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-480272MGTZQW-T92H
APPROVED BY	
DATE	

☐ Preliminary Specification
☐ Approved Specification

AMPIRE CO., LTD.
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APPROVED BY	CHECKED BY	ORGANIZED BY
Kokai	Mark	Lawlite

This Specification is subject to change without notice.

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2019/10/09	-	New Release	Lawlite

1. Features

4.3 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 4.3” TFT-LCD panel and backlight unit.

(1) Construction: 4.3” a-Si TFT active matrix and White LED Backlight.

(2) Resolution (pixel): 480(R.G.B) X 272

(3) Number of the Colors : 16.7M colors (R , G , B, 8bit digital each)

(4) LCD type : **IPS : Transmissive , normally Black**

(5) Viewing Direction: All Direction.

(6) LCD Interface : 24 Bit TTL RGB interface

(7) Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.

(8) Hardware Rotation 180 degree

(9) Projective Capacitive Touch:

a. Interface : I2C
b. Touch Controller: ST1624N32C
c. OGS Solution
d. Square double sided tape between LCD and touch panel.
e. Cover Lens :
- Printing: Black border (Pantone :Black)

2. PHYSICAL SPECIFICATIONS

NO	Item	Specification	Remark
1	LCD Size	4.3 inch (Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	480 x 3 (RGB) x 272	
4	Display Mode	Normally Black. Transmissive	
5	Dot pitch	0.198 (W) x 0.198(H) mm	
6	Active area	95.04(W) x 53.856(H) mm	
7	Module Size	110.5 x 72.7 x 5.0(Typ.)	Note 1
8	Color arrangement	RGB-stripe	
9	Luminance	425(typ)	Cd/m^2

(Note1) Refer to the mechanical drawing.

3. ABSOLUTE MAX. RATINGS

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

3.1 Electrical Absolute max. ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	V_{DD}	GND=0	-0.3	4.0	V	
Input voltage	V_{in}		-0.3	V_{DD}+0.3	V	Note 1

Note1:Hsync, Vsync, DE, DCLK, DISP, R0~R7, G0~G7, B0~B7

3.2 Environmental Absolute max. ratings

Item	OPERATING		STORAGE		Remark
	MIN	MAX	MIN	MAX	
Temperature	-20	70	-30	80	Note2,3,4,5,6,7
Humidity	Note1		Note1		
Corrosive Gas	Not Acceptable		Not Acceptable		

Note1 : Ambient temperature Ta <= 40℃ : 85% RH max

Ta > 40℃: Absolute humidity must be lower than the humidity of 85%RH at 40℃

Note2 : For storage condition Ta at -30℃ < 48h , at 85℃ < 100h

For operating condition Ta at -20℃ < 100h

Note3 : Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note4 : The response time will be slower at low temperature.

Note5 : Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25℃

Note6 : When LCM panel is operated over 60℃ (center of the panel surface temperature), the I_{LED} of the LED back-light should be adjusted to 30mA

Note7 : This is center of the panel surface temperature, not ambient temperature.

4. ELECTRICAL CHARACTERISTICS

4.1 DC CHARACTERISTICS

Typical operating conditions (GND=0V)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		V_{DD}	3.0	3.3	3.6	V	
Input Voltage for logic	H Level	V_{IH}	0.7 V_{DD}	--	V_{DD}	V	Note 1
	L Level	V_{IL}	0	--	0.3 V_{DD}	V	
Power Supply current		I_{DD}		TBD	--	mA	Note 2

Note1: :Hsync, Vsync, DE, DCLK, DISP, R0~R7, G0~G7, B0~B7

Note2: TFT power supply current.

V_{DD}=3.3V, f_V =60Hz, Ta=25℃, Display pattern: All White

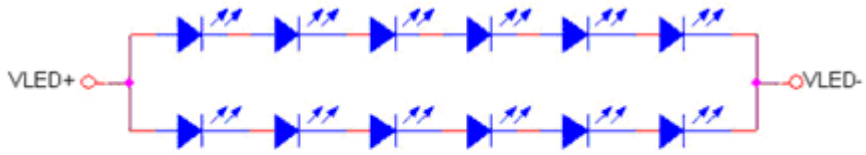
4.2 LED BACKLIGHT UNIT

Electrical characteristic of LED Back-light

The back-light system is an edge-lighting type with 12 LED.

