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SPEC

| Spec No. | TQ3C-8EAF0-E1YBD01-00 |
|---|---|
| Date | February 12, 2016 |

# TYPE : TCG057VGLAAANN-GN20

< 5.7 inch VGA transmissive color TFT with LED backlight,
Constant current circuit for LED backlight >

## CONTENTS



Issued
Feb 18, 2016
KYOCERA Display Corp.

KYOCERA DISPLAY CORPORATION

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

| Original Issue Date | Designed by: Engineering dept. | | | Confirmed by: QA dept. | |
|---|---|---|---|---|---|
| | Prepared | Checked | Approved | Checked | Approved |
| February 12, 2016 | M. Koyama | Y. Yamazaki | Y. Matsumoto | O. Sato | I. Hamada |

# 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 indemnity, 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.

# Revision record

| Date | Designed by : Engineering dept. | | | Confirmed by : QA dept. | |
|---|---|---|---|---|---|
| | Prepared | Checked | Approved | Checked | Approved |
| | | | | | |

| Rev.No. | Date | Page | Descriptions |
|---|---|---|---|
| | | | |

# 1. Application

This document defines the specification of TCG057VGLAAANN-GN20. (RoHS Compliant)

# 2. Construction and outline

| | |
| --- | --- |
| LCD | : Transmissive color dot matrix type TFT |
| Backlight system | : LED |
| Polarizer | : Glare treatment |
| Additional circuit | : Timing controller, Power supply (3.3V input)<br>(with constant current circuit for LED Backlight) |

# 3. Mechanical specifications

| Item | Specification | Unit |
| --- | --- | --- |
| Outline dimensions | 127.2 (W)× 100.4 (H) × 5.99 (D) | mm |
| Active area | 115.2 (W) × 86.4 (H)<br>(14.4cm / 5.7 inch (Diagonal)) | mm |
| Dot format | 640×(B,G,R) (W) × 480 (H) | dot |
| Dot pitch | 0.06 (W) × 0.18 (H) | mm |
| Base color 1) | Normally White | - |
| Mass | 110 | g |

1) Projection not included. Please refer to outline for details.
2) Due to the characteristics of the LCD material, the color varies with environmental temperature.

# 4. Absolute maximum ratings

## 4-1. Electrical absolute maximum ratings

| Item | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Supply voltage(+3.3V) | | $V_{DD}$ | -0.3 | 4.0 | V |
| Supply voltage(+5V) | | $V_{IN}$ | -0.3 | 6.0 | V |
| Input signal voltage 1) | RxINi+, RxINi- 2) | $V_{I1}$ | -0.3 | $V_{DD}$+0.3 | V |
| | CK IN+, CK IN- | $V_{I2}$ | -0.3 | $V_{DD}$+0.3 | V |
| | SC | $V_{I3}$ | -0.3 | $V_{DD}$+0.3 | V |
| | BLEN, BLPWM, VBRT | $V_{I4}$ | -0.3 | $V_{IN+}$0.3 | V |
| LED OPEN Pin current | | $I_{OPLED}$ | 0 | (100) | mA |

1) $V_{DD}$ must be supplied correctly within the range described in 5-1.
2) i=0,1,2

## 4-2. Environmental absolute maximum ratings

| Item | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Operating temperature | 1) | $T_{OP}$ | -20 | 70 | °C |
| Storage temperature | 2) | $T_{STO}$ | -30 | 80 | °C |
| Operating humidity | 3) | $H_{OP}$ | 10 | 4) | %RH |
| Storage humidity | 3) | $H_{STO}$ | 10 | 4) | %RH |
| Vibration | | - | 5) | 5) | - |
| Shock | | - | 6) | 6) | - |

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) Temp. = -30°C＜48h , Temp. = 80°C＜168h
Store LCD panels at normal temperature/humidity. Keep them free from vibration and shock. An LCD panel 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)

| | | |
|---|---|---|
| Frequency | 10～55 Hz | Acceleration value (0.3～9 m/s²) |
| Vibration width | 0.15mm | |
| Interval | 10-55-10 Hz 1 minutes | |

2 hours in each direction X, Y, Z (6 hours total)
EIAJ ED-2531
6) Acceleration: 490 m/s², Pulse width: 11 ms
3 times in each direction: ±X, ±Y, ±Z
EIAJ ED-2531

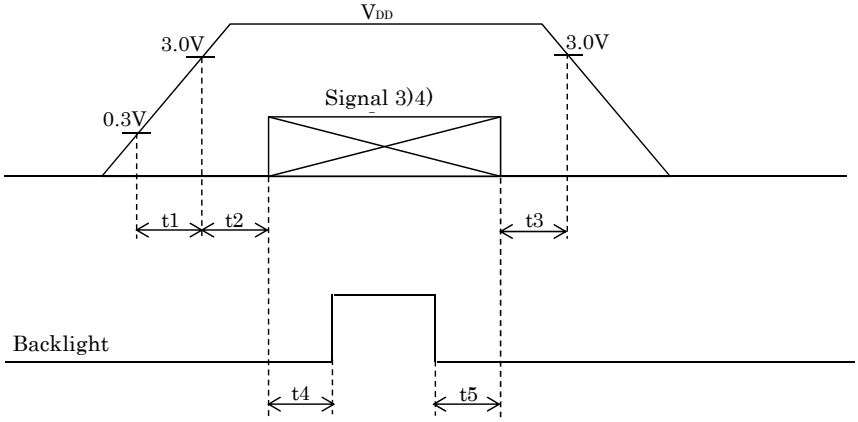
# 5. Electrical characteristics

## 5-1. LCD

Temp. = -20～70°C

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply voltage for logic 1) | $V_{DD}$ | — | 3.0 | 3.3 | 3.6 | V |
| Current consumption for logic | $I_{DD}$ | 2) | — | (180) | (235) | mA |
| Permissive input ripple voltage | $V_{RP}$ | — | — | — | 100 | mVp-p |
| Input signal voltag 3) | $V_{IL}$ | "Low" level | 0 | — | $0.2V_{DD}$ | V |
| | $V_{IH}$ | "High" level | $0.8V_{DD}$ | — | $V_{DD}$ | V |
| LVDS Input voltage 4) | $V_{TL}$ | "Low" level | -0.1 | — | — | V |
| | $V_{TH}$ | "High" level | — | — | 0.1 | V |
| | $\|V_{ID}\|$ | — | 0.1 | — | 0.6 | V |
| | $V_{ICM}$ | — | $\|V_{ID}\|/2$ | — | $2.4-\|V_{ID}\|/2$ | V |

