

SPEC.NO. TQ3C-8EACO-E1AAWC44-01

DATE December 24, 1997

S P E C

FOR: _____

TYPE:KCS057QV1AA-G03
(KCS3224ASTT-X7)

C O N T E N T S

1. Application
2. Construction and Outline
3. Mechanical Specifications
4. Absolute Maximum Ratings
5. Electrical Characteristics
6. Optical Characteristics
7. Circuit Block Diagram
8. Interface Signals
9. Interface Timing Chart
10. Data and Screen
11. Input Timing Characteristics
12. Supply Voltage Sequence Condition
13. Backlight Characteristics
14. Lot Number Identification
15. Warranty
16. Precaution for Use
17. Reliability Data / Environmental test
18. Outline Drawing

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
June 19, 1997	<i>S. Kojima</i>	<i>S. Matsuo</i>	<i>A. hisano</i>	<i>S. Hayashi</i>	<i>J. Yoshida</i>

Revision Record

Date		Designed by : Engineering Dept.			Confirmed by : QA Dept.	
		Prepared	Checked	Approved	Checked	Approved
Dec. 24 ,1997		S. Kojima	S. Matsuo	M. Ishio	S. Hayashi	Y. Yoshida
Rev. No.	Date	Page	Descriptions			
0 1	Dec.24,1997	-	Cover page -Change typename "KCS3224ASTT-X7" → "KCS057QV1AA-G03"			
		3	4-2 Environantal absolute maximum ratings ~ Change max operating humidity. " 8 5 " → " * 3 "			
		9	7-1 Power supply ~ Change type name. "KCS3224A" → "KCS057QV1A"			
		10	8-1 Interface signals ~Add note.			
		16	13-1 CFL ratings ~Change Starting discharge voltage, discharging tube voltage, "IL"value in Item "Operating life", reference value			
		17	14 Lot number Identification ~Change type name "KCS3224ASTT-X7" → "KCS057QV1AA-03"			

1. Application

This data sheet defines the specification for a $(320 \times 3) \times 240$ dot ,STN color dot matrix type Liquid Crystal Display with CFL backlight.

2. Construction and Outline

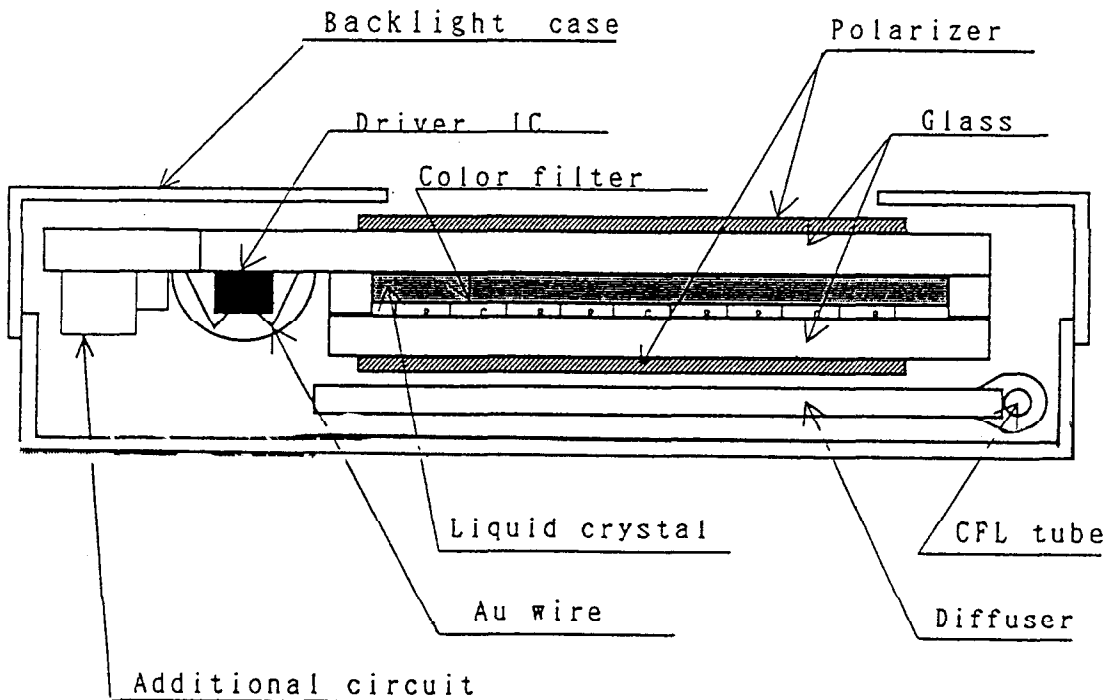
$(320 \times 3) \times 240$ dots, COG type LCD with CFL backlight.

Backlight system : Side-edge type CFL (1 tube)

Inverter : Option
Recommended Inverter : PH-BLC08-K3
(HITACHI MEDIA ELECTRONICS)
or equivalent.

Polarizer : Glare treatment.

Additional circuit : Bias voltage circuit, Randomizing circuit.



3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	154.6(W) × 114.8(H) × 8.5(D)	mm
Effective viewing area	118.18(W) × 89.38 (H)	mm
Dot number	(320×3)(W) × 240(H)	Dots
Dot size	0.10(W) × 0.34(H)	mm
Dot pitch	0.12(W) × 0.36(H)	mm
Display color #1	White #2	—
Base color #1	Black #2	—
Weight	200	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

Temp. = 25 °C

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply voltage for logic	VDD	0	7.0	V
Supply voltage for LCD driving	VEE	0	44.0	V
Input voltage	Vin	0	VDD	V

4-2 Environmental absolute maximum ratings

ITEM	SYMBOL	MIN	MAX	UNIT
Operating temperature	Top	0	50	°C
Storage temperature *1	T _{STO}	-20	60	°C
Operating humidity *2	H _{OP}	10	*3	%RH
Storage humidity *2	H _{STO}	10	*3	%RH
Vibration	—	*4	*4	—
Shock	—	*5	*5	—

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

*2 Non-condensation.

