

SPEC

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| Spec No. | TQ3C-8EAF0-E1YAJ05-00 |
| Date | January 31, 2013 |

TYPE : TG035QVLQAANN-GN00
< 3.5 inch QVGA transmissive monochrome TFT
with LED backlight>

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KYOCERA CORPORATION
LCD DIVISION

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

| Original Issue Date | Designed by: Engineering dept. | | | Confirmed by: QA dept. | |
|------------------------|--------------------------------|--------------------|--------------------|------------------------|-----------------|
| | Prepared | Checked | Approved | Checked | Approved |
| January 31, 2013 | <i>H. Mori</i> | <i>Y. Yamazaki</i> | <i>M. Fujitani</i> | <i>I. Hamada</i> | <i>T. Ishii</i> |

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Warning

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

Caution

1. Kyocera shall have the right, which Customer hereby acknowledges, to immediately scrap or destroy tooling for Kyocera modules for which no Purchase Orders have been received from the Customer in a two-year period.

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Revision record

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

1. Application

This document defines the specification of TG035QVLQAANN-GN00. (RoHS Compliant)

2. Construction and outline

| | |
|--------------------|--|
| LCD | : Transmissive monochrome dot matrix type TFT |
| Backlight system | : LED |
| Polarizer | : Glare treatment |
| Additional circuit | : Timing controller, Power supply (3.3V input) (without constant current circuit for LED Backlight) |

3. Mechanical specifications

| Item | Specification | Unit |
|-----------------------|---|------|
| Outline dimensions 1) | 76.9(W)×63.9(H)×4.9(D) | mm |
| Active area | 70.56(W)×52.92(H) (8.8cm/3.5 inch(Diagonal)) | mm |
| Dot format | 320×3(W)×240(H) | dot |
| Dot pitch | 0.0735(W)×0.2205(H) | mm |
| Base color 2) | Normally White | - |
| Mass | 40 | 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 | V _{DD} | -0.3 | 4.0 | V |
| Input signal voltage 1) | V _{IN} | -0.3 | 4.0 | V |
| LED forward current 2) 3) | I _F | - | 30 | mA |

- 1) Input signal : CK, DA0 ~ DA7, DB0 ~ DB7, DC0 ~ DC7, H_{SYNC}, V_{SYNC}, ENAB, REST, CSB, SCK, SDI
- 2) For each "AN-CA"
- 3) Do not apply reversed voltage.

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 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)

| | | |
|-----------------|-------------|---|
| Frequency | 10 ~ 55 Hz | Acceleration value (0.3 ~ 9 m/s ²) |
| 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

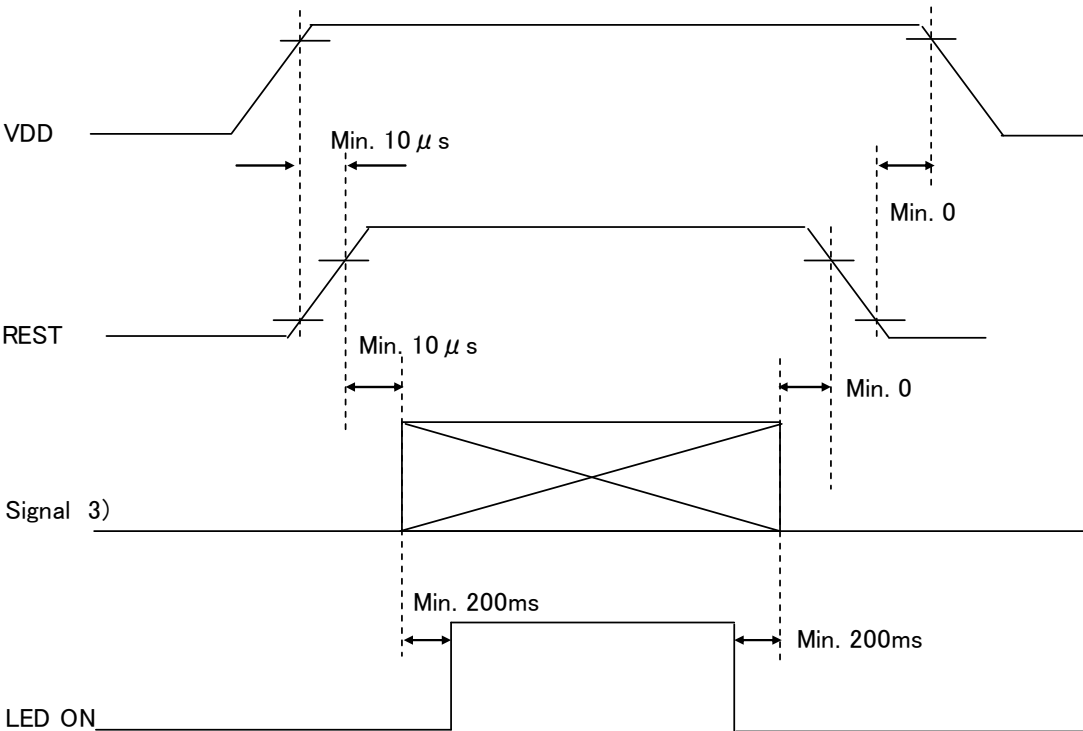
- 6) Acceleration: 490 m/s², Pulse width: 11 ms
3 times in each direction: ±X, ±Y, ±Z
EIAJ ED-2531

