Product Specification

Product Name: KTM028BM02

Product Code: MT8021

Customer
Approved by Customer
Approved Date:

Designed By	Checked by	Approved By	
		R&D	QA

E-mail: vsales@visionox.com
Tel: +86-512-57269915
Fax: +86-512-57269915

CONTENT

REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
Y01	Initial Release	2010-07-05	

1 Overview

The specifications is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC, touch panel and a backlight unit. The following table described the features of KTM028BM02.

2 Features

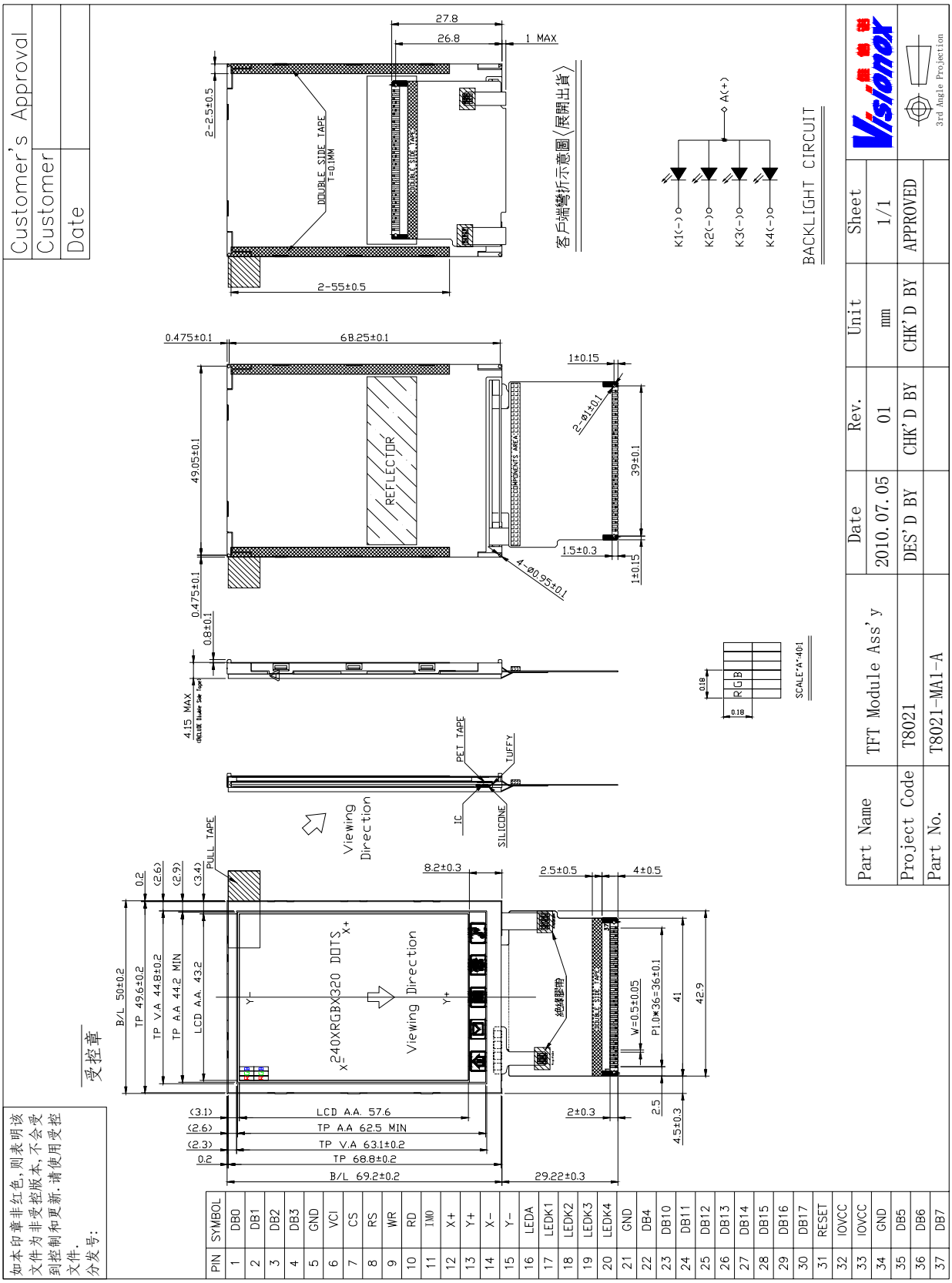
- Panel Size: 2.8 inch
- Number of Pixels /Resolution: 240×320
- Driver IC: SPFD5408B-C3
- Color: 65K/262K
- Interface: 16bits 80 system parallel interface
- Display Mode: Normally White
- Viewing Direction: 12 o'clock

