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# SPEC

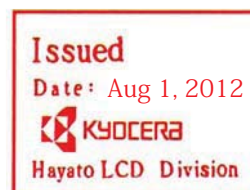
Spec No.	TQ3C-8EAF0-E1DFF41-00
Date	July 23, 2012

## TYPE : TCG043WQLBAAFA-GA00

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

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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
July 23, 2012	<i>H. Mori</i>	<i>Y. Yamazaki</i>	<i>M. Fujitani</i>	<i>T. Shikama</i>	<i>H. Ito</i>

## **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 TCG043WQLBAAFA-GA00. (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) (without constant current circuit for LED Backlight)
Touch panel	: Analog type, Non-Glare treatment

## 3. Mechanical specifications

### 3-1. LCD

Item	Specification	Unit
Outline dimensions 1)	105.5(W)×67.2(H)×7.7(D)	mm
Active area	95.04(W)×53.856(H) (10.9cm/4.3 inch(Diagonal))	mm
Dot format	480×(R,G,B)(W)×272(H)	dot
Dot pitch	0.198(W)×0.198(H)	mm
Base color 2)	Normally White	-
Mass	100	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.

### 3-2. Touch panel

Item	Specification	Unit
Input	Radius-0.8 stylus or Finger	-
Actuation Force	0.05 ~ 0.8	N
Transmittance	Typ. 80	%
Surface hardness	Pencil hardness 2H or more according	-

## 4. Absolute maximum ratings

### 4-1. Electrical absolute maximum ratings

Item	Symbol	Min.	Max.	Unit
Supply voltage	V <sub>DD</sub>	-0.5	5.0	V
Input signal voltage 1)	V <sub>IN</sub>	0	V <sub>DD</sub>	V
LED forward current 2) 3)	I <sub>F</sub>	-	100	mA
Supply voltage for touch panel	V <sub>TP</sub>	0	6.0	V
Input current of touch panel	I <sub>TP</sub>	0	0.5	mA

- 1) Input signal : CK, R0 ~ R7, G0 ~ G7, B0 ~ B7, HSD, VSD, DE
- 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 <sub>OP</sub>	-20	70	°C
Storage temperature 2)	T <sub>STO</sub>	-30	80	°C
Operating humidity 3)	H <sub>OP</sub>	10	4)	%RH
Storage humidity 3)	H <sub>STO</sub>	10	4)	%RH
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 <sup>2</sup> )
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/s<sup>2</sup>, Pulse width: 11 ms  
3 times in each direction: ±X, ±Y, ±Z  
EIAJ ED-2531

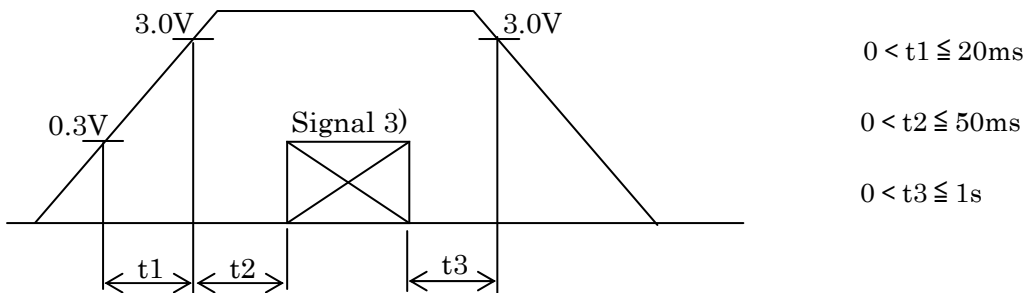
## 5. Electrical characteristics

### 5-1. LCD

Temp. = -20 ~ 70°C

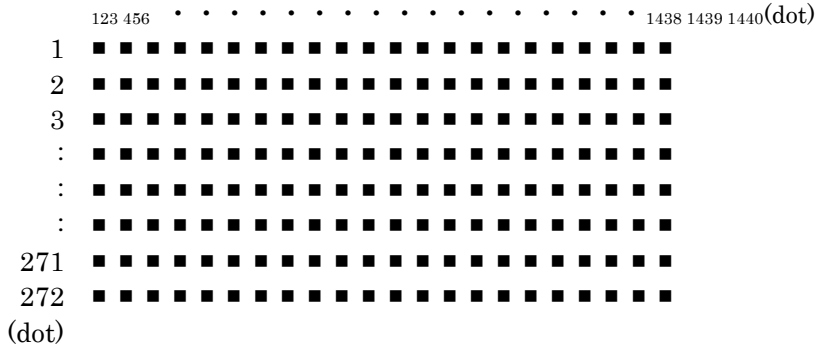
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage 1)	$V_{DD}$	-	3.0	3.3	3.6	V
Current consumption	$I_{DD}$	2)	-	14.2	21.3	mA
Input signal voltage 3)	$V_{IL}$	"Low" level	0	-	$0.3V_{DD}$	V
	$V_{IH}$	"High" level	$0.7V_{DD}$	-	$V_{DD}$	V

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



#### 2) Display pattern:

$V_{DD} = 3.3\text{V}$ , Temp. = 25°C



#### 3) Input signal : CK, R0 ~ R7, G0 ~ G7, B0 ~ B7, HSD, VSD, DE

### 5-2. Touch panel

Item	Specification
Supply voltage for touch panel	5.0V
Terminal resistance	$xL \sim xR : 483\Omega \sim 1127\Omega$
	$yU \sim yL : 177\Omega \sim 414\Omega$
Linearity	less than $\pm 2.0\%$
Insulation resistance	100M $\Omega$ or more at DC25V

