SPEC

Spec No.	TQ3C-8EAS0-E1DAJ05-01
Date	February 14, 2008

TYPE : KG038QV0AN-G00

< 3.8 inch QVGA transmissive monochrome STN >

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Issued
Date:Feb.19,2008
KYOCERA
Hayato LCD Division

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

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

Original Issue Date	Designed by: Engineering dept.			Confirmed by: QA dept.	
	Prepared	Checked	Approved	Checked	Approved
April 5, 2007	Y Asano		Y. Matsumoto	J. Sakaguchi	

Warning

1. This Kyocera LCD module has been specifically designed for use only in electronic devices and industrial machines in the area of audio control, office automation, industrial control home appliances, etc. The module should not be used in applications where the highest level of safety and and reliability are required and module failure or malfunction of such module results in physical harm or loss of life, as well as enormous damage or loss. Such fields of applications include, without limitation, medical, aerospace, communications infrastructure, atomic energy control. Kyocera expressly disclaims any and all liability resulting in any way to the use of the module In such applications.

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

Caution

1. 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
Feb. 14, 2008	Y. Asano	M. Tohmori	Y. Matsumoto	J. Sakaguchi	

Rev.No.	Date	Page	Descriptions
01	Feb. 14, 2008	10	10. Input timing characteristics ～Change “tLRDR” → “tLDD”

1. Application

This document defines the specification of KG038QV0AN-G00. (RoHS Compliant)

2. Construction and outline

LCD	: Transmissive monochrome dot matrix type STN
Duty ratio	: 1/240 duty
Backlight system	: None
Polarizer	: Glare treatment
Additional circuit	: None

3. Mechanical specifications

Item	Specification	Unit
Outline dimensions	102 (W)× 76 (H) × 2.6 (D) *(FPC and Boss not included)	mm
Active area	76.78 (W) × 57.58 (H) (9.6cm / 3.8 inch (Diagonal))	mm
Effective viewing area	78.8 (W) × 59.6 (H)	mm
Dot format	320 (W) × 240 (H)	dot
Dot size	0.22 (W) × 0.22 (H)	mm
Dot pitch	0.24 (W) × 0.24 (H)	mm
Base color *1	Normally Black	-
Mass	(30)	g

*1 Due to the characteristics of the LCD material, the color varies with environmental temperature.

4. Absolute maximum ratings

4-1. Electrical absolute maximum ratings

Item	Symbol	Min.	Max.	Unit
Supply voltage for logic	V_{DD}	0	7.0	V
Supply voltage for LCD driving	V0-V5	0	32.0	V
Input signal voltage *1	V_{IN}	0	V_{DD}	V
FRM frequency	f_{FRM}	-	150	Hz

*1 Input signal : FRM, LOAD, CP, DISP, D0～D3

4-2. Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit
Operating temperature *1	T_{OP}	0	60	°C
Storage temperature *2	T_{STO}	-20	60	°C
Operating humidity *3	H_{OP}	10	*4	%RH
Storage humidity *3	H_{STO}	10	*4	%RH
Vibration	-	*5	*5	-
Shock	-	*5	*5	-

*1 Operating temperature means a temperature which operation shall be guaranteed. Since display performance is evaluated at 25°C, another temperature range should be confirmed.

*2 Temp. = -20°C＜48h , Temp. = 60°C＜168h
Store LCD panels at normal temperature/humidity. Keep them free from vibration and shock. An LCD panel that is kept at a low or a high temperature for a long time can be defective due to other conditions, even if the low or high temperature satisfies the standard.
(Please refer to “Precautions for use” for details.)

*3 Non-condensing

*4 Temp.≦40°C, 85%RH Max.
Temp.＞40°C, Absolute humidity shall be less than 85%RH at 40°C.

*5 Confirm the problem doesn’t occur on your divice and your condition for the vibration and the shock.

5. Electrical characteristics

5-1. V_{DD} = 5.0V

V_{DD} = +5.0V±5%, Temp. = 0～60°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage for logic	V_{DD}	-	4.75	5.00	5.25	V
Supply voltage for LCD driving *1, *2	V_{op}= V0-V5	0°C	22.4	23.4	24.4	V
		25°C	21.8	22.8	23.8	V
		60°C	20.9	21.9	22.9	V
Input signal voltage (FRM,LOAD,CP,DISP,D0～D3)	V_{IN}	"High" level	0.8V_{DD}	-	V_{DD}	V
		"Low" level	0	-	0.2V_{DD}	V
Input current	I_{IN}	Input signal	-100	-	100	µA
Clock frequency	f_{CP}	-	-	-	7.14	MHz
Frame frequency *3	f_{FRM}	-	70	75	80	Hz
Randomizing frequency *4	DF	-	300	-	800	Hz
Current consumption for logic	I_{DD}	*5	-	24	31	mA
Power consumption	P_{DISP}		-	120	155	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (V_{OP} = V0-V5) for driving the LCD.

*2 Frame frequency : f_{FRM} = 75Hz

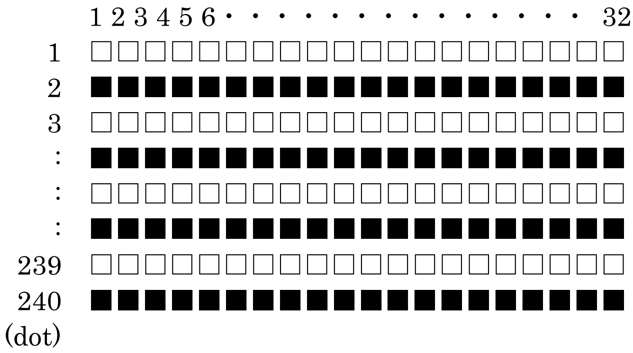
*3 In consideration of display quality, it is recommended that frame frequency be set in the range of 70-80Hz. When you have to use higher frame and clock frequencies, confirm the LCD's performance and quality prior to finalizing the frequency value. Generally, as frame and clock frequencies become higher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

*4 It is recommended that randomizing frequency be set in the range of 300-800Hz.
At finalizing the frequency, confirm with actual tests that phenomena like flickering and/or horizontal lines do not appear on screen.

*5 Current consumption for logic is a numerical value when measuring it by using our standard circuit under the following condition.

*6 Display pattern:

V_{DD} = 5.0V, V_{OP} = 22.8V(V0-V5), f_{FRM} = 75Hz, f_{CP} = 1.44MHz, Temp. = 25°C



5-2. V_{DD} = 3.3V

V_{DD} =+3.3V±0.3V, Temp. = 0～60°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage for logic	V_{DD}	-	3.0	3.3	3.6	V
Supply voltage for LCD driving *1, *2	V_{OP}= V0-V5	0°C	22.4	23.4	24.4	V
		25°C	21.8	22.8	23.8	
		60°C	20.9	21.9	22.9	V
Input signal voltage (FRM,LOAD,CP,DISP,D0～D3)	V_{IN}	"High" level	0.8V_{DD}	-	V_{DD}	V
		"Low" level	0	-	0.2V_{DD}	V
Input current	I_{IN}	Input signal	-100	-	100	μA
Clock frequency	f_{CP}	-	-	-	7.14	MHz
Frame frequency *3	f_{FRM}	-	70	75	80	Hz
Randomizing frequency *4	DF	-	300	-	800	Hz
Current consumption for logic	I_{DD}	*5	-	34	44	mA
Power consumption	P_{DISP}		-	112	145	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (V_{OP} = V0-V5) for driving the LCD.

