



# PRODUCT SPECIFICATION

## 4.6" TN TFT LCD MODULE

MODEL: TFTL-0102 Ver:1.4



< ◇ > Preliminary Specification

< ◆ > Finally Specification

<b>CUSTOMER'S APPROVAL</b>	
<b>CUSTOMER :</b>	
<b>SIGNATURE:</b>	<b>DATE:</b>

<b>APPROVED BY</b>	<b>PM REVIEWED</b>	<b>PD REVIEWED</b>	<b>PREPARED BY</b>

**Revision History**

Revision	Date	Originator	Detail	Remarks
1.0	2013.11.25		Initial Release	
1.1	2014.01.13		Add weight Modify Chromaticity Transmissive Modify Inspection Specification	P4 P6 P14
1.2	2014.04.02		Modify DC Characteristics	P4
1.3	2014.07.28		Change the LCD panel supplier Modify DC Characteristics Modify Contrast ratio Modify Timing Chart Modify Inspection Specification Modify Reliability Specification	P4 P6 P11,12 P16 P21
1.4	2014.08.28		Modify Luminance on TFT	P6

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## 1. General Description

The specification is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT-LCD panel, driver Ics and a backlight unit.

## 2. Module Parameter

Features	Details	Unit
Display Size(Diagonal)	4.6"	
LCD type	TN TFT	
Display Mode	Normally White/Transmissive	
Resolution	800 RGB x 320	Pixels
View Direction	12 O'clock	Best Image
Gray Scale Inversion Direction	6 O'clock	
Module Outline	120.7 (H) x 57.08(V) x 3.10(MAX)(T) (Note1 )	mm
Active Area	108 (H) x 43.2(V)	mm
Pixel Size	135 (H) x 135(V)	um
Pixel Arrangement	R.G.B Vertical Stripe	
Polarizer Surface Treatment	Anti-Glare	
Display Colors	16.7M	
Interface	24-bit RGB interface	
With or Without Touch Panel	Without	
Operating Temperature	-20~70	°C
Storage Temperature	-30~80	°C
Weight	42	g

Note 1: Exclusive hooks, posts, FFC/FPC tail etc.

## 3. Absolute Maximum Ratings

$V_{SS}=0V, T_a=25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VDD	-0.5	5.0	V
Storage temperature	$T_{STG}$	-30	+80	°C
Operating temperature	$T_{OP}$	-20	+70	°C

Note 1: If  $T_a$  below  $50^{\circ}C$ , the maximal humidity is 90%RH, if  $T_a$  over  $50^{\circ}C$ , absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around  $-10^{\circ}C$ , and the back ground will become darker at high temperature operating.

#### 4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	VDD	2.3	3.3	3.6	V
Logic Low input voltage	V <sub>IL</sub>	GND	-	0.3*VDD	V
Logic High input voltage	V <sub>IH</sub>	0.7*VDD	-	VDD	V
(Panel+LSI) Power Consumption	Black Mode (60Hz)	-	320	-	mW
	Standby Mode	-	95	-	mW

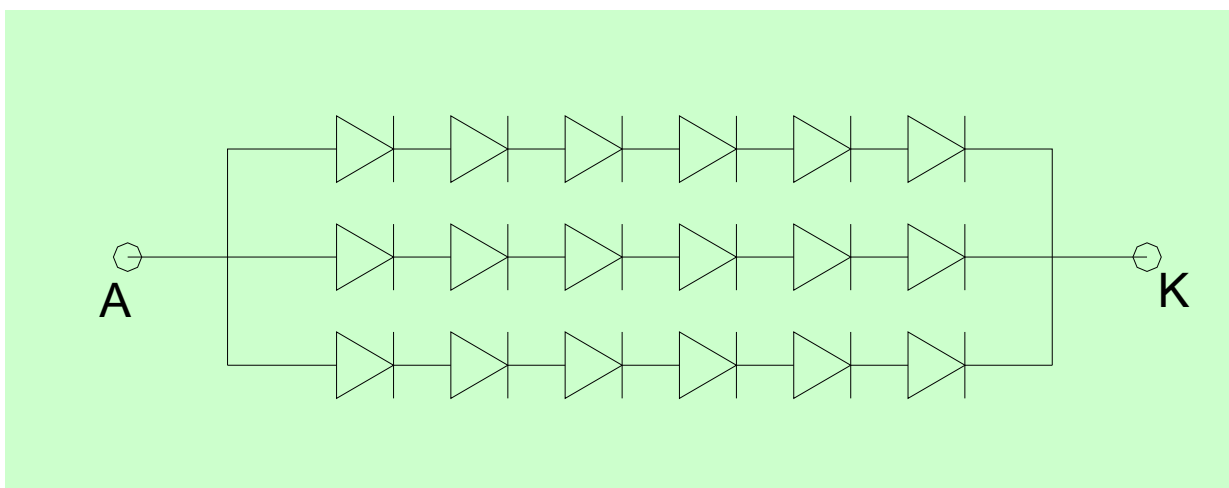
Item	Min.	Typ.	Max.	Unit
LCD driver IC's spec range of VG <sub>H</sub>	-0.3	-	42	V
LCD driver IC's spec range of VG <sub>L</sub>	-20	-	+0.3	V
LCD driver IC's spec range of VCOM	2.0	-	5.0	V
FPC circuit VG <sub>H</sub>	19.72	21.72	23.72	V
FPC circuit VG <sub>L</sub>	-8.9	-6.9	-4.9	V
FPC circuit VCOM	3.17	3.67	4.17	V

#### 5. Backlight Characteristic

##### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED	-	19.2	-	V
Forward Current	I <sub>F</sub>	T <sub>a</sub> =25 °C, V <sub>F</sub> =3.2V/LED	-	20*3	-	mA
Power dissipation	P <sub>D</sub>		-	1152	-	mW
Uniformity	Avg		75	80	-	%
Drive method	Constant current					
LED Configuration	18 White LEDs (6 LEDs in string and 3 groups in parallel)					

