



**TCL显示科技有限公司**  
TCL DISPLAY TECHNOLOGY CO., LTD.

## SPECIFICATIONS FOR LCD MODULE

CUSTOMER	桑菲
MODEL	TD-T350T2G708-xxx Ver.A2
CUSTOMER APPROVED	

ORGANIZED BY	CHECKED BY	APPROVED BY
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- ☒ Preliminary  
☐ APPROVAL FOR SPECIFICATIONS ONLY  
☐ APPROVAL FOR SPECIFICATIONS AND SAMPLE

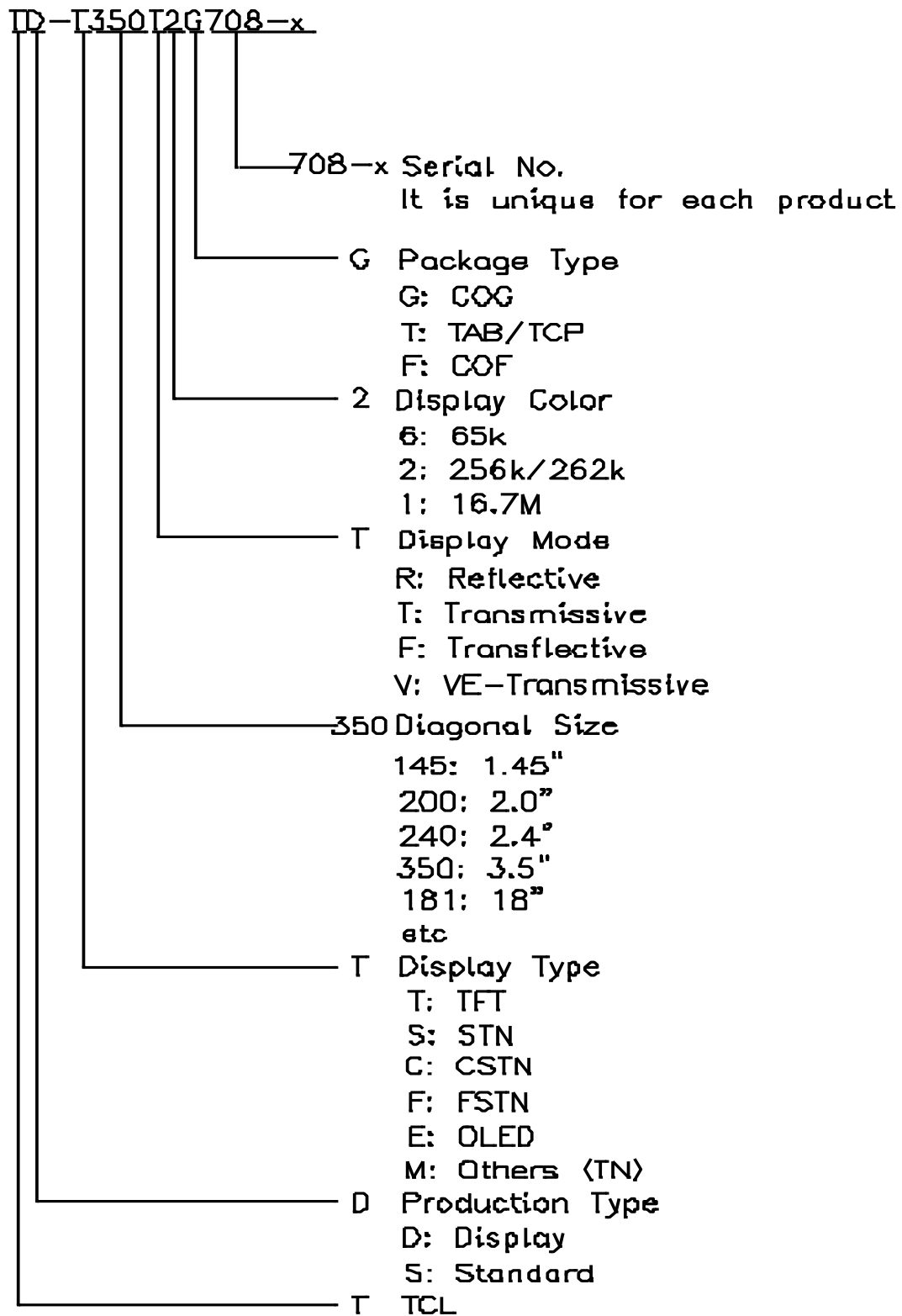
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### 3. Numbering System



**PRODUCT INFORMATION****4. FEATURES**

- (1) LCD Type: 3.5" Active matrix TFT-LCD
- (2) Resolution: 320(RGB)(W) x 480 (H) pixels
- (3) Display mode: Transmissive type / Normal Black.
- (4) Display color: 262K colors
- (5) Driver IC: ILI9481
- (6) Luminance: 290 cd/m<sup>2</sup> (Typ.).
- (7) Contrast Ratio: 500:1 (Typ).
- (8) Viewing Direction: --.
- (9) Interface: 3 wire SPI+18-bi RGB interface
- (10) Back Light : 6 white LEDs in parallel,120mA, 3.2 V(Typ.)

**5. MECHANICAL SPECIFICATIONS**

Item	Specifications
Dimensional Outline (TYP.)	54.76(W) x85.24(H) x2.10(D) mm (Typ.)
Number of Pixels	320(RGB)(W) x 480(H) pixels
Active Area	48.96(W) x 73.44 (H) mm, 3.5"
Pixel Pitch	0.153(W) x 0.153(H)
Weight (approximately)	T.B.D

**6. ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Min.	Max.	Unit	Remarks
Power Supply for Analog	VCI	-0.3	4.6	V	
LEDs Reverse Current	I <sub>R</sub>	-	85/LED	mA	
LEDs Forward Current	I <sub>F</sub>	-	30/LED	mA	
Operating Humidity	HSTG	10	90	%RH	
Operating Temperature	Top	-20	+60	°C	
Storage Temperature	Tst	-30	+70	°C	

Note : If the LSI is used above these absolute maximum ratings, it may become permanently damaged.

