

MODEL NO.: PHC2002AYR001

PRODUCT TYPE: STANDARD

OLED Character Module Datasheet

※ IC Equivalent (compatible)

WS0010, HD44780, KS0066, SPLC780, ST7066, AIP31066

This specification may be changed without any notices in order improve performance or quality etc.

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History of versions and modifications

Attention:

Some specifications of IC are not listed in this datasheet. Please refer to the IC datasheet for more details.

Revision	Date	Description	Changed By
1.0		Preliminary specification	

Coding system

P H C 2002 A Y R001

P: Pi-TEK

H: Characters

C: IC Equivalent (compatible) HD44780, KS0066, SPLC780, ST7066, AIP31066, **WS0010**

2002: 2 lines x 20 characters

A: Model

Y: Yellow

R0001: Internal Code

Functions and Features

- 2 lines x 20 characters
- Built-in controller
- Parallel or serial MPU interface (Default 6800 MPU parallel)
- +2.7V ~ +5.5V Power Supply
- viewing angle "Free"
- Wide Temperature -40°C ~ +70°C (Operating)
- Sunlight Readable Technology
- RoHS compliant

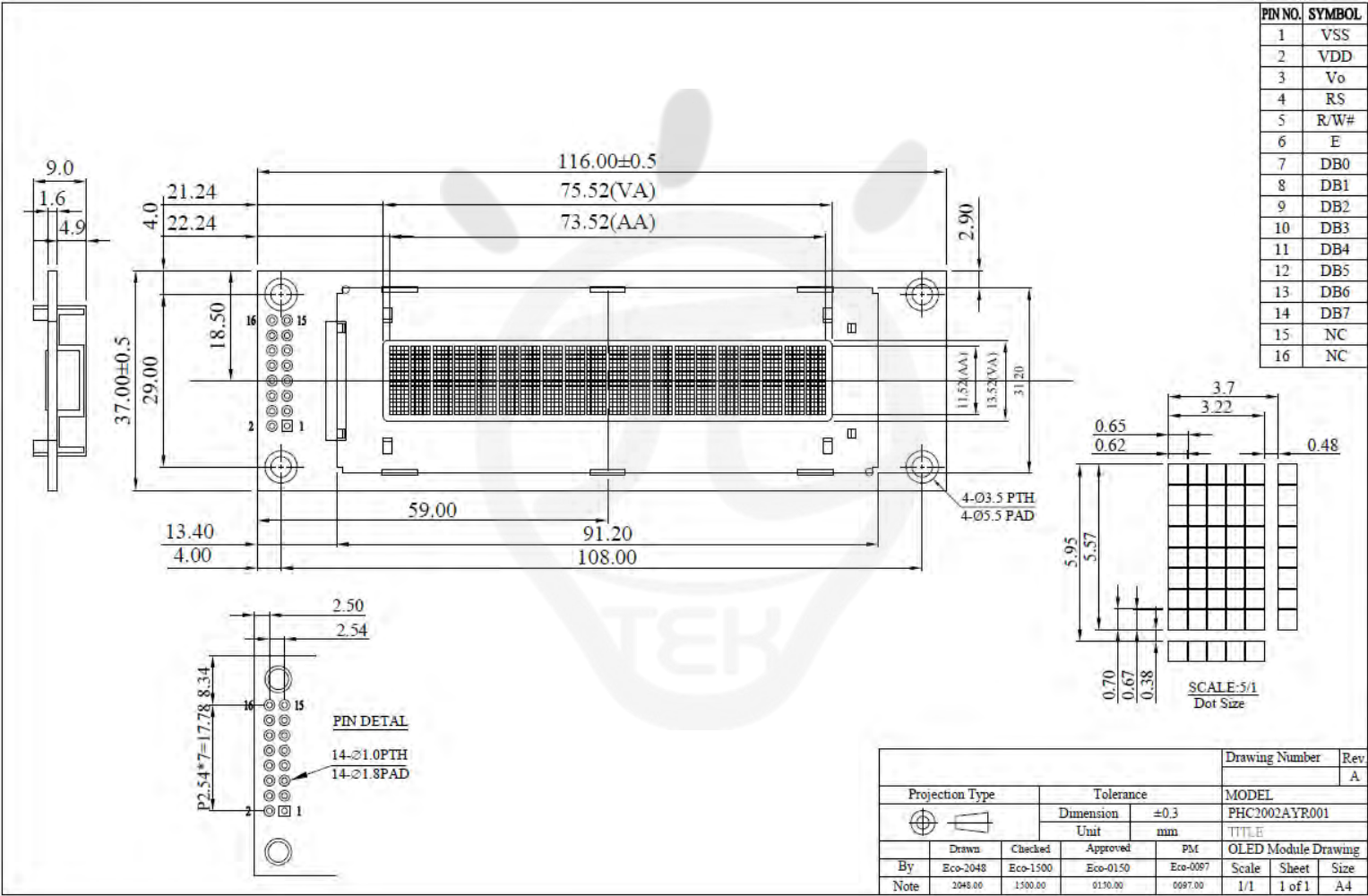
Mechanical Specification

Item	Description	
Product No.	PHC2002AYR001	
Active Area	73.52(W)×11.52(H)	mm
Module Size	116.0(W)×37.0(H)	mm
Display Format	20 characters (W)×2 lines (H)	
Controller	RT1305 or Equivalent IC Equivalent (compatible) HD44780, KS0066, SPLC780, ST7066, AIP31066, WS0010	
Interface	6800 8Bit / 4Bit (STD)	

