PEC.NO.	TQ3C-8EAC0-E1CYM08-01
DATE	May 29,2001

SPEC

FOR:

TYPE:KCB104VG2CA-A43

CONTENTS

Issued
Date: MAY.30.2001
KYOCERA
Hayato LCD Division

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

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

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
November 9,2000	T.Yamaguchi	J.Matsumoto	T.Minami	S.Hayashi	Y.Yoshida

Caution

1. This Kyocera LCD module has been specifically designed for use only in electronic devices in the areas of audio control, office automation, industrial control, home appliances, etc. The modules should not be used in medical applications where module failure could result in physical harm or loss of life, and Kyocera expressly disclaims any and all liability relating in any way to the use of the module in such medical applications.

2. Customer agrees to indemnify, defend and hold Kyocera harmless from and against any and all actions, claims, losses, damages, liabilities, awards, costs, and expenses, including legal fees, resulting from or arising out of Customer's use, or sale for use, of Kyocera modules in medical applications.

3. 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.

Revision Record

Date	Designed by : Engineering Dept.			Confirmed by : QA Dept.	
	Prepared	Checked	Approved	Checked	Approved
May 29,2001	T. Yamaguchi	Y. Matsumoto	T. Iwami	S. Hayashi	Y. Yoshida

Rev. No.	Date	Page	Descriptions
00	Nov. 9,2000	—	Change Spec.No "TQ3C-8EAC0-E1AAYM91-00" → "TQ3C-8EAC0-E1CYM08-00"
01	May 29,2001	—	All Pages ~Change of page layout
		12	9.Interface Timing Chart ~Add comment
		17	12.Supply Voltage Sequence Condition ~Add comment
		18	13.Backlight Chracteristics ~Add comment
		20	16-1.Installation of the LCD ~Delete comment

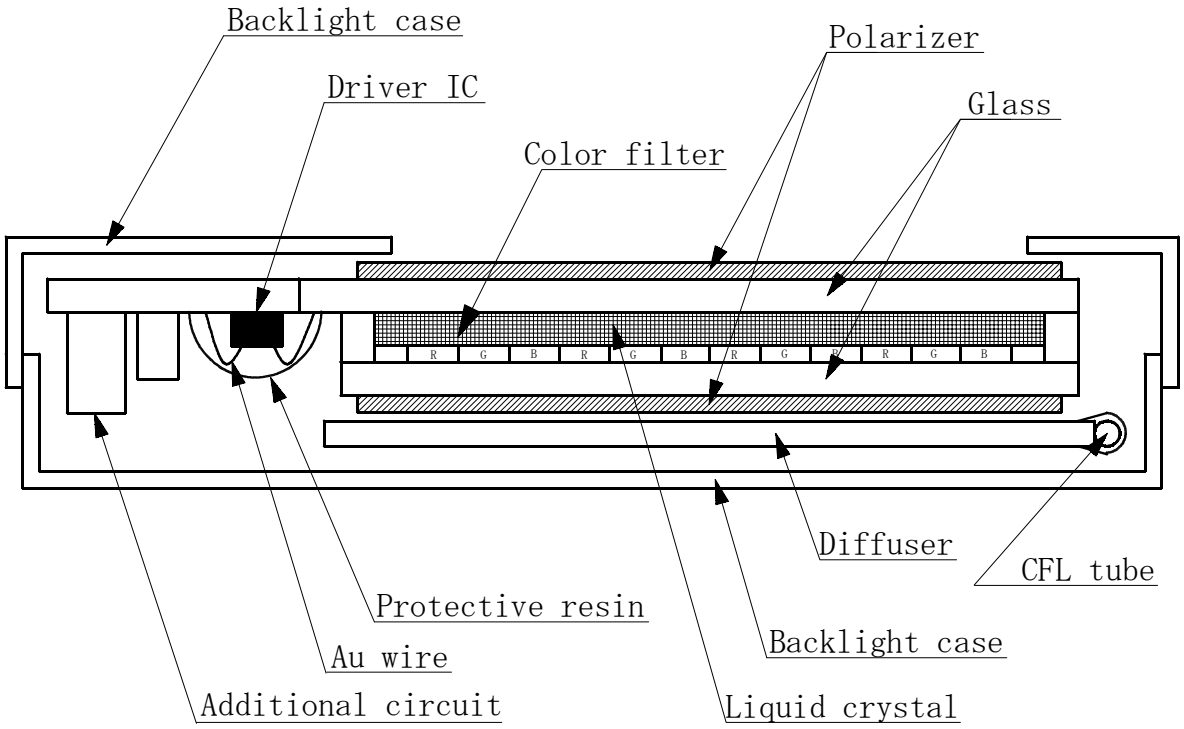
1. Application

This data sheet defines the specification for a (640×R.G.B)×480 dot, STN Transmissive color dot matrix type Liquid Crystal Display with CFL backlight.

2. Construction and Outline

(640×R.G.B)×480 dots, COB type LCD with CFL backlight.

Backlight system	: Side-edge type CFL (2 tube).
Inverter	: Option Recommended Inverter : KCI-13 (MINEBEA ELECTRONICS) or equivalent
Polarizer	: Non-Glare treatment.
Additional circuit	: Bias voltage circuit, Randomizing circuit, DC/DC converter.



This drawing is showing conception only.

3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	264.0 (W) × 183.0 (H) × 8.5 (D)	mm
Effective viewing area	215.1 (W) × 162.3 (H)	mm
Dot number	(640×R.G.B) (W) × 480 (H)	Dots
Dot size	0.09 (W) × 0.31 (H)	mm
Dot pitch	0.11 (W) × 0.33 (H)	mm
Display color *1	White *2	—
Base color *1	Black *2	—
Mass	540	g

*1 Due to the characteristics of the LC material, the color 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

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 *1	Vin	0	VDD+0.3	V

*1 Input signal : CP, LOAD, FRM, DISP, HD0～HD7, LD0～LD7

4-2. Environmental absolute maximum ratings

ITEM	SYMBOL	MIN	MAX	UNIT
Operating temperature *1	Top	0	50	℃
Storage temperature *2	T_{STO}	-20	60	℃
Operating humidity *3	Hop	10	*4	%RH
Storage humidity *3	H_{STO}	10	*4	%RH
Vibration	—	*5	*5	—
Shock	—	*6	*6	—

*1 LCD'S display quality shall not be guaranteed at the temperature range of:
below 0℃ and upper 40℃.

*2 Temp. = -20℃ ＜ 48 h , Temp = 60℃ ＜ 168 h
Store LCD panel at normal temperature/humidity.
Keep it free from vibration and shock.
LCD panel that is kept at low or high temperature for a long time can be defective due to the other conditions, even if the temperature satisfies standard.

*3 Non-condensation.

*4 Temp. ≦ 40℃, 85% RH Max.
Temp. ＞ 40℃, Absolute Humidity shall be less than 85 %RH at 40℃.

