SPEC. NO.	TQ3C-8EAC0-E1AAYM49-00
DATE	January 17, 1998

For Reference Only

S P E C

TYPE: KCB104VG2BA-A03

CONTENTS

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
January 17, 1998	S. Oshita	S. Matsuo	A. Nishino	S. Hayashi	Y.Yoshita

Revision Record

Date	Designed by: Engineering Dept.			Confirmed by: QA Dept.	
	Prepared	Checked	Approved	Checked	Approved

Rev. No.	Date	Page	Descriptions

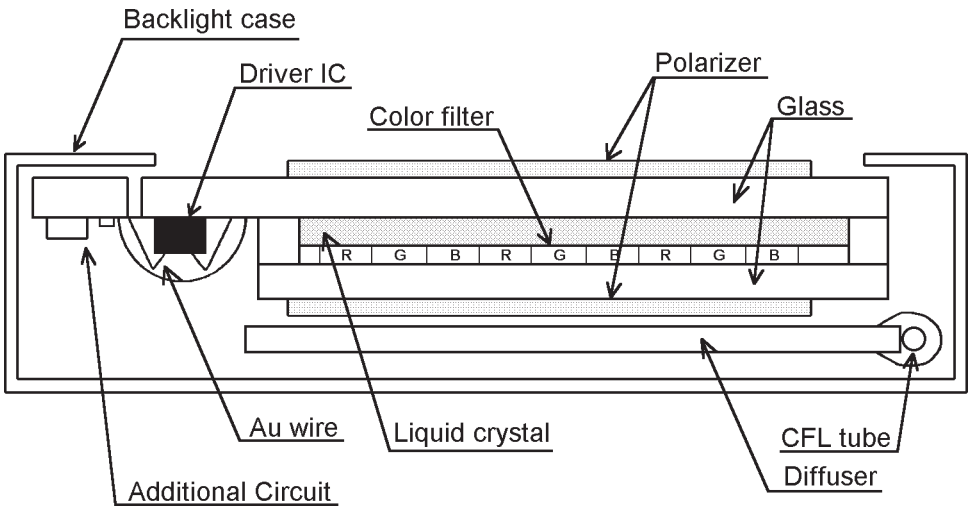
1. Application

This data sheet defines the specification for a (640 x 3) x 480 dot, STN color, dot matrix type Liquid Crystal Display with CFL backlight.

2. Construction and Outline

(640 x 3) x 480 dots. COB type LCD with CFL backlight.

Backlight system:	Side-edge type CFL (2 tubes)
Inverter:	Optional
	Recommended Inverter: KCI-13 (Minebea Electronics)
Polarizer:	Anti-Glare treatment
Additional Circuit:	Bias voltage circuit, Randomizing circuit
	DC/DC Converter



3. Mechanical Specifications

ITEM	SPECIFICATION	
Outline dimensions	264.0 (W) x 183.0 (H) x 8.5 (D)	mm
Effective viewing area	215.07 (W) x 162.27(H)	mm
Dot number	(640 x 3) (W) x 480 (H)	Dots
Dot size	0.09 (W) x 0.31 (H)	mm
Dot pitch	0.11 (W) x 0.33 (H)	mm
Display color *1	White *2	-
Base color *1	Black *2	-
Weight	540	g

*1 Due to the characteristics of the LC material, the colors vary with environmental temperature.
*2 Negative-type display

Display data “H”: R, G, B Dots ON: White
Display data “L”: R, G, B, Dots OFF: Black

4. Absolute Maximum Ratings

4.1 Electrical absolute maximum ratings

Temp. = 25°C

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply voltage for logic	VDD	0	6.0	V
Supply voltage for LCD driving	VCONT	0	VDD	V
Input signal voltage	Vin	0	VDD+0.3	V

4.2 Environmental absolute maximum ratings

ITEM	SYMBOL	MIN.	MAX.	UNIT
Operating temperature *6	Top	0	50	°C
Storage temperature *1	Tsto	-20	60	°C
Operating humidity *2	Hop	10	85	%RH
Storage humidity *2	Hsto	10	*3	%RH
Vibration	-*4	*4	-	
Shock	-	*5	*5	-

*1 Temp. = -20°C < 24 Hr.; Temp. = 60°C < 24 Hr.
No vibration and shock

*2 Non-condensing

*3 Temp. ≤ 40°C, 85% RH Max.
Temp. > 40°C, Absolute Humidity shall be less than 85% RH at 40°C.

*4

Frequency	10 ~ 55 Hz	Converted to acceleration value: (0.03 ~ 0.91G)
Vibration width	0.15 mm	
Interval	10 - 55 - 10 Hz 1 minute	

2 hours in each direction; X, Y, & Z (6 hours total) - EIAJ ED-2531

*5 Acceleration: 50G
Pulse width: 11 msec.
3 times in each direction: ±X, ±Y, & ±Z
EIAJ ED-2531

*6 The LCD's display quality is not quaranteed at temperatures below 0 C or above 40 C.

5. Electrical Characteristics

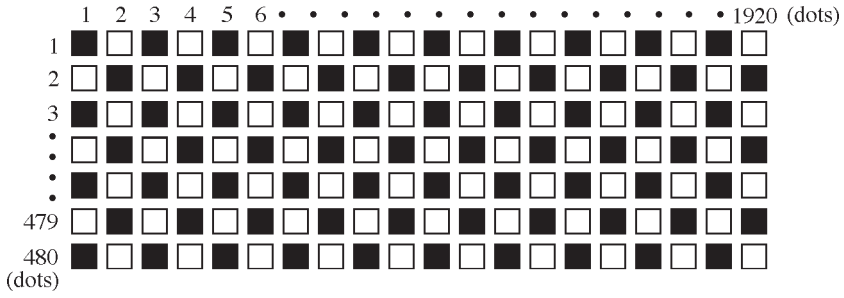
Temp. = 25°C, VDD = 5.0V ± 5%

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	-	4.75	5.00	5.25	V
LCD driving voltage *1	Vop = VCONT	0 °C	0.80	-	-	V
		25 °C	1.35	1.95	2.55	V
		40 °C	-	-	2.80	V
Input voltage	Vin	"H" Level	0.8VDD	-	VDD	V
		"L" Level	0	-	0.2VDD	V
Clock frequency	fcp		4.03	4.32	18.0	MHz
Frame frequency *2	f_{FRM}		70	75	80	Hz
Current consumption for logic	IDD	#3	-	68	102	mA
Power consumption	Pdisp		-	340	510	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (V_{op} = VCONT) for driving the LCD.

