

Preliminary Specification

Final Specification

Module	4.3 Inch Color TFT-LCD
Model Name	G043FW01 V0

Customer	Date
_____	_____
Checked & Approved by	
_____	_____
<p>Note: This Specification is subject to change without notice.</p>	

Approved by	Date
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Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.0 – 2010/12/28	-	First Draft of Preliminary Specification		
1.0 – 2011/06/13	5	module weight : TBD	Add module weight : 68g (max.)	2.1
	6	White Luminance condition:Vled = 12V	White Luminance condition:Illed = 25mA	2.2
	6	Color / Chromaticity specification : TBD	Add Color / Chromaticity specification	2.2
	9	Functional Block Diagram	Modify Functional Block Diagram	3
	10	LED BLU Drive Voltage 29.2V	LED BLU Drive Current 30.0mA	4.1
	10		Delete LED dimming Input	4.1
	11	Power Specification	Add Analog Voltage and VDDIO current	5.1.1
	11	Signal Electrical Characteristics	Delet Input Voltage for RL/UD	5.1.2
	14		Add Input Data Format	6.3
	16 17	DE mode DCLK table	Input timing table move to Chapter 6.5.2 and add rising timing information	6.5.1
	19	Power ON/OFF Sequence	Delet IC internal sequence of On/Off sequence diagram and add description of frame count and VLED.	6.7
	23		Update 2D drawing - Modify LED wire length 45mm - Add label location definition	9
	24	Shipping Label : TBD	Add Shipping Label diagram	10.1
	24	Carton Package : TBD	Add Carton Package decription and diagram	10.2
1.1 – 2011/08/09	23	Back Bezel Layout	Change the label sticking area layout in Back Bezel	9
	24	Shipping Label	Replace with new Shipping Label	10.1
1.2 – 2012/10/25	5	The most suitable view angle : 6 o'clock (gray inversion)	Gray inversion direction : 6 o'clock	2.1
	21		Add arrowhead of 6'clock	7.3

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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 Discharge) 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

G043FW01 V0 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. G043FW01 V0 offers TTL interface for display signal input.

2.1 Display Characteristics

The following items are G043FW01 V0 characteristics summary at 25 °C (Room Temperature).

Items	Unit	Specifications
Screen Diagonal	inch	4.3
Active Area	mm	95.04(H)×53.856(V)
Pixels H x V	mm	480RGB(H)×272(V)
Pixel Pitch	mm	0.198(H)×0.198(V)
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	Volt	3.3 typ.
Typical Power Consumption	Watt	0.73W (LCD:0.08W/LED BLU: 0.65W) @ All black pattern
Weight	Grams	68 (max.)
Physical Size	mm	105.7(H) × 67.4(V) × 4.19(D) (typ.)
Electrical Interface		Digital TTL 8bit
Surface Treatment		Anti-Glare, Hardness 3H
Support Color		16.7M Colors
Gray inversion direction		6 o'clock
Temperature Range		
Operating	°C	-20 to +70
Storage (Non-Operating)	°C	-30 to +80
RoHS Compliance		RoHS Compliance

