Specification For Approval

■ Preliminary specification
□ Final specification

Title	TDA150-002 XGA TFT-LCD

Buyer	
Model	

Supplier	BOE Technology CO., LTD
Model	TDA150-002

TITLE/SIGNATURE	DATE

Please return one copy confirmation with your signature and your comments.

ITEM	SIGNATURE	DATE
Approved		
Reviewed		
Prepared		

BOE Technology CO., LTD

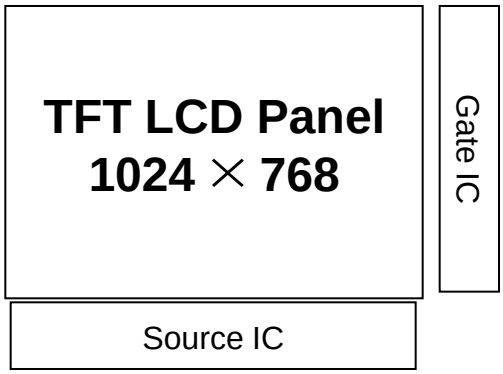
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2013. 09. 22	Hongkun Zhang

Contents

1.0 GENERAL DESCRIPTION

1.0.1 Introduction

TDA150-002 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 15.0 inch diagonally measured active area with XGA resolutions (1024 horizontal by 768 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16,194,227 colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.0.2 Features

- High luminance
- LED back-light
- LED light bar replaceable
- Wide operating temperature
- LVDS interface
- RoHS Compliant

1.0.3 Application

- Industrial
- Vehicle

1.0.4 General Specification

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	304.128 (H) × 228.096(V)	mm	
Number of pixels	1024(H) × 768(V)	Pixels	
Pixel pitch	0.297(H) × 0.297 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.2M	Colors	
Display mode	Normally White		
Dimensional outline	326.5 (H) × 253.5(V) × 11.3(D)tpy	mm	
Weight	1000	g	
Surface treatment	Haze 25%, 3H		
Back-light	Top edge side, 1-LED Lighting Bar Type		
LED life	50,000	hr	

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings> [Ta =25±2 ℃]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage (LCD Module)	V_{DD}	-0.3	3.6	V	
Back-light Power Supply Voltage	HV_{DDOUT}	-0.3	28	V	
Back-light LED Current	I_{HVDD}	80	-	mA	
Back-light LED Reverse Voltage	V_R	25.2	32.4	V	
Operating Temperature	T_{OP}	-30	+80	℃	
Storage Temperature	T_{ST}	-30	+80	℃	

3.0 ELECTRICAL SPECIFICATIONS

3.0.1 Electrical Specifications

< Table 3. Electrical specifications > Ta=25+/-2˚C

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Power Supply Input Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Power Supply Current	I_{DD}	-	605	690	mA	
LED Driver Power Supply Voltage	H_{VDD}	10.8	12	12.6	V	Note 2
LED Driver Power Supply Current	I_{HVDD}	-	930	1080	mA	
LED Driver Efficiency	η	-	81	-	%	
Positive-going Input Threshold Voltage	V_{IT+}	-		+100	mV	Vcom = 1.2V typ.
Negative-going Input Threshold Voltage	V_{IT-}	-100		-	mV	
Differential input common mode voltage	V_{com}		1.2		V	V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	2.0	3.3	W	
	P_{BL}	-	11.2	12.5	W	
	P_{Total}	-	13.2	15.8	W	
					W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25 ℃
Max value at Black Pattern

2. Calculated value for reference (VLED X ILED)

3. CTF of Power Supply Current: PD /PBL

4.0 OPTICAL SPECIFICATION

4.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θ Ø=90 (= θ12) as the 12 o'clock direction ("upward"), θ Ø=180 (= θ9) as the 9 o'clock direction ("left") and θ Ø=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by BM-5A. The backlight should be operating for 10 minutes prior to measurement. VDD shall be 3.3 ± 0.3V at 25°C. Optimum viewing angle direction is 6 'clock

