Chunghwa Picture Tubes, Ltd.
Technical Specification

To :

Date :

TFT LCD

CLAA070VA02

ACCEPTED BY :

- Tentative-

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REVISION STATUS

Revision Notice	Description	Page	Rev. Date
	Tentative Revision		2005/08/01

Catalog

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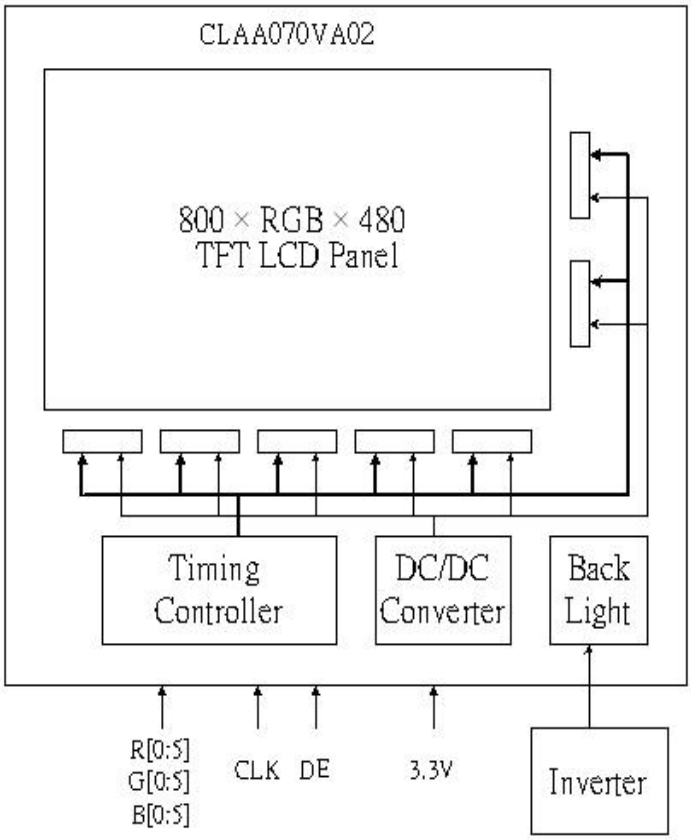
1. OVERVIEW

CLAA070VA02 **is Automobile 7" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs , and backlight. Utilizes a panel with a 16:9 aspect ratio.**

The 7.0" screen produces a high resolution image that is composed of 384,000(800×480) pixel elements in a stripe arrangement. Inverter for backlight is not included in this module.



General specifications are summarized in the following table:

ITEM	SPECIFICATION
Panel Size	7 inch
Display Area (in mm)	152.4(W) x 91.44(H)
View Area (in mm)	154.8(W) x 93.84(H)
Number of Pixels	800(W) x 480(H)
Pixel Pitch (in mm)	0.1905x0.1905
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally white
Number of color	262k
Brightness(cd/m^2)	400nit(min)/500nit(typ)(6.0 mA)
Contrast Ratio	400:1
Response Time (Tr+Tf)	30ms (typ)
Outline Dimension (in mm)	165.0 (W) x 104.0(H) x 6.0(D)
Viewing Angle(Typical) (BL On,CR>10)	140 degree (Horizontal.) 100 degree (vertical)
NTSC ratio	50%
Driving Method	TFT active matrix
BL unit	CCFL，1 lamp (L -TYPE)
Electrical Interface	TTL
Viewing Direction	6 o'clock
Surface Treatment	Anti-Glare， Hardness:3H
Weight (g)	160(Max)

2.FEATURE:

1. 7 inch TFT AMLCD, wide screen (16:9).

2. 6 bit TTL data signal input, resolution 800×480×RGB WVGA.
3. Maximum data clock rate: 50 MHz.
4. Input interface voltage: 3.3 V.
5. Data enable mode.
6. Data inverted function for reducing EMI.
7. Maximum power consumption: below 3.5 W.

3.ABSOLUTE MAXIMUM RATINGS

The following values are maximum operation conditions. If exceeded, it may cause faulty operation or damage.

