![AMP Display logo](AMP DISPLAY - A Brighter Solution)

AMP DISPLAY INC.

SPECIFICATIONS

4.3-in COLOR TFT MODULE

CUSTOMER:	
CUSTOMER PART NO.	
AMP DISPLAY PART NO.	A M - 4 8 0 2 7 2 H C T M Q W - T 0 0 H
APPROVED BY:	
DATE:	

☐   APPROVED FOR SPECIFICATIONS

☐   APPROVED FOR SPECIFICATION AND PROTOTYPES

AMP DISPLAY INC

9856 SIXTH STREET   RANCHO CUCAMONGA   CA   91730
TEL: 909-980-13410   FAX: 909-980-1419
WWW.AMPDISPLAY.COM

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2012/04/19	-	Release	Kain
2012/04/24		Modify input power	Kain
2012/8/13	4	Update Brightness	Patrick

1. FEATURES

(1) Construction : a-Si TFT-LCD with driving system and White LED Backlight
(2) LCD type : Transmissive , Normally White
(3) Number of the Colors : 16.7M colors (R,G,B 8 bit digital each)
(4) RGB Interface 54 pin.
(5) LCD Power Supply Voltage : 3.3V for TFT circuit and 16.0V for LED backlight.
(6) Capacitive type touch panel

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display size (diagonal)	4.3	inch
Resolution	480RGB (W) x 272(H)	dots
Display area	98.7 (W) x57.5 (H)	mm
Pixel pitch	0.198 (W) x 0.198 (H)	mm
Overall dimension	105.5(W)x67.2(H)x6.24(D)	mm
Color configuration	R.G.B Vertical stripe	
View Direction (Gray Inversion)	6 o'clock	

3. ABSOLUTE MAXIMUM RATINGS

item	Symbol	Values		Unit	Remark
		Min	Max		
Power Supply for logic	VCC	-0.3	3.6	V	GND=0
Signal input voltage	DCLK DE R0~R5 G0~G5 B0~b5	-0.3	VCC+0.3	V	Note 1
Operation Temperature	T_{OP}	-20	70	℃	
Storage Temperature	T_{ST}	-30	80	℃	

Note 1: Hsync, Vsync, DEN, DCLK, R0~R7, G0~G7, B0~B7

Note 2: Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

4. OPTICAL CHARACTERISTICS

Item		Symbol	Conditon	Min.	Typ.	Max.	Unit	Remark
Response Time	Rise	Tr	Θ=0°	--	15	20	ms	Note 1,2,3,5
	Fall	Tf		--	35	50		
Contrast ratio		CR	At optimized viewing angle	150	250	--		Note 1,2,4,5
Viewing Angle	Top	θf	CR≧10	--	55	--	deg.	Note1,2, 5,6
	Bottom	θb		--	35	--		
	Left	θl		--	70	--		
	Right	θr		--	70	--		
Brightness		YL	IfLED=22mA, 25℃	--	280	--	cd/m²	Note 7
Red chromaticity		XR	Θ=0°	(0.565)	(0.615)	(0.665)		Reference only.
		YR		(0.294)	(0.344)	(0.394)		
Green chromaticity		XG		(0.257)	(0.307)	(0.357)		
		YG		(0.512)	(0.562)	(0.612)		
Blue chromaticity		XB		(0.083)	(0.133)	(0.183)		
		YB		(0.100)	(0.150)	(0.200)		
White chromaticity		XW		(0.259)	(0.309)	(0.359)		
		YW		(0.300)	(0.350)	(0.400)		
LED Life time		-		--	50K	--	hour	Note 8

Note 1: LED BL : Ambient temperature=25℃,and lamp current I$_{LED}$=22mA. To be measured in the dark room.

Note 2: To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter BM-7,after 10 minutes operation.

Note 3.Definition of 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.
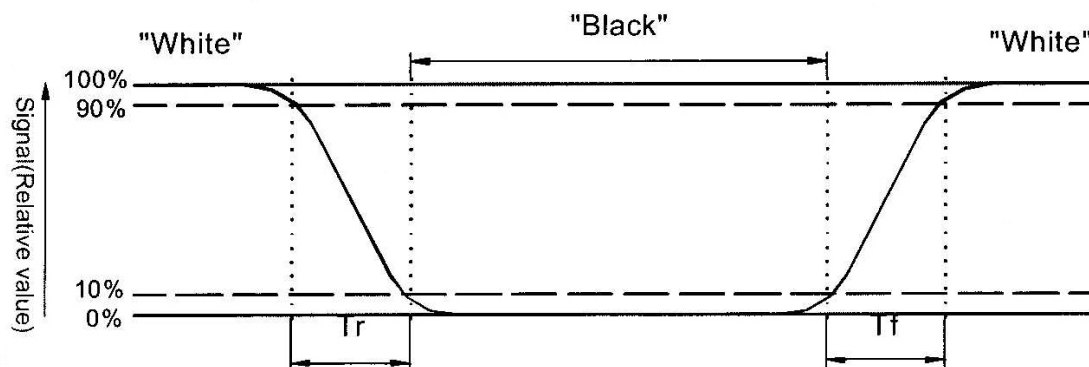
Note 4.Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

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

Note 5:White $V_i=V_{i50} +1.5V$
Black $V_i=V_{i50} +2.0V$
"±"means that the analog input signal swings in phase with V_{COM} signal.
"−" means that the analog input signal swings out of phase with V_{COM} signal.
V_{i50} : The analog input voltage when transmission is 50%.The 100% Transmission is defined as the transmission of LCD panel when all the Input terminals of module are electrically opened.

