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

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	桑菲
MODEL	TD-T350T2G708-X
CUSTOMER APPROVED	

ORGANIZED BY	CHECKED BY	APPROVED BY
何跃飞	行亚鹏	吴石梁

□ APPROVAL FOR SPECIFICATIONS ONLY

■ APPROVAL FOR SPECIFICATIONS AND SAMPLE

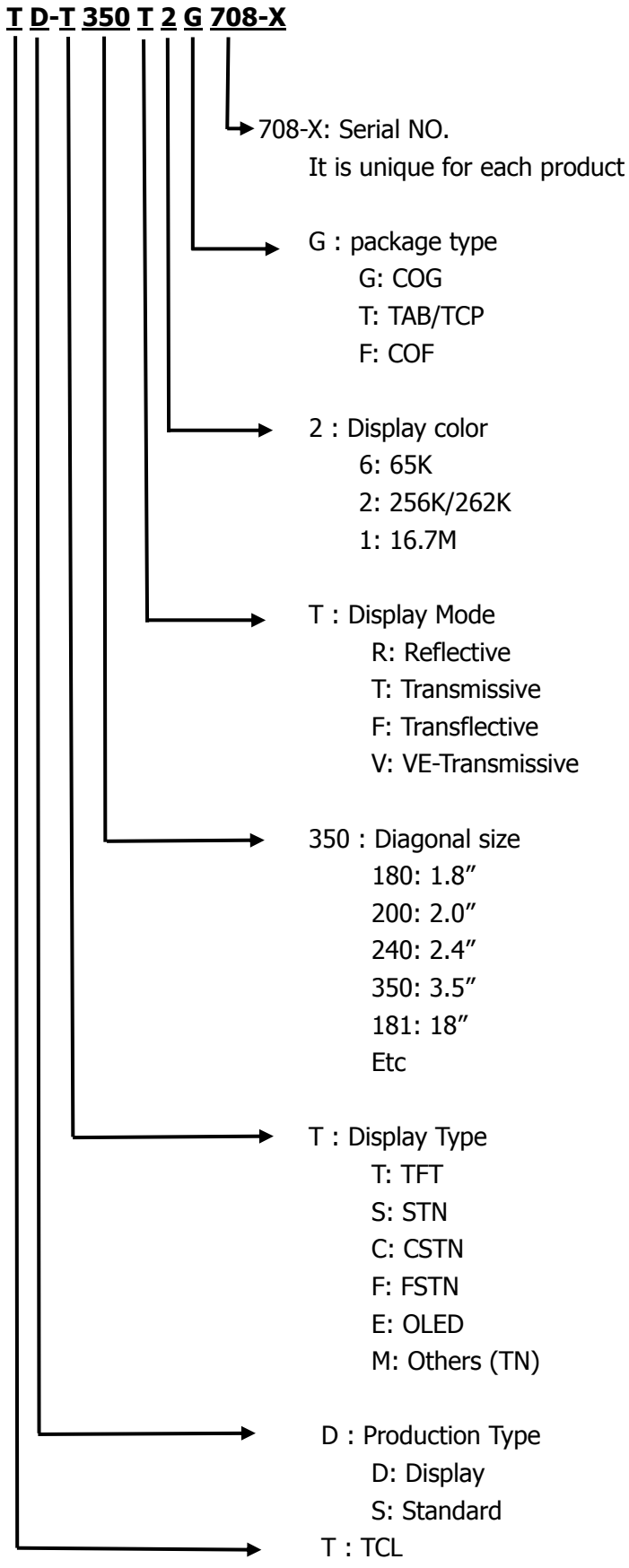
广东省惠州市江北云山东路 21 号 TCL 工业区 9 号工业厂房
Building 9, TCL Industrial Park, Yunshan East Road, Jiangbei, Huizhou, Guangdong, China.
电话/Tel: 0752-5808888 传真/Fax: 0752-5808877 邮编/P.C.: 516003
http://www.tcldisplay.com

Contents

2. Revision History

Date	Rev.	Page (New)	Item	Old	New	Reason
2011-08-08	A0	---	---	---	---	First release

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
(4)	Display color:	262K colors
(5)	Driver IC:	ILI9481B
(6)	Luminance:	330 cd/m2 (Typ.).
(7)	Contrast Ratio:	500:1 (Typ).
(8)	Viewing Direction:	Full/MVA Mode. (FULL Viewing Direction)
(9)	Interface:	3 Wire SPI+18-bit RGB interface
(10)	Back Light :	Light Emitting Diode (LED), 6 LEDs connected in parallel

5. MECHANICAL SPECIFICATIONS

Item	Specifications
Dimensional Outline (Typ.)	54.76(W) x85.24(H) x2.10(D) mm
Number of Pixels	320(RGB)(W) x 320(H) pixels
Active Area	48.96(W) x 73.44(H) mm
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	Vcc	-0.3	4.6	V	
Power Supply for Logic	Vci	-0.3	4.6	V	
LEDs Reverse Current	I_R	-	85/LED	mA	6 LEDs , parallel connection
LEDs Forward Current	I_F	-	30/LED	mA	
Operating Humidity	HSTG	10	90	%RH	
Operating Temperature	Top	-20	+70	℃	
Storage Temperature	Tst	-30	+80	℃	

