

***Preliminary***

Ver. 030

# TFT LCD Specification

## Model NO.: TD035STEB1

<b>Customer Signature</b>
Date

This technical specification is subjected to change without notice

The information contained herein is the exclusive property of toppoly Optoelectronics corporation, and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of toppoly Optoelectronics corporation.

## Table of Contents

<b>NO.</b>	<b>Item</b>	<b>Page</b>
	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	10
7	Interface Timing	11
8	Power Sequence	13
9	Optical Characteristics	14
10	Reliability	18
11	Handling Cautions	19
12	Mechanical Drawing	22
13	Packing Drawing	23

## Record of Reversion

Rev	Issued Date	Description
0.00	OCT, 25, 2002	New
0.01	DEC,11,2002	3.3 Back light pin assignment 5.2 ELECTRICAL CHARACTERISTICS 5.3 Touch panel resistance data Rx : 200 ~ 700 → 250 ~ 1100 Ry ; 250 ~ 1100 → 200 ~ 700 8. 60 ns → 60 ms 13. Add package drawing
0.20	Mar, 11, 2003	Change Product Lifecycle
0.21	Jun, 17, 2003	3.1 Add Recommend connector: HRS FH12-50S-0.5SH(CL586-0529-2) 5.1 VDD Voltage Min 11.7 V → 11.1 V Type 12V → 11.7V 5.1 New add VCC3 min current: : 2 mA VCC5 min current : 5.3 mA VDD min current : 1.0 mA VVEE min current : 9uA 9.1 Luminance 70 nit → 100 nit Reflectivity 20% → 15% Add NTSC spec : 35% 12. Mechanical drawing update : Ver 1.0 → 1,2
0.3	Jul, 17, 2003	5.1 VCC3 Supply Current → Min 1.7, TYP 1.9, Max 3 VCC5 Supply Current → Min 5, TYP 5.5, Max 6.5 VDD Supply Current → Min 0.9, TYP 1.0, Max 2 VEE Supply Current → Min 8, TYP 10, Max 20 7.1 Add Timing Max & Min value DE Inactive to CLK Rising Edge → TYP 10, Max 15 DE Active to CLK Rising Edge → TYP 10, Max 15 Data Setup Time → TYP 10, Max 15 Data Hold Time → TYP 15, Max 20 Clock frequency → Min 6.2, TYP 6.4, Max 7.1 Clock period → Min 161, TYP 156.25, Max 140.8 9.1 View angle T 11 → Min 40 View angle T 12 → Min 40 View angle T 21 → Min 45 View angle T 22 → Min 45

		<p>Contrast ratio → Min 7:1, TYP 10:1</p> <p>Reflectivity → Min 7</p> <p>9.2 View angle T 11 → Min 45, TYP 60</p> <p>View angle T12 → Min 35</p> <p>View angle T21 → Min 35</p> <p>View angle T22 → Min 45, TYP 60</p> <p>Response Time Tr → Typ 10, Max 17</p> <p>Response Time Tf → Typ 15, Max 23</p> <p>Contrast ratio → Min 55:1, TYP 80:1</p> <p>Luminance → Min 80</p> <p>NTSC → Min 32, TYP 39</p> <p>Uniformity → Typ 80</p> <p>12 Mechanic drawing → Ver. 1.4</p>

**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		42	g
Power consumption	LCD Panel + T-CON + L/S	50 (Typ)	mW
	Backlight	432 (Typ, I <sub>F</sub> = 20mA)	

\* Exclude FPC and protrusions.

### 3. INPUT/OUTPUT TERMINALS

#### 3.1 TFT LCD module

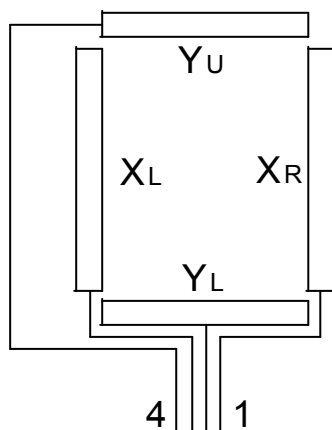
Recommend connector: HRS FH12-50S-0.5SH(CL586-0529-2)

Pin	Symbol	I/O	Description	Remark
1	VDD	-	Supply voltage for H/V driver (+ 12V)	
2	DE	I	Data enable	
3	NC	-	No connection (leave this pin open)	
4	NC	-	No connection (leave this pin open)	
5	GND	-	Ground	
6	VEE	-	Supply voltage for V driver (-6.5V)	
7	GND	-	Ground	
8	NC	-	No connection (leave this pin open)	
9	R0	I	Video data red 0 (LSB)	
10	R1	I	Video data red 1	
11	R2	I	Video data red 2	
12	R3	I	Video data red 3	
13	R4	I	Video data red 4	
14	R5	I	Video data red 5 (MSB)	
15	G0	I	Video data green 0 (LSB)	
16	G1	I	Video data green 1	
17	G2	I	Video data green 2	
18	G3	I	Video data green 3	
19	G4	I	Video data green 4	
20	G5	I	Video data green 5 (MSB)	
21	B0	I	Video data blue 0 (LSB)	
22	B1	I	Video data blue 1	
23	B2	I	Video data blue 2	
24	B3	I	Video data blue 3	
25	B4	I	Video data blue 4	
26	B5	I	Video data blue 5 (MSB)	
27	NC	-	No connection (leave this pin open)	
28	NC	-	No connection (leave this pin open)	
29	NC	-	No connection (leave this pin open)	
30	CLK	I	Video data clock	
31	NC	-	No connection (leave this pin open)	
32	NC	-	No connection (leave this pin open)	
33	VCC5	-	Supply voltage for 5V logic	