## 6. Optical characteristics

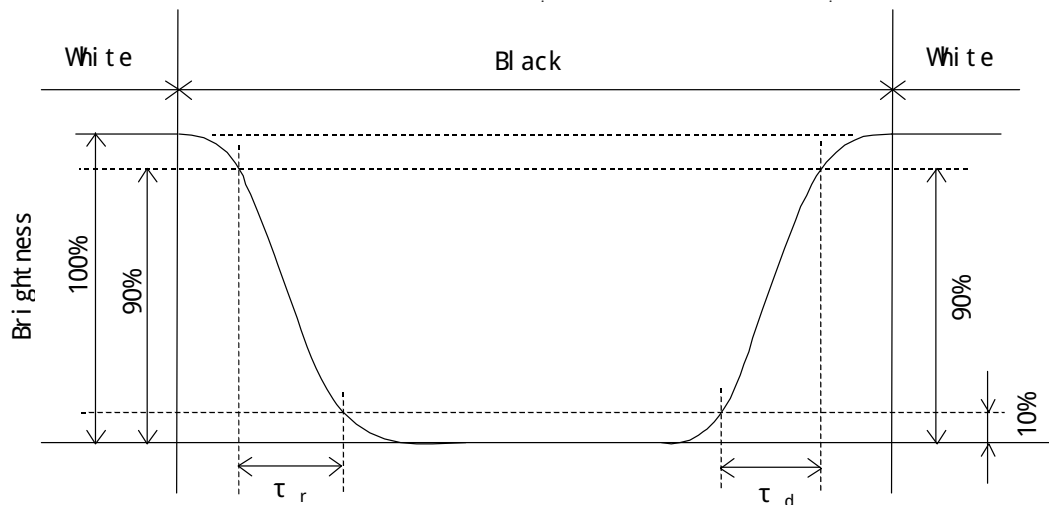
Measuring spot =  $\phi$  6.0mm, Temp. = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Response time	$\tau_r + \tau_d$	$\theta = \phi = 0^\circ$	-	25	-	ms
Viewing angle range View direction : 6 o'clock (Gray inversion)	$\theta_{UPPER}$	CR $\geq$ 10	-	60	-	deg.
	$\theta_{LOWER}$		-	65	-	
	$\phi_{LEFT}$		-	70	-	deg.
	$\phi_{RIGHT}$		-	70	-	
Contrast ratio	CR	$\theta = \phi = 0^\circ$	245	350	-	-
Brightness	L	IF=60mA/Line	250	360	-	cd/m <sup>2</sup>
Chromaticity coordinates	Red	x	$\theta = \phi = 0^\circ$	0.535	0.585	0.635
		y		0.290	0.340	0.390
	Green	x	$\theta = \phi = 0^\circ$	0.310	0.360	0.410
		y		0.520	0.570	0.620
	Blue	x	$\theta = \phi = 0^\circ$	0.100	0.150	0.200
		y		0.085	0.135	0.185
	White	x	$\theta = \phi = 0^\circ$	0.270	0.320	0.370
		y		0.300	0.350	0.400

### 6-1. Definition of contrast ratio

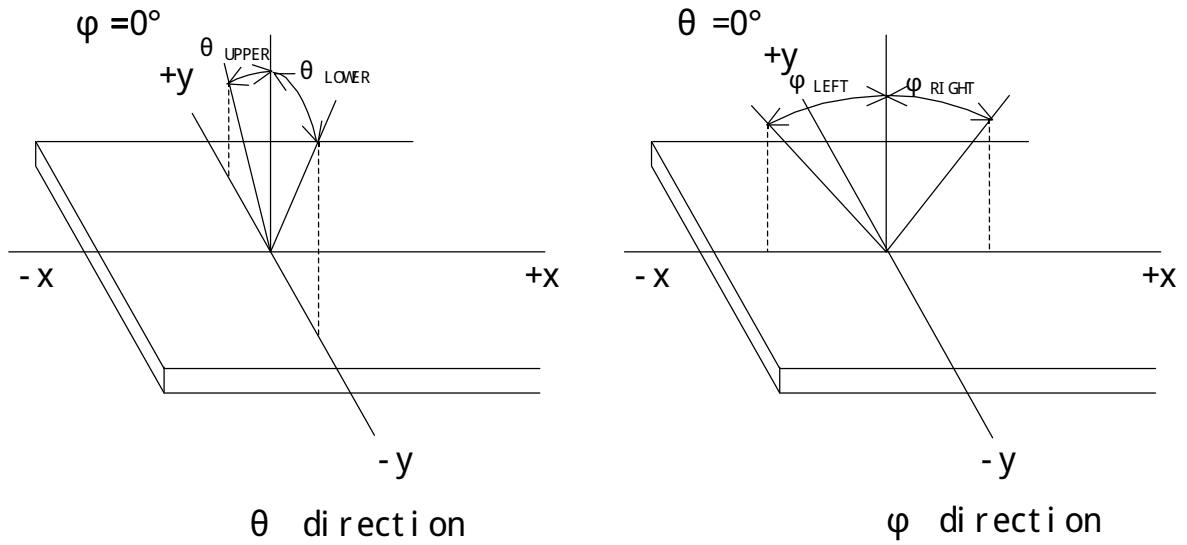
$$CR(\text{Contrast ratio}) = \frac{\text{Brightness with all pixels "White"}}{\text{Brightness with all pixels "Black"}}$$

### 6-2. Definition of response time

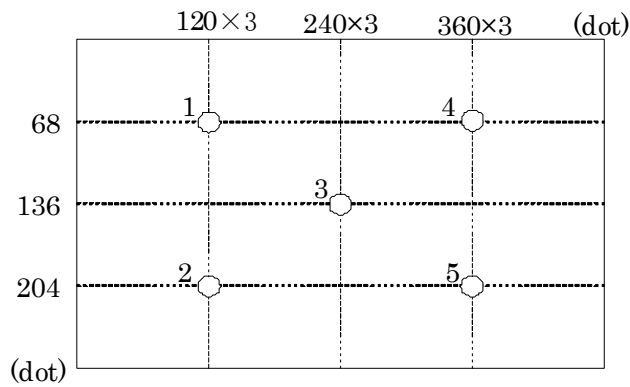




6-3. Definition of viewing angle



6-4. Brightness measuring points



- 1) Rating is defined as the white brightness at center of display screen(3).
- 2) Measured 5 minutes after the LED is powered on. (Ambient temp. = 25°C)

