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Product Specification

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Prepared By		**2010/09/15**	**PM R&D**
Checked By		**2010/09/15**	**PM R&D**
Approved By		**2010/09/15**	**PM R&D**

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1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious and not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.
6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
7) Do not open nor modify the module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the TFT Module may be damaged.
10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It’s recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

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2. General Description

This specification applies to 12.1 inch Color TFT LCD Module with LED backlight and 4wires touch sensor. This module is designed for Industrial Applications. The screen format is intended to support SVGA (800(H) x 600(V)) resolution and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits).

LED driving board for backlight unit is included in this module. LED unit is replaceable.

All input signals are LVDS interface compatible.

It designed with wide viewing angle; wide temperature and long life LED backlight is well suited for industrial applications.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25℃ condition

Items	Unit	Specifications
Screen Diagonal	[inch]	12.1
Active Area	[mm]	246 (H) x 184.5 (V)
Pixel H x V		800 x 3(RGB) x 600
Pixel Pitch	[mm]	0.3075(H) x 0.3075(V)
Pixel Arrangement		R.G.B Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 (typ.)
Typical Power Consumption	[Watt]	6.7 W All black pattern
Weight	[Grams]	680
Physical Size	[Volt]	279.0(H) x 209.0(V) x 10.8(D)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-Glare, Hardness 3H
Support Color		16.2M / 262K colors
Temperature Range Operating Storage(Shipping)	 [℃] [℃]	 -5 to +60 -30 to +70
RoHS Compliance		RoHS Compliance

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2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 ℃ (Room Temperature)

Item	Unit	Condition	Min.	Typ.	Max.	Remark
White Luminance	[cd/m^2]	I_F= 120mA/1 LED Line (center point)	260	360	-	1
White Uniformity	%	5 Points	75	-	-	2,3
Contrast Ratio	-	-	450	630	-	4
Response Time	[msec]	Rising	-	25	35	5
	[msec]	Falling	-	10	20	
	[msec]	Raising + Falling	-	35	55	
Viewing Angle	[degree]	Horizontal (Right)	70	80	-	6
	[degree]	CR≧10 (Left)	70	80		
	[degree]	Vertical (Upper)	55	65	-	
	[degree]	CR≧10 (Lower)	65	75		
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.556	0.606	0.656	
		Red y	0.300	0.350	0.405	
		Green x	0.254	0.304	0.354	
		Green y	0.527	0.577	0.627	
		Blue x	0.099	0.149	0.199	
		Blue y	0.077	0.127	0.177	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%		-	55	-	

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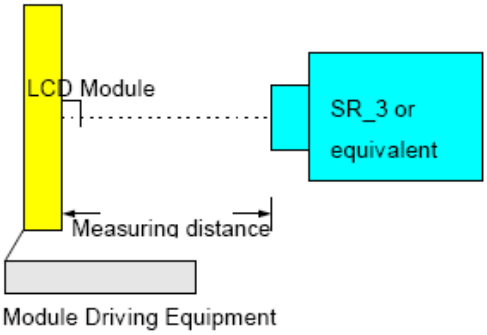
Note 1：Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

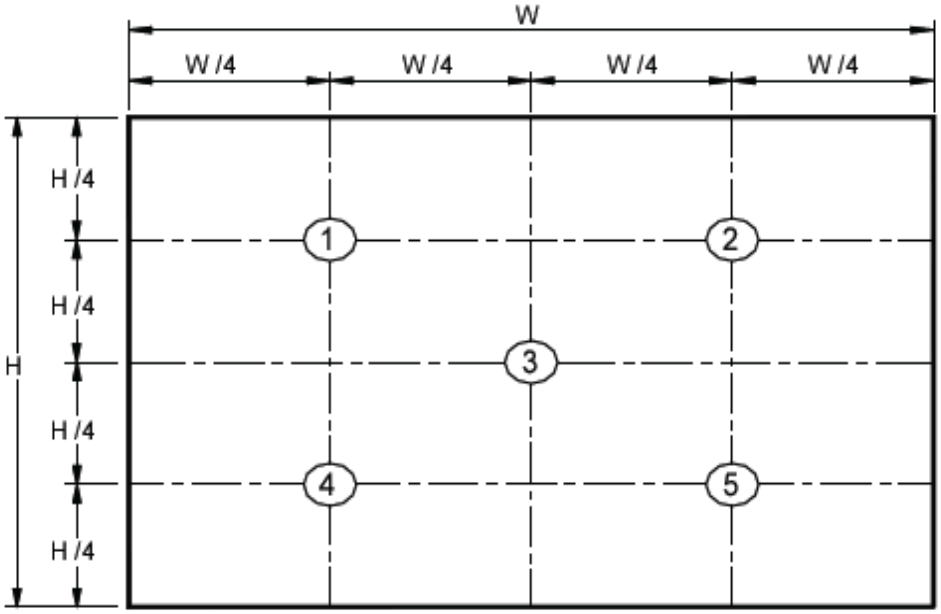
Aperture 1° with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2：Definition of 5 points position (Display active area: 246mm (H) x 184.5mm (V))



Note 3：The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

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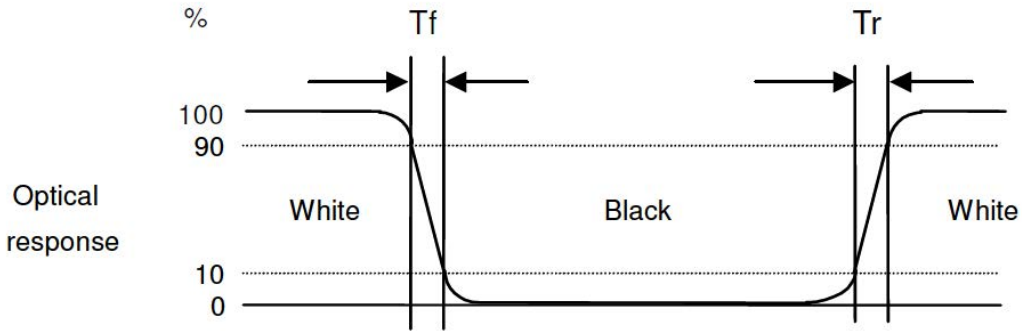
Note 4：Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the “White” state}}{\text{Brightness on the “Black” state}}$$