34	VCC5	-	Supply voltage for 5V logic	
35	NC	-	No connection (leave this pin open)	
36	NC	-	No connection (leave this pin open)	
37	VCC3	-	Supply voltage for 3.3V logic	
38	VCC3	-	Supply voltage for 3.3V logic	
39	NC	-	No connection (leave this pin open)	
40	NC	-	No connection (leave this pin open)	
41	GND	-	Ground	
42	Anode R	-	LED Power Supply (+)	
43	Cathode R	-	LED Power Supply (-)	
44	Anode L	-	LED Power Supply (+)	
45	Cathode L	-	LED Power Supply (-)	
46	GND	-	Ground	
47	XR	-	Touch Panel Right Side Pin	
48	YL	-	Touch Panel Lower Side Pin	
49	XL	-	Touch Panel Left Side Pin	
50	YU	-	Touch Panel Upper Side Pin	

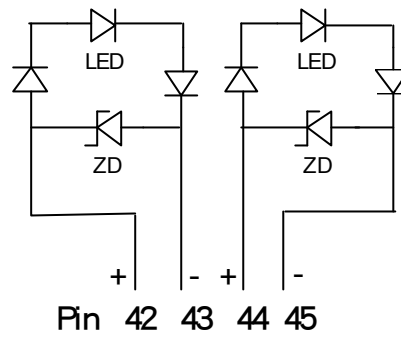
### 3.2 Touch panel Pin

Touch Panel Pin	Module Pin	Symbol	Description	Remark
1	47	XR	Touch Panel Right Side	
2	48	YL	Touch Panel Lower Side	
3	49	XL	Touch Panel Left Side	
4	50	YU	Touch Panel Upper Side	



Pin Assignment for Touch Panel

### 3.3 Back light pin assignment



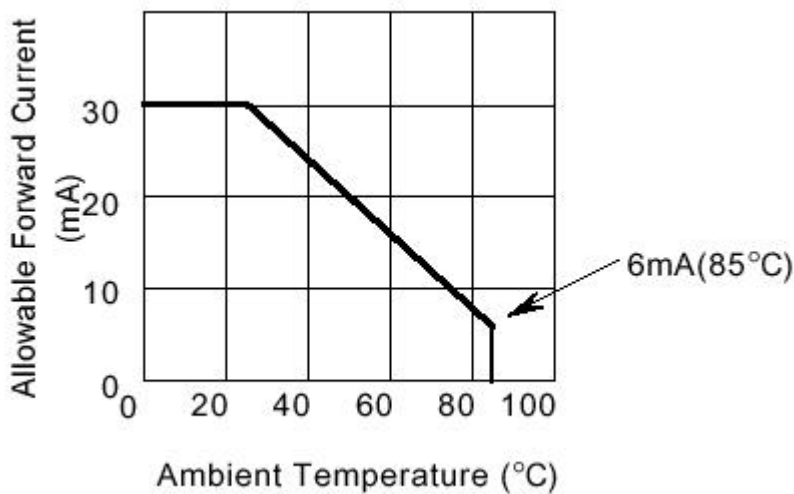


4. ABSOLUTE MAXIMUM RATINGS

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	VCC3	-0.3	4	V	
	VCC5	-0.3	6	V	
Power Supply for HV Driver	VDD	-1.0	+14	V	
	VEE	-7.5	-5.0	V	
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 ( $T_a=25^{\circ}C$ )	$I_F$	-	30	mA	Note1
Operating Temperature	$T_{opr}$	-10	+55	$^{\circ}C$	
Storage Temperature	$T_{stg}$	-20	+70	$^{\circ}C$	

Note1. 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	-	V	R[5:0], G[5:0], B[5:0], CLK DE
	Low	VIL	0	-		
VCC3 Supply Current	$I_{VCC3}$	1.7	1.9	3	mA	Note 1
VCC5 Supply Current	$I_{VCC5}$	5	5.5	6.5	mA	
VDD Supply Current	$I_{VDD}$	0.9	1.0	2	mA	
VEE Supply Current	$I_{VEE}$	8	10	20	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)



### 5.2 Driving backlight Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	$I_F$	-	20	30	mA	LED/Part
Forward Current Voltage	$V_F$	-	3.6	3.9	V	$I_F$ : 20mA LED/Part

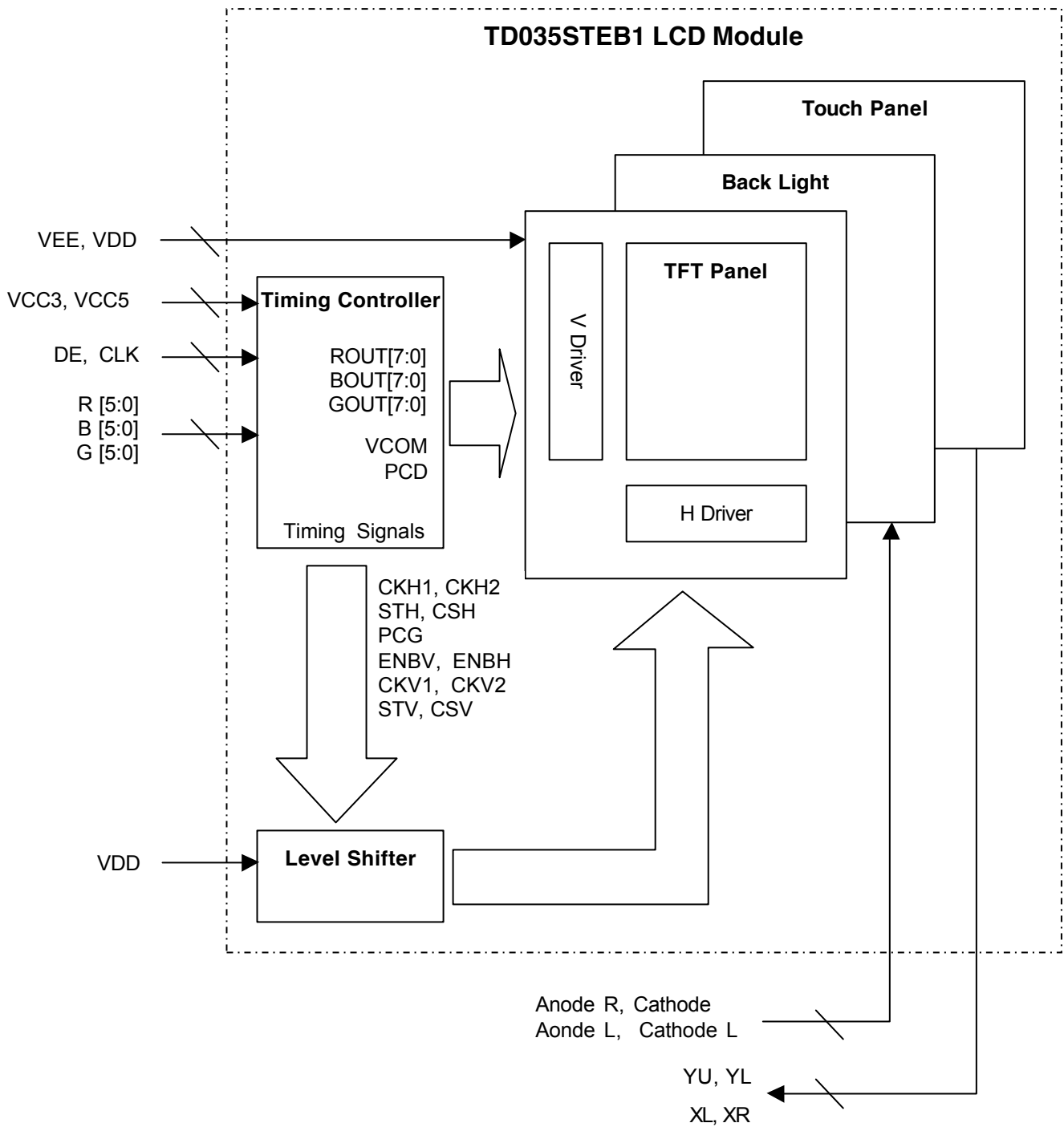
Note : Backlight driving circuit is recommend as the fix current circuit.