※Precautions in use of OLED Modules

- ①Don't disassemble , drop, bend or twist the OLED Module.
- ②Don't operate it above the absolute maximum rating.
- ③Don't modify its shape or change the components of OLED module.
- ④Storage: please storage in anti-static electricity container and clean environment.
- ⑤We have the right to change the passive components and PCB Rev.

Mechanical Drawing



Pin Description

Parallel Interface (default):

Pin No.	Symbol	Level	Description
1	VSS	0V	Ground
2	VDD	2.8~5.3V	Supply Voltage for OLED and logic
3	NC	—	No Connect
4	RS	H/L	Register select signal. H: DATA, L: Command
5	R/W#	H/L	Read/Write select signal, R/W=1: Read (MPU←Module) R/W: =0: Write (MPU→Module)
6	E	H, H→L	Operation enable signal. Falling edge triggered.
7 14	DB0 DB7	H/L	Data bus lines
15-16	NC	—	No Connect

DC Characteristics

Item	Symbol	Condition	Min.	Type	Max.	Unit
Power Supply for Logic	VDD	(Wide Voltage I/O Application)	2.7	5.0	5.5	Volt
Input Voltage for I/O Pins	Vi	(Wide Voltage I/O Application)	2.7	5.0	5.5	Volt
Input Voltage	VIL	L level	0	-	0.2 VDD	Volt
Input Voltage	VIH	H level	0.8 VDD	-	-	Volt
Output Voltage	VOL	L level	0	-	0.2 VDD	
Output Voltage	VOH	H level	0.8VDD	-	VDD	
Power Supply Current for OLED	IDD	Note	-	TBD		mA
Sleep Mode Current for VDD	IDD, SLEEP			TBD		μA

Note:

VDD = 5.0V, 25% Display Area Turn on.100 cd/m²

When random texts pattern is running, averagely, about 1/4 of pixels will be on.

Optical Characteristics

Item	Symbol	Min.	Typ	Max.	Unit
Viewing angle range			Free		Degree
Dark Room Contrast	Cr		>10,000:1		
Brightness	Lbr		100		cd/m ²
Peak Emission Wavelength	C.I.E 1931	X=0.46 Y=0.45	X=0.50 Y=0.49	X=0.54 Y=0.53	

Electrical Absolute Ratings

Item	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply for Logic	VDD	-0.3	5.0	5.5	Volt	1,2
Input Voltage for I/O Pins	VI	-0.3	5.0	5.5	Volt	1,2
Life Time (80 cd/m ²)		---	100,000	---	Hours	3

Note 1: All the above voltages are on the basis of "VSS = 0V".

