SPEC. NO.	TQ3C-8EAS0-E1FGAN03-00
DATE	February 9, 1999

SPEC

FOR : KICC

TYPE : KS6448ASHT-FW

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KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

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

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
February 9, 1999	*(signature)*	M. Fujitani	T. Minami	S. Hayashi	Y. Yoshida

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 640×480 dot, Transflective mode type Liquid Crystal Display with CFL backlight.
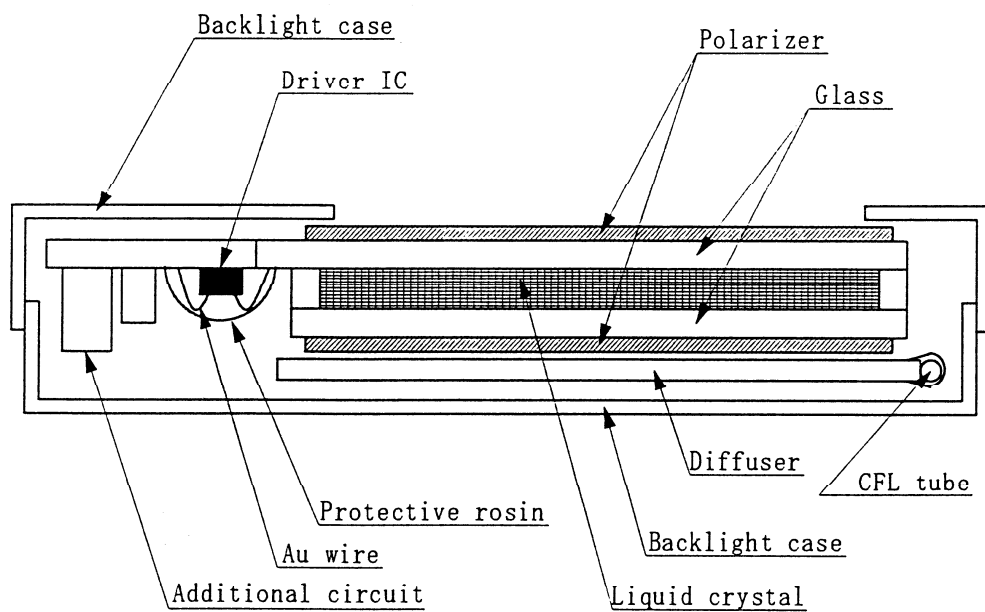
2. Construction and Outline

640×480 dots, COB type LCD with CFL backlight.

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

Inverter   : None.

Polarizer   : Glare treatment.

Additional circuit   : Bias voltage circuit.

3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	179.3 (W) × 130.5 (H) × 6.0 (D)	mm
Effective viewing area	147.90 (W) × 111.42 (H)	mm
Dot number	640 (W) × 480 (H)	Dots
Dot size	0.208 (W) × 0.208 (H)	mm
Dot pitch	0.228 (W) × 0.228 (H)	mm
Display color *1	Black *2	—
Base color *1	White *2	—
Weight	(160)	g

*1 Due to the characteristics of the LC material, the color vary with environmental temperature.

*2 Negative-type display

    Display data "H" : Dots ON : White
    Display data "L" : Dots OFF : Black

4. Absolute Maximum Ratings

4-1 Electrical absolute maximum ratings

Temp. = 25 ℃

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply voltage for logic	VDD	0	7.0	V
Supply voltage for LCD driving	VEE	0	45.0	V
Input voltage *1	Vin	0	VDD	V

*1 FRM , DF , CP , LOAD , D0～D3

ITEM	SYMBOL	MIN	MAX	UNIT
Operating temperature	Top	0	40	°C
Storage temperature *1	Tsто	-20	60	°C
Operating humidity *2	Hop	10	85	%RH
Storage humidity *2	Hsто	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-condensation.

*3   Temp. $\leqq$ 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.

5-2. Electrical Characteristics

Temp. = 25°C,   VDD = 3.3V ± 0.3V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	—	3.0	3.3	3.6	V
Supply voltage for LCD drive	VEE	—	—	(24.0)	—	V
LCD driving voltage *1	Vop=VEE	0 ℃	(24.3)	(25.3)	(26.3)	V
		25 ℃	(24.0)	(25.0)	(26.0)	V
		40 ℃	(23.6)	(24.6)	(25.6)	V
Input voltage	Vin	"H" level	0.8VDD	—	VDD	V
		"L" level	0	—	0.2VDD	V
Clock frequency	f cp	—	—	2.88	6.50	MHz
Frame frequency *2	f FRM	—	—	75	—	Hz
Randomizing frequency	DF	—	300	—	800	Hz
Current consumption for logic	IDD	*3	—	(2.0)	(3.0)	mA
Current consumption for LCD drive	IEE		—	(15.0)	(22.5)	mA
Power consumption	Pdisp		—	(367)	(550)	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD supply 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 It is recommended that frame frequency is set in the range of 300-800 Hz.

