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AM37RA-RS250-N

Product Description

- 3.7-inch AMOLED (53.94x90.00mm)
- 16.7M Colors / 2000:1 Contrast Ratio
- 480x800 Pixels
- 24-Bit RGB Interface
- Special Temperature Range

- 2.9V (Analog) / 1.8V (Logic)
- Driver IC: TL2796
- RoHS Compliant

Revision History

Date	Rev. No	Page	Summary
06/06/2024	1.0	All	First issue

Description

This is a color active matrix AMOLED module using Low Temperature Poly-silicon Thin Film Transistors (LTPS TFT) as active switching devices. This module features a 3.7-inch diagonally measured active display area with a resolution of 480 horizontal by 800 vertical pixel arrays. Each pixel is divided into RED and GREEN dots, or BLUE and GREEN dots, where two pixels share RED or BLUE dots arranged in a vertical stripe. The module is capable of displaying up to 16.7M colors.

Features

Input Voltage: 2.9V (Analog) / 1.8V (Logic)

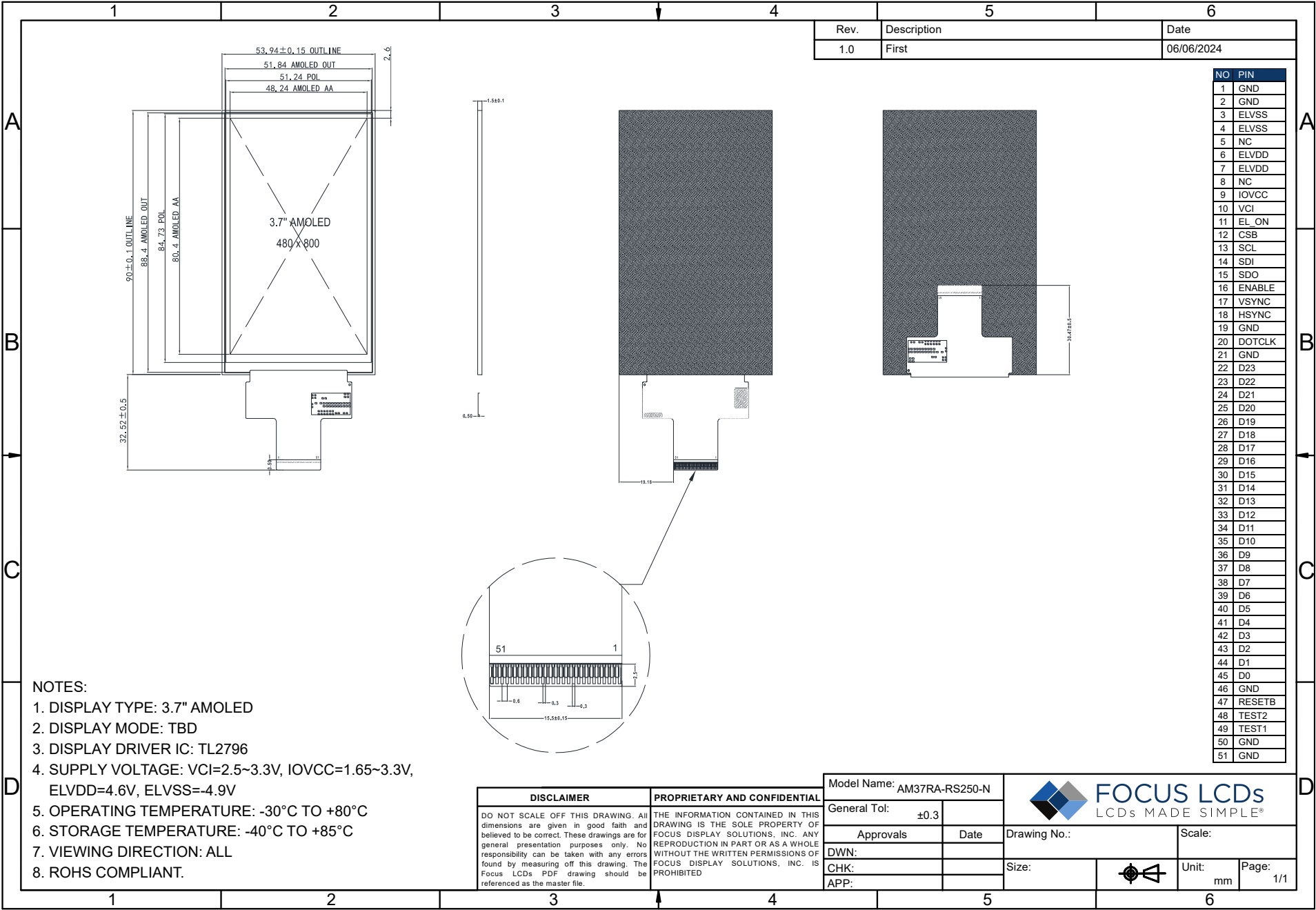
Display Interface: 24-Bit RGB

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area (AA)	48.24(H) x 80.40(V) (3.7 inch)	mm	--
Driver Element	LTPS TFT active matrix	--	--
Display Colors	16.7M	colors	--
Number of Pixels	480(RGB)x800	dots	--
Pixel Arrangement	PenTile (shared RGBG subpixel)	--	--
Viewing Angle	ALL	o'clock	--
Display Driver IC	TL2796	--	--
Operating Temperature	-30 to +80	°C	--
Storage Temperature	-40 to +85	°C	--

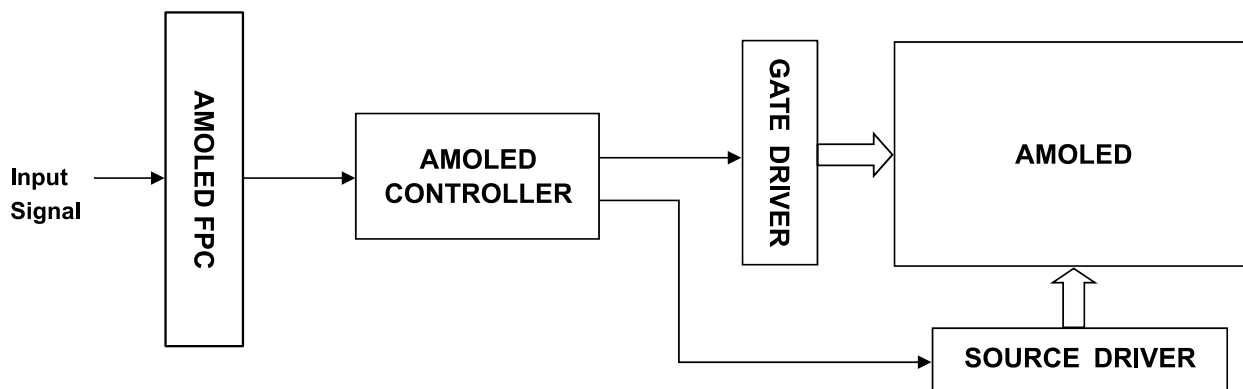
Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	53.94	--	mm	--
	Vertical (V)	--	90.00	--	mm	--
	Depth (D)	--	1.50	--	mm	--
Weight		--	TBD	--	g	--

