

# INDUSTRIAL STRENGTH... Start Your Application From YOURITECH

Integration support

Obsolescence Management

PCAP

Embedded Systems

Human Machine Interface

Touch Solutions

Software

Quality Management

Open Frame Monitors

LCD Controller

Research & Development

Firmware

EMC tests

on-site service

Optical Bonding

In-house Manufacturing

Cover glass

System solutions

OEM Solutions

Custom Display

Production Custom designs Installation

Mechanical design



# SPEC for Mass Production

|          |                       |
|----------|-----------------------|
| Spec No. | TQ3C-8EAF0-E1YCA08-00 |
| Date     | July 14, 2023         |

## **TYPE : TN0227ANVNANN-GN00**

< 2.27 inch Reflective (slightly transmissive)  
Dot Matrix Memory LC Display>

### CONTENTS

1. Application
2. Construction and Outline
3. Mechanical Specifications
4. Absolute Maximum Ratings
5. Optical Characteristics
6. Electrical Characteristics
7. Address Mapping
8. Interface Signals
9. Input Timing Characteristics
10. Warranty
11. Precautions for Use
12. Reliability Test Data
13. Outline Drawing



KYOCERA CORPORATION

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

| Original<br>Issue Date | Designed by: Engineering dept. |                 |                   | Confirmed by:<br>QA dept. |
|------------------------|--------------------------------|-----------------|-------------------|---------------------------|
|                        | Prepared                       | Checked         | Approved          | Approved                  |
| July 14, 2023          | <i>M. Yamada</i>               | <i>T. Fukui</i> | <i>A. Iwasaki</i> | <i>T. Sawada</i>          |

|                                   |                                |           |
|-----------------------------------|--------------------------------|-----------|
| Spec No.<br>TQ3C-8EAF0-E1YCA08-00 | Part No.<br>TN0227ANVNANN-GN00 | Page<br>- |
|-----------------------------------|--------------------------------|-----------|

## **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.
2. Please note that we may not be able to respond to new environmental regulations after receiving the final mass production order for this product.

|                                   |                                |           |
|-----------------------------------|--------------------------------|-----------|
| Spec No.<br>TQ3C-8EAF0-E1YCA08-00 | Part No.<br>TN0227ANVNANN-GN00 | Page<br>- |
|-----------------------------------|--------------------------------|-----------|

### Revision record

|         |      |                                 |              |          |                            |
|---------|------|---------------------------------|--------------|----------|----------------------------|
| Date    |      | Designed by : Engineering dept. |              |          | Confirmed by :<br>QA dept. |
|         |      | Prepared                        | Checked      | Approved | Approved                   |
|         |      |                                 |              |          |                            |
| Rev.No. | Date | Page                            | Descriptions |          |                            |
|         |      |                                 |              |          |                            |

# 1. Application

This document defines the specification of TN0227ANVNANN-GN00. (RoHS Compliant)

# 2. Construction and Outline

- LCD

: Reflective (slightly transmissive) dot matrix memory LC display  
The display should be readable with polarized sunglasses in portrait mode.
- Backlight System

: None
- Polarizer

: Glare type
- Additional circuit

: 1-bit pixel memory function in LCD

# 3. Mechanical Specifications

| Item                  | Specification                                | Unit |
|-----------------------|----------------------------------------------|------|
| Outline dimensions 1) | 41.65(W) × 48.5(H)                           | mm   |
| Glass thickness       | 0.5 + 0.5                                    | mm   |
| Active area           | 36.00(W) × 45.00(H)<br>(Diagonal 2.27 inch)  | mm   |
| Dot format            | 240(W) × 300(H)                              | Dot  |
| Dot pitch             | 150(W) × 150(H)                              | μm   |
| Color 2)              | Black-and-White (Binary)<br>(Normally black) | -    |
| LC Mode               | ECB mode                                     | -    |
| Weight                | 6.2                                          | g    |

1) FPC is 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>  | -25  | 80   | °C   |
| Storage temperature 2)   | T <sub>STO</sub> | -30  | 85   | °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

Temp. = 25°C

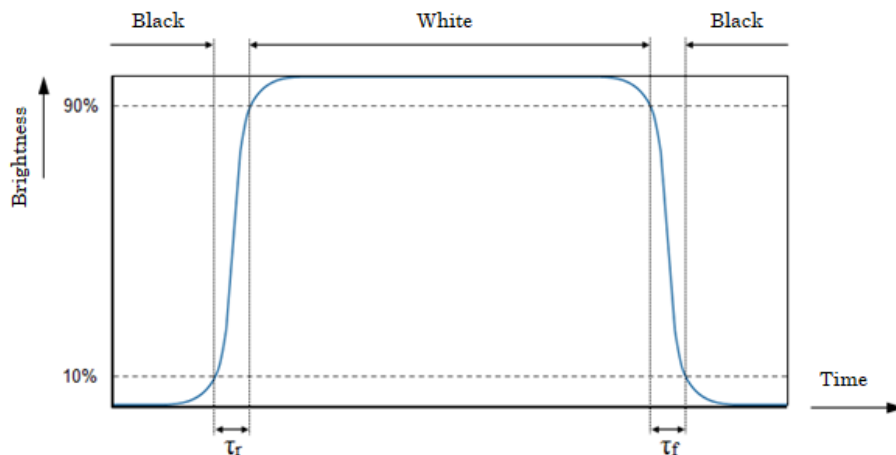
| Item                                  | Symbol           | Temp.    | Unit | Min.  | Typ. | Max. |
|---------------------------------------|------------------|----------|------|-------|------|------|
| Contrast ratio 1) 2)                  | CR               | 25°C     | -    | -     | 40   | -    |
| Reflectance 2)                        | -                | 25°C     | %    | -     | 18   | -    |
| Response time<br>3) 4)                | Rise             | $\tau_r$ | msec | -20°C | -    | 10   |
|                                       |                  |          |      | 25°C  | -    | 4    |
|                                       |                  |          |      | 40°C  | -    | 4    |
|                                       | Fall             | $\tau_f$ | msec | -20°C | -    | 30   |
|                                       |                  |          |      | 25°C  | -    | 5    |
|                                       |                  |          |      | 40°C  | -    | 5    |
| Viewing angle<br>CR $\geq 2$<br>5) 6) | $\theta_{upper}$ | 25°C     | deg. | -     | 60   | -    |
|                                       | $\theta_{lower}$ |          |      | -     | 60   | -    |
|                                       | $\theta_{left}$  |          |      | -     | 60   | -    |
|                                       | $\theta_{right}$ |          |      | -     | 60   | -    |
| Chromaticity Coordinates<br>2) 7)     | W <sub>x</sub>   | 25°C     | -    | -     | 0.30 | -    |
|                                       | W <sub>y</sub>   |          |      | -     | 0.33 | -    |

