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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-1024600KTMQW-T00H
APPROVED BY	
DATE	

- Approved For Specifications**
 Approved For Specifications & Sample

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RECORD OF REVISION

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1. Features

7 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 7" TFT-LCD panel, LED backlight, LED driver unit , touch panel and power circuit unit.

- (1) Construction: 7" a-Si TFT active matrix, White LED Backlight and power & LED driver, touch panel.
- (2) Resolution (pixel): 1024(R.G.B) X600
- (3) Number of the Colors : 16M colors (R , G , B 6 bit digital each)
- (4) LCD type : Transmissive , normally White
- (5) Interface: LVDS interface 6bit (default), 8bit by jumper setting.
- (6) Power Supply Voltage: 3.3V for logic voltage, 12V for LED driver power voltage.
- (7) With touch panel

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
LCD size	7 inch (Diagonal)	
Resolution	1024 x 3(RGB) x 600	dot
Dot pitch	0.05(W) x 0.15(H)	mm
Active area	153.6(W) x 90.0(H)	mm
Module size	165. 5(W) x 104.44(H) x 10.52(D)	mm
Surface treatment	Anti Glare	
Color arrangement	RGB-stripe	
interface	LVDS	
Brightness	400	cd/m ²
Weight	TBD	g

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3. ABSOLUTE MAX. RATINGS

Item	Symbol	Values		UNIT	Note
		Min.	Max.		
Power voltage	VCC	-0.3	4.2	V	
	VLED	-0.3	14		
Operation temperature	TOP	-20	70	°C	
Storage temperature	TST	-30	80	°C	

4. ELECTRICAL CHARACTERISTICS

4-1 Typical Operation Conditions

Item	Symbol	Values			Unit	Remark	
		MIN	TYP	MAX			
Power Voltage	V _{CC}	3.0	3.3	3.6	V	Note 1,2	
Power Consumption	I _{CC}	--	150	--	mA	Note 1,2 V _{CC} =3.3V	
Logic Input Voltage	Input Voltage	V _{IN}	0	-	V _{CC}	V	
	Logic input high voltage	V _{TH}	0.7V _{CC}	-	V _{CC}	V	Note 3
	Logic input low voltage	V _{TL}	GND	-	0.3V _{CC}	V	Note 3

Note 1: Value for Power Board combined panel.

Note 2: VCC setting should match the signals output voltage (refer to Note 3) of customer's system board.

Note 3: LVDS.

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4-2 LED Driving Conditions

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LED Driver Power Voltage	V_{LED}	5	--	12	V	
LED Driver Current Consumption	I_{LED}	--	800	--	mA	$V_{LED}=5V$ $ADJ=3.3V$ (duty 100%)
		--	350	--	mA	$V_{LED}=12V$ $ADJ=3.3V$ (duty 100%)
ADJ Input Voltage	V_{ADJ}	3.3	--	5	V	duty=100% Note(3)
LED voltage	V_{AK}	15.5	16.5	17.5	V	Note(1)
LED forward Current	I_{AK}	--	180	--	mA	$T_a=25^{\circ}C$
LED life time	--	--	30,000	--	Hr	Note(2)

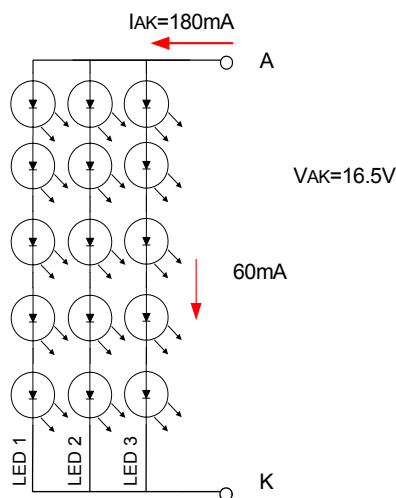
Note (1) The constant current source is needed for white LED back-light driving.

When LCM is operated over 60 deg.C ambient temperature, the I_{LED} of the LED back-light should be adjusted .

Note (2) Brightness to be decreased to 50% of the initial value.

Note (3) V_{LEDADJ} is PWM signal input. It is for brightness control.

There are 3 Groups LED shown as below , $V_{AK} = 16.5V$, $I_{AK} = 180mA$.



