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Document Chinese Title: 15.0" (G150 series)TFT-LCD 進料檢驗規範 (A)

Document English Title: Incoming Inspection Standard For 15.0" (G150 series) TFT-LCD Modules (A)

AU OPTRONICS CORPORATION
Specification for Approval
INCOMING INSPECTION STANDARD FOR
15.0" TFT-LCD MODULES (A)
Model Name: G150 Series

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General Display Business Unit/AU Optronics

Customer	Checked and Approved by



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Revision History				
Rev.	Date	Page	Old Inspection Spec	New Inspection Spec
0	2011.Feb. 28	All		Initial Specification
1	2013.Sep.01	All		1. Format changed 2. Add drawing in item3. Inspection sampling method for MIL-STD-105E. 3. Modification: item6.1 Electrical inspection specification,add the criteria for small BP and Image retention. 4.Modification: Item6.2 Appearance inspection specification.
2	2015.Oct.01	All		New version (integrate G150 TN type model)
3	2017 July 4th	9	6.2 Inspection specification	6.2 Inspection specification : Active area & Bezel
4	2018/1/12	1		(Brightness over 1000 nits)
5	2019/01/01	All		2019 New version for G150 TN and VA type including of normal and high brightness
6	2019/03/22	All		Modify the 2.Incoming inspection & 6.Classification of defects

_(Note 1) The revised inspection criteria is effective before the expiration of the IIS as specified

1. Scope:

1.1 The incoming inspection standards shall be applied to TFT-LCD Modules (hereinafter called “Modules”) that supplied by AU Optronics Corporation (hereinafter called “seller”).

1.2 Specifications contains

- Electrical inspection specification
- Appearance specification

2. Incoming inspection:

The buyer (customer) shall inspect the modules within ninety calendar days since the delivery date (the “inspection period”) at its own cost. The results of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller.

The buyer may, under commercially reasonable reject procedures, reject an entire lot in the delivery involved. Within the inspection period, if the samples of modules within a lot show a number of unacceptable defects in accordance with this incoming inspection standards, the buyer must notify the seller in writing of any such rejection promptly, and not later than within three business days in the end of the inspection period.

Should the buyer fail to notify the seller within the inspection period, the buyer’s right to reject the modules shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

The buyer (customer) shall sign the IIS back to AUO once the buyer verify the model completely and move to mass production stage. The seller(AUO) has right to follow internal specification or base on ES (engineering sample) performance to the buyer If the buyer (customer) don’t sign back to AUO.

3. Inspection sampling method:

Unless otherwise agree in writing, the method of incoming inspection shall be based on MIL-STD-105E.

3.1 Lot size: Quantity per shipment lot per model.

3.2 Sampling type: Normal inspection, single sampling.

3.3 Sampling level: Level II.

3.4 Acceptable quality level (AQL):

Major defect: AQL=1.0%.

Minor defect: AQL=2.5%.

Rig.1: Inspection Sampling standard for MIL-STD-105E :

表14-1 MIL-STD-105E 樣本代字								
批量	特殊檢驗水準				一般檢驗水準			
	S-1	S-2	S-3	S-4	I	II	III	
2~8	A	A	A	A	A	A	B	
9~15	A	A	A	A	A	B	C	
16~25	A	A	B	B	B	C	D	
26~50	A	B	B	C	C	D	E	
51~90	B	B	C	C	C	E	F	
91~150	B	B	C	D	D	F	G	
151~280	B	C	D	E	E	G	H	
281~500	B	C	D	E	F	H	J	
501~1,200	C	C	E	F	G	J	K	
1,201~3,200	C	D	E	G	H	K	L	
3,201~10,000	C	D	F	G	J	L	M	
10,001~35,000	C	D	F	H	K	M	N	
35,001~150,000	D	E	G	J	L	N	P	
150,001~500,000	D	E	G	J	M	P	Q	
500,000以上	D	E	H	K	N	Q	R	

Fig.2 Incoming inspection judgment method :

		表14-2 MIL-STD-105E正常檢驗單次抽樣計畫																											
樣本代字	樣本數	允收品質水準 (AQL · %)																											
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000		
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
G	32	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
H	50	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
J	80	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
K	125	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
L	200	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
M	315	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
N	500	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
P	800	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Q	1250	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
R	2000	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

4. Inspection instruments:

4.1 Pattern generator: LD-2000 or equivalent model.

4.2 Video board: AU video board or equivalent. The output of the signal should comply with the specification provided by AU.