The characteristics of the LED are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	--	40	--	mA	(2)
LED voltage	VL	16.2	--	19.2	V	
Operating LED life time	Hr	--	50K	--	Hours	(1)(2)



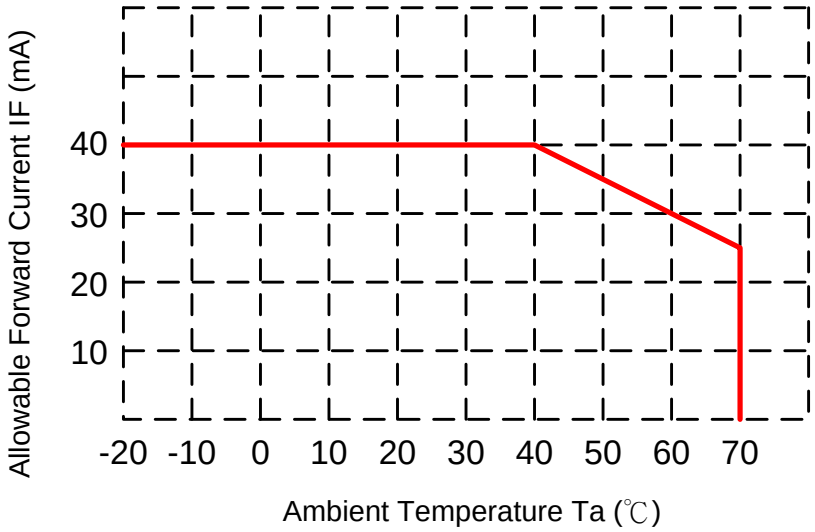
LED Light Bar Circuit

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

The constant current source is needed for white LED back-light driving. When

LCM is operated over 60℃ ambient temperature, the I_L of the LED back-light should be adjusted to 30mA max.



5. OPTICIAL CHARACTERISTICS OF LCD

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time		$T_r + T_f$	Θ=0°		30	40	ms ms	Note 1,2,3,5
Contrast ratio		CR	At optimized viewing angle	(640)	(800)	-		Note 1,2,4,5
Viewing Angle	Top Bottom Left Right		CR≧10	75	85	- - - -	deg.	Note1,2, 5,6
Brightness		Y_L	**I_{LED}=40.0mA, 25℃**	340	425	-	cd/m²	Note 7
Red chromaticity		XR	Θ=0° Θ=0°	Typ -0.05	0.629	Typ +0.05		Note 7 For reference only. These data should be update according the prototype.
		YR			0.326			
Green chromaticity		XG			0.337			
		YG			0.546			
Blue chromaticity		XB			0.136			
		YB			0.143			
White chromaticity		XW			0.320			
		YW			0.345			

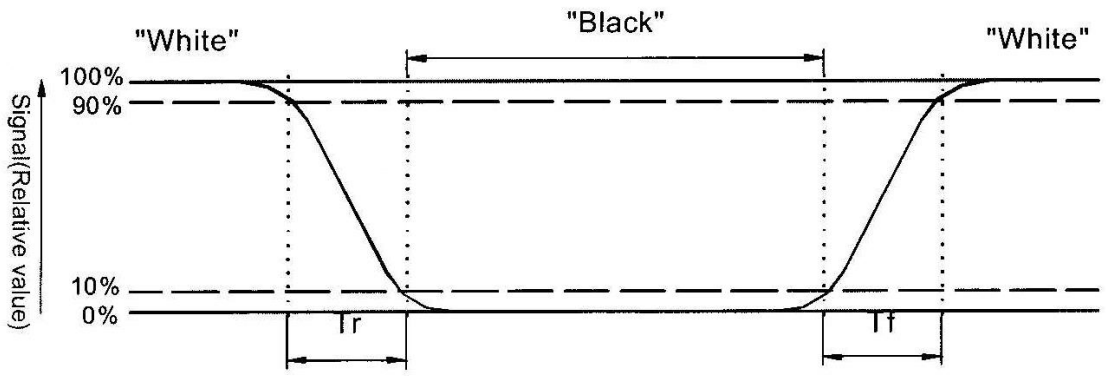
( )For reference only. These data should be update according the prototype.

Note 1:Ambient temperature=25℃,and lamp current I_{LED}=40mA.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:

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

Note 5:White $V_i=V_{i50}$ +1.5V

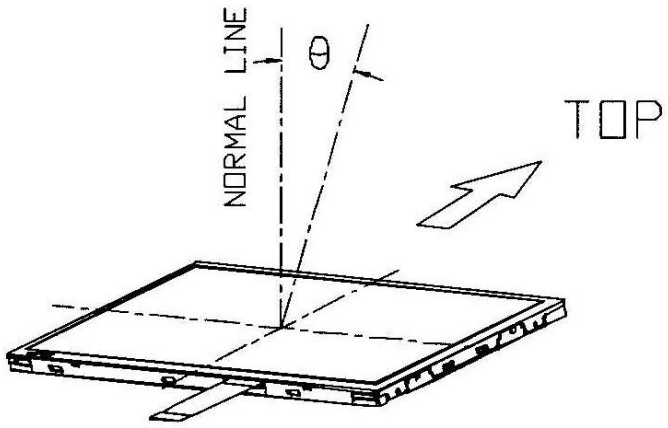
Black $V_i=V_{i50}$ +2.0V

“±”means that the analog input signal swings in phase with V_{COM} signal.