*5

Frequency	10～55 Hz	Converted to acceleration value: (0.3～9 m/s^2)
Vibration width	0.15 mm	
Interval	10-55-10 Hz 1 minute	

2 hours in each direction X/Y/Z (6 hours as total)
EIAJ ED-2531.

*6 Acceleration: 490 m/s^2
Pulse width : 11 ms
3 times in each direction : ±X/±Y/±Z.
EIAJ ED-2531.

5. Electrical Characteristics

5-1. VDD=3.3V

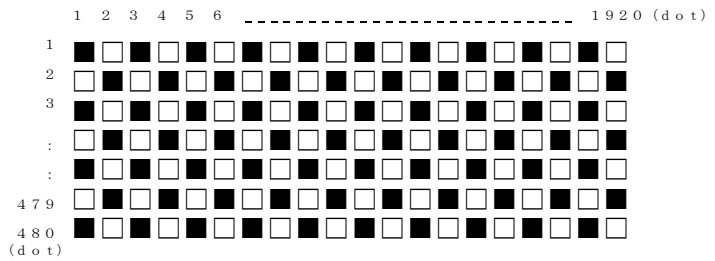
Temp. = 25℃, VDD = +3.3V ± 0.3V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	—	3.0	3.3	3.6	V
LCD driving voltage *1	Vop= VCONT	0 ℃	0.80	—	—	V
		25 ℃	1.35	1.95	2.55	V
		50 ℃	—	—	2.80	V
Input voltage	Vin	"H" level	0.8VDD	—	VDD	V
		"L" level	0	—	0.2VDD	V
Clock frequency	f cp	—	4.03	4.32	13.0	MHz
Frame frequency *2	f_{FRM}	—	70	75	80	Hz
Current consumption for logic	IDD	*3	—	71	107	mA
Power consumption	Pdisp		—	235	354	mW

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

*2 In consideration of display quality, it is recommended that frame frequency is set in the range of 70-80Hz. When you have to use higher frame and clock frequencies, confirm the LCD's performance and quality prior to finalizing the frequency values: Generally, as frame and clock frequencies become higher, current consumption will get bigger and display quality will be degraded.

*3 Display high frequency pattern, (see below).
VDD = 3.3V , Vop = VCONT , f_{FRM} = 75 Hz , fcp = 4.32 MHz
Pattern:



5-2. VDD=5.0V

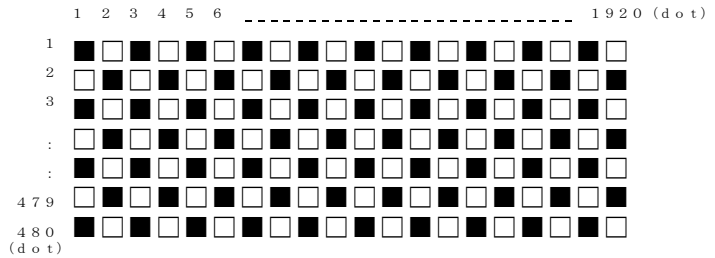
Temp. = 25℃, VDD = +5.0V ± 5%

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 ℃	0.80	—	—	V
		25 ℃	1.35	1.95	2.55	V
		50 ℃	—	—	2.80	V
Input voltage	Vin	"H" level	0.8VDD	—	VDD	V
		"L" level	0	—	0.2VDD	V
Clock frequency	f cp	—	4.03	4.32	18.0	MHz
Frame frequency *2	f_{FRM}	—	70	75	80	Hz
Current consumption for logic	IDD	*3	—	51	77	mA
Power consumption	Pdisp		—	255	385	mW

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

*2 In consideration of display quality, it is recommended that frame frequency is set in the range of 70-80Hz. When you have to use higher frame and clock frequencies, confirm the LCD's performance and quality prior to finalizing the frequency values: Generally, as frame and clock frequencies become higher, current consumption will get bigger and display quality will be degraded.

*3 Display high frequency pattern, (see below).
VDD = 5.0V , Vop = VCONT , f_{FRM} = 75 Hz , fcp = 4.32 MHz
Pattern:



6. Optical Characteristics

Temp. = 25℃

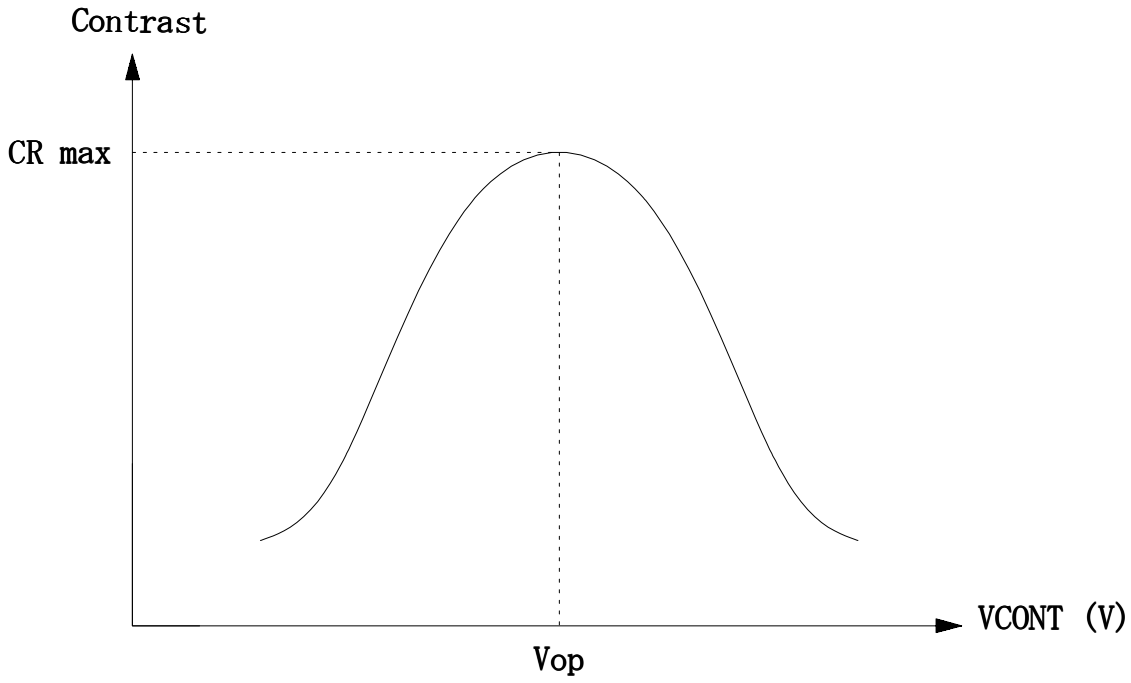
ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	$\theta=\phi=0^\circ$		—	160	260	ms
	Down	Td	$\theta=\phi=0^\circ$		—	80	180	ms
Viewing angle range		θ	CR≧2	$\phi=0^\circ$	-20	—	35	deg.
		ϕ		$\theta=0^\circ$	-45	—	45	deg.
Contrast ratio		CR	$\theta=\phi=0^\circ$		15.0	30.0	—	—
Brightness(IL=5.0mA)		L	—		120	160	—	cd/㎡
Chromaticity coordinates	Red	x	$\theta=\phi=0^\circ$		0.49	0.54	0.59	—
		y			0.29	0.34	0.39	
	Green	x	$\theta=\phi=0^\circ$		0.25	0.30	0.35	
		y			0.47	0.52	0.57	
	Blue	x	$\theta=\phi=0^\circ$		0.11	0.16	0.21	
		y			0.10	0.15	0.20	
	White	x	$\theta=\phi=0^\circ$		0.26	0.31	0.36	
		y			0.28	0.33	0.38	
	Black	x	$\theta=\phi=0^\circ$		0.25	0.30	0.35	
		y			0.25	0.30	0.35	

