



晶采光電科技股份有限公司
AMPIRE CO., LTD.

/SIMPLEPLUS
Touch Displays

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AMA-070A05-DI2511-G010
APPROVED BY	
DATE	

☐ Approved For Specifications

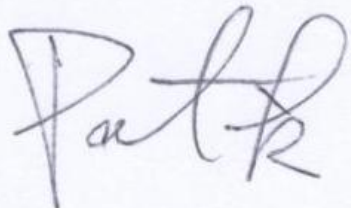
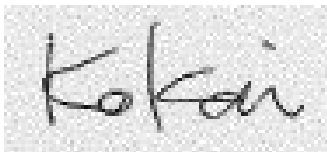

☐ Approved For Specifications & Sample

AMPIRE CO., LTD.

**4F., No.116, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei
City221, 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

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2018/2/8 2018/03/16	-- 32,33	New Release Corrected the mechanical drawing.	Emil Emil

1.0 General Descriptions

7 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module.

This module is composed of a 7" TFT-LCD panel and backlight unit.

1.1 Features

- 7 inch (16:9 diagonal) configuration
- 262K colors (R , G , B, 6bit digital each)
- RoHS

1.2 Product Summary

Item	Specification	Remark
LCD Size	7.0 inch (Diagonal)	
Resolution	800 x 3 (RGB) x 480	
Display Mode	Normally Black.	
Pixel pitch	0.1905 (W) x 0.1905(H) mm	
Active area	152.4(W) x 91.44(H) mm	
interface	RGB	
Color arrangement	RGB-stripe	
Luminance	425 cd/m ²	cd/m ²
Viewing Direction	All direction	

2.0 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remakes
Supply Voltage	V_{DD}	-0.3	3.6	V	-
Input Voltage of Logic	V_I	-0.3	$V_{DD}+0.3$	V	Note 1
Operating Temperature	T_{OP}	-30	85	°C	Note 2
Storage Temperature	T_{ST}	-30	85	°C	Note 2

Note 1: The rating is defined for the signal voltages of the interface such as CLK and pixel data pairs.

Note2: The maximum rating is defined as above based on the chamber temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.
- Operating under high temperature will shorten LED lifetime.

3.0 ELECTRICAL CHARACTERISTICS

3.1 LCD CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LCD Supply Voltage	VDD	3.0	3.3	3.6	V	-
Logic Input Voltage	VIH	0.7VDD	-	VDD		
	VIL	GND	-	0.3VDD	V	
LCD Supply Current	ICC	-	T.B.D	-	mA	(1)
Power Supply Voltage For LED Driver	VLED	11.7	12	12.3	V	(1)
Power Supply Current For LED Driver	ILED	--	T.B.D	--	mA	VLED =12V

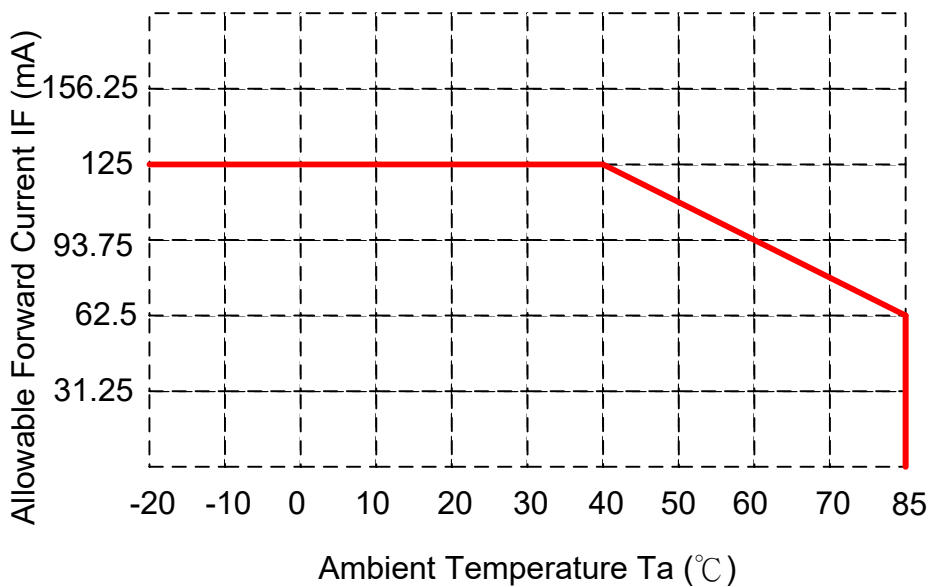
Note1: Ta=25°C , Display pattern : All White

3.2 BACKLIGHT CHARACTERISTICS

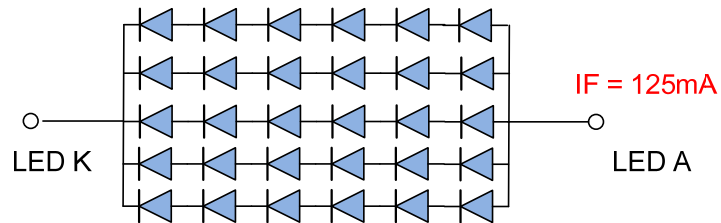
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	VLED	11.7	12.0	12.3	V	
Input Current	ILED	--	T.B.D	--	mA	0% PWM duty
DIM Frequency	Fpwm	100		20K	Hz	
DIM Signal Logic High	VIH	1.2	--	3.3	V	
DIM signal logic Low	VIL	0	--	0.4	V	
LED Forward Current	IF	--	125	--	mA	Ta=25°C
LED Forward Voltage	VF	--	18	--	V	IF=120mA, Ta=25°C
LED life time			50,000	-	Hr	IF=12mA, Ta=25°C