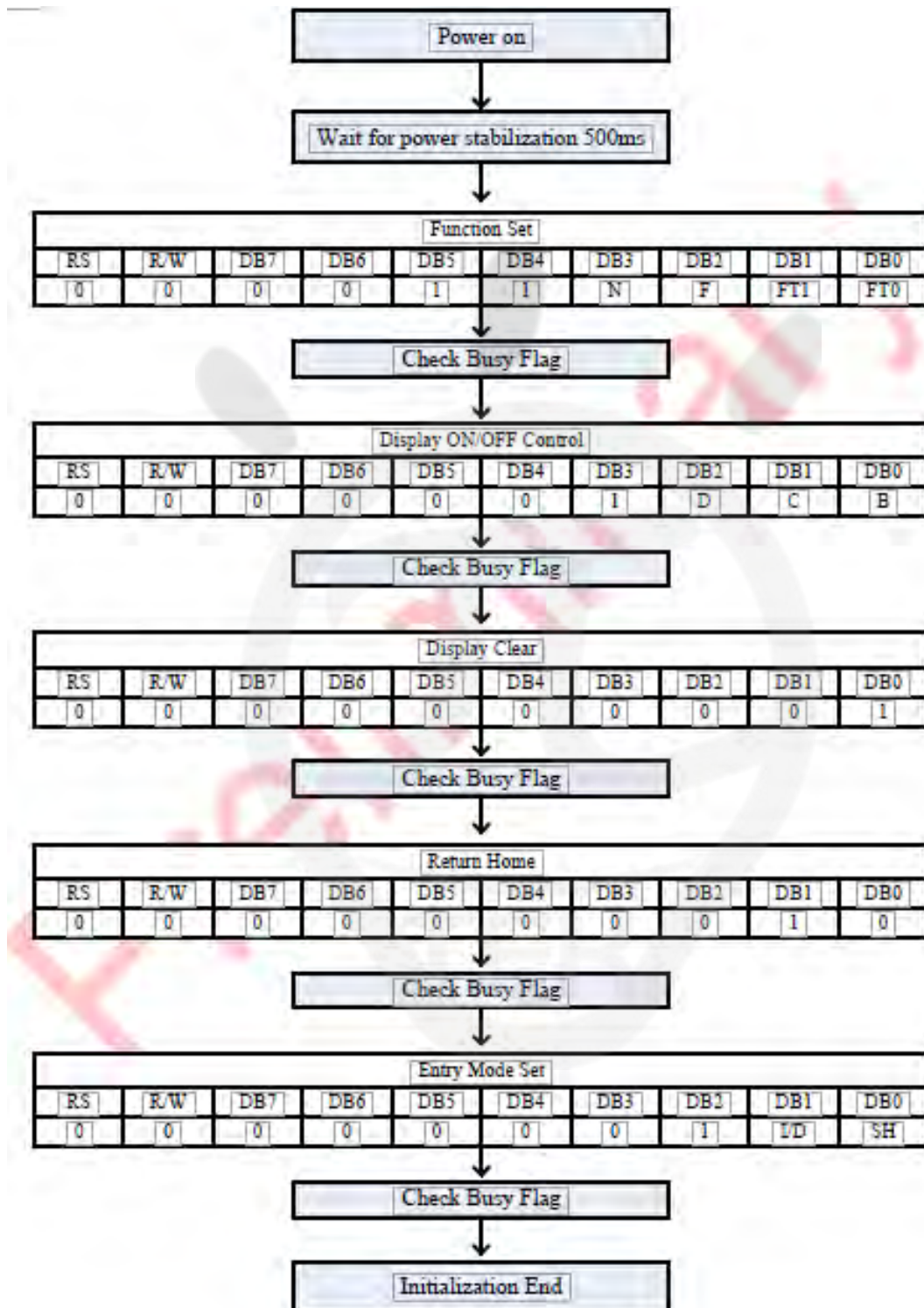
Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur.

Note 3: Ta = 25°C, 25% Checkerboard.

Software configuration follows Section ACTUAL APPLICATION EXAMPLE Initialization. End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.

Initializing of OLED Module

1. 8 bit interface mode





CHARACTER GENERATOR ROM (CGROM)

RT1305CA1-B provides four set of character font. Character font can be selected by programming FT. ENGLISH JAPANESE CHARACTER FONT TABLE (default FT[1:0]= 00)

Upper 96bit Lower 40bit	LLLL	LLLN	LLHL	LLNN	LNLL	LNHN	LNHL	LNHN	NLLL	NLLN	NLHL	NLHN	NNLL	NNHN	NNHL	NNHN
LLLL	CG RAN (1)															
LLLN	CG RAN (2)															
LLHL	CG RAN (3)															
LLNN	CG RAN (4)															
LNLL	CG RAN (5)															
LNHN	CG RAN (6)															
LNHL	CG RAN (7)															
LNHN	CG RAN (8)															
NLLL	CG RAN (9)															
NLLN	CG RAN (10)															
NLHL	CG RAN (11)															
NLHN	CG RAN (12)															
NNLL	CG RAN (13)															
NNHN	CG RAN (14)															
NNHL	CG RAN (15)															
NNHN	CG RAN (16)															

WESTERN EUROPEAN CHARACTER FONT TABLE I (FT[1:0]=01)

Upper 4bit Lower 4bit	LLLL	LLLN	LLHL	LLHH	LHLL	LHNL	LHHL	LHHH	NLLL	NLLN	NLHL	NLHN	NHLL	NHNL	NHHL	NHHH
LLLL	CG RAM (0)															
LLLN	CG RAM (1)															
LLHL	CG RAM (2)															
LLHH	CG RAM (3)															
LHLL	CG RAM (4)															
LHNL	CG RAM (5)															
LHHL	CG RAM (6)															
LHHH	CG RAM (7)															
NLLL	CG RAM (8)															
NLLN	CG RAM (9)															
NLHL	CG RAM (10)															
NLHN	CG RAM (11)															
NHLL	CG RAM (12)															
NHNL	CG RAM (13)															
NHHL	CG RAM (14)															
NHHH	CG RAM (15)															

ENGLISH_RUSSIAN CHARACTER FONT TABLE(FT[1:0]=10)