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

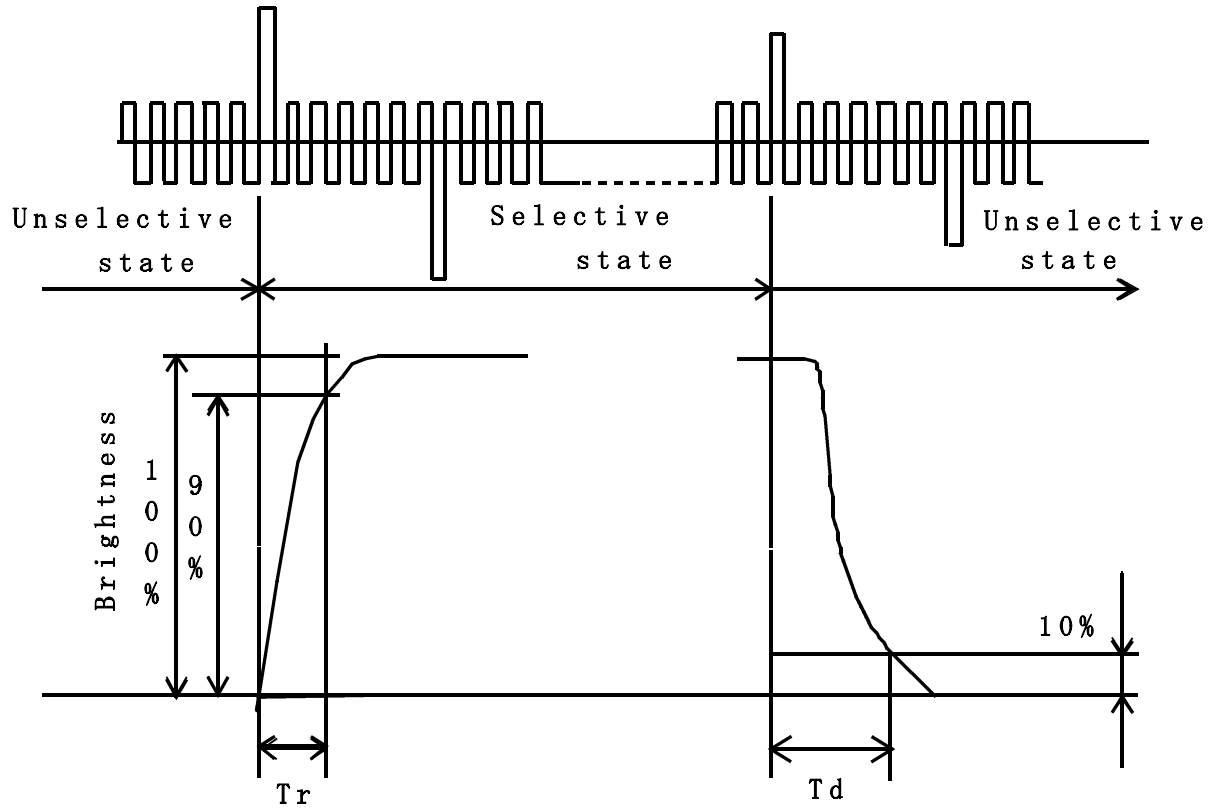
6-1.Contrast ratio is defined as follows:

$$CR = \frac{\text{Brightness all pixels "White"}}{\text{Brightness all pixels "Black"}}$$

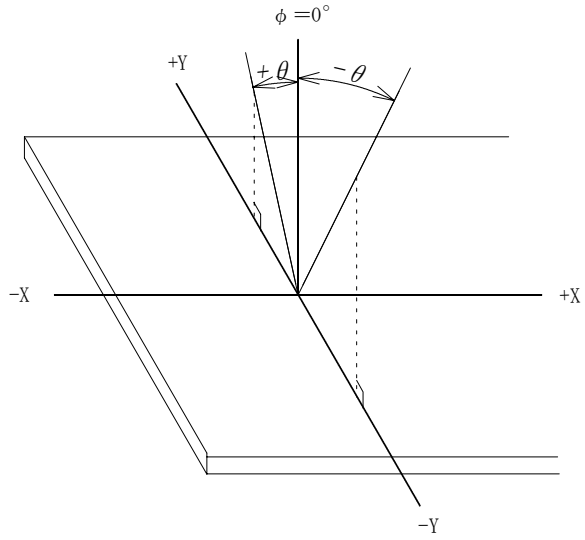
6-2. Definition of Vop



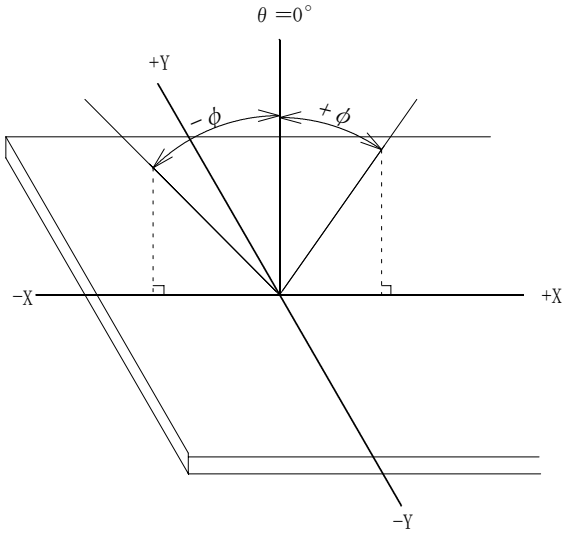
6-3. Definition of response time



6-4. Definition of viewing angle

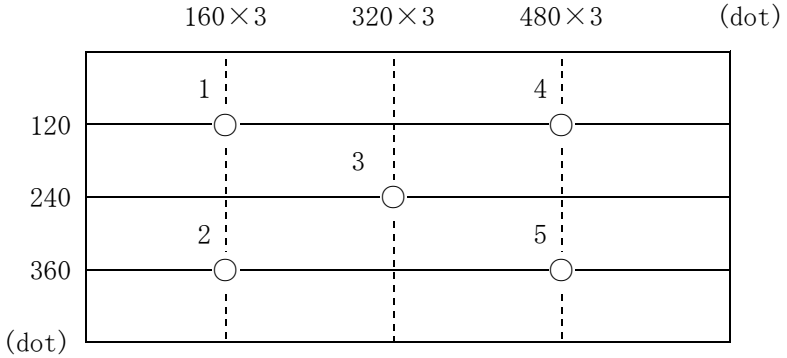


(θ direction)



