

# Specification for Approval

**PRODUCT NAME:** RGS24128022YR000  
**PRODUCT NO.:** 9921501000  
**Part Number:** PMO21501

<b>CUSTOMER</b>
<b>APPROVED BY</b>
<b>DATE:</b>

<b>RITDISPLAY CORP. APPROVED</b>

## REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
X01	■ INITIAL RELEASE	2008. 05. 07	
X02	<ul style="list-style-type: none"> <li>■ Add the operating conditions for different luminance</li> <li>■ Add the panel electrical specifications</li> <li>■ Add the application circuit</li> </ul>	2008. 06. 13	Page 4, 6, 7, 8 & 14
A01	<ul style="list-style-type: none"> <li>■ Transfer from X version</li> <li>■ Modify definition of panel thickness</li> <li>■ Add the information of module weight</li> <li>■ Add the packing specification</li> </ul>	2009. 05. 05	Page 4, 5 & 17

## CONTENTS

ITEM	PAGE
<b><u>1. SCOPE</u></b>	4
<b><u>2. WARRANTY</u></b>	4
<b><u>3. FEATURES</u></b>	4
<b><u>4. MECHANICAL DATA</u></b>	5
<b><u>5. MAXIMUM RATINGS</u></b>	6
<b><u>6. ELECTRICAL CHARACTERISTICS</u></b>	7
6.1 D.C ELECTRICAL CHARACTERISTICS	
6.2 ELECTRO-OPTICAL CHARACTERISTICS	
<b><u>7. INTERFACE</u></b>	9
7.1 FUNCTION BLOCK DIAGRAM	
7.2 PANEL LAYOUT DIAGRAM	
7.3 PIN ASSIGNMENTS	
7.4 GRAPHIC DISPLAY DATA RAM ADDRESS MAP	
7.5 INTERFACE TIMING CHART	
<b><u>8. POWER ON / OFF SEQUENCE &amp; APPLICATION CIRCUIT</u></b>	13
8.1 POWER ON / OFF SEQUENCE	
8.2 APPLICATION CIRCUIT	
8.3 COMMAND TABLE	
<b><u>9. RELIABILITY TEST CONDITIONS</u></b>	15
<b><u>10. EXTERNAL DIMENSION</u></b>	16
<b><u>11. PACKING SPECIFICATION</u></b>	17
<b><u>12. APPENDIXES</u></b>	18

## **1. SCOPE**

The purpose of this specification is to define the general provisions and quality requirements that apply to the supply of display cells manufactured by RiTdisplay. This document, together with the Module Assembly Drawing, is the highest-level specification for this product. It describes the product, identifies supporting documents and contains specifications.

## **2. WARRANTY**

RiTdisplay warrants that the products delivered pursuant to this specification (or order) will conform to the agreed specifications for twelve (12) months from the shipping date ("Warranty Period"). RiTdisplay is obligated to repair or replace the products which are found to be defective or inconsistent with the specifications during the Warranty Period without charge, on condition that the products are stored or used as the conditions specified in the specifications. Nevertheless, RiTdisplay is not obligated to repair or replace the products without charge if the defects or inconsistency are caused by the force majeure or the reckless behaviors of the customer.

After the Warranty Period, all repairs or replacements of the products are subject to charge.

## **3. FEATURES**

- Small molecular organic light emitting diode.
- Color : Yellow
- Panel resolution : 128\*22
- Driver IC : SSD1305
- Excellent Quick response time : 10 $\mu$ s
- Extremely thin thickness for best mechanism design : 2.15 mm
- High contrast : 2000:1
- Wide viewing angle : 160°
- Strong environmental resistance.
- 8-bit 6800-series Parallel Interface, 8-bit 8080-series Parallel Interface, Serial Peripheral Interface, I<sup>2</sup>C Interface.
- Wide range of operating temperature : -40 to 70°C
- Anti-glare polarizer.

#### 4. MECHANICAL DATA

NO	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128 x 22	dot
2	Dot Size	0.43 (W) x 0.51 (H)	mm <sup>2</sup>
3	Dot Pitch	0.46 (W) x 0.54 (H)	mm <sup>2</sup>
4	Aperture Rate	88	%
5	Active Area	58.85 (W) x 11.85 (H)	mm <sup>2</sup>
6	Panel Size	63.3 (W) x 20.8 (H)	mm <sup>2</sup>
7*	Panel Thickness	1.42 ± 0.1	mm
8	Module Size	64.8 (W) x 59.5 (H) x 2.15 (T)	mm <sup>3</sup>
9	Diagonal A/A size	2.36	inch
10	Module Weight	4.97 ± 10%	gram

\* Panel thickness includes substrate glass, cover glass and UV glue thickness.

## 5. MAXIMUM RATINGS

ITEM	MIN	MAX	UNIT	Condition	Remark
Supply Voltage ( $V_{DD}$ )	-0.3	3.5	V	$T_a = 25^{\circ}\text{C}$	IC maximum rating
Supply Voltage ( $V_{CC}$ )	8	16	V	$T_a = 25^{\circ}\text{C}$	IC maximum rating
Operating Temp.	-40	70	$^{\circ}\text{C}$		
Storage Temp	-40	85	$^{\circ}\text{C}$		
Humidity		85	%		
Life Time	33,000	-	Hrs	120 $\text{cd}/\text{m}^2$ , 50% checkerboard	Note (1)
Life Time	40,000	-	Hrs	100 $\text{cd}/\text{m}^2$ , 50% checkerboard	Note (2)
Life Time	50,000	-	Hrs	80 $\text{cd}/\text{m}^2$ , 50% checkerboard	Note (3)

Note:

(A) Under  $V_{CC} = 12\text{V}$ ,  $T_a = 25^{\circ}\text{C}$ , 50% RH.