5. Electrical characteristics

Temp. = -20 ~ 70°C

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------------|----------|---------------|-------------|------|-------------|-------|
| Supply voltage 1) | V_{DD} | - | 3.0 | 3.3 | 3.6 | V |
| Current consumption | I_{DD} | 2) | - | 8.0 | 11.3 | mA |
| Permissive input ripple voltage | V_{RP} | $V_{DD}=3.3V$ | - | - | 100 | mVp-p |
| Input signal voltage 3) | V_{IL} | "Low" level | 0 | - | $0.2V_{DD}$ | V |
| | V_{IH} | "High" level | $0.8V_{DD}$ | - | V_{DD} | V |

1) V_{DD} -turn-on conditions

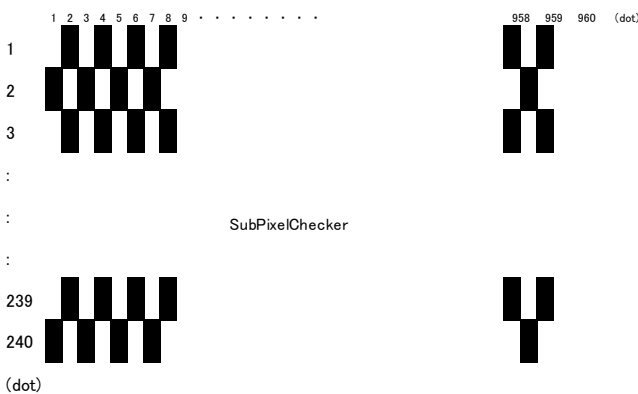


2) I_{DD} measuring conditions

Typ. : $V_{DD}=3.3V$, Temp. = 25°C

Max. : $V_{DD}=3.6V$, Temp. = 70°C

Display pattern



3) Input signal : CK, DA0 ~ DA7, DB0 ~ DB7, DC0 ~ DC7, H_{SYNC}, V_{SYNC}, ENAB, REST, CSB, SCK, SDI

6. Optical characteristics

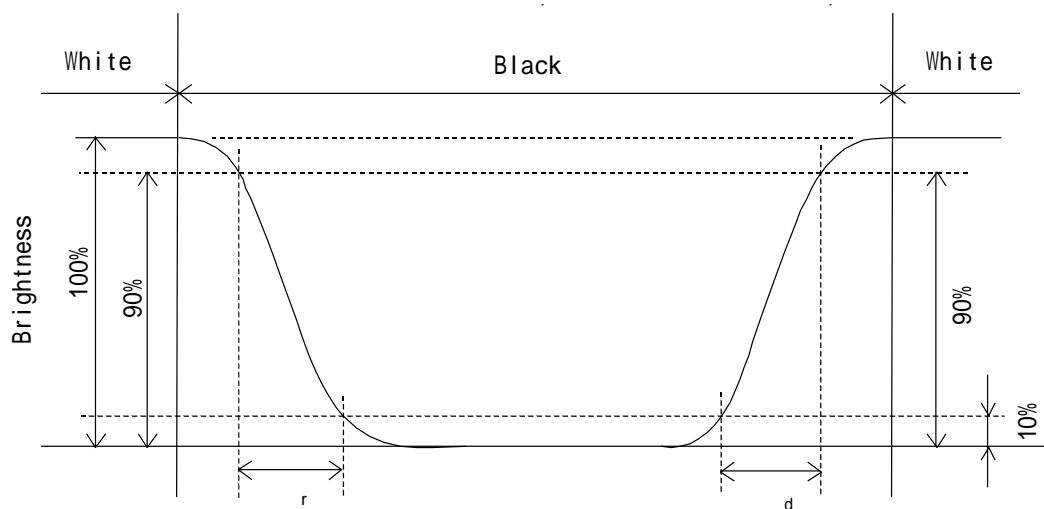
Measuring spot = 6.0mm, Temp. = 25°C

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|-------|--------------|--------------|-------|-------|-------|-------------------|
| Response time | Rise | τ_r | = 0° | - | 8 | - | ms |
| | Down | τ_d | = 0° | - | 22 | - | ms |
| Viewing angle range View direction : 12 o'clock (Gray inversion) | | UPPER | CR 10 | - | 80 | - | deg. |
| | | LOWER | | - | 60 | - | |
| | | LEFT | | - | 80 | - | deg. |
| | | ϕ RIGHT | | - | 80 | - | |
| Contrast ratio | | CR | = 0° | 700 | 1000 | - | - |
| Brightness | | L | IF=15mA/Line | 840 | 1200 | - | cd/m ² |
| Chromaticity coordinates | White | x | = 0° | 0.260 | 0.310 | 0.360 | - |
| | | y | | 0.260 | 0.310 | 0.360 | |