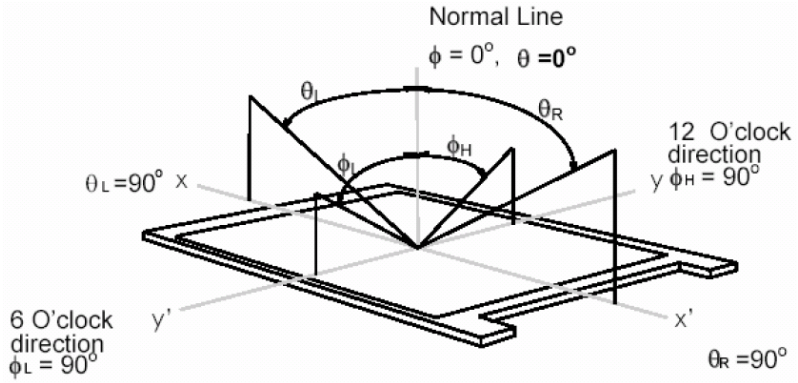
Note 5：Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (falling time) and from “Black” to “White” (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



Note 6：Definition of viewing angle

Viewing angle is the measurement of contrast ratio≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.



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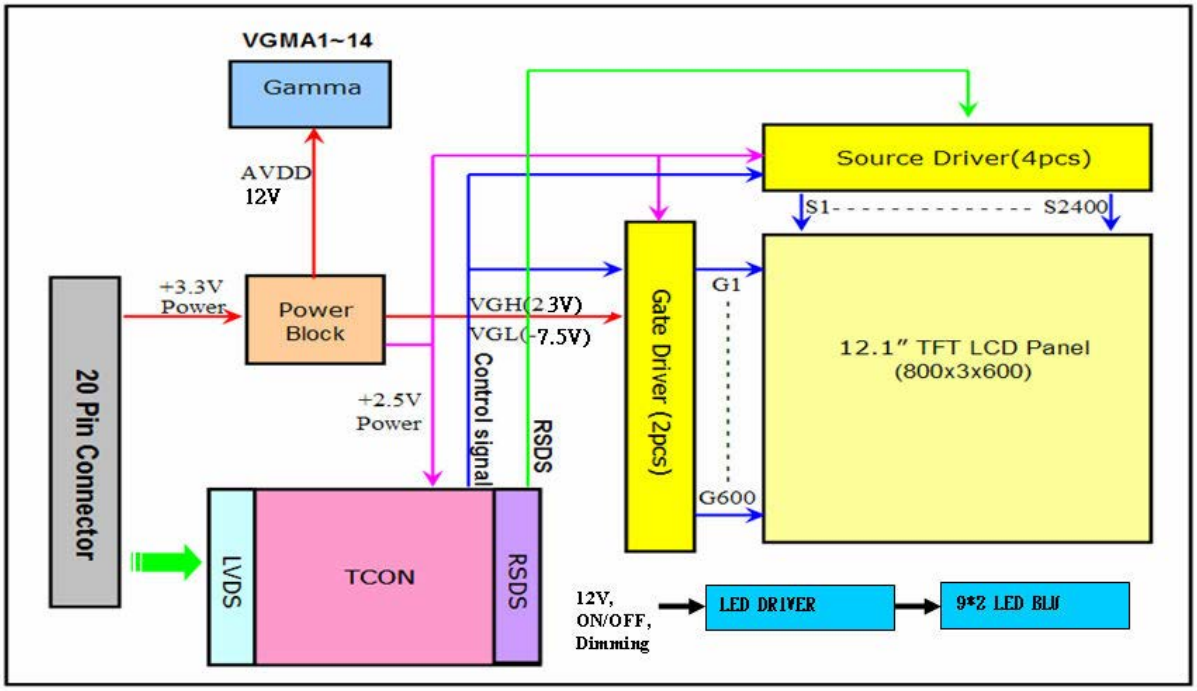
3. Functional Block Diagram

The following diagram shows the functional block of the 12.1 inch color TFT/LCD module:



4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	Vin	-0.3	+3.6	Volt

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-5	+60	[℃]
Operation Humidity	HOP	20	90	[%RH]
Storage Temperature	TST	-30	+70	[℃]
Storage Humidity	HST	10	90	[%RH]

Note 1: Maximum Wet-Bulb should be 39℃ and no condensation.

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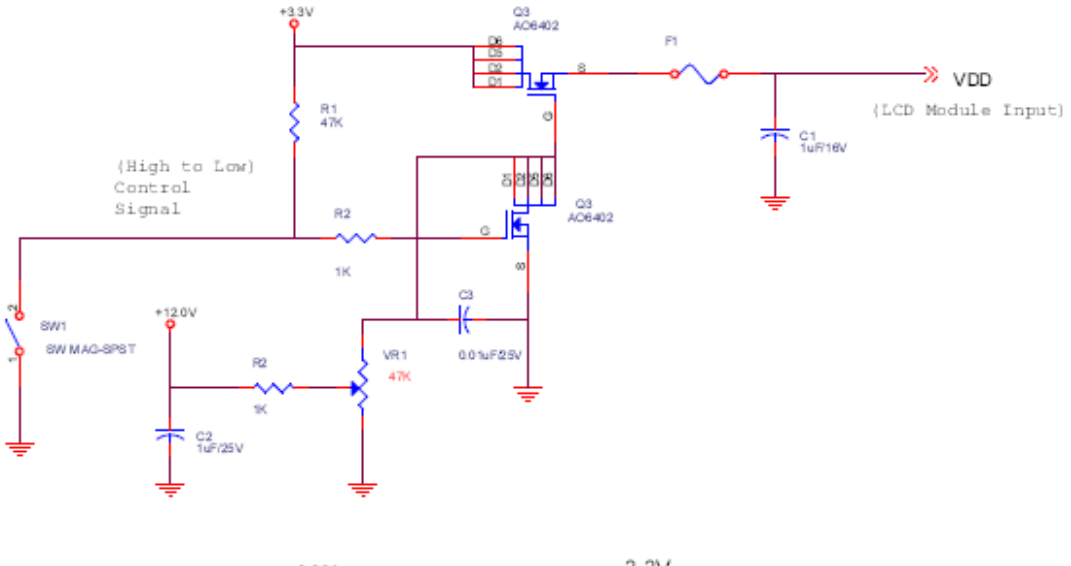
5. Electrical Characteristics

