

TFT LCD Specification

Model NO.: TD035STEB2

Customer Signature
Date

This technical specification is subjected to change without notice

Table of Contents

NO.	Item	Page
	Cover Sheet	1
	Table of Contents	2
	Record of Reversion	3
1	Features	4
2	General Specification	4
3	Input / Output Terminals	5
4	Absolute Maximum Ratings	8
5	Electrical Characteristics	9
6	Block Diagram	11
7	Timing Chart	12
8	Power On/Off Sequence	14
9	Optical Characteristics	15
10	Handling Cautions	20
11	Mechanical Drawing	23
12	Packing Drawing	25

Record of Reversion

Rev	Issued Date	Description
1.0	DEC, 31, 2003	New
1.1	Apr , 10, 2004	5.4 Modify Minimum force for linearity test 5.4 Modify Minimum tension for detecting 5.5 Grounding resistance 8. Increase VCC3 profile 11. Update connector's position spec & Label position

1. FEATURES

The 3.5"(8.89 cm) LCD module is the Transflective active matrix color TFT LCD module. LTPS (Low Temperature Poly Silicon) TFT technology is used and vertical and horizontal drivers are built on the panel. Highly integrated LCD module includes touch panel, backlight and TFT LCD panel with minimal external circuits and components required.

2. GENERAL SPECIFICATION

Item		Description	Unit
Display Size (Diagonal)		3.5 inch (8.9cm)	-
Display Type		Transflective	-
Active Area (HxV)		53.64 x 71.52	mm
Number of Dots (HxV)		240 x RGB x 320	dot
Dot Pitch (HxV)		0.0745 x 0.2235	mm
Color Arrangement		RGB Stripe	-
Color Numbers		262,144 (6 bits)	-
Outline Dimension (HxVxT)		64 x 85 x 4.05 (Max 4.9)*	mm
Weight		43 (Max)	g
Power consumption	LCD Panel + T-CON + L/S	50 (Typ)	mW
	Backlight	432 (Typ, I _F = 20mA)	

* Exclude FPC and protrusions.

3. INPUT/OUTPUT TERMINALS

3.1 TFT LCD module

Recommend connector:NAIS-AXK6F60345J

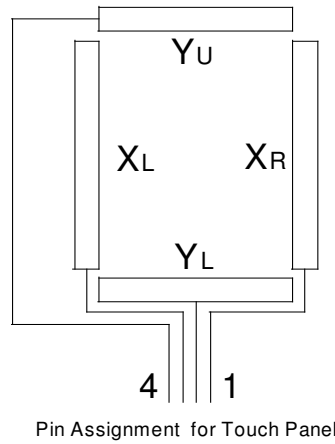
Pin	Symbol	I/O	Description	Remark
1	GND	-	Ground	
2	YU	-	Touch Panel Upper Side Pin	
3	XR	-	Touch Panel Right Side Pin	
4	YL	-	Touch Panel Lower Side Pin	
5	XL	-	Touch Panel Left Side Pin	
6	GND	-	Ground	
7	NC	-	No connection (leave this pin open)	
8	NC	-	No connection (leave this pin open)	
9	GND	-	Ground	
10	NC	-	No connection (leave this pin open)	
11	VDD	-	Supply voltage for H/V driver (+ 11.7V)	
12	NC	-	No connection (leave this pin open)	
13	NC	-	No connection (leave this pin open)	
14	NC	-	No connection (leave this pin open)	
15	GND	-	Ground	
16	VCC5	-	Supply voltage for +5V logic	
17	NC	-	No connection (leave this pin open)	
18	GND	-	Ground	
19	GND	-	Ground	
20	VCC3	-	Supply voltage for +3.3V logic	
21	GND	-	Ground	
22	B0	I	Video data blue 0 (LSB)	
23	B1	I	Video data blue 1	
24	B2	I	Video data blue 2	
25	B3	I	Video data blue 3	
26	B4	I	Video data blue 4	
27	B5	I	Video data blue 5 (MSB)	
28	GND	-	Ground	
29	G0	I	Video data green 0 (LSB)	
30	G1	I	Video data green 1	
31	G2	I	Video data green 2	
32	G3	I	Video data green 3	
33	G4	I	Video data green 4	

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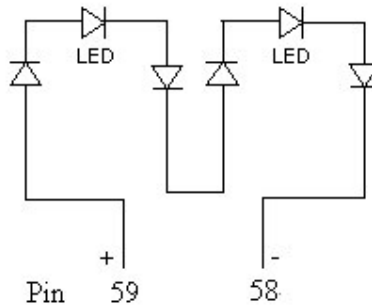
34	G5	I	Video data green 5 (MSB)	
35	GND	-	Ground	
36	R0	I	Video data red 0 (LSB)	
37	R1	I	Video data red 1	
38	R2	I	Video data red 2	
39	R3	I	Video data red 3	
40	R4	I	Video data red 4	
41	R5	I	Video data red 5 (MSB)	
42	GND	-	Ground	
43	VCC3	-	Supply voltage for +3.3V logic	
44	GND	-	Ground	
45	GND	-	Ground	
46	CLK	I	Video data clock	
47	GND	-	Ground	
48	DE	I	Data enable	
49	NC	-	No connection (leave this pin open)	
50	NC	-	No connection (leave this pin open)	
51	NC	-	No connection (leave this pin open)	
52	NC	-	No connection (leave this pin open)	
53	GND	-	Ground	
54	VCC5	-	Supply voltage for 5V logic	
55	NC	-	No connection (leave this pin open)	
56	VDD	-	Supply voltage for H/V driver (+11.7 V)	
57	VEE	-	Supply voltage for V driver (-6.5V)	
58	LED-		LED Power (-)	
59	LED+		LED Power (+)	
60	GND	-	Ground	

3.2 Touch panel Pin

Touch Panel Pin	Module Pin	Symbol	Description	Remark
1	3	XR	Touch Panel Right Side	
2	4	YL	Touch Panel Lower Side	
3	5	XL	Touch Panel Left Side	
4	2	YU	Touch Panel Upper Side	