Note 6.Definition of viewing angle, Refer to figure as below.
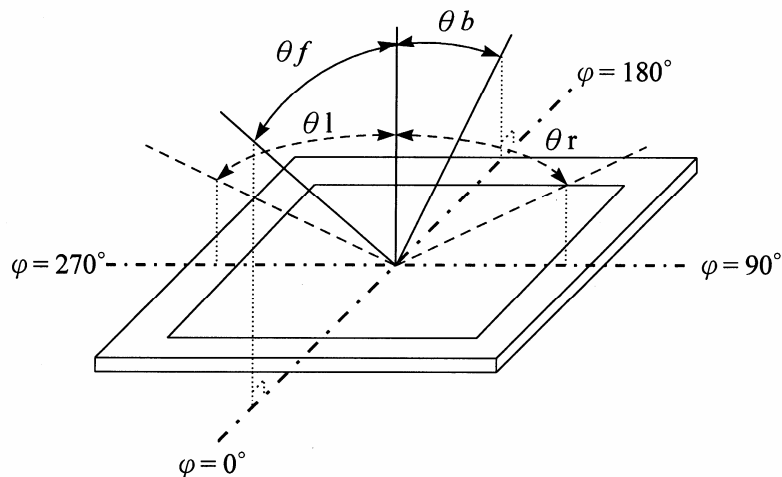
Note 7.Measured at the center area of the panel when all the input terminals of LCD
panel are electrically opened.
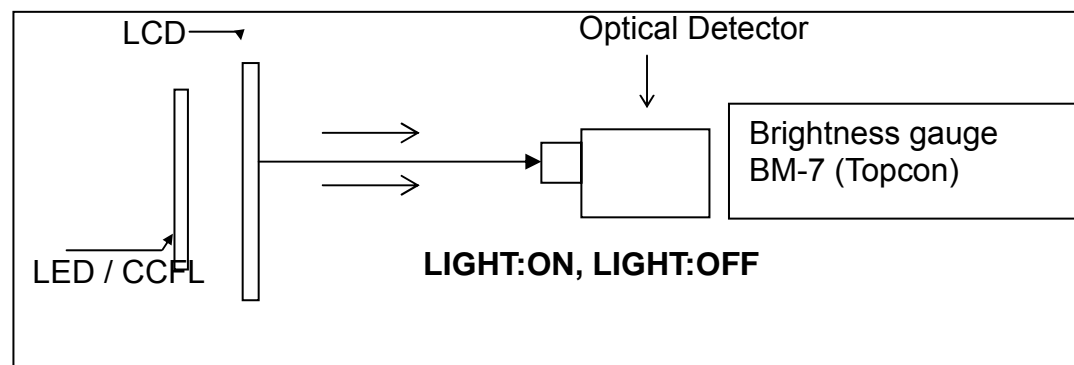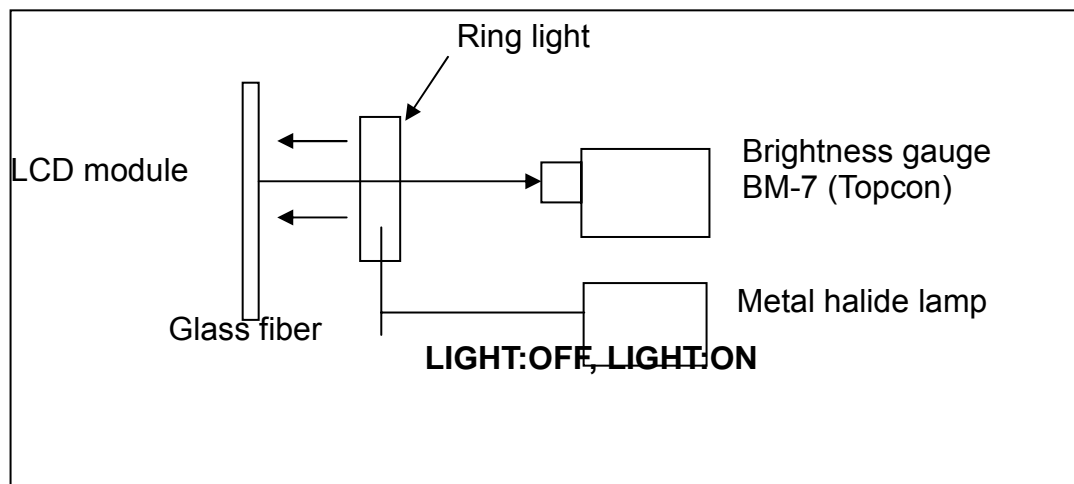
Note 8 Condition: Ta=25℃, continuous lighting
Life time is estimated data.

Definitions of failure:
1. LCM brightness becomes half of the minimum value.
2. LED doesn't light normally.

