



# Chunghwa Picture Tubes, Ltd.

## Product Specification

Date : 2007/07/19

*TFT LCD*

**CLAA090JB02CW**

ACCEPTED BY : (V1.0)

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## 1. OVERVIEW

CLAA090JB02CW is 9" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs and backlight. By applying 640×220 images are displayed on the 9" diagonal screen. Inverter for backlight is not included in this module. General specification are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	202.56(H) × 105.27(V)
Number of Pixels	640 (H)x3(RGB) × 220(V)
Pixel Pitch (mm)	0.1055(H) × 0.4785(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white, TN
Number of Colors	Full color
Optimum Viewing Angle	6 o'clock
Brightness (cd/m <sup>2</sup> )	250nit(min)/300nit(typ)
Contrast Ratio	350:1(typ)
Response Time (ms)	30 (typ)
Viewing Angle	120 degree (Horizontal.)
	110 degree (Vertical)
Power Consumption	4.2W(typ.)
Module Size (mm)	219.4 (W)x 120.8(H) x 6.55(D)
Module Weight (g)	300g(typ.)
Backlight Unit	CCFL
Surface Treatment	Anti-Glare, 3H

## 2. ABSOLUTE MAXIMUM RATINGS

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

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage For LCD	VCC	-0.3	7.0	V	GND=0
	AVDD	-0.3	7	V	AVSS=0
	VGH	-0.3	25	V	GND=0
	VGL	-15	0.3	V	GND=0
Input Voltage	V <sub>i</sub>	-0.2	AVDD+0.2	V	Note2
	V <sub>I</sub>	-0.3	VCC+0.3	V	Note3
Static Electricity	VESDt	-200	+200	V	Note1
	VESDc	-15K	+15K	V	
Operating Temperature (Environment)	T <sub>op</sub>	-30	85	°C	Note 4
Storage Temperature	T <sub>stg</sub>	-40	95	°C	Note 4
Lamp Voltage	V <sub>L</sub>		825	Vrms	
Lamp Current	I <sub>L</sub>	4	7	mVrms	Note 5
Lamp Frequency	F <sub>L</sub>	40	80	kHz	
	T <sub>D</sub>	-	1	Sec.	Note 6

[Note]

Note1 : Test Condition: IEC 61000-4-2

VESDc : Contact discharge to input connector

VESDm : Contact discharge to module

Note2 : Analog input voltage VR, VG, VB

Note 3 : Logical signal STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D.

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 Typical operation conditions

( GND = Avss = 0V )

Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Power Supply Voltage	VCC	3	5	5.5	V	
	AVDD	4.5	5	5.5	V	
	VGH	17	18	19	V	
	VGL	-7	-6	-5	V	
Signal Amplitude (VR, VG, VB)	ViA	0.4	-	AVDD-0.4	V	Note1
	ViAC	-	4	-	V	Note1
	ViDC	-	AVDD/2	-	V	Note1
VCOM	VCAC	4	5.6	6.5	Vp-p	Note1,2
	VDC	1.8	2.0	2.2	V	Note1,3
Input Signal Voltage	VIH	0.7VCC	-	VCC	V	Note4
	VIL	0	-	0.3VCC	V	

[Note]

Note1 : Please refer to VCM-RGB diagram

Note2 : Brightness level is adjusted by varying this amplitude  $V_{CAC}$ Note3 : Please adjust  $V_{DC}$  to make the flicker level be minimum.

Note4 : logical signal STHL,STHR,OEHL,L/R,CPH1~CPH3,STVD,STVU,OEV,CKV,U/D

#### 3.2 Current consumption (GND = Avss = 0V )

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Drive Current	IGH	VGH =18V	-	0.12	1	mA	
	IGL	VGL = -6V	-	0.45	1	mA	
	ICC	VCC = 5V	-	2.5	4.5	mA	
	IDD	AVDD = 5V	-	9	24	mA	