## 7. Interface signals

### 7-1. LCD

No.	Symbol	Description	Note
1	CA	Cathode	
2	AN	Anode	
3	GND	GND	
4	V <sub>DD</sub>	Power supply	
5	R0	RED data signal (LSB)	
6	R1	RED data signal	
7	R2	RED data signal	
8	R3	RED data signal	
9	R4	RED data signal	
10	R5	RED data signal	
11	R6	RED data signal	
12	R7	RED data signal (MSB)	
13	G0	GREEN data signal (LSB)	
14	G1	GREEN data signal	
15	G2	GREEN data signal	
16	G3	GREEN data signal	
17	G4	GREEN data signal	
18	G5	GREEN data signal	
19	G6	GREEN data signal	
20	G7	GREEN data signal (MSB)	
21	B0	BLUE data signal (LSB)	
22	B1	BLUE data signal	
23	B2	BLUE data signal	
24	B3	BLUE data signal	
25	B4	BLUE data signal	
26	B5	BLUE data signal	
27	B6	BLUE data signal	1)
28	B7	BLUE data signal (MSB)	
29	GND	GND	
30	DCLK	Pixel clock	
31	DISP	DISP="H", Display on DISP="L", Display off, All outputs are High-Z.	
32	HSD	Horizontal synchronous signal	
33	VSD	Vertical synchronous signal	
34	DE	Data Enable	
35	NC	No connect	
36	GND	GND	
37	NC	No connect	
38	NC	No connect	
39	NC	No connect	
40	NC	No connect	

LCD connector : 08 6212 040 340 800+ (KYOCERA Connector Products)

7-2. Touch panel

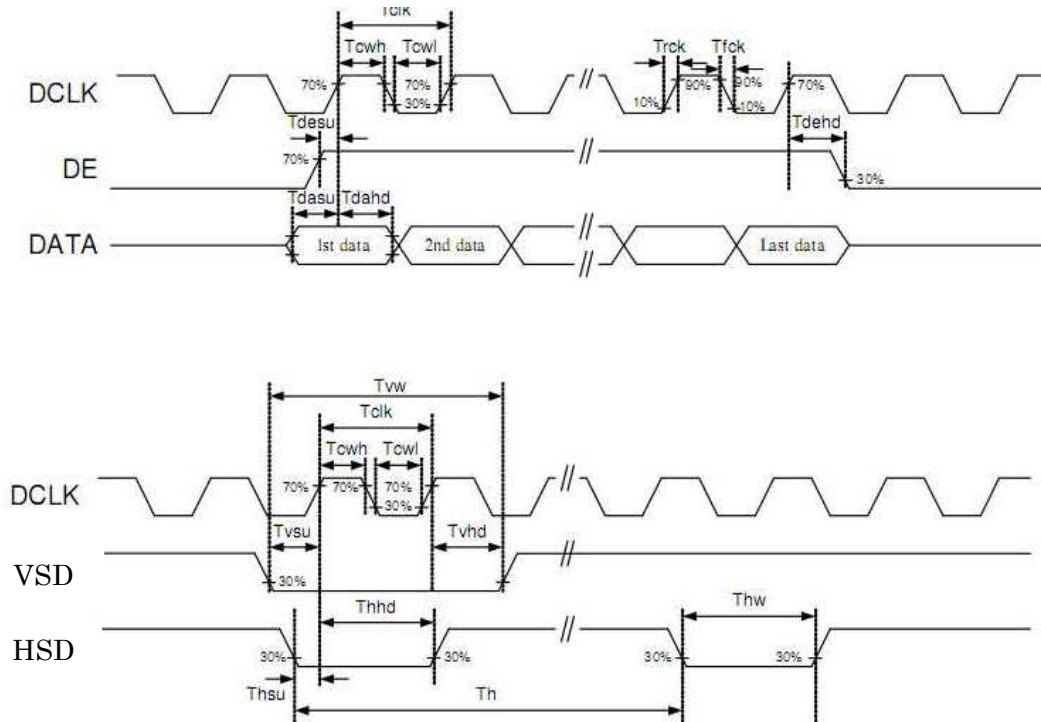
No.	Symbol	Description
1	xR	x-Right terminal
2	yL	y-Lower terminal
3	xL	x-Left terminal
4	yU	y-Upper terminal

Touch panel side connector : 1mm pitch

Recommended matching connector : 08 6262 004 940 846+ (KYOCERA Connector Products)

## 8. Input timing characteristics

### 8-1. Clock and Data Input Timing Diagram



### 8-2. AC Electrical characteristics

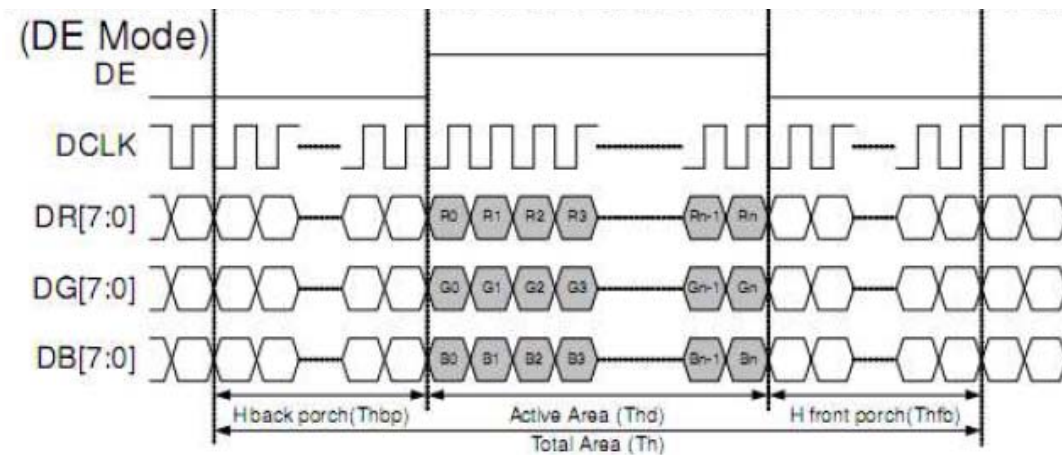
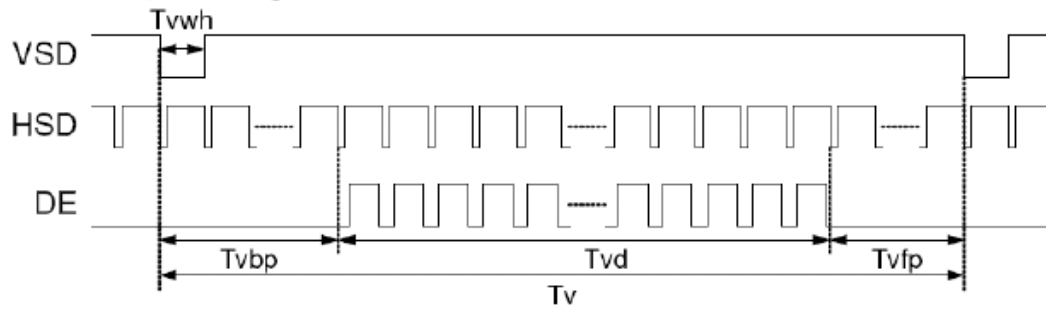
Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
Input Output timing						
DCLK clock time	Tclk	33.3	-	-	ns	DCLK=30MHz
Clock rising time	Trck	-	-	9	ns	
Clock falling time	Tfck	-	-	9	ns	
HSD width	Thw	1	-	-	DCLK	
HSD period time	Th	55	60	65	μs	
HSD setup time	Thsu	12	-	-	ns	
HSD hold time	Thhd	12	-	-	ns	
VSD width	Tvw	1	-	-	Th	
VSD setup time	Tvsu	12	-	-	ns	
VSD hold time	Tvhhd	12	-	-	ns	
Data setup time	Tdasu	12	-	-	ns	
Data hold time	Tdahd	12	-	-	ns	
DE setup time	Tdesu	12	-	-	ns	
DE hold time	Tdshd	12	-	-	ns	

