SPECIFICATIONS

CUSTOMER   : _____

MODEL NO.   :   **GFR1602LC-BNFBJES**

VERSION   :   **A**

DATE   :   **2022.10.11**

CERTIFICATION :   **ROHS**

Customer Sign	Approved By	Prepared By	Prepared By
	2022.10.11 Sidney	2022.10.11 Roger	2022.10.11 Hazel

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Revision Record

Data(y/m/d)	Ver.	Description	page
2022.10.11	A	Specification released	

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P-18-09A

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1. SCOPE

This specification covers the engineering requirements for the GFR1602LC-BNFBJES liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 16 × 2 dot matrix LCD
- STN(Blue), Negative mode LCD panel
- Transmissive , Normal temperature type
- 12 o'clock
- Multiplexing driving : 1/16duty, 1/5bias
- Interface : RS232
- LCM Controller: GMRU20X4
- Backlight: White

2.2 Mechanical Characteristics

Item	Value	Unit
Number of Character	16 X 2	Character
Dot size	0.40(W)X0.49(H)	mm
Dot pitch	0.49(W)X0.54(H)	mm
Module dimension	63.0(W) X 32.0(H) X (20.8)(T)	mm
Viewing Area	46.0 (W) X 12.0 (H)	mm
Active Area	42.1(W) X 8.94 (H)	mm
Remark	Baud Rate 19200	--
	開機畫面	--

2.3 Absolute Maximum Ratings

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	(V_{DD}).	--	--	6	V
	V+	$(V_{DD}-0.3V)$	--	11V	V
	V-	--	--	11V	V
Input Voltage	Tin	-0.3V		$(V_{DD} + 0.3V)$	V
	Rin	-15		+15	
Output Voltage	Tout	(V+, +0.3V)		(V-, -0.3V)	V
	Rout	-0.3V		$(V_{DD} + 0.3V)$	
Operating temperature range	--	0	--	+50	°C
Storage temperature range	--	-20	--	+70	°C

2.4 Electrical Characteristics (LCD)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Voltage(logic)	$V_{DD}-V_{SS}$	--	4.7	5.0	5.3	V
Input Voltage	V_{IH}	--	2.0	--	V_{DD}	V
	V_{IL}	--	V_{SS}	--	0.8	
Output Voltage	V_{OH}	I_{OH}=-0.1mA	$0.8V_{DD}$	--	V_{DD}	V
	V_{HL}	I_{OL}=0.1mA	V_{SS}	--	$0.2V_{DD}$	

2.6. Optical Characteristics

1/16 duty, 1/5 bias, Vop=4.5V, Ta=25℃

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	Vop		4.2	4.5	4.8	
Viewing angle	$\theta1$、$\theta2$	C$\geq$2.0,$\varnothing$=0°C	30°	-		Notes 1 & 2
Contrast	C	θ=5°, $\varnothing$=0°	2.0	-	-	Note 3
Response time(rise)	ton	θ=5°, $\varnothing$=0°	-	110	300ms	Note 4
Response time(fall)	toff	θ=5°, $\varnothing$=0°	-	79	270ms	Note 4

