

Preliminary Specification

PRODUCT NAME: 2.4 inch Mono Colour OLED
PRODUCT NO.: PMO9704

CUSTOMER
APPROVED BY
DATE:

Pacer PLC APPROVED

REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
X01	INITIAL RELEASE	2006. 03. 13	
X02	-Add the information of module weight -Add the panel electrical specification - Modify standby mode luminance - Modify CIE specification	2006. 03. 24	Page 5 & 8

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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. 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, which are either not addressed, or are exceptions to the supporting documents.

Pacer PLC 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"). Pacer PLC 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, Pacer PLC 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 Emission Diode.
- Color : Yellow
- Panel matrix : 128*64
- Driver IC : SSD1303T10
- Excellent Quick response time : 10 μ s
- Extremely thin thickness for best mechanism design : 2.05 mm
- High contrast : 500:1
- Wide viewing angle : 160 \square
- Strong environmental resistance.
- Wide range of operating temperature : -40 to 85 $^{\circ}$ C

4. MECHANICAL DATA

NO	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128 (W) x 64 (H)	dot
2	Dot Size	0.4 (W) x 0.4 (H)	mm ²
3	Dot Pitch	0.43 (W) x 0.43 (H)	mm ²
4	Aperture Rate	87	%
5	Active Area	55.01 (W) x 27.49 (H)	mm ²
6	Panel Size	65.5 (W) x 40.0 (H)	mm ²
7	Panel Thickness	2.05 ± 0.1	mm
8	Module Size	75.0 (W) x 52.7 (H) x 9.5 (D)	mm ³
9	Diagonal A/A size	2.4	inch
10	Module Weight	30.2 ± 10%	

5. MAXIMUM RATINGS

ITEM	MIN	MAX	UNIT	Condition	Remark
Supply Voltage (V_{DD})	-0.3	3.5	V	Ta = 25 °C	
Supply Voltage(V_{BAT})	1.8	6	V	Ta = 25 °C	
Operating Temp.	-40	85	°C		
Storage Temp	-40	85	°C		
Humidity		85	%		
Operating Life Time	40,000	-	Hrs	100 cd/m ² , 50% checkerboard	Note (1)
Operating Life Time	50,000	-	Hrs	80 cd/m ² , 50% checkerboard	Note (2)
Operating Life Time	66,000	-	Hrs	60 cd/m ² , 50% checkerboard	Note (3)

Note:

(A) Under $V_{BAT} = 3.3$ V, Ta = 25°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.

6. ELECTRICAL CHARACTERISTICS

6.1 D.C ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETERS	TEST CONDITION	MIN	TYP	MAX	UNIT
V_{BAT}	Analog power supply (For DC-DC circuit)	$T_a = -20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$	2.8	3.3	5	V
V_{DD}	Digital power supply	$T_a = -20\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$	2.4	2.7	3.5	V
I_{DD}	Operating current for V_{DD} $V_{DD} = 2.7\text{V}$, $V_{CC} = 12\text{V}$, $I_{REF} = 10\text{uA}$ No loading, All Display ON	Contrast=FF	-	190	-	uA
I_{CC}	Operating current for V_{CC} $V_{DD} = 2.7\text{V}$, $V_{CC} = 12\text{V}$, $I_{REF} = 10\text{uA}$ All Display ON	Contrast=FF	-	550	-	uA
V_{IH}	High logic input level		$0.8 * V_{DD}$	-	V_{DD}	V
V_{IL}	Low logic input level		0	-	$0.2 * V_{DD}$	V
V_{OH}	High logic output level		$0.9 * V_{DD}$	-	V_{DD}	V
V_{OL}	Low logic output level		0	-	$0.1 * V_{DD}$	V
I_{SEG}	Segment on output current $V_{DD} = 2.7\text{V}$, $V_{CC} = 12\text{V}$, $I_{REF} = 10\text{uA}$, Display on, Segment pin under test is connected with a 20K resistive load to GND	Contrast=FF	-	-	300	uA
		Contrast=AF	-	220	-	uA
		Contrast=5F	-	120	-	uA
		Contrast=0F	-	20	-	uA

Note 1: $V_{DD} = 2.7\text{V}$ $V_{BAT} = 3.3\text{V}$ Frame rate=85Hz No panel attached.

