

TFT Module Specification
PRELIMINARY
ITEM NO.: FG070011ANCWA-01

Table of Contents

1. COVER & CONTENTS	1
2. RECORD OF REVISION	2
3. APPLICATION.....	3
4. FEATURES.....	3
5. GENERAL SPECIFICATIONS	3
6. ABSOLUTE MAXIMUM RATINGS	4
7. ELECTRICAL CHARACTERISTICS	4
8. OPTICAL CHARACTERISTIC	14
9. INPUT / OUTPUT TERMINALS.....	16
10. BLOCK DIAGRAM	18
11. QUALITY ASSURANCE	19
12. LOT NUMBERING SYSTEM	20
13. LCM NUMBERING SYSTEM	20
14. PRECAUTIONS IN USE LCM	21
15. OUTLINE DRAWING	22

2. RECORD OF REVISION

Rev	Date	Item	Page	Comment
1	1/JUL/04			Initial PRELIMINARY

3. Application

This technical specification applies to 7.0" color TFT-LCD module, 7.0" color TFT-LCD. The applications of the panel are car TV, portable DVD, GPS, multimedia applications and others AV system.

4. Features

- . Compatible with NTSC and PAL system
- . Pixel in stripe configuration
- . Slim and compact
- . Image Reversion: Up/Down and Left/Right
- . Support Multi Display Mode
- . Multi Video Display Mode

5. GENERAL Specifications

Parameter	Specifications	Unit
Screen Size	7.0 (16:9 diagonal)	inch
Display Format	1440(H) x 234(V)	dot
Active Area	154.08 (H) x 86.58 (V)	mm
Dot Pitch	0.107 (H) x 0.372 (V)	mm
Pixel Configuration	Stripe	
Outline Dimension	164.9 (W) x 100 (H) x 5.7 (D)	mm
Surface treatment	Anti-glare and hard coating	
Weight	170	g
View Angle direction	6 o'clock	
Temperature Range	Operation	0~60
	Storage	-20~70

6. Absolute Maximum Ratings:

The followings are maximum values, which if exceeded, may cause faulty operation or damage to the unit.

Parameter	Symbol	MIN.	MAX.	Unit	Remark
Supply Voltage for Source Driver	V_{CC2}	-0.3	+7.0	V	
	AV_{DD}	-0.3	+7.0	V	
Supply Voltage for Gate Driver	V_{CC1}	-0.3	+7.0	V	
	$V_{GH} - V_{GL}$	-0.3	+45.0	V	
	H Level V_{GH}	-0.3	+32	V	
	L Level V_{GL}	-22	+0.3	V	
Analog input signals Level	V_R, V_G, V_B	-0.2	$V_{CC2}+0.2$	V	Note 6-1
Storage Temperature		-20	+70	V	
Operation Temperature		0	+60	V	Note 6-2

Note 6-1 : Analog Input Voltage means V_R, V_G, V_B .

Note 6-2 : Optical characteristics shown in Table 8-1 are measured under $T_a=+25^\circ\text{C}$

7. Electrical Characteristics

7.1 Recommended Driving condition for TFT-LCD panel

Parameter	Symbol	MIN.	TYP	MAX.	Unit	Remark
Supply voltage for source driver	AV_{DD}	4.5	5	5.5	V	
	Logic V_{CC2}	3	5.0	5.5	V	
Supply voltage for gate driver	H Level V_{GH}	-0.3	--	18	V	
	L level V_{GL}	-15	--	0.3	V	
	Logic V_{CC1}	3	+5.0	+5.5	V	
Analog Signal input Level	Amplitude	--	--	--	V	
Digital input voltage	H level V_{IH}	$0.7 * V_{CC2}$	--	V_{CC2}	V	
	L level V_{IL}	0	--	$0.3 * V_{CC2}$	V	
Digital output voltage	H level V_{OH}	$V_{CC2}-0.4$	--	$*V_{CC2}$	V	
	L level V_{OL}	0	--	0.4	V	
V_{COM}	$V_{COM AC}$	3.5	5.5	6.5	V_{P-P}	DC Component of V_{COM}
	$V_{COM DC}$	1.7	2.1	2.4	V	AC Component of V_{COM} Note 7-1

Note 7-1:strongly suggests that the $V_{COM DC}$ level shall be adjustable, every module's $V_{COM DC}$ level shall be carefully adjusted to show a best image performance.

7-2. Power Consumption

Ta= 25 °C

Parameter	Symbol	Conditions	TYP.	MAX	Unit	Remark
Supply current for Gate Driver (Hi level)	I_{GH}	$V_{GH} = 15V$	0.2	0.5	mA	
Supply current for Gate Driver (Low level)	I_{GL}	$V_{GL} = -10V$	0.8	1.5	mA	
Supply current for Source Driver(Digital)	I_{CC2}	$V_{CC2} = +5V$	3.0	6.0	mA	
Supply current for Source Driver(Analog)	I_{AVDD}	$AV_{DD} = +5V$	17	30	mA	
Supply current for Gate Driver (Digital)	I_{CC1}	$V_{CC1} = +5V$	2.0	4.0	mA	
LCD Panel Power Consumption			--	0.22	W	Note 7-3
Backlight Lamp Power Consumption			--	3.2	W	Note 7-4

Note 7-3: The power consumption for backlight is not included.

Note 7-4: Backlight lamp power consumption is calculated by $I_L \times V_L$.

7.3 CCFL Backlight driving

Pin No	Symbol	Description	Remark
1	HI	Input terminal (Hi voltage side)	
2	GND	Input terminal (Low voltage side)	Note 7-5

Note 7-5 : Low voltage side of backlight inverter connects with Ground of inverter circuits.

A. Driving condition for backlight

Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp voltage	V_L	--	525	--	Vrms	
Lamp current	I_L	--	6	--	mA	
Lamp frequency	P_L	--	52	--	KHz	Note 7-6
Kick-off voltage (25 °C)	V_s	--	--	900	Vrms	Note 7-7
Kick-off voltage (-20 °C)	V_s	--	--	1,100	Vrms	Note 7-7