Note 1: Definition of angles θ and $\varnothing$
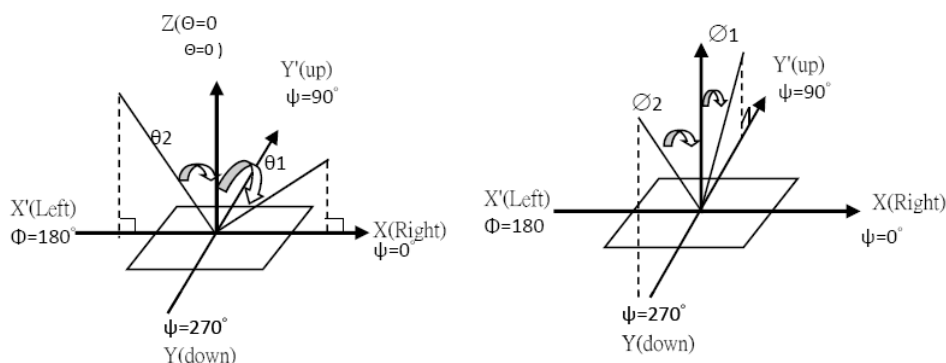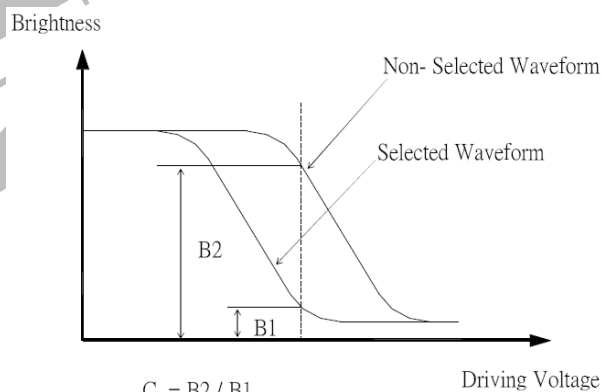
Note 2: Definition of viewing angles $\theta1$ and $\theta2$ Note 3: Definition of contrast C
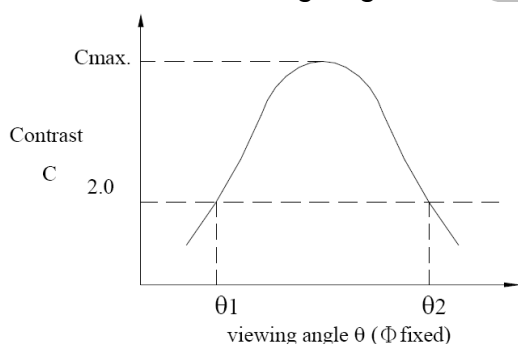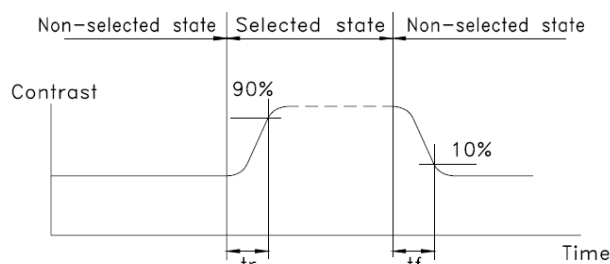
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

C = B2 / B1

Note 4: Definition of response time

Note: Measured with a transmissive LCD panel which is displayed 1 cm²

V_{OPR} : Operating voltage f_{FRM} : Frame frequency
t_{ON} : Response time (rise) t_{OFF} : Response time (fall)

2.7 LED Back-light Characteristics

2.7.1 Electrical / optical specifications

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Current	I_f	Vf =5V, White	75	--	100	mA
LED *Luminous Intensity	I_V	Vf =5V, White	1300	1800	--	cd/m^2
Chromaticity Coordinate	x	Vf =5V, White	0.26	0.29	0.33	
	y		0.26	0.29	0.33	
Luminous Uniformity	ΔLv	Vf =5V, White	70			%

Note: * Measured at the bare LED back-light unit.

2.7.2 LED Maximum Operating Range

Item	Symbol	White	Unit
Power Dissipation	P_{AD}	500	mW
Forward Current	I_F	100	mA
Reverse Voltage	V_R	5	V

3. RELIABILITY

NO.	ITEM	CONDITION		STANDARD	NOTE
1	High Temp. Storage	70℃	120 hrs	Appearance Without defect	
2	Low Temp. Storage	-20℃	120 hrs	Appearance Without defect	
3	High Temp. & High Humi. Storage	40℃ 90% RH	120 hrs	Appearance Without defect	
4	High Temp. Operating Display	50℃	120 hrs	Appearance Without defect	
5	Low Temp. Operating Display	0℃	120 hrs	Appearance Without defect	
6	Thermal Shock	0℃, 30min. →50℃,30min. ↑ (1cycle)		Appearance Without defect	10 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.

4. Interface Pin Description

No	LCM Signal	direction
1	VDD	DC Power VDD
2	GND	DC Power ground
3	RXD	LCM to PC
4	TXD	PC to LCM

5. 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 0x0F [row] : 0x00 to 0x01
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 0x0F [row] : 0x00 to 0x01
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 0x0F [row] : 0x00 to 0x01
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 0x0F [height] : 0x00 to 0x10
Erase vertical bar graph	FE 2D [col] FD	N/A	Erases vertical bar at position [col]. [col] : 0x00 to 0x0F
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.
Backlight on	FE 42 FD	on	Turns on the backlight.
Backlight off	FE 46 FD	N/A	Turns off the backlight.
Backlight brightness	FE 41 [brightness] FD	N/A	Adjust LED brightness. [brightness] : 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	0x03 =19200	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

Keypad Mapping

KEY	Character Return	State
S1	" A " (0x44h)	ENTER
S2	" B " (0x43h)	ESC
S3	" C " (0x42h)	Up
S4	" D " (0x41h)	Down

6. Character Pattern

7. 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 $25\ ^oC\pm10\ ^oC$ 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 acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

8. 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.)

