

**SPEC for Sample production**

|          |                       |
|----------|-----------------------|
| Spec No. | TQ3C-8EAF0-E1YBS03-00 |
| Date     | February 26, 2019     |

**TYPE : TN0181ANVNANN-\*N\*03**

< 1.81 inch Reflective Dot Matrix Memory LC Display >

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KYOCERA CORPORATION

| Original Issue Date | Designed by: Engineering dept. |            |           | Confirmed by: QA dept. |           |
|---------------------|--------------------------------|------------|-----------|------------------------|-----------|
|                     | Prepared                       | Checked    | Approved  | Checked                | Approved  |
| Feb. 26, 2019       | T. Onodera                     | Y. Ogihara | M. Tanaka | K. Yamada              | K. Sugami |

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## **Warning**

1. This Kyocera LCD module has been specifically designed for use only in electronic devices and industrial machines in the area of audio control, office automation, industrial control, home appliances, etc. The module should not be used in applications where the highest level of safety and reliability are required and module failure or malfunction of such module results in physical harm or loss of life, as well as enormous damage or loss.  
Such fields of applications include, without limitation, medical, aerospace, communications infrastructure, atomic energy control. Kyocera expressly disclaims any and all liability resulting in any way to the use of the module in such applications.
2. Customer agrees to indemnify, defend and hold Kyocera harmless from and against any and all actions, claims, damages, liabilities, awards, costs, and expenses, including legal expenses, resulting from or arising out of Customer's use, or sale for use, or Kyocera modules in applications.

## **Caution**

1. 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.

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**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. Application

This document defines the specification of TN0181ANVNANN-\*N\*03. (RoHS Compliant)

## 2. Construction and Outline

LCD : Low power consumption / Reflective dot matrix memory LC display  
 Backlight System : None  
 Polarizer : Glare type  
 Additional circuit : 1-bit pixel memory function in LCD

## 3. Mechanical Specifications

| Item                  | Specification                                | Unit |
|-----------------------|--|------|
| Outline dimensions 1) | 35.91(W) × 38.21(H)                          | mm   |
| Glass thickness       | 0.5 + 0.5                                    | mm   |
| Active area           | 32.51(W) × 32.51(H)<br>(Diagonal 1.81 inch)  | mm   |
| Dot format            | 256(W) × 256(H)                              | Dot  |
| Dot pitch             | 127(W) × 127(H)                              | μm   |
| Color 2)              | Black-and-White (Binary)<br>(Normally black) | -    |
| LC Mode               | ECB mode                                     | -    |
| Weight                | TBD  | g    |

1) Gasket and FPC are not included. Please refer to the drawing for details.

2) The tone of display depends on ambient temperature.

## 4. Absolute Maximum Ratings

### 4-1. Electrical absolute maximum ratings

| Item                    | Symbol          | Min. | Max. | Unit |
|-------------------------|-----------------|------|------|------|
| Supply voltage          | V <sub>DD</sub> | -0.3 | 4.0  | V    |
| Input signal voltage 1) | V <sub>IN</sub> | -0.3 | 4.0  | V    |

1) Input signals : SCLK, SI, SCS, RST, VCOM

### 4-2. Environmental absolute maximum ratings

| Item                     | Symbol           | Min.  | Max. | Unit |
|--------------------------|------------------|-------|------|------|
| Operating temperature 1) | T <sub>OP</sub>  | (-20) | (70) | °C   |
| Storage temperature 2)   | T <sub>STO</sub> | (-30) | (80) | °C   |
| Operating humidity 3)    | H <sub>OP</sub>  | (10)  | 4)   | %RH  |
| Storage humidity 3)      | H <sub>STO</sub> | (10)  | 4)   | %RH  |

- 1) Operating temperature means a temperature which operation shall be guaranteed. Since display performance is evaluated at 25°C, another temperature range should be confirmed.
- 2) Store LCD at normal temperature/humidity. Keep them free from vibration and shock. An LCD that is kept at a low or a high temperature for a long time can be defective due to other conditions, even if the low or high temperature satisfies the standard. (Please refer to "Precautions for Use" for details.)
- 3) Non-condensing
- 4) Temp. ≤(40)°C , (85)%RH Max.  
Temp. >(40)°C, Absolute humidity shall be less than 85%RH at 40°C

## 5. Optical Characteristics

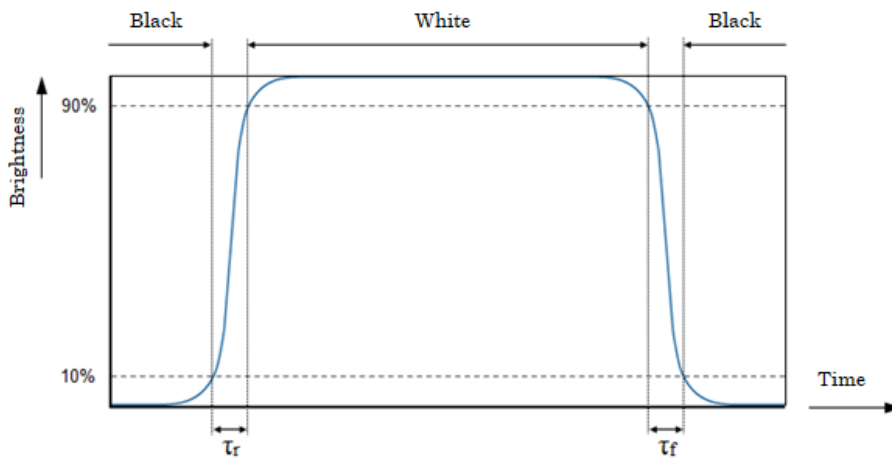
$V_{DD}=3.3V, V_{COM}=1Hz, Temp. = 25^{\circ}C$

