DATA IMAGE CORPORATION

TFT Module Specification

ITEM NO.: FG010800ANSWA-P1

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R&D Dept.	Q.C. Dept.	Eng. Dept.	Prod. Dept.
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2. RECORD OF REVISION

Rev	Date	Item	Page	Comment

3. General specifications

Parameter	Specifications	Unit
Display resolution	280(W) x 220(H)	dot
Active area	35.6(W) x 26.6(H)	mm
Screen size	1.75(Diagonal)	inch
Dot size	0.102(W) x 0.090(H)	mm
Dot pitch	0.127(W) x 0.121(H)	mm
Color configuration	R.G.B. delta	
Overall dimension	48.6(W) x 39.6(H) x 6.1(D)	mm
Weight	22±5	g
Surface treatment	Anti-glare(Haze=6% typical)	
View Angle direction	6 o'clock	

4. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	V_{CC}	GND=0	-0.3	7	V	
	AV_{DD}	AVss=0	-0.3	7	V	
	V_{GH}	GND=0	-0.3	21	V	
	V_{GL}		-15	0.3	V	
	V_{GH} -V_{GL}		-	31	V	
Input signal voltage	V_I		-0.2	V_{CC}+0.3	V	Note 1
	V_I		-0.3	V_{CC}+0.3	V	Note 2
	VCOM		-2.9	5.2	V	
Operating temperature	Topa		0	60	°C	Ambient temperature
Storage temperature	Tstg		-25	80	°C	Ambient temperature
Backlight voltage	V_L		-0.3	6.0	V	

Note 1: VR, VG, VB.

Note 2: STHL, STHR, Q1H, OEH, L/R, CPH1~CPH3, STVR, STVL,OEV,CKV,U/D.

5. Electrical characteristics

a. Typical operating conditions (GND=AV$_{SS}$=0V)

Item		Symbol	Min	Typ	Max.	Unit	Remark
Power supply		V$_{CC}$	4.8	5	5.2	V	
		AVDD	4.8	5	5.2	V	
		VGH	14.3	15	15.7	V	
		VGLAC	-	6.0	-	Vp-p	AC component of VGL. Note 1
		VGL-H	-10.5	-10	-9.5	V	High level of VGL.
Video signal Amplitude (VR,VG,VB)		VIA	AVSS+0.4	-	AVDD-0.4	V	Note 2
		VIAC	-	3	3.8	V	AC component
		VIDC	-	AVDD/2	-	V	DC component
VCOM		VCAC	-	6	-	Vp-p	AC component, Note 3
		VCDC	1.5	1.6	1.7	V	DC component
Input Signal voltage	H Level	VIH	0.8V$_{CC}$	-	V$_{CC}$	V	Note 4
	L Level	VIL	0	-	0.2V$_{CC}$	V	

Note 1: The same phase and amplitude with common electrode driving signal(VCOM).
Note 2: Refer to Fig.3(Page:10/26)
Note 3: The brightness of LCD panel could be changed adjusting the AC component of VCOM.
Note 4: STHL, STHR, Q1H,OEH, L/R, CPH1~CPH3, STVR,STVL,OEV,CKV,U/D.
Note 5: Be sure to apply GND, VCC and VGL (VGL must lower than 0 volt) to the LCD first, and then apply VGH.

b. Current consumption (GND=AV$_{SS}$=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	I$_{GH}$	V$_{GH}$=15V	-	1.6	4	mA	
	I$_{GL}$	V$_{GL}$=-10V	-	-1.6	-4	mA	
	I$_{CC}$	V$_{CC}$=5V	-	0.8	2	mA	
	I$_{DD}$	AV$_{DD}$=5V	-	2.5	8	mA	

c. Backlight driving conditions(LED)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED voltage	V$_L$	--	5.0	--	V	I$_L$ =60 mA
LED current	I$_L$	50	60	70	mA	
LED life Time		50000	80000	--	hr	Note1

Note 1: Ta=25°C,VL=3.5V

○ +5V(Red)

○ GND(White)
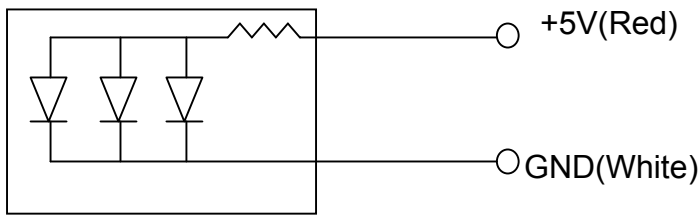
6 ELECTRO-OPTILAL CHARACTERISTIC

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	$\theta=0°$	-	25	50	ms	Note 4
	Fall	Tf		-	30	60	ms	
Contrast ratio		CR	At optimized viewing angle	60	150			Note 5,6
Viewing angle	Top		CR≥10	10	-	-	Deg.	Note 7
	Bottom			30	-	-		
	Left			45	-	-		
	Right			45	-	-		
Brightness		YL	$\theta=0°$	120	150	-	nit	Note 8
White chromaticity	X		$\theta=0°$	0.28	0.31	0.34		
	y			0.28	0.32	0.34		
Color temperature		K_L	$\theta=0°$		7000		k	

Note 1: Ambient temperature =25°C. and LED current I_L=60mA.
Note 2: To be measured in the dark room.
Note 3: To be measured on the center area of panel with a viewing cone of 1° by Topcon
 luminance meter BM-7, after 10 minutes operation.
Note 4: Definition of response time:
 The output signals of photo-detector are measured when the input signals are changed
 from "black" to "white"(rising time) and from "white" to "black"(falling time),respectively.
 The response time is defined as the time interval between the 10% and 90% of
 amplitudes. Refer to figure as shown in next page.
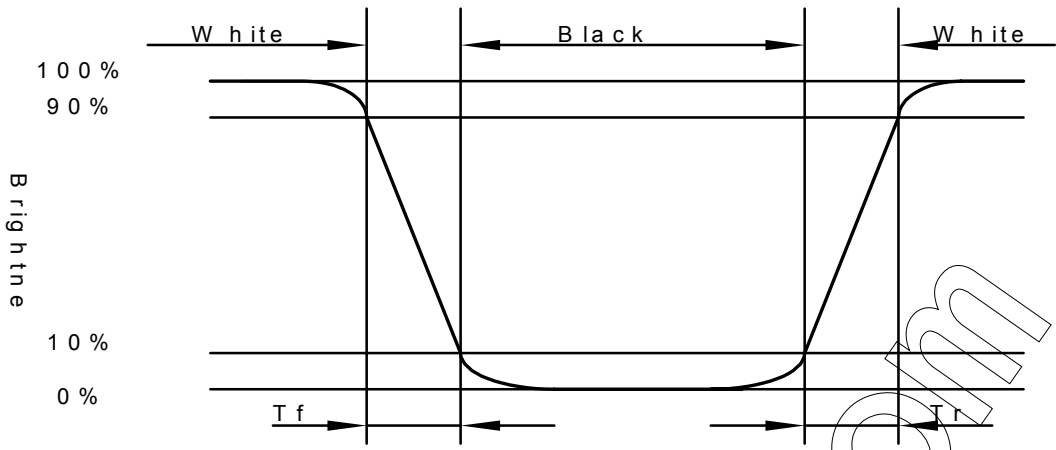
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo-detector output when LCD is at "White" state}}{\text{Photo-detector output when LCD is at "Black" state}}$$