5. ELECTRICAL CHARACTERISTICS

LCD driving

| Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power supply voltage		VDD	3.0	3.3	3.6	V	
Input voltage for logic	H Level	V_{IH}	0.8 VDD	--	VDD	V	(1)
	L Level	V_{IL}	0	--	0.2 VDD	V	
Power Supply current		IDD	--	45	--	mA	(2)

Note 1: Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note 2: fV =60Hz , Ta=25℃ , Display pattern : All Black

LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	I_f =22mA	-	16.0	-	V
Forward current	I_f	Ta=25℃	-	22	30	mA
Uniformity	-	I_f=22mA	75%*1	-	-	
Luminous color	White					
Chip connection	5 chip serial connection*3					

■ The constant current source is needed for white LED back-light driving. When LCM is operated over 60 deg.C ambient temperature, the If of the LED back-light should be adjusted to 17mA max*
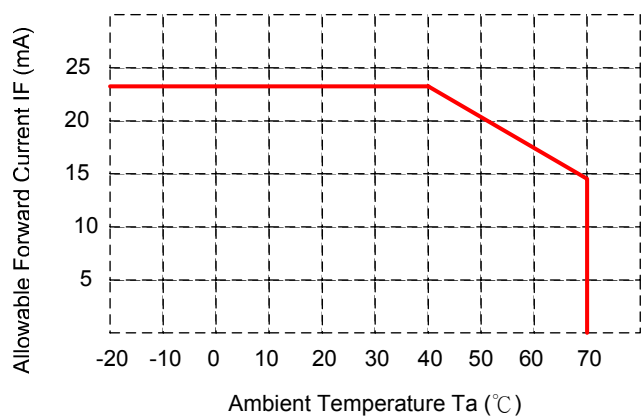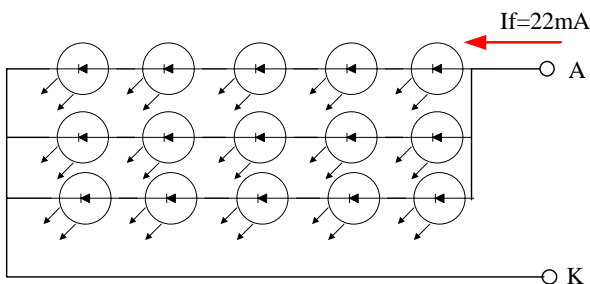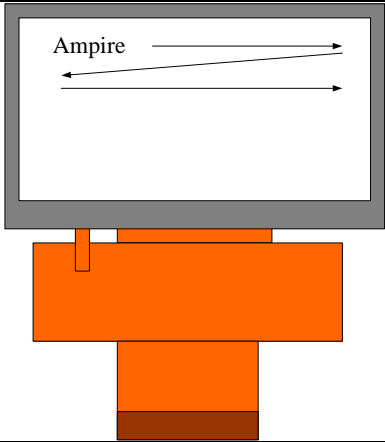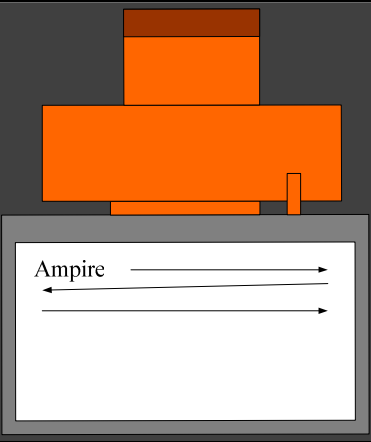
6. BLOCK DIAGRAM
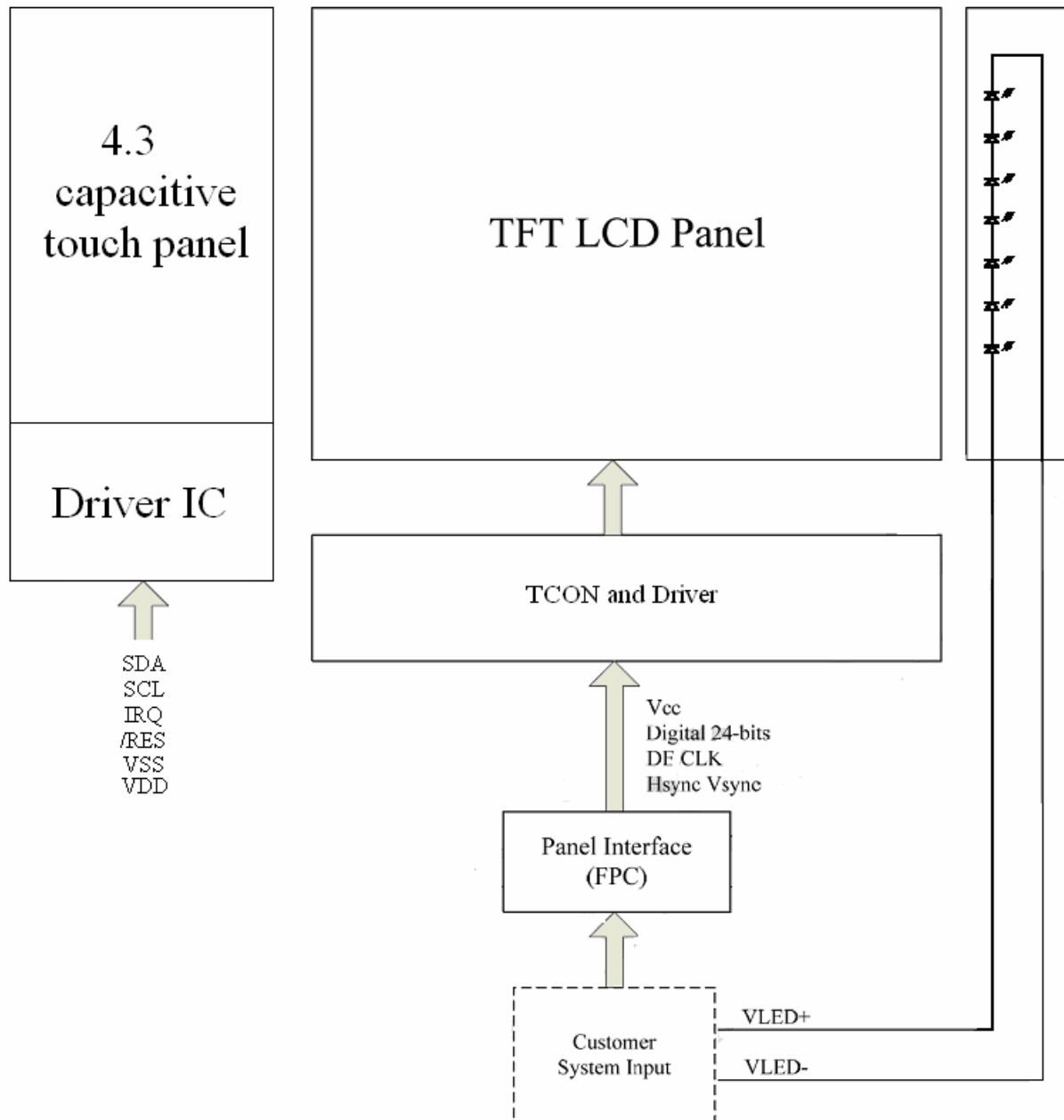
7. TFT LCD Panel FPC Descriptions