| Item                         | Symbol           | Temp.    | Min.  | Typ.    | Max. | Unit |      |
|------------------------------|------------------|----------|-------|---------|------|------|------|
| Contrast ratio               | CR               | 25°C     | -     | (40)    | -    | -    |      |
| Reflectance                  | -                | 25°C     | -     | (20)    | -    | %    |      |
| Response time                | Rise             | $\tau_r$ | -20°C | -       | (15) | -    | msec |
|                              |                  |          | 25°C  | -       | (11) | -    |      |
|                              |                  |          | 40°C  | -       | (11) | -    |      |
|                              | Fall             | $\tau_f$ | -20°C | -       | (36) | -    | msec |
|                              |                  |          | 25°C  | -       | (12) | -    |      |
|                              |                  |          | 40°C  | -       | (12) | -    |      |
| Viewing angle<br>$CR \geq 2$ | $\theta_{upper}$ | 25°C     | -     | (60)    | -    | deg. |      |
|                              | $\theta_{lower}$ |          | -     | (60)    | -    |      |      |
|                              | $\theta_{left}$  |          | -     | (60)    | -    |      |      |
|                              | $\theta_{right}$ |          | -     | (60)    | -    |      |      |
| Chromaticity coordinates     | Wx               | 25°C     | -     | (0.305) | -    | -    |      |
|                              | Wy               |          | -     | (0.335) | -    | -    |      |

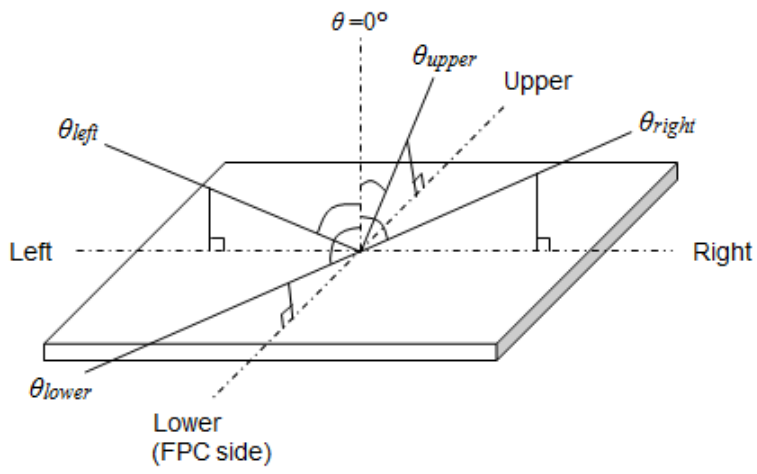
### 5-1. Definition of contrast ratio

$$CR(\text{Contrast ratio}) = \frac{\text{Brightness with all pixels "White"}}{\text{Brightness with all pixels "Black"}}$$

### 5-2. Definition of response time



## 5-3. Definition of viewing angle



## 6. Electrical Characteristics

### 6-1. LCD driving characteristics

Temp. = 25°C

| Item                        | Symbol              | Condition             | Min.                   | Typ.  | Max.                   | Unit |
|-----------------------------|---------------------|-----------------------|------------------------|-------|------------------------|------|
| Supply voltage              | V <sub>DD</sub>     | —                     | 3.0                    | 3.3   | 3.6                    | V    |
| LCD common voltage 5)       | V <sub>COM</sub>    | “Low” level           | GND                    | —     | GND+0.1                | V    |
|                             |                     | “High” level          | V <sub>DD</sub> -0.1   | —     | V <sub>DD</sub>        | V    |
| Input signal voltage 1), 4) | V <sub>IL</sub>     | “Low” level           | GND - 0.2V             | —     | V <sub>DD</sub> * 0.25 | V    |
|                             | V <sub>IH</sub>     | “High” level          | V <sub>DD</sub> * 0.75 | —     | V <sub>DD</sub> + 0.2V | V    |
| Input leak current 1)       | I <sub>IN</sub>     | T <sub>OP</sub> =25°C | TBD                    | (5)   | (10)                   | nA   |
| Current consumption         | I <sub>DD_opr</sub> | 2)                    | —                      | (23)  | TBD                    | μA   |
|                             | I <sub>DD_stb</sub> | 3)                    | —                      | (3)   | TBD                    | μA   |
| Input capacitance 1)        | C <sub>IN1</sub>    | —                     | —                      | (5)   | (10)                   | pF   |
| VCOM terminal capacitance   | C <sub>VCOM</sub>   | —                     | —                      | (120) | TBD                    | nF   |

1) SCLK, SI, SCS, RST

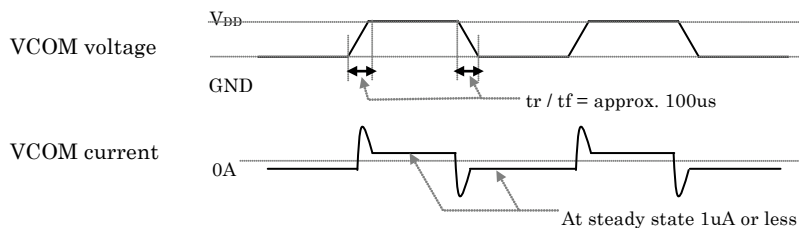
2) 1Hz full display rewriting

3) Keeping static image, and polarity inversion of VCOM with a period of 1 sec.

\*Value of the current consumption is without smoothing capacitor.