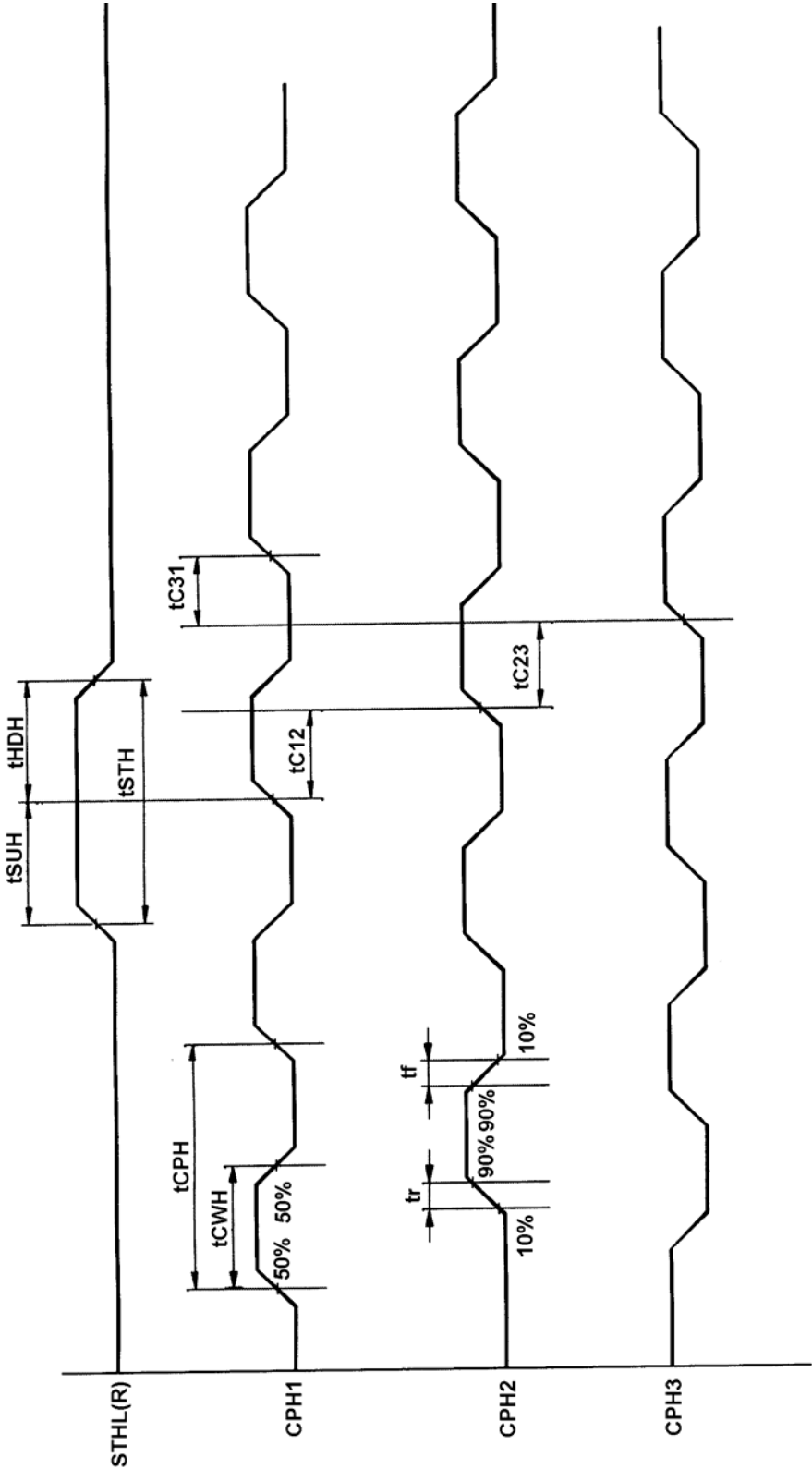
Note 7-6 : The wave form of lamp driving voltage should be as closed to a perfect sine wave as possible.

Note 7-7 :The Kick-off times ≥ 1 sec.

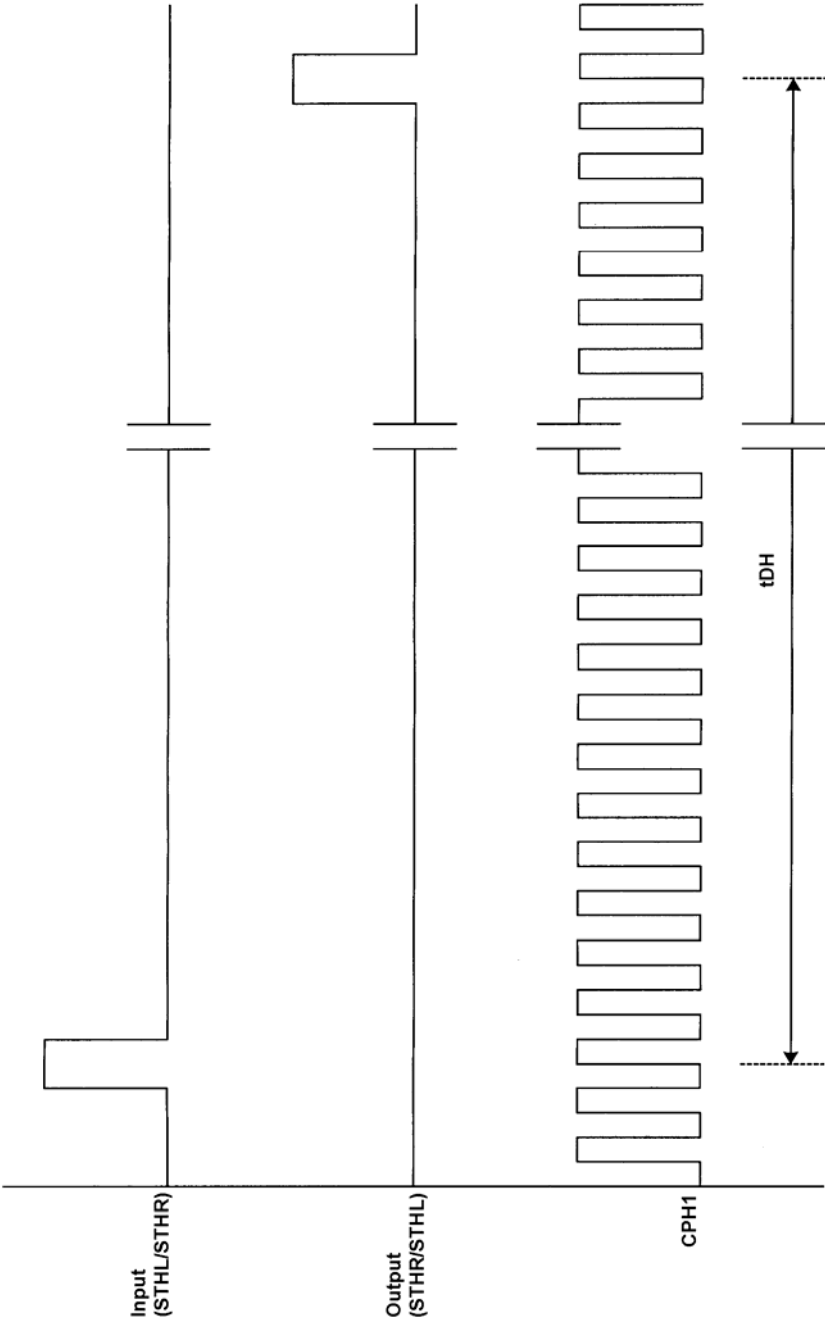
7-4. Timing Characteristics of Input Signals

Parameter	Symbol	Min	TYP.	MAX	Unit	Remark
Rising time	tr			10	ns	
Falling time	tf			10	ns	
High and low level pulse width	tCPH	9.2	9.6	10	MHz	CPH1~CPH3
CPH pulse duty	tCWH	30	50	70	%	CPH1~CPH3
CPH pulse delay	tC12 tC23 tC31	30	tCPH/3	tCPH/2	ns	CPH1~CPH3
STH setup time	tSUH	20			ns	STHR,STHL
STH hold time	tHDH	20			ns	STHR,STHL
STH pulse width	tSTH		1		tCPH	STHR,STHL
STH period	tH	61.5	63.5	65.5	μs	STHR,STHL
OEH pulse width	tOEH		1.40		μs	OEH
Sample and hold disable time	tDIS1		7.43		μs	
OEV pulse width	tOEV		18		μs	OEV
CKV pulse width	tCKV		31.75		μs	CKV
Clean enable time	tDIS2		9.0		μs	
Horizontal display start	tSH		0		tCPH/3	
Horizontal display timing range	tDH		480		tCPH	
STV setup time	tSUV	400			ns	STVR,STVL
STV hold time	tHDV	400			ns	STVR,STVL
STV pulse width	tSTV			1	tH	STVR,STVL
Horizontal lines per field	tV	256	262	268	tH	
Vertical display start	tSV		3		tH	
Vertical display timing range	tDV		234		tH	
VCOM rising time	trCOM			5	μs	
VCOM falling time	tfCOM			5	μs	
VCOM delay time	tDCOM			3	μs	
RGB delay time	tDRGB			1	μs	

