晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AM-640480GFTNQW-T06H
APPROVED BY	
DATE	

☐ Approved For Specifications
☐ Approved For Specifications & Sample

AMPIRE CO., LTD.
Building A., 4F., No.116, Sec. 1, Sintai 5th Rd., Xizhi Dist,
New Taipei City 221, Taiwan (R.O.C.)
新北市汐止區新台五路一段 116 號 4 樓(東方科學園區 A 棟)
TEL:886-2-26967269 , FAX:886-2-26967196 or 26967270

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2014/4/29	--	New Release Projected Capacitive Touch Screen + Cover Lens (1.1mm)	Kokai

1. INTRODUCTION

This is a color active matrix TFT-LCD that uses amorphous silicon TFT as a switching device. This model is composed of a 5.7inch TFT-LCD panel, a driving circuit, LED backlight system and touch panel. This TFT-LCD has a high resolution (640(R.G.B) X 480) and can display up to 262,144 colors.

1-1. Features

- VGA Resolution
- 6 Bits color driver with 1 channel TTL interface
- Wide range operation temperature
- Improved inner FPC material to better reliability
- Capacitive-type touch panel with T1.1 Cover Lens.
- I2C Interface for touch control.

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display resolution(dot)	640RGB (W) x 480(H)	dots
Display area	115.2 (W) x 86.4 (H)	mm
Pixel pitch	0.18 (W) x 0.18 (H)	mm
Color configuration	R.G.B Vertical stripe	
Overall dimension	127.0(W)x98.43(H)x9.975(D)---(Typ)	mm
Brightness	430	cd/m^2
Contrast ratio	250 : 1	
Backlight unit	LED	
Display color	262,144	colors
Viewing Direction (Gray inversion)	12 o'clock	
Display Mode	Normally White	

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN	MAX	UNIT	NOTE
Power Supply Voltage	Vcc	-0.5	5	V	
Signal Input Voltage	DCLK , DE R0~R5 G0~G5 B0~B5	-0.5	Vcc + 0.5	V	
Operation Temperature	Top	-20	70	℃	(1)
Storage Temperature	Tstg	-30	80	℃	(1)

4. ELECTRICAL CHARACTERISTICS

4-1 TFT LCD Module voltage

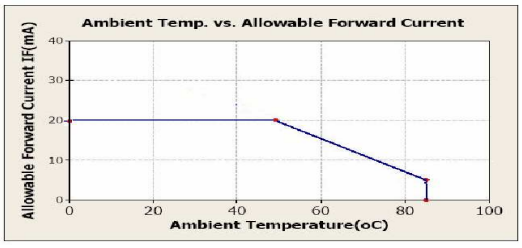
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Power Voltage For LCD	V_{CC}	3.0	3.3	3.6	V	(1)
Power Voltage For VLED	V_{DD}	--	5.0	--	V	
Logic Input Voltage	VIH	V_{CC}*0.7	--	V_{CC}	V	
	VIL	0	--	V_{CC}*0.3	V	
ADJ Input Voltage	VIH	3.0	--	5.0	V	
	VIL	GND	--	0.3	V	

4-2 TFT LCD current comsumption

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Current	Icc	-	82	-	mA	(1)
LED Power Current	I_{LED}(VLED=5V)	-	290	-	mA	(2)

NOTE : (1) Typ : under 64 gray pattern Max : under black pattern

(2) One LED dice

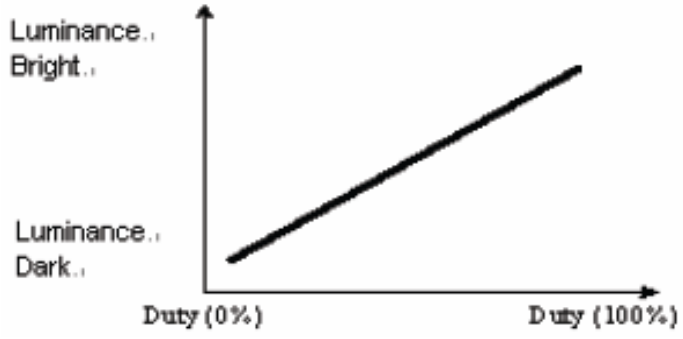


5. TFT INTERFACE

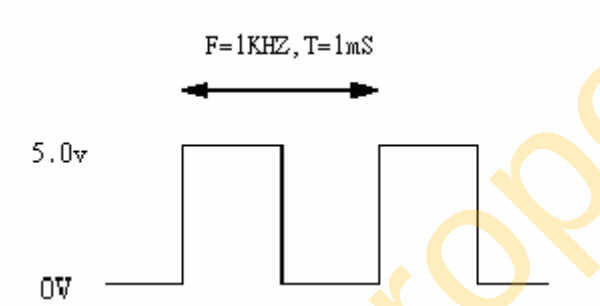
Pin No	Symbol	Function
1	U/D	Up or Down Display Control
2	(NC)	No connection
3	Hsync(NC)	Honizontal SYNC. (Sync mode used)
4	VLED	Power Supply for LED
5	VLED	Power Supply for LED
6	VLED	Power Supply for LED
7	Vcc	Power Supply for LCD
8	Vsync(NC)	Vertical SYNC. (Sync mode used)
9	DE	Data Enable
10	Vss	Power Ground
11	Vss	Power Ground
12	ADJ	Adjust for LED Brightness
13	B5	Blue Data 5 (MSB)
14	B4	Blue Data 4
15	B3	Blue Data 3
16	Vss	Power Ground
17	B2	Blue Data 2
18	B1	Blue Data 1
19	B0	Blue Data 0 (LSB)
20	Vss	Power Ground
21	G5	Green Data 5 (MSB)
22	G4	Green Data 4
23	G3	Green Data 3
24	Vss	Power Ground
25	G2	Green Data 2
26	G1	Green Data 1
27	G0	Green Data 0 (LSB)
28	Vss	Power Ground
29	R5	Red Data 5 (MSB)
30	R4	Red Data 4
31	R3	Red Data 3
32	Vss	Power Ground
33	R2	Red Data 2
34	R1	Red Data 1
35	R0	Red Data 0 (LSB)
36	Vss	Power Ground
37	Vss	Power Ground
38	DCLK	Clock Signals
39	Vss	Power Ground
40	L/R	Left or Right Display Control