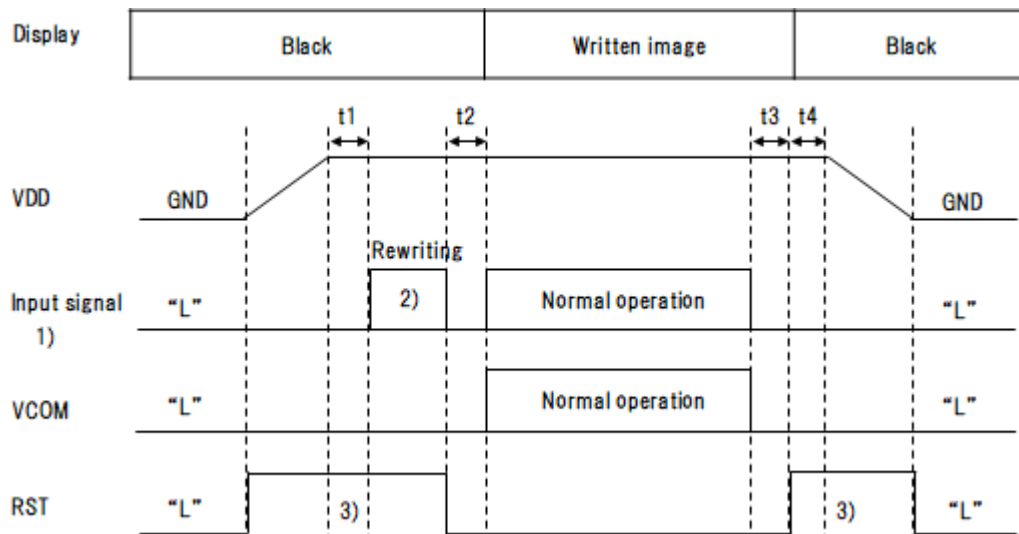
4) Since input leakage current is less than 10 nA, please control voltage so that V<sub>IL</sub>=GND and V<sub>IH</sub>=V<sub>DD</sub> in static state.

5) At 1μA VCOM load, VCOM supply voltage should be set as “Low” level = GND and “High” level = V<sub>DD</sub>. VCOM terminal capacitance is approximately 120nF. VCOM inversion time should be approximately 100us.





## 6-2. Power ON-OFF sequence



| Item                  | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------|--------|------|------|------|------|
| Power ON-OFF sequence | t1     | 0    | —    | —    | μsec |
|                       | t2     | (1)  | (10) | —    | msec |
|                       | t3     | (1)  | (10) | —    | msec |
|                       | t4     | (1)  | (10) | —    | msec |

1) SCLK, SI, SCS

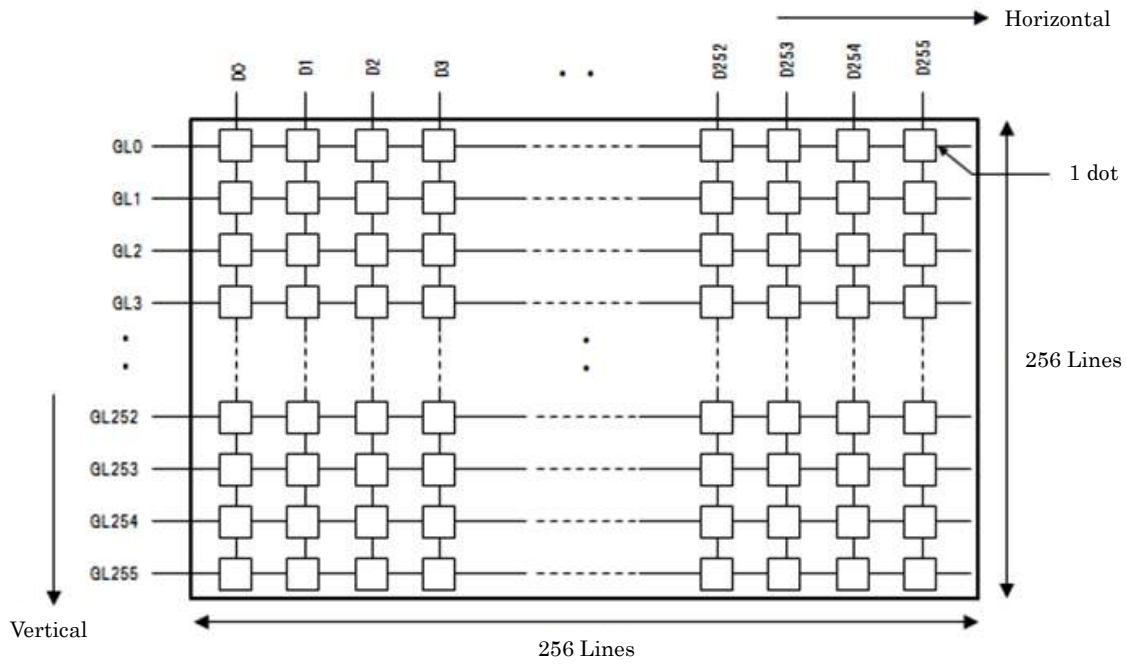
2) Rewriting to black for all addresses.

3) Display OFF when RST = "H". VCOM = "L" is necessary when RST = "H". Black display when display is OFF.

Data in pixel memory is random with black or white at power ON.

Possible to prevent black-white random data display by black display when RST = "H".

## 7. Address Mapping



Addressing of Gate line (GL\*) to be selected is necessary for vertical direction.  
Rewriting data for one line is necessary for horizontal direction due to rewriting one line at once.

-Addressing table for vertical direction

| AG7 | AG6 | AG5 | AG4 | AG3 | AG2 | AG1 | AG0 | Selected GL |
|-----|-----|-----|-----|-----|-----|-----|-----|-------------|
| 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | GL0         |
| 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | GL1         |
| 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | GL2         |
| 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | GL3         |
| ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮           |
| 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0   | GL252       |
| 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   | GL253       |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | GL254       |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | GL255       |