**7. ELECTRICAL SPECIFICATIONS(Ta=25°C)**

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Power Supply for Analog	VCI	2.73	2.8	2.87	V	±0.07V
Power Supply for Interface	IOVCC	1.75	1.8	1.85	V	±0.05V
Current for LCD	I <sub>VCI</sub>	-	TBD	TBD	mA	
LEDs Forward Voltage	V <sub>F</sub>	3.0	3.2	3.4	V	Per LED
LEDs Forward Current	I <sub>F</sub>	-	120	150	mA	20mA/Per LED
Frame Frequency	F <sub>FRAME</sub>	-	54	-	Hz	Frame inversion
Dot Clock	DOTCLK	-	-	8	MHz	

Note : The operations are guaranteed under the recommended operating conditions only. These operations are not guaranteed if a quick voltage change occurs during operation. To prevent noise, a bypass capacitor must be inserted into the line close to power pin.

## 8. Backlight LED specification

8.1 Manufacturer: TBD

8.2 Model: TBD

8.3 Luminous Intensity Rank: TBD mcd (20mA/Per LED)

## 9. OPTICAL SPECIFICATIONS(Ta=25°C)

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
Contrast Ratio		C/R	450	500	-		Fig.1
Brightness			240	290		cd/m2	Full White Pattern
Brightness Uniformity			80	-	-	%	Full White Pattern Fig.1,2
Response Time		Tr+Tf	-	30	40	ms	Fig.3
Color Coordina te	RED	Rx	-	TBD	-		IBL=20mA/Per LED Full White Pattern
		Ry	-	TBD	-		
	GREEN	Gx	-	TBD	-		
		Gy	-	TBD	-		
	BLUE	Bx	-	TBD	-		
		By	-	TBD	-		
	WHITE	Wx	-	TBD	-		
		Wy	-	TBD	-		
view angle		θl	-	80	-	Degree	Fig.4 Center (C/R≥10)
		θr	-	80	-		
		θu	-	80	-		
		θd	-	80	-		

Note:

1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all pixels white}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}{\text{Average Surface Luminance with all pixels black}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}$$

2. Brightness is the LCM's luminance from the surface with all pixels white. For more information see FIG 1.

3. Brightness Uniformity represents the consistency of LCM's Brightness, signed for  $\delta$  BRIGHTNESS.  $\delta$  BRIGHTNESS is determined by measuring luminance at each test point 1 to 9, then got the maximum and minimum luminance of 9 point. For more information, see Fig 2.

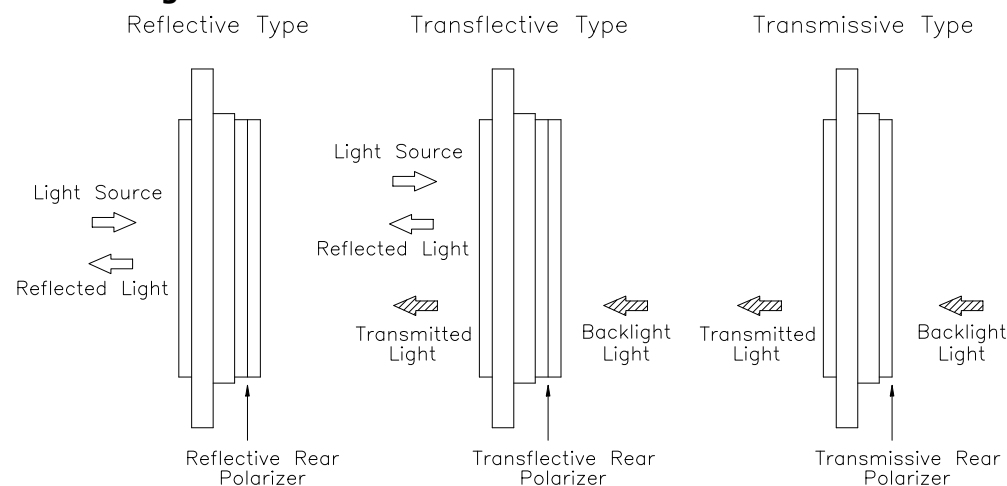
$$\delta \text{ BRIGHTNESS} = \frac{\text{Minimum Surface Luminance with all pixels white}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}{\text{Maximum Surface Luminance with all pixels white}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9)}$$

4. Response time is the time required for the display to transit from black to white (Rise Time, Tr) and from white to black (Decay Time, Tf). For additional information see FIG 3.

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Optimum contrast is obtained by adjusting the LCD Threshold voltage (Vth & Vsat)