4.3 Luminance colorimeter: Topcon BM-7 or equivalent model

5. Inspection environment conditions:

5.1 Room temperature : 20 ~ 25 C.

5.2 Humidity: 65±5% RH.

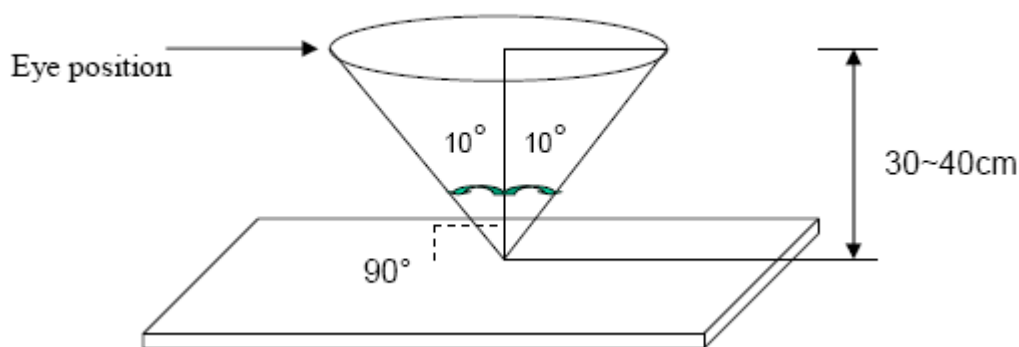
5.3 Illumination: Fluorescent light (Day-Light Type) display surface illumination to be 300 ~ 700 lux. (standard 500 lux.)

5.4 To be a distance about 35 ± 5 cm in front of LCD unit, viewing line should be perpendicular to the surface of the

module judge the visual appearance with human's eyes.

5.5 Take off the protector of polarizer while judging the display area.

5.6 If there is any question while judging, check the panel again while operating.



6. Classification of defects:

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

Major defects:

A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose.

Minor defects:

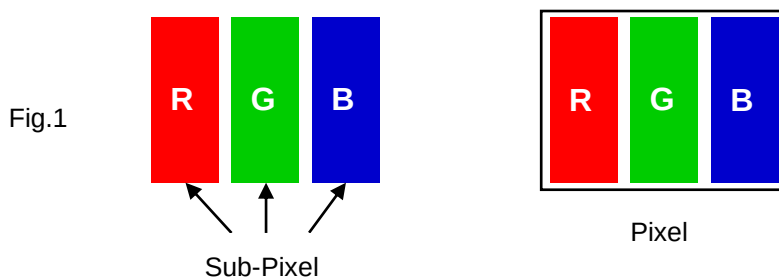
A minor defect is either a defect that is not likely to reduce materially the usability of the product for its intended purpose, or a departure from an intended purpose with little bearing on the effective use or operation of the product.

6.1 Electrical inspection specification:

No.	Inspection Item		Max. acceptable number / Distance	Unit	Note
1	Bright dots	1 dot	2	dot	1, 2, 6
2		2 Adjacent dots	0	pair	4, 5, 6
3		3 Adjacent dots	0	pair	4, 5, 6
4		Over 3 Adjacent dots	0	pair	4, 5, 6
5		Distance between bright dots	≥ 15	mm	3
6		Total (1+2+3+4)	2	pcs	
7	Dark dots	1 dot	3	dot	1, 2, 6
8		2 Adjacent dots	1	pair	4, 5, 6
9		3 Adjacent dots	0	pair	4, 5, 6
10		Over 3 Adjacent dots	0	pair	4, 5, 6

11		Distance between dark dots	≥ 15	mm	3
12		Total (7+8+9+10)	3	dot	
13	Bright dot and	2 Adjacent dots	1	pair	4, 5, 6
14	Dark dot	Distance between dots	≥ 15	mm	3
15	Total amount of Dot Defects (1~12)		5	dot	
16	Line defect		Not allowed	-	
17	Mura		Use 5% ND filter or judged by equivalent limit sample Use 1% ND filter or judged by equivalent limit sample for Brightness over 1000 nits		6, 7, 8

Note 1) Definition of pixel and sub-pixel: refer to figure 1.