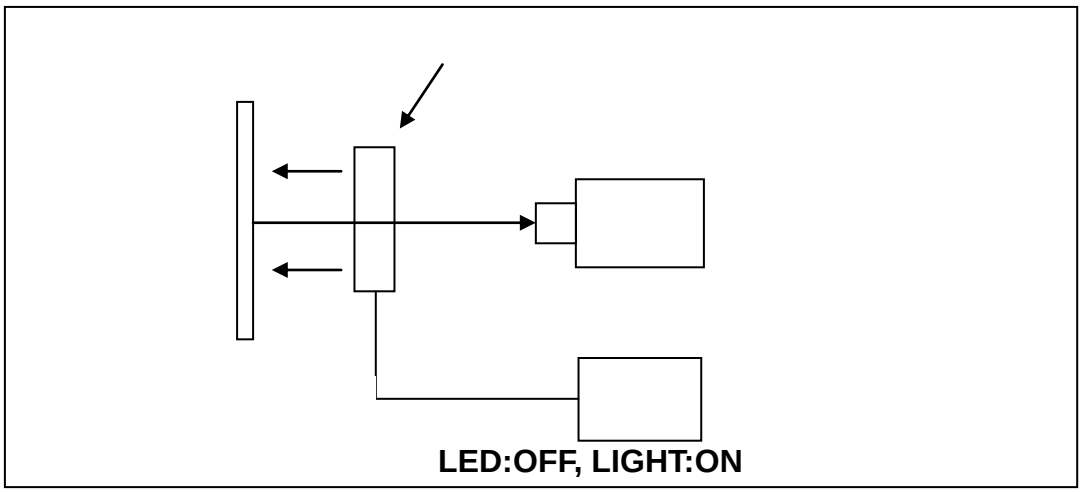
“$\begin{matrix}-\\+\end{matrix}$“ means that the analog input signal swings out of phase with V_{COM} signal.

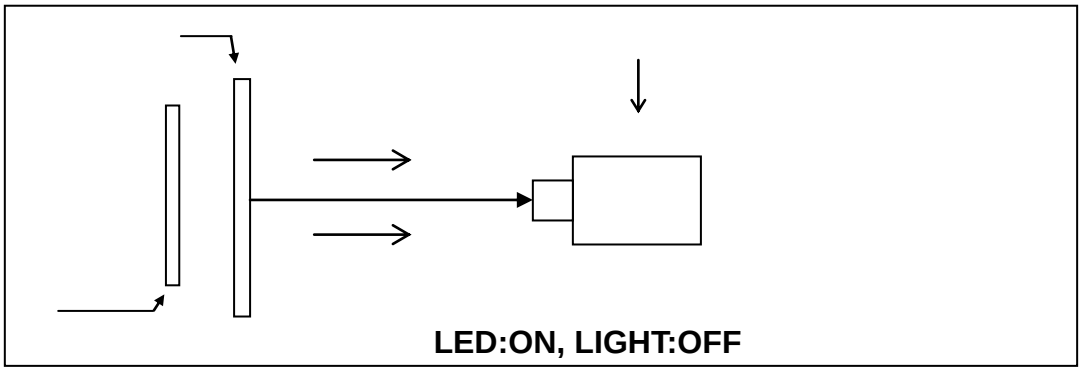
V_{i50} : The analog input voltage when transmission is 50%.The 100% Transmission is defined as the transmission of LCD panel when all the Input terminals of module are electrically opened.

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.





