



福建希恩凯电子有限公司

FUJIAN CNK ELECTRONICS CO.,LTD.

Product Specification For TFT MODULE

Model NO. : CNKT0350-21466A1

CUSTOMER NO. :

REVISION : V00

APPROVAL FOR SPECIFICATIONS ONLY

APPROVAL FOR SPECIFICATIONS AND SAMPLE

CUSTOMER APPROVAL	APPROVED BY	DATE

CNK R&D CENTER		
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Version	Date	Description
V00	2023-7-21	First issue



1. DISPLAY CHARACTERISTICS

Item	Specification	Unit	Note
LCD Size	3.5	inch	
Panel Type	TN	-	
Resolution	240(RGB)*480	pixel	
Display Mode	TRANSMISSIVE,NORMALLY BLACK	-	
Display Number of Colors	262K	-	
Viewing Direction	12:00	-	Note1
Module Size	54.50*83.00*2.15	mm	Note1
Weight	TBD	g	
Driver IC	ILI9488	-	
Interface	MCU 8Bit	-	

Note 1: Please refer to the mechanical drawing.

2. Backlight Characteristics

(at Ta=25°C,RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED forward voltage	VF	3.0	3.2	--	V	IF=20*6mA
LED forward current	IF	--	120	--	mA	
LED power consumption	PLED	--	--	--	mW	Note1
Uniformity	--	80	--	---	%	IF=20*6mA
Connection mode	--	6 in parallel (dual core LED)			/	
LED life-time	--	5000	--	--	Hrs	Note2

Note1.Calculator Value for reference: $IF \cdot VF = PLED$

Note2.The LED Life-time define as the estimated time to 50% degradation of initial brightness at Ta=25°C and IF=40mA. The LED lifetime could be decreased if operating IF is larger than 40mA

3. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power supply	VDD	2.6	3.3	V
Operation temperature	Top	-20	70	°C
Storage temperature	Tst	-30	80	°C



5. Pin Assignments

LCD Pin No.	Symbol	Function	Note
1	GND	Ground	
2	GND	Ground	
3	LED-A	back light power supply positive	
4	LEDK	back light power supply negative	
5	VCI	Power supply	
6	VCI	Power supply	
7	GND	Ground	
8	TE		
9	CS	Chip signal	
10	RS	Command / parameter or display data selection pin.	
11	WR	Write data signal (Low:active)	
12	RD	Read data signal (Low:active)	
13	GND	Ground	
14~21	DB0~DB7	Data bus	
22	/RESET	Reset PIN	
23	GND	Ground	
24	GND	Ground	

6. Electrical Characteristics

DC CHARACTERISTICS (at Ta=25°C)

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LC Operating Voltage	Vop	-	-	4.5	V	Ta=25° C
TFT Gate ON Voltage	VGH	12	-	18	V	
TFT Gate OFF Voltage	VGL	-10	-	-6	V	
TFT Common Electrode Voltage	Vcom	-2	-	5	V	



7.Optical Specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time (By Quick)	Tr+Tf	$\theta = 0^\circ$	-	20	40	ms	Note 5
Contrast ratio	CR	$\theta = 0^\circ$	-	500	-		Note 2,6
Viewing angle	Top	$CR \geq 10$	-	60	-	deg.	Note 2,6,7
	Bottom	$CR \geq 10$	-	60	-		
	Left	$CR \geq 10$	-	70	-		
	Right	$CR \geq 10$	-	70	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$	0.292	0.307	0.322		Note 3
	Wy		0.312	0.327	0.342		
	Rx		0.609	0.624	0.639		
	Ry		0.316	0.331	0.346		
	Gx		0.281	0.296	0.311		
	Gy		0.562	0.577	0.592		
	Bx		0.128	0.143	0.158		
By	0.094	0.109	0.124				
NTSC			57%	60%	-		Note 3
Cross talk	Ct		-	-	2%		Note 9
Transmittance	Trans		-	5.50%	-		Note 4

Note 1: Ambient temperature = 25°C.

