

# 希恩凯电子有限公司

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## PRODUCT SPECIFICATION

MODEL:CNKT090-18001A1

<◇> PRELIMINARY SPECIFICATION

<◆> APPROVAL SPECIFICATION

CUSTOMER
APPROVED BY
DATE:

DESIGNED	CHECKED	APPROVED

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## REVISION STATUS

Version	Revise Date	Page	Content	Modified by
V1.1	2017.10.20	-	FirstIssued.	ChenQi

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# 1. GENERAL DESCRIPTION

## 1.1 DESCRIPTION

M090BOEDD50PEK is a color active matrix thin film transistor(TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This module is composed of a TFT LCD panel, driver ICs, FPC and a Backlight unit.

## 1.2 FEATURES:

No.	Item	Specification	Unit
1	Panel Size	9"	inch
2	Number of Pixels	800(H) × 3(RGB) × 480(V)	pixels
3	Active Area	198(W) × 111.696(H)	mm
4	Pixel Pitch	0.2475(W) × 0.2327(H)	mm
5	Outline Dimension	210.7(W) × 126.4(H) × 5.5(T)	mm
6	Pixel arrangement	RGB vertical stripe	-
7	Display Mode	Normally White	-
8	Viewing Direction	6 o'clock	-
9	Display Color	16.7M	-
10	Luminance(cd/m <sup>2</sup> )	250(TYP.)	nit
11	Contrast Ratio	350(TYP.)	-
12	Surface Treatment	Anti-Glare	-
13	Interface	24bit-TTL	-
14	Backlight	White LED	-
15	Drive IC	-	-
16	Operation Temperature	-10~65	°C
17	Storage Temperature	-20~70	°C
18	Weight	TBD	g



### 3. PIN DESCRIPTION

FPC Connector is used for the module electronics interface. The recommended model is FH12A-50S-0.5SH manufactured by Hirose.

No.	Symbol	I/O	Function	Remark
1	LED+	P	Power for LED backlight (Anode)	Note 8
2	LED+	P	Power for LED backlight (Anode)	Note 8
3	LED-	P	Power for LED backlight (Cathode)	Note 8
4	LED-	P	Power for LED backlight (Cathode)	Note 8
5	GND	P	Power ground	
6	VCOM	I	Common voltage	
7	DVDD	P	Power for Digital Circuit	
8	MODE	I	DE/SYNC mode select	Note 1
9	DE	I	Data Input Enable	
10	VS	I	Vertical sync input	
11	HS	I	Horizontal sync input	
12	B7	I	Blue data(MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	Note 2
19	B0	I	Blue data(LSB)	Note 2
20	G7	I	Green data(MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data(LSB)	Note 2
28	R7	I	Red data(MSB)	Note 2
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	Note 2
35	R0	I	Red data(LSB)	Note 2
36	GND	P	Power Ground	
37	DCLK	I	Clock input	Note 3
38	GND	P	Power Ground	

39	L/R	I	Left / right selection	Note 4,5
40	U/D	I	Up/down selection	Note 4,5
41	VGH	P	Gate ON Voltage	
42	VGL	P	Gate OFF Voltage	
43	AVDD	P	Power for Analog Circuit	
44	RESET	I	Global reset pin.	Note 6
45	NC	-	No connection	
46	VCOM	I	Common Voltage	Note 7
47	DITHB	I	Dithering function	
48	GND	P	Power Ground	
49	NC	-	No connection	
50	NC	-	No connection	

I: input, O: output, P: Power

Note 1: DE/SYNC mode select. Normally pull high.

When select DE mode, MODE=" 1" , VS and HS must pull high.

When select SYNC mode, MODE=" 0" , DE must be grounded.

Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

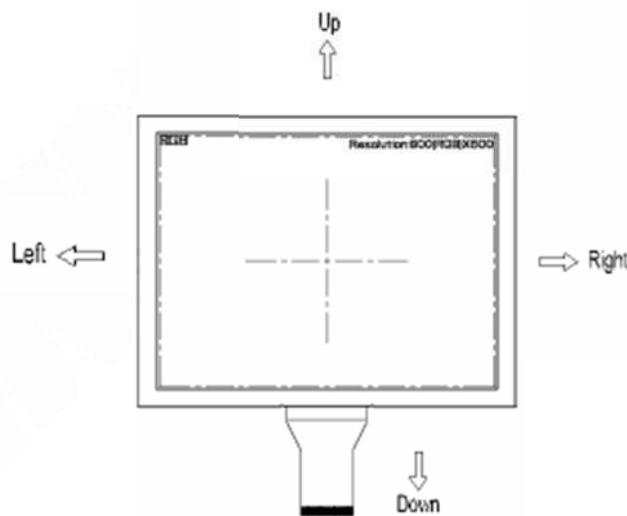
Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	DVDD	Up to down, left to right
DVDD	GND	Down to up, right to left
GND	GND	Up to down, right to left
DVDD	DVDD	Down to up, left to right

Note 5: Definition of scanning direction.

Refer to the figure as below:



Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC

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reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.

When DITHB=" 1" ,Disable internal dithering function,

When DITHB=" 0" ,Enable internal dithering function,

Note 8: Reserve for LED power input.



## 4. ELECTRICAL CHARACTERISTICS

### 4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Digital Supply Voltage	DVDD	-0.3	5.0	V	
Analog Supply Voltage	AVDD	-0.5	13.5	V	
Gate On Voltage	VGH	-0.3	42	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	12	40	V	

### 4.2 TFT LCD MODULE

#### 4.2.1 Operating Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Digital Supply Voltage	DVDD	3	3.3	3.6	V	
Analog Supply Voltage	AVDD	9.4	9.6	9.8	V	
Gate On Voltage	VGH	17	18	19	V	
Gate Off Voltage	VGL	-6.6	-6	-5.4	V	
Common Voltage	VCOM	4.1	4.3	4.5	V	Note1
Logic Input Voltage	VIH	0.7DVDD	-	DVDD	V	
	VIL	GND	-	0.3DVDD	V	

Note1: Please adjust VCOM to make the flicker level be minimum.

#### 4.2.2 Current Consumption

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Gate on Current	IVGH	VGH = 18 V	-	0.5	-	mA	Note1
Gate off Current	IVGL	VGL = -6 V	-	3.23	-	mA	Note1
Digital Current	IDVDD	DVDD = 3.3 V	-	6.45	-	mA	Note1
Analog Current	IAVDD	AVDD = 9.6 V	-	15.55	-	mA	Note1

