Laurel Electronics Co., Ltd.

SPECIFICATION FOR TFT LCD MODULE

MODEL NO.: LT035A-02AT

3.5”, 320(RGB) x 240 PIXELS TFT LCM WITH TOUCH PANEL

자세한 내용은 (주)가나시이스,
TEL: 02-2681-5611로 주시기 바랍니다.

REVISION	PREPARED	CHECKED	APPROVED
0.1	Y.D.Y.	L.Y.J.	L.Y.

RECORD OF REVISION

Date	Revision	Page	Revision Items
2010-05-20	0.1	-	New release

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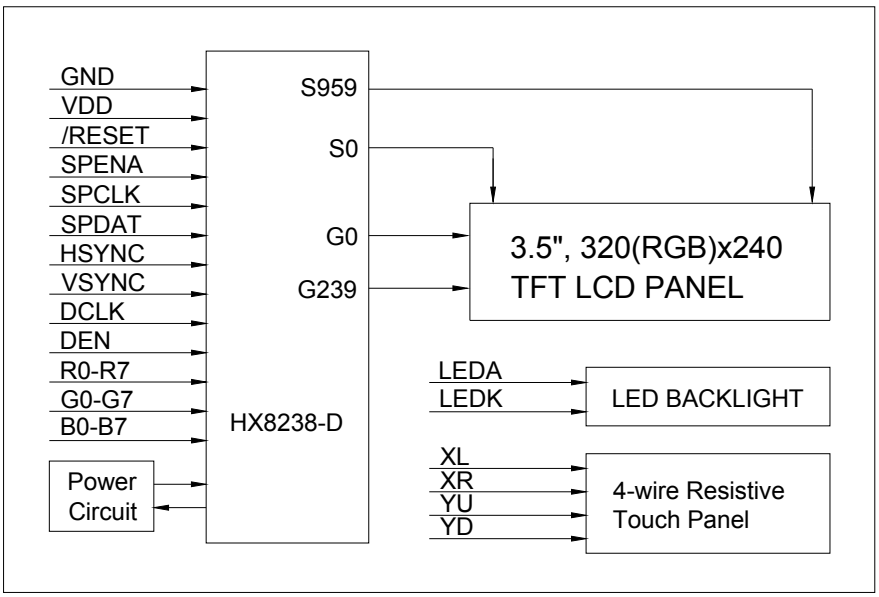
CONTENTS

1. General Description

Item	Specifications	Unit
LCD Type	TFT, Transmissive, Normally White	-
Number of Dots	320x3(RGB)×240	dot
Display Color	16.7M	-
Color Configuration	RGB-Stripe	-
Screen Size	3.5(Diagonal)	inch
Active Area (W×H)	70.08×52.56	mm
Dot Pitch (W×H)	0.073×0.219	mm
Outline Dimensions (W×H×T)	76.9×63.9×4.4	mm
Viewing Direction	6:00	O'clock
Controller	HX8238-D	-
VDD	3.3	V
Data Transfer	24 Bits RGB Parallel	-
Backlight	White LED	-
Touch Panel	4-wire Resistive	-
O		
S		
W		

2. Block Diagram



3. Interface Specification

PIN NO.	SYMBOL	DESCRIPTION
1	LEDK	Backlight cathode
2	LEDK	Backlight cathode
3	LEDA	Backlight anode
4	LEDA	Backlight anode
5	YU	Touch panel up side terminal
6	XR	Touch panel right side terminal
7	NC	No connection
8	/RESET	Reset
9	SPENA	SPI chip selection. Connect to VDD for 24-bit RGB mode
10	SPCLK	SPI serial clock input. Connect to VDD for 24-bit RGB mode
11	SPDAT	SPI serial data input. Connect to VDD for 24-bit RGB mode
12	B0	Blue data (LSB)
13	B1	Blue data
14	B2	Blue data
15	B3	Blue data
16	B4	Blue data
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	HSYNC	Horizontal synchronous signal
37	VSYNC	Vertical synchronous signal
38	DOTCLK	Data clock
39	NC	No connection