NOTE :

1. ADJ adjust brightness to control Pin , Pulse duty the bigger the brighter.



2. ADJ signal = 0 ~ 5.0V , operation frequency : 300Hz~1KHz



3. VSS Pin must ground contact , can not be floating.

4. U/D and L/R are controlled function

L/R	U/D	Function
1	0	Normally display
0	0	Left and Right opposite
1	1	Up and Down opposite
0	1	Left and Right opposite , Up and Down opposite

6. TFT LCD INPUT SIGNAL :

6-1 Timing Specification.

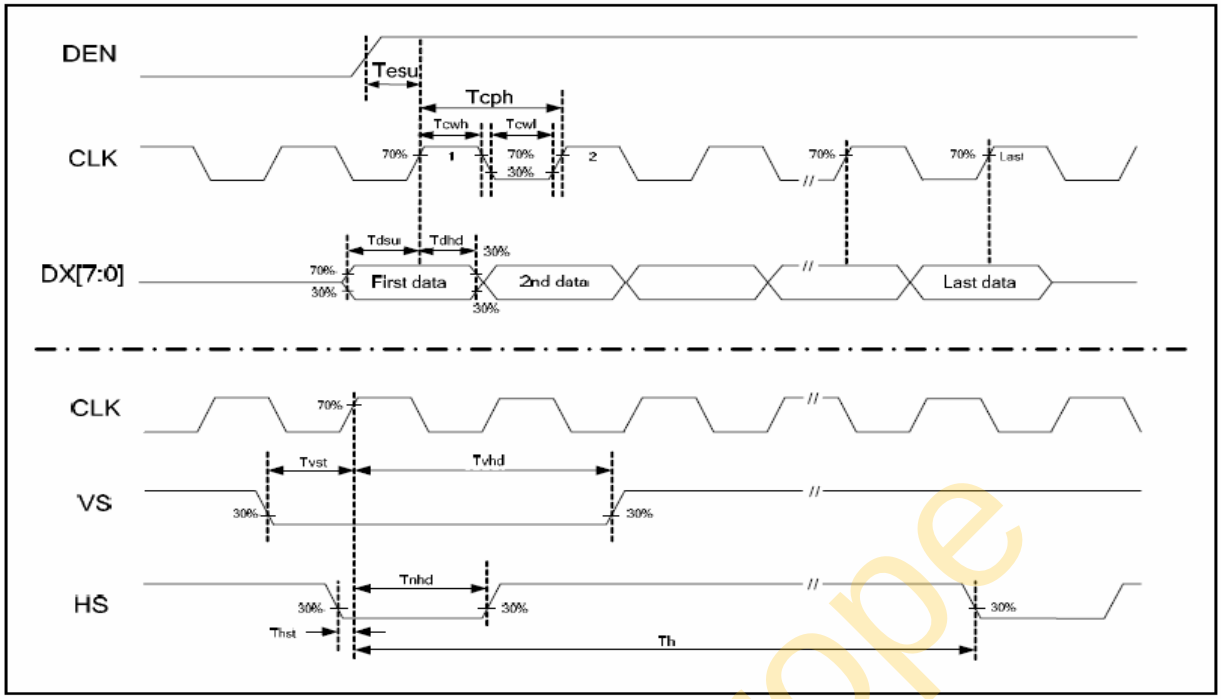
PARAMETER	Symbol	Min.	Typ.	Max	Unit
CLK frequency	FCPH		25.175		MHz
CLK period	TCPH	-	39.7	-	ns
CLK pulse duty	TCWH	40	50	60	%
HS period	TH	-	800	-	TCPH
HS pulse width	TWH	5	30	-	TCPH
HS-first horizontal data time	THS	112	144	175	TCPH
DEN pulse width	TEP	-	640	-	TCPH
VS pulse width	TWV	1	3	5	TH
VS-DEN time	TSTV	-	35	-	TH
VS period	TV	-	525	-	TH

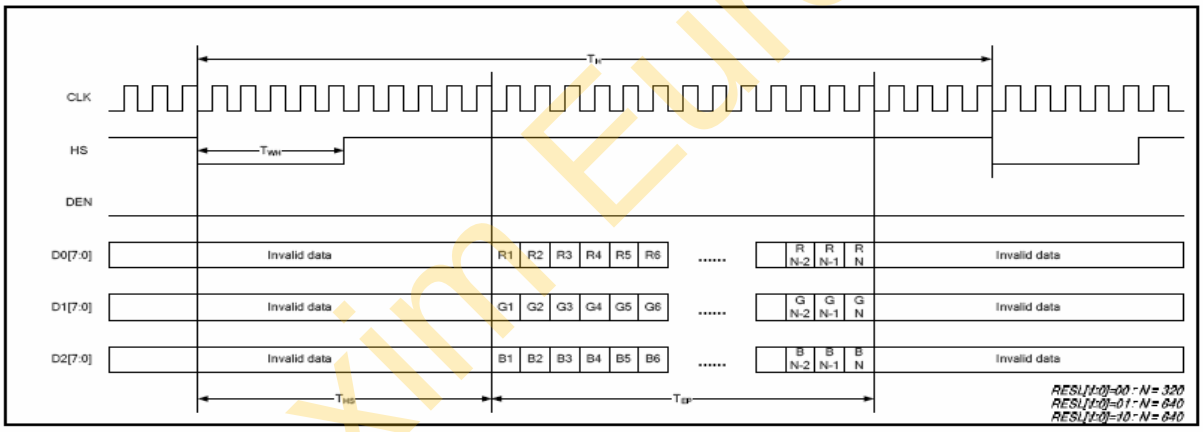
Note: When SYNC mode is used, 1st data start from 144th CLK after HS falling (when STHD[5:0]=00000)

