DATA IMAGE CORPORATION

LCD Module Specification

PRELIMINARY

ITEM NO.: **FG050600ANSWAGL2**

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Customer Companies	R&D Dept.	Q.C. Dept.	Eng. Dept.	Prod. Dept.
	ALEX	ERIC	GARY	HUANG
Approved by	Version:	Issued Date:	Sheet Code:	Total Pages:
	2	2007/6/6		22

2. RECORD OF REVISION

Rev	Date	Item	Page	Comment
1	11/MAY/07			Initial preliminary
2	6/JUN/07	14	21	Change Backlight current :14LEDs to 12LEDs ; Current:140mA to120mA.

3. GENERAL SPECIFICATION

Parameter	Specifications	Unit
Display resolution	960(W) x 234(H)	dot
Active area	113.28(W) x 84.708(H)	mm
Screen size	5.6(Diagonal)	inch
Dot pitch	0.118(W) x 0.362(H)	mm
Color configuration	R.G.B. Stripe	
Overall dimension	126.5(W) x 100(H) x 6.8(D)	mm
Weight	140	g
Surface treatment	Anti-glare(Haze=6% typical)	
View Angle direction	6 o'clock	
Our components and processes are compliant to RoHS standard		

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	18	V	
	V_{GL}		-15	0.3	V	
	V_{GH} -V_{GL}		-	31	V	
Input signal voltage	V_I		-0.3	AV_{DD}+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		-20	70	°C	Ambient temperature

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	
		AV_{DD}	4.8	5	5.2	V	
		V_{GH}	14.3	15	15.7	V	
		V_{GLAC}	-	5.0	-	Vp-p	AC component of VGL. Note 1
		V_{GL-H}	-10.5	-10	-9.5	V	High level of VGL.
Video signal Amplitude (VR,VG,VB)		V_{iA}	AV_{SS}+0.4	-	AV_{DD}-0.4	V	Note 2
		V_{iAC}	-	3	--	V	AC component
		V_{iDC}	-	AV_{DD}/2	-	V	DC component
VCOM		V_{CAC}	-	5	-	Vp-p	AC component, Note 3
		V_{CDC}	1.8	2.0	2.2	V	DC component
Input Signal voltage	H Level	V_{IH}	0.8V_{CC}	-	V_{CC}	V	Note 4
	L Level	V_{IL}	0	-	0.2V_{CC}	V	

Note 1: The same phase and amplitude with common electrode driving signal(VCOM).

Note 2: Refer to Fig.3

Note 3: The brightness of LCD panel could be adjusted by the adjustment of 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, V_{CC} and V_{GL} to the LCD first, and then apply V_{GH}.

b. current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	I_{GH}	V_{GH}=15V	-	0.2	0.8	mA	
	I_{GL}	V_{GL}=-10V	-	-0.5	-1	mA	
	I_{CC}	V_{CC}=5V	-	4	8	mA	
	I_{DD}	AV_{DD}=5V	-	12	20	mA	
	I_{VCOM}	V_{CAC}=5V	-	10	18	mA	
	I_{LI1}	-	-10	-	10	μA	Note 1

Note 1: Logic Input Leakage Current

c. Backlight Driving for Power Consumption

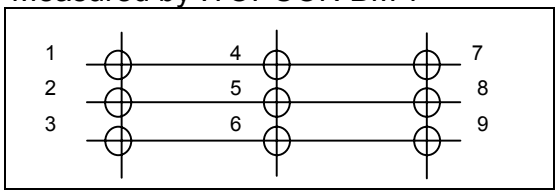
Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
VLED voltage	V_L	6	6.6	7.0	V	
LED current	I_L	--	120	--	mA	
LED Life Time decay to 50%		20000	--	--	hr	

6. ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	θ=0°	-	15	30	ms	Note 4,6
	Fall	Tf		-	20	40	ms	
Contrast ratio		CR	At optimized viewing angle	TBD	TBD	TBD		Note 5,6
Viewing angle	Top		CR≥10	10	20	-	Deg.	Note 6,7
	Bottom			30	40	-		
	Left			45	50	-		
	Right			45	50	-		
Brightness			θ=0°	150	200	--	--	Note 8
Uniformity				70	75	--		
White chromaticity		X	θ=0°	0.25	0.30	0.35		Note 8
		y		0.30	0.35	0.40		

Measured by :TOPCON BM-7



$$\text{Brightness} = \frac{1+2+3+4+5+6+7+8+9}{9}$$

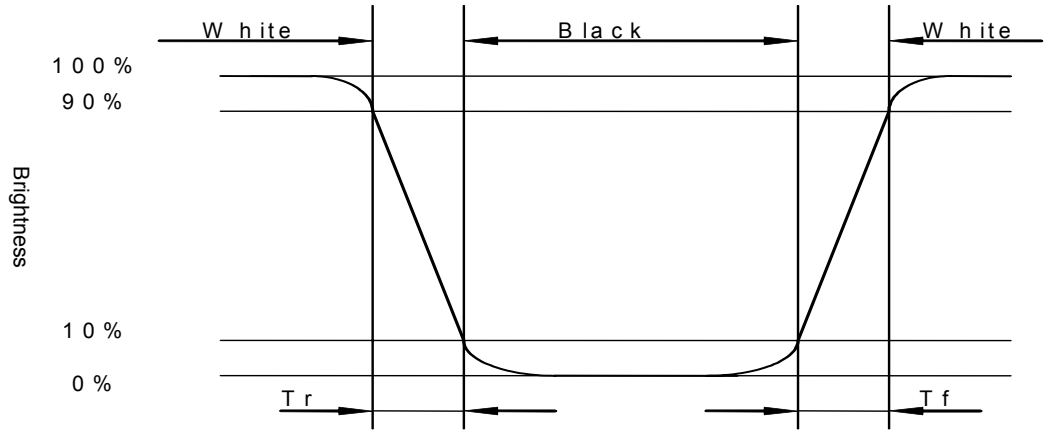
Note 1~5:See next page.

Note 1: Ambient temperature =25°C. LED current I_L =120 mArms.

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 “white” to “black”(rising time) and from “black” to “white”(falling time),respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown below.



Note5: 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_{i50} -/+ 1.5V Black Vi=V_{i50} +/- 2.0V

“+/-” means that the analog input signal swings in phase with COM signal.