PIN NO.	SYMBOL	DESCRIPTION
40	NC	No connection
41	VDD	Power supply
42	VDD	Power supply
43	YD	Touch panel down side terminal
44	XL	Touch panel left side terminal
45	NC	No connection
46	NC	No connection
47	NC	No connection
48	NC	No connection
49	VDD	Power supply
50	VDD	Power supply
51	NC	No connection
52	DEN	Data enable signal
53	GND	Ground
54	GND	Ground

Note: For 24-bit RGB mode, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed now, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest users pu

4. Absolute Maximum Ratings (Note 1)

Item	Symbol	Min.	Max.	Unit	Remark
Supply Voltage (Logic)	VDD	-0.3	4.5	V	
Input Signal Voltage	VI	-0.3	VDD+0.3	V	
Supply Voltage (LED)	If	-	25	mA	
Operating Temperature	Top	-20	70	°C	Note 2, 3
Storage Temperature	Tstg	-30	80	°C	Note 2, 3

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

Note 2: 90% RH Max. (Max. wet-bulb temperature is 60°C)
Max. wet-bulb temperature is at 60°C or less. No condensation (no drops of dew).

Note 3: In case of temperature below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

5. Electrical Characteristics

5.1 TFT LCD

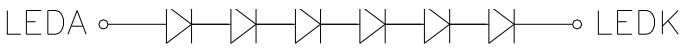
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Voltage	V_{DD}	3.0	3.3	3.6	V	-
Input Logic High Voltage	V_{IH}	0.7V_{DD}	-	V_{DD}	V	-
Input Logic Low Voltage	V_{IL}	0	-	0.3V_{DD}	V	-
Current for LCD	I_{DD}	-	9.0	15	mA	V_{DD}=3.3V

5.2 LED Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
LED Current	I_L	-	20.0	22.0	mA	
LED Voltage	V_L	17.4	18.6	19.8	V	Note 1
LED Life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED voltage is defined by the number of LED at Ta=25°C and I_L=20mA.

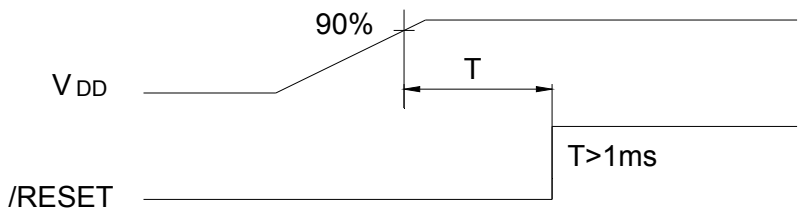
Note 2: The LED life time is defined as the module brightness decrease to 50% original brightness at 20



LED Backlight: 6 LED

5.3 Reset Timing

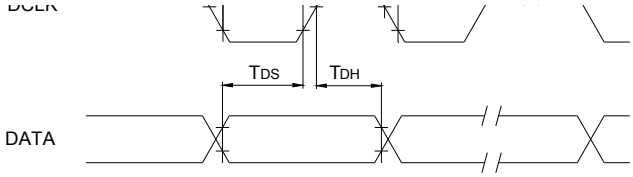
The reset input must be held at least 1ms after power is stable.