### 8-3. Output timing table

Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
DCLK frequency	Fclk	5	9	12	MHz	
DCLK cycle time	Tclk	83	110	200	ns	
DCLK pulse duty	Tcwh	40	50	60	%	

8-4. Data Input format

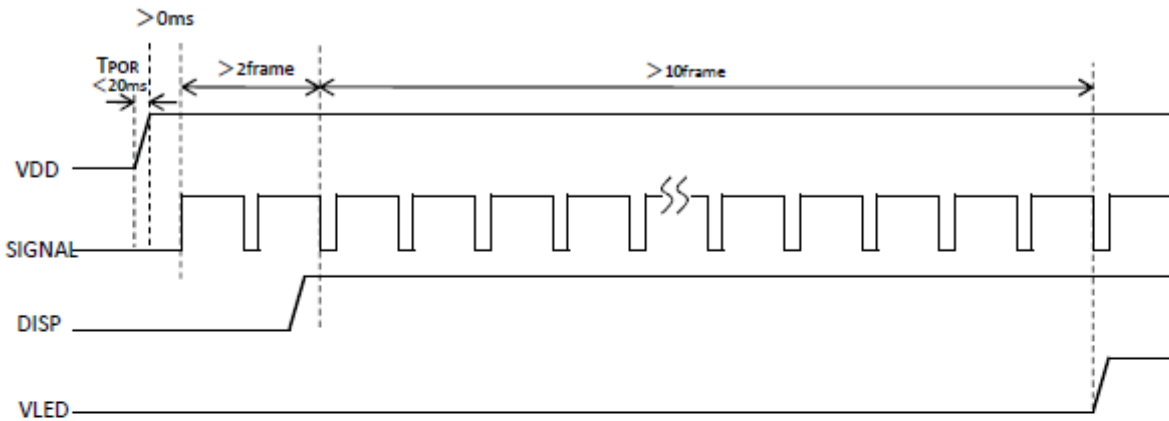
**Vertical input timing**



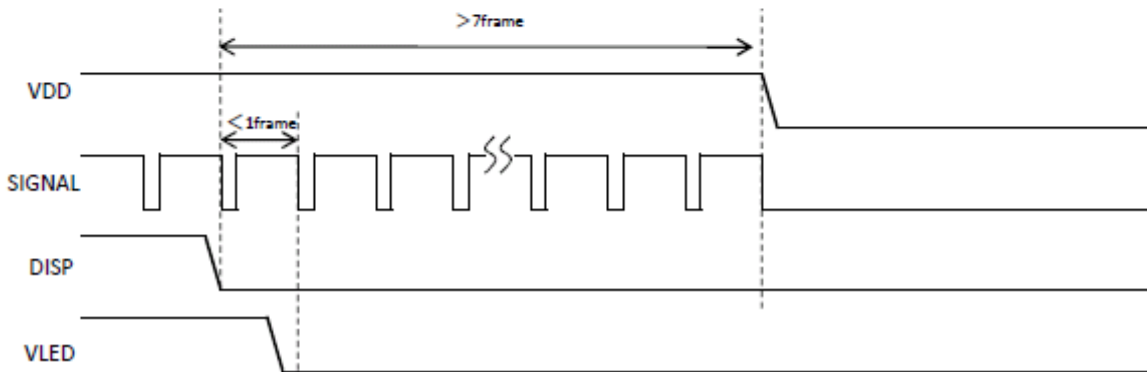
Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
DCLK frequency	Fclk	5	9	12	MHz	
VSD period time	Tv	277	288	400	H	
VSD display area	Tvd	272			H	
VSD back porch	Tvbp	3	8	31	H	
VSD front porch	Tvfp	2	8	97	H	
HSD period time	Th	520	525	800	DCLK	
HSD display area	Thd	480			DCLK	
HSD back porch	Thbp	36	40	255	DCLK	
HSD front porch	thfp	4	5	65	DCLK	

8-5. Power sequence

● Power sequence



● Power off sequence



9. Backlight characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward current 1)	IF	-	60	-	mA	Ta=-20 ~ 70°C
Forward voltage 1)	VF	-	22.0	25.8	V	IF=60mA, Ta=-20°C
		-	21.0	24.7	V	IF=60mA, Ta=25°C
		-	20.4	24.1	V	IF=60mA, Ta=70°C
Operating life time 2), 3)	T	-	70,000	-	h	IF=60mA, Ta=25°C

- 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=60mA, Ta=25°C in chamber).
- 4) An input current below 15mA 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. Design guidance for analog touch panel

10-1. 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.

10-2. 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.