1. Outline Dimensions



2. Block Diagram



3. Input Terminal Pin Assignment

3.1 Display Pin Assignment

NO.	Symbol	Description	I/O
1	GND	Ground.	P
2	GND	Ground.	P
3	ELVSS	AMOLED power negative.	P
4	ELVSS	AMOLED power negative.	P
5	NC	No connection.	--
6	ELVDD	AMOLED power positive.	P
7	ELVDD	AMOLED power positive.	P
8	NC	No connection.	--
9	IOVCC	Power supply for I/O (1.65-3.3V).	I
10	VCI	Analog voltage (2.5~3.3V).	I
11	EL_ON	DC-DC IC Enable.	O
12	CSB	Chip select signal input (low active).	I
13	SCL	Serial data transfer clock input pin.	I
14	SDI	Serial data input pin.	I
15	SDO	Serial data output pin.	O
16	ENABLE	Data enable signal pin for the RGB interface.	I
17	VSYNC	Vertical sync signal of the RGB interface.	I
18	HSYNC	Horizontal sync signal of the RGB interface.	I
19	GND	Ground.	P
20	DOTCLK	Dot clock signal of the RGB interface.	I
21	GND	Ground.	P
22	D23	Unidirectional DB.	I/O
23	D22	Unidirectional DB.	I/O
24	D21	Unidirectional DB.	I/O
25	D20	Unidirectional DB.	I/O
26	D19	Unidirectional DB.	I/O
27	D18	Unidirectional DB.	I/O
28	D17	Unidirectional DB.	I/O
29	D16	Unidirectional DB.	I/O
30	D15	Unidirectional DB.	I/O
31	D14	Unidirectional DB.	I/O

NO.	Symbol	Description	I/O
32	D13	Unidirectional DB.	I/O
33	D12	Unidirectional DB.	I/O
34	D11	Unidirectional DB.	I/O
35	D10	Unidirectional DB.	I/O
36	D9	Unidirectional DB.	I/O
37	D8	Unidirectional DB.	I/O
38	D7	Unidirectional DB.	I/O
39	D6	Unidirectional DB.	I/O
40	D5	Unidirectional DB.	I/O
41	D4	Unidirectional DB.	I/O
42	D3	Unidirectional DB.	I/O
43	D2	Unidirectional DB.	I/O
44	D1	Unidirectional DB.	I/O
45	D0	Unidirectional DB.	I/O
46	GND	Ground.	P
47	RESETB	Reset signal (0: reset, 1: normal operation).	I
48	TEST2	Test pins (leave open).	--
49	TEST1	Test pins (leave open).	--
50	GND	Ground.	P
51	GND	Ground.	P

4. AMOLED Optical Characteristics

4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Color Gamut		S(%)	vs NTSC	--	105	--	%	(5)
LCM Luminance		L _v	White mode	200	250	300	cd/m ²	(6)
Contrast Ratio		CR	θ=0° Normal viewing angle	2000	--	--	%	(2)
Color Filter Chromaticity	White	W _x		0.2560	0.2960	0.3360		(5)(6)
		W _y		0.2700	0.3100	0.3500		
	Red	R _x		0.6180	0.6580	0.6980		
		R _y		0.3010	0.3410	0.3810		
	Green	G _x		0.1650	0.2050	0.2450		
		G _y		0.6860	0.7260	0.7660		
	Blue	B _x		0.0910	0.1310	0.1710		
		B _y		0.0030	0.0430	0.0830		
OLED Life Time		Hr	50% brightness drop @250 cd/m ² , full white	--	30000	--	hours	--
Option View Direction		ALL						(1)

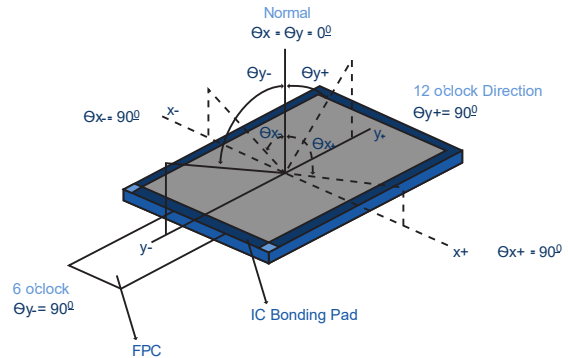
Measuring Conditions:

1. Dark Room
2. Ambient Temperature of 25±2°C
3. 15 Minute Warm up

Optical Specification Reference Notes:

(1) Definition of Viewing Angle:

The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.

