Laurel Electronics Co., Ltd.

LCD Module Specification

Model No.: LT101A-02A

10.1”, 1024 (RGB) x 600 PIXELS TFT LCD MODULE

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RECORD OF REVISION

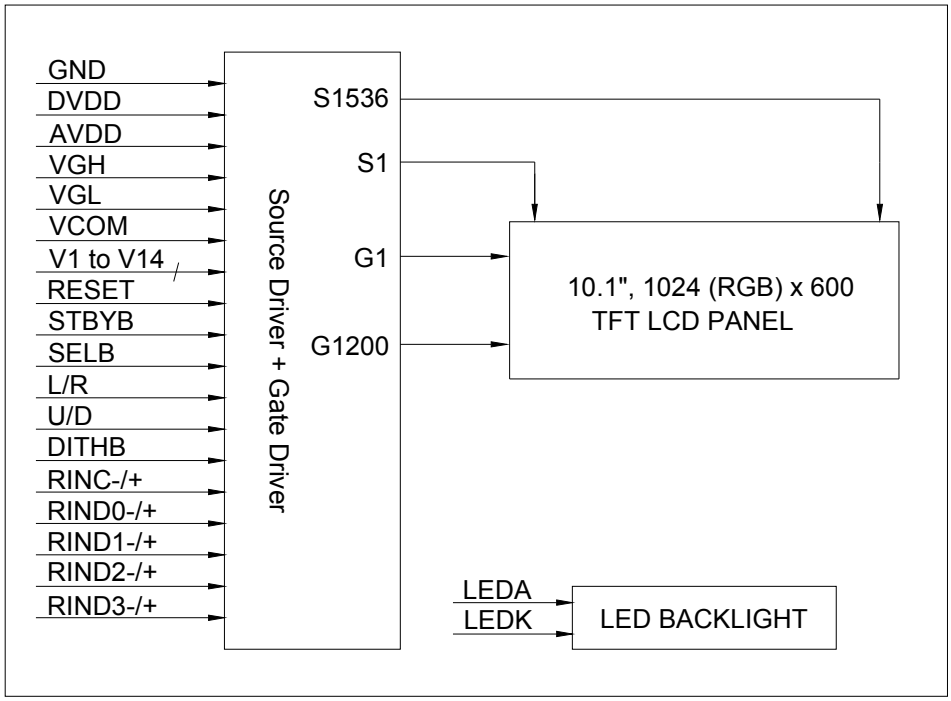
Rev.	Date	Page	Item	Description
0.1	2018/12/12	-	-	New release

1. BASIC SPECIFICATIONS

1.1 Features

Item	Specifications	Unit
Screen Size	10.1 (Diagonal)	inch
Resolution	1024 (RGB) x 600	dot
Display Mode	Normally white, transmissive TFT	-
Color Configuration	RGB-stripe	-
Color Depth	26.2K/16.7M colors	-
Viewing Direction	6:00 o'clock (Gray scale inversion direction)	-
Outline Dimension (WxHxT)	235.0 x 143.0 x 4.5 (FPC length=70.0)	mm
Viewing Area (WxH)	226.0 x 128.5	mm
Active Area (WxH)	222.72 x 125.28	mm
Dot Pitch (WxH)	0.0725 x 0.2088	mm
Touch Panel	None	-
Weight	274	g
LCD Controller	HX8282-A + HX8696-A or equivalent	-
Interface Mode	6-bit/8-bit LVDS	-
Power Supply (DV_{DD})	3.3	V

1.2 Block Diagram



1.3 Terminals Functions (I=Input; O=Output; P=Power)

Pin No.	Symbol	I/O	Function
1	GND	P	Power ground
2	AVDD	P	Power supply for analog circuit
3	DVDD	P	Power supply for digital circuit
4	GND	P	Power ground
5	VCOM	I	Common voltage
6	DVDD	P	Power supply for digital circuit
7	GND	P	Power ground
8	V14	I	Gamma correction voltage input
9	V13	I	Gamma correction voltage input
10	V12	I	Gamma correction voltage input
11	V11	I	Gamma correction voltage input
12	V10	I	Gamma correction voltage input
13	V9	I	Gamma correction voltage input
14	V8	I	Gamma correction voltage input
15	GND	P	Power ground
16	DVDD	P	Power supply for digital circuit
17	GND	P	Power ground
18	RIND3+	I	+ LVDS differential data input
19	RIND3-	I	- LVDS differential data input
20	GND	P	Power ground
21	RINC+	I	+ LVDS differential clock input
22	RINC-	I	- LVDS differential clock input
23	GND	P	Power ground
24	RIND2+	I	+ LVDS differential data input
25	RIND2-	I	- LVDS differential data input
26	GND	P	Power ground
27	RIND1+	I	+ LVDS differential data input
28	RIND1-	I	- LVDS differential data input
29	GND	P	Power ground
30	RIND0+	I	+ LVDS differential data input
31	RIND0-	I	- LVDS differential data input
32	GND	P	Power ground
33	GND	P	Power ground

