

# PRODUCT SPECIFICATION

## 3.9" TN TFT LCD MODULE

MODEL: T039480128-A0TMN-001 Ver:1.0



- < ◇ > Preliminary Specification
- < ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

---

---

### Revision History

Revision	Date	Originator	Detail	Remarks
Ver 1.0	2013.05.11		Initial Release	

## Table of Contents

No.	Item	Page
1.	General Description.....	4
2.	Module Parameter.....	4
3.	Absolute Maximum Ratings.....	4
4.	DC Characteristics .....	5
5.	Backlight Characteristic.....	5
5.1.	Backlight Characteristics .....	5
5.2.	Backlighting circuit.....	5
6.	Optical Characteristics .....	6
6.1.	Optical Characteristics.....	6
6.2.	Definition of Response Time .....	6
6.3.	Definition of Contrast Ratio .....	7
6.4.	Definition of Viewing Angles .....	7
6.5.	Definition of Color Appearance.....	8
6.6.	Definition of Surface Luminance, Uniformity and Transmittance .....	8
7.	Block Diagram and Power Supply.....	9
8.	Interface Pins Definition .....	10
9.	AC Characteristics.....	11
9.1.	Parallel RGB input requirement.....	11
9.2.	Reset Timing.....	12
10.	Quality Assurance .....	13
10.1	Purpose .....	13
10.2	Standard for Quality Test .....	13
10.3	Nonconforming Analysis & Disposition.....	13
10.4	Agreement Items .....	13
10.5	Standard of the Product Visual Inspection .....	13
10.6	Inspection Specification .....	14
10.7	Classification of Defects .....	18
10.8	Identification/marketing criteria.....	18
10.9	Packing.....	18
11.	Reliability Specification.....	19
12.	Precautions and Warranty .....	20
12.1	Safety .....	20
12.2	Handling .....	20
12.3	Storage .....	20
12.4	Metal Pin (Apply to Products with Metal Pins) .....	20
12.5	Operation.....	21
12.6	Static Electricity .....	21
12.7	Limited Warranty.....	21
13.	Packaging.....	22
14.	Outline Drawing.....	23

## 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)	3.9"	
LCD type	TN TFT	
Display Mode	Transmissive /Normally white	
Resolution	480 RGB x 128	Pixels
View Direction	6 O'clock	Best Image
Gray Scale Inversion Direction	12 O'clock	
Module Outline	105.5(H) x 40.64 (V) x 2.95 (T) (Note1 )	mm
Active Area	95.04(H) x 25.34(V)	mm
Pixel Pich	198(H) x 198(V)	um
Pixel Arrangement	Stripe	
Polarizer Surface Treatment	Normal	
Display Colors	16M	
Interface	24-bit RGB interface	
Driver IC	HX8257A	-
With or Without Touch Panel	Without	
Operating Temperature	-20~70	°C
Storage Temperature	-30~80	°C
Weight	TBD	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	VCC	-0.3	4.0	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

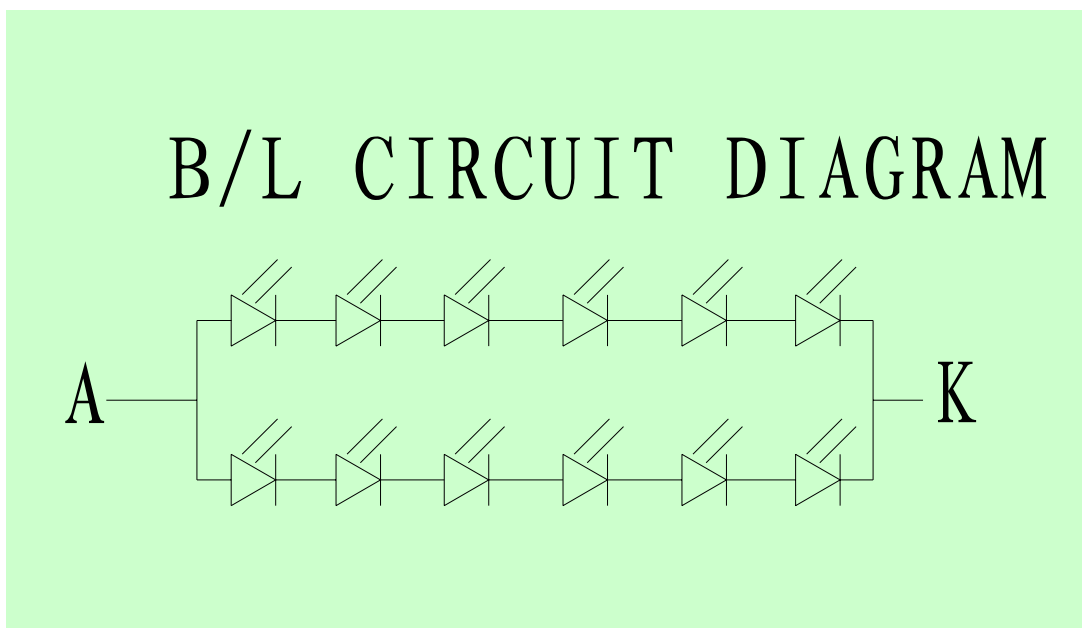
Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage	VCC	3.0	3.3	3.6	V	
Logic Low input voltage	$V_{IL}$	0	-	$0.3 \cdot V_{DD}$	V	
Logic High input voltage	$V_{IH}$	$0.7 \cdot V_{DD}$	-	VDD	V	
Logic Low output voltage	$V_{OL}$	-	-	$0.2 \cdot V_{DD}$	V	
Logic High output voltage	$V_{OH}$	$0.8 \cdot V_{DD}$	-	VDD	V	
Current Consumption All Black	Logic Analog	$I_{CC+} I_{IN}$	-	TBD	-	mA