10-3. 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) Never expand the touch panel top layer (PET-film) like a balloon by internal air pressure.  
The life of the touch panel will be extremely short.
- 3) If a dew will be on the heat-sealed area or exposed traces at the end of a flexible tail, the migration of silver can occur. This will cause sometimes a short circuit.
- 4) Must maintain a gap between inside of bezel and touch panel to avoid malfunction or electrode damage of touch panel.

## 11. Lot number identification

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

TCG043WQLBAAFA-GA00 - □□ - □□ - □ 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	2012	2013	2014	2015	2016	2017
Code	2	3	4	5	6	7

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.

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## 13. Precautions for use

### 13-1. Installation of the LCD

- 1) The LCD shall be installed so that there is no pressure on the LSI chips.
- 2) The LCD shall be installed flat, without twisting or bending.

### 13-2. 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.

### 13-3. 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.

### 13-4. 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.

### 13-5. Usage

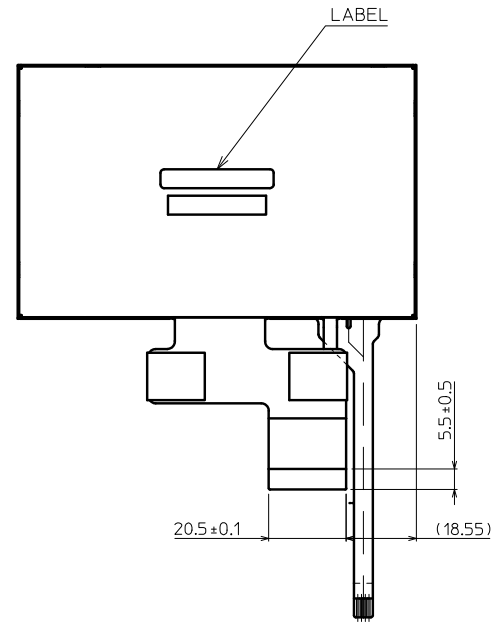
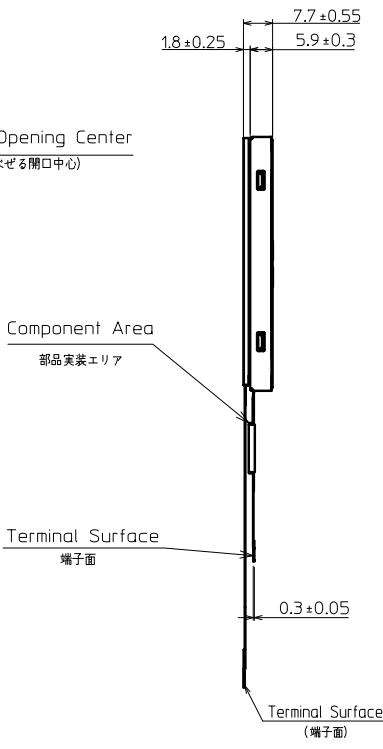
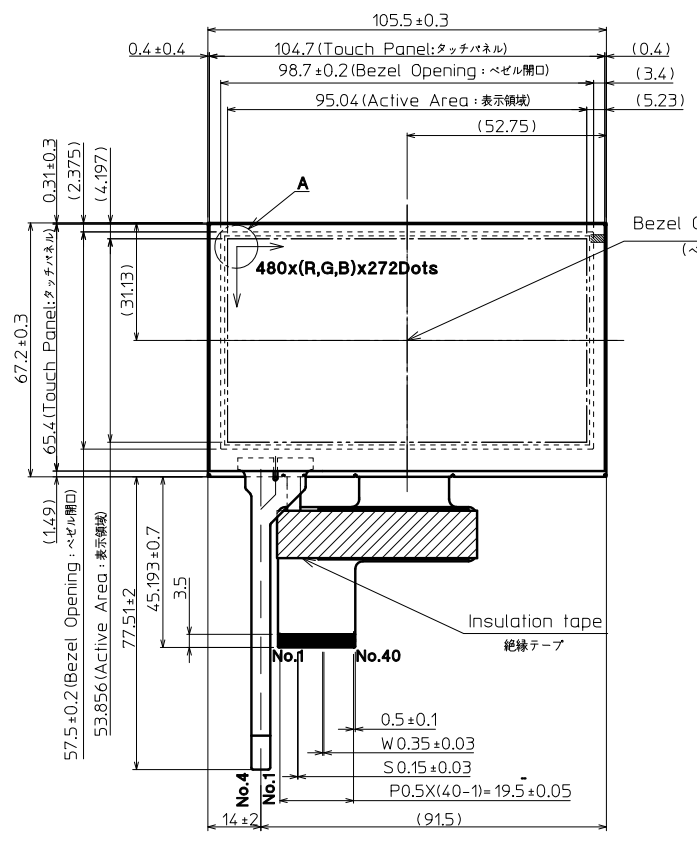
- 1) **DO NOT** store in a high humidity environment for extended periods. Polarizer degradation bubbles, and/or peeling off of the polarizer may result.
- 2) Do not push or rub the touch panel's surface with hard to sharp objects such as knives, or the touch panel may be scratched.
- 3) When the touch 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) Touch panel edges are sharp. Handle the touch panel with enough care to prevent cuts.
- 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.

## 14. 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
Point Activation life	Silicon rubber, Tip : R = 4.0 Hitting force 3N Hitting speed 2 time/s	one million times	Terminal resistance : No defect Insulation resistance : No defect Linearity : No defect Actuation Force : 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

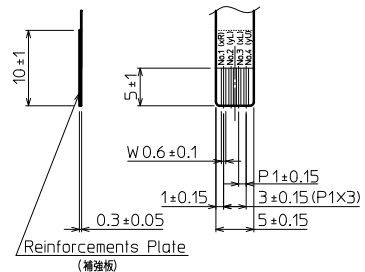


**DETAIL A (Dot Size)**  
(NTS)

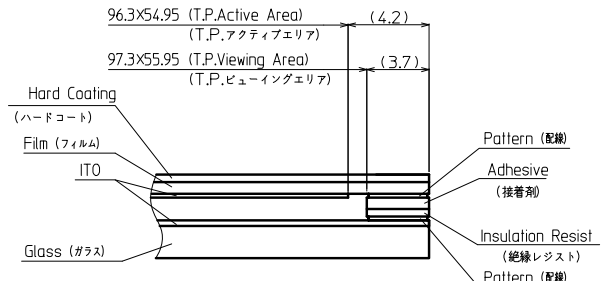
Projection part is 1.5mm thickness.  
(厚み1.5mm)