PARAMETER	Symbol	Min.	Typ.	Max	Unit
OEV pulse width	TOEV		100	-	TCPH
CKV pulse width	TCKV	-	96	-	TCPH
HS-CKV time	T1	-	52	-	TCPH
HS-OEV time	T2	-	8	-	TCPH
HS-POL time	T3	-	72	-	TCPH
STV setup time	TSUV	-	46	-	TCPH
STV pulse width	TWSTV	-	1	-	TH

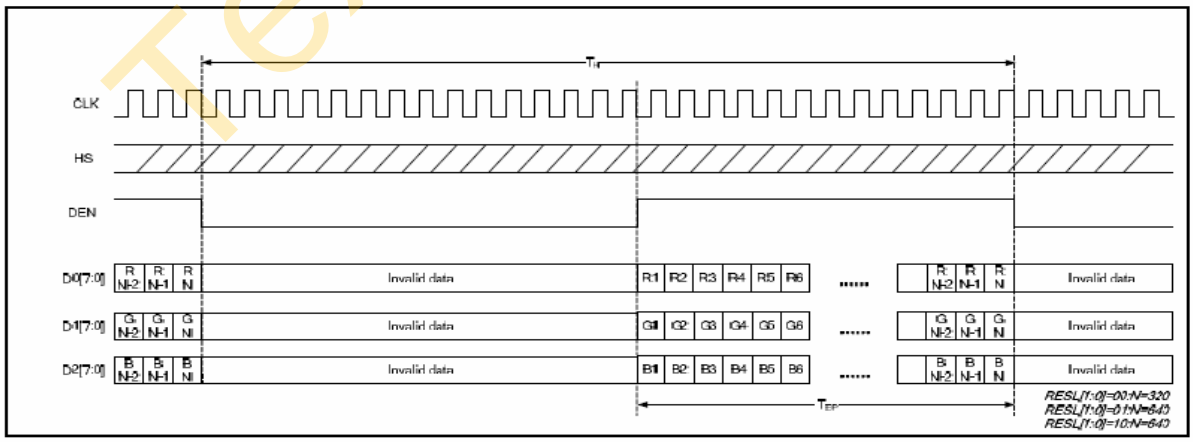
6-2 Timing chart

Clock and Data input waveforms





Parallel RGB SYNC Mode Horizontal Data Format



Parallel RGB DE Mode Horizontal Data Format

6-3 Color Data Assignment

COLOR	Input Data	R DATA						G DATA						B DATA					
		R5 MSB	R4	R3	R2	R1	R0 LSB	G5 MSB	G4	G3	G2	G1	G0 LSB	B5 MSB	B4	B3	B2	B1	B0 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	0	0	0	0	0	1
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

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

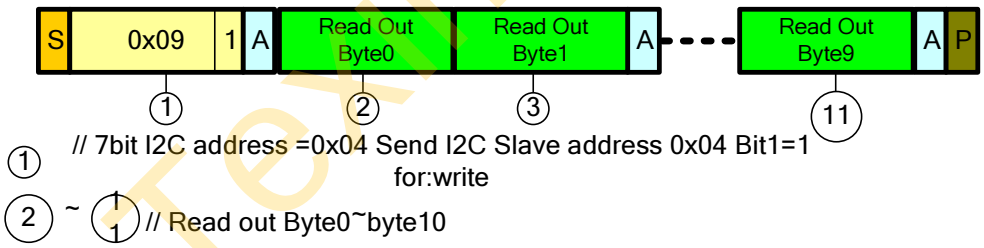
7. Projected capacitive-type touch panel

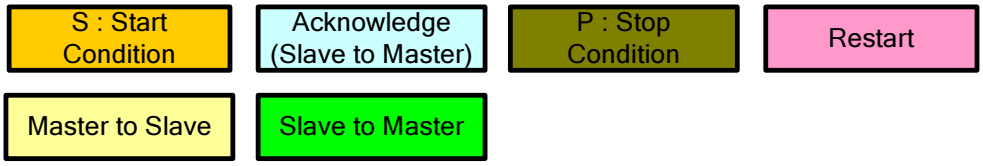
Pin No	Symbol	Function
1	VCC	Power Supply for TP controller
2	SDA	I2C Data
3	**SDA**	**I2C Data**
4	GND	Ground
5	SCL	I2C Clock
6	**SCL**	**I2C Clock**
7	INT	Interrupt
8	RES	Reset TP controller

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Power Voltage For TP controller	VCC	3.0	3.3	3.6	V

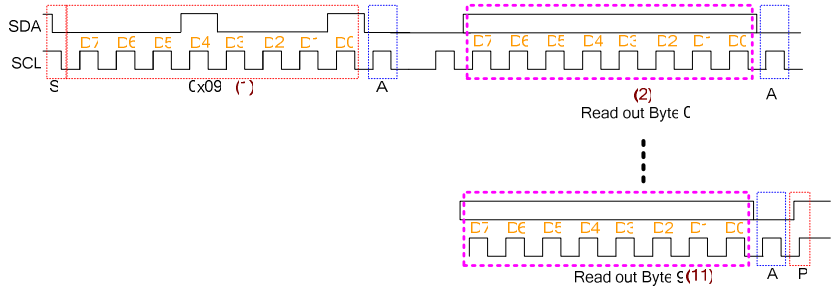
- 7-bit I2C address = 0x04.

