☐ **Preliminary Specification**
■ **Final Specification**

Module	**4.3 Inch Color TFT-LCD Module**
Model Name	**A043FW03 V2**

Customer	**Date**	**Approved by**	**Date**
		Grace Hung	2014/4/24
Checked & Approved by		**Prepared by**	
		Mask Tsai	2014/4/24
Note: This Specification is subject to change without notice.		General Display Business Division / AU Optronics corporation	

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Record of Revision

Version and Date	Page	Old description	New Description
0.0 - 2011/07/27	-	First Draft	
1.0 - 2011/11/2	5		Update Typical Power Consumption
	6		Update Optical Characteristics
	10		Update Absolute Ratings of Environment
	11		Update Power Specification
	14		Update The Input Data Format
	22		Update Reliability Test Criteria (TST condition)
	24		Update Label and Packaging
1.1 - 2011/12/12	20		Update a Power ON/OFF Sequence
1.2 - 2012/09/18	12		5.2.1 Parameter guideline for LED
1.3 - 2013/03/01	12		Remove bracket of LED voltage.
	17,18		Add Tvst,Tchd,Thst,Thhd Update Frame Frequency Delete Sync mode Update Input Timing Diagram
	19		Update Power ON/OFF Sequence
1.4 - 2013/06/28	5	Item – Pixels Unit – mm Specifications – VA	Item – Resolution Unit – dots Specifications – AMVA3
	22	1.5mm, 10~55~10Hz, Sine wave, 2hrs/axis for 3 direction (X, Y, Z)	1.5G, 10~55~10Hz, Sine wave, 2hrs/axis for 3 direction (X, Y, Z)
1.5 - 2014/4/24	5	24 bit paralle RGB	Correct typo - 24 bit parallel RGB
	6	Color Gamut	Color Gamut (NTSC)
	10		Add Digital/LCD Drive Voltage range
	15,16	Pin description - PI	Pin description - P
	24		Update description of 10.1 Shipping Label

1. Operating Precautions

1) Display area (Polarizer) of TFT-LCD Module is easily to be damaged, please be cautious and not to scratch it.
2) Be sure to power off your machine before connecting or disconnecting your signal cable to TFT-LCD Module.
3) Wipe off water drop on display area immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
5) Display area (Glass) of TFT-LCD Module may be broken or cracked if bump Module against hard object.
6) To avoid ESD (Electro Static Discharde) damage, be sure to ground yourself before handling TFT-LCD Module.
7) Do not open nor modify the TFT-LCD module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if TFT-LCD module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED Reflector edge. Instead, press at the far ends of the LED Reflector edge softly. Otherwise the TFT-LCD Module may be damaged.
10) When inserting or removing of your signal cable to TFT-LCD Module, be sure not to apply abnormal force (rotate, tilt…etc.) to the Connector of the TFT-LCD Module.
11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time.
14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.

2. General Description

A043FW03 V2 is designed for Parchinko applications with WQVGA (480 x RGB x 272) resolution and 16.7M colors (RGB 8-bits). It is composed of a TFT-LCD panel, driver ICs and backlight unit.

2.1 Display Characteristics

The following items are A043FW03 V2 characteristics summary at 25 ℃(Room Temperature).

Items	Unit	Specifications
Screen Diagonal	inch	4.3
Active Area	mm	95.04(H)×53.856(V)
Resolution	dots	480RGB(H)×272(V)
Pixel Pitch	mm	0.198(H)×0.198(V)
Pixel Arrangement	--	R.G.B. Vertical Stripe
Display Mode	--	AMVA3, Normally Black
Nominal Input Voltage VDD	Volt	3.3(typ)
Typical Power Consumption	Watt	0.75(typ)
Weight	Grams	45(typ)
Physical Size	mm	105.5(H) × 67.2(V) × 2.9(D) (typ.)
Electrical Interface	--	24 bit parallel RGB
Surface Treatment	--	Anti-Glare, Hardness 3H
Support Color	--	16.7M Colors
Temperature Range Operating Storage (Non-Operating)	 ℃ ℃	 -20 to +70 -30 to +80
RoHS Compliance	--	RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature).

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	cd/m2	I_{LED} =22mA, D_{PWM}=100% (center point)	375	500	-	Note 1
Uniformity	%	9 Points	70	75		Note 1, 2, 3
Contrast Ratio			400	800	-	Note 4
Response Time	msec	Rising	-	17	22	Note 5
	msec	Falling	-	15	20	
	msec	Rising + Falling	-	32	42	
Viewing Angle	degree degree	Horizontal (Right) CR = 10 (Left)	70 70	80 80	- -	Note 6
	degree degree	Vertical (Upper) CR = 10 (Lower)	70 70	80 80	- -	
Color / Chromaticity Coordinates (CIE 1931)		White x	0.268	0.318	0.368	
		White y	0.285	0.335	0.385	
		Red x	0.553	0.603	0.653	
		Red y	0.310	0.360	0.410	
		Green x	0.277	0.327	0.377	
		Green y	0.529	0.579	0.629	
		Blue x	0.097	0.147	0.197	
		Blue y	0.066	0.116	0.166	
Color Gamut (NTSC)	%		-	50	-	