9. RS232 LCM Dimension

NOTES:
1. DRIVE METHOD: 1/16DUTY, 1/5BIAS,VOP4.5V.
2. VIEWING ANGLE: 12 O'CLOCK.
3. DISPLAY TYPE: STN(BLUE), TRANSMISSIVE/NEGATIVE.
4. OPERATING TEMP: 0 TO 50°C.
5. STORAGE TEMP: -20 TO 70°C.
6. CONNECTION: FPC.
7. INTERFACE: RS232.
8. BACKLIGHT: WHITE.
9. NOT DIMENSION TOLERANCES IS ±0.3

Rubber KEY:
1.color of Rubber: White.
2.color of text: Pantone425.
3.所有按鍵行程=1.0±0.1mm
4.荷重: 160gam.
5.噴保護漆.

DOT SIZE

CN1		
PIN	NAME	
1	VDD	
2	GND	
3	RXD (LCM to PC)	
4	TXD (PC to LCM)	

日期	版本	修改內容
220818	00	依R01-20200707O1圖面改用1602LA的LCM，左邊RS232 4pin/右邊彎插銭5pin，出圖

Product:
GFR1602LC-BNFBJES
REV : 00
DRAWING NO. : R01-2022081801
DATE : 2022.08.18
DRAWN : Hazel
CHECKED : Sidney
UNIT : mm
SCALE : 1/1
SHEET : 1/1
PAGE : 1/1

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RoHS

10. PACKAGE INFORMATION

TBD

出貨檢驗標準書
Shipping inspection standard

核准 Approved by	審核 Checked by	作成 Made by
ANDY	JACKY	RUBY

1.目的 Purpose：

規範出貨產品之檢驗項目及判斷標準，確保產品出貨能滿足客戶要求。

Standardize the inspection items and judgment standards to ensure the products that shipped out can meet customer's requirements.

2.範圍 Area：

適用於出廠之所有產品。

Applicable to all products shipped from the factory.

3.名詞解釋 Explanation of terms：

3-1 主要缺陷：亦會造成功能缺失或嚴重外觀缺陷。

　　Major Defects: It also causes loss of function or serious appearance defects.

3-2 次要缺陷：稍有缺陷但不影響客戶使用。

　　Minor defect: Slightly defective but does not affect customer use.

4.檢驗體制 Inspection system：

4-1 抽樣計劃：依 ANSI/ASQ Z1.4 一般檢驗水準Ⅱ 之 正常檢驗一次抽驗方案。

　　Sampling plan: According to ANSI/ASQ Z1.4 general inspection level Ⅱ the normal inspection one-time sampling plan.

4-2 允收水準 Acceptable Level：(AQL)

　　主要缺陷 Major defect：0.4 %

　　次要缺陷 Minor defect：0.65 %

5.檢驗條件 Inspection conditions：

5-1 使用相關之檢測儀器及測試、量測工具。

　　Use relevant testing instrument, testing and measuring tools .

5-2 環境要求：其條件需控制在常溫下 23℃±3℃及溼度 70%RH 以下。

　　Environmental requirements: The conditions should be controlled at room temperature 23℃±3℃ and humidity below 70%RH.

5-3 外觀檢驗：須在 380±20% LUX 的白色日光燈下，其目視距離需於產品離 30±5 cm 檢驗。

　　Appearance inspection: Under the white fluorescent lamp of 380±20% LUX , the visual distance shall be checked above the product 30 ± 5 cm.