The complete I2C data format:



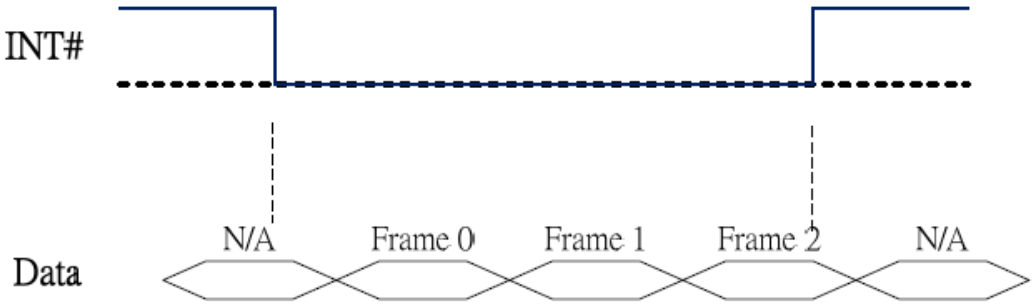


The detail Timing

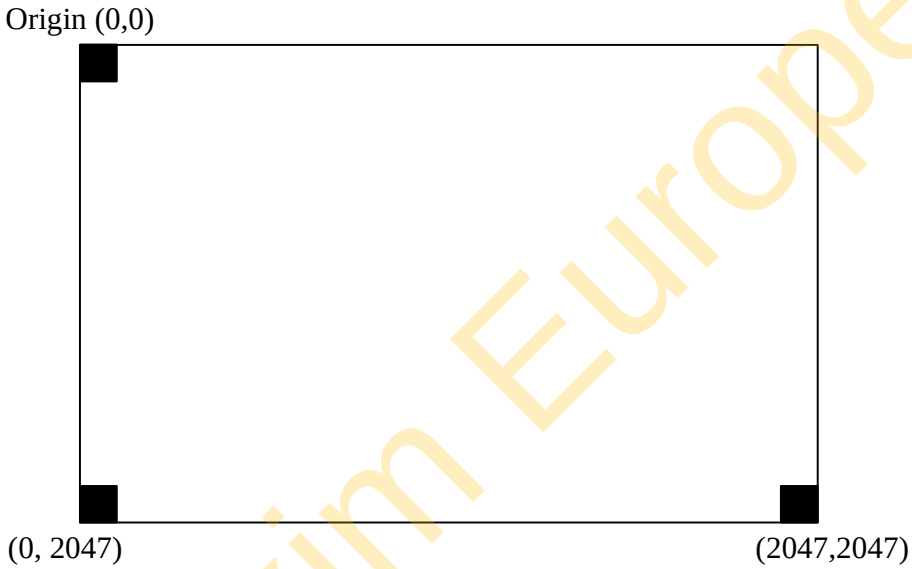


Read Out Byte	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
BYTE0	0	0	0	0	0	1	0	0
	Report ID = 0x04							
BYTE1								
	BIT[7] : When this bit =1 is Valid touch. BIT[6:2] : Contact ID. BIT[1] : In range bit , this bit is always 1. BIT[0] : This bit 1 for touch down , 0 for touch lift Example: 0x83: 1st Touch Down. 0x82: 1st Touch Lift. 0x87: 2nd Touch Down. 0x86: 2nd Touch Lift.							
BYTE2	Touch X [3:0]				Don't care			
	X Coordination Bit [3:0] in BYTE2 Bit [7: 4]							
BYTE3	Touch X [15:4]							
	X Coordination Bit [15:4] in BYTE3							
BYTE4	Touch Y [3:0]				Don't care			
	Y Coordination Bit [3:0] in BYTE2 Bit [7: 4]							
BYTE5	Touch Y [15:4]							
	Y Coordination Bit [15:4] in BYTE3							
BYTE6								
	Reserved							
BYTE7								
	Reserved							
BYTE8								
	Reserved							
BYTE9								
	Reserved							

Interrupt starts at touch-down event and ends at touch-lift event.
During the period, coordinate report rate is related to the rate which host issues read-coordinate command.