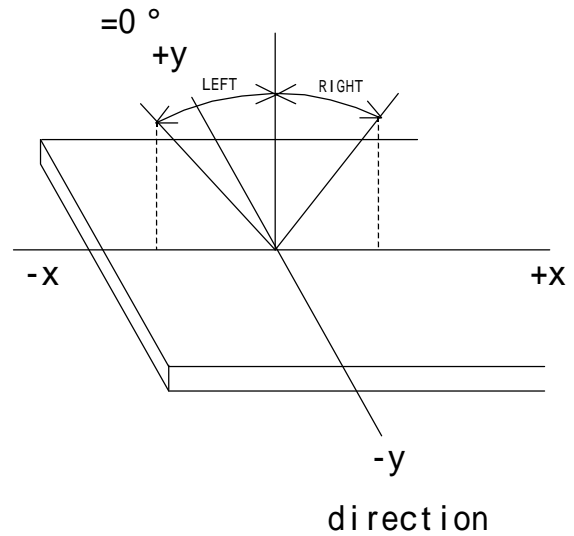
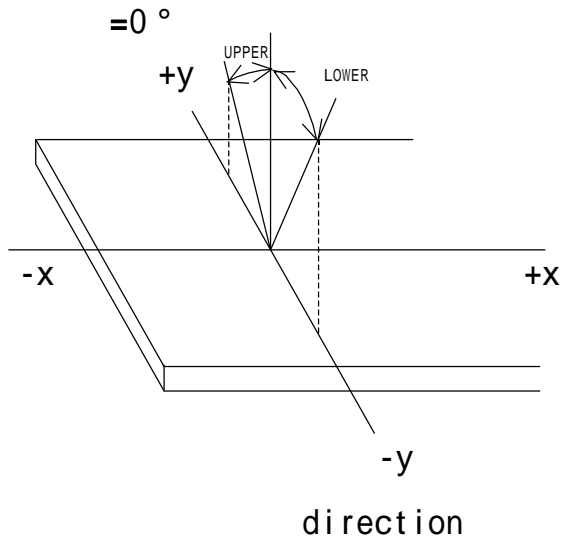
6-1. Definition of contrast ratio

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

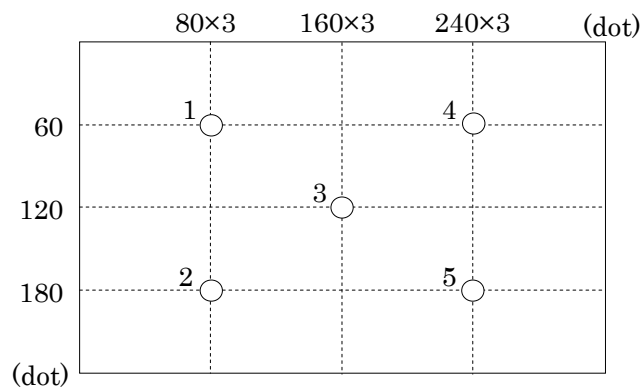
6-2. Definition of response time



6-3. Definition of viewing angle



6-4. Brightness measuring points



- 1) Rating is defined as the white brightness at center of display screen(3).
- 2) 5 minutes after LED is turned on. (Ambient Temp.=25)