ITEM	SYMBOL	MIN	MAX	UNIT	NOTE
Digital Power Voltage (Source)	VDDD	-0.5	5	V	
Digital Power Voltage (Gate)	VCC(G)	-0.3	6	V	
Analog Power Voltage	AVDD	-0.5	12.0	V	
Gamma Voltage	VR1~VR5	0.4AVDD	AVDD+0.3		
Gamma Voltage	VR6~VR10	-0.3	0.6AVDD	V	
Gate On Voltage	VDDG	-0.3	40	V	*3)
Gate Off Voltage	VEEG	-20	0.3	V	*3)
Lamp Voltage	VL	--	616	Vrms	*1)
Lamp Current	IL	2	6.5	mArms	*2)
Inverter Frequency	FL	(40)	(60)	kHz	

*1)The Lamp Voltage max=616 mArms while Lamp Current is 6 mA

*2)The Min of Lamp Current is Inverter adjust brightness tolerance by analog type, but not ensure optical characteristics would be the typical data.

*3)VDDG_MAX – VEEG_MIN= V_{GH} – V_{GL} = 40 V

4.ELECTRICAL CHARACTERISTICS

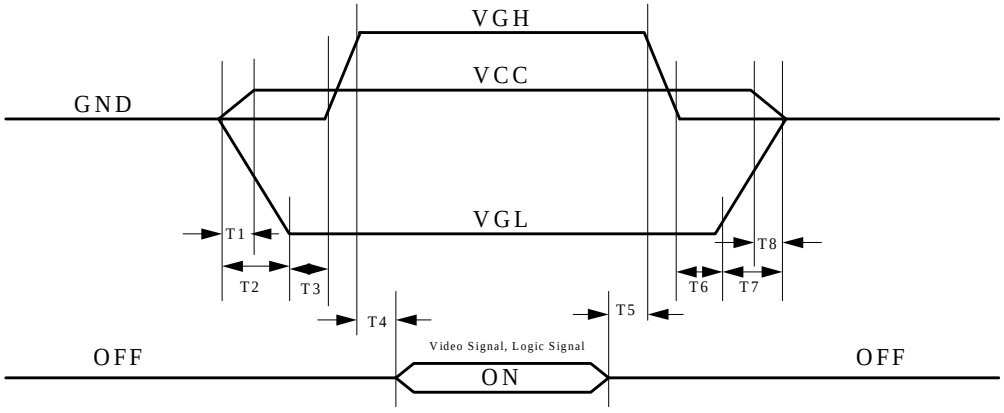
(a)TFT LCD POWER VOLTAGE

Ta=25 ℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Digital Power Voltage (Source)	VDDD	3.0	3.3	3.6	V	
Digital Power Voltage (Gate)	VCC(G)	3.0	3.3	3.6	V	
Analog Power Voltage	AVDD	9.2	9.6	10.0	V	[Note 1]
Gate On Power Voltage	VDDG	14	15	16	V	[Note 2]
Gate Off Power Voltage	VEEG	-6.6	-6.0	-5.4	V	
Common Power Voltage	VCOM	3.4	4.4	5.4	V	

[Note 1] Source、signal sequence

[Note 2] Please adjust V_{CDC} to make the flicker level be minimum.



0<T1 <T2≦ 20ms

T3 ≦ 10ms

T4≦ 10ms

T5≦ 10ms

T6≦ 10ms

T8<T7≦ 10ms

(b) TFT-LCD Power Current

Ta=25 ℃

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Digital Power Current(Source)	IVCC(S)	VCC=3.3V	-	2.8	10	mA	
Digital Power Current (Gate)	IVCC(G)	VCC=3.3V	-	12	100	uA	
Analog Power Current	IAVDD	AVDD=9.6V	-	29.2	60	mA	
Gate on Power Current	IVDDG	VDDG=15V	-	131	200	uA	
Gate off Power Current	IVEEG	VEEG=-6V	-	178	-200	uA	

