

SPEC for Mass Production

Spec No.	CPD-365200AB-01 Rev.04
Date	August 7, 2024

TYPE : C0650VG65200-BT-AB
< 6.5 inch VGA transmissive color TFT
with LED backlight and touch panel>

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KYOCERA CORPORATION

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	Approved
September 5, 2022	<i>K. Komurasaki</i>	<i>T. Fukui</i>	<i>M. Kato</i>	<i>T. Sawada</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.
2. Please note that we may not be able to respond to new environmental regulations after receiving the final mass production order for this product.

1. Application

This document defines the specification of C0650VG65200-BT-AB. (RoHS Compliant)

2. Construction and outline

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

3. Mechanical specifications

3-1. LCD

Item	Specification	Unit
Outline dimensions 1)	158.0(W)×120.36(H)×12.15(D)	mm
Active area	132.5(W)×99.4(H) (16.5cm/6.5 inch(Diagonal))	mm
Dot format	640×(R,G,B)(W)×480(H)	dot
Dot pitch	0.069(W)×0.207(H)	mm
Base color 2)	Normally White	-
Mass	280	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	Finger or Stylus pen	-
Actuation Force	20~100	gf

4. Absolute maximum ratings

4-1. Electrical absolute maximum ratings

Item	Symbol	Min.	Max.	Unit
Supply voltage	V _{CC}	0	5.5	V
Input signal voltage 1)	V _{IN}	-0.3	5.5	V
LED forward current 2) 3)	I _F	-	150	mA
Supply voltage for touch panel	V _{TP}	-	7.0	V

1) Input signal : CK, R0~R5, G0~G5, B0~B5, H_{SYNC}, V_{SYNC}, ENAB, R/L, U/D

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}	-20	70	°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. = -20°C < 48h , Temp. = 70°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 minute

2 hours in each direction X, Y, Z (6 hours total)

EIAJ ED-2531

6) Acceleration: 490 m/s², Pulse width: 11 ms

3 times in each direction: ±X, ±Y, ±Z

EIAJ ED-2531

5. Electrical characteristics

5-1. LCD

Temp. = 25°C

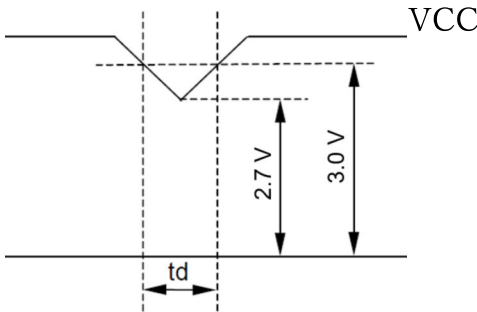
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage 1)	V _{CC}	-	3.0	3.3	3.6	V
Current consumption	I _{CC}	2)	-	120	160	mA
Permissive input ripple voltage	V _{RP}	-	-	-	100	mV _{p-p}
Input signal voltage	V _{IL}	"Low" level	-	-	0.8	V
	V _{IH}	"High" level	2.5	-	5.5	V

1) VCC-dip conditions:

When $2.7\text{ V} \leq \text{VCC} < 3.0\text{ V}$, $t_d \leq 10\text{ ms}$

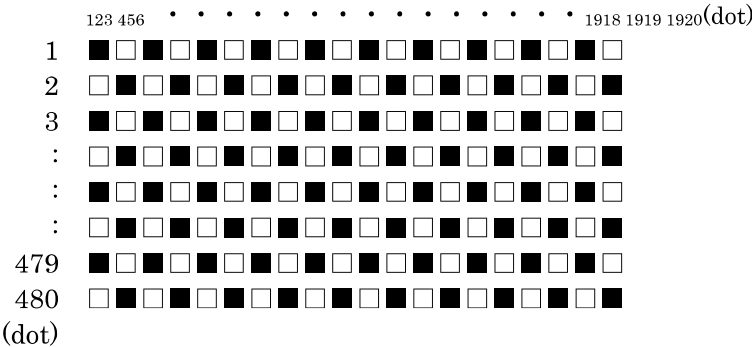
When $\text{VCC} < 2.7\text{ V}$

VCC-dip conditions should also follow the power and signals sequence.