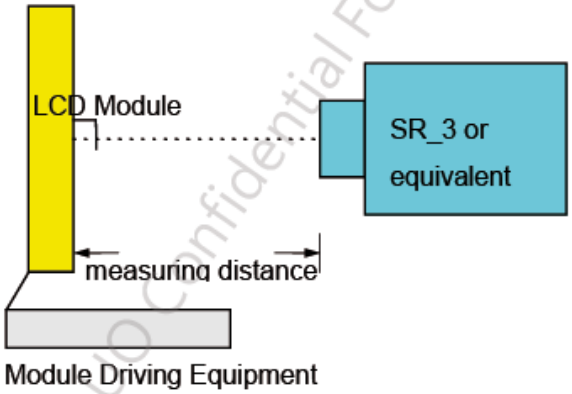
Note 1: Measurement method

Equipment: Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

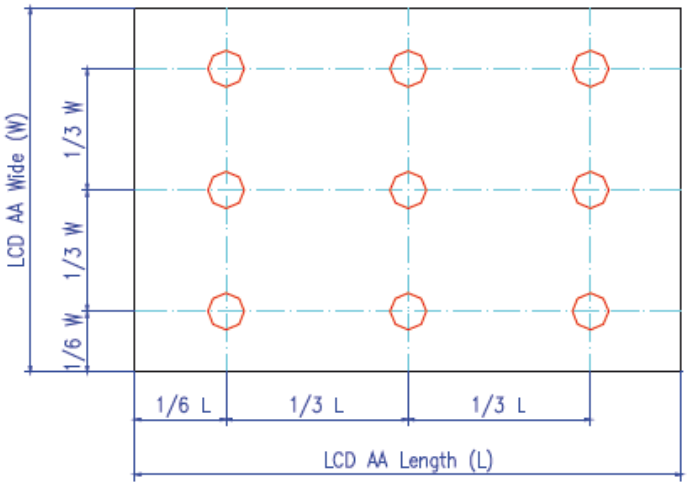
Aperture: 1° with 50cm viewing distance

Test Point: Center

Environment: *< 1 lux*



Note 2: Definition of 9 points position (Display active area: 95.04mm(W) x 53.856mm(H))



Note 3:
The luminance uniformity of 9 points is defined by dividing the maximum luminance value by the minimum luminance value at full white condition.

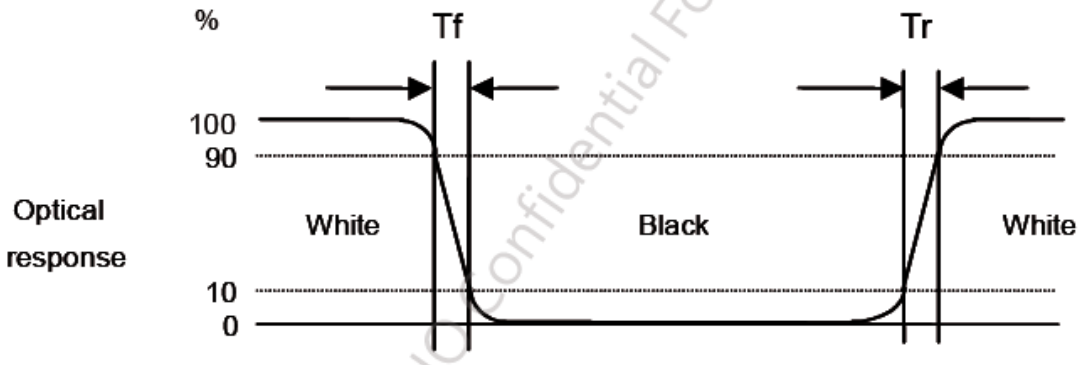
$$\delta_{W5} = \frac{\text{Maximum Brightness of nine points}}{\text{Minimum Brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness @ "White" state}}{\text{Brightness @ "Black" state}}$$

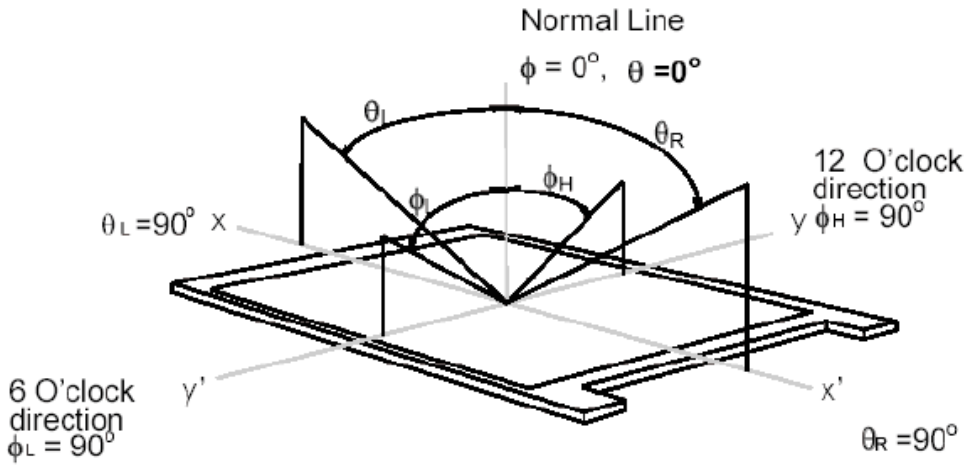
Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval definition is between 10% and 90% of amplitude. Please refer to the figure as below.



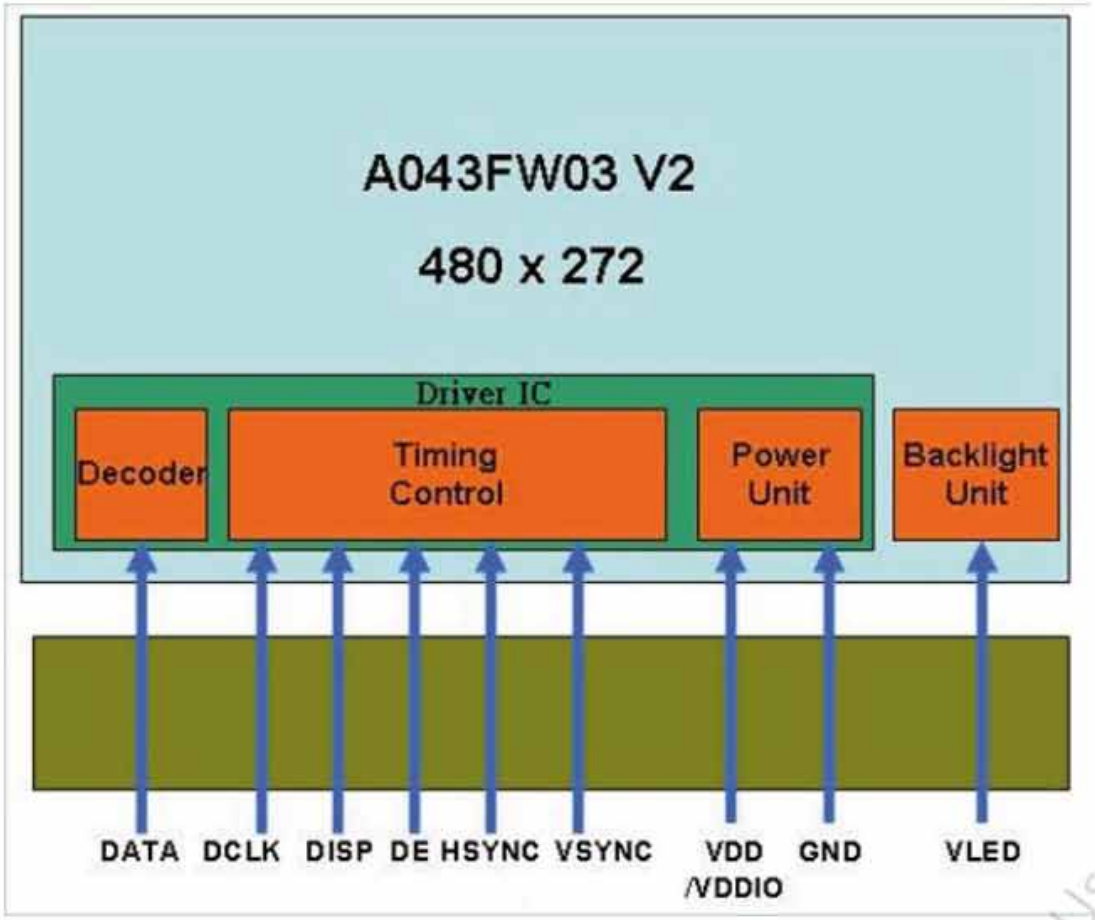
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over 180° horizontal and 180° vertical range. The 180° horizontal (θ_L, θ_R) and 180° vertical (Φ_H, Φ_L) range are illustrated as following figure.