3.3 Back light pin assignment



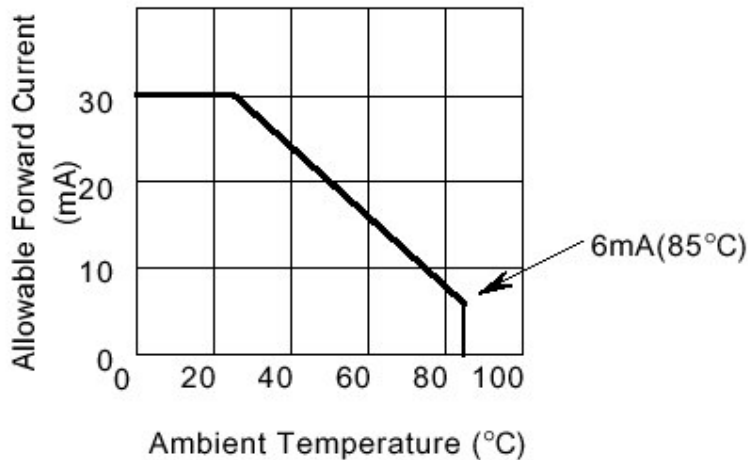
4. ABSOLUTE MAXIMUM RATINGS

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	VCC3	-0.3	4	V	
	VCC5	-0.3	6	V	
Power Supply for H/V Driver	VDD	-1.0	+14	V	
	VEE	-7.5	-5.0	V	Note 1
Data Input Voltage	R[5:0], G[5:0], B[5:0], CLK, DE	-0.3	VCC3+0.3	V	
Touch Panel Operation Voltage	V_{Touch}	-	5.5	V	
Backlight LED forward Voltage	V_F	-	30	V	
Backlight LED reverse Voltage	V_R	-	5	V	
Backlight LED forward current ($T_a=25^{\circ}\text{C}$)	I_F	-	30	mA	Note2
Operating Temperature	T_{opr}	-10	+55	$^{\circ}\text{C}$	
Storage Temperature	T_{stg}	-20	+70	$^{\circ}\text{C}$	

Note1. The operating voltage is between +0.5V and -5.0V at the moment when the power is turned on

Note 2. Relation between maximum LED forward current and ambient temperature is showed as bellow.



5. ELECTRICAL CHARACTERISTICS

5.1 Driving TFT LCD Panel

T a=25°C

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		VCC3	3.0	3.3	3.6	V	
		VCC5	4.5	5.0	5.5	V	
Power Supply for H/V Driver		VDD	11.1	11.7	12.3	V	
		VEE	-7	-6.5	-6	V	
Data Input Voltage	High	VIH	2.4	-	3.3	V	R[5:0], G[5:0], B[5:0], CLK DE
	Low	VIL	0	-	0.8		
VCC3 Supply Current		I _{VCC3}	-	1.7	3.0	mA	Note 1
VCC5 Supply Current		I _{VCC5}	-	5.5	7.0	mA	Note 2
VDD Supply Current		I _{VDD}	-	1.2	2	mA	
VEE Supply Current		I _{VEE}	-	10	30	uA	

Note 1: The typical supply current specification is measured at the line inversion test pattern (black and white interlacing horizontal lines as the diagram shown below)



Note 2: Gamma correction voltage is set to achieve the optimum at VCC5=5.0V. Use the voltage at level as close to 5.0V as possible.

5.2 DC/DC Spec

Item	Input voltage			Input Current	Input ripple(Max)	
	MIN	TYP	MAX			
VCC3	3.0 V	3.3 V	3.6 V	3.2 mA	200 mV	
VCC5	4.5 V	5 V	5.5 V	7.2 mA	100 mV	Note 1
VDD	11.1 V	11.7 V	12.3 V	2.2 mA	200 mV	
VEE	-7 V	-6.5 V	-6 V	0.04 mA	200 mV	

Note 1: 1. VCC5 is analog voltage supply therefore use as less ripple as possible.

5.3 Driving backlight

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I _F	-	20	30	mA	LED/Part
LED Life Time	-	-	10,000	-	Hr	I _F : 18mA
Forward Current Voltage	V _F	-	3.6	3.9	V	I _F : 20mA ,LED/Part

Note : Backlight driving circuit is recommend as the fix current circuit.

5.4 Driving touch panel (Analog resistance type)

Ta=25°C

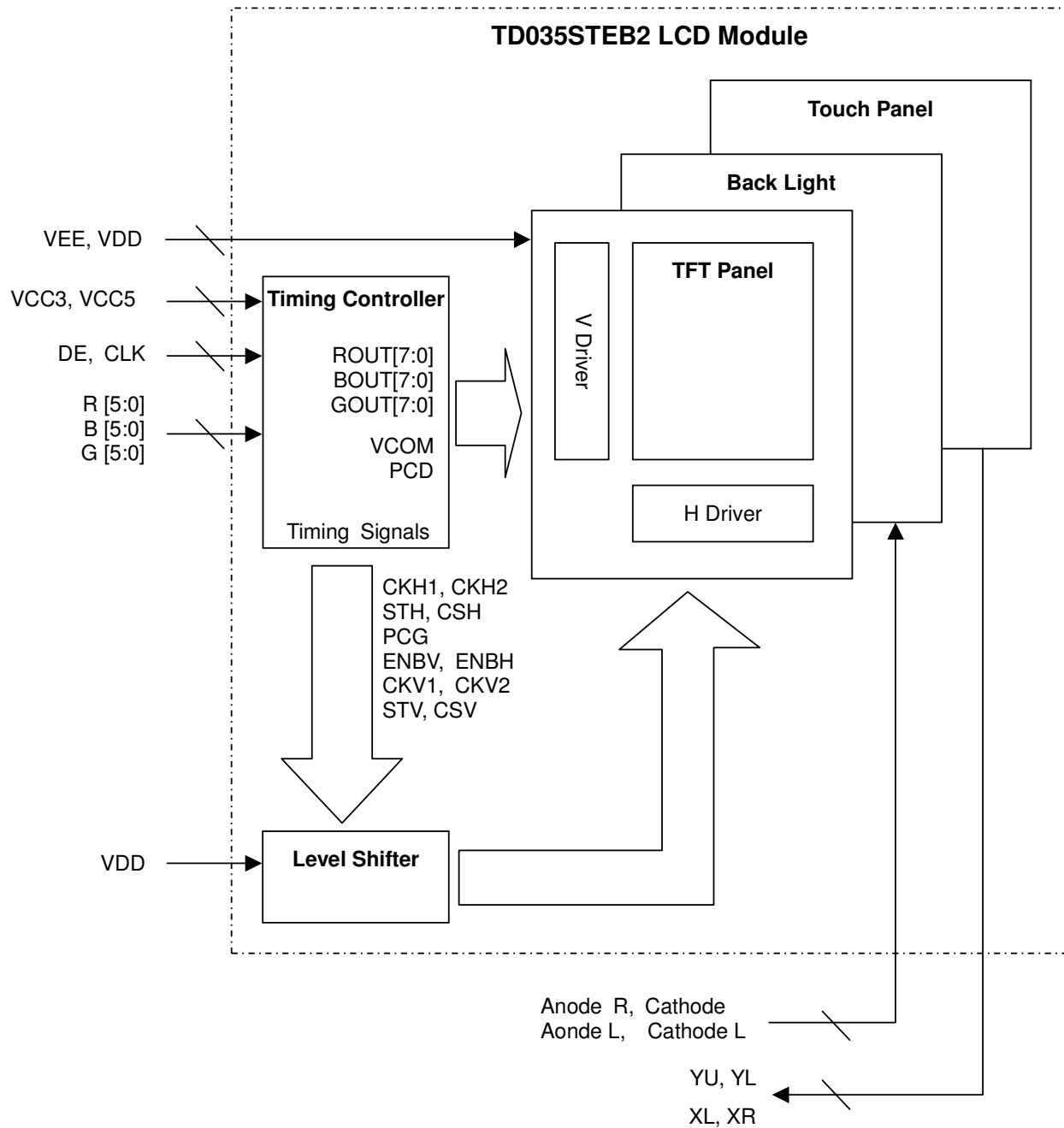
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Resistor between terminals (XR-XL)	R _x	250	-	1100	Ω	
Resistor between terminals (YU-YL)	R _y	200	-	700	Ω	
Operation Voltage	V _{Touch}	-	5	-	V	DC
Line Linearity (X direction)	-	-1.5	-	+1.5	%	
Line Linearity (Y direction)	-	-1.5	-	+1.5	%	
Chattering	-	-	-	10	ms	
Minimum force for linearity test	-	80	-	-	g	
Minimum tension for detecting	-	20	-	-	g	
Insulation Resistance	R _i	20	-	-	MΩ	At DC 25V

