






Product Specification	Model:	AWT-800480T50P03	Rev. No.	Issued Date.	Page.
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Thin Film Transistor LCD MODULE
MODEL: AWT-800480T50P03
Customer's No.:

Acceptance

10-1 Floor, No. 192, Tahtung Road,
Sec. 3, Hsi-Chih Dist,
New Taipei City, Taiwan

Approved and Checked by

Approved by	Checked by		Made by
			



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Record of Revisions

Rev	Date	Sub-Model	Description of change
A	Jan. 17, 2012		Preliminary Product Specification was first issued.
B	Feb. 05, 2014		Modified Page 22-26 (TOUCH MODULE Section): Capacitive touch panel revise IC to MSG 2138a.



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TFT MODULE

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TOUCH MODULE

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1.0 General description

1.1 Introduction

The model AWT-800480T50P03 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 5.0 (15:9) inch diagonally measured active display area with WQVGA (800 horizontal by 480 vertical pixel) resolution.

1.2 Features

5.0 (15:9 diagonal) inch configuration

8 bits + DAC with 1 channel TTL interface

LED Backlight

RoHS Compliance

1.3 Applications

Mobile NB,GPS

Personal Navigation Device

Multimedia applications and Others AV system

1.4 General information

Item	Specification	Unit
Outline Dimension	120.8 x 76.0 x 4.43 (Typ.)	mm
Display area	108.0(H) x 64.8(V)	mm
Number of Pixel	800 RGB(H) x 480(V)	pixels
Pixel pitch	0.135(H) x 0.135(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally white	
Surface treatment	Antiglare, Hard-Coating(3H)	
Weight	86(Typ.)	g
Back-light	Single LED (Side-Light type)	
Power Consumption	B/L System 0.98	W

1.5 Mechanical Information

item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	120.6	120.8	121.0	mm
	Vertical(V)	75.8	76.0	76.2	mm
	Depth(D)	4.23	4.43	4.63	mm



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2.0 Absolute maximum ratings

2.1 Electrical absolute rating

2.1.1 TFT LCD module

Item	Symbol	Min.	Max.	Unit.	Note
Power supply voltage	VDD	-0.3	5.0	V	GND=0
	VGH	0.3	40	V	GND=0
	VGL	-20	0.3	V	GND=0
	AVDD	0.5	15	V	AGND=0
	VCOM	0	6	V	
Logic Signal Input Level	V1	-0.3	VDD+0.3	V	

2.1.2 Back-light unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward voltage	Vf	17.9	19.8	20.4	V	(1)(2)
Forward current	If	35	40	45	mA	(1)(2) (3)
Power Consumption	PBL	--	800	--	mW	

Note(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) Ta =25 ± 2°C

Note (3) Test Condition: LED current 40 mA

2.2 Environment absolute rating

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



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3.0 Optical characteristics

3.1 Optical specification:

Item	Symbol	Min.	Typ.	Max.	Unit	Condition	
Response Time	Tr	2	4	8	msec	$\theta=0^\circ, \varphi=0^\circ$ (Note 1,3)	
	Tf	6	12	24			
Contrast Rate	Cr	480	600	--	--	$\theta=0^\circ, \varphi=0^\circ$ LED:ON, LIGHT:OFF(Note1,2)	
Brightness	YL	320	350	--	cd/m2	(IL=40mA)(Note1,4)	
Visual angle range front and rear	θU	50	60	70	Degree	$\varphi=90^\circ, CR \geq 10$ LED:ON LIGHT:OFF(Note 1,4)	
	θD	40	50	60	Degree		
Visual angle range left and right	θL	55	65	75	Degree		
	θR	55	65	75	Degree		
Brightness uniformity	BUNI	70			%	$\theta=0$ (Note5,7)	
Visual angle		12:00				(Note 6)	
Color Chromaticity	Red	Rx	0.592	0.642	0.692	--	Reference: CPT Panel, CIE (x, y) chromaticity (Note 1,4)
		Ry	0.293	0.343	0.393	--	
	Green	Gx	0.228	0.278	0.328	--	
		Gy	0.516	0.566	0.616	--	
	Blue	Bx	0.087	0.137	0.187	--	
		By	0.04	0.09	0.14	--	
	White	Wx	0.257	0.307	0.357	--	
		Wy	0.276	0.326	0.376	--	

3.2 Measuring condition

Measuring surrounding: dark room ,LED current IL : 40mA

Ambient temperature: 25±2°C

15min warm-up time.