(c)Backlight

Ta=25 ℃

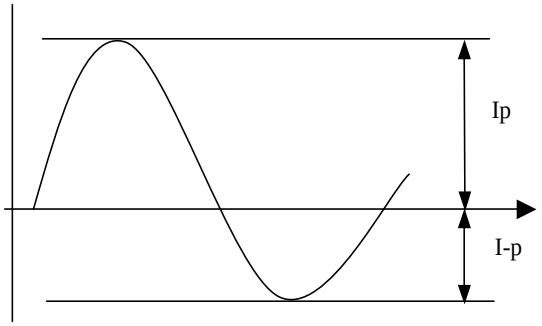
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Lamp Voltage		VL	504	560	616	V	IL=6.0mA
Lamp Current		IL	5.5	6	6.5	mA	*1)
Lamp Frequency		FI	(50)	-	(60)	kHz	*3)
Lamp life time		LT	20,000	-	-	hr	*2)*3)*4)IL=6.0mA，operation
Turn on and off life		-	100000	-	-	times	*2)*3)*4)IL=6.0mA，operation time cycle 30s
Starting Lamp Voltage	Ta=0℃	Vs	-	-	1270	V	*4)
	Ta=25℃		-	-	1060		
Power consumption		PBL	-	(3.36)	-	Watt	VL*IL, IL=6.0mA

[Note]

measure with Inverter：EMAX，type：PLCD0607101C

If the waveform of light up-driving 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 forfill the conditions under the inverter designing-stage as below:

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



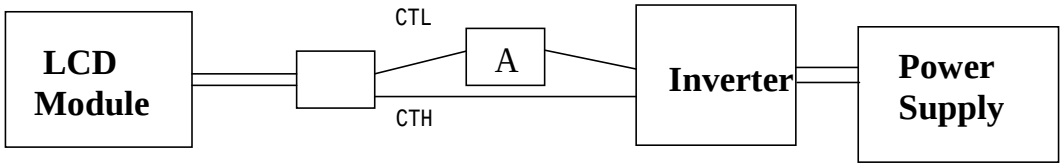
Ip：high side peak

I-p：low side peak

A：The degrees of unbalance = ｜Ip – I-p｜/ Irms ×100 (%)

B：The ratio of wave height = Ip (or I-p) / Irms

*1) Lamp Current measurement method (The current meter is inserted in cold line)



*2) Definition of the lamp life time：Luminance(L) under 50% of specification starting lamp voltage.

*3) 1.Frequency in this range can mala the characterisitics of electric and optics maintain in +/- 10% except hue.

2.Lamp frequency of inverter may produce interference with horizontal synchronous frequency (or vertical synchronous frequency),and this may cause ripple noise on the display. Therefore, please adjust lamp requency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

*4) 1.Starting Lamp Voltage: Vs = initial value Vs

2.Definition of starting lamp voltage means max. voltage of starting lamp. We suggest the inverter starting voltage greater then max. voltage of starting lamp to certify starting lamp stability.

5.INTERFACE CONNECTION:

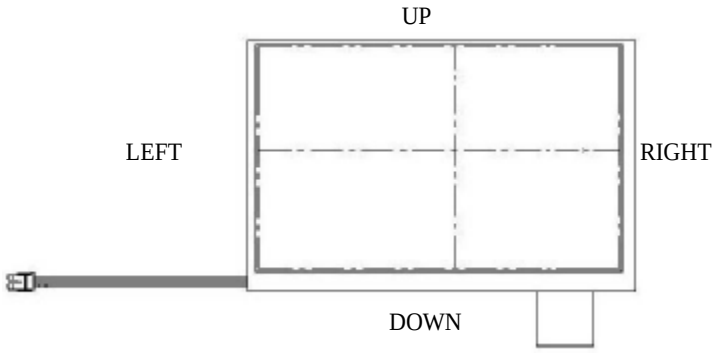
CN1:

Pin NO.	SYMBOL	DESCRIPTION
1	VCOM	Common Voltage
2	VCOM	Common Voltage
3	DIO1	Horizontal start Pulse Signal I/O
4	VDDD	Power Supply for Digital Circuit
5	CLK	Horizontal Clock
6	SHL	Select Left / Right Shift
7	D00	Red Data (LSB)
8	D01	Red Data
9	D02	Red Data
10	D03	Red Data
11	D04	Red Data
12	D05	Red Data (MSB)
13	D10	Green Data (LSB)
14	D11	Green Data
15	D12	Green Data
16	D13	Green Data
17	D14	Green Data
18	D15	Green Data (MSB)
19	AVDD(S)	Power Supply for Analog Circuit
20	VR1	Gamma Voltage Level 1
21	VR 2	Gamma Voltage Level 2
22	VR 3	Gamma Voltage Level 3
23	VR 4	Gamma Voltage Level 4
24	VR 5	Gamma Voltage Level 5
25	VR 6	Gamma Voltage Level 6
26	VR 7	Gamma Voltage Level 7
27	VR 8	Gamma Voltage Level 8
28	VR 9	Gamma Voltage Level 9
29	VR 10	Gamma Voltage Level 10
30	AVSS(S)	Power Ground
31	D20	Blue Data (LSB)
32	D21	Blue Data
33	D22	Blue Data
34	D23	Blue Data
35	D24	Blue Data
36	D25	Blue Data (MSB)
37	LD	Latch The Polarity of Output and Switch The New Data to Output
38	REV	Control Signals are Inverted or not
39	POL	Polarity Selection
40	GND(S)	Power Ground
41	DIO2	Horizontal start Pulse Signal I/O
42	OEV	Output Enable
43	UD	Up / Down Control Pin
44	VCLK	Vertical Clock
45	STVU	Vertical start Pulse Signal I/O
46	STVD	Vertical start Pulse Signal I/O Ground
47	VDDG	Gate ON Voltage
48	VEEG	Gate OFF Voltage
49	VCC(G)	Power Supply for Digital Circuit
50	GND(G)	Power Ground

Remarks：

1)GND Pin must ground contact，can not be floating.

2)SHL：Select left or right



SHL	DIO1	DIO2	SHIFT
1	Input	Output	Right
0	Output	Input	Left

3)UD：Shift up or down control

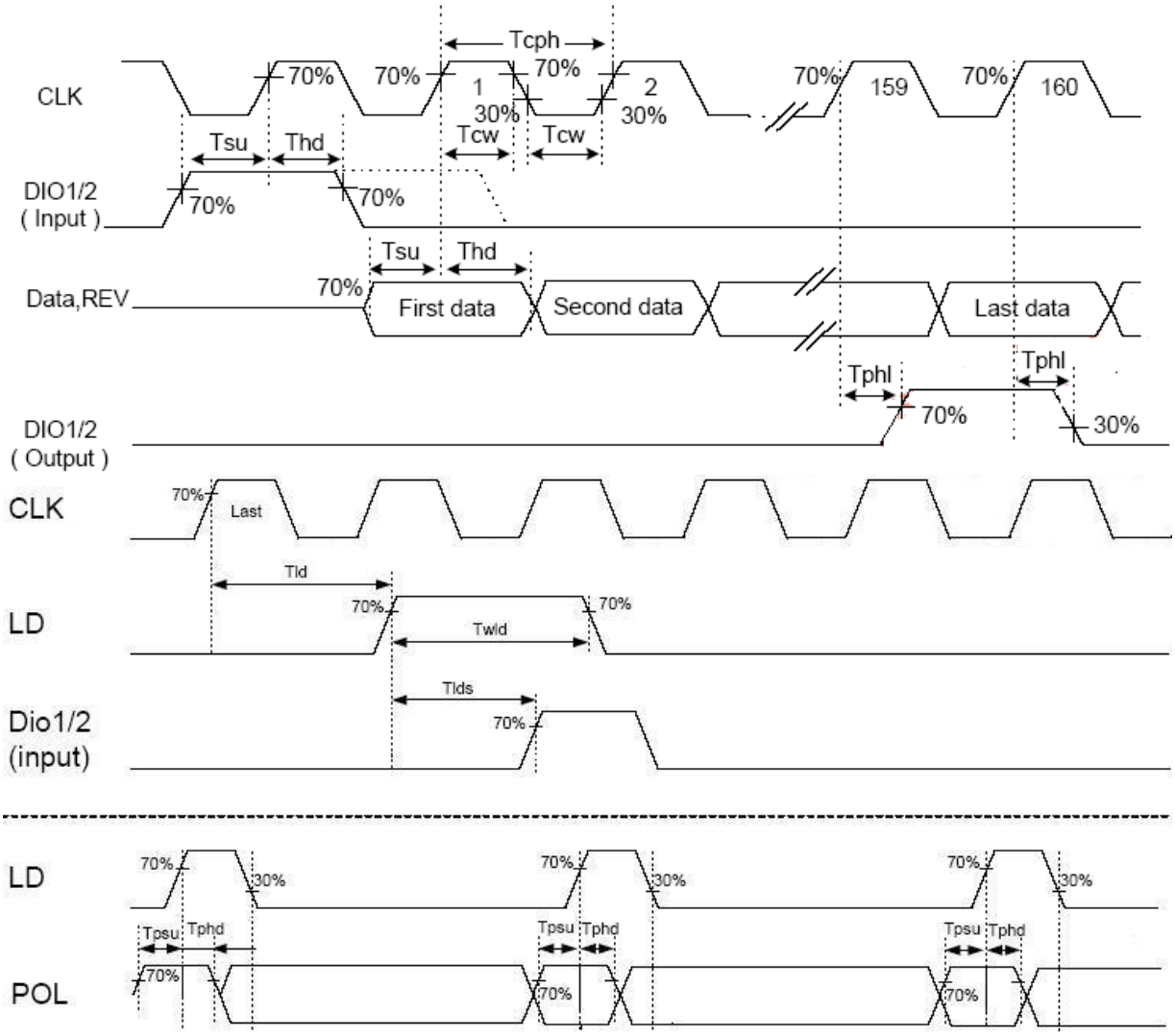
UD	STVD	STVU	SHIFT
1	Input	Output	UP
0	Output	Input	Down