- Note.(注記)
1. Matching Connector (Reference): 08 6212 040 340 800+ (KYOCERA Connector Products ) etc.  
(適合コネクタ(参考))
  2. Tolerance without indication : ±0.5  
(指示無き公差)
  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. Touch Panel P/N : P2012200 (121A8050000)

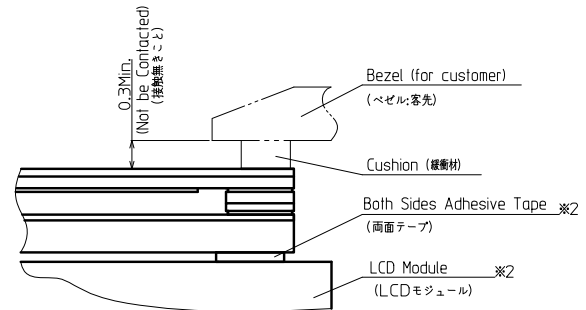
Material 材質	Treatment 処理	Approved '12.08.02	Checked	Checked '12.08.02	Drawn Rahadian	Scale 1:1(NTS)	Title TCG043WQLBAAFA		Year-Month-Day '12.07.28	Size 2
Quantity 製作数	Description 備考	RoHS		朝倉	今村	Outline Dimensions		Drawing No. 121A8061500		



VIEWING A (2:1)



SECTION C-C (NTS)

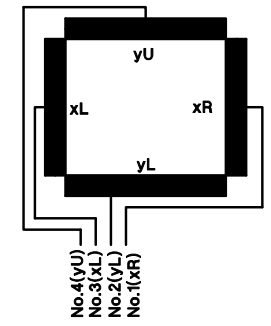
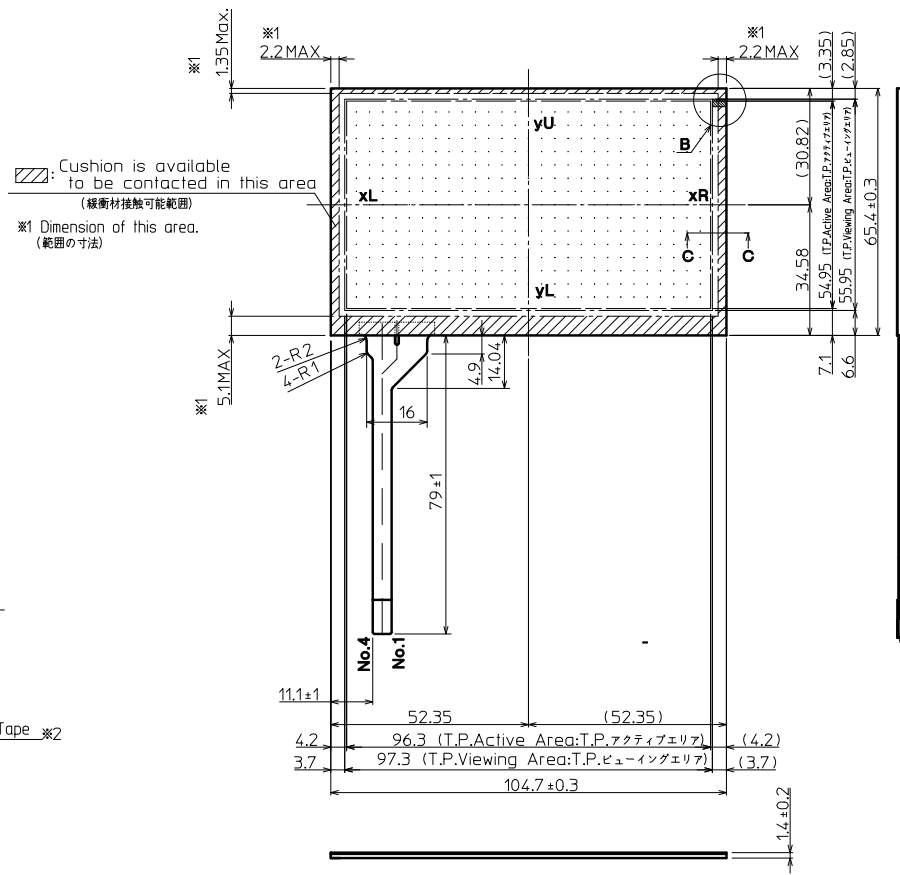


Precaution in use of touch panel.  
(タッチパネル使用上の注意事項)  
※2 In case of assemble to the LCD  
(LCDに取り付ける場合)  
1. Fix touch panel at LCD module and the rear side of touch panel.  
(タッチパネルの固定はLCDモジュール側とタッチパネル裏面とで行なうこと)  
2. Must maintain a gap between inside of bezel and touch panel to avoid malfunction or 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)

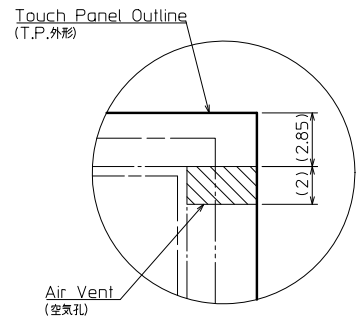
Note(注記)

No	Name (名称)	Explanation (説明)
1	T.P.	Touch panel (タッチパネル)
2	T.P. Active Area (T.P.アクティブエリア)	Operating area of touch panel (タッチパネルの動作範囲)
3	T.P. Viewing Area (T.P.ビューイングエリア)	Warranty area of touch panel's appearance (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. (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。)

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)



DETAIL B (5:1)

Precaution in use of touch panel.  
(タッチパネル使用上の注意事項)  
There is vent channel to equalize air pressure between the inner space of the touch panel and the atmosphere.  
Please make sure it is not blocked by your housing and mounting method.  
(タッチパネルの中には内圧と外圧を均一にするため通気孔を設けています。取り付け時にこの通気孔を塞がないようにしてください。)