2) Display pattern:

V_{DD} = 3.3V, Temp. = 25°C



5-2. Touch panel

Item	Specification
Supply voltage for touch panel	5V
Terminal resistance	xL~xR : 350Ω ~950Ω
	yU~yL : 150Ω ~500Ω
Linearity	less than ±1.5%
Insulation resistance	20MΩ or more at DC25V

6. Optical characteristics

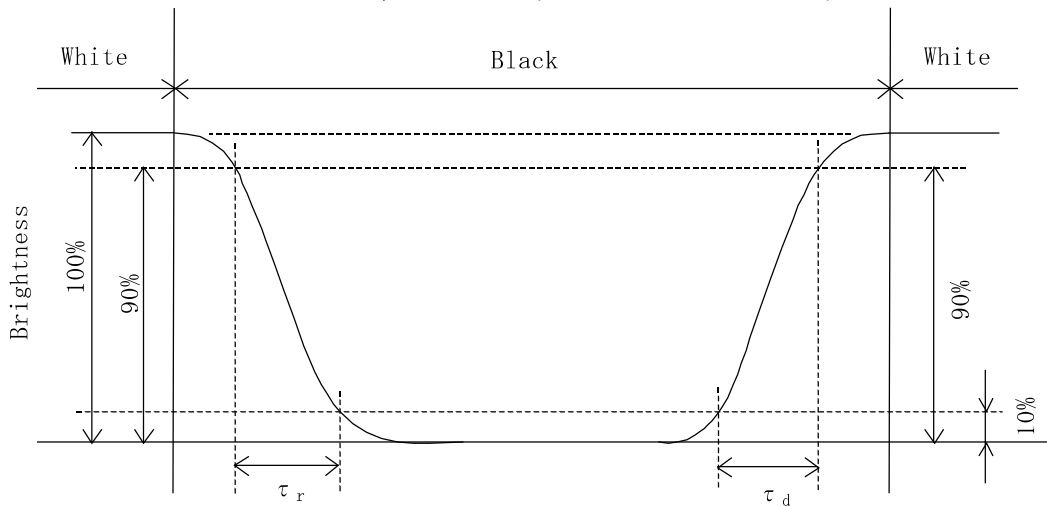
Measuring spot = ϕ 6.0mm, Temp. = 25°C

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Response time	Rise	τ_r	$\theta = \phi = 0^\circ$	-	15	-	ms
	Down	τ_d	$\theta = \phi = 0^\circ$	-	16	-	ms
Viewing angle range View direction : 6 o'clock (Gray inversion)		θ_{UPPER}	CR > 10	-	50	-	deg.
		θ_{LOWER}		-	70	-	
		ϕ_{LEFT}		-	80	-	deg.
		ϕ_{RIGHT}		-	80	-	
Contrast ratio		CR	$\theta = \phi = 0^\circ$	400	800	-	-
Brightness		L	IF=35mA/Line	560	800	-	cd/m ²
Chromaticity coordinates	Red	x	$\theta = \phi = 0^\circ$	0.555	0.605	0.655	-
		y		0.300	0.350	0.400	
	Green	x	$\theta = \phi = 0^\circ$	0.275	0.325	0.375	
		y		0.515	0.565	0.615	
	Blue	x	$\theta = \phi = 0^\circ$	0.100	0.150	0.200	
		y		0.080	0.130	0.180	
	White	x	$\theta = \phi = 0^\circ$	0.260	0.310	0.360	
		y		0.285	0.335	0.385	

