SPEC.NO.	TQ3C-8EAC0-E1CWJ02-01
DATE	May 25,2001

SPEC

FOR:

TYPE:KHS072VG2MA-J80

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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 Kyocera before ordering.

Original	Designed by :Engineering Dept.			Confirmed by :QA Dept.	
Issue Data	Prepared	Checked	Approved	Checked	Approved
September 18,2000	T. Yamaguchi	Y. 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 25,2001	T. Yamaguchi	Y. Matsumoto	T. Minami	S. Hayashi	J. Yoshida

Rev. No.	Date	Page	Descriptions
0 1	May 25,2001	—	All pages ～Change of page layout
		1	2.Construction and outline ～Add Recommended Inverter
		2	3.Mechanical specifications ～Change Mass
		5	6-2.Transmissive mode ～Change Brightness ～Change Chromaticity coordinates
		11	9.Interface Timing Chart ～Add comment
		15	12.Supply Voltage Sequence Condition ～Add comment
		16	13.Backlight Characteristics ～Add comment

1. Application

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

2. Construction and Outline

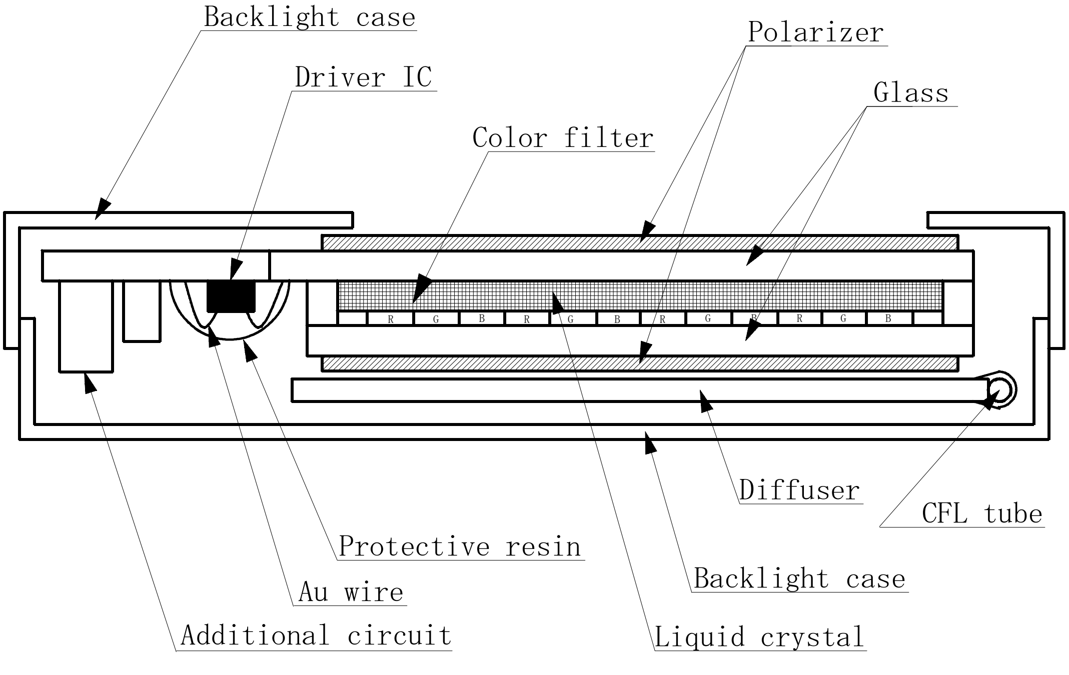
(640×R.G.B)×480 dots, COB type LCD with CFL backlight.

Backlight system : Side-edge type CFL (2 tube).

Inverter : Option.
Recommended Inverter : KCI-12(MINEBEA ELECTRONICS)
or equivalent.

Polarizer : Glare treatment.

Additional circuit : Bias voltage circuit, Randomizing circuit, DC-DC converter


Backlight case
Driver IC
Color filter
Polarizer
Glass
R
G
B
Diffuser
CFL tube
Protective resin
Backlight case
Au wire
Additional circuit
Liquid crystal

This drawing is showing conception only.

3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	189 (W) × 134 (H) × 9.2 (D)	mm
Effective viewing area	147.9 (W) × 111.4 (H)	mm
Dot number	(640×R.G.B) (W) × 480 (H)	Dots
Dot size	0.056 (W) × 0.208 (H)	mm
Dot pitch	0.076 (W) × 0.228 (H)	mm
Display color *1	White *2	—
Base color *1	Black *2	—
Mass	370	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, UD0～UD7, 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

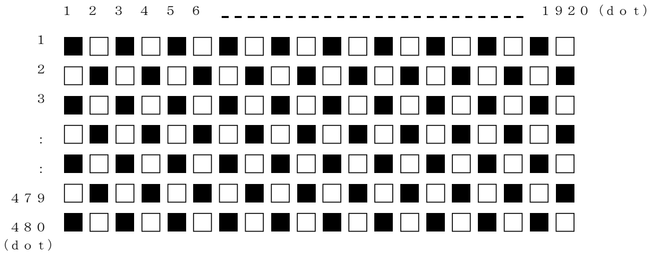
Temp. = 25℃, VDD = +3.3V ± 0.3V

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	10.0	MHz
Frame frequency *2	f_{FRM}		70	75	80	Hz
Current consumption for logic *3	IDD	—	—	126	189	mA
Power consumption	Pdisp		—	416	624	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 = 4.32MHz
Pattern:



6. Optical Characteristics

6-1. Reflective mode

Measuring Spot = ϕ6mm , Temp. = 25℃

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Response	Rise	Tr	$\theta = \phi = \theta$	—	200	300	ms
	Down	Td	$\theta = \phi = \theta$	—	150	250	ms
Contrast ratio		CR	$\theta = \phi = \theta$	2.5	5.0	—	—
Reflectance		ρ	—	1.5	3.0	—	%