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

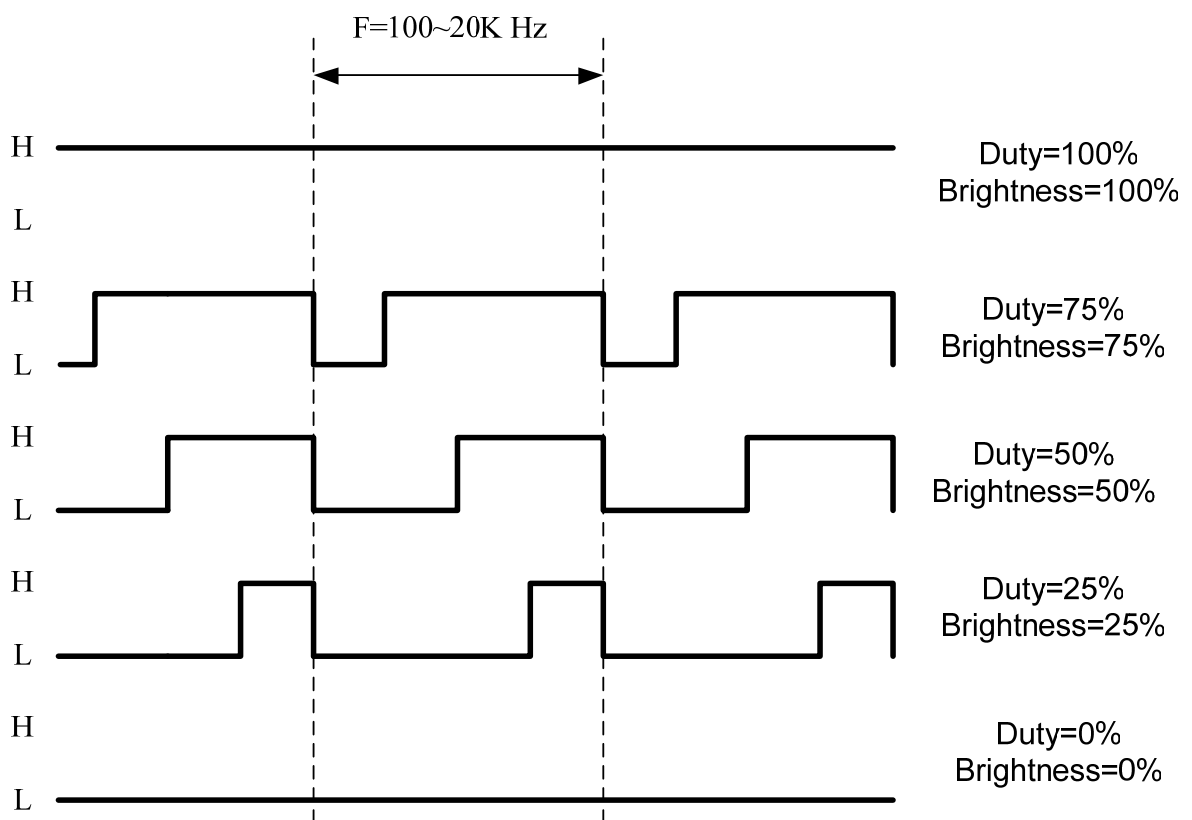
When LCM is operated over 85°C ambient temperature, the I_{LED} of the LED back-light should be adjusted to 62.5mA max