(φ direction)

6-5. Measuring points



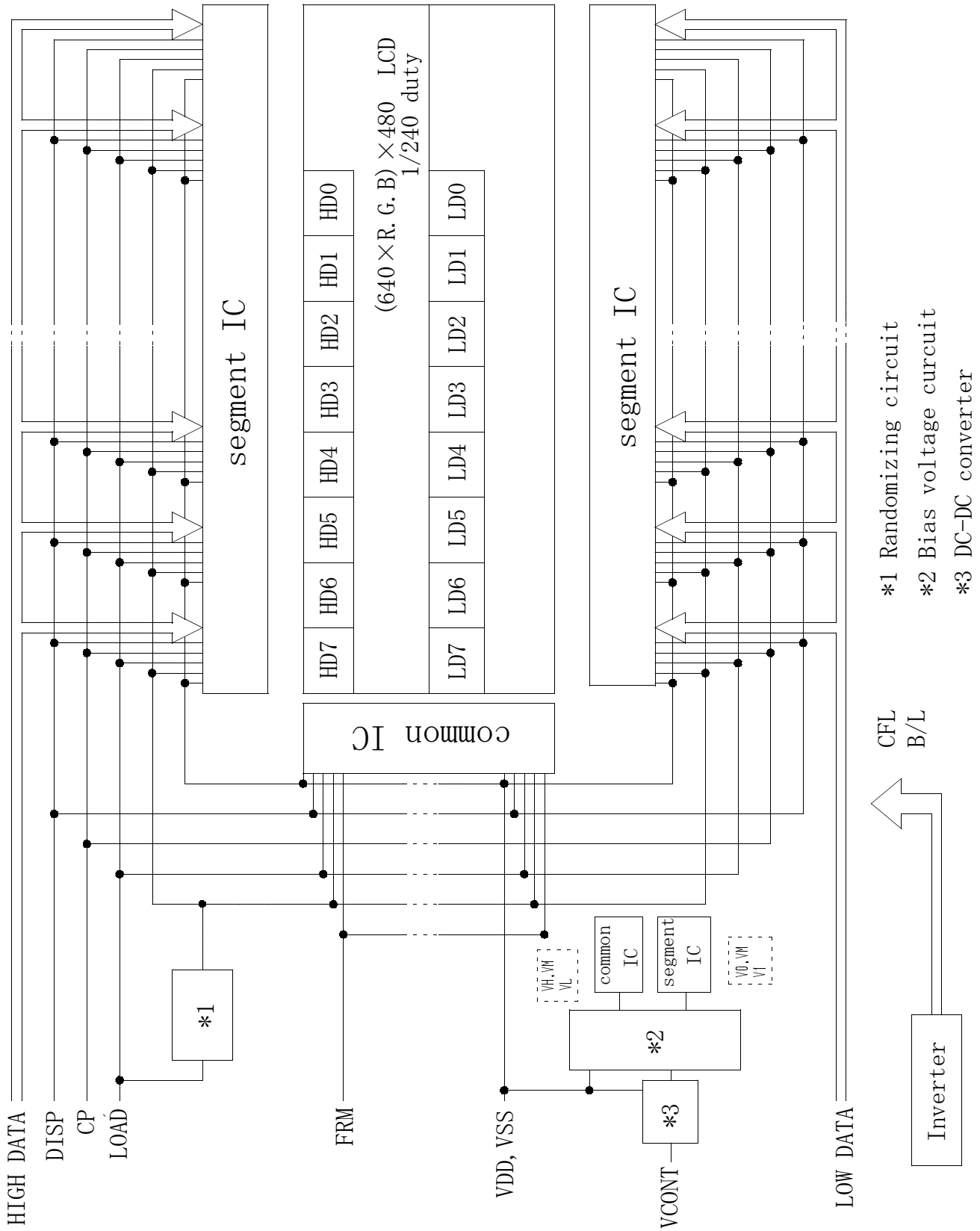
1) Rating is defined as the average brightness inside the viewing area.

2) 30 minutes after CFL is turned on. (Ambient Temp.=25℃)

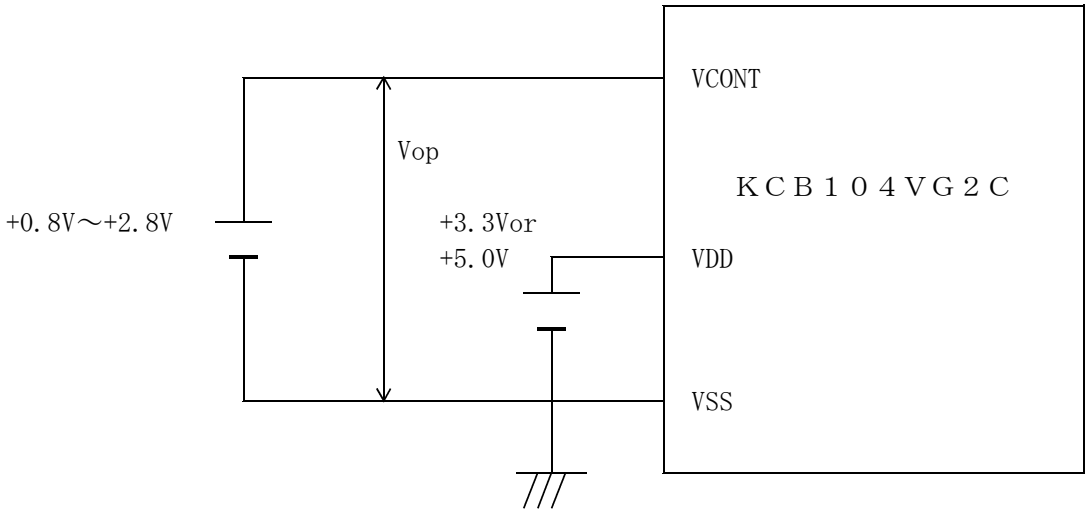
3) The inverter should meet the eccentric conditions;
-Sine, symmetric waveform without spike in positive and negative.

