

# SPECIFICATIONS FOR LCD MODULE

<b>CUSTOMER</b>	
<b>CUSTOMER PART NO.</b>	
<b>AMPIRE PART NO.</b>	<b>AM-800480AYTZQW-TARH</b>
<b>APPROVED BY</b>	
<b>DATE</b>	

☐ Preliminary Specification

☒ Formal Specification

<b>APPROVED BY</b>	<b>CHECKED BY</b>	<b>ORGANIZED BY</b>
<i>Patrick</i>	<i>Jessica</i>	<i>Mantle</i>

## RECORD OF REVISION

Revision Date	Page	Contents	Editor
2021/11/16	--	New Release	Mantle

## 1.0 General Descriptions

### 1.1 Features

7 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module.  
This module is composed of a 8" TFT-LCD panel and backlight unit.

(1) Construction: 7" a-Si TFT active matrix, Projective Capacitive Touch and White LED Backlight .

(2) Resolution (pixel): 800(R.G.B) X 480

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

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

(5) 24 Bit LVDS interface

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

(7) Projective Capacitive Touch

a. Interface : I2C

b. Touch Controller: EXC80W32

### 1.2 Product Summary

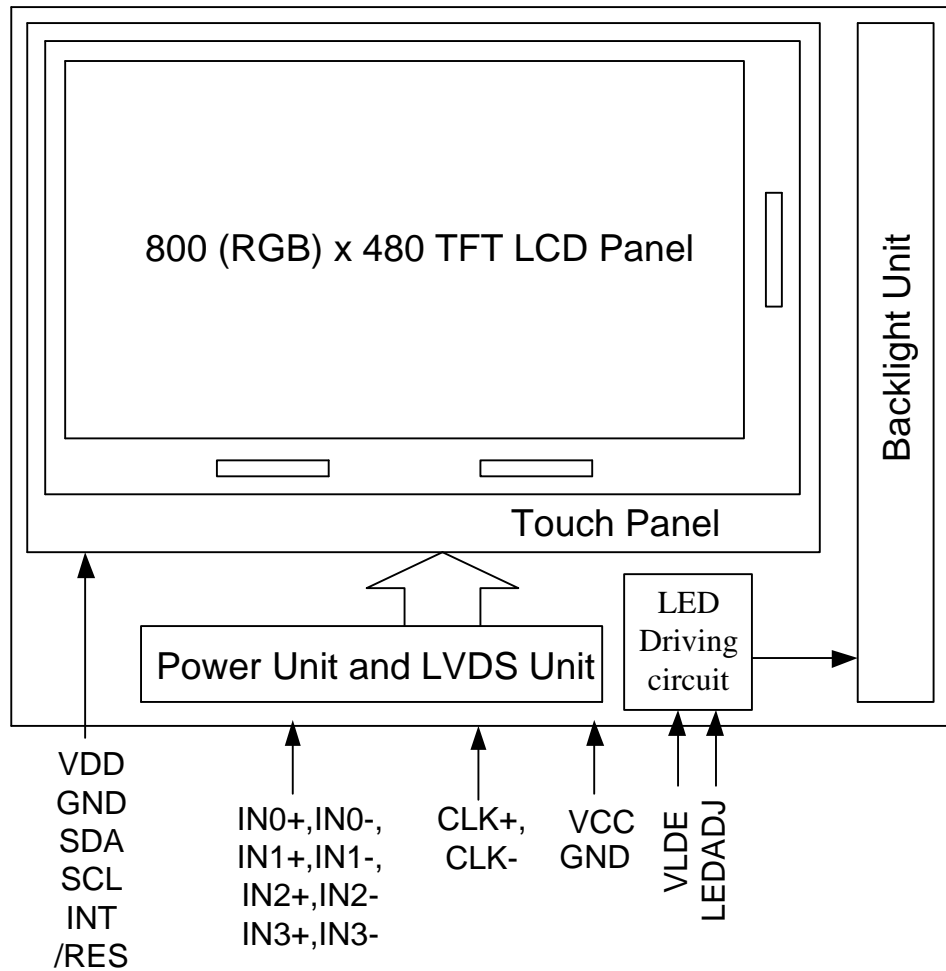
NO	Item	Specification	Remark
1	LCD Size	7.0 inch (Diagonal)	
3	Resolution	800 x 3 (RGB) x 480	
4	Display Mode	Normally Black.	
5	Pixel pitch	0.1926 (W) x 0.179(H) mm	
6	Active area	154.08(W) x 85.92(H) mm	
7	Module Size	184.0(W) x 128.0(H) x 12.8(T) mm	Note 1
8	LCD Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Luminance	470	Cd/m <sup>2</sup>
11	Viewing Direction	All direction	

(Note1) Refer to the mechanical drawing.

### 1.3 Functional Block Diagram

Shows the functional block diagram of the LCD module.

### Figure 1 Block Diagram



## 2. Absolute Maximum Ratings

Item	Symbol	Values		UNIT	Note
		Min.	Max.		
Power voltage	VDD	-0.5	3.96	V	GND=0V
Power voltage of LED Driver IC	VLED	-0.3	6	V	GND=0V
Voltage range at any terminal		-0.5	VCC+0.3	V	