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	Vcc	2.7	2.8	2.9	V	
Power Supply for Logic	Vci	1.7/2.7	1.8/2.8	1.9/2.9	V	
Current for LCD	I_{VDD}	-	-	10	mA	
LEDs Forward Voltage	V_F	2.9	3.2	3.5	V	
LEDs Forward Current	I_F	-	120	-	mA	6 LEDs in parallel, 20mA/LED

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. OPTICAL SPECIFICATIONS(Ta=25℃)

Item		Symbol	Min.	Typ.	Max.	Unit	Remarks
Contrast Ratio		C/R	350	500	-		Fig.1
Brightness			-	330		cd/m2	Full White Pattern
Brightness Uniformity			80	-	-	%	Full White Pattern Fig.1,2
NTSC			-	58	-	%	
Response Time		Tr+Tf	-	30	40	ms	Fig.3
Color Coordinate	RED	Rx	-	T.B.D.	-		IBL=120mA
		Ry	-	T.B.D.	-		
	GREEN	Gx	-	T.B.D.	-		
		Gy	-	T.B.D.	-		
	BLUE	Bx	-	T.B.D.	-		
		By	-	T.B.D.	-		
	WHITE	Wx	-	T.B.D.	-		
		Wy	-	T.B.D.	-		
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 :

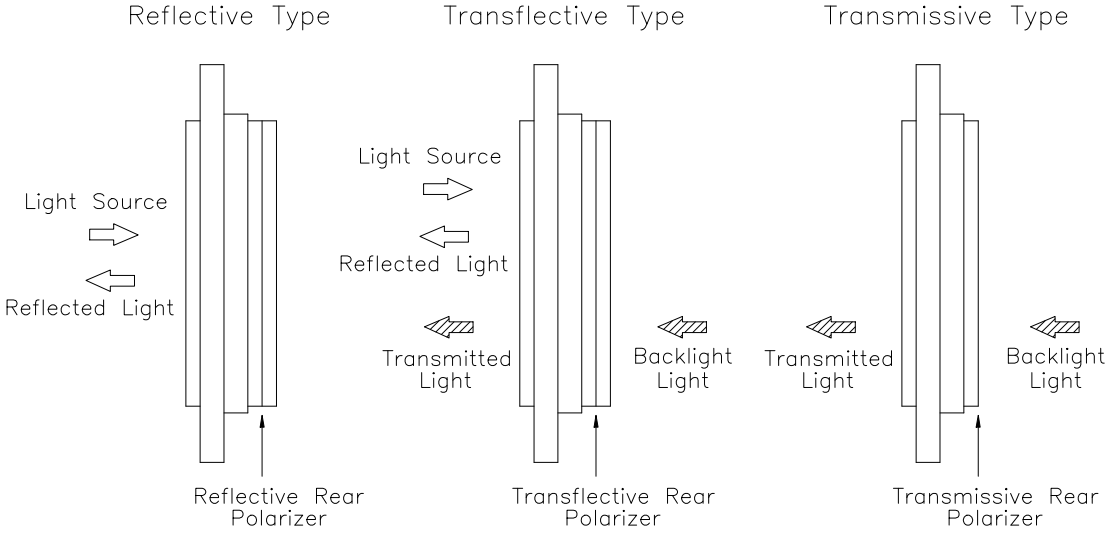
$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all pixels white}(P_1,P_2,P_3,P_4,P_5,P_6,P_7,P_8,P_9)}{\text{Average Surface Luminance with all pixels black}(P_1,P_2,P_3,P_4,P_5,P_6,P_7,P_8,P_9)}$$

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 forδBRIGHTNESS. δBRIGHTNESS is determined by measuring luminance at each test point 1 to 9,then got the maximum and mimimum luminance of 9 piont. For more information,see Fig 2.

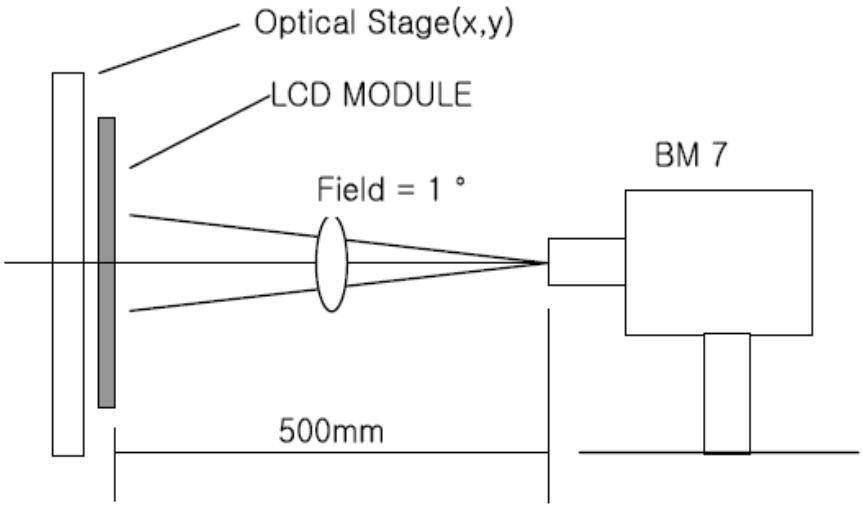
$$\delta\text{BRIGHTNESS} = \frac{\text{Minimum Surface Luminance with all pixels white}(P_1,P_2,P_3,P_4,P_5,P_6,P_7,P_8,P_9)}{\text{Maximum Surface Luminance with all pixels white}(P_1,P_2,P_3,P_4,P_5,P_6,P_7,P_8,P_9)}$$