■ 6 LED Serial x 5 LED Parallel

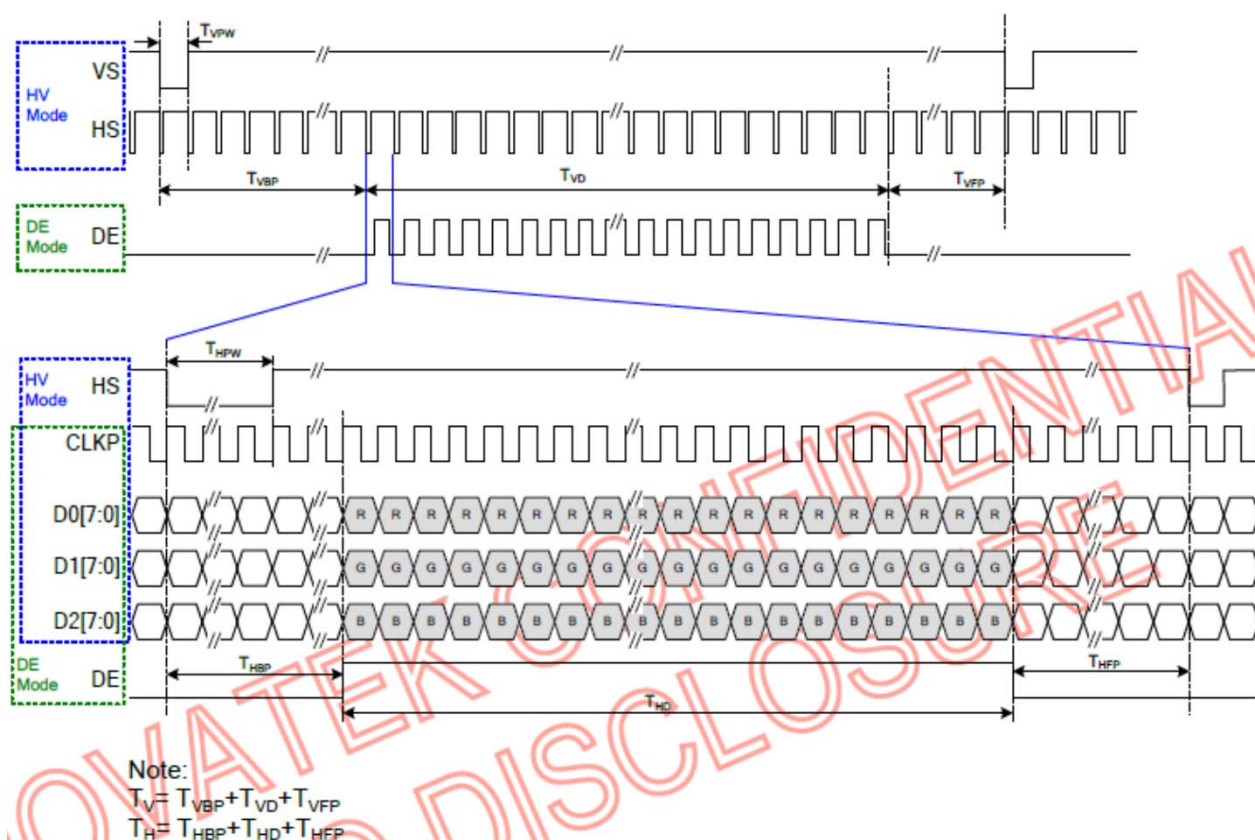


■ DIM Duty



4.0 TIMING

4.1 time table



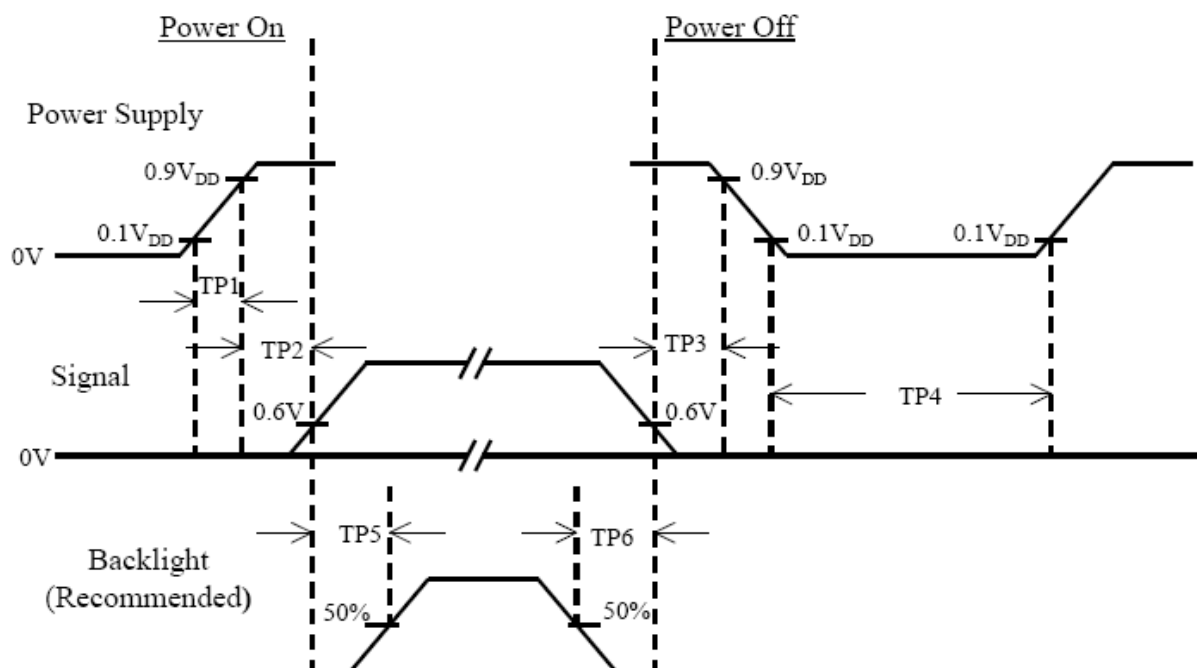
HV mode for 800x480

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	F_{CLK}	25.2	25.4	35.7	MHz
Horizontal display area	T_{HD}		800		CLK
HS period time	T_H	860	864	974	CLK
HS pulse width	T_{HPW}	1	2	40	CLK
HS back porch	T_{HBP}		32		CLK
HS front porch	T_{HFP}	28	32	142	CLK
Vertical display area	T_{VD}		480		H
VS period time	T_V	488	490	611	H
VS pulse width	T_{VPW}	1	2	20	H
VS back porch	T_{VBP}		5		H
VS front porch	T_{VFP}	3	5	126	H

DE mode for 800x480

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	F_{CLK}	25.2	25.4	35.7	MHz
Horizontal display area	T_{HD}		800		CLK
HS period time	T_H	860	864	974	CLK
HS blanking	$T_{HFP} + T_{HBP}$	60	64	174	CLK
Vertical display area	T_{VD}		480		H
VS period time	T_V	488	490	611	H
VS blanking	$T_{VBP} + T_{VFP}$	8	10	131	H

4.3 Power On / Off Sequence

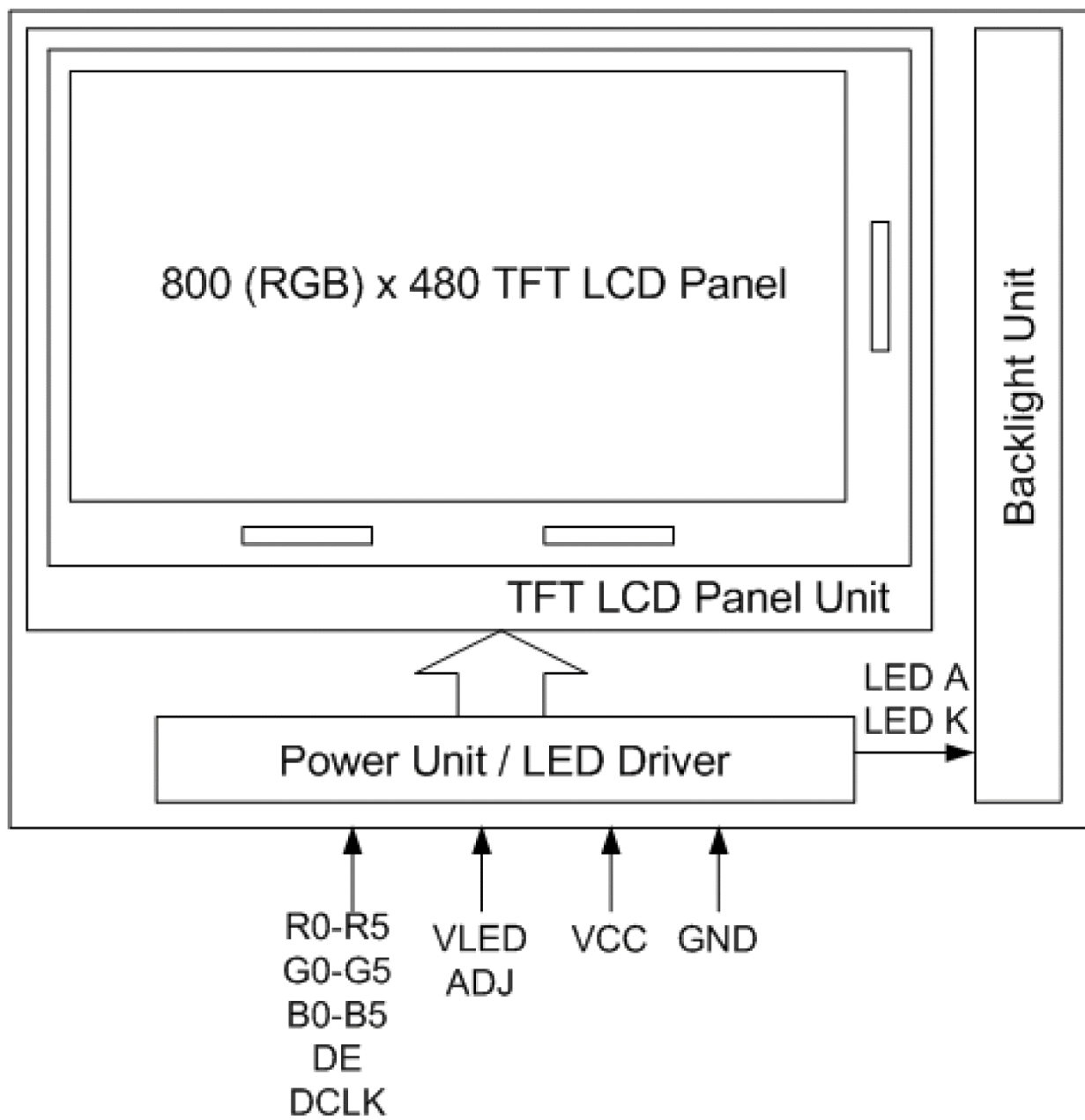


Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	500	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	

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.