## 8. Interface Signals

| No. | Symbol | Description                   | I/O 1) | Voltage | Unit | Note  |
|-----|--------|-------------------------------|--------|---------|------|-------|
| 1   | VDD    | Power supply (3.3 V)          | P      | 3.3     | V    |       |
| 2   | VSS    | GND                           | P      | 0.0     | V    |       |
| 3   | SCLK   | Clock signal for serial input | I      | 0.0/3.3 | V    | 3)    |
| 4   | SCS    | Chip select signal            | I      | 0.0/3.3 | V    | 3)    |
| 5   | SI     | Serial input signal           | I      | 0.0/3.3 | V    |       |
| 6   | RST    | Display ON/OFF signal         | I      | 0.0/3.3 | V    | 2) 3) |
| 7   | VSS    | GND                           | P      | 0.0     | V    |       |
| 8   | VDD    | Power supply (3.3 V)          | P      | 3.3     | V    |       |
| 9   | VCOM   | Common power supply control   | I      | 0.0/3.3 | V    |       |
| 10  | NC     | NC                            | -      | -       | -    |       |

Matching connector: 04 6824 610 000 846+ (KYOCERA)

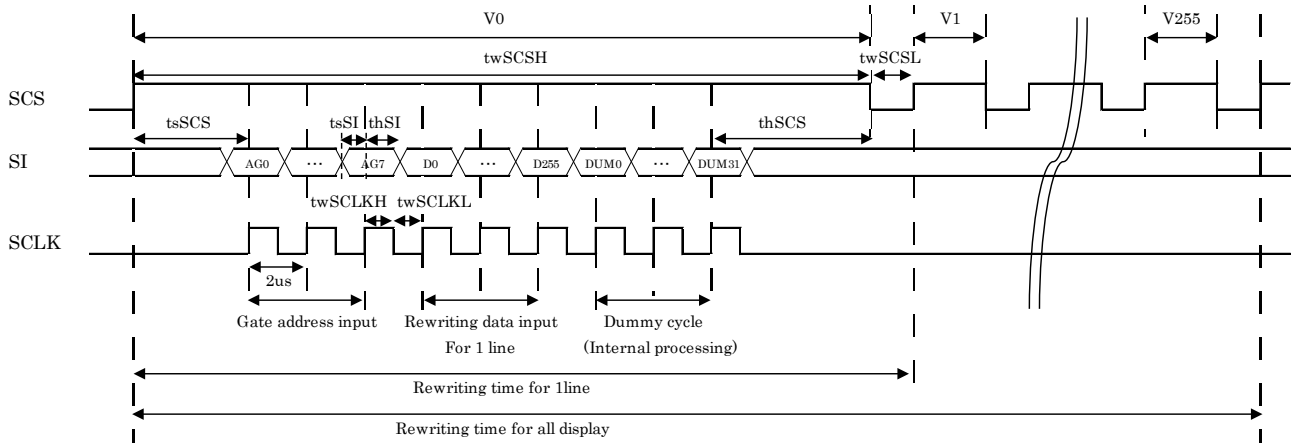
1) P: Power supply  
I: Input

2) RST = "L": Display ON  
RST = "H": Display OFF (Black display keeping pixel memory)  
VCOM = "L" is necessary when RST = "H"  
(When VCOM="H", Display does not turn to black, and current consumption increases by shoot-through-current in panel. (several mA))

3) Need to guard from signal noise  
If there is an abnormal signal not described in the timing chart on these signals, display may be distorted. Please carefully guard these signals since even if signal noise with small pulse width may cause malfunction.

## 9. Input Timing Characteristics

### 9-1. Rewriting timing <SCS activating period: 1 line>



3 lines (SCS, SCLK, and SI) are control signals to rewrite.

Rewriting 1 gate line by 1 gate line.

Input order of serial data

Input gate address

→ Input rewriting data for 1 horizontal line

→ Dummy cycle (internal processing for rewriting)

Relationship between rewriting data and display.

Data 0: Display BLACK

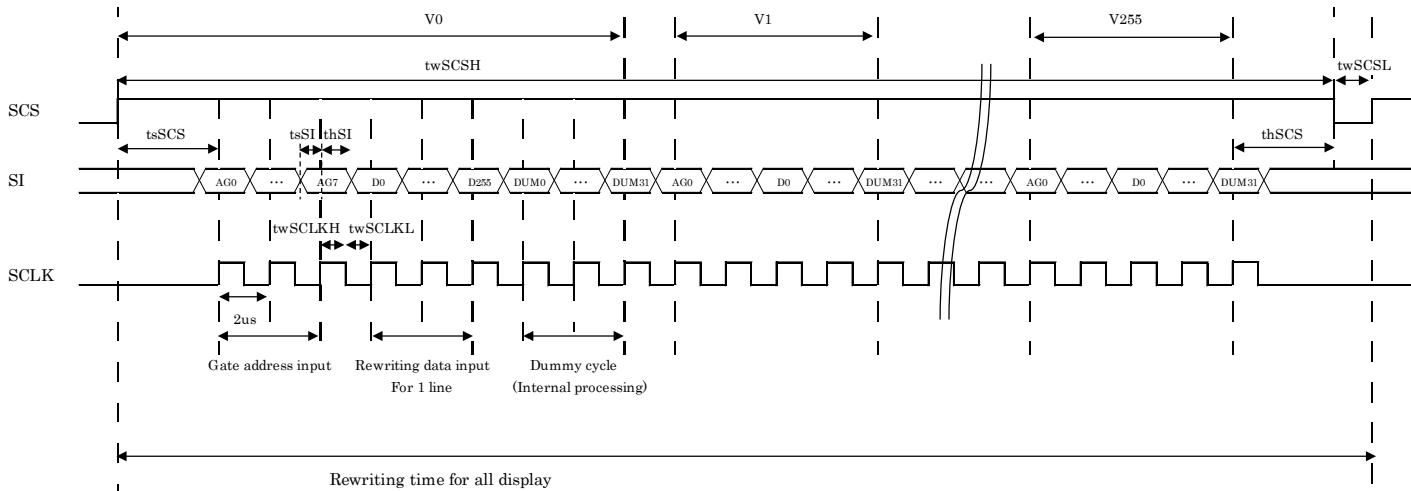
Data 1: Display WHITE

Time to rewrite in case of SCLK period = 2  $\mu s$ .

| No.                           | Item           | Parameters |
|-------------------------------|----------------|------------|
| Serial data input<br>(1 line) | Gate address   | AG0~AG7    |
|                               | Rewriting data | D0~D255    |
|                               | Dummy cycle    | DUM0~DUM31 |
| Total cycle for 1line         |                | 296 cycs   |
| Time to rewrite 1 line        |                | 0.61 msec  |
| Number of gate line           |                | 256 lines  |
| Time to rewrite full display  |                | 156.2 msec |

## 9-2. Rewriting timing <SCS activating period: 1 frame>

Rewriting  $V_0$  to  $V_{max}$  continuously during SCS activating period



3 lines (SCS, SCLK, and SI) are control signals to rewrite.