Pin No.	Symbol	I/O	Function
34	RESET	I	Global reset pin. Normally pull high. Active “L” to enter reset state. Suggest connecting with an RC reset circuit for stability.
35	STBYB	I	Standby mode selection. Normally pull high. STBYB=1: Normal operation. STBYB=0: Timing controller and source driver will turn off; all outputs are GND.
36	L/R	I	Left/Right scanning direction selection L/R=1: Scanning from left to right L/R=0: Scanning from right to left
37	DVDD	P	Power supply for digital circuit
38	U/D	I	Up/Down scanning direction selection U/D=1: Scanning from down to up U/D=0: Scanning from up to down
39	GND	P	Power ground
40	AVDD	P	Power supply for analog circuit
41	VCOM	I	Common voltage
42	DITHB	I	Dithering function. Normally pull low. DITHB=1: Enable internal dithering function DITHB=0: Disable internal dithering function
43	GND	P	Power ground
44	DVDD	P	Power supply for digital circuit
45	GND	P	Power ground
46	V7	I	Gamma correction voltage input
47	V6	I	Gamma correction voltage input
48	V5	I	Gamma correction voltage input
49	V4	I	Gamma correction voltage input
50	V3	I	Gamma correction voltage input
51	V2	I	Gamma correction voltage input
52	V1	I	Gamma correction voltage input
53	GND	P	Power ground
54	DVDD	P	Power supply for digital circuit
55	SELB	I	6-bit/8-bit mode selection SELB=1: LVDS input data is 6-bit SELB=0: LVDS input data is 8-bit
56	VGH	P	Gate on voltage
57	DVDD	P	Power supply for digital circuit
58	VGL	P	Gate off voltage
59	GND	P	Power ground
60	NC	-	No connection

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Digital)	DV_{DD}	-0.3	3.96	V
Supply Voltage (Analog)	AV_{DD}	6.5	14.85	V
Supply Voltage (Gate on voltage)	V_{GH}	-0.3	42.0	V
Supply Voltage (Gate off voltage)	V_{GL}	V_{GH} - 42.0	0.3	V
Input Voltage	V_I	-0.3	DV_{DD} + 0.3	V
LED Forward Current (Each LED)	I_F	-	25	mA
Operating Temperature	Topr	-20	+70	°C
Storage Temperature	Tstg	-30	+80	°C

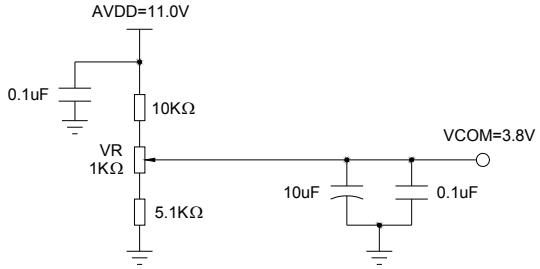
Cautions: Stresses above those listed as 'absolute maximum ratings' may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

3. ELECTRICAL CHARACTERISTICS

3.1 DC Characteristics for LCD (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	DV_{DD}		3.0	3.3	3.6	V
	AV_{DD}		10.8	11.0	11.2	V
	V_{GH}		19.0	21.0	23.0	V
	V_{GL}		-9.0	-8.0	-7.0	V
Input Signal Voltage	V_{COM}	Note 1	3.3	3.8	4.3	V
Input High Voltage	V_{IH}	Except LVDS signals	0.7DV_{DD}	-	DV_{DD}	V
Input Low Voltage	V_{IL}		0	-	0.3DV_{DD}	V
Input Gamma Correction Voltage	V1 to V7	Note 2	0.4AV_{DD}	-	AV_{DD} - 0.1	V
	V8 to V14		0.1	-	0.6AV_{DD}	V
Supply Current	I_{DD}	DV_{DD} = 3.3V	-	18	30	mA
	I_{DDA}	AV_{DD} = 11.0V	-	20.0	30.0	mA
	I_{GH}	V_{GH} = 21.0V	-	0.4	1.0	mA
	I_{GL}	V_{GL} = -8.0V	-	3.0	8.0	mA

Note 1: Reference circuit for V_{COM}

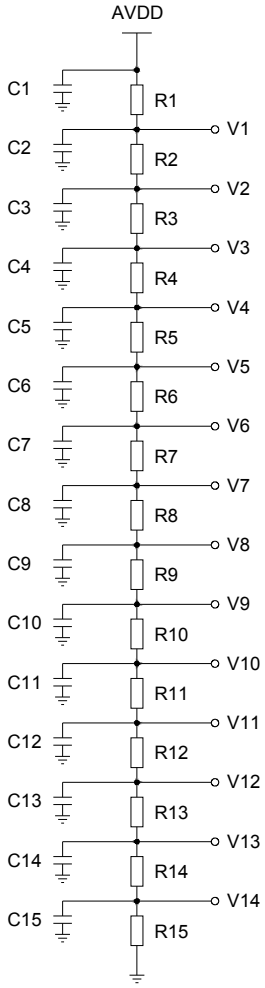


The typical V_{COM} is only a reference value. It must be optimized according to each TFT. Please use a VR and refer to the application circuit at left.

Note 2: Reference circuit for Gamma correction voltage

Item	Symbol	Min. (V)	Typ. (V)	Max. (V)
Analog Voltage	AVDD	10.8	11.0	11.2
Gamma Correction Voltage	V1	9.25	9.3	9.35
	V2	8.95	9.0	9.05
	V3	7.15	7.2	7.25
	V4	7.75	6.8	6.85
	V5	6.38	6.43	6.48
	V6	5.66	5.71	5.76
	V7	5.25	5.3	5.35
	V8	4.25	4.3	4.35
	V9	3.88	3.93	3.98
	V10	3.21	3.26	3.31
	V11	2.81	2.86	2.91
	V12	2.4	2.45	2.5
	V13	0.65	0.7	0.75
	V14	0.2	0.25	0.3

Item	Symbol	Value (Ω)
Gamma Resistor	R1	1700
	R2	300
	R3	1800
	R4	400
	R5	370
	R6	720
	R7	410
	R8	1000
	R9	370
	R10	670
	R11	400
	R12	410
	R13	1750
	R14	450
	R15	250

