HYDIS

TITLE : HV070WS1-100

Product Specification

for Customer

Rev. P0

FOR MORE INFORMATION:
AZ DISPLAYS, INC.
75 COLUMBIA, ALISO VIEJO, CA 92656
Http://www.AZDISPLAYS.com

HYDIS Technologies

REVISION HISTORY

REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
0	-	-Initial Release	11. 03. 14	-

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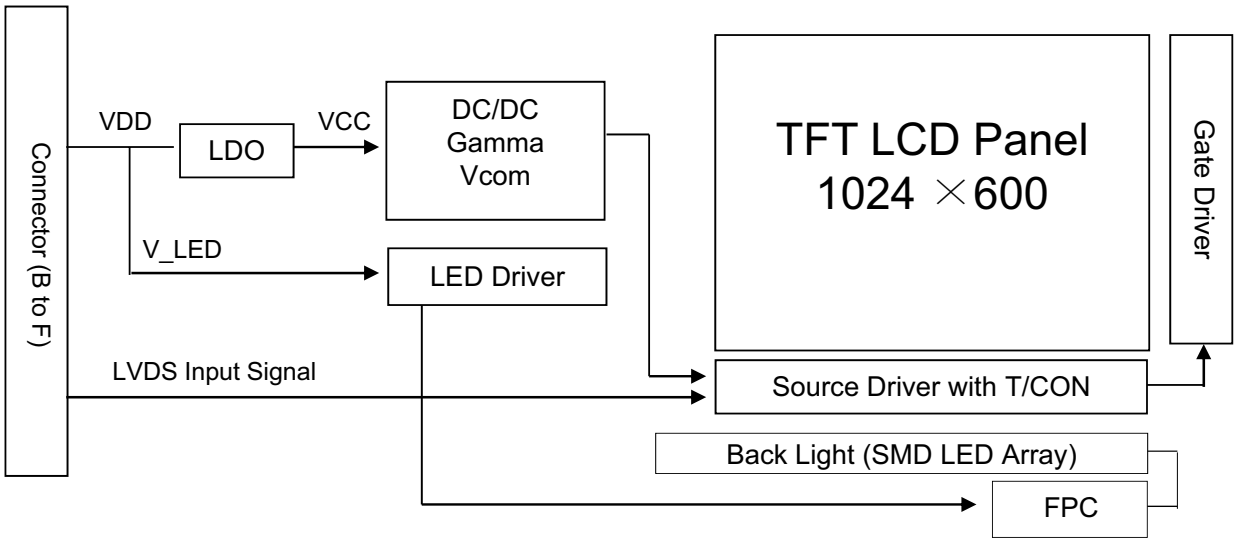
1.0 GENERAL DESCRIPTION

1.1 Introduction

HV070WS1-100 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 7.01 inch diagonally measured active area with WSVGA resolutions (1024 horizontal by 600 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is a low reflection and higher color type.



1.2 Features

- Thin and Light Weight
- 3.7 V Logic Power & Back-light power Supply
- 1 Channel LVDS Interface
- SMD LED (20EA) Array (Bottom Side/Horizontal Direction)
- 16.7M Colors
- Data Enable Signal Mode
- Green Product (RoHS) & Halogen free

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1.3 Application

- Tablet & Application Mini-PC (Wide type)

1.4 General Specifications

< Table 1. General Specifications >

Parameter	Specification	Unit	Remark
Active area	153.6(H) ×90.0(V)	mm	
Number of pixels	1024(H) ×600(V)	pixels	
Pixel pitch	0.15(H) ×0.15(V)	mm	
Pixel arrangement	RGB Vertical Stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Outline dimension	164.05±0.2(H)×99.96±0.15(V)×2.35 ±0.15(D)	mm	Note 1 (CTF)
Back-light	Bottom edge side, 20-LEDs type		

Note 1 : at without component

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2.0 ABSOLUTE MAXIMUM RATINGS

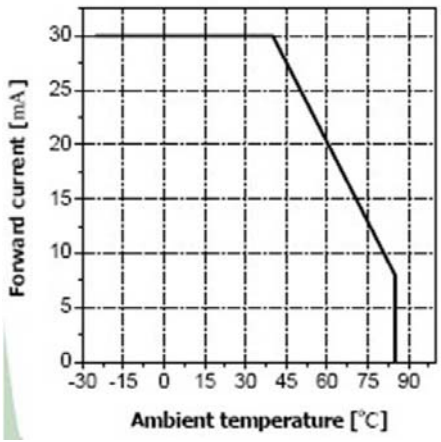
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

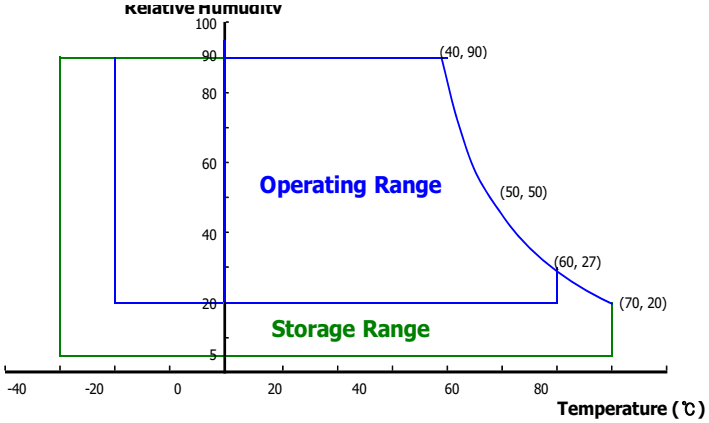
< Table 2. Absolute Maximum Ratings > Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Logic Power Supply Voltage	V_{DD}	-0.3	4.0	V	
Logic Power Supply Voltage	V_{IN}	-0.3	V_{DD}+0.3	V	
Back-light Power Supply Voltage	HV_{DD}	-0.3	40	V	
Back-light LED Current	I_{LED}	-	30	mA	Note 1
Back-light LED Reverse Voltage	V_R	-	5	V	
Operating Temperature	T_{OP}	-20	+60	℃	Note 1, Note 2
Storage Temperature	T_{SP}	-30	+70	℃	

Note 1. Ambient temperature vs allowable forward current are shown in the figure below.