1) $V_{DD}$-turn-on conditions




$0 < t1 \leqq 20ms$

$0 < t2 \leqq 50ms$

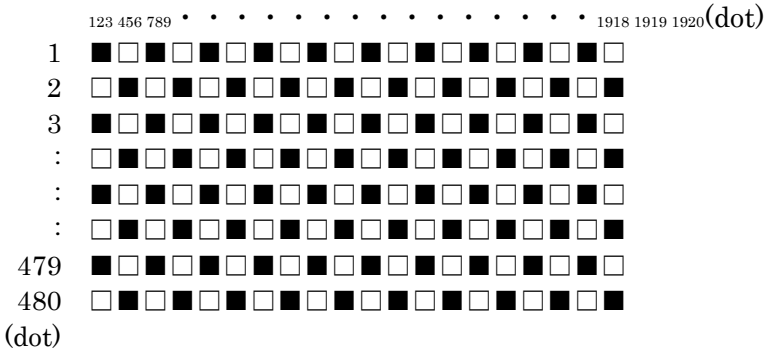
$0 < t3 \leqq 1s$

25 frame refresh $\leqq t4$

$0 \leqq t5$

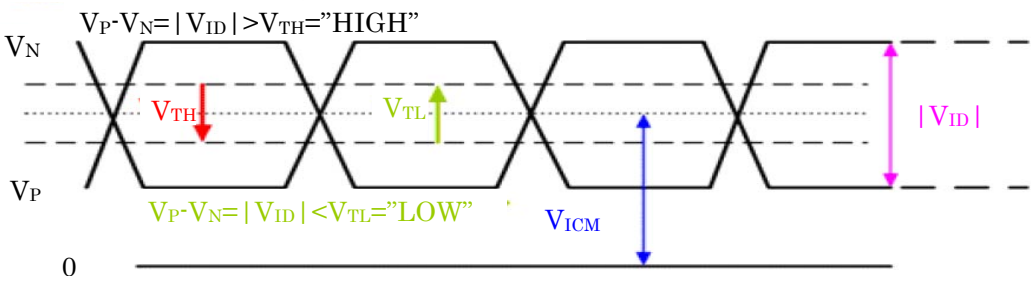
2) Display pattern:

$V_{DD}$ = 3.3V, Temp. = 25°C




3) Input signal : SC

4) Input signal : RxIN0-/+、RxIN1-/+、RxIN2-/+、CK IN-/+

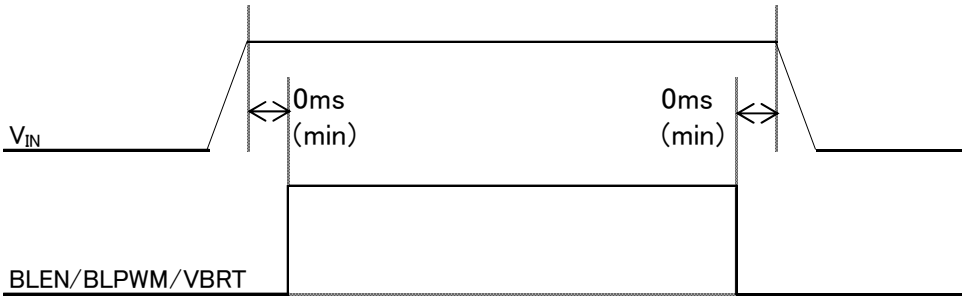



5-2. Constant current circuit for LED Backlight

Temp. = -20～70°C

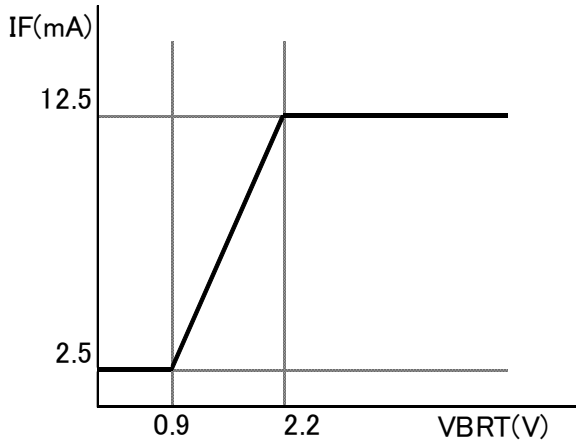
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply voltage 1) | $V_{IN}$ | - | 3.0 | 5.0 | 5.5 | V |
| Current consumption | $I_{IN}$ | 2) | - | (290) | (380) | mA |
| BLEN Input signal voltage | $V_{IL\_BLEN}$ | Backlight OFF | 0 | - | 0.8 | V |
| | $V_{IH\_BLEN}$ | Backlight ON | 2.3 | - | $V_{IN}$ | V |
| VBRT Input signal voltage | $V_{IL\_VBRT}$ | "Low" level | 0 | - | 0.8 | V |
| | $V_{IH\_VBRT}$ | "High" level | 2.3 | - | $V_{IN}$ | V |
| VBRT "Low" level threshold | L th | 3) | 0.8 | 0.9 | - | V |
| VBRT "High" level threshold | H th | 3) | - | 2.2 | 2.3 | V |
| LED Forward Current | IF | VBRT: Low level | 2.0 | 2.5 | 3.0 | mA |
| | | VBRT: High level | 12.0 | 12.5 | 13.0 | mA |
| BLPWM Input signal voltage | $V_{IL\_BLPWM}$ | Backlight OFF | 0 | - | 0.8 | V |
| | $V_{IH\_BLPWM}$ | Backlight ON | 2.3 | - | $V_{IN}$ | V |
| PWM Frequency 4) | $f_{PWM}$ | - | 100 | - | - | Hz |
| PWM Duty ratio 4) | $D_{PWM}$ | PWM Ton | 5 | - | - | μs |
| Operating life time 5), 6) | T | Temp.=25°C | - | 50,000 | - | h |

