SPEC

| Spec No. | TQ3C-8EA00-E1DFF02-00 |
|---|---|
| Date | July 8, 2010 |

# TYPE : TCG043WQLBC-C00

< 4.3 inch WQVGA transmissive color TFT
with LED backlight and touch panel >

## CONTENTS



Issued
Date: Jul 15, 2010
KYOCERA
Hayato LCD Division


KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
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 |
| July 8, 2010 | S.Maezaru | Y. Yamazaki | M.Fujitani | I.Hamada | |

KYOCERA

# 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.

# 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 TCG043WQLBC-C00. (RoHS Compliant)

This specification consists of LCD section and Touch panel section, and each section defines the LCD and the touch panel separately.
Please refer the corresponding section for each part.
(The product is ROHS compliant)

| LCD with touch panel | | LCD | |
|---|---|---|---|
| Type<br>Spec.No. | TCG043WQLBC-C00<br>TQ3C-8EA00-E1DFF02-00 | Type<br>Spec. No.<br>Inspection spec. No. | TCG043WQLBA-G00<br>TQ3C-8EA00-E1DEK06-00<br>- |
| | | Touch panel | |
| | | Type<br>Spec. No.<br>Inspection spec. No. | KTP043AGAB-C00<br>TQ3C-8EA00-E1BYF04-00<br>- |

# 2. Mechanical specifications

| Item | Specification | Unit |
|---|---|---|
| Outline dimensions 1) | 105.5(W)× 67.2(H) ×4.99(D) | mm |
| Active area | Please refer to the LCD specification | mm |
| Mass | TBD | g |

1) Projection not included. Please refer to outline for details.

# 3. Absolute maximum ratings

3-1. Electrical absolute maximum ratings

Please refer to the individual LCD and Touch Panel specifications.

3-2. Environmental absolute maximum ratings

Please refer to the individual LCD and Touch Panel specifications.

# 4. Electrical characteristics

Please refer to the individual LCD and Touch Panel specifications.

# 5. Optical characteristics

Temp. = 25°C

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Brightness | - | $I_L$=40mA | (190) | (280) | - | cd/m² |

1) Please refer to the LCD specification for measuring conditions and other optical characteristics.

## 6. Lot number identification

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

TCG043WQLBC-C00 - □□ - □□ - □ 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 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Code | 0 | 1 | 2 | 3 | 4 | 5 |

| 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 |

## 7. Warranty

Please refer to the LCD specification.

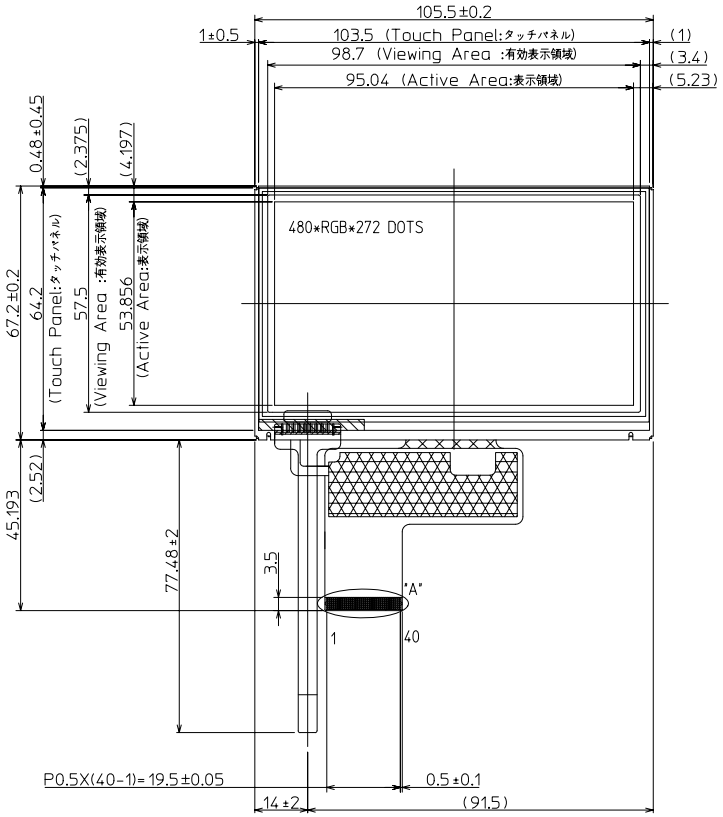
## 8. Reliability test data

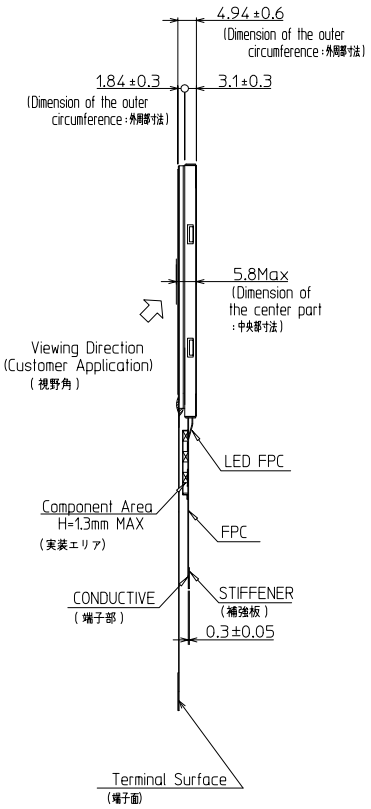
Please refer to the LCD specification.

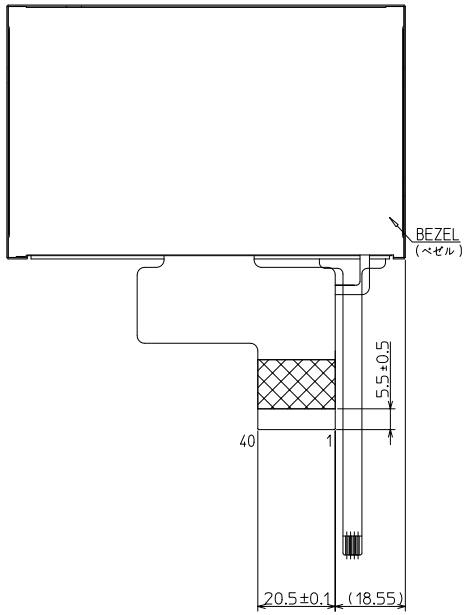
## 9. Inspection

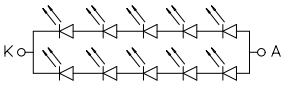
Please refer to the individual LCD and Touch Panel specifications

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



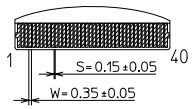



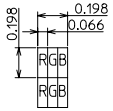




LED Circuit (If=40mA)

DETAIL "A"
Scale NTS




DETAIL "A"
Scale 2/1




Display
Scale 40:1

Mylar Tape
(マイラーテープ)

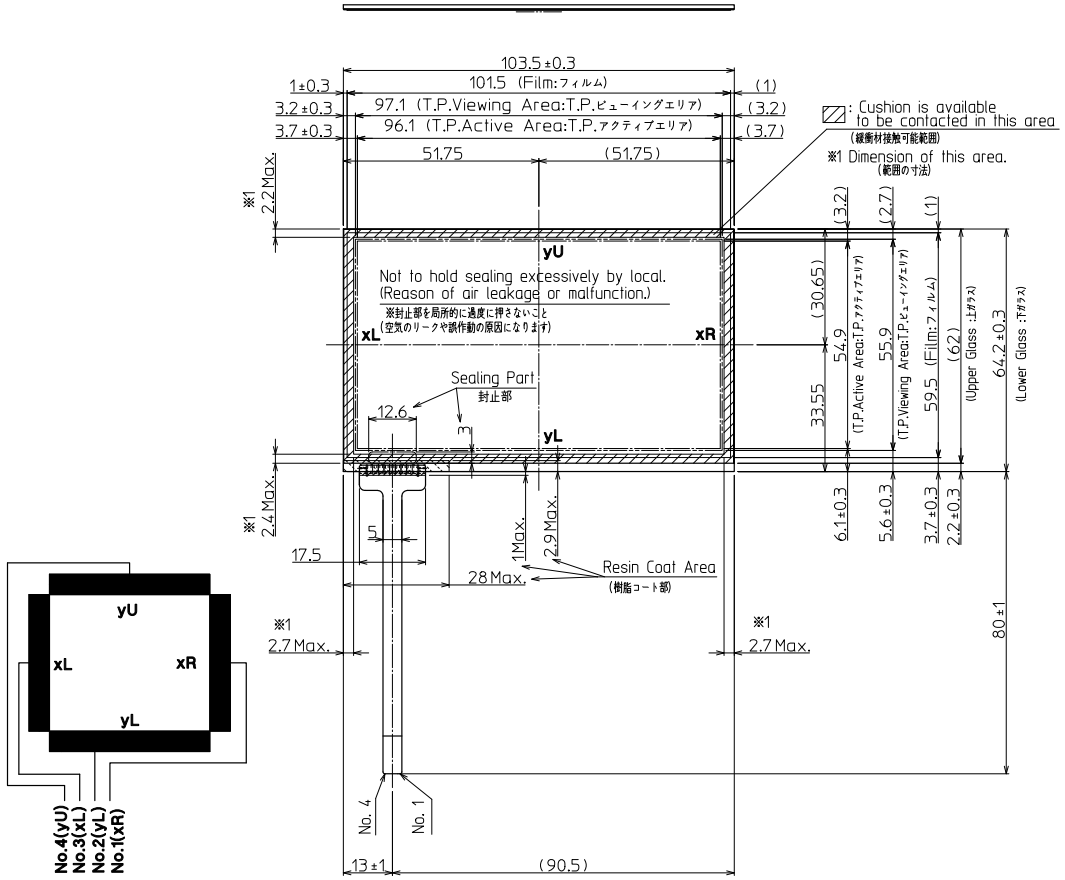
Single Side
(片面(一層)FPC部)

Note.