5.5 Grounding resistance

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Resistor between terminals and shield case	R	-	-	10	Ω	Note 1

Note 1. Terminal defined as pin 60

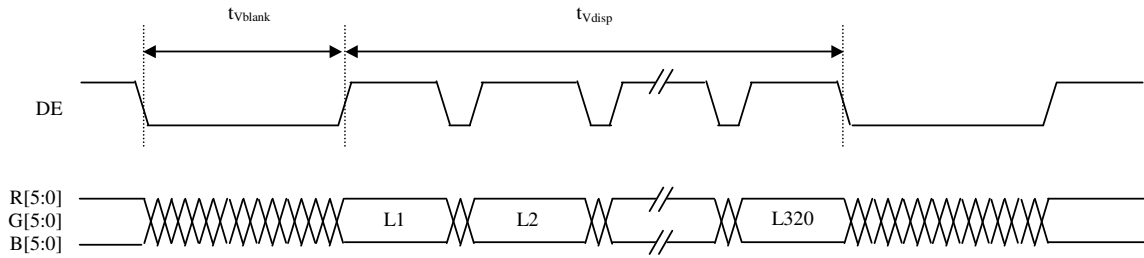
6. BLOCK DIAGRAM



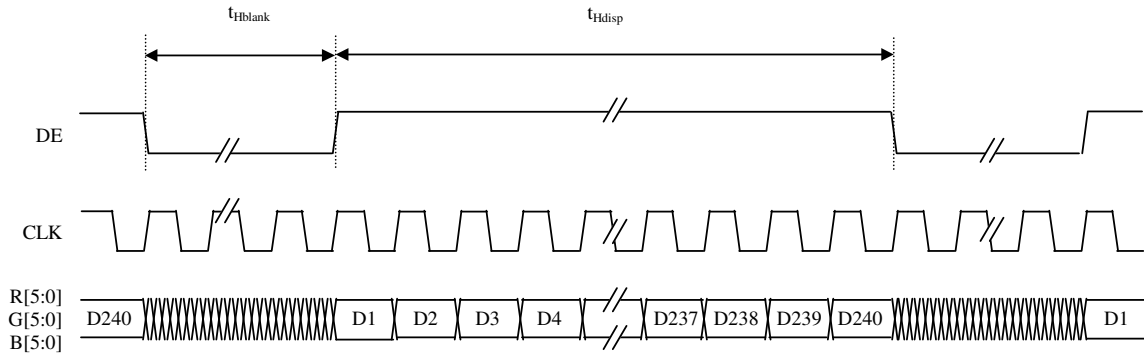
7. TIMING CHART

7.1 Display timing

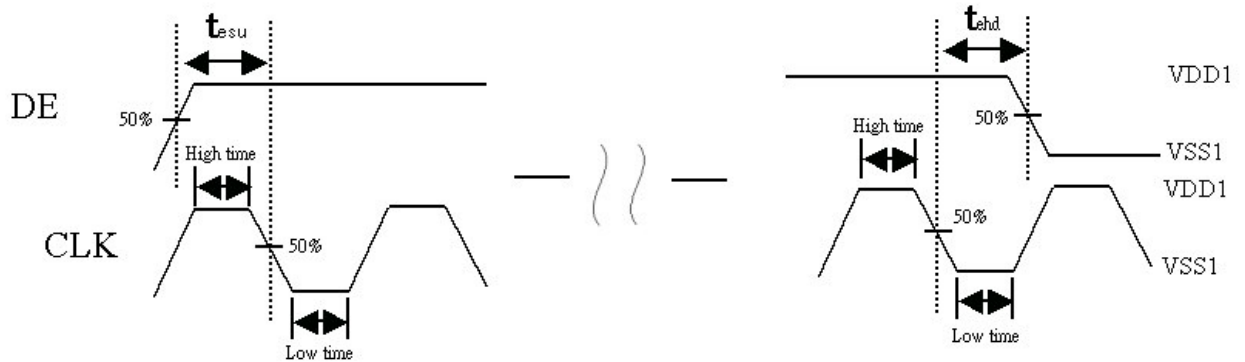
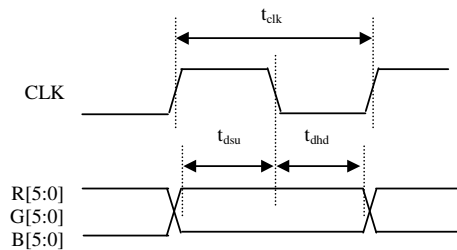
Item	Symbol	MIN	TYP	MAX	Unit
Vertical Display Active	t_{vdisp}	-	320	-	$t_{h_display}+t_{h_blank}$
Vertical Blank Time	t_{vblank}	7	13	22	$t_{h_display}+t_{h_blank}$
Horizontal Display Active	t_{Hdisp}	-	240	-	clk
Horizontal Blank Time	t_{Hblank}	79	80	100	clk
DE Setup Time	t_{esu}	5	-	-	ns
DE Hold Time	t_{ehd}	10	-	-	ns
Clock frequency	f_{clk}	6.0	6.4	7.1	MHz
Data Setup Time	t_{dsu}	5	-	-	ns
Data Hold Time	t_{dhd}	10	-	-	ns