Note 2) Bright dot and Small bright dot judgment criteria:

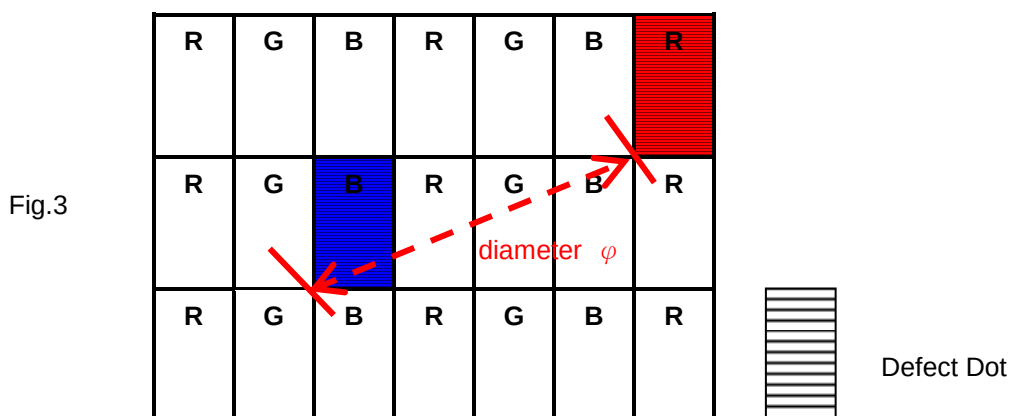
Judgment Criteria		Bright Dot Defect area	
		$> 1/2$ sub-pixel	$\leq 1/2$ sub-pixel
ND filter 10%	Visible	Bright Dot	Small Bright Dot
	Invisible	Small Bright Dot	Small Bright Dot

The drawing of 1/2 area sub-pixel definition: The 1/2 area sub-pixel can be defined as below one or more of specific shapes (Fig.2). The amount of small bright dots which are invisible through 10% ND filter should be less or equal to 10.



Fig.2

Note 3) Definition of diameter φ as following:



Note 4) Adjacent-dot defect should be observed under the same display pattern in any one of Black/Green/Blue/Red pattern.

Adjacent dot defect diagram:

Adjacent-dot defect : refer to Figure 4, dot 1,2,...,8 around A are all A's adjacent dots



Fig.4

Note 5) In three (or more) adjacent dot defect, for any 3rd dot that adjacent to 2 continuous defective dots (can be of any combination of bright dots and dark dots), the 3rd dot, no matter how large it may be, should be viewed as a dot.

Note 6) Inspection pattern: Standard inspection patterns of dot defect are listed below. AU uses these patterns as standard criteria for judging dot defect. Please inform AU if any other pattern is to be used to examine it.

Defect type	Inspecting Pattern
Mura/ display un-uniformity	L0/L128/L255
Bright Dot / Small Bright Dot	L0
Dark Dot	L255/ Monotone Red 、 Green 、 Blue
BL particle/Scratch	L255
Polarizer particle/Scratch/Bubble	L0/L255
Cosmetic defect	NA

Note 7) Unless other specified written document or limit samples, Mura (display un-uniformity) should be inspected under the 5% ND filter or 1% ND filter for brightness over 1000 nit and be acceptable when it is invisible.

ND filter use method: The inspection method of ND Filter - holding ND filter in front of the panel around 5 cm and examine the panel from 35±5 cm in the front view for 3 seconds. (Fig.5)

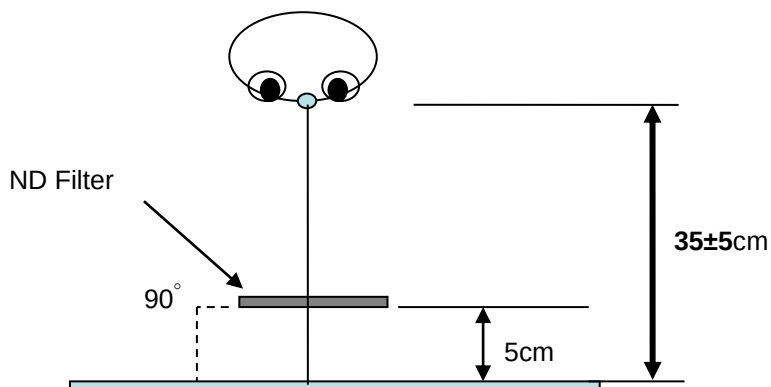


Fig.5

Note 8) While operating over 50°C ambient temperature, there should be no function failure occur and Mura (display un-uniformity) should be invisible under 1% ND filter applied.

Note 9) Image Retention: 5 seconds test pattern and image retention must be disappeared in 5 seconds after pattern changed .

