SPECIFICATION

Revision: 0.0

WKS70170-B

This module uses ROHS material

This specification may change without prior notice in order to improve performance or quality. Please contact WKS R&D department for updated specification and product status before design for this product or release of this order.

WRITTEN BY	CHECKED BY	APPROVED BY
Sandy	Eric	Jason

REVISION RECORD

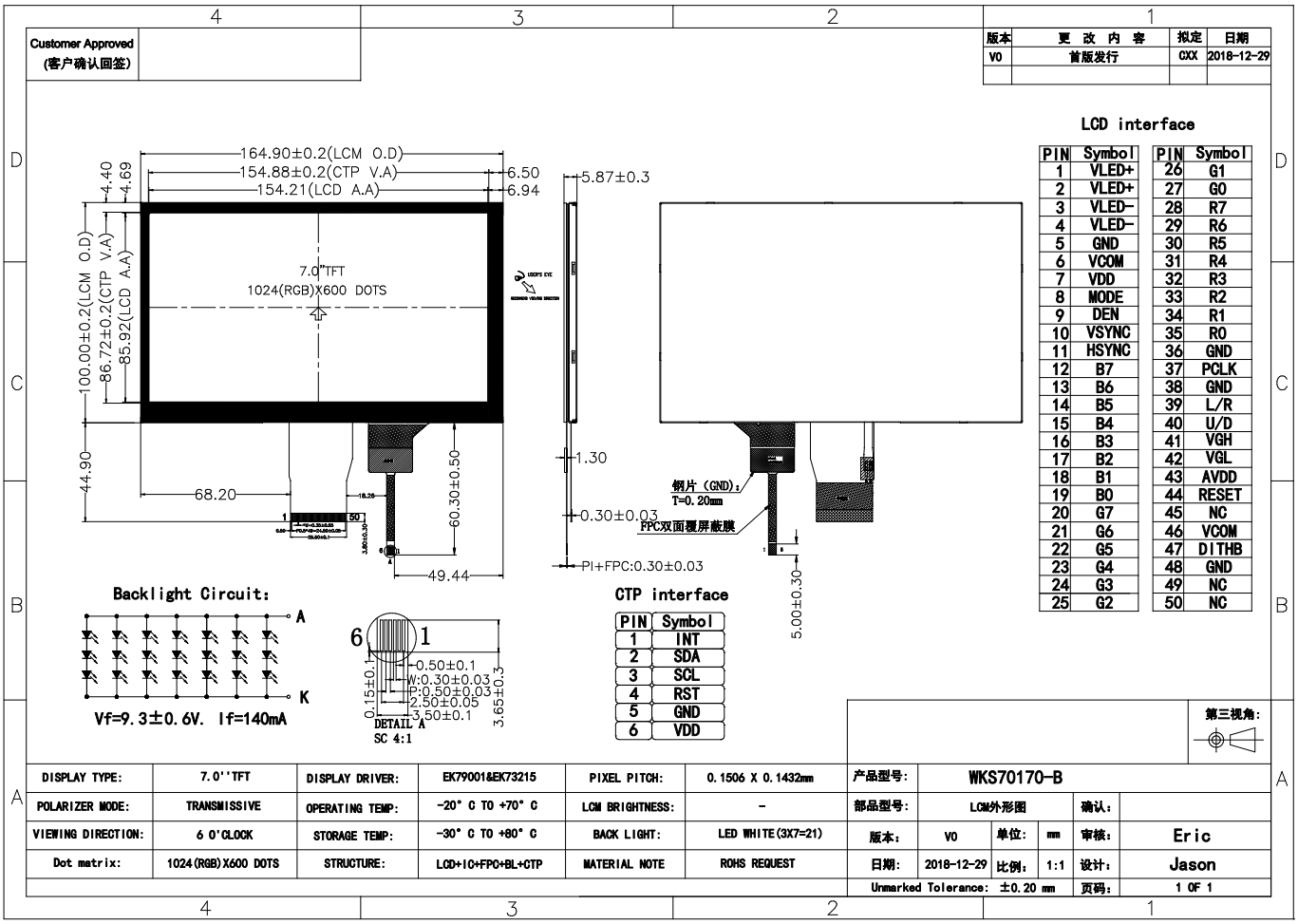
REV NO.	REV DATE	CONTENTS	REMARKS
0.0	2020-09-18	First release	Preliminary