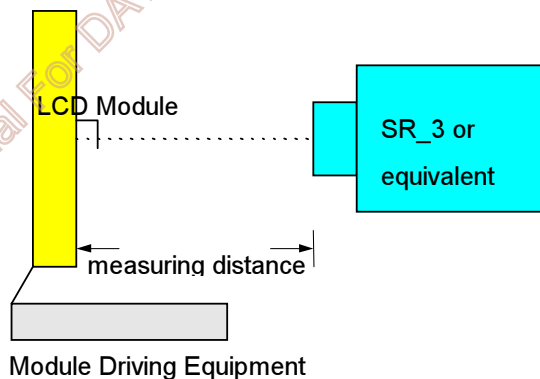
2.2 Optical Characteristics

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

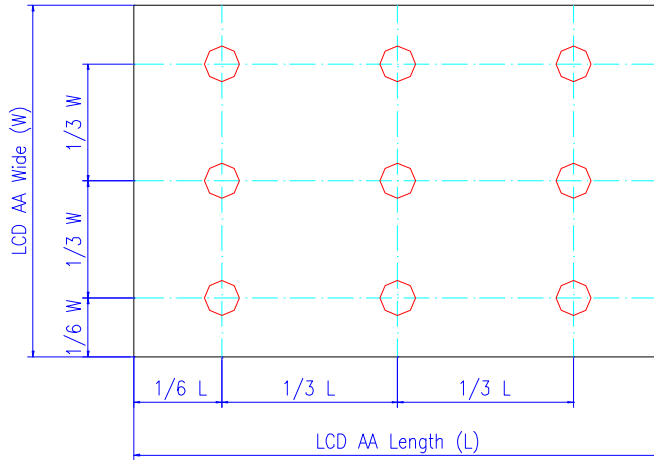
Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	cd/m ²	I _{LED} = 25mA, D _{PWM} = 100% (center point)	350	450	-	Note 1
Uniformity	%	9 Points	70	75		Note 1, 2, 3
Contrast Ratio			300	400	-	Note 4
Response Time	msec	Rising	-	15	25	Note 5
	msec	Falling	-	20	30	
	msec	Rising + Falling	-	35	55	
Viewing Angle	degree	Horizontal (Right)	50	65	-	Note 6
	degree	CR = 10 (Left)	50	65	-	
	degree	Vertical (Upper)	35	50	-	
	degree	CR = 10 (Lower)	40	55	-	
Color / Chromaticity Coordinates (CIE 1931)		White x	0.26	0.31	0.36	
		White y	0.27	0.32	0.37	
		Red x	0.56	0.60	0.64	
		Red y	0.31	0.35	0.39	
		Green x	0.31	0.35	0.39	
		Green y	0.53	0.57	0.61	
		Blue x	0.11	0.15	0.19	
		Blue y	0.08	0.12	0.16	
Color Gamut	%		-	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.

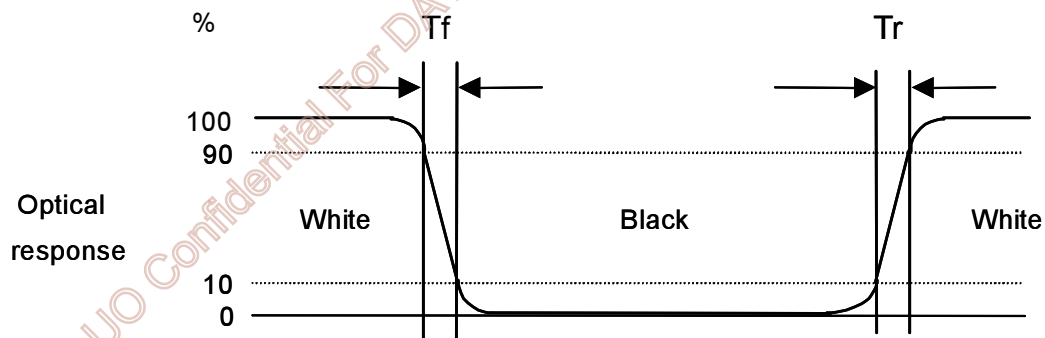
$$\delta_{w9} = \frac{\text{Maximum Brightness of nine points}}{\text{Minimum Brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

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

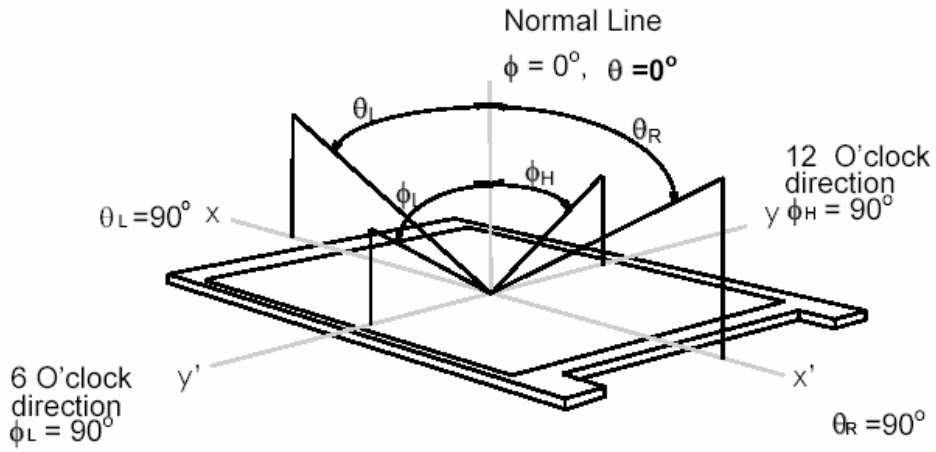
Note 5: Definition of response time:

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

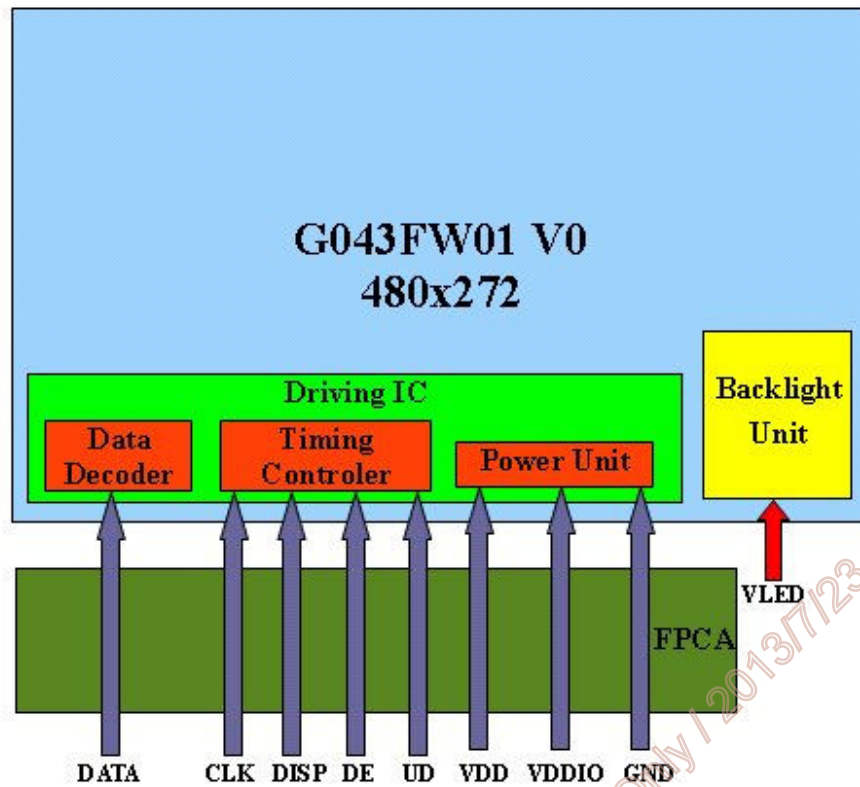
Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over 180° horizontal and 180° vertical range. The 180° horizontal (θ_L, θ_R) and 180° vertical (ϕ_H, ϕ_L) range are illustrated as following figure.



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3. Functional Block Diagram

The following diagram shows the functional block of the G043FW01 V0 color TFT/LCD module.



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4. Absolute Maximum Ratings

4.1 Absolute Ratings

Item	Symbo	Min	Max	Unit	Remark
Logic/LCD Drive Voltage	VDD	-0.3	6	Volt	Ta= 25°C
LCD Input Signal Voltage	VIN	-0.3	6	Volt	Ta= 25°C
LED BLU Drive Current	I _{LED}	-	30.0	mA	Ta= 25°C

4.2 Absolute Ratings of Environment

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

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5. Electrical Characteristics

5.1 TFT-LCD Driving

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3	3.3	3.6	Volt	
VDDIO	Analog Voltage	3	3.3	3.6	Volt	
IVDD	VDD Current	---	25	32	mA	All Black Pattern (VDD=3.3V, at 60Hz)
IVDDIO	VDDIO Current	---	20	40	uA	All Black Pattern (VDD=3.3V, at 60Hz)
PDD	VDD Power	---	0.1	0.15	Watt	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 VDD is off.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Input Signals 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°C (Room Temperature).

Symbol	Parameter	Min	Typ	Max	Units	Remark
V_{LED}	Input Voltage	-	(26)	-	Volt	Ta = 25 °C
I_{LED}	Input Current	-	25	-	mA	Ta = 25 °C
P_{LED}	Power Consumption	-	0.65	-	W	Ta = 25 °C
Operating Life		30000	-	-	Hrs	Ta = 25 °C , $I_{LED} = 25mA$ 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 channel in back light unit. See Section 6.6 for LED Backlight Unit Interface Signal Description.