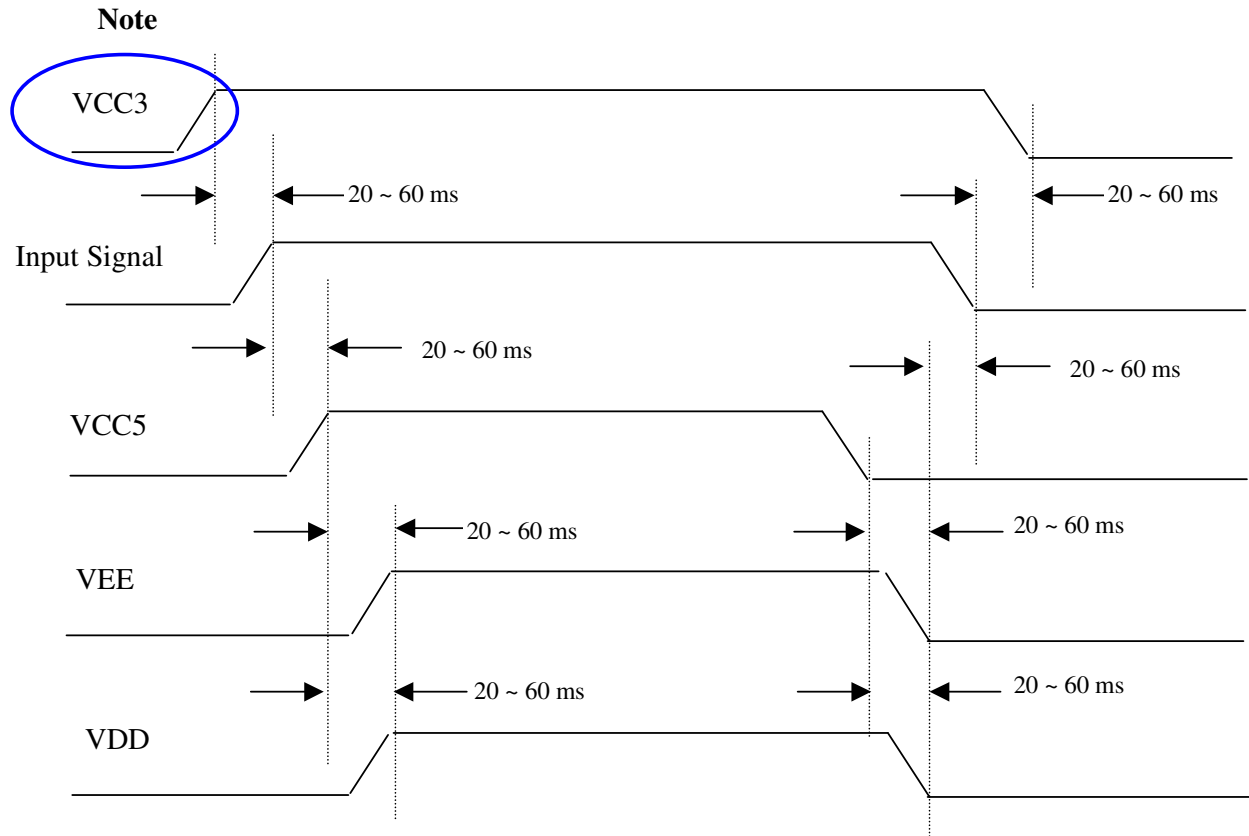
Vertical Timing



Horizontal Timing



8. POWER SEQUENCE



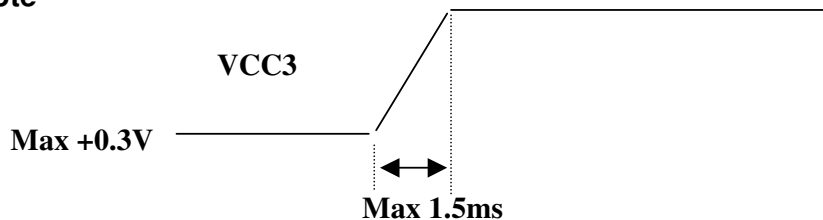
The power on sequence: VCC3 → Input Signal → VCC5 → VEE
→ VDD

VEE and VDD are powered on in the same time

The power off sequence: VCC5 → VDD → Input Signal → VCC3
→ VEE

VEE and VDD are powered off in the same time

Note



9. OPTICAL CHARACTERISTICS

9.1 Optical Specification

(1) Back light Off / w Touch panel

Ta=25°C

Item	Symbol		Condition	MIN	TYP	MAX	Unit	Remarks
Viewing Angles	Θ11		CR ≥ 2	40	50	-	Degree	Note 9-1
	Θ12			40	50	-		
	Θ21			45	55	-		
	Θ22			45	55	-		
Chromaticity	Red	x	Θ=0°	0.31	0.36	0.41	-	Note 9-3
		y		0.26	0.31	0.36		
	Green	x		0.28	0.33	0.38		
		y		0.29	0.34	0.39		
	Blue	x		0.25	0.3	0.35		
		y		0.24	0.29	0.34		
	White	x		0.28	0.33	0.38		
		y		0.28	0.33	0.38		
Contrast Ratio	CR		Θ=10°	7:1	10:1	-	-	Note 9-2
Reflectivity	R		Θ=10°	10	15	-	%	Note 9-4