7. Interface signals

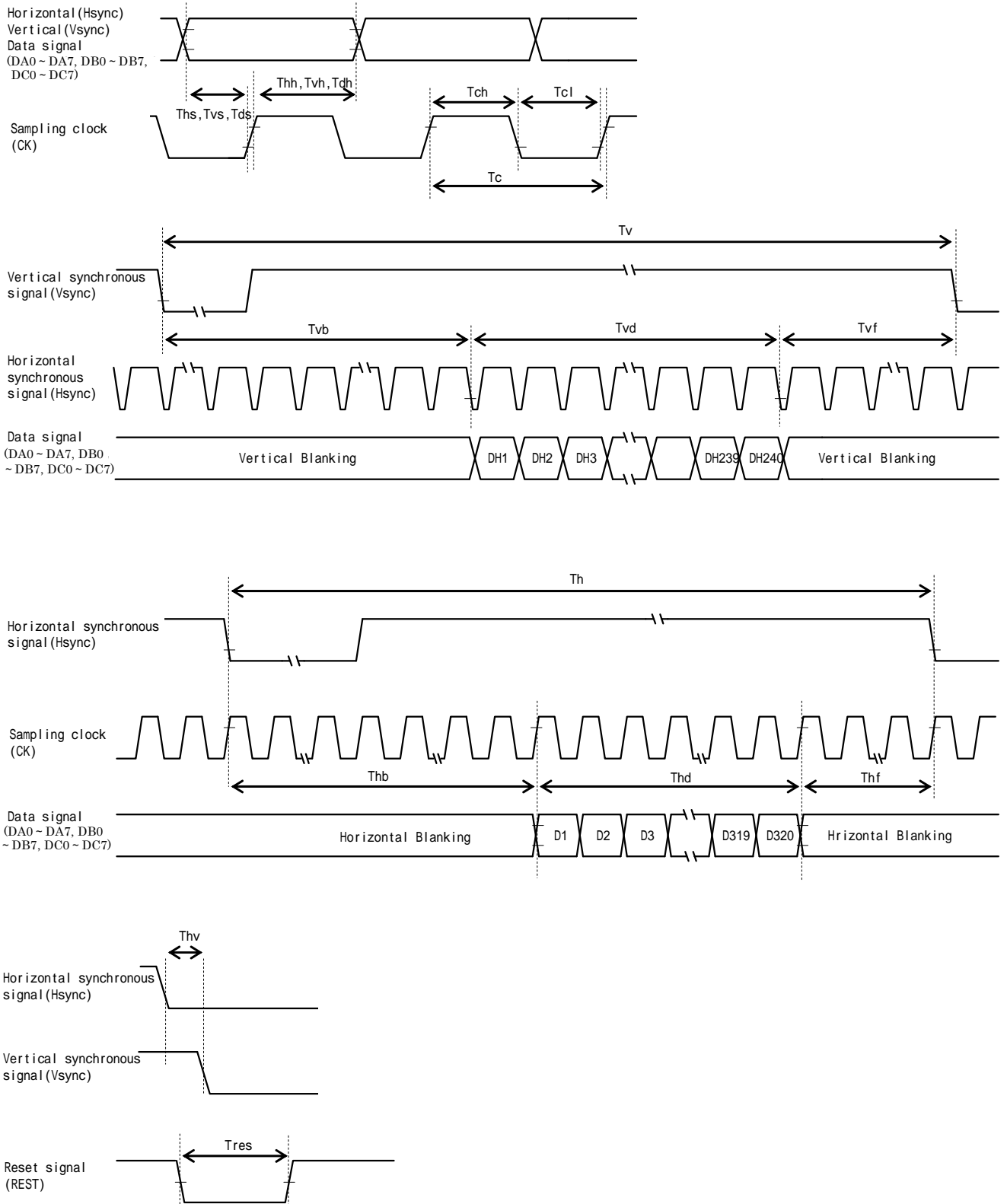
| No. | Symbol | Description | Note |
|-----|-------------------|--|------|
| 1 | GND | GND | |
| 2 | GND | GND | |
| 3 | V _{DD} | 3.3V power supply | |
| 4 | V _{DD} | 3.3V power supply | |
| 5 | DA0 | data signal(LSB) | |
| 6 | DA1 | data signal | |
| 7 | DA2 | data signal | |
| 8 | DA3 | data signal | |
| 9 | DA4 | data signal | |
| 10 | DA5 | data signal | |
| 11 | DA6 | data signal | |
| 12 | DA7 | data signal(MSB) | |
| 13 | DB0 | data signal(LSB) | |
| 14 | DB1 | data signal | |
| 15 | DB2 | data signal | |
| 16 | DB3 | data signal | |
| 17 | DB4 | data signal | |
| 18 | DB5 | data signal | |
| 19 | DB6 | data signal | |
| 20 | DB7 | data signal(MSB) | |
| 21 | DC0 | data signal(LSB) | |
| 22 | DC1 | data signal | |
| 23 | DC2 | data signal | |
| 24 | DC3 | data signal | |
| 25 | DC4 | data signal | |
| 26 | DC5 | data signal | |
| 27 | DC6 | data signal | |
| 28 | DC7 | data signal(MSB) | |
| 29 | GND | GND | |
| 30 | CK | Sampling clock | |
| 31 | CSB | Select signal(SPI) | |
| 32 | H _{SYNC} | Horizontal synchronous signal(negative) | |
| 33 | V _{SYNC} | Vertical synchronous signal(negative) | |
| 34 | ENAB | Data Enable (Low signal only) | |
| 35 | GND | GND | |
| 36 | REST | Reset signal | |
| 37 | SCK | Clock (SPI) | |
| 38 | SDI | Data signal(SPI) | |
| 39 | GND | GND | |
| 40 | NC | Since it is interior terminal, do not connect signal and make it as OPEN terminal. | |
| 41 | NC | | |
| 42 | NC | | |
| 43 | NC | NC | |
| 44 | GND | GND | |
| 45 | CA1 | Cathode1 | |
| 46 | NC | NC | |
| 47 | AN1 | Anode1 | |
| 48 | AN2 | Anode2 | |
| 49 | NC | NC | |
| 50 | CA2 | Cathode2 | |