#### 5. Backlight Characteristic

##### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$T_a=25\text{ }^\circ\text{C}$ , $I_F=20\text{mA/LED}$	18	19.2	20.4	V
Forward Current	$I_F$	$T_a=25\text{ }^\circ\text{C}$ , $V_F=3.2\text{V/LED}$	-	40	-	mA
Power dissipation	$P_D$		-	768	-	mW
Uniformity	Avg		80	-	-	%
Drive method	Constant current					
LED Configuration	12 White LEDs(6 LEDs in one string and 2 groups in parallel)					

##### 5.2. Backlighting circuit



## 6. Optical Characteristics

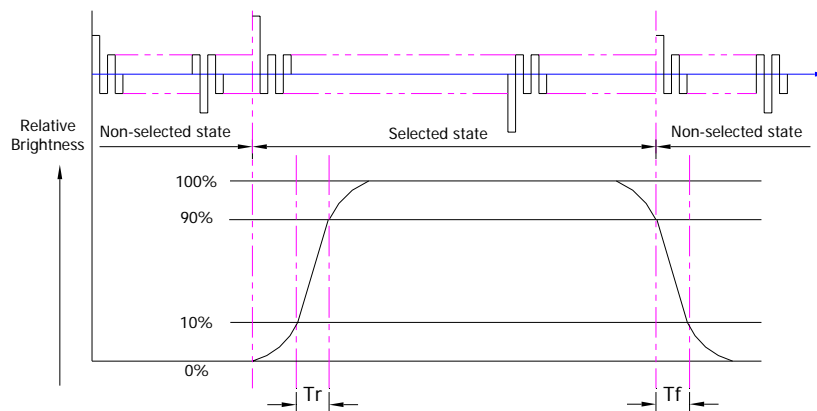
### 6.1. Optical Characteristics

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°	320	400	-	cd/m <sup>2</sup>
	Contrast ratio(See 6.3)	CR		400	500	-	
	Response time (See 6.2)	T <sub>R</sub>		-	25	30	ms
		T <sub>F</sub>					
	Chromaticity Transmissive (See 6.5)	Red	X <sub>R</sub>	0.540	0.590	0.640	
			Y <sub>R</sub>	0.300	0.350	0.400	
		Green	X <sub>G</sub>	0.298	0.348	0.398	
			Y <sub>G</sub>	0.520	0.570	0.620	
		Blue	X <sub>B</sub>	0.100	0.150	0.200	
			Y <sub>B</sub>	0.050	0.100	0.150	
White	X <sub>W</sub>	0.260	0.310	0.360			
	Y <sub>W</sub>	0.280	0.330	0.380			
Viewing Angle (See 6.4)	Horizontal	θ <sub>x+</sub>	60	70	-	Deg.	
		θ <sub>x-</sub>	60	70	-		
	Vertical	φ <sub>y+</sub>	60	70	-		
		φ <sub>y-</sub>	40	50	-		
NTSC Ratio(Gamut)				40	50	-	%

