

LCD Module Specification

Model No.: LT104A-01AMT

10.4", 800 (RGB) x 600 PIXELS TFT LCD MODULE

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RECORD OF REVISION

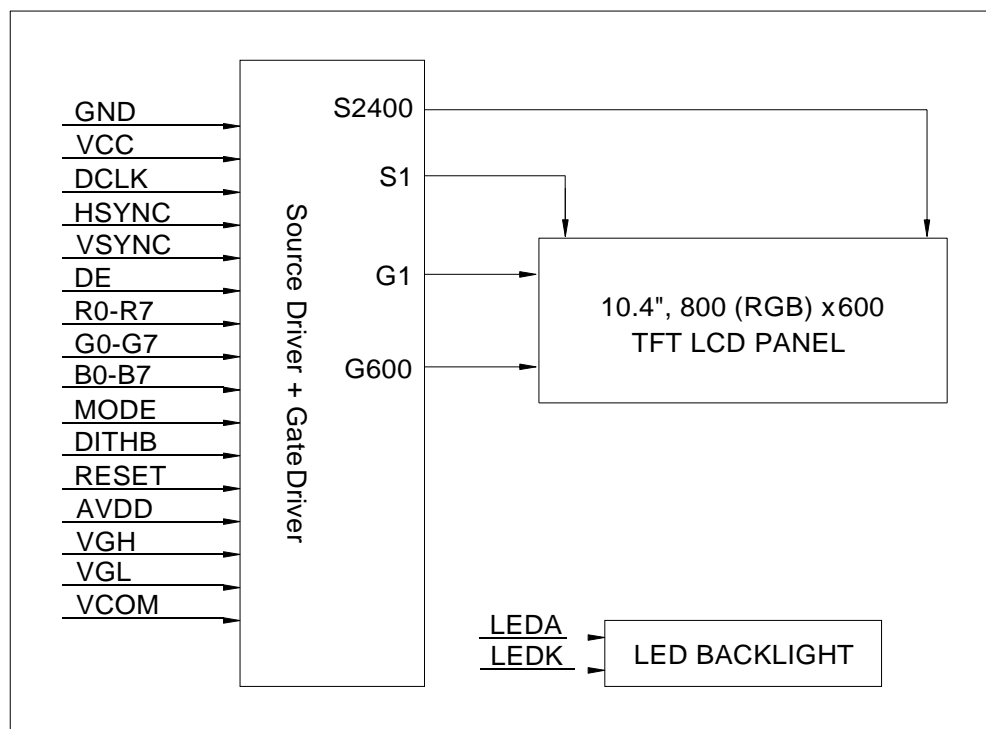
Rev.	Date	Page	Item	Description
0.1	2018/12/18	-	-	New release

1. BASIC SPECIFICATIONS

1.1 Features

Item	Specifications	Unit
Screen Size	10.4 (Diagonal)	inch
Resolution	800 (RGB) x 600	dot
Display Mode	Normally white, transmissive TFT	-
Color Configuration	RGB-stripe	-
Color Depth	24-bit (RGB=888), 16.2M colors	-
Viewing Direction	6:00 o'clock (Gray scale inversion direction)	-
Outline Dimension (WxHxT)	228.4 x 175.4 x 5.9 (FPC length=44.8)	mm
Viewing Area (WxH)	214.2 x 162.5	mm
Active Area (WxH)	211.2 x 158.4	mm
Dot Pitch (WxH)	0.088 x 0.264	mm
Touch Panel	None	-
Weight	354	g
Interface Mode	Digital 24-bit parallel RGB	-
Power Supply (VCC)	3.3	V