*2 Frame frequency : f_{FRM} = 75Hz

*3 In consideration of display quality, it is recommended that frame frequency be 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 value. Generally, as frame and clock frequencies become higher current consumption increases and display quality will degrade.

*4 It is recommended that randomizing frequency be set in the range of 300-800Hz.
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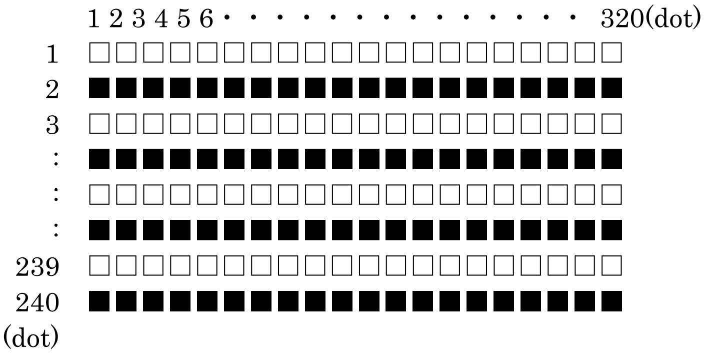
*5 Current consumption for logic is a numerical value when measuring it by using our standard circuit under the following condition.

*6 Display pattern:

V_{DD} = 3.3V, V_{OP} = 22.8V(V0-V5), f_{FRM} = 75Hz, f_{CP} = 1.44MHz, Temp. = 25°C



6. Optical characteristics

Measuring spot = ϕ 6.0mm, Temp. = 25°C

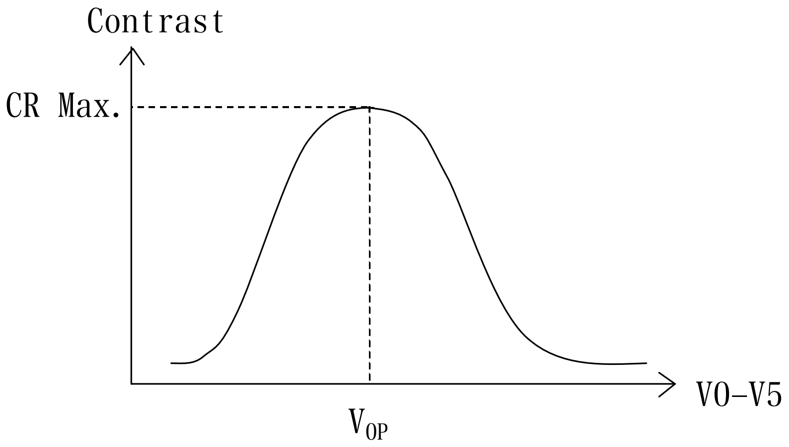
Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Response time	Rise	τ_r	$\theta=\phi=0°$	-	380	480	ms
	Down	τ_d	$\theta=\phi=0°$	-	120	220	ms
Viewing angle range		θ_{UPPER}	CR≧2	-	20	-	deg.
		θ_{LOWER}		-	40	-	
		ϕ_{LEFT}		-	45	-	deg.
		ϕ_{RIGHT}		-	45	-	
Contrast ratio		CR	$\theta=\phi=0°$	20	40	-	-
Transmissivity		τ	-	16.0	20.0	-	%