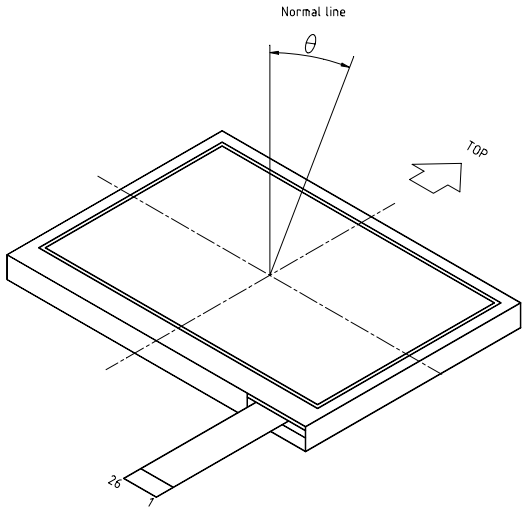
“ -/+ ” means that the analog input signal swings out of phase with COM signal.

V_{i50} : 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 CHARACTERISTICS

a. Timing conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Rising time	t_{r1}	-	-	60	ns	CPH1~CPH3
Falling time	t_{f1}	-	-	60	ns	CPH1~CPH3
Rising time	t_{r2}	-	-	120	ns	CKV
Falling time	t_{f2}	-	-	120	ns	CKV
High and low level pulse width	t_{CPH}	150	154	158	ns	CPH1~CPH3
CPH pulse duty	t_{CWH}	40	50	60	%	CPH1~CPH3
CPH pulse delay	t_{C12} t_{C23} t_{C31}	30	$t_{CPH}/3$	$t_{CPH}/2$	ns	CPH1~CPH3
STH setup time	t_{SUH}	20	-	-	ns	STHR,STHL
STH hold time	t_{HDH}	20	-	-	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}	-	7	-	t_{CPH}	OEH
Sample and hold disable time	t_{DIS1}	-	55	-	t_{CPH}	
OEV pulse width	t_{OEV}	-	27	-	t_{CPH}	OEV
CKV pulse width	t_{CKV}	-	41	-	t_{CPH}	CKV
Clean enable time	t_{DIS2}	-	16	-	t_{CPH}	
Horizontal display start	t_{SH}	-	0	-	$t_{CPH}/3$	
Horizontal display timing range	t_{DH}	-	960	-	$t_{CPH}/3$	
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	Note 1
Vertical display start	t_{SV}		3	-	t_H	
Vertical display timing range	t_{DV}		234	-	t_H	
VCOM rising time	t_{rCOM}		-	5	μs	
VCOM falling time	t_{fCOM}		-	5	μs	
VCOM delay time	t_{DCOM}		-	3	μs	
RGB delay time	t_{DRGB}		-	1	μs	

Note 1: Please don't use odd horizontal lines to drive LCD panel for both odd and even field simultaneously.

b. Timing diagram

FIG1 Sampling clock timing:

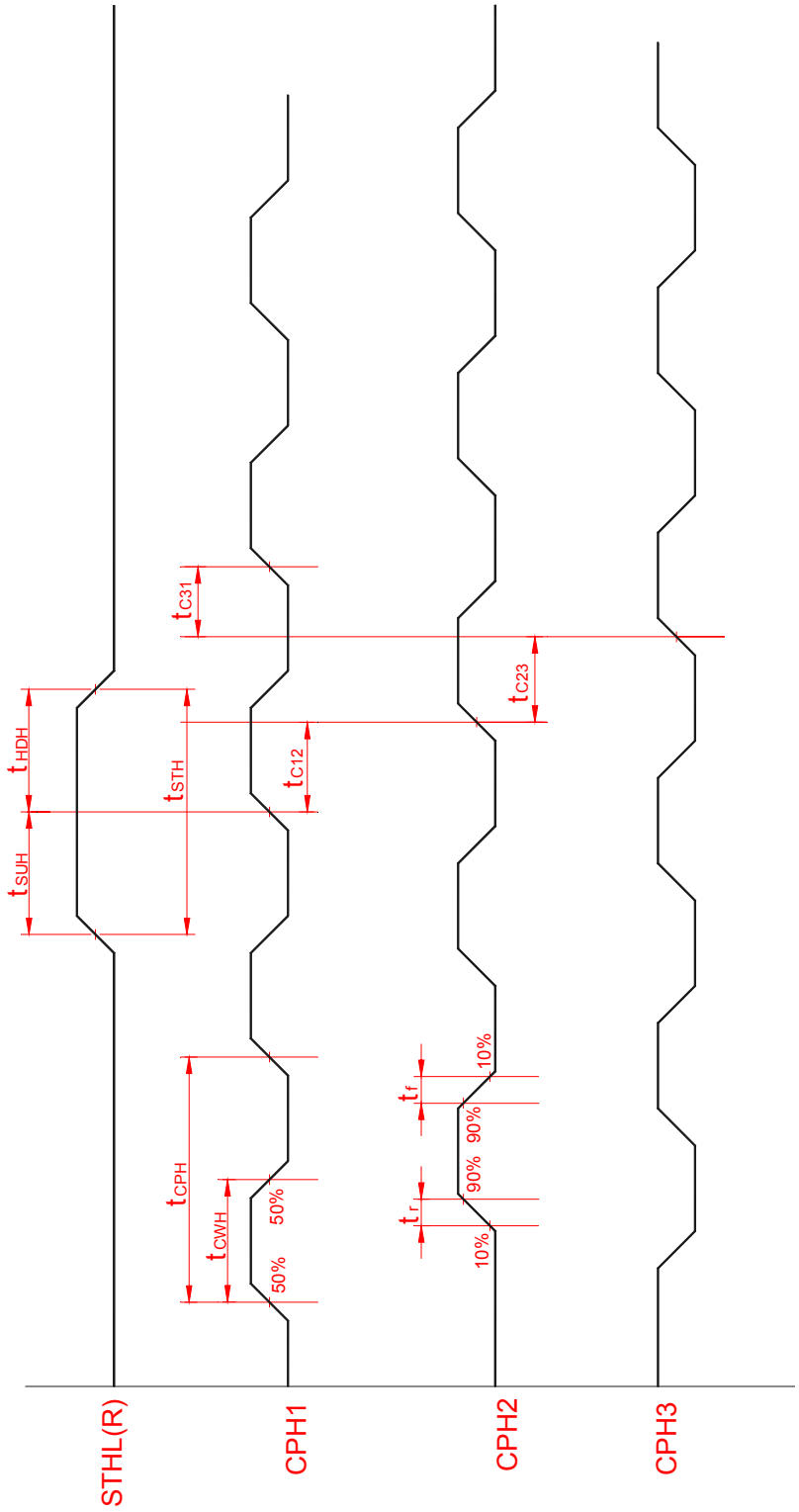


FIG2.Horizontal display timing range:

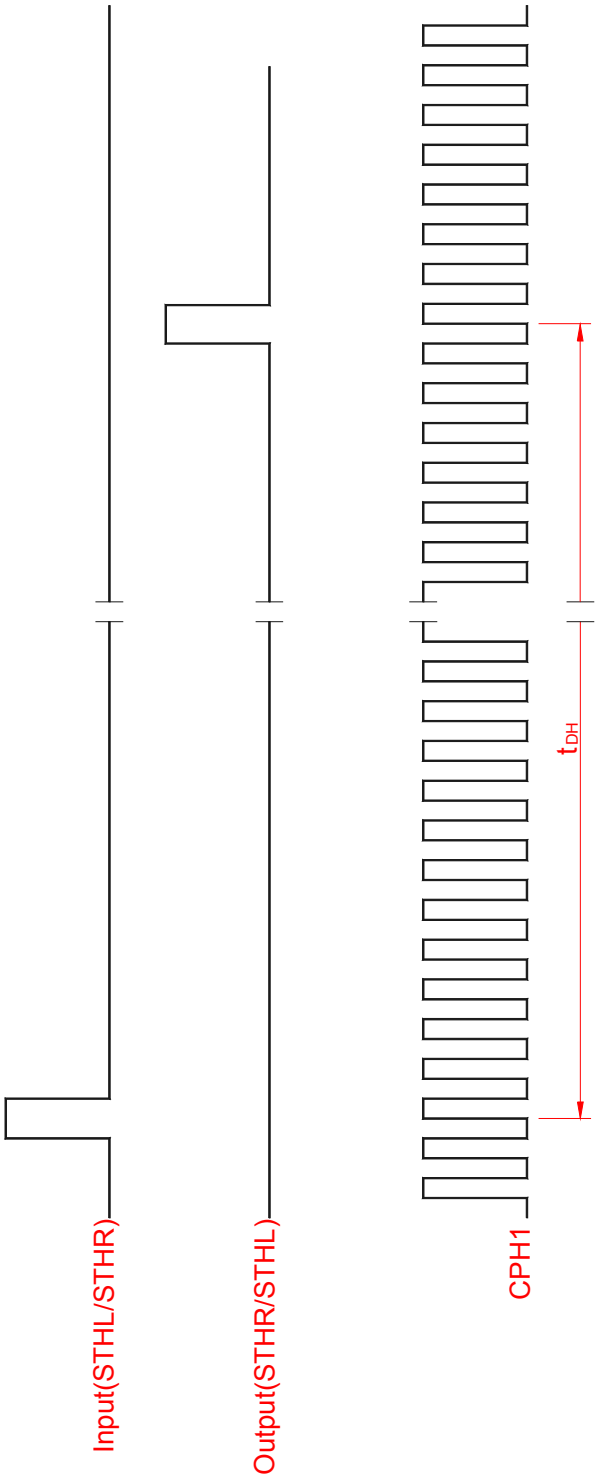


FIG3. Horizontal timing(a)

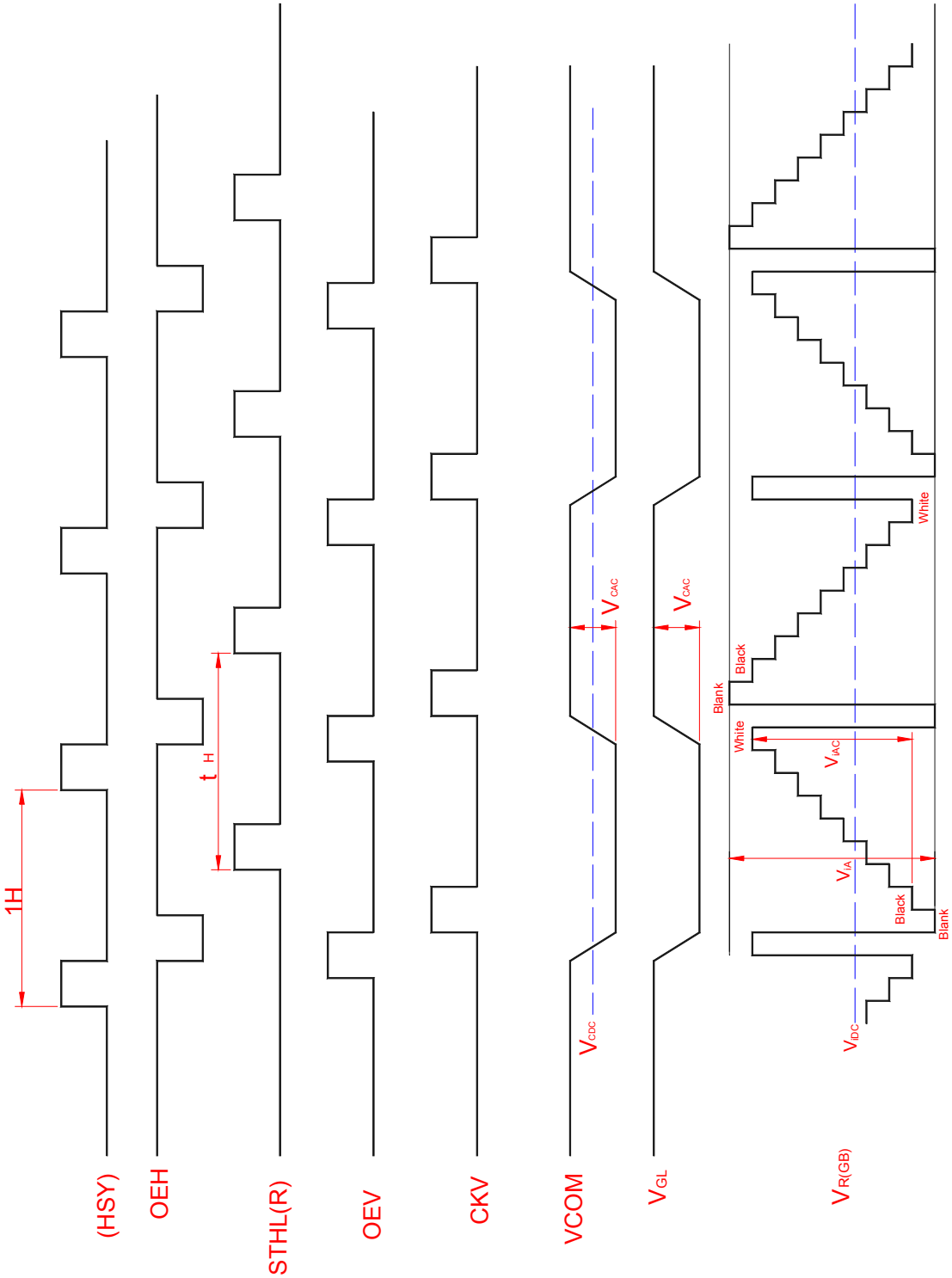


FIG3-1. Detail horizontal timing(b)