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

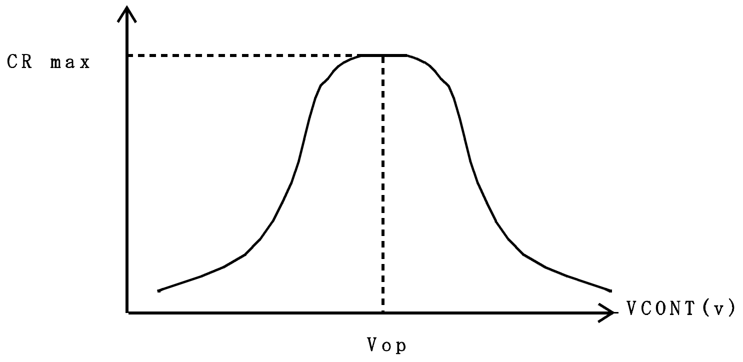
6-2. Transmissive mode

Measuring Spot = ϕ6mm , Temp. = 25℃

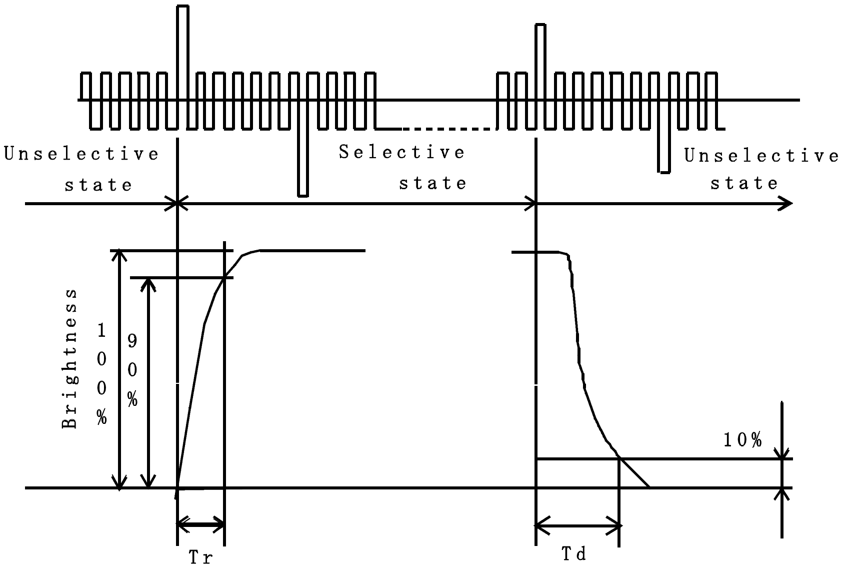
ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	$\theta = \phi = 0°$		—	200	300	ms
	Down	Td	$\theta = \phi = 0°$		—	150	250	ms
Viewing angle range		θ	CR≧2	$\phi = 0°$	-30	—	40	deg.
		ϕ		$\theta = 0°$	-50	—	50	deg.
Contrast ratio		CR	$\theta = \phi = 0°$		7.5	15.0	—	—
Brightness(IL=5.0mA)		L	—		110	160	—	cd/m^2
Chromaticity coordinates	Red	x	$\theta = \phi = 0°$		0.33	0.38	0.43	—
		y			0.22	0.27	0.32	
	Green	x	$\theta = \phi = 0°$		0.23	0.28	0.33	
		y			0.33	0.38	0.43	
	Blue	x	$\theta = \phi = 0°$		0.14	0.19	0.24	
		y			0.12	0.17	0.22	
	White	x	$\theta = \phi = 0°$		0.24	0.29	0.34	
		y			0.26	0.31	0.36	
	Black	x	$\theta = \phi = 0°$		0.17	0.22	0.27	
		y			0.10	0.15	0.20	

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

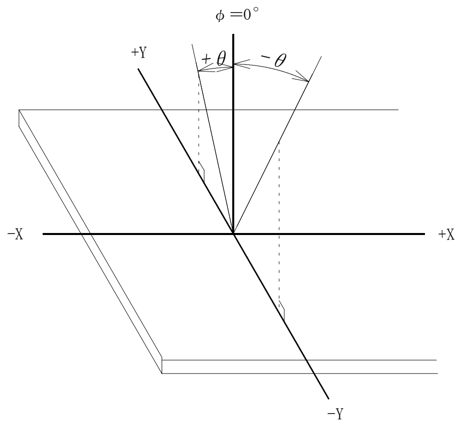
6-3. Definition of Vop



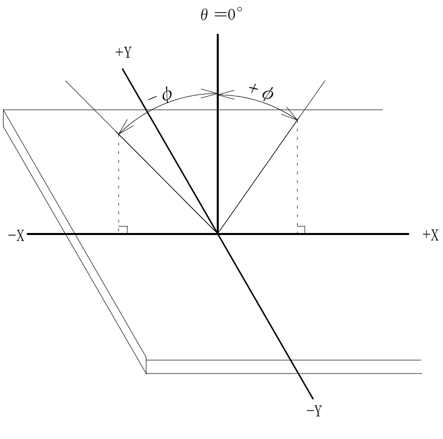
6-4. Definition of response time


Unselective state
Selective state
Unselective state
Brightness
100%
90%
10%
Tr
Td