1.2 Block Diagram



1.3 Terminals Functions

Pin No.	Symbol	I/O	Function
1	GND	P	Power ground
2	AVDD	P	Power supply for analog circuit
3	VCC	P	Power supply for digital circuit
4	R0	I	Red data (LSB)
5	R1	I	Red data
6	R2	I	Red data
7	R3	I	Red data
8	R4	I	Red data
9	R5	I	Red data
10	R6	I	Red data
11	R7	I	Red data (MSB)
12	G0	I	Green data (LSB)
13	G1	I	Green data
14	G2	I	Green data
15	G3	I	Green data
16	G4	I	Green data
17	G5	I	Green data
18	G6	I	Green data
19	G7	I	Green data (MSB)
20	B0	I	Blue data (LSB)
21	B1	I	Blue data
22	B2	I	Blue data
23	B3	I	Blue data
24	B4	I	Blue data
25	B5	I	Blue data
26	B6	I	Blue data
27	B7	I	Blue data (MSB)
28	DCLK	I	Data clock. Latch data at falling edge.
29	DE	I	Data enable signal. Active "H".
30	HSYNC	I	Horizontal sync signal. Negative polarity.
31	VSYNC	I	Vertical sync signal. Negative polarity.
32	MODE	I	DE/SYNC mode selection. Normally pull high. MODE=1: DE mode. MODE=0: SYNC mode.
33 to 35	NC	-	No Connection
36	VCC	P	Power supply for digital circuit

Pin No.	Symbol	I/O	Function
37	NC	-	No Connection
38	GND	P	Power ground
39	GND	P	Power ground
40	AVDD	P	Power supply for analog circuit
41	VCOM	I	Common voltage
42	DITHB	I	Dithering function. DITHB=1: Disable internal dithering function DITHB=0: Enable internal dithering function
43	NC	-	No Connection
44	VCOM	I	Common voltage
45 to 55	NC	-	No Connection
56	VGH	P	Gate on voltage
57	VCC	P	Power supply for digital circuit
58	VGL	P	Gate off voltage
59	GND	P	Power ground
60	NC	-	No Connection

I=Input; O=Output; P=Power

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Digital)	VCC	-0.3	5.0	V
Supply Voltage (Analog)	AVDD	6.5	15.0	V
Supply Voltage (Gate on voltage)	VGH	-0.3	42.0	V
Supply Voltage (Gate off voltage)	VGL	VGH - 42.0	0.3	V
Input Voltage	VI	-0.3	VCC + 0.3	V
LED Forward Current (Each LED)	IF	-	25	mA
Operating Temperature	Topr	-10	+50	°C
Storage Temperature	Tstg	-20	+60	°C

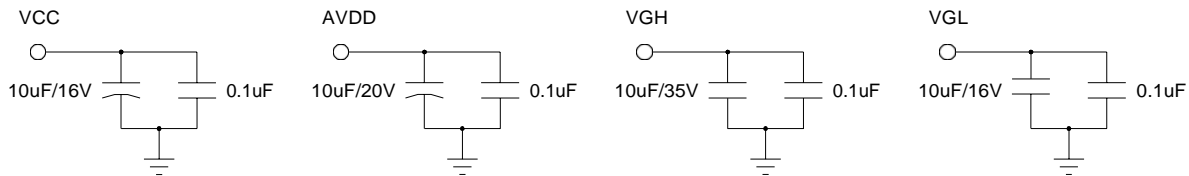
Cautions: Stresses above those listed as 'absolute maximum ratings' may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

3. ELECTRICAL CHARACTERISTICS

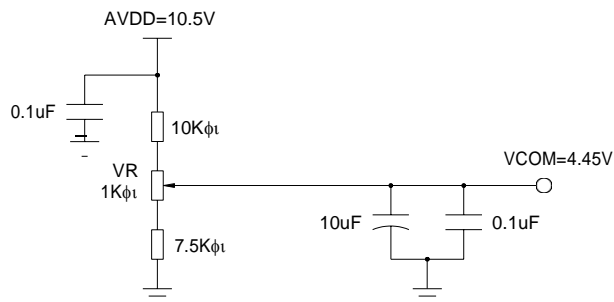
3.1 DC Characteristics for LCD (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	VCC	Note 1	3.0	3.3	3.6	V
	AVDD	Note 1	10.3	10.5	10.7	V
	VGH	Note 1	16.0	18.0	20.0	V
	VGL	Note 1	-8.0	-7.0	-6.0	V
Input Signal Voltage	VCOM	Note 2	4.15	4.45	4.75	V
Input High Voltage	VIH		0.7VCC	-	VCC	V
Input Low Voltage	VIL		0	-	0.3VCC	V
Supply Current	ICC	VCC = 3.3V	-	6.0	12.0	mA
	IDDA	AVDD = 11.0V	-	40.0	60.0	mA
	IGH	VGH = 18.0V	-	0.25	1.0	mA
	IGL	VGL = -7.0V	-	0.25	1.0	mA

Note 1: It is suggested that users follow the circuits below to design VCC, AVDD, VGH and VGL.