*4 Display high frequency pattern, (see below).
VDD = 3.3V , Vop = VEE , f FRM = 75 Hz , fcp = 2.88MHz
Pattern:

6. Optical Characteristics

Temp. = 25℃

Measured at Transmissive mode

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	$\theta = \phi = 0°$		—	(210)	(310)	ms
	Down	Td	$\theta = \phi = 0°$		—	(130)	(230)	ms
Viewing angle range	θ		$CR \geqq 2$	$\phi = 0°$	(-30)	—	(20)	deg.
	ϕ			$\theta = 0°$	(-30)	—	(30)	deg.
Contrast ratio		CR	$\theta = \phi = 0°$		—	(3.5)	—	—
Chromaticity coordinates	White	x	$\theta = \phi = 0°$		(TBD)	(TBD)	(TBD)	
		y			(TBD)	(TBD)	(TBD)	

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 follows:

$$CR = \frac{\text{Brightness all pixels "White"}}{\text{Brightness all pixels "Black"}}$$
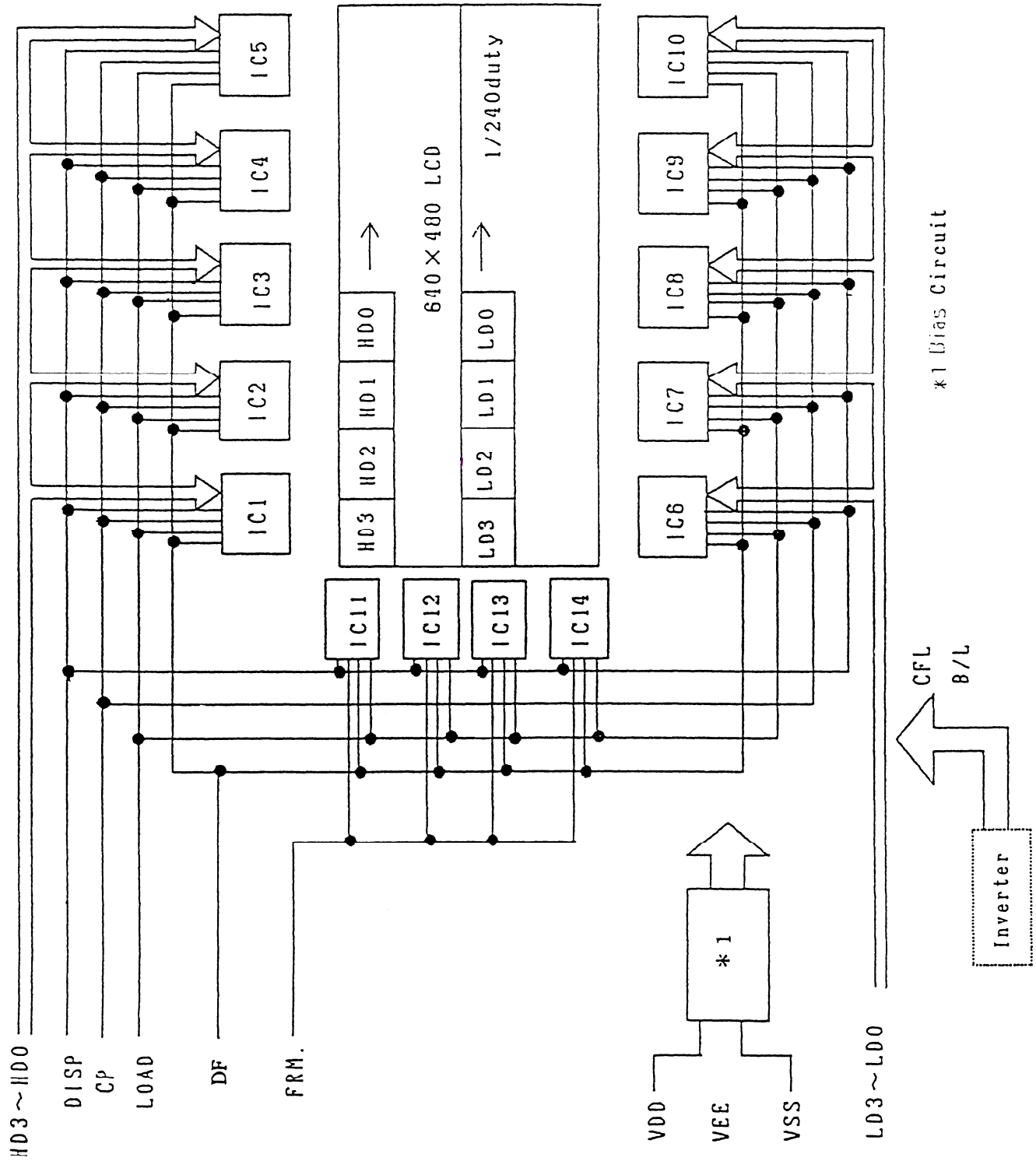
6-2. Definition of viewing angle