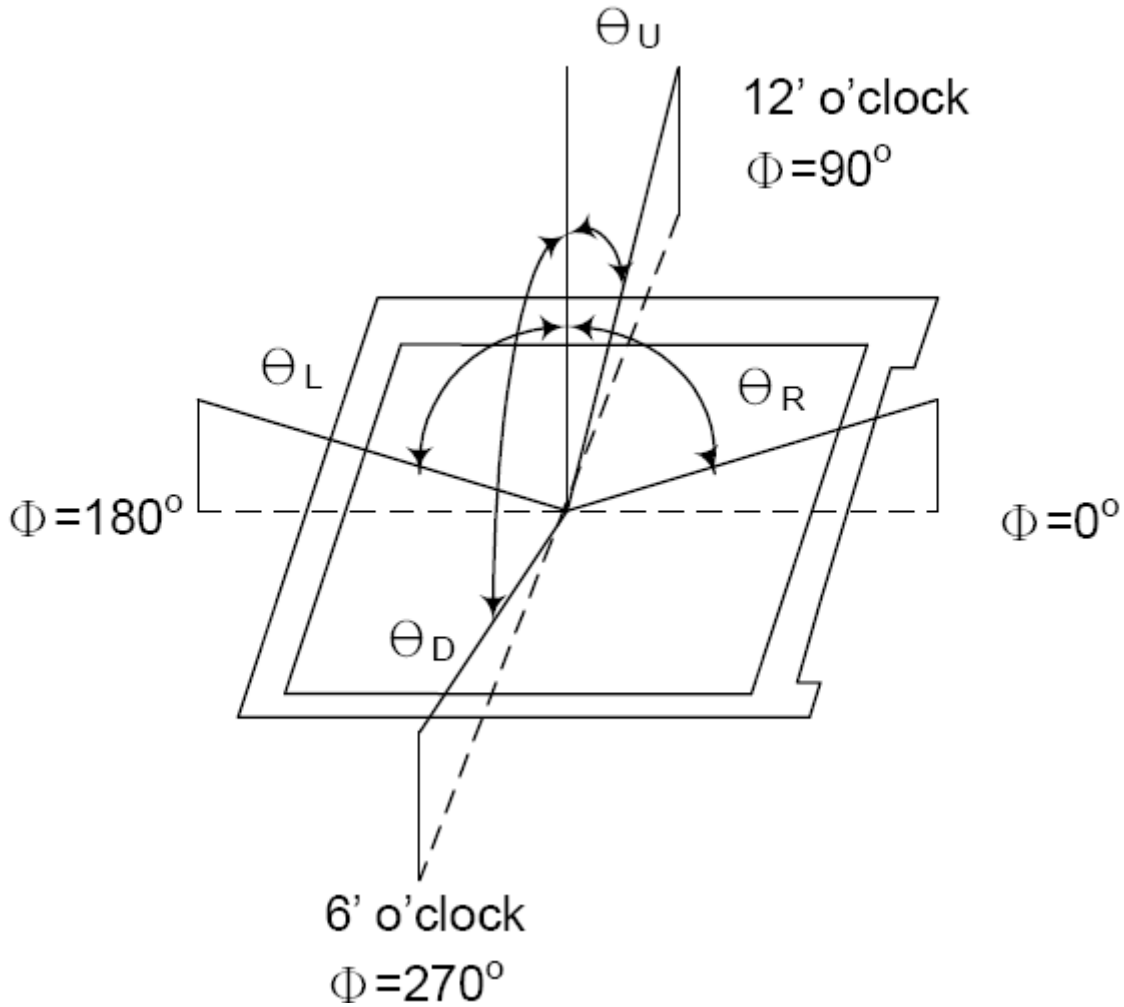
3.3 Measuring equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for chromaticity and BM-7 for other optical characteristics. Measuring spot size: 20 ~ 21 mm



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Note (1) Definition of viewing angle :



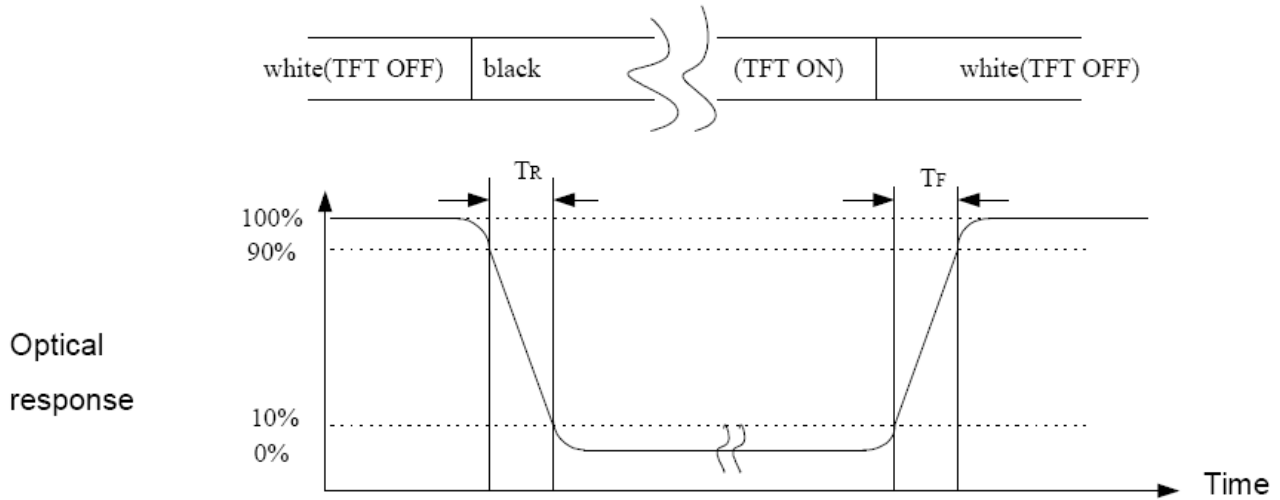
Note (2) Definition of contrast ratio (CR): Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

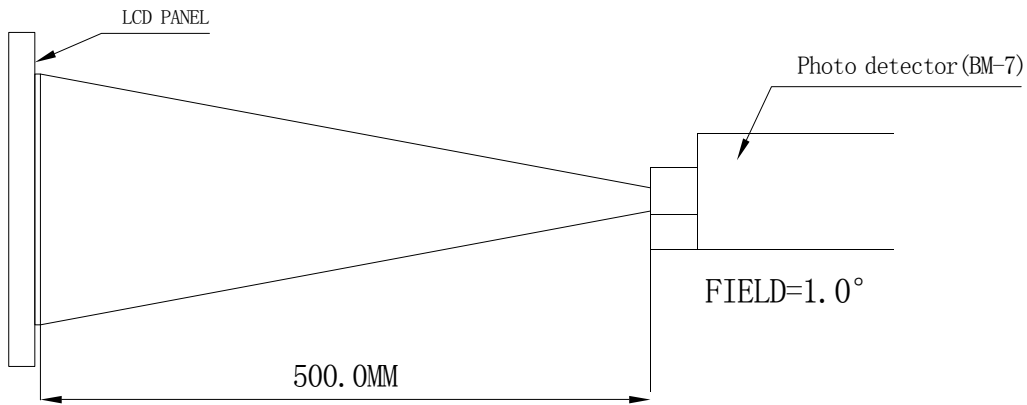


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Note (3) Definition of response time: Sum of TR and TF