Note 3: If G043FW01 V0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

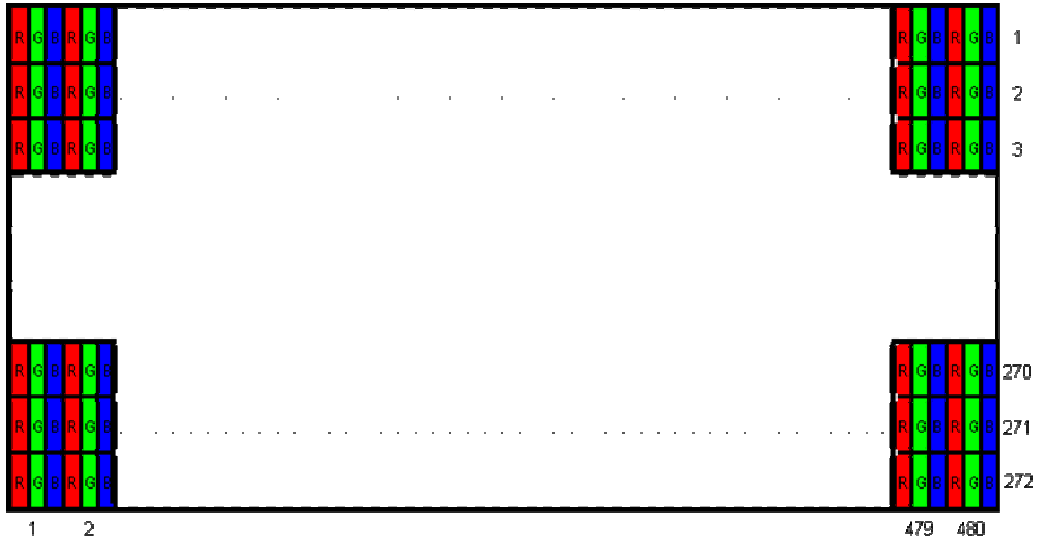
Note 4: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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6. Signal Characteristic

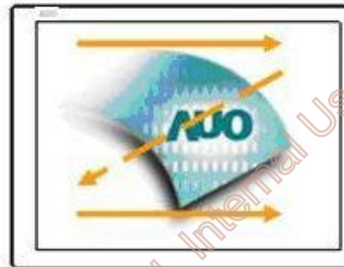
6.1 Pixel Format Image

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



6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.



U/D=High or NC



U/D=Low

Note 1: TFT-LCD interface signal description is shown in section 6.4.

6.3 The Input Data Format

This product displays 16.8M 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
	Dark	0	0	0	0	0	0	0	1	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
	Red	1	1	1	1	1	1	1	0	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
	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
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	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
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	↑																								
	↓																								
	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0

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6.4 TFT- LCD Interface Signal Description

Recommended connector: FH12A-45S-0.5SH

Pin no	Symbol	I/O	Description	Remark
1	GND	G	GND	
2	GND	G	GND	
3	VDD	PI	Power supply for analog circuit	
4	VDDIO	PI	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	GND	G	GND	
33	GND	G	GND	
34	DE	I	Data enable	

35	UD	I	0	Scan direction: Right →Left, Down→Up	IC internal pull high
			1	Scan direction: Left→Right, Up→Down(Default)	
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		

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

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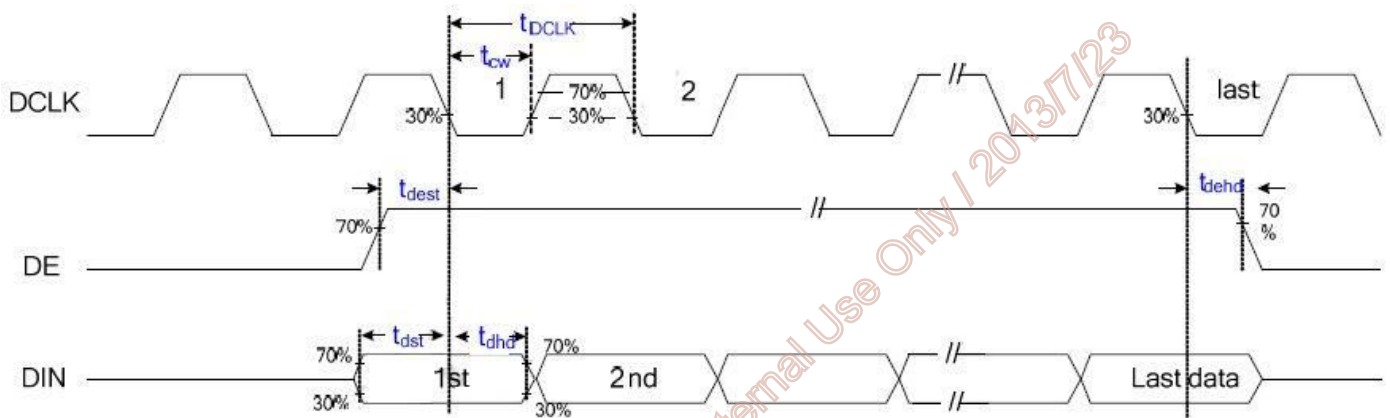
6.5 TFT- LCD Interface Timing