(2) Back Light On /w Touch panel

Ta=25°C

Item	Symbol		Condition	MIN	TYP	MAX	Unit	Remarks
Viewing Angles	Θ_{11}		$CR \geq 2$	45	60	-	Degree	Note 9-1
	Θ_{12}			35	45	-		
	Θ_{21}			35	45	-		
	Θ_{22}			45	60	-		
Response Time	Tr		$\Theta=0^{\circ}$	-	10	17	ms	Note 9-5
	Tf		$\Theta=0^{\circ}$	-	15	23	ms	
Contrast Ratio	CR		$\Theta=0^{\circ}$	60:1	80:1	-	-	Note 9-6
Luminance	L		$\Theta=0^{\circ}$ $I_F=20mA$	80	100	-	cd/m ²	Note 9-7
NTSC	-		-	32	39	-	%	Note 9-7
Uniformity	-		-	70	80	-	%	Note 9-8
Chromaticity	Red	x	$\Theta=0^{\circ}$	0.49	0.54	0.59	-	Note 9-3
		y		0.29	0.34	0.39		
	Green	x		0.27	0.32	0.37		
		y		0.51	0.56	0.61		
	Blue	x		0.12	0.17	0.22		
		y		0.09	0.14	0.19		
	White	x		0.26	0.31	0.36		
		y		0.28	0.33	0.38		

9.2 Basic measure condition

(1) Driving voltage

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VDD= 12.0V, VEE=-6.5V

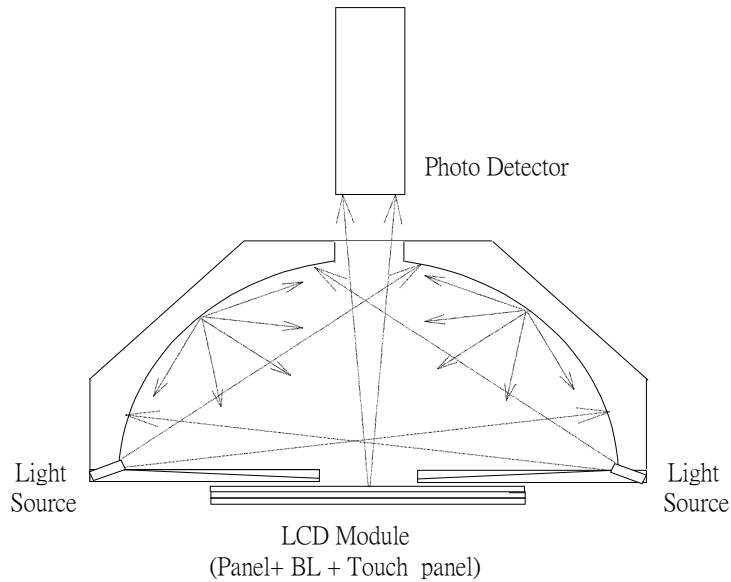
(2) Ambient temperature: $T_a=25^{\circ}\text{C}$

(3) Testing point: measure in the display center point and the test angle $\Theta=0^{\circ}$

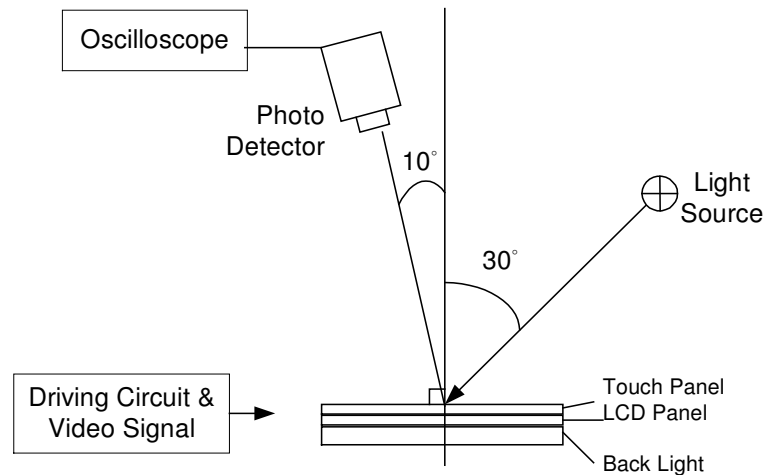
(4) Testing Facility

Environmental illumination: ≤ 10 Lux

a. System A

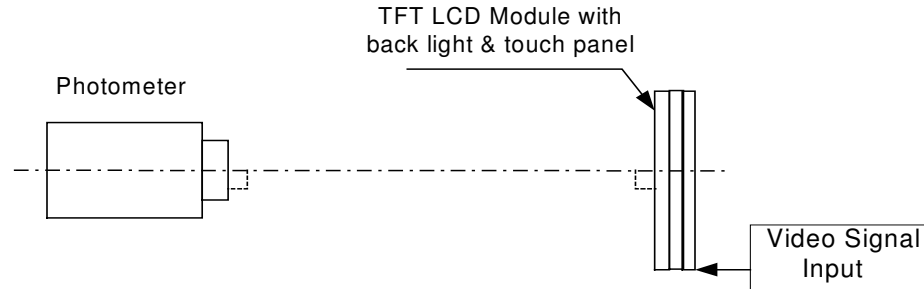


b. System B

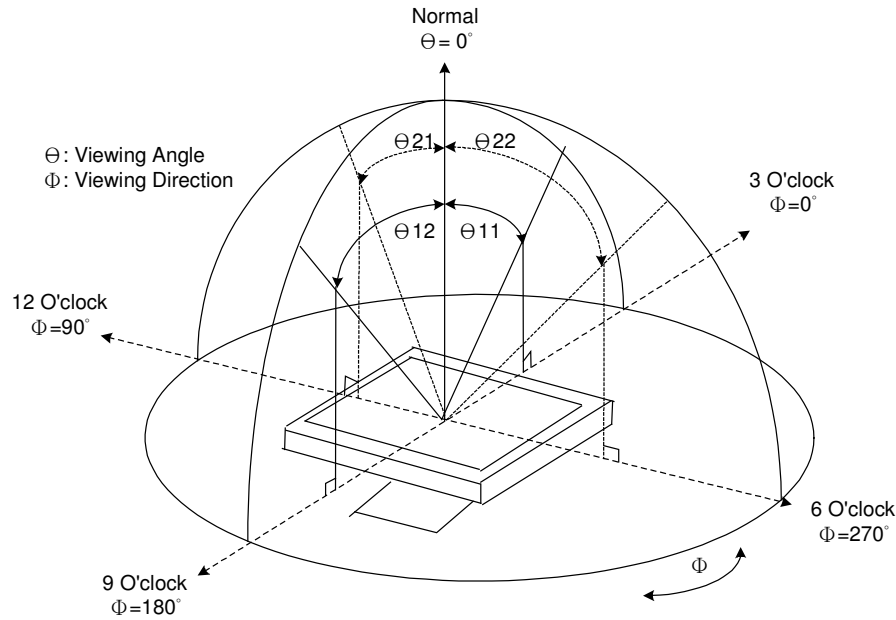


c. System C

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Note 9-1: Viewing angle diagrams (Measure System B)



Note 9-2: Contrast ratio in back light off (Measure System B)

Contrast Ratio is measured in optimum common electrode voltage.