5-4 電性測試 Electrical Testing：

　　5-4-1 有背光之產品需關燈並在 5~300Lux±3%下檢驗。

　　　　　The products with backlight should be tested at 5~300±3% Lux.
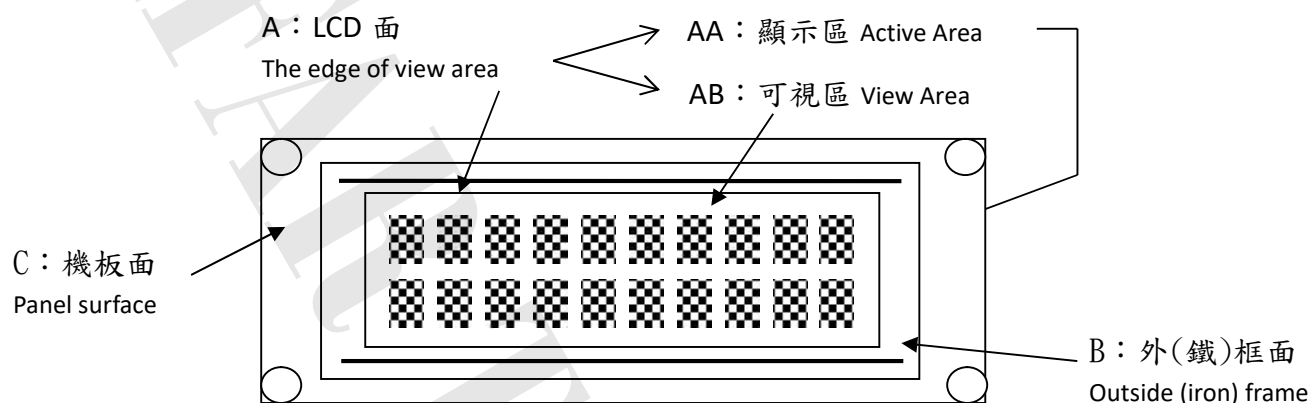
　　5-4-2 無背光之產品需開燈並在 60~300Lux±3%白色日光燈下檢驗。

　　　　　Products without backlight need to be turned on and tested under 60~300 ± 3% LUX white fluorescent lamps .

5-5 檢查視角依產品視角方向。

　　Check the viewing angle according to the product viewing angle.

5-6 其不良現象檢視區域 Bad phenomenon View area
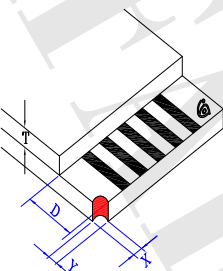　　5-6-1 適用種類 Applicable category：COB、TFT

A：LCD 面
The edge of view area

AA：顯示區 Active Area

AB：可視區 View Area

C：機板面
Panel surface

B：外（鐵）框面
Outside (iron) frame

　　5-6-2 適用種類 Applicable category：COG、TAB、TN

C：導電層區
Conductive layer

B：可視區
View Area

A：顯示區
Active Area

GI FAR TECHNOLOGY CO.,LTD — *Work Instruction*

種類 Category		COG				
編號 No.	檢驗項目 Item	檢驗內容及判定標準 Inspection Content & Standard		區域 Zone	類別 Category	缺陷等級 Level
1	點類(一) Dot(1)	黑點、刺傷…等圓狀 Black dot、Stab…and other round shape $\omega = \dfrac{(X+Y)}{2}$	兩點距離須超過 5 ㎜ Two points have to be ≧ 5 mm φ (mm) / 允收數 Acceptance Qty φ ≦ 0.1 / 無視 Ignore 0.1 < φ ≦ 0.25 / 3 0.25 < φ ≦ 0.3 / 1 φ > 0.3 / 0	A B	外觀 Appearance	次要 Minor AQL0.65%
2	點類(二) Dot(2)	氣泡、凹凸點 Bubble、Uneven dots $\omega = \dfrac{(X+Y)}{2}$	兩點距離須超過 5 ㎜ Two points have to be ≧ 5 mm φ (mm) / 允收數 Acceptance Qty φ ≦ 0.2 / 無視 Ignore 0.2 < φ ≦ 0.5 / 2 φ > 0.5 / 0	A B	外觀 Appearance	次要 Minor AQL0.65%
3	線類 Line	刮傷、毛屑…等線狀 Scratch、Fiber.. and other linear shape.	L (mm) / W (mm) / 允收數 Acceptance Qty -- / W ≦ 0.02 / 無視 Ignore L ≦ 5 / W ≦ 0.03 / 3 L ≦ 3 / W ≦ 0.05 / 2 L > 5 / W > 0.05 / 0	A B	外觀 Appearance	次要 Minor AQL0.65%
4	底色 Background color	同批供貨不能有明顯色差 No obvious color difference allowed in same shipment. (必要時與客端制定限度樣) (According to the gold samples if necessary)		B	外觀 Appearance	次要 Minor AQL0.65%
5	FPC 外觀 FPC Appearance	※ FPC 上刺傷導致線路無法導通　拒收 　Stabbing on the FPC causes the line to fail to conduct　Reject ※ FPC 上髒污或是殘留異物以致線路無法導通　拒收 　Dirty or residual foreign matter on the FPC makes the circuit unable to conduct　Reject ※ FPC 直角折痕、斷裂　拒收 　FPC right-angle crease and fracture　Reject	C	外觀 Appearance	主要 Major AQL 0.4%