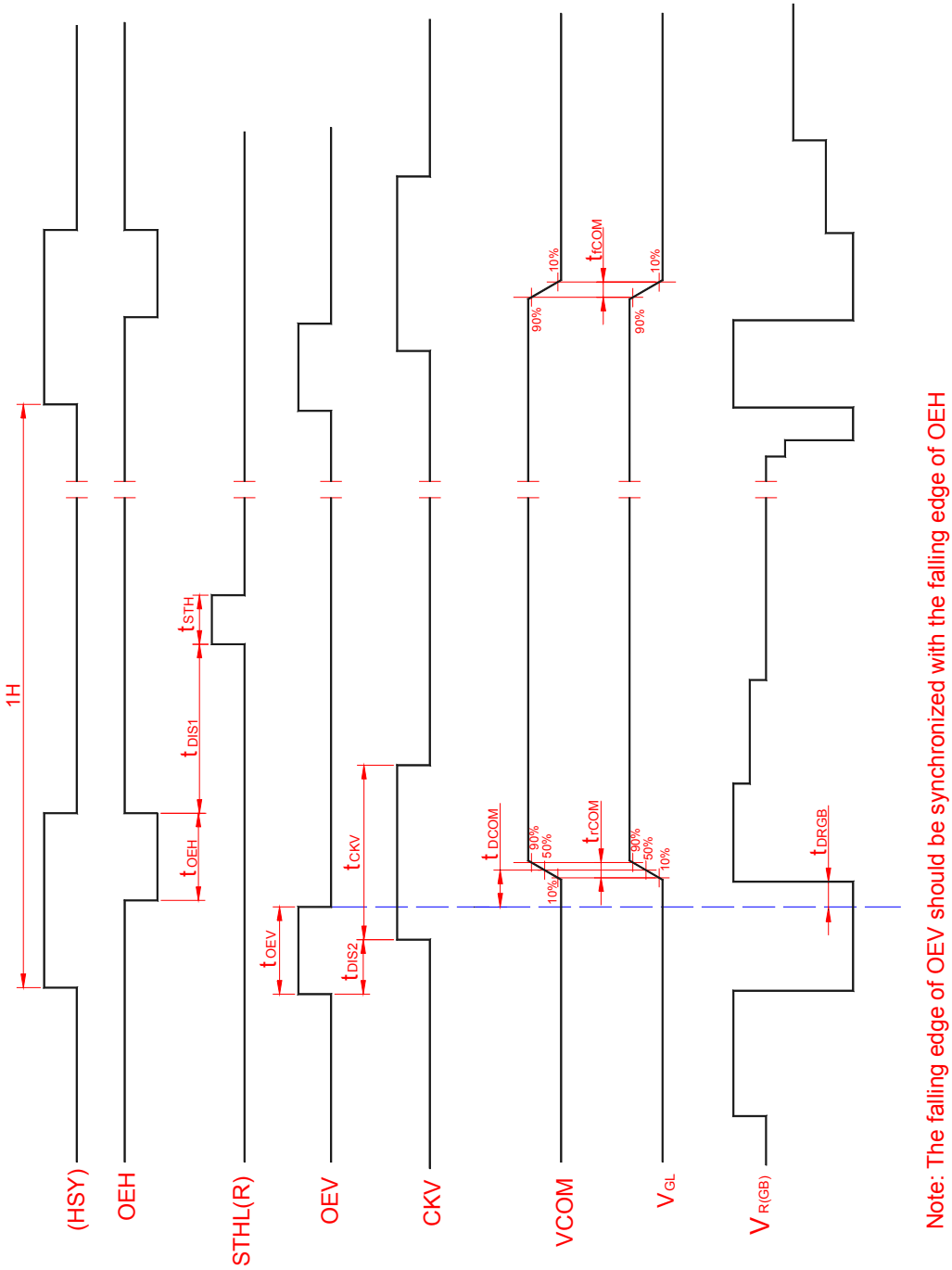


FIG4. Vertical shift clock timing:

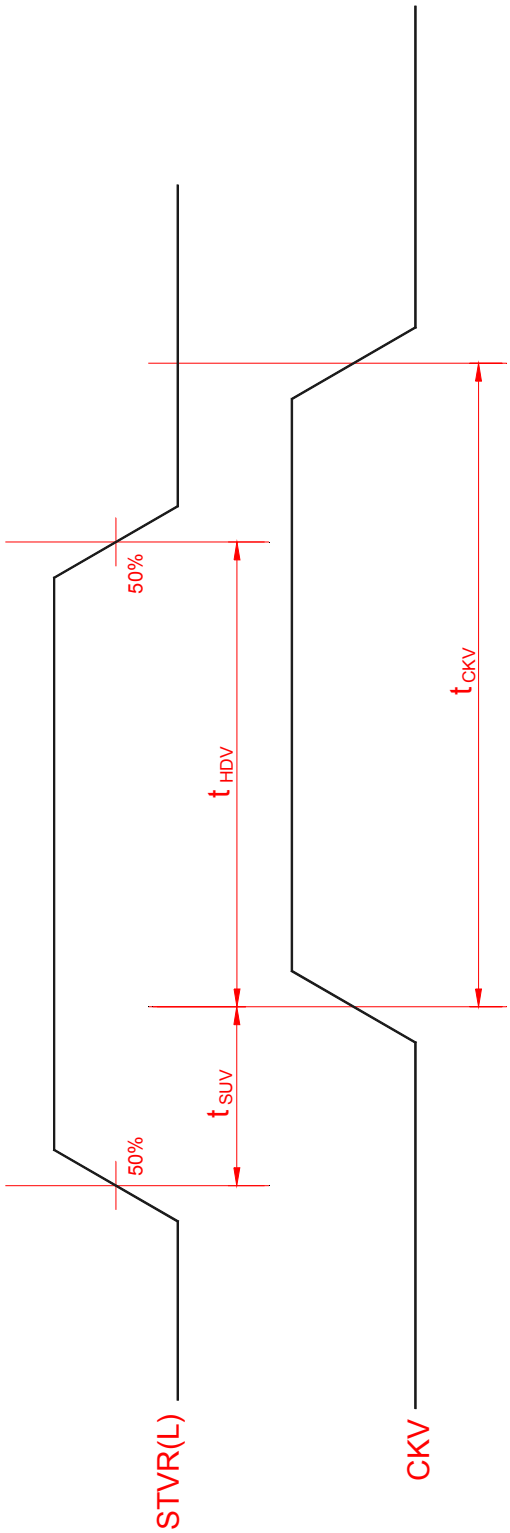


FIG5.Vertical timing (From up to down) (a):