<Table 4. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	65	75	-	Deg.	Note 1
		Θ_9		65	75	-	Deg.	
	Vertical	Θ_{12}		60	70	-	Deg.	
		Θ_6		50	60	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	400	500			Note 2
Luminance of White	9points average	Y_w	Θ = 0°	600	700	-	cd/m^2	Note 3
White Luminance uniformity	9 Points	ΔY9		75	80	-	%	Note 4
Reproduction of color	White	Wx	Θ = 0°	Typ -0.03	0.313	Typ +0.03		Note 5
		Wy			0.329			
	Red	R_x		Typ. -0.03	0.646	Typ. +0.03		
		R_y			0.343			
	Green	G_x			0.311			
		G_y			0.577			
	Blue	B_x			0.148			
		B_y			0.120			
Response Time (Rising + Falling)		T_{RT}	Ta= 25° C Θ = 0°	-	20	25	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Luminance of white is defined as luminance values of 9point average across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by BM-5A when the LED current is set at 20mA.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 9 points / Maximum Luminance of 9 points (see FIGURE 2).

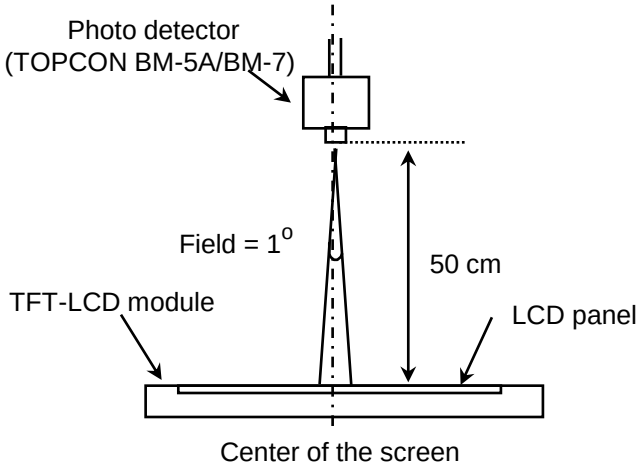
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. The Color Coordinate is the average measurement of the 9 points(see FIGURE 2).

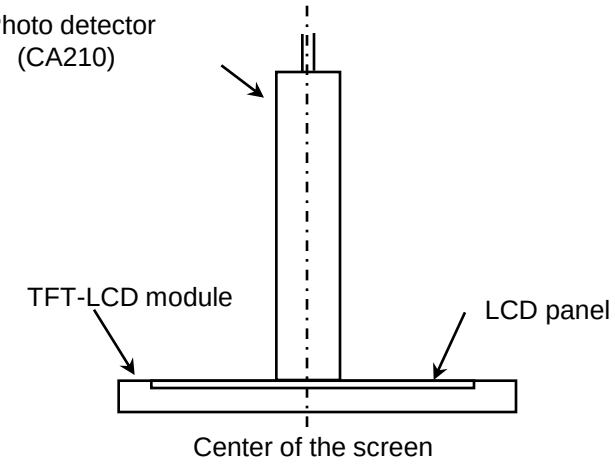
6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

7. Cross-Talk of one area of the LCD surface by another shall be measured by the formula △CT=△Bp (Max.)/ △Bp(Min.) (See FIGURE 4).