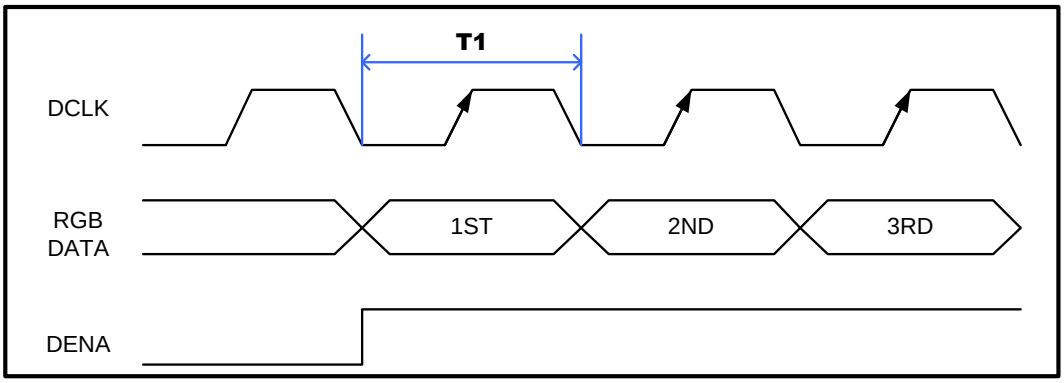
6.INTERFACE

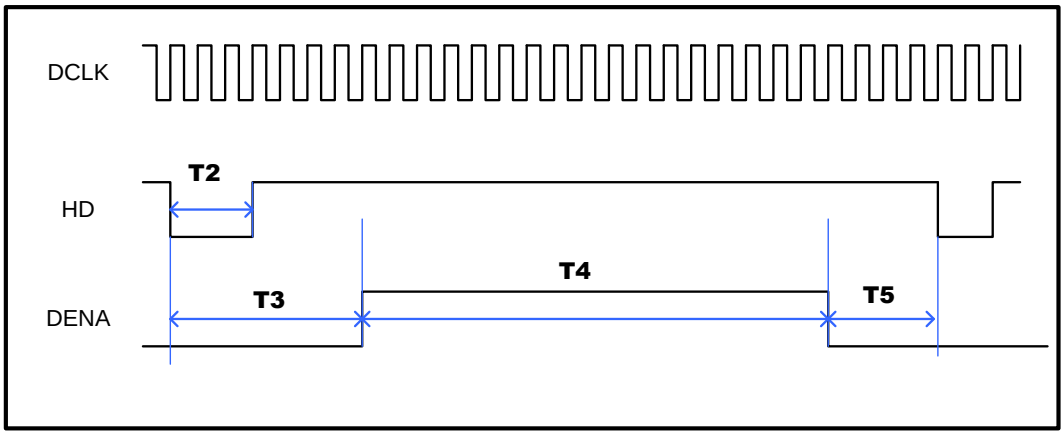
Mating connector: CSF-2082-401R/P0.5 40PIN

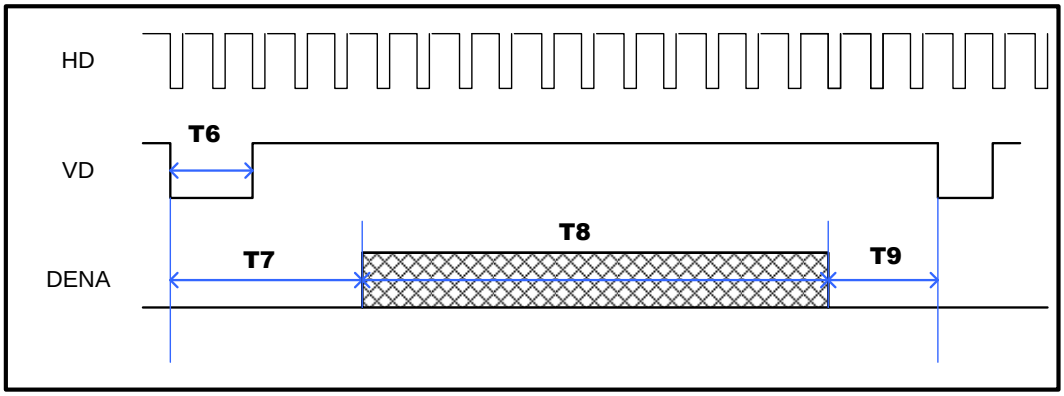
Pin no	Symbol	I/O	Description	Remark
1	VLED-	P	LED Back-light Cathode	
2	VLED+	P	LED Back-light Anode	
3	GND	P	Power GND	
4	VDD	P	Power supply for the logic (3.3V)	
5	R0	I	Red Data (LSB)	
6	R1	I	Red Data	
7	R2	I	Red Data	
8	R3	I	Red Data	
9	R4	I	Red Data	
10	R5	I	Red Data	
11	R6	I	Red Data	
12	R7	I	Green Data (MSB)	
13	G0	I	Green Data (LSB)	
14	G1	I	Green Data	
15	G2	I	Green Data	
16	G3	I	Green Data	
17	G4	I	Green Data	
18	G5	I	Green Data	
19	G6	I	Green Data	
20	G7	I	Green Data (MSB)	
21	B0	I	Blue Data (LSB)	
22	B1	I	Blue Data	
23	B2	I	Blue Data	
24	B3	I	Blue Data	
25	B4	I	Blue Data	
26	B5	I	Blue Data	
27	B6	I	Blue Data	
28	B7	I	Blue Data (MSB)	
29	GND	P	Power GND	
30	DCLK	I	Clock signal. Latching data at the rising edge.	
31	DISP	I	L : Standby mode. H: Normal display mode	
32	HSYNC	I	Horizontal sync input in digital RGB mode	
33	VSYNC	I	Vertical sync input in digital RGB mode.	
34	DE	I	Input data enable control	
35	NC	-	No connection	
36	GND	P	Power GND	
37	Y_T	-	No connection	
38	X_L	-	No connection	
39	Y_B	-	No connection	
40	X_R	-	No connection	