#### 3.3 Timing characteristics of input signals

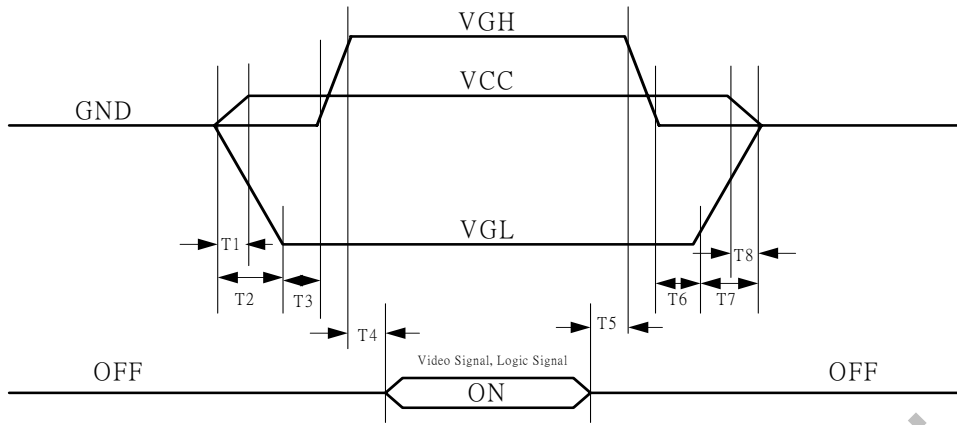
CHARACTERISTICS	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
1 Field scanning period	$T_{IV}$	-	262.5	-	H	
1 Line scanning period	$T_{IH}$	-	66.52	-	$\mu$ s	
Source driver operating frequency	$F_{OP}$	-	11.5	-	MHz	
CLK pulse width	$T_{CW}$	100	104	108	ns	
CLK pulse high period	$T_{CWH}$	40	50	60	ns	
CLK pulse low period	$T_{CWL}$	40	50	60	ns	
CLK pulse delay	TC12 TC23 TC31	32.5	35.1	38.2	ns	CPH1~CPH3
STH start pulse width	$T_{STH}$	30	85.3	-	ns	STHR,STHL
STH start pulse setup time	$T_{SUH}$	20	55.7	-	ns	STHR,STHL
STH start pulse hold time	$T_{HDH}$	10	28.8	-	ns	STHR,STHL
OEH output enable pulse width	$T_{OEH}$	1.5	2	2.5	$\mu$ s	OEH
Sample and hold disable time OEH&STH	$T_{OEH-STH}$	-	8.2	-	$\mu$ s	OEH-STH
CLKV pulse width	$T_{CKVW}$	5	63.5	-	$\mu$ s	CKV
CLKV pulse high period	$T_{CKVH}$	2.5	16.5	-	$\mu$ s	CKV
CLKV pulse low period	$T_{CKVL}$	2.5	47	-	$\mu$ s	CKV
STV start pulse width	$T_{STV}$	5	63.5	-	$\mu$ s	STVD, STVU
STV start pulse setup time	$T_{SUV}$	2.5	48	-	$\mu$ s	STVD, STVU
STV start pulse hold time	$T_{HDV}$	2.5	15.5	-	$\mu$ s	STVD,STVU

[Note1] 1. High level of source driver and gate driver logic signal are 70%

2. Low level of source driver and gate driver logic signal are 30%

[Note2] Please refer to Horizontal Timing sequence.and Vertical Timing sequence diagram

3.4 Sequence for power on/off and signal on/off



$$0 < T1 < T2 \leq 20\text{ms}$$

$$T3 \leq 10\text{ms}$$

$$T4 \leq 10\text{ms}$$

$$T5 \leq 10\text{ms}$$

$$T6 \leq 10\text{ms}$$

$$T8 < T7 \leq 10\text{ms}$$

3.5 Backlight

Ta=25°C

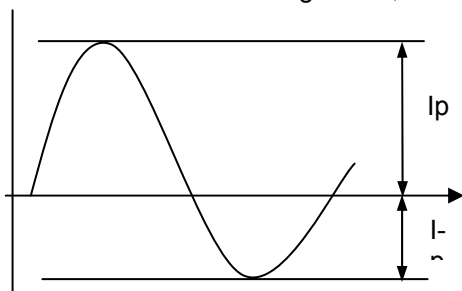
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Note
Lamp Voltage (IL=6mA)	V <sub>L</sub>	617	685	754	V	*1)
Lamp Current	I <sub>L</sub>	5.5	6	6.5	mA	*1)*2)
Inverter Frequency	F <sub>L</sub>	40	-	80	kHz	*1)*3)
Lamp life time *1)	Life L	15000			hr	*1)*4)
Starting Lamp Voltage	Ta=0°C	-	-	1530	V	*1)*5)*6)
	Ta=25°C	-	-	1180		