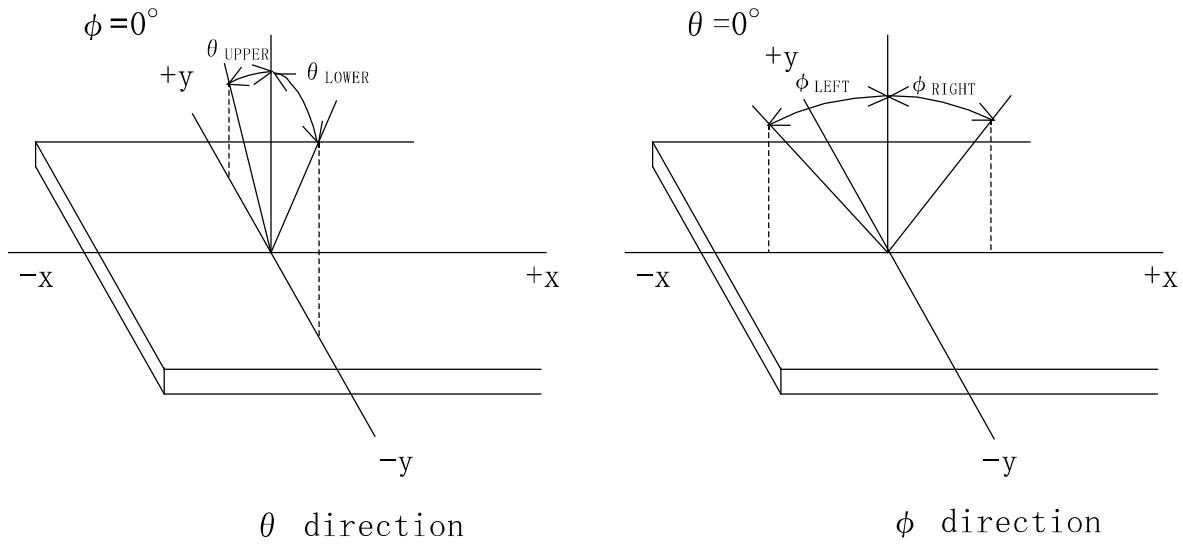
6-1. Definition of contrast ratio

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

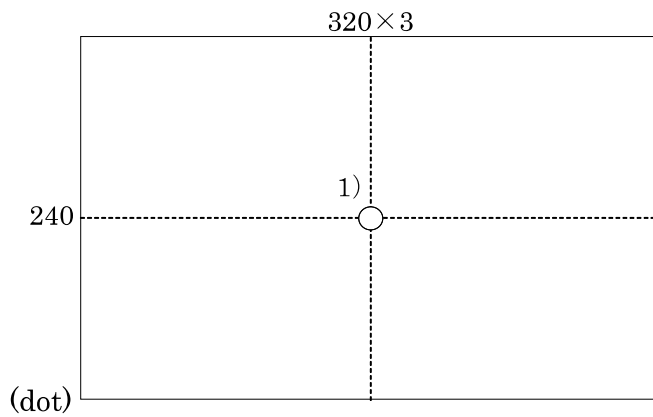
6-2. Definition of response time



6-3. Definition of viewing angle



6-4. Brightness measuring point



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

7. Interface signals

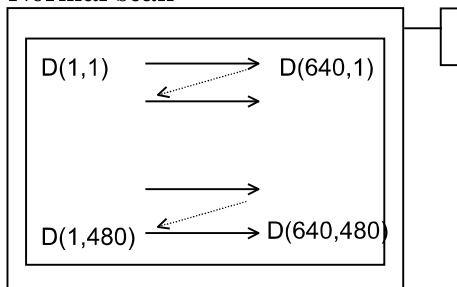
7-1. LCD

No.	Symbol	Description
1	GND	
2	DCLK	Clock signal for sampling catch data signal
3	NC	Non Connection
4	NC	Non Connection
5	GND	
6	R0	Red data signal(LSB)
7	R1	Red data signal
8	R2	Red data signal
9	R3	Red data signal
10	R4	Red data signal
11	R5	Red data signal(MSB)
12	GND	
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(MSB)
19	GND	
20	B0	Blue data signal(LSB)
21	B1	Blue data signal
22	B2	Blue data signal
23	B3	Blue data signal
24	B4	Blue data signal
25	B5	Blue data signal(MSB)
26	GND	
27	DENA	Data enable signal(to settle the viewing area)
28	VCC	Power Supply (DC 3.3V)
29	VCC	Power Supply (DC 3.3V)
30	TEST	This pin should be open. Test signal output for only internal test use.
31	REV	Reverse scan control. L = Normal, H = Reverse

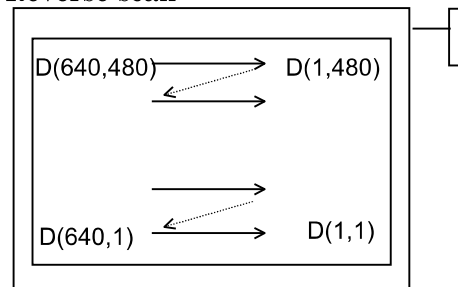
*) The shielding case is connected with GND