7. LCD INTERFACE TIMING

7.1 TTL RGB

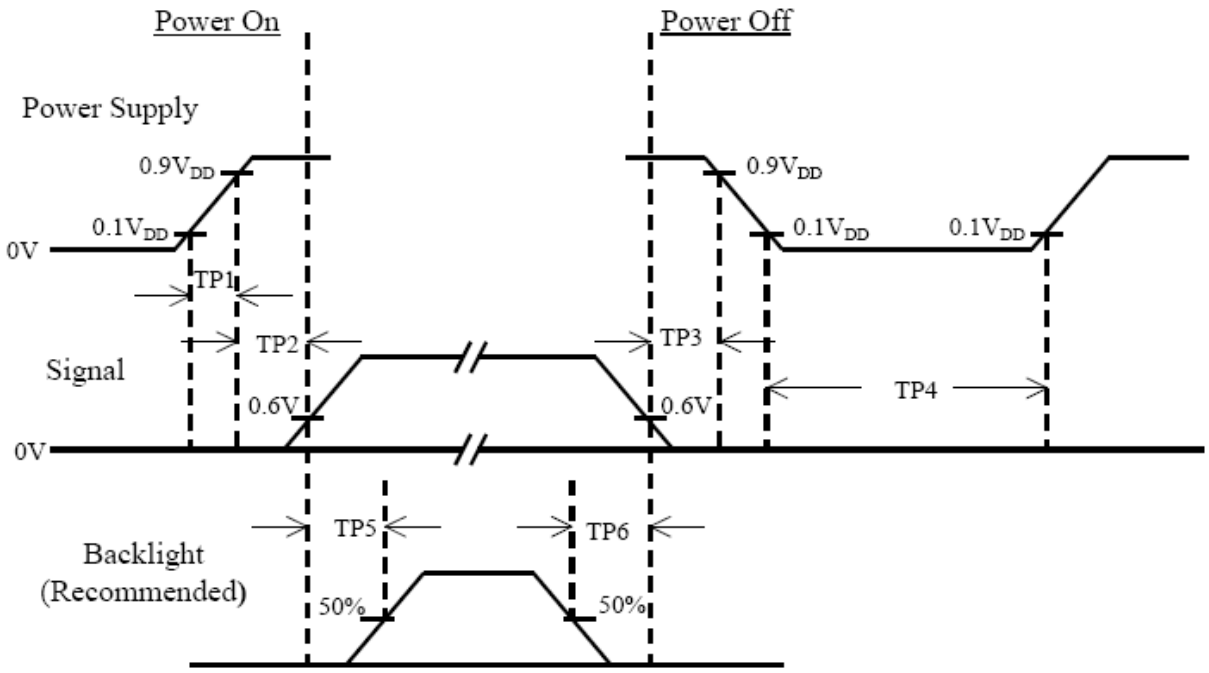






ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Clock Frequency	1/T1	8	9	12	MHz
HSYNC Pulse Wide	T2	2	4	43	clocks
HSYNC Back Porch	T3	3	43	43	Clocks
HSYNC Front Porch	T5	2	8	75	Clocks
Horizontal Display Period	T4		480		Clocks
Horizontal total Period	T3+T4+T5	485	531	598	Clocks
VSYNC Pulse Wide	T6	2	4	12	Lines
VSYNC Back Porch	T7	2	12	12	Lines
VSYNC Front Porch	T9	2	8	37	Lines
Vertical Display Period	T8		272		Lines
Vertical total Period	T7+T8+T9	276	292	321	Lines

7.2 Power On/Off Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	500	--	--	msec	
TP5	250	--	--	msec	
TP6	100	--	--	msec	

Note：

(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

8. Projective Capacitive Touch

8.1 Basic Characteristic

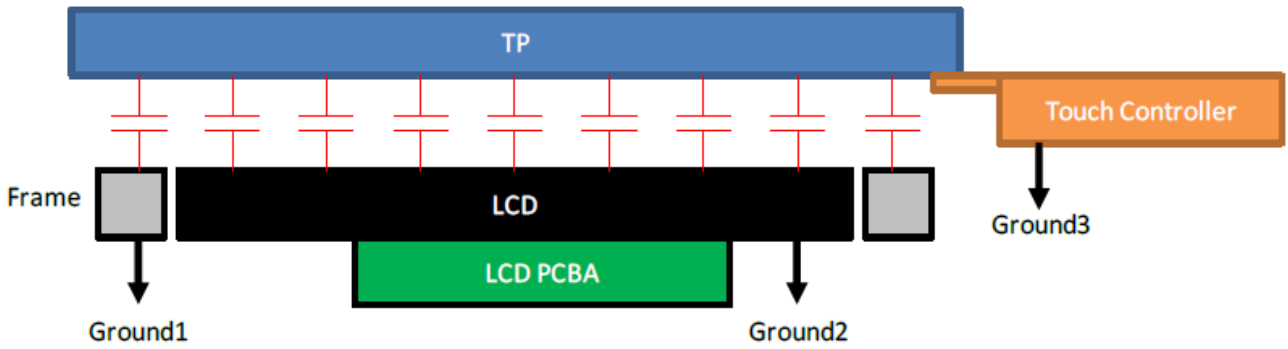
ITEM	SPECIFICATION
Type	Projective Capacitive Touch Panel
Activation	Max 5-fingers or Signal-finger
X/Y Position Reporting	Absolute Position
Touch Force	No contact pressure required
Calibration	No need for calibration
Report Rate	Approx 80 points/sec
Control IC	SITRONIX ST1624N32C
Interface	I2C