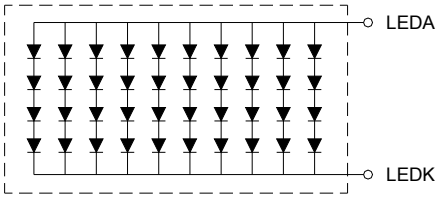


C1 to C15: 0.1uF/25V

3.2 LED Backlight Characteristics (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LED Forward Voltage	V_{LED}	Note 1	11.0	11.4	11.8	V
LED Forward Current	I_{LED}		150	200	220	mA
LED Life Time	-	Note 2	20,000	-	-	Hr

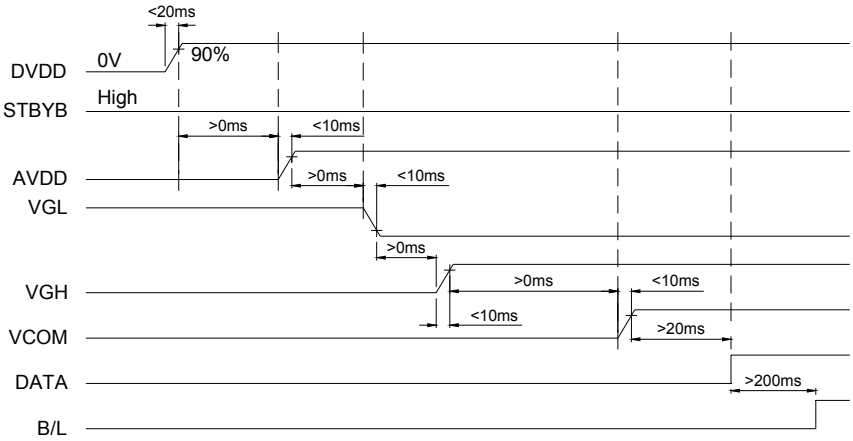
Note 1: The LED forward voltage is defined by the number of LED at Ta=25°C and I_{LED}=200mA.
Note 2: The LED life time is defined as the module brightness decreases to 50% initial brightness at Ta=25°C and I_{LED}=200mA. The LED life time could be decreased if operating I_{LED} is larger than 200mA.



