



**SPECIFICATION  
FOR  
LCD MODULE**

**Customer :** \_\_\_\_\_  
**Product Model:** YH035MQ5401  
**Sample code:** \_\_\_\_\_

Designed by	Checked by	Approved by

**Final Approval by Customer**

<input type="checkbox"/> LCM Machinery OK Checked By _____	<input type="checkbox"/> LCM Display OK Checked By _____
<input type="checkbox"/> LCM OK Approved By _____	<input type="checkbox"/> NG , Problem survey: Approved By _____

※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.



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# 1. General Specifications

Note 1 : Refer to Mechanical Drawing.

No.	Item	Specification	Remark
1	LCD size	3.5 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	320 × 3(RGB) × 240	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	219(W) × 219(H) um	
6	Active area	70.08(W) × 52.56 (H) mm	
7	Module size	76.9(W) × 64 (H) × 3.26(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight power consumption	TBD	
12	Panel power consumption	TBD	
13	Weight	TBD	

## 2. Pin Assignment

1	GLEP	GND for LED
2	GLEP	GND for LED
3	VLED	Power for LED
4	VLED	Power for LED
5	NC	No connect
6	NC	No connect
7	NC	No connect
8	RESET	Reset
9	CS	Serial data enable
10	SCK	Serial clk
11	SDI	Serial data
12	B0	Blue data(LSB)
13	B1	Blue data
14	B2	Blue data
15	B3	Blue data
16	B4	Blue data
17	B5	Blue data
18	B6	Blue data
19	B7	Blue data(MSB)
20	G0	Green data(LSB)
21	G1	Green data
22	G2	Green data
23	G3	Green data
24	G4	Green data
25	G5	Green data
26	G6	Green data
27	G7	Green data(MSB)
28	R0	Red data(LSB)
29	R1	Red data
30	R2	Red data

31	R3	Red data
32	R4	Red data
33	R5	Red data
34	R6	Red data
35	R7	Red data(MSB)
36	HS	Horizontal synchronous signal
37	VS	Vertical synchronous signal
38	CLK	Data clk
39	NC	No connect
40	NC	No connect
41	VDD	Digital power supply(+3.3V)
42	VDD	Digital power supply(+3.3V)
43	NC	No connect
44	NC	No connect
45	NC	No connect
46	NC	No connect
47	NC	No connect
48	SEL2	No connect
49	SEL1	No connect
50	SEL0	No connect
51	NC	No connect
52	DE	Data enabling signal
53	GND	Ground
54	GND	Ground

SEL 2-0: Define the input interface mode.

SEL2	SEL1	SEL0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (only support stripe type color filter)	6.5MHz
0	0	1	Serial-RGB data format	19.5MHz
0	1	0	CCIR 656 data format (640RGB)	24.54MHz
0	1	1	CCIR 656 data format (720RGB)	27MHz
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)	24.54MHz
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)	27MHz
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)	24.54MHz
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)	27MHz

# Operation Specifications

## 2.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Supply voltage	$V_{DD}$	-0.3	5.0	V	
Operation Temperature	$T_{OP}$	-20	60	°C	
Storage Temperature	$T_{ST}$	-30	70	°C	
LED Reverse Voltage	VR	-	5	V	Each LED Note 2
LED Forward Current	IF	-	25	mA	Each LED

Note 1 : The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 2 : VR Conditions: Zener Diode 20mA

### 2.1.1. Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max.		
Power voltage	$V_{DD}$	3.0	3.3	3.6	V	Note 2
Current for Driver	$I_{VDD}$	-	17	25	mA	
Input logic high voltage	$V_{IH}$	0.8 $V_{DD}$	-	$V_{DD}$	V	Note 3
Input logic low voltage	$V_{IL}$	0	-	0.2 $V_{DD}$	V	

### 2.1.2. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	$V_L$	--	19.2	21	V	Note 1
Current for LED backlight	$I_L$	--	20	25	mA	
LED life time		-	20,000	-	Hr	Note 2

Note 1 : The LED Supply Voltage is defined by the number of LED at  $T_a=25^\circ\text{C}$  and  $I_L=20\text{mA}$ .

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at  $T_a=25^\circ\text{C}$  and  $I_L=20\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 20mA.