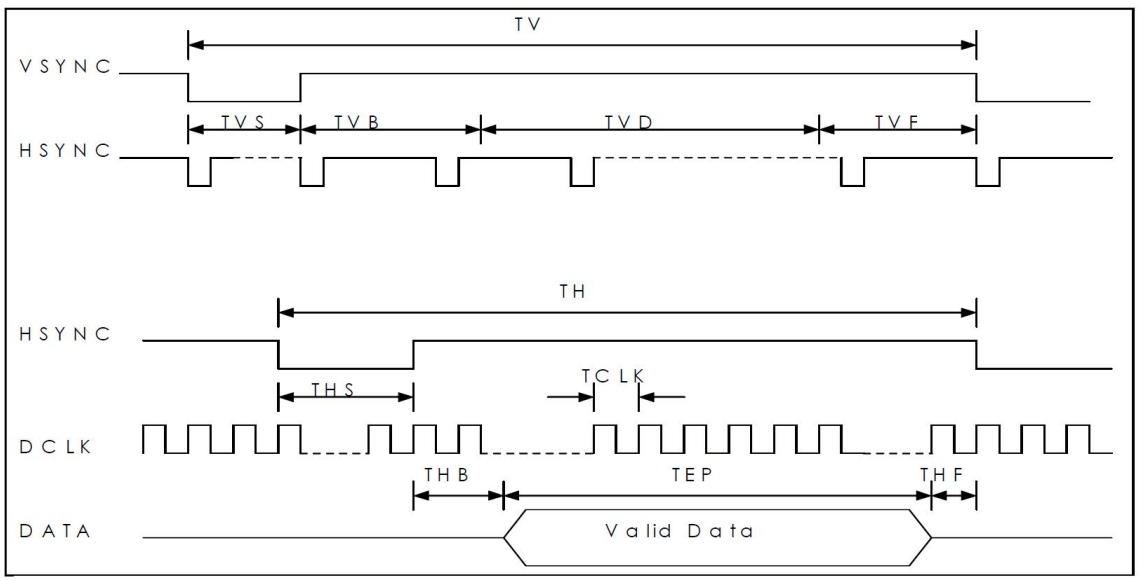


5.4 AC Characteristics (VDD=3.3V, Ta=25°C)

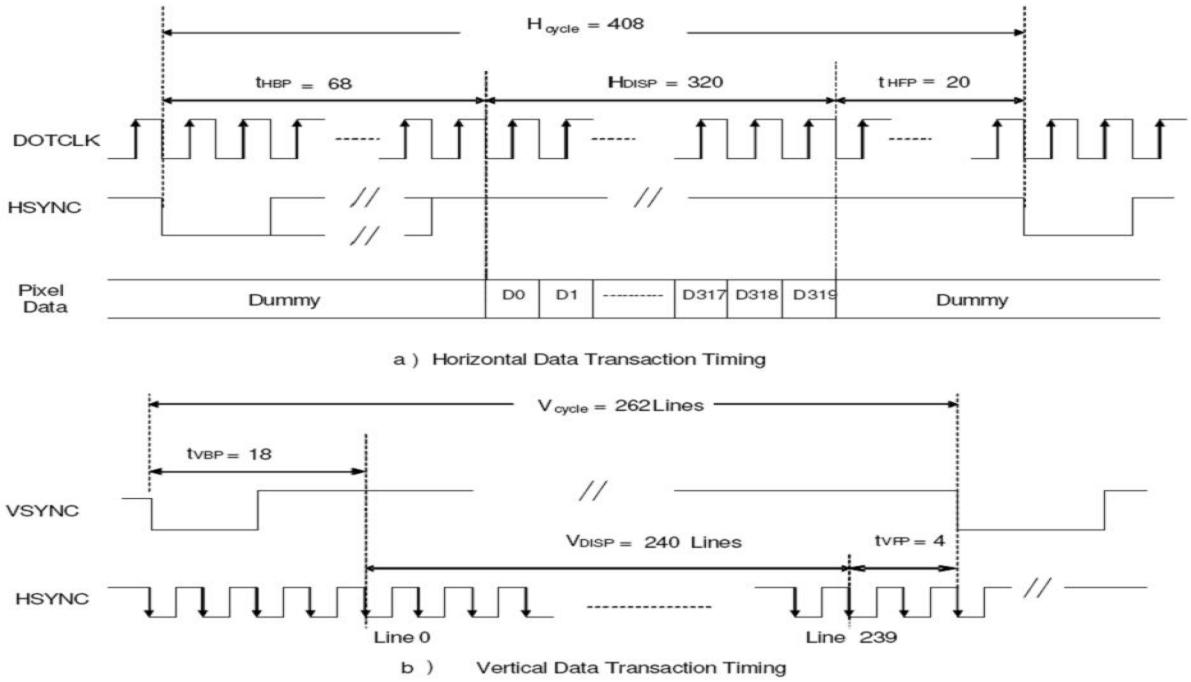
Item	Symbol	Min.	Mid.	Max.	Unit	Remark
DCLK period	T_{CLK}	-	156	-	ns	
DCLK pulse width	T_{CL}	-	78	-	ns	
DCLK pulse width	T_{CH}	-	78	-	ns	
Data set-up time	T_{DS}	12	-	-	ns	
Data hold time	T_{DH}	12	-	-	ns	
HSYNC period	T_H	-	408	-	T_{CLK}	
HSYNC width	T_{HS}	5	30	-	T_{CLK}	
HSYNC back porch	T_{HB}	-	38	-	T_{CLK}	
HSYNC display period	T_{EP}	-	320	-	T_{CLK}	
HSYNC front porch	T_{HF}	-	20	-	T_{CLK}	
VSYNC period	Tv	-	262	-	T_H	
VSYNC pulse width	T_{VS}	1	3	5	T_H	
VSYNC back porch	T_{VB}	-	15	-	T_H	
VSYNC display period	T_{VD}	-	240	-	T_H	
VSYNC front porch	T_{VF}	2	4	-	T_H	