### 6.2. Definition of Response Time

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



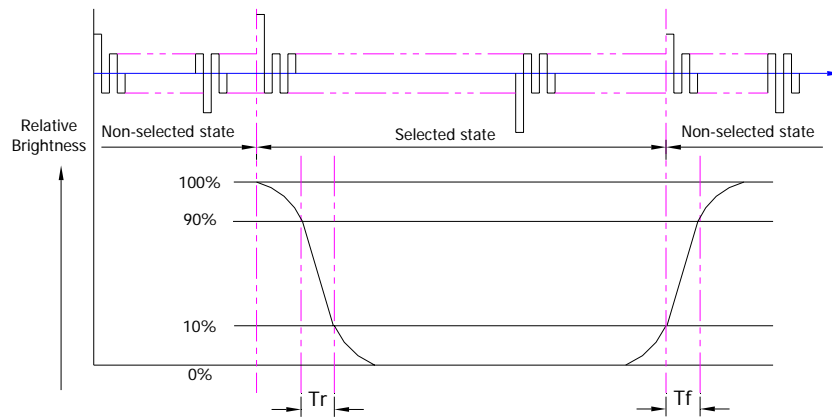
Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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 stage 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

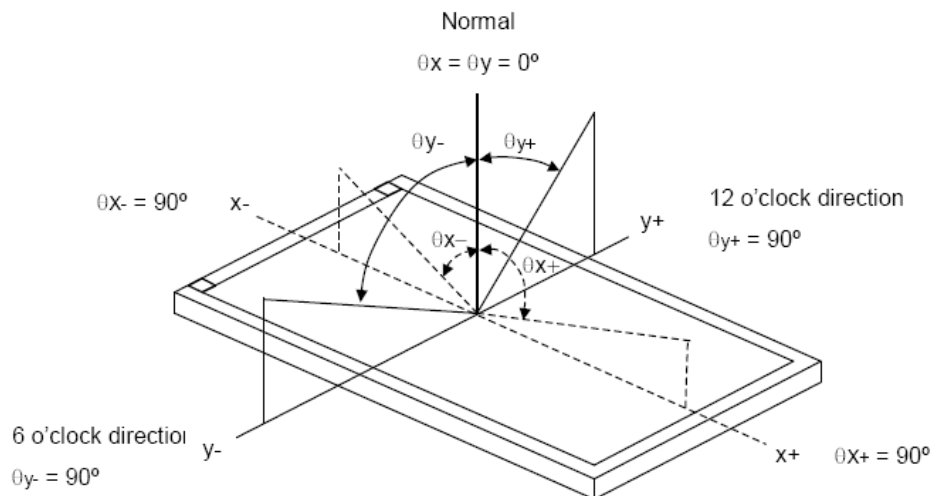
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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