## 2.3.2. Serial Transmission mode

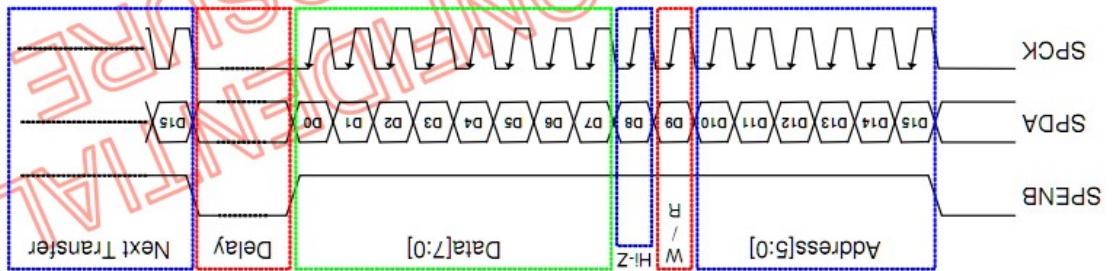
3-wire serial communication AC timing						
Serial clock	Tspck	320	-	-	ns	
SPCK pulse duty		40	50	60	%	Tckh / Tspck
Serial data setup time	Ttsu	120	-	-	ns	
Serial data hold time	Tthd	120	-	-	ns	
Serial clock high/low	Tckh/l	120	-	-	ns	
Chip select distinguish	Tcd	1	-	-	us	
SPENB to VSD	Tcv	1	-	-	us	
SPENB input setup time	TecK	150	-	-	ns	
SPENB input hold time	Tcke	150	-	-	ns	

### 3-Wire Serial Port Interface (Default Register Map)

#### 3-Wire Command Format

NT39016 uses the 3-wire serial port as communication interface for all the function and parameter setting. 3-Wire communication can be bi-directional controlled by the "R/W" bit in address field. NT39016 3-Wire engine act as a "slave mode" for all the time, and will not issue any command to the 3-Wire bus itself. Under read mode, 3-Wire engine will return the data during "Data phase". The returned data should be latched at the rising edge of SPCK by external controller. Data in the "Hi-Z phase" will be ignored by 3-Wire engine during write operation, and should be ignored during read operation also. During read operation, external controller should float SPDA pin under "Hi-Z phase" and "Data phase".

Refer to the section of "3-Wire Timing Diagram" for the detail timing, please.



Bit	Description
D15-D10	Register Address [5:0].
D9	W/R control bit. "1" for Write; "0" for Read
D8	Hi-Z bit during read mode. Any data within this bits will be ignored during write mode
D7-D0	Data for the W/R operation to the address indicated by Address phase

#### 3-Wire Command Format:

MSB	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	LSB
							1	X									
Register Address [5:0]																	
DATA (issue by external controller)																	

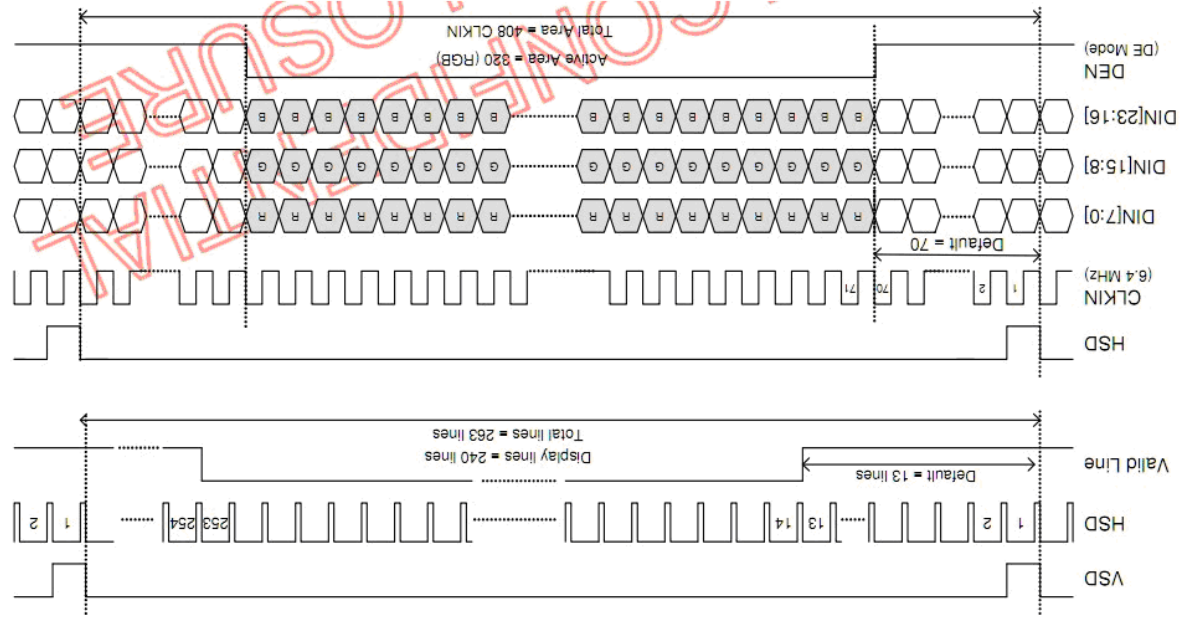
#### 3-Wire Writer Format:

MSB	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	LSB
							0										
Register Address [5:0]																	
DATA (issue by NT39016)																	

#### 3-Wire Read Format:



### 2.3.4. Data Input Format



Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	F <sub>clk</sub>	6.1	6.4	8.0	MHz	VDD = 3.0 ~ 3.6V
CLKIN cycle time	T <sub>clk</sub>	125	156	164	ns	
CLKIN pulse duty	T <sub>cwh</sub>	40	50	60	%	T <sub>clk</sub>
Time that HSD to 1 <sup>st</sup> data input(NTSC)	T <sub>hs</sub>	40	70	255	CLKIN	DLY = 70, Offset = 0 (fixed)

### 3. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	$\theta_L$	$\Phi=180^\circ$ (9 o'clock)	-	75	-	degree	Note 1
	$\theta_R$	$\Phi=0^\circ$ (3 o'clock)	-	75	-		
	$\theta_T$	$\Phi=90^\circ$ (12 o'clock)	-	70	-		
	$\theta_B$	$\Phi=270^\circ$ (6 o'clock)	-	75	-		
Response time	$T_{ON}$		-	10	20	msec	Note 3
	$T_{OFF}$		-	10	20	msec	Note 3
Contrast ratio	CR		500	700	-	-	Note 4
Color chromaticity	$W_x$	Normal $\theta=\Phi=0^\circ$	0.26	0.31	0.36	-	Note 2
	$W_y$		0.28	0.33	0.38	-	Note 5
Luminance	L	-		250	-	cd/m <sup>2</sup>	Note 6
Luminance uniformity	$Y_u$		70	75	-	%	Note 7

Test Conditions:

1.  $V_{DD}=3.3V$ ,  $I_L=20mA$  (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

