PRODUCT :   **_TFT TOUCH MODULE_**

MODULE NO. :   **_WKS35123_**

SUPPLIER: **_WKS Technology Co.,LTD_**

DATE: **_Sep 11, 2016_**

SPECIFICATION

Revision: 0.0

WKS35123

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
Jason	Eric	Henry

REVISION RECORD

REV NO.	*REV DATE*	*CONTENTS*	*REMARKS*
0.0	*2016-09-11*	*First release*	*Preliminary*

CONTENTS

1、GENERAL INFORMATION

Item of general information	Contents	Unit
LCD Display Size (Diagonal)	3.5	inch
LCD Display Type	TFT/TRANSMISSIVE	-
LCD Display Mode	Normally White	-
Recommended Viewing Direction	6	o'clock
Gray inversion Direction	12	o'clock
Module size (W×H×T)	55.26×84.69×4.00	mm
Active area (W×H)	48.96×73.44	mm
Number of pixels (Resolution)	320RGB×480	pixel
Pixel pitch (W×H)	0.153×0.153	mm
Color Pixel Arrangement	RGB Stripe	-
LCD Driver IC	-	-
CTP Driver IC	-	-
Interface Type	8080 interface/RGB interface	-
Power consumption	-	mA
Color Numbers	65K/262K	-
Backlight Type	White LED	-

2、*EXTERNAL DIMENSIONS*
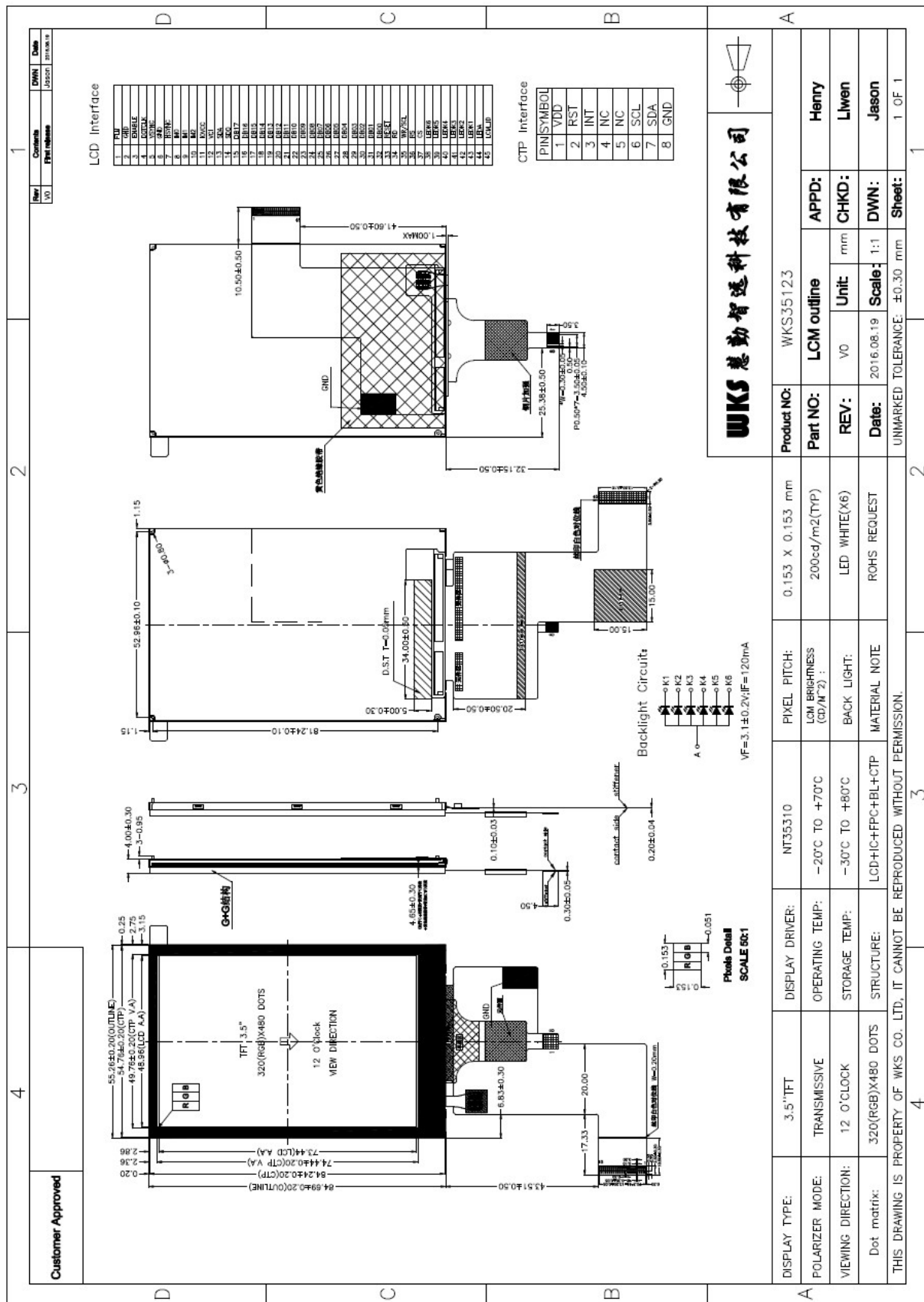
3、*ABSOLUTE MAXIMUM RATINGS*