Note 2. Temperature and relative humidity range are shown in the figure below.
90% RH Max. (40℃ ≥ Ta)
Maximum wet - bulb temperature at 39℃ or less. (> 40℃) No condensation.





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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications >

Parameter		Min.	Typ.	Max.	Unit	Remarks
Logic Power Supply Voltage	V_{DD}	3.2	3.7	4.2	V	Note 1
Logic Power Supply Current	I_{DD}	-	210	-	mA	Note 1
Logic Sleep Current	I_{DD}	-	-	10	uA	
Back-light Power Supply Voltage	HV_{DD}	3.2	3.7	4.2	V	Note 2
Back-light Power Supply Current	I_{HVDD}	-	420	-	mA	Note 2, 3
Back-light Power Consumption	P_{BL}	-	1.55	-	W	Note 2, 3
LED Driver's Efficiency	η	-	80	-	%	Note 2, 3
Back-light PWM Frequency	F_{PWM}	-	30	-	KHz	
High Level PWM Signal Voltage	V_{PWMH}	-	2.8	-	V	
Low Level PWM Signal Voltage	V_{PWML}	-	0	0.6	V	
High Level Differential Input Signal	V_{IH}	-	-	+100	mV	Vcm= 1.2V
Low Level Differential Input Signal	V_{IL}	-100	-	-	mV	
Back-light LED Voltage / Back-light LED Total Voltage	V_{LED} /V_{BL}	-	3.1 / 15.5	3.4/ 17.0	V	Note 4
Back-light LED Current / Back-light LED Total Current	I_{LED} /I_{BL}	-	20 / 80.0	-	mA	Note 4
LED Bright control signal		-	-	5	V	
Panel unit life time		50,000	-	-	Hrs	Without BL,PCB
Power Consumption	P_D	-	0.77	0.89	W	Note 1
	P_{LED}	-	1.24	1.34	W	At LED Current 20mA Note 2,3
	P_{total}	-	2.01	2.23	W	Note 1,2,3

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.7V at 25℃.
a) Typ : Color bar pattern / b) Max : White pattern
2. The power supply voltage and current is measured and specified at the interface connector of LCM including LED Driver.
3. Reference value, which is measured without LED Driver Efficiency for 3.7V.
4. Reference value, which is measured without LED Driver.
5. Calculated value for reference (V_{LED} × I_{LED} × # of LEDs (20EA)).

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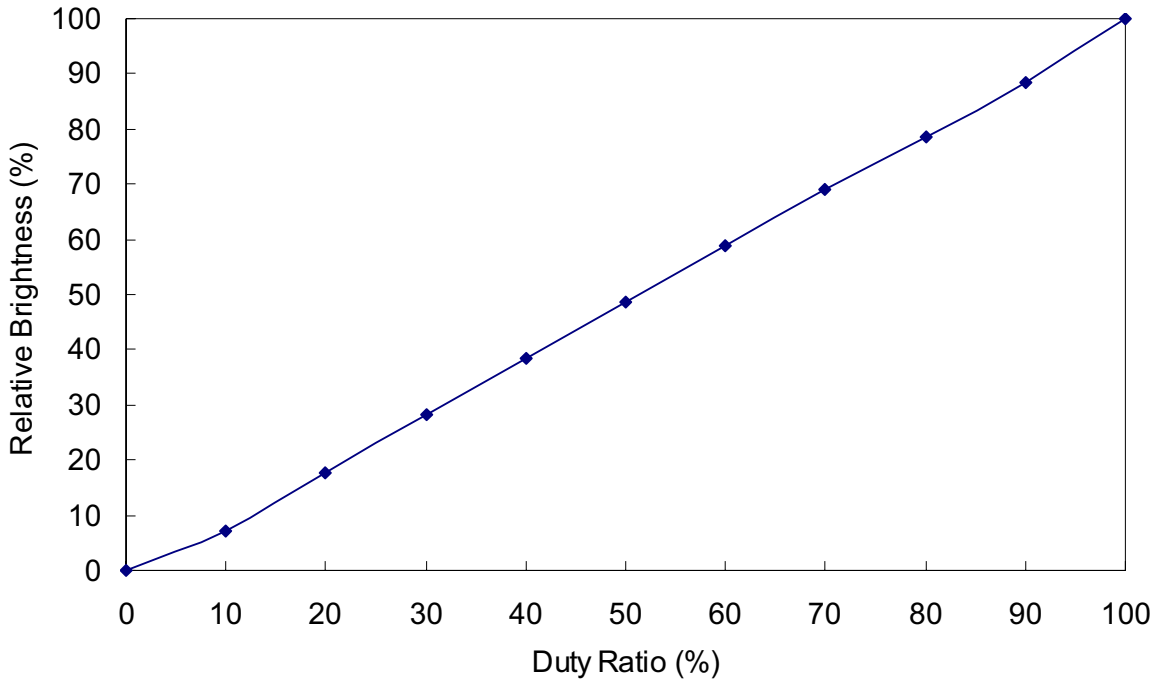
3.2 PWM Duty Ratio vs Brightness



Notes :

In case of duty ratio 0%, LED can't illuminate itself so this state is LED off.

In case of duty ratio 100%, the brightness of LED is maximum and the state is LED on.

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4.0 OPTICAL SPECIFICATIONS

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=θ3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ12) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. V_{DD} shall be 3.3+/- 0.3V at 25°C. Optimum viewing angle direction is 6o'clock.

4.2 Optical Specifications

<Table 4. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing Angle range	Horizontal	Θ_3	CR > 10	80	89	-	Deg.	Note 1
		Θ_9		80	89	-	Deg.	
	Vertical	Θ_{12}		80	89	-	Deg.	
		Θ_6		80	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	600	800	-		Note 2
Luminance of White	1 Points	Y_w	Θ = 0°	350	400 (CTF)	-	cd/m^2	At LED current 16.5mA
White Luminance uniformity	9 Points	ΔY9		80	85	-	%	Note 4
White Balance		K	Θ = 0°	9500~7000 / uv 0~0.02				
White Chromaticity		W_x	Θ = 0°	0.271	0.291	0.306		Note 3
		W_y		0.293	0.320	0.350		
Reproduction of color	Red	R_x	Θ = 0°	0.571	0.601	0.631		
		R_y		0.335	0.365	0.395		
	Green	G_x		0.294	0.324	0.354		
		G_y		0.556	0.586	0.616		
	Blue	B_x		0.126	0.156	0.186		
		B_y		0.123	0.153	0.183		
Response Time		Total ($T_r + T_d$)	Ta= 25° C Θ = 0°	-	30	45	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

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Notes :

1. 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 (see Figure1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state (see Figure1). Luminance Contrast Ratio (CR) is defined mathematically as CR = Luminance when displaying a white raster / Luminance when displaying a black raster.