### 2.1 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	Topa	-20	70	°C	
Storage Temperature	Tstg	-30	80	°C	

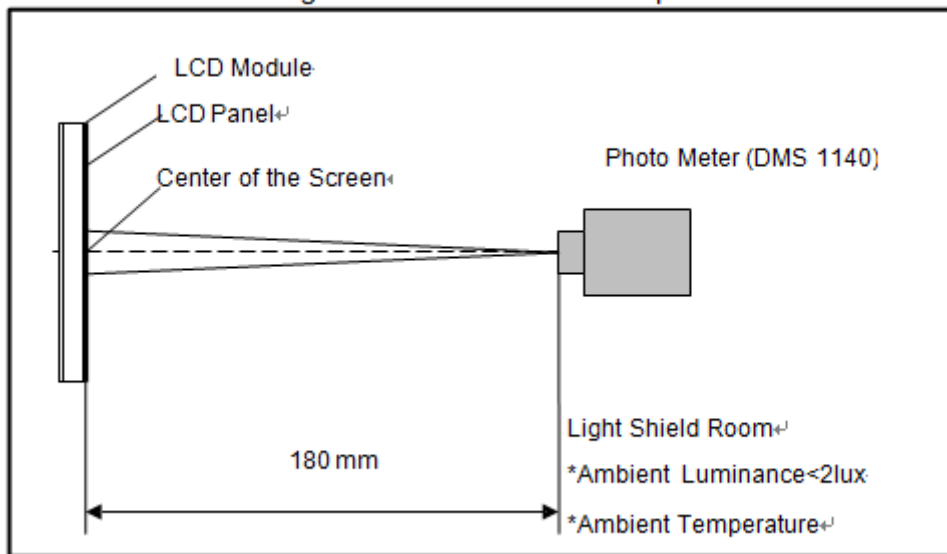
### 3. Optical Specifications

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	$\theta_L$	(80)	(88)	-	degree	(1),(2),(3)
		$\theta_R$	(80)	(88)	-		
	Vertical	$\theta_U$	(80)	(88)	-		
		$\theta_D$	(80)	(88)	-		
Contrast Ratio	Center		(700)	(900)	-	-	(1),(2),(4) $\theta_x=\theta_y=0^\circ$
Response Time	Rising + Falling		-	(30)	(40)	ms	(1),(2),(5) $\theta_x=\theta_y=0^\circ$
Color Chromaticity (CIE1931)	Red	x	Typ (-0.05)	(0.633)	Typ (+0.05)	-	(1),(2),(3) $\theta_x=\theta_y=0^\circ$
	Red	y		(0.329)		-	
	Green	x		(0.320)		-	
	Green	y		(0.613)		-	
	Blue	x		(0.150)		-	
	Blue	y		(0.053)		-	
	White	x	Typ. (-0.05)	(0.308)	Typ. (+0.05)	-	
	White	y		(0.332)		-	
NTSC	-		--	(70)	-	%	(1),(2),(3) $\theta_x=\theta_y=0^\circ$
White Luminance	Center Point		(375)	(470)	-	cd/m <sup>2</sup>	(1),(2),(6) $\theta_x=\theta_y=0^\circ$

Note (1) Measurement Setup:

The LCD module should be stabilized at given temperature(25℃ ) for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.

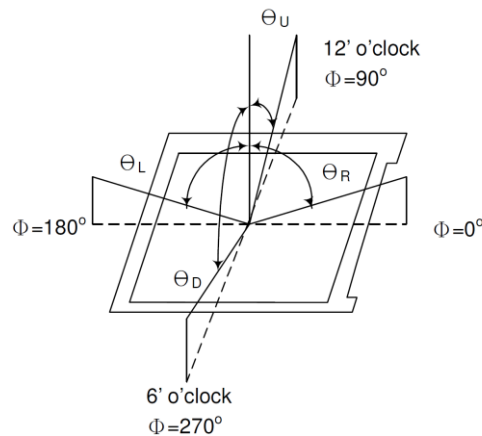
Figure 3 Measurement Setup



Note (2) The LED input parameter setting as:

$I_{LED}$ : 180mA

Note (3) Definition of Viewing Angle



Note (4) Definition Of Contrast Ratio (CR)

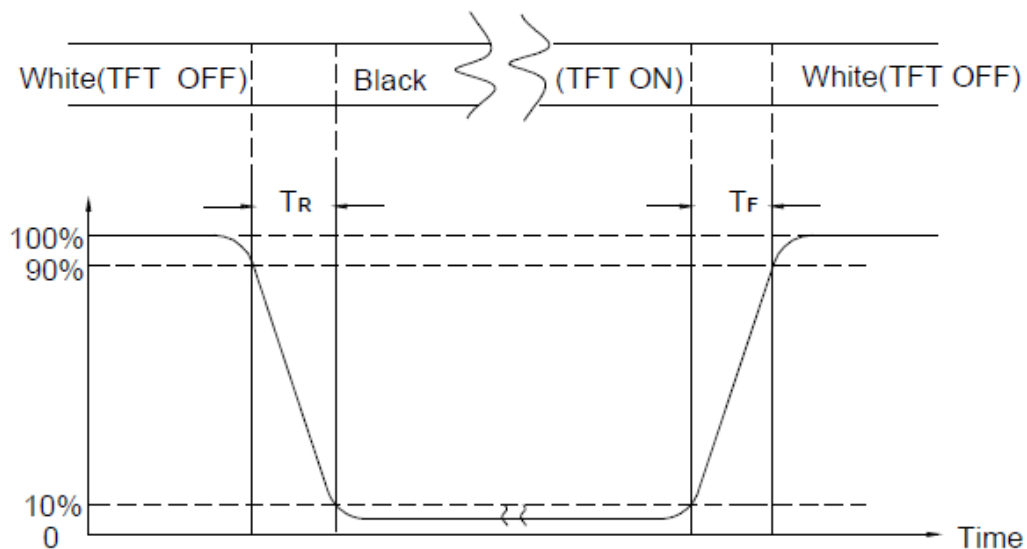
The contrast ratio can be calculated by the following

expression: Contrast Ratio (CR) =  $L_{255} / L_0$

$L_{255}$ : Luminance of gray level 255,  $L_0$ : Luminance of gray level 0

Note (5) Definition Of Response Time ( $T_R$ ,  $T_F$ )