CONTENTS

1、GENERAL INFORMATION

Item of general information	Contents	Unit
LCD Display Size (Diagonal)	7.0	inch
LCD Display Type	TFT/TRANSMISSIVE	-
LCD Display Mode	Normally White	-
Recommended Viewing Direction	12	o'clock
Gray inversion Direction	6	o'clock
Module size (W×H×T)	164.90×100.00×5.87	mm
Active area (W×H)	154.2144×85.92	mm
Number of pixels (Resolution)	1024(RGB)×600	pixel
Pixel pitch (W×H)	0.1506×0.1432	mm
Color Pixel Arrangement	RGB Stripe	-
LCD Driver IC	-	-
Interface Type	24bit Parallel RGB interface	-
Color Numbers	16.7M	-
Backlight Type	White LED	-

2、EXTERNAL DIMENSIONS



3、ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
LCD supply voltage	VDD	-0.5	5.0	V
Operating temperature	Top	-20	70	℃
Storage temperature	Tst	-30	80	℃
Humidity	RH	-	90%(Max 60℃)	RH

Note: Absolute maximum ratings mean the product can withstand short-term, not more than 120 hours. If it is a long time to withstand these conditions, the life time would be shorter.

4、ELECTRICAL CHARACTERISTICS(DC CHARACTERISTICS)

Parameter of DC characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
Analog Supply Voltage	AVDD	9.4	9.6	9.8	V	
Gate On Voltage	VGH	16	18	20	V	
Gate Off Voltage	VGL	-5	-6	-7	V	
Common Voltage	VCOM	3.4	3.5	3.6	V	Note1
Input voltage 'H' level	VIH	0.7*VDD	-	VDD	V	
Input voltage 'L' level	VIL	VSS	-	0.3*VDD	V	
Output voltage 'H' level	VOH	VDD-0.4	-	VDD	V	
Output voltage 'L' level	VOL	VSS	-	VSS+0.4	V	
Digital current	I_{VDD}	-	30	-	mA	
Analog current	I_{AVDD}	-	35	-	mA	
Gate On current	I_{VGH}	-	0.5	-	mA	
Gate Off current	I_{VGL}	-	0.5	-	mA	

Note 1: Please adjust VCOM voltage to make the flicker level be minimum.

5、BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	Vf	8.7	9.3	9.9	V	Note1
Forward Current	If	-	140	-	mA	-
Number of LED	-	-	3*7=21	-	Piece	-
LED Connection mode	P/S	-	Serial/Parallel	-	-	-
Lifetime of LED	-	-	15000	-	hour	Note2

- Note1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If=140mA.
- Note2: The LED lifetime define as the estimated time to 50% degradation of initial luminous. The LED lifetime could be decreased if operating If is larger than 140mA.

6、TOUCH CHARACTERISTICS

Item of CTP characteristics	Specification	Unit	Remark
Panel Type	Glass Cover + Glass Sensor	-	-
Resolution	1024 × 600	pixel	-
Surface Hardness	≥6H	-	-
Transparency	＞82%	-	-
Driver IC	-	-	-
Interface Type	I2C	-	-
Support Points	5(Max)	-	-
Sampling Rate	20~100	Hz	-
Supply voltage	3.3	V	-