(θ direction)　　　　(ϕ direction)
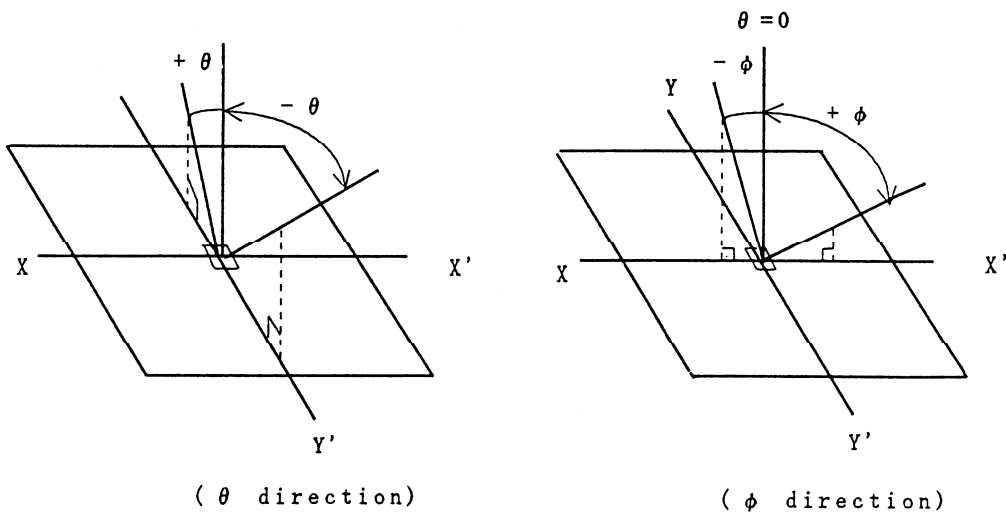
6-3. Definition of response time
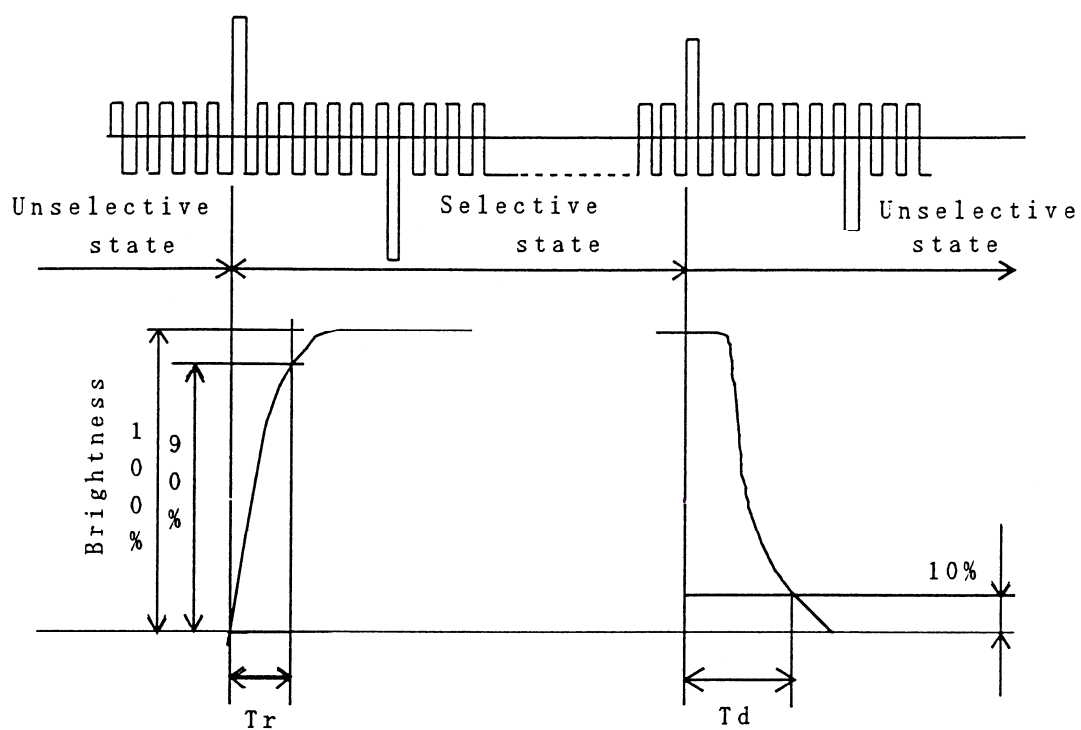
6-4. Definition of Vop
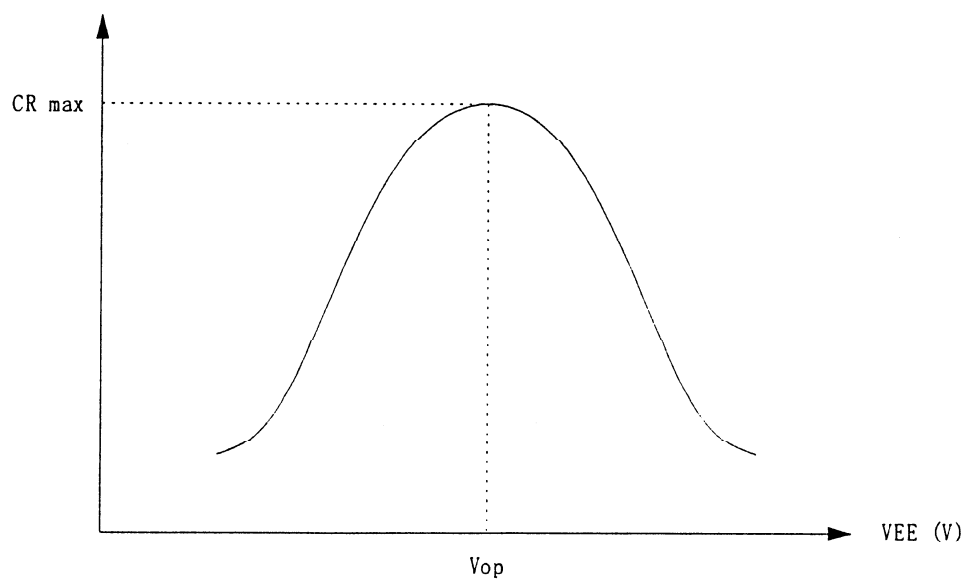
8. Interface Signals