1) $V_{IN}$-turn-on conditions




2) $V_{IN}$ = 5V, Temp. = 25℃, VBRT=2.3V～、BLPWM = 100%

3) VBRT




Within the range of Typ. 0.9～2.2V, consecutive dimming is possible.

4) In case of lower frequency, the deterioration of the display quality, flicker etc., may occur.

5) When brightness decrease 50% of minimum brightness.
The average life of a LED will decrease when the LCD is operating at higher temperatures.

6) Life time is estimated data. (Condition : IF=12.5mA, Ta=25℃ in chamber).

5-3. LED open detection

Temp. = -20～70°C

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BLPWM frequency of LED open detection | - | BLPWM Ton≧5μs | 100 | - | - | Hz |
| BLPWM Ton of LED open detection | - | PWM Frequency≧100Hz | 5.0 | - | - | μs |
| LED open Sink current | I sink | - | - | - | (100) | mA |
| Leak current | I leak | - | - | - | 1.0 | mA |
| Recovery time from LED open state * | Rtime | - | - | - | 1 | s |

* When abnormal condition is resolved in the middle of the operation, OPLED terminal return to normal operating condition from open detection condition within one second.

1) OPLED terminal detected abnormal state when LED forward current does not flow caused by opening more than one out of three LED lines or other failures.
2) OPLED terminal keeps FET's open drain inside the circuit, FET comes to turn on at abnormal state.
3) IF you use OPLED terminal, you must connect with outside terminal of voltage through pull-up resistance.
4) At abnormal state, OPLED terminal threshold voltage changes from "H" level to "L" level.
5) LED open detecting function is effective at only working condition of LED driving circuit.
6) By driving PWM dimming, LED open detecting function comes to be effective under some conditions.
7) A small amount of current would appear at in-build FET's drain leakage at normal state.
8) LED driving circuit is unstable a period of 20ms from VIN and BLEN turning on, or to stop driving by BLEN off. Therefore LED open detecting may occur malfunction.

# 6. Optical characteristics

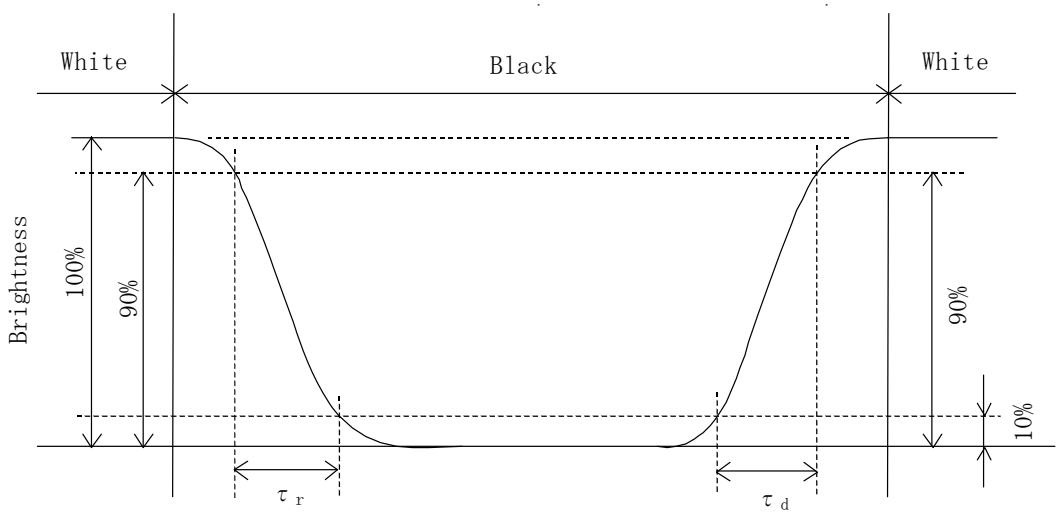
Measuring spot = $\phi$ 6.0mm, Temp. = 25°C

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Response time | Rise | $\tau_r$ | $\theta = \phi = 0°$ | - | 10 | - | ms |
| | Down | $\tau_d$ | $\theta = \phi = 0°$ | - | 25 | - | ms |
| Viewing angle range<br>View direction<br>: 6 o'clock<br>(Gray inversion) | | $\theta$ UPPER | CR≧5 | - | 80 | - | deg. |
| | | $\theta$ LOWER | | - | 80 | - | |
| | | $\phi$ LEFT | | - | 80 | - | deg. |
| | | $\phi$ RIGHT | | - | 80 | - | |
| Contrast ratio | | CR | $\theta = \phi = 0°$ | 300 | 500 | - | - |
| Brightness | | L | IF=12.5mA/Line | (300) | (450) | - | cd/m² |
| Chromaticity coordinates | Red | x | $\theta = \phi = 0°$ | 0.56 | 0.61 | 0.66 | - |
| | | y | | 0.32 | 0.37 | 0.42 | |
| | Green | x | $\theta = \phi = 0°$ | 0.29 | 0.34 | 0.39 | |
| | | y | | 0.52 | 0.57 | 0.62 | |
| | Blue | x | $\theta = \phi = 0°$ | 0.09 | 0.14 | 0.19 | |
| | | y | | 0.06 | 0.11 | 0.16 | |
| | White | x | $\theta = \phi = 0°$ | 0.27 | 0.32 | 0.37 | |
| | | y | | 0.29 | 0.34 | 0.39 | |