Coordinate



Sample Code :

```
/*****************************************************************************
* Function Name    : u8 EXC7200_I2C_CoordRead(u8 Slave_Addr,u8 read_Nbyte , u16    *ByteReturn)
* Description      : Use GPIO Read N byte data from Slave device (Addr) to Host
* Input              : u8 Slave_Addr , Ex:0x04
*                    : u8 read_Nbyte
*                    : Point for touch information
*                       ByteReturn [0] = Point X1
*                       ByteReturn [1] = Point Y1
*                       ByteReturn [2] = T.B.D
*                       ByteReturn [3] = Point Y2
*                       ByteReturn [4] = Point Y2
*                       ByteReturn [5] = T.B.D
* Return
*
* #define EXC7200_I2C_CoordRead_1stTouch_Down    0x01
* #define EXC7200_I2C_CoordRead_1stTouch_Lift    0x81
* #define EXC7200_I2C_CoordRead_2ndTouch_Down    0x02
* #define EXC7200_I2C_CoordRead_2ndtTouch_Lift    0x82
*****************************************************************************/

#define EXC7200_I2C_CoordRead_1stTouch_Down    0x01
#define EXC7200_I2C_CoordRead_1stTouch_Lift    0x81
#define EXC7200_I2C_CoordRead_2ndTouch_Down    0x02
#define EXC7200_I2C_CoordRead_2ndtTouch_Lift    0x82
#define EXC7200_I2C_CoordRead_error    0x00

u8 EXC7200_I2C_CoordRead(u8 Slave_Addr,u8 read_Nbyte , u16    *ByteReturn )
{
   u8 *pBuffer ,i ;
   u8 Byte[10] ;


   IO_I2C_start();    // Start Condiction
   IO_I2C_reg_cmd_para((Slave_Addr<<1)+1); // Send I2C Slave address+1 Bit0=1 for:read
                pBuffer=IO_I2C_read_Nbyte(read_Nbyte);      // read 10 byte

                for(i=0;i<10;i++)
                    {
                            Byte[i]=*pBuffer;
                            pBuffer++;
                    }

                if( (Byte[1]==0x83) | (Byte[1]==0x82))    //
                {
                     ByteReturn[0]=((u16)((Byte[3]&0x00ff)<<4))+((u16)((Byte[2]&0x00f0)>>4)); //Point X1
                      ByteReturn[1]=((u16)((Byte[5]&0x00ff)<<4))+((u16)((Byte[4]&0x00f0)>>4)); //Point Y1
                      ByteReturn[2]= 0xFFFF;
                      ByteReturn[3]= 0xFFFF;
                      ByteReturn[4]= 0xFFFF;
                      ByteReturn[5]= 0xFFFF;
                      Previous_X1=ByteReturn[0];
                      Previous_Y1=ByteReturn[1];

                      if ( (Byte[1]==0x83))
                      {
                              return EXC7200_I2C_CoordRead_1stTouch_Down;
                      }
                      if ( (Byte[1]==0x82))
                      {
                              return EXC7200_I2C_CoordRead_1stTouch_Lift;
                      }
```

```
    }
                if( (Byte[1]==0x87) | (Byte[1]==0x86))    //
                {
                    ByteReturn[3]=((u16)((Byte[3]&0x00ff)<<4))+((u16)((Byte[2]&0x00f0)>>4)); //Point X1
                     ByteReturn[4]=((u16)((Byte[5]&0x00ff)<<4))+((u16)((Byte[4]&0x00f0)>>4)); //Point Y1
                     ByteReturn[5]= 0xFFFF;
                     ByteReturn[0]= Previous_X1;
                     ByteReturn[1]= Previous_Y1;
                     ByteReturn[2]= Previous_Z1;

                     if ( (Byte[1]==0x87))
                     {
                             return EXC7200_I2C_CoordRead_2ndTouch_Down;
                     }
                     if ( (Byte[1]==0x86))
                     {
                             return EXC7200_I2C_CoordRead_2ndtTouch_Lift;
                     }

    }


    return EXC7200_I2C_CoordRead_error;

}


// Example Interrupt function
void EXC7200_I2C_EXT_INT (void)
{

    u16 DataBuffer[10];
    u32 TPX1,TPY1,TPX2,TPY2;
    u16 Temp_X=0xFFFF,Temp_Y=0xFFFF;
    u16 temp;
    u8 Touch_size=4;
    u8    RStatus;

       while((ReadINT1())==0)
       {
                                RStatus = EXC7200_I2C_CoordRead(0x04,10,DataBuffer);


                                TPX1=(u16) DataBuffer[0]; //first X position
                                TPY1=(u16) DataBuffer[1]; //first Y position
                                TPX2=(u16) DataBuffer[3]; //second point X position
                                TPY2=(u16) DataBuffer[4]; //second point Y position


                                 // Remapping Touch X,Y to LCD X,Y
                                TPX1*=Current_LCM_ID.LCD_X_Max;
                                 TPX1/=2048;
                                TPY1*=Current_LCM_ID.LCD_Y_Max;
                                TPY1/=2048;
                                TPX2*=Current_LCM_ID.LCD_X_Max;
                                 TPX2/=2048;
                                TPY2*=Current_LCM_ID.LCD_Y_Max;
                                TPY2/=2048;


                               switch (RStatus)
```

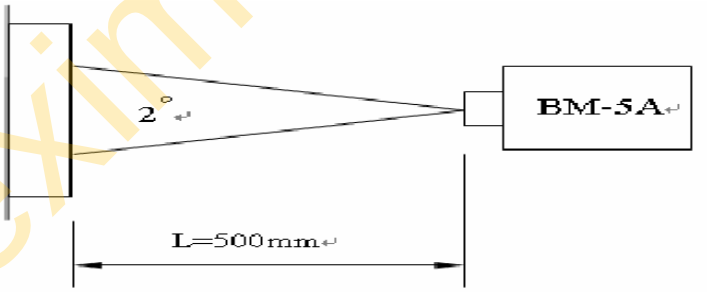
```
                {
                        case (EXC7200_I2C_CoordRead_1stTouch_Down):
                GUI_CircleFill(TPX1, TPY1, 2, rand()%0xFFFF);
                                // Do 1st touch down Function
                                break;
                        case (EXC7200_I2C_CoordRead_1stTouch_Lift):
                GUI_RectangleFill(TPX1-4, TPY1-4,TPX1+4, TPY1+4 ,rand()%0xFFFF);
                                // Do 1st touch Lift Function

                                break;
                        case (EXC7200_I2C_CoordRead_2ndTouch_Down):
                GUI_CircleFill(TPX1, TPY1, 2, RGB(128,128,128));
                GUI_CircleFill(TPX2, TPY2, 2, RGB(128,128,0));
                                // Do 2nd touch Down Function
                                break;
                        case (EXC7200_I2C_CoordRead_2ndtTouch_Lift):
                GUI_RectangleFill(TPX1-4, TPY1-4,TPX1+4, TPY1+4 ,RGB(128,128,128));
                GUI_RectangleFill(TPX2-4, TPY2-4,TPX2+4, TPY2+4 ,RGB(128,128,0));
                                // Do 2nd touch Lift Function
                                break;
                        default:
                                break;
                }

        }

}
```