1) Definition of contrast ratio

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

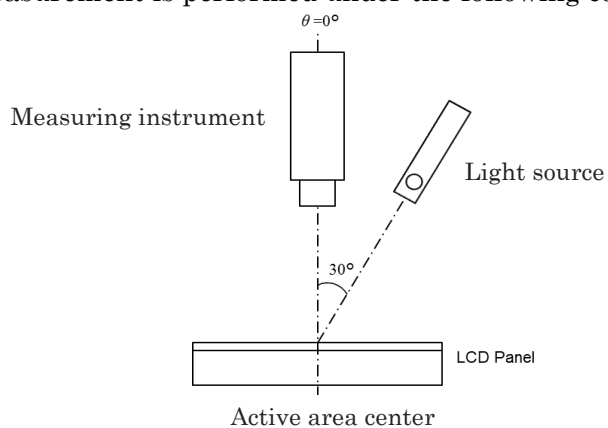
2) Reflectance and Chromaticity coordinates  
The measuring instrument is CM-2600d.

3) Definition of response time

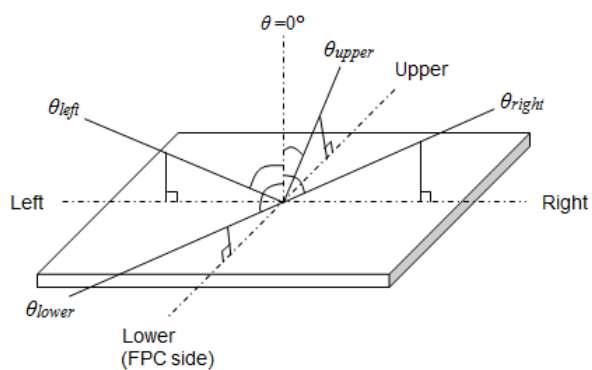


#### 4) Measurement of response time

The measurement is performed under the following conditions on LCD-5200.

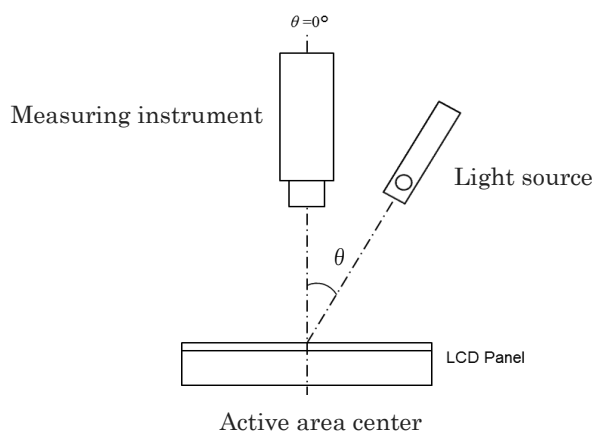


#### 5) Definition of viewing angle



#### 6) Measurement of viewing angle

The measurement is performed by changing the angle of the light source on LCD-5200.



#### 7) Condition : Reflection

Light source : Illuminant C (Converted value)

## 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    |
| Input signal voltage 1) 2) | V <sub>IL</sub>     | “Low” level           | GND-0.2  | —    | VDD*0.25 | V    |
|                            | V <sub>IH</sub>     | “High” level          | VDD*0.75 | —    | VDD+0.2  | V    |
| Input leak current 1)      | I <sub>IN</sub>     | T <sub>OP</sub> =25°C | —        | 5    | 20       | nA   |
| Current consumption 3)     | I <sub>DD_opr</sub> | 4)                    | —        | 28.1 | 57.5     | μA   |
|                            | I <sub>DD_stb</sub> | 5)                    | —        | 1.9  | 7.0      | μA   |
| Input capacitance 1)       | C <sub>IN1</sub>    | —                     | —        | 5    | 10       | pF   |

1) SCLK, SI, SCS, RST, VCOM

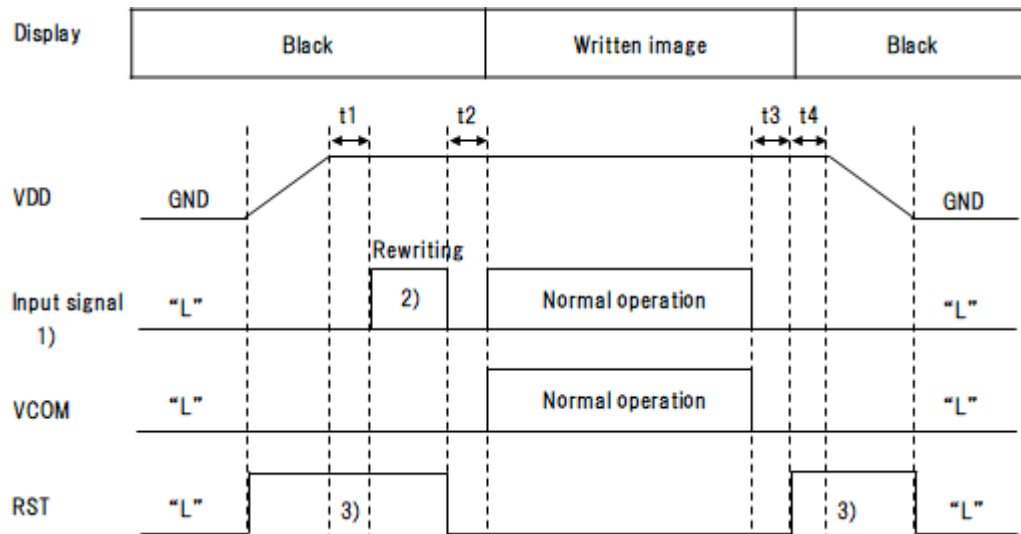
2) Since input leakage current is less than 20 nA, please control voltage so that V<sub>IL</sub>=GND and V<sub>IH</sub>=VDD in static state.

3) Value of the current consumption is without smoothing capacitor.

4) 1Hz full display rewriting (Without backlight)

5) Keeping static image, and polarity inversion of VCOM with a period of 1 sec.  
(Without backlight)  
SCLK, SCS, SI, RST: “L” state.