7、ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr+Tf	θ=0 ∅=0 Ta=25℃	-	25	40	ms	FIG 1.	4
Contrast Ratio		CR		-	400	-	-	FIG 2.	1
Luminance uniformity		δWHITE		-	80	-	%	FIG 2.	3
Surface Luminance		Lv		-	300	-	cd/m2	FIG 2.	2
CIE (x, y) chromaticity	White	White x	θ=0 ∅=0 Ta=25℃	-	0.300	-	-	FIG 2.	5
		White y		-	0.340	-			
	Red	Red x		-	0.615	-			
		Red y		-	0.320	-			
	Green	Green x		-	0.296	-			
		Green y		-	0.569	-			
	Blue	Blue x		-	0.142	-			
		Blue y		-	0.174	-			
Viewing angle range	∅=90(12 o'clock)		CR ≥ 10	-	60	-	deg	FIG 3.	6
	∅=270(6 o'clock)			-	70	-	deg		
	∅=0(3 o'clock)			-	80	-	deg		
	∅=180(9 o'clock)			-	80	-	deg		
NTSC ratio	-		-	-	50	-	%	-	-

Note 1. Contrast Ratio(CR) is defined mathematically by the following formula. For more information see FIG 2.:

$$\text{Contrast Ratio(CR)} = \frac{\text{Average Surface Luminance with all white pixels(P1,P2,P3,P4,P5,P6,P7,P8,P9)}}{\text{Average Surface Luminance with all black pixels(P1,P2,P3,P4,P5,P6,P7,P8,P9)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

Lv=Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note 3. The uniformity in surface luminance（δWHITE）is determined by measuring luminance at each test position 1 through 9, and then dividing the maximum luminance of

9points luminance by minimum luminance of 9 points luminance. For more information see FIG 2.

$$\delta WHITE = \frac{Minimum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5, P6, P7, P8, P9)}{Maximum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5, P6, P7, P8, P9)}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1.

Note 5. CIE (x, y) chromaticity ,The x,y value is determined by screen active area position 5. For more information see FIG 2.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than a specific value. For TFT module, the specific value of contrast ratio is 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 3.

Note 7. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity and CIE， the testing data is base on BM-7 photo detector.

Note 8. For TN type TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle.

FIG.1. The definition of Response Time

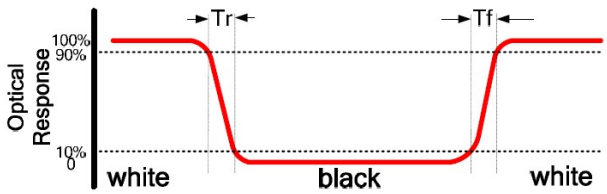


FIG.2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x , y) chromaticity

A : H/6 ;
B : V/6 ;
H,V : Active Area(AA) size
Measurement instrument: BM-7; Light spot size=5mm, 350mm distance from the LCD surface to detector lens.