Note 1: $T_{HS}+T_{HB}=68TCLK$





5.5 SYNC Mode Timing Diagram



5.6

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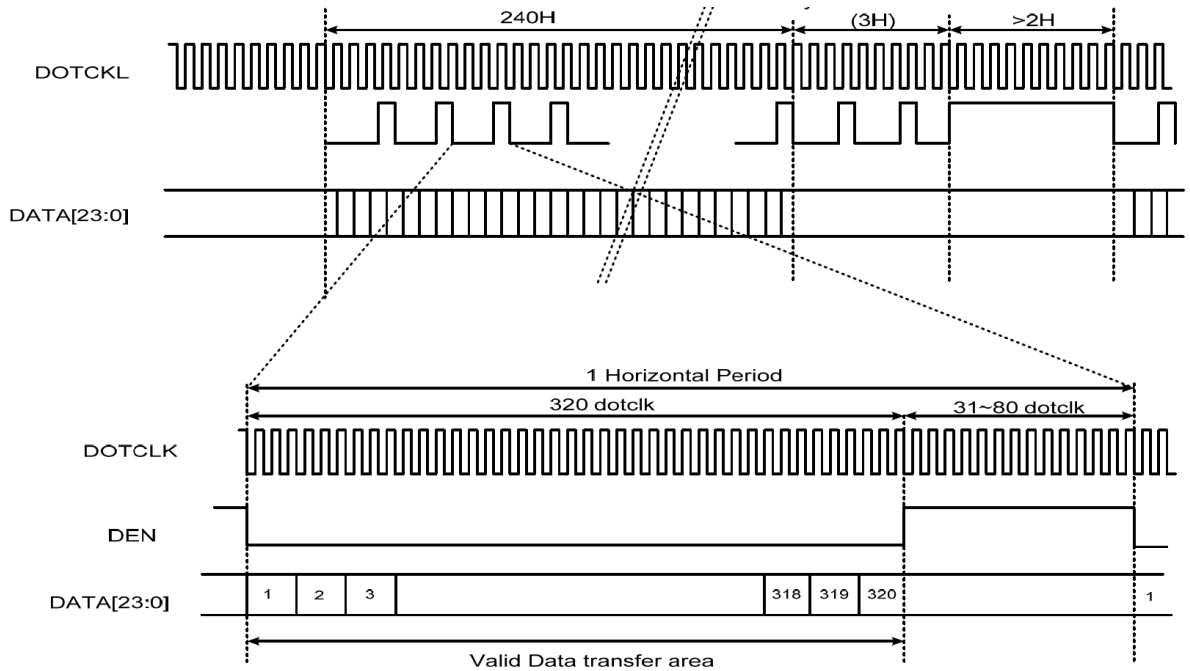


6. Touch Panel Characteristics

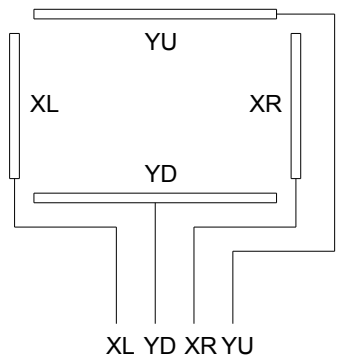
6.1 Electrical and Optical Characteristics