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

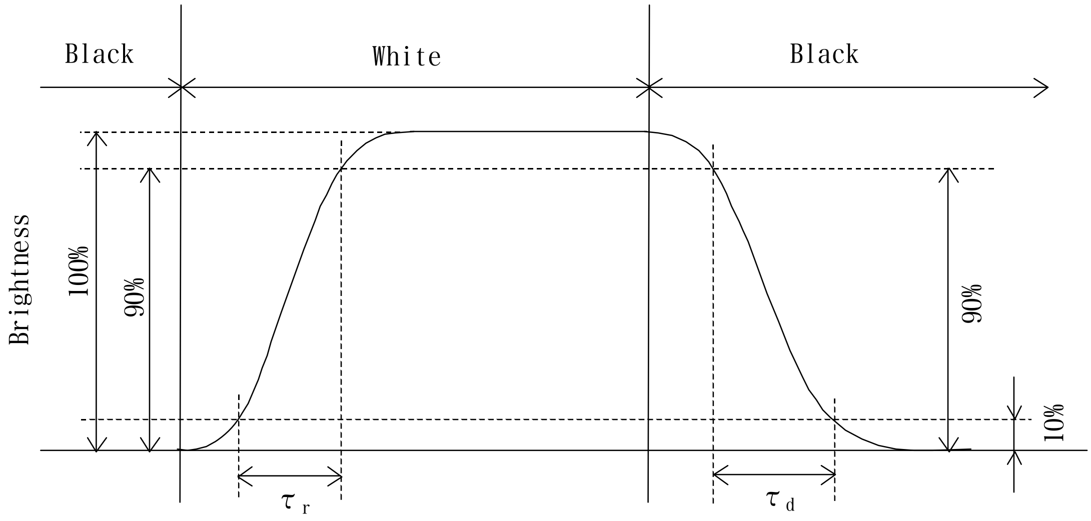
6-1. Definition of contrast ratio

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

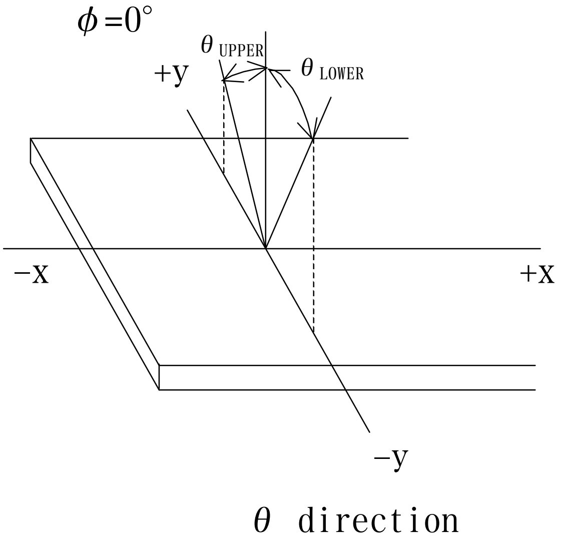
6-2. Definition of V_{OP}

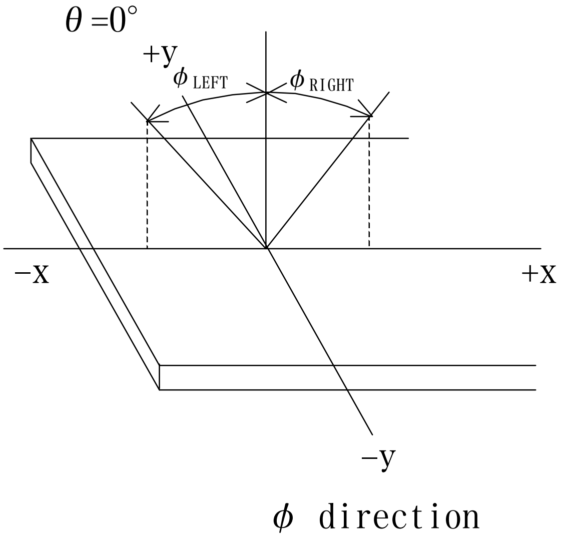


6-3. Definition of response time

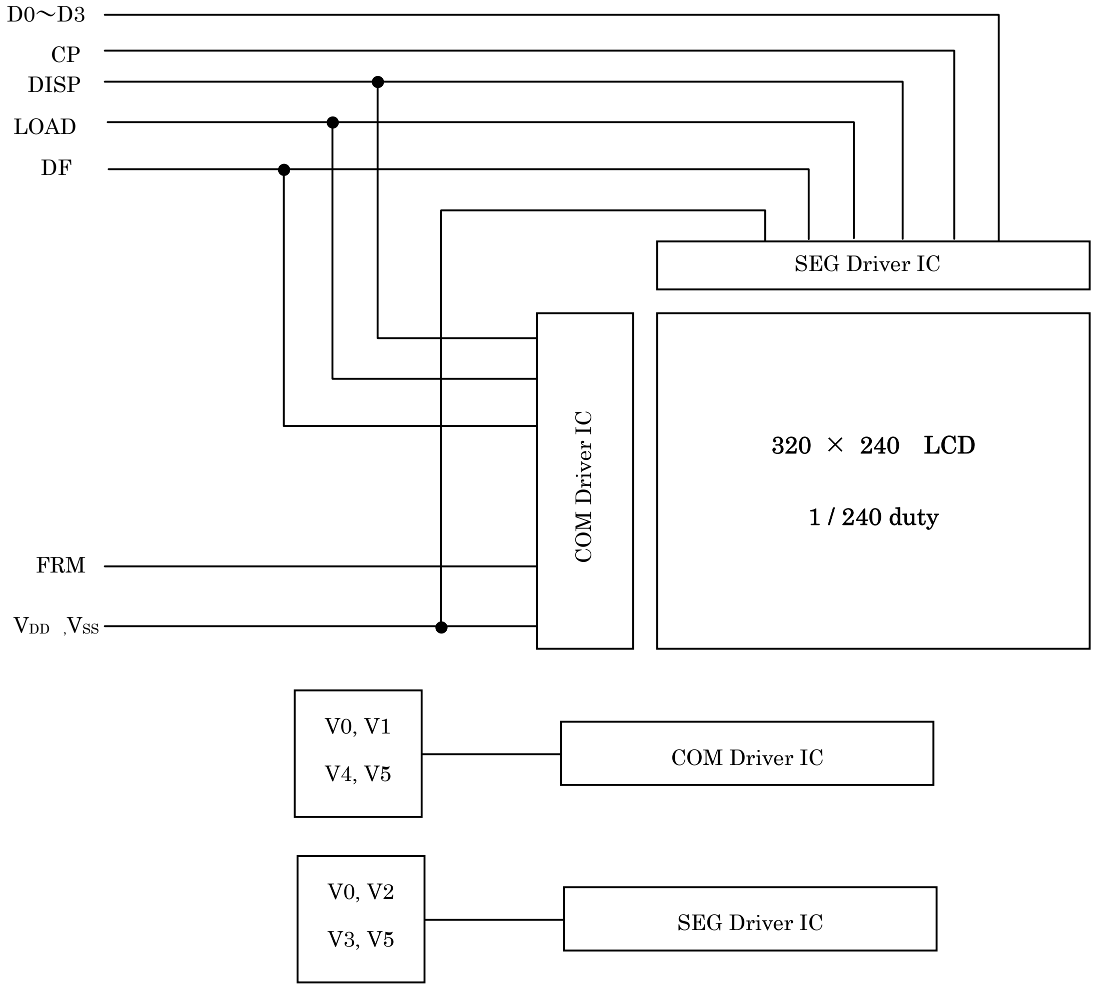

Black
White
Black
Brightness
100%
90%
90%
10%
τ r
τ d

6-4. Definition of viewing angle


ϕ =0°
θ UPPER
θ LOWER
+y
−X
+X
−y
θ direction


θ =0°
+y
ϕ LEFT
ϕ RIGHT
−X
+X
−y
ϕ direction

7. Circuit block diagram



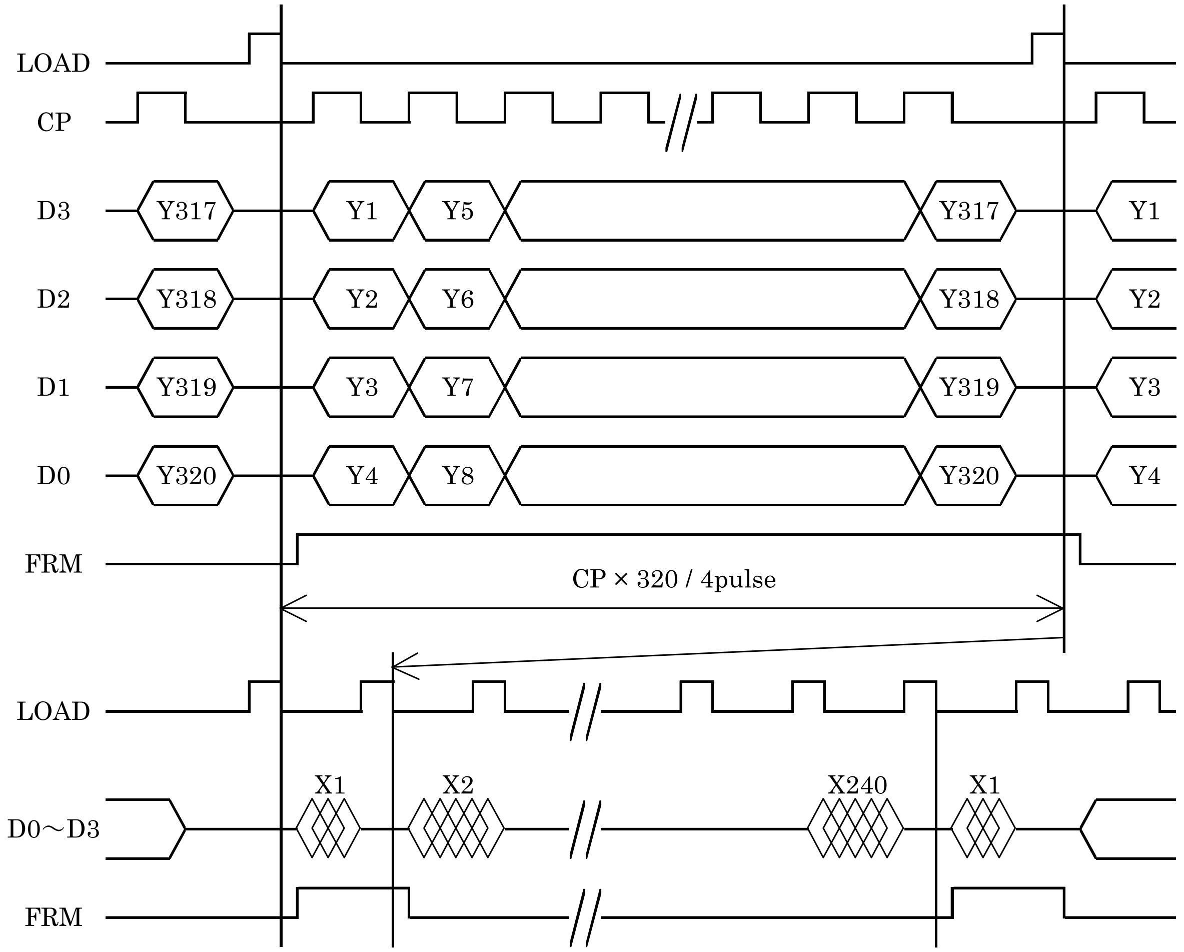
D0～D3
CP
DISP
LOAD
DF
FRM
VDD ,VSS
SEG Driver IC
COM Driver IC
320 × 240 LCD
1 / 240 duty
V0, V1
V4, V5
COM Driver IC
V0, V2
V3, V5
SEG Driver IC