6-5. Definition of viewing angle

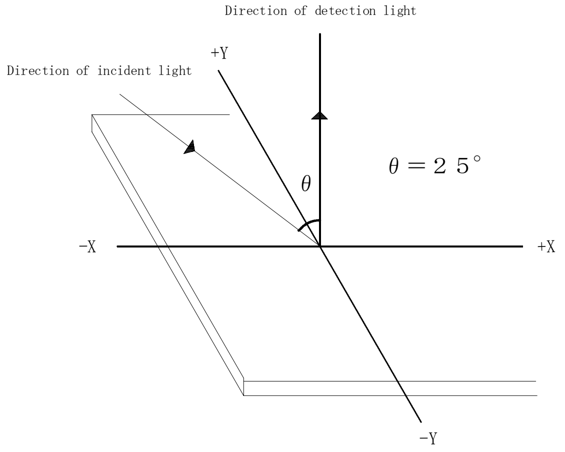


(θ direction)



(φ direction)

6-6. Measurement method of reflectance


Direction of detection light
+Y
Direction of incident light
θ
θ = 25°
-X
+X
-Y

6-7. Definition of Contrast (Reflective Mode)

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

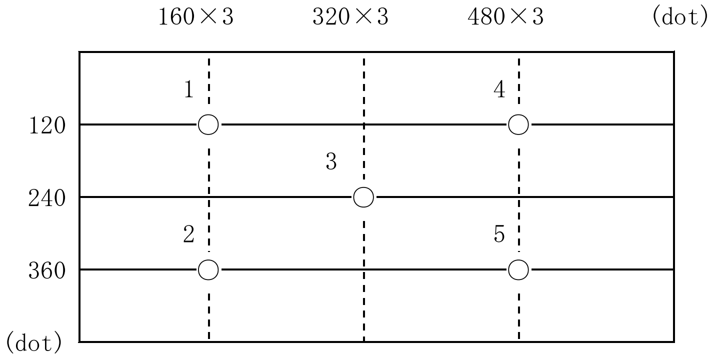
6-8. Definition of Contrast (Transmissive Mode)

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

6-9. Definition of Reflectance:

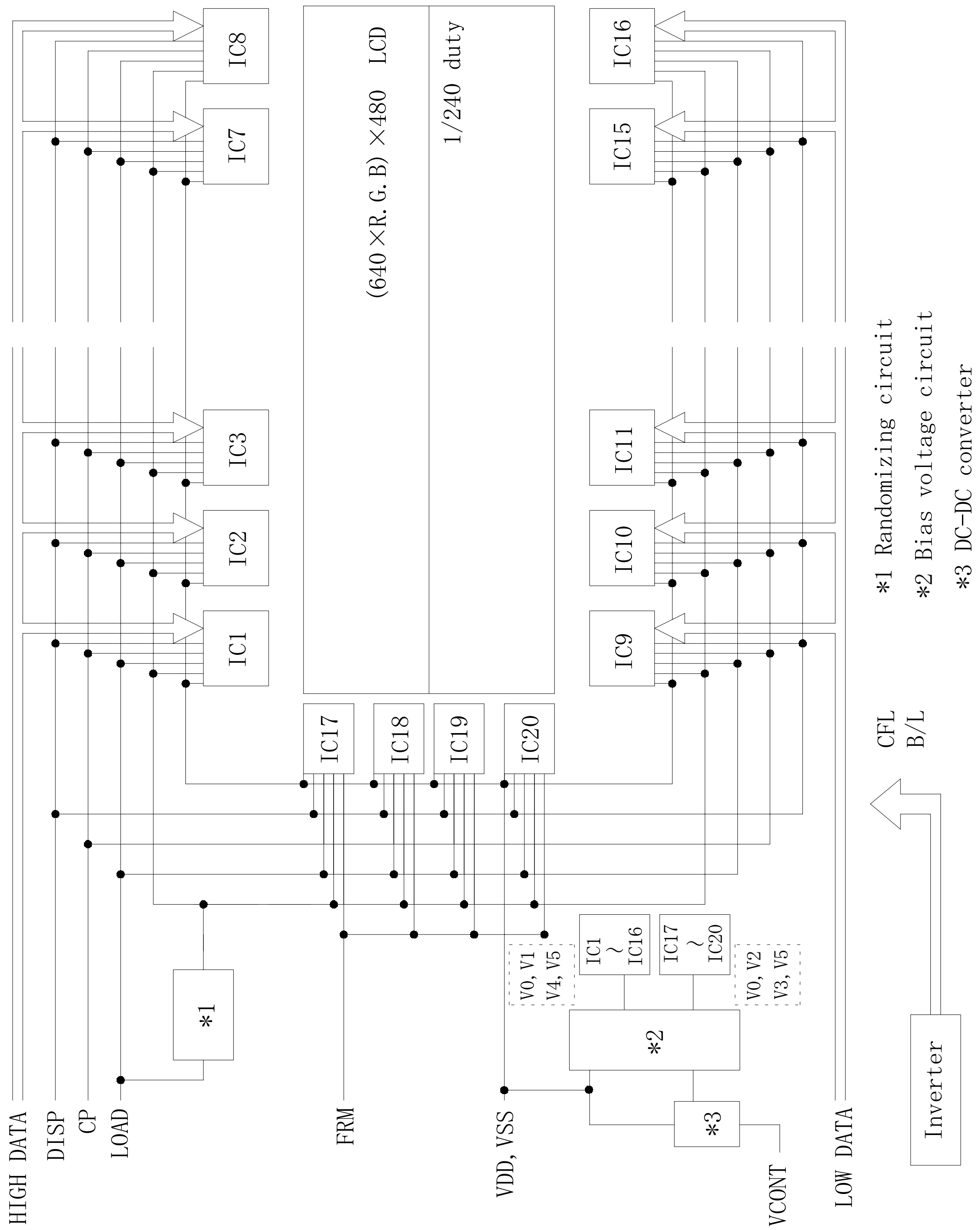
$$\rho\ \text{(Reflectance)} = \frac{\text{Measured Reflection Brightness}}{\text{Reflection Brightness against Standard White Board}} \times 100(\%)$$