Upper Abbr		LLLL	LLLR	LLRL	LLRR	LLLL	LLLR	LLRL	LLRR	RLLL	RLLR	RLRL	RLRR	RLRL	RLLR	RLRR
LLLL	00 RAN (1)															
LLLR	01 RAN (1)															
LLRL	02 RAN (1)															
LLRR	03 RAN (1)															
LLLL	04 RAN (1)															
LLLR	05 RAN (1)															
LLRL	06 RAN (1)															
LLRR	07 RAN (1)															
RLLL	08 RAN (1)															
RLLR	09 RAN (1)															
RLRL	10 RAN (1)															
RLRR	11 RAN (1)															
RLRL	12 RAN (1)															
RLLR	13 RAN (1)															
RLRR	14 RAN (1)															
RLRL	15 RAN (1)															
RLLR	16 RAN (1)															
RLRR	17 RAN (1)															
RRLL	18 RAN (1)															
RRLR	19 RAN (1)															
RRRL	20 RAN (1)															
RRRR	21 RAN (1)															

WESTERN EUROPEAN CHARACTER FONT TABLE II (FT[1:0]=11)

Upper 4bit Lower 4bit	LLLL	LLLN	LLHL	LLNH	LNLL	LNLN	LNHL	LNHN	NLLL	NLLN	NLHL	NLHN	NNLL	NNLN	NNHL	NNHN
LLLL	CG RAN (1)	士	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
LLLN	CG RAN (2)	三	!	1	A	Q	3	9	G	8	1	1	J	+	Y	0
LLHL	CG RAN (3)	7	"	2	B	R	b	F	3	R	6	7	*	3	8	2
LLNH	CG RAN (4)	𠂇	#	3	C	S	c	3	3	3	G	1	𠂇	𠂇	𠂇	𠂇
LNLL	CG RAN (5)	𠂇	𠂇	4	D	T	d	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
LNLN	CG RAN (6)	𠂇	𠂇	5	E	U	e	U	3	3	E	𠂇	𠂇	𠂇	𠂇	𠂇
LNHL	CG RAN (7)	𠂇	𠂇	6	F	U	f	U	3	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
LNHN	CG RAN (8)	𠂇	𠂇	7	G	W	g	W	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NLLL	CG RAN (9)	𠂇	𠂇	8	H	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NLLN	CG RAN (10)	𠂇	𠂇	9	I	Y	i	Y	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NLHL	CG RAN (11)	𠂇	𠂇	*	J	Z	j	Z	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NLHN	CG RAN (12)	𠂇	𠂇	+	K	L	k	L	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NNLL	CG RAN (13)	𠂇	𠂇	<	L	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NNLN	CG RAN (14)	𠂇	𠂇	=	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NNHL	CG RAN (15)	𠂇	𠂇	>	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇
NNHN	CG RAN (16)	𠂇	𠂇	?	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇	𠂇

RELIABILITY TEST CONDITIONS

No.	Items	Specification	Quantity
1	High temp. (Non-operation)	85°C, 240hrs	5
2	High temp. (Operation)	70°C, 120hrs	5
3	Low temp. (Operation)	-40°C, 120hrs	5
4	High temp. / High humidity (Operation)	65°C, 90%RH, 120hrs	5
5	Thermal shock (Non-operation)	-40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit /3min) 1cycle: 66min, 100 cycles	5
6	Vibration	Frequency : 5~50HZ, 0.5G Scan rate : 1 oct/min Time : 2 hrs/axis Test axis : X, Y, Z	1 Carton
7	Drop	Height: 120cm Sequence : 1 angle 、3 edges and 6 faces Cycles: 1	1 Carton
8	ESD (Non-operation)	Air discharge model, ±8kV, 10 times	5

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability.
2. The degradation of Polarizer are ignored for item 1, 4 & 5.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.

PACKING SPECIFICATION

TBD



OUTGOING INSPECTION PROVISION

1. 抽樣方法 / SAMPLING METHOD

- (1) MIL-STD-1916 / 驗證水準 level III / 正常檢驗 / 單次樣品檢驗
MIL-STD-1916 / inspection level III / normal inspection / single sample inspection
- (2) 主要缺陷 Level III ; 次要缺陷 Level II
Major Level III ; Minor Level II

MIL-STD-1916 樣本代字對照表							
批量	驗證水準 (VL)						
	VII	VI	V	IV	III	II	I
2 ~ 170	A	A	A	A	A	A	A
171 ~ 288	A	A	A	A	A	A	B
289 ~ 544	A	A	A	A	A	B	C
545 ~ 960	A	A	A	A	B	C	D
961 ~ 1632	A	A	A	B	C	D	E
1633 ~ 3072	A	A	B	C	D	E	E
3073 ~ 5440	A	B	C	D	E	E	E
5441 ~ 9216	B	C	D	E	E	E	E
9217 ~ 17408	C	D	E	E	E	E	E
17409 ~ 30720	D	E	E	E	E	E	E
≥ 30721	E	E	E	E	E	E	E

樣本代字 (CL)	驗證水準(VL)							
	T	VII	VI	V	IV	III	II	I
	樣本大小							
A	3072	1280	512	192	80	32	12	5
B	4096	1536	640	256	96	40	16	6
C	5120	2048	768	320	128	48	20	8
D	6144	2560	1024	384	160	64	24	10
E	8192	3072	1280	512	192	80	32	12

2. 檢驗條件 / INSPECTION CONDITION

檢查和測量在下列條件下進行的，除非另有規定。

The inspection and measurement are performed under the following conditions, unless otherwise specified.