## 10. Viewing Modes



### 10.1 Electro-Optical Characteristics Test Method

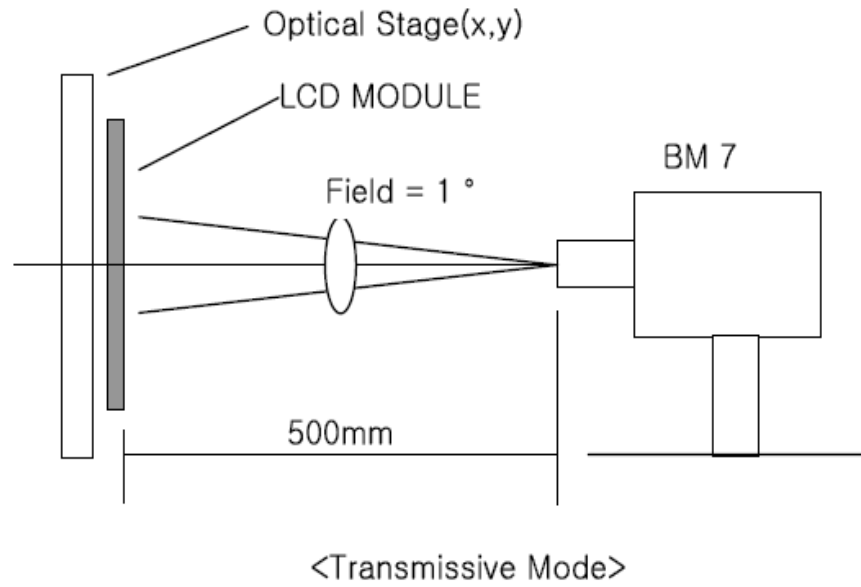
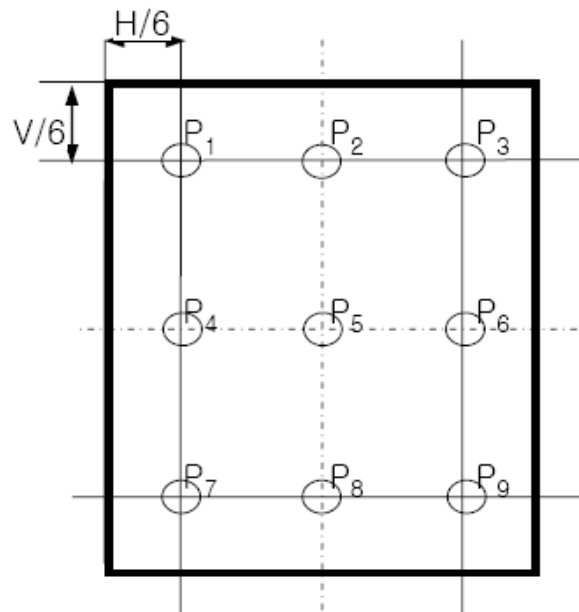