1. Tolerance without indication: ±0.5
(指示無き公差)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Material 材質 | Treatment 処理 | Approved '10.07.15 | Checked | Checked '10.07.15 | Drawn | Scale 1:1 (2:1,40:1,NTS) | Title TCG043WQLBC | KYOCERA | Year-Month-Day '10.07.13 | Size 2 |
| Quantity 製作数 | Description; 備考 RoHS | 鶴崎 | | 今村 | 圓福 | | Outline Dimensions | Drawing No. 121A8031100 | | 1/2 |

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

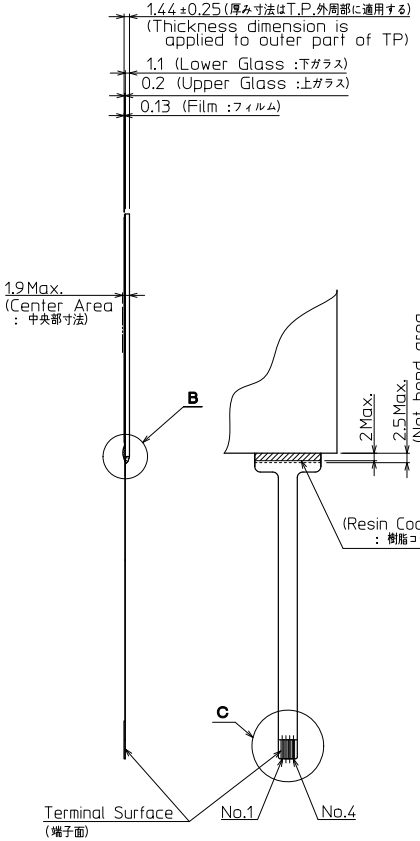


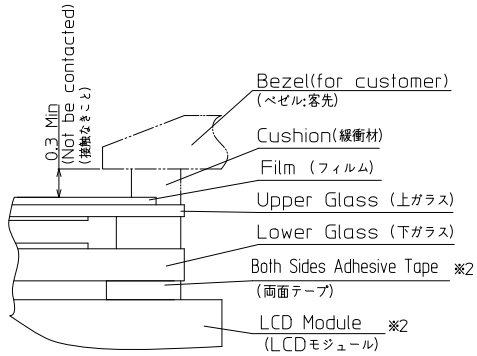




**Touch Panel Pin-assign**

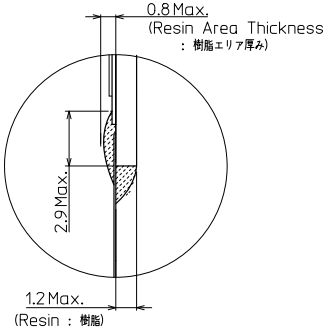
(Pin-assign from Touch side)
(タッチパネル ピンアサイン、
タッチ面側からのピンアサイン)



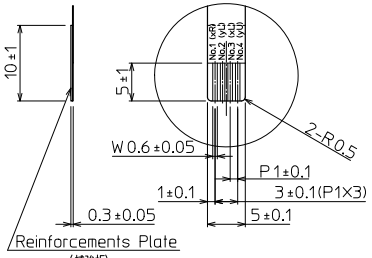




**(NTS)**

Precaution in use of touch panel.
(タッチパネル使用上の注意事項)
※2 In case of assemble to the LCD
(LCDに取りつける場合)
1. Fix touch panel at LCD module and the rear side of touch panel.
(タッチパネルの固定はLCDモジュール側とタッチパネル裏面とで行なうこと)
2. Must maintain a gap between inside of bezel and touch panel to avoid malfunction or electrode damage of touch panel.
(ベゼル内側とタッチパネルの接触厳禁。誤動作や電極破損の原因となります。)
3. Tolerance without indication: ±0.5
(指示無き公差)




**DETAIL B (5:1)**




**DETAIL C 2:1**

Note. (注記)

| | Name (名称) | Explanation (説明) |
|---|---|---|
| 1 | T.P. | Touch panel<br>(タッチパネル) |
| 2 | T.P. Active Area<br>(T.P.アクティブエリア) | Operating area of touch panel<br>(タッチパネルの動作範囲) |
| 3 | T.P. Viewing Area<br>(T.P.ビューイングエリア) | Warranty area of touch panel's appearance<br>(タッチパネルの外観(傷・異物等)保証範囲) |
| | | By giving pressure between the active area and the viewing area of the touch panel, there is a possibility that the touch panel will operate.<br>(タッチパネルアクティブエリアとタッチパネルビューイングエリア間は荷重をかけた場合は、タッチパネルが動作する可能性があります。) |

| Material 材質 | Treatment 処理 | Approved | Checked | Checked | Drawn | Scale | Title | | Year-Month-Day | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| | | '10.07.15 | | '10.07.15 | 圓福 | 1:1(2:1, 5:1,NTS) | TCG043WQLBC | KYOCERA | '10.07.13 | 2 |
| Quantity 製作数 | Description; 備考 RoHS | 鶴崎 | | 今村 | | | T.P. Outline Dimensions | | Drawing No. 121A8031100 | 2/2 |

SPEC

| Spec No. | TQ3C-8EA00-E1DEK06-00 |
|---|---|
| Date | September 15, 2009 |

# TYPE : TCG043WQLBA-G00

< 4.3 inch WQVGA transmissive color TFT with LED backlight. >

## CONTENTS



Issued
Date: Sep 28, 2009
KYOCERA
Hayato LCD Division


KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
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 |
| Sep. 15, 2009 | Y. Ikeda | Y. Yamazaki | Y. Matsumoto | J. Sakaguchi | 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 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.

# Revision record

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

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

# 1. General Description

TCG043WQLBA-G00 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC, and a backlight unit. The following table described the features of TCG043WQLBA-G00

# 2. Features

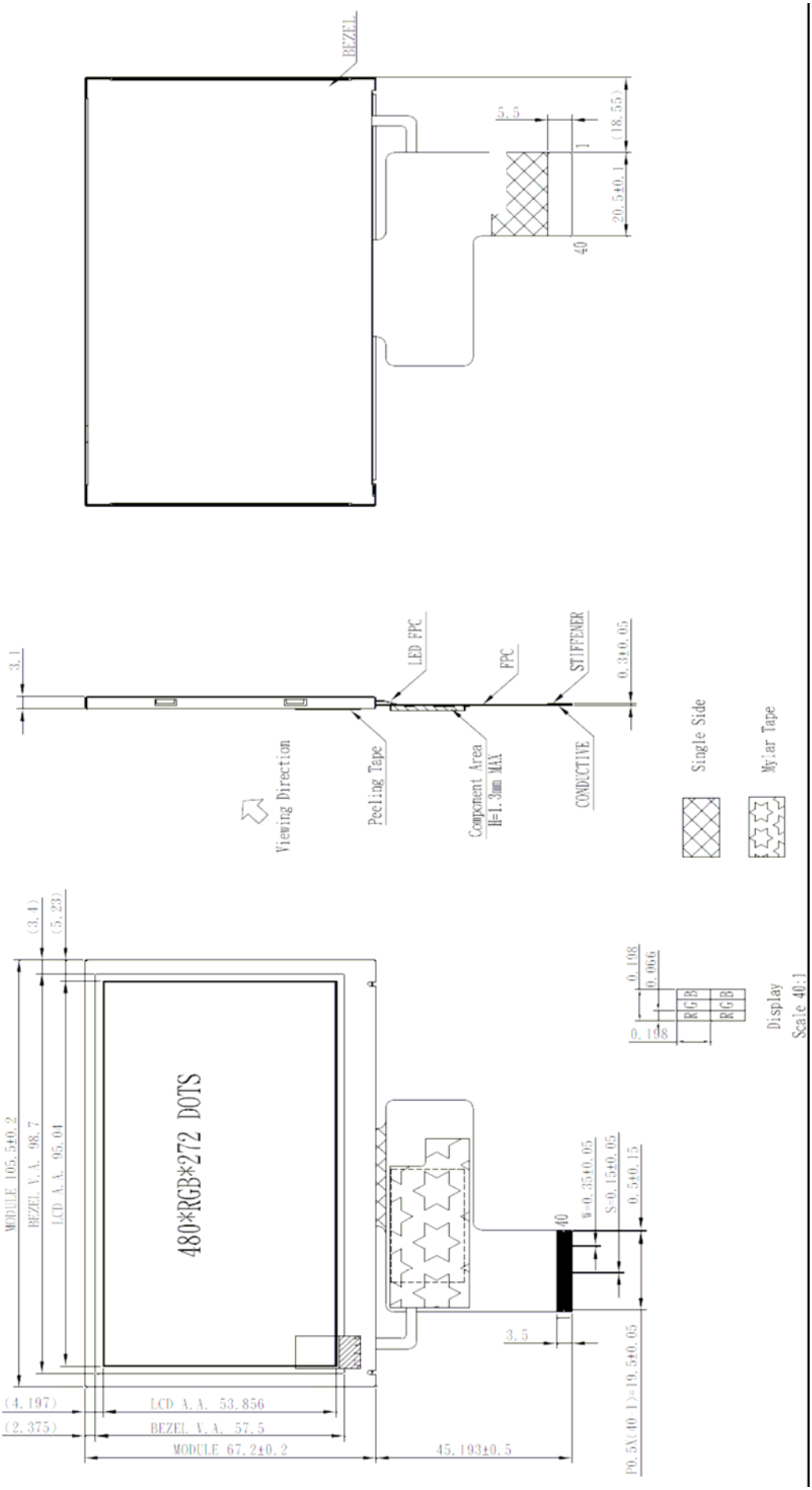
| | |
| --- | --- |
| Display Mode | Transmissive Type |
| | TFT LCD, Normally white |
| Display Format | RGB Strip type |
| Color | 16.7M color |
| Interface | RGB data bus, 24 bit parallel data |
| Viewing Direction | 6 O'clock |
| Backlight type / color | LED / White |