Pin no	Symbol	Function
1	BL-	LED cathode.
2	BL-	
3	BL+	LED Anode.
4	BL+	
5	GND	Ground
6	DISP	Display ON/OFF
7	GND	Ground
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection
11	NC	No Connection
12	B0	Blue Data Bit 0
13	B1	Blue Data Bit 1
14	B2	Blue Data Bit 2
15	B3	Blue Data Bit 3
16	B4	Blue Data Bit 4
17	B5	Blue Data Bit 5
18	B6	Blue Data Bit 6
19	B7	Blue Data Bit 7
20	G0	Green Data Bit 0
21	G1	Green Data Bit 1
22	G2	Green Data Bit 2
23	G3	Green Data Bit 3
24	G4	Green Data Bit 4
25	G5	Green Data Bit 5
26	G6	Green Data Bit 6
27	G7	Green Data Bit 7
28	R0	Red Data Bit 0
29	R1	Red Data Bit 1
30	R2	Red Data Bit 2
31	R3	Red Data Bit 3
32	R4	Red Data Bit 4
33	R5	Red Data Bit 5
34	R6	Red Data Bit 6
35	R7	Red Data Bit 7
36	HSYNC	Horizontal Sync Input
37	VSYNC	Vertical Sync Input
38	DCLK	Dot Data Clock

39	NC	NC
40	NC	NC
41	VCC	Power Supply(3.3V)
42	VCC	Power Supply(3.3V)
43	GND	Ground
44	R/L	Shift direction control pin for Horizontal R/L=H, STV OUT1 OUT2・・・OUT480 R/L=L, STV OUT480 OUT479・・・OUT1 (Note1.)
45	NC	NC
46	U/D	Shift direction control pin for Vertical U/D=H, STV OUT1 OUT2・・・OUT272 U/D=L, STV OUT272 OUT271・・・OUT1 (Note1.)
47	NC	NC
48	GND	Ground
49	GND	Ground
50	GND	Ground
51	NC	NC
52	ENB	Data Enable
53	GND	Ground
54	GND	Ground

Note1:

	L/R=1 U/D=1	Default setting L/R=0 U/D=0
scan direction		
View angle (Gray Inversion)	6H	12H

7-1 Capacitive Touch Panel FPC Descriptions

No.	Symbol	I/O	Description	Remark
1.	GND	-	Ground.(0V)	
2.	SDA	I/O	I2C Interface.	
3.	SCL	I		
4.	VDD	-	Power Supply for TP controller.(3.3V)	
5.	INT	O	IRQ Terminal.	
6.	XRES	I	Terminal of Reset TP controller.	