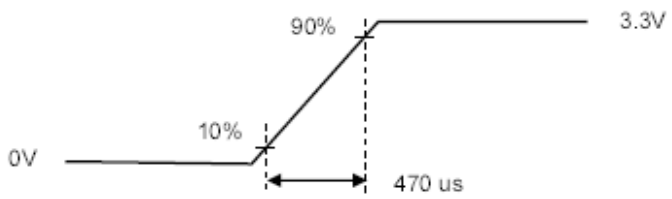
5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	±10%
IDD	VDD Current	-	280	-	[mA]	All black pattern (VDD=3.3V, at 60Hz)
I_{rush}	LCD Inrush Current	-	-	1.5	[A]	Note 1
PDD	VDD Power	-	0.93	-	[Watt]	All black pattern (VDD=3.3V, at 60Hz)
VDD	Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	All black pattern (VDD=3.3v, at 60Hz)

Note 1：Measurement condition:





VDD rising time

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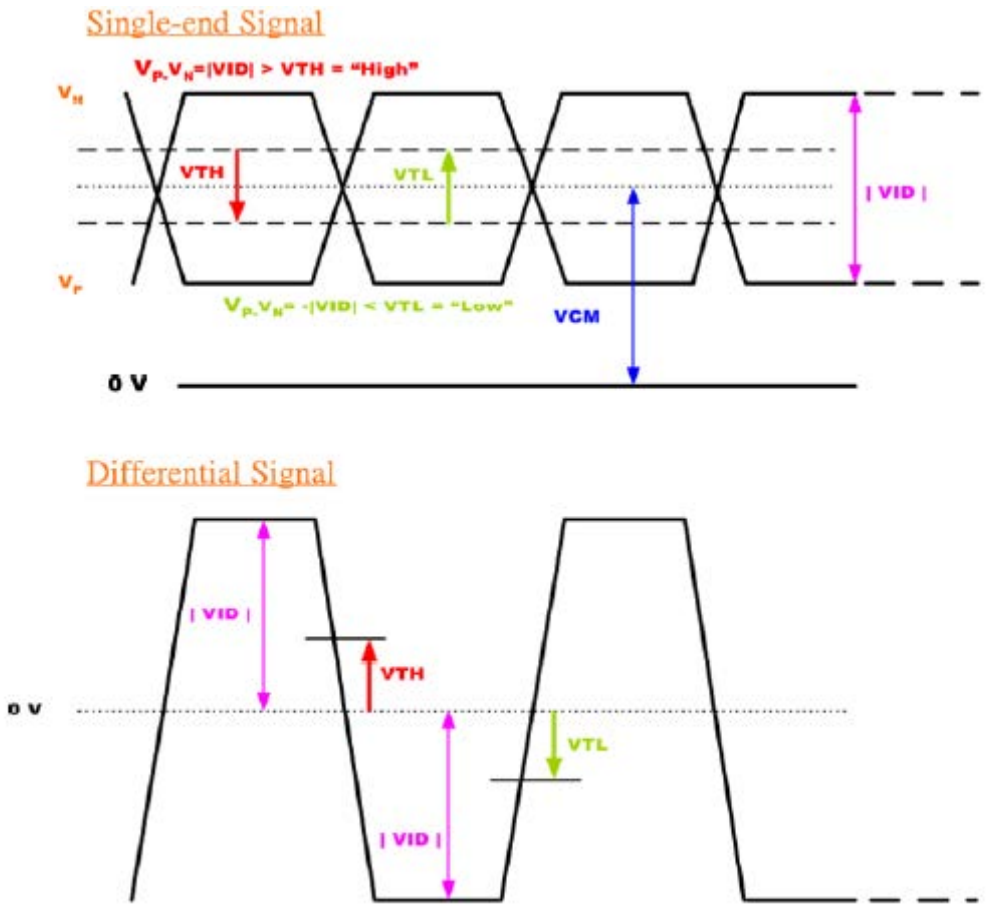
5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	[mV]	VICM=1.2V
VTL	Differential Input Low Threshold	100	-	-	[mV]	VICM=1.2V
| VID |	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1		1.45	[V]	VTH/VTL=± 100mV

Note: LVDS Signal Waveform.



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5.2 Backlight Unit

5.2.1 Parameter guideline for LCD

Following characteristics are measured under a stable condition using an inverter at 25°C (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	[Volt]	
I_{VCC}	Input Current	-	0.48	-	[A]	100% PWM Duty
P_{VCC}	Power Consumption	-	5.76	6	[Watt]	100% PWM Duty
$I_{rush\ LED}$	Inrush Current	-	-	1.5	[A]	at rising time=470us
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5.5	[Volt]	
	Dimming duty cycle	5	-	100	%	
I_F	LED Forward Current	-	80	-	[mA]	Ta = 25°C
V_F	LED Forward Voltage	-	27.9	31.5	[Volt]	I_F = 80mA, Ta = -30°C
		-	28.8	32.9	[Volt]	I_F = 80mA, Ta = 25°C
		-	30.6	35.1	[Volt]	I_F = 80mA, Ta = 85°C
P_{LED}	LED Power Consumption	-	4.9	5.6	[Watt]	
Operation Life		50,000	-	-	Hrs	I_F=80mA, Ta= 25°C

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: VCC, IVCC, Irush LED, PVCC are defined for LED backlight.(100% duty of PWM dimming)

Note 3: IF, VF are defined for one channel LED. There are two LED channel in back light unit.