# 3. Mechanical specification

| Item | Specifications | Unit |
| --- | --- | --- |
| Display Size | 4.3 | Inch |
| Dimensional outline | 105.5(W) * 67.2(H) * 3.1(D)* | mm |
| Resolution | 480 * 3(R,G,B) * 272 | dot |
| Active area | 95.04(W) * 53.856(H) | mm |
| Pixel pitch | 0.198(W) * 0.198(H) | mm |
| Polarizer | Clear | |

* Exclude FPC

# 4. Mechanical dimension



## 5. Maximum ratings

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

| Item | Symbol | Values | | Unit | Condition |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Logic supply voltage | VDDIO | -0.5 | +5V | V | |
| Digital Input Voltage | $D_{in}$ | 0 | VDDIO | V | |
| Storage Temperature | $T_{ST}$ | -30 | 80 | ℃ | |
| Operating Temperature (Ambient Temperature) | $T_{OP}$ | -20 | 70 | ℃ | |
| Humidity | - | - | 90 | %RH | Note1 |

Note1: $T_A \leqq 40℃$ Without dewing

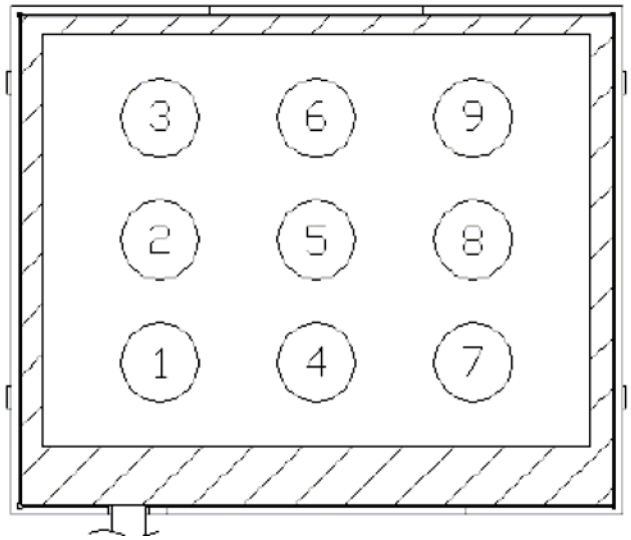
## 6. Electrical characteristics

| Item | | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Supply Voltage | | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Voltage | H level | $V_{IH}$ | 0.7*VDDIO | - | VDDIO | V | |
| | L Level | $V_{IL}$ | GND | - | 0.3VDDIO | V | |
| Output t Voltage | H level | $V_{OH}$ | VDDIO-0.4 | - | - | V | |
| | L Level | $V_{OL}$ | GND | - | GND+0.4 | V | |

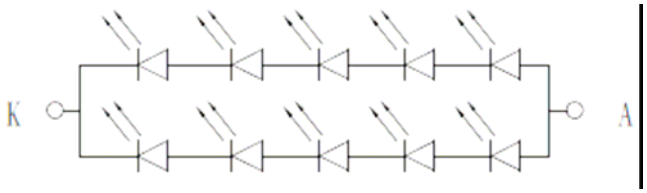
# 7. Backlight characteristics

| Item | Symbol | Values | | | Unit | Remark |
| --- | --- | --- | --- | --- | --- | --- |
| | | Min. | Typ. | Max. | | |
| Power Consumption | $P_{LED}$ | - | 660 | - | mW | |
| LED Current | $I_L$ | - | 40 | - | mA | |
| LED Voltage | $V_L$ | 15 | - | 18 | V | |

7.1.Lightguide Specification




a. Test Instrument:BM-7 (Distance =500mm; Field = 1°)
b. Light Source: LED * 10 (White)




c. Conditions: IF =40 mA, VLED (Typ.) = 16.5V
d. Measure Brightness: 1 ~ 9
e. Uniformity = (Min. Brightness / Max. Brightness)*100%
f. Uniformity ≧ 70%

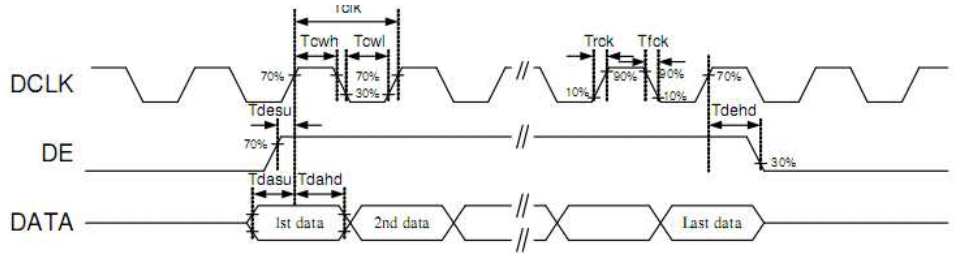
# 8. Module function description

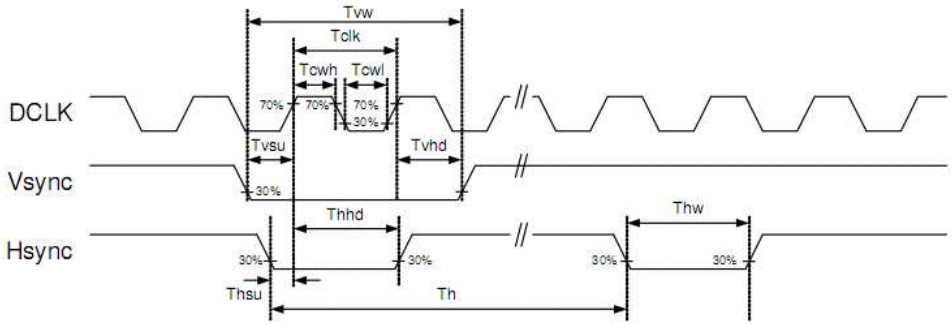
8.1.PIN Description

| Pin | Symbol | Description | Remark |
| --- | --- | --- | --- |
| 1 | VLED_ | Power for LED | |
| 2 | VLED+ | Power for LED | |
| 3 | GND | Power ground | |
| 4 | VDD | Power supply | |
| 5 | R0 | Red data(LSB) | |
| 6 | R1 | Red data | |
| 7 | R2 | Red data | |
| 8 | R3 | Red data | |
| 9 | R4 | Red data | |
| 10 | R5 | Red data | |
| 11 | R6 | Red data | |
| 12 | R7 | Red data(MSB) | |
| 13 | G0 | Green data(LSB) | |
| 14 | G1 | Green data | |
| 15 | G2 | Green data | |
| 16 | G3 | Green data | |
| 17 | G4 | Green data | |
| 18 | G5 | Green data | |
| 19 | G6 | Green data | |
| 20 | G7 | Green data(MSB) | |
| 21 | B0 | Blue data(LSB) | |
| 22 | B1 | Blue data | |
| 23 | B2 | Blue data | |
| 24 | B3 | Blue data | |
| 25 | B4 | Blue data | |
| 26 | B5 | Blue data | |
| 27 | B6 | Blue data | |
| 28 | B7 | Blue data(MSB) | |
| 29 | GND | Power ground | |
| 30 | PCLK | Pixel clock | |
| 31 | DISP | Display on/off | |
| 32 | HSYNC | Horizontal sync signal | |
| 33 | VSYNC | Vertical sync signal | |
| 34 | DE | Data enable | |
| 35 | NC | NC | |
| 36 | GND | Power ground | |
| 37 | NC | NC | |
| 38 | NC | NC | |
| 39 | NC | NC | |
| 40 | NC | NC | |

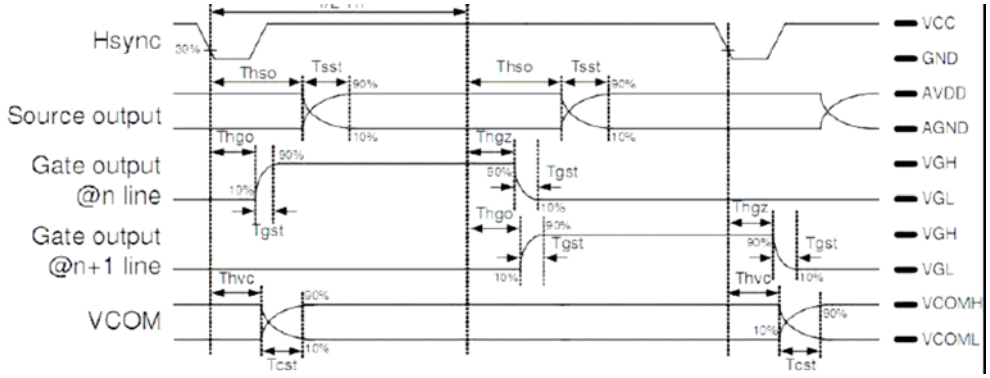
8.2.Timing characteristics

8.2.1. Clock and Data Input Timing Diagram

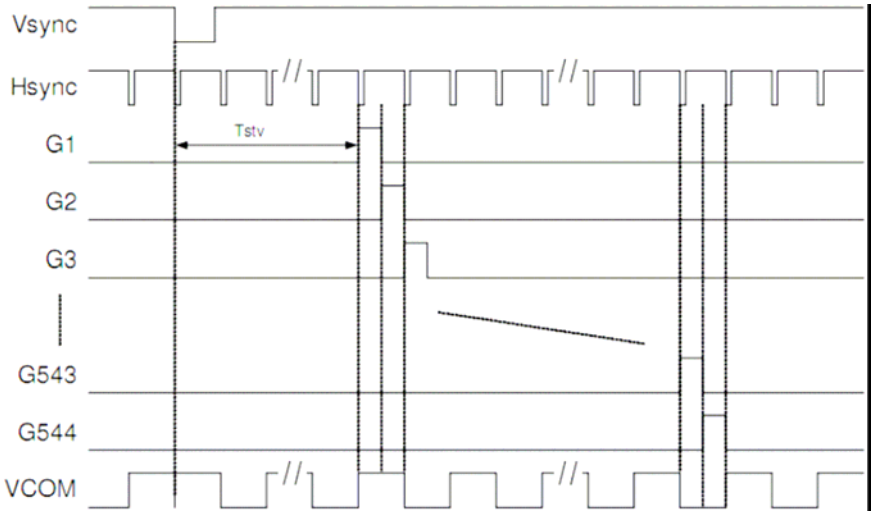



8.2.2. Output timing Diagram




8.2.3. Vertical Timing Diagram



8.2.4.DC Electrical Characteristics

(VDDIO=VDD=3.0 to 3.6V, GND=AGND=PGND=0V, TA= -20 to +85 °C)