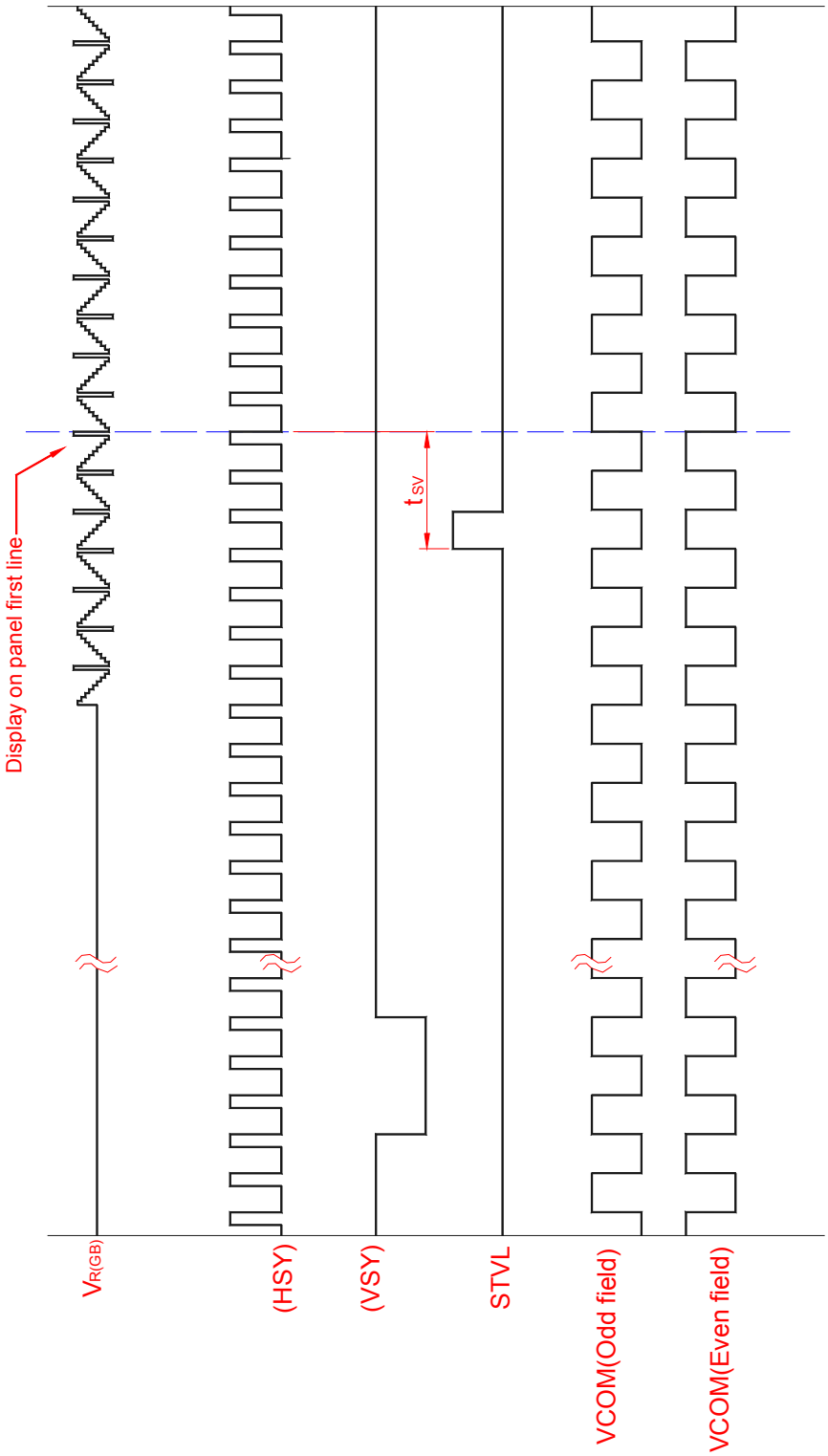
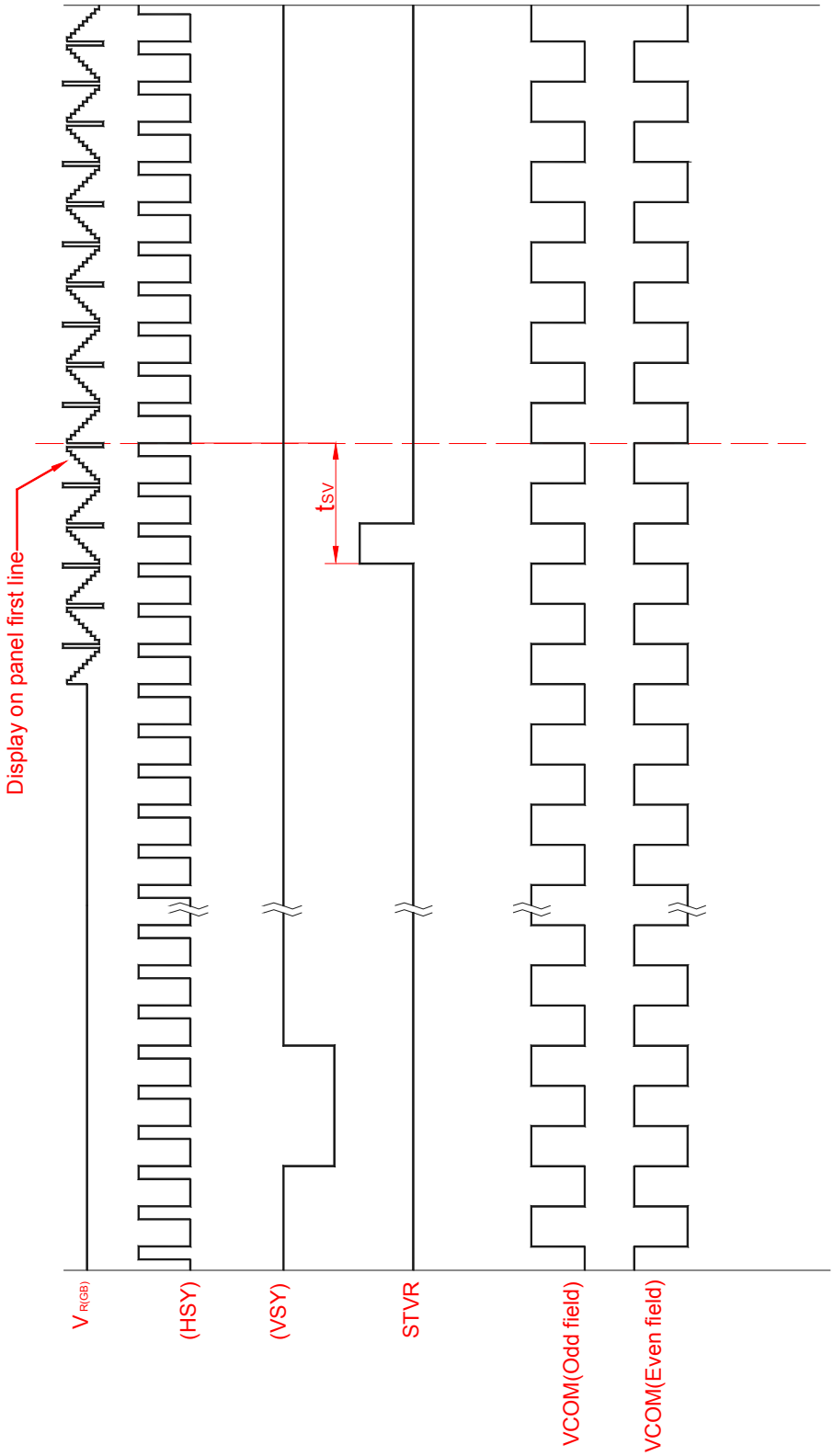