### 5.3 Driving touch panel (Analog resistance type)

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Resistor between terminals (XR-XL)	Rx	250	-	1100	$\Omega$	
Resistor between terminals (YU-YL)	Ry	200	-	700	$\Omega$	
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 tension for detecting	-	-	-	80	g	
Insulation Resistance	Ri	20	-	-	M $\Omega$	At DC 25V

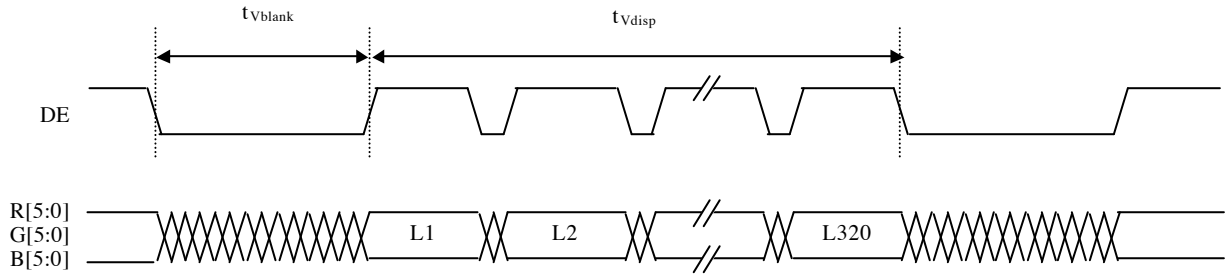
6 BLOCK DIAGRAM



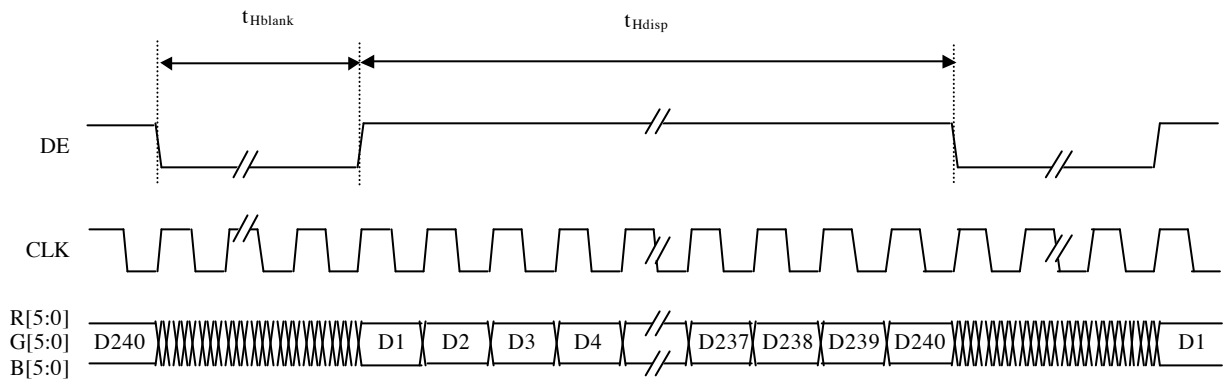
## 7 TIMING CHART

### 7.1 Display timing

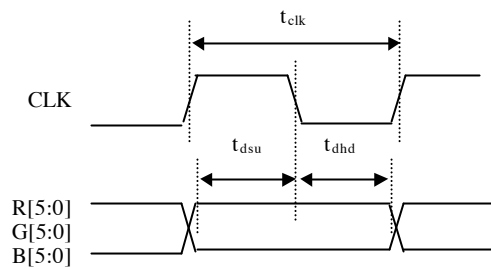
Item	Symbol	MIN	TYP	MAX	Unit
Vertical Display Active	$t_{Vdisp}$	320	320	320	ns
Vertical Blank Time	$t_{Vblank}$	7	13	22	ns
Horizontal Display Active	$t_{Hdisp}$	240	240	240	ns
Horizontal Blank Time	$t_{Hblank}$	79	80	100	ns
DE Inactive to CLK Rising Edge	$t_{dei}$	6	10	15	ns
DE Active to CLK Rising Edge	$t_{dea}$	6	10	15	ns
Clock frequency	$f_{clk}$	6.2	6.4	7.1	MHz
Clock Period	$t_{clk}$	161	156.25	140.8	ns
Data Setup Time	$t_{dsu}$	5	10	15	ns
Data Hold Time	$t_{dhd}$	10	15	20	ns