*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 as total)
EIAJ ED-2531

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

5. Electrical Characteristics

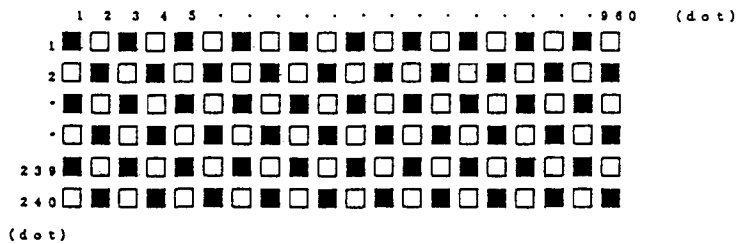
Temp. = 25°C, VDD = 5V ± 5%

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	—	4.75	5.00	5.25	V
LCD driving voltage *1	Vop=	0 °C	25.4	26.4	27.4	V
	VEE	25 °C	25.1	26.1	27.1	V
		40 °C	24.8	25.8	26.8	V
Input signalvoltage	Vin	"H" level	0.8VDD	—	VDD	V
		"L" level	0	—	0.2VDD	V
Clock frequency	f _{cp}		2.02	2.16	12.0	MHz
Frame frequency *2	f _{FRM}		70	75	80	Hz
Current consumption for logic	IDD	*3	—	3.0	4.5	mA
Current consumption for LCD driving	IEE		—	7.5	11.3	mA
Power consumption	Pdisp		—	211	330	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD driving voltage (Vop = VEE) 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 = 5V , Vop= VEE , f_{FRM}= 75 Hz , f_{cp}= 2.16 MHz



6. Optical Characteristics

Temp. = 25°C

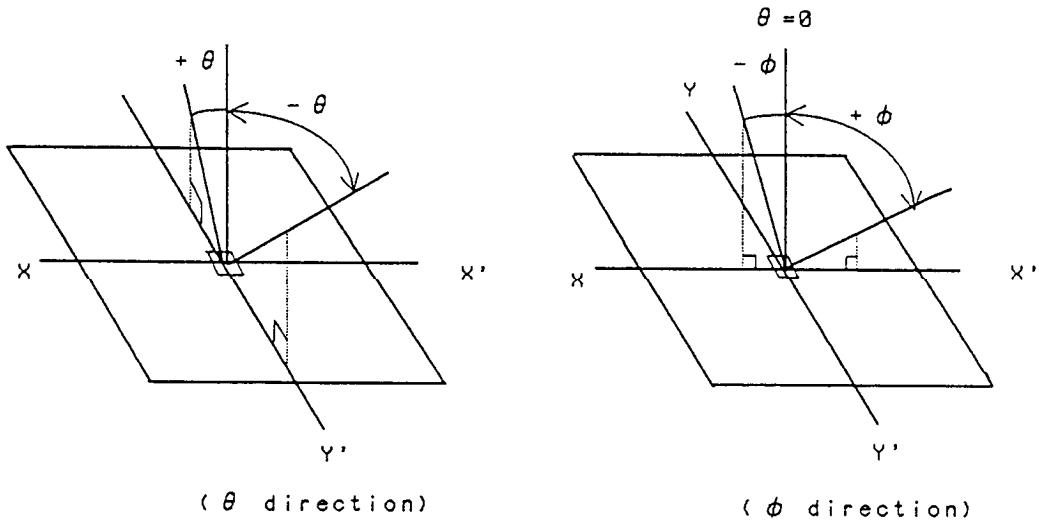
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Response time	Rise	Tr	$\theta = \phi = 0^\circ$	—	220	320	ms	
	Down	Td	$\theta = \phi = 0^\circ$	—	110	210	ms	
Viewing angle range		θ	CR ≥ 2	$\phi = 0^\circ$	-30	—	30	deg.
		ϕ		$\theta = 0^\circ$	-50	—	50	deg.
Contrast ratio		CR	$\theta = \phi = 0^\circ$	10.0	25.0	—	—	
Chromaticity coordinates	Red	x	$\theta = \phi = 0^\circ$	0.47	0.52	0.57	—	
		y		0.29	0.34	0.39		
	Green	x	$\theta = \phi = 0^\circ$	0.24	0.29	0.34		
		y		0.50	0.55	0.60		
	Blue	x	$\theta = \phi = 0^\circ$	0.11	0.16	0.21		
		y		0.10	0.15	0.20		
	White	x	$\theta = \phi = 0^\circ$	0.25	0.30	0.35		
		y		0.28	0.33	0.38		
	Black	x	$\theta = \phi = 0^\circ$	0.24	0.29	0.34		
		y		0.26	0.31	0.36		

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

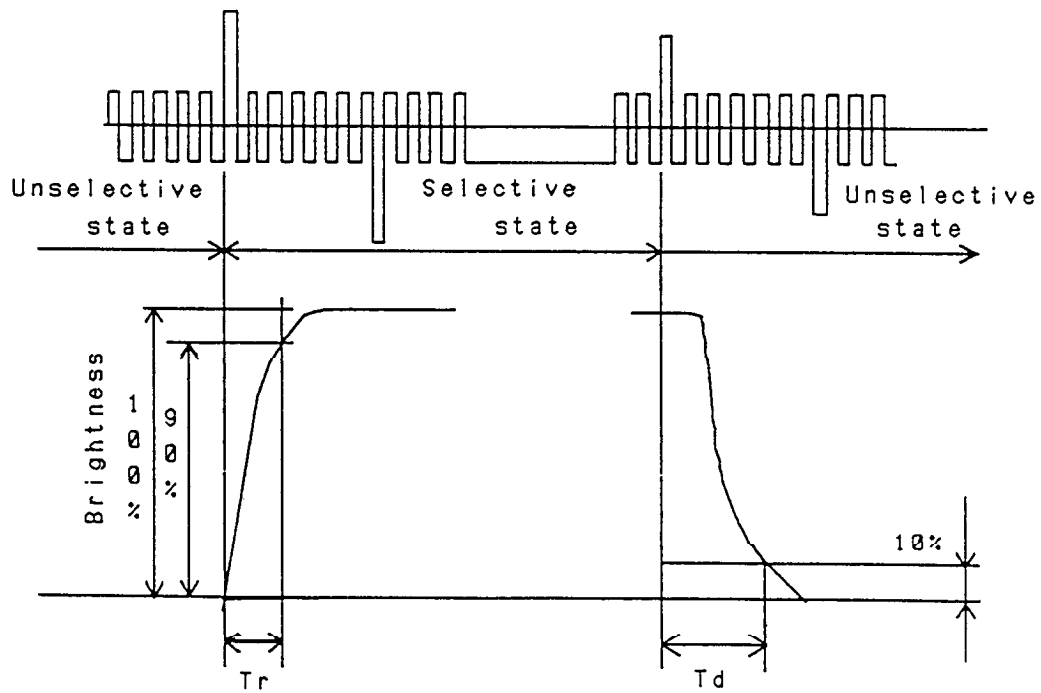
6-1. Contrast ratio is defined as follows:

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

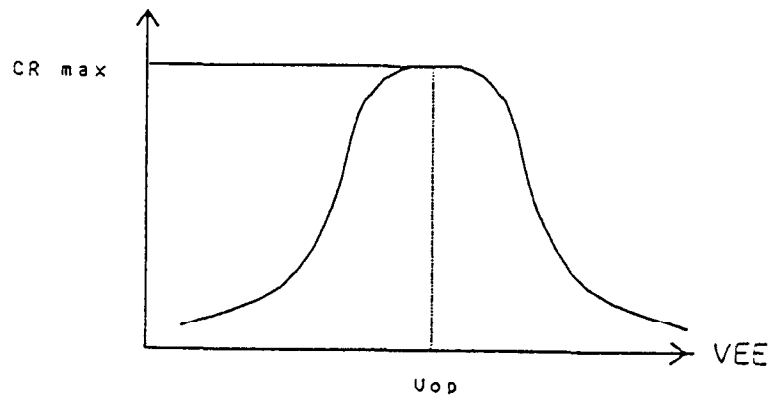
6-2. Definition of viewing angle



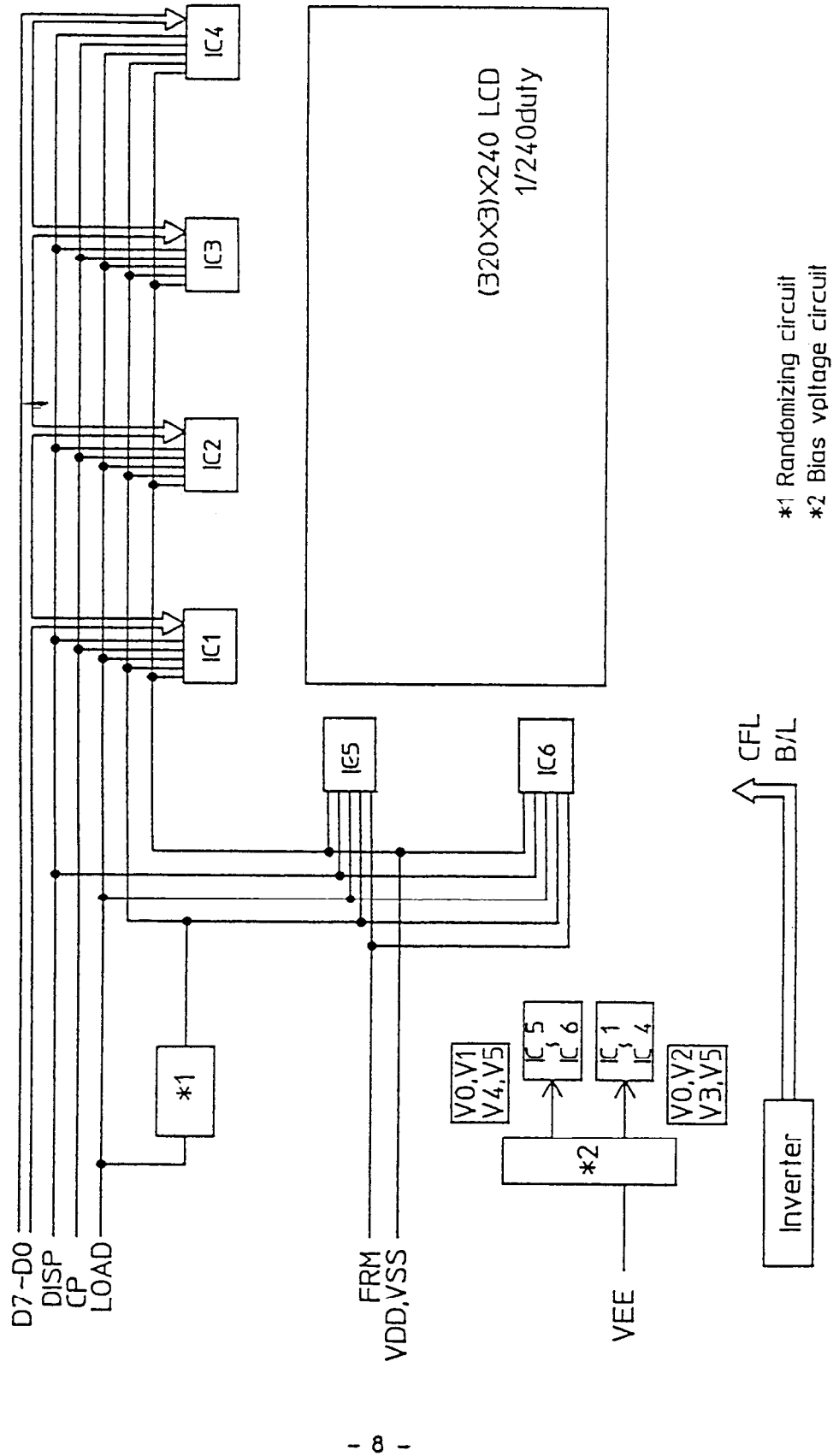
6-3. Definition of response time



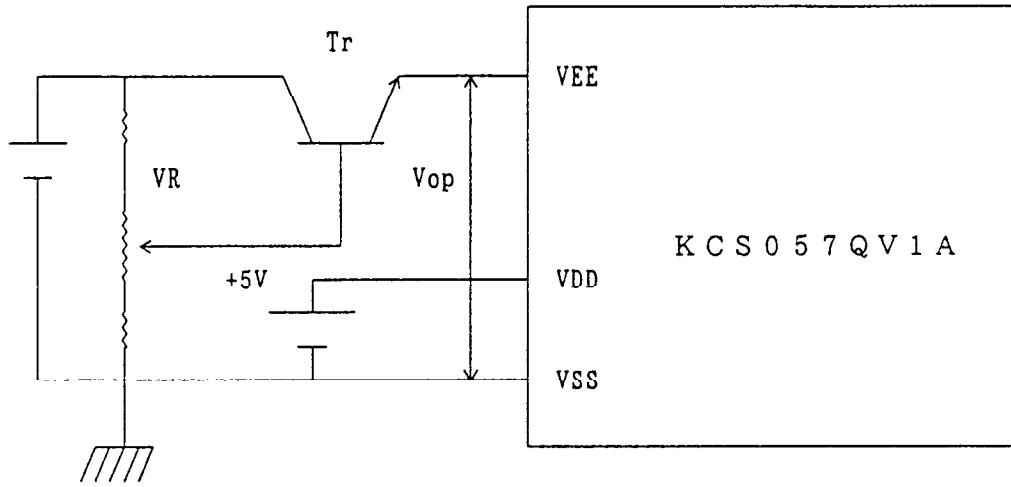
6-4. Definition of V_{op}



7. Circuit Block Diagram



7-1 Power Supply



8. Interface Signals

8-1.LCD

CN1:53261-1510(Molex)

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	FRM	Synchronous signal for driving scanning line	H
2	LOAD	Data signal latch clock	H → L
3	CP	Data signal shift clock	H → L
4	DISP	Display control signal	H(ON),L(OFF)
5	VDD	Power supply for logic	—
6	VSS	GND	—
7	VEE	Power supply for LCD	—
8	D7	Display data	H(ON),L(OFF)
9	D6		
10	D5		
11	D4		
12	D3		
13	D2		
14	D1		
15	D0		

Recommended matching connector:51021-1500(Molex)

NOTE) This pin assignment is the reverse of what Molex defined.

Remember that for your designing.