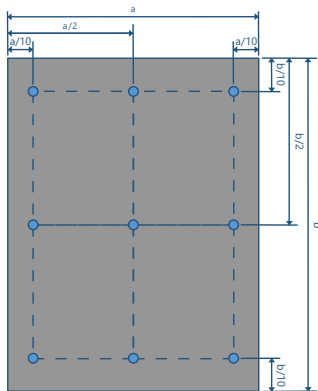


(2) Definition of Contrast Ratio:

Measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

(3) Definition of 9-points Luminance Uniformity Measurement Setup:

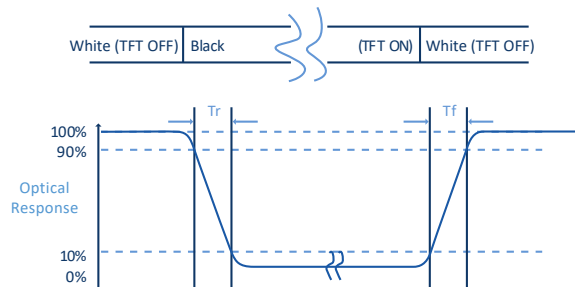


$$Luminance = \frac{(Total Luminance of 9 Points)}{9}$$

$$Uniformity = \frac{Minimum Luminance in 9 Points (1-9)}{Maximum Luminance in 9 Points (1-9)}$$

(4) Definition of Response Time (TR, TF):

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



(5) Definition of Color Gamut:

Measuring machine CFT-01. NTSC's Primaries: $R(x,y,Y)$, $G(x,y,Y)$, $B(x,y,Y)$. FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

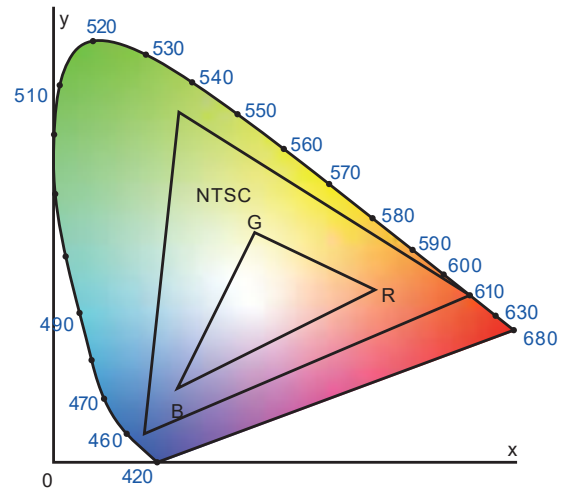
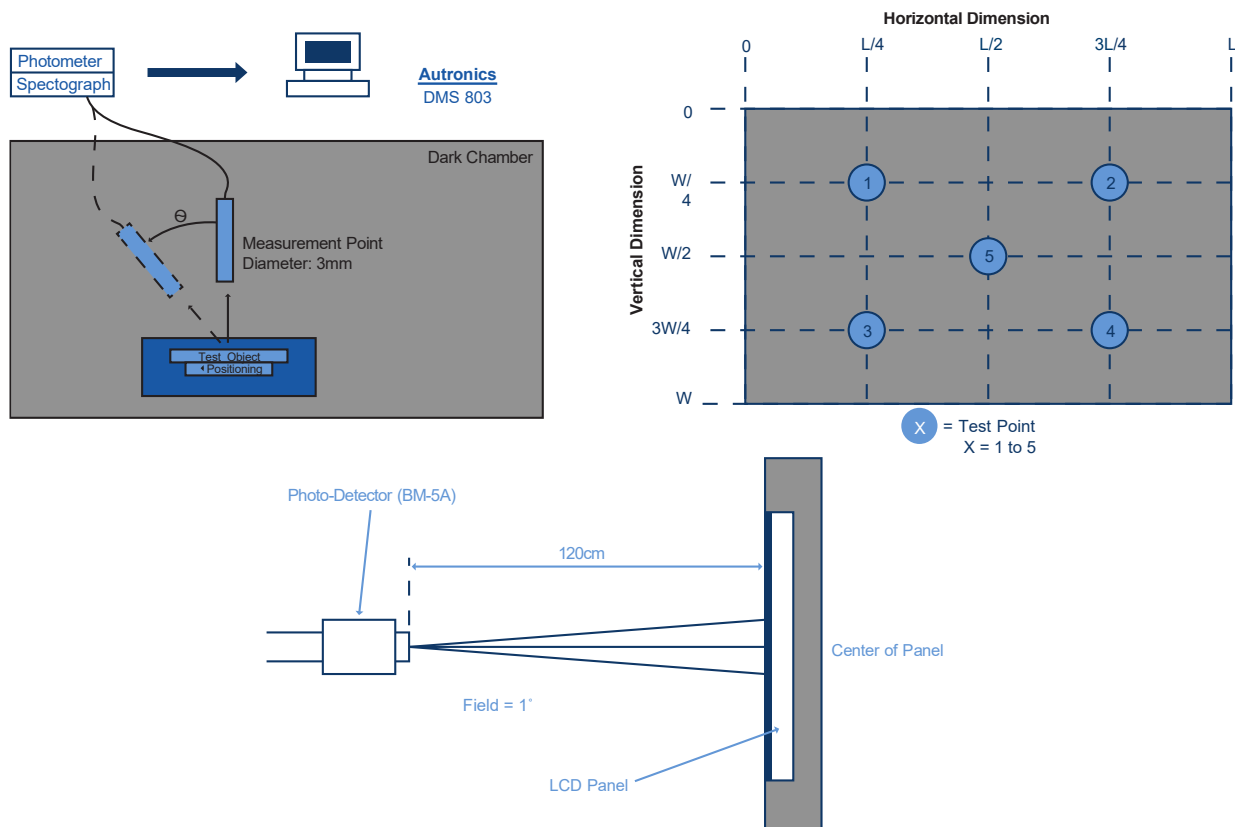