8. Interface signals

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	V_{DD}	Power supply for logic	-
6	NC	No connect	-
7	V_{SS}	GND	-
8	DF	AC signal for driving	H → L
9	V0	LCD adjust voltage	-
10	V1		
11	V2		
12	V3		
13	V4		
14	V5		
15	D0	Display data	H(ON),L(OFF)
16	D1		
17	D2		
18	D3		
19	NC	No connect	-
20	NC		
21	NC		
22	NC		

FPC： P=0.5mm (Terminal processing： Au)

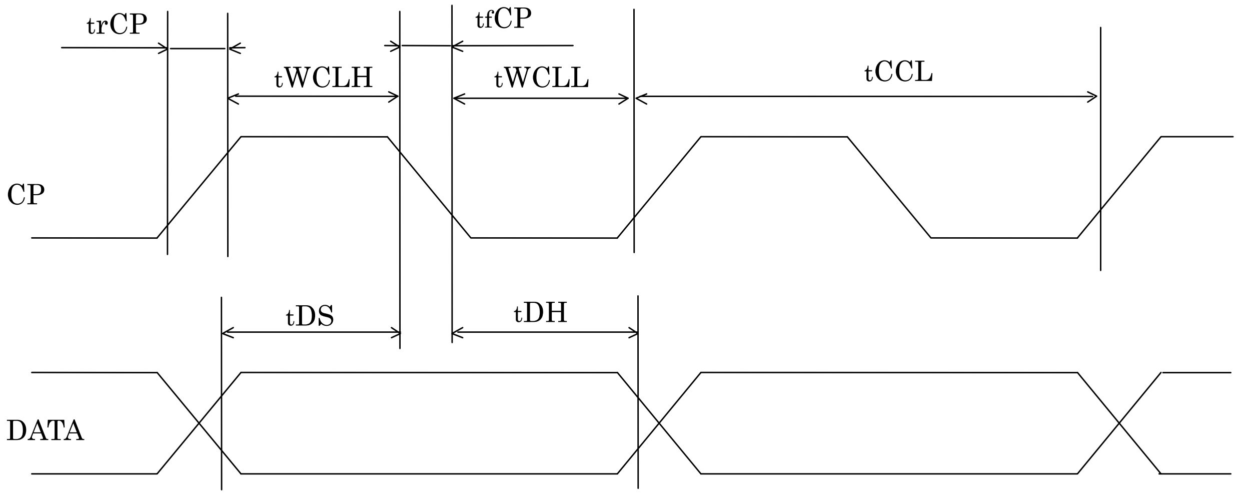
9. Interface timing chart

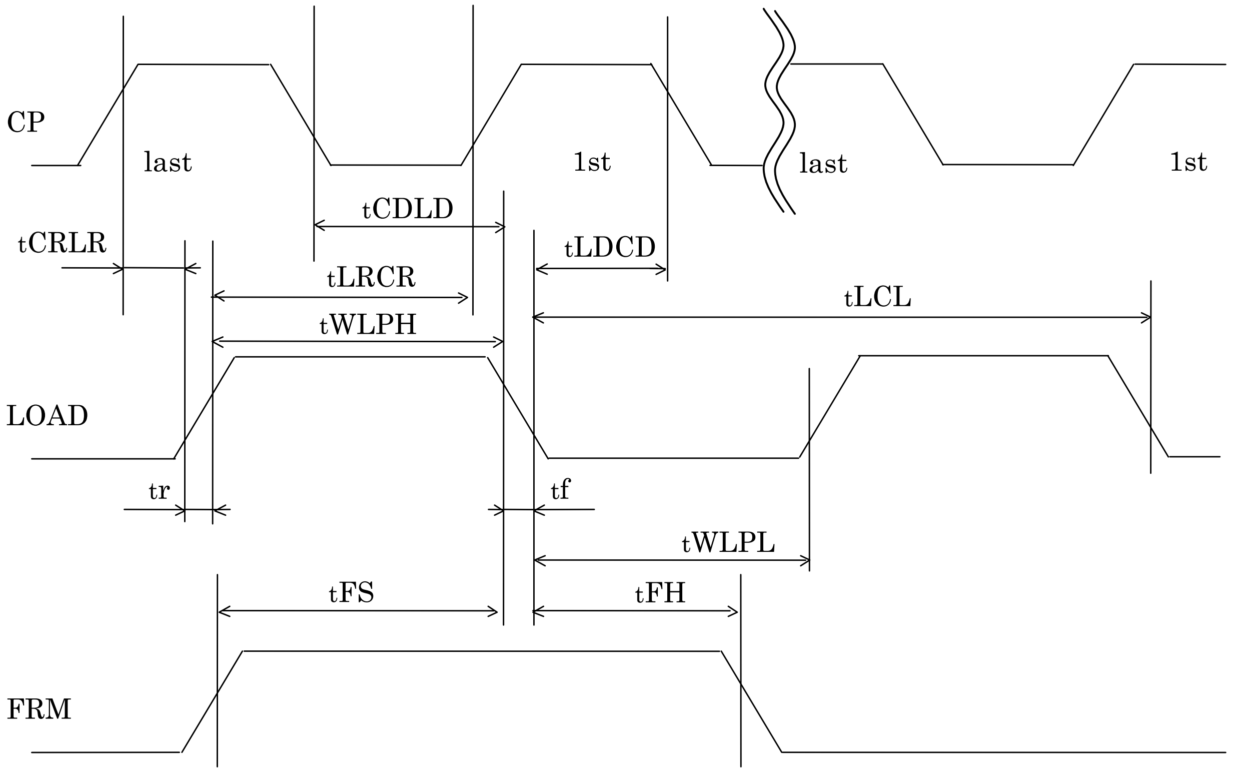

LOAD
CP
D3
Y317
Y1
Y5
Y317
Y1
D2
Y318
Y2
Y6
Y318
Y2
D1
Y319
Y3
Y7
Y319
Y3
D0
Y320
Y4
Y8
Y320
Y4
FRM
CP × 320 / 4pulse
LOAD
X1
X2
X240
X1
D0～D3
FRM