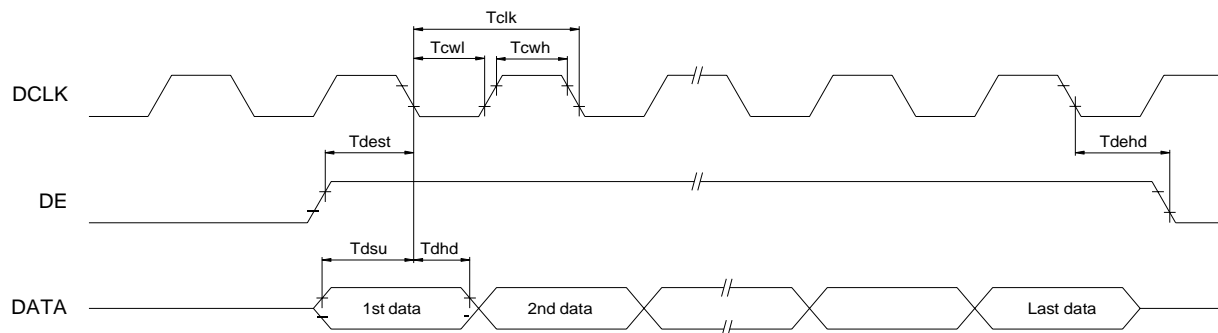
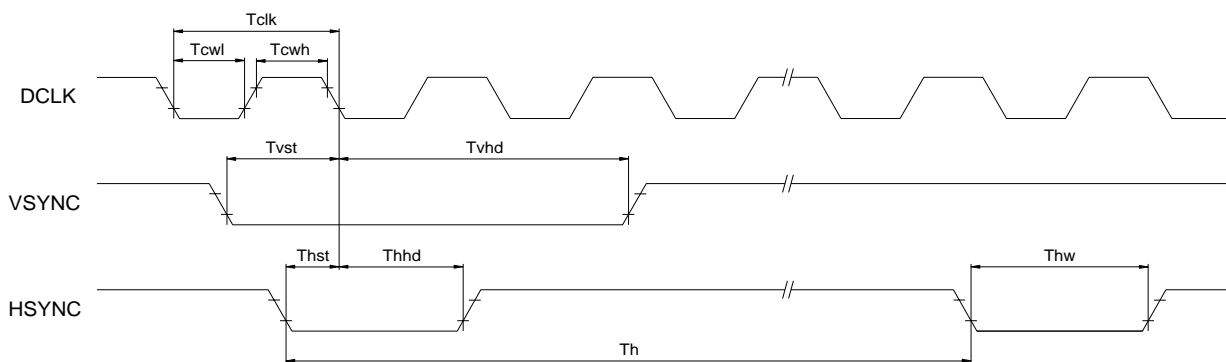
Note 2: Reference circuit for VCOM



The typical VCOM 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.

3.4 AC Characteristics (VCC=3.3V, Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit
DCLK Pulse Duty	Tcwh	40	50	60	%
DCLK Period	Tclk	20	-	-	ns
VSYNC Setup Time	Tvst	8	-	-	ns
VSYNC Hold Time	Tvhd	8	-	-	ns
HSYNC Setup Time	Thst	8	-	-	ns
HSYNC Hold Time	Thhd	8	-	-	ns
Data Setup Time	Tdsu	8	-	-	ns
Data Hold Time	Tdhd	8	-	-	ns
DE Setup Time	Tdest	8	-	-	ns
DE Hold Time	Tdehd	8	-	-	ns