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)

9. Viewing Modes

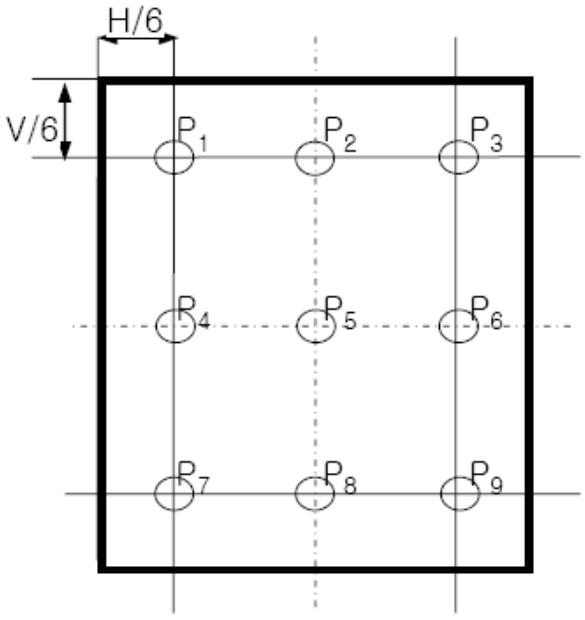


10. Electro-Optical Characteristics Test Method



<Transmissive Mode>

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".

