



SPECIFICATIONS

CUSTOMER : _____
SAMPLE CODE : **GFOR1602AA-WG01**
VERSION : **A**
DATE : **2022.07.01**
CERTIFICATION : **ROHS**

Customer Sign	Approved By	Prepared By	Prepared By
			

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1. Basic Specifications

1.1 Display Specifications

- 1) Display Mode : Passive Matrix
- 2) Display Color : Monochrome (White)
- 3) Drive Duty : 1/16 Duty

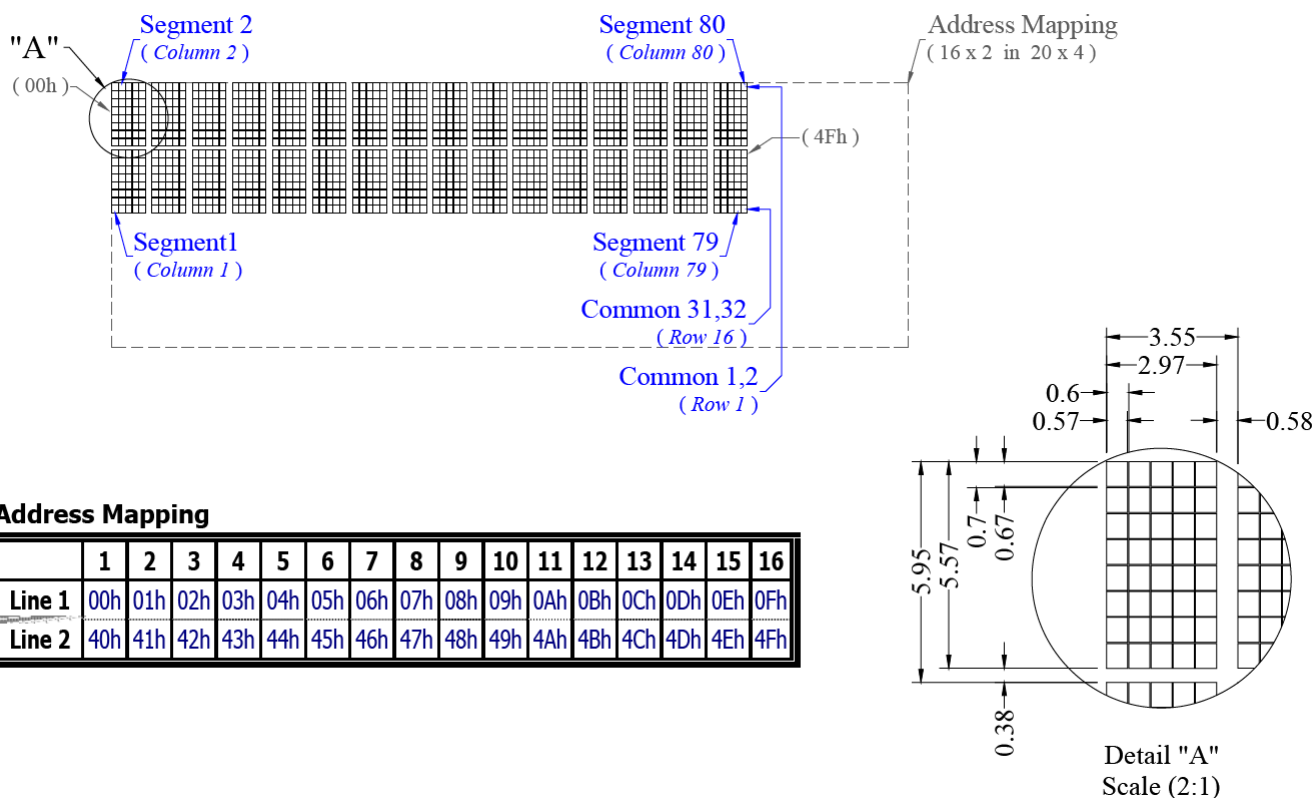
1.2 Mechanical Specifications

- 1) Outline Drawing : According to the annexed outline drawing
- 2) Number of Characters : 16 Characters (5 × 8) × 2 Lines
- 3) Module Size : 85.0 × 37.0 × 9.10 (mm)
- 5) Active Area: 56.22 × 11.52 (mm)
- 6) Character Pitch: 3.55 × 5.95 (mm)
- 7) Character Size: 2.97 × 5.57 (mm)
- 8) Pixel Pitch: 0.60 × 0.70 (mm)
- 9) Pixel Size: 0.57 × 0.67 (mm)
- 10) Weight: TBD (g)
- 11) Baud Rate: 115200
- 12) Startup Screen:





1.3 Active Area / Address Mapping & Character Construction



1.4 Pin Definition

Connector RS232

No	Signal	Direction	Function description
1	VDD		VDD
2	GND		Signal ground
3	RXD	LCM to PC	Transmit data
4	TXD	PC to LCM	Receiver data



2. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Supply Voltage for Logic	VDD	-	5	5.6	V	1
Input Voltage	Rin	-15		15	V	
Output Voltage	Tout	-15		15	V	
Life Time (80 cd/m ²)		50,000	-	-	hour	2
Life Time (60 cd/m ²)		70,000	-	-	hour	

Note 1: All the above voltages are on the basis of “GND = 0V”.

Note 2: VDD1= 5.0V, VPP generated by internal DC/DC convertor. Ta = 25°C, 50% Checkerboard.

Software configuration follows Section 5 Command Summary.



3. Optics & Electrical Characteristics(OLED)

3.1 Optics Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Brightness	L_{br}	Note 8	-	100	-	cd/m ²
C.I.E. (White)	(x)	C.I.E. 1931	0.25	0.29	0.33	
	(y)		0.27	0.31	0.35	
Dark Room Contrast	CR		-	>10,000:1	-	
View Angle			-	Free	-	degree

*Software configuration follows Section 5 Command Summary.

3.2 DC Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD1}	V1_OTP set "H"	4.5	-	5.5	V
Supply Voltage for Display	V_{PP}	Note 5	11.2	12.0	12.5	V
High Level Input	V_{IH}		$0.7 \times V_{DD1}$	-	V_{DD1}	V
Low Level Input	V_{IL}		0	-	$0.3 \times V_{DD1}$	V
High Level Output	V_{OH}	$I_{OH} = -0.5mA$	$0.7 \times V_{DD1}$	-	V_{DD1}	V
Low Level Output	V_{OL}	$I_{OL} = 0.5mA$	0	-	$0.3 \times V_{DD1}$	V
Operating Current for V_{DD1}	I_{DD1}		-	-	200	μA
Operating Current for V_{DD2}	I_{DD2}	Note 6	-	17.0	21.3	mA
		Note 7	-	26.2	32.8	mA
		Note 8	-	45.0	56.3	mA
Sleep Mode Current for V_{DD1}	$I_{DD1, SLEEP}$		-	-	10	μA
Sleep Mode Current for V_{DD2}	$I_{DD2, SLEEP}$		-	-	10	μA

Note 5: Brightness (L_{br}) and Supply Voltage for Display (V_{PP}) are subject to the change of the panel characteristics and the customer's request.

Note 6: $V_{DD1} = 5.0V$, V_{PP} generated by internal DC/DC convertor, 30% Display Area Turn on.

Note 7: $V_{DD1} = 5.0V$, V_{PP} generated by internal DC/DC convertor, 50% Display Area Turn on.

Note 8: $V_{DD1} = 5.0V$, V_{PP} generated by internal DC/DC convertor, 100% Display Area Turn on.

*Software configuration follows Section 5 Command Summary.



4. Reliability

NO.	ITEM	CONDITION		STANDARD	NOTE
1	High Temp. Storage	90°C	240 hrs	Appearance Without defect	
2	Low Temp. Storage	-40°C	240 hrs	Appearance Without defect	
3	High Temp. & High Humi. Storage	40°C 90% RH	240 hrs	Appearance Without defect	
4	High Temp. Operating Display	80°C	240 hrs	Appearance Without defect	
5	Low Temp. Operating Display	-30°C	240 hrs	Appearance Without defect	
6	Thermal Shock	-30°C, 30min. → 80°C, 30min. ↑ (1cycle)		Appearance Without defect	200 cycles

** Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

** The function test shall be conducted after 4hours storage at the normal temperature and humidity after remove from the test chamber.