4)Gamma Voltage(Reference Only)

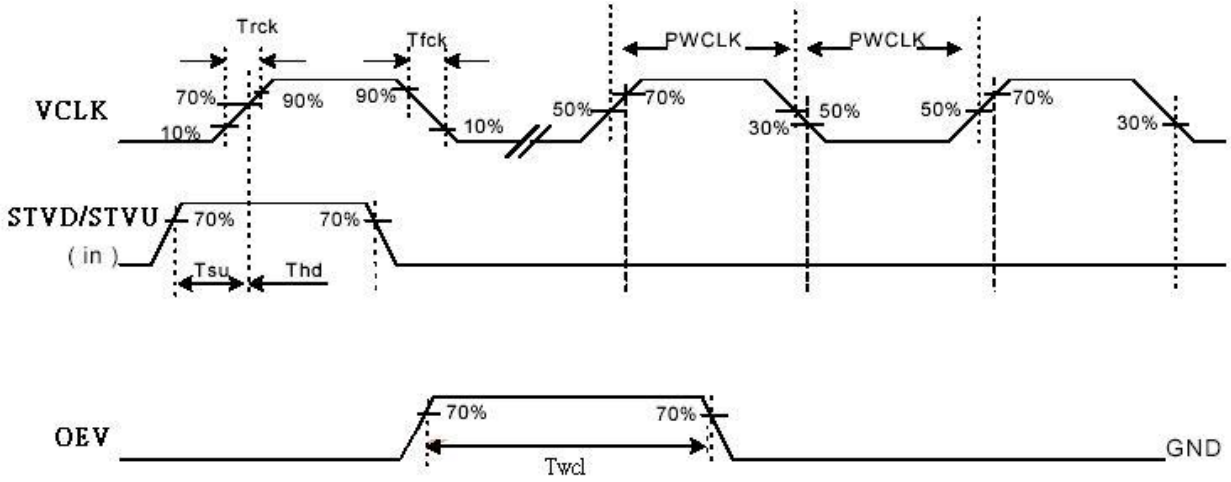
項目	VR1	VR2	VR3	VR4	VR5	VR6	VR7	VR8	VR9	VR10
單位(V)	9.21	7.91	7.27	6.83	5.82	4.02	3.02	2.59	2.06	0.21