8-1. LCD (0.5mm pich , 16pin)

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	FRM	Synchronous signal for driving scanning line	H
2	DF	AC signal for driving	—
3	LOAD	Data signal latch clock	H → L
4	CP	Data signal shift clock	H → L
5	DISP	Display control signal	H(ON),L(OFF)
6	VDD	Power supply for logic	—
7	VSS	GND	—
8	VEE	Power supply for LCD	—
9	HD0	Display data (Upper column)	H(ON),L(OFF)
10	HD1		
11	HD2		
12	HD3		
13	HD0	Display data (Lower column)	H(ON),L(OFF)
14	HD1		
15	HD2		
16	HD3		

LCD side connector   : FHY12-16S-0.5SV (HIROSE)

8-2. CFL

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

LCD side connector   : BHR-03VS-1   (JST)
Recommended matching connector : SM02-(8.0)B-BHS-1 (JST)

9. Interface Timing Chart

LOAD		
CP		
D3	Y637	Y1 Y5 Y637 Y1
D2	Y638	·Y2 Y6 Y638 Y2
D1	Y639	Y3 Y7 Y639 Y3
D0	Y640	Y4 Y8 Y640 Y4
FRM		

CP × 640 / 4 pulse

LOAD		
H D0～D3	×1 ×2 ×240 ×1	
L D0～D3	×241 ×242 ×480 ×241	
FRM		
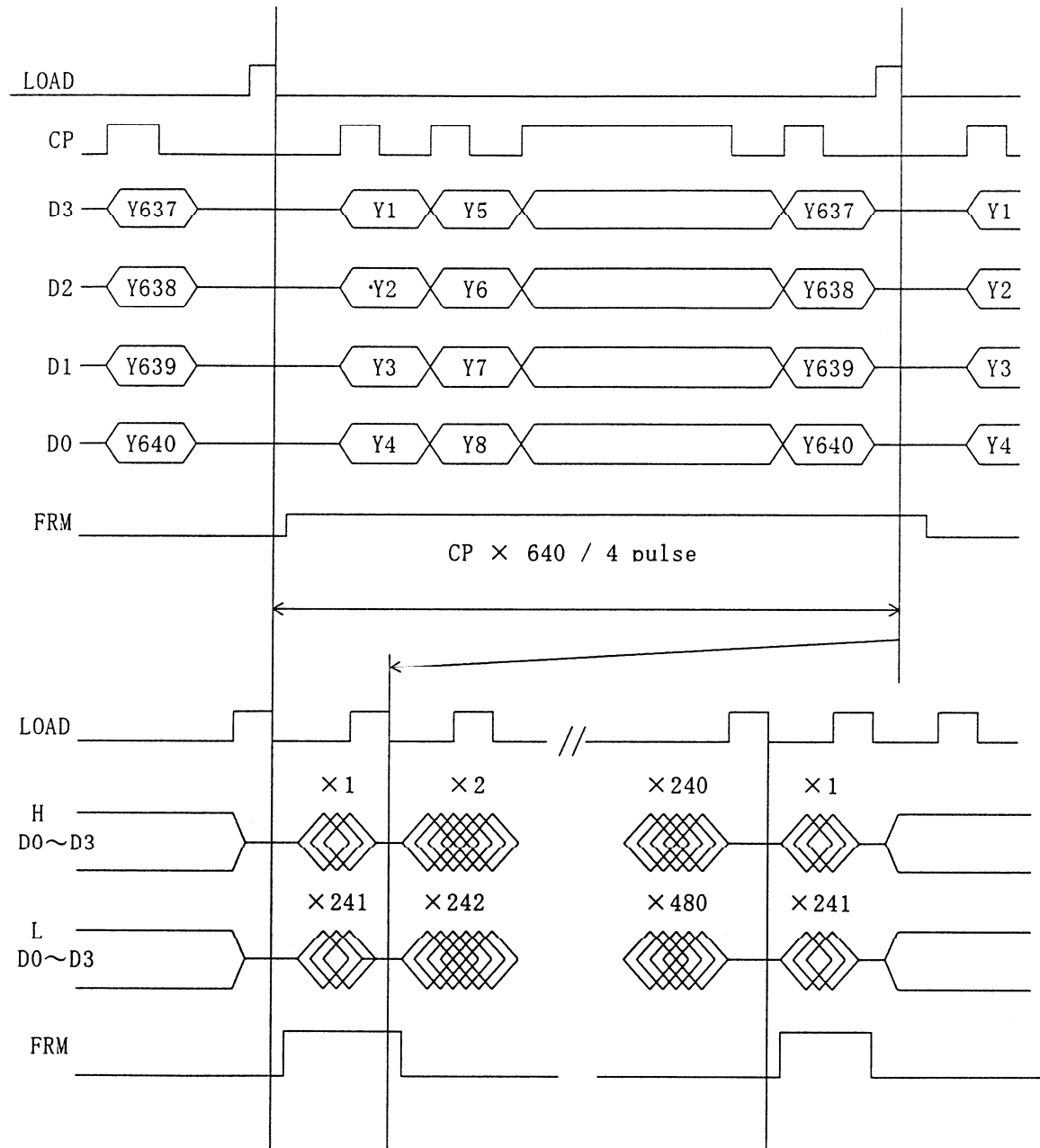
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9		Y638	Y639	Y640
								CHIP AREA						
C	X1	HD3	HD2	HD1	HD0	HD3	HD2	HD1	HD0	HD3	⋯	HD2	HD1	HD0
H	·													
P	·													
	·													
	·													
A	X240													
R	X241													
E	·	LD3	LD2	LD1	LD0	LD3	LD2	LD1	LD0	LD7	⋯	LD2	LD1	LD0
A	·													
	·													
	·													
	·													
	X480													