*2 In consideration of display quality, it is recommended that the frame frequency is set in the range of 70-80Hz. When higher frame and clock frequencies have to be used, confirm the LCD's performance and display quality before finalizing the frequency values. Generally, as frame and clock frequencies increase, current consumption increases and display quality degrades.

*3 Display high frequency pattern (see below).
VDD = 5V, V_{op} = VCONT, f_{FRM} = 75Hz, CP = 4.32MHz
Pattern:



6. Optical Characteristics

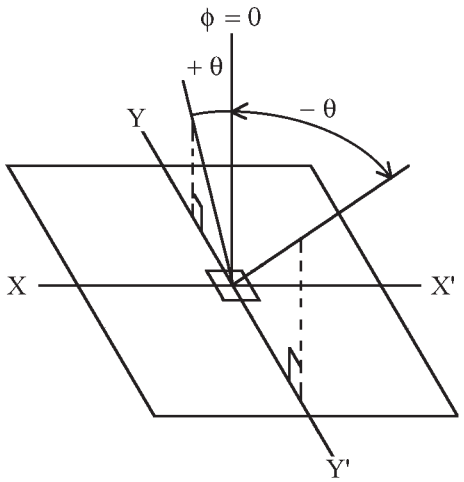
Temp. = 25°C Measuring spot = ϕ12mm

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	$\theta = \phi = 0°$	-	160	260	ms
	Down	Tf	$\theta = \phi = 0°$	-	80	180	ms
Viewing angle range		θ	CR $\geq$ 2, $\phi = 0°$	-20	-	35	deg.
		ϕ	CR $\geq$ 2, $\theta = 0°$	-45	-	45	deg.
Contrast ratio		CR	$\theta = \phi = 0°$	10.0	20.0	-	-
Chromaticity coordinates	Red	x	$\theta = \phi = 0°$	0.49	0.54	0.59	-
		y	$\theta = \phi = 0°$	0.29	0.34	0.39	-
	Green	x	$\theta = \phi = 0°$	0.25	0.30	0.35	-
		y	$\theta = \phi = 0°$	0.50	0.55	0.60	-
	Blue	x	$\theta = \phi = 0°$	0.12	0.17	0.22	-
		y	$\theta = \phi = 0°$	0.10	0.15	0.20	-
	White	x	$\theta = \phi = 0°$	0.26	0.31	0.36	-
		y	$\theta = \phi = 0°$	0.28	0.33	0.38	-
	Black	x	$\theta = \phi = 0°$	0.27	0.32	0.37	-
		y	$\theta = \phi = 0°$	0.29	0.34	0.39	-

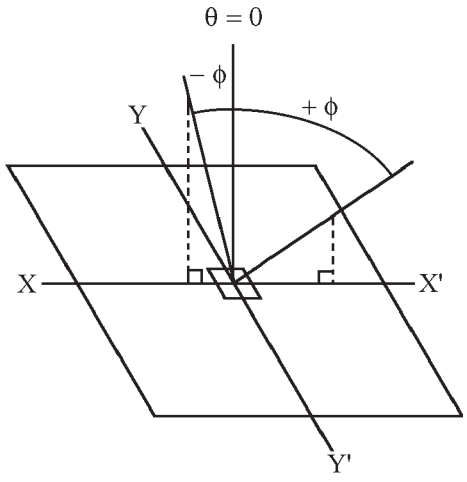
Optimum contrast is obtained by adjusting the LCD driving voltage (Vop) while at the viewing angle of $\theta = \phi = 0°$.

6.1 Contrast ratio is defined as: $$CR = \frac{\text{Brightness all pixels "White"}}{\text{Brightness all pixels "Black"}}$$

6.2 Definition of viewing angle

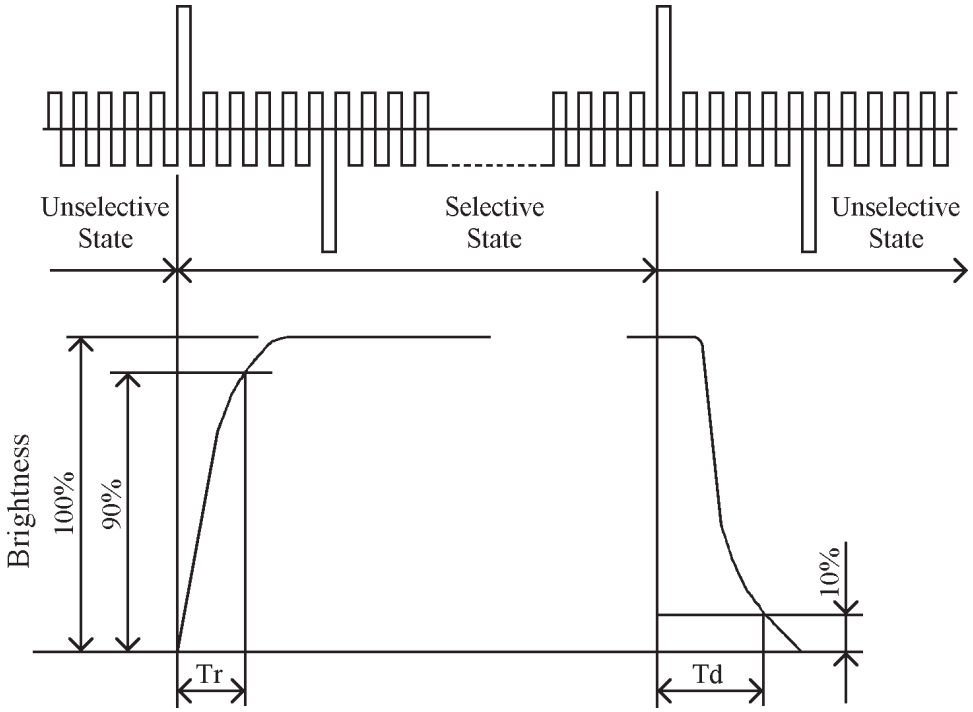


(θ Direction)