Note 4: If module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating estimated data

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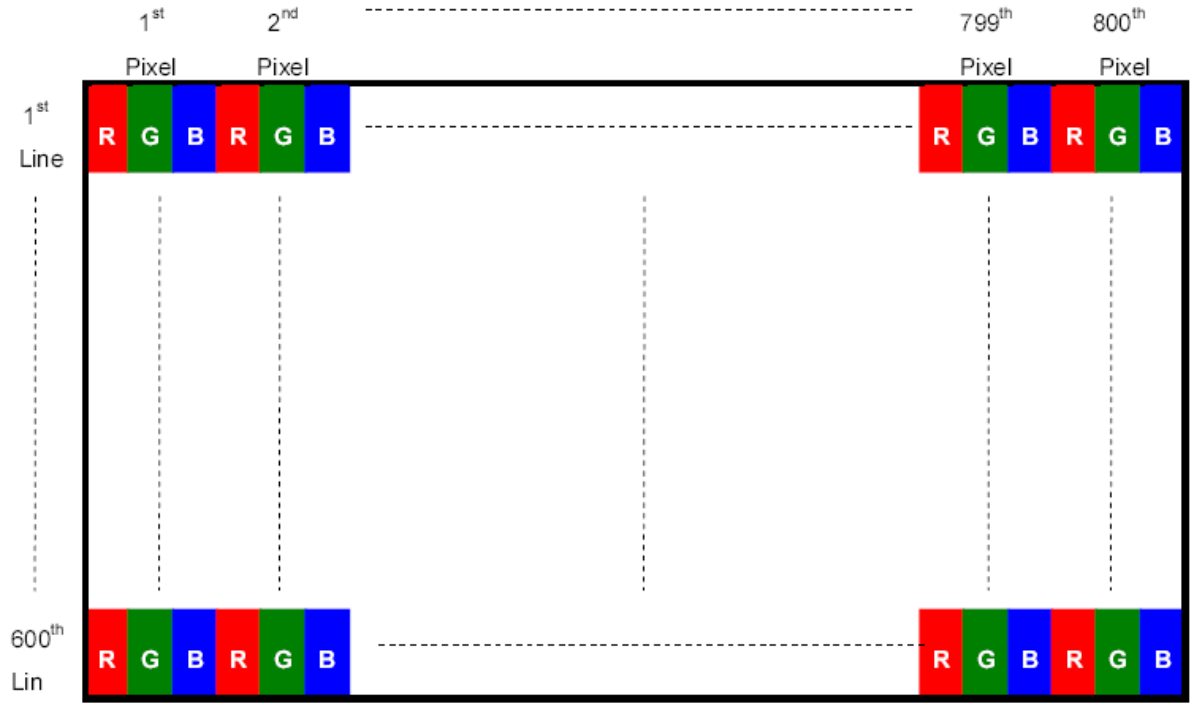
6. Signal Characteristics

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

Fig. 1 Normal scan (Pin19, RSV = Low or NC)

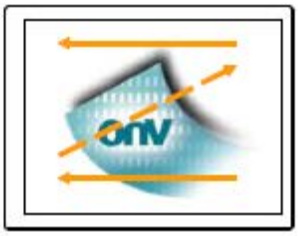


Fig. 2 Reverse scan (Pin19, RSV = High or VDD)

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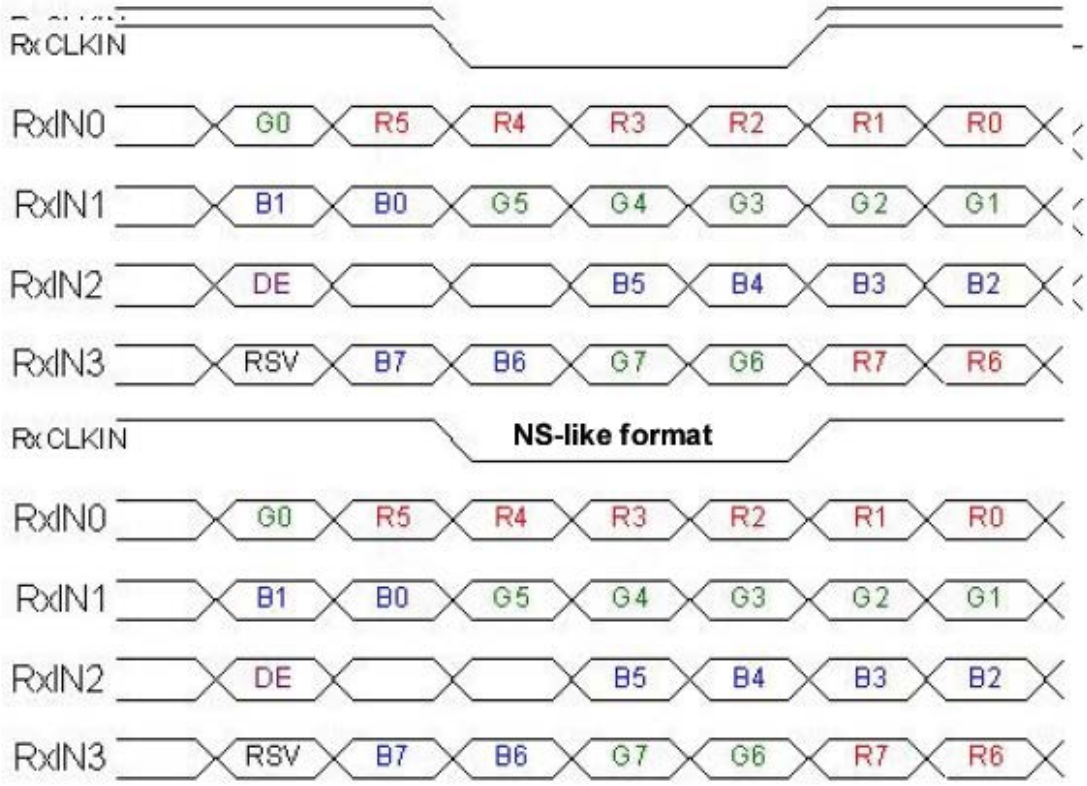
6.3 The Input Data Format

SEL68



Note 1: Please follow PSWG

Note 2: R/G/B data 7:MSB, R/G/B data 0:LSB

Signal Name	Description	
+RED5(R5) +RED4(R4) +RED3(R3) +RED2(R2) +RED1(R1) +RED0(R0)	Red Data 5 (MSB) Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB) Red-pixel Data	Red-pixel Data Each red pixel's brightness data consists of these 6 bits pixel data.
+GREEN5(G5) +GREEN4(G4) +GREEN3(G3) +GREEN2(G2) +GREEN1(G1) +GREEN0(G0)	Green Data 5 (MSB) Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0 (LSB) Green-pixel Data	Green-pixel Data Each green pixel's brightness data consists of these 6 bits pixel data.
+BLUE5(B5) +BLUE4(B4) +BLUE3(B3) +BLUE2(B2) +BLUE1(B1) +BLUE0(B0)	Blue Data 5 (MSB) Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB) Blue-pixel Data	Blue-pixel Data Each blue pixel's brightness data consists of these 6 bits pixel data.
CLK	Data Clock	The typical frequency is 40MHz. The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high.
DE	Display Timing	This signal is strobed at the falling edge of CLK. When the signal is high, the pixel data shall be valid to be displayed.