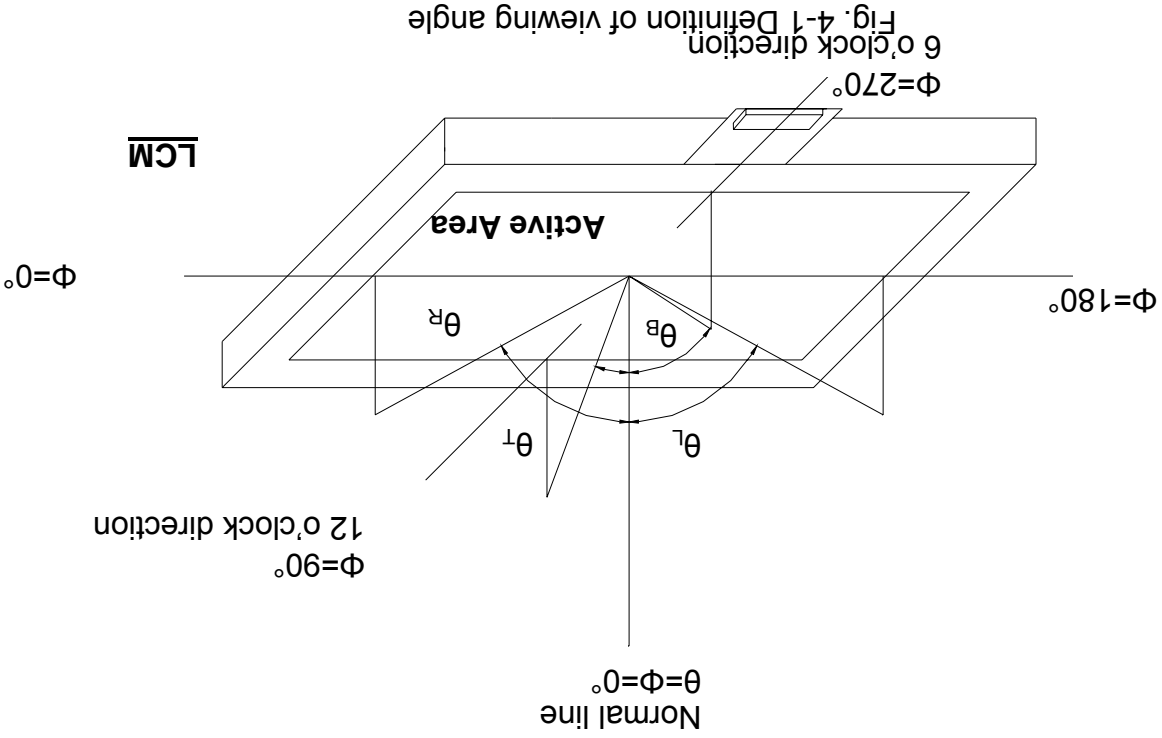


Fig. 4-1 Definition of viewing angle

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:  $1^\circ$  /Height: 500mm.)

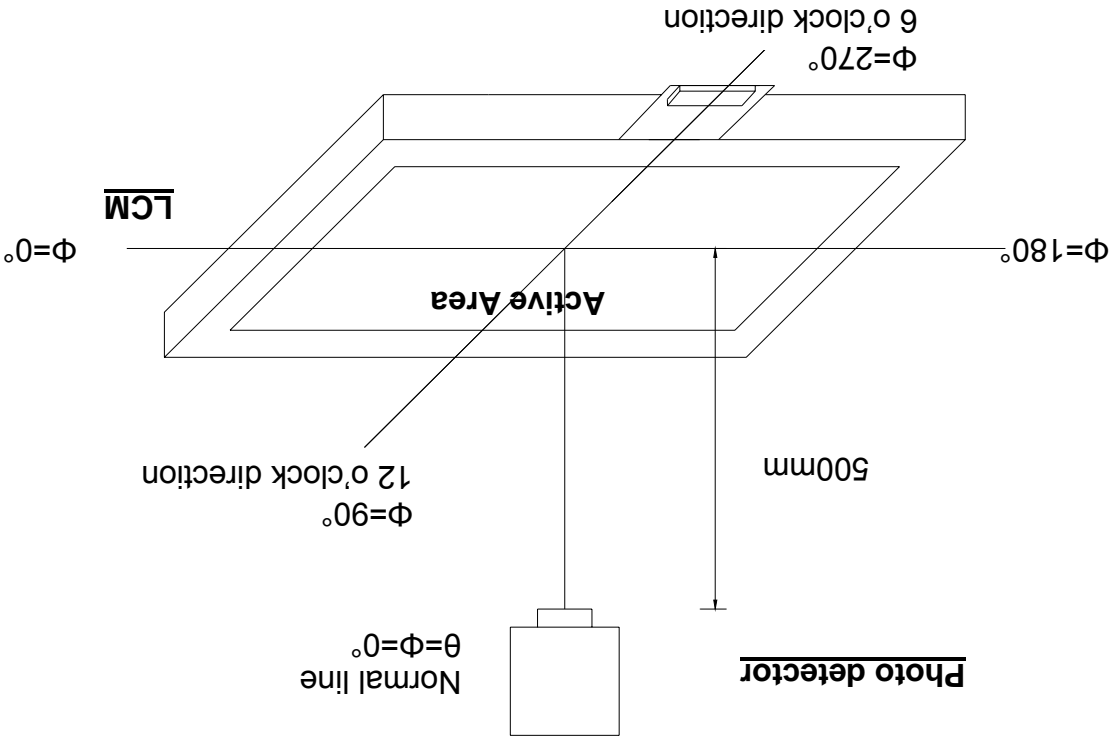


Fig. 4-2 Optical measurement system setup

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%.