[Note]

- \*1) The time that module luminance reduced to 50% of initial value, Base on Ta=25°C, I<sub>L</sub>=6mA continuous.
- \*2) "Life time" is defined as the lamp brightness decrease to 50% original brightness at I<sub>L</sub> =6.0mA, continuous lighting, Ta=25
- \*3) For starting the backlight unit, the output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.
- \*4) If the driving waveform of Lamp is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Ar gas in it. Then it may cause the abnormal phenomenon of lighting-up. Therefore, designers have to try their best to for fill the conditions under the inverter designing-stage

as below :

- The degrees of unbalance : < 10%
- The ratio of wave height : <  $\sqrt{2} \pm 10\%$



I<sub>p</sub> : high side peak

I<sub>-p</sub> : low side peak

A : The degrees of unbalance =  $| I_p - I_{-p} | / I_{rms} \times 100 (\%)$

B : The ratio of wave height =  $I_p \text{ (or } I_{-p}) / I_{rms}$

\*5) Frequency in this range can make the characteristics of electric and optics maintain in +/- 10% except

hue. Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

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## 4. INTERFACE CONNECTION

### 4.1 CN1

Pin No.	SYMBOL	I/O	FUNCTION	NOTE
1	GND	-	Digital ground pin for Gate driver	
2	VCC		Supply power for gate digital circuit	
3	VGL		Gate driver negative voltage	
4	VGH		Gate driver positive voltage	
5	STVD	I/O	Gate scanning start signal	Note 1
6	STVU	I/O	Gate scanning start signal	Note 1
7	CKV		Gate driver scanning clock pulse	
8	U/D		Up/Down scanning change	Note 1
9	OEV		Gate driver output enable	
10	VCOM		Voltage applied to color filter substrate	
11	VCOM		Voltage applied to color filter substrate	
12	L/R		Left / Right scanning change	Note 2
13	MOD		Sampling mode change (H: Simultaneous, L: Sequential)	Note 3
14	OEH		Source driver output enable	
15	STHL	I/O	Source scanning start signal	Note 2
16	STHR	I/O	Source scanning start signal	Note 2
17	CPH3		Source driver clock input 3	
18	CPH2		Source driver clock input 2	
19	CHP1		Source driver clock input 1	
20	VCC		Supply power for source digital circuit	
21	GND	-	Digital ground pin for source driver	
22	VR		Red video signal	
23	VG		Green video signal	
24	VB		Blue video signal	
25	AVDD		Supply power for analog circuit	
26	AVSS	-	Analog ground pin	

Note1 : The function of STVD and STVU is changed as follows by the U/D terminal (up/down scanning)

U/D	STVD	STVU
H(VCC)	Signal Input	Signal Output
L(GND)	Signal Output	Signal Input

Note2 : The function of STHR and STHL is changed as follows by the L/R terminal(right/left scanning)

L/R	STHL	STHR
H(VCC)	Signal Input	Signal Output
L(GND)	Signal Output	Signal Input

Note3 : MOD=H:Simultaneous sampling (Set CPH2 and CPH3 to GND)  
MOD=L:Sequential sampling