Note1: Typ. specification : Gray-level test Pattern

Max. specification : Black test Pattern



(a) Gray-level Pattern



(b) Black Pattern

## 4.3 POWER、 SIGNAL SEQUENCE

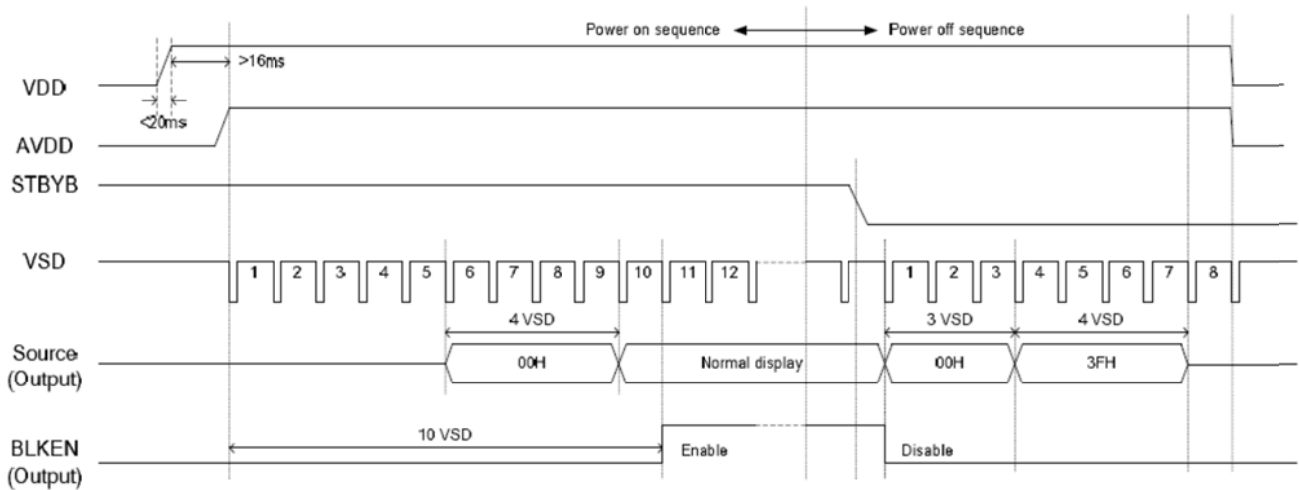
### 4.3.1 Power on/off sequence

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

Power ON: VDD, GND → AVDD, AVSS → V1 to V14

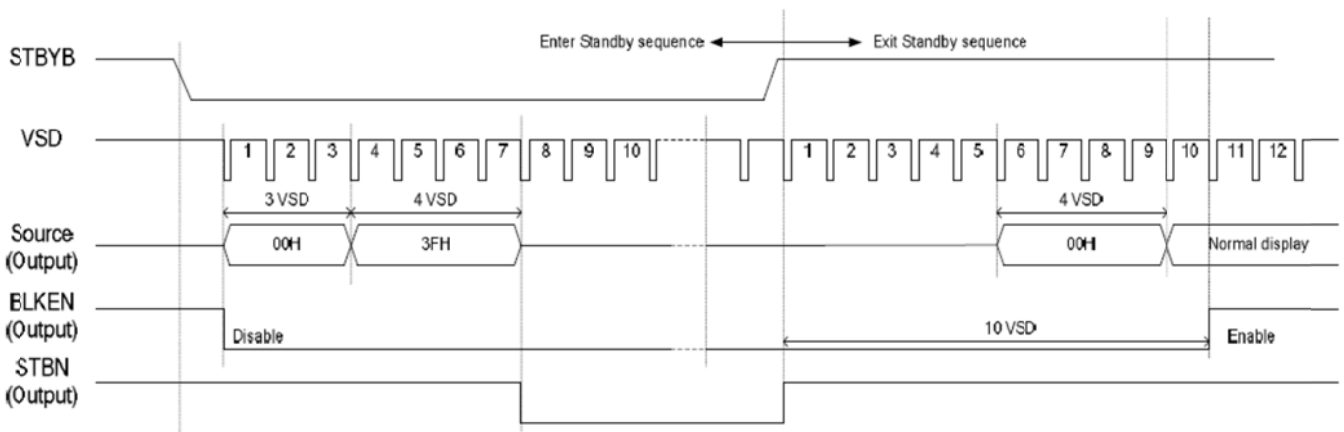
Power OFF: V1 to V14 → AVDD, AVSS → VDD, GND

### 4.3.2 Power on/off control



Power on/off timing sequence

### 4.3.3 Enter and exit standby mode sequence

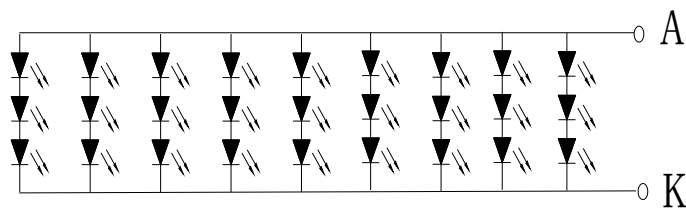


Enter and exit standby mode sequence

#### 4.4 BACKLIGHT UNIT

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED Current	Iled		180		mA	27LEDS
Forward voltage VF		8.4	9.0	9.6	V	IF=180mA,27LEDS
Reverse current	IR			50	μA	VR=3V,1LED
Luminous tolerance	IV-M	70	75		%	(Min/Max)×100
Power dissipation	Pd	1782			mW	27LEDS
Peak forward current	IFP	20			mA	1LED
Reverse Voltage	VR	3			V	1LED