Rewriting 1 gate line by 1 gate line.

Input order of serial data

Input gate address

→ Input rewriting data for 1 horizontal line

→ Dummy cycle (internal processing for rewriting)

Possible to rewrite numerous lines continuously during SCS activating period.

Gate addresses for continuous rewriting of numerous lines can be set in any order.

Relationship between rewriting data and display.

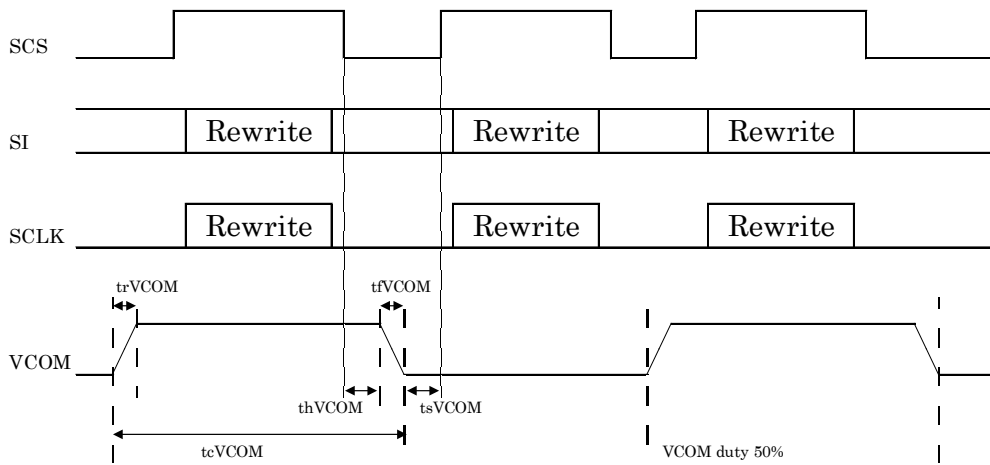
Data 0: Display BLACK

Data 1: Display WHITE

Time to rewrite in case of SCLK period = 2  $\mu$ sec.

| No.                           | Item           | Parameters |
|-------------------------------|----------------|------------|
| Serial data input<br>(1 line) | Gate address   | AG0~AG7    |
|                               | Rewriting data | D0~D255    |
|                               | Dummy cycle    | DUM0~DUM31 |
| Total cycle for 1line         |                | 296 cycs   |
| Number of gate line           |                | 256 lines  |
| Time to rewrite full display  |                | 151.6 msec |

### 9-3. VCOM AC driving



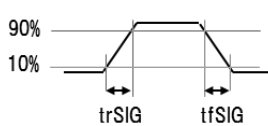
AC drive between 0 V and 3.3 V is required for VCOM signal.  
VCOM switching is performed during the period when the rewriting operation is not performed.  
(SCS="L")

## 9-4. Timing characteristics

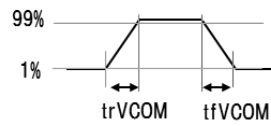
| Item                 |                         | Symbol  | Min.    | Typ.   | Max.  | Unit | Note |
|----------------------|-------------------------|---------|---------|--------|-------|------|------|
| 1 line writing time  |                         | -       | (0.61)  | —      | —     | ms   |      |
| 1 frame writing time |                         | -       | (151.6) | —      | —     | ms   |      |
| Input signal<br>1)   | Signal rise time        | trSIG   | —       | —      | (50)  | ns   | 2)   |
|                      | Signal fall time        | tfSIG   | —       | —      | (50)  | ns   | 2)   |
| SCLK                 | SCLK high width         | twSCLKH | (0.95)  | —      | —     | μs   | 4)   |
|                      | SCLK low width          | twSCLKL | (0.95)  | —      | —     | μs   | 4)   |
| SI                   | SI set-up time          | tsSI    | (0.95)  | —      | —     | μs   | 4)   |
|                      | SI hold time            | thSI    | (0.95)  | —      | —     | μs   | 4)   |
| SCS                  | SCS high width          | twSCSH  | (565)   | —      | —     | μs   | 4)   |
|                      | SCS low width           | twSCSL  | (10)    | —      | —     | μs   | 4)   |
|                      | SCS set-up time         | tsSCS   | (4)     | —      | —     | μs   | 4)   |
|                      | SCS hold time           | thSCS   | (4)     | —      | —     | μs   | 4)   |
| VCOM                 | VCOM duty               | —       | —       | (50)   | —     | %    |      |
|                      | VCOM rise time          | trVCOM  | —       | (100)  | (200) | μs   | 3)   |
|                      | VCOM fall time          | tfVCOM  | —       | (100)  | (200) | μs   | 3)   |
|                      | VCOM cycle time         | tcVCOM  | —       | (1000) | —     | ms   | 5)   |
|                      | VCOM rise/fall→SCS rise | tsVCOM  | (4)     | (4)    | —     | ms   | 5)   |
|                      | SCS fall→VCOM rise/fall | thVCOM  | (1)     | (1)    | —     | ms   | 5)   |

- 1) SCLK, SI, SCS, RST
- 2) Transition time of 10%↔90% level of signal
- 3) Transition time of 1%↔99% level of signal
- 4) Timing is defined at 50% level of signal
- 5) VCOM timing is defined at 1%↔99% level of signal. Other timing is defined at 50% level of signal.