4.0.2 Optical measurements

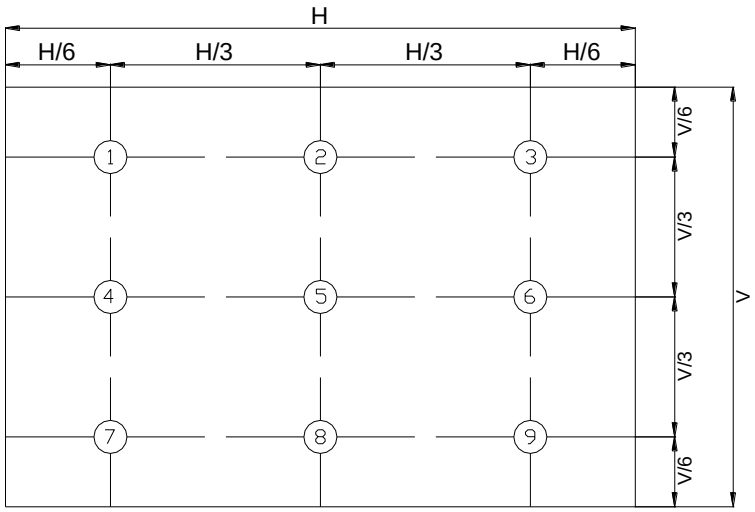
Figure 1. Measurement Set Up





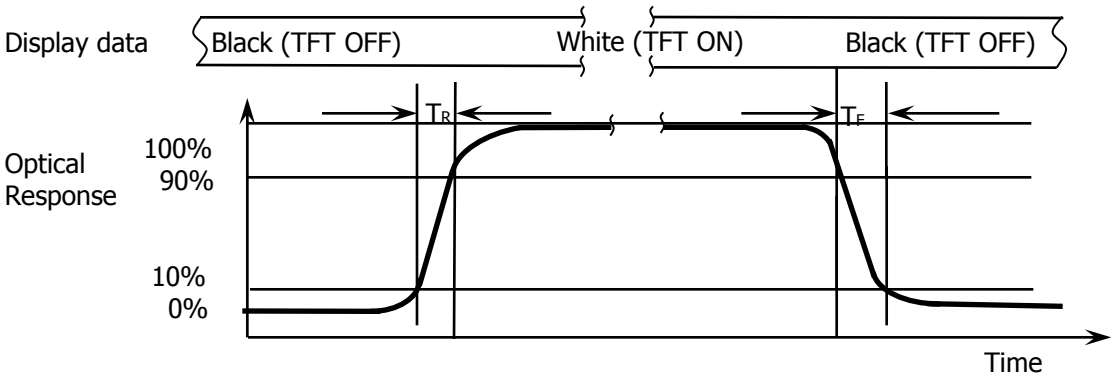
View angel range, uniformity, etc. measurement setup Flicker, measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



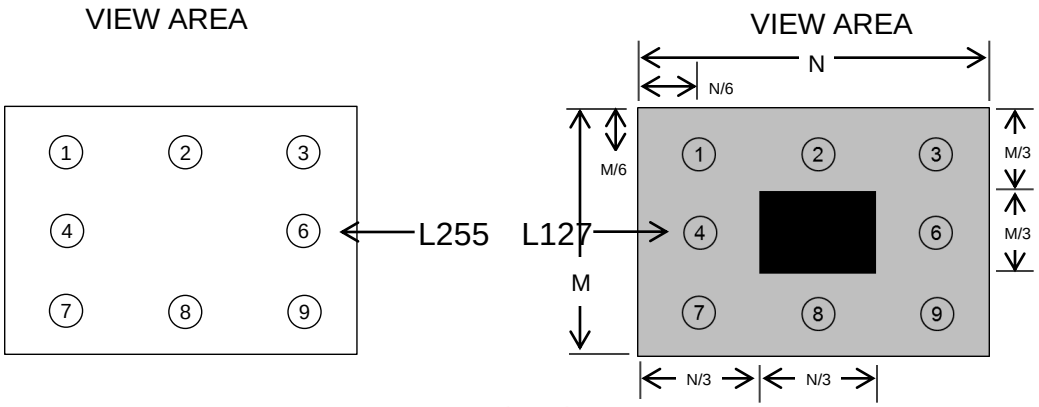
Luminance of white is defined as luminance values of average 9 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY9 = Minimum Luminance of 9 points / Maximum Luminance of 9points (see FIGURE 2).

Figure 3. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

Figure 4. Cross Modulation Test Description



$$\triangle CT = \frac{\triangle Bp\ (Max.)}{\triangle Bp(Min.)}$$

Where:

△Bpn = Bpn (gray) / Bpn (white)

Which n means the dot No. In the Cross-talk Test Pattern ;

Bpn (gray) means the brightness of the No.n spots in Cross-talk Test Pattern;

Bpn (white) means the brightness of the No.n spots in Full white Test Pattern;

△Bp (Max.) = Maximum value in △Bp1~△Bp9, except the No. 5 point.

△Bp (Min.) = Minimum value in △Bp1~△Bp9, except the No.5 point.

The location measured will be exactly the same in both patterns (Refer to FIGURE 4).

5.0 INTERFACE CONNECTION.

5.0.1 Electrical Interface Connection

The electronics interface connector is PF030-O31B-C10-H.
The connector interface pin assignments are listed in Table 6 and 7.