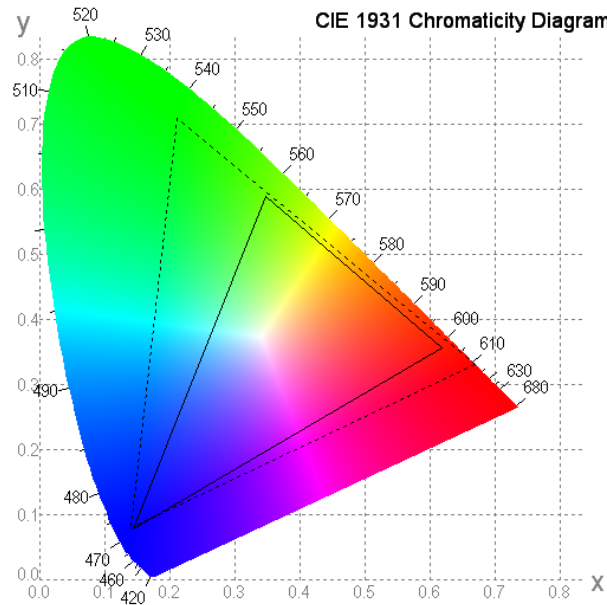
Measuring machine: LCD-5100 or EQUI

### 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

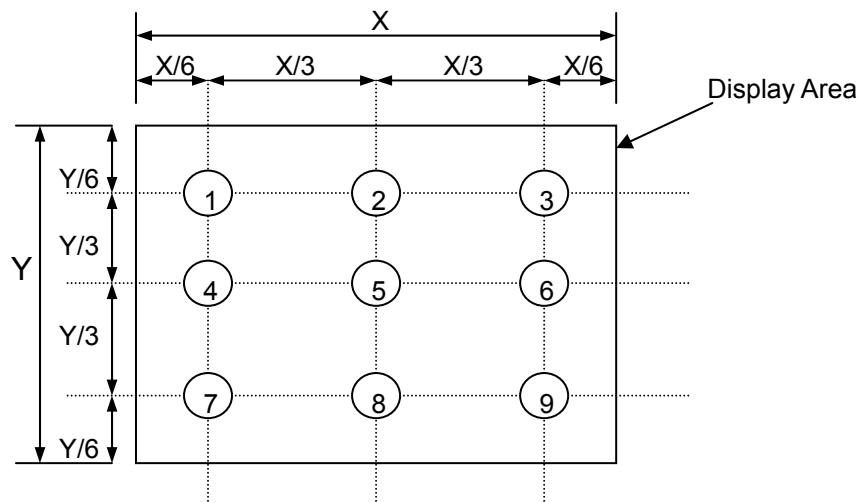
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

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

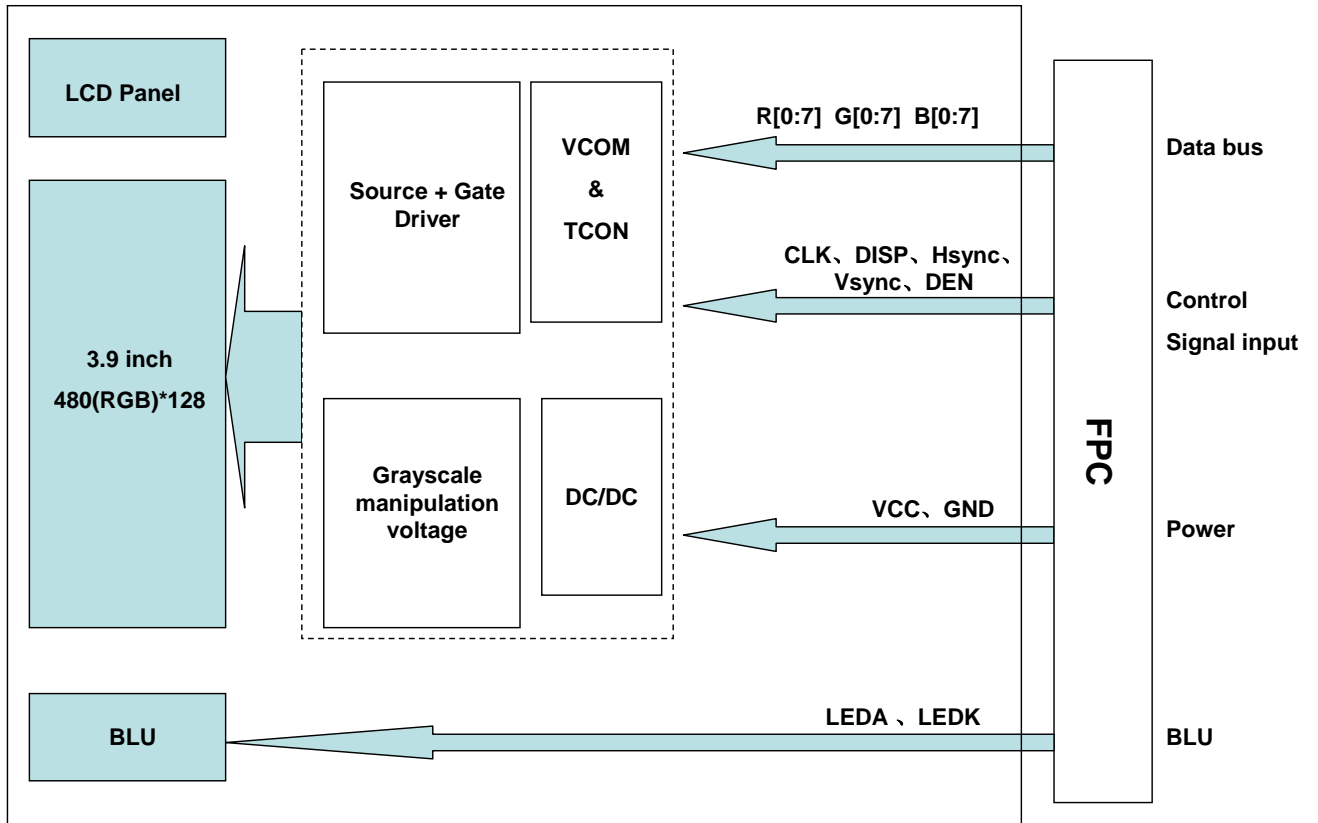
6.6.3. Transmittance =  $L_V \text{ on LCD} / L_V \text{ on Backlight} * 100\%$