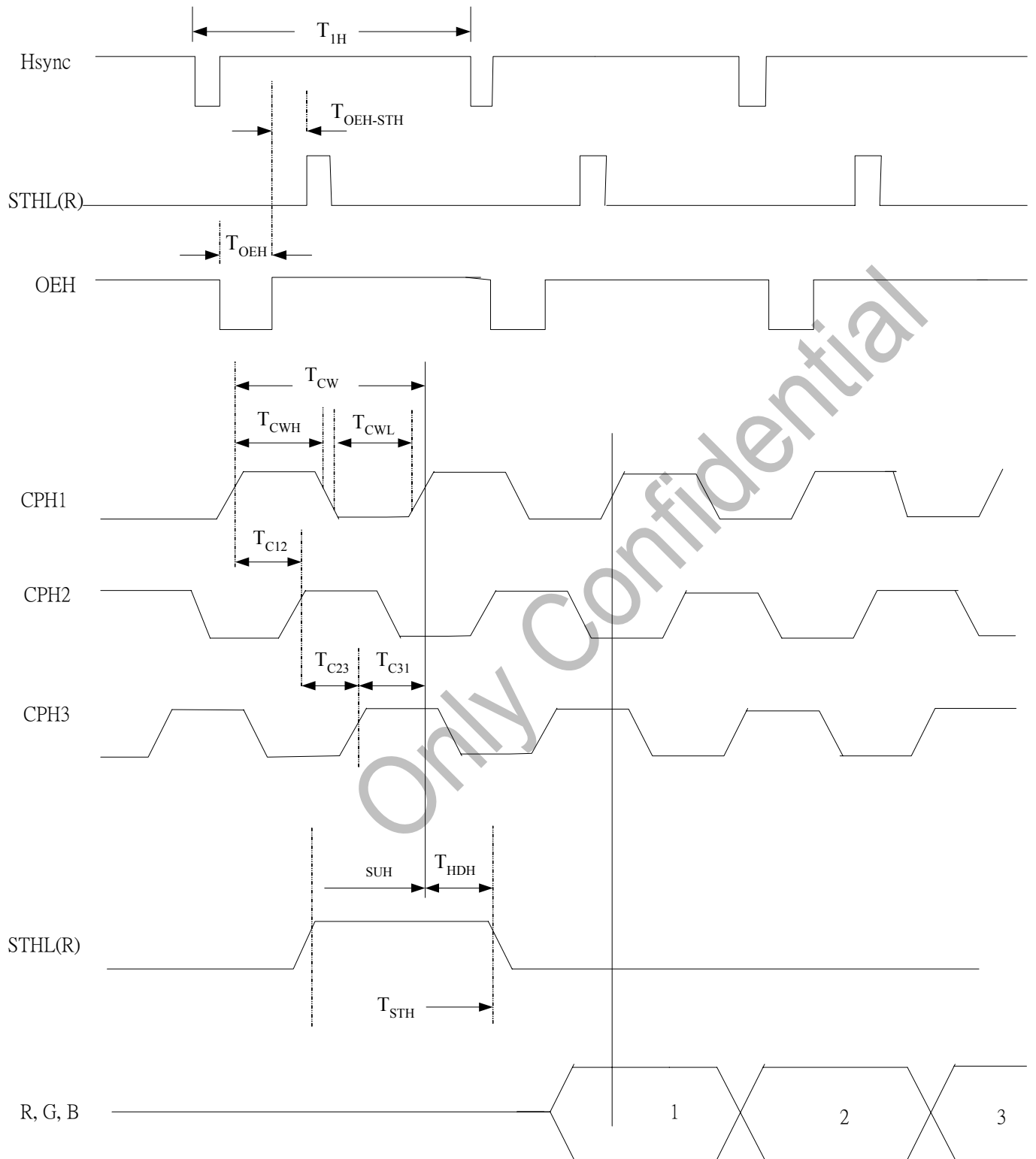


Fig.4 Horizontal Timing sequence

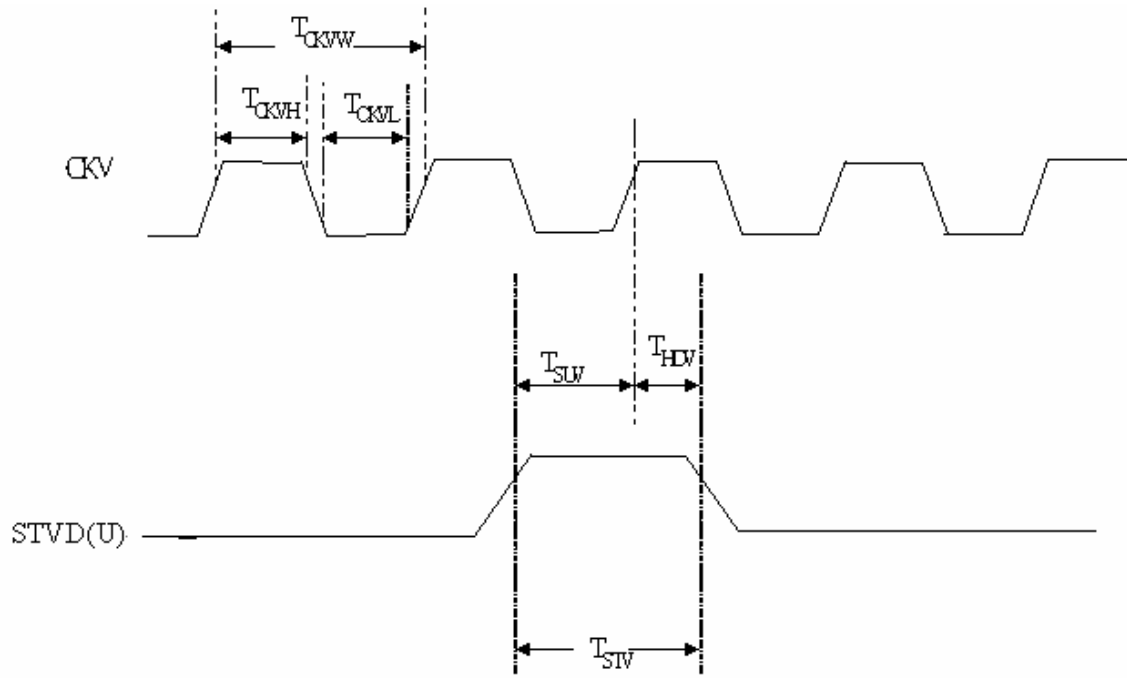


Fig.5 Vertical Timing sequence

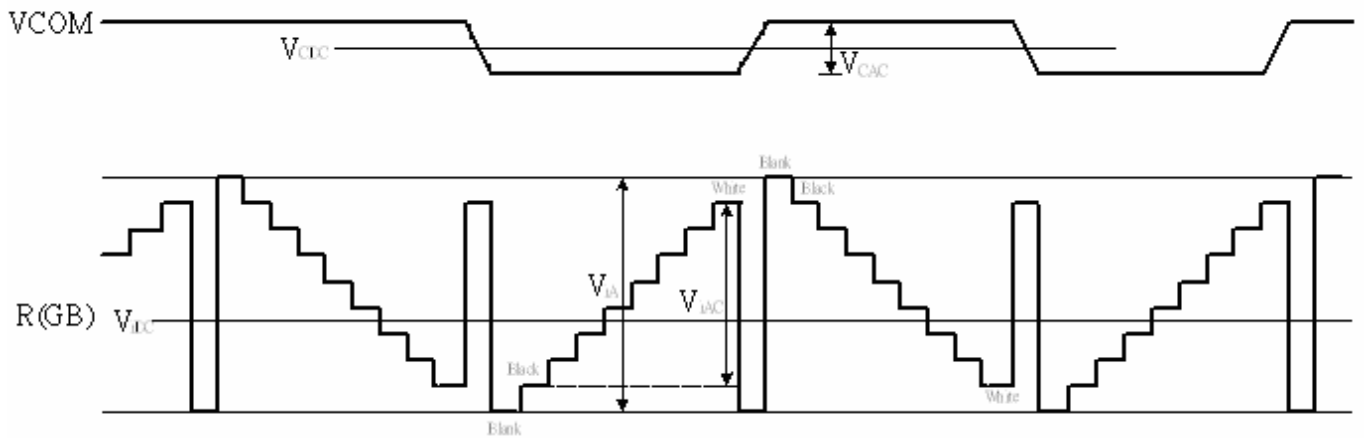


Fig.6 VCM-RGB

#### 4.2 CN2 (Back Light)

Backlight-side connector: BHSR-02VS-1 (JST made)

Pin No.	SYMBOL	FUNCTION
1	CTH	VBLH (High voltage)
2	CTL	VBLL (Low voltage)