3. Reference only / Standard Front Surface Treatment Measured with green cover glass. The color chromaticity coordinates specified in Table 4 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.

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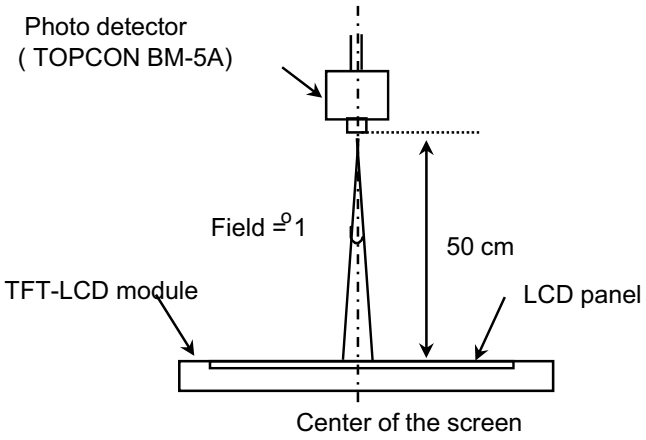
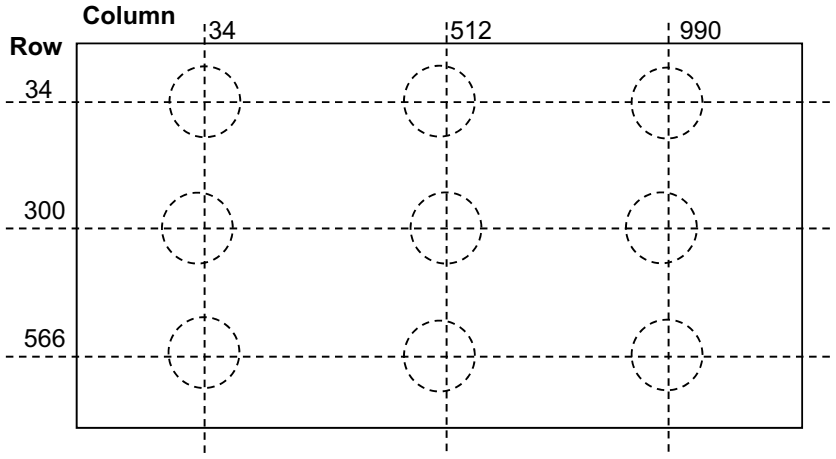
4.3 Optical Measurements

Figure 1. Measurement Set Up



Optical characteristics measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



Note 4.

Luminance of white is defined as luminance values of 9 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in Figure 2 for a total of the measurements per display.

* Yw = (Sum of 9 Points Luminance / 9)
* LED Condition = (Duty Ratio 100%, LED current 16.5mA)

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Figure 3. Response Time Testing

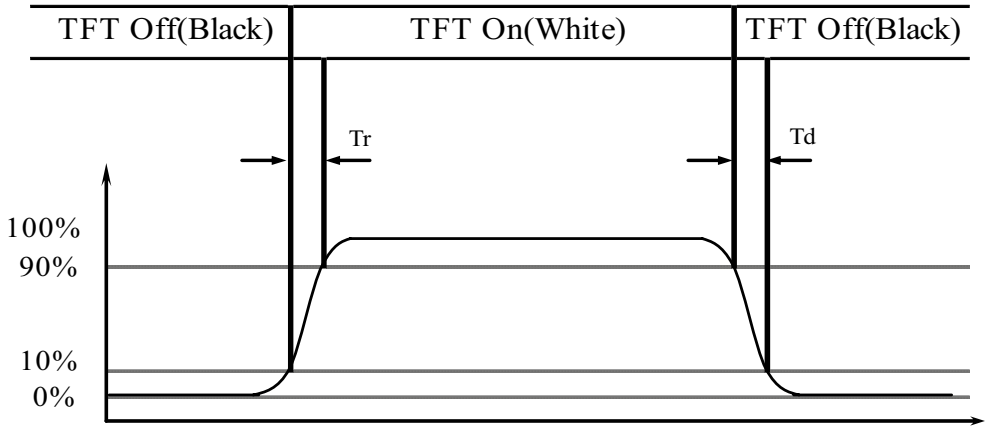

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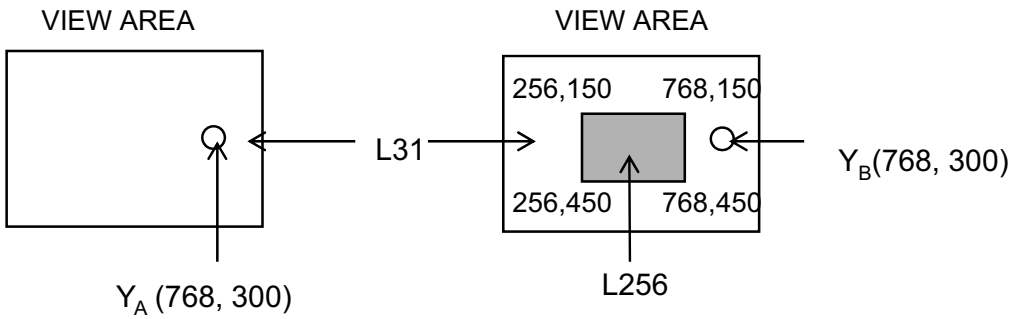
Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_B} \right| \times 100$$

Where:

Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns

Note 6.

The electro-optical response time measurements shall be made as Figure 4 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

Note 7.

Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to Figure 4).