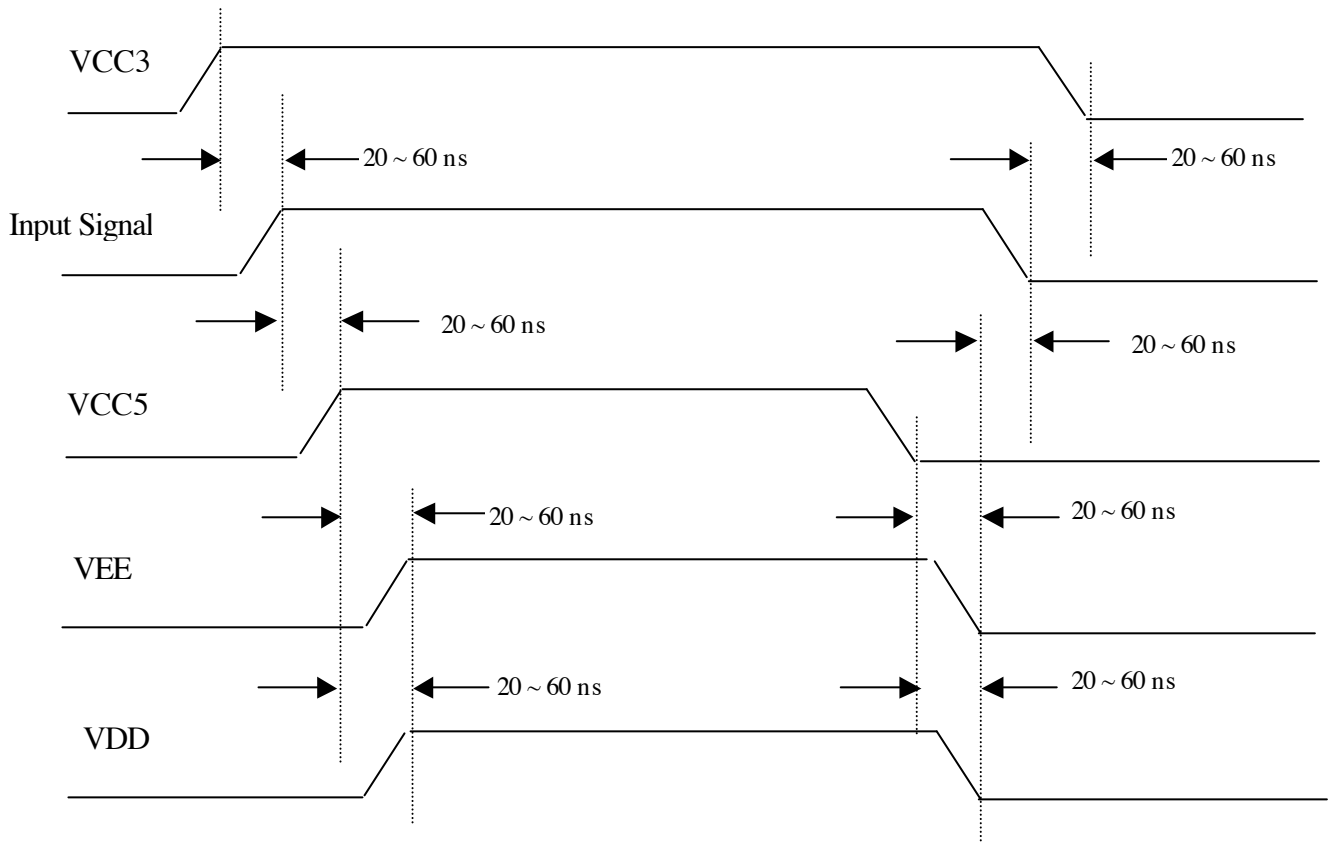
**Vertical Timing**



**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**

## 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	T 11	CR = 2	40	50	-	Degree	Note 9-1
	T12		40	50	-		
	T21		45	55	-		
	T22		45	55	-		
Contrast Ratio	CR	$\theta = 10^\circ$	7:1	10:1	-	-	Note 9-2
Reflectivity	R	$\theta = 10^\circ$	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	T 11	CR = 2	45	60	-	Degree	Note 9-1
	T12		35	45	-		
	T21		35	45	-		
	T22		45	60	-		
Response Time	Tr	$\theta = 0^\circ$	-	10	17	ms	Note 9-5
	Tf	$\theta = 0^\circ$	-	15	23	ms	
Contrast Ratio	CR	$\theta = 0^\circ$	55:1	80:1	-	-	Note 9-6
Luminance	L	$\theta = 0^\circ$ $I_F = 20\text{mA}$	80	100	-	cd/m <sup>2</sup>	Note 9-7
NTSC	-	-	32	39	-	%	Note 9-7
Uniformity	-	-	70	80	-	%	Note 9-8
Chromaticity	x	$\theta = 0^\circ$	0.26	0.31	0.36	-	Note 9-3
	y		0.28	0.33	0.38		

9.2 Basic measure condition

(1) Driving voltage

VDD= 12.0V, VEE=-6.5V

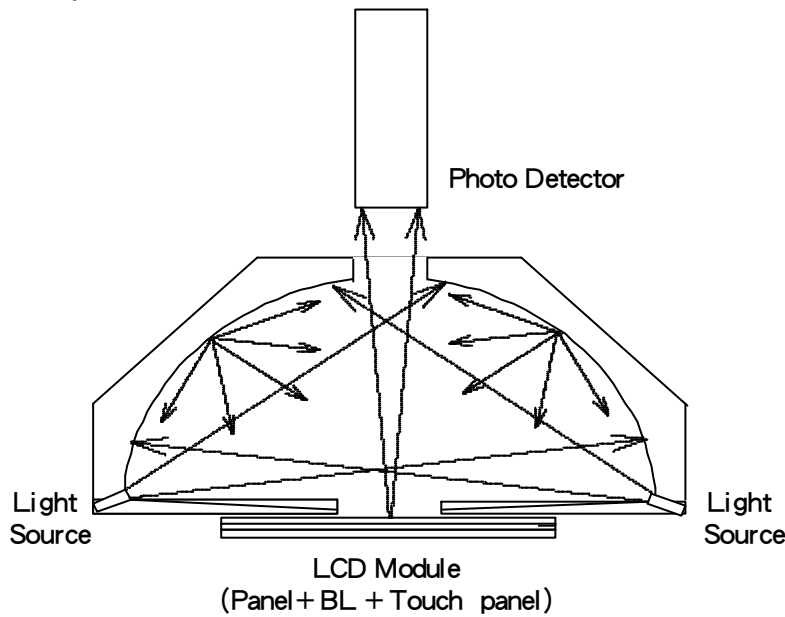
(2) Ambient temperature:  $T_a=25^{\circ}\text{C}$