(B) Life time is defined the amount of time when the luminance has decayed to less than 50% of the initial measured luminance.

(1) Setting of 120  $\text{cd}/\text{m}^2$  :

- Contrast setting : 0xAACH
- Frame rate : 105Hz
- Duty setting : 1/22

(2) Setting of 100  $\text{cd}/\text{m}^2$  :

- Contrast setting : 0x8EH
- Frame rate : 105Hz
- Duty setting : 1/22

(3) Setting of 80  $\text{cd}/\text{m}^2$  :

- Contrast setting : 0x6DH
- Frame rate : 105Hz
- Duty setting : 1/22

## 6. ELECTRICAL CHARACTERISTICS

### 6.1 D.C ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETERS	TEST CONDITION	MIN	TYP	MAX	UNIT
$V_{CC}$	Analog power supply (for OLED panel)		11.5	12	12.5	V
$V_{DD}$	Digital power supply		2.4	-	3.5	V
$I_{DD}$	Operating current for $V_{DD}$ $V_{DD} = 2.7V$ , $V_{CC} = 12V$ , $I_{REF} = 10\mu A$ No loading, All Display ON	Contrast=FF	-	100	300	$\mu A$
$I_{CC}$	Operating current for $V_{CC}$ $V_{DD} = 2.7V$ , $V_{CC} = 12V$ , $I_{REF} = 10\mu A$ , No loading, All Display ON	Contrast=FF	-	550	1000	$\mu A$
$V_{IH}$	Hi logic input level		$0.8^* V_{DD}$	-	-	V
$V_{IL}$	Low logic input level		0	-	$0.2^* V_{DD}$	V
$V_{OH}$	Hi logic output level		$0.9^* V_{DD}$	-	-	V
$V_{OL}$	Low logic output level		0	-	$0.1^* V_{DD}$	V
$I_{SEG}$	Segment on output current $V_{DD}=2.7V$ , $V_{CC}=12V$ , $I_{REF}=10\mu A$ , Display on, Segment pin under test is connected with a 20K resistive load to $V_{SS}$	Contrast=FF	294	320	346	$\mu A$
		Contrast=AF	-	220	-	$\mu A$
		Contrast=7F	-	159	-	$\mu A$
		Contrast=3F	-	79	-	$\mu A$
		Contrast=0F	-	19	-	$\mu A$

## 6.2 ELECTRO-OPTICAL CHARACTERISTICS

### PANEL ELECTRICAL SPECIFICATIONS

PARAMETER	MIN	TYP.	MAX	UNITS	COMMENTS
Normal mode current consumption	-	14	16	mA	All pixels on (1)
Standby mode current consumption	-	2	3	mA	Standby mode 10% pixels on (2)
Normal mode power consumption	-	168	192	mW	All pixels on (1)
Standby mode power consumption	-	24	36	mW	Standby mode 10% pixels on (2)
Pixel Luminance	80	100		cd/m <sup>2</sup>	Display Average
Standby Luminance		20		cd/m <sup>2</sup>	
CIE <sub>x</sub> (Yellow)	0.43	0.47	0.51		CIE1931
CIE <sub>y</sub> (Yellow)	0.45	0.49	0.53		CIE1931
Dark Room Contrast	2000:1				
Viewing Angle	160			degree	
Response Time		10		μs	

(1) Normal mode condition :

- Driving Voltage : 12V
- Contrast setting : 0x8EH
- Frame rate : 105Hz
- Duty setting : 1/22

