < L$</td> <td>0</td> </tr> <tr> <td>D</td> <td>$0.3 < W$</td> <td>—</td> <td>0</td> </tr> </tbody> </table> | | Width (mm) | Length (mm) | Acceptable No. | A | $W \leq 0.1$ | — | neglected | B | $0.1 < W \leq 0.3$ | $L \leq 5.0$ | neglected | C | $5.0 < L$ | 0 | D | $0.3 < W$ | — |
| | Width (mm) | Length (mm) | Acceptable No. | | | | | | | | | | | | | | | | |
| A | $W \leq 0.1$ | — | neglected | | | | | | | | | | | | | | | | |
| B | $0.1 < W \leq 0.3$ | $L \leq 5.0$ | neglected | | | | | | | | | | | | | | | | |
| C | | $5.0 < L$ | 0 | | | | | | | | | | | | | | | | |
| D | $0.3 < W$ | — | 0 | | | | | | | | | | | | | | | | |
| | <p>(2)Bubble (dent)</p>  <p style="text-align: center;">$d = (a + b) / 2$</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.2$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.2 < d \leq 0.3$</td> <td>5</td> </tr> <tr> <td>C</td> <td>$0.3 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>D</td> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table> | Category | Size (mm) | Acceptable number | A | $d \leq 0.2$ | neglected | B | $0.2 < d \leq 0.3$ | 5 | C | $0.3 < d \leq 0.5$ | 3 | D | $0.5 < d$ | 0 | | | |
| Category | Size (mm) | Acceptable number | | | | | | | | | | | | | | | | | |
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| B | $0.2 < d \leq 0.3$ | 5 | | | | | | | | | | | | | | | | | |
| C | $0.3 < d \leq 0.5$ | 3 | | | | | | | | | | | | | | | | | |
| D | $0.5 < d$ | 0 | | | | | | | | | | | | | | | | | |