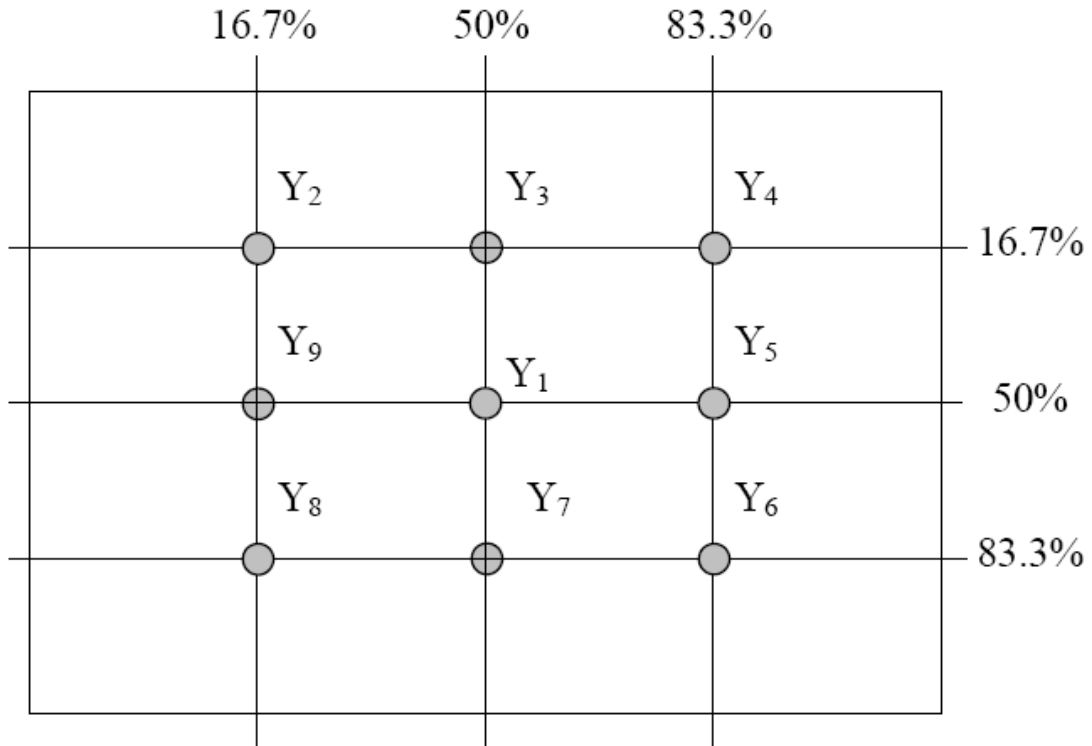
Note (4) Definition of optical measurement setup





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Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

Note (6) Rubbing direction (the different rubbing direction will cause the different optimal view direction).

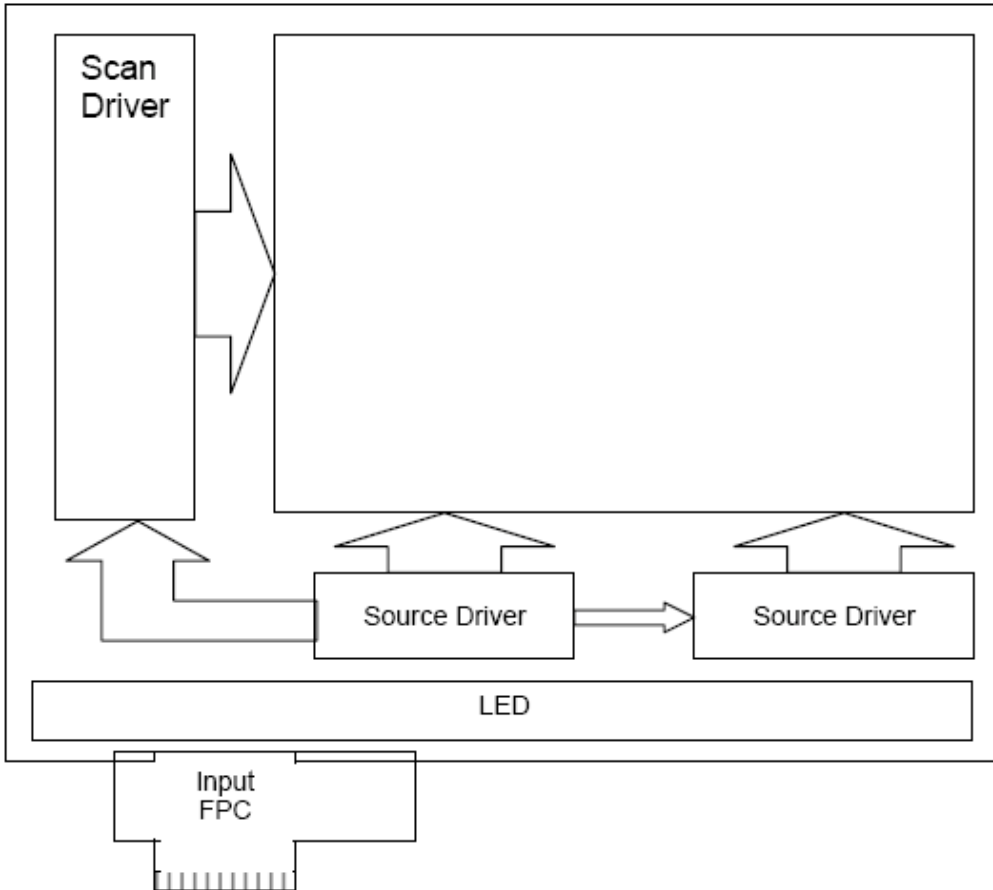
Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.



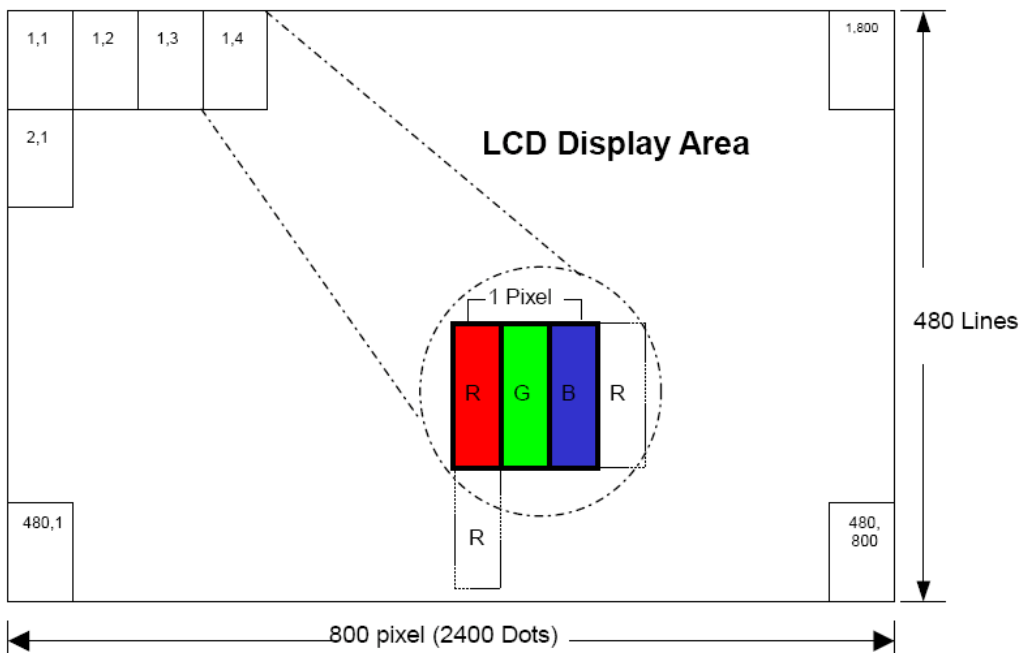
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4.0 Block diagram