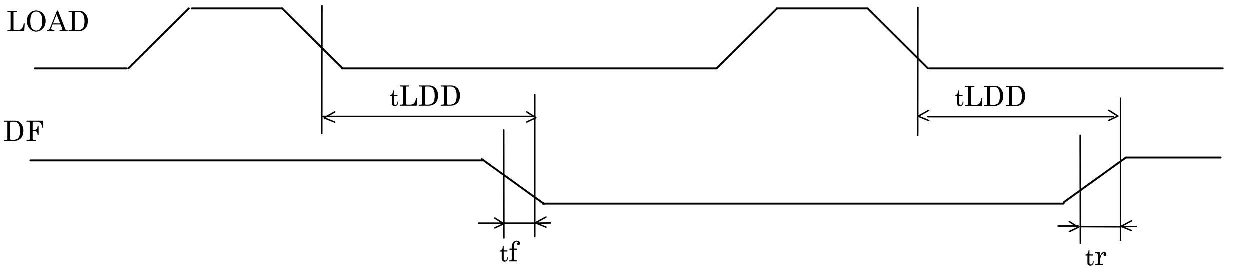
* The cycle of the LOAD signal should be stable and continuously applied without interruption.

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

10. Input timing characteristics


trCP
tfCP
tWCLH
tWCLL
tCCL
CP
tDS
tDH
DATA


CP
last
1st
last
1st
tCDLD
tCRLR
tLDCD
tLRCR
tLCL
tWLPH
LOAD
tr
tf
tWLPL
tFS
tFH
FRM


LOAD
tLDD
tLDD
DF
tf
tr

10-1. Switching characteristics

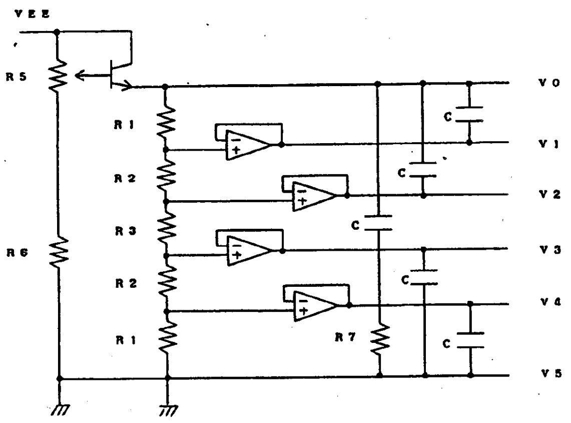
Input characteristics ： V_{DD} = +3.3V ± 0.3V and V_{DD} = +5.0V ± 5%, Temp. = 0～60°C

Item	Symbol	Min.	Max.	Unit
CP cycle *1	tCCL	140	-	ns
CP "H" pulse width	tWCLH	60	-	ns
CP "L" pulse width	tWCLL	60	-	ns
CP rise up time	trCP	-	40	ns
CP fall down time	tfCP	-	40	ns
Data set up time	tDS	40	-	ns
Data hold time	tDH	50	-	ns
LOAD "H" pulse width	tWLPH	60	-	ns
LOAD "L" pulse width	tWLPL	300	-	ns
LOAD cycle *2	tLCL	400	-	ns
CP rise → LOAD rise delay time	tCRLR	10		ns
CP down → LOAD down delay time	tCDLD	60	-	ns
LOAD rise → CP rise delay time	tLRCR	60		ns
LOAD down → CP down delay time	tLDCD	60		ns
LOAD down → DF delay time	tLDD	-	200	ns
Input signal rise up time	tr	-	40	ns
Input signal fall down time	tf	-	40	ns
FRM data set up time	tFS	40	-	ns
FRM data hold time	tFH	60	-	ns

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

*2 LOAD cycle is constant.

11. Recommended additional circuit


VEE
R5
R1
R2
R3
R6
R2
R1
R7
C
V0
V1
V2
V3
V4
V5

R1 = 6.8 kΩ ± 1 %
R2 = 6.8 kΩ ± 1 %
R3 = 75.0 kΩ ± 5 %
R7 = 15.0 kΩ ± 5 %

C = 3.3 ~ 10.0 μF

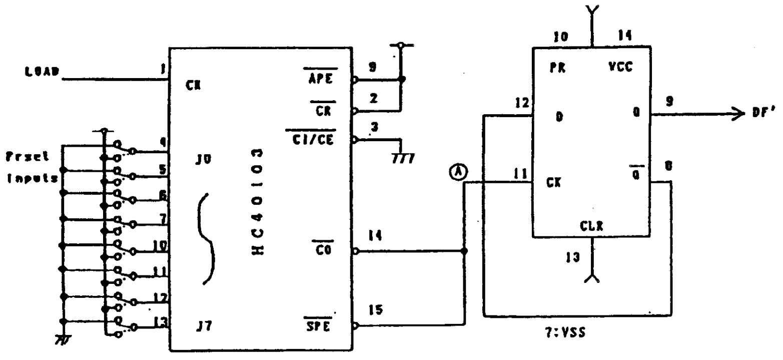
These value above are theoretically calculated. Fine tuning might be required in some cases. For fine tuning value of the resistor shall be adjust to conform with the following equation.

$$|V0-V1| = |V4-V5|$$
$$|V1-V2| = |V3-V4|$$

R5,R6 : Shall be adjust to contrast value.
(Reference : R5,R6 = 10KΩ)

12. Example of randomizing circuit

Example of randomizing circuit


LOAD
1
CK
APE
9
CR
2
CI/CE
3
Prset
Inputs
4
5
6
7
10
11
12
13
J0
J7
HC40103
CO
14
SPE
15
Ⓐ
10
14
PR
VCC
12
D
Q
9
DF'
11
CK
Q
8
CLR
13
7:VSS

HC40103
TOSHIBA

74HC74A(1/2)