##### 5.2. Backlighting circuit



## 6. Optical Characteristics

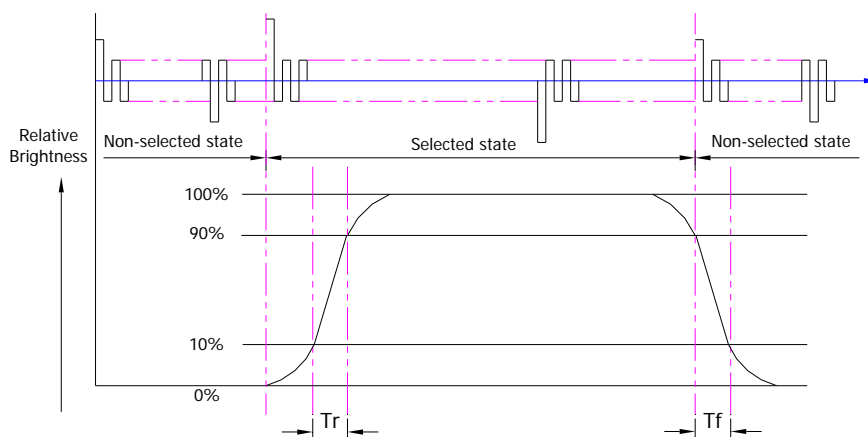
### 6.1. Optical Characteristics

Ta=25°C, V<sub>DD</sub>=3.3V, TN LC+ Polarizer

	Item	Symbol	Condition	Specification			Unit	
				Min.	Typ.	Max.		
Backlight On (Transmissive Mode)	Luminance on TFT(I <sub>f</sub> =20mA/LED)	Lv	Normally viewing angle θ <sub>X</sub> = φ <sub>Y</sub> = 0°	410	520	-	cd/m <sup>2</sup>	
	Contrast ratio(See 6.3)	CR		350	500	-		
	Response time (See 6.2)	T <sub>R</sub> +T <sub>F</sub>		-	20	-	ms	
	Chromaticity Transmissive (See 6.5)	Red	X <sub>R</sub>	Center CR≥10	0.560	0.610	0.660	
			Y <sub>R</sub>		0.300	0.350	0.400	
		Green	X <sub>G</sub>		0.285	0.335	0.385	
			Y <sub>G</sub>		0.558	0.608	0.658	
		Blue	X <sub>B</sub>		0.100	0.150	0.200	
			Y <sub>B</sub>		0.056	0.106	0.156	
	White	X <sub>W</sub>	0.248	0.298	0.348			
Y <sub>W</sub>		0.276	0.326	0.376				
Viewing Angle (See 6.4)	Horizontal	θ <sub>X+</sub>	Center CR≥10	60	65	-	Deg.	
		θ <sub>X-</sub>		60	65	-		
	Vertical	φ <sub>Y+</sub>		45	50	-		
		φ <sub>Y-</sub>		55	60	-		
NTSC Ratio(Gamut)				-	50	-	%	

### 6.2. Definition of Response Time

#### 6.2.1. Normally Black Type (Negative)



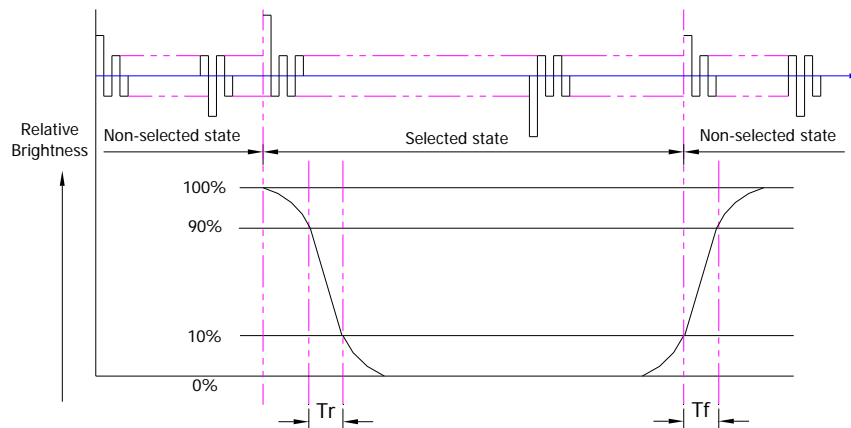
Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to

non-selected state with relative luminance 10%

Note: Measuring machine: LCD-5100

### 6.2.2. Normally White Type (Positive)



Tr is the time it takes to change from non-selected state with relative luminance 90% to selected state with relative luminance 10%;

Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note: Measuring machine: LCD-5100 or EQUI

### 6.3. Definition of Contrast Ratio

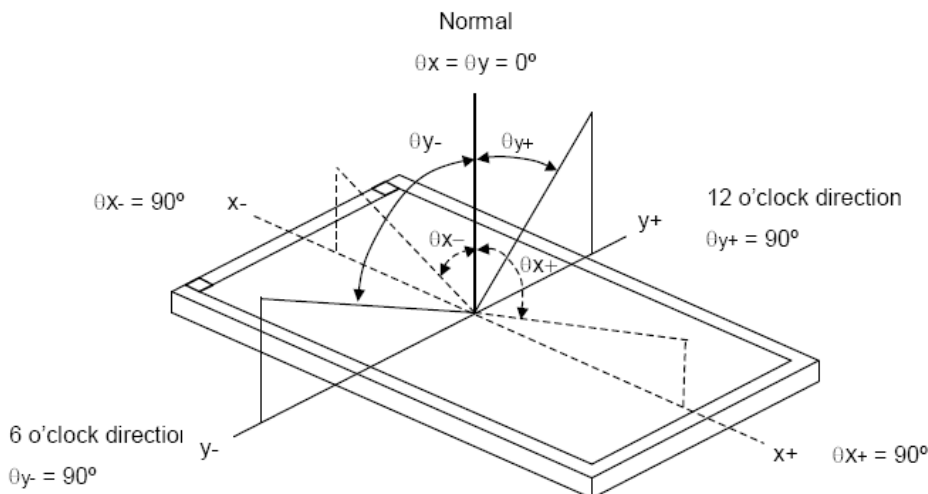
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

The measurement condition is:

Measuring Equipment	Eldim or Equivalent
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

### 6.4. Definition of Viewing Angles



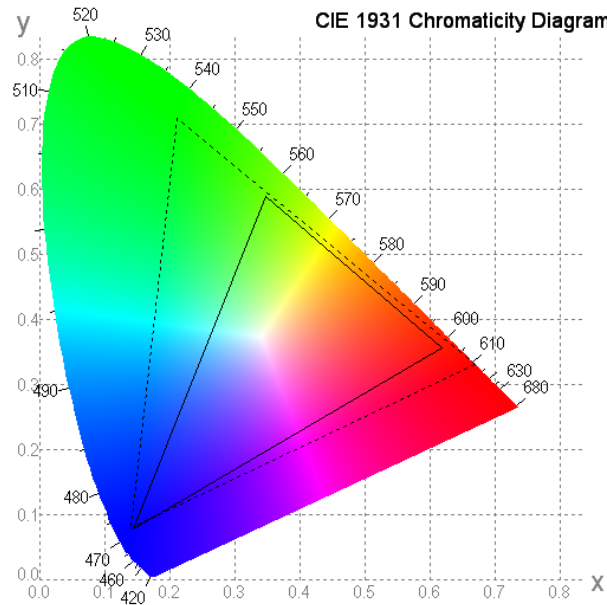
Measuring machine: LCD-5100 or EQUI

### 6.5. Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



### 6.6. Definition of Surface Luminance, Uniformity and Transmittance

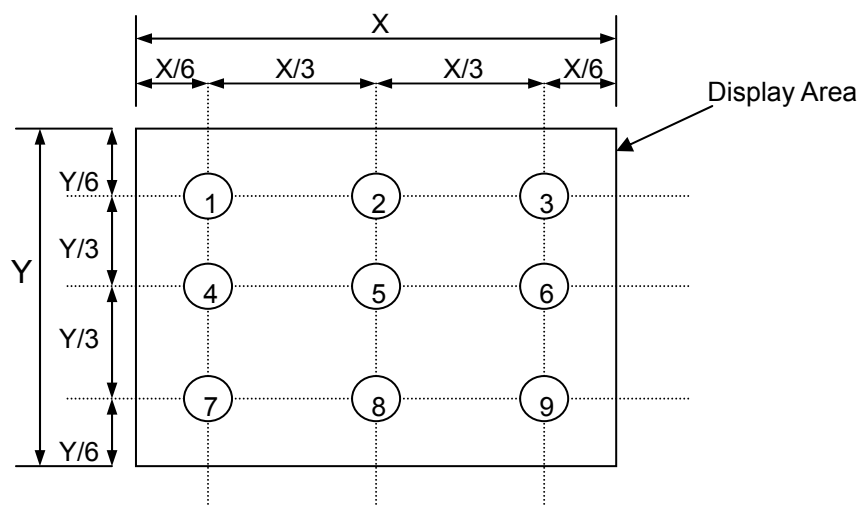
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance:  $L_V = \text{average } (L_{P1}:L_{P9})$