8.   INPUT SIGNAL

8.1 Parallel RGB input timing Chart
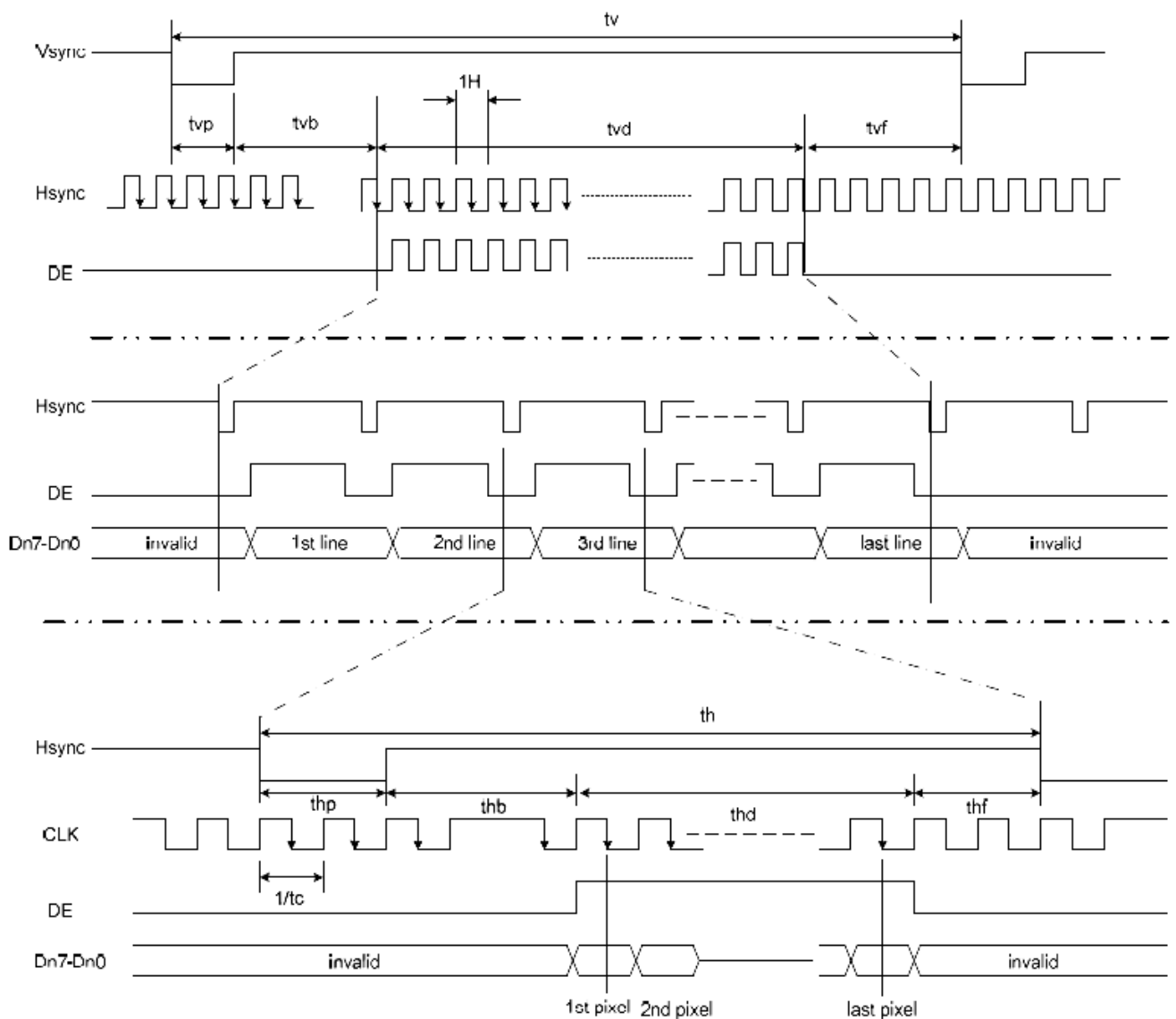
8.2 Timing Specification

Parallel RGB input timing requirement

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Clock cycle	$1/t_{c}$*1		9	15	MHz
Hsync cycle	$1/f_{H}$		17.14	-	KHz
Vsync cycle	$1/f_{v}$		59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th*2	575	575	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp	2	41	41	CLK
Horizontal back porch	thb	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285-	286	511	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp	1	10	11	H
Vertical back porch	tvb	1	2	11	H

Note:
1. Unit: CLK=1/ fCLK , H=th
2. Parallel interface. Clock frequency and horizontal signal parameters are tripled in serial interface. The Maximum clock frequency of serial interface is 33MHz
3. thd=480CLK, thf=2CLK, thp=41CLK, thb=2CLK, thf + fhp + ftb > 44