Note 2: The V_{BAT} input must keep in a stable value; ripple and noise are not allowed.

Note 3: V_{CC} is analog power supply for OLED panel (Generated from DC-DC circuit).

6.2 ELECTRO-OPTICAL CHARACTERISTICS

PANEL ELECTRICAL SPECIFICATIONS

PARAMETER	MIN	TYP.	MAX	UNITS	COMMENTS
Normal mode current		138	144	mA	All pixels on (1)
Standby mode current		9	12	mA	Standby mode 10% pixels on (2)
Normal mode power consumption		455.4	475.2	mW	All pixels on (1)
Standby mode power consumption		29.7	39.6	mW	Standby mode 10% pixels on (2)
Normal mode Luminance	60	80		cd/m ²	Display Average
Standby mode Luminance		30		cd/m ²	
CIE _x (Yellow)	0.42	0.46	0.50		x, y (CIE 1931)
CIE _y (Yellow)	0.44	0.48	0.52		
Dark Room Contrast	500:1				
Viewing Angle	160			degree	
Response Time		10		μs	

(1) Normal mode condition :

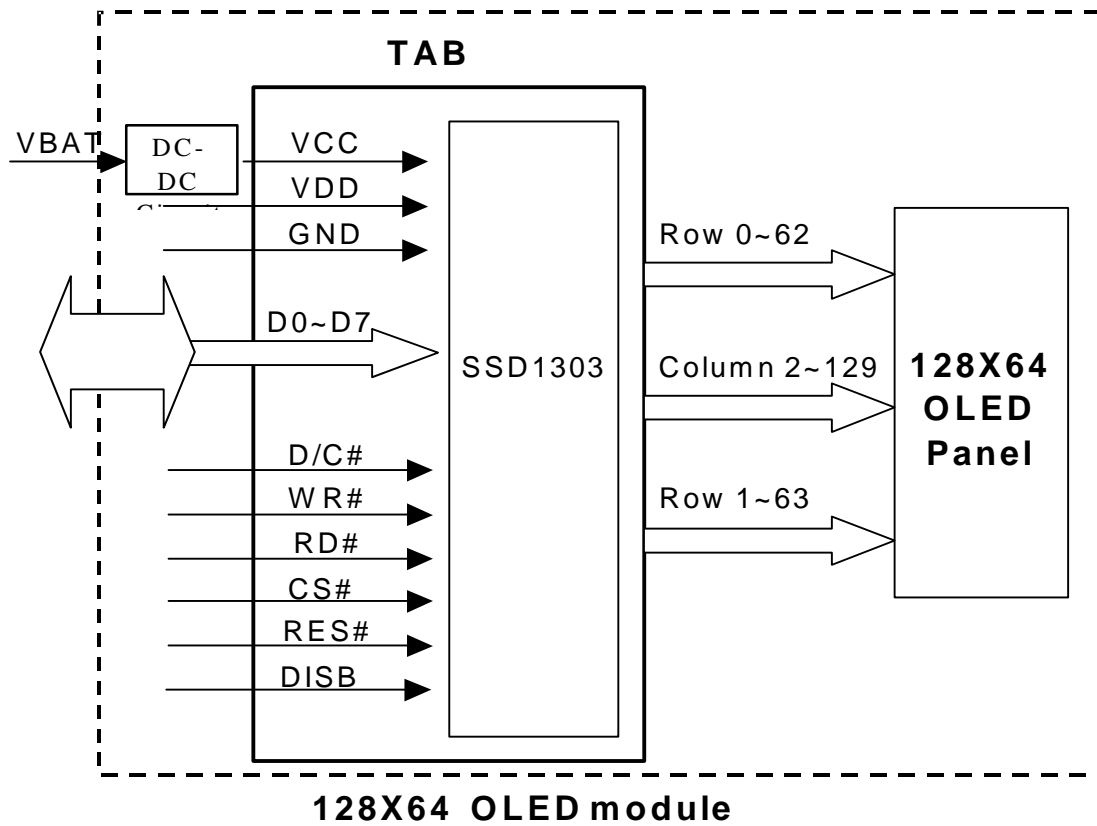
- Driving Voltage : 3.3 V
- Contrast setting : 0x8FH
- Frame rate : 85Hz
- Duty setting : 1/64