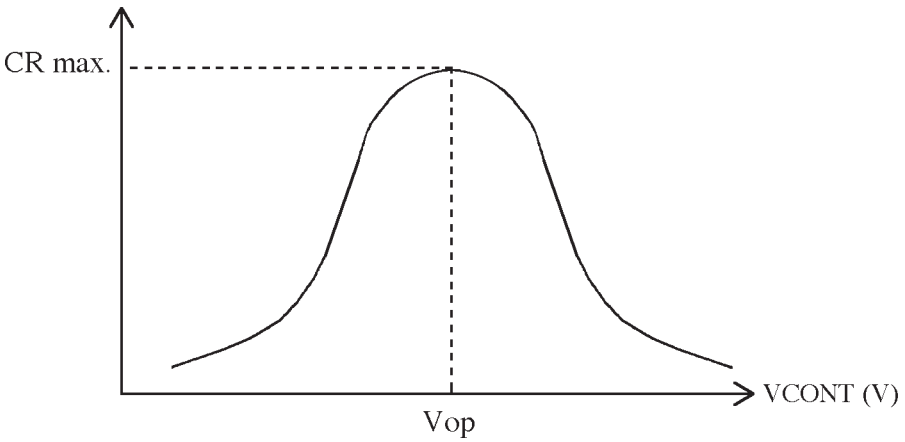


(ϕ Direction)

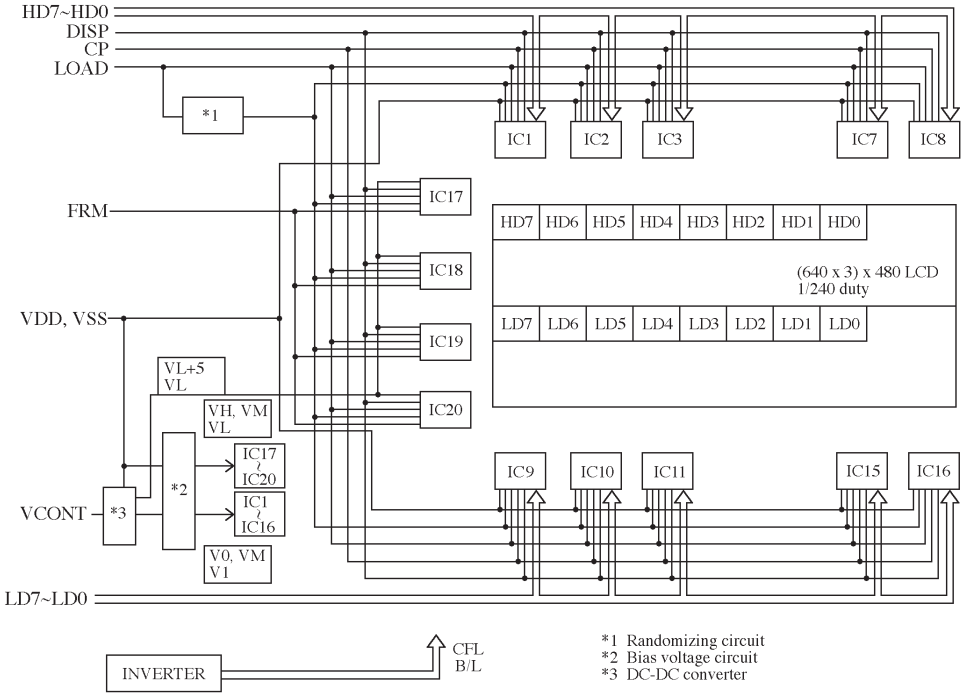
6.3 Definition of response time



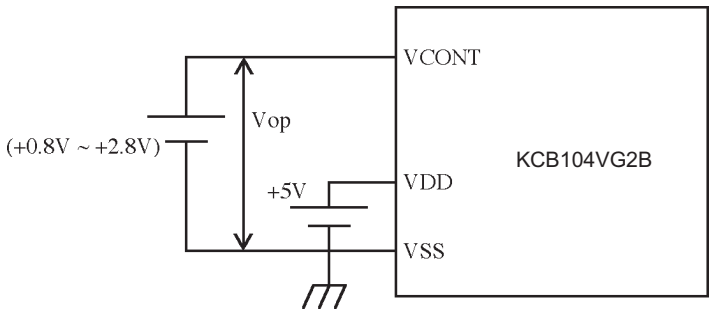
6.4 Definition of V_{op}



7. Circuit Block Diagram



7.1 Power supply



8. Interface Signals

8.1 LCD

CN1: Molex 53261-1510

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	FRM	Synchronous signal for driving scanning line	H
2	NC	No connect	-
3	DISP	Display control signal	H (ON), L (OFF)
4	LOAD	Data signal latch clock	H → L
5	VSS	GND	-
6	CP	Data signal shift clock	H → L
7	VSS	GND	-
8	HDO	Display data (Upper column)	H (ON), L (OFF)
9	HD1		
10	HD2		
11	HD3		
12	HD4		
13	HD5		
14	HD6		
15	HD7		

Recommended matching connector: Molex 51021-1500

CN2: Molex 53261-1410

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	LDO	Display data (Lower column)	H (ON), L (OFF)
2	LD1		
3	LD2		
4	LD3		
5	LD4		
6	LD5		
7	LD6		
8	LD7		
9	VDD	Power supply for logic	-
10	VSS	GND	-
11	NC	No connect	-
12	NC	No connect	-
13	NC	No connect	-
14	VCONT	LCD adjust voltage	-