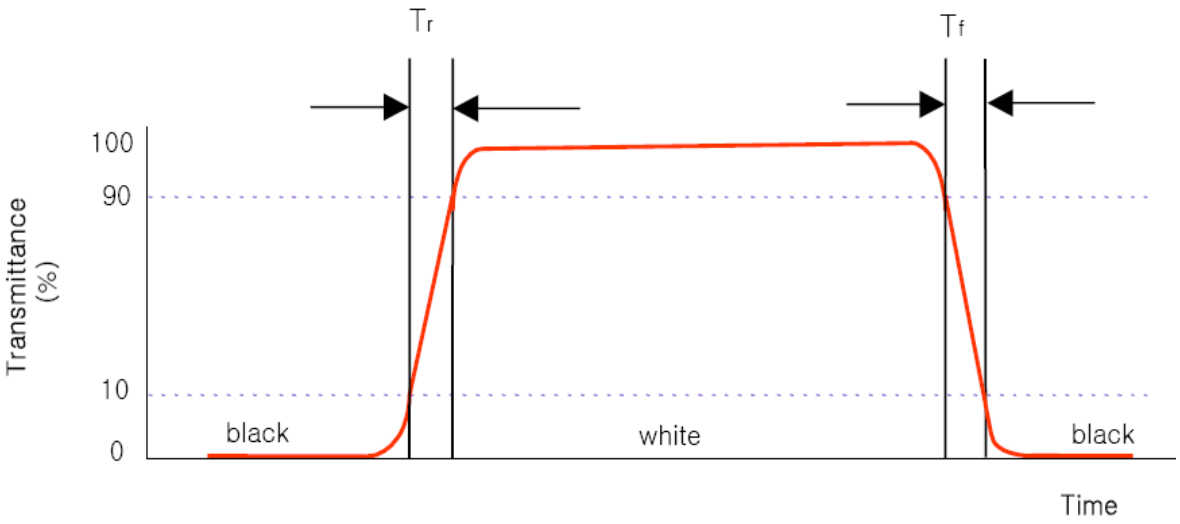


FIG.3 The definition of Response Time

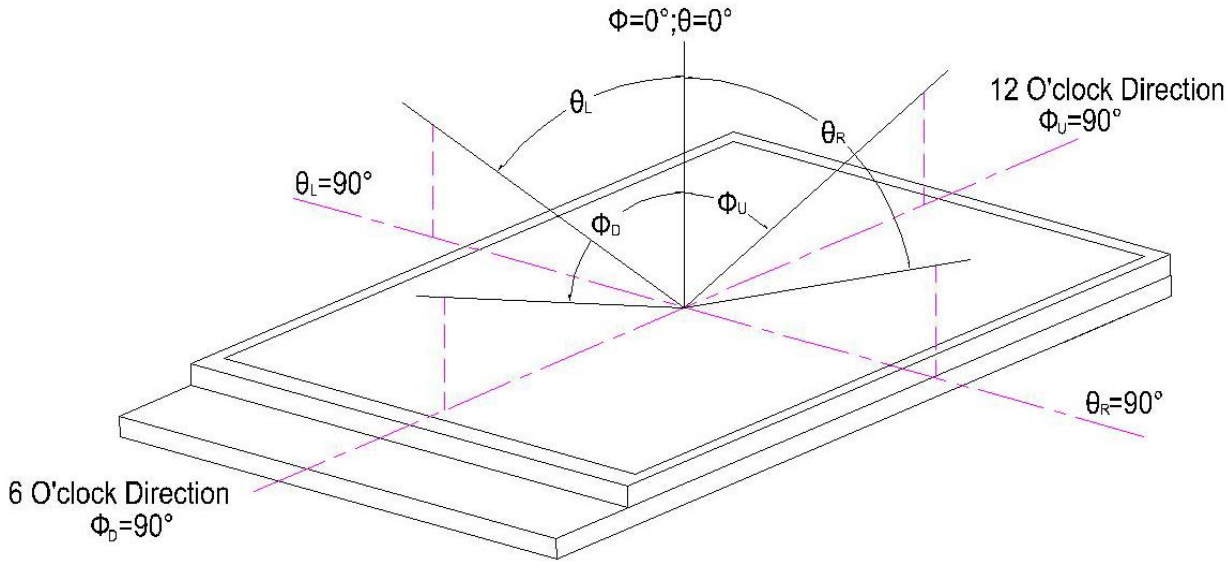