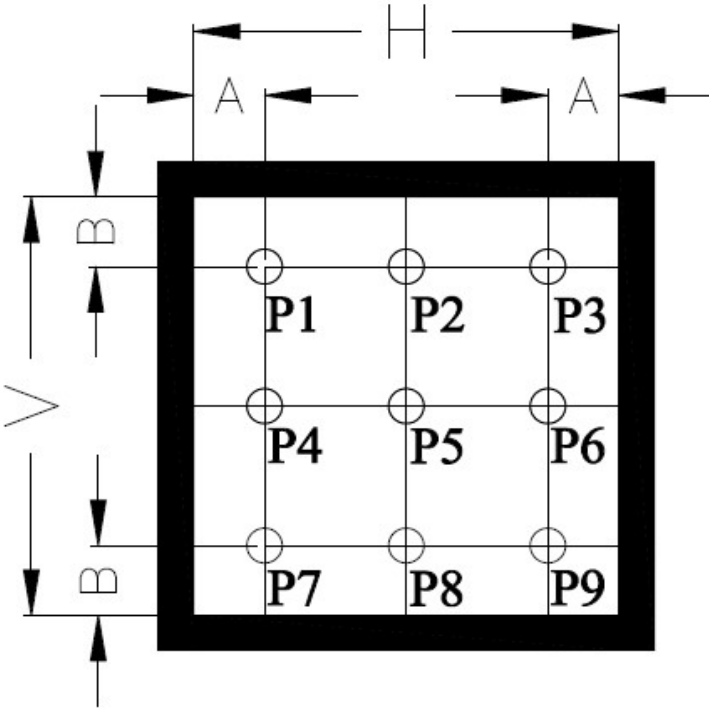
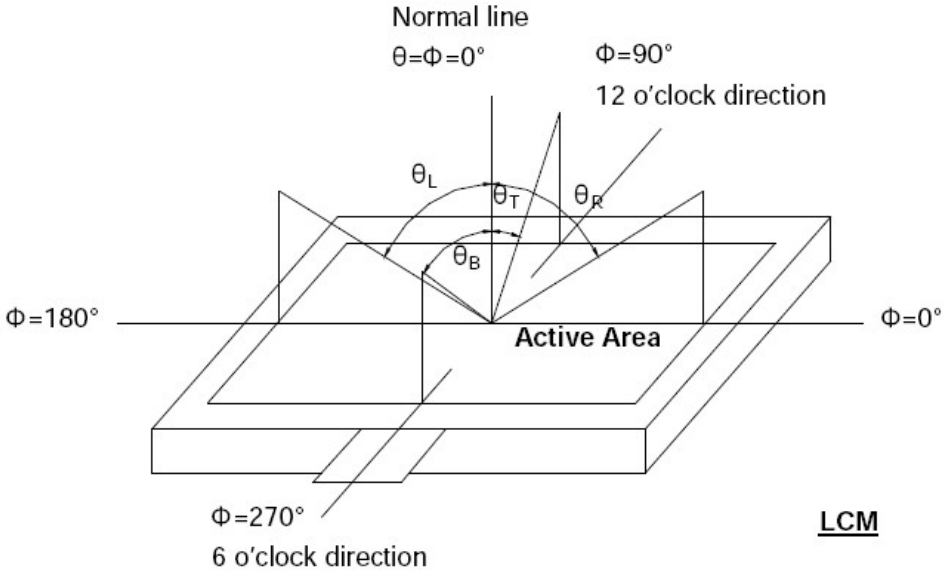


FIG.3. The definition of viewing angle



8、INTERFACE DESCRIPTION

A、LCD Interface Description

NO.	Symbol	I/O	DESCRIPTION
1~2	LED-A	Power supply	Backlight Anode
3~4	LED-K	Power supply	Backlight Cathode
5	GND	Power supply	Power ground
6	VCOM	I	For external VCOM DC input
7	VDD	Power supply	Digital Power supply
8	MODE	I	DE/SYNC mode select. H:DE mode; L:HSD/VSD mode.
9	DEN	I	Data input Enable. Active high to enable the data input Bus.
10	VSYNC	I	Vertical Sync input. Negative polarity.
11	HSYNC	I	Horizontal Sync input. Negative polarity.
12~19	B7~B0	I	8bit digital Blue data input(B7:MSB; B0:LSB)
20~27	G7~G0	I	8bit digital Green data input(G7:MSB; G0:LSB)
28~35	R7~R0	I	8bit digital Red data input(R7:MSB; R0:LSB)
36	GND	Power supply	Power ground
37	PCLK	I	Clock signal. Data latched at rising/falling edge of this signal.
38	GND	Power supply	Power ground
39	SHLR	I	Source Right or Left sequence control.
40	UPDN	I	Gate Up or Down scan control.
41	VGH	Power supply	Positive Power for TFT
42	VGL	Power supply	Negative Power for TFT
43	AVDD	Power supply	Power supply for analog circuits
44	RESET	I	LCD reset signal, Low is active
45	NC	-	No Connection
46	VCOM	I	For external VCOM DC input
47	DITHB	I	Dithering function enable control
48	GND	Power supply	Power ground
49~50	NC	-	No Connection

B、TOUCH Interface Description

NO.	Symbol	I/O	DESCRIPTION
1	INT	O	CTP External interrupt to the host
2	SDA	I/O	CTP I2C data input and output
3	SCL	I	CTP I2C clock input
4	RESET	I	CTP external reset signal, Low is active
5	GND	Power supply	Power ground
6	VDD	Power supply	CTP Power input