6.2 Inspection specification

Judge area	Judge item		Inspection specification		Judge criterion	
					Major	Minor
Active area	Particles on the polarizer	Circular	Average diameter/Length: D/L (mm)	Numbers, Distance		○
			0.15mm<D≤0.5mm;	n≤3, ND≥5mm		
		Linear	Width: W (mm), Length: L (mm)			
			0.1mm<W≤0.3mm, L≤2mm			
	Scratch/Defect on the polarizer	Circular	Average diameter: D (mm)	Numbers, Distance		○
			0.15mm<D≤0.5mm	N≤5, ND>5mm		
		Linear	Width: W (mm), Length: L (mm)	Numbers, Distance		
			0.1mm<W≤0.3mm,L≤2	N≤5, ND>5mm		
	Bubble on the polarizer	Circular	Average diameter: D (mm)	Numbers, Distance		○
			0.15mm<D≤0.5mm	N<5, ND>5mm		
	Extraneous substances	Circular	Average diameter: D (mm)	Numbers		○
			0.15mm<D≤0.5mm;	N≤2, ND>5mm		
		Linear	Width: W (mm) ;Length: L (mm)			
			0.1mm<W≤0.3mm, L≤2mm			
	Bezel	Gap between front bezel and glass on all sides	≤ 0.5mm			○
		Gap between front and back bezel on all sides	≤1mm			○
Scratches, Wrap and Sunken		No harm, dangerous			○	

	Assembly Fail	Not allowed	○	
	Color Difference	Allowed (No harm, dangerous)		○
Carton and Panel Label (S/N, B/L, WEEK)	No label	Not allowed	○	
	Invert label		○	
	Broken		○	
	Dirt	No larger than 30mm×20mm.	○	
	Not clear	Word can be read. Barcode can be scanned.		○
	Word out of shape			○
	Content Error	No allowed	○	
	Position	Be attached on right position		○
	Crease	No	○	
	Label overlapping	Allowed	○	
Screw	Not enough (Q'ty)	No	○	
	Loose	No	○	
Connector	Appearance	No broken, rising, deformation	○	

Note 10 : Extraneous substances which can be wiped out, such as fingerprint and particles are not considered as a defect.

Note 11 : Defects on the Black Matrix (outside Active Area 0.3mm) are not considered as a defect.

Note 12 : Defect size definition: (Unit:mm). When $L \geq 2W$, defect count as liner defect.

D: Average Diameter; L: Length W: Width

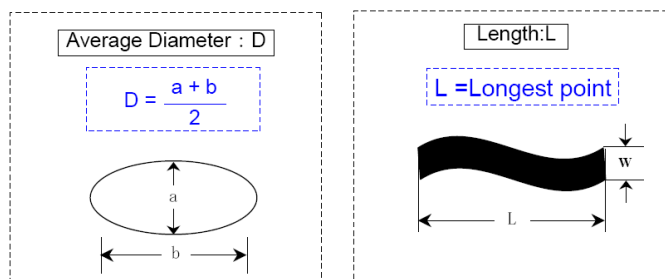


Fig.6

Note 13 : The gap between front bezel and Polarizer :

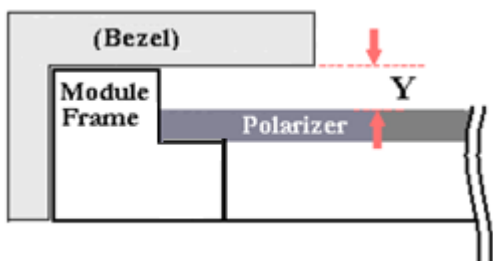


Fig.7

7. Inspection judgement:

- 7-1 The judgement of the shipped lot (acceptance or rejection) should follow the sampling plan of MIL-STD-105E, single sampling, normal inspection, level II.
- 7-2 If the number of defects is equal to or less than the applicable acceptance level, the lot shall be accepted.



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7-3 If the number of defects is more than the applicable acceptance level, the lot shall be rejected and the buyer should inform the seller of the result of incoming inspection in writing

8 Precaution:

Please pay attention to the following items when you use the LCD Module with back-light unit.

1. Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.
2. Adopt measures in adequately ventilated environment. Be sure to use the module in the specified temperature range.
3. Avoid dust or oil mist during assembly.
4. Follow the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.
5. Try to avoid the electrical magnetic interference, and it will be more safety and less noise.
6. Please operate module in suitable temperature. The response time & brightness will drift by different temperature.
7. Avoid displaying the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image sticking.
8. Be sure to turn off the power when connecting or disconnecting the circuit.
9. Display surface Polarizer scratches easily, please avoid dirt and stains carefully.
10. A dewdrop may lead to destruction. Please wipe off any moisture before using module.
11. Sudden temperature changes cause condensation, and it will cause polarizer damaged.
12. High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.
13. Avoid any acid or chlorine compounds, which are harmful to the LCD module.
14. Static electricity will damage the modules; please do not touch the module without any grounded device connected.
15. Do not disassemble and reassemble the module by self.
16. Do not touch the rear side directly to avoid the electrical shock by the backlight high voltage.
17. Avoid strong vibration or shock. or it will cause the module broken.
18. Store the modules in suitable environment with regular packing.
19. Be careful of injury from a broken display module. Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the non-uniformity or other function issue to display.

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