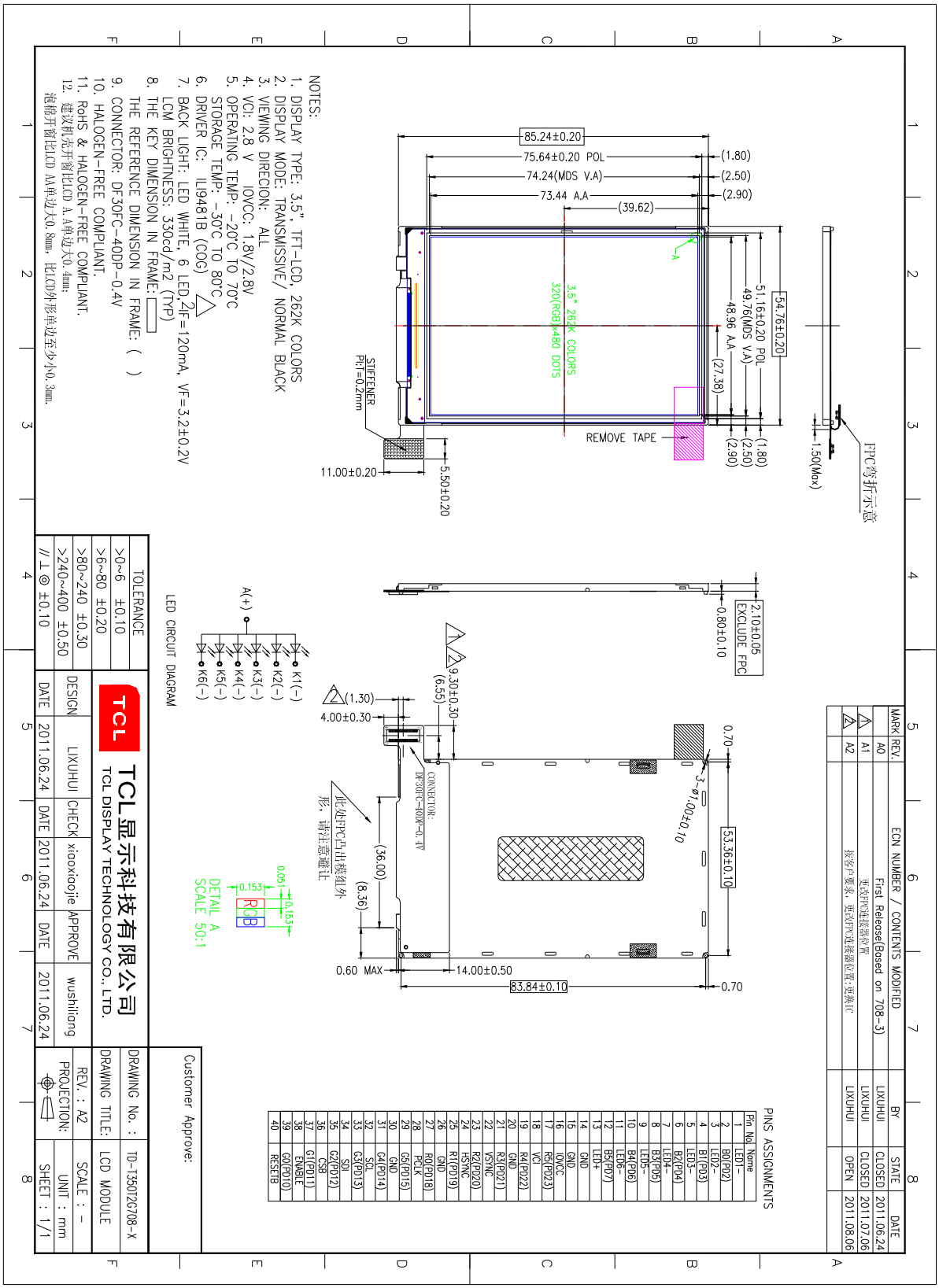
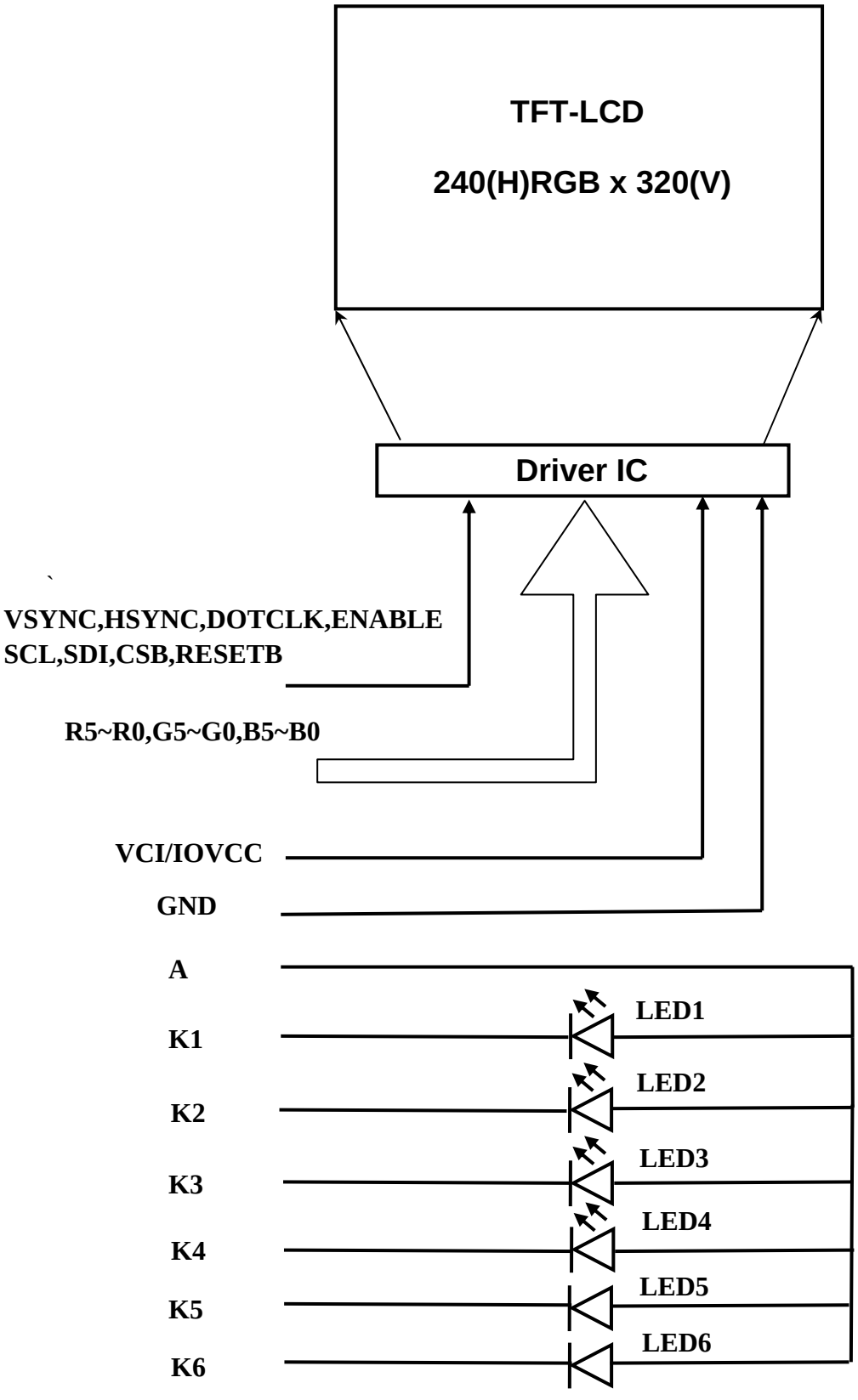