(2) Standby mode condition :

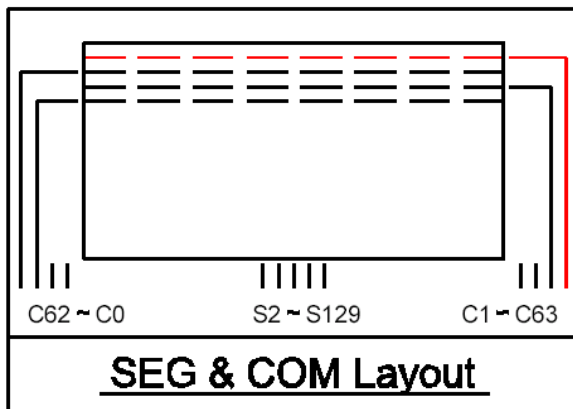
- Driving Voltage : 3.3 V
- Contrast setting : 0x01H
- Frame rate : 85Hz
- Duty setting : 1/64

7. INTERFACE

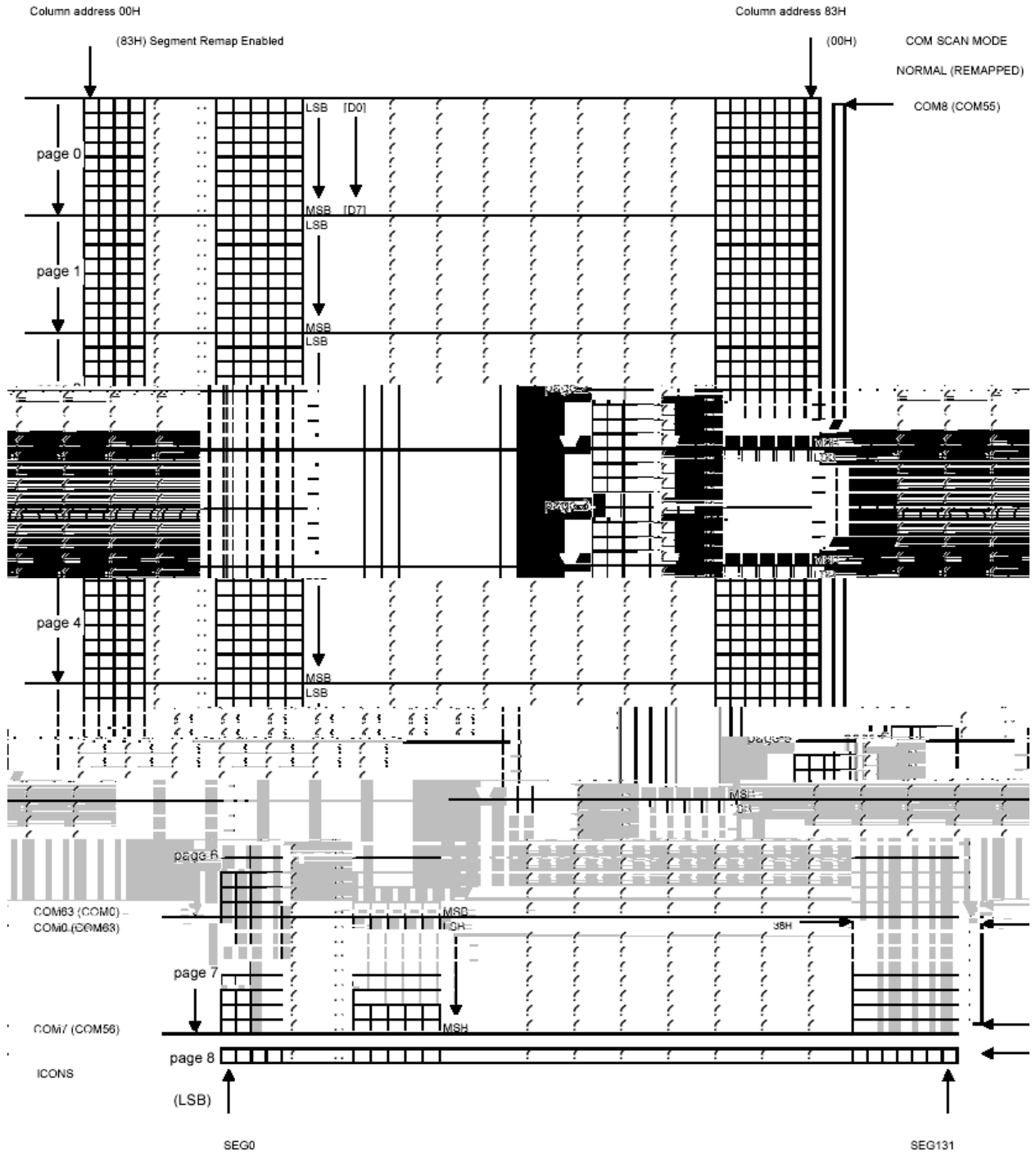
7.1 FUNCTION BLOCK DIAGRAM



7.2 PANEL LAYOUT DIAGRAM