6-10. Measuring points

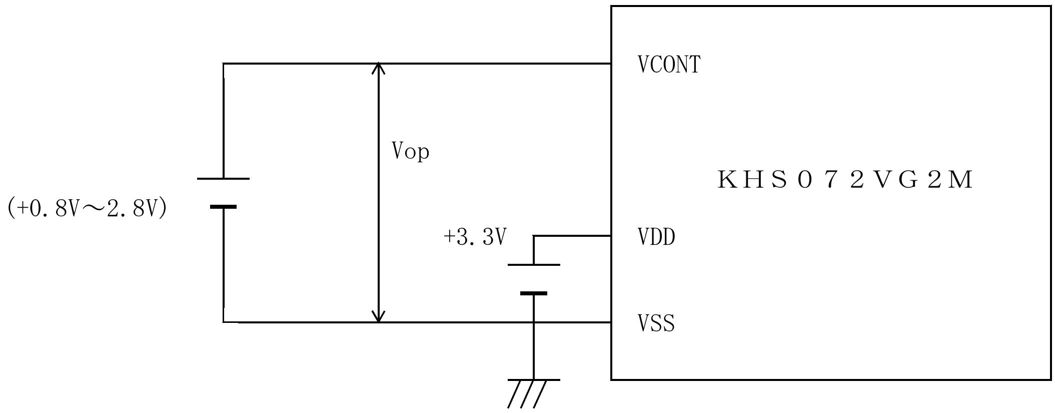

160×3
320×3
480×3
(dot)
1
4
3
2
5
120
240
360
(dot)

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.

7. Circuit Block Diagram


IC8
IC7
IC3
IC2
IC1
IC16
IC15
IC11
IC10
IC9
IC17
IC18
IC19
IC20
(640×R. G. B) ×480 LCD
1/240 duty
*1
*2
*3
IC1 ~ IC16
IC17 ~ IC20
V0, V1 V4, V5
V0, V2 V3, V5
HIGH DATA
DISP
CP
LOAD
FRM
VDD, VSS
VCONT
LOW DATA
Inverter
CFL B/L
*1 Randomizing circuit
*2 Bias voltage circuit
*3 DC-DC converter

7-1. Power supply


VCONT
Vop
ＫＨＳ０７２ＶＧ２Ｍ
(+0.8V～2.8V)
+3.3V
VDD
VSS

8. Interface signals

8-1. LCD

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	LD4	Display data (Lower column)	H(ON),L(OFF)
2	VSS	GND	—
3	LD5	Display data (Lower column)	H(ON),L(OFF)
4	FRM	Synchronous signal for driving scanning line	H
5	LD6	Display data (Lower column)	H(ON),L(OFF)
6	LOAD	Data signal latch clock	H → L
7	LD7	Display data (Lower column)	H(ON),L(OFF)
8	VSS	GND	—
9	VSS	GND	—
10	CP	Data signal shift clock	H → L
11	LD0	Display data (Lower column)	H(ON),L(OFF)
12	VCONT	LCD adjust voltage	—
13	LD1	Display data (Lower column)	H(ON),L(OFF)
14	VDD	Power supply for logic	—
15	VSS	GND	—
16	VDD	Power supply for logic	—
17	LD2	Display data (Lower column)	H(ON),L(OFF)
18	DISP	Display control signal	H(ON),L(OFF)
19	LD3	Display data (Lower column)	H(ON),L(OFF)
20	NC	No connect	—
21	VSS	GND	—
22	HD3	Display data (Upper column)	H(ON),L(OFF)
23	HD4	Display data (Upper column)	H(ON),L(OFF)
24	HD2	Display data (Upper column)	H(ON),L(OFF)
25	HD5	Display data (Upper column)	H(ON),L(OFF)
26	HD1	Display data (Upper column)	H(ON),L(OFF)
27	VSS	GND	—
28	HD0	Display data (Upper column)	H(ON),L(OFF)
29	HD6	Display data (Upper column)	H(ON),L(OFF)
30	VSS	GND	—
31	HD7	Display data (Upper column)	H(ON),L(OFF)