Note : Measuring machine: BM-7





## 7. Block Diagram and Power Supply





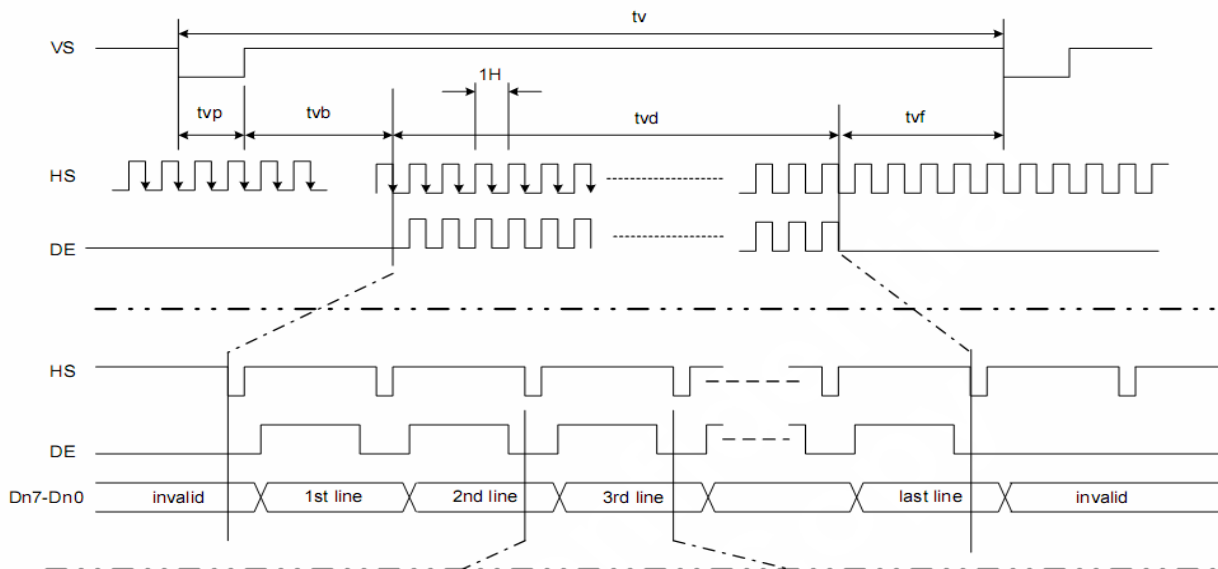
## 9. AC Characteristics

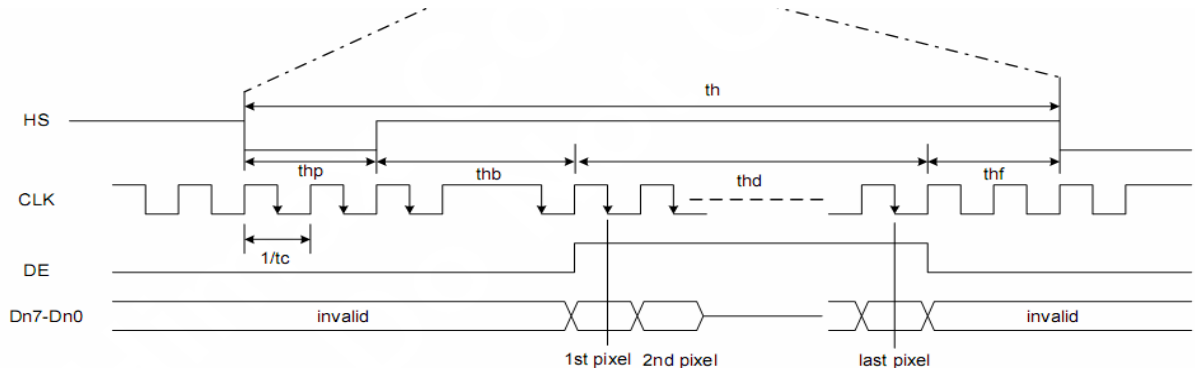
### 9.1. Parallel RGB input requirement

Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
Clock cycle	$f_{CLK}^{(1)}$	-	4.7	9.6	MHz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp <sup>(2)</sup>	2	41	41	CLK
Horizontal back porch	thb <sup>(2)</sup>	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	149	150	263	H <sup>(1)</sup>
Vertical display period	tvd	136	136	136	H <sup>(1)</sup>
Vertical front porch	tvf	1	2	128	H <sup>(1)</sup>
Vertical pulse width	tvp <sup>(2)</sup>	1	10	11	H <sup>(1)</sup>
Vertical back porch	tvb <sup>(2)</sup>	1	2	11	H <sup>(1)</sup>