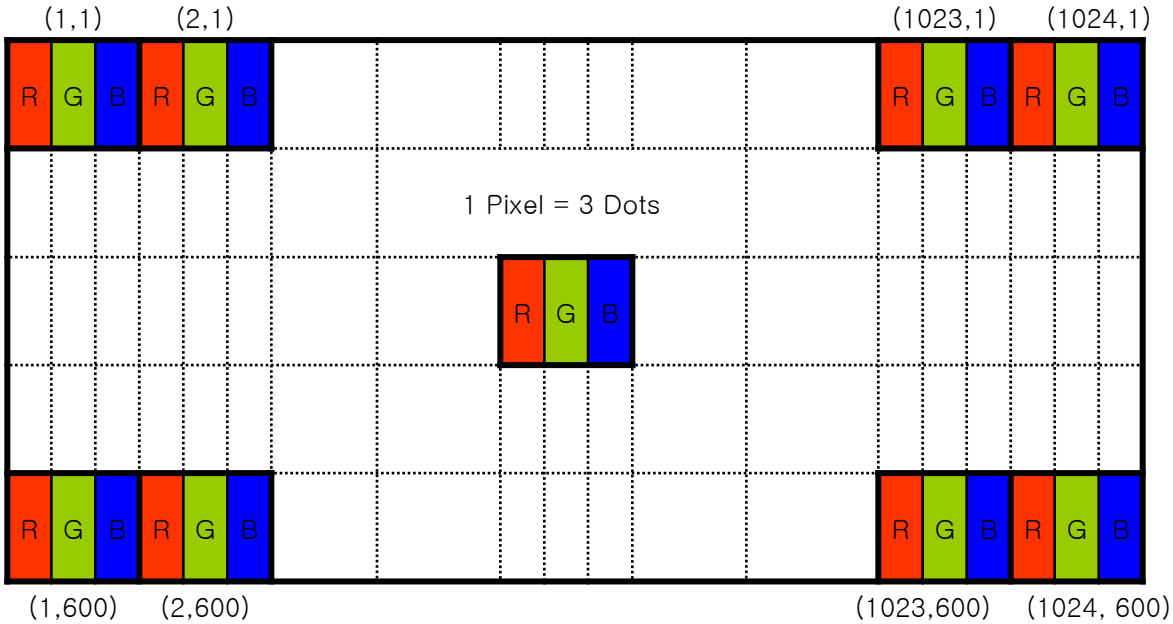
<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	VDD	Power Supply,3.3V(typical)
2	VDD	Power Supply,3.3V(typical)
3	VSS	Ground
4	VSS	Ground
5	RIN0-	-LVDS differential data input(R0-R5,G0)
6	RIN0+	+LVDS differential data input(R0-R5,G0)
7	VSS	Ground
8	RIN1-	-LVDS differential data input(G1-G5,B0-B1)
9	RIN1+	+LVDS differential data input(G1-G5,B0-B1)
10	VSS	Ground
11	RIN2-	-LVDS differential data input(B2-B5,HS,VS,DE)
12	RIN2+	+LVDS differential data input(B2-B5,HS,VS,DE)
13	VSS	Ground
14	CLKIN-	-LVDS differential clock input
15	CLKIN+	+LVDS differential clock input
16	VSS	Ground
17	RIN3-	-LVDS differential data input(R6-R7,G6-G7,B6-B7)
18	RIN3+	+LVDS differential data input(R6-R7,G6-G7,B6-B7)
19	VSS	Ground
20	NC	No Connection

<Table 7. Pin Assignments for the LED Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	VCC	12V
2	GND	GND
3	Enable	5V-On / 0V-Off
4	Dimming	PWM Dimming or Analog Dimming
5	NC	No Connection

5.0.2 Data Input Format



Display Position of Input Data (V-H)