LED Backlight: 4 x 10 = 40 LEDS

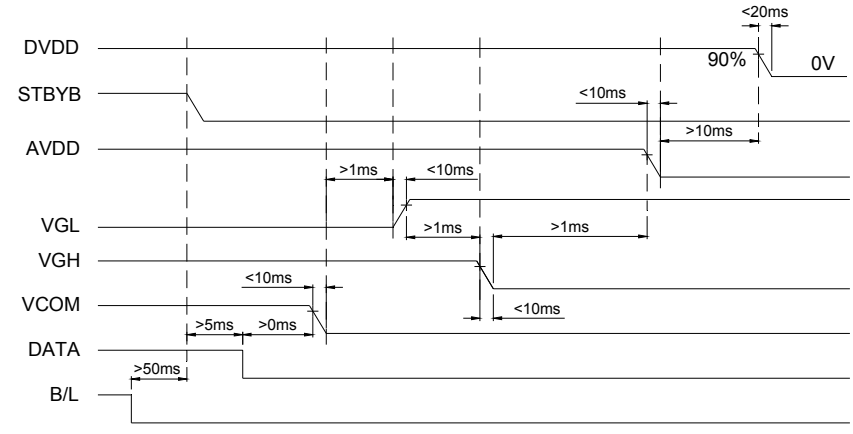
3.3 Power Sequence

3.3.1 Power on Sequence



Power on sequence: DV_{DD}→AV_{DD}→V_{GL}→V_{GH}→V_{COM}→DATA→B/L

3.3.2 Power off Sequence

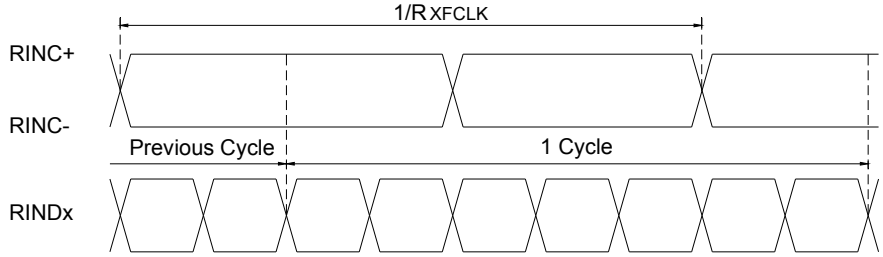


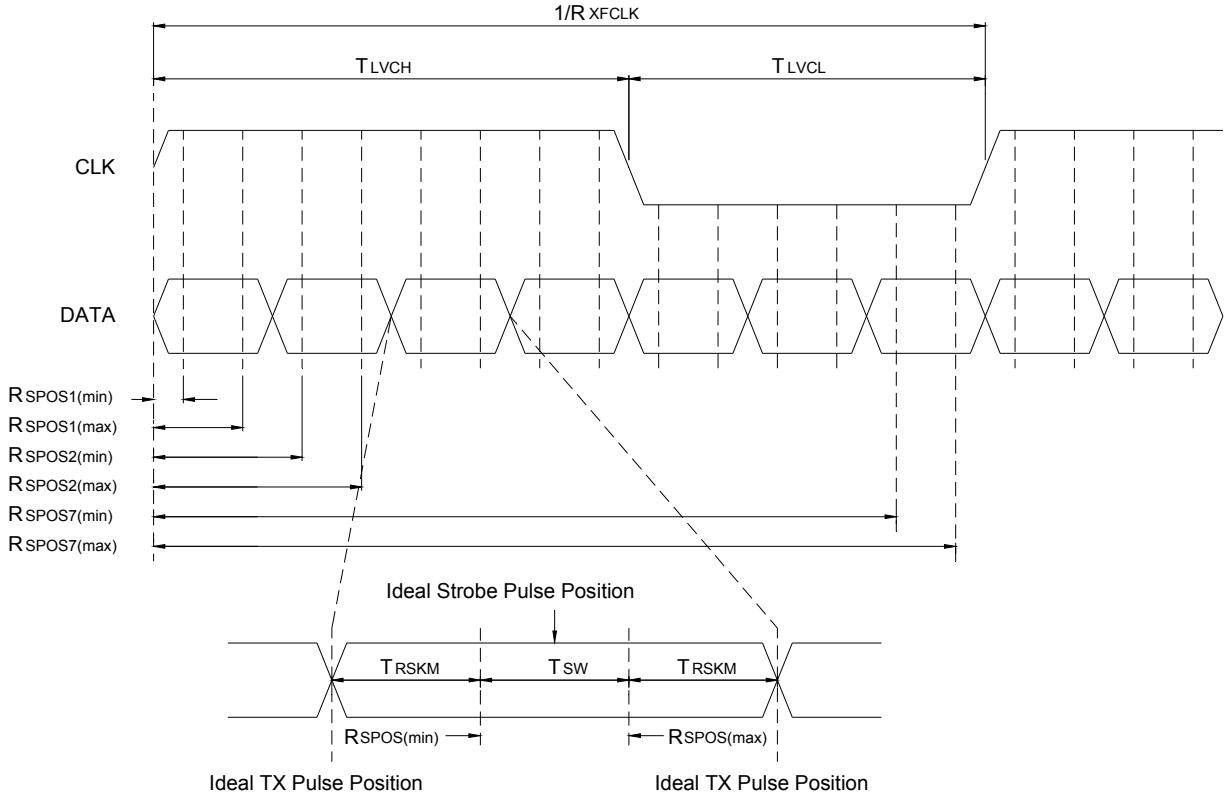
Power off sequence: B/L→DATA→V_{COM}→V_{GL}→V_{GH}→AV_{DD}→DV_{DD}

3.4 LVDS Timing Characteristics

3.4.1 LVDS AC Characteristics (Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
CLK Frequency	R_{XFCLK}	20	-	71	MHz	
Input Data Skew Margin	T_{RSKM}	500	-	-	ps	$\|V_{ID}\|$=400mV R_{XVCM}=1.2V R_{XFCLK}=71MHz
Clock High Time	T_{LVCH}	-	4/(7*R_{XFCLK})	-	ns	
Clock Low Time	T_{LVCL}	-	3/(7*R_{XFCLK})	-	ns	