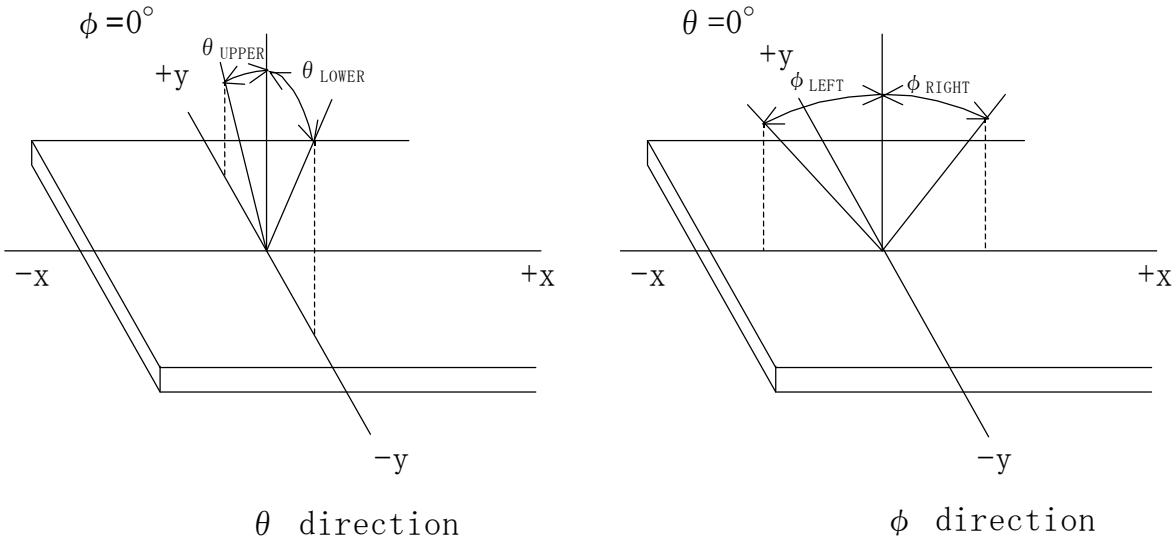
6-1. Definition of contrast ratio

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

6-2. Definition of response time

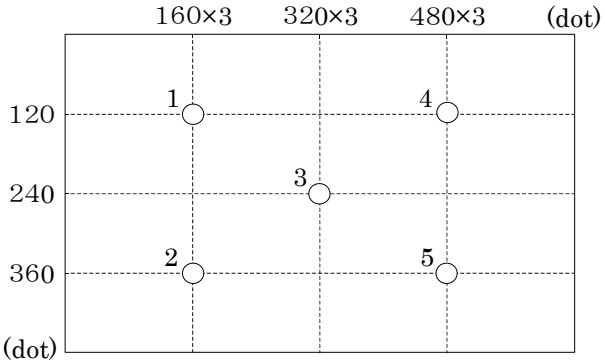


6-3. Definition of viewing angle




θ direction　　ϕ direction

6-4. Brightness measuring points




1) Rating is defined on the average in the viewing area.
2) Measured 5 minutes after the LED is powered on. (Ambient temp. = 25°C)

## 7. Interface signals

| No. | Symbol | Description | I/O | Note |
|---|---|---|---|---|
| 1 | NC | No connect | - | |
| 2 | NC | No connect | - | |
| 3 | NC | No connect | - | |
| 4 | SC | Scan direction control(High or Open: Normal、GND: Reverse) | I | 1) |
| 5 | RxIN0- | LVDS receiver signal CH0(-) | I | LVDS |
| 6 | RxIN0+ | LVDS receiver signal CH0(+) | I | LVDS |
| 7 | GND | GND | - | |
| 8 | RxIN1- | LVDS receiver signal CH1(-) | I | LVDS |
| 9 | RxIN1+ | LVDS receiver signal CH1(+) | I | LVDS |
| 10 | GND | GND | - | |
| 11 | RxIN2- | LVDS receiver signal CH2(-) | I | LVDS |
| 12 | RxIN2+ | LVDS receiver signal CH2(+) | I | LVDS |
| 13 | GND | GND | - | |
| 14 | CK IN- | LVDS receiver signal CK(-) | I | LVDS |
| 15 | CK IN+ | LVDS receiver signal CK(+) | I | LVDS |
| 16 | GND | GND | - | |
| 17 | NC | No connect | - | |
| 18 | NC | No connect | - | |
| 19 | GND | GND | - | |
| 20 | GND | GND | - | |
| 21 | $V_{DD}$ | +3.3V power supply | - | |
| 22 | $V_{DD}$ | +3.3V power supply | - | |
| 23 | OPLED | OPEN LED detection | - | |
| 24 | BLPWM | PWM signal(Brightness adjustment) | I | |
| 25 | BLEN | ON/OFF terminal voltage | I | |
| 26 | VBRT | Analog dimming | I | |
| 27 | $V_{IN}$ | +5.0V power supply | - | |
| 28 | $V_{IN}$ | +5.0V power supply | - | |
| 29 | GNDB | GND (Backlight) | - | |
| 30 | GNDB | GND (Backlight) | - | |