5. Command Summary

Introduction:

1. Receive PC UART and transfer to LCM control signal. It also respond the external switch as UART to PC.
2. Baud Rate 115200

Command Summary:

Command	Syntax	Default	Description
Auto line wrap on	FE 43 FD	on	Enables line wrapping. Character will wrap to first position of next line if it reaches the end of a line.
Auto line wrap off	FE 44 FD	N/A	Disables line wrapping. Character will go to the first position of the original line if it reaches the end of a line.
Set text insertion point	FE 47 [col] [row] FD	N/A	Sets the text insertion point to [col] and [row]. [col] : 0x00 to 0x13 [row] : 0x00 to 0x03
Set text insertion point home	FE 48 FD	N/A	Sets the text insertion point to [0] and [0].
Underline cursor on	FE 4A [col] [row] FD	N/A	Turns on the underline cursor and sets it at location [col] and [row]. [col] : 0x00 to 0x13 [row] : 0x00 to 0x03
Underline cursor off	FE 4B FD	N/A	Turns off the underline cursor.
Blinking Block cursor on	FE 59 [col] [row] FD	N/A	Turns on the blinking block cursor and sets it at Location [col] and [row]. [col] : 0x00 to 0x13 [row] : 0x00 to 0x03
Blinking Block cursor off	FE 5A FD	N/A	Turn off the blinking block cursor.
Cursor left	FE 4C FD	N/A	Moves the underline cursor to left. It will move to the end of the same line if it reaches the beginning of a line
Cursor right	FE 4D FD	N/A	Moves the underline cursor to right. It will move to the beginning of the same line if it reaches the end of a line
Initial thick vertical bar graph	FE 76 FD	N/A	Initializes 5 pixels width as the vertical bar.
Initial thin vertical bar graph	FE 73 FD	N/A	Initializes 2 pixels width as the vertical bar.



Draw vertical bar graph	FE 3D [col] [height] FD	N/A	Draws vertical bar at position [col] of the last row with height [height]. [col] : 0x00 to 0x13 [height] : 0x00 to 0x10
Erase vertical bar graph	FE 2D [col] FD	N/A	Erases vertical bar at position [col]. [col] : 0x00 to 0x13
Initialize horizontal bar graph	FE 68 FD	N/A	Initialize horizontal bar graph.
Draw horizontal bar graph	FE 7C [col] [row] [len] FD	N/A	Draws horizontal bar at position [col] and [row] With length [length]. [length] ranges from [0x00] to [0x7A].
Read Model Number	FE 30 FD	N/A	Reads 2 bytes back from LCD
Read Firmware Version	FE 31 FD	N/A	Reads 2 bytes back from LCD
Soft Reset	FE 56 FD	N/A	Resets
Clear display	FE 58 FD	N/A	Clears screen of LCD and places the text insertion point to top left.
Display on	FE 42 FD	on	Turns on the display
Display off	FE 46 FD	N/A	Turns off the display.
Set Contrast Control	FE 41 [Contrast] FD	0x08	Adjust LED Contrast. [Contrast] : 0x01 to 0x08.
Auto key hold on	FE 32 FD	N/A	Auto key hold on.
Auto key hold off	FE 33 FD	N/A	Auto key hold off.
Set RS232 port speed	FE 39 [speed] FD	115200	Sets RS232 port speed. [speed] : 0x00 to 0x06 0x00 = 115200 0x01 = 57600 0x02 = 38400 0x03 = 19200 0x04 = 9600 0x05 = 4800 0x06 = 2400
Save user defined characters	FE 4F [cc] FD	N/A	Save user defined characters. [cc] : 0x01 to 0x08..
Define custom character	FE 4E [cc] [8 bytes] FD	N/A	Defines custom character. [cc] : 0x01 to 0x08.
Load user defined characters	FE 50 [cc] FD	N/A	Load user defined characters. [cc] : 0x01 to 0x08.
Save user settings	FE 53 [ud] [4 bytes] FD	N/A	Save user settings. User is required to save 4 bytes at a time. [ud] : 0x01