FIG.4 The definition of Viewing Angle

11. Outline dimension



12. Block diagram



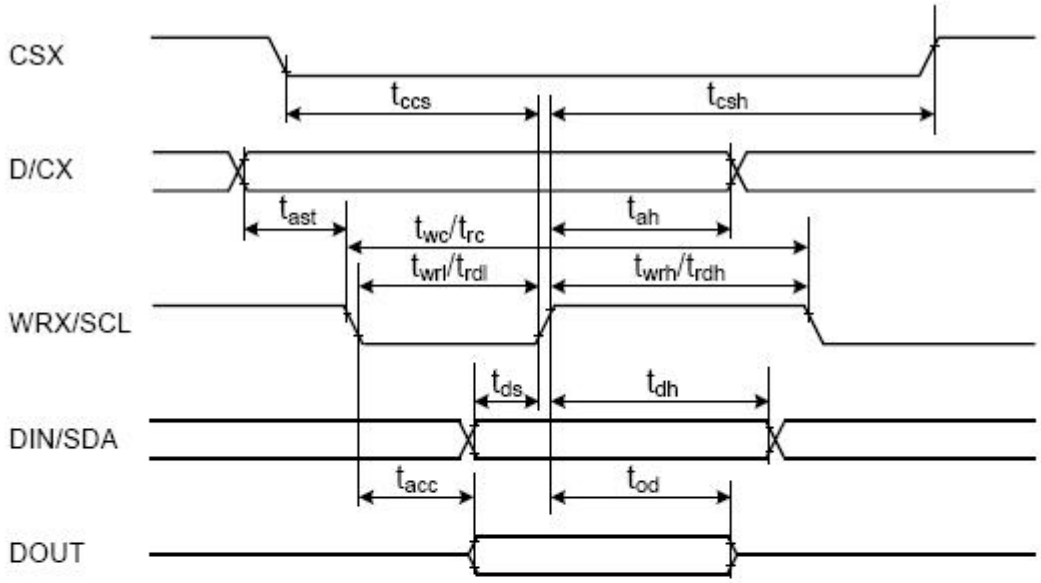
13. Table of Pin Assignment

PinNo.	Signal	I/O	Discription
1	LED1-	P	Power Supply for LED1-(Cathode)
2	B0(PD2)	I/O	DATA BUS. BLUE 0
3	LED2-	P	Power Supply for LED2-(Cathode)
4	B1(PD3)	I/O	DATA BUS. BLUE 1
5	LED3-	P	Power Supply for LED3-(Cathode)
6	B2(PD4)	I/O	DATA BUS. BLUE 2
7	LED4-	P	Power Supply for LED4-(Cathode)
8	B3(PD5)	I/O	DATA BUS. BLUE 3
9	LED5-	P	Power Supply for LED5-(Cathode)
10	B4(PD6)	I/O	DATA BUS. BLUE 4
11	LED6-	P	Power Supply for LED6-(Cathode)
12	B5(PD7)	I/O	DATA BUS. BLUE 5
13	LED+	P	Power Supply for LED+(Anode)
14	GND	P	Ground .
15	GND	P	Ground .
16	IOVCC	P	Power Supply for Interface (TYP 2.8V/1.8V)
17	R5(PD23)	I/O	DATA BUS. RED 5
18	VCI	P	Power Supply for Analog Circuit (TYP 2.8V)
19	R4(PD22)	I/O	DATA BUS. RED 4
20	GND	P	Ground .
21	R3(PD21)	I/O	DATA BUS. RED 3
22	VSYNC	I	Vertical Synchronizing Signal in RGB Interface
23	R2(PD20)	I/O	DATA BUS. RED2
24	HSYNC	I	Horizontal Synchronizing Signal in RGB Interface
25	R1(PD19)	I/O	DATA BUS. RED1
26	GND	P	Ground .
27	R0(PD18)	I/O	DATA BUS. RED 0
28	GND	P	Ground .
29	G5(PD15)	I/O	DATA BUS. GREEN 5
30	GND	P	Ground .
31	G4(PD14)	I/O	DATA BUS. GREEN 4
32	SCL	I	Synchronizing clock signal in SPI mode
33	G3(PD13)	I/O	DATA BUS. GREEN 3
34	SDI	I	Data input in SPI mode
35	G2(PD12)	I/O	DATA BUS. GREEN 2
36	CSB	I	Chip Select Signal (Low Active)
37	G1(PD11)	I/O	DATA BUS. GREEN 1
38	ENABLE	I	Data Input Enable Control in RGB Interface
39	G0(PD10)	I/O	DATA BUS. GREEN 0
40	RESETB	I	Reset Signal (Low Active)

14. Command/AC Timing

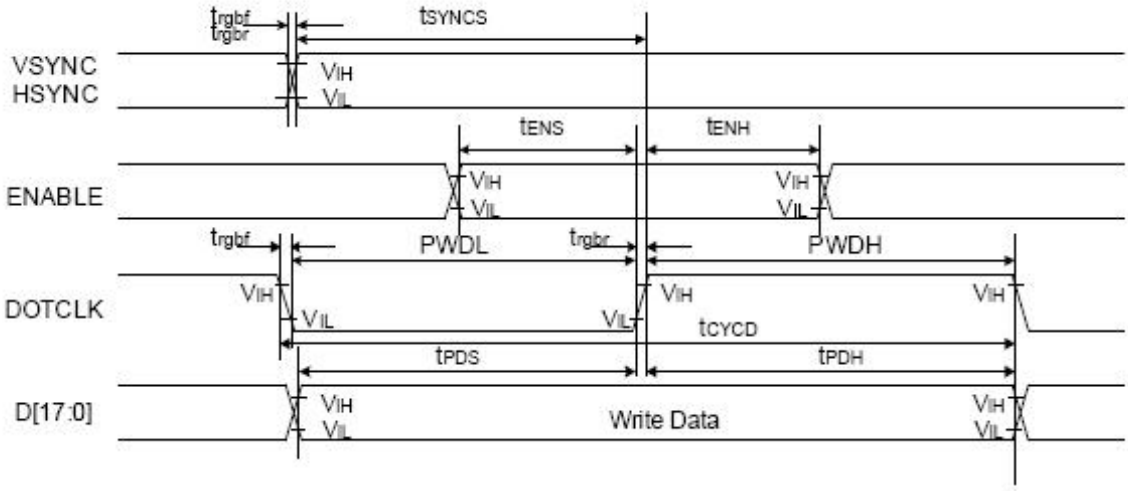
Detail technical information of "command/data", or "AC timing" can be available with following documents:
-IC specification of driver IC: ILI9481B