Note 6. White $Vi = V_i 50 \mp 1.5V$

Black $Vi = V_i 50 \pm 2.0V$

"±"means that the analog input signal swings in phase with V_{COM} signal.

"$\mp$"means that the analog input signal swings out of phase with V_{COM} signal.

"Vi50": The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:

Refer to figure as below
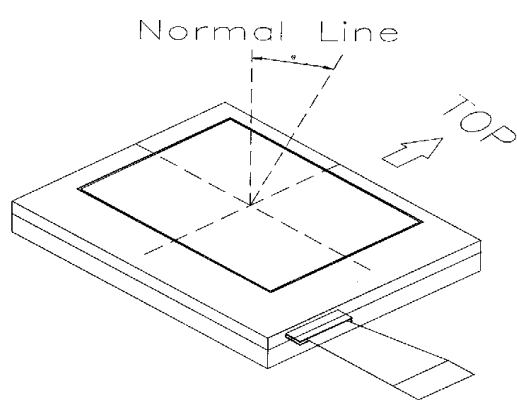
Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

# 7. TIMING CHARALTERISTICS

a. Timing conditions (AC Timing)

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Rising time	t_r	-	-	10	ns	Note 1
Falling time	t_f	-	-	10	ns	Note 1
High and low level pulse width	t_{CPH}	450	500	550	ns	CPH1~CPH3
CPH pulse duty	t_{CWH}	40	50	60	%	CPH1~CPH3
CPH pulse delay	t_{C12}, t_{C23} t_{C31}	70	$t_{CPH}/3$	$t_{CPH}/2$	ns	CPH1~CPH3
STH setup time	t_{SUH}	70	-	-	ns	STHR,STHL
STH hold time	t_{HDH}	400	-	-	ns	STHR,STHL
STH pulse width	t_{STH}	-	1	-	t_{CPH}	STHR,STHL
STH period	t_H	61.5	63.5	65.5	µs	STHR,STHL
OEH pulse width	t_{OEH}	-	3	-	t_{CPH}	OEH
Sample and hold disable time	t_{DIS1}	-	20	-	t_{CPH}	
OEV pulse width	t_{OEV}	-	5	-	t_{CPH}	OEV
CKV pulse width	t_{CKV}	2	6	10	t_{CPH}	CKV
Clean enable time	t_{DIS2}	-	4	-	t_{CPH}	
Horizontal display start	t_{SH}	-	4	-	$t_{CPH}/3$	
Horizontal display timing range	t_{DH}	-	280	-	$t_{CPH}/3$	
STV setup time	t_{SUV}	400	-	-	ns	STVL,STVR
STV hold time	t_{HDV}	400	-	-	ns	STVL,STVR
STV pulse width	t_{STV}	-	-	1	t_H	STVL,STVR
Horizontal lines per field	t_V	256	262	268	t_H	
Vertical display start	t_{SV}	-	10	-	t_H	
Vertical display timing range	t_{DV}	-	220	-	t_H	
VCOM rising time	t_{rCOM}	-	-	3	µs	
VCOM falling time	t_{fCOM}	-	-	3	µs	
VCOM delay time	t_{DCOM}	-	-	3	µs	
RGB delay time	t_{DRGB}	-	-	2	µs	

Note 1: For all of the logic signals.
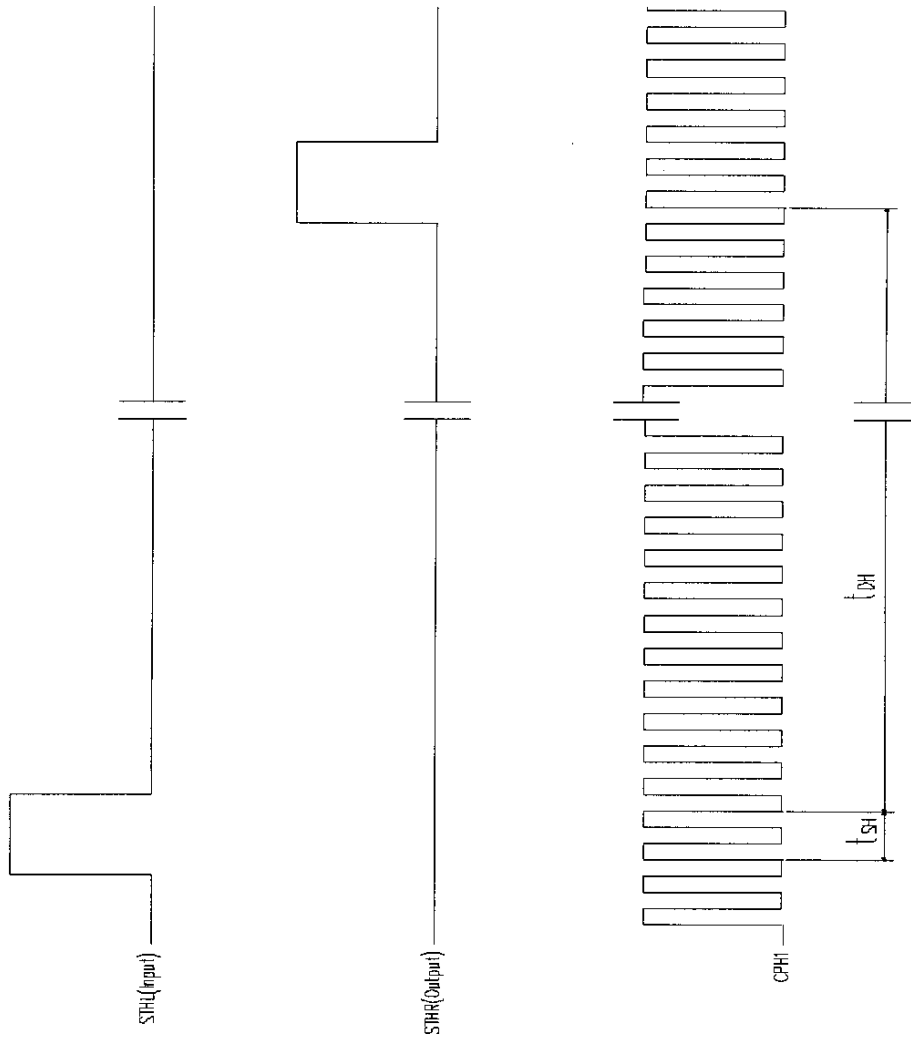
b. Timing diagram