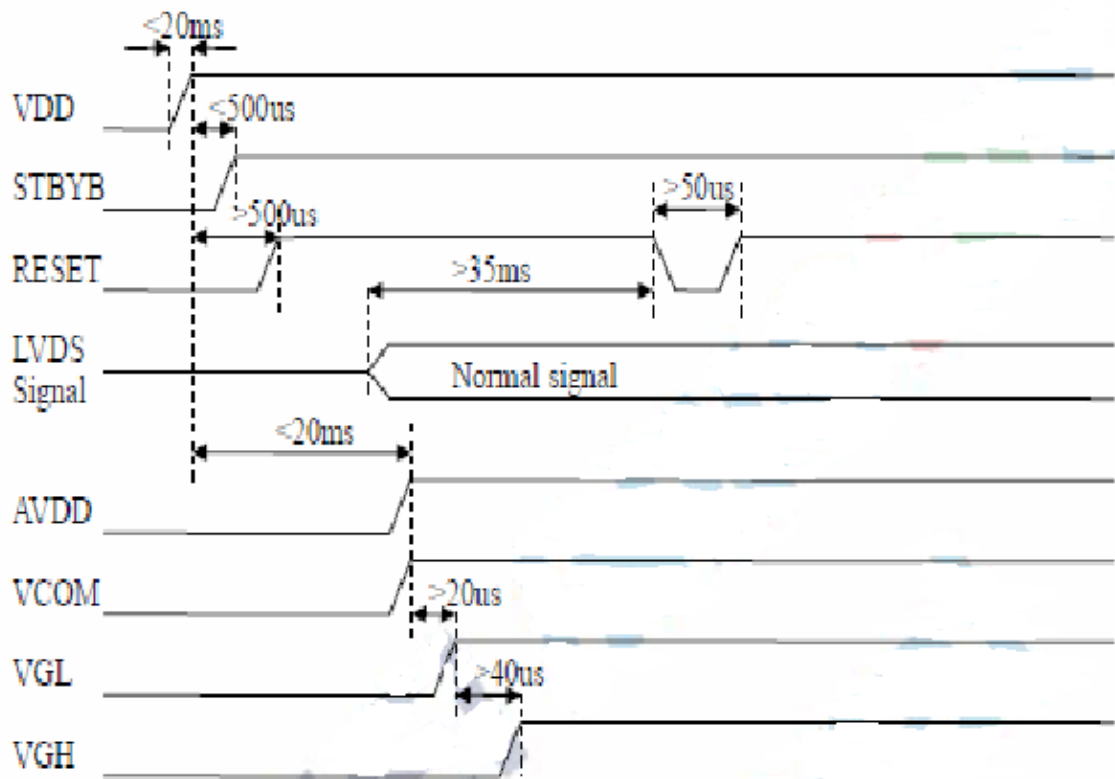
4-3 Brightness to be decreased to 50% of the initial value.

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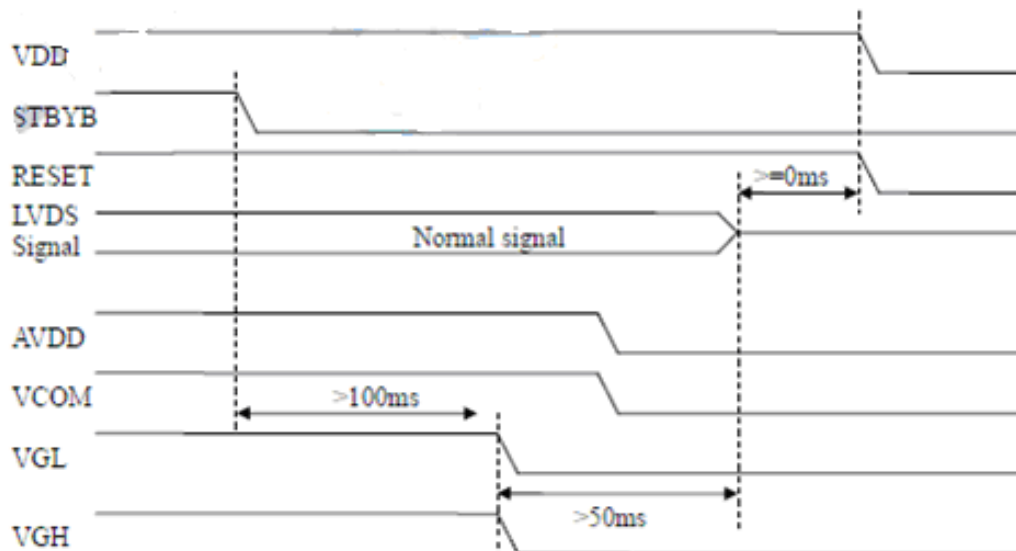
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Power Sequence

a. Power on:



b. Power off:



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5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Note
			Min.	Typ.	Max.		
Viewing angle (CR \geq 10)	θ L	$\Phi = 180^\circ$ (9 o'clock)	65	75	--	degree	Note1
	θ R	$\Phi = 0^\circ$ (3 o'clock)	65	75	--		
	θ T	$\Phi = 90^\circ$ (12 o'clock)	65	70	--		
	θ B	$\Phi = 270^\circ$ (6 o'clock)	65	75	--		
Response time	TON	Normal $\theta = \Phi = 0^\circ$	--	10	20	msec	Note3
	TOFF		--	15	30	msec	
Contrast ratio	CR		500	700	--	--	Note4
Color chromaticity	WX		0.249	0.299	0.349	--	Note5
	WY		0.273	0.323	0.373	--	Note6
Luminance	L		320	400	--	cd/m ²	Note6

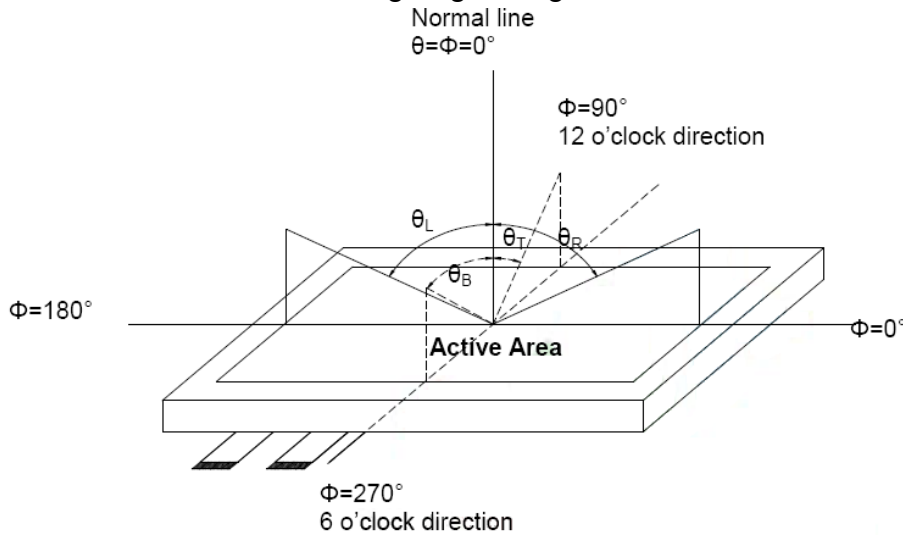
Test Conditions:

1. VCC = 3.3V, IL = 240mA (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 2.

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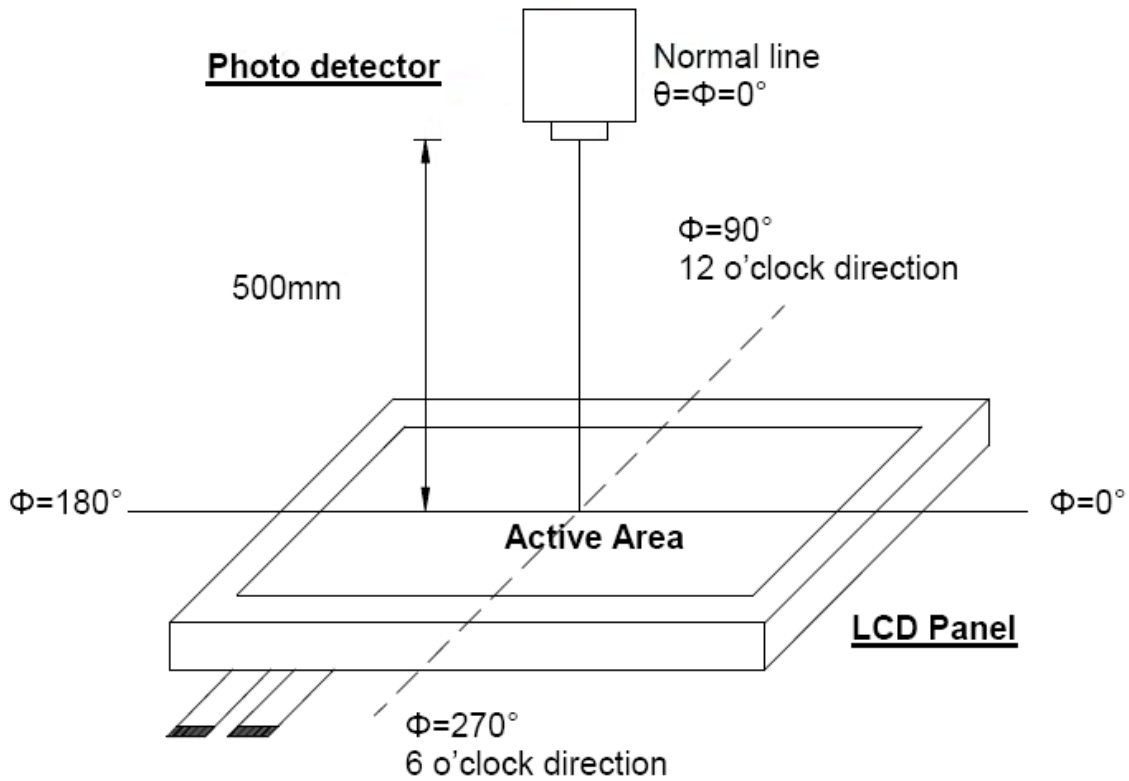
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Note 1 : Definition of viewing angle range



Note 2 : 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.)