Read user settings	FE 54 [ud] FD	N/A	Read user settings. 4 bytes are returned at each time [ud] : 0x01
Save custom startup screen	FE 40 [bb] [8bytes] FD	N/A	Save custom startup characters. [bb] for LCM0802 : 0x00 to 0x01 [bb] for LCM1202 : 0x00 to 0x02 [bb] for LCM1602 : 0x00 to 0x03 [bb] for LCM2002 : 0x00 to 0x04
Set LCM for 16x02	FE 34 FD	16x02	Set LCM for 16x02
Set LCM for 20x02	FE 35 FD	N/A	Set LCM for 20x02
Set LCM for 12x02	FE 36 FD	N/A	Set LCM for 12x02
Set LCM for 08x02	FE 37 FD	N/A	Set LCM for 08x02
Set LCM for 20x04	FE 38 FD	N/A	Set LCM for 20x04



Character Pattern

ENGLISH_JAPANESE CHARACTER FONT TABLE (FT[1:0] = [0:0])

Upper 4bit Lower 4bit		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0001	CG RAM (2)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0010	CG RAM (3)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0011	CG RAM (4)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0100	CG RAM (5)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0101	CG RAM (6)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0110	CG RAM (7)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
0111	CG RAM (8)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1000	CG RAM (1)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1001	CG RAM (2)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1010	CG RAM (3)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1011	CG RAM (4)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1100	CG RAM (5)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1101	CG RAM (6)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1110	CG RAM (7)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
1111	CG RAM (8)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒



6. NOTES

▪ Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

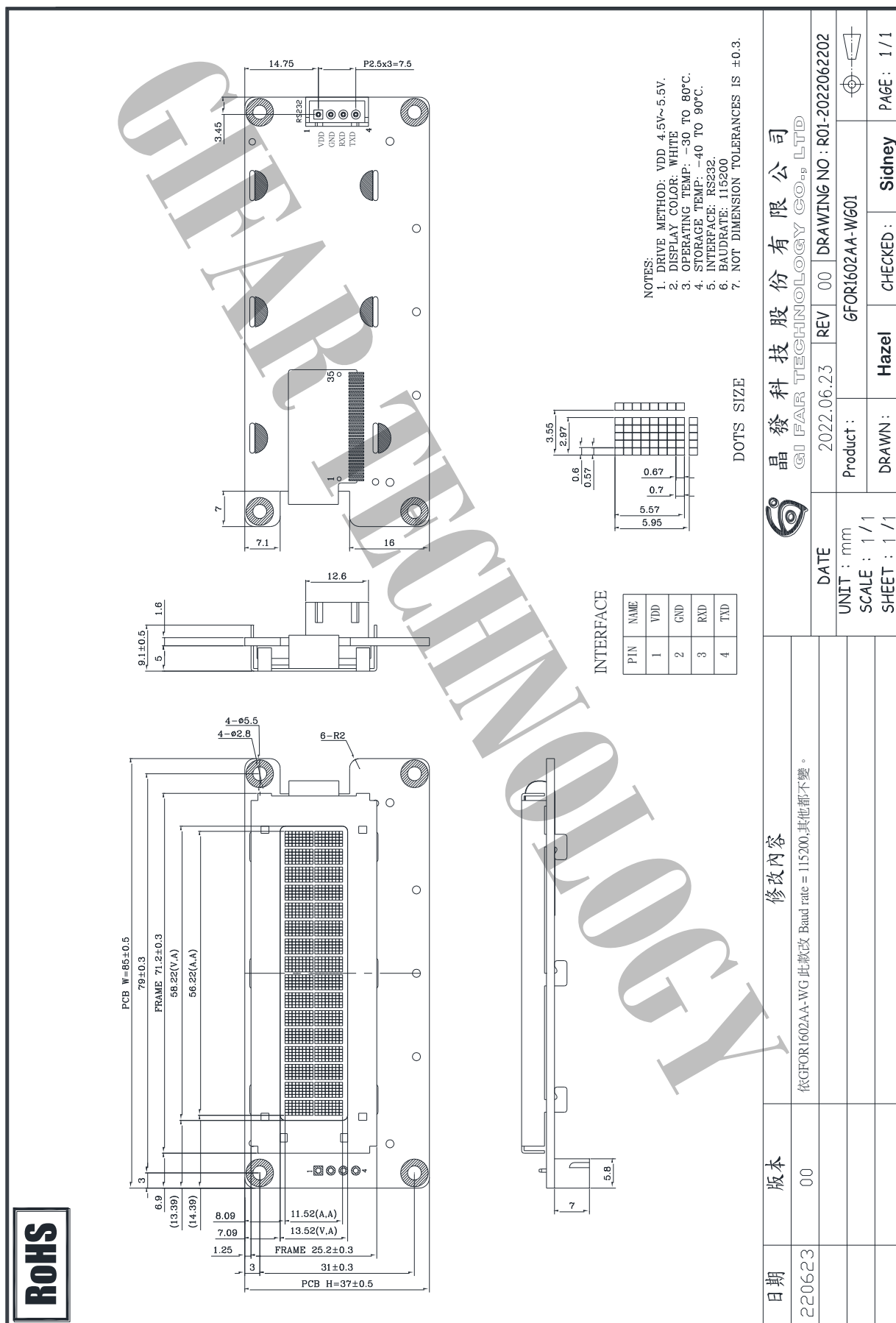
7. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