14.1 DBI Type C Interface Timing Characteristics (SPI)



Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t_{css}	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	

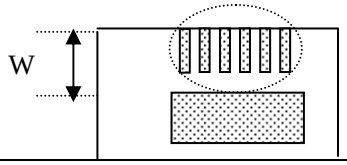
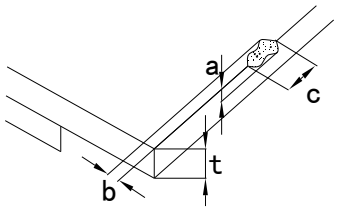
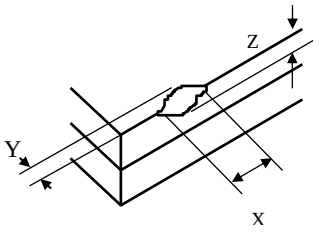
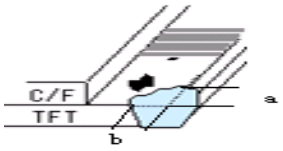
14.2 DPI Interface Timing Characteristics (RGB)



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_{PDS}	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

<table>
<tr><th>Item NO.</th><th>Inspection Item</th><th colspan="3">Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td>1</td><td>Electrical fuction Testing</td><td colspan="3">1) No display
2) Missing line
3) No backlight
4) shadow
5) black/blue display
6) Irregular operating
7) visual angle is wrong</td><td>Major</td></tr>
<tr><td>2</td><td>Outline dimension</td><td colspan="3">All outline dimension beyond the drawing is not allowed</td><td>Major</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">White/Black spot (in LCD or Backlight)</td><td colspan="2">Φ(mm)</td><td>acceptable</td><td rowspan="4">Minor
(defect distance ≥ 20mm)</td></tr>
<tr><td colspan="2">Φ≤0.10</td><td>ignore</td></tr>
<tr><td colspan="2">0.10 ＜Φ≤0.2</td><td>2</td></tr>
<tr><td colspan="2">Φ＞0.2</td><td>0</td></tr>
<tr><td>4</td><td>Dirt in POL</td><td colspan="3">as same as White/Black spot</td><td>Minor</td></tr>
<tr><td>5</td><td>Dent at POL</td><td colspan="3">as same as White/Black spot</td><td>Minor</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Bubble in POL</td><td colspan="2">Φ(mm)</td><td>acceptable</td><td rowspan="5">Minor
(defect distance ≥ 20mm)</td></tr>
<tr><td colspan="2">Φ≤0.20</td><td>3</td></tr>
<tr><td colspan="2">0.20 ＜Φ≤0.3</td><td>2</td></tr>
<tr><td colspan="2">0.30 ＜Φ≤0.5</td><td>1</td></tr>
<tr><td colspan="2">Φ＞0.5</td><td>0</td></tr>
<tr><td>7</td><td>Color/bright/dark dot</td><td colspan="3">as same as White/Black spot</td><td>Minor</td></tr>
<tr><td rowspan="6">8</td><td rowspan="6">Scratch / lines (in LCD)</td><td>Width</td><td>Length</td><td>acceptable</td><td rowspan="6">Minor
(defect distance ≥ 20mm)</td></tr>
<tr><td>W≤0.03</td><td>L＜2.0</td><td>ignore</td></tr>
<tr><td>0.03＜W≤0.05</td><td>L≤2.0</td><td>2</td></tr>
<tr><td>0.03<W≤0.05</td><td>L>2.0</td><td>0</td></tr>
<tr><td>W＞0.05</td><td>ignore</td><td>0</td></tr>
<tr><td>ignore</td><td>L＞3.0</td><td>0</td></tr>
<tr><td>9</td><td>Scratch / lines in POL</td><td colspan="3">as same as White/Black spot</td><td>Minor</td></tr>
<tr><td>10</td><td>Scratch / lines in BLU</td><td colspan="3">as same as White/Black spot</td><td>Minor</td></tr>
</table>

11	LCD defect	Crack	Unallowed	Major
		Pad break	W＞0.5mm， unallowed 。 	Major
		Con-Pad break	When a＜1/2T（T=the thickness of single LCD）: b≥1/2 PAD NG or c≥5mm NG When a≥1/2T: as same as PAD break 	Minor
		Break not in PAD	X≤1/8A; Y into the inspect area is unallawed; X≤1/8A, if Y not into the frame,Z ignore; X≤1/8A,Y≤1/2 Seal,Z≤1/2T is allawed X≤1/8A,Y＞1/2 Seal, Z≤1/4T is allawed 	Minor
		Corner break	1)'a'> 1MM unallowed 2)'b'> 1/4E unallowed (E = PAD long of short side) 	Minor

If the acceptable number is ≥ 2 ,the interval between dots or lines must be ≥ 20mm .