[Note] : VBLH-VBLL=VL



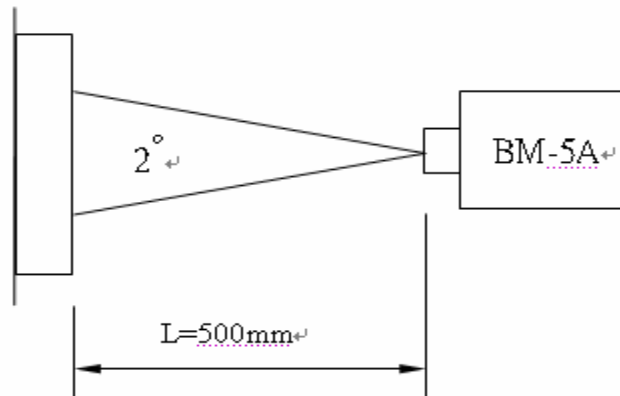
## 6. OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=3.3V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Contrast		CR	*1)	300	350	--	--
Luminance (CEN)		L	*1)	250	300	--	cd/m <sup>2</sup>
Luminance Uniformity		ΔL	*2)	70	80	--	%
Response Time		T	*4)	--	30	35	ms
View angle	Horizontal	ψ*3)	CR ≥ 10 Point-5	110	120		°
	Vertical	θ*3)		100	110		°
Color Coordinate	White	x	Point-5	0.283	0.313	0.343	
		y		0.299	0.329	0.359	
	Red	x	Point-5	0.552	0.582	0.612	
		y		0.285	0.315	0.345	
Green	x	Point-5	0.275	0.305	0.335		
	y		0.548	0.578	0.608		
Blue	x	Point-5	0.121	0.151	0.181		
	y		0.099	0.129	0.159		

### [Note]

- These items are measured by BM-5A (TOPCON) in the dark room (no ambient light), viewing cone = 2° , VCC=3.3V , I<sub>L</sub>=6mA , Inverter= EMAX PLCD0607101C(57kHz)



### \*1) Definition of contrast ratio

Measure contrast ratio on the #5 points (refer to figure1) .

Contrast ratio is calculated with the following formula :

Contrast Ratio (CR)= (White) Luminance of ON ÷ (Black) Luminance of OFF

\*2) Definition of Luminance Uniformity :

Measure maximum luminance(L(MAX) )and minimum luminance (L(MIN) )on the 9 points as figure 1(#1~#9 poin).Luminance Uniformity is calculated with the following formula :

$$\Delta L = (L(MIN) \div L (MAX)) \times 100$$

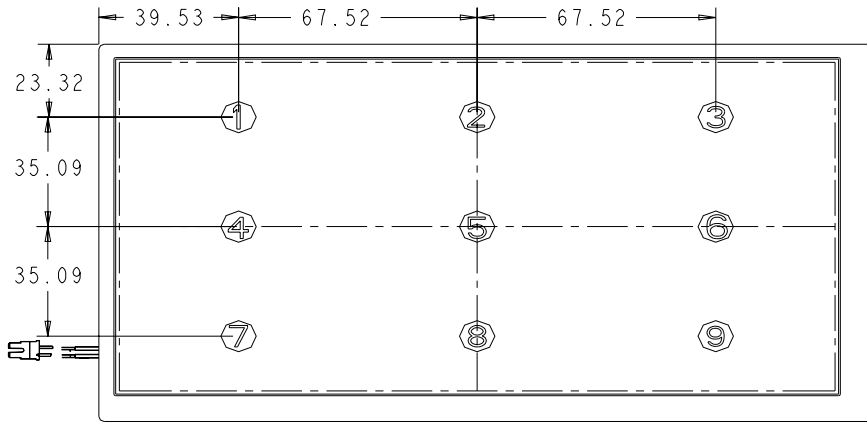


Fig.1 Measuring point

\*3) Definition of Viewing Angle( $\theta, \psi$ ),refer to Fig.2 as below :