8. OPTICAL CHARACTERISTICS

Item			Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio			CR	Point - 5 Θ=Φ=0°	200	250	--	--	(1)(2)(3)
Luminance			Lw		340	430	-	cd/m²	(1)(3)
Luminance Uniformity			ΔL		70	75	-	%	(1)(3)
Response Time (White – Black)			$T_r + T_f$		--	50	--	ms	(1)(3)(5)
Viewing Angle	Vertical		Θ	CR≧10 Point – 5	-	100	-	Deg.	(1)(2)(4)
	Horizontal		Φ		-	140	-		
Color chromaticity		Red	Rx	Point - 5 Θ=Φ=0°	0.553	0.603	0.653	--	(1)(3)
			Ry		0.322	0.372	0.422		
		Green	Gx		0.315	0.365	0.415		
			Gy		0.524	0.574	0.624		
		Blue	Bx		0.098	0.148	0.198		
			By		0.062	0.112	0.162		
		White	Wx		0.278	0.328	0.378		
			Wy		0.305	0.355	0.405		

NOTE :

(1) Measure conditions : 25℃±2℃ , 60±10%RH under 10Lux , in the dark room by BM-7TOPCON) ,viewing 2°, VCC=3.3V , VDD=3.3V



(2) Definition of Contrast Ratio :

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

(3) Definition of Luminance :

Definition of Luminance Uniformity

Measure white luminance on the point 5 as figure9-1

Measure white luminance on the point 1 ~ 9 as figure9-1

ΔL = [L(MIN) / L(MAX)] X 100%

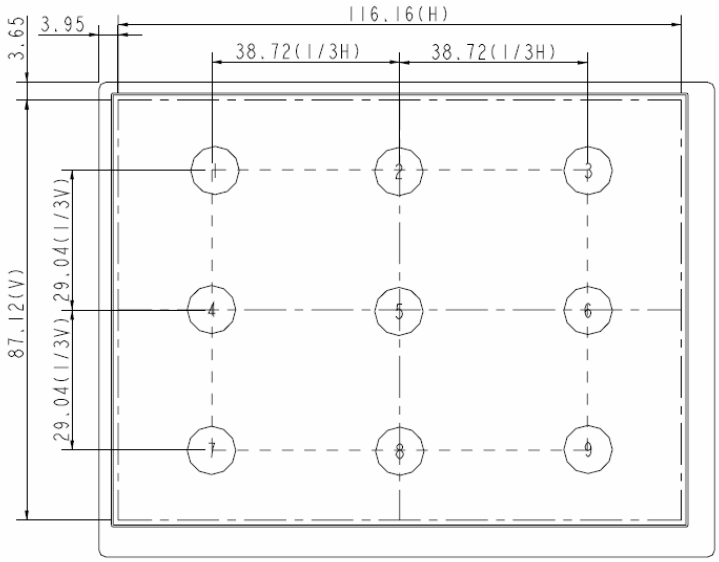


Fig9-1 Measuring point

(4) Definition of Viewing Angle(Θ,Φ), refer to Fig9-2 as below :

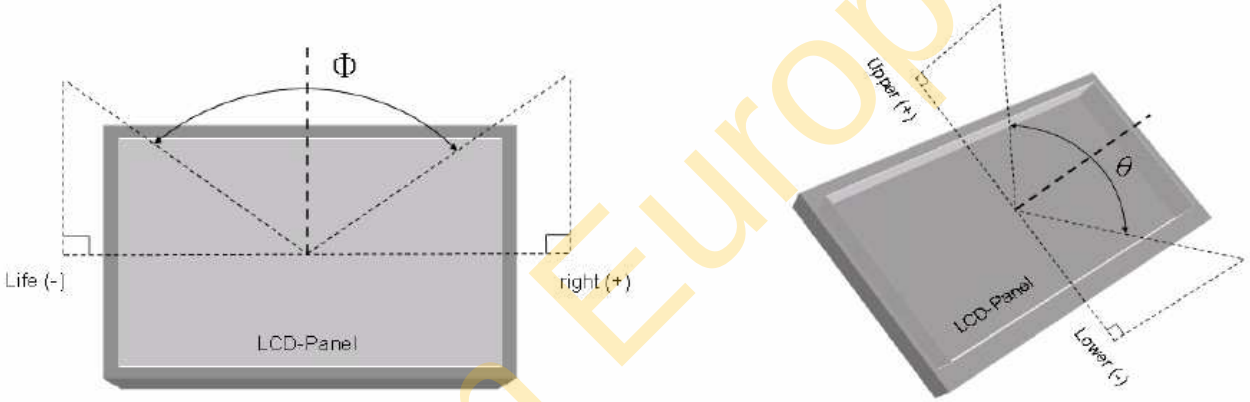


Fig9-2 Definition of Viewing Angle

(5) Definition of Response Time.(White – Black)