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

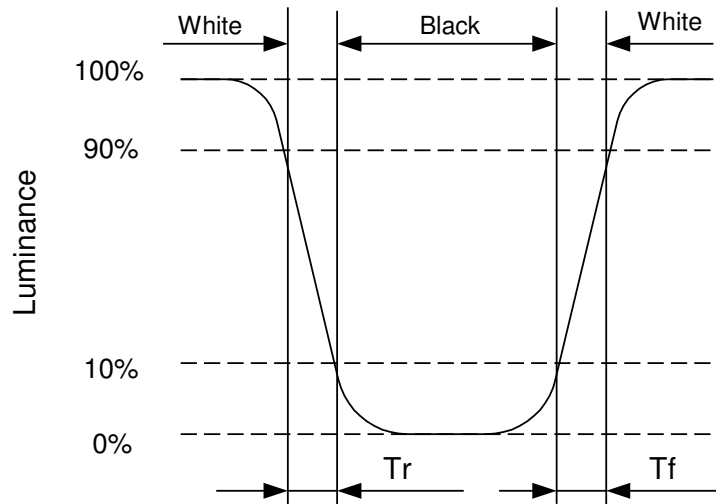
Note 9-3: White chromaticity as back light off: (Measure System A)

Note 9-4: Reflectivity (R) (Measure System B)

In the measuring system B. calculate the reflectance by the following formula.

$$\text{Reflectivity}(R) = \frac{\text{Output from the white display panel}}{\text{Output from the reflectance standard}} \times \text{Reflectance factor of reflectance standard}$$

Note 9-5: Definition of response time: (Measure System C)



Note 9-6: Contrast Ratio in back light On (Measure System C)

Contrast Ratio is measured in optimum common electrode voltage.

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

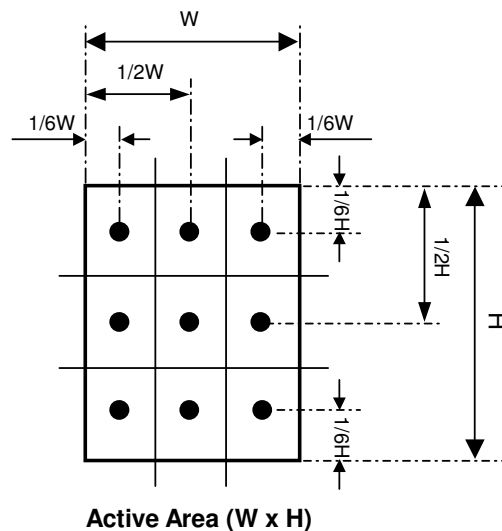
Note 9-7: Luminance: (Measure System C)

Test Point: Display Center

Note 9-8: Uniformity (Measure System C)

The luminance of 9 points as the black dot in the figure shown below are measured and the uniformity is defined as the formula:

$$\text{Uniformity} = \frac{\text{The minimum luminance among 9 points}}{\text{The maximum luminance among 9 points}}$$



10. HANDLING CAUTION

11.1 ESD (Electrical Static Discharge) strategy

ESD will cause serious damage of the panel, ESD strategy is very important in handling. Following items are the recommend ESD strategy

- (1) In handling LCD panel, please wear non-charged material gloves. And the conduction ring connect wrist to the earth and the conducting shoes to the earth is necessary.
- (2) The machine and working table for the panel should have ESD prohibition strategy.
- (3) In handling the panel, ionize flowing decrease the charge in the environment is necessary.
- (4) In the process of assembly the module, shield case should connect to the ground.

11.2 Environment

- (1) Working environment of the panel should in the clean room.
- (2) Because touch panel has protective film on the surface, please remove the protection film slowly with ionized air to prevent the electrostatic discharge.

11.3 Touch panel

- (1) The front touch panel is vulnerable to heavy weight, so any input must be done by special stylus or by a finger. Do not put any heavy stuff on it.
- (2) When any dust or stain is observed on a film surface, clean it using a lens cleaner for glasses or something similar.

11.4 Others

- (1) Turn off the power supply before connecting and disconnecting signal input cable.
- (2) Because the connection area of FPC and panel is not so strong, do not handle panel only by FPC or bend FPC.
- (3) Water drop on the surface or condensation as panel power on will corrode panel electrode.
- (4) As the packing bag open, watch out the environment of the panel storage. High temperature and high humidity environment is prohibited.
- (5) In the case the TFT LCD module is broken, please watch out whether liquid crystal leaks out or not. If your hand touches liquid crystal, wash your hands cleanly with water and soap as soon as possible

11.5 Designing note on touch panel

- (1) Explanation of each boundary of touch panel

A. Boundary of Double-sided adhesive

- a. Electrically detectable within this zone.

When holding the touch panel by housing, it needs to be held at outside of this zone.

- b. Film is supported by double-sided adhesive tape.

B. Viewing area

- a. Cosmetic inspection to be done for this area.

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This area is set as inside of boundary of double-sided adhesive with tolerance.

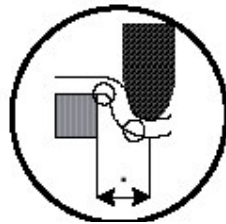
C. Boundary of transparent insulation

- Purpose is to "Help" to secure insulation.
- Electrical insulation on this area is not guaranteed.
- We do recommend not to hold by something like housing or gasket.