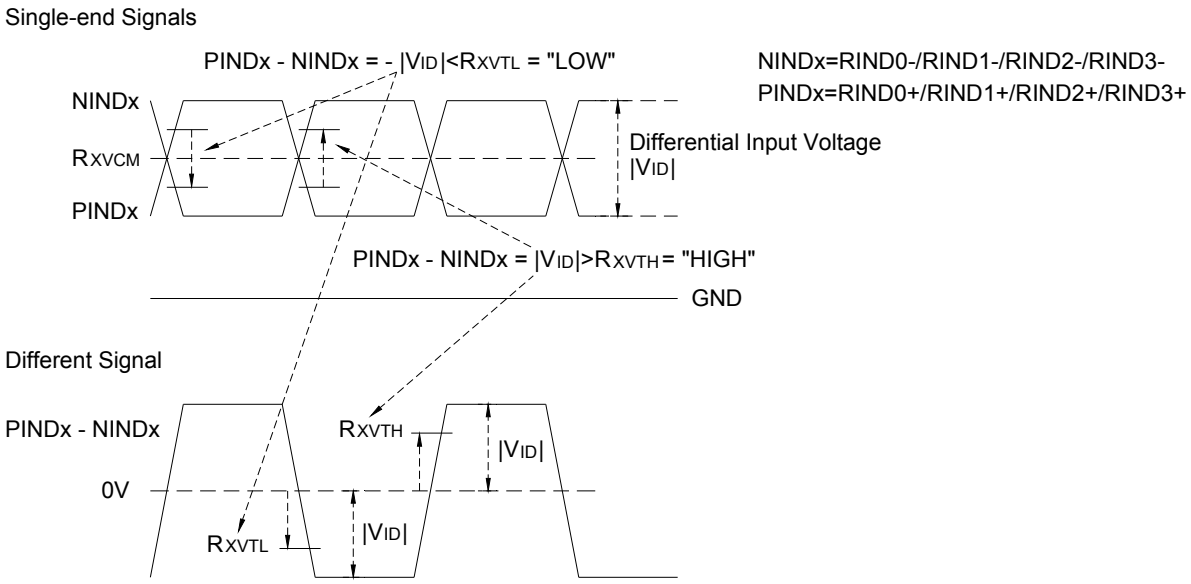
T_{RSKM} : Reciver strobe margin

R_{SPOS} : Reciver strobe position

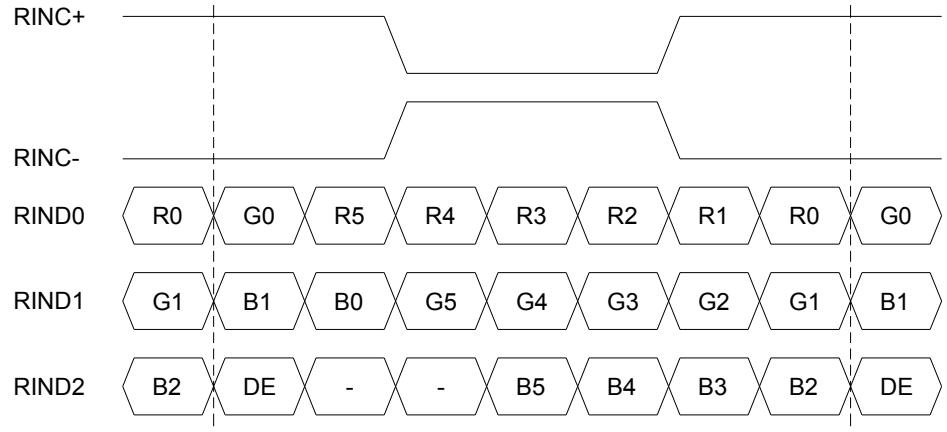
T_{SW} : Strobe width (Internal data sampling window)

3.4.2 LVDS DC Characteristics (Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential Input High Threshold Voltage	R_{XVTH}	-	-	0.1	V	R_{XVCM}=1.2V
Differential Input Low Threshold Voltage	R_{XVTL}	-0.1	-	-	V	
Input Voltage Range (Single-end)	R_{XVIN}	0	-	DV_{DD} - 1.2 + $\|V_{ID}\|/2$	V	
Differential Input Common Mode Voltage	R_{XVCM}	$\|V_{ID}\|/2$	-	DV_{DD} - 1.2	V	
Differential Voltage	$\|V_{ID}\|$	0.2	-	0.6	V	
Differential Input Leakage Current	RVxliz	-10	-	10	uA	