Item	Min.	Typ.	Max.	Unit	Remark
Linearity	-1.5	-	1.5	%	X and Y directions
Circuit Resistance	300	-	700	Ω	X direction
	100	-	500	Ω	Y direction
Insulation Resistance	20	-	-	MΩ	DC 25V
Operating Voltage	2.7	-	7	V	DC
Chatting Time	-	-	20	ms	
Transmittance	78	-	-	%	
Surface Treatment	Anti-glare				

6.2 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Remark
A					
S					
Knocking Durability	1,000,000	-	-	times	
Writing Durability	100,000	-	-	words	

6.3 Touch Panel Circuit Diagram



7. Optical Specification

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		Θ=0° Φ=0°	-	200	-	cd/m^2	1
Uniformity	△Bp			70%	-	-	-	1, 2
Viewing Angle	Hor	ΘR	Cr≥10	-	55	-	degree	3
		ΘL		-	55	-		
	Ver	ΘU		-	40	-		
		ΘD		-	50	-		
Contrast Ratio	Cr		Θ=0° Φ=0°	225	300	-	-	4
Response Time	Tr + Tf			-	25	-	ms	5
Color Coordinate	Wx		Θ=0° Φ=0°	0.26	0.31	0.36	-	1, 6
	Wy			0.28	0.33	0.38	-	

Test conditions: V_{DD}=3.3V, I_L=20mA (LED backlight current), the ambient temperature is 25°C.

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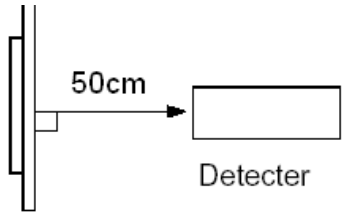
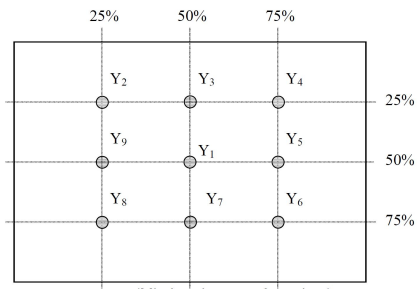
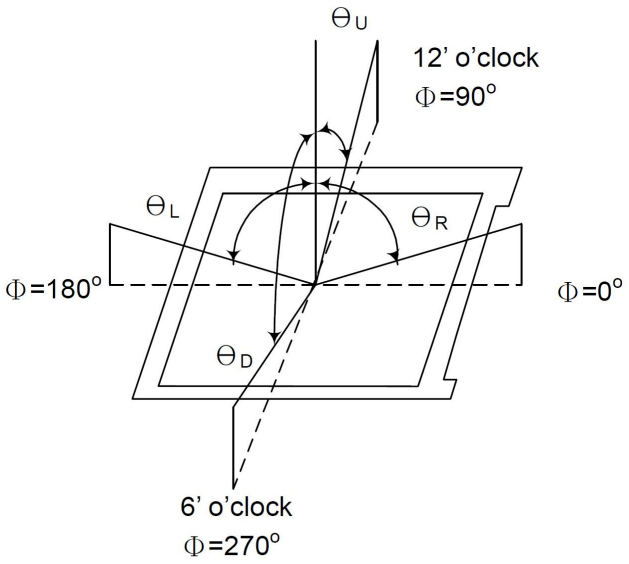


Note 2: △Bp = Bp (Min.) / Bp (Max.)×100 (%)
Bp (Max.) = Maximum brightness in 9 measured spots
Bp (Min.) = Minimum brightness in 9 measured spots.