3. Functional Block Diagram

The following diagram shows the functional block of the A043FW03 V2 color TFT/LCD module.



4. Absolute Maximum Ratings

4.1 Absolute Ratings

Item	Symbo	Min	Max	Unit	Remark
Logic/LCD Drive Voltage	VDD	-0.3	4.5	Volt	Ta= 25°C
Digital/LCD Drive Voltage	VDDIO	-0.3	4.5	Volt	Ta= 25oC
LCD Input Signal Voltage	VIN	-0.3	4.5	Volt	Ta= 25oC
LED BLU Drive Current	V_{LED}	-	25	mA	Ta= 25°C

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Remark
Operating Temperature	TOP	-20	70	℃	Note 1, 2
Operation Humidity	HOP	5	90	%RH	Note 1, 2
Storage Temperature	TST	-30	80	℃	Note 1
Storage Humidity	HST	5	90	%RH	Note 1

Note 1: Maximum Wet-Bulb should be 39℃ and no condensation.

Note 2: Only operation is guaranteed. Optical performance should be evaluated at 25℃ only.

5. Electrical Characteristics

5.1 TFT-LCD Driving

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Analog/LCD Drive Voltage	3	3.3	3.6	Volt	
VDDIO	Digital/LCD Drive Voltage	3	3.3	3.6	Volt	
IVDD	VDD Current	---	11	13	mA	All Black Pattern (VDD=3.3V, at 60Hz)
IVDDIO	VDDIO Current	---	0.1	0.3	mA	All Black Pattern (VDD=3.3V, at 60Hz)
PVDD	VDD Power	---	0.04	0.05	Watt	All Black Pattern (VDD=3.3V, at 60Hz)
PVDDIO	VDDIO Power	---	0.33	1.08	mWatt	All Black Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	---	---	100	mVp-p	All Black Pattern (VDD=3.3V, at 60Hz)

5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDDIO is off.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Input Signal Voltage	High	VIH	0.7*VDDIO	-	VDDIO	Volt	
	Low	VIL	GND	-	0.3*VDDIO	Volt	

5.2 Backlight Unit Driving

5.2.1 Parameter guideline for LED

Following characteristics are measured under stable condition at 25℃ (Room Temperature).

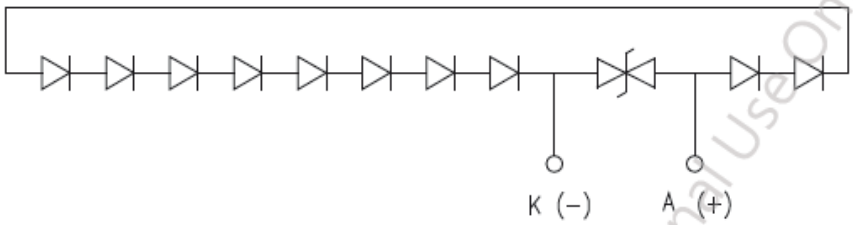
Symbol	Parameter	Min	Typ	Max	Units	Remark
V_{LED}	Input Voltage	-	32	35	Volt	Ta = 25 ℃
I_{LED}	Input Current	-	0.022	-	A	Ta = 25 ℃
P_{LED}	Power Consumption	-	0.704	0.77	W	Ta = 25 ℃
Operating Life		10000	-	-	Hrs	Ta = 25 ℃, I_{LED} = 22mA Note 3,4

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: I_{LED}, V_{LED} are defined for one channel LED. There is one LED channels in back light unit.

Note 3: If A043FW03 V2 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 4: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