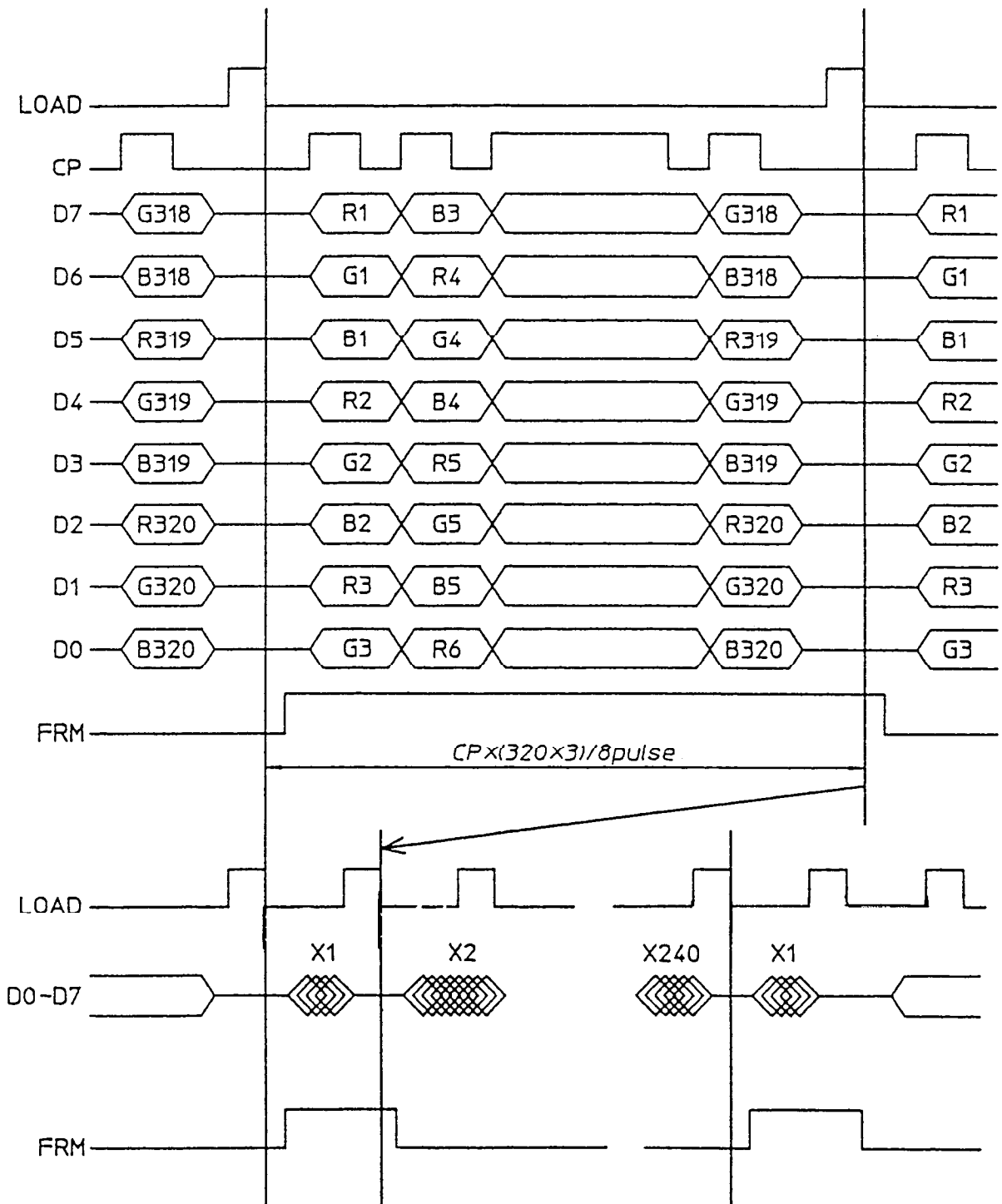
8-2.CFL

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

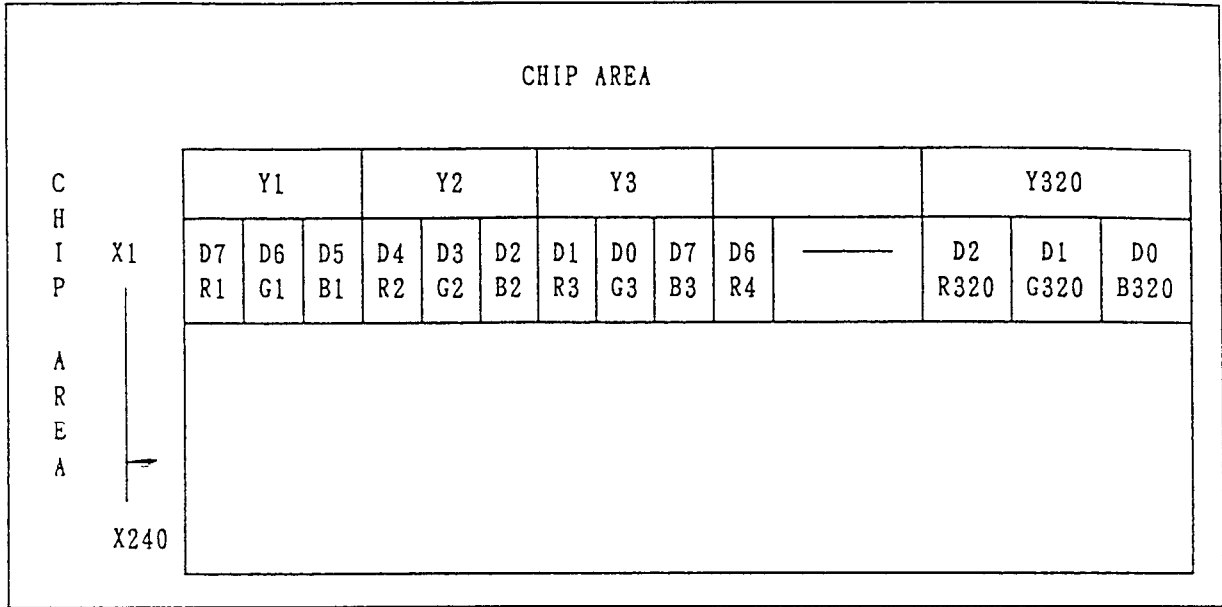
LCD side connector :BHR-03VS-1 (JST)

Recommended matching connector:SMO2-(8.0)B-BHS-1 (JST)

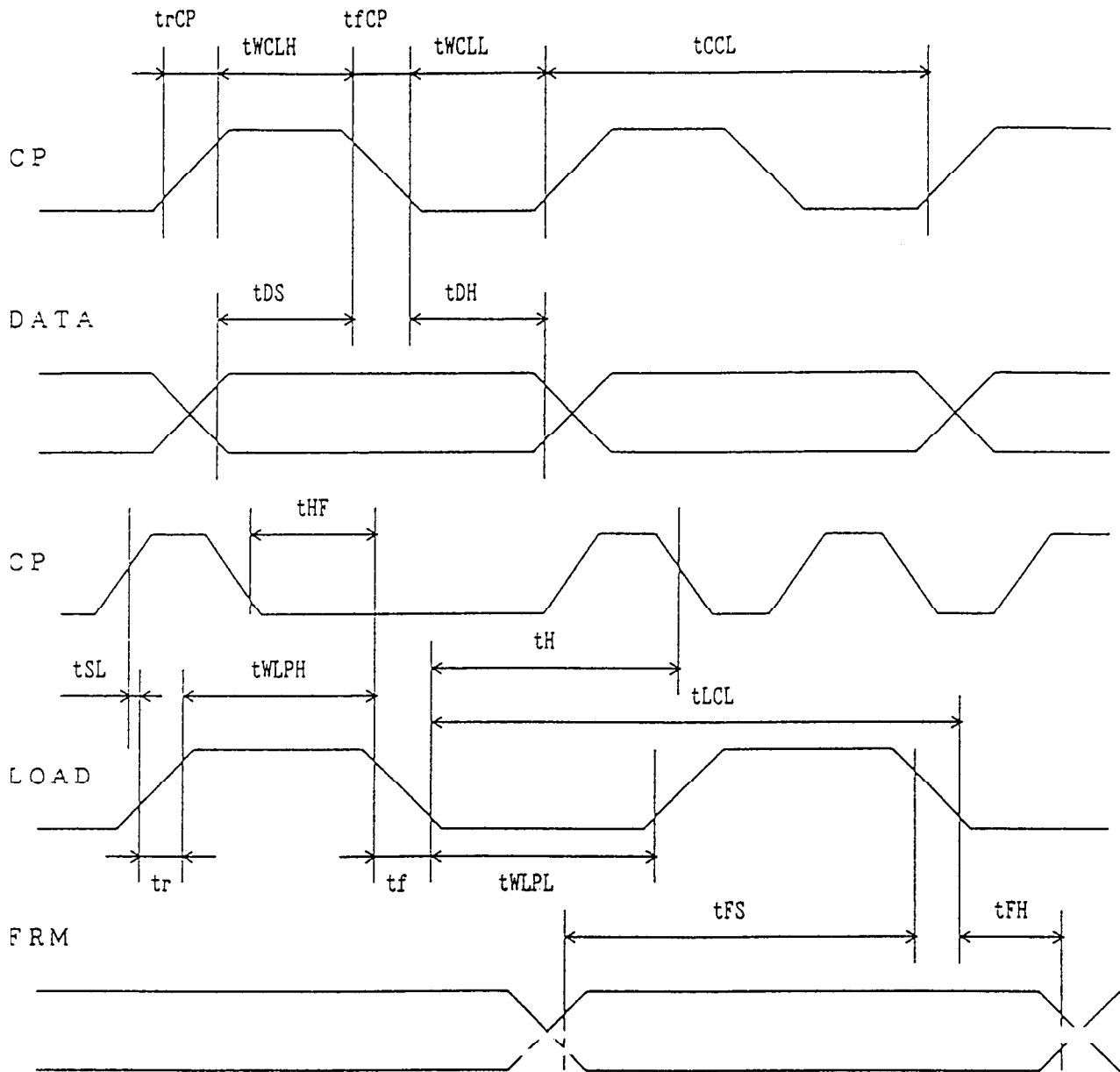
9. Interface Timing Chart



1 0 . Data and Screen



11. Input Timing Characteristics



11-1. Switching characteristics

Input characteristics ; VDD = +5V ± 5%

Temp.=25°C

ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle *1	tCCL	82	—	ns
CP "H" Pulse Width	tWCLH	28	—	ns
CP "L" Pulse Width	tWCLL	28	—	ns
CP Rise up Time	trCP	—	13	ns
CP Fall Down Time	tfCP	—	13	ns
Data Set up time	tDS	28	—	ns
Data Hold Time	tDH	20	—	ns
Load "H" Pulse Width	tWLPH	55	—	ns
Load "L" Pulse Width	tWLPL	370	—	ns
Load Cycle	tLCL	400	—	ns
Load Signal Hold Time	tHF	25	—	ns
Data Strobe Set up Time	tSL	0	—	ns
Data Strobe Hold Time	tH	40	—	ns
Input Signal Rise up Time *2	tr	—	30	ns
Input Signal Fall down Time *2	tf	—	30	ns
FRM Data Set up Time	tFS	200	—	ns
FRM Data Hold Time	tFH	30	—	ns