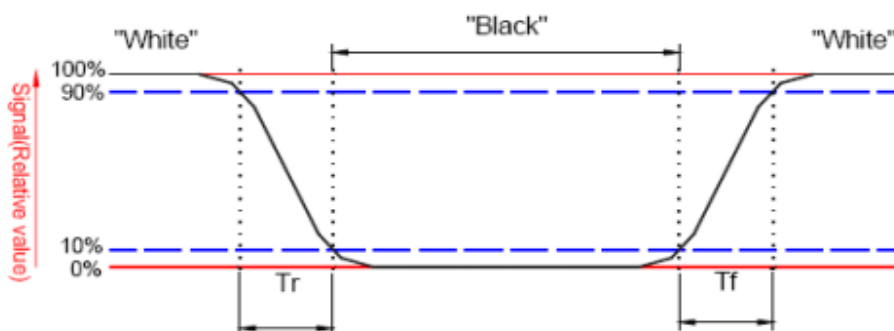
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is $\pm 10\%$.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.



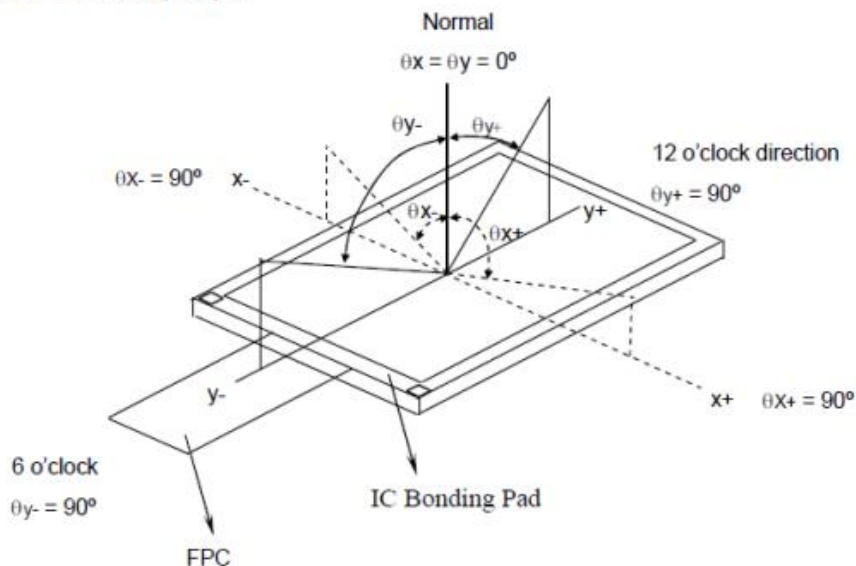


Note 6: Definition of contrast ratio:

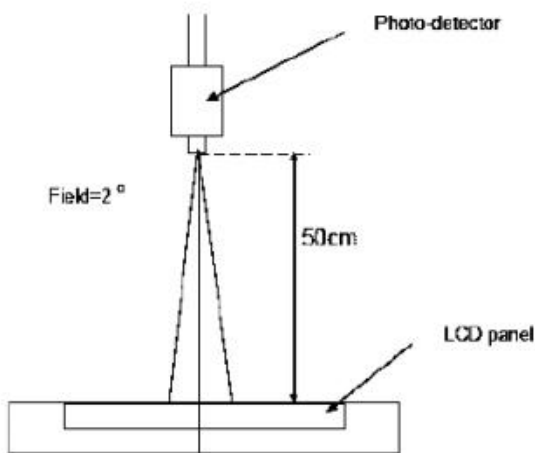
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

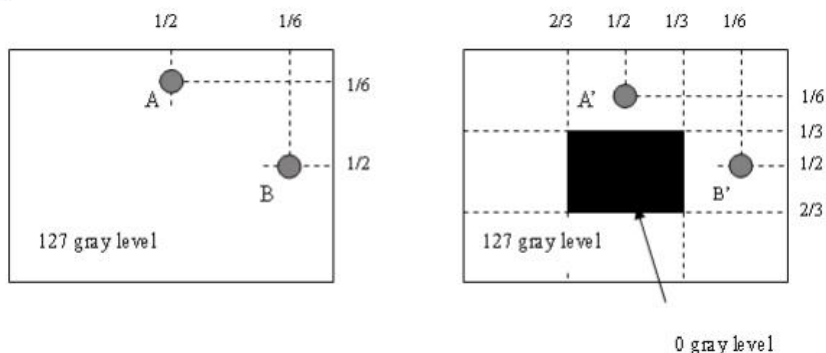
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:

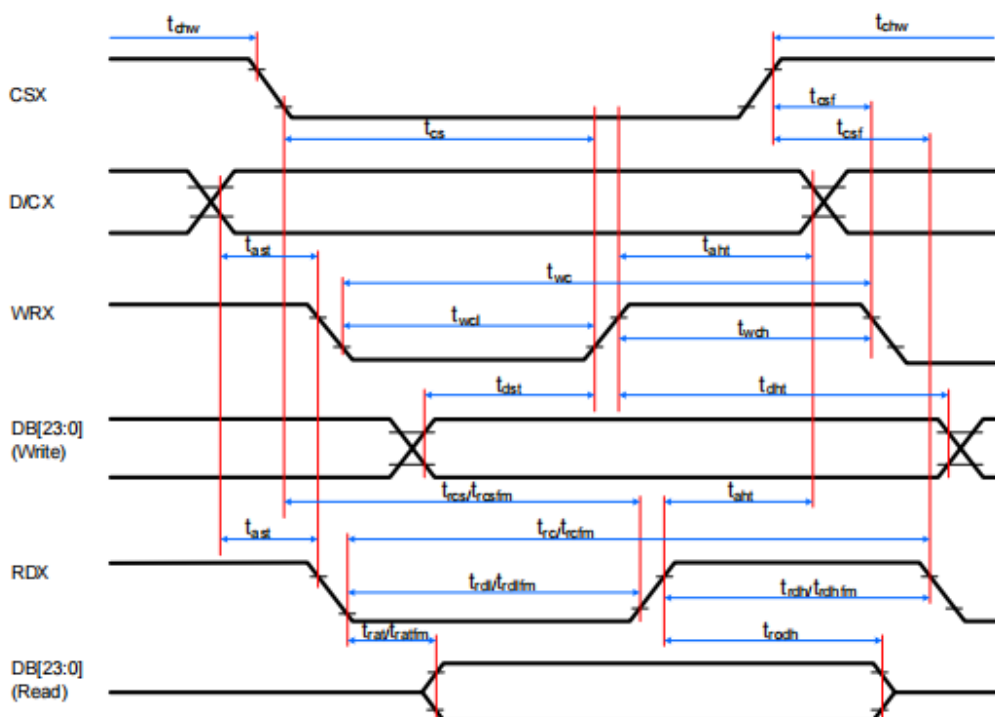


$|LA-LA'| / LA \times 100\% = 2\% \text{ max.}$, LA and LA' are brightness at location A and A'.

$|LB-LB'| / LB \times 100\% = 2\% \text{ max.}$, LB and LB' are brightness at location B and B'.



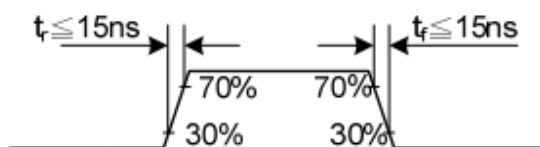
8. AC Characteristics



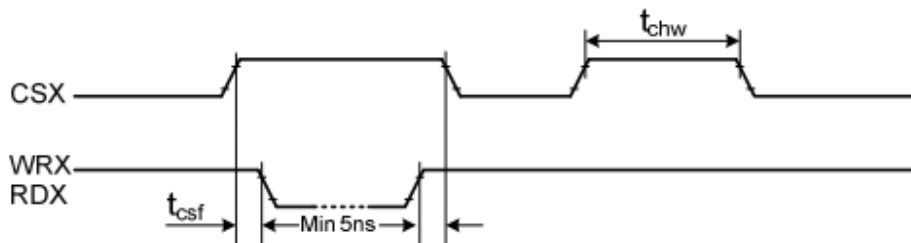
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	that	Address hold time (Write/Read)	0	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
WRX	twc	Write cycle	40	-	ns	-
	twrh	Write Control pulse H duration	15	-	ns	-
	twrl	Write Control pulse L duration	15	-	ns	-
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [7:0]	tdst	Write data setup time	10	-	ns	For maximum, CL=30pF For minimum, CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Notes:

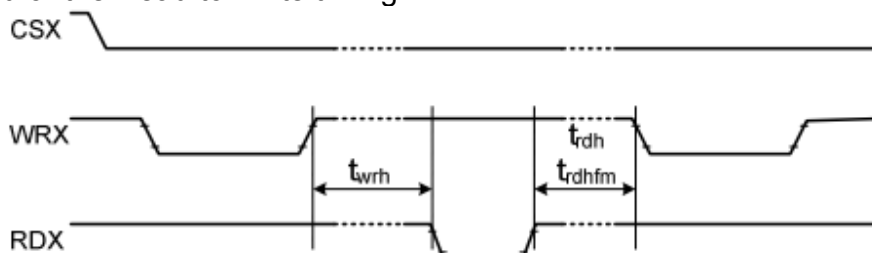
1. $T_a = -30$ to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
2. Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.
3. Input signal rising time and falling time:



4. The CSX timing:



5. The Write to Read or the Read to Write timing:



9. Reset Timing

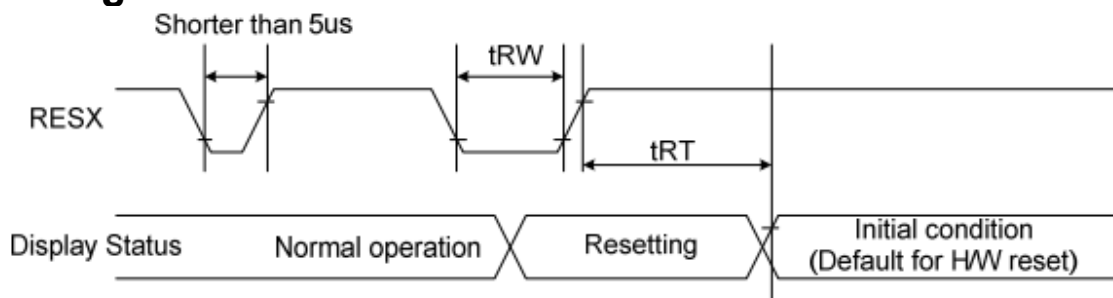


Table 39: Reset Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	t _{RW}	Reset pulse duration	10		μS
	t _{RT}	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

Notes:

- The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (t_{RT}).
- According to the Table 40, a spike due to an electrostatic discharge on the RESX line does not cause irregular system reset.

Table 40: Reset Description

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts



3. During the Reset period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains the blank state in the Sleep In mode.) and then return to the default condition for the Hardware Reset.

4. Spike Rejection can also be applied during a valid reset pulse, as shown below:

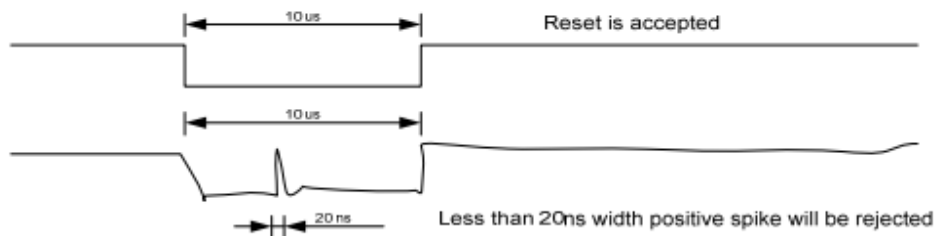


Figure 137: Positive Noise Pulse during Reset Low

5. When Reset is applied during the Sleep In Mode.

6. When Reset is applied during the Sleep Out Mode.

7. It is necessary to wait 5msec after releasing RESX before sending commands. The Sleep Out command also cannot be sent in 120msec.

10. Reliability Test Conditions

Test item	Test condition	Inspection after test
High temperature storage	80±2°C/96 hours	Note 1,2
Low temperature storage	-30±2°C/96 hours	
High temperature operating	70±2°C/96 hours	
Low temperature operating	-20±2°C/96 hours	
Temperature Shock	-20±2°C~25°C~70±2°C*10cycles (30min.) (5min.) (30min.)	
High Temperature Humidity Operation	50°C*90% RH/96 hours	
Vibration test	Frequency : 10Hz~55Hz~10Hz Amplitude : 1.5mm , X , Y , Z direction for total 2hours(Packing condition)	
Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
ESD test	Voltage : ±8KV, R:330Ω /C:150pF Air discharge, 10 time	



11. Handling Precautions

11.1. Safety

11.1.1. 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.