Parameter of absolute maximum ratings	*Symbol*	*Min*	*Max*	*Unit*
LCD supply voltage	*VCI*	*-0.3*	*5.5*	*V*
	IOVCC	*-0.3*	*5.5*	*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 the product 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*
Analog operating voltage	*VCI*	*2.3*	*2.8*	*3.3*	*V*
I/O operating voltage	*IOVCC*	*1.65*	*1.8*	*3.3*	*V*
LCD Input Current	*Idd*	*-*	*-*	*-*	*mA*
Input voltage 'H' level	*VIH*	*0.7*IOVCC*	*-*	*IOVCC*	*V*
Input voltage 'L' level	*VIL*	*VSS*	*-*	*0.2*IOVCC*	*V*
Output voltage 'H' level	*VOH*	*0.8*IOVCC*	*-*	*IOVCC*	*V*
Output voltage 'L' level	*VOL*	*VSS*	*-*	*0.2IOVCC*	*V*

5、 *BACKLIGHT CHARACTERISTICS*

Item of backlight characteristics	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*	*Remark*
Forward voltage	*Vf*	*2.9*	*3.1*	*3.3*	*V*	*Note1*
Forward Current	*If*	*-*	*120*	*-*	*mA*	*-*
Number of LED	*-*	*-*	*6*	*-*	*Piece*	*-*
LED Connection mode	*P/S*	*-*	*Parallel*	*-*	*-*	*-*
Lifetime of LED	*-*	*-*	*10000*	*-*	*hour*	*Note2*

➢ *Note1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If=120mA.*

➢ *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 120mA.*

➢ *Backlight circuit :*
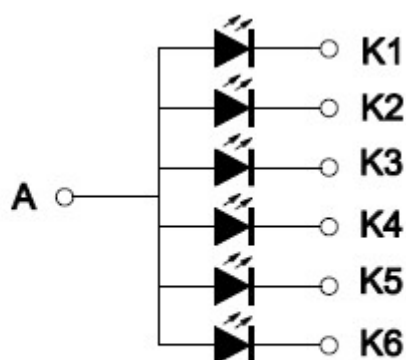
VF=3.1±0.2V;IF=120mA（Typ.）