CHIP AREA

The diagram shows input timing characteristics with the following signals and timing parameters:

CP: trCP, tWCLH, tfCP, tWCLL, tCCL

DATA: tDS, tDH

CP, LOAD, FRM: tSU, tWLPH, tH, tLCL, tr, tf, tWLPL, tFS, tFH

LOAD, DF: tDFR, tf, tr
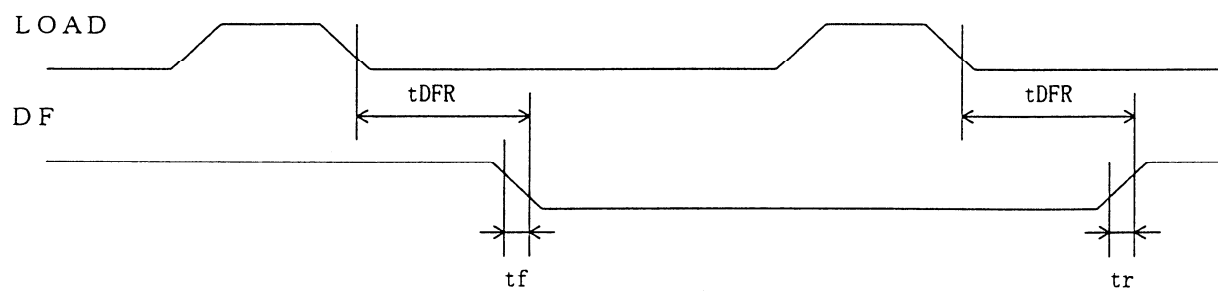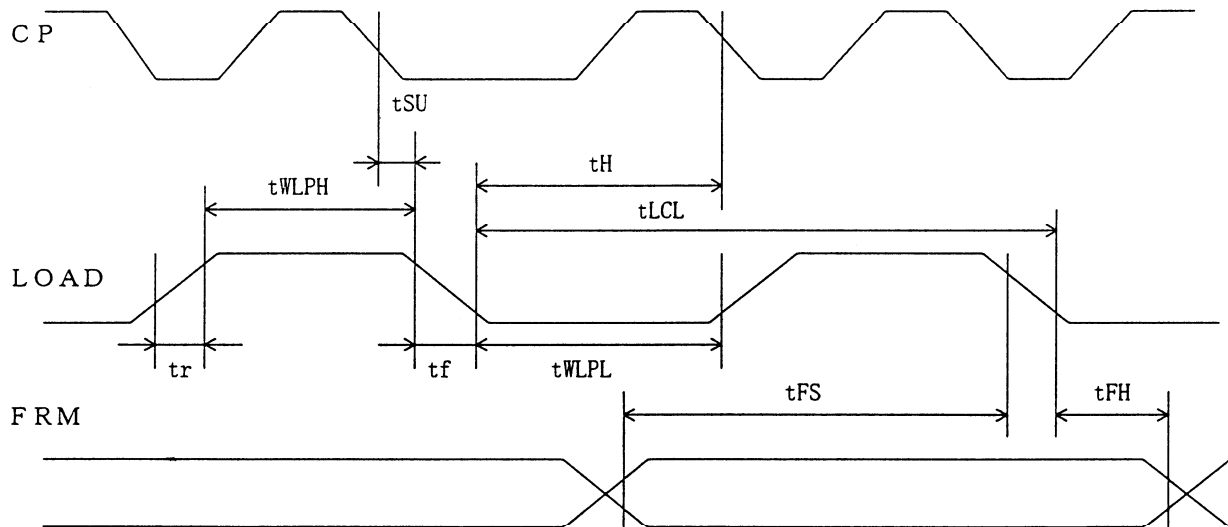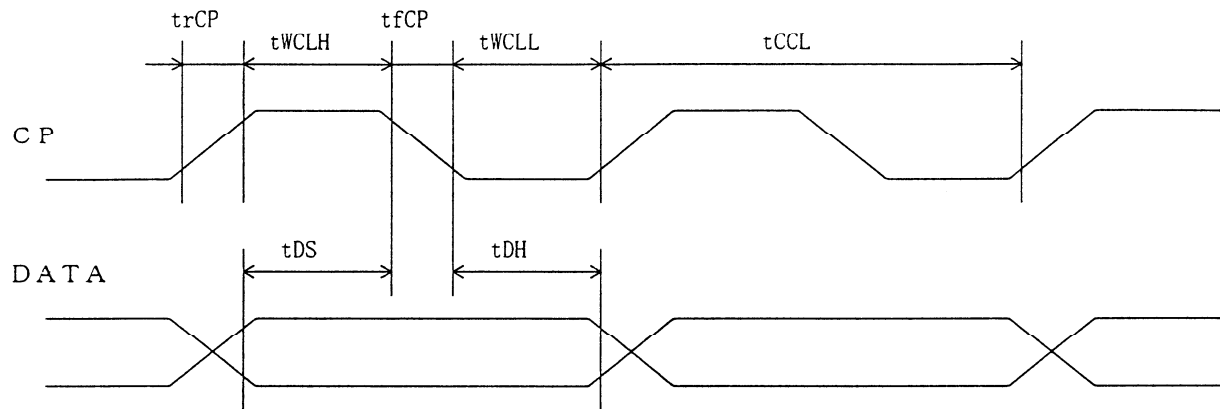
11-1. Switching characteristics