6.5.1 Rising Timing Characteristics

a. Rising Timing Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK time	t_{DCLK}	84	111	200	ns	
DCLK width	t_{cw}	42	-	-	ns	Dcw=50%
DCLK duty cycle	Dcw	40	50	60	%	$t_{cw} / t_{DCLK} \times 100\%$
Data setup time	t_{dst}	6	-	-	ns	Input data to DCLK
Data hold time	t_{dhd}	6	-	-	ns	Input data to DCLK
DE setup time	t_{dest}	6	-	-	ns	DE to DCLK
DE hold time	t_{dehd}	6	-	-	ns	DE to DCLK

b. Rising Timing Diagram



6.5.2 Input Timing

a. Input Timing Characteristics

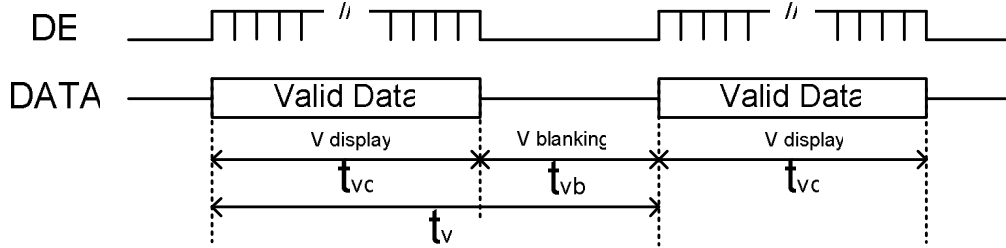
DE mode only

Signal	Symbol	Min.	Typ.	Max.	Unit	Remark	
Clock frequency (DCLK)	$1 / T_{DCLK}$	5	9	12	MHz	Note1	
Horizontal Section	Period	T_H	495	525	800	T_{DCLK}	Note1
	Active	T_{hd}	480				
	Blanking	T_{hbl}	15	45	320		
Vertical Section	Period	T_v	282	288	400	T_H	Note1
	Active	T_{vd}	272				
	Blanking	T_{vbl}	10	16	128		

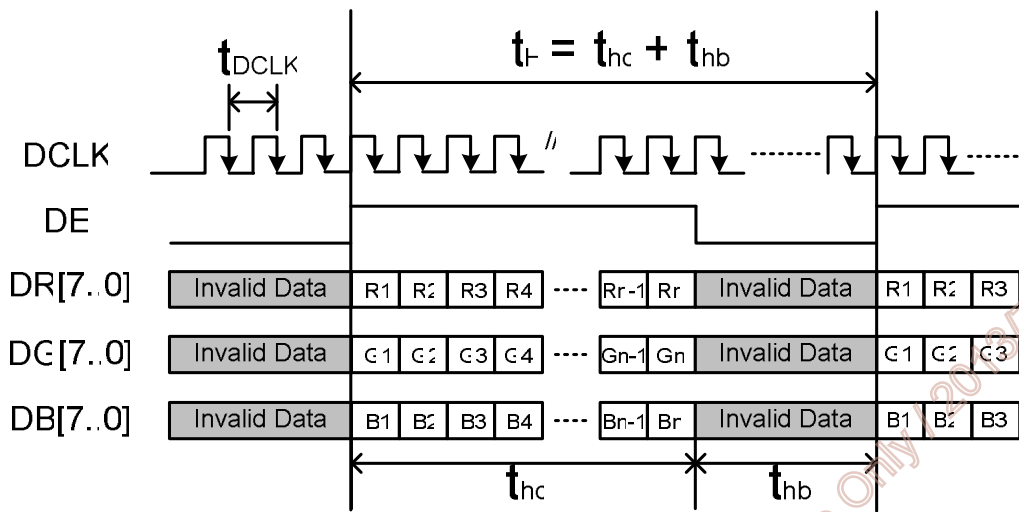
Note 1: Recommended frame rate is 60 Hz.