6.0 SIGNAL TIMING SPECIFICATION

6.0.1 The TDA150-002 is operated by the DE only.

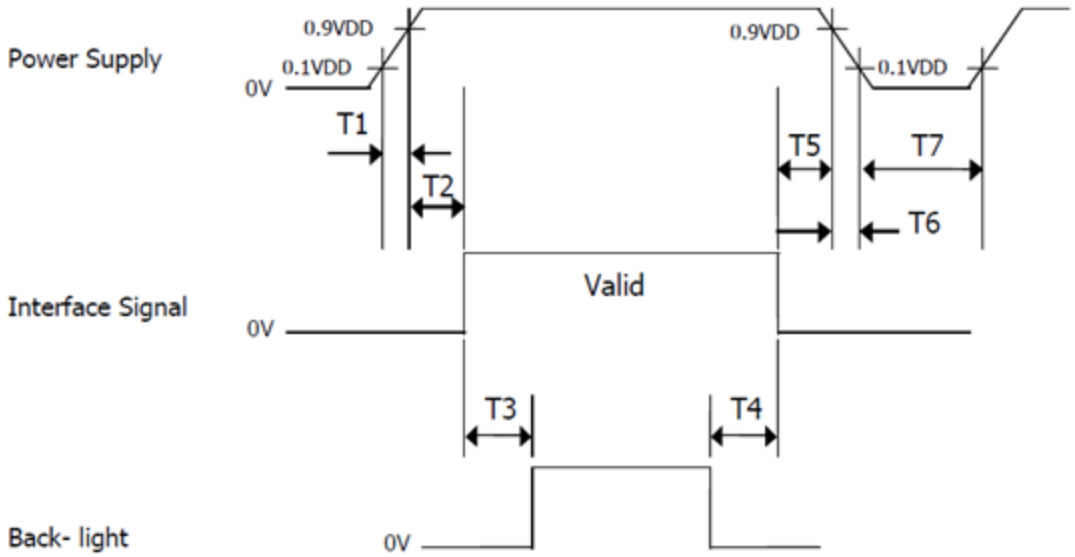
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Horizontal display area	thd		1024		pixel
HSYNC period time	th	1102	1344	2046	pixel
HSYNC blanking	thb+thfp	78	320	1022	pixel
Vertical display area	Tvd		768		H
VSYNC period time	Tv	772	806	1022	H
VSYNC blanking	Tvb+Tvfp	4	38	254	H

7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

8.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	500	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

9.0 MECHANICAL CHARACTERISTICS

9.0.1 Dimensional Requirements

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	304.128 (H) × 228.096(V)	
Number of pixels	1024(H) X768 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.297(H) × 0.297 (V)	
Pixel arrangement	RGB Vertical stripe	
Display colors	16.2M	
Display mode	Normally White	
Dimensional outline	326.5 (H) × 253.5(V) × 11.3(D)tpy	mm
Weight	1000	gram
Back-light	Top edge side, 1-LED Lighting Bar Type	
LED life	50,000	hr

11.2 Mounting

See FIGURE 6.

11.3 Glare and Polarizer Hardness.

The surface of the LCD has a hard coating to reduce scratching.

11.4 Light Leakage

There shall not be obvious light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 150lux.

10.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 10. Reliability test>

Item		Test condition
High temperature storage		80 ℃, 240 hrs
Low temperature storage		-30 ℃, 240 hrs
High temperature & high humidity operation		50 ℃, 80%RH, 240hrs
High temperature operation		80 ℃, 240hrs
Low temperature operation		-30℃, 240hrs
Thermal shock		-30 ℃ ↔ 80 ℃ (0.5 hr), 100 cycle
Vibration test	Frequency	10/ 500/10 Hz,Sine X/Y/Z Direction
	Gravity / AMP	1.5 G
	Period	±X, ±Y, ±Z 30 min
Shock test	Gravity	50G
	Pulse width	11msec, sine wave
	Direction	±X, ±Y, ±Z
On/Off test		On/10 sec, Off/10 sec, 30,000 cycles
ESD	Air	± 15KV, 150pF(330) 1sec, 8 points, 25 times/ point
	Contact	± 8KV, 150pF(330) 1sec, 8 points, 25 times/ point

11.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

12.0 LABEL

(1) Product label

1	2	3	4	5	6	7
X X	X	X	X X	1	0 0 X X	X X X X X X

Type designation

No 1. Control Number

No 2. Rank / Grade

No 3. Line classification (BOE OT:A/BC)