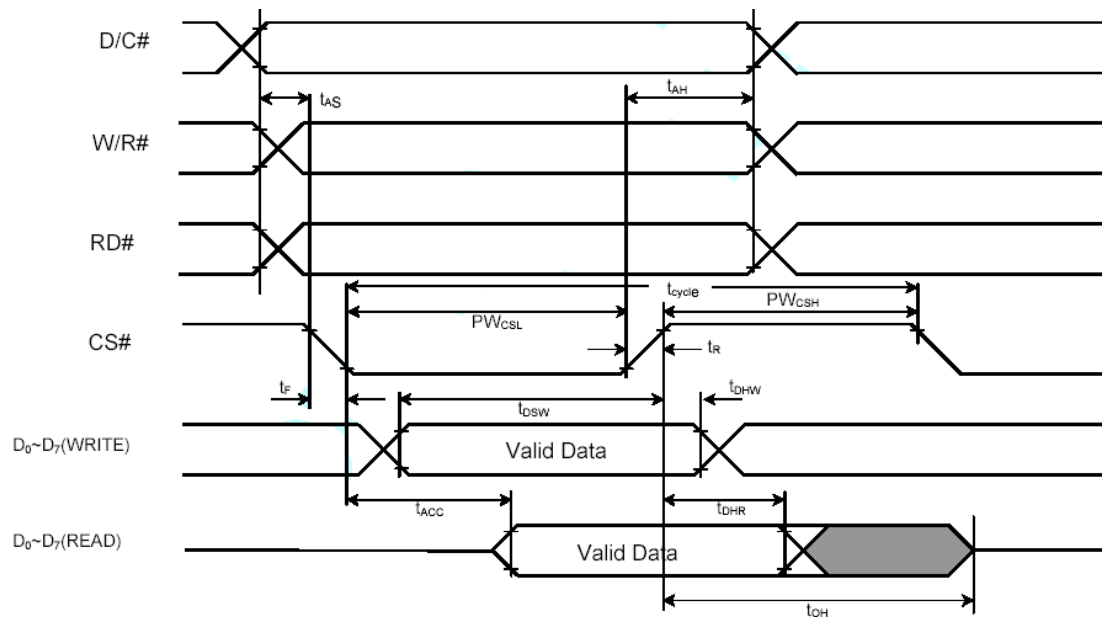


7.4 GRAPHIC DISPLAY DATA RAM ADDRESS MAP



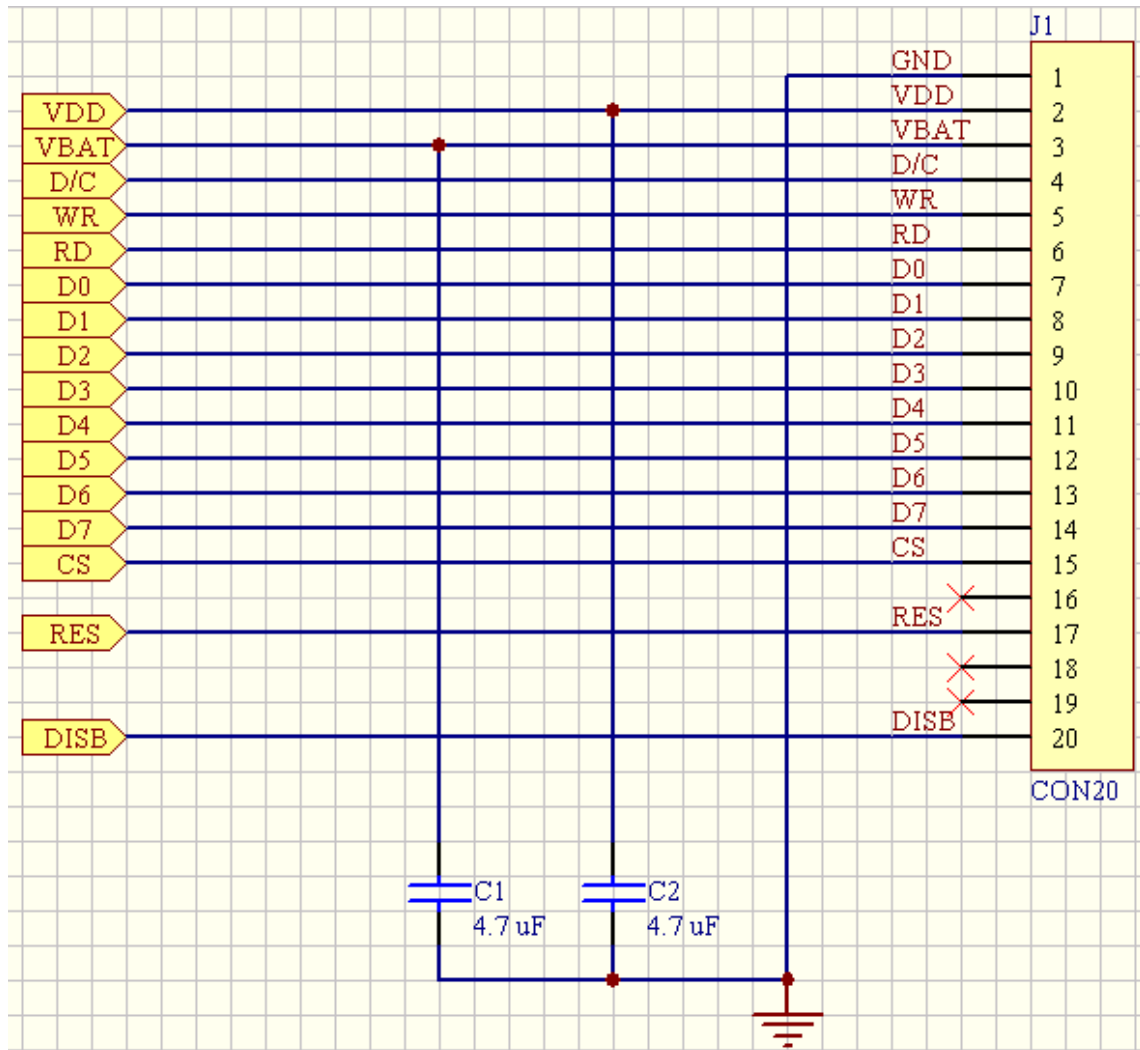
7.5 INTERFACE TIMING CHART

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns



8. APPLICATION CIRCUIT

8.1 APPLICATION CIRCUIT



Recommend component:

The C1 and C2 : 4.7uF/25V

8.2 COMMAND TABLE

Refer to IC Spec.: SSD1303

9. RELIABILITY TEST CONDITIONS

No.	Items	Specification	Quantity
1	High temp. (Non-operation)	85°C, 240hrs	5
2	High temp. (Operation)	85°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, 2 & 4.