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

*2 The formura of condition

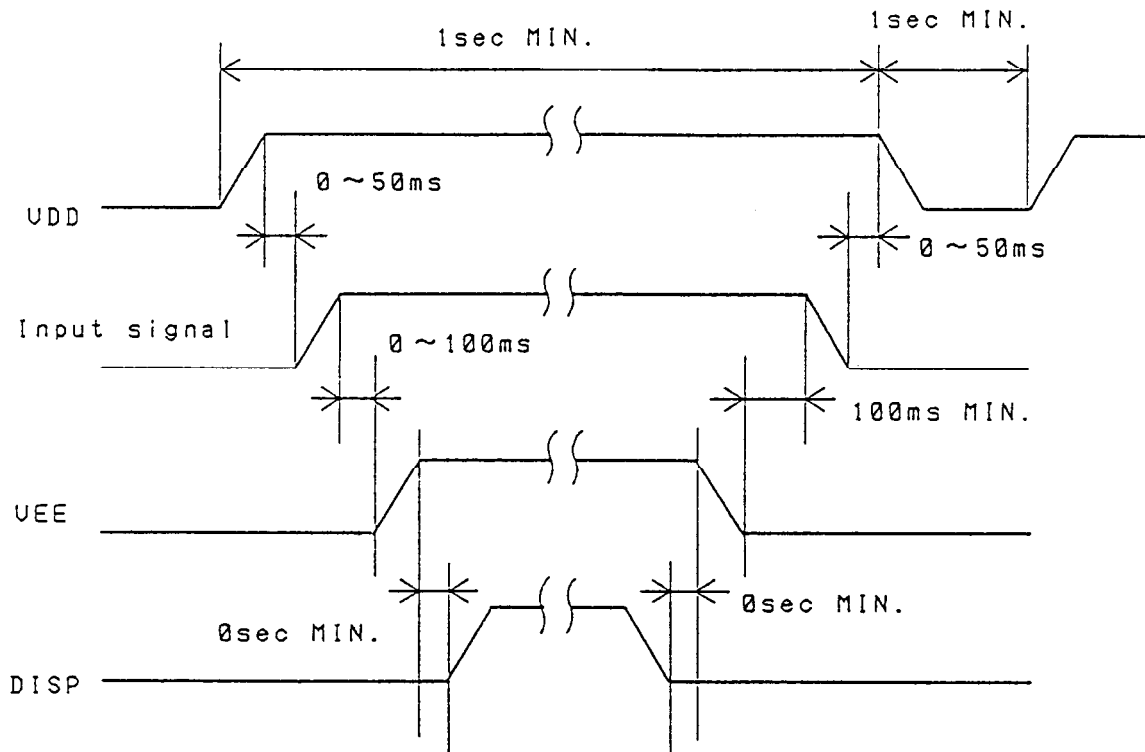
① $tr, tf < \{tCCL - (tWCLH + tWCLL)\} / 2$

② $tr, tf \leq 50(ns)$

Please use on condition that ①, ② are filled.

1 2 . 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, VEE third and finally DISP. This will prevent DC driving of the LCD or CMOS LSI latch-up as shown below.



1 3 . Backlight Characteristics

13-1 CFL ratings

Temp.= 25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	NOTE
Starting discharge Voltage *1	VS	—	—	770 Vrms.	0 °C
		—	—	510 Vrms.	25 °C
Discharging tube current	IL	3.0 mArms.	5.0 mArms.	6.0 mArms.	—
Discharging tube voltage	VL	—	315 Vrms.	—	—
Operating life *2 (IL=5.0mArms.)	T	—	25,000 Hr.	—	—
Operating frequency	F	30 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: 800 Vrms. MIN.)

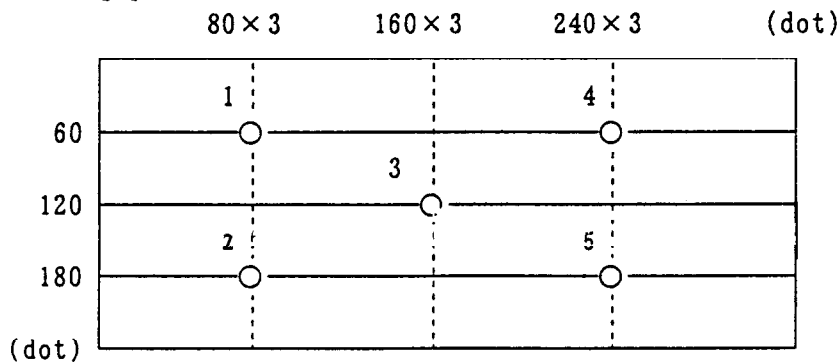
*2 When the illuminance or quantity of light has decreased to 50 % of the initial value.

13-2. Surface Brightness of LCD (IL = 5.0 mArms.)

Temp.=25°C

ITEM	MIN.	TYP.	MAX.	UNIT
Brightness	80	110	—	cd/m ²

(Measuring points)

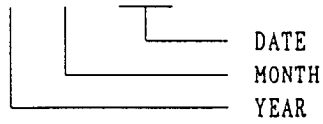


- 1) Rating is defined as the average brightness inside the viewing area.
- 2) 30 minutes after CFL is turned on. (Ambient Temp.=25°C)
- 3) The inverter should meet the eccentric conditions;
 - Sine, symmetric waveform without spike in positive and negative.

1 4 . Lot Number Identification

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

K C S 0 5 7 Q V 1 A A - G 0 3 - □ □ - □ □



YEAR	1997	1998	1999	2000
CODE	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

1 5 . Warranty

15-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

15-2. Production Warrnaty

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. A transparent protection plate shall be added to protect the LCD and its polarizers.
3. The LCD shall be installed so that there is no pressure on the LSI chips.
4. The LCD shall be installed flat, without twisting or bending.
5. The display window size should be the same as the effective viewing area.
6. 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.

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 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 polarizer 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.