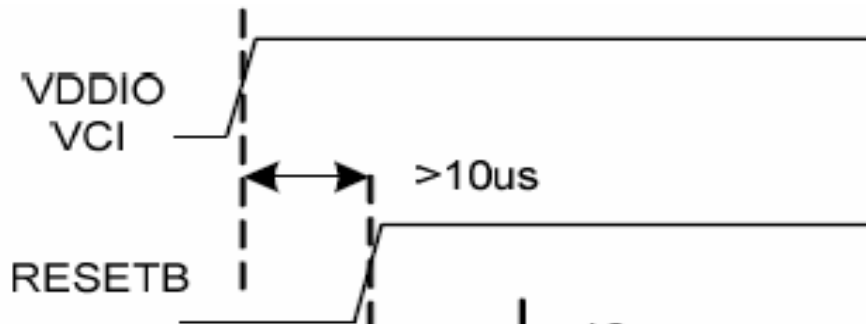
**Note:** (1) Unit: CLK=1/  $f_{CLK}$ , H= th,

(2) It is necessary to keep  $tvp+tvb=12$  and  $thp+thb=43$  in sync mode. DE mode is unnecessary to keep it.





## 9.2. Reset Timing



## 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:

ANSI / ASQC Z1.4-1993.

Single sampling, normal inspection.

#### 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 can not 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.

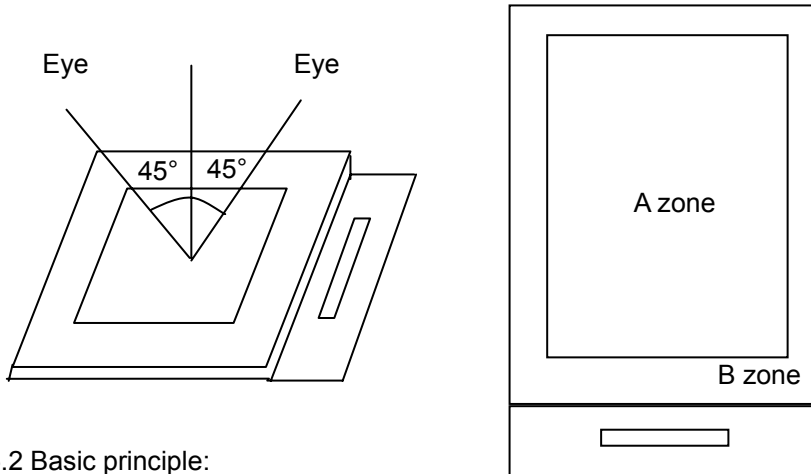
### 10.5 Standard of the Product Visual Inspection

#### 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,

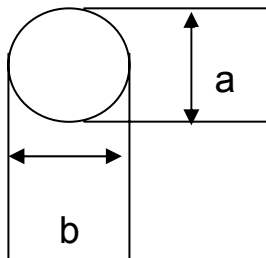
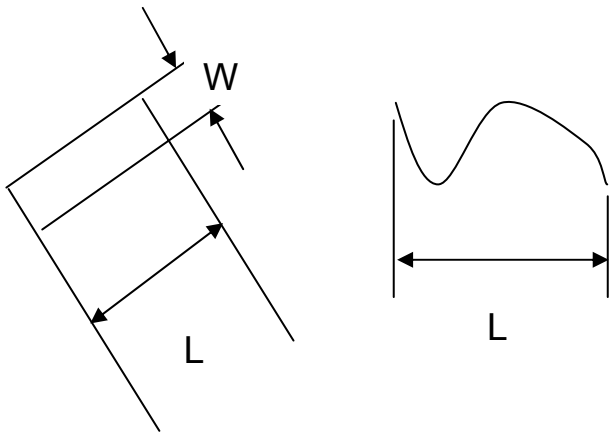