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| **Digital Block Circuit** | | | | | | |
| Low Level Input Voltage | Vil | GND | - | 0.3xVDDIO | V | Digital input pins |
| High Level Input Voltage | Vih | 0.7xVDDIO | - | VDDIO | V | Digital input pins |
| Input Leakage Current | Ii | - | - | ±1 | uA | Digital input pins |
| Pull-high/low Impedance | Rin | - | 200K | - | ohm | Digital control input pins VDDIO=3.3V |
| High Level Output Voltage | Voh | VDDIO-0.4 | - | - | V | Digital output pins; Ioh=400uA |
| Low Level Output Voltage | Vol | GND | - | GND+0.4 | V | Digital output pins; Iol=-400uA |
| Digital Stand-by Current | Idst | - | 50 | 100 | uA | Output are High-Z, all pins are default. |
| Digital Operating Current | Icc | - | 2 | - | mA | DCLK=9MHz, Fld=17.28KHz (@ 24bit RGB mode), no load |
| **Analog Block Circuit** | | | | | | |
| Analog Supply Voltage | AVDD | - | 5.0 | - | V | |
| Positive power Supply | VGH | 11.5 | 15 | 15.5 | V | By VGH_SEL[2:0] setting |
| Negative power Supply | VGL | -10.5 | -10 | -6.5 | V | By VGL_SEL[2:0] setting |
| VCOMH Output Level | VCOMH | 2.5 | - | 5 | V | By VCOM_H[7:0] setting |
| VCOML Output Level | VCOML | -3 | - | -0.46 | V | By VCOM_L[6:0] setting |
| Feed back voltage for PWM | VFB | 0.25 | 0.6 | 0.8 | V | DC-DC operating. |
| Base drive current for PWM | IDRV | - | 20 | - | mA | VDD=3.3V |
| Voltage Deviation of Outputs | Vvd | - | ±20 | ±35 | mV | Vo=0.1V ~ 0.5V & AVDD-0.5 ~ AVDD-0.1 |
| | | - | ±15 | ±20 | mV | Vo=0.5V ~ AVDD-0.5V |
| Dynamic Range of Ouput | Vdr | 0.1 | - | AVDD-0.1 | V | S1 to S720 |
| Low-level Output Current of VCOM | IOLC | - | -18 | - | mA | VCOMH=4V, VCOML=-1V VCOM output=-1V V.S. -0.1V |
| High-level Output Current of VCOM | IOHC | - | 18 | - | mA | VCOMH=4V, VCOML=-1V VCOM output=4V V.S. 3.1V |
| Source Low-level Output Current | IOLS | - | -100 | - | uA | S1 to S720; VO=0.1 V.S. 1V |
| Source High-level Output Current | IOHS | - | 100 | - | uA | S1 to S720; VO=4.9 V.S 4.0 |
| Gate Low-level Output Current | IOLG | - | -250 | - | uA | G1 to G544; VO=VGL V.S. VGL+0.5 |
| Gate High-level Output Current | IOHG | - | 250 | - | uA | G1 to G544; VO=VGH V.S. VGH-0.5 |
| Analog Stand-by Current | Iast | - | - | 100 | uA | STB="L", all function are shutdown |
| Analog Operating Current | IDD | - | 8 | - | mA | DCLK=9MHz, Fld=17.28KHz (@ 24bit RGB mode), No load |

8.2.5.AC Electrical Characteristics

(VDDIO=VDD=3.0 to 3.6V, GND=0V, TA=-20 to +85 °C)

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| **system operation timing** | | | | | | |
| VCC power source slew time | TPOR | - | - | 20 | ms | From 0V to 99% VCC |
| GRB pulse width | tRSTW | 10 | 50 | - | us | R=10Kohm, C=1uF |
| **Input Output timing** | | | | | | |
| DCLK clock time | Tclk | 33.3 | - | - | ns | DCLK=30MHz |
| Clock rising time | Trck | 9 | - | - | ns | |
| Clock falling time | Tfck | 9 | - | - | ns | |
| HSD width | Thwh | 1 | - | - | DCLK | |
| HSD period time | Th | 55 | 60 | 65 | us | |
| HSD setup time | Thst | 12 | - | - | ns | |
| HSD hold time | Thhd | 12 | - | - | ns | |
| VSD width | Tvwh | 1 | - | - | Th | |
| VSD setup time | Tvst | 12 | - | - | ns | |
| VSD hold time | Tvhd | 12 | - | - | ns | |
| Data setup time | Tdsu | 12 | - | - | ns | |
| Data hold time | Tdhd | 12 | - | - | ns | |
| DE setup time | Tdesu | 12 | - | - | ns | |
| DE hold time | Tdehd | 12 | - | - | ns | |
| Source output setting time | Tst | - | 10 | 12 | us | 10% to 90%<br>CL=60pF, RL=2Kohm |
| Gate output setting time | Tgst | - | 500 | 1000 | ns | 10% to 90%, CL=60pF |
| VCOM output setting time | Tcst | - | - | 12 | us | 10% to 90%,<br>CL=40nF, RL=50ohm |
| Time from VSD to 1st line data input | Tvs | 3 | 8 | 31 | Th | HV mode<br>By HDL[4:0] setting |
| **3-wire serial communication AC timing** | | | | | | |
| Serial clock | Tsck | 200 | - | - | ns | |
| SCL pulse duty | Tscdut | 40 | 50 | 60 | % | |
| | | | | | | |
| Serial data hold time | Tihd | 50 | - | - | ns | |
| Serial clock high/low | Tssw | 50 | - | - | ns | |
| CSB distinguish time | Tcd | 400 | - | - | ns | |
| CSB to VSD | Tcv | 1 | - | - | us | |
| CSB input setup time | Tcsu | 50 | - | - | ns | |
| CSB input hold time | Tchd | 50 | - | - | ns | |