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.

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6.4 TFT-LCD Interface Signal Description

This module using a LVDS receiver embedded in AUO' ASIC. LVDS is a differential signal technology for LCD interface and a high-speed data transfer device.

Input Signal Interface		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	SEL68	6/ 8bits LVDS data input selection [H: 8bits L/NC: 6bit]
5	RIN0-	LVDS receiver signal channel 0
6	RIN0+	LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
7	GND	Ground
8	RIN1-	LVDS receiver signal channel 1
9	RIN1+	LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
10	GND	Ground
11	RIN2-	LVDS receiver signal channel 2
12	RIN2+	LVDS Differential Data Input (B2, B3, B4, B5, HS, VS, DE)
13	GND	Ground
14	CLKIN-	LVDS receiver signal clock
15	CLKIN+	
16	GND	Ground
17	RIN3-	LVDS receiver signal channel 3, NC for 6 bit LVDS Input
18	RIN3+	LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
19	RSV	Reverse Scan Function [H: Enable; L/NC: Disable]
20	NC/GND	Reserved for AUO internal test. Please treat it as NC.

Note 1: Input signals shall be in low status when VDD is off.

Note 2: High stands for "3.3V", Low stands for "0V", NC stands for "No Connection".

Note 3: RSV stands for "Reserved".

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6.5 TFT-LCD Interface Timing

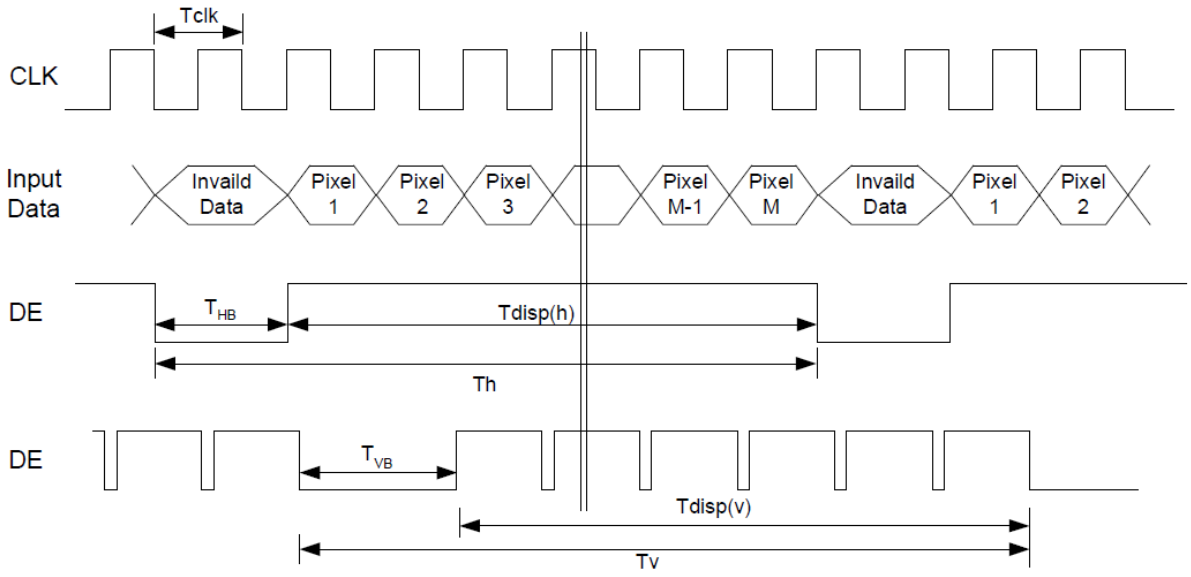
6.5.1 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		1/ T_{Clock}	34	40	48.3	MHz
Vertical Section	Period	T_V	608	628	1024	TLine
	Active	T_{VD}	-	600	-	
	Blanking	T_{VB}	8	28	423	
Horizontal Section	Period	T_H	960	1056	1060	T_{Clock}
	Active	T_{HD}	-	800	-	
	Blanking	T_{HB}	220	256	440	

Note 1: Frame rate is 60Hz.

Note 2: DE mode.

6.5.2 Input Timing Diagram



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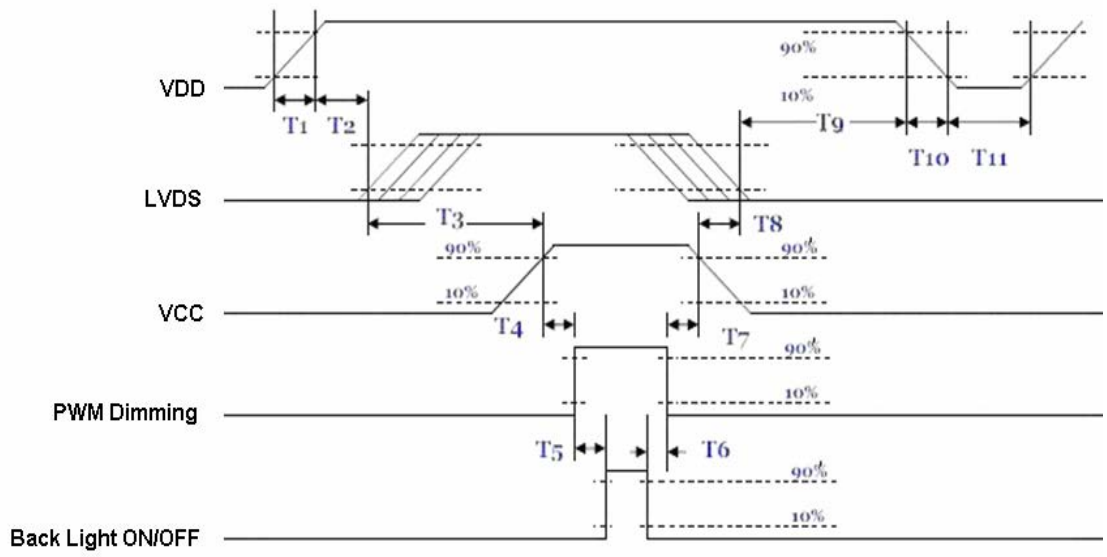
6.6 Power ON/OFF Sequence