6.6.2. Uniformity = Minimal ( $L_{P1}:L_{P9}$ ) / Maximal ( $L_{P1}:L_{P9}$ ) \* 100%

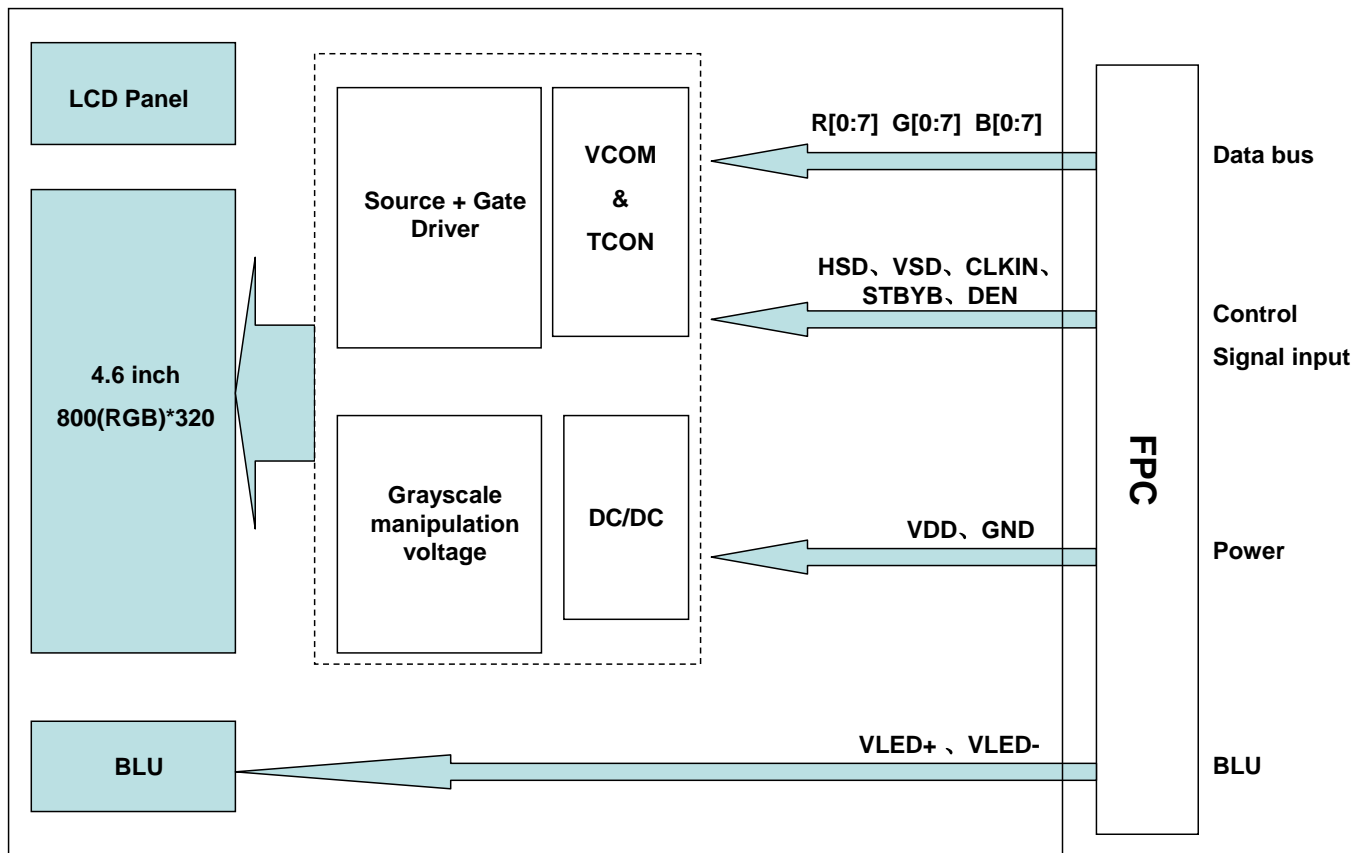
6.6.3. Transmittance =  $L_V$  on LCD /  $L_V$  on Backlight \* 100%

Note: Measuring machine: BM-7





## 7. Block Diagram and Power Supply



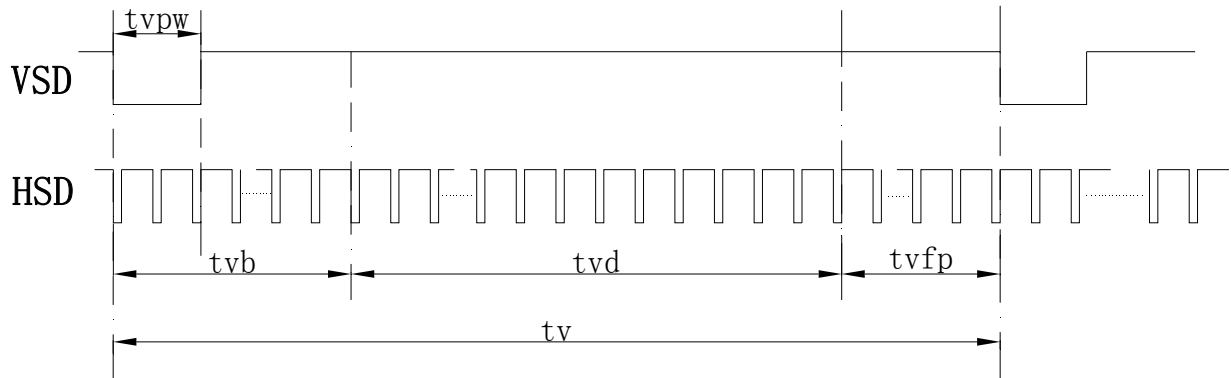
**8. Interface Pins Definition**

No.	Symbol	Function	Remark
1	VLED-	Ground(Cathode)	
2	VLED+	LED Input Terminal(Anode)	
3	GND	Power voltage	
4	VDD	Power voltage	
5	R0	Red data(LSB)	
6	R1	Red data	
7	R2	Red data	
8	R3	Red data	
9	R4	Red data	
10	R5	Red data	
11	R6	Red data	
12	R7	Red data(MSB)	
13	G0	Green data(LSB)	
14	G1	Green data	
15	G2	Green data	
16	G3	Green data	
17	G4	Green data	
18	G5	Green data	
19	G6	Green data	
20	G7	Green data(MSB)	
21	B0	Blue data(LSB)	
22	B1	Blue data	
23	B2	Blue data	
24	B3	Blue data	
25	B4	Blue data	
26	B5	Blue data	
27	B6	Blue data	
28	B7	Blue data(MSB)	
29	GND	Ground	
30	CLKIN	Clock for input data. Data latched at rising edge of this signal	
31	STBYB	STBYB="1":Display on; STBYB="0":Display off.	
32	HSD	Horizontal sync signal	
33	VSD	Vertical sync signal	
34	DEN	Data enable. (In SYNC mode this pin should not be used.)	
35	NC	No connection	
36	GND	Ground	
37	NC(XR)	No connection	
38	NC(YD)	No connection	
39	NC(XL)	No connection	
40	NC(YU)	No connection	