COG

6	點、線類 (三) Dot、Line (3)	※ 於全黑、白畫面下看見之區塊狀或線狀不良　拒收 There is a block or linear in the view area under the screen is whole black or white. Reject ※ 但依 2% ND Filter 遮蓋無視　允收 But after inspecting by 2% ND Filter without seeing block or linear, it is confirmed Acceptance	A	電訊 Electronics	次要 Minor AQL0.65%
7	點、線類 (四) Dot、Line (4)	畫面中顯示出現黑、白、亮、異色點或線狀 There is a black, white, bright or other dot or lines showing in the view area. ※ 依編號 1、3 之判定標準 According to the inspection standard: No. 1 and 3.	A	電訊 Electronics	次要 Minor AQL0.65%
8	缺字 Lack of characters	顯示時畫面缺少部份字元　拒收 Lacking part of characters in the view area. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
9	無動作 No reaction	顯示畫面一直處於起始畫面而無法進行切換　拒收 The display (view area) always show in the initial screen and can't be switched to others. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
10	無畫面 No display	通電後，完全無任何畫面顯示　拒收 After connecting to the power, there is no image. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
11	斷線 Broken line	顯示畫面中少直、橫線　拒收 There is a lack of vertical or horizontal lines in the view area. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
12	CROSS TALK	顯示畫面時有局部之條紋或拖影 There are some stripes or shadow/smear showing in the view area. 拒收或與客端簽訂限度樣 Reject or inspect according to the golden sample	A	電訊 Electronics	次要 Minor AQL0.65%
13	I CON	顯示畫面缺少部份顯示圖案　拒收 Lack of partial ICON in the view area. Reject	A	電訊 Electronics	主要 Major AQL 0.4%

COG

14	深淺不一 Color difference	顯示畫面的對比，比其他顯示深或淺並依電氣規格(VOP)值判定 The color contrast of display is obviously lighter or darker than others and according to the VOP value in the electronics specification. 拒收或與客端簽訂限度樣 Reject or inspect according to the golden sample	A	電訊 Electronics	次要 Minor AQL0.65%
15	畫面異常 Abnormal screen	通電後畫面出現未定義之電訊不良現象　拒收 After connecting to the power, there is an undefined electronics appearance showing in the view area. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
16	背光色不均 Uneven color of backlight	※ 點亮後 LED 有明暗不均現象依其均勻度判定　拒收 After lighting LEDs have brightness and darkness uneven the determined according to its uniformity. Reject ※ 點亮後 LED 色澤不一致　拒收 LED color is inconsistent after lighting. Reject	A	電訊 Electronics	次要 Minor AQL0.65%
17	亮度不足 Lack of brightness	波長、色座標、輝度與圖面標示定義不符　拒收 Wave length, chromatic coordinates, brightness don't correspond to the definition of the drawing. Reject	A	電訊 Electronics	主要 Major AQL 0.4%
18	背光腳柱 Backlit foot post	斷裂、長度不一　拒收 Fracture, different length Reject	--	外觀 Appearance	次要 Minor AQL0.65%
19	破損 Damaged	Y：破損寬 X：破損長 Y: Damaged width X: Damaged length （見下表） 	Y	X	判定 Determination
---	---	---
Y ≦1.0	-- --	允收 Acceptance
未進入可視區 Did not enter the viewing area	≦1/8 玻璃該邊長 ≦1/8 The side length of the glass	允收 Acceptance
進入可視區 Enter the viewing area	-- --	拒收 Reject		B	外觀 Appearance	次要 Minor AQL0.65%

COG

20	角崩 Corner collapse	Y：破損寬 X：破損長 Y: Damaged width X: Damaged length table below	C	外觀 Appearance	次要 Minor AQL0.65%

For item 20, the determination table:

Y	X	判定 Determination
≦1/3D	-- --	允收 Acceptance
1/3D < Y ≦ D	≦1/8 玻璃邊長 ≦1/8 The side length of the glass	允收 Acceptance
> D	-- --	拒收 Reject

21	尺寸量測 Size Measurement	未依圖面上標示　拒收 No correspond to the indication on the drawing. Reject	ALL	外觀 Appearance	主要 Major AQL 0.4%
22	其他 Other	如發現有上述未定義之不良則與客端簽訂限度樣 If there is another undefined defective situation. It will be listed as others. The inspection standard is according to the golden sample.	ALL	電訊 Electronics 外觀 Appearance	次要 Minor AQL0.65%