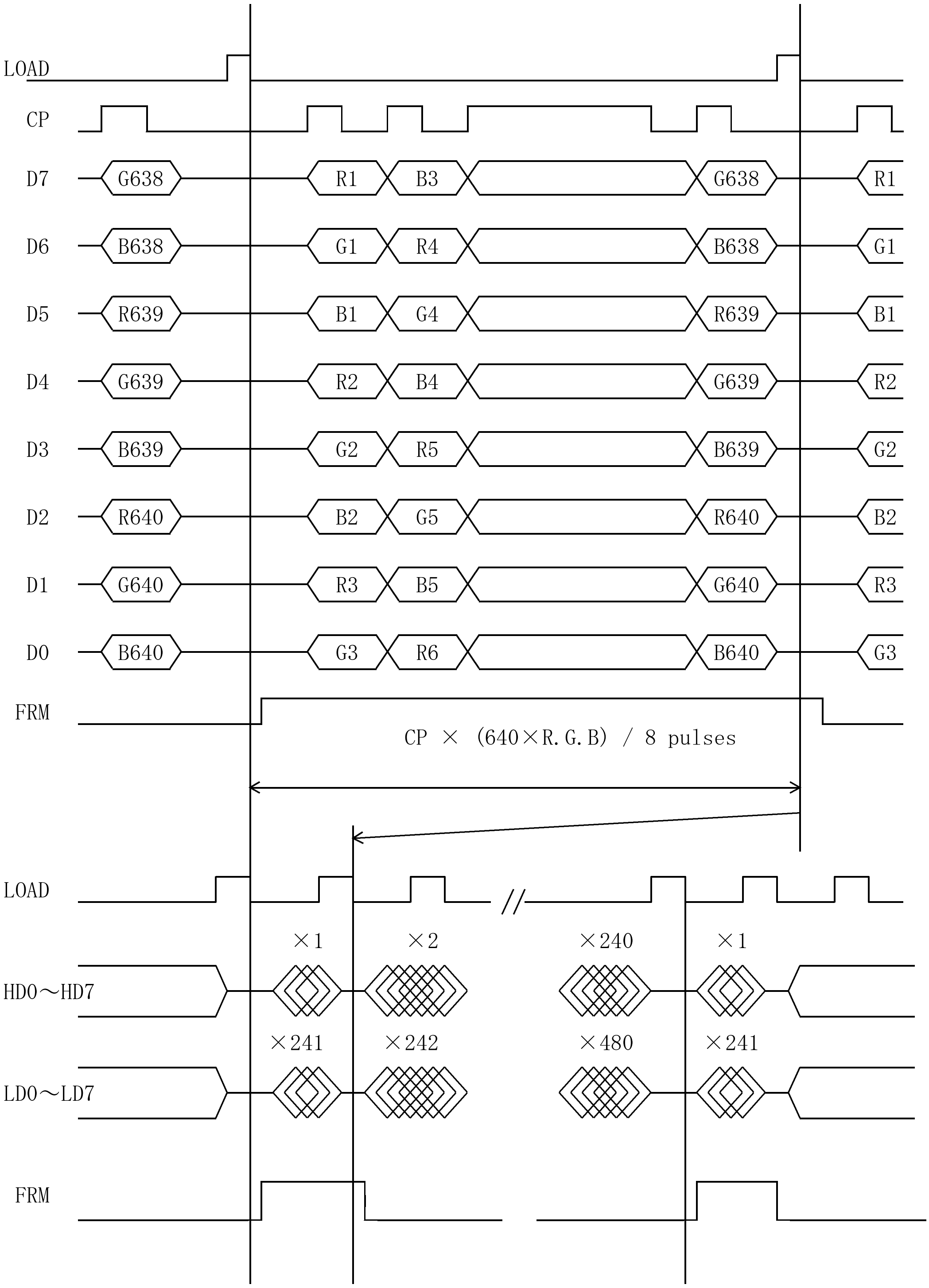
LCD side connector	:	DF9B-31P-1V (HIROSE)
Recommended matching connector	:	DF9B-31S-1V (HIROSE)

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	:	SM02-(8.0)B-BHS-1	(JST)

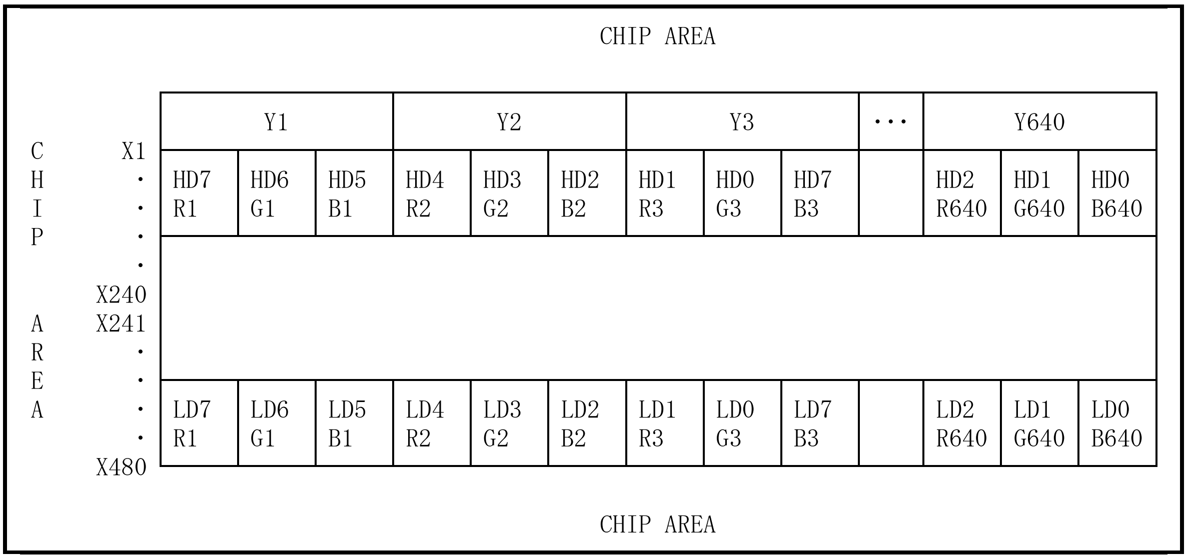
9. Interface Timing Chart


LOAD
CP
D7
G638
R1
B3
G638
R1
D6
B638
G1
R4
B638
G1
D5
R639
B1
G4
R639
B1
D4
G639
R2
B4
G639
R2
D3
B639
G2
R5
B639
G2
D2
R640
B2
G5
R640
B2
D1
G640
R3
B5
G640
R3
D0
B640
G3
R6
B640
G3
FRM
CP × (640×R.G.B) / 8 pulses
LOAD
×1
×2
×240
×1
HD0～HD7
×241
×242
×480
×241
LD0～LD7
FRM

* The cycle of load signal should be stable and continuously applied without interruption.