FIG5-1 Vertical timing(b) (From down to up):



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 of logic control circuit for scan driver	
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	Note 1
6	STVL	I/O	Vertical start pulse	Note 1
7	CKV	I	Shift clock input for scan driver	
8	U/D	I	UP/Down scan control input	Note 1,2
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	Note 1,2
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	Note 1
16	STHR	I/O	Start pulse for horizontal scan line	Note 1
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 of logic control circuit for data driver	
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}	-	Ground for analog circuit	

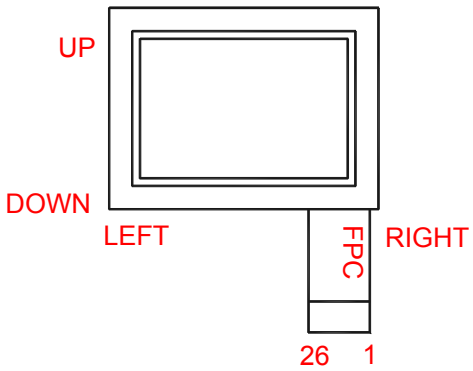
Note 1: Selection of scanning mode (please refer to the following table)

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

IN: Input; OUT: Output.

Note 2 : Definition of scanning direction.

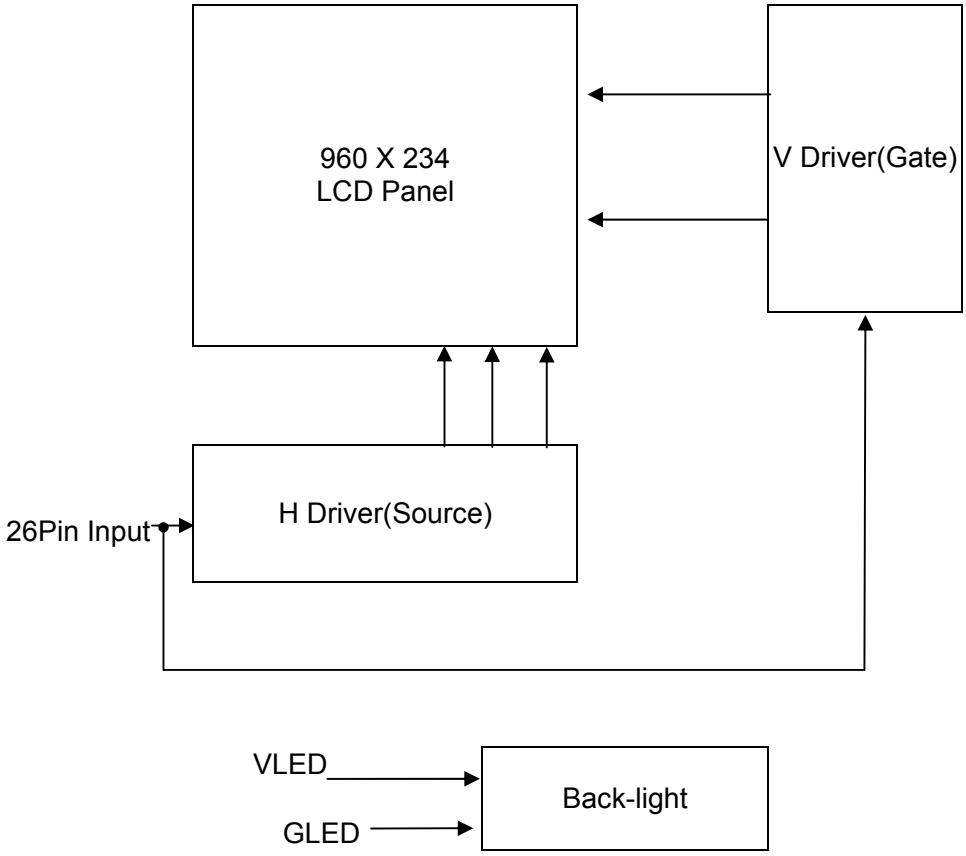
Refer to figure as below:



b. Backlight driving section

No.	Symbol	I/O	Description	Remark
1	VLED	I	Power supply for backlight unit (High voltage)	
2	GLED	-	Ground for backlight unit	

9. BLOCK DIAGRAM



10. QUALITY ASSURANCE

10.1 Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 20 ± 5°C

Humidity : 65 ± 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.