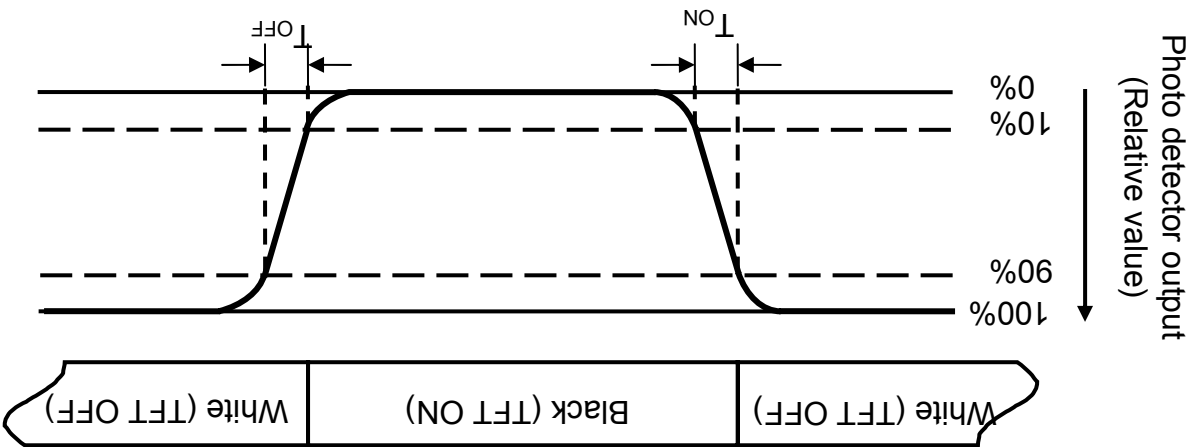


Fig. 4-3 Definition of response time

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 coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is  $I_L=120\text{mA}$ .

Note 7: Definition of Luminance Uniformity  
 Active area is divided into 9 measuring areas (Refer to Fig. 4-4 ).Every measuring point is placed at the center of each measuring area.

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

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

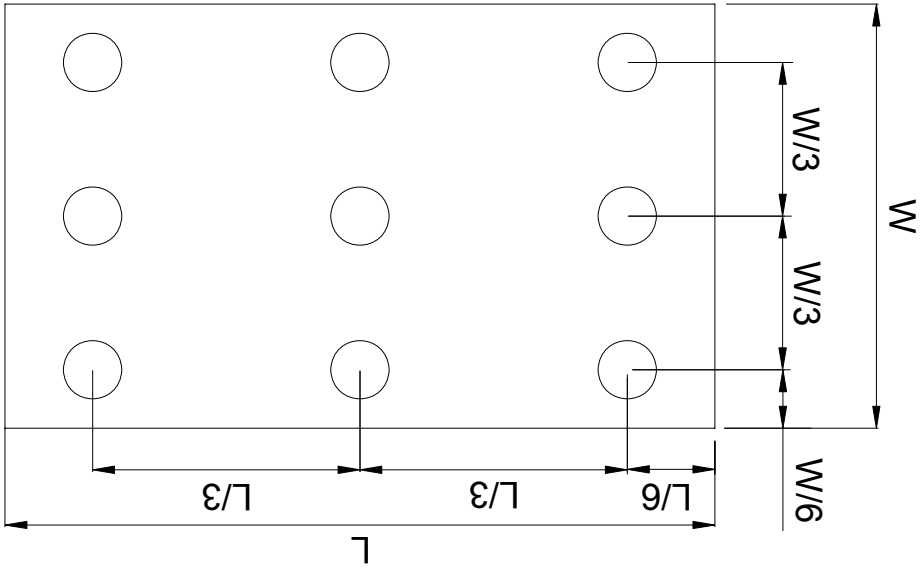


Fig. 4-4 Definition of measuring points

**B<sub>max</sub>**: The measured maximum luminance of all measurement position.  
**B<sub>min</sub>**: The measured minimum luminance of all measurement position.

## 4. Reliability Test Items

(Note3)

Item	Test Conditions	Remark
High Temperature Storage	Ta = 80°C	240hrs Note 1, Note 4
Low Temperature Storage	Ta = -30°C	240hrs Note 1, Note 4
High Temperature Operation	Ts = 70°C	240hrs Note 2, Note 4
Low Temperature Operation	Ta = -20°C	240hrs Note 1, Note 4
Operate at High Temperature and Humidity	+40°C, 90%RH	240hrs Note 4
Thermal Shock	-30°C/30 min ~ +70°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note 4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X, Y, Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X, Y, Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.