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

ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle　　　　　　　*1	tCCL	153	—	ns
CP "H" Pulse Width	tWCLH	40	—	ns
CP "L" Pulse Width	tWCLL	40	—	ns
CP Rise Up Time　　　*2	trCP	—	30	ns
CP Fall Down Time　　*2	tfCP	—	30	ns
Data Set Up Time	tDS	50	—	ns
Data Hold Time	tDH	50	—	ns
Load "H" Pulse Width	tWLPH	100	—	ns
Load "L" Pulse Width	tWLPL	4900	—	ns
LOAD Cycle	tLCL	5000	—	ns
Data Strobe Set Up Time	tSU	35	—	ns
Data Strobe Hold Time	tH	200	—	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	30	—	ns
DF Delay Time	tDFR	0	300	ns

*1 CP Cycle is adjust so that FRM signal is 75 Hz.
*2 The formula of condition
　　　　　① trCP, tfCP < {tCCL − (tWCLH + tWCLL)} / 2
　　Please use on condition that ① is filled.

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, interface second and finally VEE.
This will prevent DC driving of the LCD or CMOS LSI latch up as shown below.

1 sec. MIN.　　　　　　　　1 sec. MIN.

VDD

0～50 ms

0～50 ms

Input siganl

0～100 ms MIN.　　　0～100 ms MIN.

VEE

Osec.MIN.　　　Osec. MIN.
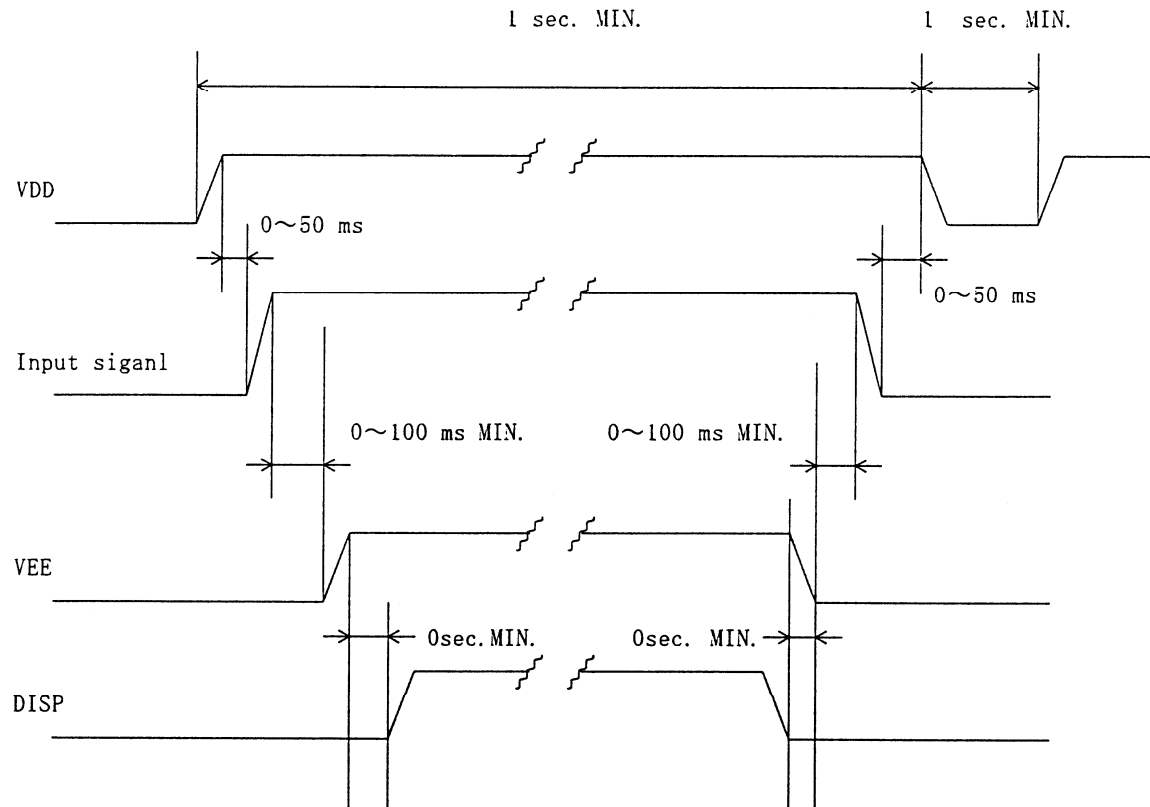
DISP

13. Example of Randomizing circuit

Randomizing circuit is recommendable in order to reduce "cross-talk" phenomenon of display images. (Tailing, vertical, strips, etc.)
Its detail is subject to change according to actual operating condition and application of the LCD. Should you have any question when installing an actual randomizing circuit, please ask Kyocera for details.