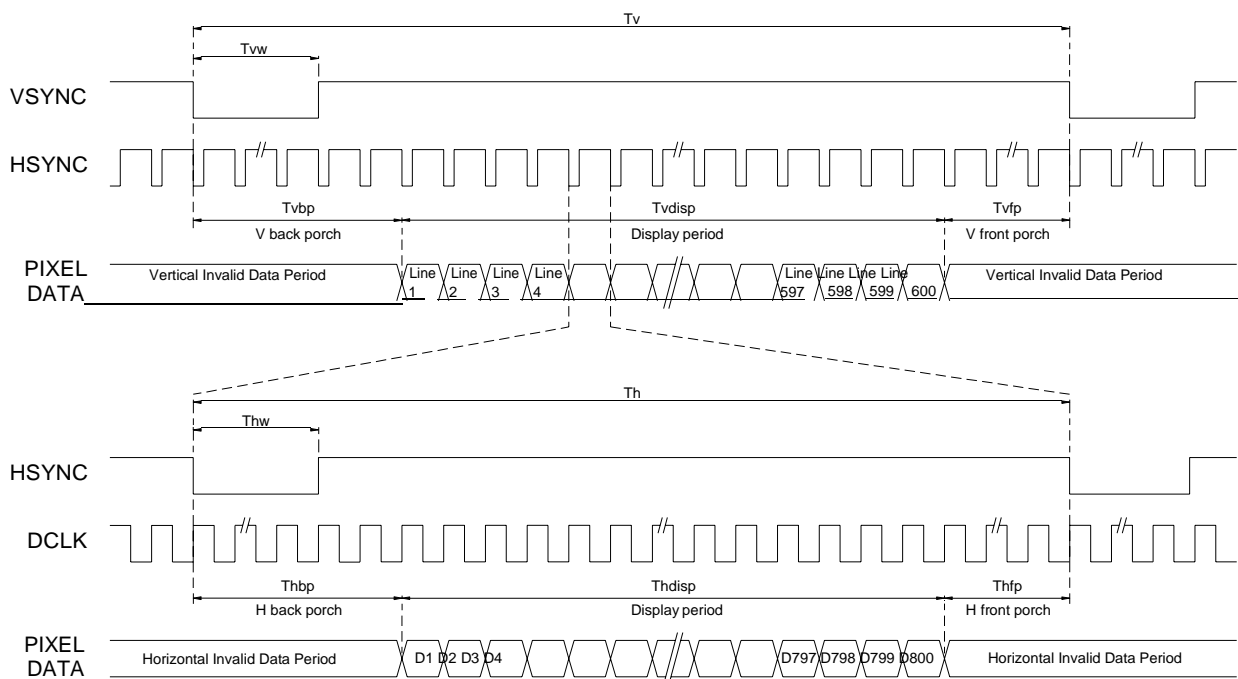


3.5 Input Signals Timing Characteristics

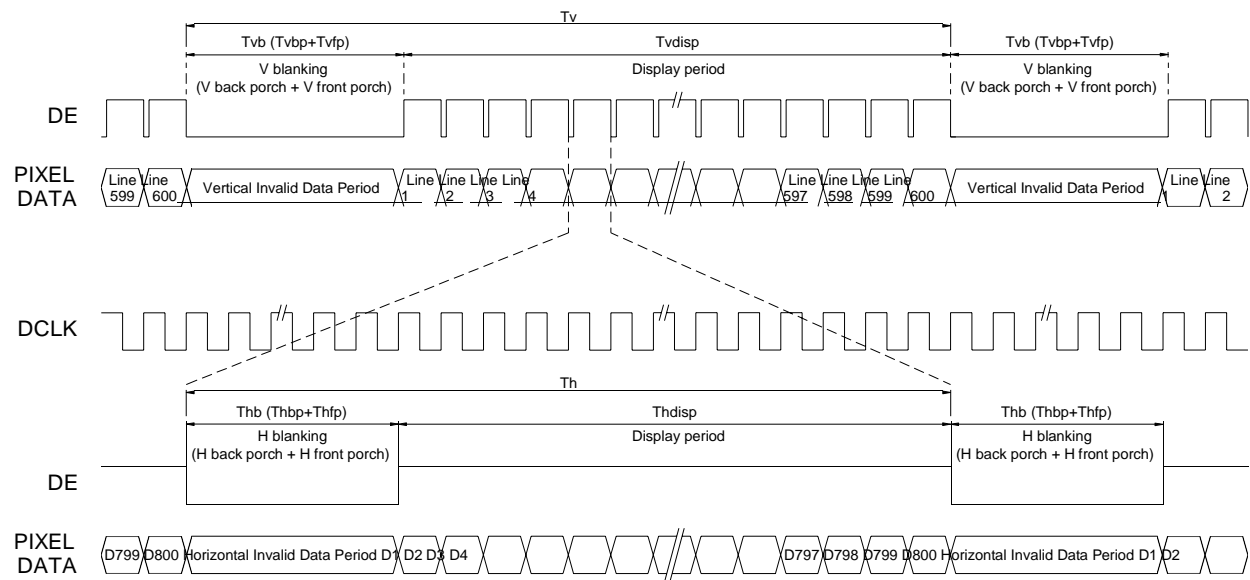
Item	Symbol	Min.	Typ.	Max.	Unit
DCLK Frequency	Fclk	33	40	50	MHz
HSYNC Period	Th	862	1056	1200	DCLK
HSYNC Display Period	Thdisp	-	800	-	DCLK
HSYNC Back Porch	Thbp	46	46	46	DCLK
HSYNC Front Porch	Thfp	16	210	354	DCLK
HSYNC Pulse Width	Thw	1	-	40	DCLK
DEH Blanking (for DE mode only)	Thb=Thbp+Thfp	62	256	400	DCLK
VSYNC Period	Tv	624	635	700	Th
VSYNC Display Period	Tvdisp	-	600	-	Th
VSYNC Back Porch	Tvbp	23	23	23	Th
VSYNC Front Porch	Tvfp	1	12	77	Th
VSYNC Pulse Width	Tvw	1	-	20	Th
DEV Blanking (for DE mode only)	Tvb=Tvbp+Tvfp	24	345	100	Th