6.INPUT SIGNAL (DE mode only):

a) Horizontal Timing



b) Vertical Timing



c) Timing Specification

ITEM	SYMBOL	SPEC			UNIT
		Min	Typ	Max	
CLK Frequency	**Fclk**	25	27	45	MHz
CLK Period	**Tclk**	22	37	40	ns
CLK Pulse Width	**Tcw**	8		-	ns
Data Set-up Time	**Tsu**	4	-	-	ns
Data Hold Time	**Thd**	2	-	-	ns
Propagation Delay of DIO2/1	**Tphl**	6	10	15	ns
Time That The Last Data to LD	**Tld**	1	-	-	Tcph
Pulse Width of LD	**Twld**	2	-	-	Tcph
Time That LD to DIO1/2	**Tlds**	5	-	-	Tcph
POL Set-up Time	**Tpsu**	6	-	-	ns
POL Hold Time	**Tphd**	6	-	-	ns
Output Stable Time	**Tst**	-	-	12	us
VCLK Rise Time	**Trck**	-	-	100	ns
VCLK Falling Time	**Tfck**	-	-	100	ns
VCLK Pulse Width (High & Low)	**PWCLK**	500	-	-	ns
STVD/STVU Set-up Time	**Tsu**	200	-	-	ns
STVD/STVU Hold Time	**Thd**	300	-	-	ns
Output Enabled pulse width	**Twcl**	1	-		us

d)Color Data Assignment

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

(1) Definition of Gray Scale

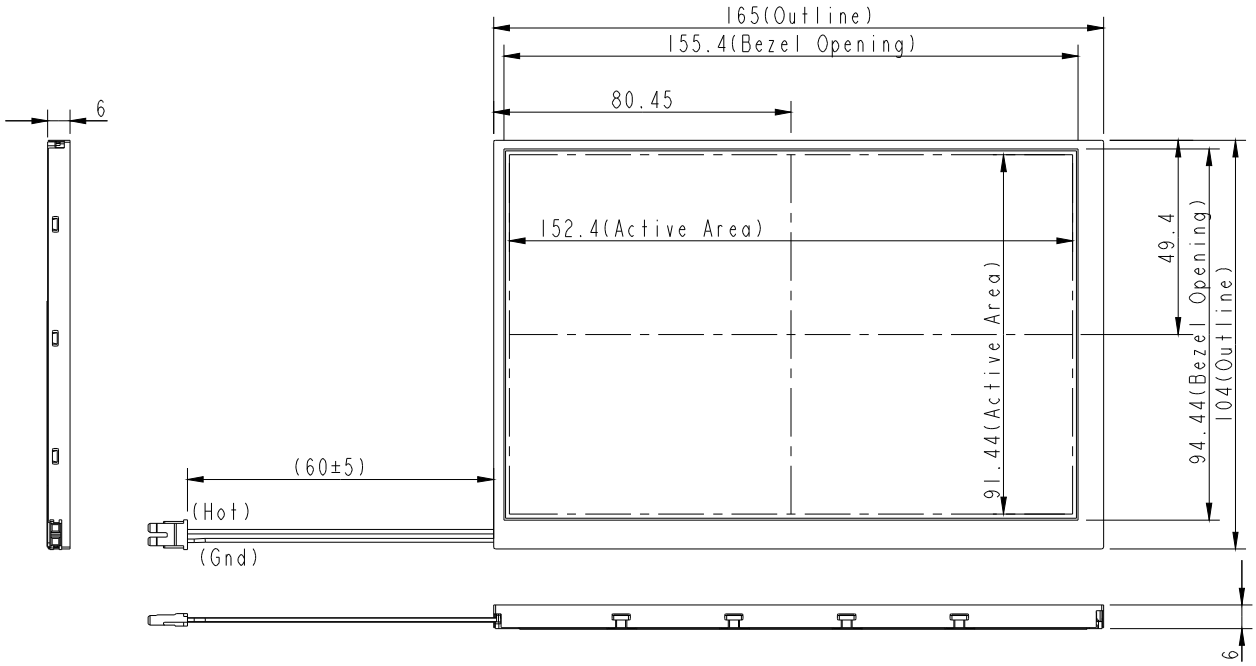
color(n)：n is series of Gray Scale

The more n value is, the bright Gray Scale.