溫度 / Temperature: $25 \pm 5^{\circ}\text{C}$

濕度 / Humidity: $50 \pm 10\% \text{R.H.}$

壓力 / Pressure: 860~1060hPa (mbar)

檢驗員拿的面板和眼睛之間的距離 / Distance between the panel and eyes of the inspector $\geq 30\text{cm}$

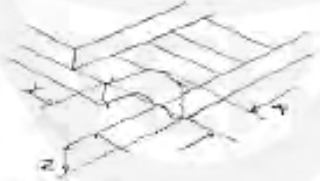
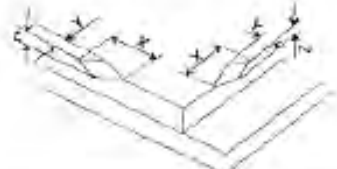


3. 品質檢驗規格 / SPECIFICATION FOR QUALITY CHECK

3.1 缺陷分類 / DEFECT CLASSIFICATION

嚴重度 Severity	檢驗項目 Inspection Item	缺陷 Defect	備註 Remark
主要缺陷 Major Defect	1. 面板 Panel	(1) 無顯示 Non-displaying	
		(2) 線缺陷 Line defects	
		(3) 故障 Malfunction	
		(4) 玻璃破損 Glass cracked	
	2. 軟板 Film	(1) 軟板尺寸超規 Film dimension out of specification	不能組裝 Can not be assembled
次要缺陷 Minor Defect	3. 尺寸 Dimension	(1) 外形尺寸超規 Outline dimension out of specification	外觀缺陷 Appearance defect
	1. 面板 Panel	(1) 玻璃刮傷 Glass scratch	
		(2) 玻璃切割異常 Glass cutting NG	
		(3) 玻璃崩邊、崩角 Glass chip	
	2. 偏光板 Polarizer	(1) 偏光板刮傷 Polarizer scratch	
		(2) 表面汗漬 Stains on surface	
		(3) 偏光板氣泡 Polarizer bubbles	
	3. 顯示 Displaying	(1) 暗點、亮點、髒污 Dim spot·Bright spot·dust	
	4. 軟板 Film	(1) 損傷 Damage	
		(2) 異物 Foreign material	

3.2 出貨規格 / OUTGOING SPECIFICATION

項目 Item	描述 Description	標準 Criterion	允收 水準 AQL															
I. 面板 Panel	1. 玻璃刮傷 Glass scratch	<table><tr><th>寬 / Width (mm) W</th><th>長 / Length (mm) L</th><th>容許個數 number of pieces permitted</th></tr><tr><td>$W \leq 0.03$</td><td>忽略 Ignore</td><td>忽略 Ignore</td></tr><tr><td>$0.03 < W \leq 0.05$</td><td>$L \leq 1$</td><td>1</td></tr><tr><td>$0.05 < W$</td><td>——</td><td>無 None</td></tr><tr><td>顯示區外 beyond A.A.</td><td>——</td><td>忽略 Ignore</td></tr></table>	寬 / Width (mm) W	長 / Length (mm) L	容許個數 number of pieces permitted	$W \leq 0.03$	忽略 Ignore	忽略 Ignore	$0.03 < W \leq 0.05$	$L \leq 1$	1	$0.05 < W$	——	無 None	顯示區外 beyond A.A.	——	忽略 Ignore	次要 Minor
寬 / Width (mm) W	長 / Length (mm) L	容許個數 number of pieces permitted																
$W \leq 0.03$	忽略 Ignore	忽略 Ignore																
$0.03 < W \leq 0.05$	$L \leq 1$	1																
$0.05 < W$	——	無 None																
顯示區外 beyond A.A.	——	忽略 Ignore																
	2. 玻璃破損 Glass crack	(1) 裂紋 / Crack 擴展裂紋是不能接受的。 Propagation crack is not acceptable. 	主要 Major															
	3. 玻璃崩邊、崩角 Glass chip	(1) 崩角 / Chip on corner  (2) 崩邊 / Chip on edge 	次要 Minor															