LCD connector : DF19G-30P-1H(54) (HIROSE)
Recommended matching connector : DF19-30S-1C (HIROSE)
: DF19G-30S-1C(05) (HIROSE)

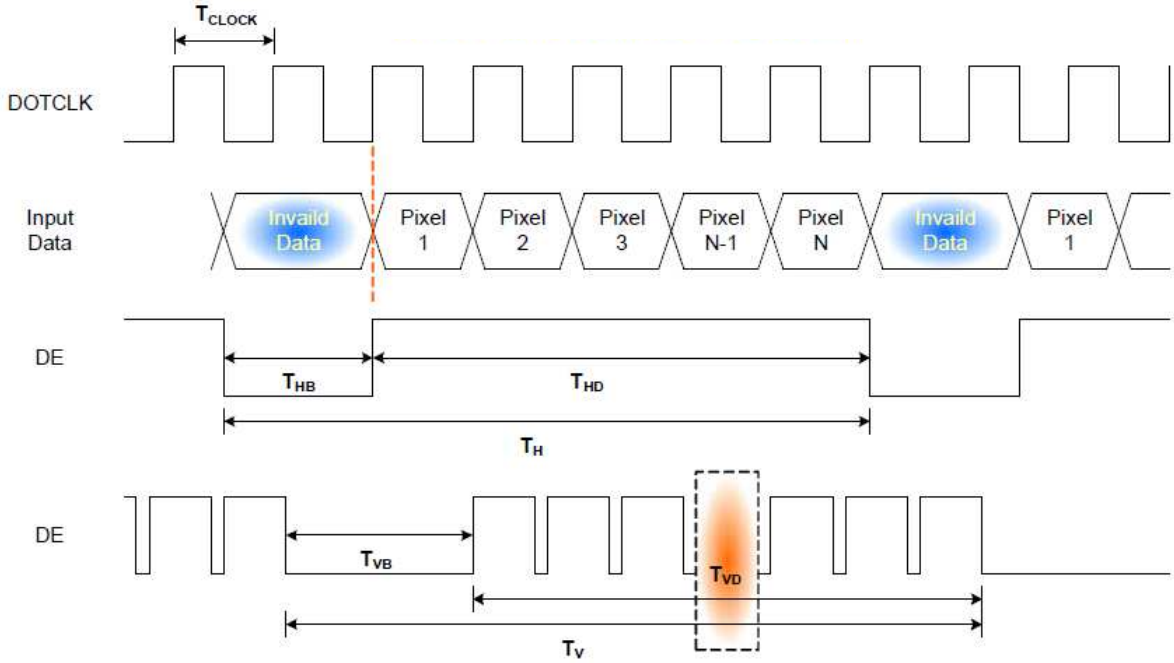
1) SC Pin
① Open or High ② Low


# 8. Input timing characteristics

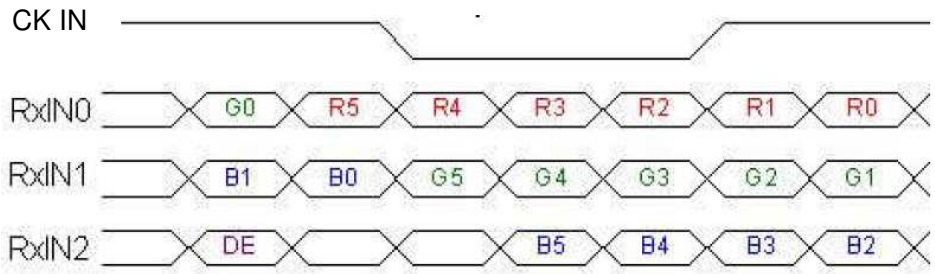
8-1. Timing characteristics

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Clock (CK) | Frequency | $1/T_{Clock}$ | 20 | 25.2 | 28.33 | MHz |
| Vertical | Period | $T_V$ | 520 | 525 | 560 | $T_H$ |
| | Display period | $T_{VD}$ | - | 480 | - | |
| | Blank period | $T_{VB}$ | 40 | 45 | 80 | |
| Horizontal | Period | $T_H$ | 770 | 800 | 900 | $T_{Clock}$ |
| | Display period | $T_{HD}$ | - | 640 | - | |
| | Blank period | $T_{HB}$ | 130 | 160 | 260 | |

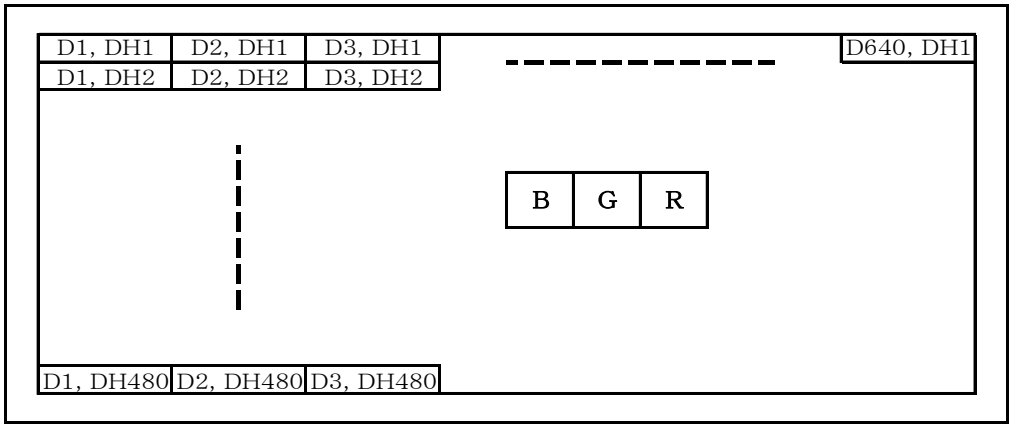
1) Frame frequency 60Hz.