Note : Requirements on Environmental Protection: RoHS

3 Mechanical Data

NO.	Item	Specification	Unit
1	Number of Pixels	240(H) × RGB × 320(V)	pixels
2	LCD Active Area	43.2(H) × 57.6(V)	mm
3	TP A.A	44.2(H) × 62.5(V)	mm
4	TP V.A	44.8(H) × 63.1(V)	mm
5	Pixel Pitch	0.18(H) × 0.18(V)	mm
6	Outline Dimension	50(H) × 69.2(V) × 4.15(D)	mm
7	Viewing Angle (S/V)	60/60/45/58	degree
8	Backlight unit	LEDx4/Parallel	
9	With /Without TP	With TP	
10	Weight	TBD	g

4 Mechanical Drawing



PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL
1	DB0	11	IM0	21	GND	31	RESET
2	DB1	12	X+	22	DB4	32	IOVCC
3	DB2	13	Y+	23	DB10	33	IOVCC
4	DB3	14	X-	24	DB11	34	GND
5	GND	15	Y-	25	DB12	35	DB5
6	VCI	16	LEDA	26	DB13	36	DB6
7	CS	17	LEDK1	27	DB14	37	DB7
8	RS	18	LEDK2	28	DB15		
9	WR	19	LEDK3	29	DB16		
10	RD	20	LEDK4	30	DB17		

5 Module Interface

No.	Symbol	I/O	Description	Remark
1	DB0	I/O	Data bus bit 0	
2	DB1	I/O	Data bus bit 1	
3	DB2	I/O	Data bus bit 2	
4	DB3	I/O	Data bus bit 3	
5	GND	P	Power Ground	
6	VCI	P	Power Supply(2.8V)	
7	CS	I	Chip select signal	
8	RS	I	Register select signal	
9	WR	I	Write enable signal	
10	RD	I	Read enable signal	
11	IM0	P	Interface Mode Select Pin	
12	X+	I	Touch Panel Pin	
13	Y+	I	Touch Panel Pin	
14	X-	I	Touch Panel Pin	
15	Y-	I	Touch Panel Pin	
16	LEDA	P	LED Power Supply(+)	
17	LEDK1	P	LED Power Supply(-)	
18	LEDK2	P	LED Power Supply(-)	
19	LEDK3	P	LED Power Supply(-)	
20	LEDK4	P	LED Power Supply(-)	
21	GND	P	Power Ground	
22	DB4	I/O	Data bus bit 4	
23	DB10	I/O	Data bus bit 10	
24	DB11	I/O	Data bus bit 11	
25	DB12	I/O	Data bus bit 12	
26	DB13	I/O	Data bus bit 13	
27	DB14	I/O	Data bus bit 14	
28	DB15	I/O	Data bus bit 15	
29	DB16	I/O	Data bus bit 16	
30	DB17	I/O	Data bus bit 17	
31	RESET	I	Reset signal	
32	IOVCC	P	Power Supply(1.8V)	
33	IOVCC	P	Power Supply	
34	GND	P	Power Ground	
35	DB5	I/O	Data bus bit 5	
36	DB6	I/O	Data bus bit 6	
37	DB7	I/O	Data bus bit 7	

Note2-1: I/O definition I----Input O----Output P----Power

*Unused pin must be fixed to GND level

6 Absolute Maximum Rating

Item	Symbol	Min	Max	Unit	Remark
I/O interface supply voltage	IOVCC	-0.24	3.2	V	
Analog power supply	VCI	-0.24	3.2	V	
Input Signal Voltage	V_{IN}	-0.24	V_{CI}	V	
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	
Humidity	RH	-	90%	RH	

Note (1): All of the voltages are on the basis of “GND = 0V”.