11.2. Handling

11.2.1. The LCD and touch panel is made of plate glass. do not subject the panel to mechanical shock or to excessive force on its surface.

11.2.2. do not handle the product by holding the flexible pattern portion in order to assure the reliability

11.2.3. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.

11.2.4. Provide a space so that the panel does not come into contact with other components.

11.2.5. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.

11.2.6. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.

11.2.7. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.

11.2.8. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3. Static Electricity

11.3.1. Ground soldering iron tips, tools and testers when they are in operation.

11.3.2. Ground your body when handling the products.

11.3.3. Power on the LCD module before applying the voltage to the input terminals.

11.3.4. do not apply voltage which exceeds the absolute maximum rating.

11.3.5. Store the products in an anti-electrostatic bag or container.

11.4. Storage

11.4.1. Store the products in a dark place at $+25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ with low humidity (65%RH or less).

11.4.2. do not store the products in an atmosphere containing organic solvents or corrosive gas.

11.5. Cleaning

11.5.1. do not wipe the touch panel with dry cloth, as it may cause scratch.

11.5.2. Wipe off the stain on the product by using soft cloth moistened with ethanol. do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. do not use any organic solvent or detergent other than ethanol.



12. Inspection Criterion

12.1 Description

This specification is made to be used as the standard acceptance/rejection criteria for TFT LCM Product.

12.1.1. 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

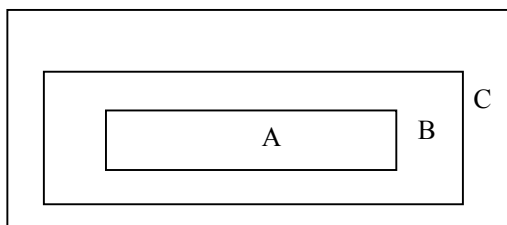
12.1.2. Inspection condition

● Viewing distance for cosmetic inspection is about $30\pm 5\text{cm}$ with bare eyes, and under an environment $600\sim 1000\text{lux}$ for visual inspection and $0\sim 200\text{lux}$ for function test., all directions for inspecting the sample should be within 45° against perpendicular line. (Normal temperature $18\sim 28^\circ\text{C}$ and normal humidity $60\pm 15\%\text{RH}$).

● Driving voltage

The Vop value from which the most optical contrast can be obtained near the specified Vop in the specification (Within $\pm 0.5\text{V}$ of the typical value at 25°C .).

12.1.3. 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.

12.2 Inspection criterion



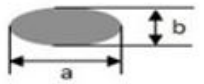
12.2.1 Function defect

Items to be inspected	Inspection criterion	Classification of defects
All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting. 6) obvious striation 7) Current beyond specification value	MA
Missing	Missing component	
Outline dimension	Overall outline dimension exceed the drawing is not allowed.	

12.2.2 LCD pixel defect (bad dot) (defect type:MI)

Checking item Item/LCD size	Judgment criterion		
	S ≤5.0 Inch	5.0 < S ≤7.0 Inch	7 < S ≤12.3 Inch
Color bad dot-bright dot(R、G、B)	1	2	3
two adjacent bright point	0	1	2
three or more adjacent point	0	0	0
total points for bad dot-bright dot	1	2	5
Bad dot-dark dot	2	4	5
two adjacent dark point	1	2	3
three or more adjacent point	0	1	1
total points for bad dot -dark dot	3	6	7
patch bright dot	Invisible with ND5% ,it is OK.		

12.2.3 dot and line defect (defect type:MI)

Checking item	Judgment criterion			Figure	
	Diameter(mm)\LCD Size	S ≤5.0 Inch	5 < S ≤7 Inch		7 < S ≤12.3 Inch
Dot defect	D ≤0.1	allowed	allowed	allowed	 D=(a+b)/2
	0.1 < D ≤0.2	4	allowed	allowed	
	0.2 < D ≤0.3	0	5	6	
	0.3 < D ≤0.5	0	0		
	D > 0.5	0	0	0	
	the distance between the two defect dot:DS ≥5mm				