8.3 Timing Chart 2
Input setup timing requirement

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-		ns
Clock period	PW_{CLK}*1	66.7	-	-	ns
Clock pulse high period	PWH*1	26.7	-	-	ns
Clock pulse low period	PWL*1	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-		ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
DE setup time	t_{des}	10	-	-	ns
DE hold time	t_{deh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note
1. For parallel interface, maximum clock frequency is 15MHz.
2. tr, tf is defined 10% to 90% of signal amplitude.
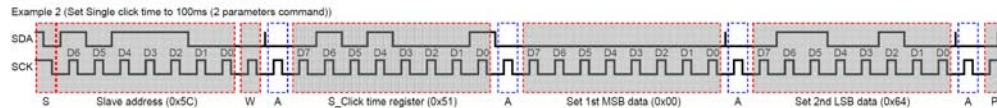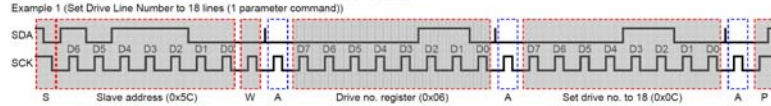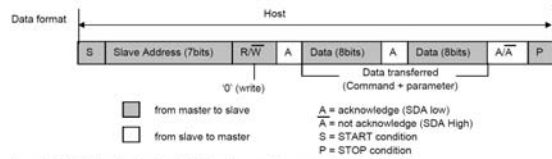
8.4 Input setup timing Chart
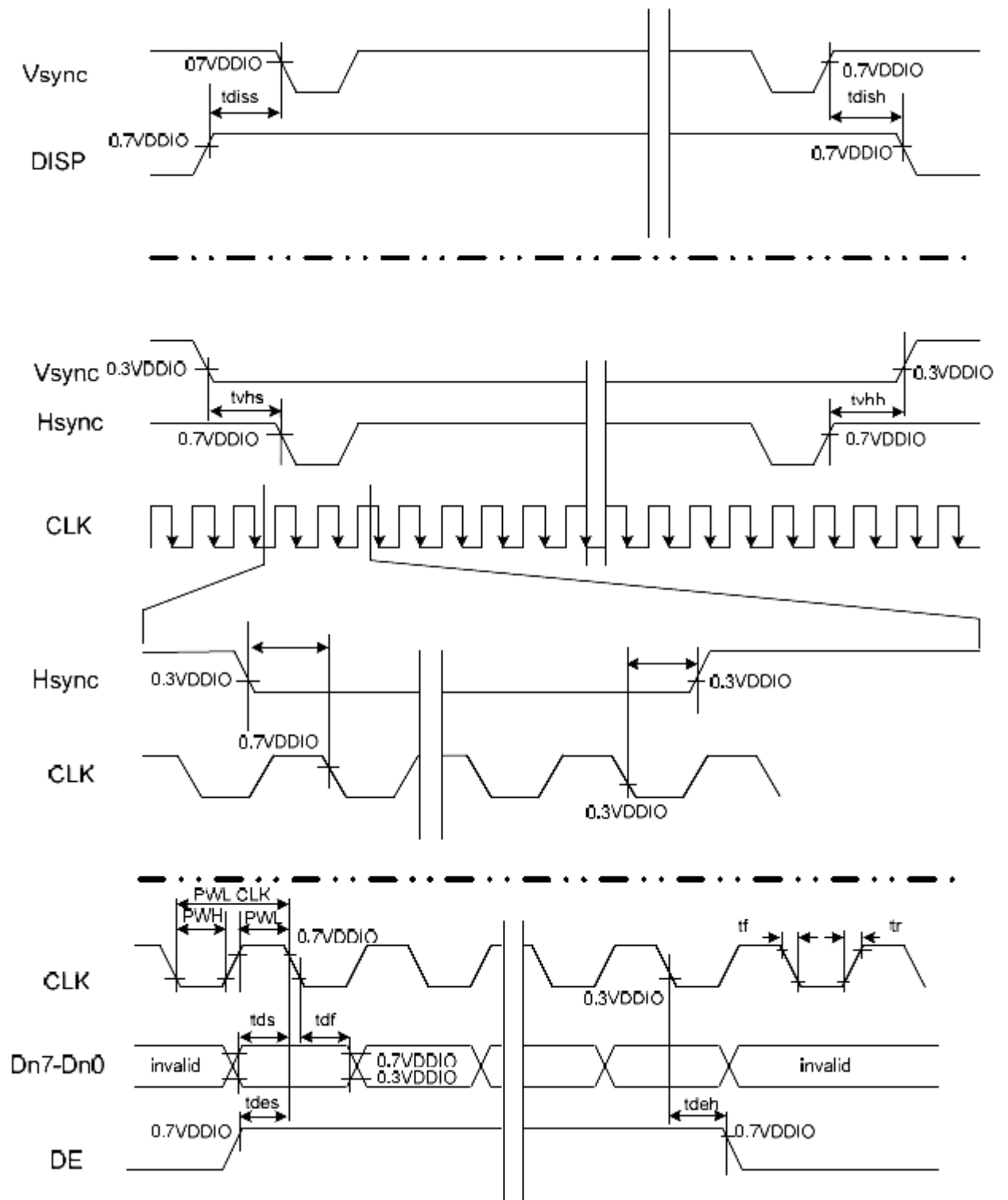
8.5 AC Timing characteristic of the capacitive touch panel
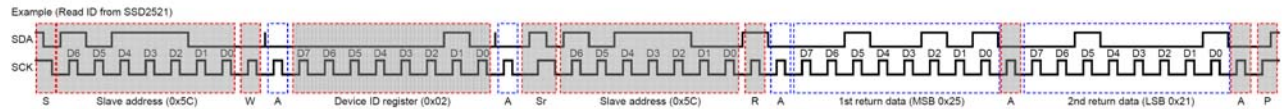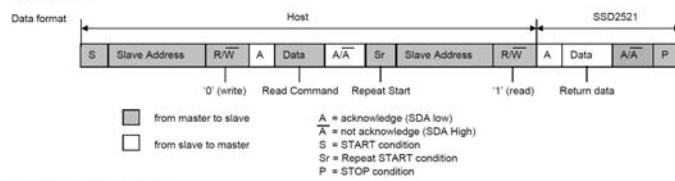
IIC Interface (T/P Controller)   Slave Address=0x5C.