## 6-2. Power ON-OFF sequence

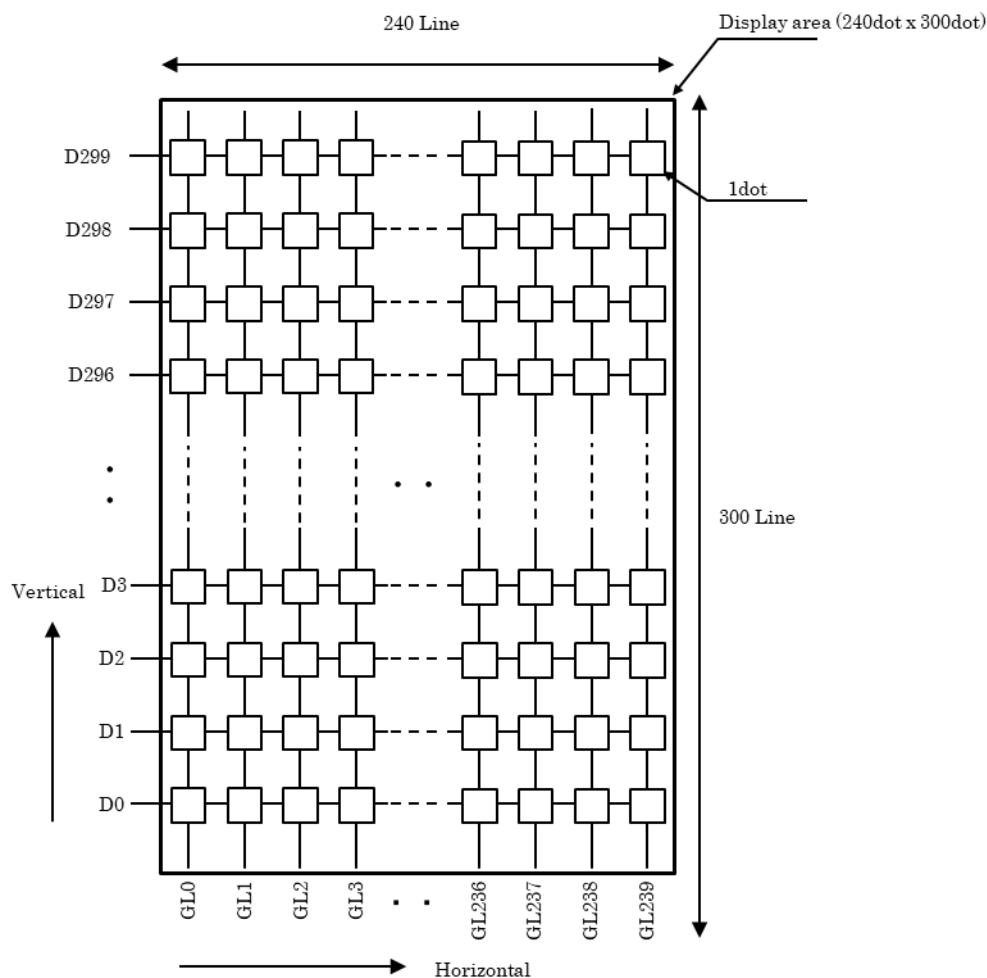


| Item                  | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------|--------|------|------|------|------|
| Power ON-OFF sequence | t1     | 0    | —    | —    | μsec |
|                       | t2     | 1    | 10   | —    | msec |
|                       | t3     | 1    | 10   | —    | 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 horizontal direction.  
Rewriting data for one line is necessary for vertical 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   | 0   | 1   | 1   | 0   | 0   | GL236       |
| 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | GL237       |
| 1   | 1   | 1   | 0   | 1   | 1   | 1   | 0   | GL238       |
| 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | GL239       |

## 8. Interface Signals

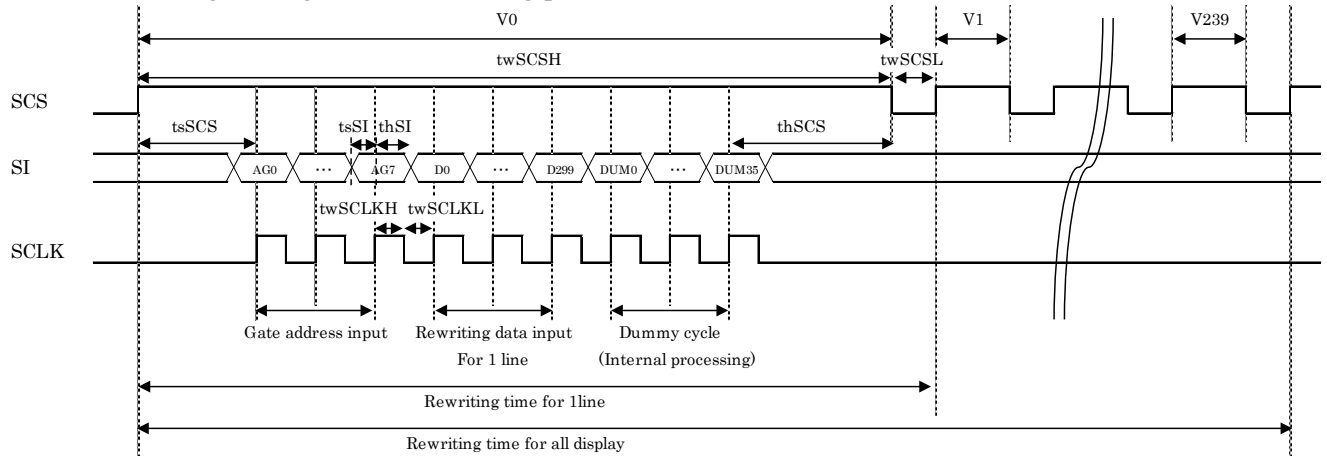
| No. | Symbol | Description                   | I/O 1) | Voltage | Unit | Note |
|-----|--------|-------------------------------|--------|---------|------|------|
| 1   | VDD    | Power supply(3.3V)            | P      | 3.3     | V    |      |
| 2   | VSS    | GND                           | P      | 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   | VCOM   | Common power supply control   | I      | 0.0/3.3 | V    |      |
| 8   | VSS    | GND                           | P      | 0.0     | V    |      |
| 9   | VDD    | Power supply(3.3V)            | P      | 3.3     | V    |      |
| 10  | NC     | NC                            | —      | —       | —    | 4)   |

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.
- 4) This pin is floating pin on LCD module.