Note (2): Permanent breakage of module may occur if the module is used beyond the maximum rating. The module can be normal operated under the conditions according to Section 7 “Electrical Characteristics”. Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the conditions.

7 Electrical Characteristics

7.1 LCD DC Electrical Characteristics

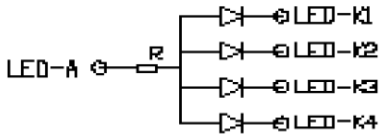
Typical Operating Conditions (Ta=25℃)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max		
Operating voltage	IOVCC	1.65	2.8	3.3	V	
	VCI	2.5	2.8	3.3	V	
Input high voltage	V_{IH}	$0.8\times V_{CI}$	-	V_{CI}	V	
Input low voltage	V_{IL}	-0.3	-	$0.2\times V_{CI}$	V	
Current Consumption	I_{VDD}	-	4.6	-	mA	

7.2 Backlight Unit

Item	Symbol	Min.	Typical	Max.	Unit
Current (One LED)	I_f	---	18	25	mA/Pcs
Number of LED ★1	---		4		Piece
Connection mode	P		parallel		---
LCM Surface Luminance ★2(if=18MA)	L_S	180	225	----	Cd/㎡
LCM Surface brightness uniform★3	L_D	80	----	----	%

★1 BACKLIGHT Block diagram：



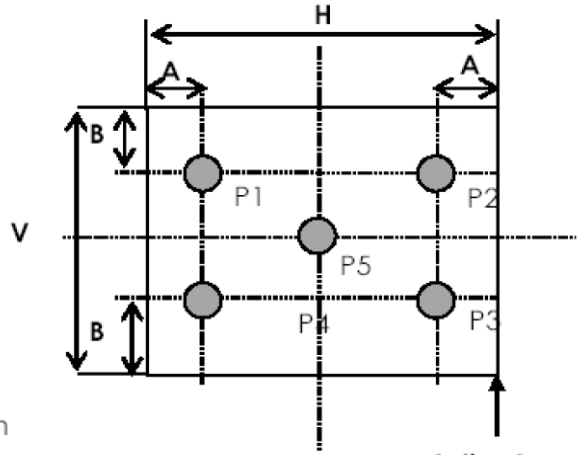
★2 Definition of Luminance:

From the LCD surface 50cm vertical suvery the center point ,use BM-7 at field 1° when all pixels displaying white.

★3 Uniform measure condition：

(1)Measure 5 point. Measure location is show below：

(2)Uniform = (Min. brightness / Max. brightness)×100%



A : 5 mm
B : 5 mm
Light source spot size ∅=2mm
H,V : Active Area
measurement device is TOPCON luminance meter BM-7

8 Touch Panel Characteristics

8.1 Electrical Characteristics

Item	Min.	Typical	Max.	Unit	Note
Linearity	-1.5	----	1.5	%	Analog X and Y directions
Terminal resistance	160	----	640	Ω	X(Glass side)
	260	----	1040	Ω	Y(Glass side)
Insulation resistance	20	----	----	MΩ	DC 25V
Voltage	----	5	7	V	DC
Bouncing	----	----	10	ms	<10ms,Tip R 3.75mm, hardness 10°~20°, silicon rubber ,500gf operation : 40 mm/sec.
Transparency	80	----	----	%	----