**Figure 5 Definition of Response Time**



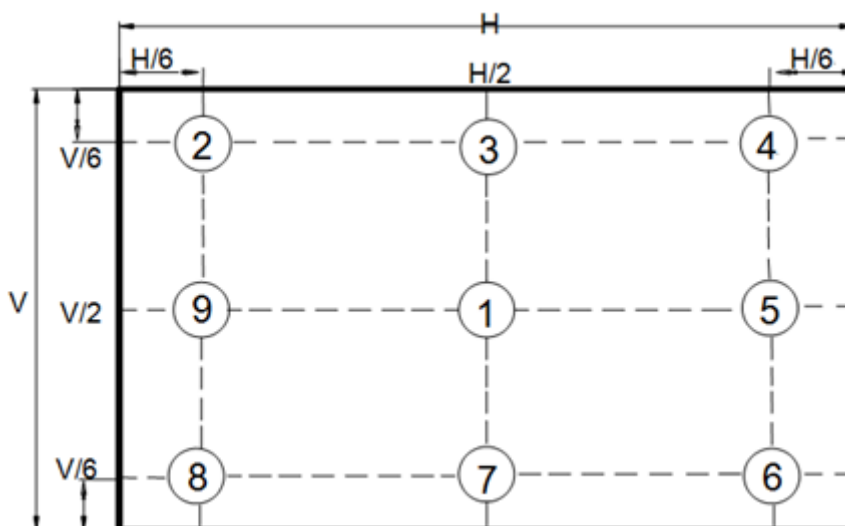
Note (6) Definition of Luminance Uniformity (Ref.: Active Area)

Measure the luminance of gray level 255 at 9 points.

Luminance Uniformity =  $\text{Min.}(L_1, L_2, \dots, L_9) / \text{Max.}(L_1, L_2, \dots, L_9)$

H—Active Area Width, V—Active Area Height, L—Luminance

**Figure 6 Measurement Locations of 9 Points**





#### 4. Interface Connections

Pin No.	Symbol	Function
1	VDD	POWER SUPPLY:3.3V
2	VDD	POWER SUPPLY:3.3V
3	GND	Power Ground
4	GND	Power Ground
5	IN0-	Transmission Data of Pixels
6	IN0+	Transmission Data of Pixels
7	GND	Power Ground
8	IN1-	Transmission Data of Pixels 1
9	IN1+	Transmission Data of Pixels 1
10	GND	Power Ground
11	IN2-	Transmission Data of Pixels 2
12	IN2+	Transmission Data of Pixels 2
13	GND	Power Ground
14	CLK-	Sampling Clock
15	CLK+	Sampling Clock
16	GND	Power Ground
17	LED ADJ	LED Dimming pin. Dimming by PWM 100Hz~200kHz.
18	VLED	Power supply of LED driving IC.
19	IN3-	Transmission Data of Pixels 3
20	IN3+	Transmission Data of Pixels 3

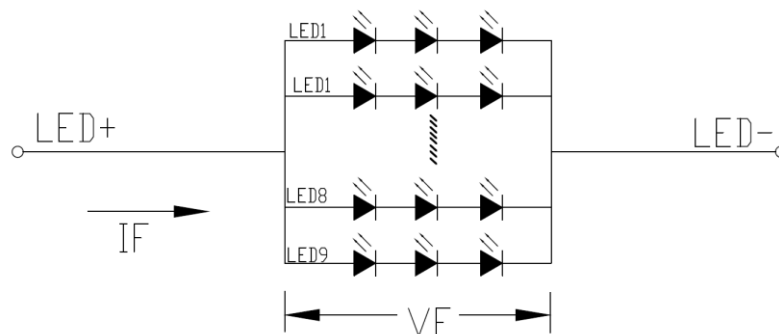
## 5. Backlight Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Driver Voltage	VLED	4.5	5.0	5.5	V	
Power Supply Current For LED Driver	ILED	-	380	-	mA	VLED=5V VADJ=3.3V (duty 100%)
ADJ Input Voltage	V <sub>LEDADJ</sub>	-	3.3	-	V	duty=100% Note(1)
LED voltage	V <sub>BL</sub>	9.0	9.3	9.6	V	IBL=180mA
LED current	IBL	--	180	--	mA	Ta=25°C
LED Life Time	-	--	20K	--	Hour	

Note (1) The constant current source is needed for white LED back-light driving.

When LCM is operated over 60 deg.C ambient temperature, the I<sub>LED</sub> of the LED back-light should be adjusted to 135mA max

Note (2) Brightness to be decreased to 50% of the initial value(Ta=25°C).



Note (3) VLEDADJ is PWM signal input. It is for brightness control.

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
ADJ signal frequency	f <sub>PWM</sub>	100	--	50K	Hz
ADJ signal logic level High	VIH	2V	--	VLED (5.0V)	V
ADJ signal logic level Low	VIL	0	--	0.5	V

## 6. Touch Panel Unit

### 6.1 Basic Characteristic

ITEM	SPECIFICATION
Type	Projective Capacitive Touch Panel
Activation	10-fingers or Signal-finger
X/Y Position Reporting	Absolute Position
Touch Force	No contact pressure required
Calibration	No need for calibration
Report Rate	Approx 100 points/sec
Resolution	16384 x 16384
Interface	I2C
Control IC	EXC80W32

Specify the normal operating condition

(GND=0V)

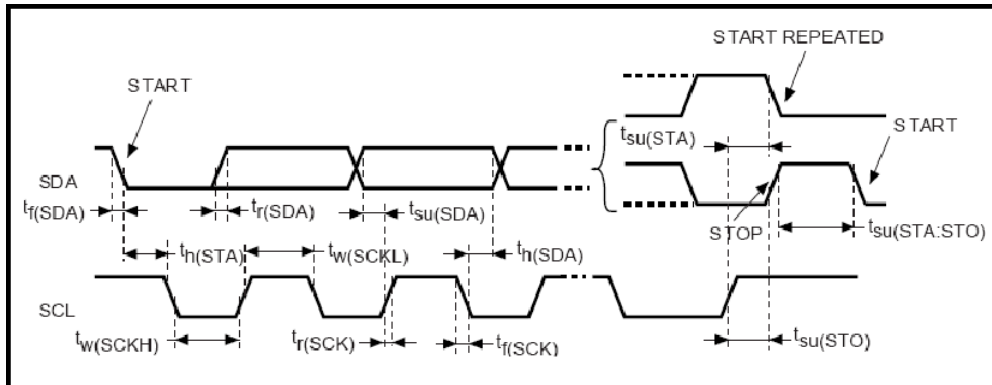
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
Low Level Input Voltage	VIL	0	--	0.8	V	1
High Level Input Voltage	VIH	0.8*VIN	--	VIN	V	1
Power Consumption	IVDD		T.B.D		mA	