##### 4.4.1 Internal Circuit Diagram



3X9=27LED 9.0V 20X9=180mA

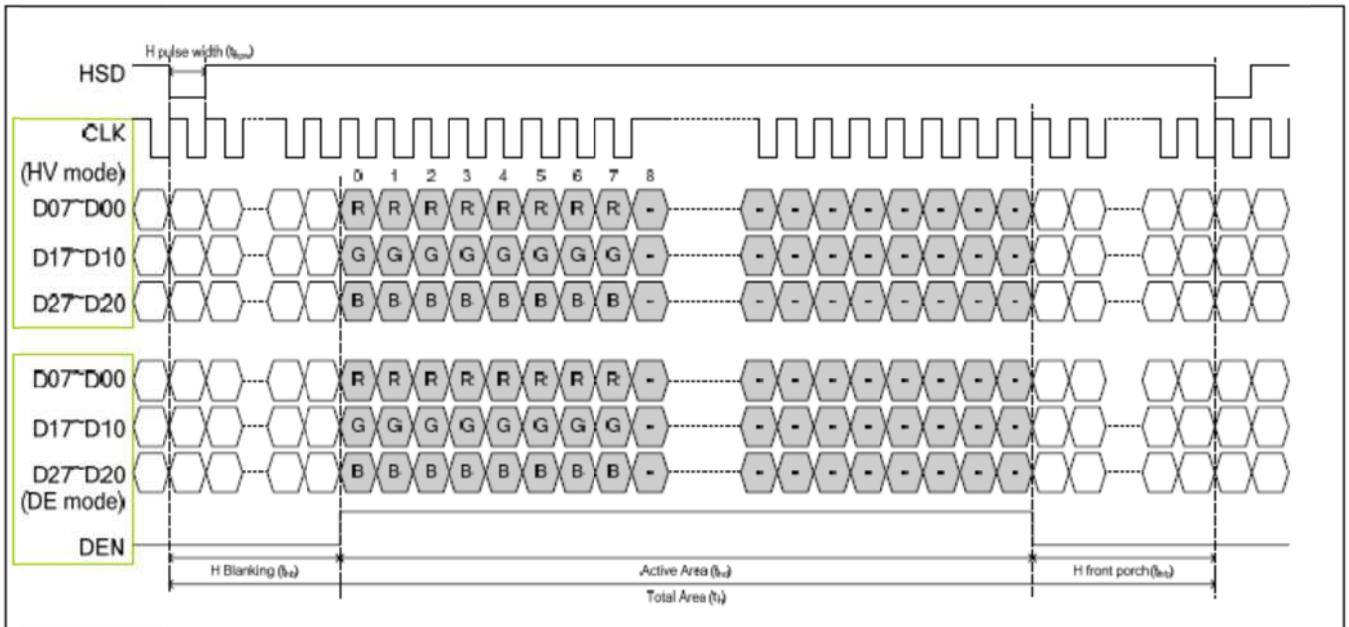
## 5.INPUT SIGNAL TIMING

### 5.1TIMING CHARACTERISTICS OF INPUT SIGNALS

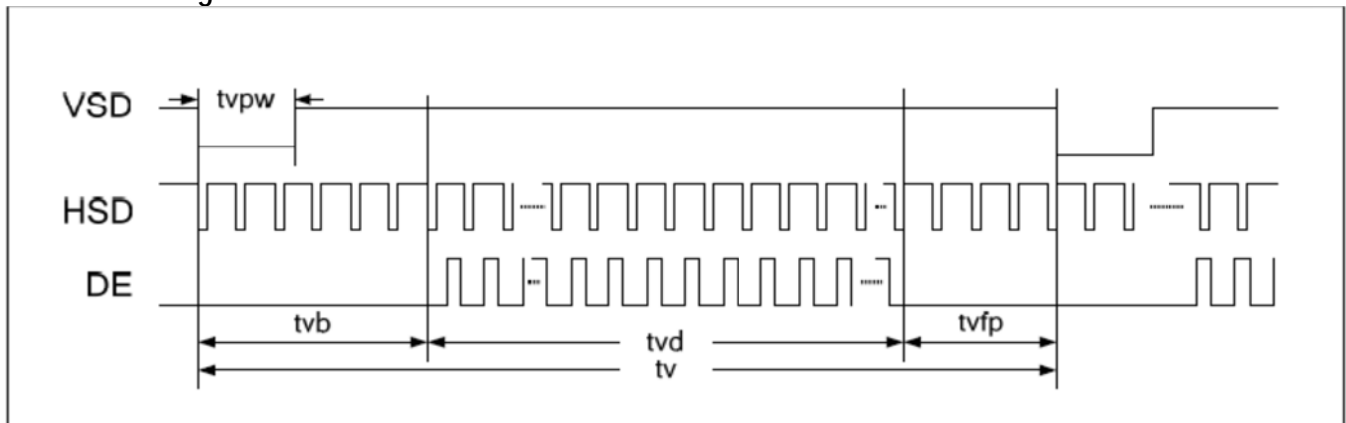
Parameter	Symbol	Spec.			Unit
		Min.	typ.	Max.	
HS setup time	$T_{hst}$	8	-	-	ns
HS hold time	$T_{hhd}$	8	-	-	ns
VS setup time	$T_{vst}$	8	-	-	ns
VS hold time	$T_{vhd}$	8	-	-	ns
Data setup time	$T_{dsu}$	8	-	-	ns
Data hold time	$T_{dhd}$	8	-	-	ns
DE setup time	$T_{esu}$	8	-	-	ns
DE hold time	$T_{ehd}$	8	-	-	ns
VDD Power On Slew rate	$T_{POR}$	-	-	20	ms
RSTB pulse width	$T_{Rst}$	10	-	-	us
CLKIN cycle time	$T_{cph}$	20	-	-	ns
CLKIN pulse duty	$T_{cwh}$	40	50	60	%
Output stable time	$T_{sst}$	-	-	6	us

### 5.2DATA INPUT FORMAT

#### Horizontal timing



## Vertical timing



## Horizontal timing

Parameter	Symbol	Min.	Typ.	Max	Unit	Note
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK frequency	fclk	-	33.3	50	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Back Porch(Blanking)	thbp		46		DCLK	
HS Front Porch	thfp	16	210	354	DCLK	
DE Mode Blanking	th-thd	45	256	400	DCLK	

## Vertical timing

Parameter	Symbol	Min.	Typ.	Max	Unit	Note
Vertical Display Area	tvd	-	480	-	th	
VS period time	tv	510	525	650	th	
VS pulse width	tvpw	1	-	20	th	
VS Back Porch(Blanking)	tvbp		23		th	
VS Front Porch	tvfp	7	22	147	th	
DE Mode Blanking	tv-tvd	4	45	170	th	