9、INPUT TIMING

HV mode input Timing table

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency@ Frame rate=60Hz	DCLK	44.9	51.2	63	MHz
Horizontal display area	thd		1024		DCLK
1 Horizontal Line	th	1200	1344	1400	DCLK
HSYNC pulse width	thpw	1	-	140	DCLK
HSYNC Blanking	thb	160	160	160	DCLK
HSYNC Front Porch	thfp	16	160	216	DCLK
Vertical display area	tvd		600		H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC Blanking	tvb	23	23	23	H
VSYNC Front Porch	tvfp	1	12	127	H

DE mode input Timing table

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency@ Frame rate=60Hz	DCLK	40.8	51.2	67.2	MHz
Horizontal display area	thd		1024		DCLK
HSYNC period time	th	1114	1344	1400	DCLK
HSYNC Blanking	thb + thfp	90	320	376	DCLK
Vertical display area	tvd		600		H
VSYNC period time	tv	610	635	800	H
VSYNC Blanking	tvb + tvfp	10	35	200	H

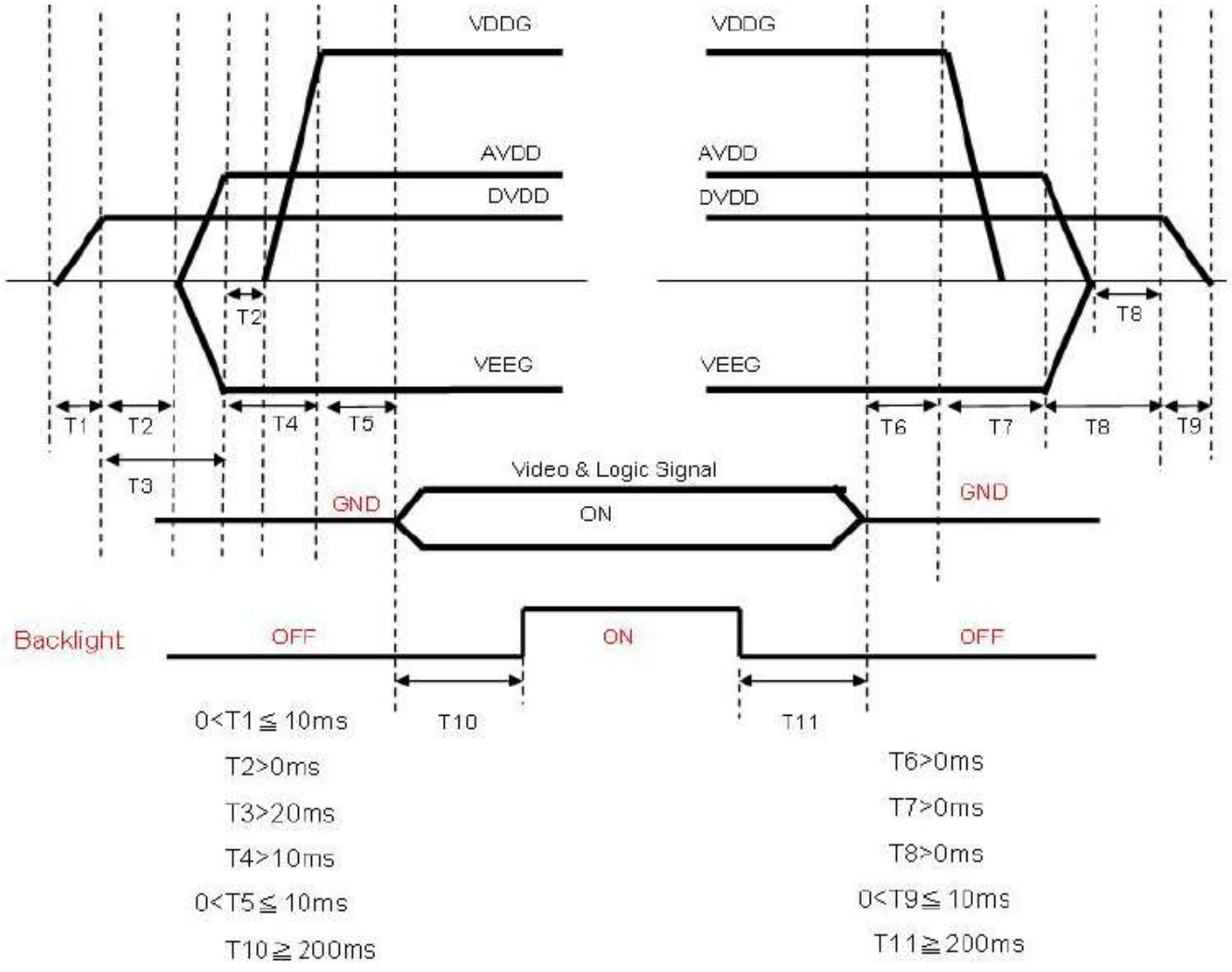
Note: Mode selection via the “MODE” pin as follows:

	Default Status	H	L
MODE	H	DE mode	HSD/VSD mode(HV mode)

10、POWER ON/OFF SEQUENCE

Power On: VDD→AVDD/VGL→VGH→Video & Logic Signal

Power Off: Video & Logic Signal→VGH→AVDD/VGL→VDD



11、RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition
1	High Temperature Storage	80℃/120 hours
2	Low Temperature Storage	-30℃/120 hours
3	High Temperature Operating	70℃/120 hours
4	Low Temperature Operating	-20℃/120 hours
5	Temperature Cycle Storage	-20℃(30min.)~25(5min.)~70℃(30min.)×10cycles

A、Inspection after test:

Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects:

- Air bubble in the LCD;
- Sealleak;
- Non-display;
- Missing segments;
- Glass crack;
- Current is twice higher than initial value.

B、Remark:

- The test samples should be applied to only one test item.
- Sample size for each test item is 5~10pcs.
- Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

12、INSPECTION CRITERION

This specification is made to be used as the standard of acceptance/rejection criteria for TFT-LCD/IPS TFT-LCD module product, and this specification is applicable only in the case that the size of module equal to or exceed than 3.5 inch.

12.1 Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:

Major defect: AQL 0.65

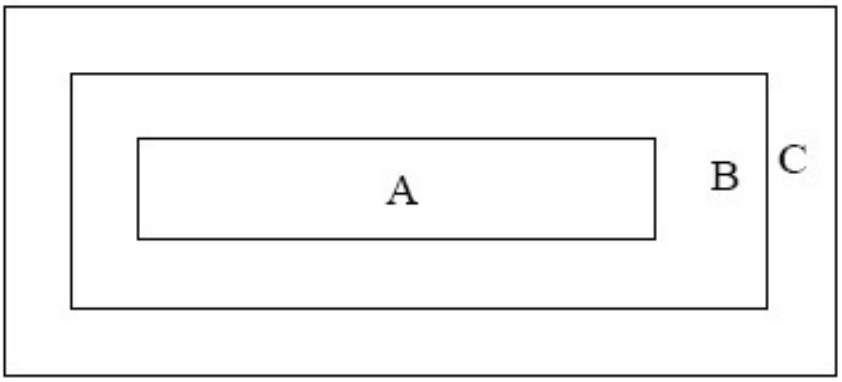
Minor defect: AQL 1.5

12.2 Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45°against perpendicular line. (Normal temperature 20~25℃and normal humidity 60 ±15%RH)

12.3 Definition of Inspection Item.

A、Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (Zone A + Zone B=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

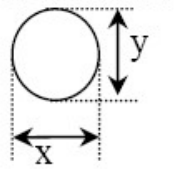
B、Definition of some visual defect

Bright dot	Because of losing all or part function, bad pixel dots appear bright and the size is more than 50% of one dot in which LCD panel is displaying under black pattern.
Dark dot	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture, or pure whiter picture.