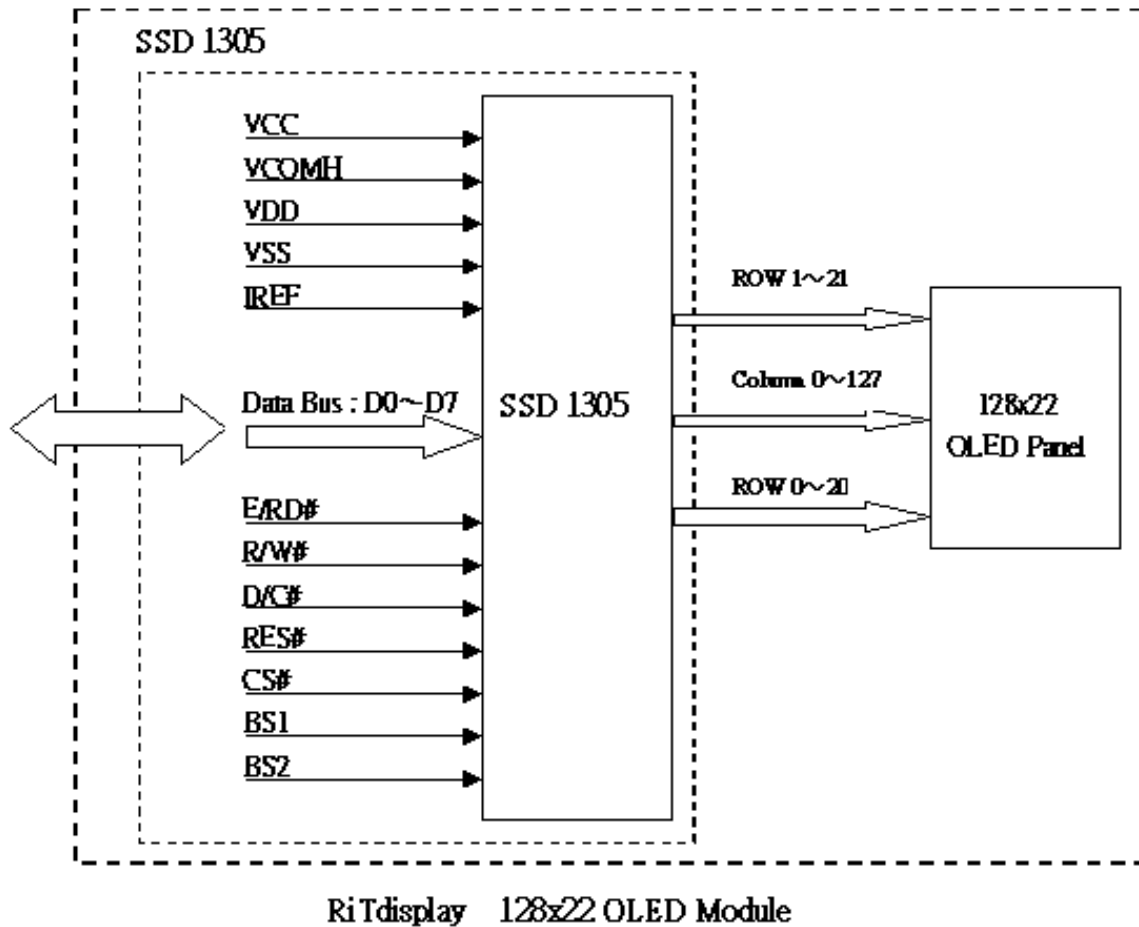
(2) Standby mode condition :

- Driving Voltage : 12V
- Contrast setting : 0x12H
- Frame rate : 105Hz
- Duty setting : 1/22

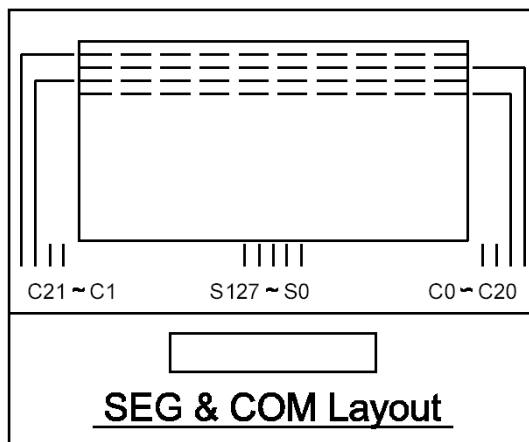


## 7. INTERFACE

### 7.1 FUNCTION BLOCK DIAGRAM



### 7.2 PANEL LAYOUT DIAGRAM



### 7.3 PIN ASSIGNMENTS

Pin No.	Pin Name	Description
1	NC	No connection.
2	VSS	This is a ground pin.
3	VSS	This is a ground pin.
4	NC	No connection.
5	VDD	Voltage power supply for logic
6	BS1	MCU interface selection pin.
7	BS2	MCU interface selection pin.
8	CS#	Chip select pin. The driver IC will be selected When CS pin is active low.
9	RES#	Hardware reset signal
10	D/C#	Data/Command control pin. When it pulled high, the input at D0-D7 is treated as display data. When it pulled low, the input at D0-D7 is transferred to command register
11	R/W#	Write strobe signal and reads data at the low level
12	E(RD#)	Read strobe signal and reads data at the low level
13	D0	8-bit data bus
14	D1	8-bit data bus
15	D2	8-bit data bus
16	D3	8-bit data bus
17	D4	8-bit data bus
18	D5	8-bit data bus
19	D6	8-bit data bus
20	D7	8-bit data bus
21	IREF	The current reference input pin, this pin should be connected to ground through a resistor.
22	VCOMH	The COM voltage reference pin, this pin should be connected to ground through a capacitor.
23	VCC	Positive OLED high voltage power supply
24	NC	No connection.

### 7.4 GRAPHIC DISPLAY DATA RAM ADDRESS MAP

The GDDRAM is a bit mapped static RAM holding the bit pattern to be displayed. The size of the RAM is 132x64= 8448bits.

For mechanical flexibility, re-mapping on both Segment and Common outputs can be selected by software.