Evaluation criteria

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

Revision	Date
02	

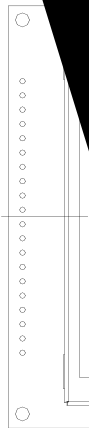
C

D

E

F

G



11. PACKING SPECIFICATION

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.

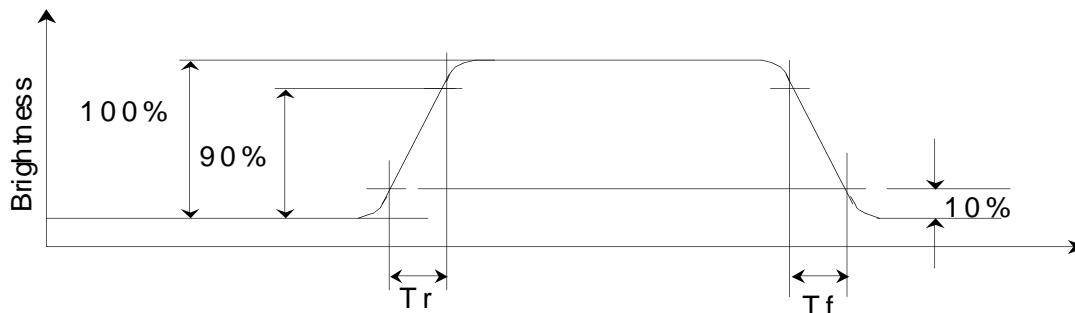


Figure 2 Response time

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.

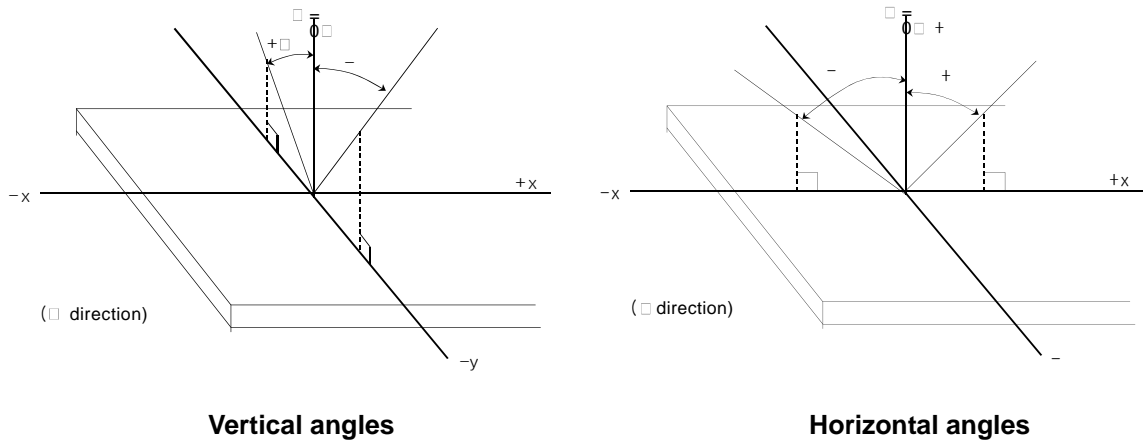
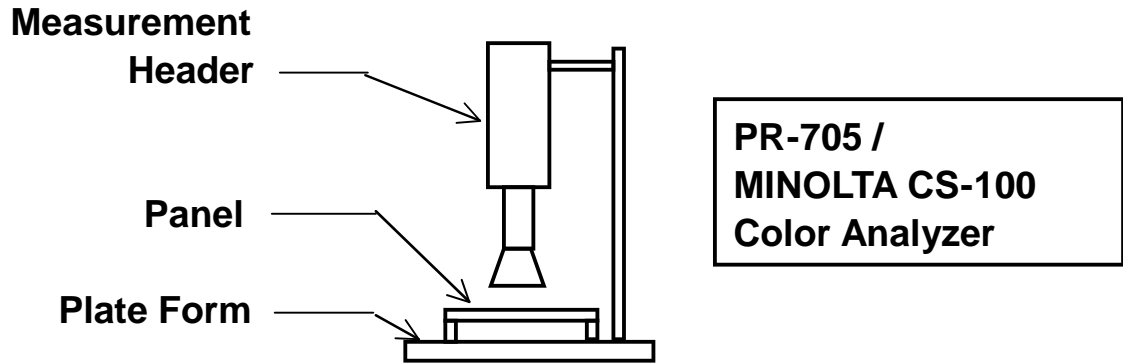