項目 Item	描述 Description	標準 Criterion	允收 水準 AQL																
I. 面板 Panel	3. 玻璃崩邊、崩角 Glass chip	<table><tr><th>崩角 Chip on corner</th><th>Size (mm)</th><th>崩邊 Chip on edge</th><th>Size (mm)</th></tr><tr><td>X</td><td>≤1.5</td><td>X</td><td>≤3.0</td></tr><tr><td>Y</td><td>≤2.0</td><td>Y</td><td>≤1.0</td></tr><tr><td></td><td>≤t</td><td>Z</td><td>≤t</td></tr></table> 備註 / Note: 1. t = 玻璃厚度 t = glass thickness 2. 崩邊或崩角延伸到 ITO 導線是不能接受的。 Chip on the corner extending into the ITO contact is not acceptable.	崩角 Chip on corner	Size (mm)	崩邊 Chip on edge	Size (mm)	X	≤1.5	X	≤3.0	Y	≤2.0	Y	≤1.0		≤t	Z	≤t	次要 Minor
	崩角 Chip on corner	Size (mm)	崩邊 Chip on edge	Size (mm)															
X	≤1.5	X	≤3.0																
Y	≤2.0	Y	≤1.0																
	≤t	Z	≤t																
	4. 尺寸 Dimension	請參閱圖紙的規範。 Refer to the drawing of the spec	主要 Major																
II. 偏光板 Polarizer	1. 刮傷 Scratch	點狀按照“項目 II-3 偏光板氣泡”的標準。 Spot type in accordance with the criteria of “Item II-3. Polarizer bubble”. 線狀按照“項目 I-1 玻璃刮傷”的標準。 Line type in accordance with the criteria of “Item I-1. Glass scratch”.	次要 Minor																
	2. 表面汙漬 Stains on surface	表面汙漬無法用軟布或類似的清潔物輕輕擦拭去除。 Stains cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	次要 Minor																
	3. 偏光板氣泡 Polarizer bubble	<table><tr><th>尺寸 Size</th><th>(mm) 容許個數 number of pieces permitted</th></tr><tr><td>Φ≤0.2</td><td>忽略 Ignore</td></tr><tr><td>0.2<Φ≤0.5</td><td>2</td></tr><tr><td>0.5<Φ</td><td>0</td></tr><tr><td>顯示區外 beyond A.A.</td><td>忽略 Ignore</td></tr></table>	尺寸 Size	(mm) 容許個數 number of pieces permitted	Φ≤0.2	忽略 Ignore	0.2<Φ≤0.5	2	0.5<Φ	0	顯示區外 beyond A.A.	忽略 Ignore	次要 Minor						
尺寸 Size	(mm) 容許個數 number of pieces permitted																		
Φ≤0.2	忽略 Ignore																		
0.2<Φ≤0.5	2																		
0.5<Φ	0																		
顯示區外 beyond A.A.	忽略 Ignore																		

項目 Item	描述 Description	標準 Criterion	允收 水準 AQL											
III. 顯示 Displaying	1. 耗電 Power consumption	該模組的工作電流消耗不應超出產品規格書的規範。 The module operating current consumption should not go beyond the standard indicated in Product Specification	主要 Major											
	2. 像素尺寸 Pixel size	顯示像素的尺寸的公差應規格的±25%之內。 The tolerance of display pixel dimension should be within ±25% of specification.	次要 Minor											
	3. 顏色 Color	依據產品規格。 Refer to the product specification.	主要 Major											
	4. 亮度 Luminance	依據產品規格。 Refer to the product specification.	主要 Major											
	5. 暗點、亮點、 髒污 Dimming spot、Lighting spot、Dust	1. <table border="1"><thead><tr><th>平均直徑 Average diameter D:(mm)</th><th>容許個數 number of pieces permitted</th></tr></thead><tbody><tr><td>D ≤ 0.1</td><td>忽略 Ignore</td></tr><tr><td>0.1 < D ≤ 0.15</td><td>1</td></tr><tr><td>0.15 < D ≤ 0.2</td><td>1</td></tr><tr><td>0.2 < D</td><td>0</td></tr><tr><td>顯示區外 beyond A.A.</td><td>忽略 Ignore</td></tr></tbody></table> D=(長邊直徑 + 短邊直徑)/2 D=(long diameter + short diameter)/2 像素暗點是不允許。 Pixel off is not allowed.	平均直徑 Average diameter D:(mm)	容許個數 number of pieces permitted	D ≤ 0.1	忽略 Ignore	0.1 < D ≤ 0.15	1	0.15 < D ≤ 0.2	1	0.2 < D	0	顯示區外 beyond A.A.	忽略 Ignore
平均直徑 Average diameter D:(mm)	容許個數 number of pieces permitted													
D ≤ 0.1	忽略 Ignore													
0.1 < D ≤ 0.15	1													
0.15 < D ≤ 0.2	1													
0.2 < D	0													
顯示區外 beyond A.A.	忽略 Ignore													