Note 1: SDA , SCL ,

### 6.2 Interface

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

## 6.3 Timing



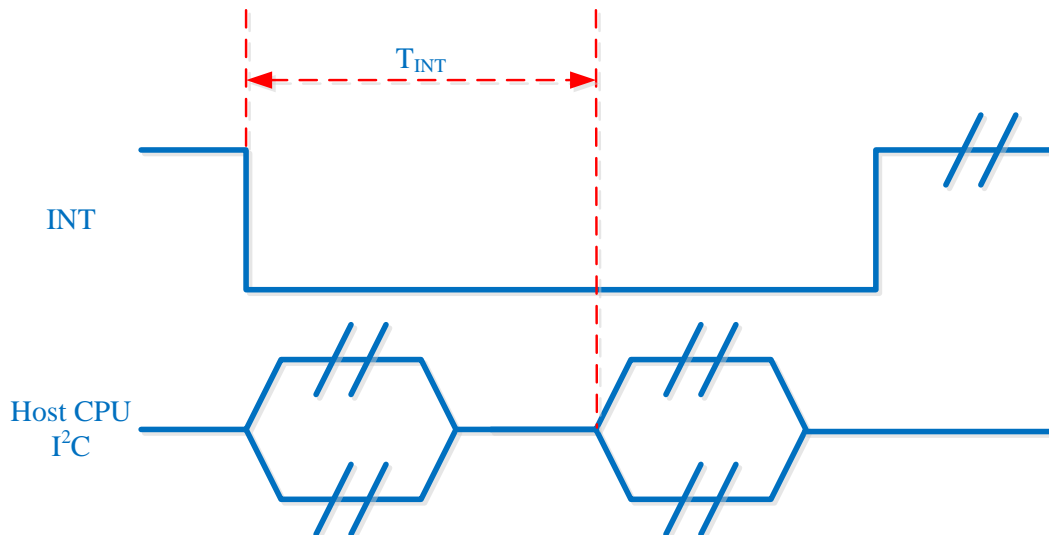
Symbol	Parameter	SCL = 100KHz		SCL = 400KHz		Unit
		Min	Max	Min	Max	
$t_{w(SCLL)}$	SCL clock low time	4.7		1.3		$\mu s$
$t_{w(SCLH)}$	SCL clock high time	4.0		0.6		
$t_{su(SDA)}$	SDA setup time	250		100		ns
$t_h(SDA)$	SDA data hold time	0		0	900	
$t_r(SDA)$ $t_r(SCL)$	SDA and SCL rise time		1000		300	
$t_f(SDA)$ $t_f(SCL)$	SDA and SCL fall time		300		300	$\mu s$
$t_h(STA)$	Start condition hold time	4.0		0.6		
$t_{su(STA)}$	Repeated Start condition setup time	4.7		0.6		
$t_{su(STO)}$	Stop condition setup time	4.0		0.6		
$t_{w(STO:STA)}$	Stop to Start condition time (bus free)	4.7		1.3		$\mu s$

### Touch Controller software protocol

The EXC80W32 7-bit slave Address=0x2A

#### ● INT operating mode

I<sup>2</sup>C Transaction Frame: each I<sup>2</sup>C transaction frame transfers one I<sup>2</sup>C packet data. The INT pin is low level trigger. The controller will pull IRQ pin low until no data in the controller buffer.



Report rate =  $1/T_{INT}$ . It depends on properties of touch panel such as resistive value, I<sup>2</sup>C clock rate, channel number, thickness and material of cover lens, etc.

For better touch performance, we strongly recommend using the 400K clock rate.

- **The complete Read back data format:**

	From Device to Host
	From Host to Device

S = START condition

Sr = Repeat START condition

P = STOP condition

R = Data direction READ (SDA HIGH)

W = Data direction WRITE (SDA LOW)

Ack = Acknowledge (SDA LOW)

Nak = Not acknowledge (SDA HIGH)

Address = 7-bit (EXC80W60 = 0x2A)

DATA = 8bit

**Read Mode :** Host-receiver , Device-transmitter.

S	Address	R	Ack	Len-LSB	Ack	Len-MSB	Ack	DATA0	Ack
---	---------	---	-----	---------	-----	---------	-----	-------	-----

DATA1	Ack					DATA63	Nack	P
-------	-----	--	--	--	--	--------	------	---

Host need to read 66 Bytes for input report retrieval.

The 1<sup>st</sup> Byte0 and 2<sup>nd</sup> Byte1 (Len-LSB and Len-MSB ): The value of “Len” is calculated by 2 Bytes for “Len: field and n Bytes for valid “Input Data in the payload.