line defect	Length(mm)	width(mm)	Judgment criterion			
	disregard	$W \leq 0.05$	allowed	allowed	allowed	
	$L \leq 5$	$0.05 < W \leq 0.1$	4	5	7	
	$L > 5$	$W > 0.1$	0	0	0	
Concave point and air bubble for polarizer	LCD Size(mm)		Judgment criterion			 $D = (a+b)/2$
	$D \leq 0.3$		allowed	allowed	allowed	
	$0.3 < D \leq 1.0$		3	4	5	
	$1.0 < D \leq 1.5$		1	2	3	
	$D > 1.5$		0	0	0	
Fold mark, linear scar for polarizer	Length (mm)	width (mm)	Judgment criterion			
	disregard	$W \leq 0.05$	allowed	allowed	allowed	
	$1 < L \leq 5$	$0.05 < W \leq 0.2$	3	4	5	
	$L > 5$	$W > 0.2$	0	0	0	
Notes:1.If the fold mark and linear scar for polarizer is visible with operating condition,the defect is judged with line judge; 2.If the fold mark and linear scar for polarizer is visible with non-operating condition,the defect is judged with the above judgment standard.						

12.2.4 Corner and others crack for LCD (defect type:MI)

Checking item	Judgment criterion	Figure
Electric conduction crack	$X \leq 3.0\text{mm}, Y \leq 1/4w, Z \leq t, N \leq 2$	
corner crack	$X \leq 3.0\text{mm}, Y \leq 3.0\text{mm}, Z \leq t, N \leq 3$ Corner crack extended to ITO PIN, none allowed	
surface crack	$X \leq 1.5\text{mm}, Y \leq 1.0\text{mm}, Z \leq t, N \leq 4$	

12.2.5 Module Cosmetic Criteria (defect type:MI)

Item	Judgment Criterion
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Difference in Spec.	None allowed
Pattern peeling	No substrate pattern peeling and floating
Soldering defects	No soldering missing No soldering bridge No cold soldering Notes:detail judgment referring to IPC-A-610 grade II
Resist flaw on Printed Circuit Boards	visible copper foil (0.5mm or more) on substrate pattern, none allowed
Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed 0.2mm)
Stain	No stain to spoil cosmetic badly
Plate discoloring	No plate fading, rusting and discoloring
Newton ring	Referring to limited sample
Mura	Invisible with 5%ND,allowed
Light leaks	Referring to limited sample

12.2.6 Module Cosmetic Criteria

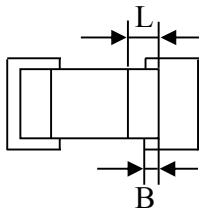
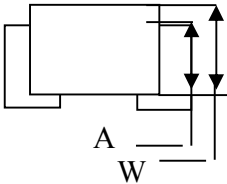
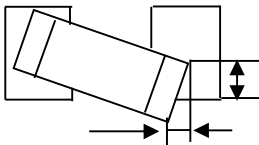
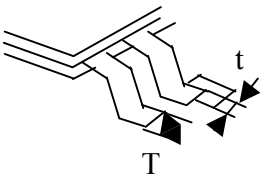
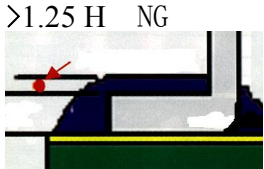
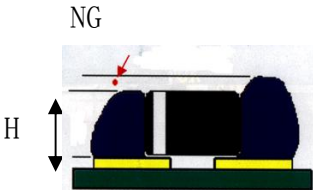
Inspection items	Inspection content	Defect level		Inspection Methods and Tools
		MAJ	MIN	
FPC segment	The PIN cannot be broken.	√		Inspection with naked eyes Standard card Magnifier
	Fold marks: Not in V" shape	√		
	Pin/line: concave, convex, skewed not to exceed 1/3 of width		√	
	Double-sided adhesive tape cannot fall off/skew		√	
	Oxidation on pins (PAD) is not allowed		√	
	open circuit /short circuit is not allowed on line	√		
	Line / line: non-conductive sundries must not cross two lines, conductive sundries according to convex / concave judgment		√	
	The PAD on the product do not warp, deform or fall off		√	
	Scratch: Scratch is not allowed on the film		√	
	Cover film: the sticker offset must not exceed the drawing requirements		√	
	Bubbles: Bubbles must not span 2 lines and must not exceed 2		√	
	Stratification: product is not layered	√		
	Screen printing: screen printing should be clear,		√	