4) Measuring Inverter : KCI-13 (MINEBEA ELECTRONICS)

7. Circuit Block Diagram



7-1.Power Supply



8. Interface Signals

8-1. LCD

CN1 : 53261-1510(Molex)

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	HD0	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 : 51021-1500(Molex)

CN2 : 53261-1410(Molex)

PIN No	SYMBOL	DESCRIPTION	LEVEL
1	LD0	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)

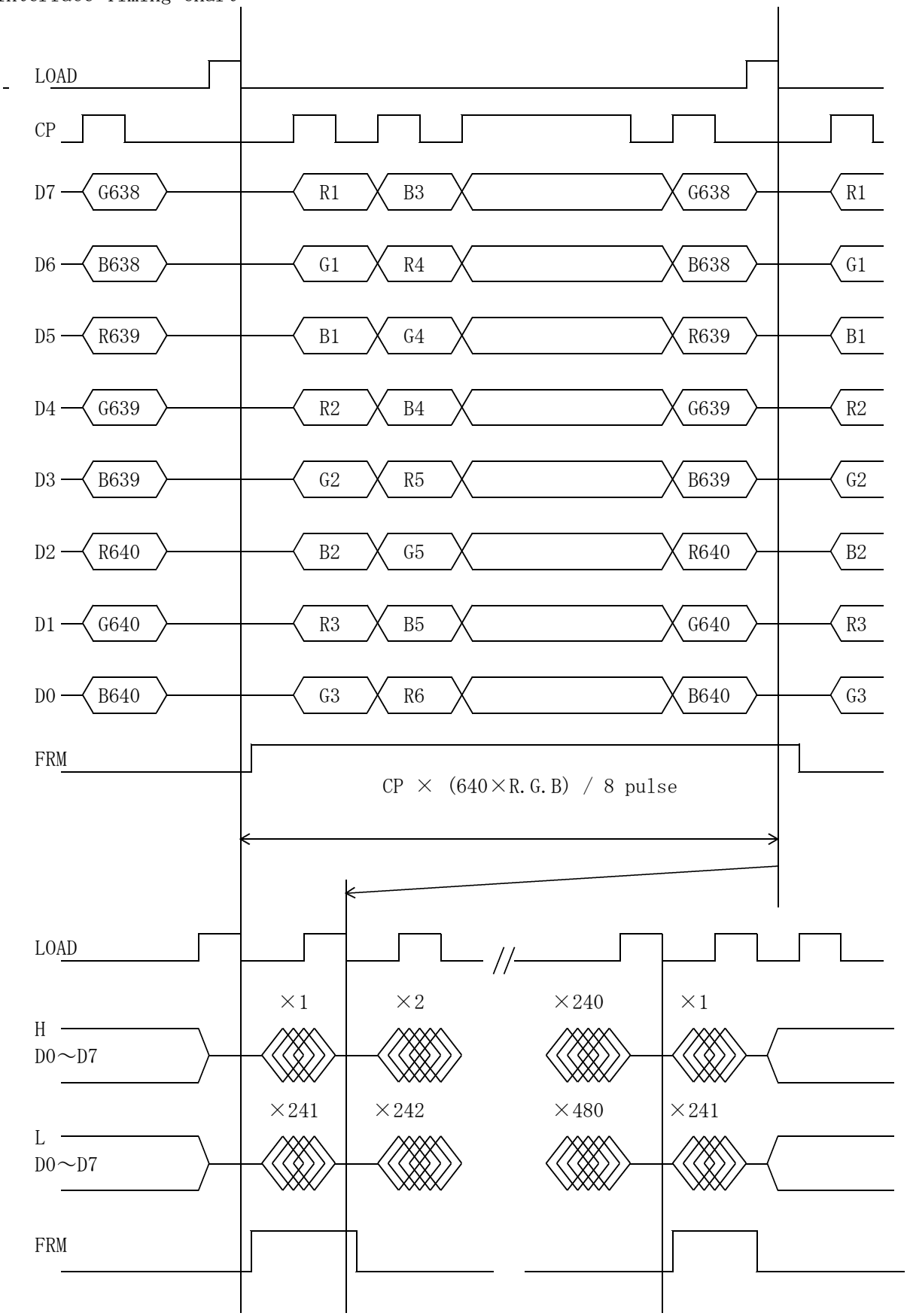
8-2. CFL

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

LCD side connector : QZ-19-3F01 (HONDA)×2

Recommended matching connector : QZ-19-A3MYL#02 (HONDA)×2

9. Interface Timing Chart



* The cycle of load signal should be stable and continuously applied without interruption.
* The above-mentioned timing chart shows a reference to set up a LCD module, not an electrical rating