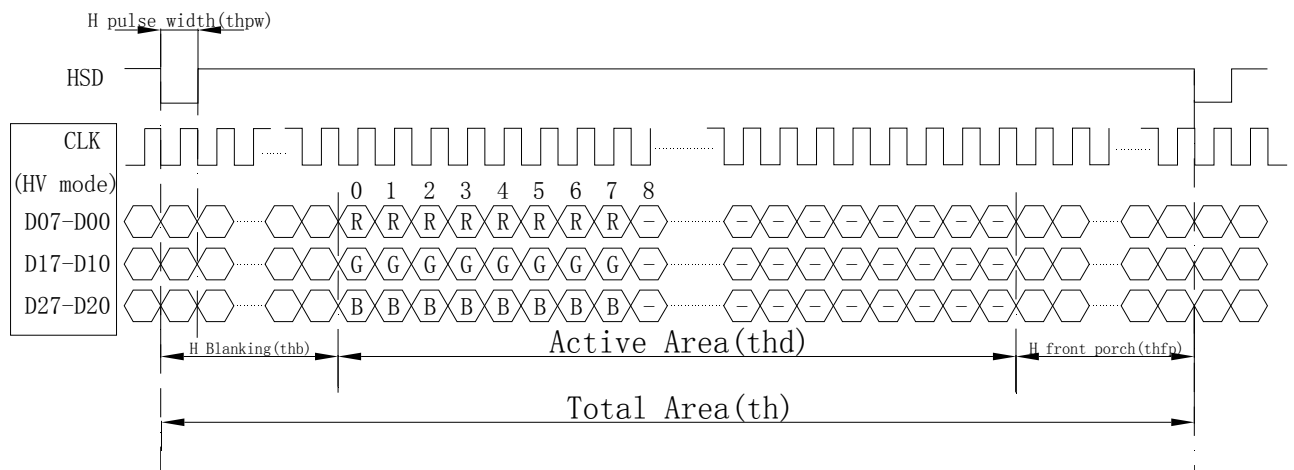
## 9. Timing Chart

### 9.1. Data Input Format

Vertical input Format



Horizontal input timing



### 9.2. Timing Parameters

Horizontal input timing

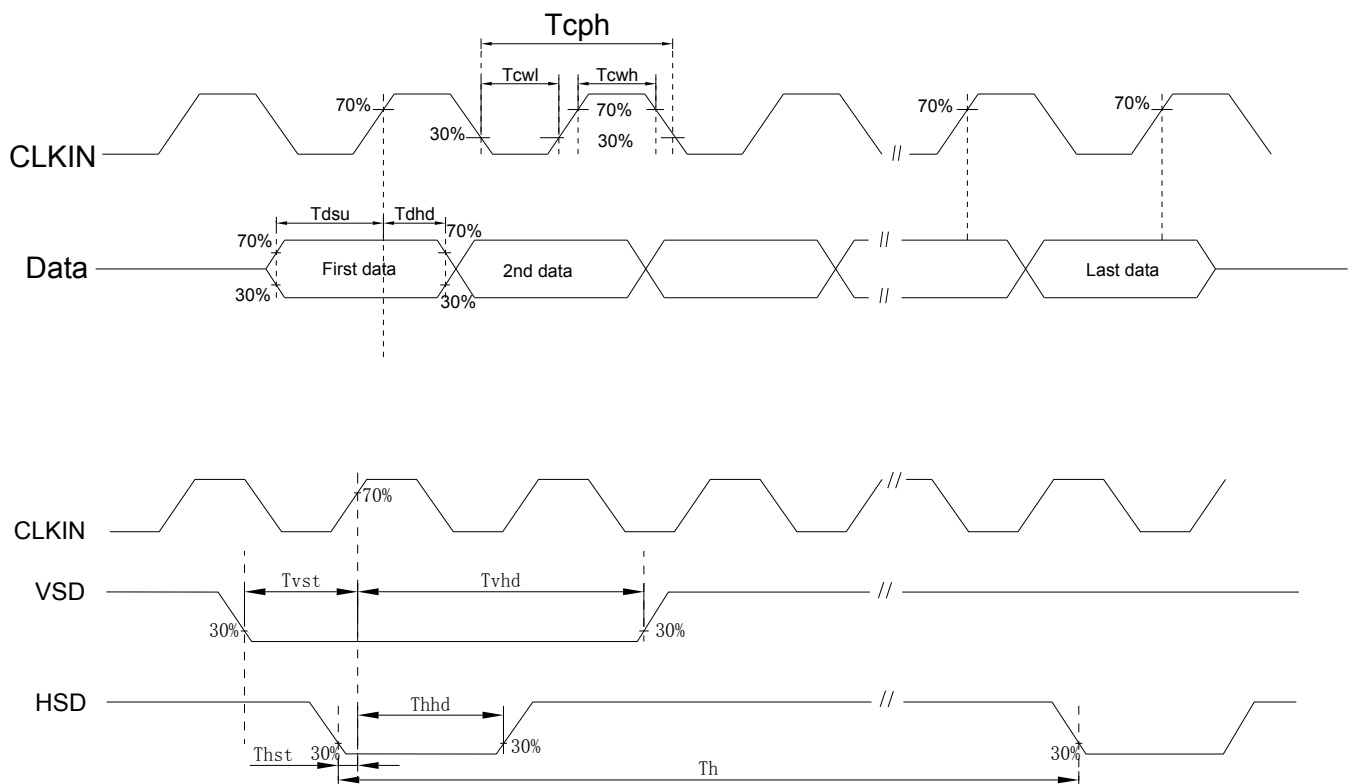
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Horizontal display area	$t_{hd}$		800		DCLK
DCLK frequency	$f_{clk}$	-	30	-	MHZ
1 Horizontal Line	$t_h$		898		DCLK
HSD pulse width	Min.		1		
	Typ.	$t_{hpw}$	2		
	Max.		-		
HSD Back Porch(Blanking)	$t_{hb}$	-	88	-	
HSD Front Porch	$t_{hfp}$	-	10	-	

**Vertical input timing**

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd	320			H
VSD period time	tv	-	522	-	H
VSD pulse width	tpw	-	2	-	H
VSD Back Porch(Blanking)	tvb	-	200	-	H
VSD Front Porch	tvfp	-	2	-	H