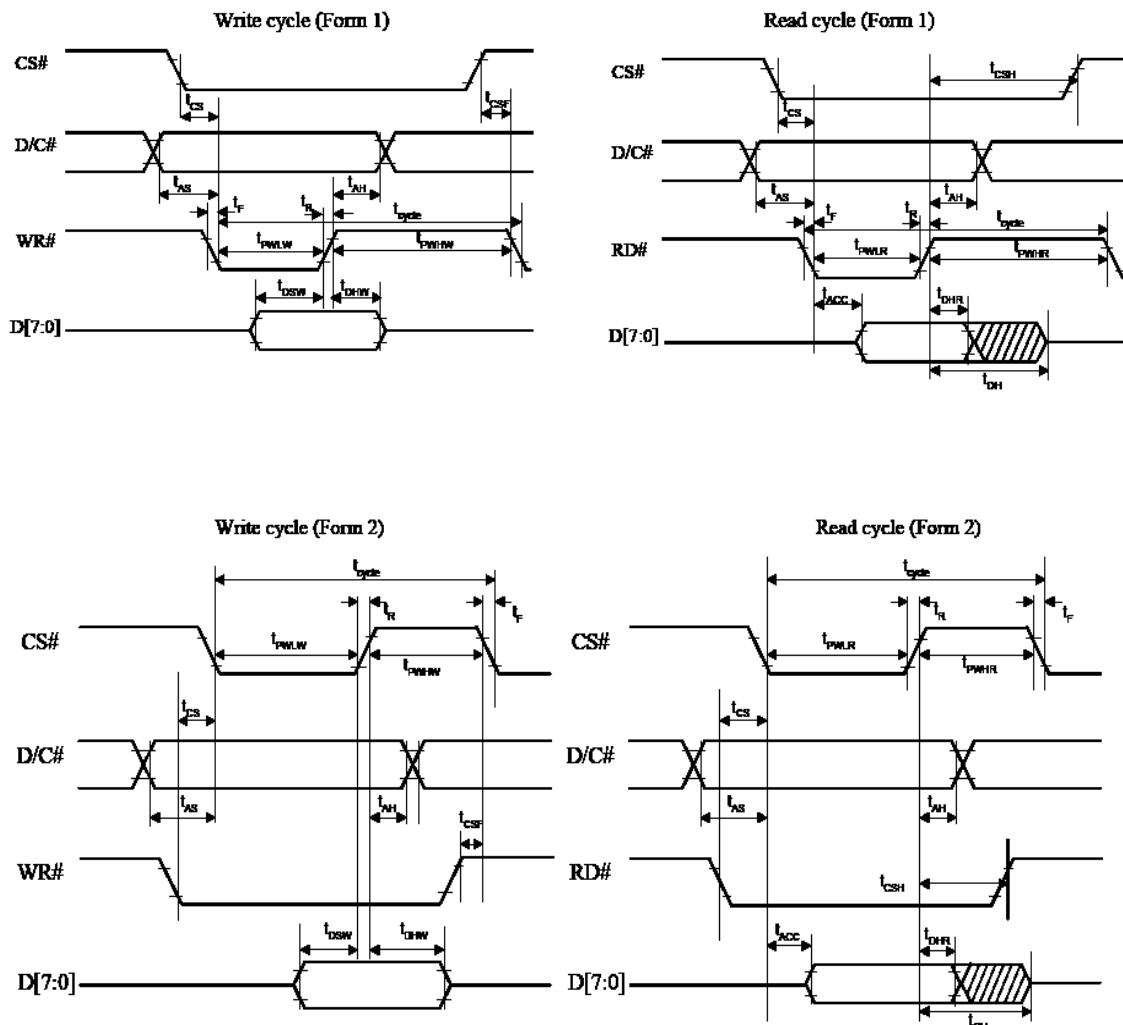
OUT	Row Address			OUT	Column Address								::	Column Address				
	Direction='1'	Direction='0'			Remap='0'	Remap='1'	SEG0	SEG1	SEG2	SEG3	SEG4	SEG5		SEG6	SEG7	SEG128	SEG129	SEG130
COM0	0x3Fh	0x00h	PAGE 0	D0														
COM1	0x3Eh	0x01h		D1														
COM2	0x3Dh	0x02h		D2														
COM3	0x3Ch	0x03h		D3														
COM4	0x3Bh	0x04h		D4														
COM5	0x3Ah	0x05h		D5														
COM6	0x39h	0x06h		D6														
COM7	0x38h	0x07h		D7														
COM8	0x37h	0x08h	PAGE 1	D0														
COM9	0x36h	0x09h		D1														
COM10	0x35h	0x0Ah		D2														
COM11	0x34h	0x0Bh		D3														
COM12	0x33h	0x0Ch		D4														
COM13	0x32h	0x0Dh		D5														
COM14	0x31h	0x0Eh		D6														
COM15	0x30h	0x0Fh		D7														
COM16	0x2Fh	0x10h	PAGE 2	D0														
COM17	0x2Eh	0x11h		D1														
COM18	0x2Dh	0x12h		D2														
COM19	0x2Ch	0x13h		D3														
COM20	0x2Bh	0x14h		D4														
COM21	0x2Ah	0x15h		D5														
COM22	0x29h	0x16h		D6														
COM23	0x28h	0x17h		D7														
...																		
COM48	0x0Fh	0x30h	PAGE 6	D0														
COM49	0x0Eh	0x31h		D1														
COM50	0x0Dh	0x32h		D2														
COM51	0x0Ch	0x33h		D3														
COM52	0x0Bh	0x34h		D4														
COM53	0x0Ah	0x35h		D5														
COM54	0x09h	0x36h		D6														
COM55	0x08h	0x37h		D7														
COM56	0x07h	0x38h	PAGE 7	D0														
COM57	0x06h	0x39h		D1														
COM58	0x05h	0x3Ah		D2														
COM59	0x04h	0x3Bh		D3														
COM60	0x03h	0x3Ch		D4														
COM61	0x02h	0x3Dh		D5														
COM62	0x01h	0x3Eh		D6														
COM63	0x00h	0x3Fh		D7														