Note: It is necessary to keep $Tvbp=23$ and $Thbp=46$ in SYNC mode. It's unnecessary to keep it in DE mode.

3.6 SYNC Mode Timing Diagram



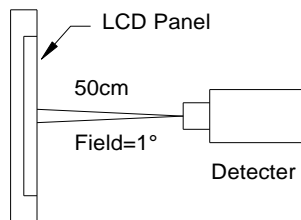
3.7 DE Mode Timing Diagram



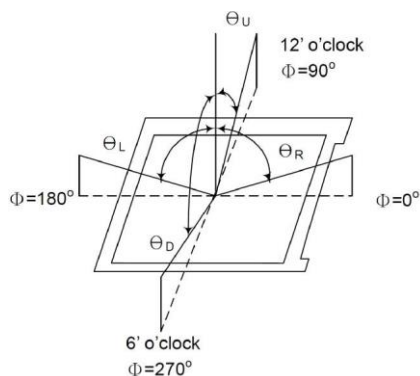
4. ELECTRO-OPTICAL CHARACTERISTICS (Ta=25°C)

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness of White	Bp		$\Theta=0^{\circ}$ $\Phi=0^{\circ}$ ILED=280mA	-	400	-	cd/m ²	1
Uniformity	ΔB_p			70%	-	-	-	2
Viewing Angle	Hor	ΘR	$Cr \geq 10$	-	70	-	deg.	3
		ΘL		-	70	-		
	Ver	ΘU		-	50	-		
		ΘD		-	60	-		
Contrast Ratio	Cr		$\Theta=0^{\circ}$ $\Phi=0^{\circ}$	300	500	-	-	4
Response Time	Tr			-	10	20	ms	5
	Tf			-	15	30		
Color Chromaticity	Wx			0.26	0.31	0.36	-	1, 6
	Wy			0.28	0.33	0.38	-	

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



Note 3: Definition of Viewing Angle



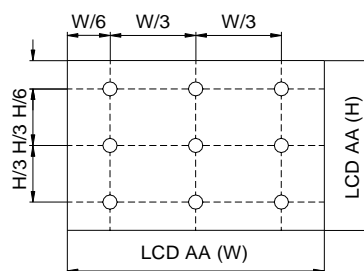
Note 4: Definition of Contrast Ratio

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

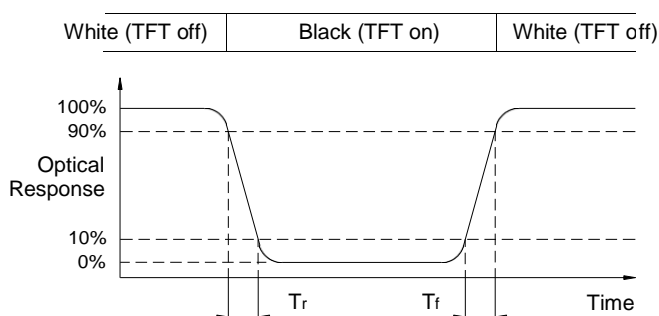
Note 6: Definition of color chromaticity (CIE1931)

Color coordinates is measured at the center point of the LCD with ILED=280mA and the LCD displays white.