## 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

1. Input gate address
2. Input rewriting data for 1 horizontal line
3. Dummy cycle (internal processing for rewriting)

Relationship between rewriting data and display.

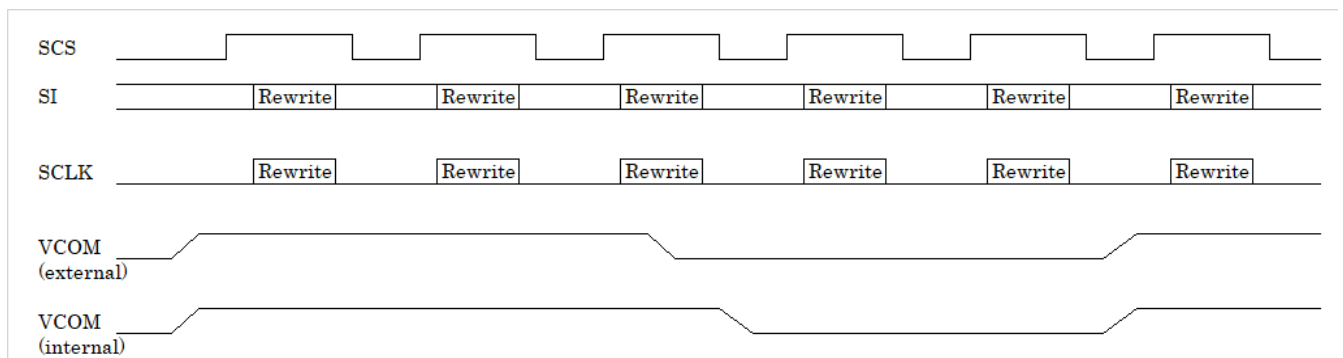
Data 0: Display BLACK  
Data 1: Display WHITE

Time to rewrite in case of SCLK frequency = 1.5MHz ( $tw_{SCLKH}=tw_{SCLKL}=0.33\mu s$ )

| No.                           | Item           | Parameters   |
|-------------------------------|----------------|--------------|
| Serial data input<br>(1 line) | Gate address   | AG0~AG7      |
|                               | Rewriting data | D0~D299      |
|                               | Dummy cycle    | DUM0~DUM35   |
| Total cycle for 1line         |                | 344 cycs     |
| Time to rewrite 1 line        |                | 5.236 msec   |
| Number of gate line           |                | 240 lines    |
| Time to rewrite full display  |                | 1,256.7 msec |



### 9-3. VCOM AC driving



AC drive between 0 V and 3.3 V is required for VCOM signal.

External VCOM switching is reflected immediately on VCOM inside the panel when switching is performed at SCS = "L", however when switching is performed in SCS = "H", external VCOM switching is reflected at the next timing when SCS = "L".

#### 9-4. Timing characteristics

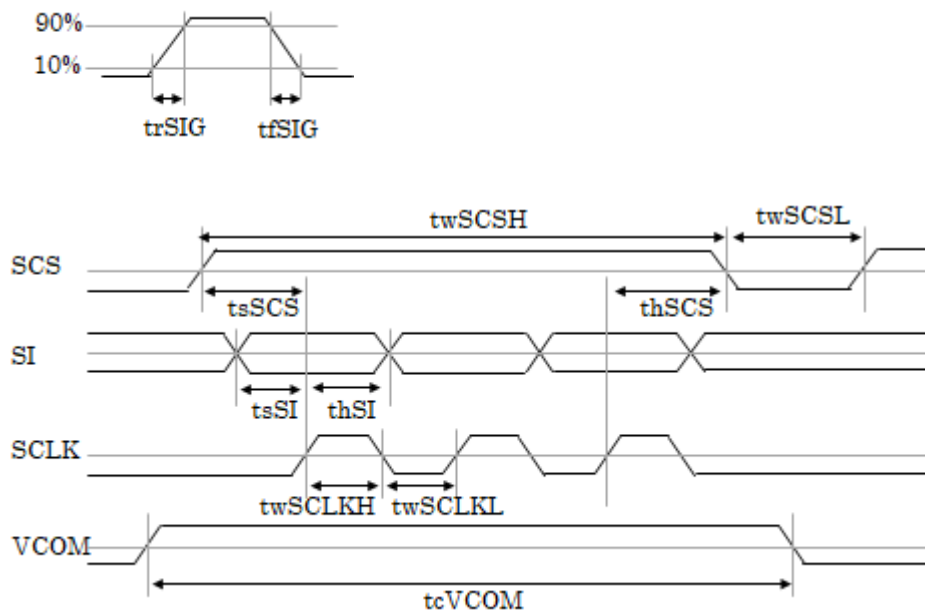
| Item                         |                  | Symbol  | Min.  | Typ. | Max. | Unit | Note |
|------------------------------|------------------|---------|-------|------|------|------|------|
| Time to rewrite 1 line       |                  |         | 5.236 | —    | —    | msec |      |
| Time to rewrite full display |                  |         | 59.34 | —    | —    | msec |      |
| Input signal<br>1)           | Signal rise time | trSIG   | —     | —    | 50   | nsec | 2)   |
|                              | Signal fall time | tfSIG   | —     | —    | 50   | nsec | 2)   |
| SCLK                         | SCLK high width  | twSCLKH | 0.33  | —    | —    | μsec | 3)   |
|                              | SCLK low width   | twSCLKL | 0.33  | —    | —    | μsec | 3)   |
| SI                           | SI set-up time   | tsSI    | 0.33  | —    | —    | μsec | 3)   |
|                              | SI hold time     | thSI    | 0.33  | —    | —    | μsec | 3)   |
| SCS                          | SCS high width   | twSCSH  | 5.226 | —    | —    | msec | 3)   |
|                              | SCS low width    | twSCSL  | 10    | —    | —    | μsec | 3)   |
|                              | SCS set-up time  | tsSCS   | 4     | —    | —    | msec | 3)   |
|                              | SCS hold time    | thSCS   | 1     | —    | —    | msec | 3)   |
| VCOM                         | VCOM duty        | —       | —     | 50   | —    | %    |      |
|                              | VCOM cycle time  | tcVCOM  | —     | 1000 | —    | msec | 3)   |

1) SCLK, SI, SCS, RST, VCOM

2) Time for the signal to shift from 10% and 90% or 90% to 10%

3) Defined as 50% value of the signal.