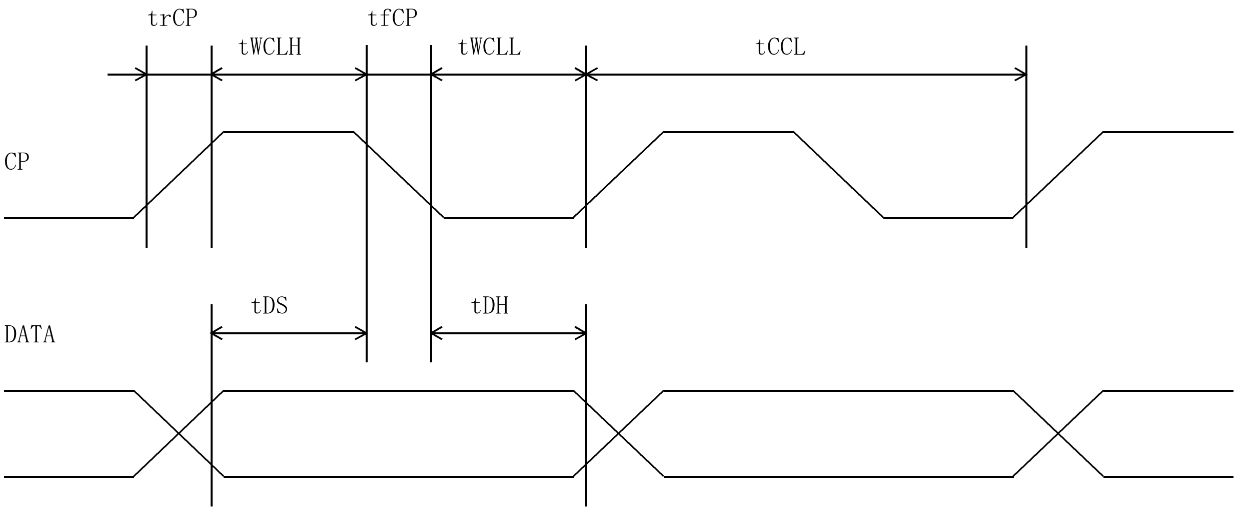
* The above-mentioned timing chart shows a reference to set up a LCD module, not an electrical rating

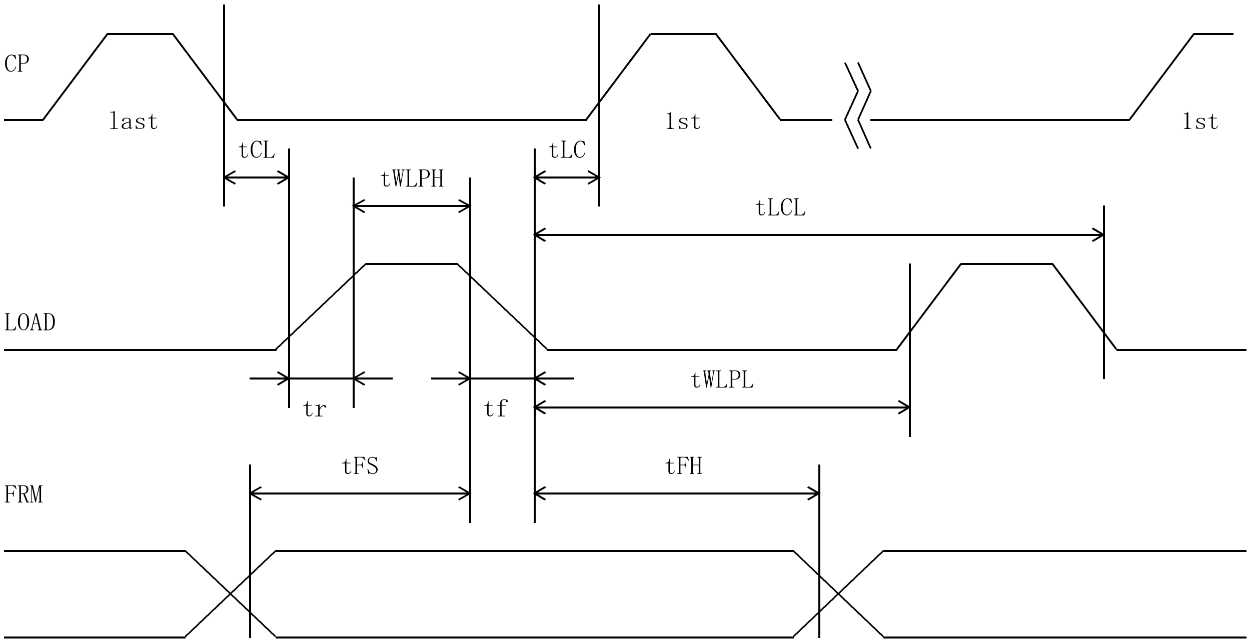
10. Data and Screen


CHIP AREA
CHIP AREA
CHIP AREA
CHIP AREA
X1
X240
X241
X480

	Y1			Y2			Y3			···	Y640		
X1	HD7 R1	HD6 G1	HD5 B1	HD4 R2	HD3 G2	HD2 B2	HD1 R3	HD0 G3	HD7 B3		HD2 R640	HD1 G640	HD0 B640
X480	LD7 R1	LD6 G1	LD5 B1	LD4 R2	LD3 G2	LD2 B2	LD1 R3	LD0 G3	LD7 B3		LD2 R640	LD1 G640	LD0 B640

11. Input Timing Characteristics


trCP
tWCLH
tfCP
tWCLL
tCCL
CP
tDS
tDH
DATA


CP
last
1st
1st
tCL
tLC
tWLPH
tLCL
LOAD
tr
tf
tWLPL
tFS
tFH
FRM

11-1. Switchig characteristics

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

ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle *1,*2	tCCL	100	—	ns
CP ″H″ Pulse Width *2	tWCLH	40	—	ns
CP ″L″ Pulse Width *2	tWCLL	40	—	ns
CP Rise Up Time *2	trCP	—	30	ns
CP Fall Down Time *2	tfCP	—	30	ns
Data Set Up Time	tDS	30	—	ns
Data Hold Time	tDH	20	—	ns
LOAD ″H″ Pulse Width	tWLPH	100	—	ns
LOAD ″L″ Pulse Width	tWLPL	4900	—	ns
LOAD Cycle *3	tLCL	5000	—	ns
CP→LOAD Delay Time	tCL	0	—	ns
LOAD→CP Delay Time *4	tLC	200-tWLPH	—	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