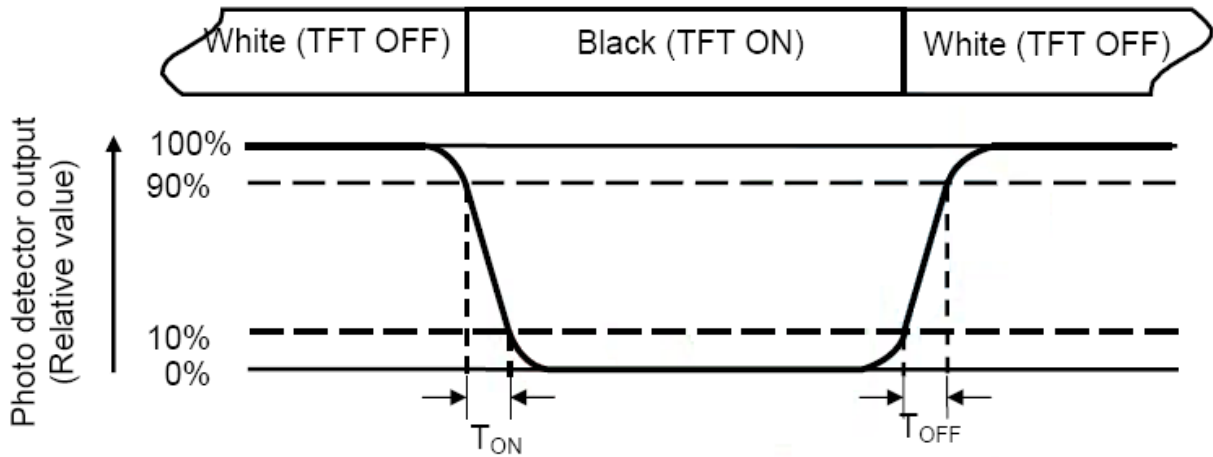


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Note 3 : Definition of Response time

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.

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6. INTERFACE

Pin No.	Symbol	I/O	Description	Note
1	VDD	P	Power Voltage for Logic: 3.3V	
2	VDD	P	Power Voltage for Logic: 3.3V	
3	U/D	I	Vertical Reverse Scan Control	
4	L/R	I	Horizontal Reverse Scan Control.	
5	IN0-	I	- LVDS differential data input	
6	IN0+	I	+ LVDS differential data input	
7	GND	P	Ground	
8	IN1-	I	- LVDS differential data input	
9	IN1+	I	+ LVDS differential data input	
10	GND	P	Ground	
11	IN2-	I	- LVDS differential data input	
12	IN2+	I	+ LVDS differential data input	
13	GND	P	Ground	
14	CLK-	I	- LVDS differential data input	
15	CLK+	I	+ LVDS differential data input	
16	GND	P	Ground	
17	IN3-	I	- LVDS differential data input	
18	IN3+	I	+ LVDS differential data input	
19	VLED	P	Power supply for backlight: 12V	
20	LEDADJ	I	LED PWM signal	

NOTE : Pin20: ADJ is PWM signal input. It is for brightness control.

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
ADJ signal frequency	f _{PWM}	10	--	100	KHz
ADJ signal logic level High	V _{IH}	3V	--	VLED (12V)	V
ADJ signal logic level Low	V _{IL}	0	--	0.4	V