**Timing Diagram**

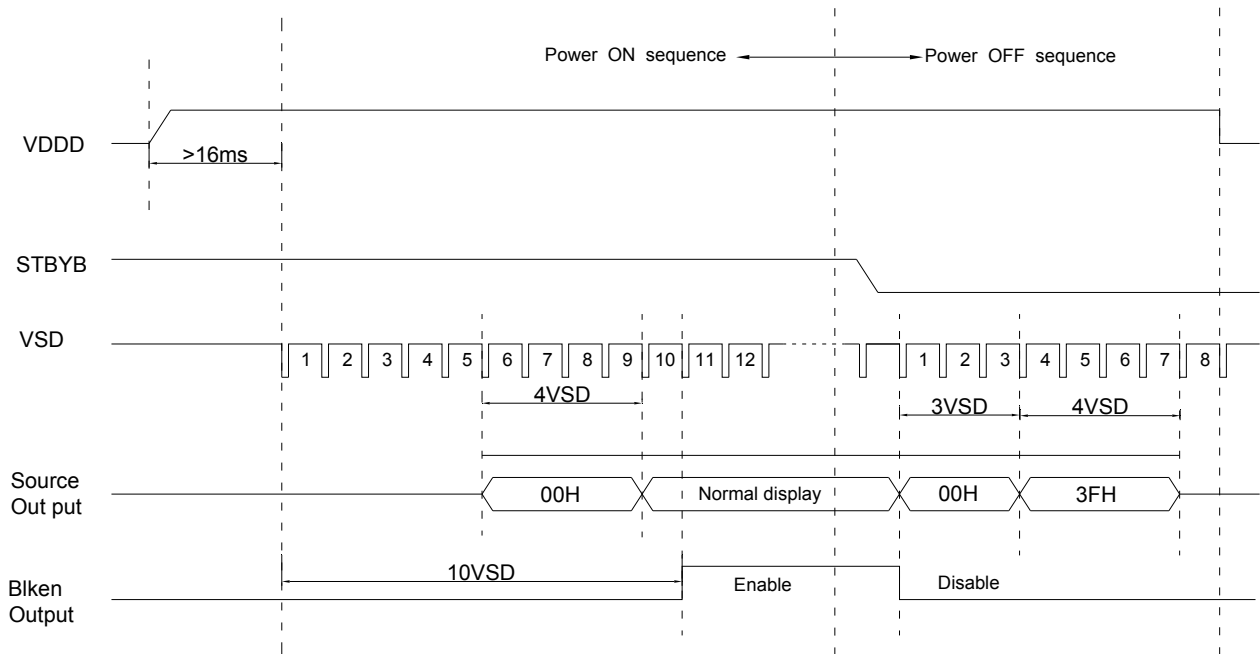
Input Clock and Data Timing Diagram



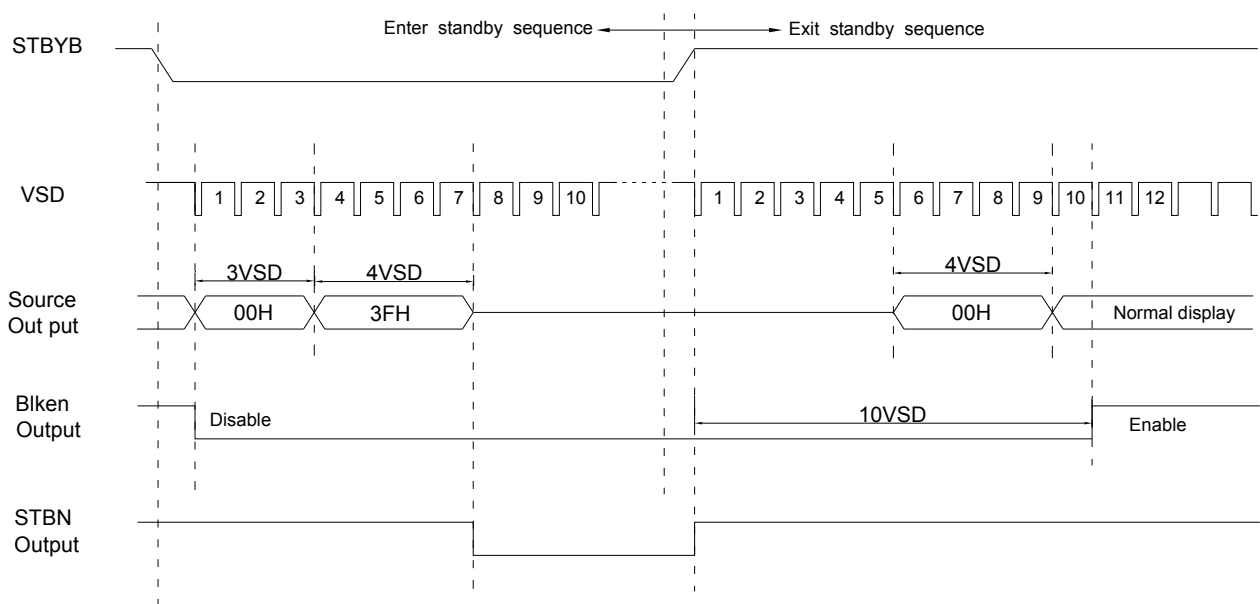
### 9.3. Power ON/OFF Sequence

In order to prevent IC from power on reset fail, the rising time ( $T_{POR}$ ) of the digital power supply VDD should be maintained within the specifications. Refer to “AC Characteristics” for more detail on timing.

#### Power-On/Off Timing Sequence:



#### Enter and Exit Standby Mode Sequence:



## 10. Quality Assurance

### 10.1 Purpose

This standard for Quality Assurance assures the quality of LCD module products supplied to customer.

### 10.2 Standard for Quality Test

#### 10.2.1 Sampling Plan:

GB2828.1-2003

Single sampling, general inspection level II

#### 10.2.2 Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 10.2.3 Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### 10.3 Nonconforming Analysis & Disposition

#### 10.3.1 Nonconforming analysis:

10.3.1.1 Customer should provide overall information of non-conforming sample for their complaints.

10.3.1.2 After receipt of detailed information from customer, the analysis of nonconforming parts usually should be finished in one week.

10.3.1.3 If cannot finish the analysis on time, customer will be notified with the progress status.

#### 10.3.2 Disposition of nonconforming:

10.3.2.1 Non-conforming product over PPM level will be replaced.

10.3.2.2 The cause of non-conformance will be analyzed. Corrective action will be discussed and implemented.

### 10.4 Agreement Items

Shall negotiate with customer if the following situation occurs:

10.4.1 There is any discrepancy in standard of quality assurance.

10.4.2 Additional requirement to be added in product specification.

10.4.3 Any other special problem.

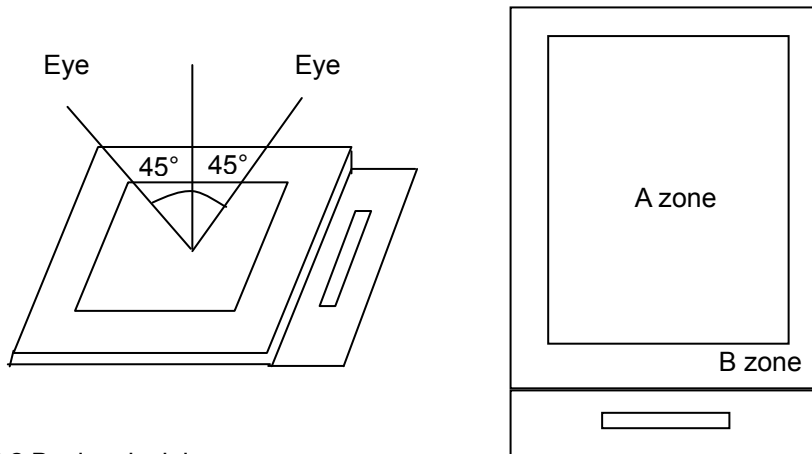
### 10.5 Standard of the Product Visual Inspection