## 5. General Precautions

### 5.1. Safety

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

### 5.2. 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.

### 5.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

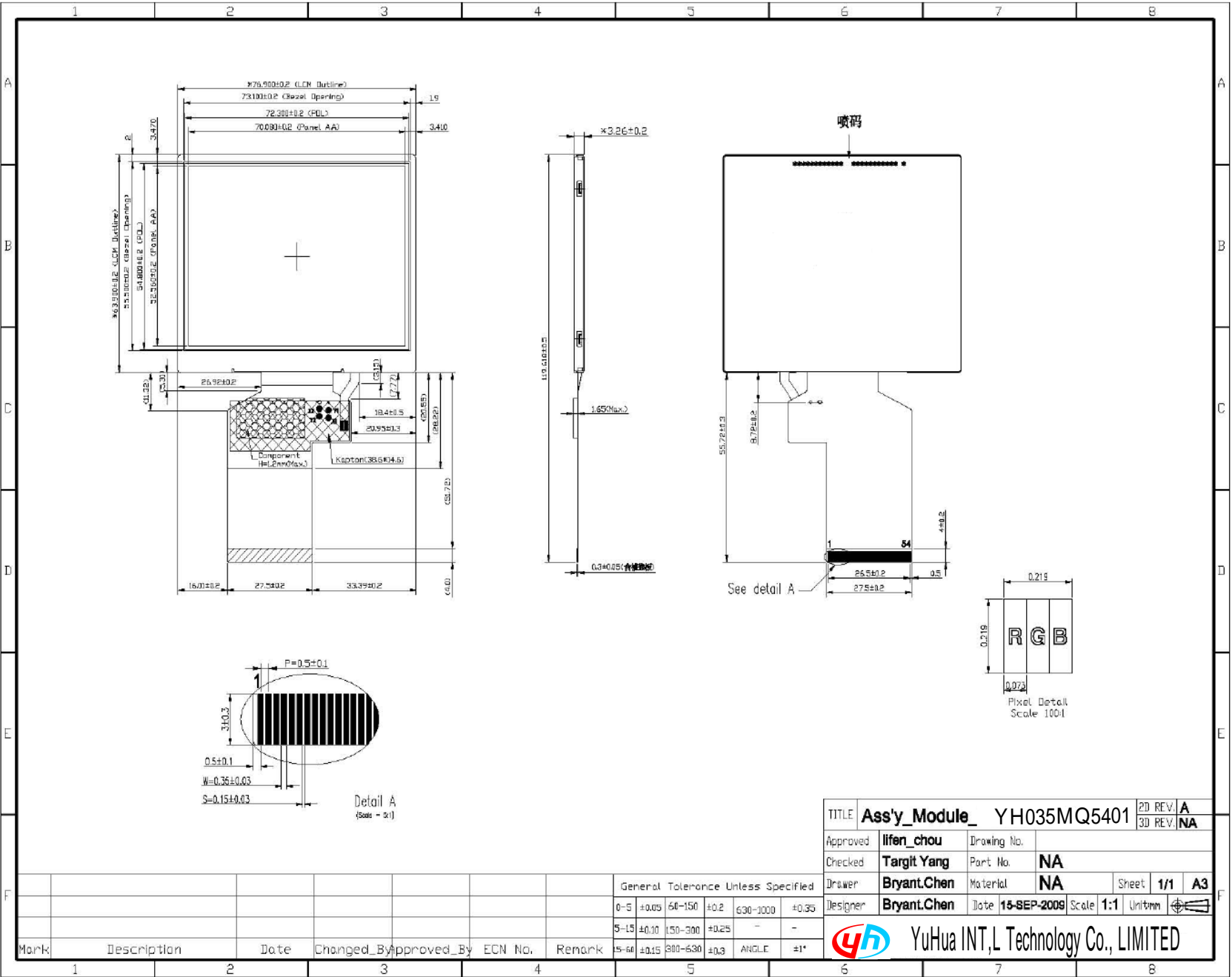
### 5.4. Storage

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.

### 5.5. 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.

# 6. Mechanical Drawing



TITLE	Ass'y Module_YH035MQ5401	2D REV	A
Approved	lifen_chou	Drawing No.	
Checked	Targit Yang	Part No.	NA
Drawer	Bryant.Chen	Material	NA
Designer	Bryant.Chen	Date	15-SEP-2009
		Scale	1:1
		Sheet	1/1
		Unit/mm	A3

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark
15-04						
5-15						
0-5						

**YuHua INT,L Technology Co., LIMITED**