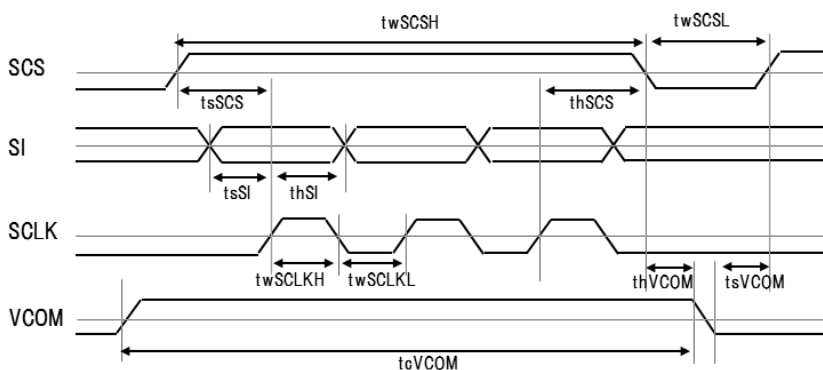
## -Timing charts



SCLK, SI, SCS, RST



VCOM



|                                   |                                 |           |
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## 10. Warranty

### 10-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

### 10-2. Production warranty

Kyocera warrants its LCD's for a period of 12 months from the ship date. Kyocera shall, by mutual agreement, replace or re-work defective LCD's that are shown to be Kyocera's responsibility.



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## 11. Precautions for Use

### 11-1. Installation of the LCD

- 1) A transparent protection plate shall be added to protect the LCD and its polarizer.
- 2) The LCD shall be installed flat, without twisting or bending.
- 3) A transparent protection sheet is attached to the polarizer. Please remove the protection film slowly before use, paying attention to static electricity.

### 11-2. Static electricity

- 1) Protect the LCD from static electricity.
- 2) Workers should use body grounding. Operator should wear ground straps.

### 11-3. 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.

### 11-4. Storage

- 1) The LCD shall be stored within the temperature and humidity limits specified.  
Store in a dark area, and protect the LCD from direct sunlight or fluorescent light.
- 2) Always store the LCD so that it is free from external pressure onto it.

### 11-5. Usage

- 1) **DO NOT** store in a high humidity environment for extended periods. Polarizer degradation bubbles, and/or peeling off of the 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 by wiping the screen surface with a soft cloth or cotton pad using a little Ethanol
- 4) Water may cause damage or discoloration of the polarizer. Clean condensation or moisture from any source immediately.
- 5) Always keep the LCD free from condensation during testing. Condensation may permanently spot or stain the polarizer.
- 6) Do not disassemble LCD because it will result in damage.
- 7) This Kyocera LCD has been specifically designed for use in general electronic devices, but not for use in a special environment such as usage in an active gas. Hence, when the LCD is supposed to be used in a special environment, evaluate the LCD thoroughly beforehand and do not expose the LCD to chemicals such as an active gas.
- 8) Please do not use solid-base image pattern for long hours because a temporary afterimage may appear. We recommend using screen saver etc. in cases where a solid-base image pattern must be used.
- 9) Liquid crystal may leak when the LCD is broken. Be careful not to let the fluid go into your eyes and mouth. In the case the fluid touches your body; rinse it off right away with water and soap.