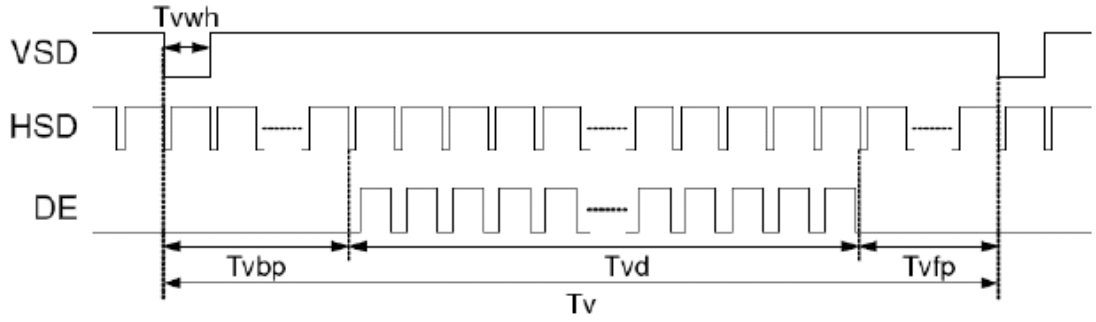
8.2.6. Output timing Table

**Parallel RGB Mode**

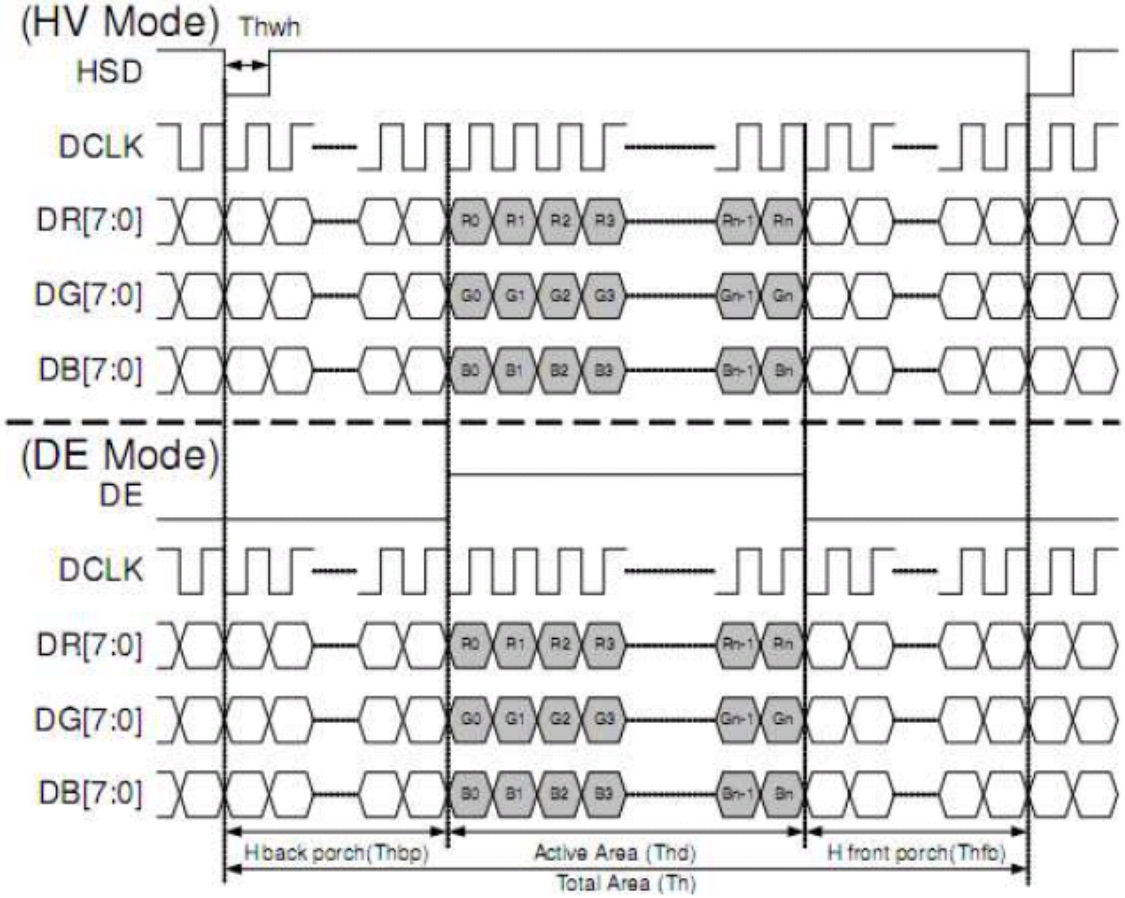
| Parameters | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| DCLK frequency | Fdk | 5 | 9 | 12 | MHz | |
| DCLK cycle time | Tdk | 83 | 110 | 200 | ns | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |
| Time from HSD to source output | Thso | - | 13 | - | DCLK | |
| Time from HSD to gate output | Thgo | - | 27 | - | DCLK | |
| Time from HSD to gate output off | Thgz | - | 3 | - | DCLK | |
| Time from HSD to VCOM | Thvc | - | 12 | - | DCLK | |

8.2.7.Data Input format

**Vertical input timing**




Parallel RGB Mode Data format




**Parallel RGB input timing table**

| Parameter | Symbol | Value | | | Unit |
| --- | --- | --- | --- | --- | --- |
| | | Min. | Typ. | Max. | |
| DCLK frequency | fclk | 5 | 9 | 12 | MHz |
| VSD period time | Tv | 277 | 288 | 400 | H |
| VSD display area | Tvd | | 272 | | H |
| VSD back porch | Tvb | 3 | 8 | 31 | H |
| VSD front porch | Tvfp | 2 | 8 | 93 | H |
| HSD period time | Th | 520 | 525 | 800 | DCLK |
| HSD display area | Thd | | 480 | | DCLK |
| HSD back porch | Thbp | 36 | 40 | 255 | DCLK |
| HSD front porch | Thfp | 4 | 5 | 65 | DCLK |

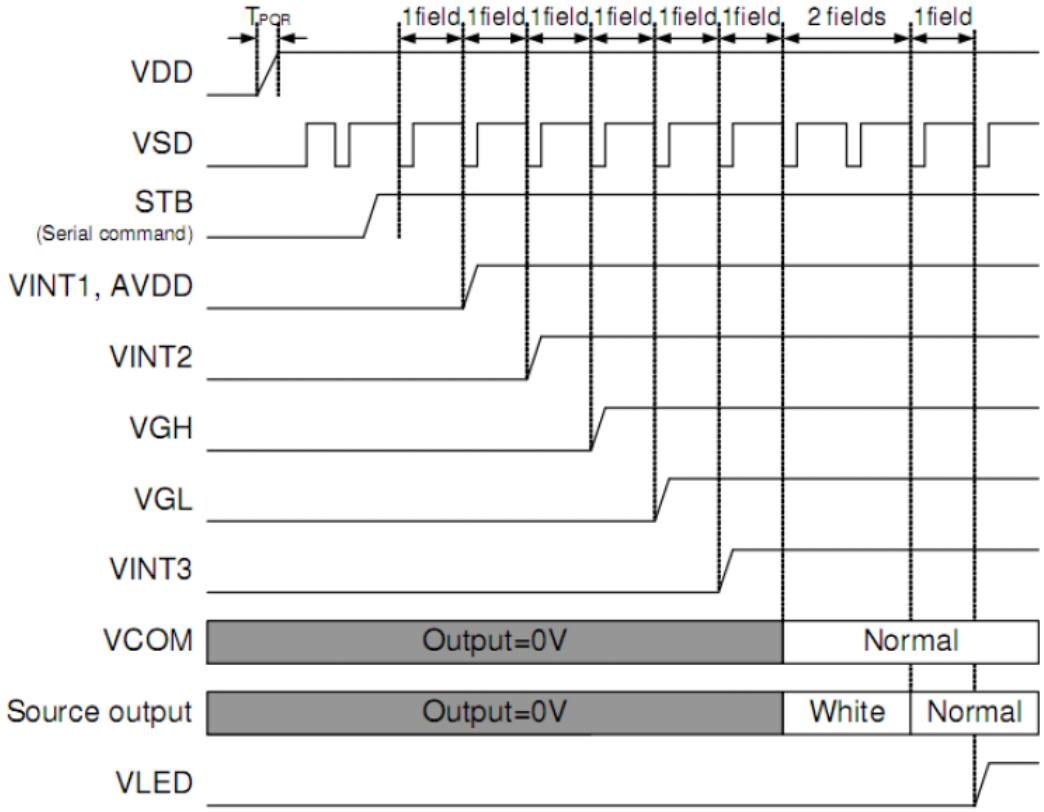
8.3. Functional Descriptions

Global Reset Time ( RGB…..pin control )

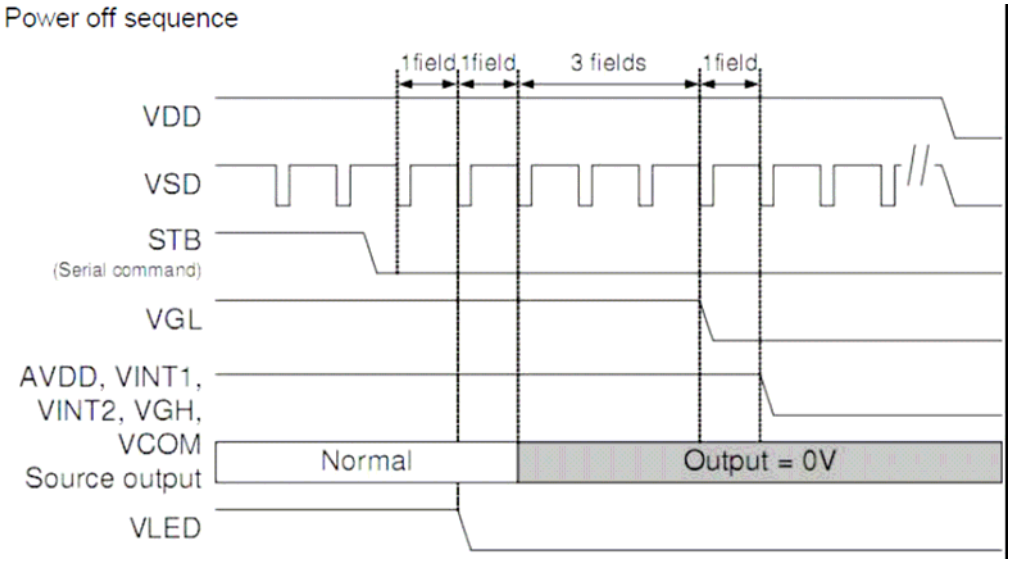

Power on/off sequence:

This IC a high-voltage LCD driver, so it may be damaged by a large current flow if incorrect power sequence is used. Connecting the drive powers, after the logical powe VCC, is the recommended sequence. When shutting off the power, shut off the drive power and then the logic system or turn off all power simultaneously.

Power on sequence




Power off sequence



# 9. Electro-optical characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Brightness | | — | — | — | 400 | — | $cd/m^2$ | — |
| Response time | | $T_R+T_F$ | $\theta=0$ | — | 25 | — | ms | Note 2 |
| Contrast ratio | | CR | At the center point of A.A. | — | 350 | — | — | Note 3 |
| Color Chromaticity | White | $W_x$ | $\theta=0$ | 0.273 | 0.313 | 0.353 | — | Note 4 |
| | | $W_y$ | | 0.289 | 0.329 | 0.369 | | |
| Viewing Angle | $\phi_H$ | 12 | CR≧10 | — | 60 | — | Degree | Note 5 |
| | $\theta_R$ | 3 | | — | 70 | — | | |
| | $\phi_L$ | 6 | | — | 65 | — | | |
| | $\theta_L$ | 9 | | — | 70 | — | | |

Ta＝25±2℃

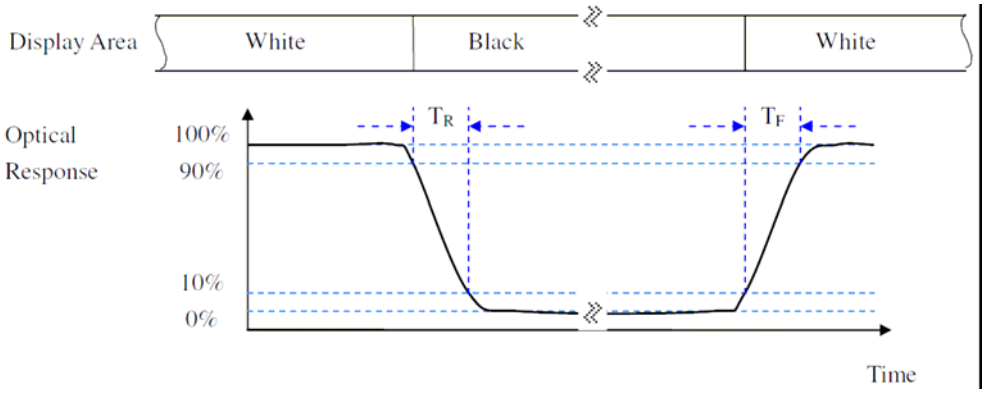
Note:

1.Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A with a viewing angle of 1° at a distance of 50cm and normal direction.