8-2. Data mapping



8-3. Input Data Signals and Display position on the screen




## 9. Lot number identification

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

TCG057VGLAAANN-GN20 - □□ - □□ - □ MADE IN □□□□□

↓↓ ↓ ↓ ↓
1 2 3 4 5

No1. - No5. above indicate
1. Year code
2. Month code
3. Date
4. Version Number
5. Country of origin (Japan or China)

| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Code | 6 | 7 | 8 | 9 | 0 | 1 |

| Month | Jan. | Feb. | Mar. | Apr. | May | Jun. |
|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 |

| Month | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|
| Code | 7 | 8 | 9 | X | Y | Z |

# 10. Warranty

10-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

10-2. Production warranty

Kyocera display warrants its LCD's for a period of 12 months from the ship date. Kyocera display shall, by mutual agreement, replace or re-work defective LCD's that are shown to be Kyocera display'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 so that there is no pressure on the LSI chips.
3) The LCD shall be installed flat, without twisting or bending.
4) 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) Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required.
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.

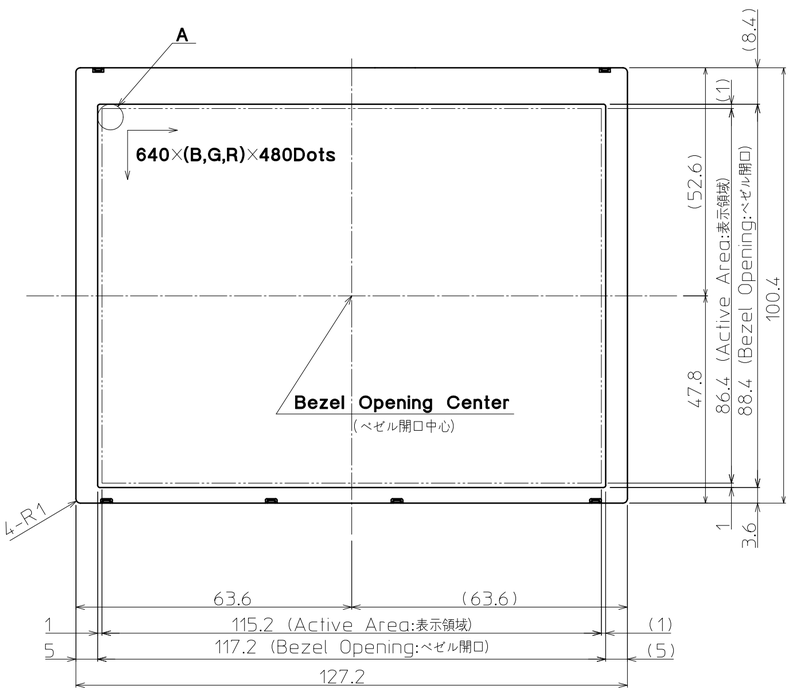
11-5. Usage
1) DO NOT store in a high humidity environment for extended periods. Polarizer degradation bubbles, and/or peeling off of the polarizer may result.
2) The front polarizer is easily scratched or damaged. Prevent touching it with any hard material, and from being pushed or rubbed.
3) The LCD 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 module because it will result in damage.
7) This Kyocera display LCD module 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 module 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.