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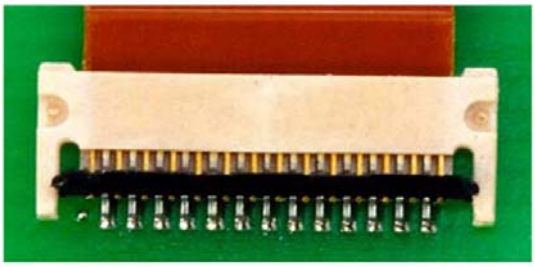
5.0 INTERFACE CONNECTIONS

5.1 Electrical Interface Connection

CN1 Interface Connector (FF12-31A-R12BN, Manufactured by DDK)

<Table 5, Electrical Interface Connection >

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VDD_3.7	Power supply : V_BAT (4.2V~3.2V)	21	GND	GROUND
2	VDD_3.7		22	LVDS_CLK-	LVDS Negative CLK signal (-)
3	VDD_3.7		23	LVDS_CLK+	LVDS Positive CLK signal (+)
4	VDD_3.7		24	GND	GROUND
5	VDD_3.7		25	RIN3-	LVDS Negative data signal (-)
6	VDD_3.7		26	RIN3+	LVDS Positive data signal (+)
7	VDD_3.7		27	GND	GROUND
8	NC	Non Connection	28	LED_EN	LED enable (PWM)
9	NC	Non Connection	29	GND	GROUND
10	LDO_EN	LDO enable for driver IC	30	GND	GROUND
11	COG3_1	GROUND	31	COG1	BIST
12	GND	GROUND			
13	RIN0-	LVDS Negative data signal (-)			
14	RIN0+	LVDS Negative data signal (-)			
15	GND	GROUND			
16	RIN1-	LVDS Negative data signal (-)			
17	RIN1+	LVDS Positive data signal (+)			
18	GND	GROUND			
19	RIN2-	LVDS Negative data signal (-)			
20	RIN2+	LVDS Positive data signal (+)			



CN1 (FF12-31A-R12BN **)**

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5.2 LVDS Interface

LVDS Transmitter : THC63LVDM83A

<Table 6, LVDS Interface >

Input Signal	Transmitter		Interface		FF12-31A-R12BN	Remark
	Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
R0	51					
R1	52					
R2	54	48	OUT0-	IN0-	13	
R3	55					
R4	56	47	OUT0+	IN0+	14	
R5	3					
G0	4					
G1	6					
G2	7					
G3	11	46	OUT1-	IN1-	16	
G4	12					
G5	14	45	OUT1+	IN1+	17	
B0	15					
B1	19					
B2	20					
B3	22					
B4	23	42	OUT2-	IN2-	19	
B5	24					
HSYNC	27	41	OUT2+	IN2+	20	
VSYNC	28					
DE	30					
MCLK	31	40	CLKOUT-	CLKIN-	22	
		39	CLKOUT+	CLKIN+	23	
R6	50					
R7	2					
G6	8	38	OUT3-	IN3-	25	
G7	10					
B6	16	37	OUT3+	IN3+	26	
B7	18					
RSVD	25					

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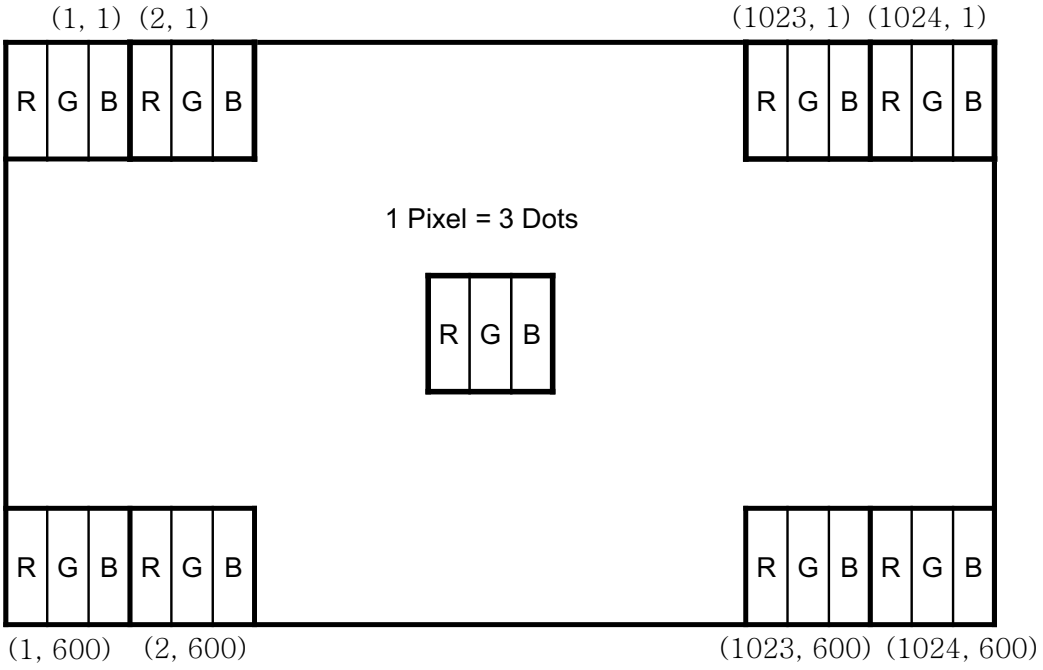
5.3 Back-light Interface

CN2 LED FPC Connector (solder type **)**

<Table 7, LED FPC connection >

Pin No.	Symbol	Function	Remark
1	Anode1	LED Anode Power Supply	LED Anode Power Supply (3.1V X 5EA = 15.5V)
2	Cathode1	LED Cathode Power Supply	
3	Cathode2	LED Cathode Power Supply	
4	Cathode3	LED Cathode Power Supply	
5	Cathode4	LED Cathode Power Supply	

5.4 Data Input Format



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6.0. SIGNAL TIMING SPECIFICATIONS