4.1 TFT LCD module



4.2 Pixel format





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5.0 Interface pin connection

5.1 TFT LCD module CN2 (input signal): FPC down connector, (FH19SC-40S-0.5SH (HIROSE), 40pin, pitch = 0.5mm)

Terminal No.	Symbol	IO	Functions
1	LEDK	P	Power for LED backlight cathode
2	LEDA	P	Power for LED backlight anode
3	GND	P	Power Ground
4	VDD	P	Power Voltage
5	R0	I	Data Input(LSB)
6	R1	I	Data Input
7	R2	I	Data Input
8	R3	I	Data Input
9	R4	I	Data Input
10	R5	I	Data Input
11	R6	I	Data Input
12	R7	I	Data Input (MSB)
13	G0	I	Data Input (LSB)
14	G1	I	Data Input
15	G2	I	Data Input
16	G3	I	Data Input
17	G4	I	Data Input
18	G5	I	Data Input
19	G6	I	Data Input
20	G7	I	Data Input(MSB)
21	B0	I	Data Input(LSB)
22	B1	I	Data Input
23	B2	I	Data Input
24	B3	I	Data Input
25	B4	I	Data Input
26	B5	I	Data Input
27	B6	I	Data Input
28	B7	I	Data Input(MSB)
29	DGND	P	Digital Ground
30	DCLK	I	Dot data clock
31	DISP	I	Display on/ off



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32	HSYNC	I	Horizontal sync Signal
33	VSYNC	I	Vertical sync signal
34	DE	I	Data Enable
35	NC	--	No Connect
36	GND	P	Power Ground
37	NC	I/O	No Connect
38	NC	I/O	No Connect
39	NC	I/O	No Connect
40	NC	I/O	No Connect



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6.0 Electrical characteristics

6.1 TFT LCD module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	2.7	3.0	3.5	V	
	VGH	14.5	15	20	V	
	VGL	-10	-7	-6.5	V	
	AVDD	9.85	10	10.15	V	
VCOM	VCOMin	--	3.9	--	V	
Input signal voltage	ViH	0.7 VDD	--	VDD	V	Note(1)
	ViL	0	--	0.3 VDD	V	
Current of power supply	IDD	--	5.426	--	mA	VDD=3.0V
	IADD	--	24.1	--	mA	AVDD=10V(Black)
	IGH	--	0.128	--	mA	VGH=15V
	IGL	--	0.344	--	mA	VGL=-7V
Input level of V1~V5	Vx	AVDD/2		AVDD-0.1		
Input level of V6~V10	Vx	0.1		AVDD/2		

Note (1): HSYNC, VSYNC, DE, Digital Data

Note (2): Be sure to apply the power voltage as the power sequence spec. Note (3): DGND=AGND=0V

6.2 Back-light unit

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

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

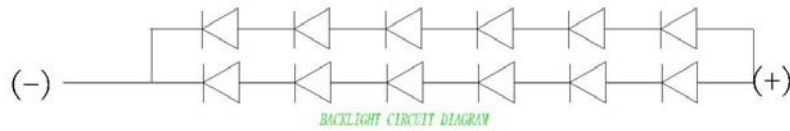
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	35	40	45	mA	(2)
LED Voltage	VL	17.9	19.8	20.4	V	
Operating LED life time	Hr	20000	--	--	Hour	(1)(2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL=40mA value indicated in the above table until the brightness becomes less than 50%.



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



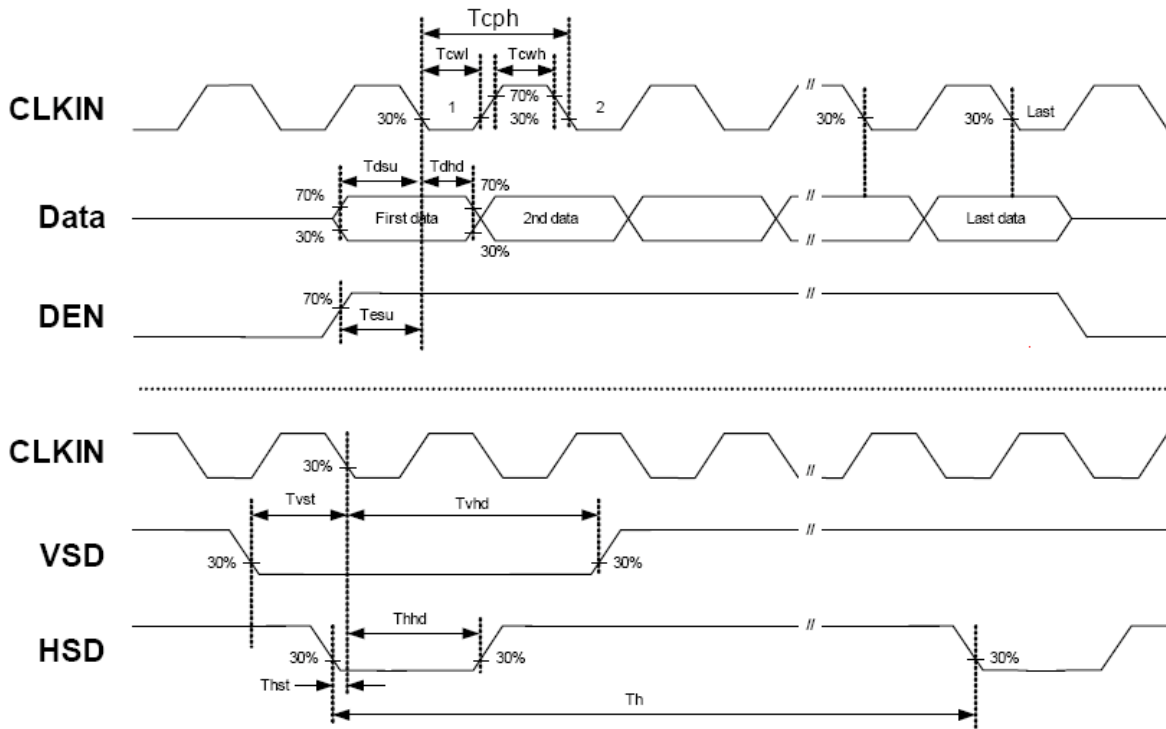
6.3 AC characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	25			ns	
DCLK frequency	felk		30	40	MHZ	
DCLK pulse duty	Tcwh	40	50	60	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
Horizontal display area	thd		800		Tcph	
HSD period time	th		928		Tcph	
HSD pulse width	thpw	1	48		Tcph	
HSD back porch	thb		40		Tcph	
HSD front porch	thfp		40		Tcph	
Vertical display area	tvd		480		th	
VSD period time	tv		525		th	
VSD pulse width	tvpw		3		th	
VSD back porch	tvb		29		th	
VSD front porch	tvfp		13		th	