Figure 3 Viewing Angle

APPENDIX 2: MEASUREMENT APPARATUS

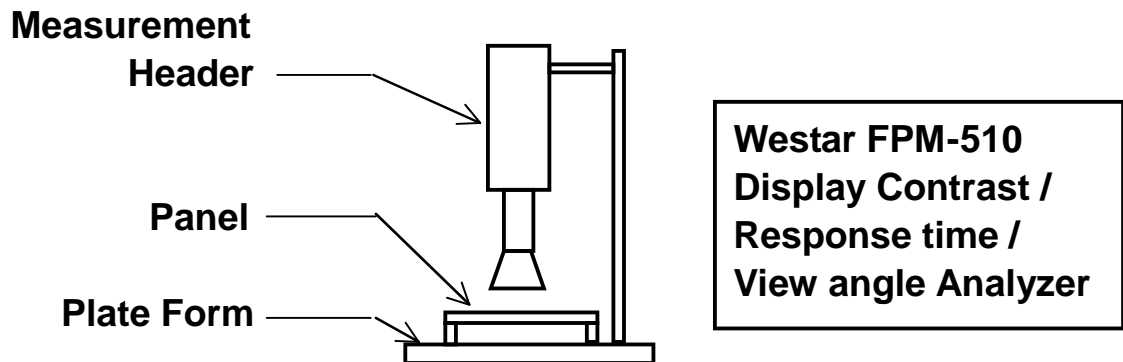
A. LUMINANCE/COLOR COORDINATE

PHOTO RESEARCH PR-705, MINOLTA CS-100

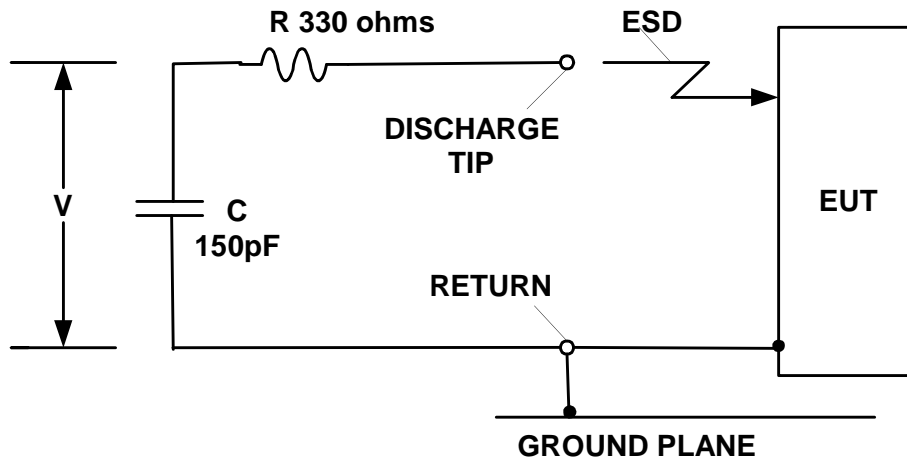


B. CONTRAST / RESPONSE TIME / VIEWING ANGLE

WESTAR CORPORATION FPM-510



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.