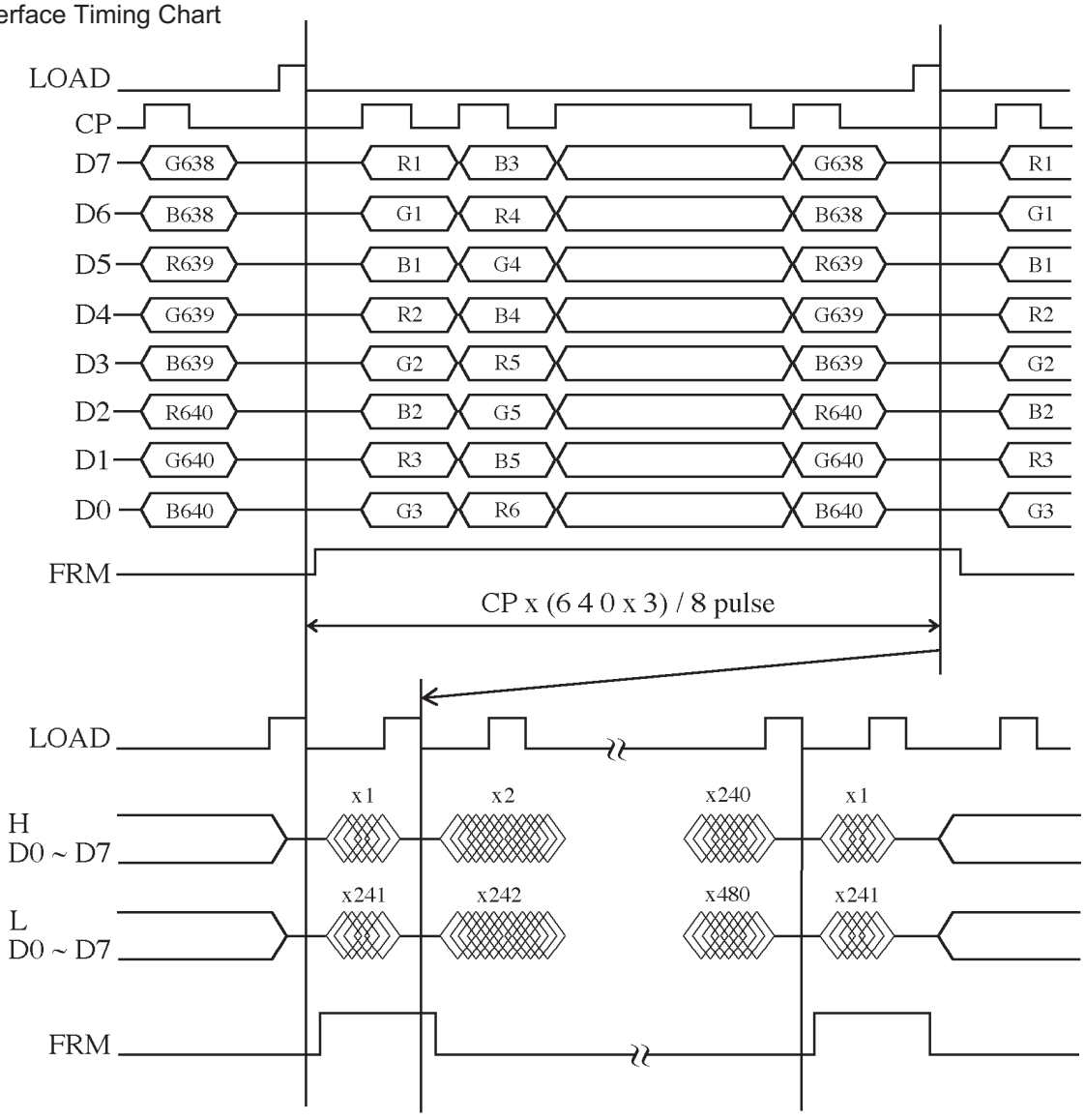
Recommended matching connector: 51021-1400 (Molex)

8.2 BACKLIGHT

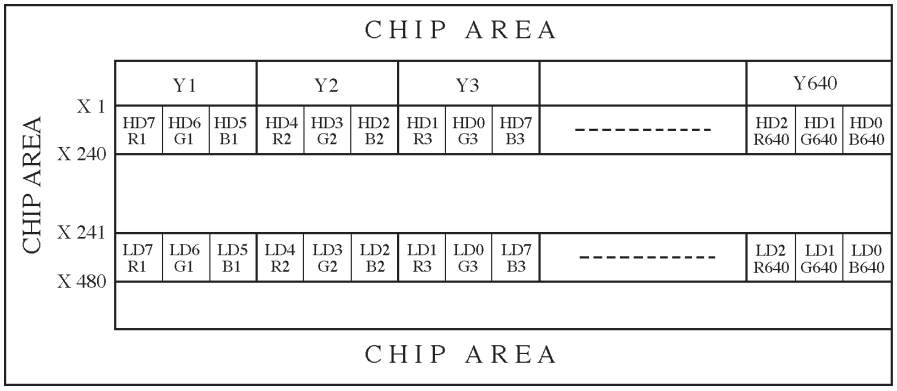
PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	GND	Ground line (from inverter)	-
2	NC	-	-
3	HV	Power supply for CFL	AC

Recommended matching connector: QZ-19-A3MYL (HONDA)x2
LCD side connector: QZ-19-3F01 (HONDA)x2