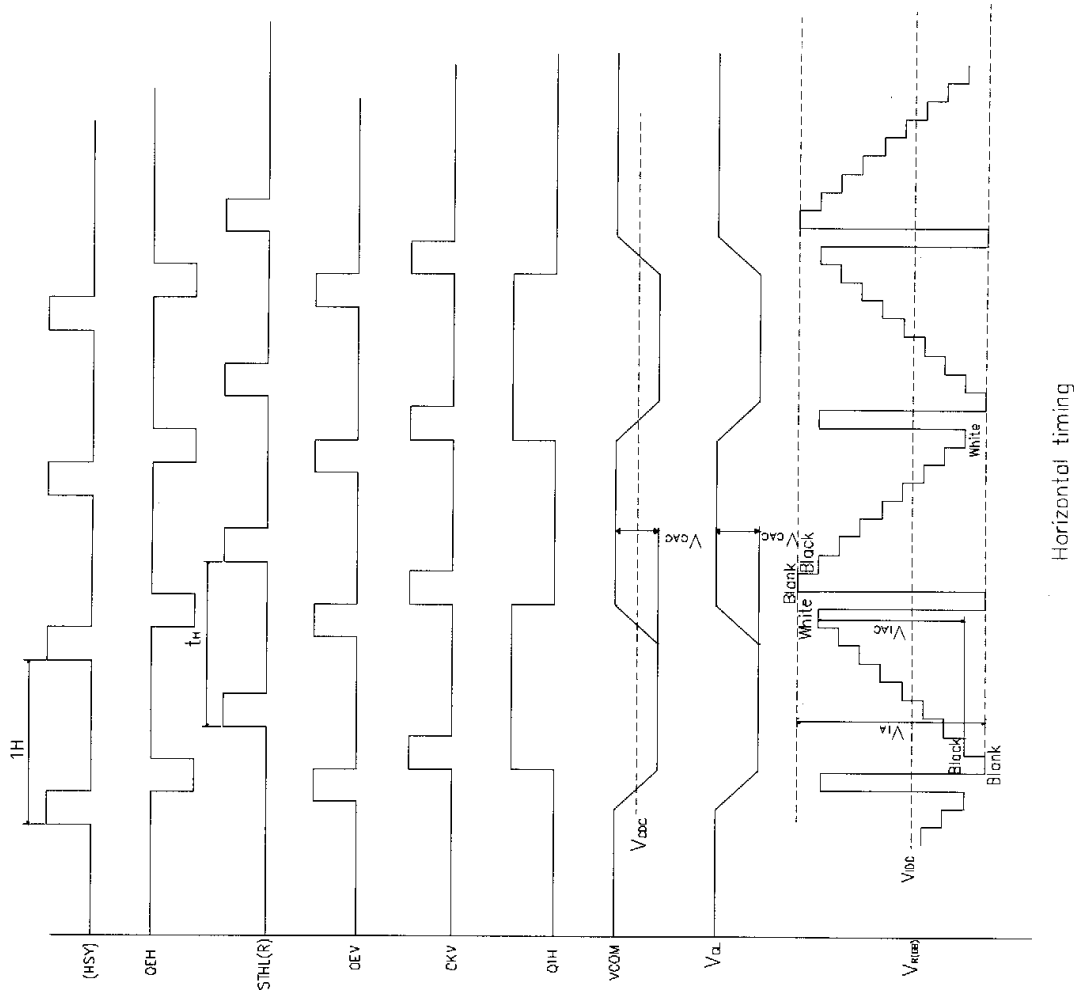Please refer to the attached drawings, from Fig1 to Fig5.