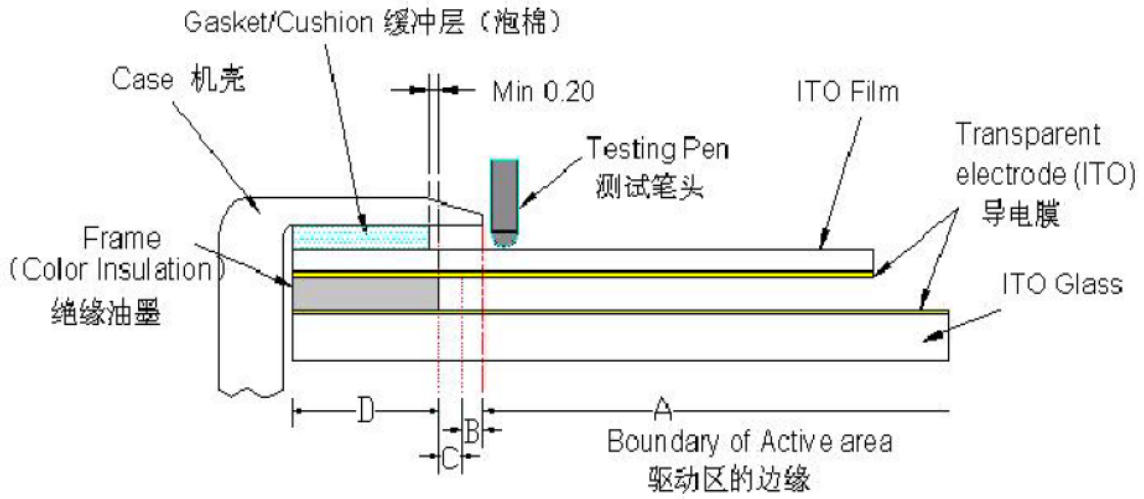
8.2 Mechanical & Reliability Characteristics

Item	Min.	Typical	Max.	Unit	Note
Activation force	----	20	50	gf	
Durability-surface scratching	Write 100000	----	----	characters	★1
Durability-surface pitting	1000000	----	----	touches	★2
Durability-chemical	----	----	----	----	
Surface hardness	3	----	----	H	Pressure 500gf ,45deg

NOTE :
★1: Sliding more than 100 thousand times with 150g force and 60mm/s frequency in the same position(10-100mm) by ¢2 Polyacetal pen.
★2:Tapping more than 1million times with 250g fore and 2times/s frequency by ¢ 2 rubber testing head,whose hardness is 60°.
Do not operate it with a thing except a polyacetal pen(tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

8.3 Structure and Area Definition

The structure and the performance guaranteedareas of this touch panel are defined below:



Area-(A) : Active area

The area guarantees a touch panel operation with the following characteristics when pressed.

(i) Operation force (ii) Electric characteristics

(iii) Tapping durability (iv) Pen sliding durability

Area-(B) : Operation non-guaranteed area

The area does not guarantee a touch panel operation and its function. When this area is pressed, touch panel shows degradation of its performance and durability.

Area-(C) : Pressing prohibition area

The area forbids pressing because an excessive load is applied to a transparent electrode and a serious damage is given to a touch panel function by pressing.

Area-(D) : Non-Active area (Frame)