VDD power, LCD interface signals and backlight on/off sequence are shown in the following chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	200	-	-	[ms]
T4	10	-	-	[ms]
T5	10	-	-	[ms]
T6	0	-	-	[ms]
T7	10	-	-	[ms]
T8	100	-	-	[ms]
T9	0	16	50	[ms]
T10	-	-	10	[ms]
T11	1000	-	-	[ms]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

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7. Connector & Pin Assignment

7.1 TFT LCD Signal (CN1): LCD Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB240420-E or compatible
Adaptable Plug	P240420 or compatible

Pin No.	Signal Name	Pin No.	Signal Name
1	VDD	2	VDD
3	GND	4	SEL68
5	RIN0-	6	RIN0+
7	GND	8	RIN1-
9	RIN1+	10	GND
11	RIN2-	12	RIN2+
13	GND	14	CLKIN-
15	CLKIN+	16	GND
17	RIN3-	18	RIN3+
19	RSV-	20	NC/GND

7.2 LED Backlight Unit (CN2): Driver Connector

Connector Name / Designation	Lamp Connector
Manufacturer	ENTERY or compatible
Connector Model Number	3808K-F05N-02R or compatible
Mating Model Number	H208K-P05N-02B or compatible

Pin No.	symbol	description
Pin1	VCC	12V input
Pin2	GND	GND
Pin3	On/OFF	5V-ON,0V-OFF
Pin4	Dimming	PWM
Pin5	NA	

7.3 LED Backlight Unit (CN4): Light bar Connector

Connector Name / Designation	Lamp Connector
Manufacturer	ENTERY or compatible
Connector Model Number	H208K–P03N-02B or compatible
Mating Model Number	3808K-F03N-02R or compatible

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Pin No.	symbol	description	Color
Pin1	H	LED anode	Red
Pin2	L	LED cathode	White
Pin3	L	LED cathode	Black

8. Touch Panel Specification

8.1 Operating condition

Item	Min.	Typ.	Max.	Unit	Remark
Operating voltage	-	-	7	V_{DC}	

8.2 Electrical characteristic

Item		Min.	Typ.	Max.	Unit	Remark
Resistance between terminal	XL-XR	300	-	1100	Ω	
	YU-YD	200	-	600	Ω	
Insulation resistance	X-Y	10	-	-	MΩ	DC 25V
Linearity	X	-	-	2	%	
	Y	-	-	2	%	

8.3 Mechanical characteristic

Item	Min.	Typ.	Max.	Unit	Remark
Pen/Finger input pressure	-	-	80	gf	Finger, Pen
Surface hardness	-	3		H	

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9. Reliability Test Criteria

Test item	Test condition	Remark
High temperature storage	70°C, 8Hrs	
Low temperature storage	-30°C, 8Hrs	
High temperature operation	60°C, 8Hrs	
Low temperature operation	-5°C, 8Hrs	

10. Display Quality

The display quality of the color TFT-LCD module should be in compliance with TechNexion's OQC inspection standard.