#### 10.5.1 Appearance inspection:

10.5.1.1 The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

10.5.1.2 The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

10.5.1.3 Definition of area: A Zone: Active Area, B Zone: Viewing Area,

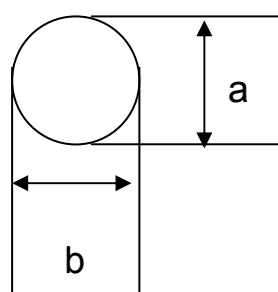


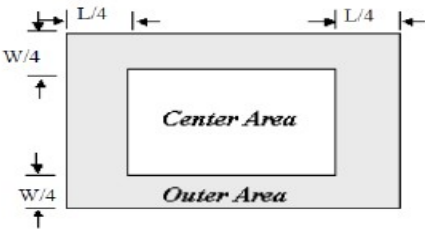
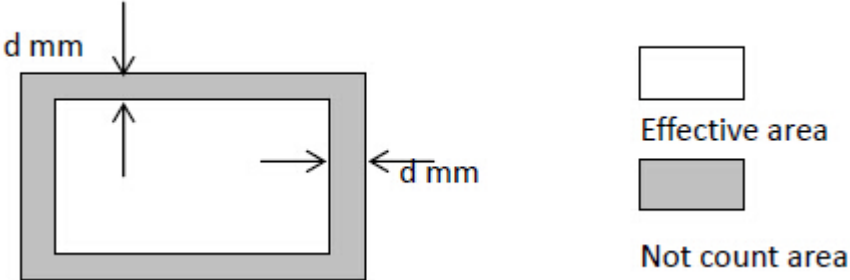
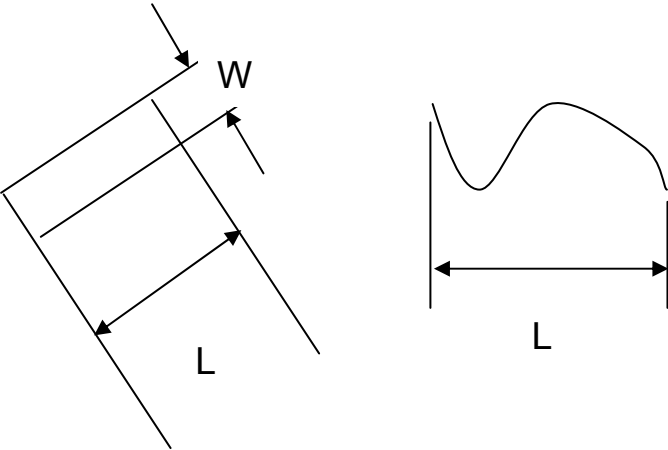
10.5.2 Basic principle:

10.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

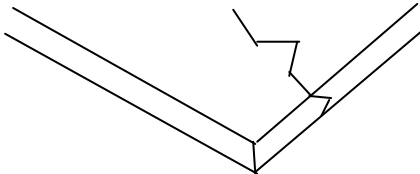
10.5.2.2 New item must be added on time when it is necessary.

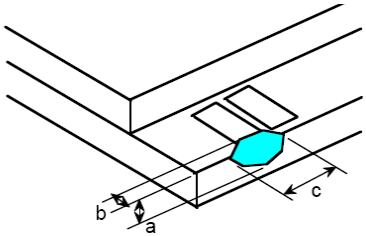
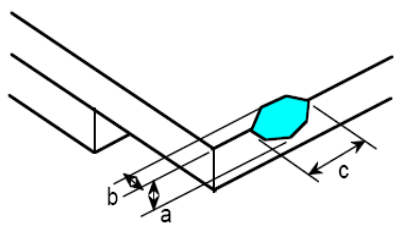
10.6 Inspection Specification

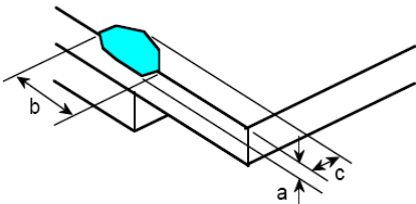
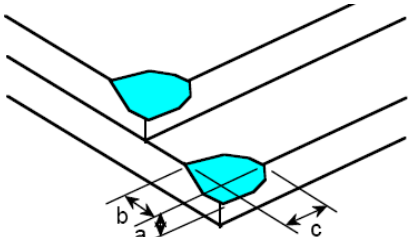
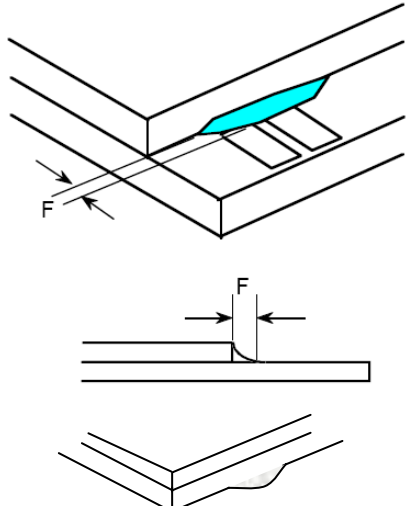
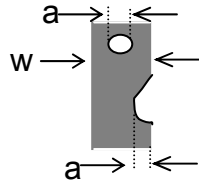
No.	Item	Criteria (Unit: mm)																		
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 <table border="1" data-bbox="909 996 1412 1209"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.20</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.50</math></td> <td></td> <td><math>N \leq 3</math></td> </tr> <tr> <td><math>0.50 &lt; \phi</math></td> <td></td> <td>0</td> </tr> </tbody> </table> <p><math>\phi = (a + b) / 2</math></p> <p>Distance between 2 defects should more than 5mm apart.</p>	Size	Area	Acc. Qty	$\phi \leq 0.20$		Ignore	$0.20 < \phi \leq 0.50$		$N \leq 3$	$0.50 < \phi$		0						
Size	Area	Acc. Qty																		
$\phi \leq 0.20$		Ignore																		
$0.20 < \phi \leq 0.50$		$N \leq 3$																		
$0.50 < \phi$		0																		
02	Electrical Defect (Minor defect)	<table border="1" data-bbox="518 1444 1380 1668"> <thead> <tr> <th></th> <th>Display Area</th> <th>Total</th> <th rowspan="3">Note1</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td><math>N \leq 2</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <td>Dark dot</td> <td><math>N \leq 4</math></td> <td><math>N \leq 4</math></td> </tr> <tr> <td>Total dot</td> <td><math>N \leq 4</math></td> <td><math>N \leq 4</math></td> <td></td> </tr> <tr> <td>Mura</td> <td colspan="2">Not visible through 5% ND filters.</td> <td>Note 2</td> </tr> </tbody> </table> <p>Remark: 1. Bright dot caused by scratch and foreign object accords to item 1.</p>		Display Area	Total	Note1	Bright dot	$N \leq 2$	$N \leq 2$	Dark dot	$N \leq 4$	$N \leq 4$	Total dot	$N \leq 4$	$N \leq 4$		Mura	Not visible through 5% ND filters.		Note 2
	Display Area	Total	Note1																	
Bright dot	$N \leq 2$	$N \leq 2$																		
Dark dot	$N \leq 4$	$N \leq 4$																		
Total dot	$N \leq 4$	$N \leq 4$																		
Mura	Not visible through 5% ND filters.		Note 2																	

<p>03</p>	<p>Inactive Area (Minor defect)</p>	<p>Line Criteria: <math>L \leq 1\text{mm}</math>, <math>W \leq 0.1\text{mm}</math>, Dot Criteria: Please refer to Note 1,2&amp;3</p> <p>Note 1: Definition of Area</p>  <p>Note 2:</p> <table border="1" data-bbox="518 667 1362 837"> <thead> <tr> <th>Size</th> <th>Inactive dot</th> <th>Center</th> <th>Outer</th> <th>Total</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>All</td> <td><math>\Phi &lt; 0.2\text{mm}</math></td> <td colspan="4">Is not counted</td> </tr> <tr> <td>&lt;6"</td> <td><math>0.2 \leq \Phi \leq 0.3\text{mm}</math> <math>L \leq 1\text{mm}, W \leq 0.1\text{mm}</math></td> <td><math>N \leq 1</math></td> <td><math>N \leq 2</math></td> <td><math>N \leq 3</math></td> <td></td> </tr> </tbody> </table> <p>Remark:</p> <p>Effective area is from the POL cutting side to 0.5mm of inside. This is no count area. Other part is effective area. In no count area, any defect can ignore. In effective area, have to judge from above-mentioned specification.</p> 	Size	Inactive dot	Center	Outer	Total	Remark	All	$\Phi < 0.2\text{mm}$	Is not counted				<6"	$0.2 \leq \Phi \leq 0.3\text{mm}$ $L \leq 1\text{mm}, W \leq 0.1\text{mm}$	$N \leq 1$	$N \leq 2$	$N \leq 3$	
Size	Inactive dot	Center	Outer	Total	Remark															
All	$\Phi < 0.2\text{mm}$	Is not counted																		
<6"	$0.2 \leq \Phi \leq 0.3\text{mm}$ $L \leq 1\text{mm}, W \leq 0.1\text{mm}$	$N \leq 1$	$N \leq 2$	$N \leq 3$																
<p>04</p>	<p>Black and White line Scratch Foreign material (Line type) (Minor defect)</p>																			