FIG 1:
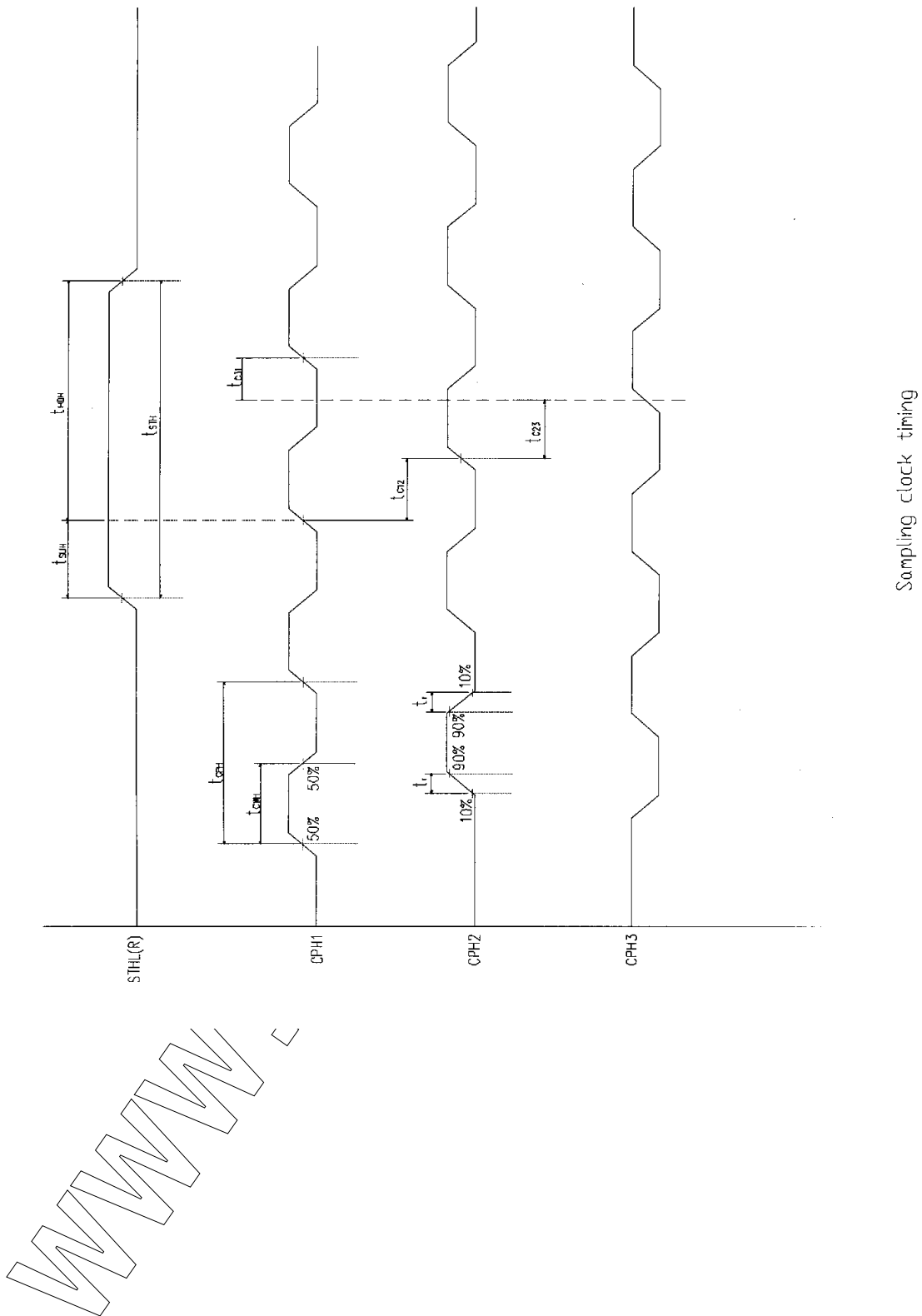
Sampling clock timing

FIG2 :

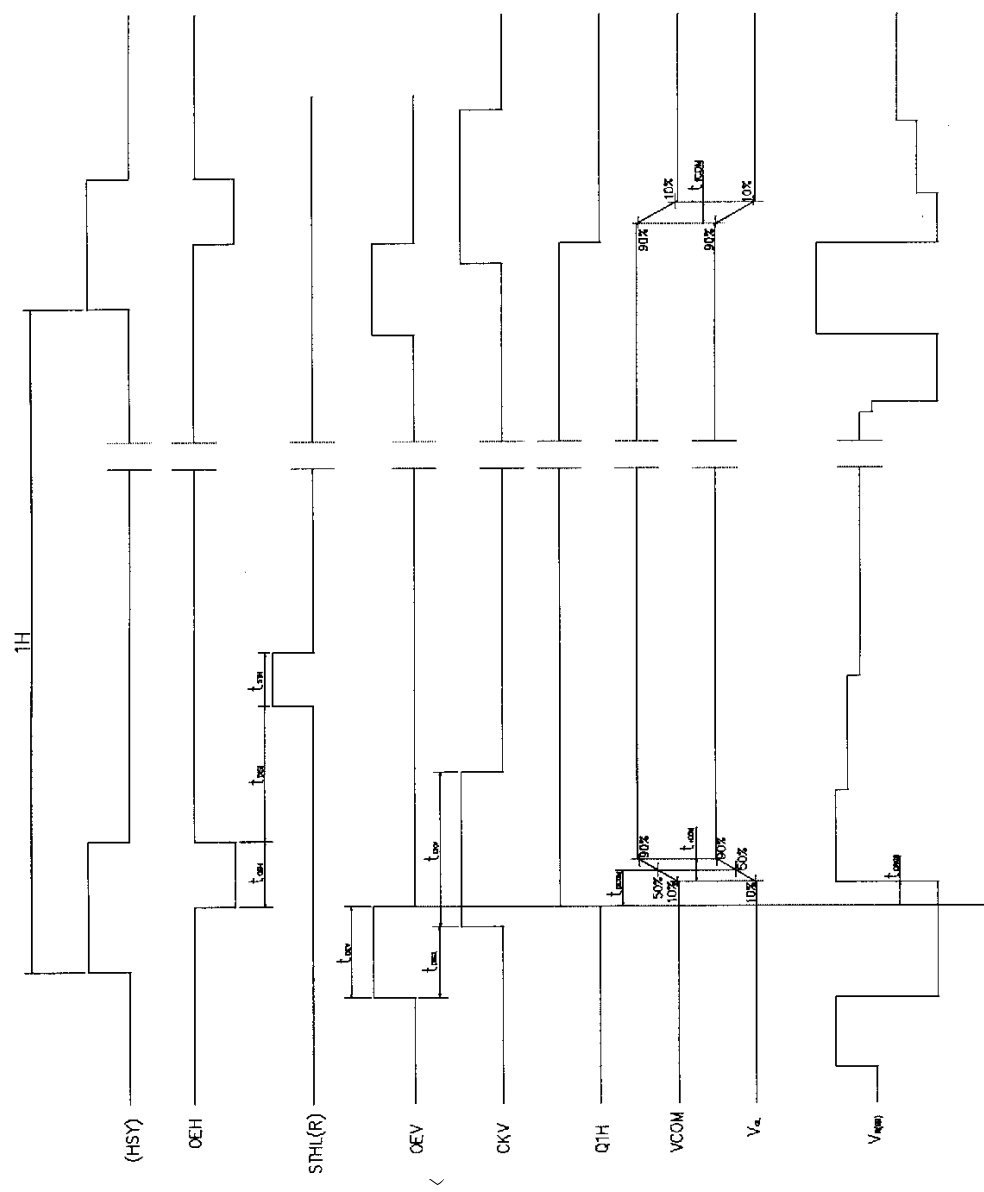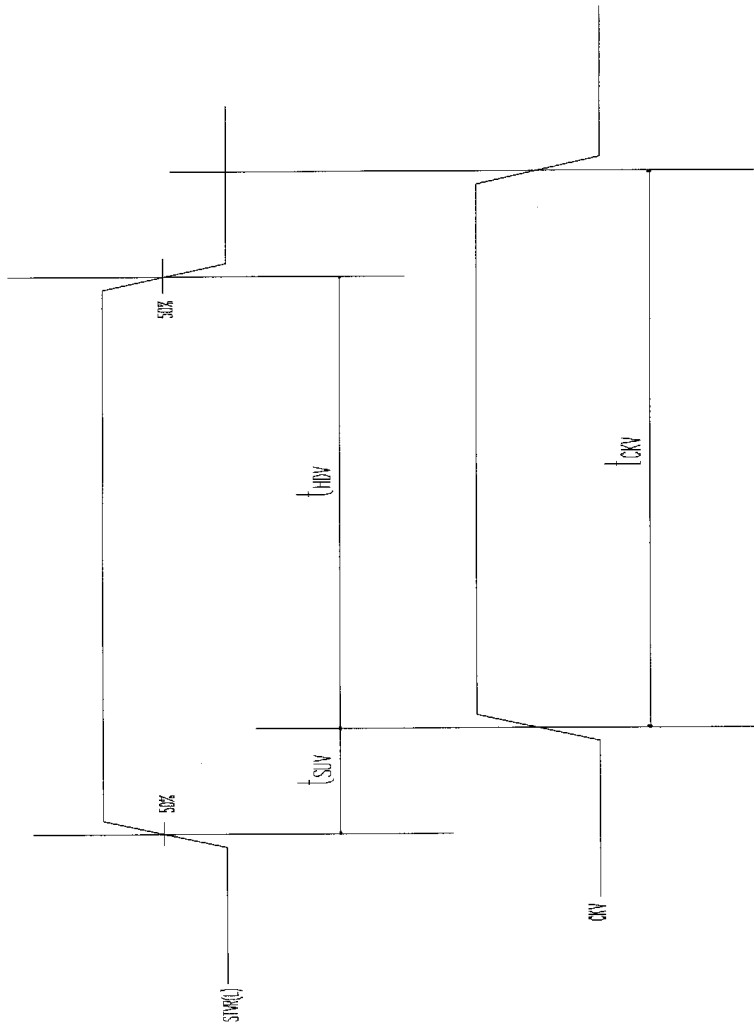Horizontal display timing range(Normal scanning mode)