#### -Timing charts



|                                   |                                |           |
|-----------------------------------|--------------------------------|-----------|
| Spec No.<br>TQ3C-8EAF0-E1YCA08-00 | Part No.<br>TN0227ANVNANN-GN00 | ページ<br>13 |
|-----------------------------------|--------------------------------|-----------|

## 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.

## 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.
- 4) FPC shall be installed after fixing the glass.
- 5) Do not apply a load to the FPC.
- 6) Do not use an assembly structure where the FPC is pulled or partially stressed.

### 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.

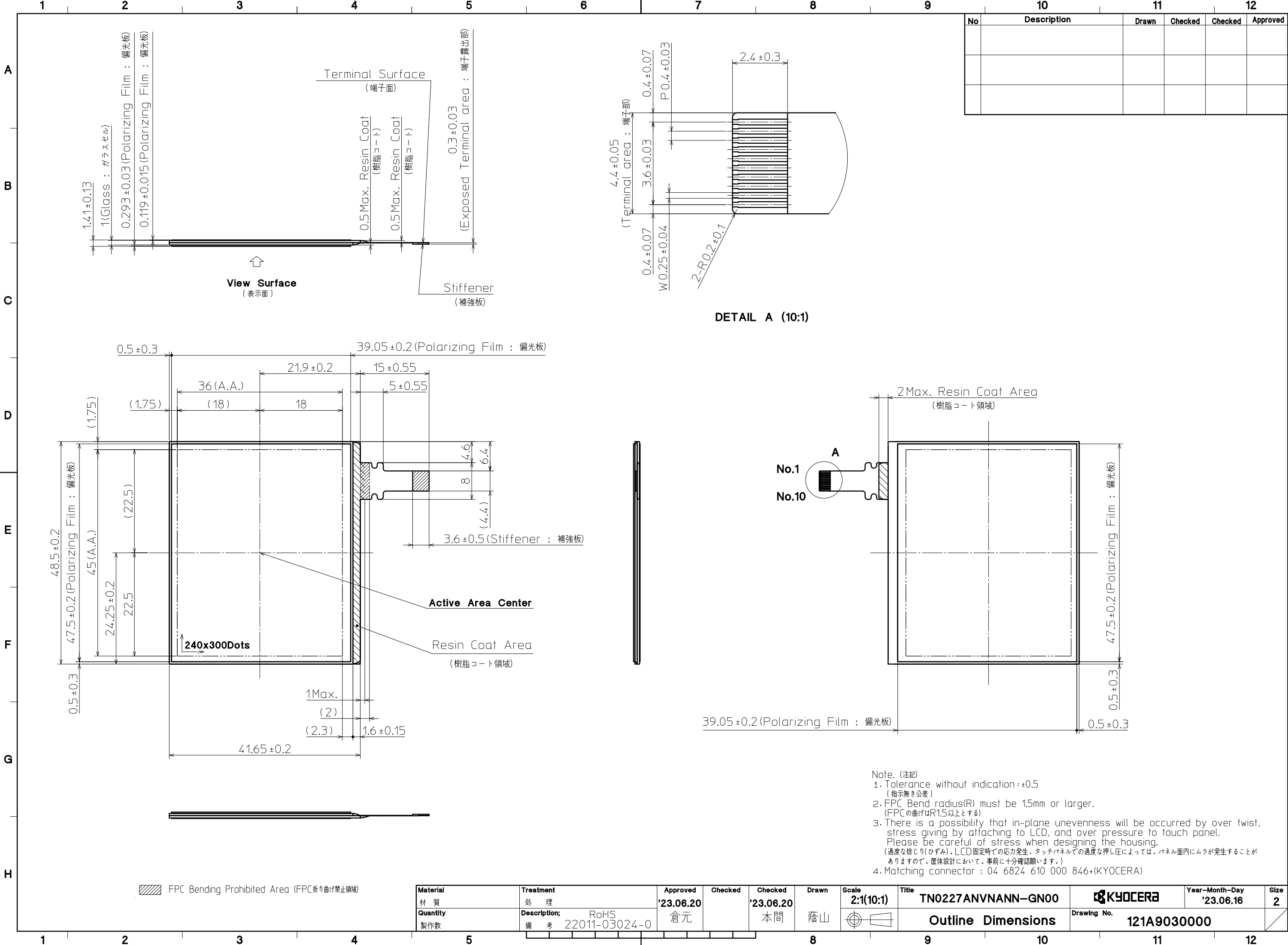
### 11-5. Usage

- 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) 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.
- 10) Do not hold the FPC alone while working.
- 11) Do not scratch or damage the exposed conductor of the FPC or FPC.
- 12) Do not touch the exposed conductor of the FPC.
- 13) Do not bend the FPC toward the surface of LCD near the glass.
- 14) Do not bend the FPC so that stress is concentrated on the FPC.

## 12. Reliability Test Data

| Test item                      | Test condition                     | Test time | Judgement                                                       |
|--------------------------------|------------------------------------|-----------|-----------------------------------------------------------------|
| High temp. atmosphere          | 85℃                                | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| Low temp. atmosphere           | -30℃                               | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| High temp. humidity atmosphere | 60℃ 90%RH                          | 240h      | Function/Display : No defect<br>Current consumption : No defect |
| Temp. cycle                    | -30℃ 0.5h<br>R.T. 0.5h<br>85℃ 0.5h | 10cycles  | Function/Display : No defect<br>Current consumption : No defect |
| High temp. operation           | 80℃                                | 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 |
|----|-------------|-------|---------|---------|----------|
|    |             |       |         |         |          |
|    |             |       |         |         |          |
|    |             |       |         |         |          |

Note. (注記)  
1. Tolerance without indication : ±0.5  
(指示無き公差)  
2. FPC Bend radius(R) must be 1.5mm or larger.  
(FPCの曲げはR1.5以上とする)  
3. 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。)  
4. Matching connector : 04 6824 610 000 846+(KYOCERA)

|                 |                    |                       |         |                      |       |                    |                             |                            |                             |           |
|-----------------|--------------------|-----------------------|---------|----------------------|-------|--------------------|-----------------------------|----------------------------|-----------------------------|-----------|
| Material<br>材質  | Treatment<br>処理    | Approved<br>'23.06.20 | Checked | Checked<br>'23.06.20 | Drawn | Scale<br>2:1(10:1) | Title<br>TN0227ANVNANN-GN00 | KYOCERA                    | Year-Month-Day<br>'23.06.16 | Size<br>2 |
| Quantity<br>製作数 | Description;<br>備考 | RoHS<br>22011-03024-0 | 倉元      | 本間                   | 蔭山    |                    | Outline Dimensions          | Drawing No.<br>121A9030000 |                             |           |

|          |                       |
|----------|-----------------------|
| Spec No. | TQ3C-8EAF0-E2YCA08-00 |
| Date     | July 14, 2023         |