5.0 BLOCK DIAGRAM



6.0 INTERFACE

Pin No	Symbol	Function
1	GND	Power Ground
2	Vcc	Power Supply for LCD
3	Vcc	Power Supply for LCD
4	Vcc	Power Supply for LCD
5	NC	Not Connection
6	NC	Not Connection
7	R0	Red data (LSB)
8	R1	Red data
9	R2	Red data
10	R3	Red data
11	R4	Red data
12	R5	Red data (MSB)
13	NC	Not Connection
14	NC	Not Connection
15	G0	Green data (LSB)
16	G1	Green data
17	G2	Green data
18	G3	Green data
19	G4	Green data
20	G5	Green data (MSB)
21	NC	Not Connection
22	NC	Not Connection
23	B0	Blue data (LSB)
24	B1	Blue data
25	B2	Blue data
26	B3	Blue data
27	B4	Blue data
28	B5	Blue data (MSB)
29	GND	Power Ground
30	DCLK	Clock Signals
31	NC	Not Connection
32	Hsync	Horizontal SYNC. (Sync mode used)
33	Vsync	Vertical SYNC. (Sync mode used)
34	DE	Data Enable
35	VLED	LED anode.
36	VLED	
37	GND	Power Ground
38	GND	Power Ground
39	ADJ	LED PWM dimming signal
40	EN	LED backlight on/off, on=high level, off=low level.

7.0 Optical Specifications

7.1 TFT Optical Characteristics

Item		Symbol	Conditio	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥ 10		80	-	Degree	Note 2
		θB			80	-		
		θL			80	-		
		θR			80	-		
Contrast Ratio		CR	θ=0°	800	1000	-		Left/right 0° Top/bottom 5°
Response Time		T _{ON} +T _{OFF}	25℃	-	25	35	ms	Note1 Note4
Chromaticity	White	x		-0.05	0.328	+0.05		Note5 Note1
		y			0.347			
	Red	x			0.615			
		y			0.321			
	Green	x			0.310			
		y			0.563			
	Blue	x			0.136			
		y			0.098			
Uniformity		U		70	--	-	%	Note1、Note6
Luminance		L		340	425	-	cd/m ²	Note7

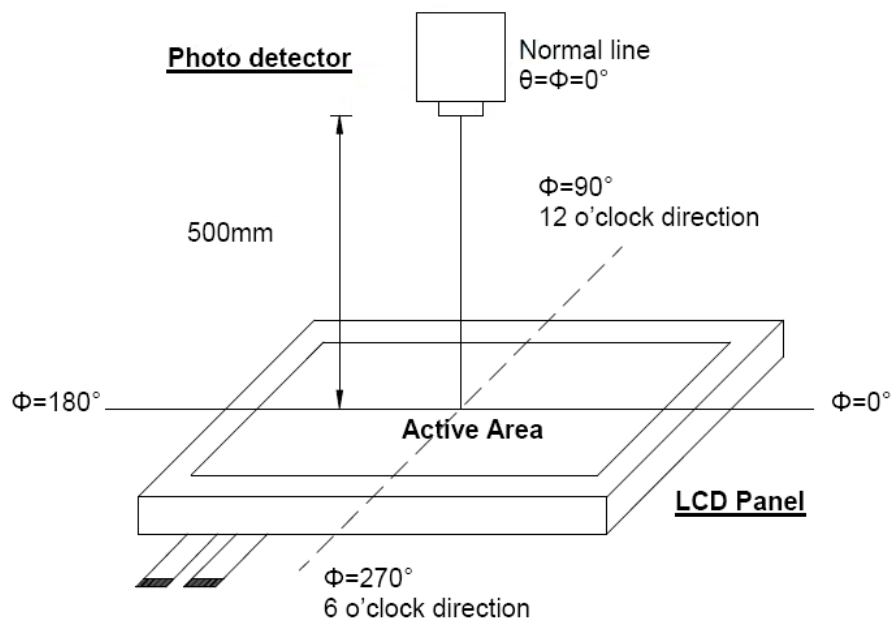
Test Conditions:

1. $I_F=25mA$ (one channel), the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 1 and Note2.

Note 1: Definition of optical measurement system.

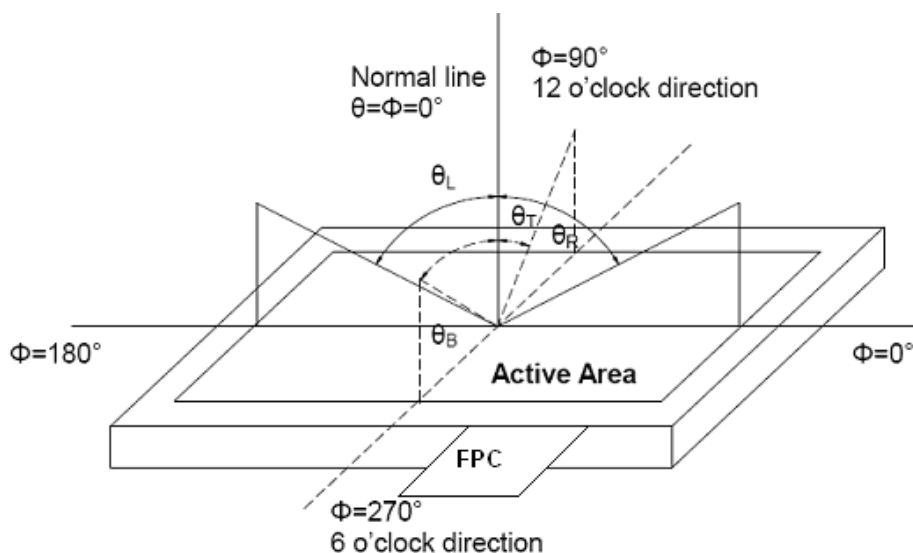
The optical characteristics should be measured in dark room. After 10 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

Note 1 : Definition of optical measurement system.