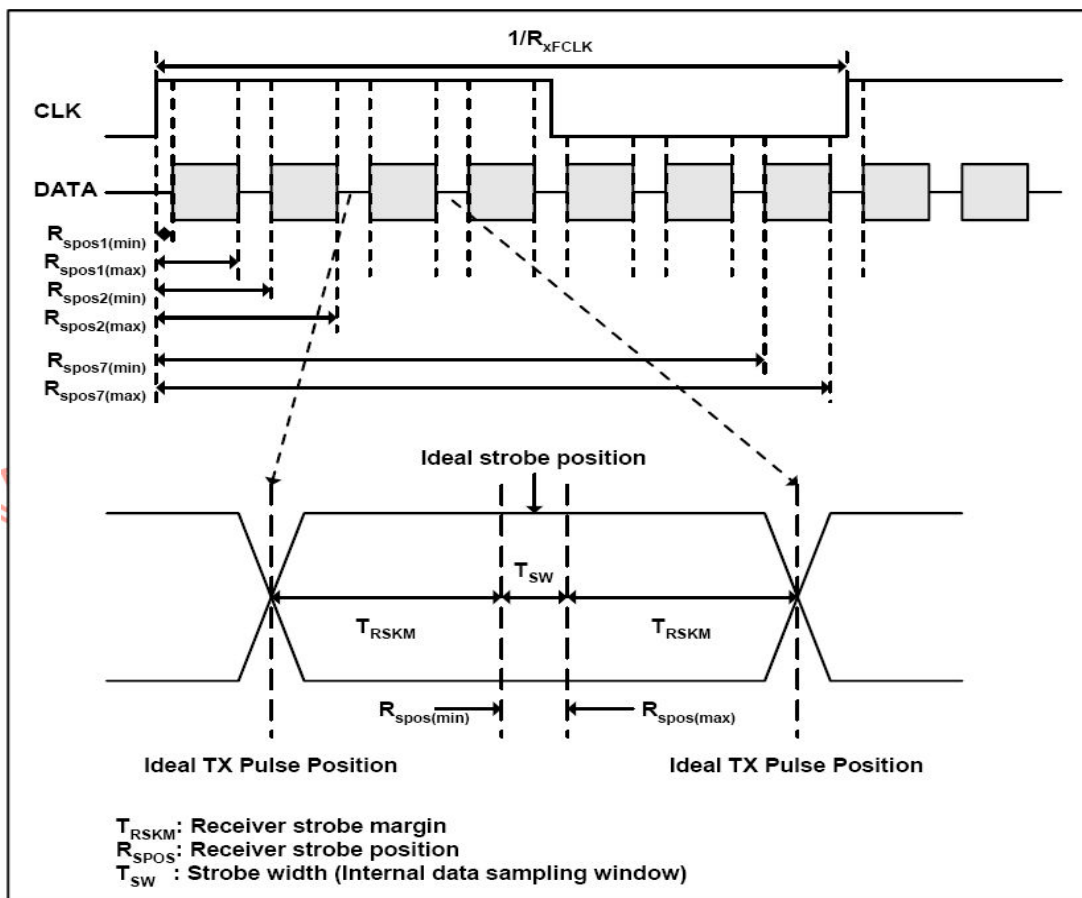
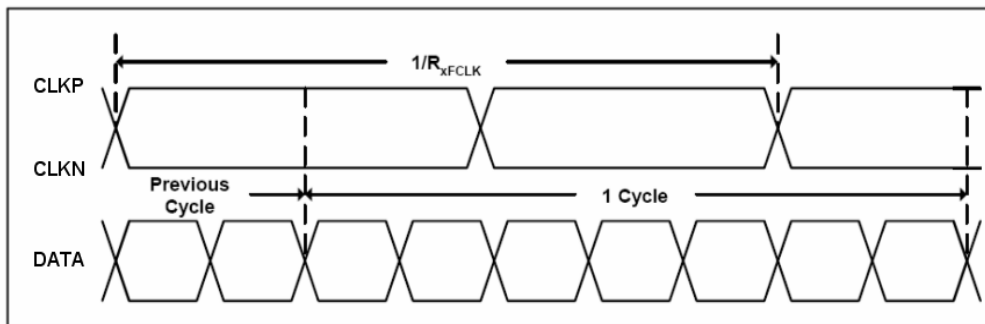
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7. TIMING CHARACTERISTICS

7-1 AC Electrical Characteristics

Parameter	Symbol	Values			Unit	Remark
		MIN	TYP	MAX		
Clock frequency	R_{xFCLK}	40.8	51.2	71		
Input data skew margin	T_{RSKM}	500	--	--		
Clock high time	T_{LVCH}	--	$4/(7 * R_{xFCLK})$	--		
Clock low time	T_{LVCL}	--	$3/(7 * R_{xFCLK})$	--		