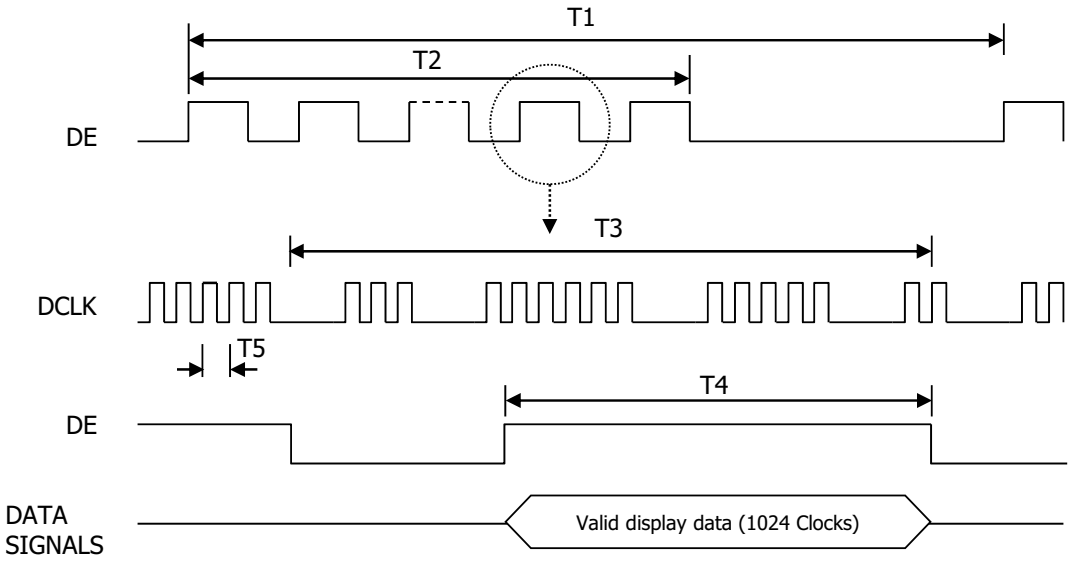
6.1 The 7" WSVGA LCM is operated by the only DE (Data enable) mode **(LVDS Transmitter Input)**

<Table 8, Signal Timing >

Item	Symbol	Min.	Typ.	Max.	Unit
Frame Period	T1	610	627	633	Lines
Vertical Display Period	T2	-	600	-	Lines
One line Scanning Period	T3	1114	1182	1259	Clocks
Horizontal Display Period	T4	-	1024	-	Clocks
Clock Frequency	1/T5	40.8	44.46	47.82	MHz

7.0 SIGNAL TIMING WAVEFORMS

7.1 Timing Waveforms of Interface Signal



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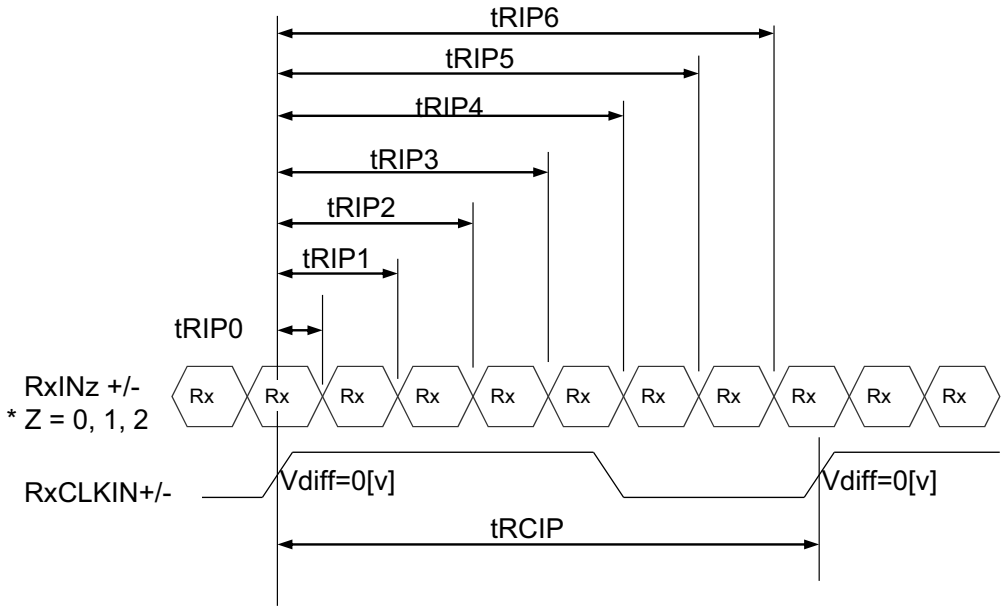
7.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter

< Table 9, LVDS Rx Interface Timing Specification>

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
CLKIN Period	tRCIP	24.53	22.49	20.91	nsec	
Input Data 0	tRIP0	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP1	tRICP/7-0.4	tRICP/7	tRICP/7+0.4	nsec	
Input Data 2	tRIP2	2 ×tRICP/7-0.4	2 ×tRICP/7	2 ×tRICP/7+0.4	nsec	
Input Data 3	tRIP3	3 ×tRICP/7-0.4	3 ×tRICP/7	3 ×tRICP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRICP/7-0.4	4 ×tRICP/7	4 ×tRICP/7+0.4	nsec	
Input Data 5	tRIP5	5 ×tRICP/7-0.4	5 ×tRICP/7	5 ×tRICP/7+0.4	nsec	
Input Data 6	tRIP6	6 ×tRICP/7-0.4	6 ×tRICP/7	6 ×tRICP/7+0.4	nsec	



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8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Each color is displayed in sixty-four gray scales from a 6 bit data signal input. A total of 16.7M colors are derived from the resultant 6 bit Hi-FRC data.