## 7.5 INTERFACE TIMING CHART

### 8080-Series MCU Parallel Interface Timing Characteristics

( $V_{DD} - V_{SS} = 2.4V$  to  $3.5V$ ,  $V_{DDIO} = V_{DD}$ ,  $T_A = 25^\circ C$ )

Symbol	Parameter	Min	Typ	Max	Unit
$t_{cycle}$	Clock Cycle Time	300	-	-	ns
$t_{AS}$	Address Setup Time	10	-	-	ns
$t_{AH}$	Address Hold Time	0	-	-	ns
$t_{DSW}$	Write Data Setup Time	40	-	-	ns
$t_{DHW}$	Write Data Hold Time	7	-	-	ns
$t_{DHR}$	Read Data Hold Time	20	-	-	ns
$t_{OH}$	Output Disable Time	-	-	70	ns
$t_{ACC}$	Access Time	-	-	140	ns
$t_{PWLr}$	Read Low Time	120	-	-	ns
$t_{PWLw}$	Write Low Time	60	-	-	ns
$t_{PWHr}$	Read High Time	60	-	-	ns
$t_{PWHw}$	Write High Time	60	-	-	ns
$t_r$	Rise Time	-	-	40	ns
$t_f$	Fall Time	-	-	40	ns
$t_{CS}$	Chip select setup time	0	-	-	ns
$t_{CSH}$	Chip select hold time to read signal	0	-	-	ns
$t_{CSF}$	Chip select hold time	20	-	-	ns

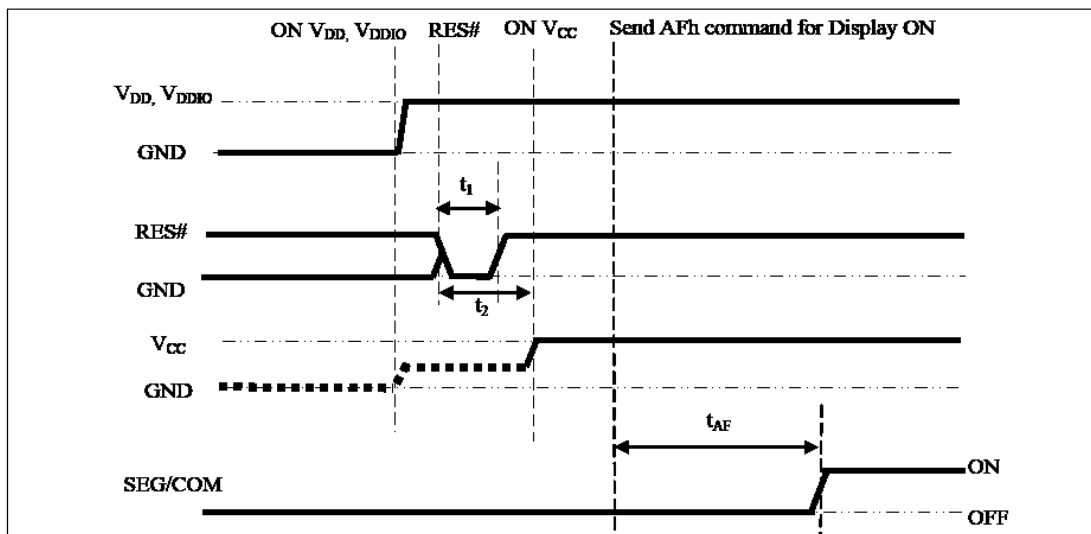


## 8. POWER ON / OFF SEQUENCE & APPLICATION CIRCUIT

### 8.1 POWER ON / OFF SEQUENCE

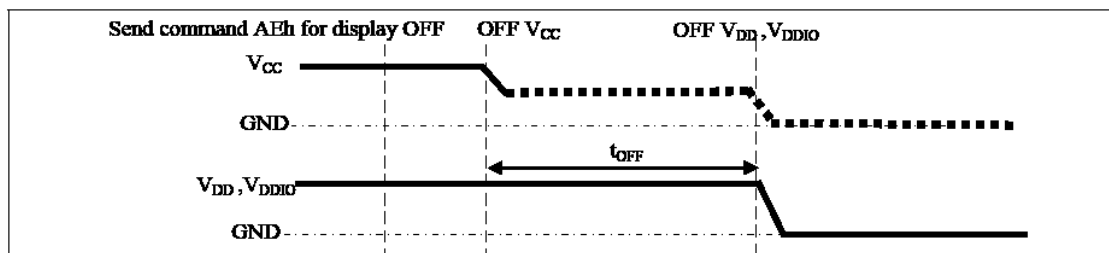
#### Power ON sequence:

1. Power ON  $V_{DD}$ ,  $V_{DDIO}$ .
2. After  $V_{DD}$ ,  $V_{DDIO}$  become stable, set RES# pin LOW (logic low) for at least  $3\mu s(t_1)$  and then HIGH (logic high).
3. After set RES# pin LOW (logic low), wait for at least  $3\mu s(t_2)$ . Then Power ON  $V_{CC}$ .(1)
4. After  $V_{CC}$  become stable, send command AFh for display ON. SEG/COM will be ON after  $100ms(t_{AF})$ .