## **KYOCERA INSPECTION STANDARD**

**TYPE : TN0227ANVNANN-GN00**

KYOCERA CORPORATION

| Original<br>Issue Date | Designed by : Engineering dept. |                 |                   | Confirmed by :<br>QA dept. |
|------------------------|---------------------------------|-----------------|-------------------|----------------------------|
|                        | Prepared                        | Checked         | Approved          | Approved                   |
| July 14, 2023          | <i>M. Yamada</i>                | <i>T. Fukui</i> | <i>A. Iwasaki</i> | <i>T. Sawada</i>           |

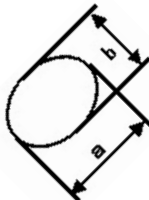
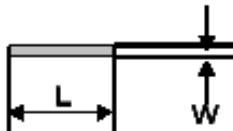
|                                   |                                |           |
|-----------------------------------|--------------------------------|-----------|
| Spec No.<br>TQ3C-8EAF0-E2YCA08-00 | Part No.<br>TN0227ANVNANN-GN00 | Page<br>- |
|-----------------------------------|--------------------------------|-----------|

### Revision record

|         |      |                                 |              |          |                            |
|---------|------|---------------------------------|--------------|----------|----------------------------|
| Date    |      | Designed by : Engineering dept. |              |          | Confirmed by :<br>QA dept. |
|         |      | Prepared                        | Checked      | Approved | Approved                   |
|         |      |                                 |              |          |                            |
| Rev.No. | Date | Page                            | Descriptions |          |                            |
|         |      |                                 |              |          |                            |

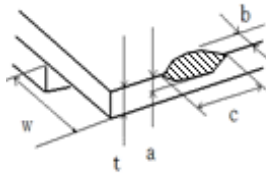
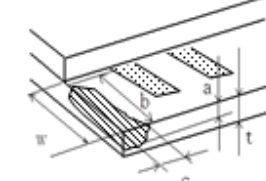
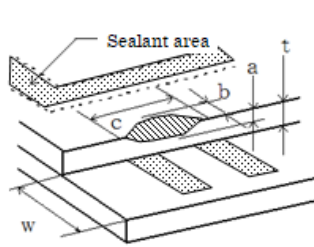
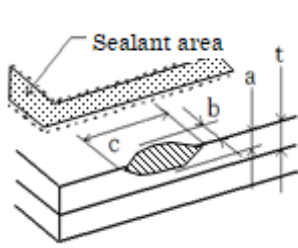
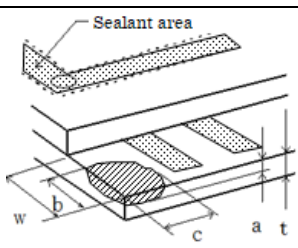
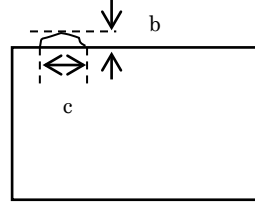
## Visuals specification

### 1) Note

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                               | Note                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| General                       | <div>1. Customer identified anomalies not defined within this inspection standard shall be reviewed by Kyocera, and an additional standard shall be determined by mutual consent.</div> <div>2. Dot defect and external inspection about the image quality shall be applied to any defect within the active area and shall not be applicable to outside of the active area.</div> <div>3. Inspection conditions<div>Luminance : 500 Lux min.</div><div>Inspection distance : 300 mm.</div><div>Temperature : 25 ± 5℃</div><div>Direction : Directly above</div></div> |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Definition of inspection item | Dot defect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Bright dot defect                                                                                                                                                                                                                                                                | <div>The dot is constantly “on” when power applied to the LCD, even when all “Black” data sent to the screen.</div> <div>Inspection tool: 5% Transparency neutral density filter.</div> <div>Count dot: If the dot is visible through the filter.</div> <div>Don't count dot: If the dot is not visible through the filter.</div> <div><table><tr><td>D(1,1)</td><td>D(2,1)</td><td>D(3,1)</td><td>D(4,1)</td><td>D(5,1)</td></tr><tr><td>D(1,2)</td><td>D(2,2)</td><td>D(3,2)</td><td>D(4,2)</td><td>D(5,2)</td></tr><tr><td>D(1,3)</td><td>D(2,3)</td><td>D(3,3)</td><td>D(4,3)</td><td>D(5,3)</td></tr></table><div><div></div> dot defect</div></div> | D(1,1) | D(2,1) | D(3,1) | D(4,1) | D(5,1) | D(1,2) | D(2,2) | D(3,2) | D(4,2) | D(5,2) | D(1,3) | D(2,3) | D(3,3) | D(4,3) | D(5,3) |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | D(1,1)                                                                                                                                                                                                                                                                           | D(2,1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D(3,1) | D(4,1) | D(5,1) |        |        |        |        |        |        |        |        |        |        |        |        |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | D(1,2)                                                                                                                                                                                                                                                                           | D(2,2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D(3,2) | D(4,2) | D(5,2) |        |        |        |        |        |        |        |        |        |        |        |        |
|                               | D(1,3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | D(2,3)                                                                                                                                                                                                                                                                           | D(3,3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D(4,3) | D(5,3) |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                               | Black dot defect<br>(Included circular shape)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <div>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</div> <div>Similar size compared to bright dot.</div> <div>For circular shape black dot, refer to inspection item of White dot, Black dot (Circular shape).</div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| White dot<br>(Circular shape) | <div>Pixel works electrically, however, circular/foreign particle makes dot appear to be “on” even when all “Black” data is sent to the screen.</div>                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| External inspection           | Bubble, Scratch, Foreign particle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <div>Visible operating (all pixels “Black” or “White”) and non-operating.</div>                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                               | Appearance inspection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <div>Does not satisfy the value at the spec.</div>                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Definition of size            | <div><div>Definition of circle size</div><div></div><div>a: major axis, b: minor axis</div><div>d = (a + b) / 2</div></div> <div><div>Definition of linear size</div><div></div></div>                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |