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

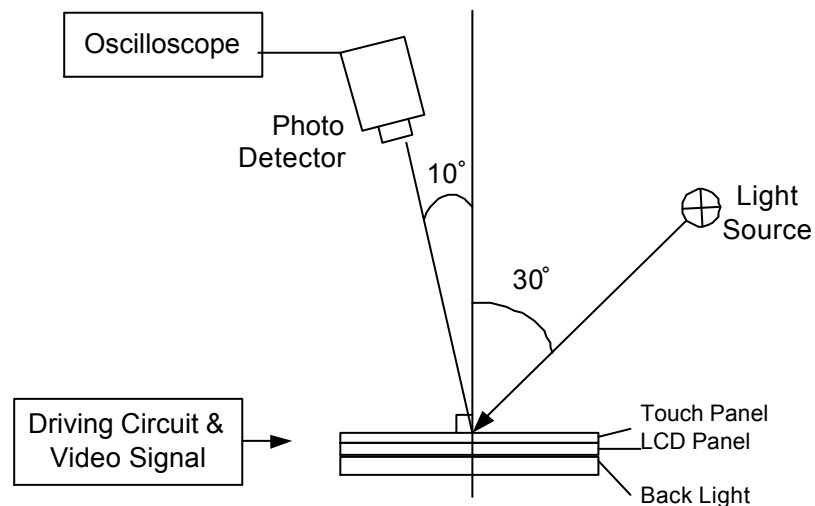
(4) Testing Facility

Environmental illumination: = 10 Lux

a. System A

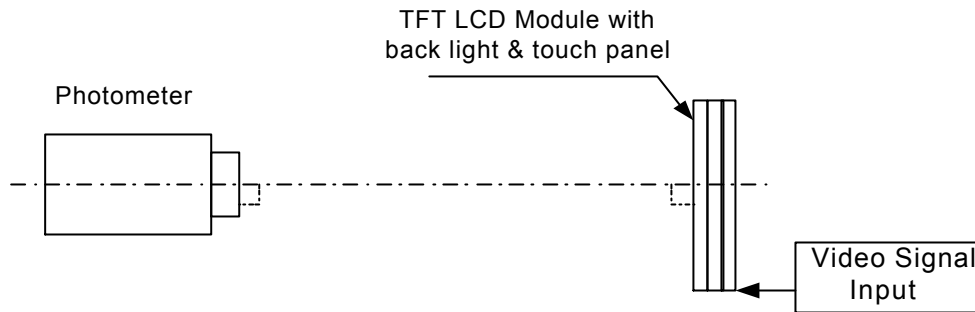


b. System B

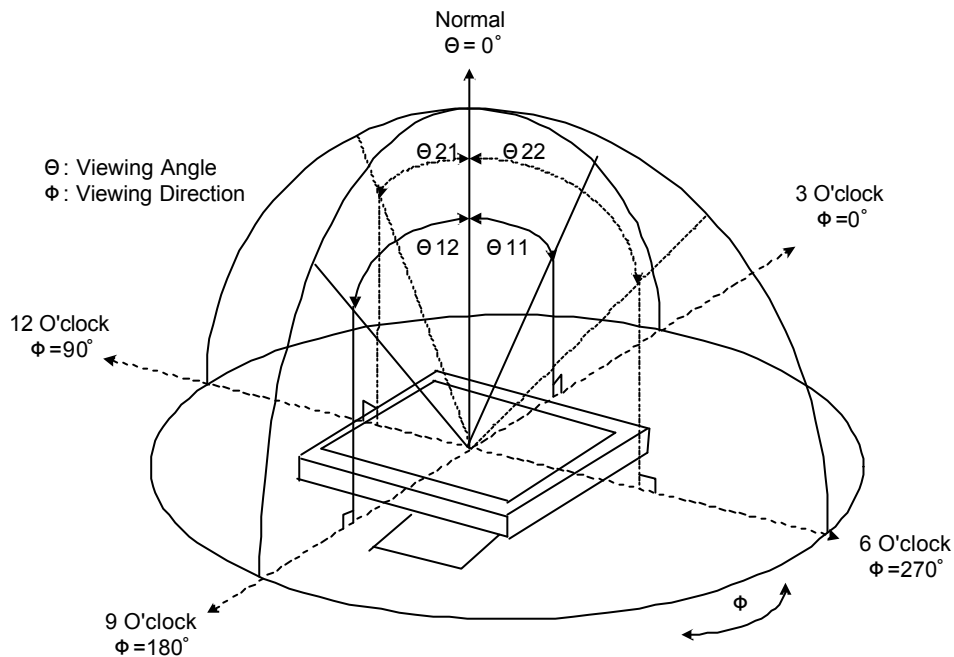




c. System C



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.