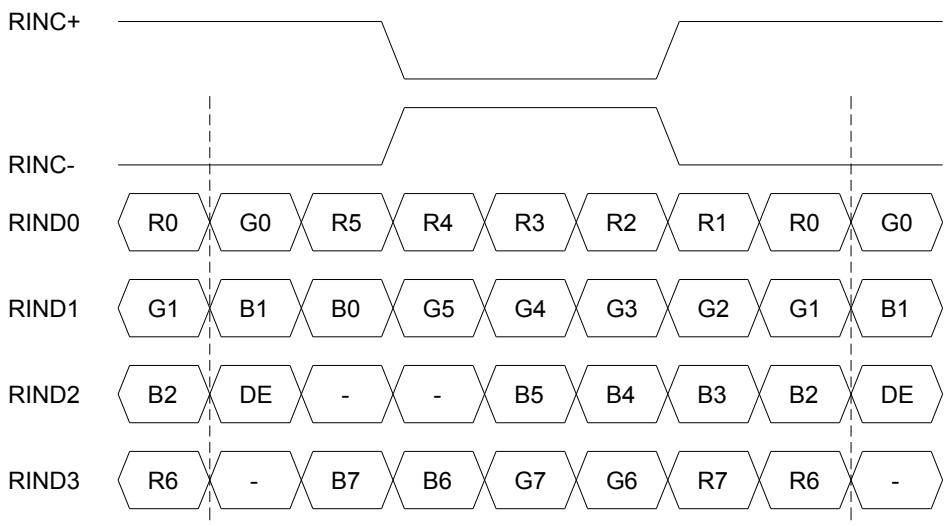


3.4.3 Timing Diagram for 6-bit LVDS Input (SELB=1)



R6/G6/B6: MSB; R0/G0/B0: LSB

3.4.4 Timing Diagram for 8-bit LVDS Input (SELB=0)

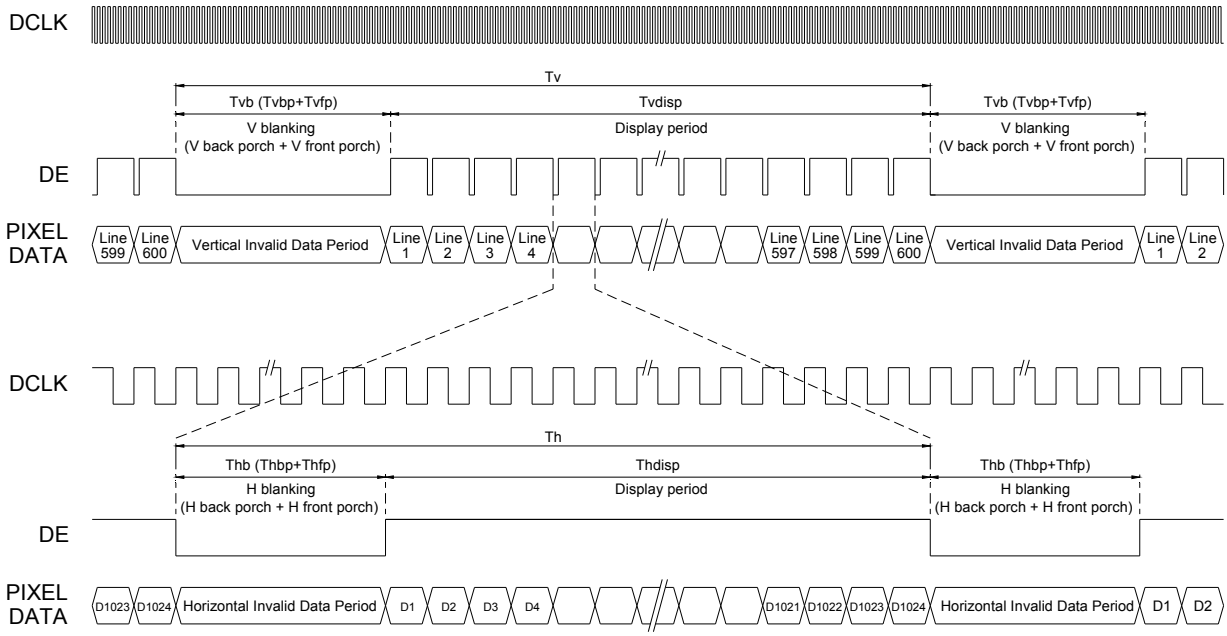


R7/G7/B7: MSB; R0/G0/B0: LSB

3.4.5 Input Signals Timing Characteristics (DE Mode)

Item	Symbol	Min.	Typ.	Max.	Unit
DCLK Frequency	Fclk	40.8	51.2	67.2	MHz
HSYNC Period	Th	1114	1344	1600	DCLK
HSYNC Display Period	Thdisp	-	1024	-	DCLK
DEH Blanking	Thb=Thbp+Thfp	90	320	376	DCLK
VSYNC Period	Tv	610	635	800	Th
VSYNC Display Period	Tvdisp	-	600	-	Th
DEV Blanking	Tvb=Tvbp+Tvfp	10	35	200	Th

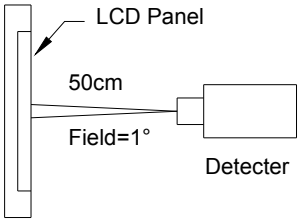
Note: This TFT supports DE mode only.



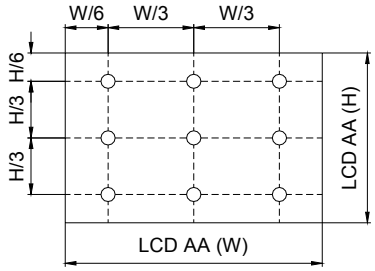
4. ELECTRO-OPTICAL CHARACTERISTICS (Ta=25°C)

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness of White	Bp		Θ=0° Φ=0° I_{LED}=200mA	-	300	-	cd/m^2	1
Uniformity	△Bp			70%	-	-	-	2
Viewing Angle	Hor	ΘR	Cr ≥10	-	80	-	deg.	3
		ΘL		-	80	-		
	Ver	ΘU		-	60	-		
		ΘD		-	75	-		
Contrast Ratio	Cr		Θ=0° Φ=0°	500	600	-	-	4
Response Time	Tr			-	10	20	ms	5
	Tf			-	15	30		
Color Chromaticity	Wx			-	0.298	-	-	1, 6
	Wy			-	0.334	-	-	

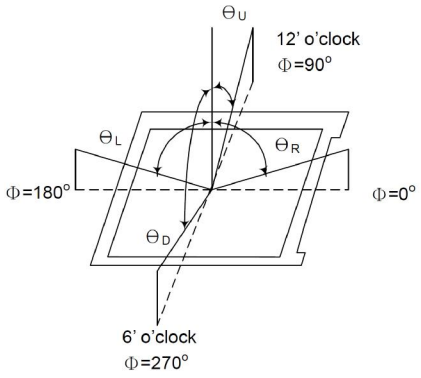
Note 1: The optical characteristics should be measured by BM-7 in dark room after 15 minutes operation. The optical properties are measured at the center point of the LCD.



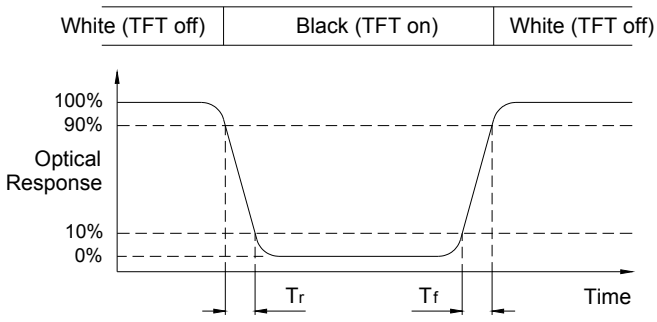
Note 2: △ Bp=Bp (Min.) / Bp (Max.) × 100 (%)
Bp(Max.)=Maximum brightness in 9
Bp(Min.)=Minimum brightness in 9