## 2) Standard

| Classification                                                                              |                                                                                                                                                                                                                                                | Inspection item                                                                                                                         | Judgement standard                                                                                                                                                                                                                                                                                                                                                                                    |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|--------------|-------------------|--------------------|---------------|---------------------|-----------|---------------|--------------|---|---------------|--------------|---|------------|---|---|
| Defect<br>(In LCD<br>glass)                                                                 | Dot<br>defect                                                                                                                                                                                                                                  | Bright dot defect                                                                                                                       | Acceptable number : 0                                                                                                                                                                                                                                                                                                                                                                                 |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                | Black dot defect                                                                                                                        | Acceptable number : 0                                                                                                                                                                                                                                                                                                                                                                                 |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                | Total dot defects                                                                                                                       | Acceptable number : 0                                                                                                                                                                                                                                                                                                                                                                                 |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             | Others                                                                                                                                                                                                                                         | White dot, Black dot<br>(Circular shape)                                                                                                | <table><tr><th>Size (mm)</th><th>Acceptable number</th></tr><tr><td><math>d \leq 0.1</math></td><td>Neglected</td></tr><tr><td><math>0.1 &lt; d \leq 0.15</math></td><td>2</td></tr><tr><td><math>0.15 &lt; d</math></td><td>0</td></tr></table>                                                                                                                                                      |              |                   | Size (mm)    | Acceptable number | $d \leq 0.1$       | Neglected     | $0.1 < d \leq 0.15$ | 2         | $0.15 < d$    | 0            |   |               |              |   |            |   |   |
| Size (mm)                                                                                   | Acceptable number                                                                                                                                                                                                                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| $d \leq 0.1$                                                                                | Neglected                                                                                                                                                                                                                                      |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| $0.1 < d \leq 0.15$                                                                         | 2                                                                                                                                                                                                                                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| $0.15 < d$                                                                                  | 0                                                                                                                                                                                                                                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| External<br>inspection<br>(Defect on<br>Polarizer or<br>between Polarizer<br>and LCD glass) |                                                                                                                                                                                                                                                | Foreign particle<br>Scratch<br>(Linear shape)                                                                                           | <table><tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr><tr><td><math>W \leq 0.02</math></td><td>—</td><td>Neglected</td></tr><tr><td><math>W \leq 0.03</math></td><td><math>L \leq 2.0</math></td><td>2</td></tr><tr><td><math>W \leq 0.05</math></td><td><math>L \leq 0.5</math></td><td>1</td></tr><tr><td><math>0.05 &lt; W</math></td><td>—</td><td>0</td></tr></table> |              |                   | Width (mm)   | Length (mm)       | Acceptable number  | $W \leq 0.02$ | —                   | Neglected | $W \leq 0.03$ | $L \leq 2.0$ | 2 | $W \leq 0.05$ | $L \leq 0.5$ | 1 | $0.05 < W$ | — | 0 |
|                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                         | Width (mm)                                                                                                                                                                                                                                                                                                                                                                                            | Length (mm)  | Acceptable number |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                         | $W \leq 0.02$                                                                                                                                                                                                                                                                                                                                                                                         | —            | Neglected         |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                         | $W \leq 0.03$                                                                                                                                                                                                                                                                                                                                                                                         | $L \leq 2.0$ | 2                 |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                         | $W \leq 0.05$                                                                                                                                                                                                                                                                                                                                                                                         | $L \leq 0.5$ | 1                 |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                | $0.05 < W$                                                                                                                              | —                                                                                                                                                                                                                                                                                                                                                                                                     | 0            |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| Foreign particle<br>Bubble<br>Scratch<br>(Circular shape)                                   | <table><tr><th>Size (mm)</th><th>Acceptable number</th></tr><tr><td><math>d \leq 0.1</math></td><td>Neglected</td></tr><tr><td><math>0.1 &lt; d \leq 0.2</math></td><td>2</td></tr><tr><td><math>0.2 &lt; d</math></td><td>0</td></tr></table> |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       | Size (mm)    | Acceptable number | $d \leq 0.1$ | Neglected         | $0.1 < d \leq 0.2$ | 2             | $0.2 < d$           | 0         |               |              |   |               |              |   |            |   |   |
|                                                                                             | Size (mm)                                                                                                                                                                                                                                      | Acceptable number                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             | $d \leq 0.1$                                                                                                                                                                                                                                   | Neglected                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             | $0.1 < d \leq 0.2$                                                                                                                                                                                                                             | 2                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| $0.2 < d$                                                                                   | 0                                                                                                                                                                                                                                              |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
| Color variation<br>(Mura)                                                                   |                                                                                                                                                                                                                                                | Determination of color variation: Invisible with ND 5% filter<br>Distance between LCD and ND filter: 150mm<br>Inspection time: 1 second |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |
|                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                       |              |                   |              |                   |                    |               |                     |           |               |              |   |               |              |   |            |   |   |

| Inspection item | Judgement standard        |                                                                                                    |            |                               |            |           |
|-----------------|---------------------------|----------------------------------------------------------------------------------------------------|------------|-------------------------------|------------|-----------|
| Glass crack     | (t = Glass Thickness)     |                                                                                                    |            |                               |            |           |
|                 | Item                      | Size (mm)                                                                                          | Judgement  |                               |            |           |
|                 | Back side of the terminal |                   | a          | b                             | c          | Neglected |
|                 |                           |                                                                                                    | $\leq t$   | $\leq w$                      | $\leq 2.0$ |           |
|                 | Terminal                  |                   | a          | b                             | c          | Neglected |
|                 |                           |                                                                                                    | $\leq t$   | $\leq w$                      | $\leq 2.0$ |           |
|                 | Display side glass        |                  | a          | b                             | c          | Neglected |
|                 |                           |                                                                                                    | $\leq t$   | < Sealant area inner boundary | $\leq 3.0$ |           |
|                 | Double glass              |                 | a          | b                             | c          | Neglected |
|                 |                           |                                                                                                    | -          | -                             | $\leq 0.2$ |           |
|                 |                           |                                                                                                    | $\leq t$   | < Sealant area inner boundary | $\leq 3.0$ |           |
|                 |                           |                                                                                                    | $> t$      | < Sealant area outer boundary | $\leq 2.0$ |           |
|                 | Corner                    |                 | a          | b                             | c          | Neglected |
|                 |                           |                                                                                                    | $\leq t$   | $\leq w$                      | $\leq 2.0$ |           |
|                 | Projection                | a:Thickness<br> | a          | b                             | c          | Neglected |
| $\leq t$        |                           |                                                                                                    | $\leq 0.3$ | -                             |            |           |

|              |                       |
|--------------|-----------------------|
| Document No. | TQ3C-8EAF0-E3YCA08-00 |
| Date         | July 14, 2023         |

## **KYOCERA PACKAGING STANDARD**

**TYPE : TN0227ANVNANN-GN00**

KYOCERA CORPORATION

|                        |                                 |                 |                   |                            |
|------------------------|---------------------------------|-----------------|-------------------|----------------------------|
| Original<br>Issue Date | Designed by : Engineering dept. |                 |                   | Confirmed by :<br>QA dept. |
|                        | Prepared                        | Checked         | Approved          | Approved                   |
| July 14, 2023          | <i>M. Yamada</i>                | <i>T. Fukui</i> | <i>A. Iwasaki</i> | <i>T. Sawada</i>           |

Document No.