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

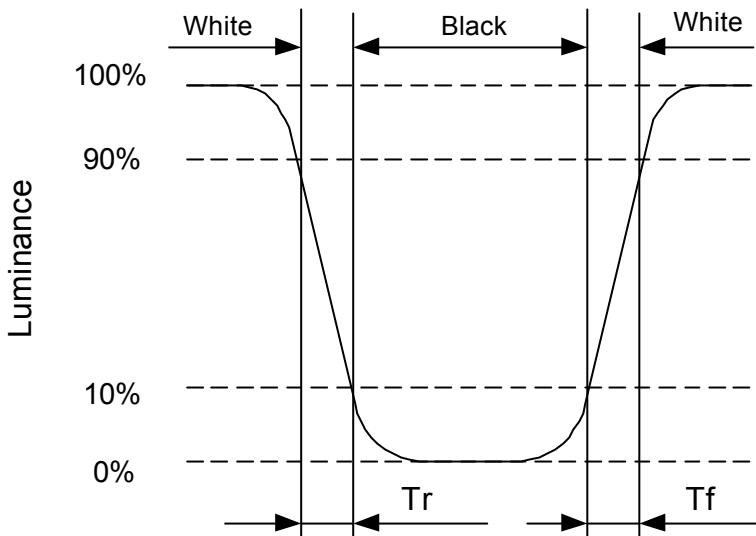
Note 9-3: White chromaticity as back light off: (Measure System A)

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.

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

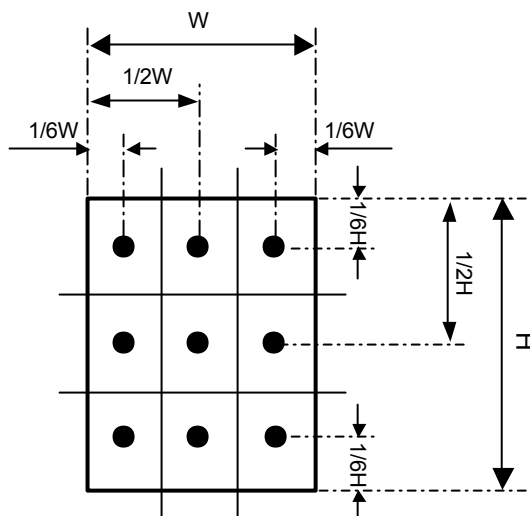
Note 9-7: Luminance: (Measure System C)

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:

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



Active Area (W x H)

**10 Reliability**

No	Test Item	Condition
1	High Temperature Operation	Ta=+55°C, 240hrs
2	High Temperature & High Humidity Operation	Ta=+40°C, 95% RH, 240hrs
3	Low Temperature Operation	Ta= -10°C, 240hrs
4	High Temperature Storage (non-operation)	Ta=+70°C, 240hrs
5	Low Temperature Storage (non-operation)	Ta= -20°C, 240hrs
6	Thermal Shock (non-operation)	-20°C ← → 70°C, 50 cycles 30 min 30 min
7	Resistance to Static Electricity Discharge (non-operation)	C=200pF, R=0 Ω; Discharge: ±150V 3 times / Terminal
8	Surface Discharge (non-operation) (LCD surface)	C=150pF, R=330 Ω; Discharge: Air: ±15kV; Contact: ±8kV 5 times / Point; 5 Points / Panel
9	Vibration (non-operation)	Frequency: 10~55Hz; Amplitude: 1.5mm Sweep Time: 11min Test Time: 2 hrs for each direction of X, Y, Z
10	Shock (non-operation)	Acceleration: 100G; Period: 6ms Directions: ±X, ±Y, ±Z; Cycles: Three times
11	Pin Activation Test (Touch Panel)	Hit 1,000,000 times with a silicon rubber of R8 HS 60. Hitting Force: 250g Hitting Speed: 3 time/sec
12	Writing Friction Resistance Test (Touch Panel)	Pen: 0.8R Polyacetal stylus Load: 250g Speed: 3 Strokes/sec Stroke: 35mm

## 11 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

「ㄨ. Boundary of Double-sided adhesive

- 。ㄗElectrically detectable within this zone.

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

- 。ㄗFilm is supported by double-sided adhesive tape.

「ㄣ. Viewing area

- 。ㄗCosmetic inspection to be done for this area.

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

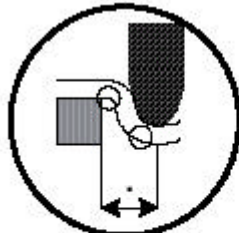
「Δ. Boundary of transparent insulation

- 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.

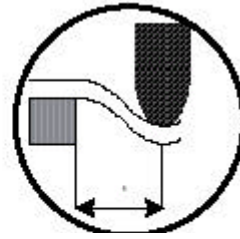
「λ. Active area

- This area is where the performance is guaranteed.

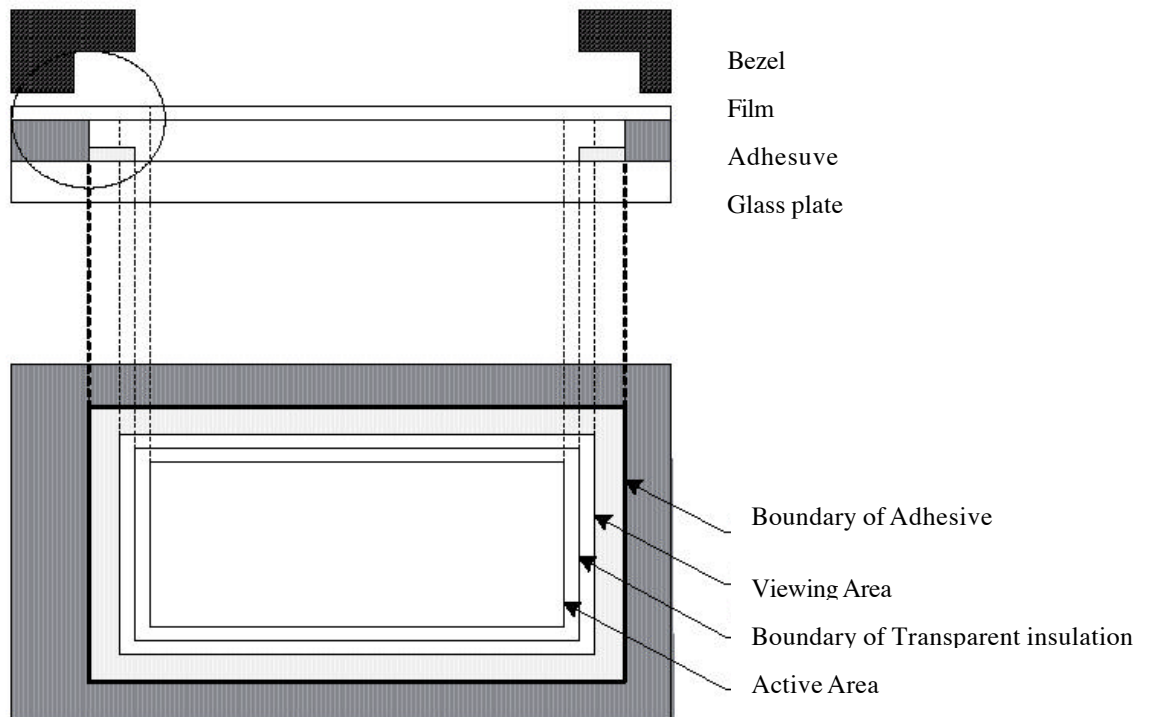
This area set as 2.3mm inside from the boundary area of double-sided adhesive tape since its neighboring area is less durable to writing friction.