## 12. Reliability Test Data

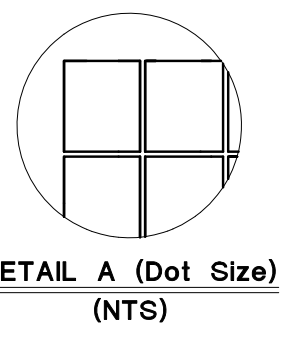
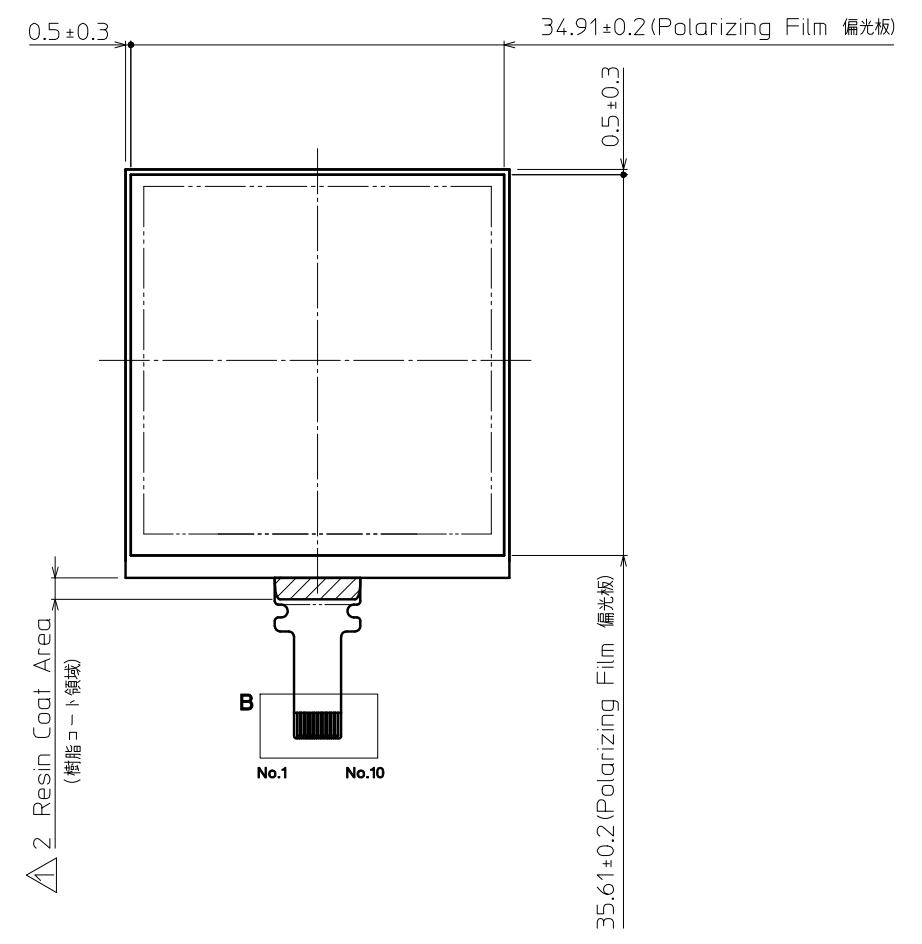
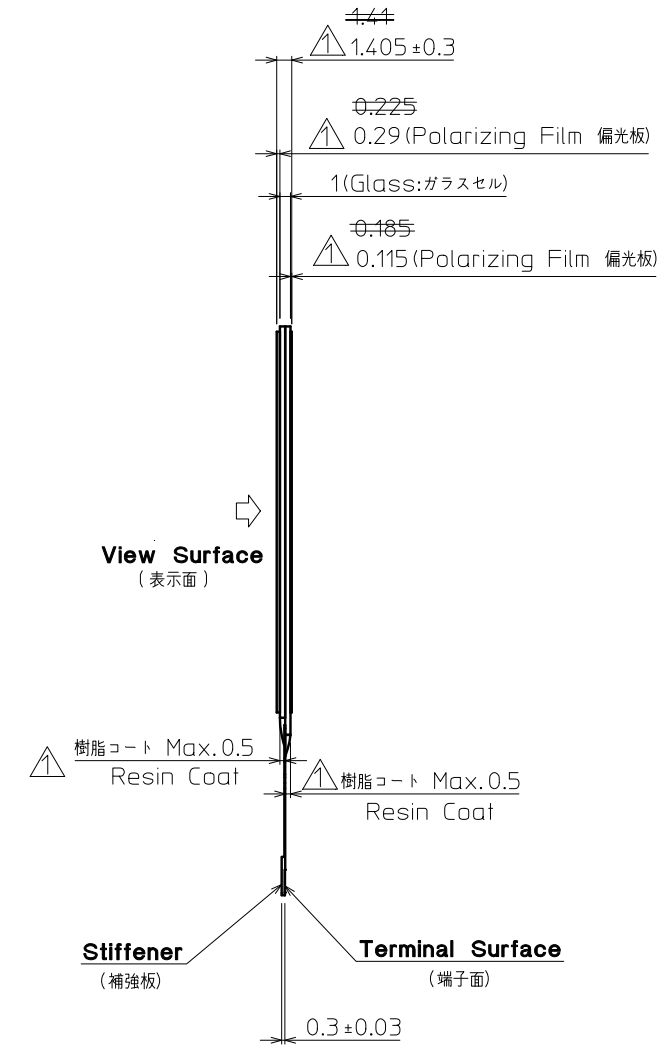
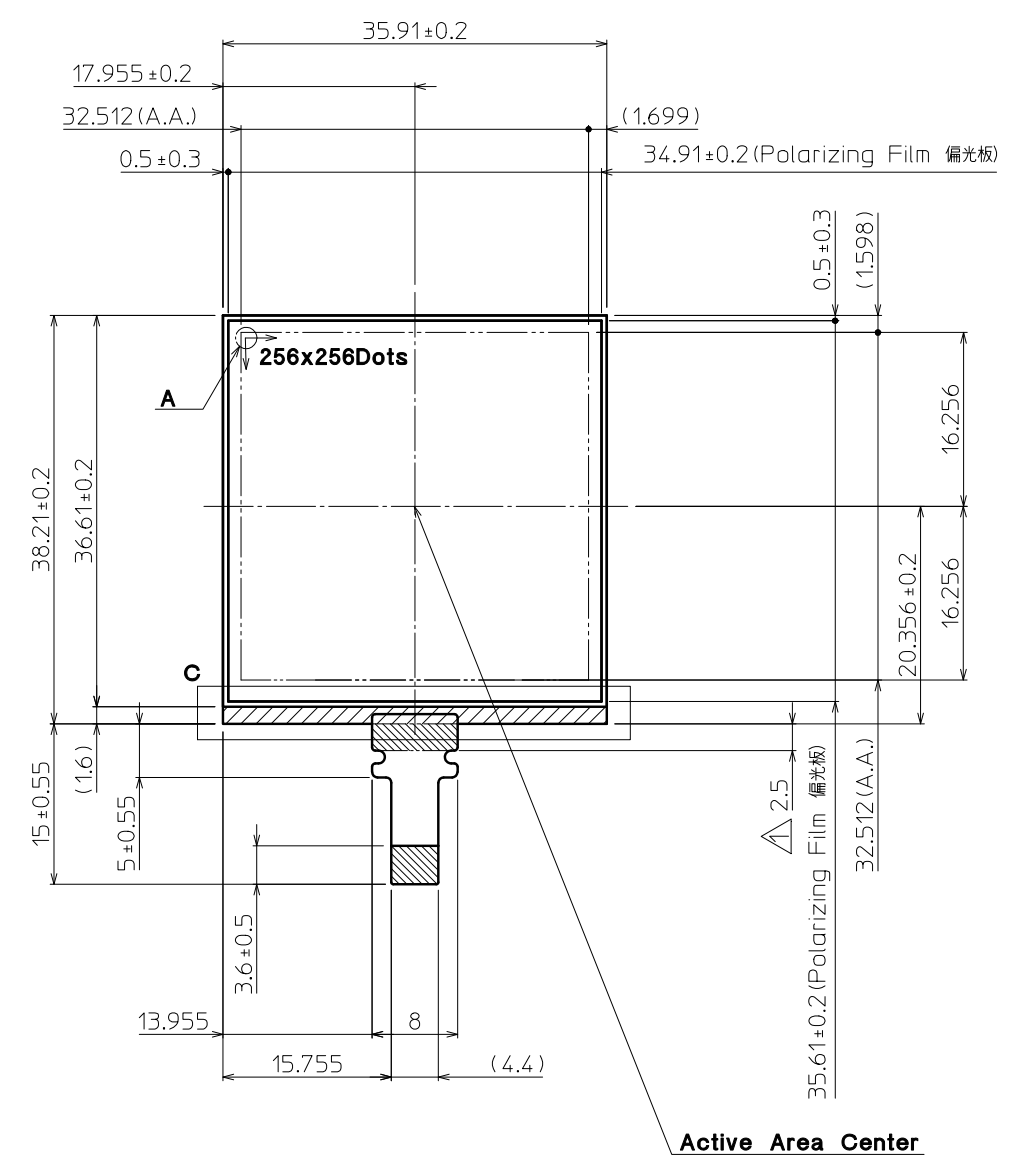
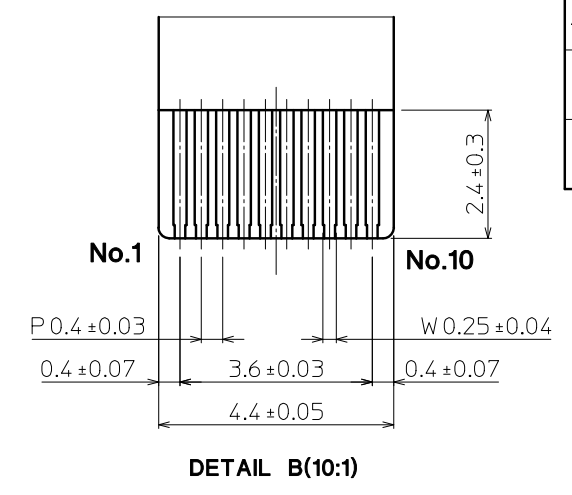
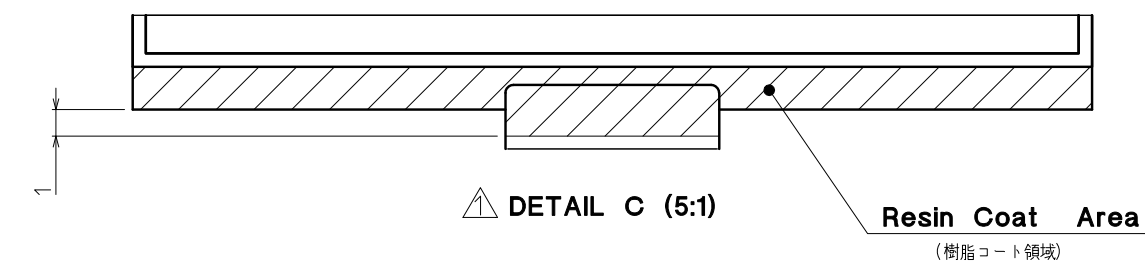
| Test item                      | Test condition                       | Test time | Judgement   |
|--------------------------------|--------------------------------------|-----------|---|
| High temp. atmosphere          | 80°C                                 | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| Low temp. atmosphere           | -30°C                                | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| High temp. humidity atmosphere | 40°C 90%RH                           | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| Temp. cycle                    | -30°C 0.5h<br>R.T. 0.5h<br>80°C 0.5h | 10cycles  | Function/Display : No defect<br>Current consumption : No defect |
| High temp. operation           | 70°C                                 | 240h      | Function/Display : No defect<br>Current consumption : No defect |