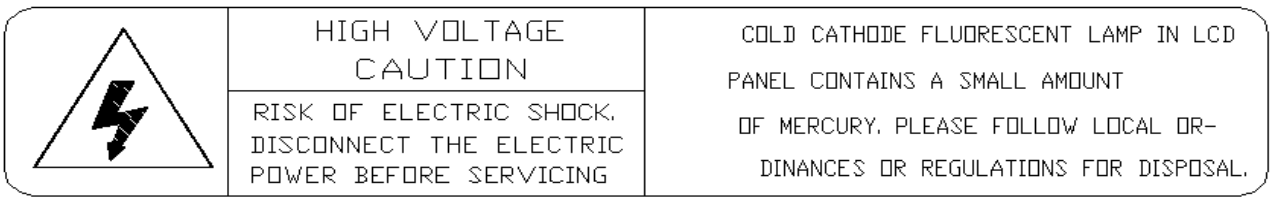
No 4. Year (10 : 2010, 11: 2011, ...)

No 5. Month (1, 2, 3, ..., 9, X, Y, Z)

No 6. Product Identification (FG)

No 7. Serial Number

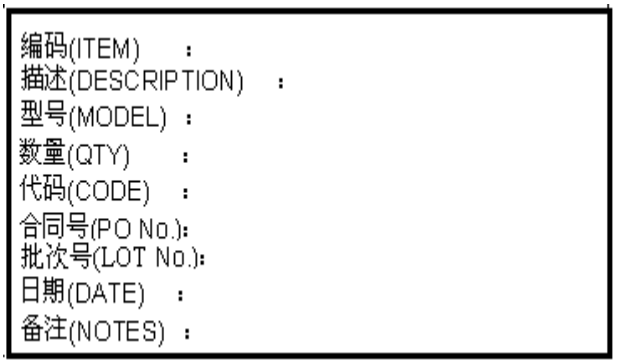
(2) High voltage caution label



(3) Box label

Label Size: Label 1：165 mm (L) × 102 mm (W)
Label 2： 100 mm (L) × 70 mm (W)
Contents
Model: TDA150-002
Q`ty: Module Q`ty in one box
Date: Packing Date
Internal use of Product