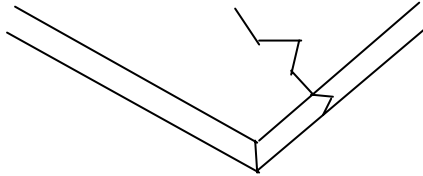
10.5.2 Basic principle:

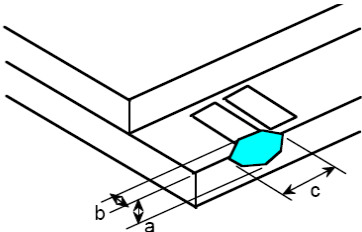
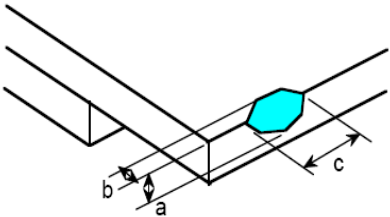
10.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

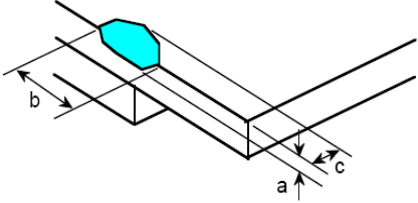
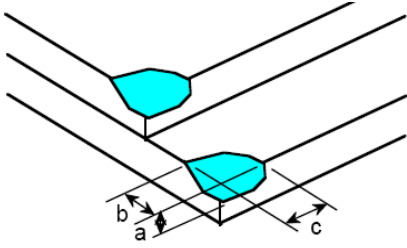
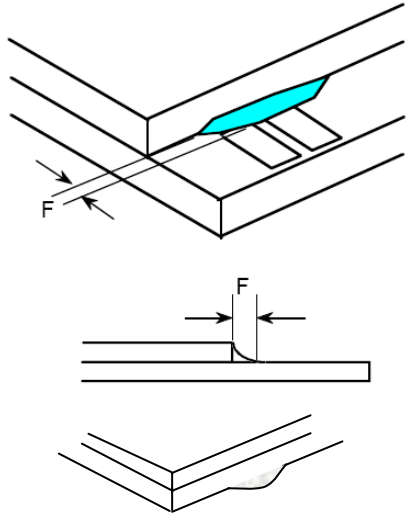
10.5.2.2 New item must be added on time when it is necessary.

10.6 Inspection Specification

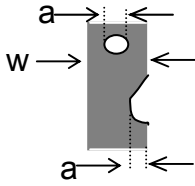
No.	Item	Criteria (Unit: mm)													
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 $\phi = (a + b) / 2$	<table border="1"> <thead> <tr> <th data-bbox="911 1032 1166 1122">Size \ Area</th> <th data-bbox="1166 1032 1417 1122">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="911 1122 1166 1167"><math>\phi \leq 0.10</math></td> <td data-bbox="1166 1122 1417 1167">Ignore</td> </tr> <tr> <td data-bbox="911 1167 1166 1211"><math>0.10 &lt; \phi \leq 0.15</math></td> <td data-bbox="1166 1167 1417 1211">2</td> </tr> <tr> <td data-bbox="911 1211 1166 1256"><math>0.15 &lt; \phi \leq 0.25</math></td> <td data-bbox="1166 1211 1417 1256">1</td> </tr> <tr> <td data-bbox="911 1256 1166 1301"><math>0.25 &lt; \phi</math></td> <td data-bbox="1166 1256 1417 1301">0</td> </tr> <tr> <td data-bbox="911 1301 1166 1379">Total</td> <td data-bbox="1166 1301 1417 1379">2 no include <math>\phi \leq 0.10</math></td> </tr> </tbody> </table> <p data-bbox="552 1458 1241 1487">Distance between 2 defects should more than 3mm apart.</p>	Size \ Area	Acc. Qty	$\phi \leq 0.10$	Ignore	$0.10 < \phi \leq 0.15$	2	$0.15 < \phi \leq 0.25$	1	$0.25 < \phi$	0	Total	2 no include $\phi \leq 0.10$
Size \ Area	Acc. Qty														
$\phi \leq 0.10$	Ignore														
$0.10 < \phi \leq 0.15$	2														
$0.15 < \phi \leq 0.25$	1														
$0.25 < \phi$	0														
Total	2 no include $\phi \leq 0.10$														
02	Black and White line Scratch Foreign material (Line type) (Minor defect)														

		<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 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &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	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total		3
Length	Width	Acc. Qty																		
/	$W \leq 0.03$	Ignore																		
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$	0																		
Total		3																		
03	Glass Crack (Minor defect)	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		