Quality warranty period: Within one year after shipment date (excluding abnormal usage way and abnormal environments.)



8. Mechanical Drawing





9. Inspection Standard

9.1 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature	: $23 \pm 5^{\circ}\text{C}$
Humidity	: $55 \pm 15\% \text{ RH}$
Fluorescent Lamp	: 30W
Distance between the Panel & Lamp	: $\geq 50\text{cm}$
Distance between the Panel & Eyes of the Inspector	: $\geq 30\text{cm}$
Finger glove (or finger cover) must be worn by the inspector.	
Inspection table or jig must be anti-electrostatic.	

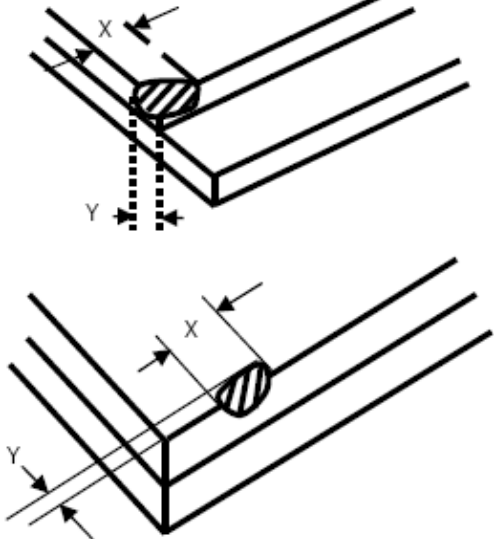
9.2 Sampling Plan

Level II, Normal Inspection, Single Sampling, MIL-STD-105E

9.3 Criteria & Acceptable Quality Level

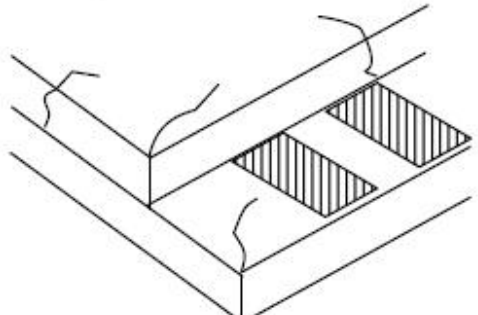
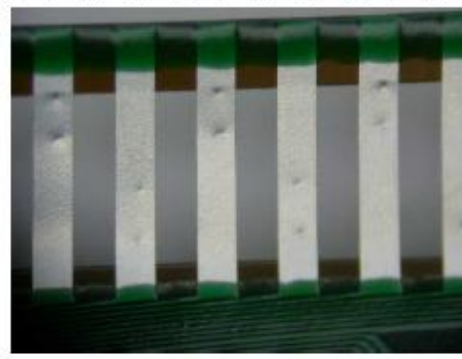
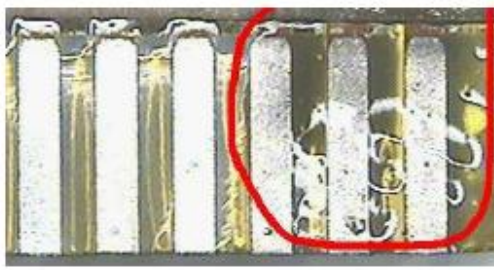
Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.0	Defects in Cosmetic Check (Display Off)