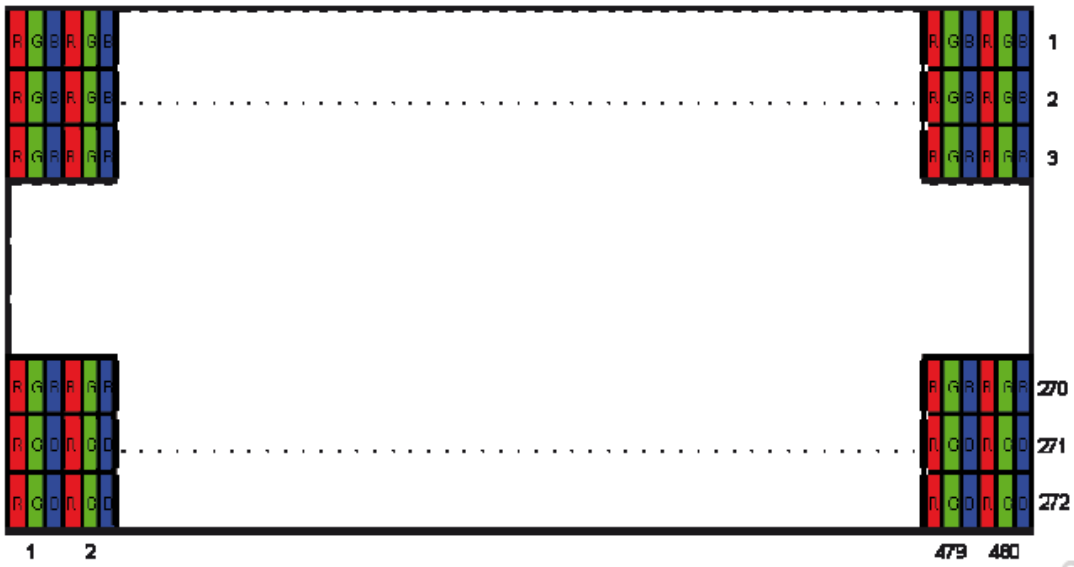


Circuit Diagram

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



6.2 The Input Data Format

This product displays 16.7M colors in terms of the 256 grey levels on RGB respectively.

Display colors		Data signal (0 : Low level, 1: High level)																									
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑ ↓																								
	bright																								
		1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑ ↓																								
	bright																								
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑ ↓																								
	bright																								
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.3 TFT- LCD Interface Signal Description

Recommended connector: FH12-50S-0.5SH

Pin no	Symbol	I/O	Description	Remark
1	GND	G	GND	
2	GND	G	GND	
3	VDD	P	Power supply for analog circuit	
4	VDDIO	P	Power supply for digital interface	
5	R0	I	Red Data Signal (LSB)	
6	R1	I	Red Data Signal	
7	R2	I	Red Data Signal	
8	R3	I	Red Data Signal	
9	R4	I	Red Data Signal	
10	R5	I	Red Data Signal	
11	R6	I	Red Data Signal	
12	R7	I	Red Data Signal (MSB)	
13	G0	I	Green Data Signal (LSB)	
14	G1	I	Green Data Signal	
15	G2	I	Green Data Signal	
16	G3	I	Green Data Signal	
17	G4	I	Green Data Signal	
18	G5	I	Green Data Signal	
19	G6	I	Green Data Signal	
20	G7	I	Green Data Signal (MSB)	
21	B0	I	Blue Data Signal (LSB)	
22	B1	I	Blue Data Signal	
23	B2	I	Blue Data Signal	
24	B3	I	Blue Data Signal	
25	B4	I	Blue Data Signal	
26	B5	I	Blue Data Signal	
27	B6	I	Blue Data Signal	
28	B7	I	Blue Data Signal (MSB)	
29	GND	G	GND	
30	DCLK	I	Pixel clock	
31	DISP	I	Display on/off signal	
32	HSYNC	I	Horizontal synchronizing signal	
33	VSYNC	I	Vertical synchronizing signal	
34	DE	I	Data enable	
35	GND	G	GND	

36	GND	G	GND	
37	GND	G	GND	
38	GND	G	GND	
39	GND	G	GND	
40	GND	G	GND	
41	GND	G	GND	
42	GND	G	GND	
43	GND	G	GND	
44	GND	G	GND	
45	GND	G	GND	
46	VLED-	P	LED backlight cathode	
47	GND	G	GND	
48	VLED+	P	LED backlight anode	
49	GND	G	GND	
50	GND	G	GND	

I: Input pin; P: Power pin; G: Ground pin;

6.4 TFT- LCD Interface Timing

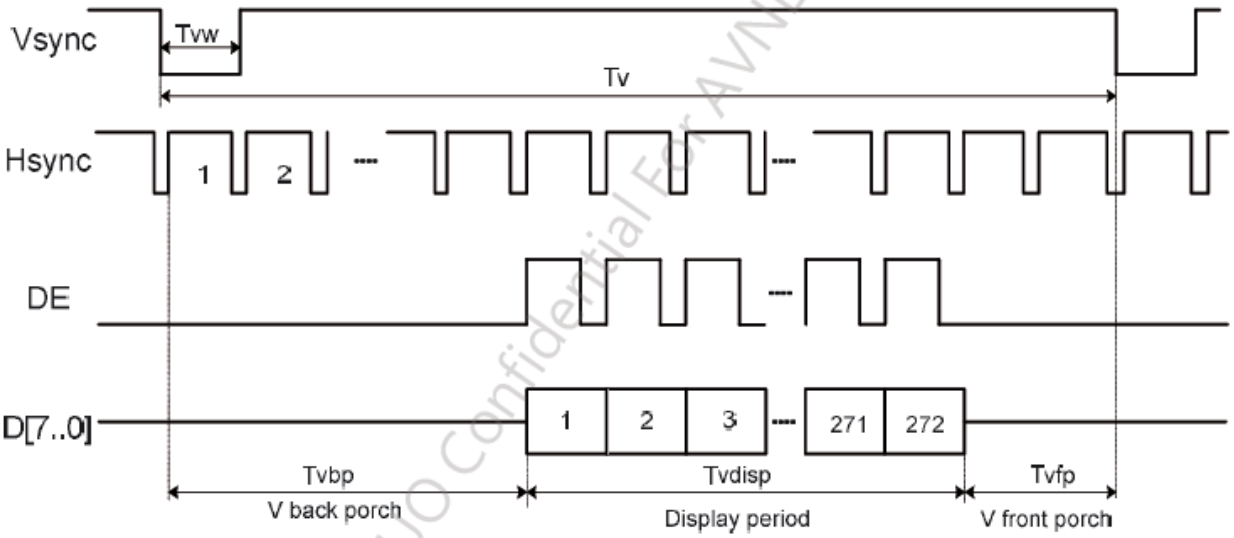
6.4.1 Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	Frequency	1/Tdclk	5	9.2	12	MHz	
	CLK pulse duty	Tcwh	40	--	--	ns	
	CLK pulse duty	Tcwl	40	--	--	ns	
Vsync	Setup Time	Tvst	12	--	--	ns	
	Hold Time	Tvhd	12	--	--	ns	
Hsync	Setup Time	Thst	12	--	--	ns	
	Hold Time	Thhd	12	--	--	ns	
Data	Setup Time	Tdsu	12	--	--	ns	
	Hold Time	Tdhd	12	--	--	ns	
DE	Setup Time	Tdesu	12	--	--	ns	
	Hold Time	Tdehd	12	--	--	ns	
Frame Rate	Frequency		55	60	65	Hz	
1 Frame Scanning Time	Cycle	Tv	275	288	335	H	
	Display Period	Tvdisp		272		H	
	Front porch	Tvfp	1	4	--	H	
	Pulse width	Tvw	1	10	--	H	
	Back porch	Tvbp	2	12	--	H	
1 Line Scanning Time	Cycle	Th	490	531	605	DCLK	
	Display Period	Thdisp		480		DCLK	
	Front porch	Thfp	2	8	--	DCLK	
	Pulse width	Thw	1	--	--	DCLK	
	Back porch	Thbp	8	43	--	DCLK	