8.2 Interface

Mating connector: 089H06-000000-G2-R/P0.5 6PIN

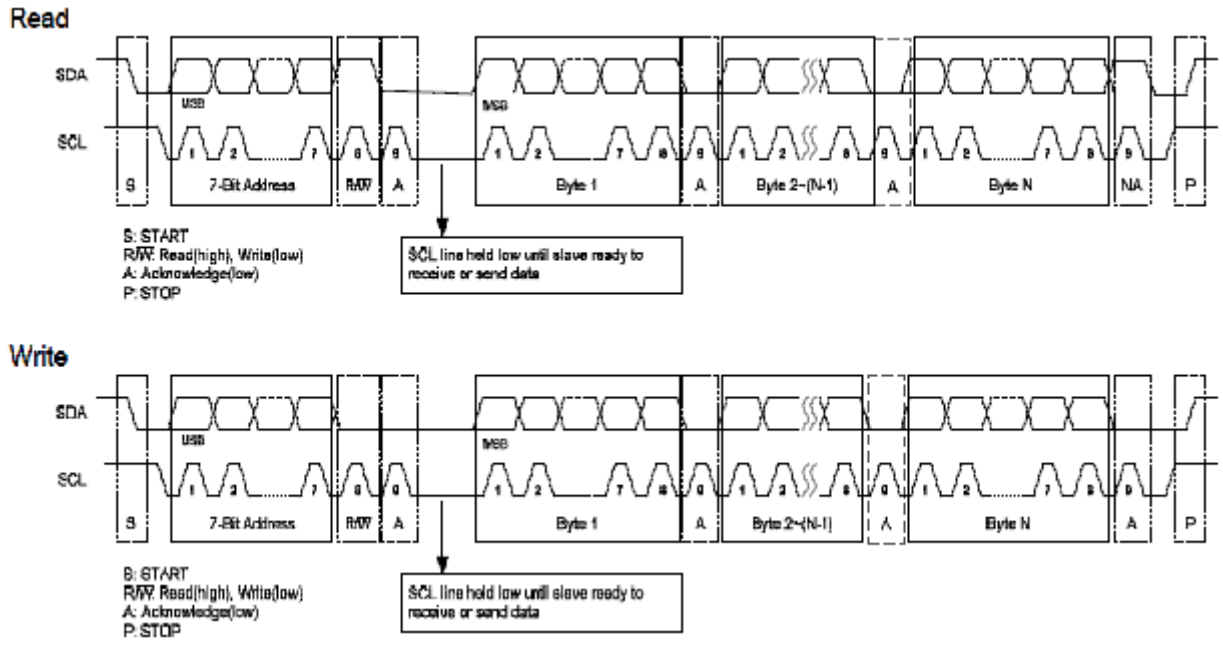
Pin No.	Symbol	Function
1	VDD	3.3V
2	GND	POWER GND
3	INT	Interrupt Request pin. Active Low
4	SCL	I2C CLOCK
5	SDA	I2C DATA
6	XRES	Reset pin to Master Chip

TP needs to work in environment with stable stray capacitance. In order to minimize the variation in stray capacitance, all conductive mechanical parts must not be floating. Intermittent floating any conductive part around the touch sensor may cause significant stray capacitance change and abnormal touch function. It is recommended to keep all conductive parts having same electrical potential as the GND of the touch controller module.



GND1, GND2 and GND3 should be connected together to have the same ground

8.3 I2C Slave Interface



Default I2C Address

I2C address is default to **0x55** (7-bits address) for Sitronix Touch IC. If the I2C address is conflict with another I2C device's address on same bus, user can change I2C address by TTK PC Utility.

Register Read

For reading register value from I2C device, host has to tell I2C device the *Start Register Address* before reading corresponding register value.

I2C Start	I2C Header (W)	Start Reg. Addr. (a)	I2C Stop	I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop

Sitronix Touch IC I2C host interface protocol supports Repeated Register Read. That is, once the Start Register Address has been set by host, consequent I2C Read(R) transactions will directly read register values starting from the Start Register Address without setting address first, as shown in Figure

I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop	I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop

Register Write

For writing register to I2C device, host has to tell I2C device the Start Register Address in each I2C Register Write transaction. Register values to the I2C device will be written to the address starting from the Start Register Address described in Register Write I2C transaction as shown in Figure

I2C Start	I2C Header (W)	Start Reg. Addr. (a)	Value to Reg(a)	Value to Reg(a+1)	…	Value to Reg(a+n)	I2C Stop

10.4 SAMPLE CODES

```
 typedef struct {
    u8 y_h: 3,
    reserved: 1,
    x_h: 3,
    valid: 1;
    u8 x_l;
    u8 y_l;
    u8 z;
} xyz_data_t;

typedef struct {
    u8 fingers: 4,
    reserved: 4;
    u8 keys;
    xyz_data_t xyz_data[10];
} stx_report_data_t;
```

// I2C Master sends *count* bytes data stored in *buf* to I2C Slave.