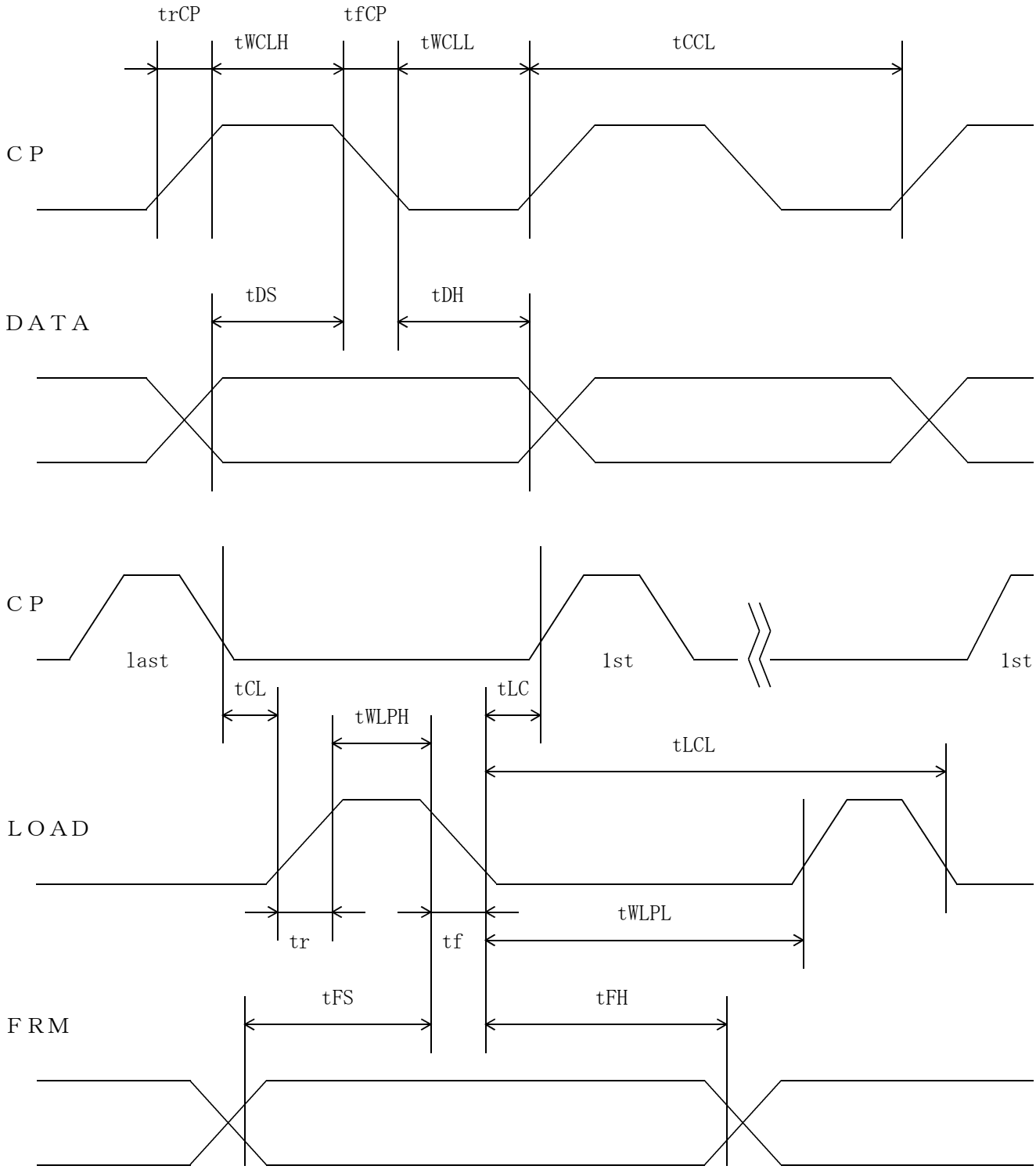
10. Data and Screen

CHIP AREA

		Y1			Y2			Y3			···	Y640		
C	X1													
H	·	HD7	HD6	HD5	HD4	HD3	HD2	HD1	HD0	HD7		HD2	HD1	HD0
I	·	R1	G1	B1	R2	G2	B2	R3	G3	B3		R640	G640	B640
P	·													
	·													
	X240													
	X241													
A	·													
R	·													
E	·	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0	LD7		LD2	LD1	LD0
A	·	R1	G1	B1	R2	G2	B2	R3	G3	B3		R640	G640	B640
	X480													

CHIP AREA

11. Input Timing Characteristics



11-1. Switching characteristics (VDD=3.3V)

Input characteristics ; VDD = +3.3V ± 0.3V, Temp. = 25 ℃

ITEM		SYMBOL	MIN.	MAX.	UNIT
CP Cycle	*1,*2	tCCL	77	—	ns
CP "H" Pulse Width	*2	tWCLH	30	—	ns
CP "L" Pulse Width	*2	tWCLL	30	—	ns
CP Rise Up Time	*2	trCP	—	30	ns
CP Fall Down Time	*2	tfCP	—	30	ns
Data Set Up Time		tDS	15	—	ns
Data Hold Time		tDH	25	—	ns
LOAD "H" Pulse Width		tWLPH	100	—	ns
LOAD "L" Pulse Width		tWLPL	900	—	ns
LOAD Cycle	*3	tLCL	1000	—	ns
CP→LOAD Delay Time		tCL	0	—	ns
LOAD→CP Delay Time	*4	tLC	10	—	ns
Input Signal Rise Up Time		tr	—	30	ns
Input Signal Fall Down Time		tf	—	30	ns
FRM Data Set Up Time		tFS	100	—	ns
FRM Data Hold Time		tFH	100	—	ns

*1 CP Cycle is adjust so that FRM signal is 75Hz.

*2 The formula of condition
① trCP + tfCP < tCCL - (tWCLH + tWCLL)
② trCP,trCP ≦ 30 ns
Please use on condition that ①,② are filled.

*3 LOAD Cycle is const.

*4 tLC ≧ 0

11-2. Switching characteristics (VDD=5.0V)

Input characteristics ; VDD = +5.0V ± 5%, Temp. = 25 ℃

ITEM		SYMBOL	MIN.	MAX.	UNIT
CP Cycle	*1,*2	tCCL	56	—	ns
CP "H" Pulse Width	*2	tWCLH	20	—	ns
CP "L" Pulse Width	*2	tWCLL	20	—	ns
CP Rise Up Time	*2	trCP	—	30	ns
CP Fall Down Time	*2	tfCP	—	30	ns
Data Set Up Time		tDS	10	—	ns
Data Hold Time		tDH	15	—	ns
LOAD "H" Pulse Width		tWLPH	100	—	ns
LOAD "L" Pulse Width		tWLPL	900	—	ns
LOAD Cycle	*3	tLCL	1000	—	ns
CP→LOAD Delay Time		tCL	0	—	ns
LOAD→CP Delay Time	*4	tLC	10	—	ns
Input Signal Rise Up Time		tr	—	30	ns
Input Signal Fall Down Time		tf	—	30	ns
FRM Data Set Up Time		tFS	100	—	ns
FRM Data Hold Time		tFH	100	—	ns

*1 CP Cycle is adjust so that FRM signal is 75Hz.

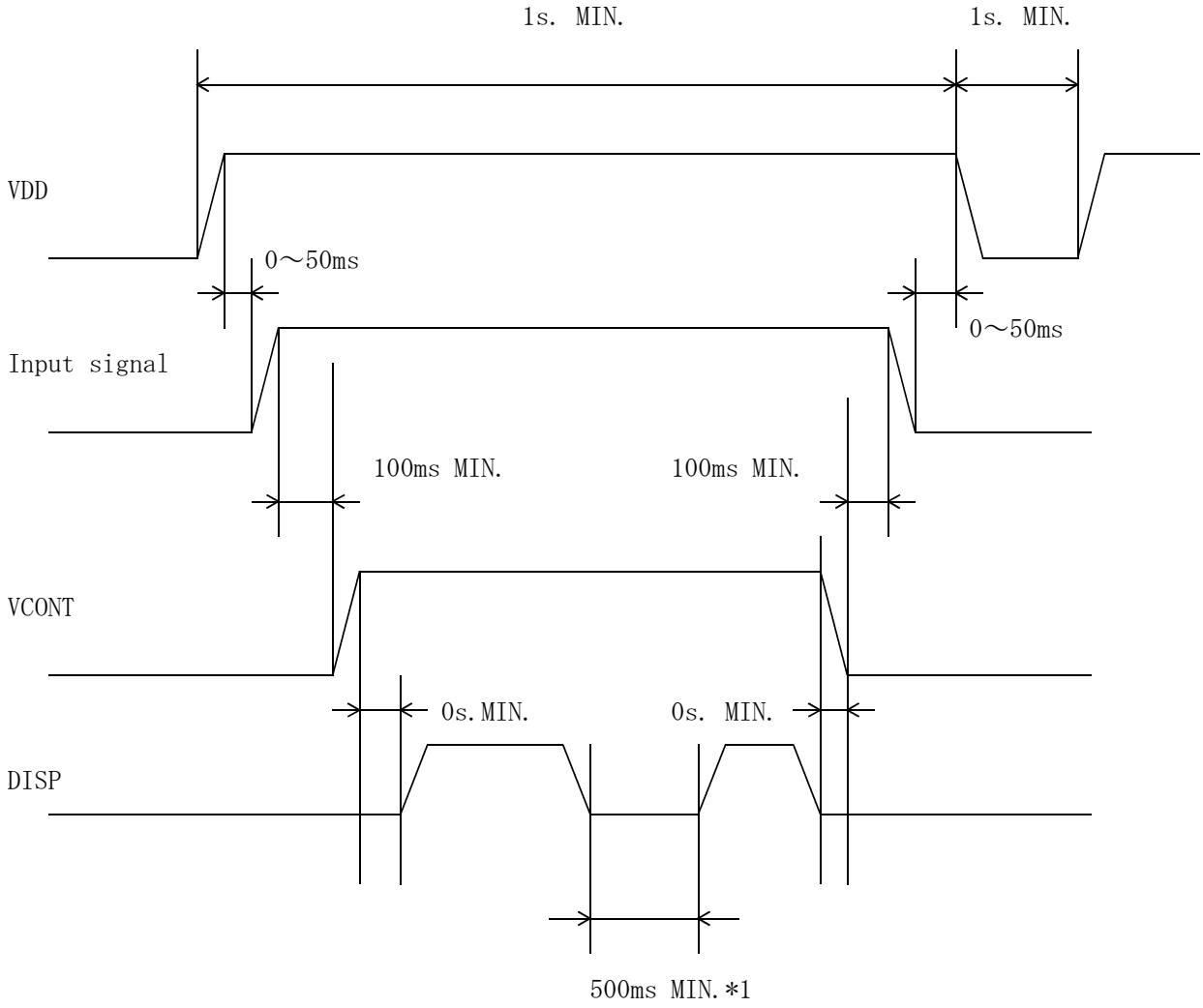
*2 The formula of condition
① trCP + tfCP < tCCL - (tWCLH + tWCLL)
② trCP,trCP ≦ 30 ns
Please use on condition that ①,② are filled.