Note 3: Definition of Viewing Angle



Note 4: Definition of Contrast Ratio

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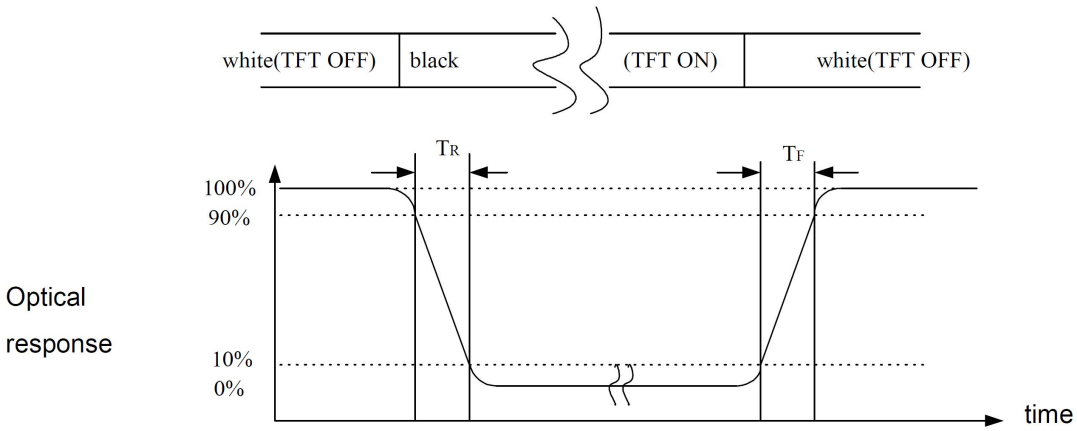
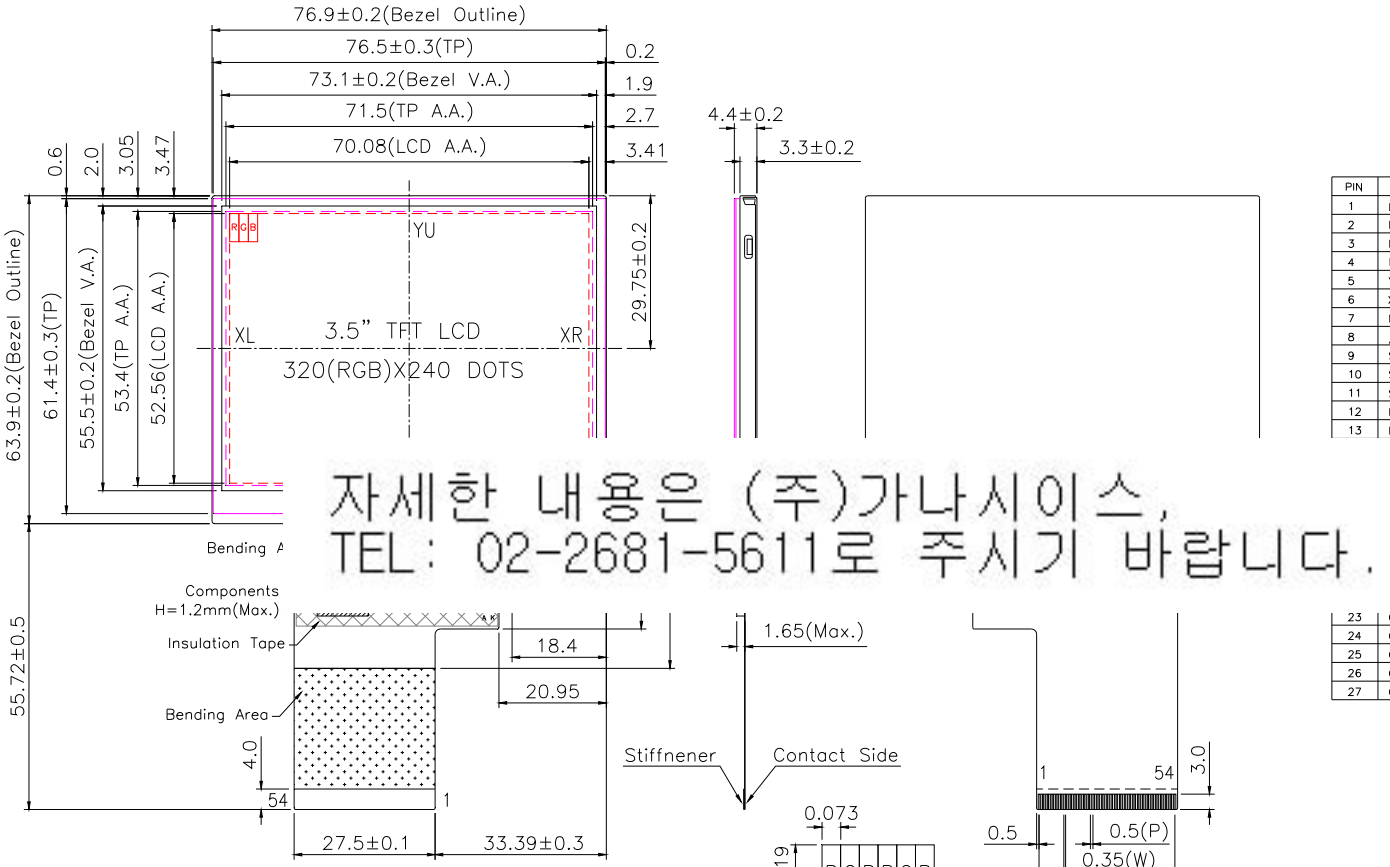
Note 5: Definition of Response Time