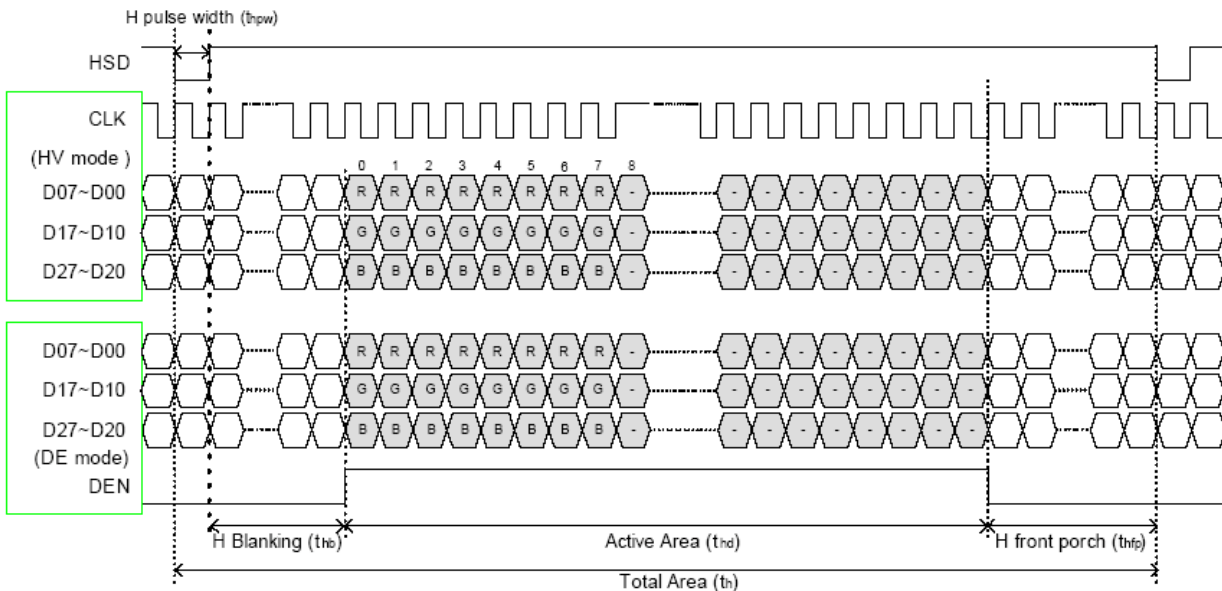


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6.4 Timing diagram of interface signal