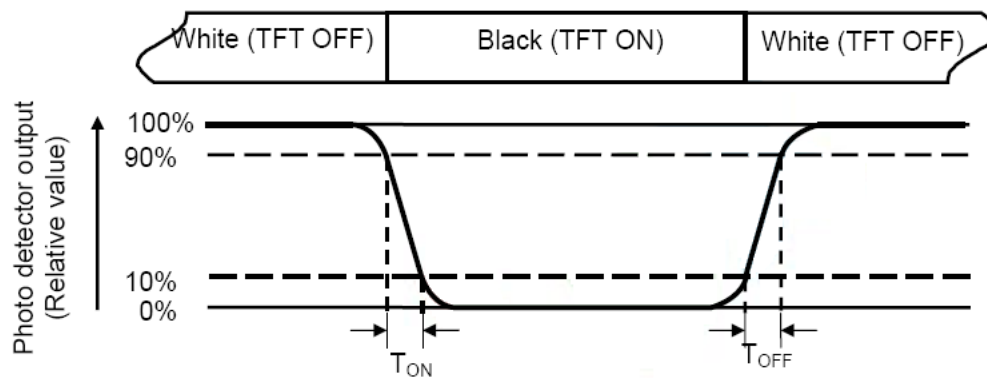
The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view : 1° / Height : 500mm.)

Note 2 : Definition of viewing angle range



Note 3 : Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 4 : Definition of contrast ratio

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

Note 5 : Definition of color chromaticity (CIE1931)

Color coordinated measured at center point of LCD.

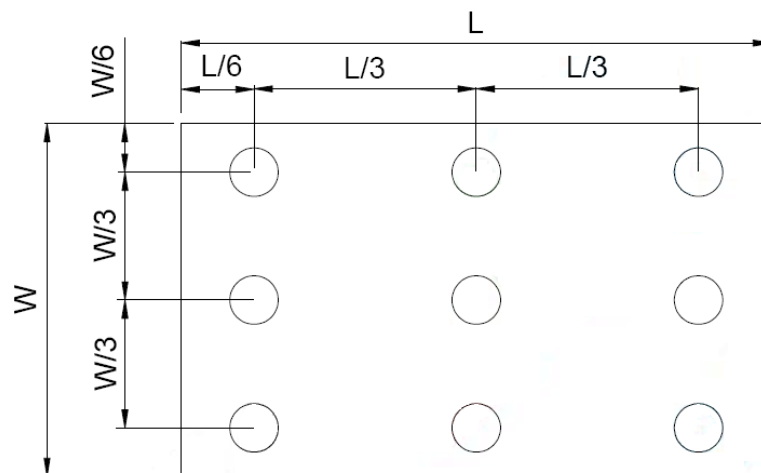
Note 6 : All input terminals LCD panel must be ground when measuring the center area of the panel.

Note 7 : Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to bellow figure). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

L ----- Active area length W ----- Active area width



B_{\max} : The measured maximum luminance of all measurement position.

B_{\min} : The measured minimum luminance of all measurement position.

8. Projected capacitive-type TOUCH PANEL ELECTRICAL SPECIFICATION

8-1 Basic Characteristic

ITEM	SPECIFICATION
Type	Projective Capacitive Touch Panel
Activation	Multi-finger
X/Y Position Reporting	Absolute Position
Touch Force	No contact pressure required
Calibration	No need for calibration
Report Rate	Approx. 100 points/sec
Interface/Protocol	IIC/V3.X
Control IC	ILI2511
Conductive susceptibility IEC/EN61000-4-6	10Vrms
Radiated Susceptibility IEC/EN61000-4-3	30V/m
Cover Glass	1.1mm chemically strength glass with black border
Bonding method	CG to sensor: optical bonding
	TP module to LCM: tape bonding

8-2 Electrical Characteristic

8-2-1 IIC Interface

Specify the normal operating condition

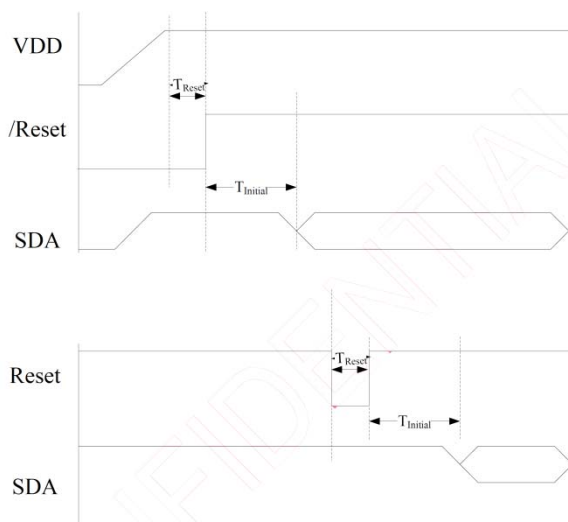
(GND=0V)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		V _{IN}	3	3.3	3.6	V	
Signal IIC Interface Logic level	Low	V _{IL}	0	-	0.3*V _{IN}	V	
	High	V _{IH}	0.7*V _{IN}	-	V _{IN}	V	
Power Consumption		I _{VIN}		50		mA	Ref.

8-2-2 Interface

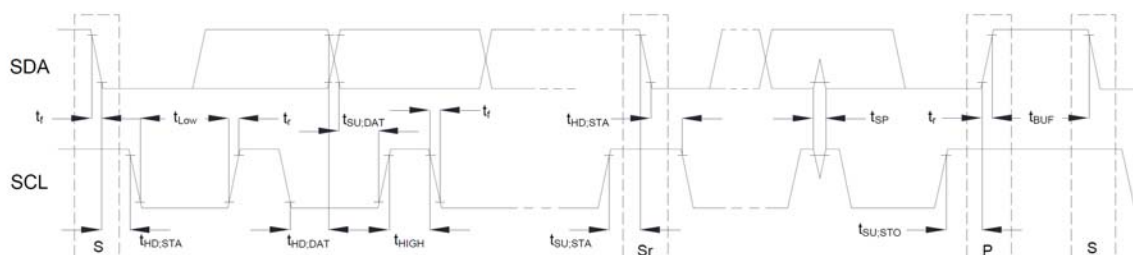
Pin No.	Symbol	Function
1	GND	POWER GND
2	SDA	IIC Data
3	SCL	IIC Clock
4	VIN	Power supply 3.3V
5	INT	Interrupt signal Active "Low"
6	RESET	Reset touch panel controller Active "Low"

8-2-3 Power- on Timing Chart (IIC interface)