- 1) Each test item uses a test LCD only once. The tested LCD is not used in any other tests.
- 2) The LCD is tested in circumstances in which there is no condensation.
- 3) The reliability test is not an out-going inspection.
- 4) The result of the reliability test is for your reference purpose only.  
The reliability test is conducted only to examine the LCD's capability.

| No | Description  | Drawn           | Checked         | Checked         | Approved         |
|----|--|-----------------|-----------------|-----------------|------------------|
| △  | Change polarizing film.<br>Add Resin coat. Change title.<br>(偏光板変更、樹脂コート追加、品名変更) | '18.07.03<br>蔭山 | '18.07.05<br>倉元 | '18.07.05<br>早田 | '18.07.05<br>宇佐美 |
|    |  |                 |                 |                 |                  |
|    |  |                 |                 |                 |                  |

**TENTATIVE**

It is possible to change some dimensions.  
(本図記載の形状・及び寸法値は変更の可能性があります)



△ FPC Bending Prohibited Area (FPC折り曲げ禁止領域)

Note. (注記)

- Tolerance without indication: ±0.5 (指示無き公差)
- FPC Bend radius (R) must be 2mm or larger. (FPCの曲げはR2以上とする)
- There is a possibility that in-plane unevenness will be occurred by over twist, stress giving by attaching to LCD, and over pressure to touch panel. Please be careful of stress when designing the housing. (過度な捻じり(ひずみ)、LCD固定時での応力発生、タッチパネルでの過度な押し圧によっては、パネル面内にムラが発生することがありますので、筐体設計において、事前に十分確認願います。)

| Material | Treatment         | Approved  | Checked   | Checked   | Drawn | Scale         | Title                     | Year-Month-Day | Size |
|----------|-------------------|-----------|-----------|-----------|-------|---------------|---------------------------|----------------|------|
| 材質       | 処理                | '17.11.15 | '17.11.15 | '17.11.01 | 蔭山    | 2:1(10:1,NTS) | △ TN0181ANVNANN-△*N*03    | '17.10.10      | 2    |
| Quantity | Description; RoHS | 阿部        | 島         | 倉元        |       |               | Outline Dimensions        |                |      |
| 製作数      | 備考                |           | 早田        | 伊原        |       |               | Drawing No. 17133-02525-1 |                |      |