		<table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.1</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.1 &lt; W \leq 0.2</math></td> <td>3</td> </tr> <tr> <td><math>L &gt; 2.5</math></td> <td><math>0.2 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.1$	Ignore	$L \leq 2.5$	$0.1 < W \leq 0.2$	3	$L > 2.5$	$0.2 < W$	0	Total		3
Length	Width	Acc. Qty															
/	$W \leq 0.1$	Ignore															
$L \leq 2.5$	$0.1 < W \leq 0.2$	3															
$L > 2.5$	$0.2 < W$	0															
Total		3															
05	Glass Crack (Minor defect)	 <p>Crack is potential to enlarge, any type is not allowed.</p>															

06	Glass Chipping Pad Area: (Minor defect)	 <table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>3</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	3	$a < \text{Glass Thickness}$			
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	3											
$a < \text{Glass Thickness}$												
07	Glass Chipping Rear of Pad Area: (Minor defect)	 <table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												

<p>08</p>	<p>Glass Chipping Except Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2" style="text-align: center;"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>09</p>	<p>Glass Corner Chipping: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &lt; 3.0, b &lt; 3.0</math></td> <td>Ignore</td> </tr> <tr> <td colspan="2" style="text-align: center;"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 3.0, b < 3.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c < 3.0, b < 3.0$	Ignore											
$a < \text{Glass Thickness}$												
<p>10</p>	<p>Glass Burr: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>F &lt; 1.0</math></td> <td>Ignore</td> </tr> </tbody> </table> <p>Glass burr don't affect assemble and module dimension.</p>	Length	Acc. Qty	$F < 1.0$	Ignore						
Length	Acc. Qty											
$F < 1.0$	Ignore											
<p>11</p>	<p>FPC Defect: (Minor defect)</p> 	<p>11.1 Dent, pinhole width <math>a &lt; w/3</math>. (<math>w</math>: circuitry width.)</p> <p>11.2 Open circuit is unacceptable.</p> <p>11.3 No oxidation, contamination and distortion.</p>										

12	Bubble on Polarizer (Minor defect)	<table border="1" data-bbox="737 241 1206 416"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.30</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td><math>N=0</math></td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.30$	Ignore	$0.30 < \varphi \leq 0.50$	$N \leq 2$	$0.50 < \varphi$	$N=0$
Diameter	Acc. Qty									
$\varphi \leq 0.30$	Ignore									
$0.30 < \varphi \leq 0.50$	$N \leq 2$									
$0.50 < \varphi$	$N=0$									
13	Dent on Polarizer (Minor defect)	<table border="1" data-bbox="737 483 1206 658"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.25</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.25 &lt; \varphi \leq 0.50</math></td> <td><math>N \leq 4</math></td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.25$	Ignore	$0.25 < \varphi \leq 0.50$	$N \leq 4$	$0.50 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.25$	Ignore									
$0.25 < \varphi \leq 0.50$	$N \leq 4$									
$0.50 < \varphi$	None									
14	Bezel	<p>14.1 No rust, distortion on the Bezel.</p> <p>14.2 No visible fingerprints, stains or other contamination.</p>								
15	Touch Panel	<p>D: Diameter W: width L: length</p> <p>15.1 Spot: <math>D &lt; 0.25</math> is acceptable <math>0.25 \leq D \leq 0.4</math></p> <p>2dots are acceptable and the distance between defects should more than 10 mm. <math>D &gt; 0.4</math> is unacceptable</p> <p>15.2 Dent: <math>D &gt; 0.40</math> is unacceptable</p> <p>15.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable, <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable</p> <p>Distance between 2 defects should more than 10 mm. <math>W &gt; 0.10</math> is unacceptable.</p>								
16	PCB	<p>16.1 No distortion or contamination on PCB terminals.</p> <p>16.2 All components on PCB must same as documented on the BOM/component layout.</p> <p>16.3 Follow IPC-A-600F.</p>								
17	Soldering	Follow IPC-A-610C standard								
18	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>18.1 Missing vertical / horizontal segment,</p> <p>18.2 Abnormal Display.</p> <p>18.3 No function or no display.</p> <p>18.4 Current exceeds product specifications.</p> <p>18.5 LCD viewing angle defect.</p> <p>18.6 No Backlight.</p> <p>18.7 Dark Backlight.</p> <p>18.8 Touch Panel no function.</p>								

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

## 10.7 Classification of Defects

10.7.1 Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

10.7.2 Two minor defects are equal to one major in lot sampling inspection.

## 10.8 Identification/marketing criteria

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

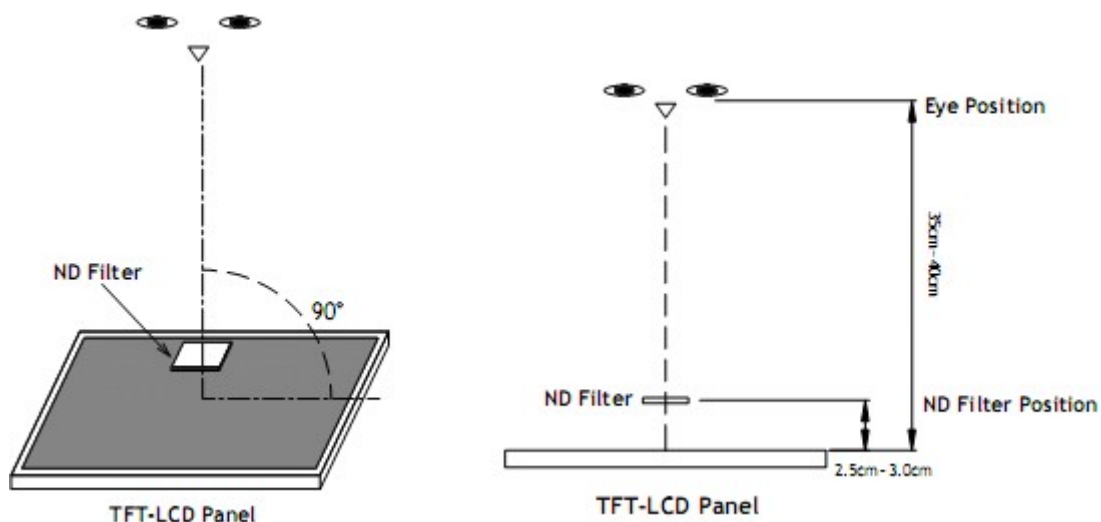
## 10.9 Packaging

10.9.1 There should be no damage of the outside carton box, each packaging box should have one identical label.

10.9.2 Modules inside package box should have compliant mark.

10.9.3 All direct package materials shall offer ESD protection

**Note1:** Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.



**Bright dot:** The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Dark dot:** Cyan, Magenta or Yellow dot size defect at white display pattern. It can be recognized by 5% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Note2:** Mura on display which appears darker / brighter against background brightness on parts of display area.