TQ3C-8EAF0-E3YCA08-00

Part No.

TN0227ANVNANN-GN00

Page

-

**Revision record**

| Date   |      | Designed by : Engineering dept. |              |          | Confirmed by :<br>QA dept. |
|--------|------|---------------------------------|--------------|----------|----------------------------|
|        |      | Prepared                        | Checked      | Approved | Approved                   |
|        |      |                                 |              |          |                            |
| RevNo. | Date | Page                            | Descriptions |          |                            |
|        |      |                                 |              |          |                            |

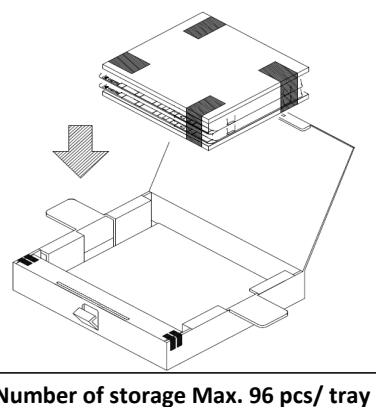
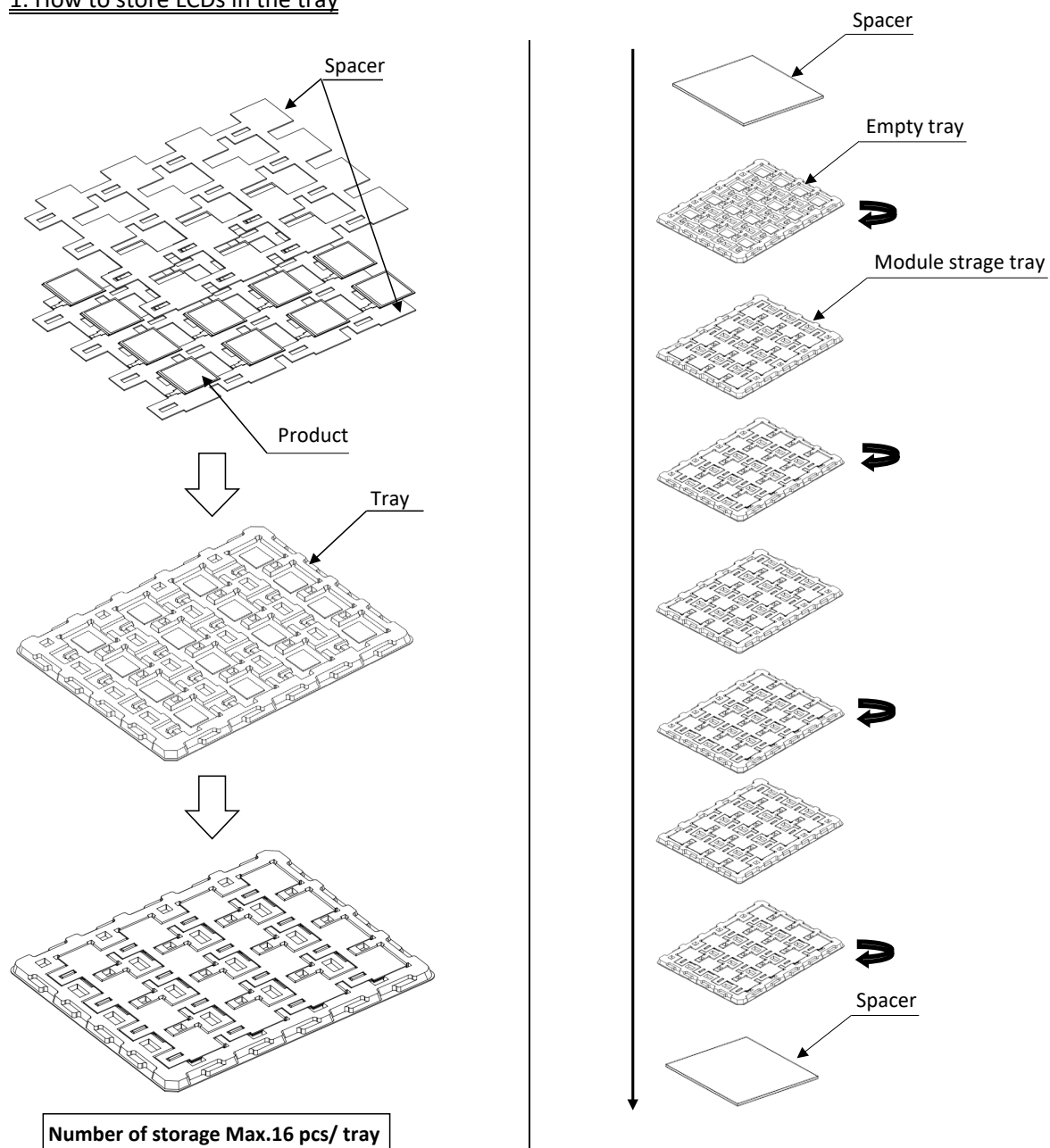
1. How to store LCDs in the tray

Diagram illustrating the assembly of an outer case for a storage unit.

The diagram shows the storage unit (left) and the outer case (right). The storage unit is secured with PP bands and labeled with Confirmation labels.

The Confirmation label table is as follows:

|                   |  |  |  |                                |
|-------------------|--|--|--|--------------------------------|
| 客先<br>(Customer)  |  |  |  | 京セラ株式会社<br>KYOCERA CORPORATION |
| 品名<br>(Parts No.) |  |  |  |                                |
| 数量<br>(QTY)       |  |  |  |                                |
| 検査者<br>(Check)    |  |  |  |                                |
| 検査者<br>(Check)    |  |  |  |                                |

The outer case is shown with cushioning material and the storage unit being placed inside.

**Number of storage Max. 384 pcs/ outer case**

[illegible]