STHL(Input)

STHR(Output)

CPH

t_{DH}

t_{SH}

FIG 3:

Horizontal timing

FIG3-1:

Detail horizontal timing

FIG4:

Vertical clock timing

FIG5:

FIG5-1:

Display on panel first line

$V_{R(B)}$

(HSY)

(VSY)

t_{SV}

STVR

Q1H

VCOM(Odd field)

VCOM(Even field)
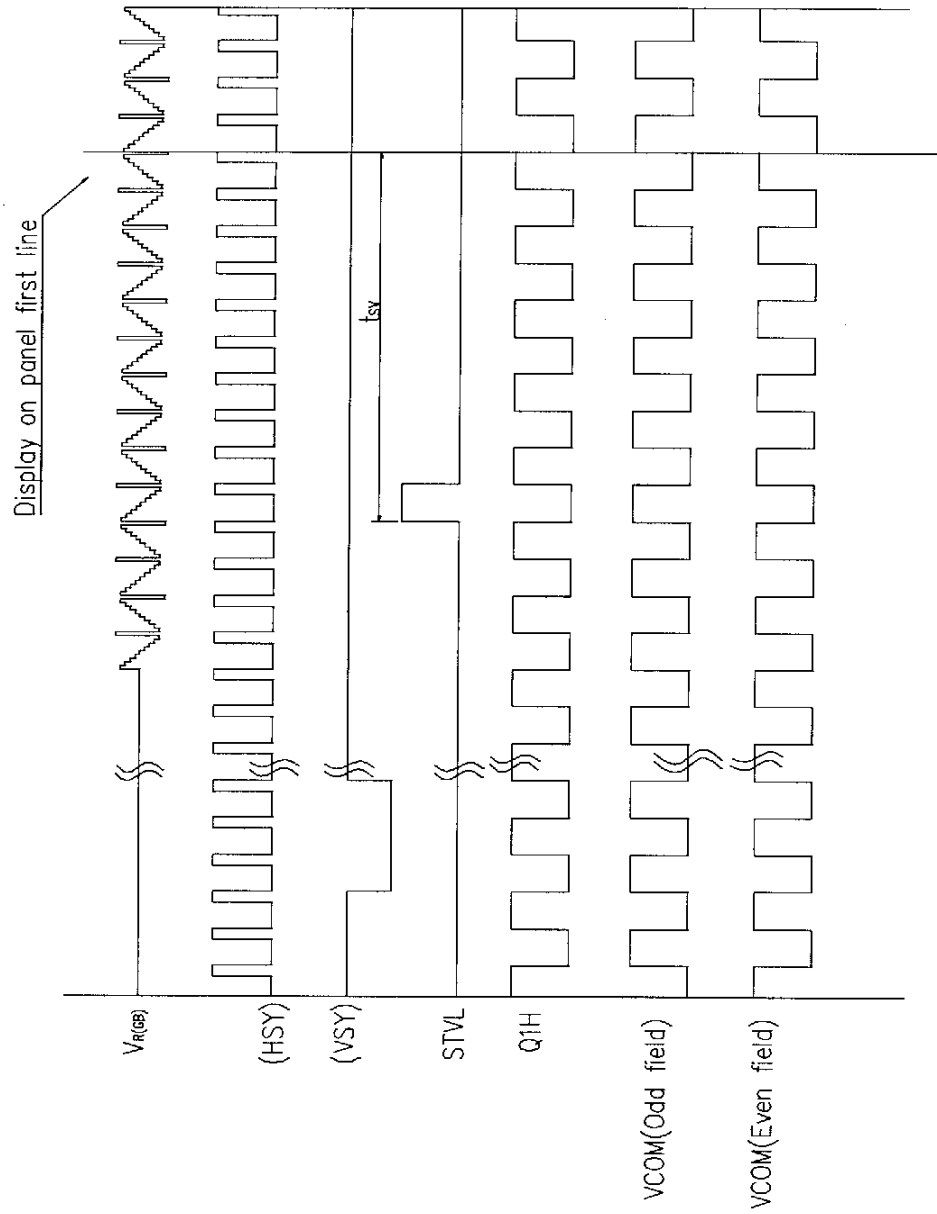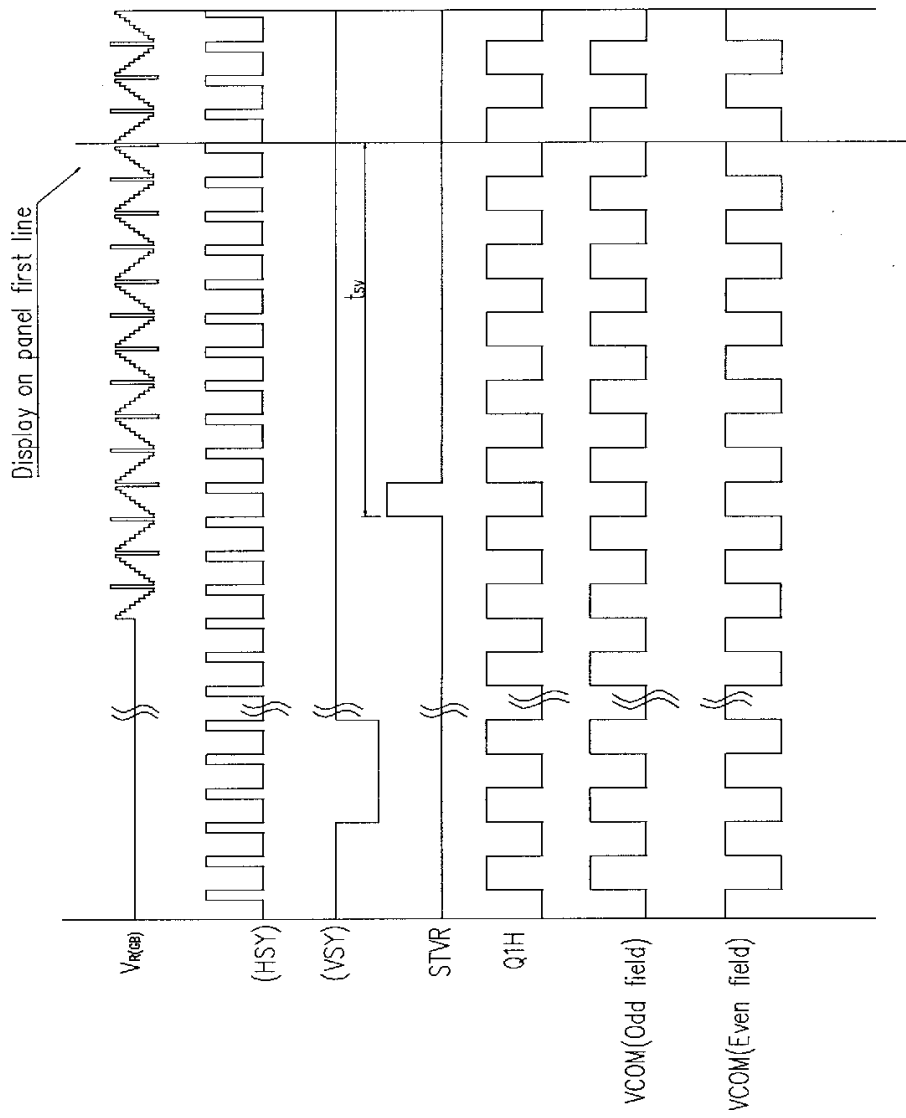
Vertical timing (From down to up)