項目 Item	描述 Description	標準 Criterion	允收 水準 AQL
III. 顯示 Displaying	5. 暗點、亮點、 髒污 Dimming spot、Lighting spot、Dust	2.	次要 Minor
		寬 width(mm) W	
		長 length(mm) L	
		容許個數 number of pieces permitted	
		$W \leq 0.03$	
		忽略 Ignore	
IV. 軟板 Film	1. 尺寸 Dimension	$0.03 < W \leq 0.05$	次要 Minor
		$L \leq 1$	
		3	
		$0.05 < W$	
		無 None	
		顯示區外 beyond A.A.	
IV. 軟板 Film	2. 損傷 Damage	軟板尺寸超規。 Film dimension out of Spec.	主要 Major
		破損；深刮傷；深摺痕；深壓痕或其他損害是不能接受的。 Crack; deep scratch; deep fold; deep pressure mark or other damage is not acceptable.	
IV. 軟板 Film	3. 異物 Foreign material	導電異物附著在導線，軟板和玻璃之間的異物是不能接受的。 Conductive foreign material sticking to the leads, foreign material between film and glass are not acceptable.	次要 Minor

APPENDIXES

APPENDIX 1: DEFINITIONS

A. DEFINITION OF CHROMATICITY COORDINATE

The chromaticity coordinate is defined as the coordinate value on the CIE 1931 color chart for R, G, B, W.

B. DEFINITION OF CONTRAST RATIO

The contrast ratio is defined as the following formula:

$$\text{Contrast Ratio} = \frac{\text{Luminance of all pixels on measurement}}{\text{Luminance of all pixels off measurement}}$$

C. DEFINITION OF RESPONSE TIME

The definition of turn-on response time T_r is the time interval between a pixel reaching 10% of steady state luminance and 90% of steady state luminance. The definition of turn-off response time T_f is the time interval between a pixel reaching 90% of steady state luminance and 10% of steady state luminance. It is shown in Figure 2.

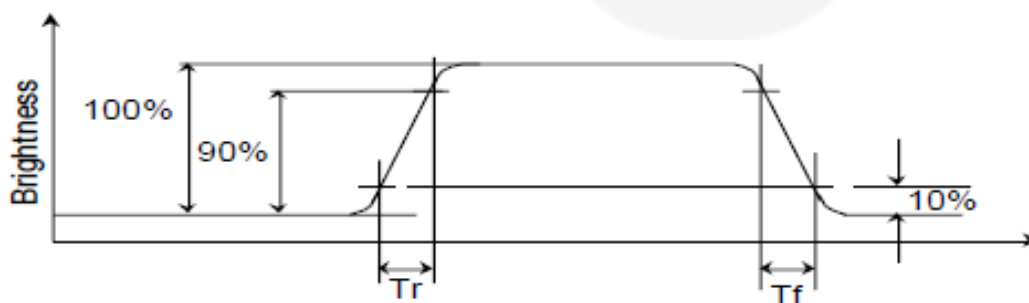


Figure 2 Response time

D. DEFINITION OF VIEWING ANGLE

The viewing angle is defined as Figure 3. Horizontal and vertical (H & V) angles are determined for viewing directions where luminance varies by 50% of the perpendicular value.

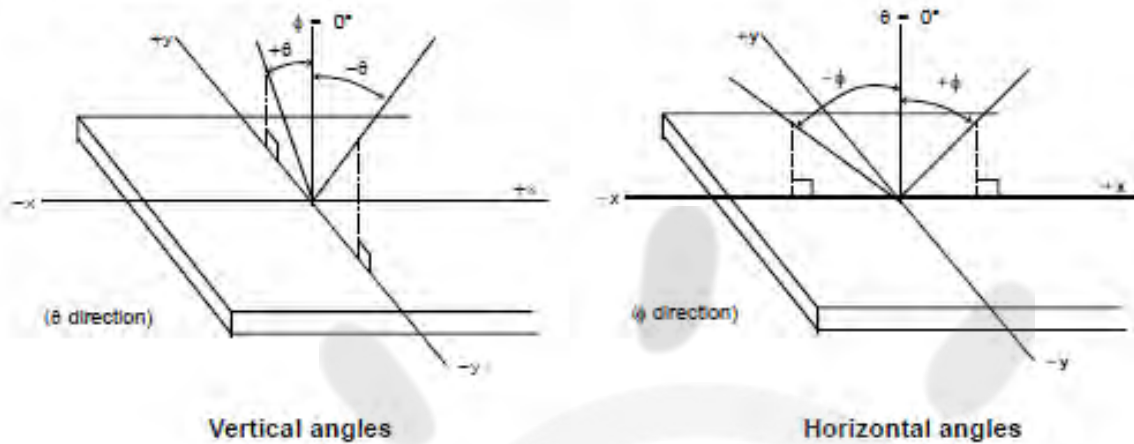
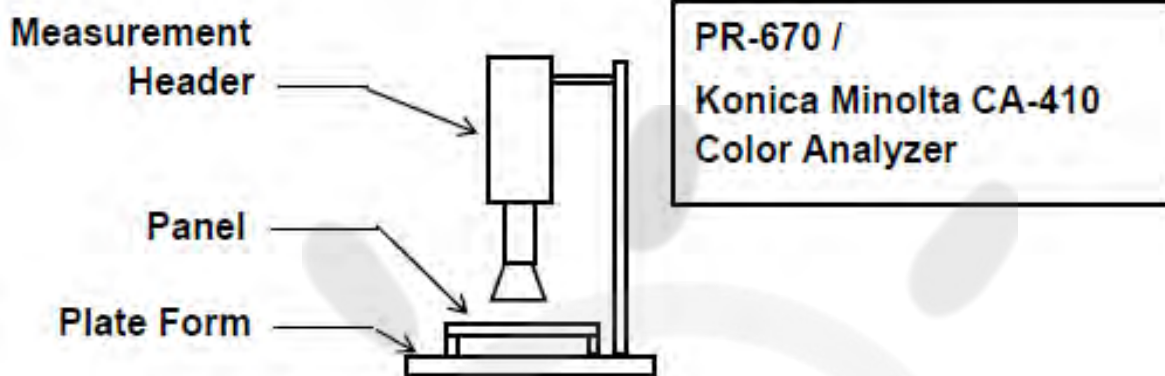