Prset	
76543210	A
00000000	X
00000001	1
00000010	2
00000011	3
::::::::	:
11111111	255
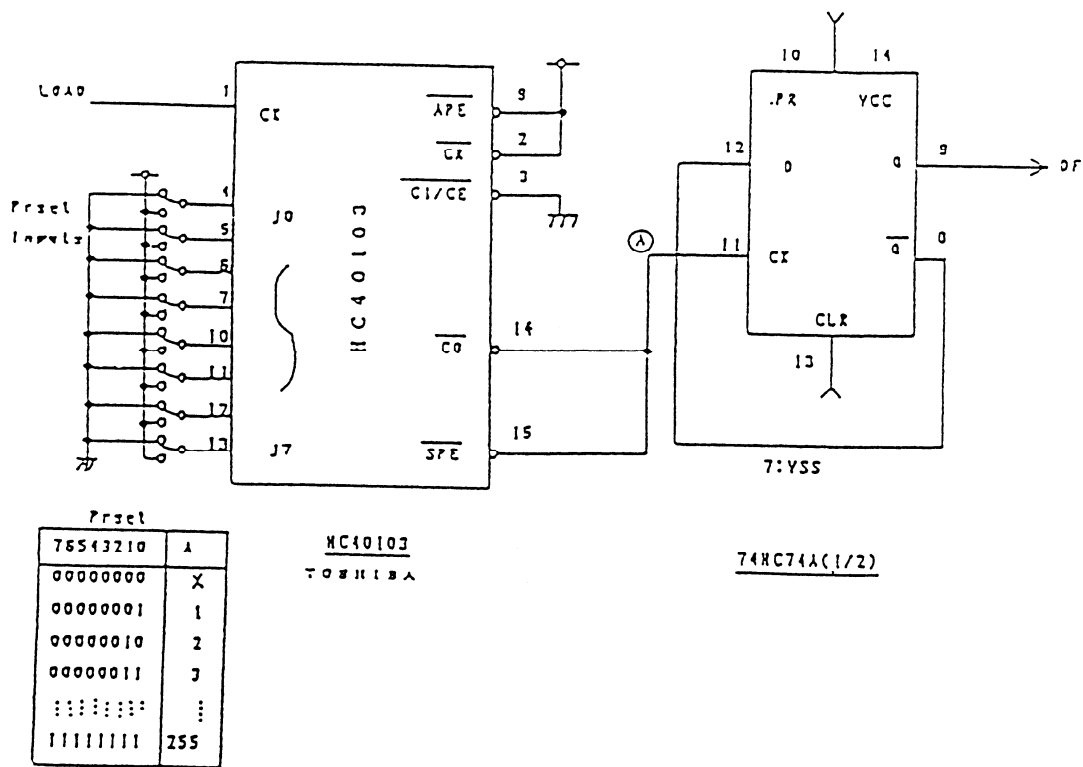
There may be flickering on screen according to some LOAD signal frequencies.
If it happens, set PRSET INPUTS terminals to select.

1 4. Backlight Characteristics

14-1. CFL ratings

Inverter:PH-BLC08-K2 (HITACHI MEDIA ELECTRONICS)   Temp. = 25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	
Starting discharge voltage *1	VS	—	—	780 Vrms.	0℃
		—	—	615 Vrms.	25℃
Discharging tube current	IL	2.0 mArms.	(4.0) mArms.	6.0 mArms.	—
Discharging tube voltage	VL	—	(372) Vrms.	—	
Operating life *2 (IL=4.0 mArms.)	T	18,000 Hr.	30,000 Hr.	—	
Operating frequency	F	20 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 : (1,014) Vrms MIN.)
*2 When the illuminance or quantity of light has decreased to 50 % of the initial
    value.

14-2. Surface Brightness of LCD (IL = (4.0) mArms.)   Temp. =25℃

ITEM	MIN.	TYP.	MAX.	UNIT
Brightness	(50)	(70)	—	cd/m^2

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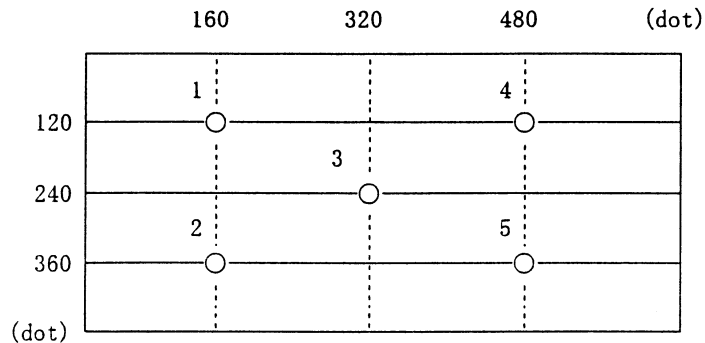
1) Rating is defined as the average brightness inside the viewing area.
2) 30 minutes after CFL is turned on. (Ambient Temp. =25℃)
3) The inverter should meet the eccentric conditions;
    -Sine, symmetric waveform without spike in positive and negative.

15. Lot Number Identification

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

KS6448ASHT-FW- □ □-□ □

- DATE
- MONTH
- YEAR
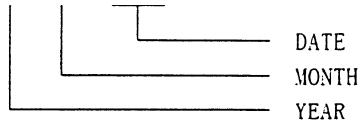
YEAR	1999	2000	2001	2002	2003
CODE	9	0	1	2	3

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

16. Warranty

16-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

16-2. 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.