8. Pin connections

(a). TFT-LCD panel driving section

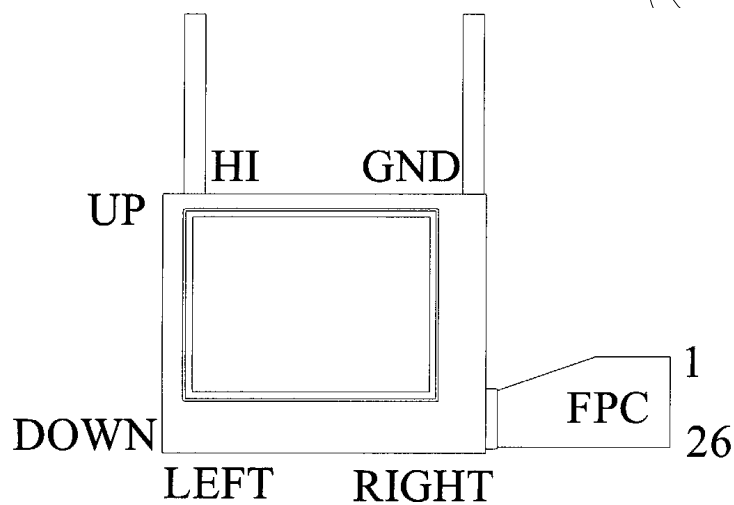| Pin no	Symbol	I/O	Description	Remark
1	GND	-	Ground for logic circuit	
2	V_{CC}	I	Supply voltage for logic control circuit	
3	V_{GL}	I	Negative power for scan driver	
4	V_{GH}	I	Positive power for scan driver	
5	STVR	I/O	Vertical start pulse	Note1
6	STVL	I/O	Vertical start pulse	Note1
7	CKV	I	Shift clock input for scan driver	
8	U/D	I	UP/DOWN scan control input	Note1,2
9	OEV	I	Output enable input for scan driver	
10	VCOM	I	Common electrode driving signal	
11	VCOM	I	Common electrode driving signal	
12	L/R	I	Left/Right scan control input	Note1,2
13	Q1H	I	Analog signal rotate input	
14	OEH	I	Output enable input for data driver	
15	STHL	I/O	Start pulse for horizontal scan line	Note1
16	STHR	I/O	Start pulse for horizontal scan line	Note1
17	CPH3	I	Sampling and shifting clock pulse for data driver	
18	CPH2	I	Sampling and shifting clock pulse for data driver	
19	CPH1	I	Sampling and shifting clock pulse for data driver	
20	V_{CC}	I	Supply voltage for logic control circuit	
21	GND	-	Ground for logic circuit	
22	VR	I	Alternated video signal input (Red)	
23	VG	I	Alternated video signal input (Green)	
24	VB	I	Alternated video signal input (Blue)	
25	AV_{DD}	I	Supply voltage for analog circuit	
26	AV_{SS}	I	Ground for analog circuit	

Note 1: Selection of scanning mode (please refer to the following table)

Setting of scan control input		IN/OUT state For start pulse				Scanning direction
U/D	L/R	STVR	STVL	STHR	STHL	
GND	Vcc	OUT	IN	OUT	IN	From up to down, and from left to right.
Vcc	GND	IN	OUT	IN	OUT	From down to up, and from right to left.
GND	GND	OUT	IN	IN	OUT	From up to down, and from right to left.
Vcc	Vcc	IN	OUT	OUT	IN	From down to up, and from left to right.