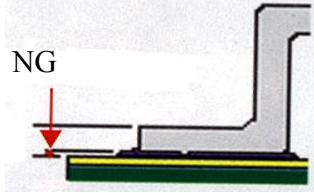

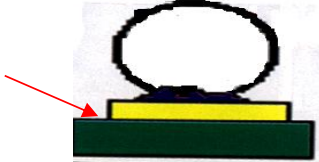
	not duplicate, missing or wrong			
Back-light	Guide pin indispensable/unbroken		√	
	No surface breakage/crack	√		
	Reflex tape/ FPC not dropped		√	
	The double-sided glue on the light guide plate must not be removed		√	
SMT segment	Solder not melted	√		
	Component standing or solder joint and end face disengage	√		
	Tin beads: removable tin beads not available, non-removable tin beads not exceeding 0.2 MM in diameter		√	

SMT segment	Line 1. Broken circuit or short circuit not allowed 2. Line damage or residual copper no more than 1/3 W	√		Visual Standard card Magnifier
	Scratch on the surface 1. scratch copper, reject 2. copper single line (not covered with green paint)>1 mm, reject 3. No more than 2 lines and exposed copper		√	
	Part error 1. Part specification, material number failed to match original part data ,reject 2. missing /multiple parts: no missing or multiple parts on the circuit board 3. reverse: no positive and negative wrong welding of parts on circuit board	√		
	Tin on board 1. Tin in front of 1/2 Lead, reject 2. products have hot pressing process, its gold finger (pressing area) tin, reject		√	
	Empty welding: welding surface and pad are not joint	√		
	No tin tip / crack or virtual welding		√	
	No white powder residue		√	



	<p>Component offset</p> <p>1. $B \geq 1/2 \bullet L$ 2. $A \geq 2/3 \bullet W$</p>   <p>3. $A \geq 2/3 \bullet W$ $B \geq 1/2 \bullet L$ 4. $t \geq 1/2 \bullet T$</p>   <p>Reference 1,2</p>		√	
SMT segment	<p>Solder height is higher than solder foot 1.25 H (gull airfoil), reject</p>  <p>Solder height is higher than surface (round type), reject</p> 		√	Visual Standard card Magnifier



	<p>Gull airfoil: Solder height less than solder foot $1/3 H$, or the solder pad less than 70% tin, reject</p>  <p>Cylindrical type: solder height less than surface $1/4 H$ or the solder pad less than 70% tin, reject</p>  			
	<p>Connectors (including: card cover) are not broken or dropped</p>	√		
	<p>Board warping: the gap between the PCB and the plane is not greater than $1/100$ of the length (if no special requirements, according to this standard)</p>		√	
Other	<p>SI/UV adhesive coating must not have obvious concave and convex</p> <p>SI/UV glue not coated/ dropped or not fit in size</p> <p>No glue in non-coating areas</p> <p>Print position / font / text not in accordance with requirements</p> <p>Easy to tear film color / position not in accordance with requirements</p>		√	Visual Magnifier
	<p>Incoming, process, ROHS process control, check for conformity</p>	√		Visual
	<p>Packaging and marking of the product are clear and correspond to the report</p>	√		Visual



The relevant information provided to the customer is complete When the customer has a request	√		
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12.2.7 structure, packaging inspection:

Inspection items	Inspection criterion	Defect level		Inspection Methods and Tools
		MAJ	MIN	
Structure segment	The structure does not conform to the drawing size	√		Visual
Packing	Packaging material compliance	√		
	Packing Type Compliance	√		
	Tray or not	√		
	Packing Quantity Compliance	√		
	Product packaging (placement) direction meets the requirements	√		
	Cartons damaged/deformed		√	
	Labels are required on inner/external packing cases (content: model, date, etc)	√		

Remarks:

1. above all structural dimensions per batch sampling quantity of 10 PCS, bad is not qualified.
2. environmental protection requirements:product inspection
 - 2.1 Incoming, process, ROSH process control, check for conformity;
 - 2.2 Packaging and marking of the product are clear and correspond to the report
 - 2.3 The relevant information provided to the customer is complete When the customer has a request