FIG. 1 Optical Characteristic Measurement Equipment and Method



**P1-P9:** Main Measuring point

Fig. 2 Measuring Points

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

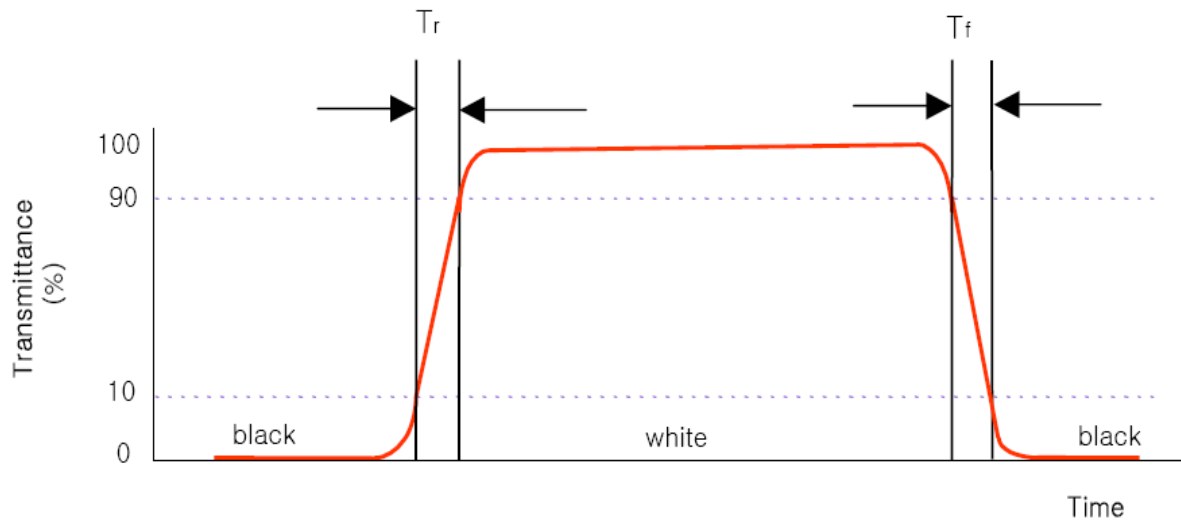


FIG.3 The definition of Response Time

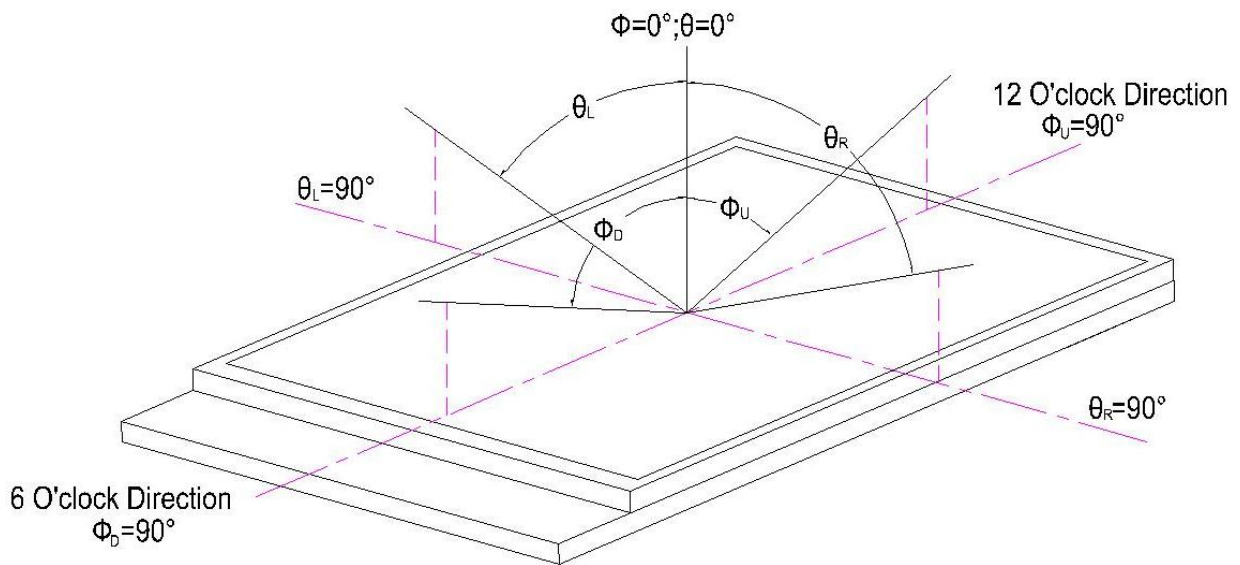
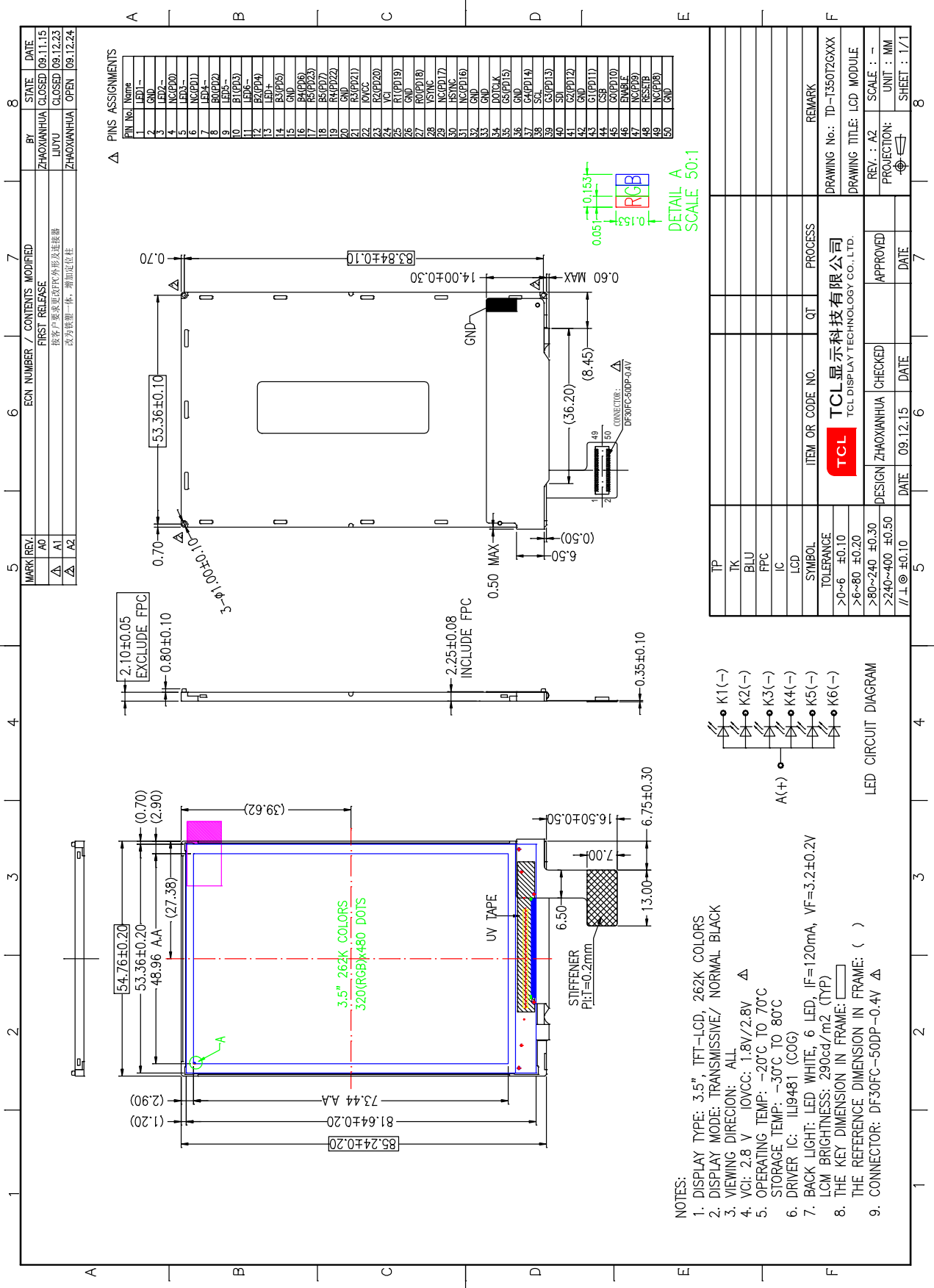