8. Input timing characteristics

8-1. LCD

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|--|-------------|--------|------|------|------|------|------|
| Clock (CK) | Frequency | 1/Tc | - | 6.5 | - | MHz | |
| | Period | Tc | - | 154 | - | ns | |
| | High time | Tch | 50 | - | - | ns | |
| | Low time | Tcl | 50 | - | - | ns | |
| Data (DA0~DA7,DB0~DB7,DC0~DC7) | Set up time | Tds | 12 | - | - | ns | |
| | Hold time | Tdh | 12 | - | - | ns | |
| Horizontal sync. Signal (H _{SYNC}) | Set up time | Ths | 20 | - | - | ns | |
| | Hold time | Thh | 20 | - | - | ns | |
| | Frequency | 1/Th | - | 14.9 | - | kHz | |
| | Period | Th | - | 408 | - | Tc | |
| | Front porch | Thf | - | 20 | - | Tc | |
| | Back porch | Thb | - | 68 | - | Tc | |
| Horizontal display period | | Thd | 320 | | | Tc | |
| Vertical sync. Signal (V _{SYNC}) | Set up time | Tvs | 20 | - | - | ns | |
| | Hold time | Tvh | 20 | - | - | ns | |
| | Period | Tv | - | 262 | - | Th | |
| | Front porch | Tvf | - | 4 | - | Th | |
| | Back porch | Tvb | - | 18 | - | Th | |
| Vertical display period | | Tvd | 240 | | | Th | |
| Synchronous signal phase lag | | Thv | 0 | - | 240 | Tc | |
| Refresh rate | | 1/Tv | - | 60 | - | Hz | |
| Reset signal (REST) | Pulse width | Tres | 10 | - | - | μs | |

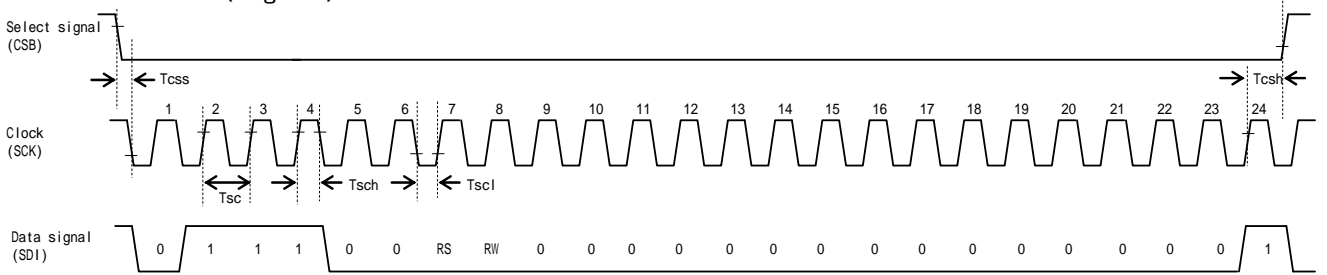
1) In case of lower frequency, the deterioration of the display quality, flicker etc., may occur.



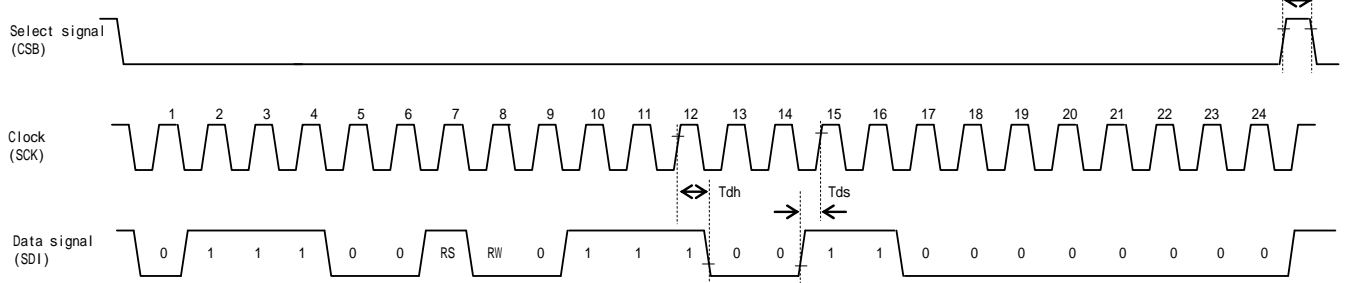
8-2. SPI

| | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------------|-------------|--------|------|------|------|------|------|
| Clock (SCK) | Period | Tsc | 50 | - | - | ns | |
| | High time | Tsch | 25 | - | - | ns | |
| | Low time | Tscl | 25 | - | - | ns | |
| Select signal (CSB) | Set up time | Tcss | 50 | - | - | ns | |
| | Hold time | Tcsh | 50 | - | - | ns | |
| | High time | Tcs | 50 | - | - | ns | |
| Data signal (SDI) | Set up time | Tds | 15 | - | - | ns | |
| | Hold time | Tdh | 15 | - | - | ns | |