Figure 3 Viewing Angle

APPENDIX 2: MEASUREMENT APPARATUS

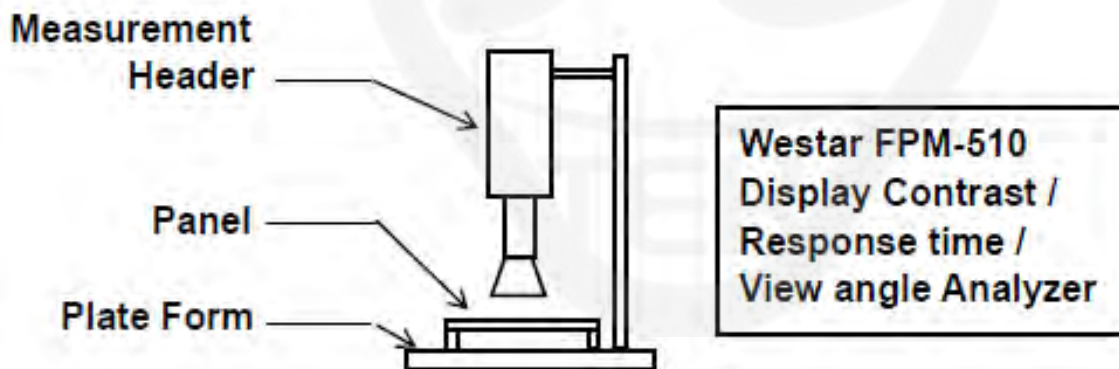
A. LUMINANCE/COLOR COORDINATE

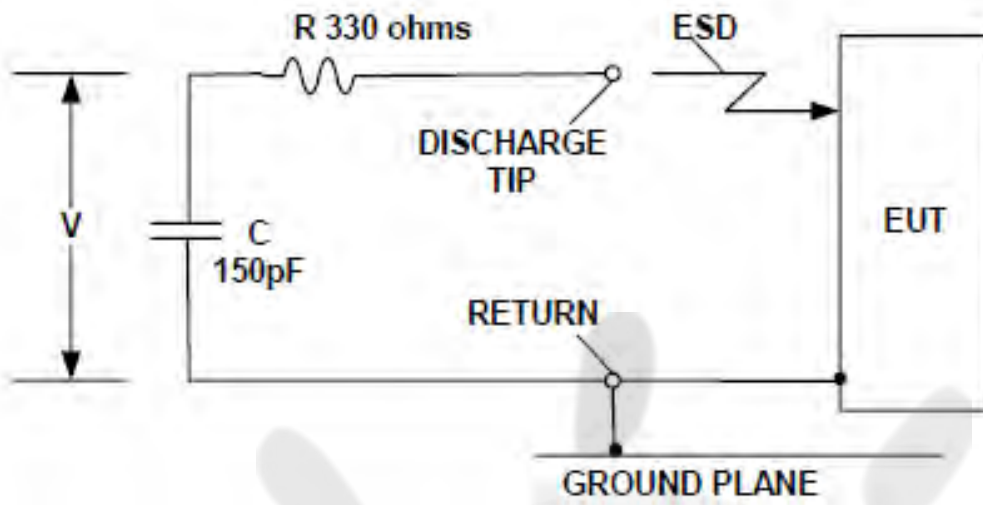
PHOTO RESEARCH PR-670, Konica Minolta CA-410



B. CONTRAST / RESPONSE TIME / VIEWING ANGLE

WESTAR CORPORATION FPM-510



C. ESD ON AIR DISCHARGE MODE

That's the end of the datasheet