6、*CTP CHARACTERISTICS*

Item of CTP characteristics	Specification	Unit	Remark
Panel Type	Cover Lens + ITO Glass	-	-
Resolution	320 ✕ 480	pixel	-
Surface Hardness	≥6H	-	-
Transparency	>85%	-	-
Driver IC	-	-	-
Interface Type	I2C	-	-
Support Points	5(Max)	-	-
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℃	-	16	32	ms	FIG 1.	4
Contrast Ratio	CR		-	400	-	-	FIG 2.	1
Luminance uniformity	δWHITE		-	80	-	%	FIG 2.	3
Surface Luminance	Lv		-	200	-	cd/m2	FIG 2.	2
CIE (x, y) chromaticity	White	White x	-	0.303	-	-	FIG 2.	5
		White y	-	0.325	-			
	Red	Red x	-	0.626	-			
		Red y	-	0.334	-			
	Green	Green x	-	0.277	-			
		Green y	-	0.549	-			
	Blue	Blue x	-	0.142	-			
		Blue y	-	0.122	-			
Viewing angle range	∅=90(12 o'clock)	CR ≥ 10	-	70	-	deg	FIG 3.	6
	∅=270(6 o'clock)		-	60	-	deg		
	∅=0(3 o'clock)		-	70	-	deg		
	∅=180(9 o'clock)		-	70	-	deg		
NTSC ratio	-	-	-	60	-	%	-	-

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,P 3,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
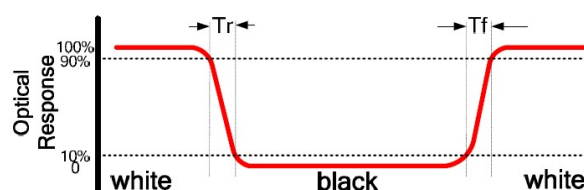
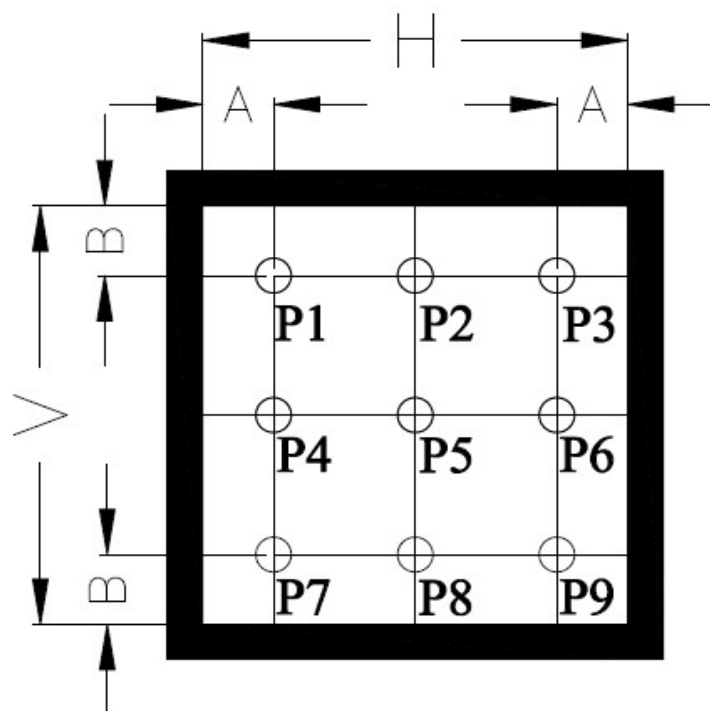## FIG.2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity,

CIE (x , y) chromaticity

A : H/6 ;