#### Power OFF sequence:

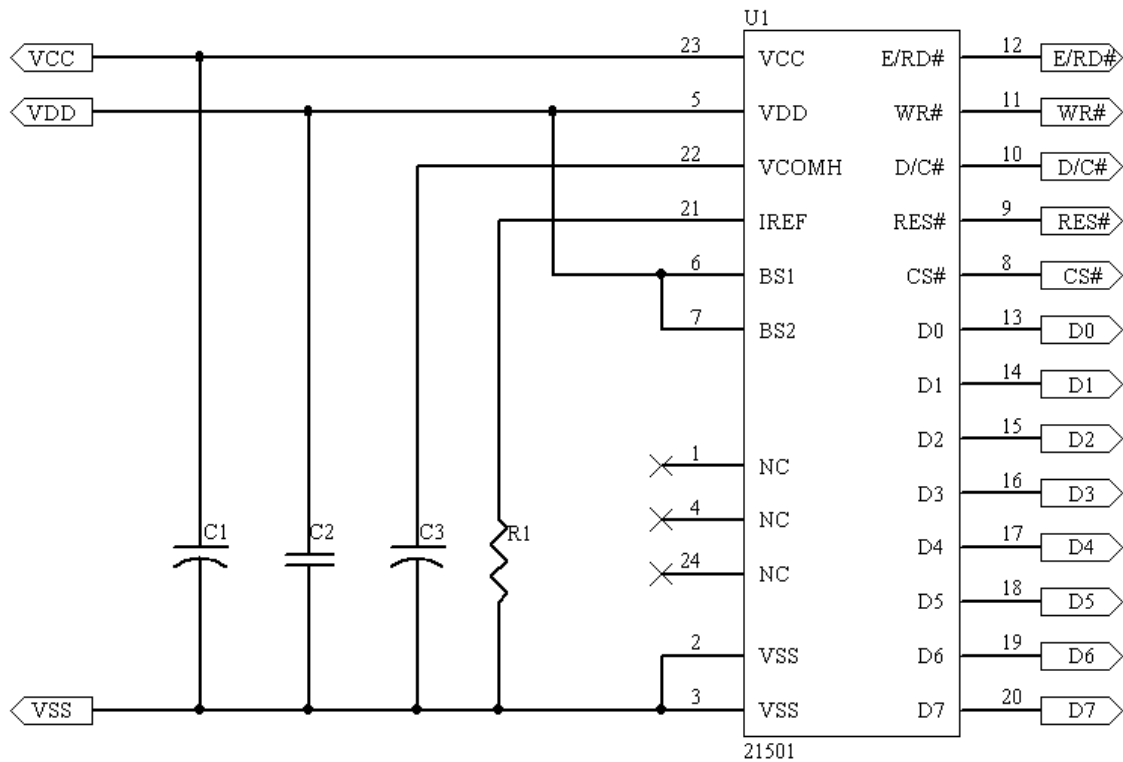
1. Send command AEh for display OFF.
2. Power OFF  $V_{CC}$ . (1), (2)
3. Wait for  $t_{OFF}$ . Power OFF  $V_{DD}$ ,  $V_{DDIO}$ . (where Minimum  $t_{OFF}=80ms$ , Typical  $t_{OFF}=100ms$ )



#### Note:

- (1) Since an ESD protection circuit is connected between  $V_{DD}$ ,  $V_{DDIO}$  and  $V_{CC}$ ,  $V_{CC}$  becomes lower than  $V_{DD}$  whenever  $V_{DD}$ ,  $V_{DDIO}$  is ON and  $V_{CC}$  is OFF as shown in the dotted line of  $V_{CC}$  in above figures.
- (2)  $V_{CC}$  should be disabled when it is OFF.

## 8.2 APPLICATION CIRCUIT



### Component :

C1, C3: 4.7uF/25V (Tantalum type), or solid tantalum 4.7uF/ 25V/ A Case (Vishay 572D)

C2: 4.7uF /16V (0805)

R1: 2M ohm /1% (0603)

This circuit is for 8080 interface.