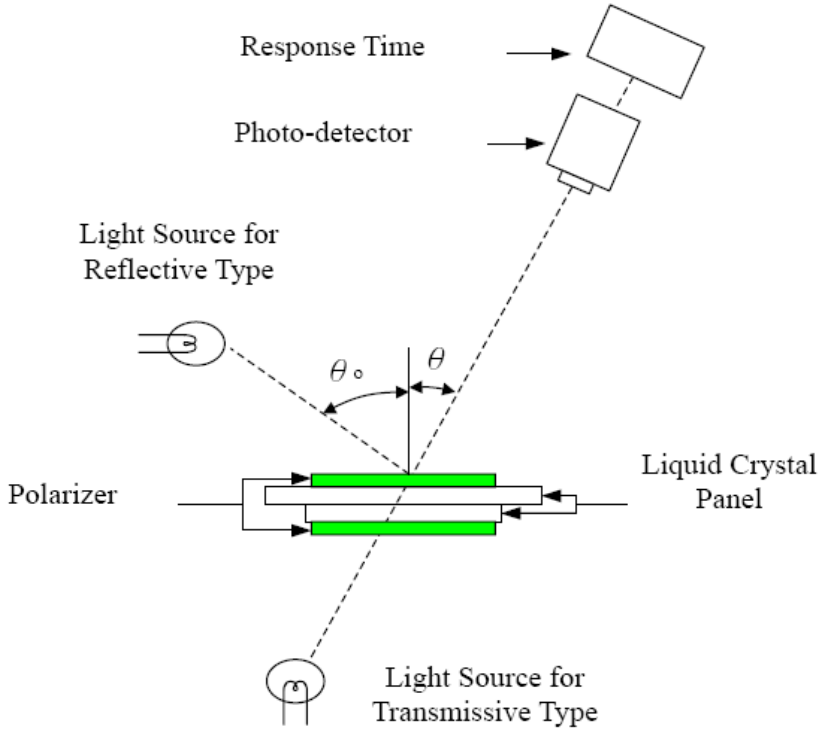
The area does not activate even if pressed.

9 Optical characteristics

9.1 Optical Specification

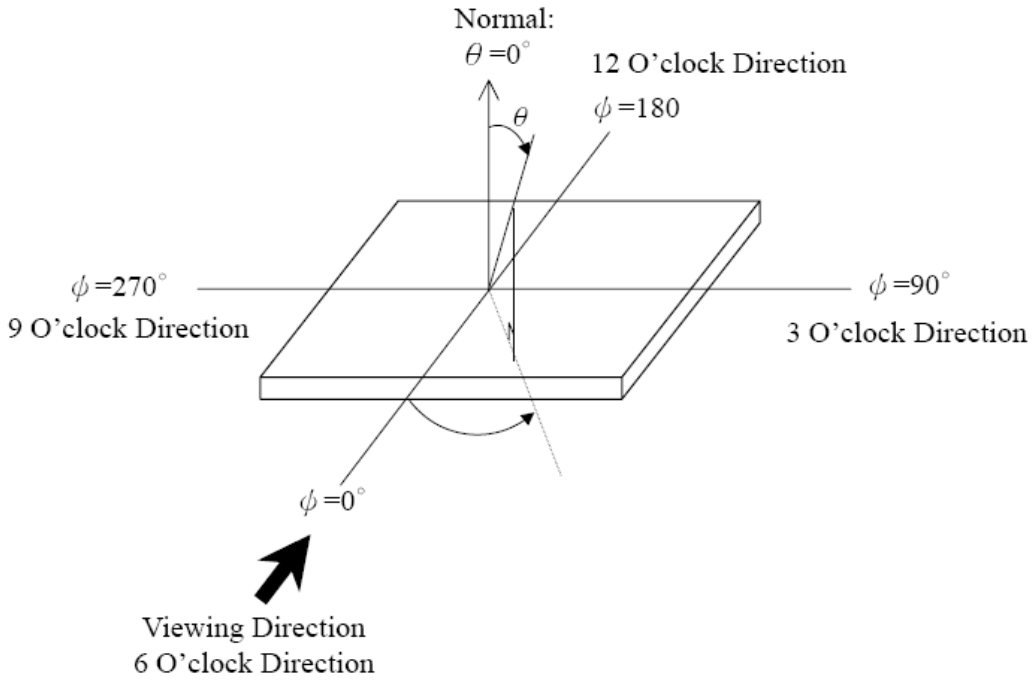
Electro-Optical Characteristics									
Item	Symbol		Condition	Temp.	Min.	Typ.	Max.	Units	Note
Viewing Angle Range	θ		ψ= 0° ψ= 90° ψ= 180° ψ= 270° (CR≧10)	25℃	---- ---- ---- ----	45 60 58 60	---- ---- ---- ----	Degree	Note 2
Response Time	Rise Time (Tr)		θ=ψ= 0° θ0 = 25°	25℃	----	10.3	----	Msec	Note 1,4
	Fall Time (Tf)				----	24.5	----		
Module Chromaticity	White	x	θ=ψ= 0°	25℃	0.26	0.28	0.34	---	Note 3
		y			0.28	0.30	0.36		
	Red	x			----	TBD	----		
		y			----		----		
	Green	x			----		----		
		y			----		----		
	Blue	x			----		----		
		y			----		----		
Module Contrast Ratio	CR		θ=ψ= 0°	25℃	----	300	----	---	Note3, 5