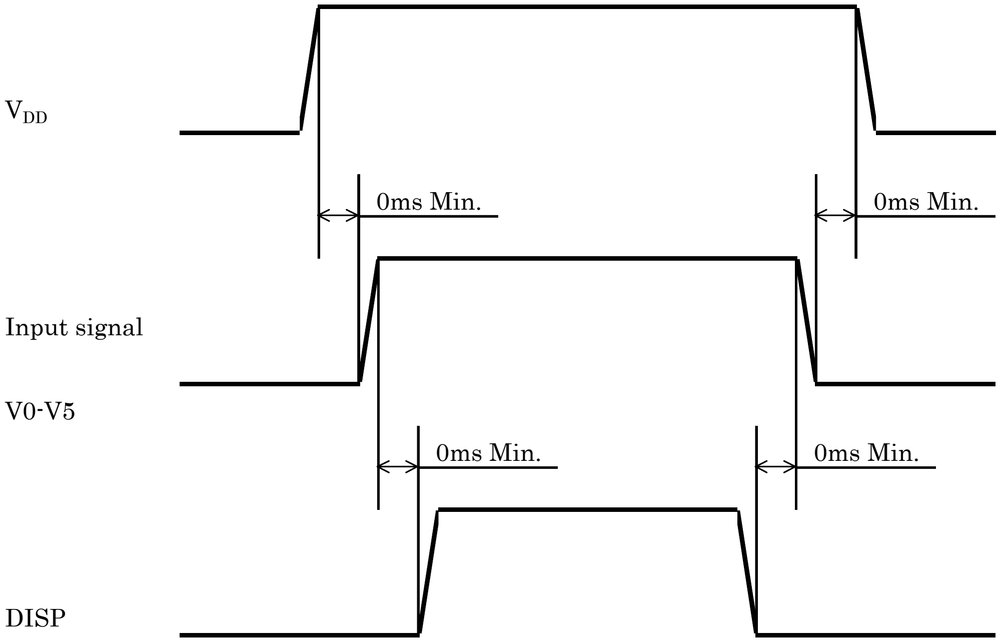
Prset

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 in happens, set PRSET INPUTS terminals to select optimized conditions.

13. Supply voltage sequence condition

In normal operation, logic within the LCD module reverses the polarity of the drive voltage every few lines to prevent DC damage to the liquid crystal material. But when a voltage is present on V_{CONT} outside of the time when the V_{DD} logic voltage is stable, a drive voltage is applied to the liquid crystal material without the polarity reversals. This sometimes result in a deterioration of display quality and a reduction in life time.



* Input signal:　FRM, LOAD, CP, D0～D3

* The above sequence should be designed as to maintain each normal voltage when the liquid crystal module load is applied to your system.

* Control the supply voltage sequence to not float any signal line when the LCD panel is being driven.

14. Lot number identification

The lot number shall be indicated on the back of the backlight case of each LCD.(Refer to the putting position to Outline Drawing.)

KG038QV0AN-G00 - □□ - □□ - □ MADE IN □□□□□

↓↓ ↓ ↓ ↓

1 2 3 4 5

No1. - No5. above indicate

1. Year code
2. Month code
3. Date
4. Version Number
5. Country of origin (Japan or China)

Year	2008	2009	2010	2011	2012	2013
Code	8	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

15. Warranty

15-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

15-2. Production warranty

Kyocera warrants its LCD's for a period of 12 months from the ship date. Kyocera shall, by mutual agreement, replace or re-work defective LCD's that are shown to be Kyocera's responsibility.

16. Precautions for use

16-1. Installation of the LCD

1) A transparent protection plate shall be added to protect the LCD and its polarizer.
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) Please design the housing window so that its edges are between the active area and the effective area of the LCD screen.
5) A transparent protection sheet is attached to the polarizer. Please remove the protection film slowly before use, paying attention to static electricity.

16-2. Static electricity

1) Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required.
2) Workers should use body grounding. Operator 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) Adjust the "Supply voltage for LCD driving (V_{CONT})" to obtain optimum viewing angle and contrast ratio.

16-4. Storage

1) The LCD shall be stored within the temperature and humidity limits specified.
   Store in a dark area, and protect the LCD from direct sunlight or fluorescent light.
2) Always store the LCD so that it is free from external pressure onto it.

16-5. Usage

1) DO NOT store in a high humidity environment for extended periods. Polarizer degradation bubbles, and/or peeling off of the 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 by wiping the screen surface with a soft cloth or cotton pad using a little Ethanol.
4) Water may cause damage or discoloration of the polarizer. Clean condensation or moisture from any source immediately.
5) Always keep the LCD free from condensation during testing. Condensation may permanently spot or stain the polarizer.
6) Do not disassemble LCD module because it will result in damage.
7) This Kyocera LCD module has been specifically designed for use in general electronic devices, but not for use in a special environment such as usage in an active gas. Hence, when the LCD is supposed to be used in a special environment, evaluate the LCD thoroughly beforehand and do not expose the LCD to chemicals such as an active gas.
8) Please do not use solid-base image pattern for long hours because a temporary afterimage may appear. We recommend using screen saver etc. in cases where a solid-base image pattern must be used.
9) Liquid crystal may leak when the module is broken. Be careful not to let the fluid go into your eyes and mouth. In the case the fluid touches your body; rinse it off right away with water and soap.

17. Reliability test data

Test item	Test condition	Test time	Judgement
High temp. atmosphere	60°C	240h	Display function : No defect Display quality : No defect Current consumption : No defect
Low temp. atmosphere	-20°C	240h	Display function : No defect Display quality : No defect Current consumption : No defect
High temp. humidity atmosphere	40°C 90% RH	240h	Display function : No defect Display quality : No defect Current consumption : No defect
Temp. cycle	-20°C 0.5h R.T. 0.5h 60°C 0.5h	10cycles	Display function : No defect Display quality : No defect Current consumption : No defect
High temp. operation	60°C	500h	Display function : No defect 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.

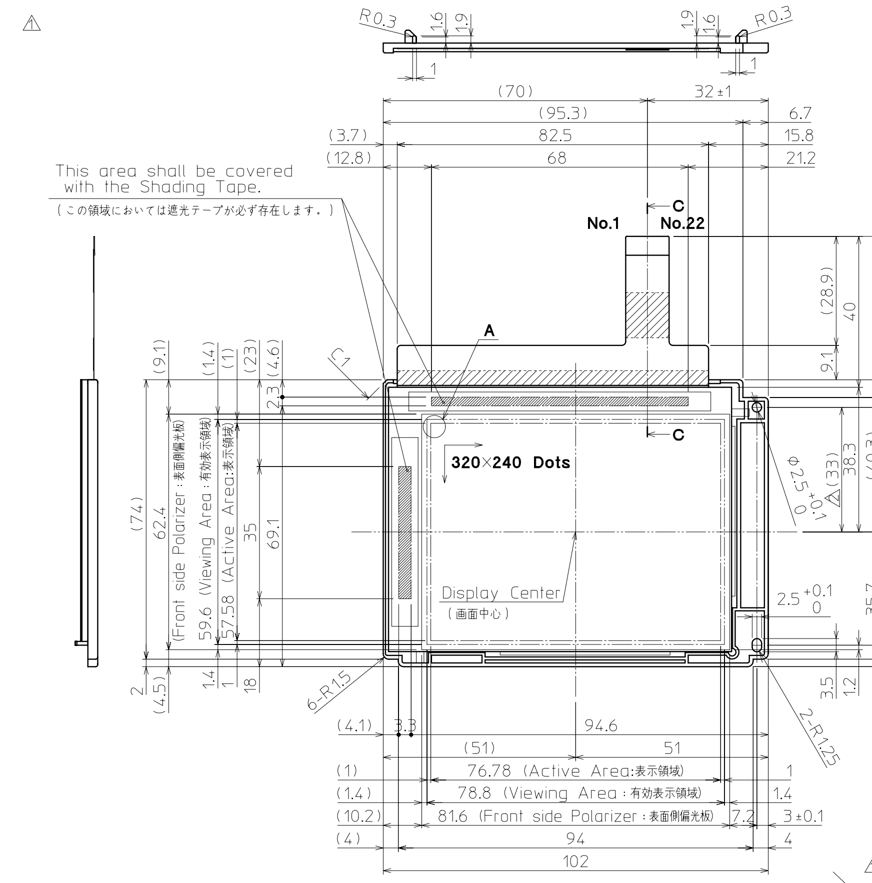
* The LCD is tested in circumstances in which there is no condensation.