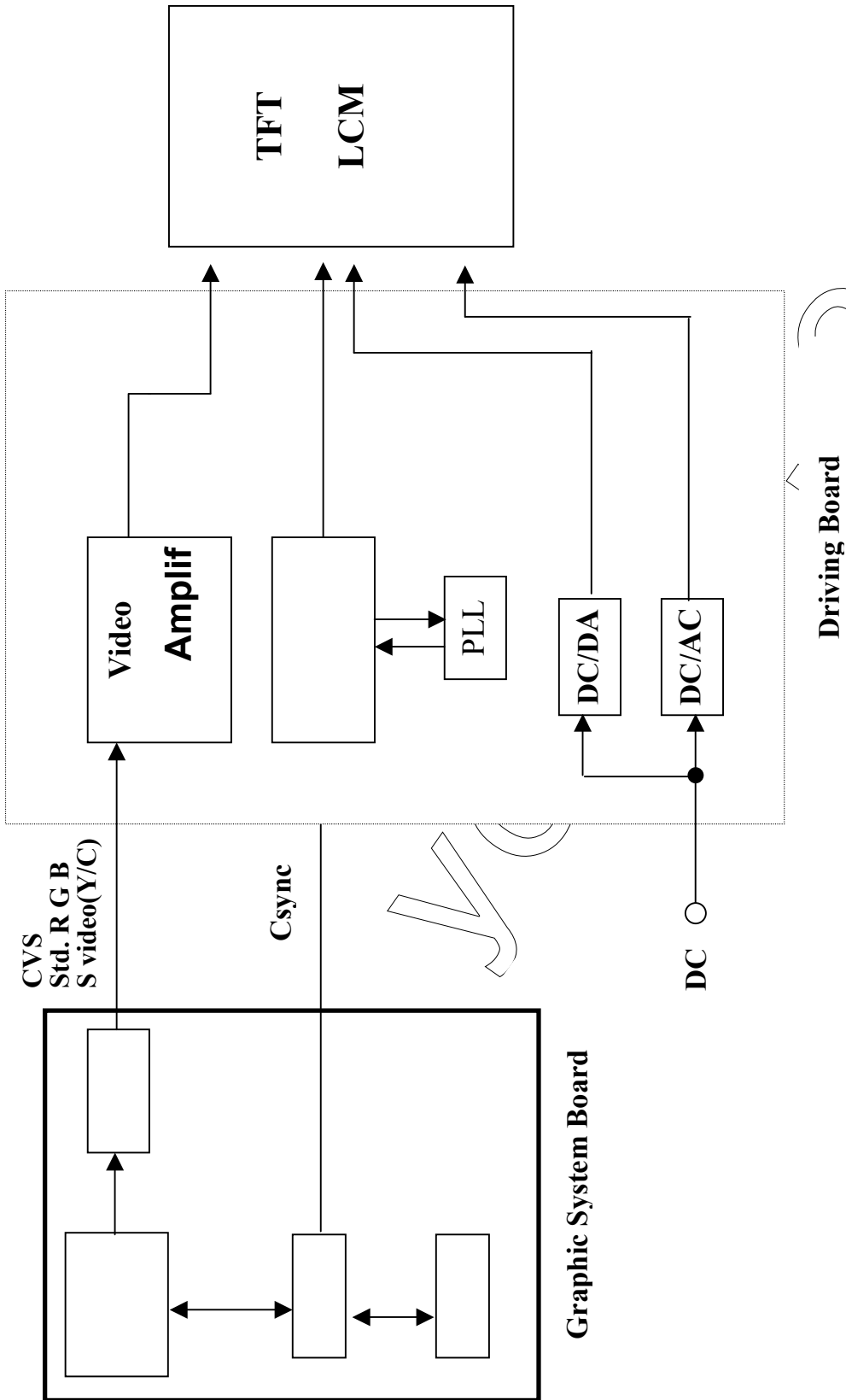IN: Input; OUT: Output.

Note 2: Definition of scanning direction

Refer to figure as below:

(b)Backlight driving section

No.	Svmbol	I/O	Description	Remark
1	GND	-	Ground	
4	HI	I	Power supply for backlight unit (LED)	

9. Block diagram

RELATED BLOCK DIAGRAM

10. QUALITY ASSURANCE
10.1 Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)
Temperature : $20 \pm 5°C$
Humidity : $65 \pm 5\%$

10.1.2 Operation
Unless specified otherwise, test will be conducted under function state.

10.1.3 Container
Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency
In case of related to deterioration such as shock test. It will be conducted only once.
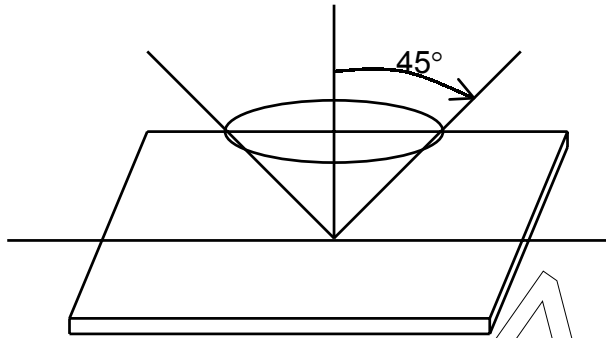
10.1.5 Test Method

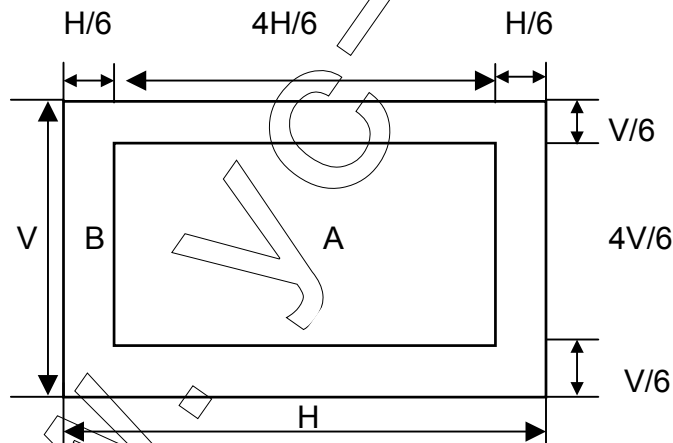| No.	Reliability Test Item & Level	Test Level
1	High Temperature Storage Test	T=80°C,240hrs
2	Low Temperature Storage Test	T=-25°C,240hrs
3	High Temperature Operation Test	T=60°C,240hrs
4	Low Temperature Operation Test	T=0°C,240hrs
5	High Temperature and High Humidity Operation Test	T=60°C,95% RH,240hrs
6	Thermal Cycling Test (No operation)	-25°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min
7	Vibration Test (No operation)	Frequency:10 ~ 55 Hz Amplitude:1.0 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z
8	Shock Test (No operation)	100G,6ms Direction:± X,± Y,± Z Cycle:3 times
9	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face

10.2   Inspection condition

10.2.1   Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.
$\theta < 45°$ inspection under non-operating condition.
$\theta < 5°$ inspection under operating condition.