## 6. OPTICAL CHARACTERISTICS

Ta = 25 ± 2°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Response time	Tr +Tf	Point-5	-	25	40	ms	Note3	
Contrast ratio	CR		-	350	-	-	Note4	
Color Chromaticity	White	X	θ=0°	0.260	0.310	0.360	Note2 Note5 Note6	
		Y		0.280	0.330	0.380		
	Red	X		0.528	0.578	0.628		
		Y		0.302	0.352	0.402		
	Green	X		0.256	0.306	0.356		
		Y		0.522	0.572	0.622		
	Blue	X		0.099	0.149	0.199		
		Y		0.054	0.104	0.154		
Luminance	L		200	250	-	cd/m2	Note6	
Luminance uniformity	YU		70	75	-	%	Note7	
Viewing Angle	Up.	θ	Point-5 CR ≥ 10	-	60	-	°	Note1
	Down.	θ		-	45	-		
	Left.	∅		-	70	-		
	Right.	∅		-	70	-		
NTSC				51		%		

Note1: Definition of viewing angle range

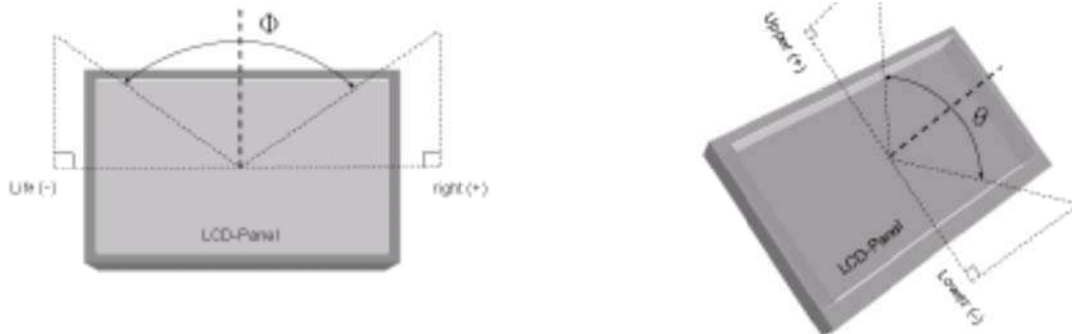


Fig. 6-1 Definition of viewing angle

Note2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

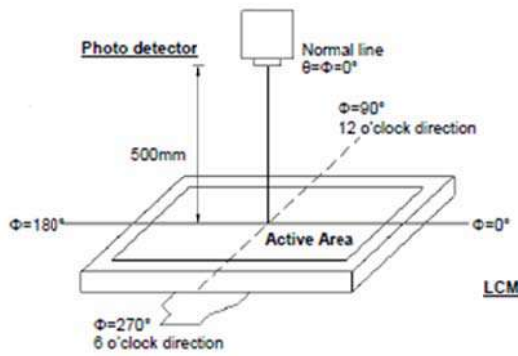


Fig. 6-2 Optical measurement system setup

Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.

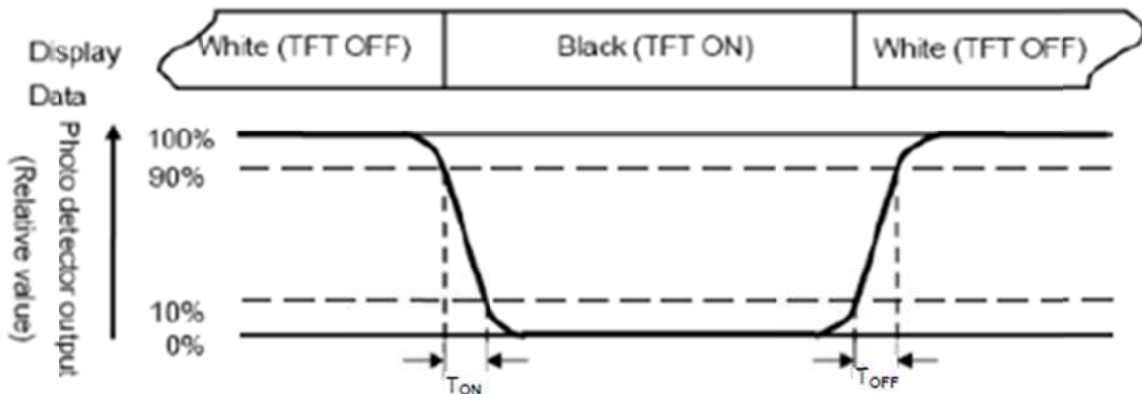


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the “White” state}}{\text{Luminance measured when LCD on the “Black” state}}$$

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is IL= 120mA.