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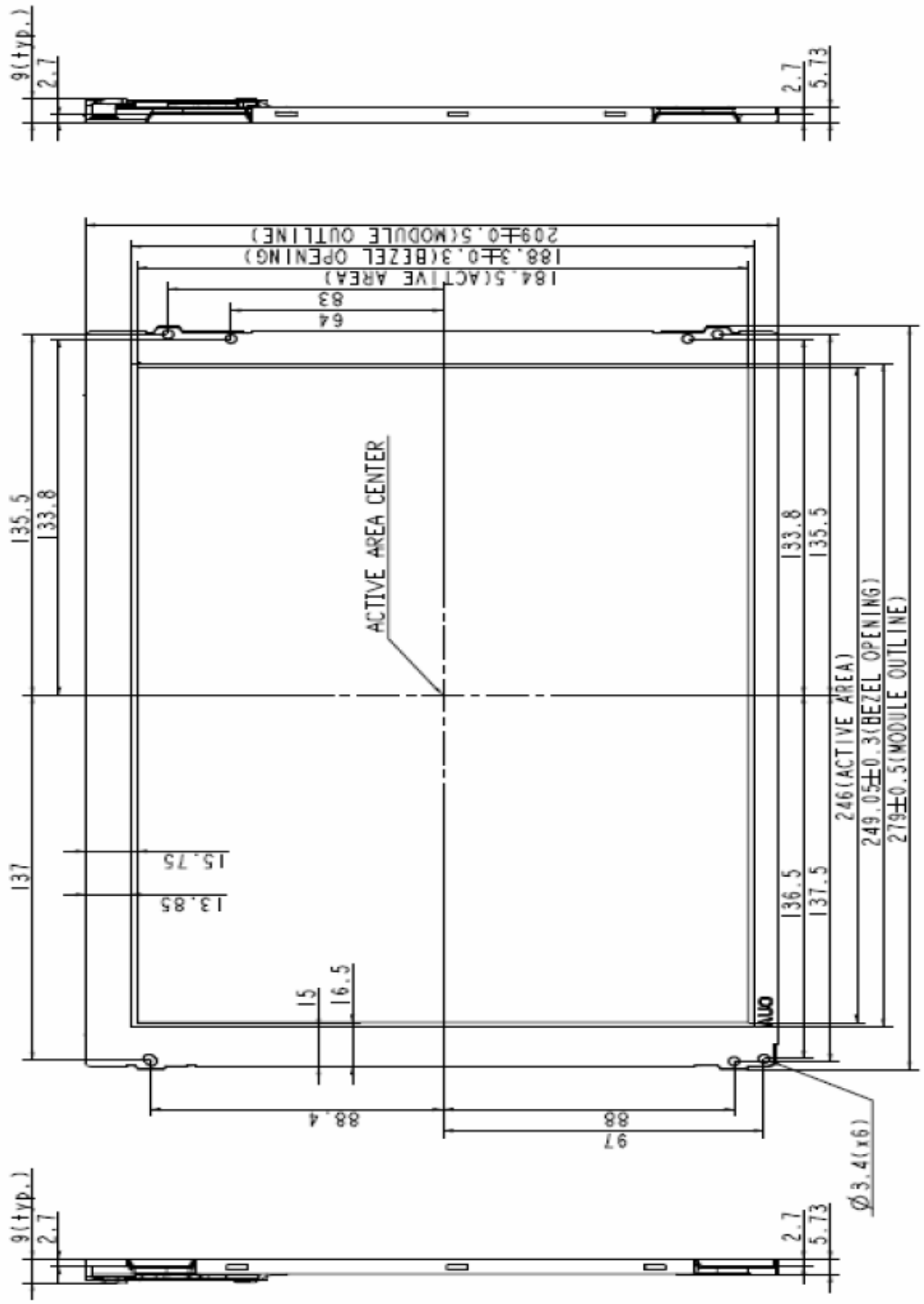
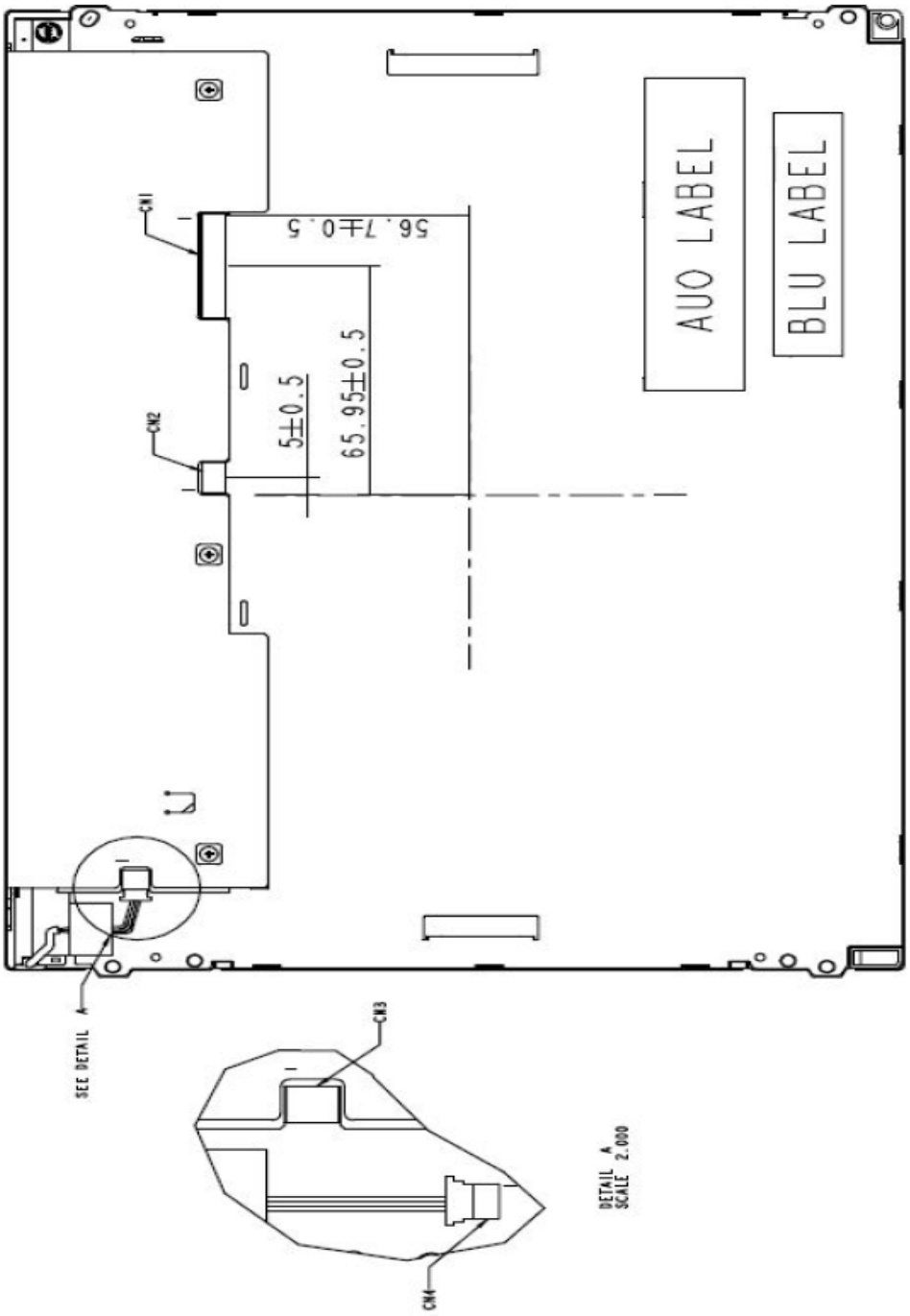
11. Mechanical Characteristics