LCD connector : DF9B-31P-1V(32) (HIROSE)
Matching connector : DF9B-31S-1V (HIROSE)

Normal scan



Reverse scan



7-2. LED

CN2

No.	Symbol	Description
1	ANODE-1(RED)	LED Anode Terminal
2	ANODE-2(RED)	LED Anode Terminal
3	NC	Non Connection
4	NC	Non Connection
5	CATHODE-1(BLACK)	LED Cathode Terminal
6	CATHODE-2(BLACK)	LED Cathode Terminal

LCD side connector : SHLP-06V-S-B (JST)

Recommended matching connector

: SM06B-SHLS-TF(LF)(SN) (JST)

CN3

No.	Symbol	Description
1	ANODE-3(RED)	LED Anode Terminal
2	ANODE-4(RED)	LED Anode Terminal
3	NC	Non Connection
4	NC	Non Connection
5	CATHODE-3(BLACK)	LED Cathode Terminal
6	CATHODE-4(BLACK)	LED Cathode Terminal

LCD side connector : SHLP-06V-S-B (JST)

Recommended matching connector

: SM06B-SHLS-TF(LF)(SN) (JST)

7-3. Touch panel

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

Touch panel side connector : 1mm pitch

8. Input timing characteristics

8-1. Timing characteristics

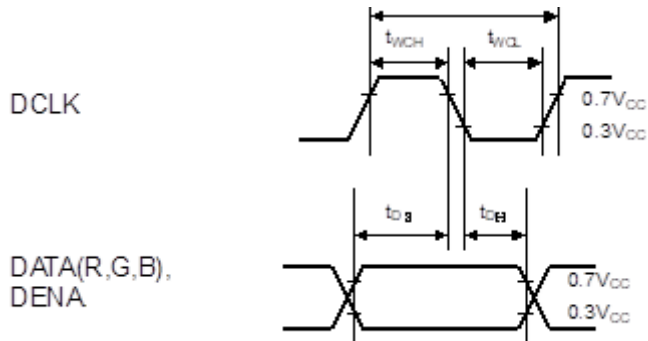
Item		Symbol	Min.	Typ.	Max.	Unit
DCLK	Frequency	f _{CLK}	23.3	25.0	30.0	MHz
	Period	t _{CLK}	33.3	40.0	42.9	ns
	Low Width	t _{WCL}	12	-	-	ns
	High Width	t _{WCH}	12	-	-	ns
DATA (R,G,B,DENA)	Set up time	t _{DS}	8	-	-	ns
	Hold time	t _{DH}	16	-	-	ns
DENA	Horizontal display area	t _{HA}	640	640	640	t _{CLK}
	Horizontal blanking time	t _{HBP} + t _{HFP}	120	154	640	t _{CLK}
	Horizontal period	t _H	760	794	1280	t _{CLK}
	Vertical display area	t _{VA}	480	480	480	t _H
	Vertical blanking time	t _{VBP} + t _{VFP}	30	45	80	t _H
	Vertical period	t _V	510	525	560	t _H
Display frame rate		f _R	55	60	70	Hz

[Note]

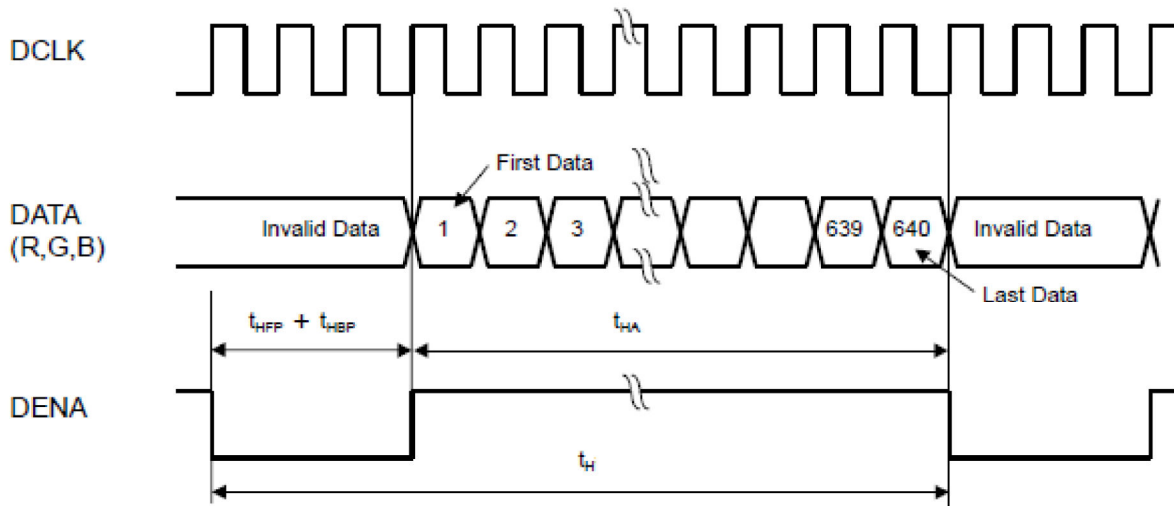
- 1) DATA is latched at fall edge of DCLK in this timing specification.
- 2) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
- 3) Accepted only 640 data and 480 lines.
- 4) REV should be stable during operation.