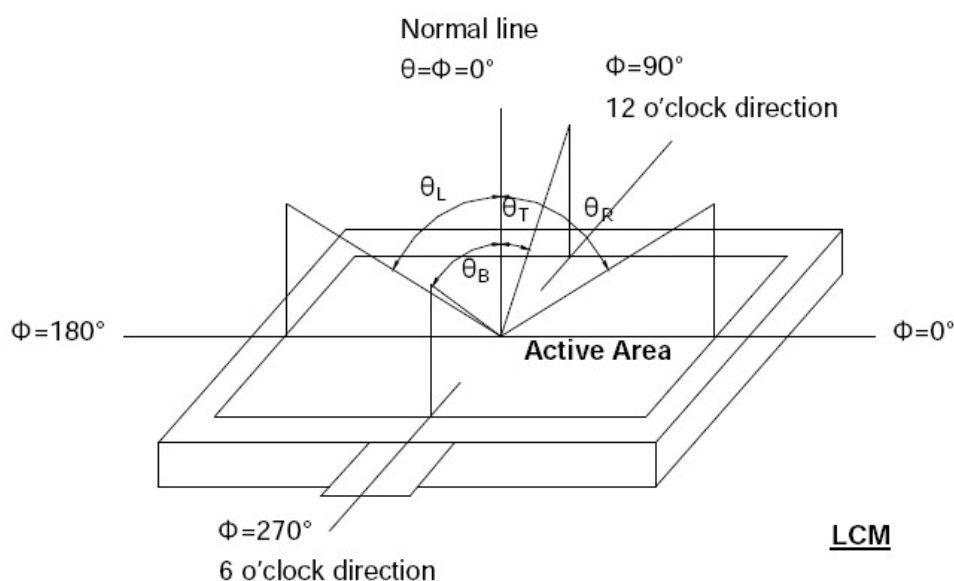*B : V/6 ;*

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	FMARK (TE)	O	Frame head pulse signal. Utilize this signal when synchronizing RAM data write operations. If not used, please open this pin.
2	GND	Power supply	Power ground
3	ENABLE	I	Data input Enable. Active high to enable the data input Bus.
4	DCLK	I	Clock signal. Latching data at the rising edge.
5	VSYNC	I	Vertical Sync input. Negative polarity.
6	GND	Power supply	Power ground
7	HSYNC	I	Horizontal Sync input. Negative polarity.
8	IM0	I	Selects the interface to MPU
9	IM1	I	
10	IM2	I	
11	IOVCC	Power supply	Power supply to the I/O.IOVCC=1.65~3.3V
12	VCI	Power supply	Power supply to the liquid crystal power supply analog circuit. VCI=2.3~3.3V
13	SDA	I	Serial data input or output signal in serial interface mode
14	SDO	O	Serial data output when SDA_EN=0
15~32	DB17~DB0	I	Data Bus
33	RESET	I	LCD RESET signal, Low is active
34	RD	I	Read strobe signal
35	WR/SCL	I	WR: Write strobe signal in the 8080-MCU interface SCL: A synchronous clock signal in serial interface
36	RS	I	Data/Command select
37	CS	I	Chip select
38	LED-K6	Power supply	Backlight Cathode
39	LED-K5	Power supply	Backlight Cathode
40	LED-K4	Power supply	Backlight Cathode
41	LED-K3	Power supply	Backlight Cathode
42	LED-K2	Power supply	Backlight Cathode
43	LED-K1	Power supply	Backlight Cathode
44	LED-A	Power supply	Backlight Anode
45	LCM_ID	O	Open

Note1:3wire or 4wire serial interface selection for B3h register:

SDA_EN	Input Pin	Output Pin
0	SDA	SDO
1	SDA	SDA

Note2: IM0~IM3:

IM2	IM1	IM0	Interface Selection
0	0	0	18bit 8080 interface
0	0	1	9bit 8080 interface
0	1	0	16bit 8080 interface
0	1	1	8bit 8080 interface
1	0	0	MDDI+9bit serial interface
1	0	1	9bit serial interface + RGB interface
1	1	0	MIPI interface
1	1	1	8bit serial interface + RGB interface

B、CTP Interface Description

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

9、INPUT TIMING

80-System Bus Interface Timing Characteristics (Register Access)