2.Definition of response time: $T_R$ and $T_F$

The figure below is the output signal of the photo detector.



3. Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

White $V_i=V_{i50\%}\pm1.5V$

Black $V_i=V_{i50\%}\mp2.0V$

”±” means that the analog input signal swings in phase with VCOM signal.

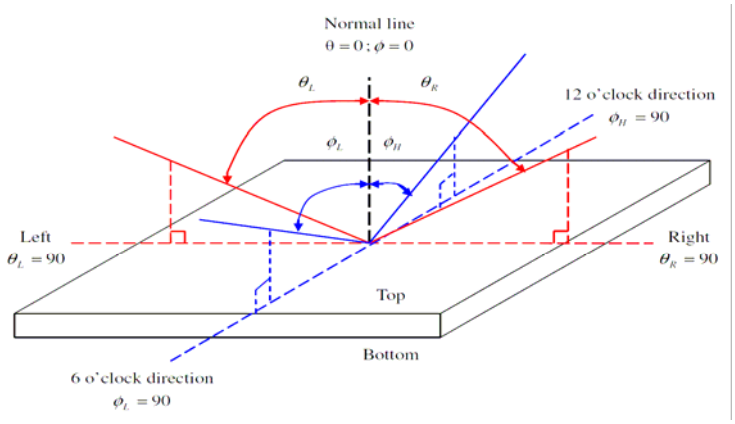
”∓” means that the analog input signal swings out of phase with VCOM signal.

Vi50%: The analog input voltage when transmission is 50%.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

4.Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

5. Definition of viewing angle



# 10. Reliability

10.1. MTTF

The LCD module shall be designed to meet a minimum MTTF value of 50,000 hours with normal condition. (25°C in the room without su nlight; not include life time of backlight)

10.2. TESTS

| NO. | ITEM | CONDITION | CRITERION |
|---|---|---|---|
| 1 | High Temperature Operating | 70℃ 240 hrs | ◦ No Defect Of Operational Function In Room Temperature Are Allowable(23±5℃). |
| 2 | Low Temperature Operating | -20℃ 240 hrs | |
| 3 | High Temperature/ Humidity Non-Operating | 60℃ ,90%RH ,240 hrs | |
| 4 | High Temperature Non-Operating | 80℃ 240 hrs | |
| 5 | Low Temperature Non-Operating | -30℃ 240 hrs | |
| 6 | Temperature Shock Non-Operating | -30℃ ◄——► 80℃ (30min) (5min) (30min) 100 CYCLES | |
| 7 | Electro-static Discharge | HBM : ±2kv | |

Note:

1: Test after 24 hours in room temperature.

2: The sampling above is individually for each reliability testing condition.

3: The color fading of polarizing filter should not care.

4: All of the reliability testing chamber above, is using D.I. water.(Min value:1.0 MΩ-cm)

5: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

10.3.Color Performance

| No. | ITEM | Criterion (initial) |
|---|---|---|
| 1 | Luminance | >50% |
| 2 | NTSC | >70% |
| 3 | Contrast Ratio | >50% |

# 11. Lot number identification

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

TCG043WQLBA-G00 - □□ - □□ - □ 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 (TBD)

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Code | 9 | 0 | 1 | 2 | 3 | 4 |

| 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 |

# 12. Warranty

12.1.Incoming inspection

Please inspect the LCD within one month after your receipt.

12.2.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.

# 13.RoHS compliant warranty

RoHs Hazardous substances including:

- Cd< 100 ppm
- Pb< 1000 ppm
- Hg< 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

# 14. Precautions for use

14.1.Safety

(1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
(2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

14.2.Storage Conditions

(1) Store the panel or module in a dark place where the temperature is 23±5°C and the humidity is below 50±20%RH.
(2) Store in anti-static electricity container.
(3) Store in clean environment, free from dust, active gas, and solvent.
(4) Do not place the module near organics solvents or corrosive gases.
(5) Do not crush, shake, or jolt the module.
(6) Do not exposed to direct sun light of fluorescent lamps

14.3.Installing LCD Module

Attend to the following items when installing the LCM.
(1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

14.4.Precautions For Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.
(2) Driving the LCD in the voltage above the limit will shorten its lifetime.
(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
(4) When turning the power on, input each signal after the positive/negative voltage becomes stable.
(5) Do not apply water or any liquid on product which composed of T/P.

14.5.Handling Precautions

(1) Avoid static electricity which can damage the CMOS LSI; please wear the wrist strap when handling.
(2) The polarizing plate of the display is very fragile. so, please handle it very carefully.
(3) Do not give external shock.
(4) Do not apply excessive force on the surface; it may cause display abnormal .
(5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
(7) Do not operate it above the absolute maximum rating.
(8) Do not remove the panel or frame from the module.
(9) Do not apply water or any liquid on product, which composed of T/P.

SPEC

| Spec No. | TQ3C-8EA00-E1BYF04-00 |
|---|---|
| Date | July 01, 2010 |

# TYPE : KTP043AGAB-C00

< Touch panel>

## CONTENTS



Issued
Date: Jul 9, 2010
KYOCERA
Hayato LCD Division


KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
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 |
| July 01, 2010 | Y.Ikeda | T.Ondera | M.Fujitani | I.Hamada | |

# Warning

1. This Kyocera touch panel 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 touch panel 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 touch panels in applications.

# Caution

1. Kyocera shall have the right, which Customer hereby acknowledges, to immediately scrap or destroy tooling for Kyocera touch panels 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 KTP043AGAB-C00. (RoHS Compliant)

# 2. Construction and outline

Touch panel : Analog type(Glass/Glass)
Surface film : Glare Anti-finger print treatment

# 3. Mechanical specifications

3-1. Mechanical specifications of touch panel

| Item | | Specification | Unit |
|---|---|---|---|
| Outline dimensions 1) | | 103.5(W)×64.2(H)×1.44(D) | mm |
| Active area | | 96.1(W)×54.9(H) | mm |
| Viewing area | | 97.1(W)×55.9(H) | mm |
| Mass | | TBD | g |
| Input | | Radius-0.8 stylus or Finger | - |
| Actuation Force | | 0.1～2.0 | N |
| Operating life | Striking(Finger-input) 2) | TBD | hits |
| | Sliding(Stylus–input) 3) | TBD | characters |
| Transmittance | | Typ.80(at full wavelength) | % |
| Reflectance | | Typ.15(550nm) | % |
| Surface hardness | | 3H or more(Pencil hardness) | - |

1) Please refer to outline drawing for details.
2) Striking test condition
Testing rod : Silicon rubber (Hardness:60°),Tip : R = 4.0,
Testing location : In active area
Input voltage : DC5V
Load : 2.94N
Cycle : 5hits/sec
Judgment : No defect in function
: No appearance defect which causes trouble to use.
*Dents, blurs and marks on surface film : neglected
3) Sliding test condition
Testing rod : Polyacetal resin, Tip : R = 0.8
Testing location : In active area
Input voltage : DC5V
Load : 2.45N
Input length : 10mm
Input speed : 50mm/sec
Sliding times : 10mm sliding (back and forth) counts as 2 times.
Judgment : No defect in function
: No appearance defect which causes trouble to use.
*Dents, blurs and marks on surface film : neglected

# 4. Absolute maximum ratings

4-1. Electrical absolute maximum ratings

| Item | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Supply voltage for touch panel | $V_{TP}$ | 0 | 6.0 | V |
| Input current of touch panel | $I_{TP}$ | 0 | 0.5 | mA |

4-2. Environmental absolute maximum ratings

| Item | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Operating temperature | $T_{OP}$ | -30 | 85 | °C |
| Storage temperature | $T_{STO}$ | -40 | 95 | °C |
| Operating humidity 1) | $H_{OP}$ | 10 | 2) | %RH |
| Storage humidity 1) | $H_{STO}$ | 10 | 2) | %RH |
| Vibration | - | 3) | 3) | - |
| Shock | - | 4) | 4) | - |

1) Non-condensing.

2) Temp.≦40°C, 85%RH Max.
Temp.＞40°C, Absolute humidity shall be less than 85%RH at 40°C.

3) The touch panel is installed on the LCD using two sided tape.

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

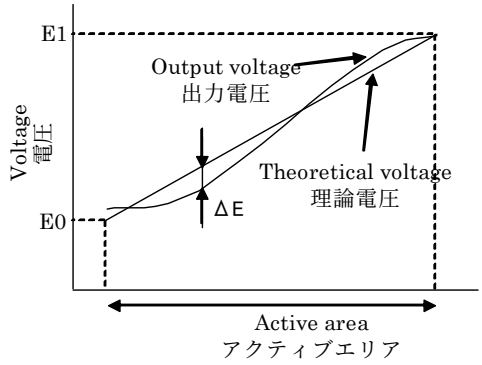
4) The touch panel is installed on the LCD using two sided tape.
Acceleration: 490 m/s², Pulse width: 11 ms
3 times in each direction: ±X, ±Y, ±Z
EIAJ ED-2531

## 5. Electrical characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Supply voltage for touch panel | | $V_{TP}$ | - | - | 5.0 | - | V |
| Terminal resistance | 1) | xL-xR | - | (TBD) | - | (TBD) | Ω |
| | | yU-yL | - | (TBD) | - | (TBD) | Ω |
| Linearity | 2) | - | - | less than ±2.5 | | | % |
| Insulation resistance | 3) | - | DC25V | 50 | - | - | MΩ |
| Chattering | 4) | - | at ON/OFF | less than 10 | | | ms |

1) Resistance between terminal xL and xR, or between yU and yL.