FIG.4 The definition of Viewing Angle

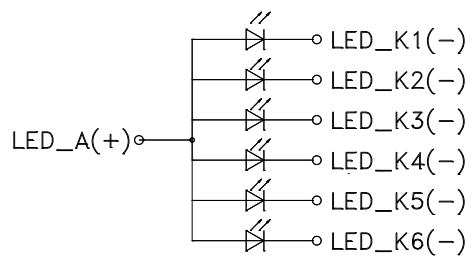
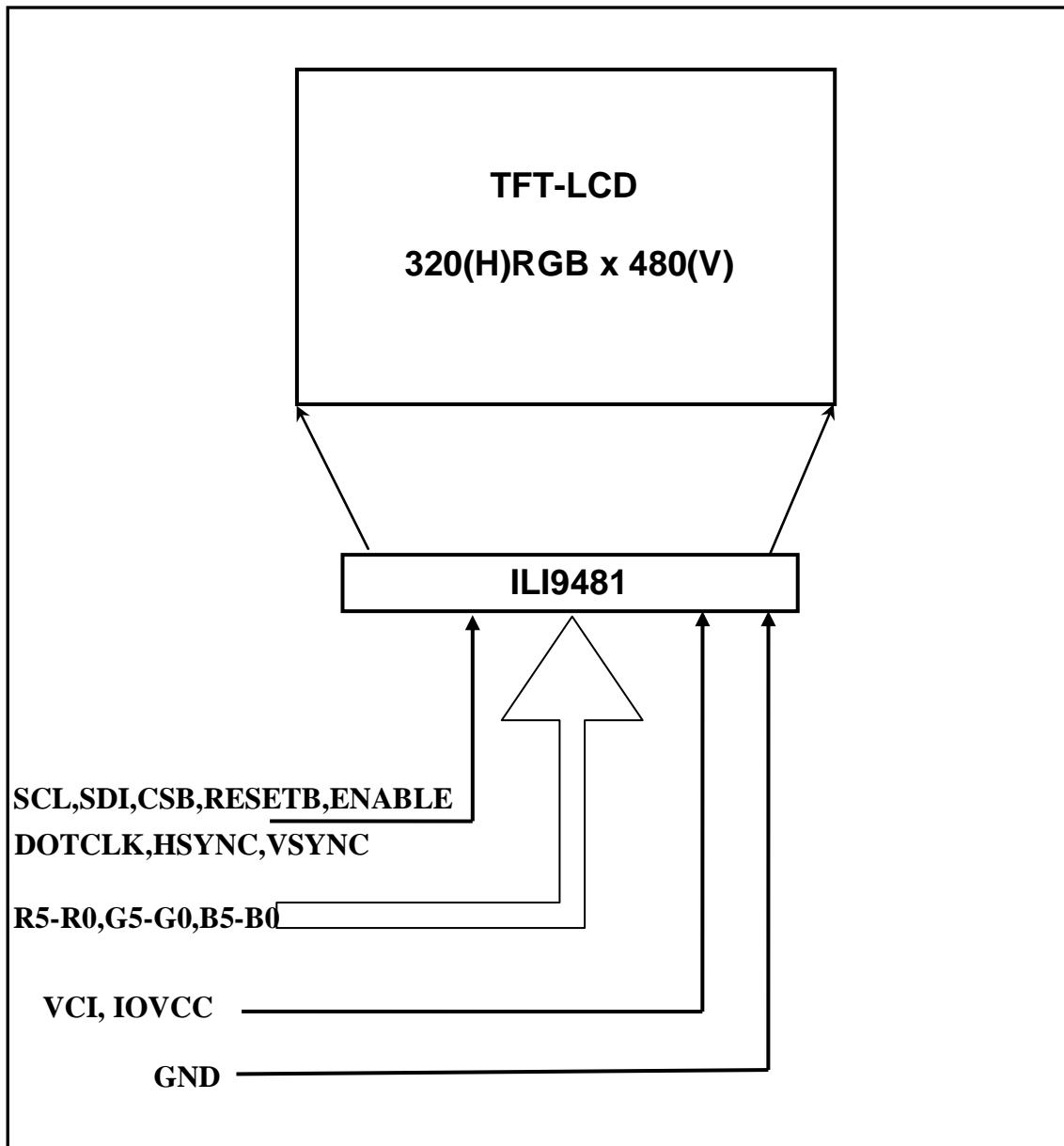