1 7 . Reliability Data / Environmental Test

TEST ITEM	TEST CONDITION	TEST TIME	RESULT
High Temp. Atmosphere	70°C	240hr.	Display Quality : No defect Display Function : No defect Current Consumption: No defect
Low Temp. Atmosphere	-20°C	240hr.	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°C 90%RH	240hr.	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Current Consumption: No defect
Temp. Cycle	-20°C 0.5hr. R.T. 0.5hr. 70°C 0.5hr.	10 cycles	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Bubble on Cell : None
High Temp. Operation	50°C Vop	500hr.	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.

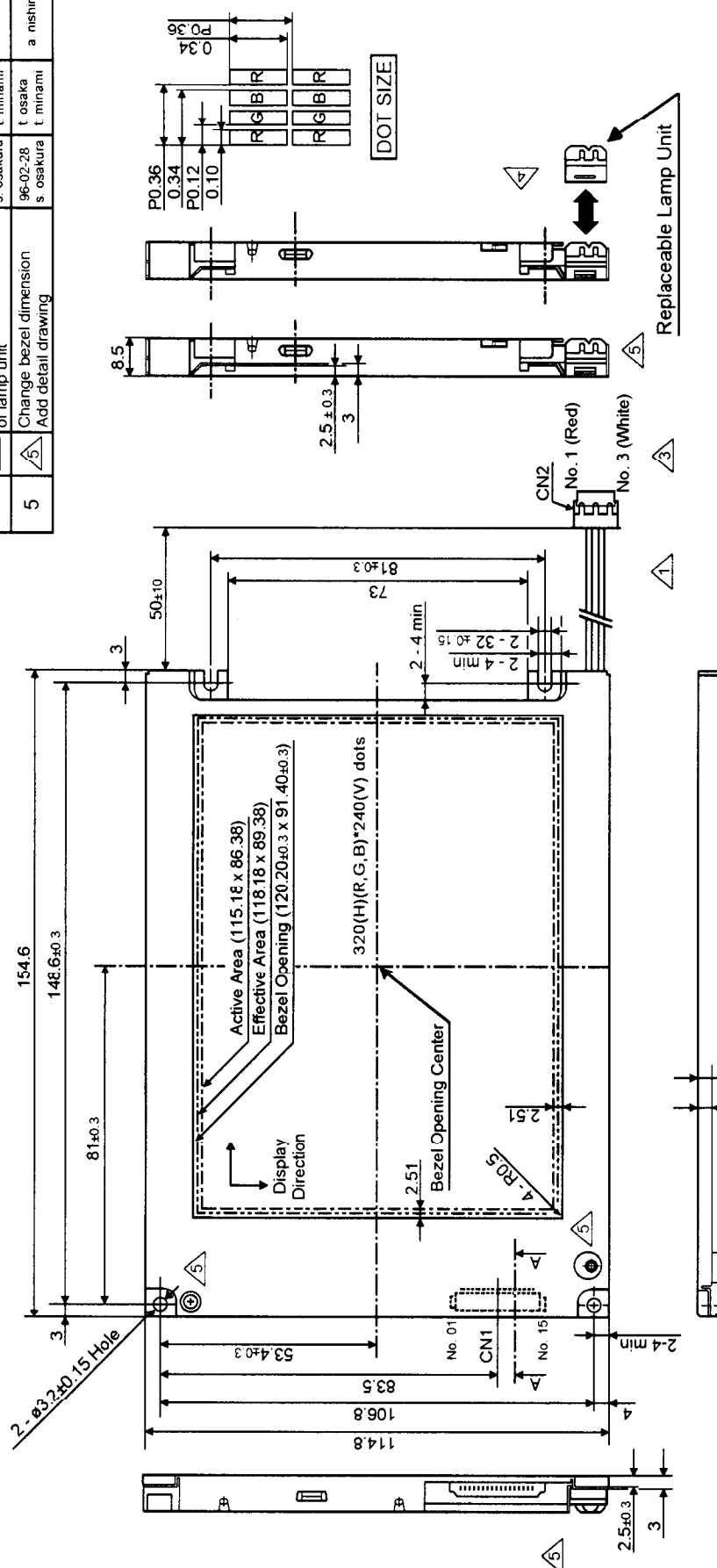
*The LCD is tested in circumstances in which there is no condensation.

*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.

Rev.	No.	Description	Drwn	Chk	App
1	△1	Change position of lamp wire	95-08-07 s. osakura	t. osaka	a. nishino
2	△2	Change replaceable direction of lamp unit	95-09-04 s. osakura	t. osaka	t. minami
3	△3	Change connector terminal number	95-09-06 s. osakura	t. osaka	t. minami
4	△4	Change replaceable direction of lamp unit	95-10-02 s. osakura	t. osaka t. minami	a. nishino
5	△5	Change bezel dimension Add detail drawing	96-02-28 s. osakura	t. osaka t. minami	a. nishino



- Note
- Connectors CN1: 53261-1510 (Molex)
CN2: BHR-03VS-1 (JST)
 - Matching Connector: 51021-1500 (Molex)
SM02-(8.0)B-BHS-1 (JST)
 - The drawing seen from the screen in the direction of from the upper left hand corner to the right.
 - Tolerance without indication: ±0.5

All dimensions in mm

SECTION A - A

Approved	Checked	Drawn	Scale	Title	Year-Month-Day	Size
a. nishino	t. minami	t. osaka	1/1	KCS3224ASTT	'95-04-11	3
				Outline Dimensions	121A0058800-5	

SPEC.NO.	TQ3C-8EAC0-E2AAWC44-01
DATE	December 24, 1997

FOR: _____

KYOCERA INSPECTION STANDARD

TYPE : KCS057QV1AA-G03
 (KCS3224ASTT-X7)
 (LIQUID CRYSTAL DISPLAY MODULE)

KYOCERE CORPORATION
 KAGOSHIMA HAYATO PLANT
 LCD DIVISION

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
June 19, 1997	<i>S. Kajima</i>	<i>S. Matsuo</i>	<i>M. Ishino</i>	<i>S. Hayashi</i>	<i>Y. Yoshida</i>