Note 6: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

8. Outline Dimension



PIN	SYMBOL	PIN	SYMBOL
1	LEDK	28	R0
2	LEDK	29	R1
3	LEDA	30	R2
4	LEDA	31	R3
5	YU(Y1)	32	R4
6	XR(X1)	33	R5
7	NC	34	R6
8	/RESET	35	R7
9	SPENA	36	HSYNC
10	SPCLK	37	VSYNC
11	SPDAT	38	DOTCLK
12	B0	39	NC
13	B1	40	NC
		41	VDD
		42	VDD
		43	YD(Y2)
		44	XL(X2)
		45	NC
		46	NC
		47	NC
		48	NC
		49	NC
23	G3	50	NC
24	G4	51	NC
25	G5	52	DEN
26	G6	53	GND
27	G7	54	GND

Notes:
1. 3.5" Transmissive, Normally-White TFT LCD Module
2. View Direction: 6:00
3. LCD Drivers: HX8238-D
4. Interface: 24-Bit RGB
5. Touch Panel: 4-wire Resistive
6. Operation Temp.: -20°C~70°C
7. Storage Temp.: -30°C~80°C
8. VDD=3.0V to 3.6V

DWN.	YDY	TITLE	LCM OUTLINE DIMENSION		
CHK.	LYJ	PART NO.	LT035A-02AT		
APPD.	LY	DWG. NO.	LT035A-02AT-WXA		
REV.	A	UNIT	mm	PROJECTION	
DATE	2010.05.08	SCALE	NTS	SHEET	1 OF 1

9. PRECAUTIONS FOR USE OF LCD MODULE

9.1 Handing Precautions

1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

2) If the display panel is damaged and the liquid crystal substance inside it leaks out,be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

3) Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to vary.

4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

5) If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.

· Isopropyl alcohol

· Ethyl alcohol Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

· Water

· Ketone

· A

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7) Be sure to avoid any solvent such as flux for soldering never stick to Heat-Seal. Such solvent on Heat-Seal may cause connection problem of heat-Seal and TAB.

8) Do not forcibly pull or bend the TAB I/O terminals.

9) Do not attempt to disassemble or process the LCD module.

10) NC terminal should be open. Do not connect anything.

11) If the logic circuit power is off, do not apply the input signals.

12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

· Be sure to ground the body when handling the LCD module.

· Tools required for assembly, such as soldering irons, must be properly grounded.

· To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

· The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

9.2 Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

2) Exercise care to minimize corrosion of the electrodes. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high humidity environment.

9.3 Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operating characteristics may be adversely affected.

2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.

3) The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range.Also, keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.

4) Sufficiently notice the mutual noise interference occurred by peripheral devices.

5) To cope with EMI, take measures basically on outputting side.

6) If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

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generated if the LCD module is subjected to a strong shock at a low temperature.

2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and aslight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

3) To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:

· Terminal electrode sections.

· Part of pattern wiring on TAB,