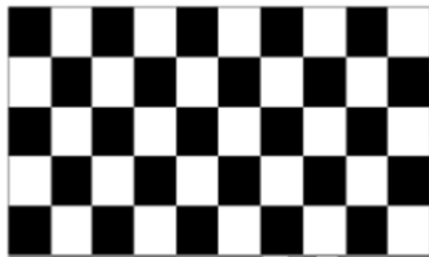
## 7. QUALITY ASSURANCE SYSTEM

### 7.1 TEMPERATURE AND HUMIDITY

Test Item	Test Condition	Remark
HighTemperatureStorage	Ta=80°C; 240hrs	IEC60068-2-1 : 2007 GB2423.2-2008
Low Temperature Storage	Ta=-30°C; 240hrs	IEC60068-2-1 : 2007 GB2423.1-2008
High Temperature Operation	Ta=70°C , 240Hrs	IEC60068-2-1 : 2007 GB2423.2-2008
Low Temperature Operation	Ta=-20°C; 240hrs	IEC60068-2-1 : 2007 GB2423.1-2008
High Temperature High Humidity Operation	Ta=60°C , 90%RH , 240Hrs(no condensation)	IEC60068-2-78 : 2001 GB/T2423.3-2006
Thermal Shock	-30°C (0.5h) ~ 80°C (0.5h) / 100cycles	Start with cold temperature , End with high temperature , IEC60068-2-14:1984,GB2423.22-2002
Image Sticking	25°C ; 4hrs	Note1

Note1:Condition of image sticking test :25°C±2°C

Operation with test pattern sustained for 4hrs,then change to gray pattern immediately.after 5 mins,the mura must be disappeared completely



(a) Test Pattern (chess board Pattern )



(b) Gray Pattern

### 7.2 VIBRATION&SHOCK

Test item	Conditions	Remark
Packing Shock (non-operation)	980m/s <sup>2</sup> ,6ms, ±x,y,z 3times for direction	IEC60068-2-27 : 1987 GB/T2423.5-1995
Packing Vibration (non-operation)	Frequency range:10 HZ~50HZ Stroke:1.0mm,sweep:10 HZ ~50HZ x,y,z 2 hours for each direction	IEC60068-2-32 : 1990 GB/T2423.8-1995

### 7.3ESD

Test item	Conditions	Remark	
Electro Static Discharge Test (non-operation)	150pF , 330Ω , Contact:±4KV,Air:±8KV	1	IEC61000-4-2 : 2001 GB/T17626.2-2006
	200pF , 0Ω , ±200V contact test	2	

Note: Measure point :

1. LCD glass and metal bezel
2. IF connector pins



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## 8. PRECAUTION RELATING PRODUCT HANDLING

### 8.1 SAFETY

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

### 8.2 STORAGE CONDITIONS

1. Store the panel or module in a dark place where the temperature is  $23\pm 5^{\circ}\text{C}$  and the humidity is below  $50\pm 20\%\text{RH}$ .
2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organics solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

### 8.3 HANDLING PRECAUTIONS

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonic solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) When the module is assembled, it should be attached to the system firmly, Be careful not to twist and bend the module.
- (10) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (11) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

### 8.4 WARRANTY

- (1) The period is within twelve months since the date of shipping out under normal using and storage conditions.
- (2) Do not repaired or modified the LCM . It may cause function to lose efficacy ,Starry does not warrant the LCM.
- (3) All process and material comply ROHS.

## 9. PACKAGE DRAWING