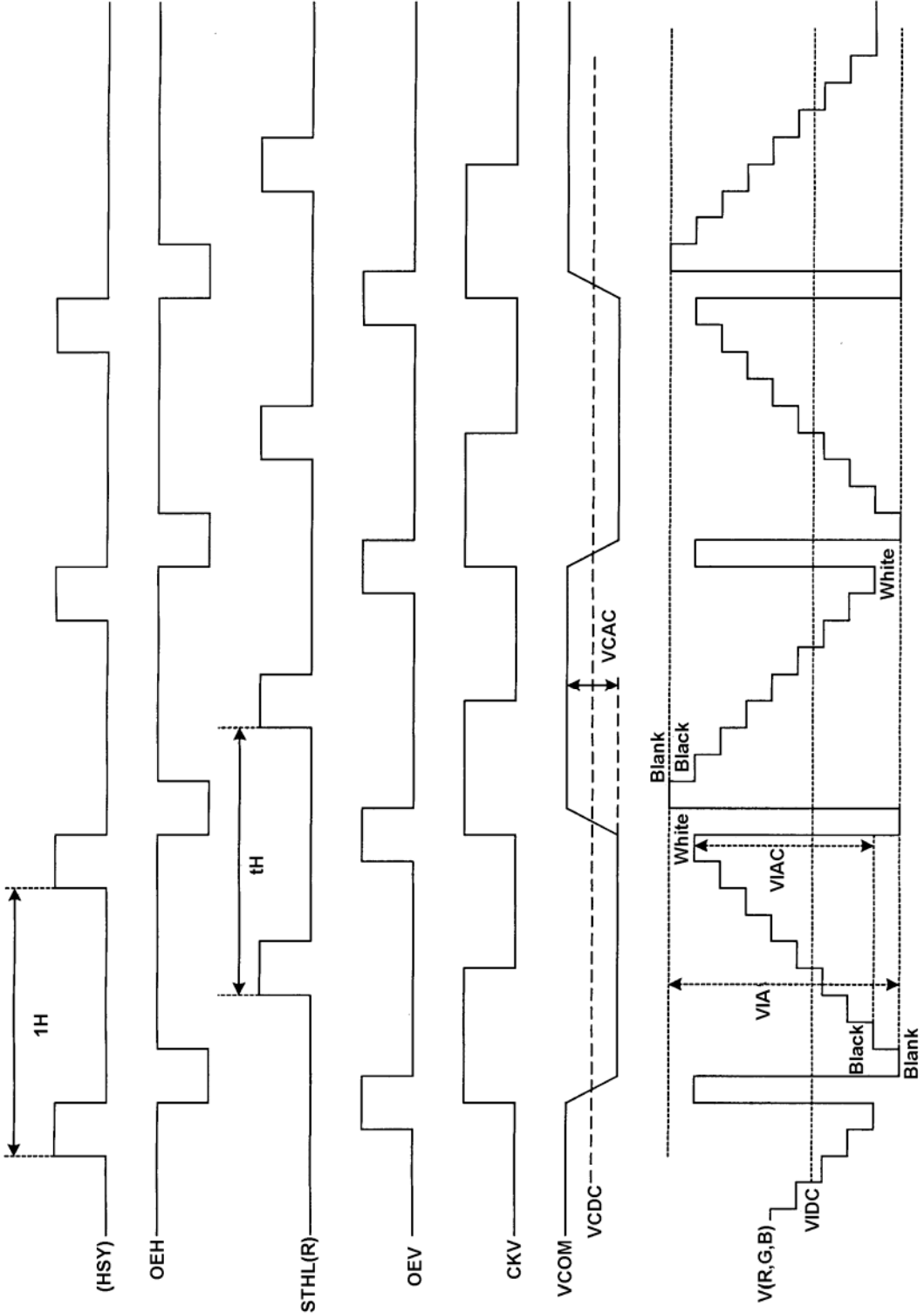
7.5) Signal Timing Waveforms



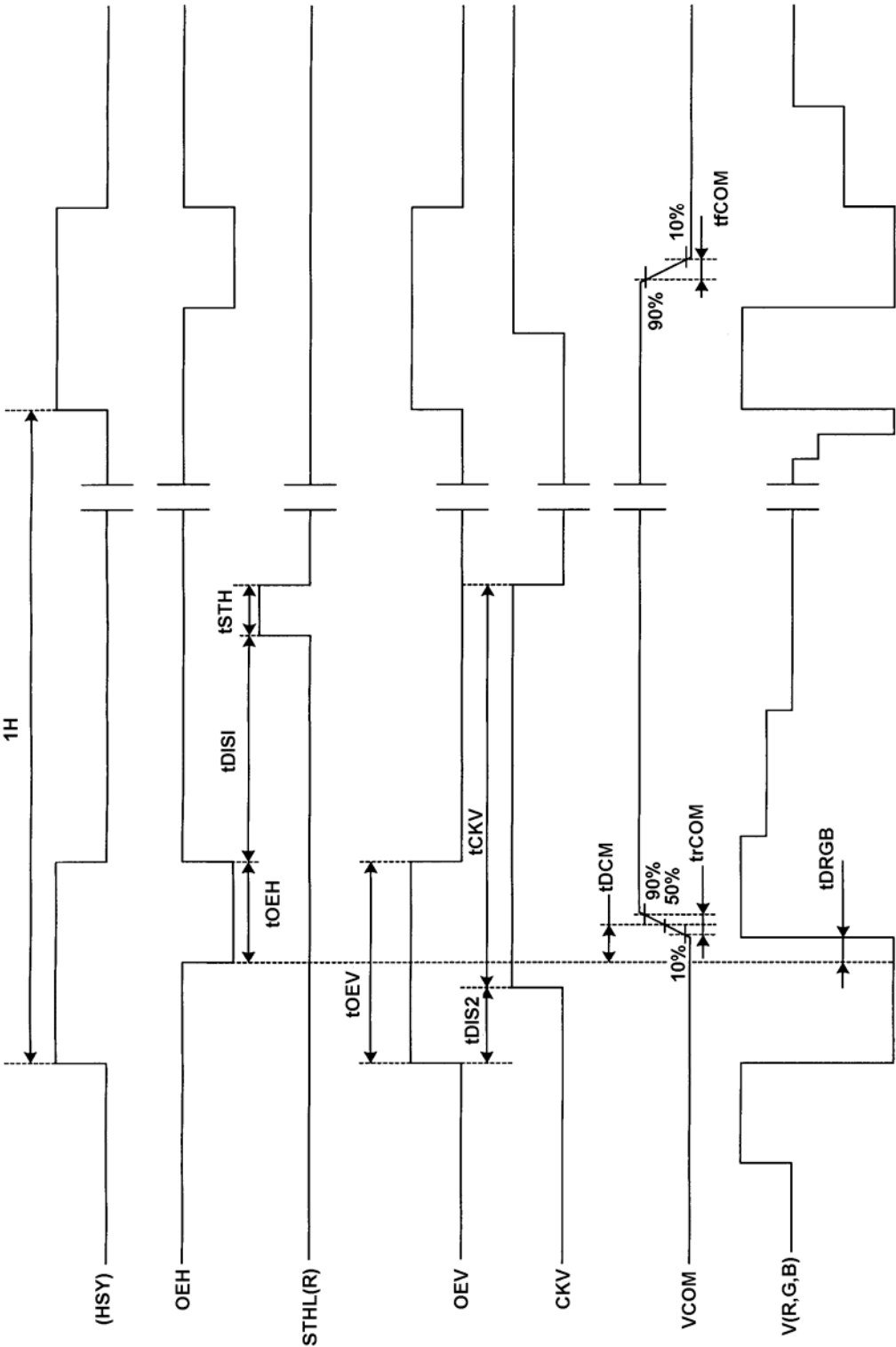
7-1 Sampling clock timing



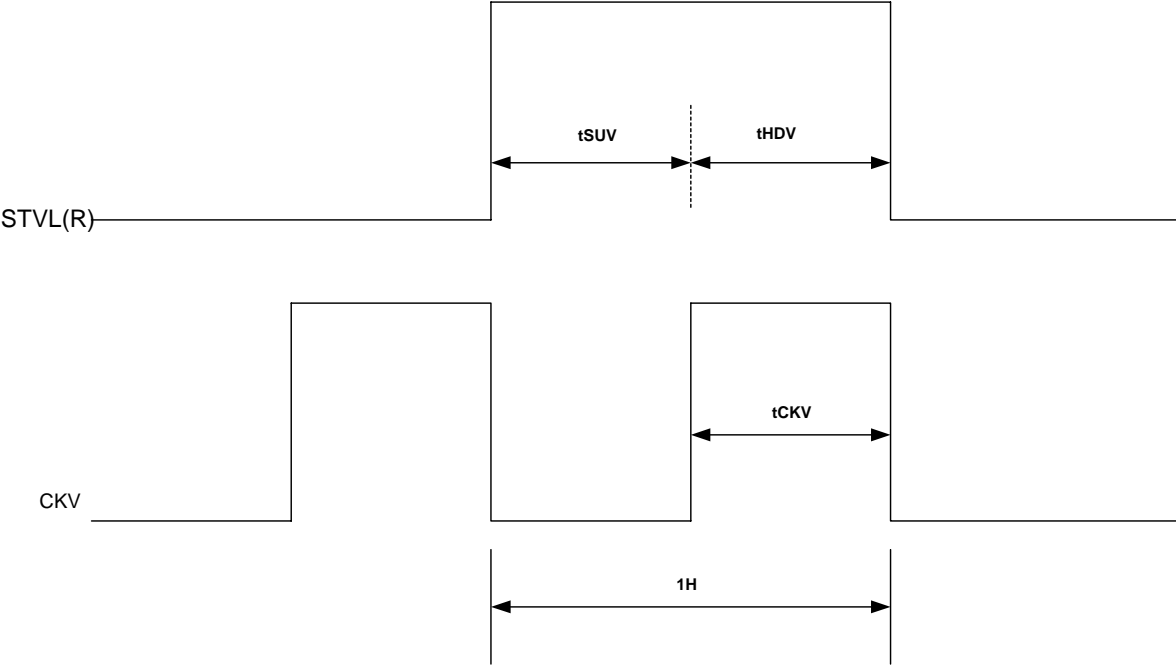
7-2 Horizontal display timing range



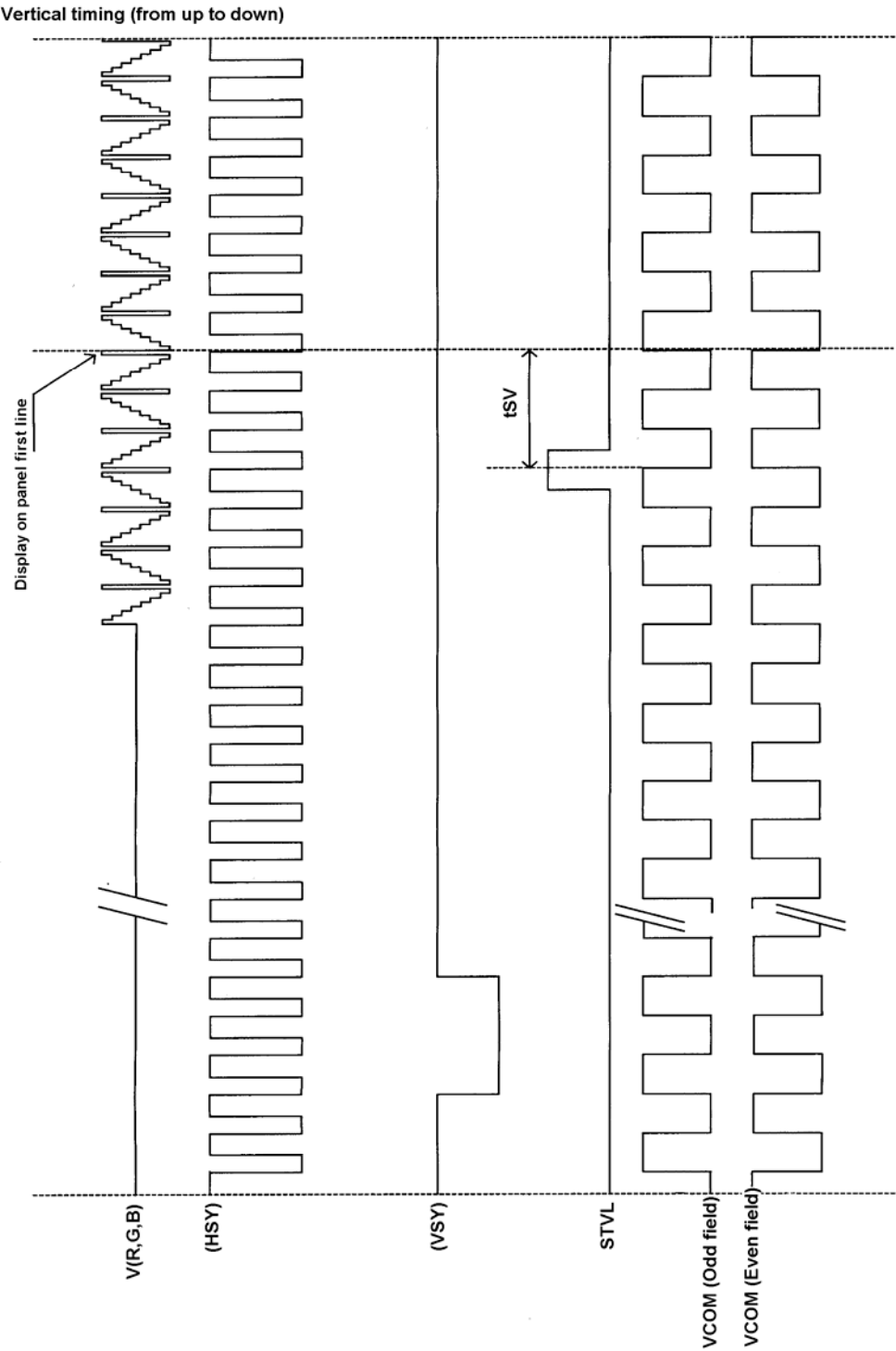
7-3-1 Horizontal timing



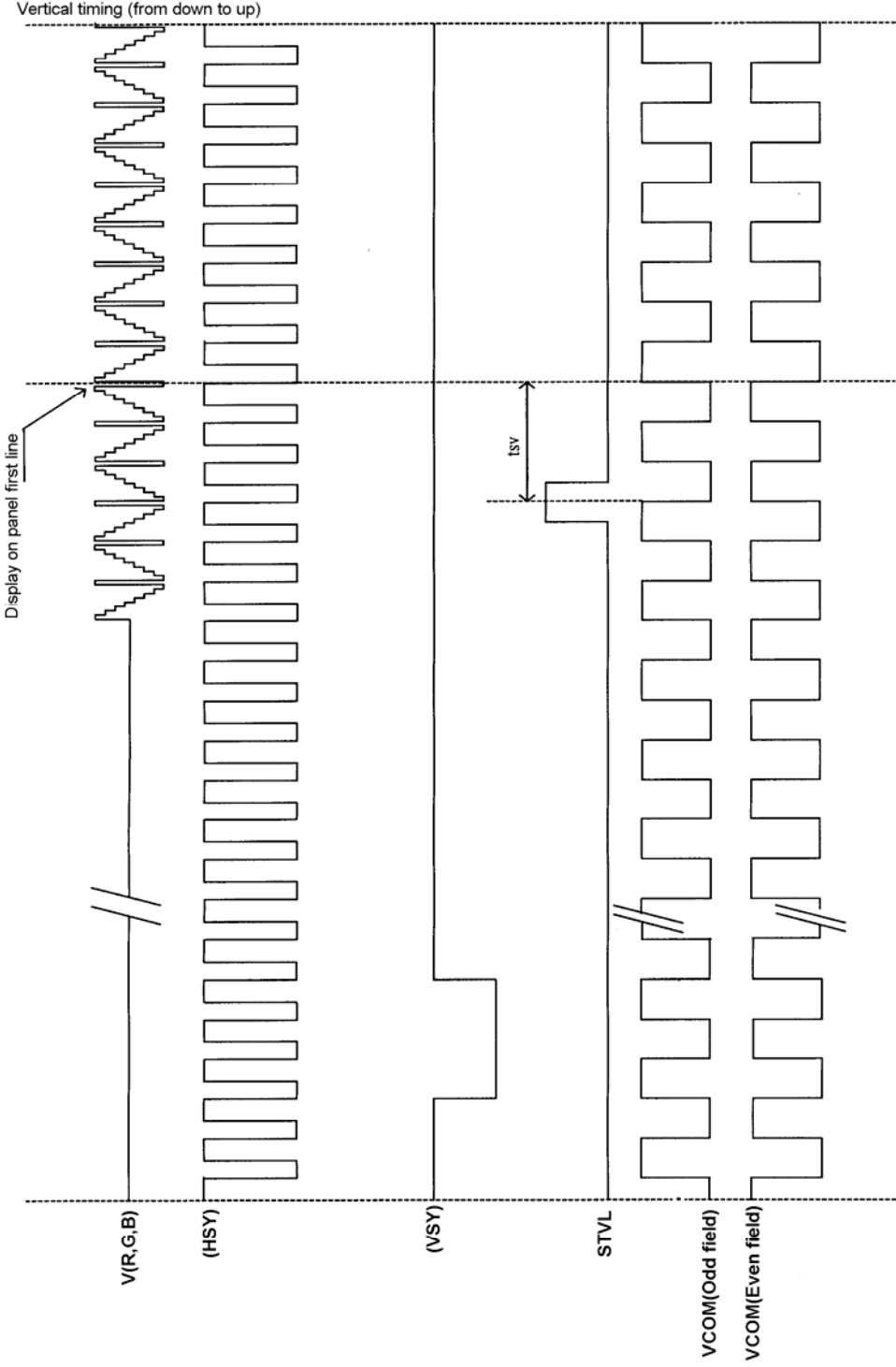
7-3-2 Detail Horizontal timing



7-4Vertical shift clock timing



7-5-1 Vertical timing (from Up to Down)