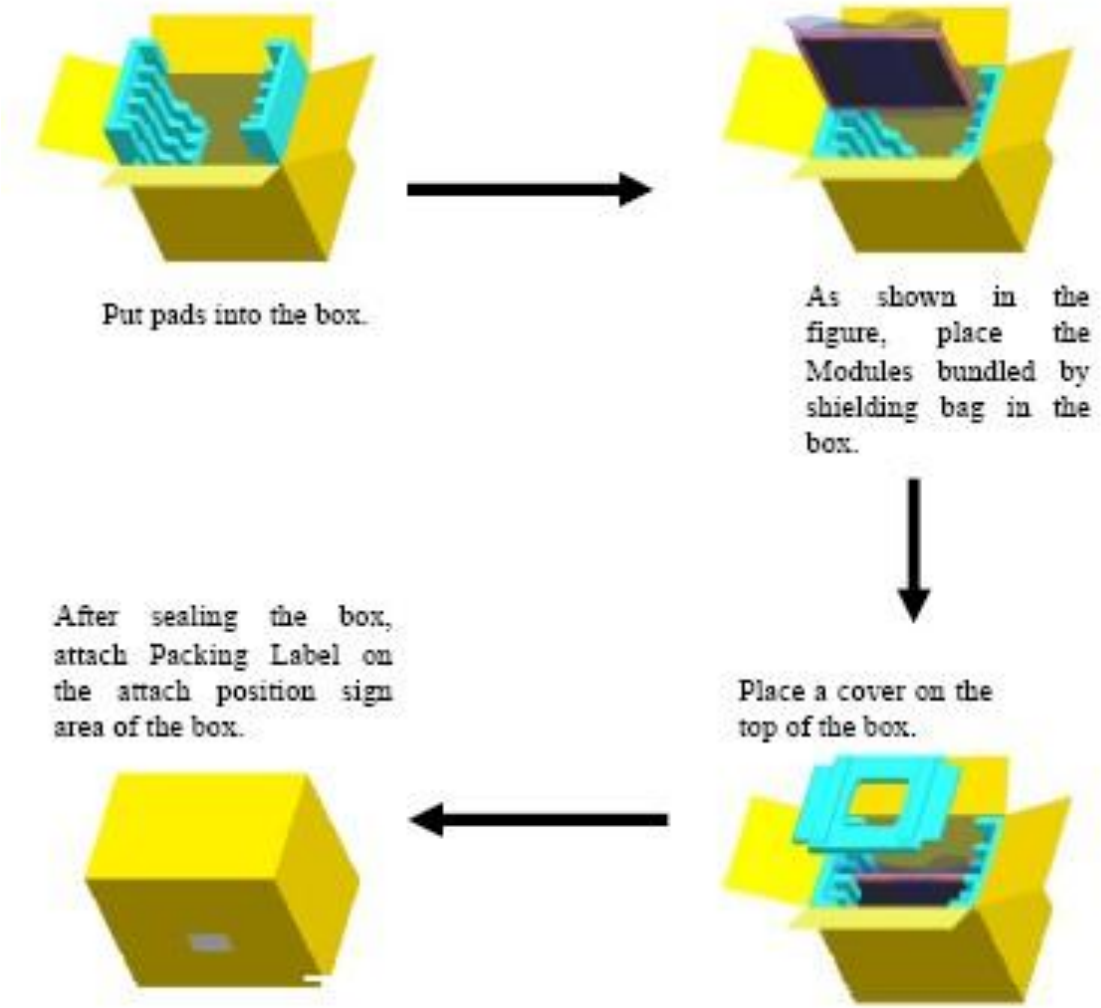
Label 1



Label 2

13.0 PACKING INFORMATION

13.0.1 Packing order



14.0 MECHANICAL OUTLINE DIMENSION

Figure 6. TFT-LCD Module Outline Dimension (Front View)

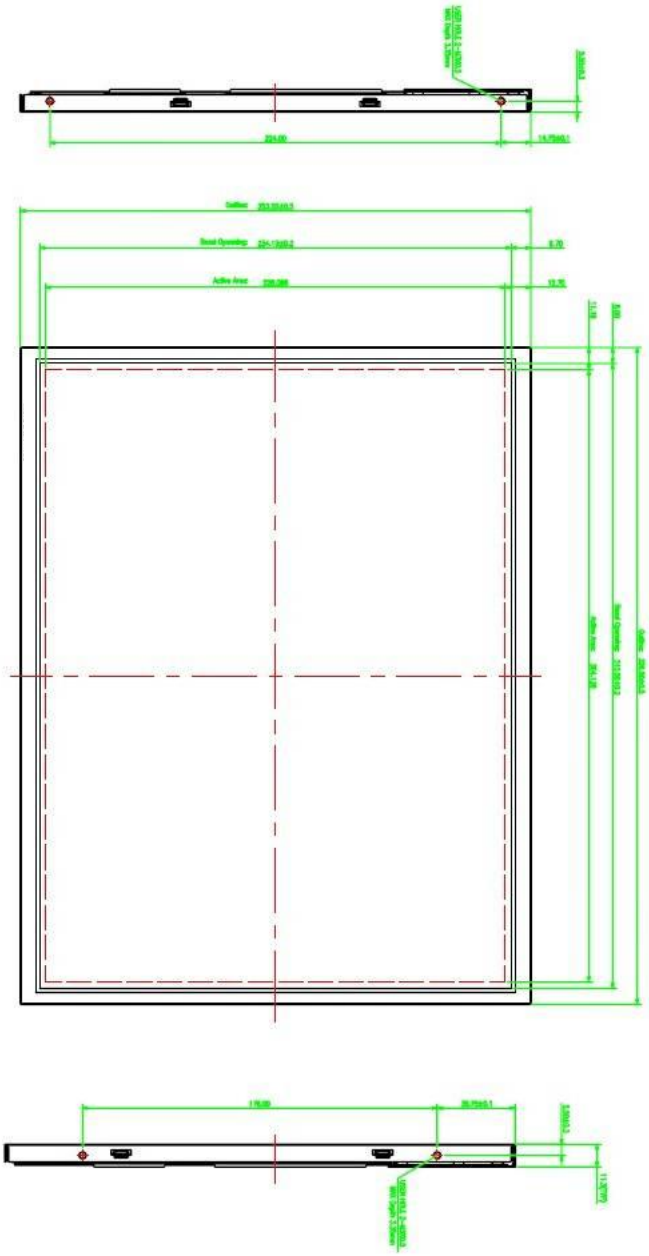


Figure 7. TFT-LCD Module Outline Dimensions (Rear view)