*3 LOAD Cycle is const.

*4 tLC ≧ 0

12. Supply Voltage Sequence Condition

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



*1 Take interval time for minimum 500ms once you cut off the Disp signal.
* Input signal : CP,LOAD,FRM,HD0～HD7,LD0～LD7
* Control the supply voltage sequence not to float all signal line when the LCD panel is driving.
* Control the input signal and VCONT to the above ON-OFF timing when you switch ON/OFF the display during VDD and DISP are on.
  And also design the circuit as VCONT's OFF level become GND level.

1 3. Backlight Characteristics

Temp.= 25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	NOTE
Starting discharge Voltage *1	VS	—	—	1,270 Vrms.	0 ℃
		—	—	845 Vrms.	25 ℃
Discharging tube current *2,*3	IL	2.0 mArms.	5.0 mArms.	6.0 mArms.	—
Discharging tube voltage	VL	—	520 Vrms.	—	—
Operating life *4 (IL=5.0mArms.)	T	25,000 h	40,000 h	—	—
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 the leak current which may be caused by wiring of CFL cables.(Reference value: 1,650Vrms MIN.)

*2 We recommend that you should set the discharging tube current at lower than typical value so as to prevent the heat accumulation of CFL tube from deteriorating a performance of the LCD.

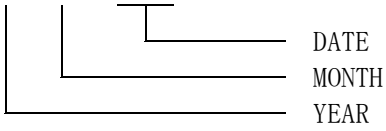
*3 Do not apply more than 6.0mA discharging tube current.
Because CFL maybe broken due to over current.

*4 When the illuminance or quantity of light has decreased to 50 % of the initial value.
Average life time of CFL wii be decreased when LCD is operating at lower and higher temperature.

１４. Lot Number Identification

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

ＫＣＢ１０４ＶＧ２ＣＡ－Ａ４３－ □ □－□ □



YEAR	2001	2002	2003	2004	2005	2006
CODE	1	2	3	4	5	6

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 one month after 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.
Kyocera shall, by mutual agreement, replace or rework defective LCDs that are shown to be Kyocera's responsibility.

16. Precautions for 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. In case you use outside frame of effective viewing area as outward appearance of your product, unevenness of its outward appearance is out of guarantee.
6. Do not pull the CFL lead wires and do not bend the root of the wires.
   Housing should be designed to protect CFL lead wires from external stress.

16-2. Static Electricity

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

16-3. 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. Vop must be adjusted to optimize viewing angle and contrast.
3. Operation of the LCD at temperature 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 protected 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℃	240 h	Display Quality : No defect Display Function : No defect Current Consumption : No defect
Low Temp. Atmosphere	-20℃	240 h	Low Temp. Bubble : None Solid Crystallization of Liquid Crystal : None Display Quality : No defect Display Function : No defect Current Consumption : No defect
High Temp. Humidity Atmosphere	40℃ 90%RH	240 h	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Current Consumption : No defect
Temp. Cycle	-20℃ 0.5 h R.T. 0.5 h 70℃ 0.5 h	10 cycles	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Bubble on Cell : None
High Temp. Operation	50℃ Vop	500 h	Display Quality : No defect Current Consumption : No defect

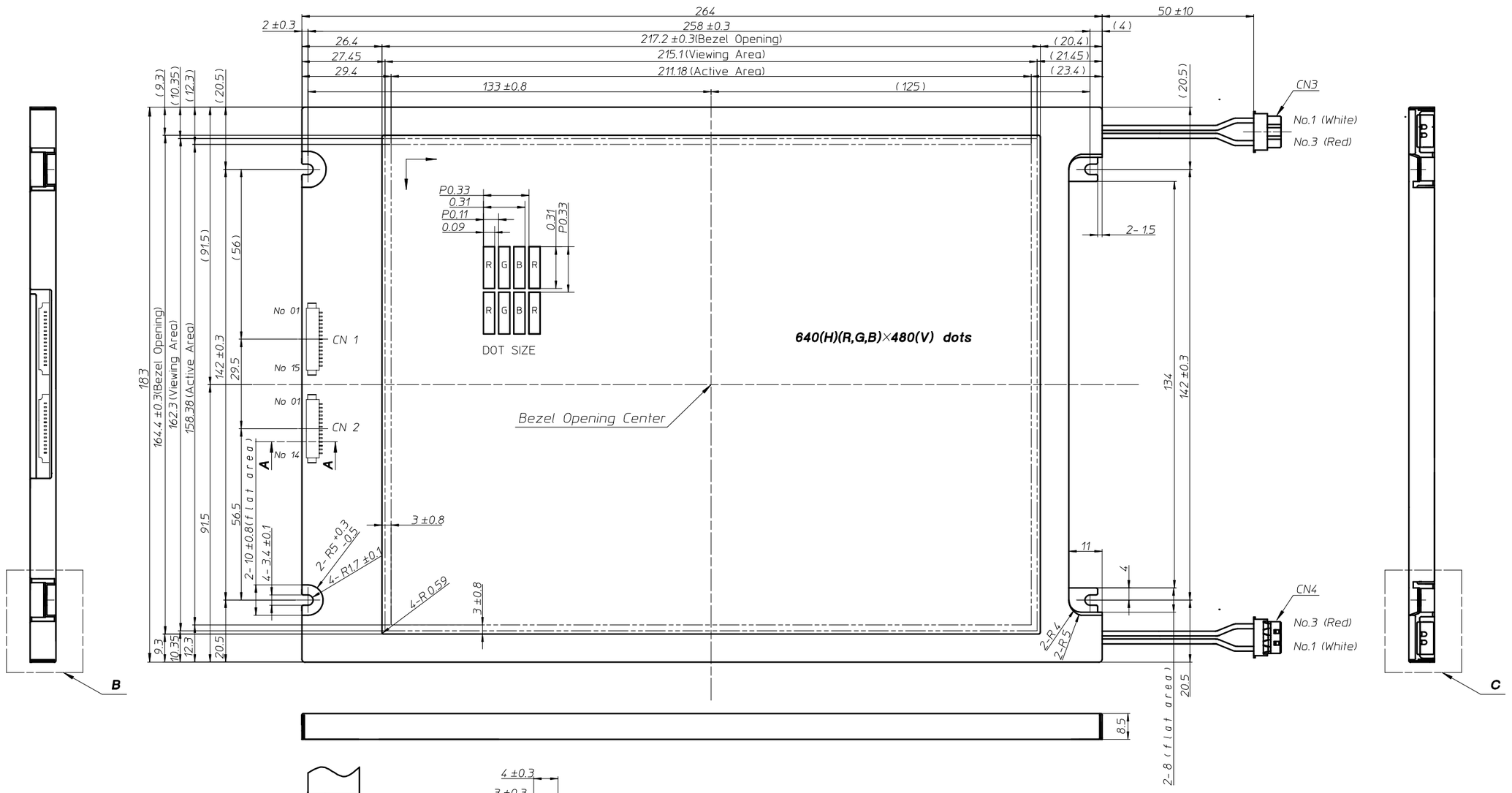
* Each test item uses a test LCD only once. The tested LCD is not used in any other tests.