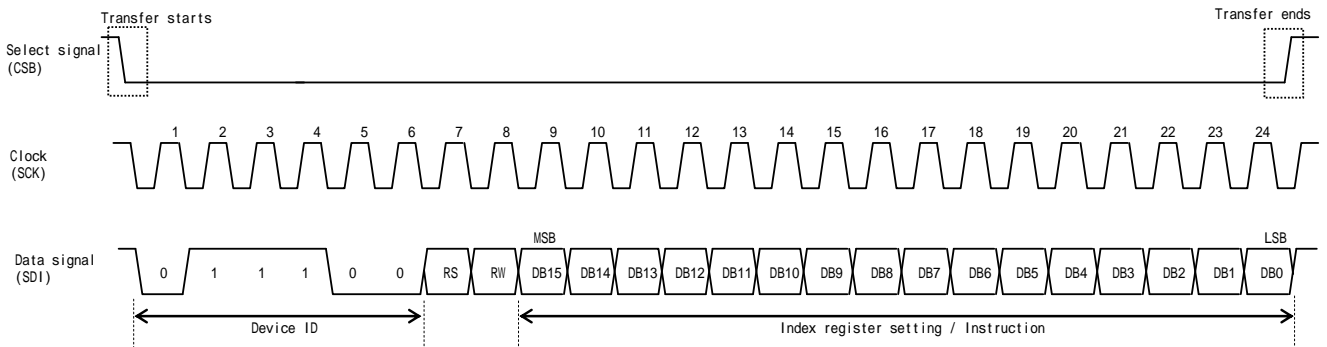
First Transmission (Register) Ex.R01h



Second Transmission (Data) Ex.7300



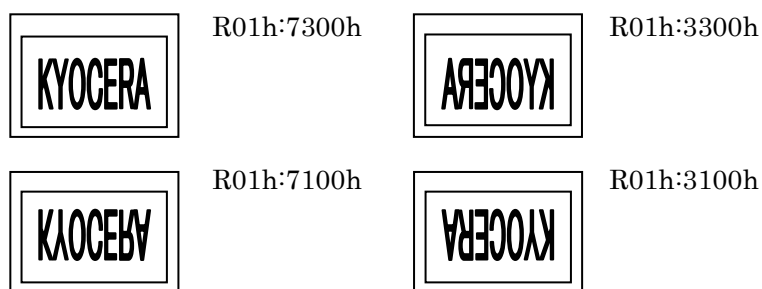
Transmission Format



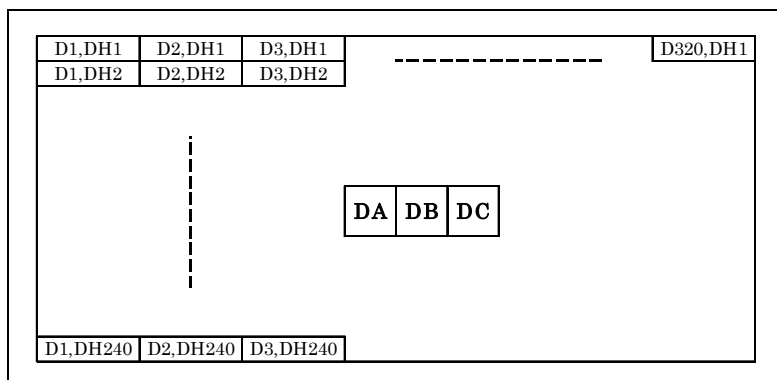
8-3. Register

| Reg# | Hex Code | Note |
|------|----------|------|
| R01h | 7300 | 1) |
| R02h | 0200 | |
| R03h | 6464 | |
| R04h | 04C7 | |
| R05h | F444 | |
| R06h | E860 | |
| R08h | 06FF | |
| R0Ah | 4008 | |
| R0Bh | D400 | |
| R0Dh | 422C | |
| R0Eh | 2D00 | |
| R0Fh | 0000 | |
| R16h | 9F80 | |
| R17h | 2212 | |
| R1Eh | 006D | |
| R30h | 0001 | |
| R31h | 0105 | |
| R32h | 0000 | |
| R33h | 0102 | |
| R34h | 0707 | |
| R35h | 0206 | |
| R36h | 0607 | |
| R37h | 0201 | |
| R3Ah | 1400 | |
| R3Bh | 1400 | |

1) Scanning



8-4. Input Data Signals and Display position on the screen



9. Backlight characteristics

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------------|--------|------|--------|------|------|-----------------|
| Forward current 1) | IF | - | 15 | - | mA | Ta=-20 ~ 70°C |
| Forward voltage 1) | VF | - | 13.0 | 13.8 | V | IF=15mA, Ta=-20 |
| | | - | 12.5 | 13.3 | V | IF=15mA, Ta=25 |
| | | - | 12.2 | 13.0 | V | IF=15mA, Ta=70 |
| Operating life time 2), 3) | T | - | 60,000 | - | h | IF=15mA, Ta=25 |

- 1) For each "AN-CA"
- 2) When brightness decrease 50% of minimum brightness.
The average life of a LED will decrease when the LCD is operating at higher temperatures.
- 3) Life time is estimated data.(Condition : IF=15mA, Ta=25 in chamber).
- 4) An input current below 5mA may reduce the brightness uniformity of the LED backlight.
This is because the amount of light from each LED chip is different. Therefore, please evaluate carefully before finalizing the input current.

10. Lot number identification

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

TG035QVLQAANN-GN00 - □□ - □□ - □ 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 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| Code | 3 | 4 | 5 | 6 | 7 | 8 |

| | | | | | | |
|-------|------|------|------|------|-----|------|
| 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 |

11. Warranty

11-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

11-2. Production warranty

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

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12. Precautions for use

12-1. 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.

12-2. 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.