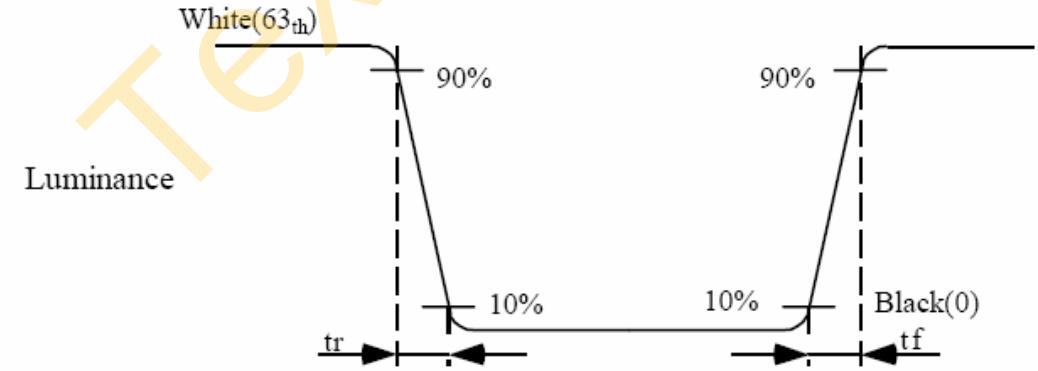


Fig9-3 Definition of Response Time(White-Black)

9. General Precautions

9-1 Safety

Liquid crystal is poisonous. Do not put it your month. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

9-2 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

9-3 Static Electricity

1. Be sure to ground module before turning on power or operation module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

9-4 Storage

1. Store the module in a dark room where must keep at +25±10℃ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

9-5 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

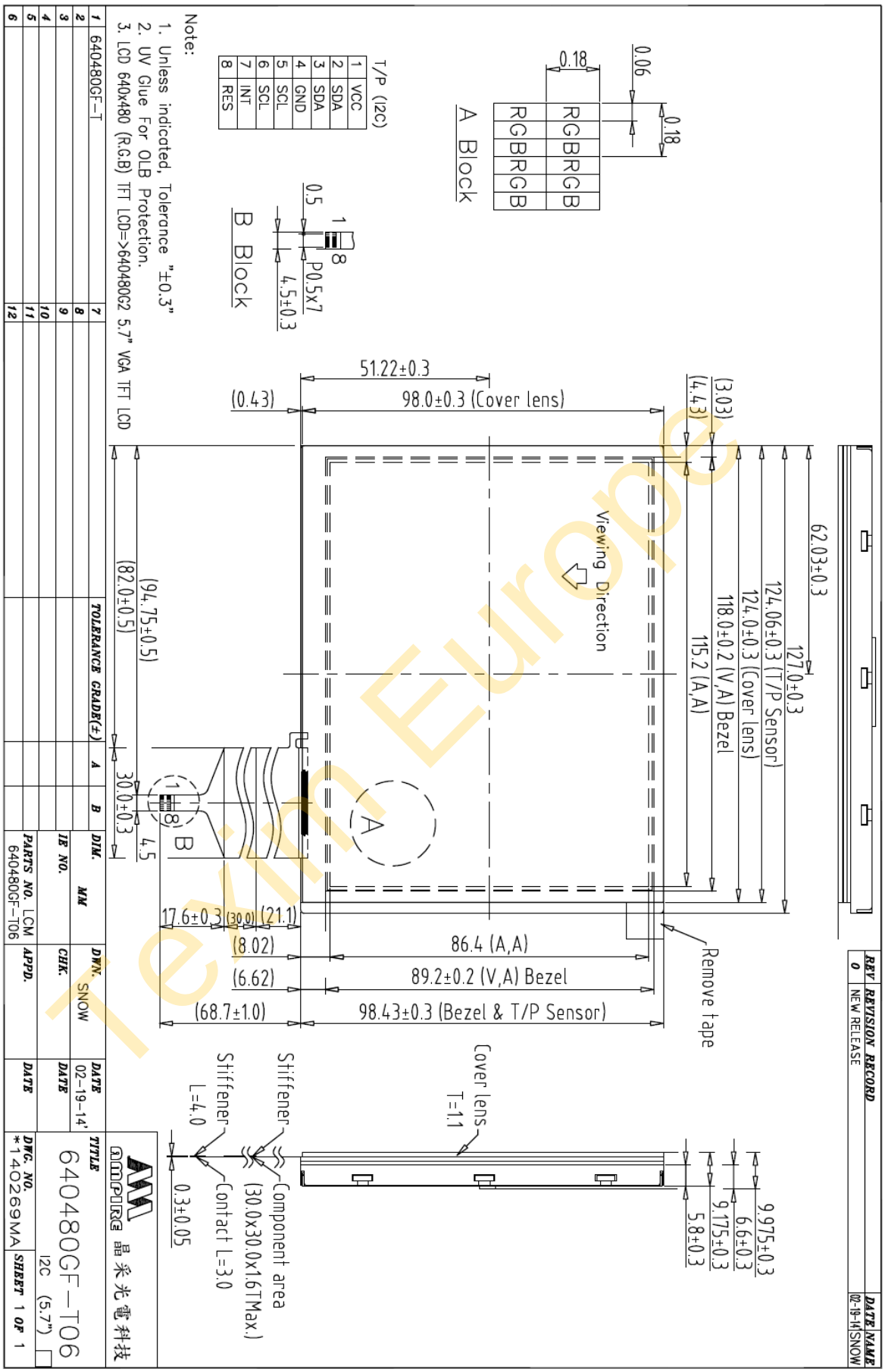
9-5 Others

1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
2. The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