Material	Treatment	Approved	Checked	Checked	Drawn	Scale	Title	Year-Month-Day	Size
材質	処理	*11.09.12		*11.09.12	角田	1:1 (2:1.5, NTS)	P2012200	11.09.02	2
Quantity	Description	RoHS	鶴崎	木口	角田		T.P. Outline Dimensions	Year-Month-Day	
製作数	備考							121A8050000	



Spec No.	TQ3C-8EAF0-E2DFF41-00
Date	July 23, 2012

**KYOCERA INSPECTION STANDARD**

**TYPE : TCG043WQLBAAFA-GA00**

KYOCERA CORPORATION  
LCD DIVISION

Original Issue Date	Designed by : Engineering dept.			Confirmed by : QA dept.	
	Prepared	Checked	Approved	Checked	Approved
July 23, 2012	<i>H. Mori</i>	<i>Y. Yamazaki</i>	<i>M. Fujitani</i>	<i>T. Shikama</i>	<i>H. Ito</i>

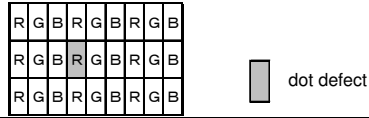
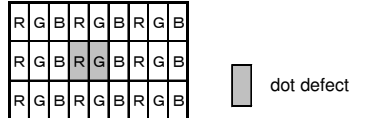
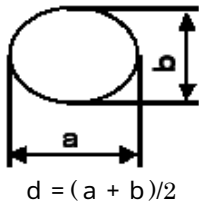
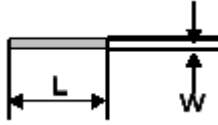
Spec No. TQ3C-8EAF0-E2DFF41-00	Part No. TCG043WQLBAAFA-GA00	Page -
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**Revision record**

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

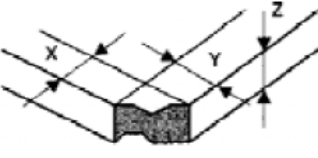
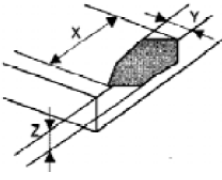
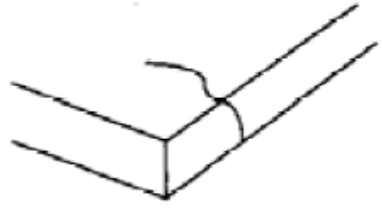
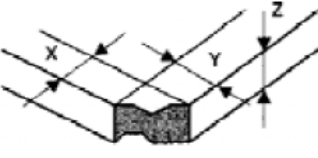
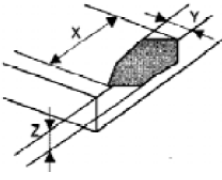
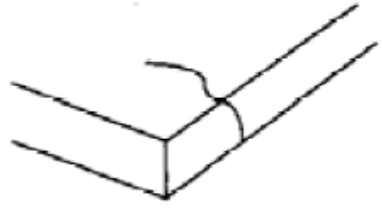
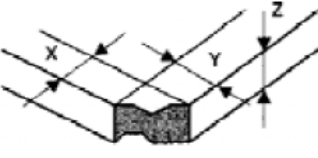
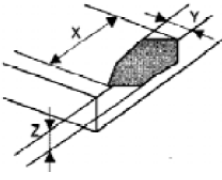
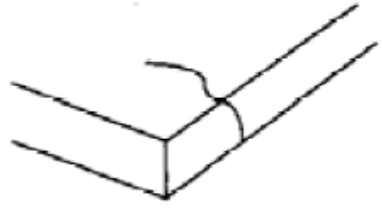
## Visuals specification

### 1) Note

	Note	
General	<p>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.</p> <p>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.</p> <p>3. Inspection conditions</p> <p>Luminance : 500 Lux min.</p> <p>Inspection distance : 300 mm.</p> <p>Temperature : 25 ± 5°C</p> <p>Direction : Directly above</p>	
Definition of inspection item	Dot defect	<p>Bright dot defect</p> <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> 
		<p>Black dot defect</p> <p>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</p>
		<p>Adjacent dot</p> <p>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.</p> 
	External inspection	<p>Bubble, Scratch, Foreign particle (Polarizer, Cell, Backlight)</p> <p>Visible operating (all pixels “Black” or “White”) and non operating.</p>
	Appearance inspection	Does not satisfy the value at the spec.
Definition of size	<p>Definition of circle size</p>  <p><math>d = (a + b)/2</math></p>	<p>Definition of linear size</p> 