16. Reliability

Item NO.	TEST Item	Condition	Criterion
1	Humidity operating	60℃±2℃, 95%RH, 96 hrs	·Placed 2 hours in normal temperature, then inspect the function and cosmetic after test. · After testing, cosmetic and function defects should not happen. · Polarizers may fail in humidity test, but only this failure is allowable.
2	Thermal shock test	25℃±2℃ (5min) → -40℃±2℃ (120min) → 25℃±2℃ (5min) → 70℃±2℃ (120min), 24cycle	
3	High temperature operating	70℃±2℃ 96 hrs	
4	Low temperature operating	-20℃±2℃ 96 hrs	
5	High temperature storage	80℃±2℃ 96 hrs	
6	Low temperature storage	-30℃±2℃ 96 hrs	
7	Packing drop test	1 corner 3 edges six faces, with carton packing, 1m height, concrete ground	· After testing, inspect the packing and product · Packing broken length<2cm, LCD visual and function check

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.

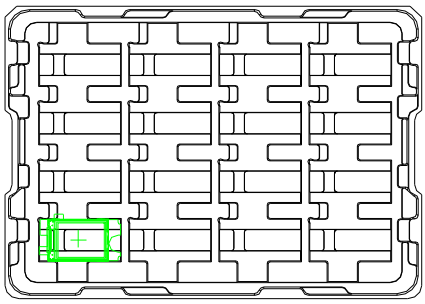
Suitable protection circuit should be applied for each system design.

7) DISPOSAL

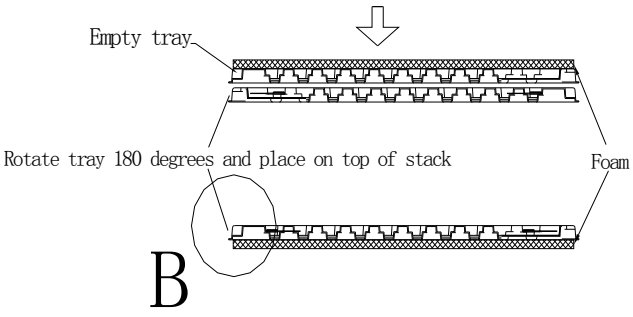
When disposing of the LCD module, obey to the applicable environmental regulations.

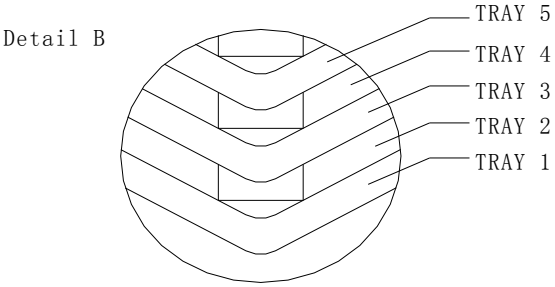
18. Packaging

Step 1: Put LCM into tray

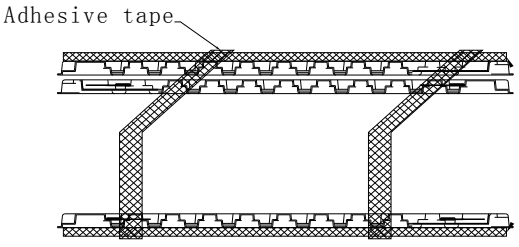


Strep 2: Tray stacking

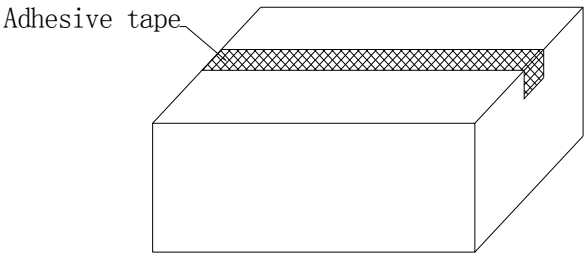




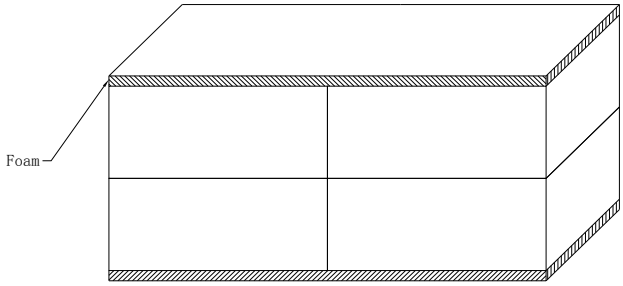
Step3: use adhesive tape to seal, with desiccant put into the shield pag for defending ESD



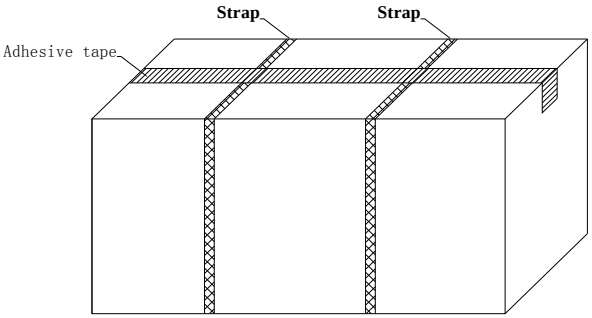
Step4: put into inner package carton ,and use adhesive tape to seal



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			
规格		预收单号	
本批送货数量		LOT NO	
		TCL验收结果	