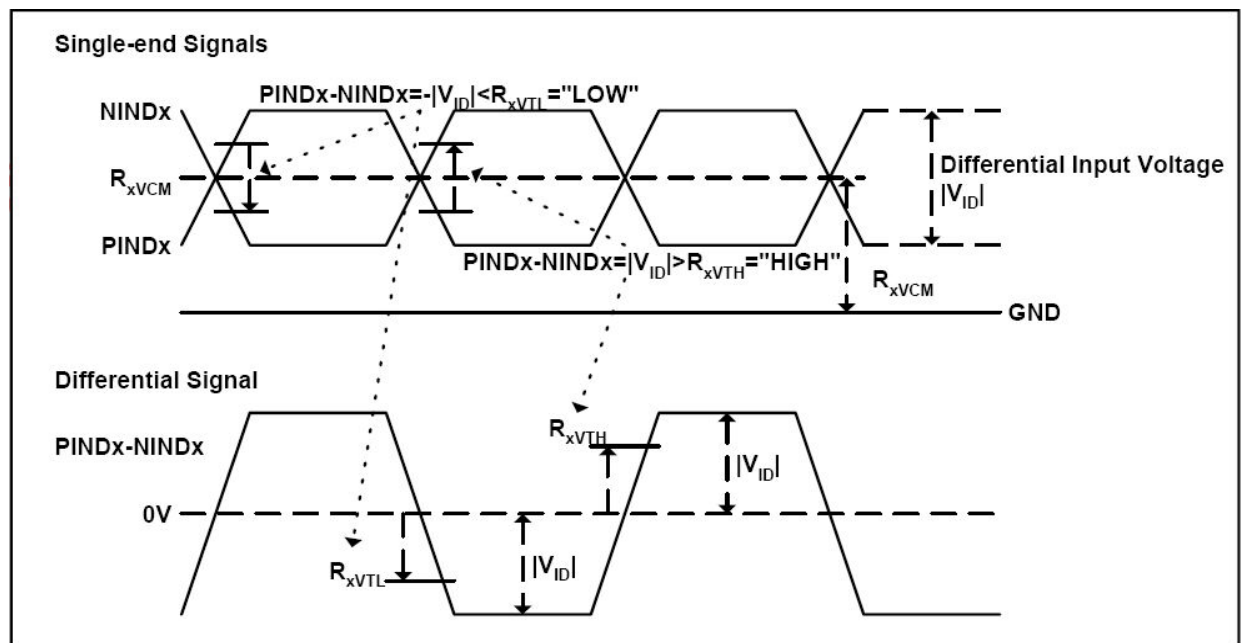


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7-2 DC Electrical Characteristics

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Differential input high Threshold voltage	R_{xVTH}	-	-	+0.1	V	$R_{xVCM}=1.2V$
Differential input low Threshold voltage	R_{xVTH}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{xVIN}	0	-	2.4	V	
Differential input common mode voltage	R_{xVCM}	$ V_{ID} /2$	-	$2.4- V_{ID} /2$	V	
Differential voltage	$ V_{ID} $	0.2	-	0.6	V	
Differential input leakage current	RV_{xliz}	-10	-	+10	μA	



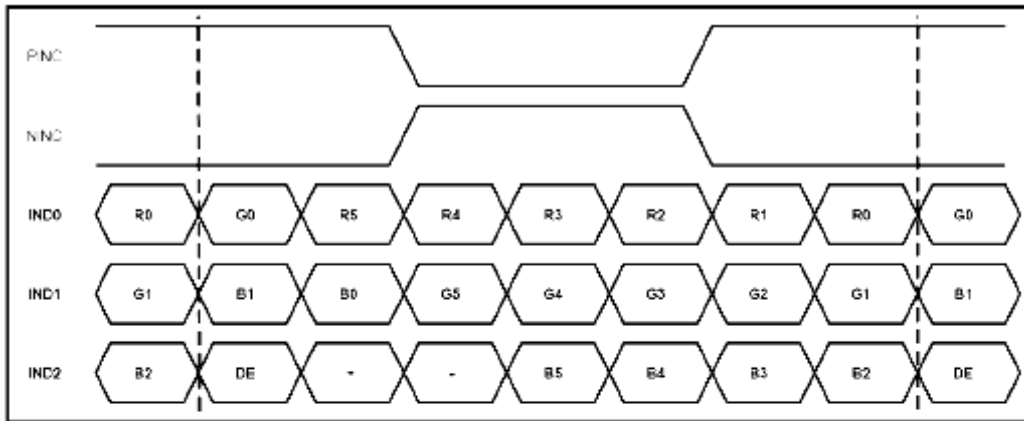
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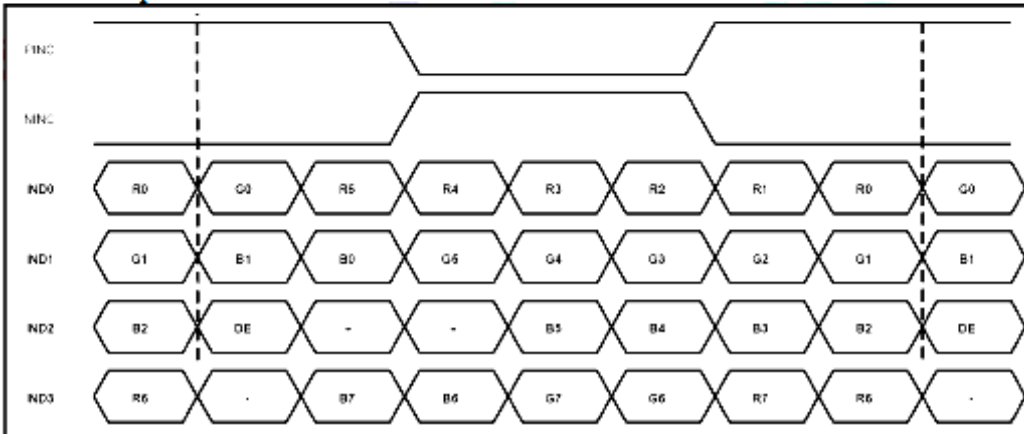
7-3 Timing