11. <Outline dimension>



方案2: 厚度2.1mm (不包括FPC) 用0.6厚的灯做, 亮度增加。

**12. <Block diagram>**



LED CIRCUIT DIAGRAM

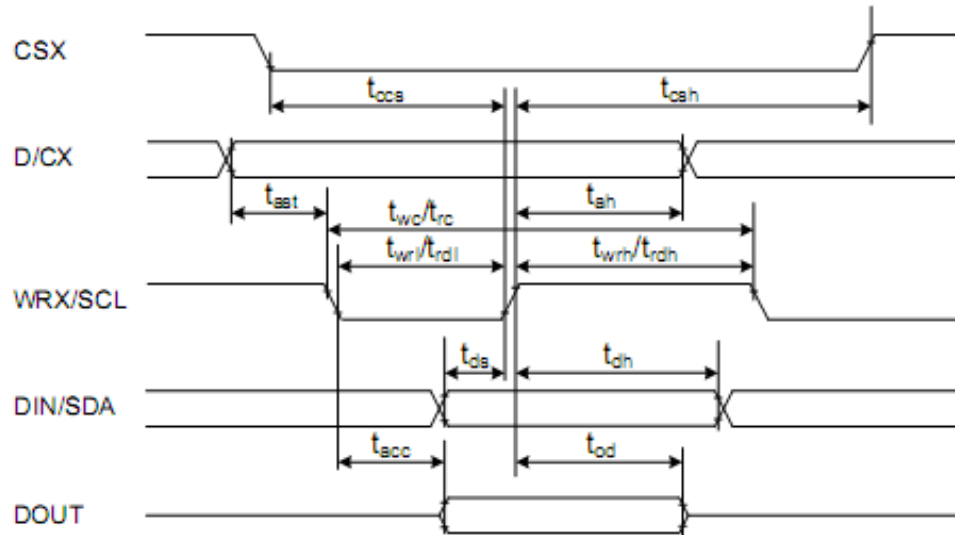
**13. <Table of Pin Assignment >**

PinNo.	Signal	I/O	Discription
1	LED1-	P	Power supply for LED1(Cathode)
2	GND	P	Ground
3	LED2-	P	Power supply for LED2(Cathode)
4	NC(PD0)	-	No Connection
5	LED3-	P	Power supply for LED3(Cathode)
6	NC(PD1)	-	No Connection
7	LED4-	P	Power supply for LED4(Cathode)
8	B0(PD2)	I/O	Data Bus.[Blue 0]
9	LED5-	P	Power supply for LED5(Cathode)
10	B1(PD3)	I/O	Data Bus.[Blue 1]
11	LED6-	P	Power supply for LED6(Cathode)
12	B2(PD4)	I/O	Data Bus.[Blue 2]
13	LED+	P	Power supply for LED(Anode)
14	B3(PD5)	I/O	Data Bus.[Blue 3]
15	GND	P	Ground
16	B4(PD6)	I/O	Data Bus.[Blue 4]
17	R5(PD23)	I/O	Data Bus.[Red 5]
18	B5(PD7)	I/O	Data Bus.[Blue 5]
19	R4(PD22)	I/O	Data Bus.[Red 4]
20	GND	P	Ground
21	R3(PD21)	I/O	Data Bus.[Red 3]
22	IOVCC	P	Power Supply for Logic Circuit (TYP 1.8V)
23	R2(PD20)	I/O	Data Bus.[Red 2]
24	VCI	P	Power Supply for Analog Circuit (TYP 2.8V)
25	R1(PD19)	I/O	Data Bus.[Red 1]
26	GND	P	Ground
27	R0(PD18)	I/O	Data Bus.[Red 0]
28	VSYNC	I	Vertical Synchronizing Signal in RGB Interface
29	NC(PD17)	-	No Connection
30	HSYNC	I	Horizontal Synchronizing Signal in RGB Interface
31	NC(PD16)	-	No Connection
32	GND	P	Ground
33	GND	P	Ground
34	DOTCLK	I	Dot Clock Signal for Data Latch in RGB Interface
35	G5(PD15)	I/O	Data Bus.[Green 5]
36	GND	P	Ground
37	G4(PD14)	I/O	Data Bus.[Green 4]
38	SCL	I	Synchronizing clock signal in SPI mode
39	G3(PD13)	I/O	Data Bus.[Green 3]
40	SDI	I	Data input in SPI mode
41	G2(PD12)	I/O	Data Bus.[Green 2]
42	GND	P	Ground
43	G1(PD11)	I/O	Data Bus.[Green 1]
44	CSB	I	Chip Select Signal (Low Active).
45	G0(PD10)	I/O	Data Bus.[Green 0]
46	ENABLE	I	Data Input Enable Control in RGB Interface
47	NC(PD9)	-	No Connection
48	RESETB	I	Reset Signal (Low Active)
49	NC(PD8)	-	No Connection
50	GND	P	Ground

## 14. <Command/AC Timing>

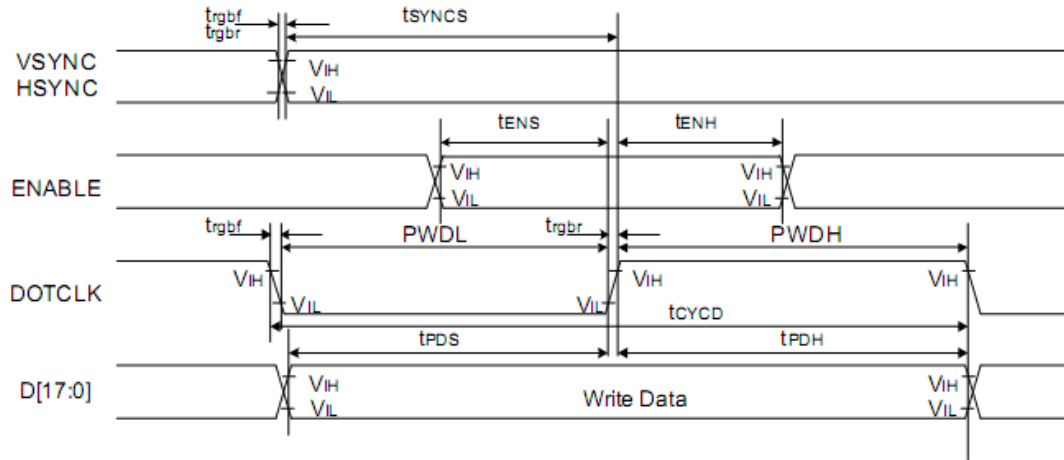
Detail technical information of "command/data", or "AC timing" can be available with following documents:  
-IC specification of driver IC: ILI9481

### 14.3.2. DBI Type C Interface Timing Characteristics



Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	$t_{ocs}$	Chip select setup time (Write)	40	-	ns	
	$t_{csh}$	Chip select hold time (Write)	40	-	ns	
D/CX	$t_{as}$	Address setup time	10		ns	
	$t_{ah}$	Address hold time (Write/Read)	10		ns	
WRX/SCL (Write)	$t_{wc}$	Write cycle	100		ns	
	$t_{wrh}$	SCL High duration (write)	40		ns	
	$t_{wrl}$	SCL Low duration (write)	40		ns	
WRX/SCL (Read)	$t_{rc}$	Read cycle	300		ns	
	$t_{rdh}$	SCL High duration (read)	120		ns	
	$t_{rdl}$	SCL Low duration (read)	120		ns	
DIN/SDA (Driver IC)	$t_{ds}$	Data setup time	30		ns	
	$t_{dh}$	Data hold time	30		ns	
DOUT (Driver IC)	$t_{acc}$	Access time	-	110	ns	
	$t_{od}$	Output disable time	10		ns	

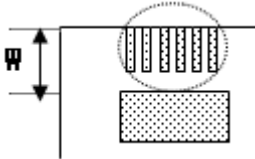
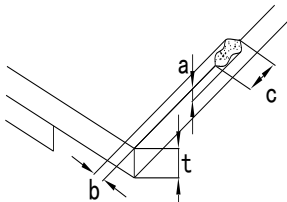
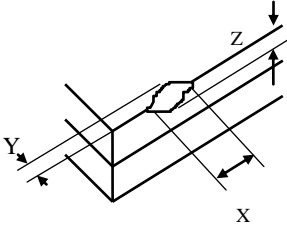
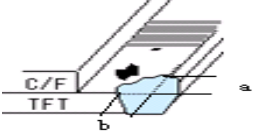
## 14.3.3. DPI Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit
VSYNC / HSYNC	$t_{SYNCS}$	VSYNC/HSYNC setup time	15	-	ns
	$t_{SYNCH}$	VSYNC/HSYNC hold time	15	-	ns
ENABLE	$t_{ENS}$	ENABLE setup time	15	-	ns
	$t_{ENH}$	ENABLE hold time	15	-	ns
D[17:0]	$t_{POS}$	Data setup time	15	-	ns
	$t_{PDH}$	Data hold time	15	-	ns
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns
	PWDL	DOTCLK low-level period	15	-	ns
	$t_{CYCD}$	DOTCLK cycle time	125	-	ns
	$t_{rgbr}, t_{rgbf}$	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns

**15. Inspection Criteria**

Item NO.	Inspection Item	Inspection Standard			Classification of defects
1	Electrical fuction Testing	1) No display 2) Missing line 3) No backlight 4) shadow 5) black/blue display 6) Irregular operating 7) visual angle is wrong			Major
2	Outline dimension	All outline dimension beyond the drawing is not allowed			Major
3	White/Black spot ( in LCD or Backlight )	$\Phi$ (mm)	acceptable		Minor
		$\Phi \leq 0.10$	ignore		
		$0.10 < \Phi \leq 0.2$	2		
		$\Phi > 0.2$	0		
4	Dirt in POL	as same as White/Black spot			Minor
5	Dent at POL	as same as White/Black spot			Minor
6	Bubble in POL	$\Phi$ (mm)	acceptable		Minor
		$\Phi \leq 0.20$	3		
		$0.20 < \Phi \leq 0.3$	2		
		$0.30 < \Phi \leq 0.5$	1		
		$\Phi > 0.5$	0		
7	Color/bright /dark dot	as same as White/Black spot			Minor
8	Scratch / lines in LCD	Width	Length	acceptable	Minor
		$W \leq 0.03$	$L < 2.0$	1	
		$0.03 < W \leq 0.05$	$L \leq 1.0$	1	
		$W > 0.08$	ignore	0	
		ignore	$L > 3.0$	0	
9	Scratch / lines in POL	as same as White/Black spot			Minor
10	Scratch / lines in BLU	as same as White/Black spot			Minor

11	LCD defect	Crack	Unallowed	Major
		Pad break	$W > 0.5\text{mm}$ , unallowed 	Major
		Con-Pad break	<p>When <math>a &lt; 1/2T</math> (<math>T</math>=the thickness of single LCD) :  <math>b \geq 1/2 \text{ PAD NG}</math> or  <math>c \geq 5\text{mm NG}</math>                      When <math>a \geq 1/2T</math>: as same as PAD break</p> 	Minor
		Break not in PAD	<p><math>X \leq 1/8A</math>;  <math>Y</math> into the inspect area is unallowed;  <math>X \leq 1/8A</math>, if <math>Y</math> not into the frame, <math>Z</math> ignore;  <math>X \leq 1/8A</math>, <math>Y \leq 1/2 \text{ Seal}</math>, <math>Z \leq 1/2T</math> is allowed  <math>X \leq 1/8A</math>, <math>Y &gt; 1/2 \text{ Seal}</math>, <math>Z \leq 1/4T</math> is allowed</p> 	Minor
		Corner break	<p>1) '<math>a</math>' <math>&gt; 1\text{mm}</math> unallowed                      2) '<math>b</math>' <math>&gt; 1/4E</math> unallowed                      (<math>E</math> = PAD long of short side)</p> 	Minor

If the acceptable number is  $\geq 2$ , the interval between dots or lines must be  $\geq 10\text{mm}$ .

**16. Reliability**

Item NO.	TEST Item	Condition	Criterion
1	Humidity operating	40°C±2°C, 95%RH, 96 hrs	<ul style="list-style-type: none"><li>· Placed 2 hours in normal temperature, then inspect the function and cosmetic after test.</li><li>· After testing, cosmetic and function defects should not happen.</li><li>· Polarizers may fail in humidity test, but only this failure is allowable.</li></ul>
2	Thermal shock test	25°C±2°C→-40°C±2°C→25°C±2°C→70°C±2°C 5(min) 120(min) 5(min) 120(min) , 24cycle	
3	High temperature operating	60°C±2°C 96 hrs	
4	Low temperature operating	-20°C±2°C 96 hrs	
5	High temperature storage	70°C±2°C 96 hrs	
6	Low temperature storage	-30°C±2°C 96 hrs	
7	Packing drop test	1 corner 3 edges six faces, with carton packing, 1m height, concrete ground	<ul style="list-style-type: none"><li>· After testing, inspect the packing and product</li><li>· Packing broken length&lt;2cm, LCD visual and function check</li></ul>



### 17. For Safety

LCD module is generally designed with precise parts to achieve light weighted thin mechanical dimensions.

In using our Modules, make certain that you fully understand and put into practice the warnings and safety precautions detailed in Engineering Information No.EE-N001 , "CAUTIONS AND INATRUCTIONNS FOR TCL DISPLAY TECHNOLOGY CO., LTD. LCD MODULES".

Refer to individual specifications and TECHNICAL DATA sheets (hereinafter called "TD") for more detailed technical information.

#### 1) SPECIAL PURPOSES

- a) TCL Display Technology's Standard LCD modules have not been customized for operation in extreme environments or for use in applications where performance failures could be life-threatening or otherwise catastrophic.
- b) Since TCL Display Technology's Standard LCD modules have not been designed for operation in extreme environments, they must never be used in devices that will be exposed to abnormally high levels of vibration or shock which exceed TCL Display Technology's published specification limits.
- c) In addition, since TCL Display Technology's Standard LCD modules have not been designed for use in applications where performance failures could be life-threatening or catastrophic, they must never be installed in aircraft navigation control systems (such as, but not limited to Traffic Collision Avoidance System and Air Traffic Indicator), in military defense or weapons systems, in critical industrial process-control systems (e.g., those involved in the production of nuclear energy), or in critical medical device or patient life-support systems.