10. RELIABILITY TEST CONDITIONS

ITEM	CONDITIONS
HIGH TEMPERATURE OPERATION	70℃ , 240Hrs
HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	60℃ , 90%RH , 240Hrs
HIGH TEMPERATURE STORAGE	80℃ , 240Hrs
LOW TEMPERATURE OPERATION	-20℃ , 240Hrs
LOW TEMPERATURE STORAGE	-30℃ , 240Hrs
THERMAL SHOCK	-30℃(0.5Hr) ~80℃(0.5Hr) 200Cycle

11. OUTLINE DIMENSION



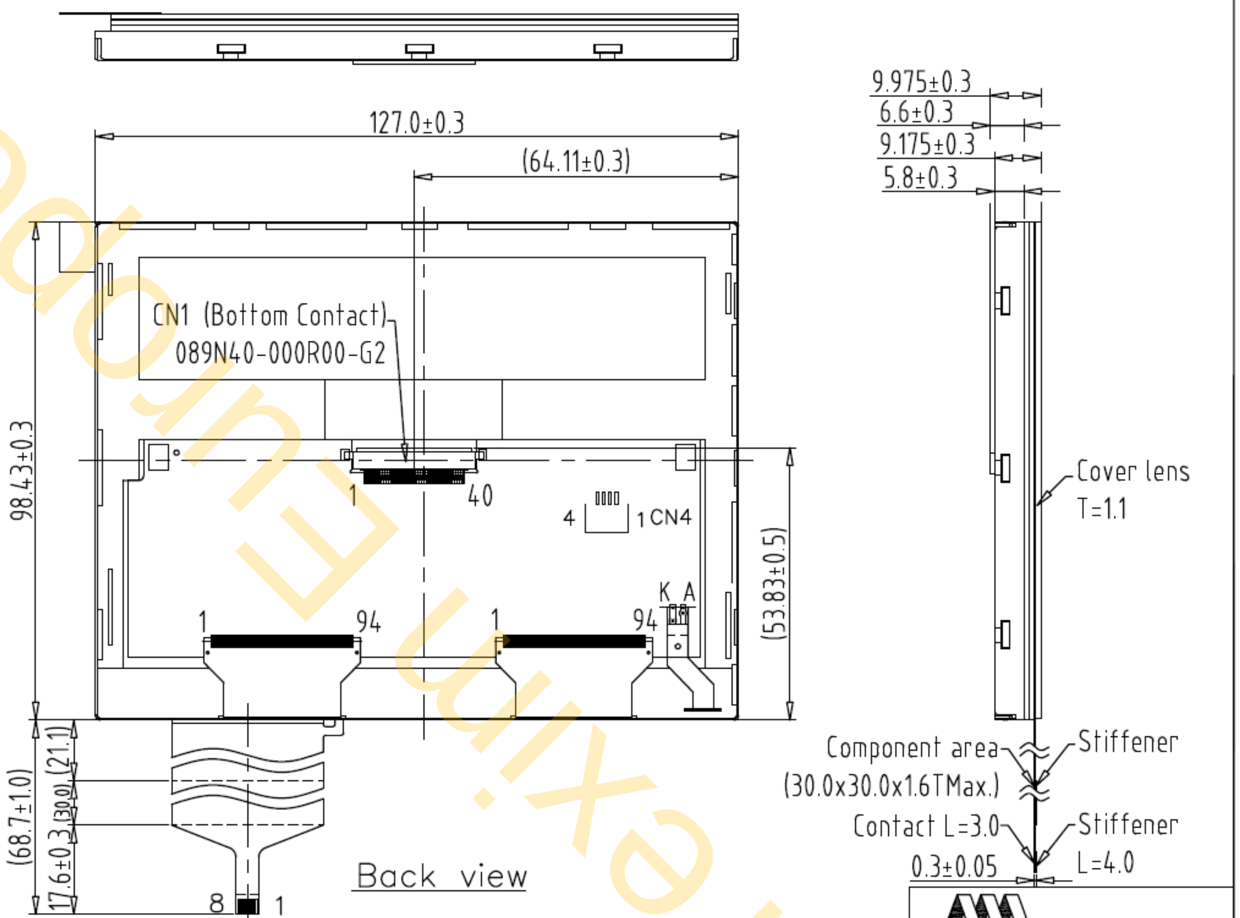
REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	02-19-14	SNOW

CN1

1	U/D	21	G5
2	DMS(NC)	22	G4
3	HSYNC(NC)	23	G3
4	VLED	24	VSS
5	VLED	25	G2
6	VLED	26	G1
7	VCC	27	G0
8	VSYNC(NC)	28	VSS
9	DE	29	R5
10	VSS	30	R4
11	VSS	31	R3
12	ADJ	32	VSS
13	B5	33	R2
14	B4	34	R1
15	B3	35	R0
16	VSS	36	VSS
17	B2	37	VSS
18	B1	38	DCLK
19	B0	39	VSS
20	VSS	40	L/R

T/P (I2C)

1	VCC
2	SDA
3	SDA
4	GND
5	SCL
6	SCL
7	INT
8	RES



Note:

1. Unless indicated, Tolerance "±0.3"
2. UV Glue For OLB Protection.
3. LCD 640x480 (R.G.B) TFT LCD=>640480G2 5.7" VGA TFT LCD

				TOLERANCE GRADE(±)	A	B	DIM. MM	DWN. SNOW	DATE 02-19-14'	TITLE
1	640480GF-T	7								AMPIRE 晶采光電科技
2		8					IE NO.	CHK.	DATE	640480GF-T06 I2C (5.7")
3		9								
4		10								
5		11					PARTS NO. LCM-1 640480GF-T06	APPD.	DATE	DWG. NO. *140270MA
6		12								SHEET 1 OF 1