Note 3: Definition of Viewing Angle



Note 5: Definition of Response Time

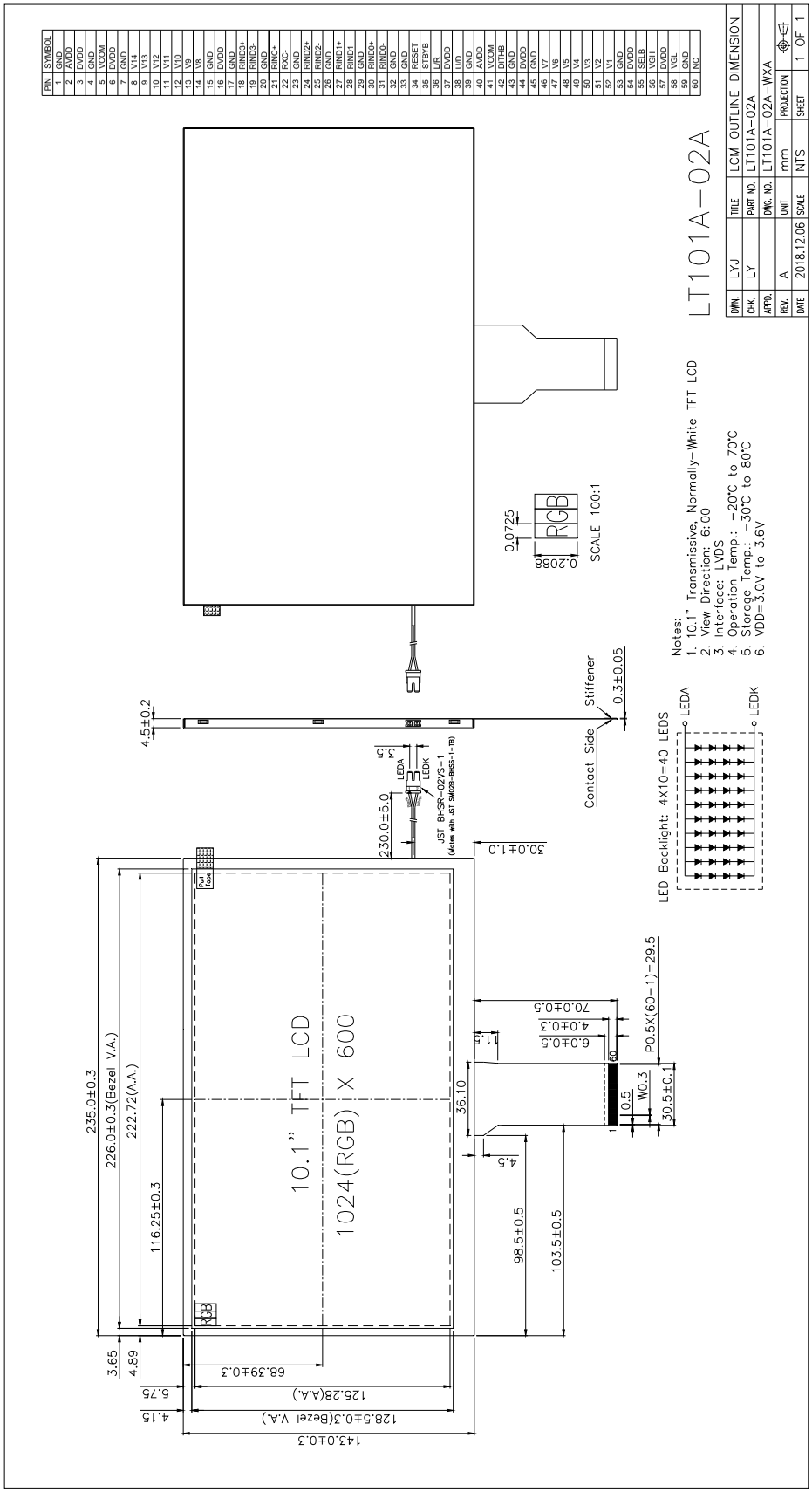


Note 4: Definition of Contrast Ratio

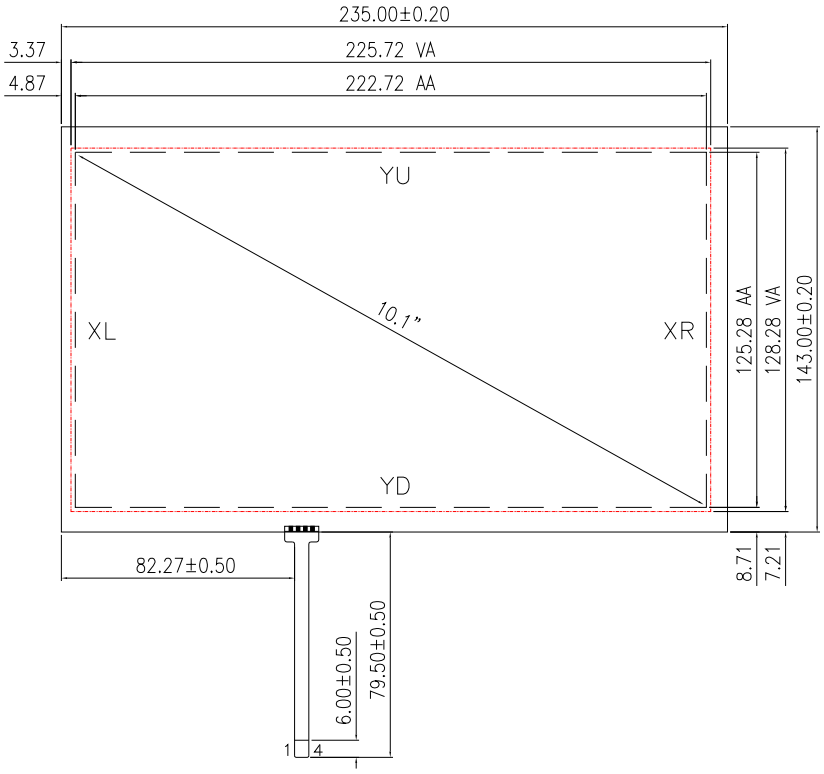
$$\text{Contrast Ratio (Cr)} = \frac{\text{Brightness measured when LCD on "White" State}}{\text{Brightness measured when LCD on "Black" state}}$$

Note 6: Definition of color chromaticity (CIE1931)
Color coordinates is measured at the center point of the LCD with I_{LED}=200mA and the LCD displays white.