11.1 LCM Outline Dimension (Front View)



11.2 LCM Outline Dimension (Rear View)



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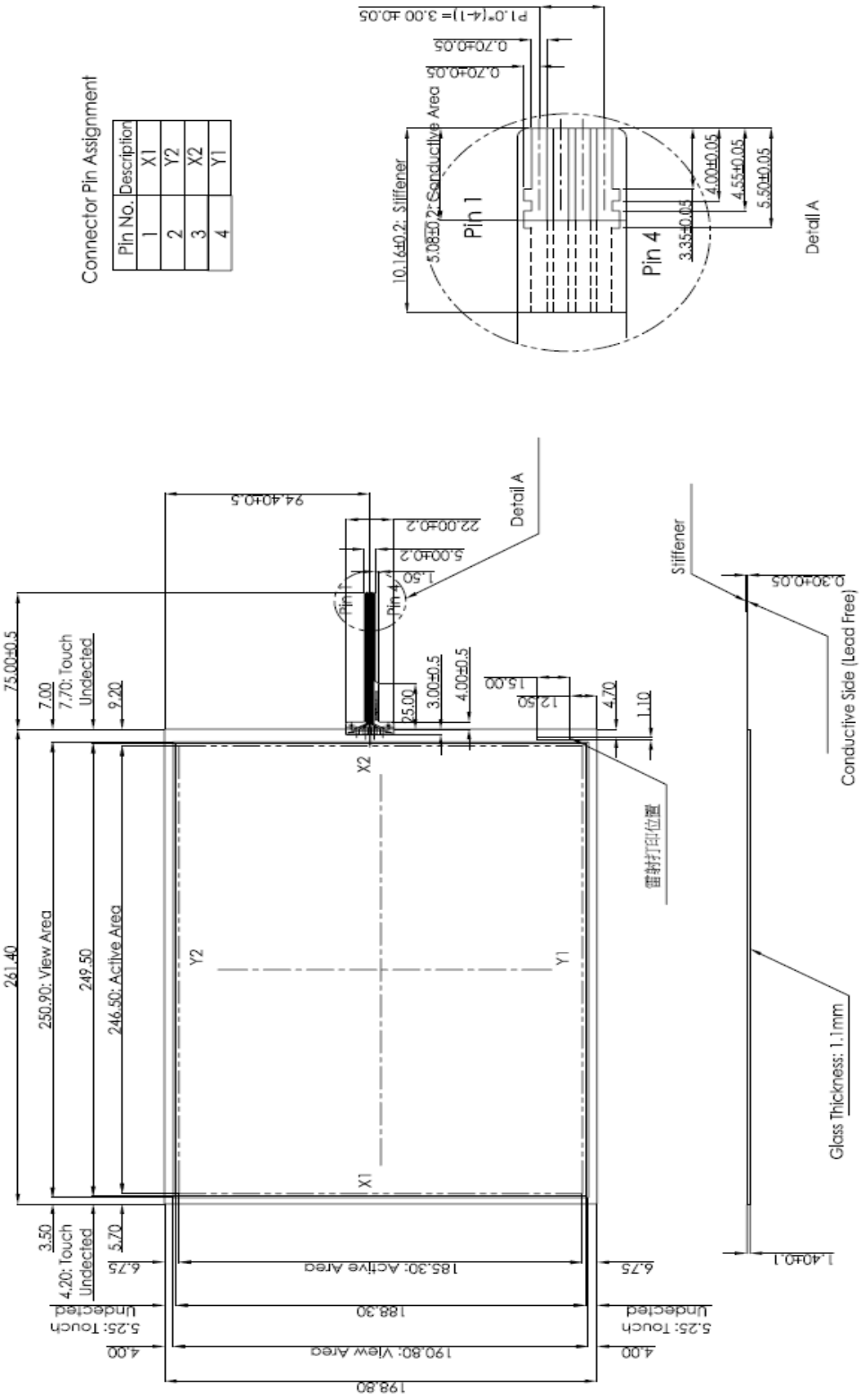
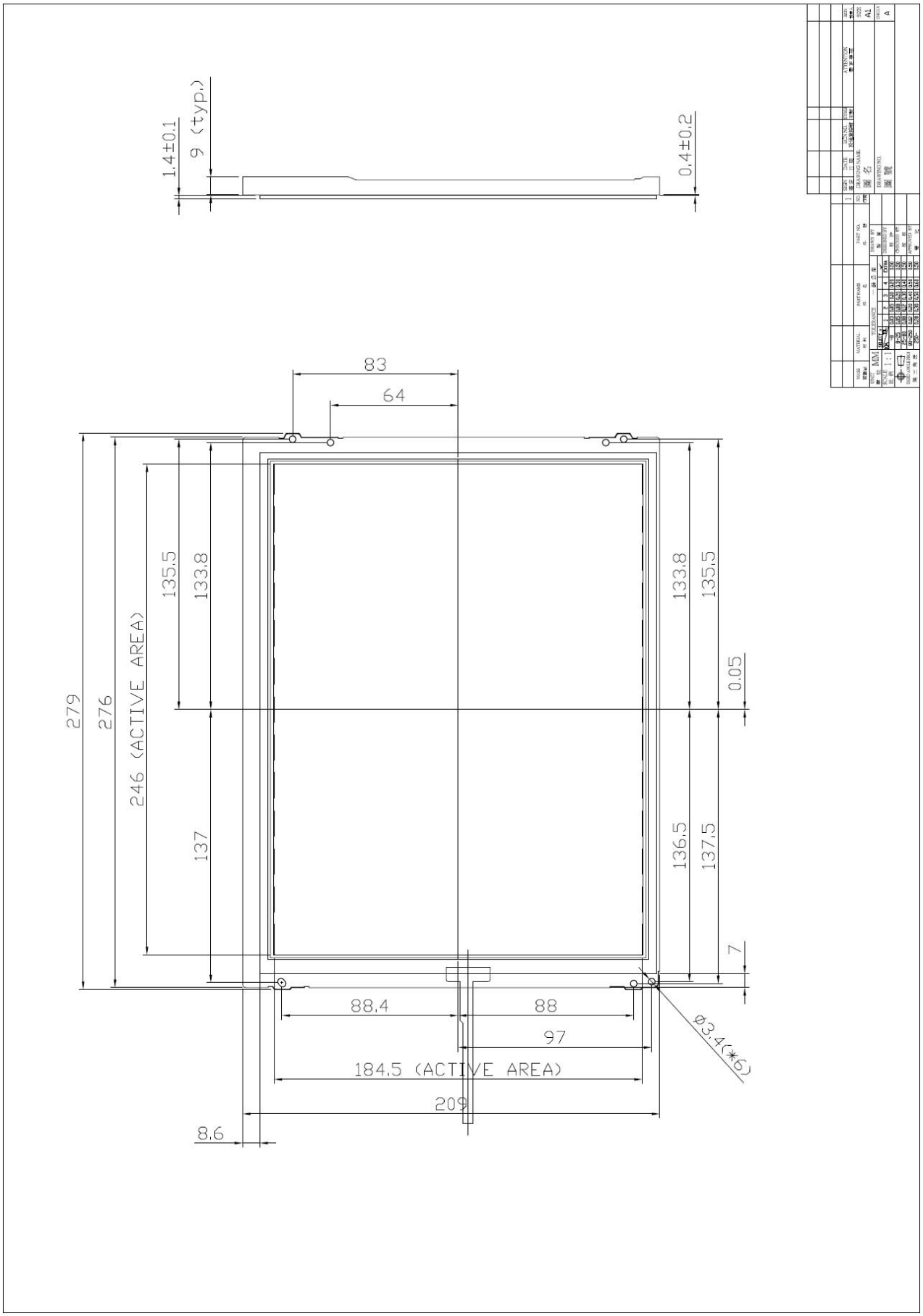
11.3 Touch Sensor Outline Dimension



11.4 Mechanical Assembly Drawing