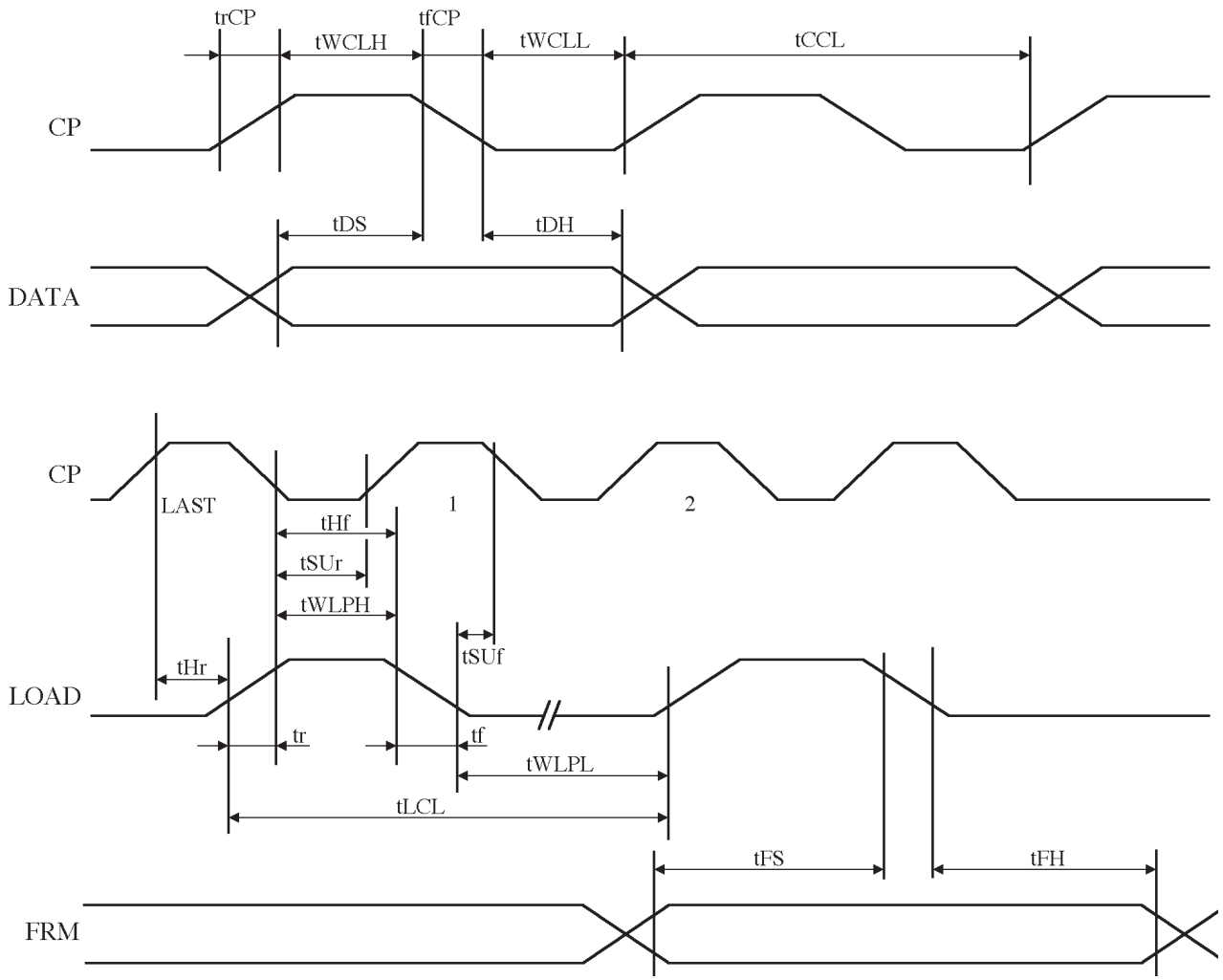
9. Interface Timing Chart



10. Data and Screen



11. Input Timing characteristics



11.1 Switching characteristics

Input characteristics: VDD = 5.0V ± 5% Temp. = 25°C

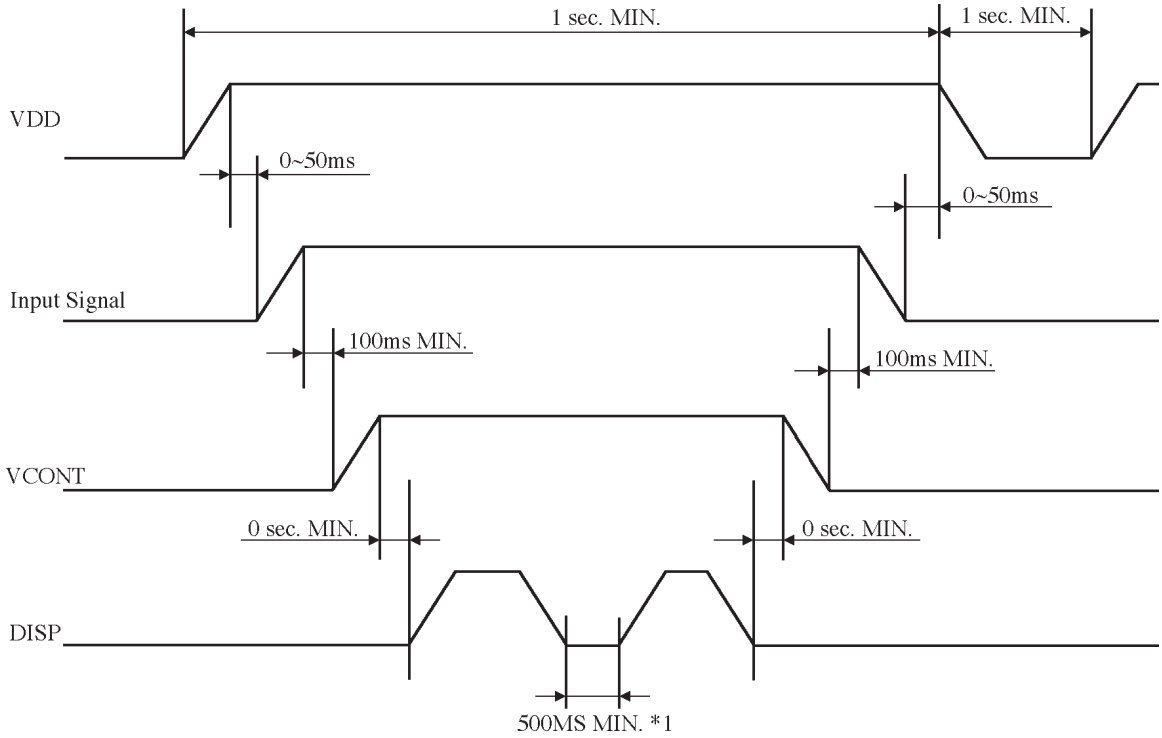
ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle *1	tCCL	56	-	ns
CP “H” Pulse Width	tWCLH	15	-	ns
CP “L” Pulse Width	tWCLL	15	-	ns
CP Rise Time *2	trCP	-	50	ns
CP Fall Time *2	tfCP	-	50	ns
Data Set-up Time	tDS	10	-	ns
Data Hold Time	tDH	10	-	ns
Load “H” Pulse Width	tWLPH	100	-	ns
Load “L” Pulse Width	tWLPL	100	-	ns
LOAD Cycle	tLCL	10	-	µs
Data Strobe Set-Up Time	tSUr	20	-	ns
Data Strobe Set-Up Time	tSUf	20	-	ns
Data Strobe Hold Time	tHr	5	-	ns
Data Strobe Hold Time	tHf	20	-	ns
Input Signal Rise Time	tr	-	30	ns
Input Signal Fall Time	tf	-	30	ns
FRM Data Set-up Time	tFS	100	-	ns
FRM Data Hold Time	tFH	100	-	ns

*1 Adjust CP Cycle so that the FRM signal is 75Hz

*2 The formula for the condition is:
(1) trCP, tfCP < [tCCL - (tWCLH + tWCLL)] / 2
This condition must be met.
Please use on condition that (1) is filled.