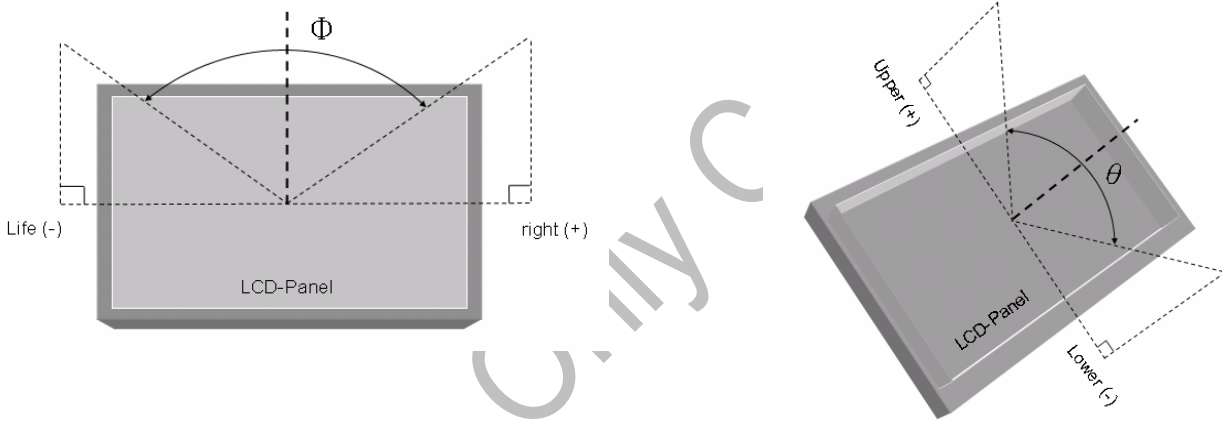


Fig.2 Definition of Viewing Angle

\*4) Definition of Response Time.

The response time is defined as the time interval between the 10% and 90% amplitudes.Refer to figure 3 as below.

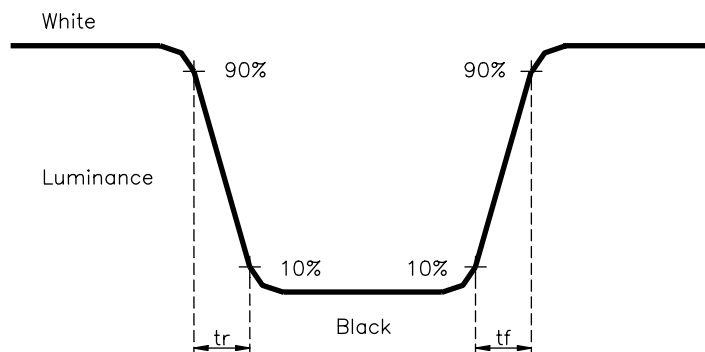


Fig.3 Definition of Response Time

## 7. RELIABILITY TEST CONDITIONS

### 7.1 Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	85°C; 240hrs
High Temperature High Humidity Operation	60°C; 90%RH; 240hrs (No condensation)
High Temperature Storage	95°C; 240hrs
Low Temperature Operation	-30°C; 240hrs (Backlight unit always turn on)
Low Temperature Storage	-40°C; 240hrs
Thermal Shock (No operation)	Between -30°C (0.5hr) and 85°C (0.5hr); 200 Cycles

### 7.2 Shock & Vibration

ITEMS	CONDITIONS
Shock (Non-Operation)	980m/S <sup>2</sup> (equal to 100G), 6ms, (1/2 Sine wave), Each axis X,Y,Z.
Vibration (Non-Operation)	Frequency range:8~33.3Hz Stoke : 1.3 mm Vibration: sinusoidal wave, perpendicular axis(both x,z axis: 2Hrs , y axis: 4Hrs). Sweep: 2.9G, 33.3~400Hz Cycle: 15 min

### 7.3 Electrostatic Discharge

TEST ITEM	CONDITIONS	Note
ESD	150pF , 330Ω , ±8kV&±15kV air & contact test	(1)
	200pF , 0Ω , ±200V contact test	(2)

[NOTE] Measure point : (1) LCD glass and metal bezel  
(2) IF connector pins

### 7.4 Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.

(Partial transformation of the module parts should be ignored.)

Fail: No display image, obvious non-uniformity, or line defects.