b. Input Timing Diagram

Vertical Timing of Input (DE mode)



Horizontal Timing of Input (DE mode)



6.6 LED Backlight Unit Interface Signal Description

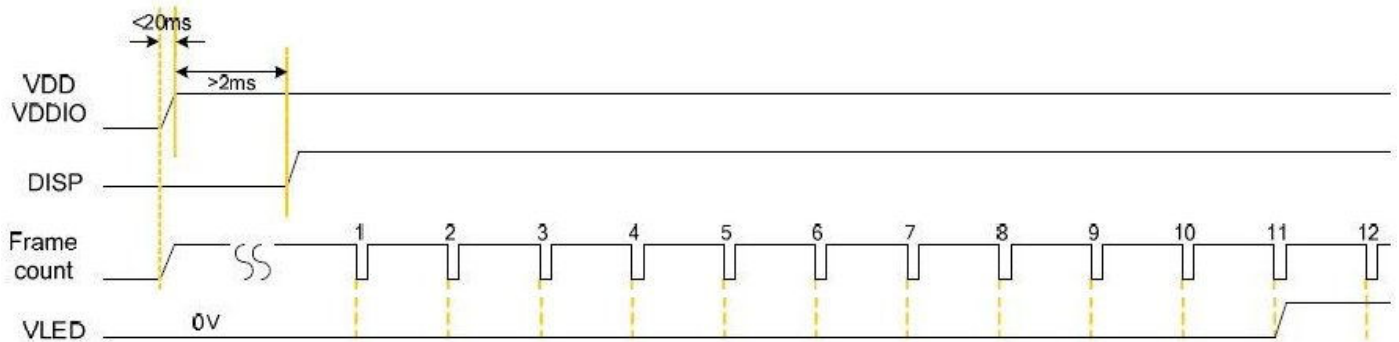


Pin #	Symbol	Pin Description
1	-	GND
2	+	Power

6.7 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.

a. Recommended Power On Sequence

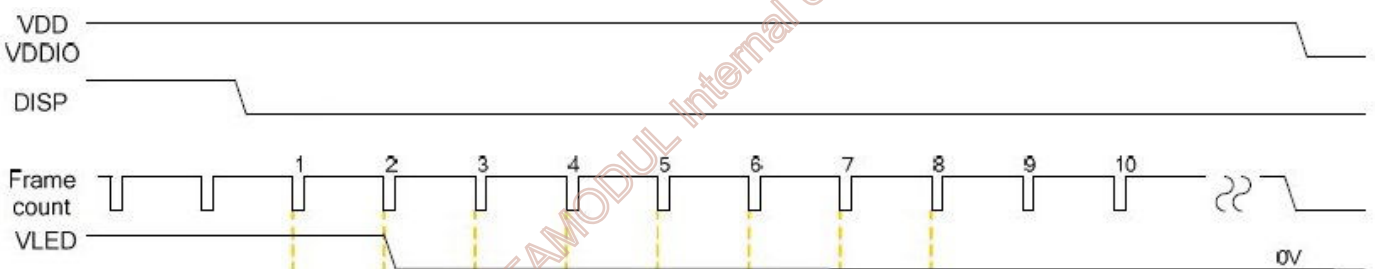


Note: 1. The driver IC default is on standby mode. It can be changed to normal operation by using DISP hardware pin.

2. "Frame count" means input timing including DE, Data and DCLK timing, detailed timing can be referred to chapter 6.5.2.