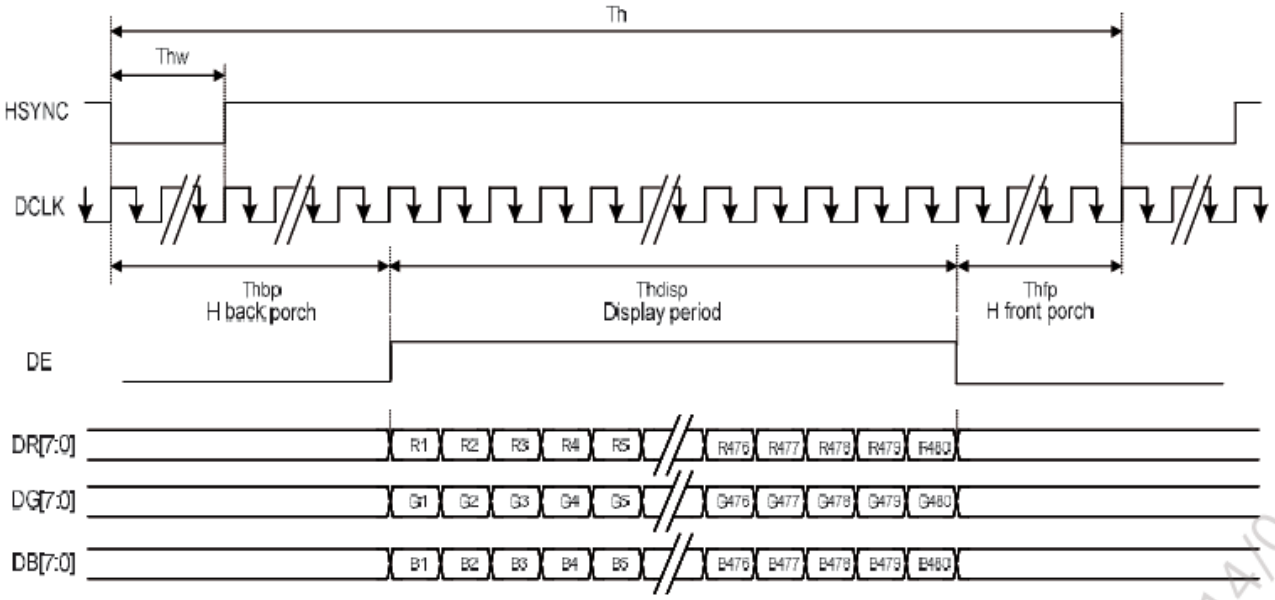
Note 1: Recommended frame rate is 60 Hz.

6.4.2 Input Timing Diagram

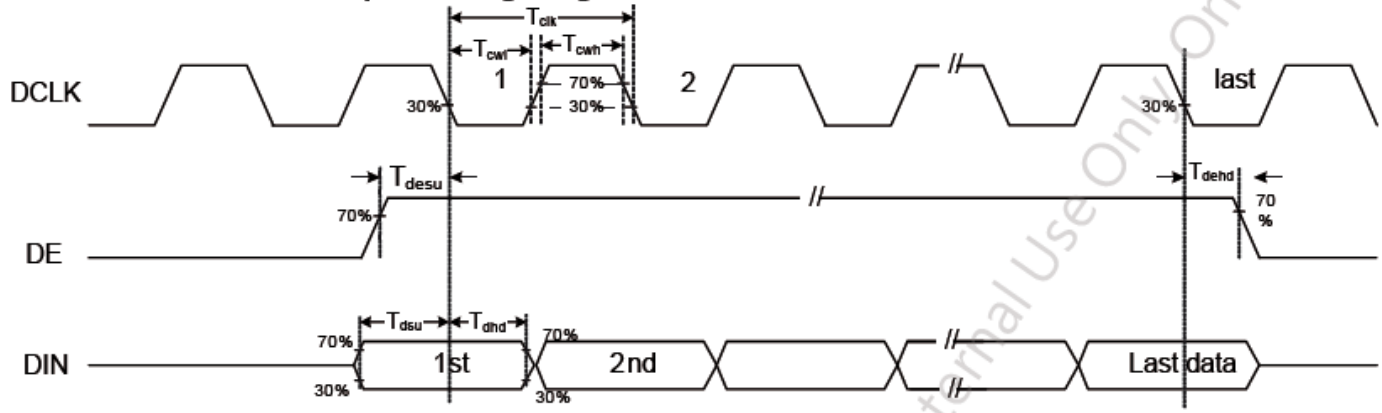
Vertical Timing of Input (Sync-DE mode)