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

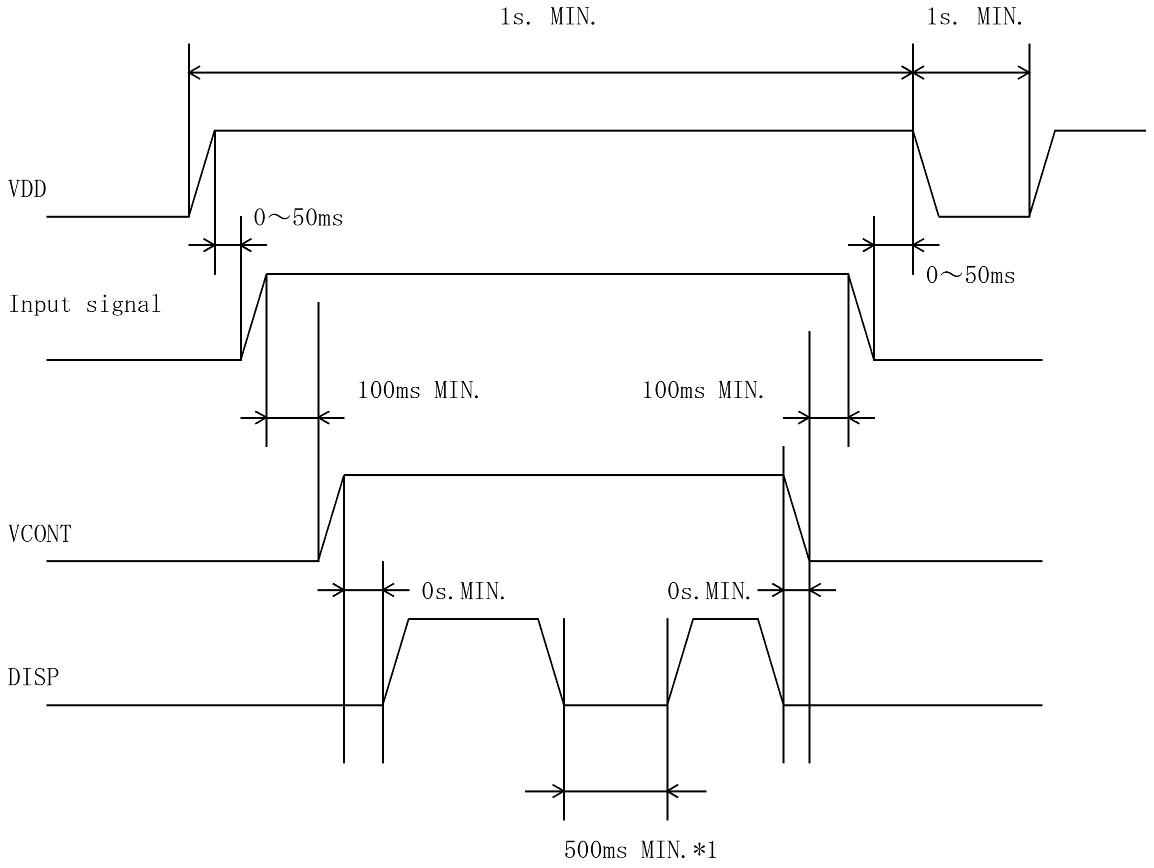
*2 The formula of condition
① trCP + tfCP ≦ tCCL - (tWCLH + tWCLL)
② trCP, tfCP ≦ 30 ns
Please use on condition that ①,② are filled.

*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.


1s. MIN.
1s. MIN.
VDD
0～50ms
0～50ms
Input signal
100ms MIN.
100ms MIN.
VCONT
0s.MIN.
0s.MIN.
DISP
500ms MIN.*1

*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.

13. Backlight Characteristics

CFL ratings

Temp.= 25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	NOTE
Starting discharge Voltage *1	VS	—	—	915 Vrms.	0 ℃
		—	—	610 Vrms.	25 ℃
Discharging tube current *2,*3	IL	2.0 mArms.	5.0 mArms.	6.0 mArms.	—
Discharging tube voltage	VL	—	390 Vrms.	—	—
Operating life *4 (IL=5.0 mArms.)	T	36,000 h	54,000 h	—	—
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: 1190 Vrms 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.

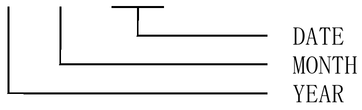
*3 Do not apply more than 6.0mA discharging tube current. Becouse CFL maybe broken due to over current.

*4 When the illuminance or quantity of light has decreased to 50 % of the initial value. Average life time of CFL will 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.

ＫＨＳ０７２ＶＧ２ＭＡ－Ｊ８０－ □ □－□ □



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. 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.

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 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.

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 Crysta : 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.