## 11. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	70°C, 96Hrs	2	GB/T2423.2-2008
2	Low Temperature Operating	-20°C, 96Hrs	2	GB/T2423.1-2008
3	High Humidity	50°C, 90%RH, 96Hrs	2	GB/T2423.3-2006
4	High Temperature Storage	80°C, 96Hrs	2	GB/T2423.2-2008
5	Low Temperature Storage	-30°C, 96Hrs	2	GB/T2423.1-2008
6	Thermal Cycling Test	-20°C, 60min~70°C, 60min, 20 cycles.	2	GB/T2423.22-2012
7	Packing vibration	Frequency range:10Hz~50Hz Acceleration of gravity:5G X, Y, Z 30 min for each direction.	2	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times	2	GB/T17626.2-2006
9	Drop Test (Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	2	GB/T2423.8-1995

Note1. No deflection cosmetic and operational function allowable.

Note2. Total current Consumption should be below double of initial value.

## 12. Precautions and Warranty

### 12.1 Safety

12.1.1 The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

12.1.2 Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

### 12.2 Handling

12.2.1 Reverse and use within ratings in order to keep performance and prevent damage.

12.2.2 Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

### 12.3 Storage

12.3.1 Do not store the LCD module beyond the specified temperature ranges.

### 12.4 Metal Pin (Apply to Products with Metal Pins)

#### 12.4.1 Pins of LCD and Backlight

12.4.1.1 Solder tip can touch and press on the tip of Pin LEAD during the soldering

12.4.1.2 Recommended Soldering Conditions

Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

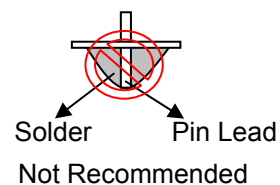
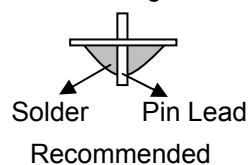
Maximum Solder Temperature: 370°C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20°C

Typical Soldering Time: ≤3s

#### 12.4.1.3 Solder Wetting



#### 12.4.2 Pins of EL

12.4.2.1 Solder tip can touch and press on the tip of EL leads during soldering.

12.4.2.2 No Solder Paste on the soldering pad on the motherboard is recommended.

12.4.2.3 Recommended Soldering Conditions

Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm

Recommended Solder Temperature: 270~290°C

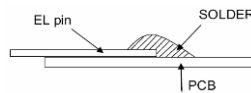
Typical Soldering Time: ≤2s

Minimum solder distance from EL lamp (body):2.0mm

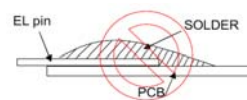
12.4.2.4 No horizontal press on the EL leads during soldering.

12.4.2.5 180° bend EL leads three times is not allowed.

#### 12.4.2.6 Solder Wetting

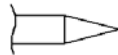


Recommended

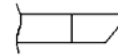


Not Recommended

#### 12.4.2.7 The type of the solder iron:

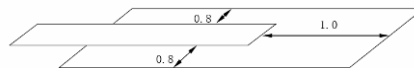


Recommended



Not Recommended

#### 12.4.2.8 Solder Pad



### 12.5 Operation

- 12.5.1 Do not drive LCD with DC voltage
- 12.5.2 Response time will increase below lower temperature
- 12.5.3 Display may change color with different temperature
- 12.5.4 Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".

### 12.6 Static Electricity

- 12.6.1 CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.
- 12.6.2 The normal static prevention measures should be observed for work clothes and benches.
- 12.6.3 The module should be kept into anti-static bags or other containers resistant to static for storage.

### 12.7 Limited Warranty

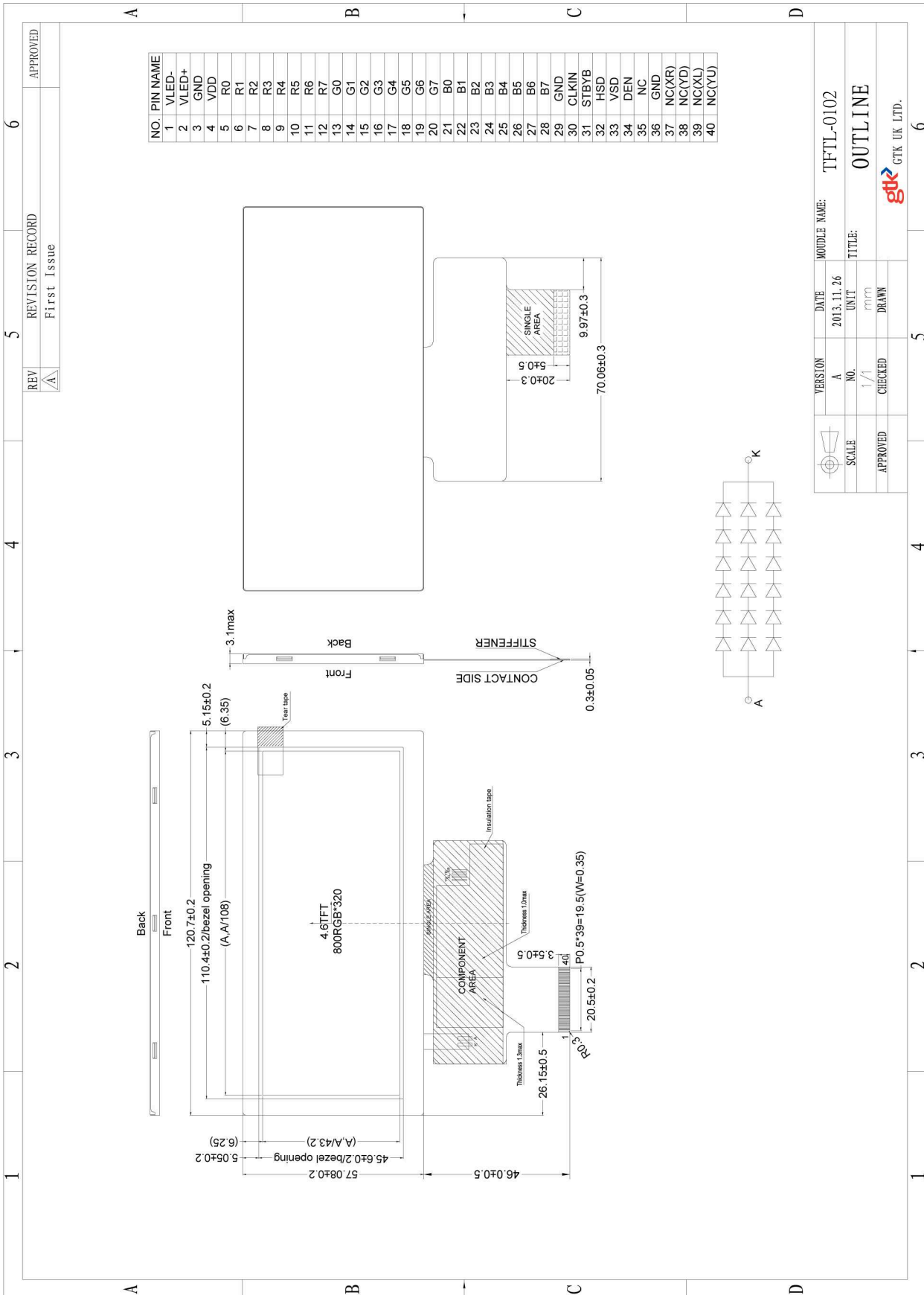
- 12.7.1 Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 12.7.2 If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.
- 12.7.3 After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

### 13. Packaging

TBD



### 14. Outline Drawing



REV	REVISION RECORD	APPROVED
A	First Issue	

VERSION	DATE	MODULE NAME:
A	2013.11.26	TFTL-0102
NO.	UNIT	TITLE:
1/1	mm	OUTLINE
CHECKED	DRAWN	
		gtek gtek UK LTD.