Item	Symbol	Min	Typ.	Max	Unit
Write cycle time	tWC	40	-	-	ns
Read cycle time	tRC	400	-	-	ns
Write control pulse "Low" duration	tWRL	19	-	-	ns
Read control pulse "Low" duration	tRDL	150	-	-	ns
Write control pulse "High" duration	tWRH	19	-	-	ns
Read control pulse "High" duration	tRDH	250	-	-	ns
Write setup time(DCX to CSX,WRX)	tAST	0	-	-	ns
Read setup time(DCX to CSX,RDX)	tAST	10	-	-	ns
Address hole time	tAHT	2	-	-	ns
Write data setup time	tDST	10	-	-	ns
Write data hold time	tDHT	10	-	-	ns
Read data access time	tRAT	-	-	150	ns
Read data hold time	tODH	5	-	-	ns
Chip select setup time	tCS	15	-	-	ns

80-System Bus Interface Timing Characteristics (RAM Data Access)

Item	Symbol	Min	Typ.	Max	Unit
Write cycle time	tWC	40	-	-	ns
Read cycle time	tRC	160	-	-	ns
Write control pulse "Low" duration	tWRL	19	-	-	ns
Read control pulse "Low" duration	tRDL	45	-	-	ns
Write control pulse "High" duration	tWRH	19	-	-	ns
Read control pulse "High" duration	tRDH	90	-	-	ns
Write setup time(DCX to CSX,WRX)	tAST	0	-	-	ns
Read setup time(DCX to CSX,RDX)	tAST	10	-	-	ns
Address hole time	tAHT	2	-	-	ns
Write data setup time	tDST	15	-	-	ns
Write data hold time	tDHT	10	-	-	ns
Read data access time	tRAT	-	-	40	ns
Read data hold time	tODH	5	-	-	ns
Chip select setup time	tCS	15	-	-	ns

10、 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.*

11、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.

11.1   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

11.2   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)

11.3   Definition of Inspection Item.

A、   Definition of inspection zone in LCD.
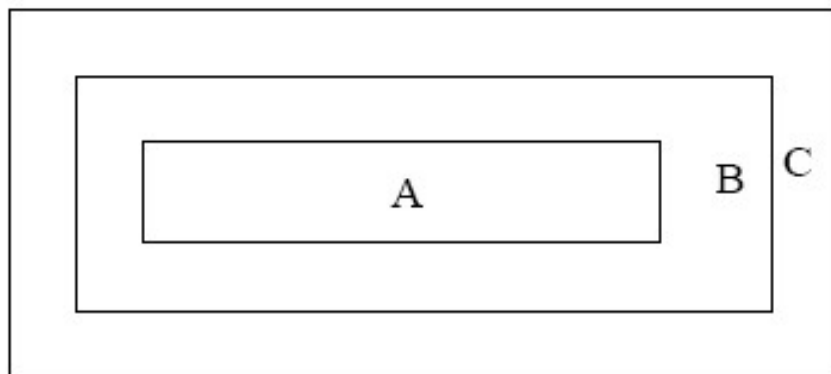
Zone A: character/Digit area

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.
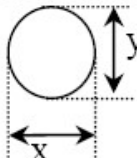
B、 *Definition of some visual defect*