Fig. 1931 CIE Chromaticity Diagram

$$\text{Color Gamut: } S = \frac{\text{Area of RGB Triangle}}{\text{Area of NTSC Triangle}} \times 100\%$$

(6) Definition of Optical Measurement Setup:

The display module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature changes during measuring. In order to stabilize the luminance, the measurement should be executed after displaying a full white pattern for 20 minutes.



5. AMOLED Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25°C)

Characteristics	Symbol	Min	Max	Unit
Digital I/O Supply Voltage	IOVCC	-0.3	3.3	V
Analog Supply Voltage	VCI	-0.3	3.3	V
Operating Temperature	T _{OP}	-30	+80	°C
Storage Temperature	T _{ST}	-40	+85	°C

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min	Typ.	Max	Unit	Note
Analog Supply Voltage	VCI	2.5	2.9	3.3	V	--
Supply Voltage (Logic)	IOVCC	1.65	1.8	3.3	V	--
OLED Positive Source	ELVDD	4.5	4.6	4.7	V	--
OLED Negative Source	ELVSS	-6.2	-4.9	-2.5	V	--
Level Input Voltage	V _{IH}	0.8*IOVCC	--	IOVCC	V	--
	V _{IL}	-0.2	--	0.2*IOVCC	V	--
Level Output Voltage	V _{OH}	0.8*IOVCC	--	IOVCC	V	--
	V _{OL}	-0.2	--	0.2*IOVCC	V	--

6. AMOLED AC Characteristics

6.1 Clock Synchronous Serial Interface Timing Characteristics

For the clock synchronous serial interface timing parameters, including chip select setup/hold times, serial clock write/read pulse widths, and data input/output delay times under standard operation, see the table and timing diagram on page 79 of the data sheet for controller IC TL2796. The data sheet can be found here: <https://focuslcds.com/wp-content/uploads/Drivers/TL2796.pdf>

6.2 RGB Interface Timing Characteristics

For parallel RGB display interface timing parameters (16/18/24-bit), including vertical and horizontal sync boundaries, setup/hold times, and clock pulse widths under standard operation, see the table and timing diagram on page 81 of the data sheet for controller IC TL2796. The data sheet can be found here: <https://focuslcds.com/wp-content/uploads/Drivers/TL2796.pdf>