9.3.1 Cosmetic Check (Display Off) in Non-Active Area

Check Item	Classification	Criteria
Panel General Chipping	Minor	$X > 6 \text{ mm}$ (Along with Edge) $Y > 1 \text{ mm}$ (Perpendicular to edge) 

9.3.1 Cosmetic Check (Display Off) in Non-Active Area (Continued)

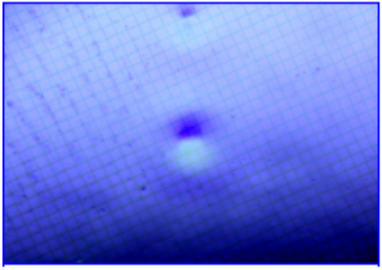


Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable. 
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
Ink Marking on Back Side of panel (Exclude on Film)	Acceptable	Ignore for Any

9.3.2 Cosmetic Check (Display Off) in Active Area

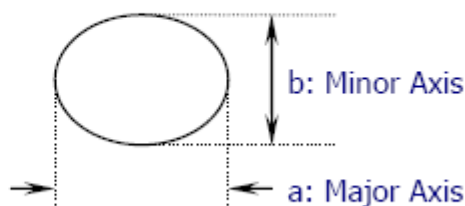
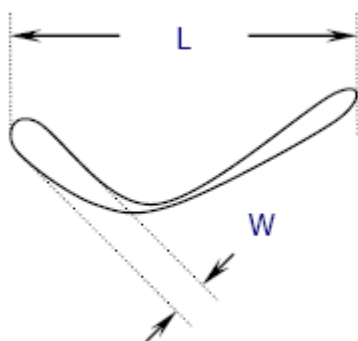
It is recommended to execute in clear room environment (class 10k) if actual in necessary.



Check Item	Classification	Criteria
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	$W \leq 0.1$ Ignore $W > 0.1$ $L \leq 2$ $n \leq 1$ $L > 2$ $n = 0$
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	$\Phi \leq 0.1$ Ignore $0.1 < \Phi \leq 0.25$ $n \leq 1$ $0.25 < \Phi$ $n = 0$
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	$\Phi \leq 0.5$ → Ignore if no Influence on Display $0.5 < \Phi$ $n = 0$ 
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable

* Protective film should not be tear off when cosmetic check.

** Definition of W & L & Y (Unit: mm): $Y = (a + b) / 2$





9.3.3 Pattern Check (Display On) in Active Area

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Pixel	Major	
Wrong Display	Major	
Un-uniform	Major	



10. PACKAGE INFORMATION

1	1 Tray	:	20 pcs (modules)
2	1 stack	:	8 tray + 1 Cover tray
3	1 Carton	:	(1 Cover tray + 8 tray)x 2 stack
4	Total pcs	:	1 Carton (20 pcs* 8 tray * 2 stack) = 320 pcs
5	Carton size = NO. 17	:	495 * 315 * 435mm
7	Net weight	:	TBD KG
8	Gross weight	:	TBD KG

** 包裝示意圖片

- 一個 tray 盤 可放 20PCS 模組
- 8 盤+1 空盤=1 疊，一箱可放入 2 疊，TRAY 盤上、下兩層需交叉堆疊放置



- 使用 17 號箱，可放入 2 疊，並使用防震材將旁邊空隙填滿