8-2. Timing chart

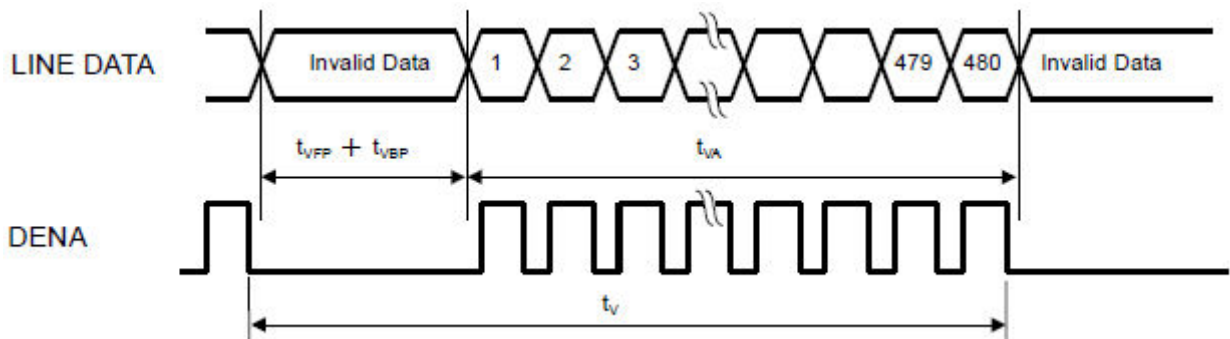
a. Pixel timing chart



b. Horizontal timing chart

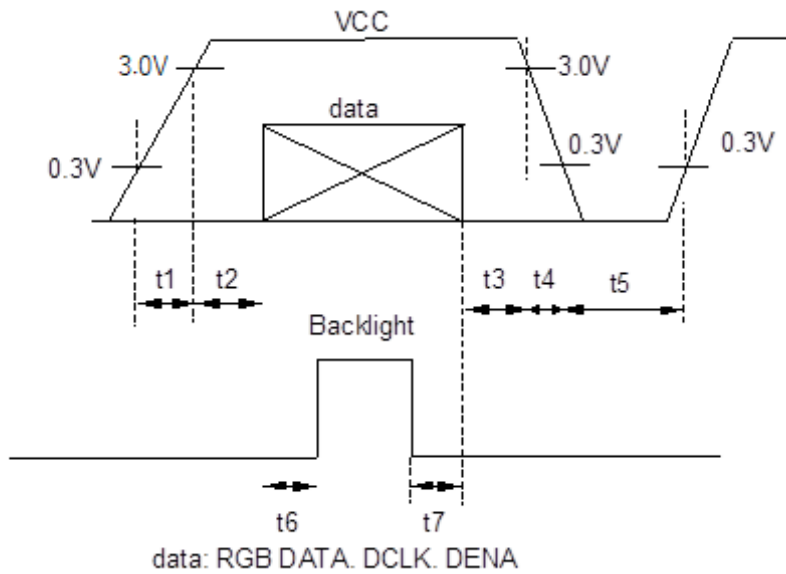


c. Vertical timing chart

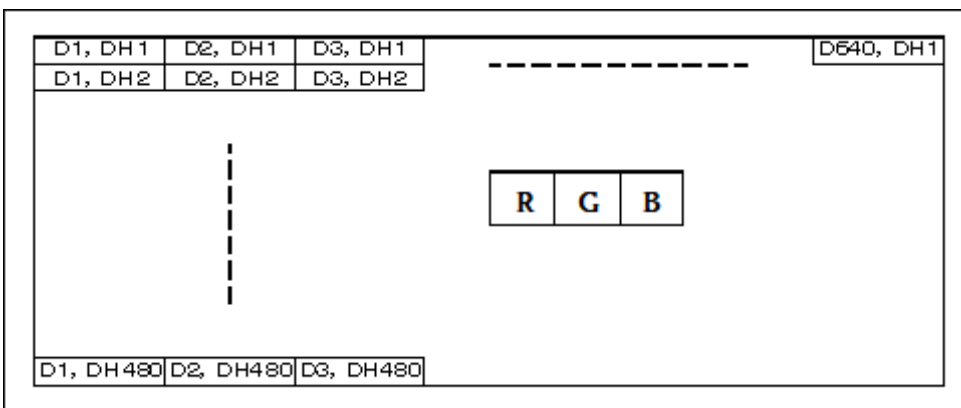


8-3. Power and signals sequence

$t1 \leq 10 \text{ ms}$
 $150 \text{ ms} \leq t2 \leq 190 \text{ ms}$
 $t3 \leq 50 \text{ ms}$
 $t4 \leq 50 \text{ ms}$
 $500 \text{ ms} \leq t5$
 $200 \text{ ms} < t6$
 $0 \leq t7$



8-4. Input data signals and display position on the screen



8-5. Color data assignment

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		MSB			LSB			MSB			LSB			MSB			LSB		
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level.

Higher n means brighter level.

2) Data 1: High, 0: Low

9. Backlight characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward current 1)	IF	-	35	-	mA	Ta=-20~70°C
Forward voltage 1)	VF	-	24.0	27.2	V	IF=35mA, Ta=-20°C
		-	22.4	25.6	V	IF=35mA, Ta=25°C
		-	21.5	24.7	V	IF=35mA, Ta=70°C
Operating life time 2), 3)	T	-	70,000	-	h	IF=35mA, Ta=25°C

- 1) For each "AN-CA"
- 2) When brightness decrease 50% of minimum brightness.
- 3) Life time is estimated data. (Condition : IF=35mA, Ta=25°C in chamber).