17. Precautions for use

17-1. 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.

7. 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.

17-2. Static Electricity

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

2. Aluminum foil covering the terminal electrodes should remain in place until installed.

17-3. 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.

17-4. 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.

17-5. 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.

18. 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 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	240 Hr.	Display Quality : No defect Display Function : No defect Peel−off of Organic Sealing : None Current Consumption : No defect
Temp. Cycle	−20°C 0.5 Hr. R.T. 0.5 Hr. 70°C 0.5 Hr.	10cycles	Display Quality : No defect Display Function : No defect Peel−off of Organic Sealing : 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 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.

DOT SIZE

P0.228
0.208
0.208
P0.228

DETAIL A 2/1

M2.6 Screw

Electric Conducting Tape
(W4xL15±3)

Electric Conducting Tape
(W4xL15±3)

2-θ7 ±0.2
2-θ3.2 Hole

(active-shading)
active area
viewing area
shading area
(hatching area)

0.8

DETAIL B 2/1

(active-shading)
active area
viewing area
shading area
(hatching area)

0.8

3.5max
2.5 ±0.2
2-3 ±0.2

5.5 ±0.2
3.5 ±0.2
6
9

SECTION C-C 4/1

terminal surface
FFC or FPC
Insert direction

CN1

Note
1 Matching Connector : SM02-(6.0)B-BHS-1(JST)
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, 6214-016-010 (ELCO)
CN2, BHR-03VS-1 (JST)

* Tolerance without indication; ±0.5

130.5
120.4 ±0.3
5.05
5.05
60.2 ±1

No.16
CN1
No.1

Display center
Viewing Area (147.90X111.42)
Active Area (145.90X109.42)
640(H)X480(V) dots

92.08 ±0.4
172.8 ±0.3
79.3

81
90 ±0.3
19.7
15.2
2.5
50 ±0.5

CN2
No.1 Red
No.3 (White)

(25)

CN1

Title: KS6448AST(H)T
Outline Dimensions

Scale 1/1
Drawing No. 121A0080900-4

KYOCERA

Year-Month-Day
'08-03-12
Size 2

Rev. No.		Description	Drwn.	Chk.	App.
1		Change Connector			
2		Add shading area			
3		Change connector			
		Change terminal surface			
4		Change products name			

Approved 08-03-13 a.nishino
Checked 08-03-13 k.abe
Drawn n.inamura

SPEC. NO.	TQ3C-8EAS0-E2FGAN03-00
DATE	February 9, 1999

FOR: KICC

KYOCERA INSPECTION STANDARD

TYPE : KS6448ASHT-FW

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
February 9, 1999		M.Fujitani	T. Minami	S.Hayashi	Y. Yoshida
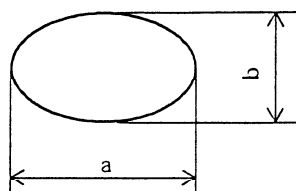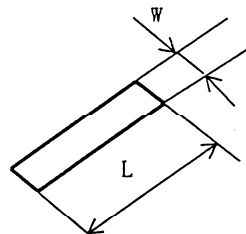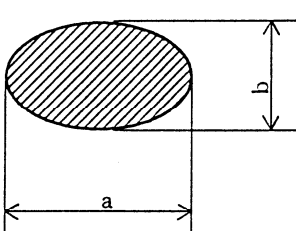
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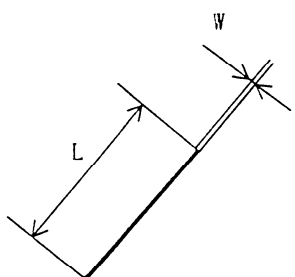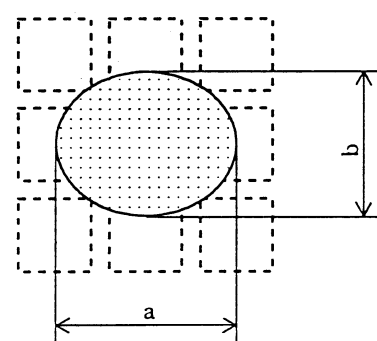
1) Note

Item	Note	
General	1. When defects specified in this Inspection Standards are inspected, operating voltage(Vop) shall be set at the level where optimized contrast is available. Display quality is applied up to effective viewing area. (Bi-Level 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

Inspection item	Judgement standard
Pinhole, Bright spot Black spot, Foreign particle	 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	
Scratch, Foreign particle	 |	Width (mm)	Length (mm)	Acceptable No.
---	---	---	---
A	W ≦ 0.03	—	neglected
B		L ≦ 2.0	neglected
C	0.03 < W ≦ 0.1	2.0 < L ≦ 4.0	3
D		4.0 < L	0
E	0.1 < W	—	According to 'Circular'	
Contrast variation	 d = (a + b) / 2 	Category	Size (mm)	Acceptable number
---	---	---
A	d ≦ 0.5	neglected
B	0.5 < d ≦ 0.7	3
C	0.7 < d	0	

Inspection item	Judgement standard

Inspection item: Polarizer (Scratch, Bubble, Dent)

Judgement standard:

(1) Scratch

	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