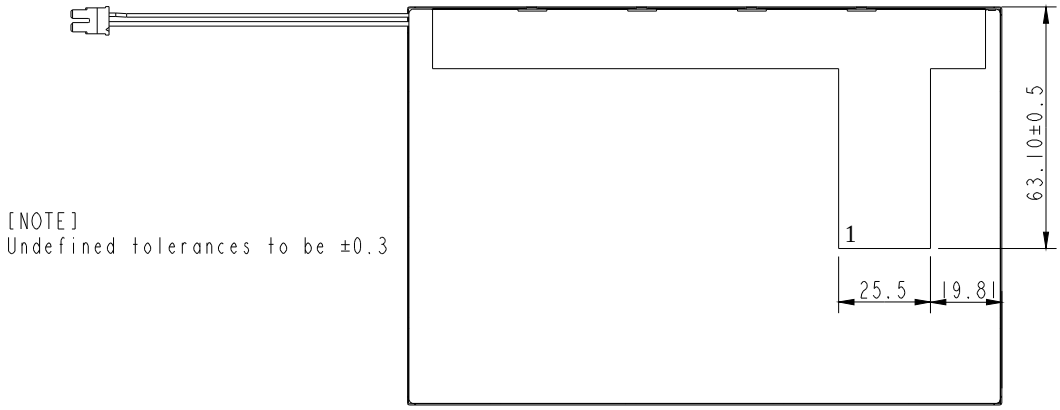
(2)Data:1-High,0-Low

7. MECHANICAL DIMENSION

(1) Front / Rear side [Unit: mm]



(2)Rear side [Unit: mm]



8. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio		CR	$\theta = \phi = 0°$ Point-5	320	400	--	--	*1) &*2)
Luminance *)		L	$*\theta = \phi = 0°$	400	500	--	cd/m^2	*2) &*3)
Luminance Uniformity		ΔL	$*\theta = \phi = 0°$	--		--20	%	*2) &*3)
Response Time		Tr+ Tf	$*\theta = \phi = 0°$	--	30	--35	ms	*5)
Viewing Angle	Horizontal	ϕ	CR≧10	120	130	--	°	*4)
	Vertical	θ	Point-5	90	100	--	°	*4)
Color Coordinate	White	Wx Wy	$\theta = \phi = 0°$ Point-5	0.293 0.309	0.313 0.329	0.333 0.349		
Color Coordinate	Red	Rx Ry		TBD	TBD	TBD	-- --	
Color Coordinate	Green	Gx Gy		TBD	TBD	TBD	-- --	*2)
Color Coordinate	Blue	Bx By		TBD	TBD	TBD		

Ta=25℃，VCC=3.3V

[Note]

- These items are measured by BM-5A (TOPCON) or CA-1000(MINOLTA) in the dark room. (no ambient light).
- Brightness conditions : I_L = 6.0 mA ,

*1) Definition of contrast ratio：

Measure contrast ratio on the below 5 points (refer to figure1, #1~#5 point) and take the average value. Contrast ratio is calculated with the following formula ：

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

*2) Definition of luminance：

Measure white luminance on the same 5 points and take the average value.

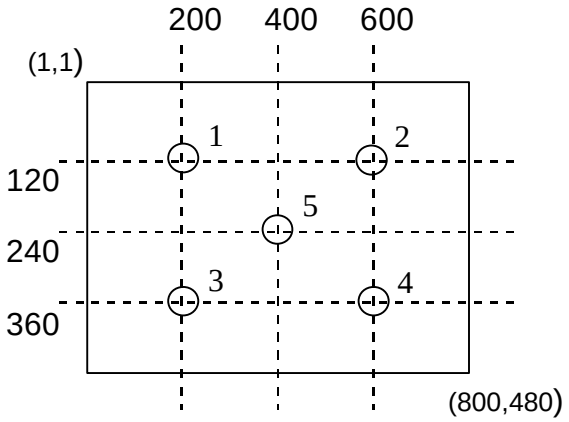


Fig.1 Measuring point

*3) Definition of Luminance Uniformity

Measure maximum luminance(L(MAX))and minimum luminance (L(MIN))on the 5 points as figure 1.Luminance Uniformity is calculated with the following formula ：