- 4) An input current below 8.0mA 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.
- 5) LED formation: 8 series, 4 parallel

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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) Analog touch panel cannot sense two points touching separately.
- 3) 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.
- 4) 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

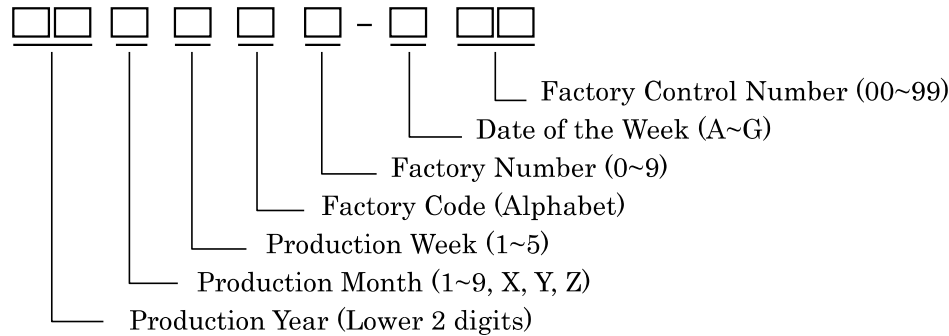
- 1) Do the "User Calibration".
- 2) "User Calibration" may be needed with long term using. Include "User Calibration" menu in your software.
- 3) When drawing a line with a stylus, there may be a slight discontinuity when the stylus passes over a spacer-dot. If necessary, please provide a compensation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



12. Warranty

12-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

12-2. Production warranty

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

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.
- 3) Please design the housing window so that its edges are between the active area and the effective area of the LCD screen.

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.