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.*
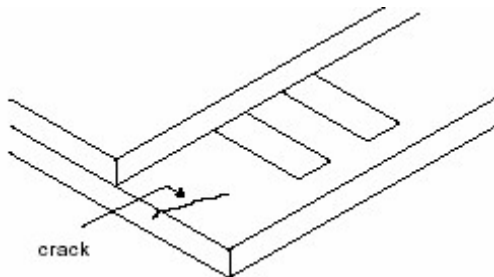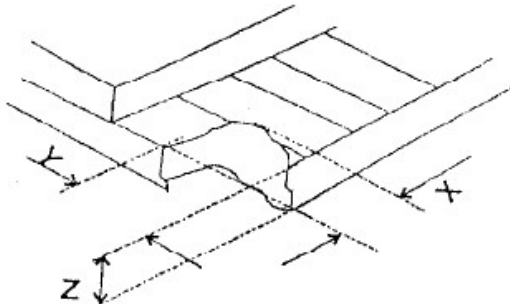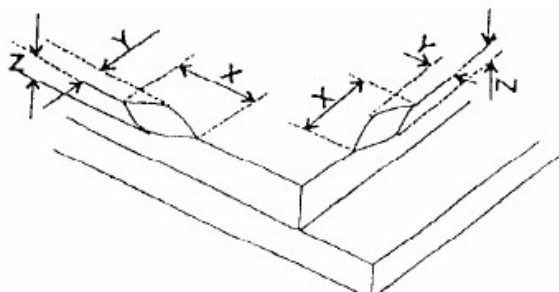
11.4   *Major Defect*

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*	
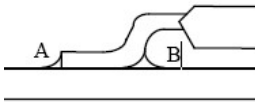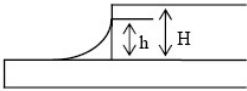
11.5   Minor Defect

Item No.	Items to be inspected	Inspection standard					Classification of defects

Item 1 — Bright dot /dark dot defect

Zone		Acceptable Qty				
		A+B			C	
		3.5～7"	7～10.1"	>10.1"		
Bright pixel dot		1	2	3		
Dark pixel dot		4	4	4	*Acceptable*	
2bright dots adjacent		0	0	0		
2dark dots adjacent		0	0	0		
Total bright and dark dots		5	6	7		

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.

Classification: *Minor*

Item 2 — Dot defect

$\Phi = (x+y)/2$

Zone Size(mm)	Acceptable Qty			
	A+B			C
	3.5"～7"	7～10.1"	>10.1"	
$\Phi \leqslant 0.2$	Acceptable	Acceptable	Acceptable	*Acceptable*
$0.2 < \Phi \leqslant 0.5$	4	5	6	
$\Phi > 0.5$	0	0	0	

Note:
1. Minimum distance between defective dots is more than 5 mm;
2. The quantity of defect is zero in operating condition.

Classification: *Minor*

Item 3 — Linear defect

Zone Size (mm)		Acceptable Qty			
		A+B			C
Length	Width	3.5"～7"	7～10.1"	>10.1"	
Ignore	W≤0.05	Acceptable	Acceptable	Acceptable	*Acceptable*
L≤5.0	0.05< W≤0.1	4	5	6	
L>5.0	W>0.1	0	0	0	

Classification: *Minor*

4	*Polarizer defect*	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		*Minor*

5.4.3 Polarizer Dent & Air bubble

Zone \ Size(mm)	A+B			C
	3.5"～7"	7～10.1"	>10.1"	
$\Phi \leqq 0.2$	Acceptable	Acceptable	Acceptable	Acceptable
$0.2 < \Phi \leqq 0.5$	4	5	6	
$\Phi > 0.5$	0	0	0	

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:

Zone \ Size (mm)		A+B			C
Length	Width	3.5"～7"	7～10.1"	>10.1"	
Ignore	W≤0.05	Acceptable	Acceptable	Acceptable	Acceptable
1.0<L ≤5.0	0.05< W≤0.20	4	5	6	
L>5.0	W>0.2	0	0	0	

5	*MURA*	*Using 3% ND filter, it's NG if it can be seen in R,G,B picture.*	*Minor*
	White/Black dot（MURA）	*Visible under：ND3%；D≦0.15mm, Acceptable；* *0.15mm<D≦0.5mm, N≦4；D>0.5mm, Not allowable.*	

| 6 | *Glass defect* | *(i) Crack*
　Cracks are not allowed.
 | *Minor* |
| | | *(ii) TFT chips on corner*
 | *Minor* |

(ii) TFT chips on corner table:

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.

(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

11.6   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