The 3<sup>rd</sup> DATA0 ~ 66<sup>th</sup> DATA65 are defined as :

DATA0	DATA1 ~ DATA 63																			
Report ID	The definitions are differences depends on report ID																			
Report ID = 0x18	<table><tr><td>DATA1</td><td colspan="9">Num of Fingers : Actual contact in this report</td></tr></table>										DATA1	Num of Fingers : Actual contact in this report								
DATA1	Num of Fingers : Actual contact in this report																			
Multi Touch format  (without width and height, 16K X/Y resolution)	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	DATA8	DATA9	DATA10	DATA11										
	Contact data 1																			
	● Contact data format :																			
	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	DATA8	DATA9	DATA10	DATA11										
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	Byte9										
	Status	Finger ID	X (LSB)	X (MSB)	Y (LSB)	Y (MSB)	Reserved	Reserved	Reserved	Reserved										
	● Status: Bit0=1 for touch Down . Bit0=0 for Lift Off.																			
	● X/Y resolution : 16384 (0~16383)																			
	The following Contact data are with the same format.																			
	DATA12	DATA13	DATA14	DATA15	DATA16	DATA17	DATA18	DATA19	DATA20	DATA21										
	Contact data 2																			
	DATA22	DATA23	DATA24	DATA25	DATA26	DATA27	DATA28	DATA29	DATA30	DATA31										
	Contact data 3																			
	DATA32	DATA33	DATA34	DATA35	DATA36	DATA37	DATA38	DATA39	DATA40	DATA41										
	Contact data 4																			
DATA42	DATA43	DATA44	DATA45	DATA46	DATA47	DATA48	DATA49	DATA50	DATA51											
Contact data 5																				
DATA52	DATA53	DATA54	DATA55	DATA56	DATA57	DATA58	DATA59	DATA60	DATA61											
Scan Time				Reserved	Reserved	Reserved	Reserved	Reserved	Reserved											
DATA62	DATA63																			
Reserved	Reserved																			
<p>The device input report contains maximum 5 contacts in one I<sup>2</sup>C frame. If it must report 10 contacts, device will break these down into 2 I<sup>2</sup>C frames that report 5 contacts each.</p> <p>The “Num of Fingers” only show in the first frame. The “Num of Fingers” of the second frame is 0.</p>																				

## 7 INPUT SIGNAL

### 7.1 LVDS Signal

switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$t_{su}$ Setup time, D0–D20 to CLKOUT↓	$C_L = 8\text{ pF}$ , See Figure 5	5			ns
$t_h$ Data hold time, CLKOUT↓ to D0–D20		5			ns
$t_{(RSKM)}$ Receiver input skew margin§ (see Figure 7)	$t_c = 15.38\text{ ns } (\pm 0.2\%)$ ,  Input clock jitter  < 50 ps¶	550	700		ps
$t_d$ Delay time, CLKIN↑ to CLKOUT↓ (see Figure 7)	$V_{CC} = 3.3\text{ V}$ , $t_c = 15.38\text{ ns } (\pm 0.2\%)$ , $T_A = 25^\circ\text{C}$	3	5	7	ns
$t_{en}$ Enable time, $\overline{\text{SHTDN}}$ to phase lock	See Figure 7		1		ms
$t_{dis}$ Disable time, $\overline{\text{SHTDN}}$ to off state	See Figure 8		400		ns
$t_t$ Transition time, output (10% to 90% $t_r$ or $t_f$ ) (data only)	$C_L = 8\text{ pF}$		3		ns
$t_t$ Transition time, output (10% to 90% $t_r$ or $t_f$ ) (clock only)	$C_L = 8\text{ pF}$		1.5		ns
$t_w$ Pulse duration, output clock			0.50 $t_c$		ns

† All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ The parameter  $t_{(RSKM)}$  is the timing margin available to allocate to the transmitter and interconnection skews and clock jitter. The value of this parameter at clock periods other than 15.38 ns can be calculated from  $t_{RSKM} = t_c/14 - 550\text{ ps}$ .

¶ |Input clock jitter| is the magnitude of the change in input clock period.