12. Supply Voltage Sequence Condition

DO NOT apply DC voltage to the LCD panel. A DC voltage will induce an irreversible electro-chemical reaction and reduce LCD life. Always follow the power supply ON/OFF sequence of VDD first, input signal second, VCONT third, and finally DISP as shown below. This will prevent DC driving of the LCD or CMOS LSI latch-up.



*1 Take interval time for minimum 500ms once you cut off the Disp signal.

*Control the supply voltage sequence to prevent the signal lines from floating when the LCD panel is driving.

13. Backlight Characteristics

13.1 CFL ratings

Measurements for Inverter: KCI-13 (Minebea Electronics) Temp. = 25°C

ITEM	SYM.	MIN.	TYP.	MAX	NOTE
Starting Discharge Voltage *1	VS	-	-	1,270 Vrms	0 °C
		-	-	845 Vrms	25 °C
Discharging tube current	IL	2.0 mArms	5 mArms	6.0 mArms	-
Discharging tube voltage	VL	-	520 Vrms	-	-
Operating life (IL =5mArms) *2	T	-	25,000 Hr.	-	-
Operating frequency	F	40 kHz	-	100 kHz	-

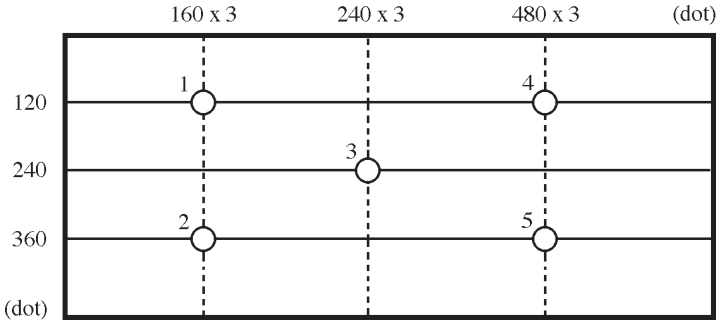
*1 The Non-load output voltage (VS) of the inverter should be designed to have some margin, because VS may increase due to leakage current that may be caused by the wiring of the CFL cables. (Reference value: 1,650Vrms MIN.)

*2 When the illuminance or quantity of light has decreased to 50% of the initial value.

13.2 Surface brightness of the LCD (IL = 5 mArms), Temp. = 25 °C

ITEM	MIN.	TYP.	MAX.	UNIT
Brightness	100	130	-	cd/m ^{2}

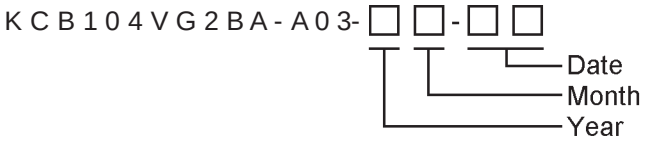
(Measuring points)



1) The rating is defined as the average brightness inside the viewing area.
2) Measurements are taken 30 min. after the CFL is turned on.
(Ambient Temp. = 25 °C)
3) The inverter should meet the eccentric conditions:
-Sine, symmetric waveform without a positive or negative spike

14. Lot Number Identification

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



YEAR	1995	1996	1997	1998	1999	2000
CODE	5	6	7	8	9	0

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

15. Warranty

15.1 Incoming Inspection

Please inspect the LCD within 30 days of your receipt.

15.2 Production Warranty

Kyocera warrants its LCDs for a period of 12 months after receipt by the purchaser, and within the limits specified herein. Kyocera shall, by mutual agreement, replace or rework defective LCDs that are shown to be Kyocera's responsibility.

16. Precautions in Use

16.1 Installation of the LCD

1. Please ground either of the mounting (screw) holes located at each corner of an LCD module in order to stabilize brightness and display quality.

2. The LCD shall be installed so that there is no pressure on the LSI chips.

3. The LCD shall be installed flat, without twisting or bending.

4. The display window size should be the same as the effective viewing area.

5. Image quality outside the effective viewing area is not warranted.

16.2 Static electricity

1. Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required. Operators should wear ground straps.

16.3 LCD operation

1. The LCD shall be operated within the limits specified. Operation at values outside of the specified limits may shorten life and/or harm display images.

2. V_{op} must be adjusted to optimize viewing angle and contrast.

3. Operation of the LCD at temperatures below the limit specified may cause image degradation and/or bubbles. It may also change the characteristics of the liquid crystal. This phenomenon may not recover. The LCD shall be operated within the temperature limits specified.

16.4 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. The LCD should be packaged to prevent damage.

16.5 Screen surface

1. DO NOT store in a high humidity environment for extended periods. Image degradation, bubbles, and/or peeling off of polarizers may result.

2. The front polarizer is easily scratched or damaged. Prevent touching it with any hard material, and from being pushed or rubbed.

3. The LCD screen may be cleaned with a soft cloth or cotton pad. Methanol or Isopropyl Alcohol may be used, but insure that all solvent residue is removed.

4. Water may cause damage or discoloration of the polarizer. Clean any condensation or moisture from any source immediately.

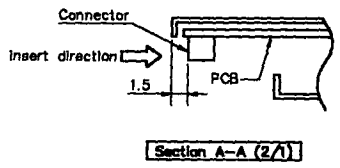
5. Always keep the LCD free from condensation during testing. Condensation may permanently spot or stain the polarizers.