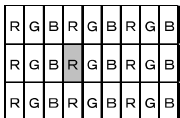
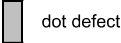
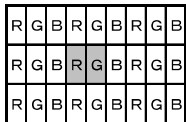
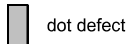
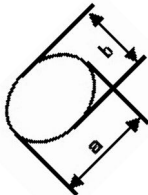
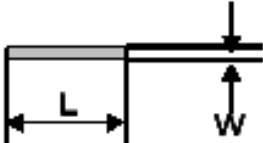
14. Reliability test data

Test item	Test condition	Test time	Judgement
High temp. atmosphere	70°C	240h	Display function : No defect Display quality : No defect Current consumption : No defect
Low temp. atmosphere	-20°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	-20°C 0.5h R.T. 0.5h 70°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.

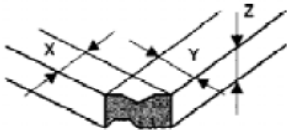
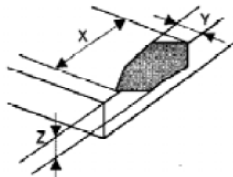
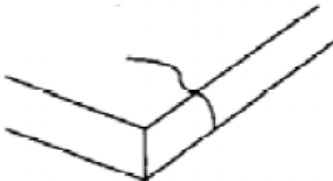
15. Visuals specification

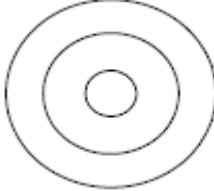

1) Note

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. 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. 3. Inspection conditions Luminance : 500 Lux min. Inspection distance : 300 mm. Temperature : $25 \pm 5^{\circ}\text{C}$ Direction : Directly above		
Definition of inspection item	Dot defect	Bright dot defect	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.  
		Black dot defect	The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen. Similar size compared to bright dot.
		White dot (Circular/foreign particle)	Pixel works electrically, however, circular/foreign particle makes dot appear to be “on” even when all “Black” data is sent to the screen.
		Adjacent dot	Adjacent dot defect is defined as two or more bright dot defects or black dot defects.  
	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	Definition of circle size		Definition of linear size
	 <p>a: major axis, b: minor axis $d = (a + b) / 2$</p>		

2) Standard

Classification		Inspection item		Judgement standard														
Defect (in LCD glass)	Single dot	Bright dot defect		Acceptable number : 7 Bright dot spacing : 5mm or more														
		Black dot defect		Acceptable number : 7 Black dot spacing : 5mm or more														
	Adjacent dot	2 dots	Bright dot defect	Acceptable number : 3														
			Black dot defect	Acceptable number : 3														
		3 or more dots		Acceptable number : 0														
	Total dot defects		Acceptable number : 10 Max															
	Others	White dot, Dark dot (Circle)		<table><tr><td>Size (mm)</td><td>Acceptable number</td></tr><tr><td>0.3 < d ≤ 0.5</td><td>4</td></tr><tr><td>0.5 < d</td><td>0</td></tr></table>			Size (mm)	Acceptable number	0.3 < d ≤ 0.5	4	0.5 < d	0						
Size (mm)	Acceptable number																	
0.3 < d ≤ 0.5	4																	
0.5 < d	0																	
External inspection (Defect on Polarizer or between Polarizer and LCD glass)		Polarizer (Scratch)		<table><tr><td>Width (mm)</td><td>Length</td><td>Acceptable number</td></tr><tr><td>0.01 < W ≤ 0.05</td><td>L ≤ 15</td><td>4</td></tr><tr><td>0.01 < W</td><td>15 < L</td><td>0</td></tr><tr><td>0.05 < W</td><td>—</td><td>0</td></tr></table>			Width (mm)	Length	Acceptable number	0.01 < W ≤ 0.05	L ≤ 15	4	0.01 < W	15 < L	0	0.05 < W	—	0
				Width (mm)	Length	Acceptable number												
				0.01 < W ≤ 0.05	L ≤ 15	4												
				0.01 < W	15 < L	0												
		0.05 < W	—	0														
		Polarizer (Bubble)		<table><tr><td>Size (mm)</td><td>Acceptable number</td></tr><tr><td>0.3 < d ≤ 0.5</td><td>5</td></tr><tr><td>0.5 < d</td><td>0</td></tr></table>			Size (mm)	Acceptable number	0.3 < d ≤ 0.5	5	0.5 < d	0						
				Size (mm)	Acceptable number													
				0.3 < d ≤ 0.5	5													
				0.5 < d	0													
		Foreign particle (Circular shape)		<table><tr><td>Size (mm)</td><td>Acceptable number</td></tr><tr><td>0.3 < d ≤ 0.5</td><td>4</td></tr><tr><td>0.5 < d</td><td>0</td></tr></table>			Size (mm)	Acceptable number	0.3 < d ≤ 0.5	4	0.5 < d	0						
				Size (mm)	Acceptable number													
				0.3 < d ≤ 0.5	4													
				0.5 < d	0													
		Foreign particle (Linear shape) Scratch		<table><tr><td>Width</td><td>Length (mm)</td><td>Acceptable number</td></tr><tr><td rowspan="2">W ≤ 0.15</td><td>L ≤ 3.0</td><td>4</td></tr><tr><td>3.0 < L</td><td>0</td></tr><tr><td>0.15 < W</td><td>—</td><td>(According to circular shape)</td></tr></table>			Width	Length (mm)	Acceptable number	W ≤ 0.15	L ≤ 3.0	4	3.0 < L	0	0.15 < W	—	(According to circular shape)	
				Width	Length (mm)	Acceptable number												
				W ≤ 0.15	L ≤ 3.0	4												
					3.0 < L	0												
				0.15 < W	—	(According to circular shape)												
		Color variation (Mura)		Not to be significantly visible. Consultation shall be held as necessary.														