45°

10.2.2 Definition of applicable Zones

H/6   4H/6   H/6

V/6

V   B   A   4V/6

V/6

H

10.2.3　Inspection Parameters

No.	Parameter	Criteria
1	Operating	Display function: No　Display malfunction (Major)
		Contrast ratio (Black, White) : Does not meet specified range in the spec. (Major) (Note:3)
		Line Defect : No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major)(Note:1)
		Point Defect (red, green, blue, dark): Active area ≤ 5dots(Minor) (Note:1)
		Non-uniformity: Visible through 2%ND filter. (Major)
2	External Inspection (non-operating)	Dimension: Outline　(Major)
		Scratch on the polarizer: (Note:2)
		Dent or bubble on the polarizer (Note:2)

Point Defect table (under No.1 Operating):

Item	Acceptable number A	Acceptable number B	Total
Bright	0	2	
Dark	2	4	5
Total	2	4	

Scratch on the polarizer (Note:2):

X (mm)	Y(mm)	Acceptable number	Class Of Defects	AQL Level
0.5<L≤5	0.1≤W≤0.5	1	Minor	1.5
L>5	0.1≤W≤0.5	0		
	W>0.5	0		
L≤0.5	W≤0.1	∗		

X : Length　　Y : Width

Dent or bubble on the polarizer (Note:2):

X (mm)	Y(mm)	Acceptable number	Class Of Defects	AQL Level
	D≤0.25	∗	Minor	1.5
	D>0.5	0		
	0.25<D≤0.5	1		

∗ : Disregard

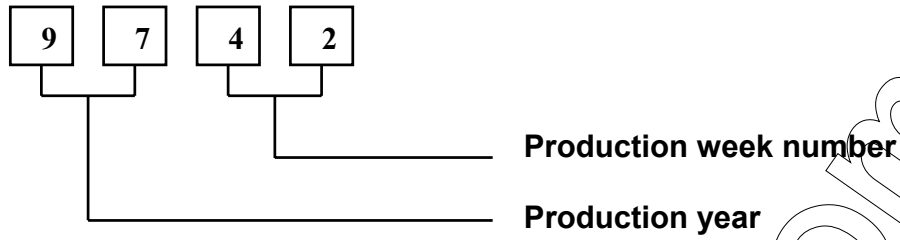| Class of defects	AQL	Definition
Major	0.65%	It is a defect that is likely to result in failure or to reduce materially the usability of the intended function.
	1.00%	It is a defect that is likely to assembly size and not result in functioning problem.
Minor	2.5%	It is a defect that will not result in functioning problem with deviation classified.

Note:1. (a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively
     and visible under 2% ND filter.
  (b)Dark point defect is defined as visible by using 5%ND filter in full white pattern.
  (c)Definition of distribution of point defect is as follows:
    -minumum separation between dark point defects should be larger than 3mm.
    -minumum separation between bright point defects should be larger than 5mm.
  (d)Definition of joined bright point defect and joined dark point defect are as follows:
    -Two or more joined bright point defects must be nil.
    -Three joined dark point defects must be nil.
    -Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maxmum.
    -Two Joined dark point is counted as two dark point with 2 pair maxmum.
  (e)The ambient illumination level is 300~500 lux.
Note:2 The external inspection should be conducted at the distance 35± 5cm between the eyes of inspctor and the panel .
Note:3 Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient illuminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

10.3.sampling condition

Unless otherwise agree in written, the sampling inspection shall be
applied to the incoming inspection of customer.
Lot size: Quantity of shipment lot per model.
Sampling type: normal inspection, single sampling
Inspection level: Level II
Sampling table: MIL-STD-105E

12. LOT NUMBERING SYSTEM

| 9 | 7 | 4 | 2 |

Production week number

Production year

13. LCM NUMBERING SYSTEM

FG 010800 A N S W A 01

VERSION :01

View direction & Temp. Range
A – Bottom view 6H & Normal temp.
B – Bottom view 6H & Wide temp.
C – Top View & Normal temp
D – Top View & Wide temp.

Backlight Color
W – White   Y – Yellow Green
G - green

Backlight
S – edge light LED B/L
C – CCFL B/L

LCD Polarize type
N – Negative   R – Reflective
M – transmissive   F – transflective

LCD type
A – TFT analog
D – TFT digital

Series code
010800 –, 1.8 inch

Model type
FG – Standard TFT Module
FX – Custom TFT Module

14. PRECAUTION FOR USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)
LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handing,
(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.
(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.
(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
(4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
(5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules
2.1 Mechanical Considerations
LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.
(1). Do not tamper in any way with the tabs on the metal frame.
(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
(4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting . Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2. Static Electricity
LCM contains CMOS LSI's and the same precaution for such devices should apply, namely
(1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
   (3). Only properly grounded soldering irons should be used.
(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

(5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
(6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Soldering
(1). Solder only to the I/O terminals.
(2). Use only soldering irons with proper grounding and no leakage.
(3). Soldering temperature : 280°C ± 10°C
(4). Soldering time: 3 to 4 sec.
(5). Use eutectic solder with resin flux fill.
(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

2.4 Operation
(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
(2). Driving voltage should be kept within specified range; excess voltage shortens display life.
(3). Response time increases with decrease in temperature.
(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
(5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5 Storage
If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty
Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

15. OUTLINE DRAWING

UNITS MM

Connector
JST ZHR-4

Color : Red (L=68±5)

Color : White (L=30±5)

SHRINK TUBE(Black)

38.4

7.1±0.2

37.4 (Polarizer)

35.6 (A.A.)

8±3

30±5

(4.5)

ACATIVE AREA
35.5x26.6

39.6

29.4 (Polarizer)

28.4 (A.A.)

26.6 (A.A.)

14.05

22.5

8.9

7.8±0.2

26.3

0.85

6±0.5 (Stiffener)

0.3±0.05

6.1

48.6

(50.4)

31.65±1

FPC

FPC

PIN FUNCTION

1.GND
2.VCC
3.VGL
4.VGH
5.STVR
6.STVL
7.CKV
8.U/D
9.OEV
10.VCOM
11.VCOM
12.L/R
13.Q1H

14.QEH
15.STHL
16.STHR
17.CPH3
18.CPH2
19.CPH1
20.VCC
21.GND
22.VR
23.VG
24.VB
25.AVDD
26.AVSS

P0.5X25=12.5

4
0.3W
26
13.5±0.1
1
0.5

Note:
1. Tolerance is ±0.3 unless otherwise noted.
2.The bending radius of FPC should be large than 0.6

AUTH	DESCRIPTION	DATE	APPROVED			
	REVISIONS					

ISSUE DATE: 08/02/02'

DRAWN: Roger

CHECK:

APPROVE:

DATA IMAGE Corporation

TITLE: TFT OUTLINE DIMENSION

A4

DWG. NO. Q020913

PART. NO. FG010800AS-P1   REV. 1

SCALE : 5/4

SHEET 1 OF 1

16.PACKAGE INFORMATION

Paper board

Antisatic tray

Paper board

Inner Carton