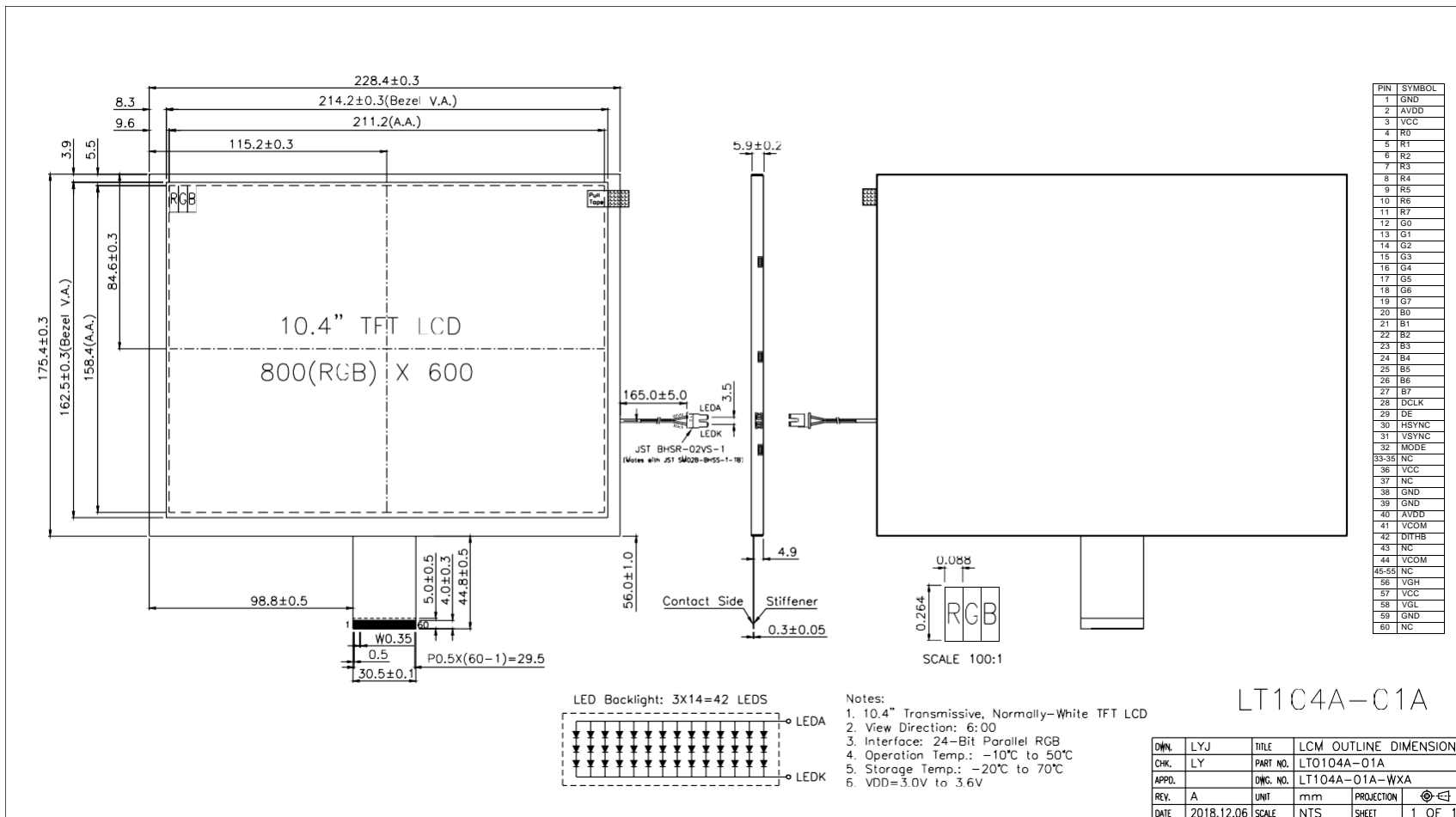
Note 2: $\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$
 $B_p (\text{Max.})$ = Maximum brightness in 9 operation.
 $B_p (\text{Min.})$ = Minimum brightness in 9