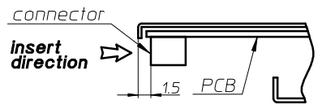
* The LCD is tested in circumstances in which there is no condensation.

* The tested LCD is inspected after 24 hours of storage at room temperature and room humidity after each test is finished.

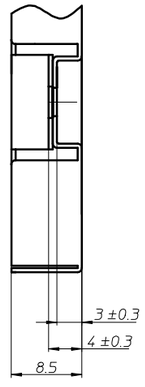
* The reliability test is not an out-going inspection.

* The results of the reliability test are for your reference purpose only.
The reliability test is conducted only to examine the LCD's capability.

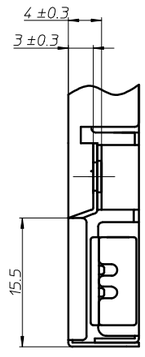




SECTION A–A (2/1)



DETAIL B (2/1)



DETAIL C (2/1)

Note

1 Matching Connector : 51021-1500,51021-1400 (MOLEX)
: QZ-19-A3MYL#02 (HONDA)

2 The drawing seen from the front, information is displayed on the screen in the direction of from the upper hand left 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	Traced	Scale	Title		Year–Month–Day	Size
99.09.16 竹本	99.09.16 今村	米満		1:1	KCB104VG2CA Outline Dimensions	KYOCERA	99–09–16	2
						Drawing No. 121A0093300		

SPEC.NO.	TQ3C-8EAC0-E2CYM10-00
DATE	November 9,2000

FOR: _____

KYOCERA INSPECTION STANDARD

TYPE : KCB104VG2CA-A43

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
November 9,2000	T. Maruta	T. Minami	Y. Matsuura	T. Uchinono	Y. Yoshida

Revision Record

Date	Designed by: Engineering Dept.			Confirmed by: QA Dept.	
	Prepared	Checked	Approved	Checked	Approved
November 9,2000	T. Maruta	T. Minami	Y. Matsuura	T. Uchiono	Y. Joshida

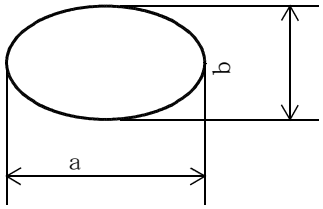
Rev. No.	Date	Page	Descriptions
00	Nov. 9,2000	—	Change Spec.No "TQ3C-8EAC0-E2AAYM91-00" → "TQ3C-8EAC0-E2CYM10-00"

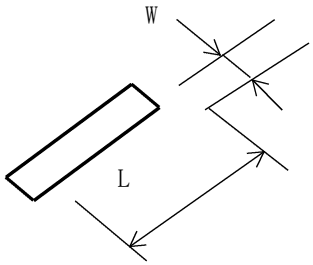
Visuals specification

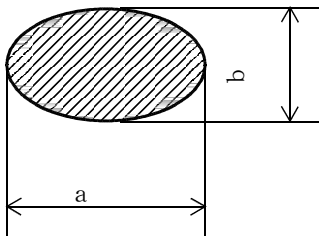
1)Note

Item	Note	
General	1.When defects specified in this Inspection Standards are inspected, operating voltage(Vop) shall be set at the level where the defect is observed most clearly. Display quality is applied up to effective viewing area. (Gray-Scale INSPECTION) 2.This inspection standard about the image quality shall be applied to any defect within the effective viewing area and shall not be applicable to outside of the area. 3.Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and Kyocera. 4.Inspection conditions Luminance : 500 Lux minimum . Inspection distance : 300 mm (from the sample) Temperature : 25 ± 5 ℃ Direction : right above	
Definition of Inspection item	Pinhole, Bright spot Black spot, Scratch Foreign particle	The color of a small area is different from the remainder. The phenomenon dose not change with voltage.
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage.
	Polarizer (Scratch, Bubble,Dent)	Scratch,Bubble and Dent in the polarizer which can be observed in on / off state.

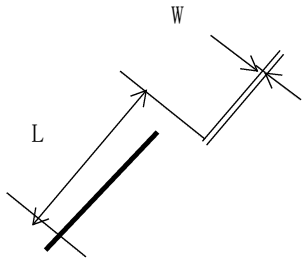
2)Standard

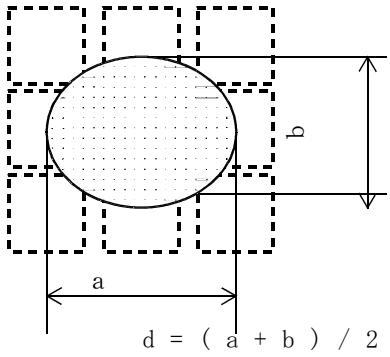
<table>
<tr><th>Inspection item</th><th>Judgement standard</th></tr>
<tr><td>Pinhole, Bright spot
Black spot,
Foreign particle</td><td>


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></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>According to Circular</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>

<table>
<tr><th>Inspection item</th><th>Judgement standard</th></tr>
<tr><td>Polarizer (Scratch, Bubble,Dent)</td><td>
(1) Scratch


<table>
<tr><th></th><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable No.</th></tr>
<tr><td>A</td><td>W ≦ 0.1</td><td>—</td><td>neglected</td></tr>
<tr><td>B</td><td rowspan="2">0.1 ＜ W ≦0.3</td><td>L ≦ 5.0</td><td>neglected</td></tr>
<tr><td>C</td><td>5.0 ＜ L</td><td>0</td></tr>
<tr><td>D</td><td>0.3 ＜ W</td><td>—</td><td>0</td></tr>
</table>
(2)Bubble (dent)


<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>
</table>