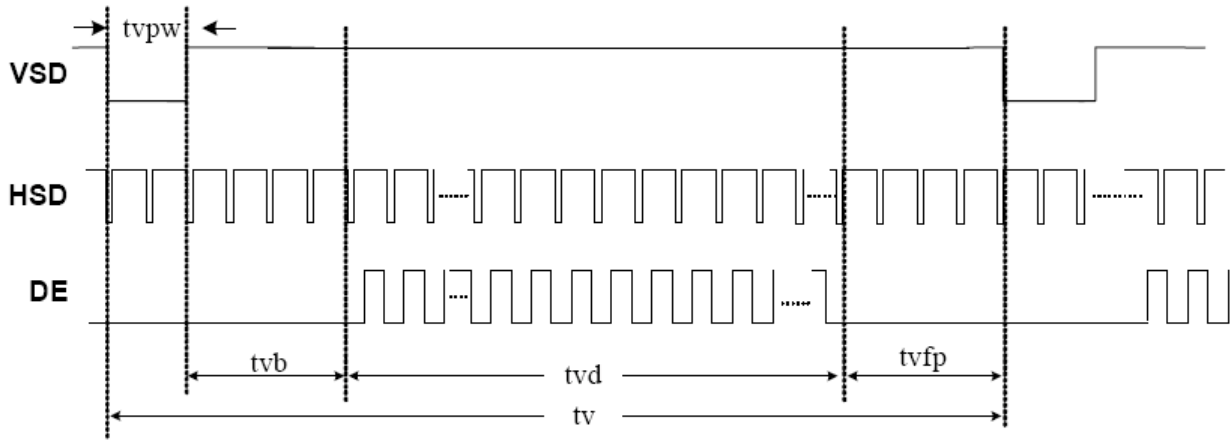
Sampling clock timing



Horizontal display timing range

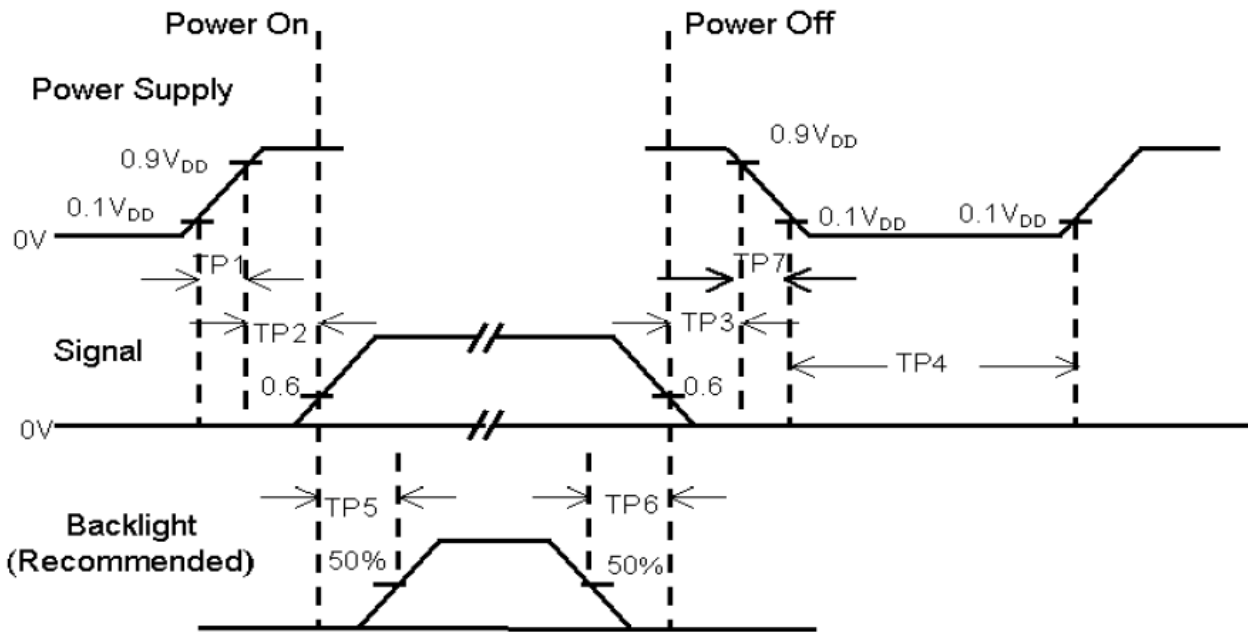


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Vertical timing

6.5 Power sequence





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Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	1000	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	
TP7	0.5	--	10	msec	

- Note :**
- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD} .
 - (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 V_{DD} = 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.



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7.0 Reliability test items

Test Item	Test Conditions	Notes
High temperature Operation	70±3°C ,T=240hrs	
Low temperature Operation	-20±3°C ,T=240hrs	
High Temperature Storage	80±3°C ,T=240hrs	1,2
Low Temperature Storage	-30±3°C ,T=240hrs	1,2
Humidity Test	60°C ,Humidity 90% ,240hrs	1,2
Thermal Shock Test	-30°C ,30min~80°C ,30min (200 cycle)	1,2
Vibration Test(Packing)	Sweep frequency 10~55~10HZ/min Amplitude:0.75mm Test direction: X,Y,Z/3 axis Duration 30min/each axis	2
Static Electricity	150Pf 330ohm ± 8KV, 10time air discharge ±4KV, 10time connect discharge	



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8.0 Incoming inspection standards

Defect type		Specification size	Count(N)	Note
Dot Shape (Particle, Scratch in display area)		$\varphi \leq 0.20 \text{ mm}$	Ignored	Note1
		$0.20\text{mm} < \varphi \leq 0.35\text{mm}$	$N \leq 3$	
		$\varphi > 0.35\text{mm}$	$N = 0$	
Dot Shape (Bubbles, Dent in display area)		$\varphi \leq 0.25\text{mm}$	Ignore	
		$0.25\text{mm} < \varphi \leq 0.5\text{mm}$	$N \leq 2$	
		$\varphi > 0.50\text{mm}$	$N = 0$	
Newton Ring (Only for Touch panel)		$\varphi \leq 50\text{mm}$	$N \leq 2$	
		$\varphi > 50\text{mm}$	$N = 0$	
TSP Fish Eyes (Only for Touch panel) (Bubble/Dent)		$0.1\text{mm} < \varphi \leq 0.2\text{mm}$	$N \leq 3$	
		$0.2\text{mm} < \varphi \leq 0.3\text{mm}$	$N \leq 2$	
		$0.3\text{mm} < \varphi \leq 0.4\text{mm}$	$N \leq 1$	
Line Shape (Particles, Scratch, Lint and Bubbles in display area)		$W \leq 0.03 \text{ mm}$	Ignored	
		$0.03\text{mm} < W \leq 0.07\text{mm}$ and $L \leq 5\text{mm}$	$N \leq 5$	
		$W > 0.07\text{mm}$ or $L > 5 \text{ mm}$	$N=0$	
Bubble in cell (active area)		It should be found by eyes		
Bezel	Scratch	No harm		
	Dirt			
	Wrap	No harm		
	Sunken	No harm		
Label	No label	No		
	Inverted label			
	Broken			
	Dirt	Word can be read.		
	Not clear	No		
	Word out of shape			
	Mistake	No		
	Position	Be attached on right position		
Screw	Not enough	No		
	Limp	No		
Connector	Connection status	No bend on pins and damage		
FPC/FFC	Broken	No		



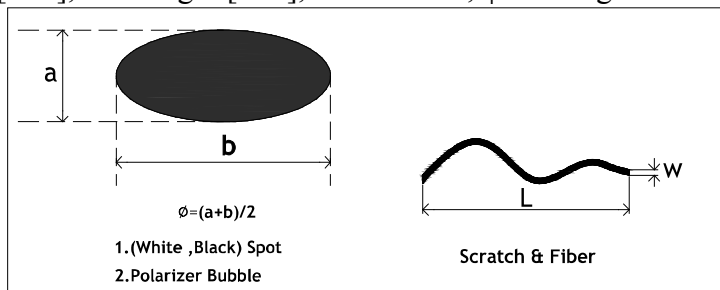
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Note: Extraneous substance and scratch not affecting the display of image, for instance, extraneous substance under polarizer film but outside the display area, or scratch on metal bezel and backlight module or polarizer film outside the display area, shall not be considered as defective or non-conforming.