Symbol	Parameter	MIN.	MAX.	Unit
$T_{Initial}$	After powering-on or resetting the device, the device needs $T_{Initial}$ time to configure the system.	-	100	ms
T_{Reset}	/Reset pin low hold time	50	-	μ s

8-2-4 IIC AC Waveform



8-2-5 IIC Characteristics

Symbol	Parameter	100KHz			400KHz		
		Min	Max	Unit	Min	Max	Unit
f_{SCL}	SCL clock frequency	0	100	kHz	0	400	KHz
$t_{HD,STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	4.0	–	μs	0.6	–	μs
t_{LOW}	LOW period of the SCL clock	4.7	–	μs	1.3	–	μs
t_{HIGH}	HIGH period of the SCL clock	4.0	–	μs	0.6	–	μs
$t_{SU,STA}$	Set-up time for a repeated START condition	4.7	–	μs	0.6	–	μs
$t_{HD,DAT}$	Data hold time	0	3.45	μs	0	0.9	μs
$t_{SU,DAT}$	Data set-up time	250	–	ns	100	–	ns
t_r	Rise time of both SDA and SCL signals	–	1000	ns	–	300	ns
t_f	Fall time of both SDA and SCL signals	–	300	ns	–	300	ns
$t_{SU,STO}$	Set-up time for STOP condition	4.0	–	μs	0.6	–	μs
t_{BUF}	Bus free time between a STOP and START condition	4.7	–	μs	1.3	–	μs

8-2-6 Format Protocol

Protocol V3.X Command List

CMD Code	Name	Set /Get	Note	b7	b6	b5	b4	b3	b2	b1	b0
0x10	Touch Information	Get		0: No touch 1: Last Report at ID 0 to ID 5 (include release status) 2: Last Report at ID 6 to ID 9 (include release status)							
			ID0	1: Touch Down, 0: Touch Off	0	X_High direction coordinate					
				X_Low direction coordinate							
				0	0	Y_High direction coordinate					
				Y_Low direction coordinate							
				Touch Pressure							
			ID1	1: Touch Down, 0: Touch Off	0	X_High direction coordinate					
				X_Low direction coordinate							
				0	0	Y_High direction coordinate					
				Y_Low direction coordinate							
				Touch Pressure							

			ID2	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID3	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID4	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		

0x14	Touch Information 2	Get	ID5	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID6	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID7	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		

			ID8	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID9	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
0x20				The maximum X coordinate (bit 7:0)		
				The maximum X coordinate (bit 15:8)		
				The maximum Y coordinate (bit 7:0)		
				The maximum Y coordinate (bit 15:8)		
				The channel numbers of X direction		
				The channel numbers of Y direction		
				The maximum report points		

				The channel numbers of TouchKey / Scrolling Bar
				For Touch Key Application (Maximum supports 31 Touch Key) Byte 8 : The Touch Key number (<32) Byte 9: 0xFF
0x30	Enter Sleep Mode	Set		--
0x40	Firmware Version	Get		Chip ID Code
				Major firmware version
				Minor firmware version
				Release firmware version
				For Customer Firmware Version
				For Customer Firmware Version
				For Customer Firmware Version
				For Customer Firmware Version
0x42		Get		Major protocol version : 0x03
				Minor protocol version : XX
				Release protocol version : XX

Protocol V3.X Data Format

CMD Code	Name	Set / Get	Note	b7	b6	b5	b4	b3	b2	b1	b0
0x10	Touch Information	Get	Packet Number	0: No touch 1: Last Report at ID 0 to ID 5 (include release status) 2: Last Report at ID 6 to ID 9 (include release status)							
			ID0	1: Touch Down, 0: Touch Off	0	X_High direction coordinate					
				X_Low direction coordinate							
				0	0	Y_High direction coordinate					
				Y_Low direction coordinate							
				Touch Pressure							

			ID1	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID2	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID3	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID4	1: Touch Down, 0: Touch Off	0	X_High direction coordinate

				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		
			ID5	1: Touch Down, 0: Touch Off	0	X_High direction coordinate
				X_Low direction coordinate		
				0	0	Y_High direction coordinate
				Y_Low direction coordinate		
				Touch Pressure		

8-2-7 Interrupt Pin (INT) Control

When a finger touches on the sensor surface, the INT pin will be pull low. TP controller supports two different type control method.

Method 1(Polling): The \overline{INT} will continue to be low until the finger leaves the sensor surface.

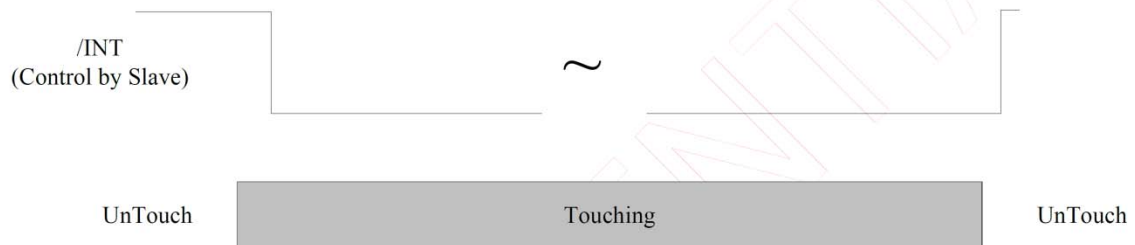


Fig 9: Method 1: \overline{INT} Pin Control Diagram (Finger Touch)

Method 2(Interrupt): The \overline{INT} will continue to be pull low until host read 0x10 command.

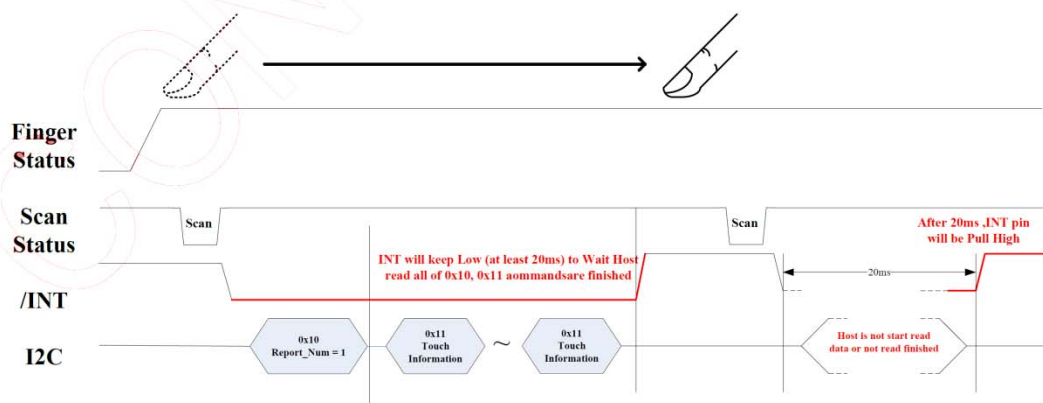


Fig 10: Method 2: \overline{INT} Pin Control Diagram (Finger Touch)