There is some possibility to damage ITO

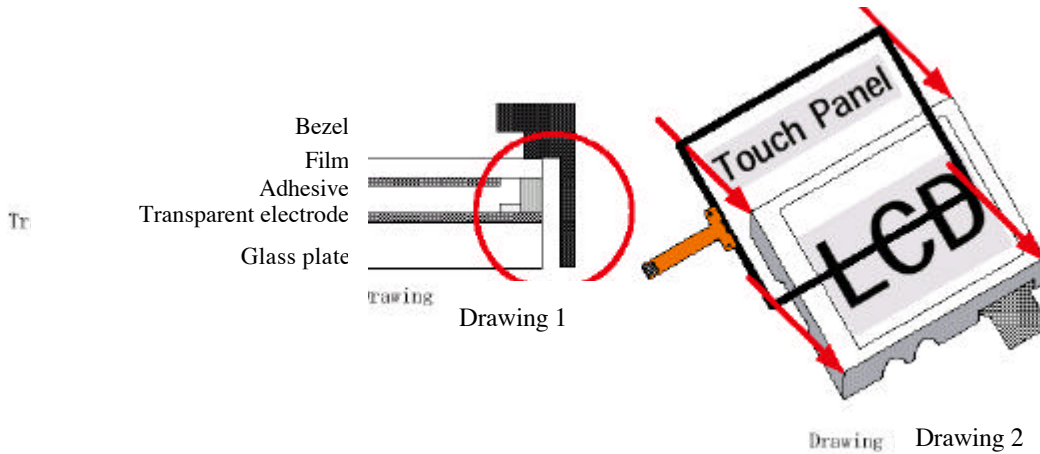


No Damage to ITO

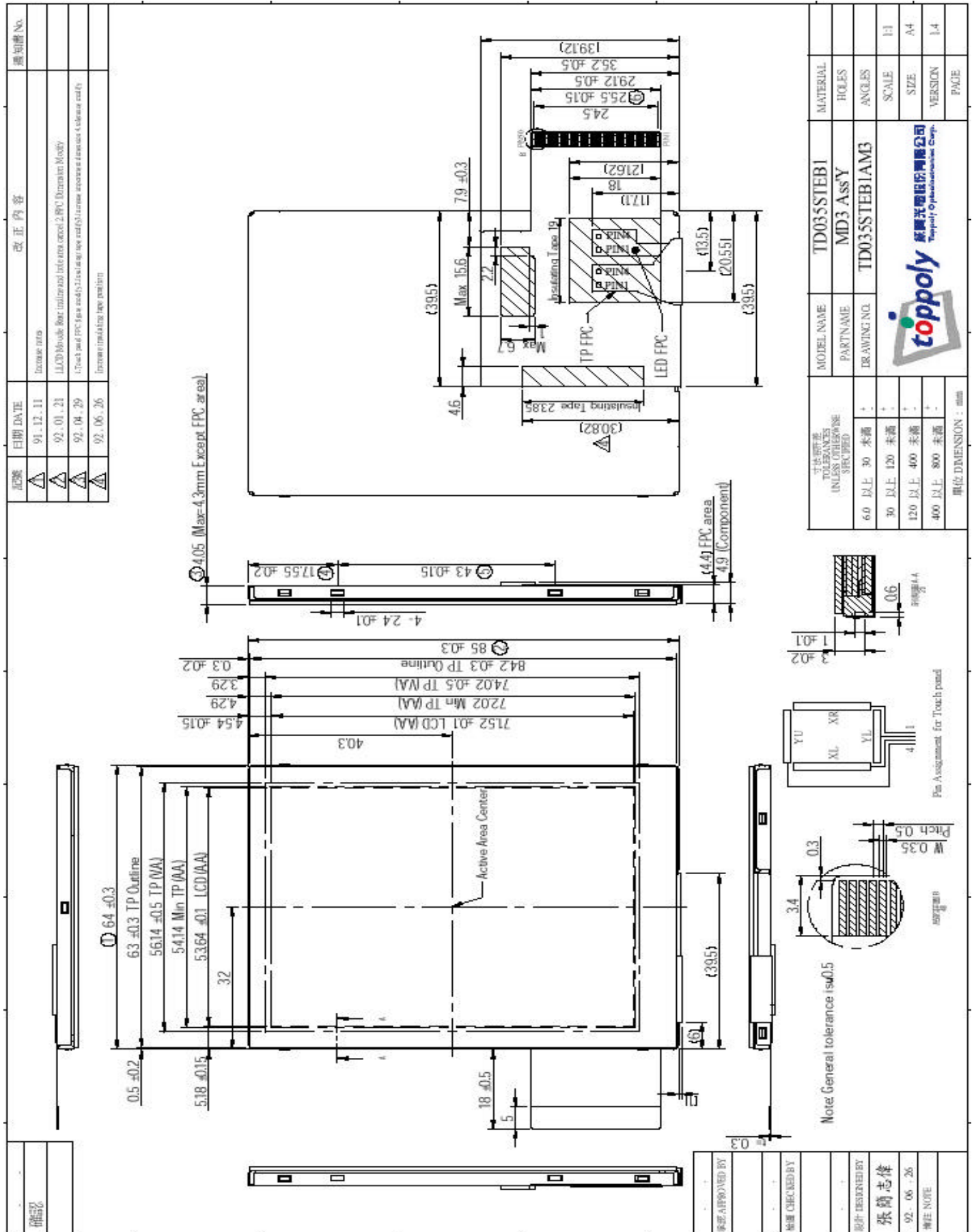


(2) Housing and touch panel

- o 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.
- o 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.