12-3. LCD operation

- 1) The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
- 2) Please select the best display pattern based on your evaluation because flicker, lines or nonuniformity or unevenness can be visible depending on display patterns.

12-4. 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.

12-5. Usage

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

13. Reliability test data

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

△ ○ FPC引き出し方法(参考例)
Wiring methods FPC(Reference Example)

△ × FPC引き出し方法(NG)
Wiring methods FPC(cases NG)

△ × FPC引き出し方法(NG)
Wiring methods FPC(cases NG)

下図のような、セット側基板などをまいた引き出しは、実装エリアに応力がかかり、部品の損傷が発生する恐れがあります。
As shown below, wiring across the board and set implementation takes the stress area, may cause damage to components.

FPCを表示面側に折り曲げての取り付けは、FPCの断線が発生する恐れがあります。
Installing the folded side to view the FPC is May cause breakage of the FPC.

| No | Description | Drawn | Checked | Checked | Approved |
|----|--|-----------------|-----------------|---------|-----------------|
| △ | ・Added reference value. (参考値追加) | '11.02.28 蔭山 | '11.02.28 朝倉 | | '11.02.28 朝倉 |
| △ | ・Added Wiring methods FPC (Reference Example) (FPC引き出し方法(参考例追加)) | '11.06.17 蔭山 | '11.07.04 倉元 | | '11.07.04 朝倉 |

参考(for Reference)

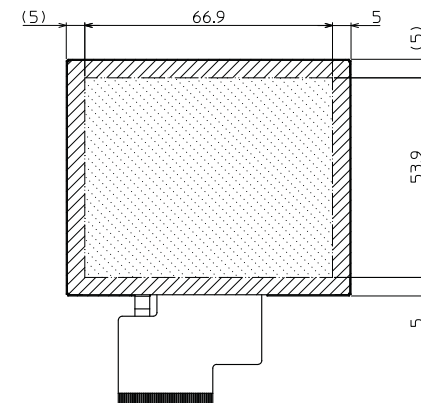
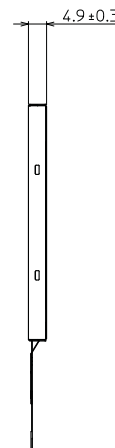
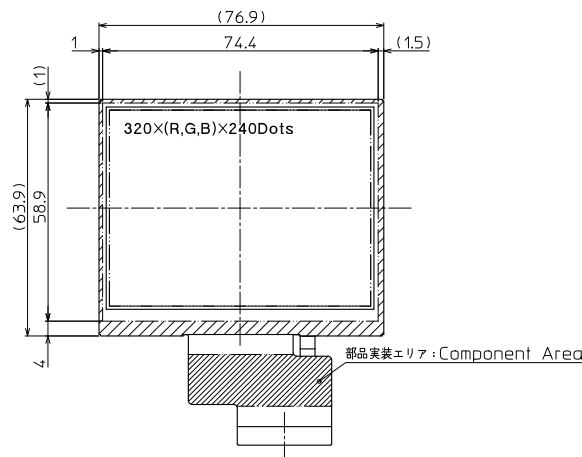
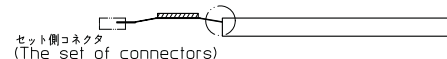
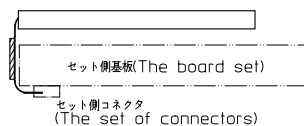
FPC引き出し部は、1Minのクリアランスを設けてください
FPC drawer unit, please provided a clearance of 1Min

セット側コネクタ(The set of connectors)

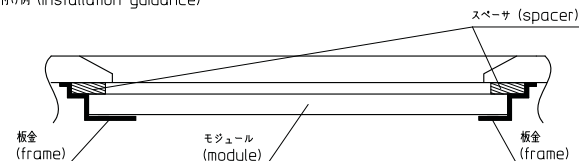
セット側基板(The board set)

実装部品がセット基板などと接触しないような引き回しをしてください
Please do not contact to the routing of printed circuit boards and components

部品実装エリア12(FPC自身の反発力で変形しない引き回しをしてください)
Mounting area 12(please do not deform in the resilience of its routing FPC)



※取り付け例 (Installation guidance)



(NTS)

△ ※裏面の押さえつけ可能領域以外 (押さえつけ禁止エリアを除く) を押さえると、取付構造によっては、表示ムラが発生する場合があります。
しかしながら、GND接続等で押さえる必要がある場合は、25mm2 (5mm×5mm) に対して、0.33kgf (3.2N) を目安として下さい。
なお、上記値は、参考数値であり、実際の取付構造により十分評価頂きますようお願いいたします。

(※ If area other than pressure available area on the rear side is pressured, there is a case that display variation is caused.
However, when pressure is needed for GND connection or so, 0.33kgf (3.2N) per 25mm2 (5mm×5mm) will be a referential figure.
Above figure is reference only. Therefore, please evaluate well under the actual installation structure.)

取り付け方法
(Installation of the LCD)

ケースにモジュールをはめ込み(X,Y固定)、裏面からZ方向を固定する事が可能。
(The LCD module shall be held in the X/Y direction by the housing, and in the Z direction using a backboard.)