// I2C package: | S | I2C Addr | W | Data (buf) | P |

extern int i2c_master_send(const char *buf, int count);

// I2C Master reads *count* bytes data to *buf* from I2C Slave.

// I2C package: | S | I2C Addr | R | Data (buf) | Nak | P |

extern int i2c_master_recv(char *buf, int count);

Read XY Coordinates

The function, get_coordinates(), reads XY Coordinate registers from I2C Slave, extracts XY information from data buffer and returns to upper layer. This function shall be called from ISR each time when host receives and INT from device.

```
static int get_coordinates(u8 *count, u32 *x0, u32 *y0, u32 *x1, u32 *y1)
{
u8 buf[42];
stx_report_data_t *pdata;
int ret = 0;
*count = 0; // Set point detected count to 0.
if (i2c_master_recv(buf, sizeof(buf))) // Read Coordinates from default Reg. address 0x10.
goto err;
pdata = (stx_report_data_t *) buf;
if (pdata->fingers) {
if (pdata->xy_data[0].valid) {
*x0 = pdata->xy_data[0].x_h << 8 | pdata->xy_data[0].x_l;
*y0 = pdata->xy_data[0].y_h << 8 | pdata->xy_data[0].y_l;
(*count)++;
}
if (pdata->xy_data[1].valid) {
*x1 = pdata->xy_data[1].x_h << 8 | pdata->xy_data[1].x_l;
*y1 = pdata->xy_data[1].y_h << 8 | pdata->xy_data[1].y_l;
(*count)++;
}
}
err:
return ret;
}
```

Coordinate

9. Reliability Test Items

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
Storage at High Temperature and Humidity	60°C, 90% RH , 240 hrs	1,2
Thermal Shock Test	-20°C (30min) ~ 70°C (30min) 100 cycles	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).

Note 3 : The module shouldn't be tested more than one condition, and all the test conditions are independent.

Note 4 : All the reliability tests should be done without protective film on the module.

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.