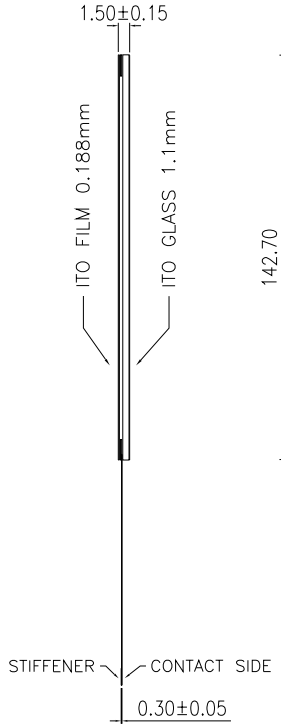
5. DIMENSIONAL OUTLINE



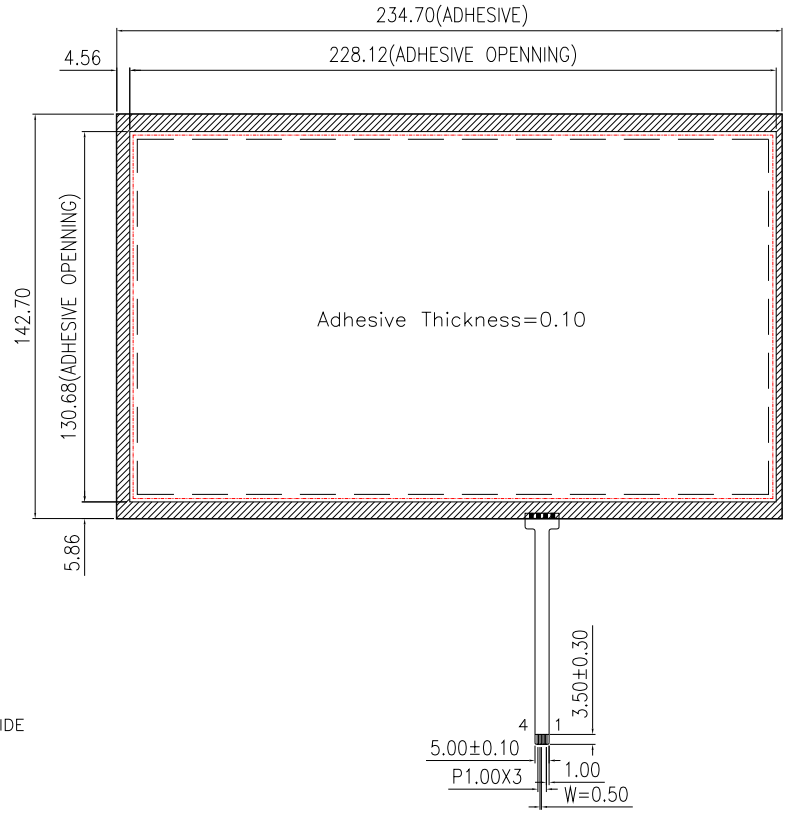
FRONT



SIDE VIEW

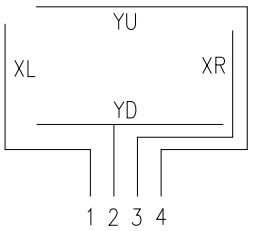


REAR



SPECIFICATION

1. Structure: Film + Glass + FPC
   Product thickness: 1.50±0.15mm
   ITO glass: 400Ω/□ 1.1mm
   ITO Film: 0.188mm(Anti-glare)
2. Surface hardness: ≥3H
3. Linearity: ≤1.5%
4. Light transmission: ≥78%
5. Chattering time: ≤10 msec
6. Insulation resistance: ≤DC 25V 20MΩ
7. Load upon operation: ≤100g
8. Hitting durability: Hit ≥1,000,000 times
9. Sliding durability: Shuttle ≥100,000 times
10. Operation temp.: -20~+70℃,≤90%RH
11. Storage temp.: -30~+80℃,≤90%RH
12. Unspecified tolerance: ±0.5mm



PIN	SYMBOL
1	XL
2	YD
3	XR
4	YU

SCALE: 1 : 1 NOT TO SCALE		LAUREL ELECTRONICS CO., LTD.	
PAGE: 1 OF 1			
GENERAL TOL.: 0.5mm		UNIT: mm	
APPROVALS		DATE	MODEL NUMBER : RXA-101002-01
APP:	MYchan	2014-09-15	CUSTOMER P/N :
CHK:	Amorll	2014-09-15	DATE: 2014-09-15
DWN:	Amorll	2014-09-15	

6. PRECAUTIONS FOR USE OF LCD MODULE

6.1 Handing Precautions

1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
2) If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
3) Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to vary.
4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
5) If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.
   · Isopropyl alcohol
   · Ethyl alcohol
   Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
   · Water
   · Ketone
   · Aromatic Solvents
6) When mounting the LCD module make sure that it is free of twisting, warping, and distortion. Distortion has great influence upon display quality. Also keep the stiffness enough regarding the outer case.
7) Be sure to avoid any solvent such as flux for soldering never stick to Heat-Seal. Such solvent on Heat-Seal may cause connection problem of heat-Seal and TAB.
8) Do not forcibly pull or bend the TAB I/O terminals.
9) Do not attempt to disassemble or process the LCD module.
10) NC terminal should be open. Do not connect anything.
11) If the logic circuit power is off, do not apply the input signals.
12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
    · Be sure to ground the body when handling the LCD module.
    · Tools required for assembly, such as soldering irons, must be properly grounded.
    · To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
    · The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

6.2 Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.
2) Exercise care to minimize corrosion of the electrodes. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high humidity environment.

6.3 Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operating characteristics may be adversely affected.

2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.
3) The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also, keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.
4) Sufficiently notice the mutual noise interference occurred by peripheral devices.
5) To cope with EMI, take measures basically on outputting side.
6) If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

6.4 Others

1) Liquid crystals solidify under low temperatures (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.
2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
3) To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:
   · Terminal electrode sections.
   · Part of pattern wiring on TAB, etc.