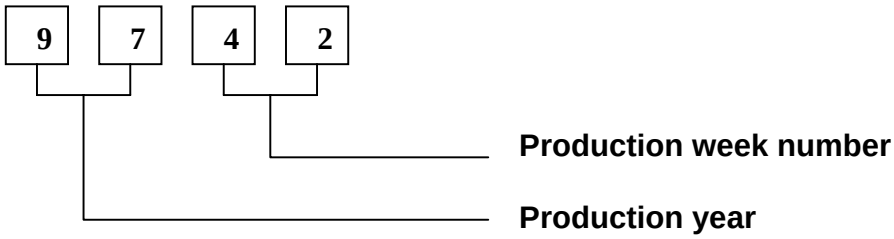
10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

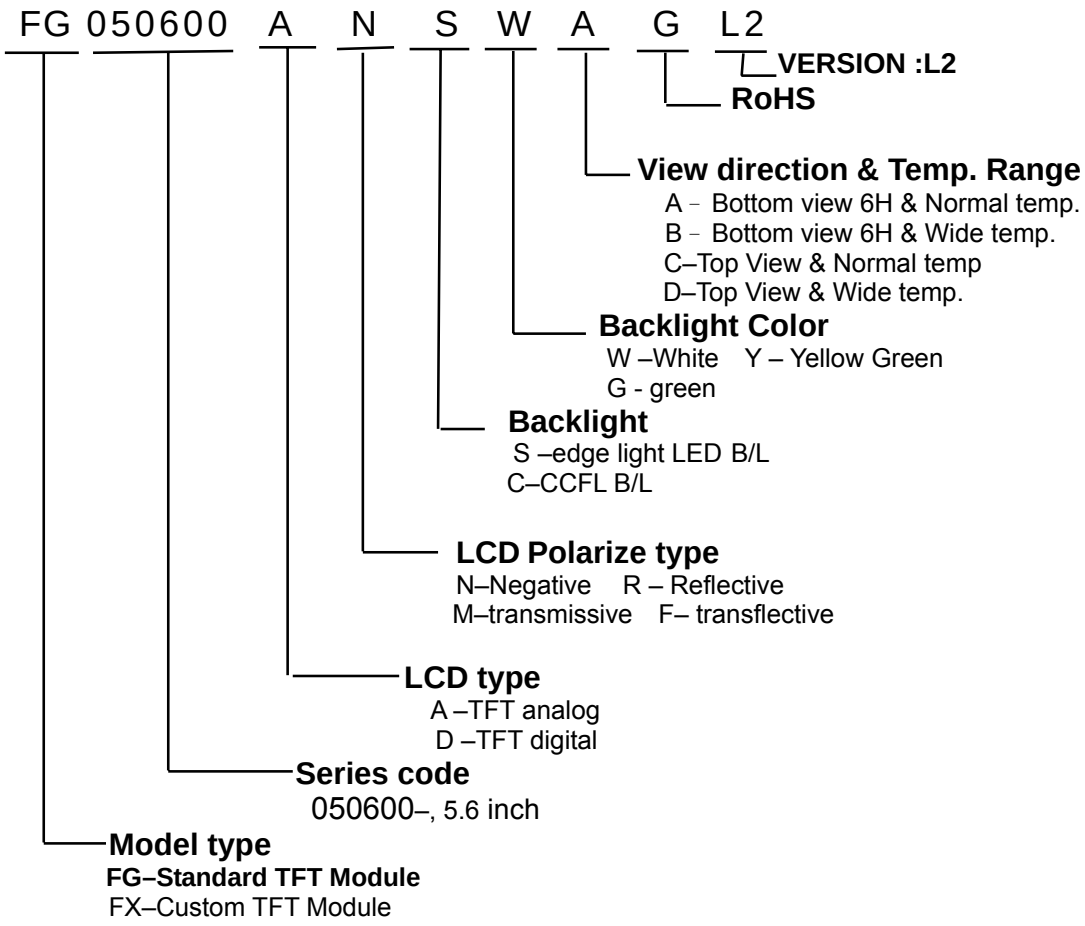
10.1.5 Test Method

No.	Reliability Test Item & Level	Test Level
1	High Temperature Storage Test	T=70°C,240hrs
2	Low Temperature Storage Test	T=-20°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=50°C,90% RH,240hrs
6	Thermal Cycling Test (No operation)	-20°C → +25°C → +70°C,200 Cycles 30 min 5min 30 min
7	Vibration Test (No operation)	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z
8	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face

11. LOT NUMBERING SYSTEM



12. LCM NUMBERING SYSTEM



13. 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 degradation, 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".