6.3 Reset Timing Characteristics

For hardware reset timing parameters, including the RESETB low-level pulse width (t_{RES}), reset rise time (t_{RES}), and reset cancel time (t_{RT}) under standard operation, see the tables and waveform diagram on page 80 of the data sheet for controller IC TL2796. The data sheet can be found here: <https://focuslcds.com/wp-content/uploads/Drivers/TL2796.pdf>

7. Operating Sequences

7.1 Power On/Off Sequence

For the required power-on and power-off sequencing of the display module, refer to the flowchart and timing intervals detailed on page 71 (Figure Power Set Up Flow) of the controller IC TL2796 data sheet. The data sheet can be found here: <https://focuslcds.com/wp-content/uploads/Drivers/TL2796.pdf>

8. Quality Inspection Standards

For AMOLED quality inspection standards, please see the following link: <https://focuslcds.com/lcd-resources/amoled-quality-inspection-standards/>

9. Cautions and Handling Precautions

9.1 Handling and Assembly Precautions

1. Mount the module firmly to the system without warping, twisting, or applying pressure to the panel, as twisting or pressing can alter the display thickness or cause color tone shifts.
2. Protect the glass display panel from drops, impacts, or excessive force to prevent physical fracturing or internal component damage.
3. Do not press or scratch the soft, fragile surface of the display polarizer.
4. Clean the surface by blowing on it and wiping gently with a dry, soft cloth or absorbent cotton; if needed, moisten only with ethyl alcohol, IPA, or hexane. Do not use water, ketone (e.g., acetone), or aromatic solvents.
5. Do not disassemble or modify the module, as doing so can cause electric shock, dust adhesion, or damage to sensitive internal parts.
6. Wear soft gloves or finger stalls during inspection and assembly to keep the surface clean, and avoid touching the interface connector pins with bare hands.
7. In case internal module contents come into contact with skin, eyes, or mouth, wipe immediately with paper towels or gauze, wash thoroughly with soap and water, and seek medical attention if necessary.
8. Protect internal cables and connectors from forced folding or extreme structural stress during assembly.
9. Ensure the enclosure window is fixed strictly within the designated active viewing area, as display characteristics outside this zone are not guaranteed.

9.2 Electrical and Operational Operating Precautions

1. Maintain an optimum grounded working environment; all operators, assembly tools (e.g., soldering irons), and equipment must be properly grounded to prevent static damage to the C-MOS LSI drivers.
2. Peel off the surface protective film slowly just before final assembly to minimize the generation of electrostatic charges.
3. Connect any unused input terminals to VDD or VSS to protect against static electricity accumulation.
4. Strictly adhere to the recommended Power-On and Power-Off sequences; do not connect or disconnect the module while power is applied, and do not input signals before the logic circuits are powered on.
5. System design must include current-limiting protection on the VDD rail to protect the module against electrical surges.
6. Incorporate a voltage-controllable function in the set module to ensure optimal operating voltages and stable contrast levels.
7. Design enclosures to shield the AMOLED panel from surrounding electromagnetic or environmental interference, and design the module layout considering emitting energy to satisfy EMI standards.
8. Avoid displaying static images for extended periods to mitigate the risk of permanent AMOLED image-sticking (burn-in).
9. Note that display response times may experience severe delays at temperatures lower than the operating range, and normal operation may be disrupted at excessively high temperatures.

9.3 Storage and Transportation Precautions

1. Store modules in environments with temperatures maintained between 0°C to 35°C (recommended) or up to 40°C max, with a relative humidity level below 70% to 80%.
2. Keep modules in a dark place, ensuring they are not directly exposed to sunlight, strong ultraviolet radiation, or prolonged fluorescent light.
3. Avoid storing the module under conditions where condensation can form, as electro-chemical reactions may occur on the pads under high humidity. Never operate the display if dew condensation has occurred inside.
4. Store the modules in clean rooms free from acids, alkalis, or harmful, corrosive gases.
5. During transit, protect modules from falls, violent mechanical shocks, excessive pressing, moisture, and direct sunshine. Handle with care to prevent stressing the circuitry FPC on the bottom side of the panel.