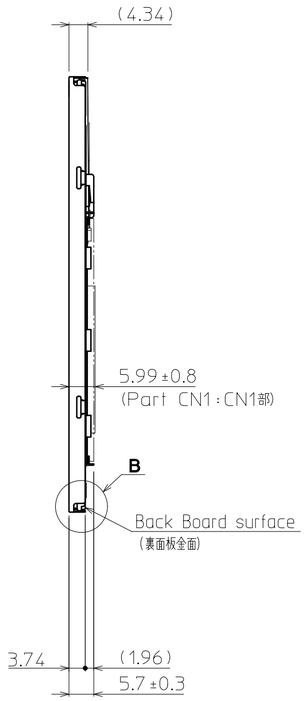
## 12. Reliability test data

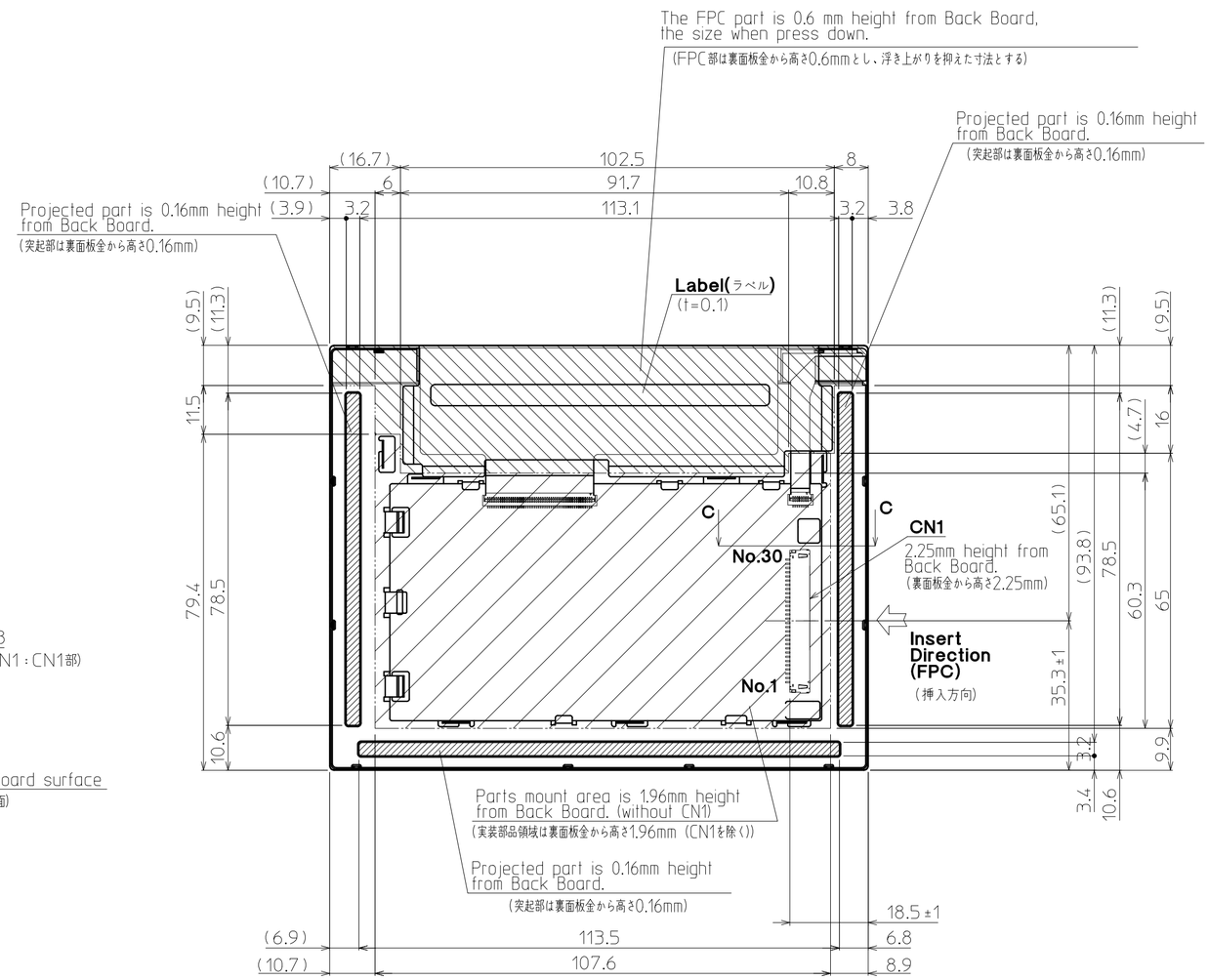
| Test item | Test condition | Test time | Judgement |
| --- | --- | --- | --- |
| High temp. atmosphere | 80°C | 240h | Display function : No defect<br>Display quality : No defect<br>Current consumption : No defect |
| Low temp. atmosphere | -30°C | 240h | Display function : No defect<br>Display quality : No defect<br>Current consumption : No defect |
| High temp. humidity atmosphere | 40°C 90% RH | 240h | Display function : No defect<br>Display quality : No defect<br>Current consumption : No defect |
| Temp. cycle | -30°C 0.5h<br>R.T. 0.5h<br>80°C 0.5h | 10cycles | Display function : No defect<br>Display quality : No defect<br>Current consumption : No defect |
| High temp. operation | 70°C | 500h | Display function : No defect<br>Display quality : 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 |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |



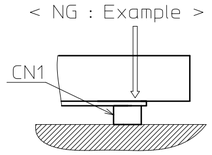




**HANDLING ATTENTION(取扱い注意)**

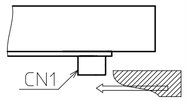
**Please take care of not overload to connector .**
コネクターに過度な負荷を加えないように注意お願いします。

< NG : Example >



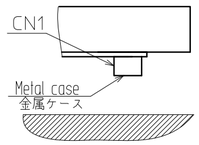

**Overload on the hard unit, when connector is put below.**
コネクター部を下にして、硬質な台の上に置いて過負荷をかける。

< NG : Example >




**Hit against connector.**
コネクターをぶつける。

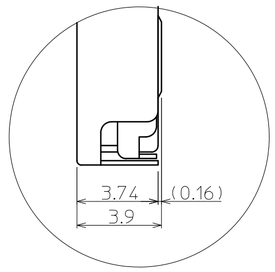
< NG : Example >




**Connector will occur electric conduction when touch other metal parts.**
コネクター外装は、金属ケースのため接触すると導通する可能性有。

**SECTION C–C**
**(NTS)**


**DETAIL A (Dot Size)**
**(NTS)**




**DETAIL B (5:1)**

Note. (注記)
1. Connector CN1: DF19G-30P-1H(54) (HIROSE)
   (コネクター)
2. Matching Connector CN1: DF19G-30S-1C(05) (HIROSE)
   (適合コネクター)
3. The Information of LCD is displayed starting at the upper left hand corner, moving right then down to the lower right hand corner.
   (LCDにおいて、画像データの表示は左上コーナーから始まり、右へ進み下へ送られ右下コーナーへ向かう。)
4. Tolerance without indication : ±0.5
   (指示無き公差)
5. Do not add excessive load so that PCB would not move when inserting or removing the I/F-CN. (PCB-FPC connection disorder avoidance)
   (I/F-CNの挿抜作業については、PCBにずれが生じるような過度の負荷が加わらないこと。)
   (PCB-FPC接続不具合回避)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Material 材質 | Treatment 処理 | Approved '14.10.21 | Checked | Checked '14.10.21 | Drawn | Scale 1:1(5:1,NTS) | Title TCG057VGLAAANN | KYOCERA | Year–Month–Day '14.10.17 | Size 2 |
| Quantity 製作数 | Description; 備考 RoHS | 加藤 | | 倉元 | 圓福 | | Outline Dimensions | Drawing No. 121A8082300 | | |

| Spec No. | TQ3C-8EAF0-E2YBD01-00 |
|---|---|
| Date | February 12, 2016 |

# KYOCERA INSPECTION STANDARD

## TYPE : TCG057VGLAAANN-GN20

KYOCERA DISPLAY CORPORATION

| Original Issue Date | Designed by : Engineering dept. | | | Confirmed by : QA dept. | |
|---|---|---|---|---|---|
| | Prepared | Checked | Approved | Checked | Approved |
| February 12, 2016 | M. Koyama | Y. Yamazaki | Y. Matsumoto | O. Sato | I. Hamada |