#### PARAMETER MEASUREMENT INFORMATION

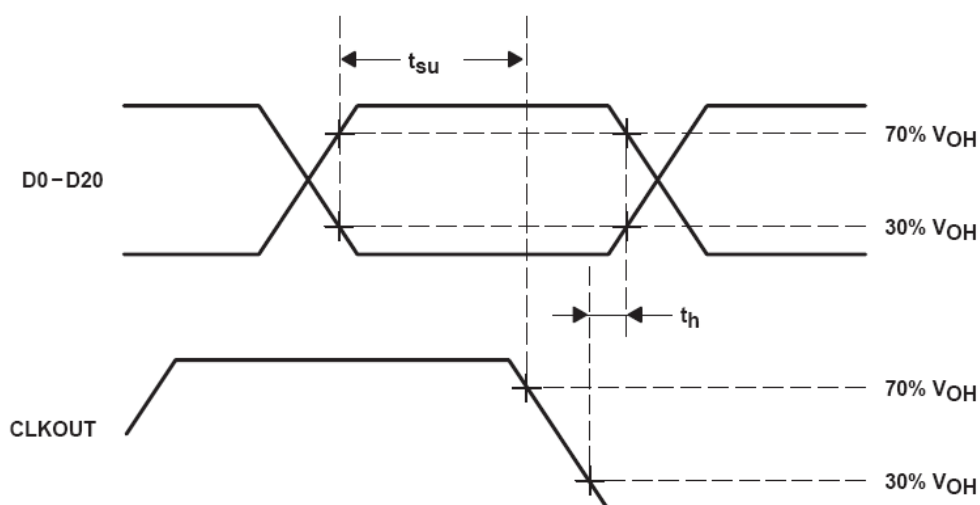


Figure 5. Setup and Hold Time Waveforms

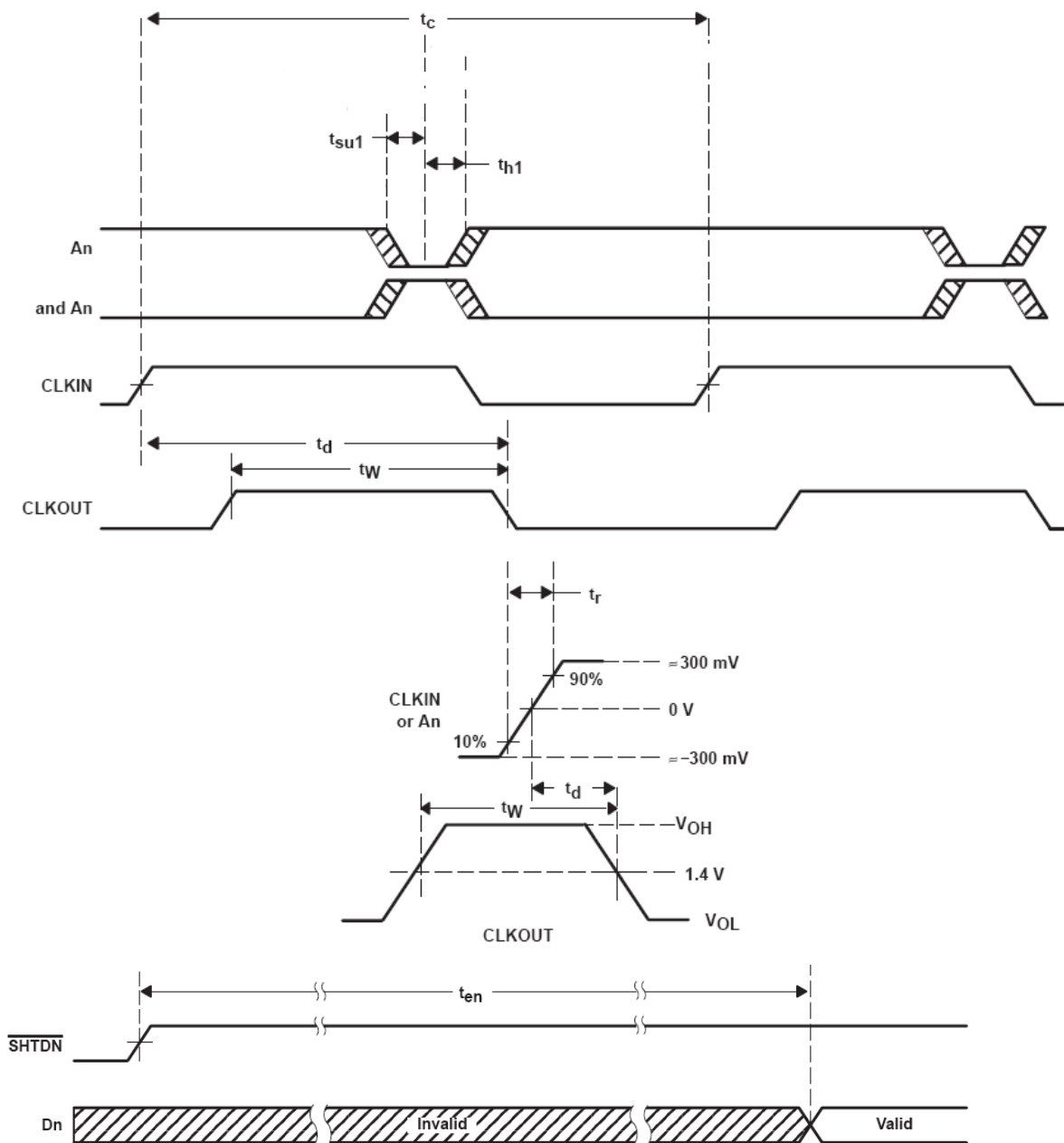


Figure 7. Enable Time Waveforms

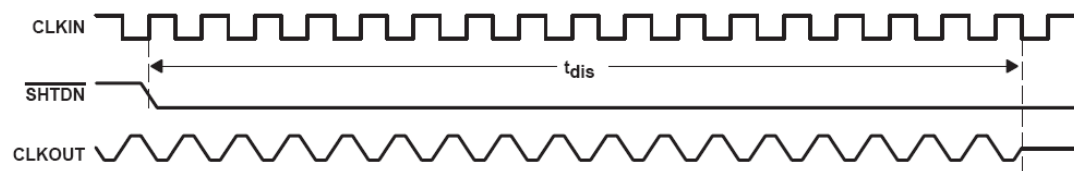


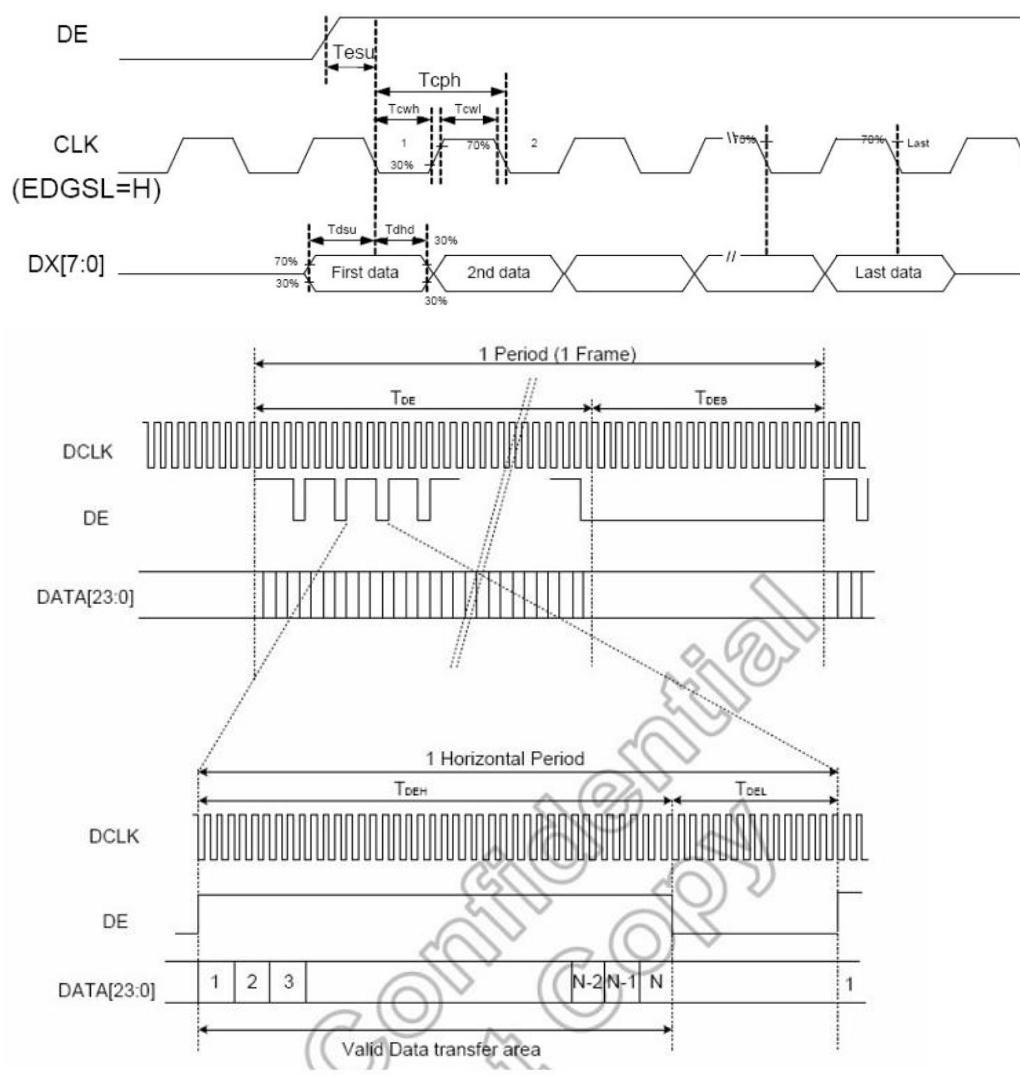
Figure 8. Disable Time Waveforms



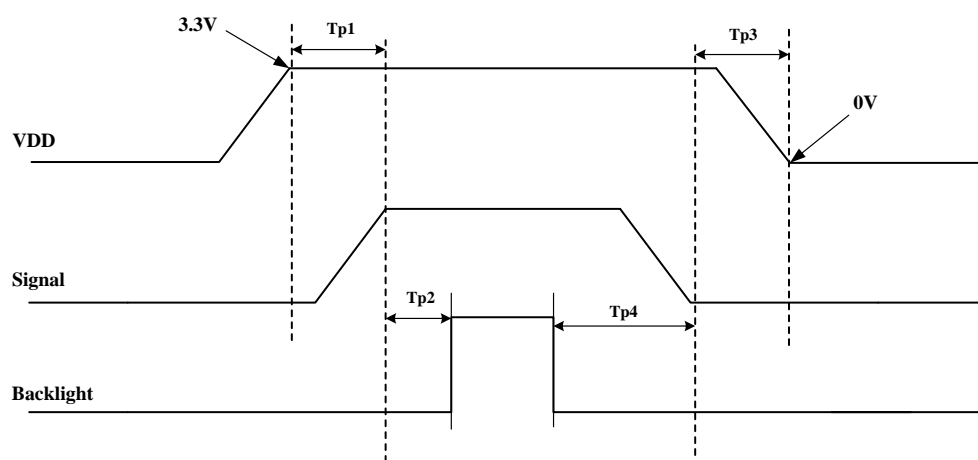
## 7.2 Timing of LCD Timing controller

Parameter	Symbol				Unit
		Min.	Typ.	Max.	
Data setup time	Tdsu	6	-	-	ns
Data hold time	Tdhd	6	-	-	Tcph
DE setup time	Tesu	6	-	-	Tcph
CLK frequency	F <sub>CPH</sub>		33.26		MHz
CLK period	T <sub>CPH</sub>		30.06		ns
CLK pulse duty	T <sub>CWH</sub>	40	50	60	%
DE period	T <sub>DEH</sub> +T <sub>DEL</sub>	1000	1056	1200	T <sub>CPH</sub>
DE pulse width	T <sub>DEH</sub>	-	800	-	T <sub>CPH</sub>
DE frame blanking	T <sub>DEB</sub>	10	45	110	T <sub>DEH</sub> +T <sub>DEL</sub>
DE frame width	T <sub>DE</sub>	-	480	-	T <sub>DEH</sub> +T <sub>DEL</sub>

Note : We suggest using the typical value, so it can have better performance.



## 8 Power On / Off Sequence



Item	Symbol	Value			Units	Remark
		Min.	Typ.	Max.		
VDD on to signal starting	Tp1	5	-	50	ms	
Signal starting to backlight on	Tp2	150	-	-	ms	
Signal off to VDD off	Tp3	5	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	

## 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	-30°C (30min) ~ 80°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.

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.