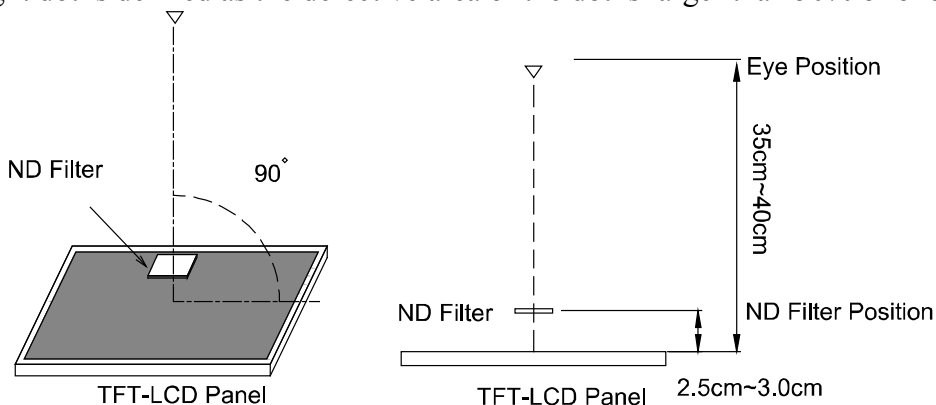
Defect type		Limit	Note
Electrical defect	Bright dot	$N \leq 2$	Note2
	Dark dot	$N \leq 2$	
	Minimum distance	10mm	
	Total dot	$N \leq 3$	
	Two adjacent dot	$N \leq 0$	Note3
	Three or more adjacent dot	Not allowed	
	Line defect	Not allowed	

- (1) The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
- (2) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
- (3) The bright dot defect must be visible through 2% ND filter.
- (4) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

Note1 : W : Width [mm], L : Length [mm], N : Number, ϕ : Average Diameter



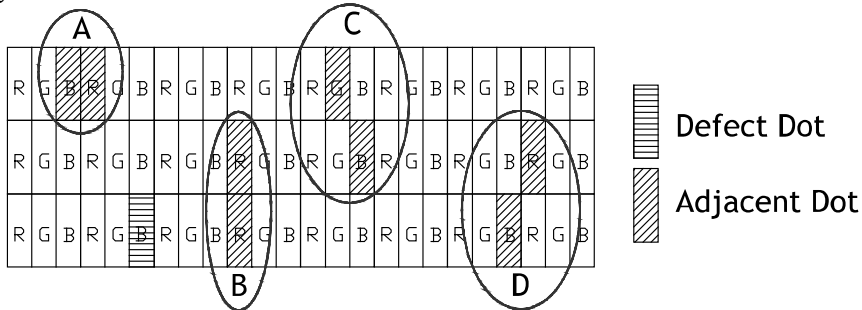
Note2 : Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.





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Note3 : Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2 defect dots in total quantity.



Note4 : Other condition

- (1) The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.
- (2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.



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10.0 General precaution

10.1 Use restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life threatening or otherwise catastrophic.

10.2 Disassembling or modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. ACROWISE does not warrant the module, if customers disassemble or modify the module.

10.3 Breakage of LCD panel

10.3.1 If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

10.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.

10.3.3 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

10.3.4 Handle carefully with chips of glass that may cause injury, when the glass is broken.

10.4 Electric shock

10.4.1 Disconnect power supply before handling LCD module.

10.4.2 Do not pull or fold the LED cable.

10.4.3 Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

10.5 Absolute maximum ratings and power protection circuit

10.5.1 Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

10.5.2 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

10.5.3 It's recommended to employ protection circuit for power supply.

10.6 Operation

10.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

10.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.



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10.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

10.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

10.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

10.7 Mechanism

Please mount LCD module by using mouting holes arranged in four corners tightly.

10.8 Static electricity

10.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

10.8.2 Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

10.9 Strong light exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

10.10 Disposal

When disposing LCD module, obey the local environmental regulations.



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1. Product Type

- 2-Point Multi-touch Capacitive Touch Panel.
- When ≥ 2 points are both on the same axis parallel to short edge.
Touch Panel won't act correctly.

2. Characteristic

2.1 Mechanical Characteristic

No.	Item	Specification	Remark
1	Outside Dimension	120.8±0.1mm x 76.0±0.1mm	
2	View Area	109.0±0.1mm x 65.8±0.1mm	-refer to Artwork
3	Active Area	109.0mm x 65.8mm	
4	Product Thickness	1.23 ± 0.1mm	
5	Input Method	Finger	
6	Hardness of Surface	$\geq 6H$	JIS-K5600

2.2 Electrical Characteristic

No.	Item	Symbol	Specification			Unit	Remark	
			MIN.	TYP.	MAX.			
1	Interface	--	I2C			--	--	
2	Power Supply	V _{VDD}	2.8	--	3.3	V		
3	Input Signal Voltage	H Level	V _{IH}	1	--	--	V	EN,SDA,SCL
		H Level	V _{IH}	2.1	--	--	V	Other
		L Level	V _{IL}	--	--	0.5	V	--
4	Output Signal Voltage	H Level	V _{OH}	VDD-0.1	--	--	V	--
		L Level	V _{OL}	--	--	0.1	V	--
5	Supply Current	I _{CI}	--	7	25	mA	V _{CI} =3.0V	
6	Report Rate	--	60			Hz		
7	Linearity	--	--	--	+/-2.5	mm	Center Area (4mm aside VA border)	
8	Accuracy 8 mm Copper stick	--			+/- 2	mm	Border area	
		--			+/- 1.5	mm	non-border area	
9	Jitter 8 mm Copper stick	--			+/- 1	mm	non-border area	
10	Sensitivity	--	8			mm	Copper stick	



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2.3 Optical Characteristic

No.	Item	Specification	Remark
1	Transmittance	84% (Typ)	ASTM D1003
2	Haze	2% (Max)	ASTM D1003