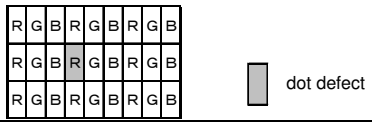
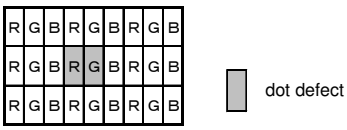
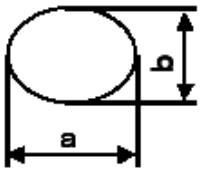
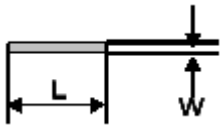
# Revision record

| Date | Designed by : Engineering dept. | | | Confirmed by : QA dept. | |
|---|---|---|---|---|---|
| | Prepared | Checked | Approved | Checked | Approved |
| | | | | | |

| Rev.No. | Date | Page | Descriptions |
|---|---|---|---|
| | | | |

# Visuals specification

1) Note

<table>
<tr><th></th><th colspan="3">Note</th></tr>
<tr><td>General</td><td colspan="3">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.<br>2. This inspection standard about the image quality shall be applied to any defect within the active area and shall not be applicable to outside of the area.<br>3. Inspection conditions<br>Luminance : 500 Lux min.<br>Inspection distance : 300 mm.<br>Temperature : 25 ± 5℃<br>Direction : Directly above</td></tr>
<tr><td rowspan="5">Definition of inspection item</td><td rowspan="3">Dot defect</td><td>Bright dot defect</td><td>The dot is constantly “on” when power applied to the LCD, even when all “Black” data sent to the screen.<br>Inspection tool: 5% Transparency neutral density filter.<br>Count dot: If the dot is visible through the filter.<br>Don’t count dot: If the dot is not visible through the filter.<br>  </td></tr>
<tr><td>Black dot defect</td><td>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</td></tr>
<tr><td>Adjacent dot</td><td>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.<br>  </td></tr>
<tr><td rowspan="2">External inspection</td><td>Bubble, Scratch, Foreign particle (Polarizer, Cell, Backlight)</td><td>Visible operating (all pixels “Black” or “White”) and non operating.</td></tr>
<tr><td>Appearance inspection</td><td>Does not satisfy the value at the spec.</td></tr>
<tr><td>Definition of size</td><td colspan="2">Definition of circle size<br>  <br>d =( a + b )/2<br>Definition of linear size<br>  </td></tr>
</table>

2) Standard

<table>
<tr><th colspan="2">Classification</th><th colspan="2">Inspection item</th><th>Judgement standard</th></tr>
<tr><td rowspan="6">Defect (in LCD glass)</td><td rowspan="5">Dot defect</td><td colspan="2">Bright dot defect</td><td>Acceptable number : 4<br>Bright dot spacing : 5 mm or more</td></tr>
<tr><td colspan="2">Black dot defect</td><td>Acceptable number : 5<br>Black dot spacing : 5 mm or more</td></tr>
<tr><td rowspan="2">2 dot join</td><td>Bright dot defect</td><td>Acceptable number : 2</td></tr>
<tr><td>Black dot defect</td><td>Acceptable number : 3</td></tr>
<tr><td colspan="2">3 or more dots join</td><td>Acceptable number : 0</td></tr>
<tr><td colspan="2">Total dot defects</td><td>Acceptable number : 5 Max</td></tr>
<tr><td>Others</td><td colspan="2">White dot, Dark dot (Circle)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>d ≦ 0.2</td><td>(Neglected)</td></tr>
<tr><td>0.2 ＜ d ≦ 0.4</td><td>5</td></tr>
<tr><td>0.4 ＜ d ≦ 0.5</td><td>3</td></tr>
<tr><td>0.5 ＜ d</td><td>0</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">External inspection (Defect on Polarizer or between Polarizer and LCD glass)</td><td colspan="2">Polarizer (Scratch)</td><td>
<table>
<tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr>
<tr><td>W ≦ 0.1</td><td>－</td><td>(Neglected)</td></tr>
<tr><td rowspan="2">0.1 ＜ W ≦ 0.3</td><td>L ≦ 5.0</td><td>(Neglected)</td></tr>
<tr><td>5.0 ＜ L</td><td>0</td></tr>
<tr><td>0.3 ＜ W</td><td>－</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Polarizer (Bubble)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>d ≦ 0.2</td><td>(Neglected)</td></tr>
<tr><td>0.2 ＜ d ≦ 0.3</td><td>5</td></tr>
<tr><td>0.3 ＜ d ≦ 0.5</td><td>3</td></tr>
<tr><td>0.5 ＜ d</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Foreign particle (Circular shape)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>d ≦ 0.2</td><td>(Neglected)</td></tr>
<tr><td>0.2 ＜ d ≦ 0.4</td><td>5</td></tr>
<tr><td>0.4 ＜ d ≦ 0.5</td><td>3</td></tr>
<tr><td>0.5 ＜ d</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Foreign particle (Linear shape)<br>Scratch</td><td>
<table>
<tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr>
<tr><td>W ≦ 0.03</td><td>－</td><td>(Neglected)</td></tr>
<tr><td rowspan="3">0.03 ＜ W ≦ 0.1</td><td>L ≦ 2.0</td><td>(Neglected)</td></tr>
<tr><td>2.0 ＜ L ≦ 4.0</td><td>3</td></tr>
<tr><td>4.0 ＜ L</td><td>0</td></tr>
<tr><td>0.1 ＜ W</td><td>－</td><td>(According to circular shape)</td></tr>
</table>
</td></tr>
</table>