7-5-2 Vertical timing (from Down to Up)

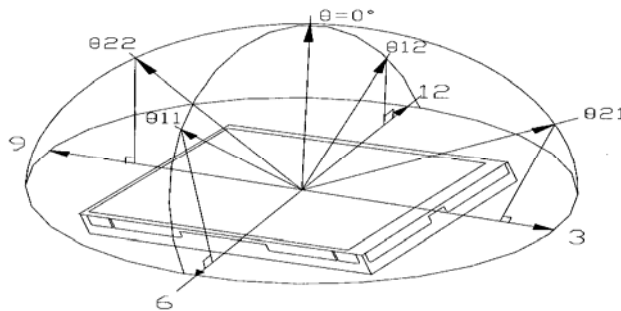
8. Optical Characteristics

8-1. Specification:

Ta = 25°C

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ_{21}, θ_{22}	$CR \geq 10$	45	55	--	deg	Note 8-1
	Vertical	θ_{12}		10	15	--	deg	Note 8-1
		θ_{11}		30	35	--	deg	Note 8-1
Contrast Ratio		CR		200	300	--		Note 8-2
Brightness				360	440	--	cd/m ²	Note 8-3
Response time	Rise	Tr	$\theta = 0^\circ$	--	--	30	ms	Note 8-4
	Fall	Tf		--	--	50	ms	