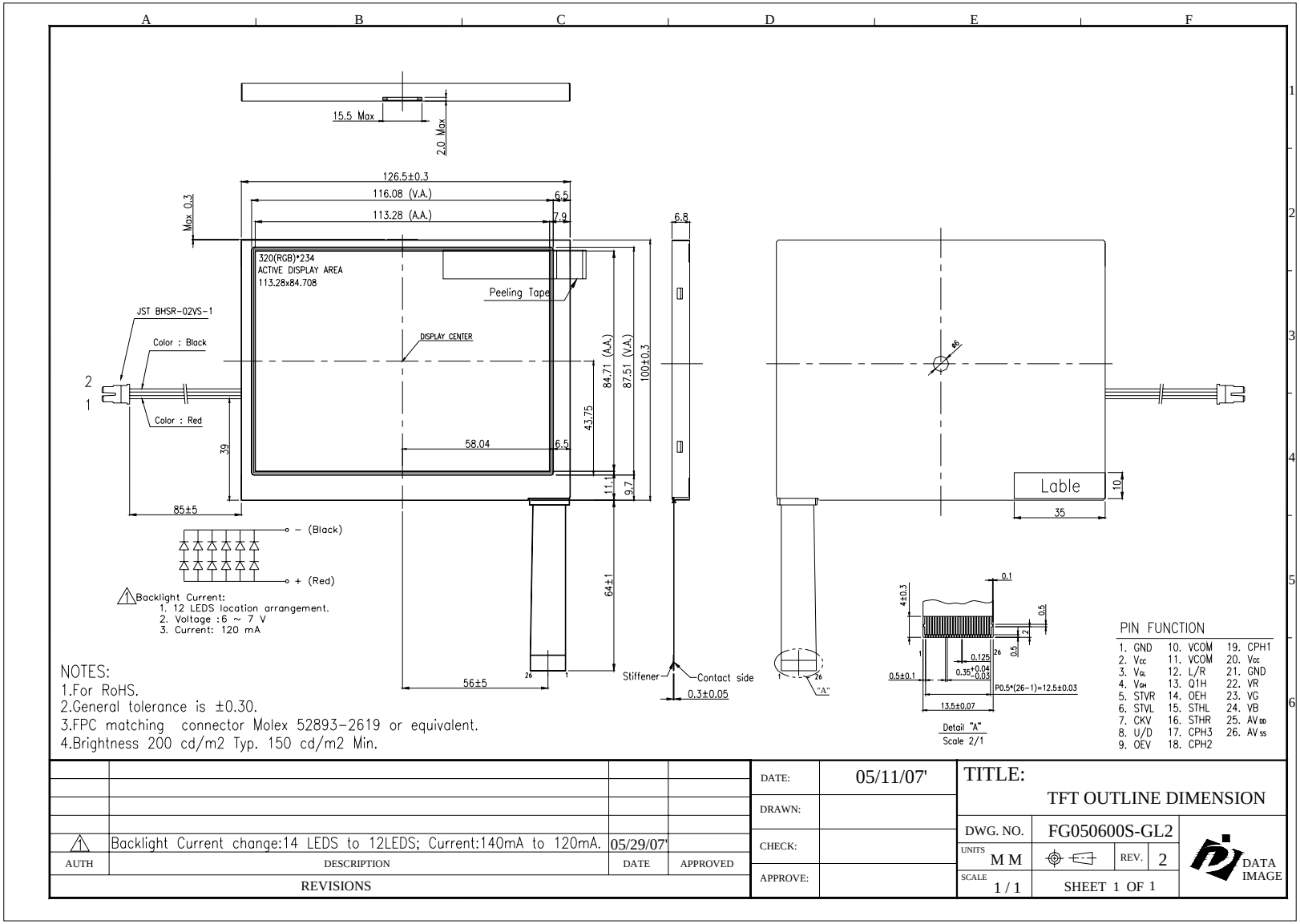
2.5 Storage

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.

14. OUTLINE DRAWING



NOTES:
1.For RoHS.
2.General tolerance is ±0.30.
3.FPC matching connector Molex 52893-2619 or equivalent.
4.Brightness 200 cd/m2 Typ. 150 cd/m2 Min.

PIN FUNCTION

1. GND	10. VCOM	19. CPH1
2. V_{CC}	11. VCOM	20. V_{CC}
3. V_{GL}	12. L/R	21. GND
4. V_{GH}	13. Q1H	22. VR
5. STVR	14. OEH	23. VG
6. STVL	15. STHL	24. VB
7. CKV	16. STHR	25. AV_{DD}
8. U/D	17. CPH3	26. AV_{SS}
9. OEV	18. CPH2	

AUTH	DESCRIPTION	DATE	APPROVED
1	Backlight Current change:14 LEDS to 12LEDS; Current:140mA to 120mA.	05/29/07'	

REVISIONS

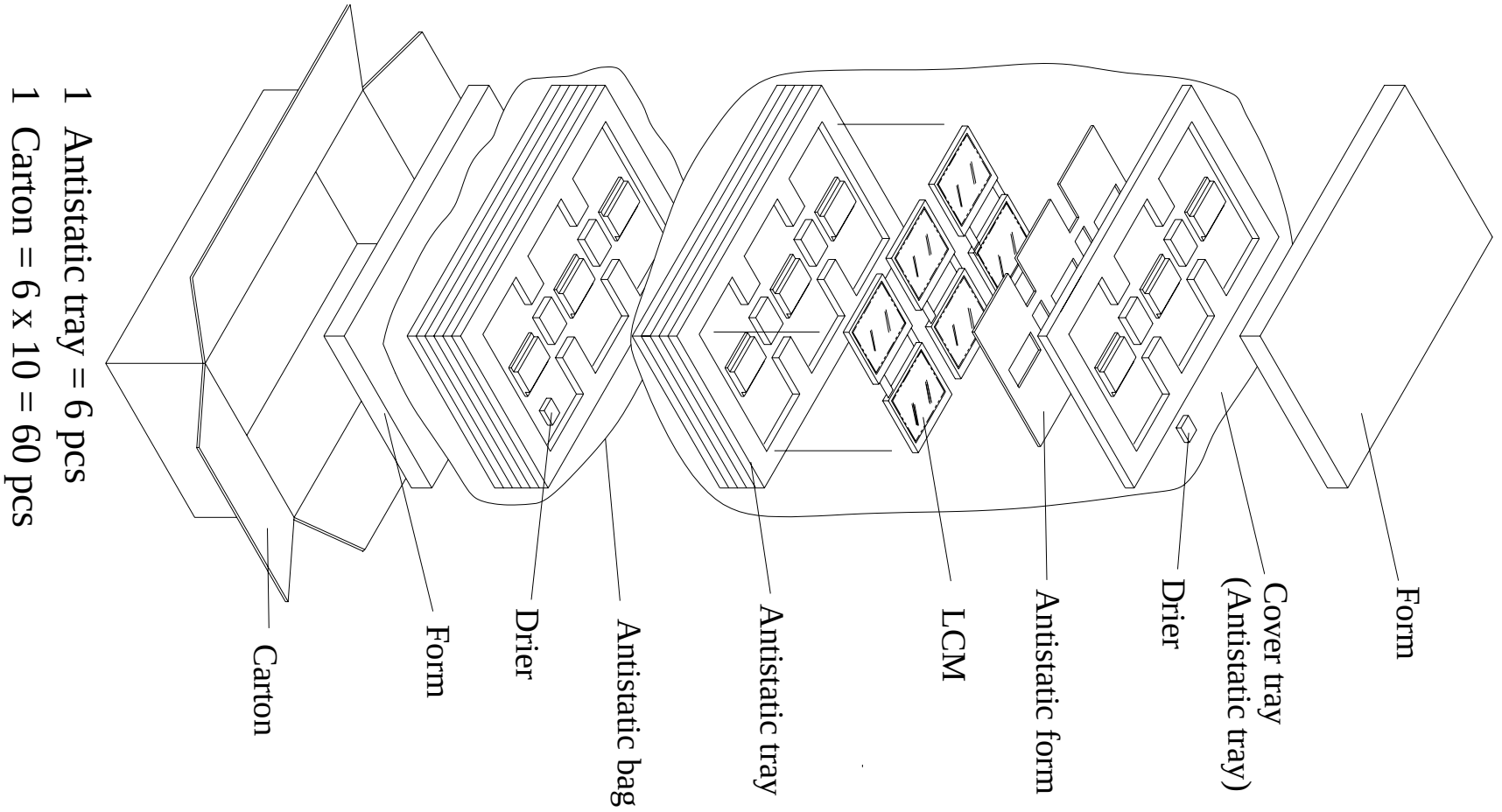
DATE:	05/11/07'
DRAWN:	
CHECK:	
APPROVE:	

TITLE: TFT OUTLINE DIMENSION

DWG. NO.	FG050600S-GL2		
UNITS M M		REV.	2
SCALE 1 / 1	SHEET 1 OF 1		

DATA IMAGE

15 . PACKAGE INFORMATION



1 Antistatic tray = 6 pcs

1 Carton = 6 x 10 = 60 pcs