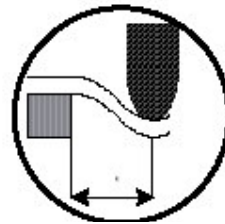
D. Active area

- This area is where the performance is guaranteed.

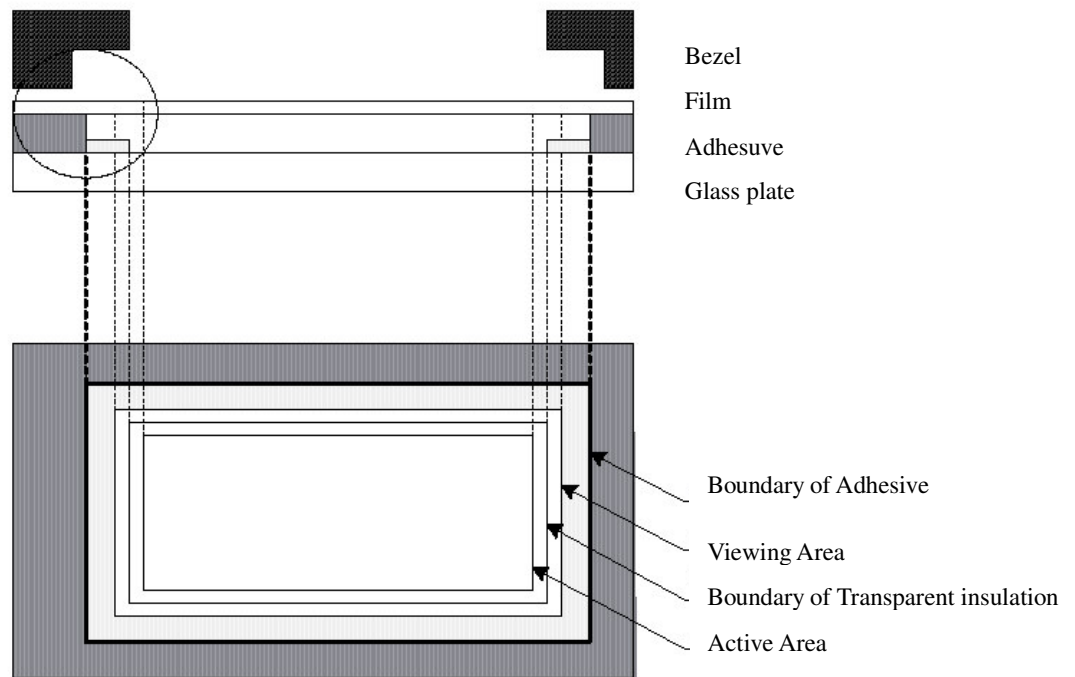
This area set as 2.3mm inside from the boundary area of double-sided adhesive tape since its neighboring area is less durable to writing friction.