Lamp Life Time +25°C				--	10000	--	hr	

Note 8-1: The definitions of viewing angles

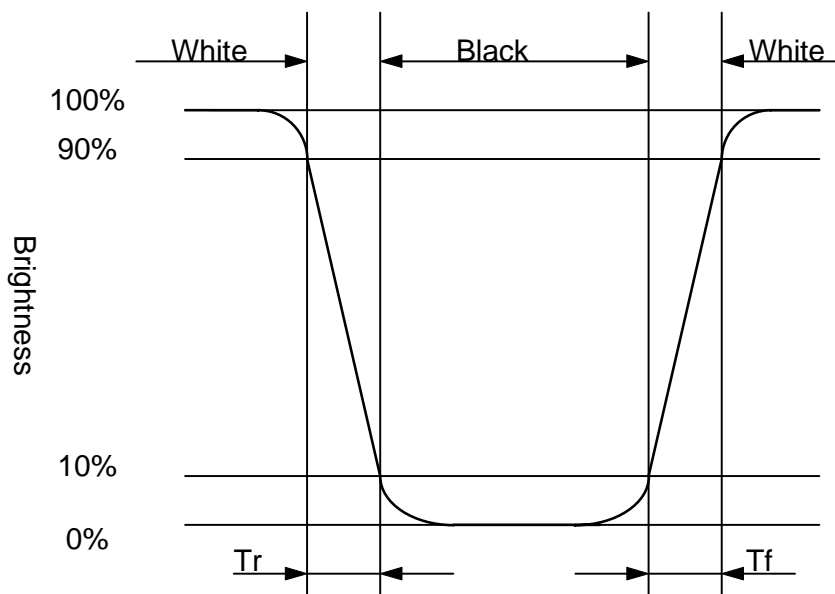


Note 8-2 : $CR = \frac{\text{Luminance when Testing point is White}}{\text{Luminance when Testing point is Black}}$

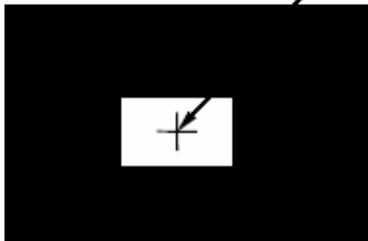
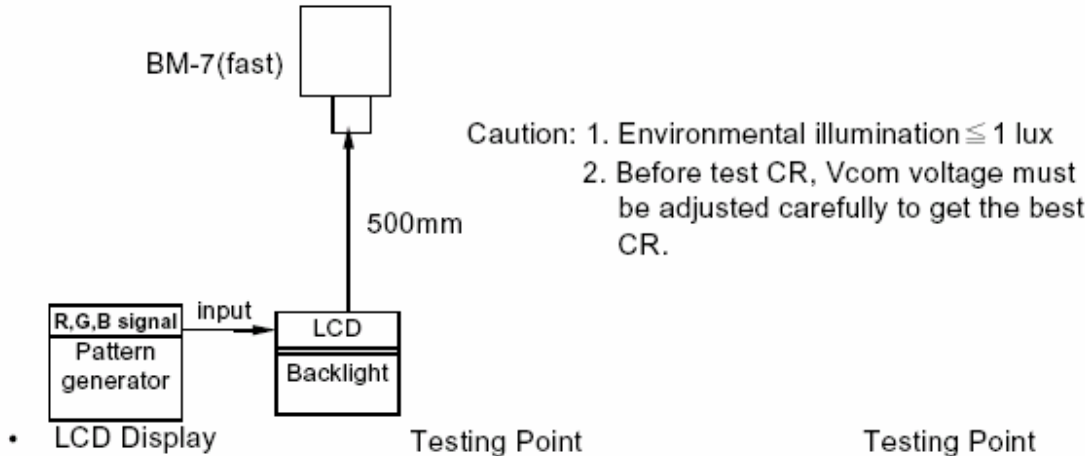
(Testing configuration see 8-2) Contrast Ratio is measured in optimum common electrode voltage, and at optimized Viewing angle.