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 border="1"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>d \leq 0.2</math></td> <td>(Neglected)</td> </tr> <tr> <td><math>0.2 &lt; d \leq 0.4</math></td> <td>5</td> </tr> <tr> <td><math>0.4 &lt; d \leq 0.5</math></td> <td>3</td> </tr> <tr> <td><math>0.5 &lt; d</math></td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable number	$d \leq 0.2$	(Neglected)	$0.2 < d \leq 0.4$	5	$0.4 < d \leq 0.5$	3	$0.5 < d$	0				
Size (mm)	Acceptable number																		
$d \leq 0.2$	(Neglected)																		
$0.2 < d \leq 0.4$	5																		
$0.4 < d \leq 0.5$	3																		
$0.5 < d$	0																		
External inspection (Defect on Polarizer or between Polarizer and LCD glass)	Polarizer (Scratch)	<table border="1"> <thead> <tr> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>W \leq 0.1</math></td> <td>-</td> <td>(Neglected)</td> </tr> <tr> <td rowspan="2"><math>0.1 &lt; W \leq 0.3</math></td> <td><math>L \leq 5.0</math></td> <td>(Neglected)</td> </tr> <tr> <td><math>5.0 &lt; L</math></td> <td>0</td> </tr> <tr> <td><math>0.3 &lt; W</math></td> <td>-</td> <td>0</td> </tr> </tbody> </table>			Width (mm)	Length (mm)	Acceptable number	$W \leq 0.1$	-	(Neglected)	$0.1 < W \leq 0.3$	$L \leq 5.0$	(Neglected)	$5.0 < L$	0	$0.3 < W$	-	0	
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	Polarizer (Bubble)	<table border="1"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>d \leq 0.2</math></td> <td>(Neglected)</td> </tr> <tr> <td><math>0.2 &lt; d \leq 0.3</math></td> <td>5</td> </tr> <tr> <td><math>0.3 &lt; d \leq 0.5</math></td> <td>3</td> </tr> <tr> <td><math>0.5 &lt; d</math></td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable number	$d \leq 0.2$	(Neglected)	$0.2 < d \leq 0.3$	5	$0.3 < d \leq 0.5$	3	$0.5 < d$	0					
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$0.5 < d$	0																		
Foreign particle (Circular shape)	<table border="1"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>d \leq 0.2</math></td> <td>(Neglected)</td> </tr> <tr> <td><math>0.2 &lt; d \leq 0.4</math></td> <td>5</td> </tr> <tr> <td><math>0.4 &lt; d \leq 0.5</math></td> <td>3</td> </tr> <tr> <td><math>0.5 &lt; d</math></td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable number	$d \leq 0.2$	(Neglected)	$0.2 < d \leq 0.4$	5	$0.4 < d \leq 0.5$	3	$0.5 < d$	0						
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$0.5 < d$	0																		
Foreign particle (Linear shape) Scratch	<table border="1"> <thead> <tr> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>W \leq 0.03</math></td> <td>-</td> <td>(Neglected)</td> </tr> <tr> <td rowspan="3"><math>0.03 &lt; W \leq 0.1</math></td> <td><math>L \leq 2.0</math></td> <td>(Neglected)</td> </tr> <tr> <td><math>2.0 &lt; L \leq 4.0</math></td> <td>3</td> </tr> <tr> <td><math>4.0 &lt; L</math></td> <td>0</td> </tr> <tr> <td><math>0.1 &lt; W</math></td> <td>-</td> <td>(According to circular shape)</td> </tr> </tbody> </table>			Width (mm)	Length (mm)	Acceptable number	$W \leq 0.03$	-	(Neglected)	$0.03 < W \leq 0.1$	$L \leq 2.0$	(Neglected)	$2.0 < L \leq 4.0$	3	$4.0 < L$	0	$0.1 < W$	-	(According to circular shape)
	Width (mm)	Length (mm)	Acceptable number																
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	$0.03 < W \leq 0.1$	$L \leq 2.0$	(Neglected)																
		$2.0 < L \leq 4.0$	3																
$4.0 < L$		0																	
$0.1 < W$	-	(According to circular shape)																	

Inspection item	Judgement standard																															
Scratch, Foreign particle (Touch screen portion)	( W = Width, L = Length, D = Diameter = (major axis + minor axis)/ 2 )																															
	<table border="1"> <thead> <tr> <th>Item</th> <th>Width(mm)</th> <th>Length(mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Scratch</td> <td><math>d \leq 0.03</math></td> <td><math>L \leq 20</math></td> <td>Neglected</td> </tr> <tr> <td><math>0.03 &lt; d \leq 0.05</math></td> <td><math>L \leq 10</math></td> <td>2pcs within <math>\phi 20\text{mm}</math></td> </tr> <tr> <td><math>0.05 &lt; d \leq 0.08</math></td> <td><math>L \leq 6</math></td> <td>2pcs within <math>\phi 20\text{mm}</math></td> </tr> <tr> <td><math>0.08 &lt; d \leq 0.1</math></td> <td><math>L \leq 4</math></td> <td>1pcs within <math>\phi 30\text{mm}</math></td> </tr> <tr> <td rowspan="2">Foreign ( line like )</td> <td><math>W \leq 0.05</math></td> <td>Neglected</td> <td>Neglected</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.1</math></td> <td><math>L \leq 5</math></td> <td>2pcs within <math>\phi 30\text{mm}</math></td> </tr> <tr> <td rowspan="2">Foreign ( circle like )</td> <td colspan="2"><math>D \leq 0.2</math></td> <td>Neglected</td> </tr> <tr> <td colspan="2"><math>0.2 &lt; D \leq 0.3</math></td> <td>2pcs within <math>\phi 30\text{mm}</math></td> </tr> </tbody> </table>	Item	Width(mm)	Length(mm)	Acceptable number	Scratch	$d \leq 0.03$	$L \leq 20$	Neglected	$0.03 < d \leq 0.05$	$L \leq 10$	2pcs within $\phi 20\text{mm}$	$0.05 < d \leq 0.08$	$L \leq 6$	2pcs within $\phi 20\text{mm}$	$0.08 < d \leq 0.1$	$L \leq 4$	1pcs within $\phi 30\text{mm}$	Foreign ( line like )	$W \leq 0.05$	Neglected	Neglected	$0.05 < W \leq 0.1$	$L \leq 5$	2pcs within $\phi 30\text{mm}$	Foreign ( circle like )	$D \leq 0.2$		Neglected	$0.2 < D \leq 0.3$		2pcs within $\phi 30\text{mm}$
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Above are applied to the visible area.																																
Unless there are foreign particle and damage affected seriously to the electrical performance out of the active area, we approve of this product.																																
Glass crack (Touch screen portion)	<table border="1"> <thead> <tr> <th>Item</th> <th colspan="2">Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Corner crack</td> <td rowspan="3">  </td> <td>X <math>\leq 3</math></td> <td rowspan="3">2 pcs /panel</td> </tr> <tr> <td>Y <math>\leq 3</math></td> </tr> <tr> <td>Z &lt; t</td> </tr> <tr> <td rowspan="3">Crack in other area than in corner</td> <td rowspan="3">  </td> <td>X <math>\leq 5</math></td> <td rowspan="3">2 pcs /side</td> </tr> <tr> <td>Y <math>\leq 1.5</math></td> </tr> <tr> <td>Z &lt; t</td> </tr> <tr> <td>Progressive crack</td> <td colspan="2">  </td> <td>0 pcs (NG even 1pcs)</td> </tr> </tbody> </table>	Item	Size (mm)		Acceptable number	Corner crack		X $\leq 3$	2 pcs /panel	Y $\leq 3$	Z < t	Crack in other area than in corner		X $\leq 5$	2 pcs /side	Y $\leq 1.5$	Z < t	Progressive crack			0 pcs (NG even 1pcs)											
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