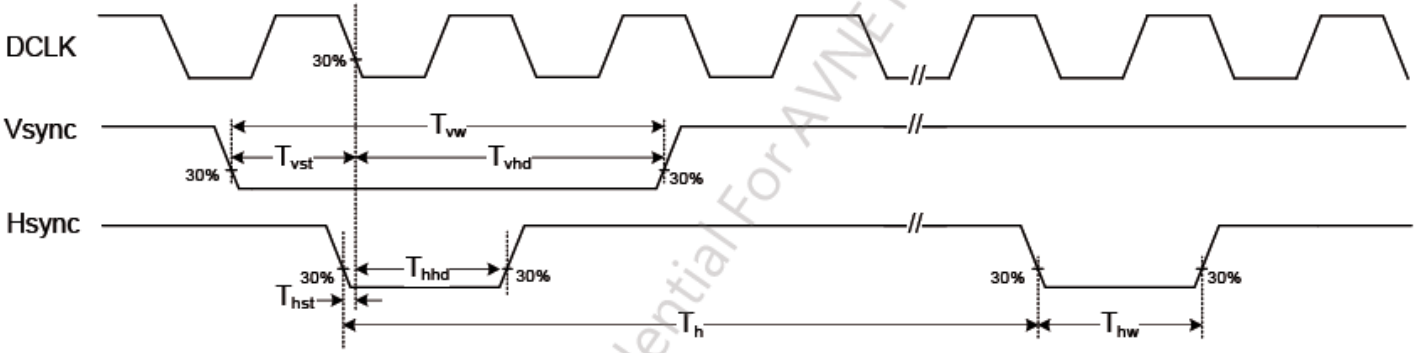


Horizontal Timing of Input (Sync-DE mode)



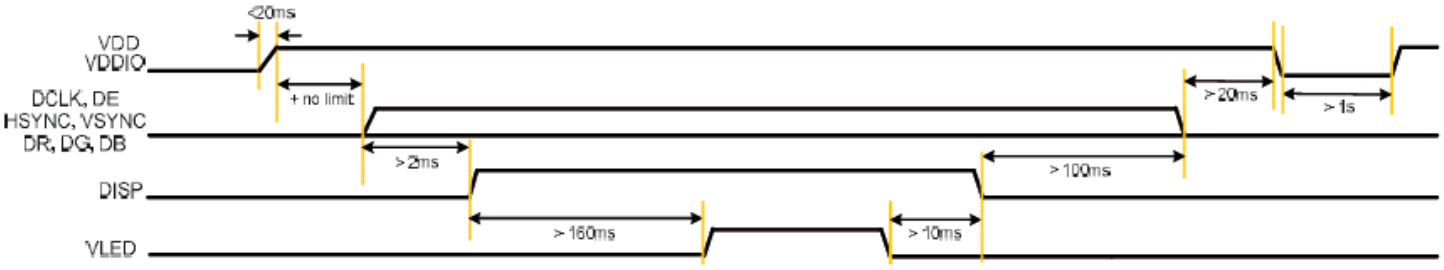
Clock and data input timing diagram





6.5 Power ON/OFF Sequence

VDD power, LCD interface signals and backlight on/off sequence are shown in the following chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Note 1 : The driver IC default is on standby mode. It can be changed to normal operation by using DISP hardware pin.

Note 2 : ON/OFF sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

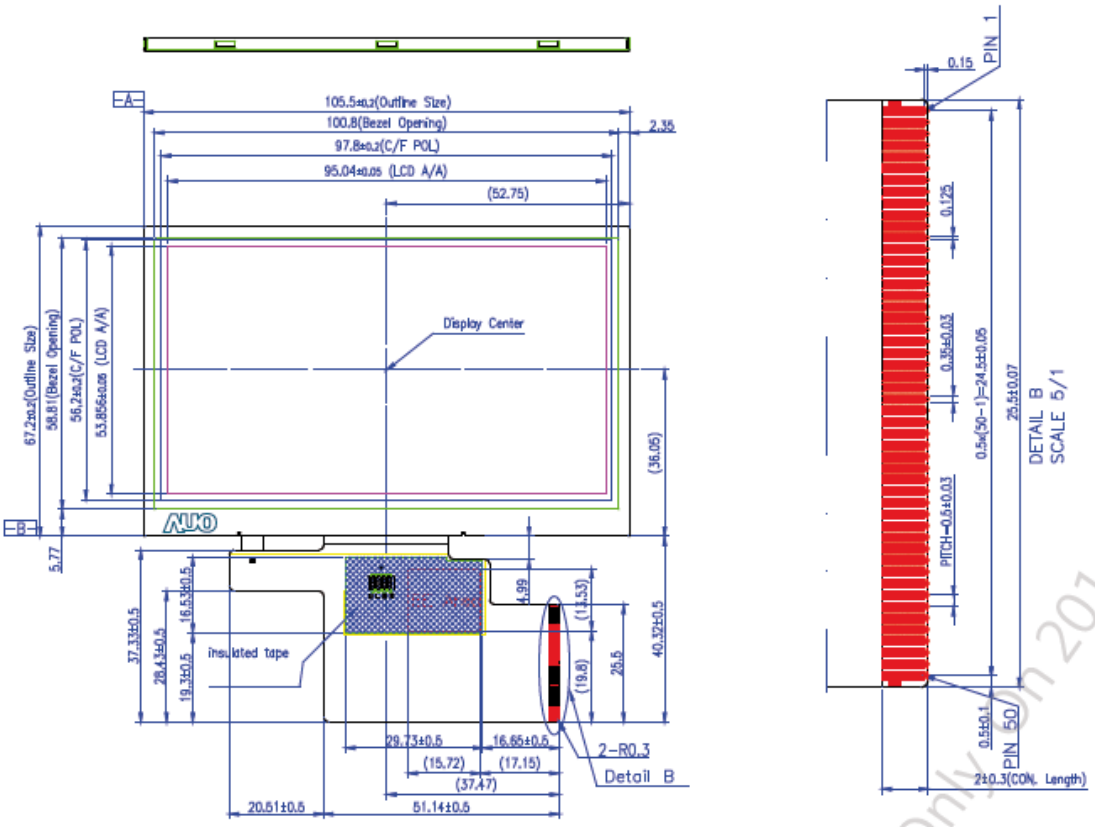
7. Connector & Pin Assignment

7.1 TFT- LCD Signal (CN1): LCD Connector

Mating Manufacturer	Hirose
Mating Connector Model Number	FH12-50S-0.5SH

Pin#	Symbol	Pin#	Symbol	Pin#	Symbol
1	GND	19	G6	37	GND
2	GND	20	G7	38	GND
3	VDD	21	B0	39	GND
4	VDDIO	22	B1	40	GND
5	R0	23	B2	41	GND
6	R1	24	B3	42	GND
7	R2	25	B4	43	GND
8	R3	26	B5	44	GND
9	R4	27	B6	45	GND
10	R5	28	B7	44	GND
11	R6	29	GND	45	GND
12	R7	30	DCLK	46	VLED-
13	G0	31	DISP	47	GND
14	G1	32	HSYNC	48	VLED+
15	G2	33	VSYNC	49	GND
16	G3	34	DE	50	GND
17	G4	35	GND		
18	G5	36	GND		