12 MECHANICALDRAWING

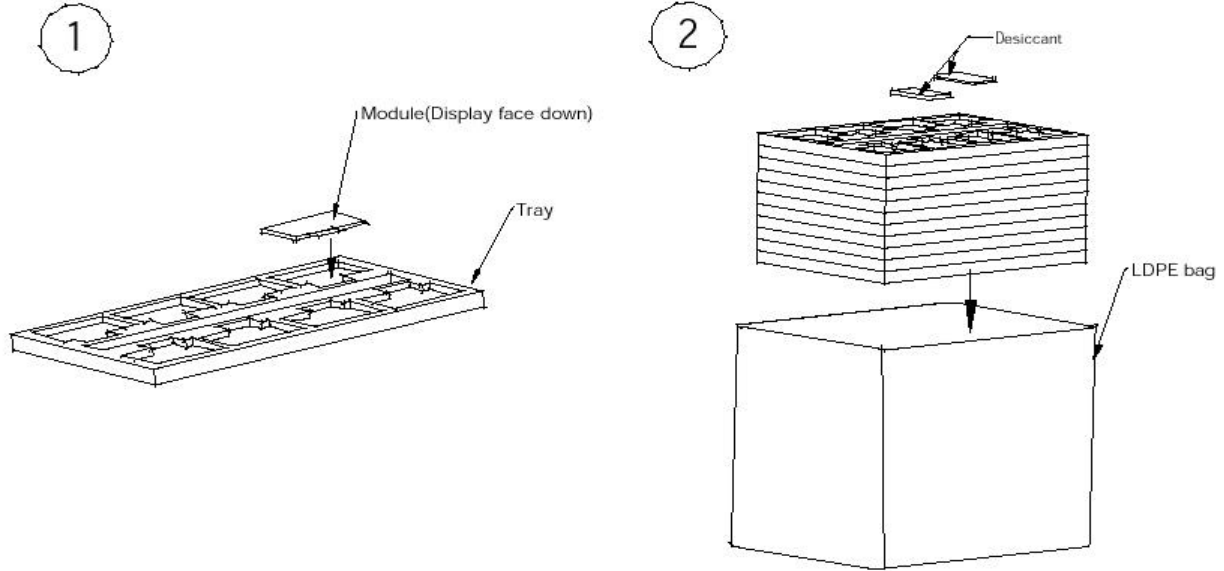


The information contained herein is the exclusive property of toppoly Optoelectronics corporation, and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of toppoly Optoelectronics corporation.



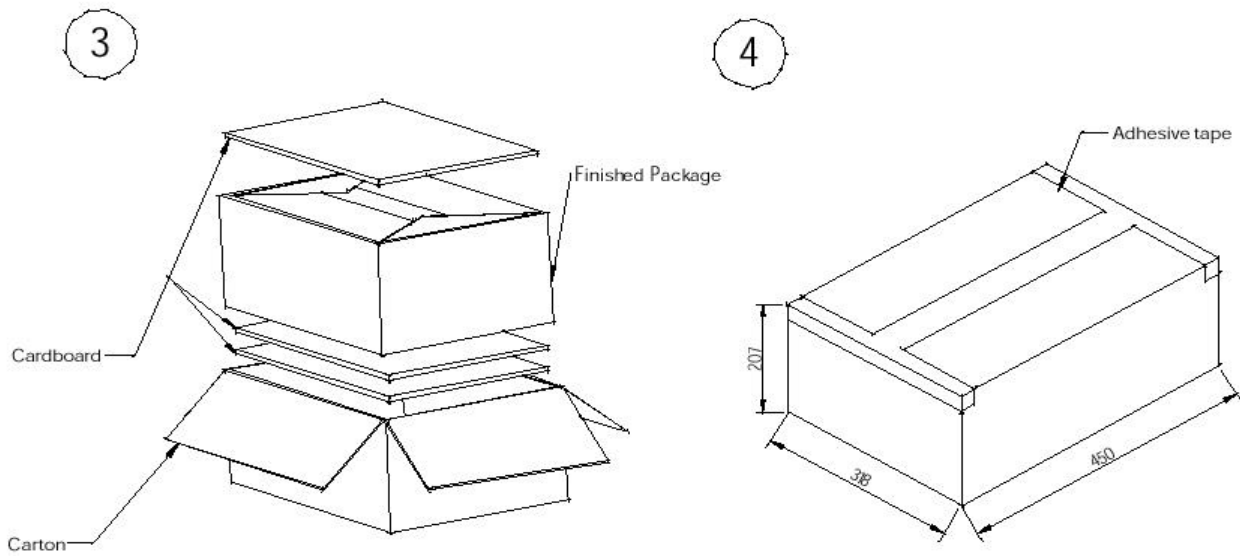
13 PACKING DRAWING

**TD035STEB1 Module Delivery Packing Instruction**



\*Packing quantity in 1 Tray :8pcs

Tray with module stacking with 11 layer  
(Including 1 pc empty tray at the top layer)



\*Module quantity in 1 carton:80pcs

**TD035STEB1 module delivery packing instruction**

- (1).Module packed into tray cavity with panel face down.
- (2).Desiccant(2pcs) put into the cavity of the top empty tray, then packed with LDPE bag as Fig(2).
- (3).Put 2pcs cardboard inside the carton bottom, then pack the finished package into the carton and put 1pc cardboard above the packing finished good as Fig(3).
- (4).Carton sealing with adhesive tape.