Colors & Gray Scale		Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale Of Red	Black	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
	Darker	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	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	1	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	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	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Gray Scale Of White & Black	Black	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	1	0	0	0	0	0	1
	Darker	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
	▽	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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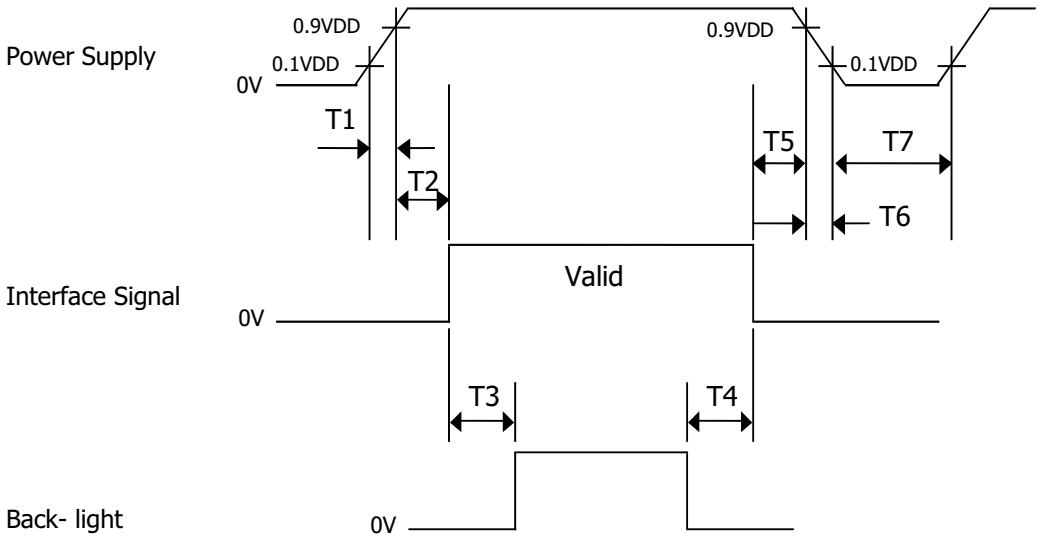
9.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 200 ms ≤ T3
- 200 ms ≤ T4
- 0 ≤ T5 ≤ 50 ms
- 0 ≤ T6 ≤ 10ms
- 200ms ≤ T7

Notes : 1. When the power supply VDD is 0V, Keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 6 & 7 (located in 11.0) shows mechanical outlines for the model

<Table11, Mechanical Characters >

Parameter	Specification	Unit
Active Area	261.12(H) X 163.20(V)	mm
Number of pixels	1024(H) X 600(V) (1 pixel = R + G + B dots)	
Pixel pitch	0.15(H) X 0.15(V)	
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M	
Display mode	Normally Black	
Outline dimension	164.05(H)×99.96(V)×2.35(D) (Typ.)	mm
Back-light	Edge side 20-LEDs type (5 X 4 Array)	

10.2 LR and Polarizer Hardness.

The surface of the LCD has an Low reflection coating and a coating to reduce scratching.

10.3 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 150lux. The manufacture shall furnish limit samples of the panel showing the light leakage acceptable.

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11.0 Mechanical Drawing

Figure 6. TFT-LCD Module Outline Dimension (Front View)