7.2 PIN definition of FPC and LED PIN definition



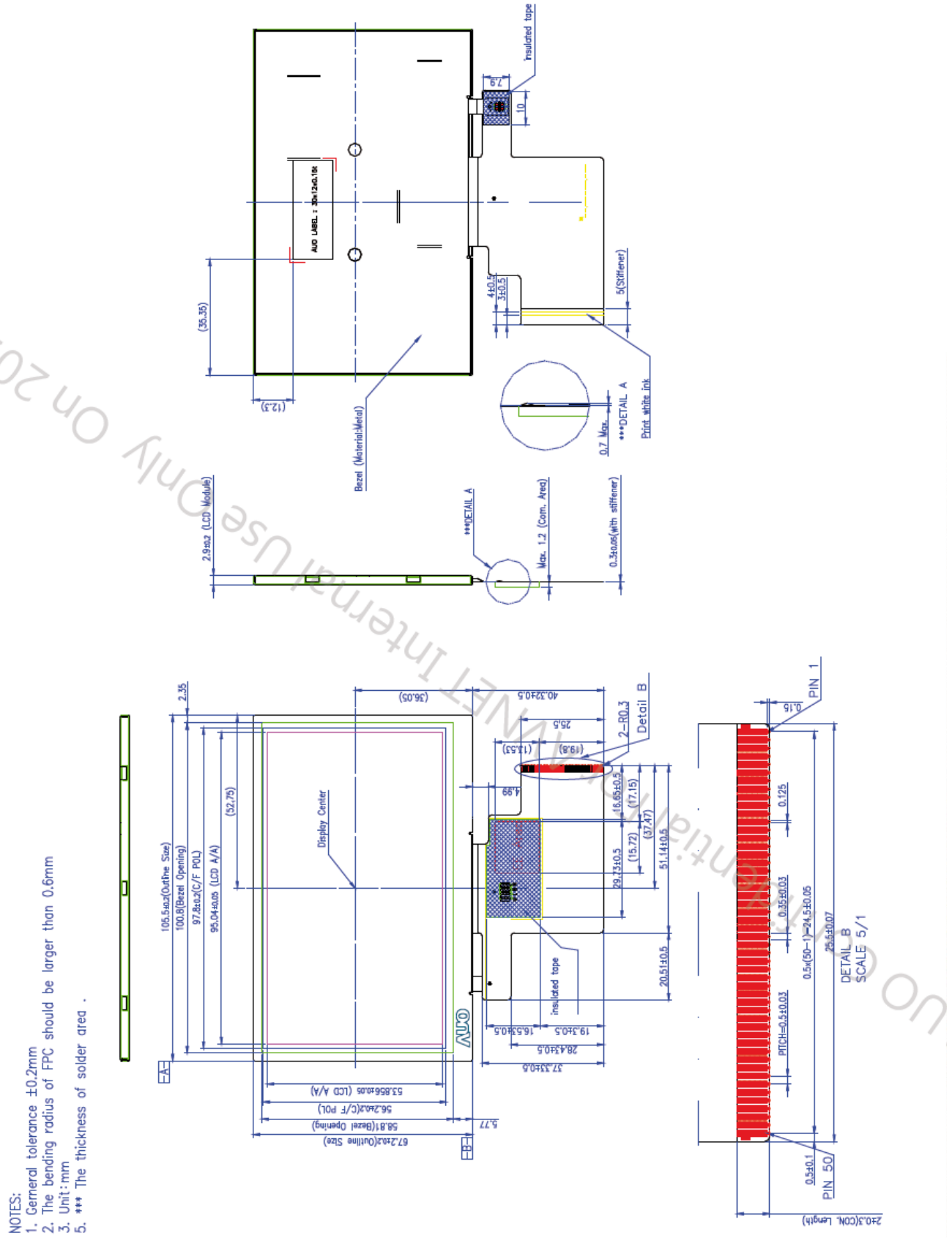
8. Reliability Test Criteria

Items	Required Condition	Remark
Temperature Humidity Bias	60℃/90%,240Hr	Note
High Temperature Operation	70℃,240Hr	Note
Low Temperature Operation	-20℃,240Hr	Note
High Temperature Storage	80℃,240 hours	Note
Low Temperature Storage	-30℃,240 hours	Note
Thermal Shock Test	-30℃/30 min ,70℃/30 min ,100cycles	Note
Shock Test (Non-Operating)	100G, 6ms for ±x, ±y, ±z; 6 directions	Note
Vibration Test (Non-Operating)	1.5G, 10~55~10Hz, Sine wave, 2hrs/axis for 3 direction (X, Y, Z)	Note

Note:

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.
- No function failure occurs.