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Clock Frequency	fclk	40.8	51.2	67.2	MHz	Frame rate =60Hz
Horizontal display area	thd	1024			DCLK	
HS period time	th	1114	1344	1400	DCLK	
HS Blanking	thb	90	320	376	DCLK	
Vertical display area	tvd	600			H	
VS period time	tv	610	635	800	H	
VS Blanking	thb	10	35	200	H	

6bit LVDS input



8bit LVDS input



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8. TOUCH PANEL ELECTRICAL SPECIFICATION

Parameter	Condition	Standard Value
Terminal Resistance	X Axis	200~ 900 Ω
	Y Axis	160 ~ 640 Ω
Insulating Resistance	DC 25 V	More than 20M Ω
Linearity	--	$\leq 1.5 \%$
Notes life by Pen	Note a	100,000 times(min)
Input life by finger	Note b	1,000,000 times (min)

Note A .

Notes area for pen notes life test is 10 x 9 mm.

Size of word is 7.5 x 6.75

Shape of pen end : R0.8mm

Load : 250 g

Note B

By Silicon rubber tapping at same point

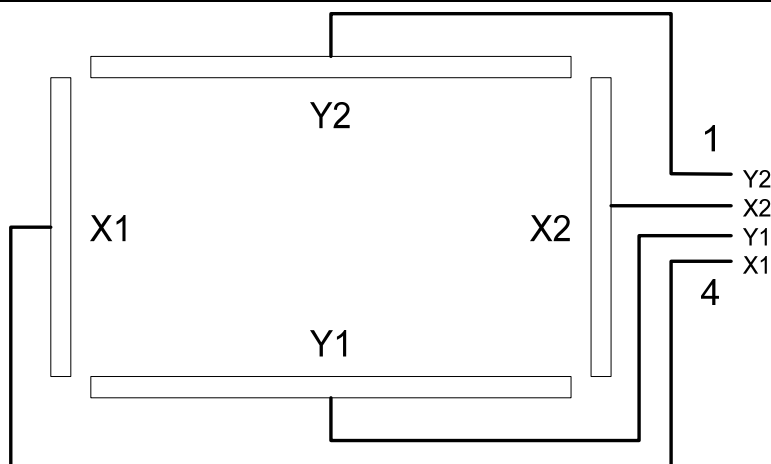
Shape of rubber end : R8mm

Load : 250gf

Frequency : 5 Hz

Interface

No.	Symbol	Function
1	Y2	Touch Panel Top Signal in Y Axis
2	X2	Touch Panel Right Signal in X Axis
3	Y1	Touch Panel Bottom Signal in Y Axis
4	X1	Touch Panel Left Signal in X Axis



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9. QUALITY AND RELIABILITY

9.1. Scope

Specifications contain

1.1 Display Quality Evaluation

1.2 Mechanics Specification

9.2. Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E LEVEL II.

9.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

9.2.2 Sampling type: Normal inspection, single sampling.

9.2.3 Sampling level: Level II.

9.2.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.0

9.3. Panel Inspection Condition

9.3.1 Environment:

Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

9.3.2 Inspection Distance:

35-40 cm

9.3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

9.3.4 Inspection time :

Perceptibility Test Time: 20 seconds max.

9.4. Display Quality

9.4.1 Function Related:

The function defects of line defect, abnormal display, and no display are considered Major defects.