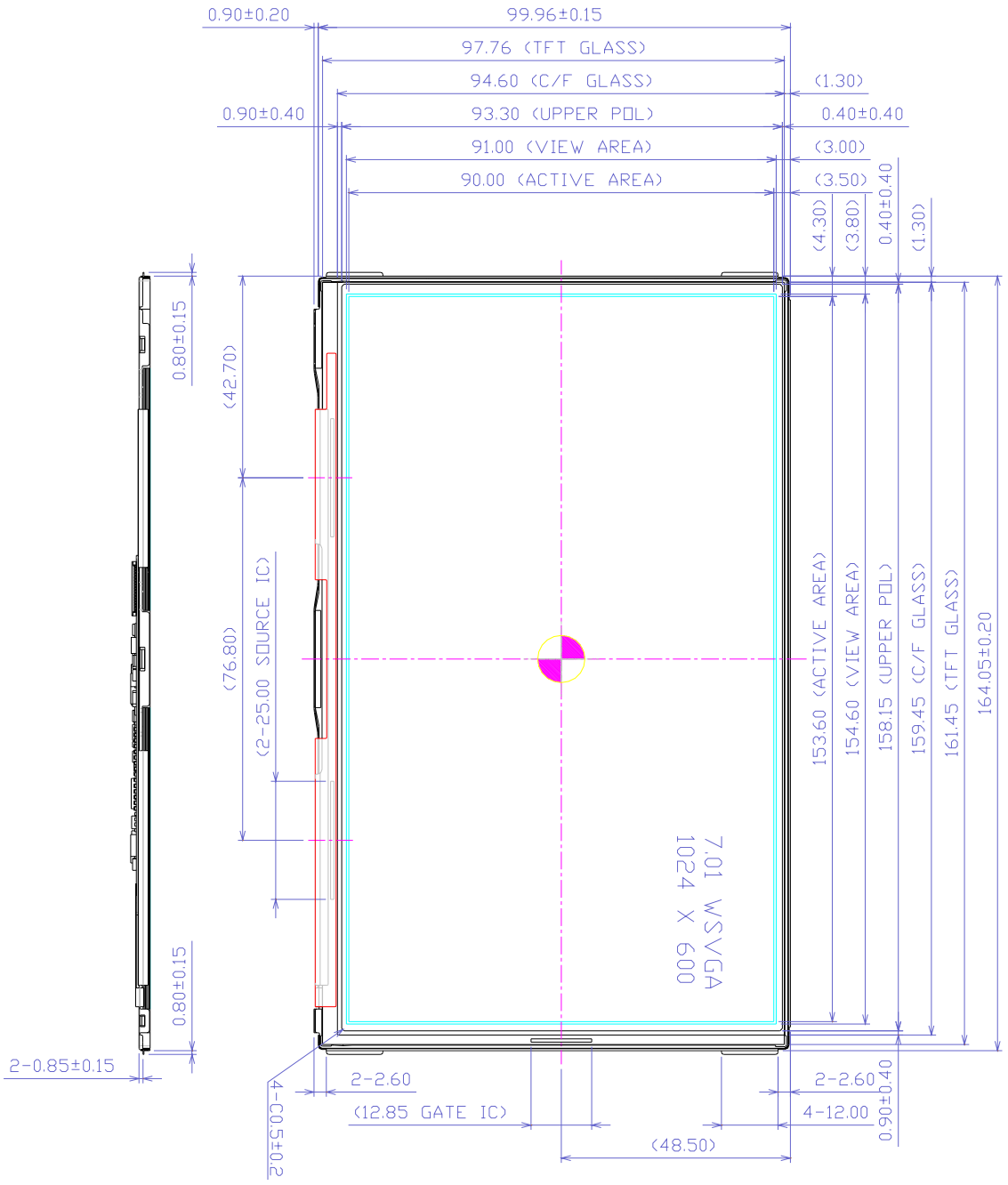

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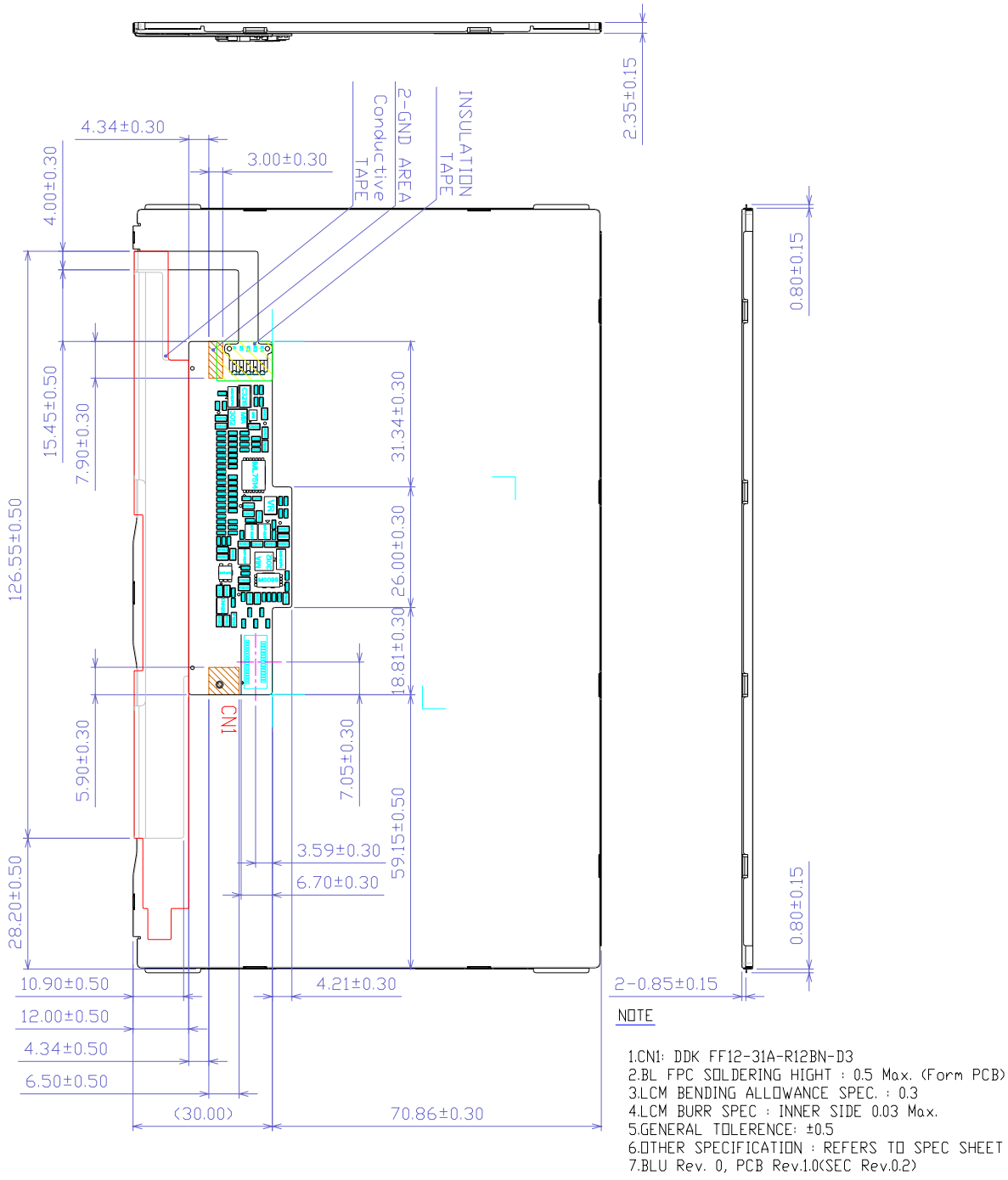
Figure 7. TFT-LCD Module Outline Dimensions (Rear view)



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12.0 RELIABLITY TEST

The Reliability test items and its conditions are shown in below.

<Table12, Reliability Test>

No	Test Item	Conditions
1	High temperature operation test	Ta = 60 °C, 24 hrs
2	Low temperature operation test	Ta = -20 °C, 24 hrs
3	High temperature & high humidity operation test	Ta = 60 ℃, 90%RH, 96hrs
4	Thermal shock	Ta = -30 °C ↔ 70 °C (30min), 30 cycle
5	Electro-static discharge test (non-operating)	Air : 150pF, 330ohm, 15KV Contact : 150pF, 330ohm, 8KV

13.0 HANDLING & CAUTIONS

13.1 Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

13.2 Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass (epoxy) material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

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13.3 Cautions for the operation

- When the module is operating, do not lose MCLK, DE signals. If any one of these signals were lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

13.4 Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

13.5 Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

13.6 Cautions for the digitizer assembly

- When assembling FPC connector, do not flip connector past 90° due to possible damage to connector.
- When positioning digitizer underneath driver IC, do not lift driver IC past 90° due to possible damage to drive IC pattern.
- Please be warned that during assembly of digitizer, the opening or closing of FPC will result in possible electrostatic discharge damage to the LED

13.7 Other cautions

- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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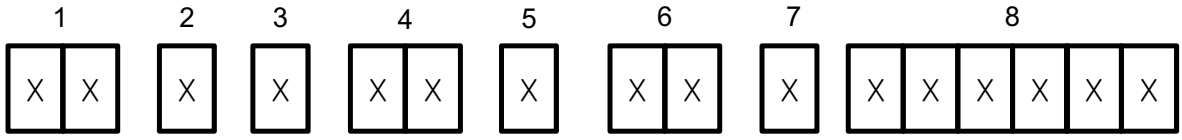
14.0 LABELS

14.1 Product Marking Table

• Barcode (Printed on back cover)



No 1. Control Number

No 2. Grade

No 3. Supplier code

No 4. Year

No 5. Month (1, 2, 3, …, X, Y, Z)