Note 8-3 : Topcon BM-7(fast) luminance meter 2°field of view is used in the testing (after 20~30 minutes operation).

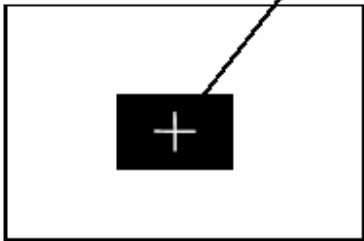
Note 8-4: The definition of response time:



8-2. Testing configuration

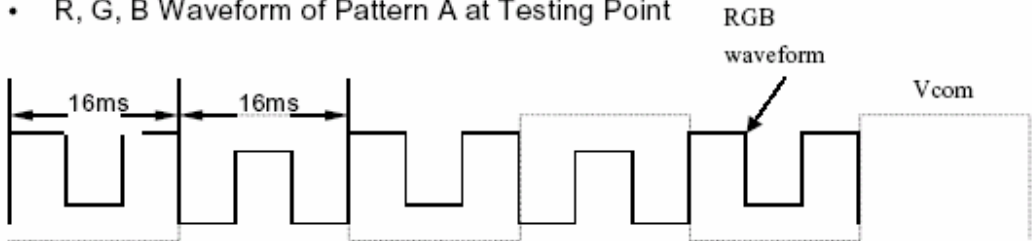


Pattern A

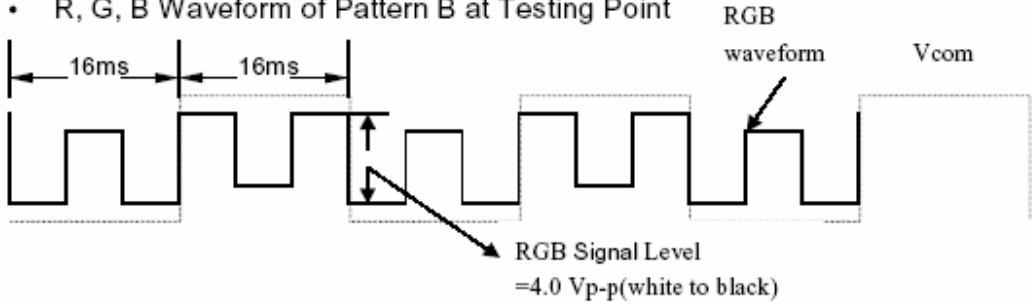


Pattern B

- R, G, B Waveform of Pattern A at Testing Point



- R, G, B Waveform of Pattern B at Testing Point



9. Input / Output Terminals

LCD Module Connector
FPC Down Connect , 26 Pins , Pitch : 1.0 mm

Pin No	Symbol	I/O	Description	Remark
1	GND	-	Ground for logic circuit	
2	V _{CC1}	I	Supply voltage of logic control circuit for scan driver	Note 9-7
3	V _{GL}	I	Negative power for scan driver	Note 9-4
4	V _{GH}	I	Positive power for scan driver	Note 9-5
5	STVR	I/O	Vertical start pulse	Note 9-1
6	STVL	I/O	Vertical start pulse	Note 9-1
7	CKV	I	Shift clock input for scan driver	
8	U/D	I	Up / Down scan control input	Note 9-1
9	OEV	I	Output enable input for scan driver	
10	V _{COM}	I	Common electrode driving signal	
11	V _{COM}	I	Common electrode driving signal	
12	L/R	I	Left / Right scan control input	Note 9-2
13	MOD	I	Sequential sampling and simultaneous sampling setting	Note 9-8
14	OEH	I	Output enable input for data driver	
15	STHL	I/O	Start pulse for horizontal scan line	Note 9-2
16	STHR	I/O	Start pulse for horizontal scan line	Note 9-2
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 _{CC2}	I	Supply voltage of logic control circuit for data driver	Note 9-6
21	GND	-	Ground for logic circuit	
22	V _R	I	Alternated Video signal input R	
23	V _G	I	Alternated Video signal input G	
24	V _B	I	Alternated Video signal input B	
25	AV _{DD}	I	Supply voltage for analog circuit	Note 9-3
26	AV _{SS}	-	Ground for digital circuit	

Note 9-1

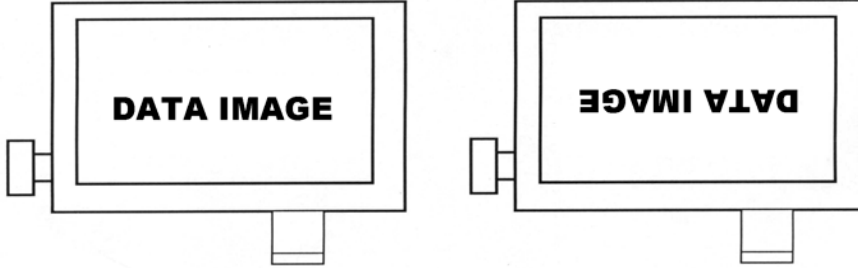
U/D	STVR	STVL	scanning direction
V _{CC1}	Input	output	down to up
GND	output	input	up to down

Note 9-2

L/R	STHR	STHL	scanning direction
V _{CC2}	output	input	left to right
GND	input	output	right to left