There is some possibility to damage ITO

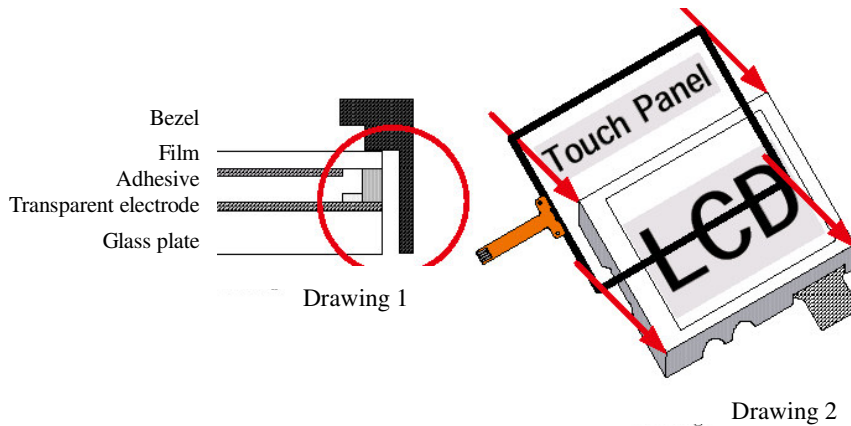


No Damage to ITO

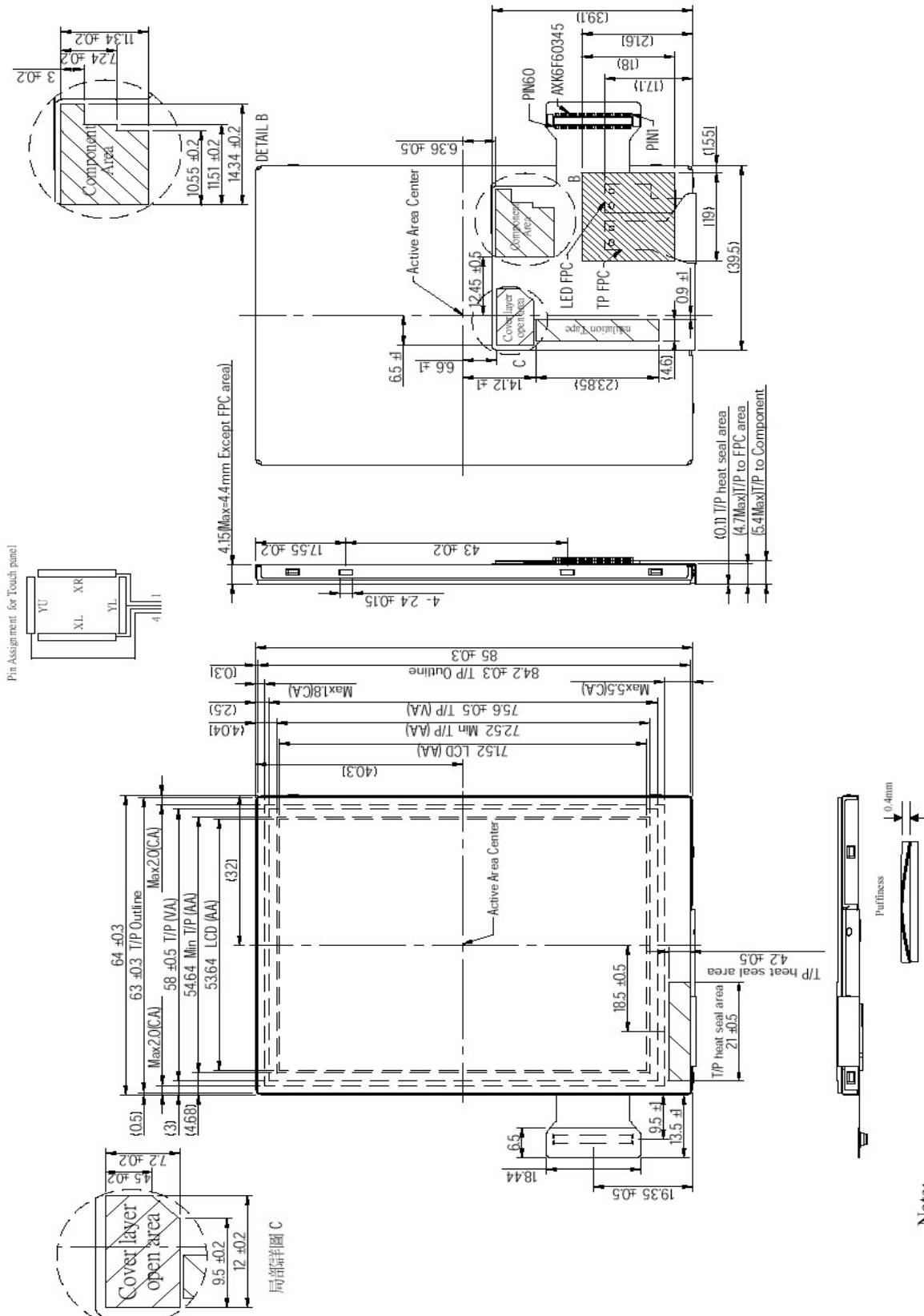


(2) Housing and touch panel

- a. Please have clearance between side of touch panel, and any conductive material such as metal frame. (Drawing.1) Transparent electrode exists on glass of touch panel from end to end.
- b. It is recommend to fix a touch panel on the LCD chassis rather than housing
Clinging conductive material and side of touch panel might cause the malfunction.



11. MECHANICAL DRAWING



Note:

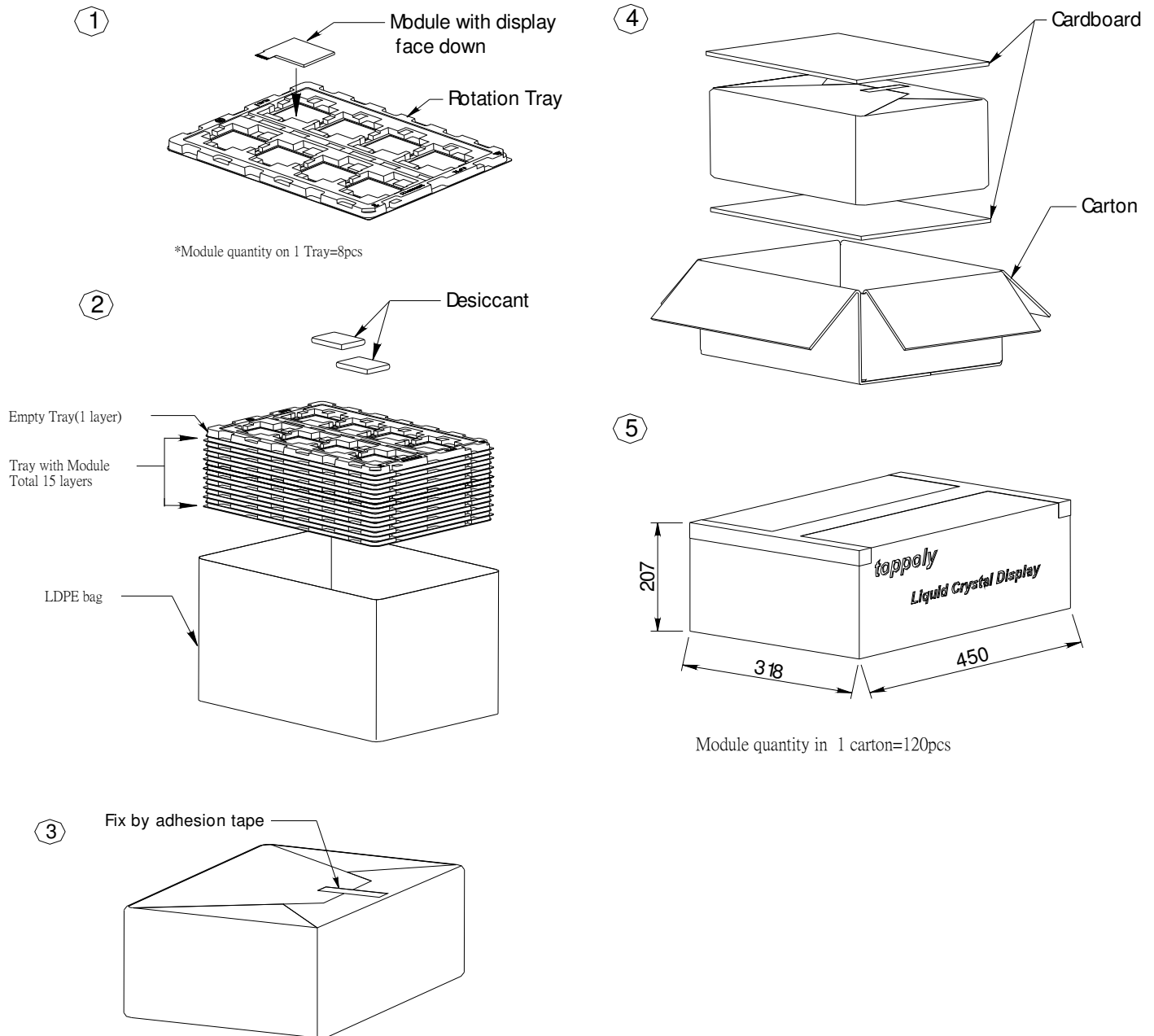
1. General tolerance is ± 0.5
2. Touch Panel Puffiness Max=0.4mm

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12. PACKING DRAWING



TD035STEB2 module delivery packing method

- (1). Module packed into tray cavity with display face down.
- (2). Tray stacking with 15 layers and with 1 empty tray above the stacking tray unit.
2 pcs desiccant put above the empty tray.
- (3). Stacking tray unit put into the LDPE bag and fix by adhesive tape.
- (4). Put 1pc cardboard inside the carton bottom, then pack the finished package into the carton.

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