17. Reliability Data / Environmental Test

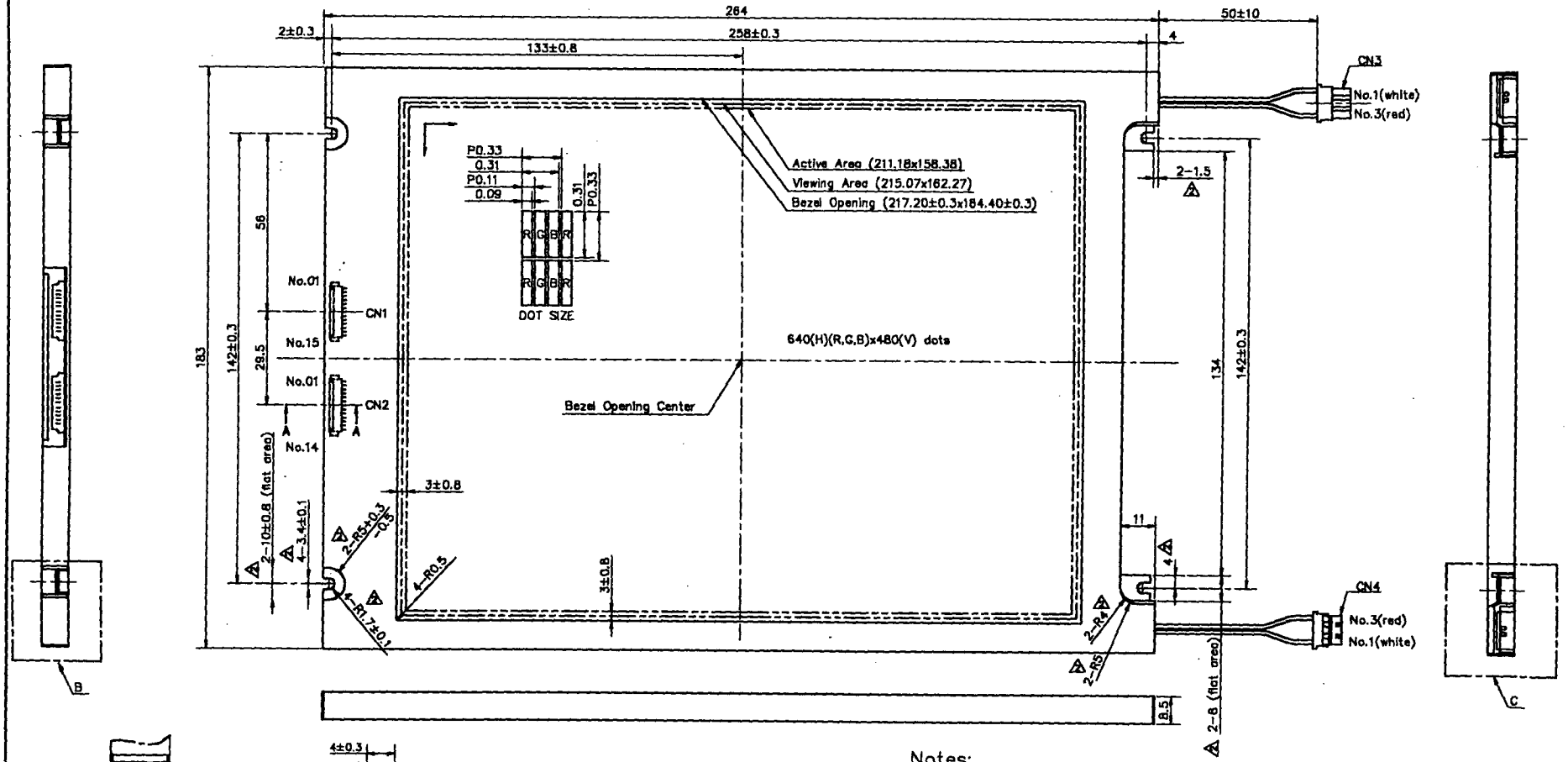
TEST ITEM	TEST CONDITION	TEST TIME	RESULT
High Temp. Atmosphere	70°C	240 hr.	Display Quality: No defect Display Function: No defect Current Consumption: No defect
Low Temp. Atmosphere	-20 °C	240 hr.	Low Temp. Bubble: None Crystalization of Liquid Crystal Material: None Display Quality: No defect Display Function: No defect Current Consumption: No defect
High Temp. & High Humidity Atmosphere	40 °C 90% RH	240 hr.	Display Quality: No defect Display Function: No defect Peeling of Organic Sealant: None Current Consumption: No defect
Temp. Cycle	-20 °C; 0.5 hr. RT; 0.5 hr. 70 °C; 0.5 hr.	10 cycles	Display Quality: No defect Display Function: No defect Peeling of Organic Sealant: None Bubble on Cell: None
High Temp. Operation	50 °C Vop	500 hr.	Display Quality: No defect Current Consumption: No defect

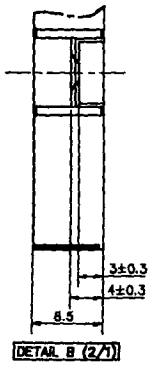
- Each test item uses a test LCD only once. The tested LCD is not used in any other test.
- The LCD is tested in circumstances in which there is no condensation.
- The test specimen is allowed to stabilize for 24 hours, at room temperature and room humidity, before post test measurements are taken.
- Reliability tests are NOT outgoing inspection tests.
- The results of reliability tests are for reference purposes only. Reliability tests are conducted only to examine an LCD's capability.

Rev	No	Description	Drwn	Chk	App
1	1	Add detail B.C.	1996.12.01 s.oshita	s.asakura	m.fujitani
2	2	Add dimension	1997.05.12 y.tatemura	1997.05.12 k.abe	1997.05.12 a.nishina
3	3	Add version	1997.07.07 y.tatemura	1997.07.07 k.abe	1997.07.07 a.nishina
4	4	Add version	1997.11.10 n.inamura	1997.11.10 k.abe	1997.11.10 t.minera

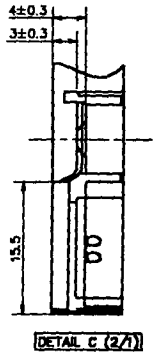


Section A-A (2/1)





DETAIL B (2/1)



DETAIL C (2/1)

Notes:

1. Matching Connector
   : 51021-1500.51021-1400 (MOLEX)
   : QZ-19-A3MYL#02 (HONDA)
2. Drawn as seen from the front. Information is displayed on the screen from the upper left hand corner to the right.