3. VLED means LED power on timing.

b. Recommended Power Off Sequence



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	FH12A-45S-0.5SH

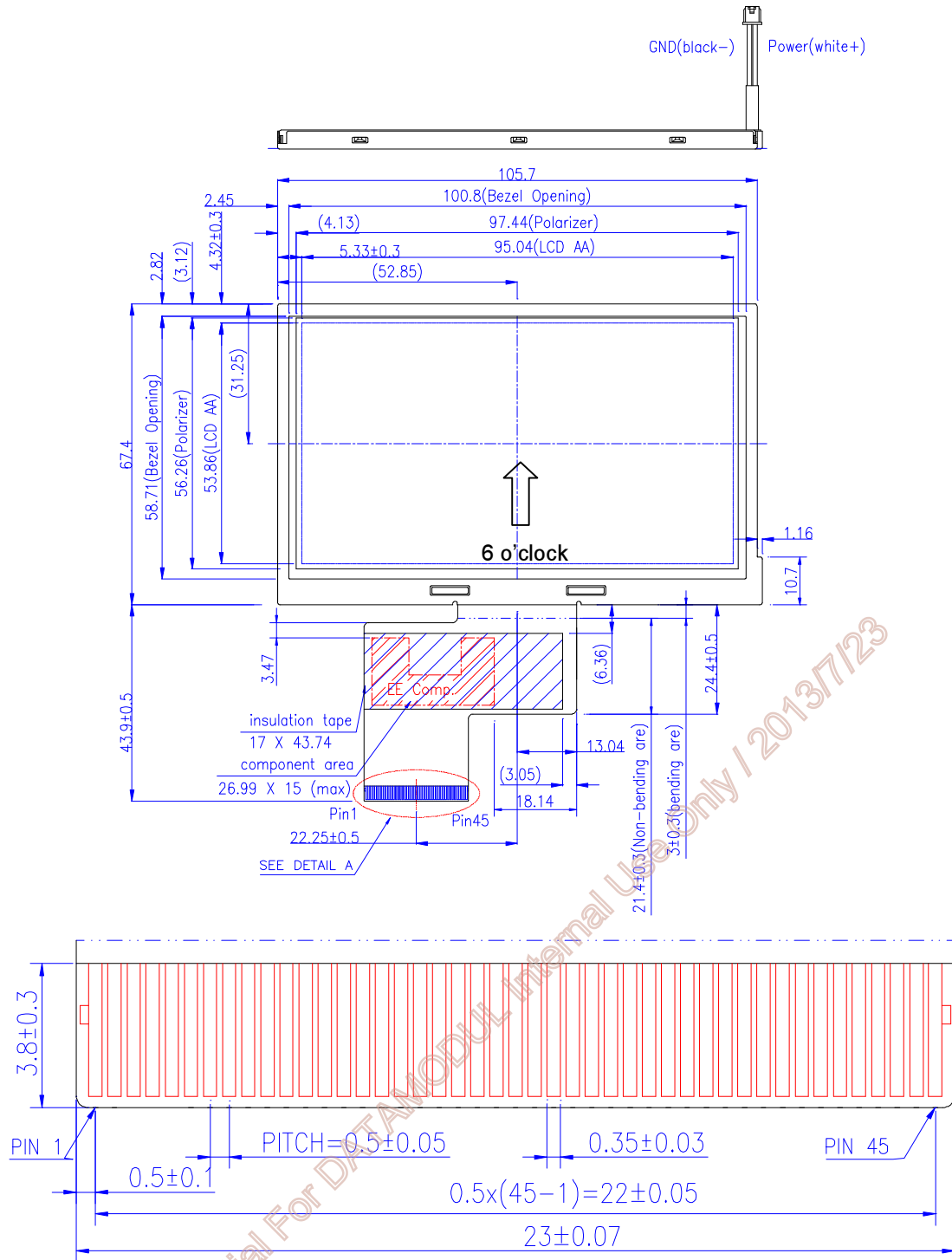
Pin#	Symbol	Pin#	Symbol	Pin#	Symbol
1	GND	16	G3	31	DISP
2	GND	17	G4	32	GND
3	VDD	18	G5	33	GND
4	VDDIO	19	G6	34	DE
5	R0	20	G7	35	UD
6	R1	21	B0	36	GND
7	R2	22	B1	37	GND
8	R3	23	B2	38	GND
9	R4	24	B3	39	GND
10	R5	25	B4	40	GND
11	R6	26	B5	41	GND
12	R7	27	B6	42	GND
13	G0	28	B7	43	GND
14	G1	29	GND	44	GND
15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

7.2 LED Backlight Unit: Backlight Connector

Manufacturer	Entery
Connector Model Number	H201K-P02N-02B
Mating Connector Model Number	3802-E02N-01R(90degree) or 3801-E02N-01R(180degree)

Pin #	Symbol
1	-(GND)
2	+(power)

7.3 PIN definition of FPC and LED PIN definition



DETAIL A SCALE 5/1

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°C,240 hours	Note
Thermal Shock Test	-30°C/60 min ,80°C/60 min ,50cycles	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.