No 6. Day

No 7. Revision code

No 8. Serial Number

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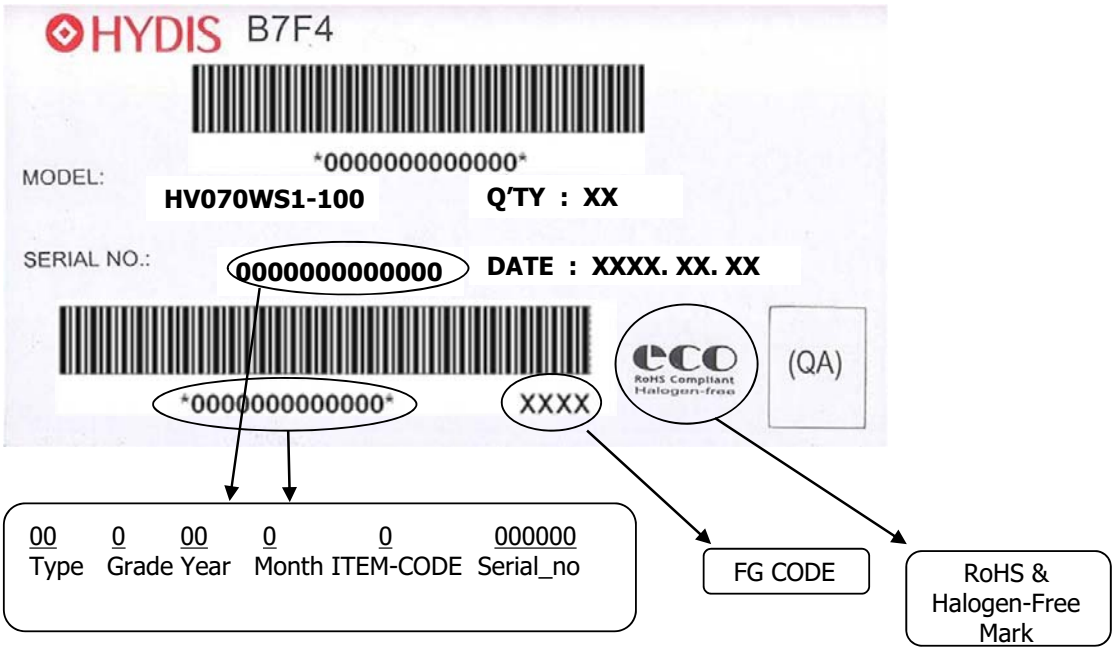
14.0 LABELS

14.2 Packing Label

Label Size: 108 mm (L) × 56 mm (W)
Contents
Model: HV070WS1-100
Q`ty: Module Q`ty in one box
Serial No.: Box Serial No. See next figure for detail description.
Date: Packing Date
FG Code: FG Code of Product



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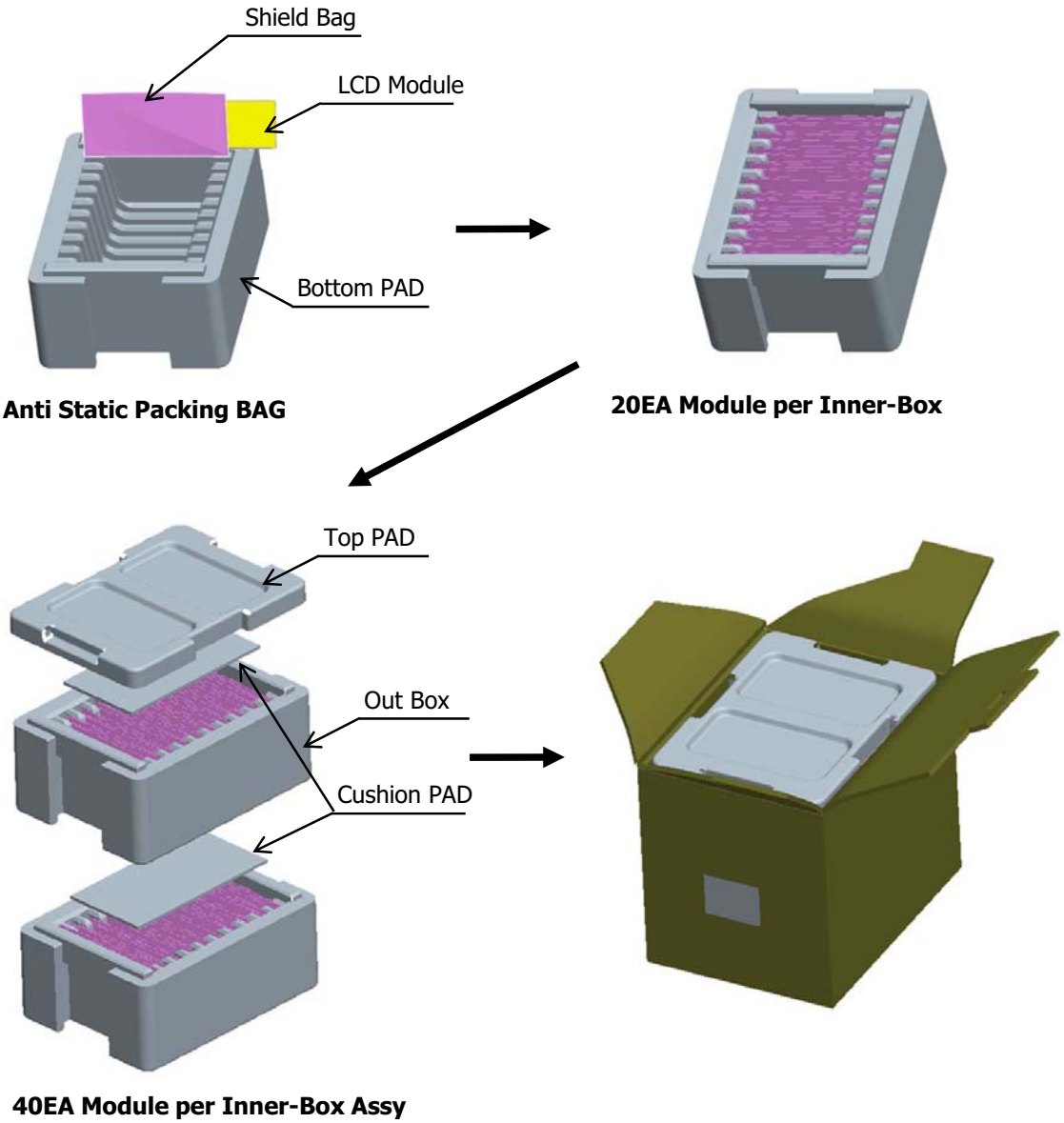
15.0 PACKING INFORMATION

15.1 Packing order



Notes : 1. Box Dimension: 350mm(W) X 265mm(D) X 320mm(H)
2. Package Quantity in one Box : 40pcs

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