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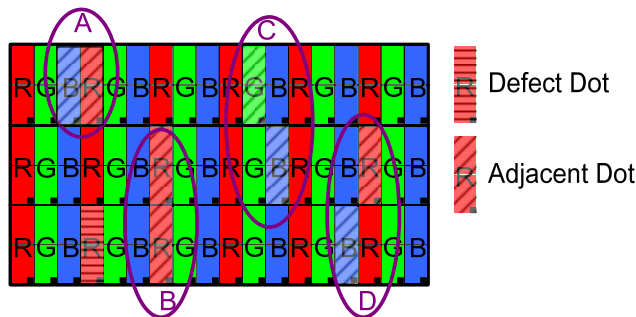
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9.4.2 Bright/Dark Dots:

Defect Type / Specification	G0 Grade	A Grade
Bright Dots	0	$N \leq 2$
Dark Dots	0	$N \leq 3$
Total Bright and Dark Dots	0	$N \leq 4$

[Note 1]

Judge defect dot and adjacent dot as following.



- (1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)
- (2) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
- (3) Allow above (as A, B, C and D status) adjacent defect dots, including bright and dark adjacent dot. And they will be counted 2 defect dots in total quantity.
- (4) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.
- (5) There should be no distinct non-uniformity visible through 6% ND Filter within 2 sec inspection times.

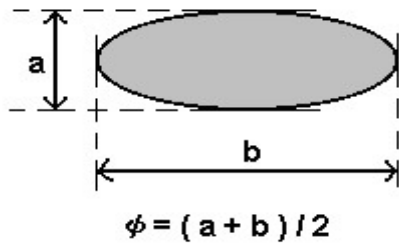
9.4.3 Visual Inspection specifications:

Defect Type	Specification	Count(N)
Dot Shape (Particle, Scratch and Bubbles in display area)	$D \leq 0.2\text{mm}$	Ignored
	$0.2\text{mm} < D \leq 0.4\text{mm}$	$N \leq 3$
	$D > 0.4\text{mm}$	$N=0$
Line Shape (Particles, Scratch, Lint and Bubbles in display area)	$W \leq 0.05\text{mm}$	Ignored
	$0.05\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$	$N \leq 3$
	$W > 0.1\text{mm}$, $L > 4\text{mm}$	$N=0$

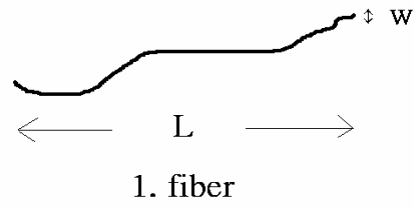
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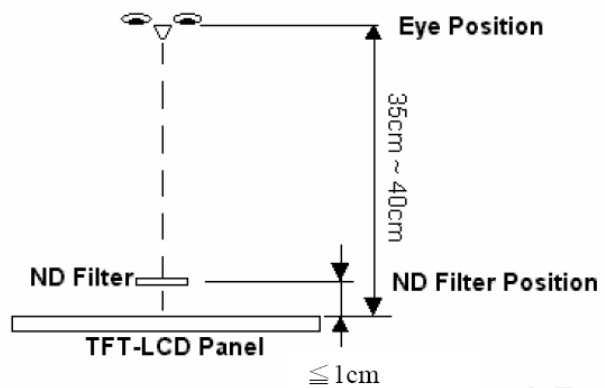
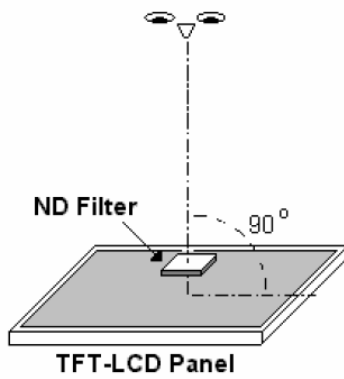
[Note 2] W : Width[mm], L : Length[mm], N : Number, ϕ : Average Diameter



- 1. (White, black) Spot
- 2. Polarizer Bubble



[Note 3] Bright dot is defined through 6% transmission ND Filter as following.



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9.5 RELIABILITY TEST CONDITIONS

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C ,Dry t=240 hrs	
Low Temperature Operation	-20±3°C, Dry t=240 hrs	
High Temperature Storage	80±3°C , Dry t=240 hrs	1,2
Low Temperature Storage	-30±3°C ,Dry t=240 hrs	1,2
Thermal Shock Test	-20°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 100 cycle(Dry)	1,2
Humidity Test	60 °C, Humidity 90%, 240 hrs	1,2

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

Note 2 : The module should be inspected after 1 hour storage in normal conditions

(15-35°C , 45-65%RH).

Definitions of life end point :

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

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10. USE PRECAUTIONS

10-1 Handling precautions

(1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.

(2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.

(3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.

(1) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

10-2 Installing precautions

(1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.

(2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.

(3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.

(4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off

10-3 Storage precautions

(1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.

(2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.

(3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

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10-4 Operating precautions

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

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

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

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

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

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

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

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

10-5 Other

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

(2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

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