## 8.3 COMMAND TABLE

Refer to IC Spec.: SSD1305

## 9. 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

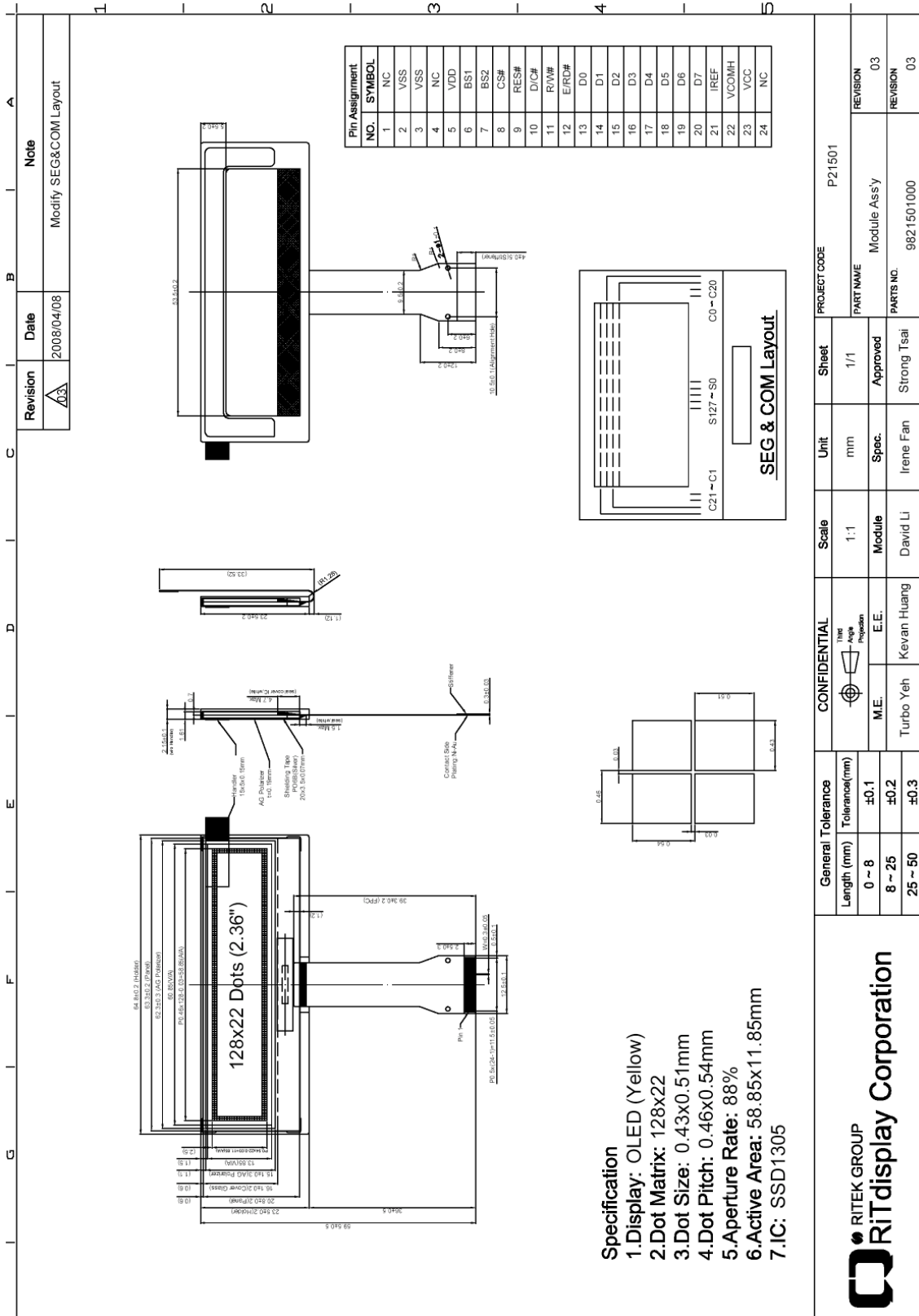
### **Test and measurement conditions**

1. All measurements shall not be started until the specimens attain to temperature stability.
2. All-pixels-on is used as operation test pattern.
3. 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.

**10. EXTERNAL DIMENSION**





**11. PACKING SPECIFICATION**

Revision	Date	Note
A	2009/05/05	Add Chinese Comment

9821501000  
Module Assy For P21501 x18 pcs

① Face up, rotate packing  
面朝上, 旋轉放置

3008000206  
Tray 330x270x8.7mm T=0.7mm, P.S, P21501

②

3010000002  
5G Silica Gel Desiccants  
矽膠乾燥劑

③ x 1 pcs (empty)

x 4 pcs

④ 3003000012  
Vacuum Bag ONY/LDPE  
真空包裝袋 ONY/LDPE  
480x285x90

Vacuum packing : 4 sec  
抽真空 : 4 秒

Tray =21 pcs

⑤ 3003000016  
Antistatic Bubble bag 440x(350+450)mm  
抗靜電氣泡袋 440x(350+450)mm

⑥ 3001000005  
Pizza Box 345x285x88,B corrugated

⑦ 3000000009  
Carton 385x305x203mm

⑧ 3006000000  
Label x1 pcs

⑧ 3006000000  
Label x2 pcs

⑨ Tape 3208000125

Rotate stack  
旋轉堆疊

ITEM	PART No.	DESC	QTY
1	9821501000	Module Assy For P21501	1
2	3008000206	Tray 330x270x8.7 T:0.7mm P.S P21501	720
3	3010000002	5G Silica Gel Desiccants	42
4	3003000012	Vacuum Bag ONY/LDPE 480x285x90	8
5	3003000016	Antistatic Bubble bag 440x(350+450)mm	2
6	3001000005	Pizza Box 345x285x88,B corrugated	2
7	3000000009	Carton 385x305x203mm	1
8	3006000000	Label	3
9	3208000125	Tape, W=48mm, L=910cm	

General Tolerance		CONFIDENTIAL		Scale	Unit	Sheet	PROJECT CODE
Length (mm)	Tolerance(mm)	M.I.E.	M.E.	1:15	mm	1/1	P21501
0 ~ 8	±0.1	Turbo Yeh	Allan Yang	Module	Spec.	Approved	PART NAME
8 ~ 25	±0.2						Packing Tray Instruction
25 ~ 50	±0.3						PARTS NO.
							9921501000
							VERSION
							02
							VERSION
							02