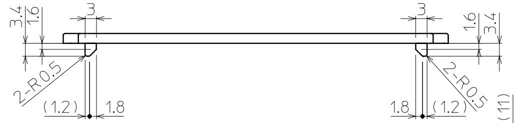
* The reliability test is not an out-going inspection.

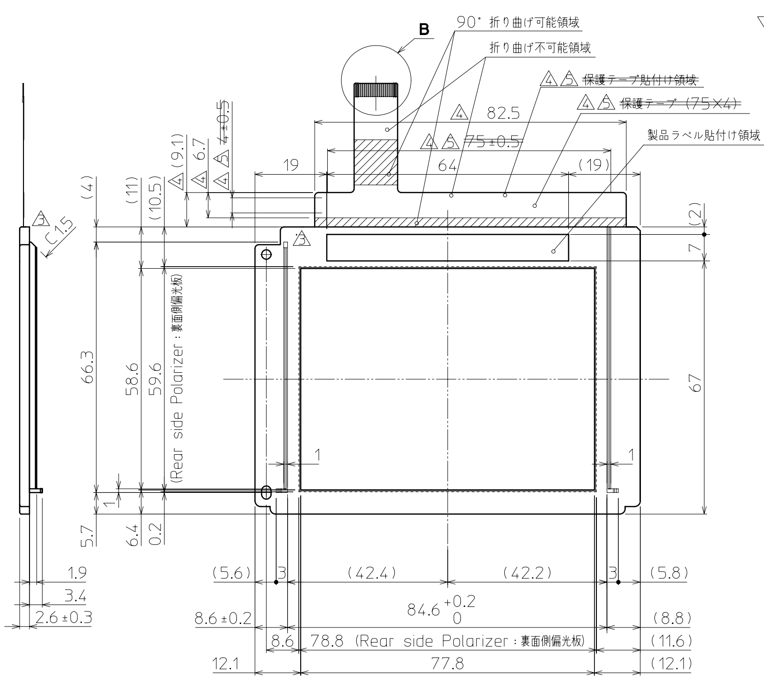
* The result of the reliability test is for your reference purpose only.
The reliability test is conducted only to examine the LCD's capability.

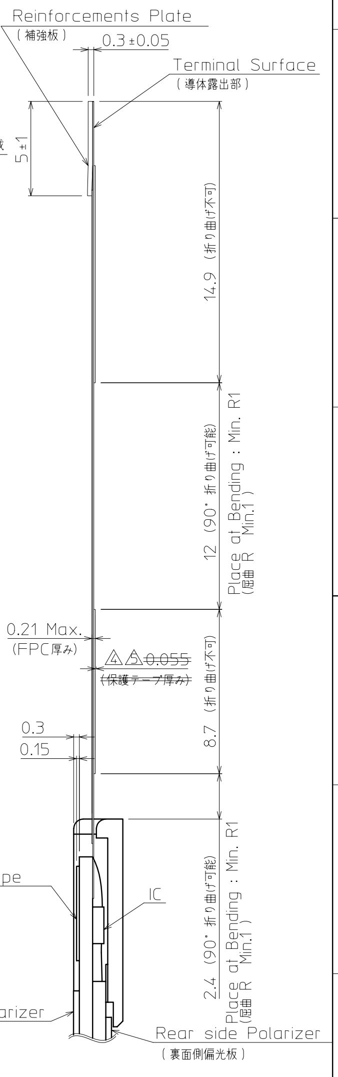
No	Description	Drawn	Checked	Checked	Approved
4	・保護テープ貼付け領域　追記 ・保護テープ　(75X4)　追記 ・寸法追記 (6箇所)	'06.06.08 茶圓	'06.06.09 今村		'06.06.09 朝倉
5	・保護テープ貼付け領域　削除 ・保護テープ　(75X4)　削除 ・寸法削除 (3箇所)	'06.08.10 茶圓	'06.08.10 今村		'06.08.11 朝倉

No	Description	Drawn	Checked	Checked	Approved
1	全面改訂　・裏面リブ追加 (左右) ・穴径変更 (2箇所) ・正面図左上部角形状変更(R1.5→C1) (1箇所) ・製品ラベル貼付け領域変更	'06.04.04 茶圓	'06.04.04 今村		'06.04.05 朝倉
2	寸法追記 (1箇所)	'06.04.06 茶圓	'06.04.06 今村		'06.04.06 朝倉
3	裏面リブ形状変更	'06.05.12 茶圓	'06.05.13 今村		'06.05.13 朝倉

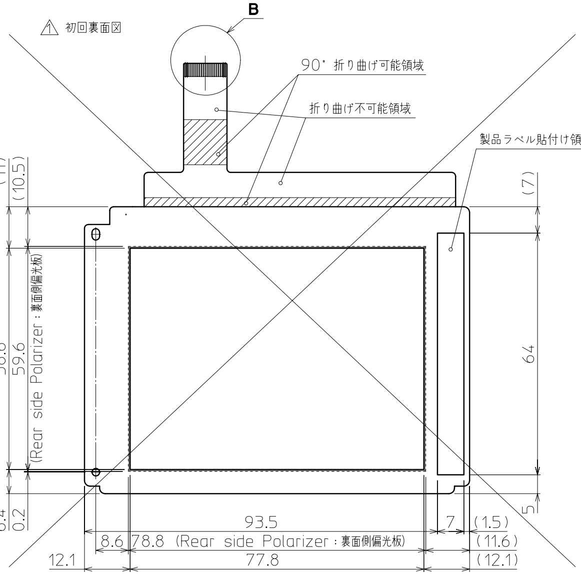

R0.3
1.6
1.9
1
(70)
32±1
(95.3)
6.7
82.5
15.8
(3.7)
(12.8)
68
21.2
This area shall be covered with the Shading Tape.
(この領域においては遮光テープが必ず存在します。)
C
No.1
No.22
A
C1
320×240 Dots
Display Center
(画面中心)
(Front side Polarizer：表面側偏光板)
59.6 (Viewing Area：有効表示領域)
57.58 (Active Area：表示領域)
(28.9)
40
38±1
9.1
(2.6)
(4.7)
Φ2.5 +0.1 0
(33)
38.3
(40.3)
63±0.1
68.7±0.1
69.3
76
2.5 +0.1 0
35.7
6-R1.5
2-R1.25
(4.1)
3.3
94.6
(51)
51
76.78 (Active Area：表示領域)
78.8 (Viewing Area：有効表示領域)
81.6 (Front side Polarizer：表面側偏光板)
7.2
3±0.1
94
102