Note 1: Electro-Optical Characteristics Test Method.



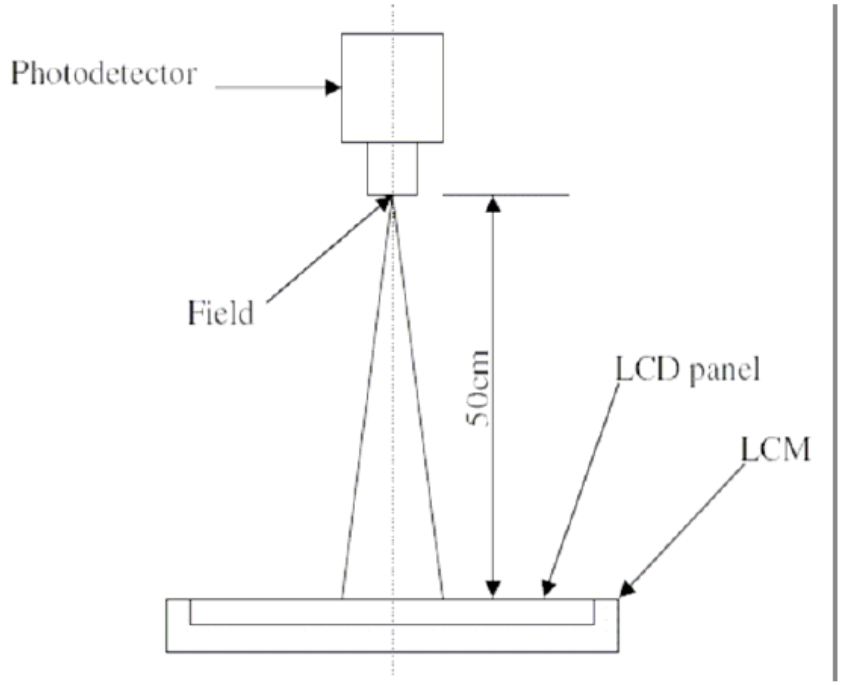
Note 2: Definition of Viewing Angel.

Viewing angle is the angle at which the contrast ratio is greater than 2,for TFT module thecontrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.