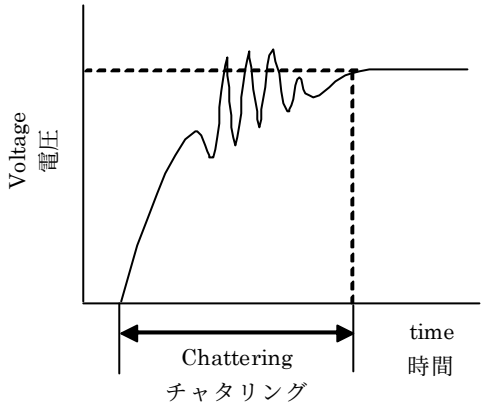
2) Apply 5VDC to the terminal xL-xR, and measure the output voltage at terminal y when a random input is applied in the active area. Measure the difference between the output and theoretical voltages. (Measure the actual voltage at the terminal using the same method.)




$$\text{Linearity リニアリティ}\ (\%) = \frac{\Delta\,\text{Emax}}{\text{E1-E0}}$$

3) Resistance between the upper and lower terminals.

4) Apply 5VDC to the terminal xL-xR, and measure the oscillation at terminal y when applying a random input in the active area. (Measure the oscillation at terminal x using the same method.)



## 6. Interface signals

| No. | Symbol | Description |
| --- | --- | --- |
| 1 | xR | x-Right terminal |
| 2 | yL | y-Lower terminal |
| 3 | xL | x-Left terminal |
| 4 | yU | y-Upper terminal |

Touch panel side connector : 1mm pitch
Recommended matching connector : Series 9616 (IRISO)
: Series 9610 (IRISO)
: Series FMS (JST)

## 7. Design guidance for analog touch panel

7-1 Electrical (In customer's design, please remember the following considerations.)

1) Do not use the current regulated circuit.
2) Keep the current limit with top and bottom layer. (Please refer to “Electrical absolute maximum ratings” for details.)
3) Analog touch panel can not sense two points touching separately.
4) A contact resistance is appeared at the touch point between top and bottom layer. After this resistance has stable read of the touch panel position data.
5) Because noise of inverter or peripheral circuits may interfere signal of touch panel itself it is necessary to design carefully in advance to avoid these noise problem.

7-2 Software

1) Do the "User Calibration".
2) "User Calibration" may be needed with long term using. Include "User Calibration" menu in your software.
3) When drawing a line with a stylus, there may be a slight discontinuity when the stylus passes over a spacer-dot. If necessary, please provide a compensation feature within your software.

7-3 Mounting on display and housing bezel

1) Do not use an adhesive tape to bond it on the front of touch panel and hang it to the housing bezel.
2) This touch panel has an airtight but not watertight structure. Please not to use it for the applications requiring watertight or under the environments occurred condensation. If it is expected to be exposed to the environments that vapor, moisture or other liquids may seep inside a bezel, please be sure to take some measurements for drip-proof or waterproof by using sealing materials on the bezel.
3) Please mount the touch panel so that it is flat. An optical interference pattern (Newton ring) may be observed if the touch panel is installed on a bent or twisted LCD surface or if it is bent or twisted after installation.
4) Please mount the touch panel so that it does not move or slide relative to the LCD, even when vibration or shock is applied and even when high humidity or high temperature may weaken the mounting adhesive.

# 8. Lot number identification

The lot number shall be indicated on the FPC tale.

KTP043AGAB-C00 - □□□□□□□□□ □□□

↓ ↓

1 2

No1. – No2. above indicate
1. Lot No. 9 digits
2. Serial 3 digits

# 9. Warranty

9-1. Incoming inspection

Please inspect the touch panel within one month after your receipt.

9-2. Production warranty

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

# 10. Precautions for use

10-1. Usage

1) DO NOT store in a high humidity environment for extended periods. Surface film degradation bubbles, and/or peeling off of the surface film may result.
2) Do not push or rub the touch panel's surface with hard to sharp objects such as knives, or the touch panel may be scratched.
3) When the touch panel is dirty, gently wipe the surface with a soft cloth, sometimes moistened by mild detergent or alcohol. If a hazardous chemical is dropped on the touch panel by mistake, wipe it off right away to prevent human contact.
4) Always keep the touch panel free from condensation during testing. Condensation may permanently spot or stain the surface film.
5) Do not pull the touch panel FPC and do not bend the root of the wires. Housing should be designed to protect touch panel FPC from external stress.
6) This Kyocera touch panel 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 touch panel is supposed to be used in a special environment, evaluate the touch panel thoroughly beforehand and do not expose the touch panel to chemicals such as an active gas.
7) The touch panel is made of glass. It may break when dropped, or vibrated excessively. Usually there is a film on the surface of the glass which would prevent broken glass from scattering, but nevertheless handle it carefully during assembly and treat it gently during use.
8) Touch panel edges are sharp, so they have a possibility of cutting your body, for example your finger. Handle the touch panel with enough care to prevent cuts. When you hold the touch panel, put on the protector, for example the gloves which have a strength enough to stand sharpness of touch panel edges.

10-2. Installation of the touch panel

1) The touch panel shall be installed flat, without twisting or bending.
2) Please design the housing window so that its edges are between the active area and the effective area of the touch screen. Must maintain a gap between inside of bezel and touch panel to avoid malfunction or electrode damage of touch panel.
3) A transparent protection sheet is attached to the touch panel. Please remove the protection film slowly before use, paying attention to static electricity.
4) Do not scratch, or put any stress outside the active area of the touch panel when you install it on to an LCD, or it may damage the ITO pattern of the touch panel.

10-3. Operation

1) The touch panel shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
2) Do not use the touch panel in environments conducive to the formation of condensation.

10-4. Storage

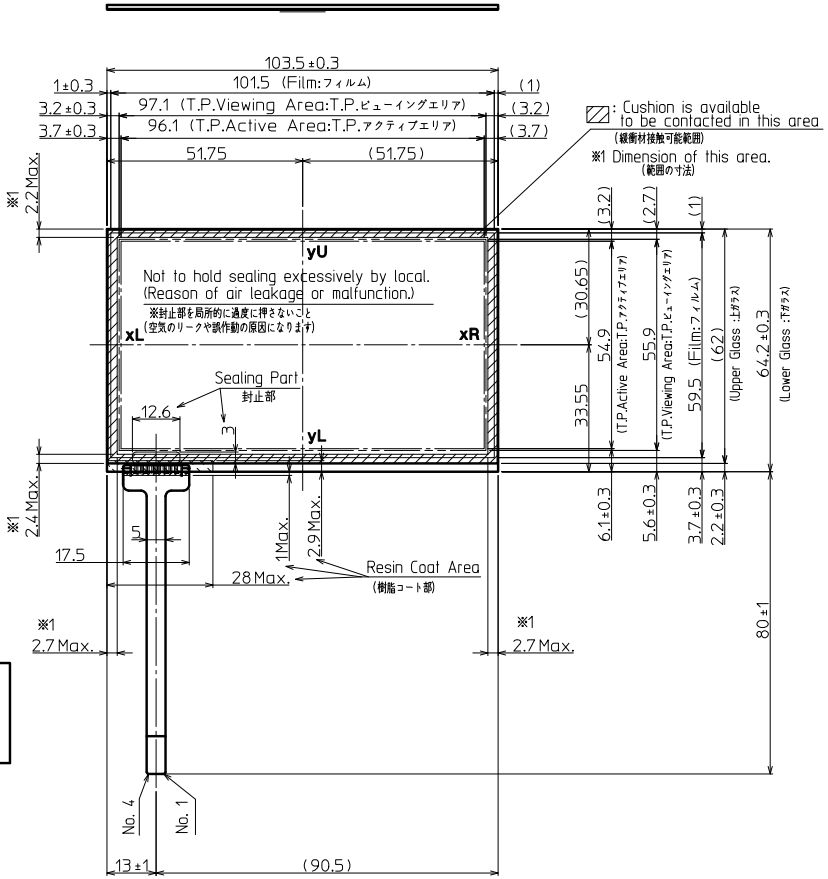
1) The touch panel shall be stored within the temperature and humidity limits specified. Store in a dark area, and protect the touch panel from direct sunlight or fluorescent light.
2) Always store the touch panel so that it is free from external pressure onto it. This will prevent the formation of Newton rings.

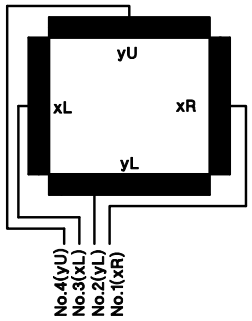
## 11. Reliability test data

| Test item | Test condition | Test time | Judgement |
|---|---|---|---|
| High temp. atmosphere | 95°C | 240h | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect |
| Low temp. atmosphere | -40°C | 240h | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect |
| High temp. humidity atmosphere | 40°C 90% RH | 240h | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect |
| Temp. cycle | -40°C 0.5h<br>R.T. 0.5h<br>95°C 0.5h | 10cycles | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect |
| High temp. operation | 85°C | 500h | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect |
| Point Activation 1) | Silicon rubber,<br>Tip : R = 4.0<br>Hardness 60°<br>Hitting force 2.94N<br>Hitting speed 5 time/s | TBD | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect<br>No appearance defect which affects touch panel function. 2) |
| Sliding 1) | Polyacetal resin,<br>Tip : R = 0.8<br>Load 2.45N<br>Input length 10mm<br>Input speed 50mm/s | TBD 3) | Touch panel function : No defect<br>Terminal resistance : No defect<br>Linearity : No defect<br>Actuation Force : No defect<br>No appearance defect which affects touch panel function. 2) |

1) Test in active area.
2) Dents, blurs and marks on surface film: neglected.
3) 10mm sliding (back and forth) counts as 2 times.
4) Each test item uses a test touch panel only once. The tested touch panel is not used in any other tests.
5) The touch panel is tested in circumstances in which there is no condensation.
6) Temp. cycle test (Heat shock included): the LCD shall be tested after leaving it stabilize at room temperature for 2 hours after the last cycle.
7) An operational test was performed after the following conditions. First, the touch panel was left for a certain time under 5V voltages applied (without touch), Then it was left at room temperature (No VDC applied) for 2 hours.
8) The reliability test is not an out-going inspection.
9) The result of the reliability test is for your reference purpose only. The reliability test is conducted only to examine the touch panel's capability.