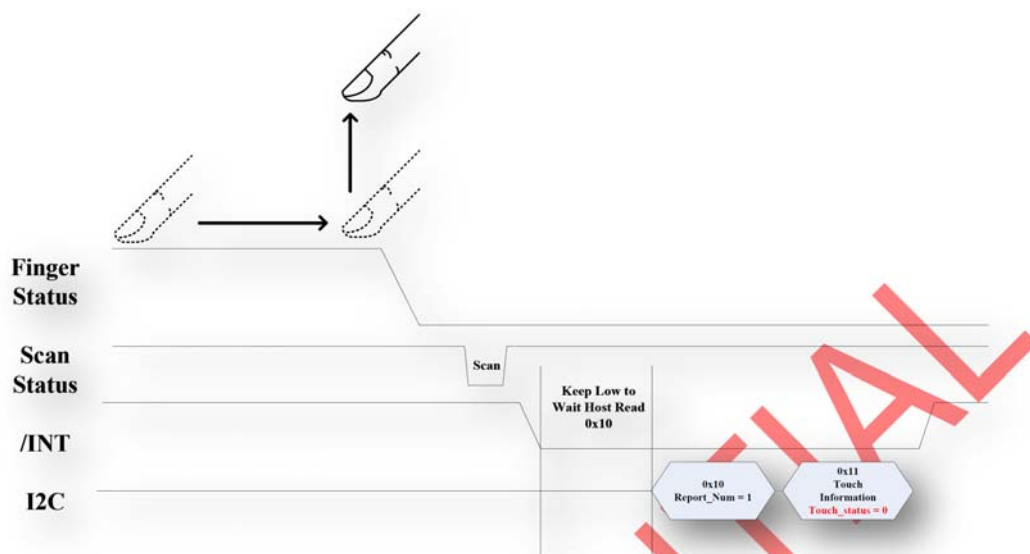


Fig 11: Method 2: $\overline{\text{INT}}$ Pin Control Diagram (Finger Release)

8-2-8 Device Address

MSB							LSB
1	0	0	0	0	0	1	0/1
Device Address							R/W

7-bit Device Address: 0x41

8-bit Device Read Address: 0x83

8-bit Device Write Address: 0x82

7-2-9 Data Transfer

Data is transferred over the IIC bus with 8-bit address and 8-bit data.

1	7	1	1	8	1	1
S	Slave Address	Wr	A	Data Byte	A	P

S Start Condition




Sr Repeated Start Condition

Rd Read (bit value of 1)

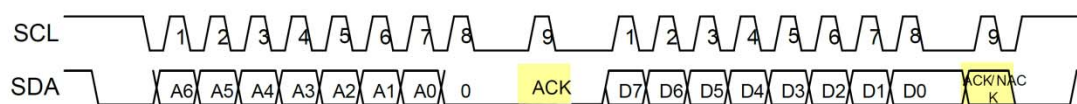
Wr Write (bit value of 0)

A/NA Acknowledge (this bit position may be '0' for an ACK or '1' for a NACK)

P Stop Condition

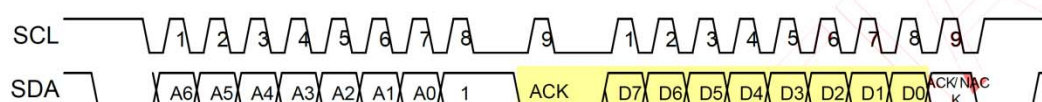
	Master-to-Slave
	Slave-to-Master
	Continue