12.4 Major Defect

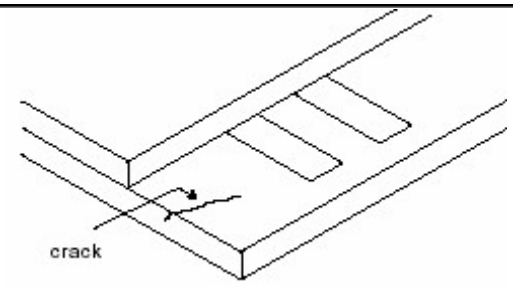
Item No.	Items to be inspected	Inspection standard	Classification of defects
1	Functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Excess power consumption 6)Backlight no lighting, flickering and abnormal lighting	major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	

12.5 Minor Defect

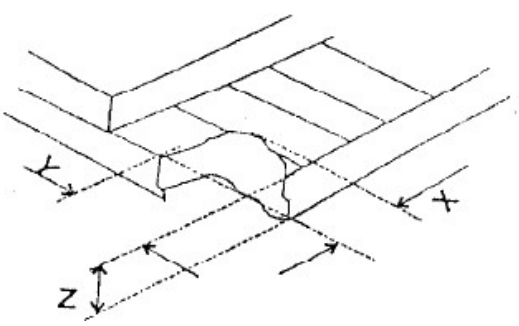
<table>
<tr><th>Item No.</th><th>Items to be inspected</th><th>Inspection standard</th><th>Classification of defects</th></tr>
<tr><td>1</td><td>Bright dot /dark dot defect</td><td>
<table>
<tr><td rowspan="2">Zone</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="2">A+B</td><td rowspan="2">C</td></tr>
<tr><td>3.5～7”</td><td>7～10.1”</td><td>＞10.1”</td></tr>
<tr><td>Bright pixel dot</td><td>1</td><td>2</td><td>3</td><td rowspan="5">Acceptable</td></tr>
<tr><td>Dark pixel dot</td><td>4</td><td>4</td><td>4</td></tr>
<tr><td>2bright dots adjacent</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2dark dots adjacent</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total bright and dark dots</td><td>5</td><td>6</td><td>7</td></tr>
</table>
Note: Minimum distance between defective dots is more than 5mm; Pixel dots’ function is normal, but bright dots caused by foreign material and other reasons are judged by the dot defect of 5.2.
</td><td>Minor</td></tr>
<tr><td>2</td><td>Dot defect
 

Φ=(x+y) /2</td><td>
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="2">A+B</td><td rowspan="2">C</td></tr>
<tr><td>3.5”～7”</td><td>7～10.1”</td><td>＞10.1”</td></tr>
<tr><td>Φ≤0.2</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.2＜Φ≤0.5</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Φ＞0.5</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Note:
1. Minimum distance between defective dots is more than 5 mm;
2. The quantity of defect is zero in operating condition.
</td><td>Minor</td></tr>
<tr><td>3</td><td>Linear defect</td><td>
<table>
<tr><td colspan="2" rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="2">A+B</td><td rowspan="2">C</td></tr>
<tr><td>Length</td><td>Width</td><td>3.5”～7”</td><td>7～10.1”</td><td>＞10.1”</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>L≤5.0</td><td>0.05＜ W≤0.1</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>L＞5.0</td><td>W＞0.1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