斜線部の領域にて、下記の条件を満たし押さえることが望ましい。
(To hold the LCD module in place, it shall be supported with pressure applied to the hatched areas indicated by the descriptions below.)

△ 押さえつけ可能領域
(Pressure may be applied in this area.)

押さえつけ可能領域面積 (裏面) : 1308.0mm2
(Pressure may be applied in this area (Back side) : 1308.0mm2)
参考全体荷重 : 4.4kgf (43.6N)
(Referential total load : 4.4kgf (43.6N))
参考平均圧力 : 3.4gf/mm2 (33.7kPa)
(Referential average pressure : 3.4gf/mm2 (33.7kPa))
※上記値は参考数値であり、実際の取付構造により十分評価頂きますようお願いいたします。
(Above figure is reference only. Therefore, please evaluate well by the actual installation structure.)

押さえつけ不可領域
(Pressure failure area.)

表面取り付け条件
(Installation conditions (Front side))

1.広い範囲で均一に押さえることが望ましい
(1. The LCD shall be uniformly supported over as wide an area as possible.)

裏面取り付け条件
(Installation conditions (Back side))

1.FPC部品実装エリアへの接触無きこと
(1. Do not allow any foreign material to contact the FPC Component Area.)

2.モジュールがたわむこと無きよう押さえつけること
(2. Do not allow the LCD module to bend or twist.)

3.広い範囲で均一に押さえることが望ましい
(3. Support the LCD with uniform pressure over as wide an area as possible.)

注記 (Note)
指定外公差 (Tolerance without indication) : ±0.5

| | | | | | | | | |
|-----------------|-------------------|-----------------------|----------------------|-------|-------------------|-----------------------|------------------------------|-----------|
| Material 材質 | Treatment 処理 | Approved '10.11.30 | Checked '10.11.30 | Drawn | Scale 1:1(NTS) | Title 3.5inch QVGA | Year—Month—Day '10.11.29 | Size 2 |
| Quantity 製作数 | Description 備考 | 朝倉 | 朝倉 | 蔭山 | | Module Installation | Drawing No. 10282-03224-2 | |

| | |
|----------|-----------------------|
| Spec No. | TQ3C-8EAF0-E2YAJ05-00 |
| Date | January 31, 2013 |

KYOCERA INSPECTION STANDARD

TYPE : TG035QVLQAANN-GN00

KYOCERA CORPORATION
LCD DIVISION

| Original Issue Date | Designed by : Engineering dept. | | | Confirmed by : QA dept. | |
|------------------------|---------------------------------|--------------------|--------------------|-------------------------|--------------------|
| | Prepared | Checked | Approved | Checked | Approved |
| January 31, 2013 | <i>X. Mori</i> | <i>Y. Yamazaki</i> | <i>M. Fujitani</i> | <i>I. Hamada</i> | <i>H. Ishikawa</i> |

Spec No.

TQ3C-8EAF0-E2YAJ05-00

Part No.

TG035QVLQAANN-GN00

Page

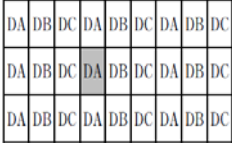
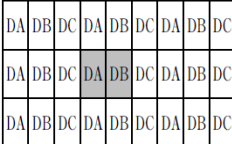
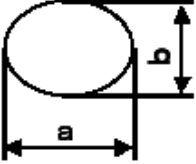
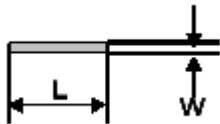
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Revision record

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

Visuals specification

1) Note

| | Note | | |
|-------------------------------|---|---|--|
| General | <ol style="list-style-type: none"> Customer identified anomalies not defined within this inspection standard shall be reviewed by Kyocera, and an additional standard shall be determined by mutual consent. 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. Inspection conditions <ul style="list-style-type: none"> Luminance : 500 Lux min. Inspection distance : 300 mm. Temperature : 25 ± 5 Direction : Directly above | | |
| Definition of inspection item | Dot defect | Bright dot defect | <p>The dot is constantly “on” when power applied to the LCD, even when all “Black” data sent to the screen. Inspection tool: 5% Transparency neutral density filter. Count dot: If the dot is visible through the filter. Don't count dot: If the dot is not visible through the filter.</p>  |
| | | Black dot defect | <p>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</p> |
| | | Adjacent dot | <p>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.</p>  |
| | External inspection | Bubble, Scratch, Foreign particle (Polarizer, Cell, Backlight) | Visible operating (all pixels “Black” or “White”) and non operating. |
| | | Appearance inspection | Does not satisfy the value at the spec. |
| | Definition of size | <div>Definition of circle size</div>  $d = (a + b) / 2$ <div>Definition of linear size</div>  | |

| | | |
|-----------------------|--------------------|------|
| Spec No. | Part No. | Page |
| TQ3C-8EAF0-E2YAJ05-00 | TG035QVLQAANN-GN00 | 2 |

2) Standard

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

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