**RITEK GROUP**  
**RiTdisplay Corporation**

## 12. 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.

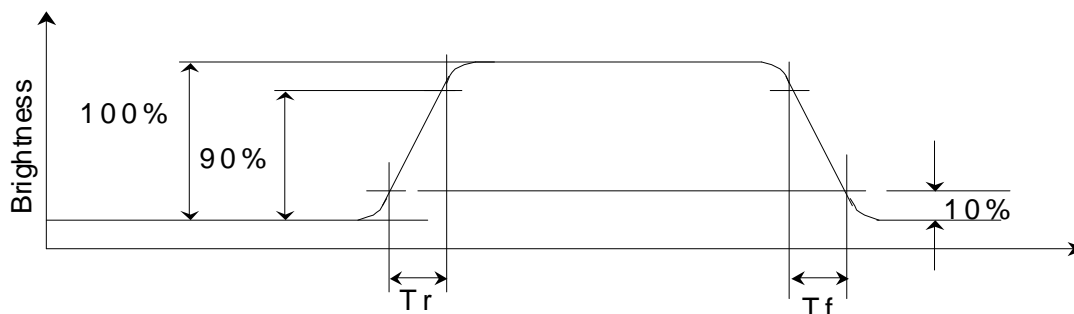
#### B. DEFINITION OF CONTRAST RATIO

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.

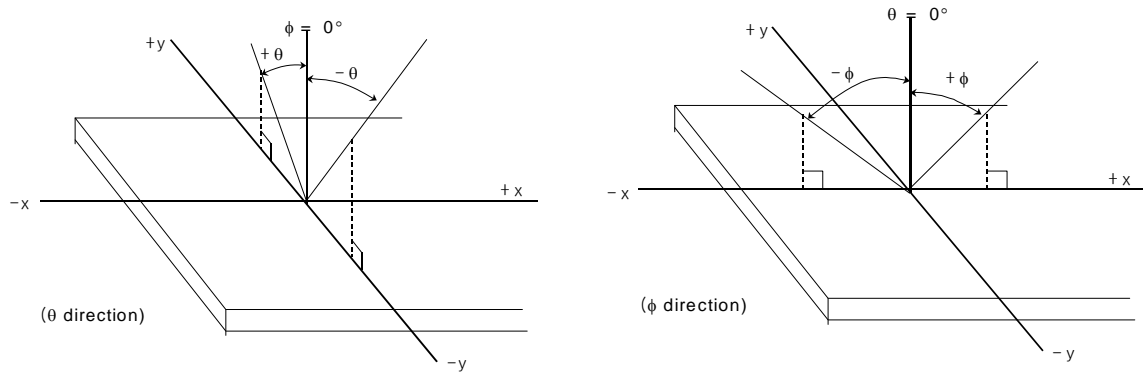


Figure 3 Viewing angle

## APPENDIX 2: MEASUREMENT APPARATUS

### A. LUMINANCE/COLOR COORDINATE

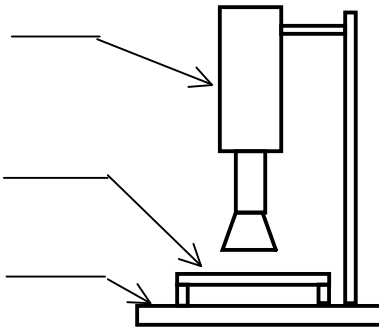
PHOTO RESEARCH PR-705, MINOLTA CS-100

**Measurement**

**Header**

**Panel**

**Plate Form**



**PR-705 /  
MINOLTA CS-100  
Color Analyzer**

### B. CONTRAST / RESPONSE TIME / VIEWING ANGLE

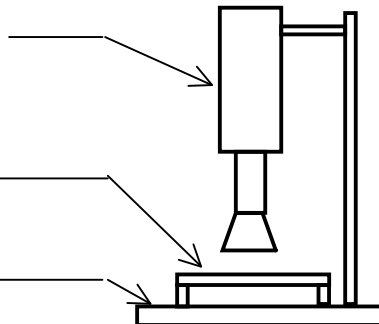
WESTAR CORPORATION FPM-510

**Measurement**

**Header**

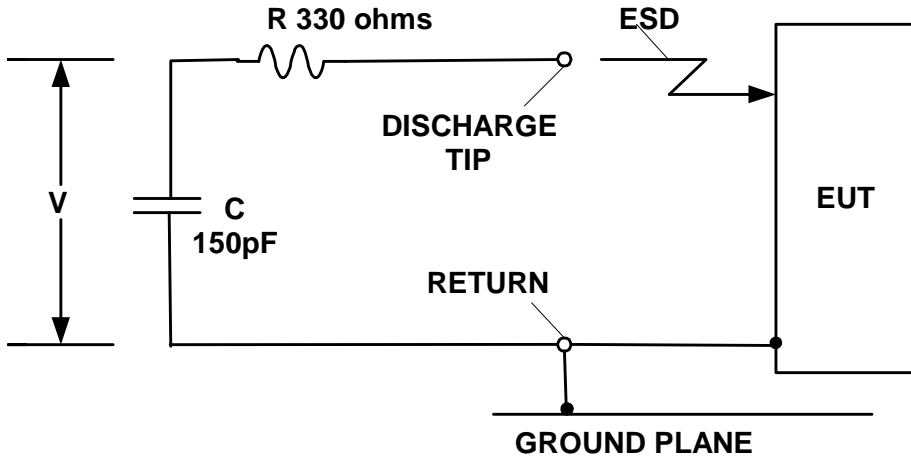
**Panel**

**Plate Form**



**Westar FPM-510  
Display Contrast /  
Response time /  
View angle Analyzer**

**C. ESD ON AIR DISCHARGE MODE**



## APPENDIX 3: PRECAUTIONS

### A. RESIDUE IMAGE

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.