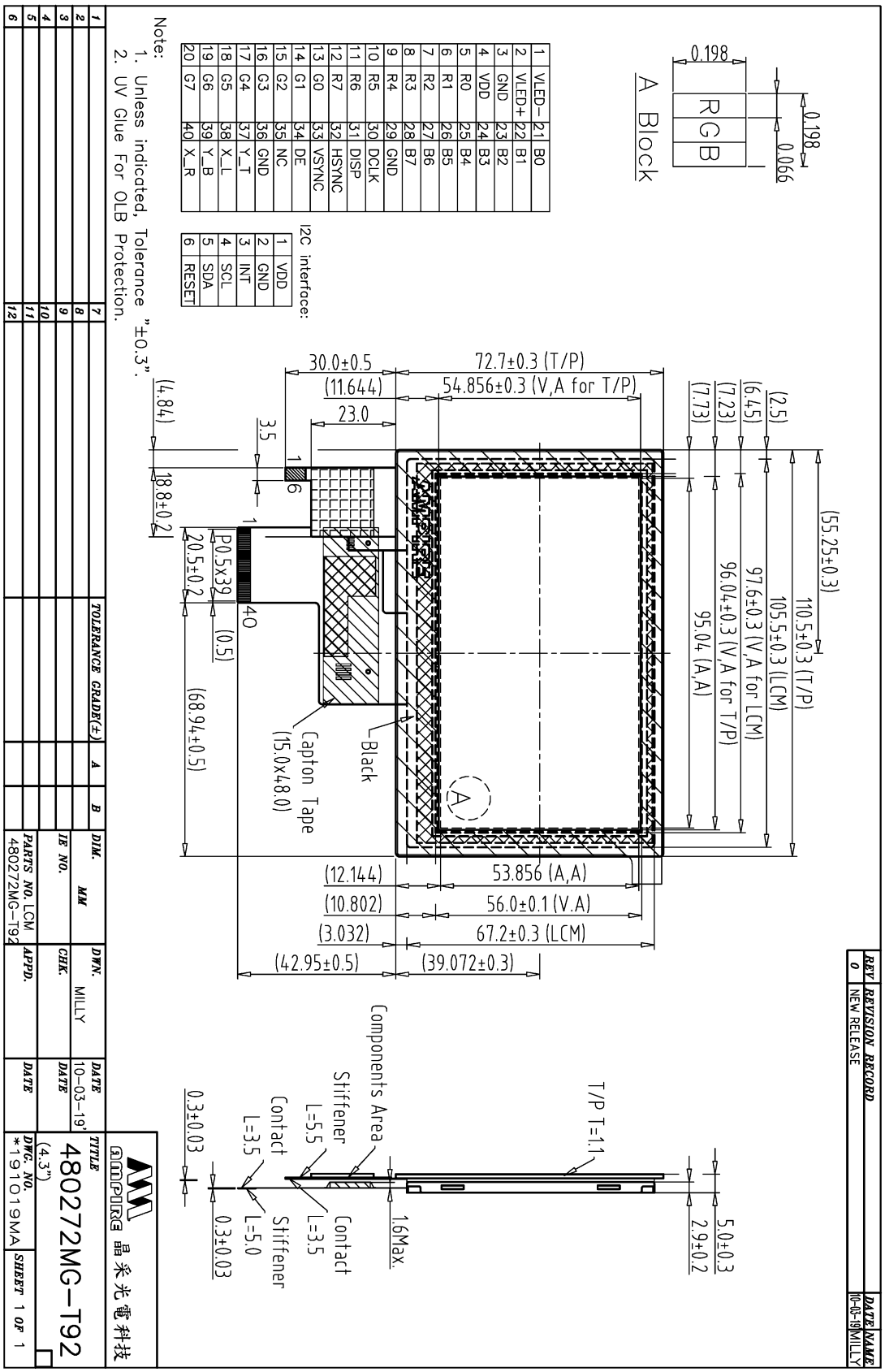
9-5 Cleaning

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.

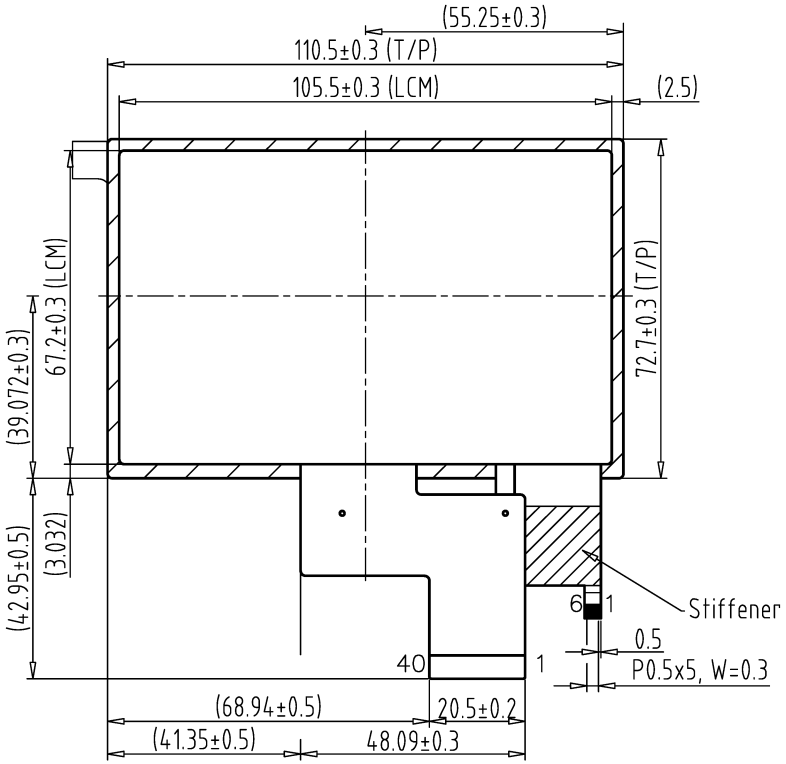
9-7 Others

1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
2. Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver

10. OUTLINE DIMENSION



REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	10-03-19	MILLY



Back View

1	VLED−	21	B0
2	VLED+	22	B1
3	GND	23	B2
4	VDD	24	B3
5	R0	25	B4
6	R1	26	B5
7	R2	27	B6
8	R3	28	B7
9	R4	29	GND
10	R5	30	DCLK
11	R6	31	DISP
12	R7	32	HSYNC
13	G0	33	VSYNC
14	G1	34	DE
15	G2	35	NC
16	G3	36	GND
17	G4	37	Y_T
18	G5	38	X_L
19	G6	39	Y_B
20	G7	40	X_R

I2C interface:

1	VDD
2	GND
3	INT
4	SCL
5	SDA
6	RESET

Note:
1. Unless indicated, Tolerance "±0.3".
2. UV Glue For OLB Protection.

1		7		TOLERANCE GRADE(±)	A	B	DIM. MM	DWN. MILLY	DATE 10-03-19	TITLE 480272MG−T92 (4.3")	
2		8					IE NO.	CHK.	DATE		
3		9									
4		10									
5		11					PARTS NO. LCM−1 480272MG−T92	APPD.	DATE	DWG. NO. *191020MA	SHEET 1 OF 1
6		12									

晶采光電科技