* Connectors
CN1, 53261-1510 (MOLEX)
CN2, 53261-1410 (MOLEX)
CN3, CN4; QZ-19-3F01 (HONDA)

* Tolerance without indication ± 0.5

Approved	Checked	Drawn	Scale	Title	KYOCERA	Year-Month-Day	Size
m.fujitani	s.asakura	s.oshita	1/1	KCB104VG2BA (KCB6448BSTT-X5,X9) 3 4		96-11-07	2
				Outline Dimensions	Drawing No. 121A0069100		

SPEC. NO.	TQ3C-8EACO-E2AAYM49-00
DATE	January 17, 1998

For Reference Only

KYOCERA INSPECTION STANDARD

TYPE: KCB104VG2BA-A03

(LIQUID CRYSTAL DISPLAY MODULE)

KYOCERA CORPORATION
LCD DIVISION, HAYATO PLANT

Original Issue Date	Designed by: Engineering Dept.			Confirmed by: QA Dept.	
	Prepared	Checked	Approved	Checked	Approved
January 17, 1998	S. Oshita	S. Matsuo	A. Nishino	S. Hayashi	Y.Yoshita

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Rev. No.	Date	Page	Descriptions

Visuals Specification

1) Note

<table>
<tr><td>General</td><td colspan="2">1. When inspecting for defects, as defined by this inspection standard, operating voltage (Vop) shall be set at the level where the defect is observed most clearly. Display quality criteria is applicable only within the effective viewing area. (GRAY-SCALE Inspection)

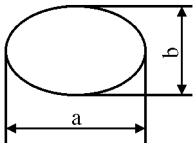
2. The inspection criteria defined in this inspection standard shall be applied to any defect within the effective viewing area. It shall not apply outside the effective viewing area.

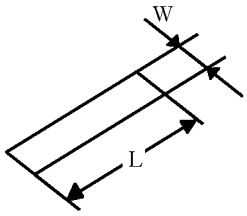
3. Should any defects, which are not specified in this standard be identified, addi tional standards shall be determined by mutual agreement between the customer and Kyocera.

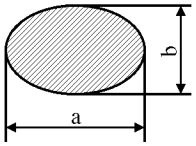
4. Inspection conditions

Luminance: 500 Lux minimum
Inspection Distance: 300mm (from the sample)
Temperature: 25±5°C
Direction: Right above</td></tr>
<tr><td rowspan="4">Definition of Inspection Items</td><td>Pinhole, Bright spot, Black spot, Scratch, Foreign particle</td><td>The color of a small area is different from the remainder. The phenomenon does not change with voltage.</td></tr>
<tr><td>Contrast Variation</td><td>The color of a small area is different from the remainder. The phenomenon changes with voltage.</td></tr>
<tr><td>Polarizer (Scratch, Bubble, Dent)</td><td>Scratch, Bubble and Dent in the polarizer, which can be seen in the ON/OFF state.</td></tr>
<tr><td colspan="2"></td></tr>
</table>

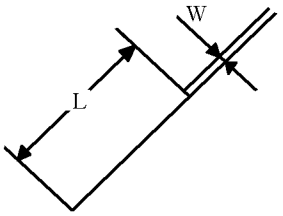
2) Standard

<table>
<tr><th>Inspection Item</th><th>Judgement Standard</th></tr>
<tr><td>Pinhole, Bright spot, Black spot, Foreign particle</td><td>


d = (a + b) / 2
<table>
<tr><th>Category</th><th>Size (mm)</th><th>Acceptable Number</th></tr>
<tr><td>A</td><td>d ≤ 0.2</td><td>neglected</td></tr>
<tr><td>B</td><td>0.2 < d ≤ 0.3</td><td>5</td></tr>
<tr><td>C</td><td>0.3 < d ≤ 0.5</td><td>3</td></tr>
<tr><td>D</td><td>0.5 < d</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Scratch, Foreign particle</td><td>


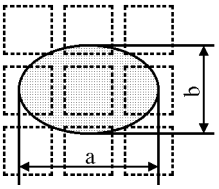
<table>
<tr><th>Category</th><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable No.</th></tr>
<tr><td>A</td><td>W ≤ 0.03</td><td>-</td><td>neglected</td></tr>
<tr><td>B</td><td rowspan="3">0.03 < W ≤ 0.1</td><td>L ≤ 2.0</td><td>neglected</td></tr>
<tr><td>C</td><td>2.0 < L ≤ 4.0</td><td>3</td></tr>
<tr><td>D</td><td>4.0 < L</td><td>0</td></tr>
<tr><td>E</td><td>0.1 < W</td><td>-</td><td>per Circular criteria</td></tr>
</table>
</td></tr>
<tr><td>Contrast variation</td><td>


d = (a + b) / 2
<table>
<tr><th>Category</th><th>Size (mm)</th><th>Acceptable Number</th></tr>
<tr><td>A</td><td>d ≤ 0.5</td><td>neglected</td></tr>
<tr><td>B</td><td>0.5 < d ≤ 0.7</td><td>3</td></tr>
<tr><td>C</td><td>0.7 < d</td><td>0</td></tr>
</table>
</td></tr>
</table>

Inspection Item	Judgement Standard
Polarizer (Scratch, Bubble, Dent)	(1) Scratch 

Category	Width (mm)	Length (mm)	Acceptable No.
A	W ≤ 0.1	-	neglected
B	0.1 < W ≤ 0.3	L ≤ 5.0	neglected
C		5.0 < L	0
D	0.3 < W	-	0

(2) Bubble (dent)



d = (a + b) / 2

Category	Size (mm)	Acceptable Number
A	d ≤ 0.2	neglected
B	0.2 < d ≤ 0.3	5
C	0.3 < d ≤ 0.5	3
D	0.5 < d	0