2.4 Reliability Environment

No.	Item	Specification	Remark
1	Operating	-20°C ~ 70°C (Humidity: 20%RH ~ 90%RH)	
2	Storage	-30°C ~ 80°C (Humidity: 20%RH ~ 90%RH)	
3	High Temperature Storage	85°C / 240hrs	Note 1
4	Low Temperature Storage	-30°C / 240hrs	Note 1
5	High Temperature and High Humidity Operation	60°C and 90%RH / 240hrs	Note 1
6	Thermal Shock (Power off)	-30°C for 30minutes and then 70°C for 30minutes, repeated by 50cycles	Note 1
7	FPC Bending Resistance	Φ=3mm Bending 180° 20cycles	
8	FPC Peeling Force	Peeling force >500gf	
9	Ball drop Test	>0.2J	Touch Panel only

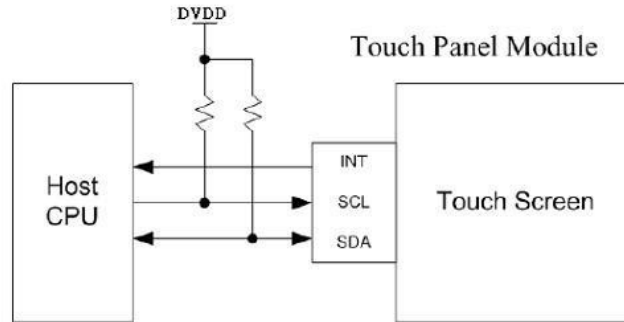
Note 1. Touch panel should be laminated on LCD module when environment reliability test.



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3. Interface

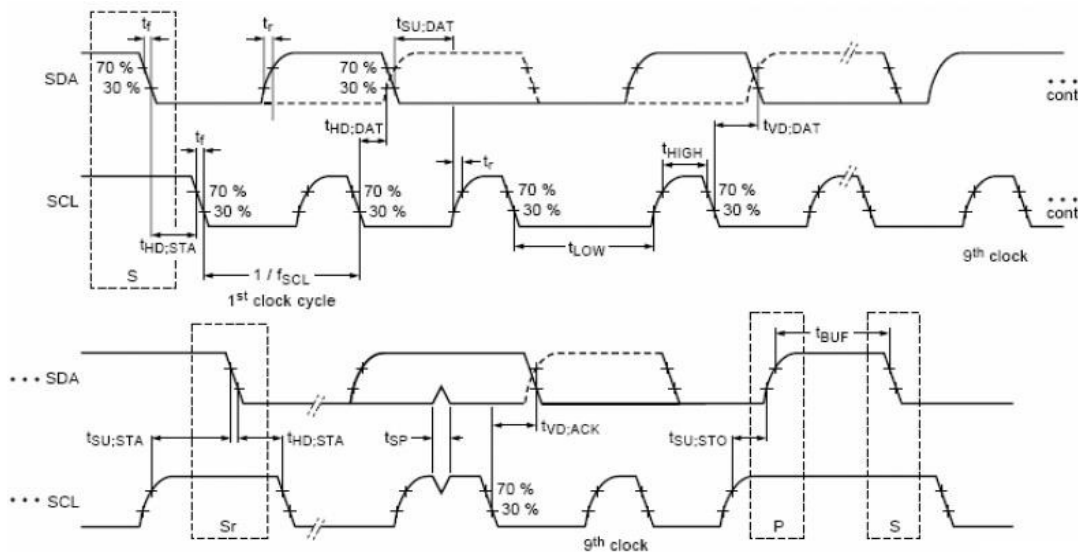
3.1 Interface Diagram



3.2 I2C Communication

3.2.1 Timing Characteristic

Symbol	Description	Conditions	Min	Max	Units
F_{SCL2C}	SCL clock frequency		0	400	kHz
$T_{HDSTA12C}$	Hold time (repeated) Start condition. After this period, the first clock pulse is generated.		0.60	-	μ s
T_{LOWI2C}	LOW period of SCL clock		1.3	-	μ s
$T_{HIGHI2C}$	HIGH period of SCL clock		0.60	-	μ s
$T_{SUSTA12C}$	Setup time for repeated Start condition		0.60	-	μ s
$T_{HDDAT12C}$	Data hold time		0	-	μ s
$T_{SUDAT12C}$	Data setup time		100	-	ns
$T_{SUSTOI2C}$	Setup time for STOP condition		0.60	-	μ s
T_{BUFI2C}	Bus free time between a Stop and Start condition		1.3	-	μ s
T_{SPI2C}	Pulse width of spikes that are suppressed by input filter	I ² C Specification 3.0 maximum is 50 ns	0	50	ns
C_{BUS}	Capacitance load for SDA or SCL		-	200 ^[25]	pF



Legend

- S I²C Start Condition
- Sr I²C Repeat Start Condition
- P I²C Stop Condition



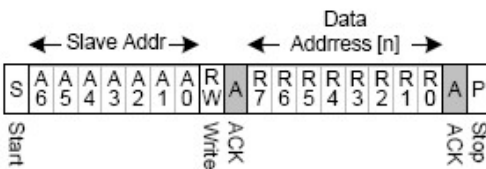
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3.2.2 I2C Protocol

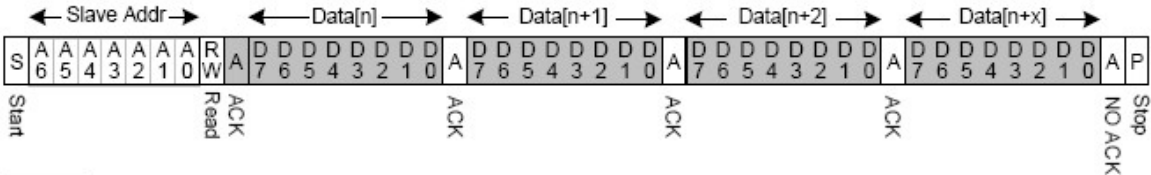
Write x Bytes to I2C Slave



Set Slave Data Pointer



Read x Bytes from I2C Slave



Master
Slave

Write and Read x Bytes to I2C Slave



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4. Pin Assignments

Pin No.	Symbol	I/O	Function
1	Reset	I	TP reset pin, Low active
2	INT	O	I2C interrupt pin
3	SDA	I/O	I2C data pin
4	SCL	I	I2C clock pin
5	GND	P	GND
6	VDD	P	Power Supply, 2.8V~3.3V