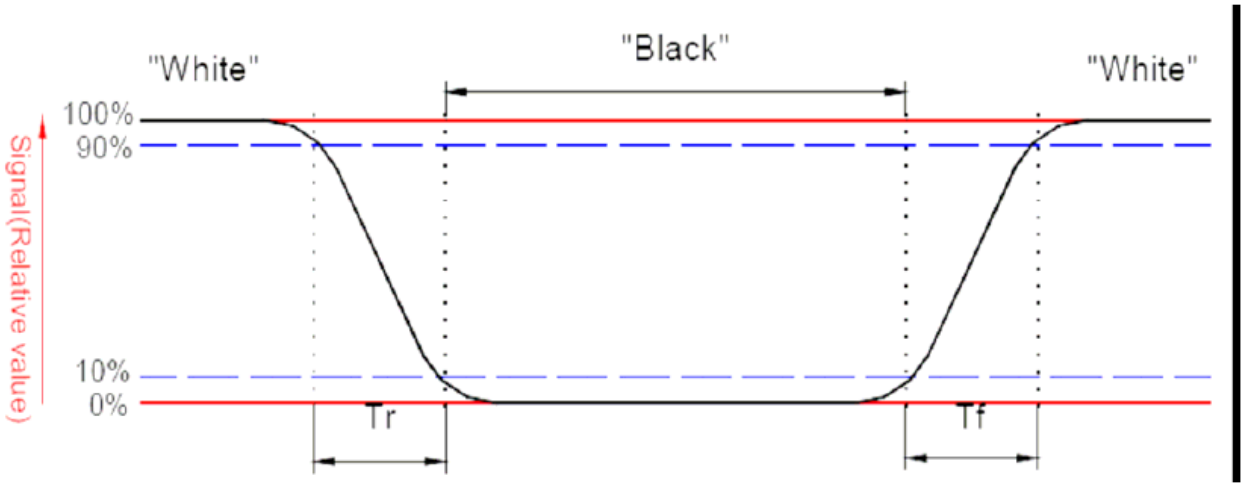
Note 3: **Optical measurement equipment setup**

-Measurement should be executed in a stable, windless, and dark room. After lighting thebacklight for 30mins.
-Environment condition : Common air conditioner cleanness Ta=25±5
Humidity=60±15%
-Distance : 50cm
-Photodetector : BM-7 (Field 1°)



Note 4: Definition of Optical Response Time

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below:



Note 5: Definition of Contrast Ratio (CR).

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

10 Package Specification

TBD

11 Reliability

TBD

12 Recommended Software Initialization

```
void   INITIAL_SPFD5408B_2.8(void)
{
    //************** Start Initial Sequence **********
    W_COM(0x00, 0x0000);          // ID read register
    W_COM(0x01, 0x0000);          // Driver output control
    W_COM(0x02, 0x0600);          // LCD driving waveform control
    W_COM(0x03, 0x50A0);          // entry mode-8 bit
    W_COM(0x04, 0x0000);          // Resize control

    W_COM(0x08, 0x0207);          // Display control 2
    W_COM(0x09, 0x0000);          // Display control 3
    W_COM(0x0A, 0x0000);          // Display control 4
    W_COM(0x0C, 0x0000);          // External display interface control1
    W_COM(0x0D, 0x0000);          // Frame marker control
    W_COM(0x0F, 0x0000);          // External display interface control2
    //---------- Gamma 2.2 Curve ----------
    W_COM(0x30, 0x0707);
    W_COM(0x31, 0x1421);
    W_COM(0x32, 0x1A24);
    W_COM(0x33, 0x241A);
    W_COM(0x34, 0x2114);
    W_COM(0x35, 0x0707);
    W_COM(0x36, 0x1504);
    W_COM(0x37, 0x0515);
    W_COM(0x38, 0x0706);
    W_COM(0x39, 0x0304);
    W_COM(0x3A, 0x0F04);
    W_COM(0x3B, 0x0F00);
    W_COM(0x3C, 0x000F);
    W_COM(0x3D, 0x040F);
    W_COM(0x3E, 0x0403);
    W_COM(0x3F, 0x0607);
  //------------------ RAM Address control ---------------
    W_COM(0x50, 0x0000);
    W_COM(0x51, 0x00EF);
    W_COM(0x52, 0x0000);
```

```
    W_COM(0x53, 0x013F);
    W_COM(0x60, 0xA700);
    W_COM(0x61, 0x0001);
    W_COM(0x6A, 0x0000);
  //--------------- Partial Display Control ---------
    W_COM(0x80, 0x0000);
    W_COM(0x81, 0x0000);
    W_COM(0x82, 0x0000);
    W_COM(0x83, 0x0000);
    W_COM(0x84, 0x0000);
    W_COM(0x85, 0x0000)
  //--------------- Panel Control --------------------
    W_COM(0x90, 0x0018);
    W_COM(0x92, 0x0000);
    W_COM(0x93, 0x0103);
    W_COM(0x95, 0x0110);
    W_COM(0x97, 0x0000);
    W_COM(0x98, 0x0000);
    W_COM(0xF0, 0x5408);
    W_COM(0xE0, 0x0001);
    W_COM(0xF2, 0x00DF);
    W_COM(0xF3, 0x6D06);
    W_COM(0xF4, 0x0011);
    W_COM(0xF0, 0x0000);
    W_COM(0x10, 0x12B0);
    Delay(0x20);                //delay   20ms
    W_COM(0x11, 0x0007);
    Delay(0x20);                //delay   20ms
    W_COM(0x12, 0x01BD);
    Delay(0x20);                //delay   20ms
    W_COM(0x13, 0x1200);
    Delay(0x20);                //delay   20ms
    W_COM(0x29, 0x000C);
    Delay(0x20);                //delay   20ms
    W_COM(0x07, 0x0112);
    Delay(150);
}
```

```
void Addr_set(uchar sx,ex,uint sy,ey)
{
      W_COM(0x50,sx);
       W_COM(0x51,ex);
       W_COM(0x52,sy);
       W_COM(0x53,ey);
       W_COM(0x20,sx);
       W_COM(0x21,sy);
        W_COM1(0x22);       //write data to RAM
}
void enter_sleep(void)
{
    W_COM(0x07,0x0000);
    Delay(0x50);                  //delay    50ms
    W_COM(0x10,0x0002);       //power control    start
    Delay(0x20);                 //delay    20ms

  }
void exit_sleep(void)
{
      W_COM(0x10, 0x12B0);
      Delay(0x20);                  //delay    20ms
      W_COM(0x11, 0x0007);
      Delay(0x20);                  //delay    20ms
      W_COM(0x12, 0x01BD);
      Delay(0x20);                  //delay    20ms
      W_COM(0x13, 0x1200);
      Delay(0x20);                  //delay    20ms
      W_COM(0x29, 0x000C);
      Delay(0x20);                  //delay    20ms
      W_COM(0x07, 0x0112);
      Delay(100);
  }
```