## **10 General Precautions**

### **10-1 Safety**

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

### **10-2 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.

### **10-3 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.

### **10-4 Storage**

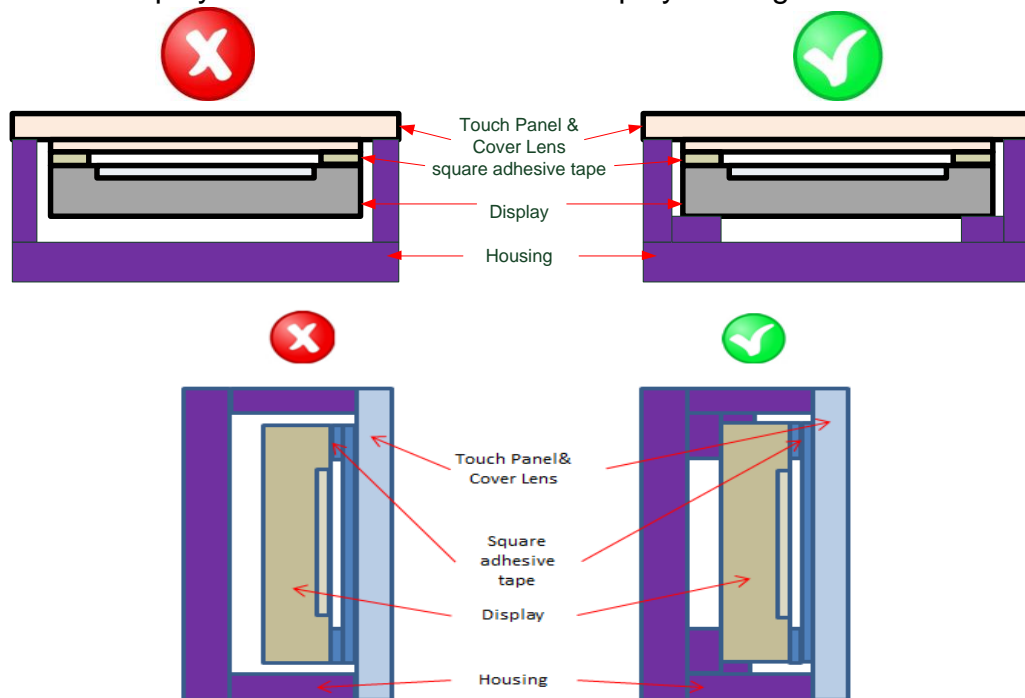
- (1) Store the module in a dark room where must keep at  $+25\pm10^{\circ}\text{C}$  and 65%RH or less.
- (2) Do not store the module in surroundings containing organic solvent or corrosive gas.
- (3) Store the module in an anti-electrostatic container or bag.

### **10-5 Cleaning**

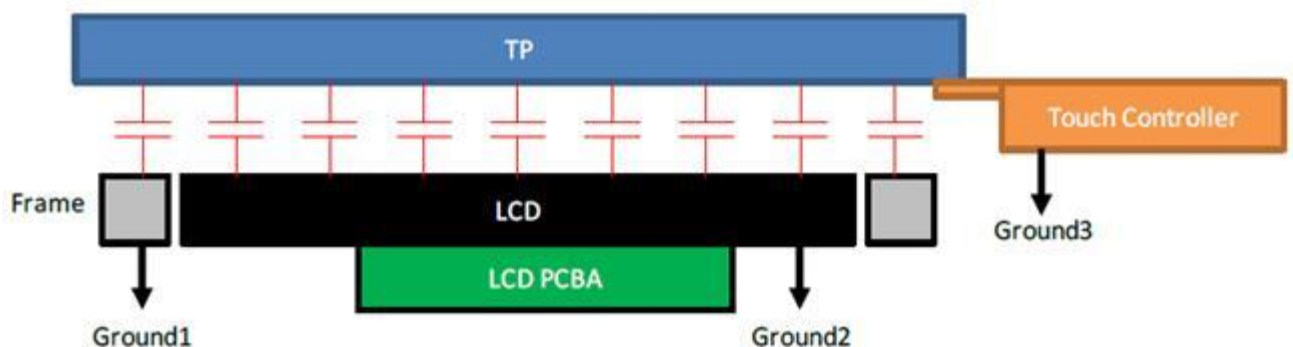
- (1) Do not wipe the polarizer with dry cloth. It might cause scratch.
- (2) Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

## 10-6 Mechanism

- (1) Please mount LCD module by using mounting holes arranged in four corners tightly.
- (2) The square adhesive tape which is between the touch panel and display can't provide well supporting in the long term and high ambient temperature condition. Whether upright or horizontal position the support holder which is in the back side of the display is needed. Do not let the display floating.



- (3) 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.

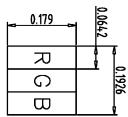


GND1, GND2 and GND3 should be connected together to have the same ground

#### **10-7 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





A Block

CN2

1	VDD	11	IN2-
2	VDD	12	IN2+
3	GND	13	GND
4	GND	14	CLK-
5	INO-	15	CLK+
6	INO+	16	GND
7	GND	17	LEDADJ
8	IN1-	18	VI-ED
9	IN1+	19	IN3-
10	GND	20	IN3+

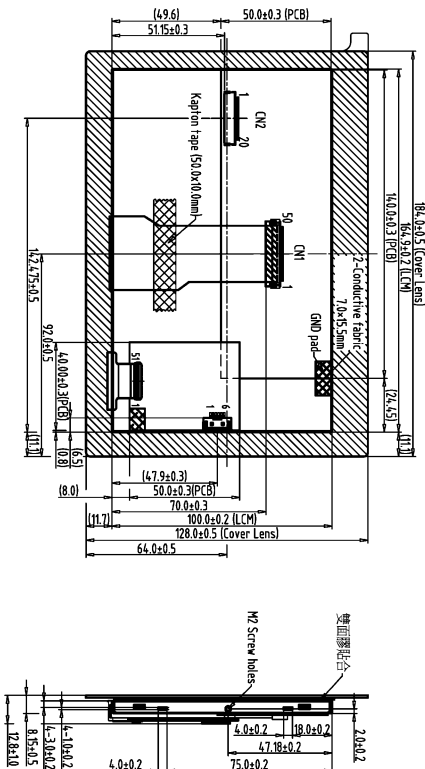
I2C interface:

1	GND
2	SDA
3	SCL
4	VDD
5	INT
6	/RES

Note:  
1. Unless indicated, Tolerance "±0.3"

- UV Glue For OLB Protection.
- CN1 connector:P0.5 50PIN/FH12A-50S-0.5SH or Equivalent.
- CN2 P1.0 20Pin CP100-S20G-H16 or Equivalent
- T/P Controller board: ENTERY 3808K-F06N-03L or Equivalent

Back View



1	800480AY-TAO LCM	7		TOLERANCE GRADU(±)	A	B	DIM.	MM	DWN.	EMILY	DATE	11-02-21	TITLE	晶 采 光 電 科 技	800480AY-TAR	DWG. NO.	*211123MA	SHEET	1 OF 1
2	EETI EXC80W32/12C/3.3V/OGS)	8									DATE								
3	T/P Controller Board(2810246020)	9									DATE								
4		10									DATE								
5		11									DATE								
6		12									DATE								