I2C Write timing



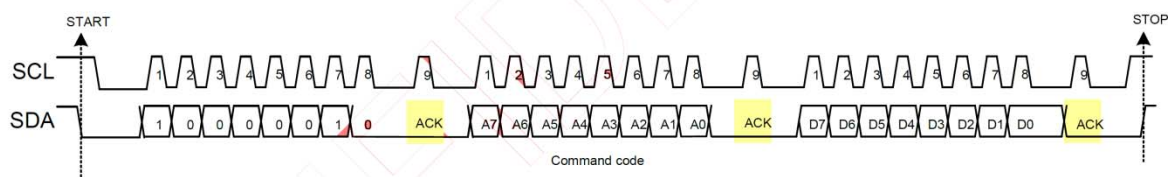
=> slave to master

I2C Read timing



=> slave to master

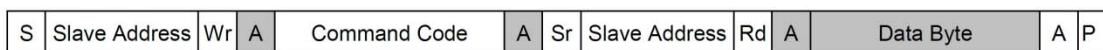
Byte Write



Byte Write

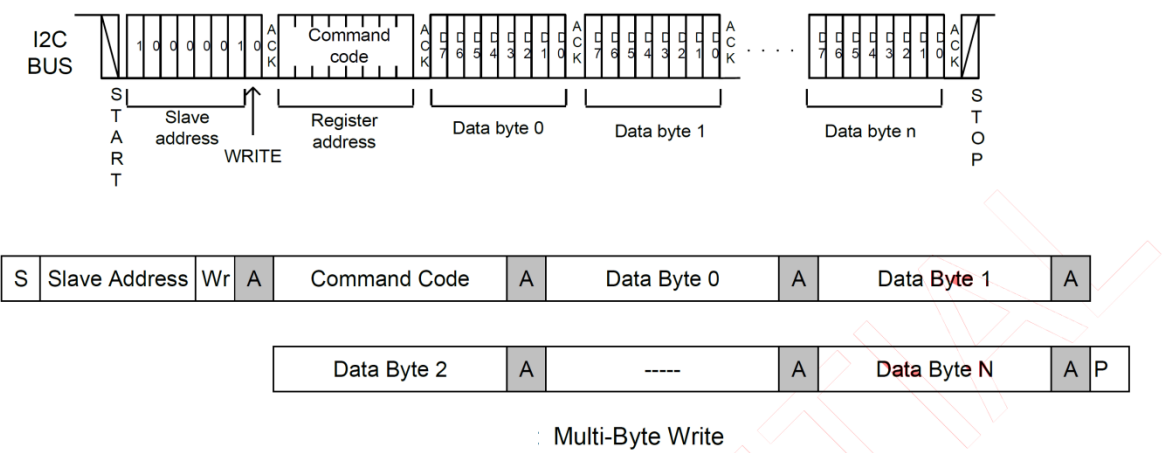
Byte Read

C

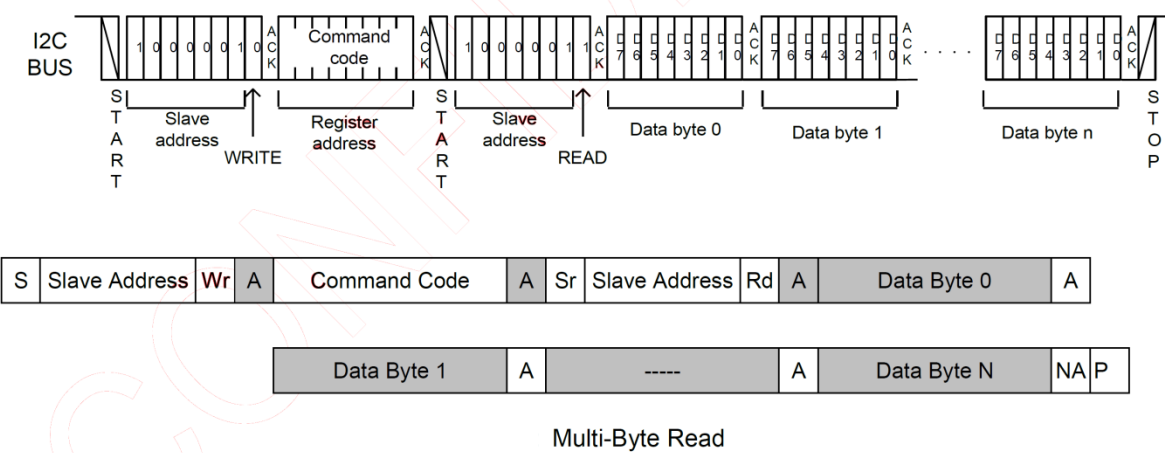


Byte Read

Multi-Byte Write



Multi-Byte Read



9. Reliability Test Items

Test Item	Test Conditions	Note
High Temperature Operation	85±3°C , t=240 hrs	
Low Temperature Operation	-30±3°C , t=240 hrs	
High Temperature Storage	85±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Storage at High Temperature and Humidity	40°C, 85% RH , 240 hrs	1,2
Thermal Shock Test	-30°C (30min) ~ 85°C (30min) 50 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.

10. GENERAL PRECAUTION

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 $+25\pm 10^{\circ}\text{C}$ 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.

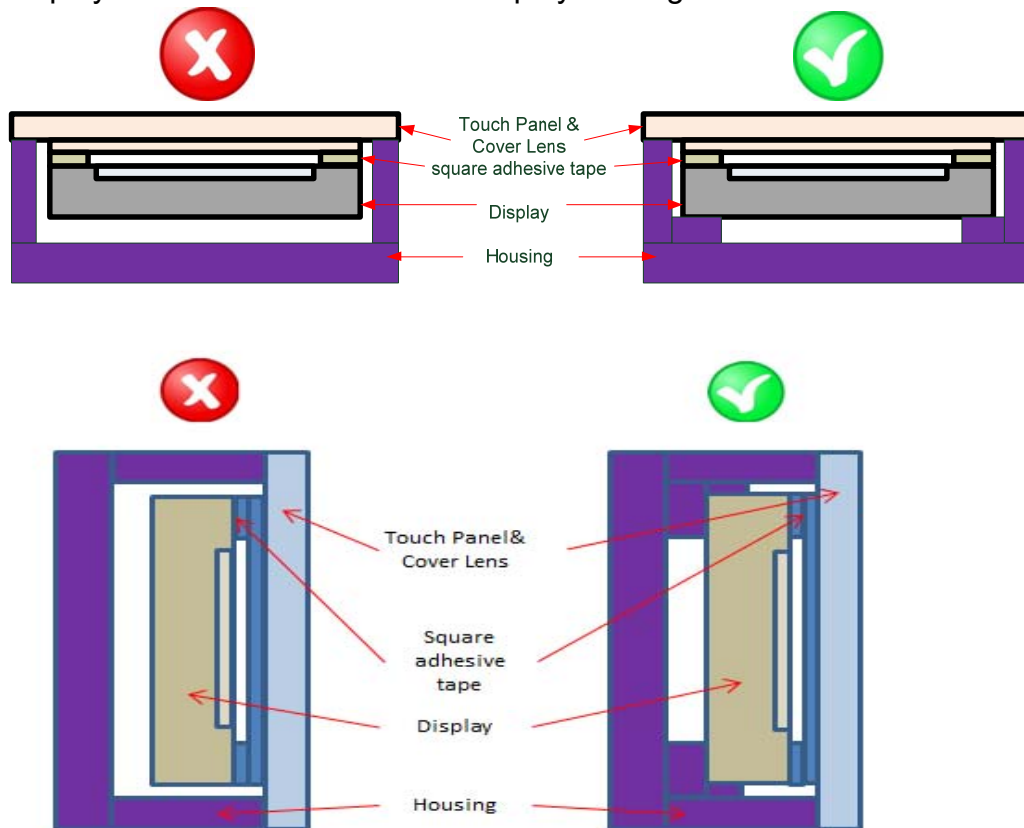
10-5 Cleaning

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

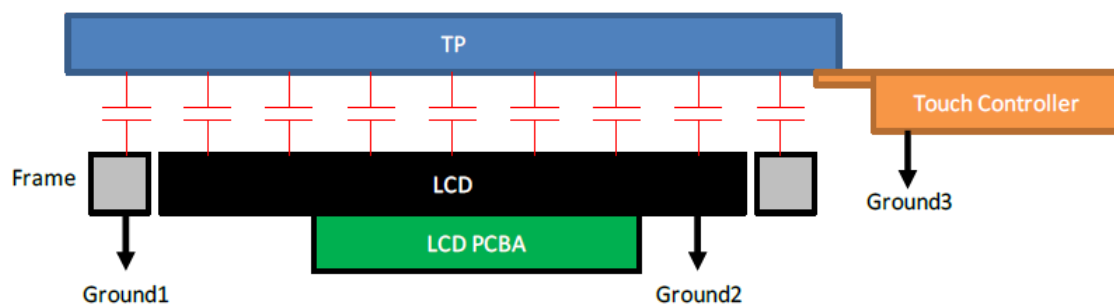
10-6 Mechanism (if the LCM using air bonding)

(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

11 Outline Dimension