13 Precautions for operation and Storage

13.1 Precautions for Operation

(1) Since the display panel is made of glass, do not apply any mechanical shock or impact or excessive force to it when installing the module. Any strong mechanical impact due to falling dropping etc. may cause damage (breakage or cracking).

(2) If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

(3) The polarizer on the display surface is made of soft material and is easily scratched. Please take most care when handing. When the display surface is contaminated, please wipe it off gently by using moisten soft cloth with isopropyl alcohol, do not use water, ketone or aromatics.If still not completely clear, moisten cloth with isopropyl alcohol or ethyl alcohol solvents.

(4) When handling the LCD module, please be sure that the body and the tools are properly grounded. And do not touch I/O pins with bare hands or contaminate I/O pins, it will cause disconnection or defective insulation of terminals.

(5) Do not attempt to disassemble or process the LCD module.

(6) The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

(7) Do not put one product on the other .Otherwise, it may cause the product to bescratched and/or change on cosmetic occur (ex. Newton ring).

13.2 Soldering

(1) Soldering should be performed only on the I/O terminals.

(2) Use soldering irons with proper grounding and no leakage.

(3) Iron: no higher than 300℃ and 3~4 sec during soldering.

13.3 Precautions for Storage

(1) Please store LCD module in a dark place. Avoid exposure to sunlight, the light of fluorescent lamp or any ultraviolet ray.

(2) Keep the environment temperature between 0℃ and 40℃ and the relative humidity less than 80%. Avoid high temperature and high humidity.

(3) Keep the LCD modules stored in the room without acid ,alkali and harmful gas.

13.4 Warranty period

Visionox Display Co., Ltd. warrants for a period of 12 months from the shipping date when stored or used under normal condition.