#### 2) DISASSEMBLING OR MODIFICATION

DO NOT DISASSEMBLE OR MODIFY the modules. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. TCL Display Technology does not warrant the modules, if customer disassembled or modified it.

#### 3) BREAKAGE OF LCD PANEL

DO NOT INGEST liquid crystal material, DO NOT INHALE this material, and DO NOT PERMIT this material with skin, if LCD panel is broken and liquid crystal material spills out.

If liquid crystal material comes into mouth or eyes, rinse mouth or eyes out with water immediately.

If this material contact with skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

#### 4) GLASS OF LCD PANEL

BE CAREFUL WITH CHIPS OF GRASS that may cause injuring fingers or skin, when the glass is broken.

#### 5) ELECTRIC SHOCK

DISCONNECT POWER SUPPLY before handing LCD module.

#### 6) ABSOLUTE MAXIMUM RATINGS AND POWER PROTECTION CIRCUIT

DO NOT EXCEED the absolute maximum rating values under the worst probable conditions caused by the supply voltage variation, input voltage variation, variation in parts' constants, environmental temperature, etc., otherwise LCD module may be damaged.

Employ protection circuit for power supply, whenever the specification or TD specifies it.

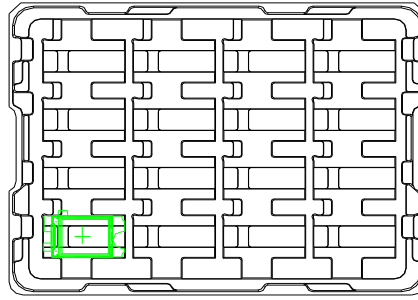
Suitable protection circuit should be applied for each system design.

#### 7) DISPOSAL

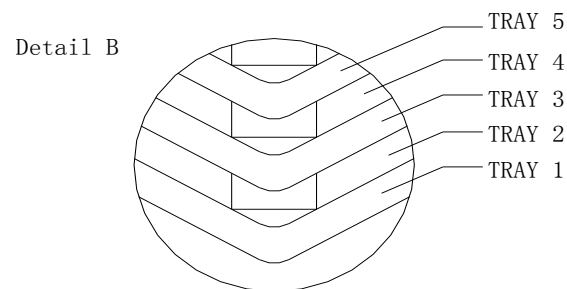
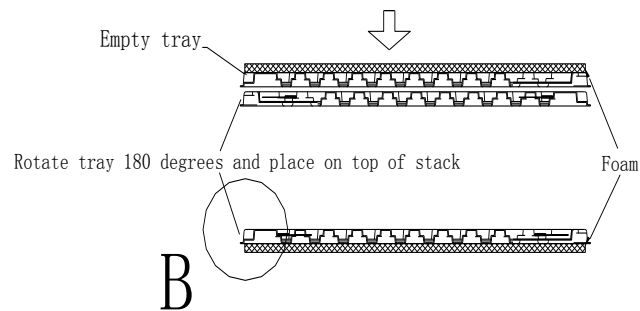
When disposing of the LCD module, obey to the applicable environmental regulations.

### 18. Packaging

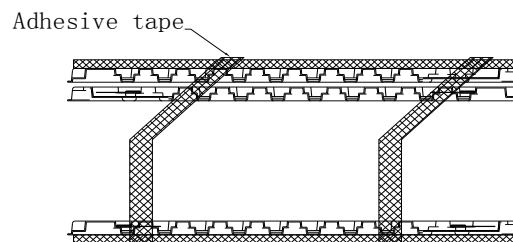
Step 1: Put LCM into tray



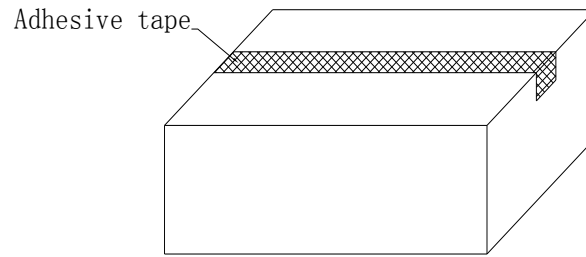
Step 2: Tray stacking



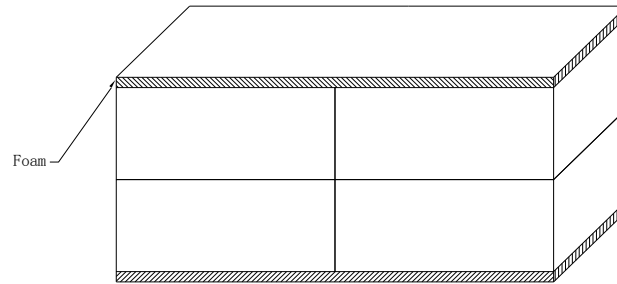
Step3: use adhesive tape to seal, with desiccant put into the shield pag for defending ESD



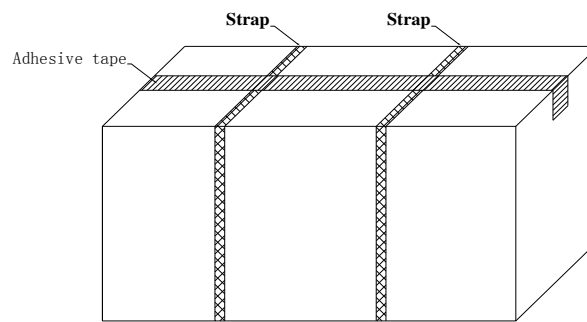
Step4: put into inner package carton ,and use adhesive tape to seal



Step5:Put four inner package carton into one outer package carton



Step6: use adhesive tape to seal,and strap.



Step7: attach a ticket to carton

现品票			
供应商名称		出厂日期	
物料名称		出厂检验结果	
物料编码		预收单号	
规格		LOT NO	
本批送货数量		TCL验收结果	