04	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											
$a < \text{Glass Thickness}$												
05	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>06</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"><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>07</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"><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>08</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											



09	<p>FPC Defect: (Minor defect)</p> 	<p>9.1 Dent, pinhole width <math>a &lt; w/3</math>. (w: circuitry width.) 9.2 Open circuit is unacceptable. 9.3 No oxidation, contamination and distortion.</p>								
10	Bubble on Polarizer (Minor defect)	<table border="1" data-bbox="743 663 1214 835"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \phi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.20$	Ignore	$0.20 < \phi \leq 0.30$	4	$0.30 < \phi$	None
Diameter	Acc. Qty									
$\phi \leq 0.20$	Ignore									
$0.20 < \phi \leq 0.30$	4									
$0.30 < \phi$	None									
11	Dent on Polarizer (Minor defect)	<table border="1" data-bbox="743 909 1214 1081"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \phi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.20$	Ignore	$0.20 < \phi \leq 0.30$	4	$0.30 < \phi$	None
Diameter	Acc. Qty									
$\phi \leq 0.20$	Ignore									
$0.20 < \phi \leq 0.30$	4									
$0.30 < \phi$	None									
12	Bezel	<p>12.1 No rust, distortion on the Bezel. 12.2 No visible fingerprints, stains or other contamination.</p>								
13	Touch Panel	<p>D: Diameter W: width L: length 13.1 Spot: <math>D &lt; 0.25</math> is acceptable <math>0.25 \leq D \leq 0.4</math> 2dots are acceptable and the distance between defects should more than 10 mm. <math>D &gt; 0.4</math> is unacceptable 13.2 Dent: <math>D &gt; 0.40</math> is unacceptable 13.3 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 Distance between 2 defects should more than 10 mm. <math>W &gt; 0.10</math> is unacceptable.</p>								
14	PCB	<p>14.1 No distortion or contamination on PCB terminals. 14.2 All components on PCB must same as documented on the BOM/component layout. 14.3 Follow IPC-A-600F.</p>								

15	Soldering	Follow IPC-A-610C standard
16	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>16.1 Missing vertical / horizontal segment, 16.2 Abnormal Display. 16.3 No function or no display. 16.4 Current exceeds product specifications. 16.5 LCD viewing angle defect. 16.6 No Backlight. 16.7 Dark Backlight. 16.8 Touch Panel no function. 16.9 Dark Dot –one Allowed. 16.10 Bright Dot – one Allowed.</p> <p>Remark:</p> <p>1. A pixel defect is acceptable if one color is none functional and causes a bright dot. The display may have one case where one color is out and cause a dark dot. 2. Bright dot caused by scratch and foreign object accords to item 1.</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 Packing

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

## 11. Reliability Specification

No	Item	Condition	Quantity
1	High Temperature Operating	70°C, 96Hrs	5
2	Low Temperature Operating	-20°C, 96Hrs	5
3	High Humidity	50°C, 90%RH, 96Hrs	5
4	High Temperature Storage	80°C, 96Hrs	5
5	Low Temperature Storage	-30°C, 96Hrs	5
6	Thermal shock	-20°C, 30min~70°C, 30min, 10 cycles.	5

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

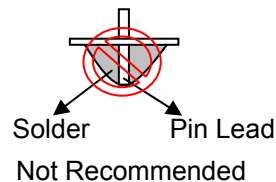
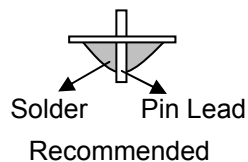
Maximum Solder Temperature: 370°C

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

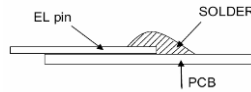
Typical Soldering Time: ≤2s

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

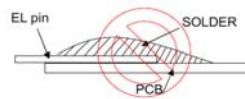
12.4.1.4 No horizontal press on the EL leads during soldering.

12.4.1.5 180° bend EL leads three times is not allowed.

#### 12.4.1.6 Solder Wetting

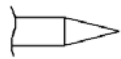


Recommended

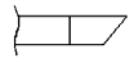


Not Recommended

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

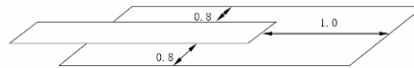


Recommended



Not Recommended

#### 12.4.1.8 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

### 13. Packaging

TBD

### 14. Outline Drawing