Note: All the command and parameter data byte must be sent within 1 transaction (i.e. between START and STOP signal)

Note: A Repeat-START condition must be use between the address setup and data read transaction.
All the data must be read within one transaction ot the address counter will return to 0 after the SSD2521 received a STOP signal (i.e. the return data will always start from 1st data bye when host issued READ request).

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	-	us
t_{HSTART}	Start condition Hold Time	0.6	-	-	us
t_{HD}	Data Hold Time (for "SDA$_{OUT}$" pin)	0	-	-	ns
	Data Hold Time (for "SDA$_{IN}$" pin)	300	-	-	ns
t_{SD}	Data Setup Time	100	-	-	ns
t_{SSTART}	Start condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	-	us
t_{SSTOP}	Stop condition Setup Time	0.6	-	-	us
t_R	Rise Time for data and clock pin	-	-	300	ns
t_F	Fall Time for data and clock pin	-	-	300	ns
t_{IDLE}	Idle Time before a new transmission can start	1.3	-	-	us
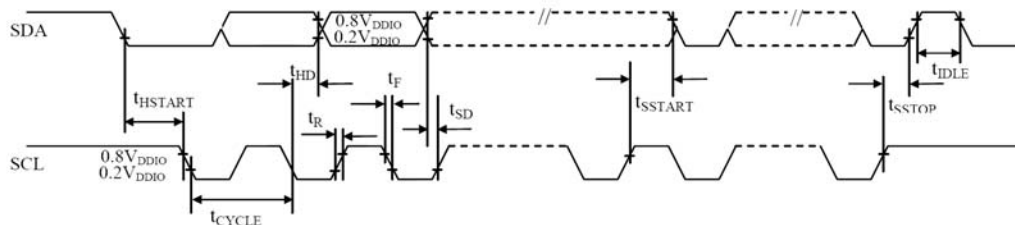
Symbol	Parameter	Min	Typ	Max	Unit
t_{PR}	Power rise time	-	-	30	us
t_{PD}	Power delay time	-	-	30	us
t_{STABLE}	Chip stable time	-	-	10	us
t_{RES}	Reset pulse	4	-	-	us
t_{READY}	Chip need time after hardware reset	-	-	1	us

9. Touch Panel Initial code

```
void TP_ini(void)
{

//IO_I2C_WR(device_Addr, Command, parameter);
//IO_I2C_WR_2Byte(device_Addr, Command, parameterH, parameterL);

IO_I2C_WR(0x5C,0x23,0x00);
Delay(10);
IO_I2C_WR(0x5C,0x2B,0x03);
IO_I2C_WR(0x5C,0xD4,0x00);
IO_I2C_WR(0x5C,0x06,0x0D);
IO_I2C_WR(0x5C,0x07,0x05);
IO_I2C_WR(0x5C,0x08,0x00);
IO_I2C_WR(0x5C,0x09,0x01);
IO_I2C_WR(0x5C,0x0A,0x02);
IO_I2C_WR(0x5C,0x0B,0x03);
IO_I2C_WR(0x5C,0x0C,0x04);
IO_I2C_WR(0x5C,0x0D,0x05);
IO_I2C_WR(0x5C,0x0E,0x06);
IO_I2C_WR(0x5C,0x0F,0x07);
IO_I2C_WR(0x5C,0x10,0x08);
IO_I2C_WR(0x5C,0x11,0x09);
IO_I2C_WR(0x5C,0x12,0x0A);
IO_I2C_WR(0x5C,0x13,0x0B);
IO_I2C_WR(0x5C,0x14,0x0C);
IO_I2C_WR(0x5C,0x15,0x0D);
IO_I2C_WR(0x5C,0x16,0x0E);
IO_I2C_WR(0x5C,0x17,0x0F);
IO_I2C_WR(0x5C,0x18,0x10);
IO_I2C_WR(0x5C,0x19,0x11);
IO_I2C_WR(0x5C,0x1A,0x12);
IO_I2C_WR(0x5C,0x1B,0x13);
IO_I2C_WR(0x5C,0x1C,0x14);
IO_I2C_WR(0x5C,0x2A,0x03);
IO_I2C_WR(0x5C,0x8D,0x01);
Delay(100);
IO_I2C_WR(0x5C,0x8D,0x00);
IO_I2C_WR(0x5C,0x25,0x0C);
Delay(100);
IO_I2C_WR(0x5C,0xC1,0x02);
IO_I2C_WR(0x5C,0xD5,0x0C);
Delay(300);
```

```
IO_I2C_WR(0x5C,0x38,0x00);
IO_I2C_WR(0x5C,0x33,0x01);
IO_I2C_WR(0x5C,0x34,0x3A);
IO_I2C_WR_2Byte(0x5C,0x35,0x00,0x40);
IO_I2C_WR(0x5C,0x36,0x1E);
IO_I2C_WR(0x5C,0x37,0x03);
IO_I2C_WR(0x5C,0x39,0x01);
IO_I2C_WR(0x5C,0x56,0x01);
IO_I2C_WR_2Byte(0x5C,0x51,0x00,0xFF);
IO_I2C_WR_2Byte(0x5C,0x52,0x00,0xFF);
IO_I2C_WR(0x5C,0x53,0x20);
IO_I2C_WR(0x5C,0x54,0x40);
IO_I2C_WR(0x5C,0x55,0x40);
IO_I2C_WR(0x5C,0xD9,0x01);
IO_I2C_WR(0x5C,0xD8,0x03);
IO_I2C_WR(0x5C,0xD7,0x04);
IO_I2C_WR(0x5C,0x2C,0x02);
IO_I2C_WR(0x5C,0x3D,0x01);
IO_I2C_WR(0x5C,0xD6,0x01);
IO_I2C_WR(0x5C,0xA2,0x00);
IO_I2C_WR(0x5C,0x2C,0x02);
IO_I2C_WR(0x5C,0x66,0x35);
IO_I2C_WR(0x5C,0x67,0x36);
}
```