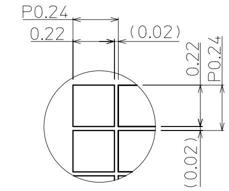

3.4
1.6
3
2-R0.5
(1.2)
1.8


B
90° 折り曲げ可能領域
折り曲げ不可能領域
~~保護テープ貼付け領域~~
~~保護テープ (75X4)~~
製品ラベル貼付け領域
82.5
~~75±0.5~~
19
64
(19)
C1.5
(Rear side Polarizer：裏面側偏光板)
66.3
58.6
59.6
67
(5.6)
(42.4)
(42.2)
(5.8)
84.6 +0.2 0
8.6±0.2
(8.8)
78.8 (Rear side Polarizer：裏面側偏光板)
(11.6)
12.1
77.8
(12.1)

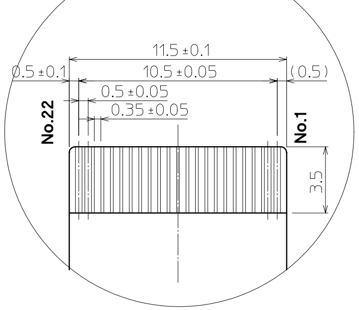

Reinforcements Plate
(補強板)
0.3±0.05
Terminal Surface
(導体露出部)
5±1
14.9 (折り曲げ不可)
12 (90° 折り曲げ可能)
Place at Bending : Min. R1
(曲げ R Min.1)
0.21 Max.
(FPC厚み)
~~0.055~~
~~(保護テープ厚み)~~
0.3
0.15
8.7 (折り曲げ不可)
2.4 (90° 折り曲げ可能)
Shading Tape
(遮光テープ)
IC
Front side Polarizer
(表面側偏光板)
Rear side Polarizer
(裏面側偏光板)

SECTION C-C (5:1)


初回裏面図
B
90° 折り曲げ可能領域
折り曲げ不可能領域
製品ラベル貼付け領域
(11)
(10.5)
(7)
(Rear side Polarizer：裏面側偏光板)
58.6
59.6
64
93.5
8.6
78.8 (Rear side Polarizer：裏面側偏光板)
12.1
77.8
(1.5)
(11.6)
(12.1)


P0.24
0.22
(0.02)

DETAIL A (Dot Size)
(NTS)


11.5±0.1
0.5±0.1
10.5±0.05
(0.5)
0.5±0.05
0.35±0.05
No.22
No.1
3.5

DETAIL B (5:1)

Note(注記)

1 Recommended Matching Connector : 08-6210-022-340-800+ (ELCO)
(推奨コネクター) 08-6210-022-340-800 (ELCO)

2 The Information of LCD is displayed starting at the upper left hand corner, moving right then down to the lower right hand corner.
(LCD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。)

3 Tolerance without indication: ±0.5
(指示無き公差)

Material 材質	Treatment 処理	Approved	Checked	Checked	Drawn	Scale	Title			Year-Month-Day	Size
		'05.09.14 阿部		'05.09.14 今村	倉元	1:1 (5:1,NTS)	KG038QV0AN	D02A	KYOCERA	'05.09.13	2
Quantity 製作数	Description; 備考 RoHS 05012AAA						Outline Dimensions		Drawing No.	121A5044200-5	

Spec No.	TQ3C-8EAS0-E2DAJ05-00
Date	April 5, 2007

KYOCERA INSPECTION STANDARD

TYPE：KG038QV0AN-G00

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT
LCD DIVISION

Original Issue Date	Designed by：Engineering dept.			Confirmed by：QA dept.	
	Prepared	Checked	Approved	Checked	Approved
April 5, 2007	Y. Asano	H. Tokumori	Y. Matsumoto	J. Sakaguchi	S. Hayashi

Revision record

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

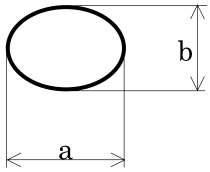
Rev.No.	Date	Page	Descriptions

Visuals specification

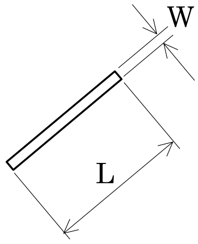
1) Note

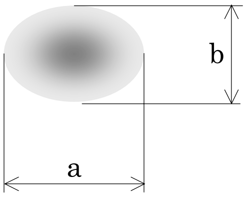
Item	Note	
General	1.When defects specified in this Inspection Standards are inspected, operating voltage (V_{OP}) shall be set at the level where optimized contrast is available. Display quality is applied up to effective viewing area. (Bi-level INSPECTION) 2.This inspection standard about the image 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°C 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 does not change with voltage.
	Contrast variation	The color of a small area is different from the remainder. The phenomenon change 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

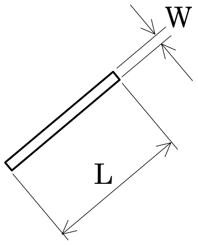
<table>
<tr><th>Category</th><th>Size(mm)</th><th>Acceptable number</th></tr>
<tr><td>A</td><td>d ≦ 0.2</td><td>Neglected</td></tr>
<tr><td>B</td><td>0.2 ＜ d ≦ 0.3</td><td>5</td></tr>
<tr><td>C</td><td>0.3 ＜ d ≦ 0.5</td><td>3</td></tr>
<tr><td>D</td><td>0.5 ＜ d</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Scratch, Foreign particle</td><td>


<table>
<tr><th></th><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</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 ≦0.10</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>0.10＜ W</td><td>-</td><td>According to ‘Circular’</td></tr>
</table>
</td></tr>
<tr><td>Contrast variation</td><td>


d = (a + b) / 2

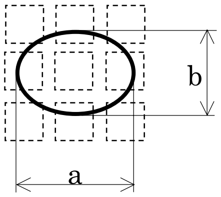
<table>
<tr><th>Category</th><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>A</td><td>d ≦ 0.5</td><td>Neglected</td></tr>
<tr><td>B</td><td>0.5 ＜ d ≦ 0.7</td><td>3</td></tr>
<tr><td>C</td><td>0.7 ＜ d</td><td>0</td></tr>
</table>
</td></tr>
</table>

Inspection item	Judgement standard
Polarizer (Scratch, Bubble, Dent)	(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