Revision Record

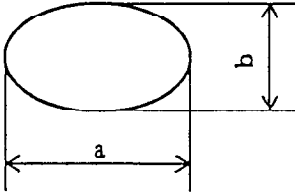
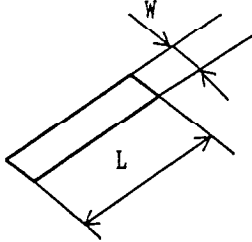
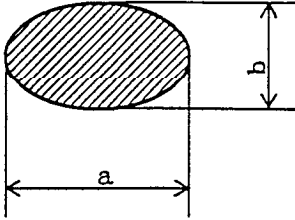
Date		Designed by : Engineering Dept.			Confirmed by : QA Dept.	
		Prepared	Checked	Approved	Checked	Approved
Dec. 24, 1997		<i>S. Kojima</i>	<i>S. Matsuo</i>	<i>N. Ishio</i>	<i>S. Hayaashi</i>	<i>Y. Yoshida</i>
Rev. No.	Date	Page	Descriptions			
0 1	Dec.24,1997	-	Cover page ~Change type name "KCS3224ASTT-X7" → "KCS057QV1AA-G03"			

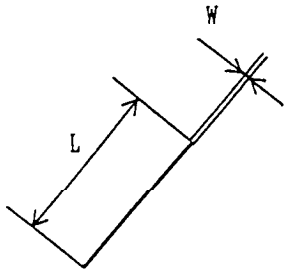
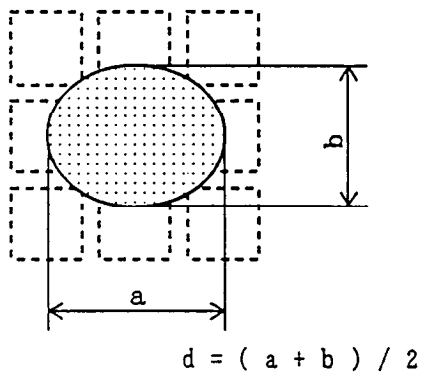
Visuals specification

1)Note

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

2)Standard

Inspection item	Judgement standard																						
Pinhole, Bright spot Black spot, Foreign particle	 $d = (a + b) / 2$ <table border="1" data-bbox="618 512 1365 726"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.2$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.2 < d \leq 0.3$</td> <td>5</td> </tr> <tr> <td>C</td> <td>$0.3 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>D</td> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table>	Category	Size (mm)	Acceptable number	A	$d \leq 0.2$	neglected	B	$0.2 < d \leq 0.3$	5	C	$0.3 < d \leq 0.5$	3	D	$0.5 < d$	0							
Category	Size (mm)	Acceptable number																					
A	$d \leq 0.2$	neglected																					
B	$0.2 < d \leq 0.3$	5																					
C	$0.3 < d \leq 0.5$	3																					
D	$0.5 < d$	0																					
Scratch, Foreign particle	 <table border="1" data-bbox="589 1073 1390 1352"> <thead> <tr> <th></th> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$W \leq 0.03$</td> <td>—</td> <td>neglected</td> </tr> <tr> <td>B</td> <td rowspan="3">$0.03 < W \leq 0.1$</td> <td>$L \leq 2.0$</td> <td>neglected</td> </tr> <tr> <td>C</td> <td>$2.0 < L \leq 4.0$</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> </tbody> </table>		Width (mm)	Length (mm)	Acceptable No.	A	$W \leq 0.03$	—	neglected	B	$0.03 < W \leq 0.1$	$L \leq 2.0$	neglected	C	$2.0 < L \leq 4.0$	3	D	$4.0 < L$	0	E	$0.1 < W$	—	According to Circular
	Width (mm)	Length (mm)	Acceptable No.																				
A	$W \leq 0.03$	—	neglected																				
B	$0.03 < W \leq 0.1$	$L \leq 2.0$	neglected																				
C		$2.0 < L \leq 4.0$	3																				
D		$4.0 < L$	0																				
E	$0.1 < W$	—	According to Circular																				
Contrast variation	 $d = (a + b) / 2$ <table border="1" data-bbox="618 1698 1365 1871"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.5$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.5 < d \leq 0.7$</td> <td>3</td> </tr> <tr> <td>C</td> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table>	Category	Size (mm)	Acceptable number	A	$d \leq 0.5$	neglected	B	$0.5 < d \leq 0.7$	3	C	$0.7 < d$	0										
Category	Size (mm)	Acceptable number																					
A	$d \leq 0.5$	neglected																					
B	$0.5 < d \leq 0.7$	3																					
C	$0.7 < d$	0																					

Inspection item	Judgement standard																			
Polarizer (Scratch, Bubble, Dent)	<p data-bbox="570 199 727 231">(1) Scratch</p>  <table border="1" data-bbox="586 619 1396 934"> <thead> <tr> <th></th> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$W \leq 0.1$</td> <td>—</td> <td>neglected</td> </tr> <tr> <td>B</td> <td rowspan="2">$0.1 < W \leq 0.3$</td> <td>$L \leq 5.0$</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> </tbody> </table>		Width (mm)	Length (mm)	Acceptable No.	A	$W \leq 0.1$	—	neglected	B	$0.1 < W \leq 0.3$	$L \leq 5.0$	neglected	C	$5.0 < L$	0	D	$0.3 < W$	—	0
	Width (mm)	Length (mm)	Acceptable No.																	
A	$W \leq 0.1$	—	neglected																	
B	$0.1 < W \leq 0.3$	$L \leq 5.0$	neglected																	
C		$5.0 < L$	0																	
D	$0.3 < W$	—	0																	
	<p data-bbox="570 970 820 1001">(2)Bubble (dent)</p>  <table border="1" data-bbox="617 1533 1372 1848"> <thead> <tr> <th>Category</th> <th>Size (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$d \leq 0.2$</td> <td>neglected</td> </tr> <tr> <td>B</td> <td>$0.2 < d \leq 0.3$</td> <td>5</td> </tr> <tr> <td>C</td> <td>$0.3 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>D</td> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table>	Category	Size (mm)	Acceptable number	A	$d \leq 0.2$	neglected	B	$0.2 < d \leq 0.3$	5	C	$0.3 < d \leq 0.5$	3	D	$0.5 < d$	0				
Category	Size (mm)	Acceptable number																		
A	$d \leq 0.2$	neglected																		
B	$0.2 < d \leq 0.3$	5																		
C	$0.3 < d \leq 0.5$	3																		
D	$0.5 < d$	0																		