10. Color Data Assignment

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	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	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	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	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	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

11. RELIABILITY

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=240 hrs	
Low Temperature Operation	-20±3°C , t=240 hrs	
High Temperature Storage	80±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Thermal Shock Test	-20°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Humidity Test	60 °C, Humidity 90%, 96 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions
(15-35°C , 45-65%RH).

Definitions of life end point :

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

12   USE PRECAUTIONS

12.1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzene and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

12.2 Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

12.3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
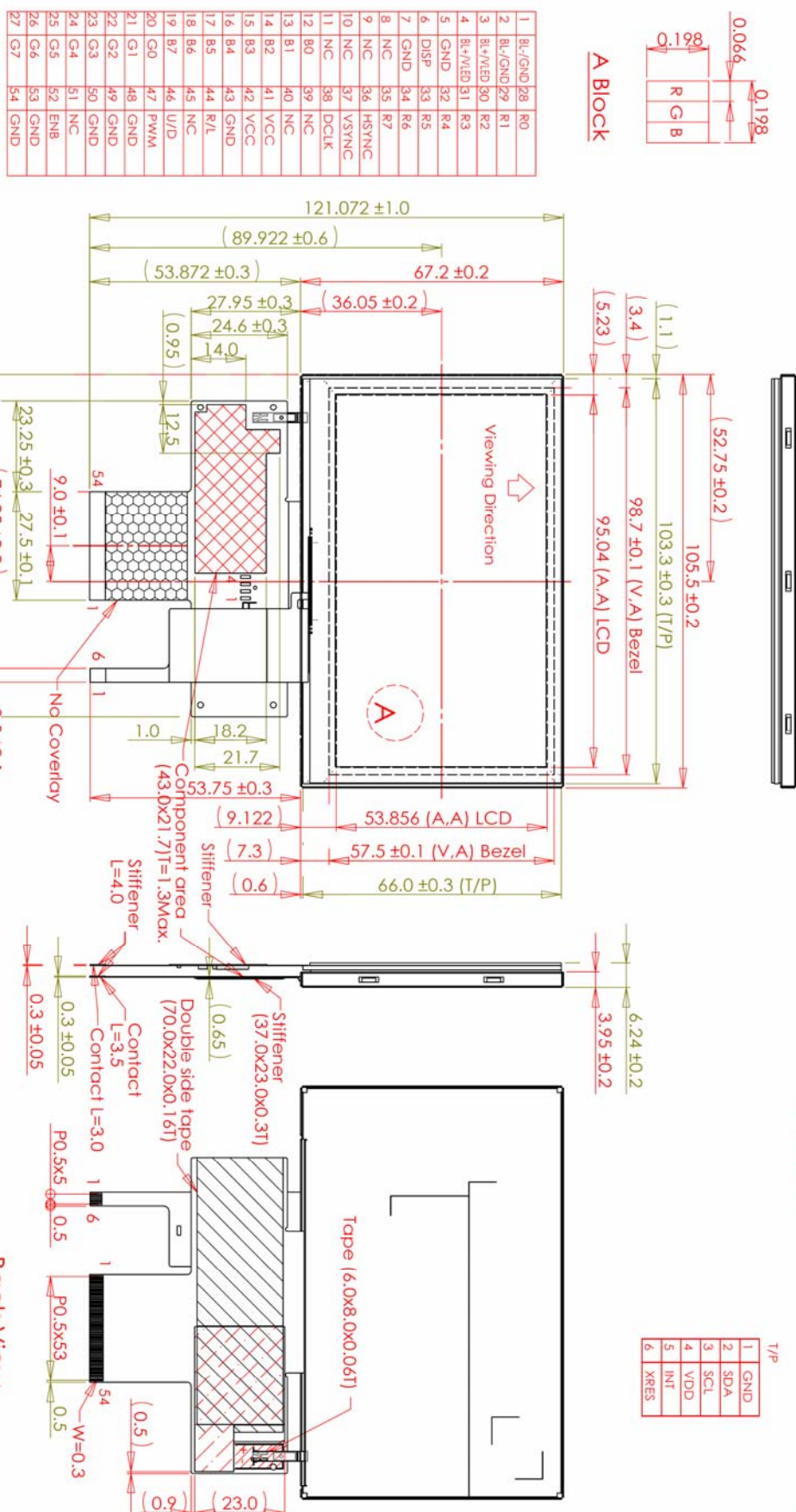3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

12.4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.

2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.

3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.

4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.

5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.

6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.

7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

12.5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.

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.

3) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.