<table>
<tr>
<td>4</td>
<td>Polarizer defect</td>
<td>5.4.1 Polarizer Position
(i) Shifting in position should not exceed the glass outline dimension.
(ii) Incomplete covering of the viewing area due to shifting is not allowed.
5.4.2 Dirt on polarizer
Dirt which can be wiped easily should be acceptable.
5.4.3 Polarizer Dent & Air bubble
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="2">A+B</td><td>C</td></tr>
<tr><td></td><td>3.5”～7”</td><td>7～10.1”</td><td>＞10.1”</td><td></td></tr>
<tr><td>Φ≤0.2</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.2＜Φ≤0.5</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Φ＞0.5</td><td>0</td><td>0</td><td>0</td></tr>
</table>
5.4.4 Polarizer scratch
(i) If the polarizer scratch can be seen after cover assembling or in the operating condition, judge by the linear defect of 5.3.
(ii)If the polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following:
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="4">Acceptable Qty</td></tr>
<tr><td colspan="3">A+B</td><td>C</td></tr>
<tr><td>Length</td><td>Width</td><td>3.5”～7”</td><td>7～10.1”</td><td>＞10.1”</td><td></td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>1.0＜L≤5.0</td><td>0.05＜W≤0.20</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>L＞5.0</td><td>W＞0.2</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td>
<td>Minor</td>
</tr>
<tr>
<td rowspan="2">5</td>
<td>MURA</td>
<td>Using 3% ND filter, it’s NG if it can be seen in R,G,B picture.</td>
<td rowspan="2">Minor</td>
</tr>
<tr>
<td>White/Black dot（MURA）</td>
<td>Visible under：ND3%；D≦0.15mm, Acceptable；
0.15mm<D≦0.5mm, N≦4；D>0.5mm, Not allowable.</td>
</tr>
<tr>
<td>6</td>
<td>Glass defect</td>
<td>(i) Crack
Cracks are not allowed.</td>
<td>Minor</td>
</tr>
</table>



(ii) TFT chips on corner

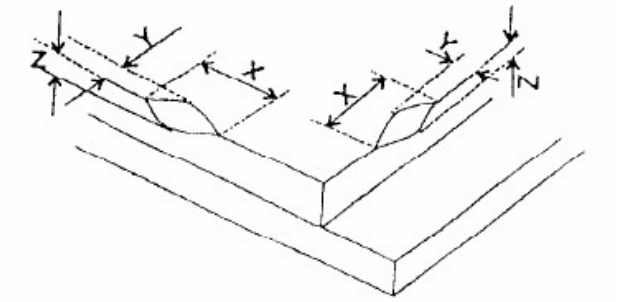


X	Y	Z	Acceptable
⩽3.0	⩽3.0	Not more than the thickness of glass	N⩽3

Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.

Minor

(iii) Usual surface crack

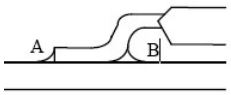
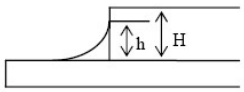


X	Y	Z	Acceptable
⩽1.5	⩽1.5	Not more than the thickness of glass	N⩽4

It is only applicable to the upper glass of LCD.

Minor

12.6 Module Cosmetic Criteria

Item No.	Items to be inspected	Inspection Standard	Classification of defects
1	Difference in Spec.	Not allowable	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing	Major
		No soldering bridge	Major
		No cold soldering	Minor
4	Resist flaw on PCB	Visible copper foil (Φ0.5 mm or more) on substrate pattern is not allowed	Minor
5	FPC gold finger	No dirt, breaking, oxidation lead to black	Major
6	Backlight plastic frame	No deformation, crack, breaking, backlight positioning column breaking, obvious nick.	Minor
7	Marking printing effect	No dark marking, incomplete, deformation lead to unable to judge	Minor
8	Accretion of metallic Foreign matter	No accretion of metallic foreign matter (Not exceed Φ0.2mm)	Minor
9	Stain	No stain to spoil cosmetic badly	Minor
10	Plate discoloring	No plate fading, rusting and discoloring	Minor
11	1. Lead parts	a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly.	Minor
		b. Components side(In case of 'Through Hole PCB') Solder to reach the Components side of PCB.	Minor
	2. Flat packages	Either 'Toe'(A) or 'Seal'(B)of the lead to be covered by "Filet". Lead form to be assume over Solder. 	Minor
	3. Chips	(3/2) H ≥h ≥(1/2) H 	Minor
	4. Solder ball/Solder splash	a. The spacing between solder ball and the conductor or solder pad h ≥0.13 mm. The diameter of solder ball d≤0.15 mm.	Minor
		b. The quantity of solder balls or solder splashes isn't beyond 5 in 600 mm2.	Minor
		c. Solder balls/Solder splashes do not violate minimum electrical clearance.	Major