The definitions of Note 9-1,9-2
 U/D(PIN 11)=Low R/L(PIN 27)=High

U/D(PIN 11)= High R/L(PIN 27)= Low



Note 9-3: AV_{DD} TYP.=+5V

Note 9-4: V_{GL} TYP.=TBDV

Note 9-5: V_{GH} TYP.=TBDV

Note 9-6: V_{CC2} TYP.=+5V

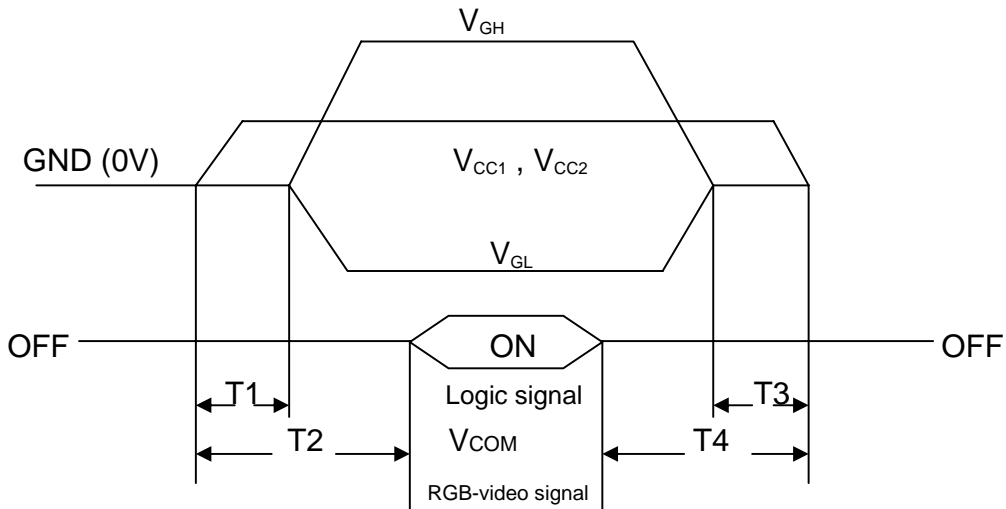
Note 9-7: V_{CC1} TYP.=+5V

Note 9-8: MOD=H: Simultaneous sampling ,MOD=L: Sequential sampling

Please set CPH2 and CHP3 to GND when MOD=H

9.2 Power Sequence

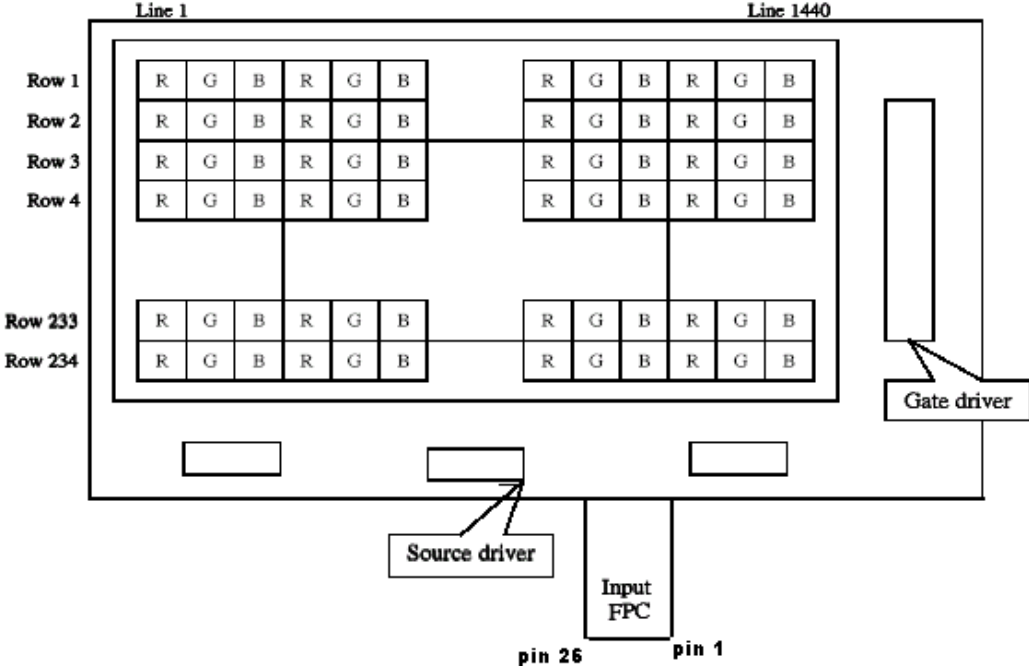
The Power on Sequence only effect by V_{CC1} , V_{CC2} , GND , V_{GL} and V_{GH} , the others do not care.



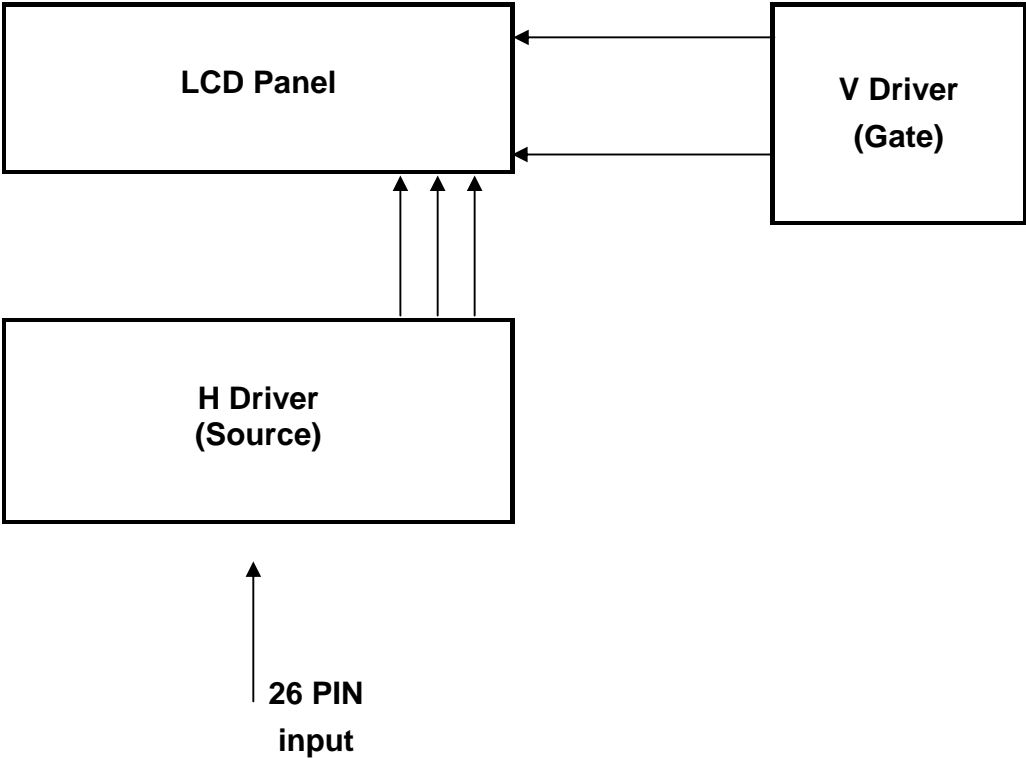
$$1. 10ms \leq T1 < T2$$

$$2. 0ms < T3 \leq T4 \leq 10ms$$

9.2 Pixel Arrangement and input connector pin NO.



10. Block Diagram



11. QUALITY ASSURANCE**11.1 Test Condition****11.1.1 Temperature and Humidity(Ambient Temperature)**Temperature : $20 \pm 5^{\circ}\text{C}$ Humidity : $65 \pm 5\%$ **11.1.2 Operation**