△L = [L(MAX)/L(MIN)-1]×100

*4) Definition of Viewing Angle(θ , ϕ),refer to Fig.2 as below：

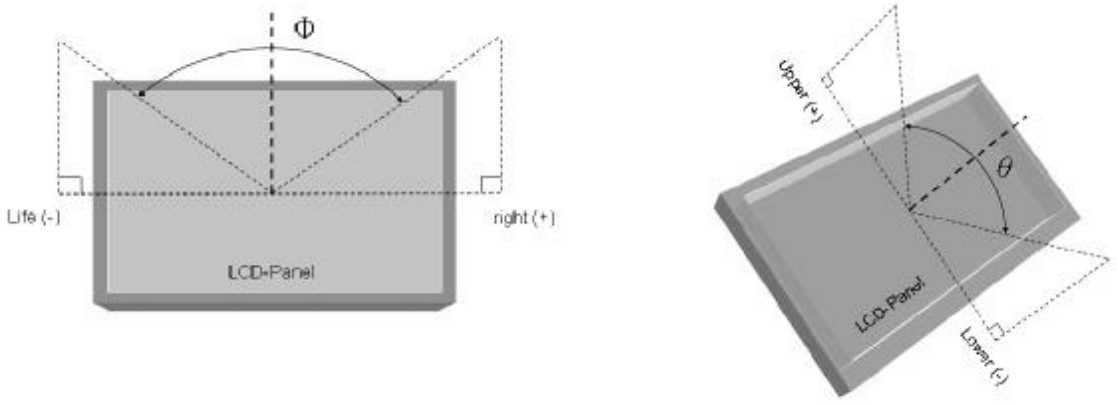


Fig.2 Definition of Viewing Angle

*5) Definition of Response Time.(White-Black)

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

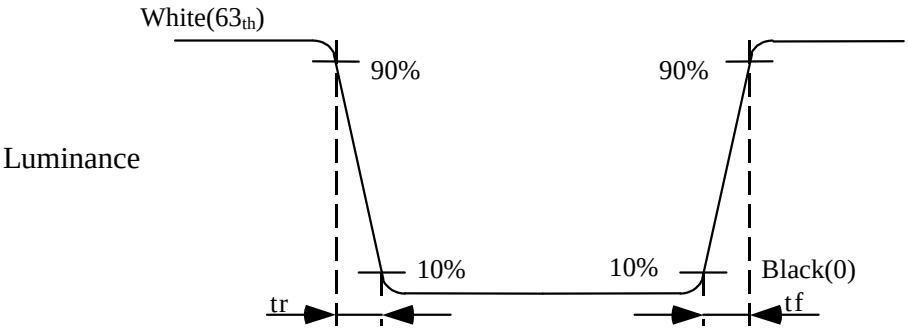


Fig.3 Definition of Response Time

10. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
HIGH TEMPERATURE OPERATION	85°C ；1000Hrs
HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	60°C ；90% RH； 1000Hrs(No condensation)
HIGH TEMPERATURE STORAGE	90°C ；1000Hrs
LOW TEMPERATURE OPERATION	-30°C ；1000Hrs, Backlight unit always turn on
LOW TEMPERATURE STORAGE	-40°C ；1000Hrs
THERMAL SHOCK (No operation)	-30°C(1Hr)～85°C(1Hr) 200 CYCLE

(2) Shock & Vibration

TEST ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	l 980m/S^2(equal to 100G), 6ms l (1/2 Sine wave),XYZ
VIBRATION (NON-OPERATION)	l Frequency range:8~33.3Hzl Stoke：1.3 mm l Vibration: sinusoidal wave, perpendicular axis(both x,z axis: 2Hrs , y axis: 4Hrs).l Sweep: 2.9G,33.3~400Hzl Cycle: 15 min

(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

(4) The judgment of the above test

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.

11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products;

(A) ASSEMBLY PRECAUTION

(1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.

(2) Please design display housing in accordance with the following guide lines.

(2.1) Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.

(2.2) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.

(2.3) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.

(2.4) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.

(2.5) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.

(3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

(4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

(5) Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.

(6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

(7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

(8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

(9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting wit inverter.

(B) OPERATING PRECAUTIONS

(1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

(2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.

(3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

(4) A condensation might happen on the surface and inside of LCD module in case of sudden

charge of ambient temperature.

(5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.

(6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

(C) PRECAUTIONS WITHELECTROSTATICS

(1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

(2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

(D) STORAGE PRECAUTIONS

(1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.

(2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH.

(3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

(E) SAFETY PRECAUTIONS

(1) When you waste LCDS, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off throughly with soap and water.

(F) OTHERS

(1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.

(2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

(3) For the. packaging box, please pay attention to the followings:

(3.1) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.

(3.2) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.

(3.3) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.

(3.4) Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)