Inspection item	Judgement standard						
Scratch, Foreign particle (Touch panel portion)	Item	Width(mm)		Length(mm)	Acceptable number		
		W < 0.05			Neglected		
		0.05 ≤ W ≤ 0.08		L ≤ 5.0	2		
	Scratch	0.08 < W		5.0 < L	0		
		W < 0.05			Neglected		
		0.05 ≤ W ≤ 0.08		L ≤ 5.0	2		
	Foreign particle (line like)	0.08 < W		5.0 < L	0		
		d ≤ 0.20			Neglected		
		0.20 ≤ d ≤ 0.25			2		
	Foreign particle (circle like)	0.25 < d			0		
*The particle will be ignored when it is cleanable.							
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 panel portion)	(t = Glass thickness)						
	Item	Size (mm)			Acceptable number		
		Corner crack			X	≤ 3	Neglected
					Y	≤ 3	
	Z				< t		
	Crack in other area than in corner			X	< 4	Neglected	
				Y	< 2		
				Z	< t		
	Progressive crack				0 pcs		

Fish eye on film, Dent on film and Air bubble	<table border="1"> <thead> <tr> <th>Size (mm)</th><th>Acceptable number</th></tr> </thead> <tbody> <tr> <td>$d \leq 0.2$</td><td>Neglected</td></tr> <tr> <td>$0.2 < d \leq 0.4$</td><td>Less than 5pcs</td></tr> <tr> <td>$0.4 < d \leq 0.5$</td><td>Less than 2pcs</td></tr> <tr> <td>$d > 0.5$</td><td>0</td></tr> </tbody> </table>	Size (mm)	Acceptable number	$d \leq 0.2$	Neglected	$0.2 < d \leq 0.4$	Less than 5pcs	$0.4 < d \leq 0.5$	Less than 2pcs	$d > 0.5$	0
Size (mm)	Acceptable number										
$d \leq 0.2$	Neglected										
$0.2 < d \leq 0.4$	Less than 5pcs										
$0.4 < d \leq 0.5$	Less than 2pcs										
$d > 0.5$	0										
Newton's ring	<p>Visual inspection shall be done at a distance of 0.3 m between eyes and a product with an angles of $60^\circ \pm 10^\circ$ to the surface of the product under a ceiling fluorescent light (40W, natural color).</p> <p>1. Regular A) When Newton ring dimension is more than 1/3 of sample dimension; it is regarded as a defect. B) When Newton ring dimension that is less than 1/3 of sample dimension and is not affect font effect and line distortion under a ceiling fluorescent light, it is acceptable.</p> <p>2. Irregular A) Newton ring dimension is more than 1/2 without lighting; it is regarded as a defect. B) As long as Newton ring affects font effect and line distortion under a ceiling fluorescent light, it is regarded as a defect. C) When Newton ring dimension is less than 1/2 of sample dimension and is not affect font effect and line distortion under a ceiling fluorescent light, it is acceptable.</p> <div style="text-align: center;">  Regular </div> <div style="text-align: center;">  Irregular </div>										
Miss matching of film and plastic board.	All round of film is inside of plastic board.										