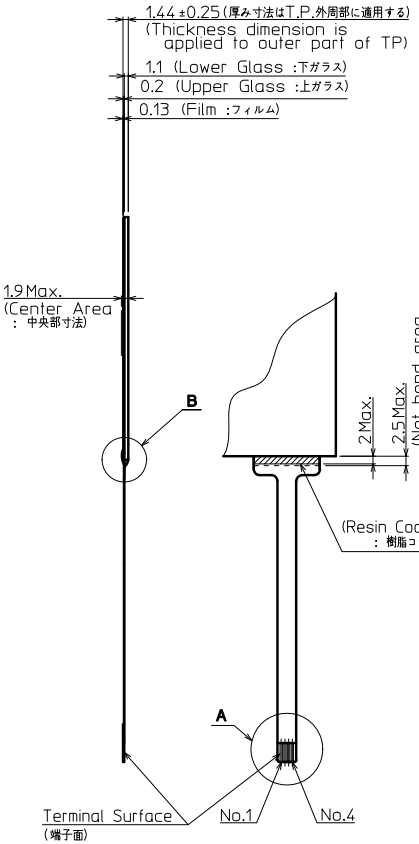
| No | Description | Drawn | Checked | Checked | Approved |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

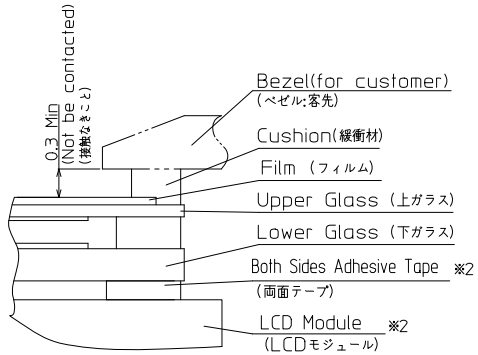



**Touch Panel Pin-assign**

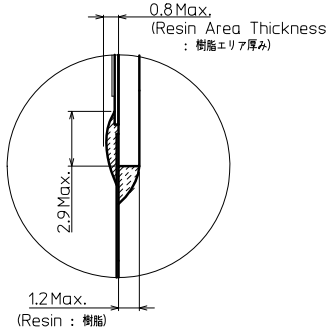
(Pin-assign from Touch side)
(タッチパネル ピンアサイン、
タッチ面側からのピンアサイン)



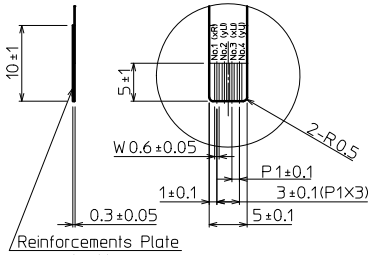




**(NTS)**

Precaution in use of touch panel.
(タッチパネル使用上の注意事項)
※2 In case of assemble to the LCD
(LCDに取りつける場合)
1. Fix touch panel at LCD module and the rear side of touch panel.
(タッチパネルの固定はLCDモジュール側とタッチパネル裏面とで行なうこと)
2. Must maintain a gap between inside of bezel and touch panel to avoid malfunction or electrode damage of touch panel.
(ベゼル内側とタッチパネルの接触厳禁。誤動作や電極破損の原因となります。)
3. Tolerance without indication: ±0.5
(指示無き公差)




**DETAIL B (5:1)**




**DETAIL A 2:1**

Note. (注記)

| | Name (名称) | Explanation (説明) |
|---|---|---|
| 1 | T.P. | Touch panel<br>(タッチパネル) |
| 2 | T.P. Active Area<br>(T.P.アクティブエリア) | Operating area of touch panel<br>(タッチパネルの動作範囲) |
| 3 | T.P. Viewing Area<br>(T.P.ビューイングエリア) | Warranty area of touch panel's appearance<br>(タッチパネルの外観(傷・異物等)保証範囲) |
| | | By giving pressure between the active area and the viewing area of the touch panel, there is a possibility that the touch panel will operate.<br>(タッチパネルアクティブエリアとタッチパネルビューイングエリア間は荷重をかけた場合は、タッチパネルが動作する可能性があります。) |

| Material 材質 | Treatment 処理 | Approved '10.06.09 今村 | Checked | Checked '10.06.09 鶴崎 | Drawn 木口 | Scale 1:1(2:1, 5:1,NTS) | Title KTP043AGAB T.P. Outline Dimensions | KYOCERA | Year-Month-Day '10.06.08 | Size 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Quantity 製作数 | Description; 備考 RoHS | | | | | | Drawing No. 121A8028200 | | | |

| Spec No. | TQ3C-8EA00-E2BYF04-00 |
|---|---|
| Date | July 01, 2010 |

# KYOCERA INSPECTION STANDARD

## TYPE : KTP043AGAB-C00

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

| Original Issue Date | Designed by : Engineering dept. | | | Confirmed by : QA dept. | |
|---|---|---|---|---|---|
| | Prepared | Checked | Approved | Checked | Approved |
| July 01, 2010 | Y.Ikeda | T.Ondera | M.Fujitani | I.Hamada | |

# Revision record

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

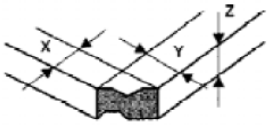
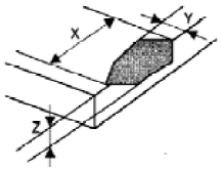
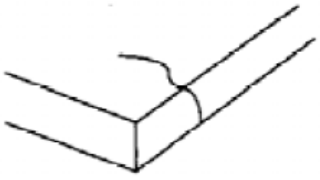
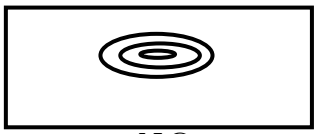
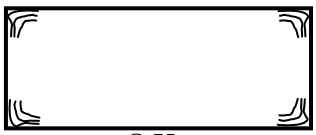
| Rev.No. | Date | Page | Descriptions |
|---|---|---|---|
| | | | |

# Visuals specification

1) Note

| | Note | | |
|---|---|---|---|
| General | 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 | | |
| Definition of inspection item | Touch Panel (Scratch , Foreign particle) | | Describes scratches on the glass and film and foreign particles between glass/glass or glass/film. |

2) Standard

<table>
<tr><th>Inspection item</th><th>Judgement standard</th></tr>
<tr><td>Scratch,<br>Foreign particle<br>(Touch screen portion)</td><td>
( W = Width, L = Length, D = Diameter = (major axis＋minor axis)/ 2)
<table>
<tr><th>Item</th><th>Width(mm)</th><th>Length(mm)</th><th>Acceptable number</th></tr>
<tr><td rowspan="4">Scratch</td><td>W ≦ 0.03</td><td>L ≦ 20</td><td>Neglected</td></tr>
<tr><td>0.03 ＜ W ≦ 0.05</td><td>L ≦ 10</td><td>2pces within ϕ20mm</td></tr>
<tr><td>0.05 ＜ W ≦ 0.08</td><td>L ≦ 6</td><td>2pces within ϕ20mm</td></tr>
<tr><td>0.08 ＜ W ≦ 0.1</td><td>L ≦ 4</td><td>1pces within φ30mm</td></tr>
<tr><td rowspan="2">Foreign<br>(line like)</td><td>W ≦ 0.05</td><td>Neglected</td><td>Neglected</td></tr>
<tr><td>0.05 ＜ W ≦ 0.1</td><td>L ≦ 5</td><td>2pces within ϕ30mm</td></tr>
<tr><td rowspan="2">Foreign<br>(circle like)</td><td colspan="2">D ≦ 0.2</td><td>Neglected</td></tr>
<tr><td colspan="2">0.2 ＜ D ≦ 0.3</td><td>2pces within ϕ30mm</td></tr>
</table>
Above are applied to the visible area.<br>
Unless there are foreign particle and damage affected seriously to the electrical performance out of the active area, we approve of this product.
</td></tr>
<tr><td>Glass crack<br>(Touch screen portion)</td><td>
<table>
<tr><th>Item</th><th colspan="3">Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>Conner crack</td><td rowspan="3">  </td><td>X</td><td>≦3</td><td rowspan="3">2 pcs<br>/panel</td></tr>
<tr><td>Y</td><td>≦3</td></tr>
<tr><td>Z</td><td>＜t</td></tr>
<tr><td>Crack in other area than in corner</td><td rowspan="3">  </td><td>X</td><td>≦5</td><td rowspan="3">2 pcs<br>/side</td></tr>
<tr><td>Y</td><td>≦1.5</td></tr>
<tr><td>Z</td><td>＜t</td></tr>
<tr><td>Progressive crack</td><td colspan="3">  </td><td>0 pcs<br>(NG even 1pcs)</td></tr>
</table>
Above are applied to the visible area.<br>
Unless there are foreign particle and damage affected seriously to the electrical performance out of the active area, we approve of this product.
</td></tr>
<tr><td>Newton’s ring</td><td>
All Newton Rings in the center of the screen must be rejected.<br>
Border around the screen are permitted.<br>
 <br>
N G<br>
 <br>
O K
</td></tr>
</table>