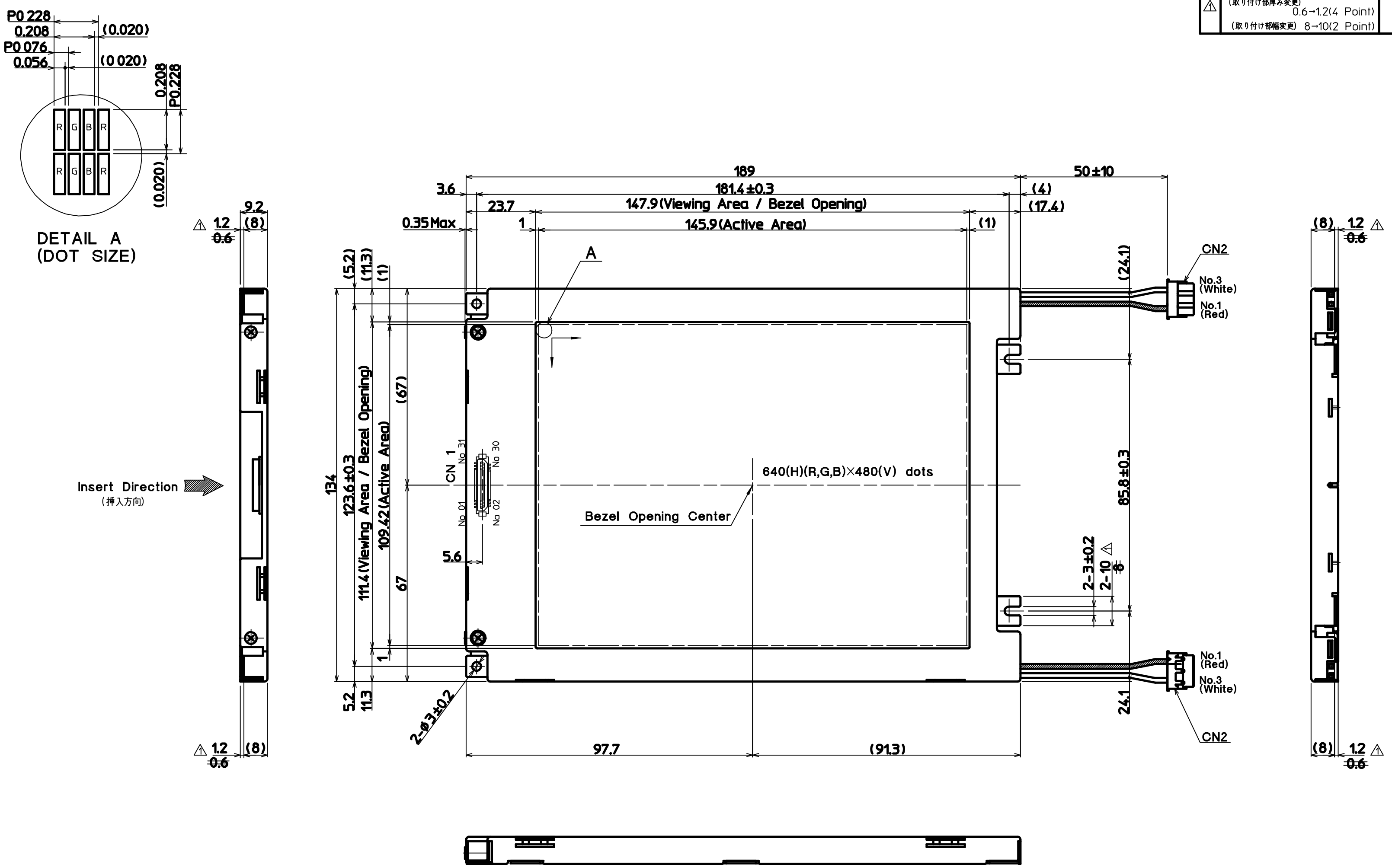
＊ The LCD is tested in circumstances in which there is no condensation.

＊ 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.

No	Description	Drawn	Checked	Checked	Approved
⚠1	Change Dimensions. （取り付け部厚み変更） 0.6→1.2(4 Point) （取り付け部幅変更） 8→10(2 Point)	'00.12.27. 阿部	'00.12.28. 西野		'00.12.28. 竹本



P0.228
0.208
(0.020)
P0.076
0.056
(0.020)
0.208
P0.228
(0.020)
R G B R
R G B R
DETAIL A
(DOT SIZE)
Insert Direction
（挿入方向）
9.2
⚠ 1.2
~~0.6~~
(8)
189
50±10
3.6
181.4±0.3
(4)
23.7
147.9(Viewing Area / Bezel Opening)
(17.4)
0.35Max
1
145.9(Active Area)
(1)
A
CN2
No.3 (White)
No.1 (Red)
(24.1)
(5.2)
(11.3)
(1)
(67)
134
123.6±0.3
111.4(Viewing Area / Bezel Opening)
109.42(Active Area)
67
1
CN 1
No 31
No 30
No 01
No 02
640(H)(R,G,B)×480(V) dots
Bezel Opening Center
5.6
85.8±0.3
2-3±0.2
2-10 ⚠
~~8~~
5.2
11.3
2-φ3±0.2
24.1
No.1 (Red)
No.3 (White)
CN2
97.7
(91.3)
(8)
1.2 ⚠
~~0.6~~

Note

1. The drawing is the front view of the LCD. Information is displayed starting at the upper left hand corner, moving right then down to the lower right hand corner.
   (LCDの正面図において、画像データの表示は左上コーナーから始まり、右へ進み下へ送られ右下コーナーへ向かう。)
2. Connector CN1 : DF9B-31P-1V (HIROSE)
   (コネクター) CN2 : BHR-03VS-1 (JST)
3. Matching Connector : DF9B-31S-1V (HIROSE)
   (適合コネクター) : SM02-(8.0)B-BHS-1 (JST)
4. Tolerance without indication; **±0.5**
   (指示無き公差)

Material 材 質	Treatment 処 理	Approved '00.09.08	Checked	Checked '00.09.08	Drawn	Scale 1:1	Title KHS072VG2MA	KYOCERA	Year–Month–Day '00.09.01	Size 2
Quantity 製作数	Description; 備 考	竹本		西野	今村		Outline Dimensions	Drawing No.	121A5003300–1	