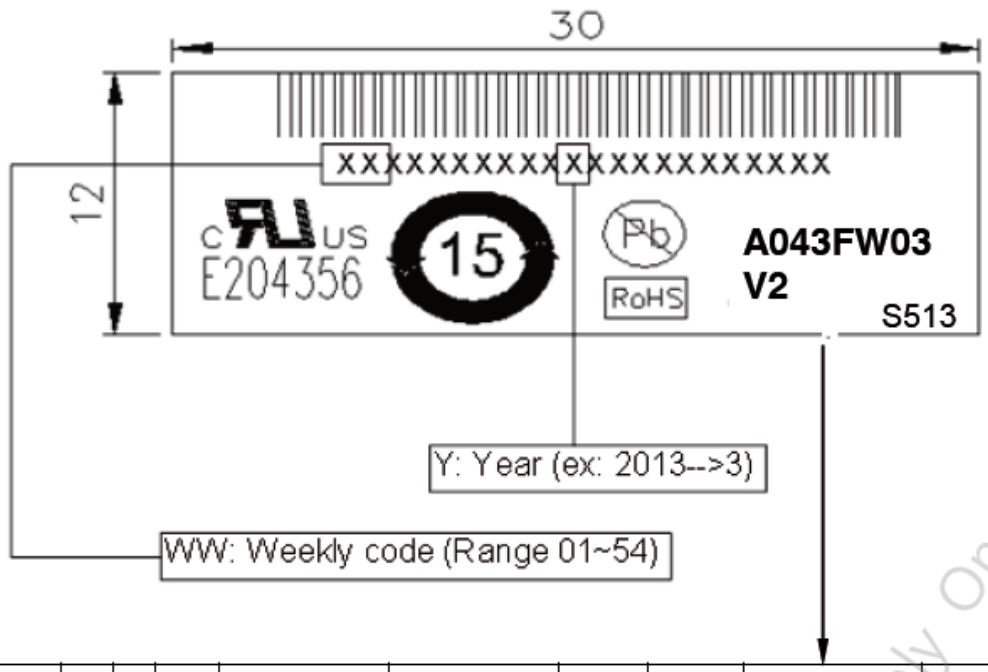
9. Mechanical Characteristics



NOTES:
1. General tolerance ±0.2mm
2. The bending radius of FPC should be larger than 0.6mm
3. Unit : mm
5. *** The thickness of solder area .

10. Label and Packaging

10.1 Shipping Label (on the rear side of TFT-LCD display)



1	2	3	4	5	6	8	9	10	11
A	0	4	3	F	W	0	3	V	2
Application A: AV C: Car G: GD	Size (4.3 inch)			Resolution (WQVGA, 480×272)	Technology Format (Wide format)	Serial No.		Version	Version No

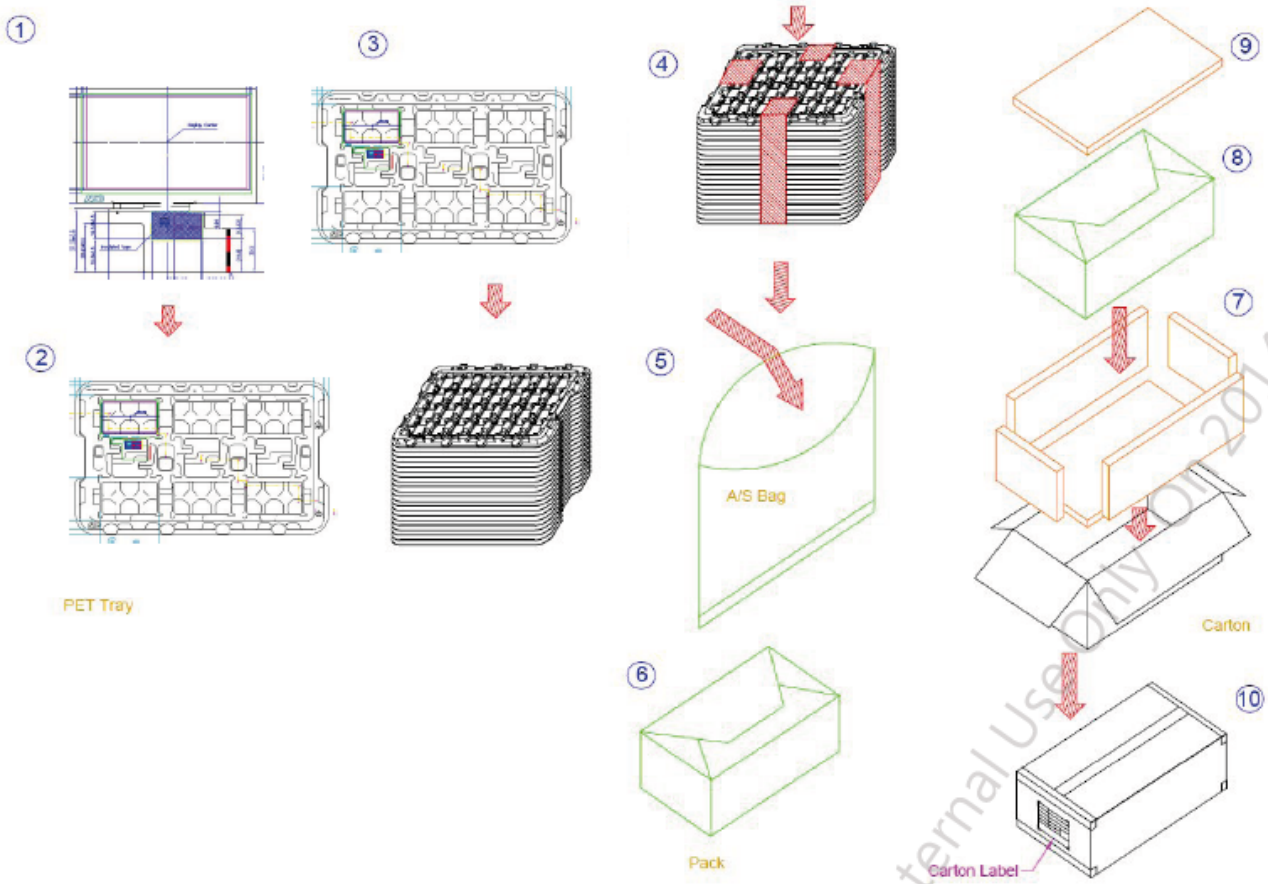
10.2 Packing Form

Max. capacity: 150 pieces TFT-LCD module per carton

Max. weight: 13.65 kg per carton

Outside dimension of carton: 520(L)mm* 340(W)mm* 250(H)mm

Pallet : 1070(L)mm* 1070(W)mm* 135(H)mm



10.3 Palletizing sequence

	pcs / box	box / layer	layer / pallet	pcs / pallet
Shipping by air	150	3*2	5	4500
Shipping by sea	150	3*2	5	4500

11 Safety

11.1 Keen Edge Requirements

There will be no keen edges or corners on the display assembly that could cause injury.

11.2 Materials

11.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the TFT-LCD module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

11.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the TFT-LCD Module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

11.3 Capacitors

If any polarized capacitors are used in the TFT-LCD module, provisions will be made to keep them from being inserted backwards.

11.4 National Test Lab Requirement

The TFT-LCD Module will satisfy all requirements for compliance to UL 60950 (U.S.A. Information Technology Equipment).