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

11.1.3 Container

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

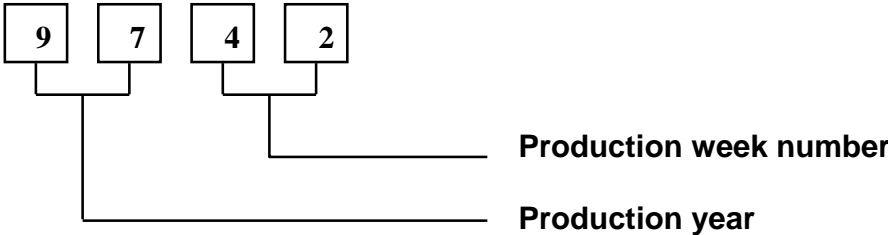
11.1.4 Test Frequency

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

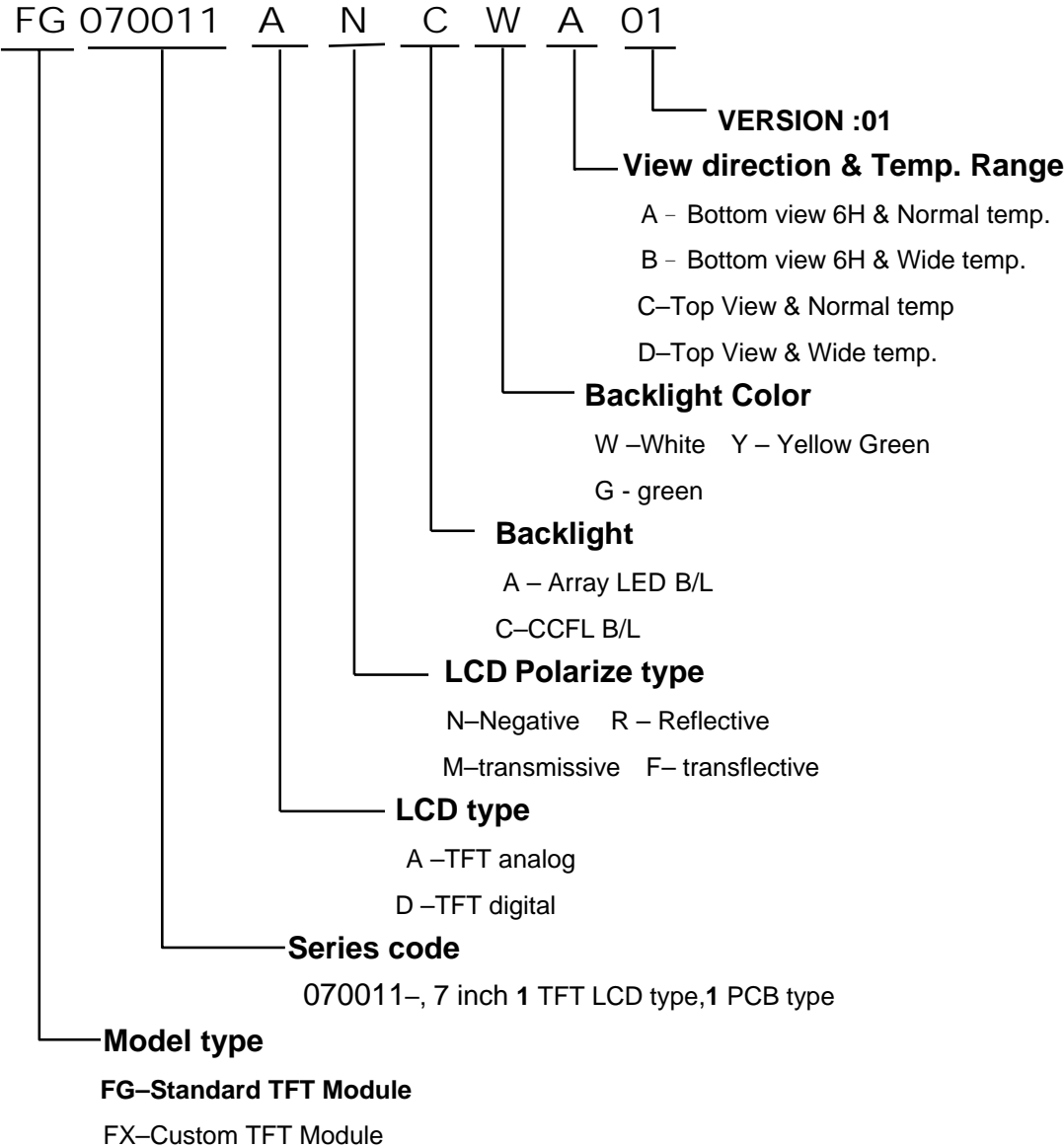
11.1.5 Test Method

No.	Reliability Test Item & Level	Test Level
1	High Temperature Storage Test	Ta = +70 °C, 240 hrs
2	Low Temperature Storage Test	Ta = -20°C, 240 hrs
3	High Temperature Operation Test	Ta = +60 °C, 240 hrs
4	Low Temperature Operation Test	Ta = 0°C, 240 hrs
5	High Temperature and High Humidity Operation Test	Ta = +60°C, 95%RH, 240 hrs
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 :10 ~ 55 Hz Amplitude :1.5 mm Sweep time : 11 mins 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 Contact: ±8KV, Air: ±15KV 10 times/point, 9 points/panel face

12. LOT NUMBERING SYSTEM



13. LCM NUMBERING SYSTEM



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 handling,

- (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 : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (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.

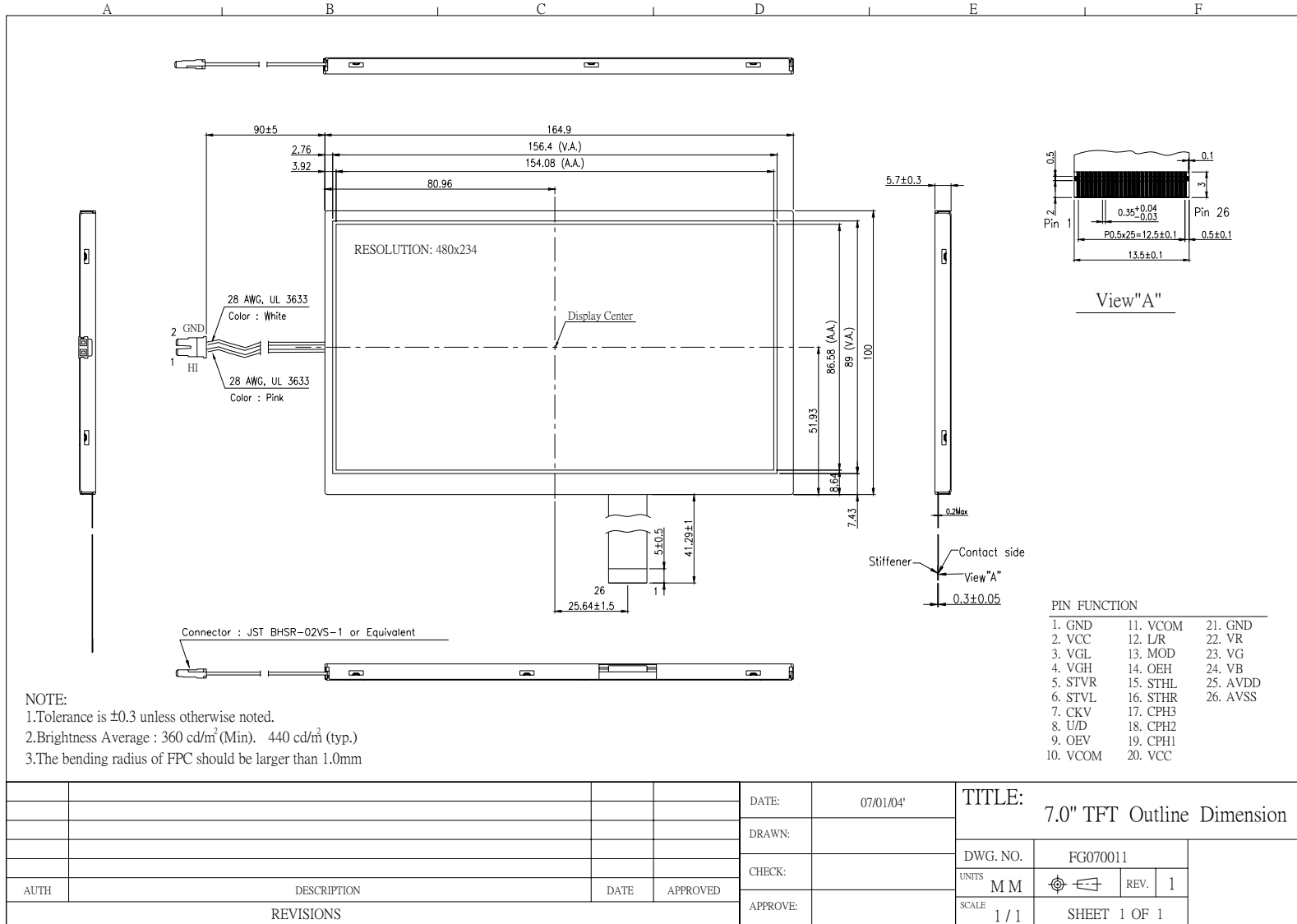
2.4 Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage V_0 .
- (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.

15. OUTLINE DRAWING



				DATE:	07/01/04'	TITLE:		7.0" TFT Outline Dimension	
				DRAWN:		DWG. NO.	FG070011		
				CHECK:		UNITS	M	REV.	1
AUTH	DESCRIPTION	DATE	APPROVED	APPROVE:		SCALE	1 / 1	SHEET 1 OF 1	
REVISIONS									