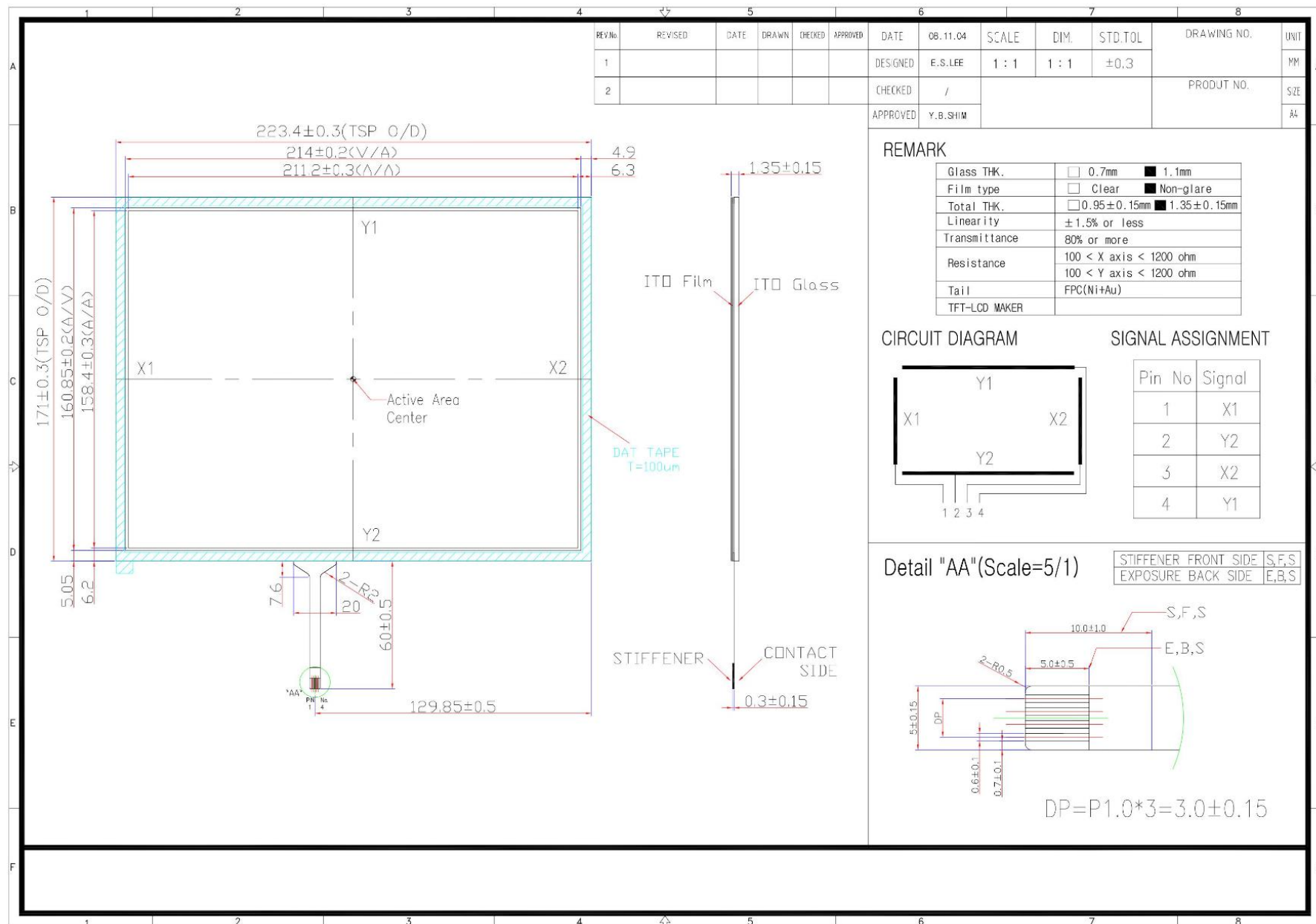


Note 5: Definition of Response Time



5. DIMENSIONAL OUTLINE





6. PRECAUTIONS FOR USE OF LCD MODULE

6.1 Handling 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 alcoholSolvents 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.