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10. Label and Packaging

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

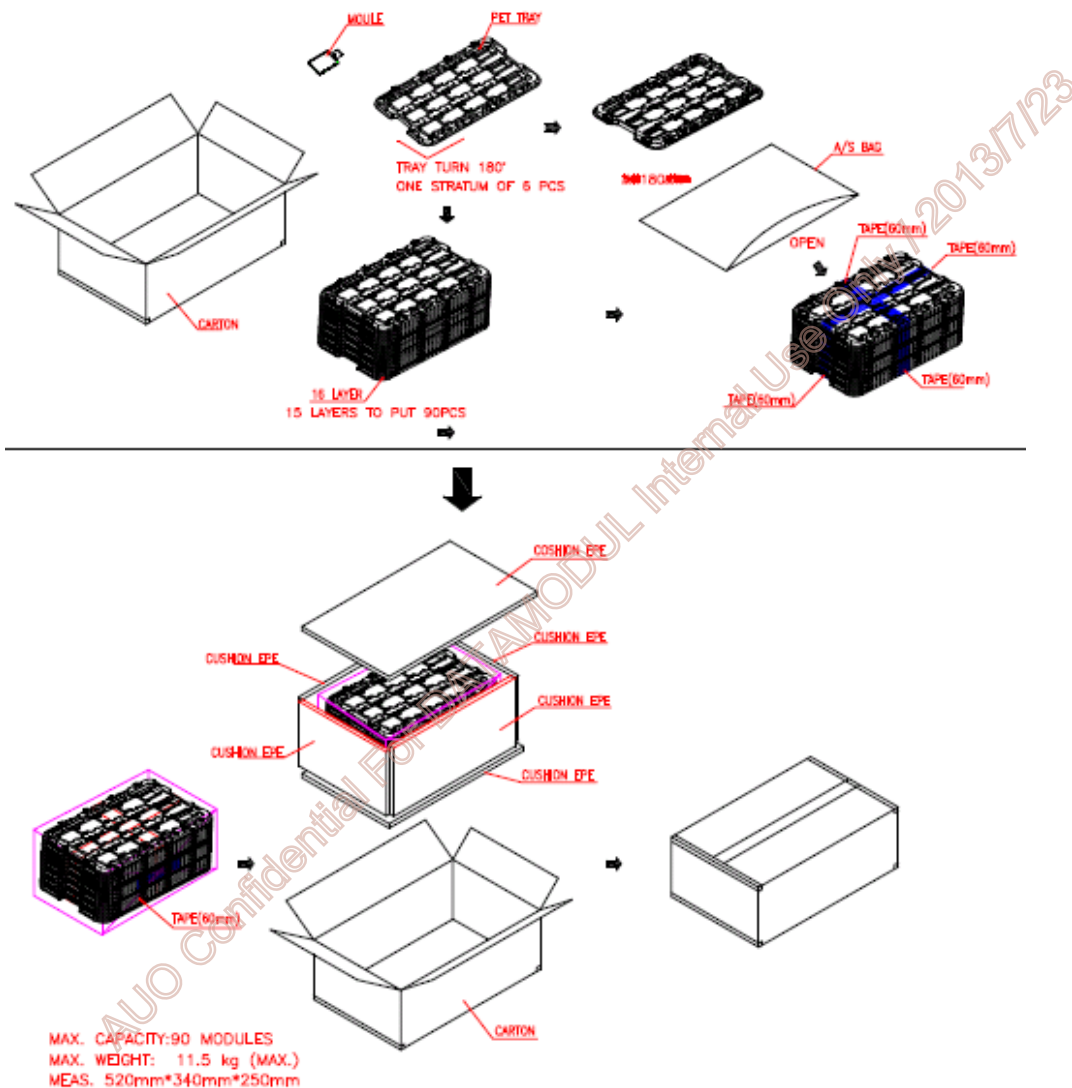


10.2 Carton Package

Max. capacity: 90 pieces TFT-LCD module per carton

Max. weight: 11.0±0.50 kg per carton

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



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).

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